EK-OLA50-TM-001

LA50 Printer

Technical Manual

digital

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LA50 Printer

Technical Manual

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of
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CHAPTER 1
GENERAL DESCRIPTION

1.1 GENERAL

The LA50 (Figure 1-1) is a desk top, receive-only, microprocessor controlled, dot-matrix printer. The printer is available in four models to meet international power requirements. They are the model LA50-RA, LA50-RB, LA50-RC, and LA50-RD which operate at 120 Vac, 220 Vac, 240 Vac, and 100 Vac respectively. Print modes are either text or graphic. In the text mode, characters define the functions and character symbols usually associated with alphanumeric printers. In the graphic mode, characters define one of 64 possible 1 × 6 dot combinations for print. The LA50 receives characters and commands through an asynchronous serial interface at selectable baud rates from 110 to 4800 baud.

1.2 PHYSICAL DESCRIPTION

The LA50 main assemblies consist of the printer mechanism, printhead, and the printed circuit board (PCB). The PCB is reached through the bottom of the printer and contains the logic, control, and power supply circuits.

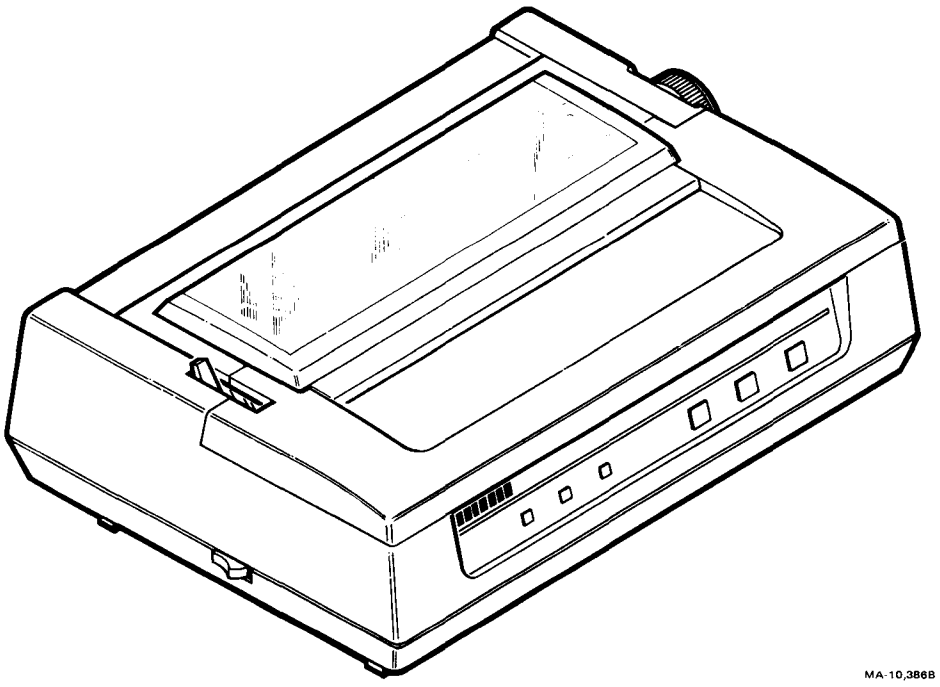

Figure 1-1 LA50 Printer

1.3 FUNCTIONAL DESCRIPTION

The LA50 is a receive-only printer which operates as an output device for a computer. Input buffer capacity is 2047 characters. The printer receives and interprets information from the computer and prints it out.

The standard character set for the LA50 is based on the US ASCII character set (Figure 1-2) which includes 94 upper- and lowercase printable characters. In addition, the printer can print the 81 Multinational, the 63 JTS Katakana, the 27 VT100 Special Graphics, and the error indicator.

B7 B6 B5 / BITS B4 B3 B2 B1 / ROW	0 0 0 / COLUMN 0		0 0 1 / 1		0 1 0 / 2		0 1 1 / 3		1 0 0 / 4		1 0 1 / 5		1 1 0 / 6		1 1 1 / 7	
0 0 0 0 / 0	NUL	0 0 0	DLE	20 16 10	SP	40 32 20	0	60 48 30	@	100 64 40	P	120 80 50	`	140 96 60	p	160 112 70
0 0 0 1 / 1	SOH	1 1 1	DC1 (XON)	21 17 11	!	41 33 21	1	61 49 31	A	101 65 41	Q	121 81 51	a	141 97 61	q	161 113 71
0 0 1 0 / 2	STX	2 2 2	DC2	22 18 12	"	42 34 22	2	62 50 32	B	102 66 42	R	122 82 52	b	142 98 62	r	162 114 72
0 0 1 1 / 3	ETX	3 3 3	DC3 (XOFF)	23 19 13	#	43 35 23	3	63 51 33	C	103 67 43	S	123 83 53	c	143 99 63	s	163 115 73
0 1 0 0 / 4	EOT	4 4 4	DC4	24 20 14	$	44 36 24	4	64 52 34	D	104 68 44	T	124 84 54	d	144 100 64	t	164 116 74
0 1 0 1 / 5	ENQ	5 5 5	NAK	25 21 15	%	45 37 25	5	65 53 35	E	105 69 45	U	125 85 55	e	145 101 65	u	165 117 75
0 1 1 0 / 6	ACK	6 6 6	SYN	26 22 16	&	46 38 26	6	66 54 36	F	106 70 46	V	126 86 56	f	146 102 66	v	166 118 76
0 1 1 1 / 7	BEL	7 7 7	ETB	27 23 17	'	47 39 27	7	67 55 37	G	107 71 47	W	127 87 57	g	147 103 67	w	167 119 77
1 0 0 0 / 8	BS	10 8 8	CAN	30 24 18	(	50 40 28	8	70 56 38	H	110 72 48	X	130 88 58	h	150 104 68	x	170 120 78
1 0 0 1 / 9	HT	11 9 9	EM	31 25 19	)	51 41 29	9	71 57 39	I	111 73 49	Y	131 89 59	i	151 105 69	y	171 121 79
1 0 1 0 / 10	LF	12 10 A	SUB	32 26 1A	*	52 42 2A	:	72 58 3A	J	112 74 4A	Z	132 90 5A	j	152 106 6A	z	172 122 7A
1 0 1 1 / 11	VT	13 11 B	ESC	33 27 1B	+	53 43 2B	;	73 59 3B	K	113 75 4B	[	133 91 5B	k	153 107 6B	{	173 123 7B
1 1 0 0 / 12	FF	14 12 C	FS	34 28 1C	,	54 44 2C	<	74 60 3C	L	114 76 4C	\	134 92 5C	l	154 108 6C	|	174 124 7C
1 1 0 1 / 13	CR	15 13 D	GS	35 29 1D	-	55 45 2D	=	75 61 3D	M	115 77 4D	]	135 93 5D	m	155 109 6D	}	175 125 7D
1 1 1 0 / 14	SO	16 14 E	RS	36 30 1E	.	56 46 2E	>	76 62 3E	N	116 78 4E	^	136 94 5E	n	156 110 6E	~	176 126 7E
1 1 1 1 / 15	SI	17 15 F	US	37 31 1F	/	57 47 2F	?	77 63 3F	O	117 79 4F	_	137 95 5F	o	157 111 6F	DEL	177 127 7F

KEY ASCII CHARACTER: ESC | 33 OCTAL | 27 DECIMAL | 1B HEX

MA-7246

Figure 1-2 ASCII Chart

Characters are printed by moving a 9-wire, solenoid-operated printhead horizontally along the print line and then firing groups of discrete wires at each printing position to form 7 × 9 dot-matrix characters. An enhanced mode prints 13 × 9 dot-matrix characters. The graphics mode printing process involves creating a single vertical column of up to six dots for each character received.

The printer uses single sheet or pinfeed paper, a plug-in printhead, and a disposable ribbon cartridge. The printhead and ribbon mount on the carriage assembly and are easily reached for removal and replacement. A reversible motor drives the carriage assembly horizontally and a stepper motor drives the platen which advances the paper vertically. A ribbon drive mechanism in the carriage assembly advances the ribbon as the carriage moves. Control logic circuits on the PCB synchronize printhead position by print commands.

A programmed microprocessor on the control/logic PCB controls input/output, character printing, and forms control. Figure 1-3 shows a simplified block diagram of the LA50 printer.

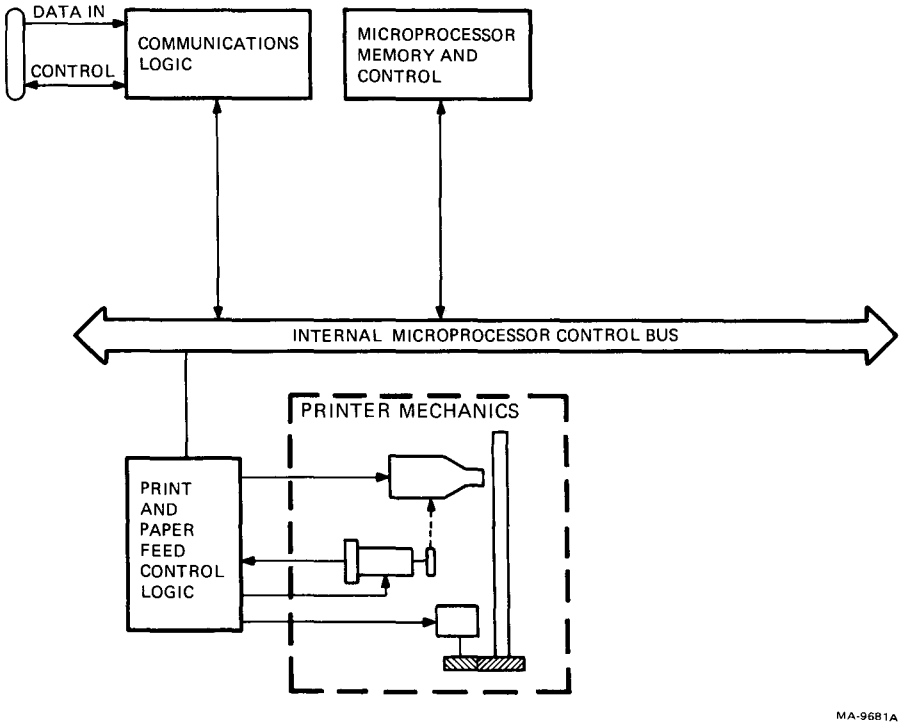

Figure 1-3 Simplified Block Diagram

1.4 RELATED DOCUMENTS

Table 1-1 lists all the documentation available to support the LA50 printer.

Table 1-1 Related Documents

Title	Document Number	Description
Installing and Using the LA50 Printer	EK-0LA50-UG	Installing and operating the printer
LA50 Printer Programmer Reference Manual	EK-0LA50-RM	Programming and interfacing the printer
LA50 Pocket Service Guide	EK-0LA50-PS	Troubleshooting and mechanical servicing information
LA50 Technical Manual	EK-0LA50-TM	Installing, operating, theory of operation, detailed troubleshooting, and mechanical servicing information
LA50 Illustrated Parts Breakdown	EK-0LA50-IP	Exploded views and parts lists
LA50 Field Maintenance Print Set	000-955	Engineering drawings

CHAPTER 2
INSTALLATION

2.1 GENERAL

This chapter contains the step-by-step procedures to inspect, install, power up, and check out the printer. These procedures allow you to verify that the printer is not damaged and is operating properly before you connect it to the communication system.

2.2 SITE CONSIDERATIONS

Install the printer in an area that is free from excessive dust, dirt, corrosive fumes, and vapors. Table 2-1 lists the environmental and power requirements of the printer. Figure 2-1 illustrates its overall dimensions. Appendix D contains a complete list of specifications.

Table 2-1 Site Considerations

Consideration	Specification	
Temperature	10° to 40° C (50° to 104° F)	
Relative humidity	10% to 90%	
Input voltage	Model LA50-RA	104 to 128 Vac
	Model LA50-RB	191 to 235 Vac
	Model LA50-RC	208 to 256 Vac
	Model LA50-RD	90 to 110 Vac
Frequency range	47 to 63 Hz	
Power consumption	Operating: 180 watts maximum Idling: 16 watts	

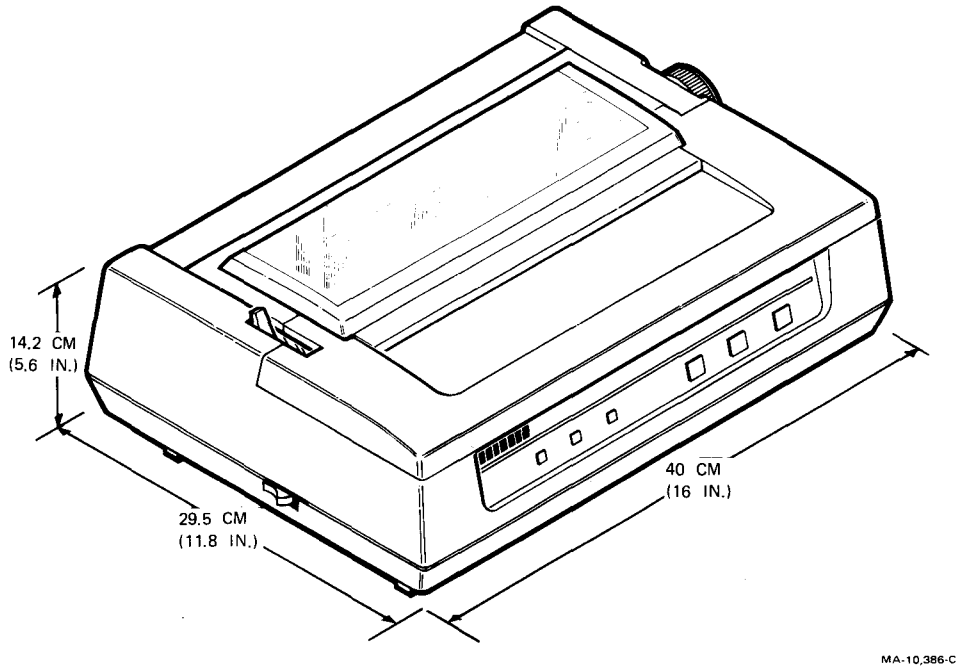

Figure 2-1 Printer Dimensions

2.3 UNPACKING AND INSPECTION

Use this procedure to unpack and inspect the printer. You need a sharp instrument to perform this procedure.

1. Open the top of the shipping carton (Figure 2-2).
2. Lift the printer up and out of the carton. Place it on a flat, clean work surface.
3. Remove the shock absorbing material and packing from around the printer.
4. Remove the documentation package, power cord, and ribbon.
5. Carefully inspect the printer for obvious shipping damage. Check for lost or missing items. Report any damaged or missing items to the local carrier and your Digital branch office.
6. Remove the access cover and remove the cardboard retainer (Figure 2-3). Replace the access cover.
7. If necessary, wipe the outer surfaces with a clean, soft, lint-free cloth.

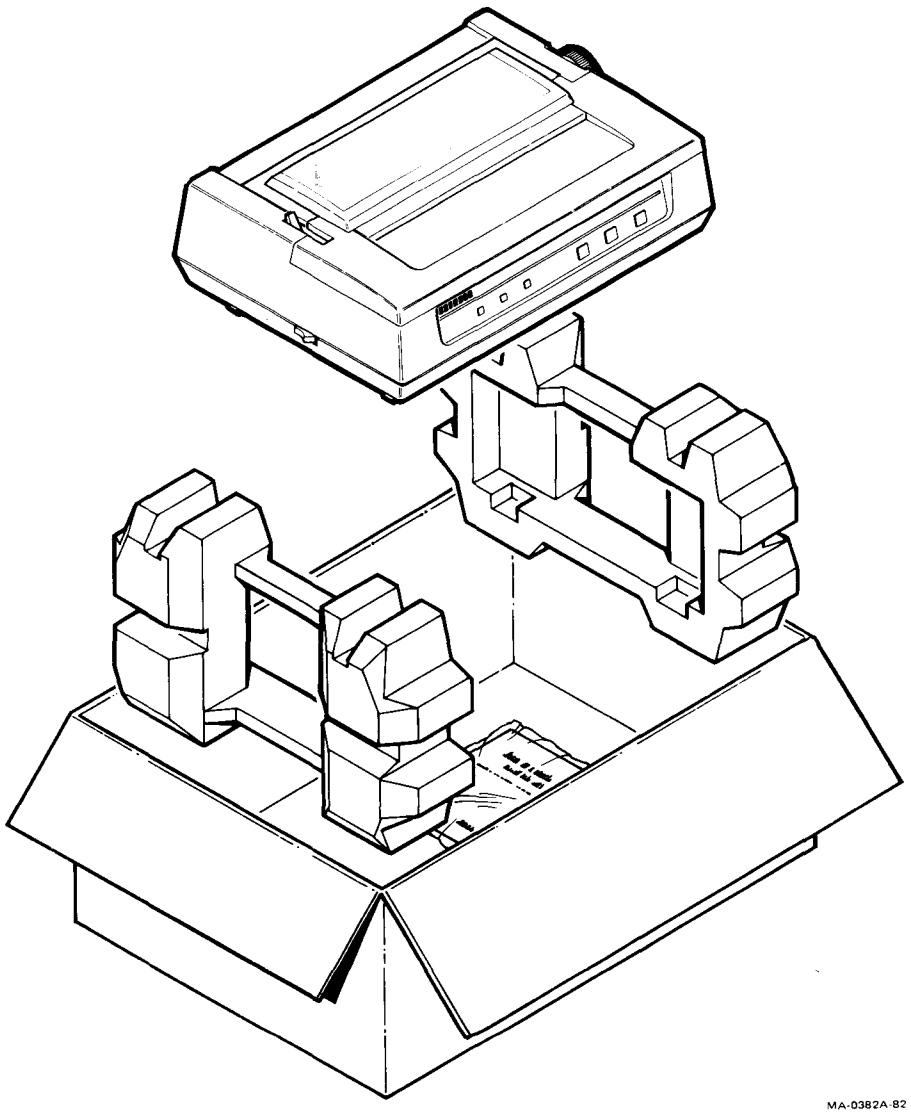

Figure 2-2 Unpacking/Packing Details

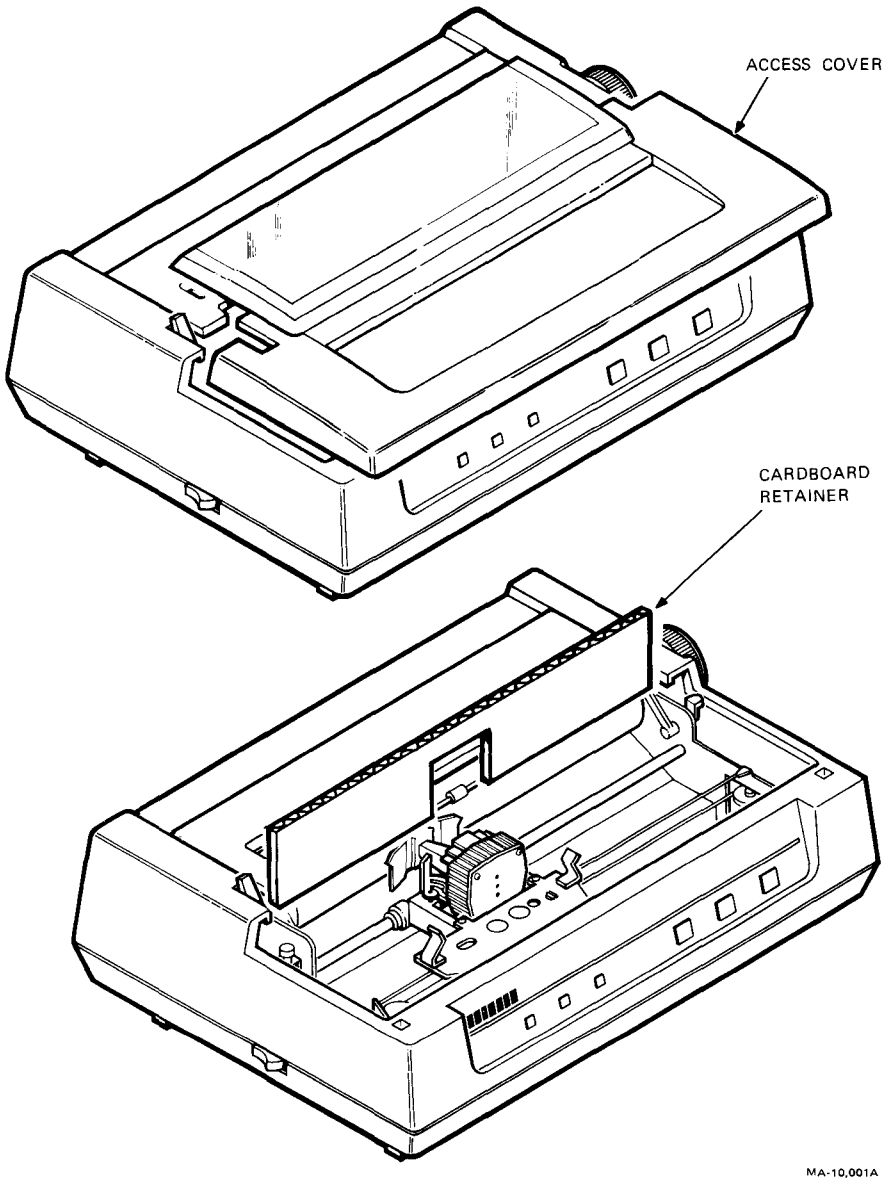

Figure 2-3 Packing Removal

2.4 REPACKING PROCEDURES

Perform the following procedure to repack the printer for shipment.

1. Remove the ribbon cartridge, paper, and all cables.

2. Remove the access cover and secure the printhead with the cardboard retainer to prevent movement while in transit. Replace the access cover (Figure 2-3).

3. Repack the printer with the shock absorbing material (Figure 2-2).

4. Seal the shipping carton with reinforced tape.

2.5 INSTALLATION PROCEDURES

Perform the following procedures to install the printer.

2.5.1 Ribbon Installation

Perform the following procedure to install the ribbon.

1. Remove the access cover.

2. Take up slack in the ribbon by turning the knob in the direction indicated by the arrow on the cartridge.

3. Position the cartridge between the clips on the carriage and push down on the cartridge until it is in place (Figure 2-4).

4. Replace the access cover.

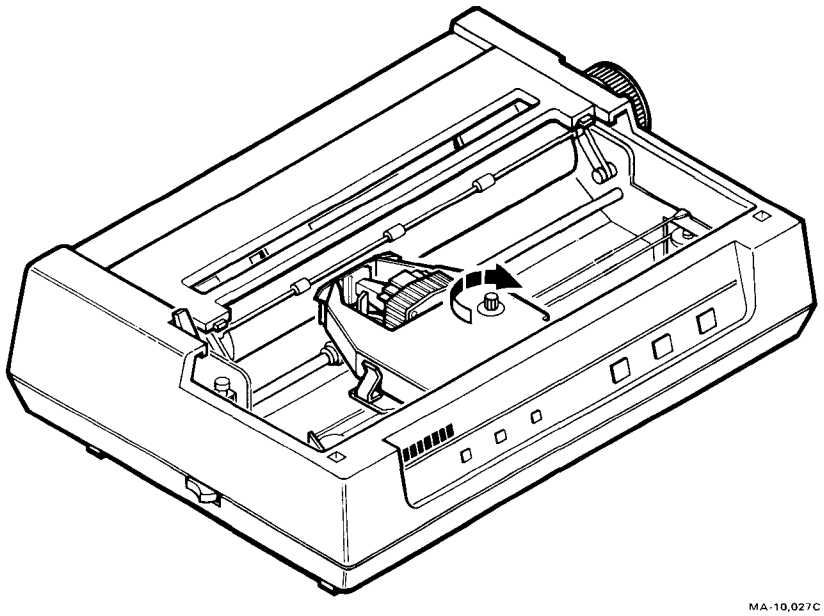

Figure 2-4 Ribbon Installation

2.5.2 Paper Installation

The printer uses pinfeed or single sheet paper. The following procedure is for installation of pinfeed paper.

1. Turn off power.
2. Open paper window (Figure 2-5).
3. Remove paper cover.
4. Pull bail bar away from platen.
5. Push paper release lever toward back of printer.
6. Open paper clamps (Figure 2-6).

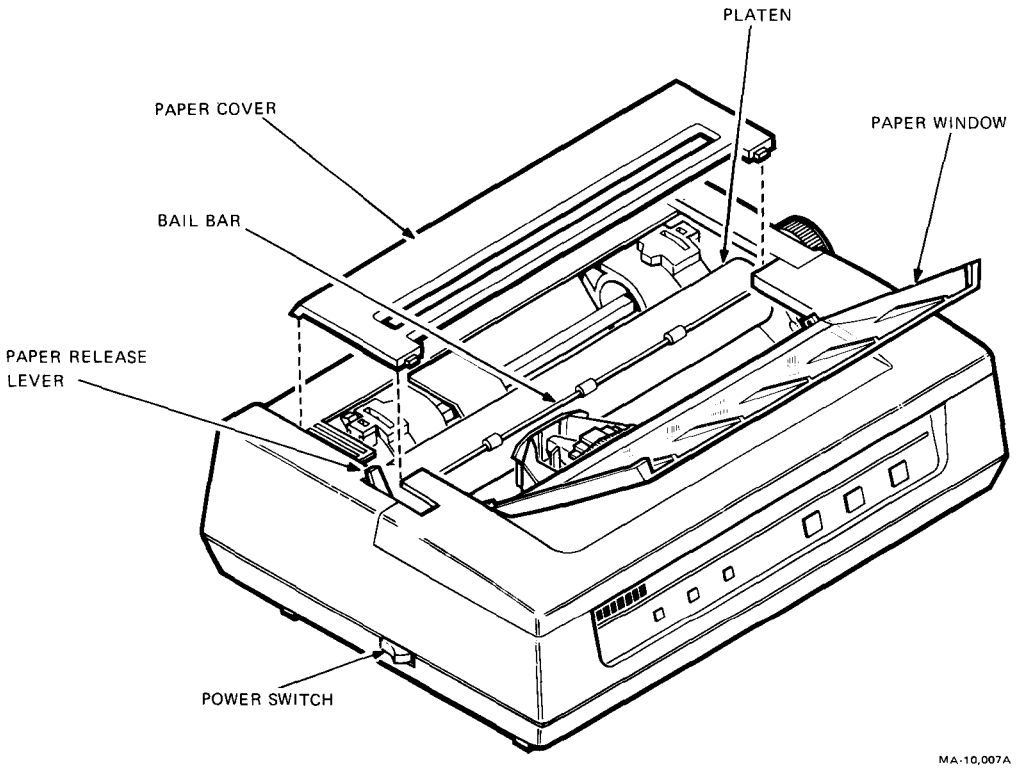

Figure 2-5 Paper Installation

7. Position paper on tractor. If paper does not fit properly, use white tractor release levers to reposition tractors.

8. Close paper clamps.

9. Turn platen knob and guide paper behind platen.

10. Advance paper until top of paper is behind bail bar.

11. Push bail bar against platen.

12. Replace paper cover.

13. Close paper window.

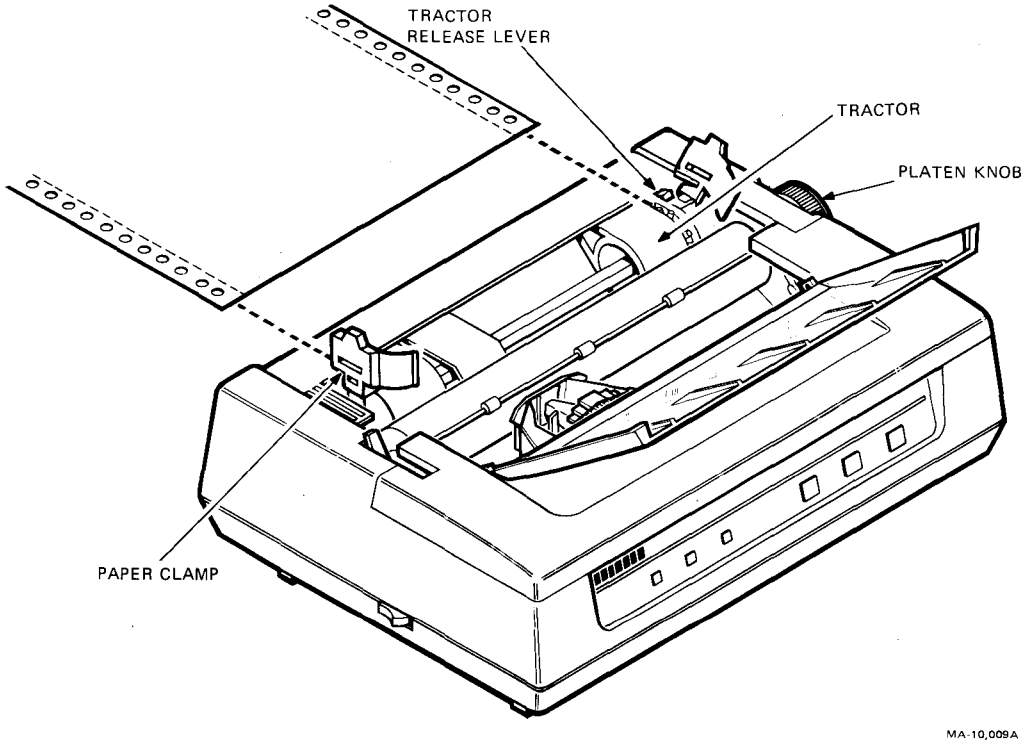

Figure 2-6 Pinfeed Paper Insertion

The following procedure is for installation of single sheet paper.

1. Turn off power.
2. Open paper window.
3. Pull bail bar away from platen.
4. Push paper release lever toward back of printer.
5. Push paper through slot in paper cover and guide it to front of platen. Align paper (Figure 2-7).
6. Pull paper release lever toward front of printer.
7. Push bail bar against platen.
8. Close paper window.
9. Turn platen knob to reposition paper.

2.5.3 Power Up and Checkout

Use this procedure to power up the printer and verify that it is operational.

1. Set the power switch to 0.
2. Plug the ac power cord into the ac power receptacle on the rear of the printer (Figure 2-8).

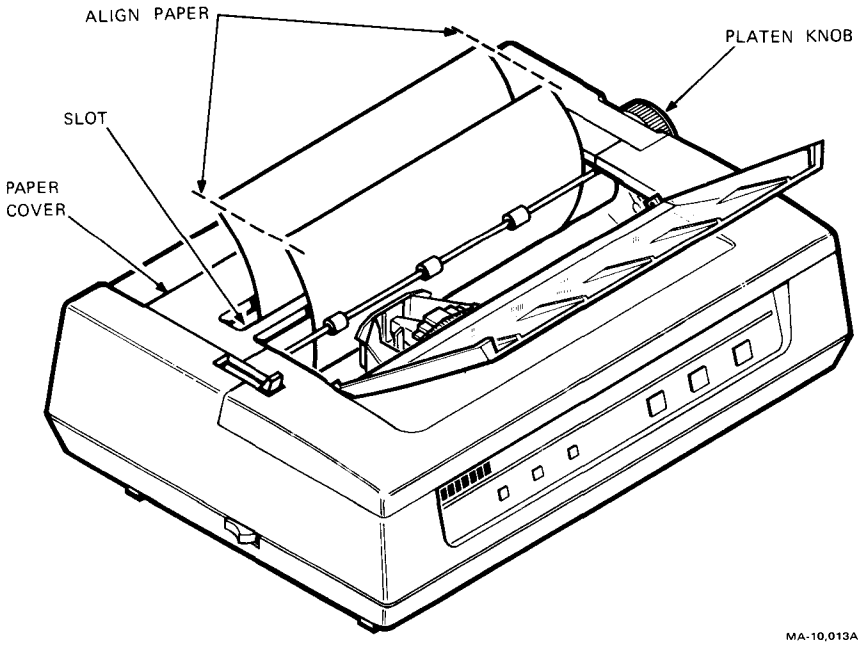

Figure 2-7 Single Sheet Paper Insertion

3. Plug the other end of the ac power cord into a nonswitched, grounded wall receptacle.

4. Insert paper into the printer.

5. Turn the power on. The POWER indicator should light.

6. Perform the self-tests described in Chapter 3, Paragraph 3.2.

7. After you have verified that the printer is operating correctly, turn off the power and connect the interface cable to the system as described in Paragraph 2.5.4.

2.5.4 Interface Cable

The cable does not come with the printer. The following is a list of cables for system interconnection:

Cable	System
BCC05	Professional 300 Series and DECmate
BCC04	Rainbow
BC22A	Other

Use the following procedure to install the interface cable.

1. Plug the system cable into the interface connector on the rear of the printer (Figure 2-8).

2. Install the other end of the cable as described in your system installation manual.

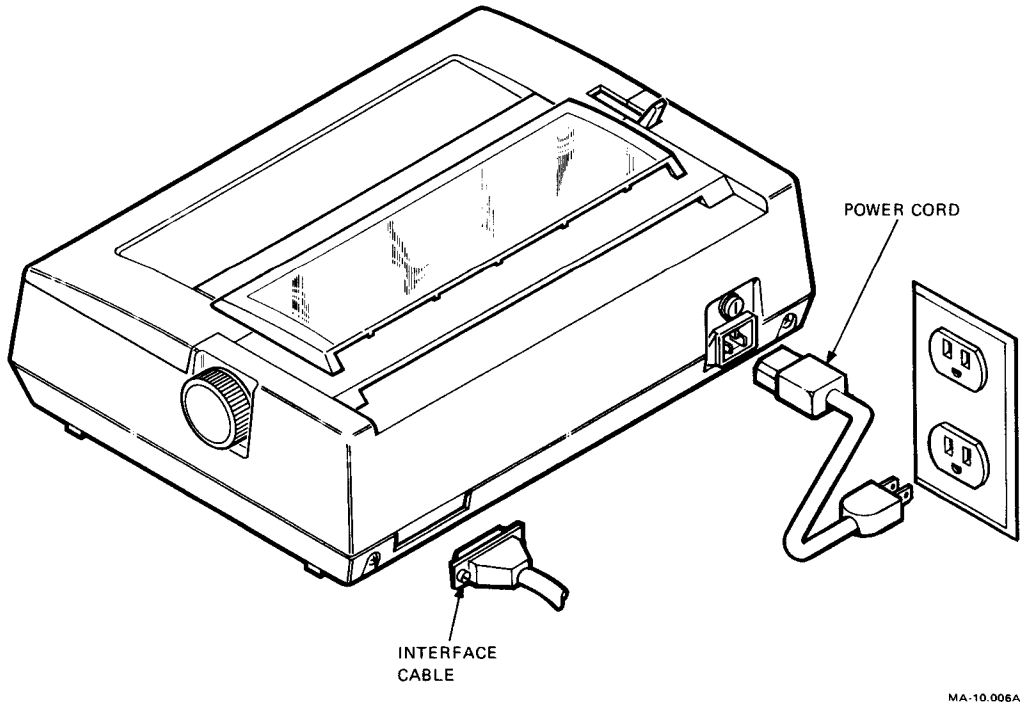

Figure 2-8 Cable Installation

2.6 CONFIGURATION SWITCHES

The LA50 printer must be compatible with computer hardware and software to communicate properly. The configuration switches allow users to tailor the terminal to operate with a specific computer. They are factory set for printer use with Digital systems.

To locate the configuration switches, remove the access cover and move the carriage to the left. Figure 2-9 shows the location of the switches and the labeled functions of each switch. To change a configuration feature, move the tab with a small blade screwdriver, ballpoint pen, or equivalent.

CAUTION

Never use a lead pencil to change a switch position. Broken lead or lead powder can cause a short or intermittent problem to occur on the printed circuit board.

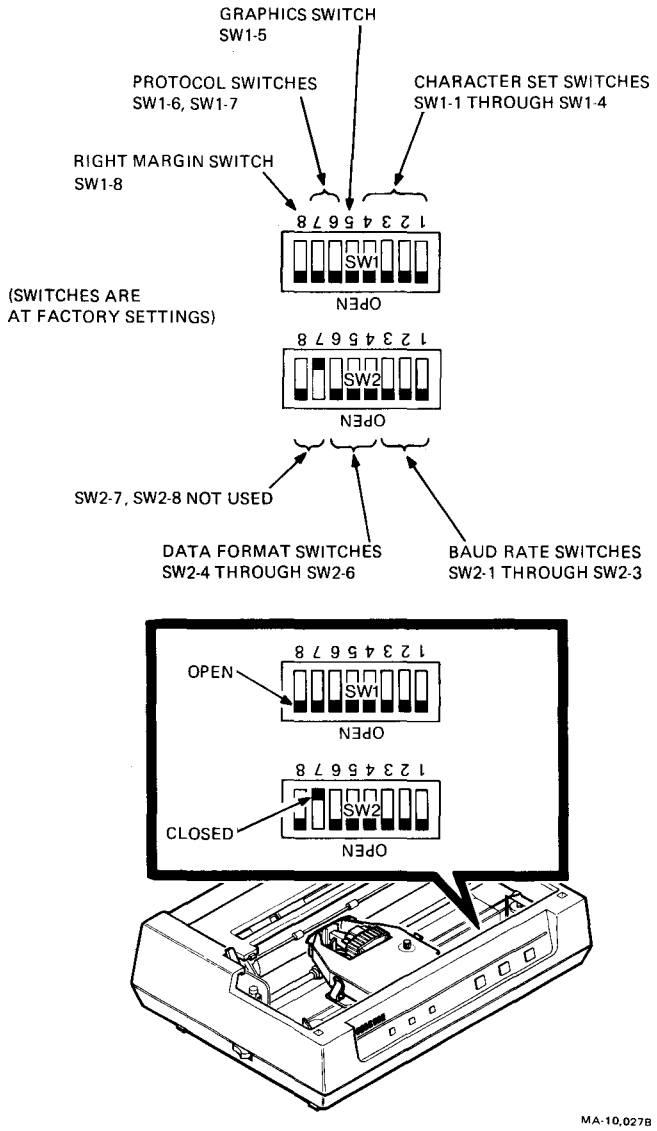

Figure 2-9 Configuration Switches

Tables 2-2 through 2-7 show the switch positions for various system configurations.

Table 2-2 National Character Set

Switches SW1-1 through SW1-4 change the characters for multinational applications. When operating the printer with Digital systems in an 8-bit environment, no change in settings is necessary.

Nation	Switch Positions SW1-1	SW1-2	SW1-3	SW1-4
United States	Open	Open	Open	Open*
Britain	Closed	Open	Open	Open
Finland	Open	Closed	Open	Open
France	Closed	Closed	Open	Open
French Canada	Open	Open	Closed	Open
Germany	Closed	Open	Closed	Open
Italy	Open	Closed	Closed	Open
Japan	Closed	Closed	Closed	Open
Norway/Denmark	Open	Open	Open	Closed
Spain	Closed	Open	Open	Closed
Sweden	Open	Closed	Open	Closed

* factory setting

Table 2-3 Graphics Aspect Ratio

Switch SW1-5 changes the horizontal to vertical dot ratio in graphic mode by changing the number of horizontal dots per inch. The number of vertical dots are kept constant at 72 dots per inch.

Ratio	Horizontal Dots/Inch	Switch Position
2:1	144	Open*
2.5:1	180	Closed

* factory setting

Table 2-4 XON/XOFF and Ready/Busy Protocol

Digital systems use XON/XOFF protocol. Other systems may require Ready/Busy protocol. Switch SW1-6 selects the protocol. Switch SW1-7 selects the ready and busy signal levels.

Protocol	SW1-6 Position
XON/XOFF	Open*
Ready/Busy	Closed
Signal Level	**SW1-7 Position**
Busy = High Ready = Low	Open*
Busy = Low Ready = High	Closed

* factory setting

Table 2-5 Right Margin

Switch SW1-8 selects the method of controlling a line of characters that exceeds the eight inch line of print. If set to truncate, the printer prints only the first eight inches of characters and drops the remaining characters. If set to wrap, the printer prints the remaining characters on the next line.

Selection	SW1-8 Switch Position
Truncate	Open*
Wrap	Closed

* factory setting

Table 2-6 Baud Rate Select

Switches SW2-1 through SW2-3 select the speed (bits per second) at which the printer communicates with the computer.

	Switch Positions		
Baud Rate	**SW2-1**	**SW2-2**	**SW2-3**
4800	Open	Open	Open (factory setting)
2400	Open	Closed	Open
1200	Open	Closed	Closed
600	Closed	Open	Open
300	Closed	Open	Closed
200	Closed	Closed	Open
110	Closed	Closed	Closed

* factory setting

Table 2-7 Data Format

Switches SW2-4 through SW2-6 select the data format to enable communication with the computer.

Data Format	Switch Position SW2-4	SW2-5	SW2-6
7 bits, plus odd parity	Open	Closed	Closed
7 bits, plus even parity	Closed	Closed	Closed
7 bits, plus 8th bit mark	Open	Open	Closed
7 bits, plus 8th bit space	Closed	Open	Closed
8 bits, plus odd parity	Open	Closed	Open
8 bits, plus even parity	Closed	Closed	Open
8 bits, no parity	Open	Open	Open*

* factory setting

CHAPTER 3
OPERATOR INFORMATION

3.1 GENERAL

This chapter provides maintenance personnel with a summary of the printer controls and indicators. Figure 3-1 shows their locations and Table 3-1 describes their functions.

3.2 OPERATOR TESTS

If at any time there appears to be a problem in the printer, the operator may start a self-test. There are four self-tests. Two of the tests provide the operator with a printout. Table 3-2 is a list of the self-test procedures and the printer component areas under test.

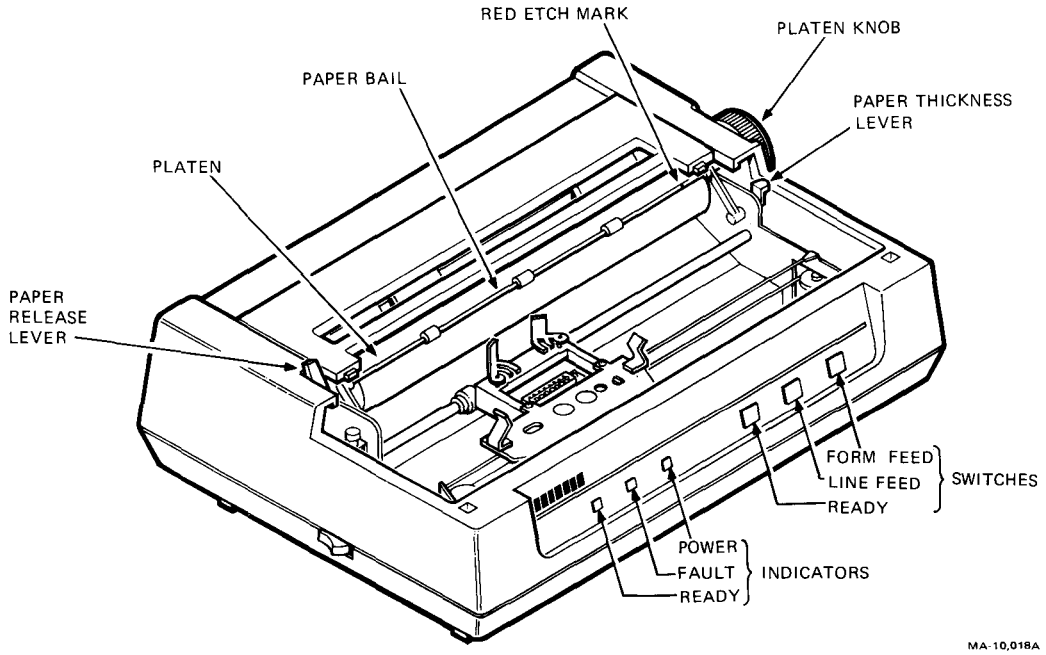

Figure 3-1 Controls and Indicators

Table 3-1 Controls and Indicators

Control/Indicator	Function
READY indicator	The green READY indicator indicates the printer's operating state. It is on when the printer is ready to print or is printing. If it is off, the printer is not ready and will not start.
FAULT indicator	The red FAULT indicator blinks when the printer detects an electronic fault. It stays on when the printer is out of paper.
POWER indicator	The green POWER indicator is on when you apply power to the printer.
READY switch	The READY switch controls the printer's operating state. Pressing the switch puts the printer in either the ready or not ready state. In the ready state the READY indicator is on.
LINE FEED switch	Pressing LINE FEED advances the paper one line.
FORM FEED switch	Pressing FORM FEED advances the paper one full sheet.
Paper bail	The paper bail holds the paper against the platen. Red etch marks on the bail help you position paper on the platen and locate the horizontal printing position.
Paper thickness lever	The paper thickness lever adjusts the printhead position to allow for different printing form thickness. Keep the lever close to the platen for normal printing. Move the lever away from the platen for thicker sheets and multicopy forms.
Paper release lever	The paper release lever controls paper holding tension. In the forward position, paper is held tightly against the platen. In the backward position, the paper is free for positioning or removal.
Platen knob	The platen knob allows manual control of the platen for paper insertion, and for changing the paper's vertical position.

Table 3-2 Self-Test Procedures

Self-Test	Checkout
Internal (runs automatically at powerup)	Checks logic and memory
Carriage motion	Checks carriage motor and drive circuits
Print	Checks line feed motor, carriage motor, printhead and associated circuits. Does not test communication lines
Loopback	Checks same functions as print self-test plus the EIA transmit and receive lines

3.2.1 Internal Self-Test

This test checks the logic circuits on the printed circuit board (PCB). It runs automatically when power is applied to the printer. The printing function is not energized during this test. The diagnostics include a checksum test to verify all of the bits of the read only memory (ROM) and a pattern test to exercise and verify all of the bits of the random access memory (RAM). If there is a failure, the FAULT light flashes.

3.2.2 Carriage Motion Self-Test

This test checks the carriage motor and drive circuitry. Its purpose is to verify that the carriage system functions and that the mechanism is clear of obstructions. The printing function is not energized during this test.

The test procedure is as follows.

1. Start with the power turned off.
2. Press and hold the FORM FEED and LINE FEED keys and turn the power on.
3. Release the keys. The carriage should go through a scanning motion. If there is a failure, the FAULT light flashes or the test stops before it is complete.
4. Turn the power off to stop the test.

3.2.3 Print Self-Test

This test checks the logic circuits, line feed motor, carriage motor, and printhead. The test is useful for general checkout of the printer and after changing an FRU. The test result is a printed pattern of the ASCII character set (Figure 3-2).

The test procedure is as follows.

1. Start with the power turned off.
2. Press and hold the FORM FEED key and turn the power on.
3. Release the key. The printing operation should start and continue until the power is turned off. A flashing FAULT light, poor print quality, or failure of the test before completion indicates a failure. A successful test is determined by examining the printed test pattern.

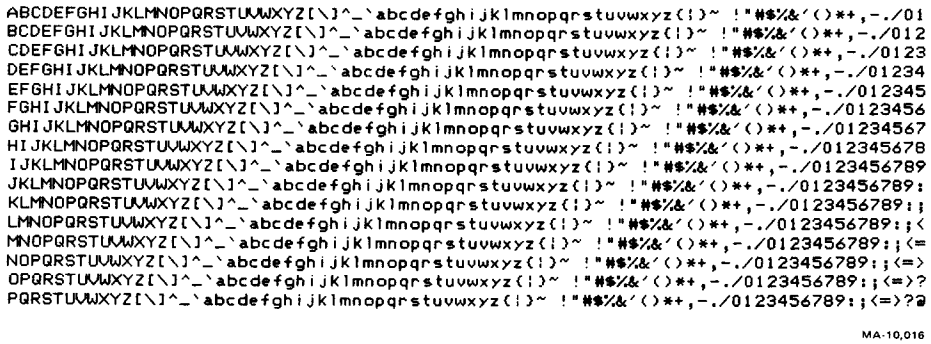

Figure 3-2 Print Test Pattern

3.2.4 Loopback Self-Test

This test checks the logic circuits, line feed motor, carriage motor, printhead, and EIA transmit and receive lines. The test is performed with a loopback connector (EIA PN 12-15336-01, Figure 3-3) that externally connects the send data signals to the receive data signals.

The test procedure is as follows.

1. Start with the power turned off.
2. Plug the external loopback connector into the printer interface receptacle.
3. Press and hold the LINE FEED key and turn the power on.
4. Release the key. The printing operation should start and continue until the power is turned off. If the printer does not detect data on the receive data line within one second after the test starts, the FAULT light flashes. A successful test is determined by examining the printed test pattern (Figure 3-2).

3.3 OPERATOR TROUBLESHOOTING

If the printer does not start when you turn the power on, or if the printer appears to be defective, refer to Table 3-3. This table describes the checks you should make before turning to the troubleshooting chapter.

CAUTION

Always turn off the printer before you attempt to correct a problem.

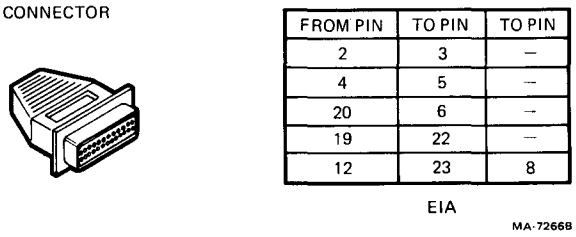

Figure 3-3 EIA Loopback Connector

Table 3-3 Operator Troubleshooting

Symptom	Probable Cause	Remedy
Printer does not start when power is turned on.	Power cord not connected, or broken	Check power cord connections. Check power cord for damage.
	Power source fault	Check power at power receptacle.
	Fuse open	Make sure fuse is in place. Replace fuse if blown (Paragraph 6.2.3)

Table 3-3 Operator Troubleshooting (Cont)

Symptom	Probable Cause	Remedy
No printout. FAULT light is on. Pressing the READY button causes printer to print one line.	Printer out of paper	Reload paper and press the READY button.
No printout. Pressing the READY button does not start printer.	Access cover open	Close cover and press the READY button.
Light print.	Paper thickness lever set incorrectly	Reset paper thickness lever to a position closer to the platen.
	Ribbon worn	Replace ribbon cartridge.
Carriage moves, but no printout	Paper thickness lever set incorrectly	Reset paper thickness lever to a position closer to the platen.
	Printhead fault	Replace printhead (Paragraph 6.2.4).
Missing dots in print; always in same row.	Printhead fault	Replace printhead (Paragraph 6.2.4).
Paper jams.	Paper path obstructed	Clear paper path.
	Paper thickness lever set incorrectly	Reset paper thickness lever to a position away from the platen.
Pinfeed paper jams.	Tractors positioned incorrectly for paper width	Release and reposition the tractors. Avoid pulling or compressing paper.

CHAPTER 4
THEORY

4.1 GENERAL

This chapter describes the functions performed by the LA50 printer. It also provides an understanding of the printer's basic operating principles for field service personnel. Block diagrams and other drawings support the text.

4.2 INTRODUCTION

The LA50 is a complete self-contained computer output hardcopy terminal. It consists of two basic components (exclusive of the enclosure), a control/logic board which contains the power supply, and the printer mechanism. The LA50 block diagram (Figure 4-1) shows these components and how they functionally tie 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 the following functional components:

- A microprocessor to manage the overall terminal operation
- 2 × 8192 bytes of read only memory (ROM) containing a microprogram and standard set-up parameters to operate the terminal with its specific features
- 2 × 2048 bytes of random access memory (RAM) for microprocessor temporary storage and input/output data storage
- An I/O buffer that provides an interface between the microprocessor and the electromechanical components in the printer mechanism
- An asynchronous serial receiver/transmitter (USART) for data exchange with the host computer
- An interval timer for control/logic system timing

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

- A 9-wire printhead
- A carriage motor for horizontal printhead position
- A stepper motor for vertical paper movement
- A paper-out sensor
- A platen, bail bar, and friction assembly

The power supply converts the ac power line into dc voltages used by the printer. A dc to dc converter transforms the regulated 5 volt dc power source to +12 volts and −12 volts.

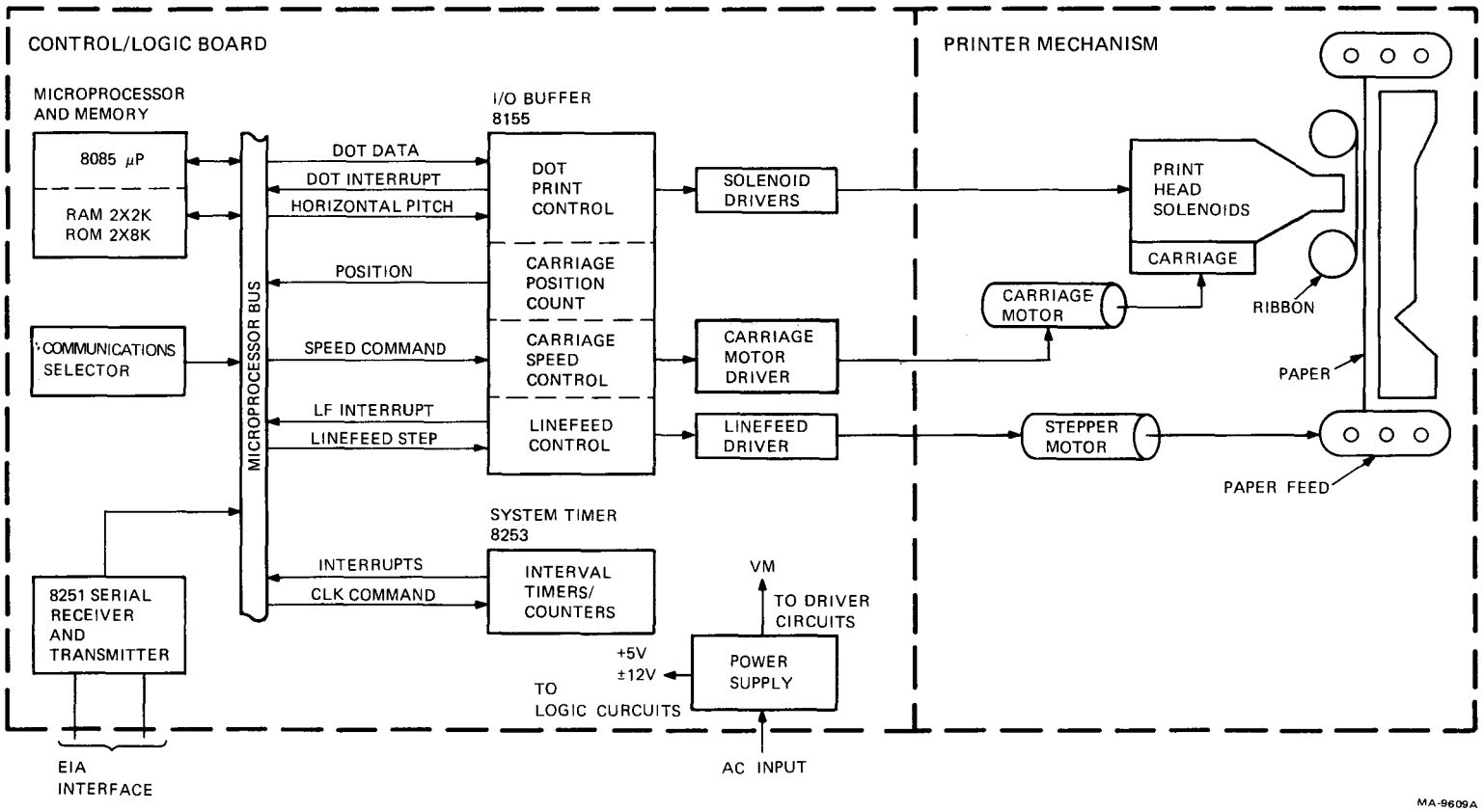

Figure 4-1 LA50 Block Diagram

4.3 FUNCTIONAL OVERVIEW

The LA50 receives characters from the host processor and examines them to determine if they are printable characters or 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.

The functional areas of the LA50 printer are divided for discussion into the following groups.

- Microprocessor/control system
- Communications and input/output data processing
- Printfeed positioning and printing process
- Paper advancing process
- Power supply and power distribution

4.4 DESCRIPTION OF FUNCTIONAL AREAS

The LA50 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.

4.4.1 Microprocessor/Control System

An 8085 microprocessor is the center of the LA50 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 4-2 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 volt logic voltage reaches its normal level. When WU goes high, the microprocessor 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. The AD lines are then free for instructions and other input/output data for the remainder of the cycle.

The microprocessor addresses devices on the address/data buses as either memory or I/O. The output signal IO/not memory (I0/M) makes the distinction. When low, I0/M enables memory (ROM/RAM) and the 8251 USART. When high, IO/M enables the 8155 I/O device. The I/O devices in the LA50 system are the many receivers and transmitters that communicate certain command and status information. I/O write addresses send commands to the printhead, carriage motor, and line feed drivers. I/O read addresses get status on the cover interlock switch, paper-out switch and the configuration of the communication DIP switches.

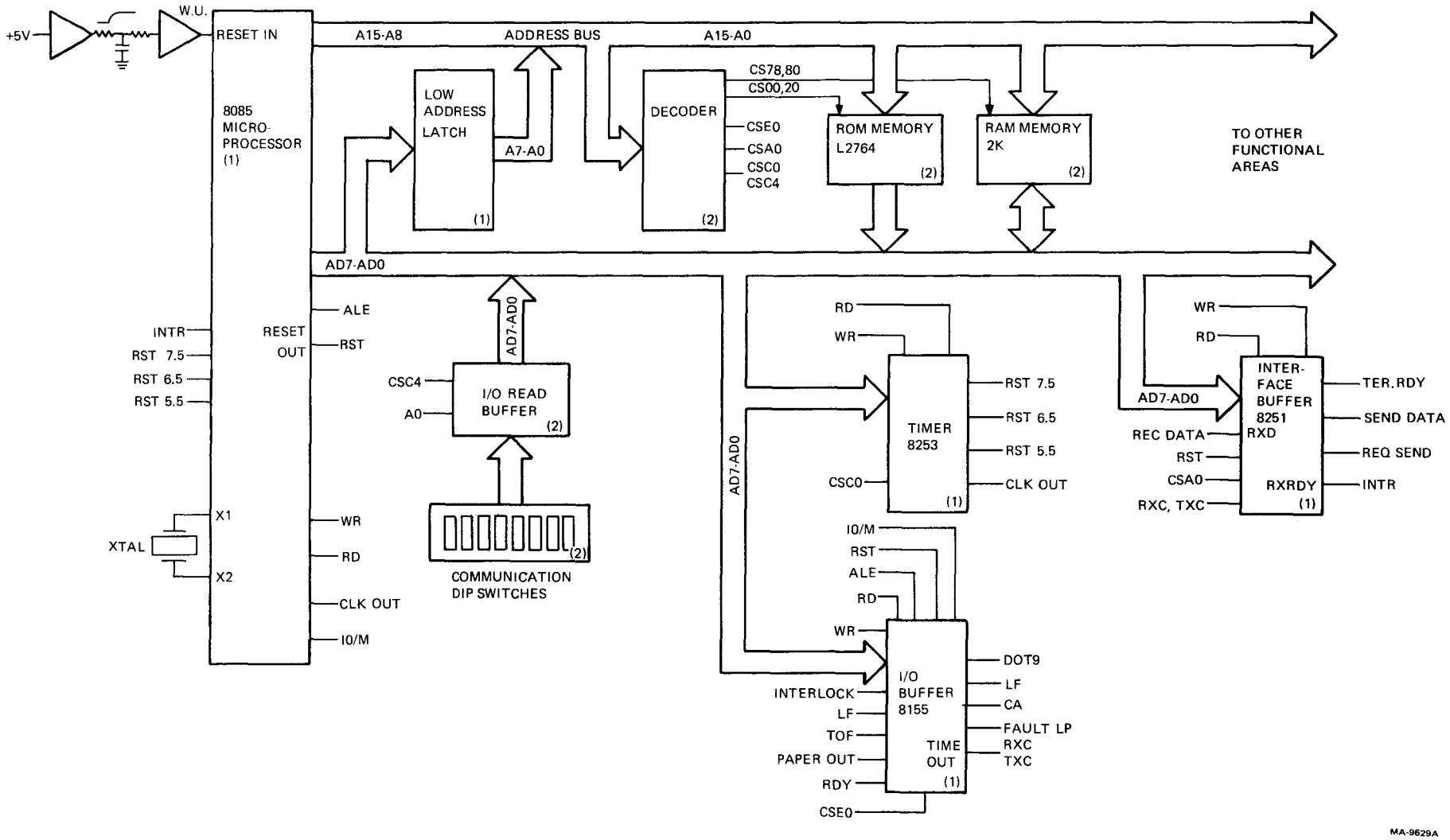

Figure 4-2 Microprocessor/Control System Logic

System timing is established by a crystal connected to the microprocessor. The microprocessor divides the crystal operating frequency (running at 6.144 MHz) in half and produces the 3 MHz CLK OUT signal. CLK OUT runs to other functional areas and produces printing and communications timing. The microprocessor runs continuously, fetching and executing instructions from memory so long as there are no interrupts. The microprocessor goes to a wait state whenever a write to, read from, or interrupt occurs. This introduces a short time period called a wait state into the microprocessor cycle to allow more time for the I/O devices to respond.

When the LA50 is turned on, a short initialization routine is run to verify all of the bits of the ROM and RAM. After executing the initialization routine, the microprocessor goes to a monitor routine. 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 to wait for the monitor loop to poll for it. Hardware interrupts are used to handle this critical information or updating. Some examples are items which must be handled in "realtime" such as processing high baud rate receiver data.

4.4.2 Communications and I/O Data Processing

The terminal interfaces to the host computer through a serial data port. The port includes a 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.

4.4.2.1 Data Format – The LA50 printer communicates using serial characters. The serial character format used must be the same character format used by the computer. Serial characters are transmitted using a start bit, seven or eight data bits, an optional parity bit and one stop bit (Figure 4-3). The number of bits and the polarity of the parity (even or odd) is switch selectable. Parity errors can be detected for either polarity.

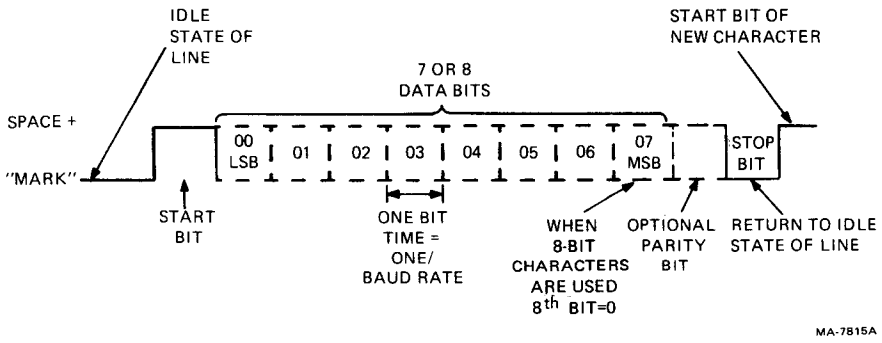

Figure 4-3 Serial Character Format

4.4.2.2 Data Handling – The complete functional definition of the USART is programmed into the printer 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 4-4 shows how data is handled across the serial line and in the printer.

Before further processing, the input buffer, which has a character capacity of 2047, temporarily stores all characters except nulls and deletes. Nulls and deletes are ignored and do not occupy space in the input buffer.

If the printer falls too far behind the incoming data, the input buffer overflows and data is lost. If characters are lost due to input buffer overflow, a single substitute control character (octal 032) is placed in the input buffer at the point of loss. If a character is received with a parity error, the character is replaced in the input buffer by the substitute control character (octal 032) thus causing the error character (reverse question mark) to be printed. The 032 control character, thus indicates loss of characters, or a character received with parity error.

When the printer is capable of printing, characters are fetched from the input buffer and printed or otherwise processed as required. When the printer is incapable of printing, the printer scans the input buffer for printer status request control sequences even if the input buffer is full.

To avoid input buffer overflow, the XON/OFF protocol or Ready/Busy protocol synchronizes the data source with the printer. Protocol selection is by an internal switch.

XON/XOFF Protocol
The XON/XOFF protocol synchronizes the data source with the printer as described below.

After successfully powering up and becoming enabled to send, the printer sends an XON control character and constantly monitors the number of empty character positions in the input buffer. When the number is less than 128, the printer sends an XOFF control character, signaling the data source to temporarily stop sending data. Meanwhile, the printer continues to take characters from the input buffer and print or otherwise process them. When the number of empty positions in the buffer exceeds 224, the printer sends an XON control character, thus signaling that transmission may resume.

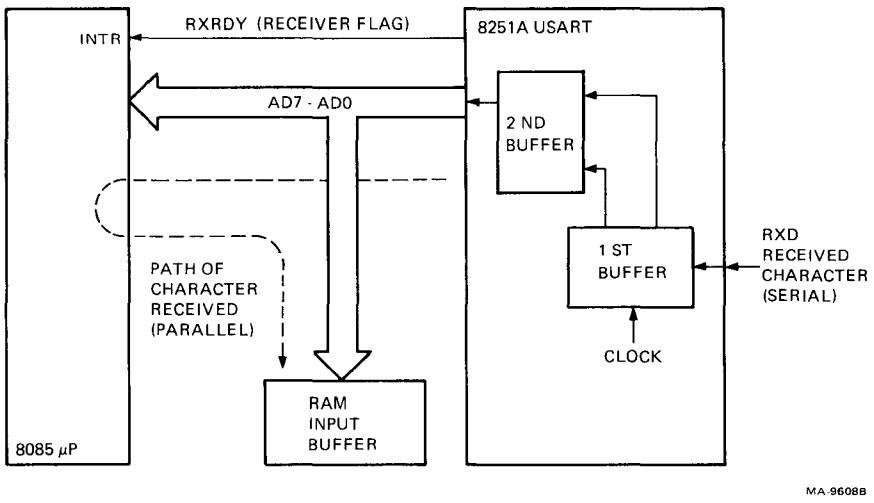

Figure 4-4 Data Handling in the USART

The printer also sends an XOFF control character when it is not ready due to error conditions or operator actions. Running out of paper or detecting a printhead position failure causes an XOFF control character to be sent. The operator actions of opening the cover or placing the printer off-line also cause an XOFF control character to be sent.

The printer sends an XON control character when an XOFF state is present and all of the following conditions are true.

- The printer is ready.
- All fault conditions are cleared.
- There are more than 224 empty positions for characters in the input buffer.

NOTE
At power up, an XOFF state is assumed.

The printer sends an XOFF control character when an XON state is present and any of the following conditions are true.

- The printer is not ready.
- A fault condition occurs.
- There are less than 128 empty positions for characters in the input buffer.

The printer sends an extra XOFF control character if more than 64 characters were received since the first XOFF control character was sent.

Ready/Busy Protocol
The Ready/Busy protocol is functionally the same as the XON/XOFF protocol. However, instead of sending an XOFF control character, the printer places the Ready/Busy signal in the Busy state and instead of sending an XON control character, the printer places the Ready/Busy signal in the Ready state.

4.4.2.3 Baud Rate Clocks – The LA50 printer is programmed to perform serial I/O communication at many different transmission rates, ranging from 110 to 4800 baud (bits per second). The rates are selected by communication switch settings. Figure 4-5 shows the hardware (logic) that creates the baud rate clocks used to shift the data stream.

The crystal controlled (6.144 MHz) microprocessor sends a CLK OUT signal to the interval timer (8253), the I/O buffer (8155) and the USART (8251). The programmable frequency dividers within them scale the CLK OUT signal down to the correct baud rate clock. Based on the selected baud rate (communication switch setup or an escape sequence), command bytes from the microprocessor specify the mathematical configuration (divisor value) of the frequency dividers. The interval timer divides the CLK OUT signal into three clocks for system timing. The I/O buffer generates the transmit (TXC) and receive (RXC) clocks for the USART buffers.

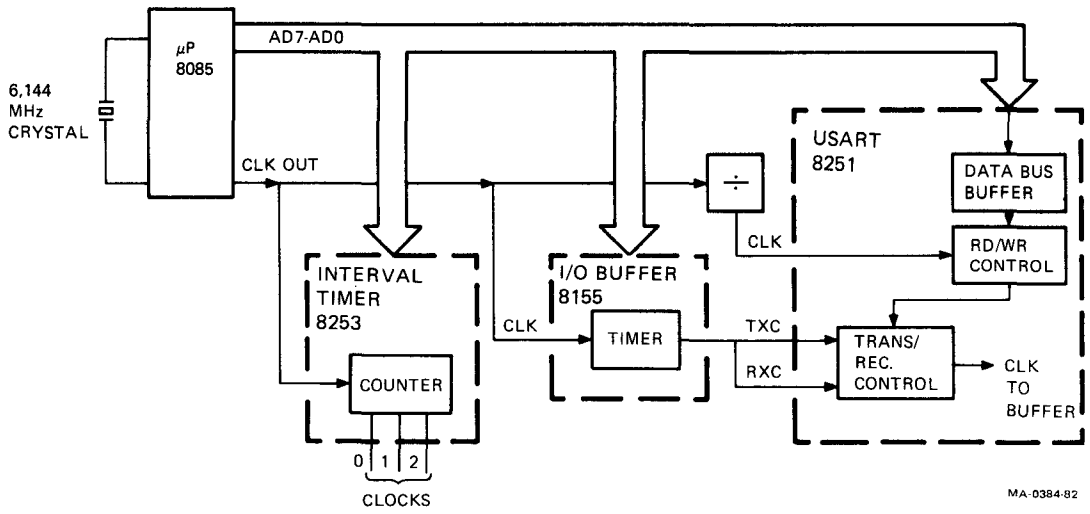

Figure 4-5 Creation of Baud Rate Clocks

4.4.2.4 Interface Signals – The LA50 data interface is RS-232C and RS-423 compatible. It includes a 25-position plug mounted on the rear of the printer for connection to an interface cable. Table 4-1 lists the interface signals described in the following paragraphs.

Receive Data – The printer receives serial encoded characters on this line.

Send Data – The printer sends serial encoded characters on this line.

Although the bit rate within a character may be up to 4800 bits per second, the character transmission rate from printer to host for any two characters does not exceed 100 characters per second.

When transmitting to the host the printer always includes at least two stop bits with each character.

Terminal Ready – The printer sends signals on the Terminal Ready line which indicate if the printer is ready to send and receive data. When this signal is ON, the printer can send and receive data. When this signal is OFF, the printer is not ready to communicate.

The terminal is ready to send and receive data after it completes its power-up initializations, and remains ready to communicate indefinitely.

Request to Send – The printer maintains the Request to Send line in the ON condition indefinitely.

Ready/Busy – This line carries the Ready/Busy signal, depending on the setting of the Ready/Busy Polarity switch. The printer is unable to receive characters if this signal is in the Busy state and is able to receive characters if this signal is in the Ready state.

Protective Ground – This line is connected via removable jumper into the chassis ground of the printer. The chassis is further connected to external grounds through the third wire of the power line cord.

Signal Ground – This line establishes the common ground reference potential for all other interface circuits.

Table 4-1 Printer Interface Signals

Function	Direction	Pin	RS-232 Mnemonic
Receive Data	To printer	3	BB
Send data	From printer	2	BA
Terminal ready	From printer	20	CD
Request to send	From printer	4	CA
Busy or ready	From printer	11	–
Protective ground	From printer	1	–
Signal ground	Common	7	AB

4.4.3 Printhead Positioning and Printing Process

This paragraph describes how data stored in RAM buffers is processed and how characters are formed on paper. It also describes how the system controls the printhead position and forms a character in the correct location.

The LA50 is an impact printer that uses a 9-element solenoid printhead. The printhead is driven horizontally and prints characters in a 7 × 9 dot matrix.

The printer can print double-width characters in 5, 6, and 8.25 character per inch modes. Therefore, the maximum number of characters per line is 40, 48, and 66 respectively. Text or graphics mode printing is selected by the control and escape sequences.

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. Each character selects 1 of 64 possible 1 × 6 dot combinations. This is done by using the top six elements of the nine-element head. The ratio of horizontal to vertical dots is variable by changing the number of horizontal dots per inch with a communication switch setting. The number of vertical dots is kept constant at 72 dots per inch. The ratio is either 2:1 or 2.5:1.

Figure 4-6 shows a functional overview of the printing/printhead positioning process. The microprocessor/control system issues a series of commands to the 8155 and printhead logic which contain instructions to print a character. This includes character storage, carriage drive speed/direction, and a start print command. Speed depends on the selection of enhanced printing. The print direction is left to right in the graphics mode. In the text mode, printing is left to right as long as less than one received line remains unprinted. If there is more than one line to be printed, the printer automatically goes to bidirectional printing. The printhead position is determined by count from the start of print.

Carriage drive information, from the microprocessor, flows through the 8155 I/O buffer to the motor drivers and motor. Drive information and print information are coordinated by the 8155 and microprocessor control logic. When a request is made to print a character, the ASCII-coded representation of the character stored in the RAM is transferred by the microprocessor to the LS374 register in the form of "dot data" bytes. Each dot data byte has an encoded pattern of dot bits that fire specific head solenoids to create the desired character on paper. If the printer is operating in graphics mode, a different type translation is performed. Each graphic character sent by the host is processed and printed as one vertical pattern of dots. When enabled by the control logic and print timing, the LS374 register fires the solenoids for the first vertical dot pattern representation of the character. Immediately more dot data shifts into the register, the carriage moves, and the printhead fires. The process continues until the character is completely printed at which time the carriage and printhead wait for the next microprocessor command.

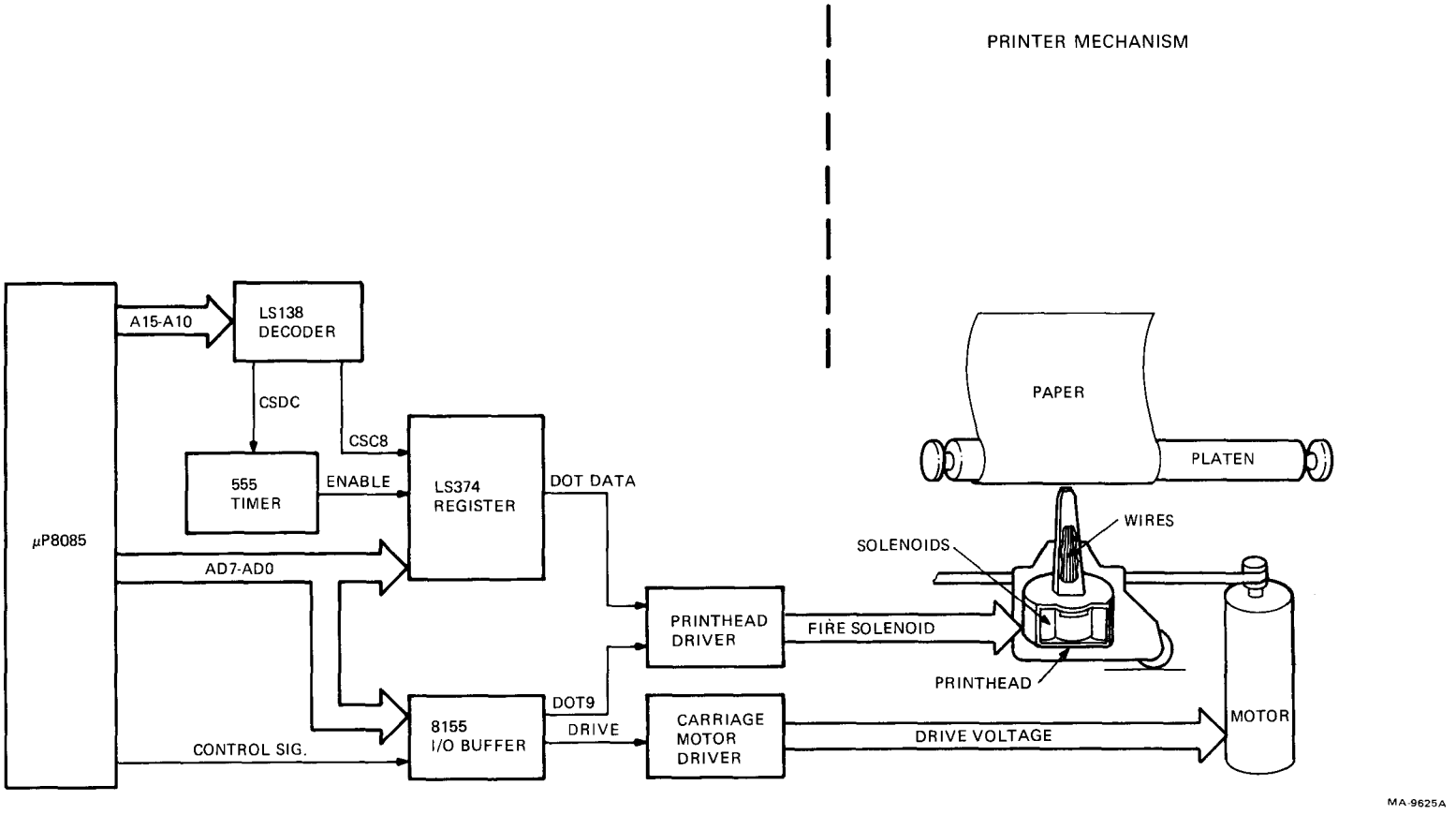

Figure 4-6 Printing and Positioning Process

4.4.4 Paper Advancing

Paper is advanced by the paper feed subsystem which includes the following.

- A stepper motor
- A paper drive cluster gear
- A platen assembly
- Friction assembly
- A pinfed tractor assembly
- Control/logic circuitry on the printed circuit board

Figure 4-7 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 8155 I/O buffer. These commands include a control signal LFON and the four motor drive signals LFMA, LFMB, LFMC, and LFMD.

When the microprocessor sends a paper advance instruction to the 8155 I/O buffer, the buffer sends a LFON enable signal to the current switch. With this input, the current switch conditions the buffer/driver to pass the drive signals to the line feed motor. In the holding mode, the LFON changes level and causes the current switch to send a chopped drive current to the line feed motor. The chopped current keeps the motor in position without overheating.

Motor rotation occurs when the signals to LFMB and LFMC are at a low level and at the same time the signals to LFMA and LFMD are at a high level. This energizes the phase current to drive the motor one step. By varying the phase pattern (Figure 4-8), the line feed motor continues the step sequence.

The rotary motion of the stepper motor armature is transferred through the paper drive cluster gear to the platen assembly. With single sheet, the platen advances the paper by friction feed. With pinfeed paper, the friction assembly is disengaged and the tractor pins push the paper into the platen assembly and around to the front of the platen.

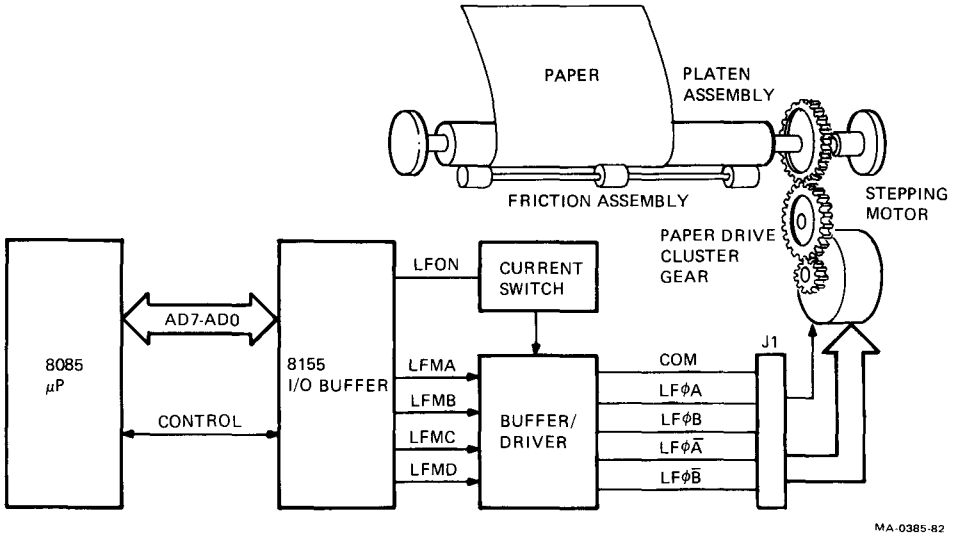

Figure 4-7 Paper Feed Subsystem

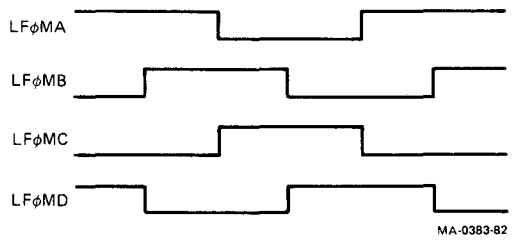

Figure 4-8 Line Feed Motor Phase Patterns

4.4.5 Power Supply – The power supply is located on the printed circuit board. The supply generates a regulated +5 Vdc, and unregulated +5 Vdc and 27 Vdc. In addition, a dc to dc converter transforms the regulated +5 Vdc to +12 Vdc and −12 Vdc. Figure 4-9 shows a block diagram of the power supply. The diagram includes a wake-up circuit. This circuit controls the initial state of the logic circuits during power turn on and off.

4.4.5.1 Input Requirements – The ac input operating voltage for each model of the LA50 is factory preset. The label on the fuse plate shows the power requirements. The models and their operating voltages are as follows:

LA50-RA	120 Vac
LA50-RB	220 Vac
LA50-RC	240 Vac
LA50-RD	100 Vac

The operating power frequency range is between 47 and 63 Hz.

The plug-in position of a connector at the input to the power transformer allows changing the operating voltage of the models. RA and RD models can operate at either 100 or 120 volts. RB and RC models can operate at either 220 or 240 volts. Refer to Paragraph 6.2.2 for the voltage change procedure.

4.4.5.2 Outputs – The following lists the power supply outputs and their use.

+5 Vdc regulated	Logic and control circuits
+5 Vdc unregulated	Wake-Up/reset circuit
+12 Vdc and −12 Vdc regulated	RS232C output interface dual line drivers
+27 Vdc unregulated	Printhead, linefeed motor, and carriage motor drivers.

4.4.5.3 Functional Description – The ac line voltage entering the supply is fused, filtered, and passes through a voltage selection connector before going to the power transformer. The secondary of the transformer feeds two bridge-type full-wave rectifier circuits. A capacitor-resistor network smooths the 27 volt output at one of the rectifier bridges. The other rectifier bridge supplies unregulated 5 volts directly from the bridge and a regulated 5 volts after regulation by a series-feedback circuit.

The Wake-Up circuit senses when the 5 volts is turned on and resets the logic circuits. In addition, it controls the printhead and line feed motor drive circuits to prevent transients during power turn on and off.

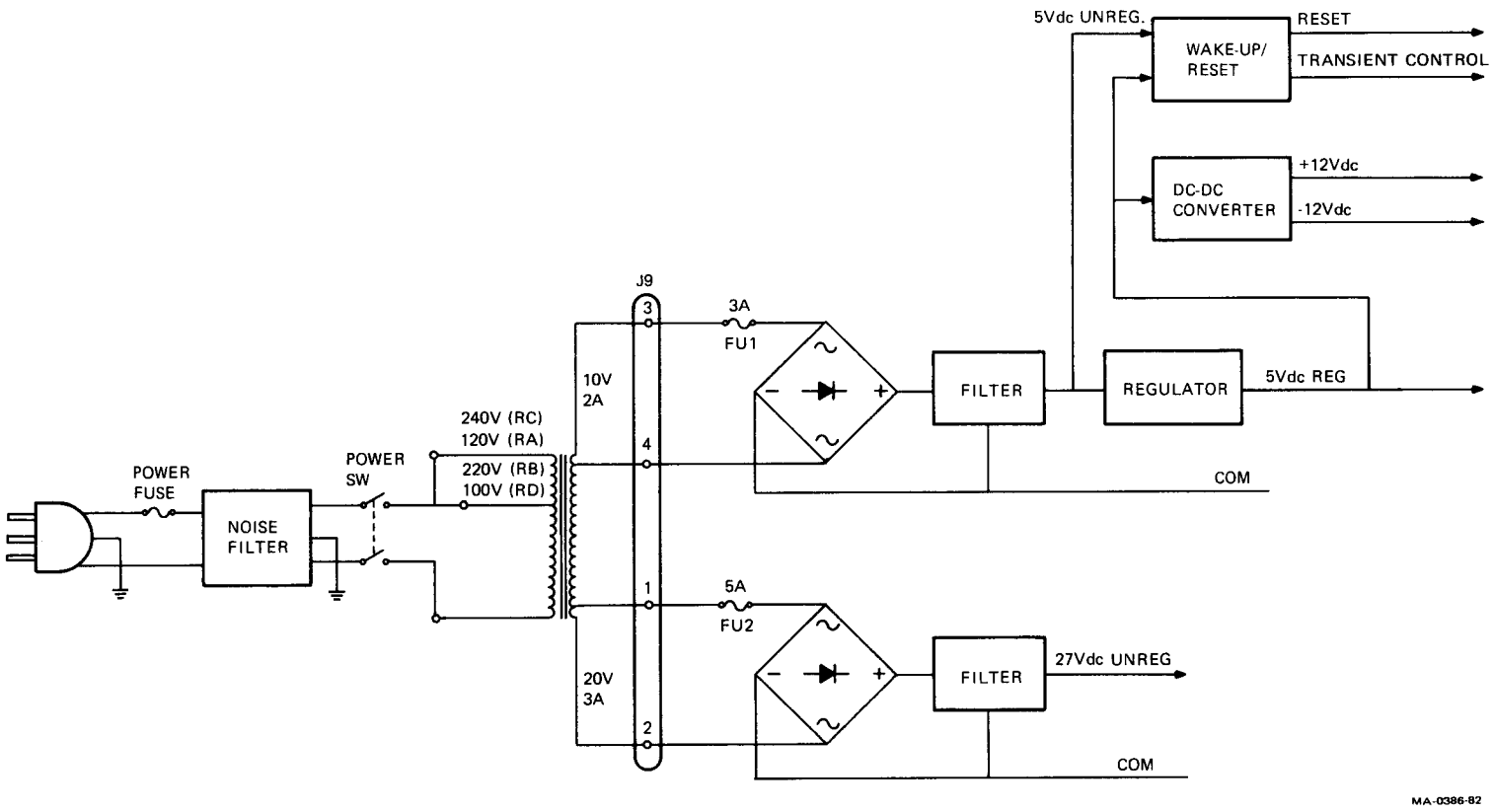

Figure 4-9 Power Supply and Wake-Up Functional Diagram

CHAPTER 5
TROUBLESHOOTING

5.1 GENERAL

This chapter includes LA50 troubleshooting and repair information. When used with the text and functional block diagrams in Chapter 4 and the Field Service Engineering Print Set, this information should lead to identifying and resolving any failure in the printer.

5.2 TROUBLESHOOTING

Troubleshooting a failure involves first identifying the type of failure by its symptoms. Then by referring to the physical/functional block diagram (Figure 5-1), tables, and procedures, locating the most probable field replaceable unit (FRU) that would cause that failure.

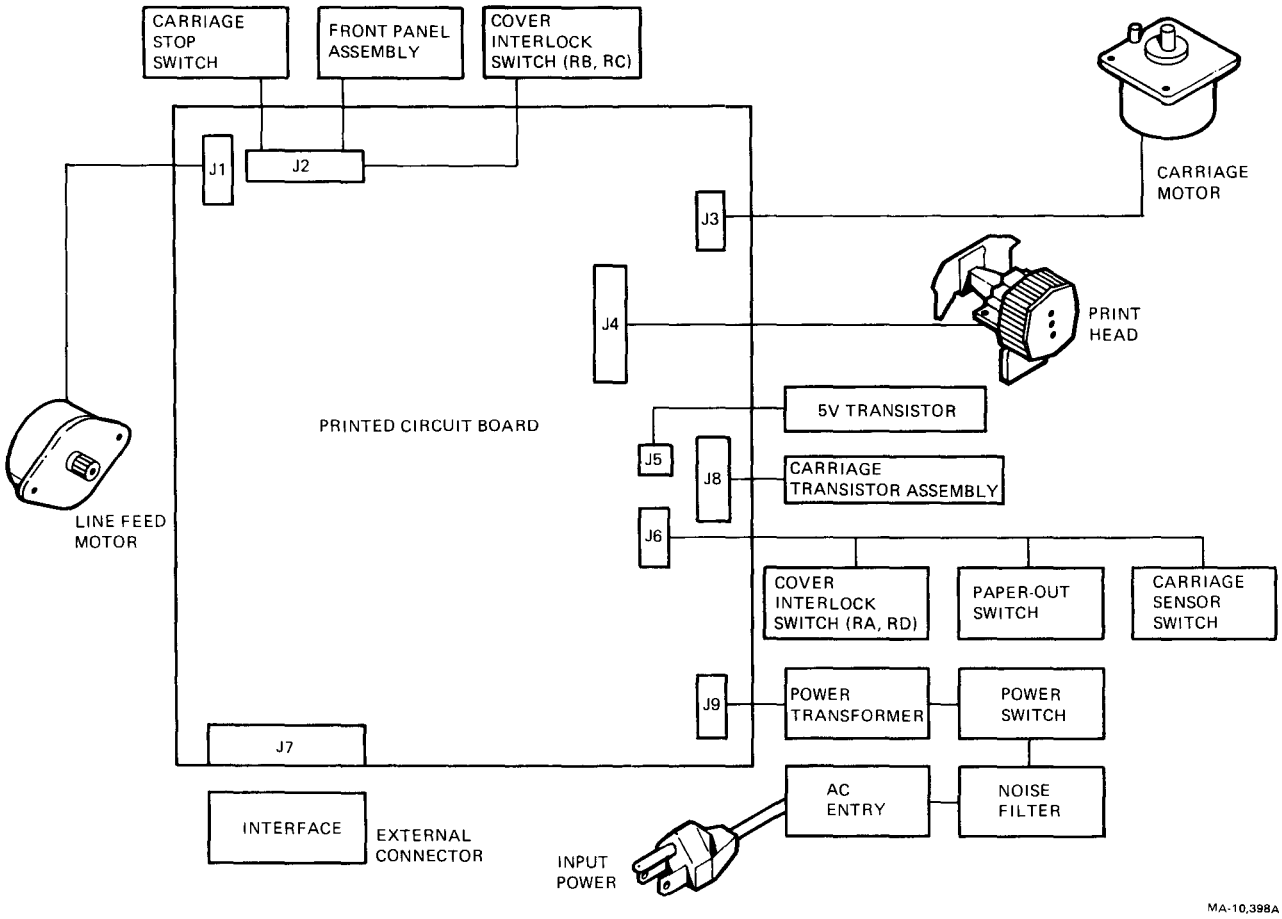

Figure 5-1 Physical/Functional Block Diagram

The symptoms displayed may represent more than one failure. Therefore, the symptoms may change as the FRUs are replaced. Always troubleshoot 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 versus the cost of the added labor involved to find a bad component.

5.2.1 Self-Tests

Paragraph 3.2 describes the four types of self-tests available. Figure 3-2 shows the correct printer output for the printout self-tests. You should run each of these self-tests and compare the resulting printer performance as part of the troubleshooting process. Then when you understand the problem symptoms better, refer to the table and procedures in the following paragraphs.

5.2.2 Troubleshooting Tables

Table 5-1 lists the most common LA50 failures, the associated symptoms, and the appropriate corrective action.

Table 5-1 Troubleshooting Checklist

Symptom	Probable Cause	Remedy
Printer does not start when power switch is set to 1.	Power cord not plugged in or is broken	Check power cord connections. Check power cord for damage.
Carriage does not move. Indicators are off.	No power at receptacle	Check power at power receptacle.
	AC line fuse open.	Fuse not inserted properly. Replace fuse if blown (Para. 6.2.3). Check power supply connector for proper plug-in orientation (Para. 6.2.2). If fuse continues to blow, replace power switch, transformer, and noise filter assembly (Para. 6.2.17).
	PCB FU1-3A fuse is open.	Replace fuse (Para. 6.2.3).
	Defective 5 V transistor	Replace 5 V transistor (Para. 6.2.18).
	Defective PCB	Replace PCB (Para. 6.2.6).

Table 5-1 Troubleshooting Checklist (Cont)

Symptom	Probable Cause	Remedy
Printer does not start. Carriage does not move. Indicators are on.	PCB FU2-5A fuse is open.	Replace fuse (Para. 6.2.3). If fuse continues to blow, replace PCB (Para. 6.2.6).
FAULT indicator flashes when power is first turned on.	Defective PCB	Replace PCB (Para. 6.2.6).
Printer does not start. Pressing READY switch does not start printer.	Access cover is open.	Close cover and press READY.
	Defective interlock switch	Replace switch assembly (Para. 6.2.12 for the LA50-RA and RD, Para. 6.2.11 for the LA50-RB and RC).
Printer does not start. FAULT light is on. Pressing READY switch causes printer to print one line.	Defective paper-out switch	Adjust paper-out switch or replace switch assembly (Para. 6.2.12).
When power is applied, carriage moves short distance to right and stops.	Defective left carriage sensor switch	Check if foreign material is disabling switch. If defective, replace switch assembly (Para. 6.2.12).
In carriage motion self-test, carriage moves to home position and stops.	Defective right carriage stop switch	Replace stop switch assembly (Para. 6.2.11).
Printhead does not fire in print self-test mode; carriage moves.	Defective or disconnected printhead cable	Check cable connections. Replace if defective (Para. 6.2.5).
	Defective printhead	Replace printhead (Para. 6.2.4).
	Defective PCB	Replace PCB (Para. 6.2.6).

Table 5-1 Troubleshooting Checklist (Cont)

Symptom	Probable Cause	Remedy
Characters have dots missing.	Printhead cable not seated or is broken.	Check connections. If broken, replace cable (Para. 6.2.5).
	Defective printhead	Replace printhead (Para. 6.2.4).
	Defective PCB	Replace PCB (Para. 6.2.6).
No printout in print self-test mode; carriage moves and printhead sounds as if it is firing.	Paper thickness lever is misadjusted.	Readjust paper thickness lever.
	Defective ribbon cartridge	Replace ribbon cartridge.
Printhead operates, but carriage does not move. (Isolate fault with carriage motion self-test.)	Defective PCB	Replace PCB (Para. 6.2.6).
	Carriage wire snagged or broken.	Replace wire if broken (Para. 6.2.14).
	Defective carriage transistor assembly	Replace defective transistor assembly (Para. 6.2.15).
	Defective carriage motor	Replace motor if defective (Para. 6.2.15).
Characters missing or incorrect (always the same character).	Defective PCB	Replace PCB (Para. 6.2.6).
Characters not spaced evenly. (Isolate fault with carriage motion self-test.)	Defective carriage transistor assembly	Replace defective transistor assembly (Para. 6.2.15).
	Defective carriage motor	Replace motor if defective (Para. 6.2.15).
	Carriage wire is snagged or tension incorrect	Replace wire if broken (Para. 6.2.14).
	Defective PCB	Replace PCB (Para. 6.2.6).

Table 5-1 Troubleshooting Checklist (Cont)

Symptom	Probable Cause	Remedy
Paper jams.	Printhead not fully seated	Make sure printhead is seated properly.
	Paper path obstructed	Clear paper path.
	Paper thickness lever misadjusted	Adjust paper thickness lever.
	Tractors (for pinfeed paper) misadjusted or defective	Adjust tractors. If defective, replace tractors (Para. 6.2.13).
Print lines overlapping.	Paper path obstructed	Clear paper path.
	Defective line feed motor	Replace line feed motor (Para. 6.2.16).
	Defective tractor mechanism	Replace tractors (Para. 6.2.13).
Light print	Printhead too far from paper	Adjust paper thickness lever.
	Defective ribbon cartridge	Replace ribbon cartridge.
Print light (ribbon not advancing).	Defective ribbon cartridge	Replace ribbon cartridge.
	Ribbon wire slipping or broken	Replace ribbon wire (Para. 6.2.10).
	Defective change-gear arm	Replace change-gear arm (Para. 6.2.9).
Print density varies across page.	Defective ribbon cartridge	Replace ribbon cartridge.
	Worn platen	Replace platen (Para. 6.2.8).
	Defective PCB	Replace PCB (Para. 6.2.6).

Table 5-1 Troubleshooting Checklist (Cont)

Symptom	Probable Cause	Remedy
Printout incorrect. Communication problems (Isolate fault with loopback self-test).	Faulty communication cable	Replace cable.
	Configuration switches set incorrectly	Check switch positions (Para. 6.2.6).
	Defective PCB	Replace PCB (Para. 6.2.6).

CHAPTER 6
SERVICING

6.1 GENERAL

This chapter explains how to remove and install the printer mechanical and electrical subassemblies. Figure 6-1 shows the assembly removal sequence. The chapter also includes lubrication requirements and procedures.

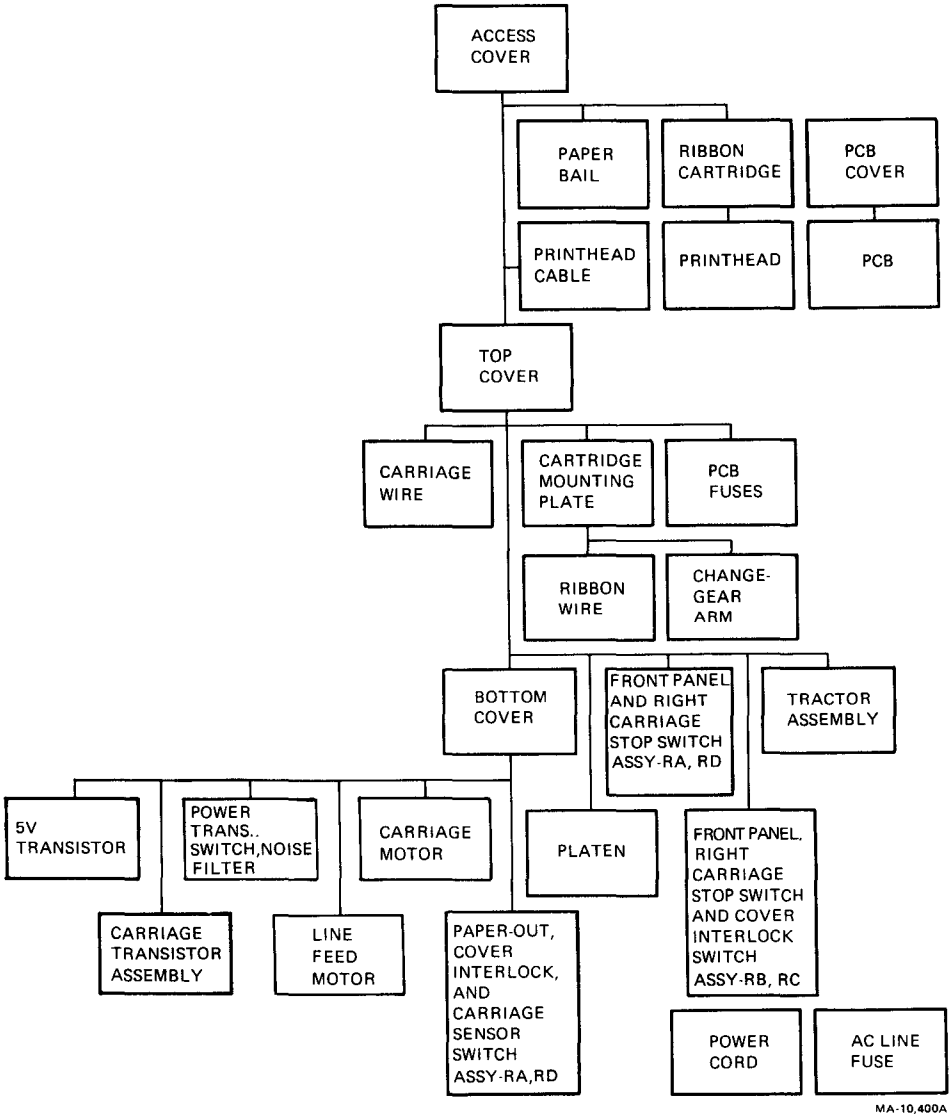

Figure 6-1 Assembly Removal Sequence

6.2 REMOVAL AND REPLACEMENT PROCEDURES

The following paragraphs describe the removal and replacement procedures.

6.2.1 Printer Housing

Perform the following procedures to remove and replace the printer housing.

Top Cover

WARNING
Set the power switch to 0 and disconnect the ac power cord.

1. Remove the paper and access covers (Figure 6-2).
2. Locate the slot in the platen knob (Figure 6-3). While prying at the slot with a small screwdriver, pull off the platen knob.
3. Remove two screws at the ends inside the front of the top cover and two screws at the rear of the bottom cover.
4. Press in the carriage stop switch side tabs (Figure 6-4). Pull the switch out of its holder. Guide the switch wires through the slot in the holder.
5. Unplug the panel connector from the PCB (Figure 6-5).
6. Unplug the ground clip from the top cover (Figure 6-6).
7. Replace the top cover by reversing the above procedure.

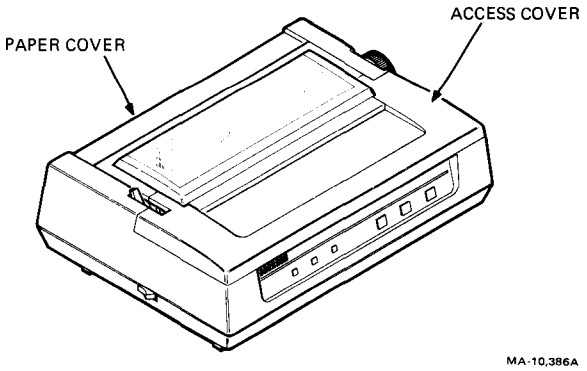

Figure 6-2 Paper and Access Covers

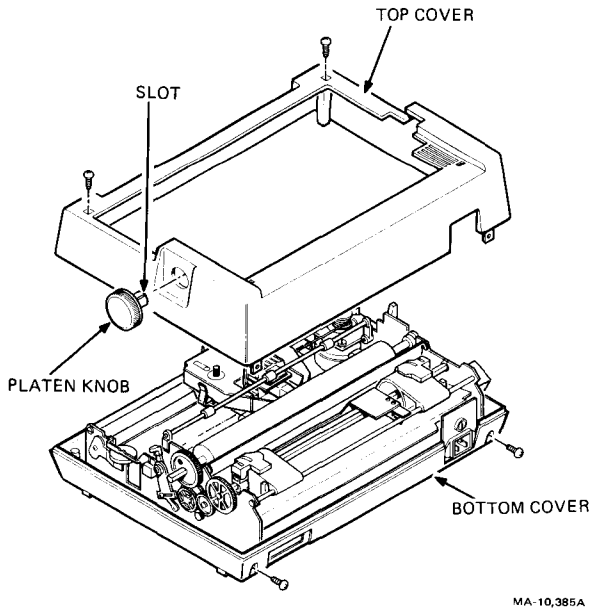

Figure 6-3 Cover Housing

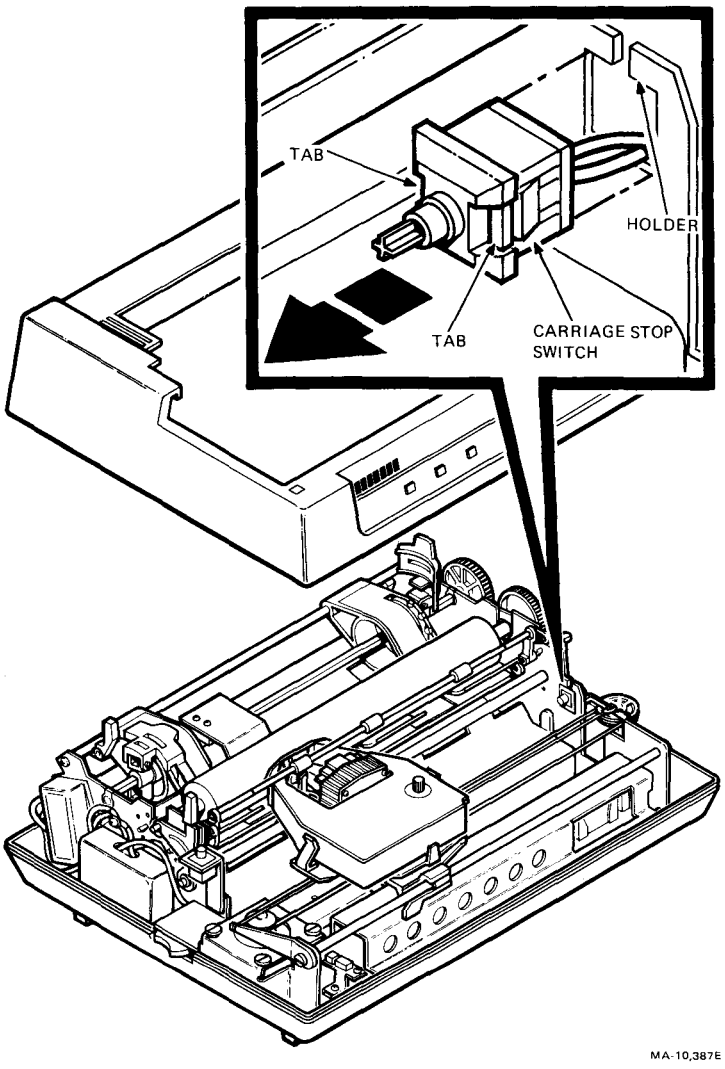

Figure 6-4 Carriage Stop Switch

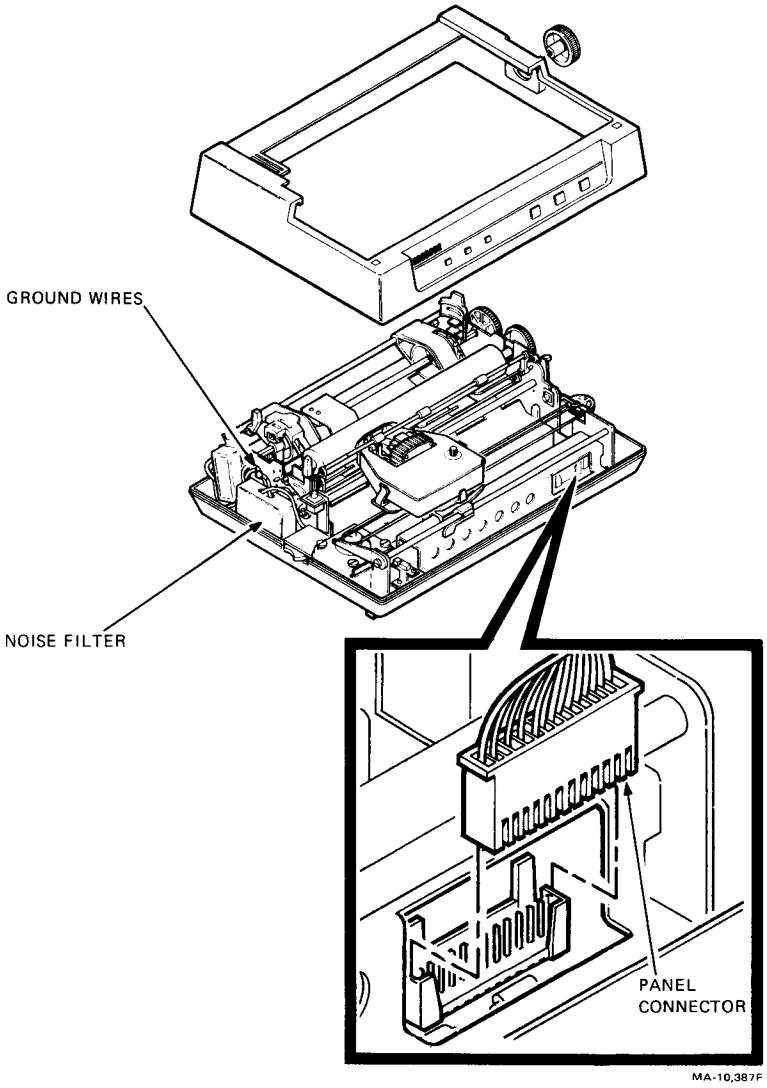

Figure 6-5 Panel Connector

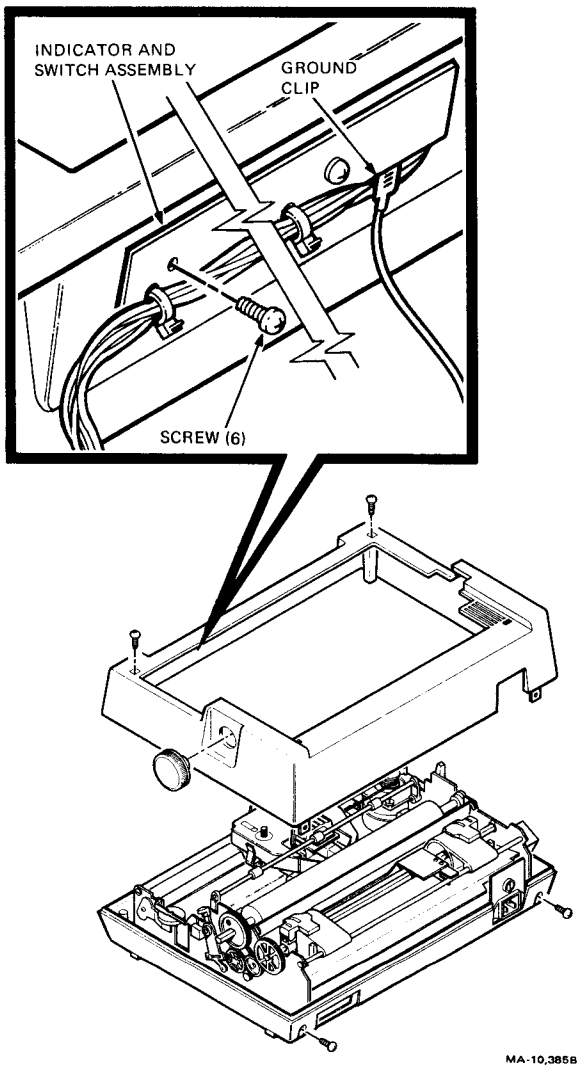

Figure 6-6 Indicator and Switch Assembly

Bottom Cover

NOTE
The power transformer, power switch, noise filter, and fuse plate are removed as an assembly with the bottom cover.

1. Remove the top cover.
2. Set the printer on its back side (Figure 6-7). Use a cushion to protect the printer from scratches.
3. Remove the four screws from the PCB cover and remove the cover.
4. Remove the screw holding the PCB at the bottom left corner.
5. Set the printer on its feet.
6. Remove the ground wires attached to the left side of the mechanism (Figure 6-5).
7. Remove the two screws from the noise filter (Figure 6-5).
8. Remove the four screws holding the mechanism to the bottom cover.
9. Lift the mechanism and remove the power transformer connector (J9) from the PCB (Figure 6-8).
10. Remove the bottom cover.
11. Install the cover by reversing the above procedure.

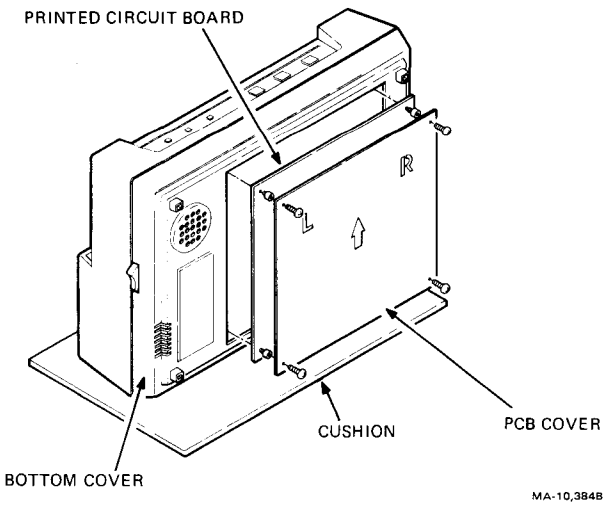

Figure 6-7 Bottom Cover

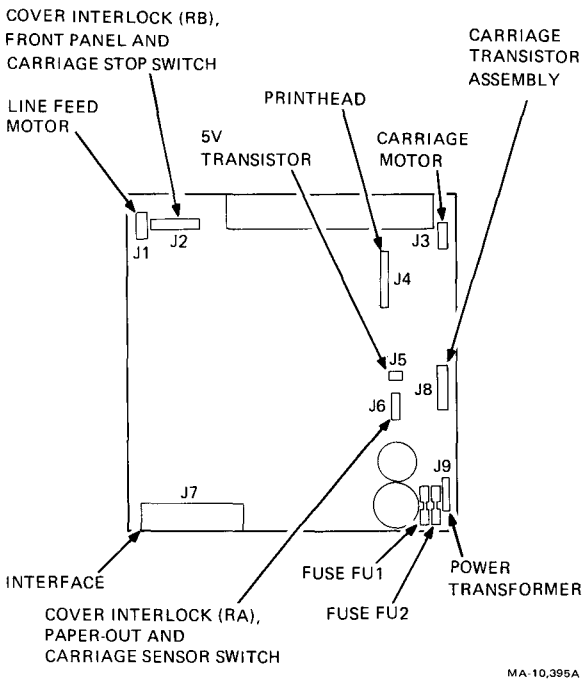

Figure 6-8 Printed Circuit Board Connector and Fuse Locations

6.2.2 Operating Voltage Setup

Printer model RA and RD can operate at either 100 or 120 volts. Model RB and RC can operate at either 220 or 240 volts. The label on the fuse plate at the rear of the printer shows the operating voltage. The plug mating of the power supply connector determines the operating voltage of the printer. Perform this procedure to check the connector plug mating and to make a change if necessary.

1. Set the power switch to 0 and disconnect the ac power cord.
2. Remove the top cover (Paragraph 6.2.1).
3. Remove the two screws from the noise filter (Figure 6-5) and remove the filter to access the power supply connector (Figure 6-9).
4. Check the plug mating of the connector. If you need to make a change, unplug the connector, rotate one end, and replug the ends. Figure 6-9 shows the connector voltage settings. For example, for the LA50-RA, the desired setting should read SET FOR 120 VAC.
5. Return the connector and noise filter to their original locations.
6. Replace the top cover.

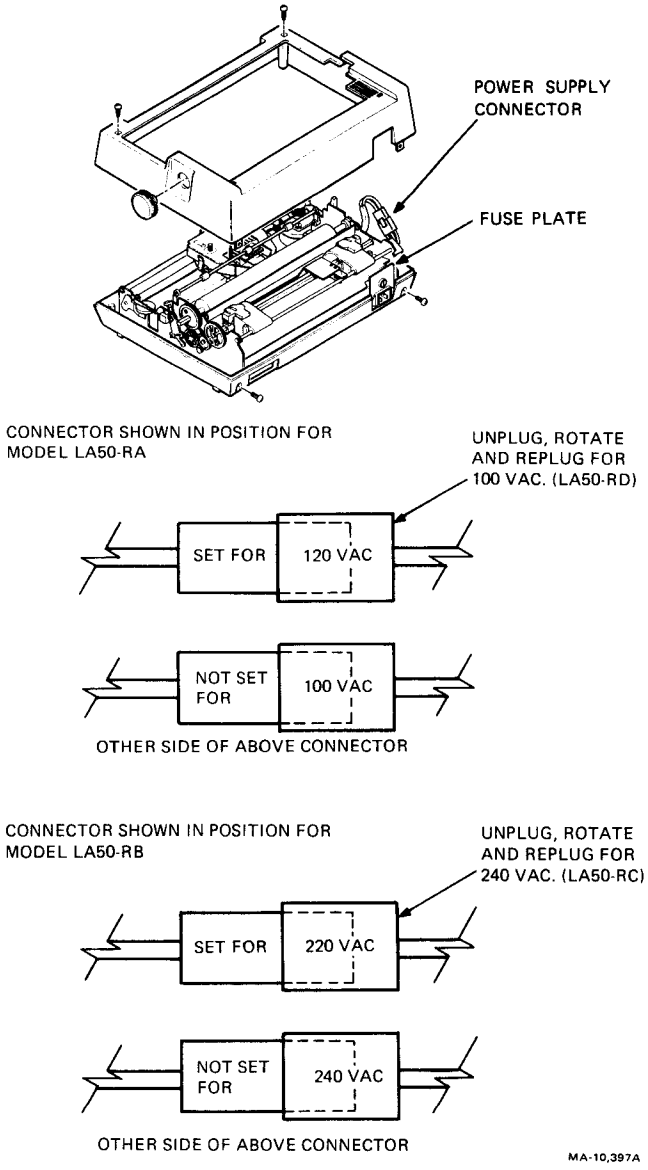

Figure 6-9 Power Supply Connector

6.2.3 Fuse Replacement

The following paragraphs describe removing and replacing fuses.

AC Line Fuse

WARNING

Set the power switch to 0 and disconnect the ac power cord.

1. Turn the fuse holder counterclockwise until it is free (Figure 6-10).
2. Pull out the fuse holder and remove the fuse.
3. Replace the fuse and holder by reversing the above procedure.

CAUTION

Replace the fuse with a fuse of equal value.

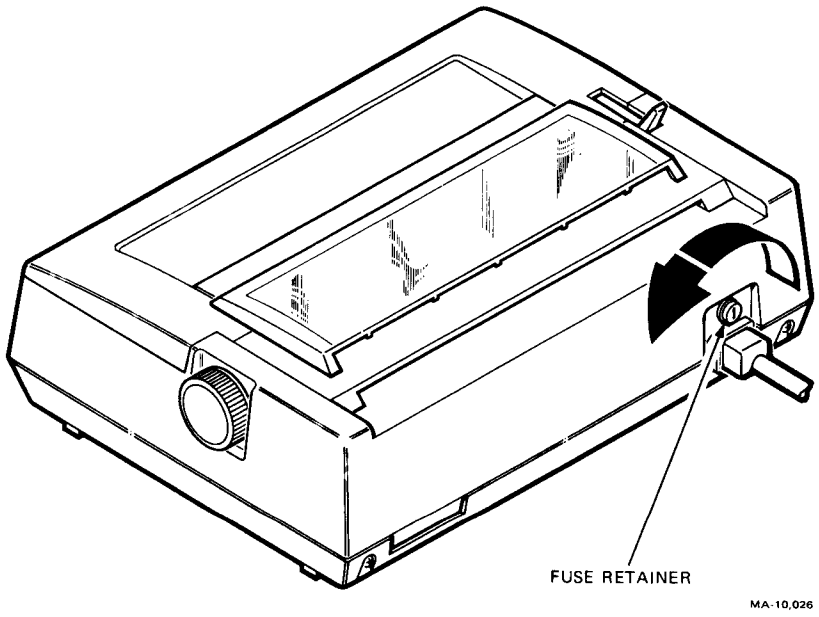

Figure 6-10 AC Line Fuse

PCB Fuses

1. Remove the top cover (Paragraph 6.2.1).
2. Turn the printer so the rear faces you.
3. The fuses are located on the right side of the PCB (Figure 6-11). Replace the blown fuse.
4. Replace the top cover.

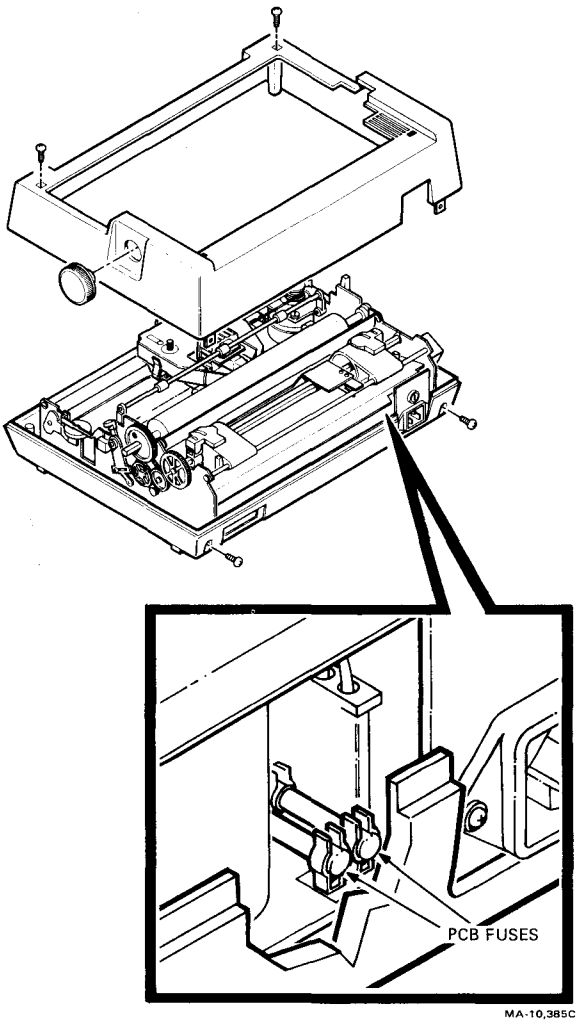

Figure 6-11 PCB Fuses

6.2.4 Printhead

Perform the following procedure to remove and replace the printhead.

WARNING

If the printer was used recently, the printhead may be hot. Be careful when handling.

Set the power switch to 0 and disconnect the ac power cord.

1. Remove the access cover (Figure 6-12). Move the carriage to the approximate center of the printer mechanism away from the paper bail rollers.

2. Remove the ribbon cartridge.

3. Release the printhead clamps in the direction of the arrows shown in Figure 6-12.

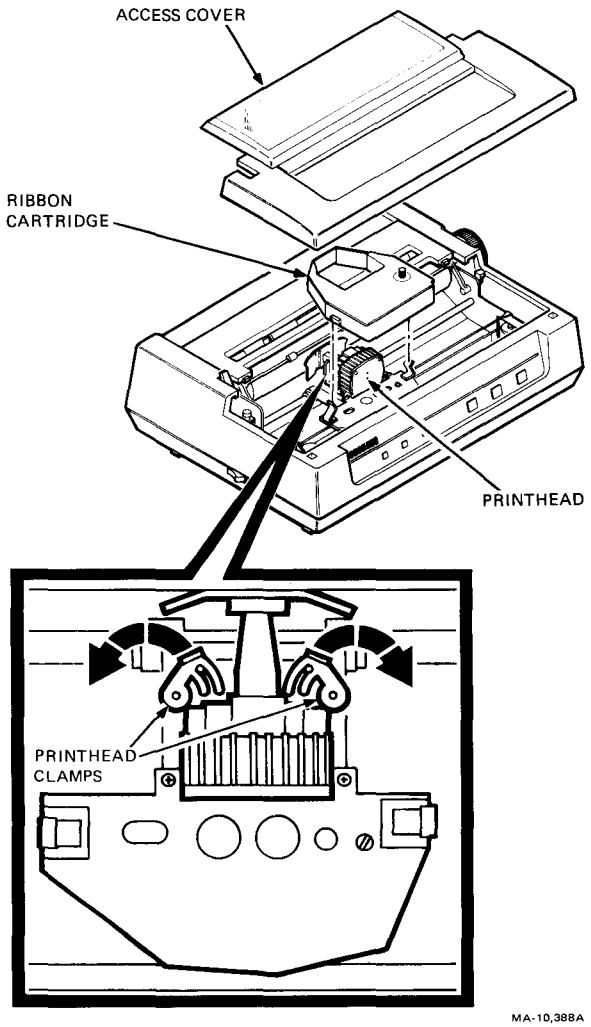

Figure 6-12 Printhead Clamps

4. Pull the head upward, carefully avoiding the paper bail bar (Figure 6-13).

5. Replace the printhead by reversing the above procedure.

6.2.5 Printhead Cable

Perform the following procedure to remove and replace the printhead cable.

WARNING
Set the power switch to 0 and disconnect the ac power cord.

1. Remove the access cover (Figure 6-2).

2. Remove the printhead (Paragraph 6.2.4).

3. Move the carriage to the right side.

4. Remove one screw from the hold-down clip and remove the clip (Figure 6-14).

5. Remove the screw holding the ground lead.

6. Unplug the cable from the PCB.

7. Remove the two screws holding the printhead plug.

8. Remove the cable assembly.

9. Replace the printhead cable by reversing the above procedure.

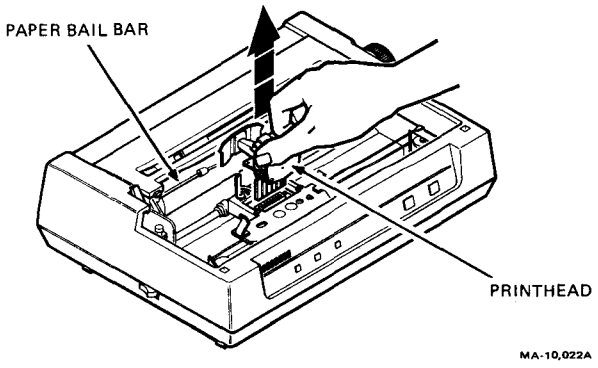

Figure 6-13 Printhead Removal

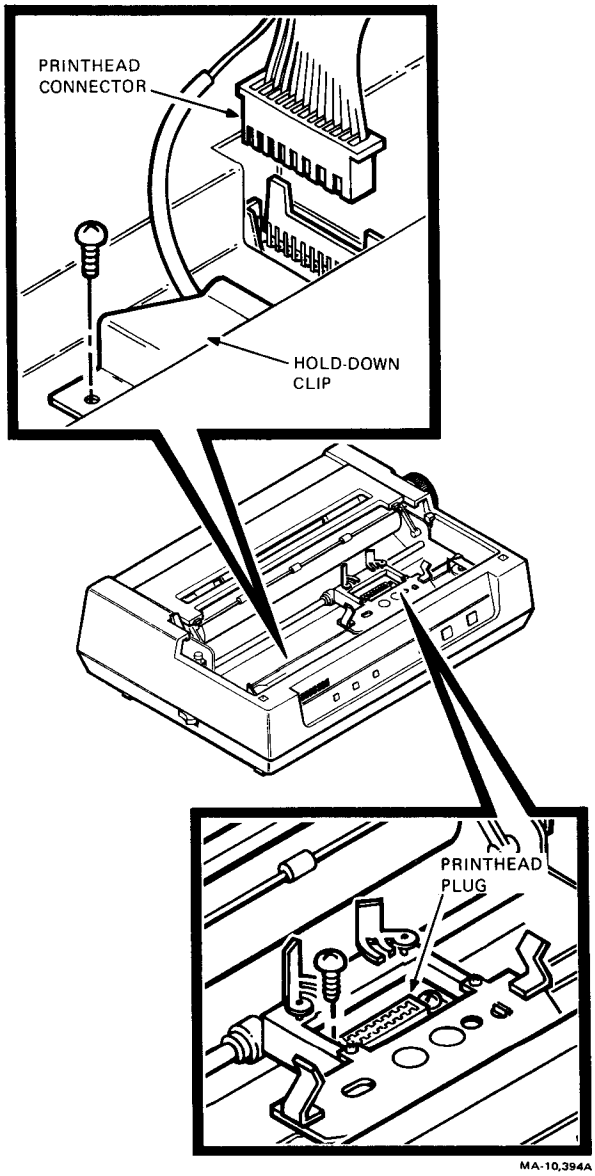

Figure 6-14 Printhead Cable

6.2.6 PCB Assembly

Perform the following procedure to remove and replace the PCB assembly.

NOTE
The PCB also contains the power supply.

WARNING
Set the power switch to 0 and disconnect the ac power cord.

CAUTION
Static electricity damages MOS components. Do not touch MOS pins.

1. Remove the paper and access covers (Figure 6-2).
2. Set the printer on its back (Figure 6-7). Use a cushion to protect the printer from scratches.
3. Remove the four screws from the PCB cover and remove the cover.
4. Remove the four screws from the PCB.
5. Disconnect the eight connectors (Figure 6-8) and the grounding wire.
6. Remove the PCB.
7. Replace the PCB by reversing the above procedure.
8. Run the Print Self-Test (Paragraph 3.2.3). Each succeeding line of characters should print directly below the previous line (Figure 3-2). If necessary, adjust potentiometer VR2 ALIGN (Figure 6-15) to move the lines. (VR1 is a factory adjustment and is not a field adjustment.)

6.2.7 Paper Bail

Perform the following procedure to remove and replace the paper bail.

1. Remove the access cover (Figure 6-2).
2. Remove the two E-rings that hold the paper bail bar (Figure 6-16).
3. Remove the paper bail bar.
4. Replace the paper bail by reversing the above procedure.

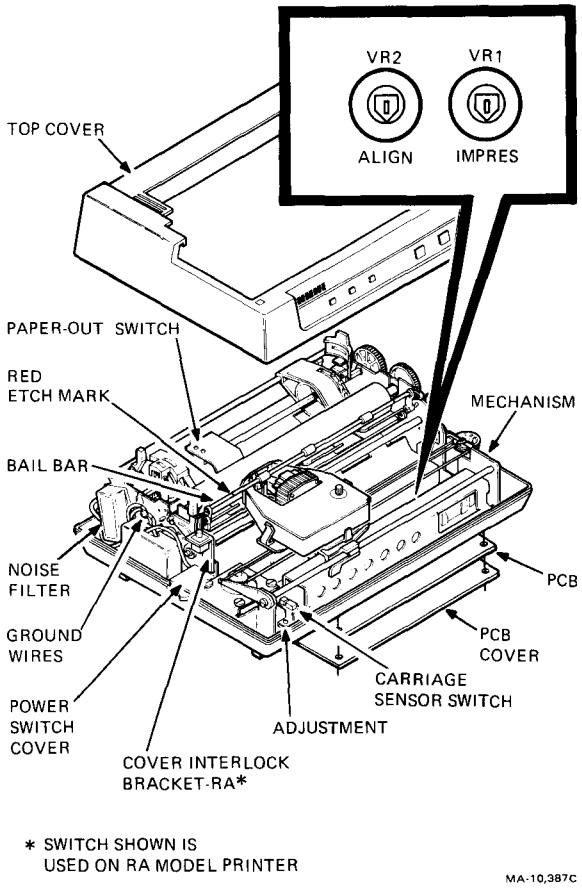

Figure 6-15 Print Adjustments

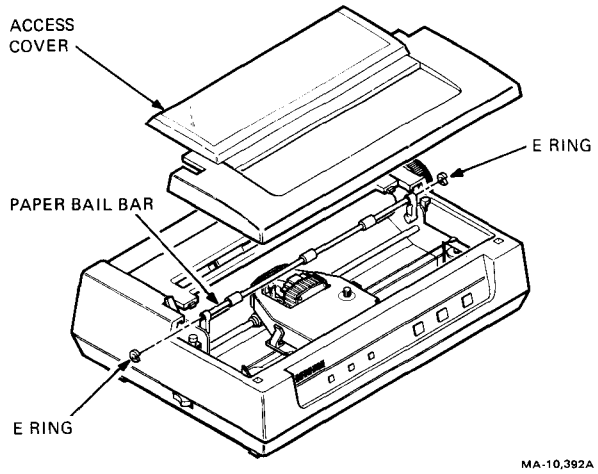

Figure 6-16 Paper Bail

6.2.8 Platen

Perform the following procedure to remove and replace the platen.

1. Remove the top cover (Paragraph 6.2.1).
2. Remove the printhead (Paragraph 6.2.4).
3. Remove the screw holding the platen on the right side (Figure 6-17). The screw is reached through a hole in paper feed gear C. An alternate method is to remove gear C first. An E-ring holds the gear in place.
4. Remove the screw holding the platen on the left side.
5. Pull the bail bar away from the platen.
6. Remove the paper feed gear D. An E-ring holds the gear in place.

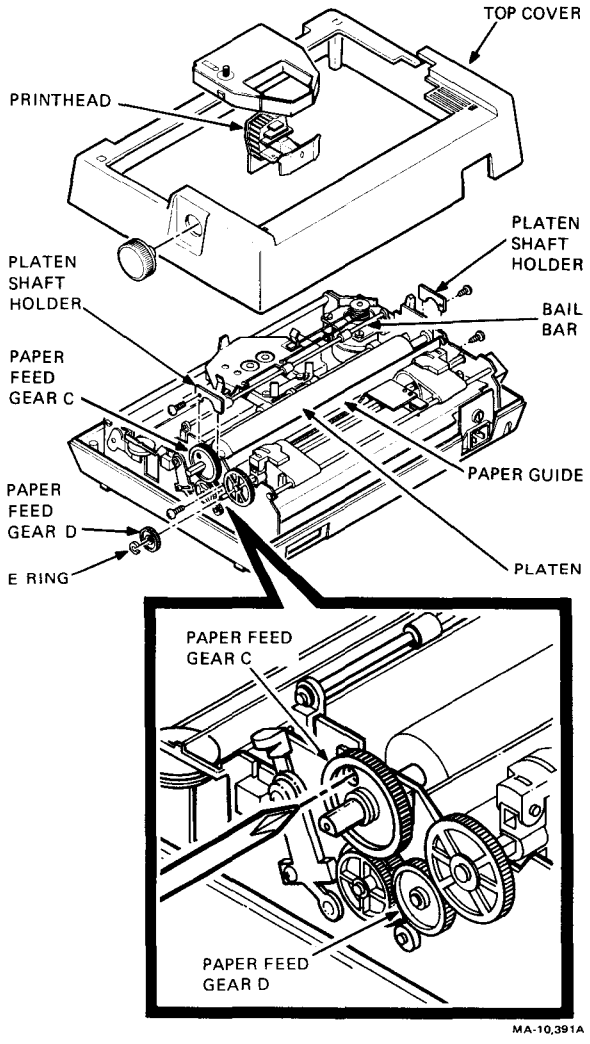

Figure 6-17 Platen

7. Remove the right and left screws that hold the paper guide.

8. Remove the platen and paper guide at the same time.

9. Replace the platen by reversing the above procedure.

6.2.9 Change-Gear Arm

Perform the following procedure to remove and replace the change-gear arm.

1. Remove top cover (Paragraph 6.2.1).

2. Remove the printhead (Paragraph 6.2.4).

3. Remove the four screws holding the cartridge mounting plate (Figure 6-18).

4. Remove the cartridge mounting plate slowly to avoid losing the ratchet spring and ribbon spring.

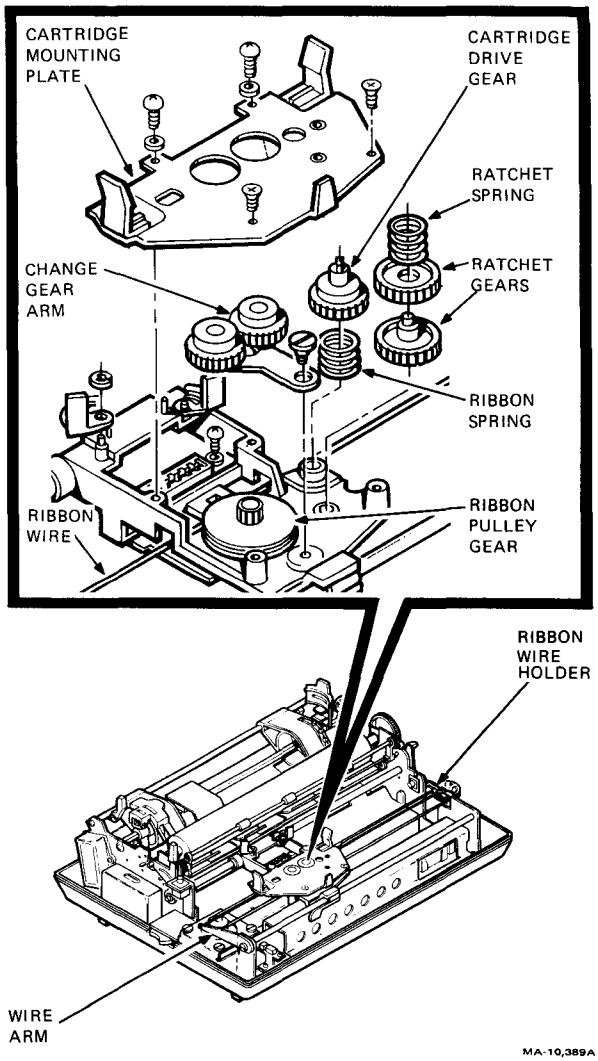

Figure 6-18 Carriage Assembly

5. Remove the cartridge drive gear and ratchet gears with springs by pulling upward.

6. Remove the screw holding the change-gear arm. Remove the arm.

7. Replace the assembly by reversing the above procedure.

6.2.10 Ribbon Wire

Perform the following procedure to remove and replace the ribbon wire.

1. Remove the change-gear arm (Paragraph 6.2.9).

2. Remove the screw from the ribbon wire holder (Figure 6-19).

3. Remove the ribbon wire from the wire holder, ribbon wire arm, and the ribbon pulley gear. Note the position of the wire on the ribbon pulley gear for reinstallation. Place the wire from the ribbon wire arm over the wire from the wire holder (Figure 6-19).

4. Replace the ribbon wire by reversing the above procedure.

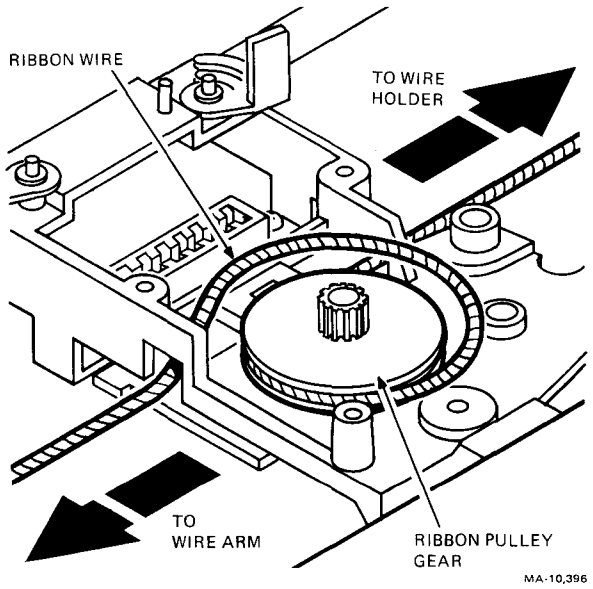

Figure 6-19 Ribbon Wire

6.2.11 Front Panel and Carriage Stop Switch Assembly – RA, RD/ Front Panel, Carriage Stop Switch, and Access Cover Interlock Switch Assembly – RB, RC

Perform the following procedure to remove and replace the front panel and carriage stop switch assembly and, if the printer is a model RB or RC, the cover interlock switch.

1. Remove the top cover (Paragraph 6.2.1).

2. Remove the six screws holding the indicator and switch assembly to the front panel (Figure 6-6).

3. For model RB or RC, remove the screw holding the cover interlock switch to the top cover (Figure 6-20).

4. Replace the assembly by reversing the above procedure.

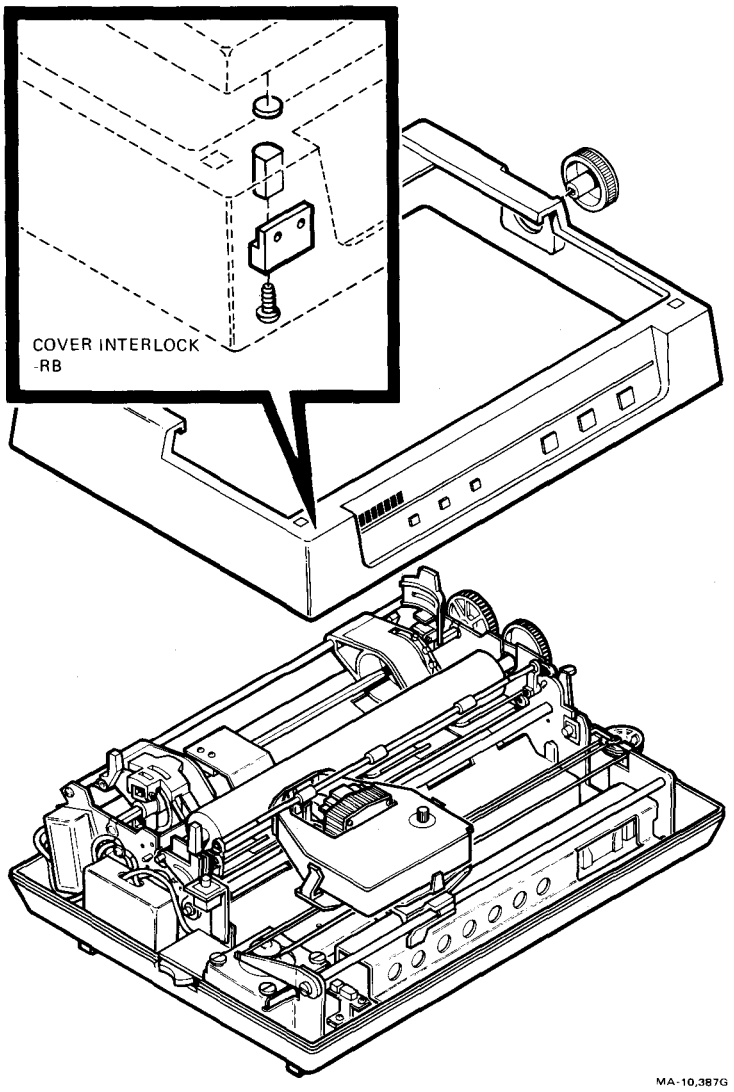

Figure 6-20 Cover Interlock – Model RB,RC

6.2.12 Paper-Out, Access Cover Interlock and Carriage Sensor Switch Assembly – RA, RD/ Paper-Out and Carriage Sensor Switch Assembly – RB, RC

Perform the following procedure to remove and replace the paper-out, access cover interlock, and carriage sensor switch assembly.

WARNING
Set the power switch to 0 and disconnect the ac power cord.

1. Remove the PCB (Paragraph 6.2.6).
2. Remove the top cover (Paragraph 6.2.1).
3. Remove the screw from the power switch cover (Figure 6-15).
4. Remove the two screws from the noise filter.
5. Remove the ground wires on the left of the mechanism.
6. Remove the four screws holding the mechanism to the bottom cover. Remove the printer mechanism.
7. Cut the switch assembly cable ties.
8. Remove the two screws from the paper-out switch and the screw from the carriage sensor switch.
9. For model RA or RD, remove the screw from the cover interlock bracket on the side of the mechanism.
10. Remove the switch assembly from the printer mechanism. Guide the paper-out switch lever from its slot.
11. Replace the assembly by reversing the above procedure.*
12. Run the Print Self-Test (Paragraph 3.2.3). The first character of the line should line up with the red etch mark on the bail bar. If necessary, adjust the carriage sensor switch (Figure 6-15) to change the line position.

NOTE
If the carriage sensor switch is set too far to the left, the carriage will jam to the left side.

* Apply Locktite 241 or equivalent to the paper-out and carriage sensor switch screws. Locktite 241 is a tradename for Thomas and Betts Co.

6.2.13 Tractor Assembly

Perform the following procedure to remove and replace the tractor assembly.

1. Remove top cover (Paragraph 6.2.1).
2. Remove the two screws from the paper-out switch (Figure 6-15).
3. Remove the two screws holding the tractor shaft (Figure 6-21).
4. Remove the E-ring from the tractor drive gear.
5. Remove the drive gear from the tractor drive shaft.
6. Remove the E-ring from the other side of the drive shaft.
7. Remove the tractor assembly.
8. Replace the tractor assembly by reversing the above procedure.

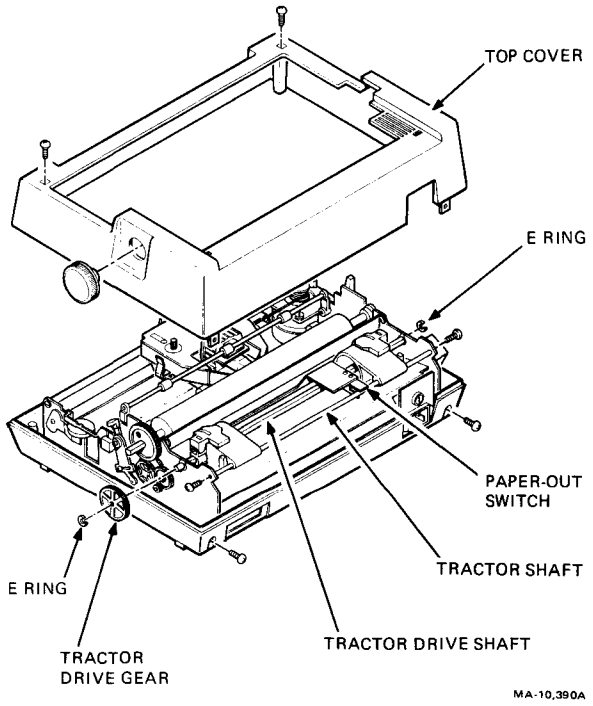

Figure 6-21 Tractor Assembly

6.2.14 Carriage Wire

Perform the following procedure to remove and replace the carriage wire.

1. Remove the top cover (Pargraph 6.2.1).
2. Remove the printhead (Paragraph 6.2.4).
3. Remove the ribbon wire (Paragraph 6.2.10).
4. Loosen the tension arm screw (Figure 6-22).

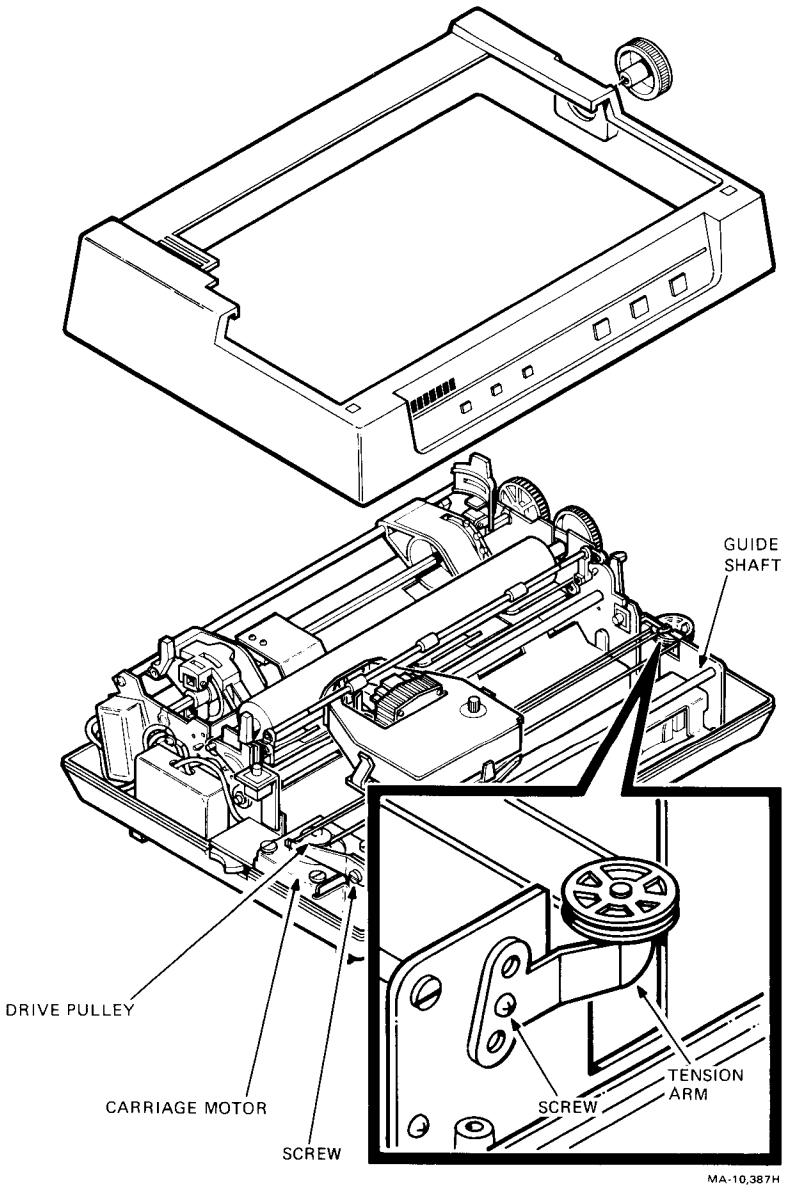

Figure 6-22 Carriage Drive Assembly

5. Remove the screw holding the drive pulley on the motor and pull up on the pulley to remove it (Figure 6-23).

6. Remove the carriage wire from the pulley.

7. Remove the screws on each end of the carriage guide shaft and pull the shaft toward you (Figure 6-22).

8. Swing the carriage assembly upward.

9. Remove the wire retainer nut under the carriage and remove the wire (Figure 6-24).

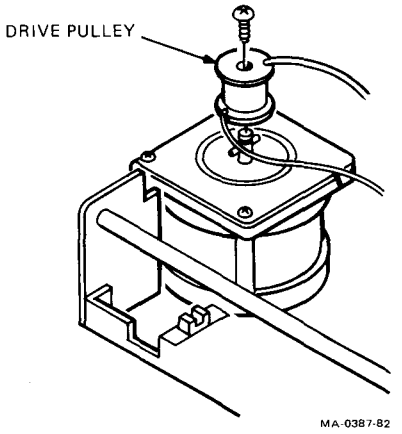

Figure 6-23 Carriage Motor

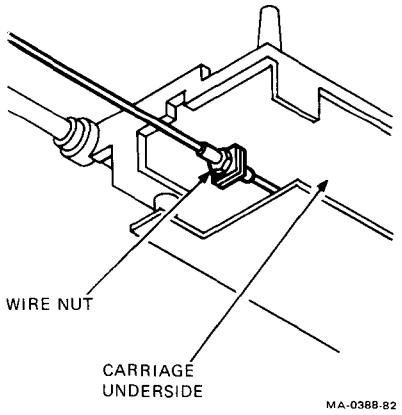

Figure 6-24 Carriage Retainer

Perform the following procedure to reasemble the carriage wire.

1. Connect the wire under the carriage with the retainer nut. Apply Locktite 241 or equivalent to the threads before tightening the nut.*
2. Position the carriage to the approximate center and reconnect the guide shaft.
3. Insert the longer end of the carriage wire into the drive pulley's lower hole and position the pulley on the motor shaft (Figure 6-25).
4. Pass the wire through the tension arm (Figure 6-22), and turn the drive pulley clockwise until the wire is tight.
5. Insert the other end of the wire in the upper hole of the pulley and tighten the pulley screw.
6. Hold the pulley in place and wind the wire on the pulley in the clockwise direction.
7. Put the wire on the tension arm pulley.
8. Push the carriage to one side and use a scale and tension gauge (Figure 6-26) to check the tension.
9. Push the center of the wire in 10 mm. The gauge should read 500 grams ± 20 grams.
10. Adjust the tension arm screw to change the tension. Tighten the screw to slacken the tension. Loosen the screw to increase the tension.

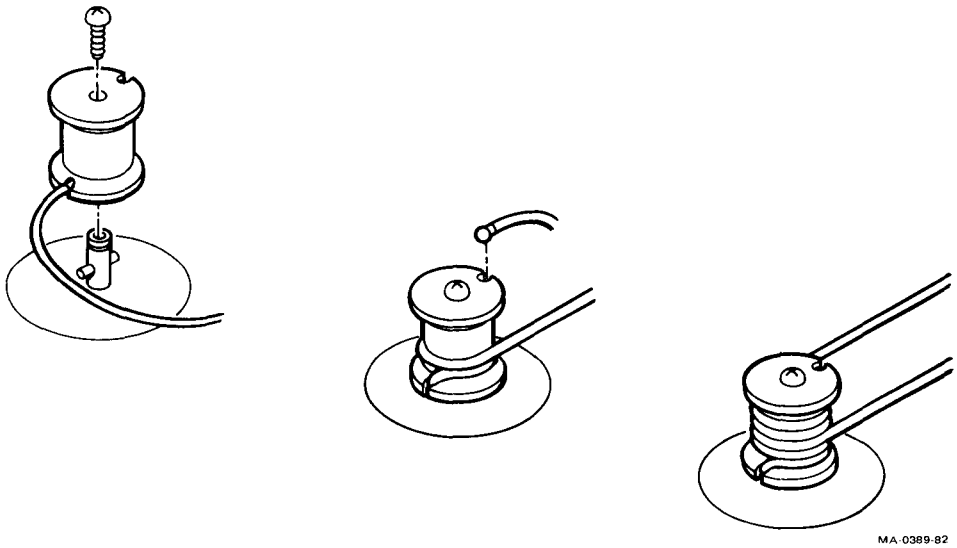

Figure 6-25 Carriage Wire Installation

* Locktite 241 is a tradename for Thomas and Betts Co.

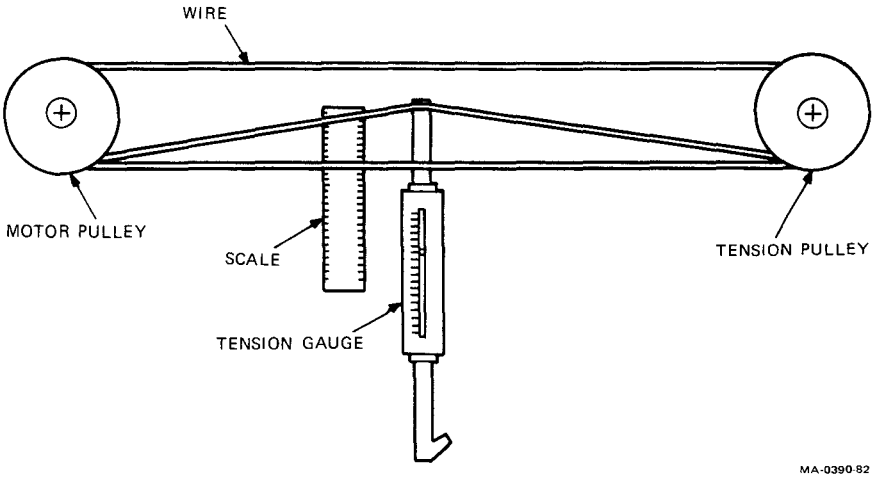

Figure 6-26 Carriage Wire Tension Adjustment

6.2.15 Carriage Motor

Perform the following procedure to remove and replace the carriage motor.

1. Remove the printer housing (Paragraph 6.2.1).

2. Loosen the ribbon wire arm screw and remove the wire from the arm (Figure 6-18). Temporarily hook the wire on the cartridge mounting plate to avoid dislocating it from the ribbon pulley gear.

3. Remove the screw from the drive pulley and remove the pulley (Figure 6-23). Keep the wires in place on the pulley.

4. Remove the three screws holding the motor and remove the motor in a downward direction.

5. Install the motor by reversing the above steps.

6. Push the carriage to one side and use a scale and tension gauge (Figure 6-26) to check the tension.

7. Push the center of the wire in 10 mm. The gauge should read 500 grams ± 20 grams.

8. Adjust the tension arm screw to change the tension. Tighten the screw to slacken the tension. Loosen the screw to increase the tension.

6.2.16 Line Feed Motor

Perform the following procedure to remove and replace the line feed motor.

1. Remove the printer housing (Paragraph 6.2.1).
2. Remove the platen (Paragraph 6.2.8).
3. Remove the tractor assembly (Paragraph 6.2.13).
4. Remove the two screws holding the paper thickness lever (Figure 6-27).
5. Loosen the carriage wire tension arm and remove the wire. (Refer to reassembly instructions of Paragraph 6.2.14 for tension adjustments.)
6. Loosen the ribbon wire holder and remove the wire.

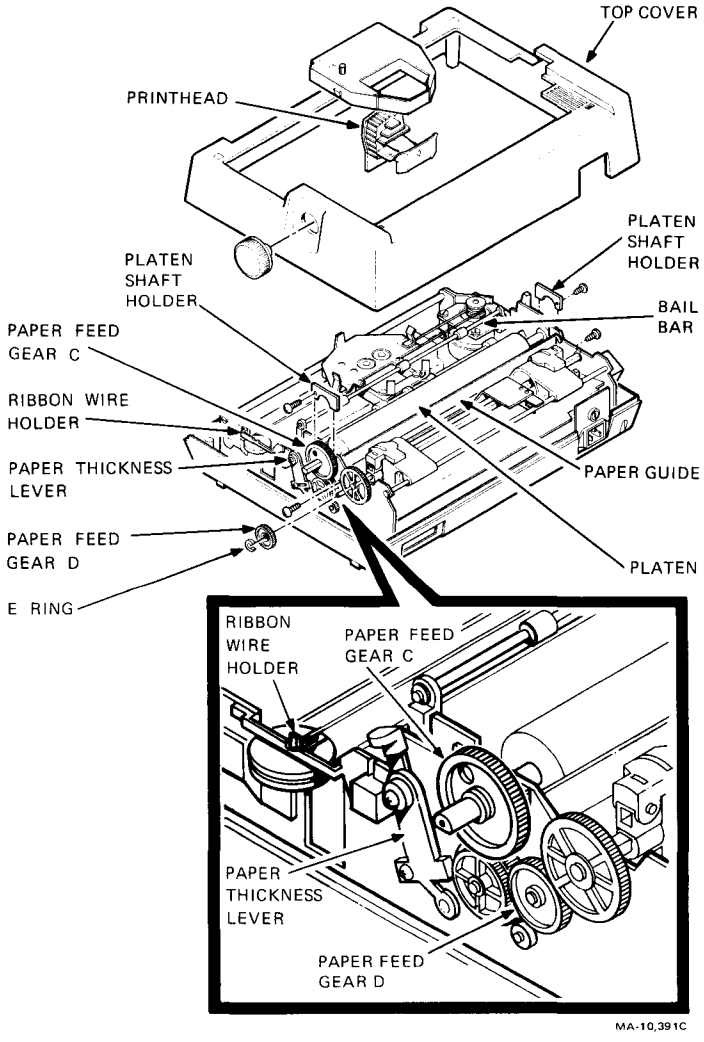

Figure 6-27 Line Feed Motor Replacement

7. Remove the gears on the right side of the mechanism.

8. Remove the nine screws holding the right side of the mechanism.

9. Remove the two screws holding the line feed motor and remove the motor.

10. Install the motor by reversing the above procedure.

NOTES

The paper thickness lever adjusts the gap between the printhead and the platen in four increments of 0.1 + 0.05 mm. The gap is adjustable from 0.5 + 0.05 mm to a maximum of 0.8 + 0.05 mm. Figure 6-28 shows the lever positions for the gap settings. If the paper thickness lever was disassembled, perform the following readjustment procedure.

1. **Loosen the screw that holds the two parts of the lever.**

2. **Adjust part A of the lever for a 0.5 mm gap between the printhead and the platen.**

3. **Position part B of the lever on the 0.5 mm indent (Figure 6-28).**

4. **Tighten the screw.**

6.2.17 Power Transformer, Power Switch, and Noise Filter

Perform the following procedure to remove and replace the power transformer, power switch, and the noise filter.

1. Remove the printer housing (Paragraph 6.2.1).

2. Unplug the power supply connector (Figure 6-9).

CAUTION

The power requirements of each model of the LA50 printer are specific. The label on the fuse plate indicates the voltage setting. When reconnecting the power supply connector, refer to Paragraph 6.2.2 for proper orientation of the connector.

3. Remove the two screws holding the transformer to the bottom cover. Remove the transformer.

4. Unplug the connector between the noise filter (Figure 6-15) and the fuse plate. Remove the noise filter and power switch.

5. Install the assembly by reversing the above procedure.

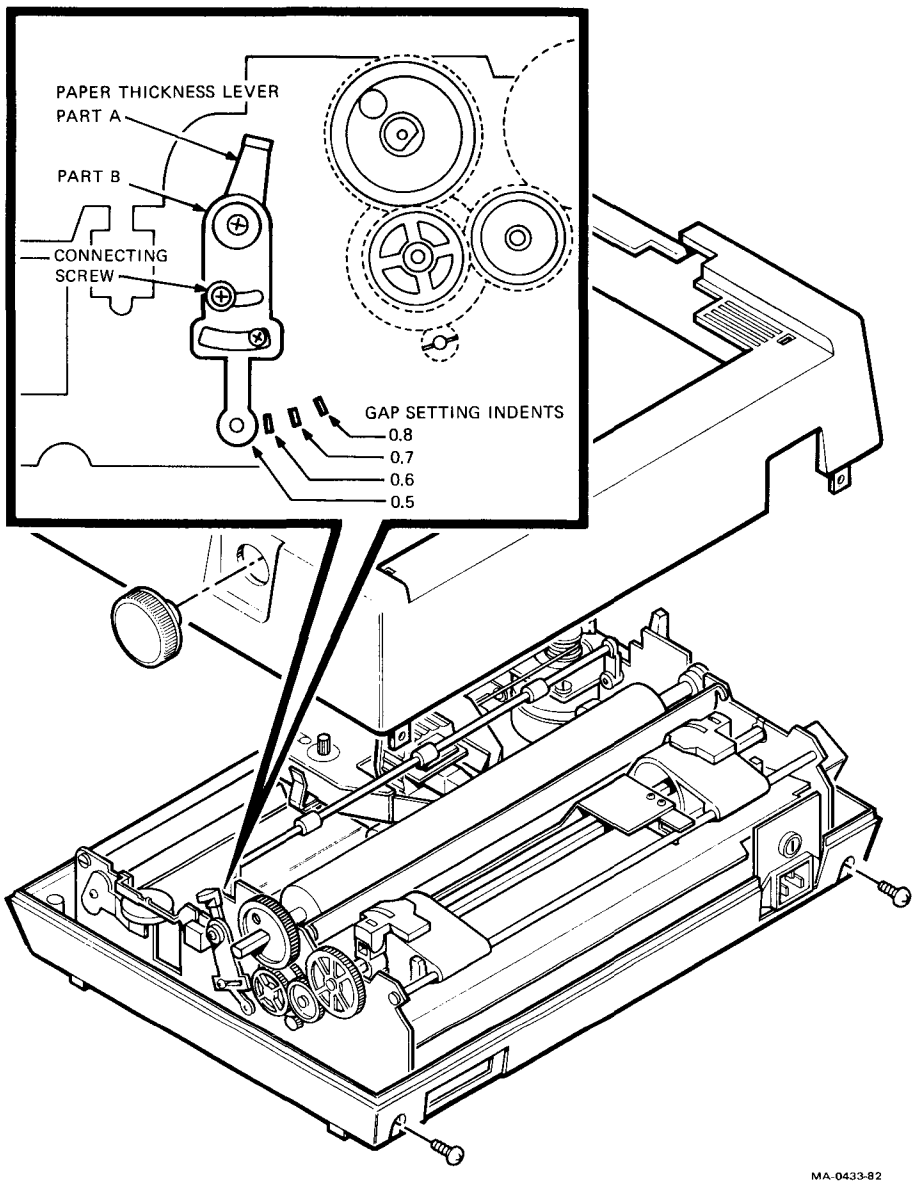

Figure 6-28 Paper Thickness Lever

6.2.18 5 V Transistor or Carriage Transistor Assembly

Perform the following procedure to remove and replace the 5 V transistor or carriage transistor assembly.

1. Remove the bottom cover (Paragraph 6.2.1).
2. Remove the PCB (Paragraph 6.2.6).
3. Remove the screw(s) holding the transistor(s) to the mechanism frame and remove the transistor or transistor assembly (Figure 6-29).
4. Replace the transistor(s) by reversing the above procedure.
5. Apply heat conducting paste under the transistor(s) and Locktite 241* or equivalent to the screw(s).

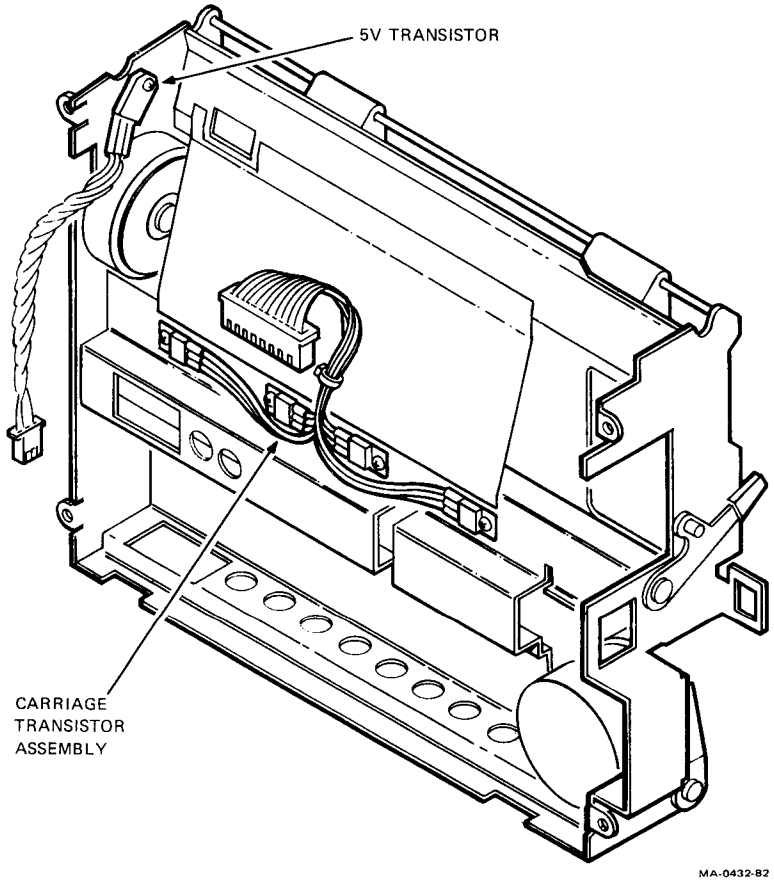

Figure 6-29 5 V Transistor and Carriage Transistor Assembly

* Locktite 241 is a tradename for Thomas and Betts Co.

6.3 LUBRICATION

The LA50 printer is lubricated at the factory. The printer requires lubrication at scheduled inspections and when major repairs are performed. Before lubrication, clean the parts of old oil, rust inhibitors, dust, and dirt. Apply new lubrication sparingly. Wipe off excessive oil.

Table 6-1 is a lubrication guide listing the parts location, intervals, and type of lube. Refer to Table A-1 for the part numbers. Figure 6-30 shows the lubrication locations. The locations on the figure are keyed to those in the table.

Table 6-1 Lubrication Guide

This table is keyed to Figure 6-30. Refer to this figure for the location codes.

Location	Part(s)	Interval	Type of Lube
A	Platen bushings	Overhaul	Mollub-Alloy No. 00
B	Tractor drive shaft bearings	Overhaul	Mollub-Alloy No. 00
C	Paper feed gear shafts-B and D	Overhaul	Mollub-Alloy No. 00
D	Carriage tension arm shaft	Overhaul	Mollub-Alloy No. 00
E	Carriage guide shaft	Overhaul	Esso Beacon No. 325
F	Carriage shaft ring	Inspection and overhaul	Launa #40

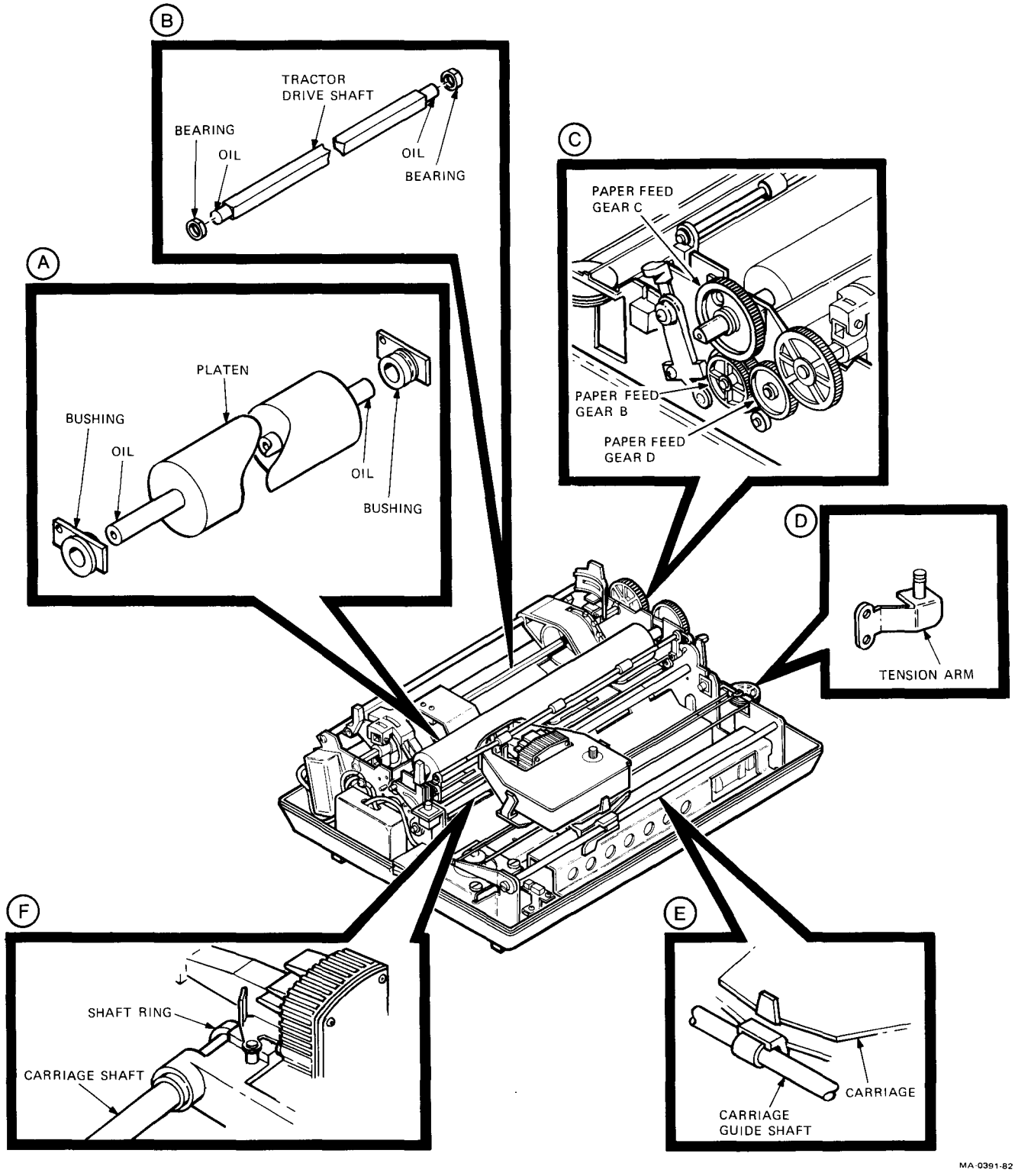

Figure 6-30 Lubrication Locations

APPENDIX A
PARTS LIST

Table A-1 is the parts list for the LA50 printer.

Table A-1 Parts List

Description	Part Number
LA50-RA (whole unit)*	30-19858-01
LA50-RB (whole unit)*	30-19858-02
LA50-RC (whole unit)*	30-19858-03
LA50-RD (whole unit)*	30-19858-04
Printhead*	29-24272-00
Printhead cable	29-24258-00
Printhead circuit board (PCB)	29-24238-00
Front panel and carriage stop assembly – RA, RD	29-24283-00
Front panel, carriage stop switch, and access cover interlock switch assembly – RB, RC	29-24284-00
Paper-out, access cover interlock, and carriage sensor switch assembly – RA, RD	29-24282-00
Paper-out, and carriage sensor switch assembly – RB, RC	29-24285-00
Power transformer, power switch and noise filter assembly – RA, RD	29-24239-00
– RB, RC	29-24240-00
Power switch – RA,RD	29-24280-00
Power switch – RB,RC	29-24233-00
5 V transistor	29-24264-00
Carriage transistor assembly	29-24247-00
Paper bail bar	29-24263-00
Platen	29-24252-00
Platen knob	29-24278-00
Paper thickness lever	29-24248-00
Paper release lever	29-24271-00
Release lever shaft	29-24268-00
Pinch roller	29-24269-00
Ribbon guide	29-24273-00
Ribbon wire	29-24277-00
Ribbon wire arm	29-24260-00
Ribbon wire holder	29-24250-00
Tractor assembly	29-24265-00
Tractor drive gear	29-24270-00
Tractor (left)	29-24266-00

Table A-1 Parts List (Cont)

Description	Part Number
Tractor (right)	29-24267-00
Carriage motor	29-24253-00
Carriage wire	29-24246-00
Tension arm	29-24244-00
Tension arm pulley	29-24245-00
Carriage motor drive pulley	29-24257-00
Carriage motor guide shaft bearing	29-24251-00
Carriage stop	29-24262-00
Carriage guide shaft	29-24259-00
Carriage shaft	29-24261-00
Carriage mechanism assembly	29-24275-00
Cartridge mounting plate	29-24274-00
Lubrication ring	29-24249-00
Change-gear arm	29-24276-00
Line feed motor	29-24254-00
Paper feed gear (B)	29-24256-00
Paper feed gear (C)	29-24243-00
Paper feed gear (D)	29-24255-00
Top cover	29-24241-00
Bottom cover	29-24279-00
Access cover – RA,RD	29-24236-00
Access cover – RB,RC	29-24237-00
Paper cover	29-24235-00
Control panel	29-24234-00
Rubber foot	29-24281-00
LA50 screws kit	29-24230-00
LA50 E-ring kit	29-24231-00
LA50 spring kit	29-24232-00
Lube, Launa No. 40	29-24578-00
Lube, Mollub-alloy No. 00	29-24579-00
Lube, Esso Beacon No. 325	29-24580-00
AC line fuse reg-blo, 2A, 250 V – RA	90-07215-00
AC line fuse T type, 1A, 250 V – RB	12-19283-00
PCB fuse FU1, 3.15A, 250 V	12-19284-05
PCB fuse FU2, 5A, 250 V	12-19284-07
Fuse holder, 3AG – RA	12-18848-02
Fuse holder, 5 × 20 mm – RB	12-18848-03
EIA loopback connector*	12-15336-01
Power Cables	
United States	17-00083-09
Australia	17-00198-00
Continental Europe	17-00199-00
United Kingdom	17-00209-00
Switzerland	17-00210-00
Denmark	17-00310-01

* CD Kit

APPENDIX B
ESCAPE SEQUENCE AND SWITCH SUMMARY

Escape Sequence Summary

Name/Mnemonic	Escape Sequence/Description
Set horizontal pitch DECSHORP	ESC [Pn w 033 133 *** 167 Pn= 0 | 1 | 2 | 4 | 5 | 6 | 8 10 | 10 | 12 | 16.5 | 5 | 6 | 8.25 CPI
Set vertical pitch DECVERP	ESC [Pn z 033 133 *** 172 Pn= 0 | 1 | 2 | 3 | 4 | 5 | 6 6 | 6 | 8 | 12 | 2 | 3 | 4 LPI
Page length selection DECSLPP	ESC [Pn t 033 133 *** 164
Pn= 0 to 252	Pn (lines/page) = Paper length (inches/page) × Vertical pitch (lines/inch)
Partial line down PLD	ESC K Move down 1/2 line (paper up 033 113 1/12 inch)
Partial line up PLU	ESC L Move up 1/2 line (paper down 033 114 1/12 inch)
Select density DECDEN	ESC [Pn " z 033 133 *** 042 172 Pn= 0, 1 Select normal density printing Pn= 2 Select enhanced density printing
Select graphic rendition SGR	ESC [Pn ;..... Pn m 033 133 *** 073 *** 155 Pn= 0 – Reset Pn= 1 – Bold on Pn = 22 – Bold off Pn= 4 – Underline on Pn = 24 – Underline off

Escape Sequence Summary (Cont)

Name/Mnemonic	Escape Sequence/Description
Device attribute DA	ESC [c 033 133 143 Sends back identification code ESC [? 1 7 c 033 133 077 061 067 143
Device status request DSR	ESC [n — Send extended status report 033 133 156 ESC [? 1 n — Disable all unsolicited status reports 033 133 077 061 156 ESC [? 2 n — Enable unsolicited brief reports and send extended status report 033 133 077 061 156 ESC [? 3 n — Enable unsolicited extended report and send extended status report 033 133 077 063 156
Brief status report (sent back by printer) DSR	ESC [0 n — No malfunction detected 033 133 060 156 ESC [3 n — Malfunction detected 033 133 063 156
Extended status reports (sent back by printer) DSR	ESC [0 n — No malfunction detected 033 133 060 156 followed by ESC [? 2 0 n 033 133 077 062 060 156 ESC [3 n — Malfunction detected 033 133 063 156 followed by ESC [? Pn ;... Pn n 033 133 077 *** 073 *** 156 Pn = 21 Hardware failure Pn = 22 Communication failure (event) Pn = 23 Input buffer overflow (event) Pn = 24 Printer deselected Pn = 26 Cover open Pn = 27 Paper empty
Enter graphics mode	ESC P q — Enter graphics mode 033 120 161 ! n Repeat introducer, n = 0 to 65535 $ Graphic carriage return – Graphic new line
Exit graphics mode	ESC \ 033 134

Character Set Selection

SO	CTRL/N (016)	Select G0 to be GL
SI	CTRL/O (017)	Select G1 to be GL
SS2	ESC N (033 116)	Select next character from G2
SS3	ESC O (033 117)	Select next character from G3
LS2	ESC n (033 156)	Select G2 to be GL
LS3	ESC o (033 157)	Select G3 to be GL
LS1R	ESC ~ (033 176)	Select G1 to be GR
LS2R	ESC | (033 175)	Select G2 to be GR
LS3R	ESC | (033 174)	Select G3 to be GR

Assign Character Sets

ESC Gn ch
Assign set ch to Gn where Gn is

"(" = G0	"*" = G2
")" = G1	"+" = G3

and ch is from the list below

B – ASCII	J – JIS Roman
A – Britain	I – JIS Katakana
5 – Finland*	6 – Norway/Denmark*
C – Finland	E – Norway/Denmark
R – France	Z – Spain
9 – French Canada*	7 – Sweden*
Q – French Canada	H – Sweden
K – Germany	< – Multinational
Y – Italy	0 – VT100 Graphics

* preferred

	Switch Bank 1			
	Switch			
Country	**4**	**3**	**2**	**1**
US (ASCII)	O	O	O	O
Britain	O	O	O	C
Finland	O	O	C	O
France	O	O	C	C
French Canada	O	C	O	O
Germany	O	C	O	C
Italy	O	C	C	O
Japan	O	C	C	C
Norway/Denmark	C	O	O	O
Spain	C	O	O	C
Sweden	C	O	C	O

O = OPEN: C = CLOSED

NOTES

1. **For all countries except Japan:**
   G0 = Selected country,
   G1 = VT100,
   G2 = Multinational, and
   G3 = ASCII

2. **For Japan:**
   G0 = JIS Roman,
   G1 = Katakana,
   G2 = Katakana, and
   G3 = ASCII

Baud Rate	Switch Bank 2 Switch 1	2	3
4800	O	O	O
2400	O	C	O
1200	O	C	C
600	C	O	O
300	C	O	C
200	C	C	O
110	C	C	C

Data Format	Switch Bank 2 Switch 4	5	6
7 Bits + odd parity	O	C	C
7 Bits + even parity	C	C	C
7 Bits + 8th bit mark	O	O	C
7 Bits + 8th bit space	C	O	C
8 Bits + odd parity	O	C	O
8 Bits + even parity	C	C	O
8 Bits + no parity	O	O	O

O = OPEN: C = CLOSED

Switch Bank 1

Aspect Ratio	(Switch 5)	Protocol Switch	(Switch 6)
2:1	O	XON/XOFF	O
2:5.1	C	Ready/Busy	C
Signal Level	**(Switch 7)**	**Right Margin**	**(Switch 8)**
Busy = High: Ready = Low	O	Truncated	O
Busy = Low: Ready = High	C	Wrap	C

Power-Up Conditions

Printer selected	on-line
Printer status report	disable unsolicited report
Horizontal pitch	10 characters/inch
Vertical pitch	6 lines/inch
Page length	11 inches
Active position	top leftmost position
Bold, underline, double width	off
Printing density	normal
7-bit mode	GL = G0
8-bit mode	GL = G0; GR = G2

Character sets, aspect ratio, protocol, right margin, and data format are selected per switch settings.

	Vertical Pitch (Characters/Inch)					
Attributes	**16.5**	**12**	**10**	**8.25**	**6**	**5**
Enhanced		×	×		×	×
Bold		×	×	×	×	×
Underline	×	×	×	×	×	×
Maximum characters/line	132	96	80	66	48	40

APPENDIX C
GLOSSARY

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
CPU	Central processing unit
DSR	Data set ready
DTR	Data terminal ready
EIA	Electronic Industries Association – refers to the EIA standard I/O interface, RS-232-C
ESC	Escape character (ASCII $1B_{16}/033_8$)
Escape character	A control character that provides code extention and is a prefix affecting the interpretation of a limited number of contiguous characters
Escape sequence	A sequence of characters that performs 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 printer communicates with
INTR	Interrupt
Interrupt	A signal to the microprocessor 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
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
On-line	When the printer receives its data from the host computer
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
RD	Read
RO	Receive only
ROM	Read only memory
Routine	A set of instructions to the microprocessor that makes it perform a specific function
RS-232-C	An EIA standard that dictates data interface characteristics
RTS	Request to send
RxD	Receive data – USART
RxRDY	Receiver ready – USART
Serial	Transmission of data bit-by-bit over a single data line
Space	One of two states of a communication line, usually defined as a high signal level or the absence of current (see also mark)

Start bit	The first bit in serial asynchronous byte transmission – always a space
Stop bit	The last bit (or bits) in serial asynchronous byte transmission – always a mark
Vector	The address of the first instruction for an interrupt handling routine
WR	Write
WU	Wake-Up
XOFF	Control character that asks the sender to stop sending
XON	Control character that asks the sender to resume sending

APPENDIX D
SPECIFICATIONS

Operating Characteristics

Printing technique	Impact dot matrix
Print method	Incremental with bidirectional lookahead
Characters	94 ASCII 81 Multinational 63 JTS Katakana 27 VT100 Special Graphics 1 error indicator
Character features	Enhanced density Bold Underlined Doublewidth
Print density	7 by 9 matrix (normal) 13 by 9 matrix (enhanced)
Graphic mode	144 or 180 dots/inch horizontal 72 dots/inch vertical 2:1 or 2.5:1 aspect ratio
Print speed	100 characters per second (7 by 9 matrix printing) 44 lines per minute (80 characters per line)
Line feed speed	100 milliseconds/line at 6 lines/inch

Character pitch	
Compressed font	16.5 characters per inch, 132 characters/line
Double width	8.25 characters per inch, 66 characters/line
Elite pitch	12 characters per inch, 96 characters/line
Double width	6 characters per inch, 48 characters/line
Pica pitch	10 characters per inch, 80 characters/line
Double width	5 characters per inch, 40 characters/line
Line spacing	12, 8, 6, 4, 3, or 2 lines/inch Partial line up and down, 1/12 inch
Paper feed	Sprocket-feed, tractor drive Friction-feed, platen drive
Paper dimensions	Single sheets: 3 to 9 inches wide Sprocket paper: 4.5 to 10 inches wide Sprocket holes: 4 to 9.5 inches on center 0.50 ± 0.01 inch spacing
Paper thickness	0.011 inches maximum (original plus 3 sheets)
Ribbon	Disposable cartridge Two million characters life expectancy (average use)

Power Requirements

Model Printer	**Nominal Vac**	**Operating Range Vac**	**Major Market Area**
LA50-RA	120	116 ± 10%	U.S. and Canada
LA50-RB	220	213 ± 10%	Mainland Europe
LA50-RC	240	232 ± 10%	United Kingdom
LA50-RD	100	100 ± 10%	Japan

Frequency range	47 to 63 Hz
Power consumption	Operating: 180 watts maximum Idling: 16 watts

Data interface serial RS232-C and RS423 EIA standard

Physical Characteristics

Weight	8.5 Kg (18.7 lb)
Dimensions	
Width	400 mm (16 in)
Depth	295 mm (11.8 in)
Height	142 mm (5.6 in)
Environment	
Temperature	10° C to 40° C 50° F to 104° F
Relative humidity	10% to 90%

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