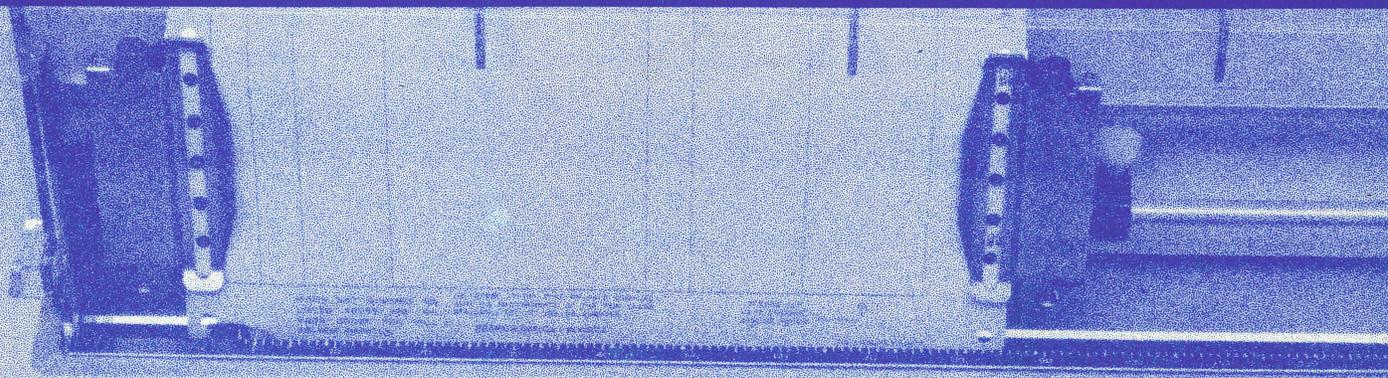
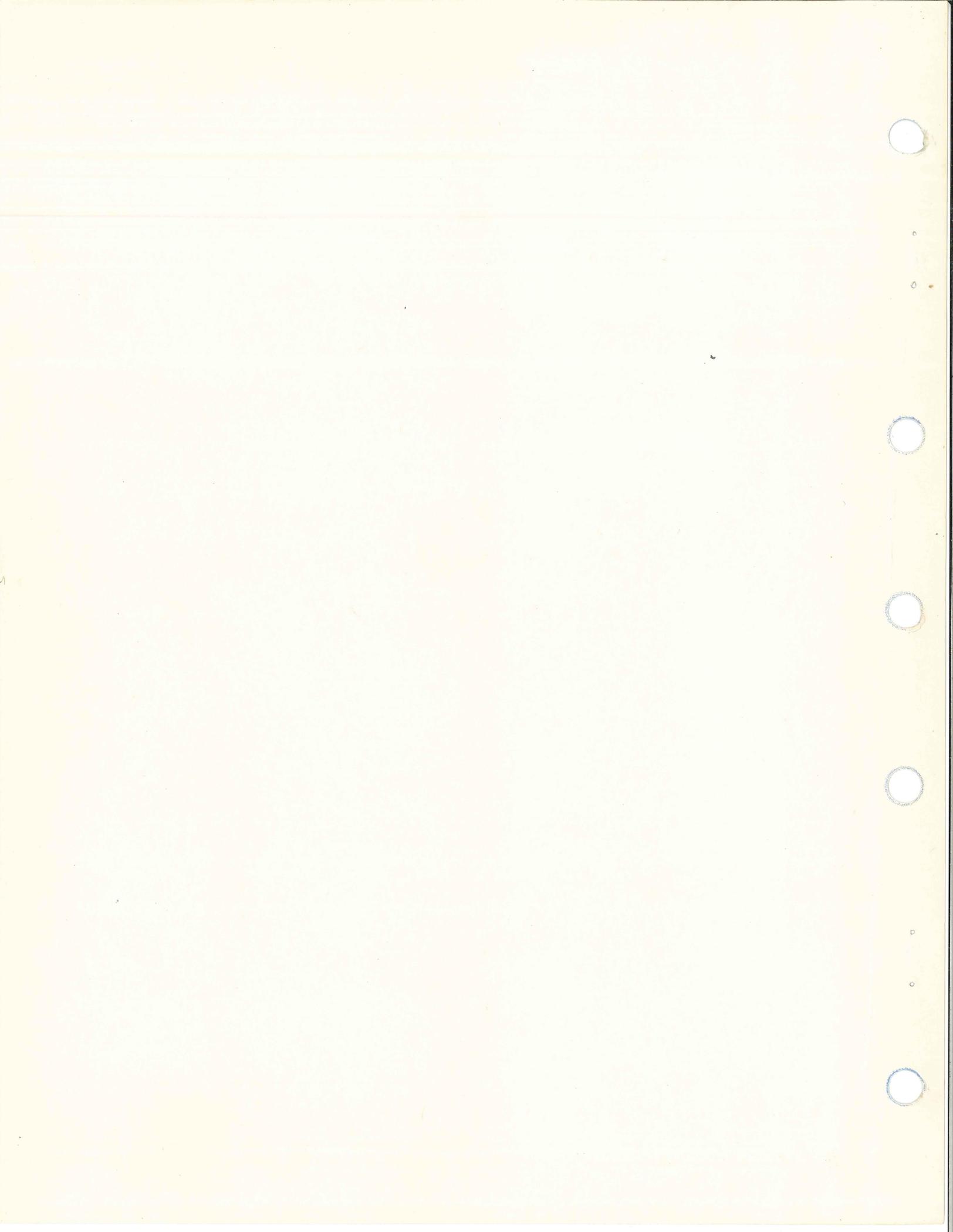


LS120 DECwriter III

1200 baud printer terminal user's manual

digital
COMPONENTS
GROUP





**LS120 DECwriter III
1200 Baud Printer Terminal
User's Manual**

Copyright © 1977 by Digital Equipment Corporation

The material in this manual is for informational purposes and is subject to change without notice.

Digital Equipment Corporation assumes no responsibility for any errors which may appear in this manual.

Printed in U.S.A.

This document was set on DIGITAL's DECset-8000 computerized typesetting system.

The following are trademarks of Digital Equipment Corporation, Maynard, Massachusetts:

DEC	DECtape	PDP
DECCOMM	DECUS	RSTS
DECsystem-10	DIGITAL	TYPESET-8
DECSYSTEM-20	MASSBUS	TYPESET-11
		UNIBUS

CONTENTS

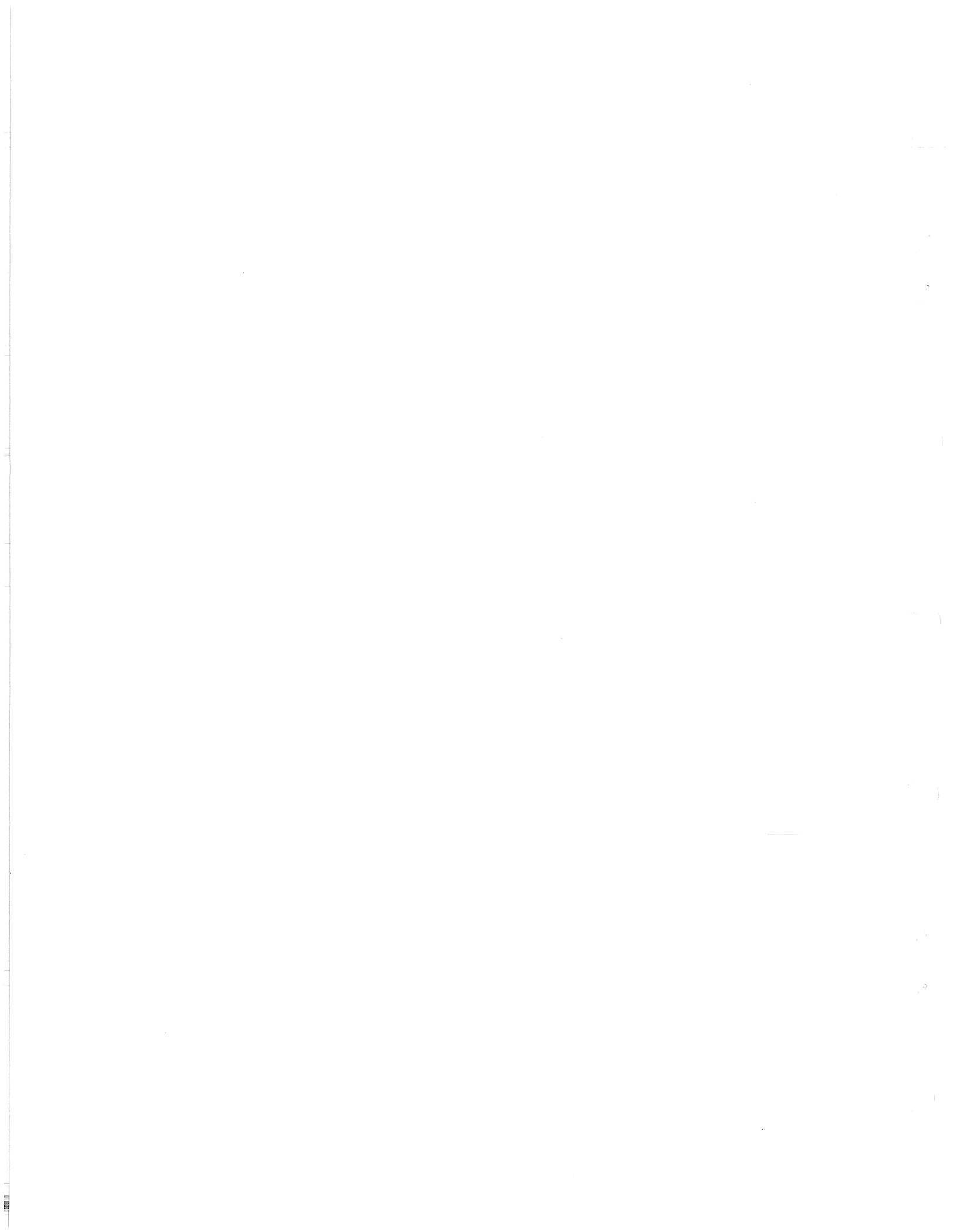
CHAPTER 1	OPERATOR'S GUIDE	
	LS120 Operator Controls and Indicators	1-1
	Self-Testing the LS120	1-6
	Setting the Top of Form Position	1-6
	Using the LS120	1-9
	LS120 Alarm Signals	1-9
	Options	1-10
CHAPTER 2	LOADING PAPER AND CHANGING RIBBON	
	Loading Paper	2-1
	Reloading Paper	2-6
	Ribbon Installation	2-7
CHAPTER 3	INSTALLATION AND CONFIGURATION CHECKOUT GUIDE	
	General Installation Information	3-1
	Unpacking and Inspection	3-1
	Packing Procedures	3-4
	Checkout and Acceptance Procedures	3-4
	Interface Information	3-5
	Auxiliary Interface Port	3-9
	LS120 Printer Board Jumper Options	3-9
	LS120 Logic Board Jumper Selection	3-11
CHAPTER 4	LS120 PROGRAMMER'S INFORMATION	
	Transmitting Characters and Commands	4-1
	Special Keys	4-1
	Receiving Characters and Commands	4-1
	Escape Commands	4-3
CHAPTER 5	TROUBLESHOOTING GUIDE	
CHAPTER 6	LS120 SPECIFICATIONS	
CHAPTER 7	OPTIONS	
	APL Option (LAXX-RC)	7-1
	Forms Option (LAXX-RA)	7-4
	14-Key Numeric Pad Option Kit (LAXX-RM)	7-11
	Programmable Answerback Option (LAXX-RF)	7-14
	Read-Only Answerback Option (LAXX-RB)	7-18
	20 mA Current Loop Interface Option (LAXX-RN)	7-19
	Acoustical Coupler Option Kit (LAXX-LM)	7-21
	LAXX-LJ Compressed Font Option Kit	7-23

FIGURES

Figure	Title	Page
1-1	Keyboard.....	1-1
1-2	Paper Advance Controls.....	1-5
1-3	Tractor Adjustments.....	1-5
1-4	Sample of Self-Test Printout.....	1-7
1-5	Top of Form Setting.....	1-9
2-1	Paper Location.....	2-2
2-2	Tractor Location.....	2-2
2-3	Carriage Adjustment.....	2-3
2-4	Paper Installation.....	2-3
2-5	Tractor Adjustment.....	2-4
2-6	Forms Adjustment.....	2-6
2-7	Paper Cover Removed.....	2-7
2-8	Ribbon Winding.....	2-8
2-9	Ribbon Installation.....	2-9
3-1	LS120 Site Considerations.....	3-2
3-2	LS120 Packaging.....	3-3
3-3	Cable Tie Location.....	3-4
3-4	EIA Interface.....	3-6
3-5	Serial Interface Timing Diagram.....	3-8
3-6	Printer Board Jumper Locations.....	3-10
3-7	LS120 Logic Board.....	3-12
3-8	S1, S2, and S3 Rocker Dip Switch.....	3-13
4-1	Standard (ASCII) Character Set.....	4-2
4-2	LS120 Line Rate Versus Column Width.....	4-3
5-1	LS120 Fuse Locations.....	5-1
5-2	Line Bunching.....	5-3
7-1	Key Caps Locating APL Characters.....	7-2
7-2	Bit Assignments for ASCII and APL Character Sets.....	7-3
7-3	Line Indicator and Column Pointer.....	7-4
7-4	Installation of Scale and Pointer.....	7-5
7-5	Keyboard and Bezel Assembly – Cabling and Hardware.....	7-12
7-6	Installation of the Answerback Board.....	7-14
7-7	Answerback Logic Board.....	7-16
7-8	Installation of the 20 mA Current Interface Option Kit.....	7-19
7-9	Installation of O Ring on Tractor Drive Shaft.....	7-21
7-10	Installation of Acoustical Coupler Option Kit (LAAXX-LM).....	7-22
7-11	Remove Printer Housing.....	7-24
7-12	Remove Print Head and Ribbon Cable.....	7-25
7-13	Installation of Compressed Font Option Kit.....	7-26
7-14	Alignment Gauge Positioning.....	7-27
7-15	Belt Tension Spring Location.....	7-28
7-16	Print Head Adjustment.....	7-30

TABLES

Table	Title	Page
1-1	LS120 Options	1-10
3-1	Interface Port Connector	3-9
3-2	Standard Factory Jumper Configuration	3-9
3-3	Standard Factory Jumper Configuration	3-11
3-4	Dip Switch Selectable Functions	3-14
7-1	Forms Option Escape Codes	7-6

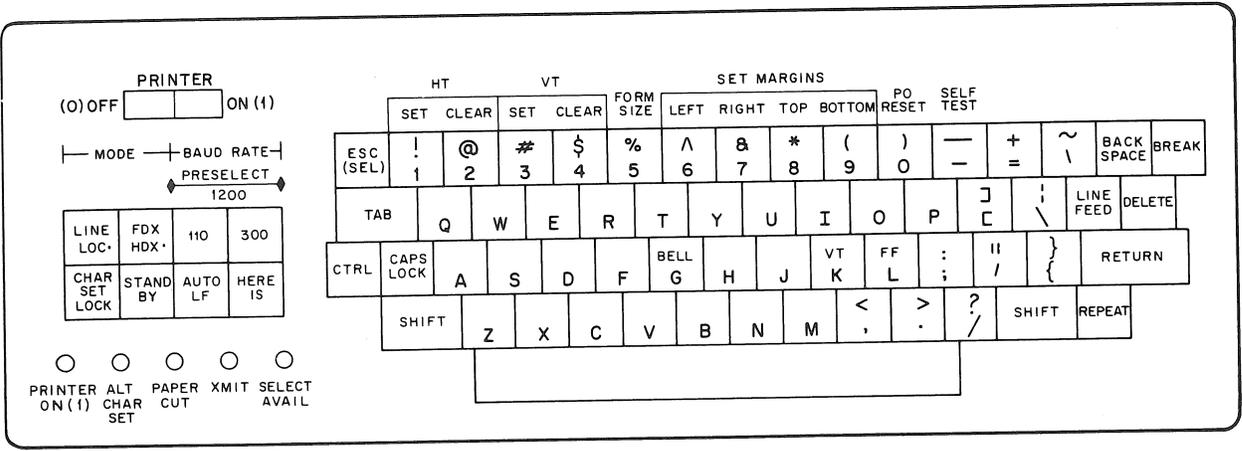


CHAPTER 1 OPERATOR'S GUIDE

LS120 OPERATOR CONTROLS AND INDICATORS (Figure 1-1)

NOTE

Dot on switch indicates function of switch when pressed.



CP-2939

Figure 1-1 Keyboard

PRINTER ON (1)/OFF (0) Switch

The PRINTER ON (1)/OFF (0) switch connects and disconnects the line voltage to the LS120 DEC-writer III. The PRINTER switch should be in the ON position for normal operation. When changing paper or ribbon, adjusting the print head, or servicing the unit, the switch should be set in the OFF position. However, when the power is OFF, some of the preset conditions must be reset.

PRINTER ON (1) Indicator

When the PRINTER ON (1)/OFF (0) switch is set to the ON position, the PRINTER ON (1) indicator is illuminated. This indicates that the LS120 is receiving power and ready for operation. The PRINTER ON (1) indicator will blink after a paper out condition is detected or when the plastic paper cover is not properly closed. The blinking will continue until the operator types the paper out-reset (ESC0) on the keyboard.

LINE/LOC Switch

The LINE/LOC switch is a 2-position switch used by the operator as a diagnostic aid. When the LINE position is selected, the LS120 is enabled and can transmit and receive data. When set to the LOC position, no data is transmitted or received and any data generated by the keyboard is echoed back to the printer. The LS120 must be in the local mode or the standby mode in order to execute some escape commands. The Data Terminal Ready (DTR) signal is low while the LS120 is in the local mode.

FDX/HDX Switch

The FDX/HDX switch controls the local printing of transmitted keyboard characters. When the FDX mode is selected, the keyboard and printer are operating independently. Therefore, the characters typed on the keyboard are transmitted only and not printed or echoed by the printer. When the HDX mode is selected, any character typed on the keyboard will not only be transmitted, but will also be echoed or printed by the printer. This allows the user to generate a local copy of any transmitted data whether he is operating in full or half-duplex protocol. The operator cannot attempt to transmit data while receiving data in the HDX mode. The local echo copy feature may be disabled by the user as described in Chapter 3. The HDX mode should not be used if the modem is supplying its own local echo.

BAUD RATE Switches

The BAUD RATE switches select the rate at which characters are transmitted and received over the communication line. The LS120 can print up to 180 characters per second and receive up to 4800 baud serial data communication. The individual switches can be used to select 110 baud (10 character/second) or 300 baud (30 characters/second). However, when both switches are selected, the LS120 operates at 1200 baud (120 characters/second). If no switch is selected (that is, both switches are in the OFF position), then the LS120 will operate at the PRESELECT baud rate. This baud rate is either 75/1200, 150/1200, 2400, or 4800, when selected as described in Chapter 3.

CHAR SET LOCK Switch

The CHAR SET LOCK switch will lock in whichever character set is presently being used. The original character set is designated as the primary set and an alternate character set can be installed as an option. The primary set is selected by issuing the ASCII code CTRL O (switch in) and the operator can switch to the alternate set by issuing the ASCII code CTRL N (switch out). If the alternate character set is not installed, the CTRL O and CTRL N commands have no effect except to control the ALT CHAR SET indicator. When the switch is pressed, it also disables the ASCII commands and locks in either the primary character set or the alternate character set. The optional secondary character set is enabled as described in Chapter 3.

ALT CHAR SET Indicator

The ALT CHAR SET indicator is illuminated when the alternate character set is being used. The indicator will respond to CTRL O and CTRL N if the CHAR SET LOCK switch is not used. However, only the primary set will be selected if the alternate character set is not installed.

AUTO LF Switch

The AUTO LF switch enables the operator to transmit a line feed code every time a carriage return code is transmitted. However, when a carriage return code is received, no line feed code will be initiated. The operator may elect to generate an automatic line feed when a carriage return is received (Chapter 3).

HERE IS Switch

The HERE IS switch is an optional operator control that is inoperative unless the answerback option is installed in the LS120. When the option is installed, pressing the HERE IS switch will cause a 20-character preprogrammed message to be transmitted.

PAPER OUT Indicator

The PAPER OUT indicator is illuminated to provide a visual indication that the LS120 is out of paper. The printer will stop whenever an out-of-paper condition is detected or the plastic paper cover is opened. The paper out condition must be manually reset by pressing the ESCAPE key and the PO RESET (0) key with the LS120 in any mode. The PO RESET key allows the LS120 to continue printing to the bottom of the current form. The paper supply must then be replaced and a new PO RESET initiated.

NOTE

If the plastic paper cover interlock switch causes a paper out condition, the PO RESET command will allow the printer to function with the cover open until the current form is completed.

XMIT Indicator

The XMIT indicator is illuminated to provide a visual indication that the LS120 is in an active transmission mode or in HDX receive mode. The indicator is extinguished when the LS120 is in local or standby, when a paper out condition exists, and when the plastic paper cover is not properly closed.

STANDBY Switch

The STANDBY switch (when pressed) is used to place the LS120 keyboard into LOC mode while the printer remains on-line. The DTR signal is unchanged. Any character typed on the keyboard will be echoed on the printer. This allows the user to perform local functions without disconnecting the LS120 from the communications line.

SELECT AVAIL Indicator

This indicator is reserved for future use.

CTRL Key

The CTRL key provides the LS120 operator with a method of transmitting ASCII control codes (000_8-037_8). Holding the CTRL key down and pressing any alphanumeric key or control key changes the standard alphanumeric ASCII code for that key to a control code (000_8-037_8).

CAPS LOCK Key

The 26 letter keys transmit only uppercase when the CAPS LOCK switch is down. None of the other keys are affected.

SHIFT Key

This is a momentary switch which, when pressed, allows selection of uppercase for all printable characters.

TAB Key

The TAB key moves the print head (tab option) to the right and stops at the first horizontal tab setting. However, the forms option must be installed to set tabs; if not, the commands are ignored. If there are no horizontal tab settings located to the right of the print head, then the print head will move one place to the right.

ESC Key

The ESC key provides the operator with a convenient method of generating an escape command sequence. The escape commands are issued in standby, local, and line modes of operation. The escape commands are detailed further in Chapters 4 and 7.

VT Key

With the CTRL key pressed, pressing the VT (K) key will advance the paper in the printer to the next vertical tab. However, the forms option must be installed to set tabs; if not, the commands are ignored. If there are no vertical tabs set, then the printer will advance the paper only one line.

BELL Key

With the CTRL key pressed, pressing the BELL (G) key will generate an audible tone from the printer.

FF Key

With the CTRL key pressed, pressing the FF (L) key will advance the paper to the next top of form position. However, the forms option must be installed to establish the top of form position and the forms length; otherwise the commands are ignored.

REPEAT Key

The REPEAT key does not generate an ASCII code. However, when the REPEAT key is held down and any key is pressed, it causes the ASCII code for that character to be transmitted and printed at a repetition rate of approximately 15 characters/second (until the key is released).

RETURN Key

The RETURN key generates code 015₈. The printer control logic causes the print head to be repositioned to the left margin each time the carriage return character code is received. If a line feed (LF) character code follows the carriage return code, the line feed operation is executed simultaneously with the carriage return. The capability of adding a line feed command after the carriage return is described in Chapter 3.

LINE FEED Key

The LINE FEED key generates code 012₈. The printer will advance the paper one line each time the LF code is received.

NOTE

Rapid paper advance can be obtained by placing the LS120 in the local or standby mode and pressing the LINE FEED and REPEAT keys.

BACKSPACE Key

The BACKSPACE key generates code 010₈. The printer control logic causes the print head to move one position to the left each time a BACKSPACE code is received, until the print head reaches the left margin.

DELETE Key

The DELETE key generates code 177₈. The printer does not respond to the delete code. When the LS120 is operating in LOC mode, the DELETE key is used to terminate SELF TEST.

BREAK Key

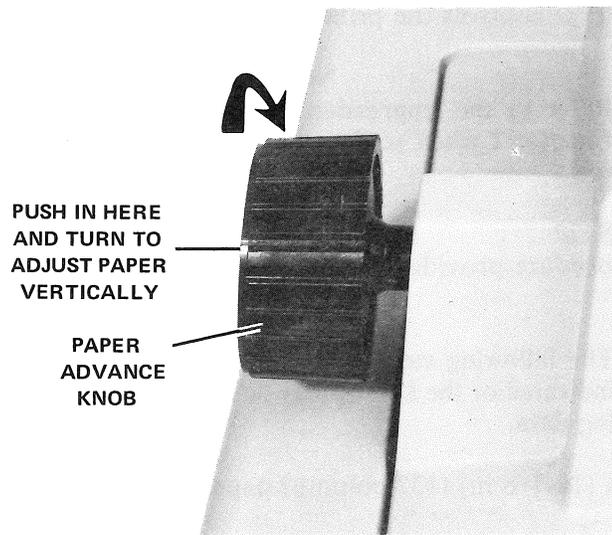
The BREAK key is provided for users that utilize the half-duplex mode of transmission with reverse channel. The BREAK key allows the LS120 operator to interrupt incoming data flow by forcing the secondary channel from a mark mode into the space mode for a period of 233 ms.

Paper Advance Knob (Figure 1-2)

The paper advance knob, when turned, advances the paper one step at a time. Pressing in and turning the paper advance knob enables the paper to be rolled freely in either direction, and allows precise vertical forms positioning.

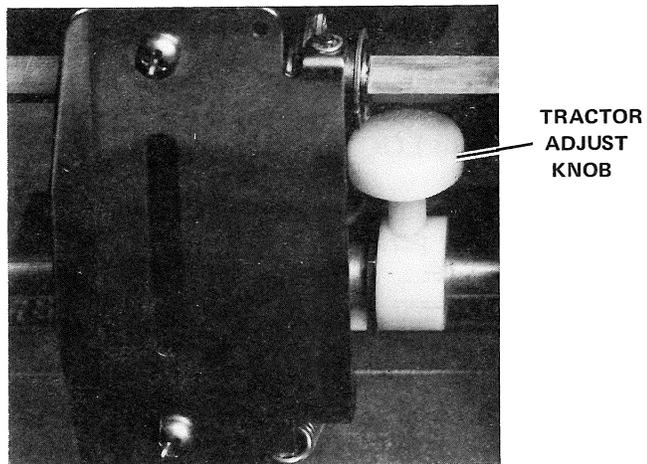
Tractor Adjust Knobs (Figure 1-3)

The tractor adjust knobs allow fine horizontal adjustment of forms.



7595-4
LS120-u

Figure 1-2 Paper Advance Controls



7595-7
LS120-u

Figure 1-3 Tractor Adjustments

Carriage Adjustment Lever (Figure 2-3)

The carriage adjustment lever controls the print head gap for single or multipart forms.

NOTE

Refer to the Impression Adjustment Procedure in Chapter 2 when setting the carriage adjustment lever.

SELF-TESTING THE LS120

The following self-test procedure provides a simple and accurate method of testing the LS120.

NOTE

The following steps must be performed in the order indicated or the LS120 may be inhibited from receiving data.

1. Install 37.78 cm (14-7/8 in) (132-column) paper.
2. Set the LINE/LOC switch to LOC and reset the paper out condition if necessary.
3. Set the PRINTER ON (1)/OFF (0) switch to ON.
4. Press the ESC key and the SELF TEST (-) key on the keyboard.
5. A sample self-test printout is shown in Figure 1-4.
6. Press the DELETE key or set the LINE/LOC switch to LINE to halt the self-test mode.

SETTING THE TOP OF FORM POSITION (Figure 1-5)

The forms option must be installed and no paper out conditions indicated to perform this procedure.

1. Set the PRINTER ON (1)/OFF (0) switch to ON.
2. Set the LINE/LOC switch to LOC.
3. Turn the paper advance knob until the top of the first line to be typed is aligned with the top of the print head or until the perforated line is aligned with the top of form bar.

NOTE

If the LS120 is turned off, the top of form starting point and the length of the form must be reestablished. When the LS120 is turned on, the top of form is established at the present position of the head and the forms length is established at 66 lines.

4. Press the ESC key and press "5N;" to set the form length at N. (N is a number from 1 to 88 which is equivalent to the number of lines that represent the length of the form.) When operating at 3 lines per inch, count each line as two. This command will establish a new top of form position which will be at the present head position.
5. Press and hold the CTRL key and press the FF key to advance to the form to the next top of form.

VT Key

With the CTRL key pressed, pressing the VT (K) key will advance the paper in the printer to the next vertical tab. However, the forms option must be installed to set tabs; if not, the commands are ignored. If there are no vertical tabs set, then the printer will advance the paper only one line.

BELL Key

With the CTRL key pressed, pressing the BELL (G) key will generate an audible tone from the printer.

FF Key

With the CTRL key pressed, pressing the FF (L) key will advance the paper to the next top of form position. However, the forms option must be installed to establish the top of form position and the forms length; otherwise the commands are ignored.

REPEAT Key

The REPEAT key does not generate an ASCII code. However, when the REPEAT key is held down and any key is pressed, it causes the ASCII code for that character to be transmitted and printed at a repetition rate of approximately 15 characters/second (until the key is released).

RETURN Key

The RETURN key generates code 015₈. The printer control logic causes the print head to be repositioned to the left margin each time the carriage return character code is received. If a line feed (LF) character code follows the carriage return code, the line feed operation is executed simultaneously with the carriage return. The capability of adding a line feed command after the carriage return is described in Chapter 3.

LINE FEED Key

The LINE FEED key generates code 012₈. The printer will advance the paper one line each time the LF code is received.

NOTE

Rapid paper advance can be obtained by placing the LS120 in the local or standby mode and pressing the LINE FEED and REPEAT keys.

BACKSPACE Key

The BACKSPACE key generates code 010₈. The printer control logic causes the print head to move one position to the left each time a BACKSPACE code is received, until the print head reaches the left margin.

DELETE Key

The DELETE key generates code 177₈. The printer does not respond to the delete code. When the LS120 is operating in LOC mode, the DELETE key is used to terminate SELF TEST.

BREAK Key

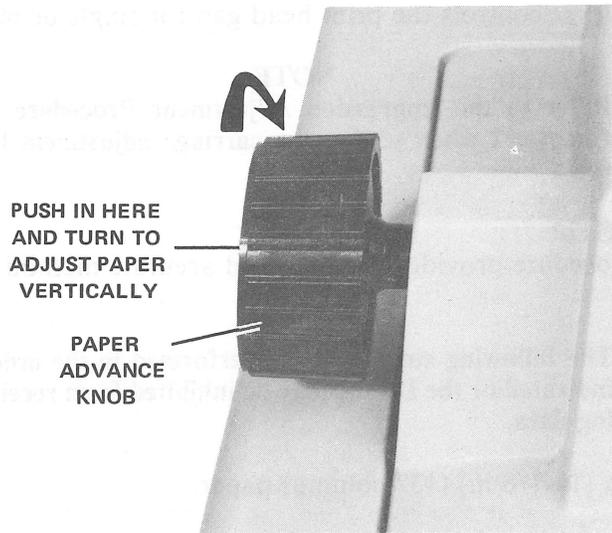
The BREAK key is provided for users that utilize the half-duplex mode of transmission with reverse channel. The BREAK key allows the LS120 operator to interrupt incoming data flow by forcing the secondary channel from a mark mode into the space mode for a period of 233 ms.

Paper Advance Knob (Figure 1-2)

The paper advance knob, when turned, advances the paper one step at a time. Pressing in and turning the paper advance knob enables the paper to be rolled freely in either direction, and allows precise vertical forms positioning.

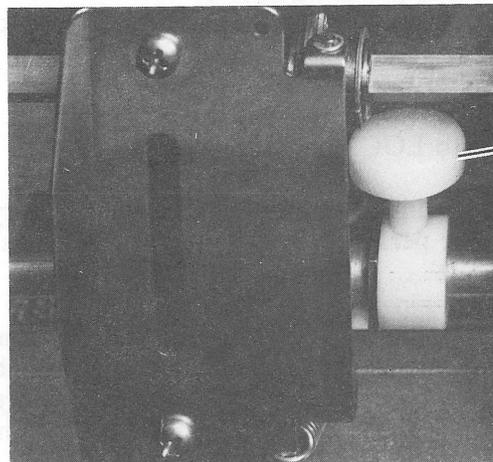
Tractor Adjust Knobs (Figure 1-3)

The tractor adjust knobs allow fine horizontal adjustment of forms.



7595-4
LS120-u

Figure 1-2 Paper Advance Controls



7595-7
LS120-u

Figure 1-3 Tractor Adjustments

Carriage Adjustment Lever (Figure 2-3)

The carriage adjustment lever controls the print head gap for single or multipart forms.

NOTE

Refer to the Impression Adjustment Procedure in Chapter 2 when setting the carriage adjustment lever.

SELF-TESTING THE LS120

The following self-test procedure provides a simple and accurate method of testing the LS120.

NOTE

The following steps must be performed in the order indicated or the LS120 may be inhibited from receiving data.

1. Install 37.78 cm (14-7/8 in) (132-column) paper.
2. Set the LINE/LOC switch to LOC and reset the paper out condition if necessary.
3. Set the PRINTER ON (1)/OFF (0) switch to ON.
4. Press the ESC key and the SELF TEST (-) key on the keyboard.
5. A sample self-test printout is shown in Figure 1-4.
6. Press the DELETE key or set the LINE/LOC switch to LINE to halt the self-test mode.

SETTING THE TOP OF FORM POSITION (Figure 1-5)

The forms option must be installed and no paper out conditions indicated to perform this procedure.

1. Set the PRINTER ON (1)/OFF (0) switch to ON.
2. Set the LINE/LOC switch to LOC.
3. Turn the paper advance knob until the top of the first line to be typed is aligned with the top of the print head or until the perforated line is aligned with the top of form bar.

NOTE

If the LS120 is turned off, the top of form starting point and the length of the form must be reestablished. When the LS120 is turned on, the top of form is established at the present position of the head and the forms length is established at 66 lines.

4. Press the ESC key and press "5N;" to set the form length at N. (N is a number from 1 to 88 which is equivalent to the number of lines that represent the length of the form.) When operating at 3 lines per inch, count each line as two. This command will establish a new top of form position which will be at the present head position.
5. Press and hold the CTRL key and press the FF key to advance to the form to the next top of form.

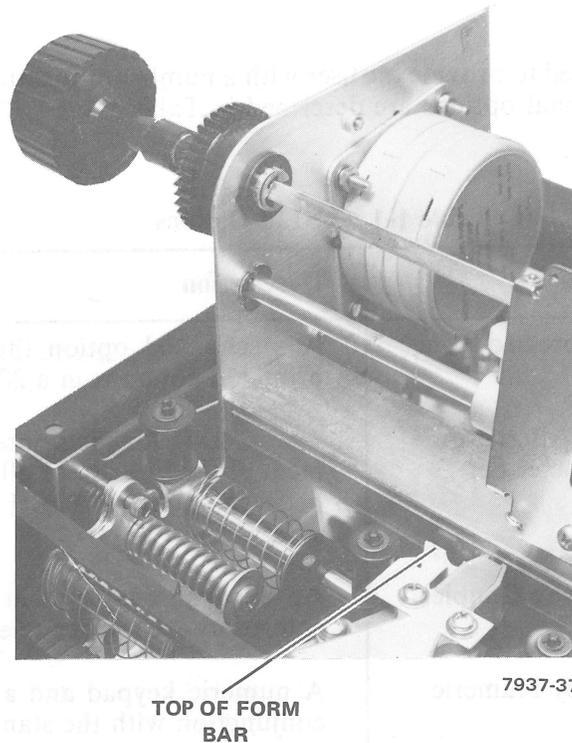


Figure 1-5 Top of Form Setting

USING THE LS120

These few steps are all that may be required to place your LS120 on-line after the dip switches (Chapter 3) have been set to the configuration of your modem.

1. Load the paper.
2. Set the LINE/LOC switch to LOC.
3. Set the PRINTER ON (1)/OFF (0) switch to ON.
4. Set the LINE/LOC switch to LINE.

The LS120 is now on-line and fully operational.

LS120 ALARM SIGNALS

The LS120 produces three different alarm signals. The operator should become familiar with these alarms in order to determine the correct response.

- Continuous Tone – Indicates a carriage jam or failure. To turn the alarm off, set the PRINTER ON (1)/OFF (0) switch to OFF. Turning the PRINTER ON (1)/OFF (0) switch OFF, then ON, resets the alarm.
- Eight Repetitive Beeps – Indicates an out of paper condition, the plastic paper cover improperly set, or a series of bell codes.
- Single Beep – Indicates a bell code, an error in an escape sequence, or that the operator is typing beyond the right margin. If an error in an escape code causes a beep, then the entire escape function has to be reentered.

OPTIONS

The basic LS120 can be expanded to provide the user with a number of functional options for receiving and handling data. The functional options are described in Table 1-1.

Table 1-1 LS120 Options

Option	Name	Description
LAXX-KJ (LJ)*	Compressed Font	A mechanical option that enables the LS120 to print 132 columns in a 20.32 cm (8 in) space.
LAXX-RC (SC)*	APL Alternate Character Set	Two ROMs for the printer board and the replacement of the keycaps to allow an operator to switch between standard ASCII and APL alternate character set.
LAXX-LM (MM)*	Acoustic Coupler	An acoustic coupler that allows input data to be entered by the use of a telephone at up to 300 baud.
LAXX-RM (SM)*	14-Key Numeric Pad	A numeric keypad and a new bezel to be used in conjunction with the standard keypad.
LAXX-RA (SA)*	Forms Package	Allows the operator to select any necessary tabs, margins, or direct position for use with any type of form. Also contains a column scale, pointer, and a light shield.
LAXX-RD (SD)*	Remote Configuration Switch	Allows the operator to select automatic new line, parity check, automatic line feed, and lines per inch from a remote switch located under the cover and behind the carriage.
LAXX-RF (SF)*	Programmable Answerback	Provides the operator with automatic answerback and preselected form data. The option also contains circuits used to blast the data into PROMs.
LAXX-RB (SB)*	Read-Only Answerback	Allows the operator to insert preprogrammed PROMs for use with automatic answerback or preselected form data. Does not have the capability to blast PROMs.
LAXX-RN (SN)*	20 mA Current Loop Interface	Allows the operator to replace the EIA modem connector with a 20 mA current loop modem connector.

*These options are available in kits of five; the option reference is designated by the letters in parentheses. Therefore, if a user wishes to order five programmable answerback options, the option number will be LAXX-SF.

CHAPTER 2

LOADING PAPER AND CHANGING RIBBON

LOADING PAPER

The LS120 can accept multipart forms, with widths from 7.62 to 37.78 cm (3 to 14-7/8 in). When loading new forms, it is necessary to perform two adjustments:

1. Paper positioning
2. Impression adjustment

In addition, there are horizontal positioning and vertical positioning adjustments. The horizontal positioning adjustment allows the paper to be slightly shifted left or right. This procedure is especially useful when typing on preprinted forms with defined horizontal zones. The vertical positioning adjustment enables the paper to be adjusted vertically. Once these adjustments have been performed, reloading paper becomes quick and simple, requiring a minimum of interruption.

NOTE

When performing any escape sequences, ensure that the CAPS LOCK key is not set.

Paper Positioning Procedure (Figure 2-1)

1. Set the PRINTER ON (1)/OFF (0) switch to OFF.
2. Lift the plastic paper cover.
3. Place the tractor-feed paper on the floor between the legs of the LS120. (The term tractor-feed refers to the holes on either side of the paper.)

NOTE

Ensure that the leading edge of the forms is directly below and parallel to the feed slot.

4. Open the left tractor cover so that the tractor pins are exposed (Figure 2-2).
5. Move the carriage adjustment lever to the highest number (toward operator) (Figure 2-3).
6. Feed the paper through the load channel under the terminal and align the left paper margin holes over the left tractor pins (Figure 2-4).
7. Close the left tractor cover.



Figure 2-1 Paper Location

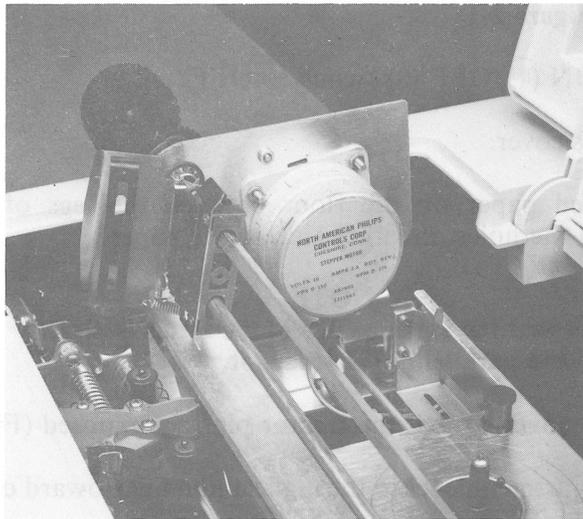
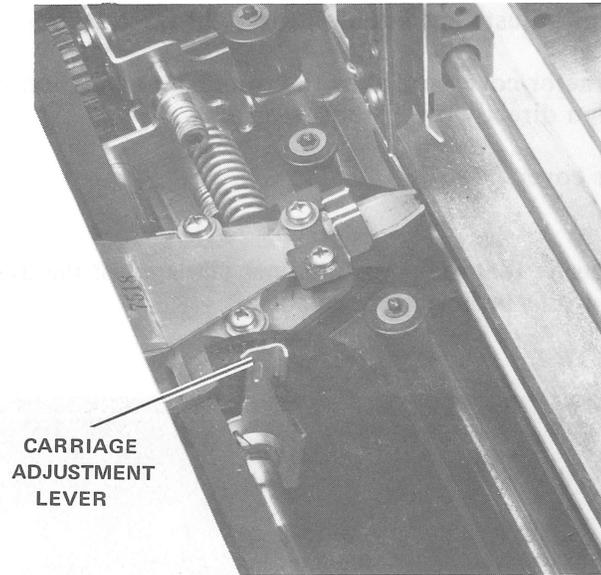
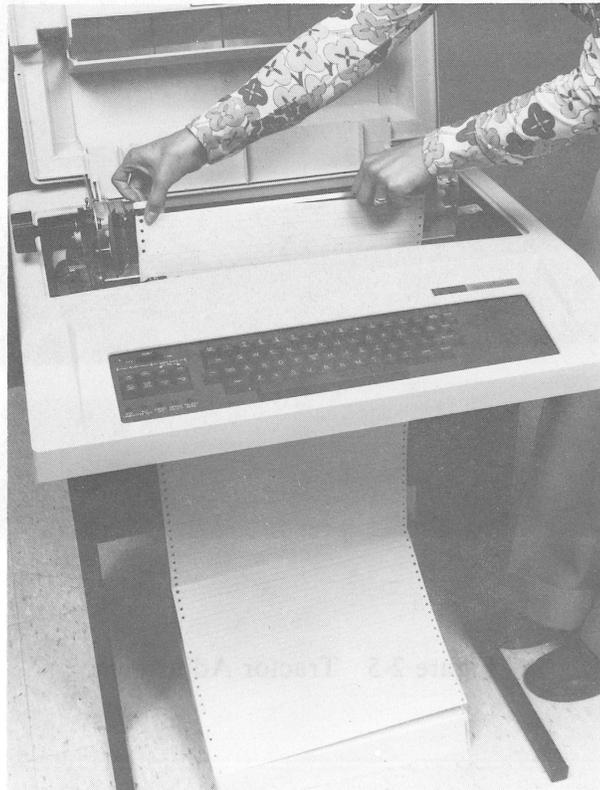


Figure 2-2 Tractor Location



7666-16
LS120-u

Figure 2-3 Carriage Adjustment



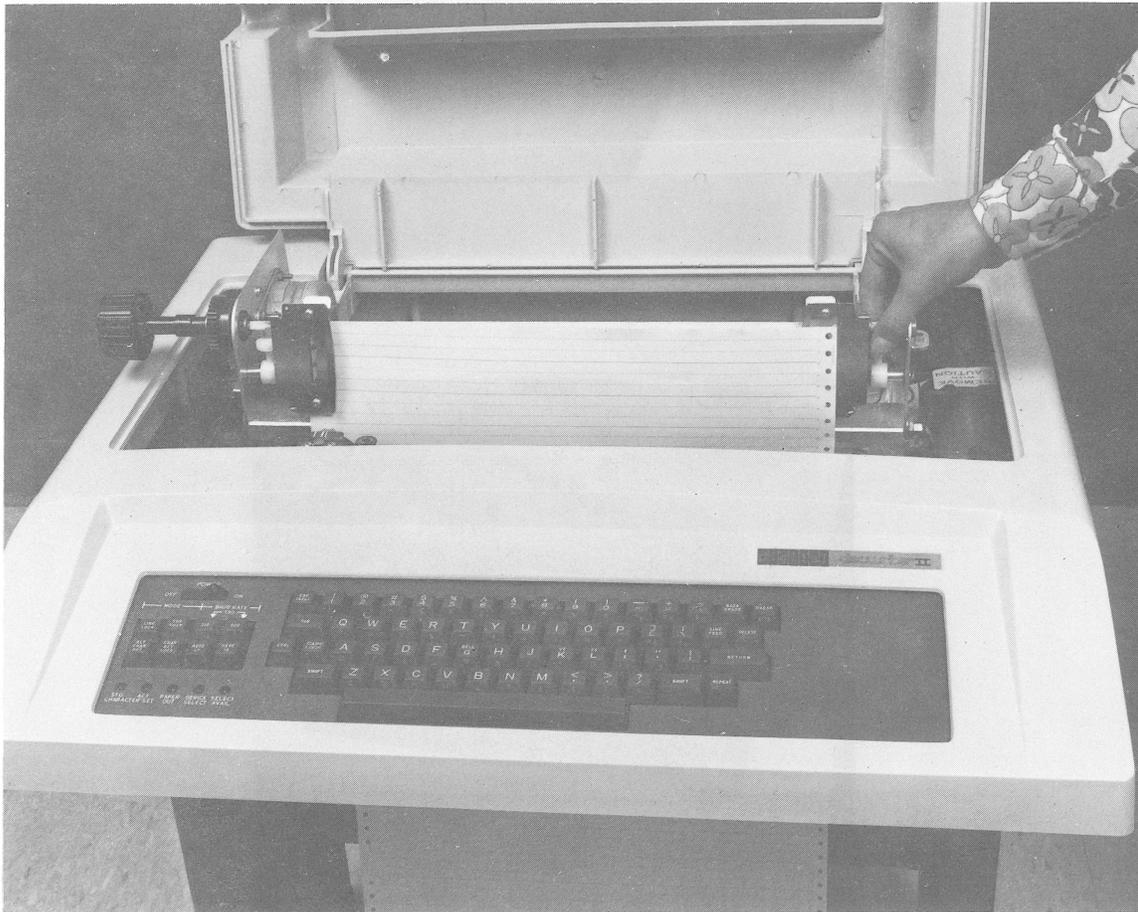
7666-33
LS120-U

Figure 2-4 Paper Installation

8. Loosen the tractor adjustment knob on the right tractor about 1/2 turn (Figure 2-5).
9. Open the right tractor cover and slide the tractor to a position where the holes on the right paper margin align directly over the tractor pins.
10. Close the tractor cover.

NOTE

Ensure that the paper does not pull against the tractor pins or bow in the middle.



7666-35
LS120-u

Figure 2-5 Tractor Adjustment

11. Tighten the tractor adjustment knob.
12. Close the plastic paper cover and set the PRINTER ON (1)/OFF (0) switch to ON.
13. Set the LINE/LOC switch to LOC and reset any paper out conditions.
14. Press the ESC key, and "5N;" , where N is a number from 1 to 88 which is equivalent to the length of the form in lines. This also sets a new top of form position at the present position of the head. The escape code will only function if the forms option is installed.

Impression Adjustment

NOTE

The carriage adjustment lever is normally set forward (to notch number 1) for single thickness paper. The following procedure is applicable only to multipart forms.

1. Set the PRINTER ON (1)/OFF (0) switch to OFF.
2. Set the carriage adjustment lever to the number corresponding to the number of parts in the form.
3. Turn the paper advance knob counterclockwise while moving the carriage adjustment lever forward one notch at a time until the paper smudges; then move the lever back one notch at a time until the paper no longer smudges (Figure 1-5).
4. Set the PRINTER ON (1)/OFF (0) switch to ON, reset any paper out conditions, and resume operation.

NOTE

If the impression is unsatisfactory due to a worn ribbon, perform the ribbon installation procedure. An indication of a worn ribbon is that the first copy in a multipart copy is poor but the remaining copies are good.

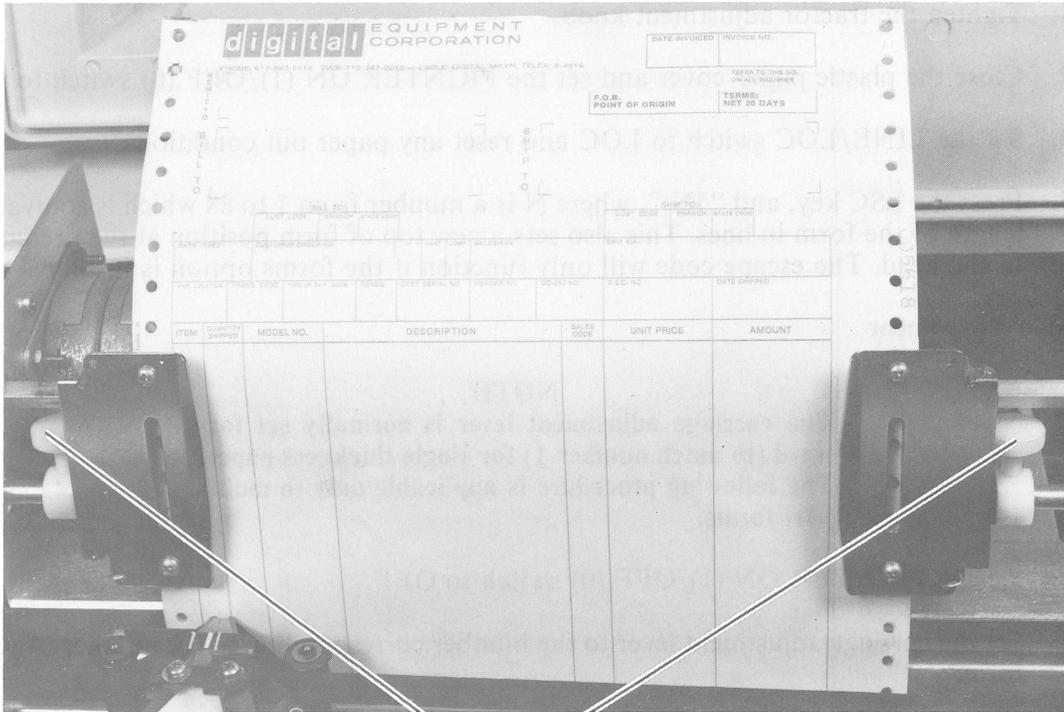
Horizontal Positioning Adjustment

The horizontal positioning adjustment enables the paper to be shifted left or right 1.27 cm (1/2 inch) maximum. Shifting the paper provides a simple means of aligning the type within the appropriate columns on the paper.

1. Set the PRINTER ON (1)/OFF (0) switch to OFF.
2. Lift the cover and loosen both tractor adjustment knobs about 1/2 turn (Figure 2-6).
3. Move the tractors the desired amount, 1.27 cm (1/2 inch) maximum, to have characters type in the appropriate columns.
4. Tighten the tractor adjustment knobs.

NOTE

Ensure that the paper does not pull against the tractor pins or bow in the middle.



TRACTOR ADJUSTMENT KNOBS

7666-10
LS120-u

Figure 2-6 Forms Adjustment

Fine Vertical Positioning

For fine vertical positioning, press in and turn the paper advance knob (Figure 1-2).

RELOADING PAPER

1. Set the PRINTER ON (1)/OFF (0) switch to OFF.
2. Lift the cover.
3. Place the tractor-feed paper on the floor between the legs of the LS120 (Figure 2-4).
4. Open both tractor covers so that the tractor pins are exposed.

NOTE

Ensure that the leading edge of the forms is directly below and parallel to the feed slot.

5. Feed the paper through the load channel under the terminal and align the paper holes over the tractor pins.
6. Close the tractor covers.
7. Set the PRINTER ON (1)/OFF (0) switch to ON, clear any paper out conditions, and resume operation.

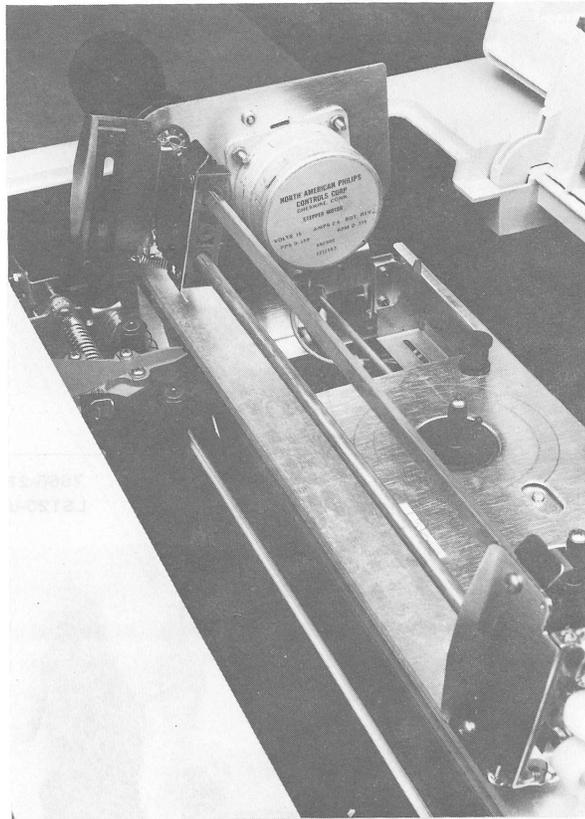
RIBBON INSTALLATION

The printer ribbon should last for 8 to 12 hours of actual printing at 180 characters/second (about 4 million characters). After 8 hours, or when the print density becomes too light, remove both ribbon spools from their drive spindles and turn the whole assembly over so that the previous lower edge of the ribbon is now on top. After rethreading the ribbon, another 4 hours (approx.) of printing time is possible before the ink is completely used. At that time, the ribbon must be replaced by removing both spools and unthreading the ribbon. Replace with a new spool and ribbon assembly (36-12153) and an empty spool. (One of the old spools may be used if desired.)

CAUTION

Use only DIGITAL-recommended ribbons (part no. 36-12153). Other ribbons can cause damage and void machine warranty. Ribbons must be made of nylon fabric with nonabrasive inks. Carbon-based inks are extremely abrasive and should not be used.

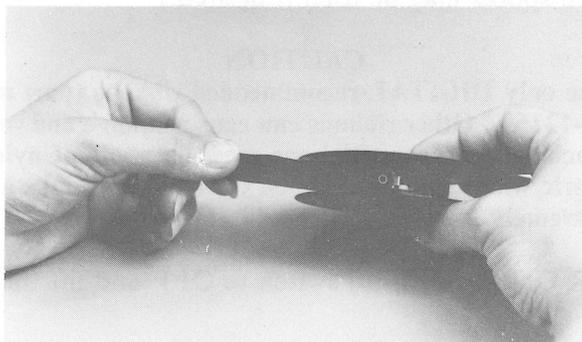
1. Set the PRINTER ON (1)/OFF (0) switch to OFF and lift the cover (Figure 2-7).



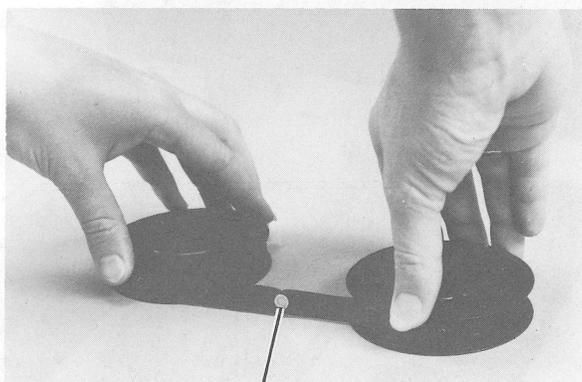
7666-32a

Figure 2-7 Paper Cover Removed

2. Record the setting of the carriage adjustment lever. Move the carriage adjustment lever to the highest number.
3. Remove the ribbon spools and ribbon. Save one spool to be used with the new ribbon.
4. Connect the hook on the end of the ribbon to the empty spool (Figure 2-8).



7666-17
LS120-u



RIVET

7666-21
LS120-u



7666-22
LS120-u

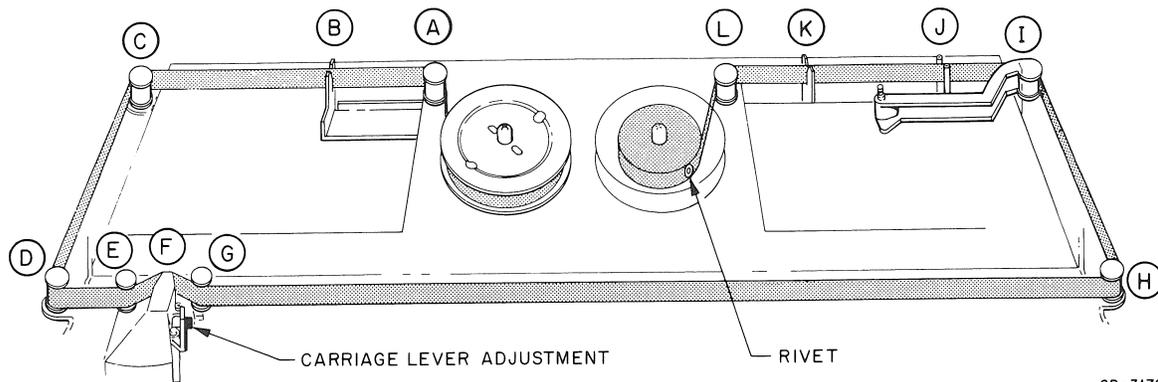
Figure 2-8 Ribbon Winding

5. Wind 10 turns of ribbon on the empty spool (Figures 2-8).
6. Place the full spool on the left spindle and turn clockwise until it drops into position (Figure 2-9).
7. Guide the ribbon around idler spool A through guide B, and around the outside of idler spools C through E.
8. Guide the ribbon around the front of head F and idler spools G and H.
9. Guide the ribbon around tension arm I, through slots J and K (direction changing guide), and around idler spool L.
10. Turn the spool clockwise until it drops into position.
11. Take up the slack in the ribbon by turning the free moving spool.
12. Return the carriage adjustment lever to its original setting.

NOTE

The rivet located on the ribbon must be on the spool or between the spool and the direction changing guide.

The ribbon can be threaded in the opposite direction (from L to A).



CP-3170

Figure 2-9 Ribbon Installation

CHAPTER 3

INSTALLATION AND CONFIGURATION CHECKOUT GUIDE

GENERAL INSTALLATION INFORMATION

This section contains the step-by-step procedures for unpacking, cabling, and unit checkout to ensure that the unit was not damaged during shipment and that the unit is operating properly prior to connection to the communication system.

The LS120 DECwriter III should be installed in an area that is free of excessive dust, dirt, corrosive fumes, and vapors. To ensure that the unit has proper ventilation and cooling, the ventilation openings on the side of the cabinet should not be obstructed. A minimum 10.1 cm (4 in) clearance between units must be maintained at all times. Adequate service clearance must also be provided for servicing the unit. (Refer to Figure 3-1.)

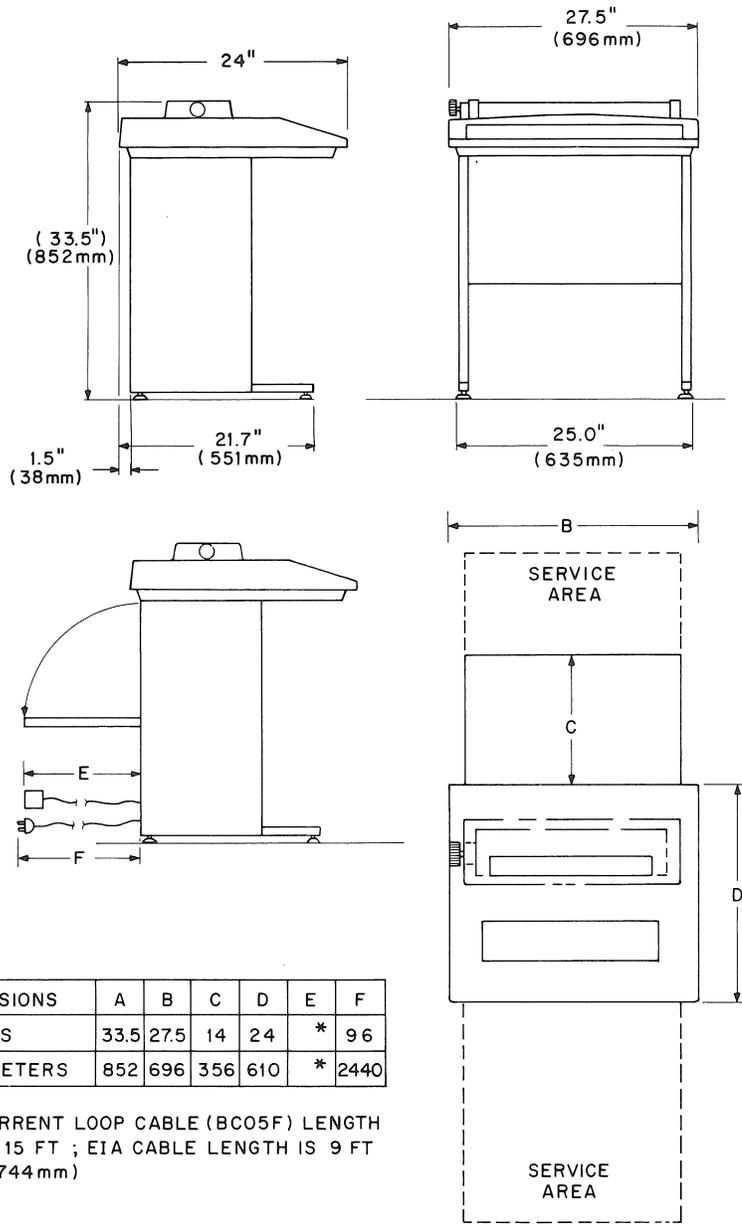
UNPACKING AND INSPECTION

The following procedure outlines the steps required for unpacking and inspecting the LS120.

1. Cut the nylon retaining straps from around the shipping carton and discard them.
2. Remove the outer cardboard shipping container.
3. Remove all shock-absorbing material and packing from around the LS120 (Figure 3-2).
4. Remove the poly bag from the printer.
5. Loosen and remove the hex head bolts that secure the wood leg brace to the skid assembly. Remove microfoam from around each leg of the LS120.
6. Carefully inspect the LS120 cabinet and carriage assembly for possible shipping damage. Inspect and check the enclosed packing list for lost or missing items. Report any damaged or missing items to the local DIGITAL Field Service or Sales Office and to the local carrier.
7. Remove the printer from the wooden shipping skid and place it in the desired location.
8. Lift the LS120 top cover assembly and clip and remove the nylon cable tie securing the print head assembly (Figure 3-3). Remove the caution tag.
9. Install and adjust the leveling feet on the LS120 legs.
10. If necessary, wipe all outer surfaces with a clean, soft, lint-free cloth.
11. Connect the interface cable to the user's equipment. (See Interface Description.)

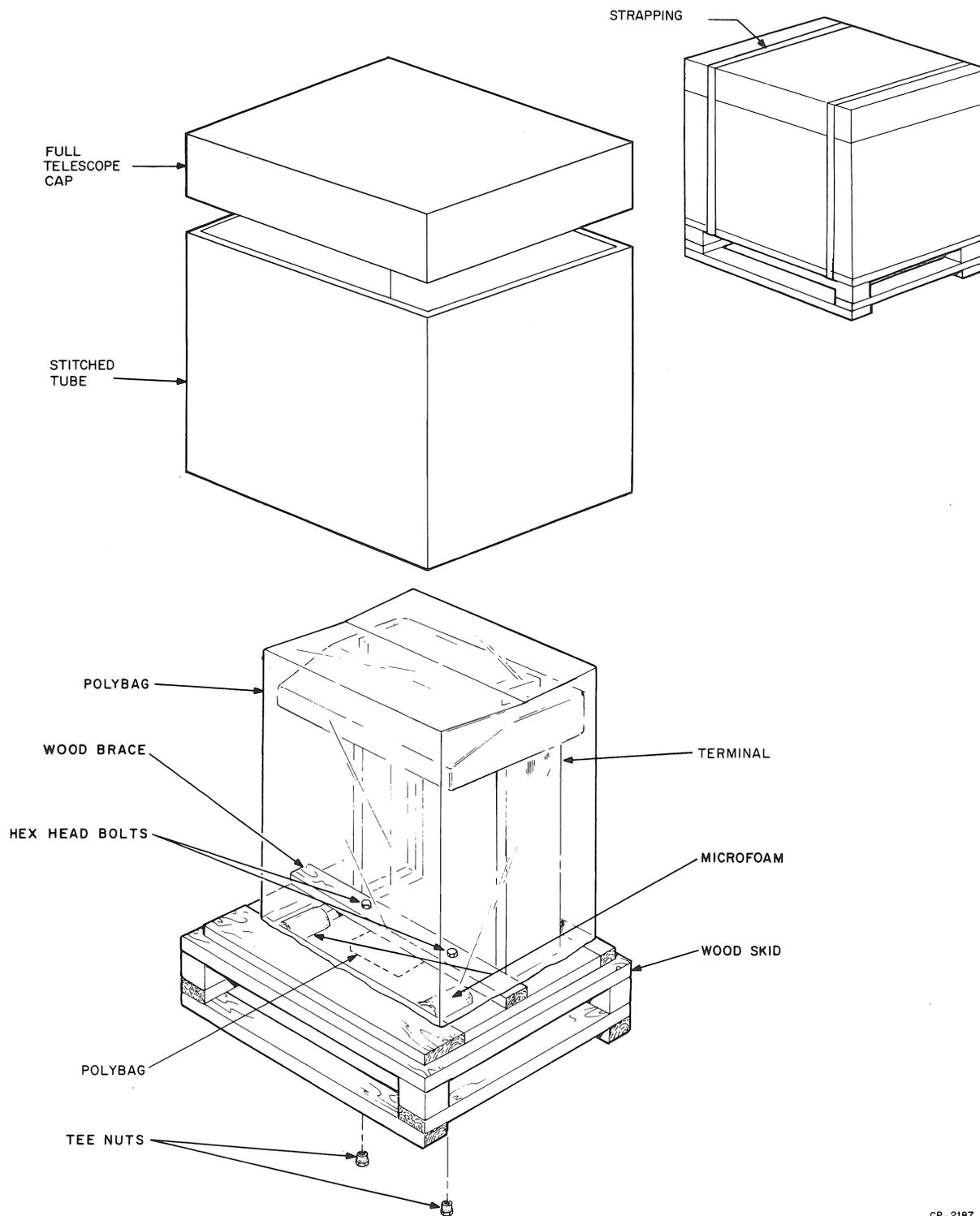
NOTE

Site plans are not supplied by Digital Equipment Corporation. Interface logic connections must be specified and provided by the system supplier or the customer because each installation may be different.



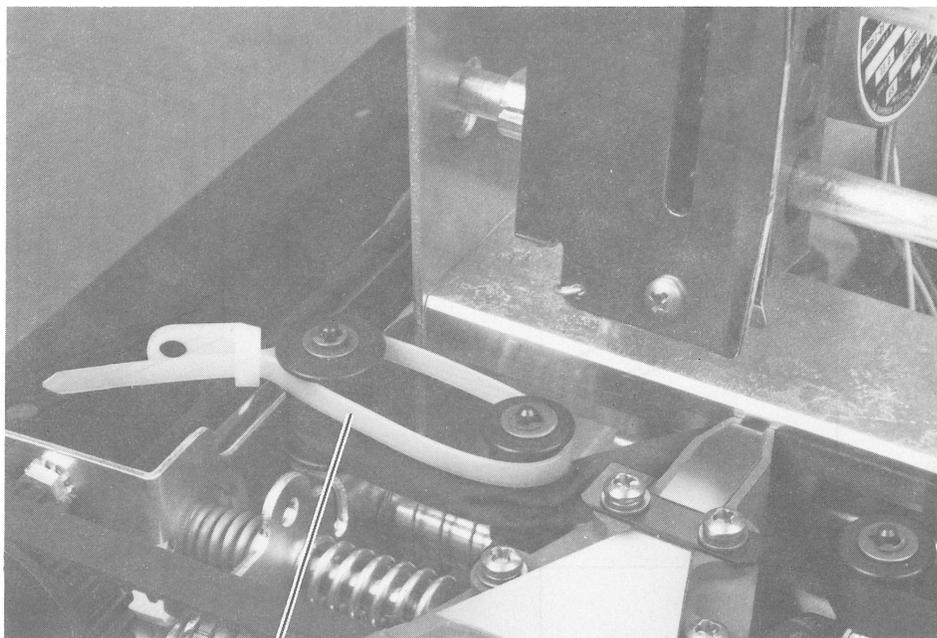
CP-2023

Figure 3-1 LS120 Site Considerations



CP-2187

Figure 3-2 LS120 Packaging



CABLE
TIE

7555-10
LS120-u

Figure 3-3 Cable Tie Location

PACKING PROCEDURES

If it becomes necessary to ship your LS120 to another location, repack it per the following procedure.

1. Remove the ribbon and paper.
2. Using a nylon cable tie, secure the print head assembly to prevent movement while in transit.
3. Pack the LS120 as shown in Figure 3-2.

CHECKOUT AND ACCEPTANCE PROCEDURES

Perform the following procedure. If the desired results are not achieved, refer to the troubleshooting guide in Chapter 5.

1. Install a ribbon per the ribbon installation procedure (Chapter 2).

NOTE

The LS120 must be loaded with 37.78 cm (14-7/8 in) wide paper when performing the self-test procedure.

2. Install paper per the paper loading procedure (Chapter 2).

CAUTION

Before connecting the LS120 to a power source, ensure that the line voltage and frequency are compatible with the power requirements of the machine. Ensure that the PRINTER ON (1)/OFF (0) switch on the control panel is OFF.

3. Connect the LS120 line cord to the correct wall receptacle; set the PRINTER ON (1)/OFF (0) switch to ON. The print head automatically positions itself to the left margin. Clear any paper out conditions by keying ESC0 (PO RESET).
4. Perform the self-test procedure as follows:
 - a. Set the LINE/LOC switch to LOC.
 - b. Press the ESC key and the SELF TEST (-) key. The LS120 will automatically print the full complement of 96 upper- and lowercase alphanumeric characters (Figure 1-4) across the line printer paper. The printer will print continuously until the operator presses the DELETE key.

INTERFACE INFORMATION

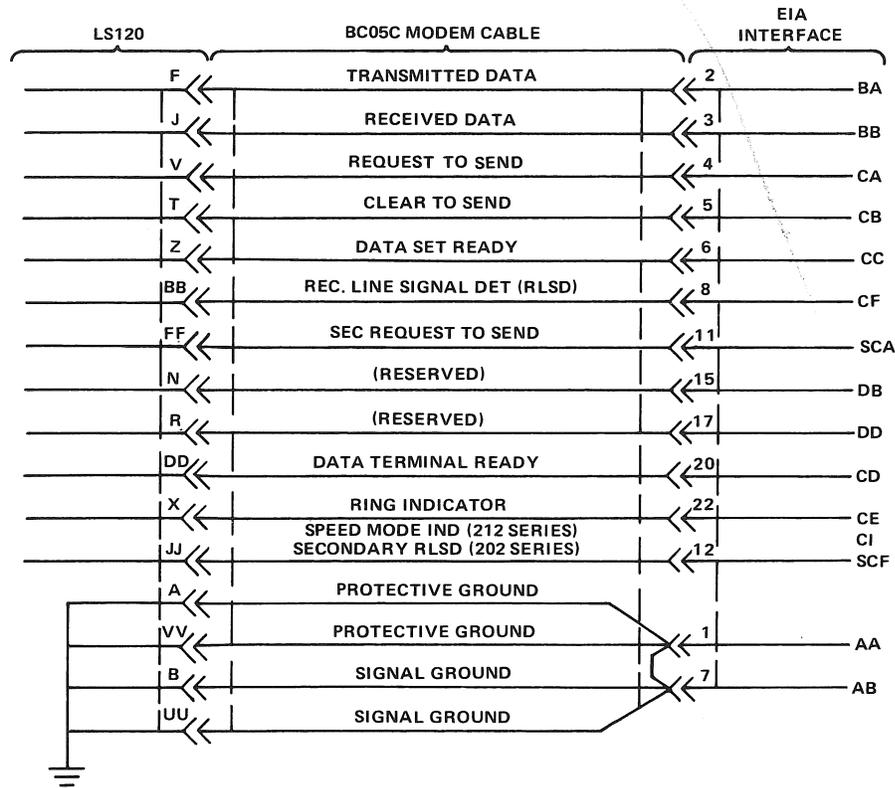
EIA Interface

The LS120 interfaces with EIA devices using a 2.74 m (9 ft) BC05C modem cable to interconnect the LS120 to a peripheral device that is terminated with a 25-pin connector. The LS120 interface is compatible with Bell 103, 212A, and 202 modems and meets the requirements of EIA specification RS232C. The interface interconnections are shown in Figure 3-4 and the interface signals are described in the following paragraphs. The LS120 configuration can be modified by using the dip switches on the logic board to enable or disable some interface signals.

Transmitted Data – The LS120 transmits characters and break signals only when the Received Line Signal Detector, Request to Send, Clear to Send, Data Set Ready, and Data Terminal Ready signals are asserted unless the protocol has been defeated by dip switch S2-3. The LS120 will hold the transmitted data in a marking condition during intervals between characters or words, and at all times when no data is being transmitted. The data is transmitted from the LS120 to the modem.

Received Data – The LS120 receives data from the modem in response to signals transmitted from the LS120. The Received Data signal is held in the marking condition at all times when the Received Line Signal Detector signal is unasserted and receives data only when the Data Terminal Ready and the Received Line Signal Detector signals are asserted.

Request to Send – The LS120 asserts the Request to Send signal when it wishes to enable the Transmitted Data signal. When operating in the half-duplex mode, the Request to Send signal remains asserted for the transmission mode and inhibits the receive mode. When the signal is unasserted, the transmission mode is inhibited and the receive mode is maintained. A transition from OFF to ON initiates the modem to react by sending the Clear to Send signal, thereby indicating to the LS120 that it can transmit data. A transition from ON to OFF indicates to the modem when the transmission is completed; the modem will disconnect the Clear to Send signal and remain in a receive mode. When the Request to Send signal is unasserted, it will not be reasserted until the modem has disconnected the Clear to Send signal.



CP-3147

Figure 3-4 EIA Interface

Clear to Send – The Clear to Send signal is generated by the modem to indicate whether or not the LS120 is ready to transmit data. When this signal is asserted along with Request to Send, Data Set Ready and Data Terminal Ready being asserted, the LS120 will be able to transmit data. If this signal is unasserted, the LS120 is unable to transmit data unless the protocol has been defeated by dip switch S2-3. The Clear to Send signal is asserted in response to the Data Set Ready and Request to Send signals. This signal can be disabled by setting dip switch S3-7 to the OFF position.

Data Set Ready – The Data Set Ready signal is asserted to allow the on-line operation of the LS120. This signal can be disabled by setting dip switch S2-3 to the ON position and therefore defeats the protocol.

Data Terminal Ready – The LS120 asserts the Data Terminal Ready signal when it is ready to transmit or receive data. The asserted condition allows the modem to be connected to the communication channel and maintains this connection. When the LS120 is equipped for automatic answering of incoming calls, the line connection only occurs in response to a combination of the ringing signal and the asserted condition of Data Terminal Ready. The unasserted condition causes the modem to be removed from the communication channel but does not disable the Ring Indicator circuits. The unasserted condition causes the incoming call to ring but does not answer. If the communication channel is connected and the Received Line Signal Detector drops for more than 5 seconds, the Data Terminal Ready signal will be unasserted for at least 70 ms to disconnect the modem and eliminate a potential hung line condition. The Data Terminal Ready signal will remain unasserted when the LS120 is not ready in order to prevent auto answering of incoming calls.

Ring Indicator – The Ring Indicator signal is asserted to indicate that a ringing signal is being received on the communication channel. If the Received Line Signal Detector is not asserted within 15 seconds after the Ring Indicator signal is asserted, the Data Terminal Ready signal will be unasserted for at least 70 ms to eliminate a potential hung line condition.

Secondary Request to Send – The Secondary Request to Send signal is used on half-duplex data sets equipped with reverse channel; the user selects the reverse channel protocol. It provides communication from the receiving data set to the transmitting data set, simultaneously with the primary data channel. This channel can only be used when Request to Send is unasserted. When the receiving terminal wishes to become transmit enabled, this signal is unasserted for 233 ms (Break signal) by the receiving terminal.

Received Line Signal Detector – The Received Line Signal Detector is asserted before the LS120 can receive characters. An unasserted signal indicates that no signal is being received or that the received signal is unsuitable for demodulation. The unasserted signal causes the Received Data signal to be held in a marking condition. On half-duplex channels, the signal is held in the unasserted state whenever Request to Send is asserted and for a brief time following the transition of the Request to Send ON to OFF transition.

Secondary Received Line Signal Detector – The Secondary Received Line Signal Detector is used on half-duplex data sets equipped with reverse channel; the user selects the reverse channel protocol. The signal is used to inform the data set transmitting on the primary channel that the receiving data set wishes to gain transmission capability. The loss of the signal is interpreted as an interrupt by the transmitting data station. This signal can be used only when the Received Line Signal Detector is unasserted.

Speed Mode Indication – The Speed Mode Indication signal provides automatic speed recognition capability to the receiving data set (on 212A compatible data sets). The LS120 monitors the Speed Mode Indication and the receiving data set will automatically switch from 300 baud to 1200 baud. The switch setting on the keyboard must be 300 baud.

Grounds

Protective Ground – This conductor is electrically bonded to the LS120 chassis. Use of this conductor for reference potential purposes is not allowed.

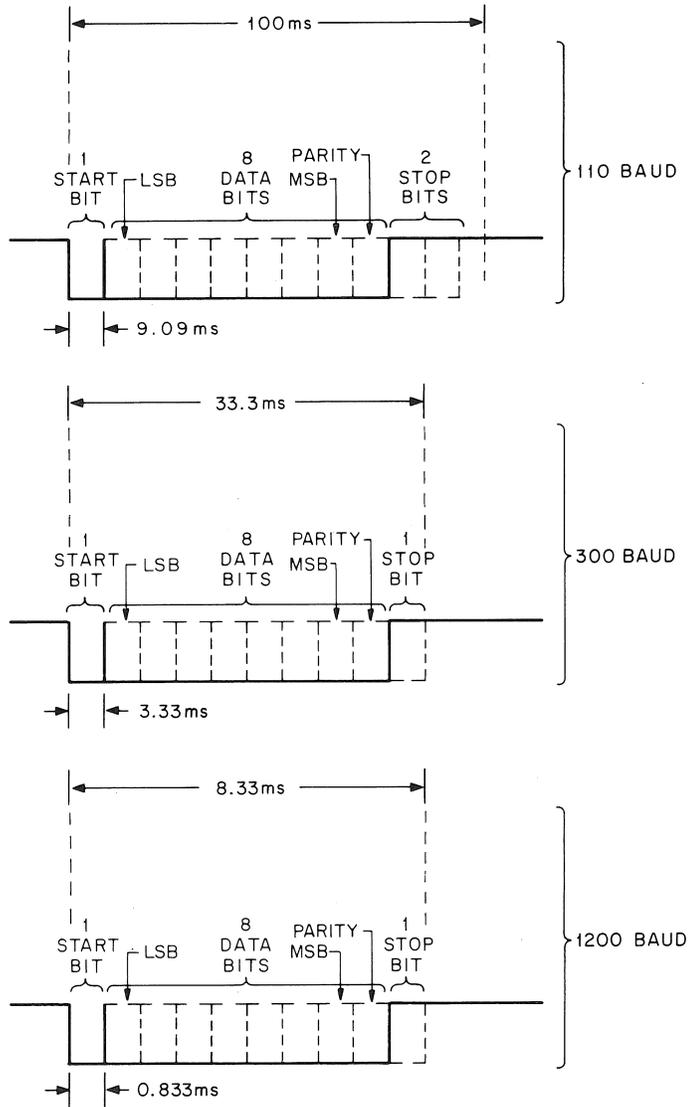
Signal Ground – This conductor establishes the common ground reference potential for all voltages on the interface. It is permanently connected to the LS120 chassis.

Interface Characteristics

All signals *transmitted* from the LS120 are defined as the mark or the unasserted state, which must be within -6.0 and -12.0 V, and the space or asserted state, which must be within $+6.0$ and $+12.0$ V.

All signals *received* by the LS120 are defined as the mark or the unasserted state, which must be within -25.0 and $+0.75$ V, and the space or asserted state, which must be within $+2.25$ and $+25.0$ V. The LS120 also recognizes an open circuit as a mark or unasserted state.

The standard asynchronous character format for baud rates of 110, 300, and 1200 is bit serial (Figure 3-5). The format consists of a start bit (space), seven data bits, a parity bit, and the stop bits. There is a single stop bit for the 300 and 1200 baud rates and two stop bits for the 110 baud rate. The seven data bits represent a 7-bit character with the least significant bit leading. The operator can select the sensing of the parity bit by designating even, odd mark, or space. Parity error detection is enabled only when even or odd parity is selected.



CP-3148

Figure 3-5 Serial Interface Timing Diagram

AUXILIARY INTERFACE PORT

The LS120 has a connector for non-EIA interfaces. The connection is via a straight 8-pin Mate-N-Lok connector with the pin designations listed in Table 3-1. This allows for the internal mounting of an option which communicates to the LS120 printer, keyboard, and data communication system as independent peripherals.

Table 3-1 Interface Port Connector

Pin	Function
1	Signal Ground
2	Serial input to LS120 from optional interface TTL level
3	Restraint (Clear to Send TTL)
4	Serial output from LS120 to optional interface TTL level
5	LS120 +5 volts
6	LS120 +12 volts
7	LS120 -12 volts
8	Terminal Ready assertion (Data Terminal Ready TTL)

LS120 PRINTER BOARD JUMPER OPTIONS

Jumper Locations

Nine jumper locations are provided on the LS120 printer board, as shown in Figure 3-6. Jumpers are installed at the factory as listed in Table 3-2 and can be altered by the user as described in the following paragraphs.

Table 3-2 Standard Factory Jumper Configuration

Jumper	Configuration (See Note)	Function
W1	Installed	Speaker volume
W2	Removed	Not used
W3	Installed	-12 V interface voltage
W4	Removed	Not used
W5	Installed	+12 V interface voltage
W6	Removed	+5 V interface voltage
W7	Installed	Alternate character set
W8	Installed	Last character visibility
W11	Removed	Not used
W12	Installed	Not used
W13	Removed	Not used
Split lugs E, COM, K, O	K is jumpered to COM only. No other connections.	Alternate character set

NOTE

Jumper configurations may vary to reflect factory-installed options.

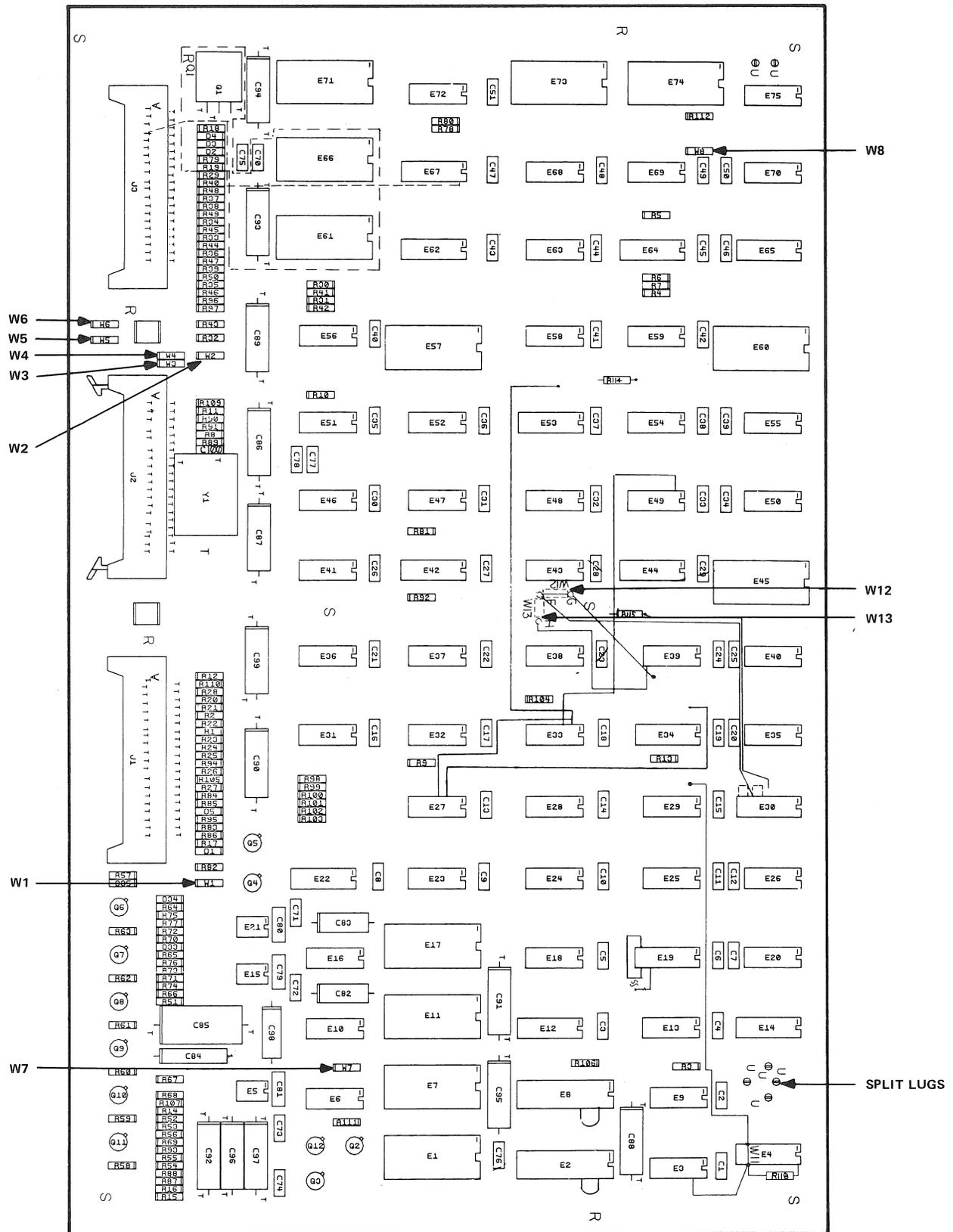


Figure 3-6 Printer Board Jumper Locations

Jumper Functions

Speaker Volume – The speaker volume can be varied by jumper W1. Removing W1 reduces the speaker volume.

-12 V Interface Voltage – Jumper W3 is installed because -12 V is required for the LS120 logic board.

Alternate Character Set – The W7 jumper must be installed when the APL alternative character set option is incorporated into the LS120. Split lugs COM and K must also be connected by a jumper wire when the option is installed.

Last Character Visibility – The last character visibility function moves the head to the right so that an operator can see the last characters typed. This function is disabled by removing jumper W8.

LS120 LOGIC BOARD JUMPER SELECTION

Jumper Locations – There are ten jumper locations provided on the LS120 logic board as shown in Figure 3-7. The jumpers are installed at the factory as listed in Table 3-3. Some of these jumpers cannot be changed by the user and others will allow the user to change the configuration of the factory standard logic board.

Table 3-3 Standard Factory Jumpers Configuration

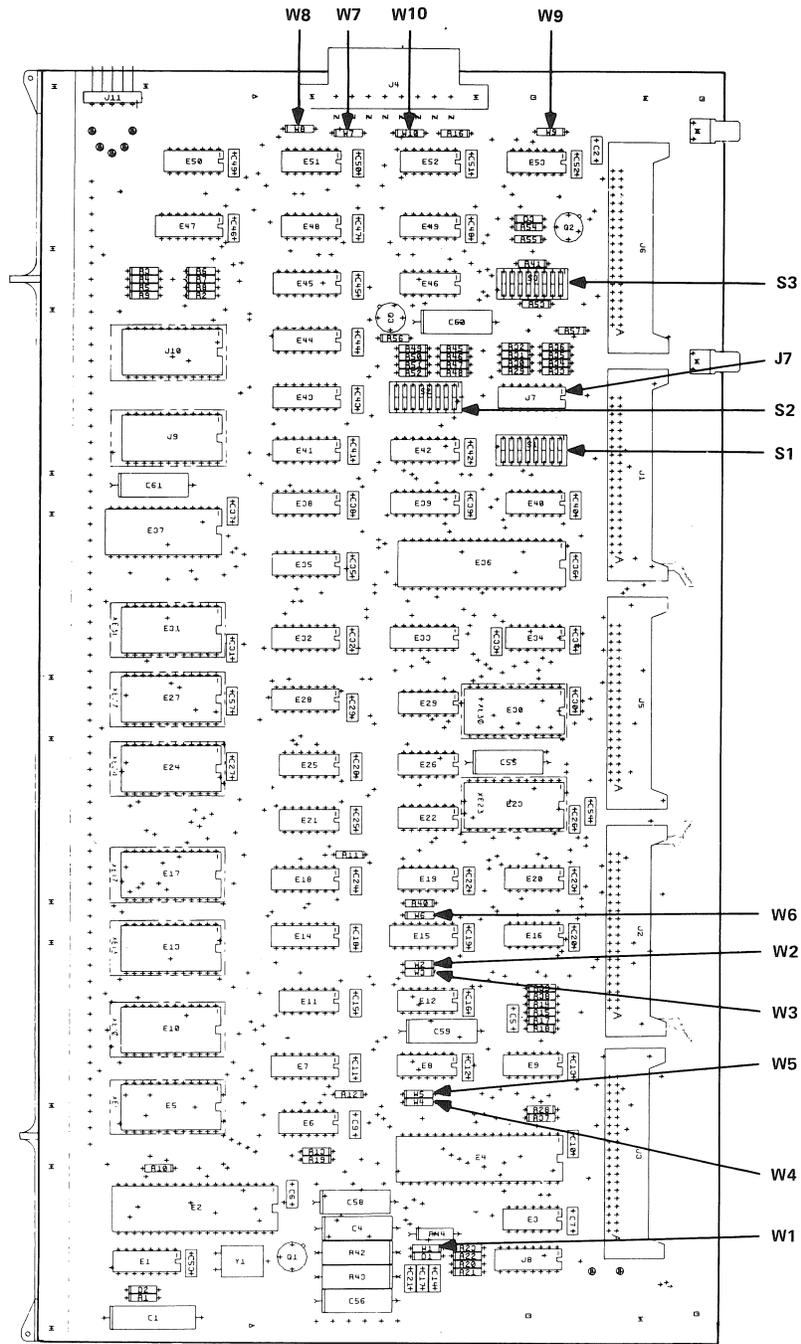
Jumper	Configuration	Function
W1	Installed	-5 Vdc Reference Voltage
W2	Removed	150 baud
W3	Installed	1200 baud
W4	Removed	150 baud split select
W5	Installed	75 baud split select
W6	Removed	Reserved
W7	Installed	TTL Data Out
W8	Installed	TERM READY H
W9	Installed	TTL Data In
W10	Installed	Restraint

Jumper Functions

W1 – This jumper must remain installed since it provides a -5 Vdc reference voltage for the 8080 microprocessor.

W2, W3 – These jumpers are used to select either a 150 or a 1200 baud rate when the keyboard baud switches (110 and 300) are in the ON position. With W2 removed and W3 installed, the operating rate will be 1200 baud as designated by the keyboard. However, if the user wishes to operate at 150 baud, he can install the W2 jumper and remove the W3 jumper and the system will operate at 150 baud and not the 1200 baud indicated on the keyboard.

W4, W5 – These jumpers are used in conjunction with the S3 dip switch on the logic board. With the S3-2 and the S3-3 switches in the OFF position, a split baud rate is selected that can send at either 75 baud or 150 baud and receive at 1200 baud. The 75 baud rate is selected by having the W5 jumper installed and the W4 jumper removed. The 150 baud rate is selected by having the W4 jumper installed and the W5 jumper removed.



CP-3150

Figure 3-7 LS120 Logic Board

W6 – This jumper is reserved for future use.

W7, W8, W9, W10 – These jumpers, when installed, are used to interconnect the EIA output connector to the auxiliary interface port. Removal of these jumpers may disrupt the normal operation of the LS120. The jumpers are only removed when the 20 mA current loop or the acoustic coupler options are installed.

Remove Jumpers when using TTL interface.

Dip Switches

Three rocker-type switches (Figure 3-8) are mounted on the LS120 logic board. These switches enable the user to select various operating conditions for the LS120. The function of these switches are listed in Table 3-4 and defined below.

S1-1 (Printer Automatic Line Feed) – This switch enables the LS120 automatic line feed function when it is set in the ON position. The LS120 will automatically perform a carriage return and a line feed whenever a carriage return is received from the modem.

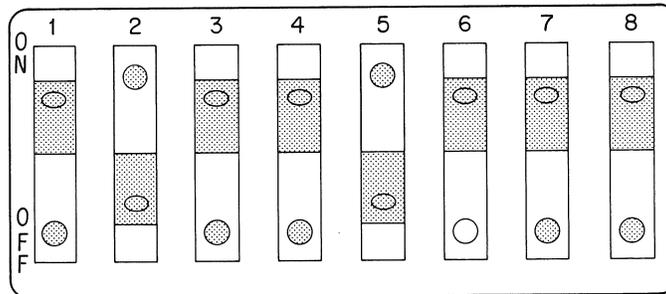
S1-2 (Parity Check Enable) – This switch enables the LS120 to perform a parity check on transmitted data when it is set in the ON position. The LS120 will always send data in the format defined by switches S1-3 and S1-4.

S1-3, S1-4 (Parity Selection) – These switches are used to select the type of parity being checked or sent by the LS120. The relative switch positions are defined below.

S1-3	S1-4	Parity
ON	ON	8th Bit Marking
OFF	ON	8th Bit Spacing
ON	OFF	Even
OFF	OFF	Odd

S1-5 (Printer Automatic New Line) – This switch enables the automatic new line function when it is set in the ON position; this function causes the LS120 to automatically perform a carriage return and a line feed whenever the print head attempts to exceed the right margin.

S1-6 (Lines per Inch Selection) – This switch selects 3 lines per inch for vertical paper motion when it is in the ON position. In the OFF position, the LS120 will operate at its normal 6 lines per inch for vertical paper motion.



CP-3151

Figure 3-8 S1, S2, and S3 Rocker Dip Switch

Table 3-4 Dip Switch Selectable Functions

POS	S1	S2	S3
1	ON	Auto line feed with CR	Disables XON/XOFF
	OFF	Disables auto line feed	Enable XON/XOFF
2	ON	Parity check enabled	Enables Half-duplex
	OFF	Parity check disabled	Enables full-duplex
3	ON	Switches S1-3 and S1-4 are used to select special parity modes:	Enables 20 mA interface
	OFF		Enables EIA interface
4	ON	a. 8th bit marking b. 8th bit spacing c. Even d. Odd	Enables reverse channel protocol
	OFF		Disables reverse channel protocol
5	ON	Auto new line when margin is reached	Selects ETX for turn-around character
	OFF	Disables auto new line	Selects EOT for turn-around character
6	ON	Selects 3 lines per inch	Paper out interlock disconnects DTR
	OFF	Selects 6 lines per inch	Paper out interlock sends XOFF or BREAK
7	ON	Spare	DTR will disconnect when EOT is received
	OFF		DLE EOT is send for disconnect
8	ON	Spare	Selects coded control mode
	OFF		Selects supervisory control mode

*Switch S3-4 and S3-6 must be set to OFF when using S3-5.

S1-7, S1-8 – These switches are not used.

S2-1 (Disable XON, XOFF) – This switch will disable the XON and the XOFF characters when it is in the ON position. The LS120 normally uses the XOFF character to signal the computer when the character buffer is approaching its capacity. The XON character is normally used to signal the computer when the character buffer content is approaching zero. If the XON and XOFF functions are disabled, or the computer does not recognize the control characters, it will be necessary to send fill characters to the LS120 to prevent overflow of the input buffer.

S2-2 (Select Half/Full-Duplex) – This switch will enable the HDX protocol when it is in the ON position. This allows the LS120 to control the transmission of data by using the Request to Send signal.

S2-3 (Defeat EIA Protocol) – The switch allows the LS120 to disable the verification of some EIA control signals on the interface when the switch is set in the ON position. The switch will force the Data Set Ready and the Received Line Signal Detector signals to be ignored. This switch must be set to the ON position when the LS120 20 mA current loop option is used.

S2-4 (Reverse Channel Select) – This switch, when in the ON position, selects the reverse channel protocol to allow the LS120 to interface with a modem using this capability. If S2-4 is OFF and S2-2 is ON, then the half-duplex protocol that uses only the turn-around character is selected.

S2-5 (Select Turn-Around Character) – This switch enables the LS120 to select either the EOT (OFF) or the ETX (ON) character to be recognized as the half-duplex turn-around character.

S2-6 (Paper Out Disconnect) – This switch, when in the ON position, will allow the LS120 to drop the Data Terminal Ready signal in order to disconnect the modem when the plastic paper cover is opened or a paper out condition occurs. When S2-6 and S2-1 are OFF, the LS120 will send XOFF (full-duplex) or a break (half-duplex with reverse channel). The computer will ignore these signals or they will be disabled by the user and the LS120 will ignore all received data after the input buffer is full.

S2-7 (Enable EOT Disconnect) – This switch, when in the ON position, allows the LS120 to pulse the Data Terminal Ready signal and cause a disconnect when an EOT character is received. When the switch is in the OFF position, then the 2-character sequence of DLE EOT must be sent to cause the disconnect.

S2-8 (Half-Duplex Reverse Channel Protocol) – This switch, when in the ON position, allows the LS120 to select the coded control mode. This mode uses S2-5 to select ETX or EOT as the coded character for line turn-around. It also can use switch S2-2 to select half-duplex and switch S2-4 to select reverse channel as the coded characters for line turn-around. When the switch is in the OFF position, the LS120 operates in the supervisory control mode. The LS120 will not recognize a turn-around character but does monitor the Received Line Signal Detector and the Secondary Received Line Signal Detector signals so that it can operate as a slave to the system host. In most protocol systems, the carriage return is used as a pseudo turn-around character.

NOTE

If the EOT is selected as the turn-around character, then DLE EOT must be selected for the disconnect sequence.

S3-1 (FDX/HDX) – This switch, when placed in the ON position, will force a local echo of the keyboard. The switch disables the FDX/HDX switch located on the keyboard. The FDX/HDX switch controls the local echo selection when this switch is in the OFF position.

S3-2, S3-3 (Preselect Baud Rates) – These switches are used together to select the baud rate assigned to the PRESELECT position of the BAUD RATE switches on the keyboard. When both of the BAUD RATE select switches on the keyboard are in the OFF position, the operating baud rate of the LS120 is determined as follows by switches S3-2 and S3-3.

S3-2	S3-3	Preselected baud rate
OFF	OFF	1200 receive, 75 send
ON	OFF	2400
OFF	ON	4800
ON	ON	0

S3-4, S3-6 (Select RLSD Signal) – These switches are used to select the polarity of the Secondary RLSD signal which is received as a restraint signal. The switches are used to select which level of the signal that the LS120 will recognize as described below.

S3-4	S3-6	Polarity
ON	OFF	Restraint is asserted high for the communication line.
OFF	ON	Restraint is asserted low for the communication line.

NOTE

Switches S3-4 and S3-6 should not be selected and set to the ON position at the same time.

S3-5 (Speed Mode Select) – This switch, when set to ON, selects the Speed Mode Indicator signal to be used by the LS120 when interfacing with a 212A type modem. The LS120 uses this signal to automatically select the 1200 baud rate. The user must select the 300 baud rate on the front panel in order for this function to properly perform and dip switches S3-4 and S3-6 must be set in the OFF position.

S3-7 (Disable Clear to Send) – This switch, when in the OFF position, allows the LS120 to ignore the Clear to Send signal from the EIA interface.

S3-8 – This switch is not used.

CHAPTER 4 LS120 PROGRAMMER'S INFORMATION

TRANSMITTING CHARACTERS AND COMMANDS

The only way an operator can transmit data is by typing keys on the keyboard. The 7-bit ASCII equivalent of each key is transmitted when the key is pressed. The LS120 does not use all the control codes available; it only uses the codes described in Figure 4-1. This figure is useful when writing programs that interface with the LS120. The 7-bit ASCII codes are listed and the operation performed by the LS120 when a specific code is received is described. Figure 4-2 illustrates the rate versus column width for the LS120. The Delete and Null commands are recommended for fill characters because these are immediately discarded by the LS120. All other nonfunctional control characters are acknowledged by the LS120 and stored in its buffer. This could cause the buffer to overflow prematurely.

SPECIAL KEYS

CTRL Key

The CTRL key is used to initiate special commands. The CTRL key must be pressed while pressing another key. When the CTRL key is pressed, it forces bits 6 and 7 of the ASCII code to be 0. For example, the ASCII code for the letter "g" is 147 (1100111).

↑ ↑
Bits 7 and 6

Holding down the CTRL key and typing the "g" key transmits the ASCII code 007 (0000111).

↑ ↑
Bits 7 and 6

The CTRL key enables the LS120 operator to transmit all the ASCII control codes (000-037).

BREAK Key

The BREAK key is commonly used to manually interrupt the flow of data coming to the LS120. Pressing the BREAK key causes the Transmitted Data signal from the LS120 to go to the space condition. The Break signal is timed to be approximately 233 ms; it is not dependent on how long the key is pressed. When the LS120 is receiving in the half-duplex mode, the Break signal will be sent on the secondary channel.

RECEIVING CHARACTERS AND COMMANDS

When the operator selects the FDX mode and has the LS120 DECwriter on-line, the received characters are printed and the keyboard characters are transmitted simultaneously. If the LS120 is receiving characters at a high transmission rate, the excess characters are temporarily stored in the print buffer.

0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1	B7 B6 B5
Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	B4 B3 B2 B1
SP	Q	@	P	\	F	∅ ∅ ∅ ∅
!	1	A	Q	æ	æ	∅ ∅ ∅ 1
"	2	B	R	b	r	∅ ∅ 1 ∅
#	3	C	S	c	s	∅ ∅ 1 1
\$	4	D	T	d	t	∅ 1 ∅ ∅
%	5	E	U	e	u	∅ 1 ∅ 1
&	6	F	V	f	v	∅ 1 1 ∅
'	7	G	W	g	w	∅ 1 1 1
(	8	H	X	h	x	1 ∅ ∅ ∅
)	9	I	Y	i	y	1 ∅ ∅ 1
*	:	J	Z	j	z	1 ∅ 1 ∅
+	;	K	E	k	€	1 ∅ 1 1
,	<	L	\	l	l	1 1 ∅ ∅
-	;	M	I	m	}	1 1 ∅ 1
.	>	N	^	n	~	1 1 1 ∅
/	?	O	...	O	DEL	1 1 1 1

CP-3152

Figure 4-1 Standard (ASCII) Character Set

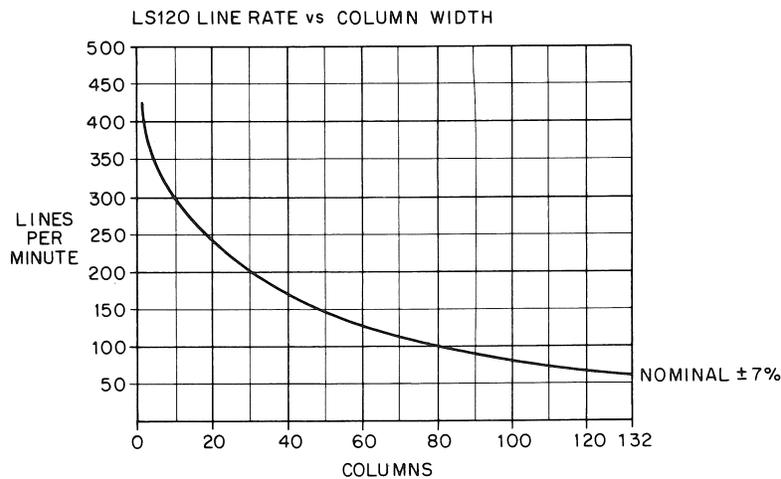


Figure 4-2 LS120 Line Rate Versus Column Width

When the capacity of the buffer fills to within 64 characters of full, then the LS120 transmits an XOFF signal to the transmitting device. After the printer has reduced the content of the buffer to within 64 characters of empty, the LS120 transmits the XON signal to the transmitting device. A received End of Transmission (EOT) or DEOT signal causes the LS120 to pulse the Data Terminal Ready (DTR) signal low and initiate a disconnect. This allows the LS120 to accept another call. The Request to Send (RTS) signal is asserted whenever DTR is asserted. A paper out condition causes the LS120 to transmit a Break or initiate a disconnect. The selection of these conditions is detailed in Chapter 3.

When the operator selects the HDX mode and has the LS120 DECwriter on-line, the received characters are printed and the keyboard characters are transmitted individually. The control of the transmission is accomplished by using the Request to Send (RTS) signal. The LS120 initially asserts the RTS signal unless the Ring Indicator signal has been received. The LS120 waits until an EOT or ETX signal is received, which is selectable as described in Chapter 3. After an EOT or ETX signal is received, the LS120 waits for Carrier Detect to be lowered and then asserts RTS. After the Clear to Send signal becomes asserted, the keyboard characters are transmitted. A transmitted EOT signal causes the RTS signal to be unasserted and whenever the Carrier Detect signal becomes asserted again, the reception of data is resumed. A received DEOT or EOT signal causes the LS120 to disconnect using the DTR signal. The disconnect commands are selectable by the dip switches. The functions of XON and XOFF, which are performed in the FDX mode, are not available.

ESCAPE COMMANDS

Pressing the escape (ESC) key generates ASCII code 033 and allows the operator to perform escape operations. There are two escape operations installed in the basic LS120 and many more are available when the forms option (LAXX-RA) is installed (Chapter 7). PO RESET and SELF TEST are the basic LS120 escape commands. The operations are recognized by the LS120 where the operator presses the ESC key and then the specific characters.

PO RESET - The PO RESET code is used to reset a paper out condition which is identified by the PAPER OUT indicator illuminated and the PRINTER ON indicator blinking on and off. The LS120 also has an interlock switch that monitors the plastic cover over the carriage and ensures that it is in place when the machine is operating. Raising the plastic paper cover while in operation will trigger the interlock switch to simulate a paper out condition. The interlock condition is corrected by properly closing the plastic paper cover. The paper out condition is corrected by inserting a new paper supply. With the LS120 in any mode, the operator then keys ESC0 (PO RESET), which will turn off the PAPER OUT indicator and allow the PRINTER ON indicator to remain illuminated. Keying a paper out-reset also allows the operator to complete the last form in the LS120, even if the plastic cover remains open.

SELF TEST - With the LS120 operating in the local mode only, the self-test mode is initiated by keying ESC- (SELF TEST). The LS120 will then print out a test pattern as shown in Figure 1-4. The self-test mode is terminated by the operator pressing the DELETE key or setting the LINE/LOC switch to LINE.

CHAPTER 5 TROUBLESHOOTING GUIDE

Symptom

LS120 does not turn on when
PRINTER ON (0)/OFF (1)
switch is set to ON.

Possible Cause and Corrective Action

AC power cord is not plugged into wall outlet; plug it in.

Current is not coming from wall outlet; check outlet with a known
working electrical device (such as a lamp).

Check ac line fuse. (For fuse location, see Figure 5-1.)

If none of the above, contact your local Field Service office.

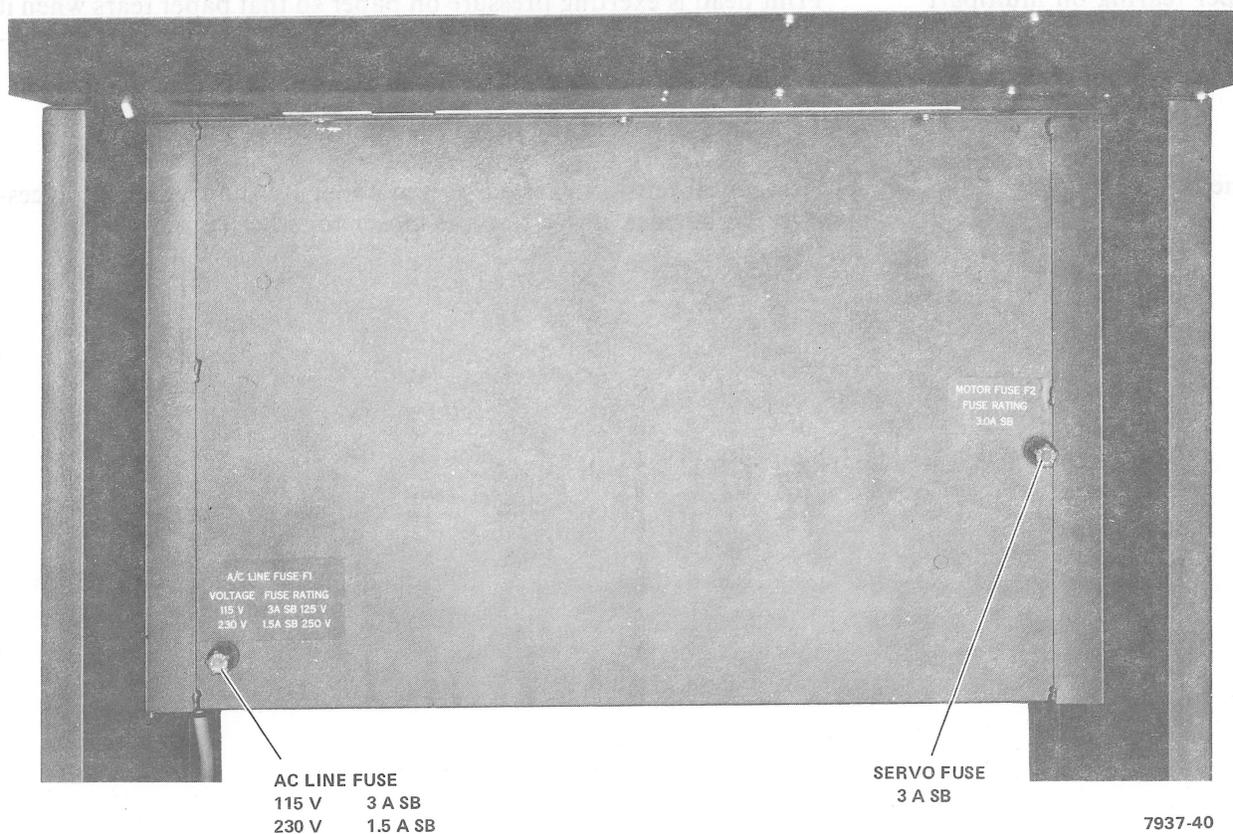


Figure 5-1 LS120 Fuse Locations

Symptom**Possible Cause and Corrective Action**

Print head does not print characters when operating in local or standby

Check servo fuse, which might be blown. (For fuse location, see Figure 5-1.)

Light print

Print head may be set too far from paper, adjust the carriage adjustment lever per Impression Adjustment Procedure in Chapter 2.

Ribbon ink has run out; replace ribbon.

Reverse ribbon after approximately 8 hours of continuous printing. Ribbon should be reversed only once, then changed.

Paper does not advance

Improper loading of paper; check tractor covers to ensure that they are closed.

Holes in paper are torn; turn LS120 OFF and reload paper per Paper Loading Procedure in Chapter 2.

Paper snagged or caught by box.

Paper tearing on multipart forms

Print head is exerting pressure on paper so that paper tears when it advances; check print head position control. (Adjust carriage adjustment lever.)

Tension exerted on the paper by the tractors is incorrect.

Line bunching

Horizontal tension exerted on the paper by the tractors is excessive. To correct, move tractors closer together (Figure 5-2).

CHAPTER 6 LS120 SPECIFICATIONS

Line Length	132 characters maximum
Spacing	10 characters/inch (horizontal) 3 or 6 lines/inch (vertical), user selected
Characters	96 upper/lowercase ASCII 7 × 7 dot matrix (0.77 × 2.54 mm, 0.07 × 0.10 in)
Paper	Tractor drive, pin-feed
Width	7.62 to 37.78 cm (3 to 14-7/8 in.)
Weight	
Single-Part	6.8 kg (15 lb) paper minimum 0.25 mm (0.010 in) thick card stock maximum
Multipart	1 to 6 parts (see notes) 0.50 mm (0.020 in) thick maximum

NOTES

1. **Multipart forms may have only one card part. The card must be the last part.**
2. **NCR or 3M paper, up to 6-part, must use ribbon on the top copy. First-surface impact paper is not recommended.**
3. **Continuous-feed, fan-fold business forms with 3- or 4-prong margin crimps on both margins (multipart) are recommended. Stapled forms are not recommended and may damage tractors and other areas of the machine. Dot or line glue margins are acceptable (if line is on one margin only). Do not line glue both margins as air will not be able to escape and poor impressions will result.**
4. **Split forms (forms with each side containing a different number of sheets) are not recommended.**

Ribbon	DIGITAL-specified nylon fabric (Part No. 36-12153)
Spool Assembly	1.27 cm wide × 54.87 m long (0.05 in × 60 yd)
Power	90–132 Vac or 180–264 Vac 50 or 60 Hz ± 1 Hz (not interchangeable) 400 W maximum (printing) 100 W maximum (idle)
Temperature	
Operating	10° to 40° C (50° to 104° F), noncondensing
Nonoperating	–40° to 66° C (–40° to 151° F), noncondensing
Relative Humidity	
Operating	10 to 90% with a maximum wet bulb temperature of 28° C (82° F) and a minimum dew point of 2° C (36° F), noncondensing
Nonoperating	5 to 95%
Dimensions	
Width	69.85 cm (27.5 in)
Height	85.09 cm (33.5 in)
Depth	60.69 cm (24 in) deep
Weight	48.64 kg (107 lb)

CHAPTER 7 OPTIONS

APL OPTION (LAXX-RC)

The APL option kit contains the following parts.

Quantity	Item	Part Number
1	APL Keycap Set	D-IA-7414521-0-0
1	Keycap Puller	C-MD-7416355-0-0
1	APL ROM	23086A6
1	APL ROM	23087A6
1	Insulated Jumper	9009185

The user installs the APL option by removing the existing keycaps, using the keycap puller, and installing the new keycaps. The new ROMs are installed on the printer board as follows: 23086A6 is inserted into E17 and 23087A6 is inserted into E11. The insulated jumper is used to connect split lug K to split lug COM.

An LS120 DECwriter containing this option can print either the standard ASCII characters or the alternate APL characters. The option is manually activated by a jumper on the printer board as described in Chapter 3. Once activated by the jumper, the use of either the standard ASCII characters or the APL characters is programmable.

In the up position, the CHAR SET LOCK switch permits the transmitting device to change character sets by sending either a CTRL O (switch in) or CTRL N (switch out) command. CTRL O (code 016₈) selects the standard ASCII character set; CTRL N (code 017₈) selects the alternate APL character set.

When the CHAR SET LOCK switch is in the down position, the operator locks in the present character set being used and the program codes CTRL O; CTRL N will not be able to change the character set. Illumination of the ALT CHAR SET lamp indicates that the LS120 is operating with the APL alternate character set.

Keyboard location of the alternate APL characters is shown in Figure 7-1. The standard ASCII characters are shown above the keys and the APL symbols are on the front of the keys. The bit assignments for both character sets are shown in Figure 7-2.

<div style="display: flex; align-items: center;"> <div style="margin-right: 5px;">b₇ _____</div> <div style="margin-right: 5px;">b₆ _____</div> <div style="margin-right: 5px;">b₅ _____</div> <div style="margin-right: 5px;">b₄ ↓</div> <div style="margin-right: 5px;">b₃ ↓</div> <div style="margin-right: 5px;">b₂ ↓</div> <div style="margin-right: 5px;">b₁ ↓</div> </div>					0	0	0	0	1	1	1	1	
					0	0	1	0	1	0	1	0	1
Bits					Column →	0	1	2	3	4	5	6	7
Row ↓					0	1	2	3	4	5	6	7	
0	0	0	0	0	0	NUL	DLE	SP	0	@	P	\	Ɔ
0	0	0	1	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	0	4	EOT	DC4	\$	4	D	T	d	t
0	1	0	1	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	1	15	SI	US	/	?	O	_	o	DEL

a. STANDARD (ASCII) CHARACTER SET

<div style="display: flex; align-items: center;"> <div style="margin-right: 5px;">b₇ _____</div> <div style="margin-right: 5px;">b₆ _____</div> <div style="margin-right: 5px;">b₅ _____</div> <div style="margin-right: 5px;">b₄ ↓</div> <div style="margin-right: 5px;">b₃ ↓</div> <div style="margin-right: 5px;">b₂ ↓</div> <div style="margin-right: 5px;">b₁ ↓</div> </div>					0	0	0	0	1	1	1	1	
					0	0	1	0	1	0	1	0	1
Bits					Column →	0	1	2	3	4	5	6	7
Row ↓					0	1	2	3	4	5	6	7	
0	0	0	0	0	0	NUL	DLE	SP	0	-	*	o	P
0	0	0	1	1	1	SOH	DC1	~	1	a	?	A	Q
0	0	1	0	0	2	STX	DC2	)	2	±	Ɔ	B	R
0	0	1	1	1	3	ETX	DC3	<	3	n	Γ	C	S
0	1	0	0	0	4	EOT	DC4	≤	4	L	~	D	T
0	1	0	1	1	5	ENQ	NAK	=	5	ε	↓	E	U
0	1	1	0	0	6	ACK	SYN	>	6	-	u	F	V
0	1	1	1	1	7	BEL	ETB	]	7	∇	ω	G	W
1	0	0	0	0	8	BS	CAN	∨	8	Δ	∩	H	X
1	0	0	1	1	9	HT	EM	^	9	ι	↑	I	Y
1	0	1	0	0	10	LF	SUB	≠	(	e	c	J	Z
1	0	1	1	1	11	VT	ESC	÷	[	'	←	K	{
1	1	0	0	0	12	FF	FS	,	;	□	┌	L	|
1	1	0	1	1	13	CR	GS	+	x	l	→	M	}
1	1	1	0	0	14	SO	RS	.	:	τ	≥	N	\$
1	1	1	1	1	15	SI	US	/	\	θ	-	O	DEL

b. ALTERNATE (APL) CHARACTER SET

CP-3156

Figure 7-2 Bit Assignments for ASCII and APL Character Sets

FORMS OPTION (LAXX-RA)

The forms option kit contains the following parts.

Quantity	Item	Part Number
1	Forms Control ROM	23009E1
1	Column Scale	C-IA-7414986-0-0
1	Column Pointer	C-MD-7415409-0-0
1	Light Shield	C-MD-7415255-0-0
1	Phillips Pan Head Screw (#4-40 × 3/8 in)	9006011-1
1	Flat Washer (#4)	9008172
1	Lock Washer (#4)	90066632

A Phillips head screwdriver is the only tool required for installation. Use Figures 7-3 and 7-4 plus the following procedure as installation guides.

1. Unplug the ac power cord, remove the paper, and remove the top cover.
2. The column pointer (item 2 in Figure 7-4) and its associated spacer are manufactured as a single unit. The spacer is attached to the side of the pointer by a thin web. Before installing the pointer, these two parts must be separated at this web. Fold the spacer down under the pointer to break apart.
3. Install the column pointer and spacer on the line indicator using the #4 screw, lock washer, and flat washer (item 3).

NOTE

If after closing the cover, the green and red positioning lines on the column pointer seem to be too high above the lip of the window, remove the spacer from beneath the column pointer.

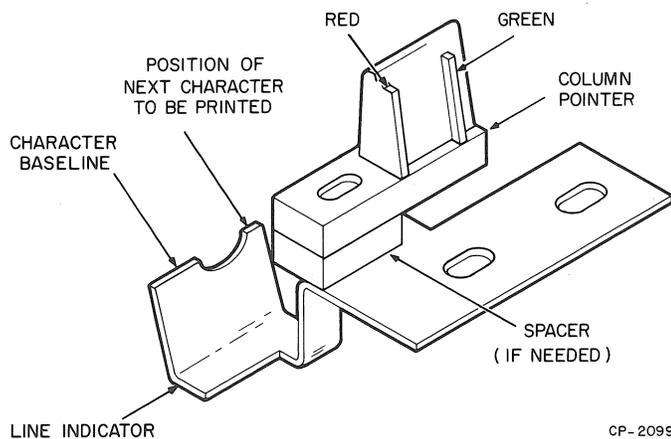
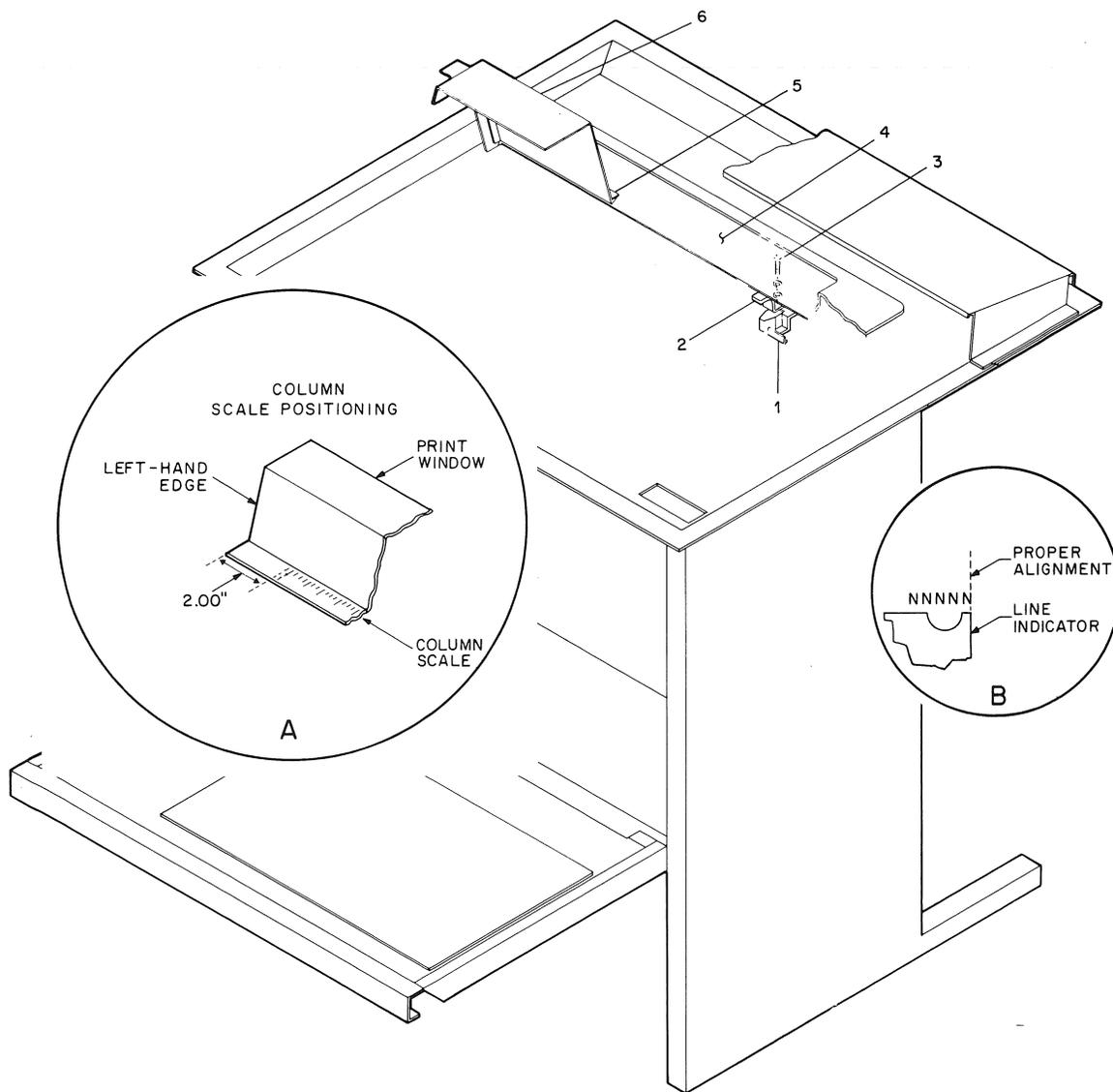


Figure 7-3 Line Indicator and Column Pointer



CP-2117

Figure 7-4 Installation of Scale and Pointer

4. The light shield (item 4) has a flat black surface that minimizes glare and reflections. The shield mounts on the sloped surface of the top cover. Peel off the backing and position the shield on the cover.
5. The column scale (item 5) adheres to the lip on the print window (item 6) as shown in Figure 7-4. Insert A of Figure 7-4 details the placement of the scale on the window lip.

6. Insert B of Figure 7-4 shows the proper alignment of the line indicator and printed characters after five Ns have been printed and a backspace occurred. The right-hand vertical ascender of the last N printed should align over the right edge of the line indicator. If necessary, loosen the two mounting screws and correct the alignment.

NOTE

After installing the column scale (item 5) and the column pointer (item 2), a horizontal adjustment may be required. The green indicator line on the column pointer should align with a corresponding line on the column scale before the last character visibility (LCV) move takes place. If alignment is performed after the last character visibility move, the red line on the column pointer is used.

7. The forms control ROM is inserted into the E27 connector on the LS120 logic board (Figure 3-7).

The ROM is preprogrammed to interpret the escape codes used for setting tabs. The keyboard is already inscribed with the function of keys used by this option. When the option is installed, the user can set and clear horizontal and vertical tabs. The user can also set left, right, top and bottom margins. The escape codes used by the operator to set the tabs and margins are listed in Table 7-1 and described in the following paragraphs.

Table 7-1 Forms Option Escape Codes

Function*	ANSI	Keyboard
Horizontal tab at the present position	ESCH	ESC1
Horizontal tabs at multiple positions up to 16	ESC[A; B; C; . . . u	
Move head to Nth column from any position	ESC[N`	
Move head N columns from present position	ESC[Na	
Vertical tab at the present position	ESCJ	ESC3
Vertical tabs at multiple positions up to 16	ESC[A; B; C; . . . v	
Move paper to line N when referenced to top of form position	ESC[Nd	
Move paper N lines from present position	ESC[Ne	
Clear all horizontal tabs	ESC[2g	ESC2
Clear horizontal tab at present position	ESC[0g, ESC [g	
Clear all vertical tabs	ESC[4g	ESC4
Clear vertical tab at present position	ESC[1g	

Table 7-1 Forms Option Escape Codes (Cont)

Function*	ANSI	Keyboard
Set length of form equal to N lines and the top of form at the print head location and clear top and bottom margins	ESC[Nt	ESC5N;
Set first printed line A lines from top of form position	ESC[Ar	ESC8A;
Set last printed line B lines from top of form position	ESC[;Br	ESC9B;
Set top margin A lines and bottom margin B lines from top of form position	ESC[A;Br	
Set left margin at column A	ESC[As	ESC6A;
Set right margin at column B	ESC[;Bs	ESC7B;
Set left margin at column A and right margin at column B	ESC[A; Bs	

*The numerical value for N, A, or B is within 1 to 88 for all vertical or line operations and within 1 to 132 for all horizontal or column operations.

Two versions of ESC sequences are supported by the LS120. The direct operator keyboard ESC sequences are initiated by using the ESC key and the top row of keys on the main keyboard (numeric row). The other version consists of ANSI-specified syntax which may be downline loaded or typed at the keyboard. The escape operations recognized by the LS120 are described in the following paragraphs. The ESC prefix requires the operator to press the ESC key and then the indicated characters.

NOTE

The characters enclosed in parentheses are used for reference designations on the keyboard.

Horizontal Tabs

With the LS120 operating in any mode, a horizontal tab is set at the present head position by keying ESC1 (SET HT). A horizontal tab can also be set at the present head position by using the ANSI code ESCJ. The ANSI code can be used to set up to 16 horizontal tabs with the single command ESC[A;B;C; . . . u. In this command, the A, B, and C are numbers representing the column locations from 1 to 132 positions. If more than 16 horizontal tabs are required, then multiple commands can be issued. Other useful ANSI codes are: ESC[N^l, which will move the print head, in the positive direction only, to column position "N" from any other position; and ESC[Na, which will move the head "N" columns from the present column position, in the positive direction only, to a new position of the print head.

Vertical Tabs

With the LS120 operating in any mode, a vertical tab is set at the present position of the paper by keying ESC3 (SET VT). A vertical tab can be set at the present position of the paper using the ANSI code ESCJ. The ANSI code can be used to set up to 16 vertical tabs with the single command ESC[A;B;C; . . . v. In this command, the A, B, and C are numbers representing line locations from 1 to 88 lines. If more than 16 vertical tabs are required, then multiple commands can be issued. Other useful ANSI codes are: ESC[Nd, which will move the paper to line "N" from the top of form position or zero line; and ESC[Ne, which will move the paper "N" lines from its present position.

Clear Horizontal and Vertical Tabs

With the LS120 operating in any mode, all horizontal tabs are cleared by keying ESC2 (CLEAR HT) and all vertical tabs are cleared by keying ESC4 (CLEAR VT). All the horizontal tabs can be cleared using the ANSI code ESC[2g and all the vertical tabs are cleared by ESC[4g. The ANSI code to clear a horizontal tab at the present position is ESC[g or ESC[0g. The ANSI code to clear a vertical tab at the present line is ESC[1g.

Form Size (Top of Form)

With the LS120 operating in the local or standby mode, the length of the form is set by keying ESC5N. The length of the form is converted from lines to inches at a rate of 6 lines per inch and "N" is a number from 1 to 88 which represents the length of the form in total lines. With the LS120 operating in any mode, the ANSI code ESC[Nt is used to set the form size at "N" lines per page. Whenever a form size command is issued, a new top of form position is established at the present position of the head and the top and bottom margins are automatically cleared.

Top and Bottom Margins

With the LS120 operating in the local or standby mode, the top margin is set by keying ESC8N;. The top margin of the first printed line is set "N" lines from the top of form position. The bottom margin is set by keying ESC9N;, where the bottom margin or the last line to be printed is set at "N" lines from the top of form position. The number of lines for the top or bottom margins must be within 1 to 88 lines. With the LS120 operating in any mode, the ANSI code that will set both margins in a single command is ESC[A;Br, where the top margin is set "A" lines from the top of form position and the bottom margin is set at "B" lines from the top of form setting. To clear top or bottom margins, the operator keys the escape code for the new margin settings and therefore deletes the existing margin setting.

Left and Right Margins

With the LS120 operating in the local or standby mode, the left margin is set by keying ESC6N;. The left margin or the first column is set "N" columns from the zero position. The right margin, is set by keying ESC7N;. The right margin or the last column that the printer will print at, is set "N" columns from the zero position. The number of columns for the left or right margins must be within 1 to 132 and the number used for the right margin must be greater than the number used for the left margin. With the LS120 operating in any mode, the ANSI code that will set both margins in a single command is ESC[A;Bs, where the left margin is set "A" columns from zero and the right margin is set "B" columns from zero. To clear the left or right margins, the operator keys the escape code for the new margin settings and therefore deletes the existing margin settings.

Form Functional Check

Set the LS120 for local operation and set the PRINTER ON (1)/OFF (0) switch ON. When the PRINTER ON (1)/OFF(0) switch is set to the ON condition, the LS120 will start with the following conditions. There will be no horizontal or vertical tabs, the form length will be set at 66 lines, the top margin will be the top of form (wherever the form is presently set), the bottom margin will be the form length (66 lines), the left margin will be set at 1, and the right margin will be set at 132.

Example 1

The verification of the forms size function can be performed by the operator using the following sample conditions with the LS120 in the LOC mode.

Keyboard Settings – Align the perforated portion of the paper to the top of the print head or to the top of the print bar and key either ESC540; or ESC[40t to establish the top of form position and a forms length of 40 lines.

To set the top margin at 5 lines, key either ESC85; or ESC[5r.

To set the bottom margin at 35 lines, key either ESC935; or ESC[:35r.

To set the left margin at 30 columns, key either ESC630; or ESC[30s.

To set the right margin at 90 columns, key either ESC790; or ESC[:90s.

Verification – Press ESC – (SELF TEST); the LS120 will initiate a printout of ASCII characters. Press the DELETE key to halt the self-test mode after the printer has completed its first sample form. The form should be 15.2 cm wide by 12.7 cm long (6 inches by 5 inches).

Example 2

Keyboard Settings – To establish new left and right margins at columns 20 and 100, key ESC[20;100s; establish new top and bottom margins at lines 12 and 30 by keying ESC[12;30r.

Verification – Repeat the same self-test operation; the form size should be 20.3 cm wide by 7.62 cm long (8 inches by 3 inches).

Example 3

The verification of the forms horizontal tab function can be performed by the operator using the following sample conditions with the LS120 in LOC mode.

Keyboard Settings – Set the PRINTER ON (1)/OFF (0) switch to OFF and then ON to reset forms for initial conditions; the head is located at the left margin.

To move the head to column 20, key ESC[20^; to set horizontal tab at that point, key either ESC1 or ESCH.

To move the head 30 columns to the right, key ESC[30a; to set a horizontal tab at that point, key either ESC1 or ESCH.

To set multiple horizontal tabs, key ESC[60;80;100;110u. The LS120 will set the tabs at 60, 80, 100, and 110.

Verification – Press the RETURN key so that the head is located at the left margin. Press the TAB key six times and verify tab settings at columns 20, 50, 60, 80, 100, and 110.

Example 4

Keyboard Settings – Press the RETURN key so that the head is located at the left margin. Press the TAB key twice to select the tab setting at column 50. To delete the tab setting at column 50, key ESC[g.

Verification – Press the RETURN key so that the head is located at the left column. Press the TAB key three times and verify tab settings at columns 20, 60, and 80.

Example 5

Keyboard Settings – Press the RETURN key so that the head is located at the left column. To delete all horizontal tabs, key either ESC[2g or ESC2.

Verification – Press the TAB key five times and verify that the head moves five individual spaces. This indicates that all the horizontal tabs have been cleared.

Example 6

The verification of the forms vertical tab function can be performed by the operator using the following sample conditions with the LS120 in the LOC mode.

Keyboard Setting – Set the PRINTER ON (1)/OFF (0) to OFF and then ON to reset forms for initial conditions; ensure that the head is located at the left margin.

Align the perforated portion of the paper to the top of the print head and key either ESC566; or ESC[66t to set the top of form position and the forms length to 66 lines.

Press the LF key five times to advance the paper five lines. Key either ESC3 or ESCJ to set a vertical tab at line 5.

Key ESC[15d to move the paper 10 lines to line 15 and key either ESC3 or ESCJ to set a vertical tab at line 15.

Key ESC[10e to move the paper 10 lines from line 15 and key either ESC3 or ESCJ to set a vertical tab at line 25.

To set multiple vertical tabs, key ESC[40;50;60v. This will set tabs at lines 40, 50, and 60.

Verification – Execute a form feed control by pressing and holding the CTRL key and then keying the FF (L) key. This will move the paper to the top of the next form. To execute a vertical tab control, press and hold the CTRL key and then press the VT (K) key. Now key six vertical tab controls and verify that the paper stops at lines 5, 15, 25, 40, 50, and 60.

Example 7

Keyboard Settings – Execute a form feed control by pressing and holding the CTRL key and pressing the FF key. To set the paper at the first vertical tab, press and hold the CTRL key and key VT. To delete the tab setting at line 5, key ESC[lg.

Verification – Perform a form feed by pressing and holding the CTRL key and keying FF. Perform a vertical tab by pressing and holding the CTRL key and keying VT. The paper should skip the vertical tab set at line 5 and go to line 15, the next vertical tab.

Example 8

Keyboard Settings – To delete all vertical tabs, key either ESC[4g or ESC4.

Verification – Perform a form feed by pressing and holding the CTRL key and keying FF. Perform a vertical tab by pressing and holding the CTRL key and keying VT. Every time a vertical tab is executed, the paper moves only one line, indicating there are no vertical tabs set.

14-KEY NUMERIC PAD OPTION KIT (LAXX-RM)

The 14-key numeric pad kit contains the following parts.

Quantity	Item	Part Number
1	Bezel	E-IA-7411427-6-0
1	LK03A Numeric Keyboard Assembly	C-UA-LK03-A-0
1	Numeric Pad Cable	C-IA-7008612-0-0
4	Standoff Spacers	9009285-00
4	Keyp Nuts	9006563-00

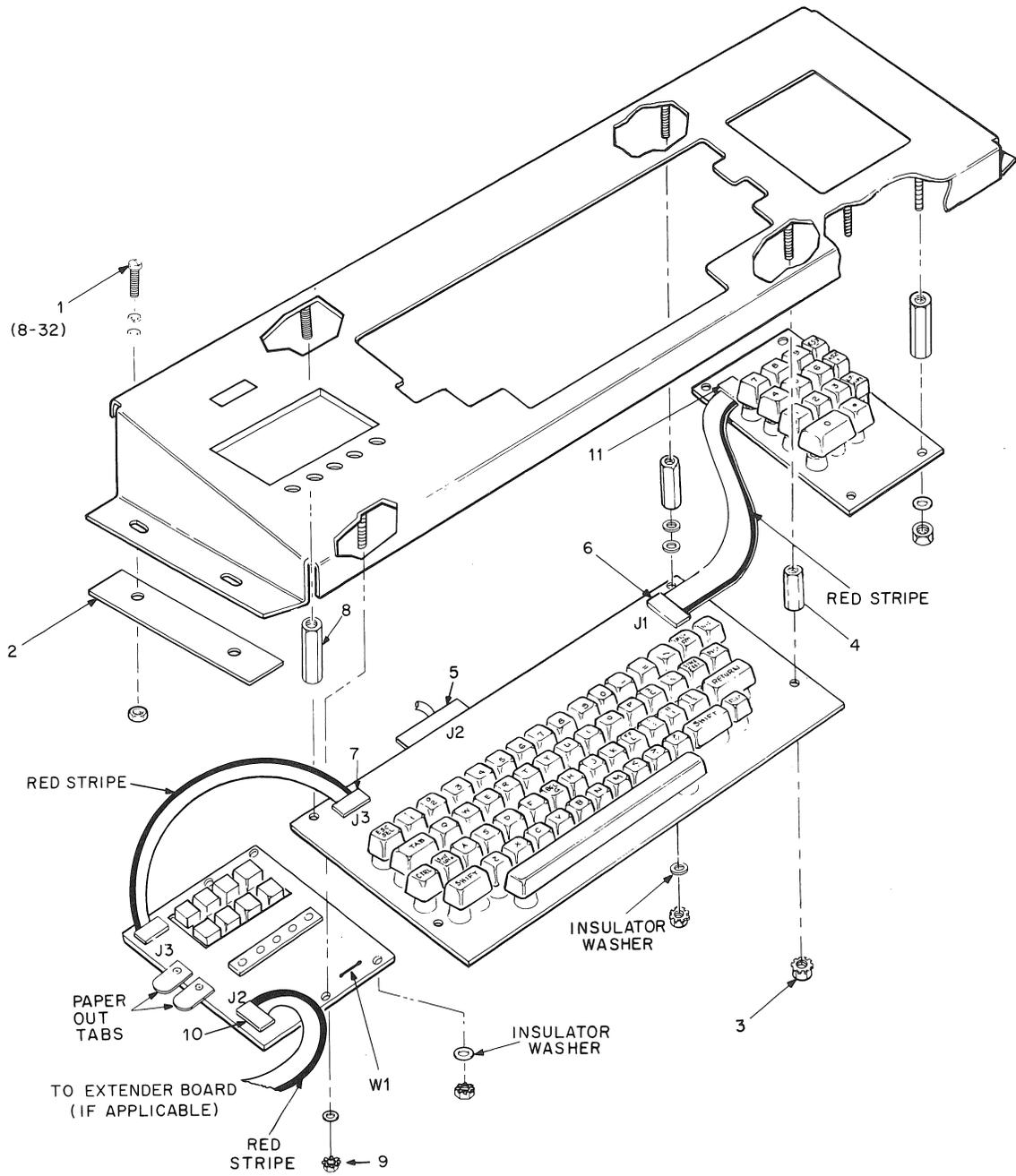
A Phillips head screwdriver and an 11/32-inch nut driver are the only tools required for installation. Use Figure 7-5 and the following procedure as installation guides.

1. Unplug the ac power cord, take the top cover off, remove the paper, and remove the plastic housing.
2. Refer to Figure 7-5. Remove the four screws, lock washers, flat washers (item 1 in Figure 7-5), and spacers (item 2) that secure the keyboard bezel to the cabinet base.
3. Turn the keyboard upside down on a piece of foam or bubble plastic and remove the four key nuts (item 3) that secure the keyboard to the bezel. Remove the four key nuts (item 9) that secure the control panel to the bezel.
4. Remove all eight standoffs from the old bezel and attach them, with the four standoffs supplied with the kit, on the new bezel as shown in Figure 7-5.
5. Connect one end of the numeric pad cable (item 6) to J1 on the keyboard. Connect the other end to the connector on the numeric pad (item 11). Ensure the red stripe is positioned as shown in Figure 7-5.
6. Carefully replace all three assemblies (control panel, keyboard, and numeric pad) on their respective standoffs and secure with the key nuts. Provide adequate cable clearances around all standoffs.

CAUTION

Ensure that all insulating washers are installed between the key nuts and the etch side of the circuit boards. Failure to insert washers at required points may cause circuit damage.

The keyboard cable (item 5 in Figure 7-5) must be routed to the inside of the standoff (item 8) and between the bezel and the component side of the keyboard. This prevents possible interference between the cable and print head assembly.



CP-2103

Figure 7-5 Keyboard and Bezel Assembly - Cabling and Hardware

7. Replace the bezel on the cabinet base and secure with the four screws, lock washers, flat washers, and spacers.

CAUTION

The keyboard bezel should be positioned as far forward (toward operator) as possible to eliminate interference between the keyboard cable and print head assembly.

Ensure that the spacers are placed under the bezel. Failure to do so may result in damage to the print head because of interference with the keyboard connector.

8. Replace and secure the plastic housing. Replace the cover and install paper.

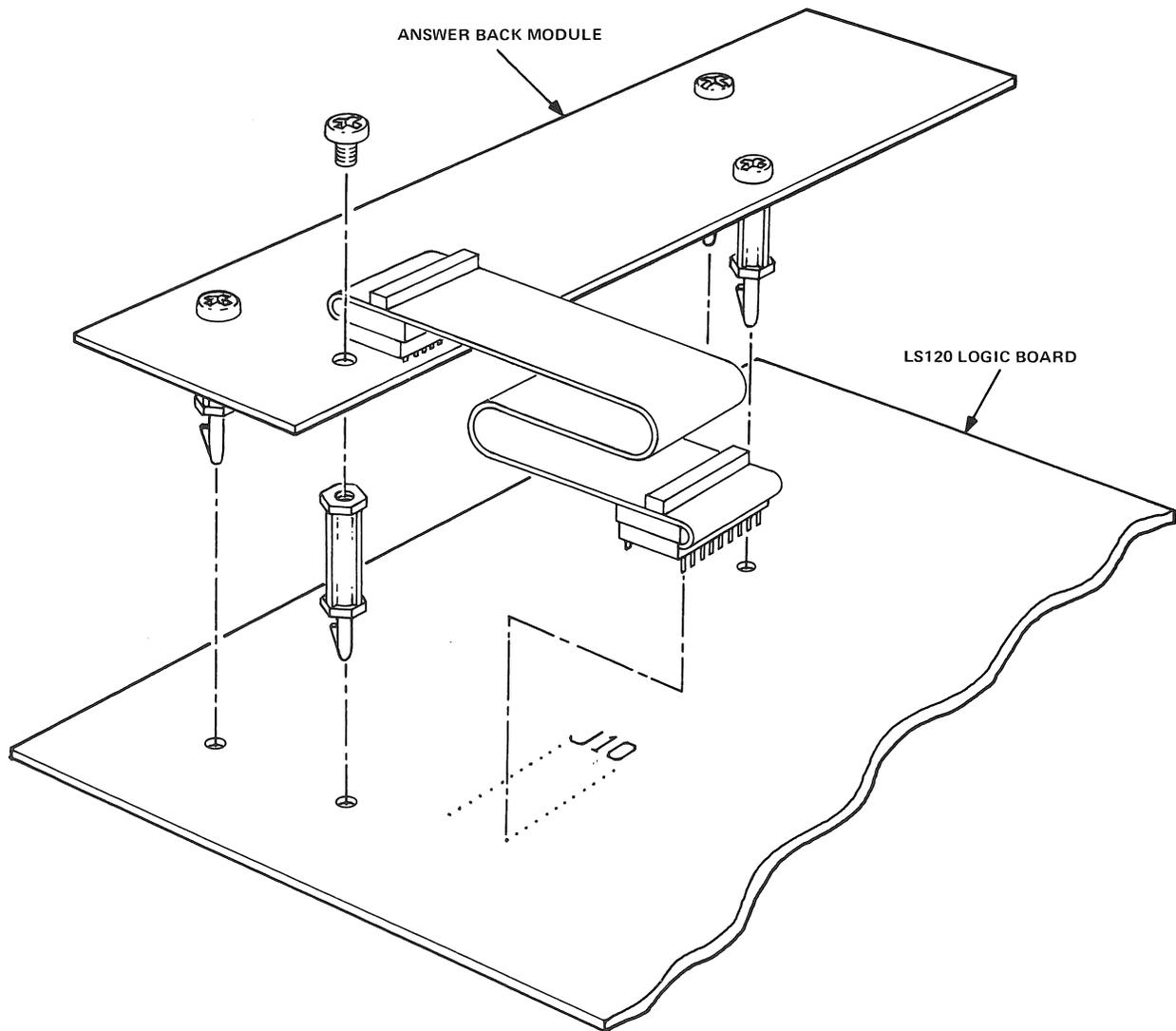
Test After Installation – Apply power and place it in local mode. The keys on the numeric pad will produce numeric characters just as if they were typed on the main keyboard.

PROGRAMMABLE ANSWERBACK OPTION (LAXX-RF)

The programmable answerback option kit contains the following parts.

Quantity	Item	Part Number
1	Programmable Answerback Circuit Board	5412608-0
1	Cable and Connector Assembly	7013370-0H
4	Screw	90-08490-00
4	Standoff	90-09670-02

The programmable answerback option is assembled as shown in Figure 7-6 and is pressed into the predrilled hole on the LS120 logic board. The cable and connector assembly is used to interconnect the option circuit board to J10 of the LS120 logic board.



CP-3157

Figure 7-6 Installation of the Answerback Board

The user provides MMI6330 or equivalent programmable ROMs which are not provided with the option but are the fusible type intended for use with the option. The automatic answerback function and preselected form data function can be set and blasted. The form data function cannot be exercised unless the forms package option (LAXX-RA) is installed. The user installs a programmable ROM into J2 on the communications option board and enters his characters into the ROM from the keyboard. When the messages are complete, the user calls up a blasting program by keying ESC=.

This program will assist the user by issuing prompting messages. The user is able to blast the programmable ROM to become a ROM that is programmed as the user desires. The ROM containing the answerback message is installed in the A socket and any preselected form data ROMs are installed into sockets 1, 2, or 3 as shown in Figure 7-7.

Automatic Answerback

The automatic answerback function consists of a programmable ROM that provides up to 20 programmable character locations. This stored message is printed out when the LS120 is in the local or standby mode and either the HERE IS key is pressed or an ENQ (0005₈) command is received.

The message is stored as 20 characters in a 32 × 8 bit ROM located in position A of the communications option circuit board. Any standard ASCII character can be incorporated into the answerback message, including nonprinting control codes, alpha, or numeric characters.

NOTE

Spaces are counted as characters.

Preselected Form Data

The preselected form data function consists of three programmable ROMs, each of which are capable of storing the complete preselected form data required to process a particular type of form. After the data is blasted into the ROM, the ROMs are mounted into positions 1, 2, and 3 on the communications circuit board. Additional ROMs may be used to store additional types of forms; in order to use these, the ROMs must be interchanged with the set of ROMs normally placed in positions 1, 2, and 3.

Blasting Routine

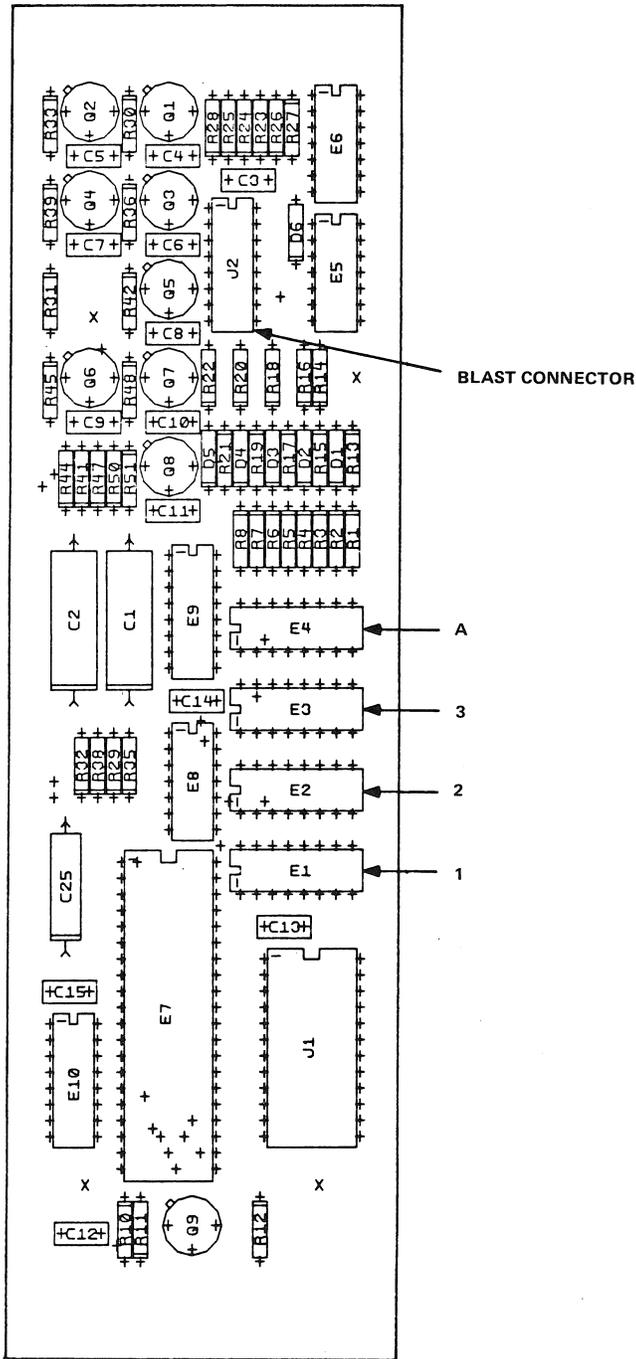
The user can blast PROMs for use as either an answerback message or to contain preselected form data. The LS120 must operate in the local mode and a sample routine of each type is described below. All characters printed by the LS120 routine are underlined.

Initially, the operator inserts a blank PROM into blasting connector J2 (Figure 7-7) and calls up the blasting subroutine by keying ESC=SBLAST.

The LS120 will respond with SAVE TERMINAL DATA? and the operator must type Y for yes or N for no. The terminal data phrase is used in programming preselected form data and therefore the operator will type N for no.

The LS120 will respond with ANSWER BACK OPTION?. The operator types Y for yes and the LS120 will respond with MESSAGE?. Now the operator can key in a 20-character message where spaces count as characters. The message must be started by a character and ended with the same character. These start and end characters do not count as part of the message; an example of the character would be quotation marks. Assume the operator wishes to key in an answerback message as follows:

“DIGITAL EQUIPMENT”



CP-3158

Figure 7-7 Answerback Logic Board

The LS120 will respond with CONFIRM? and the operator verifies the answerback message by keying Y for yes or N for no. After checking the message as typed on the LS120, the operator keys Y for yes. This initiates the PROM blasting and the XMIT indicator will be blinking. At the end of the blast routine, the LS120 will respond with DONE. The operator removes the PROM from the J2 connector and inserts it into the A connector (Figure 7-7).

With the LS120 operating in any mode, the operator now can press the HERE IS key and the answerback message will be printed on the LS120.

To blast preprogrammed form data, insert a blank PROM into the blasting connector J2, put the LS120 in the local mode, and install the forms option (LAXX-RA). Use a portion of the form functional check procedure as an example. Key in the escape sequences for the form data and then key ESC=SBLAST for the blasting routine. The LS120 will respond with SAVE TERMINAL DATA?. Key Y for yes or N for no. In this case, key a Y for yes; this initiates the PROM blasting, indicated by the XMIT indicator blinking. When the preprogrammed form data is blasted into the PROM, the LS120 will respond by printing DONE.

The PROM is now removed from the J2 connector and placed into connector 1, 2, or 3 (Figure 7-7). To enter the preprogrammed form data into the LS120, key ESC=N, where N is equal to connector 1, 2, or 3.

Enter preprogrammed form data into the LS120 and use the verification procedures of the form functional check procedures.

READ-ONLY ANSWERBACK OPTION (LAXX-RB)

The read-only answerback option kit contains the following parts.

Quantity	Item	Part Number
1	Read-Only Answerback Circuit Board	5412608-1
1	Cable and Connector Assembly	7013370-0H
4	Screw	90-08490-00
4	Standoff	90-09670-02

The read-only answerback option is assembled as shown in Figure 7-6 and is pressed into the predrilled hole on the LS120 logic board. The cable and connector assembly is used to interconnect the option circuit board to J10 of the LS120 logic board.

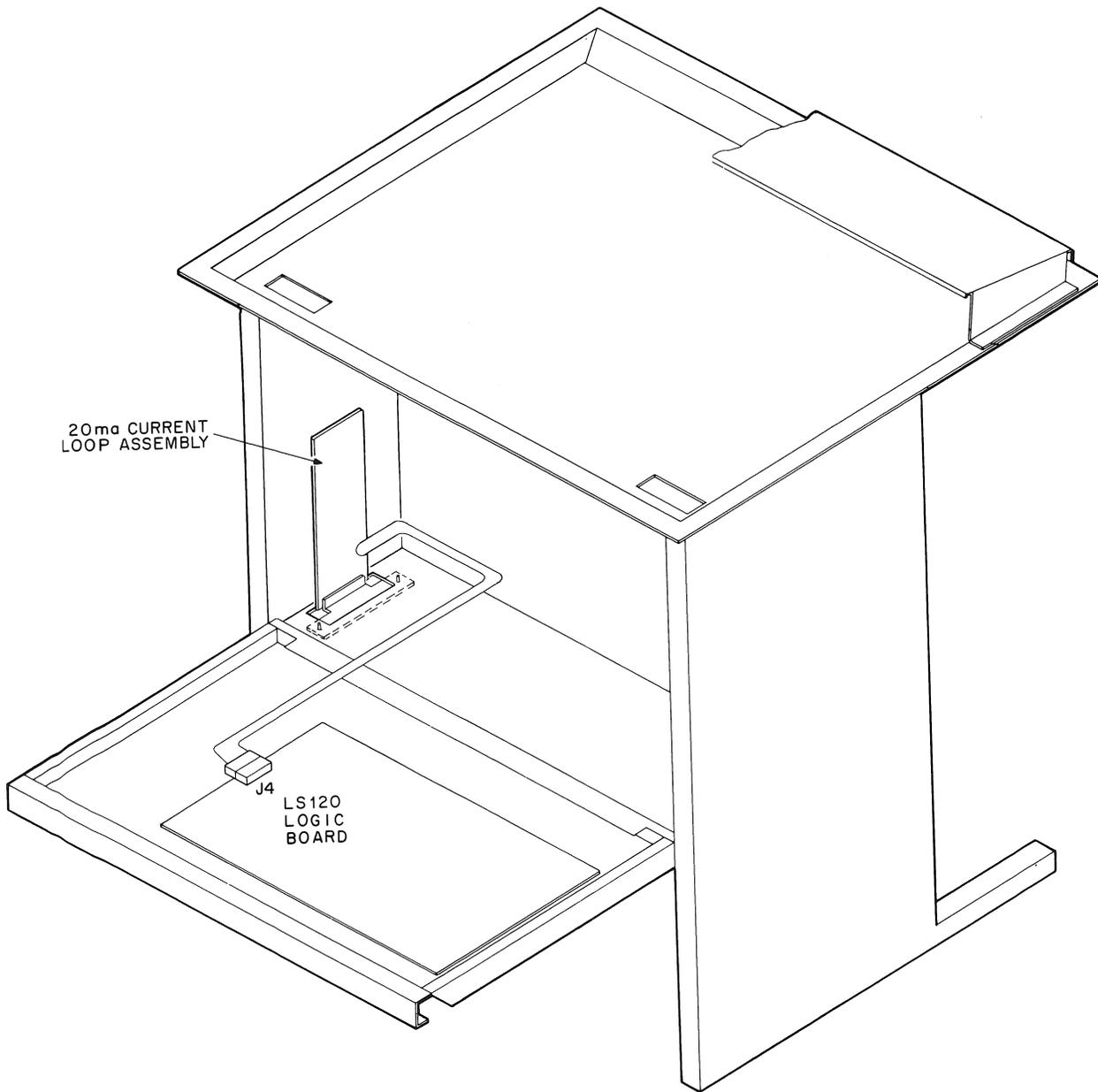
The read-only answerback option performs the same functions as the programmable answerback option except that it does not have the capability of blasting ROMs. Therefore, any ROM being used on this option must have been previously blasted by some other method. The designated MMI6330 fusible link-type ROM can be blasted with the standard answerback option. Any ROM that will meet the socket pin requirements can be blasted provided the user has his own blasting mechanism. However, the option can still provide the answerback message and use preselected form data.

20 mA CURRENT LOOP INTERFACE OPTION (LAXX-RN)

The 20 mA current loop interface option kit contains the following parts.

Quantity	Item	Part Number
1	20 mA Current Loop Assembly	70-14374
2	Phillips Pan Head Screws (#8-32 × 3/8 inch)	9006037-1
2	Lock Washers (#8)	9006690-00
2	Flat Washers (#8)	9006660-00

A Phillips head screwdriver is the only tool required for installation. Use Figure 7-8 and the following procedures as installation guides.



CP-3171

Figure 7-8 Installation of the 20 mA Current Interface Option Kit

1. Unplug the ac power cord.
2. Disconnect the EIA interface input cable from J6 on the LS120 logic board.
3. Remove the two screws that hold the EIA interface cover plate to the floor of the cabinet and remove the complete harness assembly.
4. Insert the connector end of the 20 mA interface cable up through the hole in the floor, then insert the 20 mA current loop circuit board assembly.
5. Using the #8-32 × 0.38 inch screws and washers supplied, secure the 20 mA assembly.
6. Plug the Mate-N-Lok connector into J4 of the LS120 logic board.
7. Connect the input end of the 20 mA cable assembly to the signal source.
8. Cut jumpers W7, W8, W9, and W10 on the LS120 logic board as shown in Figure 3-7.
9. Connect the ac power cord to its source.

Test After Installation – Connect the 20 mA interface connector to a modem and verify that the printer responds to 20 mA interface data.

ACOUSTICAL COUPLER OPTION KIT (LAXX-LM)

The acoustical coupler option kit contains a new cover (D-AD-7012144-0-0) that replaces the existing LS120 cover and a rubber O ring (9009793-00) that fits over the tractor drive shaft to minimize mechanical noise generation during a paper advance. A Phillips head screwdriver is the only tool required for installation.

Use Figures 7-9 and 7-10 and the following procedure as installation guides.

1. Unplug the ac power cord and remove the existing top cover.
2. Remove the paper advance knob (item 2, in Figure 7-9) by unscrewing the #6 screw (item 1) from the center of the knob.

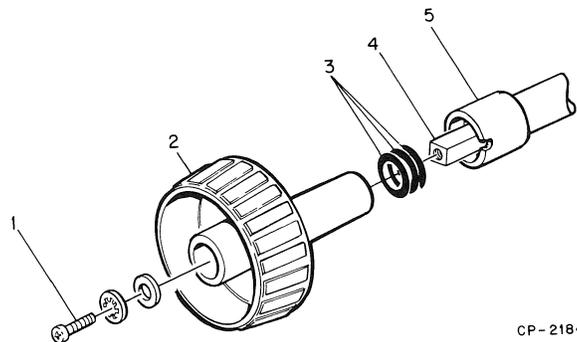


Figure 7-9 Installation of O Ring on Tractor Drive Shaft

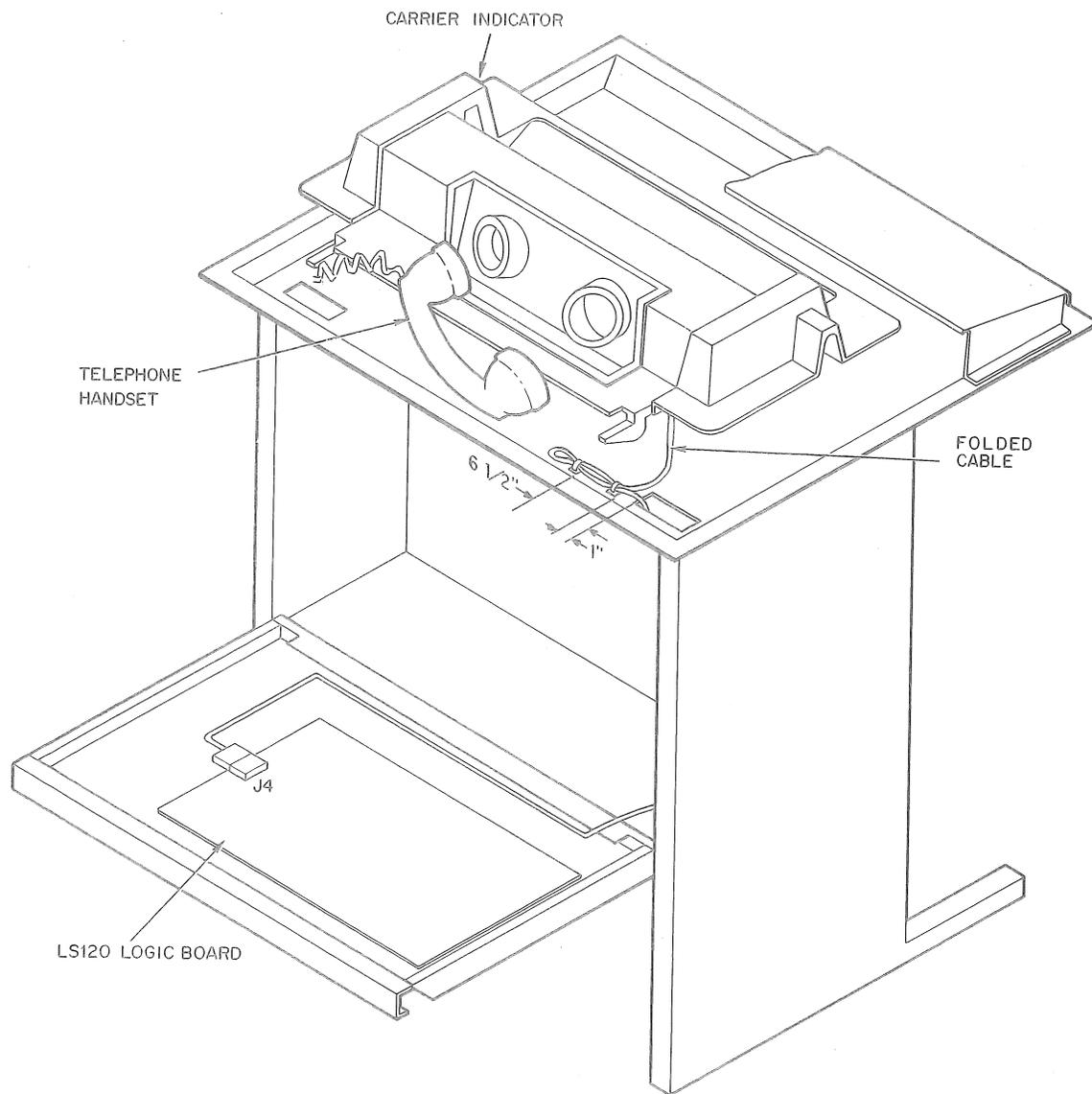
3. After removing the paper advance knob from the tractor drive shaft (item 4), remove and discard the sleeve (item 5), then slide two O rings (item 3) all the way onto the shaft.
4. Replace the knob on the tractor shaft and secure with the screw and washers.
5. Insert the new cover onto the DECwriter. Press the acoustical coupler cable down through the rear access hole as shown in Figure 7-10.
6. Connect the cable end into the EIA connector (J4) on the logic board.

Test After Installation – Perform the following procedure:

1. Set for power on, on-line, and correct baud rate.
2. Using a telephone, call the sending system and, after hearing the carrier, place the handset into the muff assembly.

NOTE

The cord end of the handset is placed in the muff with “dot” and/or “CORD” next to it.



CP-3172

Figure 7-10 Installation of Acoustical Coupler Option Kit (LAXX-LM)

3. The carrier light illuminates within 5 seconds and then normal system operation can be performed.

NOTE

Before removing the telephone handset from the muff assembly, place the DECwriter in the local mode. This action prevents the disconnect noise from causing printing of random characters.

LAXX-KJ COMPRESSED FONT OPTION KIT

The compressed font option is a mechanical option that provides the LS120 with the ability to print 132 columns on a 9-inch form with one strippable edge or on a 9-1/2 inch form with two strippable edges. Once installed, no operator intervention is required.

The compressed font option kit contains the following parts.

Quantity	Item	Part Number	Item No. (Figure 7-13)
1	30-Tooth Timing Pulley	1212446-00	4
1	15-Tooth Timing Pulley	D-MD-7414908-0-0	3
1	Pulley Clamp	C-MD-7414951-0-0	5
1	Timing Belt	1211583-02	2
1	Socket Head Cap Screw (#10-32 × 1 in)	9006350-8	6
1	Hex Socket Set Screw (#1/4-20)	9007722-10	7
2	Kep Nuts	9006565-00	6

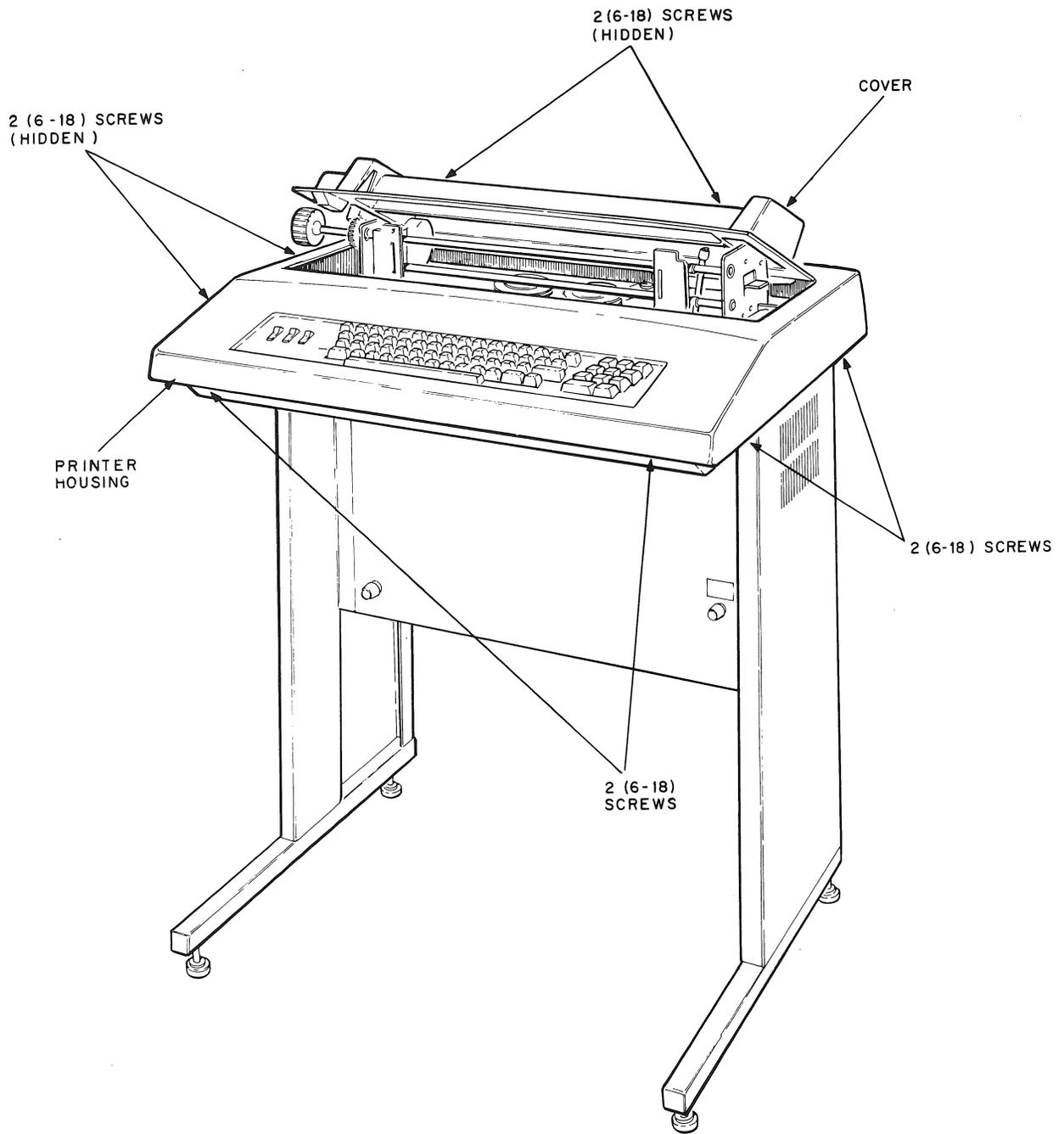
The following tools are required for installation: socket head wrenches, Phillips head screwdriver, feeler gauges, alignment gauge, and a torque-type Phillips head screwdriver. Use the following procedure as an installation guide.

1. Remove power from the LS120 by disconnecting the ac plug.
2. Remove the printer paper and printer cover.

NOTE

Do not remove bezel or fan screws when removing printer housing.

3. Remove eleven 6-18 screws and flat washers that secure the printer housing to the cabinet base (Figure 7-11) and set aside.
4. Remove the ribbon spools and ribbon.
5. Remove the four 6-32 screws, lock washers, and flat washers that secure the print head to the carriage and remove the print head and the ribbon cable (Figure 7-12).
6. Push the carriage assembly to the extreme left. Slip the timing belt off the dc motor pulley while turning the pulley clockwise; remove the belt.
7. Using a socket head wrench, loosen the set screw (item 7 in Figure 7-13) in the pulley clamp (item 5) until the existing timing pulley (item 3) can be removed from the motor shaft. This pulley clamp can be discarded.
8. Loosen the set screw in the other pulley clamp (item 4) then remove and save this pulley.
9. Assemble the cap head screw and kep nuts, then insert through the left side bracket as shown in Figure 7-13 (item 6).



CP-1559

Figure 7-11 Remove Printer Housing



7937-7

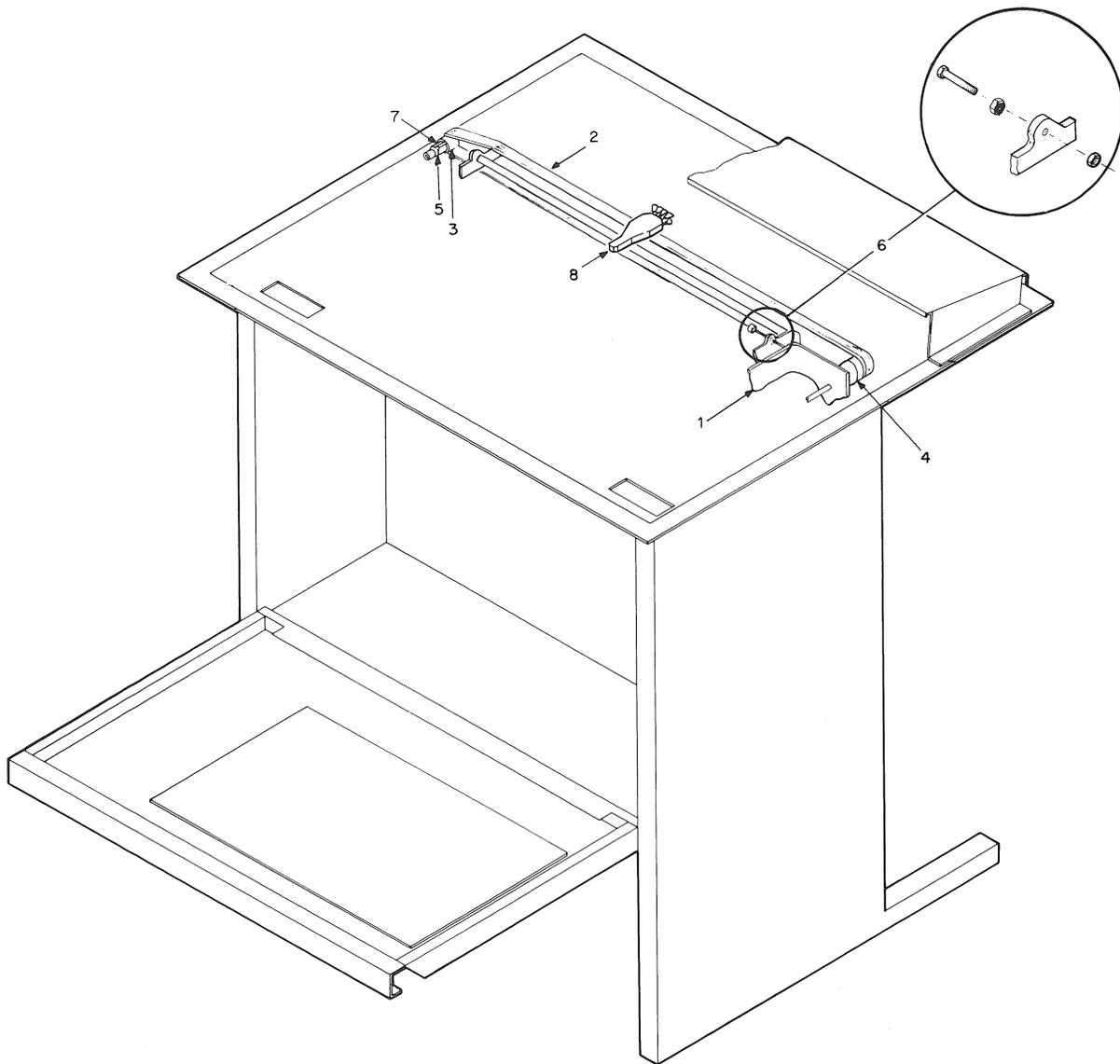
Figure 7-12 Remove Print Head and Ribbon Cable

Figure 7-13 Installation of Compressed Foil Option Kit

10. Install the new 30-tooth timing pulley on the ribbon drive shaft (item 4). The side of the pulley with the flange should be positioned toward the front of the machine. Position the pulley so that there is 0.28-0.03 inch clearance between the back of the pulley and the mounting hardware for the shaft bearing. Secure the new 30-tooth pulley using the provided timing clamp.

11. Install the new 12-tooth pulley on the motor shaft and secure it using the new pulley clamp provided.

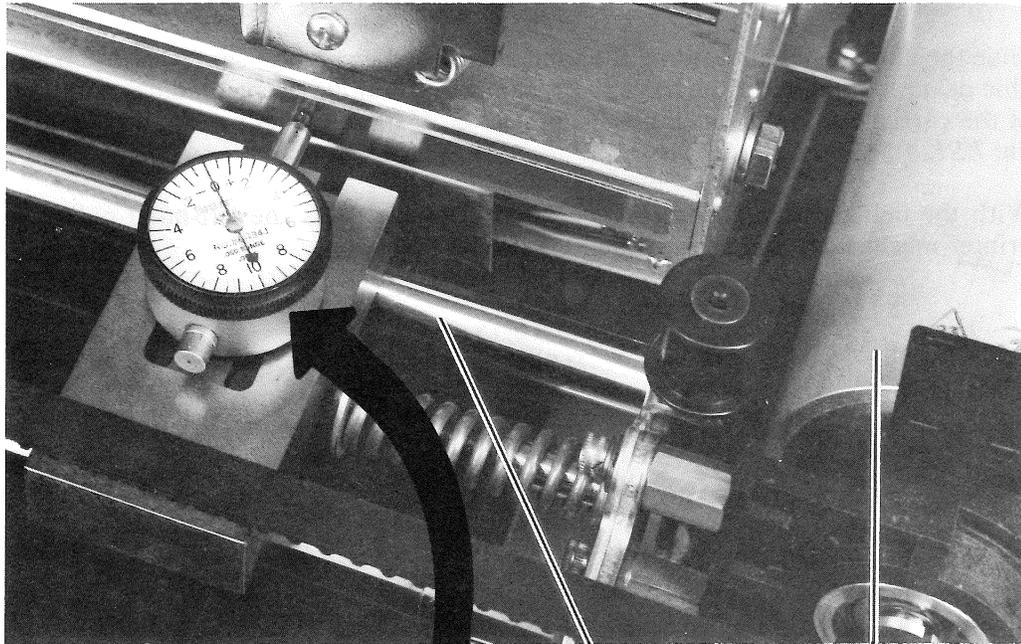
12. Set the alignment gages on the right side of the carriage shaft (Figure 7-14).



CP-2285

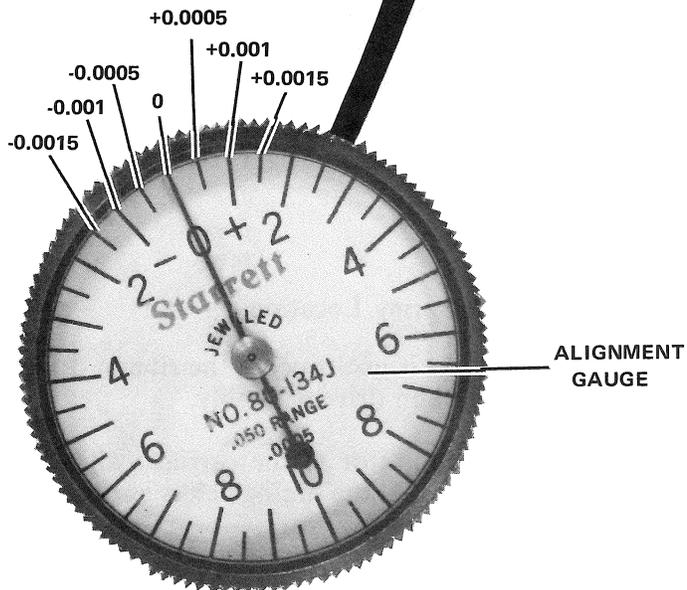
Figure 7-13 Installation of Compressed Font Option Kit

10. Install the new 30-tooth timing pulley on the ribbon drive shaft (item 4). The side of the pulley with the flange should be positioned toward the front of the machine. Position the pulley so that there is 0.29–0.03 inch clearance between the back of the pulley and the mounting hardware for the shaft bearing. Secure the new 30-tooth pulley using the previously removed pulley clamp.
11. Install the new 15-tooth pulley on the motor shaft and secure it using the new pulley clamp provided.
12. Set the alignment gauge on the right side of the carriage shafts (Figure 7-14).



RIGHT
SIDE OF
CARRIAGE
SHAFTS

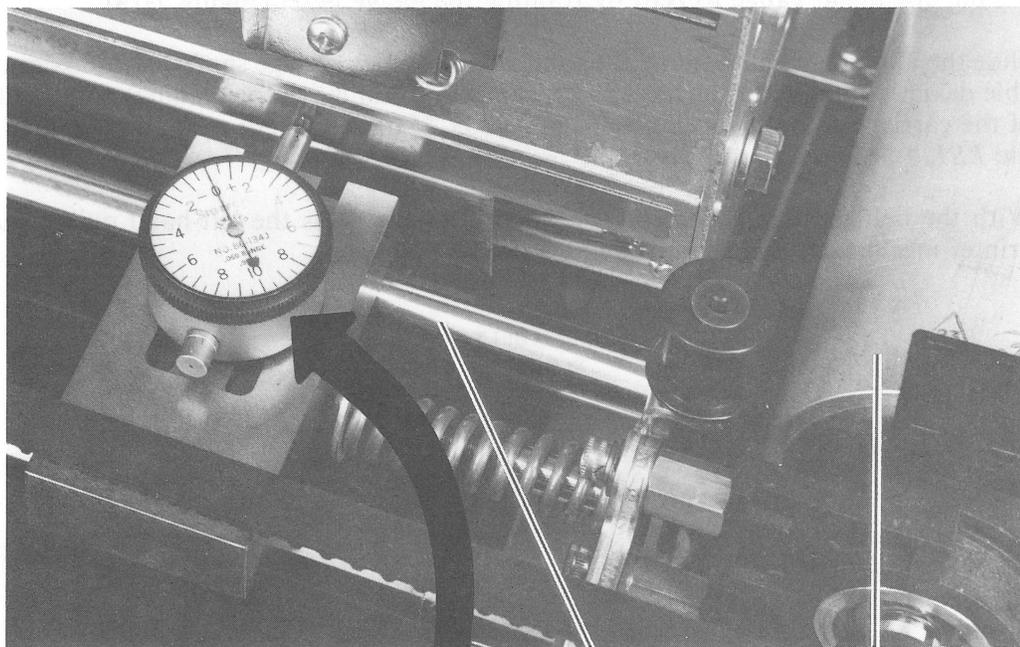
DC MOTOR



ALIGNMENT
GAUGE

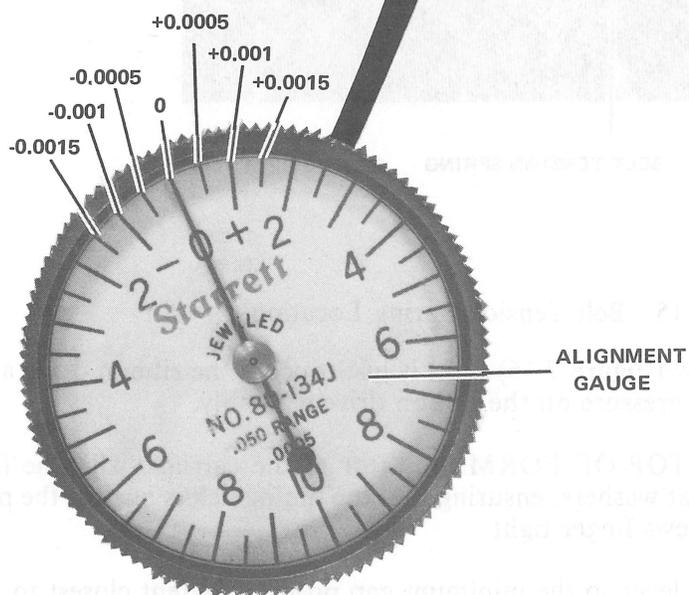
7947-43
LS120-U

Figure 7-14 Alignment Gauge Positioning



RIGHT
SIDE OF
CARRIAGE
SHAFTS

DC MOTOR

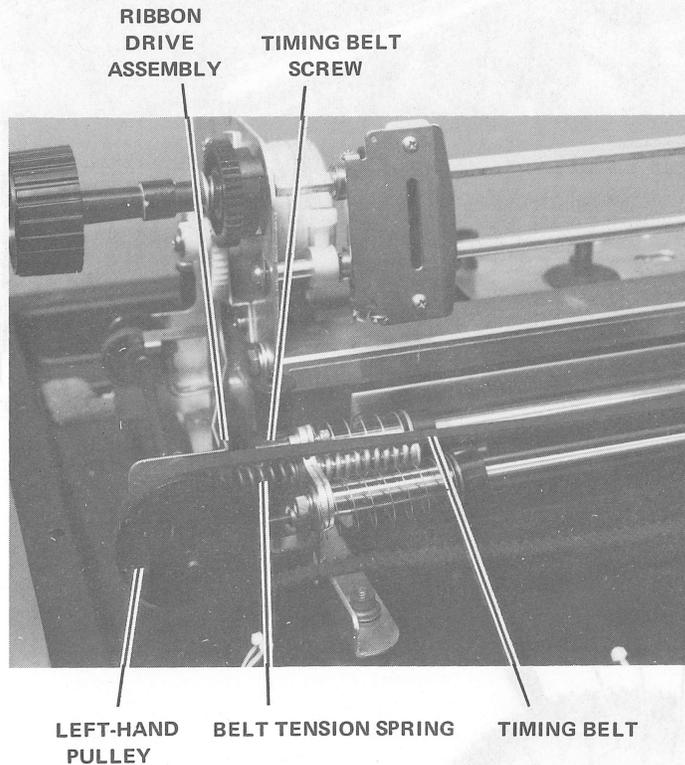


ALIGNMENT
GAUGE

7947-43
LS120-U

Figure 7-14 Alignment Gauge Positioning

13. Set the alignment gauge to zero by rotating the gauge bezel (Figure 7-14).
14. Slide the alignment gauge along the total length of the carriage shafts. The maximum allowable deviation along the carriage shaft is 0.0015 (total indicator reading) with the two ends of the carriage shaft being equal within 0.0005. If these values cannot be obtained, refer to the *LS120 Maintenance Manual*.
15. With the belt tension spring (Figure 7-15) in place, press the left-hand pulley against the printer mechanism and slip on the new timing belt.



7937-4
LS120-u

Figure 7-15 Belt Tension Spring Location

16. Rotate the timing belt screw (Figure 7-15) until it just touches the ribbon drive assembly. The screw should not exert pressure on the ribbon drive assembly.
17. Secure the print head and TOP OF FORM indicator to the carriage with the four 6-32 screws, lock washers, and flat washers, ensuring that the timing belt is against the plastic lip (Figure 7-12). Make the screws finger tight.
18. Set the carriage adjustment lever to the minimum gap position (detent closest to the print bar).

CAUTION

It is possible to set the carriage adjustment lever beyond the minimum gap position. If this is done, the correct head gap adjustment cannot be made.

19. Slide the alignment gauge along the carriage shaft to the point where the most positive reading on the gauge is obtained. Mark the high spot on the print bar with a pencil (Figure 7-16).
20. Move the carriage assembly directly in front of the spot marked on the print bar.
21. Place the alignment gauge in the center of the carriage shaft. Set the gauge to zero.
22. Place the 0.010-inch flat feeler gauge between the print head jewel and the front surface of the print bar. Push the print head snug enough against the feeler gauge to cause the indicator to move, but no more than 0.0005 (Figure 7-16).

CAUTION

Ensure that the feeler gauge rides between the protrusions on the print head. Do not exert excessive force on the print head when making the adjustment; it will cause the carriage shaft to bow, resulting in more than 0.010 inch of clearance.

23. Ensure that the print head is aligned parallel with the print bar; tighten the four 6-32 screws to 10 ± 1 in-lb of torque.

CAUTION

Do not apply more than the recommended torque when tightening the print head screws or the molded inserts in the carriage assembly may be damaged.

24. Remove the 0.010-inch feeler gauge while looking at the alignment gauge. The needle must move, but not more than 0.0005 inch

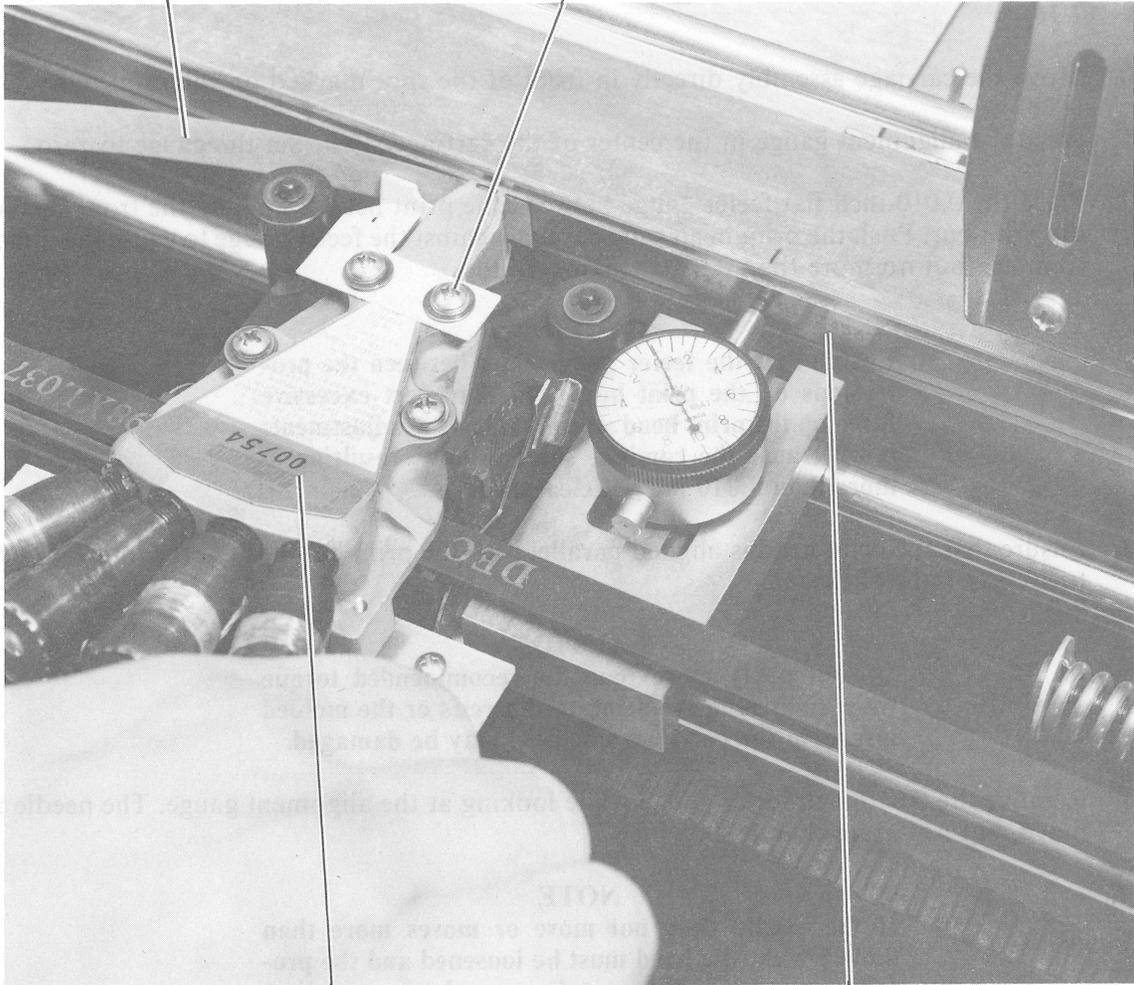
NOTE

If the needle does not move or moves more than 0.0005 inch, the head must be loosened and the procedure repeated. It may take several tries to adjust the head correctly.

25. Replace the ribbon and ribbon spools.
26. Slide the carriage assembly along the carriage shaft to ensure that nothing is binding. Check to ensure that the ribbon is not rubbing against the line indicator (adjust if necessary).
27. Install the printer housing.

0.010 FEELER GAUGE

6-32 SCREWS TO BE TIGHTENED TO 10 ± 1 IN. LBS OF TORQUE



PRINT HEAD

PRINT BAR

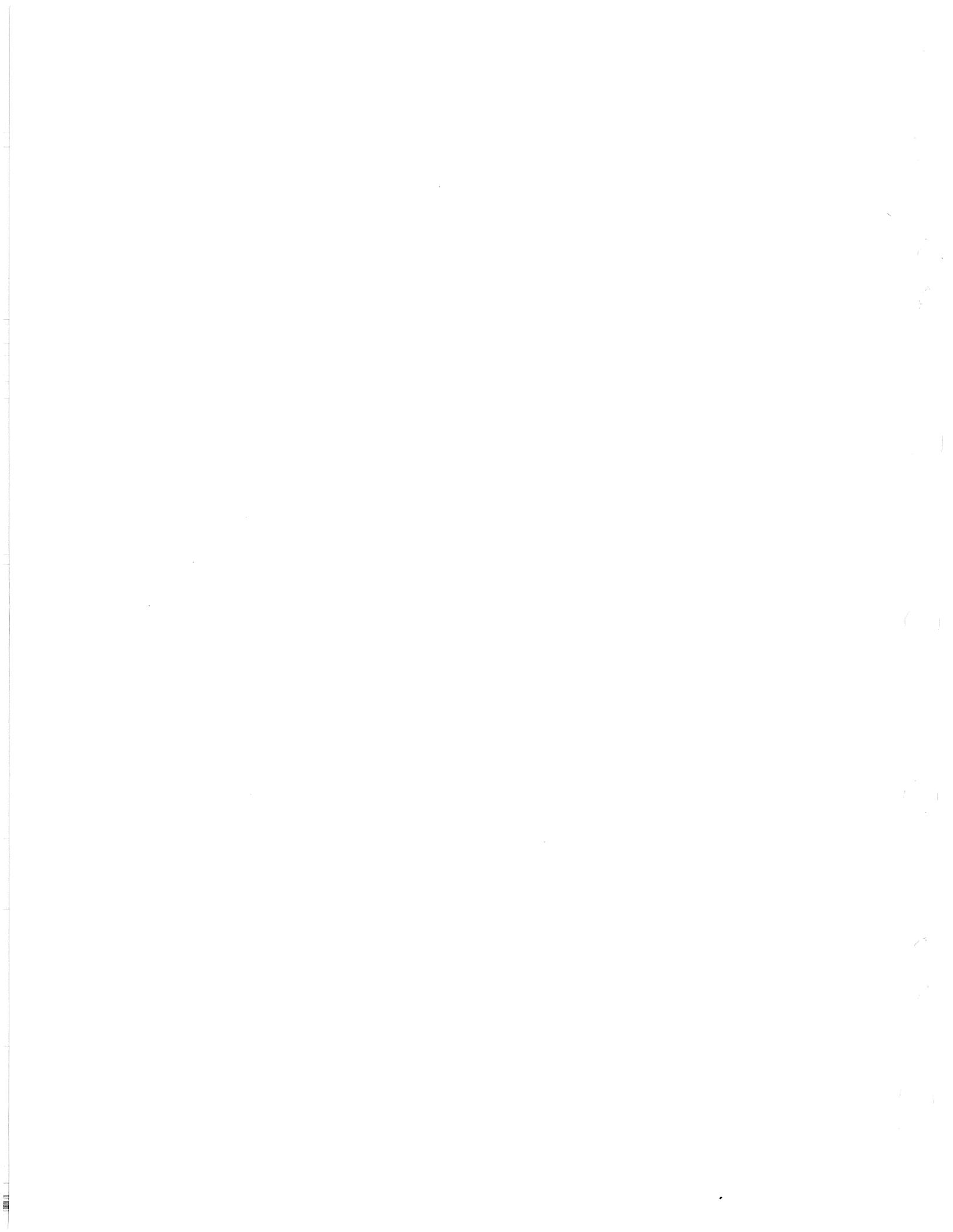
CAUTION
ENSURE THAT FEELER GAUGE IS INSERTED BETWEEN THE PROTRUSIONS ON THE PRINTHEAD. FAILURE TO DO SO WILL RESULT IN IMPROPER CLEARANCE AND SHORTEN THE LIFE OF THE PRINTHEAD.

7937-3

Figure 7-16 Print Head Adjustment

Test After Installation

1. Load the LS120 with paper that is at least 22.86 cm (9 in) wide.
2. Set the LINE/LOC switch to LOC.
3. Set the PRINTER ON (1)/OFF (0) switch to ON.
4. Press the ESC key and the SELF TEST (-) key on the keyboard.
5. The LS120 will print out all the characters as shown in Figure 1-4.
6. To terminate the test, press the DELETE key or set the LINE/LOC switch to LINE.



Reader's Comments

Your comments and suggestions will help us in our continuous effort to improve the quality and usefulness of our publications.

What is your general reaction to this manual? In your judgment is it complete, accurate, well organized, well written, etc.? Is it easy to use? _____

What features are most useful? _____

What faults do you find with the manual? _____

Does this manual satisfy the need you think it was intended to satisfy? _____

Does it satisfy *your* needs? _____ Why? _____

Would you please indicate any factual errors you have found. _____

Please describe your position. _____

Name _____ Organization _____

Street _____ Department _____

City _____ State _____ Zip or Country _____

Fold Here

Do Not Tear - Fold Here and Staple

**FIRST CLASS
PERMIT NO. 33
MAYNARD, MASS.**

**BUSINESS REPLY MAIL
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES**

Postage will be paid by:

**Digital Equipment Corporation
Technical Documentation Department
Maynard, Massachusetts 01754**

