

LA324 MultiPrinter Service Guide

Order Number EK-LA324-SV-001

**digital equipment corporation
maynard, massachusetts**

February 1990

The information in this document is subject to change without notice and should not be construed as a commitment by Digital Equipment Corporation.

Digital Equipment Corporation assumes no responsibility for any errors that may appear in this document.

Any software described in this document is furnished under a license and may be used or copied only in accordance with the terms of such license. No responsibility is assumed for the use or reliability of software or equipment that is not supplied by Digital Equipment Corporation or its affiliated companies.

Restricted Rights: Use, duplication, or disclosure by the U.S. Government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.227-7013.

© Digital Equipment Corporation 1990.
All rights reserved. Printed in U.S.A.

The Reader's Comments form at the end of this document requests your critical evaluation to assist in preparing future documentation.

The following are trademarks of Digital Equipment Corporation:

DEC	LA	RS-232	VAXstation
DECconnect	LN01	Rainbow	VMS
DECmate	LN03	ULTRIX	VT
DECserver	LN03R ScriptPrinter	VAXcluster	
DECstation	MicroVAX	VAX DOCUMENT	
DECwindows	PrintServer	VAXmate	
Digital	PRO	VAXserver	

POSTSCRIPT is a registered trademark of Adobe Systems, Inc.

IBM is a registered trademark of International Business Machines, Inc.

Intel is a registered trademark of Intel Corporation.

S1243

This document was prepared using VAX DOCUMENT, Version 1.2.

Contents

Preface

vii

Chapter 1 Theory of Operation

1.1	About the LA324 MultiPrinter	1-1
1.2	Electronic Block Diagrams	1-1
1.2.1	Carriage, Color Motor, and Printhead	1-2
1.2.2	Internal Diagrams	1-3
1.2.3	The Interface (I/F) Board	1-5
1.2.3.1	Serial and Parallel Ports	1-5
1.2.4	The Power Supply Unit (PSU)	1-6
1.3	Printer Components	1-8
1.4	Operator Panel Functions	1-12
1.4.1	Indicator Lights	1-12
1.4.2	Keypad Operation	1-13
1.5	Setup Display Menus	1-16
1.5.1	The DEC and IBM Setup Menus	1-16

Chapter 2 Testing and Troubleshooting

2.1	Troubleshooting Tools	2-1
2.1.1	Power-Up Initialization	2-2
2.1.2	Self-Test Pattern	2-3
2.1.3	Running On-Board Diagnostics	2-6
2.1.3.1	Error Displays	2-8
2.1.3.2	Warning Error Displays	2-9
2.1.4	T&DL and T&DN Subtests	2-10
2.1.4.1	EUROPE? and USA? Prompts	2-11
2.1.4.2	Paper Loading, Eject, and Edge Detection	2-11
2.1.4.3	132-Column Test Pattern	2-11

2.1.4.4	H-Pattern and First-Line Alignment	2-15
2.1.4.5	Single-Sheet Test Pattern	2-20
2.2	General Service Notes	2-22
2.2.1	Defeating the Access Cover Interlock	2-22
2.2.2	Display Panel Version Numbers	2-22
2.2.3	Circuit Board Jumpers	2-22
2.2.4	Printer Installation, Cleaning, and Maintenance	2-22
2.3	Troubleshooting Procedure	2-23

Chapter 3 Removal and Replacement Procedures

3.1	Printer Stand	3-2
3.1.1	Paper Catcher	3-4
3.2	Main Cover	3-5
3.3	Interface Cover	3-8
3.4	Font Cartridge Cover	3-9
3.5	Access Cover	3-10
3.6	Paper Chute	3-11
3.7	Interface Board (I/F)	3-12
3.8	Main Control Board	3-13
3.9	Display Panel	3-17
3.10	Operator Panel Board	3-18
3.11	Power Supply Unit (PSU)	3-19
3.12	Line Power Fuse	3-21
3.13	Fan	3-22
3.14	Mechanical Assembly	3-23
3.15	Printhead	3-25
3.15.1	Printhead Smudge Shield	3-28
3.15.2	Printhead Cable	3-29

Chapter 4 Recommended Spares Lists (RSL)

4.1	Contents of the Van Kit	4-1
4.2	Contents of the Miscellaneous Kits	4-3

Appendix A Technical Information and Tables

A.1	Serial and Parallel Connectors	A-1
A.2	Setup and Installation Menus	A-3
A.3	T&D Subtests	A-8
A.4	Combined Error Code Tables	A-10
A.4.1	Full Error K-Codes	A-11
A.5	Circuit Board Physical Information	A-16
A.5.1	Main Control Board	A-16
A.5.2	I/F Board	A-18

Appendix B General Specifications

Figures

1-1	Overall Block Diagram	1-2
1-2	Main Control Board	1-3
1-3	Location of the Infrared Sensors	1-4
1-4	I/F Block Diagram	1-5
1-5	PSU Block Diagram	1-6
1-6	Printer Components (Front View)	1-8
1-7	Printer Components (Rear View)	1-9
1-8	LA324 Operator Panel	1-12
2-1	Self-Test Pattern	2-5
2-2	T&DL and T&DN Flowchart	2-10
2-3	132-Column Test Pattern	2-13
2-4	T&DL Alignment Flow Chart	2-16
2-5	First-Line Alignment Pattern	2-17
2-6	H-Pattern	2-19
2-7	Single-Sheet Test Pattern	2-21
A-1	Main Control Board Factory Configuration	A-17
A-2	I/F Board Factory Configuration	A-18

Tables

1-1	Printer Components	1-10
1-2	Operator Panel Keys	1-13
1-3	DEC and Emulation User Setup Menus	1-17
1-4	Installation Setup Menu	1-20
2-1	Description of Diagnostic Tools	2-2
2-2	ORU Error Display	2-8
2-3	Firmware Code Versions	2-22
2-4	Level 1 Troubleshooting	2-23
2-5	Level 2 Troubleshooting	2-28
2-6	Level 3 Troubleshooting	2-34
4-1	Contents of the LA324 Van Kit	4-1
4-2	LCD and Operator Panel Kit, 29-27881-01	4-3
4-3	Main Cover Kit, 29-27882-01	4-3
4-4	Miscellaneous Kit, 29-27883-01	4-4
4-5	Mechanical Assembly Kit 1, 29-27884-01	4-4
4-6	Mechanical Assembly Kit 2, 29-27885-01	4-5
4-7	Hardware Kit, 29-27886-01	4-5
A-1	Serial Connector	A-1
A-2	Parallel Connector	A-2
A-3	DEC User Setup Menu	A-3
A-4	Installation Setup Menu	A-6
A-5	Sequence and Description of T&D Subte.	A-8
A-6	ORU Error Display	A-10
A-7	Full Error Report (K-Codes)	A-11
B-1	Specifications	B-1

Preface

Documentation

The Customer Service engineer (CSE) uses this book to repair and service the LA324 MultiPrinter in the field environment. The documentation listed below provides additional information.

Number	Description
EK-LA324-IN-001	LA324 MultiPrinter Installation Guide
EK-LA324-OP-001	LA324 MultiPrinter Operator's Guide
EK-LA324-PM-001	LA324 MultiPrinter Programmer's Reference Manual
EK-LA324-IP-001	LA324 MultiPrinter Illustrated Parts Breakdown (IPB)
ER-LA324-TM-001	LA324 MultiPrinter Technical Manual

Training

Before attempting to use the book and repair the printer, attend the Educational Services training courses recommended in the table below.

The LA324 Operations and Servicing SPI/lab format course is offered at FTC A and B sites worldwide. The SPI course number is EY-D873E-P0-001.

Europe and GIA Areas	
Number	Description
EY-2380-IV	Data Communication Fundamentals
EY-2239E-IV	Hardcopy Theory

US Area

Number	Description
EY-7629E-IV	Video Specialist Core Course

Conventions

Notes, cautions, and warnings in this guide highlight specific information.

- **Note** provides important additional information.
- **Caution** provides information for preventing equipment damage.
- **Warning** provides information for preventing personal injury.

A box is used to indicate console or keyboard keys. For example  refers to the operator panel up arrow key.

Tools

The following special tools are needed to service the LA324 MultiPrinter in the field.

Order Number	Description
29-26106-00	50-Hz terminal tool kit
29-26109-00	60-Hz terminal tool kit
12-25083-01	MMJ loopback connector
29-27887-01	Parallel loopback connector
29-11762-00	Antistatic kit

Chapter 1

Theory of Operation

1.1 About the LA324 MultiPrinter

The LA324 MultiPrinter is a high-speed, low-cost, customer-installed, desktop printer. Appendix B lists all specifications. Other features include color, multipage, and draft or letter quality printing, a dual-protocol interface, and for quiet environments, a quiet printing mode. A variety of additional fonts can be loaded by installing an external font cartridge.

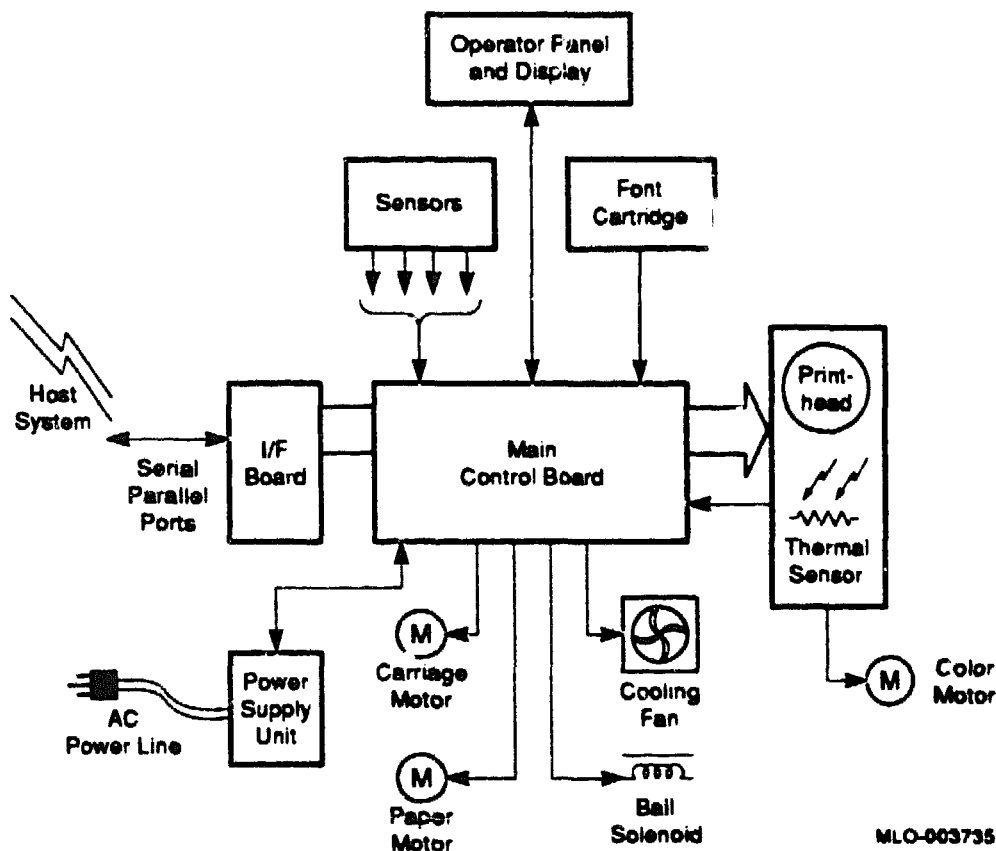
The printer is designed for quick and easy servicing. The spare parts (van) kit, described in Chapter 4 consists of nine major field replaceable units (FRUs). The on-board diagnostics and the troubleshooting procedures discussed in Chapter 2 are used to quickly diagnose and isolate a malfunction to the most likely FRU. The Customer Service engineer (CSE) then swaps the FRU to verify the malfunction and fix the printer. No special tools or complicated mechanical adjustments are required. No lubrication, periodic service, or maintenance are necessary. The electronic H-pattern adjustment compensates for carriage belt wear and can be performed by the user or by the CSE.

1.2 Electronic Block Diagrams

Figure 1-1 shows the major electronic assemblies of the LA324 MultiPrinter.

- The main control board controls all electromechanical and electronic components.
- The carriage and color motors, and the printhead, control the horizontal bidirectional color printing.
- The paper motor controls vertical paper motion. The interface (I/F) board connects the main control board to the communication network or host system.

Figure 1-1: Overall Block Diagram



1.2.1 Carriage, Color Motor, and Printhead

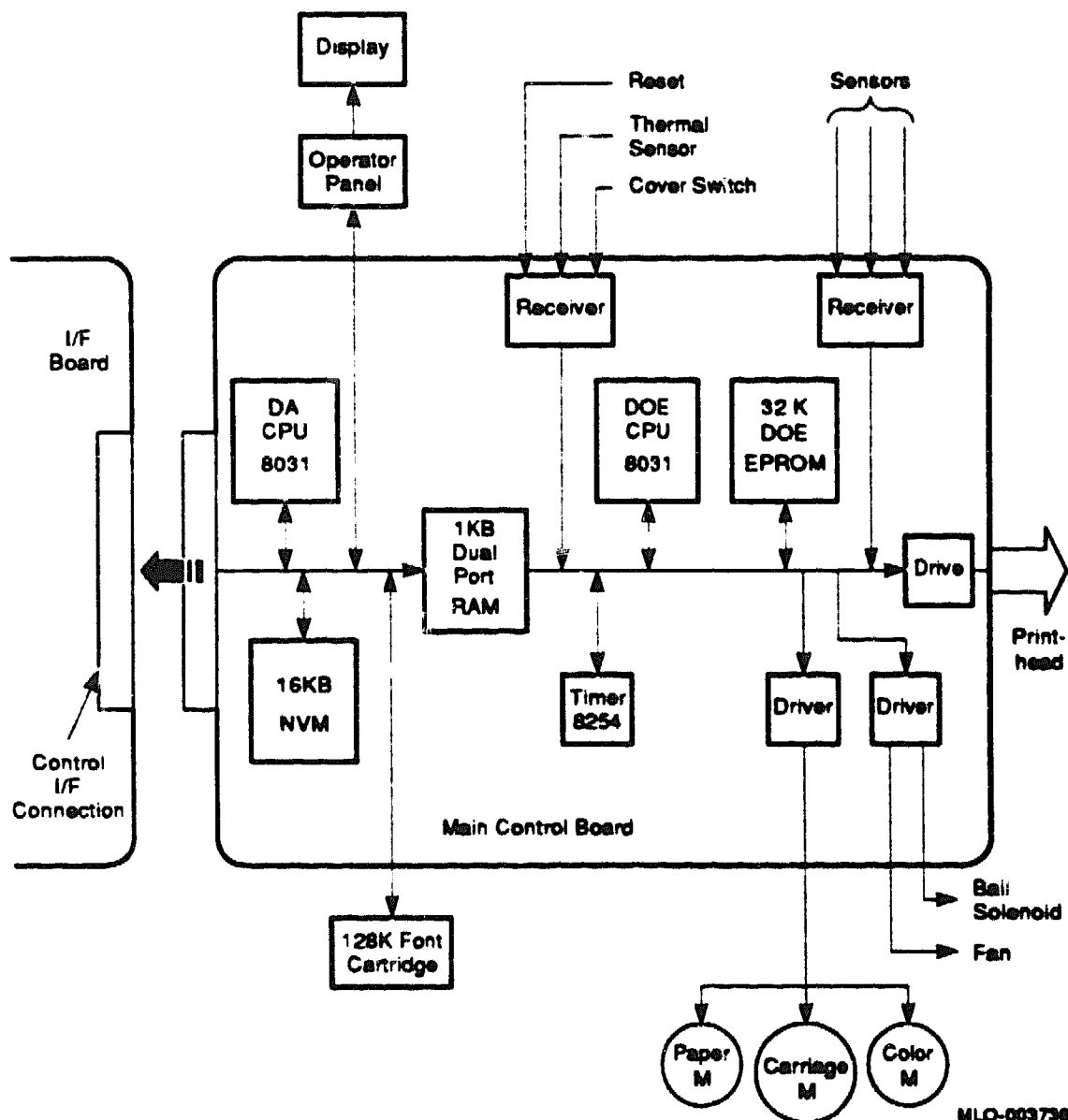
The 24-pin printhead contains a thermal sensor and sits on the horizontally movable carriage assembly. The ribbon color motor lifts the print ribbon cartridge to position the correct color band in front of the pins. If a black ribbon is installed, the color motor moves the ribbon up and down to minimize ribbon wear.

The thermal sensor signals the printhead temperature to the main control board. After a prolonged period of high-speed printing, the printhead overheats and the main control board slows down the print speed, until the printhead cools. (You can see the slowdown occur after approximately 15 minutes of 132-character full page printing.)

1.2.2 Internal Diagrams

Figure 1-2 shows the internal block diagram of the main control board.

Figure 1-2: Main Control Board



The main control board connects to the I/F board through a 64-pin connector, and to the printhead by way of the printhead cable. Both the device adapter (DA) and the device-orientated-electronic (DOE) are Intel

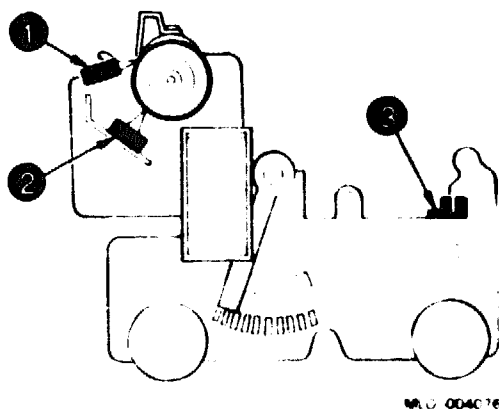
8031 processors with internal and external RAM memory. Communication between the DA and DOE processors occurs through the dual-ported memory. Receiver and driver circuits connect outside devices to the internal bus structure on the main control board. A timer circuit serves a variety of on-board functions that are not detailed in this document.

The operator panel and display serve as a two-way interface between the user and the operating firmware on the main control board.

The five sensors you can see in Figure 1-2 consist of the printhead thermal sensor, one magnetic switch, and three infrared sensors.

- Two infrared reflective sensors monitor the fanfold and single-sheet load points to detect the leading and trailing paper edges. Accurate line positioning and paper handling are made possible by accurate detection of the leading edge. Figure 1-3 shows the physical location of the ① single-sheet and ② fanfold sensors.
- One infrared interrupter sensor is used to detect the home position of the carriage and is also used to determine if a black or color ribbon cartridge is installed. Figure 1-3 shows the physical location of the ③ carriage home-position sensor.

Figure 1-3: Location of the Infrared Sensors



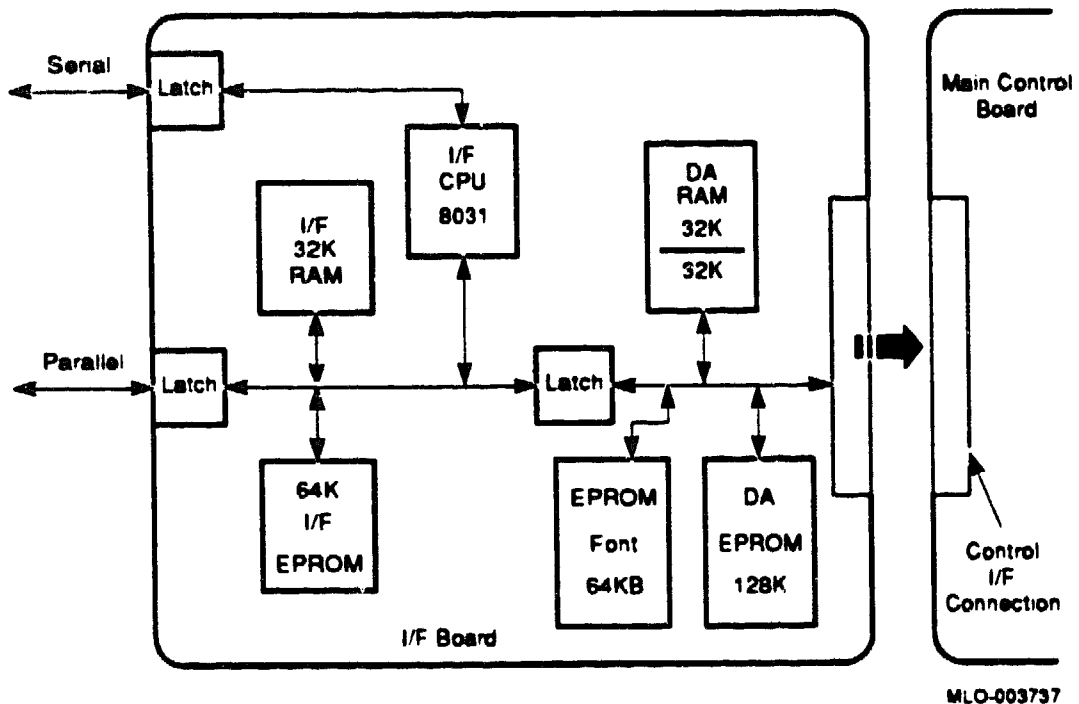
- The magnetic sensing switch (reed relay) is mounted on the main control board and serves as a safety interlock for the access cover.
- The reset signal is the power supply unit status signal.
- The thermal sensor measures printhead temperature and is discussed in Section 1.2.1.

- The bail solenoid operates the automatic bail bar. The bail bar opens when the leading edge of the sheet approaches and closes to press the sheet to the platen. When feeding stiff labels, you can set the bail bar to lift as the perforation passes underneath. See the bail bar lift feature in Table 1-4.

1.2.3 The Interface (I/F) Board

Figure 1-4 shows the internal block diagram of the I/F board. The I/F is an Intel 8031 processor with internal and external memory. Communication between the I/F and DA processors occurs through the data latch and 64-pin connector onto the main control board.

Figure 1-4: I/F Block Diagram



1.2.3.1 Serial and Parallel Ports

The I/F operates the serial and parallel ports and receives and buffers incoming data. The I/F receives and parses the buffered data for commands (for example data flow commands) and sends it to the DA processor. The *LA324 MultiPrinter Programmer's Reference Manual* has a complete list of commands. You choose ports by selecting either serial or parallel from the installation setup menu.

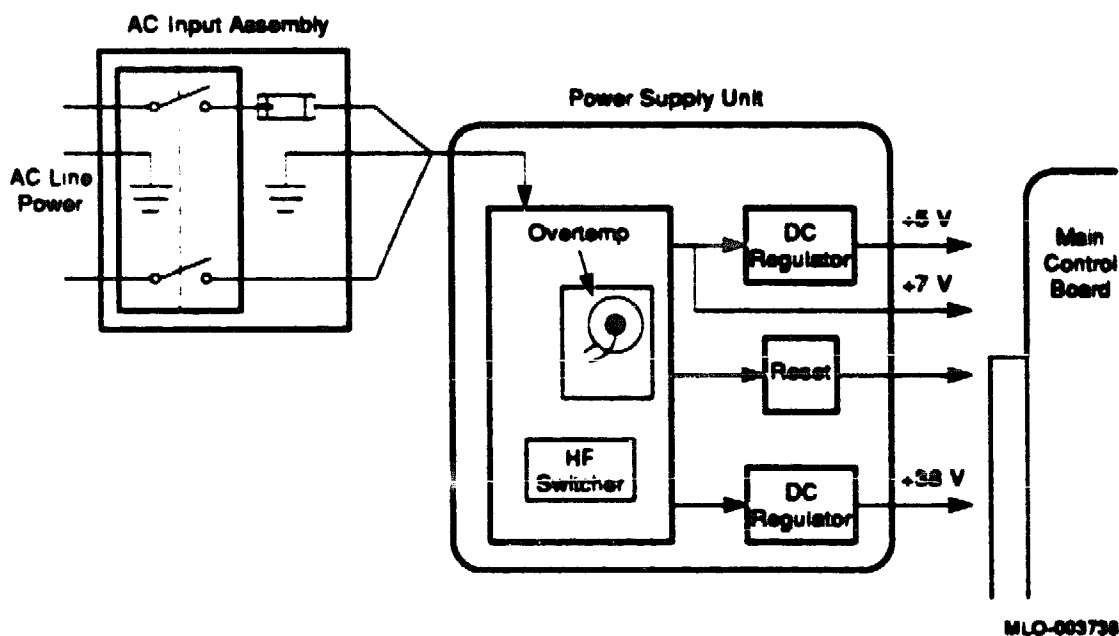
Section A.1 provides connector pin and signal information for the serial and parallel ports. The 6-pin MMJ serial port connector plugs directly into a serial port of a host system or to a modem or other communications device. The 36-pin parallel port connector is an 8-bit parallel interface bus that electrically and mechanically conforms to IBM XL24 protocol.

1.2.4 The Power Supply Unit (PSU)

The LA324 MultiPrinter uses a modern power supply unit (PSU) that requires no switches or circuit jumpers for operation over a wide range of power line voltages. Complete ac power line specifications are listed in Appendix B.

The PSU (Figure 1-5) provides regulated dc power to the printer components through the distribution network on the main control board and connects the printer to the ac line power.

Figure 1-5: PSU Block Diagram



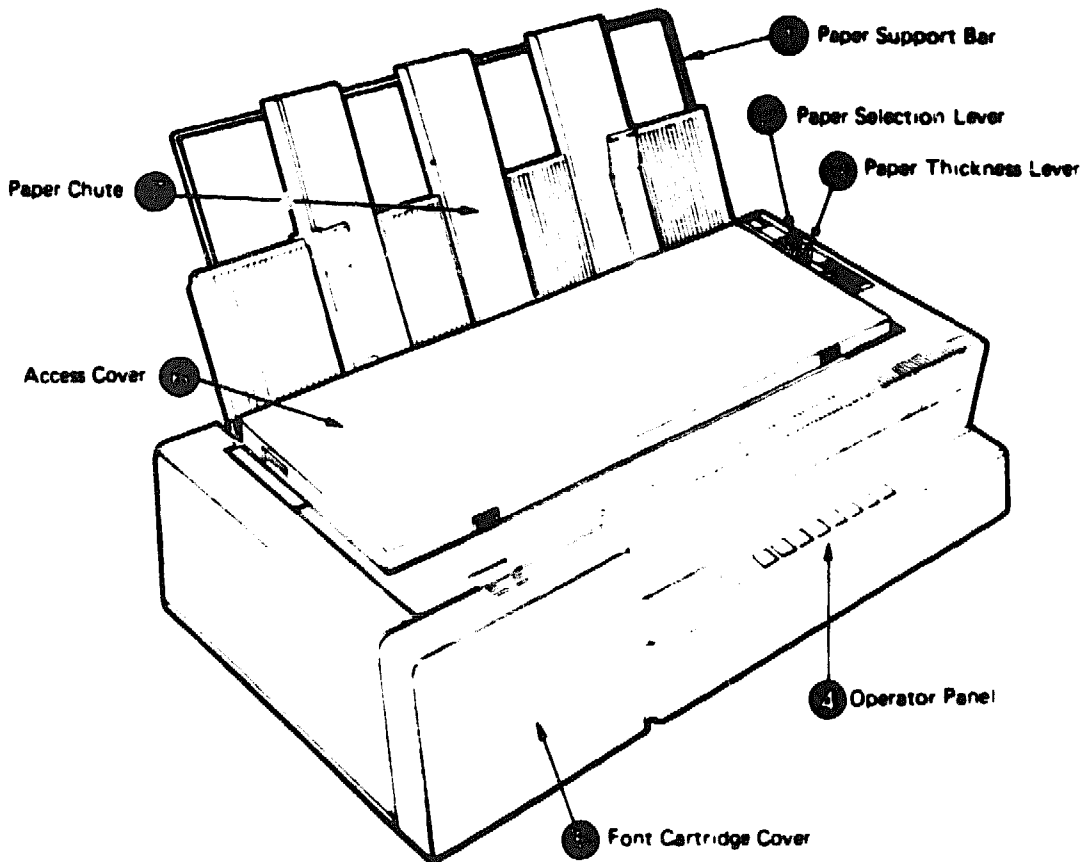
The following components are part of the PSU:

- **The ac input assembly connects the printer to the ac line power available at the site. (See Appendix B for ac power line and receptacle specifications.)**
- **The 3-ampere fast-blow fuse is mounted under the cover of the ac input assembly.**
- **The high-frequency (HF) switcher produces rectified dc power, which is fed into the regulator circuits.**
- **The PSU provides the following power outputs:**
 - **+5 Vdc power for the logic devices**
 - **Unregulated +7 Vdc power for the on-board regulators**
 - **+38 Vdc power for the electromechanical devices**
- **The Reset signal goes high after the power has stabilized and goes low before the power turns off.**
- **The resistive over-temperature device limits the ac power if the air temperature within the PSU exceeds approximately 110°C (230°F). This happens only under extreme conditions, such as a loss of cooling or generation of excessive heat within the PSU.**

1.3 Printer Components

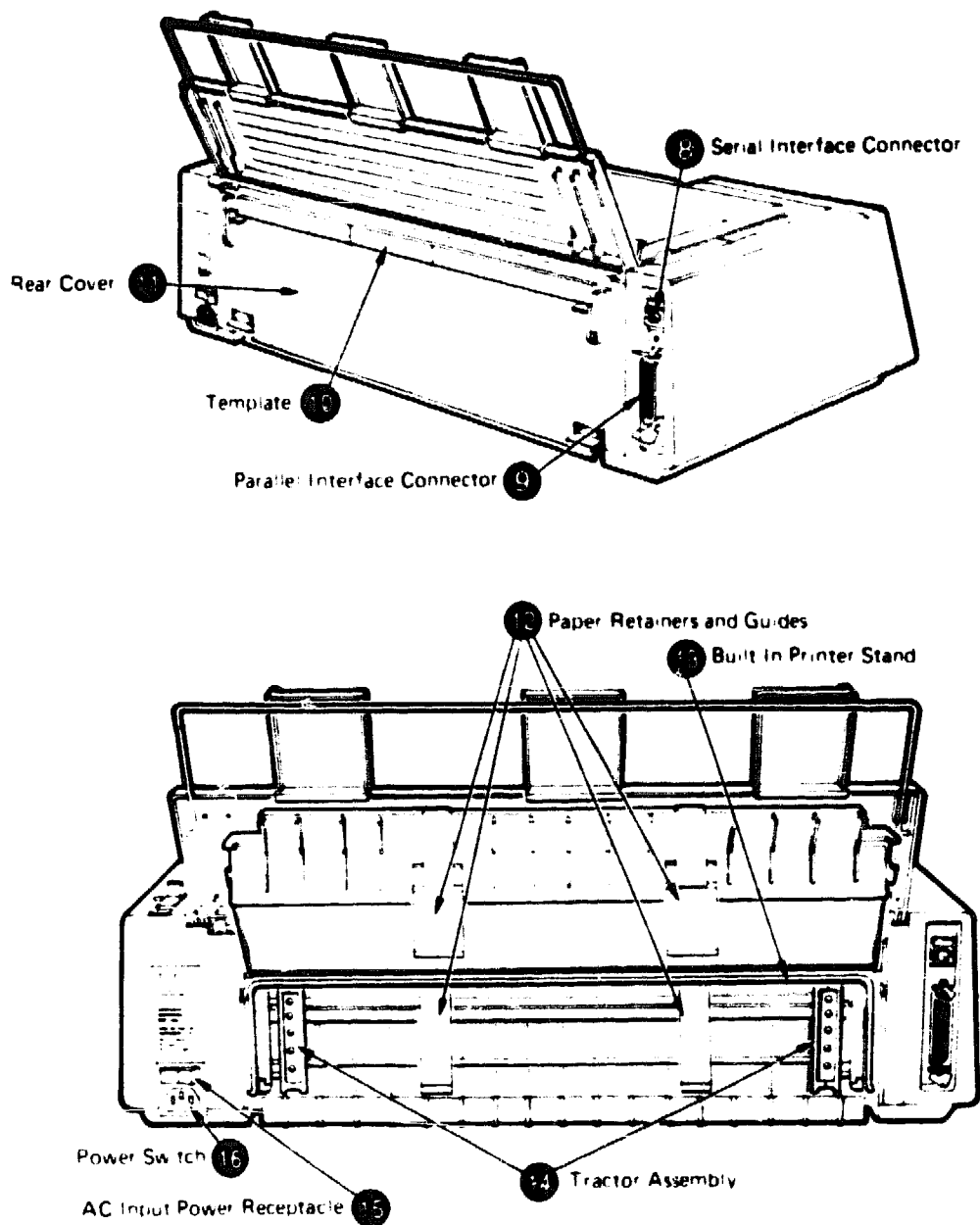
Figure 1-6 and Figure 1-7 show the front and rear components of the LA324 MultiPrinter. Table 1-1 provides a description of each component. The numbered callouts in Figure 1-6 and Figure 1-7 refer to the numbered callouts in Table 1-1.

Figure 1-6: Printer Components (Front View)



WILSON

Figure 1-7: Printer Components (Rear View)



MLO 004078

Table 1-1: Printer Components

Component	Function
① Paper support bar	Provides additional support for paper sizes longer than 11.6 in (297 mm). Set the paper support bar to the lower position when using fanfold paper.
② Paper selection lever	Engages gear to drive tractor feed assembly. Fanfold position = forward Single sheet position = rearward
③ Paper thickness lever	The thickness lever compensates for thick or thin paper or for multisheet forms. The lever moves the printhead to increase or decrease the gap between the printhead and platen. If the gap is too narrow, the printing smudges or the pins punch through the ribbon and emboss the paper. If the gap is too wide, light printing occurs with parts of characters missing. The printhead and the thickness lever move in the same direction. When the lever is pushed fully rearward, the gap is at minimum width and satisfactory printing on one paper sheet results. When the lever is pulled fully forward toward the front of the printer, the gap is at maximum width. When adjusting for thick paper or multisheet forms, adjust the thickness lever until the printing looks crisp and well defined. See Appendix B for information on media thickness.
④ Operator panel	Consists of status displays and pushbutton keypad. See Section 1.4 and Table 1-2 for details.
⑤ Font cartridge cover	Flips down for installing font cartridges.
⑥ Access cover	Easily removed acoustic cover that provides access to ribbon cartridge and carriage area. When the access cover is closed, a magnet mounted on the access cover actuates a magnetic reed switch mounted on the main control board.
⑦ Paper chute	The two-position paper chute is positioned up for single-sheet feeding, and positioned down for fanfold paper feeding.
⑧ Serial interface connector	Serial (D ^M MJ) connector for interface cable to the host computer.
⑨ Parallel interface connector	Parallel connector for interface cable to the host computer.
⑩ Template	The template shows the model and serial numbers and the approval stamps of various testing agencies.
⑪ Rear cover	Opens to load fanfold paper.

Table 1-1 (Cont.): Printer Components

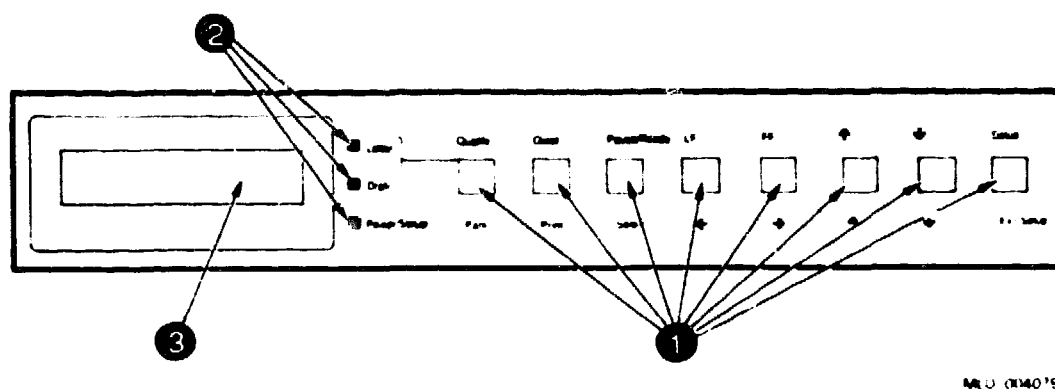
Component	Function
⑫ Paper retainers and guides	The retainers press the fanfold paper against the paper guides to control paper flow and prevent jams. The guides must align over the retainers.
⑬ Built-in printer stand	This stand tilts the printer forward to facilitate feeding and loading of fanfold paper.
⑭ Tractor assembly (left and right sides)	Used to feed fanfold paper through the printer.
⑮ AC input power receptacle	The ac power cord is connected to this receptacle.
⑯ Power switch	Connects or disconnects the printer from the ac power line.

1.4 Operator Panel Functions

Figure 1-8 shows the major divisions of the operator panel.

- ❶ The keypad enables you to select inputs in all LA324 MultiPrinter operational modes.
- ❷ The three green indicators show printer mode and print density.
- ❸ The liquid crystal display (LCD) shows the current status of the selected mode of operation.

Figure 1-8: LA324 Operator Panel



MLU 004019

1.4.1 Indicator Lights

Three green indicator lights on the operator panel do the following:

- Letter and Draft are operated by pressing **Quality** and are discussed in Table 1-2.
- Power/Setup indicates that the printer power is on, in the operational mode. In the setup mode this indicator flashes.
- When all three indicators flash, a carriage fault or other serious malfunction exists. Run the Service test diagnostic for additional in-depth error information. See Section 2.1 for information about running diagnostics.

1.4.2 Keypad Operation

The labeling above or below each operator panel key describes the function of that key when the printer is in the READY, setup, or installation mode. The keys also perform unlabeled functions during diagnostic tests, alignment routines, and power-up sequences.

Table 1-2 describes the functions of the keypad keys.

Table 1-2: Operator Panel Keys

Operating (READY) Mode		
Keypad ¹	Function	
Quality	Toggles the print density selection between the following three settings. The letter and draft indicators show the selected print density. If you press the key while the printer is printing, the change in print density occurs on the next line.	
	• Letter quality printing. • Draft quality printing. • Software selected. If the letter and draft quality indicators are off, the print density is selected under software control.	
Quiet	Invokes the quiet printing mode. The quiet mode uses fewer printhead impact wires, thus producing less printing noise. In quiet mode, more printhead passes are required and printing takes more time. If you press Quiet while the printer is printing, the change occurs on the next line.	
Pause/Ready	Toggles the printer between the pause and ready states and assigns the labeled function of the keypad keys.	
	The following table describes the prompt and tells which label (the label above or below the key) describes the function of the key	
	READY DEC	Above Printer is on line and Digital protocol is selected.
	READY EMUL	Above Printer is on line and IBM XL24 protocol is selected.
	PAUSE	Below Printer is off line and cannot receive data.
LF (Line Feed)	Advances the paper and the printer line counter one line at a time. If no paper is loaded, the key is ignored. LF differs from ↑ and ↓ in that the line counter increments, and when a form feed character is received, the paper position is reset.	

¹During the operating (READY) mode, the function labeled above each key is performed.

Table 1-2 (Cont.): Operator Panel Keys**Operating (READY) Mode**

Keypad¹	Function
FF (Form Feed)	Advances the paper to line one of the next page or loads paper from the load position to line one. If the No Forms feature is selected, pressing this key advances the paper one line, acting like LF .
↑	Advances or offsets the paper position but does not increment the line counter. Used for fine adjustments and for clearing paper jams. The advanced position offset remains until the paper is positioned to the load position. Used for clearing paper only.
↓	Reverses or offsets the paper position but does not increment the line counter. Used for fine adjustments and for clearing paper jams. The reversed position offset remains until the paper is moved to the load position. Used for clearing paper only.
Setup	The printer leaves the READY mode and enters the user setup mode or menu. In user setup, the keypad keys perform the functions labeled beneath them. See Table 1-3.

User Setup Mode

Keypad²	Function
Park	Causes fanfold paper to reverse through the paper path and park at the fanfold sensor, in the tractor assemblies. The following happens if you press Park when a single sheet is loaded or at the load point: • The loaded single sheet will eject. • A single sheet at the load position will load and jam against the closed access cover.
Print	Prints all the selected setup values.

¹During the operating (READY) mode, the function labeled above each key is performed.

²In user setup mode, the function labeled beneath each key is performed.

Table 1-2 (Cont.): Operator Panel Keys

User Setup Mode	
Keypad²	Function
	Selects the value shown on the message display, when the printer is in the installation or setup menu. An asterisk (*) marks the selected value in the menu values list. Selected values are saved or retained in the following ways (see Table 1-3 for full information): • Exiting the installation menu saves all selected installation values. • Selecting the save user setup menu feature saves user setup values.
	Displays the previous value for the current feature.
	Displays the next value for the current feature.
	Displays the previous feature on the menu.
	Displays the next feature on the menu.
	Exits the printer from setup mode back to READY mode.

Power-Up Modes	
Keypad³	Function
Power on with 	Starts the Self-test diagnostic. See Section 2.1.2 for additional information.
Power on with 	Enters the datascope mode. In datascope mode the printer prints ASCII hexadecimal code characters. The datascope is used by programmers and support engineers. See the <i>LA324 MultiPrinter Technical Manual</i> for more detail.
Power on with 	Starts the Repair center diagnostic. ⁴
Power on with 	Starts the Service test diagnostic. ⁴
Power on with 	Starts the user ALIGNMENT? routine, which is identical to the T&DL subtest alignment routine.

²In user setup mode, the function labeled beneath each key is performed.

³To invoke the power-up modes, simultaneously press the key and turn on the printer power.

⁴See Section 2.1 for more information.

Table 1-2 (Cont.): Operator Panel Keys

Power-Up Modes	
Keypad³	Function
Power on with Setup	Enters the installation menu and displays the INSTALLATION prompt. The installation menu contains features for setting printer/host communications and features relating to optional equipment. See Table 1-3. Press Exit Setup to leave the installation menu and go to READY mode.

³To invoke the power-up modes, simultaneously press the key and turn on the printer power.

1.5 Setup Display Menus

The installation and setup configuration parameters (features) of the LA324 MultiPrinter are electronically manipulated through the operator panel. There are no jumpers or switches to configure in the field. Misconfigured installation parameters can lead you to believe a problem exists in the host, printer, or interface interconnection. Always inspect the setup and installation menus before you undertake time-consuming troubleshooting procedures.

The installation menu features are set by the customer when the printer is installed and should be checked when the printer is moved or when a host parameter is changed. An incorrectly set installation parameter can hang up the firmware or disable the printer.

The setup menu features can be changed at any time by anyone who uses the printer. An incorrectly set setup parameter can cause incorrect or unexpected printer operation. For example, it may print foreign characters or handle paper badly.

1.5.1 The DEC and IBM Setup Menus

If the major firmware version number is V2.x, the LA324 MultiPrinter can be configured to operate with Digital Equipment Corporation (DEC) or IBM XL24 (Emulation) compatible interface protocols. Only the DEC protocol operates if the major firmware version number is V1.x.

Each protocol has slightly different setup features and values. The correct user setup menu appears automatically when you select the protocol. Do not confuse the selection of a protocol with the selection of the serial or parallel port. See Table 2-3 for information about protocol and firmware version numbers.

NOTE: *The Emulation user setup information is not available for this version of the LA324 MultiPrinter Service Guide.*

Table 1-3 details features and values of the DEC and Emulation setup menus.

Table 1-3: DEC and Emulation User Setup Menus

DEC User Setup Menu		
Feature	Values ¹	Comment
Protocol	DEC ² Emulation	Toggles selection between IBM XL24 and DEC protocol. The emulation protocol is inactive in the V1.1 to V2.0 range of firmware revision numbers.
DEC Defaults	Save	Saves all selected values in nonvolatile memory. Unsaved values are lost when the printer is powered down.
	Print	Prints out the selected values.
	Restore	Cancels all selected values, replacing them with saved values.
	Recall Factory	Automatically recalls and selects all the factory values for both the user setup and installation menus. Unless you select Save, the selected values disappear at power down.
Form Length	1	
	.	
	.	
	66 lines ²	
	.	
Form Width	255 lines	
	13.6 inches ²	
	8 inches	
Auto LF on CR	No auto LF ²	
	Auto LF on CR	

¹Press **Select** to select the value shown on the message display. An asterisk (*) is displayed to designate the selected values. Make sure you save all selected values. See the DEC default feature.

²Factory value. All factory values are selected by Recall Factory. Individual factory values can be selected manually.

Table 1-3 (Cont.): DEC and Emulation User Setup Menus

DEC User Setup Menu		
Feature	Values¹	Comment
Auto CR on LF	No auto CR ² Auto CR on LF	
Density	Draft ² Letter Quality	
Typestyle	Internal ² Cartridge	
Horiz. Pitch	10 CPI ² 12 CPI 13.2 CPI 17.1 CPI 18 CPI 5 CPI 6 CPI 6.6 CPI 8.55 CPI 9 CPI	CPI = characters per inch.
Vertical Pitch	6 LPI ² 8 LPI 12 LPI 2 LPI 3 LPI 4 LPI	LPI = lines per inch.
Autowrap	Truncate ² Wrap	When truncated no wrapping is performed by the printer, the host must provide carriage return and line feed characters. Autowrapping can conflict with carriage returns and line feeds sent from the host.

¹Press **Select** to select the value shown on the message display. An asterisk (*) is displayed to designate the selected values. Make sure you save all selected values. See the DEC default feature.

²Factory value. All factory values are selected by Recall Factory. Individual factory values can be selected manually.

Table 1-3 (Cont.): DEC and Emulation User Setup Menus

DEC User Setup Menu		
Feature	Values¹	Comment
G0 Cset	US ASCII²	If a font cartridge is installed, the character set is displayed here. See the <i>LA324 MultiPrinter Programmer's Reference Manual</i> for character set information.
	British	
	DEC Finnish	
	French	
	DEC Fr. Canada	
	German	
	ISO Italian	
	JIS Roman	
	DEC Nor/Dan	
	ISO Spanish	
	DEC Swedish	
	Norway/Danish	
	DEC Dutch	
	DEC Swiss	
	DEC Portuguese	
	JIS Katakana	
	DEC Spec. Graph	
	DEC Technical	
	DEC Supp	
	DEC 7bit Hebrew	
	DEC Hebrew Supp	
	Legal	
	User Preference	
User Pref. Cset	DEC Supplement²	If a font cartridge is installed, the character set is displayed here. See the <i>LA324 MultiPrinter Programmer's Reference Manual</i> for character set information.
	ISO Supplement	
	Katakana	
	DEC Hebrew Supp	
	ISO Hebrew Supp	
	cartridge	
Printer ID	Level 2 Printer²	Printer responds to selection with selected ID.
	LA120 ID	
	LA210 ID	
Top Margin	1²	Printing starts at the top margin.
	.	
	.	
	255	

¹Press **[Select]** to select the value shown on the message display. An asterisk (*) is displayed to designate the selected values. Make sure you save all selected values. See the DEC default feature.

²Factory value. All factory values are selected by Recall Factory. Individual factory values can be selected manually.

Installation Setup Menu

The features and values of the installation menu are detailed in Table 1-4.

Table 1-4: Installation Setup Menu

Feature	Values ¹	Comment
Setup Language	English ² Francais Deutsch Espanol Italiano	Language text that appears on the display panel.
Port Selection	Serial Port ² Parallel Port	
Buffer Control	XON/XOFF ² DTR	Select between DTR or control code methods of data flow control.
EOT disconnect	No disc. on EOT ² Disc. on EOT	If an end of transmission (EOT) character is received, the printer drops the data terminal ready (DTR) signal, which causes modems or communications equipment to disconnect.
Baud Rate	4800 ² 9600 19200 200 300 600 1200 2400	Must match configuration setting of the host system.
Data bits/Parity	8-None ² 8-Even 8-Odd 7-Even 7-Odd 7-Mark 7-Space	Must match configuration setting of the host system.
Sheet Feeder	Not installed ² Installed	Paper jams result if this setting is incorrect.
Bail bar lift	Lift OFF ² Lift ON	To reduce paper jamming when feeding labels, lift the bail bar for perforations.

¹Press **Select** to select the value shown on the message display. An asterisk (*) is displayed to designate the selected values.

²Factory value. All factory values are selected by the DEC user setup menu Recall Factory value. Individual factory values can be selected manually.

Table 1-4 (Cont.): Installation Setup Menu

Feature	Values¹	Comment
Error Beep	One Beep ² Three Beeps Continuous Off	
Auto tear	Auto Tear OFF ² Auto Tear ON	When selected, the fanfold perforation automatically moves to the tear bar.
Tear adjustment	0 +1 +2 +3 +4 +5 -5 -4 -3 -2 -1	Used to precisely position the fanfold tear perforation to the tear bar.

¹Press **Select** to select the value shown on the message display. An asterisk (*) is displayed to designate the selected values.

²Factory value. All factory values are selected by the DEC user setup menu Recall Factory value. Individual factory values can be selected manually.

CHAPTER 2

[illegible]

Testing and Troubleshooting

2.1 Troubleshooting Tools

The tools available for diagnosing faults in the LA324 MultiPrinter consist of the power-up initialization sequence, the user Self-test, and the T&D diagnostic programs.

The power-on initialization sequence is the sequence of visual events you look for every time you power on the printer.

The Self-test verifies that the printer can print and enables you to quickly analyze print quality. Customers can also run the Self-test to ensure that the printer is working.

The T&D diagnostic programs consist of two different strings of common subtests. Neither of the two diagnostics is accessible to customers or easy to operate (they are not user friendly). The Repair center diagnostic is a long duration exerciser that is designed for the repair depot. The Service test diagnostic enables the CSE to thoroughly test the printer and to quickly isolate a failing component, in a field environment.

Some of the T&D subtests are interactive: you must push the operator panel keys, open and close the access cover, or perform the alignment adjustments. Table A-5 shows the running sequence and gives a short description of each T&D subtest.

Table 2-1 shows the differences between the various troubleshooting tools and shows how to run or activate them.

Table 2-1: Description of Diagnostic Tools

Tool	Activation Keys¹	Description
Power-up initialization sequence	Automatic	Initialization of the printer starts at power on and ends when READY is displayed. A problem is indicated when the sequence does not complete, the indicators blink, or the beeper beeps.
Self-test	Quality	The Self-test either prints or does not print and returns no failure information. The user must read the test pattern to evaluate print quality. To thoroughly test the printer, run the Service test diagnostic. Press Pause/Ready to terminate self-test and return to READY.
Service test T&D Diagnostic	FF	The Service test is designed for the use of CSEs in the field. All the electronic boards are tested, and the access cover interlock, operator panel keys, and alignment tests are done. The Service test diagnostic is running when you see the T&D0 or T&D1 text displayed.² The T&DL and T&DN subtests are test pattern printing tests. The display prompts you to load paper and select paper size. The END text is displayed on the display panel if the printer passes all tests.
Repair center T&D Diagnostic	LF	The Repair center test should not be used in the field. The Repair center on-board test places more stress on the mechanical assembly and takes more time to run. The Repair center diagnostic is running when you see the T&D0 or T&D1 text displayed.²

¹To select and activate the diagnostic, hold down the activation key while you turn on the power. Release the keys when you see T&D on the display.

²The Service test and Repair center diagnostics display similar information as they run.

2.1.1 Power-Up Initialization

When you power on the LA324 MultiPrinter, the initialization process starts. During the initialization process the firmware program starts to run and initial values are loaded or reset. For example, the line and column counter are set to zero and the type of installed ribbon (color or black) is determined. If the three operator panel indicators flash or the initialization process appears to hang up, run the Service test diagnostic or refer to Table 2-4, Level 1 Troubleshooting, for help.

The following events occur in the sequence shown after the ac power is turned on:

- The carriage assembly moves left then right.
- The display shows LA324 text and the code revision V number.
- The Letter and Draft indicators blink and go off.
- The Power/Setup indicator goes on.
- The carriage moves to the center of the platen.
- The LOAD PAPER prompt appears on the display. Install paper and press **FE** to load or move the first line underneath the printhead.
- After the paper is loaded, the READY DEC prompt is displayed.

2.1.2 Self-Test Pattern

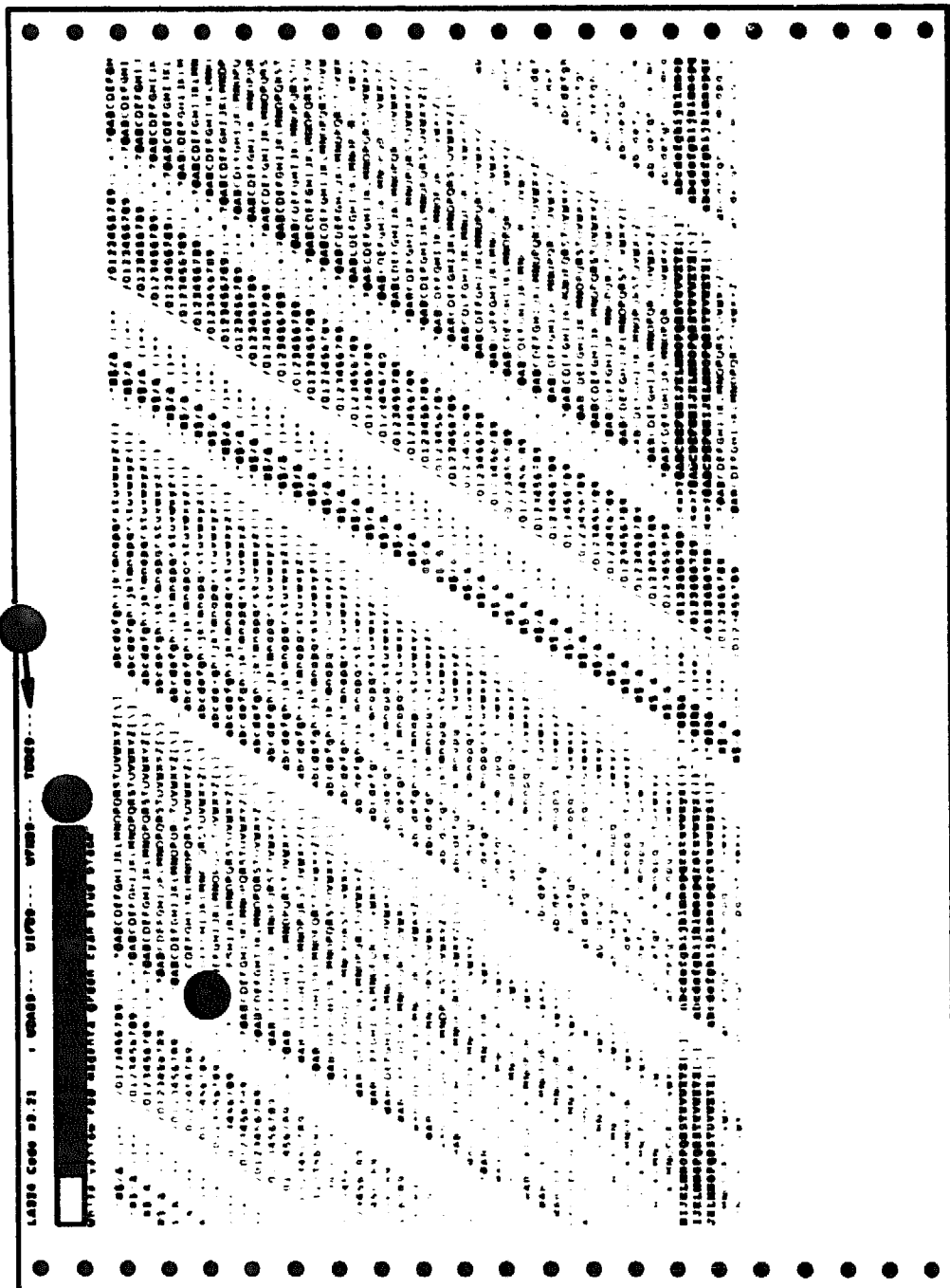
The Self-test pattern provides a quick and easy way to check the print quality and functionality of the LA324 MultiPrinter. Instructions for running the test are in the *LA324 MultiPrinter Operator's Guide* and in Table 2-1 of this guide. To completely test and stress the LA324 MultiPrinter, run the Service test diagnostics and the 132-column and single-sheet test patterns. Look for the following when you inspect any test pattern or printout:

- Equal density or darkness
- Character darkness
- No missing parts of characters
- No missing underline characters and decenders (g, y, j, p, q)
- No smudging and streaking
- Equal line density
- Correct color pattern

Figure 2–1 shows an example of the Self-test pattern. The numbers in the following list correspond to the numbered callouts in Figure 2–1.

- ❶ The following information is listed on the header line:**
 - LA324 code V1.1 (the major and minor printer revision level)**
 - The version numbers of the DA, I/F, and DOE CPUs**
 - The font cartridge number**
- ❷ The color bar is used to verify the functionality of color printing.**
- ❸ The rotating alphabetic test pattern is used to check print quality.**

Figure 2-1: Self-Test Pattern



ML0-000790

2.1.3 Running On-Board Diagnostics

Before Running a Diagnostic

1. Close the printer cover.
2. Install the MMJ loopback connector (12-25083-01).
3. Install the parallel loopback connector (29-27887-01).
4. Remove all fanfold and single-sheet paper from the printer.
5. Have available some sheets of 132-column fanfold and single-sheet paper. The interactive diagnostic prompt tells you when to load the paper.
 - Two sheets are needed for the Service test.
 - Thirty sheets are needed for the Repair center test.

Starting a Diagnostic

Do the following to select and run one of the LA324 MultiPrinter on-board diagnostics. Although there are two different on-board diagnostics, the Service test diagnostic is designed for use in the field, the Repair center diagnostic is not.

1. To select and run one of the following diagnostics, simultaneously press the key while you power on the printer. Table 2-1 describes the differences between the tests.

Service Test 

Repair Center 

2. When the T&D0 or T&D1 text is displayed the selected diagnostic is running.
3. If no error is detected, the incrementing T&D text is displayed while each subtest runs. Table A-5 shows the T&D display panel code and running sequence. An optimal replacement unit (ORU) number is displayed if a subtest detects an error. See Section 2.1.3.1 for ORU information. The Service test diagnostic is interactive; you must stay close to the printer while the diagnostic is running.

Service Test Interactivity

The following subtest prompts require your attention.

1. T&D5, the PUSHBUTTON! prompt. Push the operator panel pushbuttons in left to right sequence. An ORU error occurs if any button is not pushed within a short timeout period. To identify the faulty switch, first obtain a K-code display, then look up the K-code in Table A-7.
2. T&D7, the OPEN COVER! and CLOSE COVER! prompts. Open and close the printer carriage cover. An ORU error occurs if the cover switch does not actuate within a short timeout period.
3. T&DL subtest prompts. The following prompts occur in the order shown during the T&DL subtest.
 - EUROPE?—See Section 2.1.4.1 for a full explanation.
Press ☐ and ☐ to toggle to USA? prompt. Press to select the prompt.
 - LOAD PAPER—For the Service test diagnostic, install two sheets of 132-column fanfold paper and position the paper selection lever to the rear. Remove any single-sheet paper from the paper chute.
 - ALIGNMENT?—See Figure 2-4 in Section 2.1.4.4 for complete information.

NOTE: *If you intend to perform the first-line alignment adjustment, tear off the attached printed 132-column test page before printing the first-line test pattern. This assures that the first-line pattern prints on a clean sheet.*
4. T&DN subtest prompts. When the LOAD PAPER prompt is displayed, install a single sheet in the paper chute, position the paper selection lever forward, and press to load paper. See Section 2.1.4 for more information.
5. The END display signifies the end of the one pass of the Service test diagnostic. You must power off the printer to leave the diagnostic mode. The Repair center diagnostic automatically restarts, never displaying the END text.

2.1.3.1 ORU Error Displays

When the diagnostic detects an error, it first displays an ORU code. With the exception of ORU0, the ORU code points to a bad or malfunctioning component. The terms ORU and FRU mean the same thing. When ORU0 is displayed, you need to refer to the full error display, discussed in Section 2.1.3.2. The format of the ORU code is as follows:

ORUn

where:

ORU is the optimal replacement unit.
n represents the failing component. Look up the number in Table 2-2 to identify the part.

You can do the following in response to an ORU display:

- Press **[FF]** to restart the diagnostic from the beginning.
- Press **[]** to bypass the failing test and continue testing.
- Press **[]** to restart the failed test.
- Press **[Setup]** to obtain a full error display (K-code). See Section 2.1.3.2 for full K-code information.

Table 2-2: ORU Error Display

Error Display	Course of Action
ORU0	Nonspecific error; press [Setup] for more information. See Section 2.1.3.2.
ORU1	Replace/swap the main control board.
ORU2	Replace/swap the I/F board.
ORU3	Failure of the DA EEPROM. Replace the main control board.
ORU4	Failure of the font EEPROM. Replace/swap the main control board.
ORU5	Replace/swap the operator panel.
ORU6	Replace/swap the font cartridge.
ORU7	Failure of the DOE EEPROM. Replace/swap the main control board.
ORU8	Failure of the I/F EEPROM. Replace/swap the I/F board.

NOTE: A copy of Table 2-2 is included in Table A-6 for convenience.

2.1.3.2 Full Error Displays

If the ORU information is insufficient, press **[Setup]** to obtain the K-code. Then look up the K-code in Table A-5. The K-code gives you more in-depth information about the failure. Use the full error report information from the troubleshooting tables to fix an ORU0 problem. The code ORU0 describes a malfunction that the diagnostic cannot isolate, for example a jammed or binding carriage, mispositioned sensor, or a cover open type error.

The full error report (K-code) table and this section are included in Table A-7. The format of the K-code is as follows:

K701

where:

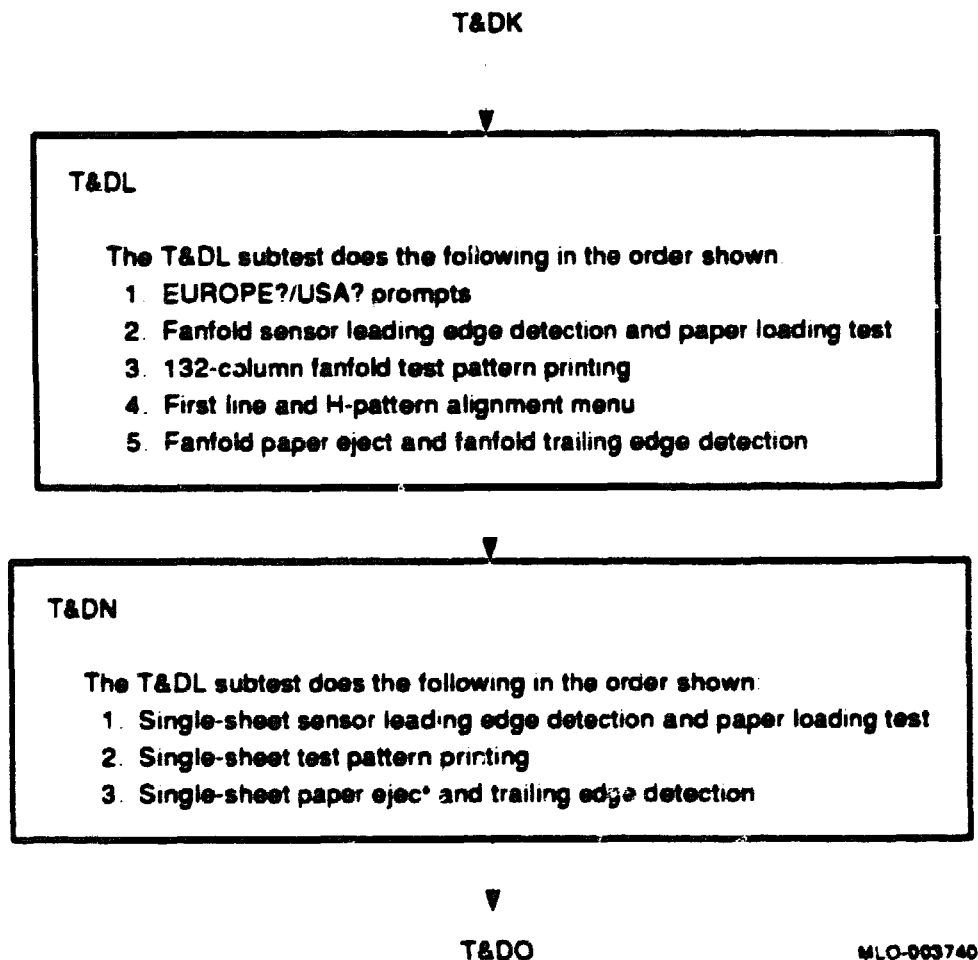
- K is the fixed code identifier.
- 7 is the test number.
- 0 is the ORU number.
- 1 is a subtest number.

NOTE: *If the full error report information is not useful to you in the field, it may be of assistance to the repair center personnel. Note all available information on the defective equipment return tag (red tag).*

2.1.4 T&DL and T&DN Subtests

The T&DL and T&DN subtests test paper handling and loading of single-sheet and fanfold paper. The test patterns enable you to isolate the source of a mechanical problem and to stress the printer. Figure 2-2 shows the flow and event sequence of the T&DL and T&DN subtests.

Figure 2-2: T&DL and T&DN Flowchart



2.1.4.1 EUROPE? and USA? Prompts

Before printing the 132-column test pattern, you must select either the EUROPE? or USA? prompt. The two prompts refer to the common lengths of sheets of paper that are used in Europe or the United States. The information about paper length is crucial to the tests described in Section 2.1.4.2. The wrong selection causes errors in both the T&DL and T&DN subtests.

- Press ☐ or ☐ to toggle the display between the USA? and EUROPE? prompts.
 - If the sheet measures 11 in (24.9 cm) select the USA? prompt.
 - If the sheet is longer than 11 in (24.9 cm) select the EUROPE? prompt.
- Press to select the prompt and start printing the 132-column test pattern.

2.1.4.2 Paper Loading, Eject, and Edge Detection

Paper loading, handling, and eject capability are tested by the T&DL and T&DN subtests. During a paper load sequence, the leading edge interrupts the fanfold or single-sheet sensor, thus establishing the position of the first line. By counting lines, the printer can precisely track the position of each line and predict the occurrence of the trailing edge.

In the last step of the T&DL and T&DN subtests, the printer ejects the test sheet and monitors the fanfold or single-sheet sensor for the trailing edge. If a trailing edge error occurs, the incorrect sheet size may have been entered at the EUROPE? USA? menu, a paper jam or tear may have occurred, or the sensor is bad.

NOTE: *If a paper length error occurs because you made an incorrect selection, you must power down the printer to clear the error.*

2.1.4.3 132-Column Test Pattern

You must run the Service test diagnostic whenever you service an LA324 MultiPrinter in the field. Figure 2-3 shows the 132-column test pattern. The Service test prints a single page. The Repair center test prints 30 consecutive sheets and requires several hours for completion.

The 132-column test consists of unique test patterns and of components of all the other test patterns. The 132-column pattern is designed to thoroughly exercise all mechanical elements of the LA324 MultiPrinter.

Inspecting the 132-Column Fanfold Test Pattern

The numbered callouts in the following list correspond to the numbered pointers in Figure 2-3. To test the color motor, you must use a color ribbon when printing the 132-column test pattern. If a black ribbon is installed, the 132-column test pattern prints as shown in Figure 2-3, but without color.

- ❶ The title line text identifies the test that is running.
 - LA 324 SERVICE TEST
 - LA 324 REPAIR CENTER
- ❷ The first-line alignment test pattern prints on first and last lines.
- ❸ The H-pattern alignment test pattern.
- ❹ The printhead pin exerciser pattern tests all 24 pins in the printhead. The printed number corresponds to the pin.
- ❺ The configuration line lists the following information:
 - Numbers of the four EEPROMs
 - Type of installed font cartridge
 - Type of installed ribbon (BLACK or COLOR.)
 - Yes or No if the automatic sheet feeder (ASF) is installed
- ❻ The paper movement test first prints two black dashed lines, then after all other steps prints a red dashed line. The red line must be in the center of the two black lines.
- ❼ Paper motion exerciser referred to as the PLU/PLD test (partial line up/partial line down).
- ❽ The incremental alphabetic (Self-test) pattern is used to verify print quality and density.
- ❾ The carriage motion exerciser places maximum stress on the carriage assembly.
- ❿ The color printing test is used to verify the correct printing of color.
- ⓫ The continuous line prints on the 49th line of the sheet.

Figure 2-3: 132-Column Test Pattern

[illegible]

PAGE 2-14 INTENTIONALLY LEFT BLANK

2.1.4.4 H-Pattern and First-Line Alignment

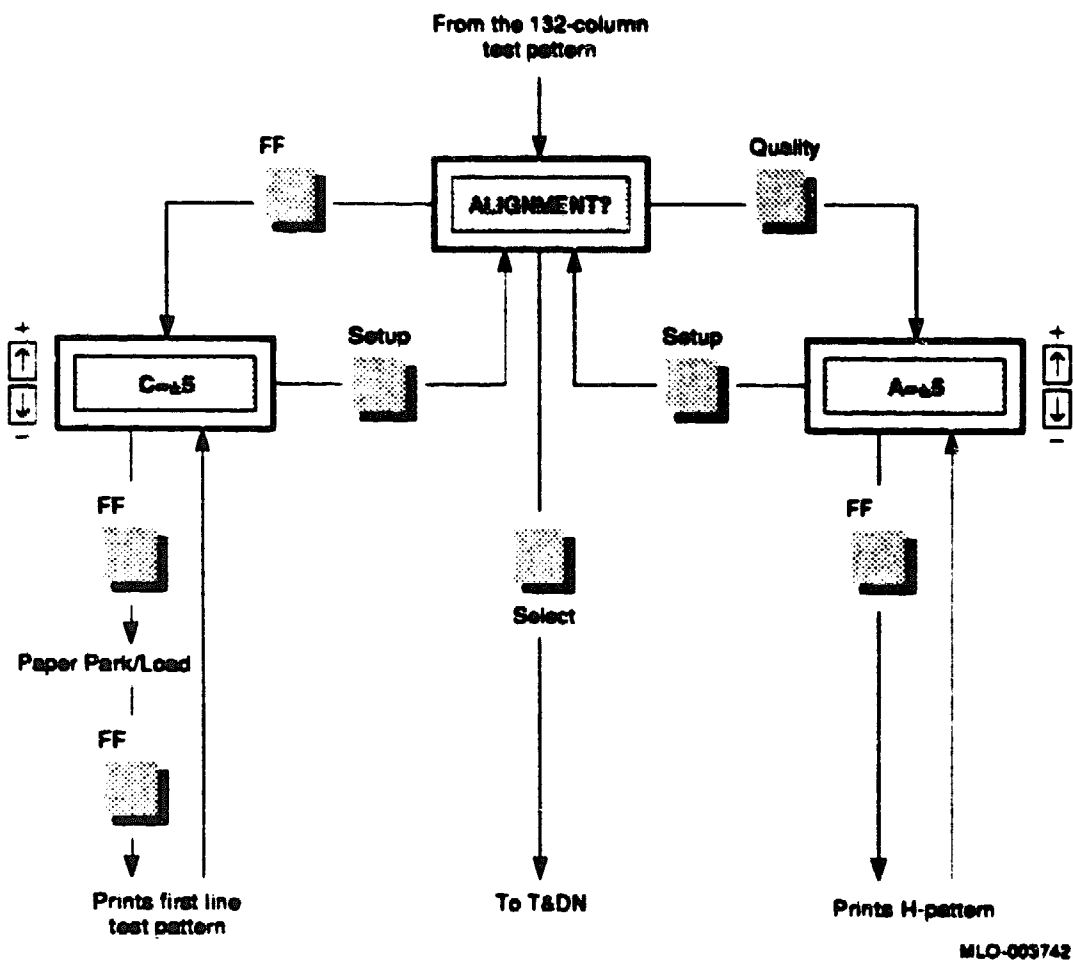
The Service diagnostic displays the ALIGNMENT? prompt after the 132-column test page is printed or if the printer is powered on with the up arrow  pressed. The Repair center diagnostic skips the alignment subtest.

Study the H-pattern and first-line alignment pattern on the 132-column test sheet (Figure 2-3). If you determine that alignment is not necessary, press **Select** to leave the ALIGNMENT? prompt and to continue on to the T&DN subtest. Figure 2-4 shows the flow of the alignment program.

NOTE: *You may find the term first-line alignment referred to as E-pattern alignment in other LA324 MultiPrinter documents.*

If you intend to perform the first-line alignment adjustment, tear off the attached printed 132-column test page before printing the first-line test pattern. This assures that the first-line pattern prints on a clean sheet.

Figure 2-4: T&DL Alignment Flow Chart



MLO-003742

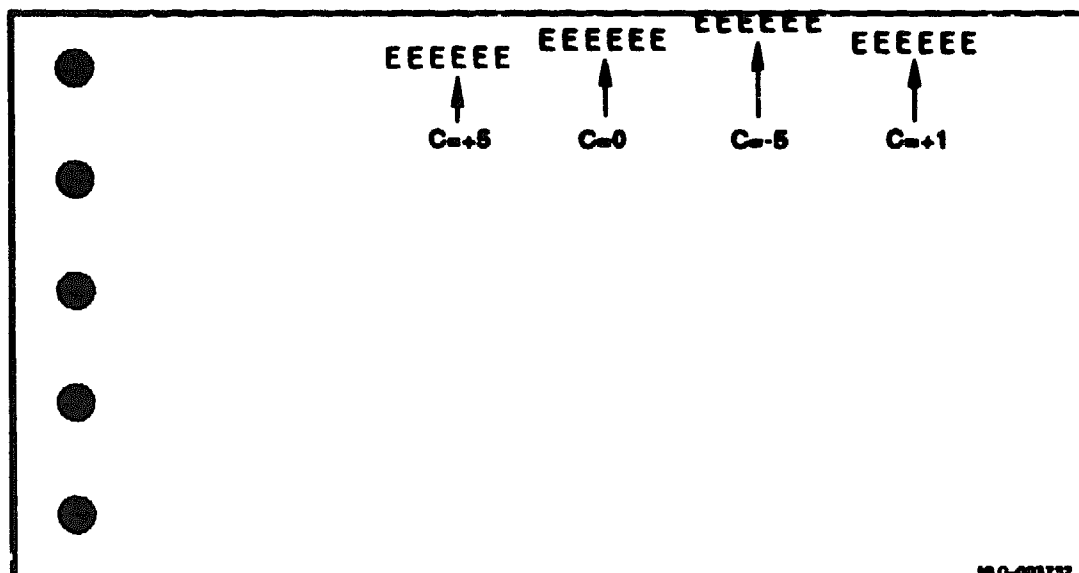
Press **[FF]** to enter the first-line alignment.

The first-line test pattern prints six uppercase E's close to the leading edge paper perforation. The first-line adjustment is perfect if the top of each E is about one-half character down from the perforation. The example in Figure 2-5 ($C=-5$) is too high; the E's print over the page perforation. $C=+5$ is too low; the E's are too far down the paper. $C=+1$ is the best first-line alignment number.

The first-line alignment is for fanfold fed paper only; the single-sheet first-line position is fixed and not adjustable.

1. Use **[↑]** and **[↓]** to set the first-line alignment number.
2. Press **[FF]** to reload paper and to print a sample pattern. Four samples of the pattern are shown in Figure 2-5.
3. Keep repeating step 1 until the E's are correctly aligned.
4. Press **[Scap]** to return to the ALIGNMENT? prompt.

Figure 2-5: First-Line Alignment Pattern



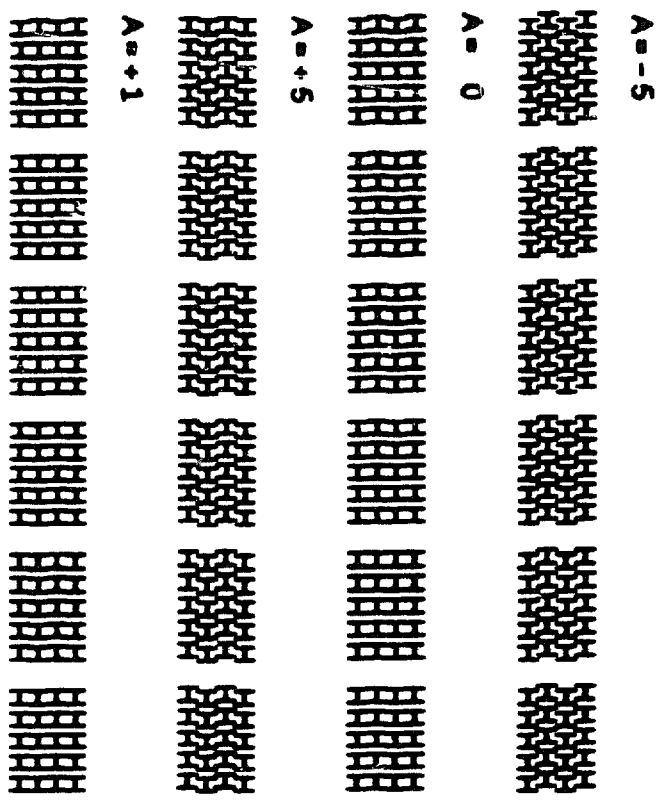
MLD-083732

Press **Quality** to enter H-pattern alignment.

The H-pattern (Figure 2–6) is a 4 line by 5 letter block arrangement of the letter H. The alignment is perfect when all the H's line up underneath each other. The H-pattern alignment adjusts the horizontal position of the line of printed characters with respect to the direction of the traveling printhead. The example given in Figure 2–6 shows A=+1 as the best H-pattern number.

1. Use **▲** and **▼** to set the H-pattern alignment number.
2. Press **FF** to print a sample pattern. Four sample patterns are shown in Figure 2–6.
3. Keep repeating step 1 until you achieve the best possible alignment.
4. Press **Setup** to return to the ALIGNMENT? prompt.

Figure 2-6: H-Pattern



MLC-003745

2.1.4.5 Single-Sheet Test Pattern

Figure 2-7 shows the single-sheet test pattern that is printed by the T&DN subtest. When the LOAD PAPER prompt is displayed, load one sheet and position the paper selector lever for single-sheet feeding.

- If United States paper size is selected, load one 8 1/2 x 11 size sheet in the narrow or portrait orientation.
- If European paper size is selected, load one A3 size sheet in the wide or landscape orientation.

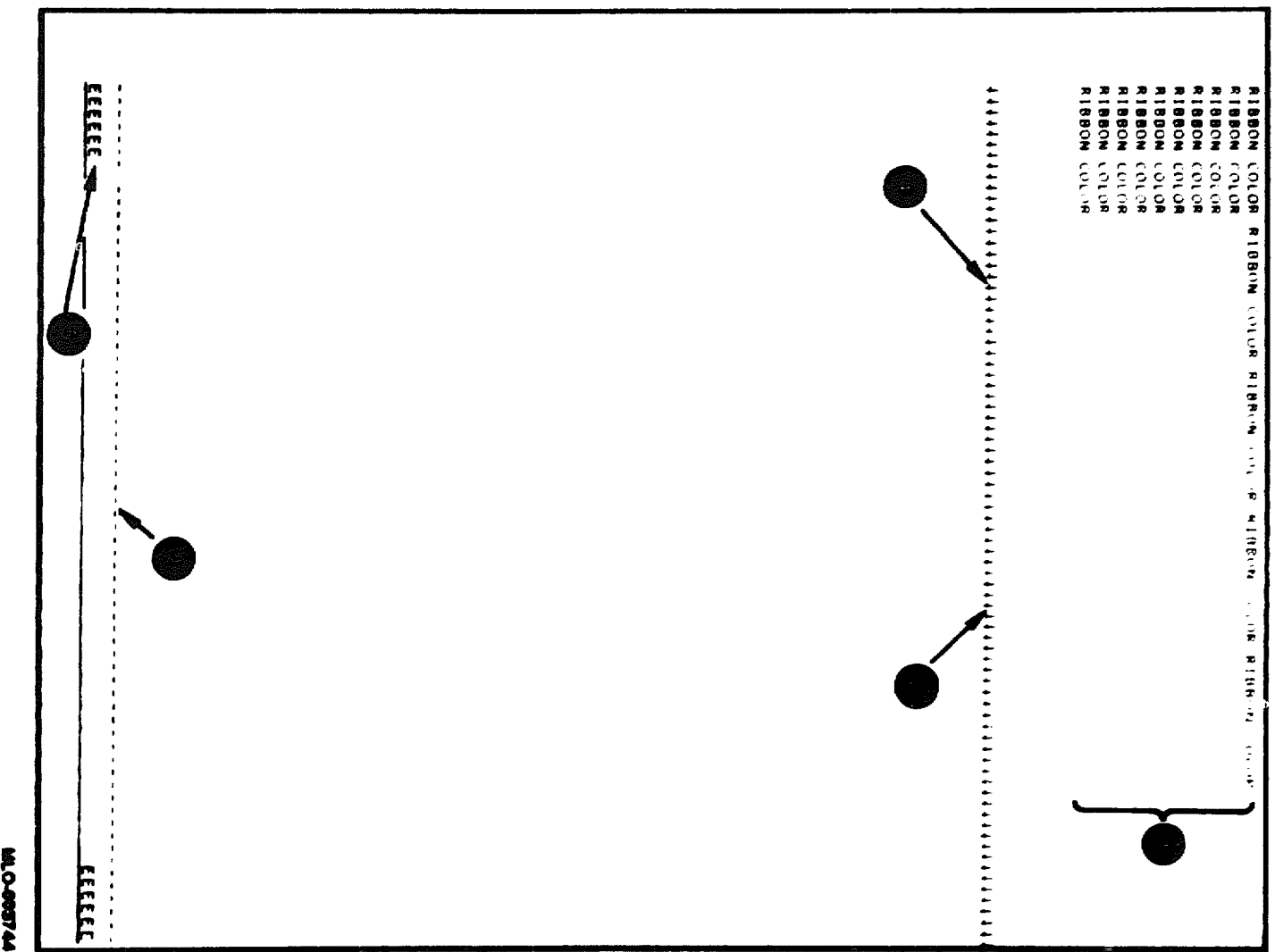
The single-sheet pattern tests the single-sheet sensor and paper alignment under stressed movement. Friction between the platen and pressure rollers controls single-sheet paper motion. Look for the following when you examine the single-sheet test pattern printout:

- The test lines are parallel to the leading edge.
- The spaces between the lines are even and parallel.
- The print quality is satisfactory.

The numbers in the following list correspond to the numbered callouts in Figure 2-7.

- ❶ The ribbon cartridge type (BLACK or COLOR) is printed several times on the first line, and printed once on lines 2 through 9.
- ❷ A row of vertical black bars is printed on the 15th line.
- ❸ The paper advances to the 62nd line and prints a line of red dashes, if a color ribbon is installed.
- ❹ The paper backs up to the 15th line and prints a line of red dashes in the center of the previously printed row of vertical black bars.
- ❺ The paper advances to the last line and prints a pattern of E's. If United States paper size is selected, the last line is line 66. If European paper size is selected, the last line is line 72.

Figure 2-7: Single-Sheet Test Pattern



2.2 General Service Notes

This section contains miscellaneous information that pertains to servicing the LA324 MultiPrinter.

2.2.1 Defeating the Access Cover Interlock

To defeat the access cover safety interlock, position any strong magnet over the circuit board mounted magnetic switch. The switch can sense a magnet positioned on top of the main cover or within approximately three inches. You can use the access cover magnet to activate the switch by removing the cover and holding the magnet and cover in position, but do not attempt to remove the magnet from the cover.

2.2.2 Display Panel Version Numbers

Table 2-3 shows the different firmware codes and template designations. See Table 1-1 for information about the printer template.

Table 2-3: Firmware Code Versions

Firmware Version	Template Designation	Comment
V1.1 to V2.0	LA324-A2	This range of code numbers describes printer firmware that supports only DEC protocols. The emulation features or protocol does not function under this range of firmware numbers.
V2.0 and higher	LA324-A3	Supports all announced protocols and options.

2.2.3 Circuit Board Jumpers

The jumpers mounted on the electronic boards are factory configured and reconfiguration of the jumpers in the field is not allowed. Section A.5 shows the factory configuration of all circuit board jumpers.

2.2.4 Printer Installation, Cleaning, and Maintenance

Refer to the *LA324 MultiPrinter Installation Guide* for installation information. A section in that document lists all recommended cables and connectors.

Unless a local agreement between Digital and a customer is in effect, all routine maintenance and cleaning tasks are performed by the customer and are detailed by the *LA324 MultiPrinter Operator's Guide*.

2.3 Troubleshooting Procedure

Use the three-level troubleshooting procedure and FRU (ORU) swap philosophy to ensure a speedy service call and a satisfied customer. Step through each level to verify a problem, find the failing FRU, and repair the LA324 MultiPrinter. Before you close the service call, step through all three levels. Help the next person at the repair depot or engineering section by writing down all symptoms and diagnostic error reports.

The three-level procedure is outlined below:

Level 1: Power on the printer. If the power-up initialization is incomplete go to Table 2-4.

Level 2: Run the Service test diagnostic. (Power on with **FE**.)

- If an ORU error occurs, go to the ORU table and replace the recommended FRU. Look in Table 2-2 or Table A-6 to find the ORU table.
- If you notice a problem with paper loading, motion, or print quality, go to Table 2-5.

Level 3: Print a file from the host system. If the file does not print, go to Table 2-6.

Table 2-4: Level 1 Troubleshooting

Symptom	Description and Response
When powered on, power indicator is off. All indicators are off. No mechanical motion is seen.	The PSU is faulty, ac power is not working, or the PSU load is disconnected. 1. Make sure both ends of the power cord are securely plugged in. 2. Check the ac voltage at the wall outlet. 3. Test the ac line cord for continuity and damage. 4. Check the operator panel to main board connection. 5. Check or swap the ac fuse. 6. Check the main board to PSU connector. 7. Swap the main control board. 8. Replace the PSU.

Table 2-4 (Cont.): Level 1 Troubleshooting

Symptom	Description and Response
Power and all indicators go off unexpectedly after a short time.	Symptoms are caused by a faulty PSU, cooling failure, or by an overloaded PSU regulator. If the overload happens suddenly, suspect an electromechanical device. If the printer runs for a considerable period of time then overloads, suspect cooling or a bad electronic board. Check the cooling system for correct operation. Make sure the air vents are unobstructed and that the fan is pulling air into the printer. Save time by disconnecting the printhead cable at the control board end. If the PSU stays on, suspect the printhead or printhead cable. 1. Swap the fan. 2. Swap the main control board. 3. Swap the printhead. 4. Swap the printhead cable. 5. Swap the mechanical assembly. 6. Swap the PSU.

Table 2-4 (Cont.): Level 1 Troubleshooting

Symptom	Description and Response
Carriage fault display with blinking indicators.	During normal operation or power-up the expected pulse from the home-position sensor is not received. The cause may be a bad home-position sensor or some serious mechanical damage that prevents the carriage from activating the home-position sensor during normal operation or initialization. 1. Inspect the following items on the mechanical assembly. If you find any damage, replace the mechanical assembly. Do not lubricate any part of the mechanical assembly. a. Turn off power and move the carriage fully to the left, then fully to the right-hand limit of travel. Some smooth resistance to movement is normal. If the carriage does not move or hangs during travel, investigate the cause. b. Check the home-position sensor for obstruction or damage. c. Check the 16-pin sensor connection to the main control board shown in Section 3.8. Inspect for misconnection, damage, or misseating. d. Check the carriage motor connection to the main control board connector. 2. Swap the main control board. 3. Swap the mechanical assembly.

Table 2-4 (Cont.): Level 1 Troubleshooting

Symptom	Description and Response
Display is blank or consists of dim solid blocks. Power indicator is on. The Self-test may print.	This symptom is commonly caused by a bad connection between the I/F and main control boards or between the display and operator panels. If the I/F and main control board connection is bad, incomplete initialization can hang up the printer. If the printer can load paper and print, suspect a malfunction in either the display or the connection between the display and operator panels. Perform the following steps in the order shown if the display does not work. 1. Remove the display, inspect the connector for damage, then replace the display. 2. Remove the I/F board and inspect the 64-pin connector for bent pins or other visual damage. If damaged is seen, replace the I/F board. 3. Swap the I/F board. 4. Swap the display assembly. 5. Swap the main control board. 6. Swap the operator panel.
Dim solid blocks on display. All indicators are on steady. Power-up initialization hangs.	Do the following if the Service diagnostic does not run. 1. Check the connection between the display and operator panel board. 2. Check the connection between the I/F and main control boards. 3. Swap the display. 4. Swap the operator panel. 5. Swap the I/F board. 6. Swap the main control board.

Table 2-4 (Cont.): Level 1 Troubleshooting

Symptom	Description and Response
LA324 CODE message is displayed and the power-up initialization hangs.	Run the Service diagnostic. Do the following if the Service diagnostic does not run. 1. Check the connection of the L/F board to the main control board. 2. Swap the L/F board. 3. Swap the main control board.
Cursor line is displayed, no text. All indicators are on. Power-up initialization is normal.	Run the Service diagnostic. Do the following if the Service diagnostic does not run. 1. Inspect the connection between the L/F and main control board for damage or misseating. 2. Swap the main control board.

Table 2-5: Level 2 Troubleshooting

Symptom	Description and Response
White lines in dark areas.	Caused by the misfiring of one or more printhead pins or by a damaged printhead. Run the Service test diagnostic; make sure all the printhead pins are firing. 1. Inspect the printhead cable for misconnection, disconnection, or damage. 2. Swap the main control board. 3. Swap the printhead. 4. Swap the printhead cable.
The printhead does not print. The Service diagnostic passes.	The thickness lever is misadjusted, the printhead cable is damaged or disconnected, or the 38 Vdc power is not reaching the printhead. 1. Inspect the printhead cable for misconnection, disconnection, or damage. 2. Swap the main control board. 3. Swap the printhead. 4. Swap the printhead cable. 5. Swap the power supply unit.

Table 2-5 (Cont.): Level 2 Troubleshooting

Symptom	Description and Response
Printed characters are light, with white spots in the dark areas.	The ribbon is worn out or there is insufficient force to drive the printhead pins. Try the following before you run the Service diagnostic. 1. Adjust the thickness lever. 2. Swap the ribbon cartridge. 3. Run the Self-test or the 132-column pattern and see if the ribbon moves correctly. If ribbon motion is incorrect, do the following: a. Swap the main control board. b. Inspect the following connectors for misconnection, disconnection, or damage. - The main control board and printhead end of the 18-pin printhead cable - The 4-pin ribbon motor connector c. Swap the printhead. d. Swap the printhead cable. e. Swap the mechanical assembly.

Table 2-5 (Cont.): Level 2 Troubleshooting

Symptom	Description and Response
Wrong colors are printed, or no color.	Check to see if the ribbon cartridge is in good working order and is mounted correctly. Run the Service diagnostic and examine the 132-column test pattern to verify the color problem. Perform the following steps to correct the problem. 1. Swap the ribbon cartridge. 2. Inspect the following connectors for misconnection, disconnection, or damage. - The main control board and printhead connector ends of the 18-pin printhead cable - The 4-pin ribbon motor connector 3. Swap the main control board. 4. Swap the printhead. 5. Swap the printhead cable. 6. Swap the mechanical assembly.
Slow printing.	Slow printing is a normal function caused after the printhead thermal sensor detects high printhead temperature. Normal slowdown occurs after approximately 15 minutes of high-speed (draft quality) Self-test printing. When the printhead cools, a high-speed print rate returns. A problem exists if slow printing occurs when the printhead is obviously not hot or if the slow speed happens intermittently. Perform the following steps to fix this problem. 1. Swap the main control board. 2. Swap the printhead. 3. Swap the printhead cable.

Table 2-5 (Cont.): Level 2 Troubleshooting

Symptom	Description and Response
Vertical misalignment of characters caused by a shift in horizontal line position.	Perform the H-pattern alignment procedure as shown in Section 2.1.4.4. Do the following if the H-pattern alignment test is ineffective or does not work. 1. Turn off power and move the carriage to full left and right-hand limit of travel. Some smooth resistance to movement is normal. If you notice more resistance in one direction than the other, replace the mechanical assembly. Do not lubricate any part of the mechanical assembly. 2. Swap the mechanical assembly.
Prints the 132-column test pattern (1/2 width).	Replace the main control board.
Paper collides into the bail bar.	Watch the operation of the bail bar. If the movement of the bar is noticeably sluggish, assume the bail bar is not working and go to that symptom. If the bail bar works with some paper but collisions occur with other paper, perform the following checks: 1. Are the bail bar rollers positioned correctly? 2. Is the form length value set correctly? (User setup menu.) 3. Is the bail bar lift value set correctly? (Installation setup menu.) 4. Is the customer using a specified media?
Bail bar does not work.	Do the following if the bail bar does not function correctly. 1. Swap the main control board. 2. Swap the mechanical assembly.
Fan does not work.	Do the following if the fan does not work. a. Inspect the fan cable connection to the main control board for misconnection, disconnection, or damage. b. Swap the fan assembly. c. Swap the main control board.

Table 2-5 (Cont.): Level 2 Troubleshooting

Symptom	Description and Response
No paper motion or printed lines overlap.	Is the paper selection set correctly? Do the following if the Service diagnostic does not isolate the FRU. 1. Inspect the paper motor cable connection to the main control board for misconnection, disconnection, or damage. 2. Swap the main control board. 3. Swap the mechanical assembly.
Bad between-line spacing.	Lines may print over each other or the space between lines varies. This problem is caused by incorrect paper tension. Paper tension is not measurable in the field. Do the following if the Service diagnostic does isolate the FRU. 1. Check to see if the paper selection lever is set correctly. 2. Clean the platen and rollers. 3. Swap the main control board. 4. Swap the mechanical assembly.
Smudge marks.	Smudges are caused when the print ribbon or printhead component collide with paper. Do the following to correct the problem. 1. Adjust the paper thickness lever. 2. Inspect the ribbon cartridge for damage and incorrect installation. 3. Inspect the printhead smudge shield for damage and incorrect installation. 4. Swap the mechanical assembly.

Table 2-5 (Cont.): Level 2 Troubleshooting

Symptom	Description and Response
First-line loading error.	Paper loads from fanfold or single-sheet source and the position of the first line is incorrect. 1. If the error occurs from only one source, inspect the mounting of the load sensor for the bad source. 2. If the error occurs from both sources, check the 16-pin sensor connection to the main control board for misconnection, damage, or misseating. 3. Swap the main control board. 4. Swap the mechanical assembly.

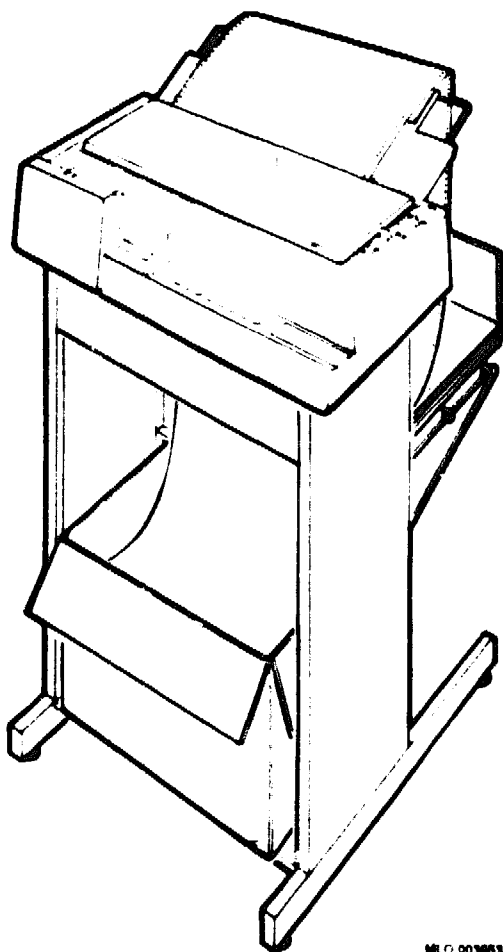
Table 2-6: Level 3 Troubleshooting

Symptom	Description and Response
Printer does not work on line when READY is displayed.	The Service diagnostics pass, the print quality of test pattern is good, and the READY DEC text is on the display, but the printer does not print a file from the host. Perform the following checks to isolate the problem. 1. Inspect the host-to-printer interface cable or communication channel equipment. Make sure the cable is correctly plugged in and is not damaged. 2. Check the setup and installation configuration settings. Refer to Table 1-3 for assistance. 3. Have a system manager check the configuration of the host system. The host and printer configuration settings should match. 4. Swap the I/F board.

Chapter 3

Removal and Replacement Procedures

The LA324 MultiPrinter consists of a desktop printer and optional printer stand.

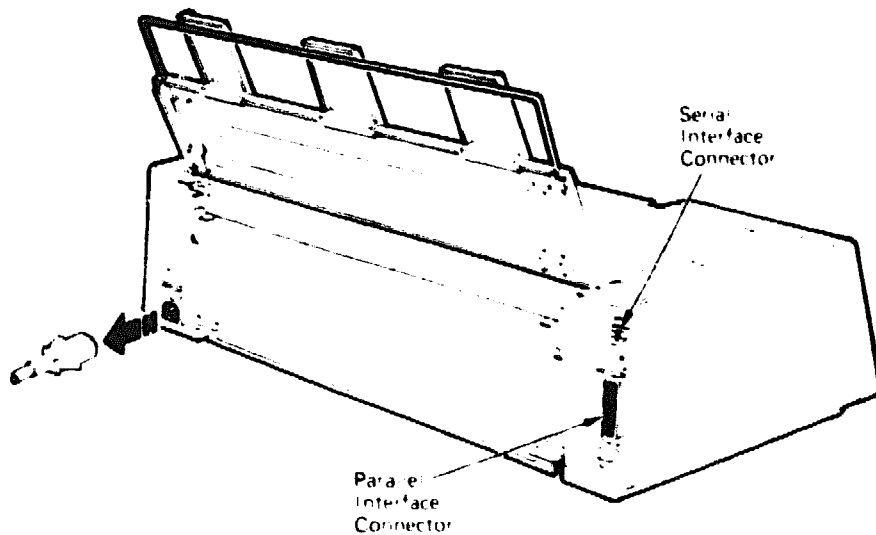


MLD 009883

3.1 Printer Stand

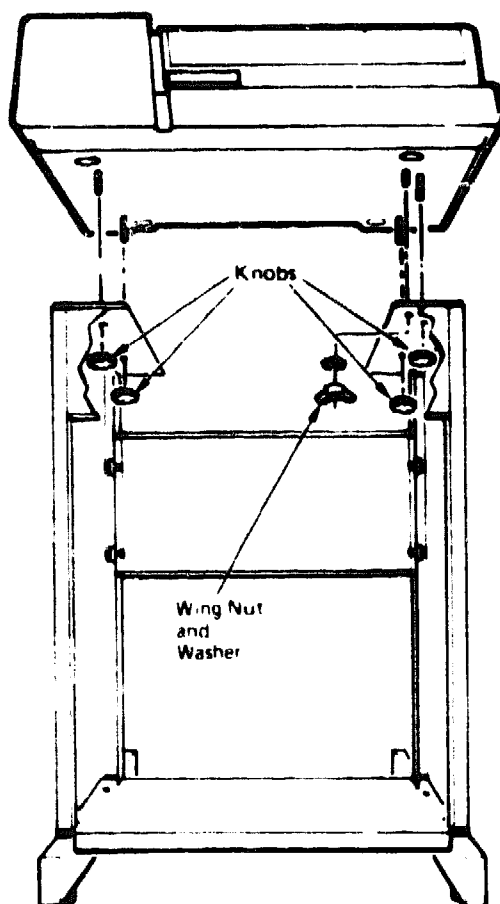
Use the following procedure to remove and replace the LA324 MultiPrinter from its mobile printer stand.

1. Unplug the ac power cord from the rear of the printer.
2. Unplug the MMJ or parallel interface cable from the rear of the printer.



MA - 004418

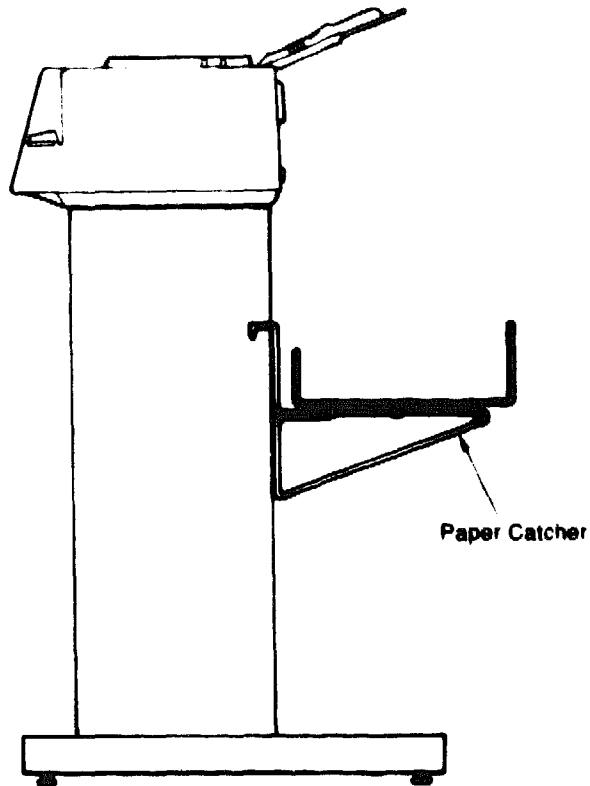
3. Remove the grounding wing nut and internal toothed washer.
4. Unscrew the four plastic knobs from the studs.
5. Lift the printer off the stand and place it on a sturdy working surface.



W - 103478

3.1.1 Paper Catcher

The following illustration shows where to attach the paper catcher to the LA324 MultiPrinter stand.



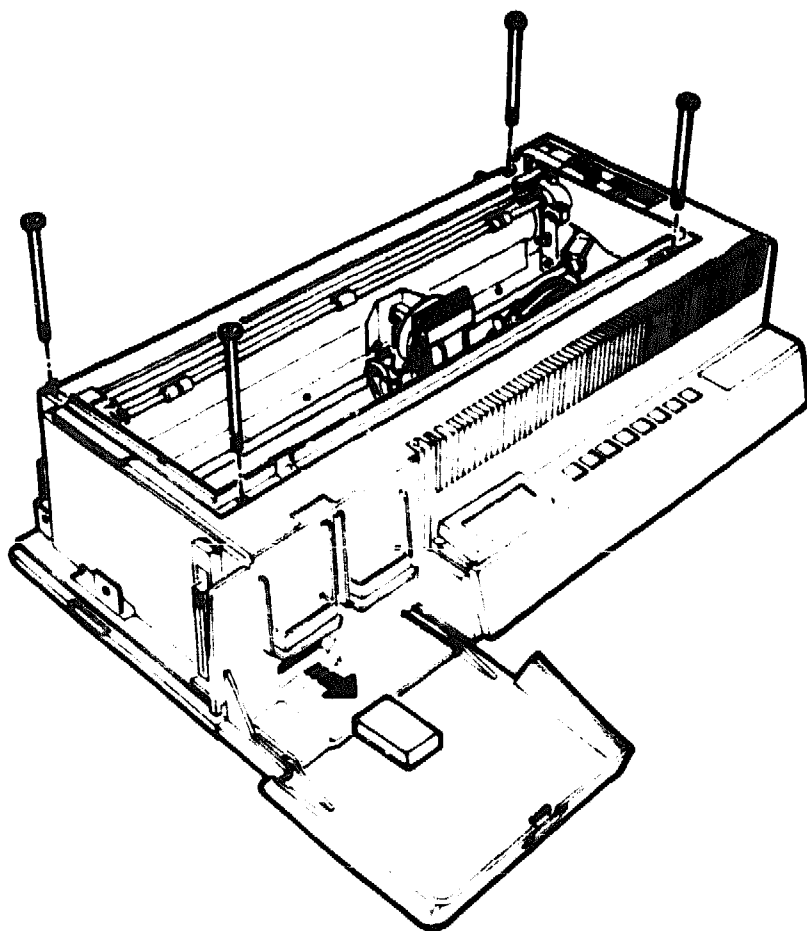
MACT-001656

3.2 Main Cover

Use the following procedure to remove and replace the main cover from the LA324 MultiPrinter.

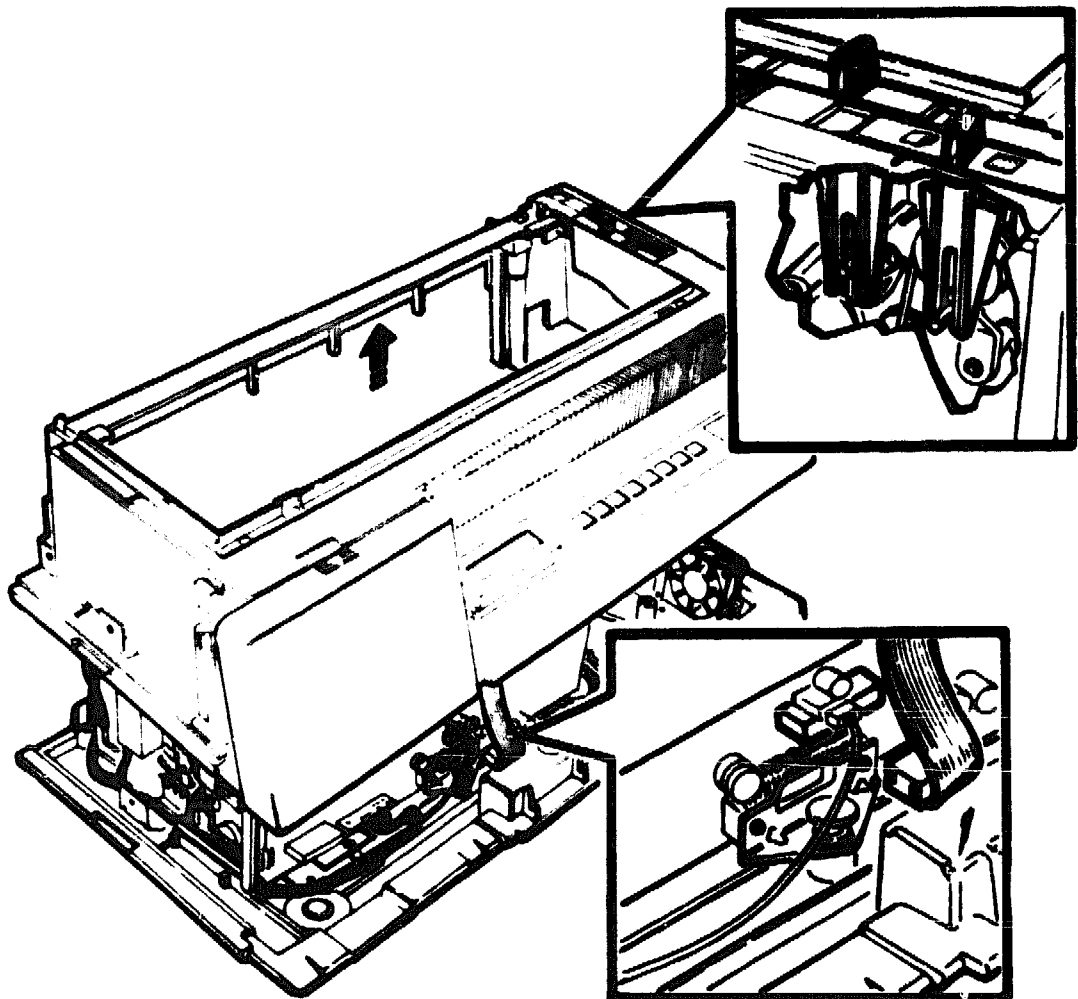
1. Disconnect the ac line cord.
2. Remove any paper from the tractors or the paper chute.
3. Remove the access cover, as shown in Section 3.5.
4. Open the cartridge cover and remove any installed font cartridge.
5. Remove the interface cover as shown in Section 3.3.
6. Remove the I/F board, as shown in Section 3.7.
7. Remove the paper chute, as shown in Section 3.6.
8. To facilitate cover removal, manually move the printhead to the center of the carriage.

9. Unscrew the four main cover screws until you feel the release of the screw threads. Leave the screws in the cover, but be careful when you tip the cover upside down. For spare screws see Table 4-3.



612 D-004034

10. Lift the cover up and off the printer, while tilting the cover forward as shown below. When replacing the main cover:
 - Make sure the forks on the paper selection and thickness levers engage the internal control rods. See Table 4-3 for spare levers.
 - After you seat the main cover, check for any pinched wires or cables.
11. Unplug the 16-pin operator panel cable from the connector on the main control board.

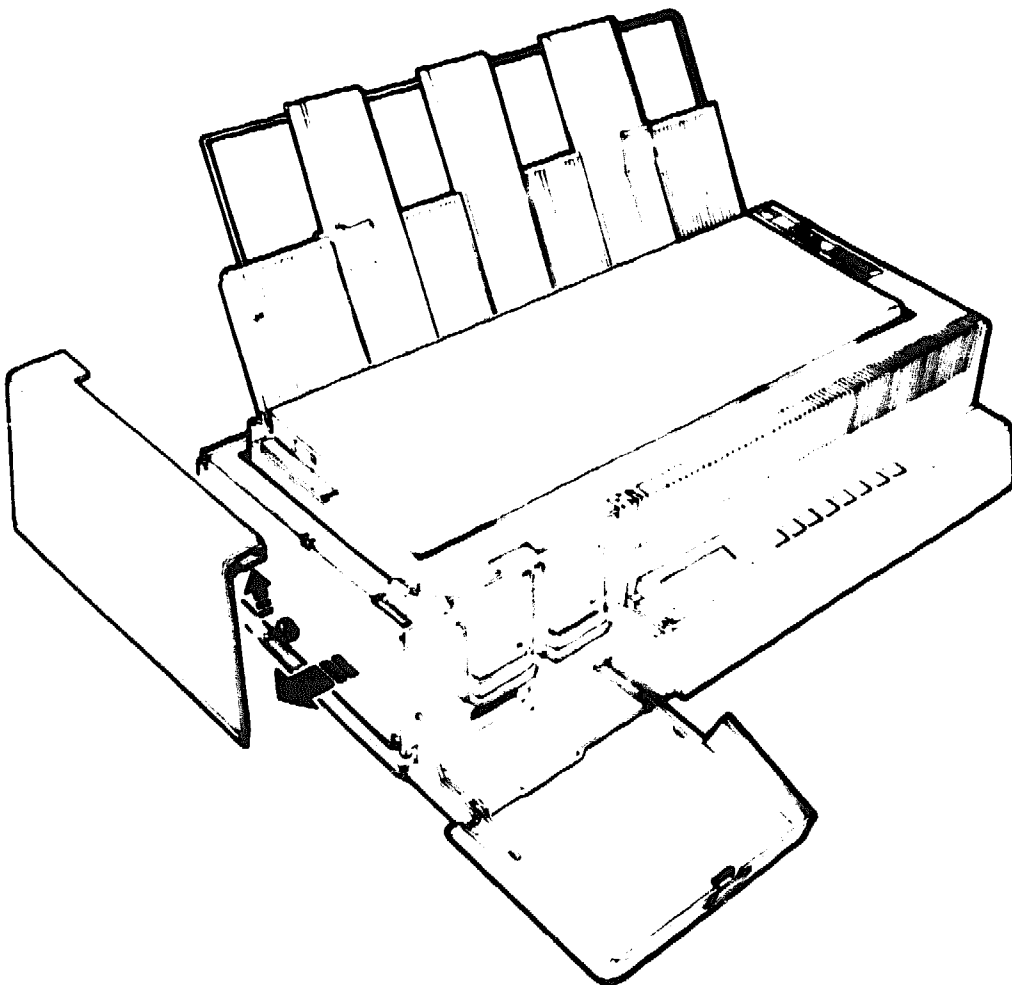


WLO-004225

3.3 Interface Cover

Use the following procedure to remove and replace the plastic interface cover, which is attached to the main cover by interlocking channels and a latching tab.

1. Disconnect the MMJ connector or (if connected) the parallel interface cable.
2. Open and fully swing down the font cartridge cover.
3. Push up the tab, and pull the cover backwards about one-half inch to disconnect the latch.
4. Slide the cover back and pull it away.

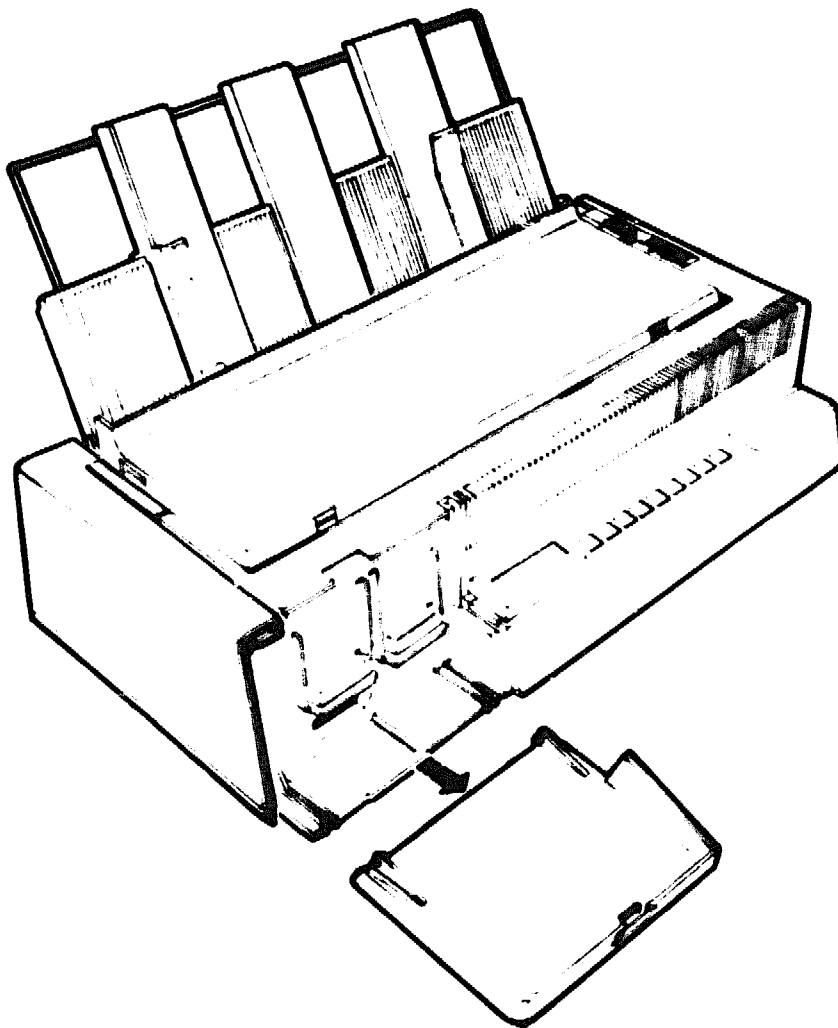


ML0-004086

3.4 Font Cartridge Cover

Use the following procedure to remove and replace the plastic font cartridge cover, which is connected to the main cover by two hinges.

1. Open and fully swing down the font cartridge cover.
2. Hold the printer with one hand and use the fingers of the other hand to apply force evenly to the edge of the font cartridge cover. The two hinges will separate smoothly when the cover is fully open and when sufficient force is applied.



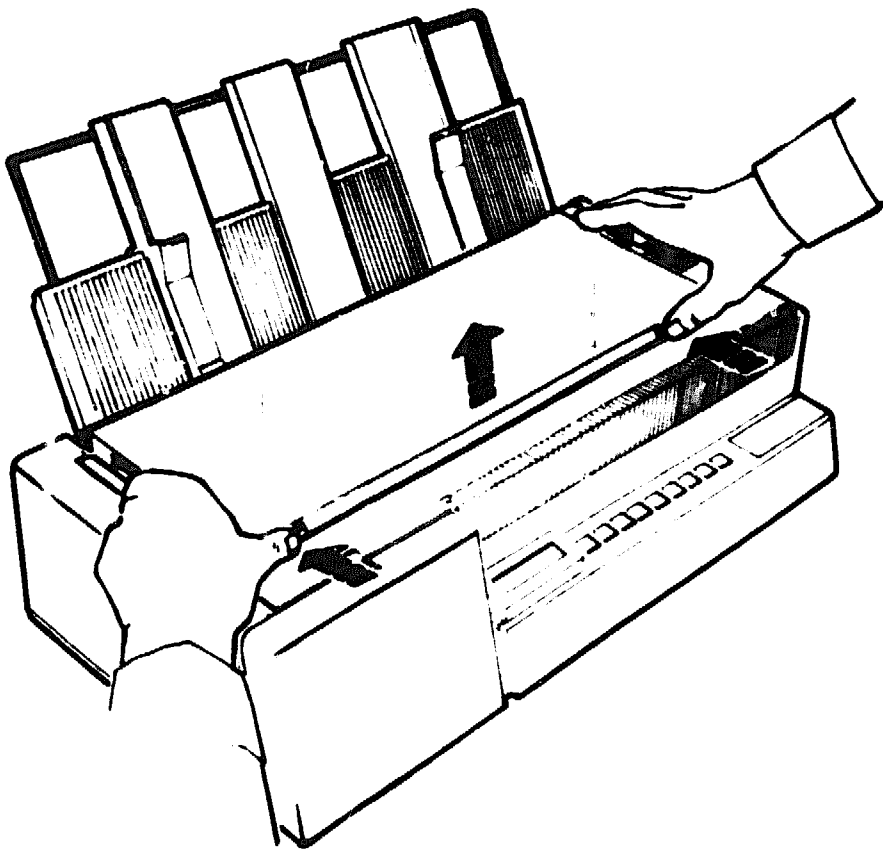
MLC 004087

3.5 Access Cover

Use the following procedure to remove and replace the access cover of the LA324 MultiPrinter.

1. Simultaneously press both release tabs and lift the access cover up and off the printer. See Table 4-2 for spare release tabs.

NOTE: *When replacing the access cover, make sure the hinge pins and locking tabs engage.*

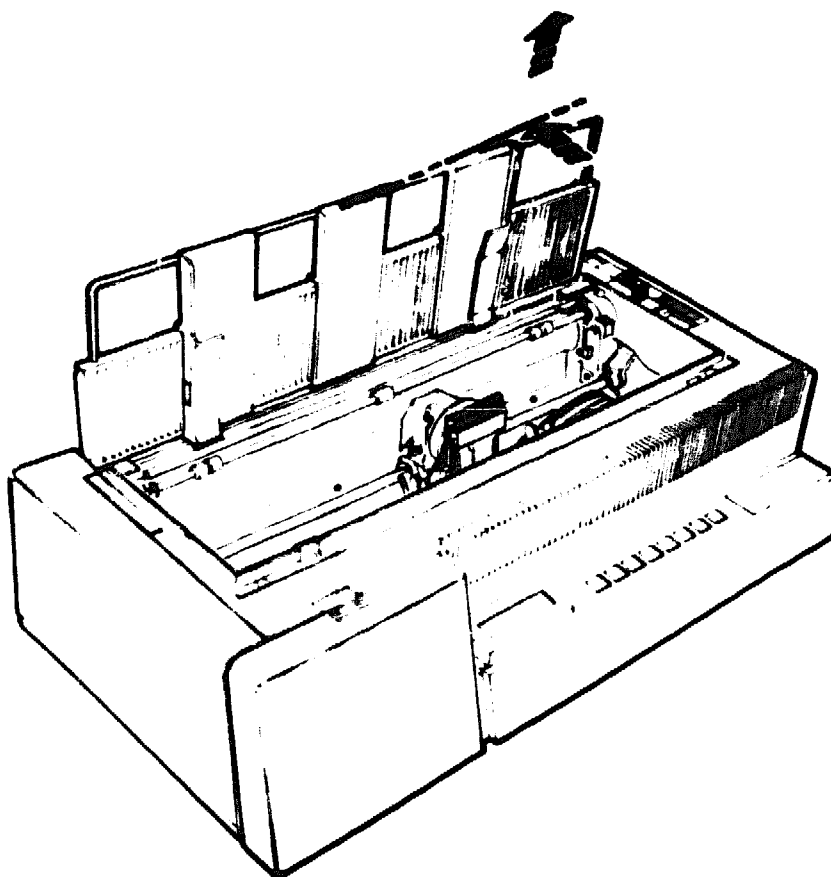


MLG 004089

3.6 Paper Chute

Use the following procedure to remove and replace the paper chute from the LA324 MultiPrinter.

1. Remove the access cover as shown in Section 3.5.
2. Lift the paper chute to the upright position.
3. To remove the paper chute, slightly bend and lift the right-hand side of the chute straight up. When installing the paper chute, the bend is not required.



M.O.-004089

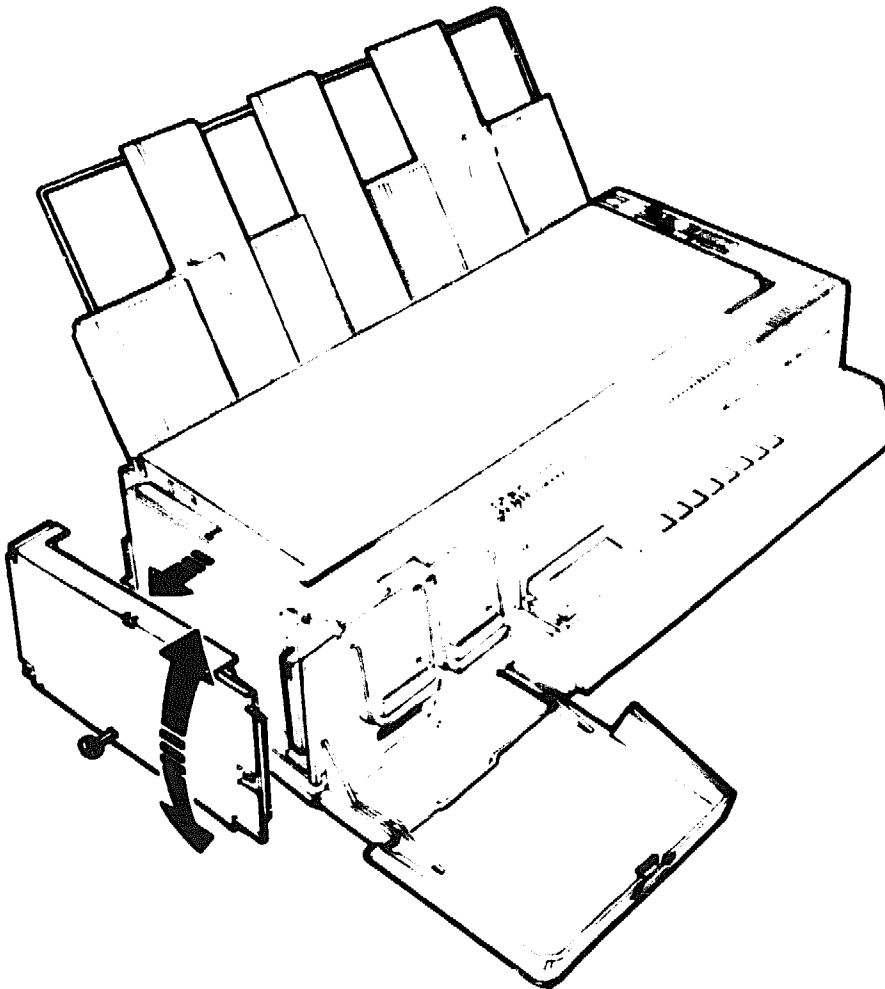
3.7 Interface Board (I/F)

Use the following procedure to remove and replace the interface board from the LA324 MultiPrinter.

1. Remove the interface cover as shown in Section 3.3.

CAUTION: *Use the recommended antistatic equipment to prevent destruction of sensitive electronic components.*

2. Loosen the captive thumb screw that holds down the I/F board.
3. With a slight rocking motion, pull back the I/F until the 64-pin connector releases.



ML0-004080

3.8 Main Control Board

Use the following procedure to remove the main control board of the LA324 MultiPrinter.

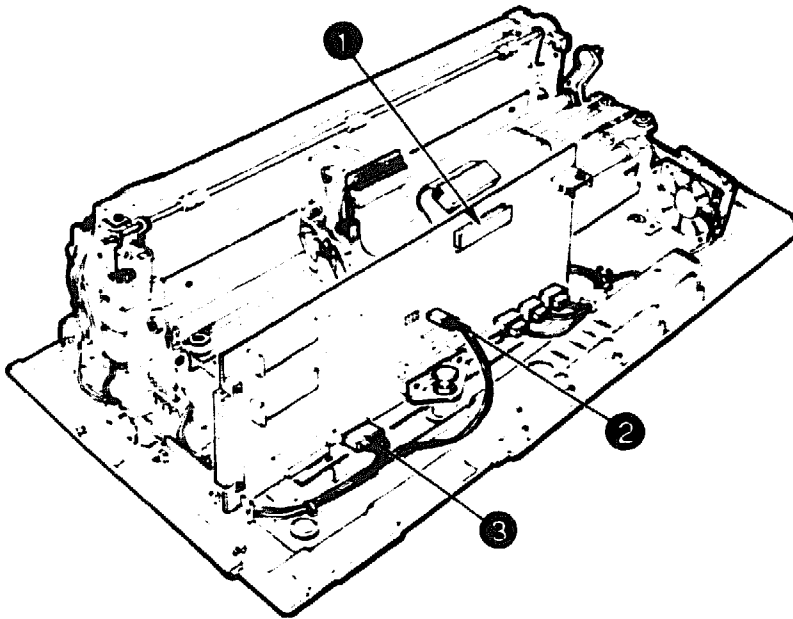
CAUTION: *Use the recommended antistatic equipment to prevent destruction of sensitive electronic components.*

1. Remove the interface cover as shown in Section 3.3.
2. Remove the I/F board as shown in Section 3.7.
3. Remove the main cover as shown in Section 3.2.

4. Unplug the following from the main control board:

- ① 32-pin printhead cable
- ② 2-pin solenoid cable
- ③ 16-pin sensor cable

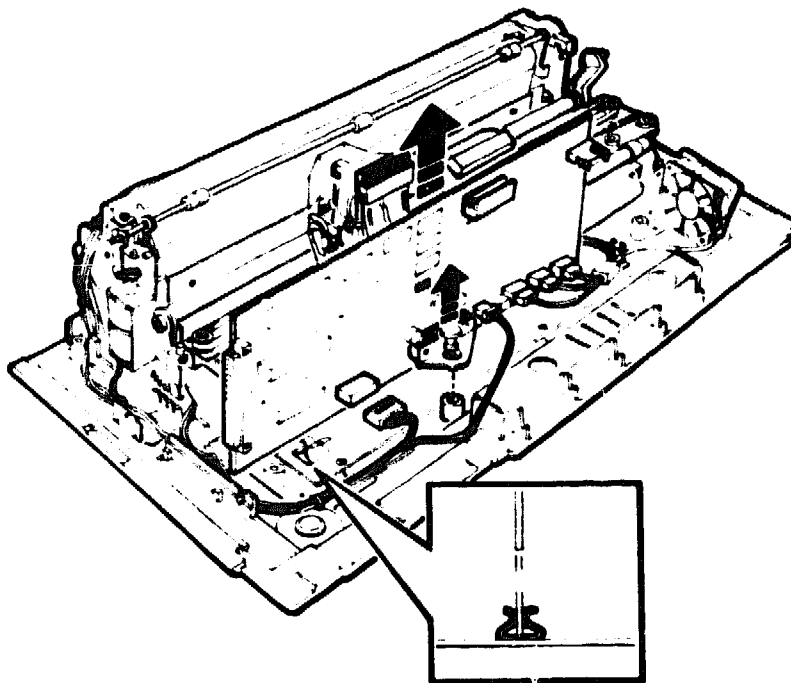
CAUTION: *Make sure the 32-pin printhead cable connector is correctly plugged in. If the connectors are incorrectly plugged in and the power is turned on, serious electrical damage can occur to the main control board, printhead, or printhead cable.*



ME 004619

5. Undo the twist clamp holding the carriage and platen motor cables to the baseplate of the printer. See Table 4-4 for a spare clamp.
6. Pull up the control board release latch. See Table 4-4 for a spare latch assembly.
7. Use a rocking motion to unplug and remove the main control board. At this point in the procedure, you cannot completely remove the board because of the three remaining cables.

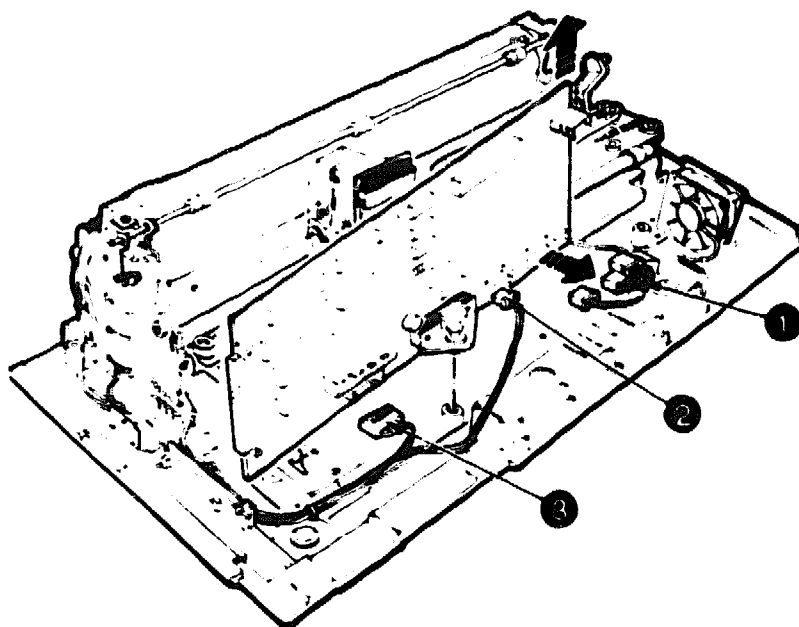
NOTE: When installing the control board, make sure the ground clip properly grasps the control board.



ML0 004092

8. While holding the main control board in one hand, unplug the following three connectors:

- ① 6-pin platen motor
- ② 4-pin carriage motor
- ③ 8-pin fan



MLD 004093

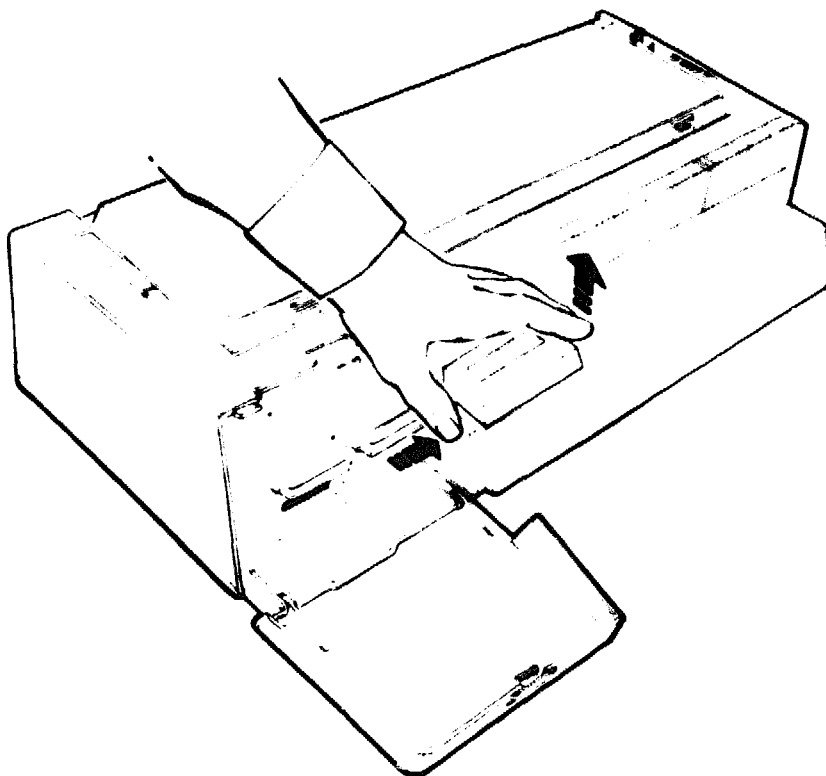
3.9 Display Panel

Use the following procedure to remove and replace the display panel and the operator panel board from the LA324 MultiPrinter. See Table 4-2 for miscellaneous display panel spare parts.

CAUTION: *Use the recommended antistatic equipment to prevent destruction of sensitive electronic components.*

1. Open the font cartridge access cover.
2. Grasp the display panel as shown and pull the panel in the direction shown to release the clips.
3. Unplug the connector from the operator panel board and remove the display panel.

NOTE: *When replacing the display panel, carefully align the connectors before snapping the plastic clips into place.*

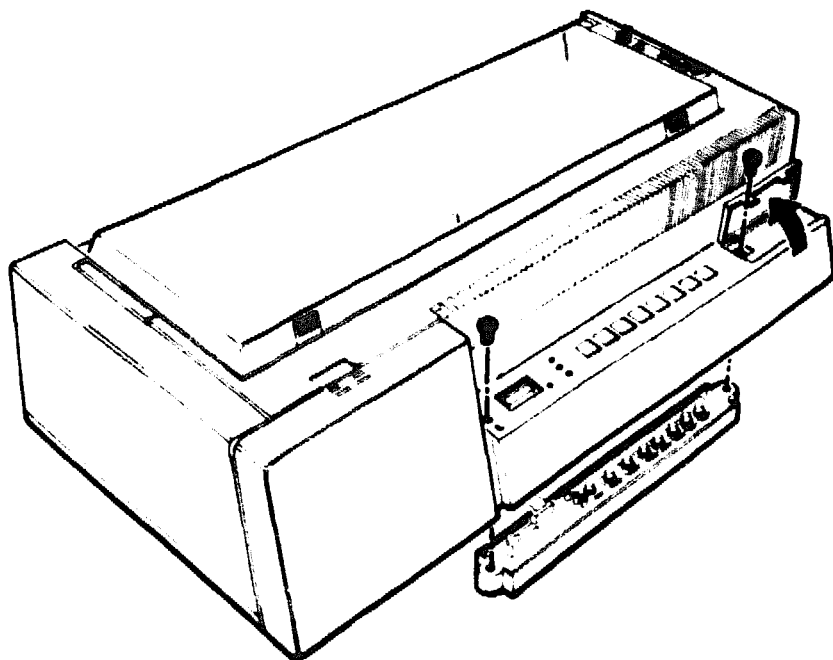


901-1001194

3.10 Operator Panel Board

Use the following procedure to remove and replace the operator panel board of the LA324 MultiPrinter.

1. Remove the display panel as shown in Section 3.9.
2. Remove the interface cover as shown in Section 3.3.
3. Remove the I/F board as shown in Section 3.7.
4. Remove the main cover as shown in Section 3.2. Place the cover on a work surface.
5. Pry up the fascia cap as shown below. See Table 4-2 for a spare cap.
6. Remove the two screws that hold the operator panel to the front cover and remove the operator panel. See Table 4-7 for spare screws.



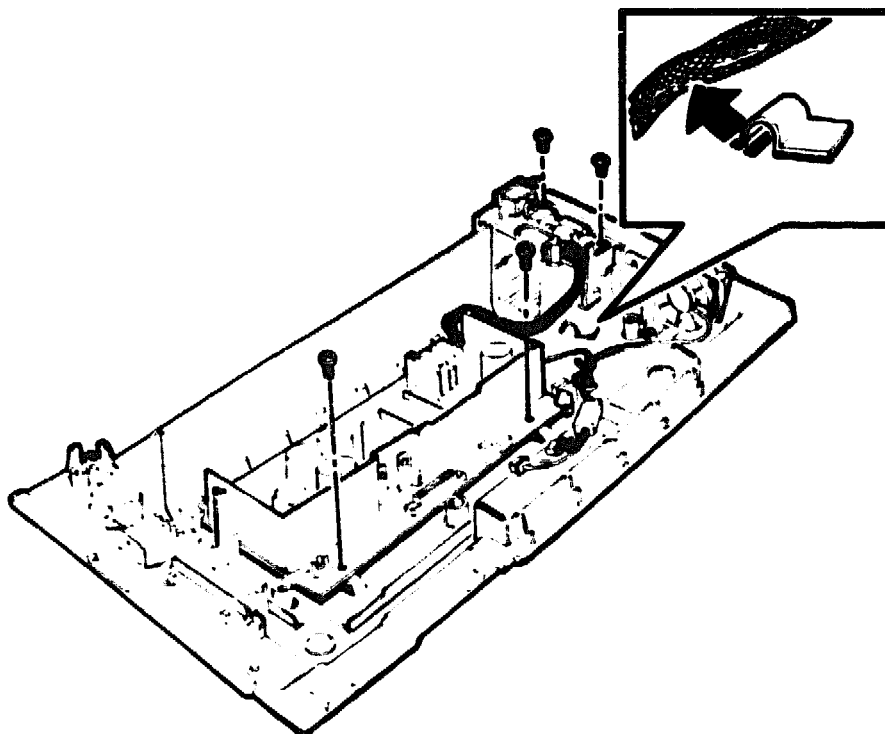
MLO-004085

3.11 Power Supply Unit (PSU)

Use the following procedure to remove and replace the PSU from the LA324 MultiPrinter. See Table 4-7 for spare screws.

CAUTION: *Use the recommended antistatic equipment to prevent destruction of sensitive electronic components.*

1. Remove the interface cover as shown in Section 3.3.
2. Remove the I/F board as shown in Section 3.7.
3. Remove the main cover as shown in Section 3.2.
4. Remove the printer mechanical assembly as shown in Section 3.14.
5. Pull the PSU power cable from underneath the cable restrainer (clamp). See Table 4-4 for a spare retainer.
6. Remove the two screws holding the PSU to the printer base plate.
7. Remove the two screws holding the ac input assembly.



MLD 004086

8. Release the plastic clip holding the front right-hand side of the power supply unit and remove the PSU and ac input assembly.

CAUTION: *The PSU and ac input assembly screws provide a safety ground (earth ground) circuit. Install and tighten all mounting screws discussed in this procedure.*

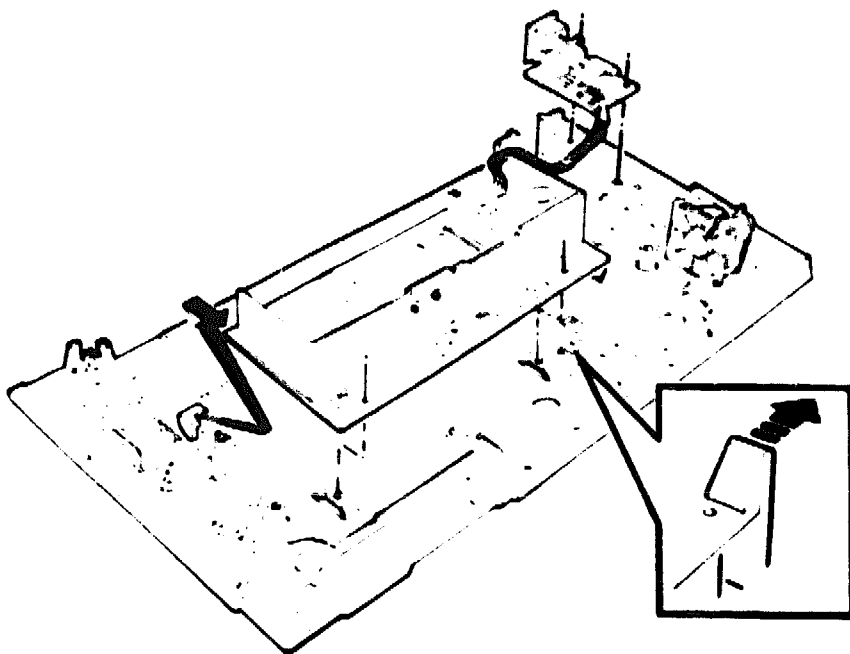


Fig. 3-14-19

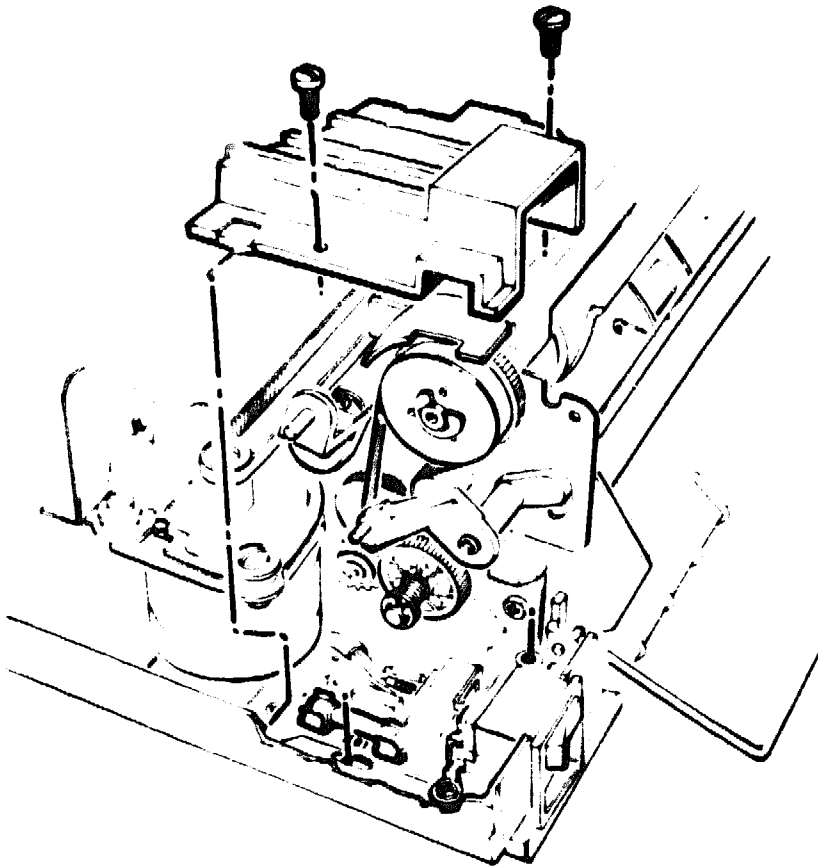
3.12 Line Power Fuse

Use the following procedure to remove and replace the line fuse.

WARNING: To prevent shocks, make sure you disconnect the ac line cord before removing the ac input assembly cover.

1. Remove the interface cover as shown in Section 3.3.
2. Remove the I/F board as shown in Section 3.7.
3. Remove the main cover as shown in Section 3.2.
4. Remove the two screws as shown below and remove the ac input assembly cover. See Table 4-7 for spare screws.
5. Remove the bad fuse and replace it with a fuse of recommended value.

CAUTION: To prevent equipment damage, always use a fuse of recommended value.

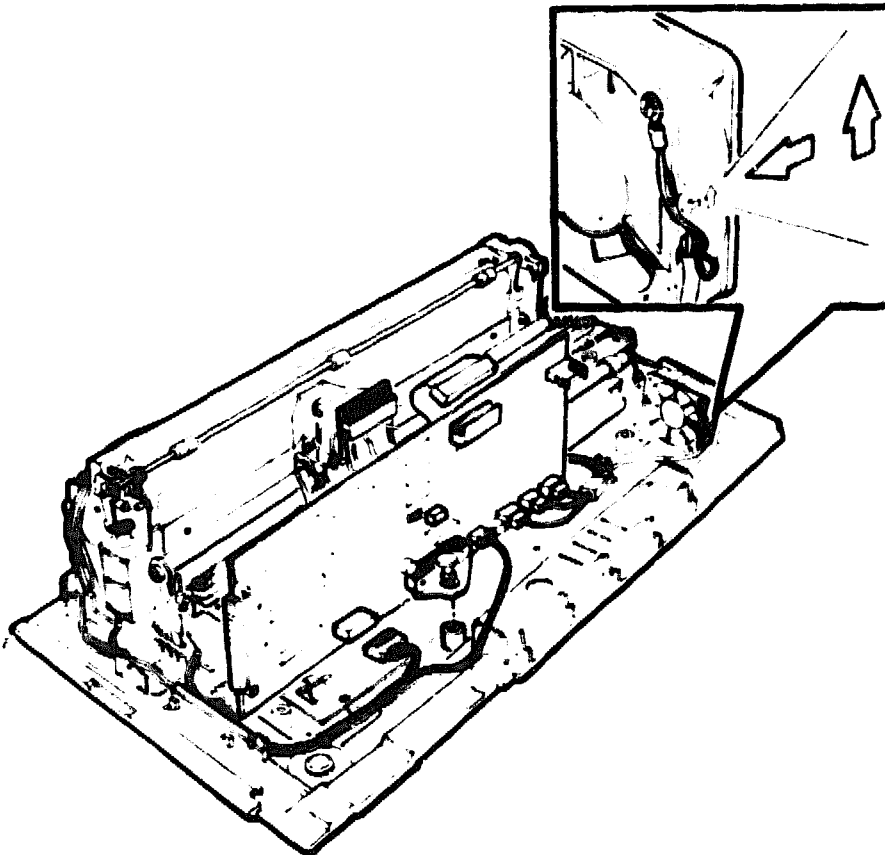


MLO 004088

3.13 Fan

Use the following procedure to remove and replace the cooling fan of the LA324 MultiPrinter. When the fan is running, it pulls outside air into the printer and blows the air over the main control board. See Table 4-4 for spare vibration damping pads, not shown in this procedure.

1. Remove the interface cover as shown in Section 3.3.
2. Remove the I/F board as shown in Section 3.7.
3. Remove the main cover as shown in Section 3.2.
4. Disconnect the 8-pin connector from the main control board.
5. Remove the cooling fan from the printer. When replacing the fan, make sure the airflow arrows are pointing towards the inside of the printer.



MLD 004099

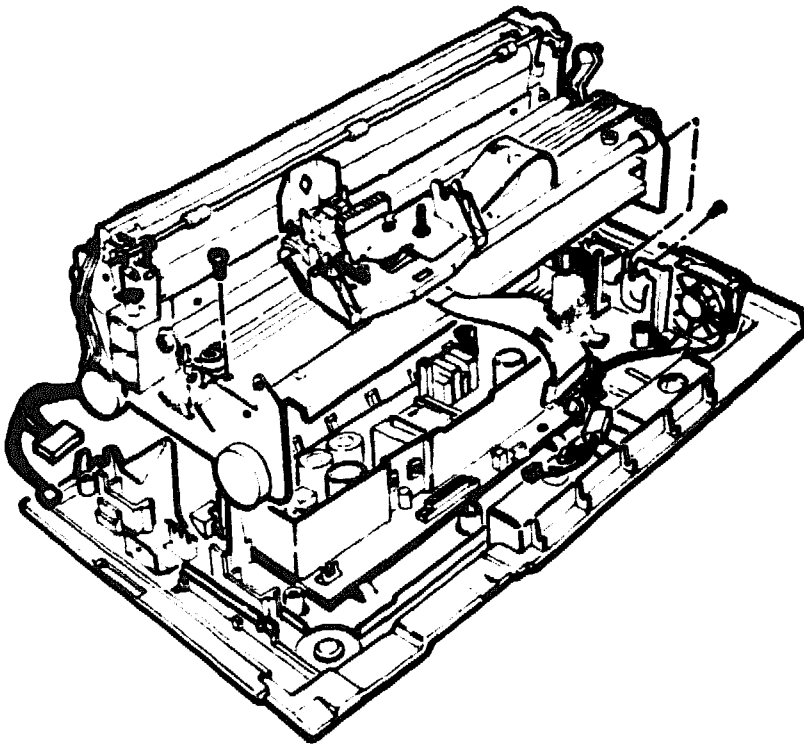
3.14 Mechanical Assembly

Use the following procedure to remove and replace the mechanical assembly from the LA324 MultiPrinter.

Before you transport or return a mechanical assembly, pack it into the special shipping container.

1. Remove the interface cover as shown in Section 3.3.
2. Remove the I/F board as shown in Section 3.7.
3. Remove the main cover as shown in Section 3.2.
4. Remove the printer ribbon.
5. Remove the printhead as shown in Section 3.15.
6. Remove the two screws holding down the ac input assembly cover and remove the cover as shown in Section 3.12. See Table 4-7 for spare screws.

7. Undo the twist clamp holding the carriage and platen motor cables to the baseplate of the printer. See Table 4-4 for a spare clamp.
8. Remove the screw holding the ground strip to the carriage. When fully installed, the screw and ground strip complete the ground (earth) circuit of the mechanical assembly. Make sure this screw is fully tightened. See Table 4-7 for a spare screw and Table 4-4 for a spare ground strip.
9. Remove the mechanical assembly as shown below.



40 184 118

3.15 Printhead

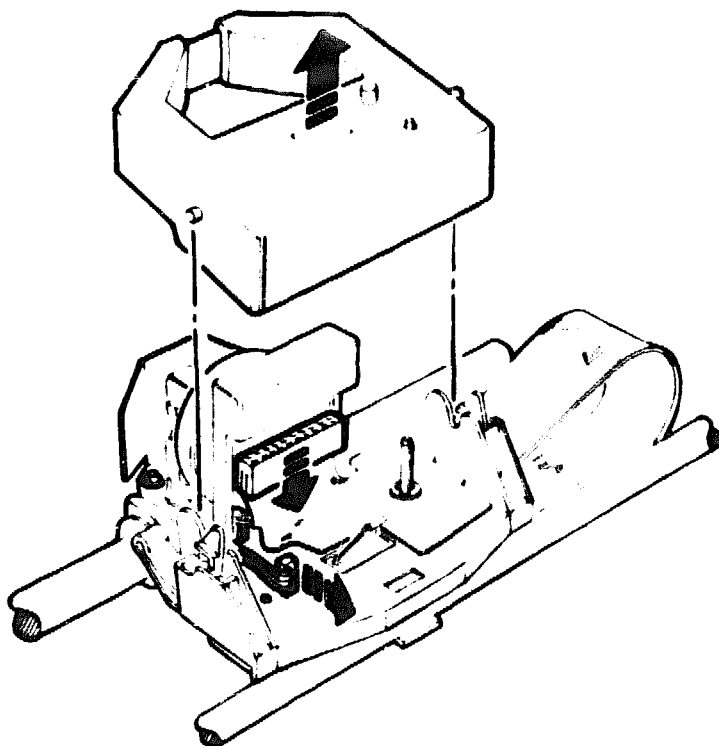
Use the following procedure to remove and replace the printhead from the LA324 MultiPrinter.

WARNING: *If recently used, the printhead may be hot enough to cause a minor skin burn. Be careful when handling the printhead.*

1. Remove the access cover as shown in Section 3.5.
2. Remove the print ribbon.
3. Unplug the 32-pin printhead connector.

CAUTION: *Make sure the 32-pin printhead cable connector is correctly plugged in. If the connectors are incorrectly plugged in and the power is turned on, serious electrical damage can occur to the the main control board, printhead, or printhead cable.*

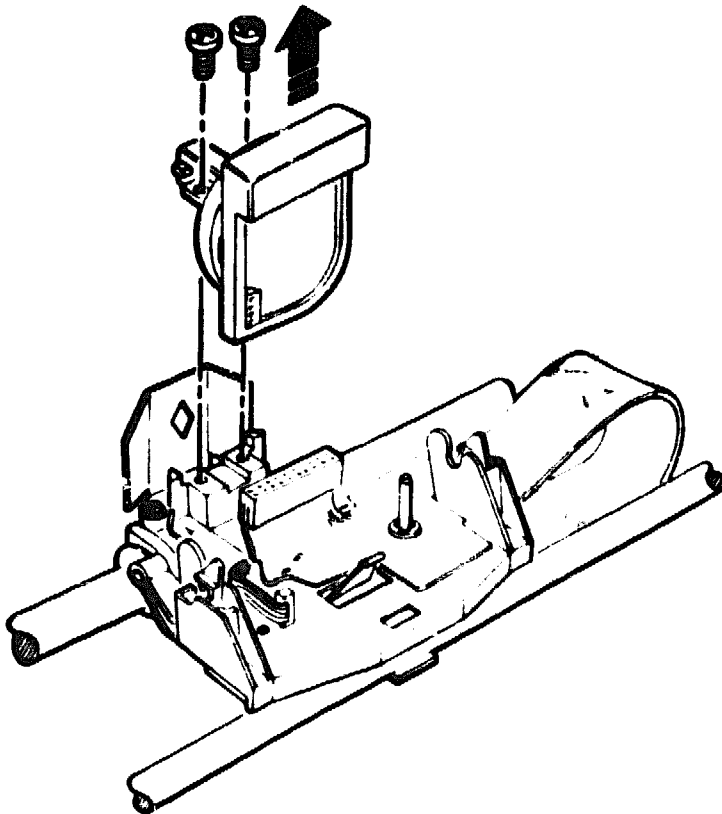
4. Unplug the 4-pin color motor connector.



M.O. 004101

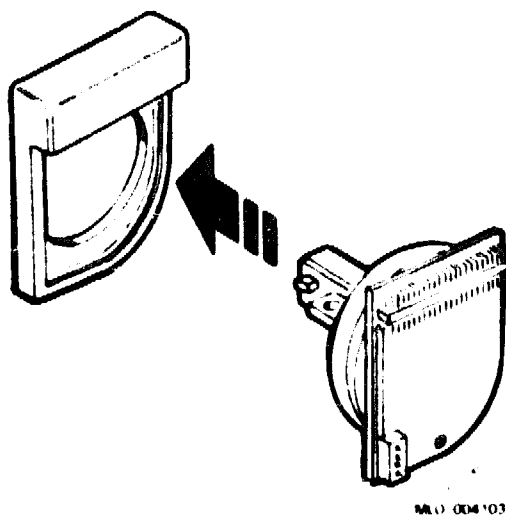
5. Remove the two screws and washers as shown below, and remove the printhead. See Table 4-7 for spare screws.

NOTE: To replace the printhead, first loosely install the two screws and washers. Then gently push and hold the printhead to the platen, and tighten the two screws.



ML0004102

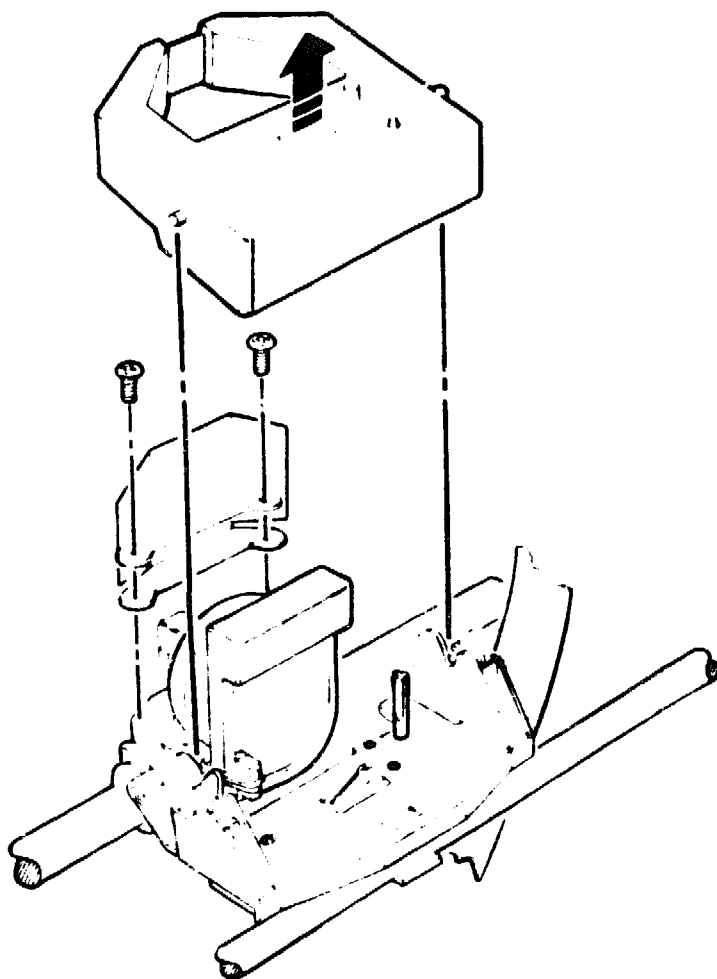
6. Remove the pliable rubber safety cap. See Table 4-5 for a spare cap.



3.15.1 Printhead Smudge Shield

Use the following procedure to remove and replace the printhead smudge shield.

1. Remove the access cover as shown in Section 3.5.
2. Remove the print ribbon as shown in Section 3.15.
3. Remove the two screws and remove the smudge shield plate and the smudge shield. See Table 4-6 for spare screws and plate.



LA324

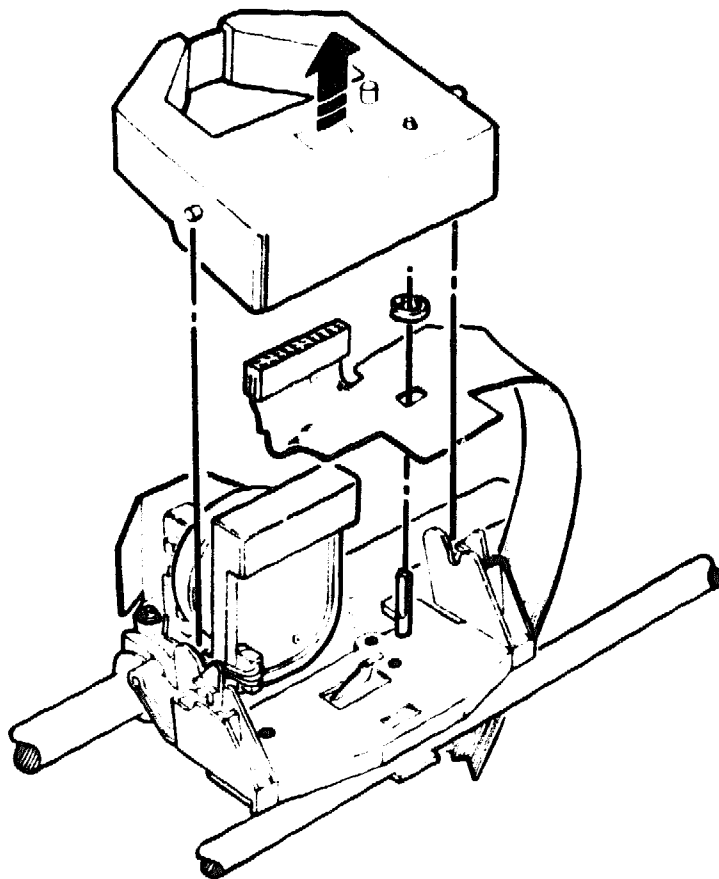
3.15.2 Printhead Cable

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

1. Remove the access cover as shown in Section 3.5.
2. Remove the print ribbon cartridge.
3. Remove the interface cover as shown in Section 3.3.
4. Remove the I/F board as shown in Section 3.7.
5. Remove the main cover as shown in Section 3.2.
6. Disconnect the printhead cable from the main control board connector.

7. Remove the E-ring from the ribbon drive shaft. See Table 4-7 for a spare E-ring.
8. Disconnect the 32-pin printhead cable from the printhead.
9. Remove the printhead cable from the carriage assembly.

CAUTION: *Make sure the 32-pin printhead cable connector is correctly plugged in. If the connectors are incorrectly plugged in and the power is turned on, serious electrical damage can occur to the main control board, printhead, or printhead cable.*

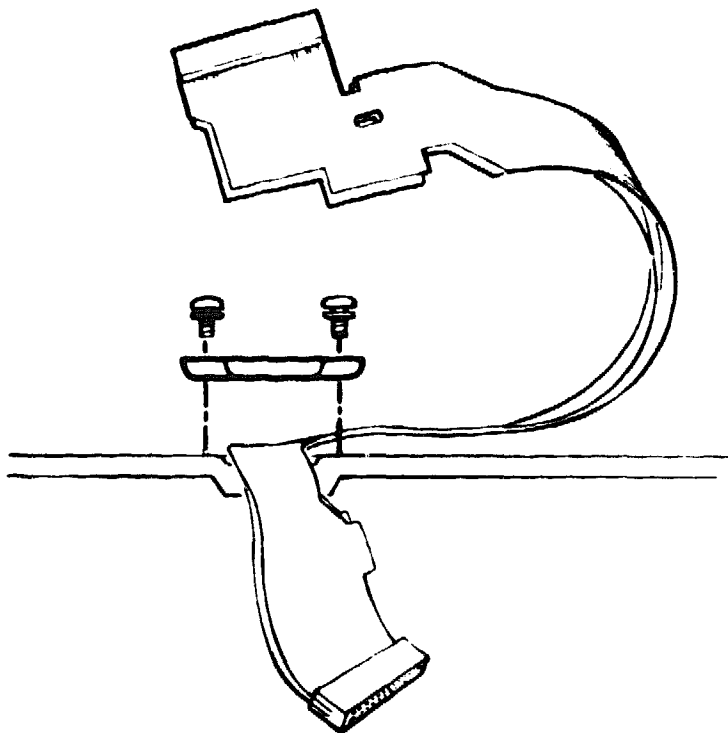


MR 11 004105

10. Remove the two screws securing the hold-down plate, and remove the hold-down plate. See Table 4-6 for a spare plate.

CAUTION: *The sharp-edged side of the hold-down plate can cut and short-circuit the cable. When replacing the hold-down plate, place the rounded edge of the plate against the printhead cable.*

11. Thread the cable around the carriage and remove the cable.



ML 0-004106

Chapter 4

Recommended Spares Lists (RSL)

4.1 Contents of the Van Kit

Table 4-1 shows the contents of the LA324 MultiPrinter van kit. The van kit is a collection of field replaceable units (FRUs) and miscellaneous parts kits. Always replace a faulty FRU with a good unit from the van kit. Repairing an FRU in the field is impractical. Complete repair and adjustment of FRUs can be done only at a fully equipped repair center. See Section 4.2 for information about the miscellaneous kits.

Table 4-1: Contents of the LA324 Van Kit

Part Numbers	Description
29-27880-01	Mechanical assembly without printhead
29-27843-01	24-pin printhead
29-27850-01	Printhead cable
29-27851-01	Main control board
29-27862-01	Interface (I/F) board
29-27861-01	Power supply unit and ac input assembly
29-27868-01	Operator panel board
29-27872-01	Display assembly
29-27845-01	Fan
90-07217-00	3-amp fuse

Table 4-1 (Cont.): Contents of the LA324 Van Kit

Miscellaneous Kits	
29-27881-01	Display and operator panel
29-27882-01	Printer cover
29-27883-01	Miscellaneous
29-27884-01	Mechanical assembly 1
29-27885-01	Mechanical assembly 2
29-27886-01	Hardware
Test Equipment	
12-25083-01	MMJ loopback connector
29-27887-01	Parallel loopback connector
Other Parts	
17-00811-02	MMJ serial cable
17-01516-00	Parallel cable (BC19M-10)
LA24R-KA	Black ribbon cartridge
LA24R-KC	Color ribbon cartridge

4.2 Contents of the Miscellaneous Kits

Table 4-2 through Table 4-7 show the contents of the six miscellaneous kits that are part of the LA324 MultiPrinter van kit. The miscellaneous kits contain major parts (gears, belts, and so on) not normally replaced in the field, and minor parts (screws, plastic panel covers, and so on) that can become lost or broken during normal CSE activity.

Table 4-2: LCD and Operator Panel Kit, 29-27881-01

Quantity	Description or Area Used
1	Operator panel fascia cap
1	Display base plate or lower cover
1	Display upper cover
2	Operator panel attachment machine screw, 4 x 8 mm
2	Access cover release or pushbutton tabs

Table 4-3: Main Cover Kit, 29-27882-01

Quantity	Description or Area Used
1	Paper selection lever
1	Paper thickness lever
1	Rear paper guide
1	Magnet for defeating access cover interlock
1	Block-off cap for main cover
2	Main cover attachment machine screw, 4 x 95 mm

Table 4-4: Miscellaneous Kit, 29-27883-01

Quantity	Description or Area Used
1	Ground strap for mechanical assembly
1	Twist-lock sensor cable tie
1	AC input assembly cover
5	Self-lock cable tie wraps
1	Vibration damping pad for the fan
1	Vibration damper for the mechanical assembly
1	Bushing for square tractor drive shaft
1	Main control board latch and bushing
1	RF choke for carriage and platen motor lead-in wires
1	PSU power cable restrainer (clamp) with adhesive backing

Table 4-5: Mechanical Assembly Kit 1, 29-27884-01

Quantity	Description or Area Used
1	Internal paper thickness lever
1	Internal paper selection lever
1	Platen drive shaft pulley
1	Platen bearing bracket
1	Tractor drive gear
1	Platen belt drive pulley assembly
1	Tractor drive shaft intermediate drive gear
1	Platen drive belt tensioner roller
1	Printhead safety cover
1	Tractor drive shaft bushing
1	Platen pulley cover

Table 4-6: Mechanical Assembly Kit 2, 29-27885-01

Quantity	Description or Area Used
1	Tractor drive gear coil spring
1	Ribbon drive wire tension spring
1	Bail bar spring
1	Platen counter roller pressure spring
1	Thickness detent cam lever
1	Printhead cable hold-down plate
1	Smudge shield mounting plate
1	Front carriage mounting bushing
1	Vibration damper for carriage motor mount
1	Carriage motor mounting screw stud
1	Platen bearing

Table 4-7: Hardware Kit, 29-27886-01

Quantity	Description or Area Used
3	E-ring 2.3 mm. Drive pulley
3	E-ring 3.2 mm. Internal selection lever mount
3	E-ring 4 mm. Ribbon drive shaft
3	E-ring 5 mm. Tractor drive shaft
3	E-ring 7 mm. Tractor stationary shaft
3	Screw 3.53 x 9.5 mm. PSU mounting screw
3	Machine screw 4 x 8 mm. Operator panel, and ac input mount
3	Screw 4 x 8 mm. PSU mounting screw
3	Machine screw 3 x 14 mm. Printhead attaching screw
3	Machine screw 3 x 6 mm. Smudge shield and carriage belt tensioner
3	Machine screw 6 x 10 mm. Bail solenoid
3	Machine screw 3 x 8 mm. Platen bearing bracket attachment
3	Machine screw 3 x 12 mm. Belt adjuster

Table 4-7 (Cont.): Hardware Kit, 29-27886-01

Quantity	Description or Area Used
3	Screw 2.9 x 9.5 mm. Carriage belt clamp
3	Machine screw 2.9 x 9.5 mm. Bail bar shaft attachment
3	Flathead machine screw 3 x 8 mm
3	Machine screw 2 x 8 mm. Used in platen roller assembly
3	Machine screw 3 x 4 mm. Carriage shaft bearing mounting
3	Machine screw 3 x 6 mm. Bail solenoid mounting
1	Bail bar pivot lever
3	Nut machine 3 mm. Belt adjuster
3	Internal toothed washer 3.2 mm. Platen motor mount
3	Internal toothed washer 5 mm
3	Internal toothed washer 6.4 mm
3	Washer 6.5 mm inside diameter. Tractor drive gear
3	Washer (25/24 type). Platen belt drive pulley

Appendix A

Technical Information and Tables

A.1 Serial and Parallel Connectors

Table A-1 and Table A-2 show the pin assignments, signal names, and loopback connections of the LA324 MultiPrinter interface port connectors. The loopback connections are made automatically when you install the serial and parallel loopback connectors to run the Service test diagnostic. The loopback connector part numbers are listed in Chapter 4.

Table A-1: Serial Connector

Pin Number	Loopback pin #	Signal Name	Signal Description
1	6	Data terminal ready (DTR)	Asserted when the printer is in READY mode.
2	5	Send data (SD)	Control data transmitted to host computer.
3	4	Send common (SC)	The SC signal originates from the printer.
4	3	Receive common (RC)	The RC signal originates from the host system.
5	2	Read data (RD)	Received print and control data from host computer.
6	1	Data set ready (DSR)	Received from the host.

Table A-2: Parallel Connector

Pin Number	Loopback pin #	Signal Direction	Signal Name	Signal Description
1	11	To printer	Strobe L	When the signal is low, the printer is reading a data byte and is in the busy state.
2	10	To printer	Data bit 1	Signal bits 1-8 are the data byte bits.
3	3	To printer	Data bit 2	
4	32	To printer	Data bit 3	
5	10	To printer	Data bit 4	
6	3	To printer	Data bit 5	
7	32	To printer	Data bit 6	
8	10	To printer	Data bit 7	
9	3	To printer	Data bit 8	
10	2, 5, 8	From printer	ACKNLG L	The signal goes low to acknowledge that the data byte is received and the printer is ready. The signal is sent at power-up or after an initialization sequence.

A.2 Setup and Installation Menus

Refer to Chapter 1 for complete information about the LA324 MultiPrinter setup and installation menus. Table A-3 is extracted from Table 1-3 and placed here for your convenience. Table A-4 is extracted from Table 1-4.

NOTE: *The Emulation user setup information is not available for this version of the LA324 MultiPrinter Service Guide.*

Table A-3 lists all the features and the values of the features displayed by the Digital (DEC) menu.

Table A-3: DEC User Setup Menu

Feature	Values ¹	Comment
Protocol	DEC ² Emulation	Toggles selection between IBM XL24 and DEC protocol. The emulation protocol is inactive in the V1.1 to V2.0 range of firmware revision numbers.
DEC Defaults	Save	Saves all selected values in nonvolatile memory. Unsaved values are lost when the printer is powered down.
	Print	Prints out the selected values.
	Restore	Cancels all selected values, replacing them with saved values.
	Recall Factory	Automatically recalls and selects all the factory values for both the user setup and installation menus. Unless you select Save, the selected values disappear at power down.
Form Length	1	
	.	
	.	
	66 lines ²	
	.	
	.	
	255 lines	

¹Press **Select** to select the value shown on the message display. An asterisk (*) is displayed to designate the selected values. Make sure you save all selected values. See the DEC default feature.

²Factory value. All factory values are selected by Recall Factory. Individual factory values can be selected manually.

Table A-3 (Cont.): DEC User Setup Menu

Feature	Values ¹	Comment
Form Width	13.6 inches ² 8 inches	
Auto LF on CR	No auto LF ² Auto LF on CR	
Auto CR on LF	No auto CR ² Auto CR on LF	
Density	Draft ² Letter Quality	
Typestyle	Internal ² Cartridge	
Horiz. Pitch	10 CPI ² 12 CPI 13.2 CPI 17.1 CPI 18 CPI 5 CPI 6 CPI 6.6 CPI 8.55 CPI 9 CPI	CPI = characters per inch.
Vertical Pitch	6 LPI ² 8 LPI 12 LPI 2 LPI 3 LPI 4 LPI	LPI = lines per inch.
Autowrap	Truncate ² Wrap	When truncated no wrapping is performed by the printer, the host must provide carriage return and line feed characters. Autowrapping can conflict with carriage returns and line feeds sent from the host.

¹Press **Select** to select the value shown on the message display. An asterisk (*) is displayed to designate the selected values. Make sure you save all selected values. See the DEC default feature.

²Factory value. All factory values are selected by Recall Factory. Individual factory values can be selected manually.

Table A-3 (Cont.): DEC User Setup Menu

Feature	Values¹	Comment
G0 Cset	US ASCII ² British DEC Finnish French DEC Fr. Canada German ISO Italian JIS Roman DEC Nor/Dan ISO Spanish DEC Swedish Norway/Danish DEC Dutch DEC Swiss DEC Portuguese JIS Katakana DEC Spec. Graph DEC Technical DEC Supp DEC 7bit Hebrew DEC Hebrew Supp Legal User Preference	If a font cartridge is installed, the character set is displayed here. See the <i>LA324 MultiPrinter Programmer's Reference Manual</i> for character set information.
User Pref. Cset	DEC Supplement ² ISO Supplement Katakana DEC Hebrew Supp ISO Hebrew Supp cartridge	If a font cartridge is installed, the character set is displayed here. See the <i>LA324 MultiPrinter Programmer's Reference Manual</i> for character set information.
Printer ID	Level 2 Printer ² LA120 ID LA210 ID	Printer responds to selection with selected ID.
Top Margin	1 ² . . . 255	Printing starts at the top margin.

¹Press **Select** to select the value shown on the message display. An asterisk (*) is displayed to designate the selected values. Make sure you save all selected values. See the DEC default feature.

²Factory value. All factory values are selected by Recall Factory. Individual factory values can be selected manually.

Installation Setup Menu

Table A-4 lists all the features and the values displayed by the installation setup menu.

Table A-4: Installation Setup Menu

Feature	Values ¹	Comment
Setup Language	English ² Francais Deutsch Espanol Italiano	Language text that appears on the display panel.
Port Selection	Serial Port ² Parallel Port	
Buffer Control	XON/XOFF ² DTR	Select between DTR or control code methods of data flow control.
EOT disconnect	No disc. on EOT ² Disc. on EOT	If an end of transmission (EOT) character is received, the printer drops the data terminal ready (DTR) signal, which causes modems or communications equipment to disconnect.
Baud Rate	4800 ² 9600 19200 200 300 600 1200 2400	Must match configuration setting of the host system.
Data bits/Parity	8-None ² 8-Even 8-Odd 7-Even 7-Odd 7-Mark 7-Space	Must match configuration setting of the host system.
Sheet Feeder	Not installed ² Installed	Paper jams result if this setting is incorrect.
Bail bar lift	Lift OFF ² Lift ON	To reduce paper jamming when feeding labels, lift the bail bar for perforations.

¹Press **Select** to select the value shown on the message display. An asterisk (*) is displayed to designate the selected values.

²Factory value. All factory values are selected by the DEC user setup menu Recall Factory value. Individual factory values can be selected manually.

Table A-4 (Cont.): Installation Setup Menu

Feature	Values ¹	Comment
Error Beep	One Beep ² Three Beeps Continuous Off	
Auto tear	Auto Tear OFF ² Auto Tear ON	When selected, the fanfold perforation automatically moves to the tear bar.
Tear adjustment	0 +1 +2 +3 +4 +5 -5 -4 -3 -2 -1	Used to precisely position the fanfold tear perforation to the tear bar.

¹Press **Select** to select the value shown on the message display. An asterisk (*) is displayed to designate the selected values.

²Factory value. All factory values are selected by the DEC user setup menu Recall Factory value. Individual factory values can be selected manually.

A.3 T&D Subtests

Table A-5 shows the running sequence and gives a short description of each T&D subtest. The subtests are numbered 0-9, then A-R, and run in that order. Use the diagrams in Section 1.2 to find the location of the various processors, memories, and other electronic devices referred to in the list.

Table A-5: Sequence and Description of T&D Subtests

Display Sequence	Subtest Description
T&D0	Verification of the DA (8031) processor and internal (0-7F) memory.
T&D1	Addressability and CRC checking of the 64K DA processor EPROM.
T&D2	0-64K DA processor external RAM test.
T&D3	64-128K DA processor external RAM test.
T&D4	Verifies the operation of the NVM EEPROM.
T&D5	The operator panel pushbuttons must be pushed in left-to-right sequence. An error occurs if any button is not pushed within a short timeout period.
T&D6	Resident font EPROM CRC test.
T&D7	Interactive test to verify operation of cover interlock switch. An error occurs if cover switch does not actuate within a short timeout period.
T&D8	RAM or ROM installed font cartridge test.
T&D9	Testing of the DA processor side of the dual-ported main control memory.
T&DA	Tests the integrity of the connection between the I/F and main control board.
T&DB	Verification of the I/F (8031) processor and internal (0-7F) memory. Similar to T&D0.
T&DC	Addressability and CRC checking of the I/F processor EPROM. Similar to T&D1.
T&DD	Verification of the 32K I/F processor RAM.
T&DE	Serial connector loopback test.
T&DF	Parallel connector loopback test.
T&DG	Tests the internal pathways between the DA and DOE processors.
T&DH	Verification of the DOE (8031) processor and internal (0-7F) memory. Similar to T&D0.
T&DI	Addressability and CRC checking of the 32K DOE processor EPROM. Similar to T&D1.

Table A-5 (Cont.): Sequence and Description of T&D Subtests

Display Sequence	Subtest Description
T&DJ	Testing of the DOE side of the dual-ported main control board memory. Similar to T&D9.
T&DK	Tests the operation of the three timer circuits that comprise the 754 integrated circuit (IC), which is located on the main control board.
T&DL	T&DL tests fanfold paper handling, prints the 132-column test pattern, and allows you to verify and perform H-pattern and first-line alignments. You must enter the correct paper size by selecting either the EUROPE? or USA? prompt, or an ORU0 error can occur. The 132-column printing test stresses each mechanical system of the printer. This enables you to quickly isolate and identify a bad or marginal component or system. See Section 2.1.4 for additional information.
T&DM	Manufacturing test not used.
T&DN	T&DN tests single-sheet paper handling and print quality. The single-sheet sensor and the printer's ability to accurately move and handle single-sheet paper are tested. To test the operation of the sensor, the test relies on the paper size information entered in the T&DL subtest. See Section 2.1.4 for additional information.
T&DO	Manufacturing test not used.
T&DP	Manufacturing test not used.
T&DQ	Manufacturing test not used.
END	The END text is displayed as opposed to T&DR. The T&DR subtest signifies the end of the Service test diagnostic. The Repair center diagnostic cycles continuously, never stopping.

A.4 Combined Error Code Tables

Table A-6 is a duplicate of Table 2-2. For a full explanation see Chapter 2.

Table A-6: ORU Error Display

Error Display	Course of Action
ORU0	Nonspecific error; press Setup for more information. See Section 2.1.3.2.
ORU1	Replace/swap the main control board.
ORU2	Replace/swap the I/F board.
ORU3	Failure of the DA EEPROM. Replace the main control board.
ORU4	Failure of the font EEPROM. Replace/swap the main control board.
ORU5	Replace/swap the operator panel.
ORU6	Replace/swap the font cartridge.
ORU7	Failure of the DOE EEPROM. Replace/swap the main control board.
ORU8	Failure of the I/F EEPROM. Replace/swap the I/F board.

A.4.1 Full Error K-Codes

Table A-7 gives the detailed report for each K-code. See Section 2.1.3.2 for more information about how and when a K-code report is useful.

Table A-7: Full Error Report (K-Codes)

Displayed Code	Subtest Failure Identification and Information
K010	DA processor integrated circuit (IC)
K130	DA EPROM CRC
K210	DA NVM 1
K310	DA NVM 2
K410	DA side of the dual-port memory
K550	Press Quality/Park switch timeout test.
K551	Press Quiet/Print switch timeout test.
K552	Press Pause/Ready/Select switch timeout test.
K553	Press LF/← switch timeout test.
K554	Press FF/→ switch timeout test.
K555	Press • switch timeout test.
K556	Press □ switch timeout test.
K557	Press Setup/Ext Setup switch timeout test.
K640	Internal font EPROM CRC
K700	Access cover is closed. ¹
K701	Access cover is open. ¹

¹Interlock circuit errors are caused by misseated access cover, missing or damaged cover magnet, or by a bad main control board.

The format of the K-code is:

K701

where:

K is the fixed code identifier
7 is the test number
0 is the ORU number
1 is a subtest number

Table A-7 (Cont.): Full Error Report (K-Codes)

Displayed Code	Subtest Failure Identification and Information
K702	Access cover is always closed. ¹
K703	Access cover is always open. ¹
K860	Wrong type of font cartridge is installed.
K861	Font cartridge is installed.
K862	Font cartridge is not installed.
K863	Font cartridge test
K910	DA side of the dual-port memory
KA20	I/F board is not responding to DA command.
KA21	Test timeout
KA22	Connection failure between I/F and D/A
KB20	I/F does not recognize DA command.
KB21	I/F test timeout
KB22	Answerback error
KB23	I/F 8031 processor IC
KC20	I/F does not recognize DA command.
KC21	I/F test timeout
KC22	Answerback communication error
KC83	I/F EPROM CRC
KD20	I/F is not responding to command.
KD21	I/F test timeout

¹Interlock circuit errors are caused by misseated access cover, missing or damaged cover magnet, or by a bad main control board.

The format of the K-code is:

K701

where:

K is the fixed code identifier

7 is the test number

0 is the ORU number

1 is a subtest number

Table A-7 (Cont.): Full Error Report (K-Codes)

Displayed Code	Subtest Failure Identification and Information
KD22	Answerback communication error
KD23	I/F external RAM
KE20	I/F does not recognize command.
KE21	Loopback test timeout
KE22	Answerback communication error
KE23	DTR/DSR loopback
KE24	Transmit/receive loopback
KE25	This subtest is not used for the Service or Repair center diagnostics.
KF20	I/F does not recognize command.
KF21	Test timeout
KF22	Answerback communication error
KF23	Loopback error, strobe busy
KF24	Parallel port pins 1, 4, and 7 loopback
KF25	Parallel port pins 2, 5, and 8 loopback
KF26	Parallel port pins 3 and 6 loopback
KF27	This subtest is not used for the Service or Repair center diagnostics.
KG10	DOE processor is not responding.
KG11	DA to DOE interconnection error
KH10	DOE processor
KI70	DOE EPROM CRC
KJ10	DOE side of the dual-port memory

The format of the K-code is:

K701

where:

K is the fixed code identifier
7 is the test number
0 is the ORU number
1 is a subtest number

Table A-7 (Cont.): Full Error Report (K-Codes)

Displayed Code	Subtest Failure Identification and Information
KK10	Timer IC, circuit 0
KK11	Timer IC circuit 1
KK12	Timer IC circuit 2
KL00	Home-position sensor fault during a fanfold sheet load. Accompanied by incomplete fanfold paper load. ²
KL01	Fanfold sensor detects incorrect trailing edge. ³
KL02	Home-position sensor timing fault ⁴
KL03	Fanfold sensor does not detect trailing edge. ³
KL04	Printhead thermal sensor minimum temperature error. ⁴ A combined sheet paper load, fanfold and single-sheet, also causes this error.
KL05	Printhead thermal sensor reads maximum temperature. ⁴
KM00	Not used for Service or Repair center diagnostic.
KM01	Not used for Service or Repair center diagnostic.
KM02	Not used for Service or Repair center diagnostic.
KM03	Not used for Service or Repair center diagnostic.
KN00	Home-position sensor fault during single-sheet loading. ²

²The carriage home-position sensor circuit is malfunctioning or the carriage is binding. Check for smooth carriage movement. Check for obstruction or damage to carriage home position sensor. Swap or replace the main control board first, then the mechanical assembly.

³The trailing edge of the paper is not detected or is misdetected. This error occurs if you load more than two pages of 132-column paper, if you load the wrong size paper, or if you set the wrong paper length from the EUROPE? USA? menu. Check the mechanical assembly for correct paper handling and the sensor assembly for damage or misseating. Swap or replace the main control board first, then the mechanical assembly.

⁴Thermal sensor circuit error. Swap main control board, printhead cable, or printhead.

The format of the K-code is:

K701

where:

K is the fixed code identifier
7 is the test number
0 is the ORU number
1 is a subtest number

Table A-7 (Cont.): Full Error Report (K-Codes)

Displayed Code	Subtest Failure Identification and Information
KN01	Single-sheet sensor detects incorrect trailing edge. ³ A combined sheet paper load, fanfold and single-sheet, also causes this error.
KN02	Home-position sensor fault, during single-sheet feeding. ²
KN03	Single-sheet sensor does not detect trailing edge. ³
KN04	Single-sheet sensor detects paper in paper path. ³
KO00	Not used for the Service or Repair center diagnostics.
KO01	Not used for the Service or Repair center diagnostics.
KO02	Not used for the Service or Repair center diagnostics.
KO03	Not used for the Service or Repair center diagnostics.
KP10	Not used for the Service or Repair center diagnostics.
KQ10	Not used for the Service or Repair center diagnostics.

²The carriage home-position sensor circuit is malfunctioning or the carriage is binding. Check for smooth carriage movement. Check for obstruction or damage to carriage home position sensor. Swap or replace the main control board first, then the mechanical assembly.

³The trailing edge of the paper is not detected or is misdetected. This error occurs if you load more than two pages of 132-column paper, if you load the wrong size paper, or if you set the wrong paper length from the EUROPE? USA? menu. Check the mechanical assembly for correct paper handling and the sensor assembly for damage or misseating. Swap or replace the main control board first, then the mechanical assembly.

The format of the K-code is:

K701

where:

- K is the fixed code identifier
- 7 is the test number
- 0 is the ORU number
- 1 is a subtest number

A.5 Circuit Board Physical Information

This section contains information about the circuit board jumpers, read only memories (ROMs), and test points that is not generally used in the field. All LA324 spares are factory configured. When a part on an FRU is bad, replacing or swapping the FRU is the correct course of action.

The jumpers are used in the manufacturing process. If the jumpers are set to a non-factory configuration, erratic, unspecified, or unexpected printer operation can result or damage can occur.

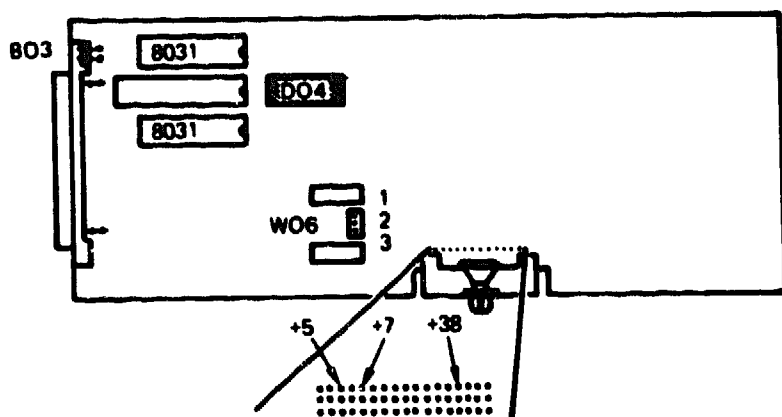
The ROM locations and information are supplied in case you need to locate a ROM.

A.5.1 Main Control Board

The factory configuration of the main control board is shown in Figure A-1 and discussed in the following list.

- The DO4 ROM contains the device output enable firmware.
- Pins 1-2 of B03 are open or the jumper is out.
- Pins 1-2 of W01 are shorted or the jumper is installed.
- Pins 1-2 of Y02 are shorted or the jumper is installed.
- The 5 and 38 Vdc power supply voltages are measured at the main control board test points.
- The 7 Vdc voltage is crucial to the operation of the printer.

Figure A-1: Main Control Board Factory Configuration



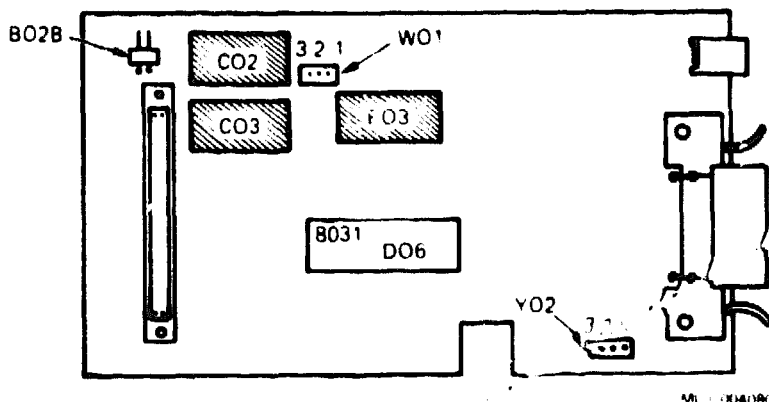
MLD-004107

A.5.2 I/F Board

The factory configuration of the I/F board is shown in Figure A-2 and discussed in the following list.

- The CO2 ROM contains the character generation firmware.
- The CO3 ROM contains the device adapter firmware.
- The EO3 ROM contains the I/F firmware.
- Pins 1-2 of BO3B are open or jumper is out.
- Pins 1-2 of WO1 are shorted or the jumper is installed.
- Pins 1-2 of YO2 are shorted or the jumper is installed.

Figure A-2: I/F Board Factory Configuration



Appendix B

General Specifications

This appendix lists the basic operating specifications for the LA324 MultiPrinter.

Table B-1: Specifications

	Printing Technology
Print method	Dot matrix
Printing technique	Bidirectional Unidirectional, left to right Forward and reverse paper motion
Printhead	24-pin dot matrix
Dot size	.2 mm (0.0085 in.) diameter
Dot spacing	180 dots per inch
Buffer control	XON/XOFF protocol DTR high and low signal voltages
Text printing speed	Draft = 300 characters per second Letter = 100 characters per second Horizontal slew rate = 30 inches per second Vertical slew rate = 5 inches per second
Print density (standard cell matrix)	Draft = 9 x 24 dots per character Letter = 30 x 24 dots per character
Print density (full cell matrix)	Draft = 12 x 30 dots per character Letter = 36 x 23 dots per character
Data interface	Serial = 6-pin modular DECconnect type connector Parallel = 36-pin Amphenol type connector

Table B-1 (Cont.): Specifications

Character Specifications	
Character sets	DEC mode: ASCII DEC Supplemental DEC Technical ISO 8-bit Supplemental DEC Special Graphics 14 National Replacement Character (NRC) sets
Color mode	Sixel graphics (DEC mode:) White (no printing) Yellow Magenta Cyan Red Green Blue Black
Character attributes	DEC mode: Bold Color text Underline Double underline Slant Overline Strike-through Subscript Superscript

Table B-1 (Cont.): Specifications

Paper	
Manual feed single-sheet paper	Width: 102 mm (4 in) to 432 mm (17 in) ¹ Length: 64 mm (2.5 in) to 432 mm (17 in) Weight: 60 g/ m ² to 90 g/ m ² basis weight (16 lb to 24 lb)
Manual feed multiple-part forms	Width: 102 mm (4 in) to 432 mm (17 in) Length: 64 mm (2.5 in) to 432 mm (17 in) Thickness: .5 mm maximum (.020 in)
Tractor feed single-part paper	Width: 108 mm (4.25 in) to 406 mm (16 in) including perforations 56 g/ m ² to 90 g/ m ² basis weight (15 lb to 24 lb)
Multiple-part forms	Six parts (1 original and 5 copies) with carbon First sheet: 60 g/ m ² to 75 g/ m ² basis weight (16 lb to 20 lb) Copies: 45 g/ m ² to 56 g/ m ² basis weight (12 lb to 15 lb) Total thickness: .5 mm (.020 in) maximum
Multiple-part forms	Six parts (1 original and 5 copies) without carbon First sheet and copies: 54 g/ m ² to 56 g/ m ² basis weight (14.5 lb to 15 lb) Last sheet: 49 g/ m ² to 56 g/ m ² basis weight (13 lb to 15 lb) Total thickness: .5 mm (.020 in) maximum
Labels	Total thickness of .3 mm (.012 in) maximum NOTE: Continuous paper/forms/labels shall have hole spacing of 13 mm (0.50 in) ± 0.01 in nonaccumulative over 51 mm (2.00 in) with a hole diameter of 3.8 mm (0.15 in) to 4 mm (0.16 in).

¹For 16 lb and lighter paper, the maximum width reduces to 304 mm (12 in).

Table B-1 (Cont.): Specifications

Ribbon Cartridges	
Black ribbon	Disposable cartridge capable of printing up to five million characters.
Color ribbon	Disposable cartridge composed of four color bands: yellow, magenta, cyan, and black. Each band can print up to 400 K characters.
Physical	
Dimensions	Height: 170 mm (6.7 in) Depth: 310 mm (12.2 in) Width: 615 mm (24.2 in)
Installed weight	14.5 kg (32.7 lb)
Power	
Power requirements	120/240 Vac, 50/60 Hz
Power consumption	170 W maximum
Power receptacle	Nonswitched, 3-prong, grounded
Environmental Requirements	
Operating temperature	10°C to 40°C (50°F to 104°F)
Operating humidity	10% to 90% relative humidity
Acoustic noise	Less than 55 dBA