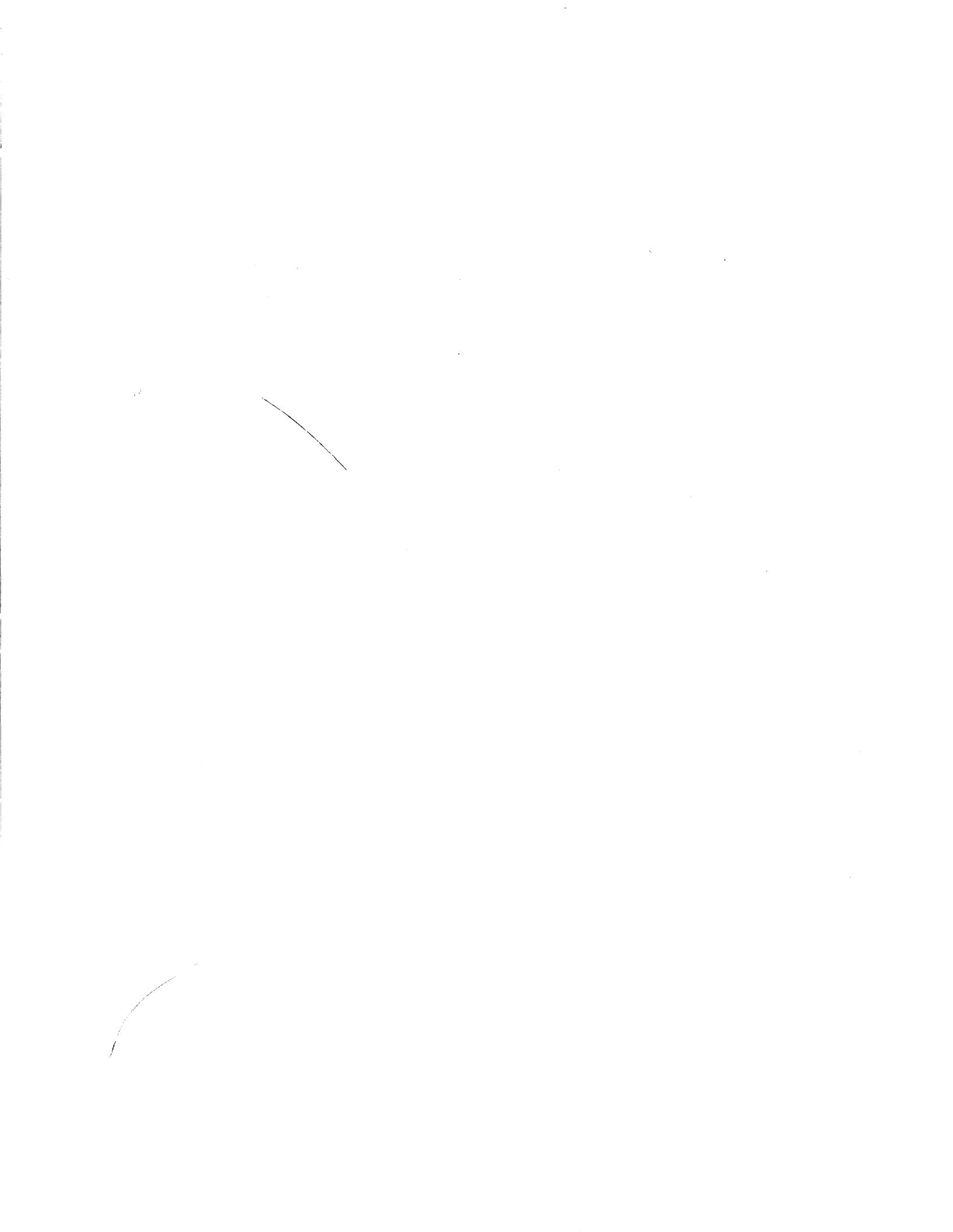


digital

EK-LA34S-TM-001

# **DECwriter IV SERIES**

## **TECHNICAL MANUAL**



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## **TECHNICAL MANUAL**

**digital equipment corporation • maynard, massachusetts**

**1st Edition, October 1981**

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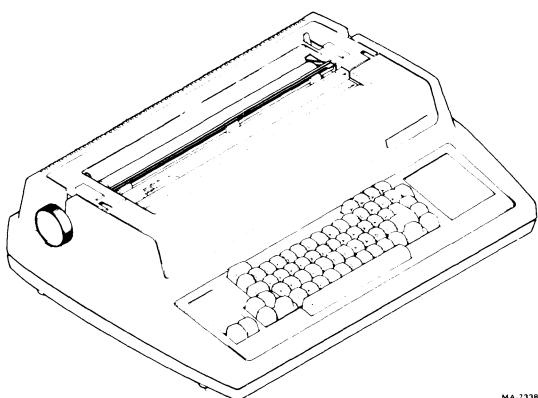
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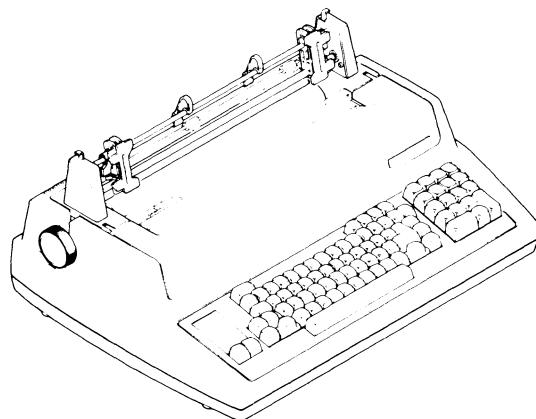
# **DECwriter IV SERIES**

## **TECHNICAL MANUAL**



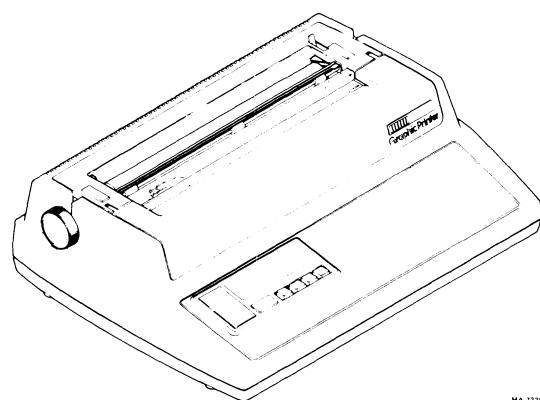
MA 7338

LA34-AA, LA34-DA Terminals



MA 7338

LA38-AA, LA38-GA Terminals



MA 7225

LA34-RO, Family Graphic Printers

## **INTRODUCTION**

This manual includes maintenance information applicable to the DECwriter IV series of terminals and printers. This includes the:

- LA34-DA Standard Terminal
- LA38-GA Standard Terminal with tractors and keypad
- LA34-AA Enhanced Terminal (graphics, forms control)
- LA38-AA Enhanced Terminal with tractors and keypad
- LA34-AA and LA38-AA Enhanced Terminals that include the LAX34-XL or LAX34-XM Extended Logic/Memory options
- LA34-RO family of receive-only graphic printers (LA34-RA, LA34-VA, LA34-WA).

The manual has been prepared for Field Service/Customer Service engineers and other technical personnel directly involved with maintaining the DECwriter IV series of terminals and printers.

Because this manual concentrates primarily on equipment maintenance, discussion pertaining to programming and operation is summarized. For detailed discussions of these topics, refer to the correct terminal or printer User Guide. (A list of all available documents pertaining to the DECwriter IV series of terminals and printers may be found in Chapter 1, Table 1-2.)

The DECwriter IV Technical Manual is divided into the following chapters.

- Chapter 1 General Description provides an overview of the terminal/printer, an introduction to its physical and functional characteristics and a list of all the available documentation for the DECwriter IV series.
- Chapter 2 Installation describes the environmental conditions that should be considered before installing the terminal. A detailed unpacking and installation procedure is provided. This chapter also provides a step-by-step procedure used to turn on and verify printer operation.
- Chapter 3 Option Installation provides the terminal option installation and operating procedures.
- Chapter 4 Operator Information provides a summary of all the operator controls and indicators of the terminal. Also included is a summary of the SET-UP parameters.
- Chapter 5 Theory of Operation provides a discussion of the terminal's internal operating principles. The discussion is broken into the primary functional areas of the terminal such as; microprocessor/control system, I/O communications system, keyboard, printing process, paper advance process, and power supply. Each functional area is handled in terms of hardware and firmware. This chapter also includes a discussion of the current loop and extended logic/memory options.

- Chapter 6 Troubleshooting guides maintenance personnel through a tabular summary of possible faulty functional areas, then makes reference to a procedure for fault isolation.
- Chapter 7 Mechanical Servicing provides the procedures necessary for removing and replacing any field replaceable assembly and the corresponding adjustment if necessary.
- Appendix A Glossary explains the technical words and phrases used in the manual.
- Appendix B Interface provides a short description of the terminals interface lines and their specifications.
- Appendix C Escape Sequence Summary provides a summary of the programming escape sequences that the DECwriter IV series terminals respond to.
- Appendix D Specifications provides a listing of the specifications for all terminals and printers in the DECwriter IV series.

## CHAPTER 1 GENERAL DESCRIPTION

### 1.1 GENERAL

The DECwriter IV terminals are microprocessor-controlled, desk top printer terminals designed for use as input/output hard-copy terminals in computer systems. They are capable of processing data at a rate of 30 characters per second to permit full use of a 300 baud serial communications line. The LA34/38-AA, LA34-DA, and LA38-GA terminals communicate at a 110 or 300 baud rate. Options available for the LA34/38-AA terminals permit 50 to 9600 baud transmission rates, while these rates are standard for the LA34-RO family of graphic printers. Each send/receive DECwriter IV terminal includes printer controls and a typewriter-style keyboard for operator use. The receive-only versions (RO) have a smaller keyboard for printer control only.

This chapter provides physical and functional descriptions of the DECwriter IV terminals. Detailed specifications may be found in Appendix D. Table 1-1 lists all available options and indicates those options that are standard on some models.

Table 1-1 DECwriter IV Options

Number	Description
LAX34-AL	Tractor Assembly Option (standard on LA38-AA/GA)
LAX34-CL	20 mA Current Loop Interface Option
LAX34-HL	APL Keycap Set
LAX34-JL	European Keycap Set
LAX34-KL	Numeric Keypad Option (standard on LA38-AA/GA)
LAX34-LL	Paper Low Option
LAX34-PC	Fan-Fold Paper Catcher
LAX34-PL	Paper Out Switch Option
LAX34-RL	Roll Paper Holder Option
LAX34-SA/SL	DECwriter Stand
LAX34-SM	Casters for LAX34-SL
LAX34-SN	Hardware Kit for LAX34-SL
LAX34-SP	Paper Tray Stand
LAX34-SQ	Paper Shelf Stand
LAX34-SR	Table Extension for Stand
LAX34-ST	Copy Stand
LAX34-SU	Stand Accessories Kit
LAX34-XL	Extended Logic Option (Answerback, APL Character Set, Nonvolatile SET-UP Parameter Storage)
LAX34-XM	Extended memory Option (LAX34-XL plus 2K Character Buffer)
LAX34-ZA	LA34/LA38 Carrying Case

## 1.2 PHYSICAL DESCRIPTION

Each DECwriter IV terminal includes three main mechanical assemblies and two main electronic assemblies. The mechanical assemblies are the printer mechanism, printhead, and keyboard bezel. The electronic components are control/logic module and power supply. All mechanical and electronic assemblies are accessible when the cover assembly is removed from the printer base.

## 1.3 FUNCTIONAL DESCRIPTION

Figure 1-1 shows the relationship of the terminal to the computer. The send/receive terminals operate as both an input and output device for the computer. The receive-only versions operate as an output device only. When the terminal is being used as an input device, information in the form of a character code is sent to the computer each time a key on the keyboard is pressed. If the terminal has been set up for local echo printing, the character corresponding to the key is printed out at the same time. When used as an output device, information from the computer is sent to the printing section of the terminal where it is interpreted and then printed out.

The standard character set for the DECwriter IV terminals is the US ASCII character set and includes 96 upper- and lowercase characters (Figure 1-2). In addition, the LA34/38-AA terminals are capable of printing in some languages other than English.

Characters are printed by moving a 7-wire, solenoid-operated printhead horizontally along the print line and then firing groups of discrete wires at each printing position to form  $9 \times 7^*$  dot-matrix characters. The graphics mode printing process involves creating a single vertical column of dots for each character received.

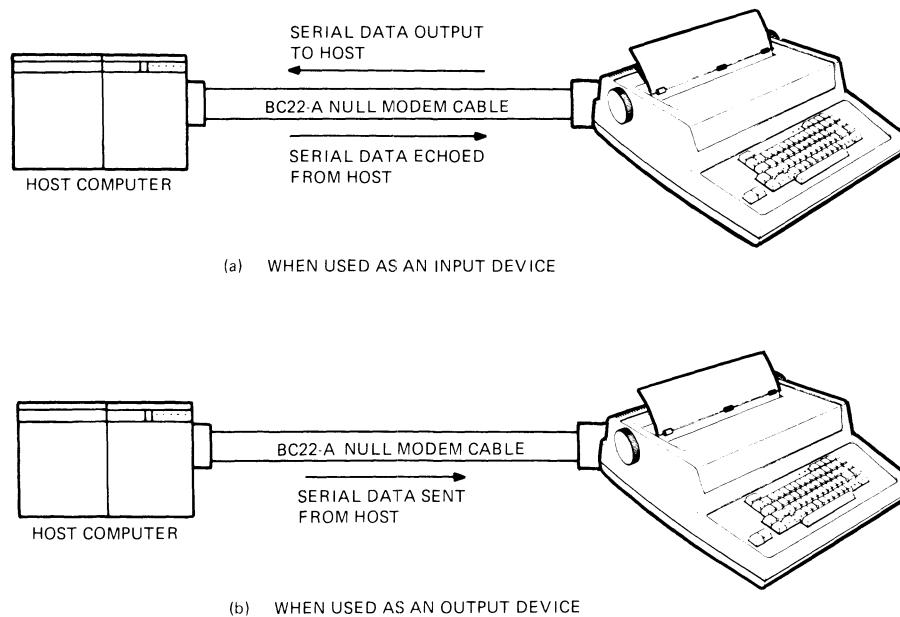


Figure 1-1 Relationship of Terminals to Computer

\* $9 \times 7$  is the effective dot matrix. The actual matrix may be either  $5 \times 7$  or  $10 \times 7$  depending on the horizontal character/inch setup.

The ribbon for the DECwriter IV is contained within a throw-away cartridge that mounts on the carriage assembly and surrounds the printhead. It is easily accessible to the operator for removal/replacement.

The printhead is mounted on the carriage assembly. This assembly is connected to a servo drive motor by a timing belt. The reversible dc servo motor provides the drive for both the carriage with printhead and the ribbon cartridge. The ribbon only advances when the carriage moves in the printing direction, (left-to-right). An encoder mechanism on the servo motor produces feedback pulses to the control logic module to track the printhead position.

The paper feed mechanism advances the paper sheet, or roll, up or down. LA34-DA, LA38-GA terminals, and all terminals operating with tractor feed, advance paper up only. A dc stepper motor drives the paper feed mechanism directly.

CODE	CHAR	CODE	CHAR	CODE	CHAR
040	Space	100	@	140	\
041	!	101	A	141	a
042	"	102	B	142	b
043	#	103	C	143	c
044	\$	104	D	144	d
045	%	105	E	145	e
046	&	106	F	146	f
047	,	107	G	147	g
050	(	110	H	150	h
051	)	111	I	151	i
052	*	112	J	152	j
053	+	113	K	153	k
054	'	114	L	154	l
055	-	115	M	155	m
056	.	115	N	156	n
057	/	117	O	157	o
060	0	120	P	160	p
061	1	121	Q	161	q
062	2	122	R	162	r
063	3	123	S	163	s
064	4	124	T	164	t
065	5	125	U	165	u
066	6	126	V	166	v
067	7	127	W	167	w
070	8	130	X	170	x
071	9	131	Y	171	y
072	:	132	Z	172	z
073	;	133	[	173	{
074	<	134	\	174	
075	=	135	]	175	}
076	>	136	^	176	~
077	?	137	-		

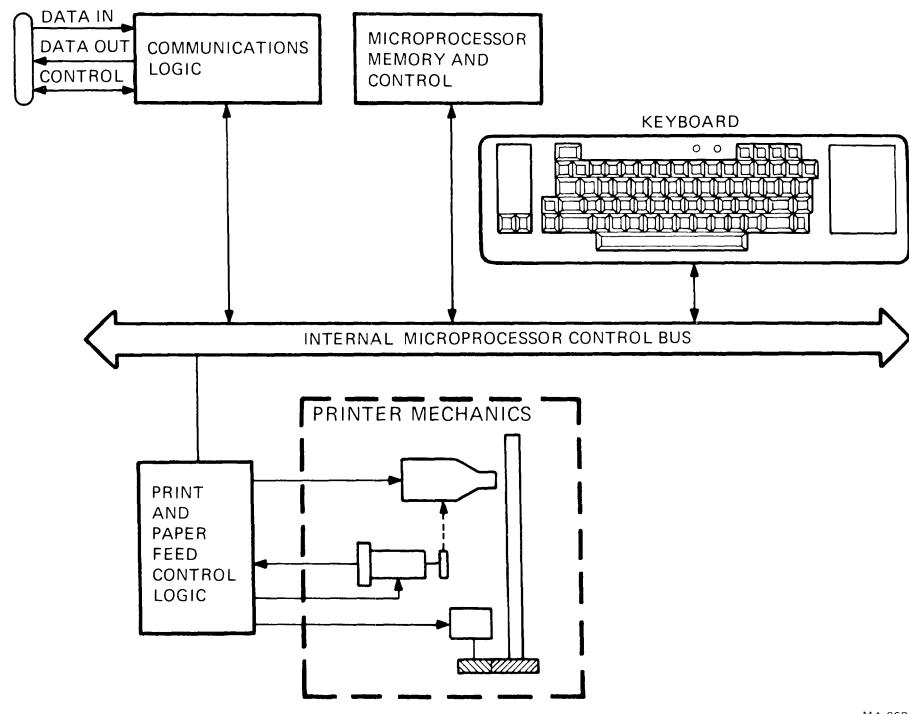
Figure 1-2 LA34 Printable Characters (Standard Character Set Shown)

An optional Extended Logic module (LAX34-XL) (available on the LA34-AA, and LA38-AA terminals only) allows the SET-UP parameters and answerback message to be stored in a memory area that holds its contents when power is removed (nonvolatile). This memory area may be overwritten as necessary when new parameters must be stored. The APL programmers character set is also available with the Extended Logic module. An optional Extended Logic with Memory module (LAX34-XM) includes the Extended Logic module features plus an added 2048-location memory area for an extended receive character buffer.

A programmed microprocessor on the control/logic module controls input/output, character printing, and forms control. Figure 1-3 shows a simplified block diagram of the DECwriter IV series terminals.

#### 1.4 RELATED DOCUMENTS

Table 1-2 lists all the documentation available to support the DECwriter IV series of printers and terminals.



MA-9681

Figure 1-3 Simplified Block Diagram

**Table 1-2 Related Documents**

Title	Document Number	Description
LA34 Users Guide	EK-0LA34-UG	Installing, operating, programming, and interfacing the LA34-DA and LA38-GA terminals
DECwriter IV Extended Logic User Guide	EK-L34XL-UG	Installing, operating, programming, and interfacing the LA34-AA and LA38-AA terminals with the LAX34-XL/XM option
DECwriter IV Graphic Printer User Guide	EK-L34RO-UG	Installing, operating, programming, and interfacing the LA34-RA, LA34-VA and LA34-WA printer terminals
DECwriter IV Operator and Programmer Reference Card	EK-0LA34-RG	A foldout card summarizing operator and programming information for the LA34-DA, and LA38-GA terminals
DECwriter IV (LA34-AA, LAX34-XL) Operator and Programmer Reference Card	EJ-20263-56	A foldout card summarizing operator and programming information for the LA34-AA, and LA38-AA terminals, with and without the LA34-XL/XM options
DECwriter IV Pocket Service Guide	EK-LA34S-PS	Troubleshooting and mechanical servicing information for the DECwriter IV series of printers and terminals
DECwriter IV Series Technical Manual	EK-LA34S-TM	Installing, operating, theory of operation, detailed troubleshooting, and mechanical servicing information for the DECwriter IV series of printers and terminals
LA34/DECwriter IV Illustrated Parts Breakdown	EK-LA34S-IP	Exploded views and parts lists for the DECwriter IV series of printers and terminals
LA38-GA Field Maintenance Print Set	MP-00754-00	Engineering drawings and parts lists for the LA38-GA and LA34-DA terminals including LAX34-AL, LAX34-KL and LAX34-PL options
LA34-AA Field Maintenance Print Set	MP-00095-00	Engineering drawings and parts list for the LA34-AA terminal
LAX34-XL Field Maintenance Print Set	MP-01078-00	Engineering drawings and parts list for the LAX34-XL extended logic option
LAX34-XM Field Maintenance Print Set	MP-01093-00	Engineering drawings and parts lists for the LAX34-XM extended logic with memory option
LA34-RA Field Maintenance Print Set	MP-01090-00	Engineering drawings and parts lists for the LA34-RA printer

**Table 1-2 Related Documents (Cont)**

Title	Document Number	Description
LA34-VA Field Maintenance Print Set	MP-01091-00	Engineering drawings and parts lists for the LA34-VA printer
LA34-WA Field Maintenance Print Set	MP-01092-00	Engineering drawings and parts lists for the LA34-WA printer
LAX34-CL Field Maintenance Print Set	MP-00714-00	Engineering drawings and parts lists for the LAX34-CL current loop interface option
LAX34-LL Field Maintenance Print Set	MP-00696-00	Engineering drawings and parts lists for the LAX34-LL paper low option
LAX34-RL Field Maintenance Print Set	MP-00753-00	Engineering drawings and parts lists for the LAX34-RL roll paper option
LAX34-SL Field Maintenance Print Set	MP-00738-00	Engineering drawings and parts lists for the LAX34-SL DECwriter stand option

## CHAPTER 2 INSTALLATION

### 2.1 GENERAL

This chapter contains the step-by-step procedures used to unpack, inspect, power up, and check out the terminal. These procedures allow you to verify that the terminal is not damaged and is operating properly before connection to the communication system.

### 2.2 SITE CONSIDERATIONS

Install the terminal in an area that is free from excessive dust, dirt, corrosive fumes, and vapors. To prevent overheating, do not block the ventilation openings on the bottom of the terminal. Table 2-1 lists the environmental and power requirements of the terminal. Figure 2-1 illustrates its overall dimensions. A complete list of specifications is contained in Appendix D.

**Table 2-1 Site Considerations**

Site Consideration	Specification
Temperature	10° to 40° C (50° to 104° F)
Relative humidity	10 to 90 percent with maximum wet bulb temperature of 28° C(82° F) and minimum dew point of 2° C (36° F) noncondensing
Input voltage	90 to 128 Vac 180 to 256 Vac (switch selectable) 47 to 63 Hz
Power consumption	Printing 45 watts maximum Nonprinting 25 watts maximum
Power receptacle	Nonswitched, three-prong, grounded receptacle

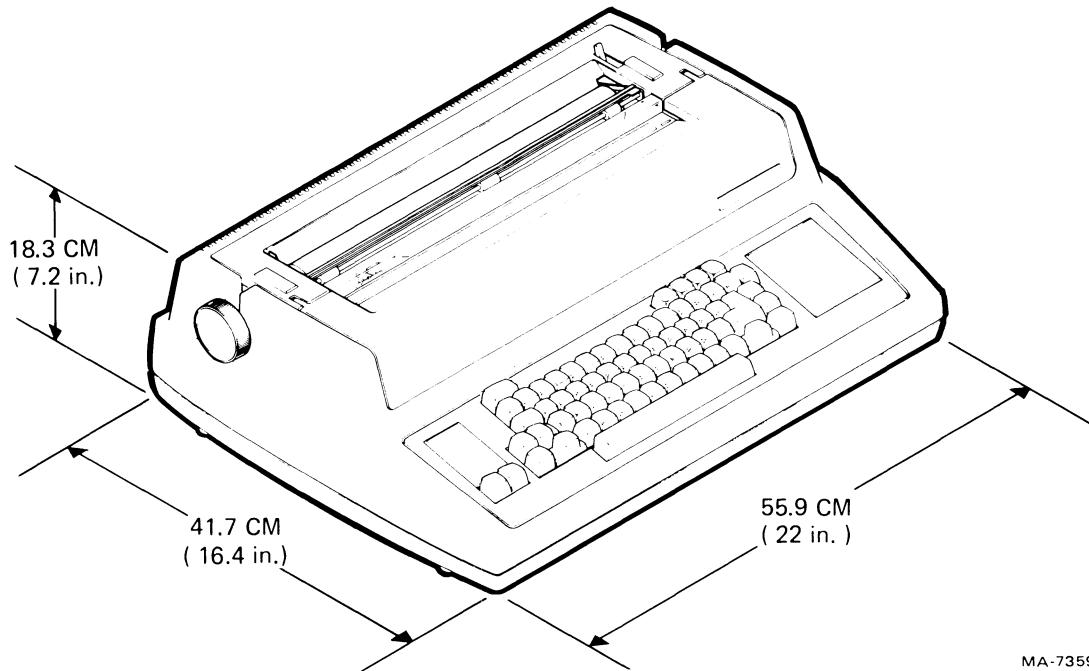
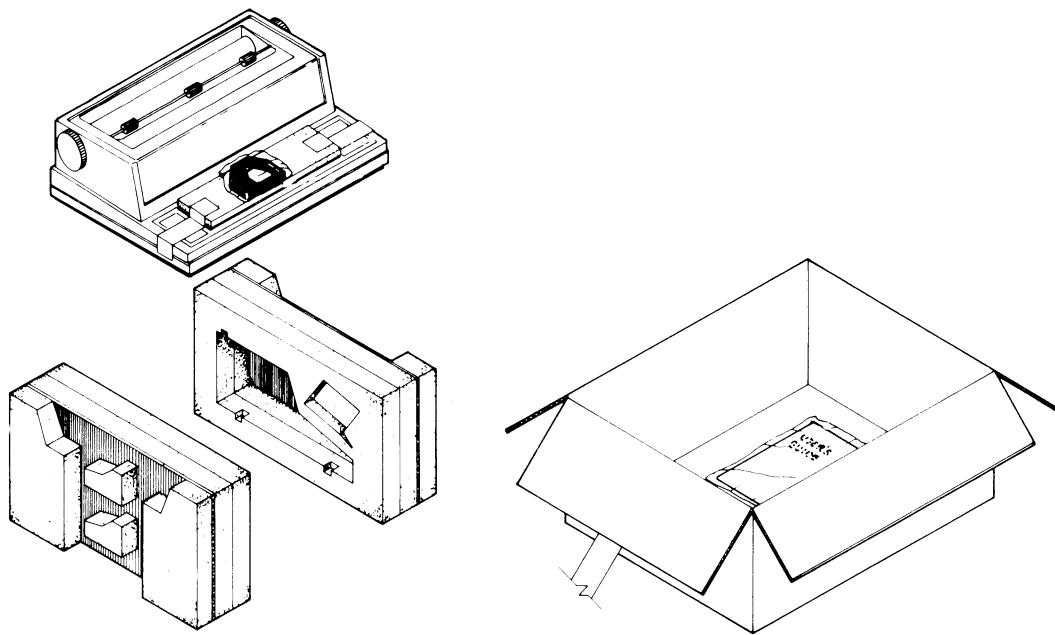


Figure 2-1 Terminal Dimensions

### 2.3 UNPACKING AND INSPECTION

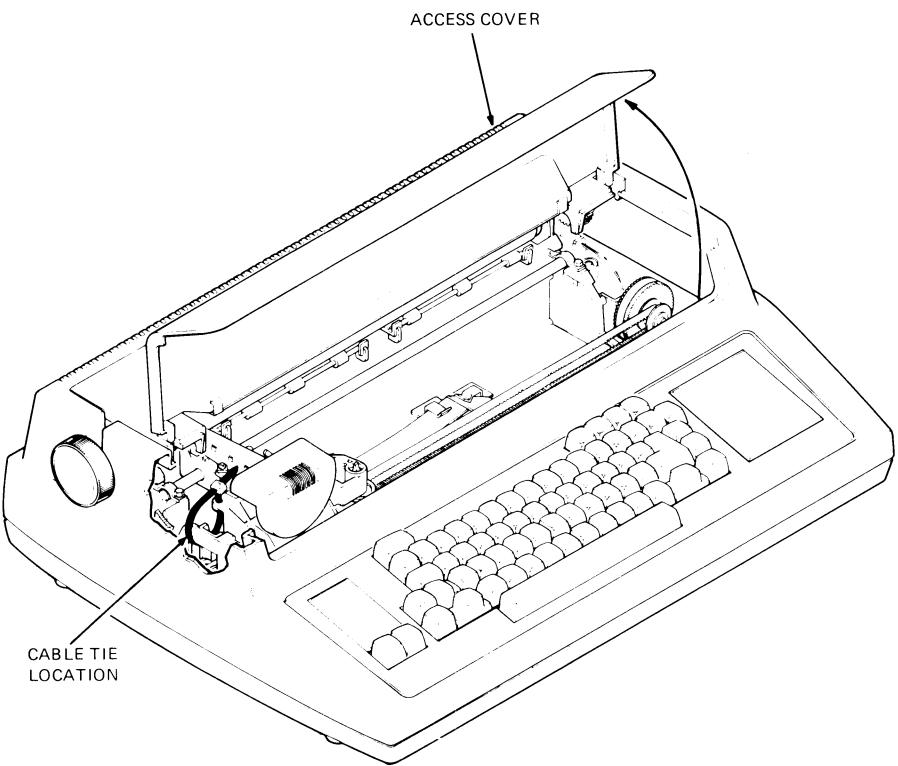
Use this procedure to unpack and inspect the terminal. A pair of diagonal cutters (or equivalent) is required to perform this procedure.

1. Open the top of the shipping carton (Figure 2-2).
2. Lift the terminal up and out of the carton. Place it on a flat, clean work surface (Figure 2-2).
3. Remove the shock absorbing material and packing from around the terminal (Figure 2-2).
4. Remove the documentation package, power cord and any other cables (Figure 2-2).
5. Remove all option cartons, if included.
6. Carefully inspect the terminal housing and carriage assembly for obvious shipping damage. Check the enclosed packing list for lost or missing items. Report any damaged or missing items to the local carrier and your DIGITAL branch office.
7. Open the access cover. Clip and remove the nylon cable tie securing the printhead assembly (Figure 2-3). Close the access cover.
8. If necessary, wipe the outer surfaces with a clean, soft, lint-free cloth.



MA-2610

Figure 2-2 Unpacking/Packing Details



MA 7360A

Figure 2-3 Cable Tie Location

## **2.4 REPACKING PROCEDURES**

Perform the following procedure to repack the terminal.

1. Remove the ribbon cartridge and paper.
2. Secure the printhead assembly to the left side plate with a nylon cable tie to prevent movement while in transit (Figure 2-3).
3. Repack the terminal as shown in Figure 2-2.

## **2.5 INSTALLATION PROCEDURES**

Perform the following procedures to install the terminal. A small blade screwdriver (or equivalent) and a right angle screwdriver are needed for some procedures.

### **2.5.1 Option Installation**

Install the extended logic option (LAX34-XL or LAX34-XM) and all other options included with the terminal according to the instructions in the Option Installation Chapter (Chapter 3).

### **2.5.2 115/230 Voltage Selection**

Figures 2-4 and 2-5 illustrate two different locations of the 115/230 voltage selector switch. If the location of this switch in your terminal is as shown in Figure 2-4, perform the following steps to select the proper voltage range. If the switch is located as shown in Figure 2-5, refer to Alternate AC Voltage Selection (Paragraph 2.5.3) for the procedure to select the proper voltage range.

1. Lift the access cover.
2. Using a small blade screwdriver or ballpoint pen select the desired ac input voltage range (Figure 2-4).

#### **CAUTION**

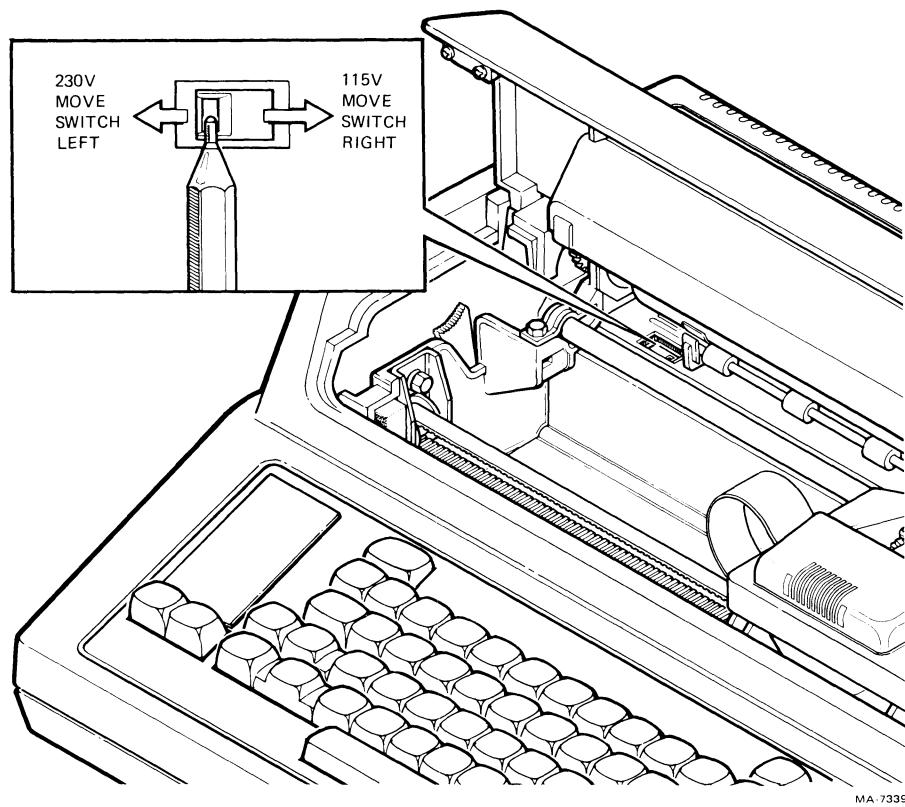
**Always use a small blade screwdriver, ballpoint pen, or equivalent to change the voltage range. Never use a pencil.**

**Always check to be sure that the selected voltage range matches the available ac supply voltage. If the terminal is operated from a 230 V source with the selector switch in the 115 V position, the power supply will be damaged.**

### **2.5.3 Alternate AC Voltage Selection**

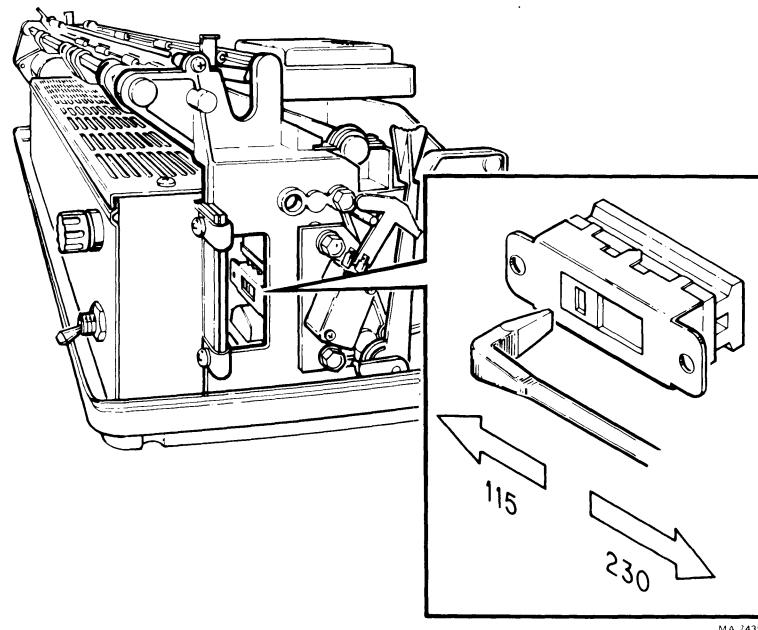
If the ac voltage selector switch is located as shown in Figure 2-5, perform the following steps to select the proper voltage range.

1. Verify that the ac power cord is not plugged into a power source. Remove the other end of the power cord from the back of the printer.
2. Lift the access cover and press the two retainer clips toward the rear of the terminal (Figure 2-6). Remove the cover.
3. Lift the bail bar to gain access to the platen (Figure 2-7). Press the two platen release levers and lift the platen straight up.



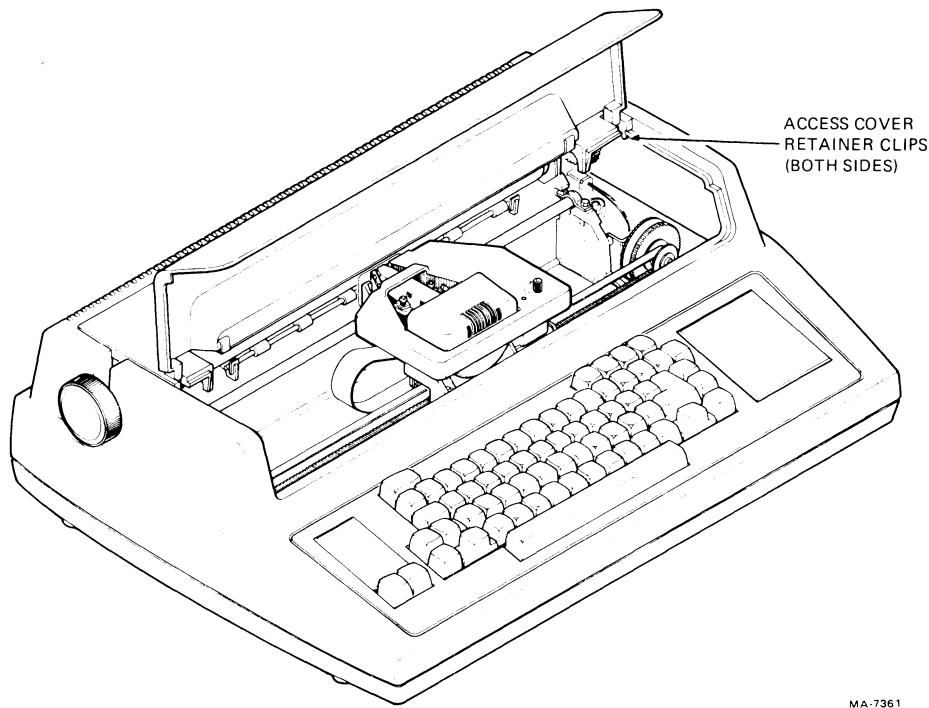
MA-7339

Figure 2-4 AC Voltage Selector Switch



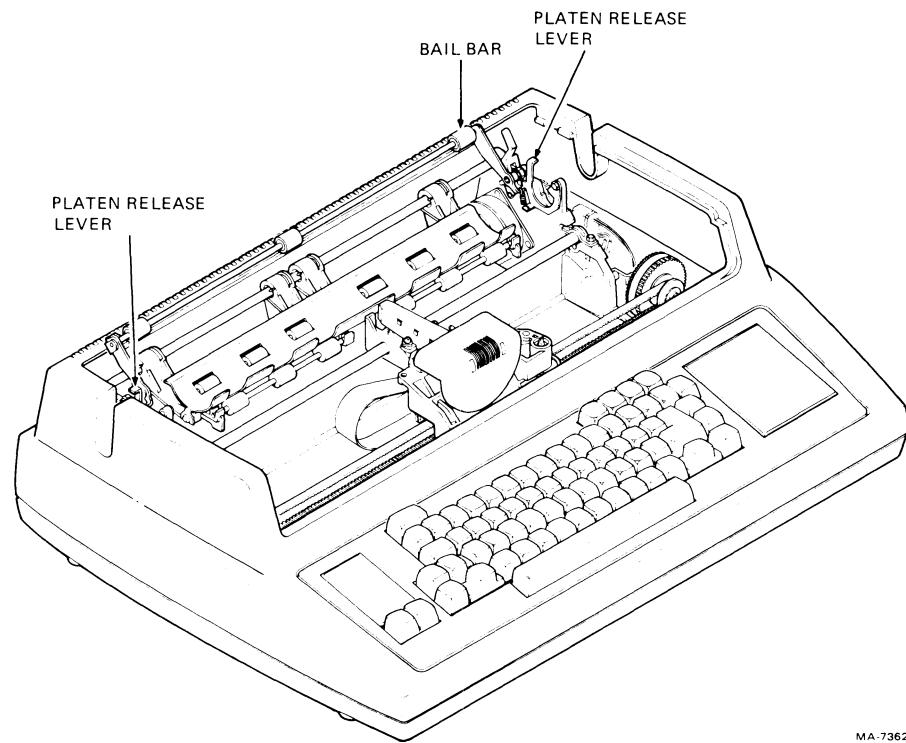
MA-7431

Figure 2-5 Alternate AC Voltage Selector Switch Location



MA-7361

Figure 2-6 Access Cover Removal



MA-7362

Figure 2-7 Platen Removal

4. Lower the bail bar.
5. With a small blade screwdriver, release the four snap fasteners that secure the printer housing to the base assembly (Figure 2-8).
6. Lift the printer housing away from the base assembly.
7. The voltage selector switch is now accessible (Figure 2-5).
8. With the right angle screwdriver, select the proper voltage range by moving the switch (Figure 2-5).
9. Reassemble the terminal by performing steps 1 through 6 in reverse order.

#### **2.5.4 Jumper Selection**

Configure the jumpers in the terminal being installed according to the following steps.

- **Local Echo Control Selection Jumper**

**(LA34-AA, LA38-AA Terminals Only)**

When the local echo control jumper is installed, no local echo operation is selected as the default condition. When the jumper is removed, the local echo feature is selected. To select the feature, perform the following procedure. A small blade screwdriver and a pair of diagonal cutters are required.

- **Modem Operation Selection Jumper**

**(LA34-RA, LA34-WA, LA34-VA Printers Only)**

When the modem/no modem jumper is installed, no modem operation is selected. When the modem/no modem jumper is removed, the modem feature is selected. To select the modem feature perform the following procedure. A small blade screwdriver and a pair of diagonal cutters are required.

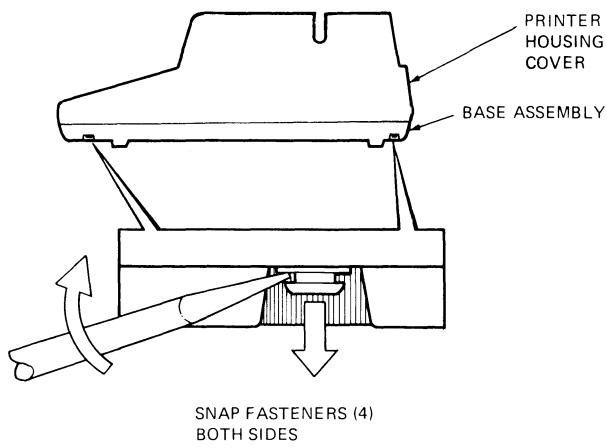


Figure 2-8 Printer Housing Removal

1. Verify that the ac power cord is not plugged into a power source. Remove the other end of the power cord from the back of the printer.
2. To remove the access cover, lift the access cover and press the two retainer clips (Figure 2-6). Lift the access cover away from the printer housing.
3. Lift the bail bar to gain access to the platen (Figure 2-7). Press the two platen release levers and lift the platen straight up. Lower the bail bar to its original position.
4. With a small blade screwdriver, release the four snap fasteners that secure the printer housing to the base assembly (Figure 2-8). Lift the printer housing away from the base assembly.
5. Press the bezel retainer clips and rotate the keyboard bezel assembly toward the front of the printer (Figure 2-9).
6. The jumper can now be seen (Figure 2-10). Cut the jumper to select local echo or the modem feature, depending upon the DECwriter IV version being installed.

**CAUTION**

**Make sure to remove the entire jumper. Any metal piece remaining may disturb the electronic operation of the printer.**

7. Make sure the keyboard bezel is properly seated then rotate the bezel to its original position.
8. Place the printer housing onto the base assembly. Press the snap fasteners to secure the housing to the base assembly.

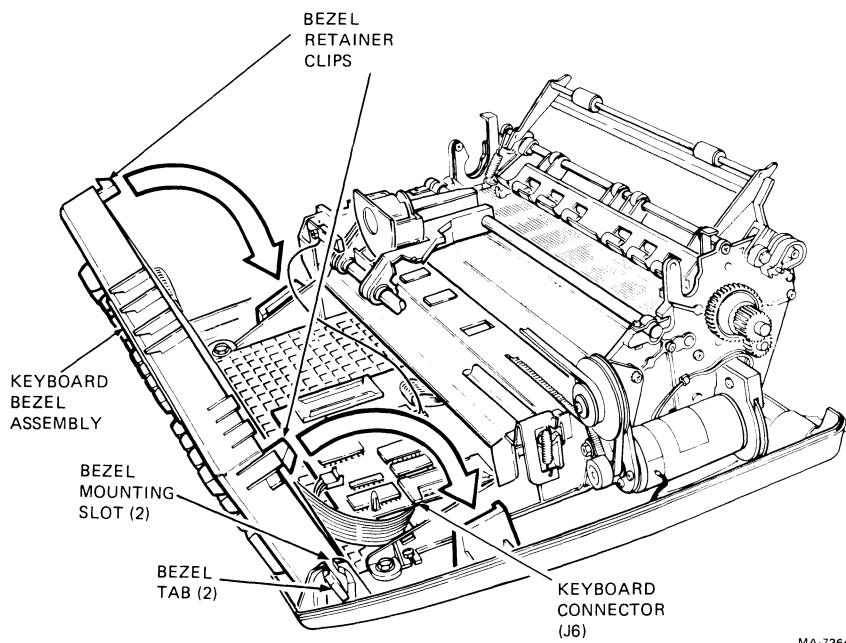


Figure 2-9 Releasing the Keyboard Bezel

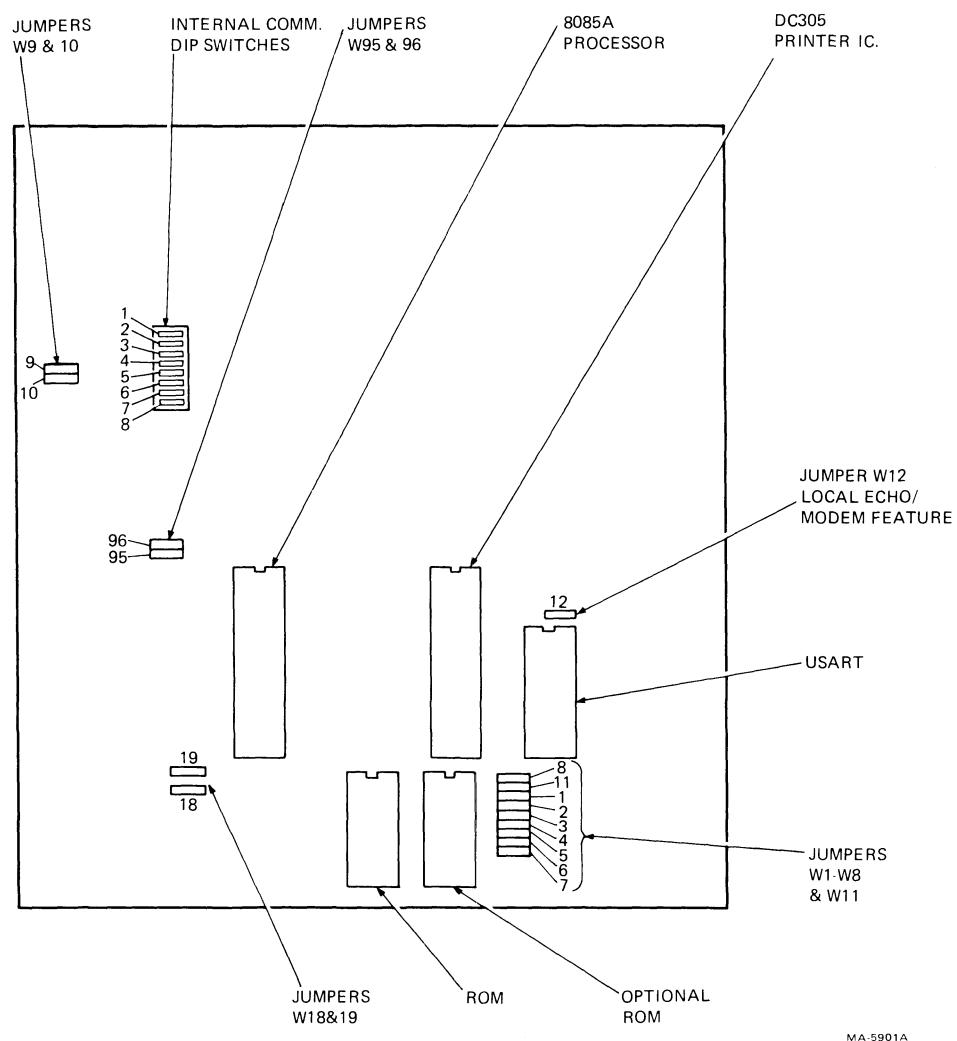


Figure 2-10 LA34/38-AA Control Board Component Location

9. Lift the bail bar and press the platen into its original position. The platen clicks into place when properly seated. Lower the bail bar to its original position.
10. Slide the back edge of the access cover under the lip in the printer housing, and press the access cover into its original position.

#### **2.5.5 Cable Installation**

Use this procedure to install the interface cable.

1. Connect interface cable to the interface connector on rear of terminal (Figure 2-11).

**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.**

2. Plug the ac power cord into the ac power receptacle on the rear of the printer (Figure 2-11). Then plug the ac power cord into a nonswitched, three-prong, grounded wall receptacle.

#### **2.5.6 Printer Preparation**

Use this procedure to prepare the printer for use.

1. Install a ribbon cartridge using the ribbon cartridge installation procedure. (Refer to your User Guide for the installation procedures.)
2. Install paper using the paper/forms loading procedure. (Refer to your User Guide for the paper/forms loading procedure.)

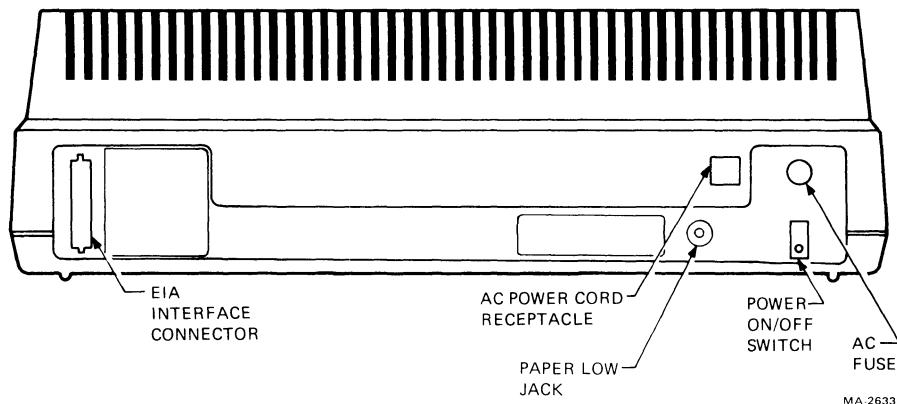


Figure 2-11 LA34, Rear View

### 2.5.7 Setting Communications Switches

The DECwriter IV terminals and printers must be compatible with the computer hardware and software to communicate properly. The data communications switches allow users to tailor the terminal to operate with a specific computer.

To locate the data communications switches, open the access cover and move the printhead to the left side plate. Figure 2-12 shows the location of the switches and the labeled function of each switch. There are three different types of switches used in the DECwriter IV series terminals; one slide switch and two types of rocker switches (Figure 2-13). It is important to identify which type of switch the printer contains before trying to change any of the communications features.

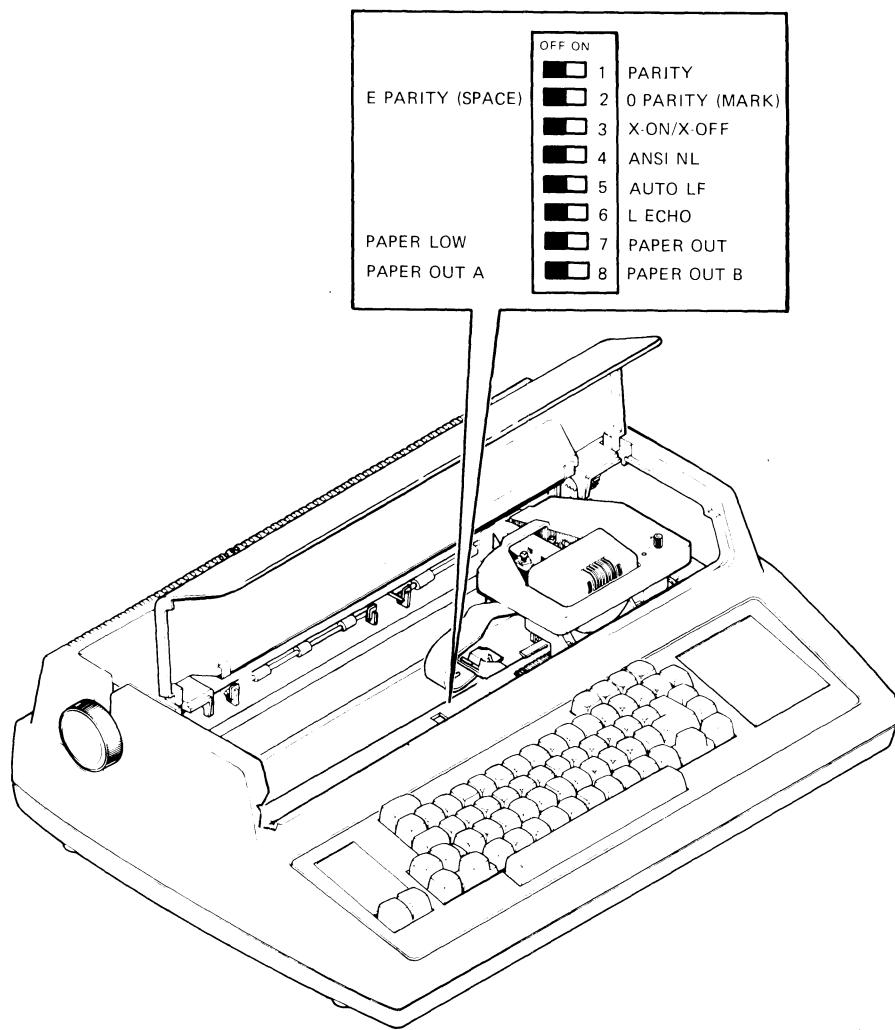
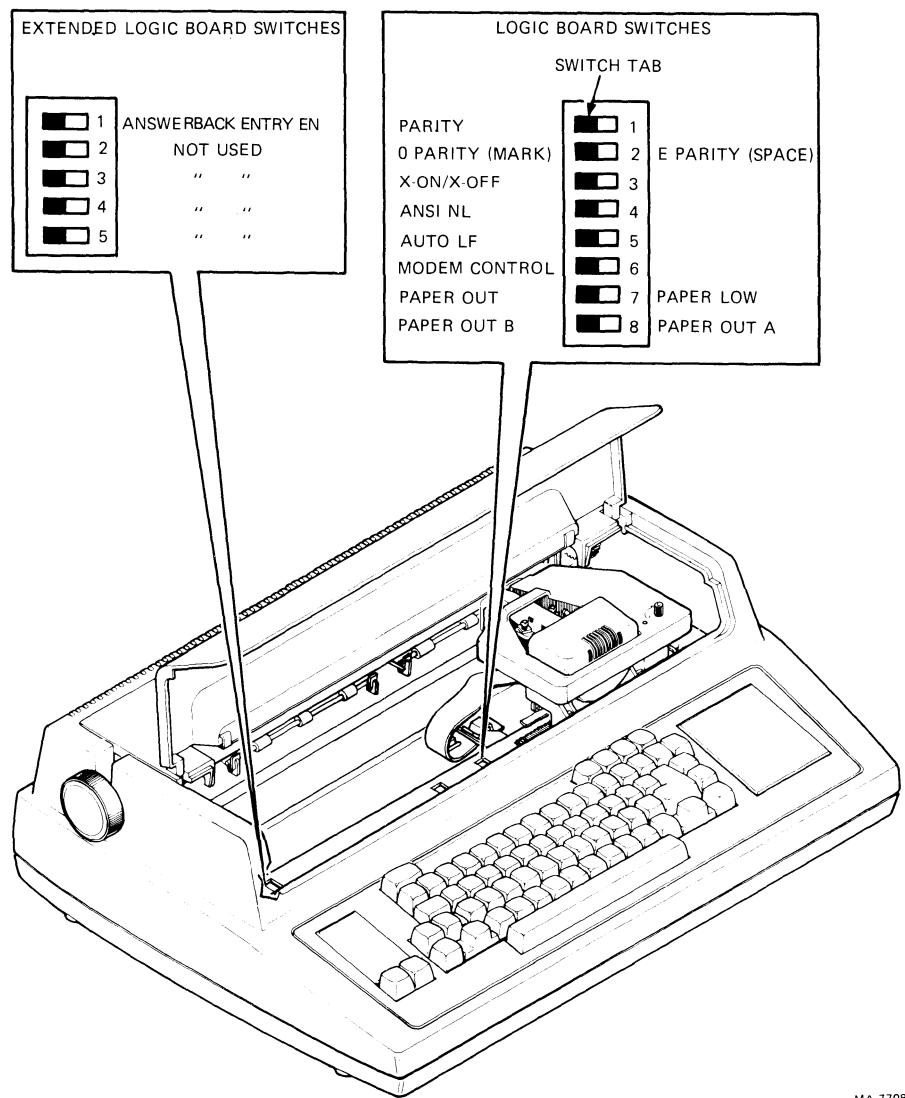


Figure 2-12 Data Communication Switches  
a. LA34-DA, LA38-GA



MA-7708

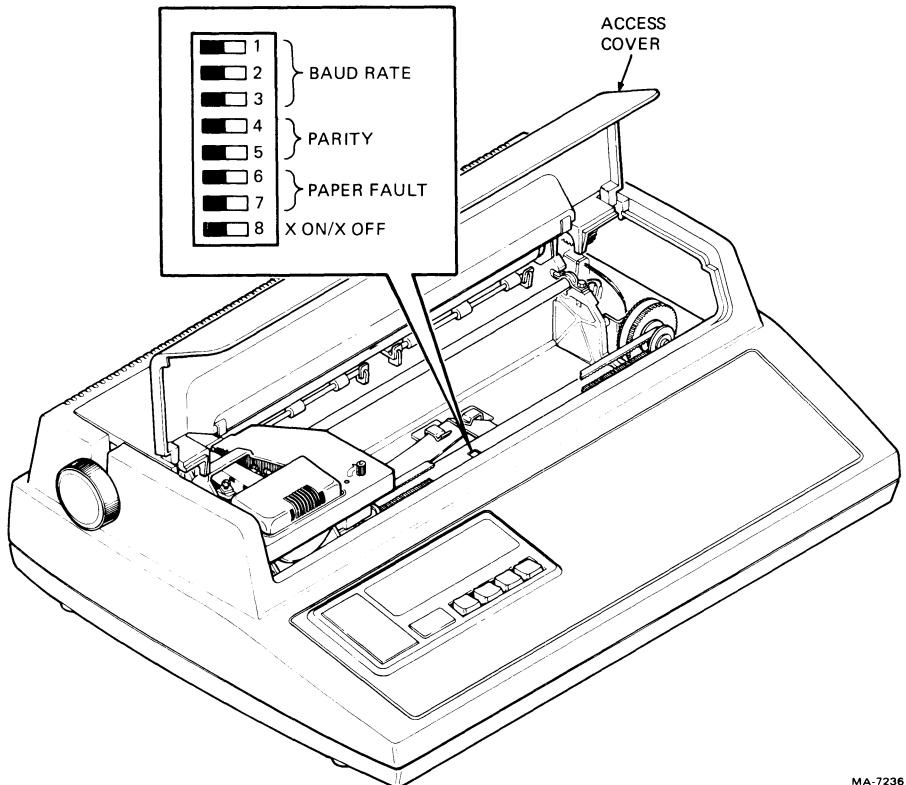
Figure 2-12 Data Communication Switches  
b. LA34-AA, LA38-AA

To select a feature using a slide switch, push the switch tab to the side that corresponds to the desired selection. To select a feature using a rocker switch, press the side of the switch that corresponds to the desired selection. For detailed descriptions of the settings for each communications switch, refer to the Communication chapter in the User Guide for the DECwriter IV you are installing.

#### **CAUTION**

**Always use a small blade screwdriver, ballpoint pen, or equivalent to change a communications feature. Never use a lead pencil! Broken lead or lead powder can cause a short or intermittent problem to occur on the printed circuit board.**

After you select a communications feature, close the access cover and press the **FAULT RESET** or **CLEAR FAULT** key.



MA-7236

Figure 2-12 Data Communication Switches  
c. LA34-RA, LA34-VA, LA34-WA

### 2.5.8 Power Up and Checkout Procedures

Use this procedure to power up the terminal and verify proper operation.

#### NOTE

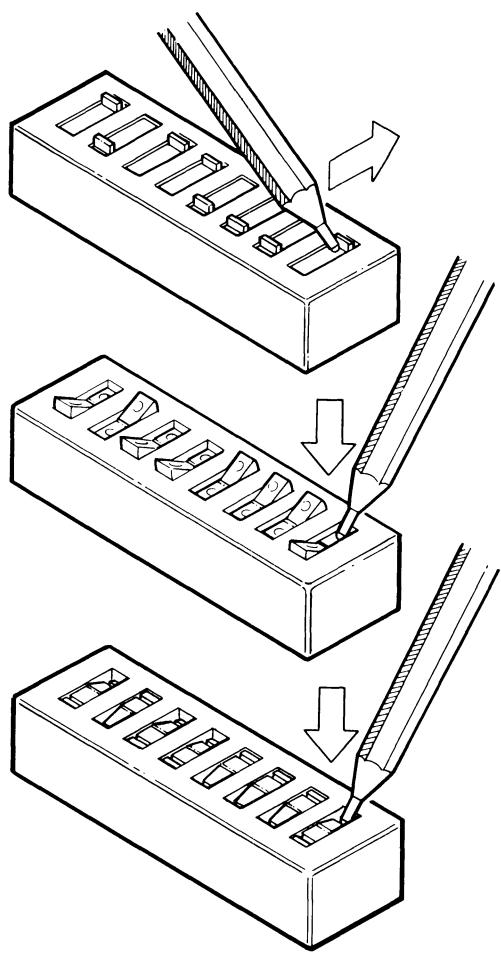
**The following step is ONLY performed the first time the terminal is powered up and ONLY after installing the LAX34-XL or LAX34-XM option.**

1. While holding the SET-UP key down, set the power ON/OFF switch to ON (Figure 2-11). Note that the SET-UP indicator remains on for up to nine seconds. If the conditions in the above note do not apply, simply set the power ON/OFF switch to ON.

#### NOTE

**Step 1 loads the default SET-UP features into permanent memory on the LAX34-XL (or LAX34-XM) option board. If the SET-UP key is not held down, the terminal may print NVM err on power up.**

2. Verify that the POWER/FAULT indicator turns on and the printhead automatically positions itself to the left margin.



MA-7256

Figure 2-13 Data Communication Switch Types

3. Print the status message to verify proper operation of the printer. (Refer to the SET-UP Features in Chapter 4 for more detail.)
4. Perform the printing self-tests described in Chapter 4, Paragraph 4.4.
5. After you have verified that the printer is operating correctly, select the SET-UP features if desirable.

## CHAPTER 3

### OPTION INSTALLATION

#### 3.1 GENERAL

Printer options are designed to enhance the basic terminal and make it useful in an even wider range of applications. The following paragraphs describe the options available and the procedure used to install each option. The installation procedure for each option is the same for all printer/terminal variations.

LAX34-XL	Extended Logic Option (LA34/38-AA only)
LAX34-XM	Extended Logic with Memory Option (LA34/38-AA only)
LAX34-RL	Roll Paper Holder Option (all printers/terminals)
LAX34-AL	Tractor Option (all printers/terminals)
LAX34-SL	Printer Stand Option (all printers/terminals)
LAX34-LL	Paper Low Detection Option (all printers/terminals)
LAX34-PL	Paper Out Detection Option (all printers/terminals)
LAX34-CL	20 mA Current Loop Option (all printers/terminals)
LAX34-JL	International Character Keycap Option (LA34/38-AA only)
LAX34-HL	APL Character Keycap Option (LA34/38-AA with LAX34-XL/XM only)

#### 3.2 LAX34-XL EXTENDED LOGIC OPTION (LA34-AA, LA38-AA Only)

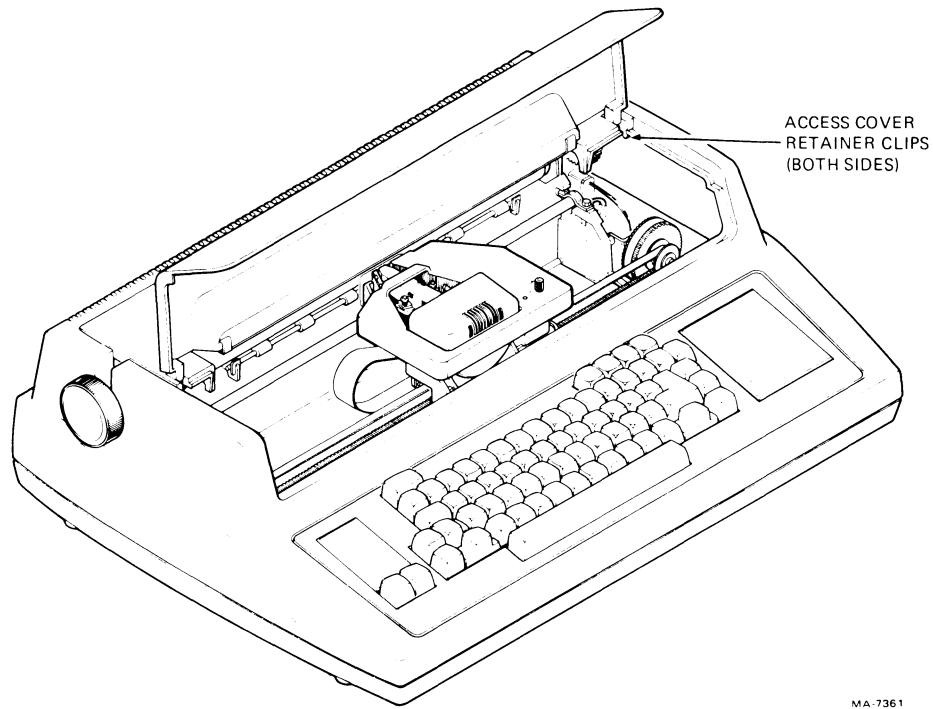
The extended logic option increases the terminal's usability in both operation and communication. With this option added, the operator or programmer can select more features to permit terminal operation in a wider range of applications.

Perform the following procedure to install the extended logic option. Be sure to follow each step carefully and to observe all precautionary measures where noted.

#### CAUTION

**Do not remove the option ROM from its shipping carton until you are ready to install it on the control logic board. Static electricity charge buildup on hands can damage the chip.**

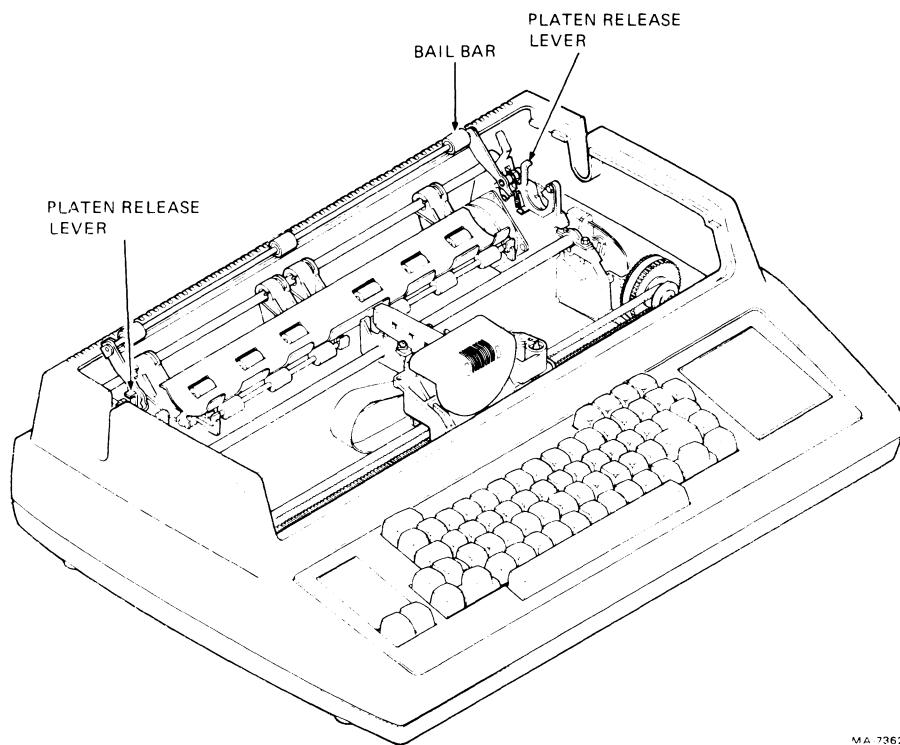
1. Turn the power ON/OFF switch, located on the rear of the terminal, to the OFF position. Disconnect the ac line cord from the wall receptacle and then the terminal.
2. Remove the paper, and if installed, the roll paper holder or tractor options.
3. Remove the access cover by opening it and pressing the two access cover retainer clips at the same time. Lift the cover straight up (Figure 3-1).
4. Remove the ribbon cartridge.



MA-7361

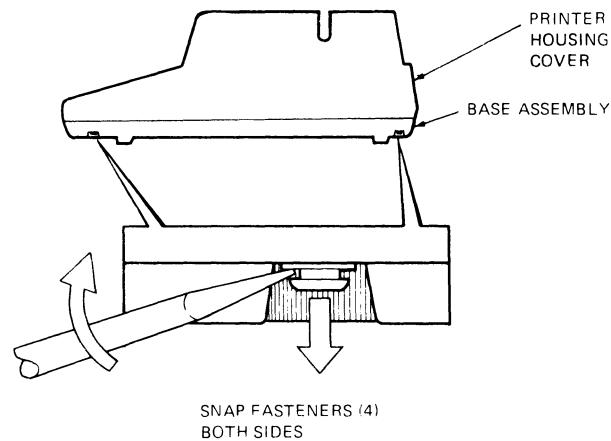
Figure 3-1 Access Cover Removal

5. Lift the bail bar to gain access to the platen. Remove the platen by pressing the two platen release levers at the same time. Lift the platen straight up (Figure 3-2). Lower the bail bar to its original position.
6. Use a small blade screwdriver to release the four snap fasteners that secure the printer housing to the base assembly (Figure 3-3). Remove the printer housing.
7. Press the bezel retainer clips and rotate the bezel towards front of terminal (Figure 3-4).
8. Remove the keyboard connector from J6 on the control board (Figure 3-5). Lift the keyboard bezel assembly straight out.
9. Remove the control board safety cover (Figure 3-6).
10. Move the EIA interface cable connected to J7 on the control board until there is room at the left to install the option board (Figures 3-5 and 3-7).
11. Disconnect the interlock and paper out/paper low connector at J9 and move out of the way.
12. Mount the plastic standoffs to the bottom shielding plate as follows.
  - a. Secure the left standoff to the shielding plate grid (Figure 3-7) using the 6-32 screw. Use a pair of pliers (or equivalent) to hold the standoff while installing the screw. Do not tighten.
  - b. Locate the right standoff a distance of approximately 4-3/4 inches to the right of the left standoff (Figure 3-7). Secure the standoff to the grid but do not tighten.



MA 7362

Figure 3-2 Platen Removal



MA 7262

Figure 3-3 Printer Housing Removal

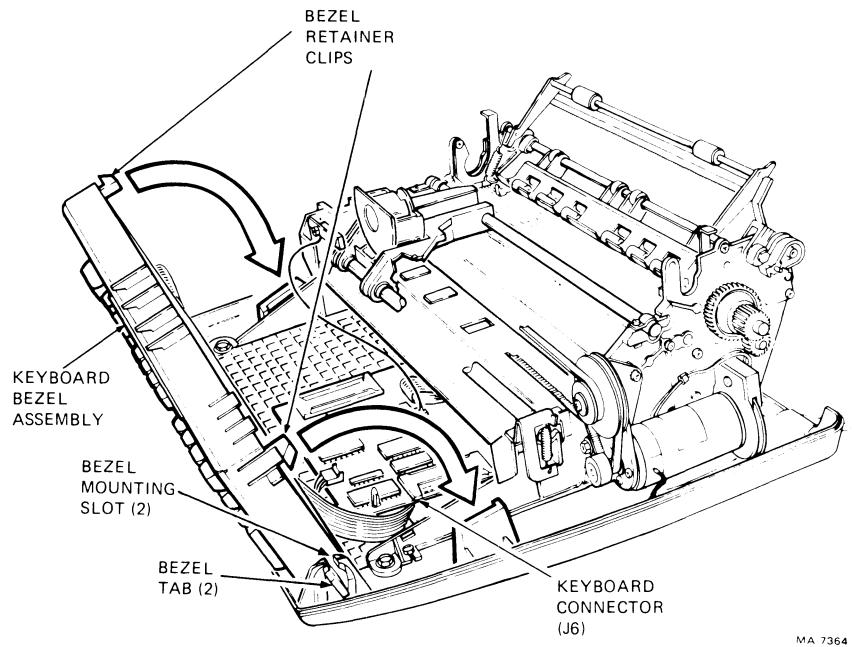


Figure 3-4 Keyboard Bezel Assembly Removal

13. Slide the rear edge of the extended logic board into the upper slot of the dual PC card support (Figure 3-7). Align the two mounting holes in the board with the standoffs and press the board onto the standoffs.
14. Adjust board position until its front edge is approximately parallel to the grid. Tighten the standoff mounting screws.
15. Connect the ribbon cable from J1 on the extended logic board to J8 on the control board. Be sure that the ribbon cable is positioned as shown in Figure 3-7.
16. Reconnect the interlock and paper out/paper low connector to J9 on the control board (Figure 3-5).
17. Install the option ROM chip as follows.

#### **CAUTION**

**Always hold ROM chips by the plastic body, being careful not to touch the pins with your hands. Static electricity buildup on hands can damage the chip.**

- a. Remove the ROM chip at location E14 on the control board (Figure 3-7). Insert tip of small flat blade screwdriver between chip and receptacle. Turn tool slightly at each end until pins are free. Do not use rocking motion while removing chip.
- b. Carefully remove the option chip from its conductive carrier. Mount the original chip in its place for storage.
- c. Ground your hand by touching a metallic part of the printer mechanism assembly. Then pick up the option chip for installation.

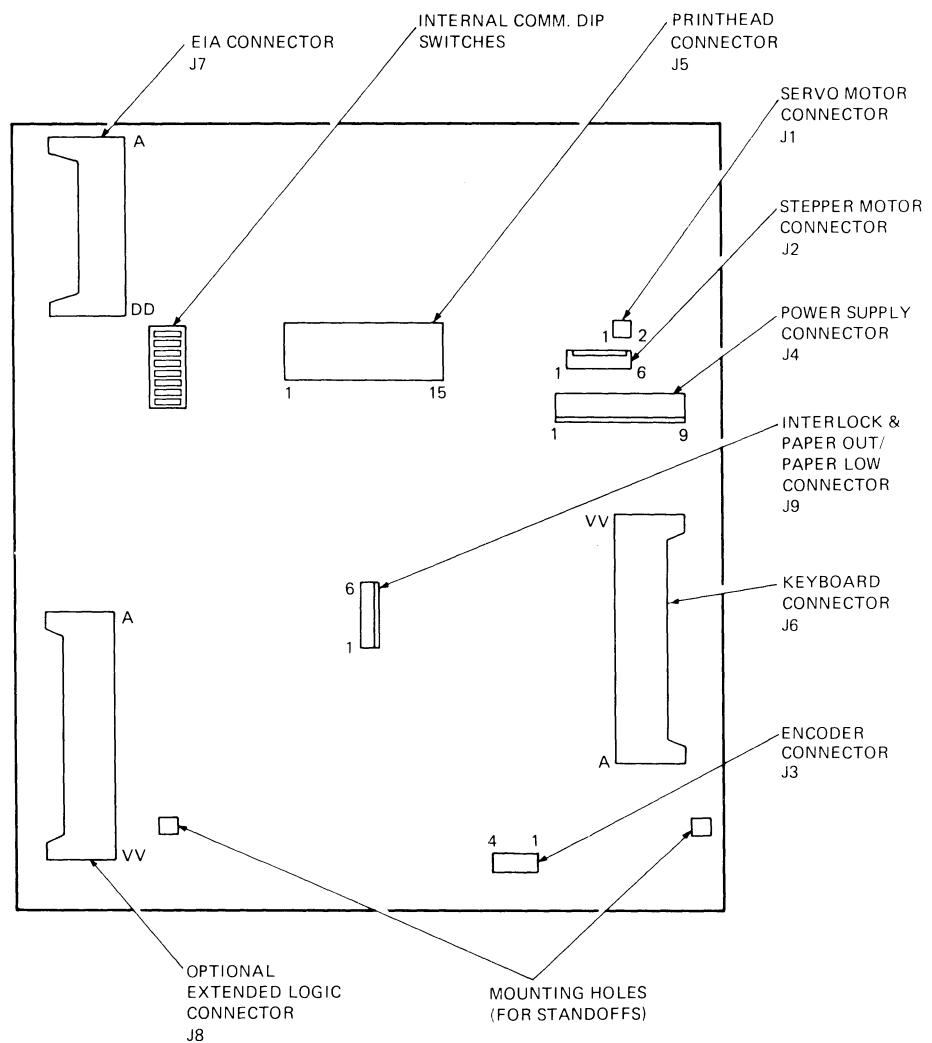


Figure 3-5 Control Board Connector Locations

MA 5900A

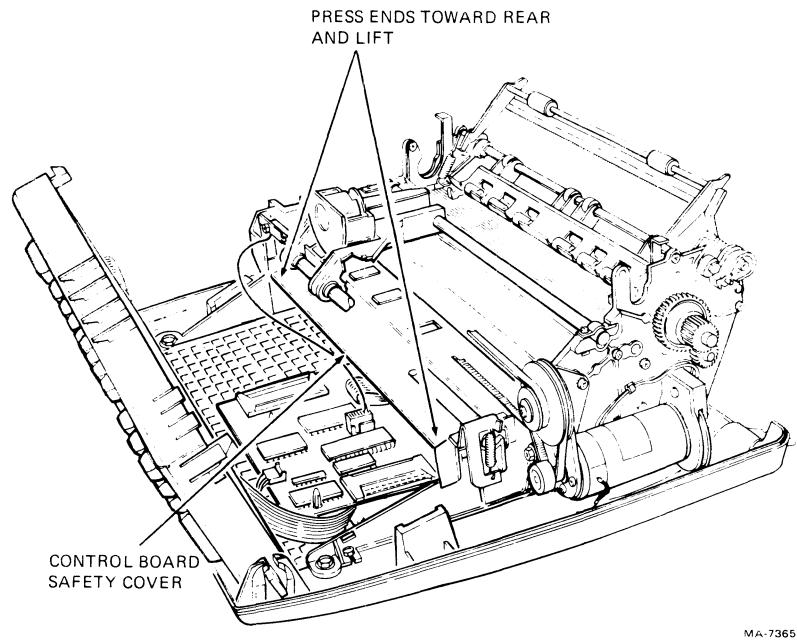


Figure 3-6 Control Board Safety Cover Removal

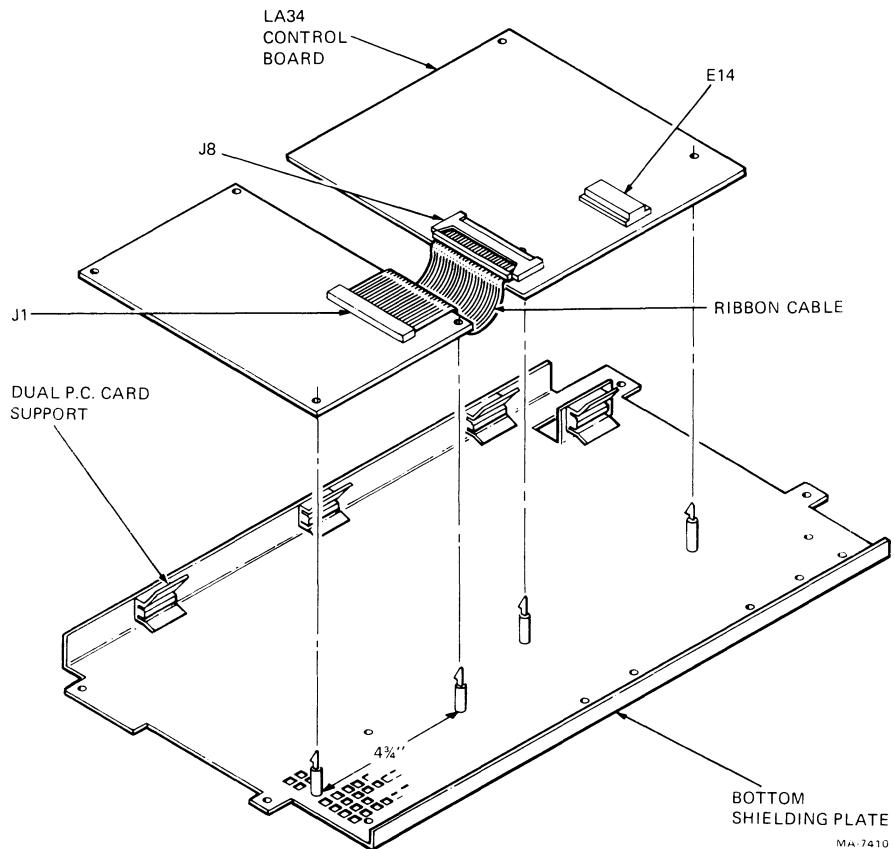


Figure 3-7 LA34-XL/XM Option Board Installation

- d. With pin 1 of option chip (identified by a small dot) located in the upper-left corner, slightly engage all pins on the left side of the chip in the corresponding side of the connector socket. Then with a slight pressure toward that side, angle the other side down and engage those pins. Then press the entire chip straight down into the socket, firmly engaging all the pins. Be sure to install the chip as shown in Figure 3-8.
  - e. Gently press the chip straight in until it is fully seated. Do not use a rocking motion while installing the chip.
  - f. Check to be sure that all chip pins are engaged and that the dot is in the upper-left corner.
18. Remove the plastic plug in the control board safety cover (directly over the XL board DIP switch) and reinstall the safety cover.
19. Return the keyboard bezel assembly to the slots in the base assembly. Connect the keyboard cable to J6 on the control board.
20. Rotate the bezel back to its original position and press the bezel retainer clips to secure the bezel in place.
21. Replace the printer housing cover on the base assembly. Secure the printer housing cover to base assembly by pressing the four snap fasteners on the base assembly.

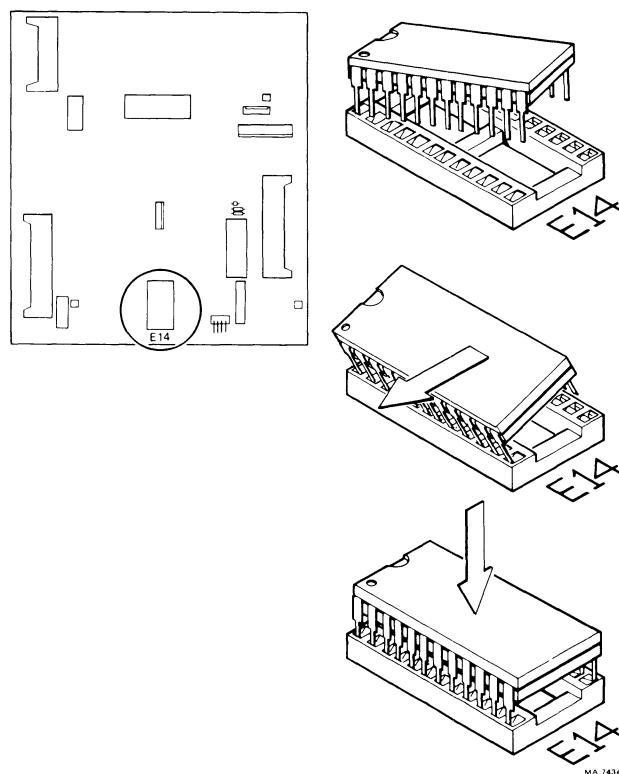


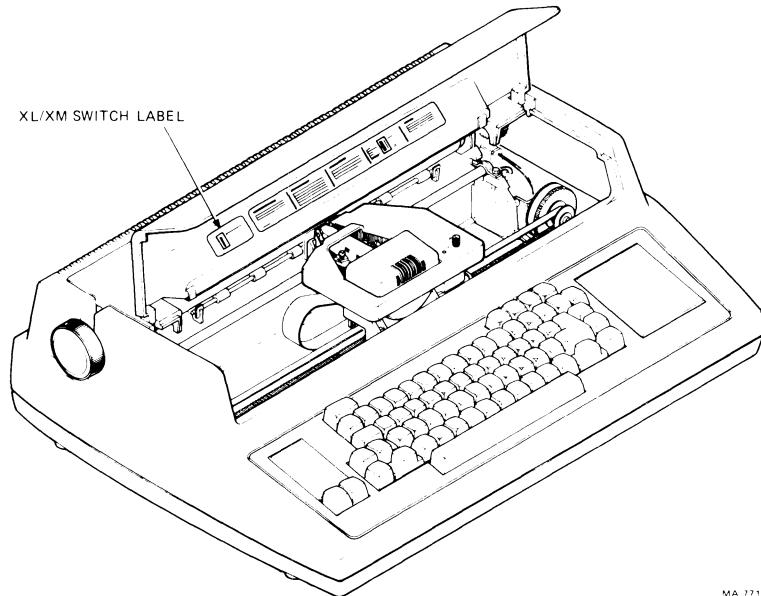
Figure 3-8 Option ROM CHIP Installation

22. Lift the bail bar to reinstall the platen. Press the platen into place. Rotate the paper advance knob to verify that the platen rolls freely. Lower the bail bar to its original position.
23. Slide the rear edge of the access cover under the lip in the printer housing and press the access cover back into its original position.
24. Remove backing from XL switch label and paste label on inside surface of access cover (Figure 3-9). Reinstall the ribbon cartridge. Close the access cover.
25. Reinstall the paper and roll paper holder or tractor options if necessary.
26. Plug the ac line cord into the rear of the terminal and then into a nonswitched, three-prong grounded outlet. Hold the **SET-UP** key down and then turn the power ON/OFF switch ON. This step loads the default SET-UP feature settings into the options nonvolatile memory. [Refer to the Installation Chapter (Chapter 2) for more details.]

### 3.2.1 Test After Installation

Perform the following tests to verify proper operation of the option. Refer to SET-UP Features Summary in Chapter 4 for procedure details.

1. Perform status message procedure.
2. Change parity and local echo selections at keyboard.
3. Perform store procedure.
4. Perform initialization procedure.
5. Perform status procedure again.
6. Check status printout. Parity and local echo selections should be the same as in step 1.
7. Perform recall procedure.
8. Perform another status procedure.
9. Check status printout. Parity and local echo selections should be those selected in step 2.



MA 7710

Figure 3-9 LAX34-XL/XM Switch Label Location

### **3.3 LAX34-XM EXTENDED LOGIC WITH MEMORY OPTION**

The extended logic with memory option increases the terminal's usability in both operation and communication. With this option added, the operator or programmer can select more features to permit terminal operation in a wider range of applications. The memory feature of this option provides selection of memory sizes for the input buffer for different communication arrangements.

The installation procedure for this option is the same as the procedure for the LAX34-XL extended logic option (refer to Paragraph 3.2).

#### **3.3.1 Test After Installation**

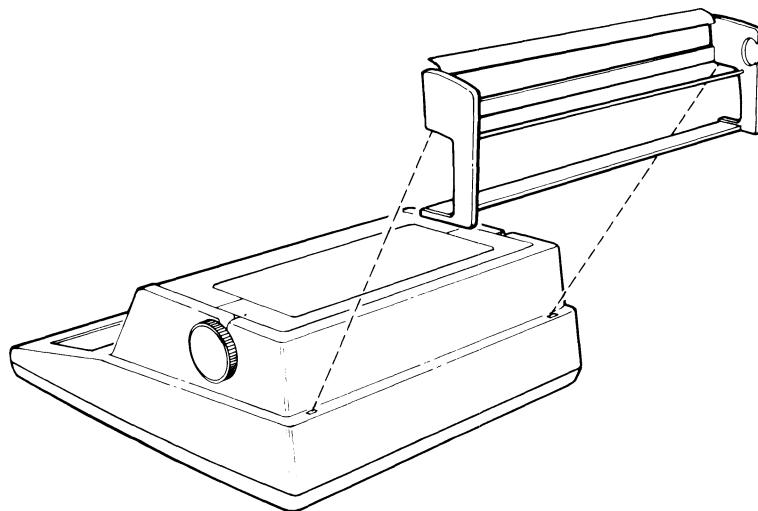
Perform the following tests to verify proper operation of the option. Refer to SET-UP Features Summary in Chapter 4 for procedure details.

1. Perform status message procedure.
2. Change parity and buffer size selections at keyboard.
3. Perform store procedure.
4. Perform initialization procedure.
5. Perform status procedure again.
6. Check status printout. Parity and local echo selections should be the same as in step 1.
7. Perform recall procedure.
8. Perform another status procedure.
9. Check status printout. Parity and buffer size selections should be those selected in step 2.

### **3.4 LAX34-RL ROLL PAPER HOLDER OPTION**

The roll paper holder option allows the LA34 series terminals to be configured to accept roll paper up to 37.78 cm (14-7/8 inches) in width.

To install the roll paper holder, line up the notches on the holder with the corresponding holes in the back of the terminal (Figure 3-10). The roll paper holder is ready to be loaded with paper. Refer to your User Guide for paper loading information.



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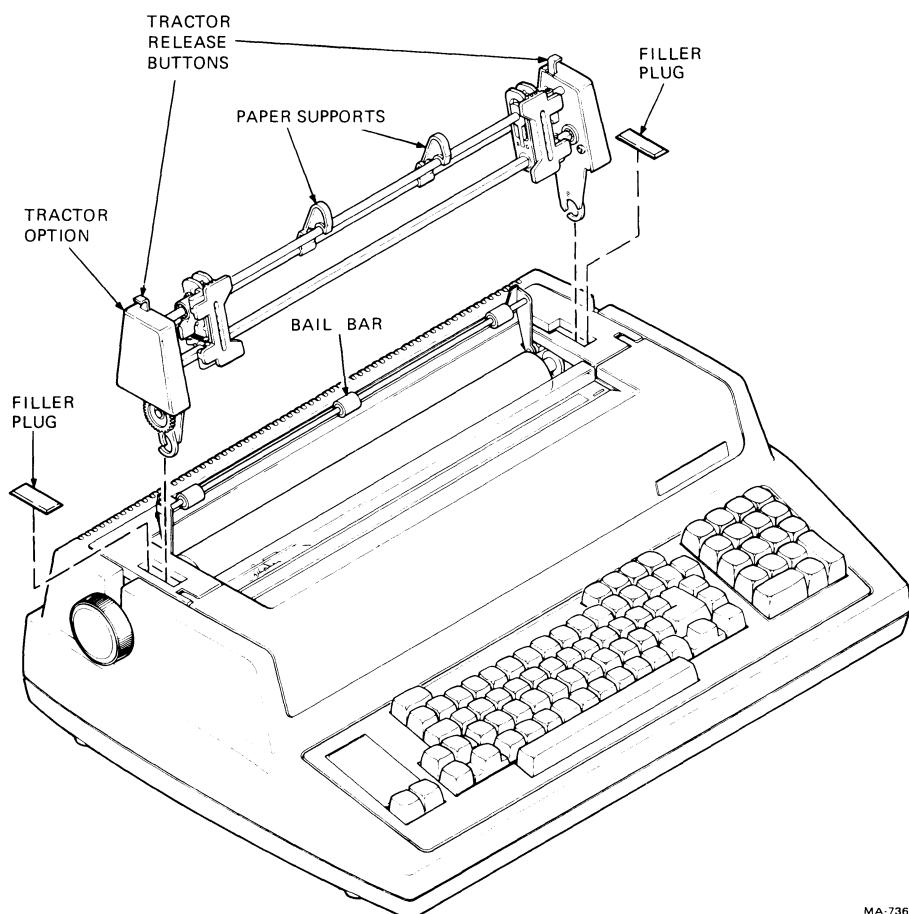
Figure 3-10 Roll Paper Holder Installation

### 3.5 LAX34-AL TRACTOR OPTION

The tractor option (LAX34-AL) allows the LA34 series terminals to be configured to handle tractor-feed paper in single or multipart forms.

Use this procedure to install the tractor option.

1. Turn the power ON/OFF switch (located at the rear of the terminal) to the OFF position.
2. Remove the access cover by opening it and pressing the two access cover retainer clips at the same time. Lift the cover straight up (Figure 3-1).
3. Locate and remove (pop out) filler plugs from the access cover (Figure 3-11). This allows the tractor option to be attached to the platen drive gear.
4. Reinstall the access cover by sliding the back edge of the cover under the lip in the printer housing and pressing the access cover into its original position.
5. Lift the bail bar (Figure 3-11).



MA-7366

Figure 3-11 Tractor Option Installation

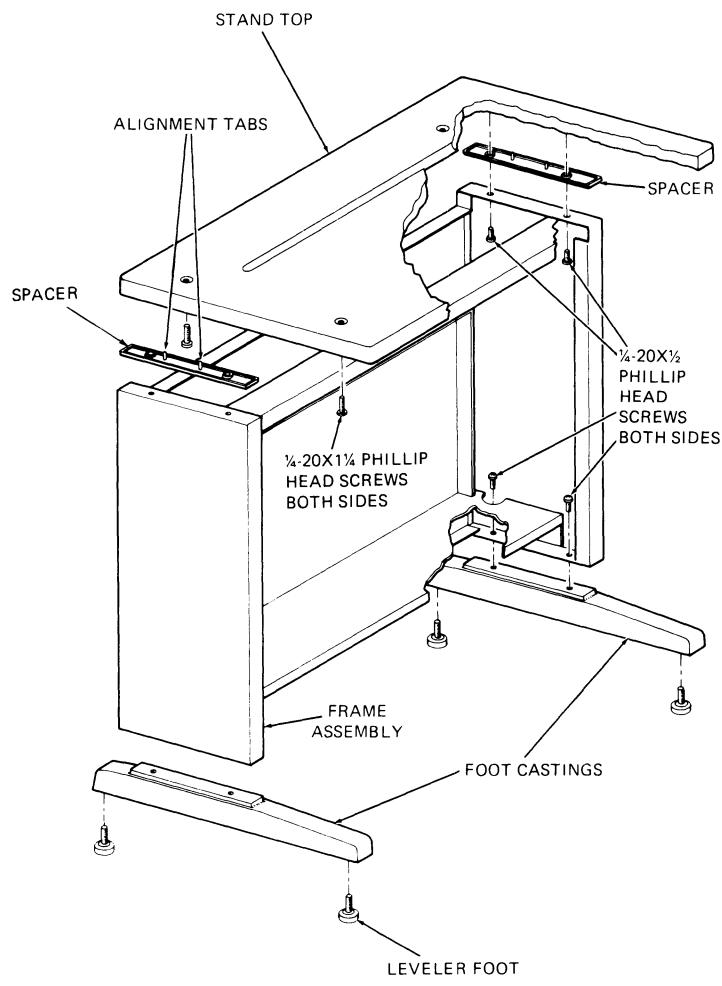
6. Press the left and right tractor release levers and position the tractor option into place on the platen assembly (Figure 3-11). Release the tractor release levers after the tractor assembly snaps into place.
7. The terminal is now ready to be loaded with paper. Refer to your User Guide for paper loading information.

### **3.6 LAX34-SL PRINTER STAND OPTION**

The LAX34-SL printer stand option allows paper to be fed from the bottom of the terminal. In addition the stand is a useful and attractive work surface for your terminal.

The only tool required to assemble the printer stand is a Number 1 phillips screwdriver. To assemble the LAX34-SL printer stand (Figure 3-12) perform the following procedure.

1. Attach the four leveler feet to the outermost tapped holes in the foot castings.
2. Secure the frame assembly to the foot castings using four ( $10 \times 1/2$ ) phillips screws.



**Figure 3-12 Printer Stand Assembly**

3. Place the stand top upside down on a sheet of paper on the floor.
4. Place the spacers on the stand top. Make sure that the alignment tabs on the spacers are in place as shown in Figure 3-12.
5. Secure the frame assembly to the stand top using four (10 × 1/2) phillips screws.
6. Return the printer stand to an upright position.
7. Secure the printer to the printer stand top using four (1/4-20 × 1-1/4) phillips screws.
8. The printer is now ready to be loaded with paper. Refer to your User Guide for more information on paper loading.

### **3.7 LAX34-LL PAPER LOW DETECTION OPTION**

The LAX34-LL paper low detection option is designed to detect a paper low condition in the roll paper holder option (LAX34-RL). A paper low condition occurs when the roll of paper is nearly empty. When a paper low condition occurs, the POWER/FAULT light flashes. The terminal responds by generating a preselected signal. This signal is determined by the data communication switch settings.

Use this procedure to install the LAX34-LL paper low option. The tools required to perform the procedure include Number 0 and Number 1 phillips screwdrivers and a small blade screwdriver.

1. Turn the power ON/OFF switch OFF. Disconnect the ac power cord from the wall receptacle and then the terminal.
2. Remove the paper and roll paper holder option.
3. Remove the access cover by opening it and pressing the two access cover retainer clips at the same time. Lift the access cover straight up (Figure 3-1).
4. Remove the ribbon cartridge.
5. Lift the bail bar to gain access to the platen. Remove the platen by pressing the two platen release levers at the same time. Lift the platen straight up (Figure 3-2). Lower the bail bar to its original position.
6. With a small blade screwdriver, release the four snap fasteners that secure the printer housing cover to the base assembly. Remove the printer housing (Figure 3-3).
7. Press the keyboard bezel retainer clips and rotate the bezel towards the front of the terminal (Figure 3-4).
8. Remove the rear insert (Figure 3-13).
9. Locate the paper low jack in the option kit and remove the attached nut and washer (Figure 3-13).
10. Insert the paper low jack through the rear cover insert and secure it using the nut and washer removed during the previous step (Figure 3-13).
11. Route paper low cable around the printer mechanism (Figure 3-14). Connect the cable terminals to jack J9, pins 3 and 4 on the control/logic board (Figure 3-5). The terminal for the white wire connects to J9 pin 3 and the terminal for the black wire connects to J9 pin 4. Push the terminals straight down into the jack.

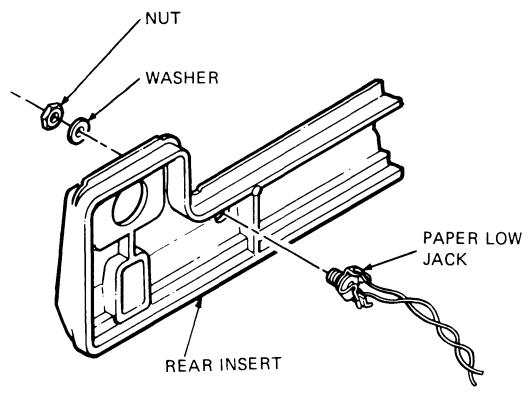


Figure 3-13 Attaching Paper Low Jack

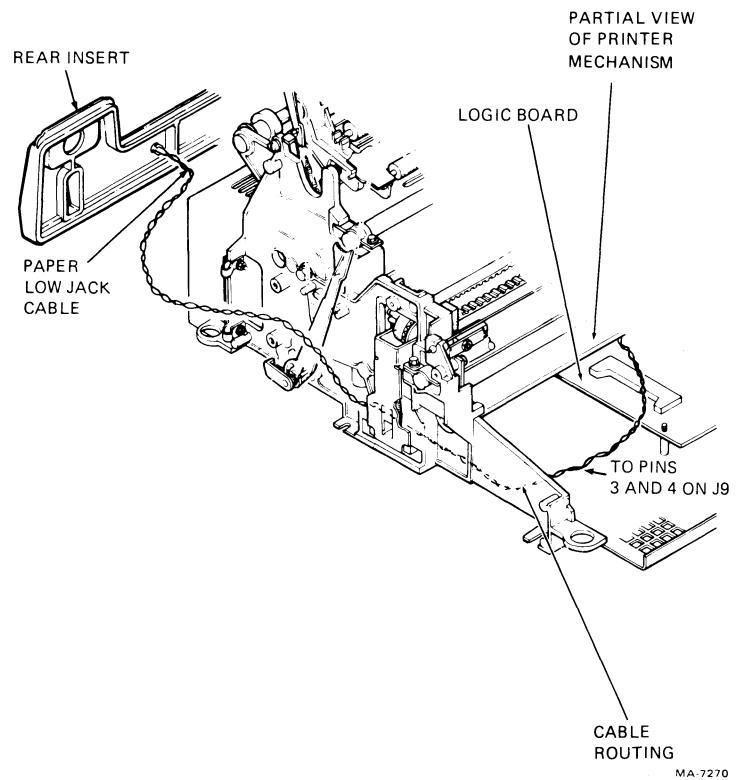


Figure 3-14 Paper Low Jack Cable Routing

12. Reinstall the rear insert.
13. Rotate the bezel forward to its original position and press the retainer clips to secure the bezel into place.
14. Replace the printer housing cover on the base assembly.
15. Secure the printer housing cover to the base assembly by pressing the four snap fasteners on the base assembly.
16. Reinstall the platen by lifting the bail bar and pressing the platen into place. Rotate the paper advance knob to verify that the gears are properly engaged. Lower the bail bar to its original position.
17. Slide the rear edge of the access cover under the lip in the printer housing and press access cover back into its original position.
18. Reinstall the ribbon cartridge.
19. Using a Number 1 phillips screwdriver, remove the three (6-32 × 1/4) phillips screws that secure the right roll paper cover cap (as viewed from the back) to the roll paper holder, and set the cap aside (Figure 3-15).

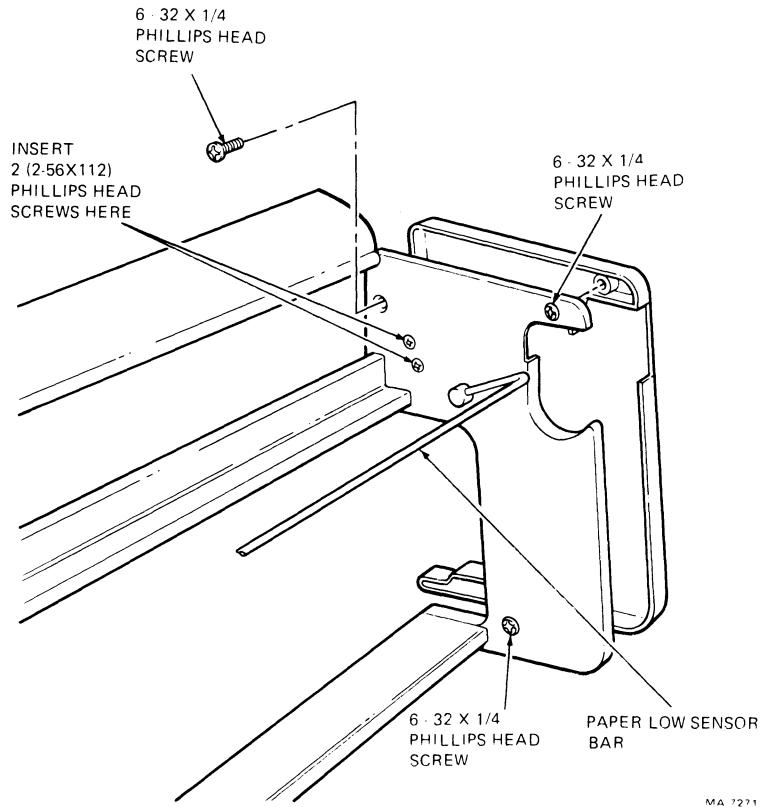


Figure 3-15 Roll Paper Holder Cover Cap

20. Insert the two (2-56 × 1/2) flathead phillips screws through the inner side of roll paper holder (Figure 3-15).
21. Press down on the paper low sensor bar (Figure 3-15) to open cam (Figure 3-16).
22. With the contact of the paper low switch facing the cam, place the switch onto the two (2-56 × 1/2) flathead phillips screws inserted in the previous step. Then release the paper low bar.
23. Secure the paper low switch using two speed nuts (Figure 3-16).
24. Route the paper low jack cable through the paper holder assembly (Figure 3-16).
25. Reinstall the left roll paper cover cap.
26. Reinstall the roll paper holder and paper.

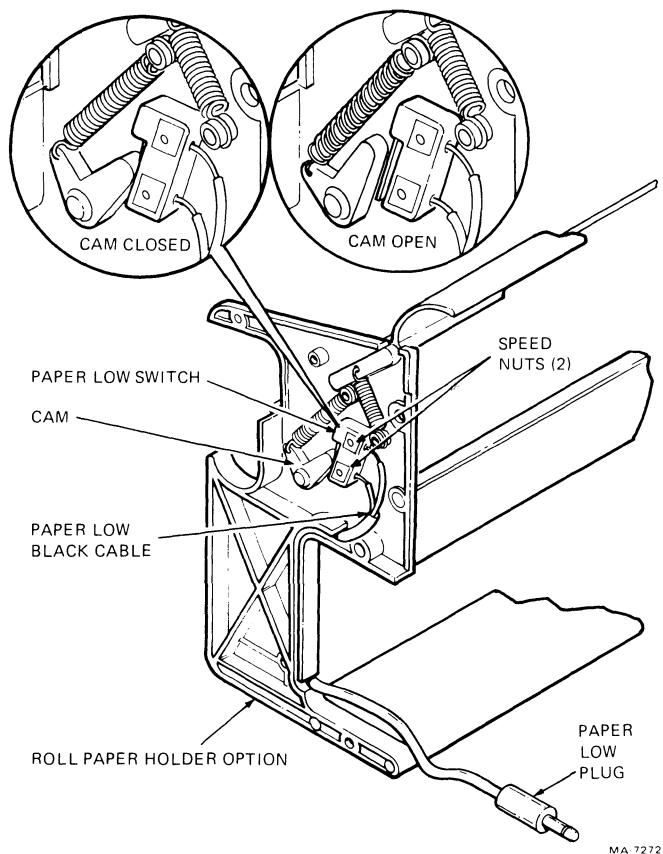


Figure 3-16 Paper Low Switch Installation

27. Plug the paper low cable into the paper low jack on the rear insert.

**NOTE**

**To override the paper low switch, disconnect the paper low cable from the paper low jack on the rear of the terminal.**

28. Set the communication switches to the paper low position [refer to the Installation Chapter (Chapter 2) for more detail concerning the communication switches].
29. Plug the ac line cord into the rear of the terminal. Then plug the ac line cord into a non-switched, three-prong, grounded wall receptacle and turn the power switch on.

### **3.8 LAX34-PL PAPER OUT DETECTION OPTION**

The LAX34-PL paper out detection option is designed to detect a paper out condition. A paper out condition occurs when the physical edge of the last sheet of paper passes the paper out sensor. When a paper out condition occurs the POWER/FAULT light flashes and the printer generates a preselected signal. The signal generated is determined by the data communication switch settings [refer to the Installation chapter (Chapter 2) for more detail].

Use this procedure to install the LAX34-PL paper out detection option. The tools needed to perform the procedure include a Number 0 phillips screwdriver, a Number 1 phillips screwdriver, a small blade screwdriver, and a 1/4-inch open-end wrench.

1. Turn the power ON/OFF switch off. Disconnect the ac power cord from the wall receptacle and then the terminal.
2. Remove the paper and tractor options.
3. Remove the access cover by opening it and pressing the two access cover retainer clips at the same time. Lift the access cover straight up (Figure 3-1).
4. Remove the ribbon cartridge.
5. Lift the bail bar to gain access to the platen. Remove the platen by pressing the two platen release levers at the same time. Lift the platen straight up (Figure 3-2). Lower the bail bar to its original position.
6. With a small blade screwdriver, release the four snap fasteners that secure the printer housing cover to the base assembly. Remove the printer housing (Figure 3-3).
7. Press the keyboard bezel retainer clips and rotate the bezel towards the front of the terminal (Figure 3-4).
8. Press the paper out override lever onto the paper out shaft (Figure 3-17).
9. Spread the legs of the tension spring to increase tension. Place the spring on the switch actuator (Figure 3-17).
10. Press the switch actuator onto the paper out shaft. Make sure the spring is held in place between the retaining pins on the paper out override lever and the switch actuator (Figure 3-17).

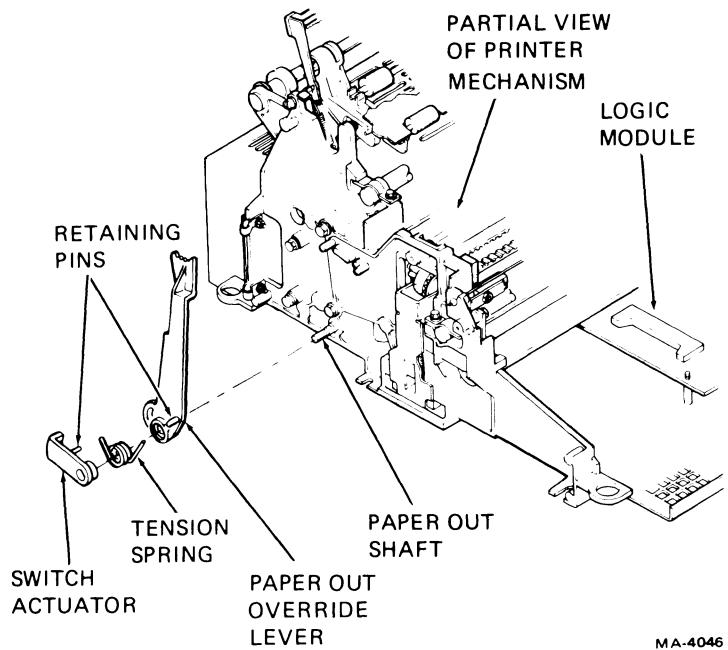


Figure 3-17 Paper Out Override Lever Installation

11. Secure the microswitch and detent helper spring to the switch support plate using two (4-40 × 5/8) fillister screws and two (4-40) kep nuts (Figure 3-18).
12. Using a 1/4 inch open-end wrench, remove the top switch support plate hex-head screw and loosen the bottom switch support plate hex-head screw (Figure 3-18).
13. Slide the switch support plate assembly onto the bottom switch support plate hex-head screw. Tighten the screw fingertight only. Attach the top switch support plate hex-head screw fingertight only.

**NOTE**

**The switch support plate must be adjusted before securing it to the printer mechanism.**

14. With the paper out override lever in the detect on position, adjust the switch support plate to activate (press) the microswitch (Figure 3-18). Using a 1/4-inch open-end wrench, tighten the hex-head screw on the bottom switch support plate.

**NOTE**

**The paper out detection option will operate when the paper out override lever is in the detect position. When switched to the override position, the paper out detection option will not operate.**

15. Tighten the hex-head screw on the top switch support plate.

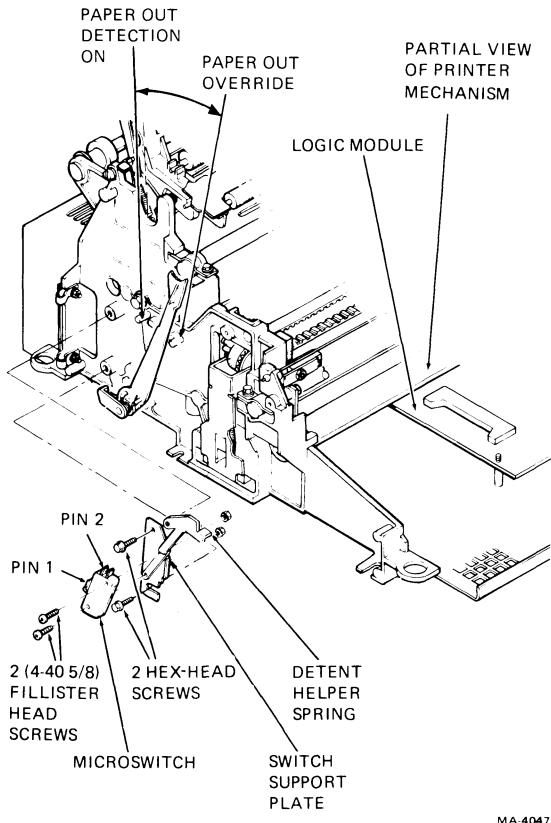


Figure 3-18 Paper Out Detection Switch Installation

16. Connect the paper out cables to the microswitch and route the cables under the printer mechanism (Figure 3-19). Connect the cable terminals to pins 1 and 2 of J9 on the logic board (Figure 3-5).
17. Rotate the keyboard bezel forward to its original position and press the retainer clips to secure the bezel in place.
18. Replace the printer housing cover on the base assembly.
19. Secure the printer housing cover to the base assembly by pressing the four snap fasteners on the base assembly.
20. Reinstall the platen by pressing it into place. Rotate the paper advance knob to verify that the gears are properly engaged.
21. Slide the rear edge of the access cover under the lip in the printer housing and press access cover back into its original position.
22. Reinstall the ribbon cartridge.
23. Reinstall the tractor option and paper.

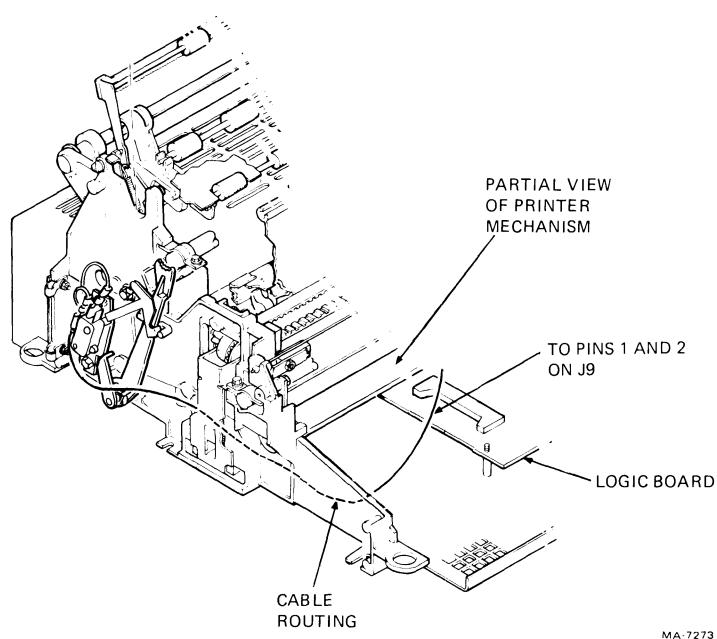


Figure 3-19 Paper Out Switch Cable Routing

24. Set the data communication switches to the correct settings. (Refer to the Installation chapter – Chapter 2.)
25. Plug the ac line cord into the rear of the terminal and then into a nonswitched, three-prong, grounded outlet.

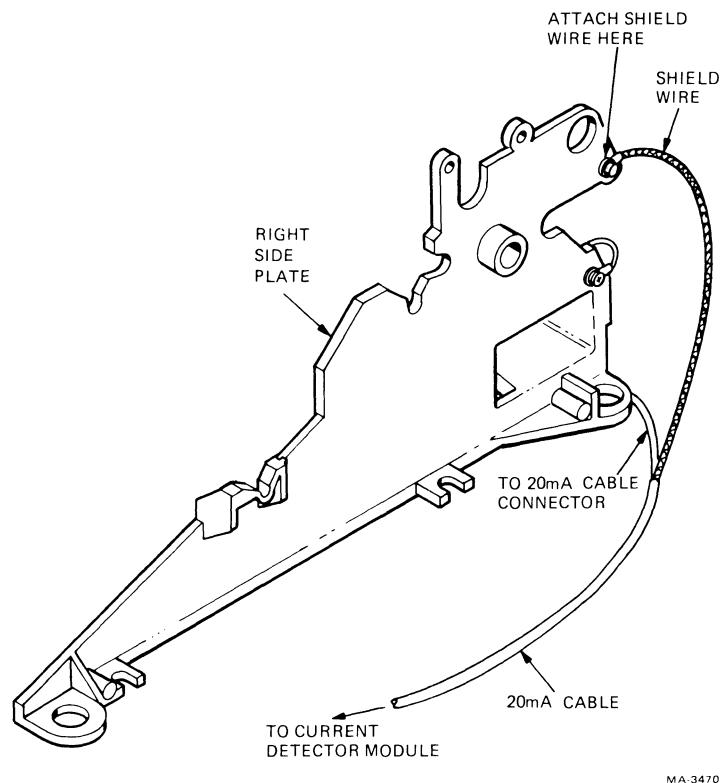
### 3.9 LAX34-CL 20 mA CURRENT LOOP INTERFACE OPTION

The 20 mA current loop interface option allows the terminal to communicate with a computer up to a distance of 305 m (1000 ft) without the use of a modem.

Use this procedure to install the 20 mA current loop option.

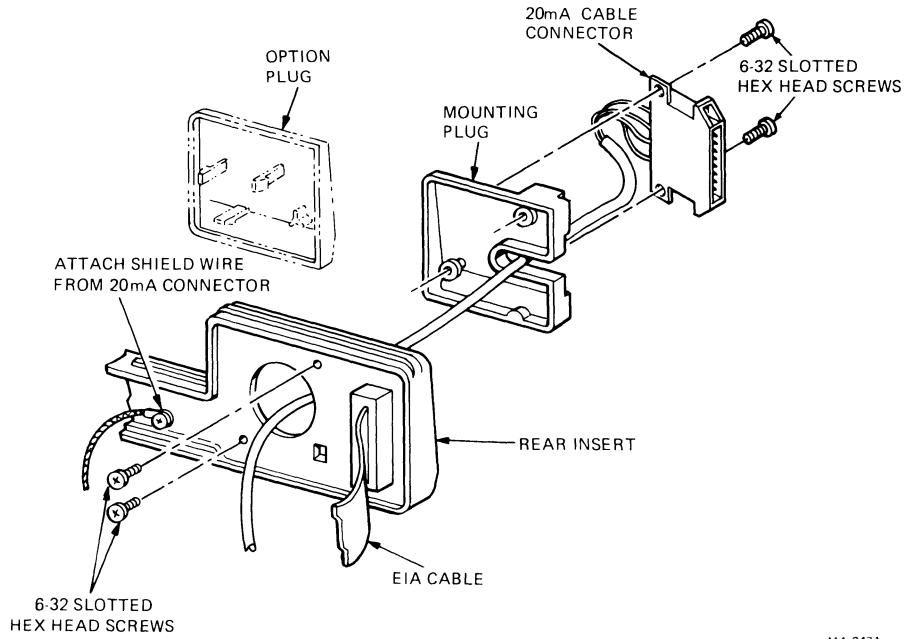
1. Turn the power ON/OFF switch located on the rear of the terminal to the OFF position. Disconnect the ac line cord from the wall receptacle and then the terminal.
2. Remove the paper, and if installed, the roll paper holder or tractor options.
3. Remove the access cover by opening it and pressing the two access cover retainer clips at the same time. Lift the cover straight up (Figure 3-1).
4. Remove the ribbon cartridge.
5. Lift the bail bar to gain access to the platen. Remove the platen by pressing the two platen release levers at the same time. Lift the platen straight up (Figure 3-2). Lower the bail bar to its original position.
6. Use a small blade screwdriver to release the four snap fasteners that secure the printer housing to the base assembly (Figure 3-3). Remove the printer housing.

7. Press the keyboard bezel retainer clips and rotate the bezel towards the front of the terminal (Figure 3-4).
8. Remove the keyboard assembly connector from J6 on the logic board (Figure 3-5). Lift the bezel straight out.
9. Secure the shield wire on the 20 mA cable to the right side plate using existing hardware (Figure 3-20).
10. Remove the option plug from the rear insert (Figure 3-21).
11. Insert the 20 mA cable connector through the hole now visible in the rear insert (Figure 3-21).
12. Attach the 20 mA cable connector to the mounting plug using two (6-32) slotted hex-head screws (Figure 3-21).
13. Attach the mounting plug to the rear insert with two (6-32) slotted hex-head screws (Figure 3-21).
14. Remove the control board safety cover (Figure 3-6).
15. Disconnect the EIA interface connector from J7 on the logic board (Figure 3-5).
16. Secure the circuit board supports to the shielding plate with two (6-32) slotted hex-head screws (Figure 3-22).
17. Slide the rear edge of the current detector circuit board into the upper slot in the rear of the printer mechanism. Then press the board onto the circuit board supports (Figure 3-22).
18. Connect P1 of the internal 20 mA adapter cable to the current detector circuit board (Figure 3-22).
19. Slide the internal 20 mA adapter cable under the logic board and connect to J7 on the logic board (Figure 3-22).
20. Set the TRANS and REC switches to the NORMAL position (Figure 3-22). If the terminal is to provide current to either the receive or transmit line set the corresponding switch to ACT. If these switches are not set correctly, the terminal will not send and receive characters properly.
21. Reinstall the logic board safety cover.
22. Return the keyboard bezel to the slots in the base assembly. Connect the operator control panel cable to J6 on the logic board.
23. Rotate the bezel back to its original position and press the bezel retainer clips to secure the bezel in place.
24. Replace the printer housing cover on the base assembly. Secure the printer housing cover to base assembly by pressing the four snap fasteners on the base assembly.



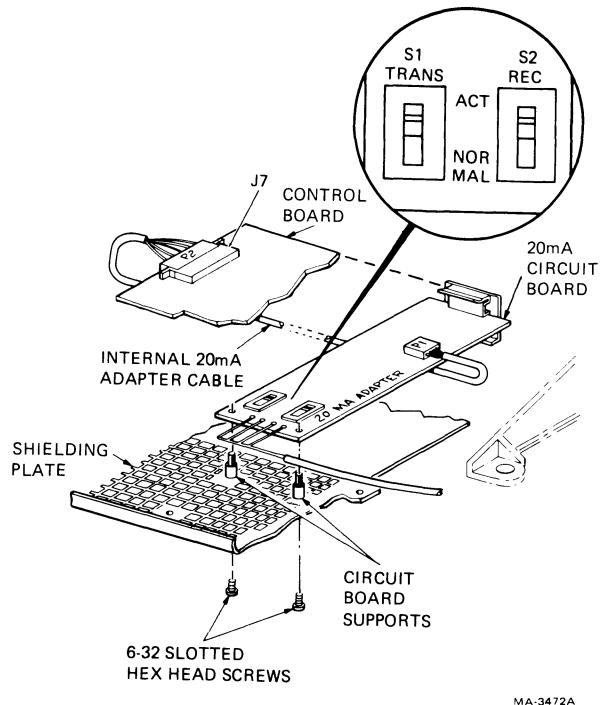
MA-3470

Figure 3-20 Attaching Shield Wire to Side Plate



MA-3471

Figure 3-21 Mounting 20 mA Cable Connector



MA-3472A

Figure 3-22 20 mA Circuit Board Installation

25. Lift the bail bar to reinstall the platen. Press the platen into place. Rotate the paper advance knob to verify that the platen rolls freely. If roll paper will be used, lower the bail bar to its original position.
26. Slide the rear edge of the access cover under the lip in the printer housing and press the access cover back into its original position.
27. Reinstall the ribbon cartridge.
28. Reinstall the paper and roll paper holder or tractor options if necessary.
29. Plug the ac line cord into the rear of the terminal and then into a nonswitched, three-prong grounded outlet. Turn the power ON/OFF switch ON.

### 3.10 LAX34-JL INTERNATIONAL CHARACTER KEYCAP OPTION

The LAX34-JL international character keycap option permits the operator to use the keyboard for data transmission and printing in seven international languages as well as in the standard USASCII language of the LA34-AA and LA38-AA terminals. Keycaps are provided in this option to adapt the keyboard to the following countries: United Kingdom, Finland, Sweden, Norway/Denmark, Germany, France and French Canada.

Use this procedure to install the selected international language keycaps.

1. Set the power ON/OFF switch to OFF.
2. Start at upper-left corner of keyboard. Insert keycap puller (Figure 3-23) between first cap to be replaced and adjacent keycap. Be sure that long puller leg is away from you.

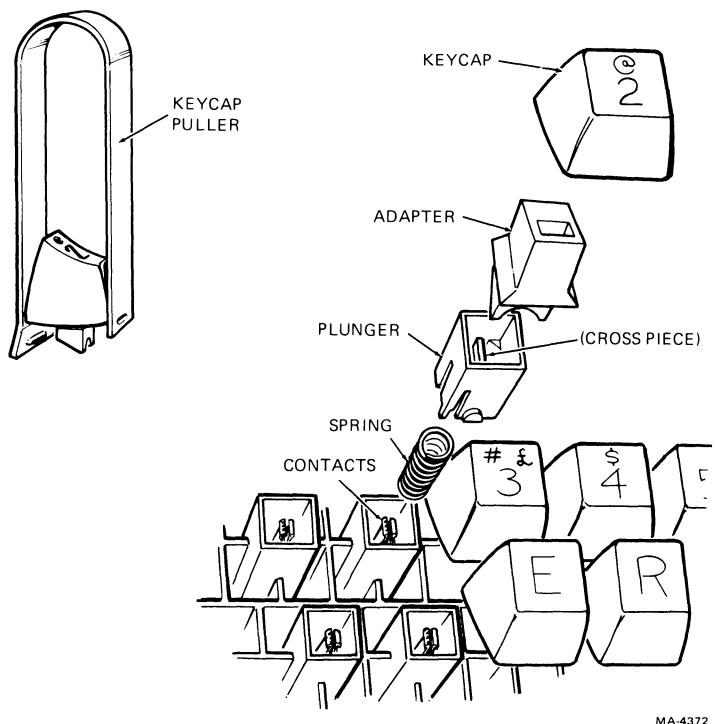


Figure 3-23 Keycap Removal

3. Squeeze puller legs together and slowly pull straight up to remove cap.

**NOTE**  
**In some terminals the adapter and the keycap may  
be one molded part.**

4. If the adapter does not come off with the cap (Figure 3-23), carefully remove adapter with long nose pliers. Reinstall adapter in the keycap, making sure that the pointed adapter ends face front of cap.
5. In a very few cases, the plunger might also come off. If so, take care to prevent the spring from flying out (Figure 3-23). Replace plunger and spring as follows.

**CAUTION**  
**Follow this procedure carefully to prevent damage to  
key contacts.**

- a. Slide spring into plunger. Place spring and plunger in slot and over key contacts. Make sure crosspiece of plunger is vertical, not horizontal.
- b. Slowly push plunger down until the crosspiece touches contacts. Verify that the crosspiece is located between the two contacts.
- c. Push plunger further down until it snaps into place. Release plunger and check that contacts are separated.

6. Remove all replacement keycaps for desired language from plastic shipping bag. Store all original keycaps in bag.
7. Locate the proper replacement keycap over key assembly and engage mating parts. Gently press cap straight down until fully seated.
8. Repeat previous procedure for each individual keycap to be replaced.
9. When all replacement keycaps are installed, check keyboard against Figure 3-24 to make sure that keycaps are properly located.

### **3.10.1 Tests After Installation**

Use this procedure to make sure that all keycaps are installed in the proper locations and that the desired international characters are being printed.

**NOTE**

**Refer to the SET-UP Features Summary in Chapter 4 for more details in performing the following steps.**

1. Select local echo at the keyboard.
2. Select keyboard operation in the desired language.
3. Press each replacement keycap (lowercase, uppercase or both) and check that the proper character(s) are printed out.

### **3.11 LAX34-HL APL CHARACTER KEYCAP OPTION**

The LAX34-HL APL character keycap option permits the operator to use the keyboard in a programmer's language (APL) as well as in the standard USASCII language provided with the LA34-AA and LA38-AA printer terminals. All necessary replacement keycaps are provided for the APL language.

**NOTE**

**This option is used with the LAX34-XL/XM options. Terminals without the XL/XM option will not transmit APL characters.**

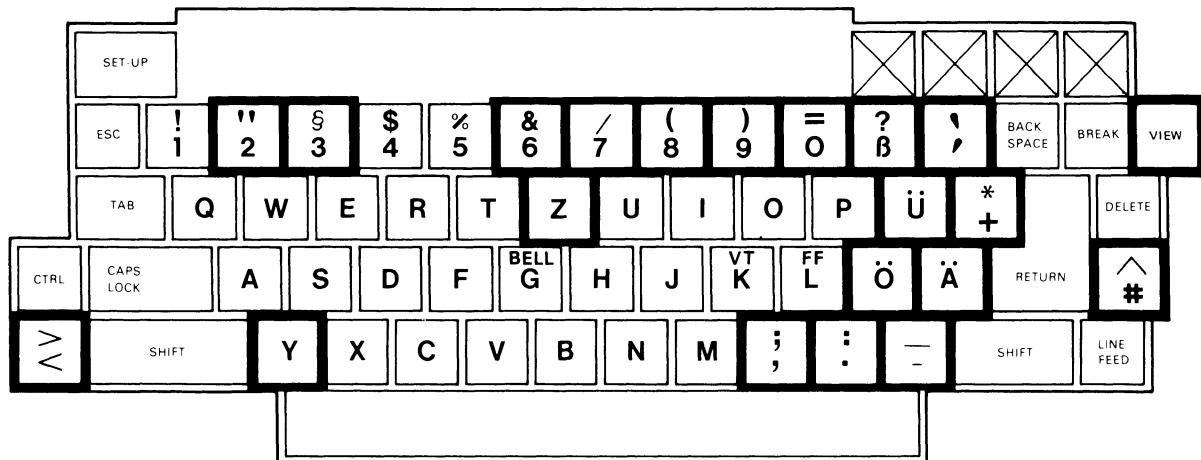
The installation procedure for this option and the LAX34-JL option are the same. Perform all steps of that procedure to install this option.

**NOTE**

**Refer to Figure 3-25 for proper APL character keycap locations.**

### **3.11.1 Tests After Installation**

The test procedure for this option and the LAX34-JL option are the same. Refer to Paragraph 3.10.

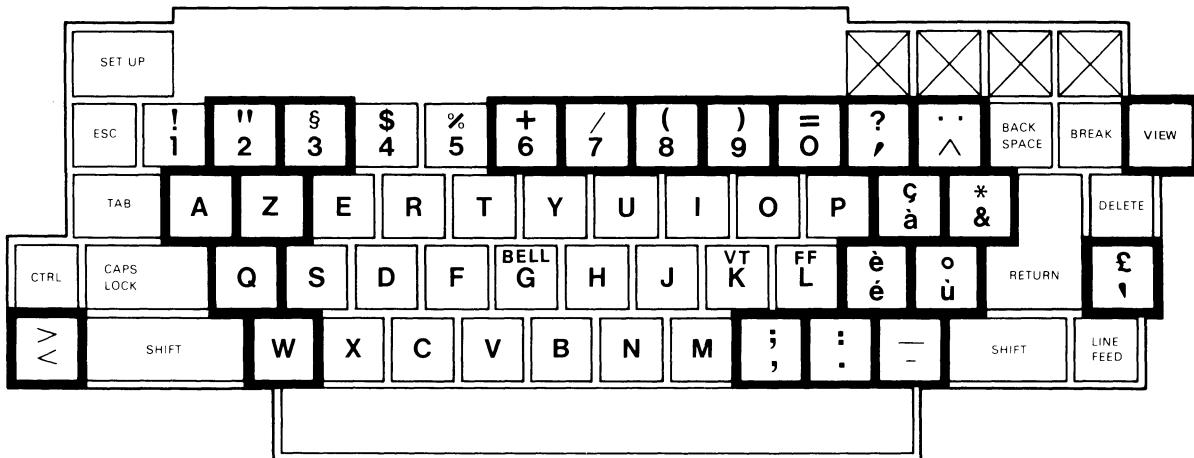


DENOTES KEY POSITION IS AVAILABLE FOR SPECIFIC APPLICATION USE.

GERMANY

DENOTES KEYCAPS WHICH MUST BE REPLACED FOR THIS EUROPEAN LANGUAGE.

MA-4371



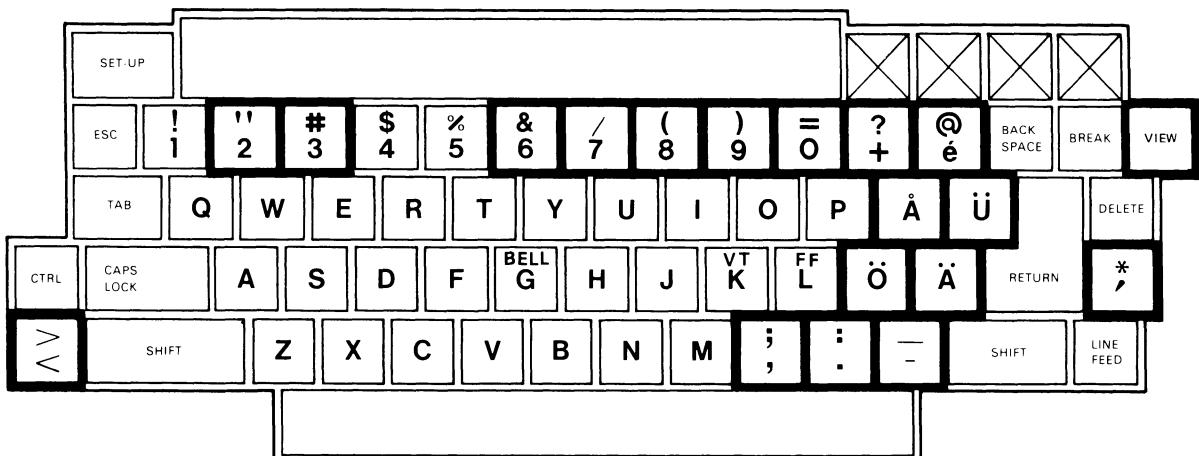
DENOTES KEY POSITION IS AVAILABLE FOR SPECIFIC APPLICATION USE.

FRANCE

DENOTES KEYCAPS WHICH MUST BE REPLACED FOR THIS EUROPEAN LANGUAGE.

MA-4369

Figure 3-24 International Character Keycap Sets (Sheet 1 of 3)

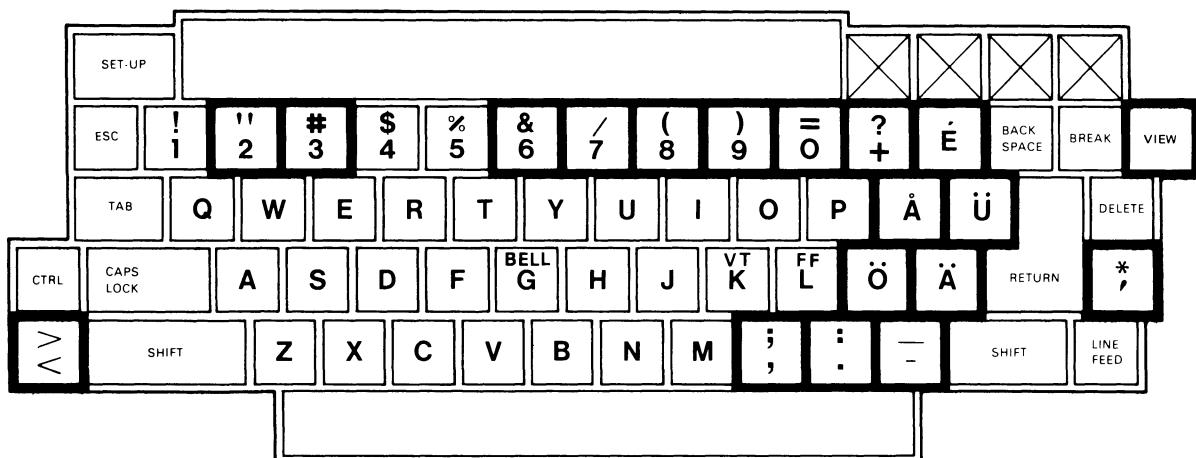


DENOTES KEY POSITION IS AVAILABLE FOR SPECIFIC APPLICATION USE.

FINLAND

DENOTES KEYCAPS WHICH MUST BE REPLACED FOR THIS EUROPEAN LANGUAGE.

MA-4370



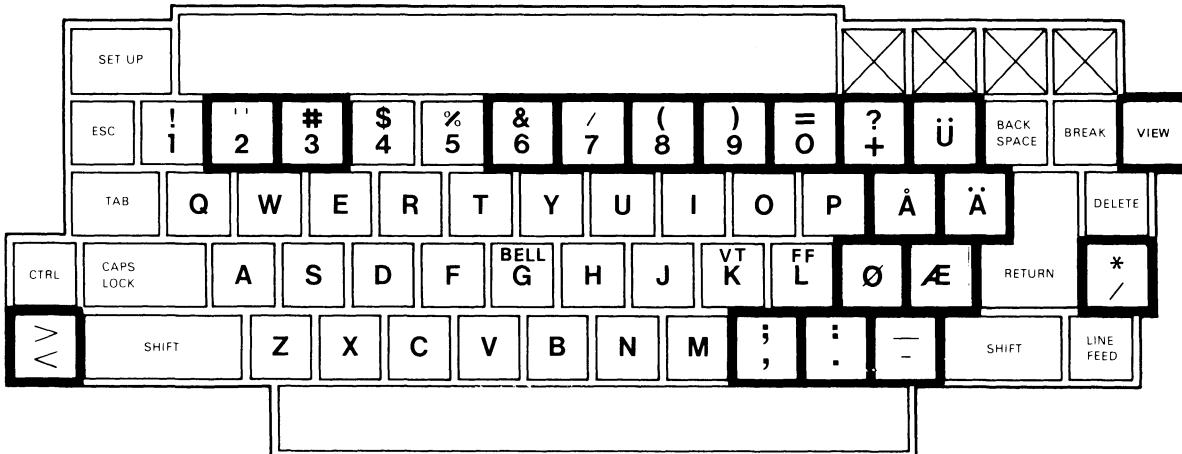
DENOTES KEY POSITION IS AVAILABLE FOR SPECIFIC APPLICATION USE.

SWEDEN

DENOTES KEYCAPS WHICH MUST BE REPLACED FOR THIS EUROPEAN LANGUAGE.

MA-4368

Figure 3-24 International Character Keycap Sets (Sheet 2 of 3)

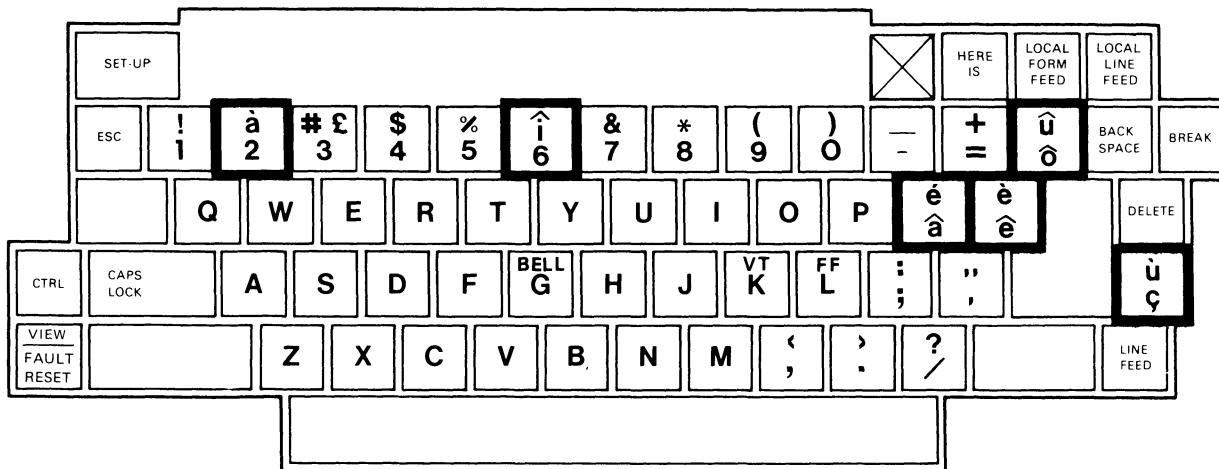


DENOTES KEY POSITION IS AVAILABLE FOR SPECIFIC APPLICATION USE.

DENOTES KEYCAPS WHICH MUST BE REPLACED FOR THIS EUROPEAN LANGUAGE.

#### NORWAY/DENMARK

MA-4381



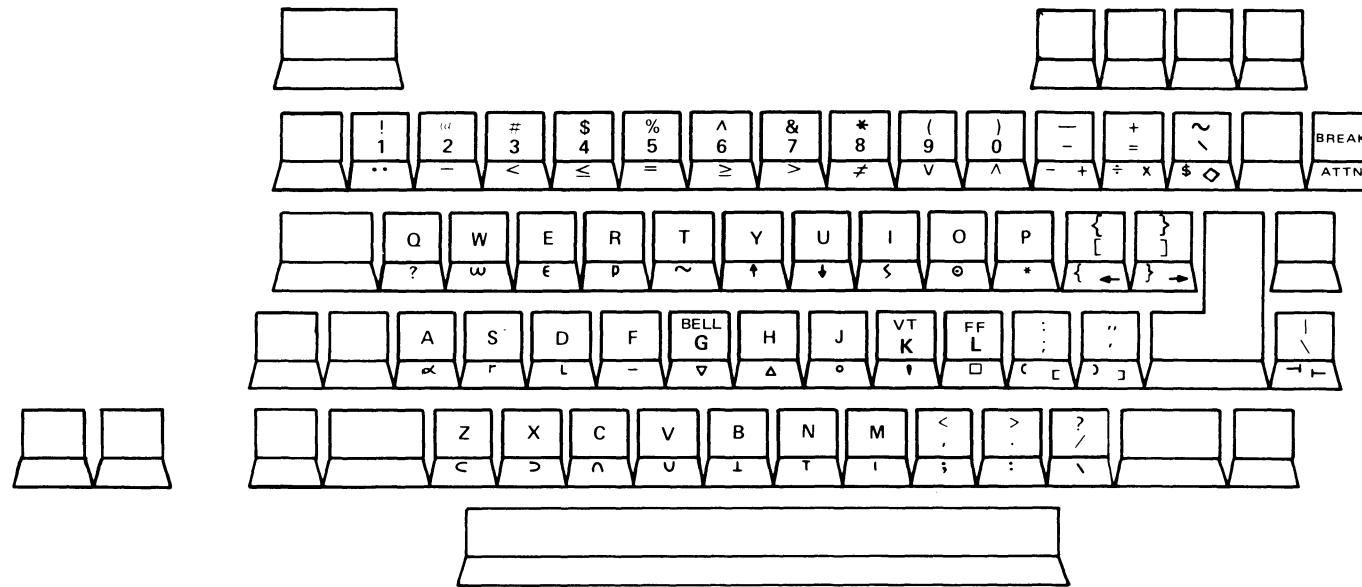
DENOTES KEY POSITION IS AVAILABLE FOR SPECIFIC APPLICATION USE.

DENOTES KEYCAPS WHICH MUST BE REPLACED FOR THIS LANGUAGE.

#### FRENCH-CANADA

MA-3370B

Figure 3-24 International Character Keycap Sets (Sheet 3 of 3)



**NOTE:**

KEYCAPS WITH ILLUSTRATED LEGENDS INDICATE REPLACEMENT LOCATIONS.

MA-4379A

Figure 3-25 APL Character Keycap Set

## **CHAPTER 4**

### **OPERATOR INFORMATION**

#### **4.1 GENERAL**

The LA34/LA38 terminals are designed and styled to resemble an office typewriter in both operation and appearance. In addition, many of the operator functions are identical to the usual functions performed on a standard office typewriter.

This chapter provides maintenance personnel with a summary of all SET-UP features available with the LA34/LA38 terminals, and a set of tables to explain all controls and indicators. Short descriptions are included in each table. Detailed procedures for selection and use of these features, and familiar practices such as ribbon and paper loading as they apply to printer terminals, are included in the LA34/LA38 User Guide.

Most features, controls, and indicators are common to both the LA34-DA/LA38-GA terminals and the LA34-AA terminals. Those which are available only with the LA34-AA are identified in the tables and drawings.

#### **4.2 SET-UP FEATURE SUMMARY**

Table 4-1 summarizes the SET-UP features for the LA34-DA/LA38-GA and the LA34-AA Terminals. Features which are only available with the LA34-AA are identified in the SET-UP feature column. All other features are common to all terminals.

#### **NOTES**

**The terminals must be in SET-UP mode to examine or change features. To place the terminal in SET-UP mode, press the CTRL and SET-UP keys at the same time. To exit SET-UP mode, press the SET-UP key.**

**Do not use the SHIFT key except where specified.**

**Table 4-1 SET-UP Feature Summary**

SET-UP Feature	Keys Used to Change or Interrogate Feature	Function
Status	8	Prints the current terminal status
	<b>A RETURN</b> (LAX34-XL/XM only)	Prints available Auto-Answerback selections and current selection
	<b>B RETURN</b> (LAX34-XM only)	Prints available buffer size selections and current selection
	<b>C RETURN</b> (LA34/38-AA only)	Prints available G0 character set selections and current selection
	<b>D RETURN</b> (LA34/38-AA only)	Prints available G1 character set selections and current selection
	<b>E RETURN</b> (LA34/38-AA only)	Prints available local echo selections and current selection
	<b>F RETURN</b> (LA34/38-AA only)	Prints current form length status
	<b>G RETURN</b> (LAX34-XL/XM only)	Prints available keyboard selections and current selection
	<b>H RETURN</b>	Prints available horizontal pitch (characters per inch) selections and current selection
	<b>K RETURN</b> (LAX34-XL/XM only)	Prints available keyboard mapping selections and current selection
	<b>V RETURN</b>	Prints available vertical pitch (lines per inch) selections and current selection
	<b>Y RETURN</b> (LAX34-XL/XM only)	Prints available keypad selections and current selection
	<b>SHIFT 9</b> (LAX34-XL/XM only)	Stores the current feature status information into nonvolatile memory
	<b>9 RETURN</b> (LAX34-XL/XM only)	Recalls present parameters now in nonvolatile memory
Terminal reset	<b>I RETURN</b>	Resets the temporarily stored SET-UP features to permanent settings

Table 4-1 SET-UP Feature Summary (Cont)

SET-UP Feature	Keys Used to Change or Interrogate Feature	Function
Horizontal pitch	<b>H = A RETURN</b> <b>H = B RETURN</b> <b>H = C RETURN</b> <b>H = D RETURN</b>	Selects 10 char/in Selects 12 char/in Selects 13.2 char/in Selects 16.5 char/in
(LA34-AA only)	<b>H = E RETURN</b> <b>H = F RETURN</b> <b>H = G RETURN</b> <b>H = H RETURN</b>	Selects 5 char/in Selects 6 char/in Selects 6.6 char/in Selects 8.25 char/in
↓		
Vertical pitch	<b>V = D RETURN</b> <b>V = E RETURN</b> <b>V = F RETURN</b> <b>V = A RETURN</b> <b>V = B RETURN</b> <b>V = C RETURN</b>	Selects 2 lines/in Selects 3 lines/in Selects 4 lines/in Selects 6 lines/in Selects 8 lines/in Selects 12 lines/in
Horizontal margins	5 6 7	Sets the left margin at the current column Sets the right margin at the current column Clears both the left and right margins
Horizontal tabs	1 2 3	Sets a horizontal tab stop at the current column Clears the horizontal tab stop at the current column Clears all horizontal tab stops
Form length (LA34-AA only)	<b>F = Number of lines</b>	Sets form length at desired number of lines (can be 1 through 168 lines per page)
Top of form (LA34-AA)	4	TOF is set at current line
Vertical margins (LA34-AA only)	<b>SHIFT (hold) 5</b> <b>SHIFT (hold) 6</b> <b>SHIFT (hold) 7</b>	Sets the top margin at the current line Sets the bottom margin at the current line Clears both the top and bottom margins
Vertical tabs (LA34-AA only)	<b>SHIFT (hold) 1</b> <b>SHIFT (hold) 2</b> <b>SHIFT (hold) 3</b>	Sets a vertical tab stop at the current line Clears the vertical tab stop at the current line Clears all vertical tab stops
Local echo (LA34-AA only)	<b>E = A RETURN</b> <b>E = B RETURN</b> <b>E = C RETURN</b>	Selects no echo (default to jumper W12 mode) Selects no local echo Selects local echo

**Table 4-1 SET-UP Feature Summary (Cont)**

SET-UP Feature	Keys Used to Change or Interrogate Feature	Function
Printer character set G0 (LA34-AA only)	C = A RETURN C = B RETURN C = C RETURN C = D RETURN C = E RETURN C = F RETURN C = G RETURN C = H RETURN C = I RETURN C = J RETURN	Selects US ASCII Selects United Kingdom Selects French-Canadian Selects German Selects Swedish Selects French Selects Finnish Selects Norway/Denmark Selects APL (LAX34-XL/XM only) Selects VT100 line drawing (LAX34-XL/XM only)
Printer character set G1 (LAX34-XL/XM only)	D = A RETURN D = B RETURN D = C RETURN D = D RETURN D = E RETURN D = F RETURN D = G RETURN D = H RETURN D = I RETURN D = J RETURN	Selects US ASCII Selects United Kingdom Selects French-Canadian Selects German Selects Swedish Selects French Selects Finnish Selects Norway/Denmark Selects APL Selects VT100 line drawing
Parity (LA34-AA only)	P = A RETURN P = B RETURN P = C RETURN P = D RETURN P = E RETURN P = F RETURN	Selects parity set by parity switches Selects even parity Selects odd parity Selects no parity, bit 8 set to space Selects no parity, bit 8 set to mark Selects override parity received from computer, transmit parity default to switch setting
Parity (LAX34-XL/XM only)	P = A RETURN P = B RETURN P = C RETURN P = D RETURN P = E RETURN P = F RETURN	Selects 7-bit, parity=space Selects 7-bit, parity=even Selects 7-bit, parity=mark Selects 7-bit, parity=odd Selects 8-bit, parity=even Selects 8-bit, parity=odd
Receive error override (LAX34-XL/XM only)	R = A RETURN R = B RETURN	Disables receive parity error override (print error blob) Enables receive parity error override (disregard errors; print data as received)

**Table 4-1 SET-UP Feature Summary (Cont)**

SET-UP Feature	Keys Used to Change or Interrogate Feature	Function
Speed (LAX34-XL/XM only)	<b>S = A RETURN</b> <b>S = B RETURN</b> <b>S = C RETURN</b> <b>S = D RETURN</b> <b>S = E RETURN</b> <b>S = F RETURN</b> <b>S = G RETURN</b> <b>S = H RETURN</b> <b>S = I RETURN</b> <b>S = J RETURN</b> <b>S = K RETURN</b> <b>S = L RETURN</b> <b>S = M RETURN</b> <b>S = N RETURN</b> <b>S = O RETURN</b> <b>S = P RETURN</b> <b>S = Q RETURN</b> <b>S = R RETURN</b> <b>S = S RETURN</b> <b>S = T RETURN</b> <b>S = U RETURN</b> <b>S = V RETURN</b>	Sets speed to 50 baud Sets speed to 75 baud Sets speed to 110 baud Sets speed to 134.5 baud Sets speed to 150 baud Sets speed to 200 baud Sets speed to 300 baud Sets speed to 600 baud Sets speed to 1200 baud Sets speed to 1800 baud Sets speed to 2400 baud Sets speed to 4800 baud Sets speed to 7200 baud Sets speed to 9600 baud Sets split speed to 75 transmit, 600 receive Sets split speed to 75 transmit, 1200 receive Sets split speed to 150 transmit, 600 receive Sets split speed to 150 transmit, 1200 receive Sets split speed to 300 transmit, 2400 receive Sets split speed to 300 transmit, 4800 receive Sets split speed to 600 transmit, 2400 receive Sets split speed to 600 transmit, 4800 receive
Answerback (LAX34-XL/XM only)	<b>A = A RETURN</b> <b>A = B RETURN</b> <b>M = (delimiter-message-delimiter)</b>	Disables auto-answerback Enables auto-answerback Enters 30 character answerback message flagged by delimiter characters
Buffer size (LAX34-XM only)	<b>B = A RETURN</b> <b>B = B RETURN</b> <b>B = C RETURN</b>	Sets buffer size to 160 characters in length Sets buffer size to 1184 characters in length Sets buffer size to 2208 characters in length
Keyboard (LAX34-XL/XM only)	<b>G = A RETURN</b> <b>G = B RETURN</b> <b>K = A RETURN</b> <b>K = B RETURN</b> <b>K = C RETURN</b> <b>K = D RETURN</b> <b>K = E RETURN</b> <b>K = F RETURN</b> <b>K = G RETURN</b> <b>K = H RETURN</b>	Disables printing of control characters* Enables printing of control characters* Selects US ASCII Selects United Kingdom Selects French-Canadian Selects German Selects Swedish Selects French Selects Finnish Selects Norway/Denmark

\* Used for debugging

**Table 4-1 SET-UP Feature Summary (Cont)**

SET-UP Feature	Keys Used to Change or Interrogate Feature	Function
Keyboard (LAX34-XL/XM only) (Cont)	<b>U = A RETURN</b>  <b>U = B RETURN</b> <b>Y = A RETURN</b> <b>Y = B RETURN</b>	Enables break key to function [i.e., BREAK=275 ms; SHIFT (hold) BREAK=3.8 seconds] Disables break key Selects normal keypad mode Selects functional keypad mode
Self-test	<b>T RETURN</b> <b>T, SHIFT (hold) /</b>  <b>T</b> any printable character <b>T</b> Space bar	Prints out a ripple pattern Prints out a pattern of multiple vertical bars in four passes per line Prints out the selected character continually Spaces across the platen, line feeds, and then repeats.
<b>NOTE</b> <b>Self-test ends when any character is typed on the keyboard.</b>		

### 4.3 CONTROLS AND INDICATORS

All terminals include controls and indicators necessary for the operator to set up, monitor, and control terminal operation. Although most are common to all terminals, there are some controls and indicators that are unique to LA34-AA terminals or are part of specific options. These items are identified within tables by terminal or option name.

The information included in the following paragraphs is arranged in four groups:

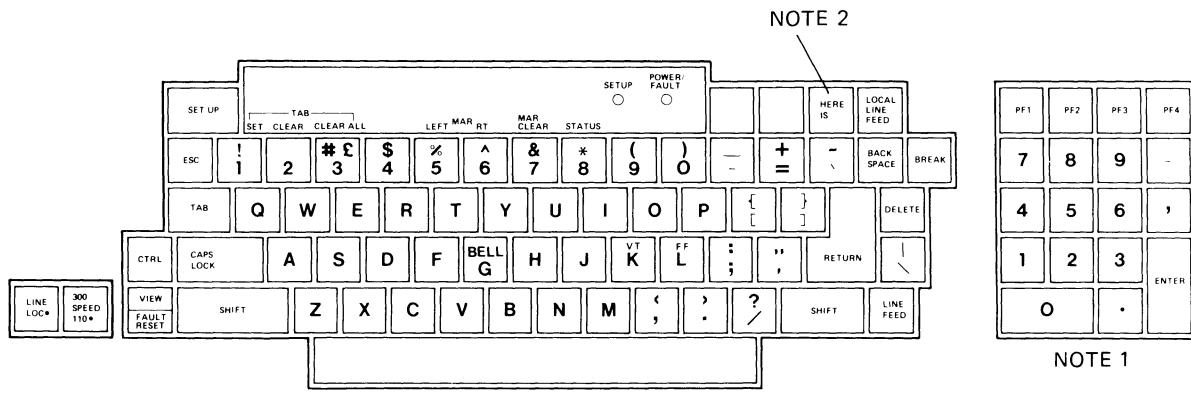
1. Keyboards,
2. Operating controls,
3. Visual indicators, and
4. Audible indicator.

#### 4.3.1 Keyboards

Each LA34/LA38 terminal includes a keyboard styled like the keyboard on a standard office typewriter and designed for similar operation. An optional numeric keypad (standard on LA34-AA and LA38-GA models) permits rapid numeric operations the same as a calculator.

The terminal operates as both an input and an output device for the computer. When the terminal is being used as an input device, information in the form of a character code is sent to the computer each time a key is pressed. If the terminal has been set up for local printing, the character corresponding to the key is printed out at the same time. When used as an output device, information from the computer is sent to the printing section of the terminal where it is interpreted and then printed out.

There are two different keyboard arrangements shown in Figures 4-1 and 4-2: one for the LA34-DA/38-GA terminals and the other for the LA34-AA terminal. Most of the keys are the same on both keyboards. Those keys that are unique to the LA34-AA are shown in Figure 4-3. The two keyboards also have different legend strips at the top (as shown). These legends show some added functions available with the LA34-AA terminals.

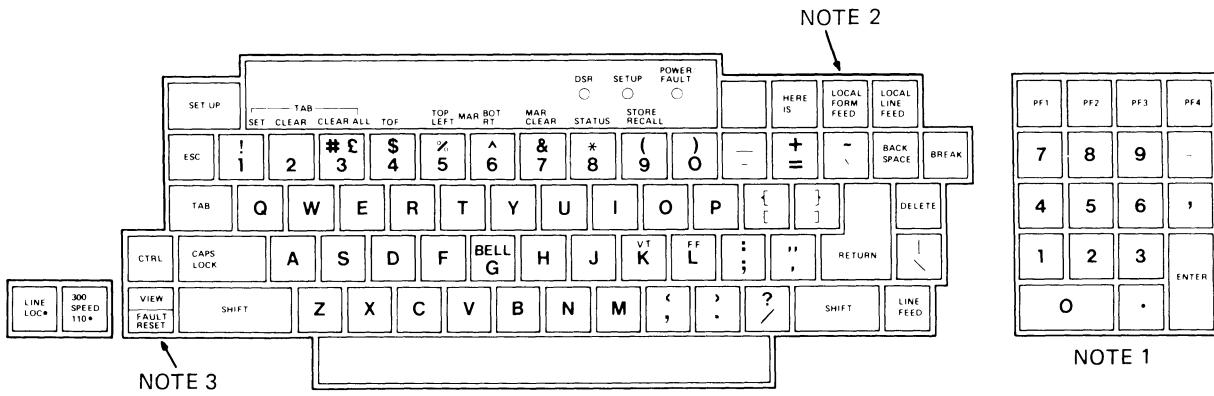


#### NOTES

1. THE NUMERIC KEYPAD IS STANDARD ON LA38, OPTIONAL ON LA34.
2. HAS NO FUNCTION. RESERVED FOR FUTURE EXPANSION.

MA-8162

Figure 4-1 LA34-DA/LA38-GA Keyboard

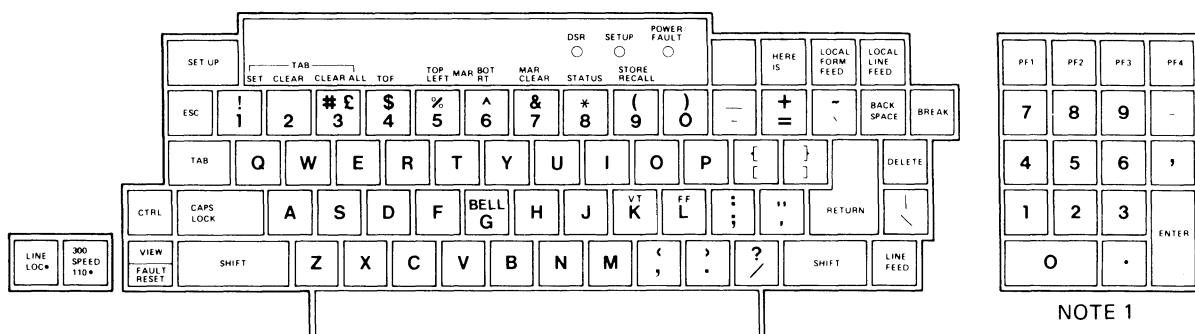


#### NOTES

1. THE AUXILIARY KEYPAD IS STANDARD ON LA38, OPTIONAL ON LA34.
2. THIS KEY IS BLANK ON SOME UNITS. THE FUNCTION IS THE SAME.
3. THIS KEY IS LABELLED VIEW ON SOME UNITS. THE FUNCTION IS THE SAME.

MA-2607B

Figure 4-2 LA34-AA/LA38-AA Keyboard



#### NOTES

1. THE NUMERIC KEYPAD IS STANDARD ON LA38, OPTIONAL ON LA34.

MA-8163

Figure 4-3 Keys Unique to the LA34-AA

### 4.3.2 Operating Controls

**4.3.2.1 Special Function Keys** – Figure 4-4 shows the special function keys on the keyboard. Table 4-2 lists all of these keys and their functions.

**4.3.2.2 SET-UP Mode Keys** – Figure 4-5 shows the SET-UP mode keys on the keyboards. Most of these keys are used to set up forms before using the terminal in a specific application. In addition, many other keys on the keyboards perform special functions in SET-UP mode. Refer to Table 4-1 for a complete list of SET-UP commands. Table 4-3 lists and describes the set-up mode keys.

#### NOTE

The numeric keypad usually generates the same codes as the unshifted numeric keys on the main keyboard unless in functional keypad mode (LAX34-XL/XM only).

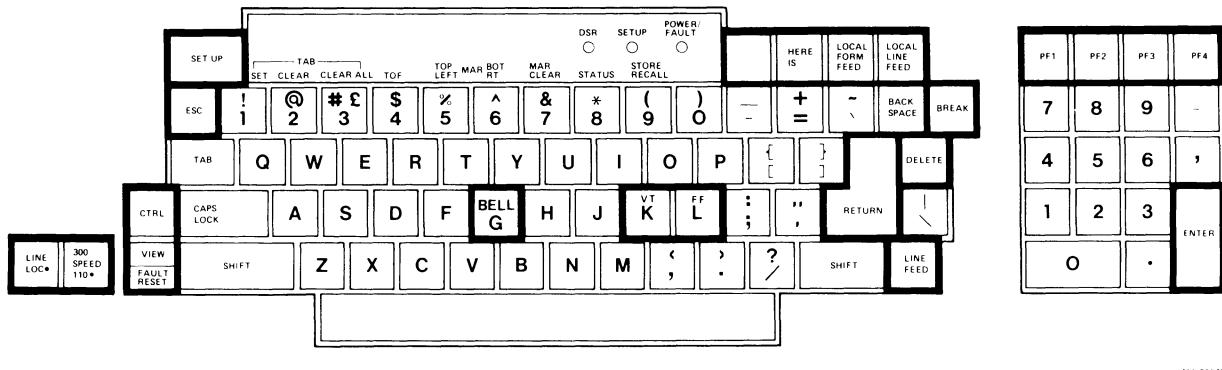
**4.3.2.3 Terminal Controls** – Table 4-4 lists and describes the function of the terminal controls.

### 4.3.3 Visual Indicators

Table 4-5 lists and describes the function(s) of the visual indicators on the terminal.

### 4.3.4 Audible Indicator

The terminal sounds a bell tone when any of the conditions listed in Table 4-6 occur.



MA 2607D

Figure 4-4 Special Function Keys

Table 4-2 Special Function Keys (Figure 4-4)

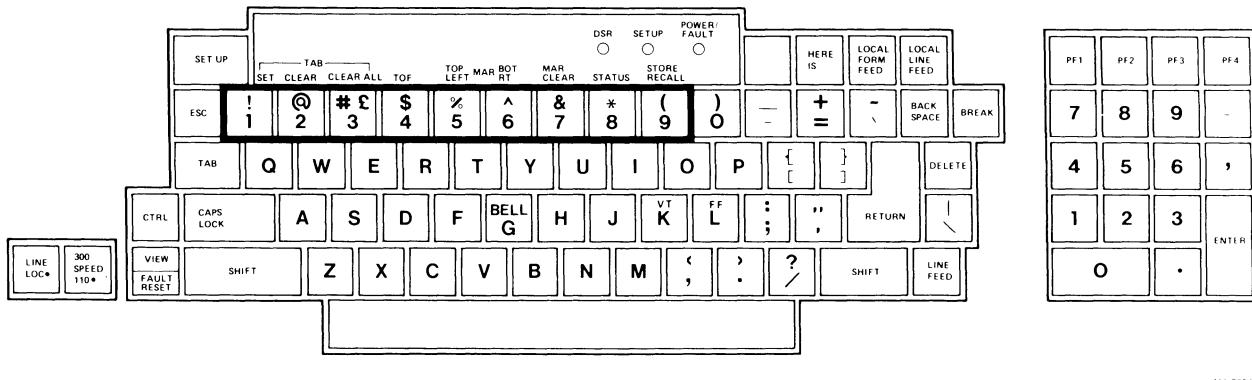
Key	Function
<b>LINE LOC•</b>	This key completes electrical connections between terminal and communication lines to permit sending and receiving data.
<b>LOC• (down position)</b>	This key disconnects electrical connections between terminal and communication lines to permit local operation without sending information to the computer.
<b>300 SPEED 110•</b>	This key enables terminal to transmit and receive data at the rate of approximately 30 characters per second (300 baud).
<b>110• (down position)</b>	This key enables terminal to transmit and receive data at the rate of approximately 10 characters per second (110 baud). If LAX34-XL/XM option is installed, it enables the terminal to operate at previously selected SET-UP speed.
<b>VIEW/ FAULT RESET</b>	This key allows the operator to see the last printed character by moving the printhead 10.16 cm (0.4 in) to the right of the character. On LA34-AA/LA38-AA terminals, it operates only when manual last character visibility (LCV) has been keyboard-selected. It is inoperative during automatic LCV. It is used with CTRL key to enter or exit auto LCV mode.
<b>VIEW</b>	This key allows the operator to see the last printed character by moving the printhead 10.16 cm (0.4 in) to the right of the character. On LA34-AA/LA38-AA terminals, it operates only when manual last character visibility (LCV) has been keyboard-selected. It is inoperative during automatic LCV. It is used with CTRL key to enter or exit auto LCV mode.

**Table 4-2 Special Function Keys (Figure 4-4) (Cont)**

Key	Function
FAULT RESET	<p>This key resets any fault condition after cause of fault is removed (e.g., access cover, paper out). It returns terminal to normal operation.</p> <p><b>NOTE</b> On some LA34-DA/LA38-GA terminals, this key is labelled VIEW. The functions are the same as above.</p>
CTRL	When held down while another key is pressed, this key modifies the code generated by the other key.
ESC	This key generates the ASCII code for escape.
BELL G	When pressed at the same time as the CTRL key, this key generates a bell code. It sounds a bell tone when local echo is selected.
V T K	This key generates the code for vertical tab when pressed at the same time as the CTRL key. It advances paper to next vertical tab when local echo is selected (LA34-AA/38-AA terminals only).
F F L	This key generates the code for form feed when pressed at the same time as the CTRL key. Advances paper to top margin of next form when local echo is selected (LA34-AA/38-AA terminals only).
BLANK KEY	This key is provided for future expansion.
HERE IS (LAX34-XL/XM only)	This key causes the terminal to send an answerback message. The answerback message is selected in SET-UP.
<b>NOTE</b> This key is included on some LA34DA/38GA terminals, but it performs no function.	
LOCAL FORM FEED (LA34-AA/38-AA terminals only)	This key advances the paper to the top margin of the next form without sending a form feed code to the computer.
LOCAL LINE FEED	This key advances the paper one line without sending a line feed code to the computer.

**Table 4-2 Special Function Keys (Figure 4-4) (Cont)**

Key	Function
<b>BREAK</b>	This key causes the terminal to send a timed break signal (0.250 s) to the computer. When used with SHIFT, it causes the terminal to send a long break disconnect signal (3.8 s minimum).
<b>DELETE</b>	This key generates the ASCII code for delete.
<b>RETURN</b>	This key generates the ASCII code for a carriage return or the ASCII codes for a carriage return and line feed in auto line feed mode.
<b>LINE FEED</b>	This key generates the ASCII code for line feed. Advances the paper one line when local echo is selected.
<b>ENTER</b>	This key generates the same ASCII code as the RETURN key on the keyboard.
<b>PF1 PF2</b> <b>PF3 PF4</b>	These keys generate ESCape control sequences that may be assigned by the user for special computer operations.



MA 260/E

Figure 4-5 SET-UP Mode Keys

Table 4-3 SET-UP Mode Keys (Figure 4-5)

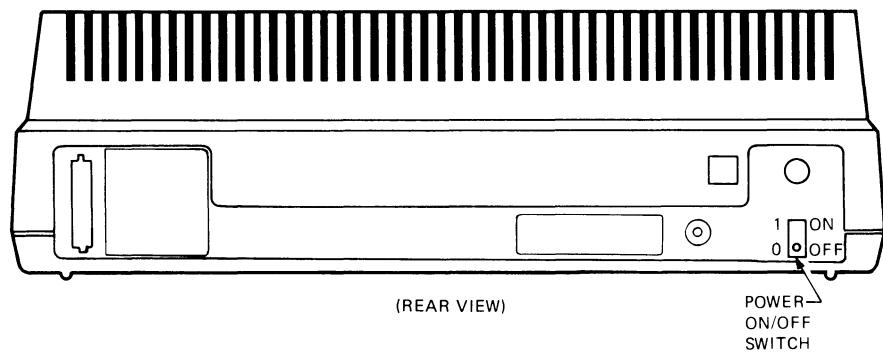
Key	Legend	Function
SET-UP	None	This key is used with <b>CTRL</b> to enter SET-UP mode. It is used alone to exit SET-UP mode.
!	SET TAB	This key sets a horizontal tab stop at the current printhead position when used alone.  (LA34-AA/38-AA only) This key sets a vertical tab stop at the current paper position when used with <b>SHIFT</b> .
@	CLEAR TAB	This key clears a horizontal tab stop at the current printhead position when used alone.  (LA34-AA/38-AA only) This key clears a vertical tab stop at the current paper position when used with <b>SHIFT</b> .
#	CLEAR ALL	This key clears all horizontal tab stops when used alone.  (LA34-AA/38-AA only) This key clears all vertical tab stops when used with <b>SHIFT</b> .
\$	TOF (LA34-AA/38-AA only)	This key selects the current paper position as top of form. If this position is not the same as the selected top margin, the paper will move to the top margin position (first printing line) during operation.

Table 4-3 SET-UP Mode Keys (Figure 4-5) (Cont)

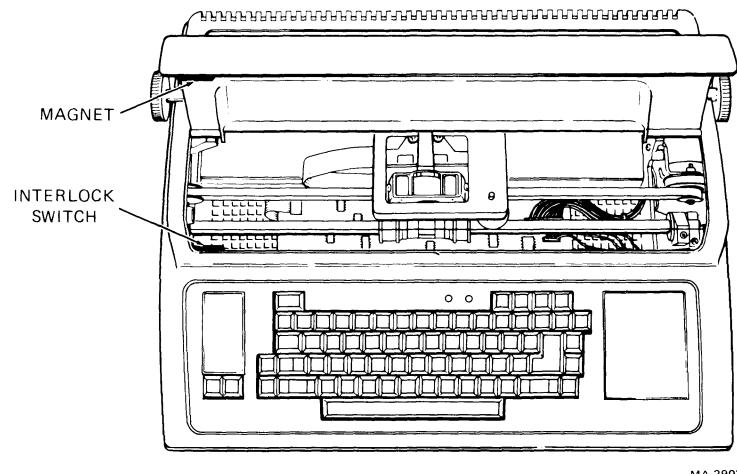
Key	Legend	Function
% 5	TOP/LEFT MAR	(All terminals) This key sets the left horizontal margin at the current column when used without <b>SHIFT</b> .
		(LA34-AA/38-AA only) This key sets the top margin at the current line when used with <b>SHIFT</b> .
^ 6	BOT/RT MAR	(All terminals) This key sets the right horizontal margin at the current column when used alone.
		(LA34-AA/38-AA only) This key sets the bottom vertical margin at the current line when used with <b>SHIFT</b> .
& 7	MAR CLEAR	(All terminals) This key clears both left and right horizontal margins when used alone.
		(LA34-AA/38-AA only) This key clears both top and bottom vertical margins when used with <b>SHIFT</b> .
* 8	STATUS	This key prints the status message which contains the current values of form SET-UP features and communication features selected by the internal communication switches.
<p style="text-align: center;"><b>NOTE</b></p> <p>With the LA34-AA/38-AA, some of the communication switch settings may be overridden at the keyboard during operation. The status message will reflect any such changes.</p>		
( 9	STORE RECALL (LAX-XL/XM only)	This key stores the contents of the operating memory into user permanent memory when used with <b>SHIFT</b> . It recalls the SET-UP features stored in user permanent memory when pressed alone.
<p style="text-align: center;"><b>NOTE</b></p> <p>When using the Store function, the SET-UP indicator stays on for the duration of the memory-to-memory transfer (approximately five seconds).</p>		

**Table 4-4 Terminal Controls**

Control	Figure	Function
Power ON/OFF switch	4-6	This switch turns power to the terminal on or off.
Cover interlock switch	4-7	This switch is a safety feature which prevents operation of the terminal while the access cover is open. It causes a fault condition.
Paper advance knob	4-8	This knob advances the paper 1/12 of an inch at a time. Pressing in and turning the knob on the right enables the paper to be rolled freely in either direction for precise vertical positioning.
Paper release lever	4-9	This lever allows the operator to reposition or remove the paper (or preprinted form) from the terminal.
Printhead adjustment lever	4-10	This lever controls the printhead gap for single or multipart forms to provide the proper print impression.
Ribbon adjust knob	4-11	This knob allows the operator to remove any slack from the ribbon.
Manual override lever (P/O LAX34-PL Paper Out Option)	4-12	This lever allows the operator to disable paper out detection when using single-sheet or roll paper.
Tractor adjust levers (P/O LAX34-AL Tractor Option)	4-13	These levers provide horizontal positioning of sprocket-feed paper or forms.
Tractor release levers (P/O LAX34-AL Tractor Option)	4-14	These levers allow the operator to install or remove the LAX34-AL tractor option.

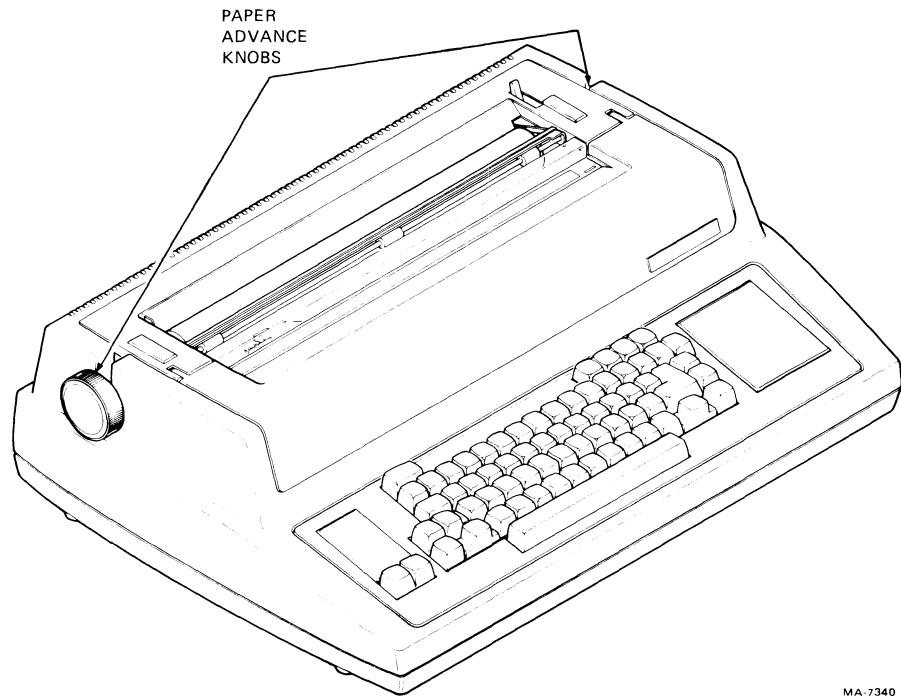


**Figure 4-6 Power ON/OFF Switch**



MA-2903

Figure 4-7 Cover Interlock Switch



MA-7340

Figure 4-8 Paper Advance Knobs

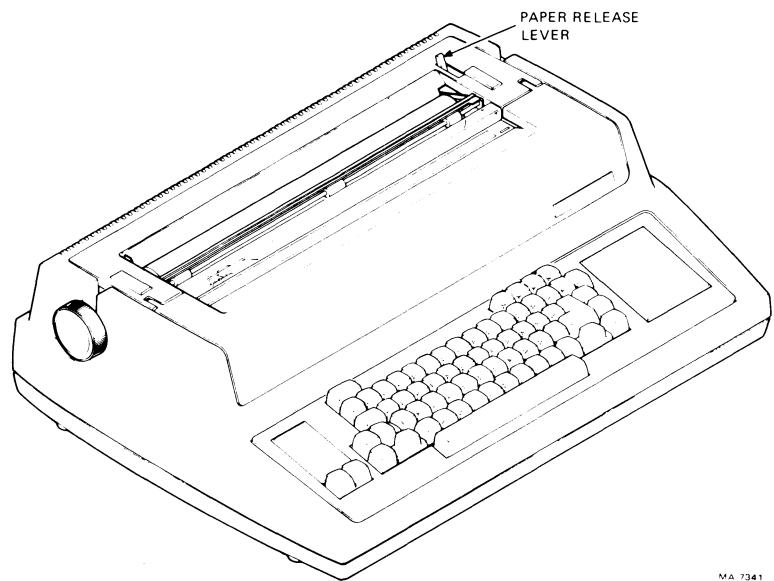


Figure 4-9 Paper Release Lever

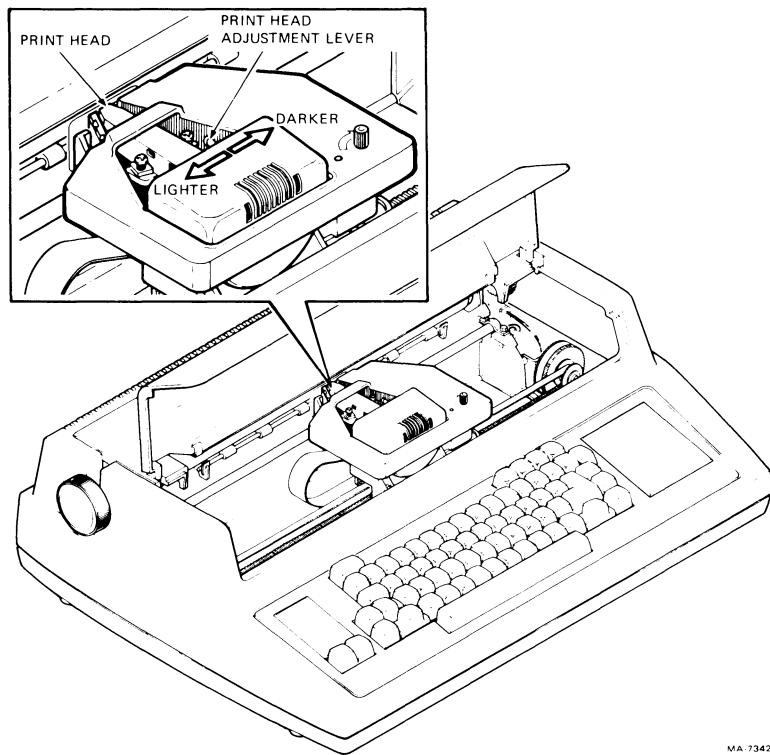
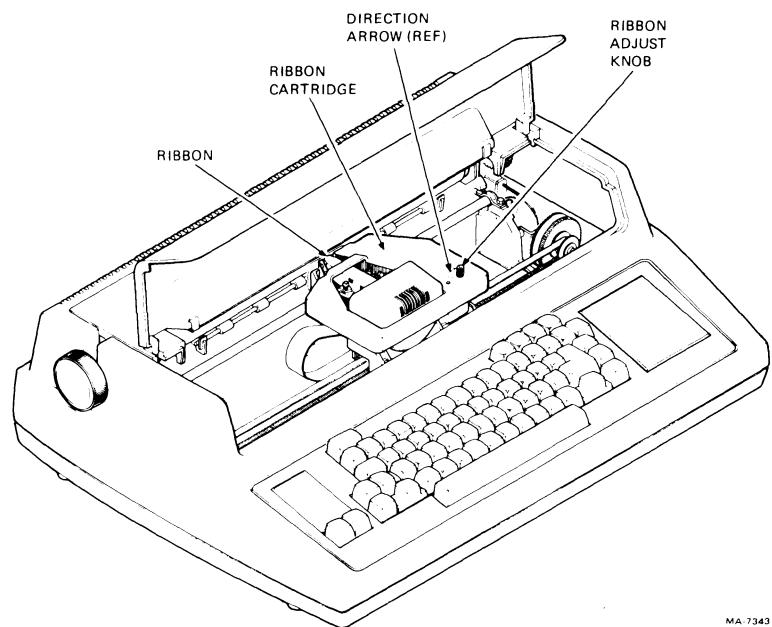
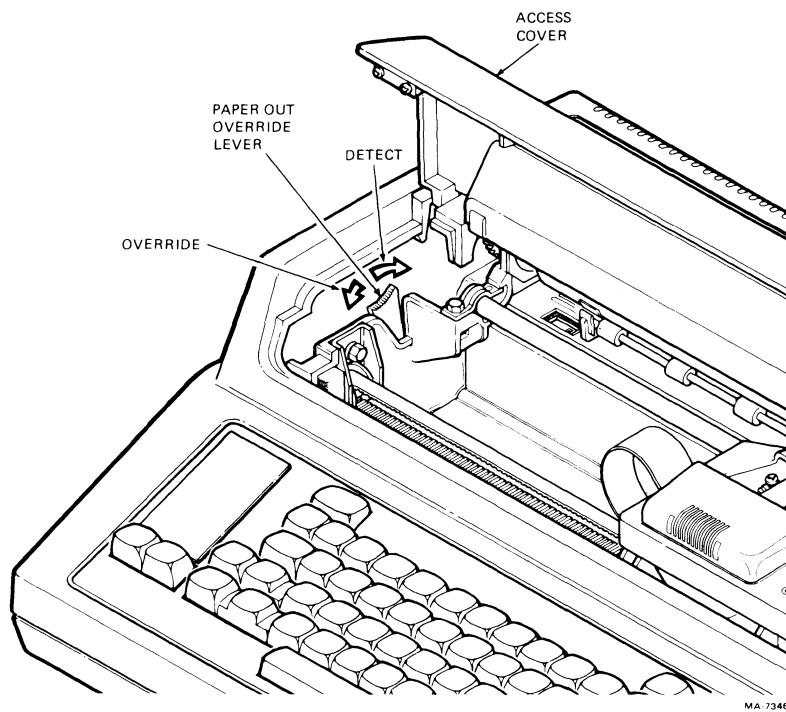


Figure 4-10 Printhead Adjustment Lever



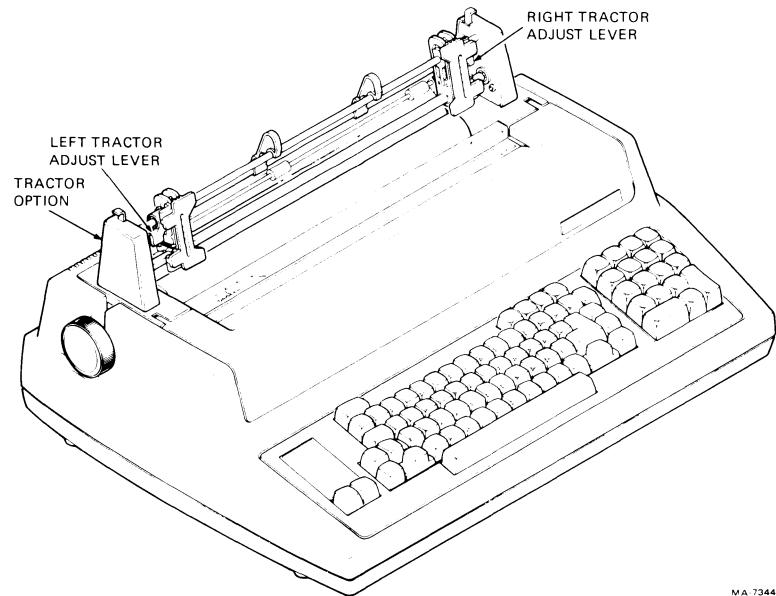
MA-7343

Figure 4-11 Ribbon Adjust Knob



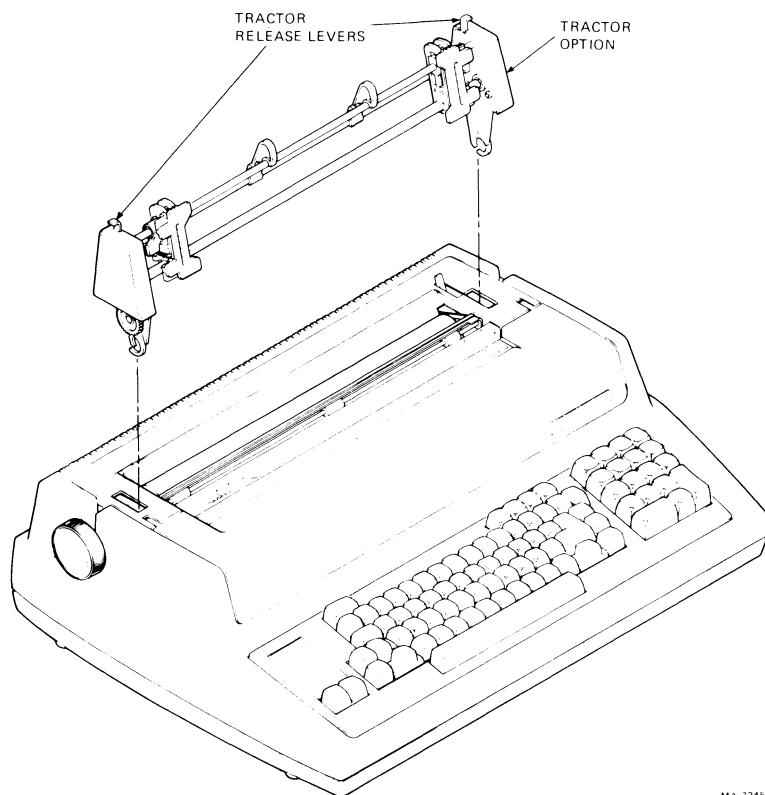
MA-7346

Figure 4-12 Paper Out Manual Override Lever



MA 7344

Figure 4-13 Tractor Adjust Levers

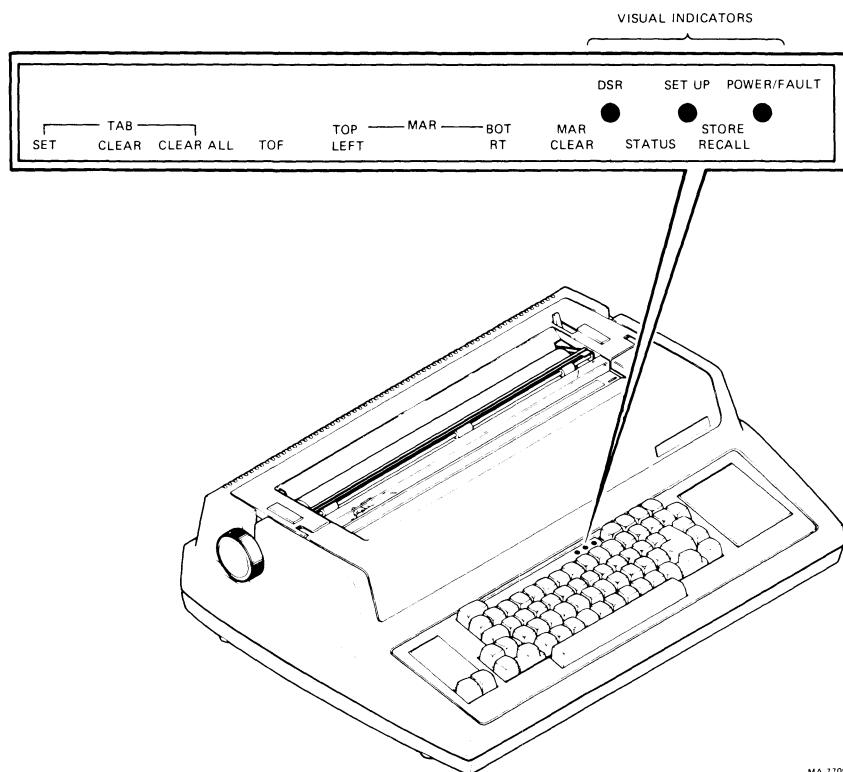


MA 7345A

Figure 4-14 Tractor Release Levers

**Table 4-5 Visual Indicators (Figure 4-15)**

Indicator	Function
SET-UP indicator	This indicator is on and flashing whenever the terminal is in SET-UP mode.
POWER/FAULT indicator	This indicator is on when power has been turned on. It flashes whenever any of the following fault conditions occurs: <ul style="list-style-type: none"> <li>● Paper fault (roll paper low or fan roll paper out)</li> <li>● Access cover open</li> <li>● Printhead jam</li> </ul> It remains flashing until the fault is cleared by pressing the <b>VIEW/FAULT RESET</b> key.
DSR indicator	This indicator is on when DSR (Data Set Ready) is asserted and modem control is enabled. It is on continuously when modem control is disabled (LA34-AA, LA38-AA only).
Column indicator scales	These scales show the current position of the printhead. Scales are provided for the four normal character spacing (CPI) selections.



**Figure 4-15 Visual Indicators**  
a. Keyboard Indicators

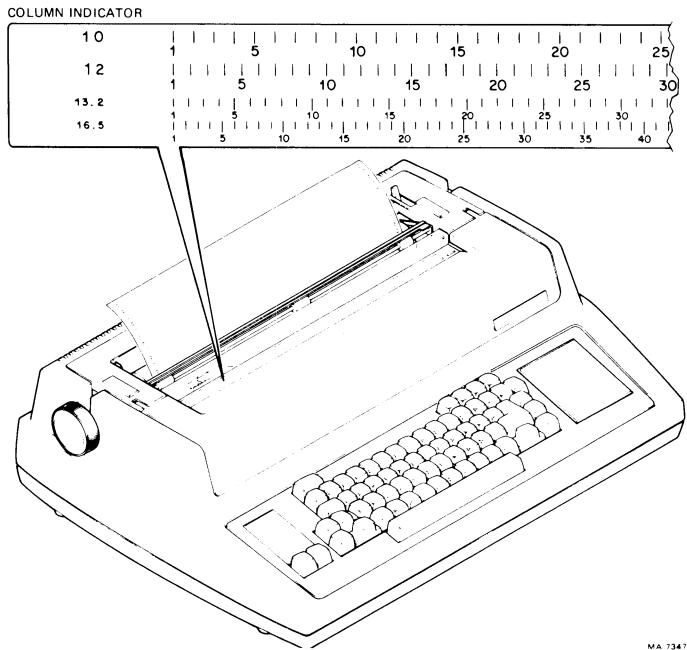


Figure 4-15 Visual Indicators  
b. Column Indicator Scale

Table 4-6 Audible Indicator Conditions

Conditions	Actions/Comments
Approaching right margin	A bell tone sounds when the printhead reaches the eighth column from the right margin (except during computer-controlled operation).
Input buffer overflow	If input data is received faster than 300 baud (without XON/XOFF), an input buffer overflow can occur. During an overflow condition, the bell tone sounds with each character received and the character is lost.
Output buffer overflow	Typing faster than the communication line can handle causes an output buffer overflow. During an overflow condition, a bell tone sounds for each typed character and the character is lost.
Bell code	Each bell code received by the terminal sounds the bell tone.
Head jam	A head jam is indicated by a flashing POWER/FAULT light and multiple bell tones.
Illegal character typed during SET-UP mode	Typing an illegal character while in SET-UP mode causes the bell tone to sound each time the character is typed.

## 4.4 OPERATOR TESTS

If at any time there appears to be a problem in the terminal, the operator may start a self-test. Four self-tests are provided. Three of the self-tests provide the operator with a visual indication that the terminal is functional. The fourth is a nonprinting self-test that may be used without paper.

### 4.4.1 Ripple Pattern Self-Test

Use this procedure to print the ripple pattern self-test (Figure 4-16).

Procedure	Comments/Indication
Enter SET-UP mode	SET-UP flashes.
Press <b>T</b> then <b>RETURN</b>	The self-test ripple pattern is printed out continuously until the test is terminated.
Press any character key	Self-test is terminated.
Exit SET-UP mode	SET-UP light stops flashing.

#### NOTE

**The horizontal margins must be set for a minimum of two columns for this test.**

```
! "#%&'()**,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[ ]^`'abcdefshijklmnopqrstuvwxyz{`'  
! "#%&'()**,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[ ]^`'abcdefshijklmnopqrstuvwxyz{`'  
! "#%&'()**,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[ ]^`'abcdefshijklmnopqrstuvwxyz{`'  
! "#%&'()**,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[ ]^`'abcdefshijklmnopqrstuvwxyz{`'  
! "#%&'()**,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[ ]^`'abcdefshijklmnopqrstuvwxyz{`'
```

a. 16.5 Characters/Inch

```
! "#%&'()**,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[ ]^`'abcdefshijklmnopqrstuvwxyz{`'  
! "#%&'()**,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[ ]^`'abcdefshijklmnopqrstuvwxyz{`'  
! "#%&'()**,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[ ]^`'abcdefshijklmnopqrstuvwxyz{`'  
! "#%&'()**,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[ ]^`'abcdefshijklmnopqrstuvwxyz{`'
```

b. 10 Characters/Inch

```
! "#%&'()**,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[ ]^`'abcdefshijklmnopqrstuvwxyz{`'  
! "#%&'()**,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[ ]^`'abcdefshijklmnopqrstuvwxyz{`'  
! "#%&'()**,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[ ]^`'abcdefshijklmnopqrstuvwxyz{`'  
! "#%&'()**,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[ ]^`'abcdefshijklmnopqrstuvwxyz{`'  
! "#%&'()**,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[ ]^`'abcdefshijklmnopqrstuvwxyz{`'
```

c. 5 Characters/Inch

Figure 4-16 Ripple Pattern Self-Test

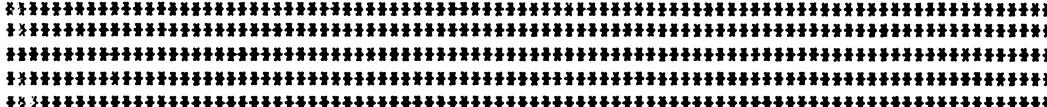
#### **4.4.2 Character Self-Test**

Use this procedure to print the character self-test (Figure 4-17).

<b>Procedure</b>	<b>Comments/Indication</b>
Enter SET-UP mode	SET-UP light flashes.
Press <b>T</b> then press the desired character key	The selected character is printed out continuously until the test is terminated.
Press any character key	Self-test is terminated.
Exit SET-UP mode	SET-UP light stops flashing.

a. 16.5 Characters/Inch

This image shows a continuous horizontal pattern of asterisks (\*). It consists of approximately 20 lines of text, each containing about 80 characters. The pattern is used to demonstrate a high character density setting of 16.5 characters per inch.

b. 10 Characters/Inch


This image shows a continuous horizontal pattern of asterisks (\*). It consists of approximately 20 lines of text, each containing about 40 characters. The pattern is used to demonstrate a medium character density setting of 10 characters per inch.

c. 5 Characters/Inch

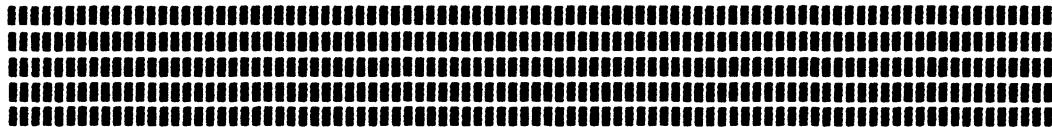

This image shows a continuous horizontal pattern of asterisks (\*). It consists of approximately 20 lines of text, each containing about 20 characters. The pattern is used to demonstrate a low character density setting of 5 characters per inch.

Figure 4-17 Character Self-Test (Asterisk \* Shown)

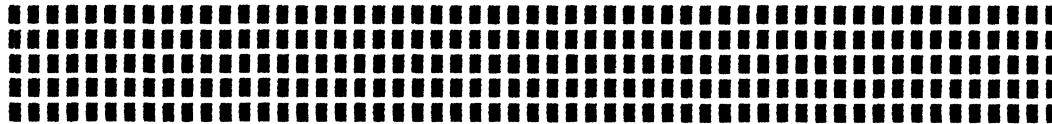
#### **4.4.3 Vertical Bar Self-Test**

Use this procedure to print the vertical bar self-test (Figure 4-18).

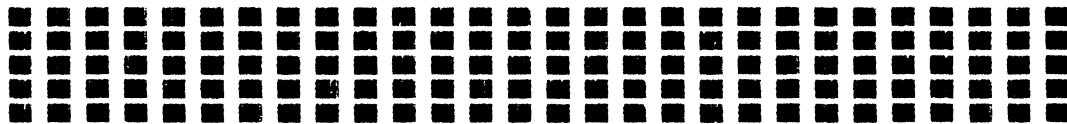
<b>Procedure</b>	<b>Comments/Indication</b>
Enter SET-UP mode	SET-UP light flashes.
Press <b>T</b> then <b>SHIFT</b> and <b>\</b>	A pattern of multiple vertical bars is printed out continuously until the test is terminated. The terminal prints one vertical column in each character position. Four passes of the printhead are required to print each line as shown in Figure 4-18.
Press any character key	Self-test is terminated.
Exit SET-UP mode	SET-UP light stops flashing.



a. 16.5 Characters/Inch



b. 10 Characters/Inch



c. 5 Characters/Inch

Figure 4-18 Vertical Bar Self-Test

#### 4.4.4 Nonprinting Self-Test

Use the following procedure to perform the nonprinting self-test.

Procedure	Comments/Indication
Enter SET-UP mode	SET-UP light flashes.
Press T then Space Bar	The printhead advances across the platen, returns and then repeats until the test is terminated.
Press any character key	Self-test is terminated.
Exit SET-UP mode	SET-UP light stops flashing.

#### 4.4.5 Data Loopback Tests

In addition to printing/nonprinting tests, a data loopback test can be performed. During this test, the transmit and receive lines are connected to each other.

Testing is accomplished with the aid of a loopback connector. EIA and 20 mA connectors are available from the Accessories and Supplies Group, or can be manufactured locally (Figure 4-19).

**4.4.5.1 Data Loopback Test (LA34-DA/AA, LA38-GA/AA Terminals)** — Use this procedure to perform the data loopback test.

1. Disconnect the data cable from the rear of the terminal.
2. Attach the appropriate loopback connector to the terminal input connector.
3. Exit SET-UP mode by pressing the SET-UP key.
4. Place the terminal on-line by placing the **ON-LINE** key in the up position.

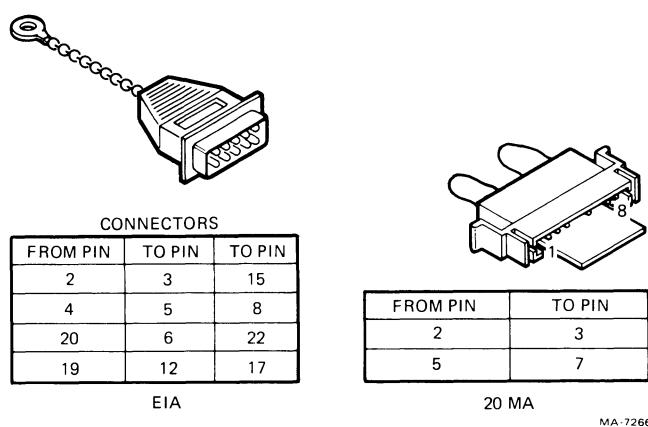


Figure 4-19 EIA and 20 mA Loopback Connectors

- Type a few characters. The terminal should respond by printing whatever was typed. If anything other than what was typed appears, a failure has occurred.

**NOTE**

**The transmit and receive baud rates must be set to the same value or this test will fail.**

**4.4.5.2 Data Loopback Test (LA34-RA/VA/WA Printers)** — During the data loopback test, the graphic printers transmit a set of characters automatically. All Control signals are checked (in EIA), as are the baud rate and parity. The graphic printer compares the output and input and then prints the status message. The status message includes one of the following messages.

DATA OK - CTRL OK  
DATA ERR - CTRL ERR  
DATA ERR - CTRL OK  
DATA OK - CTRL ERR (20 mA)

**NOTE**

**When using the 20 mA interface, the terminal prints the DATA OK – CTRL ERR message when the data loopback test has successfully completed. The 20 mA interface does not use the CTRL lines.**

During the test the bell is sounded each time 126 characters are successfully transmitted and received at the correct speed and parity.

Use the following procedure to perform the data loopback test.

- Connect the appropriate loopback connector to the graphic printer interface connector.
- If the 20 mA interface option is used, set the TRANS/REC switches on the option board; one to NORMAL and one to ACTIVE [refer to the Options chapter (Paragraph 3.9) to gain access to the switches].
- Press and lock the **ON LINE/OFF** key in the OFF (down) position.
- Press and lock the **SELF TEST** key in the down position. At this point the status message is printed out.
- Wait four or five seconds after the status message is printed and then press the **TOF** key to begin the data loopback test. The test is started and the graphic printer prints a pass or fail message. The bell tone sounds every time 126 characters are successfully transmitted.
- If the 20 mA interface option is used, return the TRANS/REC switches to their original positions.

## **4.5 OPERATOR TROUBLESHOOTING**

If you are not able to turn power to the terminal on, or if the terminal appears to be defective, refer to Table 4-7. This table describes the checks you should make before turning to the troubleshooting chapter.

**Table 4-7 Operator Troubleshooting**

Symptom	Possible Cause and Corrective Action
POWER/FAULT light is not on when power ON/OFF switch is turned on	AC power cord is not plugged into the wall outlet or rear of terminal. Plug in cord.  Power is not coming from the wall outlet. Check the outlet with a known working device (such as a lamp). If no power, call your electrician.  AC line fuse is blown. Turn terminal OFF and have the fuse at rear of terminal replaced.
Characters will not print, POWER/FAULT light flashes	Printer is out of paper. Reload paper and reset the cover open fault by pressing the <b>VIEW</b> key.  Access cover is open or ajar. Close the access cover and reset the cover open fault by pressing the <b>VIEW</b> key.
No keyboard or printer response	The communication set up is incorrect.
Light print	Ribbon is out of ink. Replace the ribbon cartridge.  Printhead is too far from paper. Perform print impression adjustment.
Ink smudges during print operation	Paper is not firmly wrapped around platen. Lift bail bar and smooth the paper over the surface of the platen. Return the bail bar to its normal position.  Printhead is too close to paper. Perform print impression adjustment.
Paper does not advance	Paper not loaded properly. Reload paper.  Feed holes are torn. Reload paper.
Paper tearing on multipart forms	Printhead exerting too much pressure on paper. Perform print impression adjustment.  Paper not straight in printer. Realign paper.
Printhead jam or printhead does not move	Paper or printhead is jammed. Open access cover and clear the jam. Reset the cover open fault by pressing the <b>VIEW</b> key.
Garbled or double characters	Communication set up is incorrect (local echo on).  Ribbon is not tight around printhead. Tighten the ribbon by turning the ribbon adjust knob.

## **CHAPTER 5 THEORY**

### **5.1 GENERAL**

This chapter provides a description of the functions performed by the LA34 series terminals. The description provides an understanding of the terminal's basic operating principles for field service personnel. Refer to Paragraph 1.3 for a general description of the terminal. The description in this chapter starts where the description in Chapter 1 leaves off.

Block diagrams and other drawings support the text. You may want to refer to the correct LA34/LA38 Field Maintenance Print Set for circuit details while studying this chapter. The descriptions usually cover a wide enough area to support the theory of the DECwriter IV series of terminals. However, where specifics are mentioned which apply to one terminal in the series, and not to the others, the model number is identified.

### **5.2 INTRODUCTION**

The LA34 is a complete self-contained computer input and output hardcopy terminal. It includes four basic components (not including the enclosure) plus three important options. The components are the control/logic board, keyboard, printer mechanism, and power supply. The options are the extended logic, extended memory, and current loop adapter options. Figure 5-1, the LA34 block diagram, shows these components and options, and how they are functionally tied together.

The control/logic board manages the printing, paper advancing, and communication processes. All other components and major options connect to it. The control/logic board includes these functional components:

1. A microprocessor to manage the overall terminal operation.
2. 6144/8192 bytes of read only memory (ROM) containing a microprogram and standard set-up parameters to operate the terminal with its specific features.
3. 1024 bytes of random access memory (RAM) for microprocessor temporary storage and input/output data storage.
4. A printer controller that provides an interface between the microprocessor and the electro-mechanical components in the printer mechanism.
5. An asynchronous serial receiver/transmitter (USART) for data exchange with the host computer.

The keyboard is a conventional typewriter-style input device. In addition to the common alphanumeric keys, it has special purpose set-up/command keys and LED indicators that show internal states of the terminal. The keyboard is basically a switch matrix that is interrogated by the control/logic board for any switch closures.

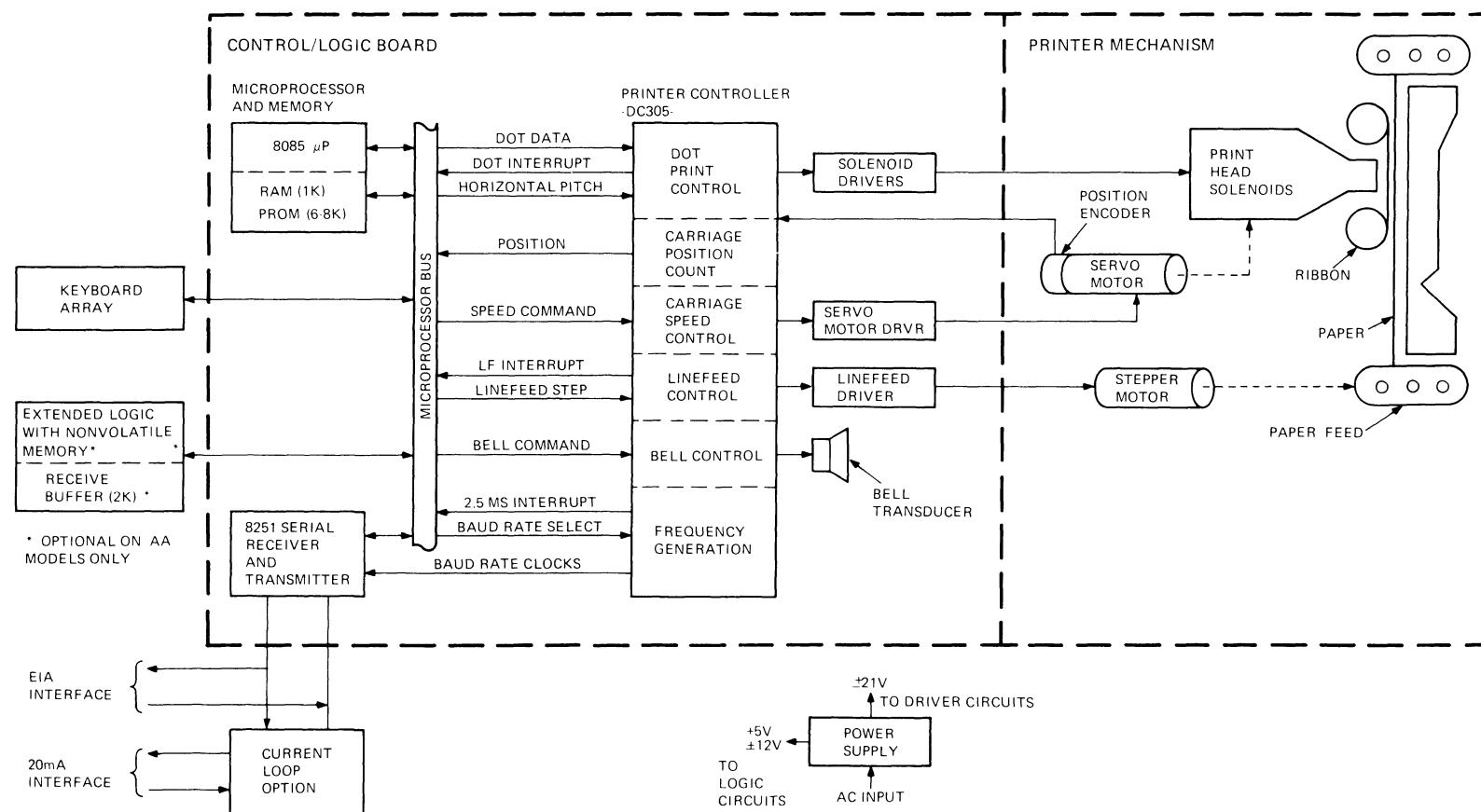


Figure 5-1 LA34 Block Diagram

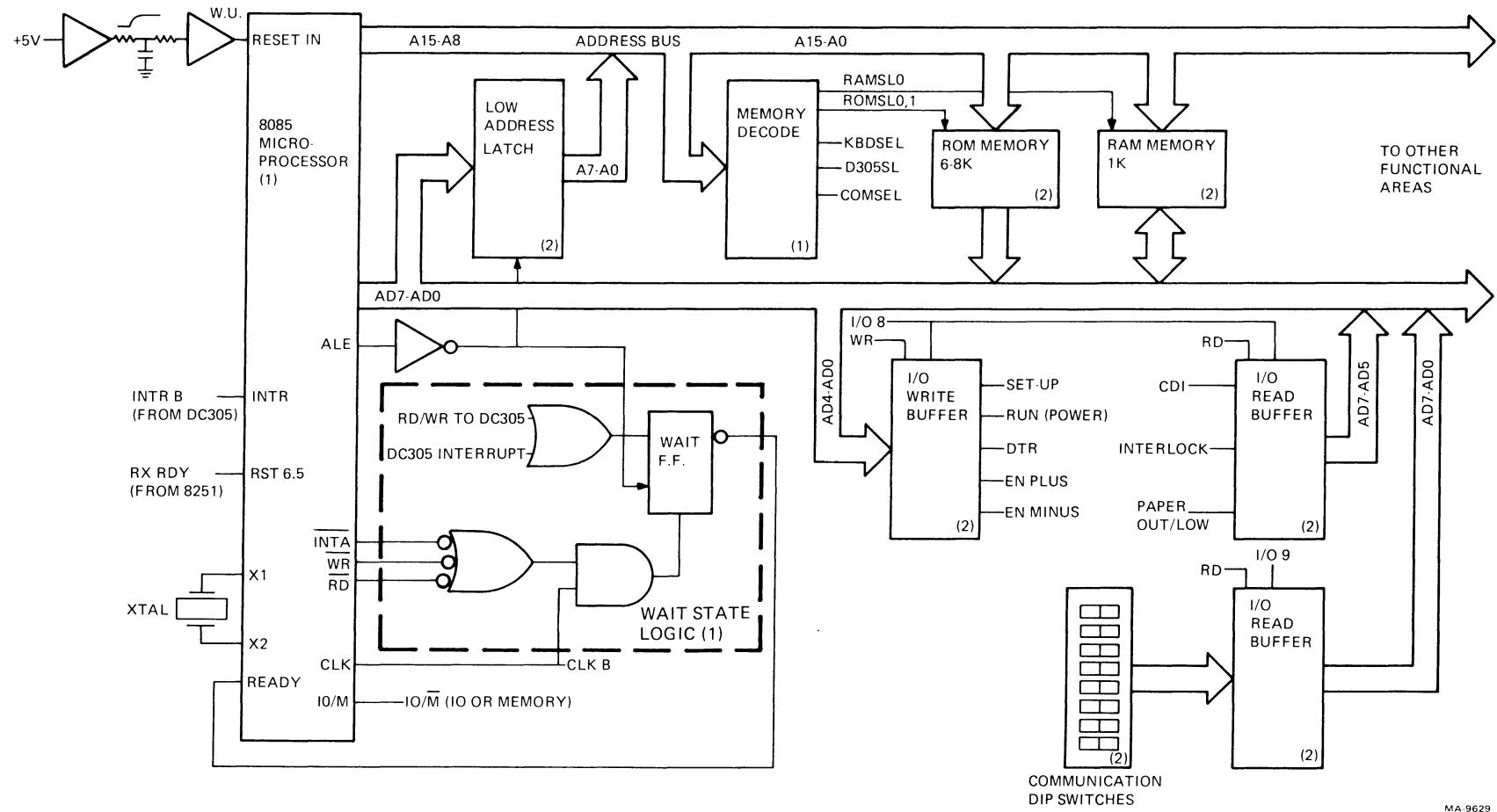


Figure 5-2 Microprocessor/Control System Logic

**Table 5-1 LA34-AA System Address Map**

Address Range (Hex)	Decoded Enabling Signal (E33)	Responding Device
0000-0FFF	ROMSL0	E14 ROM (4K)
1000-1FFF	ROMSL1	E8 ROM (4K)
2000-23FF	RAMSL0	E21, E26 RAM (1K)
2400-2FFF	RAMSL0	Not used
3000-300F	KBDSEL	Keyboard
3010-3FFF	KBDSEL	Not used
4000-4003	D305SL	E9 print controller
4004-4FFF	D305SL	Not used
5000-5001	COMSEL	E4 USART
5002-5FFF	COMSEL	Not used
6000-6FFF	CE7	Not used
7000-7FFF	CE8	Not used
8000-FFFF	—	Not used

**Table 5-2 LA34-DA System Address Map**

Address Range (Hex)	Decoded Enabling Signal (E40)	Responding Device
0000-07FF	ROMSL0	E6 ROM (4K)
0800-0FFF	ROMSL0	E33 ROM/IO port
1000-17FF	ROMSL1	E10 ROM
1800-1FFF	ROMSL1	Not used
2000-23FF	RAMSL0	E21, E22 RAM
2400-2FFF	RAMSL0	Not used
3000-300F	KBDSEL	Keyboard
3000-3FFF	KBDSEL	Not used
4000-4003	D305SL	E14 print controller
4004-4FFF	D305SL	Not used
5000-5001	COMSEL	E27 USART
5002-5FFF	COMSEL	Not used
6000-6FFF	CE7	Not used
7000-7FFF	CE8	Not used
8000-FFFF	—	Not used

The printer mechanism includes all of the mechanical and electromechanical components necessary for impact printing and paper/forms control. This includes the following.

1. Seven-wire printhead.
2. Servo motor/position encoder for horizontal printhead motion/position sensing.
3. Stepper motor for vertical paper movement.
4. Paper low/out sensors (if installed).
5. Platen, bail bar, friction assembly, and other mechanisms for paper control.

The power supply converts the ac power line into the five dc voltages used by the terminal. It has a switching regulator for high efficiency and cool operation.

The extended logic option has an added ROM for expanded character sets and an electrically alterable ROM (nonvolatile memory) for storing set-up parameters and the answerback message.

The extended memory option includes the extended logic option plus an added 2048 bytes of RAM for an expanded receive character buffer.

The current-loop adapter option changes the EIA output of the terminal to a more noise-immune system when longer distances between the terminal and the computer are needed.

### **5.3 FUNCTIONAL OVERVIEW**

As you have read in Chapter 1, two main functions are performed by the LA34 terminal. It functions as an input device and as an output device. As an input device it processes keyboard data and transmits this data to the host processor. As an output device, characters received from the host processor are examined (parsed) and either treated as printable characters or interpreted as commands. Specific character strings called escape sequences are used to change parameters such as; vertical and horizontal character pitch, set tabs and margins, or to select alternate character sets.

These two main functions can be broken down into many smaller functional areas. It is these functional areas that will be examined in this chapter and how they work together to implement the main functions.

The functional areas of the LA34 terminal are divided for discussion into the following groups.

1. Microprocessor/control system
2. Communications and input/output data processing
3. Keyboard
4. Printing Process
  - a. Character formation and printing
  - b. Printhead advancing
5. Paper advance process
6. Power supply and power distribution
7. Option functions
  - a. Nonvolatile memory
  - b. Extended memory
  - c. 20 mA current loop

## **5.4 DESCRIPTION OF FUNCTIONAL AREAS**

The LA34 is a microprocessor-controlled system that uses the interaction of hardware circuits with firmware programs to perform control functions and provide functional characteristics. This paragraph describes these functions and the hardware/firmware interactions that produce them.

### **5.4.1 Microprocessor/Control System**

An 8085 microprocessor is the center of the LA34 control system. The 8085 performs all the usual functions of a stored program computer: fetching instructions and data from ROM and RAM, and responding to service requests from various devices in the system. Figure 5-2 shows the microprocessor/control system logic. This includes the microprocessor chip, ROM/RAM memory, address decode logic, some command/status buffering, and miscellaneous timing logic.

The Wake-Up (WU) signal holds the microprocessor RESET IN input low until the +5 V logic voltage reaches its normal level. When WU goes high, the microprocessors program counter addresses location 0000 and the first instruction from memory is fetched and executed.

The microprocessor addresses memory and other devices with a 16-line address bus (A15–A0). The high address byte (A15–A8) is asserted on the bus for the duration of the processor cycle. However, the low address byte is asserted on the multiplexed 8-line address/data bus (AD7–AD0) for a short time at the beginning of the cycle, so it must be captured in a register. Signals AD7–AD0 pass through the low address latch and are frozen for the remainder of the cycle by the falling edge of the Address Lines Enable (ALE) signal. Then the AD lines are free for instructions and other input/output data for the remainder of the cycle.

Although the microprocessor has a 16-bit address (64K bytes), only part of the address range is decoded and used. Tables 5-1 and 5-2 summarize the system address map. Table 5-1 shows the map for the LA34-AA, LA38-AA, and the LA34-RO family terminals (54-13747 control board). Table 5-2 shows the map for the LA34-DA and LA38-GA terminals (54-13374 logic board).

The microprocessor addresses devices on the address/data busses as either memory or I/O. The output signal IO/not memory (IO/M) makes the distinction. When low, IO/M enables memory (ROM/RAM) and other devices addressed as memory such as the 8251 USART and the DC305 print controller. When high, IO/M enables I/O devices. The I/O devices in the LA34 system are the many receivers and transmitters that communicate certain command and status information. An I/O write to address 0008<sub>16</sub> sends a command to turn keyboard power/set-up LEDs on or off, enable the DTR modem line, and sends motion commands to the servo motor drivers. An I/O read from address 0008<sub>16</sub> gets status on the cover interlock switch, paper out/low switches and the communications carrier detect signal. An I/O read from address 0009<sub>16</sub> gets the configuration of the communication DIP switches.

The microprocessor receives hardware interrupts from the DC305 printer controller and the 8251 USART. The DC305 raises the INTR B line to the INTR input while asserting an interrupt vector address on the AD7–AD0 lines. The 8251 raises the RX RDY line to the RST6.5 input. The interrupt types, vector addresses (new program counter value), and descriptions are given in Table 5-3.

System timing is established by a crystal connected to the microprocessor. The microprocessor divides the crystal operating frequency (running at 2 MHz) in half and produces the 1 MHz Clock B (CLK B) output. CLK B runs to other functional areas and produces printing and communications timing. The microprocessor usually runs continuously, fetching and executing instructions from memory so long as its READY input is high. The wait state logic (Figure 5-2) pulls READY low whenever a write to, read from, or interrupt from the DC305 printer controller occurs. This introduces a short time period called a wait state into the microprocessor cycle to allow more time for the DC305 to respond.

**Table 5-3 Hardware Interrupt Vectors**

Restart Interrupt Name	Interrupt Vector Address	Microprocessor Interrupt Input	Reason for Interrupt
RST0	0000	RESET IN (WU)	Power up
RST1	0008	INTR (INTR B)	Both RST3 and RST5
RST3	0018	INTR (INTR B)	2.5 ms tick from DC305
RST5	0028	INTR (INTR B)	DC305 real time clock timeout (while linefeeding) or dot FIFO's are half empty
RST6.5	0034	RST 6.5 (RX RDY)	Character present at USART receiver output

The microprocessor continuously runs a ROM resident microprogram called the monitor. Figure 5-3 shows the basic monitor program loop. While the actual monitor program differs from one terminal type to another (depending on options present; receive only, graphics, etc.) this flow shows the elements that are common to all.

When the LA34 is turned on, a short initialization routine is run before entering the monitor loop. This routine includes the following events.

1. Disable all hardware interrupts
2. Perform a write/read check on RAM area
3. Move set-up parameters from ROM to RAM
4. Initialize the DC305 dot print FIFOs
5. Reset all tabs
6. Initialize the DC305 printer controller
7. Initialize the I/O registers (LA34-DA, LA38-GA only)
8. Set the print carriage to the first legal column
9. Perform a line feed
10. Initialize the 8251 USART
11. Set appropriate baud rates
12. Enable all hardware interrupts

After executing the initialization routine, the microprocessor branches to the monitor loop. The monitor is basically a polling routine looking for status such as cover open, paper out, and any data to print or process. Some internal status information may be too critical in nature for the monitor loop to poll for it. That is, the loop may take too long to circulate and operate on it. Hardware interrupts are used to handle this critical information or updating. Some examples are items which must be handled in "real time" such as keyboard scanning and processing high baud-rate receiver data. These interrupt routines are shown in Figure 5-3 separated from the monitor loop.

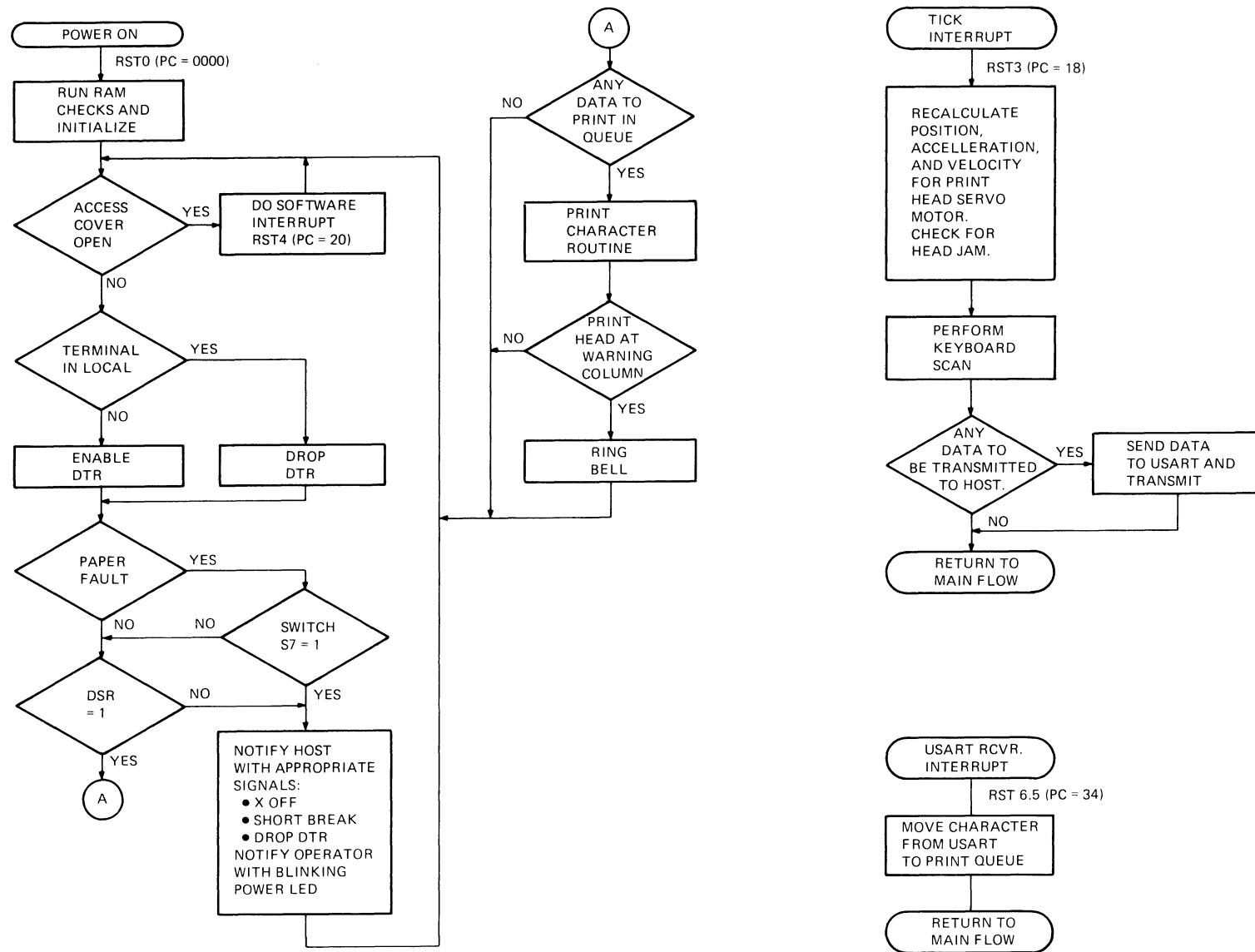


Figure 5-3 Microprocessor Monitor Polling Loop

## **5.4.2 Communications and I/O Data Processing**

The terminal interfaces to the host computer through a serial data port. The port includes an 8251A programmable universal synchronous or asynchronous receiver-transmitter (USART) and supporting logic. The USART translates between parallel and serial data formats, adding or removing start and stop bits as needed.

**5.4.2.1 Data Format** – The DECwriter IV series terminals only communicate asynchronously. Asynchronous transmission uses bits added to each data character to provide synchronization between the transmitter and the receiver. Figure 5-4 shows the ASCII data format exchanged between the terminal and the host computer. Because any two data exchanges can originate at random times with clock frequencies as much as one percent different, the protocol assumes random arrival of any character of data, and relies on the synchronization information in the character. This synchronization consists of extra bits appended to the beginning and end of the character. One bit at each end (one start bit and one stop bit) is the most common configuration, although two stop bits are used at 110 baud and below.

The start bit and stop bit are defined to have specific states, and in particular, the start bit has a different state from the idling condition on the line. The data port “looks” for the transition from the idling state (called mark) to the start bit state (called space) and then clocks in the character. The stop bit is the mark state, as is the idling line, so a character immediately following has the correct mark to space transition to provide synchronization. The data bits, which occur between a start and a stop bit, are represented by a mark for a one and a space for a zero.

The terminal communicates using 7-bit serial characters. A 7-bit serial character is transmitted using a start bit, 7 or 8 data bits per character, a selectable parity bit and one or two stop bits. The data bits are transmitted with the least significant bit first. With 7 data bits per character selected (data bits/character and parity are selected in SET-UP mode or through communications switches 1 and 2), the parity bit can be set to mark, space, even, or odd parity. With 8 data bits per character selected, the parity bit can be set to even or odd parity only. The speed at which the serial character is transmitted or received is selected using the Baud Rate (Speed) SET-UP feature.

**5.4.2.2 Data Handling Through the USART** – The complete functional definition of the USART is programmed into the terminals microprogram. A set of control bytes must be sent out by the microprocessor to initialize the USART to support the desired communications format. Once programmed, the USART is ready to perform its communications functions. Figure 5-5 shows how data is handled across the serial line and in the terminal. Figure 5-5a shows transmitted data and Figure 5-5b shows received data.

### **Transmit Data**

When the microprocessor wants to send a character out, it requests a status byte from the USART and checks the transmitter ready flag. If this flag is high the transmit buffer is empty and can accept data. If the flag is low, the microprocessor continues through its monitor program and returns to check again later.

When the flag is high, the microprocessor loads a data byte from the output buffer in RAM into the USART transmit buffer. The USART is double buffered; this means that there is a second data buffer inside that is automatically loaded from the first buffer. The second buffer's contents get start and stop bits and parity (if enabled) appended and are shifted out on the TXD line by a continuously running clock. Immediately after the second buffer is loaded, the transmit ready flag goes high and the first (transmit) buffer can be loaded again.

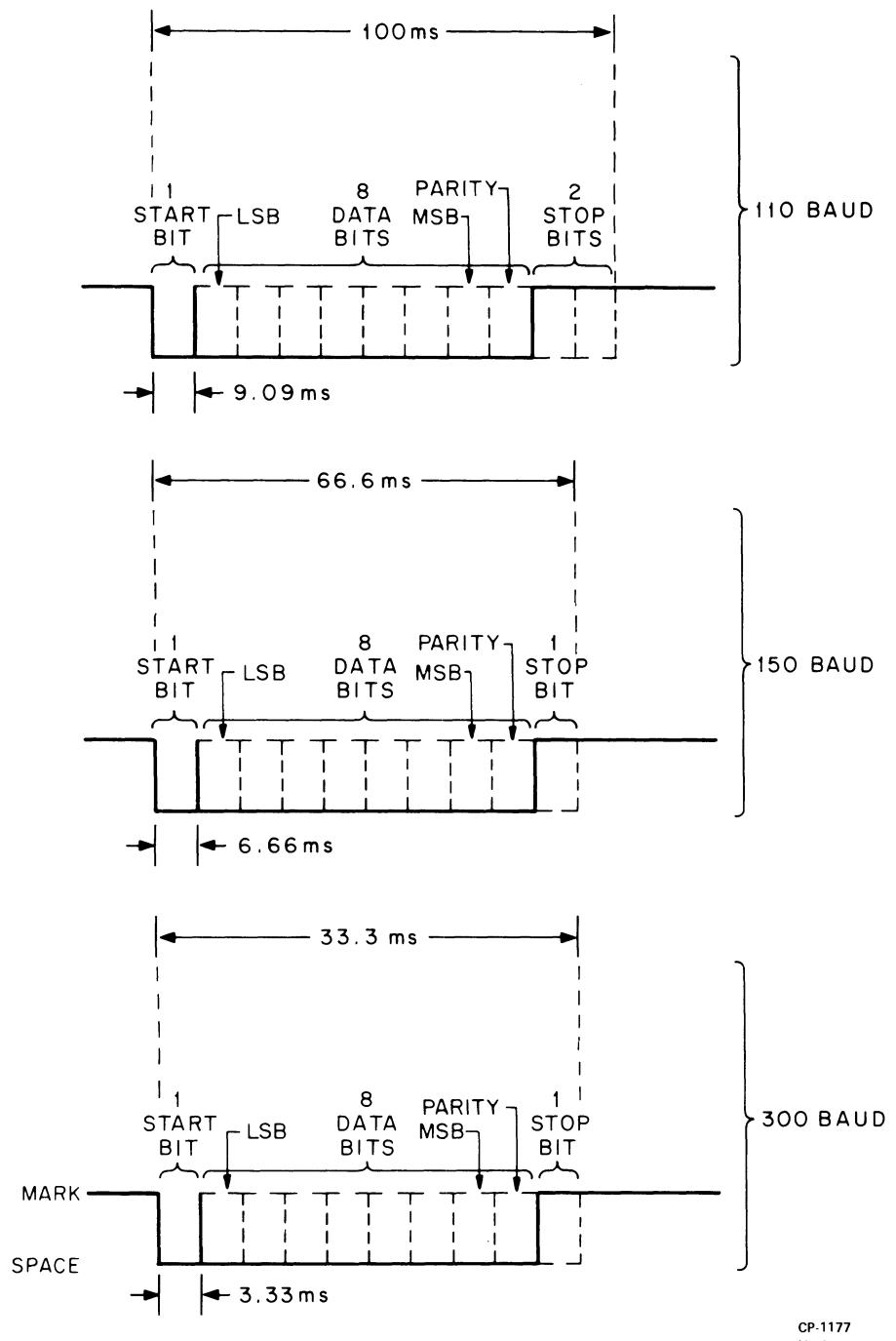
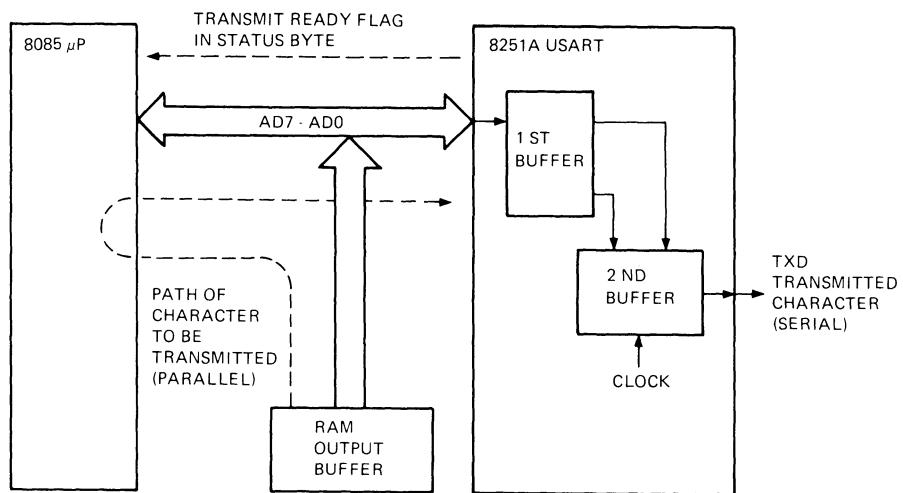
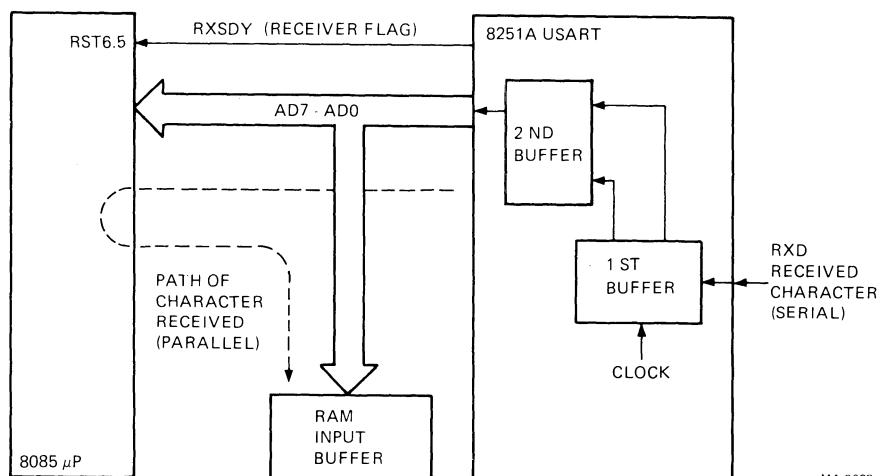


Figure 5-4 Serial Data Formats

CP-1177  
MA 9610



a. Transmit Data



b. Receive Data

Figure 5-5 Data Handling in the USART

### **Receive Data**

Any data that appears on the receive data line (RXD) is shifted into the USART receive buffer (first buffer). When a full character has arrived, the start, stop, and parity bits are removed. Parity is checked, and if bad, the parity error flag in the status byte is set. Data is transferred to the USART receive data buffer (second buffer), and the receive flag (RXRDY) is set. This flag requests an interrupt from the microprocessor. The microprocessor then has the amount of time it takes the next character to shift in to read the first character. After reading the character, the microprocessor checks the USART status byte to verify the integrity of the data. If the data is good it is sent to the input queue in RAM memory. If the data is bad, or another error is reported, a SUB character (⌘) is sent to the queue. If the microprocessor does not read the receive data buffer in time, the second character writes over the first one, which is lost. Then an overrun error is reported in the status byte.

**5.4.2.3 Baud Rate Clocks** – The DECwriter IV series terminals may be programmed or set-up to perform serial I/O communication at many different transmission rates, ranging from 50 to 9600 baud (bits per second) depending upon the terminal type. Figure 5-6 shows the hardware (logic) that creates the baud rate clocks used to shift the serial data stream in or out of the USART.

The microprocessor divides the 2 MHz crystal frequency by 2 and provides a 1 MHz CLK B signal to the printer controller (DC305) and USART (8251A) chips. Both these chips have programmable frequency dividers within them to scale the CLK B input down to the correct baud rate clock. Based on the selected baud rate (through keyboard set-up or an escape sequence), the microprocessor sends command bytes to the printer controller and the USART. The command bytes specify the mathematical configuration (divisor value) of the frequency dividers. The printer controller has two dividers to allow different receive and transmit (split) baud rates. These dividers output the intermediate transmit (TXC) and receive (RXC) clocks to the USART. The USART further divides the intermediate clocks by 16 or 64 to provide the final baud rate clock which is applied to the transmit/receive buffers.

Table 5-4 shows the clock periods and serial bit rate for each of the baud rates available. Note that all baud rates are not available on all terminals. It depends on model type and options installed.

**5.4.2.4 Interface Signals and Modem Control** – All terminals in the DECwriter IV series support full-duplex communication; that is, they can send and receive data at the same time. The LA34-AA, LA38-AA and LA34-RO series terminals also support a modem control scheme. When the terminal is configured for no modem control, data transmission and reception is always enabled while on-line. When modem control is enabled, both the terminal and the modem recognize the correct EIA signals before transmitting data.

The EIA communication interface complies with the standards created by EIA (RS-232-C) and CCITT (V.24). The EIA connector (type DB-25) pins and signals are defined in Appendix C. The signals supported are; Transmitted Data (TXD), Received Data (RXD), Request To Send (RTS), Clear To Send (CTS), Data Set Ready (DSR), Receive Line Signal Detect/Carrier Detect (RSLD/CD), and Data Terminal Ready (DTR). Table 5-5 shows the state of each interface signal while on-line with no modem control, on-line with modem control, and off-line.

Figure 5-7 shows how the interface signals are recognized or controlled by the terminal hardware. The Transmit Data (TXD)/Receive Data (RXD) serial lines are discussed in Paragraph 5.4.2.2. Basically, all the modem control lines are controlled by the microprocessor, either directly, or through the USART or the I/O transmitter/receiver.

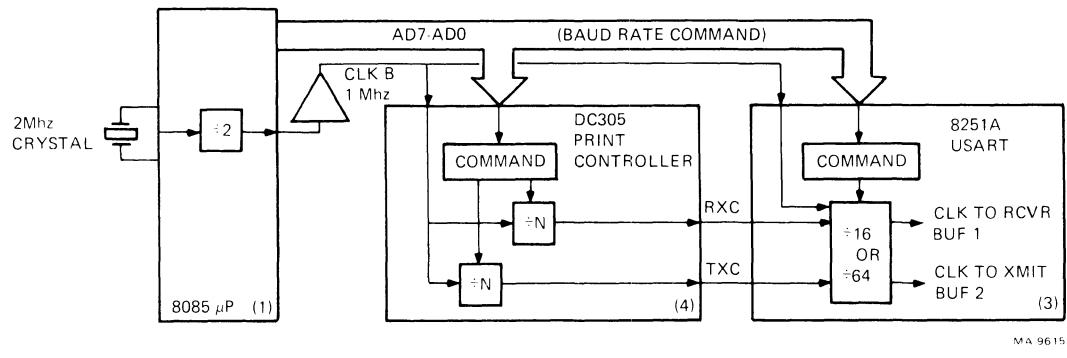


Figure 5-6 Creation of Baud Rate Clocks

Table 5-4 USART Baud Rates and Clock Frequencies

Baud Rate	DC305 Output		USART Serial I/O Bit Rate	
	TxC	RxC	XMIT	RCVE
50-T/50-R	312 $\mu$ s	312 $\mu$ s	20.0 ms	20.0 ms
75-T/75-R	208 $\mu$ s	208 $\mu$ s	13.3 ms	13.3 ms
110-T/110-R*	142 $\mu$ s	142 $\mu$ s	9.1 ms	9.1 ms
134.5-T/134.5-R	116 $\mu$ s	116 $\mu$ s	7.4 ms	7.4 ms
150-T/150-R	104 $\mu$ s	104 $\mu$ s	6.67 ms	6.67 ms
200-T/200-R	312 $\mu$ s	312 $\mu$ s	5.0 ms	5.0 ms
300-T/300-R*	208 $\mu$ s	208 $\mu$ s	3.3 ms	3.3 ms
600-T/600-R	104 $\mu$ s	104 $\mu$ s	1.67 ms	1.67 ms
1200-T/1200-R	13 $\mu$ s	13 $\mu$ s	883 $\mu$ s	883 $\mu$ s
1800-T/1800-R	8.7 $\mu$ s	8.7 $\mu$ s	556 $\mu$ s	556 $\mu$ s
2400-T/2400-R	6.5 $\mu$ s	6.5 $\mu$ s	417 $\mu$ s	417 $\mu$ s
4800-T/4800-R	3.3 $\mu$ s	3.3 $\mu$ s	208 $\mu$ s	208 $\mu$ s
7200-T/7200-R	8.7 $\mu$ s	8.7 $\mu$ s	139 $\mu$ s	139 $\mu$ s
9600-T/9600-R	6.5 $\mu$ s	6.5 $\mu$ s	104 $\mu$ s	104 $\mu$ s
<b>Split Baud Rates</b>				
75-T/600-R	208 $\mu$ s	26 $\mu$ s	13.3 ms	1.67 ms
75-T/1200-R	208 $\mu$ s	13 $\mu$ s	13.3 ms	883 $\mu$ s
150-T/600-R	104 $\mu$ s	26 $\mu$ s	6.67 ms	1.67 ms
150-T/1200-R	104 $\mu$ s	13 $\mu$ s	6.67 ms	883 $\mu$ s
300-T/2400-R	208 $\mu$ s	26 $\mu$ s	3.3 ms	417 $\mu$ s
300-T/4800-R	208 $\mu$ s	3.3 $\mu$ s	3.3 ms	208 $\mu$ s
600-T/2400-R	104 $\mu$ s	26 $\mu$ s	1.67 ms	417 $\mu$ s
600-T/4800-R	104 $\mu$ s	3.3 $\mu$ s	1.67 ms	208 $\mu$ s

\* LA34-DA, LA38-GA and LA34/38-AA without LAX34-XL/XM option, 110/300 baud only

**Table 5-5 Interface Signal States**

Common/RS-232-C/CCITT	Pin	On-Line Data Only	On-Line Modem Control*	Off-Line
TXD/BA/103	2	Active	Active	Mark
RXD/BB/104	3	Active	Active	Ignored
RTS/CA/105	4	On (LA34-AA) Off (LA34-DA)	On	Off
CTS/CB/106	5	Inactive (LA34-AA) Ignored (LA34-DA)	Active	Ignored
DSR/CC/107	6	Inactive (LA34-AA) Ignored (LA34-DA)	Active	Ignored
RLSD(CD)/CF/109	8	Inactive	Active	Ignored
DTR/CD/108.2	20	Active	Active	Off

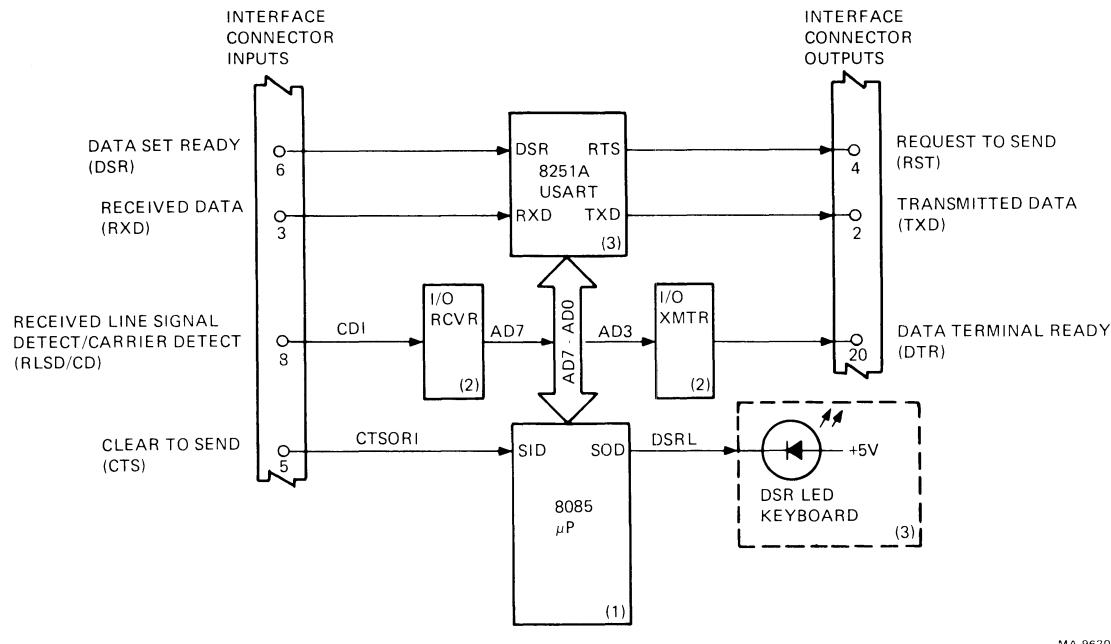
\* Does not apply to LA34-DA, LA38-GA terminals.

**KEY**

Off	The signal is deasserted at the EIA connector.
On	The signal is asserted at the EIA connector.
Active	The signal turns on or off depending upon state of printer or serial data stream.
Inactive	The signal is ignored at EIA connector but terminal forces signal function on internally.
Ignored	The signal is disregarded.
Mark	The signal is forced to the off (marking) state.

The microprocessor examines a bit (bit 7) in the USART status byte to detect the state of the DSR line and sets a bit (bit 5) in the USART control byte to assert the RTS line. Likewise, the microprocessor examines a bit (bit 7) from the internal I/O receiver to detect the state of the RLSD line and sets a bit (bit 3) in the internal I/O transmitter to assert the DTR line. The CTS line is examined by the microprocessor directly through its serial in data (SID) port by executing a unique internal microinstruction. A similar microinstruction raises the DSRL signal through the serial out data (SOD) port and causes the DSR LED on the keyboard to light.

**5.4.2.5 Internal Data Manipulation** – Figure 5-8 shows graphically how input/output data is managed by the microprocessor. Data moved to or from the USART or keyboard passes through one or both of two areas in RAM memory called queues. There is an input queue and an output queue. Both queues are in effect first-in/first-out (FIFO) buffers. The input queue has a variable length (determined by SET-UP or escape commands) and may be 100, 1184, or 2208 characters in length. The 1184 and 2208 character queue (buffer) is available only when the LAX34-XM option is installed. The output queue has a fixed length of 16 characters.



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Figure 5-7 Interface Signal Recognition and Control

Sources of data for the top of the input queue include the USART receiver and the bottom of the output queue when local echo is enabled (LA34-AA, LA38-AA control board jumper W12 out/LA34-DA, LA38-GA switch S6 set). Sources of data for the top of the output queue are the keyboard and the answerback message area in RAM.

During on-line operation, characters taken off the bottom of the input queue are sent to the character processing routine (one of the microprograms run during monitor polling). Characters taken off the bottom of the output queue are sent to the USART transmit buffer. In local operation, characters taken off the bottom of the output queue are sent to the character processing routine.

The character processing routine determines whether the character should be routed to the print line builder (a printable character), the escape sequence parser (an escape control character from the USART receiver), the SET-UP command handler (a set-up character from the keyboard), or the answerback message handler (answerback character being entered from the keyboard). The appropriate builder/parser/handler processes the character which is then either printed or made to effect a parameter change.

**5.4.2.6 Communications Firmware** – Figures 5-9 and 5-10 show the primary microprogramming tasks that are run when processing a character to or from the USART. Figure 5-9 shows the receive character processing routine entered when the USART raises the RXRDY line to the microprocessor generating an RST6.5 interrupt. Figure 5-10 shows the transmit character processing routine entered when the microprocessor wants to send a character out to the USART.

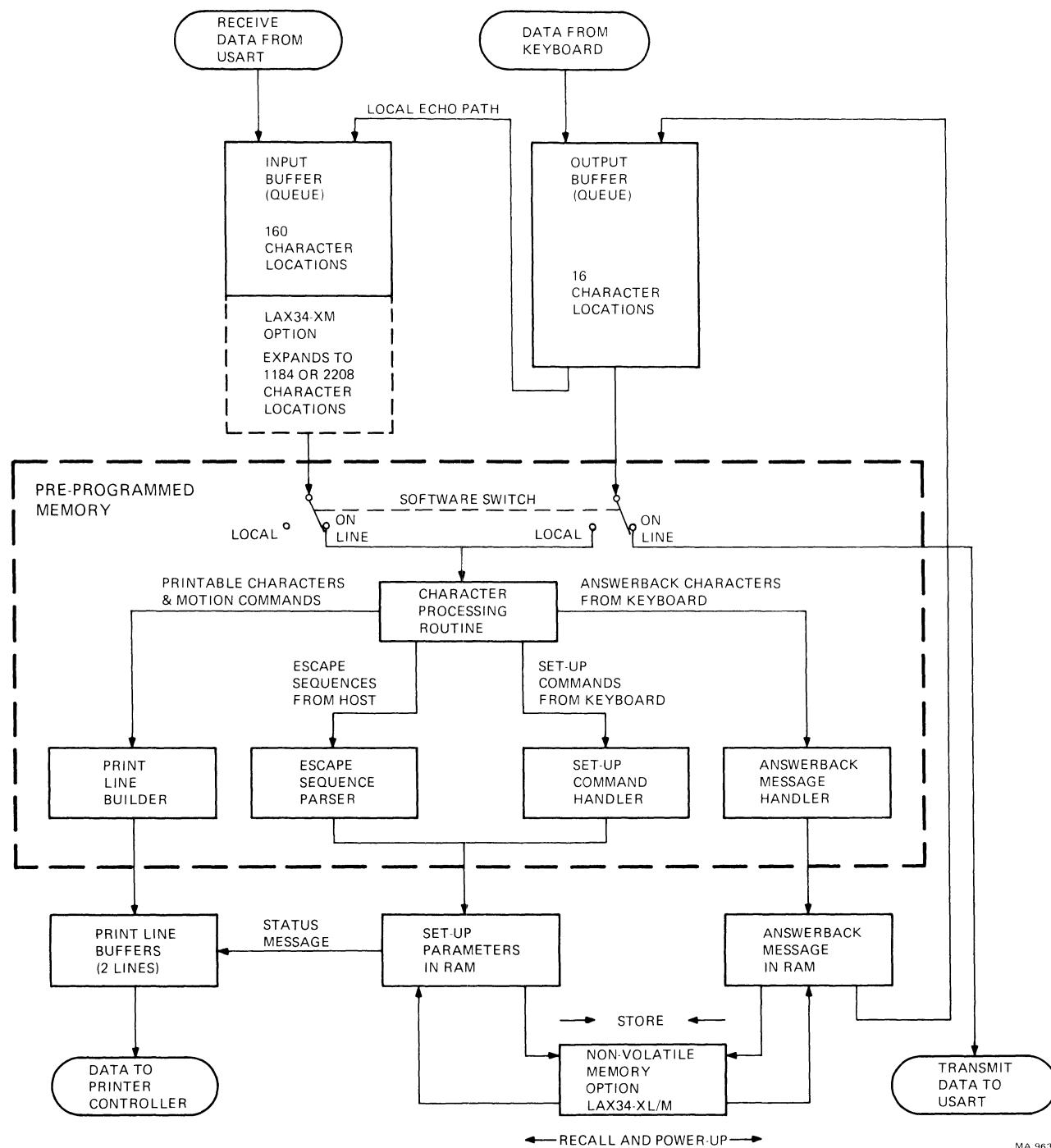


Figure 5-8 Internal Data Management

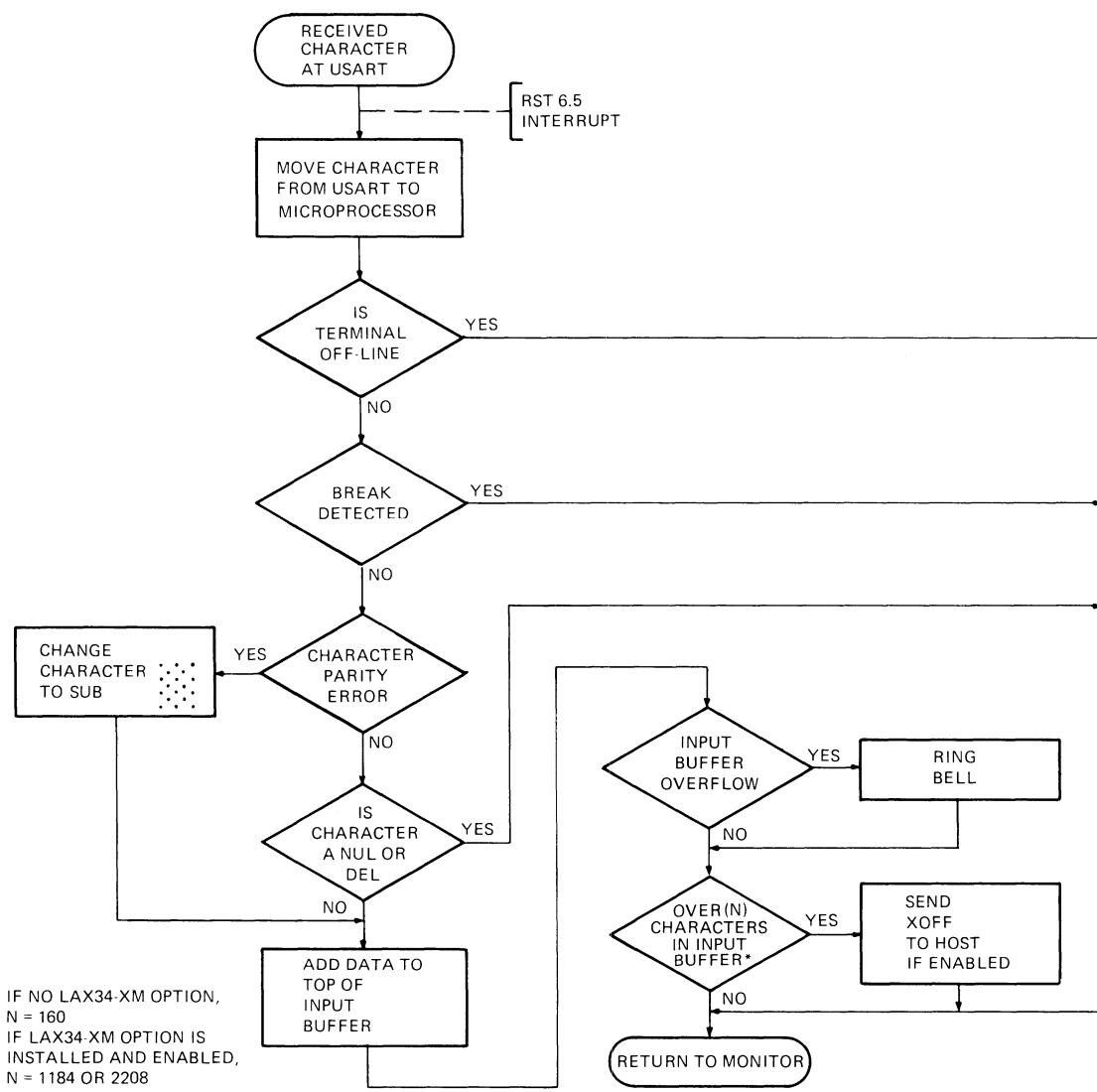
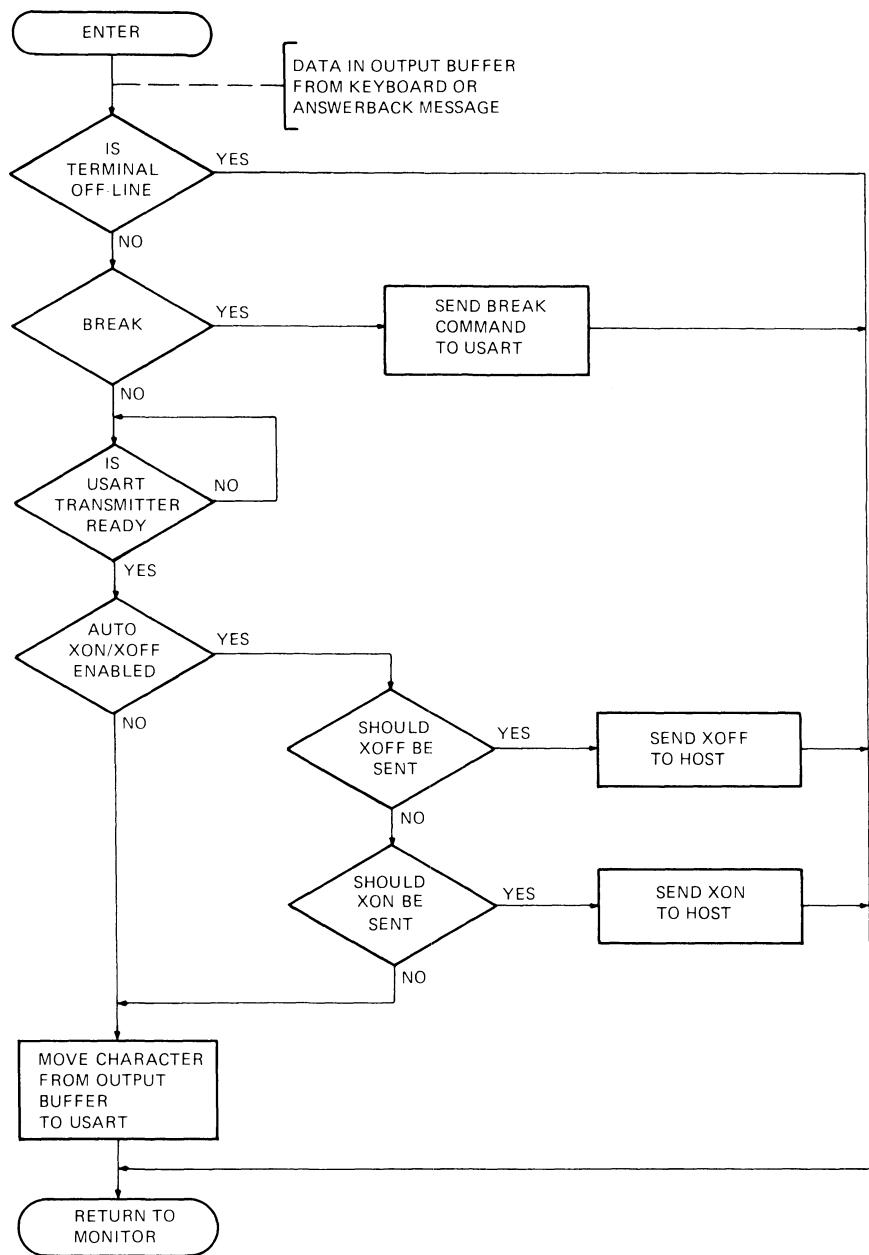


Figure 5-9 Receive Character Processing Routine



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Figure 5-10    Transmit Character Processing Routine

### 5.4.3 Keyboard

The keyboard for the DECwriter IV send and receive series terminals is a typewriter-like array of momentary, normally open switches. The DECwriter IV receive-only series terminals use a smaller version of the keyboard with only four keys. Both keyboard types include three LED status indicators. The operating principles behind both types of keyboards are the same. For that reason, this paragraph describes only the send/receive type keyboard. The keyboard mounts in the base of the terminal and connects electrically with the control/logic board at J6 through a single flat cable.

The microprocessor in the terminal directly addresses and reads the keyboard switch array, filters the data and generates the correct ASCII codes for the output buffer or performs other internal actions. Figure 5-11 shows a functional block diagram of the keyboard switch array and supporting logic.

The keyboard switch array appears to the microprocessor as 16 bytes of bit-encoded data; one bit per switch. It is a two dimension array of contact pairs arranged in 16 columns and 8 rows (Figure 5-12). Each column has a unique address in the keyboard range ( $3000\text{-}3016_{16}$ ). Each row has a unique bit position in the data byte returned to the microprocessor. The microprocessor “reads” the switch array by addressing any one of the 16 columns and looking for a one bit in the data byte read back. Bits that are read back as 1’s are closed keys, while 0’s are open, unpressed keys.

For example, if the microprocessor is currently reading address  $3002_{16}$  and an  $E1_{16}$  byte is read (bits 0 and 7 are ones), this would indicate that the SHIFT and 2 are pressed down. This means that the operator wanted to send or print the @ character. (Rows corresponding to bit positions 5 and 6 are not used. These bit positions are read back as constant 1’s.)

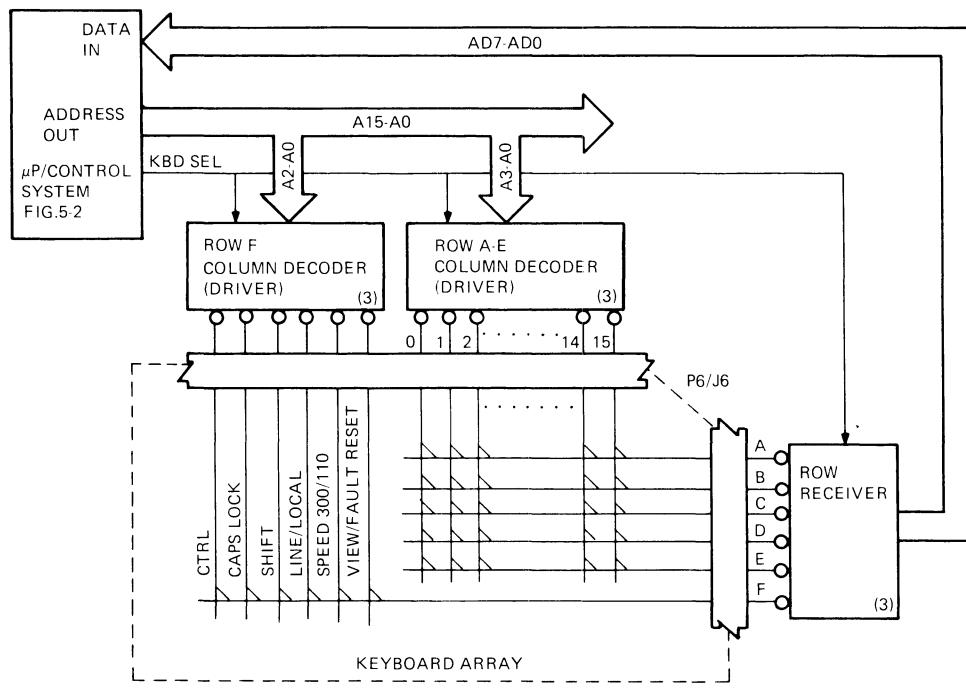


Figure 5-11 Keyboard Logic

ADDRESS 16	DATA BIT						
	ROW F D7	D6 D5	ROW E D4*	ROW D D3	ROW C D2	ROW B D1	ROW A D0
3000 COLUMN 0	CTRL	(UNUSED)	N1	Z	TAB	ESC	SET-UP
3001 COLUMN 1	CAPS LOCK	(UNUSED)	N2	X	A	Q	! 1
3002 COLUMN 2	SHIFT	(UNUSED)	N3	C	S	W	@ 2
3003 COLUMN 3		(UNUSED)	N4	V	D	E	# 3
3004 COLUMN 4		(UNUSED)	N5	B SPACE	F	R	\$ 4
3005 COLUMN 5	LINE/ LOCAL	(UNUSED)	N6	BAR	G	T	% 5
3006 COLUMN 6	SPEED	300/110	(UNUSED)	N7	H	Y	^ 6
3007 COLUMN 7	VIEW/ FAULT		RESET†	(UNUSED)	N8	M	J
3008 COLUMN 8				(UNUSED)	N9	<	VT†/. K
3009 COLUMN 9	CTRL CAPS			(UNUSED)	NO	>	FF†/ L
300A COLUMN 10	LOCK				?	/	O
300B COLUMN 11	SHIFT		(UNUSED)	N.	:	;	P
300C COLUMN 12				ENTER	,	{	) 0
300D COLUMN 13					,	[	— —
300E COLUMN 14	LINE/ LOCAL			N,	LF	}	+ =
300F COLUMN 15				(UNUSED)	N-	]	HERE IS LOCAL
					\	DEL	~ \ FF LOCAL LF
				PF1	PF3	BREAK	BS
				PF2	PF4	RET	

\* Nx = Key labeled "x" on numeric keypad.

† = LA34-AA only

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Figure 5-12 Keyboard Array Internal Addressing

When the microprocessor determines that a switch closure has been made, it references the point in the keyboard matrix to a firmware table where it converts to an ASCII character representation. In the above example (@), a  $40_{16}$  ( $100_8$ ) would be placed into the output buffer for processing. The microprocessor continues the scanning process, looking at all columns and all rows for a one bit. A complete scan of all available keys in the send/receive terminal keyboard is performed every 12.5 milliseconds. Therefore, every key is examined 80 times per second.

For a key to be recognized as a new key, it must not have been down in the scan before the entry is accepted. The microprocessor checks each key's history (in RAM) at each scan. If a key was down during the last scan, it is old and not re-entered. Only new keys, those previously not seen, are entered. This system allows a key to be held down without being continuously entered at each scan.

If the key is detected as down for the first time in a while, the microprocessor assumes that it has been pressed. During the scan when the key is first down, the contacts may bounce for many milliseconds. The time window when the contact is examined is very short ( $1.5 \mu s$ ). If the contact happens to be bouncing open during that interval, it is not detected in that scan, but the time between scans is long so it is finished bouncing by the next scan and is detected normally. If the contact happens to be closed for the first scan while still bouncing, it is detected. It is also detected on the next scan after it has stopped bouncing but now it is an old key and is not re-entered.

More than one key can be down and be accepted. This is called key rollover. Normally the DECwriter IV accepts three-key rollover. If the keys were pressed during different keyboard scans, they will be accepted in the order in which they were pressed. If they were all pressed during the same keyboard scan, they will be accepted in the order in which they are addressed.

As a result of the keyboard's design, simultaneous pressing of three or more keys can make it appear that one or more additional keys are also pressed, but in fact are not. Specifically, three switches closed in three corners of a rectangular pattern, as in Figure 5-13, will cause a fourth apparent key closure. This phenomenon is called the sneak path. (Refer back to Figure 5-12 to see how the pattern fits into

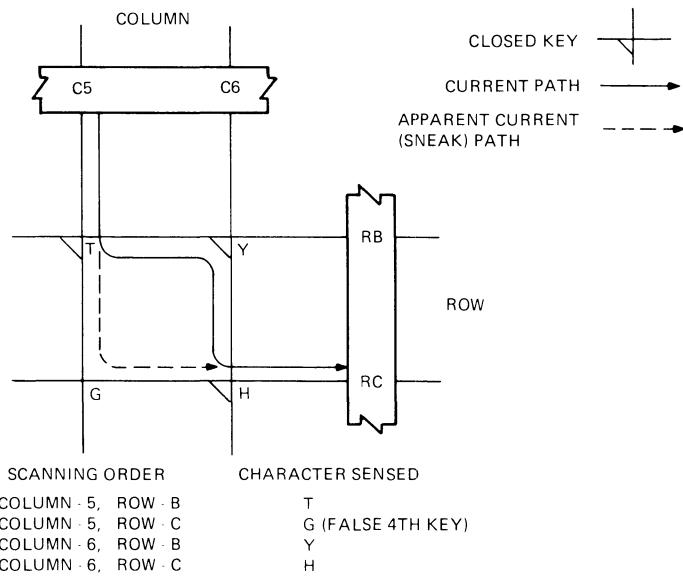


Figure 5-13 Sneak Path

the row-column configuration.) For this reason, although the microprocessor may detect any number of key closures during a keyboard scan, no more than three may be detected if any are to be accepted. If four or more are detected, the terminal ignores all of them and waits for a scan with only three.

The special function keys (**CTRL**, **CAPS LOCK**, **SHIFT**, **LINE/LOCAL**, **SPEED 300/110**, and the **VIEW/FAULT RESET** keys) are in a part of the matrix where there is no pattern sensitivity and no ambiguity. They are all accepted in the same scan with the regular keys and are not counted in the three-key maximum. The special function keys are all combined into row F (bit 7).

The sneak path problem is also the reason that the microprocessor looks for the appearance of a key in two consecutive scans. In Figure 5-13, the keys are scanned in the order **T**, **G**, **Y**, **H**. Usually, the microprocessor counts the number of keys in a scan and ignores all of them if the count is over three, as it is in this example. But it is possible for the user to briefly press keys **T**, **Y**, and **H** and then release **H** before the scan is completed. Then the microprocessor might detect **T**, **Y**, and the false key **G**, and, because **H** was lifted immediately before it was scanned, register only three keys. One would be false, but with a count of only three, all would be accepted. To prevent this, the microprocessor looks for the same keys two scans in a row. Because the **H** key is released, the **G** key does not appear in the second scan, and only **T** and **Y** appear and are accepted as valid.

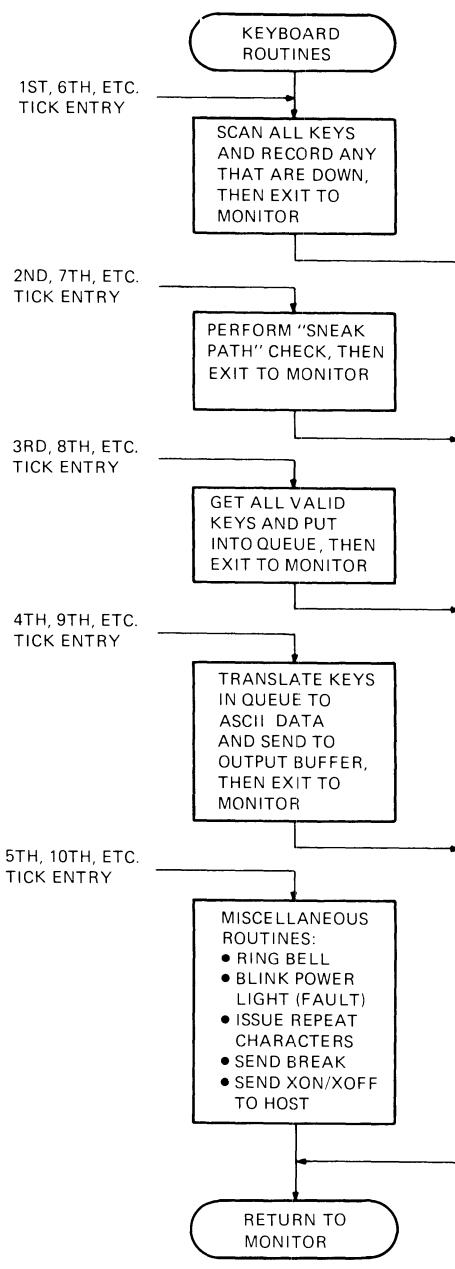
The microcode routines connected with keyboard sensing and data processing are shown in Figure 5-14. Referring back to Figure 5-3, the monitor loop, the keyboard is scanned as a result of a tick interrupt (RST 3) from the printer controller chip. The scan actually takes place every fifth tick interrupt. Figure 5-14 shows that the other tick interrupts cause other keyboard related jobs to run such as, performing the sneak path check, translating the keyboard matrix location to an ASCII character, and performing miscellaneous tasks.

#### 5.4.4 Printing/Printhead Positioning Process

This paragraph describes how data stored away in RAM buffers is processed and how characters are formed on paper. It also describes how the printhead/carriage positions to cause the dots that make up a character to be placed in the correct spot.

**5.4.4.1 Overview** – The DECwriter IV is an impact printer that uses a 7-wire solenoid activated printhead. The printhead is driven horizontally (left-to-right) and prints characters in a  $9 \times 7$  dot matrix. The text mode characters are formed from microcode tables using a style that does not permit the use of horizontally adjacent dots. Therefore, the maximum number of dots per single-width character is 35 ( $5 \times 7$  matrix). The LA34-AA, LA38-AA versions print double-width characters in the 5, 6, 6.6, and 8.25 character per inch modes. Therefore, the maximum number of dots per double-width character is 70 ( $10 \times 7$  matrix).

While processing characters in text mode, characters are printed as they are received. In graphics mode, each character received defines a specific set of dots to be printed. A one-to-one relationship does not occur between the sequence of received characters and the activity of printing. Columns of dots are collected and printed in groups of fourteen. A group of columns is printed when either 14 columns of dots have been received, or when an “exit graphics mode” command has been received. Because any dot pattern may be specified, and because there is no inter-character gap present in graphics mode, a dot density of 100 percent can be achieved in this mode. As a result of this high dot density, the rate of printing is much slower than is possible in the text mode of printing.



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Figure 5-14    Keyboard Microcode Routines

The center of the printing/printhead positioning process is the DC305 printer controller chip. The DECwriter IV series terminals use the DC305 for special functions beyond the capabilities of the microprocessor chip. The functions of the DC305 that are discussed in this paragraph are:

- Printhead servo motor control,
- Printhead position tracking, and
- Printhead solenoid control.

Figure 5-15 shows a functional overview of the printing/printhead positioning process. The microprocessor/control system issues a series of commands to the DC305 that instruct it to print a character. This includes a start print command to initialize the process and a servo speed/direction command. Servo speed depends on the horizontal character pitch selected. Direction is always positive (left to right) when printing, except for carriage returns and repositioning after view (last character visibility) which is negative (right to left).

A position encoder mounted at the back of the servo motor is directly connected to the motor shaft. The encoder sends a pulse train to the DC305 which keeps track of the current head position anywhere across the carriage assembly in an internal register. The microprocessor queries this position register regularly to determine printhead acceleration, velocity, and relation to the selected left and right margins.

During the time that the printhead is accelerating, the DC305 requests the first bits of character information required for printing on paper. Remember that the microprocessor has previously stored away in RAM an ASCII-coded representation of the character that it wants to print. Now that character must be translated into a series of vertical dot patterns. The microprocessor performs this translation and sends groups of "dot data" bytes to the DC305 on request. Each dot data byte has an encoded pattern of dot bits that the DC305 uses to fire specific head solenoids in order to create the desired character on paper. If the DECwriter IV is operating in graphic mode, a different type of translation is performed. Each graphic character sent by the host is processed and printed as one vertical pattern of dots.

When the DC305 determines that the printhead is in the correct position, it fires the solenoids on the fly for the first vertical dot pattern representation of the character. Immediately the DC305 shifts more dot data to its output while asking for more dot data bytes from the microprocessor via a hardware interrupt. This process continues until the character is completely printed at which time the DC305 decellerates the printhead servo motor to a complete stop.

**5.4.4.2 Servo/Head Positioning** – The servo/head positioning logic and microcode is responsible for accelerating the printhead, maintaining its velocity during the impact printing phase, and decellerating the printhead when printing is complete. Figure 5-16 shows the logic connected with this process.

The microprocessor/control function sends speed/direction commands to the DC305 printer controller chip. The speed command specifies the direction of head movement (left-to-right for printing, right-to-left for carriage return) and the magnitude of the carriage servo's speed (velocity). The binary value of the speed command is computed based on how far the printhead is from where it should be. Once the speed command is sent, the tachometer and feedback control circuitry in the DC305 try to maintain it. The microprocessor decreases the magnitude of the speed command as the printhead moves nearer to the correct location. This is so that it arrives there at a reasonable speed.

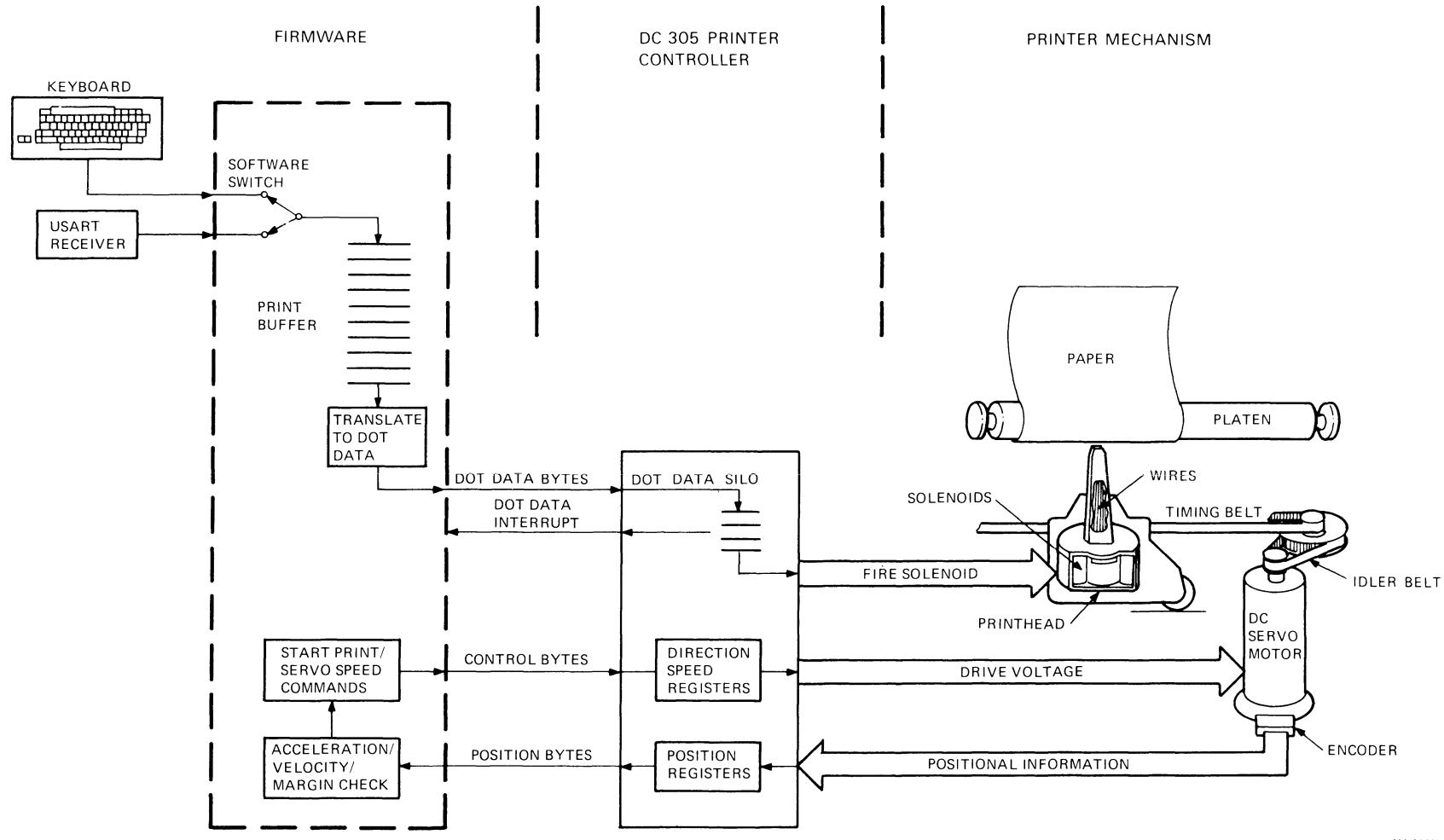


Figure 5-15 Printing/Head Positioning Process

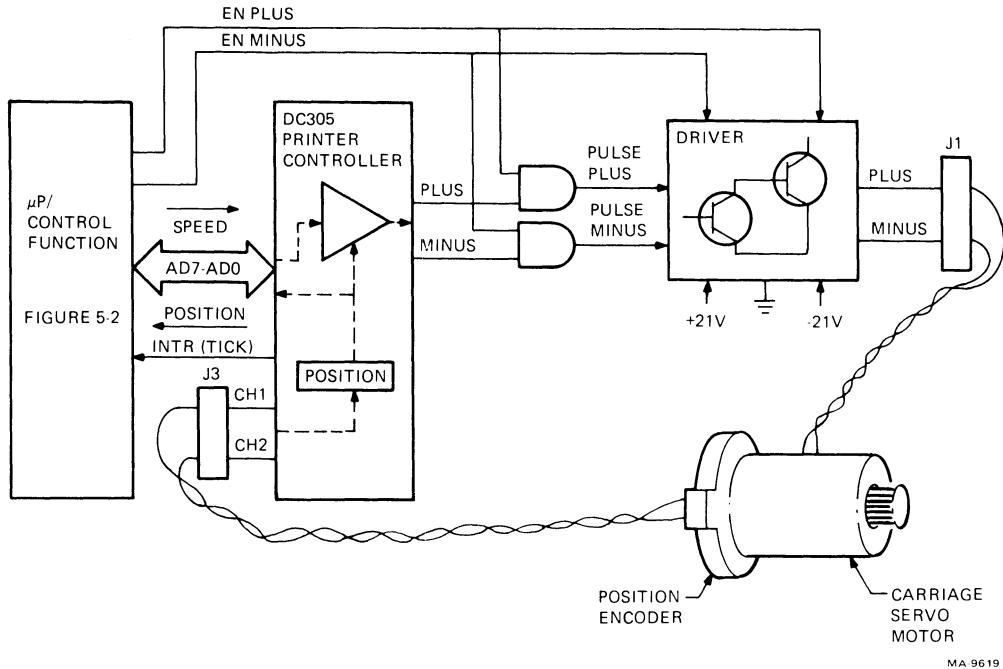


Figure 5-16 Servo/Head Positioning Logic

The DC305 controls carriage speed by a pair of pulse streams. These are output signals PLUS and MINUS. PLUS and MINUS are ANDed with EN PLUS and EN MINUS from the microprocessor/control function to produce PULSE PLUS and PULSE MINUS. The enabling signals (EN PLUS, EN MINUS) are always held true as long as a head jam does not occur. This maintains a holding current through the servo motor so that position is not lost during idle periods.

The PULSE PLUS and PULSE MINUS signals input to the servo driver network where they are conditioned and current amplified. Both pulse streams are duty cycled to produce the correct output voltage to the servo motor. The first pulse stream has a duty cycle that is proportional to the binary value of the speed command. The second pulse stream has a duty cycle that is proportional to the frequency of the printhead position feedback signals (i.e., motor speed). The integrated pulse streams are subtracted in the driver network to yield the motor voltage. A steering circuit in the DC305 interchanges the the roles of the two pulse streams to provide direction control as a function of the speed command and the motor speed.

The position of the printhead/carriage is measured by an incremental two-channel encoder mounted on the back of the servo motor. Each channel (CH1 and CH2) has a square wave output with the output of one channel leading the output of the other channel by 90 degrees. Therefore, their binary states change in quadrature to each other (00, 01, 11, 10, 00) as the carriage moves. The CH1 and CH2 position signals enter the DC305 where they accumulate in a register. The microprocessor reads the position register every tick interrupt (2.5 ms intervals) to determine, and if necessary correct, the print-head speed, and position over the width of the carriage.

**5.4.4.3 Character Printing** – Figure 5-17 shows the logic connected with the impact printing process. When there is at least one character to print, the microprocessor/ control function first clears, then loads the first-in/first-out dot buffers (dot FIFOs) in the DC305 with the first four columns of character or graphic dot data. The dot FIFOs are used to buffer and transmit character (or graphic) dot patterns from the microprocessor to the printhead solenoid drivers.

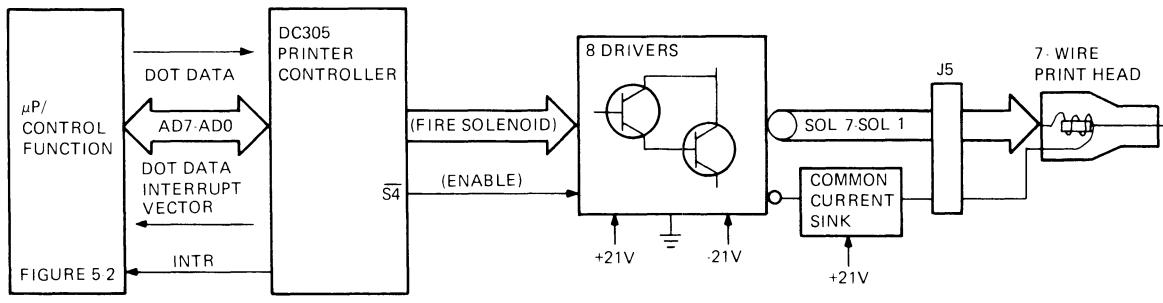


Figure 5-17 Printing Logic

When the carriage speed and position are correct for printing, the microprocessor enables printing and the dot interrupt by sending certain commands to the DC305. Printhead motion signals from the carriage position encoder are combined with horizontal pitch SET-UP data to trigger a countdown timer that allows selected head drivers to be turned on. At the termination of the count, the drivers are turned off and the dot FIFOs advance the next column of dot data to solenoid driver inputs.

When there is room for more dot pattern data in the FIFOs, the DC305 generates a dot data interrupt (RST 5) to the microprocessor, asking that it load more dot data. When there is no more dot data to be printed, the microprocessor disables the dot interrupt. When the FIFOs become empty, printing stops.

When a head driver is turned on by the DC305, the driver output (SOL7-SOL1) goes low. This causes the head solenoid to energize through the common current sink which drives the respective head wire out of the head impacting the ribbon and paper.

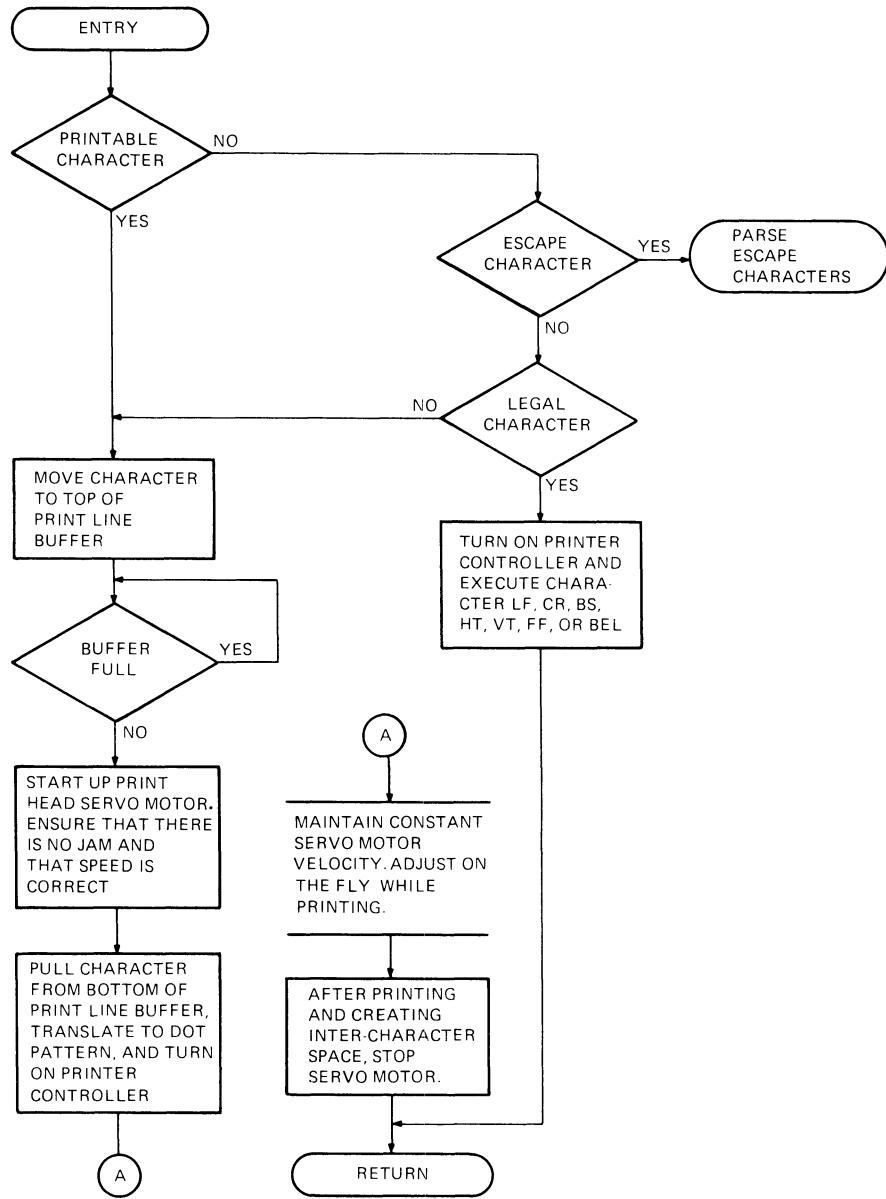
**5.4.4.4 Microcode** – Figure 5-18 shows a simplified flow of the internal microcode associated with printing and carriage control.

#### 5.4.5 Paper Advancing

Paper is advanced by the paper feed subsystem which includes:

- A stepper motor,
- A paper drive cluster gear,
- A platen assembly,
- A friction assembly,
- Associated circuitry on the control/logic board, and
- An optional pin-fed tractor assembly.

Figure 5-19 shows the paper feed subsystem. When the microprocessor/control function identifies a line feed character in the print buffer, it issues a series of commands to the DC305 printer controller chip. These commands include a control byte that sets up a real time clock in the DC305, and a line feed motor control byte which issues a two-bit state field to the motor drivers. This state field controls the polarity of the voltage to each of the line feed stepper motor windings. A third control byte issues a bit that controls the amplitude of the current in the stepper motor windings. A higher current is used to run the motor than to hold a steady position.



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Figure 5-18 Print Character Routine

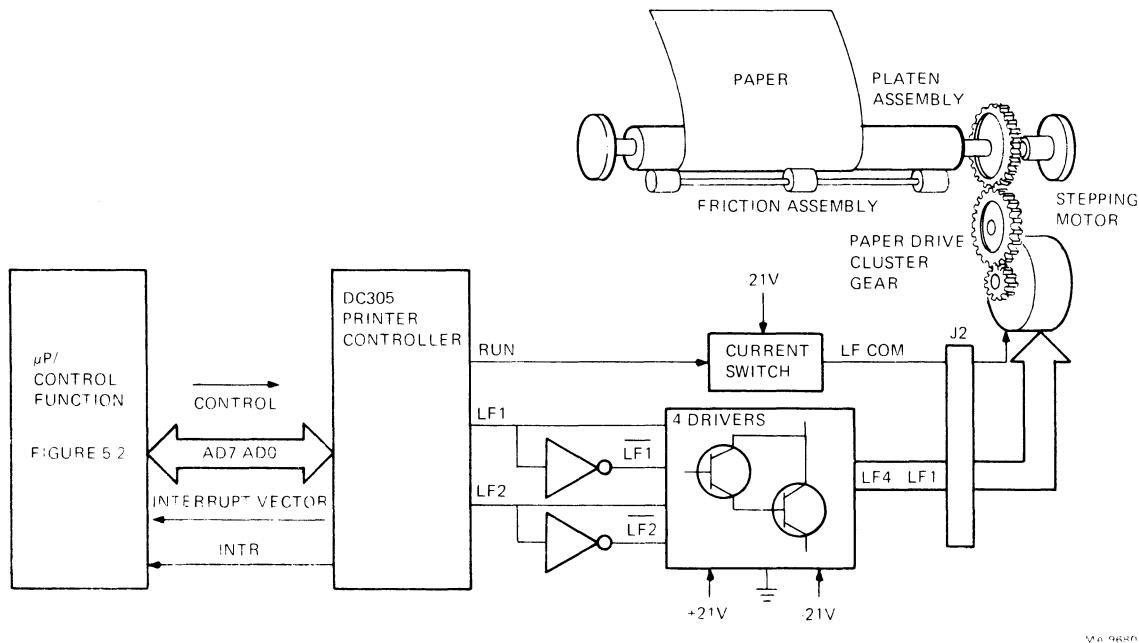


Figure 5-19 Paper Feed Subsystem/Logic

The state field directly affects the DC305 motor control output lines LF1 and LF2. These lines and their complements are input to the line feed motor driver to form a four-phase control field. The motor control outputs operate in the following sequence of states to produce paper movement.

Paper Step	Upward		Downward	
	Paper Motion	LF1/LF2	Paper Motion	LF1/LF2
1	0	0	0	0
2	0	1	1	0
3	1	1	1	1
4	1	0	0	1
5	0	0	0	0

The four driver outputs, LF1-LF4, connect to the stepper motor through jack J2. At any given time, two of the four outputs are always driving current through two of the four stepper motor windings. The sequence in which the windings are energized determines which way the motor will turn. The motor windings are connected together at a common point (LF COM) and return through the current switch. When the DC305 asserts the RUN signal, the current switch changes from the holding current mode to the higher running current mode.

As the stepper motor advances through one of its steps, the real time clock (initialized at the beginning of the command) times out and causes an interrupt to occur. The microprocessor recognizes the interrupt, reinitializes the clock, and sends the next state control command to the DC305, if needed, therefore enabling a different combination of motor windings. This sequence of interrupts and state change commands continues until the line feed motor has advanced the other components of the paper feed subsystem to the correct point.

The rotary motion of the stepper motor armature is transferred through the paper drive cluster gear to the platen assembly. The platen turns, thus moving the paper due to the pressure caused by the friction assembly. When the optional tractor assembly is installed, the friction assembly is disabled because the tractor pins pull the paper across the platen. The use of tractors permits flat surface feeding which eliminates interleaf slippage in multipart forms. When using tractors however, only upward paper motion is permitted because the tractors cannot push the paper back across the platen in a downward direction.

#### **5.4.6 Power Supply and Distribution**

The DECwriter IV series terminals use the H7834 power supply. The H7834 is a completely self-contained supply and is located in the bottom rear of the terminal enclosure. The following paragraphs follow the distribution of power through the terminal and offer a short functional description of the H7834.

**5.4.6.1 Power Distribution** – Power is distributed through the terminal as shown in Figure 5-20. Line voltage (115/230 Vac) enters the supply through a detachable power cord. The supply transforms line voltage into five direct current voltages; +5, +12, -12, +21, and -21 Vdc. The dc power exits the supply at connector J2, is conducted across an 8-wire cable, and enters the control/logic board via J4.

The control/logic board uses the +5 Vdc supply for general logic voltage, the ±12 Vdc supplies for communication line conditioning, and the ±21 Vdc supplies for the printhead/servo motor/stepper motor driver circuits.

If the optional extended logic board is installed, +5, +12, and -21 Vdc leave the control/logic board at connector J8, travel across a flat cable, and enter the option board at connector J1. The extended logic board uses the +5 Vdc supply for general logic voltage, and the +12/-21 Vdc supplies to generate -24 Vdc for the nonvolatile ROM chip.

#### **5.4.6.2 H7834 Power Supply**

##### **Specifications**

The H7834 is a pulse-width modulated, flyback, switch-mode type power supply. The following is a list of the input/output specifications for the H7834.

##### **Input**

90-128 Vac, 47-63 Hz @ 1.3 A  
174-256 Vac, 47-63 Hz @ 0.7 A  
65 W maximum

##### **Outputs**

+5.1 Vdc, ±5% @ 2.0 A maximum	Or any combination that equals 22 W
+12 Vdc, ±5% @ 0.2 A maximum	
-12 Vdc, ±5% @ 0.2 A maximum	
+21 Vdc, ±10% @ 0.5 A maximum } -21 Vdc, ±10% @ 0.5 A maximum }	

All outputs over-current protected, +5 over-voltage protected at +5.4 Vdc

##### **Functional Description** (Refer to Figure 5-21)

AC line voltage entering the supply is filtered, fused, and passes through a voltage selection switch matrix. AC voltage from the matrix goes to a low current bias supply which provides a +12 start-up voltage to the control circuitry. This bias voltage is provided so that, at power up time, the supply's switching elements start up in a predictable way.

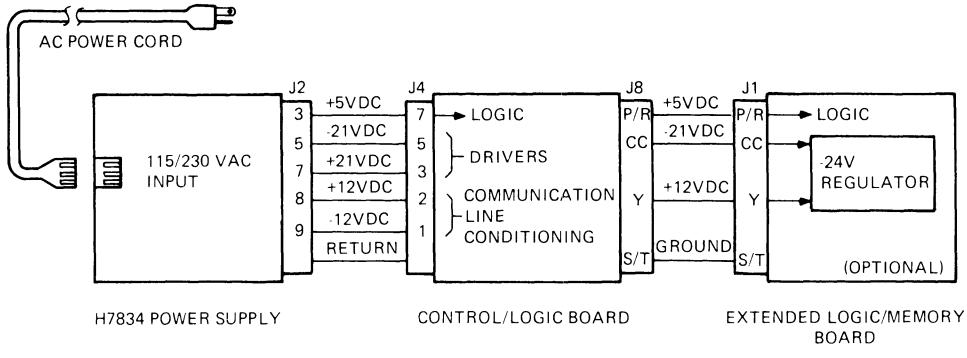


Figure 5-20 DECwriter IV Power Distribution

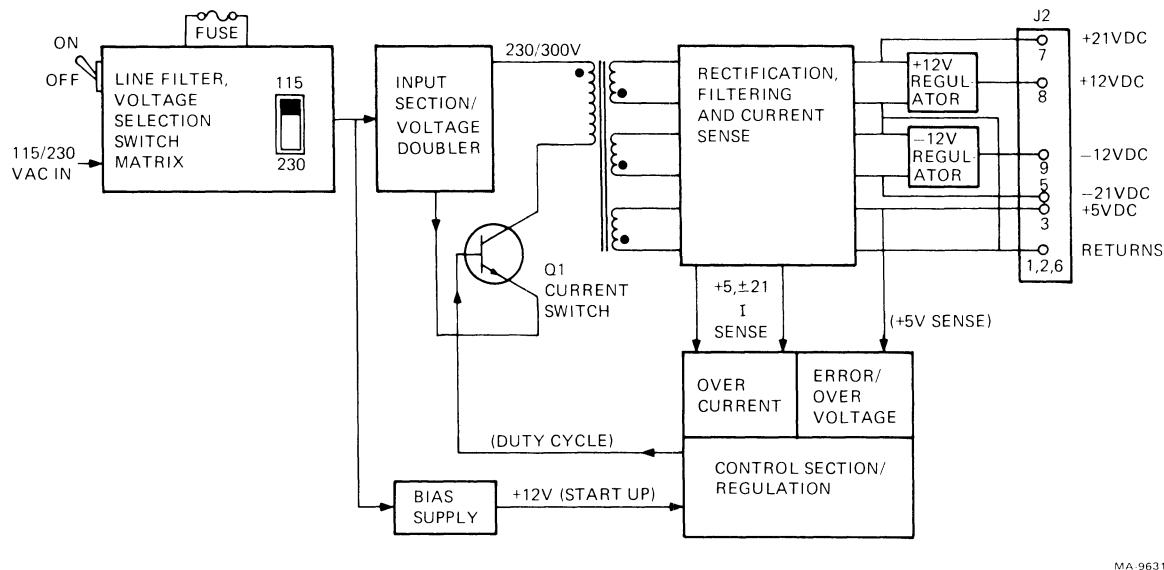


Figure 5-21 H7834 Power Supply Functional Block Diagram

AC voltage from the matrix also goes to the input section where it is rectified. When operating from a 230 Vac source, the rectification is accomplished through a full-wave bridge and input to the transformer (T3) primary winding. If the source voltage is 115 Vac, it is rectified through a voltage doubler network and approximately 300 Vdc is input to the primary.

The control section starts up by producing a chopped waveform to the base of the switch transistor (Q1). The switch transistor turns on causing current to conduct through the transformer primary. When the control section turns the switch transistor off, the stored energy in the transformer primary is transferred to the three secondaries. This constitutes the "flyback" action. So, the effective energy profile in the transformer would be a leading-ramp sawtooth.

Secondary voltages are rectified and filtered to produce the +5, +21, and -21 volt outputs. The +12 volt regulated output is developed from the +21 volt supply through a three terminal linear regulator. Similarly, the -12 volt regulated output is developed from the -21 volt supply through a 3-terminal linear regulator.

Resistors in the +5 and  $\pm$  21 volt supplies develop current sense signals that provide part of the feedback input to the control section. The other part of the feedback is formed by +5 volt sense. Together, the two feedback elements cause the control section to act as a regulator, varying the chopping frequency and duty cycling to the current switch. The duty cycle of the 34 KHz chopping frequency is changed as a function of the voltage sense feedback. The frequency is halved (17 KHz) when over-current is sensed.

The  $\pm$  21 volt supplies do not have regulators, nor do their outputs return to the control section to form part of the feedback network. Instead, they are cross-regulated from the +5 volt supply.

#### 5.4.7 Options

This section describes the Extended Logic (LAX34-XL), Extended Logic with Memory (LAX34-XM), and Current Loop Adapter (LAX34-CL) options.

**5.4.7.1 LAX34-XL Extended Logic and LAX34-XM Extended Logic with Memory Options** – The Extended Logic (XL) option expands the capabilities of the LA34-AA and LA38-AA terminals. Basically, the Extended Logic option provides 45 character per second throughput for interface transmission at rates greater than 300 baud and faster terminal set-up with parameters stored in a nonvolatile state. It also allows the user to enter and save a 30-character answerback message, allows interface communication up to 9600 baud, allows split transmit/receive baud rates, and provides the Advanced Programming Language (APL) character set.

The Extended Logic with Memory (XM) option provides all of the features of the XL option plus an added 2048 bytes of RAM memory. This memory is a temporary storage area for characters received at the terminal input at baud rates higher than the mechanical sections of the printer can physically process.

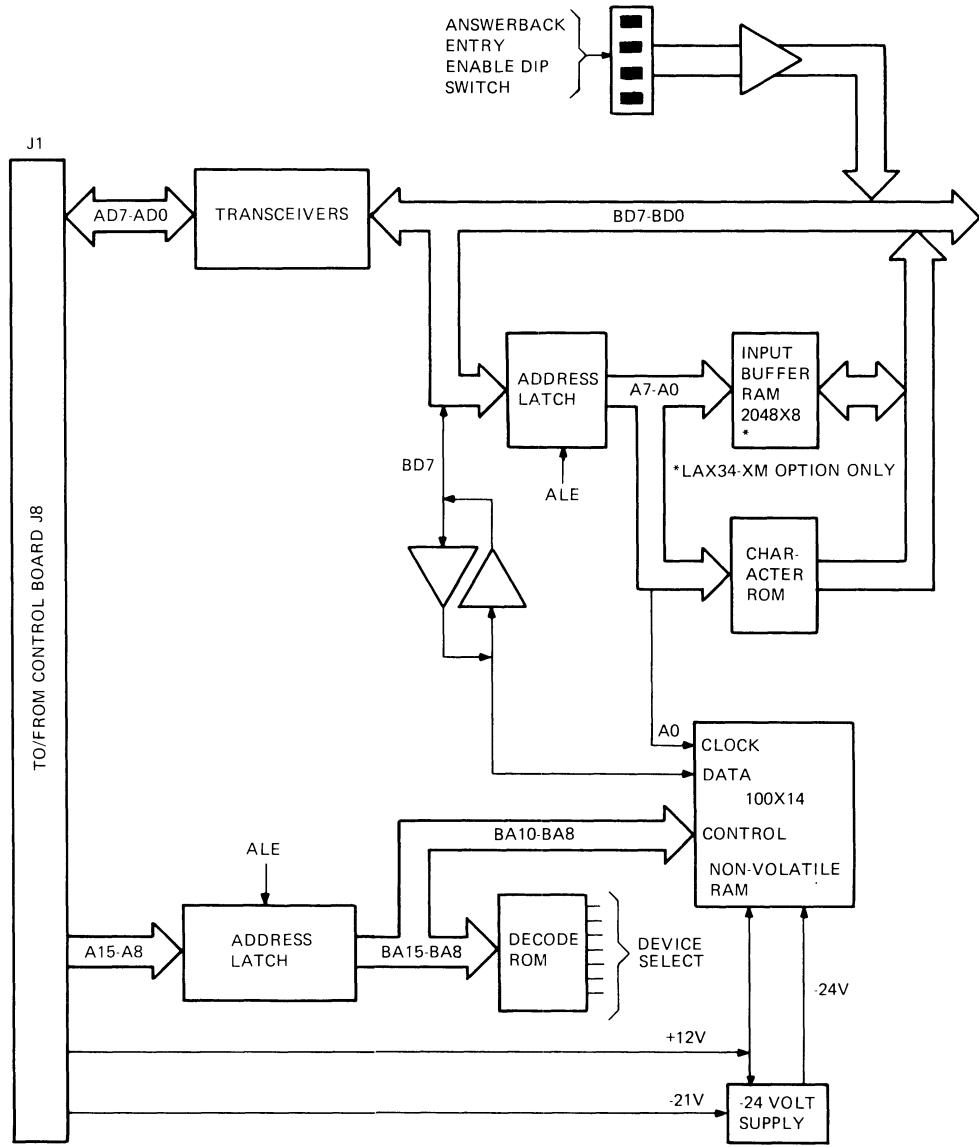
#### Physical Description

The Extended Logic (XL) and Extended Logic with Memory XM options consist of an internal plug-in board which mounts next to the control board in LA34/38-AA terminals only. Either option interfaces to the control board via a single flat cable which attaches to control board J8. The options also include a PROM chip with a modified operating system (monitor) that replaces one of the PROMs on the control board.

#### Functional Description (Refer to Figure 5-22)

The microprocessor/control function on the LA34 control board addresses the XL/XM options via address lines A15–A8 and multiplexed address/data lines AD7–AD0. The high and low order addresses are latched by the signal address lines enable (ALE). The high order byte is asserted on lines BA15–BA8 and the low order byte is asserted on lines A7–A0. The BA lines address the input of a decode ROM whose outputs select different elements of the option depending on the address such as, the DIP switch, the character ROM, the RAM buffer (XM option only), or the nonvolatile memory (NVM) RAM.

After the address selection phase of the microprocessor cycle is complete, the data phase transfers one byte of data either from or to the option. Data is transferred over the multiplexed AD7–AD0 and BD7–BD0 lines. Data to the option from the control board may be destined for the RAM buffer (communication line receive characters before processing), or the NVM RAM (SET-UP parameters and/or the answerback message). Data from the option may originate at the DIP switch (answerback message enable bit), the character ROM (APL character set), the RAM buffer (communication line receive characters ready for processing), or the NVM RAM (SET-UP parameters and/or answerback message).



MA-9618

Figure 5-22 LAX34-XL/XM Functional Block Diagram

The nonvolatile RAM used in the XL/XM options can hold its data for about 10 years (or 1 billion reads). This device may also be called an electrically alterable read-only memory (EAROM). It contains the SET-UP parameter information that would otherwise have to be reentered every time power was turned on.

The NVM RAM (ER1400) is a 1400-bit memory arranged as 100 14-bit words. Data and addresses enter and leave the device in serial form through a single bidirectional line (BD7). Data is conditioned by a level converter before entering or leaving the NVM RAM. Information is shifted in or out with a clock (A0). Identification of the meaning of the bit stream is made by setting three control lines (BA10–BA8) that specify the operation in progress.

An on board power supply develops –24 volts from +12 and –21 volts to supply the NVM RAM chip.

**5.4.7.2 LAX34-CL 20 mA Current Loop Option** – The LA34 Current Loop adapter converts the Electronic Industries Association (EIA) standard serial voltage input and output from the control/logic board to 20 milliamp current signals. Both receiver and transmitter can be separately switched to operate either passively or actively.

#### **Configurations**

In most current loop applications, the LA34 will be connected in the passive configuration; that is, current is provided to the LA34. In this mode the transmitter and receiver are both passive, that is, both optically isolated, and the transmitter goes to the mark state when power is turned off.

Conversion from active to passive mode (or vice versa) for either transmit or receive side is switch selectable. In the active mode either the transmitter, or the receiver, or both may be connected so that the LA34 sources the 20 mA of current. In the active mode, isolation is not present, and the transmitter will go to the space state when power to the LA34 is turned off.

#### **Transmitter Functional Description** (Refer to drawing #D-CS-5413206-0-1)

An EIA to TTL level converter (E3) inverts the LA34 output signal (from the USART) and a second stage reinverts it. The TTL signal switches a pair of paralleled open collector drivers which drive the LED inside an opto-coupler. Resistor R11 limits the LED current. The LED output controls the conductance of the phototransistor inside the opto-coupler.

When the phototransistor is conducting, the base drive for Q3 is diverted and Q3 and Q4 are cut off to put the transmitter in the space state. The only current that can flow in the space state passes through D3, which is a constant current diode rated for 1 mA. When the phototransistor is cut off, D3 provides base drive to Q3 and forces the transmitter to the mark state. Use of the constant current diode D3 allows enough base drive to Q3 to keep the transmitter in the mark state when the phototransistor is cut off or when power is removed from the LA34. D3 limits the current through the transmitter to less than 2 mA even with 50 volts across the circuit.

In the passive mode the transmitter can control the flow of current from an external current source. In the active mode the transmitter is placed in series with the current provided from the +5 and –12 volt power supplies and limited by series resistance.

#### **Receiver Functional Description** (Refer to drawing #D-CS-5413206-0-1)

In passive mode, the LED in opto-coupler E1 accepts current from a remote source limited by R2 and Q1. The optional capacitor on the input gives line transient immunity. To ensure acknowledgement of the off state, R1 draws 3 mA to bypass low level currents around the LED. If the line current rises to make the voltage drop across R2 greater than 0.6 volts, transistor Q1 turns on to shunt excess current around the LED. Besides protecting the LED, this also improves speed by decreasing saturation of the LED and transistor. D1 protects the circuit from reverse connection of the signal line.

In active mode the adapter provides power for the line; +5 and -12 volts through similar resistors R8 and R9. The remote device passively switches current to activate the circuit.

The phototransistor in the opto-coupler controls the base current to Q2. R5 speeds up Q2's turn-off by pulling the base down faster, while C1 speeds its turn-on. R3 prevents the phototransistor from saturating by allowing the base and emitter voltages to rise until excess base charge can be removed by conduction through R4.

The output is pseudo EIA (RS232) because an assumption is made that a particular receiver device is being used which happens to accept a 0 as a mark. The RS-232-C specification calls for +6 = space and -6 = mark. D4 shunts -12 in case the EIA signal accidentally touches the exposed connector while the current loop option is installed (protects E2 pin 3). R7 pulls up to give high drive to the 1489 EIA receiver – TTL converter on the control/ logic board.

### **Interface Specifications**

The specifications for the 20 mA current loop option are as follows.

<b>Transmitter</b>	<b>Min</b>	<b>Max</b>	<b>Units</b>
Open circuit voltage	5.0	50	volts
Voltage drop marking	0.0	4.0	volts
Spacing current	–	2.0	mA
Marking current	20	50	mA

<b>Receiver</b>	<b>Min</b>	<b>Max</b>	<b>Units</b>
Voltage drop marking	–	2.5	volts
Spacing current	–	3.0	mA
Marking Current	15	50	mA

Figure 5-23 shows the interface mark and space states. Refer to Appendix B for more 20 mA interface specifications.

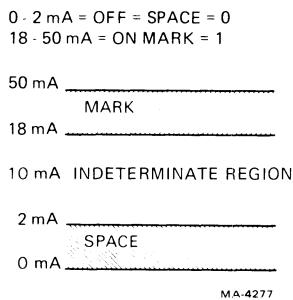


Figure 5-23 Interface States



## **CHAPTER 6**

### **TROUBLESHOOTING**

#### **6.1 GENERAL**

This chapter includes troubleshooting and repair information for the DECwriter IV terminal. The information presented here, when used in connection with the text and functional block diagrams in Chapter 5 and the Field Service Engineering Print Set, should lead to the identification and resolution of any failure in the terminal.

#### **6.2 TROUBLESHOOTING**

Troubleshooting a failure involves first identifying the type of failure by its symptoms. Then by referring to tables and procedures, locating the most probable field replaceable unit (FRU) that would cause that failure.

The symptoms displayed may represent more than one failure. Therefore, the symptoms may change as the FRUs are replaced. Always troubleshoot according to the current symptoms.

Spare parts do fail. The chance of a similar failure should not be ignored just because the FRU has been replaced once.

At times the failure may be traced to a component of the FRU. However, as a general maintenance philosophy, troubleshooting to the component level is not recommended due to the cost of FRU spares vs. the cost of the added labor involved to find a bad component.

##### **6.2.1 Self-Tests**

Paragraph 4.4 describes the five types of self-tests available. Figures 4-16, 4-17, and 4-18 show the correct printer output for each of the tests. You should run each of these self-tests and compare the resulting printer output with these figures as part of the troubleshooting process. Then, when you have a better understanding of the problem symptoms, reference the table and procedures in the following paragraphs.

##### **6.2.2 Troubleshooting Tables**

Table 6-1 lists the most common LA34 failures, the associated symptoms, and the appropriate corrective action. Check for symptoms in the order given.

**Table 6-1 LA34 Troubleshooting Chart**

Symptom	Probable Cause	Corrective Action
There is no response when POWER ON/OFF switch (S1) is set to the on position. LED indicators are off (carriage does not move).	Power fuse (F1) Not plugged in No power at wall receptacle 115/230 voltage selector switch Power supply Logic board	Replace fuse. Plug in. Try a different receptacle if possible, check breaker, call electrician. Make sure that the 115/230 voltage switch is set to the proper range. Check power supply (Paragraph 6.3.1). Replace if necessary. Check logic board(Paragraph 6.3.2). Repair or replace as necessary.
LED indicators are off, but carriage moves.	Keyboard cable Keyboard assembly Logic board	Check keyboard connector at J6 on the logic board. Check keyboard (Paragraph 6.3.8). Check logic board(Paragraph 6.3.2). Repair or replace as necessary.
Power is ON, all indicators come on and stay on	Logic board	Check logic board(Paragraph 6.3.2). Repair or replace as necessary.
Power/Fault light flashes (no bell tone).	Paper out Access cover open Access cover	Install paper. Close cover. Replace switch.
<b>NOTES</b>		
<ol style="list-style-type: none"> <li>Without touching the access cover, reach in and move the carriage assembly. If it moves freely, either the access cover is not seated properly, or the switch is bad.</li> <li>The access cover interlock switch is a magnetic proximity type switch. Before replacing switch, check magnet to access cover.</li> </ol>		
Printhead prints, but carriage does not move.	Pulley/tension gear Timing belt broken or slipped out of carriage	Replace pulley/tension assembly. Check and replace timing belt if necessary.

**Table 6-1 LA34 Troubleshooting Chart (Cont)**

Symptom	Probable Cause	Corrective Action
Power light flashes and bell tone sounds.	Head jam	Clear jam and reset fault by pressing the <b>VIEW</b> key.
	Servo motor encoder connectors	Check servo connectors at J1, J3 of the logic board, and connectors on servo motor encoder assembly.
	Encoder wheel loose	Tighten encoder wheel.
	Servo motor encoder encoder assembly	Check servo motor encoder assembly (Paragraph 6.3.4).
	Logic board	Replace logic board.
	Platen assembly	Check that gears are properly engaged, also platen clutch/gear assembly.
	Platen assembly dirty	Clean platen assembly.
	Stepper motor connector	Check stepper motor connector at J2 on the logic board.
	Paper drive cluster gear	Replace gear.
	Stepper motor	Check line feed stepper motor (Paragraph 6.3.6).
There are no line feeds when the <b>LOCAL LINE FEED</b> key is pressed.	Logic board	Check logic board (Paragraph 6.3.2 or 6.3.6). Repair or replace as necessary.
	Keyboard cable	Check keyboard cable at J6 on the logic board.
	Keyboard/keycap assembly	Replace keyboard/keycap assembly.
	Platen assembly	Check that gears are properly engaged, also platen clutch/gear assembly.
	Paper guide	Check paper guide is properly seated.
	Stepper motor connector	Check stepper motor connector at J2 on the logic board.
	Stepper motor	Check stepper motor and, check logic board (Paragraph 6.3.6).
	Logic board	
Line feeds are improper (inconsistent vertical motion).	Platen assembly	Check that gears are properly engaged, also platen clutch/gear assembly.
	Paper guide	Check paper guide is properly seated.
	Stepper motor connector	Check stepper motor connector at J2 on the logic board.
	Stepper motor Logic board	Check stepper motor and, check logic board (Paragraph 6.3.6).

**Table 6-1 LA34 Troubleshooting Chart (Cont)**

Symptom	Probable Cause	Corrective Action
Line feeds are continual.	Keyboard/keycap assembly	Replace keyboard/keycap assembly.
	Logic board	Replace logic board.
There is no printout when printable character key is pressed, in local mode (carriage does not move).	Keyboard cable	Check keyboard connector at J6 on the logic board. Replace keyboard/keycap assembly.
	Keyboard/keycap assembly	
	Logic board	Replace logic board.
	Power supply	Replace power supply.
There is no printout when printable character key is pressed in local mode (carriage does move).	Printhead adjustment	Adjust printhead assembly.
	Ribbon cartridge	Replace ribbon cartridge.
	Printhead cable	Check printhead connector at J5 on the logic board.
	Printhead assembly Logic board	Check printhead assembly and, check logic board (Paragraph 6.3.5).
There are dots missing on printable character (always same row missing).	Printhead cable	Check printhead connector at J5 on the logic board.
	Printhead assembly Logic board	Check printhead assembly and, check logic board (Paragraph 6.3.5).
There are dots missing only when certain printable keys are pressed.	Logic board	Replace logic board or character generator ROM.
Print density drops off to no impression.	Printhead adjustment	Adjust printhead assembly.
	Ribbon cartridge	Replace ribbon cartridge.
	Platen assembly	Platen not seated properly; reseat.
	Ribbon drive cable	Check cable and replace if necessary.
	Ribbon drive pulley	Replace carriage assembly.
Print density varies randomly across page.	Ribbon cartridge	Replace ribbon cartridge.
	Ribbon drive cable	Check cable and replace if necessary.
	Carriage assembly	Replace carriage assembly.

**Table 6-1 LA34 Troubleshooting Chart (Cont)**

Symptom	Probable Cause	Corrective Action
There is no bell tone when <b>CTRL</b> and <b>BELL</b> keys are pressed in local mode.	Keyboard cable	Check keyboard connector at J6 on the logic board.
	Keyboard/keycap assembly	Replace keyboard/keycap assembly.
	Logic board	Check logic board and bell (Paragraph 6.3.3).
<b>NOTE</b> Use your hand to cause a head jam. If no bell tone sounds logic board is bad.		
Printer operates in local but not on-line (EIA operation).	LINE/LOC switch	Check for proper switch selection.
	EIA input cable	Check EIA connector J7; if necessary replace cable.
	Logic board	Check logic board and USART (Paragraph 6.3.2.2 and 6.3.7).
	Keyboard/keycap assembly	Replace keyboard/keycap assembly.
	Power supply (+12 V, -12 V)	Check power supply. Replace if necessary.

### 6.3 FUNCTIONAL TESTS

The following paragraphs describe the different functional tests that may be performed when troubleshooting a failure in the LA34 terminal.

#### **WARNING**

**Be careful if and when checking internal portions of the power supply. Exposed 120/230 Vac line voltage and internal voltages approaching 300 Vac are present.**

#### **CAUTION**

**The logic modules include static sensitive components. Before handling any of these subassemblies (removing or installing from LA34 terminal, removing from shipping package, bench handling), touch the LA34 chassis or some relatively large metal object, to remove static body charges.**

Figure 6-1 shows a physical/functional block diagram of the LA34 terminal. Refer to this figure when performing the functional tests.

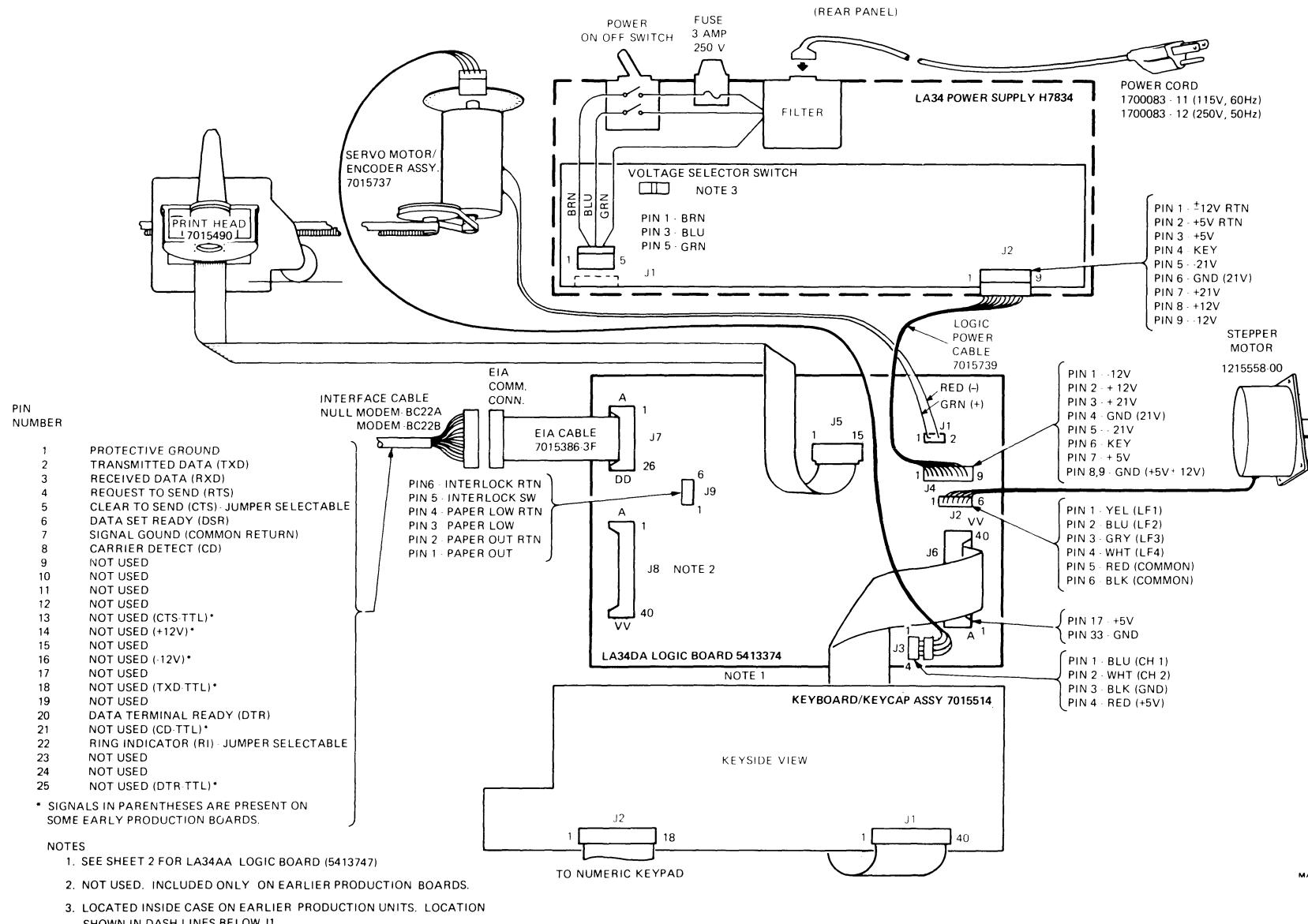


Figure 6-1 LA34 Physical/Functional Block Diagram

When performing any of the functional tests involving the removal of the access cover and the printer housing, the access cover sensor input must be jumpered out. This is accomplished by separating P9 from J9 (Figure 6-1) and jumpering J9 pin 5 and 6 together.

#### NOTE

The DECwriter IV series of terminals and printers use two types of circuit boards, each differing slightly in terms of shape and component layout/identification. The LA34-DA and LA38-GA terminals use the 54-13374 logic board. All other terminals and printers use the 54-13747 control board. Where chip/pin numbers are called out in the functional tests, the first call-out references the logic board and the second call-out references the control board.

#### 6.3.1 Power Supply

Table 6-2 lists the dc voltages and test points. Checks should be made at J4/P4 on the logic board with a digital voltmeter when under load. Do not unplug P4 from the logic board when making these measurements.

#### 6.3.2 Logic Board

Perform the following tests to check the basic sanity of the logic board.

Table 6-2 DC Voltage Supply

Voltage (V)	Tolerance (V)	Logic Board Test Points (Figure 6-1)
+ 5.1	$\pm 0.25$	P4-7 (Red)
+12	$\pm 0.6$	P4-2 (White)
-12	$\pm 0.6$	P4-1 (Purple)
+21	$\pm 2.1$	P4-3 (Orange)
-21	$\pm 2.1$	P4-5 (Blue)
0 -21 gnd)	-	P4-4 (Black) P4-9 (Black)
0 (logic gnd)	-	P4-8 (Black)

### 6.3.2.1 Wake-Up Test – Use this procedure to check the sanity of the logic board.

1. Remove power from the terminal.
2. Remove the access cover, printer housing, and the logic board safety cover.
3. Connect channel 1 of scope to E39-5/E36-5 (+5 volt sense). Connect channel 2 of scope to signal WU at E39-1/E36-1. Set up scope according to Figure 6-2.
4. Apply power to the terminal and check for waveshape of Figure 6-2. The WU (Wake Up) signal should go high approximately 150 ms after +5 volt sense reaches the peak of its ramp. Turn power off and on to repeat the waveshape.

#### NOTE

**Leave power off for a few seconds to allow for capacitor discharge. Otherwise the +5 volt sense ramp and WU delay will not appear in the same relationship.**

5. Remove power from the terminal and remove the scope leads.

### 6.3.2.2 System Clocks – The clock test checks the operation of the 4 MHz crystal and the divider network in the 8085A microprocessor chip.

1. Check crystal input to microprocessor by connecting channel 1 of the scope to E36-1/E22-1. The waveform should be sinusoidal with a period of 500 ns at approximately 5 V p-p.
2. Move the scope probe to E36-37/E22-37. The system clock output (CLK B) should be a 1 MHz (1  $\mu$ s) square wave.

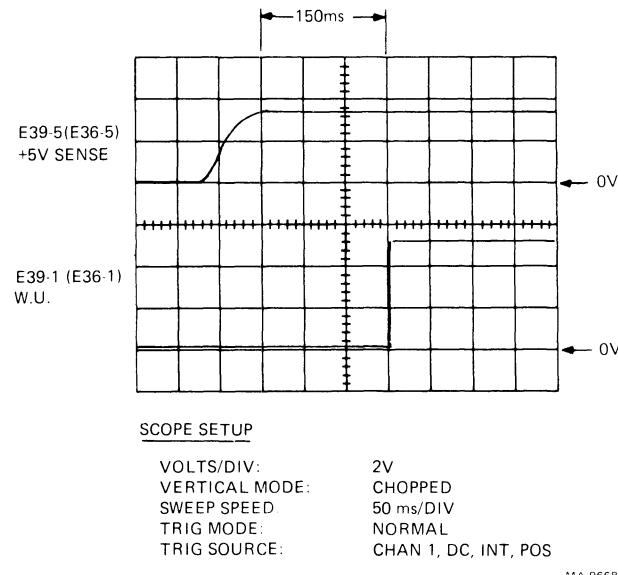


Figure 6-2 DC Wake-Up Waveform

**6.3.2.3 Interrupts** – The print controller supplies a 2.5 ms interrupt to the microprocessor so that it may perform certain software routines regularly. This test checks that interrupt and the resulting acknowledge signal sent back from the microprocessor. If the test is successful, you may conclude that the microprocessor chip, and supporting microprogram memory, are probably operating correctly.

1. Connect channel 1 of scope to E23-13/E10-13 (signal INTR B). A positive going pulse, with a period of 2.5 ms indicates that the interrupt is operating correctly.
2. Connect the scope probe to E23-12/E10-12 (signal not INTA). A positive going pulse, with a period of 2.5 ms indicates that the microprocessor is acknowledging the print controllers interrupt.

### 6.3.3 Bell Test

Use the following procedure to test the sanity of the logic board.

1. Remove power from the terminal.
2. Remove the access cover, printer housing, and the logic board safety cover.
3. Connect channel 1 of scope to E4-3/E6-3 (-BELL). Set up scope according to Figure 6-3.
4. Apply power to the terminal and set it to local.
5. Check the bell circuit by pressing **CTRL/G**. The waveform displayed on the scope should be similar to Figure 6-3. The microprocessor and print controller generate a pattern of 8 chopping pulses every 400  $\mu$ s, for a tone of 2.5 KHz.

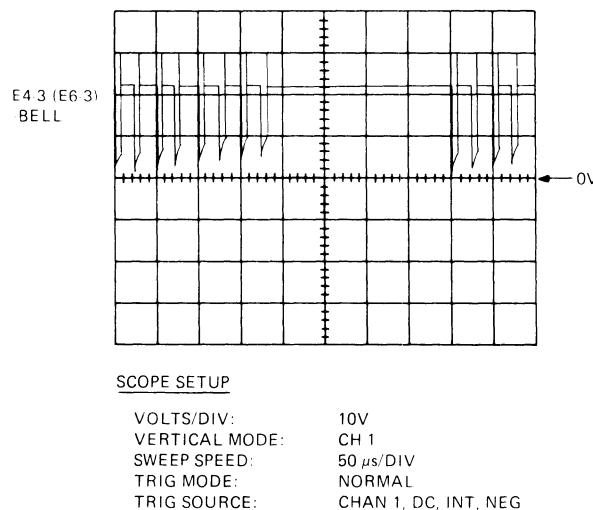


Figure 6-3 Bell Test Waveform

### 6.3.4 DC Servo/Encoder Test

Use the following procedure to test the sanity of the logic board.

1. Remove power from the terminal.
2. Remove the access cover, printer housing, and the logic board safety cover.

#### Static Check

3. Check the print carriage for freedom of movement on the carriage rails. Also check that the rails are lubricated. Check the two timing belts. If there is any sign of wear (fraying or teeth missing) replace the worn belt.

#### Dynamic Check

4. Remove the pulley/tension assembly (Paragraph 7.14) and slip the timing belt off of the servo pulley assembly.
5. Disconnect the servo motor by pulling the two clips off of the motor terminals.
6. Jumper 5 volts to the motor by connecting the + motor terminal to +5 V at capacitor C59 (+ side), and the - motor terminal to ground.
7. Connect the scope to E14-6/E9-6 (encoder CH1). Set the scope as shown in Figure 6-4. Turn power on. The servo motor should be turning counterclockwise. The waveform on the scope should be a square wave similar to Figure 6-4 with a duty cycle of 50 percent.

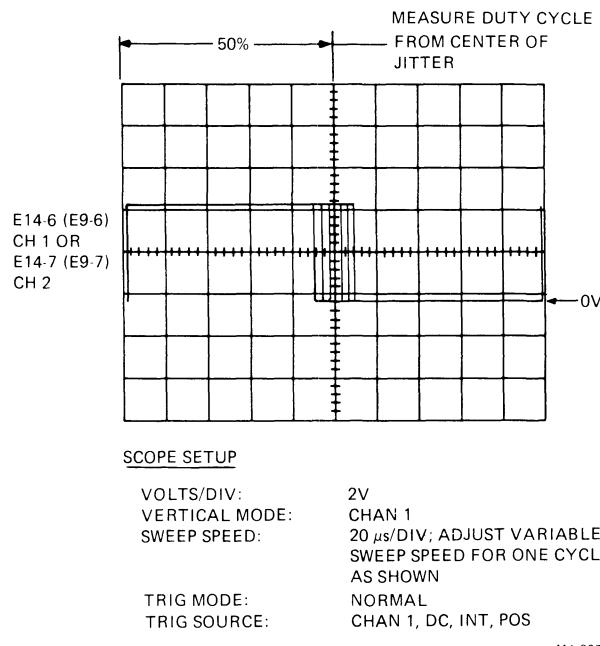


Figure 6-4 Encoder Output Waveform

- Move the scope probe to E14-7/E9-7 (encoder CH2). Look for a similar waveform.

**NOTE**  
**The encoder duty cycle is not adjustable.**

- Connect the scope to the print controller servo output. Connect channel 1 to E14-8/E9-8 (not MINUS), and channel 2 to E14-9/E9-9 (not PLUS). Set the scope as shown in Figure 6-5. The waveform on the scope should match the waveform in Figure 6-5.
- With a digital voltmeter check the servo amplifier output. Connect the +DVM lead to J1-1 and the -DVM lead to J1-2. The DVM should read approximately 25 Vdc.
- Remove power from the terminal and reverse the jumpers that supply +5 volts to the servo motor. This will cause the motor to turn in a clockwise direction.
- Set the scope as shown in Figure 6-6 and apply power to the terminal. The waveform on the scope should match the waveform in Figure 6-6.
- Remove power from the terminal but leave the scope probes connected as in step 9.
- Reassemble the timing belt and pulley/tension assembly. Reconnect the servo motor wires.

**NOTE**  
**The following steps involve looking at waveforms while the printhead is in motion. It is advisable to tape the printhead cable to the logic board so that it does not snag on the printhead carriage.**

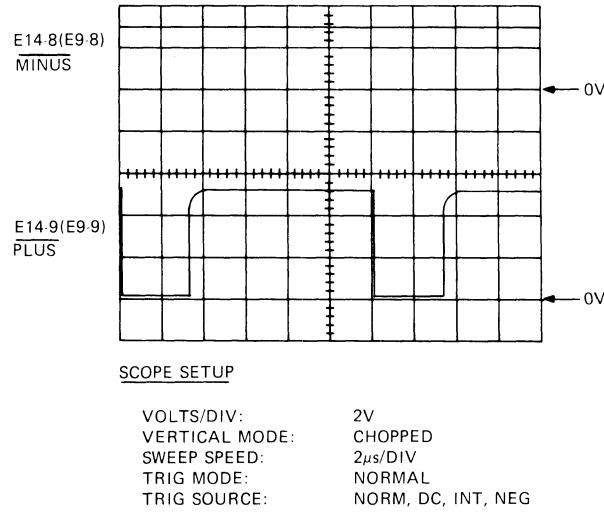
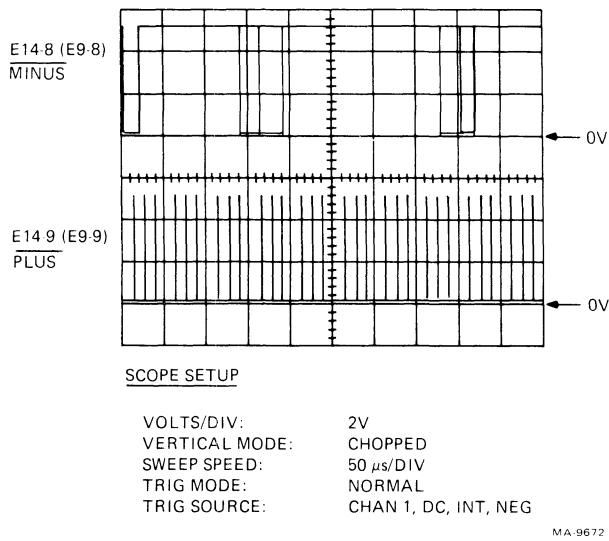


Figure 6-5 DC Servo Motor Being Driven  
Counterclockwise



**Figure 6-6 DC Servo Motor Being Driven Clockwise**

15. Set the scope as shown in Figure 6-7 and apply power to the terminal. Command the terminal to test spaces. Press **CTRL/SET-UP, T, SPACE BAR**.
16. The waveform on the scope should match the waveform in Figure 6-7 during left-to-right carriage motion. Channel 2 should be at or near 0 V and channel 1 should be pulsing high.
17. Change the scope settings to; Sweep: 10  $\mu$ s/DIV and NORMAL trigger source. The waveform on the scope during a right-to-left carriage return should match the waveform in Figure 6-8.

### 6.3.5 Print Character Test

The print character test checks printhead operation and the circuits that process the character signal before going to the printhead. The test bar character ( | ) is used for the waveforms used in this test. It is an ideal test character because it fires all seven wires in the printhead and fires them only once in each character. Other characters would produce different waveforms according to which wires are fired and how many times they are fired.

1. Remove power from the terminal.
2. Remove the access cover, printer housing, and the logic board safety cover.

#### NOTE

**The following steps involve looking at waveforms while the printhead is in motion. It is advisable to tape the printhead cable to the logic board so that it does not snag on the printhead carriage.**

3. Using an ohmmeter, check the continuity of the printhead solenoid in the defective channel. The resistance of a good printhead solenoid is about 2.5 ohms.

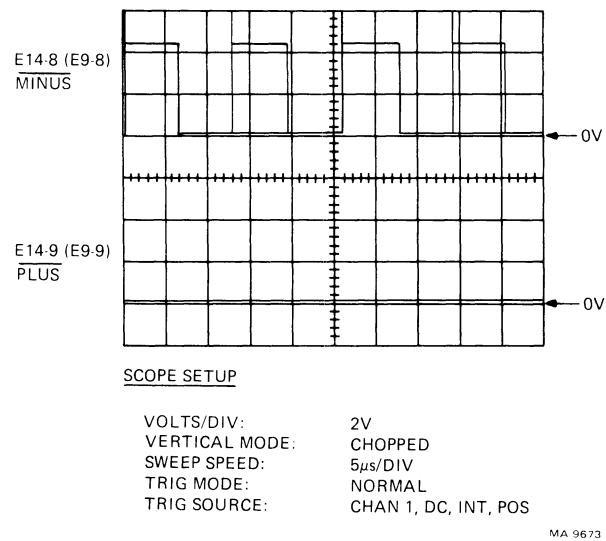


Figure 6-7 DC Servo Motor Being Stepped Left-to-Right

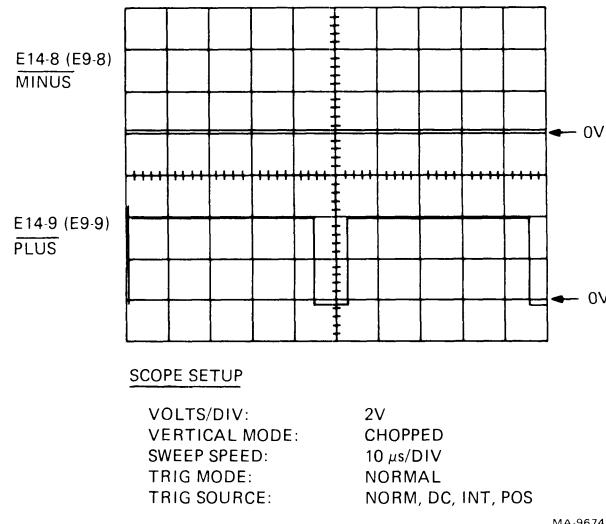


Figure 6-8 DC Servo Motor Being Driven Right-to-Left during Carriage Return

4. Connect channel 1 of scope to output of the defective channel of the print controller (E14/E9). Set up scope according to Figure 6-9.
5. Apply power to the terminal. Place the terminal in local mode. Enter set-up mode and start the vertical bar self-test. Press **CTRL/SET-UP**, **T**, **SHIFT 1**.
6. A good solenoid circuit will produce a waveform similar to Figure 6-9. A waveform with no pulse on channel 1 indicates a bad print controller. A waveform with a pulse on channel 1 but 0 volts on channel 2 indicates a blown driver chip. A waveform similar to Figure 6-10 indicates an open print wire solenoid or cable.

### 6.3.6 Line Feed Test

The line feed test checks the print controller, the line feed driver, and the stepper motor.

1. Remove power from the terminal. Remove paper from the terminal.
2. Remove the access cover, printer housing, and the logic board safety cover.
3. Disconnect P2 to check stepper motor windings. Using an ohmmeter, check between the following pins on P2:
  - 5 and 1
  - 5 and 2
  - 6 and 3
  - 6 and 4.

All four readings should be  $7.5 \pm 0.5$  ohms.

4. Connect channel 1 of scope to E14-13/E9-13 (LF1). Connect channel 2 of scope to E14-12/E9-12 (LF2). Set up scope according to Figure 6-11.
5. Apply power to the terminal and place it in local mode.
6. Press **LINE FEED** and look at the two channel inputs to the line feed drivers. Check that the waveforms are as shown in Figure 6-11.
7. Each phase of the quadrature phase line feed driver is checked by connecting channel 1 of scope to driver input, and channel 2 to driver output. Set up scope as shown in Figure 6-12.
8. Press **LINE FEED** and check for a waveform similar to Figure 6-12. The example given in the figure is for channel LF1 or LF2. Channels LF3 and LF4 are similar except that the input phase is reversed (switch scope trigger from - to +). If only one or two outputs look bad, then the line feed driver is suspected. If all outputs look bad, then the RUN line darlington switch (Q3) is probably defective.

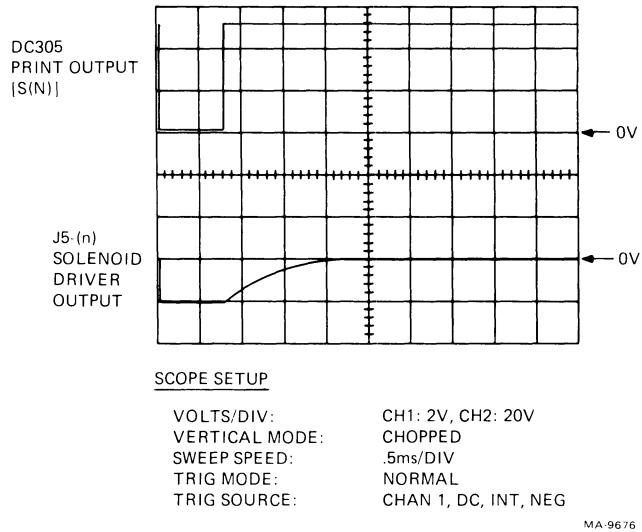


Figure 6-9 Print Solenoid Input vs Output (The Character “I” with Good Driver and Solenoid)

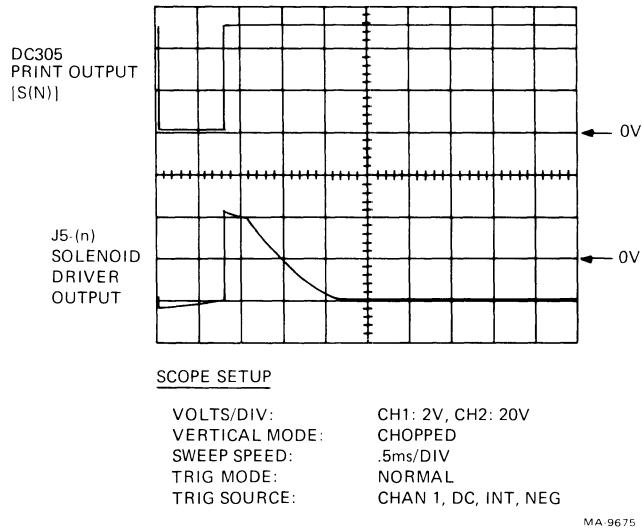


Figure 6-10 Print Solenoid Input vs Output (The Character “I” with Good Driver and Open Solenoid)

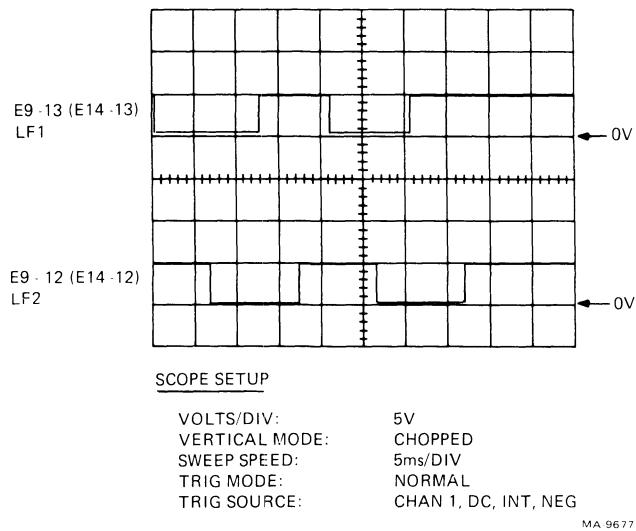


Figure 6-11 Line Feed Signal Output of DC305

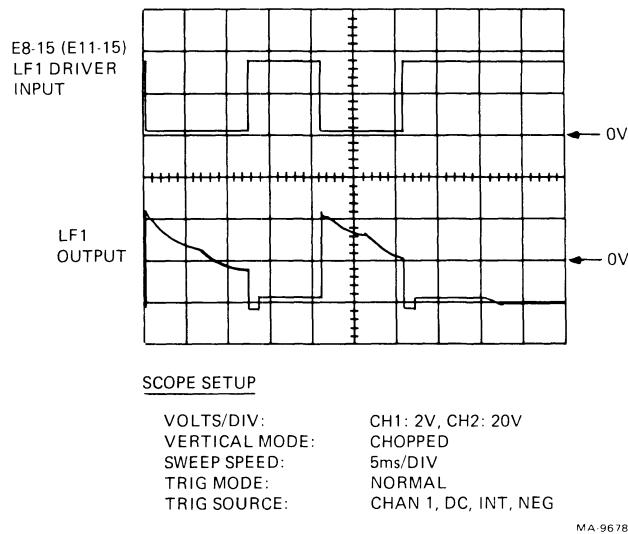


Figure 6-12 Line Feed Input vs Output (Phase 1 Shown)

### 6.3.7 USART Test

The USART test checks the baud rate generator section of the print controller chip and the communications controller (USART) chip.

1. Remove power from the terminal.
2. Remove the access cover, printer housing, and the logic board safety cover.
3. Connect the scope to E27-9/E4-9 (signal not TxC).
4. Apply power to the terminal, perform an initialize command in set-up mode, (press **CTRL/SET-UP, I, RETURN**), and set the speed to 300 baud.
5. Observe a transmit clock with a period of 208  $\mu$ s.
6. Move the scope probe to E27-25/E4-25 (signal not RxC).
7. Observe a receive clock with a period of 208  $\mu$ s. If either of these clocks is absent, replace the DC305 print controller.

#### NOTES

1. **Other Baud Rates may be selected in SET-UP mode to perform this check. Refer to Table 5-4 for a listing of the different frequencies for each baud rate.**
2. **The following steps involve wrapping data transmitted by the terminal back to its receive input. Use a prepared test data wraparound adapter for this purpose. The DIGITAL part numbers for the adapters are:**

I/O port type	DIGITAL P/N
EIA (RS232)	12-15336
20 mil	70-18353

8. Remove power from the terminal and install the correct test adapter at the I/O connector.
9. Connect the scope to E27-19/E4-19 (signal TxD). Set the scope as shown in Figure 6-13.
10. Apply power to the terminal. Press and hold the lower case **m** key and check for the waveform of Figure 6-13. This is the serial representation of ASCII data for this character.
11. Move the scope probe to E27-3/E4-3 (signal RxD). Observe a similar waveform.
12. Move the scope probe to E27-14/E4-14 (signal RxRDY) and change the scope triggering from NEG to POS. Observe a high going pulse each time a character is transmitted (and subsequently received).

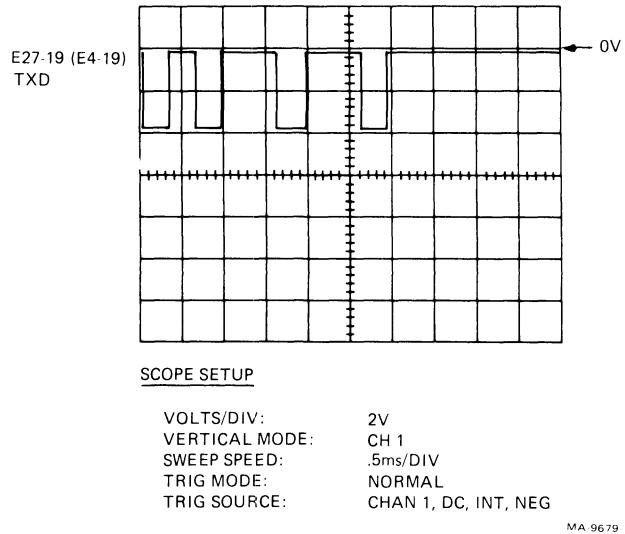


Figure 6-13 USART Serial Data (Lowercase "m")

### 6.3.8 Keyboard Test

Perform the keyboard test when a single key is suspected. If more than one key is failing (a complete row or column) the associated decoder or octal receiver on the logic board is probably defective.

1. Remove power from the terminal.
2. Remove the access cover and the printer housing. Swing the keyboard out to access the opposite side. Etched on the keyboard backplane are the names of the corresponding keys. While pressing the suspected key, measure the resistance of the keyswitch at the two backplane terminals with an ohmmeter. A good keyswitch will measure 0 ohms. Anything greater than 0.5 ohms indicates a marginal or completely bad keyswitch.

## CHAPTER 7 MECHANICAL SERVICING

### 7.1 GENERAL

This chapter contains information pertaining to the removal, replacement, and adjustment of the mechanical assemblies of the LA34.

Figure 7-1 lists all the removal procedures described in this chapter and the sequence in which these procedures are performed. As an example, to remove the stepper motor the printer housing cover and paper drive cluster gear must first be removed.

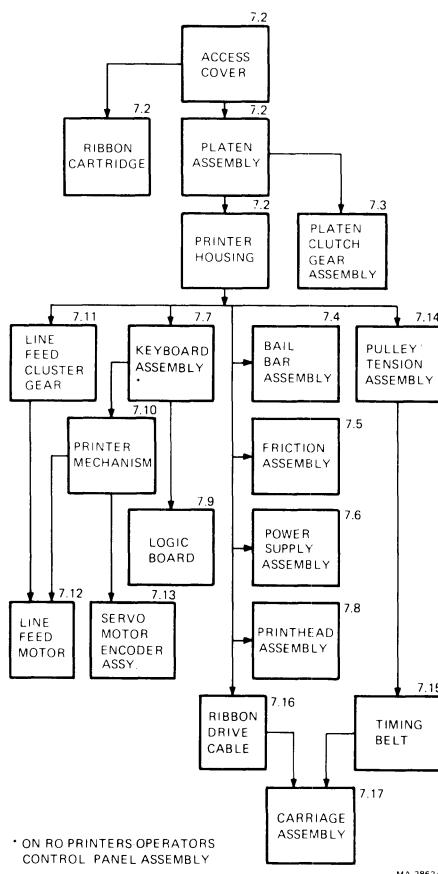


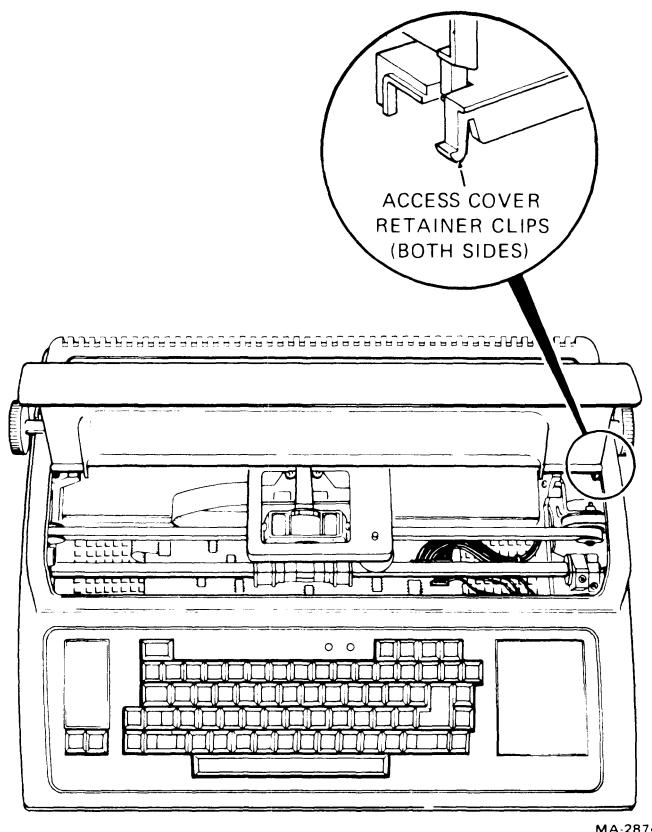
Figure 7-1 Assembly Removal Sequence

## 7.2 PRINTER HOUSING COVER

### 7.2.1 Printer Housing Cover Removal

Use this procedure to remove the printer housing cover.

1. Turn the power ON/OFF switch to off.
2. Unplug the ac power cord from the wall receptacle and then the printer.
3. Remove the paper from the printer.
4. If the printer is attached to a printer stand, remove the terminal from the stand. Refer to the Options chapter (Chapter 3) for more detail.
5. Remove the roll paper holder or tractor options if installed. Refer to the Options chapter (Chapter 3) for more detail.
6. Remove the access cover by opening it and pressing the two access cover retainer clips at the same time (Figure 7-2). Lift the access cover straight up.
7. Remove the ribbon cartridge.



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Figure 7-2 Access Cover Removal

8. Lift the bail bar to gain access to the platen. Remove the platen by pressing the two platen release levers at the same time (Figure 7-3). Lift the platen straight up. Lower the bail bar to its original position.
9. With a small blade screwdriver, release the four snap fasteners that secure the printer housing cover to the base assembly (Figure 7-4).
10. Remove the printer housing cover by lifting it straight up.

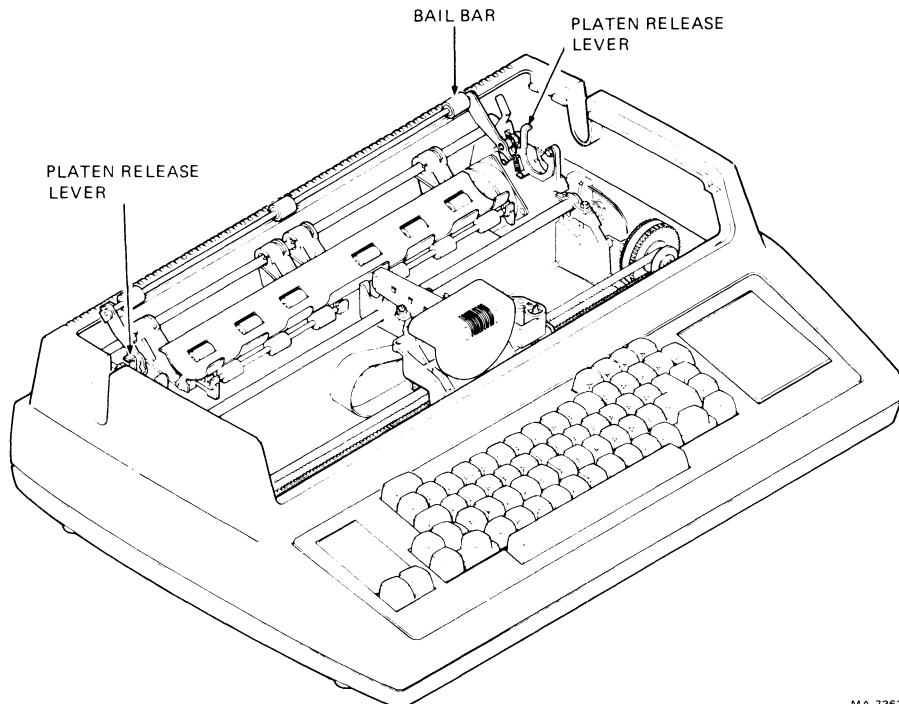


Figure 7-3 Platen Removal

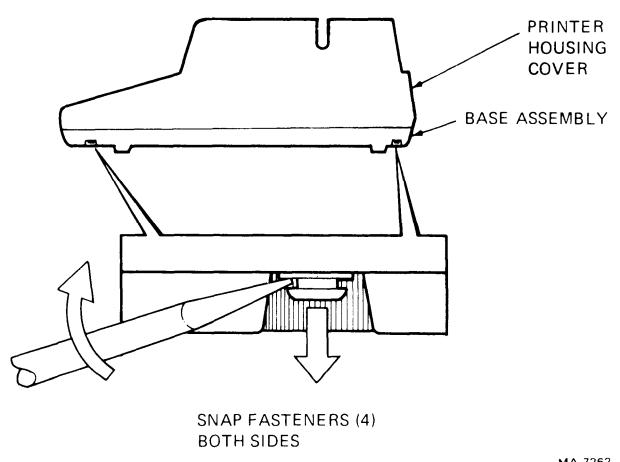


Figure 7-4 Printer Housing Removal

### **7.2.2 Printer Housing Cover Installation**

Use this procedure to install the printer housing cover.

1. Make sure the tabs on the rear insert line up with the slots in the printer housing cover.
2. Place the printer housing cover on the base assembly.
3. Press the four snap fasteners closed to secure the cover to the base assembly.
4. Reinstall the platen by lifting the bail bar and pressing the platen into place. Rotate the paper advance knob to verify that the gears are properly engaged. Lower the bail bar to its original position.
5. Reinstall the ribbon cartridge.
6. Slide the back edge of the access cover under the lip in the printer housing cover and press the access cover into place.
7. Reinstall the roll paper holder or tractor options if needed. Refer to the Options chapter (Chapter 3) for more detail.
8. If the printer stand is used, attach the terminal to the stand. Refer to the Options chapter (Chapter 3) for more detail. Reinstall the paper.
9. Plug the ac power cord into the back of the printer. Then plug the power cord into a non-switched, three-prong, grounded wall receptacle.
10. Turn the power ON/OFF switch on.

## **7.3 PLATEN CLUTCH/GEAR ASSEMBLY**

### **7.3.1 Platen Clutch/Gear Assembly Removal**

Use this procedure to remove the platen clutch/gear assembly.

1. Turn the power ON/OFF switch to off.
2. Unplug the ac power cord from the wall receptacle.
3. Remove the paper and tractor option if installed.
4. Remove the access cover by opening it and pressing the two access cover retainer clips at the same time (Figure 7-2). Lift the access cover straight up.
5. Lift the bail bar to gain access to the platen. Remove the platen by pressing the two platen release levers at the same time (Figure 7-3). Lift the platen straight up. Lower the bail bar to its original position.
6. Using a small blade screwdriver, lift the tab on the end of the platen knob enough to release the knob from the platen shaft (Figure 7-5).
7. Remove the platen clutch/gear assembly.

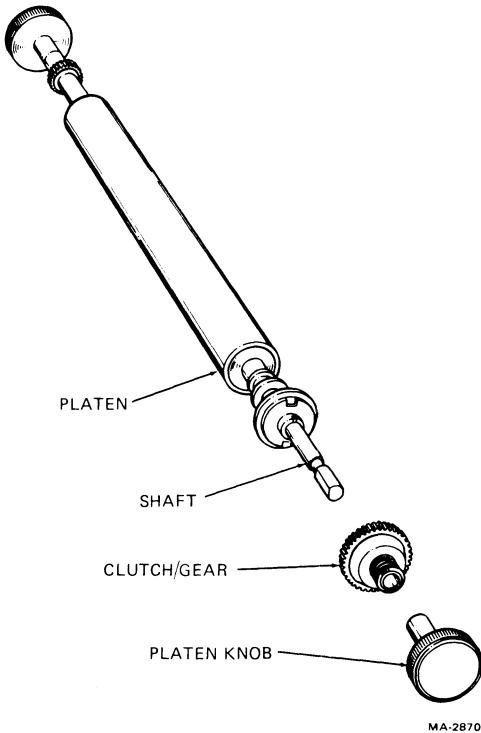


Figure 7-5 Platen Clutch/Gear Assembly

### 7.3.2 Platen Clutch/Gear Assembly Installation

Use this procedure to install the platen clutch/gear assembly.

1. Slide the new assembly onto the shaft. Make sure the tabs on the gear engage the slots in the platen assembly (Figure 7-5).

**NOTE**  
**If it becomes necessary to clean the platen, use a damp cloth only.**
2. Slide the platen knob onto the shaft. The knob is keyed and will only fit one way.
3. Reinstall the platen by lifting the bail bar and pressing the platen into place. Rotate the paper advance knob to verify that the gears are properly engaged. Lower the bail bar to its original position.
4. Slide the rear edge of the access cover under the lip in the printer housing and press the access cover into place.
5. Reinstall the paper and tractor option if installed.
6. Plug the ac power cord into a nonswitched, three-prong, grounded wall receptacle.

## **7.4 BAIL BAR ASSEMBLY**

This procedure describes the removal and installation of the bail bar assembly.

1. Perform the printer housing cover removal procedure (Paragraph 7.2).
2. Using needlenose pliers, remove one end of the J-clips from each end of bail bar (Figure 7-6).
3. Using needlenose pliers, remove the bail bar retainer rings (C clips) from each end of the bail bar (Figure 7-6).
4. Press both ends of the bail bar and lift straight up (Figure 7-6).
5. To install a new bail bar assembly, perform steps 1 through 4 in reverse order.

## **7.5 FRICTION ASSEMBLY**

The following procedure describes the removal and installation of the friction assembly.

1. Perform the printer housing cover removal procedure (Paragraph 7.2).
2. Lift bail bar to gain access to the paper guide. Lift paper guide straight out (Figure 7-7).
3. Remove the J-clip that secures the paper release lever to the bail bar assembly (Figure 7-7).
4. Remove the (10-32) nut that secures the paper release lever to right side plate (Figure 7-7).
5. While holding the friction assembly down, slide the stud out of the right side plate and lift the paper release lever straight up.
6. With a blade screwdriver, remove the E-ring that secures the friction assembly end cap to the right side plate (Figure 7-7).
7. Remove the end cap from the friction assembly (right side plate side) (Figure 7-7).

### **NOTE**

**When reinstalling the friction assembly make sure  
that the springs on each end cap are properly seated  
in the side plates.**

8. Pull the friction assembly towards the right side plate until it is free from the left side plate.
9. To install a new friction assembly, perform steps 1 through 8 in reverse order.

## **7.6 POWER SUPPLY ASSEMBLY**

This procedure describes the removal and installation of the power supply assembly.

1. Perform the printer housing cover removal procedure (Paragraph 7.2).
2. Remove the rear insert.
3. Loosen the two 8-32 hex-head screws that secure the power supply to the left side as viewed from the rear of the terminal (Figure 7-8).

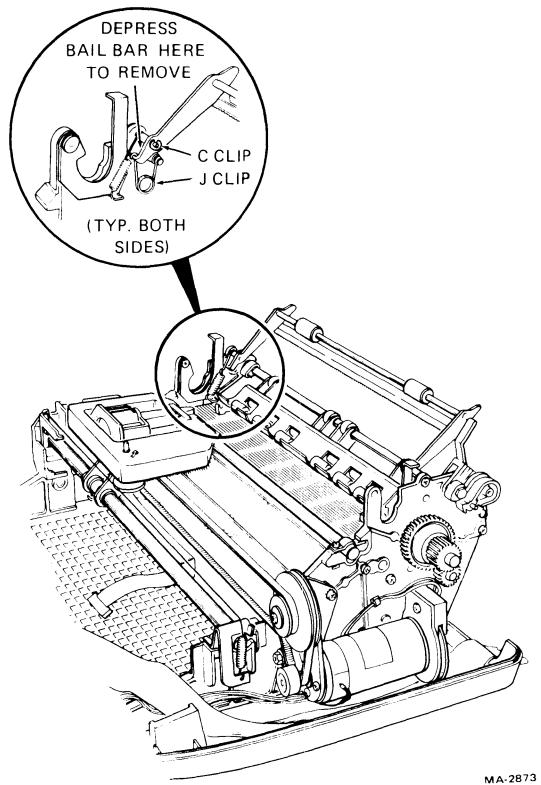


Figure 7-6    Bail Bar Assembly

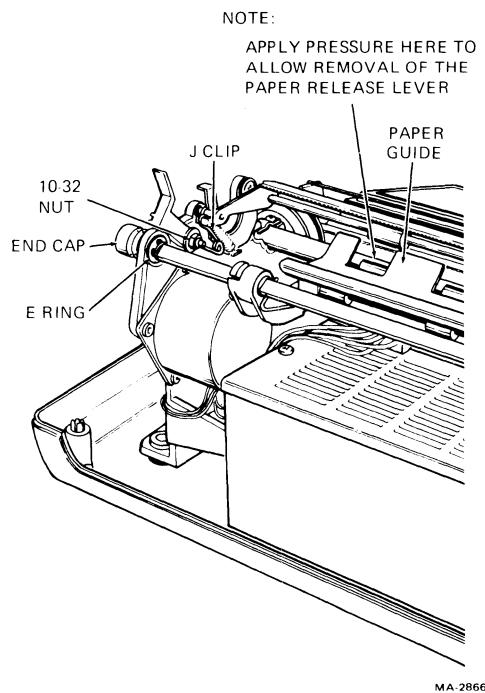
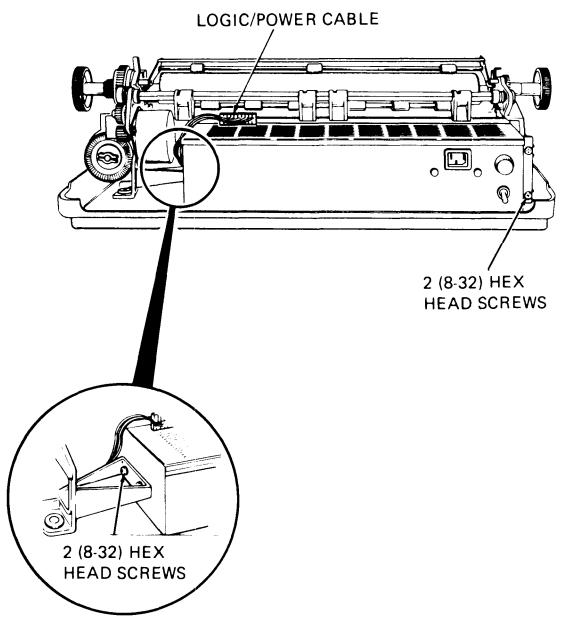


Figure 7-7    Friction Assembly Removal



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Figure 7-8 Power Supply Removal

4. Remove the two 8-32 hex-head screws that secure the power supply to the right side as viewed from the rear (Figure 7-8).
5. Remove the logic/power cable from J6 on the power supply.
6. Carefully slide power supply from the printer mechanism.
7. To install the new power supply, perform steps 1 through 6 in reverse order.

**NOTE**

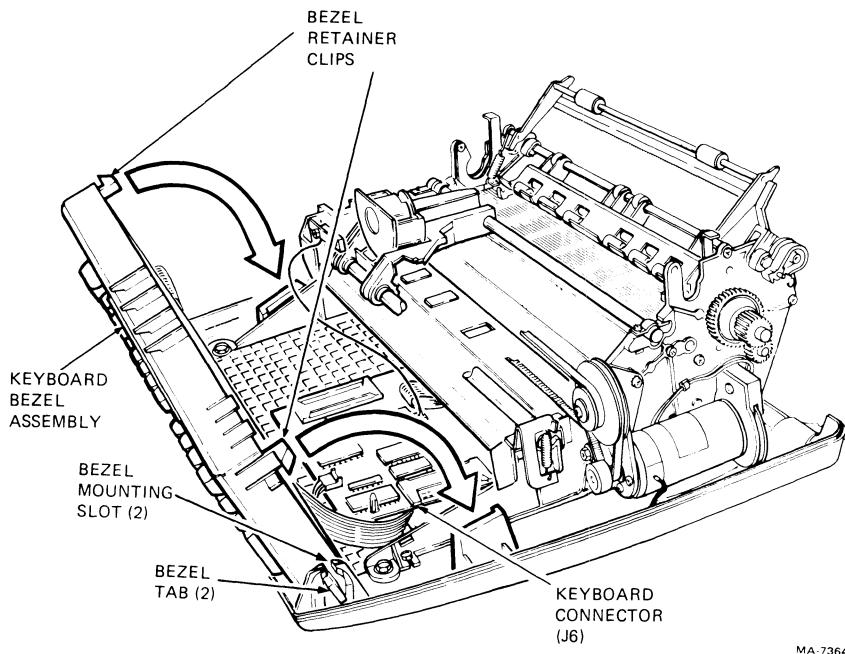
**Some variations of the power supply have a short wire protruding from the metal enclosure. When installing the new supply, the connector at the end of this wire must be placed between the nearest hex-head mounting screw and the supply's enclosure to provide a good ground.**

8. Set the voltage selection switch on the new supply to match the line voltage to which the terminal is connected.

## 7.7 KEYBOARD/OPERATOR CONTROL PANEL ASSEMBLY

This procedure describes the removal and installation of the keyboard/operator control panel assembly.

1. Perform the printer housing cover removal procedure (Paragraph 7.2).
2. Press the bezel retainer clips and rotate the keyboard/operator control panel toward the front of the terminal (Figure 7-9).



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Figure 7-9 Removing Keyboard Bezel

3. Remove the keyboard/operator control panel connector from J6 on the logic board.
4. Lift the keyboard/operator control panel straight up.

**NOTE**

**When reinstalling the keyboard/operator control panel, be sure it is properly seated in the slots in the base assembly before attempting to rotate it forward to its original position.**

5. To install the new keyboard/operator control panel assembly, perform steps 1–4 in reverse order. Fold the new cable to fit the same way the old cable did.
6. On the keyboard/keycap assemblies for LA34-AA terminals, complete the following steps.
  - a. Replace existing keycaps with replacement keycaps included in the keyboard upgrade kit. (Refer to Table 7-1 at the end of this chapter.)
  - b. With a sharp pointed instrument, pry up one corner of the legend strip and peel it off the keyboard. Carefully install a new LA34-AA legend strip.

## 7.8 PRINthead ASSEMBLY

### 7.8.1 Printhead Removal

Use this procedure to remove the printhead.

1. Perform the printer housing cover removal procedure (Paragraph 7.2).
2. Press the bezel retainer clips and rotate the keyboard/operator control panel toward the front of the terminal (Figure 7-9).
3. Remove the logic board safety cover to gain access to the printhead cable. Gently disconnect the printhead ribbon cable from J5 on the logic board by lifting the top cover off the plug (Figure 7-10).
4. Remove the printhead ribbon cable from the two clips that secure it to the printer mechanism.
5. Remove the U-clip that secures the printhead ribbon cable to the carriage assembly.
6. Remove the printhead heat shield.
7. Remove the two (6-32) screws, spacers, flat washers and springs that secure the printhead to the carriage assembly (Figure 7-11).
8. Remove the printhead from the carriage assembly and carefully guide the printhead ribbon cable up through the slot in the carriage assembly.

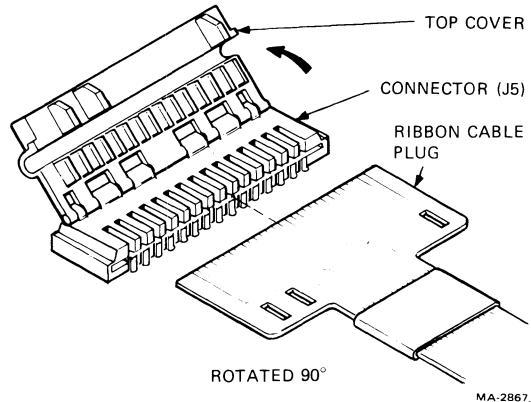


Figure 7-10 Printhead Ribbon Cable Removal

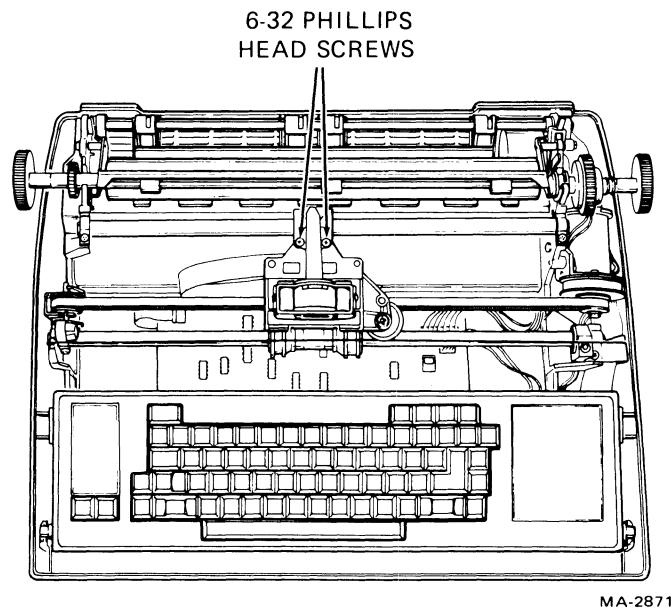


Figure 7-11 Printhead Removal

### 7.8.2 Printhead Installation

Use this procedure to install the printhead.

1. Thread the printhead ribbon cable down through the slot in the carriage assembly.
2. Secure the printhead to the carriage assembly with the two (6-32) screws, spacers, flat washers and spring.
3. Secure the printhead ribbon cable to the carriage assembly using the ribbon cable U-clip.
4. Secure the printhead ribbon cable to the printer mechanism. Make sure that the cable lies completely flat and does not obstruct the path of the carriage assembly.
5. Connect the printhead ribbon cable connector to J5 on the logic board.

**CAUTION**

**The ribbon cable is keyed and must be reinstalled correctly to ensure proper operation (Figure 7-10).**

6. Reinstall the logic board safety cover over the cable.

**CAUTION**

**Move the carriage assembly to the extreme right and left to make sure that there is adequate slack in the printhead cable to prevent any strain being placed on the cable or printhead board.**

7. Swing the keyboard back and snap it into position (Paragraph 7.7).
8. Perform the printer housing cover installation procedure (Paragraph 7.2).

## **7.9 LOGIC BOARD**

The following procedure describes the removal and installation of the logic board.

1. Perform the printer housing cover removal procedure (Paragraph 7.2).
2. Perform the keyboard/operator control panel removal procedure (Paragraph 7.7).
3. Remove the logic board safety cover.
4. Squeeze the three snap fasteners on the front of the board to free the logic board from the base assembly.
5. Slide the logic board toward the front of the terminal.

**NOTE**

**To remove cables from J1, J2, and J9 in the following steps, pull tab away from the plug and then pull plug straight up.**

Refer to Figure 7-12 for steps 6 through 12.

6. Disconnect the encoder cable from J3 on the logic board.
7. Disconnect the communication cable from J7 on the logic board.
8. Disconnect the logic/power cable from J4 on the logic board.
9. Disconnect the servo motor cable from J1 on the logic board.
10. Disconnect the stepper motor cable from J2 on the logic board.
11. Disconnect the printhead ribbon cable from J5 on the logic board.
12. Disconnect any option connectors from J8 and J9 on the logic board.
13. To install new logic board, perform steps 1 through 12 in reverse order.

**NOTE**

**When installing a new logic board in step 5, be sure that the rear edge of the board is lined up with the mounting slot in the printer mechanism.**

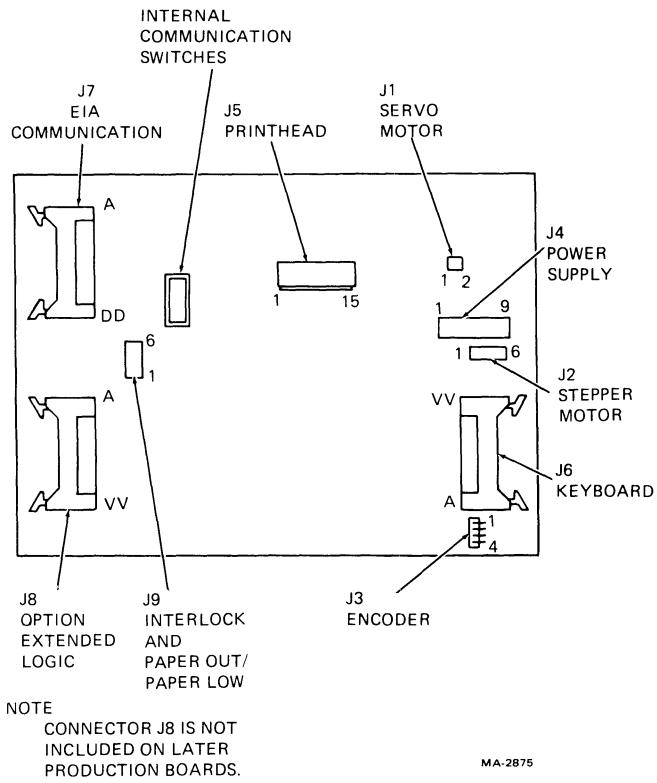


Figure 7-12 Logic Board  
a. LA34-DA Terminals

## 7.10 PRINTER MECHANISM

The following procedure describes the removal and installation of the printer mechanism.

1. Perform the printer housing cover removal procedure (Paragraph 7.2).
2. Perform the keyboard/operator control panel assembly removal procedure (Paragraph 7.7).
3. Remove the rear insert.
4. Remove the four hex-head screws that secure printer mechanism to base (Figure 7-13).
5. Remove encoder wires from clip on right side of base.
6. Lift the printer mechanism straight up.
7. To install a new printer mechanism, perform steps 1 through 6 in reverse order.

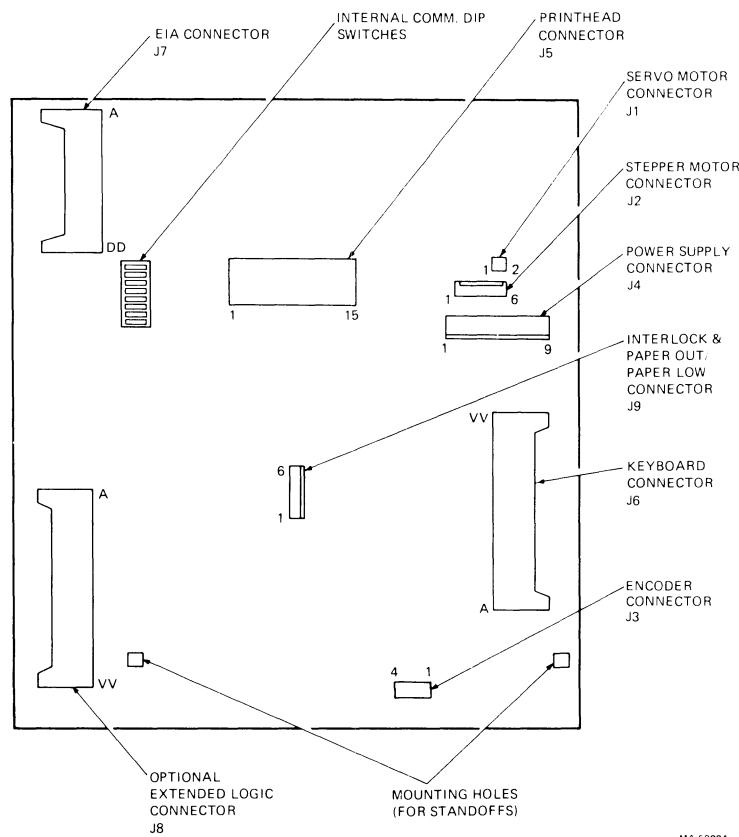


Figure 7-12 Logic Board  
b. LA34-AA Terminals

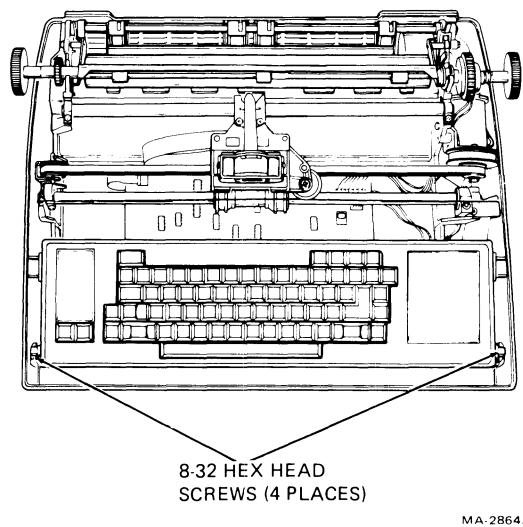


Figure 7-13 Printer Mechanism Removal

## 7.11 PAPER DRIVE CLUSTER GEAR

The following procedure describes the removal and installation of the paper drive cluster gear.

1. Perform the printer housing removal procedure (Paragraph 7.2).
2. Using retainer clip pliers, remove the C clip that secures the paper drive cluster gear (Figure 7-14).
3. Remove the paper drive cluster gear and washers.
4. To install the new paper drive cluster gear, perform steps 1 through 3 in reverse order.

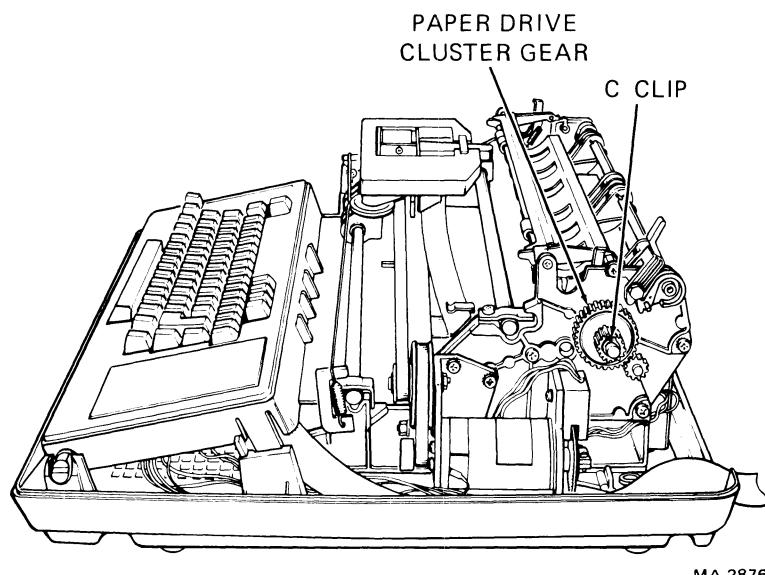
### NOTE

**Before reinstalling the printer housing cover, make sure that some movement of the paper drive cluster gear is possible and that the gear is not jammed.**

## 7.12 STEPPER MOTOR ASSEMBLY

The following procedure describes the removal and installation of the stepper motor assembly.

1. Perform the printer housing cover removal procedure (Paragraph 7.2).
2. Remove the rear insert.
3. Press the bezel retainer clips and rotate the keyboard/operator control panel assembly toward the front of the terminal (Figure 7-9).
4. Remove the logic board safety cover.
5. Disconnect the stepper motor connector from J2 on the logic board (Figure 7-12).



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Figure 7-14 Paper Drive Cluster Gear Removal

6. Perform the paper drive cluster gear removal procedure (Paragraph 7.11).
7. Remove the four (6-32) hex-head screws that secure the stepper motor to the right side plate (Figure 7-15).
8. Remove the ground strap and note its position.
9. Carefully feed the stepper motor cable through the printer mechanism and remove the stepper motor assembly.
10. To install the stepper motor perform steps 1 through 9 in reverse order.

### **7.13 SERVO MOTOR AND ENCODER ASSEMBLY**

The following describes the removal and installation of the servo motor and encoder assembly.

1. Perform the printer housing cover removal procedure (Paragraph 7.2).
2. Disconnect the encoder connector from J3 on the logic board (Figure 7-12).
3. Disconnect the servo drive connector from J1 on the logic board (Figure 7-12).

**NOTE**

**Note original cable routing and make sure that the original routing is followed when installing a new assembly.**

4. Perform the pulley/tension assembly removal procedure (Paragraph 7.14).

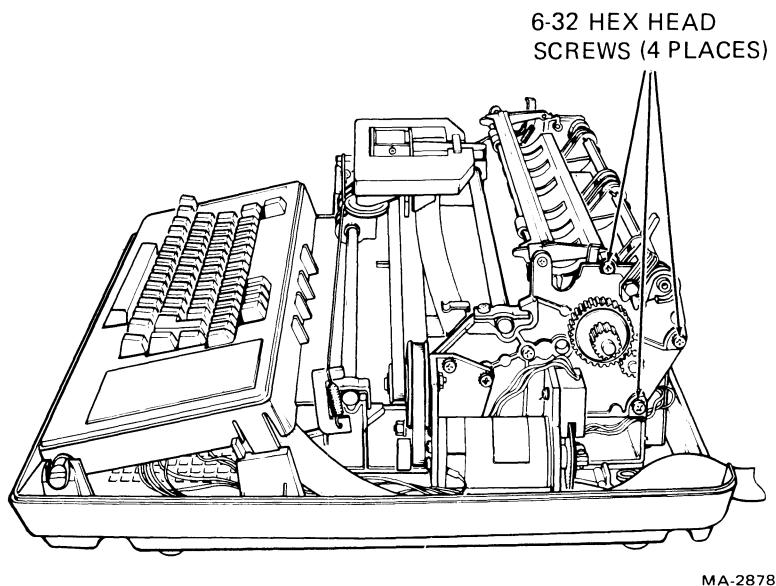


Figure 7-15 Stepper Motor Removal

5. Remove the four hex-head screws securing the print mechanism to the base assembly (Figure 7-13).
6. Remove the three hex-head screws securing the motor to the right side plate (Figure 7-16).
7. Lift the motor free from the right side plate.
8. To install the new servo motor and encoder, perform steps 1 through 7 in reverse order.

#### **7.14 PULLEY/TENSION ASSEMBLY**

The following procedure describes the removal and installation of the pulley/tension assembly.

1. Perform the printer housing cover removal procedure (Paragraph 7.2).
2. Remove the spring from the bottom of the idler stabilizer bracket (Figure 7-17).
3. Lift the idler stabilizer bracket assembly over the retainer screw (Figure 7-17).
4. Remove the pulley and tension assembly.
5. To install a new pulley/tension assembly, perform steps 1 through 4 in reverse order.

#### **7.15 TIMING BELT**

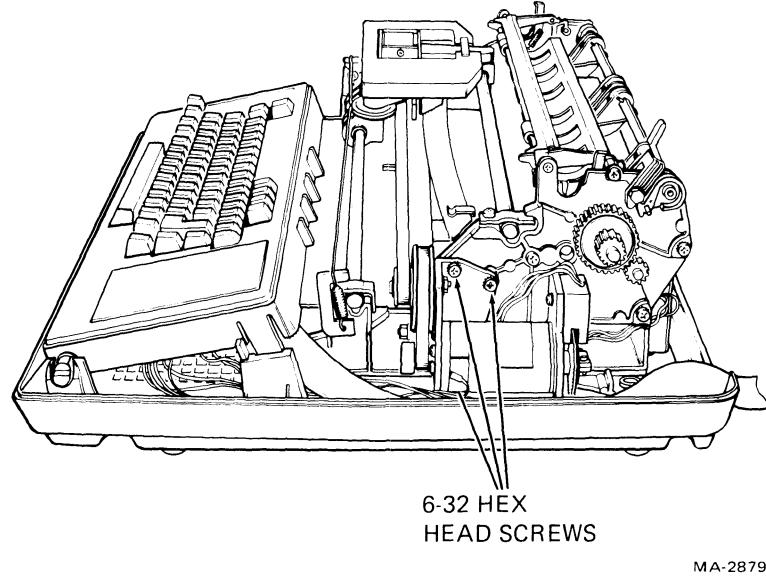
The following procedure describes the removal and installation of the timing belt.

1. Perform the printer housing cover removal procedure (Paragraph 7.2).
2. Perform the printhead removal procedure (Paragraph 7.8).
3. Perform the pulley/tension assembly removal procedure (Paragraph 7.14).
4. Remove the timing belt from the servo motor pulley.
5. Remove the clip that secures the timing belt to the carriage assembly.
6. Slip the timing belt out of the carriage assembly. Remove the timing belt.
7. To install the new timing belt, perform steps 1 through 6 in reverse order.

#### **7.16 RIBBON DRIVE CABLE**

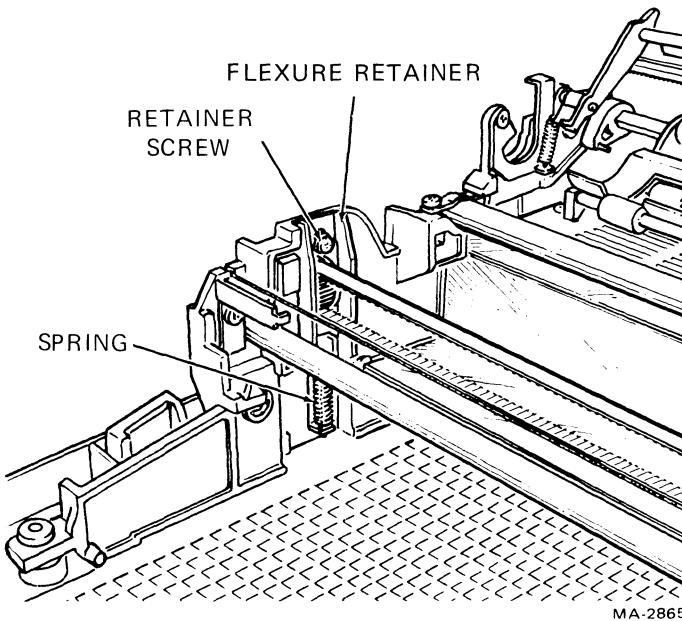
The following procedure describes the removal and installation of the ribbon drive cable assembly.

1. Perform the printer housing removal procedure (Paragraph 7.2).
2. Slide the cable over right bracket to relieve pressure.
3. Remove the spring that secures the cable to the bracket.
4. Remove the ribbon drive cable.
5. To install a new ribbon drive cable, perform steps 1 through 4 in reverse order.



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Figure 7-16 Servo Motor/Encoder Removal



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Figure 7-17 Pulley/Tension Assembly Removal

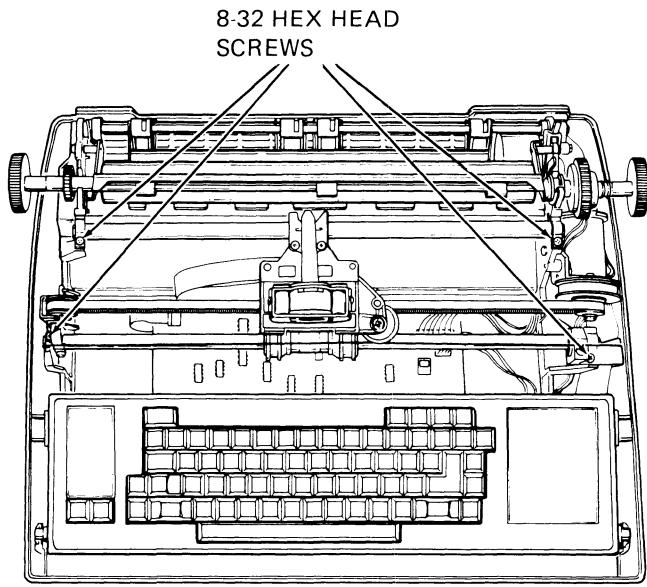
## 7.17 CARRIAGE ASSEMBLY

The following procedure describes the removal and installation of the carriage assembly.

1. Perform the printer housing removal procedure (Paragraph 7.2).
2. Perform the printhead removal procedure (Paragraph 7.7).
3. Remove the clip that secures the timing belt to the carriage assembly.
4. Slide the timing belt from the carriage assembly.
5. Perform the ribbon drive cable removal procedure (Paragraph 7.16).
6. Remove the rear carriage shaft by removing the two (8-32) hex-head screws at the end of the rear carriage shaft (Figure 7-18).
7. Loosen the two (8-32) hex-head screws at each end of the front carriage shaft (Figure 7-18).
8. Remove the front carriage shaft by sliding it out toward the left side plate.
9. Remove the carriage assembly.
10. To install a new carriage assembly, perform steps 1 through 9 in reverse order.
11. After installing a new carriage assembly, adjust parallelism of front and rear carriage shafts until the carriage slides freely on the shafts.

## 7.18 RECOMMENDED SPARES LIST (RSL)

Table 7-1 lists the recommended spares for the LA34-DA and LA34-AA terminals.



MA-2863

Figure 7-18 Carriage Assembly Removal

**Table 7-1 Recommended Spares List – DECwriter IV Series**

Part Number	Description	Quantity						XL	XM
		AA	DA	RA	VA	WA	GA		
H7834-00	Power supply	1	1	1	1	1	—	—	—
12-15348-00	Ribbon drive cable	1	1	1	1	1	—	—	—
12-15350-00	Paper drive cluster gear	1	1	1	1	1	—	—	—
12-15362-00	Timing belt (printhead)	1	1	1	1	1	—	—	—
12-15915-00	Timing belt (intermediate)	1	1	1	1	1	—	—	—
12-15558-00	Line feed stepper motor	1	1	1	1	1	—	—	—
70-15514-00	Keyboard/keycap assembly	1	1	—	—	—	—	—	—
12-14333-JU	AA keycap kit	1	—	—	—	—	—	—	—
12-14333-JY	DA keycap kit	—	1	—	—	—	—	—	—
36-15450-00	Legend strip	—	1	—	—	—	—	—	—
36-15450-01	Legend strip	1	—	—	—	—	—	—	—
70-17886-00	Keyboard/keycap assembly	—	—	1	1	1	—	—	—
54-13747-00	Control board	1	—	1	1	1	—	—	—
23-021E4-00	ROM	1	—	—	—	—	—	—	—
23-034E4-00	ROM	—	—	1	1	1	—	—	—
54-13374-00	Logic board	—	1	—	—	—	—	—	—
23-060E2-00	ROM	—	1	—	—	—	—	—	—
70-15386-3F	EIA cable assembly	1	1	1	1	1	—	—	—
70-15490-00	Printhead assembly	1	1	1	1	1	—	—	—
70-15727-00	Platen assembly	1	1	1	1	1	—	—	—
70-15733-00	Friction assembly	1	1	1	1	1	—	—	—
70-15734-00	Carriage assembly	1	1	1	1	1	—	—	—
70-15735-00	Idler/pulley assembly	1	1	1	1	1	—	—	—
70-16304-00	Interlock switch assembly	1	1	1	1	1	—	—	—
70-15737-00	Servo motor/encoder assembly	1	1	1	1	1	—	—	—
70-15738-00	Bail bar assembly	1	1	1	1	1	—	—	—
70-15739-00	Logic/power cable	1	1	1	1	1	—	—	—
70-15742-00	Clutch/hub assembly	1	1	1	1	1	—	—	—
70-15728-00	LAX34-RL roll paper holder	1	1	—	1	—	—	—	—
70-16260-00	LAX34-AL tractor option	1	1	—	—	1	—	—	—
54-13782-00	Extended logic board	—	—	—	—	—	1	—	—
54-13782-01	Extended memory board	—	—	—	—	—	—	1	—
23-030E4-00	ROM	—	—	—	—	—	—	1	1
90-07217-00	Fuse, 3 A/250 V	1	1	1	1	1	—	—	—

## **APPENDIX A**

### **GLOSSARY**

20 mA	Value of current used for the current loop communications option
8085	Microprocessor device
8251	Universal Synchronous/Asynchronous Receiver/Transmitter (USART)
A15:A0	Sixteen-line microprocessor address bus
AD7:AD0	Eight-line multiplexed Address/Data bus
ALE	Address Lines Enable
ANSI	American National Standards Institute
ASCII	American Standards Committee for Information Interchange
Asynchronous	For serial data transmission, method allowing sender and receiver to operate with nonidentical clocks
Baud rate	Rate of data exchange on a serial interface
Bus	A group of wires carrying many separate but related signals
Byte	Eight bits considered as a unit
CCITT	Comite Consultatif International Telegraphique et Telephonique – a European advisory committee.
CPU	Central Processing Unit
DC305	Printer controller device
DSR	Data Set Ready
DTR	Data Terminal Ready
EIA	Electronic Industries Association – used to refer to the EIA standard I/O interface, RS-232-C

ER1400	The nonvolatile RAM device (user permanent memory)
ESC	Escape character (ASCII 1B <sub>16</sub> /033 <sub>8</sub> )
Escape character	A control character that provides code extention and that is itself a prefix affecting the interpretation of a limited number of contiguous characters
Escape sequence	A sequence of characters that is used for control purposes to perform a control function
Firmware	Microprocessor program (microprogram)
Flag	External signal to the microprocessor
Full-duplex	Communications system capable of transmitting data in two different directions at the same time
Host	Computer that the DECwriter IV communicates with
INTA	Interrupt Acknowledge
Interrupt	A signal to the microprocessor to get it to set aside its current work to take care of a high priority task. Such tasks include getting data from a communication line before it disappears
IO/M	Input-Output/(not)memory
LED	Light Emitting Diode
Local	A condition in which the output from the keyboard goes directly to the printer without going to the host
Mark	One of two states of a communication line, usually defined as a low signal level or the presence of current flow (see also Space)
Matrix	An arrangement that allows addressing of many discrete points with few address lines, and is used in the keyboard switch array
Modem	MOdulator/DEModulator – A device that converts the DECwriter IV's EIA output to audio tones that can pass over telephone lines to a computer and vice versa
Nonvolatile RAM	Writable memory that does not lose its data when power is off
On-line	A condition in which all keyboard information passes to the host computer and the printer receives its data from the host
Parallel	Data path where all bits travel on separate wires at the same time
Parser	A firmware process that separates a sequence of characters into its component parts
RAM	Random Access Memory

<b>RD</b>	Read
<b>RO</b>	Receive Only
<b>Rollover</b>	Ability to accept more than one key pressed at the same time
<b>ROM</b>	Read Only Memory
<b>Routine</b>	A set of instructions to the microprocessor that makes it perform a specific function
<b>RS-232-C</b>	An EIA standard that dictates data interface characteristics
<b>RSL</b>	Recommended Spares List
<b>RTS</b>	Request To Send
<b>RxD</b>	Receive Data – USART
<b>RxRDY</b>	Receiver Ready – USART
<b>Serial</b>	Transmission of data bit-by-bit over a single data line
<b>SET-UP</b>	A special mode of terminal operation for entering operating parameters from the keyboard
<b>Silo</b>	An area in the printer controller (DC305) where dot data coming in from the print line buffer is queued up on a first-in/first-out basis
<b>Space</b>	One of two states of a communication line, usually defined as a high signal level or the absence of current (see also Mark)
<b>Start bit</b>	The first bit in serial asynchronous byte transmission; always a space
<b>Stop bit</b>	The last bit (or bits) in serial asynchronous byte transmission; always a mark
<b>TxD</b>	Transmitter Data – USART
<b>Vector</b>	The address of the first instruction for an interrupt handling routine
<b>WR</b>	Write
<b>WU</b>	Wake-Up
<b>XOFF</b>	Control character that asks the sender to stop sending
<b>XON</b>	Control character that asks the sender to resume sending



## APPENDIX B INTERFACE

### B.1 GENERAL

Table B-1 gives a description of the EIA interface pin assignments.

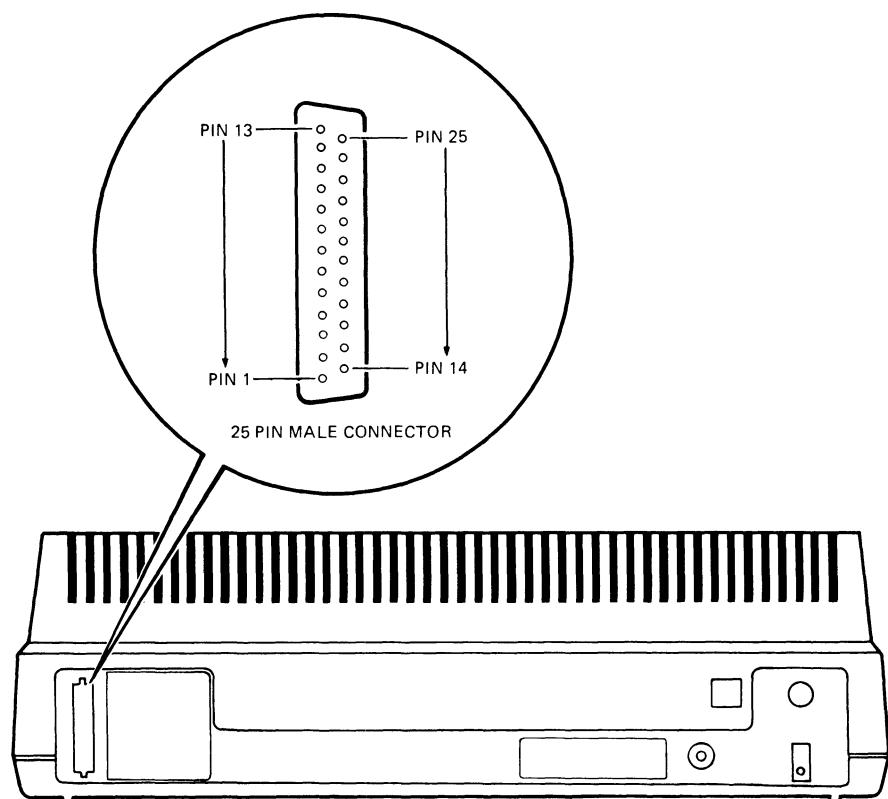
Figure B-1 shows the DB-25 (EIA RS-232-C type) connector at the rear of the terminal.

**Table B-1 EIA Interface Pin Assignments**

Pin	Name	Mnemonic	CCITT/EIA Designation	Description
1	Protective Ground	PGND	101/AA	This signal is connected to the chassis. It is also connected to external grounds through the third wire of the power cord.
2	Transmitted Data	TXD	103/BA	This signal consists of serially encoded characters generated by the terminal.
3	Received Data	RXD	104/BB	This signal consists of serially encoded characters received by the terminal.
4	Request to Send	RTS	105/CA	When the RTS signal is on, the terminal is ready to receive data.
5	Clear to Send	CTS	106/CB	The modem sends CTS in response to RTS to indicate that it is ready to transmit data.
6	Data Set Ready	DSR	107/CC	DSR is on when the modem is ready. The terminal will not receive data until this signal is on.
7	Signal Ground	SGND	102/AB	This circuit establishes a common ground reference potential for all interface circuits. This circuit is permanently connected to protective ground.

**Table B-1 EIA Interface Pin Assignments (Cont)**

Pin	Name	Mnemonic	CCITT/EIA Designation	Description
8	Receive Line Signal Detect (Carrier Detect)	RSLD (CD)	109/CF	When RSLD is on, the modes has received the Data Carrier signal. The terminal will not receive data until this signal is on.
9-19	No Connection			
20	Data Terminal Ready	DTR	108.2/CD	When the DTR signal is on, the terminal is capable of sending and receiving data.
21-25	No Connection			



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**Figure B-1 EIA Connector**

The current loop option interfaces to external communication equipment through an 8-pin Mate-N-Lok™ connector as described in Table B-2.

Figure B-2 shows the 20 mA connector (optional) at the rear of the terminal and the connector pin assignments.

**Table B-2 20 mA Connector Pin Assignments**

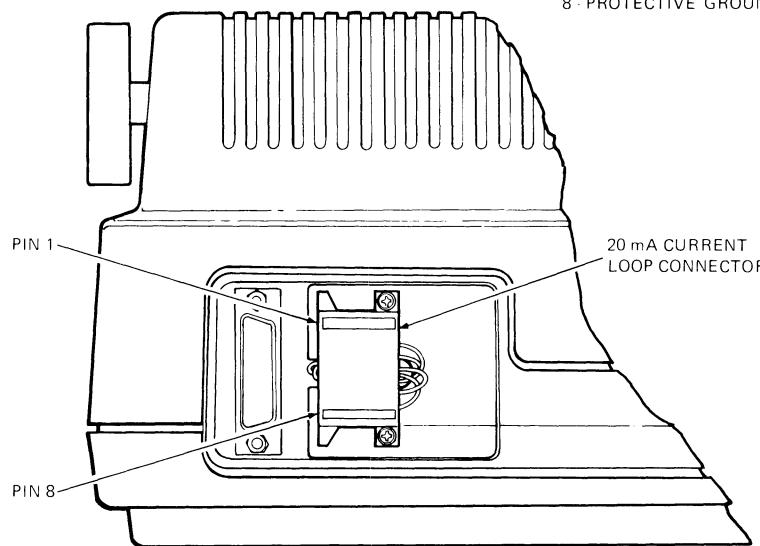
Pin Number	Signal Name	Passive Mode	Active Mode
1	(Not Used)	—	—
2	Transmit Negative (T-)	Current flows away from this terminal.	Current flows into this terminal which is connected to V- via a series resistance Rs.
3	Receive Negative (R-)	Current flows away from this terminal.	Current flows into this terminal.
4	(Not Used)		
5	Transmit Positive (T+)	Current flows into this terminal.	Current flows away from this terminal. The equivalent voltage source is $(V+) - V_d$ with a series resistance Rs.
6	(Not Used)		
7	Receive Positive (R+)	Current flows into this terminal.	Current flows away from this terminal which is connected to V+ via a series resistance Rs.
8	(Not Used)		

**NOTE**

**V- = -12 Vdc 5%**  
**V+ = +5 Vdc 5%**  
**Rs = 330 ohms 5%**  
**Vd = 2.0 Vdc maximum**

PIN ASSIGNMENTS

2 - TRANSMIT-  
3 - RECEIVE-  
5 - TRANSMIT +  
7 - RECEIVE +  
8 - PROTECTIVE GROUND



MA 7275A

Figure B-2 20 mA Connector

## APPENDIX C

### ESCAPE SEQUENCE SUMMARY

#### C.1 TEXT MODE SEQUENCES

##### **Escape Sequence Format**

ESC	I...I	F
033	040-057	060-176
Escape	Intermediate	Final
Sequence	Characters	Character
Introducer	(any number of characters— zero or more)	(one character)

##### **Character Sets (LA34-AA/38-AA only)**

Name	G0 Designator			G1 Designator		
United Kingdom	ESC 033	( 050	A 101	ESC 033	) 051	A 101
United States	ESC 033	( 050	B 102	ESC 033	) 051	B 102
Finland	ESC 033	( 050	C 103	ESC 033	) 051	C 103
Norway/Denmark	ESC 033	( 050	E 105	ESC 033	) 051	E 105
Sweden	ESC 033	( 050	H 110	ESC 033	) 051	H 110
Germany	ESC 033	( 050	K 113	ESC 033	) 051	K 113
French Canada	ESC 033	( 050	Q 121	ESC 033	) 051	Q 121
France	ESC 033	( 050	R 122	ESC 033	) 051	R 122

### Character Sets (LA34-AA/38-AA only) (Cont)

Name	G0 Designator			G1 Designator		
VT100 compatible	ESC 033	( 050	0 060	ESC 033	) 051	0 060
APL (LAX34-XL/XM only)	ESC 033	( 050	8 070	ESC 033	) 051	8 070

#### NOTE

The \*\*\* character is used to indicate variable numeric parameters within the octal representation of the control or escape sequence.

### Active Column and Active Line

Name	Mnemonic	Sequence		
Index	IND	ESC 033	D 104	
Vertical position absolute (LAX34-XL/ XM only)	VPA	ESC 033	[ 133	Pn *** d 144
Next line	NEL	ESC 033	E 105	
Horizontal position absolute (LA34-AA/ 38-AA only)	HPA	ESC 033	[ 133	Pn *** ° 140
Horizontal position relative (LA34-AA/ 38-AA only)	HPR	ESC 033	[ 133	Pn *** a 141
Vertical position relative up (LA34-AA/ 38-AA only)	VPRU	ESC 033	[ 133	Pn *** A 101

Name	Mnemonic	Sequence			
Vertical position relative down (LAX34-XL/ XM only)	VPRD	ESC 033	[ 133	Pn ***	e 145
Partial line down (LA34-AA/ 38-AA only)	PLD	ESC 033	K 113		
Partial line up (LA34-AA/ 38-AA only)	PLU	ESC 033	L 114		
Reverse index (LA34-AA/ 38-AA only)	RI	ESC 033	M 115		
Multiple reverse index (LA34-AA/ 38-AA only)		ESC 033	[ 133	Pn ***	A 101

#### Horizontal Pitch (Characters Per Inch)

Set horizontal pitch 10 char/in	DECOSHORP	ESC 033	[ 133	0 060	w 167
10 char/in		ESC 033	[ 133	1 061	w 167
12 char/in		ESC 033	[ 133	2 062	w 167
13.2 char/in		ESC 033	[ 133	3 063	w 167
16.5 char/in		ESC 033	[ 133	4 064	w 167

## Horizontal Pitch (Characters Per Inch) (Cont)

Name	Mnemonic	Sequence					
5 char/in (LA34-AA/ 38-AA only)		ESC 033	[ 133	5 065	w 167		
6 char/in (LA34-AA/ 38-AA only)		ESC 033	[ 133	6 066	w 167		
6.6 char/in (LA34-AA/ 38-AA only)		ESC 033	[ 133	7 066	w 167		
8.25 char/in (LA34-AA/ 38-AA only)		ESC 033	[ 133	8 070	w 167		

## Horizontal Margins

Set left and right margins	DECSLRM	ESC 033	[ 133	Pn ***	; 073	Pn ***	s 163
----------------------------------	---------	------------	----------	-----------	----------	-----------	----------

## Horizontal Tabs

Horizontal tabulation set	HTS	ESC 033	H 110				
Horizontal tabulation set	DECHTS	ESC 033	I 061				
Tabulation clear	TBC	ESC 033	[ 133	0 060	g 147		
Tabulation clear	TBC	ESC 033	[ 133	2 062	g 147		
Tabulation clear	TBC	ESC 033	[ 133	3 063	g 147		
Clear all horizontal tabs	DECCAHT	ESC 033	2 062				
Set horizontal tabs	DECSHTS	ESC 033	[ 133	Pn ***	; 073	... ...	Pn *** u 165

## **Vertical Pitch (Lines Per Inch)**

<b>Name</b>	<b>Mnemonic</b>	<b>Sequence</b>			
Set vertical pitch 6 lines/in	DECVERP	ESC 033	[ 133	0 060	z 172
6 lines/in		ESC 033	[ 133	1 061	z 172
8 lines/in		ESC 033	[ 133	2 062	z 172
12 lines/in		ESC 033	[ 133	3 063	z 172
2 lines/in		ESC 033	[ 133	4 064	z 172
3 lines/in		ESC 033	[ 133	5 065	z 172
4 lines/in		ESC 033	[ 133	6 066	z 172

## **Form Length**

Set lines per physical page (LA34-AA/ 38-AA only)	DECSLPP	ESC 033	[ 133	Pn ***	t 164
---------------------------------------------------------	---------	---------	-------	--------	-------

## **Vertical Margins**

Set top, bottom margins (LA34-AA/ 38-AA only)	DECSTBM	ESC 033	[ 133	Pn ***	;	073	Pn ***	r 162
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## **Vertical Tabs**

Vertical tab set (LA34-AA/ 38-AA only)	VTS	ESC 033	J 112
Vertical tab set (LA34-AA/ 38-AA only)	DECVTS	ESC 033	3 063

## Vertical Tabs (Cont)

Name	Mnemonic	Sequence					
Set vertical tab stops (LA34-AA/ 38-AA only)	DECSVTS	ESC 033	[ 133	Pn ***	; 073	...	Pn *** v 166
Clear tabulation at current line (LA34-AA/ 38-AA only)	TBC	ESC 033	[ 133	1 061	g 147		
Tabulation clear (LA34-AA/ 38-AA only)	TBC	ESC 033	[ 133	4 064	g 147		
Clear all vertical tabs (LA34-AA/ 38-AA only)	DECCAVT	ESC 033	4 064				

## Alternate Keypad

Alternate keypad (LA38-AA only)	DECKPAM	ESC 033	= 075
Numeric keypad (LA38-AA only)	DECKPNM	ESC 033	> 076

## Product Initialization and Identification

Name	Mnemonic	Sequence			
Terminal reset	—	ESC	c		
		033	143		
Device attributes*	DA	ESC	[	c	
		033	133	143	
Device attributes*	DA	ESC	[	0	c
		033	133	060	143
Identify terminal*	DECID	ESC	Z		
		033	132		

### C.1.1 Text Mode Control Characters

The following summary lists the text mode control characters to which the terminal responds.

Name	Mnemonic	Octal Code	Function
Null	NUL	000	This character has no operation; it is not stored in the input buffer. It is used as a fill character.
Enquiry	ENQ	005	This character causes the terminal to transmit the answerback message.
Bell	BEL	007	This character causes an audible bell tone to sound.
Backspace	BS	010	This character causes the active column to move left one column unless the active column is at the left margin. This condition causes no action to occur.
Horizontal tab	HT	011	This tab advances the active column to the next horizontal tab stop or to the left margin on the next line if there are no more tab stops on the line.
Line feed	LF	012	This character causes the active line to advance one line or to the top margin of the next page if active line is at the bottom margin. Active column is also set to the left margin if ANSI new line is on.

---

\*The responses will be:

```

ESC[?3;0c  v1,x (LA34-DA)
ESC[?3;1c  v1,x (LA34-DA)
ESC[?3;2c  v2,x (LA34-AA)
ESC[?3;3c  —
ESC[?3;4c  v4,x (LA34-JA)
ESC[?3;5c  v5,x (LA34-AA)
ESC[?3;6c  v6,x (LAX34-XL/XM installed)
ESC[?3;7c  v7,x (LA34-VA)

```

Name	Mnemonic	Octal Code	Function
Vertical tab	VT	013	This tab causes the active line to advance to the next vertical tab stop or the top margin of the next page if there are no more tabs on the page.
Form feed	FF	014	This character causes the active line to advance to the top margin on the next page.
Carriage return	CR	015	This character causes the active line to return to the left margin.
Shift out	SO	016	This character causes the terminal to switch to the G1 printable character set.
Shift in	SI	017	This character causes the terminal to switch to the G0 printable character set.
Cancel	CAN	030	This character causes any control or escape sequence to end immediately.
Substitute	SUB	032	This character causes any control or escape sequence to end immediately. Any characters received with errors are replaced by the SUB character. The SUB character is printed as “*”.
Escape	ESC	033	This character is the introducer of an escape sequence.
Delete	DEL	177	This character has no operation (not stored in the input buffer).

## C.2 GRAPHIC MODE SEQUENCES

### Graphic String Format

ESC 033	P 120	Pn 060	q 161	D...D 000-176	ESC 033	\ 134
------------	----------	-----------	----------	------------------	------------	----------

DCS Introducer	Protocol Selector	Data (control characters 000-076 or data 077-176)	DCS Terminator
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## Graphic Mode ANSI Control Characters

Name	Mnemonic	Octal Code	Function
Null	NUL	000	This character has no operation; it is not stored in the input buffer. It is used as a fill character.
Bell	BEL	007	This character causes an audible bell tone to sound.
Cancel	CAN	030	This character immediately causes an exit from graphics mode.
Substitute	SUB	032	This character replaces any characters received with errors. SUB is processed as a one column space.
Escape	ESC	033	This character is the introducer or terminator of a graphic string.

## Graphic Mode Private Control Characters

Name	Mnemonic	ASCII Character	Octal Code	Function
Graphic repeat introducer	DECGR1	!	041	Begin processing a repeat sequence
Graphic carriage return	DECGR	\$	044	The collected column definitions are printed, then carriage moves back to position where first character was printed after entering graphic mode. This allows lines to be overprinted
Graphic new line	DECGNL	-	055	The collected column definitions are printed and carriage moves back to first character printed after entering graphic mode; then paper is advanced 1/12 inch. This allows printing of two consecutive lines of graphic data at the same horizontal position



## APPENDIX D SPECIFICATIONS

### D.1 GENERAL

This appendix lists the specifications for all terminals in the DECwriter IV series. Table D-1 lists the specifications for the LA34-DA and LA38-GA terminals. Table D-2 lists the specifications for the LA34-AA and LA38-AA terminals (with or without the LAX34-XL/XM options). Table D-3 lists the specifications for the LA34-RA, LA34-WA and LA34-VA graphic printers.

**Table D-1 LA34-DA, LA38-GA Specifications**

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#### Operating Characteristics

Printing technique	Impact dot matrix
Print matrix	9 dots wide by 7 dots high
Maximum print speed	30 characters per second
Maximum throughput	30 characters per second
Horizontal slew rate	50 inches per second
Single line feed time	50 ms
Vertical slew rate	5 inches per second
Paper feed	Sprocket-feed, tractor drive Friction-feed, platen drive
Vertical pitch	2, 3, 4, 6, 8, or 12 lines per inch – User selected
Horizontal	10, 12, 13.2, 16.5 characters per inch – User selected
Maximum line length (varies with horizontal pitch)	10 characters/inch = 132 columns 12 characters/inch = 158 columns 13.2 characters/inch = 168 columns 16.5 characters/inch = 216 columns
Margins	Left, right User selected
Tabs	217 horizontal User selected

---

**Table D-1 LA34-DA, LA38-GA Specifications (Cont)****Operating Characteristics**

Character set	USASCII upper/lowercase set
Other printer features	Cover open interlock, self-test, status message, terminal reset, manual last character visibility

**Keyboard Specifications**

Keyboard	Typewriter style with multi-key rollover
Numeric keypad (Standard on the LA38-GA)	18 keys including 4 function keys
Other keyboard features	Local line feed, auto repeat on all alphanumeric keys

**Physical Characteristics**

## Dimensions (basic terminal)

Length	55.9 cm (22 in)
Width	16.4 cm (16.4 in)
Height	18.3 cm (6.5 in)
Weight	10 Kg (22 lb) without paper

## Terminal power

Voltage	90-128 Vac or 180-256 Vac Switch selectable 47 - 63 Hz
Watts (max)	Printing 45 watts Nonprinting 25 watts

## Temperature

Operating	10° to 40° C (50 to 104° F), noncondensing
Non-operating	-40° to 66° C (-40° to 151° F), noncondensing

## Relative humidity

Operating	10 to 90 percent with maximum wet bulb temperature of 28° C (82° F) and a minimum dew point of 2° C (36° F), noncondensing
Non-operating	5 to 95%, noncondensing

**Table D-1 LA34-DA, LA38-GA Specifications (Cont)**

---

**Paper Specifications**

**Roll Feed**

Width	7.62 to 37.78 cm (3 to 14-7/8 in)
Weight	
Single-part	6.8 kg (15 lb) paper minimum
Roll diameter	4-1/2 inch maximum
Core diameter	1 inch

**NOTES**

1. Single-sheet or roll paper may be used.
2. Preprinted forms are not recommended.
3. Multipart forms are not recommended.
4. Impact paper is not recommended.
5. Card stock is not recommended.

**Sprocket 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 1 to 4 parts (refer to notes)
Multipart	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. First-surface impact paper is not recommended.
  3. Dot or line glue margins are acceptable (if line is on one margin only).
  4. Split forms (forms with each side containing a different number of sheets) are not recommended.
  5. Stapled forms are not recommended.
-

**Table D-1 LA34-DA, LA38-GA Specifications (Cont)**

<b>Ribbon Specifications</b>	
Cartridge	
Dimensions	
Length	10.64 cm (4.188 in)
Width	14.15 cm (5.570 in)
Height	1.42 cm $\pm$ 0.051 cm (0.560 in $\pm$ 0.02 in)
Ribbon Fabric	
Material	Nylon, nontextured
Thickness	0.086 mm – 0.1076 mm (0.0034 in – 0.0042 in)
Width	1.27 cm $\pm$ 0.0381 cm (0.5 in $\pm$ 0.15 in)
Ribbon Life	16 hours of continuous printing

**Table D-2 LA34-AA, LA38-AA Specifications****Operating Characteristics**

Printing technique	Impact dot matrix
Print matrix	9 dots wide by 7 dots high
Maximum print rate	
Text mode	30 characters per second 45 characters per second with optional extended logic/memory option installed and operating at baud rates higher than 300
Graphics mode	320 columns per second
Graphics mode horizontal resolution	132 columns per inch with a fifty percent overlap
Graphics mode vertical resolution	72 dots per inch with no overlap between dots, 4/9 of a dot overlap between lines
Aspect ratio	1.83

**NOTE**

**Aspect ratio is the ratio of the horizontal resolution to the vertical resolution.**

**Table D-2 LA34-AA, LA38-AA Specifications (Cont)****Operating Characteristics**

Horizontal slew rate	45 inches per second
Single line feed time	50 ms
Vertical slew rate	5 inches per second
Paper feed	Pin-feed, tractor drive Friction-feed, platen drive
Vertical pitch	2, 3, 4, 6, 8, or 12 lines per inch Keyboard and computer selectable
Horizontal pitch	10, 12, 13.2, or 16.5 single width characters per inch and 5, 6, 6.6, or 8.25 double width characters per inch Keyboard and computer selectable
Maximum line length (varies with horizontal pitch)	10 char/in 12 char/in 13.2 char/in 16.5 char/in 5 char/in 6 char/in 6.6 char/in 8.25 char/in  132 columns 158 columns 168 columns 216 columns 66 columns 79 columns 84 columns 108 columns
Margins	Left, right, top, bottom Keyboard and computer selectable
Tabs	216 horizontal 168 vertical
<b>Printer Character Sets</b>	USASCII United Kingdom Finland Norway/Denmark Sweden Germany French Canada France VT100 compatible APL (with optional extended logic/memory option) Keyboard and computer selectable

**Table D-2 LA34-AA, LA38-AA Specifications (Cont)**

<b>Keyboard Character Sets</b>	USASCII United Kingdom Finland Norway/Denmark Sweden Germany French Canada France Keyboard selectable
<b>Answerback</b>	Up to 30 characters (may be stored in the extended logic/memory option)
<b>Positioning Commands</b>	Horizontal and vertical, absolute and relative
<b>SET-UP Feature Storage</b>	True nonvolatile memory (no batteries) with extended logic/memory option
<b>Other Printer Features</b>	Cover open interlock, self-test, status message, auto and manual last character visibility
<b>Communications Features</b>	
Interface	EIA standard 20 mA optional
Baud rates	110, 300 baud standard 50, 75, 134.5, 150, 200, 600, 1200, 1800, 2400, 4800, 7200, and 9600 baud with optional extended logic/memory option
Split baud rates (with extended logic/memory option)	75 baud send/600 baud rec 75 baud send/1200 baud rec 150 baud send/600 baud rec 150 baud send/1200 baud rec 300 baud send/2400 baud rec 300 baud send/4800 baud rec 600 baud send/2400 baud rec 600 baud send/4800 baud rec
Character format	7- or 8-bit ASCII, serial, asynchronous
Parity	Even, odd, or none (eighth bit set to mark or space)
Input buffer	160 characters standard With extended memory option: 1184 characters or, 2208 characters
Modem control	Full-duplex with or without EIA control (switch selectable)

**Table D-2 LA34-AA, LA38-AA Specifications (Cont)**

<b>Physical Characteristics</b>	Refer to Table D-1
<b>Paper Requirements</b>	Refer to Table D-1
<b>Tractor Feed</b>	Refer to Table D-1
<b>Ribbon Specification</b>	Refer to Table D-1

**Table D-3 LA34-RA, LA34-VA, LA34-WA Specifications****Operating Characteristics**

Printing technique	Impact dot matrix
Print matrix	9 dots wide by 7 dots high
Maximum print rate	
Text mode	45 characters per second
Graphics mode	320 columns per second or 960 dots per second
Graphic mode horizontal resolution	132 columns per inch with a 50 percent overlap
Graphic mode vertical resolution	72 dots per inch with no overlap between dots, 4/9 of a dot overlap between lines
Aspect ratio	1.83

**NOTE**

**Aspect ratio is the ratio of the horizontal resolution to the vertical resolution.**

Horizontal slew rate	45 inches per second
Single line feed time	70 ms
Vertical slew rate	5 inches per second
Paper feed	Pin feed, tractor drive Friction feed, platen drive
Vertical pitch	2, 3, 4, 6, 8, or 12 lines per inch (computer selected)

**Table D-3 LA34-RA, LA34-VA, LA34-WA Specifications (Cont)****Operating Characteristics**

Horizontal pitch	10, 12, 13.2, 16.5, 5, 6, 6.6, 8.25 characters per inch (computer selected)
Maximum line length (varies with horizontal pitch)	10 char/in 12 char/in 13.2 char/in 16.5 char/in 5 char/in 6 char/in 6.6 char/in 8.25 char/in
	132 columns 158 columns 168 columns 216 columns 66 columns 79 columns 84 columns 108 columns
Margins	Left, right, top, bottom (computer selected)
Tabs	216 horizontal 168 vertical (computer selected)
Character sets	USASCII United Kingdom Finland Norway/Denmark Sweden Germany French Canada France VT100 compatible
Other printer features	Cover open interlock, self-test, status message, auto last character view
Operator control panel features	On-line, off-line, self-test, top of form, form feed
<b>Physical Characteristics</b>	Refer to Table D-1
<b>Paper Requirements</b>	Refer to Table D-1
<b>Ribbon Specification</b>	Refer to Table D-1



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