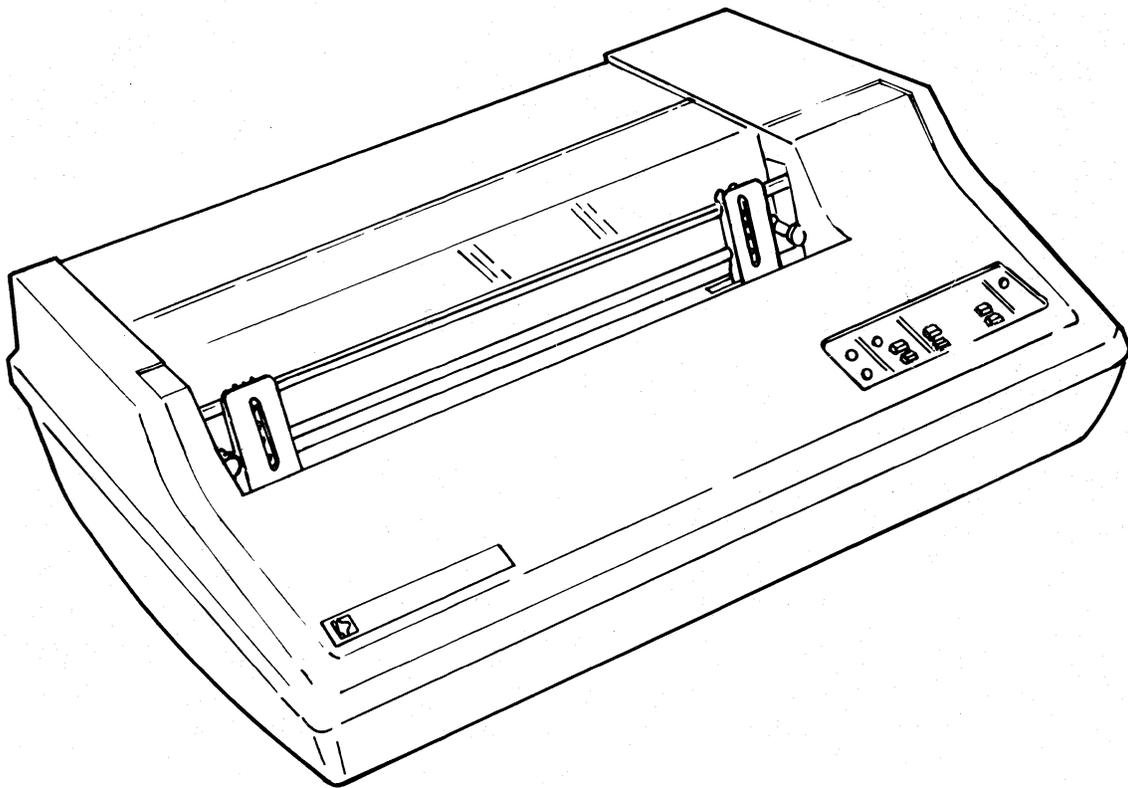




Model 810LQ Printer (Enhanced Model 810)



User's Manual

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Preface

This manual describes the operation of the Enhanced Model 810, dual-mode word processing and data processing TI *OMNI 800** Model 810LQ (Letter-Quality) Printer, which is an upgrade of the Model 810 Printer. Installation procedures, programming instructions, and theory of operation are also discussed.

Section 1, GENERAL DESCRIPTION — Provides a brief description of the Model 810LQ Printer and indicates those sections of the manual which are of special interest to the various users.

Section 2, OPERATOR INSTRUCTIONS — Provides instructions for manual selection of type fonts by the operator.

Section 3, MODEL 810LQ PRINTER FUNCTIONAL DESCRIPTION — Provides a detailed description of the Model 810LQ Printer and a summary of functional enhancements.

Section 4, PRINT QUALITY, PRINTER VARIANCES, AND PRECAUTIONS — Provides the background for determining dot-matrix print quality and lists variances from the standard Model 810 Printer. Precautions for operation of the Model 810LQ Printer are also discussed.

Section 5, SOFTWARE COMMANDS FOR PRINT AND PLOT MODES — Describes the software commands for the Model 810LQ Printer. Character fonts are illustrated; control codes and escape commands are summarized; and block characters, bar codes, and X-plot graphics are described.

Section 6, CONTROL CHARACTER PROGRAMMING EXPLANATIONS — Explains the use of control codes.

Section 7, ESCAPE SEQUENCE PROGRAMMING EXPLANATIONS — Explains the use of escape sequence commands.

Section 8, COMBINED FUNCTIONS AND PRINTING EXAMPLES — Provides tables of functions that can be combined and examples of combined-function printing that illustrate some of the Model 810LQ Printer applications.

The appendixes contain reference information. Subjects covered are:

- Block-character and bar-code dot patterns and codes
- Bar-code-specification sources
- Installation and testing procedures
- Site preparation
- Theory of operation
- Troubleshooting procedures
- Assembly drawings, logic diagrams, and lists of materials
- Specifications

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OTHER PUBLICATIONS

The following additional publications support the Model 810LQ Printer:

Model 810 Printer Operating Instructions
(TI Part No. 994353-9701)

Model 810 Printer Maintenance Manual
(TI Part No. 994386-9701)

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USING THIS MANUAL

The *Model 810 Printer Operating Instructions* describes operation of the Model 810LQ Printer in standard Model 810 Printer mode. The *Model 810LQ Printer User's Manual* supplements the operating instructions for the Model 810 Printer and describes operation of the printer in the "Enhanced Model 810" mode.

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Section 1

General Description

1.1 INTRODUCTION TO THE MODEL 810LQ PRINTER

The TI Model 810LQ (Enhanced Model 810) Printer is a near-letter-quality, receive-only, dot-matrix impact printer. It upgrades the functional performance of the Model 810 Printer by providing both word processing fonts (Courier, Helvetica, and Elite) and data processing fonts (Standard Model 810, Focus, and Fast Focus). New features include graphic character sets (block characters and bar codes) and a six-bit, dot-matrix plotting mode plus serial interface X – ON, X – OFF protocol.

The Model 810LQ Printer is available from the factory, or the Model 810 Printer can be modified by installation of one of the field-upgrade kits, TI Part No. 2360091-0001 (first-generation, full-sized board) or TI Part No. 2360091-0002 (second-generation, half-sized board). The second-generation kit also provides hard-wired, jumper-selectable international character sets. A printer from the factory with an optional international character set preselected is designated by a dash number, Model 810 Printer Option Index, TI Drawing No. 2360026.

This manual provides instructions on front panel control for operators, software information for system users and programmers, plus installation procedures and troubleshooting information for technicians. Operators, users, and technicians should also be thoroughly familiar with the Model 810 Printer functions described in the *Model 810 Printer Operation Instructions*.

1.2 MODEL 810LQ PRINTER FRONT PANEL OPERATION

Section 2 of this manual describes front panel selection of alternate data processing and word processing fonts on the Model 810LQ Printer.

1.3 MODEL 810LQ PRINTER SOFTWARE CONTROL

Section 3 describes in detail the new features for system users and programmers. The flow of data from the line to the printhead for printout by way of the various buffers is also described. Section 4 defines limitations for upgradable Model 810 Printers and discusses the subjective aspects of letter-quality, dot-matrix printing. Print quality samples are provided.

Section 5 summarizes software control. Software control of functions includes selection of alternate fonts, dot-matrix plotting, user-defined printable characters, and other features that enhance the performance of the Model 810 Printer. Section 6 explains control codes, and Section 7 explains escape sequences. Section 8 is a sampling of printer applications. Appendix A provides block-character and bar-code dot patterns and bar-code-specification sources.

1.4 INSTALLATION, TROUBLESHOOTING, AND REPAIR

Appendix B describes Model 810LQ Printer upgrade kit installation for technicians. The kit

includes the LQ plug-in conversion (upgrade) board, a replacement universal printhead, and a replacement, high-resolution, paper-advance stepping motor. Both the first production LQ upgrade full board and the LQ upgrade half board with international character sets are described. Printer adjustments for print quality are also described.

Appendix C describes site preparation for the printer. Appendix D provides the theory of operation. Appendix E describes troubleshooting and repair, and Appendix F contains the drawings and parts lists. Appendix G lists specifications for the Model 810LQ Printer.

Section 2

Operating Instructions

2.1 INTRODUCTION

This section describes front panel selection of alternate data processing and word processing fonts provided by the Model 810LQ Printer. Procedures to aid the operator are also described.

All standard Model 810 operating instructions regarding front panel control and indicator actions are described in the *Model 810 Printer Operating Instructions*. The operator should be familiar with these functions. Front panel control functions are essentially not altered but are increased with selection of near-letter-quality fonts.

2.2 INITIAL CONDITIONS ON POWER-UP

The Model 810LQ Printer assumes the following conditions on power-up:

Printhead position	Left margin (position zero)
Power indicator	ON
ONLINE indicator	OFF
Paper-out indicator	OFF
Error indicator	OFF

Compressed print indicator 16.5	OFF (10 cpi)
8 lines per inch indicator 8 lpi	OFF (6 lpi)*
Font selected	Standard Model 810†
Characters per inch	10 cpi†
Form length	279 mm (11 in)‡
Line counter	0 or retained line count for printers with VFC or VCO options
Line (receive FIFO) buffer	Empty
Vertical tabs	Cleared*
Horizontal tabs	Cleared

2.3 FRONT-PANEL-SELECTABLE FONTS

Five type fonts can be selected from the front panel (see subsection 2.4). They are Standard Model 810, Courier, Helvetica, Elite, and Focus. The Standard Model 810 and Focus data processing fonts are available in fixed character spacing of 10 cpi. The Elite word processing font is available in fixed character spacing of 10 cpi and 12 cpi. The word processing fonts Courier and Helvetica are available in proportional spacing of approximately 10 cpi and 12 cpi (approximate character count due to proportional spacing). Examples of these fonts are shown in Figures 2-1 through 2-8.

Figure 2-1. Standard Model 810 Font (10 cpi)

2380090-5

* VFC and VCO printers restore the conditions of the current VFC switch.

†The manually selected font (including characters per inch, proportional spacing, and intercharacter gap) is restored at

power-up for printers having VFC or VCO options. (See Table 2-2).

‡FLC and FCO printers having form length position are set to a length of 279 mm (11 in). VFC and VCO printers restore the conditions of the current VFC switch.

!"#\$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNO
PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

2360090-6

Figure 2-2. Courier Font (12 cpi)

!"#\$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNO
PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

2360090-7

Figure 2-3. Courier Font (10 cpi)

!"#\$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNO
PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

2360090-8

Figure 2-4. Helvetica Font (12 cpi)

!"#\$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNO
PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

2360090-9

Figure 2-5. Helvetica Font (10 cpi)

!"#\$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNO
PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

2360090-10

Figure 2-6. Elite Font (12 cpi)

!"#\$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNO
PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

2360090-11

Figure 2-7. Elite Font (10 cpi)

!"#\$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNO
PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

2360090-12

Figure 2-8. Focus Font (10 cpi)

2.4 OPERATOR SELECTION OF TYPE FONTS

The operator can select one of the fonts shown in Figures 2-1 through 2-8 at the auxiliary control panel. Table 2-1 lists the printer versions and the corresponding auxiliary control panel configuration codes. Printers with configuration codes VCO or VFC save the selected font when power is removed from the printer. Printers with configuration codes FCO and VCO can also provide compressed print of the selected font.

Table 2-2 lists the front-panel-selectable fonts. The "switch actions" or "beeps" refer to the selection

procedures described in paragraphs 2.4.1 and 2.4.2. The corresponding software commands for each font selection are also designated in the table.

Fonts of fixed character spacing that are selected from the front panel can be used for printing tabular or multicolumn information. When selected, the Elite word processing font, in both 10 and 12 cpi, and the Standard Model 810 and Focus data processing fonts have fixed character spacing. The elite font is recommended for printing when a near-letter-quality font is required.

Table 2-1. Auxiliary Control Panel Configurations

Printer Version	TI Part Number	Configuration Code
Basic	994292-0001	BSC
Forms Length Control	994292-0002	FLC
Vertical Format Control	994292-0003	VFC
Forms Length and Compressed Print	994293-0001	FCO
Vertical Format Control and Compressed Print	994293-0002	VCO

Table 2-2. Front Panel Selection of Fonts

Switch Actions (No. of Beeps)	Font Selection	Characters per Inch*	Spacing	Software Control Designations
1	Standard Model 810	10	Fixed	ESC #0 ESC V 24 ESC T
2	Courier	12	Proportional	ESC #5 ESC I 6 ESC U
3	Courier	10	Proportional	ESC #5 ESC I 10 ESC U
4	Helvetica	12	Proportional	ESC #6 ESC I 8 ESC U
5	Helvetica	10	Proportional	ESC #6 ESC I 12 ESC U
6	Elite	12	Fixed	ESC #7 ESC V 20 ESC T
7	Elite	10	Fixed	ESC #7 ESC V 24 ESC T
8	Focus	10	Fixed	ESC #1 ESC V 24 ESC T
9	Hexadecimal Listing			ESC #1 ESC V 24 ESC T
10	(Selection Cycle Repeats)			

* Characters per inch is approximate for proportional spacing.

2.4.1 First-Generation Auxiliary Control Panels

Raise the top cover and locate the NORMAL — TEST/VFC toggle switch and the 8 LPI toggle switch on the first-generation auxiliary control panel. Figure 2-9 shows two of the five versions of this panel to illustrate the locations of these switches.

To manually select a font, set the NORMAL — TEST/VFC toggle switch to the TEST/VFC position. Next, toggle the 16.5 LPI — 8 LPI switch to the 8 LPI position and back to center the required number of times to select the desired font. Table 2-2 gives the number of switch operations (beeps) for a specific font. An audible tone (beep) sounds each time the 8 LPI switch is toggled to the 8 LPI position from center. The selection cycle repeats after the ninth switch operation.

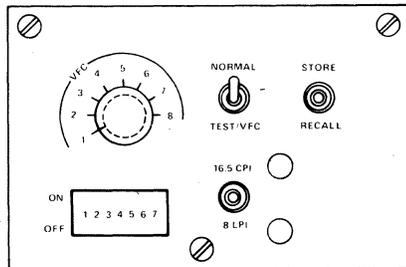
After the font is selected, set the NORMAL — TEST/VFC toggle switch to the NORMAL position. The selected font is retained when power goes off in printers with the VCO or VFC option.

2.4.2 Second-Generation Auxiliary Control Panels

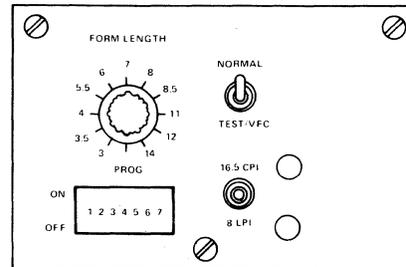
Raise the top cover and locate the TEST/VFC switch and the 8 LPI switch on the second-generation auxiliary control panel. Figure 2-10 shows two of the four versions of this panel to illustrate the locations of these switches.

To manually select a font, press the TEST/VFC pushbutton switch. Next, press the 8 LPI pushbutton switch the required number of times to select the desired font. Table 2-2 gives the number of switch operations (beeps) for a specific font. An audible tone (beep) sounds each time the 8 LPI switch is pressed. The selection cycle repeats after the ninth switch operation.

After the font is selected, press the NORMAL pushbutton switch. The selected font is retained when power goes off in printers with the VCO or VFC option.



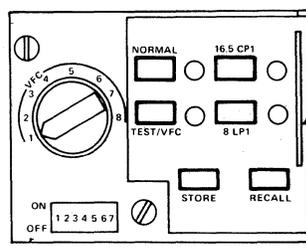
VERTICAL FORMAT CONTROL AND COMPRESSED PRINT (994293.0002) VCO



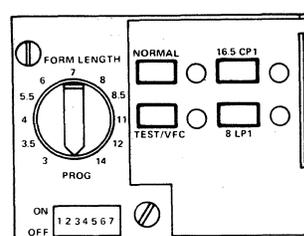
FORMS LENGTH AND COMPRESSED PRINT (994293.0001) FCO

2360090-3

Figure 2-9. First-Generation Auxiliary Control Panels



VERTICAL FORMAT CONTROL AND COMPRESSED PRINT (994293.0002) VCO



FORMS LENGTH AND COMPRESSED PRINT (994293.0001) FCO

2360090-4

Figure 2-10. Second-Generation Auxiliary Control Panels

2.5 OPERATOR AIDS

The following procedures enable the operator to manually clear data, to replace paper without losing data, and to save data sent to the printer.

NOTE

Whenever paper is handled (replaced, torn off, or form aligned), at least one vertical paper action (line feed or form feed) must be performed before printing near-letter-quality fonts or plot data to retain the required high-resolution vertical paper motion.

2.5.1 Procedure for Resetting (Clearing) the Buffers

To clear the receive first-in, first-out (FIFO) buffer, the character buffer, and the plot buffer of unwanted data, press the TEST/VFC switch and then press the NORMAL switch on the control panel. On first-generation auxiliary control panels, set the NORMAL TEST/VFC toggle switch to the TEST/VFC position and then set to NORMAL.

Setting the power switch OFF and then ON also clears the buffers.

2.5.2 Procedure for Replacing Paper Without Clearing the FIFO Buffer

When the printer is OFFLINE:

1. Press the FORM FEED switch to advance the form.

2. Remove the current printout.
3. Load paper (see *Model 810 Printer Operating Instructions*).
4. Press the RESET switch to clear paper-out error.
5. Press the ONLINE switch to continue printing.

When the printer is ONLINE:

1. Press the FORM FEED switch to advance the form.
2. Remove the current printout.
3. Load paper (see *Model 810 Printer Operating Instructions*).
4. Press the RESET switch to clear paper-out error and continue printing.

2.5.3 Procedure for Removing Error Condition Without Clearing the FIFO Buffer

Error conditions such as carriage jam or parity error can be cleared without clearing the FIFO buffer by the following procedure:

1. If an error occurs because an obstruction has jammed the carriage, remove the obstruction.
2. Press the RESET switch to clear the error condition and continue printing.

Section 3

Model 810LQ Printer Functional Description

3.1 INTRODUCTION

This section describes the features of the Model 810LQ Printer. Maximum versatility of the Model 810LQ Printer is obtained by software control of printer functions. Manual (front panel) selection of fonts, including 10-pitch and 12-pitch word processing fonts, provides near-letter-quality printing without using software control (see Section 2).

3.1.1 Standard Model 810 Printer

The unmodified Model 810 Printer is a dot-matrix printer that uses a moving printhead to place dots on the paper. The printhead contains seven wires arranged in a vertical row and spaced 0.353 mm (1/72 in) apart.

The position of the printhead in the horizontal direction is determined by a shaft encoder on the carriage-drive motor. The encoder provides a resolution of 4.724 positions per mm (120 positions per in) in the normal print mode. Resolution is 7.795 positions per mm (198 positions per in) in compressed print for printers with the FCO or VCO option. The paper is advanced by a stepping motor whose steps are 0.353 mm (1/72 in). A microprocessor in the printer controls the carriage-drive motor, the paper-advance stepping motor, and the firing of the printhead wires to place the dots on the paper. The resolution at 190.5 mm per second (mmps) (7.5 in per second [ips]) is 4.724 dots per mm (dpmm) (120 dots per in [dpi]) horizontally and 2.835 dpmm (72 dpi) vertically.

The Model 810 Printer microprocessor receives data and formats that data into patterns. At a speed of 381 mmps (15 ips), which corresponds to 60 dpi, a printhead wire does not have sufficient

time to print a dot, retract, and print another dot at the next adjacent position on the row. However, dots are large enough to overlap and produce a continuous line when placed at 2.362 dpmm (60 dpi).

3.1.2 Model 810LQ Printer

To upgrade the Model 810 Printer requires an LQ plug-in conversion (upgrade) board and a replacement, high-resolution, paper-advance stepping motor. The Model 810LQ upgrade kit also contains a replacement printhead required to ensure print quality.

The LQ upgrade board contains a Z80 microprocessor, 16K of random-access memory (RAM), and 20K of read-only memory (ROM). When installed, the LQ upgrade board makes the Model 810LQ a two-processor printer. The Z80 microprocessor performs the data-formatting functions while the printer processor handles input data and print control functions. This expanded capability allows plotting speeds as high as 11 700 pixels per second. Although the Model 810 shaft encoder is limited to a horizontal resolution of 4.724 dpmm (120 dpi), software on the LQ upgrade board increases the horizontal resolution to 9.449 dpmm (240 dpi) for alternate passes at slow print speed.

The replacement paper-advance stepping motor provides a vertical resolution four times greater than that of the standard stepping motor. Four steps of the replacement motor equal one step of the replaced motor. The increased number of steps provides the control for placement of individual dots to achieve a vertical resolution of 11.339 dpmm (288 dpi).

3.2 STATES OF OPERATION

The Model 810LQ Printer has two distinct modes of operation:

- Printing of firmware fonts and the user-defined (software) font. As characters are processed, they are placed in the character buffer.
- Plotting of dot-addressable data. As data is received, it is converted to dots that are placed in the plot buffer.

In most applications, only one buffer is printed at a time. The other remains empty. In special applications, data is entered into each buffer in the respective mode and the contents merged when the line is printed.

When power is applied, the printer is in the print mode and data is stored in the character buffer. The plot mode is entered by sending a special sequence of control characters followed by plot data, which is stored in the plot buffer. Line terminator control codes produce printout of the merged buffer contents. The print mode is reentered by sending a specific control character.

The font selected for print mode automatically determines the print resolution. The near-letter-quality fonts are printed in a four-pass operation that results in 9.449×11.338 -dpmm (240×288 -dpi) resolution. In the plot mode, the resolution normally available is 4.724×2.835 dpmm (120×72 dpi) and is referred to as dot-matrix plotting (X-plot).

In the print mode, the characters are stored in the character buffer that keeps track of the character, width, font, and gap following. In the plot mode, the pattern of the dots is stored in the plot buffer. Both the character buffer and the plot buffer contain 7 rows by 5232 positions. The number 5232 is derived from the maximum character cell width of 24 dots (23 printable dots plus an intercell dot) times 218 characters per line in compressed print.

When the character buffer fills or a line terminator is received, the character and plot buffers are printed. The characters (or pieces of characters in

the case of the four-pass font) are loaded into the dot buffer. When the printhead drive mechanism is energized, the contents of the dot buffer are transmitted to the printhead wires to create a hard-copy image of the bit pattern in the dot buffer.

When four-pass fonts are used, the dot buffer is loaded with the next group of character pieces for the next pass of the printhead. To improve overall speed, two dot buffers are used in a Ping-Pong fashion; that is, one buffer is being loaded while the other is being printed. When the buffers switch, paper motion required for a four-pass character can be observed by the user. The printer examines the buffers to determine the shortest travel path and maximum acceleration for the printhead.

3.3 SUMMARY OF MODEL 810LQ PRINTER FUNCTIONS

Upgrade of the Model 810 Printer to the Model 810LQ Printer provides the following functions:

- Software Debug Mode. In this mode, all data including the parity bit is converted to the hexadecimal value and then printed. This printout allows the user to see the received data and diagnose problems. See Table 2-2 and paragraphs 2.4.1 and 2.4.2 for instructions to access this mode. Refer to Table 5-1 for the decimal numbers, ASCII code characters, and binary codes in hexadecimal notation (hex code) with zero parity bit.
- Serial Interface Protocol (X — ON, X — OFF). See subsection 3.5 for a description of this feature.
- Printing Font Selection. Six alphanumeric fonts, the block character font, the bar-code font, and the user-defined font can be chosen for use in the printing mode. See the description in subsection 5.4 for programming instructions.
- Character Graphics Printing. Block characters and bar codes are printed without interline gap in the print mode described in subsection 5.5.

- Dot-Matrix Plotting (X-Plot)*. The six-bit, X-plot graphics mode is described under the command ESCape X in subsection 5.6 and paragraph 7.2.33.
- Compressed Print Mode. With the compressed print option installed (FCO or VCO printers), 218 characters per line (cpl) can be printed in compressed print mode. X-plot data is compressed by 60 percent. See ESCape 7 in paragraph 7.2.10.
- Parameter Storage and Recall. Mixed printing formats often require setting and resetting parameters such as line width, tab stops, expansion factor, and many others. A single command saves these parameters and another command recalls them. Parameters are not retained if printer power goes off. See ESCape = and ESCape @ in paragraphs 7.2.15 and 7.2.16.
- Enhanced Printing. The appearance of the printed characters can be improved by exercising escape sequences. ESCape B puts the printer into a slow speed mode that allows the printing of adjacent dots at 4.724 dpmm (120 dpi) - horizontally. ESCape O puts the printer into the overprinting mode, which causes the printer to print all the dots of the characters twice at the same dot location. The printer can be in both modes simultaneously. See ESCape B in paragraph 7.2.18 and ESCape O in paragraph 7.2.26.
- Horizontal Expansion. An expansion factor from 1 to 4 can be used on all printing characters and plot data including X-plot. See ESCape E in paragraph 7.2.19.
- User-Defined Font Characters. As many as 95 characters can be defined and loaded by the user. See the description under ESCape F in paragraph 7.2.20.
- Justification. Commands provide left only, right only, or right and left justification of margins as well as automatic centering. See ESCape J in paragraph 7.2.22.
- Squaring. The normal resolution of 4.724 × 2.835 dpmm (120 × 72 dpi) can be changed to a symmetrical 2.835 × 2.835-dpmm (72 × 72-dpi) resolution using the command ESCape S in paragraph 7.2.28.
- Proportional Spacing. The operator controls the spacing from character to character (fixed pitch) or between characters (proportional spacing) in the case of the near-letter-quality fonts. See ESCape U in paragraph 7.2.30.
- Underlining. The underlining mode causes printing characters to be underlined as long as the mode is active. See ESCape _ in paragraph 7.2.36.
- Test Pattern. A special barberpole test pattern is useful in diagnosing problems. Portions of this test pattern also allow the user to observe the software font that has been loaded. See paragraph B.6.2 in Appendix B for the procedure to run the barberpole test.
- Receive FIFO Buffer. A 3000-character FIFO buffer facilitates reception of burst transmission and reduces host CPU connect time.
- Diagnostics. Diagnostics of the LQ upgrade board are run automatically each time the printer is powered up. Successful completion is signaled with a short audible tone (beep).

3.4 UNDERSTANDING NEW FUNCTIONS

This subsection clarifies several important functions; however, the level of detail in this subsection is not required to understand adequately the print mode used for printing ASCII characters, block characters, and bar codes.

* Dot-matrix plotting (X-plot) is defined as the means by which a wire dot is placed on a page with a specified resolution such as 4.724 dpmm (120 dpi) horizontally by 2.835 dpmm (72 dpi) vertically. Other resolutions are available.

The Model 810LQ Printer has 9.449 × 11.339-dpmm (240 × 288-dpi) resolution for printing near-letter-quality fonts. The Model 810LQ Printer can be used for combined printing and plotting. Differences between printing and plotting formats are defined.

3.4.1 Horizontal Functions

The horizontal location of a dot on printout is determined by the position in a 5232-dot-wide buffer. This buffer is sufficiently wide that 218 cpl can be placed on the 381-mm (15-in) paper in the compressed print mode at a resolution of 15.591 dpmm (398 dpi). In the normal mode, the buffer is 3168 dots wide for 132 cpl in 10 pitch at 9.449 dpmm (240 dpi).

The printhead can move across the paper at two speeds; the high speed is 0.591 mm/ps (15 ips), and the low speed is 0.295 mm/ps (7.5 ips). High speed permits printing of every fourth dot (60 dpi); low speed allows printing of every other dot (120 dpi).

The font characters are designed so that no dots are in adjacent columns. Low-speed printing is selected for near-letter-quality fonts to enhance appearance and when adjacent dots are to be printed or plotted. The printer scans the dot buffer before it is printed to turn off dots that cannot be printed at the selected speed.

In the horizontal direction, printing and plotting are completely independent. Margins are set independently. The character buffer and plot buffer store the data separately until a line is to be printed. The plot buffer contains the rows of X-plot data; the character buffer contains font-selected characters or bar codes. Data from both buffers is merged into the dot buffer when a line terminator is received before the line is printed.

3.4.2 Vertical Functions

The vertical location of a dot on the paper is determined by the paper-advance stepping motor and one of the seven printhead wires. Each step of the motor is 0.088 mm (1/288 in). Each position in the dot buffer has seven bits corresponding to the seven wires.

The spacing of the vertically adjacent printhead wires is nearly equivalent to four steps of the

paper-advance stepping motor. The printer makes use of a variable called the vertical motion index (vmi) that corresponds to the number of motor steps between printed dot lines. The location of a dot row is a multiple of the vertical motion index, which specifies the vertical position (VP). The vertical position of a dot row is defined in motor steps of 0.088 mm (1/288 in) from the top of form. Table 3-1 shows the vertical position of dot locations for multiple-pass fonts and several line feeds. A line feed (LF) moves the paper to the next printing line. For a line feed of 0.236 lpmm (6 lpi), the vmi is 48; for 0.315 lpmm (8 lpi), 36.

A plotting line is produced when the paper motion to print the line causes the bottom dots of one line to be placed adjacent to the top dots of the next line and does not create an interline gap. For this paper motion, the vmi is 28. The plotting line is produced automatically in the X-plot mode for continuous plotting. In the print mode, ESCape CR moves the paper to the next plotting line. The use of ESC CR is generally required for specialized printing such as the printing of graphic characters (block characters and bar codes).

The paper can be moved only in the vertical direction. In the vertical direction, printing and plotting are not independent. The commands that cause printing, in effect, tell the printer where to move the paper after printing is completed. If near-letter-quality characters are used in a line, the paper advances between passes of the printhead, and this motion is taken into account by any subsequent motion. Some commands (such as CR without auto line feed), which do not move the paper when the printer is printing data processing fonts, cause paper to move several steps when the printer is printing near-letter-quality fonts.

3.4.3 X — ON, X — OFF

The Model 810LQ Printer preserves all standard Model 810 Printer interface protocols and adds a serial interface protocol. This new protocol uses the transmitted data pin (pin 2) on the serial interface connector to transmit a DC3 control code (X — OFF) when the receive FIFO buffer is full and to transmit a DC1 control code (X — ON) when the receive FIFO buffer is empty and more characters can be received. As the printer receives characters, it places them in the receive buffer. When the buffer fills to the point where fewer than 287

Table 3-1. Vertical Positions (VP) and Printhead Dot Positions

Vertical Position (Motor Steps)	Printhead Dot Rows	Comments
1 2 3 4 5 6 7 8 9 : : 25 26 27 28	1 2 3 : : 7	Row 1 dot (top dot) of both word processing and data processing fonts. Data processing fonts require 25 VP; word processing fonts require 28 VP for capital letters and 32 VP for lowercase descenders. Row 7 dot (bottom dot) of data processing fonts and character-font plotting.
29 30 31	8	Row 1 dot (top dot) of second line if first line is followed by ESC CR (see paragraph 7.2.2).
32		Lowest dot for word processing font descenders.
33 34 35 36	9	Interline spacing in character printing for 0.236-lpmm (6-lpi) and 0.315-lpmm (8-lpi) line feeds.
37 38 39	10	Row 1 dot (top dot) of second line for 0.315-lpmm (8-lpi) line feed.
40		Underline for word processing fonts.*
41 42 43 44 45 46 47 48	11 12	Continuation of interline spacing in character printing for 0.236-lpmm (6-lpi) line feed.
49	13	Row 1 dot (top dot) of second line for 0.236-lpmm (6-lpi) line feed.

*Underlining in near-letter-quality font requires 0.236-lpmm (6-lpi) line feed to avoid printing on the next line.

additional characters can be stored (full point), the printer sends a DC3 control code to signal the transmitting device to stop sending characters. As characters are processed, the receive buffer empties. When the buffer empties to the point where 2860 characters remain (empty point), the printer sends a DC1 control code that signals the transmitting device to resume sending characters. Replacing the standard Model 810 with a Model 810LQ Printer can present a computer time-out problem (see subsection 4.4).

NOTE

First production Model 810LQ Printers transmit DC3 when 256 additional characters can be stored, and DC1 when 256 characters remain.

Transmission is *not* stopped (DC3 transmitted) when the print mechanism halts or the carriage jams until the FIFO buffer is full. In like manner, a transmission request (DC1 transmitted) is sent only when the buffer reaches the empty point or after the buffer is manually cleared.

The RS-232 Request to Send (RTS) lead (pin 4) of the standard Model 810 Printer is maintained at

logic zero while power is on. In the Model 810LQ Printer, RTS is always at logic one while power is on.

3.4.4 Model 810LQ Buffers

Four buffers are required to describe the flow of data from the line to the printhead for printout. The FIFO buffer receives each ASCII code from the line. Each code is processed from the FIFO buffer in the order in which it is received. Operating codes are stored in working memory for use in formatting the characters and data to be printed. Operating codes include such functions as font, left margin, line width, etc. Other codes, such as most control codes, cause printer action when processed from the FIFO buffer. ASCII characters become dot patterns in the character buffer. If the printer is in the X-plot mode, each byte becomes part of the plotting dot pattern in the plot buffer.

On receipt of a line terminator (see subsection 5.7), the contents of both the character buffer and the plot buffer are merged into a dot buffer for printing. The contents of the dot buffer are sent to the printhead drivers as the printhead moves across the page. As previously stated, two dot buffers are used to produce higher throughput. The image of the dot buffer corresponds to the dot pattern of the printout.

Section 4

Print Quality, Printer Variances, and Precautions

4.1 PRINT QUALITY

The Model 810LQ Printer produces word processing printout that meets most demands for letter-quality applications. Individual printers may produce slight variations in horizontal or vertical spacing of characters or dots, in dot size, and in accuracy of dot placement. Most variations, however, can be removed by user adjustments and maintenance procedures (see Appendix B).

Print quality of a dot-matrix printer calls for a subjective judgment, and individual users differ on what constitutes acceptable quality depending on application. Also, print-quality variations can occur due to the type of paper used and the condition of the ribbon. For best print results, use a tractor-fed bond paper, which is available from most office-supply outlets. Print quality for a particular printer can be determined by comparing printout to the standard print samples shown in Figure 4-1.

Data processing character sets printed at 150 and 200 characters per second (cps) do not provide letter-quality printing. Some degradation of printout compared to print samples may be detected. In expanded print modes particularly, some waviness in printout can be expected. It is not feasible to enhance the print quality of data processing fonts to letter-quality standards.

4.2 MODEL 810 PRINTER UPGRADE VARIANCES

The Model 810LQ Printer field-upgrade option should be added only to Model 810 Printers having product service code 815. The product service

code is the third, fourth, and fifth digits of the serial number. The serial number is located on the label beside the power cord receptacle at the rear of the terminal.

Printers that have product service code 711 and the Model 810LQ Printer Field Installation Kit (upgrade option) installed might not produce print that meets the quality of the samples shown in Figure 4-1. Print quality for these printers might be improved by replacement of subassemblies at the customer's expense, but this is not guaranteed.

4.3 MODEL 810LQ PRINTER FUNCTIONAL VARIANCES

Model 810LQ Printer functions differ from those of the standard Model 810 Printer as follows:

- The RS-232 Request to Send (RTS) lead (pin 4) of the standard Model 810 Printer is maintained at logic zero while power is on. In the Model 810LQ Printer, RTS is always at logic one while power is on.
- The LINE FEED switch on the standard Model 810 Printer operates only in the off-line mode and causes single line feeds. This switch on the Model 810LQ Printer operates both in online and offline modes and is self-repeating.
- The Model 810 Printer prints the barberpole test in serial mode only. The Model 810LQ Printer prints the barberpole test in both serial and parallel modes.

- Special ROMs, which may have been installed on the Model 810 Printer processor board to perform unique functions for special applications, are bypassed by the LQ upgrade board and do not function.
- The Model 810 Printer reads pencil switches 1 through 7 whenever the printer goes ONLINE. The Model 810LQ Printer reads pencil switches 6 and 7 before each line is printed.
- The Model 810 Printer advances paper on receipt of a line feed. The Model 810LQ Printer does not advance paper on receipt of a line feed when the vmi is set to zero (see paragraph 7.2.23).

4.4 MODEL 810LQ PRINTER PRECAUTIONS

The Model 810LQ Printer user should be aware of the following items:

- The number of characters printed during the life of the printhead is reduced by the printing of word processing character sets as compared to the printing of data processing character sets. The dense dot patterns required for near-letter-quality printing cause greater wear of the printhead.
- Frequent use of the plotting mode for high-density printing increases the duty cycle of the printhead. Plotting more than 15 lines of solid black can blow a fuse. Reduction of printhead life is expected as more dots per line are printed.
- Computer time-out can occur when the Model 810 Printer is replaced with an early Model 810LQ Printer. (See note in paragraph 3.4.3.) The increased size of the receive FIFO buffer and the slower print speed in word processing fonts can cause the printer to be OFF for a longer period of time. Computer time-out period may need to be increased.
- Sustained operation in the plot mode of applications that print more than 40 percent of allowable dots per line can cause accelerated life reduction of the printhead and printhead driver circuits.

CAUTION

The Model 810LQ Printer should never be used to print reverse video outputs that cause paper to be printed black for more than 15 lines.

- Use of the SHIFT OUT (SO) control character without a user-defined (software) font causes the printer to become inoperative until a SHIFT IN (SI) control character is received. SI restores a firmware font. Refer to the SHIFT OUT and SHIFT IN commands in paragraphs 6.2.8 and 6.2.9.
- When the vmi is set to 0 (zero line feed motion), no paper motion occurs when the printer is printing a data processing character set. When the printer is printing a word processing character set, a slight paper motion occurs between printhead passes. This paper motion is required for the generation of characters.
- For best quality bar-code printing, the Model 810LQ Printer should be operated in the overprint mode (ESC O).
- Because the LQ option upgrade board must be inserted in the rear option slot of the Model 810 Printer, other options that make use of this slot cannot be implemented in the Model 810LQ Printer. These are:

Designation	Option	TI Part No.
TTY *	20-mA current loop board	2230497-0001
LBE	Line buffer board, EIA	994511-0001
LBT	Line buffer board, TTY current loop	994512-0001
LBP	Line buffer board, parallel	994513-0001

* Can be used with second-generation LQ upgrade board.

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Section 5

Software Commands for Print and Plot Modes

5.1 CODING

The Model 810LQ Printer interprets eight-bit binary codes as ASCII code characters or decimal numbers. ASCII character numbers 0 through 9 are designated by *N*. Decimal numbers 0 through 127 are designated by *n*. Hexadecimal representa-

tions of binary codes are preceded by a "greater than" symbol. For example, the hexadecimal notation >41 represents the ASCII character "A" and the equivalent decimal number "65". Table 5-1 gives the decimal numbers, ASCII code characters, and binary codes in hexadecimal notation (hex code).

Table 5-1. Decimal Numbers, ASCII Characters, and Corresponding Hexadecimal Codes

DECIMAL NUMBER	ASCII CHARACTER	HEXADECI-MAL NUMBER	DECIMAL NUMBER	ASCII CHARACTER	HEXADECI-MAL NUMBER	DECIMAL NUMBER	ASCII CHARACTER	HEXADECI-MAL NUMBER	DECIMAL NUMBER	ASCII CHARACTER	HEXADECI-MAL NUMBER
0	NUL	00	32	SPACE	20	64	@	40	96		60
1	SOH	01	33	!	21	65	A	41	97	a	61
2	STX	02	34	"	22	66	B	42	98	b	62
3	ETX	03	35	#	23	67	C	43	99	c	63
4	EOT	04	36	\$	24	68	D	44	100	d	64
5	ENQ	05	37	%	25	69	E	45	101	e	65
6	ACK	06	38	&	26	70	F	46	102	f	66
7	BEL	07	39	'	27	71	G	47	103	g	67
8	BS	08	40	(	28	72	H	48	104	h	68
9	HT	09	41	)	29	73	I	49	105	i	69
10	LF	0A	42	*	2A	74	J	4A	106	j	6A
11	VT	0B	43	+	2B	75	K	4B	107	k	6B
12	FF	0C	44	,	2C	76	L	4C	108	l	6C
13	CR	0D	45	-	2D	77	M	4D	109	m	6D
14	SO	0E	46	.	2E	78	N	4E	110	n	6E
15	SI	0F	47	/	2F	79	O	4F	111	o	6F
16	DLE	10	48	0	30	80	P	50	112	p	70
17	DC1	11	49	1	31	81	Q	51	113	q	71
18	DC2	12	50	2	32	82	R	52	114	r	72
19	DC3	13	51	3	33	83	S	53	115	s	73
20	DC4	14	52	4	34	84	T	54	116	t	74
21	NAK	15	53	5	35	85	U	55	117	u	75
22	SYN	16	54	6	36	86	V	56	118	v	76
23	ETB	17	55	7	37	87	W	57	119	w	77
24	CAN	18	56	8	38	88	X	58	120	x	78
25	EM	19	57	9	39	89	Y	59	121	y	79
26	SUB	1A	58	:	3A	90	Z	5A	122	z	7A
27	ESC	1B	59	;	3B	91	[	5B	123	{	7B
28	FS	1C	60	<	3C	92	\	5C	124	|	7C
29	GS	1D	61	=	3D	93]	5D	125	}	7D
30	RS	1E	62	>	3E	94	^	5E	126	~	7E
31	US	1F	63	?	3F	95	_	5F	127	DEL	7F

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5.2 CONTROL CODES – SUMMARY

ASCII code characters > 00 through > 1F and > 7F are control codes or control characters that provide special functions. These control code functions are listed in Table 5-2. The use of control codes is explained in Section 6. Examples of the use of control codes are provided in Section 8.

printer is in the print mode, an ESCape, > 1B, followed by certain other characters modifies the operation of the printer. Some of these modifications are retained when the printer is put into the X-plot mode (see Table 8-2). Table 5-3 summarizes the escape sequence commands. The use of escape sequence commands is explained in Section 7. Examples for the use of escape sequence commands are provided in Section 8.

5.3 ESCAPE COMMANDS – SUMMARY

The Model 810LQ Printer has both a print mode and an X-plot mode. ASCII characters, user-defined font characters, block characters, and bar codes are printed in the print mode. When the

NOTE

Do not insert spaces between characters in the escape sequence commands. Spaces between characters in Table 5-3 are for clarity only.

Table 5-2. Control Code Functions

Control Code	Hex Code	Function
NUL	00	Null — Terminate horizontal and vertical tab settings
SOH	01	Ignored
STX	02	Ignored
ETX	03	Ignored
EOT	04	Ignored
ENQ	05	Ignored
ACK	06	Ignored
BEL	07	Bell — Sound audible tone for 0.5 second
BS	08	Backspace — Backspace one character position
HT	09	Horizontal Tabulation
LF	0A	Line Feed
VT	0B	Vertical Tabulation
FF	0C	Form Feed
CR	0D	Carriage Return
SO	0E	Shift Out — Select user-defined character font
SI	0F	Shift In — Select firmware character font
DLE	10	Ignored
DC1	11	Device Control 1 — Receive FIFO buffer empty (READY)
DC2	12	Device Control 2 — Tab to line of next byte
DC3	13	Device Control 3 — Receive FIFO buffer full (BUSY)
DC4	14	Device Control 4 — Tab to position of next byte
NAK	15	Ignored
SYN	16	Ignored
ETB	17	Ignored
CAN	18	Ignored
EM	19	Ignored
SUB	1A	Ignored
ESC	1B	ESCape — ESCape sequence commands follow
FS	1C	File Separator — Terminate plot mode
GS	1D	Group Separator — Terminate plot row
RS	1E	Ignored
US	1F	Ignored
DEL	7F	Delete — Clear the character buffer and plot buffer (not the receive FIFO buffer)

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Table 5-3. Escape Sequence Commands

Function	Received Sequence "ESC" plus _____	Definition of Command
Line Feed	LF <i>n</i>	Print character and plot buffers, advance paper <i>n</i> steps or <i>n</i> /11.339 mm (<i>n</i> /288 in); $0 \leq n \leq 127$.
Carriage Return	CR	Print character and plot buffers, advance paper to next plot line.
Font Selection	# <i>N</i>	Print in selected firmware font <i>N</i> ; $0 \leq N \leq 8$ except 4* (see Table 5-4).
Vertical Tab Setting	1 <i>n n ... n</i> NUL	Clear vertical tabs, set new tabs at <i>n</i> lines.
Form Length Setting	2 <i>n</i>	Set form length to <i>n</i> lines; $4 \leq n \leq 127$.
Horizontal Tab Setting	3 <i>n n ... n</i> NUL	Clear horizontal tabs, set new tabs at <i>n</i> character positions.
Vertical Motion (Lines per Inch)	4	Set vertical motion index to 48 (0.236 lpmm [6 lpi]).
	5	Set vertical motion index to 36 (0.315 lpmm [8 lpi]).
Compressed Printing or Plotting	6	Turn off the compressed print mode.
	7	Turn on the compressed print mode.
Vertical Format Storage and Recall	8 <i>N</i>	Store current vertical format in memory channel <i>N</i> ; $1 \leq N \leq 8$, (VFC and VCO only).
	9 <i>N</i>	Recall vertical format from memory channel <i>N</i> ; $1 \leq N \leq 8$.
Line Width Setting	: <i>n</i>	Set line width to $n \times 2.54$ mm ($n \times 0.1$ in); $1 \leq n \leq 127$.
	;	Set the line width to 132 character positions if compressed print is not active, 218 if active.
Save (Store) Operating Parameters	=	Save operating parameters while power is on.
Recall Operating Parameters	@	Restore saved operating parameters.
Print Speed	A	Set printing speed to 381 mm/s (15.0 ips).
	B	Set printing speed to 190.5 mm/s (7.5 ips) (enhanced density).
Expanded Print	E <i>N</i>	Set the horizontal expansion factor <i>N</i> ; $1 \leq N \leq 4$.
Load User-Defined Font	F <i>n</i>	Load user-defined font into memory with <i>n</i> character patterns; $1 \leq n \leq 95$ (see Figure 7-1).
Intercharacter Gap	I <i>n</i>	Set intercharacter gap to <i>n</i> if proportional spacing is active; $0 \leq n \leq 127$.

*Software font must be loaded first or printer does not print.

Table 5-3. Escape Sequence Commands (Continued)

Function	Received Sequence "ESC" plus _____	Definition of Command
Justification	J 0	Left justify (initial condition)
	J 1	Left and right justify
	J 2	Right justify
	J 3	Center
Line Spacing (Vertical Motion Index)	L <i>n</i>	Set number of steps between print lines to <i>n</i> or $n/11.339$ mm ($n/288$ in); $0 \leq n \leq 127$.
Left Print Margin	M <i>n</i>	Set left margin $n \times 2.54$ mm ($n \times 0.1$ in) from machine left margin; $0 \leq n \leq 127$.
Overprinting	N	Select the normal printing mode. Disable overprinting.
	O	Select overprint (enhanced print) mode. Disable normal print.
Squaring Mode	R	Disable the squaring mode.
	S	Enable the squaring mode 2.835×2.835 dpmm (72×72 dpi).
Proportional Character Spacing	T	Disable proportional spacing.
	U	Enable proportional spacing.
Fixed Character Spacing	V <i>n</i>	Set fixed character spacing to <i>n</i> ; $0 \leq n \leq 127$; $n \times 25.4/240$ mm ($n/240$ in). Pitch becomes $240/n$.
Line Width in Dots	W <i>nn</i>	Set line width to <i>nn</i> dots; $1 \leq nn \leq 3168$, or $1 \leq nn \leq 5232$ for compressed print.
Six-Bit, X-Plot Mode	X	Set printer to six-bit, X-plot mode (see Figure 5-5). FS, >1C, terminates plot mode; GS, >1D, terminates plot line.
Left Plot Margin	Y <i>n</i>	Set left plot margin to $n \times 2.54$ mm ($n \times 0.1$ in) to the right of left machine margin; $0 < n < 127$.
Conditions	Z	Select standard conditions.**
Underlining	—	Turn on the underlining mode.
	^	Turn off the underlining mode.

**These conditions are different from those in subsection 2.2:

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1. Left printing margin equals 0.
2. Normal printing (overprint OFF).
3. Standard Model 810 font.
4. Left justification.
5. Expansion factor is 1.
6. Proportional spacing is OFF.
7. Horizontal motion index equals 24 (0.1 in).
8. Intercharacter gap equals 6.
9. Fast printing mode for single-pass fonts.

5.4 PRINTING

In the print mode, the Model 810LQ Printer prints ASCII code characters for hexadecimal codes > 20 through > 7E. These codes are converted to the character patterns for the particular character set or font. There are nine character sets from which to choose, eight of which are stored in firmware. The additional character set is the user-defined font. One character set or font is active at a time. To select a font, send to the printer, the escape sequence ESC #, > 1B > 23, followed by an identifying ASCII code number *N* for the required font. The ASCII numbers and hexadecimal codes for selecting the fonts are shown in Table 5-4.

The Fast Focus font can be compressed to print at 200 cps by decreasing the horizontal motion index (hmi) to 18. For the sequence ESC V *n*, > 1B > 56 > XX, the value of *n* is the horizontal motion index. The pitch is 240 divided by the horizontal motion index. For a pitch of 10 cpi, the hmi is 24, the power-up initial condition value. The printhead moves at 15 ips and, for 10 cpi, prints at 150 cps. For an hmi of 18, cpi equals 240/18, or 13.3 cpi. Printing 13.3 cpi at 15 ips produces 200 cps.

The type fonts are shown in Figure 5-1 in fixed pitch of 10 cpi.

Table 5-4. ASCII Numbers and Hexadecimal Codes for Character-Set Selection

ASCII Number	Hex Code	Model 810LQ Printer Character Set or Font
0	30	Standard Model 810 (power-up normal condition)
1	31	Focus
2	32	Bar-code characters (see paragraph 5.5.2)
3	33	Block characters (see paragraph 5.5.1)
4	34	User-defined (see ESCape F, paragraph 7.2.20)
5	35	Courier
6	36	Helvetica
7	37	Elite
8	38	Fast Focus

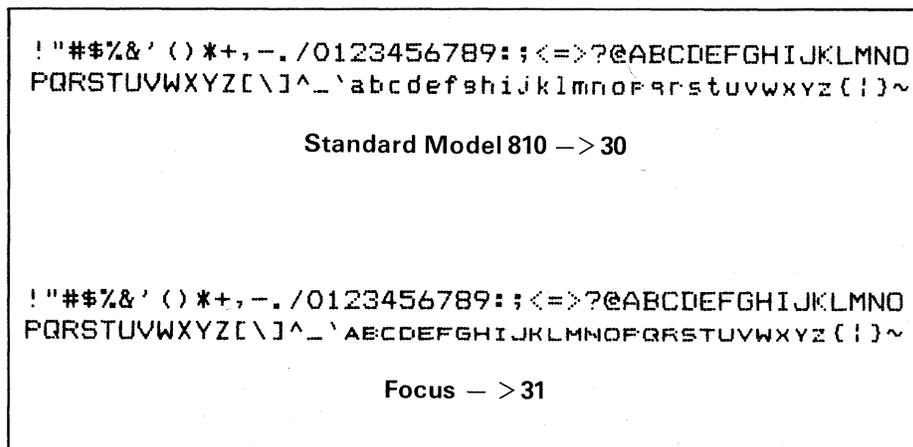
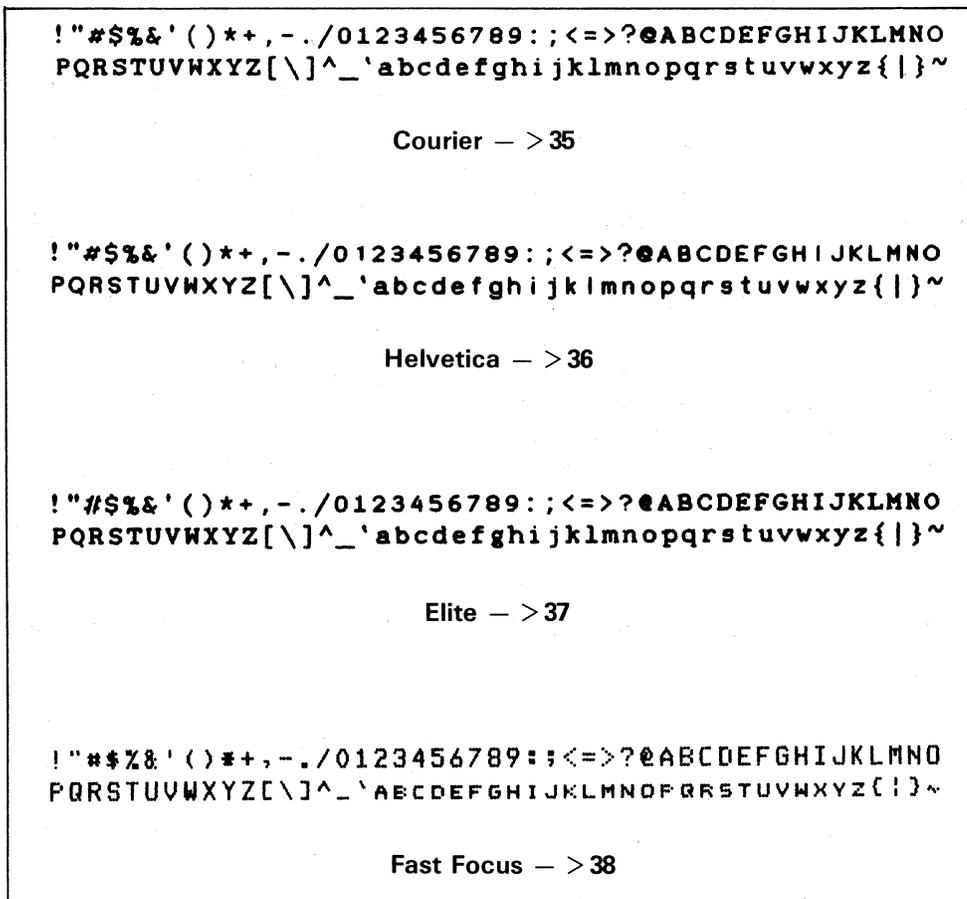


Figure 5-1. Firmware Printing Fonts



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Figure 5-1. Firmware Printing Fonts (Concluded)

The cell width in dots for each printed character of each firmware character set is shown in Table 5-5. Each character set or font can be modified by the escape commands in Table 5-3 to produce printout that is expanded, compressed, enhanced, etc. Section 7, Escape Sequence Programming Explanations, describes in detail the use of each command. Additional examples are provided in Section 8, Printer Applications.

Block-character and bar-code-character sets should not have a gap between printed lines (see paragraph 7.2.2, ESC CR).

Tables 5-6 through 5-13 provide those changes for the international character sets of Table 5-5. Inter-

national character sets are hard-wire selected on the second-generation LQ upgrade board.

5.5 CHARACTER GRAPHICS

The Model 810LQ Printer provides two graphic character sets in firmware — block characters and bar codes.

These character sets are selected in the print mode. Generally, no vertical interline gap appears in block-character or bar-code printing. The normal interline gap is eliminated by sending ESC CR, >1B >0D, as the line terminator (see paragraph 7.2.2).

Table 5-5. Hexadecimal Codes, Character Sets, and Character Cell Dot Widths

Hex Code	810	Focus	Bar Code	Block Char.	Courier	Helvetica	Elite	Fast Focus
	Dot Width for Character Set or Cell							
	9	9	9	9	Variable	Variable	Variable	7
20					14	14	14	
21	!	!	|	■	! 3	! 3	! 3	!
22	"	"	|	▲	" 11	" 11	" 11	"
23	#	#	|	▼	# 19	# 19	# 20	#
24	\$	\$	|	▲	\$ 14	\$ 13	\$ 13	\$
25	%	%	||	▼	% 18	% 18	% 18	%
26	&	&	|	▲	& 16	& 16	& 16	&
27	'	'	|	▼	' 3	' 3	' 3	'
28	(	(	|	·	( 7	(7	(7	(
29	)	)	||	·	) 7	) 7	) 7)
2A	*	*	||	·	* 13	* 13	* 13	*
2B	+	+	||	┌	+ 13	+ 13	+ 13	+
2C	,	,	|	┐	,	,	,	,
2D	-	-	||	└	- 13	- 13	- 13	-
2E	.	.	|	┘	. 3	. 3	. 3	.
2F	/	/	■	┘	/ 16	/ 16	/ 16	/
30	0	0	|	■	0 13	0 13	0 13	0
31	1	1	||	■	1 13	1 7	1 13	1
32	2	2	||	▶	2 13	2 13	2 13	2
33	3	3	||	◀	3 13	3 13	3 13	3
34	4	4	||	■	4 15	4 15	4 13	4
35	5	5	|||	■	5 13	5 13	5 13	5
36	6	6	||	■	6 13	6 13	6 13	6
37	7	7	||	■	7 13	7 13	7 13	7
38	8	8	|	■	8 13	8 13	8 13	8
39	9	9	||	■	9 13	9 13	9 13	9
3A	:	:	||	■	:	:	:	:
3B	;	;	||	■	;	;	;	;
3C	<	<	|	■	< 11	< 11	< 11	<
3D	=	=	||	■	= 13	= 13	= 13	=
3E	>	>	■	■	> 11	> 11	> 11	>
3F	?	?	■	■	? 15	? 15	? 13	?
40	@	@	|	■	@ 17	@ 17	@ 13	@
41	A	A	||	■	A 17	A 15	A 16	A
42	B	B	||	■	B 14	B 12	B 15	B
43	C	C	||	■	C 15	C 15	C 15	C
44	D	D	||	■	D 16	D 14	D 16	D
45	E	E	|||	■	E 15	E 13	E 15	E
46	F	F	||	■	F 15	F 13	F 15	F
47	G	G	||	■	G 17	G 15	G 17	G
48	H	H	||	■	H 17	H 13	H 17	H
49	I	I	|||	■	I 9	I 3	I 9	I
4A	J	J	|||	■	J 17	J 13	J 17	J
4B	K	K	|||	■	K 17	K 13	K 17	K
4C	L	L	||	■	L 17	L 13	L 17	L
4D	M	M	|||	■	M 17	M 13	M 17	M
4E	N	N	||	■	N 15	N 11	N 15	N
4F	O	O	||	||	O 17	O 17	O 15	O

Table 5-5. Hexadecimal Codes, Character Sets, and Character Cell Dot Widths (Concluded)

Hex Code	810	Focus	Bar Code	Block Char.	Courier	Helvetica	Elite	Fast Focus
	Dot Width for Character Set or Cell							
	9	9	9	9	Variable	Variable	Variable	7
50	P	P	█	█	P 14	P 12	P 14	P
51	Q	Q	██	█	Q 17	Q 17	Q 15	Q
52	R	R	██	█	R 17	R 12	R 17	R
53	S	S	██	█	S 14	S 13	S 13	S
54	T	T	██	█	T 17	T 13	T 17	T
55	U	U	██	█	U 17	U 13	U 17	U
56	V	V	██	█	V 17	V 15	V 17	V
57	W	W	██	█	W 17	W 13	W 17	W
58	X	X	██	█	X 15	X 15	X 15	X
59	Y	Y	██	█	Y 17	Y 15	Y 17	Y
5A	Z	Z	██	█	Z 15	Z 15	Z 15	Z
5B	[	[	██	█	[ 7	[7	[7	[
5C	\	\	██	█	\ 16	\ 16	\ 16	\
5D	]	]	██	█	] 7	] 7	] 7]
5E	^	^	██	█	^ 13	^ 13	^ 13	^
5F	_	_	██	█	_ 23	_ 23	_ 23	_
60	`	`	██	█	` 4	` 4	` 4	`
61	a	A			a 17	a 17	a 15	A
62	b	B			b 17	b 13	b 15	B
63	c	C			c 13	c 13	c 13	C
64	d	D			d 15	d 13	d 15	D
65	e	E			e 13	e 13	e 13	E
66	f	F			f 13	f 9	f 13	F
67	g	G			g 15	g 13	g 12	G
68	h	H			h 19	h 13	h 19	H
69	i	I			i 9	i 3	i 9	I
6A	j	J			j 7	j 7	j 7	J
6B	k	K			k 17	k 9	k 15	K
6C	l	L			l 13	l 3	l 13	L
6D	m	M			m 19	m 15	m 19	M
6E	n	N			n 15	n 11	n 15	N
6F	o	O			o 13	o 13	o 13	O
70	p	P			p 17	p 13	p 17	P
71	q	Q			q 15	q 13	q 15	Q
72	r	R			r 14	r 12	r 14	R
73	s	S			s 11	s 11	s 11	S
74	t	T			t 9	t 9	t 9	T
75	u	U			u 15	u 11	u 15	U
76	v	V			v 17	v 11	v 17	V
77	w	W			w 17	w 13	w 17	W
78	x	X			x 15	x 11	x 15	X
79	y	Y			y 17	y 13	y 17	Y
7A	z	Z			z 13	z 13	z 13	Z
7B	{	{			{ 9	{ 7	{ 9	{
7C	|	|			| 1	| 3	| 1	|
7D	}	}			} 9	} 7	} 9	}
7E	~	~			~ 17	~ 17	~ 17	~
7F								

Table 5-6. Hexadecimal Codes, Character Sets, and Character Cell Dot Widths for Canadian French Characters

Hex Code	810	Focus	Courier	Helvetica	Elite	Fast Focus
	Dot Width for Character Set or Cell					
	9	9	Variable	Variable	Variable	7
40	à	À	à 17	à 17	à 17	À
5B	â	Â	â 17	â 17	â 17	Â
5C	ç	Ç	ç 13	ç 13	ç 13	Ç
5D	ê	Ê	ê 13	ê 13	ê 13	Ê
5E	ï	Ï	ï 9	ï 9	ï 9	Ï
60	ô	Ô	ô 13	ô 13	ô 13	Ô
7B	é	É	é 13	é 13	é 13	É
7C	ù	Ù	ù 15	ù 11	ù 15	Ù
7D	ê	Ê	ê 13	ê 13	ê 13	Ê
7E	û	Û	û 15	û 11	û 15	Û

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Table 5-7. Hexadecimal Codes, Character Sets, and Character Cell Dot Widths for United Kingdom Characters

Hex Code	810	Focus	Courier	Helvetica	Elite	Fast Focus
	Dot Width for Character Set or Cell					
	9	9	Variable	Variable	Variable	7
23	£	£	£ 17	£ 17	£ 15	£

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Table 5-8. Hexadecimal Codes, Character Sets, and Character Cell Dot Widths for German Characters

Hex Code	810	Focus	Courier	Helvetica	Elite	Fast Focus
	Dot Width for Character Set or Cell					
	9	9	Variable	Variable	Variable	7
5B	Ä	Ä	Ä 17	Ä 15	Ä 16	Ä
5C	ö	ö	ö 17	ö 17	ö 17	ö
5D	ü	ü	ü 17	ü 13	ü 17	ü
7B	ä	ä	ä 17	ä 17	ä 15	ä
7C	ö	ö	ö 13	ö 13	ö 13	ö
7D	ü	ü	ü 15	ü 11	ü 15	ü
7E	ß	ß	ß 16	ß 17	ß 16	ß

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Table 5-9. Hexadecimal Codes, Character Sets, and Character Cell Dot Widths for Spanish Characters

Hex Code	810	Focus	Courier	Helvetica	Elite	Fast Focus
	Dot Width for Character Set or Cell					
	9	9	Variable	Variable	Variable	7
5B	í	í	í 3	í 3	í 3	í
5C	ñ	ñ	ñ 15	ñ 11	ñ 15	ñ
5D	¿	¿	¿ 19	¿ 19	¿ 19	¿
7B	ó	ó	ó 9	ó 9	ó 9	ó
7C	ñ	ñ	ñ 15	ñ 11	ñ 15	ñ
7D	ç	ç	ç 13	ç 13	ç 13	ç

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Table 5-10. Hexadecimal Codes, Character Sets, and Character Cell Dot Widths for Swedish/Finnish Characters

Hex Code	810	Focus	Courier	Helvetica	Elite	Fast Focus
	Dot Width for Character Set or Cell					
	9	9	Variable	Variable	Variable	7
24	Š	Š	Š 17	Š 17	Š 17	Š
40	É	É	É 13	É 13	É 13	É
5B	Å	Å	Å 17	Å 15	Å 16	Å
5C	ö	ö	ö 17	ö 17	ö 17	ö
5D	Ä	Ä	Ä 17	Ä 15	Ä 17	Ä
5E	Û	Û	Û 17	Û 13	Û 17	Û
60	é	é	é 13	é 13	é 13	é
7B	ä	ä	ä 17	ä 17	ä 15	ä
7C	ö	ö	ö 13	ö 13	ö 13	ö
7D	å	å	å 17	å 17	å 15	å
7E	ü	ü	ü 15	ü 11	ü 15	ü

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Table 5-11. Hexadecimal Codes, Character Sets, and Character Cell Dot Widths for Danish/Norwegian Characters

Hex Code	810	Focus	Courier	Helvetica	Elite	Fast Focus
	Dot Width for Character Set or Cell					
	9	9	Variable	Variable	Variable	7
5B	Æ	Æ	Æ 19	Æ 19	Æ 19	Æ
5C	Ø	Ø	Ø 17	Ø 17	Ø 17	Ø
5D	Å	Å	Å 17	Å 15	Å 17	Å
7B	æ	æ	æ 21	æ 21	æ 21	æ
7C	ø	ø	ø 13	ø 13	ø 13	ø
7D	å	å	å 17	å 17	å 15	å

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Table 5-12. Hexadecimal Codes, Character Sets, and Character Cell Dot Widths for Swiss Characters

Hex Code	810	Focus	Courier	Helvetica	Elite	Fast Focus
	Dot Width for Character Set or Cell					
	9	9	Variable	Variable	Variable	7
23	£	£	£ 17	£ 17	£ 15	£
40	À	À	à 17	à 17	à 17	À
5B	É	É	é 13	é 13	é 13	É
5C	ƒ	ƒ	ƒ 13	ƒ 13	ƒ 13	ƒ
5D	È	È	è 13	è 13	è 13	È
7B	Ä	Ä	ä 17	ä 17	ä 15	Ä
7C	Ö	Ö	ö 13	ö 13	ö 13	Ö
7D	Ü	Ü	ü 15	ü 11	ü 15	Ü
7E 12	.. 12	.. 12	..

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Table 5-13. Hexadecimal Codes, Character Sets, and Character Cell Dot Widths for French Word Processing Characters

Hex Code	810	Focus	Courier	Helvetica	Elite	Fast Focus
	Dot Width for Character Set or Cell					
	9	9	Variable	Variable	Variable	7
23	£	£	£ 17	£ 17	£ 15	£
40	À	À	à 17	à 17	à 17	À
5B	°	°	° 9	° 9	° 9	°
5C	ƒ	ƒ	ƒ 13	ƒ 13	ƒ 13	ƒ
5D	§	§	§ 18	§ 18	§ 18	§
7B	É	É	é 13	é 13	é 13	É
7C	Ù	Ù	ù 15	ù 11	ù 15	Ù
7D	È	È	è 13	è 13	è 13	È
7E 12	.. 12	.. 12	..

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5.5.1 Block-Character Printing

Receipt of the escape sequence ESC # 3, >1B >23 >33, causes the printer to select the block-character set. Block characters are programmed on a line-by-line basis. Several lines of block characters can be used to print patterns or characters of a height determined by the number of lines. The vertical motion index of 28 obtained by ESC CR, >1B >0D, produces paper movement of 2.469 mm per line feed (approximately 0.1 in). For a printed character 12.347 mm high (nearly 0.5 in), five consecutive lines must be programmed. Figure 5-2 shows typical printed characters that are formed using block-character segments. The lines of code that produce the printed characters are shown in hexadecimal notation.

The lines of code shown in Figure 5-2 perform the following functions:

Line	Hex Code	Function
1	>1B >5A >1B >23 >33 >1B >4F >1B >42 >1B >0D	Sets printer to standard conditions. Selects block-character set. Selects overprint mode. Selects slow print speed. Performs plot line carriage return.
2 - 6	>14 >0F >2X . . . >30 >1B >0D	Enters horizontal tab to column 15. Enters block characters for five plot lines. Prints plot line before carriage return.
7	>1B >5A >0D	Sets printer to standard conditions. Performs carriage return.

Block characters can be entered into the character buffer for any line with other print-mode-selectable characters and then merged with the contents of the plot buffer on a line of printout. The interline gap must be considered, however, when printing other print-mode characters on consecutive lines when space between lines is required. Block-character applications are further illustrated in subsection 8.5.

CAUTION

Using the block characters to print large black areas accelerates print-head wear.

5.5.2 Bar-Code Printing

Receipt of the escape sequence ESC # 2, >1B >23 >32, causes the printer to produce bar-code characters that can be mixed with readable characters for identification of marked items. Bar-code-character segments can be entered into the character buffer with other print-mode-selectable characters and then merged with the plot buffer on a line of printout.

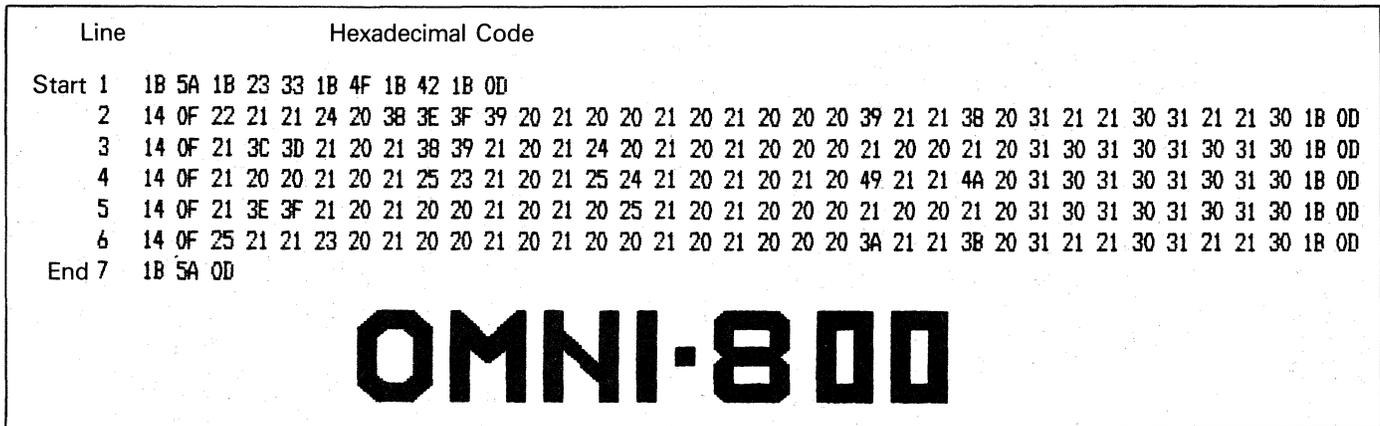
Bar-code specifications and formats in current use are available from original equipment manufacturers and industry organizations, such as the Uniform Product Code Council. Producers of bar-code-scanning equipment are also a source of user information. Bar-code-specification sources are listed in Appendix A, subsection A-2.

Bar-code programming is similar to block-character programming. Bar-code character

segments form the bar code. Generally, several consecutive lines of bar code are printed for height. Figure 5-3 is an example of Universal Product Code (UPC) bar-code programming and printing. The lines of code, shown in hexadecimal notation, are programmed on a line-by-line basis. Other print-mode-selectable characters can be programmed on any of the lines with the bar codes. Tabbing or spacing to the right of the margin for bar-code printing must be done with the same font selected to ensure the same size character cell. Also, the interline gap must be considered when printing characters on consecutive lines. Figure A-2, in Appendix A, shows bar-code dot patterns.

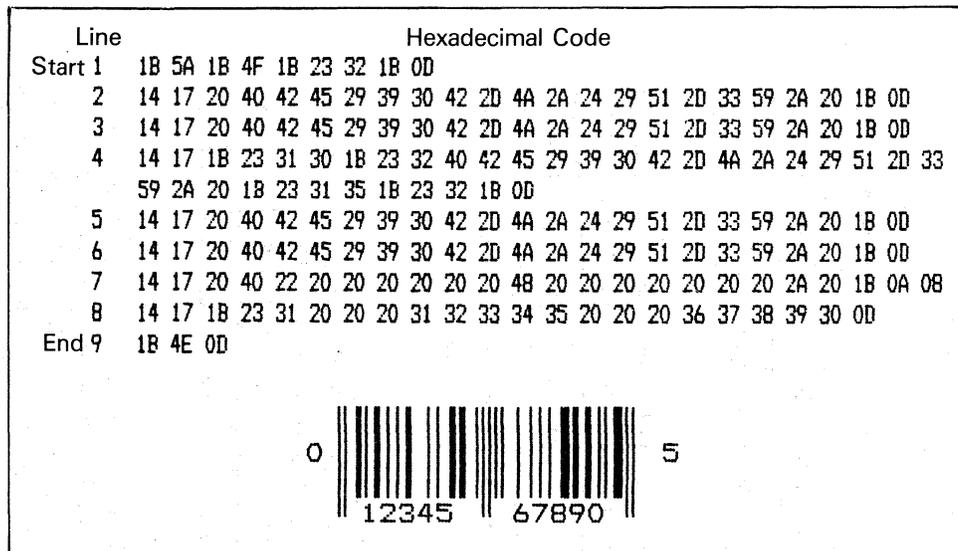
The lines of code shown in Figure 5-3 perform the following functions:

Line	Hex Code	Function
1	>1B >5A >1B >4F >1B >23 >32 >1B >0D	Sets printer to standard conditions. Sets printer into overprint mode. Selects bar-code character set. Prints plot line before carriage return.
2, 3	>14 >17 >20 >40 . . . >20 >1B >0D	Enters horizontal tab to column 23 and space. Enters first and second lines of bar code. Prints plot line before carriage return.
4	>14 >17 >1B >23 >31 >30 >1B >23 >32 >40 . . . >20 >1B >23 >31 >35 >1B >23 >32 >1B >0D	Enters horizontal tab to column 23. Selects print font and enters 0. Selects bar-code character set. Enters third line of bar code. Selects print font and enters 5. Selects bar-code character set. Prints plot line before carriage return.
5, 6	>14 >17 >20 >40 . . . >20 >1B >0D	Enters horizontal tab to column 23 and space. Enters fourth and fifth lines of bar code. Prints plot line before carriage return.
7	>14 >17 >20 >40 . . . >20 >1B >0A >08	Enters horizontal tab to column 23 and space. Enters leading, center, and trailing bar code for fifth line. Prints line and performs partial line feed (advances paper eight steps).
8	>14 >17 >1B >23 >31 >20 . . . >30 >0D	Enters horizontal tab to column 23 and space. Selects print font. Spaces and enters numbers 1 through 0. Prints line and performs carriage return.
9	>1B >4E >0D	Selects normal print mode and performs carriage return.



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Figure 5-2. Block-Character Printing Example



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Figure 5-3. Bar-Code Printing Example

5.6 PLOTTING

Receipt of the escape sequence ESC X, >1B >58, causes the printer to enter the six-bit, X-plot mode and interpret the value of the low-order six bits of following bytes as plot data. Each bit in the received code that is ON (binary "1") represents a dot to be placed on the paper. Halftone pictures, schematics, and complex curves can be printed in the plotting mode. The margin, expansion, compression, squaring, overprint, and printhead speed attributes are retained if set before the X-plot mode is entered (see Table 8-2).

In the X-plot mode, the printer ignores ASCII control codes (>00 through >1F) except for the Group Separator (GS), >1D, and the File Separator (FS), >1C. Delete (DEL), >7F, does not clear the buffer in X-plot mode.

X-plot plotting can be programmed and the data entered into the plot buffer before or after print-mode-selectable characters are entered into the character buffer. On receipt of a line terminator, the printer merges the contents of both the character buffer and the plot buffer and then prints the line (see subsection 5.7).

5.6.1 Programming

The printer enters the X-plot mode only on receipt of the escape sequence ESC X, >1B >58, and exits only on the control code command FS, >1C. GS, >1D, terminates data entry for a plotting row. On the seventh row, GS acts as a line terminator.

FS, >1C, terminates the X-plot mode and saves the plot line in the buffer until the next line is printed, at which time both the character buffer contents and plot buffer contents are sent to the printhead drivers. This allows text printing to be programmed and printed on the same line with the plot data. Seven rows of plot data need not be entered; the rows that have been entered are printed.

As the plot data bytes are received, the low-order six bits are placed in the plot buffer with bit 0 (least significant bit) at the left and bit 5 at the right (see Figure 5-5 for six-bit, X-plot codes). Bit 0 of the second byte is placed next to the previous bit 5,

and so on. To illustrate, the binary number 01011111, or >5F, is printed as:

*****_

where 0 equals a space designated by "-" and 1 equals a dot designated by "*". The two-byte code >5F >7E appears as:

*****_*****

The data is placed starting at the left plot margin. The right margin is the end of the plot buffer or about 335.28 mm (13.2 in) from the left margin.

The plot data bytes are assembled in the plot buffer from left to right until the row is full. Bits of a byte that extend past the right margin are saved and printed. Bytes that are received when the row is full are discarded. GS, >1D, ends a row and causes the next plot byte to be placed in the plot buffer at the left plot margin in the next row of dots on the page. This process continues until seven complete rows have been placed into the plot buffer or the plot mode is terminated with a FS, >1C.

Terminating the seventh row with a GS causes the plot line to be printed. The plot buffer is cleared and paper is advanced to the next plot line (usually 28 vmi).

5.6.2 Plot Mode Programming Helps

To facilitate plot mode programming:

- Use slow print speed (ESC B).

Before plotting, set the printer to slow print speed (ESC B), which causes plot mode data to be entered and printed at 120 dpi. Or use the squaring mode (ESC S), which causes the plot mode data to be entered and printed at 72 dpi. When high printhead speed (ESC A) is used, some dots represented by the six-bit plot data are ignored because the maximum dot density that can be printed is 60 dpi.

- Use squaring mode (ESC S) for equal dot densities horizontally and vertically.

The squaring mode interprets six-bit plot data as 72 x 72 dpi. Disabling squaring

mode (ESC R) provides 120 dpi horizontally by 72 dpi vertically. Squaring mode is not enabled when the printer is powered on.

- Use a horizontal expansion factor of 1 (ESC E 1) for plotting.

A horizontal expansion factor of 1 through 4 (ESC E *N*) can be used for plotting. See paragraphs 7.2.19 and 8.7 for more information and illustrations. The horizontal expansion factor is 1 when the printer is powered on.

- Use normal-width (noncompressed) printing (ESC 6) for 120 dpi or the squaring mode.

Normal-width printing ensures that the

squaring mode produces 72 x 72-dpi and that the nonsquared mode produces 120x 72-dpi. When compressed print is used, slow print provides 198 x 72-dpi and the squaring mode provides 119 x 72-dpi.

5.6.3 Applications

The Model 810LQ Printer can place dots on any dot position within the 132-column (335.28-mm[13.2-in]) print line. The user can address any individual dot position for printing.

Figure 5-4 shows an example of X-plot programming and printing in 72 x 72-dpi format. The lines of code, shown in hexadecimal notation, are programmed on a line-by-line basis (see Figure 5-5 for the six-bit, X-plot dot patterns). The lines of code shown in Figure 5-4 perform the following functions:

Line	Hex Code	Function
1	>1B >0D >1B >53 >1B >4F >1B >58	Performs plot line carriage return. Sets 72 × 72-dpi format. Selects overprint mode. Selects X-plot mode.
2 - 28	>XX . . . >XX >1D	Enters row plot data. Ends row data entry and prints line if seventh row.
29	>40 . . . >44	Enters row plot data.
30	>1C >1B >23 >37 >1B >55 >14 >03 >54 >65 . . . >73 >1B >0D >1B >58	Terminates plot mode with plot buffer loaded. Selects Elite font. Selects proportional spacing. Tabs to column 3. Enters "Texas". Prints character buffer and plot buffer line before carriage return. Selects X-plot mode.
31 - 49	>40 . . . >XX >1D	Enters row plot data. Ends row data entry and prints line if seventh row.
50	>1C >1B >52 >0D >0A	Terminates X-plot mode. Disables squaring mode. Performs carriage return. Performs line feed.

Line	Hexadecimal Code																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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	44	40	40	40	40	46	40	42	1D									45	40	40	40	40	4E	40	42	1D									46	40	40	40	40	5C	40	42	1D									47	40	40	40	40	78	40	44	1D									48	40	40	40	40	70	43	44	1D									49	40	40	40	40	7F	43	1D									End	50	1C	1B	52	0D	0A																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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	46	40	40	40	40	5C	40	42	1D									47	40	40	40	40	78	40	44	1D									48	40	40	40	40	70	43	44	1D									49	40	40	40	40	7F	43	1D									End	50	1C	1B	52	0D	0A																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
	47	40	40	40	40	78	40	44	1D									48	40	40	40	40	70	43	44	1D									49	40	40	40	40	7F	43	1D									End	50	1C	1B	52	0D	0A																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
	48	40	40	40	40	70	43	44	1D									49	40	40	40	40	7F	43	1D									End	50	1C	1B	52	0D	0A																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
	49	40	40	40	40	7F	43	1D									End	50	1C	1B	52	0D	0A																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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Figure 5-4. X-Plot Printing Example

2360090-27

Other examples of X-plot printouts are provided in subsection 8.7.

5.6.4 Six-Bit, X-Plot Codes

A complete set of *plotting bytes must not include* >1C and 1D because they are commands to the printer in the plot mode. The easiest set to use is >40 through >7F. For computers that have difficulty sending codes greater than >5F, the set >40

through >5F and >20 through >3F can be programmed at some increase in complexity for the programmer. Figure 5-5 shows a recommended set of six-bit, X-plot dot patterns and codes.

Parity can be employed in this mode. In the case of a parity error, a >00 is substituted for the plot byte.

- = 0, • = 1

Dot Pattern		Hex Code		Dot Pattern		Hex Code		Dot Pattern		Hex Code	
LSB	MSB	MSB	LSB	LSB	MSB	MSB	LSB	LSB	MSB	MSB	LSB
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
000000		000000		101010		010101		010101		101010	
-----		>40		•••••		>55		•••••		>6A	
•-----		>41		•••••		>56		•••••		>6B	
••-----		>42		•••••		>57		•••••		>6C	
•••-----		>43		•••••		>58		•••••		>6D	
••••-----		>44		•••••		>59		•••••		>6E	
•••••-----		>45		•••••		>5A		•••••		>6F	
••••••-----		>46		•••••		>5B		•••••		>70	
•••••••-----		>47		•••••		>5C		•••••		>71	
••••••••-----		>48		•••••		>5D		•••••		>72	
•••••••••-----		>49		•••••		>5E		•••••		>73	
••••••••••-----		>4A		•••••		>5F		•••••		>74	
•••••••••••-----		>4B		•••••		>60		•••••		>75	
••••••••••••-----		>4C		•••••		>61		•••••		>76	
•••••••••••••-----		>4D		•••••		>62		•••••		>77	
••••••••••••••-----		>4E		•••••		>63		•••••		>78	
•••••••••••••••-----		>4F		•••••		>64		•••••		>79	
••••••••••••••••-----		>50		•••••		>65		•••••		>7A	
•••••••••••••••••-----		>51		•••••		>66		•••••		>7B	
••••••••••••••••••-----		>52		•••••		>67		•••••		>7C	
•••••••••••••••••••-----		>53		•••••		>68		•••••		>7D	
••••••••••••••••••••-----		>54		•••••		>69		•••••		>7E	
•••••••••••••••••••••-----				•••••				•••••		>7F	

2360090-28

Figure 5-5. Six-Bit, X-Plot Dot Patterns and Codes

5.7 LINE TERMINATORS

Line terminators cause the contents of both the character buffer and the plot buffer to be sent to the printhead. The contents of the two buffers are merged into a one-line printout. Character and plot data are easily merged if correct line spacing is programmed; otherwise, the merge can cause overprinting. Paper advance is determined by the function of the specific line terminator. A line terminator always performs a carriage return (sets a pointer) which, without other commands, produces left justification of the next line. A carriage return is not evidenced by printhead movement.

Line-terminator control codes and functions are given in Table 5-14.

Table 5-14. Line Terminators

Control Code	Function
LF	Line feed
ESC LF <i>n</i>	Line feed of <i>n</i> steps
FF	Form feed
CR	Carriage return
ESC CR	Plot line feed
VT	Vertical tab
HT	Horizontal tab (if past last horizontal tab setting)
DC2 <i>n</i>	Line feed to line <i>n</i>
GS	Group separator (each seventh GS while the printer is in the X-plot mode)

Section 6

Control Code Programming Explanations

6.1 INTRODUCTION

This section explains the use of ASCII control codes for the Model 810LQ Printer. The explanations also illustrate some of the uses of the codes but do not exhaust the possibilities. The control codes are described for the print mode and for the six-bit, X-plot mode.

6.2 PRINT MODE CONTROL CODES

The following paragraphs describe and examples demonstrate the functions of the control codes the printer recognizes while in the print mode. The examples show sequences of hexadecimal code with the ASCII code character or decimal number beneath the hexadecimal notation.

In certain examples, words or letters enclosed in double quotation marks (" ") signify that the characters within the quotes have been transmitted to the printer. Decimal numbers 0 through 127 are designated by *n*.

6.2.1 Bell — BEL

Receipt of the BEL code, >07, causes the printer to sound an audible tone for approximately 0.5 second.

6.2.2 Backspace — BS

Receipt of the BS code, >08, causes the printer to move the character buffer pointer back one character position. Characters in the character buffer to the right of the pointer are erased as the pointer backspaces. The pointer does not back past the left margin at the beginning of the line. Backspace works in both compressed and expanded print modes.

Assume that the left margin is set to 5 and that the line "NOW IS THE TIME" is transmitted to the printer. The internal pointer is now pointing to the position just to the right of the "E" in "TIME". Next, assume the printer receives the sequence:

```
>08 >08 >08 >2D >2D >0A  
BS BS BS - - LF
```

This sequence causes the printer to move the internal pointer back three positions, which clears the patterns for the letters "E", "M", and "I". The printer then enters two of the "-" character pattern. When the line is printed, the "I" and "M" are substituted by "-", and the "E" is cleared as shown in Figure 6-1.

6.2.3 Horizontal Tab — HT

Receipt of the HT code, >09, causes the printer to advance the buffer pointer to the next horizontal tab stop or to the beginning of the next line if no tab stops remain on the current line. Tab positions are determined by the intercharacter gap functions currently in the printer.

Assume that the left margin is set at 3 and horizontal tabs are set at positions 10 and 21. Assume the printer receives the sequence:

```
>4E >4F >57 >09 >49 >53  
N O W HT I S  
  
>09 >54 >48 >45 >20  
HT T H E SP  
  
>54 >49 >4D >45 >0A  
T I M E LF
```

The printout would appear as shown in Figure 6-2.

```

Line
No.          Top of Form
-----0-----
0 :
1 :
2 :
3 :
4 :
5 :
6 :    NOW IS THE T--
7 :

```

Figure 6-1. Printout Showing Use of Backspace Control Code

2360090-29

```

Line
No.          Top of Form
-----0-----
0 :
1 :
2 :
3 :
4 :
5 :
6 :    NOW      IS      THE TIME
7 :

```

Figure 6-2. Printout Showing Use of Horizontal Tab Control Code

2360090-30

Note the spacing caused by the action of the tab function. Tab positions are numbered from the left margin starting at 0. The maximum valid tab position is 127. The tab function does not use absolute positions. Variable-spaced characters do not maintain tab positions and, therefore, should not be used. It is recommended that the proportional spacing (ESC U) be turned off when tabbing is being used to create columns.

6.2.4 Line Feed – LF

Receipt of the LF code, >0A, causes the printer to print the contents of the character and plot buffers and to advance the paper to the next printing line as determined by the vertical motion index. The control character LF is a line terminator.

6.2.5 Vertical Tab – VT

Receipt of the VT code, >0B, causes the printer to print the contents of the character and plot buffers and to advance the paper to the next vertical tab

stop, or to the top of form if no vertical tab stops remain on the current page. The control character VT is a line terminator.

Assume that the left margin is set at 5 and that vertical tab stops are set at line 5 and line 9 (line 0 is the top line on the page) and that the paper is at top of form. Assume the printer receives the sequence:

```

>4E >4F >57 >0B >49 >53
N O W VT I S

>0B >54 >48 >45 >0A
VT T H E LF

>54 >49 >4D >45 >0A
T I M E LF

```

The printout would appear as shown in Figure 6-3.

Line No.	Top of Form
0	-----0-----
0 :	NOW
1 :	
2 :	
3 :	
4 :	
5 :	IS
6 :	
7 :	
8 :	
9 :	THE
10 :	TIME
11 :	(next print line)

2360090-31

Figure 6-3. Printout Showing Use of Vertical Tab Control Code

The paper would be positioned at line 11. The actual amount of paper moved is determined by the vertical motion index. Note that the top line on a page is 0.

6.2.6 Form Feed — FF

Receipt of the FF code, >0C, causes the printer to print the contents of the character and plot buffers and to advance the paper to the top of form of the next page, as determined by the current form length setting. The control character FF is a line terminator.

6.2.7 Carriage Return — CR

Receipt of the CR code, >0D, causes the printer to print the contents of the character and plot buffers. If pencil switch 6 (auto line feed) on the auxiliary control panel is in the OFF position, the paper advances to the next printing line as determined by the vertical motion index. Selection of a word processing font with pencil switch 6 OFF results in a partial line feed of 8 vmi, which is required to print a four-pass font. The control character CR is a line terminator.

6.2.8 Shift Out — SO

Receipt of the SO code, >0E, causes the printer to change from using the selected firmware character set to the user-defined (software) font stored in working memory. If a character pattern has not been loaded into the user-defined-font memory location specified by received code, the printer does not print a character at that location of the printout on receipt of a line terminator. If character

patterns have not been loaded, the printer does not print. See paragraph 7.2.20 for loading the user-defined character patterns.

6.2.9 Shift In — SI

Receipt of the SI code, >0F, causes the printer to use a firmware font to generate character patterns. The firmware font used is the font that was active prior to the receipt of SHIFT OUT.

6.2.10 Device Control 1 — DC1

Receipt of the the DC1 code, >11, causes the printer to go online unless disabled by the DCO option. This control character is useful in applications where power to the printer is turned on automatically by some device in response to remote commands (via telephone lines). The normal power-up sequence puts the printer offline. Before characters can be received, the printer must be online. The printer is put online by the operator when the ONLINE key is pressed or by the printer when the DC1 code is received. The DC1 code is ignored if the printer is already online. The DCO printer option disables recognition of the DC1 and DC3 codes.

6.2.11 Device Control 2 — DC2 n

Receipt of the the DC2 code, >12 >XX, causes the printer to interpret the second byte as a vertical line position and use the value of the low-order seven bits as a line number. Valid line numbers range from 0 (top of page) to 127. If the specified line is greater than the current line, the contents of the character and plot buffers are printed and the

paper advances to the specified line. The location of the line is determined from the vertical motion index. If the specified line is greater than the length of the form, the paper is advanced to the top of form. The control character DC 2 *n* is a line terminator. If the specified line is less than or equal to the current line, the command is ignored.

Assume that the left margin is set to 5 and paper is at the top of form. Assume the printer receives the sequence:

```
>41 >12 >05 >42 >12 >07 >43 >0A
A DC2 5 B DC2 7 C LF
```

The printout would appear as shown in Figure 6-4.

The paper would be positioned to line 8. Note that the top line on a page is 0.

6.2.12 Device Control 3 — DC3

Receipt of the DC3 code, >13, causes the printer to go offline. The printer ignores all characters except DC1 when offline. The DCO printer option disables recognition of the DC1 and DC3 codes.

6.2.13 Device Control 4 — DC4 *n*

Receipt of the the DC4 code, >14 >XX, causes the printer to interpret the second byte as a horizontal character location (column) and use the value of the low-order seven bits to set the internal pointer to a position right of the left margin at that value unless it is greater than the line width.

Assume that the next print line is 6 and the left margin is set at 5. Assume the printer receives the sequence:

```
>14 >04 >32 >14 >0A >33
DC4 c4 2 DC4 c10 3
```

```
>14 >10 >34 >14 >20 >35
DC4 c17 4 DC4 c32 5
```

```
>14 >01 >31 >0A
DC4 c1 1 LF
```

where on the second line, the lowercase "c" denotes column. The printout would appear as shown in Figure 6-5.

In each case, the horizontal position of the character is determined by the value of the byte following the DC4 character. Note that the first position in the line is addressed as 1. The location specified must not be greater than the line width.

6.2.14 Delete — DEL

Receipt of the DEL code, >7F, causes the printer to clear the FIFO buffer and the character and plot buffers unless the No Delete (NDE) option is installed. If the NDE option is installed, the printer ignores the DEL command. The DEL binary code is used as data in the X-plot mode.

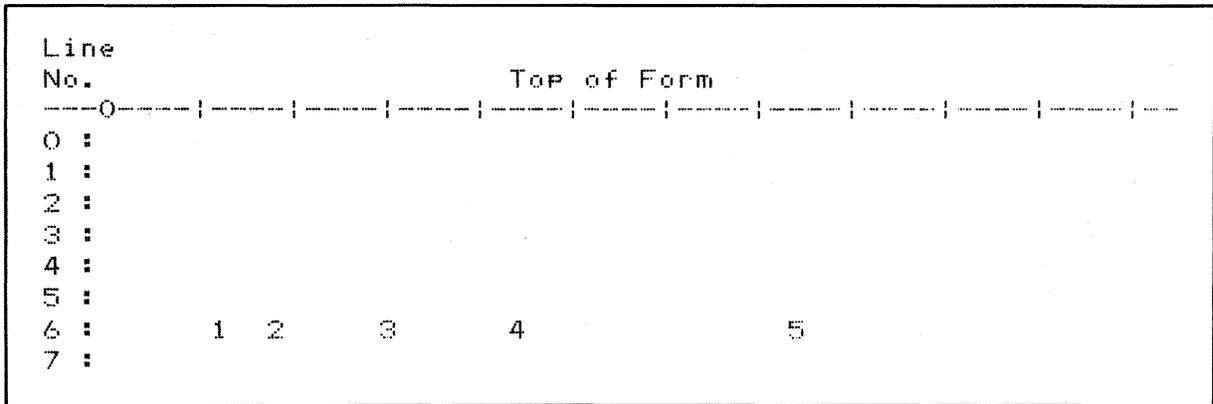
6.2.15 Null — NUL

Receipt of the NUL code, >00, causes the printer to terminate the escape sequence commands for setting horizontal tabs (ESC 3) and for setting vertical tabs (ESC 1). Otherwise this control code is ignored.

Line No.	Top of Form
0	-----0-----
0 :	A
1 :	
2 :	
3 :	
4 :	
5 :	B
6 :	
7 :	C
8 :	(next print line)

Figure 6-4. Printout Showing Use of Device Control 2 Control Code

2360090-32



2360090-33

Figure 6-5. Printout Showing Use of Device Control 4 Control Code

6.3 SIX-BIT, X-PLOT MODE CONTROL CODES

Receipt of the escape sequence ESC X, >1B >58, causes the printer to enter the six-bit, X-plot mode and interpret the value of the low-order six bits of following bytes as plot data. In the X-plot mode, the printer ignores ASCII control codes (>00 through >1F) except for the File Separator (FS), >1C, and the Group Separator (GS), >1D. Delete (DEL), >7F, does not clear the buffer in X-plot mode.

6.3.1 File Separator — FS

Receipt of the FS code, >1C, causes the printer to terminate the X-plot mode and save the plot line in

the buffer until the next line is printed. At that time, the contents of the character buffer and the plot buffer are merged and sent to the printhead drivers.

6.3.2 Group Separator — GS

Receipt of the GS code, >1D, causes the printer to terminate data entry for a plotting row. On the seventh row, GS acts as a line terminator and the contents of both the character buffer and the plot buffer are merged and sent to the printhead drivers. Seven rows of plot data need not be entered; the rows that have been entered are printed when the seventh GS code is received.



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Section 7

Escape Sequence Programming Explanations

7.1 INTRODUCTION

This section explains the use of the escape sequence commands for the Model 810LQ Printer. Examples illustrate some of the uses of certain escape commands.

When the printer is in the print mode, receipt of the control code for ESCape, >1B, identifies the start of a sequence of characters that performs control functions in the printer. The character that follows the ESC code, identifies the escape sequence command. ASCII numbers 0 through 9 are designated by *N*. Decimal numbers 0 through 127 are designated by *n*.

When the printer is in the X-plot mode, it does not recognize escape sequence commands. The printer does retain, however, certain functions (refer to Table 8-2) enabled before the X-plot mode is entered.

7.2 ESCAPE SEQUENCE COMMANDS

The following paragraphs describe the escape sequence command functions. The examples show sequences of hexadecimal code with the ASCII code character or decimal number beneath the hexadecimal notation.

7.2.1 Line Feed — ESC LF *n*

Receipt of the ESC LF sequence, >1B>0A>XX, causes the printer to print the merged contents of both the character buffer and the plot buffer. The value of the low-order seven bits of the third byte specifies the number of steps the paper moves. The range of the value of *n* is 0 to 127, and one step is 0.088 mm (1/288 in). The ESC LF sequence is a line terminator.

Receipt of the sequence:

```
>41 >1B >0A >40 >42 >0A  
A ESC LF 64 B LF
```

causes the printer to print the letter "A" on the present line. The paper advances 64 steps and the printer prints the letter "B". A paper advance of 64 steps corresponds to 0.177 lpmm (4.5 lpi).

Control of the vertical paper motion is useful for certain types of specialized printing and combined printing and plotting. This command overrides the vertical motion index, ESC L *n* (paragraph 7.2.23).

7.2.2 Carriage Return — ESC CR

Receipt of the ESC CR sequence, >1B>0D, causes the printer to print the merged contents of both the character buffer and the plot buffer and advance the paper to the next plot line. The ESC CR sequence is a line terminator.

The ESC CR command assumes a fixed value of 28 for the vmi. This command is used for plotting and for the block-character and bar-code printing without interline gap.

7.2.3 Font Selection — ESC # *N*

Receipt of the ESC # sequence, >1B>23>XX, where the third byte is an ASCII number 0 through 8 (>30 through >38), causes the printer to print in the selected character set or font. There are nine character sets from which to choose, eight of which are stored in firmware. The additional character set is the user-defined font. One character set is active at a time. ASCII numbers and hexadecimal codes that identify the fonts are duplicated (from Table 5-4) in Table 7-1 for the user's convenience.

Table 7-1. ASCII Numbers and Hexadecimal Codes for Character-Set Selection

ASCII Number	Hex Code	Model 810LQ Printer Character Set or Font
0	30	Standard Model 810 (power-up normal condition)
1	31	Focus
2	32	Bar-code characters (see paragraph 5.5.2)
3	33	Block characters (see paragraph 5.5.1)
4	34	User-defined (see ESCape F, paragraph 7.2.20)
5	35	Courier
6	36	Helvetica
7	37	Elite
8	38	Fast Focus

7.2.4 Vertical Tab Setting — ESC 1 *n n . . . n* NUL

Receipt of the ESC 1 sequence, >1B >31 >XX . . . >XX >00, causes the printer to enter the vertical tab set mode. The first action of the printer in this mode is to clear all vertical tabs currently set. The second action is to interpret the value of the low-order seven bits of *each of the bytes* that follow as line numbers where vertical tabs are to be set.

Valid positions are 1 through 127 with position 0 as the top line of the page (no tab can be set at this position). The printer continues the tab-setting sequence until it receives a NUL, >00, command.

Receipt of the sequence:

```
>1B >31 >06 >10 >28 >00
ESC 1 6 16 40 NUL
```

causes the printer to set vertical tabs at lines 6, 16, and 40.

7.2.5 Form Length Setting — ESC 2 *n*

Receipt of the ESC 2 sequence, >1B >32 >XX, causes the printer to interpret the value of the low-order seven bits of the third byte as the length of the form in lines. The top of form is set at the present position of the printhead. Form length is set *n* lines below the printhead location. Valid form length values are 4 through 127. The printer ignores this command for values less than 4.

Receipt of the sequence:

```
>1B >32 >42
ESC 2 66
```

causes the printer to set a form length of 66 lines.

7.2.6 Horizontal Tab Setting — ESC 3 *n n . . . n* NUL

Receipt of the ESC 3 sequence, >1B >33 >XX . . . >XX >00, causes the printer to enter the horizontal tab set mode. The first action of the printer in this mode is to clear all the horizontal tabs currently set. The second action is to interpret the value of the low-order seven bits of *each of the bytes* that follow as a character position at which a tab stop is to be set.

Valid positions are 1 through 127 with position 0 as the first printable position on a line (no tab can be set at this position). The printer continues the tab-setting sequence until it receives a NUL, >00, command.

Receipt of the sequence:

```
>1B >33 >05 >0A >0F >14 >00
ESC 3 5 10 15 20 NUL
```

causes the printer to set tab stops to the right of the left margin at character positions 5, 10, 15, and 20.

7.2.7 Six-Lines-per-Inch Printing — ESC 4

Receipt of the ESC 4 sequence, >1B>34, causes the printer to set the vmi to 48 (288/6), which produces 6-lpi printing.

7.2.8 Eight-Lines-per-Inch Printing — ESC 5

Receipt of the ESC 5 sequence, >1B>35, causes the printer to set the vmi to 36 (288/8), which produces 8-lpi printing.

7.2.9 Normal-Width Printing (Noncompressed) — ESC 6

Receipt of the ESC 6 sequence, >1B>36, causes the printer to be set into the 10-cpi mode.

7.2.10 Compressed Printing or Plotting — ESC 7

NOTE

The printer must have the compressed-print option installed or it ignores this command.

Receipt of the ESC 7 sequence, >1B>37, causes the printer to be set into the compressed-print (16.5-cpi) mode. Plotting as well as printing is compressed in this mode.

7.2.11 Vertical Format Storage — ESC 8 N

NOTE

The printer must have the VCO or VFC option installed or it ignores this command.

Receipt of the ESC 8 sequence, >1B>38>XX, causes the printer to store the current vertical format information (form length, vertical tab settings, and lines per inch) into the memory channel specified by the third byte. The printer ignores this command when a channel less than 1, >31, or greater than 8, >38, is specified.

Only values of 6 lpi or 8 lpi are stored. Any other value is replaced as 6 lpi on power-up or by using

the manual RECALL switch (see *Model 810 Printer Operating Instructions*).

7.2.12 Vertical Format Recall — ESC 9 N

NOTE

The printer must have the VCO or VFC option installed or it ignores this command.

Receipt of the ESC 9 sequence, >1B>39>XX, causes the printer to recall the vertical format information stored in the memory channel specified by the third byte. The printer ignores this command when a channel less than 1, >31, or greater than 8, >38, is specified. Only values of 6 lpi or 8 lpi are stored. Any other value is replaced with 6 lpi on power-up or by using the manual RECALL switch (see *Model 810 Printer Operating Instructions*).

7.2.13 Line Width Setting by Characters — ESC : n

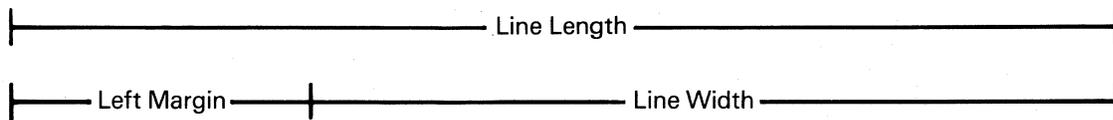
Receipt of the ESC : sequence, >1B>3A>XX, causes the printer to set the width of the line. The value of the low-order seven bits of the third byte is interpreted as the line width in characters at 10 cpi, or 2.54-mm (0.1-in) units. Valid values of *n* are 1 through 127. The printer ignores the command for a line width of zero characters.

Receipt of the sequence:

```
>1B>3A>40
ESC : 64
```

causes the printer to set the line width to 64 characters, or 162.56 mm (6.4 in).

Maximum line length is 132 characters at 10 cpi (218 characters in compressed print at 16.5 cpi). Line width is reduced when the left margin plus the line width is greater than maximum line length of 132 characters at 10 cpi (218 characters in compressed print). Figure 7-1 shows the relationship of line length to left margin and line width.



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Figure 7-1. Relationship of Line Length to Left Margin and Line Width

7.2.14 Maximum Line Width Setting – ESC; Receipt of the ESC; sequence, >1B>3B, causes the printer to set the line width to 132 characters (3168 dots) if normal density is enabled, or to 218 characters (5232 dots) if compressed print density is enabled. Line widths of other than 3163 dots or 5232 dots can be specified using the sequence ESC W *nn* (paragraph 7.2.32).

7.2.15 Operating Parameter Storage – ESC = Receipt of the ESC = sequence, >1B>3D, causes the printer to save the current values of the print parameters. Only one set of parameters can be stored at a time. The parameters saved in a memory location are those that select line width, horizontal tab stops, justification, print speed, compressed density, vertical lines per inch, left print margin, character spacing, proportional mode, intercharacter gap, overprint, firmware font number, horizontal expansion factor, left plot margin, and squaring. These parameters are lost if the printer power goes off.

7.2.16 Operating Parameter Recall – ESC @ Receipt of the ESC @ sequence, >1B>40, causes the printer to recall the values of the print parameters stored in a memory location by the ESC = sequence (paragraph 7.2.15). The ESC @ command can be used to restore all operating parameters.

7.2.17 15-Inches-per-Second Print Speed – ESC A

Receipt of the ESC A sequence, >1B>41, causes the printhead to move at a horizontal print speed of 15.0 ips. This is normal speed and allows printing at the highest rate. At this speed, the dot density is 60 dpi.

7.2.18 7.5-Inches-per-Second Print Speed – ESC B

Receipt of the ESC B sequence, >1B>42, causes the printhead to move at a horizontal print speed of 7.5 ips. This speed produces a horizontal dot density of 120 dpi, which results in improved image

quality (enhanced print) for all modes of printing and plotting. The printhead slows to this speed automatically whenever a word processing character is in the line being printed.

7.2.19 Horizontal Expansion Factor – ESC E N Receipt of the ESC E sequence, >1B>45>XX, causes the printer to interpret the valid third byte (>31 through >34) as an expansion factor of 1 through 4. The factor is set to 1 on power-up.

The expansion factor is used to expand printing and plotting data as they are placed in the respective buffers. Once set, the expansion factor remains active until set to another value. The expansion factor can be changed at any point of the line.

Receipt of the sequence:

```
>41 >1B >45 >32 >42
A ESC E 2 B
```

```
>1B >45 >31 >43 >0A
ESC E 1 C LF
```

causes the printer to print a line containing a single-width letter "A" followed by a double-width letter "B" followed by a single-width letter "C". The printer ignores this command when an expansion factor of 0 or greater than 4 is specified. The expansion factor affects escape sequences ESC I *n* (paragraph 7.2.21) and ESC V *n* (paragraph 7.2.31).

7.2.20 Load User-Defined Font – ESC F *n*

Receipt of the ESC F sequence, >1B>46>XX...>XX, causes the printer to load the user-defined (software) font character patterns. The value of the low-order seven bits of the *third byte specifies the number of character patterns* to be loaded. All bytes that follow are loaded into the user-defined font memory in the order in which they are received. The characters are defined on a 7 high by 12 wide grid, and from 1 to 95 characters can be loaded. The

printer ignores this command when zero patterns are specified. If more than 95 patterns are specified, the first 1140 bytes (95 x 12) are loaded and the remaining bytes are ignored.

Each font character is defined with 12 bytes of data. If two font patterns are specified, 24 bytes of font data follow. Load the font patterns from left to right as they would appear on paper — one byte per vertical column of the pattern. Bit 0 (the least significant bit of each byte) controls the top row of the 7 x 12 grid. Bit 6 of each byte controls the bottom row. Bit 7 of each byte can be used for parity and does not appear in the grid. In case of a parity error, a >00 is loaded.

When the user-defined font is loaded, the resulting spacing of the grid dots is 4.724 dpmm (120 dpi) horizontally, and the characters are approximately 2.54 mm (0.1 in) square. At normal print speed, adjacent horizontal dots in the grid are not printed. The horizontal grid is spaced at 4.724 dpmm (120 dpi) when the expansion factor is 1, and the speed is set at 190.5 mmps (7.5 ips).

The code for loading this font is shown in Figure 7-2. The intercharacter gap is determined by the pattern loaded.

User-defined-font patterns for the characters alpha and beta can be loaded using the sequence:

```
>1B >46 >02
ESC F 2
```

```
Alpha : >08 >14 >22 >00 >22 >00
        >22 >14 >08 >14 >22 >00
```

```
Beta : >00 >00 >7F >00 >15 >00
        >15 >0A >00 >00 >00 >00
```

The patterns are stored in memory as shown in Figure 7-3.

Bytes four and six in each character are defined as zero (no dots). If bytes four and six are defined the same as byte five of each respective character, a series of five adjacent dots would appear on several rows, which would require 120-dpi printing. Dots of bytes four and six can print only when the 7.5-ips print-speed mode (enhanced print) is enabled.

The first user-defined-character (udc) pattern in memory is printed when the code for the blank SPACE, >20, is received. The second character pattern in memory is printed when the code for "!", >21, is received. In the same manner, the code for the last character is printed when "˘", >7E, is received.

Consider that the font memory has been loaded with the two character patterns. Receipt of the sequence:

```
>0E >20 >21 >0A
SO udc udc LF
```

causes the alpha and beta characters to be printed as shown in Figure 7-4.

7.2.21 Intercharacter Gap — ESC I n

Receipt of the ESC I sequence, >1B>49>XX, causes the printer to interpret the value of the low-order seven bits of the third byte as the intercharacter gap used for proportional spacing (ESC U active). ESC T (paragraph 7.2.29) overrides ESC I n unless ESC J 1 (paragraph 7.2.22) is active.

The intercharacter gap is expressed in inches as $n/240$. The power-up initial condition value of n is 6 and corresponds to 0.635 mm (0.025 in). The range of values for n is 0 through 127 for an expansion factor of 1. The intercharacter gap is measured between characters so character overlap cannot occur. The value of n for the intercharacter gap is a function of the horizontal expansion factor. Allowable values are:

Expansion Factor	1	2	3	4
Maximum n	127	63	42	31

7.2.22 Justification — ESC J N

Receipt of the ESC J sequence, >1B >4A >XX, causes the printer to interpret the third byte (>30 through >33) as the type of justification to be used when the line is printed. The four types are as follows:

ESC J 0 — Left justification. This is the normal mode. The printer begins printing at the left print margin and places characters in sequence to the right with spacing or intercharacter gap.

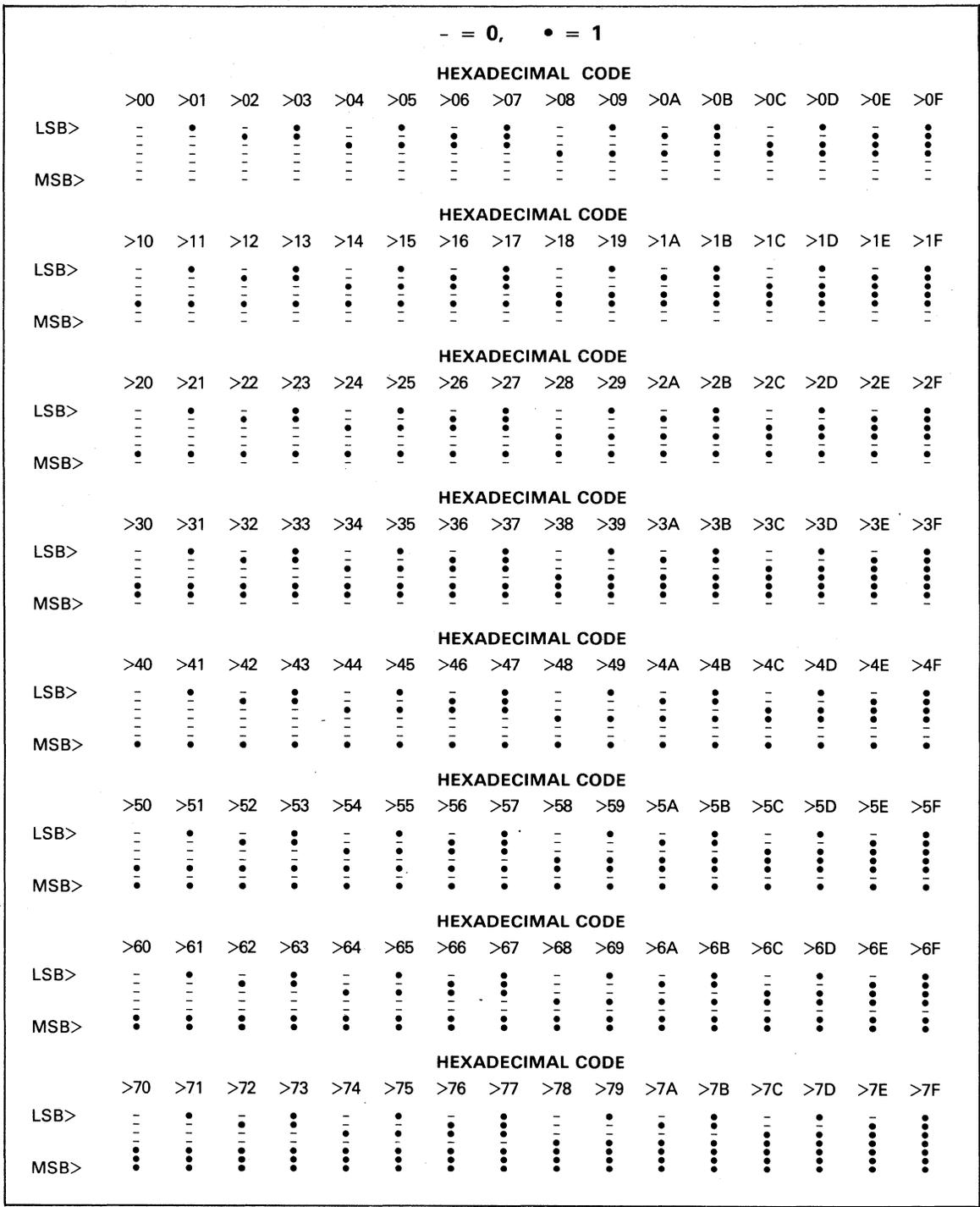
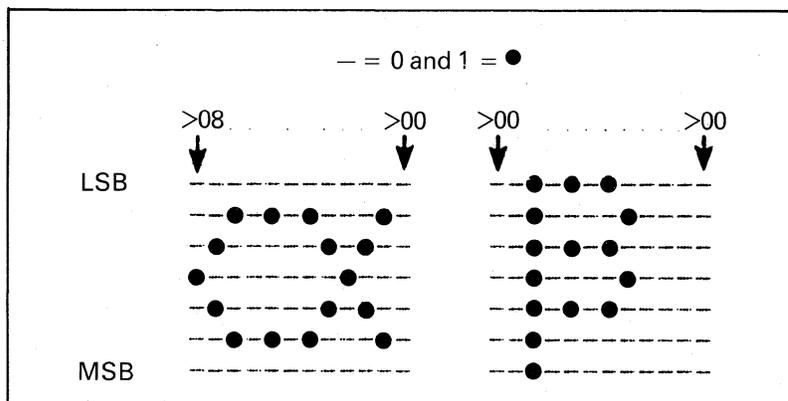


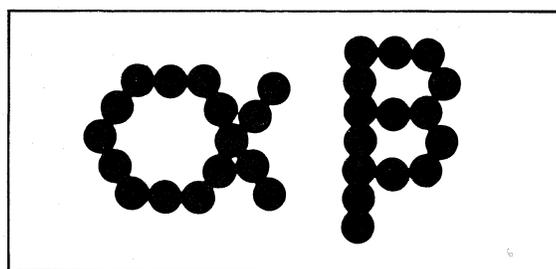
Figure 7-2. User-Defined-Font Dot Patterns and Codes

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2360090-36

Figure 7-3. User-Defined-Font Dot Patterns for the Characters Alpha and Beta



2360090-37

Figure 7-4. Magnified Printout of the Characters Alpha and Beta

ESC J 1 — Left and right justification. This mode is used to left and right justify a printed line slightly shorter than a full line. A short line is expanded as much as 10 percent to justify the right margin. If the line is too short, it remains left justified and expanded approximately 10 percent. Left and right justification operates with all word processing fonts (proportional spacing enabled or disabled) and with all data processing fonts including the user-defined font. It is not intended for use with block or bar-code fonts, nor should it be used for data processing fonts when proportional spacing is enabled.

The printer produces line expansion to obtain left and right justification by increasing the gap between characters. The maximum gap expansion between characters is limited to an increase of 50 percent of the gap defined by the value of the intercharacter gap, ESC I *n* (paragraph 7.2.21).

Initial conditions provide a value for the intercharacter gap of *n* = 6.

This mode justifies left and right margins as set by the left print margin, ESC M *n* (paragraph 7.2.24) and line width in characters per line, ESC : *n* (paragraph 7.2.13), or in dots per line, ESC W *nn* (paragraph 7.2.32). For a short line, the length of the unfilled segment of the line from the last character to the right margin is divided by the number of characters in the line minus one. This value is added to the gap between characters to produce left and right justification. Again, expansion is limited to a maximum of half the intercharacter gap (ESC I *n*).

The maximum expansion per character is half the intercharacter gap added to:

- a. The fixed character spacing, ESC V *n* (paragraph 7.2.31), for non-proportional spacing.

- b. The character width plus the intercharacter gap (ESC I *n*) for proportional spacing.

The power-up, initial-condition fixed character spacing (ESC V *n*) is *n* = 24.

ESC J 2 — Right justification. The characters to be printed are moved to the right margin using the predetermined spacing or gap so that the right margin is justified when a line terminator is received.

ESC J 3 — Centering. The characters to be printed are moved to the center using the predetermined spacing or gap.

Receipt of the sequence:

```
> 1B > 4A > 33
ESC   J   3
```

followed by a line of text causes the printer to print that text in the center of the page when it receives the line terminator.

7.2.23 Line Spacing — ESC L *n*

Receipt of the ESC L sequence, > 1B > 4C > XX, causes the printer to interpret the value of the low-order seven bits of the third byte as the vertical motion index. This value, in millimeters (inches), divided by 288 equals the vertical distance between lines of printing. For 0.236 lpmm (6 lpi), the value of the vmi is 48, > 30. For 0.315 lpmm (8 lpi), the value of the vmi is 36, > 24. When the vmi is set to 0, no paper motion occurs except when printing word processing fonts.

7.2.24 Left Print Margin — ESC M *n*

Receipt of the ESC M sequence, > 1B > 4D > XX, causes the printer to interpret the value of the low-order seven bits of the third byte as the position of the left print margin in 2.54 mm (0.1 in). The range of values is 0 to 127 or 0.0 to 322.58 mm (0.0 to 12.7 in). The value is 0 at power-up.

Receipt of the sequence:

```
> 1B > 4D > 0A
ESC   M   10
```

causes the printer to place the first character in the eleventh-column character position.

Line width is reduced when the left margin plus the line width are greater than 132 characters at 10 cpi (218 characters in compressed print). The line width may need to be changed after the left margin is moved to the left in order to maintain the right margin.

7.2.25 Disable Automatic Overprint — ESC N

Receipt of the ESC N sequence, > 1B > 4E, causes the printer to disable the overprint mode. This command causes the patterns in the dot buffers to be printed in one pass of the printhead, which is the normal mode of operation.

7.2.26 Enable Automatic Overprint — ESC O

Receipt of the ESC O sequence, > 1B > 4F, causes the printer to enter the overprint mode, which enhances printed image quality. This command causes the patterns in the dot buffers to be printed twice after receipt of a line terminator. This mode is recommended when printing bar codes.

7.2.27 Disable Squaring Mode — ESC R

Receipt of the ESC R sequence, > 1B > 52, causes the printer to disable the squaring mode. This command causes the printer to return to the normal condition, producing a horizontal dot resolution of 4.724 dpmm (120 dpi). Horizontal dot resolution is 7.795 dpmm (198 dpi) in compressed print.

7.2.28 Enable Squaring Mode — ESC S

Receipt of the ESC S sequence, > 1B > 53, causes the printer to enter the squaring mode, which produces a plot of 2.835 x 2.835 dpmm (72 x 72 dpi). This mode is used to compensate for the unequal dot density of the plot mechanism (4.724 dpmm [120 dpi] horizontally and 2.835 dpmm [72 dpi] vertically). Quality for certain kinds of images requires equal dot resolution on both axes. Activation of the squaring mode causes the plot data to

be expanded by a factor of 120/72 before the buffer is loaded to produce equal dot resolution. When plot data squaring is required, the command must be issued before the X-plot mode is entered.

7.2.29 Disable Proportional Spacing — ESC T
 Receipt of the ESC T sequence, >1B>54, causes the printer to disable proportional spacing, ESC U (paragraph 7.2.30). This ESC T command causes the characters to be spaced from the right edge of the character cell to the left edge using the fixed-space character value, ESC V *n* (paragraph 7.2.31). The intercharacter gap value, ESC I *n* (paragraph 7.2.21), is also used for left and right justification, ESC J 1 (paragraph 7.2.22).

7.2.30 Enable Proportional Spacing — ESC U
 Receipt of the ESC U sequence, >1B>55, causes the printer to enter the proportional spacing mode. In this mode, spacing between characters is specified by the intercharacter gap value, ESC I *n* (paragraph 7.2.21). ESC U overrides fixed character spacing, ESC V *n* (paragraph 7.2.31). ESC U can be used with word processing fonts to obtain proportional spacing for left and right justification to the specified line width if ESC J 1 (paragraph 7.2.22) is active. This spacing between characters is recalculated for left and right justification.

NOTE

If problems occur with proportional spacing enabled, try the same text with proportional spacing disabled.

7.2.31 Fixed Character Spacing — ESC V *n*
 Receipt of the ESC V sequence, >1B>56>XX, causes the printer to interpret the value of the low-order seven bits of the third byte (0 through 127) as the fixed character spacing.

The value of *n* is the horizontal motion index, and the pitch is 240 divided by the horizontal motion index. For a pitch of 10 cpi, the hmi is 24, the power-up initial condition value. Proportional spacing, ESC U (paragraph 7.2.30), and left and right justification, ESC J 1 (paragraph 7.2.22), override ESC V *n*.

ESC V *n* is generally used with fixed-space characters. The spacing is measured from the left side of the character cell, which allows for character overlap. For an hmi of 0, different characters can be overprinted if left and right justification (ESC J 1) is not active. ESC V *n* can be used for proportionally spaced characters if ESC U is disabled.

The value of *n* is a function of the horizontal expansion factor. Allowable values for *n* are:

Expansion Factor	1	2	3	4
Maximum <i>n</i>	127	63	42	31

7.2.32 Line Width Setting by Dots — ESC W *nn*
 Receipt of the ESC W sequence, >1B >57 >XX >XX, causes the printer to set line width in terms of dots rather than characters and to interpret the value of the low-order seven bits of the next third and fourth bytes to specify the width. The low-order seven bits of the third byte are the low-order bits of the width, and the low-order bits of the fourth byte are the high-order bits of the width.

Only widths of 1 dot through 3168 dots are valid in noncompressed print mode. Widths of 1 dot through 5232 dots are valid in compressed print mode. The printer ignores this command when it receives invalid width specifications.

Receipt of the sequence:

```
>1B >57 >48 >01
ESC W 200
```

causes the printer to set a line width of 200 dots. Note that the printer retains the line-width setting until another line-width-setting command is received.

7.2.33 Six-Bit, X-Plot Mode — ESC X
 Receipt of the ESC X sequence, >1B >58, causes the printer to enter the X-plot mode and to interpret the value of the low-order six bits of following bytes as plot data. In this mode, the printer ignores codes from >00 through >1F except for >1C (FS) and >1D (GS). This feature allows the printer to receive data from computers with operating systems that do not permit some data sequences or that insert control codes automatically when sending data to a printer. Any plot enhancements, such as squaring, print speed, and overprint, must

be issued before the printer enters the X-plot mode.

In this mode, the printer behaves as a plotter, placing a single row of dots normally spaced at 4.724 dpmm (120 dpi). As the printer receives the plot data bytes, it places the low-order six bits in the plot buffer with bit 0 (the least significant bit) at the left and bit 5 at the right. Bit 0 of the next byte is placed next to the previous bit 5, and so on (see subsection 5.6 and Figure 5-5).

In this mode, the printer begins placing data at the left plot margin. The right margin is the end of the plot buffer, or approximately 335.28 mm (13.2 in) from column zero. The plot data bytes are assembled in the plot buffer from left to right until the row is full or terminated with GS, > 1D. Bits that extend past the right margin are saved and printed. Bytes received when the row is full are discarded. The GS control code, > 1D, ends a row and causes the next plot byte to be placed in the plot buffer starting at the left plot margin in the next row of dots to be printed down the page. This process continues until seven complete rows have been placed into the plot buffer.

Termination of the seventh row with a GS, > 1D, causes the printer to plot the line, clear the buffer, and advance the paper to the next plot line. If the X-plot mode is still active, the printer places the next plot byte at the left plot margin in the first row of the cleared plot buffer.

The FS control code, > 1C, terminates the six-bit, X-plot mode. If the printer exits the X-plot mode before the seven rows are terminated, it saves the data in the plot buffer. The printer prints the contents of the plot buffer when it receives a line terminator.

Parity can be employed in this mode. In the case of a parity error, a > 00 is substituted for the plot byte.

7.2.34 Left Plot Margin — ESC Y n

Receipt of the ESC Y sequence, > 1B > 59 > XX, causes the printer to interpret the value of the low-order seven bits of the next byte as the position of the left plot margin to the right of column zero. The range of the value is 0 to 127. The value is 0 at power-up. This command is used only for the X-plot mode, and must be issued before the ESC X command is issued.

7.2.35 Select Standard Conditions — ESC Z

Receipt of the ESC Z sequence, > 1B > 5A, causes the printer to set the conditions for printing as:

- Left print margin = 0
- Normal printing (overprint OFF)
- Standard Model 810 font
- Left justification
- Expansion = 1
- Proportional spacing OFF
- Horizontal motion index = 24 (10 pitch)
- Intercharacter gap = 6
- Fast printing for single-pass fonts

7.2.36 Enable Underlining Mode — ESC _

Receipt of the ESC _ sequence, > 1B > 5F, causes the printer to be in the underlining mode. When this mode is active, characters sent to the printer are underlined by a separate pass of the printhead. The underline is continuous from the left edge of the first character to the right edge of the last character sent while the mode is active. The mode can be used several times within any line.

7.2.37 Disable Underlining Mode — ESC ^

Receipt of the ESC ^ sequence, > 1B > 5E, causes the printer to terminate the underlining mode.

Section 8

Printer Applications

8.1 INTRODUCTION

The Model 810LQ Printer versatility is demonstrated in this section with more examples of printing and plotting. Combinations of compatible control codes and escape commands are shown.

8.2 CONTROL CODE COMPATIBILITY

Table 8-1 gives the control codes for the firmware fonts and the modes in which they can be used.

Table 8-1. Model 810LQ Printer Fonts and Control Code Functions

Font	Escape Code	Control Code												
		SI	SO	FS	GS	HT	BS	LF	VT	FF	DC1	DC2	DC3	DC4
Standard Model 810	# 0	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Focus	# 1	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bar Code	# 2	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Block	# 3	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Software	# 4	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Courier	# 5	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Helvetica	# 6	Y	Y	N	N	1	Y	Y	Y	Y	Y	Y	Y	1
Elite	# 7	Y	Y	N	N	1	Y	Y	Y	Y	Y	Y	Y	1
Fast Focus	# 8	Y	Y	N	N	1	Y	Y	Y	Y	Y	Y	Y	1
X-Plot	X	N	N	Y	Y	N	N	N	N	N	N	N	N	N

NOTES: Y — Can be used in this mode.
 N — Cannot be used in this mode.
 1 — Not recommended for near-letter-quality character fonts.

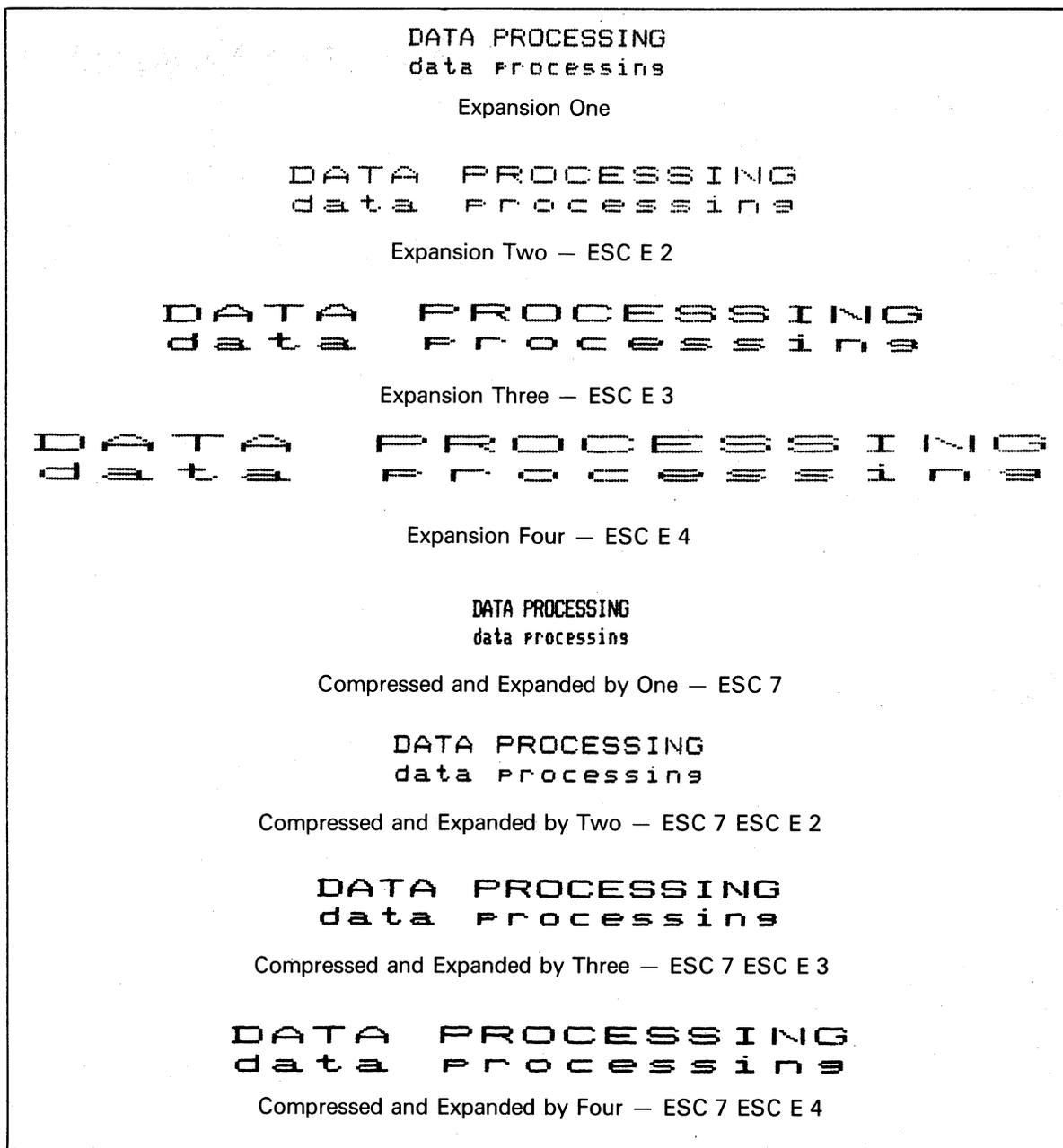
8.3 ESCAPE COMMAND COMPATIBILITY

Table 8-2 gives the escape commands for the fonts and the modes in which they can be used.

8.4 DATA PROCESSING FONT EXAMPLES

8.4.1 Standard Model 810 Font

Figure 8-1 shows examples of the Standard Model 810 font in expanded print and compressed expanded print above the escape commands that produce them.



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Figure 8-1. Expanded Print and Compressed Expanded Print in Standard Model 810 Data Processing Font

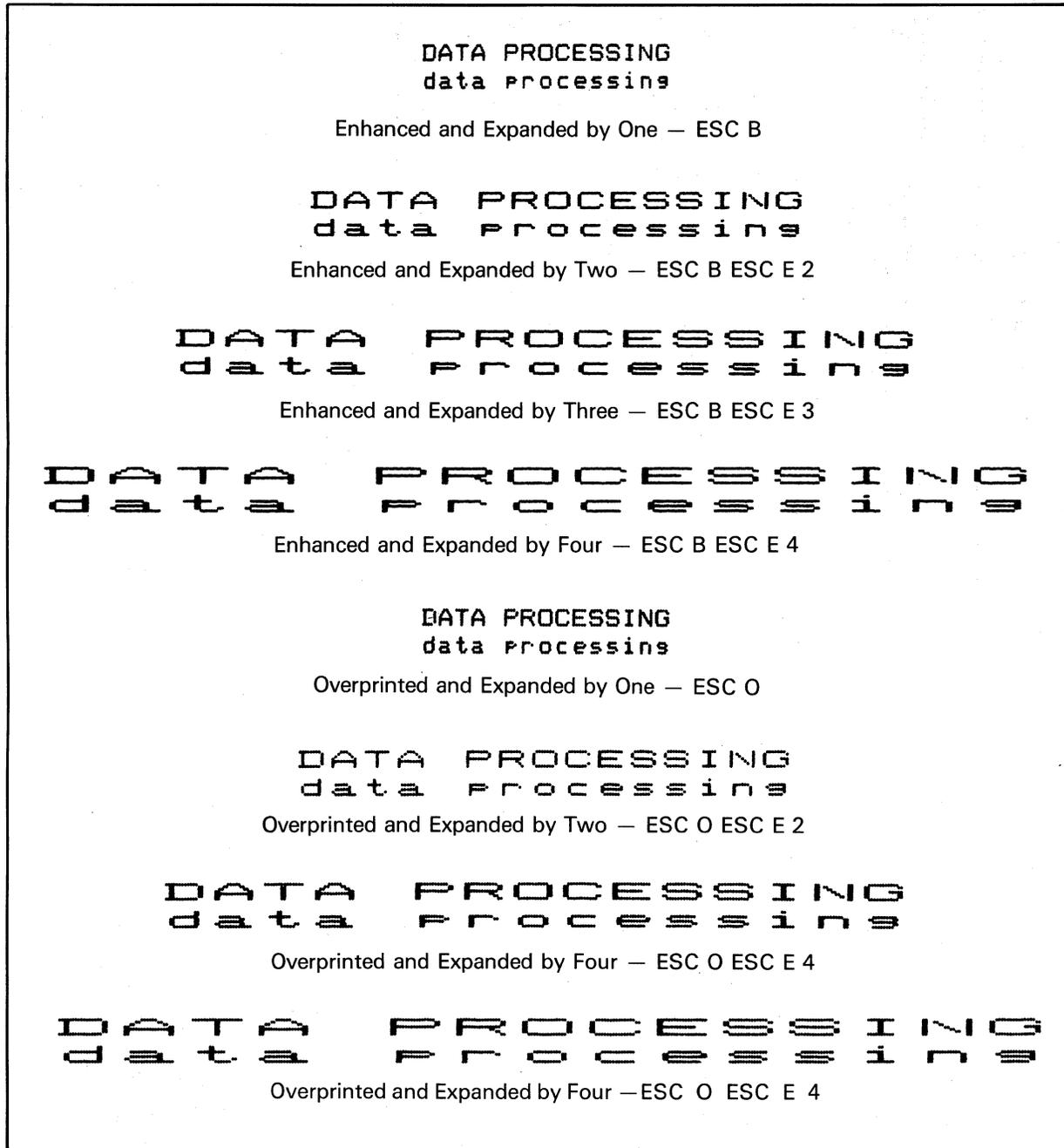
Table 8-2. Model 810LQ Printer Fonts and Escape Commands

Font	Escape Code	Escape Command																																	
		LF	CR	1	2	3	4	5	6	7	8	9	:	;	=	@	A	B	E	I	J	L	M	N	O	R	S	T	U	V	W	Y	Z	^	_
Standard Model 810	# 0	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	1	Y	Y	Y	Y	Y	2	2	Y	1	3	4	2	Y	Y	Y
Focus	# 1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	1	Y	Y	Y	Y	Y	2	2	Y	1	3	4	2	Y	Y	Y
Bar Code	# 2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	2	2	Y	N	N	4	2	Y	5	5	
Block	# 3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	2	2	Y	N	N	4	2	Y	5	5	
Software	# 4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	1	Y	Y	Y	Y	Y	2	2	Y	1	3	4	2	Y	Y	Y	
Courier	# 5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	6	Y	1	Y	7	Y	Y	6	2	2	Y	1	3	4	2	Y	Y	Y	
Helvetica	# 6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	6	Y	1	Y	7	Y	Y	6	2	2	Y	1	3	4	2	Y	Y	Y		
Elite	# 7	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	6	Y	1	Y	7	Y	Y	6	2	2	Y	1	3	4	2	Y	Y	Y		
Fast Focus	# 8	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	1	Y	Y	Y	Y	Y	2	2	Y	1	3	4	2	Y	Y	Y	
X-Plot*	X	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	Y	Y	Y	N	N	N	N	N	Y	Y	Y	N	N	N	N	Y	N	N	N	

* Parameters used in X-plot must be set before entering X-plot mode.

- NOTES:**
- Y — Can be used in this mode.
 - 1 — Not recommended for near-letter-quality character fonts.
 - 2 — Proportional spacing must be enabled to use intercharacter gap.
 - 3 — Recommend nonproportional character sets.
 - 4 — VMI values of 0 through 7 are not recommended for near-letter-quality fonts.
 - N — Cannot be used in this mode.
 - 5 — Not recommended for block-character and bar-code fonts.
 - 6 — Proportional spacing can not be active when using the horizontal motion index, ESC V.
 - 7 — Codes must be set before entering X-plot mode and are active only in X-plot mode.

Figure 8-2 shows examples of the Standard Model 810 font in enhanced expanded print and in overprinted expanded print above the escape commands that produce them.

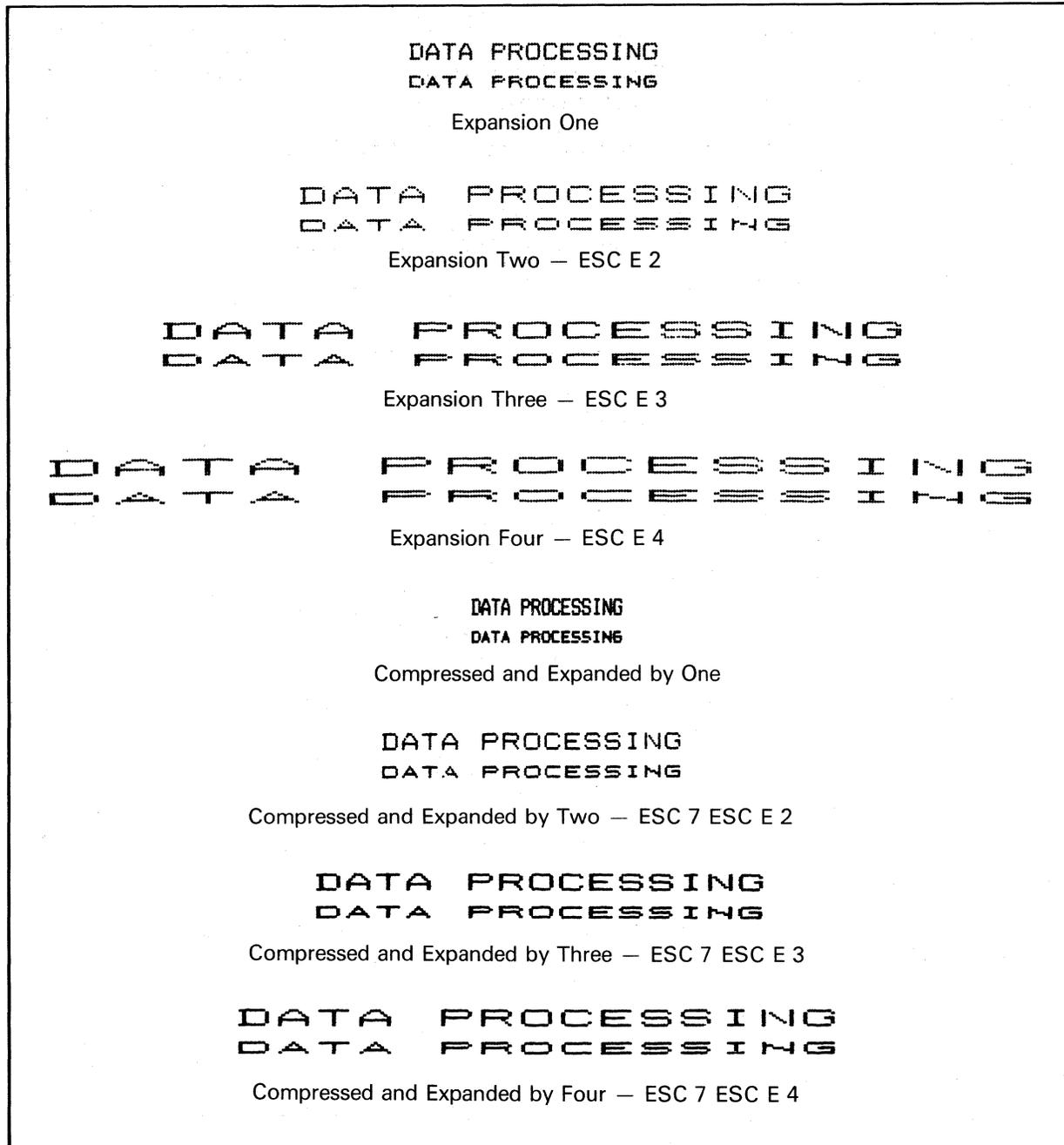


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Figure 8-2. Enhanced Expanded Print and Overprinted Expanded Print in Standard Model 810 Data Processing Font

8.4.2 Focus Font

Figure 8-3 shows examples of the Focus font in expanded print and compressed expanded print above the escape commands that produce them.



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Figure 8-3. Expanded Print and Compressed Expanded Print in Focus Data Processing Font

Figure 8-4 shows examples of the Focus font in enhanced expanded print and overprinted expanded print above the escape commands that produce them.

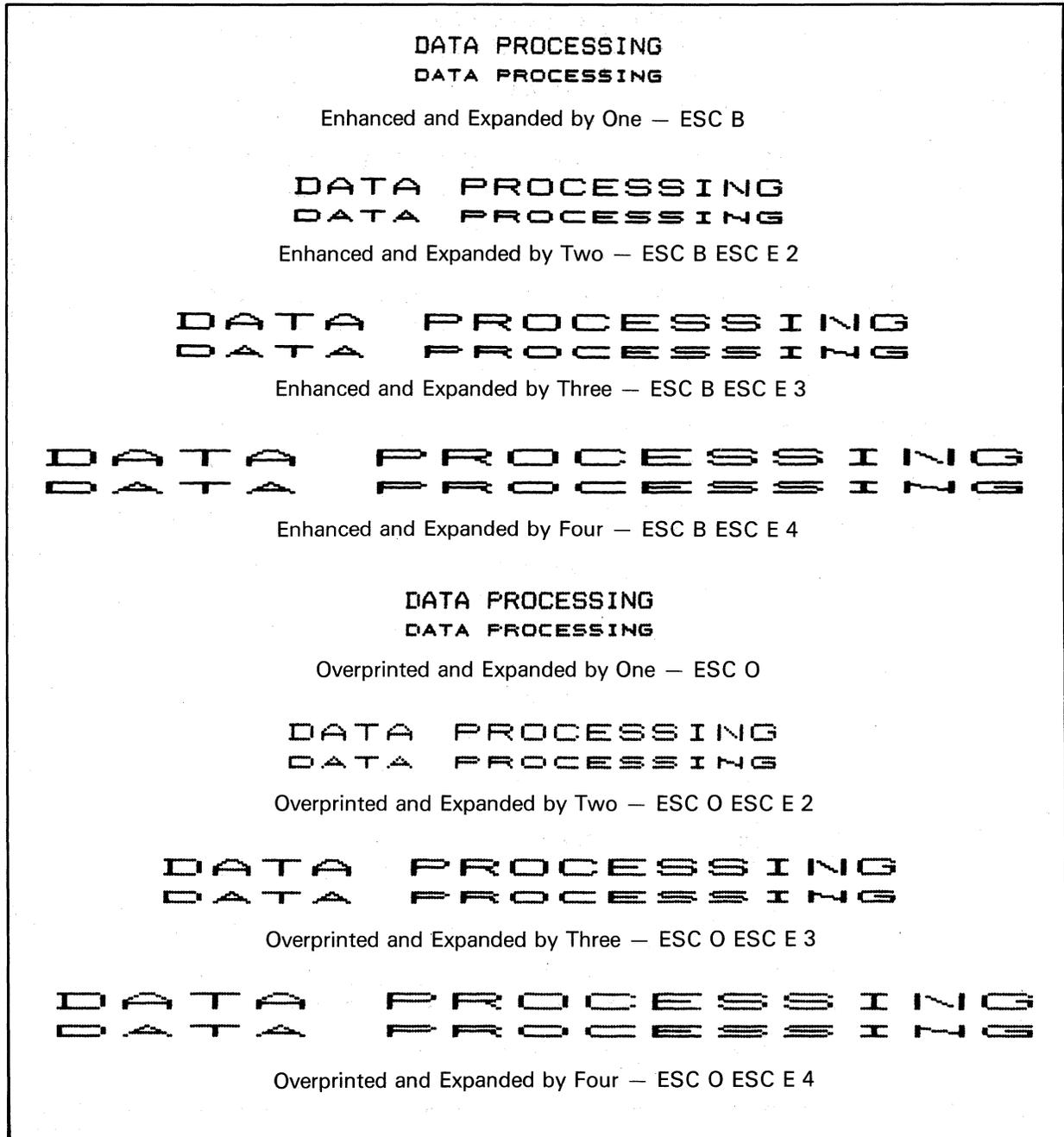
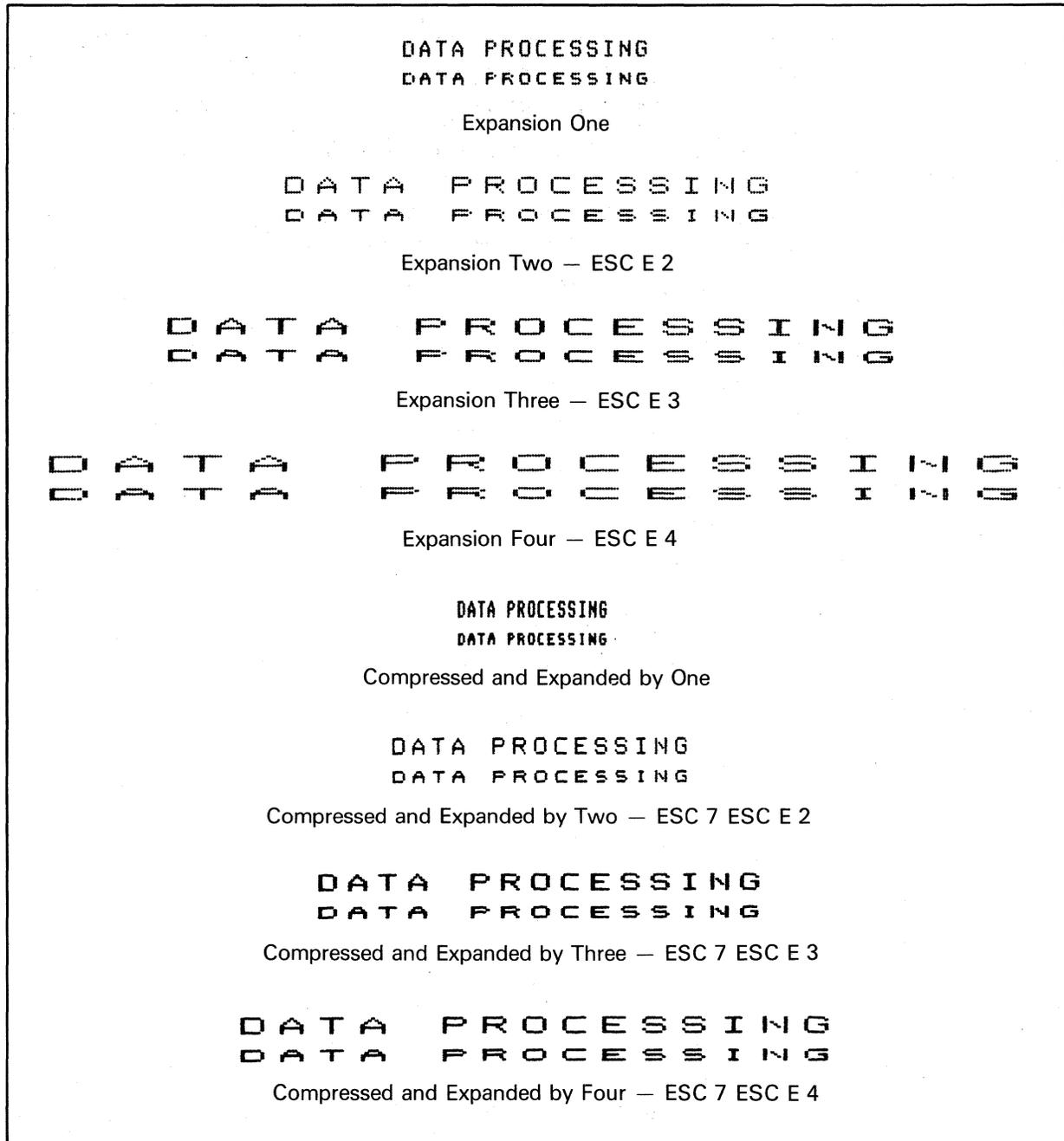


Figure 8-4. Enhanced Expanded Print and Overprinted Expanded Print in Focus Data Processing Font

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8.4.3 Fast Focus Font

Figure 8-5 shows examples of the Fast Focus font in expanded print and compressed expanded print above the escape commands that produce them.



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Figure 8-5. Expanded Print and Compressed Expanded Print in Fast Focus Data Processing Font

Figure 8-6 shows examples of the Fast Focus font in enhanced expanded print and overprinted expanded print above the escape commands that produce them.

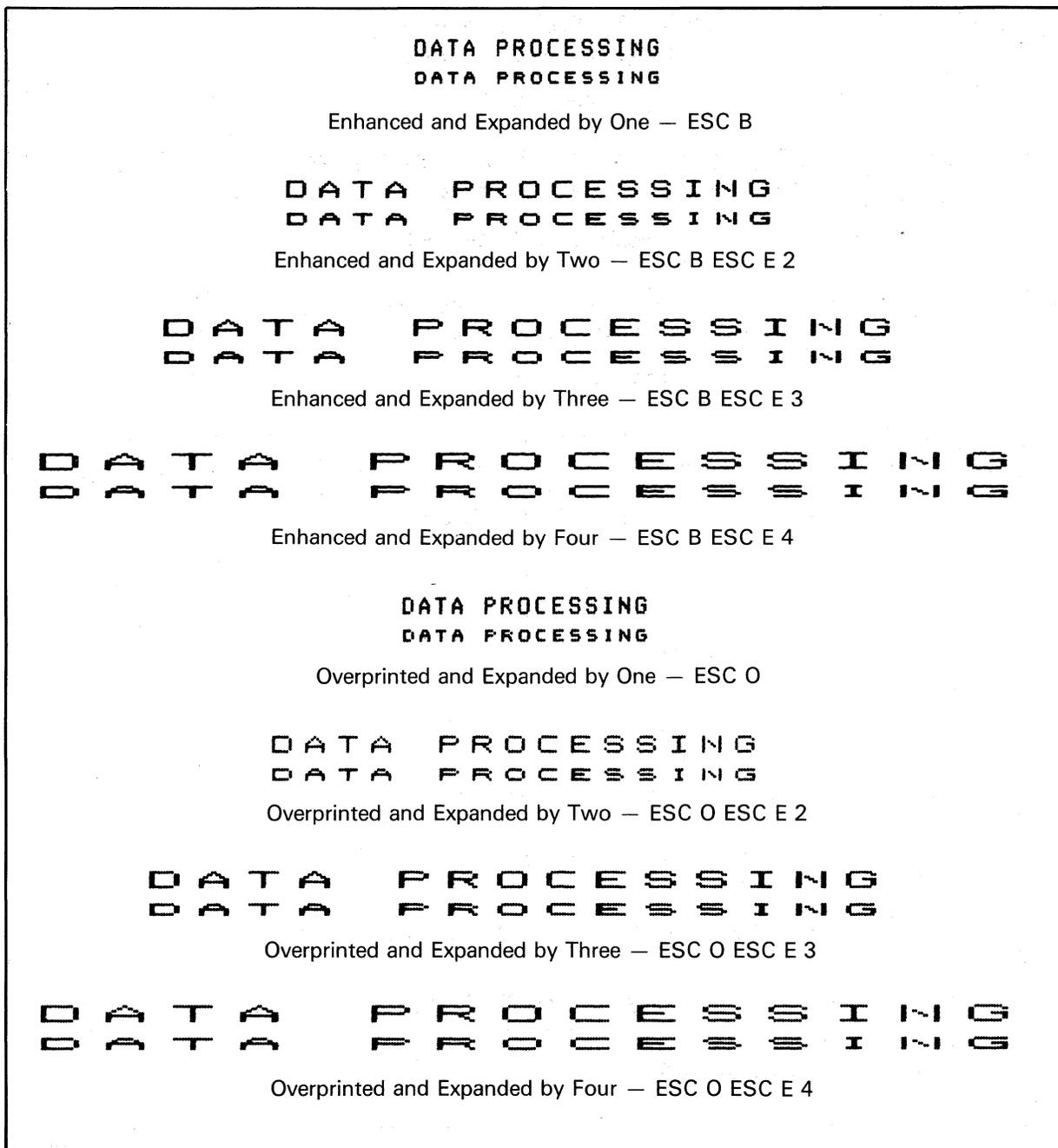


Figure 8-6. Enhanced Expanded Print and Overprinted Expanded Print in Fast Focus Data Processing Font

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8.5 WORD PROCESSING FONT EXAMPLES

8.5.1 Courier Font

Figure 8-7 shows examples of the Courier font in expanded print and compressed expanded print above the escape commands that produce them. Enhanced printing and overprinting can also be produced but examples are not shown.

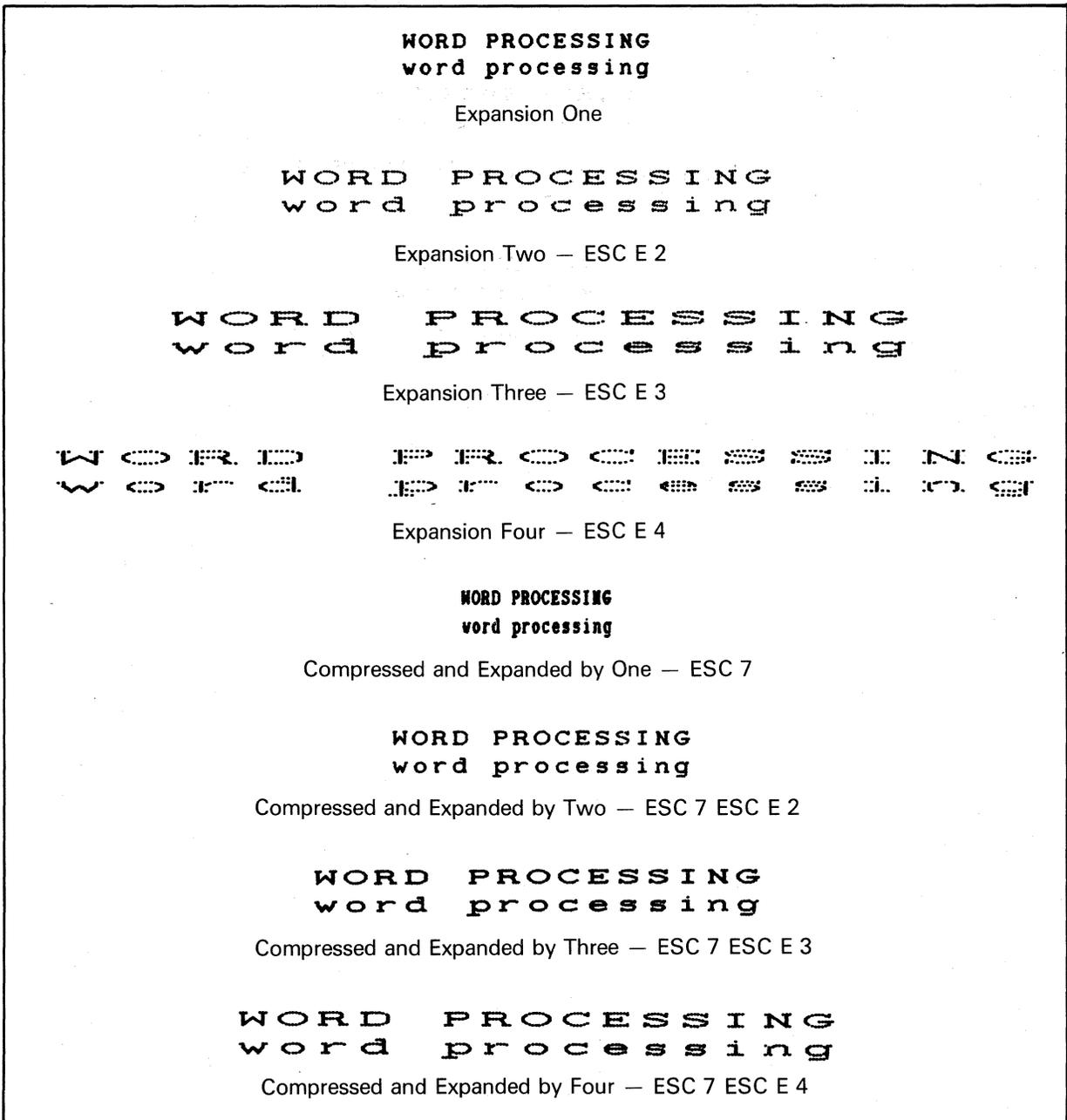


Figure 8-7. Expanded Print and Compressed Expanded Print in Courier Word Processing Font

2380090-44

Figure 8-8 shows examples of the Courier font print with proportional spacing and specified inter-character gap (ICG) above the escape commands (in ASCII Code characters) that produce them.

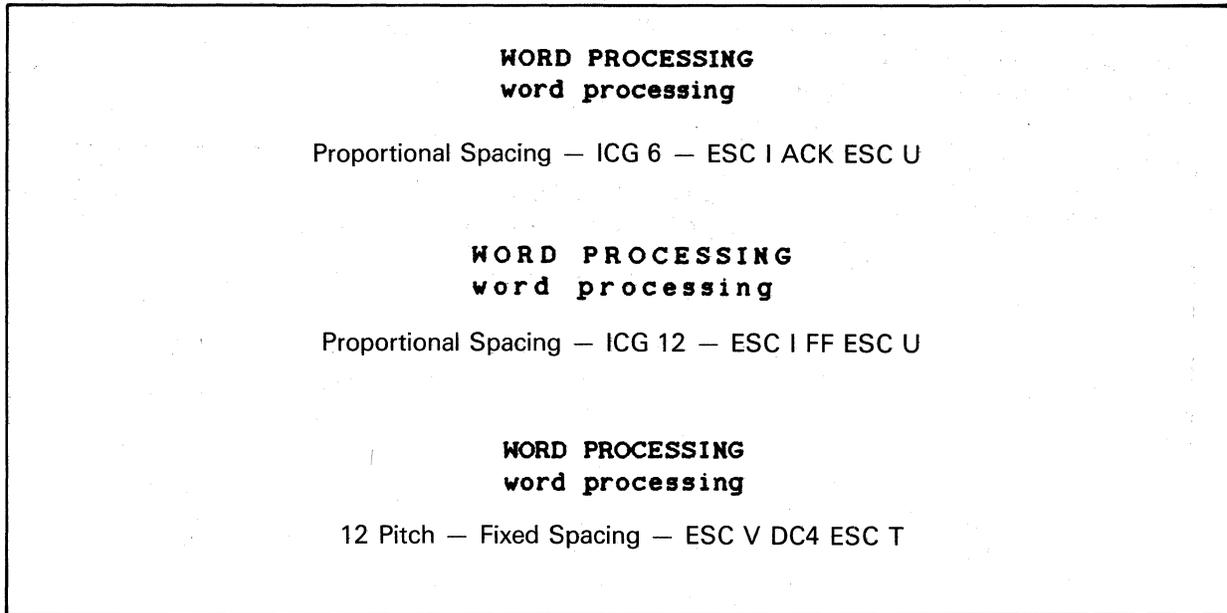
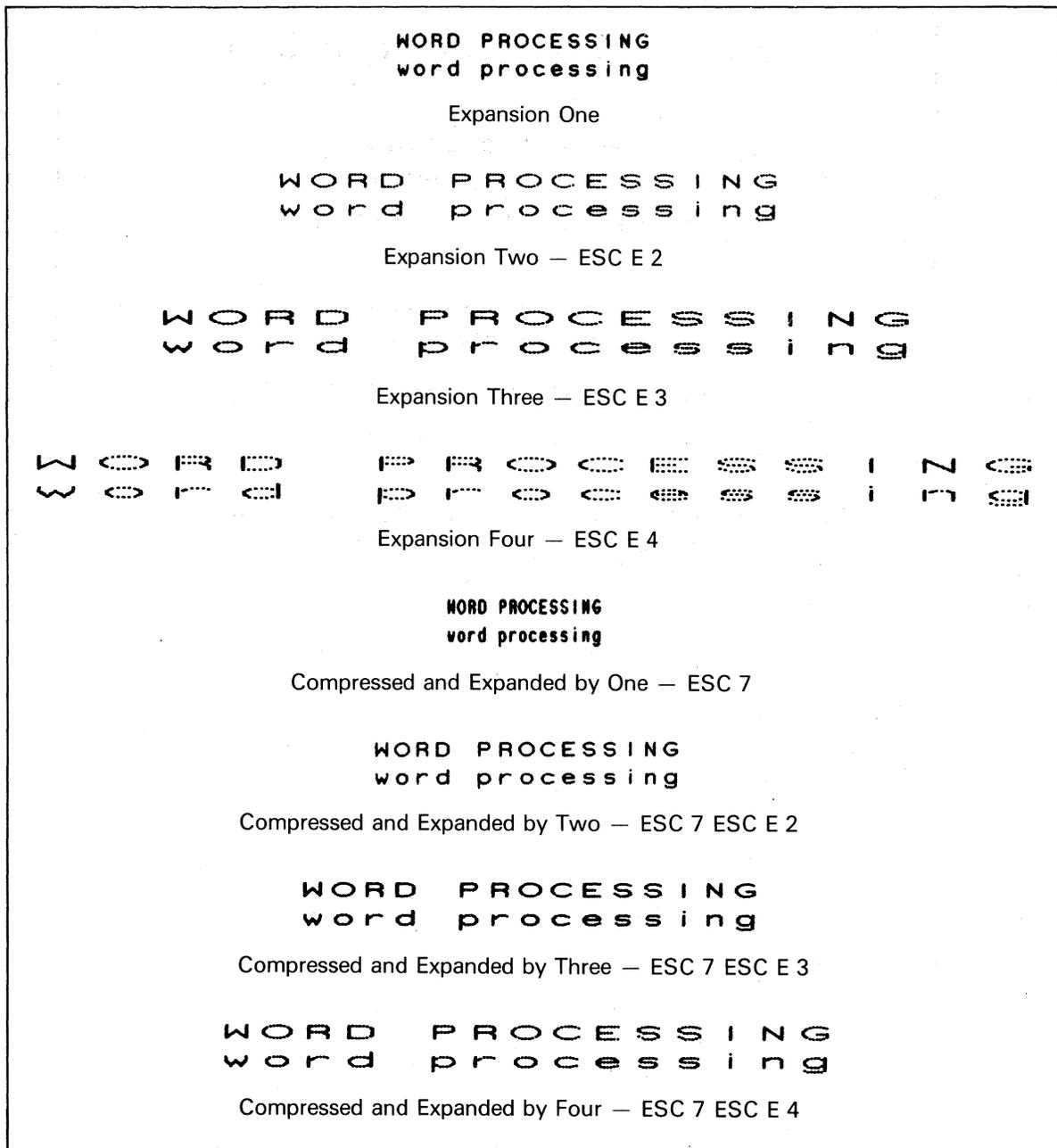


Figure 8-8. Proportional Spacing and Intercharacter Gap (ICG) Print in Courier Word Processing Font

2360090-45

8.5.2 Helvetica Font

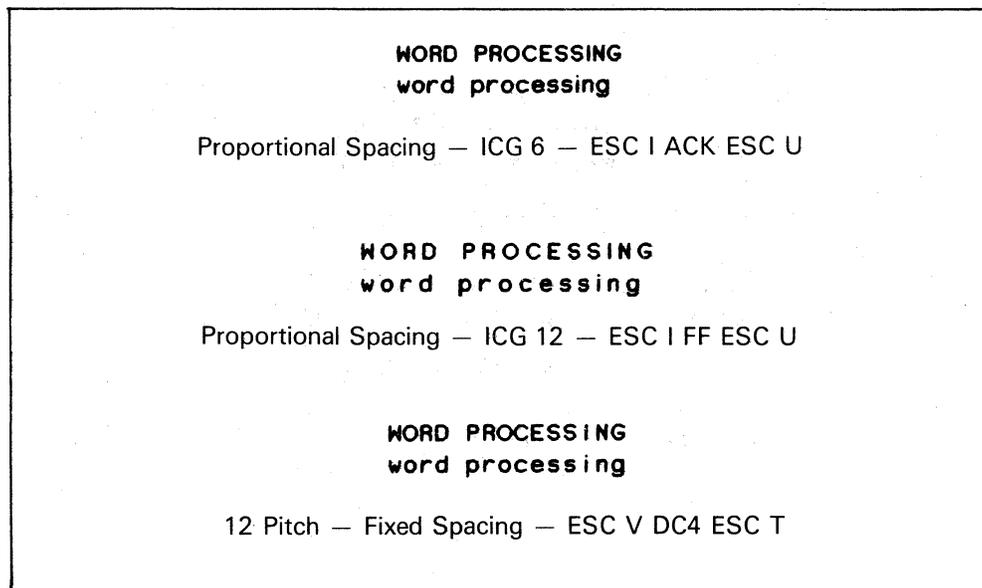
Figure 8-9 shows examples of the Helvetica font in expanded print and compressed expanded print above the escape commands that produce them. Enhanced printing and overprinting can also be produced but are not shown.



2360090-46

Figure 8-9. Expanded Print and Compressed Expanded Print in Helvetica Word Processing Font

Figure 8-10 shows examples of the Helvetica font with proportional spacing and specified inter-character gap (ICG) above the escape commands (in ASCII Code characters) that produce them.

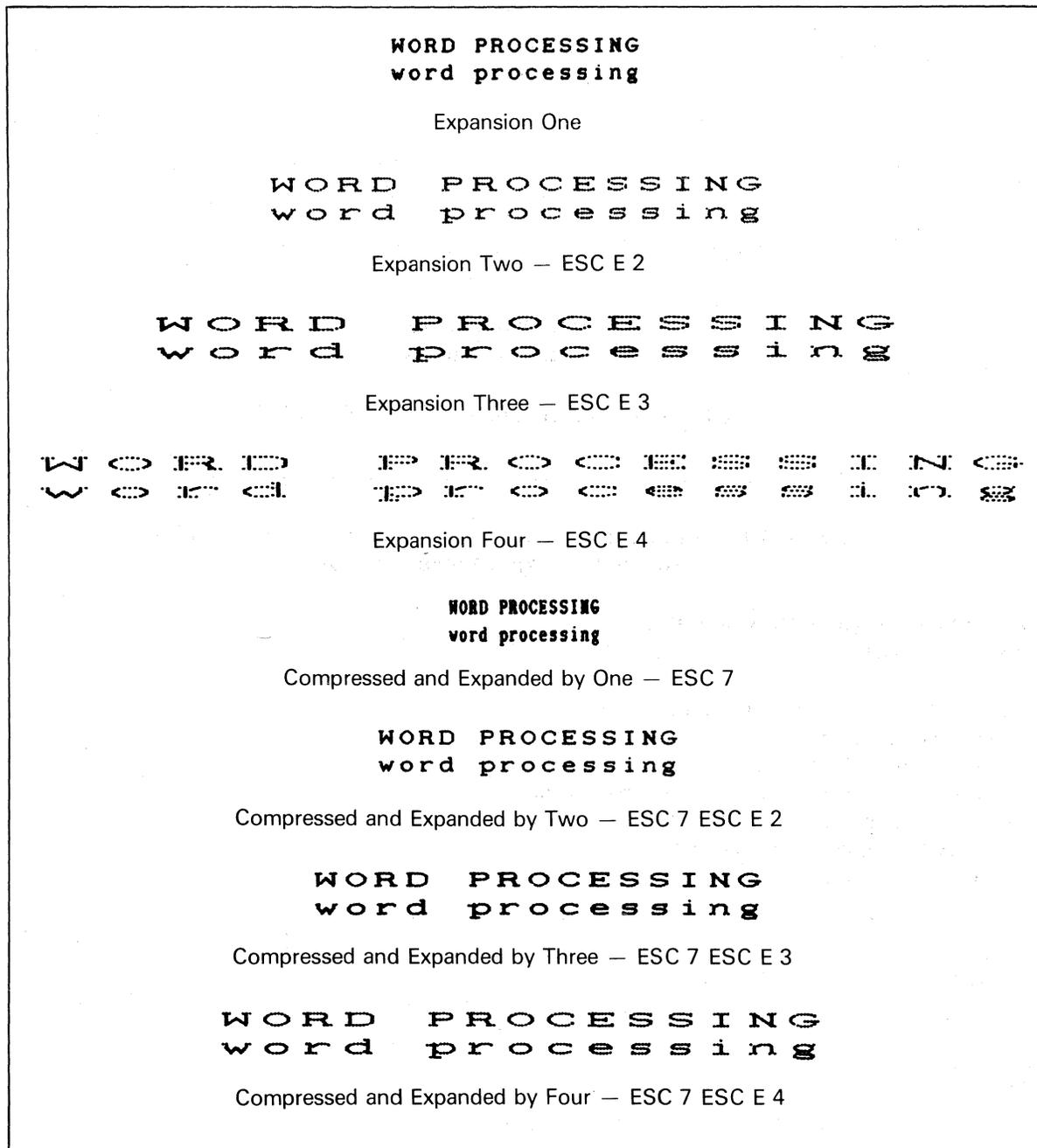


2360090-47

**Figure 8-10. Proportional Spacing and Intercharacter Gap (ICG)
Print in Helvetica Word Processing Font**

8.5.3 Elite Font

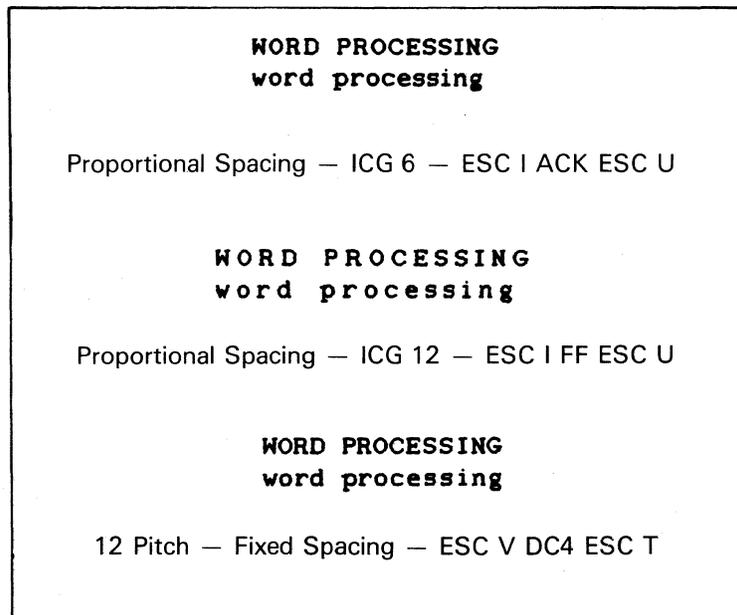
Figure 8-11 shows examples of the Elite font in expanded print and compressed expanded print above the escape commands that produce them. Enhanced printing and overprinting can also be produced but examples are not shown.



2360090-48

Figure 8-11. Expanded Print and Compressed Expanded Print in Elite Word Processing Font

Figure 8-12 shows examples of the Elite font with proportional spacing and specified intercharacter gap (ICG) above the escape commands (in ASCII Code characters) that produce them.



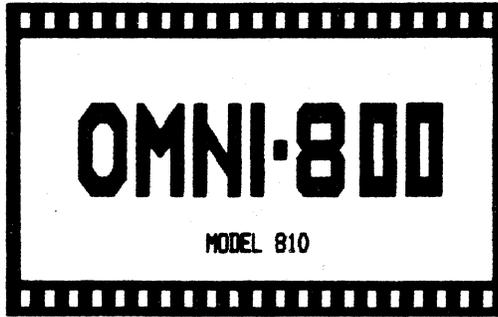
2360090-49

Figure 8-12. Proportional Spacing and Intercharacter Gap (ICG) Print in Elite Word Processing Font

8.6 BLOCK-CHARACTER PLOTTING APPLICATIONS

Figure 8-13 shows an example of combined block-character plotting and printing. The code that produces the example is shown below the printout. Table A-1, in Appendix A, provides a conversion for hexadecimal codes to ASCII code characters. Figure A-1, in Appendix A, shows the dot patterns for the block characters.

Figure 8-14 is a compressed print example of Figure 8-13. For compressed print, line 2 of the code that produces this example must be modified to include ESC 7, > 1B > 37.



2360090-51

Figure 8-14. Compressed Print Example of Figure 8-13

8.7 SIX-BIT, X-PLOT EXAMPLES

Examples of X-plot plotting and character printing using active escape sequence command functions are shown in Figure 8-15. These examples show the 72 × 72 dot-matrix printout or squaring (ESC X) of Figure 5-4 (see paragraph 5.6.2), as well as illustrations of the figure in expanded print and compressed expanded print above the code that produces each one. A similar X-plot with 120 × 72 dpi gives eight examples with different aspect ratios.

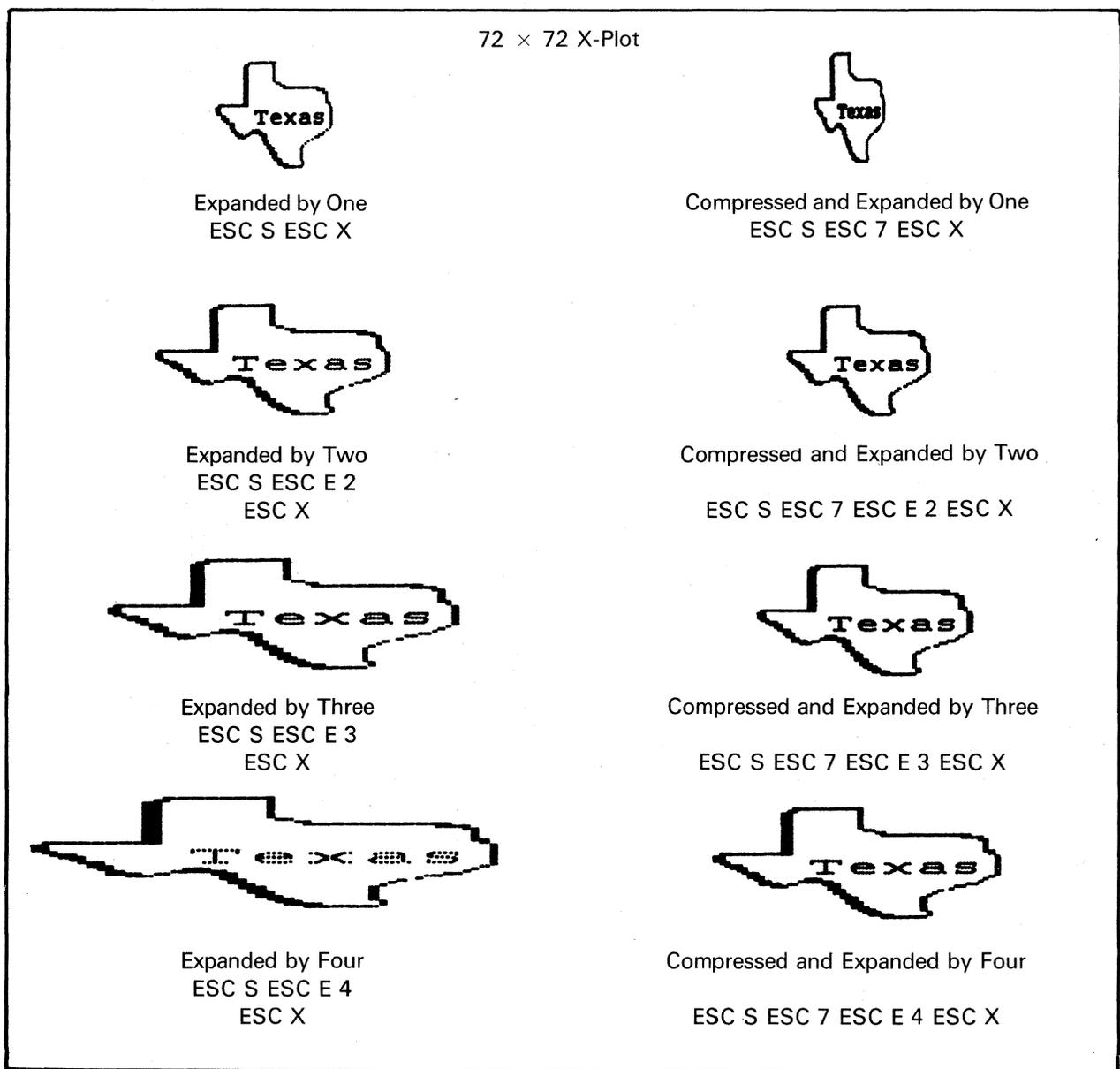


Figure 8-15. Six-Bit, X-Plot Printing Examples

2360090-52



Appendix A

Block-Character and Bar-Code Dot Patterns and Bar-Code Specification Sources

A.1 INTRODUCTION

Table A-1 lists the USASCII Code characters and decimal numbers in a matrix with the corresponding hexadecimal codes and binary codes. Figure A-1 shows block-character dot patterns. Figure A-2 shows bar-code dot patterns.

A.2 BAR-CODE SPECIFICATION SOURCES

A reference for bar codes, titled *Bar Code Symbolology*, by David C. Allais, can be purchased from:

Interface Mechanisms, Inc. (INTERMEC)
4405 Russel Road
P.O. Box N
Lynnwood, WA 98036
(206) 743-7036

Table A-2 is a partial listing of bar-code specification sources.

Table A-1. USASCII Code Characters and Decimal Numbers and the Corresponding Hexadecimal Codes and Binary Codes

Most Significant Bits

	Hex Code	0	1	2	3	4	5	6	7
Hex Code	Binary Code	0000	0001	0010	0011	0100	0101	0110	0111
0	0000	NUL 0	DLE 16	SP 32	0 48	@ 64	P 80	 96	p 112
1	0001	SOH 1	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113
2	0010	STX 2	DC2 18	" 34	2 50	B 66	R 82	b 98	r 114
3	0011	ETX 3	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115
4	0100	EOT 4	DC4 20	\$ 36	4 52	D 68	T 84	d 100	t 116
5	0101	ENQ 5	NAK 21	% 37	5 53	E 69	U 85	e 101	u 117
6	0110	ACK 6	SYN 22	& 38	6 54	F 70	V 86	f 102	v 118
7	0111	BEL 7	ETB 23	' 39	7 55	G 71	W 87	g 103	w 119
8	1000	BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120
9	1001	HT 9	EM 25	) 41	9 57	I 73	Y 89	i 105	y 121
A	1010	LF 10	SUB 26	* 42	: 58	J 74	Z 90	j 106	z 122
B	1011	VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123
C	1100	FF 12	FS 28	, 44	< 60	L 76	\ 92	l 108	| 124
D	1101	CR 13	GS 29	- 45	= 61	M 77	] 93	m 109	} 125
E	1110	SO 14	RS 30	. 46	> 62	N 78	^ 94	n 110	~ 126
F	1111	SI 15	US 31	/ 47	? 63	O 79	_ 95	o 111	DEL 127

2360090-53

Least Significant Bits

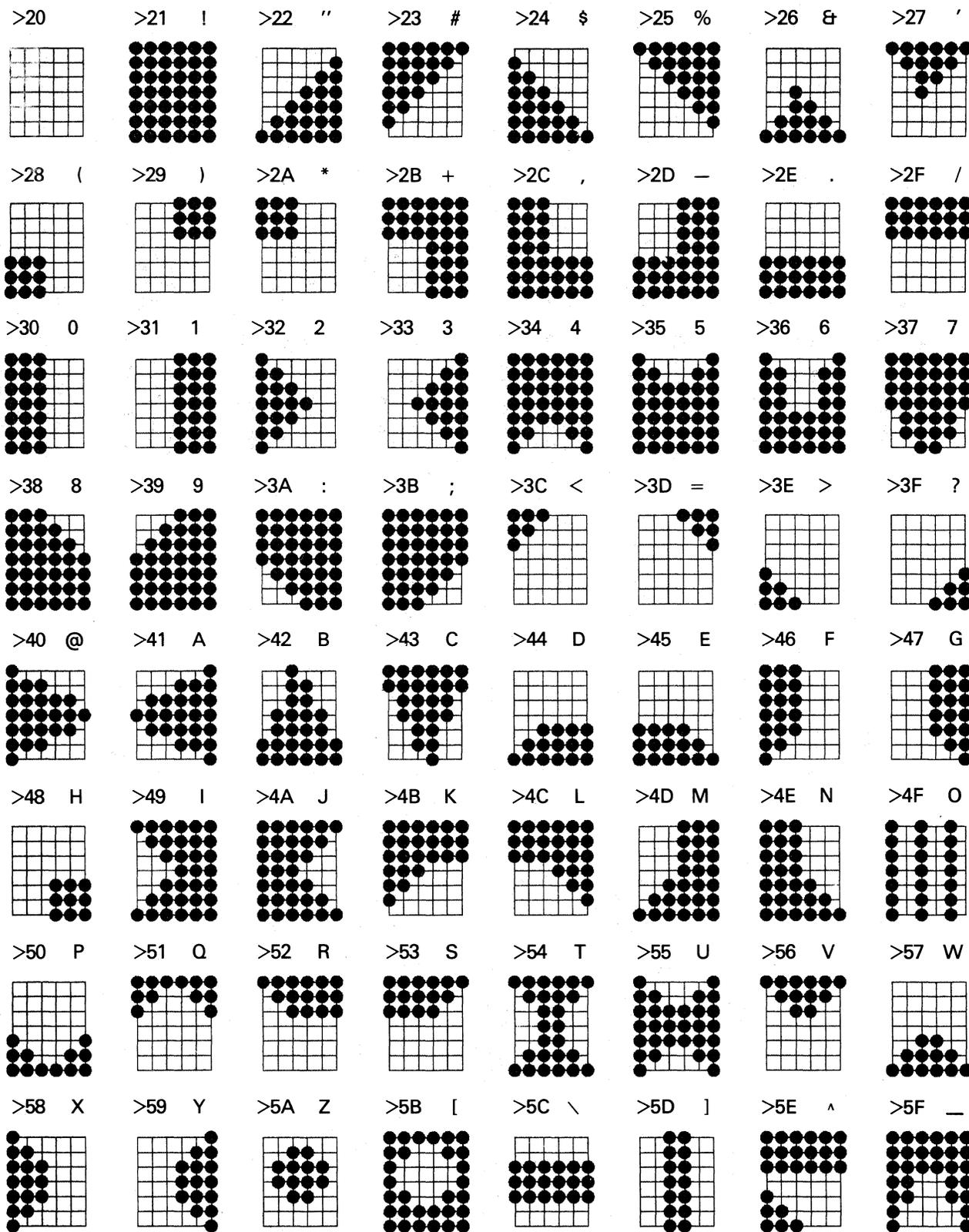


Figure A-1. Block-Character Dot Patterns and Codes

2360090-54

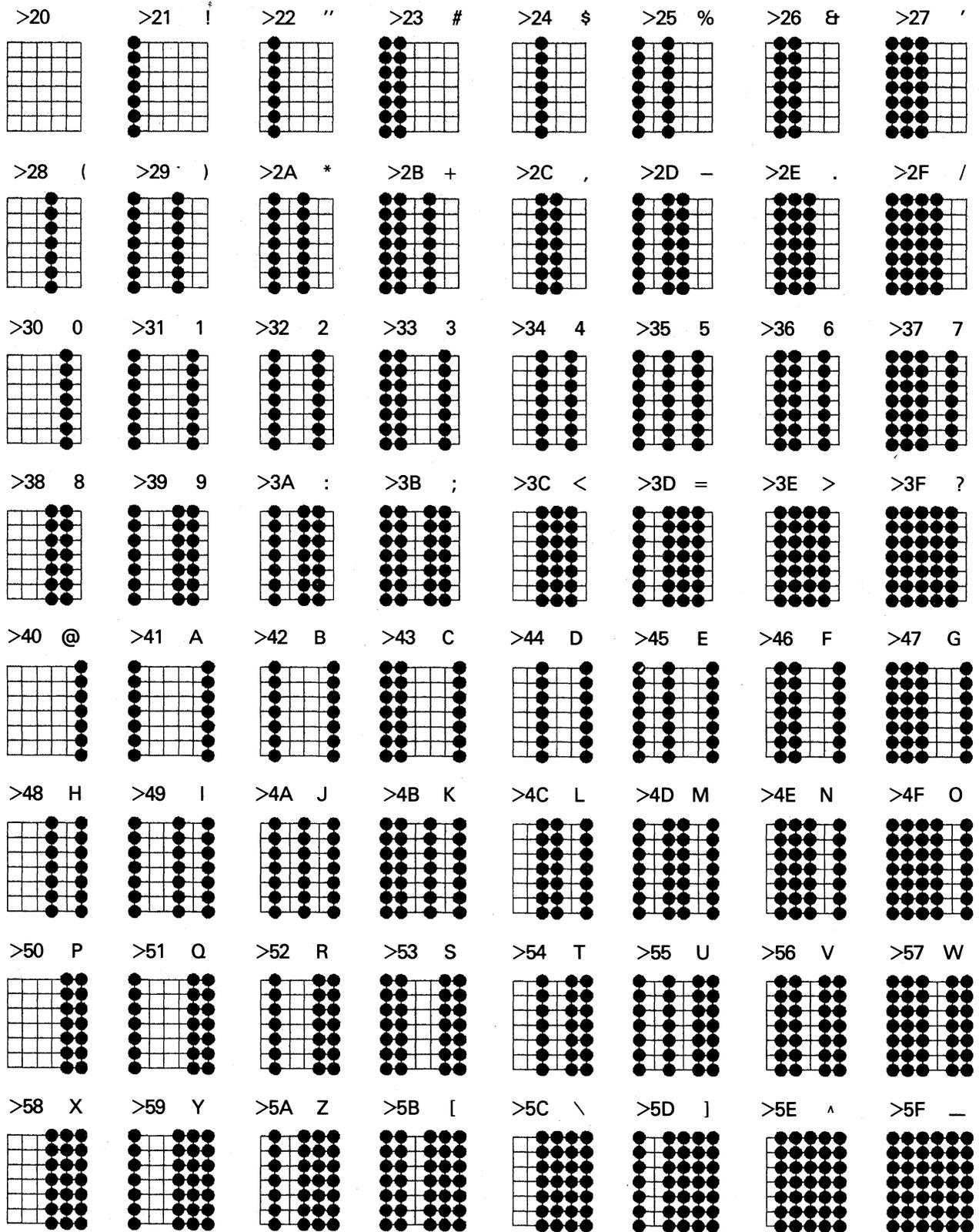


Figure A-2. Bar-Code Dot Patterns and Codes

2360090-55

Table A-2. Partial Listing of Bar-Code Specification Sources

CODE DESIGNATION	SOURCE
<p>CODE 39* or CODE 3 of 9</p> <p>INTERLEAVE 2 of 5</p> <p>CODABAR</p>	<p><i>ANSI MH 10.X — 1981, Draft specifications for bar code symbols on transport packages and unit loads.</i></p> <p>American National Standards Institute 1430 Broadway Street New York, NY 10018</p>
<p>IDENTICON 2/5</p>	<p>Identicon Corp. One Kenwood Circle Franklin, MA 02038 (617) 528-6500</p>
<p>MSI</p>	<p>MSI Data Corp. 340 Fischer Ave. Costa Mesa, CA 92626 (714) 549-6000</p>
<p>UPC</p>	<p>Uniform Product Code Council, Inc. 7051 Corporate Way Suite 201 Dayton, OH 45459 (513) 435-3870</p>

*Code 39 is a registered trademark of Interface Mechanisms, Inc.

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Appendix B

Installation and Adjustment Instructions

B.1 DESCRIPTION

The parts required to upgrade a standard Model 810 Printer having a product service code 815 to a Model 810LQ Printer are contained in the Model 810LQ Printer Field Installation Kits:

- TI Part No. 2360091-0001, first generation
- TI Part No. 2360091-0002, second generation*

For the location of the product service code and related information on product service code 711, see Section 4.

.NOTE

Before installation, see Section 4, Print Quality, Printer Variances, and Precautions.

This appendix provides the installation procedures for the LQ upgrade board and LQ paper-advance stepping motor that transform the standard printer into a near-letter-quality, graphics printer.

To ensure reliable print quality, the universal print-head provided in the kit must be installed. If, however, the part number of the present printhead matches that of the printhead in the kit, leave the present printhead in place and retain the kit print-

head as a spare. Installation instructions are provided in this appendix.

Two static ground brackets and a cable are included in the kit. These should be installed to protect the printer against electrostatic discharge. Instructions for the installation of the brackets are also provided in the kit.

B.2 PARTS

The Model 810LQ Printer Field Installation Kit contains both Model 810LQ upgrade parts and electrostatic discharge suppression parts, which are listed in Table B-1.

B.3 TOOLS REQUIRED

The tools required for installing the LQ upgrade kit are:

- Screwdriver (small flatbladed)
- Wrench (3/16 in)
- Needle nose pliers

B.4 INSTALLATION PROCEDURES

The procedures for installing the Model 810LQ upgrade kits are provided in this subsection. Procedures for both kits are the same with the exception of the LQ upgrade board.

* The second-generation field installation kit is compatible with new RS422 and TTY interface options and provides for hard-wired selection of international character sets.

Table B-1. Field Installation Kit Parts

Description	TI Part No.
Model 810LQ Printer Upgrade Parts for TI Part No. 2360091-0001, Full-Sized LQ Upgrade Board	
LQ Paper-Advance Stepping Motor	0994207-0002
LQ Upgrade Board Assembly	2360095-0001
Universal Printhead	2217374-0002
Configuration Label	0994351-0001
Yellow Color Dot	0231792-0004
User's Manual	2360090-9701
Model 810LQ Printer Upgrade Parts for TI Part No. 2360091-0002, Half-Sized LQ Upgrade Board	
LQ Paper-Advance Stepping Motor	0994207-0002
LQ Second-Generation Upgrade Board Assembly	2232575-0001
Universal Printhead	2217374-0002
Center Card Guide	0994294-0001
Pushnut Fastener	0996255-0001
Configuration Label	0994351-0001
User's Manual	2360090-9701
Electrostatic Discharge Suppression Parts for both TI Part Nos. 2360090-0001 and 2360090-0002	
Left Static Ground Bracket	2360075-0001
Right Static Ground Bracket	0994438-0002
Basket Ground Cable	0999941-0001
Installation Instructions	
(Terminal Stand Paper Basket)	0999940-9701, Rev. A
Installation Instructions	
(Terminal Paper Basket Kit)	0999941-9701, Rev. B

NOTE

Check the operation of the Model 810 Printer before installing the upgrade kit. Verify printer performance and data processing print quality before proceeding.

WARNING

Before installing the upgrade kit, set the terminal ON/OFF switch to OFF. Disconnect the data cable and then disconnect the power cord to prevent shock.

B.4.1 Preparation of the LQ Upgrade Board for Installation into the Printer

Both the first- and second- generation LQ upgrade boards must be prepared for installation. The first steps are the same for both boards. To prepare the LQ upgrade board:

1. Determine printer configuration. Lift the Model 810 Printer access door and locate the configuration label on the right. Figure B-1 shows the configuration label and defines the configuration codes.

CAUTION

Prevent possible damage by electrostatic discharge. Before handling terminal electronic assemblies, ground static charge by touching hands, containers, and tools to the printer carriage guide rod. (The printer is not grounded when the power cord is disconnected.)

2. Configure the jumpers of the LQ upgrade board to match the printer version. These jumpers are located on the component side and at the top right of center on the full-sized board and at the bottom left

corner of the half-sized board. See the assembly drawing on page F-7 or F-16 in Appendix F.

BSC — E5 — E6 and E2 — E3
FLC — E4 — E5 and E2 — E3
VFC — E4 — E5 and E2 — E3
FCO — E4 — E5 and E1 — E2
VCO — E4 — E5 and E1 — E2

3. If the LQ upgrade board is a half-board (second generation), select the desired international character set by removing or installing resistor jumpers* R1, R2, R3, and R4 (1 kohm, 0.25 watt) on the LQ upgrade board, assembly 2232575, as indicated in Table B-2. Check the configuration label to determine the present international character set. These jumpers are located to the left of the ejector on the top left corner of the board. See the assembly drawing on page F-16 in Appendix F.

NOTE

See Table 5-5 in Section 5 for characters and hexadecimal codes of the international character sets available on second-generation LQ upgrade boards.

Table B-2. International Character Set Jumpers

Character Set	R1	R2	R3	R4
United States	IN	IN	IN	IN
Canadian French	IN	IN	IN	OUT
United Kingdom	IN	IN	OUT	IN
Germany/Austria	IN	IN	OUT	OUT
Spain/Latin America	IN	OUT	IN	IN
Sweden/Finland	IN	OUT	IN	OUT
Denmark/Norway	IN	OUT	OUT	IN
Switzerland	IN	OUT	OUT	OUT
France WP	OUT	IN	IN	IN

*Jumper wires or 0-ohm resistors can be used for R1, R2, R3, and R4 in place of 1 kohm resistors.

**810 PRINTER
CONFIGURATION**

Printer Type: BSC ___ FLC ___ VFC ___ FCO ___ VCO ___ LQP ___ PKG ___	Interface Option: TTY ___ PLT ___ LBE ___ BRO ___ DSC ___ IRC ___ DNB ___ GED ___ GDS ___	Character Set: FUL ___ UKF ___ UKL ___ DNF ___ DNL ___ SWF ___ SWL ___ GRF ___ GRL ___ KAT ___ EXP ___ KTS ___ UAL ___ SPF ___ Other: _____			
		Special: _____			
		Voltage: 100V ___ 120V ___ 220V ___ 240V ___			
		Notes: _____			
		Processor Options: NDE ___ DNB ___ IRC ___ LB ___ BRO ___ DCO ___ ISC ___	LBP ___ DSC ___ GDS ___ LBT ___ HDP ___ BRO ___ DSC ___ GDS ___ Other: _____		

TI PN 994351-0001

Definitions of Printer Configuration Codes

Printers:

- BSC — basic
- FCO — forms length control, compressed print
- FLC — forms length control
- VCO — vertical format control compressed print
- VFC — vertical format control
- LQP — letter-quality printer
- PKG — vertical format control, compressed print, United States full-ASCII

Processor Options:

- NDE — ignore DElete character
- DNB — buffer full/buffer ready, DTR (pin 20)
- IRC — inverted reverse channel (ON for busy)
- LB† — line buffer board
- BRO — baud rate option
- DCO — disable recognition of DC1 and DC3 characters
- ISC — isolated signal and chassis ground
- GRD — connected signal and chassis ground

Interface Options:

- TTY* — 20-mA current loop
- PLT — parallel interface
- LBE† — line buffer board, EIA/RS-232C compatible
- LBP† — line buffer board, parallel
- LBT† — line buffer board, TTY current loop

Character Sets:††

- FUL — United States full-ASCII
- UKF* — United Kingdom full-ASCII
- UKL* — United Kingdom limited-ASCII
- DNF* — Denmark/Norway full-ASCII
- DNL* — Denmark/Norway limited-ASCII
- SWF* — Sweden/Finland full-ASCII
- SWL* — Sweden/Finland limited-ASCII
- GRF* — Germany full-ASCII
- GRL* — Germany limited-ASCII
- KAT† — Katakana and United States full-ASCII
- EXP — expanded print (domestic United States)
- KTS† — Katakana plus six special characters and United States full-ASCII
- UAL† — special character set

LEGEND

* Not compatible with the first-generation (full-sized LQ upgrade board) kit installation, TI Part No. 2360091-0001.

† Not compatible with the LQ upgrade installation.

‡ Character set can be hard-wire selected on second-generation (half-sized LQ upgrade board) kit installation, TI Part No. 2360091-0002. Limited ASCII sets are subsets of full-ASCII sets.

Figure B-1. Model 810 Printer Configuration Label

4. Remove the five screws that secure the printer cover. Three screws are located under the access door, as shown in Figure B-2. Two screws are located at the left and right rear corners of the printer cover.
5. Lift off the printer cover.
6. Loosen the three screws on the electronics cover and lift the cover up and off, as shown in Figure B-3.

B.4.2 LQ Upgrade Board Installation

Installation procedures for the LQ upgrade board depend on which board is being installed. Follow the proper procedure for the particular board.

B.4.2.1 Installation of the First-Generation LQ Upgrade Board. The full-sized LQ upgrade board, TI Part No. 2360095-0001, is inserted in the rear option slot of the Model 810 Printer. Other options that make use of this slot cannot be implemented in the Model 810LQ Printer and, if installed, must be removed. These options are:

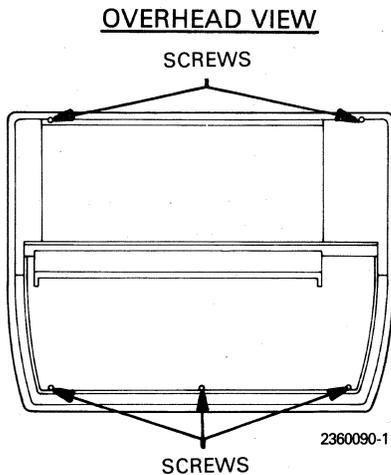


Figure B-2. Locations of Printer Cover Screws

Designation	Option	TI Part No.
TTY	20-mA current loop board	2230497-0001
		or 994305-0001
LBE	Line buffer board, EIA	994511-0001
LBT	Line buffer board, TTY	994512-0001
	current loop	
LBP	Line buffer board, parallel	994513-0001
422	RS422 interface board	2230497-0002

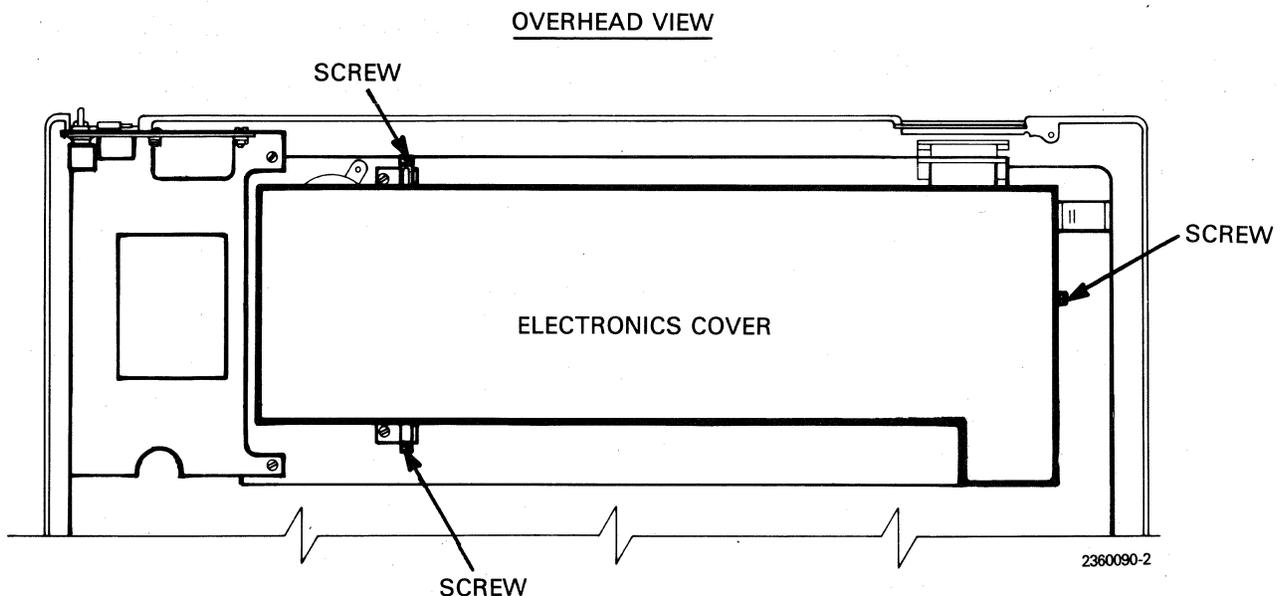


Figure B-3. Locations of Electronics Cover Screws

The steps for installing the full-sized board are as follows:

1. Place the yellow dot on the card cage at the location indicated in Figure B-4. This dot identifies the color and location of the ejector when the LQ upgrade board is properly installed.
2. Install the board in the option card slot at the rear of the cage with the component side toward the front of the printer. Figure B-4 shows the location of the boards in the motherboard.

NOTE

Be certain to initialize the nonvolatile memory by performing step 5 of paragraph B.5.

B.4.2.2 Installation of the Second-Generation LQ Upgrade Board. The Model 810LQ Printer with the near-letter-quality upgrade installation, TI Part No. 2360091-0002, has a redesigned LQ upgrade board, which uses only half the XA3 slot (XA3P2 connector). This "half-sized" board permits installation of one of the following communication interface options in the other half of the XA3 slot (XA3P1 connector):

- RS-422 Serial Interface Option (TI Part No. 2230789-0001)

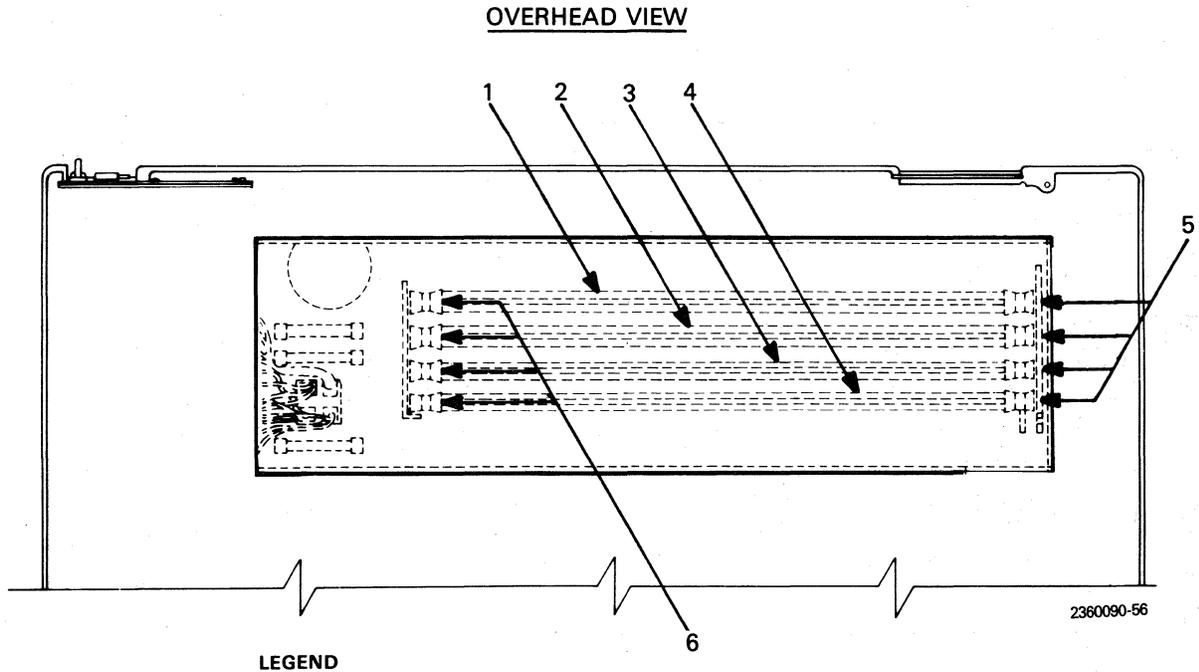
- TTY 20-mA Current Loop Option (TI Part No. 2230790-0001)
- TTY 20-mA Current Loop Option (TI Part No. 0994402-0001)

NOTE

TTY 20-mA Current Loop Option, TI Part No. 0994402-0001, does not support DC1/DC3 protocol.

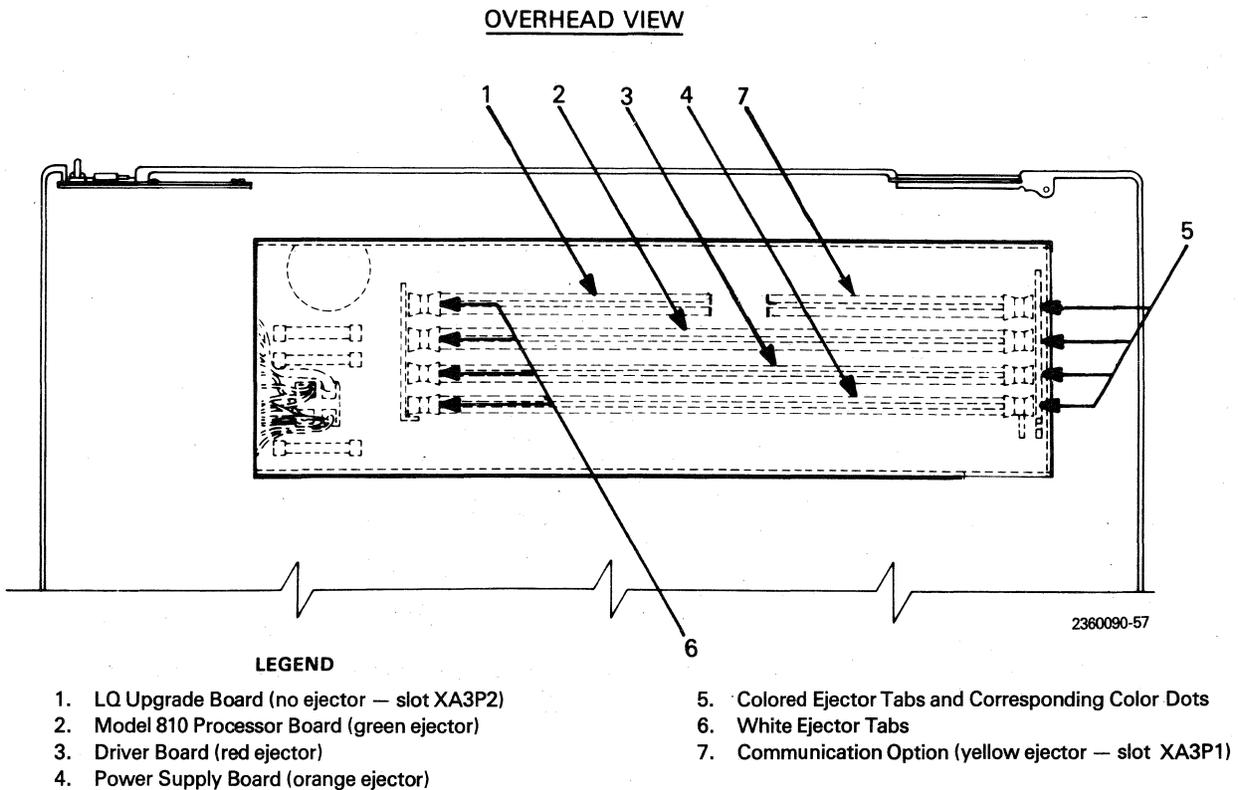
The steps for installing the half-sized board are as follows:

1. Remove the Model 810 processor board, assembly 994244, (green ejector) from slot XA2, which is shown in Figure B-5. Place your thumbs under the inside tabs of the ejectors and lift.
2. Locate socket XU36 on the left side of the Model 810 processor board, assembly 994244, and then remove the ROM (TI Part No. 996279). See Figure B-6.
3. Locate the carrier socket XU14 on the LQ upgrade board, assembly 2232575. See Figure B-7. Remove the PROM/EPROM from socket XU14 and exchange it with the *non*-letter-quality ROM (TI Part No. 996279) removed from the Model 810 processor board, assembly 994244.



- | | |
|--|--|
| 1. LQ Upgrade Board (yellow ejector) | 4. Power Supply Board (orange ejector) |
| 2. Model 810 Processor Board (green ejector) | 5. Colored Ejector Tabs and Corresponding Color Dots |
| 3. Driver Board (red ejector) | 6. White Ejector Tabs |

Figure B-4. Locations of Printed Wiring Boards — Full-Sized LQ Upgrade Board



- | | |
|---|---|
| 1. LQ Upgrade Board (no ejector — slot XA3P2) | 5. Colored Ejector Tabs and Corresponding Color Dots |
| 2. Model 810 Processor Board (green ejector) | 6. White Ejector Tabs |
| 3. Driver Board (red ejector) | 7. Communication Option (yellow ejector — slot XA3P1) |
| 4. Power Supply Board (orange ejector) | |

Figure B-5. Location of Printed Wiring Boards — Half-Sized LQ Upgrade Board

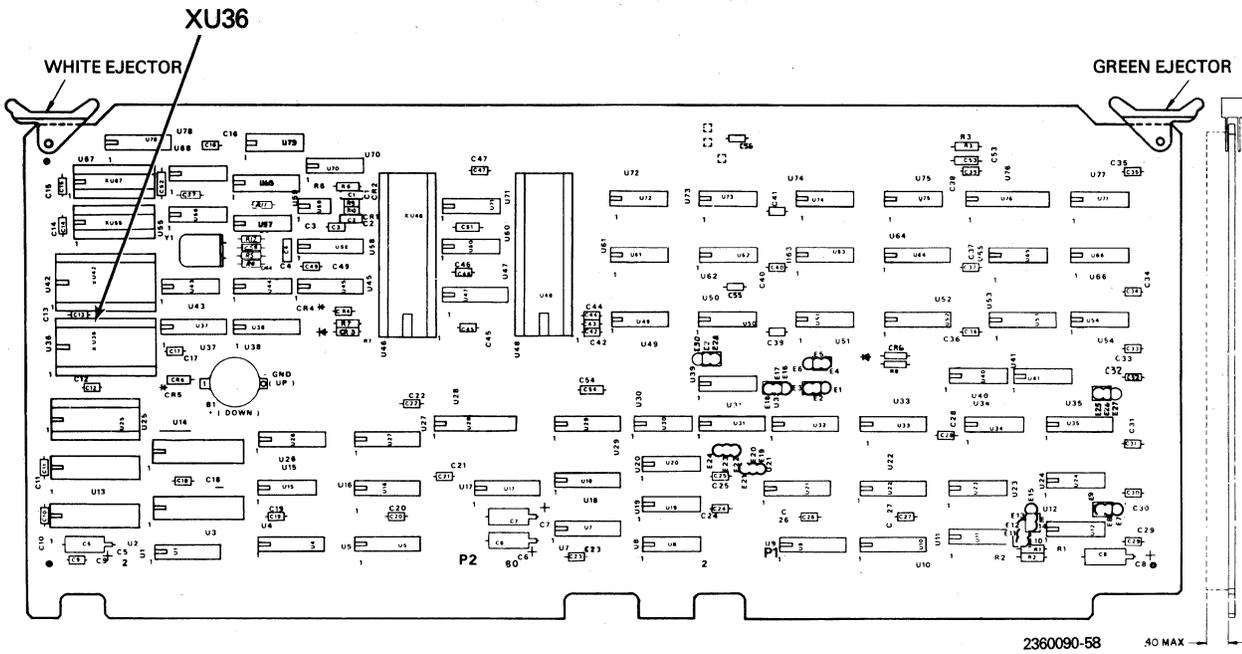


Figure B-6. Location of Socket XU36 on the Model 810 Processor Board

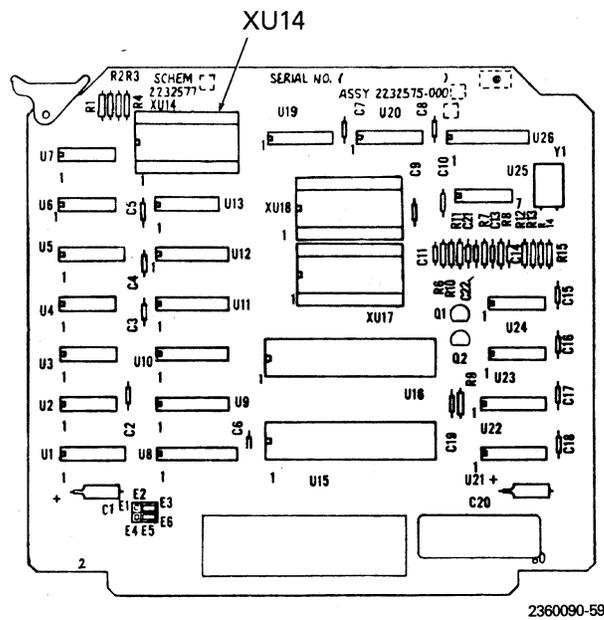


Figure B-7. Location of Socket XU14 on the LQ Upgrade Board

NOTE

See Appendix E, Table E-2 for a ROM/ EPROM location truth table.

- 4. Install the center card guide, TI Part No. 994294-0001. Ensure that card slot XA3 has a center card guide located between motherboard connectors XA3P1 and XA3P2, as shown in Figure B-8. To install the center card guide:

- a. Remove the pushnut fasteners (if installed) from each of two short posts that protrude through the motherboard. Clamp together the upturned edges of the fastener with long-nose pliers and lift the fastener off the post.

- b. Locate the center card guide by placing the guide on the motherboard so that the short posts protrude through the holes in the base.

NOTE

The center card guide is nonsymmetrical; ensure that the guide surfaces are centered between connectors XA3P1 and XA3P2, as shown in Figure B-5.

- c. Lock the center card guide into position by placing a pushnut fastener (TI Part No. 996225-0001) on each post and then pushing it down firmly.

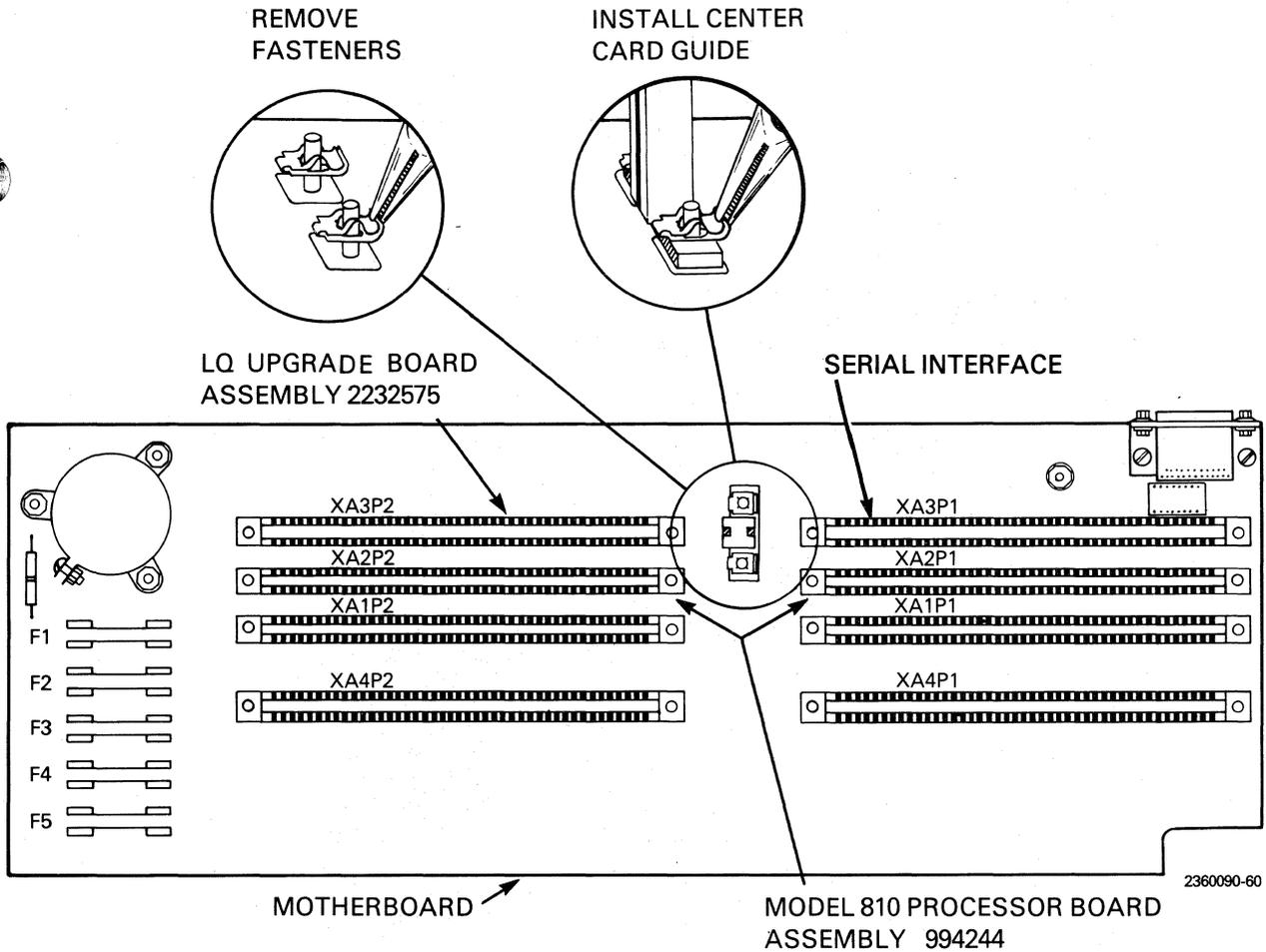


Figure B-8. Card Slot XA3 and the Center Card Guide Location

5. Install the Model 810 processor board, assembly 994244, into the slot from which it was removed. (Refer to Figure B-5.)
6. Install the LQ upgrade board, assembly 2232575, into connector XA3P2 with the component side to the front of the printer.

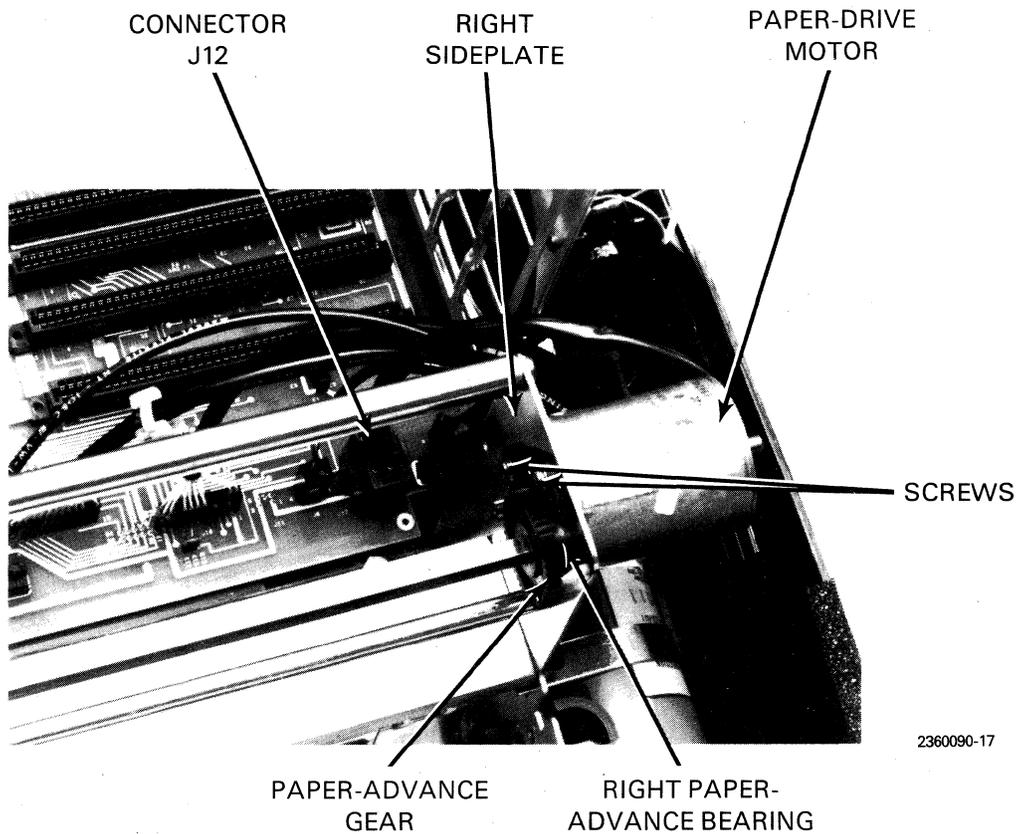
NOTE

Be certain to initialize the nonvolatile memory by performing step 5 of paragraph B.5.

B.4.3 Paper-Advance Stepping Motor Installation

The steps for installing the paper-advance stepping motor are as follows:

1. Unplug the paper-advance stepping motor from the motherboard. Squeeze the tabs on the connector (J12) and lift the plug out of the card cage. If more room is required, remove the front printed wiring board.
2. Figure B-9 shows the orientation of the paper-advance stepping motor. Remove the three screws that hold the motor in place. Use a small flatbladed screwdriver and be careful not to damage the plastic gear that partially covers two of the screws.
3. Install the new motor with the same orientation as the original. Plug the connector into the motherboard.
4. Install the front printed wiring board if it was removed in step 1.



2360090-17

Figure B-9. Paper-Advance Stepping Motor Installation

B.4.4 Printhead Installation

The steps for installing the printhead are as follows:

1. Manually slide the printhead to the center of the printing area. Move the printhead away from the platen using the printhead adjustment lever. Note the initial position of the lever and then move the lever away from the platen.
2. Use the 3/16-inch wrench to remove the two long hex nuts, which secure the printhead to the carriage, as shown in Figure B-10.
3. Remove the printhead from the carriage by rotating the printhead back and downward out of the carriage mounting holes.
4. Remove the printhead cable connector by supporting the connector with one hand while pulling the printhead up with the other hand.
5. Install the new printhead by first connecting the printhead cable and then mounting the printhead on the carriage using the reverse of the removal procedure.

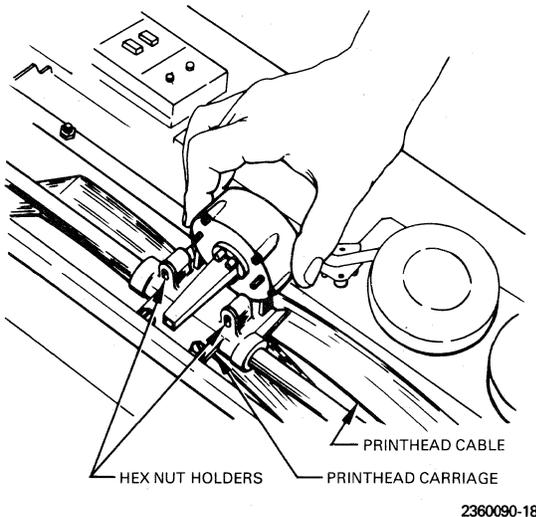


Figure B-10. Printhead Removal and Installation

6. Install the two hex nuts and tighten them by hand. Use the wrench to turn each nut 90 additional degrees.

B.4.5 Static Ground Brackets and Cable Installation

Install the left and right static ground brackets as described in *Terminal Paper Basket Kit Installation Instructions*.

NOTE

The static ground brackets should be installed even if the terminal-mounted paper basket is not presently used.

Install the basket ground cable as described in *Terminal Stand Paper Basket Installation Instructions*, if the printer is mounted on a stand supplied by Texas Instruments.

B.4.6 Configuration Label Installation

Compare the new configuration label with the label on the inside of the printer access door. Mark the corresponding codes on the new label except for those which are not compatible with LQ upgrade board installation. Also mark the LQP code. Remove the protective sheet from the new label. Place the new label over the old label and then rub the label on.

B.5 INSTALLATION CHECKOUT

See Appendix E, Troubleshooting and Repair, if the printer fails the checkout procedure. Verify that printer operation was satisfactory prior to the upgrade installation.

1. Connect the power cord.
2. Connect the data cable.
3. Load paper, at least 215.9 mm (8 1/2 in) wide, into the printer.
4. Ensure that the ribbon is properly installed.

5. Switch power ON. The printhead should move to the left margin, and the audible tone should sound indicating the power-up self-test is successfully completed.

NOTE

VCO and VFC printers require that all vertical format information, including the font, be reprogrammed. This can be done either manually or with software.

To continue the installation checkout, it is necessary to load the nonvolatile memory with font and line feed data before the printer can operate properly.

6. Press the NORMAL switch and observe that the NORMAL indicator lights. Press the 8 LPI switch and observe that the 8 LPI indicator lights. Press the 8 LPI switch again to enter 6 lpi. Press the TEST/VFC switch and observe that the TEST/VFC indicator lights. Press the 8 LPI switch once to enter the standard Model 810 font. Press the STORE switch to load the font and line feed data into nonvolatile memory. Press the NORMAL switch, then continue the installation check.

For first-generation auxiliary/control panels, set the NORMAL-TEST/VFC switch to the NORMAL position. Toggle the 16.5 CPI-8 LPI switch to the 8 LPI position and observe that the 8 LPI indicator lights. Toggle the switch to the 8 LPI position again to enter 6 lpi. Set the NORMAL-TEST/VFC switch to the TEST/VFC position. Toggle the 16.5 CPI-8 LPI switch to the 8 LPI position to enter the standard Model 810 font. Toggle the STORE-RECALL switch to the STORE position to load the font and line feed data into nonvolatile memory. Set the NORMAL-TEST/VFC switch to NORMAL, then continue the installation check.

7. Adjust the printhead to the platen. Place the printhead adjustment lever at least two positions further from the platen than the lever originally was positioned. Follow the adjustment procedure of paragraph B.6.2.
8. Turn power OFF. Replace the electronics cover and the printer cover. Tighten all screws.

B.6 PRINTER ADJUSTMENT FOR QUALITY PRINTING

Printhead adjustment can improve print registration and reduce ribbon smudging.

B.6.1 Printhead Ribbon Guide Adjustment

The steps for adjusting the printhead ribbon guide are as follows:

1. Lift open the front access door.
2. Carefully remove the ribbon from the printhead ribbon guides and place the ribbon out of the way.
3. Loosen the two screws on either side of the nose of the printhead. Slide the ribbon guide away from the platen to expose the printhead nose through the ribbon guide window.
4. Place a shim (credit card, punched card, file card, etc.) between the platen and the printhead nose; use the adjustment lever to push the the printhead nose against the shim so that it is held firmly against the platen.
5. Slide the ribbon guide toward the platen while holding the guide flush against the shim; tighten the screws. Remove the shim.
6. Replace the ribbon and set the printhead adjustment lever for proper printing.

B.6.2 Printhead/Platen Adjustment

The steps for adjusting the printhead/platen are as follows:

1. Lift open the front access door.
2. Ensure that the ribbon is properly installed and adjusted (see paragraph B.6.1) and that paper is installed correctly.
3. Press the TEST/VFC switch or set the NORMAL — TEST/VFC toggle switch to the TEST/VFC position.
4. Press the ONLINE switch to start the barberpole print test. Figure B-11 shows the barberpole test pattern.

NOTE

Printhead adjustment can be made when the printer is printing the barberpole test. Move the printhead adjustment lever forward until print quality is satisfactory.

The barberpole test pattern consists of two lines of each of the nine character sets including bar codes and block characters. The user-defined font is also printed if characters have been loaded. To the right of these character sets is a row of 16 vertical bars used in adjusting vertical registration. As the barberpole is being printed, adjust the printhead lever to produce the minimum vertical column deviation of the bars while observing a consistent print image of the character sets.

If dots are missing or if some dots are consistently lighter, the printhead may need to be replaced. Check and replace the ribbon before making a decision to replace the printhead.

B.6.3 Paper Adjustment

To ensure optimum print quality, align the paper supply box or stack either directly behind or beneath the printer depending on the method of feed. The paper should feed evenly across the platen during printing. Adjust the tractors if necessary.

Moving the paper supply or pulling on the top sheet to tear sheets apart during printing can result in poor print quality.

NOTE

Bottom feed is recommended for multipart and label print stock. There should be sufficient tension of the paper between the tractors to prevent paper bulge. Tension should not be so great that the paper holes tear when the paper is advancing.

B.7 PRINTER CARE AND CLEANING

Cleanliness of printer guide rods and platen is important in maintaining print quality and preventing carriage jams. For top performance, the printhead and ribbon area should be cleaned when noticeable dust appears on the printhead tip or carriage rods. At least every three months, perform the following procedure:

1. Remove power to the printer.
2. Remove the ribbon.
3. Carefully vacuum paper chaff from the printhead and ribbon area. Move the carriage manually in order to vacuum beneath the printhead.
4. If residues accumulate, use denatured alcohol to clean the platen.
5. Wipe carriage guide rods free of paper and dust with a dry clean cloth.

CAUTION

Never oil printhead guide rods on a Model 810 Printer having a product service code 815 or product service code 817 (Model 810LQ Printer).

```

!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`
"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`a
#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`AB
$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`ABC

```

User-defined software font prints in this area.

```

+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`'abcdefghijklmnopq
-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`'abcdefghijklmnopq
./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`'abcdefghijklmnopq
/0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`'abcdefghijklmnopq
0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`'abcdefghijklmnopq
123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`'abcdefghijklmnopq
23456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`'abcdefghijklmnopq
3456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`'abcdefghijklmnopq
456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`'abcdefghijklmnopq
56789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`'abcdefghijklmnopq
6789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`'abcdefghijklmnopq

```

User-defined software font prints in this area.

```

=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`'abcdefghijklmnopqrstuvwxyz{|}
>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`'abcdefghijklmnopqrstuvwxyz{|}
?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`'abcdefghijklmnopqrstuvwxyz{|}
@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`'abcdefghijklmnopqrstuvwxyz{|}
ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`'abcdefghijklmnopqrstuvwxyz{|}
BCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`'abcdefghijklmnopqrstuvwxyz{|}

```

Figure B-11. Barberpole Test Pattern

Appendix C

Site Preparation

C.1 AC POWER REQUIREMENTS

WARNING

Do not attempt to use a receptacle that does not accommodate a three-conductor plug. Do not cut the grounding prong from the plug. An electrical shock hazard can result.

For personal safety of the operator, as well as correct operation, the printer must be grounded by plugging the power cord into a mating three-prong receptacle, which is grounded in accordance with the National Electrical Code and local codes and ordinances. The following conditions pose possible safety hazards or can cause printer malfunctions.

- Open safety ground
- Safety ground connected to hot
- Safety ground connected to neutral in the receptacle
- Safety ground connected to conduit only
- Hot and neutral connections reversed in receptacle

If a properly wired wall receptacle is not available, it is the responsibility and obligation of the user to have such a receptacle installed by a qualified electrician.

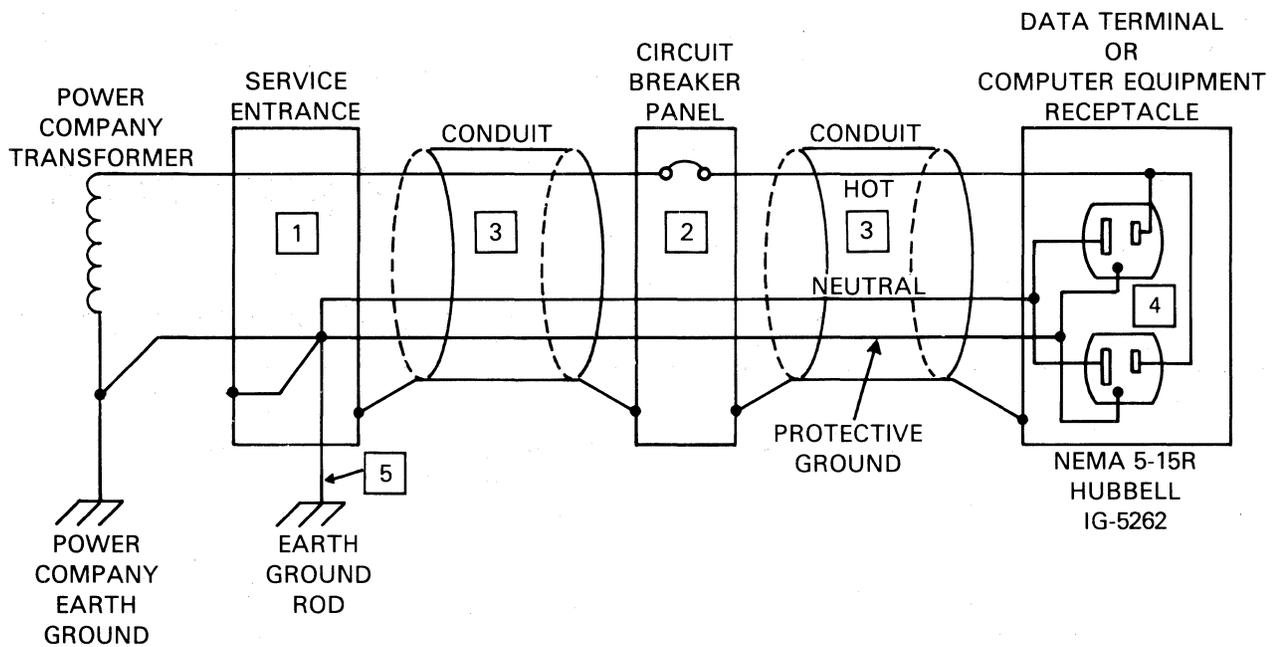
For satisfactory operation, it is recommended that the printer not be installed on the same ac branch circuit with copying machines, water coolers, or similar appliances that produce power-line transients. If printer malfunctions occur as a result of the operation of such devices, it is the user's responsibility to relocate the printer to a different branch circuit or to install appropriate transient-suppression devices.

C.2 EARTH GROUND

In some installations, the earth ground of the power receptacle is supplied by a metal conduit that connects to the neutral phase at the circuit-breaker box. Depending on site conditions, this metal conduit can conduct current from other sources that can interfere with the operation of a printer plugged into the socket. To avoid this possibility, it is recommended that the earth ground and neutral be isolated from the conduit (except at the circuit-breaker housing) for the computing system and printer ac circuit as shown in Figure C-1. This ensures that the protective ground carries only fault and leakage currents from the printer or computing system.

C.3 SINGLE-POINT GROUNDING RULE FOR EIA RS-232-C INTERFACE

In a system using the Electronics Industries Association interface EIA RS-232-C, protective ground is electrically connected to the printer frame (chassis ground), which is in turn connected to earth ground via the ac power cord. Signal



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NOTES:

1. Neutral and protective ground are connected together at a single point at the service entrance.
2. Neutral and protective ground are isolated from each other except where connected at the service entrance.
3. Neutral and protective ground are isolated from the conduit except where connected at the service entrance. This is accomplished with a HUBBELL IG-5262 receptacle wired in accordance with the National Electrical Manufacturers Association specification NEMA 5-15R.
4. The protective ground wire should have a resistance of less than 1 ohm.
5. Earth ground should have a resistance of 1 ohm or less.

Figure C-1. AC Power Distribution and Grounding

ground is the common reference potential for all the interface circuits except protective ground. Signal ground and protective ground should be connected, and this connection should be made at only one point in a directly connected system to avoid forming a "ground loop." A ground loop allows unpredictable current flow in the equipment.

Extraneous characters, parity errors, missing characters, and even component damage can be symptoms of multiple, common system grounds. If these problems appear, the signal ground/protective ground connection should be investigated and the correct configuration made.

In general, the connection between protective ground and signal ground should be made in the equipment with the largest ac power (current) requirement. When the printer is connected directly to a central system, such as a host computer that draws much more ac current than the printer, it is recommended that the single grounding point be made at the central system and not at the printer. The data cable should have a protective ground wire. When the cable does not have a protective ground, connections should be made to short the grounds in both the printer and the modem or host at the other end of the data cable. This connection must be made in the manner recommended by the equipment manufacturer and not in the data cable itself.

C.4 PRINTER GROUNDING — SIGNAL GROUND / PROTECTIVE GROUND

The Model 810 printer is normally assembled with protective ground and signal ground connected by a wire between E6 and E7 and a 3900-picofarad (pF) capacitor on the motherboard.

When a system requires the signal-chassis ground to be isolated (ISC option), remove the wire between E6 and E7, but do *not* remove the capacitor. The capacitor is installed to reduce electromagnetic interference (EMI) produced by the printer. Cutting the capacitor permits the Model 810 Printer to radiate EMI above the limit permitted by the Federal Communication Commission (FCC) for this type of device. When in doubt as to which configuration to use, measure the resistance between pins 1 and 7 with the system end connected. If an open circuit is measured, E6 to E7 should have the wire and capacitor installed. If a short circuit is measured, the wire between E6 to E7 should be removed and the capacitor left in.

C.5 STATIC ELECTRICITY

If erratic printer operation occurs in a dry atmosphere, the problem can be caused by static electricity. The following procedures are recommended to obtain static-free operation:

- Ensure that paper baskets are correctly grounded to the printer. (See "Paper Basket Installation" in Section 2 of the *Model 810 Printer Operating Instructions* for proper connections.)
- Keep relative humidity at 40 to 60 percent.
- Place an antistatic floor mat in front of the printer for the operator to stand on.



Appendix D

Theory of Operation

D.1 INTRODUCTION

This section describes the theory of operation for a Model 810 Printer modified to produce enhanced print. The Model 810LQ Printer (Enhanced Model 810) provides data processing and word processing print, graphics, and user-defined (software) fonts.

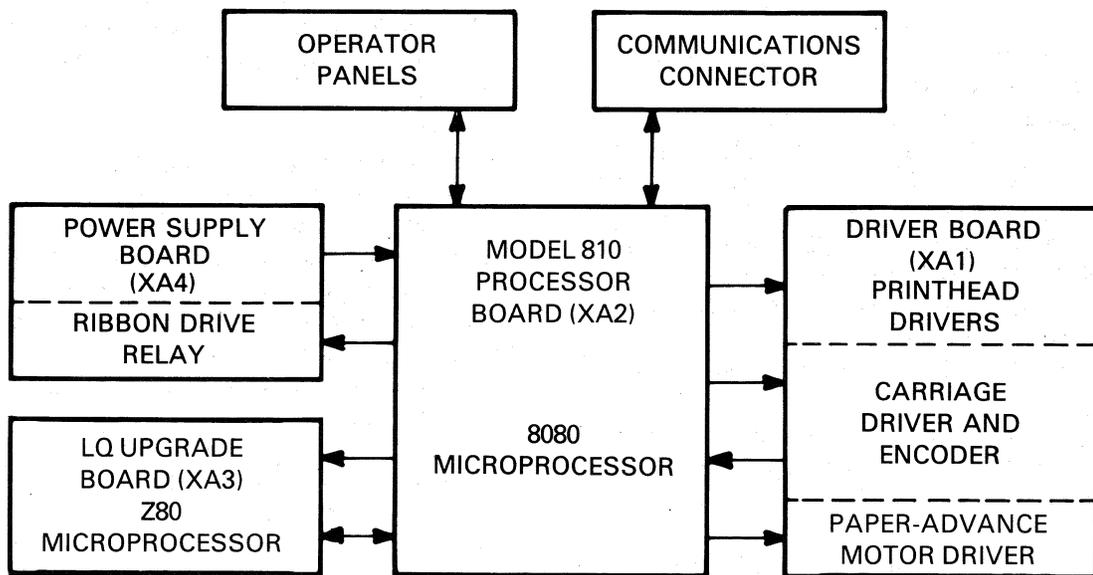
The hardware modification consists of adding the LQ upgrade board (either first or second generation) in the rear slot of the Model 810 Printer card cage and replacing the standard paper-advance stepping motor with the LQ paper-advance stepping motor, which provides greater vertical resolution. The LQ upgrade board, which contains hardware and firmware to control the printer hardware, produces near-letter-quality printout while

retaining standard Model 810 Printer features. The new paper-advance stepping motor has a step one-fourth the step of the standard motor, which results in 11.339 steps per millimeter (288 steps per inch) of vertical paper motion.

The user should be familiar with the theory of operation of the Model 810 Printer, which is described in Section 7 of the *Model 810 Printer Maintenance Manual*.

D.2 GENERAL DESCRIPTION OF BOARD FUNCTIONS

Figure D-1 is a simplified block diagram that shows the relationship of the functional components on the printed wiring boards.



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Figure D-1. Simplified Block Diagram of the Model 810LQ Printer

D.2.1 LQ Upgrade Boards — First and Second Generations

Both the first- and second-generation LQ upgrade boards are functionally equivalent, as shown in the simplified block diagram of Figure D-1. The second-generation LQ upgrade board provides for compatibility with one of the communication options (TTY or RS-422) and for international character set selection. Installation of either LQ upgrade kit provides new firmware for the first 4K addresses of the 8080 microprocessor on the Model 810 processor board. This firmware controls the 8080 microprocessor and causes the Model 810 processor board to send all input data to the 3K FIFO buffer on the LQ upgrade board.

The function of the Z80 microprocessor on the LQ upgrade board is to receive data from the Model 810 processor board, decode control characters and escape sequence commands, and generate the various dot patterns for the print characters and row plot data. All data received from the host system passes through the Model 810 processor board to the LQ upgrade board. Print data is formatted and then returned to the Model 810 processor board for printing.

The firmware for the Model 810 processor provides a serial interface X — ON, X — OFF protocol; paper-advance stepping motor and carriage motor control algorithms, which produce many print variations; and other features described in Section 3.

D.2.1.1 First-Generation LQ Upgrade Board — 2360095, XA3. Installation of the first-generation LQ upgrade board into the XA3 slot of the printer card cage connects a ground to pin P2-35. This ground disables the first 4K addresses of the Model 810 processor board (ROM in XU36) and allows the firmware on the LQ upgrade board to control the 8080 microprocessor on the Model 810 processor board. This firmware does not access the option PROM in XU67 and the VFC option ROM in XU42 on the Model 810 processor board.

Firmware for the Z80A microprocessor resides in four 4K x 8 ROM. Eight 16K x 1 memory devices provide RAM.

D.2.1.2 Second-Generation LQ Upgrade Board — 2232575, XA3P2. Installation of the second-generation LQ upgrade board into the

XA3P1 also requires that the PROM/ROM from socket XU14, assembly 2232575, be exchanged with *non-letter-quality* PROM/ROM in socket XU36 on the Model 810 processor board, assembly 994244. This PROM/ROM provides the firmware to control the 8080 microprocessor on the Model 810 processor board.

Memory on the half-board is physically more compact. Firmware for the Z80A microprocessor resides in two 8K x 8 ROM devices. This firmware on the second-generation LQ upgrade board permits jumper selection of international character sets. Two 16K x 4 memory devices provide RAM.

Again, the second-generation LQ upgrade board is compatible with installation of TTY and RS-422 communication options. The selected option board plugs into the half-board slot XA3P1.

D.2.2 Model 810 Processor Board — 994244, XA2

With the exception of the firmware changes noted in paragraphs D.2.1.1 and D.2.1.2, the Model 810 processor board performs identical functions in the standard Model 810 Printer and the Model 810LQ Printer. These include the communications and hardware interfaces. The 8080 microprocessor provides serial and parallel communication interfaces, carriage motor and paper-advance stepping motor control, printhead control, and operator control panel interfaces. During the time when the carriage is moving across the paper, the LQ upgrade board transmits the dot patterns to the Model 810 processor board for energizing the printhead solenoids.

D.2.3 Driver Board — 994528, XA1

The driver board receives carriage motor control, paper-advance stepping motor control, and printhead control pulses from the Model 810 processor board and converts them to the required control signals needed to drive the carriage motor, the paper-advance stepping motor, and fire printhead solenoids. All drivers are constant-current-switching regulators.

D.2.4 Power Supply Module and Power Supply Board — 994534, XA4

The ac power module converts the ac line voltages to lower ac voltages for the power supply board and fan.

The power supply board provides the required regulated voltage sources for all subsystems in the printer. It also generates the power good and reset signals for initializing the system when the printer is turned on. The ribbon drive relay is also on this board.

D.3 DETAILED MODEL 810 PROCESSOR BOARD AND LQ UPGRADE BOARD OPERATION

The hardware of both the first- and second-generation LQ upgrade boards has five major functional systems:

- 8080 Microprocessor Program and Addressing (U28)
- Z80 Microprocessor System
- Receive FIFO Buffer
- Control Panel Interface
- Interprocessor Communications

This subsection describes the implementation of these functional systems. Refer to Appendix F, Assembly Drawings, Logic Diagrams; and Lists of Materials, for signal references, components, and component locations.

D.3.1 8080 Microprocessor Program and Addressing

Logic and data paths are shown for the first-generation LQ upgrade board in Figure D-2 and for the second-generation board in Figure D-3.

D.3.1.1 8080 Microprocessor Board with the First-Generation LQ Upgrade Board. Figure D-2 shows the logic and data paths on the first-generation LQ upgrade board at the interface with the Model 810 processor board. Plugging the LQ upgrade board into the printer card cage XA3 slot disables the ROM in XU36 (the first 4K addresses) on the Model 810 processor board. The program in ROM U28 on the LQ upgrade board then controls the 8080 microprocessor. This firmware does not access the option PROM in XU67 or the VFC option ROM in XU42. U19 on the LQ upgrade board decodes the addresses to generate a control signal "PROM*" that, through U27, gates the program data on U28 to the 8080 microprocessor through U11.

Most of the remaining 8080 address space is allocated to interface of the standard printer. Two addresses that are not used, >78F0 and >78F1, are chosen as the port addresses for communicating with the Z80 microprocessor on the LQ upgrade board. These signals are decoded by U17, U18, and U19 to generate the port read and write signals. These addresses are not used in the software.

The interrupt acknowledge flip-flop, U39, disables all devices on the LQ upgrade board when the 8080 microprocessor is being interrupted.

D.3.1.2 8080 Microprocessor Board with the Second-Generation LQ Upgrade Board.

Figure D-3 shows the logic and data paths for the second-generation LQ upgrade board at the interface with the Model 810 processor board. The standard ROM in XU36 is removed and exchanged with 8080 ROM supplied on the LQ upgrade board, assembly 2232575, in socket XU14. With the 8080 ROM located on the Model 8080 processor board, the circuit used by the first-generation LQ upgrade board to disable the 8080 ROM is deleted.

The 8080 address space is not changed by using the second-generation LQ upgrade board, with the exception of >78F0 and >78F1. These port addresses are used for communication with the Z80 microprocessor on the LQ upgrade board. The functions of these port addresses are identical for first- and second-generation LQ upgrade boards.

The interrupt acknowledge flip-flop, U2, prevents access to the 8080 data bus by all devices on the LQ upgrade board when the 8080 microprocessor is being interrupted. These signals are decoded by U1 and U22 on the second-generation LQ upgrade board.

D.3.2 Z80 Microprocessor System

D.3.2.1 First-Generation Z80 Microprocessor System. The Z80 microprocessor for the first-generation LQ upgrade board has 16K ROM and 16K RAM plus two ports. Address space >0000 through >3FFF is for ROM. RAM addresses are >4000 through >7FFF. The switch port uses address >8000 and the communication port to the 8080 microprocessor uses I/O addresses >00

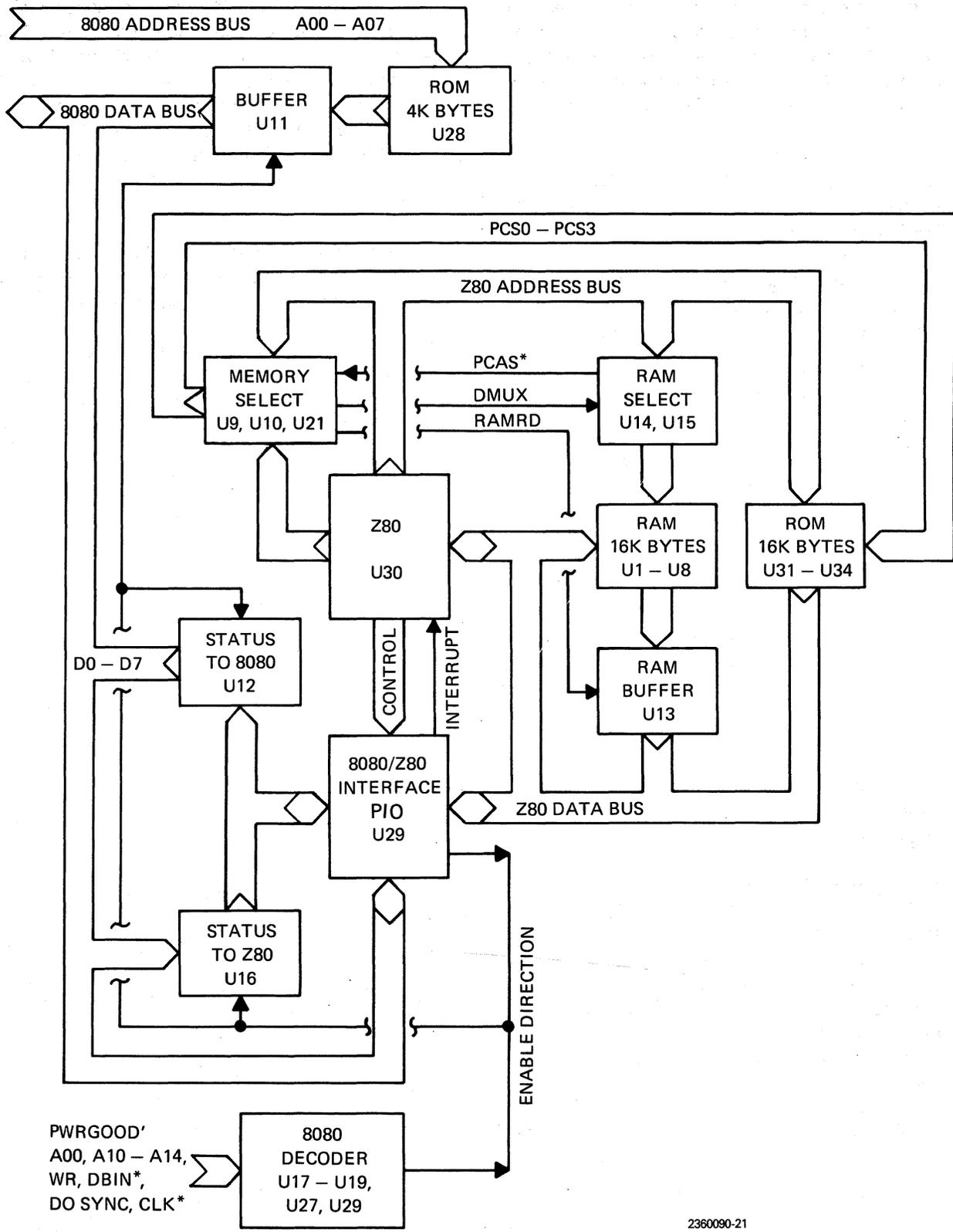
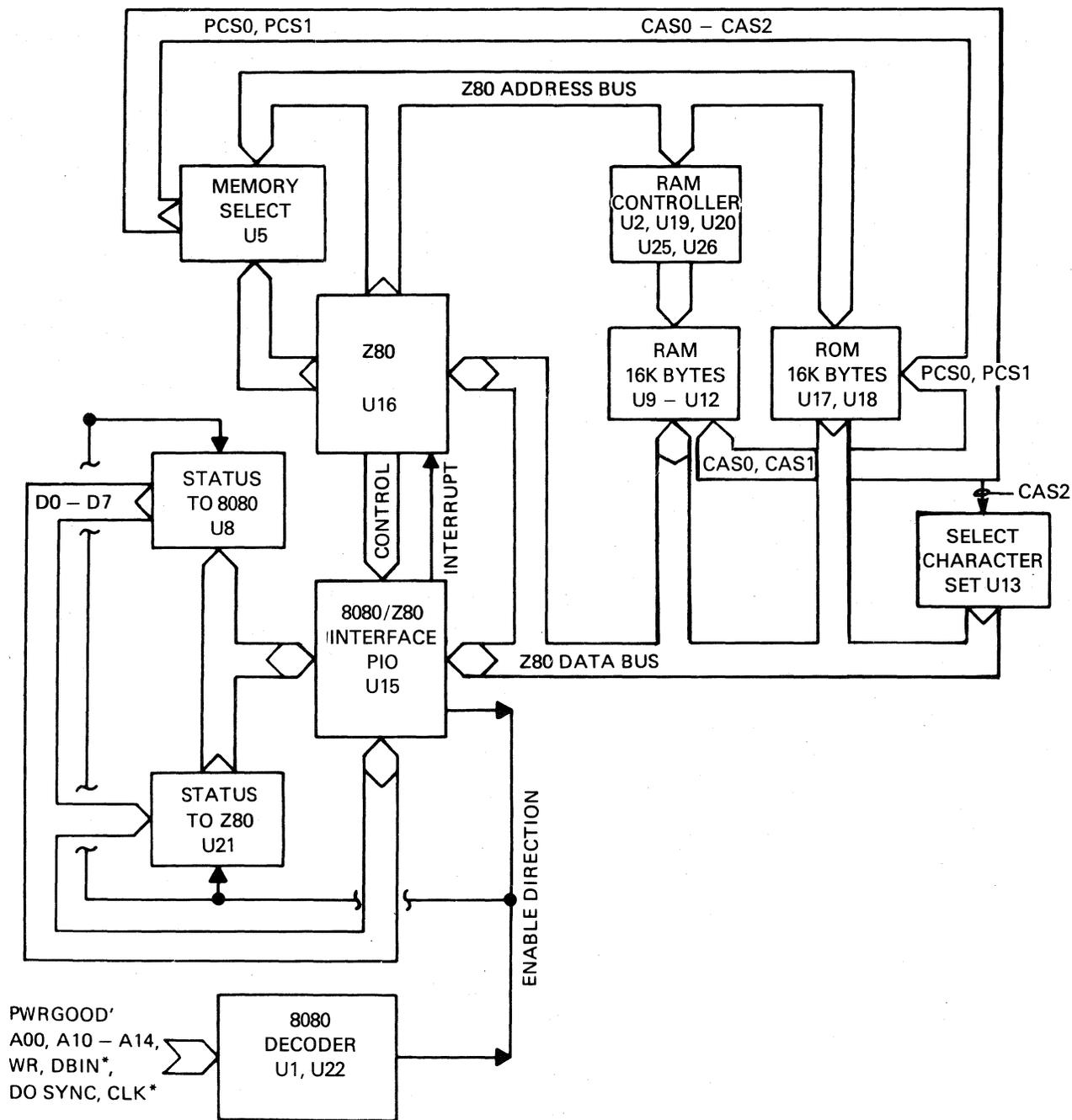


Figure D-2. Simplified First-Generation LQ Upgrade Board Logic Diagram



2360090-22

Figure D-3. Simplified Second-Generation LQ Upgrade Board Logic Diagram

through >03. U9 buffers the signals that drive the RAM array. These are eight 16K x 1 dynamic memory devices. A control signal "ZMREQ*" starts a memory cycle by causing another control signal "RAS*" to go low. The low addresses to the memory are then selected by U14 and U15 and are latched by "RAS*". If the cycle is not a refresh cycle, a control signal "MUX" goes low. This signal is delayed through U9, U14, and U9 twice to generate control signal "CAS*" to the memories.

U13 gates the memory data onto the Z80 bus. The Z80 microprocessor automatically refreshes the dynamic memories. U25 buffers switch data to the processor. U38, U26, and Q1 are the active elements of the clock circuit. An 8-MHz crystal-controlled oscillator is divided by two to produce 4 MHz. This guarantees a 50-percent duty cycle. Q1 ensures a strong clock signal.

D.3.2.2 Second-Generation Z80 Microprocessor System. The Z80 microprocessor for the second-generation LQ upgrade board has 16K ROM (2 ROM each 8K x 8 in U17 and U18), which resides in memory addresses >0000 through >3FFF. There is 16K RAM (2 DRAM each 16K x 4 in U9 and U11), which resides in memory addresses >4000 through >7FFF. The jumpers for the international character sets reside at address >C000 and are implemented by U13.

When the Z80 accesses the RAM, RRSW* stays high to disable the refresh address buffer, U26,

and enable the RAM address buffers, U19 and U20. The row addresses to the memory are then gated through U19 and U20 onto the DRAM address bus. After 70 ns, the address bus becomes stable, and ZMREQ* and ZMRD* go low. As ZMRD* goes low a flip-flop, 1/2 U2, is enabled. CAS* is clocked low by the Z80 with a delay of 40 ns after ZMREQ* goes low and gates the column address onto the DRAM address bus. CAS* is delayed through two buffers to allow the address to become stable. CASD* then enables the CAS decoder to select the RAM or to read the character set jumpers from U13 and complete the memory cycle.

Refresh occurs through discrete logic rather than the Z80 ZRFSH* signal. Whenever the Z80 accesses ROM, RRSW* goes low, which disables RAM address buffers U19 and U20 and enables refresh address buffer U26. ZMRD* then goes low to refresh the DRAMs. After the refresh cycle is complete, the refresh counter is incremented by RFCK* going low to complete the refresh cycle.

ROM reads cause a short wait state, which is generated by U4 to allow the use of slower memory devices.

The active devices for the Z80 clock circuit are U23, U24, Q1, and Q2. An 8-MHz crystal-controlled oscillator is divided by two to produce 4 MHz. This guarantees a 50-percent duty cycle. Q1 and Q2 ensure a strong clock signal.

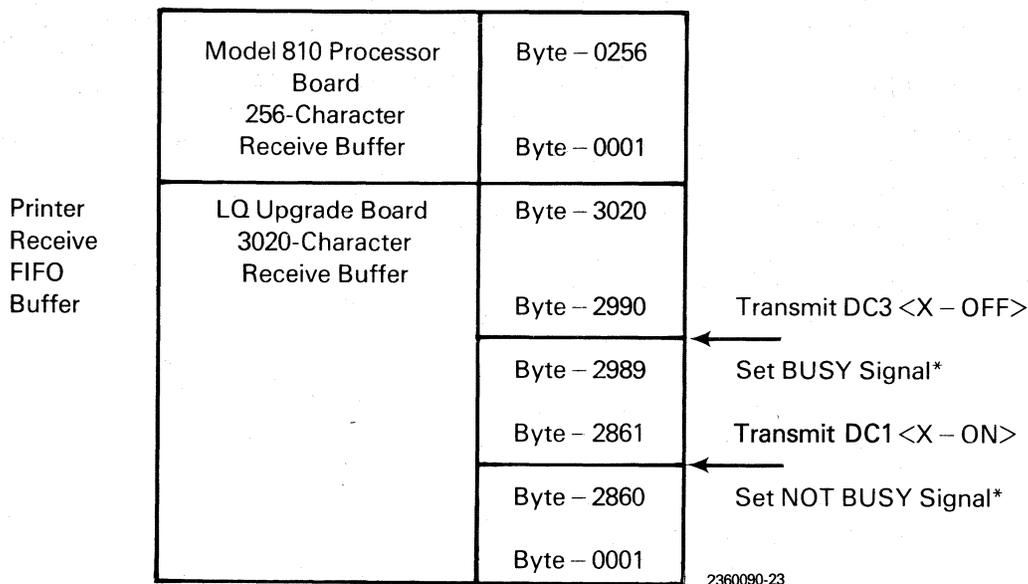
D.3.3 Receive FIFO Buffer

Character data from the host is put into the 256-character receive buffer on the Model 810 processor board. The characters are continually removed from this buffer and sent to a 3K buffer on the LQ upgrade board via the eight-bit parallel interface. These two buffers make up the printer receive FIFO buffer. Figure D-4 shows the FIFO buffer and X — ON, X — OFF points. Characters enter at the top to fill the FIFO from the bottom until the LQ upgrade board buffer is full. DC3 is transmitted when the 3K buffer on the LQ upgrade board is full and cannot accept a character from the Model

810 processor board. The characters are processed from the bottom of the FIFO, and DC1 is transmitted when 2860 characters remain in the 3K buffer.

NOTE

Early first-generation LQ upgrade full-sized boards set X—OFF when 256 addresses remain to be filled and X—ON when 256 addresses remain full.



* Refers to the state of the REVERSE CHANNEL signal in the serial interface and the BUSY signal in the parallel interface. (See the *Model 810 Printer Operator Instructions*, Table 5-1 and Table 5-2.)

Figure D-4. Model 810LQ Printer Receive FIFO Buffer Data Flow

D.3.4 Control Panel Interface

Whenever a button is pressed on the operator control panel, a switch command is sent by the Model 810 processor board to the LQ upgrade board through the interface. The status register tells the LQ upgrade board the difference between a character and a command. The command codes are decoded by the Z80 on the LQ upgrade board, and appropriate instructions for execution are issued to the 8080 microprocessor on the Model 810 processor board. Control panel pencil switches 1 through 5 are read only when the printer goes ONLINE. Pencil switches 6 and 7 are read during interrupt routines, and switch data is entered immediately.

D.3.5 Interprocessor Communication

All interprocessor communication (8080/Z80) takes place through the PIO, a parallel input/output (I/O) device designed specifically to interface with the Z80 microprocessor. This chip is augmented by the "Status to the 8080" and the "Status to the Z80" devices to provide four data paths. The PIO is under Z80 microprocessor control and is programmed at initialization to have a bidirectional "A" port. Also programmed are the interrupt vectors associated with "A" port read/write. The four high bits of the "B" port are programmed to be inputs, and the four low bits of the "B" port to be outputs.

Two signals are important in understanding data transfer through the PIO. ARDY is a flag indicating that the Z80 microprocessor has written data to port "A" and that the 8080 microprocessor should read the data. BRDY is a flag indicating that "A" port can accept data from 8080. Both flags are checked by the 8080 through the "Status to the 8080" device.

The LQ upgrade board provides the Model 810 processor board with status information as follows:

- The Z80 microprocessor is ready to send a command or data byte to the Model 810 processor board.
- The FIFO buffer is full.
- The printer is a BSC, FLC, FCO, VFC, or VCO (this determines the jumper selection on the LQ upgrade board).
- The LQ upgrade board is not ready to receive data from the Model 810 processor board.

The Model 810 processor board provides the LQ upgrade board with status information as follows:

- The 8080 microprocessor is idle and can accept commands from the LQ upgrade board.
- The 8080 microprocessor is printing from right to left and accepting printhead data from the LQ upgrade board.
- The 8080 microprocessor is printing from left to right and accepting printhead data from the LQ upgrade board.
- The 8080 microprocessor is presenting a byte to the LQ upgrade board.
- The 8080 microprocessor is presenting a "switch command" byte to the LQ upgrade board.
- The 8080 microprocessor tells the LQ upgrade board that the compressed print option is installed.

D.4 FIRMWARE

From the perspective of the Z80 microprocessor on the LQ upgrade board, the rest of the printer appears to be an intelligent peripheral that is controlled by sending commands and data over the eight-bit "A" port and monitoring status on the eight-bit "B" port.

D.4.1 8080 Microprocessor

D.4.1.1 8080 Commands. The 8080 microprocessor responds to 26 different commands from the LQ upgrade board. This set of commands is sufficient to permit the LQ upgrade board to have control over the printer. The commands are as follows:

- Start printing and indicate direction of print.
- Do a line feed.
- Advance to top of form.
- Go ONLINE and set baud rate and parity with the pencil switches.
- Go OFFLINE.
- Accept the next two bits as left-edge character position for printing.
- Accept the next two bits as right-edge character position for printing.
- Accept the next two bits as number of steps to advance paper.
- Accept the next byte as steps-per-line-feed data.
- Accept the next byte as length-of-form data.
- Accept the next byte as line-number data and set vertical tab.
- Advance to vertical tab.
- Accept the next byte as line-number data.

- Accept the next byte as vertical format memory channel address and store.
- Accept the next byte as vertical format memory channel address and load.
- Set the carriage to 120 positions per inch.
- Set the carriage to 198 positions per inch.
- Interrogate pencil switch 6.
- Clear all vertical tab stops.
- Sound the audible tone for 500 ms.
- Sound the audible tone for 100 ms.
- Accept the next two bits as number of steps to move the paper in reverse.
- Set the carriage speed to 15 ips.
- Set the carriage speed to 7.5 ips.
- Advance the paper to next line using 28 steps.
- Turn on the parity error lamp.

D.4.1.2 8080 Firmware Modules. This paragraph summarizes programs for the Model 810 processor board after the LQ upgrade board is installed. The Model 810 processor board firmware is located in U28 on the LQ upgrade board. The 8080 firmware modules consist of power-up initialization and the mainline loop.

The power-up initialization functions include:

- Verifying the checksum of the program ROM
- Zeroing the RAM
- Clearing all error lines and lamps
- Initializing the carriage against the LEFT stop
- Setting the form length to 11 inches for the BSC printer

- Setting the form length to the rotary switch selection for the FLC and FCO printers
- Recalling the vertical format for VFC and VCO printers

If the checksum fails, the program goes into an infinite loop and the rest of the initialization is not done. Failure causes all the lamps to light and the audible tone to sound for 500 ms.

The mainline loop functions include:

- Displaying errors (paper out, carriage jam)
- Scanning and execution of the operator control panel switches
- Processing commands from the LQ upgrade board such as:
 - Paper motion
 - Carriage motion and speed
 - Print patterns sent from the LQ upgrade board
- Processing interface signals such as:
 - Serial character input
 - I/O procedures (FIFO buffer)
 - Nonvolatile memory procedures
 - Watchdog timer (carriage jam)

D.4.2 Z80 Microprocessor

The firmware for the Z80 microprocessor on the LQ upgrade board processes all the data characters and issues the required commands to the printer hardware via the 8080 microprocessor on the Model 810 processor board.

D.4.2.1 Z80 Software Data Structures. The major data structures in the Z80 firmware are:

- Input software FIFO used to store characters received from the host via the Model 810 processor board

- Font buffer used to store user-defined character patterns
- Character buffer used for storage of characters to be printed on one line of text (includes font number, character dot pattern, width, and gap)
- Plot buffer used to store one line of six-bit, X-plot data
- Dual dot buffers used to store the dot patterns to be transmitted to the printhead via the Model 810 processor board
- The command FIFO used to store commands to be sent to the Model 810 processor board

D.4.2.2 Z80 Firmware Modules. The Z80 firmware modules consist of a power-up self-test, initialization, and a mainline loop.

The self-test functions include:

- Making a full test of RAM
- Verifying the checksums in the ROM
- Zeroing the RAM

If the test passes, the audible tone sounds for 100 ms. If the test fails, the rest of the initialization is not done and the program goes into an infinite loop.

The initialization functions include:

- Initializing all registers

- Sending a SHORT BELL command (100 ms) to the Model 810 processor board (indicating passage of self-test)

The mainline loop functions include:

- Processing commands from the Model 810 processor board including the control panel (switch processing)
- Processing all characters from the host received via the Model 810 processor board including:
 - Interrupt procedures
 - Character processing
 - ... Horizontal position procedures
 - ... Adding characters
 - ... Plotting
 - ... Print line procedures
 - ... Character generation
 - ... Printing procedures
 - ... Miscellaneous procedures
 - Hexadecimal translation
- Generating characters for the self-test pattern when this mode is active

Appendix E

Troubleshooting

E.1 INTRODUCTION

This section provides recommended procedures for troubleshooting the Model 810LQ Printer. The technician should be familiar with troubleshooting and repair procedures for the standard Model 810 Printer. The first-generation LQ upgrade board (2360095) and the second-generation LQ upgrade board (2232576) perform the same functions with the following exceptions:

- Firmware for the Model 810 processor board with the first-generation LQ upgrade board is on the LQ upgrade board.
- Firmware for the Model 810 processor board with the second-generation LQ upgrade board is on the Model 810 processor board. The second-generation LQ upgrade board has a carrier socket, XU14, which contains a ROM that must be swapped with the Model 810 processor board ROM in socket XU36.
- The second-generation LQ upgrade board provides international character sets. The specific character set selected is determined by jumpers.

The physical differences are:

- The first-generation LQ upgrade board is a full-width board and requires both XA3P1 and XA3P2 locations.
- The second-generation LQ upgrade board is a half-sized board and must be installed in the XA3P2 (left half) location.

Troubleshooting procedures are to the board level only, and repair procedures for the LQ upgrade boards are not provided. For repair of other boards, see the *Model 810 Printer Maintenance Manual*.

E.2 TROUBLESHOOTING PROCEDURES

Successful troubleshooting of the Model 810LQ printer requires that service personnel differentiate between nonhardware and hardware failures. Various sections and appendixes of this manual contain the specific information required to understand the printer functions, and are listed below for reference.

- Printer font selection in manual mode (see Section 2; Table E-1 in this appendix)
- Printer functions (see Section 3)
- Print quality comparison (see Section 4)
- Printer variances and precautions (see Section 4)
- Software application errors (see subsections 4.3 and 4.4)
- Print quality improvement (see Appendix B)
- Printer installation and grounding (see Appendixes B and C)
- Assembly failure diagnostics (see Table E-2 in this appendix)

E.2.1 Software Debug

When the printer is in the software debug mode, all data including the parity bit is converted to the hexadecimal value and then printed. The printout allows the user to see the received data and diagnose problems. Refer to Table 5-1, which gives the decimal numbers, ASCII code characters, and binary codes in hexadecimal notation with a zero parity bit.

Raise the top cover of the printer and locate the TEST/VFC switch and the 8 LPI switch on the auxiliary control panel. Refer to Figures 2-9 and 2-10, which show several versions of this panel to illustrate the locations of these switches.

To manually select a font, activate the TEST/VFC switch. Next, activate the 8 LPI switch nine times to select the hexadecimal listing. An audible tone (beep) sounds each time the 8 LPI switch is activated. The information in Table 2-2 is reproduced here as Table E-1 for the user's convenience. Table E-1 gives the number of switch actions required to select a specific font. The selection cycle repeats after the ninth switch operation.

After the hexadecimal listing is selected, activate the NORMAL switch. The selection is retained when power goes off in printers having the VCO or VFC option.

E.2.2 Power-Up Self-Tests

E.2.2.1 Model 810 Processor Board Power-Up and Initialization Functions. These functions include:

- Verifying the checksum of the program ROM (U28 on the first-generation LQ upgrade board or U36 on the Model 810 processor board for the second-generation LQ upgrade)
- Zeroing the RAM
- Resetting and initializing mode
- Resetting and initializing functions
- Clearing all error lines and lamps
- Initializing the carriage against the LEFT stop
- Setting the form length to 279.4 mm (11 in) for the BSC printer
- Setting the form length to the rotary switch selection for the FLC and FCO printers

Switch Actions (No. of Beeps)	Font Selection	Characters per Inch*	Spacing	Software Control Designations
1	Standard Model 810	10	Fixed	ESC #0 ESC V 24 ESC T
2	Courier	12	Proportional	ESC #5 ESC I 6 ESC U
3	Courier	10	Proportional	ESC #5 ESC I 10 ESC U
4	Helvetica	12	Proportional	ESC #6 ESC I 8 ESC U
5	Helvetica	10	Proportional	ESC #6 ESC I 12 ESC U
6	Elite	12	Fixed	ESC #7 ESC V 20 ESC T
7	Elite	10	Fixed	ESC #7 ESC V 24 ESC T
8	Focus	10	Fixed	ESC #1 ESC V 24 ESC T
9	Hexadecimal Listing			ESC #1 ESC V 24 ESC T
10	(Selection Cycle Repeats)			

* Characters per inch is approximate for proportional spacing.

Table E-1. Front Panel Selection of Fonts

- Recalling the vertical format for the VFC and VCO printers

If the checksum fails, the program goes into an infinite loop. The rest of the initialization is not completed. Failure causes all the lamps to light, the audible tone to sound for 500 ms, and the carriage does not initialize to the left margin.

E.2.2.2 LQ Upgrade Board Power-Up Self-Test and Initialization. The self-test functions include:

- Making a full test of RAM
- Verifying the checksums of the ROM (U31 through U34 on the first-generation LQ upgrade board or U17 and U18 on the second-generation LQ upgrade board)
- Zeroing the RAM

The initialization functions include:

- Initializing all registers
- Sending a SHORT BELL command (100 ms) to the Model 810 processor board (indicating passage of self-test)

If the test passes, the audible tone sounds for 100 ms. If the test fails, the rest of the initialization is not done, and the program goes into an infinite loop.

E.2.3 Troubleshooting Processor Boards

To determine whether the Model 810 processor board or the LQ upgrade board is the cause of failures that are not related to printing, perform the following analysis, which permits isolation of the fault.

E.2.3.1 First-Generation LQ Upgrade (Full-Sized) Board. Remove the LQ upgrade board. The Model 810LQ Printer then returns to standard Model 810 Printer operation as run by firmware on the Model 810 processor board. The power-up self-test must run if the Model 810 processor board has not failed. The barberpole test or data from a host produces overprinted lines because of the smaller step of the LQ paper-advance stepping

motor. A single line feed entered as a line terminator followed by eleven additional line feeds can cause the printer to produce standard Model 810 Printer copy. This is not always true, however, because the stepping motor algorithm on the Model 810 processor board differs from the LQ upgrade board algorithm. Paper motion, however, must be observed for this analysis to isolate defects to the LQ upgrade board.

E.2.3.2 Second-Generation LQ Upgrade (Half-Sized) Board. Remove the LQ upgrade board and replace it with a known-good LQ upgrade board, and then check printer operation.

Remove the Model 810 processor board and replace it with a known-good Model 810 processor board, and then check printer operation.

NOTE

VCO and VFC printers require that all vertical format information, including the font, be reprogrammed. This can be done either manually or with software.

Another method is to remove both the Model 810 processor board and the LQ upgrade board. If a ROM is located in socket XU14 on the LQ upgrade board, swap it with the ROM in socket XU36 on the Model 810 processor board.

CAUTION

Repeated handling of memory devices creates a risk of static damage and bent pins.

Install the Model 810 processor and check operation of the printer. The Model 810LQ Printer then returns to standard Model 810 Printer with the exception of the paper-advance motor. The barberpole test or data from a host produces overprinted lines because of the smaller step of the LQ paper-advance stepping motor. A single line feed entered as a line terminator followed by eleven additional line feeds can cause the printer to produce standard Model 810 Printer copy. This is not

always true, however, because the stepping motor algorithm for the Model 810 Printer differs from the LQ upgrade algorithm. Paper motion, however, must be observed for this analysis to isolate defects to the LQ upgrade board.

E.2.3.3 Second-Generation LQ Upgrade Board ROM/EPROM Location Truth Table.

Table E-2 is a guide to help distinguish the placement of the STANDARD ROM/EPROM and the LETTER-QUALITY ROM/EPROM by the operation of the printer with the second-generation half-board. In each case, both the Model 810 processor board and LQ upgrade board are installed.

E.2.4 Failure Analysis Chart

Table E-3 gives an analysis of malfunctioning printer components. Numbers in the table indicate the order of failure probability. Use the left column to identify the failure within one of the categories. Read across to the numbers and up from each

number to find the area of probable failure. Corrective actions are listed in the right-hand column.

NOTE

VCO and VFC printers require that all vertical format information, including the font, be reprogrammed. This can be done either manually or with software.

For the printer to operate properly, it is necessary to load the nonvolatile memory with font and line feed data. The nonvolatile memory must be loaded if the Model 810 processor board, CMOS RAM, or battery is replaced. See subsection B.5, Installation Checkout, for a procedure to load the nonvolatile memory.

Table E-2. ROM/EPROM Location Truth Table

Location of ROM or EPROM		Results
XU36	XU14	
Letter Quality	Standard	Fully functional letter-quality printer*
Letter Quality	No ROM/EPROM	Fully functional letter-quality printer*
Standard	Letter Quality	Printer prints; however, lines overlap

* If the ROMs or EPROMs are installed correctly and the line spacing is still incorrect, initialize the nonvolatile memory. Perform step 5 of paragraph B.5, Appendix B.

Table E-3. Failure Analysis Chart

FAILURE CATEGORY	POSSIBLE AREA OF FAILURE														CORRECTIVE ACTION					
	AC MODULE (9944481)	POWER SUPPLY BOARD (9944534)	DRIVER BOARD (9944528)	PROCESSOR BOARD (9942244)	MOTHERBOARD (9945312)	MOTOR ENCODER ASSY (9945346)	CONTROL PANEL (9944558)	LO UPGRADE BOARD (2217274)	HOST	CHARASSIS BOARD (2380096, 2228278)	SIGNAL GROUND	CONFIGURATION	RIBBON DRIVE	PAPER FEED ASSY (2208274)		PAPER FEED MOTOR (9942072)	FAN ASSEMBLY (994275)	AC POWER FUSES (416434)	MOTHERBOARD (MPB) FUSES (416434)	PRINTHEAD TO PLATEN ADJUST	MECHANICAL ASSEMBLY (994291)
1. Fails to align carriage: Power on, LED ON Power on, LED OFF	3	4	5	2	3	4										1	2			Recycle power switch several times. Remove all circuit boards except power supply board to check for shorted +5V or -12V.
2. Fails to print (error light not on). a. Self-test mode (1) Carriage moves normally. (2) Carriage does not move. b. Print quality and mode (1) Prints too light. (2) Misses dots. (3) Misses characters. c. Fails to print (self-test OK) or move carriage through ONLINE.																		1	2	User-defined font not loaded. Cycle power or enter ESC Z (see par. 7.2.20). Check fuse F1 on motherboard. 75-Vac power supply. Replace worn ribbon. If printer maintains column position on printed characters, check pencil switches. See Section 3 of the <i>Model 810 Printer Operating Instructions</i> . Check cables and software compatibility.
3. Carriage: a. Drifts left or right. b. Slams left or right.				2	3	1														Check capstan, wire rope, and carriage. Check closely for damage after a slam.
4. Blows line fuse but motherboard fuses are OK.	1				2															Check for proper fuse size and line voltage setting. Remove all cards and internal ac power cable from motherboard and recheck.
5. Blows fuse F2 on motherboard (3ASB) 30-Vdc power supply.		1	2		3	4														Disconnect motors and remove circuit boards, then recheck. Test filter capacitor C1 on motherboard.
6. Blows fuse F5 on motherboard (1.5A) 28-Vac power supply.		3			4						2									Disconnect fan ribbon drive and recheck.
7. Blows fuse F3 on motherboard (1A) 20-Vac power supply.		1			2															
8. Blows fuse F4 on motherboard (1A) 20-Vac power supply.		1			2															
9. Blows fuse F1 on motherboard 75-Vac power supply.		2	1				3													
10. Fan stops.																				Check for frozen fan motor.
11. Ribbon drive is inoperative.		3			4						2							1		Note that processor-controlled ribbon runs during printing only.

NOTE: Numbers indicate the order of failure probability.

2360090-61

Table E-3. Failure Analysis Chart (Concluded)

FAILURE CATEGORY	POSSIBLE AREA OF FAILURE																CORRECTIVE ACTION					
	AC MODULE (994461)	POWER SUPPLY BOARD (994534)	DRIVER BOARD (994528)	PROCESSOR BOARD (994244)	MOTHERBOARD (994531-2)	MOTOR BOARD (994531-2)	CONTROL ENCODER ASSY (994536)	PRINTHEAD (2217374)	LQ UPGRADE BOARD (994535)	HOST	CHASSIS GROUND (2220375)	SIGNAL GROUND	CONFIGURATION	RIBBON	PAPER DRIVE ASSY (2208274)	PAPER FEED MOTOR (994207-2)		AC ASSEMBLY (996275)	AC POWER FUSES (416434)	MOTHERBOARD (MB) FUSES (416434)	PRINTHEAD TO PLATEN ADJUST	MECHANICAL ASSEMBLY (994291)
12. Power does not come up (panel indicator does not light).	3	4	5													1	2					Recycle power several times to check for inadvertent crowbar operation. Measure +12V and -5V on power supply board; defective +12V inhibits -5V supply.
13. Carriage moves and stops, error light blinks.				2	4	3																Check penetration adjustment. Check for obstruction of carriage movement.
14. No response to manual panel inputs, but power indicator is ON.							1															Check cable connections.
15. Vertical format programs are not retained on power-down.				1			2															Check battery and CMOS RAM (U25).
16. Paper does not advance on line feed or partial advance results in overprinting.																						Vertical motion index set to zero. Cycle power or enter ESC Z (see par. 7.2.23).
17. Form feeds intermittently or randomly.								1		2												
18. Vertical character registration is out of tolerance.													2				1					Check gearmesh. Change paper drive plastic gear if worn.
19. Paper feeds out of tractors.														1								Adjust lateral tractor tension (right tractor). Check paper box alignment with chute.
20. All lights stay on and the bell sounds continuously on power-up.	3			2			1															Indicates power-up test failure. Recycle power. Replace LQ upgrade board.
21. Overprints lines, LQ functions do not work.				2	3		1						4									TEST* is not grounded on motherboard by installation of LQ upgrade board.
22. Prints incorrect dot patterns for standard fonts.				2	3		1															Run LQ barberpole print test.
23. Prints incorrect dot patterns for user-defined fonts. Standard fonts OK.				3			2	1														Run LQ barberpole print test and inspect user-defined font area.
24. During a long printout, characters print OK initially but become garbled.							1			2												Ensure the host system is monitoring busy. This symptom indicates buffer overflow.
25. Prints unexplainable garbage.						3	1			2												Check baud rate (pencil switches).

NOTE: Numbers indicate the order of failure probability.

Appendix F

Assembly Drawings, Logic Diagrams, and Lists of Materials

This appendix contains assembly drawings, logic diagrams, and lists of materials for the upgrade of the Model 810 Printer to the Model 810LQ Printer.

TI Drawing No.	Title	LMS	Page No.
2360097	Diagram, Logic, Letter-Quality Printer		F-2
2360095	Letter-Quality Assembly	-0001, -5001	F-7
2232577	Schematic, Letter-Quality, 2nd Gen		F-11
2232575	Letter-Quality Assembly, 2nd Gen	-0001, -5001, -5501	F-16

8

7

6

5

4

3

2360097 2

1

MEMORY DECODE

D

D

C

C

B

B

A

A

8

7

6

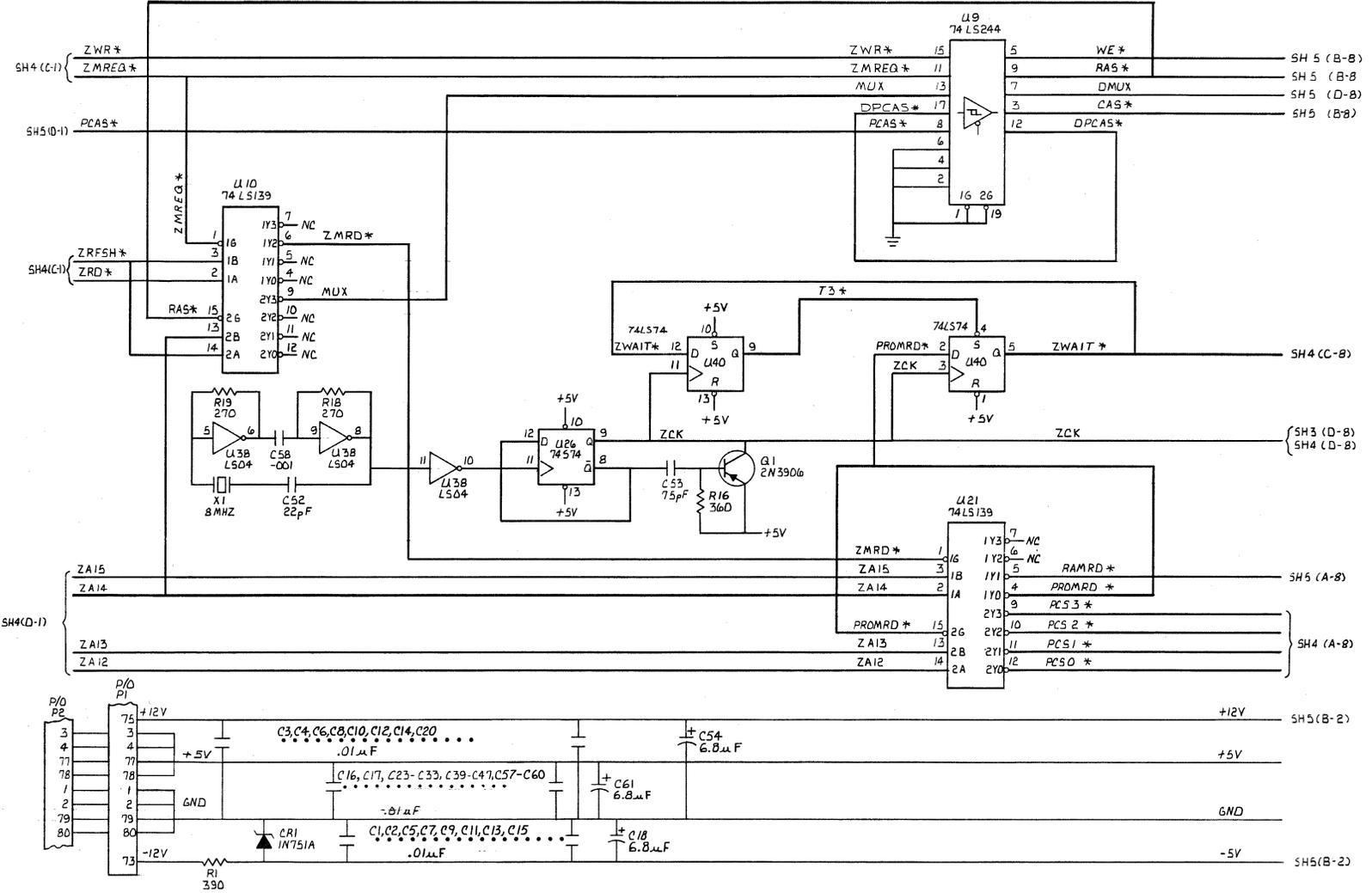
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4

3

2

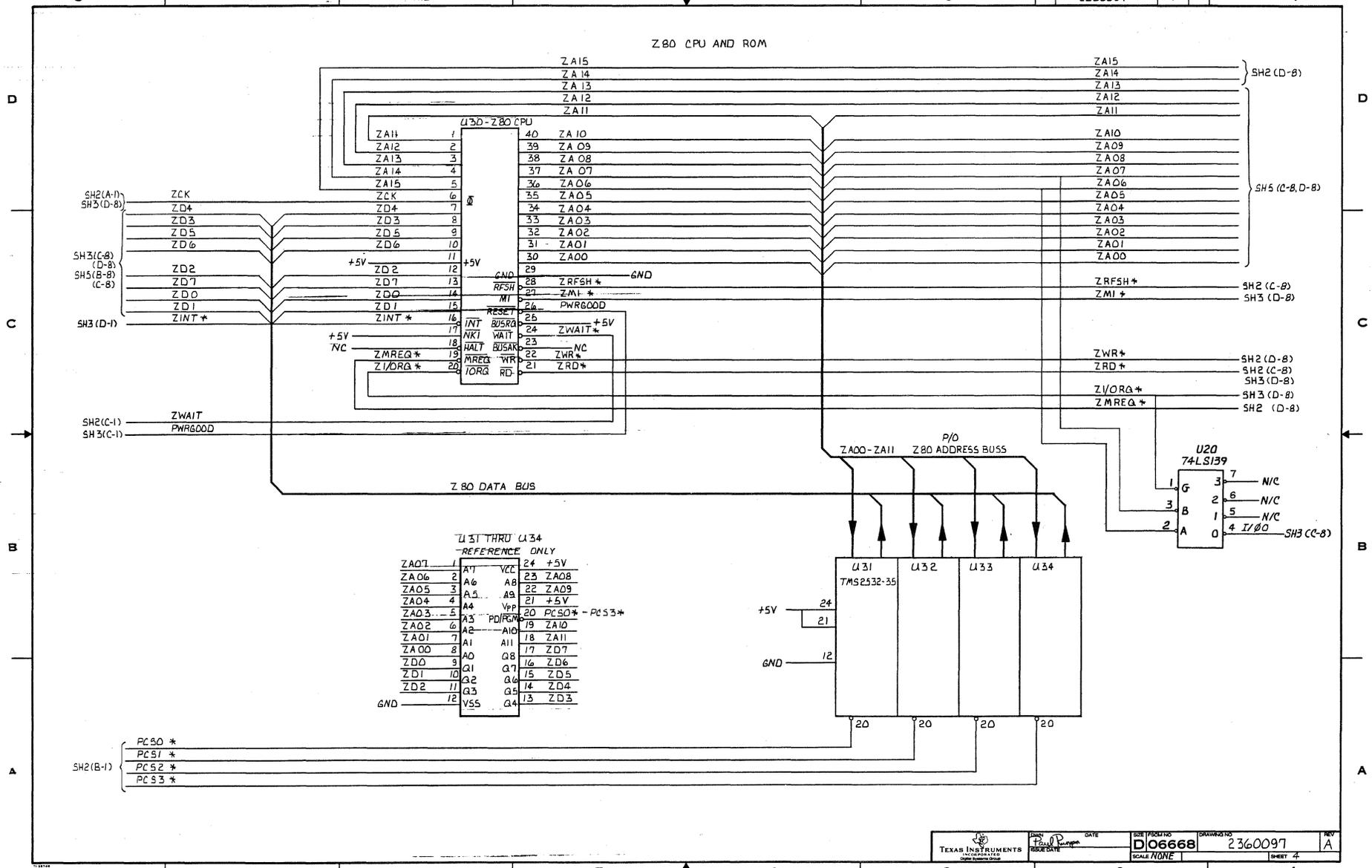
1



 TEXAS INSTRUMENTS <small>DAVIDSON BUILDING MILLS CREEK DRIVE DALLAS, TEXAS 75243</small>	DRAWN <i>Paul Penney</i>	DATE 4-30-82	SIZE FROM NO. D06668	DRAWING NO. 2360097	REV A
	DESIGNED DATE	CHECKED DATE	SCALE NONE	SHEET 2	

F-3

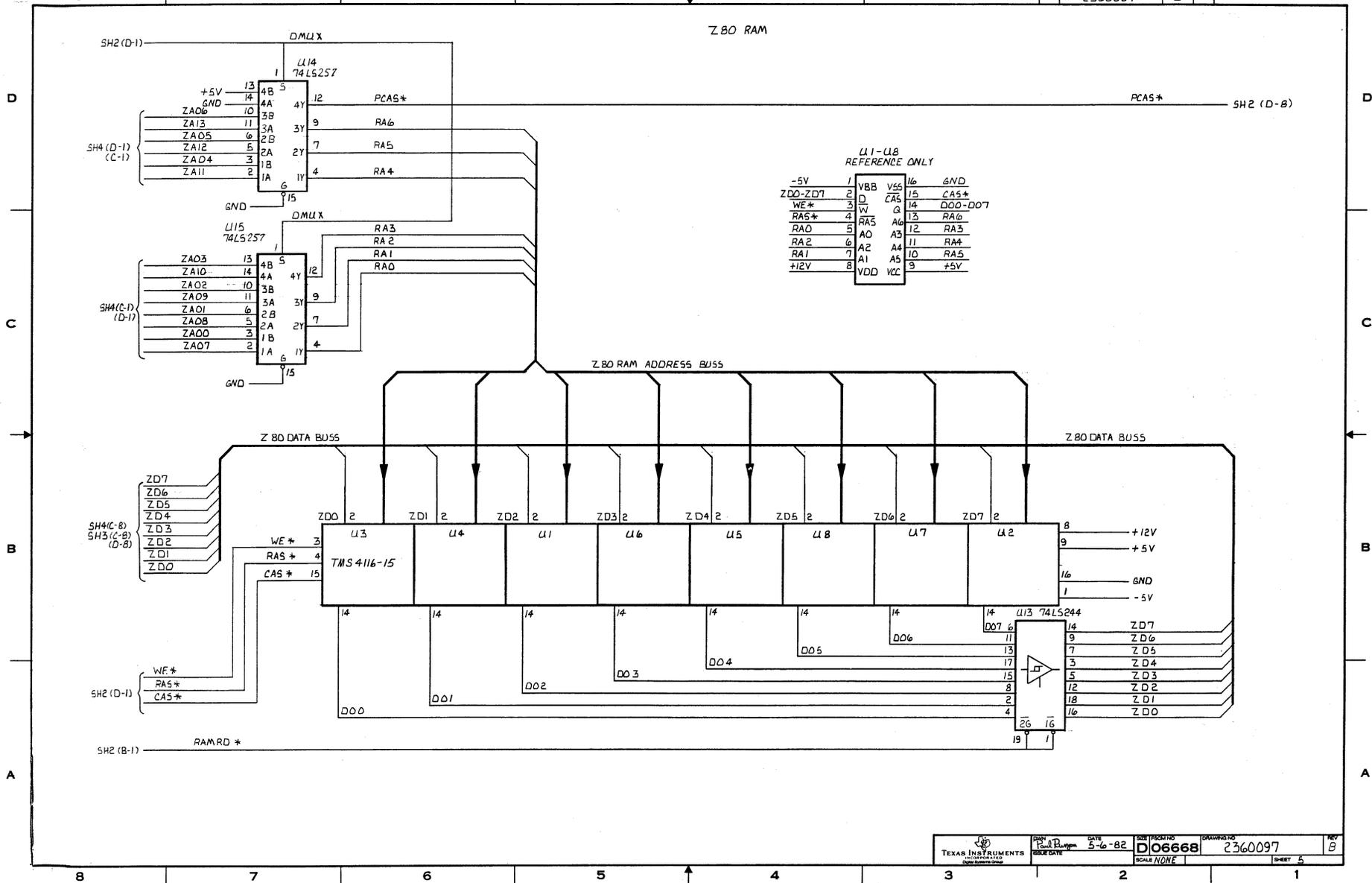
Z80 CPU AND ROM



LIST THRU U34
REFERENCE ONLY

ZA07	1	A1	VCC	24	+5V
ZA06	2	A6	A8	23	ZA08
ZA05	3	A5	A9	22	ZA09
ZA04	4	A4	Vp	21	+5V
ZA03	5	A3	Vp	20	PC50* - PC53*
ZA02	6	A2	PD/PGM	19	ZA10
ZA01	7	A1	A10	18	ZA11
ZA00	8	A0	A11	17	ZD7
ZD0	9	Q0	Q8	16	ZD6
ZD1	10	Q1	Q7	15	ZD5
ZD2	11	Q2	Q6	14	ZD4
		Q3	Q5	13	ZD3
GND	12	VSS	G4		

SH2(B-1) {
PC50 *
PC51 *
PC52 *
PC53 *



8

7

6

5

4

3

1

NOTES: UNLESS OTHERWISE SPECIFIED:

1 POSITION JUMPERS (ITEM 30) PER TABLE I AND PRINTER TYPE.

2 JUMPER WIRE (ITEM 32) INSTALLED BETWEEN GULL LAND & GULL LUG POSITION.

3 LOCATE LABEL (ITEM 36) IN LOWER RIGHT HAND CORNER OF PC BOARD IN APPROXIMATE LOCATION AS SHOWN.

4 JUMPERS WILL BE IDENTIFIED ON THE SALES ORDER.

5. MAXIMUM LEAD LENGTH TO BE 203 MM FROM CONDUCTOR SIDE OF BOARD

6. CAUTION: THIS ASSEMBLY AND COMPONENTS ARE SUSCEPTIBLE TO DAMAGE FROM ELECTROSTATIC DISCHARGE. PERSONAL AND EQUIPMENT GROUNDING AND PROTECTIVE PACKAGING ARE REQUIRED

7 INSTALL EJECTORS (ITEMS 31 AND 35) AFTER PROCESS 2

REV	DESCRIPTION	DATE	APPROVED
A	CN48716(1) SD (1) - 1 LM ITEM 30 WAS QTY 1	8-5-82	J.D. Doherty
B	CN468966 (2) SD (1) - 1 LM: DELETED ITEM 11, ADDED ITEM 40, 41, 42, 43 AND 44 (2) NOTE 1 WAS ...TABLE I. (3) DELETED NOTE 4	8-5-82	J.D. Doherty
C	CN494731 (B) (1) ON -0001 LM, REVISED ITEM 30 AND ITEMS 40-44 (2) ON - 1 LM, DELETED ITEM 37 (3) ON -5001 LM, ADDED U20 TO ITEM 5	2/1/83	R. Holzman
D	CN503596 (C) (1) ON -5001 LM, ITEM 6 WAS P/N 972686-1	8/11/83	R. Holzman
E	CN503589 (B) (1) ON - 1 LM, ITEMS 40-43 WERE REVISED	2/1/83	R. Holzman
F	CN506202 (C) (1) ON -5001 LM, ITEM 8 WAS P/N 2210662-1	2/1/83	R. Holzman
G	CN507024 (C) SD (1) - 5001 LM: ITEM 4 QTY WAS 4, ITEM 5 QTY WAS 3, DELETED ITEM 6 (2) - 1 LM, ADDED ITEM 45, 46 AND 47	3-25-83	J.D. Doherty
H	CN491467 (B) SD (1) - 1 LM: ITEM 40 WAS 2230485-3	3-25-83	J.D. Doherty
J	CN498744 (B) REX KARL (1) - 1 LM: ITEM 41 WAS 2230486-11 ITEM 43 WAS 2230486-13	5-16-83	J.D. Doherty
K	CN505431 (D) PRUNYON (1) ON -8001 LM ADDED ITEM 2 AND ITEM 1 QTY WAS 1, 00	8-23-83	R. Holzman
L	CN505787 (B) PRUNYON (1) ON -0001 ITEM 40 P/N WAS 2230485-0004	8-23-83	R. Holzman
M	CN506784 (D) PRUNYON (1) ON -0001 LM ADDED ITEM 48 (2) CRNAD TITLE QTY -0001 & -8001	8-23-83	R. Holzman
N	CN506787 (B) PRUNYON (1) ON -0001 LM ITEMS 41, 42, 43 & 44 P/N'S WERE 2230486-21, 2230486-0006, 2230486-0023 & 2230486-0008	8-23-83	R. Holzman

D

D

C

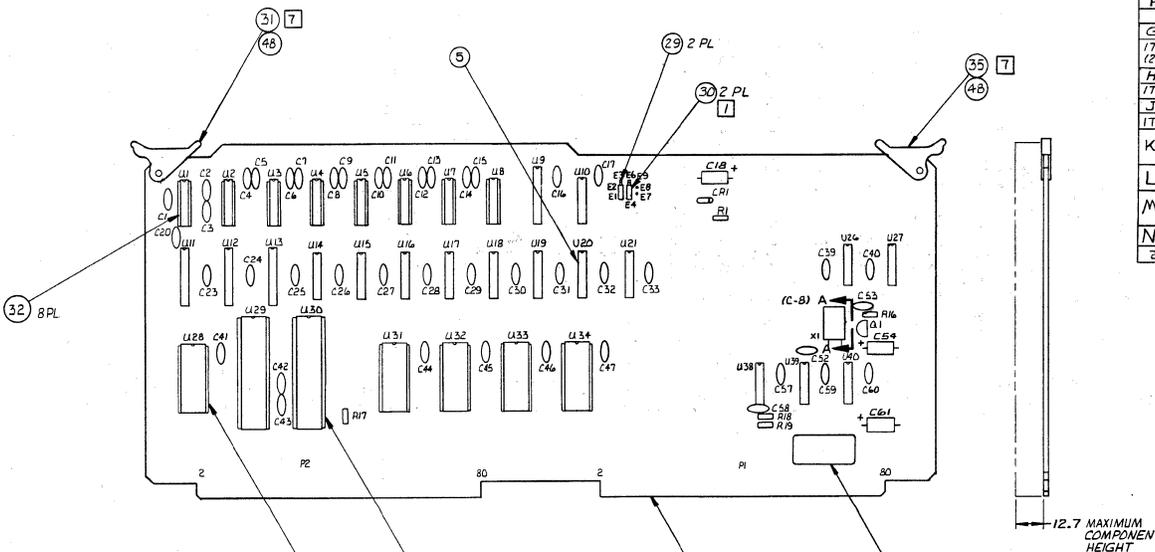
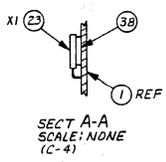
C

B

B

A

A



MM	IN
0.25	.010
C-5	.02
2.3	.09
12.7	.50
2.53	.080

PRINTER TYPE	JUMPER SETTINGS
BSC	E2-E3, E5-E6
VFC/FLC	E2-E3, E4-E5
VCO/FCO	E1-E2, E4-E5

JUMPER POSITIONS FOR STANDARD ASSY - E1-E2, E4-E5 (VCO/FCO)

TABLE I

PART NUMBER	DESCRIPTION
2360095 - 5001	AUTO INSERTED PARTS LIST FOR -0001
2360095 - 0001	TWB ASSY, BIG L& (FULL SIZE)

QTY	DESCRIPTION	UNIT	REMARKS
1	SLDR	127-01	00
1	SLDR	124-02	00
1	MARK	902-01	01

REV	STATUS	DATE	BY
1	ISSUED	8-5-82	J.D. Doherty

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SLDR	127-01	00
2	SLDR	124-02	00
1	MARK	902-01	01

QTY	DESCRIPTION	UNIT	REMARKS
3	SL		

LIST OF MATERIALS

01/18/84

PART NUMBER REV DESCRIPTION.....
 2360095-0001 N PWB ASSY, 810 LQ (FULL-SIZE)

ITEM.	QUANTITY.	COMPONENT..	DESCRIPTION.....	UM
0002	RFF	2360097-0001	DIAGRAM, LOGIC, LETTER QUALITY PRINTER-810	EA
0003	00008.000	0996680-0003	IC, TMS4116-15/Z41137, 16K DYNAMIC RAM	EA
0003A			001295-TMS4116-15 U1, U2, U3, U4, U5, U6, U7, U8	
0012	00001.000	2210972-0001	001295-TMS4116-15 IC, PARALLEL I/O CONTROLLER	EA
0012A			SEE TI- DRAWING U29	
0013	00001.000	2210301-0001	SEE TI- DRAWING IC, MICROPROCESSOR, CPU	EA
0013A			056708-280A-CPU-PS U30	
0016	00003.000	0972924-0018	056708-280A-CPU-PS CAP FIX TANT SOLID 6.8 MFD 10 % 35 VOLT	EA
0016A			QPL -M39003/1-2304 C18, C54, C61	
0017	00041.000	0530953-0001	QPL -M39003/1-2304 CAP, FIX, CERAMIC .01 MF 50V 80-20%	EA
0017A			CRL - CK103 C1, C2, C3, C4, C5, C6, C7, C8, C9	
0017B			CRL - CK103 C10, C11, C12, C13, C14, C15, C16	
0017C			CRL - CK103 C17, C20, C23, C24, C25, C26, C27	
0017D			CRL - CK103 C28, C29, C30, C31, C32, C33, C39	
0017E			CRL - CK103 C40, C41, C42, C43, C44, C45, C46	
0017F			CRL - CK103 C47, C57, C59, C60	
0018	00001.000	0410529-0102	CRL - CK103 CAP FIX CERAMIC .001 MF 10% 1 KV	EA
0018A			CRL - DD-102 C58	
0019	00001.000	0972929-0367	CRL - DD-102 CAP FIX CERAMIC 22.0 PF 10 % 200 V	EA
0019A			QPL -M39014/01-1367 C52	
0020	00001.000	0972926-0024	QPL -M39014/01-1367 CAP FIX MICA 500V 75.0 PF 5 %	EA
0020A			QPL -CM04E750J0D C53	
0021	00001.000	0236091-0022	QPL -CM04E750J0D XST 2N3906	EA
0021A			004713-2N3906 Q1	
0022	00001.000	0972934-0006	004713-2N3906 DIODE, 1N751A 5.1 V 5% SIL VOLT REG	EA
0022A			QPL - 1N751A CRL	
0023	00001.000	0538031-0003	QPL - 1N751A CRYSTAL UNIT QUARTZ 8.00 MHZ .005%	EA
0023A			5955-2000-000 X1	
0024	00001.000	0972946-0055	5955-2000-000 RES FIX 390 OHM 5 % .25 W CARBON FILM	EA
0024A			ROH - R-25 R1	
0026	00001.000	0972946-0054	ROH - R-25 RES FIX 360 OHM 5 % .25 W CARBON FILM	EA
			ROH - R-25	

LIST OF MATERIALS

01/18/84

PART NUMBER REV DESCRIPTION.....
 2360095-0001 N PWB ASSY, 810 LQ (FULL-SIZE)

ITEM.	QUANTITY.	COMPONENT..	DESCRIPTION.....	UM
0026A			R16	
0027	00001.000	0972946-0089	ROH - R-25 RES FIX 10K OHM 5% .25 W CARBON FILM 1658- -000	EA
0027A			R17 1658- -000	
0028	00002.000	0972946-0051	RES FIX 270 OHM 5% .25 W CARBON FILM ROH - R-25	EA
0028A			R18,R19 ROH - R-25	
0029	00002.000	0772696-0010	HEADER, 3 PIN .300LG SGL ROW, STRIP OF 3 -0002364	EA
0029A			E1-3, E4-6 -0002364	
0030	00002.000	0972487-0001	JUMPER PLUG, CONNECTOR BLACK 5935-0900-000	EA
0031	00001.000	0413277-0001	EJECTOR, PCB, NON-LOCKING, WHITE SCA -S-200 (NATURAL)	EA
0032	00008.000	2210188-0012	SOCKET, DIP, 16-PINS, LOW PROFILE SEE T -I DRAWING	EA
0032A			XU1, XU2, XU3, XU4, XU5, XU6, XU7 SEE T -I DRAWING	
0032R			XU8 SEE T -I DRAWING	
0033	00005.000	2210188-0016	SOCKET, DIP, 24-PIN, LOW PROFILE SEE T -I DRAWING	EA
0033A			XU28, XU31, XU32, XU33, XU34 SEE T -I DRAWING	
0034	00002.000	2210188-0018	SOCKET, DIP, 40-PINS, LOW PROFILE SEE T -I DRAWING	EA
0034A			XU29, XU30 SEE T -I DRAWING	
0035	00001.000	0413277-0005	EJECTOR, PCB, NON-LOCKING, YELLOW SCA -S-200 (YELLOW)	EA
0036	00001.000	2363830-0002	LABEL, SYMBOLIZATION (51MM X 13MM) 1225- -000	EA
0038	00001.000	2211540-0001	FOAM, .35X.50X.05, POLY, ADHESIVE BACKED SEE TI- DRAWING	EA
0039	00001.000	2360095-5001	AUTO-INSERTED PARTS LIST FOR -0001 1225-5095-016	EA
0040	00001.000	2230485-0005	EPROM, 810LQ, 280 1225-1485-001	EA
0040A			U28 1225-1485-001	
0041	00001.000	2230486-0031	EPROM, 810LQ, 280, 1 (U31) 1225-0000-000	EA
0041A			U31 1225-0000-000	
0042	00001.000	2230486-0012	EPROM, 810LQ, 280, 2 (U32) 1225-0000-000	EA
0042A			U32 1225-0000-000	
0043	00001.000	2230486-0033	EPROM, 810LQ, 280, 3 (U33) 1225-0000-000	EA
0043A			U33 1225-0000-000	
0044	00001.000	2230486-0014	EPROM, 810LQ, 280, 4 (U34) 1225-0000-000	EA
0044A			U34 1225-0000-000	
0045	00001.000	0996089-0004	IC, SN74LS244N LINE DRIVER -SN74LS244N	EA

LIST OF MATERIALS

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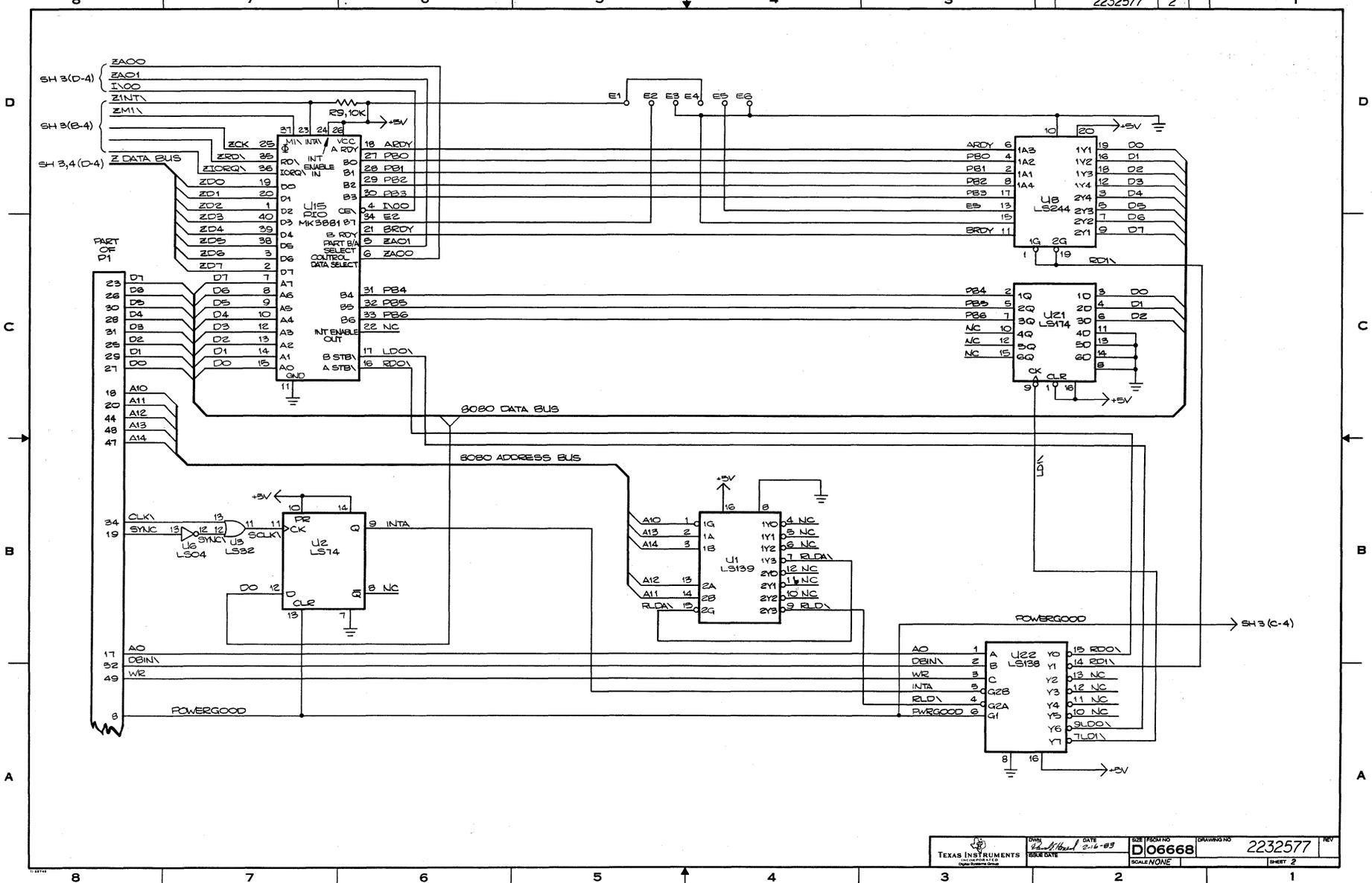
PART NUMBER REV DESCRIPTION.....
 2360095-0001 N PWB ASSY, 810 LO (FULL-SIZE)

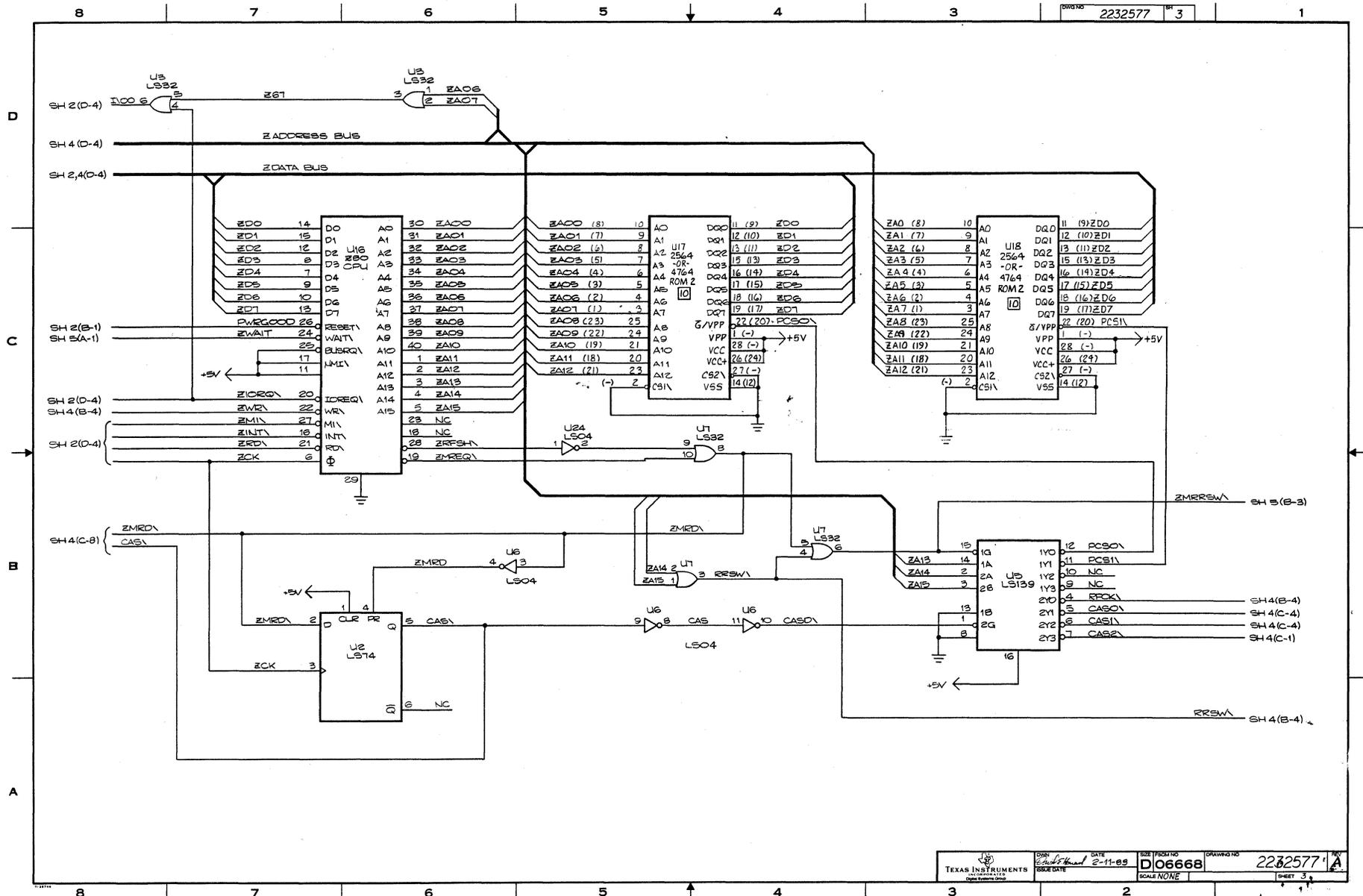
ITEM.	QUANTITY.	COMPONENT..	DESCRIPTION.....	UM
0045A			U12 -SN74LS244N	
0046	00001.000	0972900-7139	NETWORK SN74LS139N TI -SN74LS139N	EA
0046A			U17 TI -SN74LS139N	
0047	00002.000	0996136-0001	IC, SN74LS257N, DATA SELECTORS/MULTIPLEXER TI -SN74LS257N	EA
0047A			U14, U15 TI -SN74LS257N	
0048	00002.000	0085936-0065	EYELET, ROLLED FLANGE, .089 O.D. X .312 LG	EA
0048A			*USED WITH ITEMS 31 & 35	

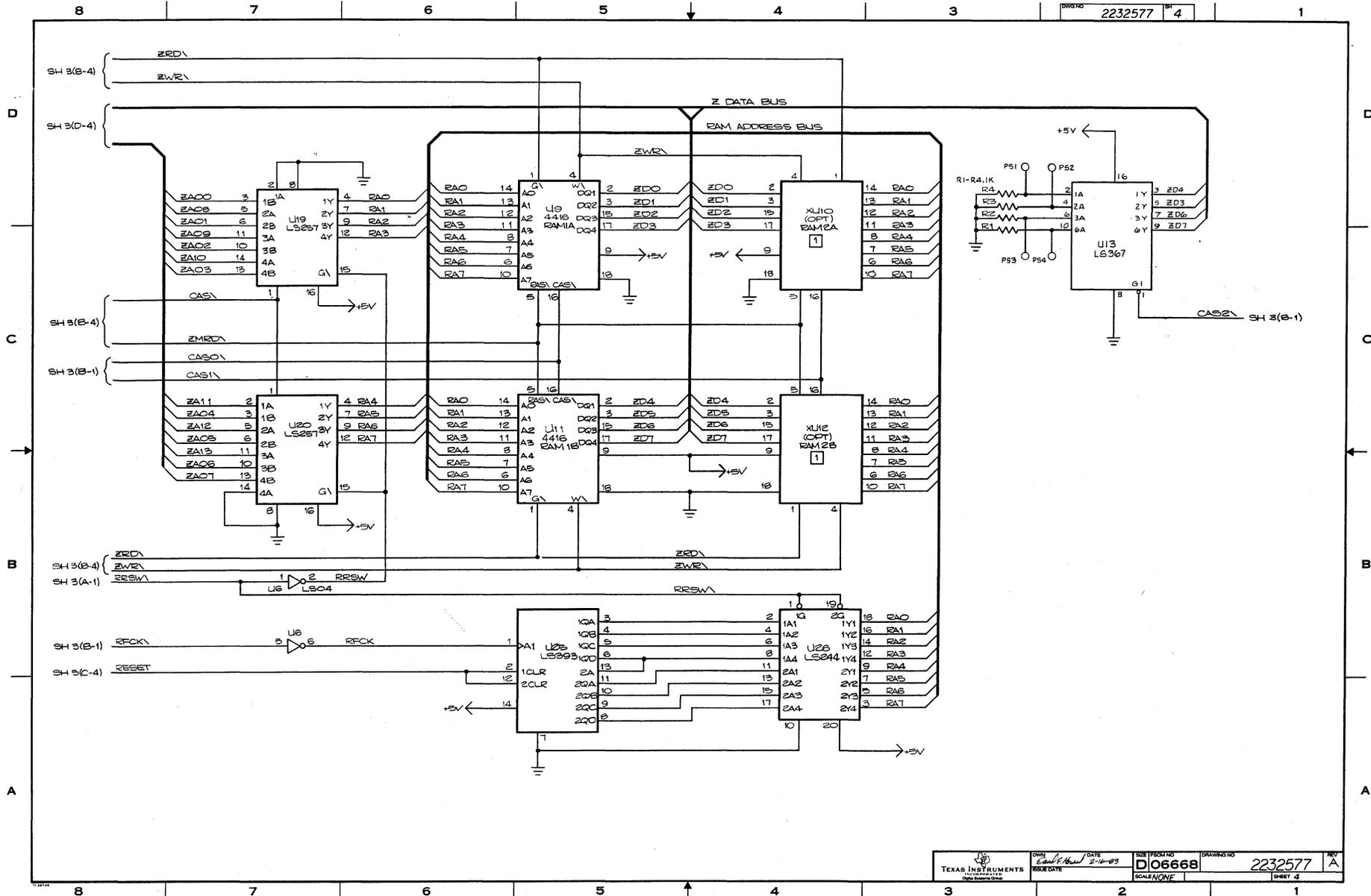
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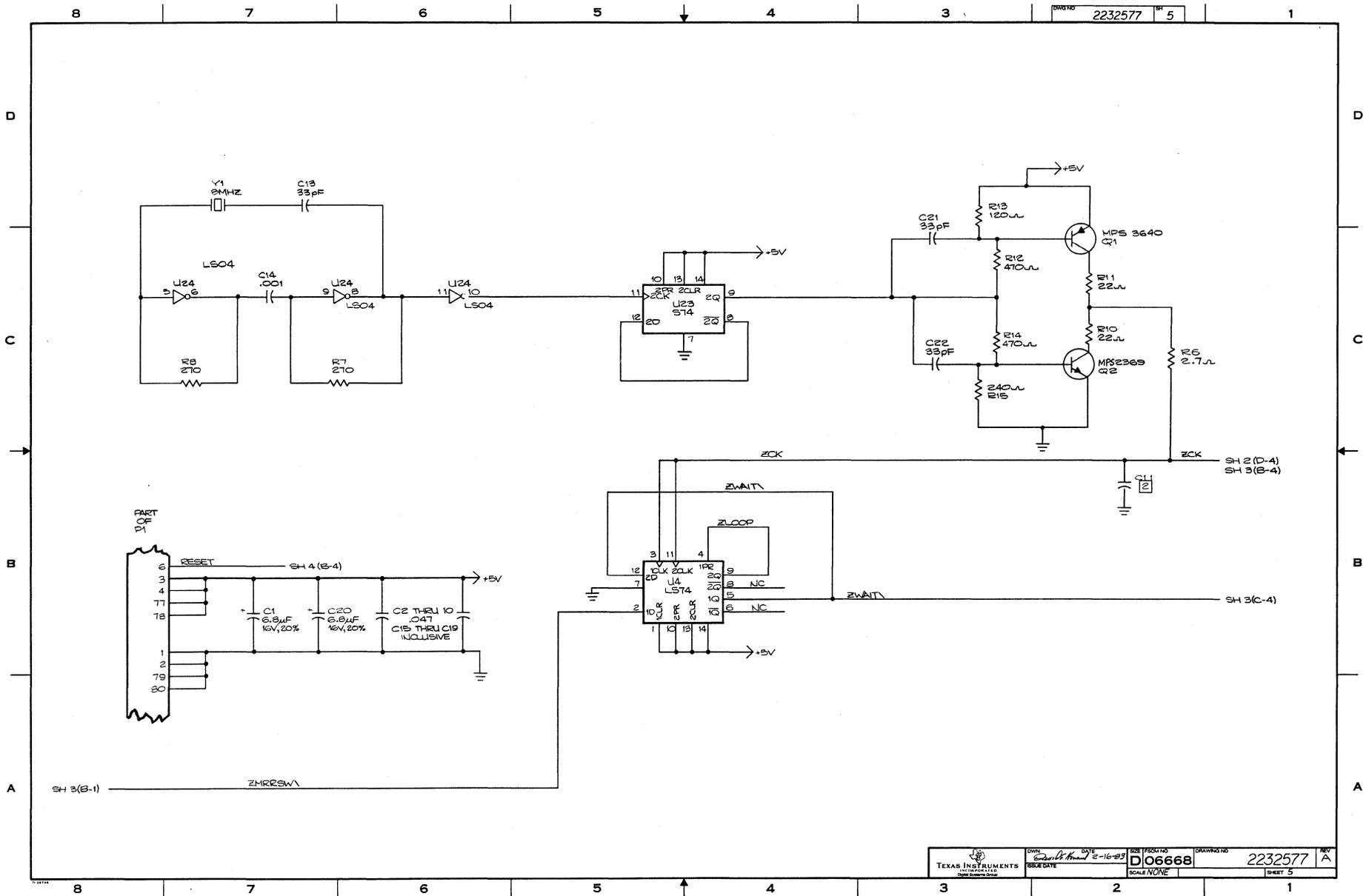
PART NUMBER REV DESCRIPTION.....
 2360095-5001 N AUTO-INSERTED PARTS LIST FOR -0001

ITEM.	QUANTITY.	COMPONENT..	DESCRIPTION.....	UM
0001	00001.000	2360098-0001	PCB, LETTER QUALITY PRINTER 1225-0000-000	EA
0004	00003.000	0996089-0004	IC, SN74LS244N LINE DRIVER -SN74LS244N	EA
0004A			U9, U11, U13 -SN74LS244N	
0005	00004.000	0972900-7139	NETWORK SN74LS139N TI -SN74LS139N	EA
0005A			U10, U18, U20, U21 TI -SN74LS139N	
0007	00001.000	0972900-7174	NETWORK SN74LS174N	EA
0007A			U16	
0008	00001.000	0972900-7138	NETWORK SN74LS138N TI -SN74LS138N	EA
0008A			U19 TI -SN74LS138N	
0009	00001.000	0219402-7474	NETWORK SN74S74N	EA
0009A			U26	
0010	00001.000	0972900-7432	NETWORK SN74LS32N TI -SN74LS32N	EA
0010A			U27 TI -SN74LS32N	
0014	00001.000	0972900-7404	NETWORK SN74LS04N	EA
0014A			U38	
0015	00002.000	0972900-7474	NETWORK SN74LS74N	EA
0015A			U39, U40	









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2232575

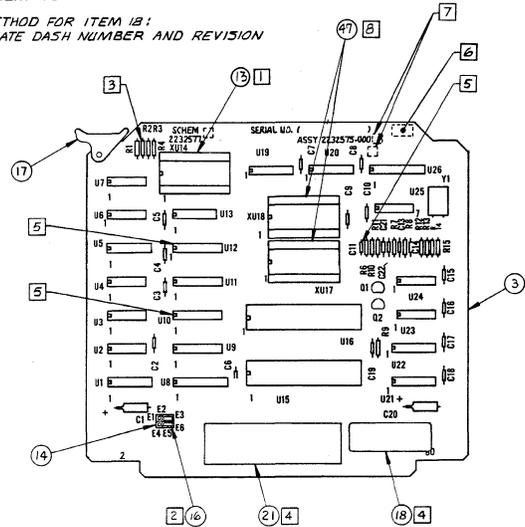
SH

1

NOTES: UNLESS OTHERWISE SPECIFIED:

- 1 ROM/EPROM (ITEM 7) IN XU14 OF THIS ASSEMBLY IS TO BE EXCHANGED WITH THE ROM/EPROM (ITEM 5) IN XU36 ON PROCESSOR ASSEMBLY 994244. THE STANDARD 810 ROM/EPROM SHOULD BE PLACED INTO XU14 OF THIS ASSEMBLY
- 2 POSITION JUMPERS (ITEM 16) PER TABLE I AND PRINTER TYPE
- 3 REMOVE THE RESISTOR JUMPERS (ITEM 39) PER TABLE II AND DESIRED CHARACTER SET
- 4 LOCATE LABEL APPROXIMATELY AS SHOWN (DO NOT COVER GOLD TABS)
- 5 C11, U10 AND U12 ARE FOR FUTURE USE
- 6 ALTERNATE METHOD FOR ITEM 18: MARK ASSEMBLY SITE/DATE CODE IN LOCATION SHOWN PER ITEM 45
- 7 ALTERNATE METHOD FOR ITEM 18: MARK APPROPRIATE DASH NUMBER AND REVISION LETTER
- 8 PINS 1, 2, 27 & 28 OF XU17 & XU18 ARE NOT USED WHEN 24 PIN DEVICES ARE USED FOR U18 & U17 (ITEM 0008 & 0009).

REV	DESCRIPTION	DATE	APPROVED
A	CN497794(C)PRUNYON (1) ITEM 7 P/N WAS 2230485-0004	8-23-83	B. H. H. H.
B	CN498894(C)PRUNYON (1) ITEM 11 QTY WAS 100 ON -0001/LM (2) ON -0001 LM ADDED ITEM 46 (3) PROCESS 1 ADDED REF TO NOTES 417 (4) ON -0001/LM ITEM 849 P/N'S WERE 2230794-1 & 2230794-2	8-23-83	B. H. H. H.
C	CN504878(C)PRUNYON (1) ON -0001 LM ITEM 849 P/N'S WERE 2230794-3 & 2230794-4 (2) ON -0001 LM ADDED ITEMS 48 & 49 (3) ON -0001/LM ITEM 18 P/N WAS 2368830-0002, ITEM 13 QTY WAS 3.00 AND ALSO ADDED ITEM 47 (4) ADDED NOTE 8 (5) UPDATE PICTORIAL	8-23-83	B. H. H. H.



CHARACTER SET	R4	R3	R2	R1
DOMESTIC	X	X	X	X
UNITED KINGDOM	X	0	X	X
GERMANY	0	0	X	X
SPAIN	X	X	0	X
SWEDEN/FINLAND	0	X	0	X
DENMARK/NORWAY	X	0	0	X
SWISS	0	0	0	X
FRENCH WORD PROCESSING	X	X	X	0
FRENCH CANADIAN	0	X	X	X

X=EXISTS
0=OMIT

TABLE II 3

CONVERSION CHART	
MM	IN
0.25	.010
0.5	.02
12.7	.50

PRINTER TYPE	JUMPER ONE (1)	JUMPER TWO (2)
BSC	E2-E3	E5-E6
VFC/FLC	E2-E3	E4-E5
VCO/FCO	E1-E2	E4-E5

TABLE I 2

2232575-5501	SEQUENCE TAPE FOR -5001
2232575-5001	AUTO INSERTED PARTS LIST FOR -0001
2232575-0001	LETTER QUALITY, 2ND GENERATION - 810
PART NUMBER	DESCRIPTION

SEQ NO	IDENT	F-SPEC	NO	ADDITIONAL	NOTES	REV STATUS OF SHEETS	REV	SH
3	SLDR	127-01	00					
2	SLDR	124-02	00					
1	MARK	914-01	00	COLOR BLACK				

-3		-2		-1		FORM NO	PART OR IDENTIFYING NUMBER		NOMENCLATURE OR DESCRIPTION		NOTES					
QTY	QTY	QTY	QTY	QTY	QTY											
<p>UNLESS OTHERWISE SPECIFIED</p> <ul style="list-style-type: none"> DIMENSIONS ARE IN MILLIMETERS TOLERANCES: 2 PLACE DECIMALS ±0.25 1 PLACE DECIMALS ±0.5, ANGLES ±1° INTERPRET DRAWING PER DODD-100 REMOVE ALL BURRS AND SHARP EDGES CONCENTRICITY MATCHED DIAMETERS 0.25 PRA DIMENSIONAL LIMITS APPLY BEFORE PROCESSING PARENTHESES INFO FOR REF ONLY 							<p>2360091 8733</p> <p>0.33 THRU 3.18 ±0.10±0.03 3.30 THRU 6.35 ±0.10±0.03 6.35 THRU 12.70 ±0.10±0.03 12.7 THRU 19.05 ±0.20±0.03 19.05 THRU 25.40 ±0.25±0.03 25.4 THRU 50.80 ±0.30±0.03</p>		<p>THIRD ANGLE PROJECTION</p>		<p>TEXAS INSTRUMENTS</p> <p>SI-METRIC</p>		<p>LETTER QUALITY, 2ND GENERATION - 810</p>		<p>DATE PRODUCED: 3-10-83</p> <p>DRAWING NO: 2232575</p> <p>SCALE: 1:1</p> <p>SHEET: 1</p>	

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2 FILMED

LM

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SH

LIST OF MATERIALS

01/18/84

PART NUMBER	REV	DESCRIPTION.....	UM	
2232575-0001	D	LETTER QUALITY, 2ND GENERATION - 810		
ITEM.	QUANTITY.	COMPONENT..	DESCRIPTION.....	UM
0001	00001.000	2232575-5001	AUTO INSERTED PARTS LIST FOR -0001	EA
0004	REF	2232577-0001	1225-5575-010 DIAGRAM, 2ND GEN-810 LQ (HALF SIZE)	EA
0005	00001.000	2210972-0001	IC, PARALLEL I/O CONTROLLER	EA
0005A			SEE TI- DRAWING	
0006	00001.000	2210301-0001	IC, MICROPROCESSOR, CPU	EA
0006A			056708-280A-CPU-PS U16	
0007	00001.000	2230485-0005	056708-280A-CPU-PS EPROM, 810 LQ, 8080	EA
0007A			1225-1485-001 U14	
0008	00001.000	2232603-0001	1225-1485-001 IC, 8192 X 8 BIT ROM1, CUSTOM	EA
0008A			SEE TI- DRAWING U17	
0009	00001.000	2232603-0002	SEE TI- DRAWING IC, 8192 X 8 BIT ROM2, CUSTOM	EA
0009A			SEE TI- DRAWING U18	
0010	00001.000	0800257-0001	TRANSISTOR, MPS 3640, PNP, SWITCHING	EA
0010A			004713-MPS3640 Q1	
0011	00000.000	0972955-0001	004713-MPS3640 XSTR 2N2369A, NPN, HIGH SPEED SW, TO-18	EA
0011A			MOT - 2N2369A *ALTERNATE TO ITEM 46	
0012	00002.000	2211700-0017	MOT - 2N2369A CAP. 6.8UF, 16VOLT, ALUM, ELECT	EA
0012A			SEE TI- DRAWING C1, C20	
0013	00001.000	2210188-0016	SEE TI- DRAWING SOCKET, DIP, 24-PIN, LOW PROFILE	EA
0013A			SEE T -I DRAWING XU14	
0014	00001.000	2210057-0003	SEE T -I DRAWING HEADER, STRAIGHT PIN, 6 POS.	EA
0014A			007791--87215-2 E1, E2, E3, E4, E5, E6	
0015	00001.000	2210835-0013	007791--87215-2 CRYSTAL, 8.00 MHZ, PARALLEL RESONANT	EA
0015A			SEE TI- DRAWING Y1	
0016	00002.000	0972487-0001	SEE TI- DRAWING JUMPER PLUG, CONNECTOR BLACK	EA
0017	00001.000	0413277-0001	5935-0900-000 EJECTOR, PCB, NON-LOCKING, WHITE	EA
0018	00001.000	2363830-0001	SCA -S-200 (NATURAL) LABEL, SYMBOLIZATION (38MM X 13MM)	EA
0019	00000.000	2211540-0001	1225- -000 FOAM, .35X.50X.05, POLY, ADHESIVE BACKED	EA
0019A			SEE TI- DRAWING *USED WITH ITEM 20	
0020	00000.000	0538031-0003	SEE TI- DRAWING CRYSTAL UNIT QUARTZ 8.00 MHZ .005%	EA
0020A			5955-2000-000 *ALTERNATE TO ITEM 15	
0021	00001.000	2232581-0001	5955-2000-000 LABEL, ROM/EPROM, 810 LQ	EA

LIST OF MATERIALS

01/18/84

PART NUMBER	REV	DESCRIPTION.....
2232575-0001	D	LETTER QUALITY,2ND GENERATION - 810

ITEM.	QUANTITY.	COMPONENT..	DESCRIPTION.....	UM
0045	REF	0994396-0001	PROC., SITE/DATE CODE AND SERIALIZATION	EA
0046	00001.000	2211475-0001	TRANSISTOR,MPS2369, NPN, SWITCHING	EA
0046A			5961-2110-000 Q2	
0047	00002.000	2210188-0008	SOCKET,LOW PROFILE,DIP,28 CONT	EA
0047A			003612-DILB28P-108	
0048	00000.000	2230794-0003	XU17,XU18 003612-DILB28P-108	EA
0048A			EPROM,2ND GENERATION,810 LQ,(U17)	
0049	00000.000	2230794-0004	1225-3794-000 *ALTERNATE FOR ITEM 8	EA
0049A			1225-3794-000 EPROM,2ND GENERATION,810 LQ,(U18)	
			1225-4794-000 *ALTERNATE FOR ITEM 9	
			1225-4794-000	

01/18/84

PART NUMBER	REV	DESCRIPTION.....
2232575-5001	D	AUTO INSERTED PARTS LIST FOR -0001

ITEM.	QUANTITY.	COMPONENT..	DESCRIPTION.....	UM
0002	00001.000	2232575-5501	SEQUENCE TAPE FOR -5001	EA
0003	00001.000	2232576-0001	1225-2575-009 PWB,LETTER QUALITY,2ND GENERATION - 810	EA
0022	00002.000	0972900-7404	NETWORK SN74LS04N	EA
0022A			U6,U24	
0023	00002.000	0972900-7432	NETWORK SN74LS32N	EA
0023A			TI -SN74LS32N U3,U7	
0024	00002.000	0972900-7474	TI -SN74LS32N NETWORK SN74LS74N	EA
0024A			U2,U4	
0025	00001.000	0972900-7138	NETWORK SN74LS138N	EA
0025A			TI -SN74LS138N U22	
0026	00002.000	0972900-7139	TI -SN74LS138N NETWORK SN74LS139N	EA
0026A			TI -SN74LS139N U1,U5	
0027	00001.000	0972900-7174	TI -SN74LS139N NETWORK SN74LS174N	EA
0027A			U21	
0028	00002.000	0996089-0004	IC,SN74LS244N LINE DRIVER	EA
0028A			-SN74LS244N U8,U26	
0029	00002.000	0996136-0001	-SN74LS244N IC,SN74LS257N,DATA SELECTORS/MULTIPLEXER	EA
0029A			TI -SN74LS257N U19,U20	
			TI -SN74LS257N	

LIST OF MATERIALS

01/18/84

PART NUMBER REV DESCRIPTION.....
 2232575-5001 D AUTO INSERTED PARTS LIST FOR -0001

ITEM.	QUANTITY.	COMPONENT..	DESCRIPTION.....	UM
0030	00001.000	0972787-0003	NETWORK SN74LS367N	EA
0030A			U13	
0031	00001.000	0996508-0001	IC, 74LS393N DUAL BINARY COUNTER	EA
0031A			001295-74LS393N U25	
0032	00001.000	0219402-7474	NETWORK SN74S74N	EA
0032A			U23	
0033	00002.000	2220517-0002	IC, 16KX4BIT RAM, 330NSEC READ CYCLE TIME	EA
0033A			SEE TI- DRAWING U9, U11 SEE TI- DRAWING	
0034	00002.000	0972946-0025	RES FIX 22.0 OHM 5 % .25 W. CARBON FILM	EA
0034A			ROH - R-25 R10, R11	
0035	00001.000	0972946-0043	RES FIX 120 OHM 5 % .25 W CARBON FILM	EA
0035A			ROH - R-25 R13	
0036	00001.000	0972946-0050	RES FIX 240 OHM 5 % .25 W CARBON FILM	EA
0036A			ROH - R-25 R15	
0037	00002.000	0972946-0051	RES FIX 270 OHM 5 % .25 W CARBON FILM	EA
0037A			ROH - R-25 R7, R8	
0038	00002.000	0972946-0057	RES FIX 470 OHM 5 % .25 W CARBON FILM	EA
0038A			ROH - R-25 R12, R14	
0039	00004.000	0972946-0065	RES FIX 1.0K OHM 5% .25 W CARBON FILM	EA
0039A			ROH - R-25 R1, R2, R3, R4	
0040	00001.000	0972946-0089	RES FIX 10K OHM 5% .25 W CARBON FILM	EA
0040A			1658- -000 R9	
0041	00014.000	0972763-0021	CAP., FIXED, AXIAL LEAD, .047 UF, +80%, -20%	EA
0041A			1632-0000-000 C2, C3, C4, C5, C6, C7, C8, C9, C10	
0041B			1632-0000-000 C15, C16, C17, C18, C19	
0042	00001.000	0972757-0013	CAP., FIXED, AXIAL LEAD, 1000 PF, 10%, 50V	EA

LIST OF MATERIALS

01/18/84

PART NUMBER	REV	DESCRIPTION.....
2232575-5501	D	SEQUENCE TAPE FOR -5001

ITEM.	QUANTITY.	COMPONENT..	DESCRIPTION.....	UM
0042A			C14	
0043	00003.000	0972757-0041	CAP, FIX, CERAMIC, 33 PF, 50 V, 10%	EA
0043A			007115-SEE TI DWG C13, C21, C22	
0044	00001.000	0972946-0003	RES FIX 2.7 OHM 5 % .25 W. CARBON FILM	EA
0044A			ROH - R-25 R6 ROH - R-25	

Appendix G

Specifications

G.1 POWER REQUIREMENTS

AC Voltage:	100, 120, 220, or 240 Vac (- 10% to + 15%)
Frequency:	47 to 63 Hz
Power Consumption:	200 W maximum
Power Fuse:	100 Vac to 120 Vac requires a 5-A, 250-V fuse

G.2 PHYSICAL DIMENSIONS

Width:	654 mm (27.75 in)
Depth:	508 mm (20 in)
Height:	203.2 mm (8.0 in)
Weight:	25 kg (55 lb)

G.3 ACOUSTICS

Noise Level:	70 dB (A-weighted) maximum at 1 meter
--------------	---------------------------------------

G.4 ENVIRONMENT

Operating Temperature:	+ 5°C (+ 41°F) to + 40°C (+ 104°F)*
Storage Temperature:	- 30°C (- 27°F) to + 70°C (+ 158°F)
Operating Humidity:	5% to 90% (no condensation)
Storage Humidity:	5% to 95% (no condensation)

* Up to 2121 m (7000 ft) mean sea level (MSL). Derate linearly to 25°C (+77°F) at 3030 m (10 000 ft) MSL.

G.5 PRINTER

G.5.1 General

Method:	Wire matrix impact
Pattern:	9 × 7 (9 wide, 7 high) dot matrix
Characters Per Line:	132 maximum
Paper Drive:	2 pinfeed tractors (4 pins each)
Paper Feed:	Rear or bottom
Paper Width:	76.2 (3 in) to 377.8 mm (14.875 in)
Paper Type:	Continuous feed, fanfold, or multipart (original copies) 0.53-mm (0.021-in) thickness maximum
Ribbon:	36.58 m (40 yd), auto reversing
Line Feed Time:	60.8 ms
Paper Slew Rate:	2.78 ips
Adjustments:	Forms width, thickness, and alignment
Fault Detection:	Paper-out, carriage jam
Printhead Slew Rate:	800.1 mm (31.5 in) per second
Expanded Print:	10 cpi, 5 cpi, 3.33 cpi, 2.5 cpi
Justification:	Left, right and left, right, centering
Underline:	Underline available in all character sets
Debug Mode:	Hexadecimal printout of data, barberpole test, power-up diagnostics

G.5.2 Spacing and Tabulation

Intercharacter:	0 to 13.4417 mm (0.5292 in) in 0.1067-mm (0.0042-in) increments measured from left edge of character cell
Interline:	0 to 11.2014 mm (0.4410 in) in 0.0889-mm (0.0035-in) increments measured from top of line
Tabs:	Horizontal and vertical



G.6 DRAFT MODE

Speed:	150 or 200 cps bidirectional (see character sets)
Print Pattern:	9 × 7 (9 wide, 7 high) dot matrix
ASCII Character Sets:	Standard Model 810 (150 cps), 96 characters Focus (150 cps), 96 characters Fast Focus (200 cps), 96 characters Bar Code (150 cps), 64 characters Character Graphics (150 cps), 64 characters User-Defined (150 cps), 95 characters
Character Spacing:	10 cpi Standard Model 810 Focus Bar Code Character Graphics User-Defined 13.3 cpi Fast Focus
Line Spacing:	6 and 8 lpi



G.7 NEAR-LETTER-QUALITY MODE

Speed:	Four-pass bidirectional @ 20 cps throughput
Print Pattern:	23 × 28 (23 wide, 28 high) dot matrix
ASCII Character Sets:	Courier, 96 characters Helvetica, 96 characters Elite, 96 characters
Character Spacing:	10 or 12 cpi or proportional spacing

G.8 ENHANCED PRINT

Overprint:	Overprints all dots in each character
Enhanced Density:	Prints half-dot positions at half speed

G.9 GRAPHICS MODE

Dot Resolution:	120 × 72 dpi, 72 × 72 dpi
Dot Format:	Seven horizontal dot rows printed simultaneously from buffer



G.10 COMMUNICATIONS

Interface: EIA RS-232-C

Type Transmission: Asynchronous

Code: USASCII

Speed: 110, 150, 300, 1200, 2400, 4800, 9600 baud

Modes: Full duplex

Parity: Odd, even, or ignore

Receive FIFO Buffer: Approximately 3200 characters

Line Control: Printer READY/BUSY and X — ON, X — OFF

G.11 OPTIONS

Printer: Compressed print — 16.5 characters per 25.4 mm (16.5 cpi), 218 cpl maximum

Character Set: Seven International ASCII character sets*

Control: Vertical forms control, selectable form lengths

Interface: Parallel character buffer

Serial 20-mA current loop (TTY)†
Serial RS 422

Accessories: Tear bar (100 columns wide)
Floor-mount stand
Paper-catch trays
(stand mounted or machine mounted)

* Second-generation LQ upgrade board provides eight international character sets.

† Can be used with a second-generation LQ upgrade board, Model 810 Printer Field Installation Kit (TI Part No. 2360091-0002)

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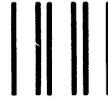


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