LEXMARK™

Forms Printer 248x/249x

Technical Reference

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Introduction

Your dot-matrix printer is an easy-to-use desktop printer that provides low-cost, high-quality output from your personal computer. It handles cut forms, document-on-demand, and continuous form applications.

Your printer is a wire-matrix printer. The printer makes impressions by forcing a hardened wire against an ink ribbon to transfer ink to the paper on impact. A dot is printed each time the wire strikes the ribbon against the paper. This impact printing technology has unique capabilities. The information in this manual enables you to fully use the capabilities of dot-matrix impact printing.

This book applies to the Lexmark Forms Printer 2400 Series dot-matrix family of printers. Differences that occur between printer models are noted.

The information in this manual is intended primarily for hardware and software programmers, engineers, technicians, and others who require in-depth technical information. If you need information to operate your printer, see your *User's Guide.*

Available Options

Options	Part Number	2480	2481	2490	2491
Parallel Cable	1329605 (10 ft.), 1427498 (20 ft.), or equivalent	Yes	Yes	Yes	Yes
Serial interface • Internal RS-232 • Serial cable	12T0154 1038693 (50 ft), or equivalent	Yes Yes	Yes Yes	Yes Yes	Yes Yes
Auto Sheet Feeder-Narrow Carriage	12T0150	Yes	No	Yes	No
Auto Sheet Feeder-Wide Carriage	12T0151	No	Yes	No	Yes
Tractor 2 Feeder-Narrow Carriage	12T0152	Yes	No	Yes	No
Tractor 2 Feeder-Wide Carriage	12T0153	No	Yes	No	Yes
USB cable	12A2405	Yes	Yes	Yes	Yes
248x OKI emulation	12T0155	Yes	Yes	No	No
Cut Sheet Output Support Stand	12T0014	Yes	Yes	Yes	Yes

Physical Characteristics

	Width	Height	Depth	Weight
2480/2490	491.5 mm (18.75 in.)	195 mm (7.36 in.)	290 mm (11.28 in.)	8.0 kg (14.8 lb)
2481/2491	633.5 mm (24.35 in.)	195 mm (7.36 in.)	290 mm (11.28 in.)	9.8 kg (18.7 lb)

Print Speeds

Your printer supports the following burst print speeds in characters per second (cps).

Mode	2480/2481	2490/2491
Fast Draft • 10 cpi • 12 cpi	• 438 cps • 510 cps	• 409 cps • 465 cps
Draft • 10 cpi • 12 cpi	• 309 cps • 304 cps	• 274 cps • 328 cps
Near Letter Quality - Gothic, Courier • 10 cpi • 12 cpi	• 77 cps • 76 cps	• 91 cps • 109 cps
Letter Quality - Prestige, Presentor, Orator, and Script • 10 cpi	N/A	91 cps

Printhead Description

Your printer uses dot-matrix impact technology to generate characters. The 248x has a 9-wire printhead. The 249x has a 24-wire printhead.

248x

The 248x printhead has nine wires arranged in a single vertical column. The diameter of each wire is 0.30 mm (0.012 in.). The center-to-center distance between wires is 0.353 mm (1/72 in.). The printhead has an impact force sufficient to generate readable copies on multipart forms and envelopes up to and including 6-ply forms (original plus 5 copies).

249x

The 249x printhead has twenty-four wires arranged in two parallel vertical columns of twelve wires each. The diameter of each wire is 0.22 mm (0.009 in.). The wires in each of the rows are vertically separated to produce a 0.141 mm (1/180 in.) space between the centers of adjacent dots. The printhead has an impact force sufficient to generate readable copies on multipart forms and envelopes up to and including 4-ply forms (original plus 3 copies).

Printhead Movement

The printhead moves by a direct-current stepper motor.

The printhead can print while moving in both directions (bidirectional print).
When the printhead is printing in both directions, it automatically finds the
shortest path to print the next line.

The maximum velocity of the printhead is 1117.6 mm (44 in.) per second for the
248x and 1041.4 mm (41 in.) per second for the 249x.

Environmental Conditions

Optimum Temperature Ranges

Condition	Operating	Stored	Shipping
Ambient air temperature range	+10° to +40.6°C (+50° to +105°F)	+1° to +60°C +34° to +140°F	-40° to +60°C (-40° to +140°F)
Humidity range	8.0% to 90%	5.0% to 100%	5.0% to 100%

Vibration

Although this desktop printer is portable and durable, do not operate or place
the printer in vibration-prone areas. For best results, operate the printer on a
level surface.

Clearances

Printer operation produces natural convection, or airflow. To allow sufficient
airflow, make sure there is 50.8 mm (2 in.) of space around all exposed surfaces.

Power Requirements

Power Consumption

- 38 W average operating power
- 7 W average idle power

Alternating Current Line Voltage Power

Your printer uses one of the following alternating current (ac) line voltage power values.

Note: Input voltage value varies with the country where the printer was pur-chased.

- 90-137 V ac, 50/60 Hz
- 180-265 V ac, 50/60 Hz

Power Cord

Printers for the United States and Canada have a 1.83 m (6.0 ft) power cord. Printers for all other countries have a 2.74 m (9.0 ft) power cord, with the correct plug to match the country requirements.

Noise Emission Value

The following are noise emission values for your printer.

Noise Emission Values	*248x-001*	*249x-001*
Operating 4 Mic Average, Draft	**57 dB(A)**	**N/A**
Operating Front MicAverage, Draft	**56 dB(A)**	**N/A**
Operating 4 Mic Average, NLQ	**54 dB(A)**	**55 dB(A)**
Operating Front MicAverage, NLQ	**53 dB(A)**	**53 dB(A)**
IDLE (standby mode)	**0 dB(A)**	**0 dB(A)**

All measurements were made in accordance with ISO 7779.

Paper Specifications

2480/2490 (Narrow Carriage Models)

Paper Dimensions	Cut Forms		Continuous Forms		Envelopes
	Single	Multiple part	Single	Multiple part	
Width					
Maximum	297 mm (11.7 in.) See Note	297 mm (11.7 in.) See Note	254 mm (10 in.)	254 mm (10 in.)	241 mm (9.5 in.)
Maximum Hole to Hole	N/A See Note	N/A	241 mm (9.5 in.)	241 mm (9.5 in.)	N/A
Minimum	76 mm (3.0 in.)	76 mm (3.0 in.)	76 mm (3.0 in.)	76 mm (3.0 in.)	152 mm (6.0 in.)
Minimum Hole to Hole	N/A	N/A	63 mm (2.5 in.)	63 mm (2.5 in.)	N/A
Note: When the optional Auto Sheet Feeder or Tractor 2 Feeder is installed, the maximum width of a cut form is 215 mm (8.5 in.) for manual loading.					
Page Length					
Maximum	559 mm (22.0 in.)	559 mm (22.0 in.)	559 mm (22.0 in.)	559 mm (22.0 in.)	152 mm (6.0 in.)
Minimum	76 mm (3.0 in.)	76 mm (3.0 in.)	3.2 mm (0.125 in.)	3.2 mm (0.125 in.)	110 mm (4.1 in.)
Weight					
Maximum	90 g/m^2 (24 lb.)	N/A	90 g/m^2 (24 lb.)	N/A	90 g/m^2 (24 lb.)
Minimum	60 g/m^2 (16 lb.)	N/A	56 g/m^2 (15 lb.)	N/A	75 g/m^2 (20 lb.)
Thickness - Multiple Part Forms of 45 g/m^2 (12 lb.) paper					
	0.058 mm (0.0023 in.)	See Note	0.058 mm (0.0023 in.)	See Note	0.042 mm (0.017 in.)
Note: Thickness up to 0.512 mm (0.0202 in.) for 2480/2481 printers; up to0.36 mm (0.015 in.) for 2490/2491 printers.					

2481/2491 (Wide Carriage Models)

Paper Dimensions	Cut Forms		Continuous Forms		Envelopes
	Single	Multiple part	Single	Multiple part	
Width					
Maximum	420 mm (16.5 in.)	420 mm (16.5 in.)	406 mm (16.0 in.)	406 mm (16.0 in.)	241 mm (9.5 in.)
Maximum Hole to Hole	N/A	N/A	393 mm (15.5 in.)	393 mm (15.5 in.)	N/A
Minimum	76 mm (3.0 in.)	76 mm (3.0 in.)	76 mm (3.0 in.)	76 mm (3.0 in.)	152 mm (6.0 in.)
Minimum Hole to Hole	N/A	N/A	63 mm (2.5 in.)	63 mm (2.5 in.)	N/A
Page Length					
Maximum	559 mm (22.0 in.)	559 mm (22.0 in.)	559 mm (22.0 in)	559 mm (22.0 in.)	152 mm (6.0 in.)
Minimum	76 mm (3.0 in.)	76 mm (3.0 in.)	3.2 mm (0.125 in.)	3.2 mm (0.125 in.)	110 mm (4.1 in.)
Weight					
Maximum	90 g/m^2 (24 lb.)	N/A	90 g/m^2 (24 lb.)	N/A	90 g/m^2 (24 lb.)
Minimum	60 g/m^2 (16 lb.)	N/A	56 g/m^2 (15 lb.)		75 g/m^2 (20 lb.)
Thickness - Multiple Part Forms of 45 g/m^2 (12 lb.) paper					
	0.058 mm (0.0023 in.)	See Note	0.058 mm (0.0023 in.)	See Note	0.053 mm (0.021 in.)
Note: Thickness up to 0.512 mm (0.0202 in.) for 2480/2481 printers; up to0.36 mm (0.015 in.) for 2490/2491 printers.					

Paper Size	Narrow carriage (2480/2490)	Wide carriage (2481/2491)
Automatic Feed Mode (single-part form)		
Length	139.7 mm (5.5 in.) minimum	139.7 mm (5.5 in.) minimum
	355.6 mm (14.0 in.) maximum	355.6 mm (14.0 in.) (See Note 1) maximum
		558.8 mm (22 in.) (See Note 2)
Width	105 mm (4.13 in.) minimum	105 mm (4.13 in.) minimum
	215.9 mm (8.5 inch) maximum	364 mm (14.3 in.) maximum
Tractor Feeder (continuous forms)		
Length	76 mm (3.0 in.) minimum	76 mm (3.0 in.) minimum
	N/A maximum	N/A maximum
Width	76 mm (3.0 in.) minimum	76 mm (3.0 in.) minimum
	254 mm (10 in.) maximum	406 mm (16.0 in.) maximum
Notes:		
1 For paper width greater than 8.5 inches.		
2 For paper width up to 8.5 inches.		
Manual Feed (cut sheets)		
Length	76.2 mm (3.0 in.) minimum	76.2 mm (3.0 in.) minimum
	558.8 mm (22.0 in.) maximum	558.8 mm (22.0 in.) maximum
Width	76.2 mm (3.0 in.) minimum	76.2 mm (3.0 in.) minimum
	279.4 mm (11.0 in.) maximum	420 mm (16.5 in.) maximum
Paper Weight	16 ~ 24 lbs (60 ~ 90 g/m^2)	

Ribbon Specifications

The life expectancy of the 2300/2400 series standard re-inking ribbon is approximately 4 million characters in 10 characters per inch (cpi) draft mode. For replacement ribbon, order ribbon number 11A3540.

Length: 1.8 m (6.0 ft)
Width: 8 mm (0.315 in.)
Fabric: Nylon

High yield re-inking ribbon is available for the 2400 series printer. It has a life expectancy of approximately 8 million characters in 10 cpi draft mode. For replacement ribbon, order ribbon number 11A3550.

Length: 2.5 m (8.3 ft)
Width: 8 mm (0.315 in.)
Fabric: Nylon

Diagnostics

This section discusses diagnostics at power-on and how to do the printer test.

Power-On Diagnostics

The following tests are performed when the printer is turned On.

*   RAM Test
*   Font ROM/Microcode Sum Test
*   Timer/Interrupt Controller Test
*   NVRAM Test
*   Switch Scan Test of the operator panel
*   Carrier Initialization
*   Paper Feed Initialization

If any errors occur during the tests, a combination of blinking LEDs indicate which test failed.

Printer Test

You can run a Printer Test to aid in problem determination. In addition to the normal power-on internal tests (see "Power-On Diagnostics" on page 15), the printer test generates a sample printout.

This test printout can be printed either with or without connecting the printer to your computer.

To run the printer test, follow these steps:

1 Make sure the paper and ribbon are installed.

2 Turn the printer Off.

3 Press **Line Feed** while you turn the printer On.

4 After a few seconds, release **Line Feed**.

To stop or interrupt the printer test:

1 Press **Start/Stop**. The test stops after a complete line of characters has printed.

2 Press **Start/Stop** to continue the printer test.

Programming Examples

Examples in this manual have been formatted to be processed by a simple BASIC program. The BASIC program reads an input file and writes data to an output file. Printer commands may be entered into the input file in a hexadecimal format and enclosed with opening and closing delimiters.

The opening delimiter is a less-than symbol, '<', followed by an '**x**'. The '**x**' may be either upper or lower case. The closing delimiter is a greater-than symbol, '**>**'.

Within the delimiters, hexadecimal data must be presented in two-digit pairs. White space, blanks, carriage returns and line feeds may be used between the pairs. In addition, a comment may be added to the end of a line by using a minus sign, '-', at the start of the comment. All data after a minus sign is ignored until a carriage return or line feed is encountered.

The example format used in this book is shown below:

```
<x

  1B36                      - select character set 2

  1B5B0400000001B5          - select code page 437

  1B5B640100A0              - set print quality to letter quality

  1B5B4905000055007801      - set font global to Courier 12

>
```

All of the examples use this encoding method and have been tested using the following BASIC program:

```
1000 INPUT "Enter file name to be printed"; FILENAME$
1010 OPEN FILENAME$ FOR INPUT AS #1
1020 OPEN "prtrout.bin" FOR OUTPUT AS #2
1030 WHILE EOF(1) = 0
1040   I$ = INPUT$(1, #1)
```

```
1050    IF(I$ <> "<")THEN PRINT #2,I$;: GOTO 1090
1060    I$ = INPUT$(1, #1)
1070    IF(I$ = "x")OR (I$ = "X") THEN GOSUB 1130: GOTO 1090
1080    IF(I$ = "<")THEN PRINT#2,I$;: GOTO 1090 ELSE GOTO 1290
1090 WEND
1100 CLOSE #1: CLOSE #2:
1110 SHELL "copy prtrout.bin/b lpt1 >nul"
1120 END
1130 '-------------------process hex mode data-------------
1140 WHILE EOF(1) = 0
1150    I$ = INPUT$(1, #1)
1160    IF(I$ = " ")OR(I$ = CHR$(10))OR(I$ = CHR$(13))THEN GOTO 1230
1170    IF(I$ = "-")THEN GOSUB 1300: GOTO 1230
1180    IF(I$ = ">") THEN RETURN
1190    GOSUB 1250: N1 = N
1200    IF EOF(1) GOTO 1290
1210    I$ = INPUT$(1,#1): GOSUB 1250
1220    PRINT #2,CHR$((N1 * 16) + N);
1230 WEND
1240 RETURN
1250 '-------------------hex digit conversion-------------
1260 IF(I$ >= "0") AND (I$ <= "9")THEN N= ASC(I$)-48:RETURN
1270 IF(I$ >= "A") AND (I$ <= "F") THEN N= ASC(I$)-55:RETURN
1280 IF(I$ >= "a") AND (I$ <= "f")THEN N= ASC(I$)- 87: RETURN
1290 PRINT "Invalid hexadecimal data - [" + I$ + "]": STOP
1300 '----------------comments bypass subroutine------------
1310 WHILE EOF(1) = 0
1320    I$ = INPUT$(1, #1)
1330    IF (I$ = CHR$(10)) OR (I$ = CHR$(13)) THEN RETURN
1340 WEND
1350 GOTO 1100
```

Set Initial Conditions (SIC) Command

The SIC command sets the printer to the default values that were set at the factory or to user-defined defaults.

SIC Command Format

Use the following format:

```
Format    ESC [   K   Ln  Hn  init   ID  p1...p22

Decimal   27  91  75  Ln  Hn

Hex       1B  5B  4B  Ln  Hn
```

Ln is the number of parameters plus 2. **Hn** is 0.

The decimal and hexadecimal digits for the printer command appear below the printer command format.

init sets the printer to user-defined or factory settings. The value for init can be:

Initial Values	Description
0	Initializes printer to user-defined settings. The download font remains unchanged. If parameters are specified, they over-write the default settings. If the emulation mode is changed, the download font is initialized. This command only copies data from the selected macro, add parameter changes, if any, and store in working RAM; the data stored in the macro's non-volatile RAM is not affected.
1	Initializes printer to user-defined settings. The download font is initialized. If parameters are specified, they overwrite the default settings. This command only copies data from the selected macro, add parameter changes, if any, and store in working RAM; the data stored in the macro's non-volatile RAM is not affected.
4	Initializes printer to factory settings. The download font remains unchanged. If parameters are specified, they over-write the default settings. If the emulation mode is changed, the download font is initialized. This command only copies the default settings from ROM, add parameter changes, if any, and store in working RAM; the data stored in the macro's non-volatile RAM is not affected.
5	Initializes printer to factory settings. The download font is initialized. If parameters are specified, they overwrite the default settings. This command only copies the default settings from ROM, add parameter changes, if any, and store in working RAM; the data stored in the macro's non-volatile RAM is not affected.
254	Initializes printer to user-defined settings. The download font is initialized. If parameters are specified, they overwrite the default settings. This command changes data stored in the selected macro. It copies data from the selected macro, add parameter changes, if any, and store in working RAM and in the selected macro. It also changes the default macro to the value of parm 3.
255	Initializes printer to default settings. The download font is initialized. If parameters are specified, they overwrite the default settings. This command changes data stored in the macro's non-volatile RAM. It copies default settings from ROM, add parameter changes, if any, and store in working RAM and all macros. It also sets the default macro to Disable.

Use the following parameters (parms) with SIC commands that use the printer ID of C5 and C6:

Printer	Dec	Hex
2480	197	C5
2481	197	C5
2490	198	C6
2491	198	C6

Parm	Description	Selection	Dec	Hex
1	Emulation	0=No Change 1=PPDS 2=Epson	0 1 2	00 01 02
2	Panel Disable (see Note 1)	0=No Change 1=Panel Disabled 2=Panel Enabled	0 1 2	00 01 02
3	Macro (see Note 2)	0=No Change 1=Macro 1 2=Macro 2 3=Macro 3 4=Macro 4 255=Disable Macro	0 1 2 3 4 255	00 01 02 03 04 FF

Notes:

1 You can disable specific buttons on the operator panel. The upper 6 bits of parm 2 represent the different buttons on the operator panel. The lower 2 bits are reserved to enable or disable the panel.

Bit	**Off**	**On**
7. Font	Disabled	Enabled
6. Pitch	Disabled	Enabled
5. Micro ↑	Disabled	Enabled
4. Micro ↓	Disabled	Enabled
3. LF	Disabled	Enabled
2. Macro	Disabled	Enabled

Bits 0 and 1 allow for existing panel disable functions.
To disable the panel or any of the buttons, bit 0 must be On.
The Start/Stop button and the Form Feed button are always enabled.

In the following example the Micro ↑ and Micro ↓ buttons are enabled:

Format	ESC	[	K	Ln	Hn	init	ID	P1	P2
Decimal	27	91	75	04	00	254	197	00	49
Hex	1B	5B	4B	04	00	FE	C5	00	31

Parm	Description	Selection	Dec	Hex
Notes (cont.):				

2 If Parm 3 has no value (macro has not been supplied), the printer default macro is used to store the change.

When init=04H or 05H is specified, parm3 is ignored.

When init=00H, 01H, FEH, FFh are specified, parm3 value is used as Macro No. instead of Default Macro setting No.

When init=FEH, FFh are specified parm3 value is overwritten to Default Macro setting in NVRAM. When the disable(=255) is set to parm3 Macro No.1 setting is used to initialize.

Parm	Description	Selection	Dec	Hex
4	Font	0=No Change	0	00
		1=Fast Draft	1	01
		2=Draft	2	02
		3=Gothic	3	03
		4=Courier	4	04
		5=Download Font	5	05
		6=Prestige	6	06
		(249x Plus only)		
		7=Presentor	7	07
		(249x Plus only)		
		8=Orator	8	08
		(249x Plus only)		
		9=Script	9	09
		(249x Plus only)		
5	Pitch	0=No Change	0	00
		1=10 Pitch	1	01
		2=12 Pitch	2	02
		3=15 Pitch	3	03
		4=17.1 Pitch	4	04
		5=20 Pitch	5	05
		6=PS	6	06
		7=24 Pitch	7	07
		(249x Plus only)		

Parm	Description	Selection	Dec	Hex
6	Code Page	0=No Change 1=437 2=850 3=860 4=863 5=865 6=437G 7=813 8=851 9=853T 10=857 11=869 12=920 13=1053 14=861 15=1004 16=858	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
7	Form Length	0=No Change 1=1 to 176 Lines	0 1	00 01
8	Lines Per Inch	0=No Change 1=3 2=4 3=6 4=8	0 1 2 3 4	00 01 02 03 04
9	Left Margin	0=No Change 1=0 Inch 2=1 Inch 3=2 Inches 4=3 Inches	0 1 2 3 4	00 01 02 03 04
10	Right Margin	0=No Change 1=4 Inches 2=5 Inches 3=6 Inches 4=7 Inches 5=8 Inches 6=13.6 Inches (2491 models only)	0 1 2 3 4 5 6	00 01 02 03 04 05 06
11	Bottom Margin	0=No Change 1=0 Inch 2=1/2 Inch 3=1 Inch 4=2 Inches 5=3 Inches	0 1 2 3 4 5	00 01 02 03 04 05
12	Alarm	0=No Change 1=Disable Alarm 2=Enable Alarm	0 1 2	00 01 02
13	Auto CR	0=No Change 1=On 2=Off	0 1 2	00 01 02

Parm	Description	Selection	Dec	Hex
14	Auto LF	0=No Change 1=On 2=Off	0 1 2	00 01 02
15	Slash Zero	0=No Change 1=Slashed Zero 2=Normal Zero	0 1 2	00 01 02
16	Character Set	0=No Change 1=Set 1 2=Set 2	0 1 2	00 01 02
17	Print Direction	0=No Change 1=Unidirectional 2=Bidirectional	0 1 2	00 01 02
18	Sheet Feeder	0=No Change 1=Disable 2=Enable	0 1 2	00 01 02
19	Lock	0=No Change 1=Font Lock 2=Pitch Lock 3=Font and Pitch Lock 4=Font and Pitch Unlock 254=SIC Command Lock 254=SIC Command Unlock	0 1 2 3 4 5 6	00 01 02 03 04 05 06
20	FF Enable (2480 only)	0=No Change 1=Ignore FF 2=Honor FF	0 1 2	00 01 02
21	TOF Read	0=No Change 1=TOF Read Disable 2=TOF Read Enable	0 1 2	00 01 02
22	Tractor	0=No Change 1=Tractor 1 2=Tractor 2	0 1 2	00 01 02
23	Tear Off	0=No Change 1=On 2=Off 3=One Second	0 1 2	00 01 02

IBM Emulation Mode Printer Commands

This section provides a detailed description of IBM emulation mode commands you can use with your printer.

Control Codes

Control codes are one-character printer commands that are used to:

- Manage the printing of a job.
- Control the movement of the cursor, which changes the current print position.
- Control primary and secondary font selection.

The first 32 characters of the Standard ASCII table are control codes. This printer uses the following control codes.

Code Name	Symbol	Description	Value (Dec)	Value (Hex)
Null	NUL	Null character.	0	00
Sound Beeper	BEL	Sounds the printer beeper for approximately 1 second.	7	07
Backspace	BS	Causes the printer to move the current print position one character position to the left.	8	08
Horizontal Tab	HT	Moves the printhead to the horizontal tabulation stops.	9	09
Line Feed	LF	Advances the paper one line on the page.	10	0A
Vertical Tab	VT	Moves the paper to the next vertical tabulation stop set with the printer command Set Vertical Tabulation Stops (ESC B).	11	0B
Form Feed	FF	Advances the paper to the top of the next page and does a carriage return.	12	0C

Code Name	Symbol	Description	Value (Dec)	Value (Hex)
Carriage Return	CR	Moves the current print position to the left margin of the current line.	13	0D
Double-Wide Printing by Line	SO	Prints all characters in double-width mode.	14	0E
Condensed Printing	SI	Condenses printing from 10 characters per inch (cpi) to 17.1 and 12 cpi to 20.	15	0F
Select Printer	DC1	Selects the printer.	17	11
Select 10 cpi	DC2	Returns condensed printing to normal (10 cpi)	18	12
Deselect Printer	DC3	Signals the printer to stop accepting data from the computer. This control code has no effect on the parallel interface.	19	13
Cancel Double-Wide Printing by Line	DC4	Cancels double-width printing mode and returns printing to normal.	20	14
Cancel Data	CAN	Clears current line buffer of data already received to print on the current line since last Form Feed, Line Feed, Carrier Return, or Cancel.	24	18
Space	SP	Moves the print position one character space to the right.	32	20

Escape Sequences

An escape sequence (two or more characters of information) lets you change the way the printer is currently printing. Like a control code, it gives you control over the printed output. The escape sequence begins with the character ESC (decimal 027, hexadecimal 1B). The printer recognizes this character as the beginning of a printer command signalling that the information that follows is control information and not data to be printed.

Printer Command Parameters

A command parameter sets the value for a command. This value stays constant until either a different value resets the command or a command resets the printer to its default values. For example, after the printer receives a command

that selects a right margin beginning at column 63, the right margin of each printed page begins at column 63. The margin remains constant until a right margin command with a different value resets the margin, or the printer is reset.

In this section, command parameters are indicated by a lowercase **n**. Usage Notes explain how to compute this parameter.

Command Structure

The printer commands use ASCII; the decimal and hexadecimal digits are shown for your convenience.

Most commands have the following structure (spaces have been added for readability; do not include spaces when you type the command):

`ESC & a n C data`

&	Parameterized character from ASCII table range 33-47 decimal.
a	Group character from ASCII table range 96-126 decimal that specifies a group type of control.
n	Value within specified numeric range, from ASCII table range 48-57, 45, 46 decimal. If a value is not specified, a value of 0 is assumed.
C	Termination character from ASCII table range 64-90 (47-122 w/chaining) decimal.
data	Binary 8-bit data (from graphics, and so on). The value field specifies the number of bytes of binary data.

Example of IBM Emulation Mode Printer Command

Select Code Page (*name of command*)

(*A short description of the command follows*)

This command placed before the first character changes the active code page.

(*The printer command format follows with the decimal and hexadecimal values*).

```
Format    ESC [   T   4   0  0    0 Hc  Lc

Decimal   27  91  84  4   0  0    0 Hc  Lc

Hex       1B  5B  54  04 00 00  00 Hc  Lc
```

Usage Notes

The digits **4 0 0 0** (decimal), **04 00 00 00** (hexadecimal) are constants.

To calculate **Hc Lc** for a code page that is not shown:

- Divide the code page number, such as 437, by 256.
  - — The whole number result is the Hc value.
  - — The remainder is the Lc value.
- If your code page has an alphabetic character, such as 437G, add 10,000 to the code page number, then divide by 256.
- Code page information begins on page 188.

Related commands list other commands that can or should be used with the printer command being described.

Usage Notes give additional information for that command, such as:

- how the command reacts with other commands
- any other command that is required, or that supplements the command
- how the datastream is affected by the command

Pay attention to the uppercase (capital letter) and the lowercase letters. If the format shows an uppercase letter, enter the command with an uppercase letter. If the letter in the command format is lowercase, enter it as lowercase. The printer looks at the uppercase and lowercase letters as separate command instructions.

The uppercase letter O is different from the numeral 0 (zero). Notice that the uppercase O is wider and rounder than the zero. To help you with this distinction, the text that describes the command shows the numeral 0 and also spells out zero.

Printer Command Quick Reference (IBM Emulation Mode)

Function	Command	Dec	Hex	For more information see...
Begin/End Continous Underline	ESC _	27 45 **n**	1B 2D **n**	page 47
Set Line Space to 1/8 inch	ESC 0	27 48	1B 30	page 57
Set Line Space to 7/72 inch	ESC 1	27 49	1B 31	page 57
Activate Line Spacing for Text	ESC 2	27 50	1B 32	page 57
Set Line Spacing for Graphics	ESC 3	27 51 **n**	1B 33 **n**	page 58
Set Top of Form	ESC 4	27 52	1B 34	page 59
Automatic Line Feed	ESC 5	27 53 **n**	1B 35 **n**	page 55
Select Character Set 2	ESC 6	27 54	1B 36	page 33
Select Character Set 1	ESC 7	27 55	1B 37	page 33
Select 12 cpi	ESC :	27 58	1B 3A	page 40
Download a Character Set	ESC =	27 61	1B 3D	page 35
Set Line Spacing for Text	ESC A	27 65 **n**	1B 41 **n**	page 57
Set Vertical Tab Stops	ESC B	27 66 **n,n1,n2...**	1B 42 **n,n1,n2...**	page 56
Set Page Length in Lines	ESC C	27 67 **n**	1B 43 **n**	page 59
Set Page Length in Inches	ESC C 0	27 67 0 **n**	1B 43 00 **n**	page 59
Set Horizontal Tab Stops	ESC D	27 68 **n,n1,n2...** 0	1B 44 **n,n1,n2...** 00	page 53
Begin Emphasized (Bold) Print	ESC E	27 69	1B 45	page 44
End Emphasized (Bold) Print	ESC F	27 70	1B 46	page 44
Begin Double-Strike Print	ESC G	27 71	1B 47	page 44
End Double-Strike Print	ESC H	27 72	1B 48	page 44
Select Print Mode	ESC I	27 73	1B 49	page 40
Move PaperVertically	ESC J	27 74 **n**	1B 4A **n**	page 55
Normal Density Bit Image Graphics	ESC K	27 75 **Ln Hn** data	1B 4B **Ln Hn** data	page 49
Dual-Density Bit Image Graphics (Half-Speed)	ESC L	27 76 **Ln Hn** data	1B 4C **Ln Hn** data	page 51
Set Skip Perforation	ESC N	27 78 **n**	1B 4E **n**	page 60
Cancel Skip Perforation	ESC O	27 79	1B 4F	page 60
Proportional Space Mode	ESC P	27 80	1B 50	page 58
Deselect Printer	ESC Q	27 81	1B 51	page 61
Set Default Tab Stops	ESC R	27 82	1B 52	page 53
Begin Subscript/ Superscript	ESC S	27 83 **n**	1B 53 **n**	page 45
End Subscript/Superscript	ESC T	27 84	1B 54	page 45

Function	Command	Dec	Hex	For more information see...
Set Print Direction	ESC U	27 85	1B 55	page 45
Continuous Double-Wide Printing	ESC W	27 87	1B 57	page 46
Set Horizontal Margins	ESC X	27 88 **n1,n2**	1B 58 **n1,n2**	page 54
Dual-Density Bit Image Graphics (Normal Speed)	ESC Y	27 89 **Ln Hn** data	1B 59 **Ln Hn** data	page 52
High-Density Bit Image Graphics	ESC Z	27 90 Ln Hn data	1B 5A Ln Hn data	page 52
Score Select (249x only)	ESC [-	27 91 45 2 0 *loc type*	1B 5B 2D 02 00 *loc type*	page 46
Select Print Type Style	ESC [@	27 91 64 4 0 **m1** 0 **m3 m4**	1B 5B 40 04 00 **m1** 00 **m3 m4**	page 42
Set Initial Condition	ESC [K	27 91 75 **Ln Hn**	1B 5B 4B **Ln Hn**	page 21
Select Global Font	ESC [I	27 91 73 2 0 **Hf Lf**	1B 5B 49 02 00 **Hf Lf**	page 36
Select Code Page	ESC [T	27 91 84 4 0 0 0 **Hc Lc**	1B 5B 54 4 0 0 0 **Hc Lc**	page 49
Set Vertical Units (249x only)	ESC [\	27 91 92 4 0 0 0 **Lu Hu**	1B 5B 5C 04 00 00 00 **Lu Hu**	page 56
Set Print Quality	ESC [d	27 91 100 1 0 **m**	1B 5B 64 01 00 **n**	page 48
Setup Barcode Parameter	ESC [f	27 91 102 6 0 **k m s...**	1B 5B 66 06 00 **k m s...**	
High Resolution Graphics (249x only)	ESC [g	27 91 103 **Ln Hn mode data**	1B 5B 67 **Ln Hn mode data**	page 50
Setup Barcode Data	ESC [p	27 91 112 **Ln Hn** data	1B 5B 70 **Ln Hn** data	page 63
Continuously Print Characters from Code Page	ESC \	27 92 **Ln Hn n1,n2...**	1B 5C **Ln Hn n1,n2...**	page 34
Reverse Line Feed	ESC]	27 93	1B 5D	page 55
Print One Character	ESC ^	27 94 **n**	1B 5E **n**	page 35
Begin/End Continuous Overscore	ESC _	27 95 **n**	1B 5F **n**	page 47
Move Current Print Position	ESC d	27 100 **Ln Hn**	1B 64 **Ln Hn**	page 54

Selecting a Character Set

Select Character Set 1

Character set 1 contains characters and symbols that are used in the English language.

```
Format    ESC 7

Decimal   27  55

Hex       1B  37
```

See pag e216 for more information.

Select Character Set 2

Character set 2 contains characters and symbols that are used in English and non-English languages.

```
Format     ESC 6

Decimal    27  54

Hex        1B  36
```

See pag e217 for more information.

Select Code Page

Use this printer command to change the active code page.

```
Format    ESC [   T   4     0   0   0   Hc  Lc

Decimal   27  91  84  4     0   0   0   Hc  Lc

Hex       1B  5B  54  04  00  00  00   Hc  Lc
```

Usage Notes

The digits **4 0 0 0** (decimal), **04 00 00 00** (hexadecimal) are constants.

To calculate **Hc Lc** for a code page that is not shown:

- Divide the code page number, such as 437, by 256.
  — The whole number result is the Hc value.
  — The remainder is the Lc value.
- If your code page has an alphabetic character, such as 437G, add 10,000 to

the code page number, then divide by 256.
*   Code page information begins on page 188.

Print From Code Page

Continuously Print Characters from a Code Page

Use this command to print characters from the all Characters Chart of a Code Page (see "Printing a Code Page" on page 204).

```
Format    ESC \   Ln  Hn  n1.....nn
Decimal   27  92  Ln  Hn  n1.....nn
Hex       1B  5C  Ln  Hn  n1.....nn
```

Ln Hn

Ln (low number) and Hn (high number) identify the number of characters that you want to print.

See below for ways to calculate this variable.

n1 n2 n3......nn

The variables, **n1 n2 n3** and so on, are the number of characters that you want to print. For example, for each character, **n1 n2 n3....**, that you want to print, you substitute the decimal or hexadecimal digit for that character.

Use the code page tables for the decimal or the hexadecimal digit (see "Code Pages" on page 187).

*   Locate the character on the code page table.
*   Use the decimal or hexadecimal digit for that character in the printer command format.

Usage Notes

To print less than 256 characters:

*   **Hn** is 0.
*   **Ln** is the number of characters you want to print.

To print more than 256 characters:

*   Divide the number of characters you want to print by 256.
    —   The result is **Hn**.
    —   The remainder is **Ln**.
    You must input a decimal or hexadecimal digit for each character (**n1.....nn**) you want to print. The decimal and hexadecimal digits are

located in the code page tables beginning on page 188.

Print One Character

Use this command to print a character from the All Characters Chart of a Code Page (see "Code Pages" on page 187).

```
Format    ESC ^   n
Decimal   27  94  n
Hex       1B  5E  n
```

Usage Note

Substitute the decimal or hexadecimal digit of the character you want to print for the variable **n**.

Download a Character Set

This command downloads a character set to the printer and starts a character font image download. Up to 256 consecutive characters can be downloaded in each ESC = sequence.

To download fonts, download must be enabled in the Setup menu.

```
Format    ESC =   count low/high id   start low/high data
Decimal   27  61  count low/high id   start low/high data
Hex       1B  3D  count low/high id   start low/high data
```

Usage Notes

count low/count high

The number of bytes of data being downloaded starting with the printer **id** byte.

id

A 1-byte number identifying the printer.

Printer	Dec	Hex
2480 Plus	182	B6
2481 Plus	184	B8
2490 Plus	183	B7
2491 Plus	185	B9

start low/start high

When character data is downloaded, the start address is the absolute address of the start of the character data. When the lookup table data is downloaded, the start address is the address of the new entry in the lookup table.

data

Character data from the character design, or lookup table data.

Select Global Font

This command allows you to vary the font and pitch typestyle within a file.

Format	ESC	[	I	2	0	Hf	Lf	Hs	Ls	Sm	Nul	Hc	Lc
Decimal	27	91	73	2	0	Hf	Lf	Hs	Ls	Sm	Nul	Hc	Lc
Hex	1B	5B	49	02	00	Hf	Lf	Hs	Ls	Sm	Nul	Hc	Lc

Usage Notes

- The digits 2 and 0 are constants.
- If Font Lock and Pitch Lock are active, this command is ignored.
- The **Hf** and **Lf** variables identify the pitch and font typestyle you want to print. Tables 1 and 2 on page 37 describe the **Hf** and **Lf** variables. To use the tables:

    1 Locate the type style (pitch and font) you want in the left column (**Pitch**).

    2 For the decimal digits for **Hf Lf**, look across the row to the second through fifth columns (depending on the typestyle you want to print).

    3 For the hexadecimal digits for **Hf Lf**, look across the row to the sixth through ninth columns (depending on the typestyle you want to print).

    4 Substitute these digits for **Hf Lf** in the printer command syntax.

- The size parameters (**Hs**, **Ls** and **Sm**) are valid when the pitch and font typestyle variables (**Hf** and **Lf**) are not valid and the size modifier parameter (**Sm**) is 1 (decimal) or 01 (hexadecimal). Table 3 on page 39 specifies the pitch for valid size parameters. Other valid sizes for Sm include:

    1 00 - No change

    2 01 - Width is measured in 0.018 mm (1/1440 in.)

    3 02, 03 - Font is porportional

    4 All other values are regarded as 0.

- The **Hc** and **Lc** variables identify the Code Page you want to use. (See Table 4 on page 39.)

Table 1. 248x: Select Global Font

Pitch	Decimal Hf Lf				Hex Hf Lf			
	Normal	Bold	Italic	Bold/Ital	Normal	Bold	italic	Bold/Ital
Courier								
5	0 244	0 245			00 F4	00 F5		
10	0 11	0 46	0 18	0 57	00 0B	00 2E	00 12	00 39
12	1 235	0 108	0 92	0 116	01 EB	00 6C	00 5C	00 74
15	1 236	0 214	0 215	0 216	01 EC	00 D6	00 D7	00 D8
17	1 237	0 253			01 ED	00 FD		
20	1 238				01 EE			
PS	0 171	0 184	0 172	0 185	00 AB	00 B8	00 AC	00 B9
Gothic								
5	0 241	0 242			00 F1	00 F2		
10	0 36	0 39			00 24	00 27		
12	1 143	0 110	0 109		01 8F	00 6E	00 6D	
15	1 142	0 110	0 109		01 8E	00 6E	00 6D	
17	1 141	0 220			01 8D	00 DC		
20	1 140				01 8C			
PS	0 174	0 157	0 162		00 AE	00 9D	00 A2	

Table 2. 249x: Select Global Font

Pitch	Decimal Hf Lf				Hex Hf Lf			
	Normal	Bold	Italic	Bold/Ital	Normal	Bold	italic	Bold/Ital
Courier								
5	0 244	0 245			00 F4	00 F5		
10	0 11	0 46	0 18	0 57	00 0B	00 2E	00 12	00 39
12	1 235	0 108	0 92	0 116	01 EB	00 6C	00 5C	00 74
15	1 236	0 214	0 215	0 216	01 EC	00 D6	00 D7	00 D8
17	1 237	0 253			01 ED	00 FD		
20	1 238				01 EE			
24	1 30				01 1E			
PS	0 171	0 184	0 172	0 185	00 AB	00 B8	00 AC	00 B9
Prestige								
5								
10	0 12	00 60			00 0C	00 3C		
12	1 239	0 111	0 112		01 EF	00 6F	00 70	
15	1 240				01 F0			
17	1 201				01 C9			
20	1 202				01 CA			
24	1 31				01 1F			
PS	1 164				01 A4			

Table 2. 249x: Select Global Font (Continued)

Pitch	Decimal Hf Lf				Hex Hf Lf			
	Normal	Bold	Italic	Bold/Ital	Normal	Bold	italic	Bold/Ital
Gothic								
5	0 241	0 242			00 F1	00 F2		
10	0 36				00 24			
12	1 143	0 110	0 109		01 8F	00 6E	00 6D	
15	1 142				01 8E			
17	1 141				01 8D			
20	1 140				01 8C			
24	1 32				01 20			
PS	0 174	0 157	0 172	0 185	00 AE	00 9D	00 A2	
Presentor								
10	0 25				00 19			
12	1 208				01 D0			
15	1 209				01 D1			
17	1 210				01 D2			
20	1 211				01 D3			
24	1 35				01 23			
PS	0 199				00 C7			
Orator								
10	0 5				00 05			
12	1 203				01 CB			
15	1 204				01 CC			
17	1 205				01 CD			
20	1 206				01 CE			
24	1 33				01 21			
PS	0 198				00 C6			
Script								
10	0 212				01 D4			
12	1 213				01 D5			
15	1 214				01 D6			
17	1 215				01 D7			
20	1 216				01 D8			
24	1 36				01 24			
PS	0 200				00 C8			

Table 3. Global Font and Size Parameters

Pitch	Dec (Hs, Ls)	Hex (Hs, Ls)
24 CPI Subscript (*249X only*)	0 00 - 0 65	00 00 - 00 41
20 CPI Subscript	0 66 - 0 77	00 42 - 00 4D
17 CPI Normal	0 78 - 0 89	00 4E - 00 59
15 CPI Normal	0 90 - 0 107	00 5A - 00 6B
12 CPI Normal	0 108 - 0 131	00 6C - 00 83
10 CPI Normal	0 132 - 0 155	00 84 - 00 9B
8.5 CPI (17 CPI double-wide	0 156 - 0 179	00 9C - 00 B3
7.5 CPI (15 CPI double-wide	0 180 - 0 215	00 B4 - 00 D7
6 CPI (12 CPI double-wide	0 216 - 0 254	00 D8 - 00 FF
5 CPI (10 CPI double-wide	0 255 - 0 256	01 00 - FF FF

Table 4. Global Font and Code Page

Code Page	Decimal		Hex	
	Hc	Lc	Hc	Lc
437	1	181	01H	B5H
850	3	82	03H	52H
860	3	92	03H	5CH
863	3	95	03H	5FH
865	3	97	03H	61H
437G	40	197	28H	C5H
813	3	45	03H	2DH
851	3	83	03H	53H
853T	42	101	2AH	65H
857	3	89	03H	59H
869	3	101	03H	65H
920	3	152	03H	98H
1053	4	29	04H	1DH
861	3	93	03H	5DH
1004	3	236	03H	ECH
858	3	90	03H	5AH

Select 12 cpi

This command sets the pitch at 12 cpi.

```
Format    ESC :
Decimal   27  58
Hex       1B  3A
```

Select Print Mode

This command selects the normal font or the download font in Draft , NLQ (248x only) or LQ (249x only).

```
Format    ESC I   n
Decimal   27  73  n
Hex       1B  49  n
```

Usage Note

• This command cancels any print combinations that conflict with ESC I.
• The following table shows valid values for **n** for the 248x and 249x printers:

248x			249x		
Dec	Hex	Print Mode	Dec	Hex	Print Mode
0	00	Draft - Resident	0	00	Normal (Draft) 10 cpi
1	01	Fast DP (12 cpi) - Resident	8	08	Normal (Draft) 12 cpi
2	02	NLQ Gothic - Resident	16	10	Normal (Draft) 17 cpi
3	03	NLQ Courier - Resident	2	02	Normal (LQ) 10 cpi - Courier
4	04	Draft - Download	10	0A	Normal (LQ) 12 cpi - Prestige
5	05	Fast DP (12 cpi) - Download	18	12	Normal (LQ) 17 cpi - Courier
6	06	NLQ - Download	3	03	Normal (LQ) Porportional
7	07	NLQ - Download	4	04	Downloaded 10 cpi Draft
8	08	Draft - Download	12	0C	Downloaded 12 cpi Draft
9	09	Fast DP (12 cpi) - Download	20	14	Downloaded 17 cpi Draft
10	0A	NLQ Gothic - Download	6	06	Downloaded 10 cpi LQ
11	0B	NLQ Courier Italic - Download	14	0E	Downloaded 12 cpi LQ
12	0C	Draft - Download	22	16	Downloaded 17 cpi LQ
13	0D	Fast DP (12 cpi) - Download	7	07	Downloaded Porportional LQ
14	0E	NLQ - Download			
15	0F	ALT NLQ II - Download			

Select Print Type Style

This command is used for varying the type style of the character and the number of line spacing. Use this printer command for:

- Single-high character
- Double-high character
- Single-wide character
- Double-wide character
- Single line feed
- Double line feed
- Italic print (for 249x only)
- Shadow (for 249x only)
- Outline (for 249x only)

Format	ESC	[	@	4	0	0	0	**m3**	**m4**
Decimal	27	91	64	4	0	0	0	**m3**	**m4**
Hex	1B	5B	40	04	00	0	00	**m3**	**m4**

Usage Note

- You may combine these selections; for example, italic print with double-high, double-wide character, and double line feed.

See the following table for **m1**, **m3**, and **m4** selections.

m1		Selection	
Dec	**Hex**		
0		No Change	
1		Start Italic Print (249x only)	
2		Stop Italic Print (249x only)	
4		Start Outline Print (249x only)	
8		Stop Outline Print (249x only)	
16		Start Shadow Print (249x only)	
32		Stop Shadow Print (249x only)	

m3		Height	Line Space
Dec	**Hex**		
0		No Change	No Change
1		Single	No Change
2		Double	No Change
16		No Change	Single
17		Single	Single
18		Double	Single
32		No Change	Single
33		Single	Double
34		Double	Double

m4		Width	
Dec	**Hex**		
0		Unchanged	
1		Single	
2		Double	

Emphasized (Bold) Print

Use this command for bold print.

To begin bold print:

```
Format    ESC E
Decimal   27  69
Hex       1B  45
```

To end bold print:

```
Format    ESC F
Decimal   27  70
Hex       1B  46
```

Double-Strike Print

Double-strike print results in a darker print because the printhead strikes the character twice.

To begin double-strike print:

```
Format    ESC G
Decimal   27  71
Hex       1B  47
```

To end double-strike print:

```
Format    ESC H
Decimal   27  72
Hex       1B  48
```

Superscript or Subscript

To begin superscript:

```
Format    ESC S    n
Decimal   27  83   0
Hex       1B  53   00
```

To end superscript:

```
Format    ESC T
Decimal   27  84
Hex       1B  54
```

To begin subscript:

```
Format    ESC S    n
Decimal   27  83   1
Hex       1B  53   01
```

To end subscript:

```
Format    ESC T
Decimal   27  84
Hex       1B  54
```

Set Print Direction

This command sets the printer to print either unidirectionally or bidirectionally.

```
Format    ESC U    n
Decimal   27  85   n
Hex       1B  55    n
```

Usage Note

The value of **n** can be any of the following:

Decimal	Hex	Direction
0	00	bidirectional (both directions)
1	01	Unidirectional (left to right)

Continuous Double-wide Printing

This command selects or cancels a double-wide printing mode that is not canceled by line feed terminators.

```
Format    ESC  W    n
Decimal   27   87   n
Hex       1B   57   n
```

Usage Note

The value of **n** can be any of the following:

Decimal	Hex	Direction
0	00	Cancels double-wide printing mode
1	01	Sets double-wide printing mode.

Score Select

For 249x printers only.

This command selects several forms of overscore, underscore, and strikethrough.

```
Format    ESC  [    -    2    0   loc type
Decimal   27   91   45   2    0   loc type
Hex       1B   5B   2D   02   00  loc type
```

To select **loc**:

	Underscore	Strikethrough	Overscore
Decimal	1	2	3
Hex	01	02	03

To select **type**:

	Cancel	Single	Double
Decimal	0	1	2
Hex	00	01	02

Usage Note

To cancel this command, designate type as Dec 255 or Hex FF.

Continuous Underline

This command begins and ends continuous underline of spaces and characters.

To begin Continuous Underline:

```
Format    ESC -    n
Decimal   27  45   1
Hex       1B  2D   01
```

To end Continuous Underline:

```
Format    ESC -    n
Decimal   27  45   0
Hex       1B  2D   00
```

Continuous Overscore

This command prints a line above spaces and characters.

To begin Continuous Overscore:

```
Format    ESC _    n
Decimal   27  95   1
Hex       1B  5F   01
```

To end Continuous Overscore:

```
Format    ESC _    n
Decimal   27  95   0
Hex       1B  5F   00
```

Set Print Quality

This command sets the print quality to draft or letter quality.

```
Format    ESC [    d  1   0  n
Decimal   27  91  100  1   0  n
Hex       1B  5B   64 01  00  n
```

Usage Notes

- For 2480 printers, the value of **n** can be any of the following:

Decimal	Hex	
0	00	No Change
1 to 63	01 to 3F	Fast Draft
64 to 127	40 to 7F	Draft
128 to 254	80 to FE	Near Letter Quality
255	FF	Default Quality

- For 2490 printers, the value of **n** can be any of the following:

Decimal	Hex	
0	00	No Change
1 to 63	01 to 3F	Fast Draft
64 to 127	40 to 7F	Draft
128 to 191	80 to BF	Letter Quality
192 to 254	CO to FE	Enhanced Letter Quality
255	FF	Default Quality

Graphics Print Modes

Normal Density Bit Image Graphics

Use this command to print normal density bit images at 60 dots per inch (dpi) horizontally and 72 dpi vertically.

```
Format     ESC K   Ln   Hn   data

Decimal    27  75  Ln   Hn   data

Hex        1B  4B  Ln   Hn   data
```

Usage Notes

- **Ln** and **Hn** identify the number of bytes in data.
  To print less than 256 bytes:
  — **Hn** is 0.
  — **Ln** is the number of bytes you want to print.
  To print more than 256 bytes:
  — Divide the number of bytes you want to print by 256.
  — The result is **Hn**.
  — The remainder is **Ln**.
- **data** is the bit-mapped graphics information.

Each vertical dot column can have **8** rows of dots. To print bit image graphics, the printer uses either the first **8** (248x) or 20 (249x) wires of the printhead to map the eight bits of data. The following table shows how the print wires are mapped for the 249x printer:

Bit Number	Binary Value	Print Wires
7	128	1, 2 If dots 7 and 6 print, wire 3 is also used
6	64	4, 5
5	32	6, 7 If dots 5 and 4 print, wire 8 is also used.
4	16	9, 10
3	8	11, 12 If dots 3 and 2 print, wire 13 is also used.

Bit Number	Binary Value	Print Wires
2	4	14, 15
1	2	16, 17 If dots 1 and 0 print, wire 18 is also used.
0	1	19, 20

Mode and Horizontal Density (249x Only)

For 249x printers only.

Use this command to select the mode and horizontal density for dot matrix graphics.

```
Format    ESC [     g  Ln  Hn  mode  data
Decimal   27  91  103  Ln  Hn  mode  data
Hex       1B  5B   67  Ln  Hn  mode  data
```

Usage Notes

• **Ln** and **Hn** identify the number of bytes in **mode** and **data**.

To print less than 256 bytes:

— **Hn** is 0.

— **Ln** is the number of bytes you want to print, plus 1 for the mode byte.

To print more than 256 bytes:

— Divide the number of bytes you want to print (plus 1 mode byte) by 256.

— The result is **Hn**.

— The remainder is **Ln**.

• **mode** is the vertical wire count and the horizontal density in dots per inch. Select mode from the following table.

Mode			
Dec	**Hex**	**Horizontal Density**	**Wires**
0	00	60	8
1	01	120	8
2	02	120	8
3	03	240	8

Mode		Horizontal Density	Wires
Dec	Hex		
8	08	60	24
9	09	120	24
11	0B	180	24
12	0C	360	24
13	0D	120	24
14	0E	180	24
16	10	360	48

•   **data** is the bit-mapped graphics information. The printhead moves at half the speed of mode 2, giving better resolution.

Dual-Density Bit Image Graphics (Half Speed)

Use this command to print normal density bit images at 120 dpi horizontally and 72 dpi vertically.

```
Format     ESC L   Ln   Hn   data

Decimal    27  76  Ln   Hn   data

Hex        1B  4C  Ln   Hn   data
```

Usage Notes

•   **Ln** and **Hn** identify the number of bytes in data.

   To print less than 256 bytes:

   —   **Hn** is 0.

   —   **Ln** is the number of bytes you want to print.

   To print more than 256 bytes:

   —   Divide the number of bytes you want to print by 256.

   —   The result is **Hn**.

   —   The remainder is **Ln**.

•   **data** is the bit-mapped graphics information.

Dual-Density Bit Image Graphics (Normal Speed)

Use this command to print dual-density bit images at 120 dpi horizontally and 72 dpi vertically.

```
Format    ESC Y   Ln   Hn   data

Decimal   27  89   Ln   Hn   data

Hex       1B  59   Ln   Hn   data
```

Usage Notes

- **Ln** and **Hn** identify the number of bytes in data.
  To print less than 256 bytes:
  — **Hn** is 0.
  — **Ln** is the number of bytes you want to print.
  To print more than 256 bytes:
  — Divide the number of bytes you want to print by 256.
  — The result is **Hn**.
  — The remainder is **Ln**.
- **data** is the bit-mapped graphics information.

High-Density Bit Image Graphics

Use this command to print high-density bit images at 240 dpi horizontally and 72 dpi vertically.

```
Format    ESC Z   Ln   Hn   data

Decimal   27  90   Ln   Hn   data

Hex       1B  5A   Ln   Hn   data
```

Usage Notes

- **Ln** and **Hn** identify the number of bytes in data.
  To print less than 256 bytes:
  — **Hn** is 0.
  — **Ln** is the number of bytes you want to print.
  To print more than 256 bytes:
  — Divide the number of bytes you want to print by 256.
  — The result is **Hn**.
  — The remainder is **Ln**.
- **data** is the bit-mapped graphics information.

Horizontal Movement

Set Horizontal Tabulation Stops

This command sets up to 28 tabulation stops to be used with the printer command HT, Horizontal Tabulation.

```
Format     ESC D   tab stops   0

Decimal    27  680 n1.....n28   0

Hex        1B  44  n1.....n28  00
```

Usage Notes

n1.....n28 is used to set the tabulator stop positions.

- ESC D is terminated by a 0 entry.
- The first tabulation stop is at the leftmost column.
- Input the tabulation stops (**n1.....n28**) in ascending numerical order.
- ESC D 0 clears all existing horizontal tab stops.
- The printer command ESC R resets to the default horizontal tabulation stops, which are set at every eight positions beginning at column 9 (9, 17, 25, and so on).
- The printer command HT, Horizontal Tabulation, activates the tabulation stops set by this printer command.

Set Default Tabulation Stops

This command sets the tabulation stops to the default settings. The default tabulation stops are set to every 8 columns, beginning at column 9 (9, 17, 25, and so on).

```
Format     ESC R

Decimal    27  82

Hex        1B  52
```

Usage Notes

- ESC R clears all vertical tabulation stops.
- To set user-defined tabulation stops, use printer command ESC D.

Set Horizontal Margins

This command sets the left and right margins.

```
Format    ESC X    n1   n2
Decimal   27  88   n1   n2
Hex       1B  58   n1   n2
```

Usage Notes

- Use **n1** to select the left margin position.
- Use **n2** to select the right margin position.
- Margins are specified in the character positions at the current pitchand are stored in absolute displacement from the left edge of the paper.
- The values for **n1** and **n2** must be between 0 and 255. If the value is set at 0, the margin is left unchanged.

Move Current Print Position

This command moves the current print position to the right in increments of 1/120 inch.

```
Format    ESC d    increment
Decimal   27  100  Ln    Hn
Hex       1B  64   Ln    Hn
```

Usage Notes

To move less than 256 increments:

- **Hn** is 0.
- **Ln** is the increment you want to move.

To move more than 256 increments:

- Divide the number of increments you want to move by 256.
  - — The result is **Hn**.
  - — The remainder is **Ln**.

Line Control

Automatic Line Feed (LF)

Executes an automatic line feed when a carriage return is received.

To begin automatic line feed (LF) on carriage return (CR):

```
Format    ESC 5    Begin
Decimal   27  53   1
Hex       1B  35   01
```

To end automatic line feed (LF) on carriage return (CR):

```
Format    ESC 5    End
Decimal   27  53   0
Hex       1B  35   00
```

Reverse Line Feed

Causes a reverse line feed; the paper is reversed according to the current line spacing.

```
Format    ESC ]
Decimal   27  93
Hex       1B  5D
```

We do *not* recommend using this command.

Move Paper Vertically

Advances the paper in a vertical movement a distance of **n**/216 inches relative to the current print position.

```
Format    ESC J    n
Decimal   27  74   n
Hex       1B  4A    n
```

Usage Notes

- **n** is a value from 0 to 255 (decimal) or 0 to FF (hex).
- **n** must be a multiple of 3 to advance exactly **n**/216 inch.

Set Vertical Units

For 249x printers only.

This command lets you set the size of the increments for the following commands:

- Set Line Spacing for Graphics (ESC 3)
- Move Paper Vertically (ESC J).

```
Format    ESC  [   \    4    0    0    0   m3   m4
Decimal   27  91  92    4    0    0    0   m3   m4
Hex       1B  5B  5C   04   00   00   00   m3   m4
```

Usage Notes

- **4 0 0 0** (decimal), **04 00 00 00** (hex) are constant digits.
- **m3** and **m4** designate the denominator (the lower number) of a two-part fraction. The fraction can be 1/180, 1/216, or 1/360, and indicates the fraction of an inch at which line feed spacing increments .

m3 (Hex)	m4 (Hex)	Denominator
D8H	00H	216
B4H	00H	180
68H	01H	360

Vertical Tabulation

Set Vertical Tabulation Stops

Sets as many as 64 tabulation stops by line number.

```
Format    ESC  B   tab settings   0
Decimal   27  66   n1.....n64      0
Hex       1B  42   n1.....n64     00
```

Usage Notes

- Use ESC B to set the tabulation stops and to advance paper to the next vertical tabulation stop (VT) to activate them.

- ESC R (Set Default Tabulation Stops) and ESC B 0 will clear all vertical tab stops.
- Set the tabulation stops in ascending order (n1.....n64).
- The last digit in the sequence must be a 0 to terminate the command.

Line Spacing

Set Line Spacing to 1/8 Inch

This command (ESC zero) sets the line spacing at 1/8 inch between each line, which is 8 lines per inch (lpi).

```
Format    ESC 0
Decimal   27  48
Hex       1B  30
```

Set Line Spacing to 7/72 Inch

This command sets the line spacing at 7/72 inch between each line, which is 10.3 lpi.

```
Format    ESC 1
Decimal   27  49
Hex       1B  31
```

Activate Line Spacing for Text

This command activates the line spacing designated by the Set Line Spacing for Text (ESC A) printer command.

```
Format    ESC 2
Decimal   27  50
Hex       1B  32
```

Set Line Spacing for Text

This command sets line spacing in **n**/72 inch increments. To activate the line spacing, use the printer command Activate Line Spacing for Text (ESC 2).

```
Format    ESC A   n
Decimal   27  65  n
Hex       1B  41  n
```

Usage Note

The value for **n** must be between 1 and 85.

Set Line Spacing for Graphics

This command sets line spacing to n/216 inches. It does not cause the form to move. It changes the vertical distance moved when a line feed command is received.

```
Format    ESC 3   n
Decimal   27  51  n
Hex       1B  33  n
```

Usage Notes

• The number can be from 0 to 255 (decimal), 00 to FF (hexadecimal).
• **n** must be a multiple of 3 to advance exactly **n**/216 inches.

Porportional Space Mode

This command turns porportional space mode on and off.

```
Format    ESC P   n
Decimal   27  80  n
Hex       1B  50  n
```

Usage Notes

• Porportional spacing is ON when n is set to 0 (decimal) or 00 (hexadecimal).
• Porportional spacing is OFFwhen n is set to 1 (decimal) or 01 (hexadecimal).

Set Top of Form and Page Length

Set Top of Form

This command sets the first line of printing on each page to the current paper position.

```
Format    ESC  4

Decimal   27   52

Hex       1B   34
```

Set Page Length in Inches

This command sets the page length to a specified number of inches.

```
Format    ESC  C     0   inches

Decimal   27   67    0   n

Hex       1B   43    00  n
```

Usage Notes

- The value of **n** is the number of inches you want to set as the page length and must be between 1 and 255.
- When the command is sent, the current vertical position becomes the new top of form.
- If the printer command Set Skip Perforation (ESC N) is active, or if "skip over perforation" is On in the printer setup, this printer command deactivates it.

Set Page Length in Lines

This command sets the page length to a specified number of lines.

```
Format    ESC  C    lines

Decimal   27   67   n

Hex       1B   43   n
```

Usage Notes

- The value of **n** is the number of lines you want to set as the page length and works in conjunction with the current line spacing (ESC A).

- When the command is sent, the current vertical position becomes the new top of form.
- If the printer command Set Skip Perforation (ESC N) is active, or if "skip over perforation" is On in the printer setup, this printer command deactivates it.

Set Skip Perforation

This command specifies the number of lines to be skipped at the bottom of each page, which creates a bottom margin.

```
Format    ESC N    lines
Decimal   27  78   n
Hex       1B  4E   n
```

Usage Notes

- This command remains in effect until:
  — Cancel Skip Perforation (ESC O) printer command is received.
  — Set Page Length in Lines (ESC C) printer command is received.
  — Set Page Length in Inches (ESC C 0) printer command is received.
- Valid values for n are 1 through 255 (decimal), 01 through FF (hexadecimal).
- To cancel this printer command, use Cancel Skip Perforation (ESC O).

Cancel Skip Perforation

This command cancels Set Skip Perforation (ESC N).

```
Format    ESC O
Decimal   27  79
Hex       1B  4F
```

Printer Control

Deselect Printer

When this command is sent, the printer ignores all data except DC1 .

```
Format    ESC Q   n
Decimal   27  81  n
Hex       1B  51  n
```

The following values of **n** are valid:

Model	Dec	Hex	Mode Setting
2480	3	03	ON
	182	B6	OFF
2481	22	16	ON
	184	B8	OFF
2490		23H	
		B9H	
2491		24H	
		B7H	

Setup Barcode Parameter

This command sets the barcode parameters to the printer.

```
Format    ESC [   f   6    0  k  m  s  v1  v2  c
Decimal   27  91  102 6    0  k  m  s  v1  v2  c
Hex       1B  5B  66  06  00  k  m  s  v1  v2  c
```

Usage Note

The printer must receive this command prior to the barcode data command.

The barcode type is denoted by **k**. The following values are valid for **k**:

k		Barcode Type
Dec	**Hex**	
177	B1	<reserved>
178	B2	EAN-13
179	B3	EAN-8
180	B4	CODE 39
181	B5	<reserved>
182	B6	INTERLEAVED 2 of 5
183	B7	UPC-A
184	B8	<reserved>
185	B9	POST-NET (barcode)
186	BA	CODE 128

Module width is denoted by **m**. When **m** is 1, the barcode prints by
1/360 or 1/240 full dot method. For all other values, the barcode prints by half
dot method. The suggested values for m are as follows:

m		Unit Module Dots	Width	
Dec	**Hex**		**24 wire**	**9 wire**
0	00		0.015 in.	0.021 in.
1	01		0.012 in.	0.017 in.
2	02		0.015 in.	0.021 in.
3	03		0.021 in.	0.030 in.
4	04		0.026 in.	0.038 in.

The variable **s** denotes the space width adjustment and affects the barcode
printing width. The value for **s** may range from 3 (03 hex) to -3 (FD hex),
however, 0 is the default value. The adjustment unit for 24 wire printers is
1=1/360 in. and for 9 wire printers the unit is 1=1/240 in.

The variables **v1** and **v2** control the bar length. The minimum value of v1, v2 is
288 dec (24 wire) and 270 (9 wire).

The variable c denotes the control code. The control is made up of 8 bits (b1 - b8). The 8 bits are defined as follows:

b1   Check Digit

b2   Human Readable Character (0: print On, 1: print Off)

b3   EAN-13, UPC-A flag character position (0: Center, 1: Under)

b4 -**b8** Not used

Setup Barcode Data

This command sets the barcode data on the current printing position. .

```
Format    ESC [   p   n1   n2    d1   d2
Decimal   27  91  112 n1   n2    d1   d2
Hex       1B  5B  70  n1   n2    d1   d2
```

Usage Notes

*   The printer must receive the ESC [f command prior to the ESC [p command.
*   The barcode prints after the printer receives the LF line feed command.

Command length is denoted by **n1** and **n2**. The following values are valid for **n1** and **n2** when the automatic check digit generation flag is on and when it is off:

Automatic Check Digit Generation Flag Off				
n1 (low byte)		n2(high byte)		Barcode Type
Dec	Hex	Dec	Hex	
13	0D	0	00	EAN-13
8	08	0	00	EAN-8
1 to 255	01 to FF	0	00	CODE 39
1 to 255	01 to FF	0	00	INTERLEAVED 2 of 5
12	0C	0	00	UPC-A
10	0A	0	00	POST-NET (barcode)
2 to 255	02 to FF	0	00	CODE 128

Automatic Check Digit Generation Flag On				
n1 (low byte)		**n2(high byte)**		**Barcode Type**
Dec	**Hex**	**Dec**	**Hex**	
12	0C	0	00	EAN-13
7	07	0	00	EAN-8
1 to 255	01 to FF	0	00	CODE 39
1 to 255	01 to FF	0	00	INTERLEAVED 2 of 5
11	0B	0	00	UPC-A
9	09	0	00	POST-NET (barcode)
2 to 255	02 to FF	0	00	CODE 128

Epson Emulation Mode Printer Commands

This section provides tables describing Epson mode commands you can use with your printer.

Font Selection

Name	Dec	Hex	Description
ESC %	27 37 *n*	1B 25 *n*	**Select User-defined Set** *n*=0 Selects the resident set. *n*=1 Selects the user-defined set.
ESC (-	27 40 45 3 0 1 *d1 d2*	1B 28 2D 03 00 01 *d1 d2*	**Select Score (249x only)** *d1*=1 Underline *d1*=2 Strike-through *d1*=3 Overscore *d2*=0 Cancel *d1* selection *d2*=1 Single continuous line *d2*=2 Double continuous line *d2*=5 Single broken line *d2*=6 Double broken line
ESC I	27 73 *n*	1B 49 *n*	**Printable Code Area Expansion (248x only)** *n*=1 Allows non-printable codes to be used for user-defined characters. *n*=0 Cancels *n*=1 selection.

Name	Dec	Hex	Description
ESC R	27 82 n	1B 52 n	**Select an International Character Set** n=0 USA n=1 France n=2 Germany n=3 U.K. n=4 Denmark 1 n=5 Sweden n=6 Italy n=7 Spain 1 n=8 Japan n=9 Norway n=10 Denmark 2 n=11 Spain 2 n=12 Latin America n=13 Korea (*249x only*) n=64 Legal (*249x only*)

Name	Dec	Hex	Description
ESC k	27 107 *n*	1B 6B *n*	**248x: Select Near-Letter-Quality Font** Selects the font to be used in NLQ mode. *n*=0 Courier *n*=1 Gothic **249x: Select Letter-Quality Font** Selects the font to be used in LQ mode. *n*=0 Prestige *n*=1 Gothic *n*=2 Courier *n*=3 Prestige *n*=4 Script *n*=5 Gothic *n*=6 Gothic *n*=7 Orator *n*=8 Presentor
ESC q	27 113 *n*	1B 71 *n*	**Select Character Style (249x only)** *n*=0 Normal *n*=1 Outline *n*=2 Shadow *n*=3 Outline with shadow
ESC t	27 116 *n*	1B 74 *n*	**Select Character Tables** Selects italic or character graphics as the extended character. *n*=0 Italics Character table *n*=1 Epson Extended Graphics table *n*=2 User-defined Character table (*249x only*)
ESC x	27 120 *n*	1B 78 *n*	**248x: Select Near Letter Quality or Draft** *n*=0 Selects Draft mode *n*=1 Selects NLQ mode **249x: Select Letter Quality or Draft** *n*=0 Selects Draft mode *n*=1 Selects LQ mode

Name	Dec	Hex	Description
ESC (t	27 40 116 3 0 d_1 d_2 d_3	1B 28 74 3 0 d_1 d_2 d_3	**Assign Character Tables**

Parameter range

$0 \leq d_1 \leq 1$, $48 \leq d_1 \leq 50$
$0 \leq d_2 \leq 255$
$d_3 = 0, 16$

Function
Assigns the d_2 and d_3 registered character table to the d_1 character table according to the following values (the d_1 character table is one of the four tables selectable with the ESC t command):

d_2	d_3	Table/Code Page
0	0	Italic table
1	0	Graphic table/437
1	16	Graphic table/437G
2	16	Graphic table/813
3	0	Graphic table/850
3	16	Graphic table/858
4	0	Graphic table/851
4	16	Graphic table/920
5	0	Graphic table/853T
5	16	Graphic table/1053
6	16	Graphic table/1004
7	0	Graphic table/860
8	0	Graphic table/863
9	0	Graphic table/865
11	0	Graphic table/857
15	0	Graphic table/869
24	0	Graphic table/861

Text Print Mode

Name	Dec	Hex	Description
ESC M	27 77	1B 4D	**Print 12 Characters per Inch**
ESC P	27 80	1B 50	**Print 10 Charaters per Inch**
ESC SP	27 32 n	1B 20 n	**Set Variable Character Spacing** Sets additional space to the right of each character, which is added to the original space alloted to the character cell, $n/120$ inch. n can be a value of 0 to 127.
ESC !	27 33 n	1B 21 n	**Select Print Style** Selects the print style as indicated in the n parameter. See the table on page 70 for the print styles available.
DC2	18	12	**Cancel Condensed Mode**
ESC 4	27 52	1B 34	**Start Italic Printing**
ESC 5	27 53	1B 35	**Stop Italic Printing**
ESC –	27 45 n	1B 2D n	**Begin or End Continuous Underline** n=0 End n=1 Begin
ESC E	27 69	1B 45	**Begin Emphasized Printing**
ESC F	27 70	1B 46	**End Emphasized Printing**
ESC G	27 71	1B 47	**Begin Double-Strike Printing**
ESC H	27 72	1B 48	**End Double-Strike Print**
ESC p	27 112 n	1B 70 n	**Proportional Spacing Mode** n=0 End n=1 Begin
ESC S	27 83 n	1B 53 n	**Begin Superscript or Subscript** n=0 Superscript n=1 Subrscript
ESC T	27 84	1B 54	**End Superscript or Subscript**

Name	Dec	Hex	Description
ESC a	27 97 *n*	1B 61 *n*	**Select Justification** *n*=0 prints the line of characters against the left margin. *n*=1 centers the line of characters between the left and right margins. *n*=2 prints the line of characters against the right margin. *n*=3 causes lines of characters to be printed evenly along both the left and right edges when the buffer becomes full.
ESC w	27 119 *n*	1B 77 *n*	**Begin or End Double-high Printing** *n*=0 End *n*=1 Begin
DEL	127	7F	**Delete Text** Deletes the text character at the end of a print line.

The following table lists the *n* parameters for the ESC ! command.

n=	On	Off	Dec	Hex	Print Style
0	No	Yes	0	00	10 cpi
	Yes	No	1	01	12 cpi
1	Yes	No	2	02	Proportional
2	Yes	No	4	04	Condensed
3	Yes	No	8	08	Emphasized
4	Yes	No	16	10	Double-Strike
5	Yes	No	32	20	Double-Wide
6	Yes	No	64	40	Italic
7	Yes	No	128	80	Underscore

Graphics Print Modes

Name	Dec	Hex	Description
ESC ^	27 94 *m Ln Hn data*	1B 5E *m Ln Hn data*	**9-Pin Graphics Mode (248x only)** Prints 9-pin bit-image graphics. *m*=0 Normal density (60 dpi) *m*=1 Dual density (120 dpi) *m*=2 High speed dual density (120 dpi) *m*=3 Quadruple density (240 dpi)
ESC ?	27 63 *n1 n2*	1B 3F *n1 n2*	**Change Graphics Mode Command** Changes the graphic mode assigned to a graphics mode command. *n1*=K Normal density *n1*=L Dual density *n1*=Y High speed, dual density *n1*=Z Quadruple density *n2* 0, 1, 2, 3, 4, 6, 7, 32, 33, 38, 39, and 40 (Decimal) Selects the graphic mode number to be assigned to the graphics mode command specified by the ESC * command. See the ESC * command on page 72.
ESC K	27 75 *Ln Hn data*	1B 4B *Ln Hn data*	**Normal Density Bit Image Graphics** Prints normal density bit images at 60 dpi horizontally and 72 dpi vertically.
ESC L	27 76 *Ln Hn data*	1B 4C *Ln Hn data*	**Dual Density Bit Image Graphics** Prints normal density bit images at 120 dpi horizontally and 72 dpi vertically.
ESC Y	27 89 *Ln Hn data*	1B 59 *Ln Hn data*	**Dual Density Bit Image Graphics (HighSpeed)** Prints dual density bit images at 120 dpi horizontally and 72 dpi vertically.
ESC Z	27 90 *Ln Hn data*	1B 5A *Ln Hn data*	**Quadruple Density Bit Image Graphics** Prints high density bit images at 240 dpi horizontally and 72 dpi vertically.

Name	Dec	Hex	Description
ESC *	27 42 *n Ln Hn data*	1B 2A *n Ln Hn data*	**Set Graphics Mode** Prints bit-image graphics in the mode specified by *n*. See the following tables for modes that can be specified by parameter *n*.

248x Graphic Modes that can be specified by parameter *n* in the ESC * command:

n=	Density	Dots per Inch (dpi)	Equivalent Command
0	Normal	60	ESC K
1	Dual	120	ESC L
2	Dual (High speed)	120	ESC Y
3	Quadruple	240	ESC Z
4	CRT-I Screen	80	None
5	Plotter (1:1)	72	None
6	CRT-II Screen	90	None
7	Dual Plotter	144	None

249x Graphic Modes include 0, 1, 2, 3, 4 and 6 from the 248x table above and the following additional values of *n* in the ESC * command:

n=	Density	Dots per Inch (dpi)	Equivalent Command
32	High resolution for ESC K	60	None
33	High resolution for ESC L	120	None
38	CRT-III Screen	90	None
39	High resolution, triple density	180	None
40	High resolution, hex density	360	None

Horizontal Movement

Name	Dec	Hex	Description
BS	8	08	**Backspace** Moves left one space, based on pitch setting.
HT	9	09	**Horizontal Tab** Moves right to the next horizontal tab stop. Tab is set with the ESC D command.
ESC D	27 68 0 *n1 n2...n32* 0	1B 44 0 *n1, n2...n32* 00	**Set Horizontal Tab Stops** Sets up to 32 tabs by column number (n1...n32) in ascending order. The sequence ends with 0.
ESC $	27 36 *n1 n2*	1B 24 *n1 n2*	**Set Absolute Print Position** Offsets the print position by an absolute distance from the left margin. The formula for calculating offset is: $(n1 + (n2 \times 256))/60$ (inch).
CR	13	0D	**Carriage Return** Moves print position horizontally to the left margin.
SP	32	20	**Space** Moves print position one print column to the right.
ESC I	27 108 *n*	1B 6C *n*	**Set Left Margin** Sets the left margin in character positions at the current pitch. Left margin=*n* (character) x cpi
ESC Q	27 81 *n*	1B 51 *n*	**Set Right Margin** Sets the right margin in character positions at the current pitch.
ESC \	27 92 *n1 n2*	1B 5C *n1 n2*	**Set Relative Position** Offsets the print position by the relative distance from the current position. Offset=$(n1 + (n2 \times 256))/120$ (inch).

Vertical Movement

Name	Dec	Hex	Description
LF	10	0A	**Line Feed** Advances the form one line.
VT	11	0B	**Vertical Tab** Advances the paper to the next vertical tab stop.
ESC B	27 66 0 *n1* *n2...n16* 0	1B 42 0 *n1, n2...n16* 00	**Set Vertical Tab Stops** Sets up to 16 tab stops. The sequence ends with 0.
FF	12	0C	**Form Feed** Advances the paper to the top of the next page.
ESC J	27 74 *n*	1B 4A *n*	**Relative Move Base Line** Advances the paper by $n/216$ inches on 248x printer; $n/180$ inches on 249x printer.
ESC j	27 106 *n*	1B 6A *n*	**Reverse Relative Move Base Line** Feeds the paper by $n/216$ inches in the reverse direction on 248x printer; $n/180$ inches in the reverse direction on 249x printer.
ESC b	27 98 *m* *n1...n8* 0	1B 62 *m* *n1...n8* 00	**Set Vertical Tabs in Channel** Sets vertical tab stops in specified channel by *m*. *m* must be a one-byte decimal value from 0 to 7.
ESC Q	27 81 *n*	1B 51 *n*	**Set Right Margin** Sets the right margin in character positions at the current pitch.
ESC /	27 47 *n*	1B 2F *n*	**Select Vertical Tab Channel**

Line Spacing

Name	Dec	Hex	Description
ESC +	27 43	1B 2B	**Set n/360 Line Spacing - 249x only**
ESC 0	27 48	1B 30	**Set 1/8 Inch Line Spacing** Sets line spacing to eight lines per inch.
ESC 1	27 49	1B 31	**Set 7/72 Inch Line Spacing - 248x only** Sets line spacing to 7/72 lines per inch.
ESC 2	27 50	1B 32	**6 Lines Per Inch** Sets line spacing to six lines per inch.

Name	Dec	Hex	Description
ESC 3	27 51 *n*	1B 33 *n*	**Set Graphics Line Spacing - 248x only** Use a line spacing of 24/216 for bit-image graphics using 8 bits. *n* must be a 1-byte decimal value from 0 to 255. To move exactly n/216 inch per line, n must be an integer multiple of 3. **Set Graphics Line Spacing - 249x only** Sets line spacing to *n*/180 inches per line.
ESC A	27 65	1B 41	**Set n/72 Inch Line Spacing** Sets line spacing to n/72 inch for subsequent line feed command. The value of *n* must be between 0 and 85.
ESC b	27 98 *m* *n1...n16* 0	1B 62 *m* *n1...n8* 00	**Set Vertical Tabs in Channel** Sets vertical tab stops in specified channel by *m*. *m* must be a one-byte decimal value from 0 to 7.

Page Format

Name	Dec	Hex	Description
ESC C 0	27 67 0 *m*	1B 43 00 *m*	**Set Page Length to *m* Inches**
ESC C	27 67 *n*	1B 43 *n*	**Set Page Length to *n* Lines**
ESC N	27 78 n	1B 4E n	**Set Skip Perforation** Creates a bottom margin by skipping *n* lines. Valid values of *n* are 0 through 255.
ESC O	27 79	1B 4F	**Cancel Skip Perforation** Cancels the skip perforation function.

Printer Control

Name	Dec	Hex	Description
ESC s	27 115	1B 73	**Turn Half Speed Mode On/Off -248x only**
ESC EM	27 25 *n*	1B 19 *n*	**Auto Sheet Feeder On/Off** *n*=0 Off *n*=4 On *n*=R Eject
ESC B	27 66 0 *n1* *n2...n16* 0	1B 42 0 *n1,* *n2...n16* 00	**Set Vertical Tab Stops** Sets up to 16 tab stops. The sequence ends with 0.
FF	12	0C	**Form Feed** Advances the paper to the top of the next page.

Name	Dec	Hex	Description
BEL	7	07	**Beeper** Sounds the printer beeper for approximately 1 second.
DC1	17	11	**Select Printer** (XON) The host sends this command to signal the printer to begin printing data.
DC3	19	13	**Null** (XOFF)
CAN	24	18	**Cancel Data** Clears data received since the last buffer terminator.
NUL	0	00	**Null**
ESC U	27 85 n	1B 55 n	**Set Print Direction** n=0 bidirectional n=1 unidirectional
ESC @	27 64	1B 40	**Initialize Printer** Clears all data stored in the printer buffer.
ESC [K	27 91 75	1B 5B 4B	**Set Initial Condition** Resets the printer to its original state. (This command is the same as ESC [K command in IBM mode. See page 32.)
ESC K	27 91 75	1B 5B 4B	**String Descriptor Download Command** Resets the printer to user default settings after downloading the string descriptor to the printer. (This command is the same as ESC K command in IBM mode. See page 32.)

Other Commands

Name	Dec	Hex	Description
ESC 6	27 54	1B 36	**Printable Code Area Expansion**
ESC 7	27 55	1B 37	**Cancel Printable Code Area Expansion**
ESC 8	27 56	1B 38	**Disable Paper-out Sensor (248x only)** Turns off the paper-out sensor to allow printing to the end of a paper.
ESC 9	27 56	1B 38	**Disable Paper-out Sensor (248x only)** Cancels ESC 8.
ESC #	27 35	1B 23	**Disable Control of MSB** Disables the control of the MSB value set by ESC = or ESC >.

Name	Dec	Hex	Description
ESC &	27 38 0 *n1 n2 d1 data*	1B 26 0 *n1 n2 d1 data*	**Define Download Characers**
ESC :	27 58 0 *n* 0	1B 3A 00 *n* 00	**Copy Normal Characters from ROM to RAM**
ESC <	27 60	1B 3C	**Select Left-to-Right Printing**
ESC =	27 61	1B 3D	**Set MSBs to Zero** Sets the MSBs of all data sent to the printer to 0.
ESC >	27 62	1B 3E	**Set MSBs to One** Sets the MSBs of all data sent to the printer to 1.
ESC W	27 87 *n*	1B 57 *n*	**Begin or End Continuous Double-Wide Printing** *n*=0 End *n*=1 Begin
ESC [f	27 91 102	1B 5B 66	**Setup Barcode Parameter** This command is the same as the ESC [f command in the IBM mode. (See page 32.)
ESC [f	27 91 112	1B 5B 70	**Setup Barcode Data** This command is the same as the ESC [p command in the IBM mode. (See page 32.)
SI	15	0F	**Start 17 cpi printing**
SO	14	0E	**Begin Double-Wide Printing by Line**
ESC SO	27 14	1B 0E	**Select Double-Wide**
ESC SI	27 15	1B 0F	**Select Condensed Mode**
DC2	18	12	**Cancel Condensed Mode**
DC4	20	14	**End Double-Wide Printing by Line**
ESC :	27 58	1B 3A	**Set 12 Pitch Font**

OKI Microline Emulation Mode Printer Commands

This section provides tables describing OKI Microline mode commands you can use with your printer.

Character Set

Name	Dec	Hex	Description
ESC ! 0	27 33 48	1B 21 30	**Select Standard Character Set**
ESC ! 1	27 33 49	1B 21 31	**Select Block Graphics Character Set**
ESC ! 2	27 33 50	1B 21 31	**Select Line Character Set**
ESC ! *n*	27 33 *n*	1B 21 *n*	**Select an International Character Set** *n* Character Set *Dec* *Hex* 64 40 USA 65 41 USA 2 66 42 British 70 46 Danish 72 48 Dutch 68 44 French 74 4A Fr. Canadian 67 43 German 73 49 Italian 76 4C Latin Am. 71 47 Norway 90 5A Publisher 75 4B Spaini 69 45 Swedish

Name	Dec	Hex	Description
ESC [T	27 91 84 L_n H_n 0 0 H_{cp} L_{cp} 0	1B 5B 54 L_n H_n 0 0 H_{cp} L_{cp} 04	**Print from Code Page** If printing less than 256 characters: L_n = # characters to be printed H_n = 0 If printing more than 256 characters, divide the total number of characters by 256: L_n = whole number of quotient H_n = remainder of quotient H_{cp} L_{cp} **Code Page Set** **Decimal** 1 181 USA 2 82 Multilingual 3 92 Canadian French 3 95 Portugal 3 97 Norway 4 16 BRASCII 4 17 Abicomp H_{cp} L_{cp} **Code Page Set** **Hexadecimal** 01 B5 USA 02 52 Multilingual 03 5C Canadian French 03 5F Portugal 03 61 Norway 04 10 BRASCII 04 11 Abicomp

Character Size and Spacing

Name	Dec	Hex	Description
RS	30	1E	**Print 10 Characters per Inch**
FS	28	1C	**Print 12 Charaters per Inch**
ESC g	27 103	1B 67	**Print 15 Charaters per Inch**
GS	29	1D	**Print 17.1 Charaters per Inch**
ESC # 3	27 35 51	1B 23 33	**Print 20 Charaters per Inch**
ESC J	27 74	1B 4A	**Start Superscript Printing**
ESC K	27 75	1B 4B	**Stop Superscript Printing**
ESC L	27 76	1B 4C	**Start Subscript Printing**
ESC M	27 77	1B 4D	**Stop Subscript Printing**
ESC US	31	1F	**Begin Double-Width Printing**
ESC US 1	27 31 49	1B 1F 31	**Begin Double-Height Printing**
ESC US 0	27 31 48	1B 1F 30	**End Double-Height Printing**
ESC &	27 38 *n1 n2 n3 n4* 58	1B 26 *n1 n2 n3 n4* 3A	**Select Print Features** Selects print quality, character pitch and other print features. See the Table 1 on page 82 for the features applicable to each variable and the value of each. To calculate the total value of a variable, add the values (column 1) of each feature you want to use, and then add that sum to the variable factor (bottom row). **Note:** You may enter any combination of the variables (*n1* to *n4*) in any order.
ESC Y	27 89	1B 59	**Select Porportional Spacing** Adjusts the space between letters to compensate for the varying widths of individual characters. **Note:** Available only with Near Letter Quality (NLQ) and Draft printing.
ESC Z	27 90	1B 5A	**Cancel Porportional Spacing**
ESC N	27 78 *n*	1B 4E *n*	**Select Intercharacter Spacing** Adds additional spacing to the right of each character. Valid values for *n* must be between 0 and 11.

Table 1. Variable Values and Factors for Combined Print Features Command

Value	Variable/Feature			
	n1	**n2**	**n3**	**n4**
1	10 cpi	Cancel super/ subscripts	Utility	HSD
2	12 cpi	Subscripts	NLQ	N/A
4	17.1 cpi	Superscripts	DLL	Underlining
8	20 cpi	Emphasized (Bold)	Italics	Double Height
16	Double Width	Enhanced	N/A	N/A
Factor	**32**	**64**	**96**	**112**

Character Style

Name	Dec	Hex	Description
ESC # 0	27 35 48	1B 23 30	**Select Fast Draft Print Mode**
ESC 0	27 48	1B 30	**Select Draft Print Mode**
ESC 1	27 49	1B 31	**Select NLQ Font**
ESC 3	27 51	1B 33	**Select Near Letter Quality Gothic Font**
ESC ! /	27 33 42	1B 21 2A	**Select Italics Printing**
ESC ! *	27 33 47	1B 21 2F	**Cancel Italics Printing**
ESC T	27 84	1B 54	**Select Emphasized (Bold) Printing**
ESC H	27 72	1B 48	**Select Enhanced Printing**
ESC I	27 73	1B 49	**Cancel Emphasized (Bold)/Enhanced Printing**
ESC C	27 67	1B 43	**Select Underline Printing**
ESC D	27 68	1B 44	**Cancel Underline Printing**

Custom Characters

Name	Dec	Hex	Description
ESC $	27 36	1B 24	**Copy ROM Character Set to RAM Character Set** Copies a complete set of the characters resident in the printer to the area of its memory reserved for custom characters.
ESC % A	27 37 65 *m* *n1...n11*	1B 25 41 *m* *n1...n11*	**Down Line Load Ascender Characters** Begins downloading an ascender character.
ESC % D	27 37 68 *m* *n1...n11*	1B 25 44 *m* *n1...n11*	**Down Line Load Descender Characters** Begins downloading an descender character.
ESC 2	27 50	1B 32	**Set DLL in Draft Mode** Switches custom character printing on when the printer is set for the Draft print mode.
ESC 7	27 55	1B 37	**Select DLL NLQ mode** Switches custom character printing on when the printer is set for the NLQ print mode.

Graphics Print Modes

Name	Dec	Hex	Description
ESC P	27 80	1B 50	**Single Density Graphics**
ESC Q	27 81	1B 51	**Single Density Graphics**
ESC R	27 82	1B 52	**Double Density Graphics**
ESC # Q	27 35 81	1B 23 51	**Double Speed and Quadruple Density Graphics**
ESC *	27 42 *n1 n2* 58	1B 2A *n1 n2* 3A	**Select Graphics Mode** Selects the density and defines the speed and "word size." For more information, see Table 2 and Table 3 on page 84.
ETX	3	03	**Select Graphics Print Mode**
ETX STX	3 2	03 02	**Cancel Graphics Print Mode**
ETX LF	3 10	03 0A	**Graphics Line Feed with Carriage Return (Text)**
ETX SO	3 14	03 0E	**Graphics Line Feed with Carriage Return (Graphics)**
ETX DC2	3 18	03 12	**Graphics Line Feed without Carriage Return (Text)**
ETX DC4	3 20	03 14	**Graphics Line Feed without Carriage Return (Graphics)**

Name	Dec	Hex	Description
ETX ETX	3 3	03 03	**Stored graphics data in one dot column buffer** Determines the graphics setting. In 7-bit mode, the graphic setting is 14/144"; in 8-bit graphics mode, it is 16/144"

Table 2. Density

n1	Dots per inch/Density
1	60 dpi
2	72 dpi
4	Single density
8	Double density
16	Quadruple density

To calculate the density (value for **n1**),

1 Locate the dpi and density you want from the above table.

2 Select the corresponding n1 values for each.

3 Add the values selected in step 2.

4 Add 96 to the total.

Example: For 60 dpi printing at quadruple density, calculate the value of n1 as follows: **n1**=1+16+96=113

Table 3. Speed and Word Size

n2	Speed/Word Size
0	Normal speed
8	Double speed
0	7-bit graphics
16	8-bit graphics

To calculate the speed and word size (value for n2),

1 Locate the speed you want from the above table.

2 Select the corresponding n2 value.

3 Locate the word size (7 or 8-bit graphics).

4 Select the corresponding n2 value.

5 Add the values selected in steps 2 and 4.

6 Add 64 to the total.

Example: For double speed, 8-bit graphics, calculate the value of n2 as follows:
n2=8+16+64=88

Horizontal Movement

Name	Dec	Hex	Description
BS	8	08	**Backspace**
CR	13	0D	**Carriage Return**.
ESC % C	27 37 67 *n1 n2 n3*	1B 25 43 *n1, n2, n3*	**Set Left Margin** If the value for the left margin is less than 3 digits, use zeros for the first digit(s). Maximum margin value is 899 (2480 printer model) or 999 (2481 printer model). Units are set at 1/120".
ESC % R	27 37 82 *n1 n2 n3 n4*	1B 25 52 *n1 n2 n3 n4*	**Set Right Margin** The right margin must be at least 60 units greater than the left margin. If the value for the right margin is less than 4 digits, use zeros for the first digit(s). Maximum margin value is 0960 (2480 printer model) or 1632 (2481 printer model). Units are set at 1/120".
ESC HT	9	09	**Execute Horizontal Tab** Advances the printhead 8 columns to the right before printing the next character.
ESC HT ... CR	27 9 *x1 y1 z1...x16 y16 z16* 13	1B 09 *x1 y1 z1...x16 y16 z16* 0D	**Set Horizontal Tabs by Characters** Sets tab stops for up to 16 positions. The values for x, y and z must be entered as three-digit ASCII numbers (use leading zeros if necessary), separated by commas, and in ascending order. Maximum values are as follows: <table><tr><td>**Pitch**</td><td>**2480**</td><td>**2481**</td></tr><tr><td>10 cpi</td><td>080</td><td>136</td></tr><tr><td>12 cpi</td><td>096</td><td>163</td></tr><tr><td>15 cpi</td><td>120</td><td>204</td></tr><tr><td>17.1 cpi</td><td>137</td><td>233</td></tr><tr><td>20 cpi</td><td>160</td><td>272</td></tr></table>

Name	Dec	Hex	Description
ESC ETX ... CR	27 3 *x1 y1 z1 w1...x16 y16 z16 w16* 13	1B 03 *x1 y1 z1 w1...x16 y16 z16 w16* 0D	**Set Horizontal Tabs by Dot Columns** Sets tab stops for up to 16 positions. The character pitch determines the distance represented by the tab (distance from the center of one dot to the center of the next dot). **Pitch** **Shift Increment** 10 cpi 1/120 12 cpi 1/144 15 cpi 1/180 17.1 cpi 1/206 20 cpi 1/240 The values for x, y, z and w must be entered as four-digit ASCII numbers (use leading zeros if necessary), separated by commas, and in ascending order. To calculate the value, multiply the position for which you want to set a tab by the pitch increment of shift, and then subtract one from the product. For example, to set a tab for 2″ from the left margin using 12 cpi pitch, multiply 2 by 144, and then subtract 1. The value would be 0287. Maximum values are as follows: **Pitch** **2480** **2481** 10 cpi 959 1631 12 cpi 1151 1956 15 cpi 1339 2447 17.1 cpi 1643 2795 20 cpi 1917 3261
ESC HT CR	27 9 13	1B 09 0D	**ESC HT CR** Clears horizontal tabs set by character spacing.
ESC % B	27 37 66 *n1 n2 n3 n4*	1B 25 42 *n1 n2 n3 n4*	**Indent from Left Margin** See the command ESC ETX ... CR on page 86 for instructions on calculating the value for *n1...n4*. (Use the same pitch increment of shift values as the ESC ETX ... CR command.)

Name	Dec	Hex	Description
ESC DLE @	27 16 64 *pN* *a1 a2 p1 p2 p3 p4*	1B 10 40 *pN* *a1 a2 p1 p2 p3 p4*	**Set Multiple Print Positions** Moves the print position to the right or left, as an absolute or relative print position. *pN*=0 to 127 *a1*=0 (absolute print position) *a1*=1 (relative print position) *a2*=0 (move to the left (backward)) *a2*=1 (move to the right (forward)) The character pitch determines the distance represented by the tab (distance from the center of one dot to the center of the next dot).

Pitch   **Shift Increment**

Pitch	Shift Increment
10 cpi	1/120
12 cpi	1/144
15 cpi	1/360
17.1 cpi	1/411
20 cpi	1/480

The values for *p1, p2, p3* and *p4* must be entered as four-digit ASCII numbers (use leading zeros if necessary), separated by commas, and in ascending order.

To calculate the value, multiply the position for which you want to set a tab by the pitch increment of shift, and then subtract one from the product. For example, to set a tab for 2" from the left margin using 12 cpi pitch, multiply 2 by 144, and then subtract 1. The value would be 0287.

Maximum values are as follows:

Pitch	2480	2481
10 cpi	959	1631
12 cpi	1151	1956
15 cpi	1339	2447
17.1 cpi	1643	2795
20 cpi	1917	3261

Name	Dec	Hex	Description
ESC % F	27 37 70 *n1 n2 n3 n4*	1B 25 46 *n1 n2 n3 n4*	**Move to the Left** See the command ESC ETX ... CR on page 86 for instructions on calculating the value for *n1...n4*. (Use the same pitch increment of shift values as the ESC ETX ... CR command.)
ESC % E	27 37 69 *n1 n2 n3 n4*	1B 25 45 *n1 n2 n3 n4*	**Move to the Right** See the command ESC ETX ... CR on page 86 for instructions on calculating the value for *n1...n4*. (Use the same pitch increment of shift values as the ESC ETX ... CR command.)
ESC -	27 45	1B 2D	**Begin Uni-directional Printing**
ESC =	27 61	1B 3D	**End Uni-directional Printing**

Vertical Movement

Name	Dec	Hex	Description
ESC G	27 71 $H_n L_n$	1B 47 $H_n L_n$	**Set Page Length in Inches** Sets the page length in increments of $1/2$" x the values of $H_n L_n$. The values for H_n and L_n should be between 00 and 99. For lengths less than 4.5", $H_n = 0$.
ESC F	27 70 $H_n L_n$	1B 46 $H_n L_n$	**Set Page Length in Lines** Sets the page length in increments of line pitch x the values of $H_n L_n$. The values for H_n and L_n should be between 00 and 99. For values less than 10, $H_n = 0$.
ESC % S 1	27 37 83 49	1B 25 53 31	**Select Skip Over Perforation** Skips an inch from the bottom of one page to the top of the next.
ESC % S 0	27 37 83 48	1B 25 53 30	**Cancel Skip Over Perforation**
FF	12	0C	**Form Feed (with carriage return)** Advances the paper to the top of the next page.
LF	10	0A	**Line Feed (with carriage return)** Advances the form one line.
ESC DC2	27 18	1B 12	**Graphics Line Feed (without carriage return)** Advances the form one line without returning to the left margin. Allows you to overstrike a line of printing and to create special effects like double underlines.
ESC ? n :	27 63 n 58	1B 3F n 3A	**Carriage Return/Feed Selection** **Value of n** **Operation** 33 Carriage return only 34 Forward line feed, no carriage return 35 Forward line feed w/carriage return 48 Reverse line feed, no carriage return 49 Reverse line feed w/carriage return
ESC % 5 n	27 37 53 n	1B 25 35 n	**Perform n/144" Line Feed** $0 < n < 127$
ESC VT	27 11 $H_n L_n$	1B 0B $H_n L_n$	**Skip Down Select Number of Lines**
ESC LF	27 10	1B 0A	**Reverse Line Feed**
ESC 6	27 54	1B 36	**Set Line Spacing to 1/6"**
ESC 8	27 56	1B 38	**Set Line Spacing to 1/8"**
ESC % 9	27 37 57 n	1B 25 39 n	**Set Line Spacing to n/144"**

Name	Dec	Hex	Description
DC4 SP...SP *n*... SP...SP *n*...?	20 32...32 *n*... 32...32 *n*... 63	14 20...20 *n*... 20...20 *n*... 3F	**Set Vertical Format Unit (VFU)** Programs up to 12 sets (channels) of vertical tabs. The maximum tab stops in one set (channel) is 27. This command works in conjunction with the VT command followed by a channel code (n). When the VT command is received, the printer skips to the next tab stop in that channel. To set your tabs, follow the DC4 code with one SP code for each line to be skipped in order to advance to the line where you want your first tab stop. For example, the command DC4 32 32 32 5 32 12 32 32 20 32 32 32 32....32 63 causes the printer to skip 3 lines, enters a tab stop at 5, skips 1 line, enters a tab stop at 12, skips 2 lines, enters a tab stop at 20, and then skips however many lines remain on the page.
VT	11 *n*	0B *n*	**Vertical Tab** Advances the paper to the next vertical tab stop. Valid channel codes are 49 through 60.
ESC 5	27 53	1B 35	**Set Top of Form**

Other Commands

Name	Dec	Hex	Description
CAN	24	18	**Cancel Data** Clears all data from the print buffer, but does not reset printing features.
ESC {	27 123 *n*	1B 7B *n*	**Change Emulation** When n=2 the emulation changes to IBM Proprinter. When n=65 the emulation changes to Epson.
ESC CAN	27 24	1B 18	**Initialize Printer** Clears all data from the print buffer, and returns the printer to the current menu settings.
ESC <	27 60	1B 3C	**Select Half-speed Printing**
ESC >	27 62	1B 3E	**Cancels Half-speed Printing**
ESC E 0	27 69 0	1B 45 00	**Select Paper-out Sensor**
ESC E 1	27 69 1	1B 45 01	**Cancel Paper-out Sensor**
DC3	19	13	**Select Print Suppress Mode**
DC1	17	11	**Cancel Print Suppress Mode**
ESC { NUL	27 125 0	1B 7D 00	**Software-Prime**

Name	Dec	Hex	Description
ESC V	27 86	1B 56	**Eject Page**

Using the Printer Interface

The printer interface is the physical connection point between the printer and other devices, such as a computer. The 2400 series printer offers a choice of three printer interfaces: parallel, Universal Serial Bus (USB), or serial.

Use the parallel interface and parallel cable if you are attaching the printer to a personal computer's parallel port.

Use the USB interface and USB cable when you are attaching the printer to a personal computer's USB port.

Use the serial interface and serial cable when you:

*   share the printer using a printer sharing device.
*   need to connect the printer to a computer that does not have a parallel port, or to a computer that does not have an available parallel port.

Parallel Interface

Use Lexmark parallel cable 1329605 (3 m or 10 ft.) or 1427498 (6.1 m or 20 ft.).

The parallel cable must be IEEE 1284-compliant and must support two-way (bidirectional) communications printing

The parallel interface sends 8 bits (one byte) of data at one time and is transistor-transistor logic (TTL) compatible.

Parallel Interface Voltage Levels

The maximum voltage level for control or data lines is +5.2 volts.

A control or data line is:

*   High, if the voltage is greater than +2.4 volts.
*   Low, if the voltage is less than +0.8 volts.

Computer to Printer Communication

The parallel interface transfers data from computer to printer. The data path is 8 bits wide. The printer and the computer synchronize data transfer with the interface signals STROBE*, ACKNLG*, and BUSY.

When the computer is ready to send a byte of data to the printer, the computer puts the byte of data on the data lines. Then the computer sends a STROBE* (low) pulse to the printer. The printer responds with a BUSY (high) signal.

After the printer receives the data, the printer pulses the ACKNLG* (low) line. This signals the computer that the printer has read the byte of data into printer memory. If the printer buffers are not full and the printer can receive more data, the printer removes the BUSY (low) signal.

Pin Connections

The following illustration shows the pin assignments for connecting the 25-pin connector to the 36-pin connector.

Lexmark Parallel Cables
P/N 1329605 (10 ft.)
P/N 1427498 (20 ft.)

Computer				Printer
		Shield		
STROBE	1	→	1	STROBE
DATA 0	2	→	2	DATA 0
DATA 1	3	→	3	DATA 1
DATA 2	4	→	4	DATA 2
DATA 3	5	→	5	DATA 3
DATA 4	6	→	6	DATA 4
DATA 5	7	→	7	DATA 5
DATA 6	8	→	8	DATA 6
DATA 7	9	→	9	DATA 7
ACKNLG*	10	←	10	ACKNLG*
BUSY	11	←	11	BUSY
PE	12	←	12	PE
SLCT	13	←	13	SLCT
AUTO FEED	14	→	14	AUTO FEED
ERROR*	15	←	15	**N/C**
INIT*	16		16	0 VOLTS
SLCTIN*	17		17	**N/C**
			18	**N/C**
GROUND	18		19	GROUND
GROUND	19		20	GROUND
			21	GROUND
GROUND	20		22	GROUND
			23	GROUND
GROUND	21		24	GROUND
			25	GROUND
GROUND	22		26	GROUND
			27	GROUND
GROUND	23		28	GROUND
			29	GROUND
GROUND	24		30	GROUND
			31	INIT*
GROUND	25		32	ERROR
			33	GROUND
			36	SLCTIN*
		Shield		

Lexmark compliant cables are supported up to 20 feet.

Parallel Pin Assignments

Pin	Line	Description
1	STROBE*	When the printer receives the STROBE* low from the computer, the printer reads the data from the interface and sets the BUSY line high. STROBE* must not occur when the BUSY line is high; otherwise, unpredictable results may occur.
2-9	DATA	These signals are the 8 bits of parallel data sent from the computer. A high level indicates a logical 1. A low level indicates a logical 0. The printer reads data from the DATA lines when a STROBE* pulse is received.
10	ACKNLG*	The ACKNLG* pulse tells the computer that the data from the previous STROBE* pulse has been read. An ACKNLG* pulse is also generated when the printer is turned on, or at the completion of the printer initialization by an INIT* requested from the computer.
11	BUSY	When the printer sets BUSY high, it cannot receive data. The BUSY line goes high in response to a STROBE* pulse. This line remains high until the data is read. BUSY is also high when: • The receive buffer is full. • An out-of-paper condition occurs. • The printer receives an INIT* signal. • Start/Stop is pressed to go offline. • A printer error condition has occurred. • The printer is initializing.
12	PE	The printer sets Paper End (PE) high when approximately 12.7 mm (0.5 in.) of paper remains in the printer. PE remains high until the operator loads paper and presses **Start/Stop**.
13	SLCT	When the printer is ready, it sets the SLCT line high. The SCLT lines go low when: • Start/Stop is pressed to go offline. • There is an error or out-of-paper condition. • The printer receives an ESC Q. It ignores all incoming data except DC1, which returns the printer to a select state.
14	AUTO FEED XT	The printer executes one line feed when this signal, *valid only in Epson** mode*, is low.
15		Not used.
16	GND	Logic ground.
17	CHASSIS GROUND	Ground level.
18	+5 volts	Maximum 300 mA.
19-30	GND	Ground level.
* Inverted logic (signal is active when low).		

Pin	Line	Description
31	INIT*	INIT* from the system resets the printer to its initial power-on-state. The BUSY line goes high, and any received data is printed. When INIT* goes low, the printer resets to the power-on default state. If data is in the USB buffer, the USB FIFO is not reset.
32	ERROR*	The printer sets the ERROR* line low if the printer detects an error or out-of-paper condition. A critical error condition exists when both ERROR* and PE are low.
33	GND	Ground level.
34-35		Not used.
36	SELECT IN	The printer does not respond to the DC1/DC3 code when this signal, *valid only in Epson mode*, is low.
* Inverted logic (signal is active when low).		

Timing

The following chart shows the timing in microseconds of these signals.
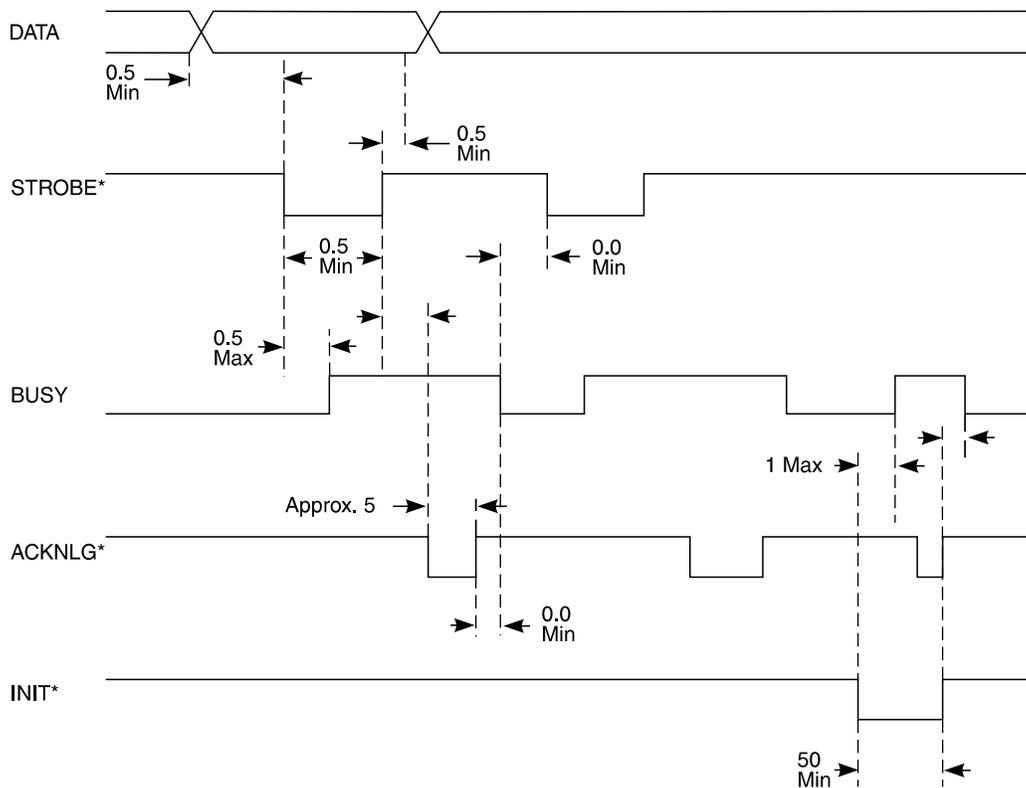
Universal Serial Bus Interface

The USB interface, with a signaling bit rate of 12 Mb/s (full speed), is in full compliance with the Universal Serial Bus Specification Revision 1.0. It has a USB Function Controller with two FIFO-based Endpoints:

- One bidirectional Control Endpoint 0 (8 bytes)
- One receive Endpoint 1 (1*64 bytes)

Serial Interface

You may want to use the serial interface when you need to use a cable more than 6 m (20 ft.) in length, share the printer using a printer sharing device, if you need to connect the printer to a computer that does not have a parallel port, or to a computer that does not have an available parallel port.

Use the RS-232C protocol if the printer is more than 6 m (20 ft.) from the computer.

Serial Interface Option

The Lexmark serial interface, part number 12T0154, supports the RS-232C protocol. All serial interface parameters can be selected by the operator panel. The serial interface installs internally into the back of the printer, and connects to the serial cable, part number 1038693.

How to Connect the RS-232C Serial Interface

To connect the serial interface, use the following cable:

- Lexmark Part Number 1038693 (15.24 m or 50 ft.)

Serial Cable Pin Assignments (RS-232C)

The following illustration shows the RS-232C serial cable:

Serial Adapter Side   Computer Side
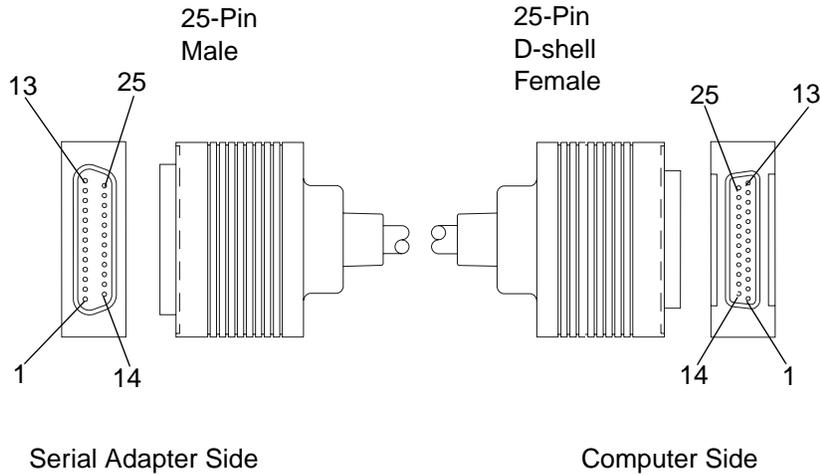
RS-232C Serial Connector Pin Assignments		
Pin	**Signal**	**Description**
2	TXD (Transmit Data)	This line transmits data from the printer to the host. The data characteristics are specified by the function menu settings which are read only during a Power On Reset (POR). The only data transmitted are XON (x'11') and XOFF (x'13') signals. Transmission occurs only when CTS is high.
3	RXD (Receive Data)	This line receives data from the host. The serial interface accepts data only when DSR is On.
4	RTS (Request to Send)	This line is set high and remains high even after the serial interface finishes its POR.
5	CTS (Clear to Send)	This line is monitored only if the XON/XOFF protocol is selected because transmission occurs only when CTS is high.
6	DSR (Data Set Ready)	DSR is another method of providing data integrity. Data is accepted only when DSR is high.
20	DTR (Data Terminal Ready)	This line is set high after the serial interface finishes its POR sequence. However, if you select DTR pacing handshake protocol, this line is used to indicate to the host whether or not the printer is ready to receive any more data.

Serial Interface Cable (RS-232C)

The recommended RS-232C serial cable is 50 feet long. This cable works with the IBM PS/2 series and other compatible host systems using a 25-pin male connector. The maximum total capacitance of the cable and the connector should be less than 2500 pF, or it will delay the signal transition by more than 4%.

Following is a diagram of the serial cable (Lexmark part number 1038693 (15.24 m or 50 ft.)).

HOST		RS-232C Cable	SERIAL I/F	
Pin	Signal		Signal	Pin
2	TXD		TXD	2
3	RXD		RXD	3
4	RTS		RTS	4
5	CTS		CTS	5
6	DSR		DSR	6
7	GND		GND	7
8	DCD		DCD	8
20	DTR		DTR	20
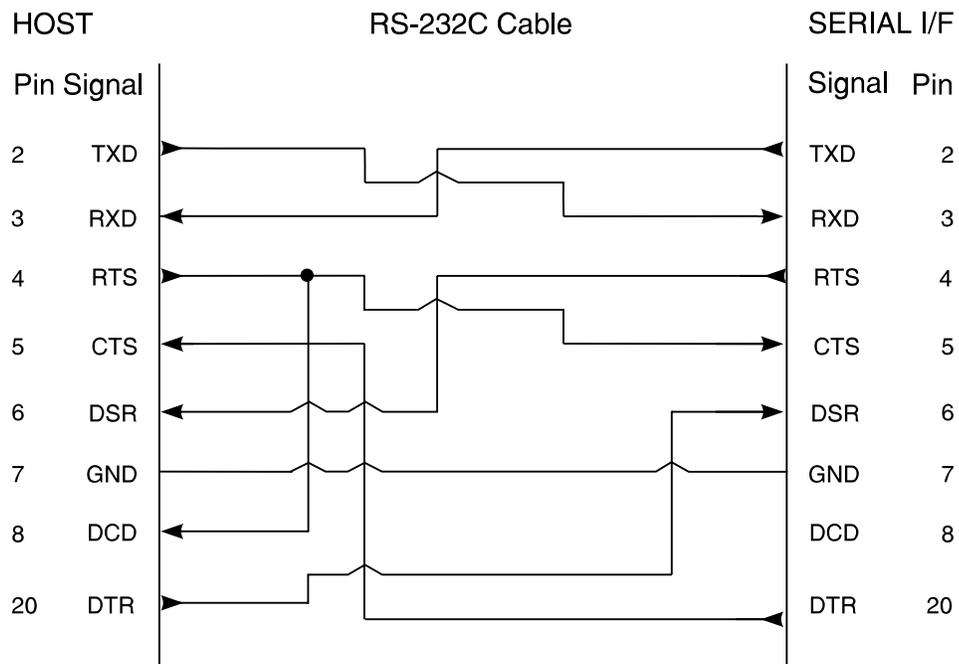
Using an IBM AT Personal Computer (RS-232C)

If you are using an IBM AT or compatible computer, use a 9-pin to 25-pin EIA RS-232C cable.

We recommend one of the following for a 9-pin to 25-pin cable:

*   IBM P/N 6450242 (254 mm or 10 in.)
*   IBM P/N 6450217 (3 m or 10 ft.)

The following illustration shows the pin assignments for the 9-pin to 25-pin RS-232C serial cable.
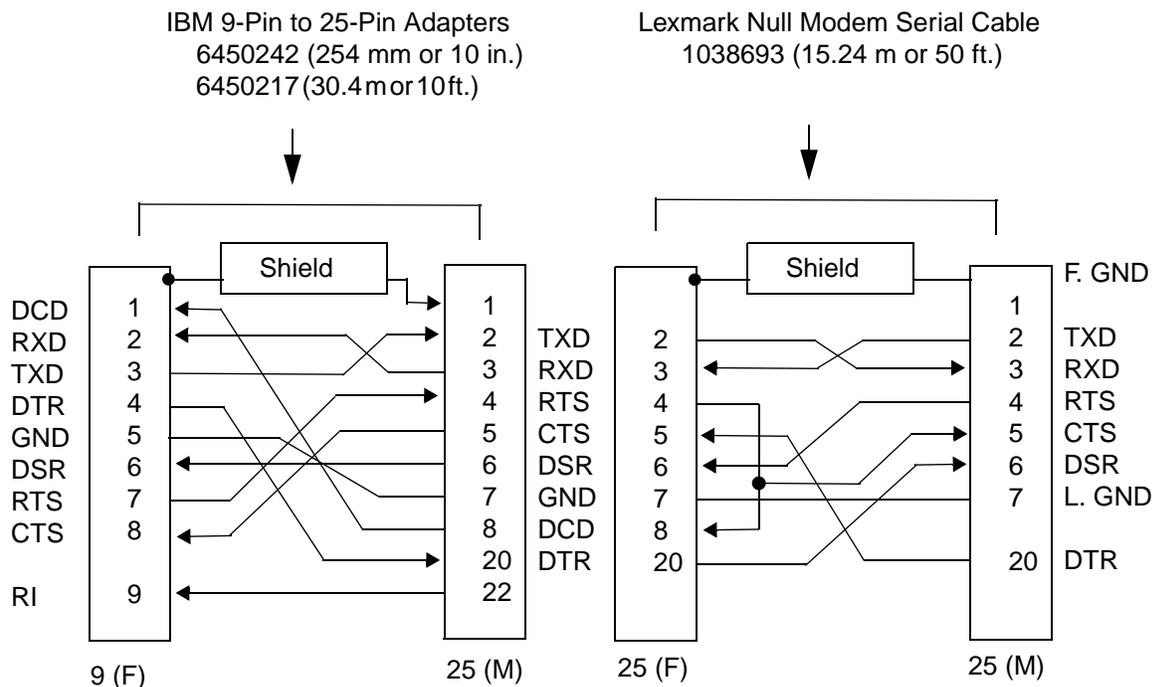
Serial Communication Parameters (RS-232C)

The acceptable values for serial communications parameters follow.

Voltage Level Range

The maximum voltage level range for control lines or data lines is from ± 25 positive V dc to ± 25 negative V dc.

The voltage reference point is the signal ground on pin 7. A timing or control line is active if the voltage is more than +3 V, or inactive if the voltage is less than -3 V.

A data signal more than +3 V means that the bit is a logical 0; less than -3 V means that the bit is a logical 1.

For additional information, refer to the *Interface between Data Terminal Equipment* and *Data Communications Equipment Employing Serial Binary Data Interchange*, published by the Electronic Industries Association, publications EIA RS-232C and EIA\TIA-232-E.

Serial Data Frame Considerations (RS-232C)

The computer sends serial data in data frames (also known as packets). You can create 10-bit, 11-bit, or 12-bit data frames and set the serial data transfer parameter so that each data frame contains 7 or 8 data bits. However, the printer is an 8-bit printer; characters, controls, and APA graphics need 8 bits of data. If you select 7-bit data transfer, some unexpected characters might print.

Data Transmission

Data transfer rates (in bits per second):

- 300 bps
- 600 bps
- 1200 bps
- 2400 bps
- 4800 bps
- 9600 bps
- 19200 bps

Start and Stop Bits

The printer receives data with 1 start bit and either 1 or 2 stop bits. The printer always sends 1 start and 2 stop bits.

Parity

There are four possible parity settings: *Even*, *Odd*, *No*, and *Ignore.*

When *Even* parity is selected, the printer expects to receive data frames with an even number of logical 1's per byte. The printer transmits data with even parity.

When *Odd* parity is selected, the printer expects to receive data frames with an odd number of logical 1's per byte. The printer transmits data with odd parity.

When *No* parity is selected, the pritner expects no parity bit when it receives data. The printer transmits data without parity bits.

When *Ignore* parity is selected, the printer expects a parity bit when it receives a data frame. Although the printer expects a parity bit, it ignores the bit and does not check for a parity error condition. The printer uses even parity when it transmits data.

Errors

The serial interface recognizes the following three error conditions: *Parity Error*, *Framing Error*, and *Buffer Overrun*.

When a *parity error* is detected, the interface prints an upside down question mark. Although the printer continues to receive data, it prints an upside down question mark for each byte that has a parity error.

A *framing error* is similar to a parity error. When a framing error is detected, the interface also prints an upside down question mark and continues to receive data. However, unlike a parity error which causes the interface to print question marks only for the bytes with incorrect parity, a framing error causes the interface to print question marks for **all** bytes transmitted.

A buffer overrun error occurs when the host does not obey the selected protocol and continues to send data even after the buffer is full. The buffer can only hold 128 bytes of data after the printer signals that it is busy. If the host sends more than this amount, the data is lost and a buffer overrun error occurs.

Data Flow Control

Flow control is accomplished by way of software or the hardware DTR (Data Terminal Ready). Three flow control protocols are available:

- DTR Pacing (hardware)
- XON/XOFF (software)
- Multi XON/XOFF (software)

DTR Protocol Timing

You use DTR to control the data flow from the computer. DTR goes from high to low to indicate to the computer that the printer cannot receive more data due to one of the following conditions:

- Buffer full
- Attendance error (paper out, printer error)
- Printer not in ready state

The following diagram illustrates DTR Protocol Timing.

RTS

DTR

RXD

1

2

3
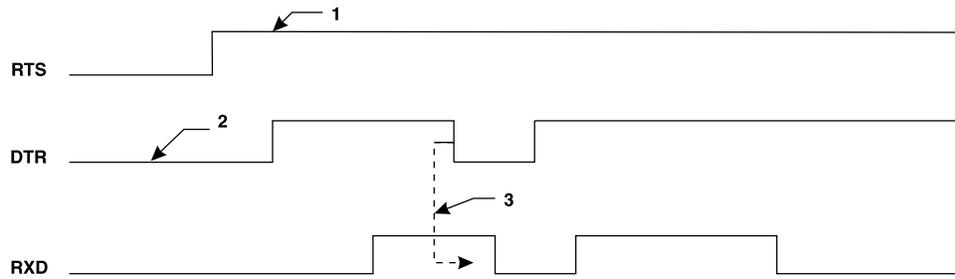
Legend:

1   The RTS signal is driven directly by the RS-232C line driver and is active any time power is supplied to the printer.

2   The DTR signal becomes active (high) when initialization is complete, telling the computer that the printer is ready to receive data.

3   DTR drops (low) to tell the computer that the printer buffer is full or the printer is busy and data transmission should stop. If the computer continues to send data after the printer lowers the DTR signal, data could be lost. DTR is raised (high) when the printer is again ready to receive data.

XON/XOFF Protocol Timing

When you select this flow control protocol, the printer sends an XOFF command to the host to indicate that the printer cannot receive more data because it has one of the following conditions:

- Buffer full
- Attendance error (paper out, printer error)
- Printer is not in ready state

The following diagram illustrates XON/XOFF Protocol Timing.

XMT

RXD

XON   XOFF   XON

1

2   3
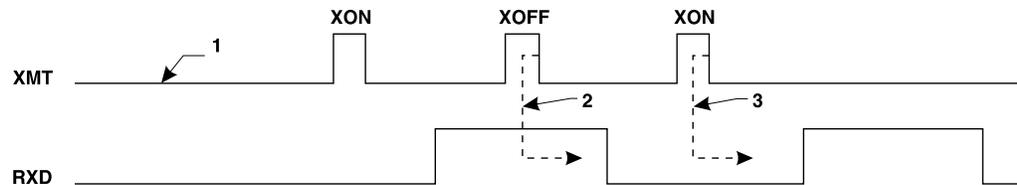
Legend:

1   Data received when DSR is low is invalid and discarded.

2 Because all data transmissions require CTS, it must be detected prior to the XON/XOFF protocol initiating. Once CTS is detected, after POR, the printer transmits an XON command. It is not necessary for the host to detect this initial XON command prior to transmitting data to the printer.

3 The printer transmits an XOFF command to the host when the receive buffer is full.

4 The printer transmits an XON command to the host when buffer space becomes available and the printer is ready to receive more data.

Serial Computer Configuration Recommendations (RS-232C)

For the correct operation of the serial adapter, you must configure the operating system of the computer. The following examples show how to configure DOS and OS/2 for the printer using serial DTR protocol.

DOS

From the DOS prompt, enter the following commands:

```
mode com1:9600,n,8,1
```

Include this command statement in the AUTOEXEC.BAT file on the computer so it runs each time your system starts operating.

OS/2 1.2 and 1.3

1 From **Desktop Manager** or **Group Utilities**, select **Utilities**.

2 Select **Control Panel**.

3 Select **Options**.

4 Select **Communications Port**.

5 For the port you wish to set up, set the following parameters to match the printer defaults.

> Baud rate = 9600
> Word length = 8
> Parity = none
> Stop bits =1
> Handshake = hardware

6 Select **Set**.

OS/2 2.0 and 2.1

Make sure the OS/2 serial port settings match the switch settings on the serial adapter. To view or to change the settings:

1 Select the printer icon.

2 Select **Open**.

3 Select **Settings**. The Printer - Settings screen appears.

4 Select the serial port to which you want to attach the printer. The Serial Port - Settings screen appears.

5 Select the settings you want to use.

6 Select **OK**.

The next example shows an alternative way to configure OS/2.

From the OS/2 prompt, enter the following command:

```
mode com1:9600,n,8,1,,DTR=on,OCTS=on,ODSR=on
```

You can also include the following command statement in the CONFIG.SYS file on your computer so that it runs each time you start your computer:

```
run c:\os2\mode.com com1:,,,,,DTR=on,OCTS=on,ODSR=on
```

Downloading Characters and Fonts

Section 7

This chapter explains how to download characters and provides programming examples for several escape sequences. The first part of the chapter is for 248x users; the second part is for 249x users.

The downloading feature lets you create custom fonts and special characters. You can create and print complete italic or foreign language character sets as well as symbols and special characters not in the printer character sets.

The examples in this chapter use the BASIC programming format shown on page 16.

248x Printers

Designing Draft and NLQ Characters

For Draft and NLQ (Near-Letter Quality) characters, the 9-wire printers use a character matrix that is 12-dots wide and 9-dots high. Ascenders generally use the top 7 rows, establishing row 7 as the baseline. Descender characters generally use the bottom 7 rows. For uniform and evenly spaced characters, each character should be 9-dots wide and start in column 1.

How Dots Are Added in NLQ Mode

The 9-wire printers can print downloaded draft characters in NLQ mode. Downloaded characters print at the same speed as standard characters. You design the characters for Draft and the printer adds the additional dots to each character when printing in NLQ mode.

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Vertical Lines

The following drawing shows how the printer adds dots to a vertical line.
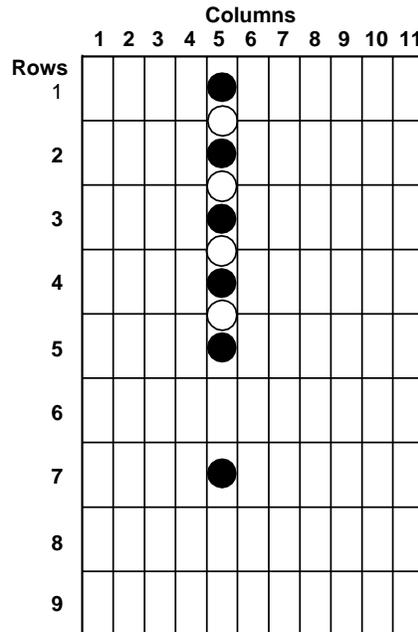
The solid dots must be specified in the font. Hollow dots are generated by the printer.

Diagonal Lines

These drawings show how the printer adds dots to diagonal lines.
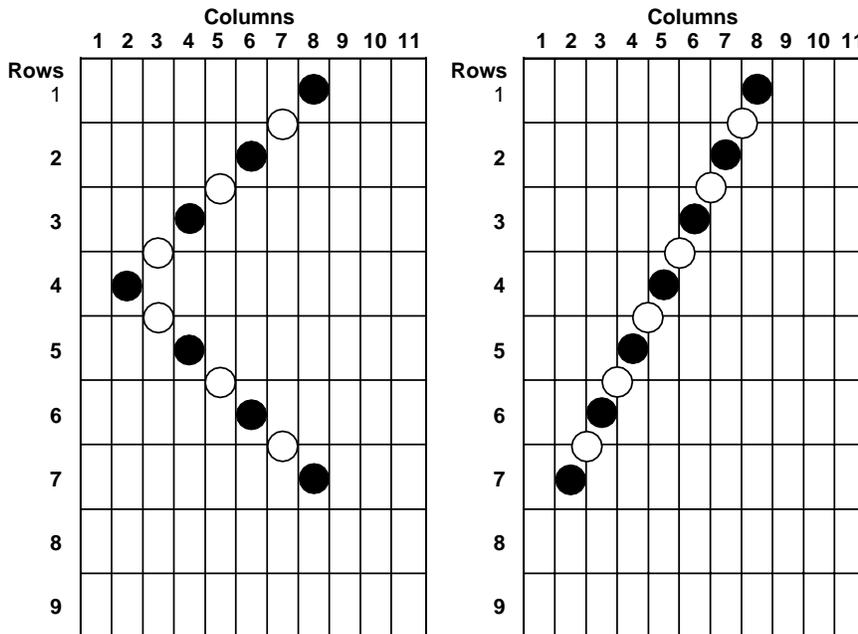
Intersections of Vertical and Horizontal Lines

The drawing on the left shows how the printer adds the vertical dots to a vertical line that intersects a horizontal line.

The character design must specify all dots in the horizontal line. The printer removes adjacent dots from horizontal lines when printing in Draft, which is illustrated in the drawing on the right.
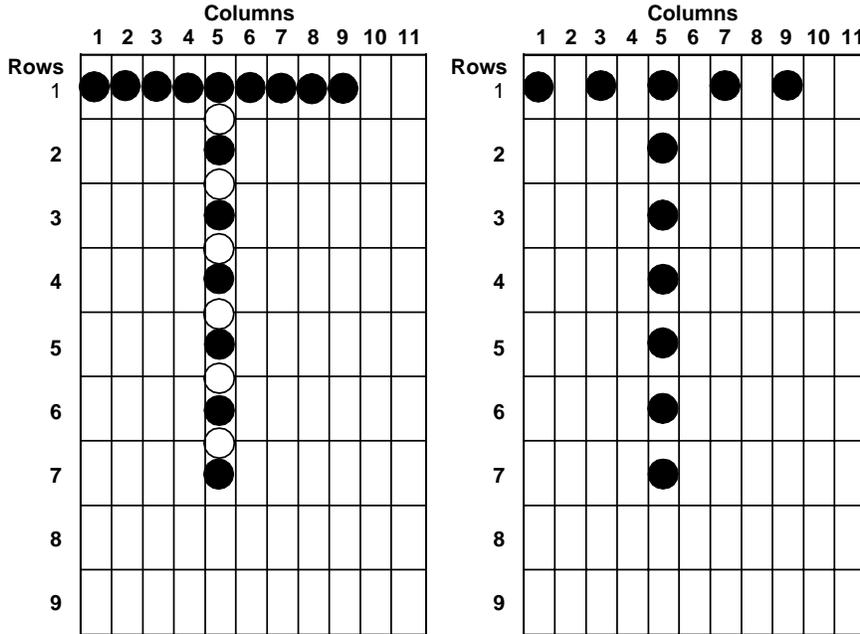
Diagonal Intersecting Horizontal Line

This drawing shows how the printer adds dots at the intersection of horizontal and diagonal lines. The printer considers the point of intersection as a two-dot vertical line.
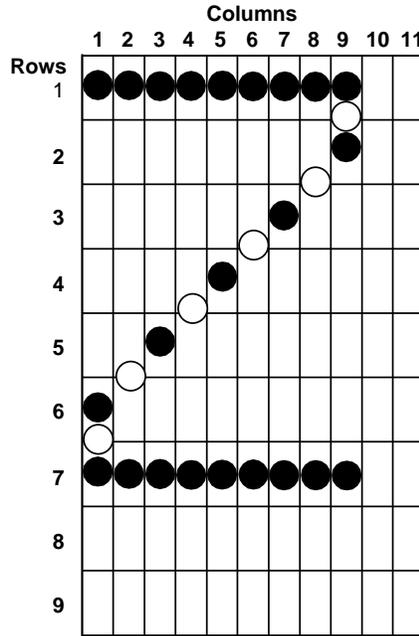
Diagonal Intersecting Vertical Line

The **'M'** shows how the printer adds dots when a diagonal line meets the end of a vertical line.
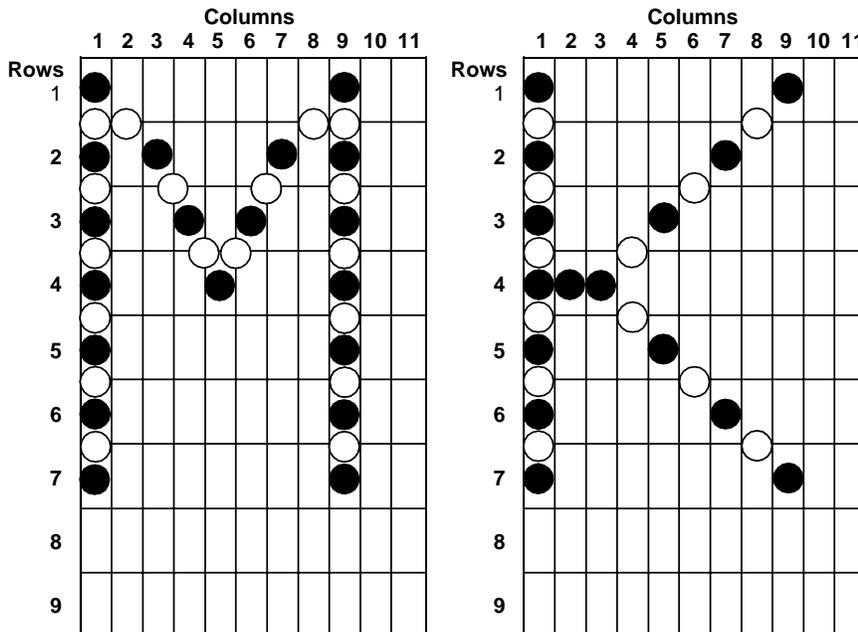
When a diagonal line intersects a vertical line at a point other than the end of the vertical line, you should specify a horizontal dot at the intersection to improve character appearance. This ensures that the character is acceptable in Draft.

Designing Fast Draft Characters

The character matrix for Fast Draft characters is 10-dots wide and 9-dots high. Ascender characters generally use the top 7 rows, establishing row 7 as the baseline. Descender characters use the bottom 7 rows. Fast Draft characters must be no wider than 9 dots, or they will be truncated when printed. Fast Draft characters cannot be printed in NLQ mode.

Designing NLQ II Characters

NLQ II characters are designed on a character matrix 24-dots wide and 18-dots high. Ascenders generally use the top 15 rows, establishing row 15 as the baseline.

Descenders use the bottom 16 rows (rows 3 through 18). The maximum character width is 23 dots. The maximum height of a character is 16 dots, beginning with row 1 (for ascenders) or row 3 (for descenders). If you design a character that is higher than 16 dots, it will be truncated when printed.

Consecutive horizontal dots are eliminated (except in emphasized mode) when characters are printed. To ensure a character looks the same when printed left to right or right to left, the number of consecutive dots in a character design should be **odd**.

To design characters that will blend with the resident characters, use rows 2 through 15 when designing a capital letter. If you are designing a lowercase letter such as '**a**', '**c**', or '**e**', use rows 6 through 15. For lowercase ascenders such as '**b**', '**d**', or '**f**', use rows 1 through 15. For lowercase descenders such as '**g**', '**p**', or '**q**', use rows 6 through 18.

Downloading Characters

The 9-wire printers have 3 download areas. The first download area is for a draft character set and can store 256 characters in any area of the character set. The draft download area can also be used to store a downloaded Fast Draft character. The other two download areas are for NLQ II+. Any type of character can be downloaded using the **ESC =** command and selected for printing with the **ESC I** command.

If you use the operator panel to select a code page from Character Options the draft download area is initialized to code page 437. The two NLQ II download areas are also unitized to code page 437 Courier and italic fonts.

Initializing the Download Area

Use the following command to initialize the download areas to the resident fonts:

```
 <x

  1B3D    -  download command prefix

  0000    -  byte count when zero causes initialization of
             download area

 >
```

Downloading a Draft/NLQ Character Set

The sequence to download characters for Draft/NLQ and Fast Draft is shown below:

```
 Syntax:   ESC   =    count1 count2 font id  start

 Decimal:  27  61   count1 count2 20       start

 Hex:      1B  3D   count1 count2 14       start
```

There are two parts of the **ESC** = escape sequence.

Part one includes *count 1, count 2, font ID byte,* and the *start* code. Use this part once for each download command.

Part two is made up of one or more sequences of 13 bytes of data. The first two bytes of data are the *2 attribute bytes,* and the remaining 11 bytes (3 through 13) are *printable data*. Repeat this part (2 attribute bytes plus 11 printable bytes) for each character you download:

```
     attr1 attr2 col1 col2 col3 ... col11
```

Part One: Calculating Count 1, Count 2

Count 1, count 2	is a two-byte integer value, starting with the low order byte followed by the high order byte.
Font ID byte	is 20 (x14) for the Draft/NLQ font.
Start	The start code specifies the first download character. The download characters replace normal characters starting at that code point.
	For example, to download a character set that replaces characters starting with the uppercase letter 'A', use a start code of 65 (x41).

Part Two: Specifying the Download Data

Attribute byte 1 specifies the character type and additional information.

Bit	Bit Values	Functions
7	*0* if the character is an ascender (a character using only the upper 8 wires of the print head).	Ignored if bit 0 or bit 1 is set to 1.
	1 if the character is a descender, a character using only the lower 8 wires of the print head (for example, **g**).	Ignored if bit 0 or bit 1 is set to 1.
6-2	Not used; set to zeros.	
1, 0	*0,0* no expansion.	Normal ascender/descender character based on bit 7.
	0,1 line-drawing character.	The dots in row 8 are extended downward through rows 9, 10, 11, and 12. Bit 7 is ignored. Use this mode to create characters similar to resident font characters 179 to 223.
	1,0 shading character.	The dots in rows 1, 2, 3, and 4 are repeated as rows 9, 10, 11, and 12. NLQ mode is ignored. Use this mode to create characters similar to resident font characters 176 to 178.
	1,1 not valid.	

Attribute byte 2 specifies proportional-spacing information. Bits 6-0 specify spacing information. Set these bits to 0 if proportional spacing is not desired. When you use proportional spacing with a downloaded font that has bits 6-0 set to 0, all 11 bytes of character data print.

Bit	Bit Values	Functions
7	Set to 0.	
6, 5, 4	Interpreted as a binary number.	Specifies the number of leading dot columns to ignore. This number is the offset. Up to 7 dot columns can be ignored.
3, 2, 1, 0	Interpreted as a binary number.	Specifies the number of dot columns to be printed. Each character is automatically followed by a blank column that is not included in the character width. Widths greater than 11 will be treated as 11.
Printable Data (Bytes 3 through 13)	Define the printable data.	These bytes are unique to each character, and must be specified for each download character. The printer prints one byte at a time. Each wire in the printhead has a corresponding bit in each byte, depending on whether the character is an ascender or a descender. To print the dot, set the bit to 1. See the following illustration.

Designing and Downloading the Draft/NLQ Copyright (©) Symbol

This example shows how the 11 bytes of printable data for the '©' symbol were determined.

Columns

Rows 1 2 3 4 5 6 7 8 9 10 11   **Bits**

(dot-matrix grid showing the '©' symbol with rows 1–9 and bits 7–0)

Decimal Values- 56 68 0 146 170 170 170 130 0 68 56

Hexadecimal Values- 38 44 00 92 AA AA AA 82 00 44 38
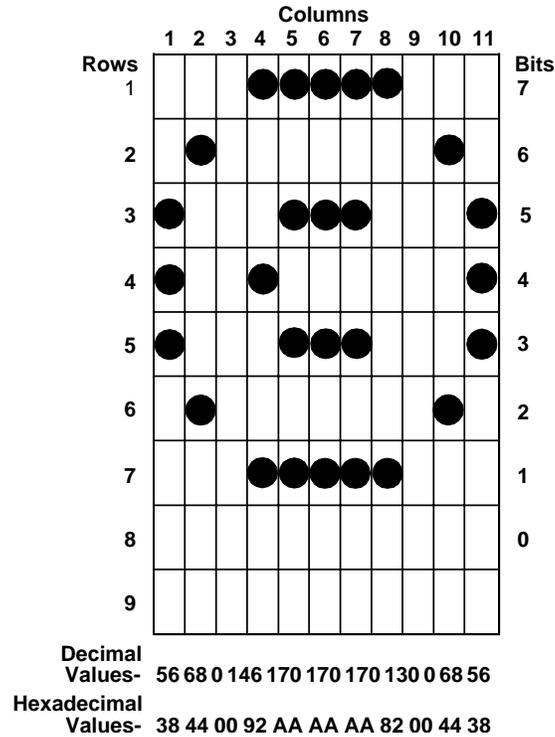
This example replaces the '@' character with the Draft '©' symbol. This character is an ascender without proportional spacing. **Count 1** and **count 2** for the example are:

> **total count = (1 x 13) + 2 = 15**
> **count 1 = x0F**
> **count 2 = x00**

The following example loads data for the copyright symbol into the printer. The data remains in the download storage area until you:

- Set the power switch to Off.
- Overlay the data with download character data.
- Download area is initialized.

```
<x
 1B3D    -  download command prefix
 0F00    -  byte count (low byte first)
 14      -  font ID for Draft/NLQ
 40      -  start code – '@' character
 00      -  attribute byte 1 – ascender – no 12 high
            expansion
 00      -  attribute byte 2 – default proportional
            space data


 38      -  column 1
 44      -  column 2
 00      -  column 3
 92      -  column 4
 AA      -  column 5
 AA      -  column 6
 AA      -  column 7
 82      -  column 8
 00      -  column 9
 44      -  column 10
 38      -  column 11
 1B4904  -  select download font
 40      -  print '@' character
 >
```

Downloading an NLQ II Character Set

The 248x printers can download two sets of NLQ II characters. The first set is initialized to a Courier-like font, and the second to a Courier italic-like font. Since there are two download areas, you must use a Select Print Mode, **ESC I,** before downloading to select between the two download areas. To select the first area, use the **ESC I x07** command. For the second download area, use the **ESC I x0F** command.

Downloading NLQ II character set is performed using the **ESC =** command similar to the Draft/NLQ download command.

```
Syntax:  ESC  =   count1 count2  font id start

Decimal: 27  61  count1 count2  21     start

Hex:     1B  3D  count1 count2  15     start
```

Part One: Calculating Count 1, Count 2

Count 1, count 2   specify the number of bytes to be downloaded.

Font ID byte   is the value assigned to identify the type of font data. The ID for NLQ II is 21 (x15).

Start   The start code is the ASCII value (code-point) for the first downloaded character. It must be in the range of x00 to xFF. You can start your downloaded character set at any point in the character table. The download characters replace normal characters starting at this code-point. For example, to download a character set that replaces characters starting with the uppercase letter 'A', use a start code- point equal to 65 (x41), 'A'. All character codes within the same download command must be consecutive from the start code-point.

Part Two: Specifying the Download Data

Each font character is made up of 48 bytes of data. There are 2 bytes of attribute data and 46 bytes of character data. This field of 48 bytes must be repeated for each character. The following text describes the specifications of the attribute bytes and the character data.

Attribute byte 1 specifies the character type.

Bit	Bit Values	Functions
7	**0** if the character is an ascender.	Ignored if bit 0 or bit 1 is set to 1.
	1 if the character is a descender (for example, **'g'**).	Ignored if bit 0 or bit 1 is set to 1.
6-2	Currently ignored and should always be zero.	
1,0	**0,0** no 12-high expansion. Bit 7 is valid.	
	0,1 line-drawing character. Expand the bottom row 15 down to rows 17, 19, 21, and 23. Expand the bottom row 16 down to rows 18, 20, 22, and 24. The ascender/descender bit 7 above is ignored.	This type mode should be used to create characters similar to resident font characters 179 to 223.
	1,0 shading character. Expand the top dots in rows 1, 3, 5, and 7 down to rows 17, 19, 21, and 23. Expand the top dots in rows 2, 4, 6, and 8 down to rows 18, 20, 22, and 24. The ascender/descender bit 7 above is ignored.	This type mode should be used to create characters similar to resident font characters 176 to 178.

Attribute byte 2 is not used when specifying NLQ II. Set it to zero.

Bit	Functions
Printable Data (Columns 1 to 23)	• Defines the column data for each character from left to right. • Column 24 is always blank; therefore, only 23 columns can be defined. • There are 2 bytes per dot column, 46 bytes of printable data for each character. The two bytes of each dot-column are defined as follows: • The first byte defines dots in rows 1, 3, 5...15 (3, 5, 7...17 for descender characters). • The second byte defines dots in rows 2, 4, 6...16 (4, 6, 8...18 for descender characters). Consecutive horizontal dots are eliminated (except in emphasized mode). The number of consecutive horizontal dots should always be **odd** (for example 1, 3, 5, 7, 9) to ensure that a character appears the same when printed left-to-right or right-to-left.

When NLQ II font data is downloaded, it is compressed. By filling in-between adjacent horizontal dots, character compression by the printer is more efficient.

When you want to print the '©' symbol:

- Send **ESC I x07** to the printer to select the download characters in NLQ II mode.
- Send data by any method that would cause the normal '&' character to be printed.

The following figure shows the copyright symbol as it is designed and printed. Solid dots indicate downloaded and printed dots. Hollow dots indicate dots that are added to fill the design and take advantage of the compression algorithm.

Byte 1 00 1C 00 22 00 00 08 55 41 41 41 41 41 41 41 41 14 00 00 22 00 1C 00
Byte 2 00 18 24 00 00 42 18 00 24 24 24 24 24 24 24 00 00 42 00 00 24 18 00

To replace the ampersand ('&') symbol, use the following example to download and print the copyright © symbol.

```
 <x
  1B3D      -   command prefix='ESC =' - download character
  3200      -   count - x0032, 50
  15        -   Type=NLQ II
  26        -   Start code='&'
  00        -   attribute byte 1=ascender, not line-drawing, not
                graphics character
  00        -   attribute byte 2=not used for download

  00     00 -   column 1
  1C     18 -   column 2
  00     24 -   column 3
  22     00 -   column 4
  00     00 -   column 5
  00     42 -   column 6
  08     18 -   column 7
  55     00 -   column 8
  41     24 -   column 9
  41     24 -   column 10
  41     24 -   column 11
  41     24 -   column 12
  41     24 -   column 13
  41     24 -   column 14
  41     24 -   column 15
  41     00 -   column 16
  14     00 -   column 17
  00     42 -   column 18
  00     00 -   column 19
  22     00 -   column 20
  00     24 -   column 21
  1C     18 -   column 22
  00     00 -   column 23
 1B4907     -   select download font. This is a download NLQ II
                character (©).

  >&
```

249x Printers

Designing and Downloading Characters

The text that follows shows you how to design and download characters for the 249x printers. The definitions use binary and hexadecimal notation. The examples are in the program format shown on page 16.

Note: Download fonts must be reloaded after a power off/on cycle.

Downloading a New Font

The first step in downloading a new font is designing and creating the character data for the characters in the font. You can download up to 256 characters. You may *share* resident characters by loading the lookup table entry with the address of the resident character and setting bit 6 in attribute byte 1 to 1. This code indicates a resident character. Set the other bytes of the lookup table entry appropriately. After selecting the characters you want to download and those you want to use from the resident fonts, you must create the character data and download it. Next, you must download the lookup table, being careful to use the correct addresses and masks for any shared characters.

The first downloadable address is x800C. This address is the first (high) byte of a 2-byte code page ID. The second (low) byte is stored at x800D. A zero code page ID lets you switch between the resident fonts and downloaded fonts with the **ESC I** command, **Select Print Mode**. If the code page ID of the download font is not zero and does not match the selected resident font, then a **Set Code Page** command is required to select the font.

Note: The **ESC = 00** command copies the current code page to the code page ID.

Address x800E and x800F are reserved and you should set them to zero.

The first lookup table must always begin at address x8010. If a second lookup table is present, it must begin at x8911. A third and fourth lookup table should begin at x9212 and x8B13, respectively. Four is the maximum number of lookup tables that may be accessed. Character data can begin at address xA414 or greater.

The first byte of any lookup table is the font descriptor byte. This byte should not be changed unless you are downloading a new lookup table. Changing this byte does not change the font characteristics. If the font descriptor byte does not match the characteristics of the font you have downloaded, the characters are unrecognizable when printed.

The font descriptor byte identifies the default font. (The first font marked default is chosen if no user-defined default has been stored using the operator panel menu.) This byte also tells if another lookup table follows this one and identifies the quality of the font. If the default font has a non-zero code page ID, that code page ID becomes the active code page when the printer is switched

on. For Letter Quality fonts, the font descriptor byte also identifies the pitch of the font. If multiple lookup tables have the same combinations of pitch and quality, only the first one is accessible.

Font Descriptor Byte

Bit 7	1 = This is the default font.
Bit 6	1 = Another lookup table follows.
Bits 5,4	Reserved (should be zero).
Bits 3-0	Quality and pitch.

                        0000 = Draft

                        0001 = 10 cpi Letter Quality

                        0010 = 12 cpi Letter Quality

                        0011 = Proportional Letter Quality

                        0100 = Fast Draft

                        0101 = 10 cpi Enhanced Letter Quality

                        0110 = 12 cpi Enhanced Letter Quality

                        0111 = Proportional Enhanced Letter Quality (other values are not valid).

The pointer, control bytes, and compression masks for the 256 characters make up an ASCII font (character 0 is first and character 255 is last). The first two bytes of each entry are the absolute address of the first byte of the character's image data and are stored high-byte first, then low-byte second.

For examples of the download sequence, see "Designing Monospaced Fast Draft Characters" on page 125, "Designing Monospaced Draft Characters" on page 130, "Designing Proportionally Spaced Characters" on page 135, or "Designing Enhanced Letter Quality Characters" on page 141.

Design Considerations

The 24-wire printers use a character matrix that is 24-dots high. The width of the character matrix can vary. Typical monospaced characters widths are:

Fast Draft	9 dots
Draft	10 dots

10 cpi LQ	36 dots
12 cpi LQ	30 dots
10 cpi ELQ	36 dots
12 cpi ELQ	30 dots

Proportional characters in the 249x are based on a 7-unit width system where 1 unit is equal to 1/60 inch. Because 1 dot-column equals 1/360 inch, 1 unit is equal to 6 dot-columns. Proportional character width may vary from 3 units to 7 units.

If you want to design a character that is **n** dots wide, you can only use **n**-1 dots. The nth dot-column must always be specified as a blank. For example, a 10 cpi character that is 36 dot-columns wide is designed with 35 dot-columns of data; the last column must be specified as a blank.

Row 20 is generally used as the baseline. However, you may use all 24 rows for your character design.

The 249x cannot print two horizontal dots next to each other except when using an Enhanced Letter Quality (ELQ) font. The ELQ font can be printed by two-pass printing. If you design a character with consecutive horizontal dots, the first dot prints, and the second does not. Every alternate dot in the row of consecutive dots is printed starting with dot positions 1, 3, 5, and so on, until the group of consecutive dots ends (that is, there is a break in the row of dots).

The inability to print consecutive horizontal dots is not direction dependent. If you are printing left to right, the first consecutive dot in the design is printed and the dot to its right is not printed. If you are printing right to left, the internal algorithms compensate and print the design as it would appear if printed from left to right.

After you have designed the character, you can compress the character data to conserve memory. The compression algorithm is based on not storing a column that is identical to the column just to its left. To compress a character design, you must add consecutive dots to fill the design and act as place holders.

After completing the design, calculate the character data and the lookup table data. Then download the data and print the character.

The Download Sequence

This information shows the download sequence for downloading character data, lookup table data, and, for an entire font, the font descriptor byte. The following examples using the sequence include designing and downloading a monospaced draft character and a proportional character.

```
Syntax:   ESC =  countlow  counthigh  id startlow  starthigh  data

Decimal:  27   61 countlow  counthigh  35 startlow  starthigh  data

Hex:      1B   3D countlow  counthigh  23 startlow  starthigh  data
```

Count	Count is the number of bytes of data being downloaded starting with the font ID byte. The count is a 2-byte value downloaded as the low byte followed by the high byte.	
Font ID Byte	The font ID byte is a 1-byte number that identifies the font. The ID byte for the 249x is 35 (x23).	
Start	When downloading character data, the start address is the absolute address of the start of the character data. When downloading lookup table data, the start address is the address of the new entry in the lookup table. The start address is a 2-byte hexadecimal value downloaded as the low byte followed by the high byte.	
Data	When data is character data, it comes from the character design. When downloading lookup table data, **data** is as follows:	

Bit	Bit Values	Functions
1, 2, and 3 (Attribute Byte 1)		The absolute address of the character's image data.
7	*1*	Indicates that this is a block graphic character (connects at 6 LPI).
6	*0*	Indicates a downloaded character.
	1	Indicates a resident character.
5-0	The number of character data dot columns stored in memory.	
4 (Attribute Byte 2)		
7, 6	*0,0* Shading character.	The type of block graphic character.
	0,1 Line drawing character.	The type of block graphic character.
	1,0 Underscore character.	The type of block graphic character.
	1,1 Not supported.	The type of block graphic character.
5-0	For a 10 cpi Letter Quality 36 column character, bits 5-0 would be 35.	The number of dot columns of character data printed minus one.

Bit	Bit Values	Functions
5-9		Used for the compression mask. There is one bit per dot column with bit 7 of byte 5 mapping to the leftmost column. For a character with 36 dot columns when decompressed, bit 4 of byte 9 would map to the rightmost column. All zeros indicate that a character is not compressed. If a proportional character has more dot columns than compression mask bits, the remaining dot columns must be stored without compression. Only 39 dot columns can be compressed. Bit 40 of the compression mask is reserved.

The Lookup Table

- ASCII character 255, xFF, cannot be defined. It is a mandatory space and is the same size as ASCII character 32, x20.

- ASCII Character 0, x00, is the zero slash. Any character downloaded to 0, x00 replaces the zero. If the zero slash is selected from the operator panel, the download character is printed instead of ASCII character 48, x30.

- All block graphic characters are 30 dots high, even though only 24 dots are defined for each column.

  An underscore character is defined as a blank-block graphic character (all zeros). The underscore is generated by the printer during the second pass.

  A shading-block graphic character repeats dots 1-6 of each column as dots 25 through 30, respectively.

  A line-drawing-block graphic character repeats dots 23 and 24 as the pairs 25/26, 27/28, and 29/30.

- An entry can point to any character data image whether resident or down-loaded. Multiple entries can point to the same image. The address of an undefined entry should be zero. An undefined entry is printed as a space.

Managing the Download Area

If you are downloading and know the status of preceding downloaded information, you should not have any conflicts in character management. If, however, there is previously downloaded information in the download area and you are not sure of its status, you can write over the download area with the resident lookup tables for the currently selected code page. To write over any existing download data, send the printer command **ESC = 0 0**. Sending **ESC = 0 0** clears the existing download data and copies the resident lookup tables to the download area.

Note: The lookup tables copied using the **ESC = 0 0** command point to the resident fonts with the current code page. After receiving an **ESC = 0 0** command, the download area appears empty. Any valid download command activates the download access.

For more information, see "Downloading a New Font" on page 120.

The following four examples get you started. The first is an example of designing and downloading a monospaced Fast Draft character with compression. The second is an example of designing and downloading a draft character without compression. The third example illustrates how to design and download an LQ proportional character with compression. The fourth example shows how to design and download an ELQ 10 cpi character with compression. A description of downloading an entire font is in the following examples.

Designing Monospaced Fast Draft Characters

When designing monospaced Fast Draft characters, design the character for 10 cpi output and use as many dot-columns as possible.

Start with a grid that is 9 dots wide by 24 dots high. Although the character matrix is 10 dots wide, column 10 must be left blank.

```
          1 2 3 4 5 6 7 8 9

MSB   1
      2
      3
B     4
Y
T     5
E
      6
1
      7
LSB   8
MSB   9
     10
     11
B    12
Y
T    13
E
     14
2
     15
LSB  16
MSB  17
     18
     19
B    20
Y
T    21
E
     22
3
     23
LSB  24
```

Byte 1 00 0F 10 20 10 0F 00 00 00
Byte 2 07 18 A0 58 86 01 0E 00 00
Byte 3 C0 20 10 20 10 C0 30 00 00
Compresson
Mask   0 0 0 0 0 0 0 0 1
              0   0   8
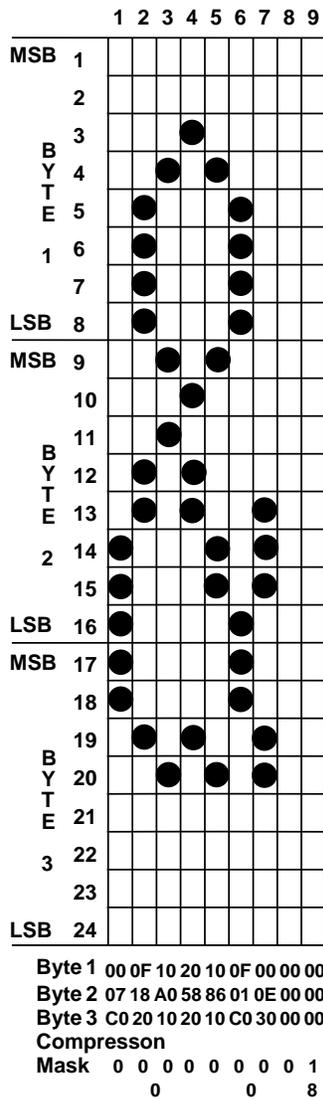
This example shows the design for the ampersand character (ASCII 38) from the
All Characters chart. This character design does not have any occurrences
where extra dots can be added, resulting in a column being identical to its
predecessor. For instance, column 4, row 4, could be turned on because it would
automatically be turned off during printing, but other bits in column 4 are
different from column 3, which means no compression can occur. Column 9 is
identical to column 8 (blank).

Creating the Character Data

Each dot column is sent to the printer as three bytes of data. To get the values of this data, convert the binary values to hexadecimal values.

First byte of data (most significant byte)	Top 8 print wires
Second byte of data	Middle 8 print wires
Third byte of data (least significant byte)	Bottom 8 print wires

The ampersand figure shows the hexadecimal value for each byte in each column of the character. For example, the last byte of column one is binary 1100 0000 or 192, xC0.

Initializing the Download Area

Use the following command to initialize the download area:

```
<x
 1B3D – download command prefix – initialize download area
 0000 – byte count (low byte first) – 0
>
```

Downloading the Character Data

You can start the character data at any unused memory address greater than xA413. This example uses xB000.

```
<x
  1B3D     -  download command prefix
  1B00     -  byte count (low byte first) - x001B, 27
  23       -  font ID for 249x printers
  00B0     -  start address - xB000

  0007C0   -  column 1
  0F1820   -  column 2
  10A010   -  column 3
  205820   -  column 4
  108510   -  column 5
  0F01C0   -  column 6
  000E30   -  column 7
  000000   -  columns 8 & 9
>
```

Downloading the Font Descriptor Byte

Send the following descriptor byte information to the printer:

```
<x
 1B3D   -  download command prefix
 0400   -  byte count (low byte first) - x0004, 4
 23     -  font ID for 249x printers
 1080   -  start address - x8010
 04     -  font descriptor byte - fast draft
>
```

For more information about the Font Descriptor Byte, see page 121.

Creating the Lookup Table Data

Before creating lookup table data, note the following memory addresses:

- The valid download address range for the 249x is x800C to xFFFF.
- The ASCI character 0 lookup table entry addresses for the resident fonts are:
    — Draft (10 and 12 cpi and Fast Draft (10 cpi) - x8011
    — 10 cpi Letter Quality and Enhanced Letter Quality - x8912
    — Proportional LQ and ELQ - x9213
    — 12 cpi LQ and ELQ - x9B14
- Download character data can start at any address greater than xA413.

In the example for the ampersand (Draft), ASCII character 38 is replaced with the ampersand (Fast Draft). Entry zero of the draft lookup table starts at x8011 and there are nine bytes per entry:

9 x 38 = 342 = x156 (the offset into the table)

x156 + x8011 = x8167 (offset + character lookup table address start)

The address for the new lookup table entry for ASCII character 38 is x8167.

Downloading the Lookup Table Data

Send the following lookup table information to the printer:

```
<x

 1B3D        -    download command prefix

 0C00        -    byte count (low byte first) - x000C,12

 23          -    font ID byte for 249x printers

 6781        -    start address in Lookup Table - x8167

 B000        -    start address of character data (high byte
                  first) - xB000

 08          -    number of stored columns

 09          -    number of printed columns - 1 (for last
                  blank column)

 0080000000  -    compression mask

 >
```

Printing the Character

To print the ampersand symbol, send the following command sequence:

```
<x

 1B49    - ESC,I - select print mode
 04      - draft, 10 cpi


 1B5B64  - ESC,[,@ - select print quality
 0100    - byte count (low byte first) - x0001, 1
 01      - print quality = Fast Draft


 1B5E    - print one character command
 26      - print character x26, ASCII 38 - ampersand

>
```

Designing Monospaced Draft Characters

When designing monospaced draft characters, design the character for 10 cpi output and use as many dot-columns as possible. This method also creates a better designed 12 cpi draft character.

To design a draft character, start with a grid that is 9 dots wide by 24 dots high. Although the character matrix for a draft character is 10 dots wide, the last column must be blank.

This example shows the design for the two-sixteenth note character (ASCII 14) from the All Characters Chart. Because the design of this character does not contain any consecutive columns that are identical, no compression can take place.
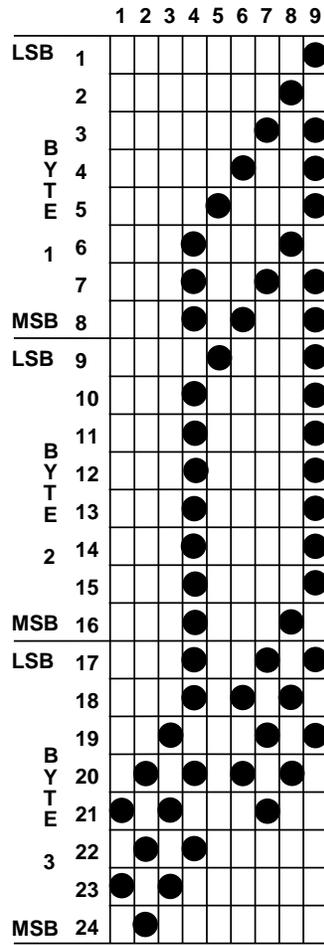
Byte 1 00 00 00 07 08 11 22 44 BB
Byte 2 00 00 00 7F 80 00 00 01 FE
Byte 3 0A 15 2A D4 00 50 A8 50 A0

Creating the Character Data

Each dot-column is sent to the printer as three bytes of data. To get the values of this data, convert the binary values to hexadecimal values.

First byte of data (most significant byte)	Top 8 print wires
Second byte of data	Center 8 print wires
Third byte of data (least significant byte)	Bottom 8 print wires

The two-sixteenth character shows the hexadecimal value for each byte in each column of the character. For example, the last byte of column one is binary 0000 1010 or 10, x0A. The character data is shown in the example below.

Initializing the Download Data

Use the following command to initialize the download area:

```
<x
 1B3D - download command prefix - initialize download area
 0000 - byte count (low byte first) - 0
>
```

Downloading the Character Data

You can start the character data at any unused memory address greater than xA413. This example uses xB000.

```
<x
  1B3D      -  download command prefix
  1E00      -  byte count (low byte first) - x001E, 30
  23        -  font ID for 249x printers
  00B0      -  start address (low byte first) - xB000

  0000A0    -  column 1
  000015    -  column 2
  00002A    -  column 3
  077FD4    -  column 4
  088000    -  column 5
  110050    -  column 6
  2200A8    -  column 7
  440150    -  column 8
  BBFEA0    -  column 9
 >
```

Creating the Lookup Table Data

Before creating lookup table data, make note of the following memory addresses.

*   The valid download address range for the 249x printers is x800C to xFFFF.
*   The ASCII character 0 lookup table entry addresses for the resident fonts are:
    —   Draft (10 and 12 cpi) and Fast Draft (10 cpi) - x8011
    —   10 cpi Letter Quality and Enhanced Letter Quality - x8912
    —   Proportional LQ and ELQ - x9213
    —   12 cpi LQ and ELQ - x9B14
    —   Download character data can start at any address greater than xA413

Example:

Replace ASCII character 173 (inverted exclamation point) with the two-sixteenth note. There are 9 bytes per entry, and entry 0 of the draft table starts at x8011.

> 9 x 173 = 1557 = x615 (the offset into the table)
>
> x615 + x8011 = x8626 (offset + character 0 lookup table address)
>
> The address for the new lookup table entry for ASCII character 173 is x8626.

Downloading the Lookup Table Data

Use the following example to send the lookup table information to the printer:

```
<x

 1B3D        -    download command prefix

 0C00        -    byte count (low byte first) - x000C,12

 23          -    font ID for 249x printers

 2686        -    start address in Lookup Table (low byte
                  first) - x8626

 B000        -    start address of character data (high
                  byte first) - xB000

 09          -    number of stored columns

 09          -    number of printed columns - 1 (for last
                  blank column)

 0000000000  -    compression mask

 >
```

Printing the Character

To print the two-sixteenth note character at 12 cpi download draft, send the following sequence:

```
<x
  1B49   -    ESC,I - select print mode
  0C     -    draft, 12 cpi


  1B5E   -    print one character command
  AD     -    print character xAD, ASCII character 173
>
```

Designing Proportionally Spaced Characters

Proportional characters in the 249x are based on a 7-unit width system described in "Design Considerations" on page 121.

Typical proportional character widths are:

- 3 unit character-18 dot columns wide (3 x 6)
- 4 unit character-24 dot columns wide (4 x 6)
- 5 unit character-30 dot columns wide (5 x 6)
- 6 unit character-36 dot columns wide (6 x 6)
- 7 unit character-42 dot columns wide (7 x 6)

You are not restricted to following this unit system when designing a proportional character. You may not design a character that is wider than 42 dots.

The following grid shows a 7 unit trademark symbol. Only 41 columns are shown because column 42 must be blank. Solid dots indicate downloaded and printed dots. Hollow dots indicate consecutive dots that may be added back to the design to take advantage of the compression algorithm.

Byte 1 3C 20 20 20 20 20 20 31 20 20 20 20 20 20 3C 00 00 20 20 20 3F 30 10 06 04 02 01 00 00 00 01 02 04 06 10 30 3F 20 20 20 00

Byte 2 00 00 00 04 04 04 04 FC 04 04 04 04 00 00 00 00 04 04 04 04 FC 04 04 04 04 00 00 80 C0 80 00 00 04 04 04 04 FC 04 04 04 04

Byte 3 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

Compression

Mask 0 0 1 0 | 1 1 1 0 | 0 1 1 1 | 0 1 0 0 | 0 0 1 1 | 0 0 0 0 | 0 0 0 0 | 0 0 0 0 | 0 0 0 0 | 0 0 1 0 | 0

        2   E   7   4   3   0   0   0   0   2

Creating the Character Data

Each dot-column is sent to the printer as three bytes of data. To get the values of this data, convert the binary values to hexadecimal values.

First byte of data (most significant byte)	Top 8 print wires
Second byte of data	Middle 8 print wires
Third byte of data (least significant byte)	Bottom 8 print wires

The figure shows the hexadecimal value for each byte in each column of the character. For example, the first byte of column one is binary 0011 1100 or 60, x3C.

Compressing the Character

To make a compression mask, set the mask bit for each column (which is identical to the column to its left) to one. Note that only 39 columns can be compressed. The grid on page 136 shows that column 40 is the same as column 39; however, column 40 must be stored. Therefore, compression mask bit 40 is set to zero.

Next, convert the binary values to hexadecimal. The compression mask for the TM symbol is **x2E74300002.**

If you use compression, download only dot-columns with mask bits set to zero. Data, with mask bits set to one, is generated by the printer according to the compression mask.

Initializing the Download Area

Use the following command to initialize the download area:

```
<x
 1B3D - download command prefix - initialize download area
 0000 - byte count (low byte first) - 0
>
```

Downloading the Character Data

You can start the character data at any unused memory address greater than xA413. This example uses xA414.

```
<x
 1B3D    -   download command prefix – character data
 5D00    -   byte count (low byte first) - x005D, 93
 23      -   font ID for 249x printers
 14A4    -   start address (low byte first) - xA414

 3C0000  -   column 1
 200000  -   columns 2 & 3
 200400  -   columns 4, 5 6 & 7
 3FFC00  -   column 8
 200400  -   columns 9, 10, 11 & 12
 200000  -   columns 13 & 14
 3C0000  -   column 15
 000000  -   column 16
 000400  -   column 17
 200400  -   columns 18, 19 & 20
 3FFC00  -   column 21
 300400  -   column 22
 100400  -   column 23
 060400  -   column 24
 040400  -   column 25
 020000  -   column 26
 010000  -   column 27
 008000  -   column 28
 00C000  -   column 29
 008000  -   column 30
 010000  -   column 31
 020000  -   column 32
 040400  -   column 33
 060400  -   column 34
 100400  -   column 35
 300400  -   column 36
 3FFC00  -   column 37
 200400  -   columns 38 & 39
 200400  -   column 40
 000400  -   column 41
 >
```

Creating the Lookup Table Data

Before downloading lookup table data or character data, make note of the following memory addresses.

- The valid download address range for the 249x is x800C to xFFFF.
- The ASCII character 0 lookup table addresses for the resident fonts are:
  — Draft (10 and 13 cpi) and Fast Draft (10 cpi) - x8011
  — 10 cpi Letter Quality and Enhanced Letter Quality - x8912
  — Proportional LQ and ELQ - x9213
  — 12 cpi LQ and ELQ - x9B14
  — Download character data can start at an address greater than xA413

In this example, the inverted exclamation mark, ASCII character 173, is replaced with the trademark symbol. Entry zero of the proportional table starts at x9213 and there are nine bytes per entry:

9 x 173 = 1557 = x615 (the offset into the table)

x615 + x9213 = x9828 (offset + character 0 lookup table address)

The address for the new lookup table entry for ASCII character 173 is x9828.

Downloading the Lookup Table Data

Send the following lookup table example to the printer:

```
<x
  1B3D       -  download command prefix - lookup table
                data
  0C00       -  byte count (low byte first) - x000C,12
  23         -  font id for 249x printers
  2898       -  start address in Lookup Table (low byte
                first) - x9828
  A414       -  start address of character data (high byte
                first) - xA414
  1E         -  number of stored columns
  29         -  number of printed columns - 1 (for last
                blank column)
  2E74300002 -  compression mask
>
```

Printing the Character

To print the trademark character, send the following sequence:

```
<x
 1B49  -  ESC, I - select print mode
 07    -  Letter Quality, proportional space

 1B5E  -  print one character command
 AD    -  print character xAD, ASCII character 173
>
```

Designing Enhanced Letter Quality Characters

When designing monospaced Enhanced Letter Quality characters, you can use horizontal consecutive dots.

To design a character, start with a 35 dot wide by 24 dot high grid. Although the character matrix for an ELQ character is 36 dots wide, the last column must be blank.

This example shows the draft design for the capital AE character (ASCII 146) from the All Characters Chart.

Note: A blank column must be added after the last column of this character.

Byte 1 00 00 00 00 00 00 00 10 10 10 10 13 17 1C 18 10 10 10 10 10 10 1F 1F 10 10 10 10 10 10 10 10 10 10 1F 1F
Byte 2 00 00 00 00 00 03 07 1C 38 E8 C8 08 08 08 08 08 08 08 FF FF 10 10 10 10 10 10 10 7C 00 00 00 00 00 03 03
Byte 3 10 10 10 30 F0 D0 10 10 00 00 00 00 00 00 00 10 10 10 F0 F0 10 10 10 10 10 10 10 10 10 10 10 10 10 F0 F0

Compression

Mask |0 1 1 0 |0 0 0 0 |0 0 0 0 |0 0 0 1 |0 1 1 0 |1 0 1 1 |1 1 1 1 |0 0 1 1 |1 0 1
         6   0   0   1   6   B   F   3   A

Creating the Character Data

Each dot-column is sent to the printer as three bytes of data. To get the value for the first byte of data, convert the binary values of the bottom eight print wires to hexadecimal. The most significant bit of each byte is the top dot. The least significant bit of each byte is the bottom dot.

The figure on page 141 shows the value for each byte in each column of the character. For example, the last byte of column two is binary 0001 0000 or 10. The character data is shown in the following example.

Initializing the Download Area

Use the following command to initialize the download area:

```
<x
 1B3D ₋ download command prefix - initialize download area
 0000 ₋ byte count (low byte first) - 0
>
```

Downloading the Character Data

You can start the character data at any unused memory address greater than xA413. This example uses xA414.

```
 <x

  1B3D      -     download command prefix - character data

  3C00      -     byte count (low byte first) - x003C, 60

  23        -     font ID for 249x printers

  14A4      -     start address (low byte first) - xA414


  000010    -     columns 1-3

  000030    -     column 4

  0000F0    -     column 5

  0003D0    -     column 6

  100710    -     column 7

  101C10    -     column 8

  103800    -     column 9

  10E800    -     column 10

  13C800    -     column 11

  170800    -     column 12

  1C0800    -     column 13

  180800    -     column 14

  100800    -     columns 15 & 16

  100810    -     columns 17 - 19

  1FFFF0    -     columns 20 & 21

  101010    -     columns 22 - 28

  107C10    -     column 29

  100010    -     columns 30 - 33

  1F03F0    -     columns 34 & 35

 >
```

Downloading the Font Descriptor Byte

Send the following descriptor byte information to the printer:

```
<x
  1B3D  -  download command prefix - font descriptor byte
  0400  -  byte count (low byte first) – x0004, 4
  23    -  font ID for 249x printers
  189   -  font descriptor byte address (low byte first) –
           x8911
  05    -  font descriptor byte – ELQ
>
```

For more information about the Font Descriptor Byte, see page 121.

Creating the Lookup Table Data

Before creating lookup table data, make note of the following memory addresses.

- The valid download address range for the 249x is x800C to xFFFF.
- The ASCII character 0 lookup table entry addresses for the resident fonts are:
  - — Draft (10 and 12 cpi) and Fast Draft (10 cpi) - x8001
  - — 10 cpi Letter Quality and ELQ - x8912
  - — Proportional Letter Quality and ELQ - x9213
  - — 12 cpi Letter Quality and ELQ - x9B14
- Download character data can start at any address greater than xA413

In this example, the Letter Quality capital AE character (ASCII character 146) is replaced with the ELQ capital AE character. Entry zero of the draft table starts at x8011 and there are nine bytes per entry:

9 x 146 = 1314 = x522 (the offset into the table)

x522 + x8912 = x8E34 (offset + character ASCII 146 lookup table address)

The address for the new lookup table entry for ASCII character 146 is x8E34.

Downloading the Lookup Table Data

Send the following lookup table information to the printer:

```
<x
  1B3D          -   download command prefix - lookup table
                    data
  0C00          -   byte count (low byte first) - x000C, 12
  23            -   font ID for 249x printers
  348E          -   start address in Lookup Table (low byte
                    first) - x8E34
  A414          -   start address of character data (high
                    byte first) - xA414
  13            -   number of stored columns
  23            -   number of printed columns - 1 (for last
                    blank column)
  60016BF3A0    -   compression mask
>
```

Printing the Character

To print the character at 10 cpi download Enhanced Letter Quality, send the following sequence:

```
<x
  1B49     -   ESC, I - select print mode
  06       -   Letter Quality, 10 cpi
               dpi
  1B5B64   -   ESC, [, d - set print quality
  0100     -   byte count (low byte first) - x0001, 1
  FE       -   Enhanced Letter Quality

  1B5E     -   print one character command
  92       -   print character x92, ASCII character 146
>
```

Barcodes

This section describes how to use your printer to generate barcodes.

Barcode Function

You can print barcodes on your printer in both IBM and Epson emulation modes.

In the 248x printer's **Data Options** setup menu, the barcode option must be set to **ENABLE** to reserve 1K of the receive buffer for barcode processing. If the option is not set to **ENABLE**, barcode printing is not possible. For 249x printers, buffer space is reserved automatically for barcode processing.

Resident barcodes include:

EAN-13	UPC-A
EAN-8	POSTNET
Code 39	Code 128

Interleaved 2of5

A barcode is a set of adjacent parallel bars and spaces of specific widths that has an encoded algorithm for the barcode type.

The *module width* is the base unit of measurement used to determine the overall width of a printed barcode. A character width within a barcode is an integral multiple of a module width. Each bar and space is an integral multiple of a module width. In order to account for differences in tolerances and optical conditions between printing and scanning a barcode, your printer provides "space width adjustment" for fine adjustment of space and bar ratios.

Barcodes may be printed with or without *human readable characters.* Typically, these characters are printed below the barcode, which allows the data to be manually entered if the barcode cannot be scanned.

UPC-A and EAN-13 barcodes use a ***flag character*** for number system encoding and country code. Your printer provides the capability of printing the human readable form of this flag character either in the vertical center along the left side of the barcode, or under the barcode with the other human readable characters.

Some barcodes use a ***check characte***r, a character at a predetermined position within a barcode, whose value is computed by a mathematical algorithm. When the barcode is scanned, the scanner can check the data using the same algorithm to validate that the barcode was read correctly.

Flag Character → 1

Human Readable Characters → 2 3 4 5 6 7 8 9 0 1

2 ← **Check Character**
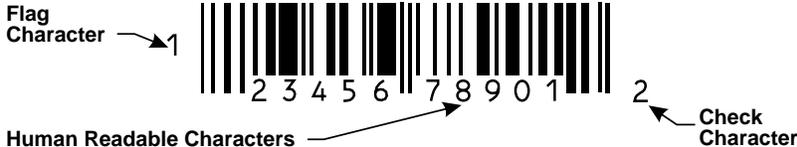
Each barcode type has a defined set of characters. Specific parameters for each barcode type, including their character set definitions, are covered in the Barcode Symbologies section beginning on page 153.

Accessing the printer's resident barcode function requires sending two escape sequences to the printer:

- Barcode setup command
- Data transfer command

The barcode function is explained in the following four sections:

> Barcode Setup Command
>
> Data Transfer Command
>
> Barcode Symbologies
>
> Notes on Barcoding

Barcode Setup Command

This command specifies all the necessary parameters to define the desired barcode symbology.

```
Syntax:   ESC [    f   6  0  k  m  s  v1  v2  c

Decimal:  27  91  102 6  0  k  m  s  v1  v2  c

Hex:      1B  5B  66  0  0  k  m  s  v1  v2  c
                        6  0
```

k is the barcode type.

Barcode Type	k value
EAN-13	178, xB2
EAN-8	179, xB3
Code 39	180, xB4
Interleaved 2of5	182, xB6
UPC-A	183, xB7
POSTNET	185, xB9
Code 128	186, xBA

m is the module width.

Module is a term defining the smallest unit of measurement within a barcode. The module width, **m**, is used to determine both bar and space widths.
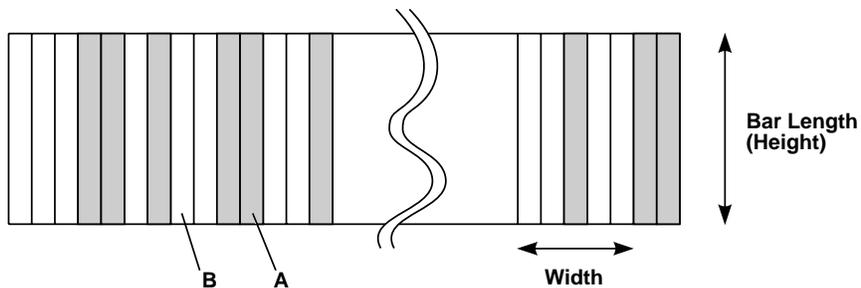
B is a space module.   **A** is a bar module.

m value	# of dots	248x module width	249x module width
0 (default)	2 dots	0.021 inches	0.015 inches
1	2 dots	0.017 inches	0.012 inches
2	2 dots	0.021 inches	0.015 inches
3	3 dots	0.030 inches	0.021 inches
4	4 dots	0.038 inches	0.026 inches

Note: If **m** = 1, the human readable character is not printed.

An example of Code 39, with **m** = 0 and **m** = 1, follows:

m = 0 (the human readable character is printed)

m = 1 (the human readable character is <u>not</u> printed)

s **is the space width adjustment factor.**

This parameter affects only **space** modules. It can be used to adjust the width of space modules.

The range for possible **s** values is: -3 <= **s** <= 3.

s value	248x space module adjustment	249x space module adjustment
-3, xFD	-3/240 inch	-3/360 inch
-2, xFE	-2/240 inch	-2/360 inch
-1, xFF	-1/240 inch	-1/360 inch
0, x00 (default)	0	0
1, x01	1/240 inch	1/360 inch
2, x02	2/240 inch	2/360 inch
3, x03	3/240 inch	3/360 inch

Notes:

- The **s** value affects the actual width of the entire barcode.
  To minimize the width of space modules, set **s** = xFD.
  To maximize the width of space modules, set **s** = x03.
- If an invalid **s** value is specified, it is ignored and the default value (**s** = 00) is used.

v1, v2 define the bar height.

Use the following steps to calculate the values of **v1** and **v2**:

1 Determine the approximate desired height (in inches) of the bar.

2 Let $V = 2160$ x (height in inches). Round V to the nearest whole number.

3 **v1** is the lower byte of V (remainder of V divided by 256).

4 **v2** is the upper byte of V (quotient of V divided by 256).

Example:

1 Desired height is 0.47 inch.

2 $V = $ round (2160 x 0.47) = round (1015.2) = 1015.

3 **v1** = remainder (1015 divided by 256) = 247, xF7

4 **v2** = quotient (1015 divided by 256) = 3, x03

v1, v2 are subject to the following limitation:

Printer Model	Minimum V value	Minimum v1, v2 values
248x	270	x0E, x01
249x	288	x20, x01

Notes:

- If you try to use values less than the minimum values, the printer ignores your values and uses the minimum values.
- The vertical pitch for 248x printers is 1/72 inch.
  The vertical pitch for 249x printers is 1/180 inch.

c is the control flag.

c is a multi-purpose parameter. It has three bits that determine check digit, human readable character, and flag character position.

x	x	x	x	x	Flag Char.	Human Read. Char.	Check Digit
b7	b6	b5	b4	b3	b2	b1	b0

b0: check digit

    0:      If check digit is to be printed, host/software generates it.

    1:      Printer generates and prints check digit.

b1: human readable character

    0:      Prints human readable character.
    1:      Does not print human readable character.

b2: flag character position (for EAN-13 and UPC-A only)

    0:      Center
    1:      Under

b3-b7:   Not used

An example of deriving the **c** parameter follows:

1 Check digit is to be printed by the printer.
The human readable character is to be printed.
The flag character position is to be centered.

2 Therefore, b2 = 0, b1 = 0, and b0 = 1.

					0	0	1
b7	b6	b5	b4	b3	b2	b1	b0

Data Transfer Command

This command transfers the barcode data to the printer for printing.

```
Syntax:   ESC [   p   n1  n2  data

Decimal: 27  91  112 n1  n2  data

Hex:      1B  5B  70  n1  n2  data
```

Use the following steps to calculate the values of **n1** and **n2**, which specify the number of characters of barcode data:

1 Let N = the actual number of characters of data to be transferred.

2 **n1** is the lower byte of N (remainder of N divided by 256).

3 **n2** is the upper byte of N (quotient of N divided by 256).
n2 is normally 0.

The printer may not print the barcode if N does not match the number of characters required for the barcode type.

After sending the data transfer command and the barcode data, sufficient vertical movement is required to move past the length of the bars. In the Barcode Symbology examples that follow, this movement is indicated by an ellipsis.

Data is the actual data to be transferred into the barcode symbology.

The data for the barcode data transfer command is a string of ASCII characters immediately following the **n1, n2** count bytes. The string "APPLE" is transferred in the example below:

```
<x

 1B5B70   -  barcode data transfer command prefix

 0500     -  byte count (low byte first) – x0005, 5

          -  5 bytes following the '>' is the data to be
             transferred

 >APPLE
```

To determine the data length requirement for each barcode type, continue with Barcode Symbologies.

Barcode Symbologies

The seven barcode symbologies (EAN-13, EAN-8, Code 39, Interleaved 2of5, UPC-A, POSTNET and Code 128) are defined, with examples, in the following section.

EAN-13

The European Article Numbering (EAN) barcode is the European version of the all-numeric, fixed length UPC symbology.

k value:	178, xB2
m value:	0 to 4, x00 to x04
s value:	-3 to 3, xFD to x03
minimum **v1, v2** values:	x0E, x01 (248x) x20, x01 (249x)
c parameter:	available functions: b0, check digit b1, human readable b2, flag character position

n1 value (**b0 = 0**):	13, x0D
n1 value (**b0 = 1**):	12, x0C
n2 value:	0, x00

data character set:

Character	Hex
'0'	x30
'1'	x31
'2'	x32
'3'	x33
'4'	x34
'5'	x35
'6'	x36
'7'	x37
'8'	x38
'9'	x39

Examples:

Valid EAN-13 command:

```
<x
  B5B66              - barcode setup command prefix
  0600               - setup data length (low byte first) -
                       x0006, 6
  B2                 - barcode type = EAN-13
  00                 - module width = default
  00                 - space width adjustment = default
  4003               - height (low byte first) - x0340 =
                       832 = 0.385 inches
  00                 - control byte: check digit from
                       host, print human readable
                       character, center flag character

  1B5B70             - barcode data transfer command
                       prefix
  0D00               - data transfer length (low byte
                       first) - x000D, 13
 >2359458890256 ...
```


Since the b0 bit of the **c** parameter has a value of 0 (check digit by host∕ software), there must be 13 data characters (**x0D**) specified in the Data Transfer Command.

Invalid EAN-13 command:

```
<x

 1B5B66              - barcode setup command prefix

 0600                - setup data length (low byte first) -
                       x0006, 6

 B2                  - barcode type = EAN-13

 00                  - module with = default

 00                  - space width adjustment = default

 4003                - height (low byte first) - x0340 =
                       832 = 0.385 inches

 01                  - control byte: check digit from host,
                       print human readable character,
                       center flag character


 1B5B70              - barcode transfer command prefix

 0D00                - data transfer length (low byte
                       first) - x000D, 13

 >0584454824159 ...
```

Since the b0 bit of the **c** parameter has a value of 01 (check digit by printer), there must be **12** data characters (**x0C**), <u>not</u> **13** (**x0D**), specified in the Data Transfer.

EAN-8

k value:	179, xB3
m value:	0 to 4, x00 to x04
s value:	-3 to 3, xFD to x03
minimum **v1, v2** values:	x0E, x01 (248x)
	x20, x01 (249x)
c parameter:	available functions: b0, check digit b1, human readable
n1 value (**b0 = 0**):	8, x08
n1 value (**b0 = 1**):	7, x07
n2 value:	0, x00

data character set:

Character	Hex
'0'	x30
'1'	x31
'2'	x32
'3'	x33
'4'	x34
'5'	x35
'6'	x36
'7'	x37
'8'	x38
'9'	x39

Examples:

Valid EAN-8 command:

```
<x

 1B5B66        - barcode setup command prefix

 0600          - setup data length (low byte first) -
                 x0006, 6

 B3            - barcode type = EAN-8

 00            - module width = default

 00            - space width adjustment = default

 4003          - height (low byte first) - x0340 = 832 =
                 0.385 inches

 01            - control byte: check digit from host, print
                 human readable character


 1B5B70        - barcode data transfer command prefix

 0700          - data transfer length (low byte first) -
                 x0007, 7

>2359458 ...
```

2 3 5 9   4 5 8 6

Since the b0 bit of the **c** parameter has a value of 01 (check digit by printer), there must be 7 data characters (**x07**) specified in the Data Transfer Command.

Invalid EAN-8 command:

```
 >x

  1B5B66        - barcode setup command prefix

  0600          - setup data length (low byte first) -
                  x0006, 6

  B3            - barcode type = EAN-8

  00            - module width = default

  00            - space width adjustment = default

  4003          - height (low byte first) - x0340 = 832 =
                  0.385 inches

  01            - control byte: check digit from host, print
                  human readable character


  1B5B70        - barcode data transfer command prefix

  0700          - data transfer length (low byte first) -
                  x0007, 7
 >058C454 ...
```

The letter **'C'** is not a valid data character for EAN-8; the numbers '0'-'9' are the only valid characters.

CODE 39

This barcode symbology uses both alphabetic and numeric characters. The printer will add a start/stop character, '*', to the barcode and human readable character automatically.

k value:	180, xB4
m value:	0 to 4, x00 to x04
s value:	-3 to 3, xFD to x03
minimum **v1, v2** values:	x0E, x01 (248x)
	x20, x01 (249x)
c parameter:	available functions:
	b0, check digit
	b1, human readable
n1 value (**b0 = 0**):	1 to 255, x01 to xFF
n1 value (**b0 = 1**):	1 to 255, x01 to xFF
n2 value:	0, x00

data character set:

Character	Hex	Character	Hex
'0'	x30	'M'	x4D
'1'	x31	'N'	x4E
'2'	x32	'O'	x4F
'3'	x33	'P'	x50
'4'	x34	'Q'	x51
'5'	x35	'R'	x52
'6'	x36	'S'	x53
'7'	x37	'T'	x54
'8'	x38	'U'	x55
'9'	x39	'V'	x56
'A'	x41	'W'	x57
'B'	x42	'X'	x58
'C'	x43	'Y'	x59
'D'	x44	'Z'	x60
'E'	x45	'-'	x2D
'F'	x46	'.'	x2E
'G'	x47	space	x20
'H'	x48	'$'	x24
'I'	x49	'/'	x2F
'J'	x4A	'+'	x2B
'K'	x4B	'%'	x25
'L'	x4C	—	—

Examples:

Valid Code 39 command:

```
<x
  1B5B66     - barcode setup command prefix
  0600       - setup data length (low byte first) - x0006,
               6
  B4         - barcode type = Code 39
  04         - module width = 4 = 0.038 inches on 248x,
               0.026 inches on 249x
  03         - space width adjustment = 3 = 0.0125 inches
               on 248x, 0.0083 inches on 249x
  0303       - height (low byte first) - x0303 = 771 =
               0.357 inches
  00         - control byte: check digit from host, print
               human readable character


  1B5B70     - barcode data transfer command prefix
  0400       - data transfer length (low byte first) -
               x0004, 4
>FOOD ...
```

Invalid Code 39 command:

```
<x
 1B5B66    - barcode setup command prefix
 0600      - setup data length (low byte first) -
             x0006, 6
 B4        - barcode type = Code 39
 00        - module width = default
 00        - space width adjustment = default
 4003      - height (low byte first) - x0340 = 832 =
             0.385 inches
 00        - control byte: check digit from host,
             print human readable character


 1B5B70    - barcode data transfer command prefix
 0300      - data transfer length (low byte first) -
             x0003, 3
 >CaT ...
```

The lowercase **'a**' is not a valid data character for Code 39.

INTERLEAVED 2of5

Interleaved 2of5 is used to express all-numeric messages. Two bytes of data are encoded to form one barcode character. If the check digit generation flag is on (b0 = 1), the printer will add a '0' to the data string automatically.

k value:	182, xB6
m value:	0 to 4, x00 to x04
s value:	-3 to 3, xFD to x03
minimum **v1, v2** value:	x0E, x01 (248x)
	x20, x01 (249x)
c parameter:	available functions:
	b0, check digit
	b1, human readable
n1 value (**b0 = 0**):	1 to 255, x01 to xFF
n1 value (**b0 = 1**):	1 to 255, x01 to xFF
n2 value:	0, x00

data character set:

Character	Hex
'0'	x30
'1'	x31
'2'	x32
'3'	x33
'4'	x34
'5'	x35
'6'	x36
'7'	x37
'8'	x38
'9'	x39

Examples:

Valid Interleaved 2of5 command:

```
<x

 1B5B66    - barcode setup command prefix

 0600      - setup data length (low byte first) -
             x0006, 6

 B6        - barcode type = Interleaved 2of5

 00        - module width = default

 00        - space width adjustment = default

 1003      - height (low byte first) - x0310 = 784 =
             0.363 inches

 01        - control byte: check digit from host,
             print human readable character


 1B5B70    - barcode data transfer command prefix

 0400      - data transfer length (low byte first) -
             x0004, 4

>2359 ...
```


Since the b0 bit of the **c** parameter has a value of 01 (check digit by printer), note the 0 character added to the barcode above.

Invalid Interleaved 2of5 command:

```
<x
 1B5B66    - barcode setup command prefix
 0600      - setup data length (low byte first) - x0006, 6
 B6        - barcode type = Interleaved 2of5
 00        - module width = default
 00        - space width adjustment = default
 4003      - height (low byte first) - x0340 = 832 = 0.385
             inches
 00        - control byte: check digit from host, print
             human readable character


 1B5B70    - barcode data transfer command prefix
 0400      - data transfer length (low byte first) -
             x0004, 4
>058$ ...
```

Four characters are specified in the Data Transfer Command. The first three characters, **"058"**, are in the character set for Interleaved 2of5. The fourth character,' **$**', is not valid for Interleaved 2of5.

UPC-A

UPC-A is an all-numeric, fixed-length symbology.

k value:	183, xB7
m value:	0 to 4, x00 to x04
s value:	-3 to 3, xFD to x03
minimum **v1, v2** values:	x0E, x01 (248x)
	x20, x01 (249x)
c parameter:	available functions:
	b0, check digit
	b1, human readable
	b2, flag character position
n1 value (**b0 = 0**):	12, x0C
n1 value (**b0 = 1**):	11, x0B
n2 value:	0, x00

data character set:

Character	Hex
'0'	x30
'1'	x31
'2'	x32
'3'	x33
'4'	x34
'5'	x35
'6'	x36
'7'	x37
'8'	x38
'9'	x39

Valid UPC-A command:

```
<x
  1B5B66            - barcode setup command prefix

  0600              - setup data length (low byte first) -
                      x0006, 6

  B7                - barcode type = UPC-A

  00                - module width = default

  00                - space width adjustment = default

  1003              - height (low byte first) - x0310 = 784
                      = 0.363 inches

  01                - control byte: check digit from host,
                      print human readable character, center
                      flag character


  1B5B70            - barcode data transfer command prefix

  0B00              - data transfer length (low byte first)
                      - x000B, 11
>12345678901 ...
```

Since the b0 bit of the **c** parameter has a value of 01 (check digit by printer), there must be **11** data characters (**x0B**) specified in the Data Transfer Command.

Invalid UPC-A command:

```
<x
```

1B5B66	– barcode setup command prefix
0600	– setup data length (low byte first) – x0006, x
B7	– barcode type = UPC-A
00	– module width = default
00	– space width adjustment = default
4003	– height (low byte first) – x0340 = 832 = 0.385 inches
00	– control byte: check digit from host, print human readable character, center flag character
1B5B70	– barcode data transfer command prefix
0B00	– data transfer length (low byte first) – x000B, 11

```
 >05852549545 ...
```

Since b0 bit of the **c** parameter has a value of **0** (check digit by host/software), there must be **12** data characters (**x0C**), not **11** (**x0B**), specified in the Data Transfer Command.

POSTNET

This all-numeric symbology is used to express U.S. Postal Service ZIP codes.

k value:	185, xB9
m value:	0 to 4, x00 to x04
s value:	ignored
minimum **v1, v2** values:	ignored; POSTNET uses two different bar lengths only: a *long* bar and a *short* bar. For 248x printers, the actual lengths of the *long* bar and *short* bar are 18/144 inch and 6/144 inch, respectively. For 249x printers, the actual lengths of the *long* bar and *short* bar are 24/180 inch and 8/180 inch, respectively.
c parameter:	available functions: b0, check digit

n1 value (**b0=0**):

6, x06	5-digit ZIP code
10, x0A	ZIP+4
12, x0C	Delivery Point Barcode (DPBC)

n1 value (**b0=1**):

5, x05	5-digit ZIP code
9, x09	ZIP+4
11, x08	Delivery Point Barcode (DPBC)

n2 value: 0, x00

data character set:

Character	Hex
'0'	x30
'1'	x31
'2'	x32
'3'	x33
'4'	x34
'5'	x35
'6'	x36
'7'	x37
'8'	x38
'9'	x39

Examples:

Valid POSTNET command:

```
<x

 1B5B66              - barcode setup command prefix

 0600                - setup data length (low byte first) -
                       x0006, 6

 B9                  - barcode type = POSTNET

 00                  - module width = default

 00                  - space width adjustment = default

 0000                - height (low byte first) - 0

 00                  - control byte: no functions selected


 1B5B70              - barcode data transfer command prefix

 0C00                - data transfer length (low byte first)
                       - x000C, 12

>405111876403 ...
```

Ildulllmulldulltmlllulldmblllmldlllmlltl

Since the **v1, v2** values for the bar length are ignored for POSTNET, 00 00 is an
acceptable bar length specification.

Invalid POSTNET command:

```
<x
 1B5B66         -  barcode setup command prefix
 0600           -  setup data length (low byte first) -
                   x0006, 6
 B9             -  barcode type = POSTNET
 00             -  module width = default
 00             -  space width adjustment = default
 0000           -  height (low byte first) - ignored for
                   POSTNET
 00             -  control byte: no functions selected


 1B5B70         -  barcode data transfer command prefix
 0A00           -  data transfer length (low byte first) -
                   x000A, 10
>40511-876 ...
```

The '-' (dash) is an invalid character for POSTNET.

Code 128

Code 128 is a flexible symbology that uses numeric and certain alphabetic and symbolic characters. It provides three separate character sets and a method of shifting between character sets within the same barcode. The first byte of the data string defines the character set. If an invalid character is included for the first byte, the printer ignores all data defined by **n1, n2** and does not print the barcode. Valid values for the first byte are x41 (for character set A), x42 (for character set B), and x43 (for character set C). To shift to another character set, two special codes are provided in each character set. They may be included in the barcode data to shift to one of the two alternative character sets. If the check digit generation flag is on (b0 = 1), the printer adds a **0** to the data string automatically.

k value:	186, xBA
m value:	0 to 4, x00 to x04
s value:	-3 to 3, xFD to x03
minimum **v1, v2** values:	x0E, x01 (248x)
	x20, x01 (249x)
c parameter:	functions available: b0, check digit b1, human readable
n1 value (**b0 = 0**):	2 to 255, x02 to xFF
n1 value (**b0 = 1**):	2 to 255, x02 to xFF
n2 value:	0, x00

data character sets:

Function	Hex
START A	x41
START B	x42
START C	x43

The character and corresponding hex code for each of these character sets are shown on the following pages.

data character set **A**:

Character	Hex Code	Character	Hex Code	Character	Hex Code	Character	Hex Code
NUL	x00	Space	x20	'@'	x40	FNC 3	x60
OH	x01	'!'	x21	'A'	x41	FNC 2	x61
STX	x02	' " '	x22	'B'	x42	Shift	x62
ETX	x03	'#'	x23	'C'	x43	CodeC	x63
EOT	x04	'$'	x24	'D'	x44	CodeB	x64
ENO	x06	'%'	x25	'E'	x45	FNC 4	x65
ACK	x06	'&'	x26	'F'	x46	FNC 1	x66
BEL	x07	' ' '	x27	'G'	x47	—	—
BS	x08	'('	x28	'H'	x48	—	—
HT	x09	')'	x29	'I'	x49	—	—
LF	x0A	'*'	x2A	'J'	x4A	—	—
VT	x0B	'+'	x2B	'K'	x4B	—	—
FF	x0C	','	x2C	'L'	x4C	—	—
CR	x0D	'-'	x2D	'M'	x4D	—	—
SO	x0E	'.'	x2E	'N'	x4E	—	—
SI	x0F	'/'	x2F	'0'	x4F	—	—
DLE	x10	'0'	x30	'P'	x50	—	—
DC1	x11	'1'	x31	'Q'	x51	—	—
DC2	x12	'2'	x32	'R'	x52	—	—
DC3	x13	'3'	x33	'S'	x53	—	—
DC4	x14	'4'	x34	'T'	x54	—	—
NAK	x15	'5'	x35	'U'	x55	—	—
SYN	x16	'6'	x36	'V'	x56	—	—
ETB	x17	'7'	x37	'W'	x57	—	—
CAN	x18	'8'	x38	'X'	x58	—	—
EM	x19	'9'	x39	'Y'	x59	—	—
SUB	x1A	':'	x3A	'Z'	x5A	—	—
ESC	x1B	';'	x3B	'['	x5B	—	—
FS	x1C	'<'	x3C	'¥'	x5C	—	—
GS	x1D	'='	x3D	']'	x5D	—	—
RS	x1E	'>'	x3E	'^'	x5E	—	—
US	x1F	'?'	x3F	'_'	x5F	—	—

data character set **B**:

Character	Hex Code	Character	Hex Code	Character	Hex Code	Character	Hex Code
		Space	x20	'@'	x40		x60
		'!'	x21	'A'	x41	'a'	x61
		' " '	x22	'B'	x42	'b'	x62
		'#'	x23	'C'	x43	'c'	x63
		'$'	x24	'D'	x44	'd'	x64
		'%'	x25	'E'	x45	'e'	x65
		'&'	x26	'F'	x46	'f'	x66
		' ' '	x27	'G'	x47	'g'	x67
		'('	x28	'H'	x48	'h'	x68
		')'	x29	'I'	x49	'i'	x69
		'*'	x2A	'J'	x4A	'j'	x6A
		'+'	x2B	'K'	x4B	'k'	x6B
		','	x2C	'L'	x4C	'l'	x6C
		'-'	x2D	'M'	x4D	'm'	x6D
		'.'	x2E	'N'	x4E	'n'	x6E
		'/'	x2F	'O'	x4F	'o'	x6F
		'0'	x30	'P'	x50	'p'	x70
		'1'	x31	'Q'	x51	'q'	x71
		'2'	x32	'R'	x52	'r'	x72
		'3'	x33	'S'	x53	's'	x73
		'4'	x34	'T'	x54	't'	x74
		'5'	x35	'U'	x55	'u'	x75
		'6'	x36	'V'	x56	'v'	x76
		'7'	x37	'W'	x57	'w'	x77
		'8'	x38	'X'	x58	'x'	x78
FNC 3	x19	'9'	x39	'Y'	x59	'y'	x79
FNC 2	x1A	':'	x3A	'Z'	x5A	'z'	x7A
Shift	x1B	';'	x3B	'['	x5B	'{'	x7B
CodeC	x1C	'<'	x3C	'¥'	x5C	'|'	x7C
FNC 4	x1D	'='	x3D	']'	x5D	'}'	x7D
CodeA	x1E	'>'	x3E	'^'	x5E	'-'	x7E
FNC 1	x1F	'?'	x3F	'_'	x5F	DLE	x7F

data character set **C**:

Character	Hex Code	Character	Hex Code	Character	Hex Code	Character	Hex Code
'00'	x3030	'32'	x3332	'64'	x3634	'96'	x3936
'01'	x3031	'33'	x3333	'65'	x3635	'97'	x3937
'02'	x3032	'34'	x3334	'66'	x3636	'98'	x3938
'03'	x3033	'35'	x3335	'67'	x3637	'99'	x3939
'04'	x3034	'36'	x3336	'68'	x3638	CodeB	x3A
'05'	x3035	'37'	x3337	'69'	x3639	CodeA	x3B
'06'	x3036	'38'	x3338	'70'	x3730	FNC 1	x3C
'07'	x3037	'39'	x3339	'71'	x3731	—	—
'08'	x3038	'40'	x3430	'72'	x3732	—	—
'09'	x3039	'41'	x3431	'73'	x3733	—	—
'10'	x3130	'42'	x3432	'74'	x3734	—	—
'11'	x3131	'43'	x3433	'75'	x3735	—	—
'12'	x3132	'44'	x3434	'76'	x3736	—	—
'13'	x3133	'45'	x3435	'77'	x3737	—	—
'14'	x3134	'46'	x3436	'78'	x3738	—	—
'15'	x3135	'47'	x3437	'79'	x3739	—	—
'16'	x3136	'48'	x3438	'80'	x3830	—	—
'17'	x3137	'49'	x3439	'81'	x3831	—	—
'18'	x3138	'50'	x3530	'82'	x3832	—	—
'19'	x3139	'51'	x3531	'83'	x3833	—	—
'20'	x3230	'52'	x3532	'84'	x3834	—	—
'21'	x3231	'53'	x3533	'85'	x3835	—	—
'22'	x3232	'54'	x3534	'86'	x3836	—	—
'23'	x3233	'55'	x3535	'87'	x3837	—	—
'24'	x3234	'56'	x3536	'88'	x3838	—	—
'25'	x3235	'57'	x3537	'89'	x3839	—	—
'26'	x3236	'58'	x3538	'90'	x3930	—	—
'27'	x3237	'59'	x3539	'91'	x3931	—	—
'28'	x3238	'60'	x3630	'92'	x3932	—	—
'29'	x3239	'61'	x3631	'93'	x3933	—	—
'30'	x3330	'62'	x3632	'94'	x3934	—	—
'31'	x3331	'63'	x3633	'95'	x3935	—	—

Valid Code 128 command:

```
<x
  1B5B66      - barcode setup command prefix
  0600        - setup data length (low byte first) - x0006,
                6
  BA          - barcode type = Code 128
  00          - module width = default
  00          - space width adjustment = default
  0404        - height (low byte first) - x0404 = 0.476
                inches
  00          - control byte: check digit from host, print
                human readable character


  1B5B70      - barcode data transfer command prefix
  0500        - data transfer length (low byte first) -
                x0005, 5
<A2345 ...
```

Invalid Code 128 command:

```
<x

 1B5B66        - barcode setup command prefix

 0600          - setup data length (low byte first) -
                 x0006, 6

 BA            - barcode type = Code 128

 00            - module width = default

 00            - space width adjustment = default

 0404          - height (low byte first)

 00            - control byte: check digit from host, human
                 readable character


 1B5B70        - barcode data transfer command prefix

 0500          - data transfer length (low byte first) -
                 x0005, 5
>49545 ...
```

The first byte of the data string defines the character set and must be either 'A', 'B' or 'C'. **'4'** is an invalid first byte.

Valid Code 128 command using multiple character sets:

```
<x
```

1B5B66	–	barcode setup command prefix
0600	–	setup data length (low byte first) – x0006, 6
BA	–	barcode type = Code 128
00	–	module width = default
00	–	space width adjustment = default
0404	–	height (low byte first) – x0404 = 0.476 inches
00	–	control byte: check digit from host, print human readable character
1B5B70	–	barcode data transfer command prefix
1300	–	data transfer length (low byte first) – x0013, 19
41	–	start with character set A
323334	–	characters from character set A – "234"
64	–	shift to character set B
212324	–	characters from character set B – "!#$"
1C	–	shift to character set C
333233333334	–	characters from character set C – "323334"
3B	–	shift to character set A
3C3D3E	–	characters from character set A – "<=>"

```
>...
```



```
2 3 4   ! # $   323334   < = >
```

Notes For Barcode Printing

- Barcode printing is always performed unidirectionally (left-to-right).
- The desired barcode will not print if the barcode print area exceeds the right margin of the printer.
- The desired barcode will not print if the barcode print area exceeds the bottom of the page or bottom margin.
- The desired barcode may not print if undefined values are specified for the command parameters.

Example:

```
<x

 1B5B66    - barcode setup command prefix

 0600      - setup data length (low byte first) -
             x0006, 6

 B5        - barcode type (invalid value for a
             barcode type)

 00        - module width = default

 00        - space width adjustment = default

 3804      - height (low byte first) - x0438 = 0.50
             inches

 00        - control byte

 >
```

- The desired barcode may not print if invalid characters are specified in the data transfer command.

Example:

```
<x

 1B5B66      - barcode setup command prefix

 0600        - setup data length (low byte first) -
               x0006, 6

 B9          - barcode type = POSTNET

 00          - module width = default

 00          - space width adjustment = default

 0E01        - height (low byte first) - x010E =
               0.125 inches

 00          - control byte


 1B5B70      - barcode data transfer command prefix

 0500        - data transfer length (low byte first)
               - x0005, 5

 >012a5 ...
```

Since the desired barcode is POSTNET (**B9**), the letter **'a'** is not a valid character. The numbers **'0'**-**'9'** are the only valid characters for POSTNET.

- The desired barcode may not print if the number of characters specified by **n1**, **n2** does not match the required number for the desired barcode type.

Example:

```
<x

 1B5B66      -  barcode setup command prefix

 0600        -  setup data length (low byte first) -
                x0006, 6

 B2          -  barcode type = EAN-13

 00          -  module width = default

 00          -  space width adjustment = default

 3002        -  height (low byte first) - x0230 = 0.259
                inches

 00          -  control byte: check digit by host,
                print human readable character, center
                flag character


 1B5B70      -  barcode data transfer command prefix

 0500        -  data transfer length (low byte first)
                - x0005, 5

 >45678 ...
```

The desired barcode type is EAN-13 **(B2)**. The check digit is generated by the host/software (b0=0). This means there must be 13 data characters in the Data Transfer Command. Five characters are defined in the data transfer command; this conflicts with the required number of 13.

- When the **m** parameter is set to 1 (**m** = 1), the printer does not print the human readable character.

    Example:

    ```
    <x

     1B5B66   -  barcode setup command prefix

     0600     -  setup data length (low byte first) -
                 x0006, 6

     B4       -  barcode type = Code 39

     01       -  module width = 1 = 0.017 inches for 248x
                 0.012 inches for 249x

     00       -  space width adjustment = default

     3804     -  height (low byte first) - x0438= 0.50
                 inches

     00       -  control byte: check digit by host, print
                 human readable character

     >
    ```

    Although the **c** parameter has a value of **x00**, which tells the printer to print the human readable character, the **m** parameter has a value of **x01**, which causes the b1 bit value of the **c** parameter to be ignored. No human readable character is printed.

- Be cautious when sending commands to change the page length and margins. The barcode print area cannot exceed the page length, bottom margin, or right margin.

- Completing the barcode setup and data transfer commands is not enough to print the desired barcode. Before the barcode can be printed, the printer must receive sufficient vertical movement commands (line feed, vertical tab, form feed, etc.) to move down past the length of the barcode (and human readable character, if applicable).

Example:

```
<x

1B5B66        -  barcode setup command prefix

0600          -  setup data length (low byte first) -
                 x0006, 6

B4            -  barcode type = Code 39

00            -  module width = default

00            -  space width adjustment = default

5000          -  height (low byte first) - x0050 =
                 0.037 inches

00            -  control byte


1B5B70        -  barcode data transfer command prefix

0400          -  data transfer length (low byte first)
                 - x0004, 4

30 33 39 32 -  data string "0392"

>
```

If you were to send the two previous escape sequences <u>only</u> in the data-stream, nothing would print.

The same two escape sequences followed by the line feeds (**x0A**'s) will result in a printed Code 39 sample because of sufficient vertical movement to move past the length of the bars and human readable character.

Example:

```
<x
 1B5B66          -      barcode setup command prefix
 0600            -      setup data length (low byte
                        first) - x0006, 6
 B4              -      barcode type = Code 39
 00              -      module width = default
 00              -      space width adjustment = default
 5000            -      height (low byte first) - x0050
                        = 0.037 inches
 00              -      control byte


 1B5B70          -      barcode data transfer command
                        prefix
 0400            -      data transfer length (low byte
                        first) - x0004, 4
 30 33 39 32     -      data string "0392"
                 -      1 carriage return and 6 line
 0D0A0A0A0A0A0A         feeds
 >
```

- Barcode data and other print data (for example, text data) are controlled independently. It is necessary to provide sufficient horizontal space for the barcode when mixing barcodes with other data, otherwise, the text and barcode data will overlap, as shown in the following example:

Example:

```
<x1B5B66 0600 B4 00 00 3804 00>
Barcode Print Sample: <x1B5B70 0300> 395 Text Printing
<x0A0A0A0A0A>
```

Barcode Print Sample:

In this example, sufficient horizontal space is inserted to eliminate overlap:

Example:

```
<x1B5B66 0600 B4 00 00 3804 00>
Barcode Print Sample: <x1B5B70 0300> 395 Text Printing
<x0A0A0A0A0A>
```

Barcode Print Sample: ‖‖‖‖‖ ‖‖ ‖‖‖ ‖‖ ‖‖ Text Printing
* 3 9 5 *

Code Pages

Section   9

Your printer supports code pages 437, 437G, 813, 850, 851, 853T, 857, 858, 860, 861, 863, 865, 869, 920, 1004, and 1053. Additional code pages are available for designated countries. Code page 437 (U.S. English) is the factory default code page.

All code pages are shown on the following pages.

Code Page 437

	0-	1-	2-	3-	4-	5-	6-	7-	8-	9-	A-	B-	C-	D-	E-	F-
-0	Ø	▶		0	@	P	`	p	Ç	É	á	▦	└	┴	α	≡
-1	☺	◀	!	1	A	Q	a	q	ü	æ	í	▓	┴	╤	ß	±
-2	☻	↕	"	2	B	R	b	r	é	Æ	ó	▓	┬	╥	Γ	≥
-3	♥	‼	#	3	C	S	c	s	â	ô	ú	│	├	╨	π	≤
-4	♦	¶	$	4	D	T	d	t	ä	ö	ñ	┤	─	╞	Σ	⌠
-5	♣	§	%	5	E	U	e	u	à	ò	Ñ	╡	┼	╟	σ	⌡
-6	♠	▬	&	6	F	V	f	v	å	û	ª	╢	╞	╓	μ	÷
-7	●	↕	'	7	G	W	g	w	ç	ù	º	╖	╟	╫	τ	≈
-8	◘	↑	(	8	H	X	h	x	ê	ÿ	¿	╕	╚	╪	Φ	°
-9	○	↓	)	9	I	Y	i	y	ë	Ö	⌐	╣	╔	┘	Θ	∙
-A	◙	→	*	:	J	Z	j	z	è	Ü	¬	║	╩	┌	Ω	∙
-B	♂	←	+	;	K	[	k	{	ï	¢	½	╗	╤	█	δ	√
-C	♀	∟	,	<	L	\	l	|	î	£	¼	╝	╟	▄	∞	ⁿ
-D	♪	↔	-	=	M	]	m	}	ì	¥	¡	╜	═	█	φ	²
-E	♫	▲	.	>	N	^	n	~	Ä	₧	«	╡	╪	█	ε	■
-F	☼	▼	/	?	O	_	o	△	Å	ƒ	»	╖	╧	▄	∩	

Code Page 437G

	0-	1-	2-	3-	4-	5-	6-	7-	8-	9-	A-	B-	C-	D-	E-	F-
-0	Ø	▶		0	@	P	`	p	A	P	ι	⠿	└	⊥	ω	Ώ
-1	☺	◄	!	1	A	Q	a	q	B	Σ	κ	▓	⊥	╤	ά	±
-2	☻	↕	"	2	B	R	b	r	Γ	T	λ	▦	┬	╥	έ	≥
-3	♥	‼	#	3	C	S	c	s	Δ	Y	μ	│	├	╙	ή	≤
-4	♦	¶	$	4	D	T	d	t	E	Φ	ν	┤	─	╘	ï	⌠
-5	♣	§	%	5	E	U	e	u	Z	X	ξ	╡	┼	╒	ί	⌡
-6	♠	▬	&	6	F	V	f	v	H	Ψ	ο	╢	╞	╓	ό	÷
-7	●	↨	'	7	G	W	g	w	Θ	Ω	π	╖	╟	╫	ύ	≈
-8	◘	↑	(	8	H	X	h	x	I	α	ρ	╕	╚	╪	ü	°
-9	○	↓	)	9	I	Y	i	y	K	β	σ	╣	╔	┘	ώ	£
-A	◙	→	*	:	J	Z	j	z	Λ	γ	ς	║	╩	┌	Ά	·
-B	♂	←	+	;	K	[	k	{	M	δ	τ	╗	╦	■	Έ	√
-C	♀	∟	,	<	L	\	l	|	N	ε	υ	╝	╠	▬	Ή	^{n}
-D	♪	↔	-	=	M	]	m	}	Ξ	ζ	φ	╜	═	▐	Ί	^{2}
-E	♫	▲	.	>	N	^	n	~	O	η	χ	╛	╬	█	Ό	■
-F	☼	▼	/	?	O	_	o	⌂	Π	θ	ψ	┐	╨	▬	Ύ	

Code Page 813

	0-	1-	2-	3-	4-	5-	6-	7-	8-	9-	A-	B-	C-	D-	E-	F-
-0				0	@	P	`	p			º	ï	Π	Ü	π
-1			!	1	A	Q	a	q			'	±	Α	Ρ	α	ρ
-2			"	2	B	R	b	r			'	²	Β		β	ς
-3			#	3	C	S	c	s			£	³	Γ	Σ	γ	σ
-4			$	4	D	T	d	t				΄	Δ	Τ	δ	τ
-5			%	5	E	U	e	u				¨΄	Ε	Υ	ε	υ
-6			&	6	F	V	f	v			¦	Ά	Ζ	Φ	ζ	φ
-7			'	7	G	W	g	w			§	·	Η	Χ	η	χ
-8			(	8	H	X	h	x			¨	Έ	Θ	Ψ	θ	ψ
-9			)	9	I	Y	i	y			©	Ή	Ι	Ω	ι	ω
-A			*	:	J	Z	j	z				Ί	Κ	Ϊ	κ	ϊ
-B			+	;	K	[	k	{			«	»	Λ	Ϋ	λ	ϋ
-C			,	<	L	\	l	|			¬	Ό	Μ	ά	μ	ό
-D			-	=	M	]	m	}			-	½	Ν	έ	ν	ύ
-E			.	>	N	^	n	~				Ύ	Ξ	ή	ξ	ώ
-F			/	?	O	_	o					―	Ώ	Ο	ί	ο

Code Page 850

	0-	1-	2-	3-	4-	5-	6-	7-	8-	9-	A-	B-	C-	D-	E-	F-
-0	Ø	►		0	@	P	`	p	Ç	É	á	░	└	ð	Ó	-
-1	☺	◄	!	1	A	Q	a	q	ü	æ	í	▒	┴	Đ	ß	±
-2	☻	↕	"	2	B	R	b	r	é	Æ	ó	▓	┬	Ê	Ô	=
-3	♥	‼	#	3	C	S	c	s	â	ô	ú	│	├	Ë	Ò	¾
-4	♦	¶	$	4	D	T	d	t	ä	ö	ñ	┤	─	È	õ	¶
-5	♣	§	%	5	E	U	e	u	à	ò	Ñ	Á	┼	ı	Õ	§
-6	♠	▬	&	6	F	V	f	v	å	û	ª	Â	ã	Í	µ	÷
-7	•	↨	'	7	G	W	g	w	ç	ù	º	À	Ã	Î	þ	¸
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-2	☻ 2	↔ 18	" 34	2 50	B 66	R 82	b 98	r 114	é 130	È 146	ó 162	▓ 178	┬ 194	╥ 210	Γ 226	≥ 242
-3	♥ 3	‼ 19	# 35	3 51	C 67	S 83	c 99	s 115	â 131	ô 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243
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-5	♣ 5	§ 21	% 37	5 53	E 69	U 85	e 101	u 117	à 133	ò 149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245
-6	♠ 6	▬ 22	& 38	6 54	F 70	V 86	f 102	v 118	Á 134	Ú 150	ª 166	╢ 182	╞ 198	╓ 214	µ 230	÷ 246
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-8	◘ 8	← 24	(40	8 56	H 72	X 88	h 104	x 120	ê 136	Ì 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248
-9	○ 9	→ 25	) 41	9 57	I 73	Y 89	i 105	y 121	Ê 137	Õ 153	Ò 169	╣ 185	╔ 201	┘ 217	Θ 233	∙ 249
-A	◎ 10	↑ 26	* 42	: 58	J 74	Z 90	j 106	z 122	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250
-B	♂ 11	↓ 27	+ 43	; 59	K 75	[91	k 107	{ 123	Í 139	¢ 155	½ 171	╗ 187	╦ 203	█ 219	δ 235	√ 251
-C	♀ 12	∟ 28	, 44	< 60	L 76	\ 92	l 108	| 124	Ô 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	^{n} 252
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-B	˛		+	;	K	[	k	{	‹	›	«	»	Ë	Û	ë	û
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-D			-	=	M	]	m	}			-	½	Í	Ý	í	ý
-E			.	>	N	^	n	~			®	¾	Î	Þ	î	þ
-F			/	?	O	_	o		Ÿ		¿	‾	Ï	ß	ï	ÿ

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	0-	1-	2-	3-	4-	5-	6-	7-	8-	9-	A-	B-	C-	D-	E-	F-
-0				0	@	P	`	p				°	À	Đ	à	ð
-1			!	1	A	Q	a	q			¡	±	Á	Ñ	á	ñ
-2			"	2	B	R	b	r			¢	²	Â	Ò	â	ò
-3			#	3	C	S	c	s			£	³	Ã	Ó	ã	ó
-4			$	4	D	T	d	t			¤	´	Ä	Ô	ä	ô
-5			%	5	E	U	e	u			¥	µ	Å	Õ	å	õ
-6			&	6	F	V	f	v			¦	¶	Æ	Ö	æ	ö
-7			'	7	G	W	g	w			§	·	Ç	×	ç	÷
-8			(	8	H	X	h	x			¨	¸	È	Ø	è	ø
-9			)	9	I	Y	i	y			©	¹	É	Ù	é	ù
-A			*	:	J	Z	j	z			ª	º	Ê	Ú	ê	ú
-B			+	;	K	[	k	{			«	»	Ë	Û	ë	û
-C			,	<	L	\	l	|			¬	¼	Ì	Ü	ì	ü
-D			-	=	M	]	m	}				½	Í	Ý	í	ý
-E			.	>	N	^	n	~			®	¾	Î	Þ	î	þ
-F			/	?	O	_	o	▓			¯	¿	Ï	ß	ï	ÿ

Printing a Code Page

To print all 256 characters of a code page, use one of the following commands with the program that follows. Replace the first line of the program with the appropriate command for the code page you want to print.

Code Page	Command
437	<x1B5B54 0400 0000 01B5>
437G	<x1B5B54 0400 0000 28C5>
813	<x1B5B54 0400 0000 032D>
850	<x1B5B54 0400 0000 0352>
851	<x1B5B54 0400 0000 0353>
853T	<x1B5B54 0400 0000 2A65>
857	<x1B5B54 0400 0000 0359>
858	<x1B5B54 0400 0000 035A>
860	<x1B5B54 0400 0000 035C>
861	<x1B5B54 0400 0000 035D>
863	<x1B5B54 0400 0000 035F>
865	<x1B5B54 0400 0000 0361>
869	<x1B5B54 0400 0000 0365>
920	<x1B5B54 0400 0000 0398>
1004	<x1B5B54 0400 0000 03EC>
1053	<x1B5B54 0400 0000 041D>

The following example prints all 256 characters from Code Page 437 in a matrix format:

```
<x1B5B54 0400 0000 01B5>
     x0x1x2x3x4x5x6x7x8x9xAxBxCxDxExF
0x <x1B5C 2000 0020012002200320 0420052006200720
     082009200A200B20 0C200D200E200F20>
1x <x1B5C 2000 1020112012201320 1420152016201720
     182019201A201B20 1C201D201E201F20>
2x <x1B5C 2000 2020212022202320 2420252026202720
     282029202A202B20 2C202D202E202F20>
3x <x1B5C 2000 3020312032203320 3420352036203720
     382039203A203B20 3C203D203E203F20>
4x <x1B5C 2000 4020412042204320 4420452046204720
     482049204A204B20 4C204D204E204F20>
5x <x1B5C 2000 5020512052205320 5420552056205720
     582059205A205B20 5C205D205E205F20>
6x <x1B5C 2000 6020612062206320 6420652066206720
     682069206A206B20 6C206D206E206F20>
7x <x1B5C 2000 7020712072207320 7420752076207720
     782079207A207B20 7C207D207E207F20>
8x <x1B5C 2000 8020812082208320 8420852086208720
     882089208A208B20 8C208D208E208F20>
```

```
9x <x1B5C 2000 9020912092209320 9420952096209720 982099209A209B20
       9C209D209E209F20>
Ax <x1B5C 2000 A020A120A220A320 A420A520A620A720 A820A920AA20AB20
       AC20AD20AE20AF20>
Bx <x1B5C 2000 B020B120B220B320 B420B520B620B720 B820B920BA20BB20
       BC20BD20BE20BF20>
Cx <x1B5C 2000 C020C120C220C320 C420C520C620C720 C820C920CA20CB20
       CC20CD20CE20CF20>
Dx <x1B5C 2000 D020D120D220D320 D420D520D620D720 D820D920DA20DB20
       DC20DD20DE20DF20>
Ex <x1B5C 2000 E020E120E220E320 E420E520E620E720 E820E920EA20EB20
       EC20ED20EE20EF20>
Fx <x1B5C 2000 F020F120F220F320 F420F520F620F720 F820F920FA20FB20
       FC20FD20FE20FF20>
```

The output from the previous example is shown below:

	x0	x1	x2	x3	x4	x5	x6	x7	x8	x9	xA	xB	xC	xD	xE	xF
0x	∅	☻	☻	♥	♦	♣	♠	•	◘	○	◙	♂	♀	♪	♫	☼
1x	►	◄	↕	‼	¶	§	▬	↨	↑	↓	→	←	∟	↔	▲	▼
2x		!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
3x	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
4x	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
5x	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
6x	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
7x	p	q	r	s	t	u	v	w	x	y	z	{	|	}	~	⌂
8x	Ç	ü	é	â	ä	à	å	ç	ê	ë	è	ï	î	ì	Ä	Å
9x	É	æ	Æ	ô	ö	ò	û	ù	ÿ	Ö	Ü	¢	£	¥	₧	ƒ
Ax	á	í	ó	ú	ñ	Ñ	ª	º	¿	⌐	¬	½	¼	¡	«	»
Bx	░	▒	▓	│	┤	╡	╢	╖	╕	╣	║	╗	╝	╜	╛	┐
Cx	└	┴	┬	├	─	┼	╞	╟	╚	╔	╩	╦	╠	═	╬	╧
Dx	╨	╤	╥	╙	╘	╒	╓	╫	╪	┘	┌	█	▄	▌	▐	▀
Ex	α	ß	Γ	π	Σ	σ	µ	τ	Φ	Θ	Ω	δ	∞	φ	ε	∩
Fx	≡	±	≥	≤	⌠	⌡	÷	≈	°	•	·	√	ⁿ	²	■	

Set Font Global, ESC [I

You can vary the font and pitch type style within a file with this command. It can also be used to change the code page.

```
Syntax:    ESC   [   I   LnHn   HfLf   HsLs   Sm   HcLc

Decimal:   27   91  73   LnHn   HfLf   HsLs   Sm   HcLc

Hex:       1B   5B  49   LnHn   HfLf   HsLs   Sm   HcLc
```

ESC [I changes the font, pitch, and code page. It uses the following best-fit algorithm:

1   Requested font, pitch, and code page.

2   Requested pitch and code page, first font found.

3   Requested code page, first font and pitch found.

4   No change.

countlow (Ln): A 1-byte binary number that is the less significant byte of the 2-byte parameter count.

counthigh (Hn): The binary number that is the more significant byte of the 2-byte parameter count. Zero is a valid count.

fgidhigh (Hf): The binary number that is the more significant byte of the 2-byte font global ID.

fgidlow (Lf): The binary number that is the less significant byte of the 2-byte font global ID.

248x Font Global IDs (FGIDs) Decimal, Hex and Byte Decimal				
Pitch	**Font Style**	**Decimal (Hf times 256 plus Lf)**	**Hex (Hf Lf)**	**Byte Decimal (Hf, Lf)**
Courier				
5 (Double Wide)	Normal	244/246	x00F4/x00F6	00,244/00,246
	Emphasized	245	x00F5	00,245
	Italic			
	Emph./Italic			
10	Normal	11	x000B	00,11
	Emphasized	46	x002E	00,46
	Italic	18	x0012	00,18
	Emph./Italic	57	x0039	00,57
12	Normal	85/491	x0055/ x01EB	00,85/01,235
	Emphasized	108	x006C	00,108
	Italic	92	x005C	00,92
	Emph./Italic	116	x0074	00,116
15	Normal	492	x01EC	01,236
	Emphasized	214	x00D6	00,214
	Italic	215	x00D7	00,215
	Emph./Italic	216	x00D8	00,216
17.1	Normal	254/493	x00FE/ x01ED	00,254/01,237
	Emphasized	253	x00FD	00,253
	Italic			
	Emph./Italic			
20	Normal	454/494	x01C6/ x01EE	01,198/01, 238
	Emphasized			
	Italic			
	Emph./Italic			

248x Font Global IDs (FGIDs) Decimal, Hex and Byte Decimal				
Pitch	**Font Style**	**Decimal (Hf times 256 plus Lf)**	**Hex (Hf Lf)**	**Byte Decimal (Hf, Lf)**
Courier (cont.)				
PS	Normal	171	x00AB	00,171
	Emphasized	184	x00B8	00,184
	Italic	172	x00AC	00,172
	Emph./Italic	185	x00B9	00,185
Gothic				
5 (Double Wide)	Normal	241	x00F1	00,241
	Emphasized	242	x00F2	00,242
	Italic			
10	Normal	36	x0024	00,36
	Emphasized	39	x0027	00,39
	Italic			
12	Normal	87/399	x0057/x018F	00,87/01,143
	Emphasized	110	x006E	00,110
	Italic	109	x006D	00,109
15	Normal	222/398	x00DE/x018E	00,222/01,142
	Emphasized	220	x00DC	00,220
	Italic			
17.1	Normal	255/397	x00DE/x018D	00,255/01,140
	Emphasized	220	x00 DC	00, 220
	Italic			
20	Normal	396	x018C	01,140
	Emphasized			
	Italic			
PS	Normal	174	x00AE	00,174
	Emphasized	157	x009D	00,157
	Italic	162	x00A2	00,162

Pitch	Font Style	Decimal (Hf times 256 plus Lf)	Hex (Hf Lf)	Byte Decimal (Hf, Lf)
249x Font Global IDs (FGIDs) Decimal, Hex and Byte Decimal				
Courier				
5 (Double Wide)	Normal	244/246	x00F4/x00F6	00,244/00,246
	Emphasized	245	x00F5	00,245
	Italic			
	Emph./Italic			
10	Normal	11	x000B	00,11
	Emphasized	46	x002E	00,46
	Italic	18	x0012	00,18
	Emph./Italic	57	x0039	00,57
12	Normal	85/491	x0055/ x01EB	00,85/01,235
	Emphasized	108	x006C	00,108
	Italic	92	x005C	00,92
	Emph./Italic	116	x0074	00,116
15	Normal	223/492	x00DF/ x01EC	00,223/01,236
	Emphasized	214	x00D6	00,214
	Italic	215	xx00D7	00,215
	Emph./Italic	216	00D8	00,216
17.1	Normal	255/493	x00FF/ x01ED	00,255/01,237
	Emphasized	253	x00FD	00,253
	Italic			
	Emph./Italic			
20	Normal	494	x01EE	01, 238
	Emphasized			
	Italic			
	Emph./Italic			

Pitch	Font Style	Decimal (Hf times 256 plus Lf)	Hex (Hf Lf)	Byte Decimal (Hf, Lf)
249x Font Global IDs (FGIDs) Decimal, Hex and Byte Decimal				
Courier (cont.)				
24	Normal	286	x011E	01, 30
	Emphasized			
	Italic			
	Emph./Italic			
PS	Normal	171	x00AB	00,171
	Emphasized	184	x00B8	00,184
	Italic	172	x00AC	00,172
	Emph./Italic	185	x00B9	00,185
Prestige				
10	Normal	12	x000C	00,12
	Emphasized	60	x003C	00,60
	Italic			
12	Normal	86/495	x0056/ x01EF	00,86/01,239
	Emphasized	111	x006F	00,111
	Italic	112	x0070	00,112
15	Normal	221/492	x00DD/ x01F0	00,221/01,240
	Emphasized			
	Italic			
17.1	Normal	256/457	x0100/ x01C9	01,00/01,201
	Emphasized			
	Italic			
20	Normal	458	x01CA	01, 202
	Emphasized			
	Italic			

249x Font Global IDs (FGIDs) Decimal, Hex and Byte Decimal				
Pitch	Font Style	Decimal (Hf times 256 plus Lf)	Hex (Hf Lf)	Byte Decimal (Hf, Lf)
Prestige (cont.)				
24	Normal	287	x011F	01, 31
	Emphasized			
	Italic			
PS	Normal	420	x01A4	01,164
	Emphasized			
	Italic			
Gothic				
5 (Double Wide)	Normal	241	x00F1	00,241
	Emphasized	242	x00F2	00,242
	Italic			
	Emph./DS		X00F3	00,243
10	Normal	36	x0024	00,36
	Emphasized			
	Italic			
	Emph./DS			
12	Normal	87/399	x0057/x018F	00,87/01,143
	Emphasized	110	x006E	00,110
	Italic	109	x006D	00,109
	Emph./DS			
15	Normal	222/398	x00DE/ x018E	00,222/01,142
	Emphasized	220		
	Italic			
	Emph./DS			
17.1	Normal	255/397	x00FF/ x018D	00,255/01,141
	Emphasized			
	Italic			
	Emph./DS			
20	Normal	396	x018C	01,140
	Emphasized			
	Italic			
	Emph./DS			

249x Font Global IDs (FGIDs) Decimal, Hex and Byte Decimal				
Pitch	**Font Style**	**Decimal (Hf times 256 plus Lf)**	**Hex (Hf Lf)**	**Byte Decimal (Hf, Lf)**
Gothic (cont.)				
24	Normal	288	120	01,32
	Emphasized			
	Italic			
	Emph./DS			
PS	Normal	174	x00AE	00,174
	Emphasized	157	x009D	00,157
	Italic	162	x00A2	00,162
	Emph./DS			

sizehigh (Hs): The binary number that is the more significant byte of the 2-byte font size.

sizelow (Ls): The binary number that is the less significant byte of the 2-byte font size.

Hs and Ls represent a 2-byte, unsigned integer parameter that specifies the font width in units of 1/1440 inches. This parameter will be valid only if **Hf Lf** is not specified, and Size-Modifier is equal to X'01'.

Sizemod (Sm): The binary number that is the size modifier. The valid sizes are:

- 00 - No change
- 01 - Size measures the width in 0.018 mm (1/1440 in.)
- 02, 03 - The font is proportional
- All other values default to 0

Size values are used only when the font ID is not found.

cpidhigh (Hc): The binary number that is the more significant byte of the 2-byte code page ID.

cpidlow (Lc): The binary number that is the less significant byte of the 2-byte code page ID.

	Decimal		Hex	
Code Page	**Hc**	**Lc**	**Hc**	**Lc**
437	1	181	x01	xB5
850	3	82	x03	x52
860	3	92	x03	x5C

Code Page	Decimal		Hex	
	Hc	Lc	Hc	Lc
863	3	95	x03	x5F
865	3	97	x03	x61
437G	40	197	x28	xC5
813	3	45	x03	x2D
851	3	83	x03	x53
853T	42	101	x2A	x65
857	3	89	x03	x59
869	3	101	x03	x65
920	3	152	x03	x98
1053	4	29	x04	x1D
861	3	93	x03	x5D
1004	3	236	03	EC
858	3	90	03	5A

Set Print Quality, ESC [d

This command sets the print quality for draft or letter quality print:

```
Syntax:     ESC    [      d     1     0      n

Decimal:    27     91    100    1     0      n

Hex:        1B     5B    64     01    00     n
```

- 1 and 0 (decimal) and 01 and 00 (hexadecimal) are constants.
- The value of **n** is a single digit that can be any one of the following digits:

Set Print Quality Selections		
Print Quality	Decimal	Hex
No Change	0	x00
Fast Draft	1 to 63	x01 to x3F
Draft	64 to 127	x40 to x7F
NLQ	128 to 191	x80 to xBF

Set Print Quality Selections		
Print Quality	**Decimal**	**Hex**
Enhanced Letter Quality	192 to 254	xC0 to xFE
Default Font	255	xFF

Example

Select Fast Draft:

```
Syntax:    ESC    [    d     1    0    n
Decimal:   27     91   100   1    0    1
Hex:       1B     5B   64    01   00   01
```

Interaction of Set Font Global and Set Print Quality

Every font has an LQ version and a Draft version. Set Font Global changes the font and pitch within the current quality. Set Print Quality changes the quality within the current font and pitch.

For example, if the current quality is draft and you use Set Font Global to select Courier 15, you get Draft 15, which is the draft version of Courier 15. If you then set the quality to LQ, you get Courier 15.

Character Sets 1 and 2

The printer's interpretation of code pages is based on whether character set 1 or character set 2 is selected. Character set 1 is the factory default character set and is printed if you do not specify otherwise. Character set 2 has foreign language characters and fewer control words.

You can select a character set from Setup Mode or by using the **Select Character Set** (ESC 6 or ESC 7) command.

Character set 1 has control codes located between:

- Hex 00 and hex 1F
- Hex 80 and hex 9F

Character set 2 has control codes located only between hex 00 and hex 1F.

The character sets contain a mixture of printer control codes and characters. The boxes show how the printer will interpret single-byte codes, depending on which character set you have selected. For example, hex 0A from code page 437:

Character Set 1

	0 -	**1 -**		**8 -**	**9 -**
- 0	NUL `0`	► `16`	**- 0**	Ç `128`	É `144`
- 1	☺ `1`	DC1 ◄ `17`	**- 1**	ü `129`	DC1 æ `145`
- 2	☻ `2`	DC2 ↕ `18`	**- 2**	é `130`	DC2 Æ `146`
- 3	♥ `3`	‼ `19`	**- 3**	â `131`	ô `147`
- 4	♦ `4`	DC4 ¶ `20`	**- 4**	ä `132`	DC4 ö `148`
- 5	♣ `5`	§ `21`	**- 5**	à `133`	ò `149`
- 6	♠ `6`	▬ `22`	**- 6**	å `134`	û `150`
- 7	BEL • `7`	↨ `23`	**- 7**	BEL ç `135`	ù `151`
- 8	BS ■ `8`	↑ `24`	**- 8**	BS ê `136`	ÿ `152`
- 9	HT ○ `9`	↓ `25`	**- 9**	HT ë `137`	Ö `153`
- A	LF ◙ `10`	→ `26`	**- A**	LF è `138`	Ü `154`
- B	VT ♂ `11`	ESC ← `27`	**- B**	VT ï `139`	ESC ¢ `155`
- C	FF ♀ `12`	∟ `28`	**- C**	FF î `140`	£ `156`
- D	CR ♪ `13`	↔ `29`	**- D**	CR ì `141`	¥ `157`
- E	SO ♫ `14`	▲ `30`	**- E**	SO Ä `142`	Pts `158`
- F	SI ☼ `15`	▼ `31`	**- F**	SI Å `143`	ƒ `159`
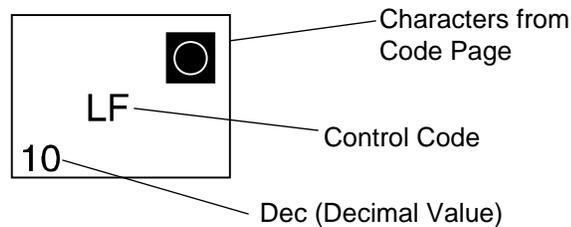
Character Set 2

	0 -	1 -
- 0	NUL `0`	► `16`
- 1	☺ `1`	DC1 `17`
- 2	☻ `2`	DC2 `18`
- 3	♥ `3`	‼ `19`
- 4	♦ `4`	¶ DC4 `20`
- 5	♣ `5`	§ `21`
- 6	♠ `6`	▬ `22`
- 7	• BEL `7`	↨ `23`
- 8	◘ BS `8`	↑ `24`
- 9	○ HT `9`	↓ `25`
- A	◙ LF `10`	→ `26`
- B	♂ VT `11`	← ESC `27`
- C	♀ FF `12`	∟ `28`
- D	♪ CR `13`	↔ `29`
- E	♫ SO `14`	▲ `30`
- F	☼ SI `15`	▼ `31`

	8 -	9 -
- 0	Ç `128`	É `144`
- 1	ü `129`	æ `145`
- 2	é `130`	Æ `146`
- 3	â `131`	ô `147`
- 4	ä `132`	ö `148`
- 5	à `133`	ò `149`
- 6	å `134`	û `150`
- 7	ç `135`	ù `151`
- 8	ê `136`	ÿ `152`
- 9	ë `137`	Ö `153`
- A	è `138`	Ü `154`
- B	ï `139`	¢ `155`
- C	î `140`	£ `156`
- D	ì `141`	¥ `157`
- E	Ä `142`	Pts `158`
- F	Å `143`	ƒ `159`

Glossary

A

APA. All points addressable.

B

bidirectional. Printing in either direction, right-to-left or left-to-right.

buffer storage. A temporary storage area for holding input or output data.

byte. The representation of a character. Usually, 8 bits grouped together as a unit make up a byte.

C

characters-per-inch (cpi). The number of characters printed within 1 inch horizontally across a page.

characters-per-line (cpl). The maximum number of characters that can be printed on a line at a specified pitch.

characters-per-second (cps). The number of characters printed in 1 second.

check character. A character within a barcode that, when scanned, validates the barcode was read correctly.

code page. A set of 256 graphic designs (characters) associated with unique code values from 0 through 255, x00 to xFF.

control code. Tells the printer to perform a function, such as changing line space.

cpi. See *characters-per-inch.*

cpl. See *characters-per-line.*

cps. See *characters-per-second.*

D

default. A value, parameter, or attribute the printer uses when none is specified.

DP. Draft Print. A style of print used for draft material. Compare with Letter Quality print mode.

dpi. Dots per inch.

E

ELQ. Enhanced letter quality.

Escape sequence. Two or more characters of information that let you change the way the printer is currently printing.

F

flag character. Used by UPC-A and EAN-13 for number system encoding and country code.

font. A set of characters of a given size and style.

H

Hertz (HZ). A unit of frequency equal to 1 cycle per second.

human readable characters. Numbers or letters printed below a barcode.

I

impact printer. A printer that uses mechanical impacts to generate character images.

L

lines-per-inch (lpi). The number of lines of text or graphics that can be printed in 1 vertical inch. LPI is the movement of the line advance, not the size of the character being printed. If you set 6 LPI, one line is 1/6-inch; 8 LPI is 1/8-inch.

LQ. Letter quality.

N

NLQ. Near letter quality.

M

mm. Millimeter.

P

parallel interface. A type of connection that links a printer to a computer, by which all 8 bits of a character are sent at the same time.

print quality. Refers to the actual appearance of the printed matrix character, such as draft print or letter quality.

print speed. The number of characters that are printed for each unit of time.

Proportional spacing. A print style in which the characters are spaced according to their natural width.

R

random access memory (RAM). A memory area that may be written to repeatedly, such as the print buffer. The contents of RAM are overwritten when more data is received. The contents of RAM are lost when the printer power is turned off.

read-only memory (ROM). A memory area that can be read from but not written to. ROM holds the printer's resident microcode.

S

software application. Any program loaded on your computer used to perform a specific task; for example, a word processing or spreadsheet program.

symbol set. A group of symbols that are extensions to standard characters used in a particular country or in a specific application. The symbol set provides codes for the nonstandard upper half of the ASCII character set.

T

TTL. Transistor-transistor logic.

top-of-form (TOF). The line position of the paper where the first line of text prints.

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IBM 248x/249x
Technical Reference Manual
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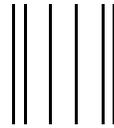
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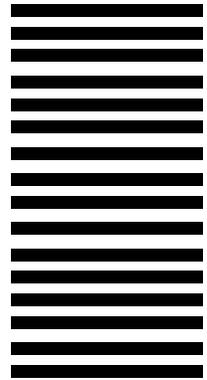
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