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# **LP Series Printers**

**— Maintenance Manual**

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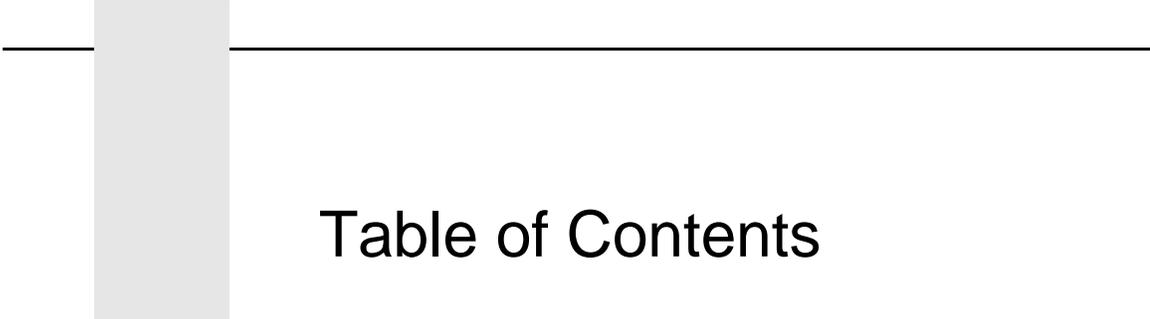
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# 1

## *Maintenance Overview*

### **About the Printer**

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The Hewlett-Packard LP Series is a family of fast, reliable line matrix printers. The nameplate on the printer cover indicates the speed rating and the type of printer housing, as shown in Table 1.

LP Series printers feature a flash memory architecture that permits rapid access to stored printer emulations. A variable-speed shuttle, half-step paper control, and system architecture contained on a single circuit board enable LP printers to print a wide variety of high-volume jobs with minimum maintenance and maximum reliability.

LP Series printers are excellent graphics printers. Code V™ II is a simple but versatile programming language available as an option for LP printers. Code V II graphics language is a QMS® emulation.

Although technologically advanced, an LP Series printer is easy to use. The operator can select every printer function at the control panel or by sending printer control codes in the data stream from the host computer.

Table 1. LP Series Printers

Nameplate	Model Number	Print Speed <sup>1</sup> (LPM)	Housing	Data Controller Clock Speed <sup>2</sup>	Hammer Bank
LP 475	C3201A	475	Pedestal	25 MHz	28 Hammers
LPQ 475	C3202A	475	Cabinet	25 MHz	28 Hammers
LP 500	C3201B	500	Pedestal	25 MHz	28 Hammers
LPQ 500	C3202B	500	Cabinet	25 MHz	28 Hammers
LP 500	C3201C	500	Pedestal	40 MHz	28 Hammers
LPQ 500	C3202C	500	Cabinet	40 MHz	28 Hammers
LP 800	C3203A	800	Pedestal	25 MHz	49 Hammers
LPQ 800	C3204B	800	Cabinet	25 MHz	49 Hammers
LPQ 1000	C3204C	1000	Cabinet	40 MHz	60 Hammers
LPQ 1200	C3205B	1200	Cabinet	25 MHz	91 Hammers
LPQ 1400	C5640B	1400	Cabinet w/Power Stacker	40 MHz	91 Hammers
LPQ 1500	C3205C	1500	Cabinet	40 MHz	102 Hammers
LPQ 1500	C5640C	1500	Cabinet w/Power Stacker	40 MHz	102 Hammers

<sup>1</sup> Printing speed is determined by the interaction of many variables. The speeds listed in the table above are the highest speeds attainable under certain conditions. For more information about printing speeds, refer to the section entitled "Printing Rates" in Appendix B.

<sup>2</sup> The microprocessor of the Data Controller unit on the CMX controller board runs at 25 MHz or 40 MHz, depending on printer model. This means there are two kinds of CMX controller board for these printers, used as indicated in the table above. The 40 MHz controller board, however, is backwards compatible with all models that use the 25 MHz board.

## Printer Evolution

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The following models have been added to the LP Series:

- LP 500 (Model C3201C)
- LPQ 500 (Model C3202C)
- LPQ 1000 (Model C3204C)
- LPQ 1500 (Model C3205C / C5640C)

These “C” model printers have a redesigned shuttle frame assembly and hammer bank which are not compatible with earlier models. These models also must use the CMX 040 controller board, which has a 40 MHz clock speed for the Data Controller unit. (The CMX 040 controller board can be installed in earlier model LP printers, but must be used in the new models.)

## Important Maintenance Notes

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To ensure the best performance of the LP Series printer, remember the following principles whenever you service it.

- Do *not* adjust the platen gap unless:
  - 1) the original shuttle frame assembly or platen has been replaced with a new or rebuilt unit, or
  - 2) you are instructed to do so in a troubleshooting procedure.
- The hammer springs and hammer tips on the hammer bank are delicate and precisely aligned. *Never* bend or tweak hammer springs and always handle hammer springs by the thick mounting base.
- Use only the ribbons specified in Appendix B. Use of incorrect ribbons can lead to ink migration problems, degraded print quality, and expensive damage to the printer.
- Incorrect closure of the forms thickness lever can lead to smearing, degraded print quality, paper jams, and damage to the platen and shuttle assembly. Never close the forms thickness lever too tightly.

## About This Manual

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This is a field service maintenance manual. It is designed so that you can quickly locate maintenance information.

Taking a systematic approach to maintenance tasks will help you restore the printer to operation as quickly as possible:

1. Locate the procedure or information you need. (Refer to the Table of Contents or the Index.)
2. Read the entire procedure before you do it.
3. Gather the parts and tools you will need.
4. Make sure you understand all safety notices before you start a task. Notes and notices are defined below.

## Notes and Notices

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For your safety and to protect valuable equipment, read and comply with all information highlighted in notes and notices. The hand symbol of a notice indicates the kind of information it contains:

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### Warning



Warning messages call attention to situations that could hurt you.

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### Caution



Caution messages indicate procedures which, if not observed, could result in damage to equipment.

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### Note



Notes contain important information set off from the text.

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## Printing Conventions in This Manual

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Control panel keys and indicators are highlighted in **bold print**.  
Example: Press the **CLEAR** key, then press the **ON LINE** key.

LCD (Liquid Crystal Display) messages are set off by quotation marks ("").  
Example: Press the **ON LINE** key. "OFF LINE" appears on the LCD.

Key combinations are denoted by the + (plus) symbol.  
Example: Press **▲ + ▼**.

means Press the **▲ (UP)** key and the **▼ (DOWN)** key at the same time.

## Related Documents

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This manual does not explain how to operate or configure the printer. Printer setup, operation, and configuration are covered in other manuals that accompany each model:

- *LP Series Printers: User's Guide*  
(Part Number 165018-001PX)  
Explains how to configure the printer and provides simple troubleshooting guidelines.
- *LP Series Printers: Cabinet and Pedestal Model Installation Instructions*  
(Part Number 165019-001PX)  
Explains how to set up the printer for operation.
- *LP Series Printers: Quick Reference Guide*  
(Part Number 165014-001PX)  
Describes the keys on the control panel and provides quick reference information on daily printer operations such as loading paper and replacing ribbons.
- *LP Series Printers: Technical Reference Manual*  
(Part Number 165015-001PX)  
Describes the host control codes and character sets for the LinePrinter Plus® and PCL®-II emulations.
- *LP Series Printers: QMS Code V Technical Reference Manual*  
(Part Number 165017-001PX)  
Explains how to write graphics programs using the optional QMS Code V-II Printronix® emulation. This graphics programming language allows the user to create and store forms, generate logos, bar codes, and expanded characters, create graphic images, and merge graphics with alphanumeric data as a document is printed.

## Safety Notices

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The following notices apply at all times when you are working on the printer:

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**Warning**



To prevent serious personal injury from electrical shock when connecting or disconnecting the signal cable, set the power switch to the off position, and unplug the power cable.

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**Warning**



Always disconnect the AC power cord from the power source before performing any maintenance procedure. Failure to remove power could result in injury to persons or damage to equipment. If you must apply power during maintenance, you will be instructed to do so in the maintenance procedure.

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**Warning**



To prevent injury from electric shock, wait at least one minute after shutting off power before removing the power supply circuit board. Wear a properly grounded static wrist strap when handling the power supply board. Handle the board by the sides. Do not touch components or flex the board during removal/installation.

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**Warning**



Over time, the upper edge of the paper ironer can become sharp. To avoid cutting yourself, handle the paper ironer on the sides.

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**Warning**



Hold the printer cover securely while disengaging the gas spring assembly.

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## Hinweise zur Sicherheit

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### Vorsicht



Um erstliche körperliche Verletzungen durch Stromschlag beim Anschließen oder Trennen des Signalton-Kabels zu vermeiden, muß der Drucker auf jeden Fall ausgeschaltet und der Netzstecker herausgezogen werden.

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### Vorsicht



Bevor Sie anfällige Wartungsarbeiten durchführen, müssen Sie zuerst immer das Netzkabel aus der Steckdose ziehen. Wird das Netzkabel nicht herausgezogen, könne Verletzungen oder Geräteschäden entstehen. Falls die Wartungsarbeit Stromzufuhr erfordert, wird im Wartungsablauf darauf hingewiesen.

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### Vorsicht



Um Verletzungen durch Elektroschocks zu vermeiden, warten Sie mindestens eine Minute nach Stromausschaltung, bevor Sie die elektrische Schaltkarte entfernen. Bitte immer einen geerdeten, statischen Handgelenkriemen tragen, wenn Sie die elektrische Schaltkarte handhaben. Halten Sie die Karte nur an den seitlichen Auswurfshebeln. Während des Herausnehmens/Installierens dürfen die Komponenten der Karte nicht berührt oder gebogen werden.

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### Vorsicht



Die obere Kante der Papierschiene wird mit der Zeit scharf. Halten Sie die Schiene deshalb an den Seiten, damit Sie sich nicht schneiden.

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### Vorsicht



Behalten Sie die Druckerabdeckung sicher im Griff, wenn Sie das Gasfederpaket entfernen.

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## Controls and Indicators

Electrical Controls and Indicators, Cabinet Models (Figure 1)

Switch or Indicator	Function	Active Online	Active Offline
Power Switch	Turns printer on and off: 1 = on, 0 = off. This switch is also a circuit breaker.		
Status Indicator	On when the printer is online, off when the printer is offline. Flashes to indicate a fault or warning.	✓	✓
LCD	Liquid Crystal Display. Displays printer status messages, fault messages, and menus which permit user to set various configurations.	✓	✓
ONLINE	Toggles the printer online and offline. Clears the printer after a fault is corrected and returns the printer to offline state.	✓	✓
FF	Prints any data in the buffer then moves paper to top of form as defined by the currently active form length.	✓	✓
LF	Prints any data in the buffer then moves one line feed as defined by the currently active line spacing. Repeats if held down.	✓	✓
VIEW	Moves the current print position to the tractor area for viewing. Press again to move paper back to the print position.	✓	✓
▲ (UP)	Displays next higher level of a configuration menu. After <b>VIEW</b> is pressed, moves paper up 1/72 inch.		✓
▼ (DOWN)	Displays next lower level of a configuration menu. After <b>VIEW</b> is pressed, moves paper down 1/72 inch.		✓
▶ (NEXT)	Displays the next option in a configuration menu.		✓
◀ (PREV)	Displays the previous option in a configuration menu.		✓
CLEAR	Clears the printer after a fault is corrected and returns the printer to the offline state.		✓
SHIFT + L.P.I ADJ	Selects new line spacing.		✓
SHIFT + CLEAR	Resets PCL-II emulation.		✓
SHIFT + PAGE L ADJ	Selects new form length in inches, which is then selected with <b>PAGE L ADJ</b> key.		✓
SET TOF	Sets the location of the first line of print on a page, independent of form length.		✓
ENTER	Enters an option displayed on the LCD into printer non-volatile memory. Starts and stops printer tests. Must be unlocked before using. (See below.)		✓
▲ + ▼	Locks and unlocks the <b>ENTER</b> key.		✓



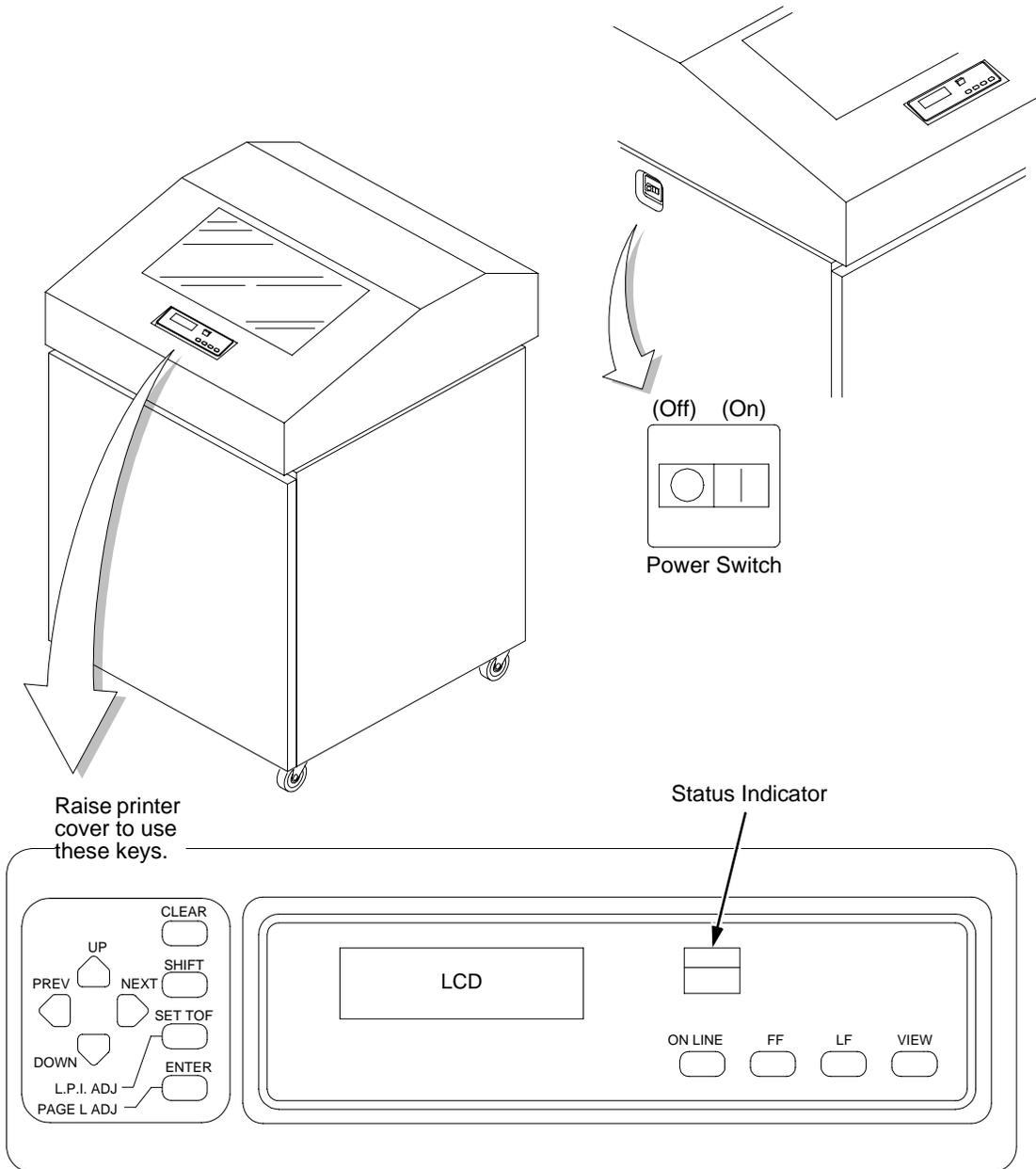


Figure 1. Electrical Controls, Cabinet Models

Electrical Controls and Indicators, Pedestal Models (Figure 2)

Switch or Indicator	Function	Active Online	Active Offline
Power Switch	Turns printer on and off: 1 = on, 0 = off. This switch is also a circuit breaker.		
On Line LED	On when the printer is online, off when the printer is offline. Flashes to indicate a fault or warning.	✓	✓
LCD	Liquid Crystal Display. Displays printer status messages, fault messages, and menus which permit user to set various configurations.	✓	✓
On Line	Toggles the printer online and offline. Clears the printer after a fault is corrected and returns the printer to offline state.	✓	✓
FF	Prints any data in the buffer then moves paper to top of form as defined by the currently active form length.	✓	✓
LF	Prints any data in the buffer then moves one line feed as defined by the currently active line spacing. Repeats if held down.	✓	✓
View	Moves the current print position to the tractor area for viewing. Press again to move paper back to the print position.	✓	✓
↑ (Up)	Displays next higher level of a configuration menu. After <b>View</b> is pressed, moves paper up 1/72 inch.		✓
↓ (Down)	Displays next lower level of a configuration menu. After <b>View</b> is pressed, moves paper down 1/72 inch.		✓
→ (Next)	Displays the next option in a configuration menu.		✓
← (Prev)	Displays the previous option in a configuration menu.		✓
Clear	Clears the printer after a fault is corrected and returns the printer to the offline state.		✓
Shift + L.P.I Adj	Selects new line spacing.		✓
Shift + Clear	Resets PCL-II emulation.		✓
Shift + Page L Adj	Selects new form length in inches, which is then selected with <b>Page L Adj</b> key.		✓
Set TOF	Sets the location of the first line of print on a page, independent of form length.		✓
Enter	Enters an option displayed on the LCD into printer non-volatile memory. Starts and stops printer tests. Must be unlocked before using. (See below.)		✓
↑ + ↓	Locks and unlocks the <b>ENTER</b> key.		✓

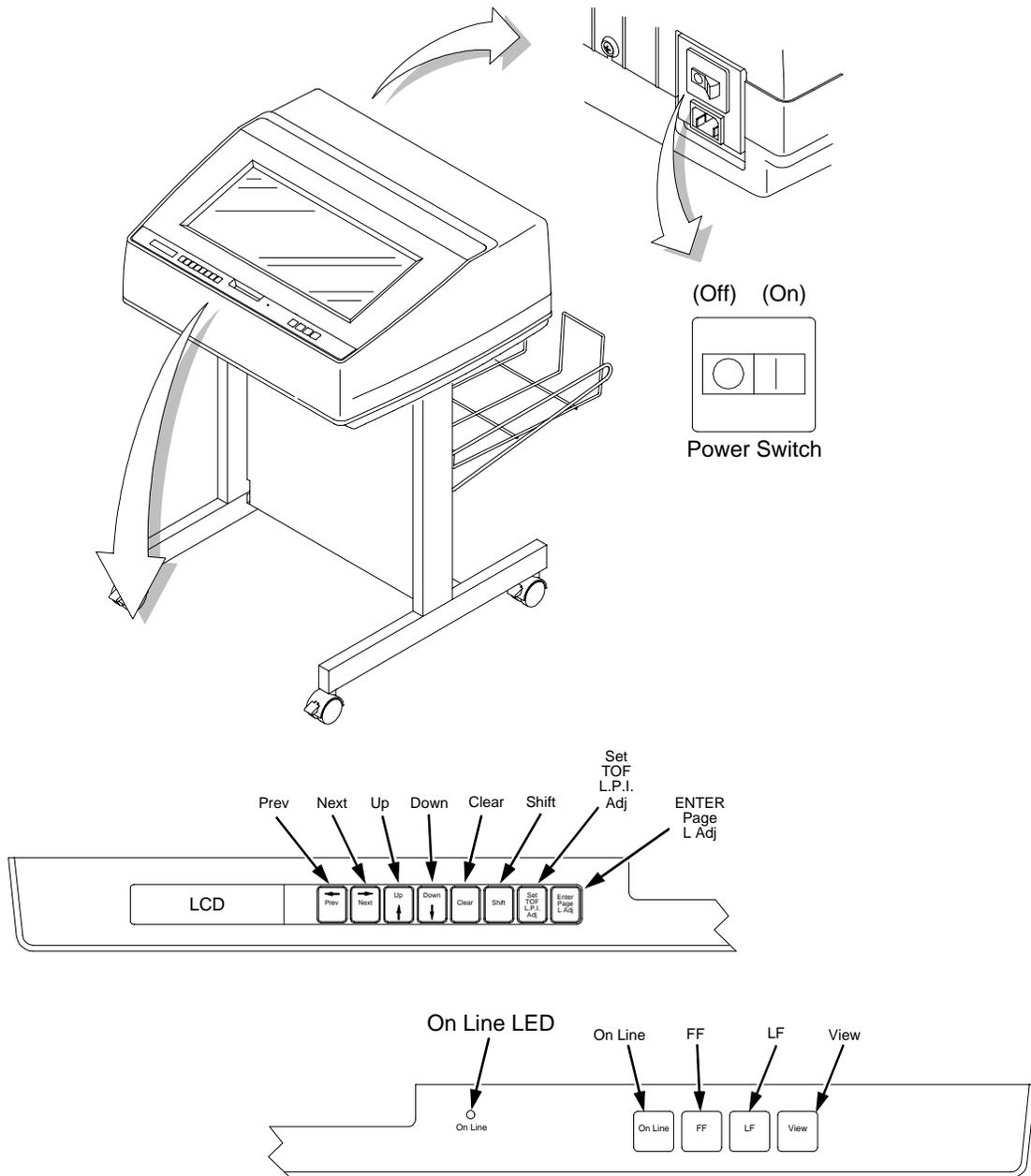
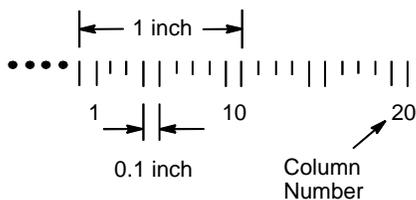
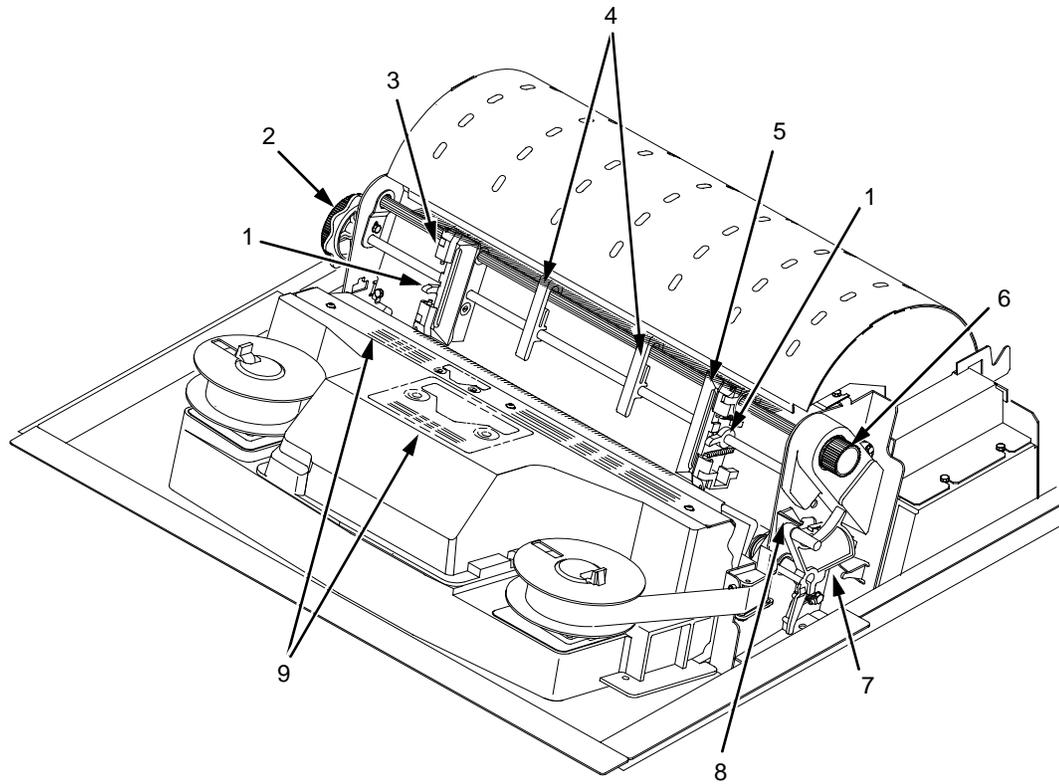


Figure 2. Electrical Controls, Pedestal Models

Mechanical Controls and Indicators, All Models (Figure 6)

Control or Indicator	Function
Forms Thickness Lever	Sets the platen for paper and forms of different thicknesses. Lever must be fully opened (raised) to load or unload paper.
Paper Supports	Help prevent paper jams by supporting inner sections of paper. They are positioned manually by sliding them along the shafts.
Forms Thickness Pointer and Scale	Indicates relative thickness of forms and paper. Set this lever at A for thin (single-part) forms, B for thicker forms, and so on.
Tractors (2)	Hold and feed paper. Used to set side margin and position paper horizontally.
Tractor Locks (2)	Lock tractors in position.
Horizontal Adjustment Knob	Allows fine positioning of left print margin. Moves paper and tractors left or right.
Vertical Position Knob	Used to set top of form or first line to be printed. Rotate this knob to move paper vertically. Works when forms thickness lever is open.
Ribbon Loading Path Diagrams	Instructions showing how to load the ribbon correctly. One diagram is cast in relief on the shuttle cover, and another is printed on the paper scale.
Paper Scale	A horizontal scale graduated in tenths of an inch, useful for setting paper margins and counting text columns. (See below.)





**Legend:**

- 1) Tractor Lock
- 2) Horizontal Adjustment Knob
- 3) Left Tractor
- 4) Paper Supports
- 5) Right Tractor
- 6) Vertical Position Knob
- 7) Forms Thickness Lever
- 8) Forms Thickness Pointer
- 9) Ribbon Loading Diagrams

**Figure 3. Mechanical Controls and Indicators, All Models**

## Tools, Test Equipment, and Supplies

---

The tools and equipment required for field level maintenance of the printer are listed below.

- Alcohol, Anhydrous
- Allen Wrench, 1/16 inch
- Allen Wrench, 3/32 inch
- Allen Wrench, 5/64 inch
- Allen Wrench, 7/64 inch
- ESD Wrist Strap
- Feeler Gauge, .010 inch
- Feeler Gauge, .011 inch
- Feeler Gauge, .040 inch
- Grip Ring Pliers, External
- Lubricant, Bearing (Lubriko® M-3, Master Lubricants Co.)  
(P/N101805-001PX)
- Nut Driver, 1/4 inch
- Nut Driver, 5/16 inch
- Nut Driver or Open End Wrench, 7/32 inch
- Open End Wrench, 5/16 inch
- Screwdriver, Philips, #1
- Screwdriver, Philips, #2
- Spring Hook, Heavy Duty
- Tie Wraps, 4 inch
- Torx® T-10 Driver

---

# 2

## *Installation*

### **Installation**

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To install and configure the printer, refer to the following documents:

- *LP Series Printers: Cabinet and Pedestal Model Installation Instructions* (P/N 165019-001PX)
- *LP Series Printers: User's Guide* (P/N 165018-001PX)





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# 3

## *Preventive Maintenance*

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### **Cleaning the Printer**

---

The LP Series printer is designed to require very little maintenance. Aside from normal replenishment of paper and ribbons, the only preventive maintenance required is periodic cleaning.

Because operating conditions vary widely, the user must determine how often to clean the printer.

Since there is no guarantee that the user will clean the printer regularly, you should clean the printer whenever you are called to service it.

---

#### **Warning**



**Always disconnect the AC power cord before cleaning the printer.**

---

---

#### **Caution**



Do not use abrasive cleaners, particularly on the window.  
Do not drip water into the printer. Damage to the equipment will result.  
Do not spray directly onto the printer when using spray solutions. Spray the cloth, then apply the dampened cloth to the printer.  
Do not vacuum the circuit boards.

---

---

#### **Note**



The cleaning procedures in this chapter are the same for all models.

---

## Cleaning the Outside Surfaces

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1. Power off the printer.
2. Disconnect the AC power cord from the printer or the power source.
3. Remove paper and the ribbon.
4. Dampen a clean, lint-free cloth with water and a mild detergent or with window cleaning solution. The cloth must be damp, not wet. Wipe down the outside surfaces of the printer.
5. Dry the outside surfaces with a clean, lint-free cloth.
6. Open the printer cover.
7. Using a soft-bristled, non-metallic brush (such as a toothbrush), brush paper dust and ribbon lint off the tractors, shuttle cover assembly, base casting, and ribbon guides. Vacuum up the residue. (See Figure 4.)
8. Wipe the splined shaft with a soft cloth.

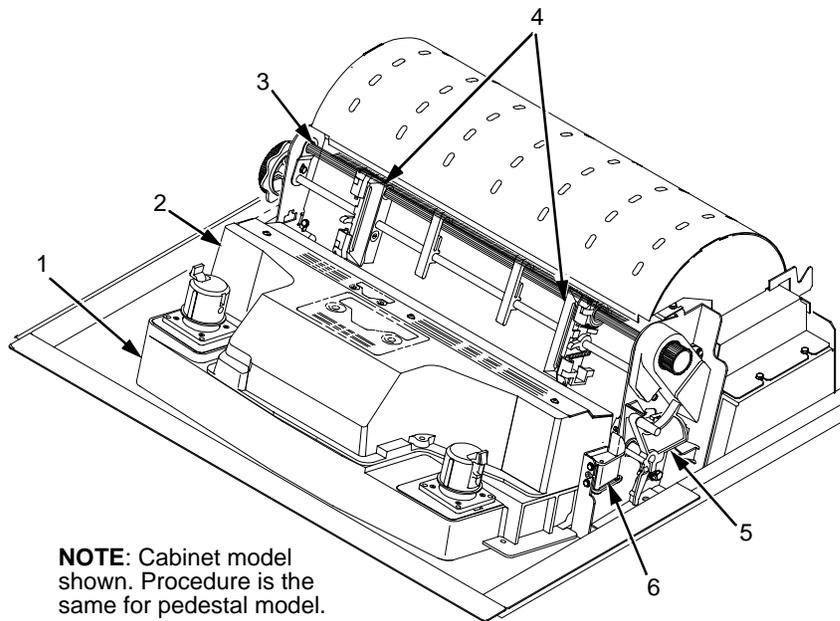
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### Caution



To avoid corrosion damage, use only alcohol when cleaning printer mechanical elements, and make sure the cleaning solution contains no water.

- 
9. Using a cloth dampened (not wet) with alcohol, clean the ribbon guides.
  10. Vacuum up dust and residue from the lower cabinet.
  11. Wipe the interior of the lower cabinet with a clean, lint-free cloth dampened with water and a mild detergent or window cleaning solution.
  12. Dry the cabinet interior with a clean, lint-free cloth.
  13. Clean the shuttle frame assembly, as described in the next section.



**NOTE:** Cabinet model shown. Procedure is the same for pedestal model.

**Legend:**

- 1) Base Casting
- 2) Shuttle Cover Assembly
- 3) Splined Shaft
- 4) Tractors
- 5) Forms Thickness Lever
- 6) Ribbon Guide (2)

**Figure 4. Cleaning Inside the Cabinet or Top Cover**

## Cleaning the Shuttle Frame Assembly

---

1. Remove the shuttle cover assembly (page 142).
2. Remove the shuttle frame assembly (page 174).
3. Remove the paper ironer (page 157).

---

### Warning



Over time, the upper edge of the paper ironer can become sharp. To avoid cutting yourself, handle the paper ironer on the sides.

- 
4. Moisten a clean, soft cloth with alcohol. Wipe the paper ironer to remove lint, ink, and paper residue.
  5. Install the paper ironer (page 157).
  6. Remove the hammer bank / ribbon mask cover assembly (page 139).

---

### Caution



The ribbon mask is thin and easily bent. Be careful not to crease or kink the ribbon mask when handling and cleaning it.

- 
7. Moisten a clean, soft cloth with alcohol. Wipe the hammer bank cover and ribbon mask to remove lint, ink, and paper residue. Clean the holes in the cover strips. Carefully wipe between the hammer bank cover and the ribbon mask.

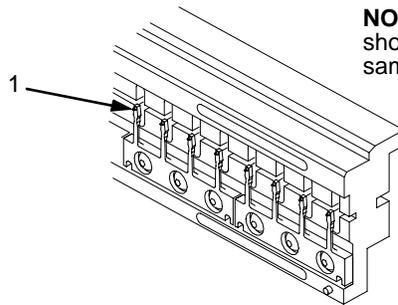
---

### Caution



Do not use any solvents or liquids to clean the hammer tips. Clean the hammer tips gently—too much pressure can chip them.

- 
8. Using a stiff, non-metallic brush (such as a toothbrush), gently brush the hammer tips to remove lint and ink accumulations. (See Figure 5.) Vacuum up any residue.



**NOTE:** 500 lpm hammer bank is shown, but the procedure is the same for all hammer banks.

**Legend:**

- 1) Hammer Tip

**Figure 5. Cleaning the Hammer Tips**

---

**Caution**



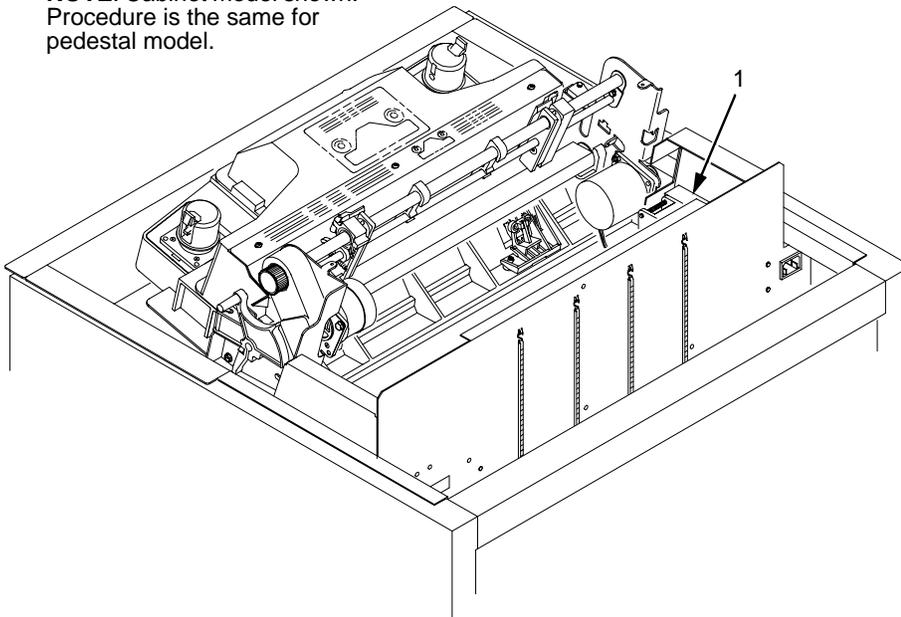
The hammer bank contains a strong magnet. To prevent damage to the hammer tips, do not let the hammer bank cover assembly snap into place as the hammer bank magnet attracts it. Any impact of the cover against the hammer bank can break hammer tips.

- 
9. Install the hammer bank / ribbon mask cover assembly (page 139).
  10. Install the shuttle frame assembly (page 174).
  11. Install the shuttle cover assembly (page 142).
  12. Clean the card cage fan assembly, as described in the next section.

## Cleaning the Card Cage Fan Assembly

1. Cabinet Models: Remove the paper path (page 158).  
Pedestal Models: Remove the top cover assembly (page 143).
2. Vacuum the card cage fan assembly and surrounding areas to remove paper particles, dust, and lint. (See Figure 6.)
3. Cabinet Models: Install the paper path (page 158)  
Pedestal Models: Install the top cover assembly (page 143).
4. Return the printer to normal operation (page 103).

**NOTE:** Cabinet model shown.  
Procedure is the same for  
pedestal model.



**Legend:**

- 1) Card Cage Fan Assembly

**Figure 6. Cleaning the Card Cage Fan Assembly**

---

# 4

# *Troubleshooting*

---

## Introduction

This chapter lists fault messages and symptoms, and provides procedures for troubleshooting printer malfunctions.

Always have the *User's Guide* handy when you troubleshoot because this manual does not cover printer operation or configuration. You must operate the printer to check its performance, and sometimes you may have to reconfigure it.

---

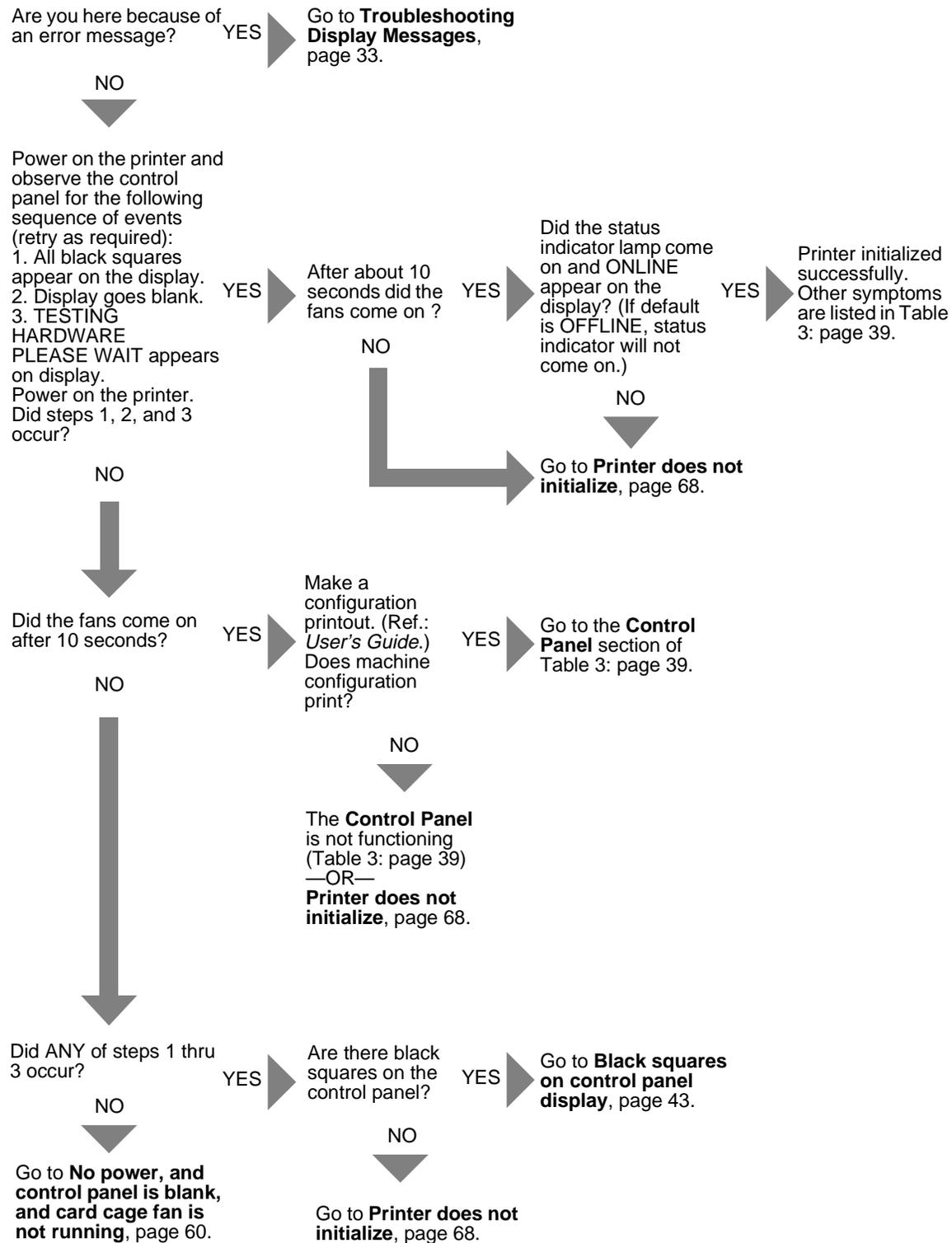
## Troubleshooting Aids

Troubleshooting is faster and more effective if you understand the equipment and make use of all available tools.

This manual provides a number of troubleshooting aids to help you isolate printer malfunctions:

- **“Start Here” Logic Tree** **page 32**
- **Troubleshooting Display Messages** **page 33**
- **Message List** **page 34**
- **Troubleshooting Other Symptoms** **page 38**
- **General Symptom List** **page 39**
- **Troubleshooting Procedures** **page 40**
- **Communications Failures** **page 85**
- **Diagnostic Printer Tests** **page 86**
- **Hex Code Printout** **page 92**
- **ASCII Character Set** **page 94**
- **The Power On Sequence** **page 96**
- **Appendix A: Wire Data** **page 229**

Start Here...





## Troubleshooting Display Messages

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### Warning



Always disconnect the AC power cord from the printer before doing a maintenance procedure. Failure to remove power could result in injury to you or damage to equipment. If you must apply power during maintenance, you will be instructed to do so in the maintenance procedure.

---

Three kinds of messages appear on the Liquid Crystal Display (LCD):

- Status messages
- Configuration menus and menu options
- Fault messages

### Note



Most fault messages are cleared from the LCD by first correcting the fault condition then pressing the **CLEAR** key. Fault messages that can only be cleared by shutting down and restarting the printer are indicated by an asterisk (\*) appended to the message.

---

If printer logic detects a fault condition, three things happen:

- The status indicator on the control panel flashes on and off.
- The audible alarm beeps if it is enabled. Press **CLEAR** to silence the alarm.
- The control panel LCD displays a fault message.

## How to Clear LCD Messages

---

Find the message in the **Message List** below, go to the troubleshooting procedure, and follow the numbered instructions. After correcting an error, press the **CLEAR** key to clear the message and place the printer in the offline state. Reinstall any parts you replaced earlier that did not solve the problem.

If an error is not cleared, the printer will try to print again but will display the error message until the error is cleared.

**Table 2: Message List**

Symptom	Troubleshooting Procedure
8.5V POWER FAIL *	page 41
15V CTL FAIL*	page 41
23.5V CTL FAIL*	page 42
48V PWR FAIL*	page 42
ACCESS NULL PTR*	page 42
A TO D OVERRUN*	page 43
BUFFER OVERRUN	page 43
CLEAR PAPER JAM	page 45
CLEARING PROGRAM FROM FLASH	page 47
CLOSE PLATEN	page 47
COIL HOT	page 48
CTL VOLT FAIL*	page 50
DIAGNOSTIC PASSED	page 50
DRVR CIR BAD*	page 51
ERROR: DC PROGRAM NOT VALID	page 51
ERROR: DRAM AT ADDRESS XXXXXXXX	page 51
ERROR: EC PROGRAM NOT VALID	page 51
ERROR: EC STOPPED AT STATE XXXX	page 52
ERROR: FLASH DID NOT PROGRAM	page 52
ERROR: FLASH NOT DETECTED	page 52
ERROR: NO DRAM DETECTED	page 52
ERROR: NVRAM FAILURE	page 53
ERROR: PROGRAM NEEDS MORE DRAM	page 53

**Table 2: Message List**

Symptom	Troubleshooting Procedure
ERROR: PROGRAM NEEDS MORE FLASH	page 53
ERROR: PROGRAM NOT COMPATIBLE	page 53
ERROR: PROGRAM NOT VALID	page 53
ERROR: SECURITY PAL NOT DETECTED	page 53
ERROR: SHORT AT ADDRESS XXXX	page 54
ERROR: WRITING TO FLASH	page 54
ERROR: WRONG CHECKSUM	page 54
EXHAUST FAN FLT	page 54
FIRMWARE ERROR	page 55
FM HEADER ERROR	page 56
FRAMING ERROR	page 56
HAM. COIL OPEN*	page 56
HAMMER COIL BAD #, #, #, #, ... etc.	page 56
HB NOT INSTALLD*	page 56
HMR BANK FAN FLT	page 57
ILL EXT BUS ACC*	page 58
ILL INST ACCSS*	page 58
ILLGL OPR ACCSS*	page 58
INTAKE FAN FAULT	page 58
LO DRV. SHORT*	page 59
LOAD PAPER	page 59
LOADING PROGRAM FROM PORT XX%	page 60
PAP BAD TABLE*	page 61
PAP BSY TOO LNG*	page 61
PAP FIFO OVERFL*	page 61

Table 2: Message List

Symptom	Troubleshooting Procedure
PAP FIFO UNDRFL*	page 62
PAP ILLGL ST*	page 62
PAP INCMPL ENER*	page 62
PAP INVLD CMD*	page 63
PAP INVLD PARM*	page 63
PAP NOT SCHED*	page 63
PAP NT AT SPEED*	page 63
PAP UNEXP INT*	page 64
PARAMETER ERROR	page 64
PARITY ERROR	page 64
PLAT INV CMD*	page 64
PLAT INV PARM*	page 65
PLAT INV STATE*	page 65
PLEASE WAIT... RESET IN PROGRESS	page 65
POWER SAVER MODE	page 66
POWER SUPPLY HOT	page 66
PRINTER HOT	page 70
PROTECTED INSTR*	page 70
PWR SUPP VOLT*	page 70
RESTORING BOOT CODE	page 71
RIB INVLD CMD*	page 72
RIB INVLD STATE*	page 72
RIBBON DRIVE	page 72
SECURITY CODE VIOLATION	page 73
SECURITY PAL NOT DETECTED	page 73
SENDING PROGRAM TO EC PROCESSOR	page 74
SF ERROR	page 74
SHUTL INV CMD*	page 75
SHUTL INV PARM*	page 75

**Table 2: Message List**

Symptom	Troubleshooting Procedure
SHUTTLE JAM	page 76
SOFTWARE ERROR* CYCLE POWER	page 77
STACK OVERFLOW*	page 77
STACK UNDERFLOW*	page 77
STACKER FAULT	page 79
STACKER FULL	page 80
STACKER JAM	page 80
TABLE MISMATCH DOWNLOAD AGAIN	page 82
TCB CORRUPTED*	page 82
UNDEF INTERRUPT*	page 83
UNDFNED OP CODE*	page 83
UP DRV. SHORT*	page 84

## Troubleshooting Other Symptoms

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### Warning



Always disconnect the AC power cord from the printer before doing a maintenance procedure. Failure to remove power could result in injury to you or damage to equipment. If you must apply power during maintenance, you will be instructed to do so in the maintenance procedure.

---

Use standard fault isolation techniques to troubleshoot malfunctions not indicated by display messages. These techniques are summarized below:

1. Ask the operator to describe the problem.
2. Verify the fault by running a diagnostic printer test or by replicating conditions reported by the user.
3. Look for a match in the **General Symptom List** below. If you find a match, go to the troubleshooting procedure and follow the numbered instructions.
4. If you cannot find the symptom in the **General Symptom List**, use the Half-Split Method to find the malfunction:
  - a. Start at a general level and work down to details.
  - b. Isolate faults to half the remaining system at a time, until the final half is a field-replaceable part or assembly. (Troubleshooting aids are listed on page 31.)
5. Replace the defective part or assembly. Do not attempt field repairs of electronic components or assemblies. Most electronic problems are corrected by replacing the printed circuit board assembly, sensor, or cable that causes the fault indication. The same is true of failures traced to the hammer bank—replace the entire shuttle frame assembly. It is not field repairable.
6. Test printer operation after every corrective action.
7. Important: reinstall any parts you replaced earlier that did not solve the problem.
8. Stop troubleshooting and return the printer to normal operation when the reported symptoms disappear.

**Table 3: General Symptom List**

Symptom	Troubleshooting Procedure
Communications Failures	page 85
<b>Jams</b>	
CLEAR PAPER JAM message instead of LOAD PAPER when printer is out of paper	page 46
CLEAR PAPER JAM message will not clear and paper does not move	page 46
CLEAR PAPER JAM message will not clear but paper moves	page 47
<b>Control Panel</b>	
Black squares on control panel	page 43
Control panel blank	page 49
Control panel keys do not work	page 49
Control panel display shows garbled, broken characters	page 49
<b>Power Failures</b>	
No power, and control panel blank, and card cage fan not running	page 60
Printer does not initialize	page 68
<b>Power Stacker</b>	
Printer does not detect presence of power stacker	page 67
Stacker "chatters" at upper or lower limit	page 77
Stacker does not stack properly	page 78
Stacker elevator does not move	page 78
Stacker elevator moves by itself	page 79
Stacker limit switch check	page 81
Stacker motor check	page 82
Stacker not operating	page 67
<b>Print Quality</b>	
Characters or dots are missing, smeared, too light, or too dark	page 44
Horizontal misalignment of characters (Dots or characters move left or right from dot row to dot row or line to line)	page 57
Randomly misplaced dots	page 71

Table 3: General Symptom List

Symptom	Troubleshooting Procedure
Vertical misalignment of characters: 1. Dots or characters move up or down from dot row to dot row or line to line 2. Incorrect spacing from dot row to dot row or line to line 3. Characters randomly compressed and/or enlarged	page 84
<b>Printer Operation</b>	
Downloads consistently fail	page 50
Flash SIMM won't copy	page 55
Paper feeds poorly	page 65
Power on "hang" condition	page 66
Printer does not print from the host	page 68
Printer does not print self tests	page 69
Reverse paper feed: platen does not open	page 71
TOF is lost repeatedly	page 82
<b>Ribbon</b>	
Ribbon folding or feed problems	page 73
<b>Shuttle</b>	
Shuttle does not move	page 74
Shuttle is noisy	page 75

## Troubleshooting Procedures

Troubleshooting procedures are listed in this section. Every troubleshooting procedure has three parts:

**MESSAGE / MALFUNCTION** — The LCD message or a description of the malfunction.

1. **TEST / INSPECTION / EXPLANATION** — Numbered steps that provide information and tell you what to test or inspect.

**CORRECTIVE ACTION** — Actions to take as a result of tests or inspections.



## How to Use the Troubleshooting Procedures

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1. Find the message or symptom you want to troubleshoot in the **Message List** (page 34) or the **General Symptom List** (page 39). The lists tell you which page the troubleshooting procedure is on. Go to that page.
2. Start at step 1 of the troubleshooting procedure. Each step has corrective action(s) indented below it.
3. Test the printer after every step and corrective action.
4. Work sequentially down the steps until the problem is solved. STOP troubleshooting as soon as the problem is solved.
5. Reinstall any original parts you replaced earlier that did NOT solve the problem.
6. Reassemble the printer and give it a final test.

## The Procedures

---

### 8.5V PWR FAIL\* Message

1. 8.5 Volt Power Failed. Internal power failure.  
Cycle power. If the message appears, replace the power supply board.
2. Power on the printer.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.
3. Power on the printer.  
If the message appears, replace the shuttle frame assembly.

### 15V CTL FAIL\* Message

1. Controller Voltage Failure.  
Cycle Power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the flash memory.
3. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board. Also check the resistance of connectors P106/LRIB M and P107/RRIB M. (Refer to the Main Wire Harness Test Tables in Appendix A.) If ribbon motor resistance is not correct, replace the motor and/or the intermediate cable, if installed.
4. Power on the printer. Run the print job again.  
If the message appears, replace the power supply board.
5. Power on the printer.

If the message appears, replace the shuttle frame assembly.

### **23.5V CTL FAIL\* Message**

1. 23.5 Volt Controller Failed: a voltage failure on the CMX controller board.  
Cycle Power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the flash memory.
3. Power on the printer. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.
4. Power on the printer. Run the print job again.  
If the message appears, replace the power supply board.
5. Power on the printer.  
If the message appears, replace the shuttle frame assembly.

### **48V PWR FAIL\* Message**

1. 48 Volt Power Failed: an internal power failure. Power off the printer. Remove the paper path or pedestal top cover. Check that power supply connector P101 is fully seated in connector J101 on the CMX controller board.  
Connect power supply connector P101 to J101 on the CMX controller board.
2. Power on the printer.  
If the message appears, replace the hammer bank logic cable assembly (P108) and the power cable assembly (P105). (Refer to Appendix A.)
3. Power on the printer.  
If the message appears, replace the power supply board.
4. Power on the printer.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.
5. Power on the printer.  
If the message appears, replace shuttle frame assembly.

### **ACCESS NULL PTR\* Message**

1. Access Null Pointer. The processor tried to access a pointer that contains nothing (null).  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### **A TO D OVERRUN\* Message**

1. Analog to Digital Overrun. The analog-to-digital converter overflowed.  
Cycle power. Run the print job again. If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### **Black squares on control panel display**

1. Power off the printer. Remove the paper path or pedestal top cover. Disconnect the control panel cable from the panel and from J110 on the CMX controller board. Check continuity of the cable. (See Appendix A.)  
Replace the control panel cable if it fails continuity test. Connect the cable. Power on the printer. If the symptom appears, replace the control panel.
2. Power off the printer. Make sure the flash memory is seated properly in J10 and J11 on the CMX controller board. Regardless of memory configuration, J11 must be used.  
Reseat flash memory.
3. Power on the printer.  
If black squares appear on the LCD, the flash memory could be blank. Replace the flash SIMM in J11 with a new flash SIMM with the boot program installed.
4. Power on the printer.  
If black squares appear on the LCD, replace the CMX controller board. Record the message and return it with defective CMX board. If the LCD displays characters correctly, download the emulation software again (page 285).

### **BUFFER OVERRUN Message**

1. The print buffer has overflowed on a serial interface. The printed output may contain random \* (asterisk) characters. Make a configuration printout. Verify that the printer matches the host serial interface configuration settings for Data Protocol, Baud Rate, Data Bits, Stop Bits, Parity, Data Terminal Ready, and Request to Send.  
Set printer serial interface parameters to match those of the host.
2. Send a print job to the printer.  
If the message appears, go to **Communications Failures**, page 85.

### Characters or dots are missing, smeared, too light, or too dark

1. Check the forms thickness lever: if it is set too loose or too tightly print quality can be affected.  
Set the forms thickness lever to match the thickness of the paper being used.
2. Check the paper tension between the tractors.  
Adjust the right tractor so that it does not pull paper too tightly or leave it too loose. The right tractor should hold the paper under "slight" tension.
3. Inspect the shuttle frame assembly for print chaff, debris, or ink residue that could be causing the problem.  
Clean the shuttle frame assembly.
4. Check the ribbon for folds or tears. Check that the ribbon guides are tight and the ribbon tracks straight across them.  
Rewind or install new ribbon. If the ribbon does not track straight across the ribbon guides, adjust the ribbon guides. If the ribbon guides are loose, tighten them. If the ribbon guides are damaged, replace them.
5. Power off the printer. Remove the shuttle cover. Remove the shuttle frame assembly. Inspect the ribbon mask for bends or deformation that adversely affect paper feeding. Make sure the hammer bank cover assembly is correctly installed on its mounting pegs. Check the shuttle frame assembly for broken hammer springs, hammer tips, or contaminations.  
Replace any damaged hammer spring assemblies. Replace the hammer bank cover assembly if it is deformed or damaged.
6. Check the platen gap.  
Adjust the platen gap.
7. Remove the paper guide assembly or pedestal top cover. Make sure Connectors P105 and P108 have good connections on the CMX controller board. Make sure connectors P04 and P05 have good connections at the shuttle frame assembly.  
Reseat connectors P04, P05, P105, and P108.
8. Power on the printer.  
If the problem still occurs, replace the shuttle frame assembly.
9. Power on the printer.  
If the problem still occurs, replace the power supply board.
10. Power on the printer.  
If the problem still occurs, replace the CMX controller board.

## CLEAR PAPER JAM Message

1. Inspect the paper path for jams.  
Clear jams. Load paper.
2. Press **FF** several times and check that forms feed without erratic motion, noise, or pin-hole damage.  
If forms do not feed, go to **Paper feeds poorly**, page 65.  
If forms feed, go to step 3.
3. Press **VIEW** once and check that forms move up.  
Make sure the forms thickness lever is not set too tightly.
4. Press **VIEW** again and check that the forms thickness lever rotates and the paper moves down.  
If the forms thickness lever does not rotate and/or the paper does not move down, refer to **Reverse paper feed: platen does not open**, page 71.
5. Check the paper tension between the tractors.  
Adjust the right tractor so that it does not pull paper too tightly or leave it too loose. The right tractor should hold the paper under "slight" tension.
6. Inspect the ribbon mask for bends or deformation that block the paper path or prevent paper from exiting the pedestal top cover.  
Replace a damaged hammer bank cover assembly.
7. Check the condition and tension of the platen open belt.  
Adjust the platen open belt. Replace the belt if it is damaged.
8. Check the platen open pulley and the platen pulley for looseness.  
Bottom out the platen open motor pulley on the motor shaft and tighten the 1/16 inch set screw. Tighten the 7/64 inch setscrew in the platen shaft pulley, then open and close the forms thickness lever and check that the platen pulley setscrew does not hit the left ribbon guide.
9. Inspect the tractors and tractor door springs for damage or excessive wear.  
If either tractor is worn or damaged, replace both tractor assemblies.
10. Check the condition and tension of the paper feed belt.  
Adjust the paper feed belt. Replace the belt if it is damaged.
11. Check the platen gap.  
Adjust the platen gap.
12. Clean the paper motion detector with a cotton swab and alcohol. At the control panel, set the paper motion detector (PMD) fault setting to **DISABLE**. Load paper. Run a print test and observe how the paper feeds.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board. If the message

does not appear, replace the paper detector switch assembly and set the paper motion detector (PMD) to ENABLE.

### **CLEAR PAPER JAM message instead of LOAD PAPER when printer is out of paper**

1. Power off the printer. Remove the paper path or pedestal top cover. Remove the barrier shield (cabinet model) or the barrier shield and paper guide (pedestal model). Check that the paper detector switch assembly is securely mounted in its bracket.  
Install the paper detector switch assembly.
2. Check that connector P106/PMD is fully seated in connector J106 on the CMX controller board.  
Connect P106/PMD to J106 on the CMX controller board.
3. Load paper. Power on the printer.  
Replace the paper detector switch assembly if either message appears.
4. Load paper. Power on the printer.  
Replace the CMX controller board if either message appears. Record the message and return it with defective CMX board.

### **CLEAR PAPER JAM message will not clear and paper does not move**

1. Remove the paper path or pedestal top cover. Make sure connector P107/PAPR M is fully seated in connector J107 on the CMX controller board.  
Connect P107/PAPR M to J107 on the CMX controller board.
2. Check the paper feed motor pulley for looseness.  
Hold the collar snug against the motor pulley and tighten the 7/64 inch setscrew.
3. Check the condition and tension of the paper feed timing belt.  
Adjust the paper feed timing belt. Replace the belt if it is damaged.
4. Load paper. Power on the printer. Press **FF** and **VIEW** several times and check that paper moves correctly in both directions.  
Replace the paper feed motor if the message appears or the paper moves erratically.
5. Power on the printer. Press **FF** and **VIEW** several times and check that paper moves correctly in both directions.  
Replace the CMX controller board if the message appears or the paper moves erratically. Record the message and return it with defective CMX board.

**CLEAR PAPER JAM message will not clear but paper moves**

1. Power off the printer. Remove the paper path or pedestal top cover. Check that connector P106/PMD is fully seated in connector J106 on the CMX controller board.  
Connect P106/PMD to J106 on the CMX controller board.
2. Remove the barrier shield (cabinet model) or the barrier shield and paper guide (pedestal model). Check that the paper detector switch assembly is securely mounted in its bracket.  
Install the paper detector switch assembly.
3. Check that the paper detector switch assembly is securely mounted to the mechanism base.  
Tighten the two screws securing the paper detector switch assembly to the mechanism base.
4. Check that the motion detector wheel rotates.  
Replace the paper detector switch assembly if the wheel does not rotate.
5. Load paper. Power on the printer.  
Replace the paper detector switch assembly if the message appears.
6. Load paper. Power on the printer.  
Replace the CMX controller board if the message appears. Record the message and return it with defective CMX board.

**CLEARING PROGRAM  
FROM FLASH Message**

1. Status message: emulation software successfully loaded into printer RAM and the checksum matched. The old program is now being deleted from flash memory.  
No action required.

**CLOSE PLATEN Message**

1. The forms thickness lever is open.  
Load paper. Close the forms thickness lever.
2. Power off the printer. Remove the paper path or pedestal top cover. Disconnect connector P107 from the CMX controller board. Check continuity of the platen interlock switch from P107/PLO to the switch.  
Replace the platen interlock switch assembly if it fails the continuity test. (Refer to Appendix A, Switch Assembly, Platen Interlock.)
3. Check that the platen interlock switch is not loose.  
Tighten the screws securing the platen interlock switch
4. Check the condition and tension of the platen open belt.  
Adjust the platen open belt. Replace the belt if it is damaged.

5. Check the platen open pulley and the platen pulley for looseness.  
Bottom out the platen open motor pulley on the motor shaft and tighten the 1/16 inch set screw. Tighten the 7/64 inch setscrew in the platen shaft pulley, then open and close the forms thickness lever and check that the platen pulley setscrew does not hit the left ribbon guide.
6. Disconnect connector P106 from the CMX controller board. Check the resistance of connector P106/PLAT M. (Refer to the Main Wire Harness Test Tables in Appendix A.)  
Replace the platen open motor if it fails the resistance test.
7. Run a print test.  
If the message appears, replace the CMX controller board. Record the message and return it with the defective board.

### **COIL HOT Message**

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#### **Note**



The printer has sensor circuits that sample the operating temperature of key components of the print mechanism. When higher than normal temperatures are sensed, print speed is automatically reduced by 50% and a COIL HOT message is sent to the LCD to inform the operator. When the coil(s) cool down, print speed automatically returns to 100% and the message clears from the LCD. This message is normal for extremely dense print jobs, such as “All Black” plot. If the printer often prints at half speed, it may be operating in a severe environment. A severe environment is one with an ambient temperature at or above 40° Celsius (104° Fahrenheit) or that is dirty enough to create blockage of the cabinet fan vents. The printer must never be run at ambient temperatures greater than 40° Celsius (104° Fahrenheit). If the printer is located in such an environment, relocate it to a cooler, cleaner area.

---

1. One or more hammer coils are overheating. Inspect printer environment for severity. (See NOTE above.)  
Advise the user to move the printer to cooler, cleaner location.
2. Check the kinds of print jobs the user is running: look for very dense graphics and layouts.  
Advise the user to run jobs in smaller batches.
3. Power off the printer. Remove the paper path or pedestal top cover. Check all fan cable connections.  
Connect fan cables.
4. Power on the printer. Verify that all fans operate.  
Replace any fan that does not operate.
5. Inspect vents and fan airways for obstructions. Look underneath cabinet models for items blocking the cabinet exhaust vents.  
Remove any obstructions from vents and airways.



6. Install the paper path or pedestal top cover. Load paper. Run the “All E’s” print test for 5 to 10 minutes.

If the message appears, replace the shuttle frame assembly.

7. Run the “All E’s” print test for 5 to 10 minutes.

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### **Control panel blank**

1. Power off the printer. Remove the paper path or pedestal top cover. Check all cable connections into the CMX controller board; make sure the control panel cable is seated in connector J110 on the controller board.

Connect all cables.

2. Power on the printer. Inspect the control panel display and cooling fans.

If the control panel is blank and the cooling fans come on, replace the control panel cable assembly and/or the control panel, as required.

3. Power on the printer.

If the control panel is blank and the fans do not come on, replace the CMX controller board.

### **Control panel keys do not work**

1. Power on the printer. Check the operation of the control panel keys.

Replace the control panel assembly.

2. Power on the printer. Check the operation of the control panel keys.

Replace the control panel cable assembly.

3. Power on the printer. Check the operation of the control panel keys.

Replace the CMX controller board.

### **Control panel display shows garbled, broken characters**

1. Remove the paper path or pedestal top cover. Check cable connections into the CMX controller board. Make sure the control panel cable is seated in connector J110 on the controller board.

Connect all cables.

2. Make sure the DRAM SIMM(s) is/are seated properly in J15/J16.

Reseat DRAM SIMM(s).

3. Power on the printer. Inspect the control panel display.

If the control panel shows broken characters, replace the DRAM.

**CTL VOLT FAIL\* Message**

1. Controller Voltage Failure. 15 V failure on the CMX controller board.  
Cycle Power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the flash memory.
3. Power on the printer. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.
4. Power on the printer. Run the print job again.  
If the message appears, replace the power supply board.
5. Power on the printer.  
If the message appears, replace the shuttle frame assembly.

**DIAGNOSTIC****PASSED Message**

1. Status message: the printer passed its memory and hardware initialization tests.  
No action required.

**Downloads consistently fail**

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**Note**

Most download problems are detected by software during the procedure and communicated by LCD messages. (See Table 6: on page 288.) If downloads fail consistently with no messages or with erratic messages, suspect a hardware failure.

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1. Power off the printer. Remove the paper path or pedestal top cover. Check the I/O cable connections from the host to the printer. Check the parallel cable connection at J112 on the CMX controller board. Inspect all cables for damaged, bent, broken, or burnt pins.  
Replace any damaged cables. Reconnect all I/O cables; make sure all connections are clean and tight.
2. Remove the flash SIMMs. Inspect the flash SIMM sockets on the CMX controller board.  
If any socket pins are bent or damaged, replace the CMX controller board.
3. Check that customer has the right size SIMMs for the emulation. (See page 154)  
Install SIMMs that support the emulation software.

4. Power up the printer. Download the emulation (page 285).  
If the download fails, activate the Boot Diagnostics Menu (page 89) and run MISC UTILITIES / RUN MEMORY TESTS. If memory fails test, replace the DRAM. If memory tests OK, replace the flash SIMM(s).
5. Power up the printer. Download the emulation (page 285).  
If the download fails, replace the CMX controller board.

### **DRVr CIR BAD\* Message**

1. Driver Circuit Bad: the hammer coil count test failed.  
Cycle power. If the message appears, press **CLEAR**.
2. Power off the printer. Remove the shuttle cover. At the shuttle frame assembly, disconnect the hammer bank logic and power cables. Power on the printer.  
If "HB NOT INSTALLED" appears on the LCD, replace the shuttle frame assembly. If "HB NOT INSTALLED" does not appear on the LCD, replace the CMX controller board.

### **ERROR: DC PROGRAM**

#### **NOT VALID Message**

1. The printer cannot find the data controller program or the validation checksum is corrupt.  
Download the program again (page 285). If the message appears, replace all flash memory SIMMs.

### **ERROR: DRAM AT**

#### **ADDRESS XXXXXXXX Message**

1. The printer found a defective memory location.  
Replace the DRAM.
2. Power on the printer.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### **ERROR: EC PROGRAM**

#### **NOT VALID Message**

1. The printer cannot find the engine controller program or the validation checksum is corrupt.  
Download the program again (page 285). If the message occurs again, replace all flash memory SIMMs.
2. Power on the printer. Download the emulation.

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### **ERROR: EC STOPPED**

#### **AT STATE XXXX Message**

**NOTE:** If the EC stops at state 0000 at power-up, replace the CMX controller board. Record the message and return it with the defective board.

1. Where XXXX is a number from 0000 to 0010. The Engine Controller has stopped and is in the state identified by the number displayed. Power off the printer. Remove all flash memory and DRAM SIMMs. Inspect the SIMM sockets on the CMX controller board.

If any socket pins are bent or damaged, replace the CMX controller board.

2. Install the flash and DRAM SIMMs, making sure they are fully and correctly seated. Power on the printer. Download the emulation (page 285).

If the message appears, replace the flash SIMM(s).

3. Power on the printer. Download the emulation.

If the message appears, replace the DRAM SIMM(s).

4. Power on the printer. Download the emulation.

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### **ERROR: FLASH**

#### **DID NOT PROGRAM Message**

1. The printer encountered an error trying to program flash memory.

Download the program again (page 285). If the message occurs again, replace the flash memory.

### **ERROR: FLASH**

#### **NOT DETECTED Message**

1. The printer could not find flash memory.

Check flash memory on the CMX controller board. If present, reseal the flash SIMMs; if missing, install flash SIMMs.

### **ERROR: NO DRAM**

#### **DETECTED Message**

1. The printer could not find any DRAM.

Check DRAM on the CMX controller board. If present, reseal DRAM; if missing, install DRAM.

**ERROR: NVRAM****FAILURE Message**

1. The non-volatile memory has failed.  
Replace the CMX controller board. (Do NOT attempt to replace NVRAM.) Record the message and return it with defective CMX board.

**ERROR: PROGRAM****NEEDS MORE DRAM Message**

1. The printer requires more DRAM memory in order to run the downloaded program.  
Add DRAM or use a smaller emulation program.

**ERROR: PROGRAM****NEEDS MORE FLASH Message**

1. The printer requires more flash memory in order to run the downloaded program.  
Add flash memory or use a smaller emulation program.

**ERROR: PROGRAM****NOT COMPATIBLE Message**

1. The printer is not compatible with the downloaded program.  
Use the correct emulation software option(s) for this model printer.

**ERROR: PROGRAM****NOT VALID Message**

1. The printer does not see a program in flash memory.  
There is no program in printer memory. Download the emulation (page 285).

**ERROR: SECURITY PAL****NOT DETECTED Message**

1. The security PAL is not present or has failed.  
Check the security PAL at location U54 on the CMX controller board. If the PAL is absent, install the correct PAL. If a security PAL is present, replace it.
2. Power on the printer.  
If the message appears, replace the replace the CMX controller board. Record the message and return it with the defective board.

**ERROR: SHORT AT  
ADDRESS XXXX Message**

1. Hardware failure in DRAM or CMX controller circuitry.  
Download the program again (page 285). If the message occurs again, replace the DRAM. If message occurs with new memory, replace the CMX controller board. Record the message and return it with defective CMX board.

**ERROR: WRITING  
TO FLASH Message**

1. Hardware or software fault in flash memory.  
Replace flash memory. If message occurs with new memory, replace the CMX controller board. Record the message and return it with defective CMX board.

**ERROR: WRONG  
CHECKSUM Message**

1. The printer received the complete program but the checksum did not match. The data may have been corrupted during download.  
Power off the printer. Download the program again from the beginning (page 285). If the message appears, replace the DRAM.
2. Download the program using a new software diskette.  
If the message appears, replace the flash memory.
3. Download the program.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

**EXHAUST FAN FLT Message**

1. Exhaust Fan Fault. Sensors cannot detect current in the fan circuit.  
Cycle power. If the message appears, press **CLEAR**.
2. Check that the exhaust fan is connected to exhaust fan cable connector J307.  
Connect the fan cable connector.
3. Power off the printer. Remove the paper path. Disconnect connector P107 from the CMX controller board. Test connector P107/EHF for shorts or opens. (Refer to the Main Wire Harness Test Tables in Appendix A.)  
Replace components that fail test.
4. Make sure connector P107/EHF has a good connection at J107 on the CMX controller board.  
Connect P107 to the CMX controller board.

5. Inspect for obstructions of airways and vents. Check for items beneath the printer blocking cabinet vents.  
Remove obstructions. Make sure cabinet exhaust fan vents are not blocked.
6. Power on the printer. Check for fan operation.  
If the message appears or the fan doesn't work, replace the exhaust fan.
7. Power on the printer.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### **FIRMWARE ERROR Message**

1. Application software tried to perform an illegal printer function or damaged memory is detected on the CMX controller board. (If the message appears at power-up, replace the CMX controller board. Record the message and return it with defective CMX board.)  
Cycle power. Run the print job. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the flash memory.
3. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.
4. Power on the printer. Run the print job again.  
If the message still appears, there is an application software error. Use your local support procedure to request assistance.

### **Flash SIMM won't copy**

1. Power off the printer. Remove the flash SIMMs. Inspect the flash SIMM sockets on the CMX controller board.  
If any SIMM socket pins are bent or damaged, replace the CMX controller board.
2. Make sure the blank SIMM is the same size as the SIMM to be copied. Install the SIMMs, making sure they are fully and correctly seated. Power on the printer. From the Boot Diagnostics menu, select and run MISC UTILITIES / COPY FLASH SIMMS. (See page 89.)  
If the DESTINATION NOT DETECTED message appears, the blank SIMM is not a type supported by the boot code on the original SIMM. If SOURCE LARGER THAN DESTINATION appears, the blank SIMM is not large enough to contain the code on the original SIMM. If the SIMM does not copy or the ERROR WRITING TO FLASH message appears, replace the blank SIMM.
3. Power on the printer. From the Boot Diagnostics menu, select and run MISC UTILITIES / COPY FLASH SIMMS.

If the new SIMM does not copy, replace the CMX controller board.

### **FM HEADER ERROR** Message

1. Frame Header Error. Application software has violated header parameters.

Not a printer problem. The system administrator should correct applications data or configuration.

### **FRAMING ERROR** Message

1. The printed output may contain random ! (exclamation point) characters. Make a configuration printout. Verify that the printer matches host configuration settings for Data Protocol, Baud Rate, Data Bits, Stop Bits, Parity, Data Terminal Ready, and Request to Send.

Set printer serial interface parameters to match those of the host.

2. Send a print job to the printer.

If the message appears, go to **Communications Failures**, page 85.

### **HAM. COIL OPEN\*** Message

1. Hammer Coil Open. Electrical malfunction of one or more hammer coils.

Cycle power. If the message appears, replace the shuttle frame assembly.

2. Power on the printer. Run a print test.

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### **HAMMER COIL BAD**

#### **#, #, #, #, ... etc.** Message

1. Hammer coil(s) number #, #, etc. failed the electrical current test at power-up. Check that the hammer bank cables are connected.

Cycle power. If the message appears, replace the shuttle frame assembly. Record the message and return it with the defective assembly.

2. Power on the printer.

If the message appears, replace CMX controller board. Record the message and return it with the defective assembly.

### **HB NOT INSTALLED\*** Message

1. Hammer Bank Not Installed. Self-test routines do not detect hammer coils at printer start-up. Power off the printer. Verify that the shuttle frame assembly is installed.

Install the shuttle frame assembly.



2. Remove the paper path or pedestal top cover. Verify that the hammer bank logic cable is connected to connector J108 on the CMX controller board and to the shuttle frame assembly.
 

Connect the hammer bank logic cable to connector J108 on the CMX controller board and to the shuttle frame assembly.
3. Power on the printer.
 

If the message appears, replace the hammer bank logic cable.
4. Power on the printer.
 

If the message appears, replace the shuttle frame assembly.
5. Power on the printer.
 

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### **HMR BANK FAN FLT Message**

1. Hammer Bank Fan Fault. Sensors cannot detect current in the fan circuit.
 

Cycle power. If the message appears, press **CLEAR**. If the message does not clear, go to step 2.
2. Power off the printer. Remove the paper path or pedestal top cover. Disconnect connector P107 from the CMX controller board. Test connector P107/HBF for shorts or opens. (Refer to the Main Wire Harness Test Tables in Appendix A.)
 

Replace components that fail test.
3. Make sure P107/HBF has a good connection at J107 on the CMX controller board.
 

Connect P107 to the CMX controller board.
4. Inspect for obstructions of airways and vents.
 

Remove obstructions.
5. Power on the printer.
 

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### **Horizontal misalignment of characters (Dots or characters move left or right from dot row to dot row or line to line)**

1. If dots between alternate dot rows are misaligned, check the hammer phasing.
 

Adjust hammer phasing.
2. If the printer is a 475 or 500 lpm model, check the shuttle speed setting.
 

Set the shuttle speed (page 125).
3. Inspect the shuttle frame assembly area for ink residue, paper chaff, or debris.
 

Clean the shuttle frame assembly.

4. Check the MPU gap.  
Using a feeler gauge, adjust the gap between the MPU assembly and the flywheel to  $0.010 \pm .001$  inch ( $0.254 \pm 0.025$  mm). Tighten the 7/16 inch MPU clamp screw.
5. Power up the printer. Run a print test.  
If the symptom is not gone, replace the MPU.
6. Power up the printer. Run a print test.  
If the symptom is not gone, replace the CMX controller board.
7. Power up the printer. Run a print test.  
If the symptom is not gone, replace the shuttle frame assembly.

#### **ILL EXT BUS ACC\* Message**

1. Illegal External Bus Access. Firmware error on the CMX controller board.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

#### **ILL INST ACCSS\* Message**

1. Illegal Instruction Accessed. Firmware error on the CMX controller board.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

#### **ILLGL OPR ACCSS\* Message**

1. Illegal Operand Accessed. Firmware error on the CMX controller board.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

#### **INTAKE FAN FAULT Message**

1. Sensors cannot detect current in the card cage fan circuit.  
Cycle power. If the message appears, press **CLEAR**. If the message does not clear, go to step 2.
2. Power off the printer. Remove the paper path or pedestal top cover. Disconnect connector P106 from the CMX controller board. Test

connector P106/CCF for shorts or opens. (Refer to the Main Wire Harness Test Tables in Appendix A.)

Replace components that fail test.

3. Make sure P106/CCF has a good connection at J106 on the CMX controller board.

Connect P106 to the CMX controller board.

4. Inspect for obstructions of airways and vents.

Remove obstructions.

5. Power on the printer.

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### **LO DRV. SHORT\*** Message

1. Lower Driver Short. Circuit(s) on the hammer bank or in the hammer bank power cable are shorted to ground.

Cycle power. If the message appears, press **CLEAR**. If message does not clear, replace the hammer bank logic cable and the hammer bank power cable.

2. Power on the printer.

If the message appears, replace the shuttle frame assembly.

3. Power on the printer.

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### **LOAD PAPER** Message

1. Printer is out of paper.

Load paper. Press **CLEAR**. If message does not clear, go to step 2.

2. Power off the printer. Remove the paper path or pedestal top cover. Remove the barrier shield (cabinet model) or the barrier shield and paper guide (pedestal model). Check that the paper detector switch assembly is securely mounted in its bracket.

Install the paper detector switch assembly.

3. Check that connector P106/PMD is fully seated in connector J106 on the CMX controller board.

Connect P106/PMD to J106 on the CMX controller board.

4. Load paper. Power on the printer.

Replace the paper detector switch assembly if message appears.

5. Load paper. Power on the printer.

Replace the CMX controller board if message appears. Record the message and return it with defective CMX board.

## LOADING PROGRAM

### FROM PORT XX% Message

1. Status message: the emulation program is loading into printer RAM. XX% indicates how much of the program has loaded.

No action required.

### No power, and control panel blank, and card cage fan not running

1. Check that the AC power outlet has power.  
Restore AC power.
2. Unplug the printer AC power cord from the printer (leave it plugged into the power outlet) and check for AC power at the printer end of the cord.  
If there is no power through the AC power cord, replace it. Plug the AC power cord into the printer and power outlet.
3. Remove the paper path or pedestal top cover. Verify that the AC-in power cable and the AC power input cables are connected to the on/off switch-circuit breaker. (See Figure 33, page 194 and Figure 40, page 208.)  
Connect the AC-in power supply cable and AC power input cables to the on/off switch-circuit breaker. Make sure all ground connections are clean and tight.
4. Check that AC-in power cable connector P1 is connected to J1 on the power supply board.  
Connect AC-in power cable connector P1 to J1.
5. Check that power supply cable connector P101 is connected to J101 on the CMX controller board.  
Connect power supply connector P101 to J101 on the CMX controller board.
6. Check all cable connections on the CMX controller board.  
Connect all cables.
7. Disconnect AC-in power supply cable connector P1. Set the circuit breaker to 1 (on). Measure AC voltage at pins 1 and 2 of connector P1.  
If no voltage, replace the circuit breaker. If there is voltage, replace the power supply board.

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## PAP BAD TABLE\* Message

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### Note



If this message appears during a software download, do the download again. If the message appears on the second try, replace the CMX controller board. Record the message and return it with defective CMX board.

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1. Paper Bad Table. The paper feed process on the CMX controller board has a corrupted table.

Cycle power. Run the print job again. If the message appears, download the emulation software again.

2. Cycle power. Run the print job again.

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

## PAP BSY TOO LNG\* Message

1. Paper Busy Too Long. Firmware error on the CMX controller board.

Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).

2. Run the print job again.

If the message appears, power off the printer. Remove the paper path or pedestal top cover. Make sure connectors P106 and P107 are fully seated on the CMX controller board. Make sure the MPU cable, the hammer bank logic cable, and the hammer bank power cable are undamaged and have good connections. Replace as necessary. (Refer to Appendix A.)

3. Power on the printer. Run the print job again.

If the message appears, replace the shuttle frame assembly.

4. Power on the printer. Run the print job again.

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

## PAP FIFO OVERFL\* Message

1. Paper First In First Out Overflow. Firmware error on the CMX controller board.

Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).

2. Power on the printer. Run the print job again.

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

**PAP FIFO UNDRFL\* Message**

1. Paper First In First Out Underflow.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Run the print job again.  
If the message appears, power off the printer. Remove the paper path or pedestal top cover. Make sure connectors P106 and P107 are fully seated on the CMX controller board. Make sure the MPU cable, the hammer bank logic cable, and the hammer bank power cable are undamaged and have good connections. Replace as necessary. (Refer to Appendix A.)
3. Check hammer phasing.  
Try using a lower phasing value; sometimes this message indicates too high a hammer phase value.
4. Power on the printer. Run the print job again.  
If the message appears, replace the shuttle frame assembly.
5. Power on the printer. Run the print job again.  
If the message appears, replace the power supply board.
6. Power on the printer. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

**PAP ILLGL ST\* Message**

1. Paper Illegal State. Firmware error on the CMX controller board.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

**PAP INCMPL ENER\* Message**

1. Paper Incompletely Energized. Firmware error on the CMX controller board.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

**PAP INVLD CMD\* Message**

1. Paper Invalid Command. Firmware error on the CMX controller board.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

**PAP INVLD PARM\* Message**

1. Paper Invalid Parameter. Firmware error on the CMX controller board.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

**PAP NOT SCHED\* Message**

1. Paper Not Scheduled. The paper feed process is not scheduling on the CMX controller board, and the printer cannot feed paper.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the MPU cable assembly.
3. Power on the printer. Run the print job again.  
If the message appears, replace the power supply board.
4. Power on the printer. Run the print job again.  
If the message appears, replace the shuttle frame assembly.
5. Power on the printer. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

**PAP NT AT SPEED\* Message**

1. Paper Not At Speed. Firmware error on the CMX controller board.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### PAP UNEXP INT\* Message

1. Paper Unexpected Interrupt. Firmware error on the CMX controller board.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### PARAMETER ERROR Message

1. Illegal parameter value received in a command code over a coax/twinax interface.  
Press **CLEAR** then press **ONLINE**.
2. Run the print job that generated the error message.  
If the message appears, check the host data for invalid characters.
3. Ask the system operator to verify that the printer's Device ID is set to the correct emulation with respect to the host configuration.  
Set printer Device ID to the correct emulation with respect to the host configuration.
4. Run the print job that generated the error message.  
If the message appears, go to **Communications Failures**, page 85.

### PARITY ERROR Message

1. The printed output may contain random ? (question mark) characters. Make a configuration printout. Verify that the printer matches host serial configuration settings for Data Protocol, Baud Rate, Data Bits, Stop Bits, Parity, Data Terminal Ready, and Request to Send.  
Set printer serial interface parameters to match those of the host.
2. Send a print job to the printer.  
If the message appears, replace the serial data cable.
3. Send a print job to the printer.  
If the message appears, go to **Communications Failures**, page 85.

### PLAT INV CMD\* Message

1. Platen Invalid Command. Firmware error on the CMX controller board.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.



**PLAT INV PARM\* Message**

1. Platen Invalid Parameter. Firmware error on the CMX controller board.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

**PLAT INV STATE\* Message**

1. Platen Invalid State. Firmware error on the CMX controller board.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

**PLEASE WAIT...****RESET IN PROGRESS Message**

1. Status message: the printer finished loading the program into flash memory and is automatically resetting itself.  
No action required.

**Paper feeds poorly**

1. Check the forms thickness lever: if it is set too tightly paper feeding can be affected.  
Set the forms thickness lever to match the thickness of the paper being used.
2. Power off the printer. Remove paper. Inspect the paper feed path for obstructions that could snag paper.  
Clear paper feed path of any obstructions.
3. Inspect the tractors and tractor door springs for damage or excessive wear.  
If either tractor is damaged or excessively worn, replace both tractor assemblies.
4. Check the paper feed motor pulley for looseness.  
Hold the collar snug against the motor pulley and tighten the 7/64 inch setscrew.
5. Check the condition and tension of the paper feed timing belt.  
Adjust the paper feed timing belt. Replace the belt if it is damaged.
6. Check the platen gap.  
Adjust the platen gap.

7. Remove the paper path or pedestal top cover. Make sure connector P107/PAPR M is fully seated in connector J107 on the CMX controller board.

Connect P107/PAPR M to J107 on the CMX controller board.
8. Load paper. Power on the printer. Press **FF** and **VIEW** several times and check that paper moves in both directions.

Replace the paper feed motor if paper does not move in both directions.
9. Power on the printer. Press **FF** and **VIEW** several times and check that paper moves in both directions.

Replace the CMX controller board if paper does not move in both directions.

### **Power on “hang” condition**

1. Remove the paper path or pedestal top cover. Check all cable connections to the CMX controller board and the power supply board.

Connect cables.
2. Power up the printer.

If the printer “hangs,” replace the CMX controller board.
3. Power up the printer.

If the printer “hangs,” replace the power supply board.

### **POWER SAVER MODE Message**

1. This is a status message. The printer is in low-energy idle state, all fans and higher voltages are off, only +5Vdc logic circuits are active.

No action required, but you can press the **FF** key to revive the printer from power saver mode.

### **POWER SUPPLY HOT Message**

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#### **Note**



The printer has sensor circuits that sample the operating temperature of key components of the power supply. When higher than normal temperatures are sensed, print speed is automatically reduced. If the printer runs at reduced speed for an extended period of time, the POWER SUPPLY HOT message is sent to the LCD and printing stops, allowing printer components to cool down. Pressing the **CLEAR** key resumes the print task. Check the operating environment. A severe environment is one with an ambient temperature at or above above 40° Celsius (104° Fahrenheit) or is dirty enough to create blockage of the cabinet fan vents. The printer must never be run at ambient temperatures greater than 40° Celsius (104° Fahrenheit). If the printer is located in such an environment, relocate it to a cooler, cleaner area.

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1. Inspect printer environment for severity. (See the NOTE above.)  
Advise the user to move the printer to cooler, cleaner location.
2. Check the kinds of print jobs the user is running: look for very dense graphics and layouts.  
Advise the user to run jobs in smaller batches.
3. Power off the printer. Remove the paper path or pedestal top cover. Check that the power supply guard/air deflector is correctly positioned over the power supply board. **WARNING: DO NOT TOUCH THE POWER SUPPLY**, but hold your hand close enough to check for heat radiating off the power supply board.  
If the power supply is noticeably hot, replace it.
4. Check that all fan cables are connected.  
Connect all fan cables.
5. Inspect vents and fan airways for obstructions. Look underneath cabinet models for items blocking the cabinet exhaust vents.  
Remove any obstructions from vents and airways.
6. Install paper path or pedestal top cover. Load paper. Power on the printer. Run the "All E's" print test for 5-10 minutes.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### Printer does not detect presence of power stacker

—or—

### Stacker not operating

1. Check that the power stacker is enabled under the Printer Control menu. (Refer to the *User's Guide*.)  
Enable the power stacker under the Printer Control menu. If the power stacker enable/disable option does not appear in the menu, go to the next step.
2. Open the rear cabinet door. Check that the ON/OFF indicator lamp is lit.  
If the ON/OFF indicator is not lit, go to step 3.  
If the ON/OFF indicator is lit, press the **ONLINE** key and check that the ONLINE indicator lights. If the ONLINE indicator comes on, the stacker is detected by the printer. If the ONLINE indicator does not come on, go to step 4.
3.
  - a) Power off the printer.
  - b) Unfasten the cable clamp holding the stacker control panel cables.
  - c) Disconnect the stacker power cable from the back of the stacker control panel. (See Figure 60, page 307.)
  - d) Locate pin 1 of connector P106. (See the cable assembly drawing in Appendix A.)
  - e) Power on the printer.
  - f) At connector P106 check for +48 volts DC between pins 1 and 2 and +5 volts DC between pins 3 and 4.

If the voltages are correct, replace the stacker control panel. If the voltages are not correct, power off the printer, remove the paper path, and disconnect the stacker power cable from the CMX controller board. (See Figure 64, page 311.) Check the continuity of the stacker power cable between P105 and P106. If the cable fails the continuity test, replace it. If the cable is OK, replace the CMX controller board.

4. Power off the printer. Remove the paper path. Disconnect stacker cables from the CMX controller board, stacker assembly, and the stacker control panel (see Figure 64, page 311). Check cables for cuts, breaks, or damaged pins. Check continuity of cables. (See Appendix A.)

Replace any cable that is damaged or fails continuity test. Reconnect all stacker cables to the CMX controller board, stacker, and stacker control panel.

5. Power on the printer. Check that the ONLINE indicator lights on the stacker control panel.

If the ONLINE indicator does not light, replace the stacker control panel.

6. Power on the printer. Check that the ONLINE indicator lights on the stacker control panel.

If the ONLINE indicator does not light, replace the CMX controller board.

### **Printer does not initialize**

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#### **Note**



Power-on initialization is explained on page 96.

1. Power off the printer. Remove the paper guide or pedestal top cover. Check that all cables are connected to the CMX controller board.  
Reseat all cable connectors on the CMX controller board, especially connectors P106 and P107.
2. Power up the printer.  
If the fans run but the printer does not initialize, replace the power supply board.
3. Power up the printer.  
If the fans run but the printer does not initialize, replace the CMX controller board.

### **Printer does not print from the host**

1. Check the host data cable connection at the rear of the printer.  
Attach the data cable to the printer interface.

2. Make a configuration printout. Verify that the printer matches host interface settings.

Set printer interface parameters to match those of the host.

3. Power up the printer. Send a print job from the host.

If printer does not print and the interface is RS-232, interchange the wires to pins 2 and 3. (This is the most common cause of an inoperative RS-232 cable.) Verify that the host and printer have the same baud rate, number of data bits, number of stop bits, and parity. Configure the host for XON/XOFF if possible, since this requires the least complex cable.

4. Power up the printer. Send a print job from the host.

If the printer does not print from the host, replace the data and interface cable assemblies.

5. Remove the paper path or pedestal top cover. Check all cable connections on the CMX controller board.

Reseat all cable connectors on the CMX controller board.

6. Power up the printer. Send a print job from the host.

If the printer still does not print from the host, replace the CMX controller board.

### **Printer does not print self tests**

1. Power off the printer. Remove the paper path or pedestal top cover. Disconnect the control panel cable from connector J110 on the CMX controller board. Disconnect the control panel cable from the control panel. Check continuity of the control panel cable assembly.

Replace the control panel cable assembly if it fails continuity test.

2. Connect the control panel cable assembly to J110 on the CMX controller board and to the control panel. Load paper. Power on the printer. Run a self test.

If the self test does not run, replace the control panel assembly.

3. Power on the printer. Run a self test.

If the self test does not run, replace the CMX controller board.

## PRINTER HOT Message

### Note



This message indicates internal temperatures over 60° Celsius (140° Fahrenheit). Print jobs will not create such temperatures, so immediately determine that the fans are operating and that all air vents are unobstructed. It is crucial that the exhaust vents on the floor of the cabinet remain unblocked, since hot air from inside the printer is vented through the cabinet floor. Nothing must be stored under the printer. Then check the operating environment. A severe environment is one with an ambient temperature at or above 40° Celsius (104° Fahrenheit) or is dirty enough to create blockage of the cabinet fan vents. The printer must never be run at ambient temperatures greater than 40° Celsius (104° Fahrenheit). If the printer is located in such an environment, relocate it to a cooler, cleaner area.

1. CMX controller board sensors report high temperatures on the board. Inspect printer environment for severity. (See the NOTE above.)  
Advise the user to move the printer to cooler, cleaner location.
2. Power off the printer. Remove the paper path or pedestal top cover. Check that all fan cables are connected.  
Connect all fan cables.
3. Inspect vents and fan airways for obstructions. Look underneath cabinet models for items blocking the cabinet exhaust vents.  
Remove any obstructions from vents and airways.
4. Install paper path or pedestal top cover. Load paper. Power on the printer. Run the "All Black" print test for 1/4 page.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

## PROTECTED INSTR\* Message

1. Protected Instruction. Firmware error on the CMX controller board.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

## PWR SUPP VOLT\* Message

1. Power Supply Voltage. The power supply has failed.  
Replace the power supply board.

## RESTORING

### BOOT CODE Message

1. Normal download initialization message.  
No action required.

### Reverse paper feed: platen does not open

1. Raise the forms thickness lever and check that the platen opens.  
If the platen opens with difficulty, inspect for and remove jams or obstructions.
2. Check the platen open pulley and the platen pulley for looseness.  
Bottom out the platen open motor pulley on the motor shaft and tighten the 1/16 inch set screw. Tighten the 7/64 inch setscrew in the platen shaft pulley, then open and close the forms thickness lever and check that the platen pulley setscrew does not hit the left ribbon guide.
3. Check the condition and tension of the platen open belt.  
Adjust the platen open belt. Replace the belt if it is damaged.
4. Check the platen gap.  
Adjust the platen gap.
5. Power off the printer. Remove the paper guide assembly. Disconnect connector P106 from the CMX controller board. Check the resistance of connector P106/PLAT M. (Refer to the Main Wire Harness Test Tables in Appendix A.)  
Replace the platen open motor if it fails the resistance test.
6. Power on the printer. Press **FF** and **VIEW** several times and check that paper moves in both directions.  
Replace the CMX controller board if the platen does not open during paper reverse.

### Randomly misplaced dots

1. Power off the printer. Check the platen gap.  
Adjust the platen gap.
2. Remove the paper guide assembly or pedestal top cover. On the left rear wall of the card cage, make sure the nut which secures the line filter ground line and the AC-In Power Supply cable lead to the ground stud is tight. (See Figure 33, page 194 and Figure 40, page 208.)  
Tighten the nut on the ground stud.
3. Disconnect the AC power cord and check the ground leads for continuity.  
Replace the AC power cord if it fails continuity test.
4. Make sure the printer is plugged in to a grounded power outlet. Power up the printer. Run a print test.

- If the problem occurs, replace the hammer bank logic cable.
- 5. Power up the printer. Run a print test.
  - If the problem occurs, replace the flash memory and DRAM. Download the emulation software again (page 285).
- 6. Power up the printer. Run a print test.
  - If the problem occurs, replace the CMX controller board.
- 7. Power up the printer. Run a print test.
  - If the problem occurs, replace the power supply board.
- 8. Power up the printer. Run a print test.
  - If the problem occurs, replace the shuttle frame assembly.

### **RIB INVLD CMD\* Message**

- 1. Ribbon Invalid Command. Firmware error on the CMX controller board.
  - Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
- 2. Cycle power. Run the print job again.
  - If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### **RIB INVLD STATE\* Message**

- 1. Ribbon Invalid State. Firmware error on the CMX controller board.
  - Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
- 2. Cycle power. Run the print job again.
  - If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### **RIBBON DRIVE Message**

- 1. The CMX controller board does not detect a ribbon drive motor.
  - Cycle power. If the message appears, power off the printer. Remove the paper path or pedestal top cover. Reseat the cable connections of both ribbon drive motors.
- 2. Power on the printer. Using a screwdriver, short across the ribbon guide screws to reverse ribbon hub motion. Check for a ribbon drive motor that will not wind the ribbon.
  - If the ribbon will not wind in one or both directions, replace the defective ribbon drive motor(s). If the ribbon winds in both directions, replace the CMX controller board. Record the message and return it with defective CMX board.



## Ribbon folding or feed problems

1. Check that both ribbon spools are fully seated on the ribbon hubs and the ribbon runs between the ribbon mask and hammer bank cover.  
Install the ribbon correctly.
2. Check that the ribbon spools are not rubbing against the shuttle cover assembly.  
Install the shuttle cover assembly correctly, so that the ribbon spools do not rub against it.
3. Inspect the paper print path for paper chaff, ink residue, and debris.  
Clean the shuttle frame assembly.
4. Power on the printer. Run a print test and observe ribbon movement across the left and right ribbon guides.  
Adjust the right and left ribbon guides.
5. Observe ribbon movement at both left and right ribbon posts as the metal end strip crosses each ribbon post.  
If the metal strip moves past either post without reversing the direction of the ribbon, power down the printer. Remove the paper path or pedestal top cover. Reseat connectors P106/LRP and P107/RRP on the CMX controller board.
6. While shorting across each ribbon post with the ribbon metal strip or a screwdriver, check for continuity in connector P106/LRP pins 10 and 12, and connector P107/RRP pins 14 and 16. (Refer to the Main Wire Harness Test Tables in Appendix A.)  
Replace a ribbon post that fails the continuity test.
7. Check the platen gap.  
Adjust the platen gap.

## SECURITY PAL NOT DETECTED Message

1. The security PAL is missing or has failed. Power off the printer. Remove the paper path or pedestal top cover.  
Check the security PAL at location U54 on the CMX controller board. If the PAL is absent, install the correct PAL. If security PAL is present, replace the CMX controller board. Record the message and return it with defective CMX board.

## SECURITY CODE VIOLATION Message

1. Security code of the PAL on the CMX controller board does not match the code of the firmware on the CMX controller board. Remove the paper path or pedestal top cover. Check that the security PAL is correctly installed.  
Install correct PAL for the customer's emulations with the notched end facing toward the flash and DRAM SIMM sockets.
2. Run a print test.

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### **SENDING PROGRAM**

#### **TO EC PROCESSOR Message**

1. Status message: the printer is loading the engine controller program into the engine controller.  
No action required.

#### **SF ERROR Message**

1. Structured Field Error. Application software has violated structured data field parameters.  
Not a printer problem. Have the system administrator correct applications data or configuration.

#### **Shuttle does not move**

1. Power down the printer. Remove the shuttle cover. Check the MPU gap.  
Adjust the gap between the MPU assembly and the flywheel to  $0.010 \pm .001$  inch ( $0.254 \pm 0.025$  mm). Tighten the 7/16 inch MPU clamp screw.
2. Check that the MPU cable is connected to J03 on the mechanism base. Check that the shuttle motor cable is connected to J02 on the mechanism base.  
Connect the MPU and the shuttle motor cables.
3. Remove the paper path or pedestal top cover. Check that the shuttle motor drive cable is connected to J116 on the CMX controller board.  
Connect the shuttle motor drive cable.
4. Check the platen gap.  
Adjust the platen gap.
5. Inspect the ribbon mask for bends or deformation that snag and interfere with shuttle movement. Make sure the hammer bank cover assembly is correctly installed on its mounting pegs.  
Reinstall the hammer bank cover assembly. Replace a damaged or deformed hammer bank cover assembly.
6. Check continuity of the shuttle motor drive cable assembly.  
Replace shuttle motor drive cable assembly if it fails continuity test.
7. Power up the printer. Run a Shuttle Slow or Shuttle Fast test.  
If the shuttle does not move, replace the shuttle frame assembly.
8. Power up the printer. Run a Shuttle Slow or Shuttle Fast test.  
If the shuttle does not move, replace the power supply board.
9. Power up the printer. Run a Shuttle Slow or Shuttle Fast test.

If the shuttle does not move, replace the CMX controller board.

### **SHUTL INV CMD\* Message**

1. Shuttle Invalid Command. Firmware error on the CMX controller board.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### **SHUTL INV PARM\* Message**

1. Shuttle Invalid Parameter. Firmware error on the CMX controller board.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### **Shuttle is noisy**

1. Check the bolts securing the mechanism base to the base pan.  
Tighten the mechanism base mounting bolts if they are loose enough to permit movement of the mechanism base.
2. Remove the shuttle cover. Check the shuttle frame assembly mounting/clamp screws for looseness.  
Tighten the 5/32 inch socket head clamp screws. Tighten the center captive 5/32 inch socket head screw.
3. Inspect the shuttle area for loose hardware.  
Tighten loose hardware.
4. Check that the hammer bank cover assembly is correctly installed, that it has not slipped off the mounting pegs. Check that the ribbon mask has not partially separated from the hammer bank cover. Check for debris trapped between the ribbon mask, hammer bank cover, and hammer bank.  
Clean the shuttle frame assembly and hammer bank cover assembly if you find debris. Replace the hammer bank cover assembly if you find any damage to the ribbon mask or hammer bank cover.
5. Power up the printer. Run a shuttle test.  
Replace the shuttle frame assembly if it is noisy or rattles.

## SHUTTLE JAM Message

1. The shuttle is not moving or is moving at the wrong speed. Check the forms thickness lever: if it is set too tightly, it can slow the shuttle enough to trigger the fault message.

Set the forms thickness lever to match the thickness of paper and provide satisfactory print quality, but not too tightly.

2. Check the platen gap.

Adjust the platen gap.

3. Inspect the ribbon mask for bends or deformation that snag and interfere with shuttle movement. Make sure the hammer bank cover assembly is correctly installed on its mounting pegs.

Reinstall the hammer bank cover assembly. Replace a damaged or deformed hammer bank cover assembly.

4. Run a print test.

If the message appears, power off the printer.

5. Remove the shuttle cover. Remove the paper path or the pedestal top cover. Inspect the shuttle mechanism for obstructions. Check that all cables are attached at the shuttle and the CMX controller board. Make sure the MPU cable is not pinched. (Refer to the Interconnection Diagrams in Appendix A.)

Remove obstructions and reseal all cables. Check the resistance of the MPU at connector P107. (Refer to the Main Wire Harness Test Tables in Appendix A.) Replace the MPU if it fails the test.

6. Run a shuttle test and observe shuttle movement.

If the shuttle oscillates too slowly, adjust the gap between the MPU assembly and the flywheel to  $0.010 \pm .001$  inch ( $0.254 \pm 0.025$  mm). Tighten the 7/16 inch MPU clamp screw.

7. Run a print test.

If the message appears, replace the MPU and the MPU cable assembly.

8. Run a print test.

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

9. Run a print test.

If the message appears, replace the power supply board.

10. Run a print test.

If the message appears, replace the shuttle frame assembly.

## **SOFTWARE ERROR\***

### **Cycle power Message**

1. Application software tried to perform an illegal printer function or damaged logic circuits were detected on the CMX controller board.  
Cycle power. If the message appears, power off the printer.
2. Disconnect the input data line from the host computer. Power on the printer.  
If the message appears, download the emulation software again (page 285).
3. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. If the message is gone, there is an application software error. Request assistance from your local support group.

### **STACK OVERFLOW\* Message**

1. Firmware error on the CMX controller board.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### **STACK UNDERFLOW\* Message**

1. Firmware error on the CMX controller board.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### **Stacker “chatters” at upper or lower limit**

1. Power off the printer. Unload paper. Open the rear cabinet door and check that stacker motion is not obstructed by the control panel cable or other obstruction.  
Remove obstruction or reroute the stacker control panel cable as necessary.
2. Verify that the stacker rails are vertical and parallel.  
Adjust the stacker rails if necessary: they must be vertical and parallel.
3. Move the elevator up and down by hand and check that the limit switches are being tripped at the highest and lowest limits of elevator travel.

Adjust the limit switches, if necessary, by gently bending the contact arms. Replace switches that cannot be adjusted.

4. Power on the printer. Operate the power stacker. (Refer to the *Quick Reference Guide*.) While the stacker is operating, check that:
  - a) all motors are operating
  - b) the paddles are rotating
  - c) the elevator moves smoothly and without obstruction
  - d) the timing belts are undamaged and the belt pulleys are not slipping
  - e) the extension springs are attached and undamaged (not bent or stretched)
  - f) the drive rollers are not damaged
  - g) the constant force springs are tightly mounted and undamaged

Tighten pulley setscrews and/or replace damaged components as necessary.

### **Stacker does not stack properly**

—or—

### **Stacker elevator does not move**

1. Check for obstructions preventing elevator movement.

Remove obstructions.
2. Check for misaligned stacker rails.

Adjust the stacker rails if they are not vertical and parallel.
3. Power on the printer. Operate the power stacker. (Refer to the *Quick Reference Guide*.) While the stacker is operating, check that:
  - a) all motors are operating
  - b) the paddles are rotating
  - c) the elevator moves smoothly and without obstruction
  - d) the timing belts are undamaged and the belt pulleys are not slipping
  - e) the extension springs are attached and undamaged (not bent or stretched)
  - f) the drive rollers are not damaged
  - g) the constant force springs are tightly mounted and undamaged

Tighten pulley setscrews and/or replace damaged components as necessary.
4. Check the stacker limit switches. (See page 81.)

If the limit switches are OK, go to the next step.
5. Check the stacker motors. (See page 82.)

If the stacker motors are OK, go to the next step.
6. Remove the paper path. Disconnect stacker cables from the CMX controller board, stacker assembly, and the stacker control panel (see Appendix H). Check cables for cuts, breaks, or damaged pins. Check continuity of cables. (See Appendix A.)

Replace any cable that is damaged or fails continuity test. Reconnect all stacker cables to the CMX controller board, stacker, and stacker control panel.

## Stacker elevator moves by itself

1. Power off the printer. Inspect all stacker LEDs for dust, chaff, or dirt. (See Figure 79 through Figure 82, page 328 through page 334.)  
Clean the stacker LEDs and the sight tubes in the LED mounts.
2. Power on the printer.  
If the stacker elevator moves by itself, replace the stacker LEDs. (See Figure 79 through Figure 82, page 328 through page 334.)

## STACKER FAULT Message

**NOTE:** This message is triggered when the elevator cannot reach either the top or bottom position switch before timing out.

1. Power on the printer. Operate the power stacker. (Refer to the *Quick Reference Guide*. Check for obstructions preventing elevator movement.  
Remove obstructions.
2. Operate the power stacker. While the stacker is operating, check that:
  - a) all motors are operating
  - b) the paddles are rotating
  - c) the elevator moves smoothly and without obstruction
  - d) the timing belts are undamaged and the belt pulleys are not slipping
  - e) the extension springs are attached and undamaged (not bent or stretched)
  - f) the drive rollers are not damaged
  - g) the constant force springs are tightly mounted and undamagedTighten pulley setscrews and/or replace damaged components as necessary.
3. Check for misaligned stacker rails  
Adjust the stacker rails if they are not vertical and parallel.
4. Check the stacker limit switches. (See page 81.)  
If the limit switches are OK, go to the next step.
5. Disable the power stacker unit under the Printer Control menu. (Refer to the *User's Guide*.)  
If the message occurs, replace the CMX controller board.
6. Power off the printer. Remove the paper path. Disconnect stacker cables from the CMX controller board, stacker assembly, and the stacker control panel (see Appendix H). Check cables for cuts, breaks, or damaged pins. Check continuity of cables. (See Appendix A.)  
Replace any cable that is damaged or fails continuity test. Reconnect all stacker cables to the CMX controller board, stacker, and stacker control panel.

### STACKER FULL Message

1. Status message: the power paper stacker is full.  
Unload the stacker.
2. Check the stacker limit switches. (See page 81.)  
If the limit switches are OK, go to the next step.
3. Power off the printer. Remove the paper path. Disconnect stacker cables from the CMX controller board, stacker assembly, and the stacker control panel (see Appendix H). Check cables for cuts, breaks, or damaged pins. Check continuity of cables. (See Appendix A.)  
Replace any cable that is damaged or fails continuity test. Reconnect all stacker cables to the CMX controller board, stacker, and stacker control panel.

### STACKER JAM Message

1. Paper is bunching above the elevator or the paper motion detector is not working properly.  
Remove the paper jam.
2. Power off the printer. Check that the wheel of the stacker paper motion detector rests against the rear brace of the paper throat. Also make sure the wheel rotates freely on its axle.  
If necessary, gently bend the brace toward the paper motion detector wheel until the wheel contacts the brace. Clean the stacker paper motion detector.
3. Power on the printer. Operate the power stacker. (Refer to the *Quick Reference Guide*.) While the stacker is operating, check that:
  - a) all motors are operating
  - b) the paddles are rotating
  - c) the elevator moves smoothly and without obstruction
  - d) the timing belts are undamaged and the belt pulleys are not slipping
  - e) the extension springs are attached and undamaged (not bent or stretched)
  - f) the drive rollers are not damagedTighten pulley setscrews and/or replace damaged components as necessary.
4. Power off the printer. Remove the paper path. Disconnect stacker cables from the CMX controller board, stacker assembly, and the stacker control panel (see Appendix H). Check cables for cuts, breaks, or damaged pins. Check continuity of cables. (See Appendix A.)  
Replace any cable that is damaged or fails continuity test. Reconnect all stacker cables to the CMX controller board, stacker, and stacker control panel.



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## Stacker limit switch check

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### Note



This procedure tests the motion limit switches at the top and bottom of the vertical rails. You will usually be referred to this procedure from other troubleshooting procedures. When you have completed this procedure, return to the procedure that sent you here.

- 
1. Power off the printer. Open the rear cabinet door. Unload the power stacker. Move the elevator up and down by hand, checking that it moves smoothly and without chattering or shuddering.

Eliminate causes of chattering or shuddering. (E.g., loose, damaged, or broken constant force springs, bent or misaligned rails, obstructions, etc.)

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### Note



If the elevator assembly or the rails are bent or damaged, you must replace the entire power stacker assembly.

- 
2. Move the elevator up and down by hand. Check that the limit switches are physically tripped when elevator reaches top and bottom of travel.

If necessary, gently bend the contact arms to adjust limit switches. If you cannot adjust a switch that requires adjustment, replace it.

3.
  - a) Unfasten the cable clamp holding the stacker control panel cables.
  - b) Disconnect stacker rail cable connector P107 from connector J3 on the back of the stacker control panel. (See Figure 60, page 307.)
  - c) Locate pin 1 of connector P107. (See the cable assembly drawing on page 260.)
  - d) Check the stacker rail cable and limit switches for continuity and shorts. Check continuity of the switch when open and closed. (See the power stacker control panel PCBA pinout drawing on page 239. STK FULL is the upper limit switch, STK LIMIT is the bottom switch.)

Replace the stacker rail cable if it is damaged or fails continuity test. Replace any switch that fails continuity test.

## Stacker motor check

### Note



This procedure tests the four stacker motors and their cables. You will usually be referred to this procedure from other troubleshooting procedures. When you have completed this procedure, return to the procedure that sent you here.

1. a) Power off the printer.  
 b) Open the rear cabinet door.  
 c) Unfasten the cable clamp holding the stacker control panel cables.  
 d) Disconnect stacker rail cable connector P107 from connector J3 on the back of the stacker control panel. (See Figure 60, page 307.)  
 e) Disconnect stacker frame cable connector P102 from connector J4 on the rear of the stacker control panel. (See Figure 60, page 307.)  
 f) Locate pin 1 of connector P102 and connector P107. (See the cable assembly drawings on page 257 and page 260.)  
 g) Check both cables for pin damage, continuity, and shorts. Check all motors for  $15.2 \pm 1.5$  Ohms on both phases. (Refer to the power stacker control panel PCBA pinout drawing on page 239.)

Replace any cable that is damaged or fails continuity test.

Replace any motor that fails the resistance test.

## TABLE MISMATCH

### DOWNLOAD AGAIN Message

1. This message indicates that an EC software update is in process.

Power off the printer. Download the program again from the beginning (page 285).

### TCB CORRUPTED\* Message

1. Task Control Block Corrupted. Firmware error on the CMX controller board.

Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).

2. Cycle power. Run the print job again.

If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### TOF is lost repeatedly

1. Check that the customer is setting the forms length to match the size paper used.

Set the forms length to match the length of paper being used.

2. If the customer is using multi-part forms, check that the forms thickness lever is not being set too tightly.  
Set the forms thickness lever to match the thickness of paper and provide satisfactory print quality, but not too tightly.
3. Check the paper feed motor pulley for looseness. Make sure the correct pulley is being used: it should have 25 teeth.  
Hold the collar snug against the motor pulley and tighten the 7/64 inch setscrew. Replace the paper feed pulley if it does not have 25 teeth.
4. Check the condition and tension of the paper feed timing belt.  
Adjust the paper feed timing belt. Replace the belt if it is damaged.
5. Remove the paper path or pedestal top cover. Make sure connector P107/PAPR M is fully seated in connector J107 on the CMX controller board.  
Connect P107/PAPR M to J107 on the CMX controller board.
6. Power on the printer. Load paper and set TOF. Press **FF** and **VIEW** several times and check that paper returns to TOF.  
Replace the paper feed motor if paper does not return to TOF.
7. Power on the printer. Press **FF** and **VIEW** several times and check that paper returns to TOF.  
Replace the CMX controller board if paper does not return to TOF.

### **UNDEF INTERRUPT\*** Message

1. Undefined Interrupt. Firmware error on the CMX controller board.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### **UNDFNED OPCODE\*** Message

1. Undefined Opcode. Firmware error on the CMX controller board.  
Cycle power. Run the print job again. If the message appears, download the emulation software again (page 285).
2. Cycle power. Run the print job again.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.

### UP DRV. SHORT\* Message

1. Upper Driver Short. Hammer driver circuits on the CMX controller board are shorted to ground.  
Cycle power. If the message appears, press **CLEAR**. If the message does not clear, replace the hammer bank logic cable and the hammer bank power cable assemblies.
2. Power on the printer.  
If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.
3. Power on the printer.  
If the message appears, replace the shuttle frame assembly.

### Vertical misalignment of characters:

- Dots or characters move up or down from dot row to dot row or line to line

- Incorrect spacing from dot row to dot row or line to line

- Characters randomly compressed and/or enlarged

1. Load paper. Press **FF** and check that paper feeds smoothly. Press **VIEW** to verify that paper moves in both directions. Check the forms thickness lever: if it is set too loose or too tightly print quality can be affected.  
Set the forms thickness lever to match the thickness of the paper being used.
2. Check the paper feed motor pulley for looseness.  
Hold the collar snug against the motor pulley and tighten the 7/64 inch setscrew.
3. Check the condition and tension of the paper feed timing belt.  
Adjust the paper feed timing belt. Replace the belt if it is damaged.
4. Check the platen gap.  
Adjust the platen gap.
5. Inspect the tractors and tractor door springs for damage or excessive wear.  
If either tractor is damaged or excessively worn, replace both tractor assemblies.
6. Remove the paper guide assembly or pedestal top cover. Make sure connector P107/PAPR M is fully seated in connector J107 on the CMX controller board.  
Connect P107/PAPR M to J107 on the CMX controller board.
7. Load paper. Power on the printer. Run a print test.  
If the problem occurs, replace the paper feed motor.
8. Run a print test.

If the problem occurs, replace the CMX controller board.

9. Run a print test.

If the problem occurs, replace the power supply board.

## Communications Failures

Many host-printer communications problems are complex. With the exception of a defective interface cable, most communications problems are not a result of a hardware failure. They usually result from an incompatible configuration of the host computer system, network (LAN, print server, controller, multiplexer, etc.), or the printer. Sometimes the print application program itself is at fault.

If you have limited communications experience, and the cause of the problem is not readily apparent, do the following:

1. Print out the printer configuration.
2. Obtain a copy of the Device Host Configuration if possible.
3. Call your support group for assistance in problem analysis.

If you cannot obtain support, or you have experience solving host-printer communications problems, the following additional information is provided.

You can quickly check the ASCII portion of the printer logic by sending a plain text file from a PC to the printer via the parallel or serial port. For a description of each of the ASCII interfaces, refer to the *User's Guide*.

**Table 4: Common Communications Problems**

Problems	Interface	Common Causes
Fails to print from host -or- Prints incorrect characters -or- Prints extra characters -or- Drops characters	Parallel	- Interface cable defective - Host/Network configuration - Printer logic - Terminating Resistors
	Serial	- Host/Printer interface cable pinouts incompatible - Host/Printer/Network configuration - Set DTR and RTS both True - Interface cable defective - Printer logic

## Diagnostic Printer Tests

---

A set of printer tests is included in the configuration menu structure for use as diagnostic tools. Use these printer tests to check the print quality and basic operation of the printer. You will also use some of the tests in some adjustment procedures. The diagnostic printer tests are summarized below:

- **Shift Recycle** — A “sliding” alphanumeric pattern useful for identifying missing or malformed characters, improper vertical alignment, or vertical compression.
- **All E’s** — A pattern of all uppercase letter E’s useful for identifying missing characters, misplaced dots, smeared characters, improper phasing, or light/dark character variations.
- **E’s + TOF** — A pattern of all E’s repeated for ten lines and followed by a form feed to the top of the next page. This test is useful for identifying paper motion or paper feed problems.
- **All H’s** — A pattern of all uppercase letter H’s useful for detecting missing characters or dots, smeared characters, or improper phasing.
- **Underline Only** — An underline pattern useful for identifying hammer bank misalignment.
- **All Black** — Prints all dot positions, creating a solid black band. Exercises the shuttle and hammer bank at maximum capacity.
- **Shuttle Slow** — Exercises the shuttle and ribbon mechanisms at low speed. You can also use this test to check ribbon tracking and reversing.
- **Shuttle Fast** — Exercises the shuttle and ribbon mechanisms at high speed. You can also use this test to check ribbon tracking and reversing.
- **Shuttle Only** — Runs the shuttle mechanism with no ribbon movement.
- **Phase Printer** — A hammer timing test that permits you to adjust the hammer phase value. The hammer phase value is a timing parameter that controls the vertical alignment of dots in character printing. The numerical units are relative, they do not represent a physical measurement or value. There is no “correct” value or range. The factory prints the initial phase value on the casting of the shuttle assembly, next to the motor housing. Use this value as your starting point when adjusting hammer phasing.
- **Paperout Adj.** — Prints a vertical comb pattern. You use this pattern when you do the end of forms (paper out) adjustment procedure. The comb pattern lets you measure the number of dot rows from the completion of a paper out fault to the end of the paper.
- **Burnin Test** — Do not use. This test is used by the printer manufacturer to burn in the printer prior to shipment and has no value as a maintenance tool.

## Selecting and Running Diagnostic Printer Tests

**Note**



You must set TOF after running any diagnostic test.

Step	Press	LCD Result	Notes	
1.			Make sure the printer is on. Raise the printer cover.	
2.			Load paper.	
3.			Set TOF. (Refer to the <i>User's Guide</i> .)	
4.	ON LINE 	OFFLINE CONFIG. CONTROL	The printer must be offline to run a print test.	
5.	 + 	ENTER SWITCH UNLOCKED		
		OFFLINE CONFIG. CONTROL	Unlocks <b>ENTER</b> key and control panel.	
6.	 UNTIL	OFFLINE DIAGNOSTICS		
7.		DIAGNOSTICS Printer Tests		
8.	 UNTIL	DIAGNOSTICS Test Width		
9.		Test Width Full Width*		
10.	 OR 	Test Width X		Cycle through choices. X = Full Width or X = 80 columns.
11.	ENTER 	Test Width X*		
12.		DIAGNOSTICS Test Width		
13.	 UNTIL	DIAGNOSTICS Printer Tests		

Step	Press	LCD Result	Notes
14.		Printer Tests Shift Recycle*	
15.	 OR 	Printer Tests All E's	
16.	ENTER 	Printer Tests All E's*	
17.	ENTER 	Printer Tests All E's*	
18.	 + 	ENTER SWITCH LOCKED	
19.	ON LINE 	ONLINE LinePrinter+	
20.	Examine print quality. Characters should be fully formed and of uniform density.		
21.	Set TOF. (Refer to the <i>User's Guide</i> .)		



## Boot Diagnostics Menu

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Printer boot-up software contains a “Boot Diagnostics” menu that you can access by holding down two keys while powering on the printer. This menu is not intended for the end user, but provides useful information for manufacturing and maintenance personnel.

The boot diagnostics menu is a multi-level menu that operates the same way as the user menus. The menu structure is shown in Figure 7 on page 90.

### Activating the Boot Diagnostics Menu

1. Set the printer power switch to O (off).
2. On cabinet models, raise the printer cover.
3. On the control panel, press and hold down ◀ (PREV) + ▼ (DOWN).
4. While holding ◀ (PREV) + ▼ (DOWN), set the printer power switch to 1 (on).
5. When “BOOT DIAGNOSTICS / PRESS ENTER” appears on the LCD, release the ◀ (PREV) + ▼ (DOWN) keys.
6. Press the ENTER key. Menu options are shown in Figure 7.

### Exiting the Boot Diagnostics Menu

**Method 1:** Resetting the printer from the Boot Diagnostics Menu

1. Using the directional keys, move to the MISC UTILITIES / RESET PRINTER menu option. (Refer to the menu map on page 90.)
2. Press the ENTER key.

**Method 2:** Cycling power

1. Power off the printer.
2. Wait 15 seconds.
3. Power on the printer.

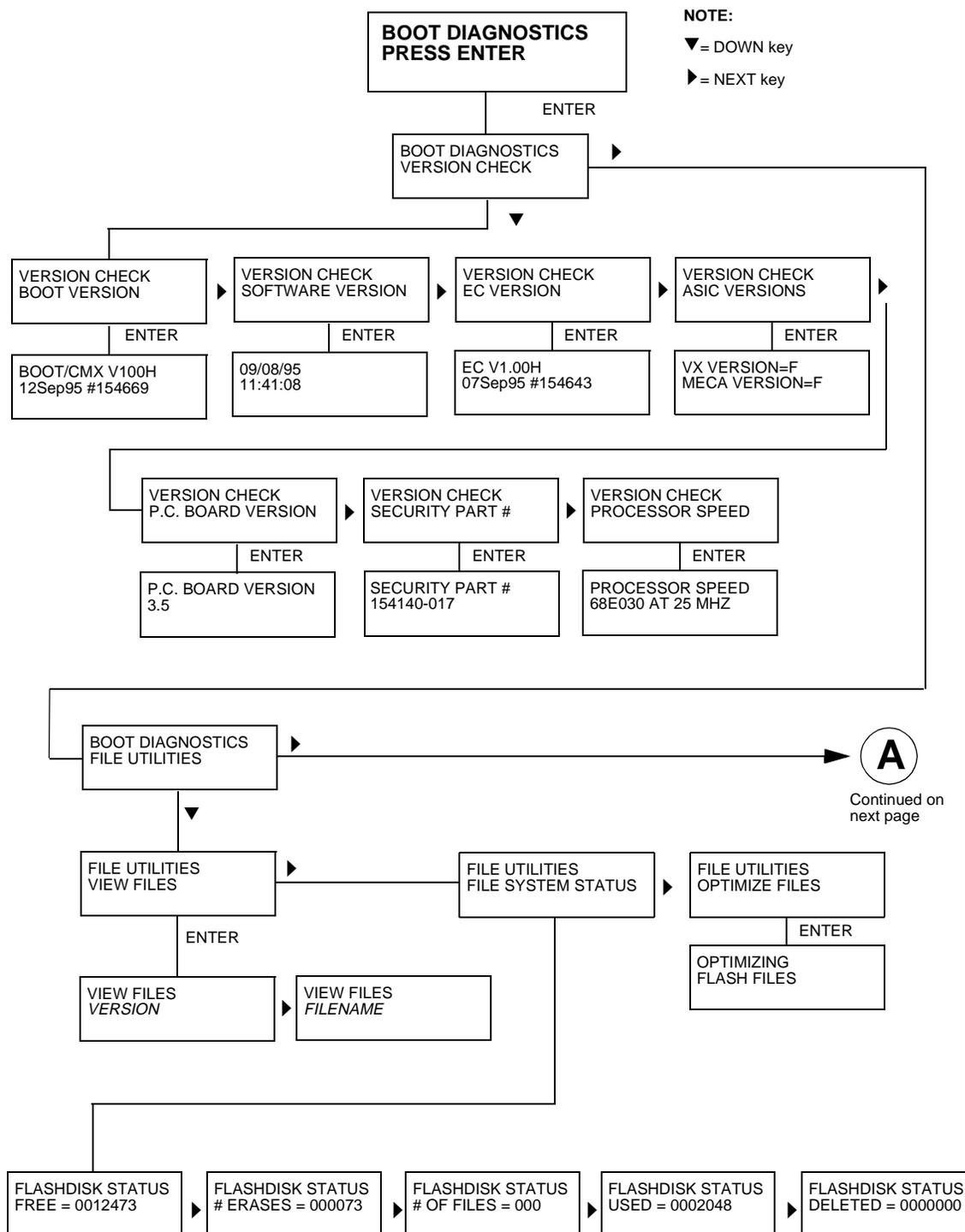


Figure 7. Boot Diagnostics Menu

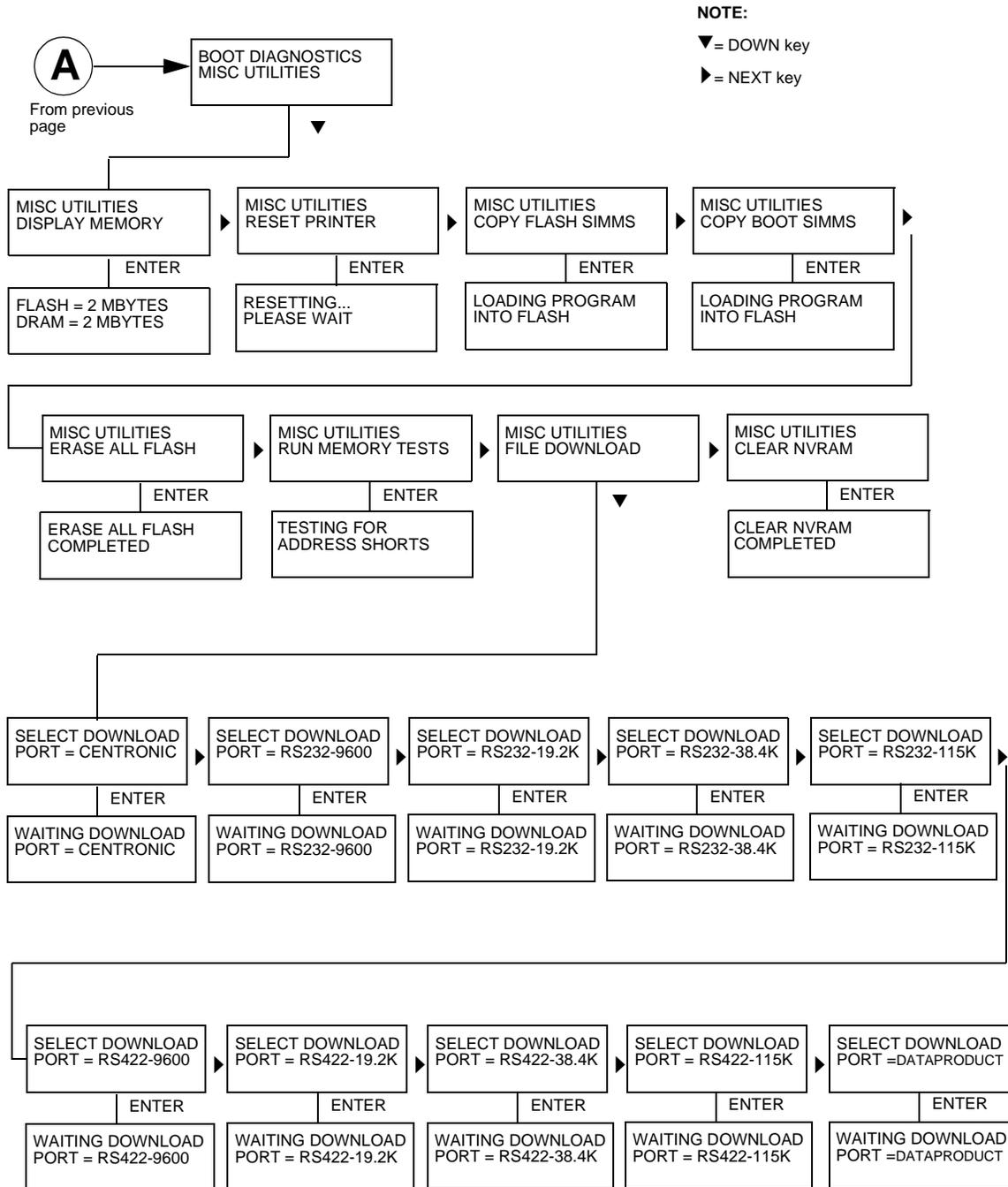


Figure 7. Boot Diagnostics Menu (continued)

## Hex Code Printout

A hex code printout (or “hex dump”) prints every ASCII data character received from the host computer, and lists its corresponding two-digit hexadecimal code. (See Figure 8 below.) You can use hex dumps as an aid in troubleshooting data reception problems.

In a hex dump every printable character is printed both as its assigned symbol and as its hex equivalent. Every unprintable (ASCII control) character is printed out as a period (.) and its hex equivalent. If the printer is using a parallel interface, the letter “p” before a hex code indicates an active Paper Instruction (PI) line, and a blank space before a hex code indicates an inactive PI line.

To convert an ASCII character to its corresponding hex code, or vice versa, refer to the ASCII code chart on page 94. To make a hex code printout, refer to the procedure on page 93.

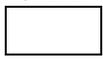
```

!"#$%&'()*+,-./ 20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F
0123456789:;<=>? 30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F
@ABCDEFGHIJKLMNO 40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F
PQRSTUVWXYZ[\]^_ 50 51 52 53 54 55 56 57 58 59 5A 5B 5C 5D 5E 5F
`abcdefghijklmno 60 61 62 63 64 65 66 67 68 69 6A 6B 6C 6D 6E 6F
pqrstuvwxyz{|}~ 70 71 72 73 74 75 76 77 78 79 7A 7B 7C 7D 7E 20
!"#$%&'()*+,-./0 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F 30
123456789:;<=>?@ 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F 40
ABCDEFGHIJKLMN 41 42 43 44 45 46 47 48 0D 0A 21 22 23 24 25 26
'()*+,-./0123456 27 28 29 2A 2B 2C 2D 2E 2F 30 31 32 33 34 35 36
789:;<=>?@ABCDEF 37 38 39 3A 3B 3C 3D 3E 3F 40 41 42 43 44 45 46
GHIJKLMNOPQRSTU 47 48 49 4A 4B 4C 4D 4E 4F 50 51 52 53 54 55 56
WXYZ[\]^_`abcd 57 58 59 5A 5B 5C 5D 5E 5F 60 61 62 63 64 65 66
ghijklmnopqrst 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74 75 76
wxyz{|}~!"#$%&' 77 78 79 7A 7B 7C 7D 7E 20 21 22 23 24 25 26 27
()*+,-./01234567 28 29 2A 2B 2C 2D 2E 2F 30 31 32 33 34 35 36 37
89:;<=>?@ABCDEF 38 39 3A 3B 3C 3D 3E 3F 40 41 42 43 44 45 46 47
HI..!"#$%&'()*+,- 48 49 0D 0A 22 23 24 25 26 27 28 29 2A 2B 2C 2D
./0123456789:;<= 2E 2F 30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D
>?@ABCDEFGHIJKLM 3E 3F 40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D
NOPQRSTUVWXYZ[\ 4E 4F 50 51 52 53 54 55 56 57 58 59 5A 5B 5C 5D
^_`abcdefghijklm 5E 5F 60 61 62 63 64 65 66 67 68 69 6A 6B 6C 6D
nopqrstuvwxyz{|} 6E 6F 70 71 72 73 74 75 76 77 78 79 7A 7B 7C 7D
~!"#$%&'()*+,-. 7E 20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E
/0123456789:;<=> 2F 30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E
?@ABCDEFGHIJ..## 3F 40 41 42 43 44 45 46 47 48 49 4A 0D 0A 23 24
%&'()*+,-./01234 25 26 27 28 29 2A 2B 2C 2D 2E 2F 30 31 32 33 34
56789:;<=>?@ABCD 35 36 37 38 39 3A 3B 3C 3D 3E 3F 40 41 42 43 44
EFGHIJKLMNOPQRST 45 46 47 48 49 4A 4B 4C 4D 4E 4F 50 51 52 53 54
UVWXYZ[\]^_`abcd 55 56 57 58 59 5A 5B 5C 5D 5E 5F 60 61 62 63 64
efghijklmnopqrst 65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74
uvwxyz{|}~!"#$% 75 76 77 78 79 7A 7B 7C 7D 7E 20 21 22 23 24 25
&'()*+,-./012345 26 27 28 29 2A 2B 2C 2D 2E 2F 30 31 32 33 34 35
6789:;<=>?@ABCDE 36 37 38 39 3A 3B 3C 3D 3E 3F 40 41 42 43 44 45
FGHIJK..%&'()*+ 46 47 48 49 4A 4B 0D 0A 24 25 26 27 28 29 2A 2B
,-./0123456789: 2C 2D 2E 2F 30 31 32 33 34 35 36 37 38 39 3A 3B
<=>?@ABCDEFGHIJK 3C 3D 3E 3F 40 41 42 43 44 45 46 47 48 49 4A 4B
LMNOPQRSTUVWXYZ 4C 4D 4E 4F 50 51 52 53 54 55 56 57 58 59 5A 5B
\]^_`abcdefghijkl 5C 5D 5E 5F 60 61 62 63 64 65 66 67 68 69 6A 6B
lmnopqrstuvwxyz{ 6C 6D 6E 6F 70 71 72 73 74 75 76 77 78 79 7A 7B
}|}~!"#$%&'()*+ 7C 7D 7E 20 21 22 23 24 25 26 27 28 29 2A 2B 2C

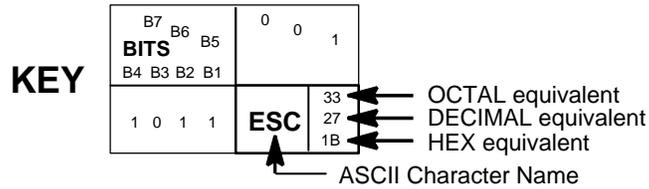
```

Figure 8. Sample Hex Dump

## How to Print a Hex Dump

Step	Press	LCD Result	Notes
1.	Make sure the printer is on. Raise the printer cover.		
2.	ON LINE 	OFFLINE CONFIG. CONTROL	
3.	 + 	ENTER SWITCH UNLOCKED	Unlocks <b>ENTER</b> key and control panel.
		OFFLINE CONFIG. CONTROL	
4.	 UNTIL	OFFLINE MAINT / MISC	
5.		MAINT / MISC Hex Dump Mode	
6.		Hex Dump Mode Disable*	Default
7.	 OR 	Hex Dump Mode Enable	Cycle through choices.
8.	ENTER 	Hex Dump Mode Enable*	Asterisk (*) indicates choice is active.
9.	 + 	ENTER SWITCH LOCKED	Locks the ENTER key and control panel.
10.	ON LINE 	ONLINE LinePrinter+	Places the printer in online mode.
11.	Send a file from the host computer. The printer outputs a hex dump. Refer to the ASCII chart on page 94.		
12.	When the hex dump is complete, take the printer offline and change the Hex Dump Mode back to Disable. Follow the steps outlined above and select Disable.		

# ASCII Character Set



BITS		COLUMN		1		2		3		4		5		6		7	
B7	B6	B5	B4	B3	B2	B1	ROW	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	NUL	DLE	SP	0	@	P	\	p		
0	0	0	1	1	1	1	1	SOH	DC1 (XON)	!	1	A	Q	a	q		
0	0	1	0	2	2	2	2	STX	DC2	"	2	B	R	b	r		
0	0	1	1	3	3	3	3	ETX	DC3 (XOFF)	#	3	C	S	c	s		
0	1	0	0	4	4	4	4	EOT	DC4	\$	4	D	T	d	t		
0	1	0	1	5	5	5	5	ENQ	NAK	%	5	E	U	e	u		
0	1	1	0	6	6	6	6	ACK	SYN	&	6	F	V	f	v		
0	1	1	1	7	7	7	7	BEL	ETB	,	7	G	W	g	w		
1	0	0	0	8	8	8	8	BS	CAN	(	8	H	X	h	x		
1	0	0	1	9	9	9	9	HT	EM	)	9	I	Y	i	y		
1	0	1	0	10	10	10	10	LF	SUB	*	:	J	Z	j	z		
1	0	1	1	11	11	11	11	VT	ESC	+	;	K	[	k	{		
1	1	0	0	12	12	12	12	FF	FS	,	<	L	\	l			
1	1	0	1	13	13	13	13	CR	GS	-	=	M	]	m	}		
1	1	1	0	14	14	14	14	SO	RS	.	>	N	^	n	~		
1	1	1	1	15	15	15	15	SI	US	/	?	O	_	o	DEL		

## Soft vs. Hard Reset

---

### Soft Reset

A soft(ware) reset clears printer memory then loads the power-up configuration set by the user. (If no power-up configuration has been set by the user, the factory default configuration is loaded.) It is called a soft reset because no hardware is tested. All diagnostic and initialization tests are bypassed and memory is simply refreshed with the power-up printer configuration.

The printer must be offline to do a soft reset:

1. Press the **ON LINE** key to put the printer in the offline state.
2. Press the **◀ (PREV) + ▶ (NEXT)** keys simultaneously.

The LCD will display “Standby / Soft Reset” while the printer loads the power-up configuration.

### Hard Reset (“Cycle Power”)

A hard(ware) reset is a power shutdown and restart that runs all initialization and diagnostic routines. This is also called “cycling power.”

1. Set the printer power switch to 0 (off).
2. Wait 15 seconds.
3. Set the printer power switch to 1 (on).

---

#### Note



A hard printer reset causes the +48V power supply (fans, motors, etc.) to shut down in 1 to 5 seconds, depending on the amount of memory installed on the controller board.

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## The Power On Sequence

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This section describes the normal sequence of events from the time the power switch is set to 1 until “ONLINE” (or “OFFLINE” if so configured by the user) appears on the LCD.

Use this sequence as a reference baseline to help you isolate problems that occur before the printer completes its boot and initialization routines.

The power on sequence consists of two sets of routines:

1. CMX controller board handshake sequences (DC hardware initialization)
2. DC software initialization and power up

The routines are listed below, in order of occurrence.

### CMX Controller Board Handshake Sequences

---

- **Processor Alive** — The green LED marked CR1 on the CMX controller board is turned on to indicate that the processor received a valid reset vector and the first instructions to the processor are correct. This LED is used to report all DC errors and states.
- **Test VX Data Bus** — A walking zero and one test verifies that all 32 data lines from the VX bus to the processor are connected. If a bad line is detected, a 4-1-1-XX blink code is sent to the LED on the CMX controller, where XX is the data line plus 1. (For example, a bad data line 8 would blink as 4-1-1-9.)
- **Initialize VX ASIC** — The boot code detects the processor type and sets up the internal registers of the VX ASIC.
- **Initialize Debug Serial Port** — The boot code checks the validity of the debug serial parameters in NVRAM; if they are valid, it sets the baud rate, data type, and which messages should be sent out the debug port. If the values in NVRAM are not valid, boot code initializes NVRAM to 9600 baud, 8 data bits, one stop bit, no parity bit, and standard messages.
- **Turn On Instruction Cache** — The instruction cache is turned on to help speed up memory tests and the entire boot process.
- **Enable DRAM Controller** — A DRAM controller is built into the VX ASIC. DRAM must be refreshed a few times to operate correctly. To speed the boot process, the refresh rate is temporarily increased. The message “TESTING HARDWARE PLEASE WAIT” is sent to the LCD, during which time the refreshes run and finish. At this point, the fans start. After sending the message, the refresh rate is set to the proper rate and DRAM is ready to be tested.
- **Test I/O Clock** — The VX ASIC has two clocks for internal timing, a processor clock and an I/O clock. The processor clock cannot be checked because the processor will not run without it, but the I/O clock can be checked. The I/O clock is used for sending data to the control panel and to get the time for DRAM refreshes. If the boot code detects a problem with the I/O clock, the error blink code 4-3-4 is sent to the diagnostic LED on the CMX board.



- **Read Control Panel Keys** — The control panel keys are read to determine if the user is requesting that the printer be placed in download mode, diagnostic mode, or debug SIMM disabled. If **ON LINE** and **FF** are pressed during start-up, the printer is placed in download mode. If **◀ (PREV)** and **▼ (DOWN)** are pressed during start-up, the printer is placed in diagnostic mode. If any other combination of keys are pressed, the debug SIMM is disabled. Key states are put in an internal register in the VX ASIC.
- **Detect DRAM** — The VX ASIC supports up to four banks of DRAM totalling up to 32 Megabytes. Boot code detects how much DRAM is located in each bank, and relocates the banks to create one contiguous block of DRAM. The size and location of each bank is then displayed on the debug terminal through the debug serial port.
- **Test DRAM** — DRAM is tested by writing a pseudo-random number sequence to all the DRAM, then reading the pattern back to verify it against what was originally written. If an error is detected, the message “ERROR: DRAM AT ADDRESS XXXXXXXX” is displayed on the LCD. When finished, the DRAM test sets all memory to zero.
- **Inform the EC Processor** — The first 8 Kilobytes of DRAM are reserved for the EC processor, which must be notified when DRAM is ready to be used. This is done by putting the message “DCS1” in the ECDC communications register in the VX ASIC.
- **Detect Ethernet Adapter** — An Ethernet™ adapter must be detected early in the power up sequence so the printer can tell the adapter it has been detected and continue with its own power up sequence. An Ethernet adapter takes a long time to complete its internal diagnostic tests, so the boot code allows the adapter to power up in parallel with the printer to reduce its effect on overall boot time.
- **Load Boot Messages** — The boot code scans flash memory for OEM boot messages and loads them into DRAM. The manufacturer’s boot code is the same for all OEMs, and contains a set of default messages. Boot messages for specific OEMs are stored in the DC code, not the boot code.
- **Load Boot Code into DRAM** — Flash memory cannot be accessed while flash is being detected, cleared, or programmed. This prevents boot code from running in flash because the opcodes cannot be fetched. This is solved by copying the program into DRAM and executing the program out of DRAM. The boot code is position-independent in order for the program to operate at a different address. The interrupt vector table is also move to DRAM and the vectors are changed to reflect the new address.
- **Detect Flash** — The boot code supports many different kinds of flash memory, permitting any mixture of flash in the four memory banks. The only requirement is that flash must exist in bank 0 and have boot code programmed on it. The boot code displays flash configuration, manufacturer’s part number, size, and start address out the debug serial port.
- **Display VX Registers** — The boot code displays the values of the VX registers out of the debug serial port.

- **Check for Pedestal** — Boot code uses the control panel to determine if the printer is a pedestal or floor cabinet model. Boot code needs to know the difference so the exhaust fan fault can be disabled on a pedestal model. “FAN DISABLED” is printed out at the debug serial port of a pedestal model.
- **Check for Download Mode** — Boot code checks whether the **ON LINE** and **FF** keys were pressed at power up. If so, the printer enters download mode. If not, the printer continues the boot routines.
- **Check for Diagnostics Mode** — Boot code checks whether the **◀ (PREV)** and **▼ (DOWN)** keys were pressed at power-up. If so, the printer enters the Boot Diagnostics menu. If not, the printer continues the boot routines.
- **Check for Remote Download Mode** — Boot code checks if the user remotely requested the printer to enter download mode. If so, the printer enters download mode. If not, the printer continues boot routines.
- **Check for Flash Optimize** — Boot code checks if the user requested the flash file system to be optimized at power up. If so, flash memory is optimized at this time. If not, the printer continues boot routines.
- **Check EC Program** — The EC calculates a checksum of the program stored in its flash memory. If there is problem with its program, the EC puts the message “nopg” in the ECDC communications register. If the boot code detects this message, it displays “ERROR: EC PROGRAM NOT VALID” on the LCD. If the EC processor does not respond within three seconds, the boot code sends “EC STOPPED AT STATE XXXX” to the LCD, where XXXX is one of these states:

State	Description
0000	Power up
0001	Enter checksum calculation
0002	Enter copy download code from FLASH into shared DRAM
0003	Enter programming FLASH mode
0004	Erase EC FLASH
0005	Program FLASH
0006	Finish programming FLASH
0007	Enter initialization of EC serial debug
0008	Enter EC firmware task initializations
0009	Enter power up coil diagnostic
000A	Start running normal EC firmware

- **Check Security PAL and NVRAM** — The chip select for NVRAM comes from the security PAL. If the PAL is not installed, NVRAM cannot be accessed, so the PAL is tested before NVRAM. If the security PAL is not

detected, boot codes displays “ERROR: SECURITY PAL NOT DETECTED”. If a security PAL is detected, boot code checks for the presence of NVRAM. If NVRAM is not found, boot code displays “ERROR: NVRAM FAILURE”.

- **Test for Powerup File** — Boot code checks for a DC executable file called powerup.sbr. If found, it executes the file, then returns to boot routines. If the file is not found, boot routines are resumed. If any key was held down during power up, boot code does not look for the powerup file and continues the boot sequence.
- **Automatic EC Update** — Boot code checks whether the automatic EC update feature is enabled by the DC program. If so, it looks for a copy of the EC program in the Flash File System. If it has a copy, it compares the program in EC flash to the program in the Flash File System, and updates the EC program if they are different. If the automatic EC update was not enabled, or if any key was held down during power up, automatic EC update is skipped and the boot sequence continues normally.
- **Debug SIMM** — The debug SIMM contains fast static RAM that automatically replaces the flash memory. Boot code checks for the debug SIMM and, if found, copies the contents of flash memory into the SIMM, then remaps the address of the SIMM to the location of flash. This allows breakpoints and single-stepping from the MTOS debugger. When the debug SIMM is found, boot code displays “DEBUG SIMM ACTIVATED” on the panel and out the debug port.
- **Verify DC Program** — Boot code calculates a checksum at every power up to verify that the program has not been corrupted. If the checksum does not match, boot code displays “ERROR: DC PROGRAM NOT VALID”.
- **Check Security** — The security check verifies that security PAL supports the software that is loaded in flash memory. If the PAL does not support the software, boot code displays “SECURITY CODE VIOLATION”.
- **Check Required DRAM** — Boot code checks whether the amount of DRAM required to run the DC program is larger than the amount of DRAM in the printer. If so, it displays the message “ERROR: PROGRAM NEEDS MORE DRAM”.
- **Tell EC Processor to Finish Booting** — Boot code informs the EC processor that everything is okay and can finish booting up.
- **Diagnostics Passed** — If all tests pass, boot code displays “DIAGNOSTICS PASSED”. At this point, the ribbon motors engage. Boot code then jumps to the start address of the DC software.
- **Display DC Program Information** — Boot code sends the following information out the debug port: the compile time, date, and the address it will jump to to start the DC program.
- **Waiting Ethernet** — If boot code earlier detected an Ethernet adapter, it places the message “WAITING FOR THE ETHERNET ADAPTER” on the LCD so the user will not think the printer has crashed.
- **Jump Back into Flash and Clear DRAM** — Boot code jumps back into flash memory, then clears the DRAM that held the boot code.

- **Jump to MTOS** — Jump to start initialization of the MTOS® (Multi-Tasking Operating System).

## DC Software Initialization and Power Up

---

The final part of the power up sequence is initialization and startup of the DC software, which occurs in the following order:

- **Clear Uninitialized RAM Variables**
- **Set Initialized RAM Variables**
- **Configure RAM (allocated based upon amount in the printer)**
- **Jump to MTOS (Multi-Tasking Operating System)**
- **Initialize the Processor (cache, vector table, etc.)**
- **Partition RAM for Tasks**
- **Allocate Peripheral Interfaces (console driver, etc.)**
- **Start Main Task (supervisor)**
- **Verify and Initialize NVRAM (statistics are cleared if NVRAM is not valid)**
- **Initialize Libraries (fault, system, emulation)**
- **Load Front Panel Menus from ROM**
- **Initialize these tasks, then start them after all have initialized:**
  - Print Engine Driver Task
  - CT Driver Task (sends 8344 code to the CT expansion board)
  - Serial Driver Task
  - Parallel Driver Task
  - CT Emulation Task
  - IGP Task (VGL)
  - Base Emulation Task:
    - Initialize Fonts
    - Initialize Graphics Library
    - Complete Emulation Library Initialization
    - Wait for all emulation tasks to initialize
  - Front Panel Task
- **Display “ONLINE” on control panel**

---

# 5

## *Adjustment Procedures*

### **Introduction**

---

The printer is a durable, low-maintenance machine, but some components and systems require occasional adjustment.

Usually, you will be referred to this chapter by a troubleshooting procedure, or as part of a removal/installation procedure.

## Preparing the Printer for Maintenance

---

To prepare the printer for maintenance, do the following steps *before* you make any adjustments:

---

### Warning



**Unplug the printer power cord from the printer or power outlet before you do any maintenance procedure. Failure to remove power could result in injury to you or damage to equipment. If you must apply power during maintenance, you will be instructed to do so in the maintenance procedure.**

---

---

### Note



Do not attempt field repairs of electronic components or assemblies. Do not de-solder any circuit board components. Replace a malfunctioning electronic assembly with an operational spare. Most electronic problems are corrected by replacing the printed circuit board assembly, sensor, or cable that causes the fault indication. The same is true of failures traced to the hammer bank—you must replace the entire shuttle frame assembly. It is not field repairable. Hammer spring assemblies are the only replaceable components of the shuttle frame assembly.

---

1. Set the printer power switch to O (off).
2. Unplug the printer power cord from the printer or AC power source.
3. Disconnect the data (signal) cable from the printer interface.
4. Open the printer cover.
5. Unload paper.
6. Remove the ribbon.
7. Read the entire maintenance procedure before you begin working on the printer.
8. Gather the necessary parts before you begin working on the printer.

---

## Returning the Printer to Normal Operation

---

When you are finished servicing the printer, do the following steps:

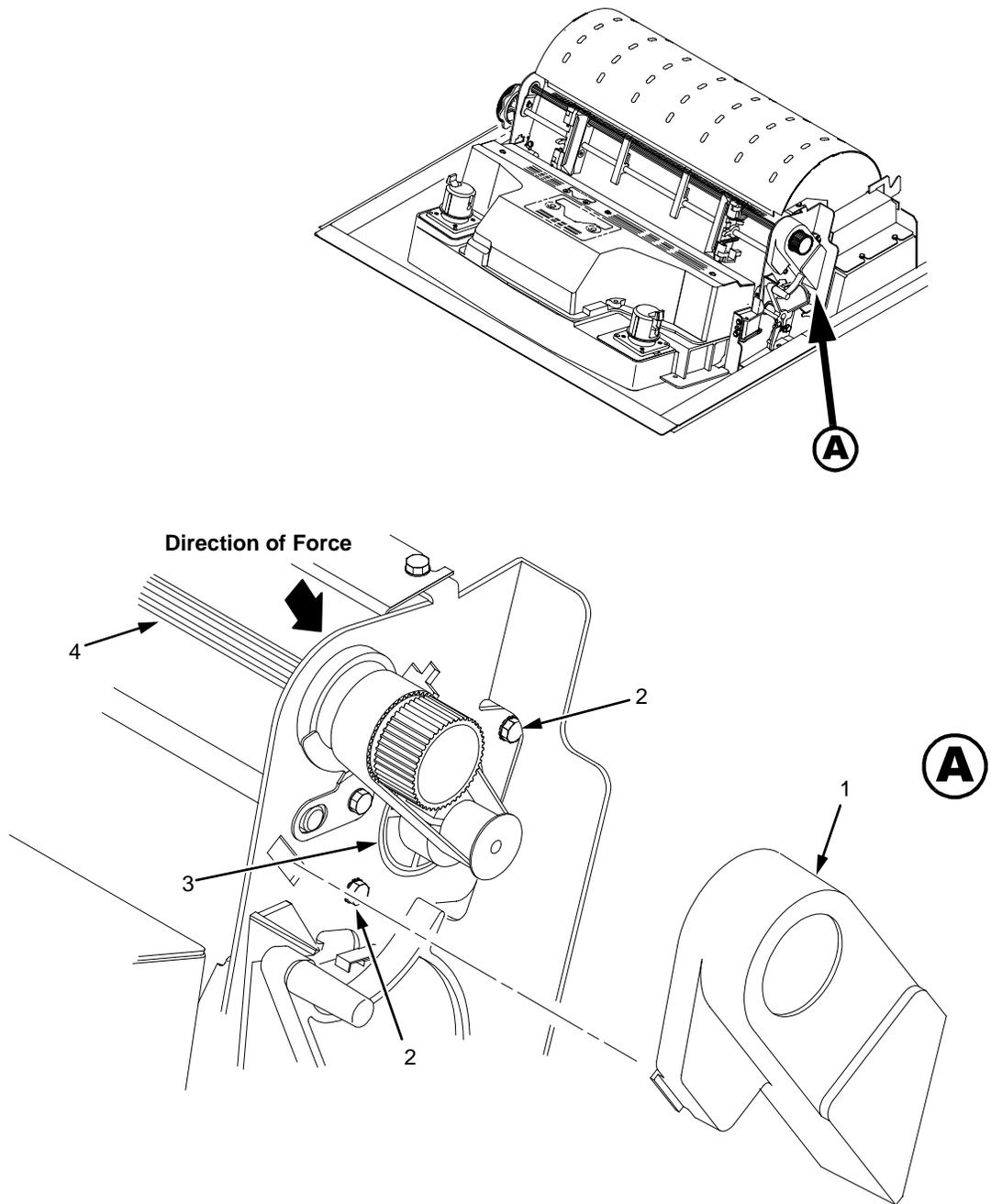
1. Install the ribbon.
2. Load paper.
3. Connect the data (signal) cable to the printer interface.
4. Plug the AC power cord into the printer and the power source.
5. Close the cabinet doors.
6. Set the printer power switch to | (on).
7. Test printer operation by selecting and running one of the operator print tests. (See page 87.)
8. Select the emulation. (Refer to the *User's Guide*.)
9. Set the top-of-form. (Refer to the *User's Guide*.)
10. Close the printer cover.

## Belt, Paper Feed Timing, Adjustment (Figure 9)

---

1. Prepare the printer for maintenance (page 102).
2. Cabinet Models: Remove the paper path (page 158).  
Pedestal Models: Remove the top cover assembly (page 143).
3. Cabinet Models: Loosen four screws and remove the barrier shield. (See page 190, items 3, 4 and 9.)  
Pedestal Models: Loosen the four screws securing the paper guide and barrier shield and remove both. (See page 192, items 3, 4, and 5.)
4. Remove the timing belt cover (1) by squeezing the front and back to release the plastic tabs from the slots in the side plate.
5. Loosen (do not remove) the two 5/16 inch motor mount bolts (2).
6. Push the motor (3) toward the rear of the printer until there is 1/8 inch deflection of the belt midway between the pulleys, then tighten the two 5/16 inch mount bolts.
7. Snap the timing belt cover (1) into the slots in the side plate.
8. Cabinet Models: Install the barrier shield and tighten the four screws. (See page 190, items 3, 4 and 9.)  
Pedestal Models: Install the barrier shield and paper guide and tighten the four screws. (See page 192, items 3, 4, and 5.)
9. Cabinet Models: Install the paper path (page 158).  
Pedestal Models: Install the top cover assembly (page 143).
10. Return the printer to normal operation (page 103).





**Legend:**

- 1) Timing Belt Shield
- 2) Motor Mount Bolt (2)
- 3) Paper Feed Drive Motor
- 4) Splined Shaft

**Figure 9. Paper Feed Timing Belt Adjustment**

## Belt, Platen Open, Adjustment (Figure 10)

---

1. Prepare the printer for maintenance (page 102).
2. Cabinet Models: Remove the paper path (page 158).  
Pedestal Models: Remove the top cover assembly (page 143).
3. Remove the platen open belt cover (1) by squeezing the top and bottom to release the plastic tabs from the slots in the side plate.
4. Loosen the two 5/16 inch motor mount screws (2) enough to permit movement of the platen open motor. (Some motors are mounted with nuts and bolts; other motors have threaded flanges, eliminating the need for nuts.)
5. Close the forms thickness lever all the way.

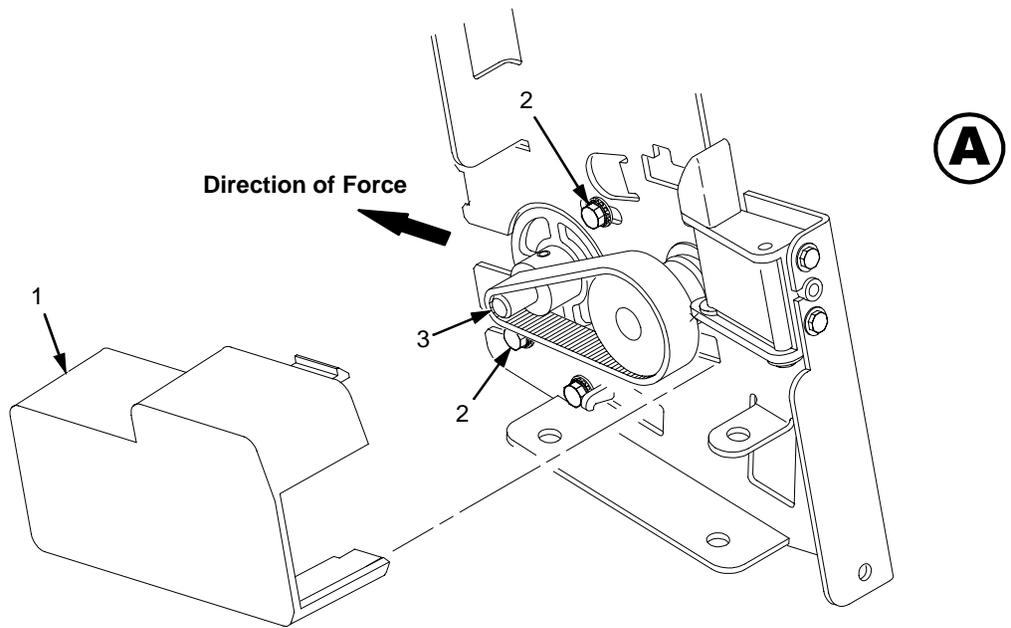
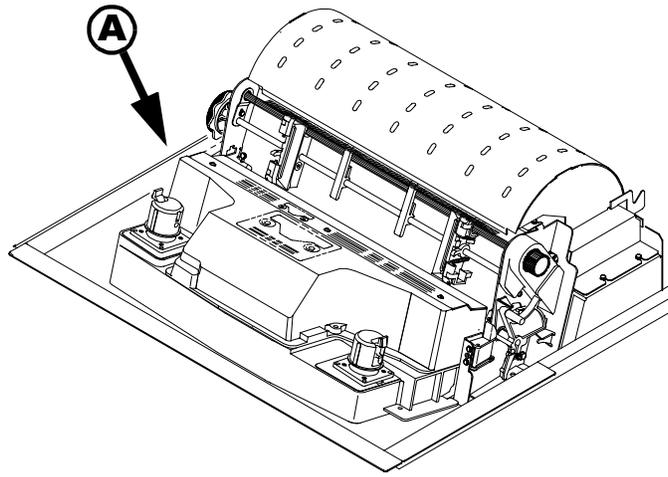
---

### Caution



Too much tension on the platen open belt can cause the platen gap to change, which can lead to premature wear of the platen, damaged hammer tips, and poor print quality.

- 
6. Push the platen open motor toward the rear of the printer until there is 1/8 inch belt deflection midway between the pulleys, then tighten the upper motor mount screw with a 5/16 inch nutdriver. Tighten the lower motor mount screw with a 5/16 inch open end wrench. Check belt deflection after both motor mounts have been tightened.
  7. Snap the platen open belt cover (1) into the slots in the side plate.
  8. Cabinet Models: Install the paper path (page 158).  
Pedestal Models: Install the top cover assembly (page 143).
  9. Return the printer to normal operation (page 103).



**Legend:**

- 1) Belt Cover
- 2) Motor Mount Screw (2)
- 3) Platen Open Motor Shaft

**Figure 10. Platen Open Belt Adjustment**

## Paper Drive Motor Pulley Alignment (Figure 11)

---

1. Prepare the printer for maintenance (page 102).
2. Cabinet Models: go to step 3.  
Pedestal Models: Remove the top cover assembly (page 143).
3. Remove the timing belt cover (1) by squeezing the front and back to release the plastic tabs from the slots in the side plate.
4. Loosen the 7/64 inch screw (2) in the motor pulley collar (3).
5. Align the paper drive motor pulley (4) with the splined shaft pulley (5).

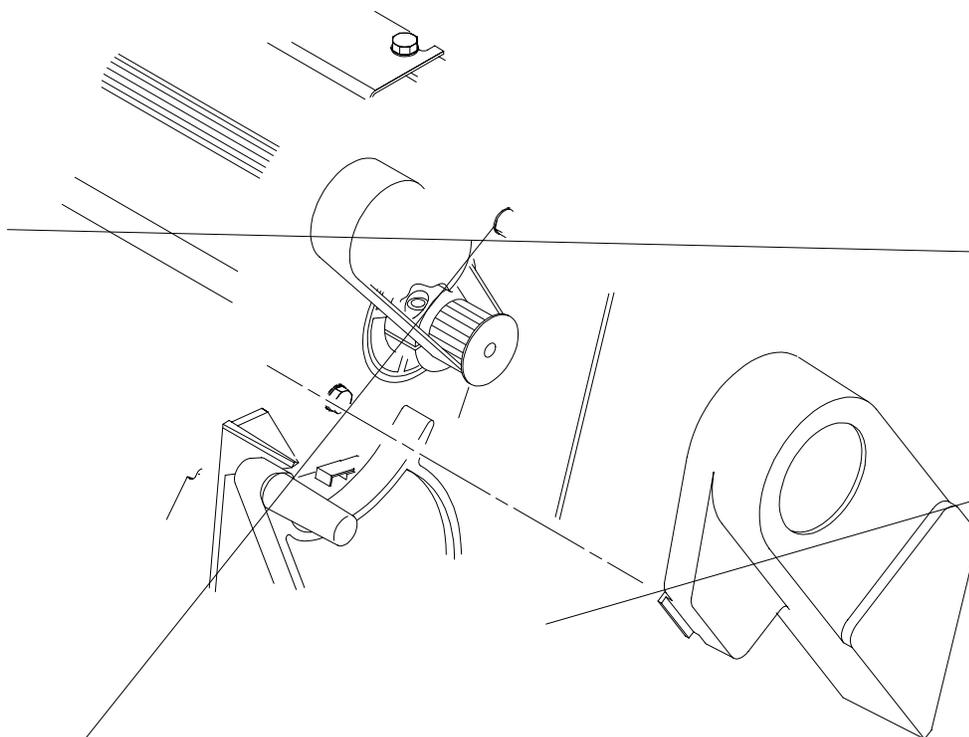
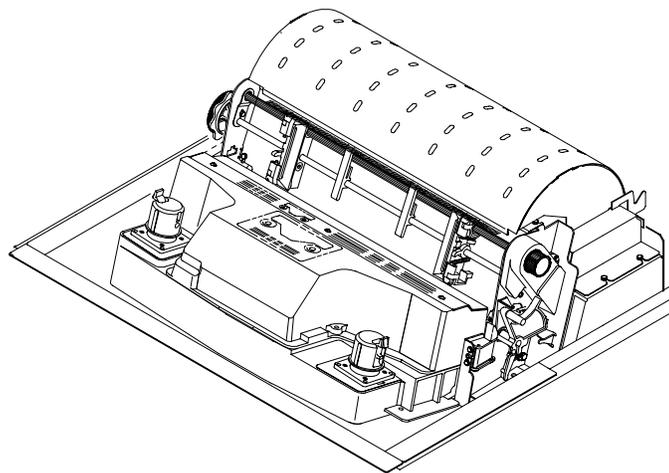
---

### Caution



Make sure there is at least 0.040 inches (1.016 mm) of clearance between the collar/pulley and the motor face plate.

- 
6. Hold the collar (3) flush against the motor pulley (4) and tighten the 7/64 inch screw (2).
  7. Check for correct tension on the paper feed timing belt (page 104). Adjust if necessary.
  8. Snap the timing belt cover (1) into the slots in the side plate.
  9. Cabinet Models: go to step 10.  
Pedestal Models: Install the top cover assembly (page 143).
  10. Return the printer to normal operation (page 103).



Legend:

- 1) Belt Shield
- 2) Cap Screw
- 3) Motor Pulley Collar
- 4) Motor Pulley
- 5) Splined Shaft Pulley

Figure 11. Paper Drive Motor Pulley Alignment





## Platen Gap Adjustment (Figure 13)

### Note



Only do this procedure if the original equipment shuttle frame assembly or platen has been replaced by a new or refurbished unit or if you have been instructed to do so in a troubleshooting procedure.

1. Prepare the printer for maintenance (page 102).
2. Remove the shuttle cover assembly (page 142).
3. Loosen the platen open belt (page 106, steps 2, 3, and 4).
4. Raise the forms thickness lever (1) to the fully open position.

### Caution



Do not force the platen against the feeler gauge and do not move the feeler gauge laterally across the hammer bank. Damage to the hammer tips will result.

5. Insert a 0.011 inch (0.28 mm) flat feeler gauge (2) straight down between the hammer bank cover plate (3) and ribbon mask (4), within four hammer positions of the left end of the hammer bank.

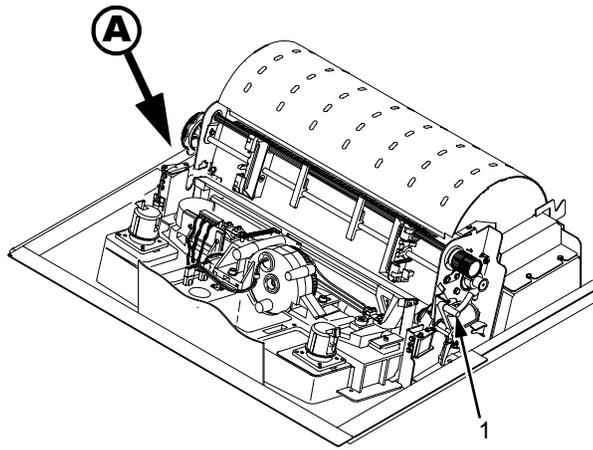
### Caution



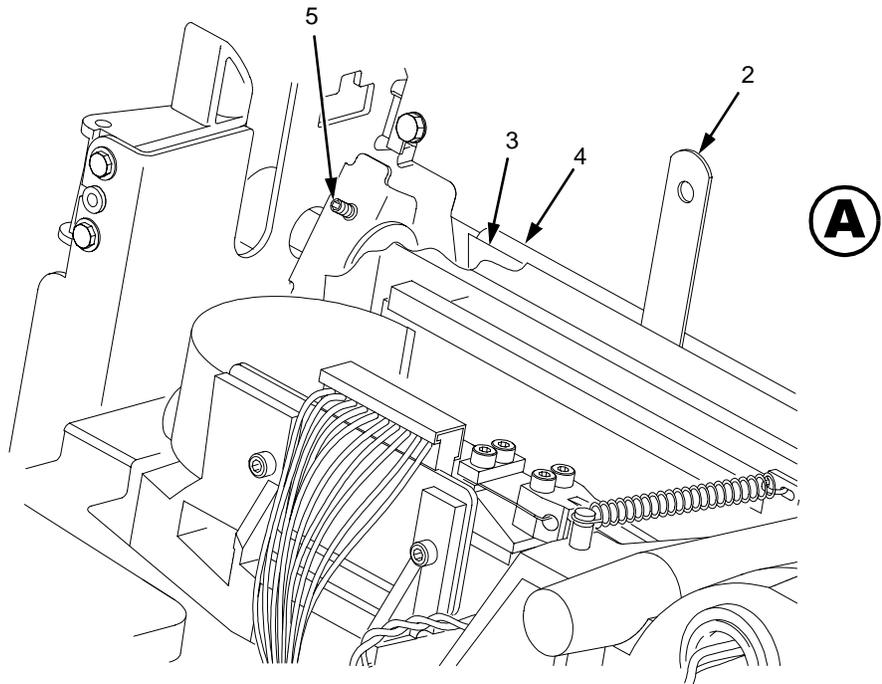
Adjust the platen set screws less than 1/4 turn on one side, then check the other side. Adjustment sensitivity is approximately 0.03 inch per revolution of the set screw. Also, insert the feeler gauge no more than 2 inches down from the top of the ribbon mask.

6. Gently close the forms thickness lever (1). As the platen is closing, gently slide the feeler gauge up and down, keeping it between the hammer tip and ribbon mask. If the feel is too tight when the platen is being closed, adjust the 3/32 inch set screw (5) at the end of the platen counterclockwise. If the feel is too loose, adjust the set screw clockwise. With the forms thickness lever closed all the way, the feeler gauge should contact both the tips and the ribbon mask and move with light friction. Shift the gauge slightly to verify.
7. Repeat steps 4 through 6 at the right end of the hammer bank.
8. After adjusting both sides, check the gap again at both ends. Readjust if necessary.
9. When the platen gap is correct at both ends of the platen, adjust the platen open belt (page 106).
10. Install the shuttle cover assembly (page 142).
11. Check the hammer phasing adjustment (page 123).
12. Return the printer to normal operation (page 103).





**NOTE:** Left side adjustment shown. Right side is the same.



**Legend:**

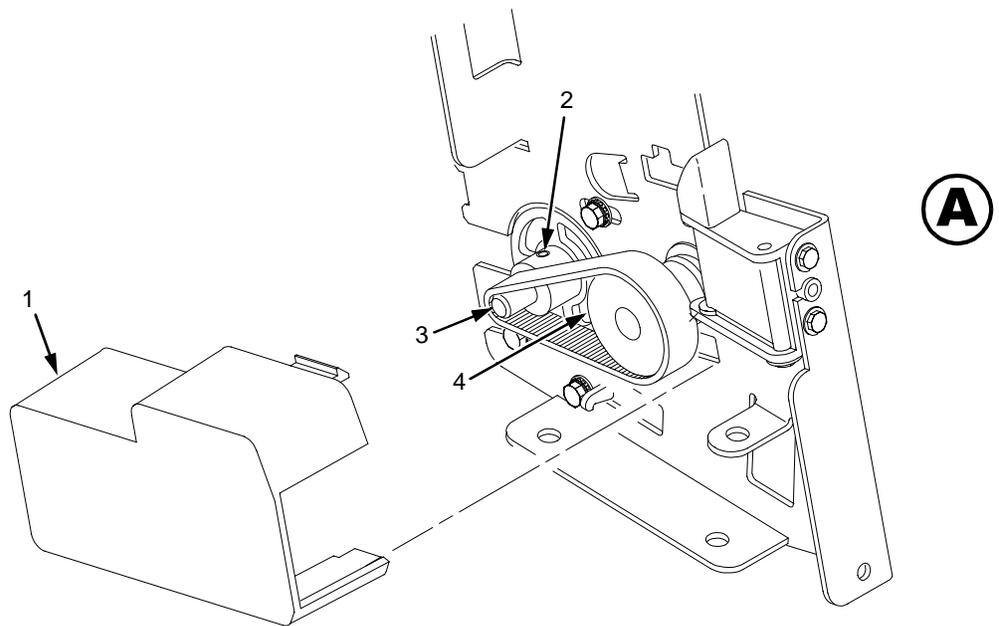
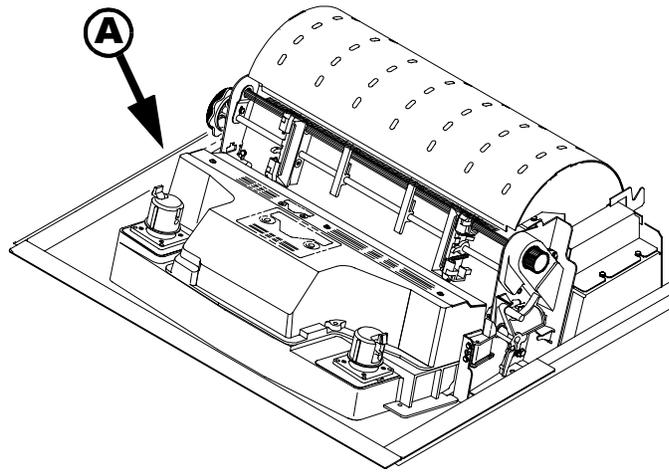
- 1) Forms Thickness Lever
- 2) Feeler Gauge
- 3) Hammer Bank Cover
- 4) Ribbon Mask
- 5) Set Screw, 3/32 inch hex (2)

**Figure 13. Platen Gap Adjustment**

## Platen Open Motor Pulley Alignment (Figure 14)

---

1. Prepare the printer for maintenance (page 102).
2. Cabinet Models: Go to step 3.  
Pedestal Models: Remove the top cover assembly (page 143).
3. Remove the platen open belt cover (1) by squeezing the top and bottom to release the plastic tabs from the slots in the side plate.
4. Loosen the 1/16 inch set screw (2) in the motor pulley.
5. Bottom out the platen open motor pulley (3) on the motor shaft and tighten the 1/16 inch set screw (2).
6. Check the platen open belt tension (page 106). Adjust if necessary.
7. Snap the platen open belt cover (1) into the slots in the side plate.
8. Cabinet Models: Go to step 9.  
Pedestal Models: Install the top cover assembly (page 143).
9. Return the printer to normal operation (page 103).



**Legend:**

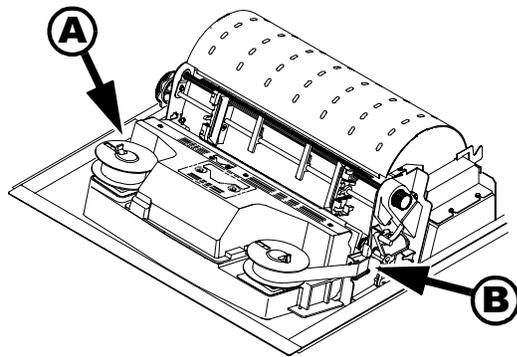
- 1) Belt Cover
- 2) Set Screw
- 3) Platen Open Motor Pulley
- 4) Platen Shaft Pulley

**Figure 14. Platen Open Motor Pulley Alignment**

## Ribbon Guide Alignment (Figure 15)

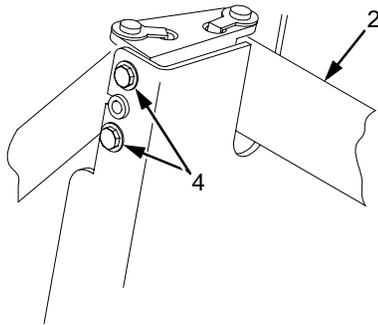
---

1. Open the printer cover.
2. Load paper and install the ribbon. To align a ribbon guide, wind the ribbon fully onto the ribbon spool on the opposite side. For example, to align the left ribbon guide, wind the ribbon until the right ribbon spool is full.
3. Check ribbon tracking by running a ribbon and shuttle diagnostic self-test. (See Chapter 3.)
4. On the ribbon guide to be adjusted, momentarily short between the ribbon guide skid screws (1) to verify that the ribbon reverses.
5. Observe how the ribbon (2) passes around and across the ribbon guide. It should be centered and not folding against either of the two white nylon washers (3).
6. If the ribbon is not centered, loosen the retaining screws (4) just enough so that you can rotate the ribbon guide to new positions, but it remains in place once moved.
7. Rotate the ribbon guide as required to center the ribbon (2).
8. Observe how the ribbon (2) winds onto the ribbon spool of the side you adjusted. If the ribbon is interfering with the flange of the spool, make sure the ribbon hub and spool are mounted correctly.
9. Tighten the retaining screws (4).
10. Allow most of the ribbon to wind onto the ribbon spool on the side you adjusted, then repeat steps 3 through 9 for the other ribbon guide.

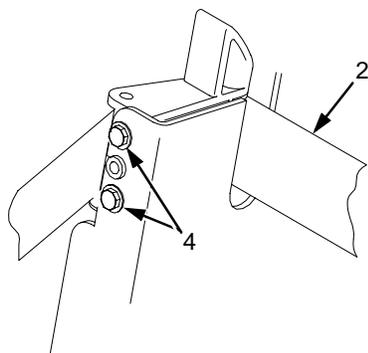
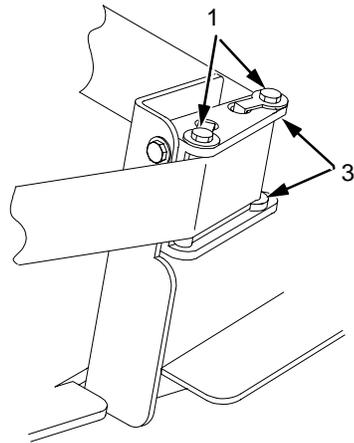


**A** Left Ribbon Guide

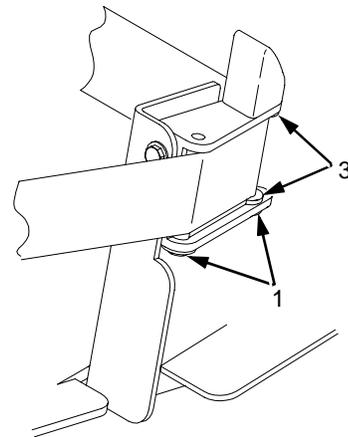
Right Ribbon Guide **B**



Early Models



Later Models



**Legend:**

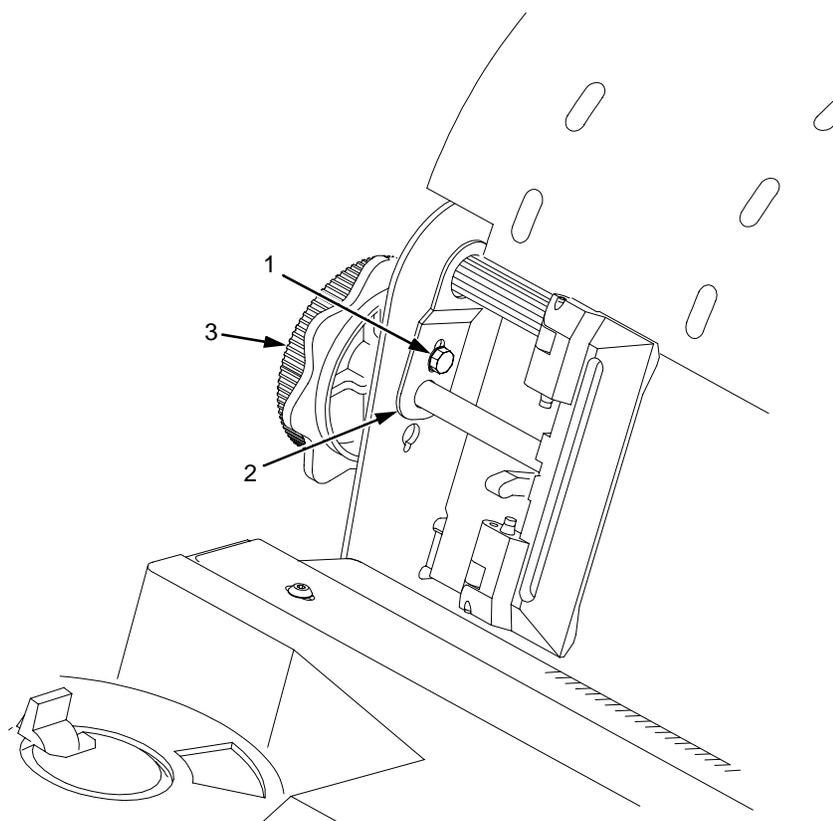
- 1) Screw, Skid (2)
- 2) Ribbon
- 3) White Nylon Washer
- 4) Screw, Retaining (2)

**Figure 15. Ribbon Guide Alignment**

## Splined Shaft Skew Adjustment (Figure 16)

If lines of print are not parallel with the perforations on the paper, perform the following adjustment.

1. Open the printer cover.
2. Loosen the screw (1) securing the adjusting link (2).
3. Adjust the link (2) by raising or lowering the horizontal adjustment knob (3) to obtain print parallel with paper perforations. Tighten the screw (1).
4. Return the printer to normal operation (page 103).



**Legend:**

- 1) Screw
- 2) Adjusting Link
- 3) Horizontal Adjustment Knob

**Figure 16. Splined Shaft Skew Adjustment**

---

## Paper Out Adjustment

---

This procedure tests and sets the distance from the page perforation at which a LOAD PAPER fault message is triggered. This adjustment prevents printing on the platen when the printer runs out of paper. The measurement units are dot rows.

You will use the dot row patterns printed by the Paper Out Adjustment test to verify that this parameter is set correctly.

---

### Note



Do this procedure only if a new paper detector switch assembly has been installed, the CMX controller board has been replaced, or if you are sure the paper out adjustment is incorrect. A paper out triggering distance of 1 or 2 dot rows above the perforation is acceptable; 5 to 7 dot rows above or any dot rows below indicates adjustment is required.

Also, although it is not required, it is advisable to test the paper out triggering distance with 6-part paper, in order to verify correct printing with multi-part forms.

---

The procedure below describes how to run the Paper Out Adjustment test and modify the paper out “Dots” value.

1. Open the printer cover.
2. On cabinet models, open the cabinet front door.
3. Load paper. Make sure the forms thickness lever is closed.
4. Power on the printer.
5. On the sheet of paper just below the paper entrance slot, tear a four inch square on the left side, immediately below the perforation. (See Figure 17.) This creates a hole that will trigger a “LOAD PAPER” fault message, but allows printing to the right of the hole (which would normally be on the platen).
6. If the printer is online, press the **ON LINE** key to place the printer offline.

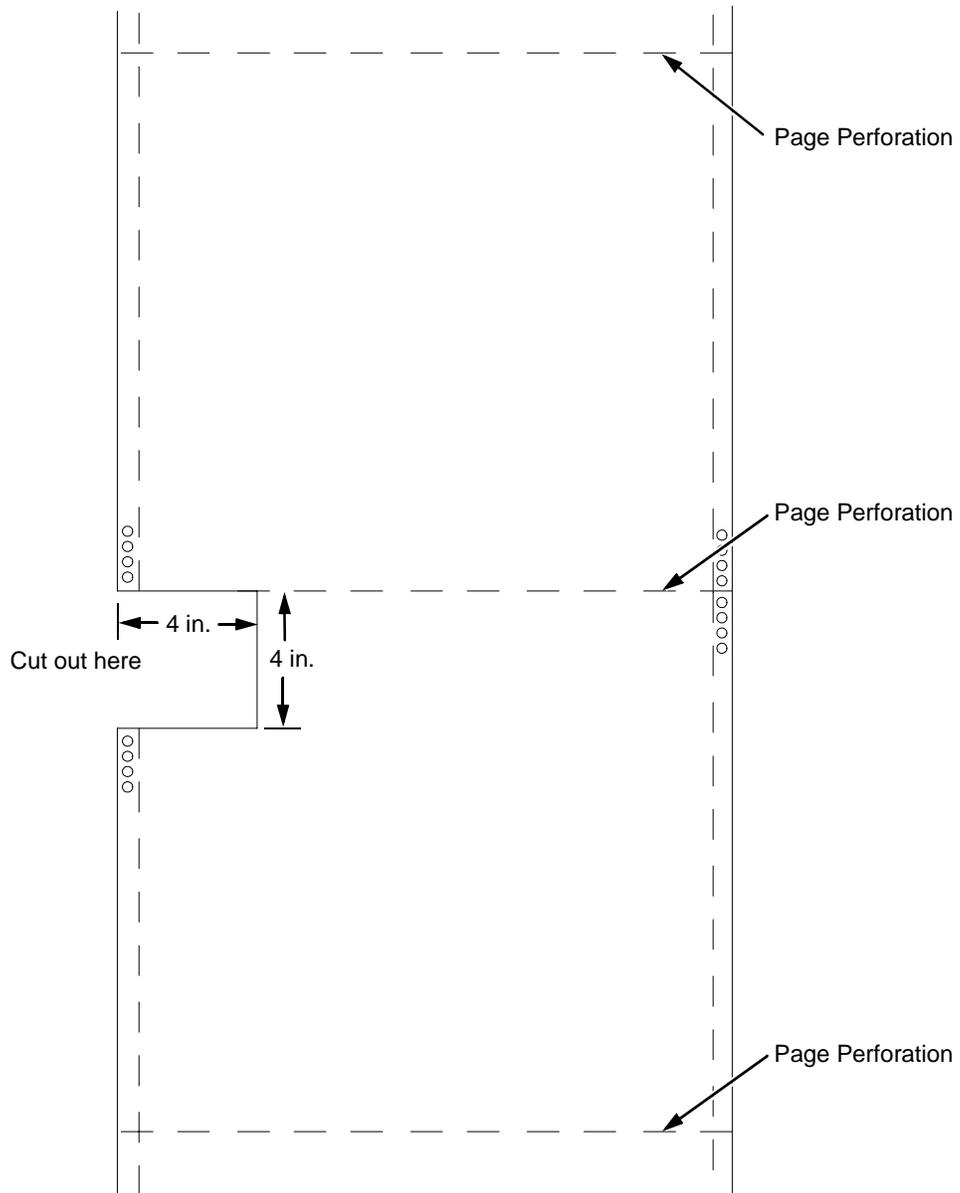
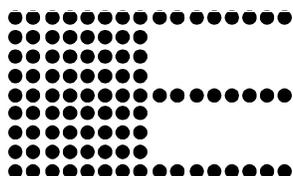


Figure 17. Paper Preparation for Paper Out Adjustment Test



- 
7. On the control panel, press the ▲ + ▼ keys to unlock the **ENTER** key. “ENTER SWITCH UNLOCKED” briefly displays. (If “LOCKED” displays, simply press ▲ and ▼ again.)
  8. Press the ◀ key. “DIAGNOSTICS” displays.
  9. Press ▼. “DIAGNOSTICS / Printer Tests” displays.
  10. Press ▼. “SHIFT / RECYCLE” displays.
  11. Press ▶ until “Paper Out Adjustment” displays.

This test will print a vertical “comb” pattern at around column 70, each long bar separated by three shorter bars. An enlarged example of the comb pattern is shown below.



12. Press **ENTER** until the Paper Out Adjustment test starts. The comb pattern will print until the display shows “LOAD PAPER” and the audible alarm sounds.
13. Open the platen and move the paper up with the vertical position knob and examine the area of the page perforation.  
  
If a long bar just meets the perforation, the paper out adjustment distance is correct, skip to step 26. (1 or 2 dot rows above the perforation is OK; 5 to 7 dot rows above or any dots below the perforation mean adjustment of the Paper Out Dots value is required.)  
  
If the comb pattern stopped short of the perforation or printed beyond the perforation, go to step 14.
14. Measure how short or long the comb pattern printed by counting the number of dot rows needed to reach the perforation, or the number of dot rows that printed beyond the perforation.

---

### Note



You can use the long bars to count the dot rows quickly. There are three dot rows between each long bar, so each long bar increases the number of dot rows by four. You can also tear off a small piece of the comb pattern from the beginning of the pattern and use it as a ruler to help you measure the dot rows required either to reach the perforation or back up to it.

- 
15. Close the platen.
  16. Press **CLEAR** to remove the fault condition. “OFFLINE / CONFIG. CONTROL” displays.
  17. Press the ◀ key. “DIAGNOSTICS” displays.
  18. Press ▼. “DIAGNOSTICS / Printer Tests” displays.
  19. Press ▶ until “Paper Out Dots” displays.
  20. Press ▼. The top line of the display will show “Paper Out Dots” and the bottom line will show the current setting for the number of dots.

21. Press **▼**. The number of dots will move up to the top line of the display with an asterisk (\*) next to it.
22. Using the **▶** or **◀** key, adjust the XX DOTS value up or down by the number of dots you counted in step 14. (If the comb pattern stopped short of the perforation, increase the number of dots. If the comb pattern printed beyond the perforation, decrease the number of dots.)
23. Press **ENTER** to select the new number of dots as the active value. (The asterisk that appears tells you that it is now the active value.)
24. Press **CLEAR** to place the printer offline.  
"OFFLINE / CONFIG. CONTROL" displays.
25. Run the Paper Out Dots and the Paper Out Adjustment tests until the comb pattern prints at an acceptable distance from the page perforation. (Return to step 9.)
26. When the paper out triggering distance is acceptable, reload the paper, feed it past any remaining unused holes that you tore in it, and set the top of form.
27. Press **▲ + ▼**. "ENTER SWITCH LOCKED" briefly displays.
28. Close the printer cover.
29. Press the **ON LINE** key to place the printer on-line.

---

## Hammer Phasing Adjustment

---

You must check and adjust hammer phasing if the CMX controller board is replaced, the shuttle frame assembly is removed, or if the MPU is replaced.

The hammer phase value is a timing parameter that permits you to adjust the vertical alignment of dots in character printing. The phase value numerical units are relative; they do not represent a physical measurement or value. Thus there is no “correct” value or range. But, if the phasing value is far enough from the theoretical ideal value on a particular printer, errors can occur. If, for example, you are adjusting phasing and an error such as PAF FIFO UNDRFL\* occurs, the phase value may be too high. Try a lower value.

The factory prints the initial phase value on the aluminum casting of the shuttle assembly, next to the motor housing. Adjust the phasing to this value and recheck the vertical alignment. When vertical alignment is acceptable, write the new phasing value on the shuttle.

Phasing should be adjusted with the printer printing at full paper width.

---

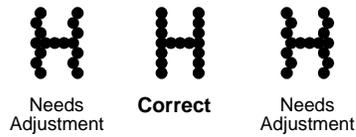
### Note



The printer must be printing the Phase pattern of “H’s” when the Phasing Value is changed, or the New Phasing Value will not be written into NVRAM. If the value is changed when not printing, the printer will return to its default phasing value when powered off then back on.

---

1. Raise the printer cover.
2. Install the ribbon.
3. Load full width (136 column) paper and set the top of form.
4. Power on the printer.
5. If the printer is online, press the **ON LINE** key to place the printer offline. “OFFLINE / CONFIG. CONTROL.” displays.
6. On the control panel, press the ▲ + ▼ keys to unlock the **ENTER** key. “ENTER SWITCH UNLOCKED” briefly displays. (If “LOCKED” displays, simply press ▲ and ▼ again.)
7. Press the ◀ key. “OFFLINE / DIAGNOSTICS” displays.
8. Press ▼. “DIAGNOSTICS / Printer Tests” displays.
9. Press ▼. “Printer Tests / Shift Recycle” displays.
10. Press ◀ until “Printer Tests / Phase Printer” displays.
11. Press **ENTER**. The display shows “Printer Tests / Phase Printer” and the test begins. The current phasing value is printed on the left of the printed pattern of all H’s. As the pattern prints, compare the H’s to the figure below. If the phasing needs adjustment, go to step 12. If the phasing is OK, go to step 15.



12. Press ▼: The current phase index displays. Press ▼ again: An asterisk (\*) appears next to the phase value.
13. Press ► to increase or ◀ to decrease the phasing index value, then press **ENTER** to activate the value as it prints. Continue to increase or decrease the phasing index until the pattern of H's is acceptable.
14. Press ▲ twice: "Printer Tests / Phase Printer" displays.
15. Press **ENTER** to stop the test.
16. Press **CLEAR**. "OFFLINE / CONFIG. CONTROL" displays.
17. Press ▲ + ▼. "ENTER SWITCH LOCKED" briefly displays.
18. Close the printer cover.
19. Press the **ON LINE** key to place the printer on-line.

---

**Note**



If you changed the phasing value, power down the printer, remove the shuttle cover, and write the new phase value on the aluminum shuttle casting.

---

---

## Set Shuttle Speed

---

### Note



Do this procedure if you replaced the CMX controller board or the shuttle frame assembly in a 475 or 500 lpm printer or if you were instructed to do so in a troubleshooting procedure. Do not do this procedure if you removed and reinstalled the original CMX board or shuttle frame assembly from a 475 or 500 lpm printer as part of other maintenance tasks.

Do not do this procedure on 800, 1000, 1200, 1400, or 1500 lpm printers.

---

1. Raise the printer cover.
2. Power on the printer.
3. If the printer is online, press the **ON LINE** key to place the printer offline. "OFFLINE / CONFIG. CONTROL" displays.
4. On the control panel, press the **▲ + ▼** keys to unlock the **ENTER** key. "ENTER SWITCH UNLOCKED" briefly displays. (If "LOCKED" displays, simply press **▲** and **▼** again.)
5. Press the **▲ + ▼ + ◀ + ▶** keys simultaneously to enter the Factory Menu. "Factory / Shuttle Speed" appears on the display.
6. Press the **▼** key. "Shuttle Speed / 500\*" or "Shuttle Speed / 475" appears on the display. The asterisk [\*] indicates which shuttle speed is currently active.
7. Press the **▶** key until the shuttle speed you want appears on the display.
8. Press the **ENTER** key. An asterisk [\*] appears next to the selection, indicating it is now the active shuttle speed.
9. Press the **ON LINE** or **CLEAR** key to exit the Factory Menu.
10. Press the **▲ + ▼** keys to lock the **ENTER** key. "ENTER SWITCH LOCKED" briefly displays.
11. **Cycle printer power to activate the shuttle speed setting: set the power switch to O, wait 15 seconds, then set the power switch to 1.**
12. Adjust the hammer phasing (page 123).
13. Adjust the paper out distance (page 119).
14. If the printer is online, press the **ON LINE** key to place the printer offline. "OFFLINE / CONFIG. CONTROL" displays.
15. Print out the printer configuration. (Refer to the *User's Guide*.) Verify that the configuration printout shows the correct SHUTTLE TYPE. If the shuttle type is incorrect, return to step 3 and do this procedure again.
16. Return the printer to normal operation (page 103).



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# 6

## *Replacement Procedures and Illustrated Parts Lists*

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### Organization of This Chapter

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This chapter is divided into two sections.

- **Section I: Replacement Procedures**

Written procedures for removing and installing components that are replaceable at the field service level of maintenance. The replacement procedures refer you to the illustrations in Section II.

Section I begins on page 128.

- **Section II: Illustrated Parts Lists**

Drawings of all electrical and mechanical assemblies in the printer. On the page facing each illustration is a list of the illustrated parts and their part numbers.

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#### Note



Only field-replaceable spares are given part numbers in the illustrated parts lists. Part numbers are not listed for common fasteners and attachment hardware. Items marked “Ref” in the illustrations refer to parts that are not spared or are part of another assembly.

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Section II begins on page 181.

## Section I: Replacement Procedures

### Warning



**Unplug the printer power cord from the printer or power outlet before doing any maintenance procedure. Failure to remove power could result in injury to you or damage to equipment. Only apply power during maintenance if you are instructed to do so in a maintenance procedure.**

### Note



The components specified in this chapter are field replaceable units (FRUs). FRUs must be repaired at the factory. Do not repair these items in the field.

Do not attempt field repairs of electronic components or assemblies. Do not de-solder any circuit board components. Replace a malfunctioning electronic assembly with an operational spare. Most electronic problems are corrected by replacing the printed circuit board assembly, sensor, or cable that causes the fault indication. The same is true of failures traced to the hammer bank: it is not field repairable so you must replace the entire shuttle frame assembly. Hammer spring assemblies, the hammer bank cover, and the ribbon mask are the only replaceable components of the shuttle frame assembly.

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## Belt, Paper Feed Timing

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Cabinet Models: Remove the paper path (page 158).  
Pedestal Models: Remove the top cover assembly (page 143).
3. Cabinet Models: Loosen four screws and remove the barrier shield.  
(See page 190, items 3, 4, and 9.)  
Pedestal Models: Loosen four screws and remove the paper guide and barrier shield. (See page 192, items 3, 4, and 5.)
4. Remove the timing belt cover by squeezing the front and back to release the plastic tabs from the slots in the side plate. (See page 190, item 7.)
5. Loosen the 7/64 inch setscrew in the paper feed motor pulley collar. (See page 206, item 8.)
6. Loosen (do not remove) the two 5/16 inch paper feed motor mount screws. (See page 206, item 10.)
7. Remove the paper feed timing belt by sliding the paper feed motor pulley off the motor shaft and the belt off the splined shaft pulley.

### Installation

1. Install the paper feed timing belt over the splined shaft pulley and the motor pulley and collar. Slide the motor pulley and retaining collar onto the paper feed motor shaft.
2. Align the belt so that it will run straight on both pulleys. Tighten the two 5/16 inch bolts to secure the paper feed motor so that there is 1/8 inch deflection in the belt midway between the pulleys.
3. Holding a 0.040 inch feeler gauge between the pulley collar and the motor body, tighten the 7/64 inch collar screw.
4. Snap the timing belt cover into the slots in the side plate. (See page 190, item 7.)
5. Cabinet Models: Install the barrier shield and tighten the four screws.  
(See page 190, items 3, 4, and 9.)  
Pedestal Models: Install the barrier shield and paper guide and tighten the four screws. (See page 192, items 3, 4, and 5.)
6. Cabinet Models: Install the paper path (page 158).  
Pedestal Models: Install the top cover assembly (page 143).
7. Return the printer to normal operation (page 103).

---

## Belt, Platen Open

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Cabinet Models: Remove the paper path (page 158).  
Pedestal Models: Remove the top cover assembly (page 143).
3. Remove the platen open belt cover by squeezing the top and bottom to release the plastic tabs from the slots in the side plate (page 204, item 24).
4. Loosen (do not remove) the two 5/16 inch mounting screws of the platen open motor (page 206, item 15).
5. Push the motor toward the front of the printer to loosen the platen open belt.
6. Loosen the 1/16 inch setscrew in the platen open motor pulley and remove the pulley. (See page 206, item 6.)
7. Remove the platen open belt by sliding the belt off the platen open pulley.

### Installation

1. Slide the platen open timing belt over the platen open pulley and the motor pulley.
2. Slide the motor pulley onto the platen open motor shaft and tighten the 1/16 inch pulley setscrew.
3. Finger tighten the two 5/16 inch screws securing the platen open motor.

---

### Caution



Too much tension on the platen open belt can cause the platen gap to change, which can lead to premature wear of the platen, damaged hammer tips, and poor print quality.

4. While pulling the platen open motor toward the rear, adjust the belt tension to 1/8 inch deflection midway between the pulleys. Tighten the upper motor mount screw with a 5/16 inch nutdriver. Tighten the lower 5/16 inch with an open end wrench. Check the deflection of the platen open belt again after the mount screws are tight.
5. Snap the platen open belt cover into the slots in the side plate.
6. Cabinet Models: Install the paper path (page 158).  
Pedestal Models: Install the top cover assembly (page 143).
7. Return the printer to normal operation (page 103).

## Cable Connectors and Connector Shells

Some of the cable connectors in the printer are grouped inside connector shells. The procedure below explains how to remove and install cable connectors from connector shells.

### Note



There is also a diagram of the P106 and P107 connector shells on the plastic heat shield over the power supply.

### Removal

1. Prepare the printer for maintenance (page 102).
2. Cabinet Models: Remove the paper path (page 158).  
Pedestal Models: Remove the top cover assembly (page 143).
3. Disconnect the cable connector shell containing the cable assembly that you will replace.
4. Pull the side of the connector shell outward and gently pull the cable connector upward. (See Figure 18.) Notice that two-wire connectors are grouped across from two-wire connectors in a connector shell. Four-wire connectors are grouped across from four-wire connectors in a connector shell.
5. Disengage the key tab(s) on the cable connector from the slots in the side of the connector shell.
6. Remove the cable connector from the connector shell. (Remove only the cable connector for the cable you are replacing; leave the other cable connectors in the shell.)

### Installation

1. Position the cable connector in the connector shell. Two-wire connectors are always grouped across from two-wire connectors in a connector shell. Four-wire connectors are always grouped across from four-wire connectors in a connector shell. (See Figure 18.)
2. Pull the side of the connector shell outward and gently push the cable connector down into the connector shell.
3. Engage the key tab(s) on the cable connector in the slots in the side of the connector shell. Press the sides of the connector shell inward to make sure all cable connector tabs are engaged in the shell slots.
4. Connect the cable connector shell to its printer connection.
5. Cabinet Models: Install the paper path (page 158).  
Pedestal Models: Install the top cover assembly (page 143).
6. Return the printer to normal operation (page 103).

**P106 Connector Configuration**

2	4	6	8	10	12	14	16	18	20
LRIB M	LRP	PMD							
PLAT M	CCF	POD							
1	3	5	7	9	11	13	15	17	19

Pin No. →

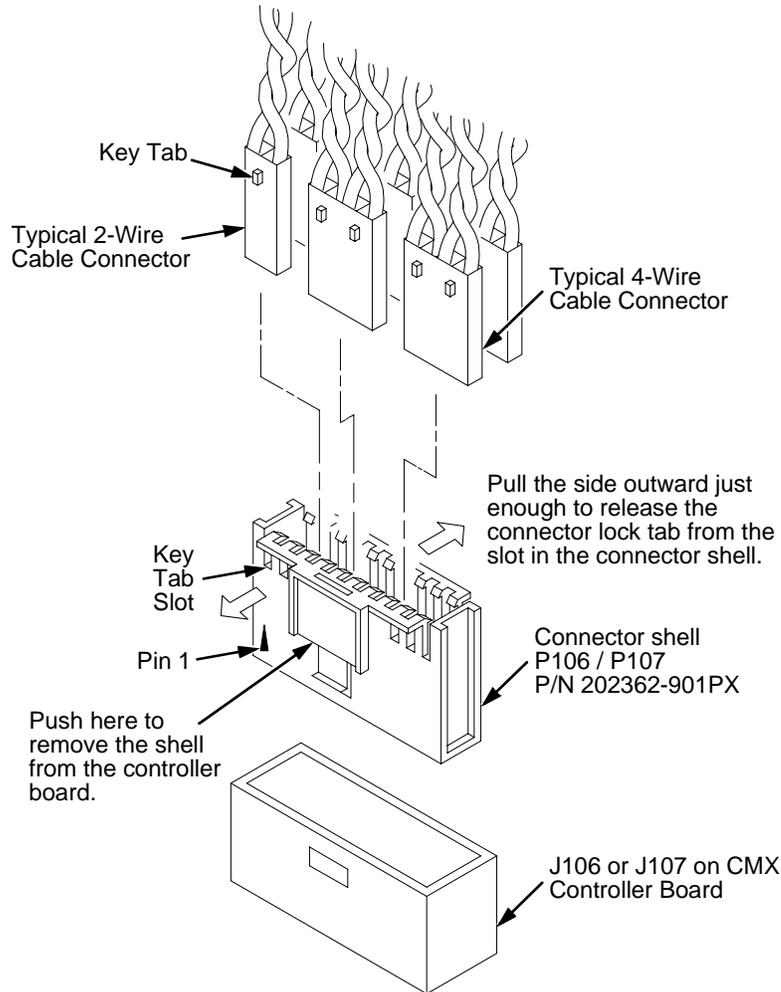
CCF = Card Cage Fan  
 LRIB M = Left Ribbon Motor  
 LRP = Left Ribbon Guide  
 PLAT M = Platen Open Motor  
 PMD = Paper Motion Detector (Switch)  
 POD = Paper Out Detect (Switch)

**P107 Connector Configuration**

2	4	6	8	10	12	14	16	18	20
RRIB M	HBF	RRP	JMP						
PAPR M	EHF	PLO	MPU						
1	3	5	7	9	11	13	15	17	19

EHF\* = Exhaust Fan  
 HBF = Hammer Bank Fan  
 JMP = Jumper Wire  
 MPU = Magnetic Pickup  
 PAPR M = Paper Feed Motor  
 PLO = Platen Open (Switch)  
 RRIB M = Right Ribbon Motor  
 RRP = Right Ribbon Guide

\* JMP (jumper) on pedestal models, which is used as a spacer



**Figure 18. Cable Connector Shell, Disassembly/Assembly**

## Circuit Breaker

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Remove the card cage fan (page 145).
3. Disconnect the four circuit breaker electrical leads.  
(Cabinet Models: See page 208.  
Pedestal Models: See page 194.)
4. Press in on the spring clips and remove the circuit breaker from the printer.

### Installation

1. Press the circuit breaker into the cutout until the spring clips snap into place.  
(Cabinet models: See page 208.  
Pedestal models: See page 194.)

---

### Caution



To prevent severe damage to the printer, the circuit breaker electrical leads must be connected correctly.

- 
2. Connect the four circuit breaker electrical leads.  
(Cabinet Models: See page 208.  
Pedestal Models: See page 194.)
  3. Install the card cage fan (page 145).
  4. Return the printer to normal operation (page 103).

## Control Panel Assembly, Cabinet Models

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Disconnect RJ11 connector P310 from connector J310 on the control panel.
3. Loosen four screws securing the control panel to the control panel bracket. (See page 186, item 1.)
4. Remove the control panel assembly from the keyways in the control panel bracket.

### Installation

1. Position the control panel assembly on the bracket, engage the mounting screws in the keyways, and hand tighten the screws. (See page 186, item 1.)
2. Connect RJ11 connector P310 to connector J310 on the control panel.
3. Lower the printer cover and center the control panel assembly in the cutout of the printer cover.
4. Open the printer cover and tighten the four control panel mounting screws.
5. Return the printer to normal operation (page 103).

## Control Panel Assembly, Pedestal Models

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Open the printer cover.
3. Loosen the four captive screws until the control panel is released from the printer top cover. (See page 188, item 2.)
4. Remove the two 5/16 inch screws securing the control panel ground straps. (See page 188, item 11.)
5. Lift the control panel and disconnect the RJ11 cable connector from the control panel assembly.
6. Remove the control panel assembly.

### Installation

1. Reverse steps 2 through 6 of the removal procedure.
2. Return the printer to normal operation (page 103).



## Controller Board (CMX)

---

### Removal

---

**Caution**

To prevent electrostatic damage to electronic components, always wear a properly grounded static wrist strap when you handle circuit boards.

---

1. Make a configuration printout of all saved configurations. (Refer to the *User's Guide*.)
  2. Prepare the printer for maintenance (page 102).
  3. Cabinet Models: Remove the paper path (page 158).  
Pedestal Models: Remove the top cover assembly (page 143).
  4. Disconnect all cable connectors from the controller board. (See page 196.)
  5. Loosen but do not remove the two screws securing the controller shield near serial cable connector J201.
  6. Loosen but do not remove the screw securing the controller shield to the bottom of the card cage, on the left side near the card cage fan.
- 

**Caution**

Do not separate the CMX controller board from the controller shield. The shield serves as a stiffener and ground plane, and is an integral part of the CMX controller board assembly.

---

7. Slide the controller board assembly to the left until the keyway clears the screw securing the controller board to the bottom of the card cage. Lift the controller board out of the printer.

## Installation

---

**Caution**

To prevent electrostatic damage to electronic components, always wear a properly grounded static wrist strap when you handle circuit boards.

---

---

**Note**

Models C3201C, C3202C, C3204C, C3205C, and C5640C must use the CMX 040 (40 MHz) controller board. (The CMX 040 is compatible with all models, but must be used on “C” models.)

---

1. Position the controller board in the card cage, shield side down, component side up. Engage the screw on the bottom of the card cage in the keyway in the controller shield. Slide the board to the right until the serial cable connector J201 on the controller board lines up with the cutout in the card cage. (See page 196.)
  2. Tighten the two screws securing the controller shield near serial cable connector J201.
  3. Tighten the screw securing the controller shield to the bottom of the card cage.
  4. Connect all cable connectors to the controller board, using the Interconnection Diagram in Appendix A as your guide.
  5. Cabinet Models: Install the paper path (page 158).  
Pedestal Models: Install the top cover assembly (page 143).
- 

**Note**

If the original CMX board was replaced, you must download the emulation software again. Installing flash memory from the old board onto the new board does not transfer all operating system software.

---

6. Load flash memory. (See Appendix D.)
7. 475 and 500 lpm models only: set shuttle speed if the original CMX board was replaced (page 125).
8. Adjust the hammer phasing (page 123).
9. Adjust the paper out distance (page 119).
10. Using the configuration printout(s) you made as step 1 of the removal procedure, reset and save the printer configuration(s). (Refer to the *User's Guide*.)

## Cover Assembly, Hammer Bank / Ribbon Mask

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Remove the shuttle frame assembly (page 174).
3. Early models:

Lift the thick plate of the hammer bank cover assembly at one end, and peel the cover away from hammer bank magnets. (See Figure 19.)
4. Later models:
  - a. Using a Torx T-10 driver, remove the six screws and three ribbon mask clamp plates securing the ribbon mask to the hammer bank cover. Remove the ribbon mask. (See Figure 19.)

---

### Note



If you are replacing just the ribbon mask, simply loosen the six screws until you can slip the ribbon mask off the alignment pins.

- 
- b. Using a Torx T-10 driver, remove the 12 screws securing the hammer bank cover to the hammer bank. Remove the hammer bank cover. (See Figure 19.)

## Installation

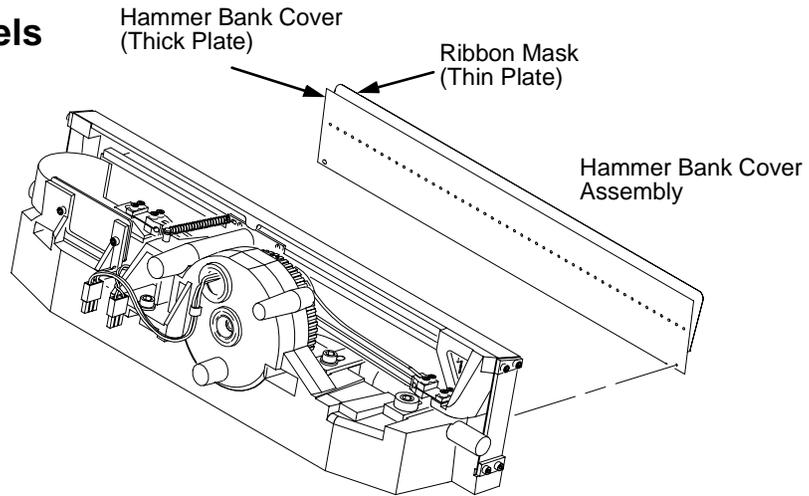
### Caution



The hammer bank contains a strong magnet. To prevent damage to the hammer tips, do not let the steel hammer bank cover assembly of early models snap into place as the hammer bank magnet attracts it. Any impact of the cover against the hammer bank can break hammer tips.

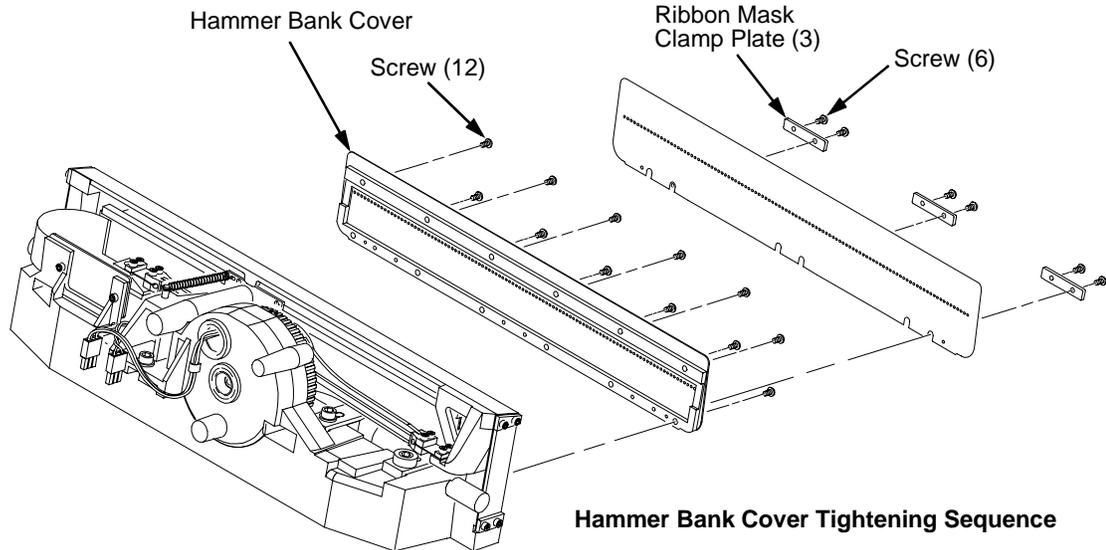
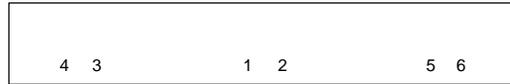
1. Early models:
  - a. With the thick plate facing the hammer bank, engage the bottom edge of the hammer bank cover assembly on the alignment pins. Engage the round hole first, then the oblong hole, to ensure that the cover lies flat on the hammer bank.
  - b. Gently lower the hammer bank cover assembly until it lies flush on the hammer bank.
  - c. Check that the hammer bank cover assembly is properly positioned over the alignment pins and hammer tips.
2. Later models:
  - a. Position the hammer bank cover on the alignment pins on the hammer bank. Make sure the hammer bank cover is properly positioned over the alignment pins and hammer tips and lies flat on the hammer bank.
  - b. Install all 12 hold-down screws finger tight. Using a Torx T-10 driver, tighten the hold-down screws in the sequence shown in Figure 19.
  - c. With the seam of the folded lower edge of the ribbon mask facing inward (toward the hammer bank cover), position the ribbon mask on the alignment pins on the hammer bank cover. The ribbon mask is correctly installed when the angled ends of the ribbon mask match the angled ends of the hammer bank cover. Install the three clamp plates and six screws finger tight. Using a Torx T-10 driver, tighten the six screws in the sequence shown in Figure 19.
3. Install the shuttle frame assembly (page 174).
4. Return the printer to normal operation (page 103).

**Early Models**



**Later Models**

**Ribbon Mask Tightening Sequence**



**Hammer Bank Cover Tightening Sequence**

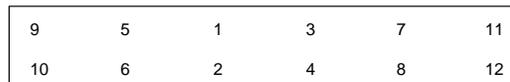


Figure 19. Hammer Bank Cover Assembly / Ribbon Mask

## Cover Assembly, Shuttle

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Loosen the shuttle cover screws (page 190, item 2).
3. Grasping the edges of the shuttle cover assembly, tilt the rear edge up and lift the shuttle cover assembly out of the printer.

### Installation

1. Place the shuttle cover assembly in the printer. Tilt the forward edge of the cover down slightly and work the cover into position.

---

#### Note



Make sure the holes in the cover are over the locating pins on the base casting.

- 
2. Tighten the shuttle cover screws (page 190, item 2).
  3. Return the printer to normal operation (page 103).

## Cover Assembly, Top, Pedestal Models

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Loosen, but do not remove, the two #2 Phillips hold-down screws on the rear of the printer. (See page 188, item 5.)
3. Open the printer cover.
4. Loosen the four captive #1 Phillips screws until the control panel is released from the printer top cover. (See page 188, items 1 and 2.) Set the control panel assembly on the shuttle cover assembly.
5. Loosen the two captive #2 Phillips screws in the lower front corners of the top cover. (See page 188, item 3.)
6. Lift the top cover assembly off the printer base.

### Installation

1. Reverse steps 2 through 6 of the removal procedure.
2. Return the printer to normal operation (page 103).

## Fan Assembly, Cabinet Exhaust

---

---

### Note



This procedure applies only to cabinet models.

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Open the front and rear cabinet doors and the printer cover.
3. Remove the paper fence/paper tray assembly. (See page 184.)
4. Remove the two 1/4 inch screws securing bottom of the air exhaust duct. (See page 186, item 4).
5. Remove the 1/4 inch screw directly below the forms thickness lever.
6. Disconnect the fan cable connector from connector P307 and remove the air exhaust duct.
7. Disconnect the fan cable connector from the side of the air exhaust duct.
8. Remove the two 1/4 inch fan mounting screws and the cabinet exhaust fan assembly.

### Installation

---

### Caution



Air flow is DOWN. Install the cabinet exhaust fan so the label on the fan faces down.

---

1. Reverse steps 2 through 8 of the removal procedure.
2. Return the printer to normal operation (page 103).



## Fan Assembly, Card Cage

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Cabinet Models: Remove the paper path (page 158).  
Pedestal Models: Remove the top cover assembly (page 143).
3. Disconnect the card cage fan cable connector. (See page 206.)
4. Cabinet Models: Remove the two fan mounting screws from the bottom of the fan. (See page 206, item 2.)  
Pedestal Models: Remove the four fan mounting screws and nut. (See page 194, items 1 through 4.)
5. Remove the card cage fan assembly from the card cage.

### Installation

---

#### Caution



Air flow is INTO the card cage. Install the card cage fan so the label faces toward the inside of the printer and the cable faces the front of the printer.

- 
1. Reverse steps 2 through 5 of the removal procedure.
  2. Return the printer to normal operation (page 103).

## Fan Assembly, Hammer Bank

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Remove the shuttle cover assembly (page 142).
3. Cabinet Models: Remove the paper path (page 158).  
Pedestal Models: Remove the top cover assembly (page 143).
4. Trace the hammer bank fan cable assembly back to the controller board connector P107, releasing it from all cable constraints. (See the cable routing diagrams in Appendix A.)
5. Disconnect the fan connector from connector shell P107 on the controller board. (See page 132.)
6. Remove the two screws securing the fan to the base casting. Angle the hammer bank fan assembly up and out of the base casting and feed the motor wires and cable connector out from between the base casting and the base pan. (See page 206, items 21 and 22.)

### Installation

---

#### Caution



Air flow is UP. Install the hammer bank fan so the label faces up.

- 
1. Feed the hammer bank fan cable connector and motor wires between the fan well of the base casting and the base pan. Reach up under the base casting and route the fan cable to the right and angle the hammer bank fan assembly under the shuttle motor and down into the fan well. (See page 206.)
  2. Route the fan motor wires (see cable routing diagrams, Appendix A) and connect the fan cable connector to J107 on the controller board. (See page 132.)
  3. Install two screws in the locations shown in Figure 39 (page 206, item 21).
  4. Cabinet Models: Install the paper path (page 158).  
Pedestal Models: Install the top cover assembly (page 143).
  5. Install the shuttle cover assembly (page 142).
  6. Return the printer to normal operation (page 103).

## Hammer Spring Assembly

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Remove the shuttle frame assembly (page 174).
3. Carefully vacuum the shuttle frame assembly.
4. Remove the hammer bank cover assembly (page 139).

---

### Caution



Hammer springs and hammer tips are fragile. Do not touch the hammer springs or tips. Handle hammer spring assemblies by the thick mounting base only. Apply pressure only to the mounting base.

- 
5. Remove the mounting screws from the old hammer spring assembly. (See Figure 20, page 148.)
  6. Handling the hammer spring assembly by the mounting base only, gently push up the mounting base and pry the old spring assembly off its mounting pins. (See Figure 20, page 148.)
  7. Inspect the hammer bank and the old hammer spring assembly:
    - a. If there is ink on the hammer bank mounting surface, the hammer spring assembly mounting surface, or the hammer spring neck or tines, reinstall the old hammer spring assembly and replace the shuttle frame assembly (page 174).
    - b. If the old hammer spring assembly and the hammer bank are free of ink, install the new hammer spring assembly, as shown in the next section.

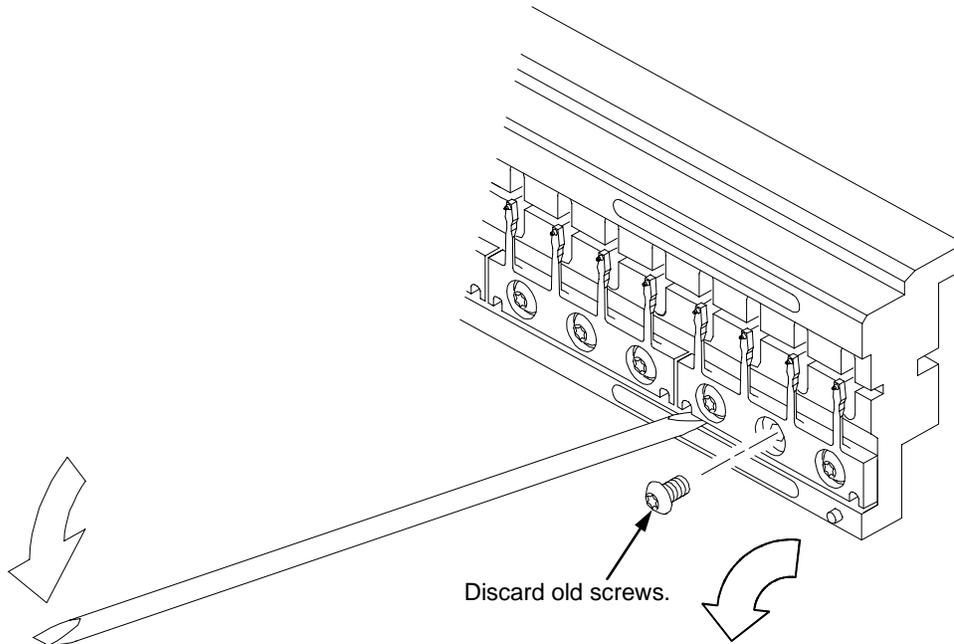
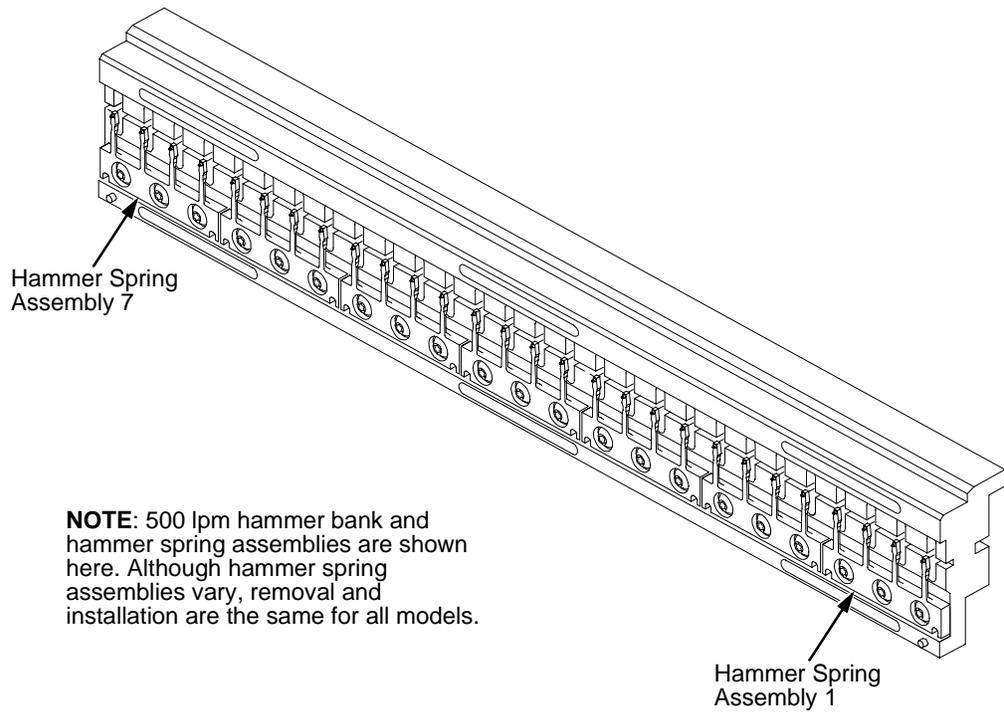


Figure 20. Hammer Spring Assembly, Removal

## Installation

1. Using a clean dry cloth, wipe the hammer spring mounting surface on the hammer bank. Make sure the cloth does not leave lint on the hammer bank.

---

### Caution



Hammer springs and hammer tips are fragile. Do not touch the hammer springs or tips. Handle hammer spring assemblies by the thick mounting base only. Apply pressure only to the mounting base.

- 
2. Handling the hammer spring assembly by the mounting base only, remove the new assembly and mounting screws from the box.
  3. Handling the hammer spring assembly by the mounting base only, carefully position the new assembly onto the hammer bank mounting pins and press it into position with the stick supplied in the hammer spring replacement kit. (See Figure 21, page 150.)
  4. Install the mounting screws from the replacement kit. Using a Torx T-10 bit adapter, tighten the center screw(s) then the outer screws. (See Figure 21, page 150.)
  5. Install the hammer bank cover assembly (page 139).
  6. Install the shuttle frame assembly (page 174).
  7. Install the ribbon and load paper.

---

### Caution



Do not attempt to adjust or “tweak” hammer springs.

- 
8. Run a Diagnostic Printer Test and check print quality (page 86).
    - a. If print quality is acceptable, return the printer to normal operation (page 103).
    - b. If print quality is still degraded, replace the shuttle frame assembly (page 174).

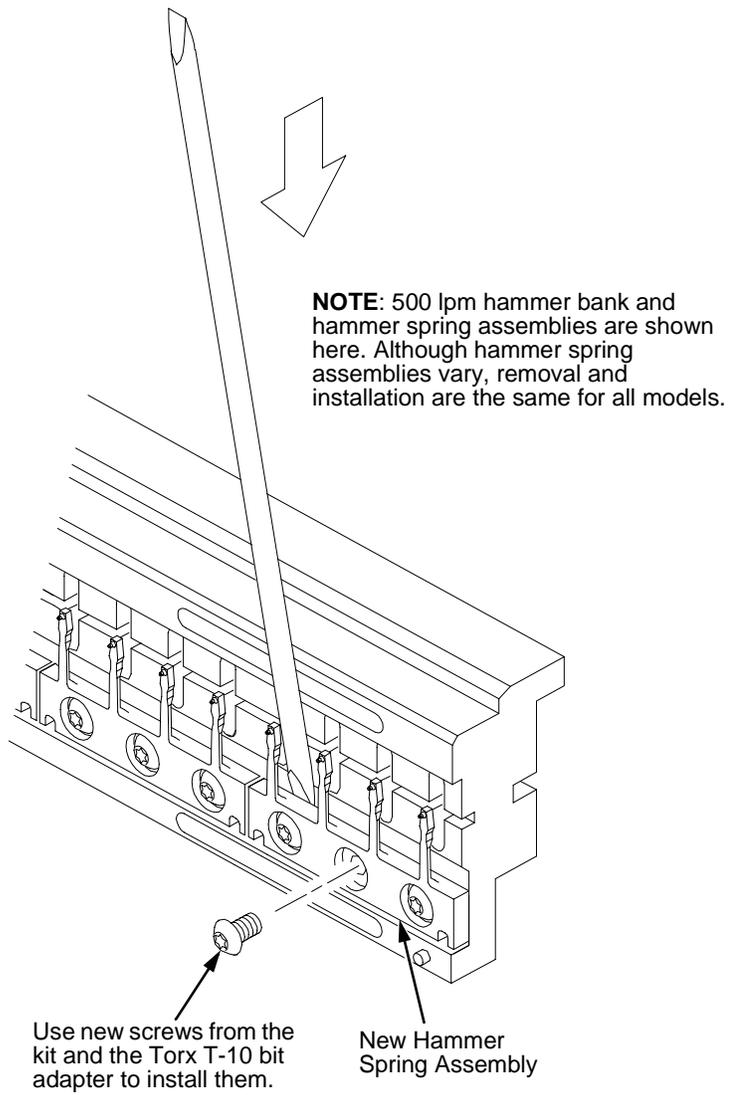


Figure 21. Hammer Spring Assembly, Installation

## Magnetic Pickup (MPU) Assembly

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Remove the shuttle cover (page 142).
3. Disconnect the magnetic pickup (MPU) cable connector (page 200, item 5).
4. Loosen the 7/64 inch hex MPU clamp screw (page 200, item 3).
5. Unscrew the MPU assembly from the MPU bracket.

### Installation

1. Install the MPU assembly by screwing it into the MPU bracket. (See Figure 36, page 200).
2. Using a feeler gauge, adjust the gap between the MPU assembly and the flywheel to  $0.010 \pm .001$  inch ( $0.254 \pm 0.025$  mm). Tighten the 7/16 inch MPU clamp screw.
3. Check the gap between the MPU assembly and the flywheel with a feeler gauge:
  - a. If the gap is  $0.010 \pm .001$  inch ( $0.254 \pm 0.025$  mm), go to step 4.
  - b. If the gap is not  $0.010 \pm 0.001$  inch ( $0.254 \pm 0.025$  mm), loosen the MPU clamp screw and go back to step 2.
4. Route the MPU cable under the extension spring and connect the MPU cable connector (page 200, item 5). Make sure the MPU cable does not touch the extension spring after cable connection.
5. Install the shuttle cover (page 142).
6. Adjust the hammer phasing (page 123).
7. Return the printer to normal operation (page 103).

## Memory Modules and Security PAL

---

### Removal

1. Make a configuration printout of all saved configurations. (Refer to the *User's Guide*.)
2. Prepare the printer for maintenance (page 102).
3. Cabinet Models: Remove the paper path (page 158).  
Pedestal Models: Remove the top cover assembly (page 143).

---

### Caution



To prevent electrostatic damage to electronic components, always wear a properly grounded static wrist strap when you handle memory modules and circuit boards.

---

4. Gently pry the side locks open, angle the SIMM toward the front of the printer, and remove the SIMM from the socket. (See Figure 22, page 154.)
5. If the security PAL must be replaced, remove the old PAL. (See Figure 22, page 154.) The printer uses security PAL P/N 154141-007PX.



## Installation

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### Caution



To prevent electrostatic damage to electronic components, always wear a properly grounded static wrist strap when you handle memory modules and circuit boards.

---

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### Note

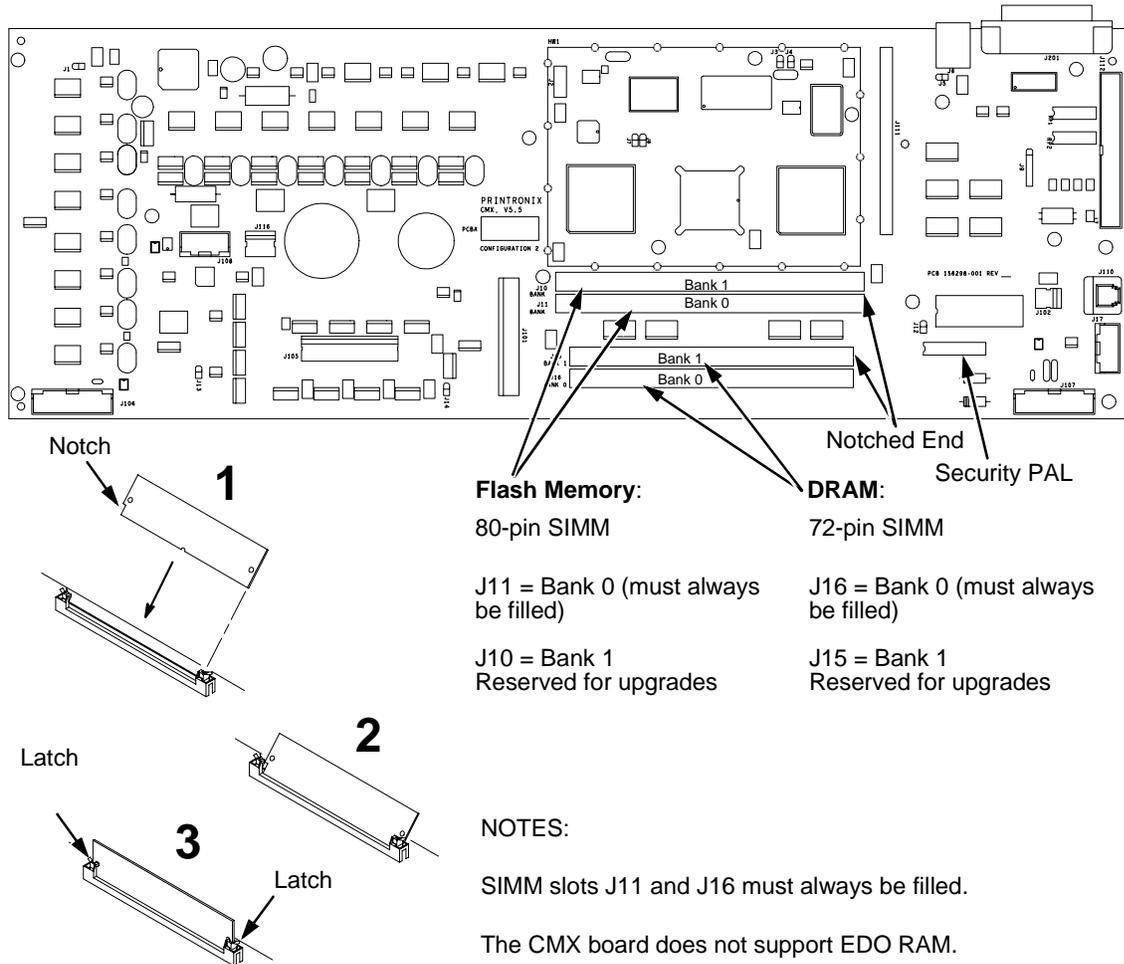


Flash SIMMs from one CMX controller board must be placed in the same slot on a replacement CMX controller board. Installing flash memory from one controller board to another does not transfer all operating system software, so you must download the emulation again.

---

1. If you are replacing the security PAL, observe the correct pin orientation (see page 154) and install P/N 154141-007PX.
2. Insert the memory module into the correct socket on the CMX controller board:
  - a. Position the SIMM with the notched end toward the right side of the CMX controller board. (See Figure 22, page 154.)
  - b. Press the SIMM into the socket with the top of the SIMM angled *away* from the center of the board. When the SIMM is seated in the socket, gently push on the ends until it locks in the upright position.
3. Cabinet Models: Install the paper path (page 158).  
Pedestal Models: Install the top cover assembly (page 143).
4. Download the emulation (page 285).
5. Return the printer to normal operation (page 103).
6. Using the configuration printout(s) you made in step 1 of the removal procedure, reset and save the printer configuration(s). (Refer to the *User's Guide*.)

### CMX Controller Board



**Flash Memory:**  
80-pin SIMM

**DRAM:**  
72-pin SIMM

J11 = Bank 0 (must always be filled)

J16 = Bank 0 (must always be filled)

J10 = Bank 1  
Reserved for upgrades

J15 = Bank 1  
Reserved for upgrades

**NOTES:**

SIMM slots J11 and J16 must always be filled.

The CMX board does not support EDO RAM.

Models LP 500 (C3201C), LPQ 500 (C3202C), LPQ 1000, LPQ 1500: one 4MB flash SIMM and one 4MB DRAM SIMM.

All other models: one 1MB flash SIMM and one 2MB DRAM SIMM.

Figure 22. Memory Modules and Security PAL

## Paper Feed Motor

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### Removal

1. Prepare the printer for maintenance (page 102).
2. Cabinet Models: Remove the paper path (page 158).  
Pedestal Models: Remove the top cover assembly (page 143).
3. Cabinet Models: Loosen four screws and remove the barrier shield. (See page 190, items 3, 4, and 9.)  
Pedestal Models: Loosen the four screws and remove the barrier shield and paper guide. (See page 192, items 3, 4, and 5.)
4. Remove the timing belt cover by squeezing the front and back to release the plastic tabs from the slots in the side plate (page 190, item 7).
5. Loosen, but do not remove, the two 5/16 inch paper feed motor mounting screws. (See page 206, item 10.)
6. Loosen the 7/64 inch shaft collar setscrew and remove the paper feed motor pulley, shaft collar, and paper feed timing belt. (See page 206, items 7, 8, and 9.)
7. Trace the paper feed motor cables back to the controller board, releasing it from tie wraps. (See the cable routing diagrams in Appendix A.)
8. Disconnect connector P107 from the controller board and remove the paper feed motor connector from connector P107. (See page 133.)

---

### Note



Some paper feed motors are mounted with nuts and bolts; other motors have threaded flanges, eliminating the need for nuts.

- 
9. Remove the motor mount screws (and nuts, if present).
  10. Remove the paper feed motor assembly.

## Installation

1. Position the paper feed motor assembly on the right side plate and install the motor mount bolts and nuts finger tight. (See page 206, items 10 and 23.)
2. Connect the paper feed motor cable connector to connector P107, then connect P107 to J107 on the controller board. (See page 133.)
3. Install the collar, paper feed motor pulley, and timing belt.
4. Align the paper feed motor pulley with the splined shaft pulley.

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### Note



Make sure there is at least 0.040 inches (1.016 mm) of clearance between the collar/pulley and the motor face plate.

- 
5. Hold the collar snug against the motor pulley and tighten the 7/64 inch setscrew.
  6. While pushing the motor toward the rear of the printer, tighten the two 5/16 inch mounting bolts so there is 1/8 inch of belt deflection midway between the pulleys.
  7. Snap the timing belt cover into the slots in the side plate.
  8. Cabinet Models: Install the barrier shield and tighten the four screws. (See page 190, items 3, 4, and 9.)  
Pedestal Models: Install the barrier shield and paper guide and tighten the four screws. (See page 192, items 3, 4, and 5.)
  9. Cabinet Models: Install the paper path (page 158).  
Pedestal Models: Install the top cover assembly (page 143).
  10. Return the printer to normal operation (page 103).

## Paper Ironer

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### Warning



Over time, the upper edge of the paper ironer can become sharp. To avoid cutting yourself, handle the paper ironer on the sides.

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Remove the shuttle frame assembly (page 174).
3. Move the forms thickness lever to the open position.
4. Push the ends of the paper ironer toward the rear of the printer, disengage the tabs, then lift it up and out (page 204, item 3).

### Installation

### Note



The black tape on the paper ironer faces toward the rear of the printer and towards the paper detector switch assembly.

---

1. Position the paper ironer so the black tape is on the side that faces the rear of the printer, towards the paper detector switch assembly. (See page 204, item 3.)
2. Push the paper ironer down into the slots until the tabs engage.
3. Install the shuttle frame assembly (page 174).
4. Return the printer to normal operation (page 103).

## Paper Path

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### Note



This procedure applies only to cabinet models.

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Loosen the three paper path hold-down screws (page 190, item 6).
3. Slide the paper path to the left and lift it off the card cage.

### Installation

1. Position the paper path offset slightly to the left on the card cage with the keyway cutouts over the three loosened hold-down screws page 190, Figure 31).
2. Slide the paper path to the right, engaging the three hold-down screws in the keyway slots. Slide the paper path to the right as far as it will go.
3. Tighten the three hold-down screws (page 190, item 6).
4. Return the printer to normal operation (page 103).

---

## Platen

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### Removal

1. Prepare the printer for maintenance (page 102).
2. Remove the shuttle frame assembly (page 174).
3. Remove the paper ironer (page 157).
4. Remove the three 1/4 inch screws securing the paper ironer bracket assembly and remove the assembly. (See page 204, items 4, 5, and 6.)
5. Remove the platen open belt (page 131).
6. Remove the platen pulley (page 204, item 21), as follows:
  - a. Loosen the 7/64 inch collar clamp screw.
  - b. Pull the platen pulley off the platen shaft.
7. Pull the spring link and white plastic bushing off the platen shaft and remove the spring link, bushing, and spring. (See page 204, items 16, 17, and 18.)
8. Remove the forms thickness lever by loosening the 7/64 inch clamp screw and pulling the lever off the platen shaft. (See page 204, item 15.)
9. Remove the right side platen support spring by repeating step 7 on the right side of the platen.
10. Remove the Phillips #1 screw and washer securing the forms thickness indicator plate from the inside of the right side bracket. (See page 204, items 9 and 10.)
11. Pull the indicator plate, with the interlock switch assembly attached, off the platen shaft.
12. Remove the two 7/32 inch screws and washers securing the right ribbon guide assembly to the side plate. (See page 206, items 11, 13, and 14.)
13. Slide the ribbon guide assembly out of the side plate.
14. Pull the right side of the platen toward the front of the printer and move the platen to the right and out of the left side plate. (Hold the black metal washer on the left side of the shaft as you remove the platen. Make sure the copper wear saddles in the platen seat of the mechanism base stay in place.)

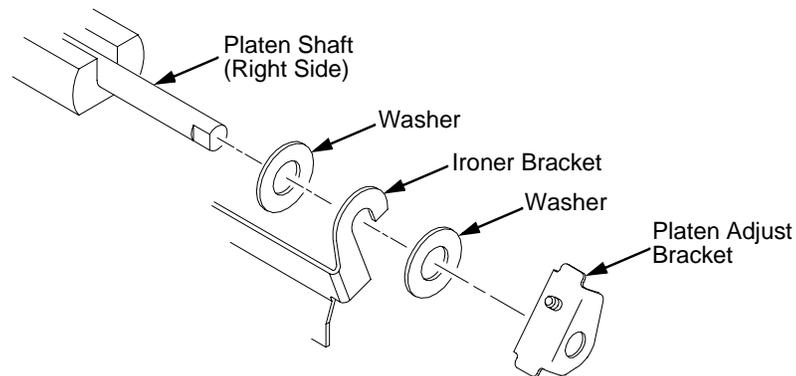
## Installation

### Note



The dowel pins protruding from the ends of the platen are the platen shafts. The platen shafts are not of equal length. The platen must be installed with the longer shaft on the right side.

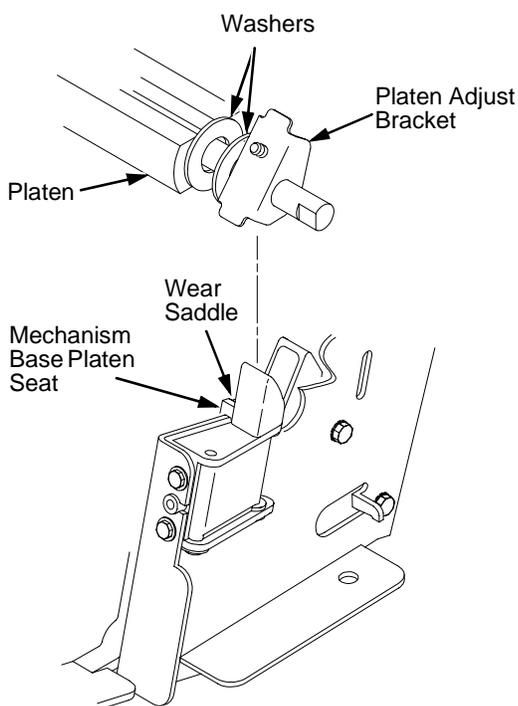
1. Wipe the platen shafts clean of grease and debris.
2. Install two washers on the longer (right) platen shaft. (See Figure 23 below.)
3. Apply bearing lubricant to both platen shafts.



**Figure 23. Installing the Platen Adjust Bracket**

4. Make sure the two wear saddles are set flush into the corners of the mechanism base platen seat. (See Figure 24.)
5. Apply a layer of bearing lubricant 1/4 inch high to the seat of each wear saddle, making the layer as wide as the saddle and touching the rear angled surface.
6. Install one platen adjust bracket onto the longer platen shaft, with the screw at the top of the bracket.
7. Place the other bracket onto the left side mechanism base platen seat so that the mechanism base platen seat is between the flanges of the bracket.
8. Insert the shorter platen shaft through the left adjust bracket and through the opening in the left side plate. Rotate the longer shaft into the opening in the right side plate and position the adjustment brackets as shown in Figure 24.





**Figure 24. Positioning the Platen Adjust Brackets**

9. Slide the right ribbon guide assembly into the side plate and install the two 7/32 inch screws and washers. (See page 206, items 11, 13, and 14.)
10. Install the forms thickness indicator plate:
  - a. Slide the indicator plate, with the interlock switch assembly attached, onto the platen shaft and up against the right side plate.
  - b. Install the Phillips #1 screw and washer securing the indicator plate.
11. Install the black metal washer onto the left side of the platen shaft. (See page 204, item 26.)
12. Apply bearing lubricant to the nylon bearings in the two spring links, slide the spring links onto the two platen shafts, and connect the springs to the spring hooks in the side plates. (See page 204, items 16, 17, and 18.)
13. Apply bearing lubricant to the two platen shafts on both sides, between the ends of the platen and the platen adjustment brackets.
14. Install the paper ironer bracket. (See Figure 23.)
  - a. With the flat part of the bracket facing the front of the printer, place the two hooks of the upper part of the paper ironer over the platen shafts.

The left hook of the paper ironer bracket goes between the left platen adjustment bracket and the platen.

On the right side of the platen, position a washer on both sides of the paper ironer bracket hook and position the hook to the left of the right platen adjustment bracket. (See Figure 23.)

- b. Install and tighten the three screws.
- 15. Push the platen to the left.
- 16. Install the forms thickness lever onto the right side platen shaft, pressing the interlock switch out of the way as the lever slides past it. Tighten the 7/64 inch setscrew. (See page 204, item 15.) Open and close the forms thickness lever to make sure the setscrew does not touch the right ribbon guide.
- 17. Install the platen shaft pulley with the 7/64 inch setscrew facing up and tighten the setscrew. Open and close the forms thickness lever and check that the platen pulley setscrew does not hit the left ribbon guide.
- 18. Install, but do not adjust, the platen open belt and platen open motor pulley (page 204, items 21 and 23).
- 19. Install the paper ironer with the black tape towards the rear of the printer (page 204, item 3).
- 20. Install the shuttle frame assembly (page 174).
- 21. Adjust the platen gap (page 112).
- 22. Adjust the platen open belt (page 106).
- 23. Check ribbon guide alignment (page 116).
- 24. Check the hammer phasing (page 123).
- 25. Return the printer to normal operation (page 103).

## Platen Open Motor

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Cabinet Models: Remove the paper path (page 158).  
Pedestal Models: Remove the top cover assembly (page 143).
3. Cabinet Models: Remove the card cage fan (page 145).
4. Remove the platen open belt cover by squeezing the top and bottom to release the plastic tabs from the slots in the side plate (page 204, item 24).
5. Loosen the two 5/16 inch motor mount screws (page 206, item 15).
6. Loosen the 1/16 inch hex pulley setscrew and remove the motor pulley and platen open belt.
7. Trace the platen open motor cables back to connector P106 on the controller board, releasing the cables from all tie wraps. (See cable routing diagrams in Appendix A.)
8. Remove the platen open cable connector from connector P106. (See page 133.)

---

### Note



Some platen open motors are mounted with nuts and bolts; other motors have threaded flanges, eliminating the need for nuts.

- 
9. Remove the two 5/16 inch motor mount screws (and nuts, if present).
  10. Remove the platen open motor assembly.

## Installation

1. Position the platen open motor assembly with the wires toward the rear (page 206, item 5).
2. Install the two 5/16 inch motor mount screws (and nuts, if present) finger tight.
3. Install the platen open belt and motor pulley. Bottom out the motor pulley on the motor shaft and tighten the 1/16 inch setscrew.
4. Connect the platen motor cable connector to connector shell P106.
5. Connect shell connector P106 to the controller board and install tie wraps to secure the motor cable. (See the wire routing diagrams in Appendix A.)
6. Close the forms thickness lever all the way.
7. Finger tighten the two 5/16 inch screws securing the platen open motor.

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### Caution



Too much tension on the platen open belt can change the platen gap, which can lead to premature wear of the platen, damaged hammer tips, and poor print quality.

- 
8. While pulling the platen open motor toward the rear of the printer, adjust the belt tension to 1/8 inch deflection midway between the pulleys. Tighten the upper motor mount screw with a 5/16 inch nutdriver. Tighten the lower 5/16 inch screw with an open end wrench. Check the deflection of the platen open belt again after the mount screws are tight.
  9. Snap the platen open belt cover into the slots in the side plate.
  10. Cabinet Models: Install the card cage fan (page 145).
  11. Cabinet Models: Install the paper path (page 158).  
Pedestal Models: Install the top cover assembly (page 143).
  12. Return the printer to normal operation (page 103).

## Power Supply Board

---

### Warning



To prevent injury from electric shock, wait at least one minute after shutting off power before removing the power supply board. Do not touch components or flex the board during removal or installation. Handle the board by its sides and always wear a properly grounded static wrist strap when handling the power supply board.

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Cabinet Models: Remove the paper path (page 158).  
Pedestal Models: Remove the top cover assembly (page 143).
3. Disconnect output connector P101 from the controller board and AC input connector P1 from the power supply board. (See page 196, items 4 and 5; or page 198, items 7 and 8, depending on printer model.)
4. Loosen the three captive screws securing the power supply board to the rear wall of the card cage. (See page 196, item 15, or page 198, item 18.)
5. Carefully pry the power supply board off the three studs on the rear wall of the card cage.
6. Remove the power supply board from the card cage.

### Installation

1. Reverse steps 2 through 6 of the removal procedure.
2. Return the printer to normal operation (page 103).

## Resistors, Terminating

For parallel interface configurations, the printer is equipped with 470 ohm pull-up terminating resistors and 1K ohm pull-down terminating resistors on the controller board. These are suitable for most applications. (See Figure 25, page 167.)

If the standard terminating resistor pack is not compatible with the particular interface driver requirements of the host computer, other values of pull-up and pull-down resistors may be required. 220 ohm pull-up and 330 ohm pull-down alternate terminating resistors are provided with the printer. If you install the 220 ohm pull-up resistor, you must also install the 330 ohm pull-down resistor. Possible terminating resistor combinations are shown below.

Configuration	RP1 (Pull-Up)	RP2 (Pull-Down)
Factory Default	470 Ohm	1K Ohm
Alternate 1	220 Ohm	330 Ohm
Alternate 2	1K Ohm	None

### Removal

#### Caution



To prevent electrostatic damage to electronic components, always wear a properly grounded static wrist strap when you handle circuit boards.

1. Prepare the printer for maintenance (page 102).
2. Cabinet Models: Remove the paper path (page 158).  
Pedestal Models: Remove the top cover assembly (page 143).
3. Locate the terminating resistor packs. (See Figure 25, page 167.)
4. Using a chip puller, remove the resistor packs.

### Installation

#### Caution



To prevent electrostatic damage to electronic components, always wear a properly grounded static wrist strap when you handle circuit boards.

1. Using a chip installation tool, install the resistor packs in the correct socket. (See Figure 25, page 167.)

2. Cabinet Models: Install the paper path (page 158).  
Pedestal Models: Install the top cover assembly (page 143).
3. Return the printer to normal operation (page 103).

## CMX Controller Board

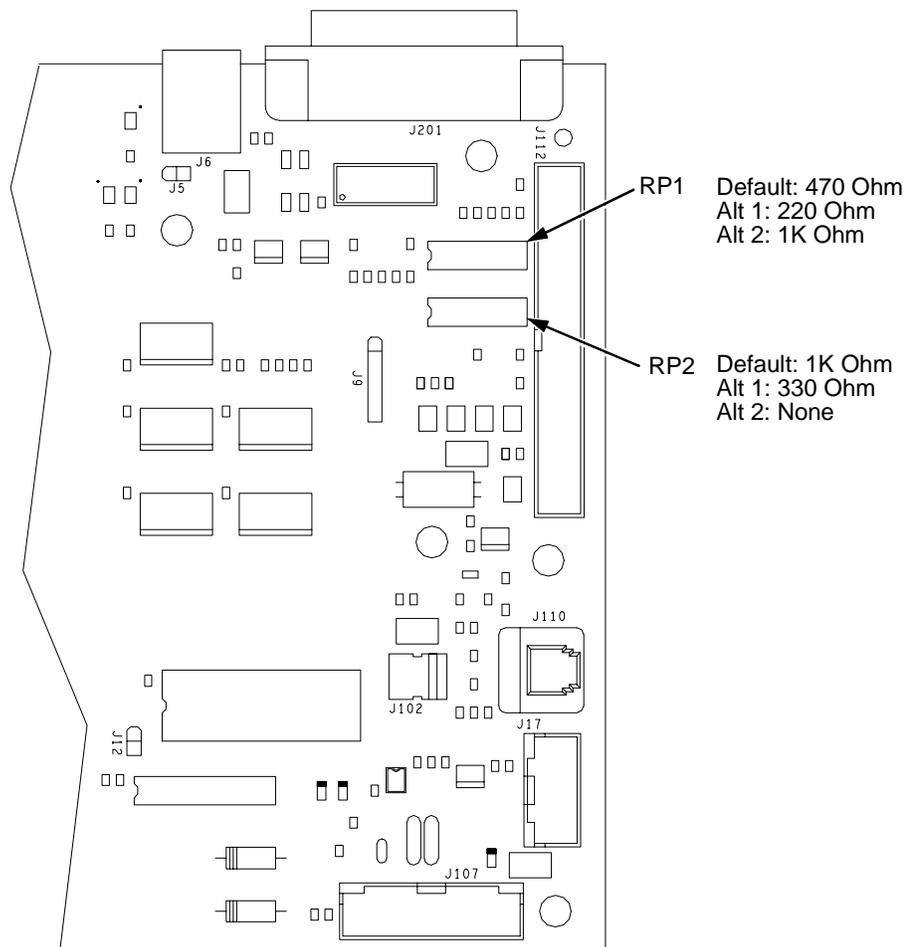


Figure 25. Terminating Resistors, Removal/Installation

## Ribbon Drive Motor

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### Removal

1. Prepare the printer for maintenance (page 102).
2. Remove the ribbon hub (page 170).
3. Remove two screws and washers securing the ribbon drive motor to the base casting. (See page 206, items 18 and 19.)
4. Lift and rotate the ribbon drive motor until the motor cable is aligned with the slot on the base casting.
5. Disconnect the ribbon drive motor cable connector.
6. Remove the ribbon drive motor.

### Installation

1. Reverse steps 2 through 6 of the removal procedure above.

---

#### Note



The ribbon drive motor should be secured at the front right and rear left corners. (See page 206, item 17.)

---

2. Return the printer to normal operation (page 103).



## Ribbon Guide Assembly (L/R)

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**Note**

The right ribbon guide is shown exploded in Figure 39 on page 206. The removal procedure is the same for both ribbon guides.

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Cut and remove the tie-wrap from the tie wrap hole to free the ribbon guide cable. (See page 206, item 11.)
3. Cabinet Models: Remove the paper path (page 158).  
Pedestal Models: Remove the top cover assembly (page 143).
4. Trace the ribbon guide cable back to the controller board, releasing it from the cable restraints. (See the cable routing diagrams in Appendix A.)
5. For the left ribbon guide, disconnect connector shell P106 from the controller board. For the right ribbon cable, disconnect connector shell P107 from the controller board.
6. Trace the ribbon guide wires to the connector shell, and remove the cable connector from the connector shell (page 133).
7. Remove the two 7/32 inch screws and washers securing the ribbon guide assembly to the side plate. (See page 206, items 13 and 14.)
8. Slide the ribbon guide assembly out of the side plate.

### Installation

1. Reverse steps 2 through 8 of the removal procedure above.
2. Align the ribbon guides (page 116).
3. Return the printer to normal operation (page 103).

## Ribbon Hub

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Loosen the Torx T-10 screw in the ribbon spool hub (page 206, item 20).
3. Remove the hub from the shaft of the ribbon drive motor.

### Installation

1. Install the ribbon spool hub over the motor shaft (page 206, item 20).
2. Tighten the Torx T-10 hub screw so that it contacts the flat section of the motor shaft.
3. Return the printer to normal operation (page 103).

## Shaft, Splined

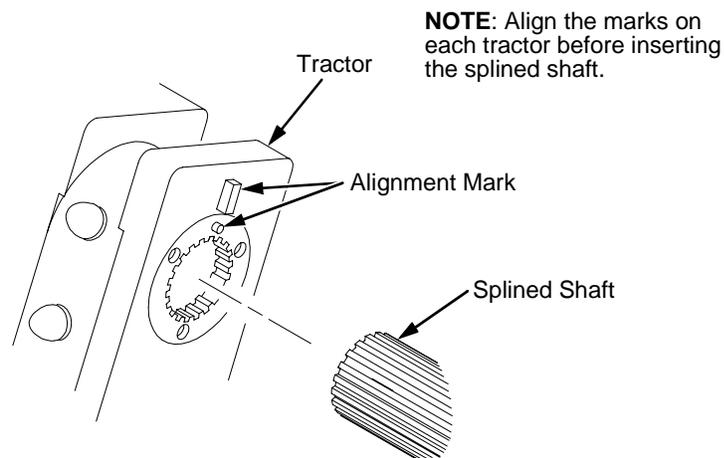
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### Removal

1. Prepare the printer for maintenance (page 102).
2. Remove the paper supports from the splined shaft and support shaft. (See page 202, item 20.)
3. Remove the paper feed timing belt (page 130).
4. Remove the 1/4 inch screw securing the ground clip, and remove the clip (page 202, items 10 and 11).
5. With grip ring pliers, remove the grip ring from left side of the splined shaft (page 202, item 6).
6. Pull the bearing and spring link with the spring off the left side of the splined shaft (page 202, items 7, 8, and 9).
7. Unlock the left and right tractors and slide them to the center of the shaft.
8. Remove the 1/4 inch screw securing the bearing clamp on the right side of the splined shaft, and remove the clamp (page 202, items 13 and 14).
9. Hold the tractors so they do not fall, grasp the vertical adjustment knob, and slide the splined shaft to the right out of the side plates and the tractors.

## Installation

1. Open the doors on the left and right tractors. Position the tractor belts so the alignment marks are at the top on both tractors. (See Figure 26 below.)
2. Grasp the vertical adjustment knob and slide the splined shaft through the right side plate, the tractors, and the left side plate. (See page 202.) Make sure the same spline passes the marked groove on each tractor.
3. Install the bearing clamp and screw.
4. Apply a thin film of bearing lubricant to the bearing.
5. Slide the spring link and bearing onto the left side of the splined shaft with the white nylon bushing flange to the outside of the printer.
6. Attach the spring to the left side plate and the spring link.
7. Install the grip ring on the splined shaft with 0.010 inches of clearance between the grip ring and the nylon bearing.
8. Install the ground clip and screw.
9. Install the paper feed timing belt (page 130).
10. Set the paper feed timing belt tension (page 104).
11. Adjust splined shaft skew (page 118).
12. Install the paper supports on the splined shaft and support shaft. (See page 202, item 20.)
13. Return the printer to normal operation (page 103).



**Figure 26. Splined Shaft and Tractor Installation**

## Shaft, Support

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Unlock the tractors and slide them to the far right.
3. Remove the paper supports from the splined shaft and support shaft. (See page 202, item 20.)
4. Remove the E-ring (page 202, item 17).

---

### Note



Hold the tractors while removing the support shaft. Be careful not to lose the curved spring washers. (See page 202, item 5.)

5. Slide the support shaft assembly—consisting of the support shaft, two curved washers, bushing, horizontal adjustment knob, washer and screw—to the left, out of the tractors and the left side plate. (See page 202, items 1 through 5 and 15.)

### Installation

1. Slide the support shaft assembly—consisting of the support shaft, two curved washers, bushing, horizontal adjustment knob, washer, and screw—into the left side plate. (See page 202, items 1 through 5 and 15.)
2. Slide the tractors onto the support shaft.
3. Slide the support shaft assembly through the right side plate.
4. Push the horizontal adjustment knob to compress the curved washers and install the E-ring in the groove on the support shaft.
5. Install the paper supports to the splined shaft and support shaft. (See page 202, item 20.)
6. Return the printer to normal operation (page 103).

## Shuttle Frame Assembly

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Remove the shuttle cover assembly (page 142).
3. Disconnect the MPU cable connector P03 and shuttle motor cable connector P02 (page 200, items 5 and 6).

---

### Caution



To prevent electrostatic damage to electronic components, always wear a properly grounded static wrist strap when you handle the shuttle frame assembly.

---

4. Disconnect the hammer drive and hammer logic cable connectors from the terminator board on the shuttle frame assembly. (See page 196 or page 198.)
5. Loosen the side 5/32 inch socket head clamp screws on each end of the shuttle and pull the clamps back and off the guide shaft. Do not remove the clamps. Hand tighten the clamp screws to hold the clamps back.
6. Loosen the center 5/32 inch socket head screw enough to release the shuttle frame assembly from the base casting.
7. Unlock and slide the tractors outward as far as they will go on the tractor support shaft.
8. Open the forms thickness lever all the way.
9. Grasping the support legs cast on both sides of the shuttle motor, lift the shuttle frame assembly out of the base casting. Lift it slowly and carefully: the shuttle frame assembly is heavy.

## Installation

1. Install the hammer bank / ribbon mask cover assembly if it was removed (page 139).

---

### Caution



To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when you handle the shuttle frame assembly.

DO NOT remove the grease from the shaft of the replacement shuttle frame assembly. The shuttle shaft is aluminum, and the clamped ends of the shaft must be greased to prevent galling.

---

2. Open the forms thickness lever and move the tractors as far left and right as possible.
3. Holding the shuttle frame assembly by the support legs cast on both sides of the shuttle motor, set it into the base casting. **Use both hands: the shuttle frame assembly is heavy** (page 196 or page 198).
4. Align the center 5/32 inch socket head screw in the base casting and hand turn the screw until only two or three threads have started.
5. Pull the shuttle frame assembly toward the front of the printer and hold it in this position while you do step 6.

---

### Caution



Do not over-tighten the shuttle frame assembly clamp screws.

---

6. Slide the side clamps over the guide shaft and tighten the 5/32 inch socket head clamp screws.
7. Tighten the center captive 5/32 inch socket head screw.
8. Connect the hammer drive and hammer logic cable connectors to the terminator board on the shuttle frame assembly.
9. Connect the shuttle motor cable connector. (See page 200, item 6.)
10. Route the MPU cable under the extension spring and connect the MPU cable connector. (See page 200, item 5.) Make sure the MPU cable does not touch the extension spring after it is connected.
11. If the shuttle assembly is a new or refurbished unit, adjust the platen gap (page 112); otherwise, skip to step 12.
12. Install the shuttle cover assembly (page 142).
13. 475 and 500 lpm models only: set shuttle speed if original shuttle frame assembly was replaced (page 125).
14. Adjust the hammer phasing (page 123).
15. Return the printer to normal operation (page 103).

## Spring Assembly, Gas

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### Caution



Two persons may be required to do this procedure. Prop or hold the printer cover securely while disengaging the gas spring assembly.

This procedure applies only to cabinet models.

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Open the cabinet rear door.
3. Pry back the spring retaining clips. (See Figure 29, page 186.)
4. Remove the gas spring assembly from the ball studs.

### Installation

---

### Caution



The gas spring assembly must be installed with the gas cylinder in the uppermost position.

Two persons may be required to do this procedure. Prop or hold the printer cover securely while installing the gas spring assembly.

---

1. Position the gas spring assembly against the ball studs on the upper and lower brackets. (See Figure 29, page 186.) The gas cylinder must be uppermost.
2. Using external grip ring pliers to spread the retaining clips, push the gas spring assembly onto the ball joints and slide the spring clips over the top (bottom) of the ball joint into the retaining grooves.
3. Close the printer cover.
4. Return the printer to normal operation (page 103).



## Spring, Extension, Hammer Bank

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### Caution



Do not let the hammer bank rotate toward the platen during spring replacement.

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Remove the shuttle cover assembly (page 142).
3. Unhook the extension spring from the spring lugs on the hammer bank and shuttle frame. (See page 200, item 4.)

### Installation

1. Apply a dab of bearing lubricant to both spring lugs.
- 

### Caution



Do not let the hammer bank rotate toward the platen during spring replacement. Make sure the extension spring does not touch the MPU cable after installation.

---

2. Hook the extension spring over the spring lugs. (See page 200, item 4.)
3. Install the shuttle cover assembly (page 142).
4. Return the printer to normal operation (page 103).

## Switch Assembly, Paper Detector

---

### Removal

1. Prepare the printer for maintenance (page 102).
2. Cabinet Models: Remove the paper path (page 158).  
Pedestal Models: Remove the top cover assembly (page 143).
3. Cabinet Models: Loosen four screws and remove the barrier shield.  
(See page 190, items 3, 4, and 9.)  
Pedestal Models: Loosen the four screws and remove the paper guide and barrier shield. (See page 192, items 3, 4, and 5.)
4. Remove the two 1/4 inch screws securing the paper detector switch assembly. (See page 206, item 4.)
5. Trace the paper detector switch cables back to controller board connector P106, removing all tie wraps. (See the cable routing diagrams in Appendix A.)
6. Disconnect connector shell P106 from the controller board (page 133).
7. Trace the paper detector switch cables to the connector shell, and remove the PMD and POD cable connector from the connector shell (page 132).
8. Remove the paper detector switch assembly.

### Installation

1. Holding the slotted wheel against the PMD sensor, position the paper detector switch assembly and install the two 1/4 inch screws securing it to the printer base. (See page 206, item 4.)
2. Check PMD sensor arm range: make sure it travels freely and completely back into the sensing cavity.
3. Route the switch cables back to the controller board connector P106. (See the cable routing diagrams in Appendix A.)
4. Connect switch cables PMD and POD to the connector shell (page 133), then connect P106 to controller board connector J106.
5. Cabinet Models: Install the barrier shield and tighten the four screws. (See page 190, items 3, 4, and 9.)  
Pedestal Models: Install the barrier shield and paper guide and tighten the four screws. (See page 192, items 3, 4, and 5.)
6. Cabinet Models: Install the paper path (page 158).  
Pedestal Models: Install the top cover assembly (page 143).
7. Check the paper out adjustment (page 119).
8. Return the printer to normal operation (page 103).

## Switch Assembly, Platen Interlock

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### Removal

1. Prepare the printer for maintenance (page 102).
2. Cabinet Models: Remove the paper path (page 158).  
Pedestal Models: Remove the top cover assembly (page 143).
3. Fully close the forms thickness lever (position 'A').
4. Trace the platen interlock switch cable back to the controller board.  
Remove tie-wraps as necessary to free the cable. (See cable routing diagrams in Appendix A.)
5. Disconnect connector shell P107 from the controller board.
6. Remove the platen interlock cable connector from the connector shell (page 133).
7. Remove two Phillips #1 screws securing the platen interlock switch assembly. (See page 204, item 11.)
8. Remove the platen interlock switch assembly from the switch bracket.
9. Remove the switch cable from the cutout in the right side plate.

### Installation

1. Reverse steps 2 through 9 of the removal procedure.
2. Return the printer to normal operation (page 103).

## Tractor (L/R)

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### Removal

1. Prepare the printer for maintenance (page 102).
2. Remove the support shaft (page 173).
3. Remove the splined shaft (page 171).

### Installation

1. Using the replacement tractors, install the support shaft (page 173).
2. Install the splined shaft (page 171).
3. Return the printer to normal operation (page 103).

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## Section II: Illustrated Parts Lists

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### Note



Only field-replaceable spares are given part numbers in the illustrated parts lists. Part numbers are not listed for common fasteners and attachment hardware. Items marked “Ref” in the illustrations refer to parts that are not spared or are part of another assembly.

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### Illustrations of Printer Components

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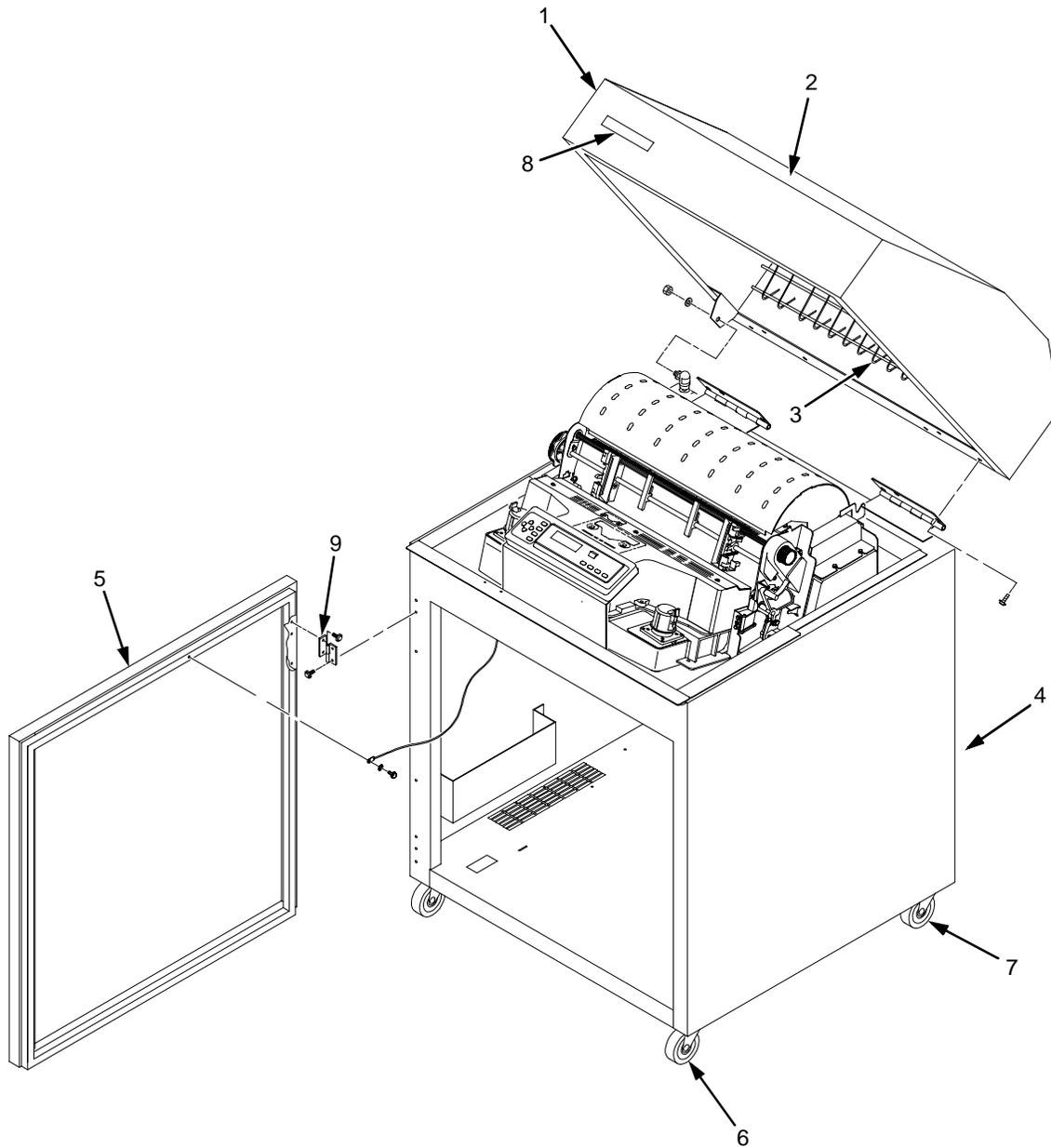


Figure 27. Top Cover, Doors, and Casters

Item No.	Part No.	Description	Notes
1	164212-905PX	Top Cover Kit, Cabinet	Includes mounting hardware
2	131803-901PX	Window, Top Cover	Not visible in Figure 27
3	153997-001PX	Field Kit, Paper Path	Includes mounting hardware and static brush
4	153084-902PX	Rear Door Kit	Includes mounting hardware
5	153084-903PX	Front Door Kit	Includes mounting hardware
6	141278-901PX	Caster, with Brake	Two at front
7	141278-902PX	Caster, without Brake	Two at rear
8	Ref	Logo	
9	131829-001PX 112367-001PX	Hinge Plate, Door, Top Hinge Plate, Door, Bottom	

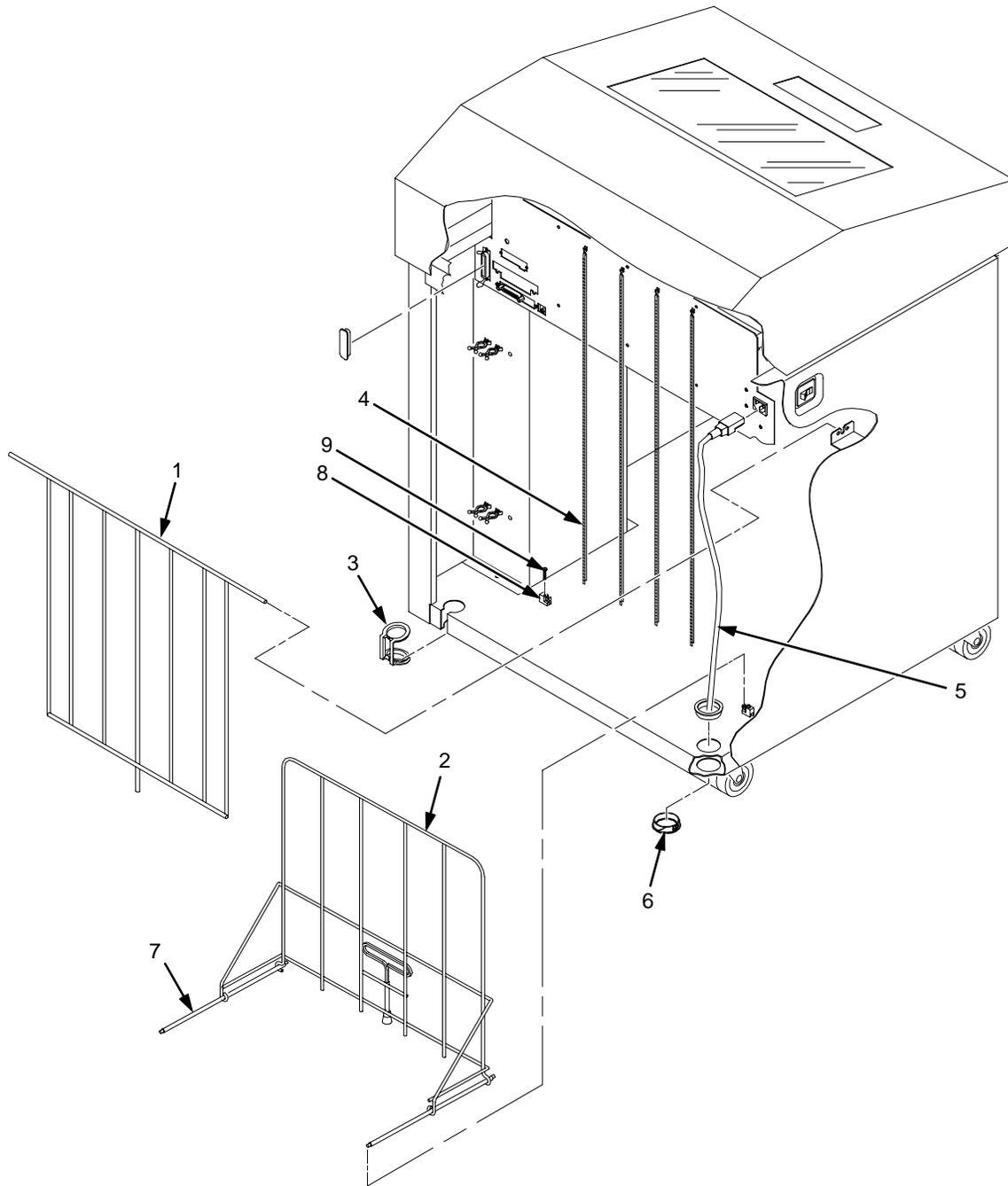


Figure 28. Paper Fence and Chains



Item No.	Part No.	Description	Notes
1	Ref	Paper Fence	475 and 500 lpm models
2	Ref	Paper Tray Assembly	800, 1000, 1200, 1400, and 1500 lpm models. (SureStak Power Stacker Option available for cabinet models. See Appendix F.)
3	153503-001PX	Grommet Kit, Cabinet	
4	153778-001PX	Chain Assembly Kit	
5	Ref	AC Power Cord	
6	Ref	Grommet, Power Cord (2)	Included in item 3
7	Ref	Rail, Stacker	Part of item 2
8	151831-001PX	Clip, Rail, Stacker	
9	Ref	Screw (4)	

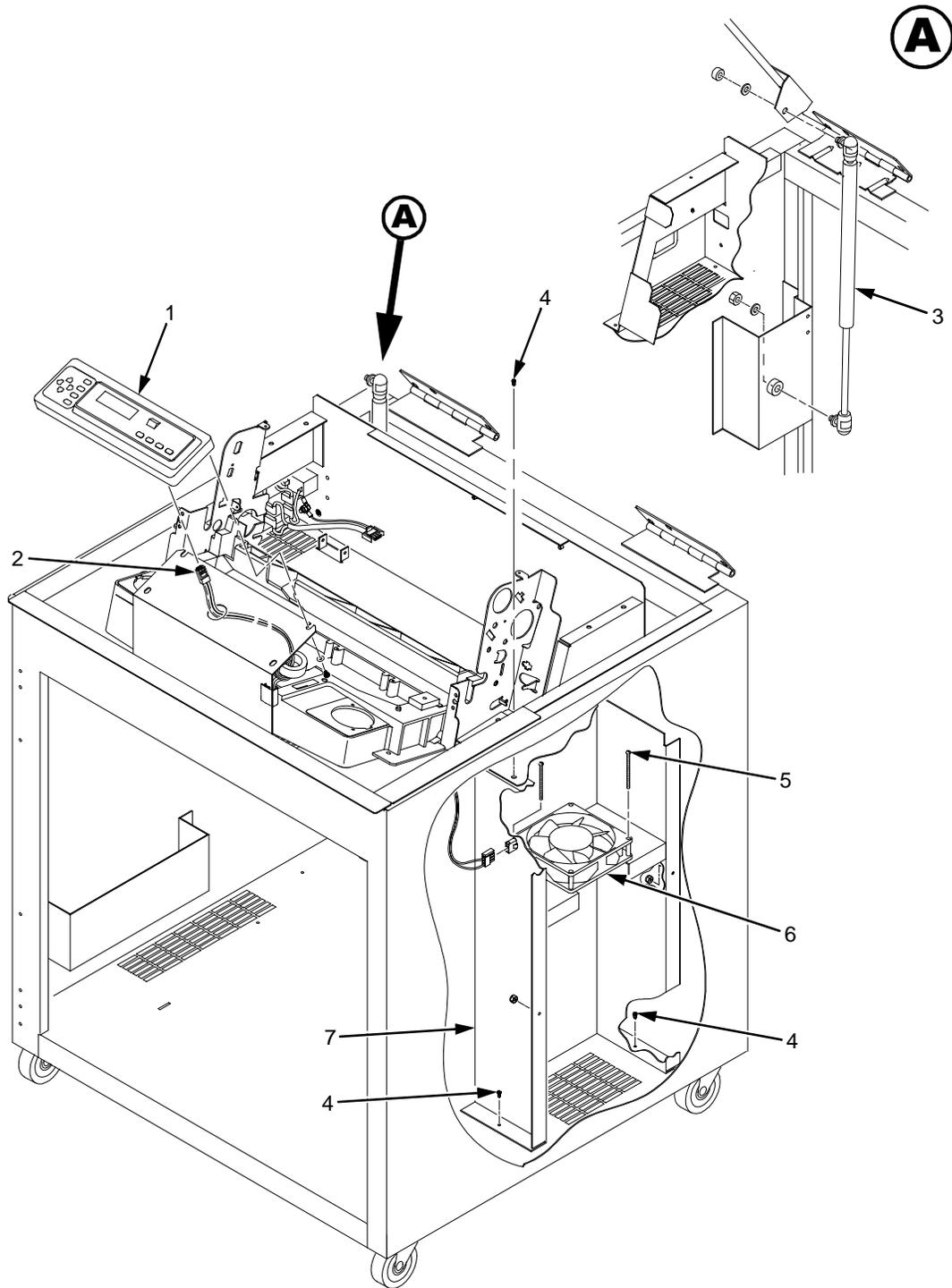


Figure 29. Control Panel and Cabinet Details

Item No.	Part No.	Description	Notes
1	153700-901PX	Control Panel Assembly	Includes mounting hardware
2	152440-901PX	Cable Assembly, Control Panel	Installed with shielding beads: See Appendix E
3	107961-905PX	Gas Spring Kit	Includes ball studs, spring clips, and mounting hardware
4	Ref	Screw, w/Lock Washer (2)	6-32x.375
5	Ref	Screw, w/Lock Washer (3)	6-32x2.00
6	150261-901PX	Fan Assembly	Includes mounting hardware
7	Ref	Duct, Air Exhaust	

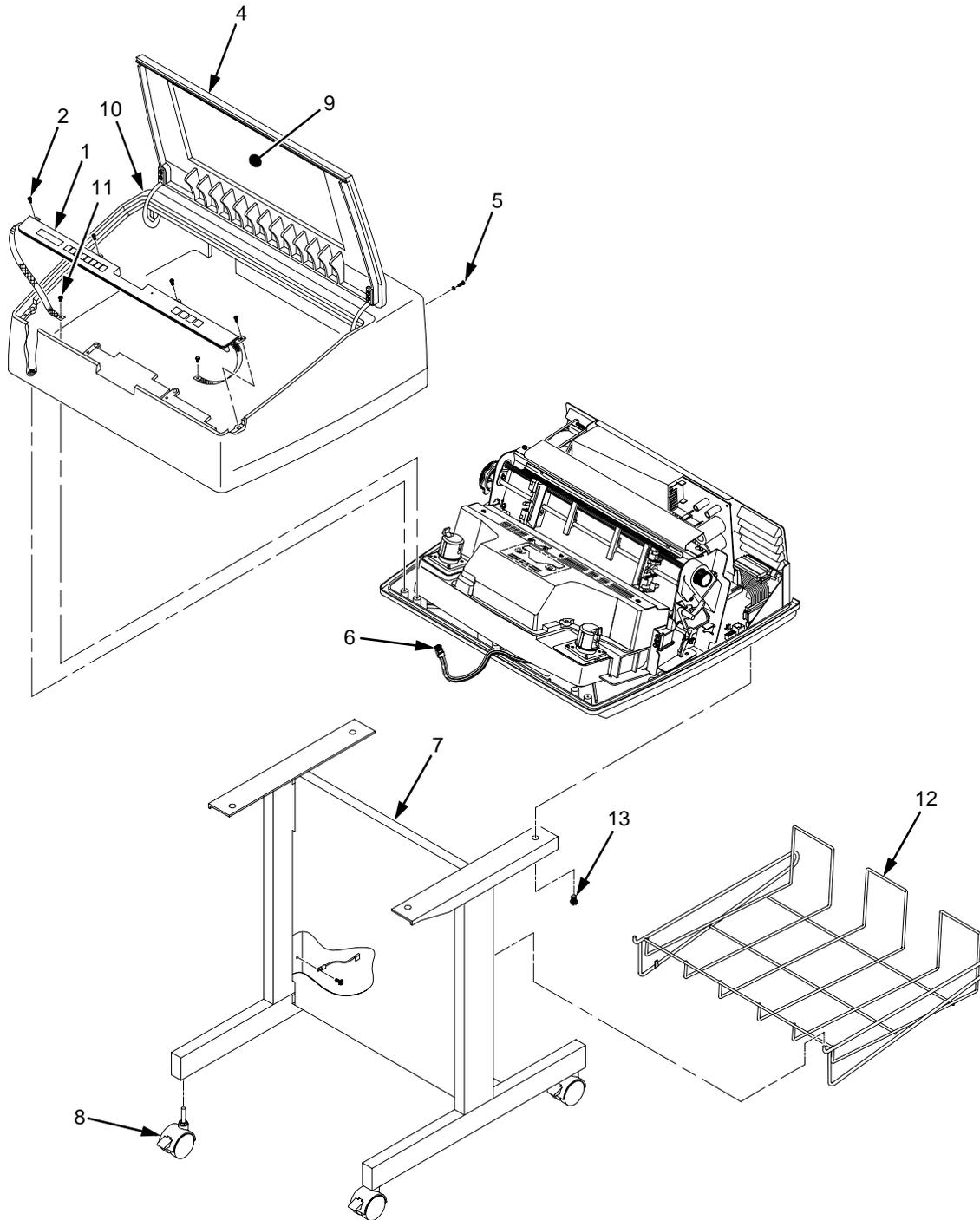


Figure 30. Pedestal Details

Item No.	Part No.	Description	Notes
1	153366-901PX	Control Panel Assembly	
2	Ref	Screw, Captive (4)	
3	Ref	Screw, Captive (2)	Part of item 10
4	Ref	Lid, Pedestal Model	Part of item 10
5	Ref	Screw (2)	
6	152440-901PX	Cable Assembly, Control Panel	
7	154288-002PX	Pedestal Kit w/Tray	
8	158635-001PX	Caster w/Brake, Pedestal (4)	
9	Ref	Window, Top Cover	Part of item 10
10	157337-901PX	Top Cover, Complete	
11	Ref	Screw (2)	Control panel ground strap
12	110718-001PX	Paper Tray	
13	Ref	Screw (4)	10-32x.625

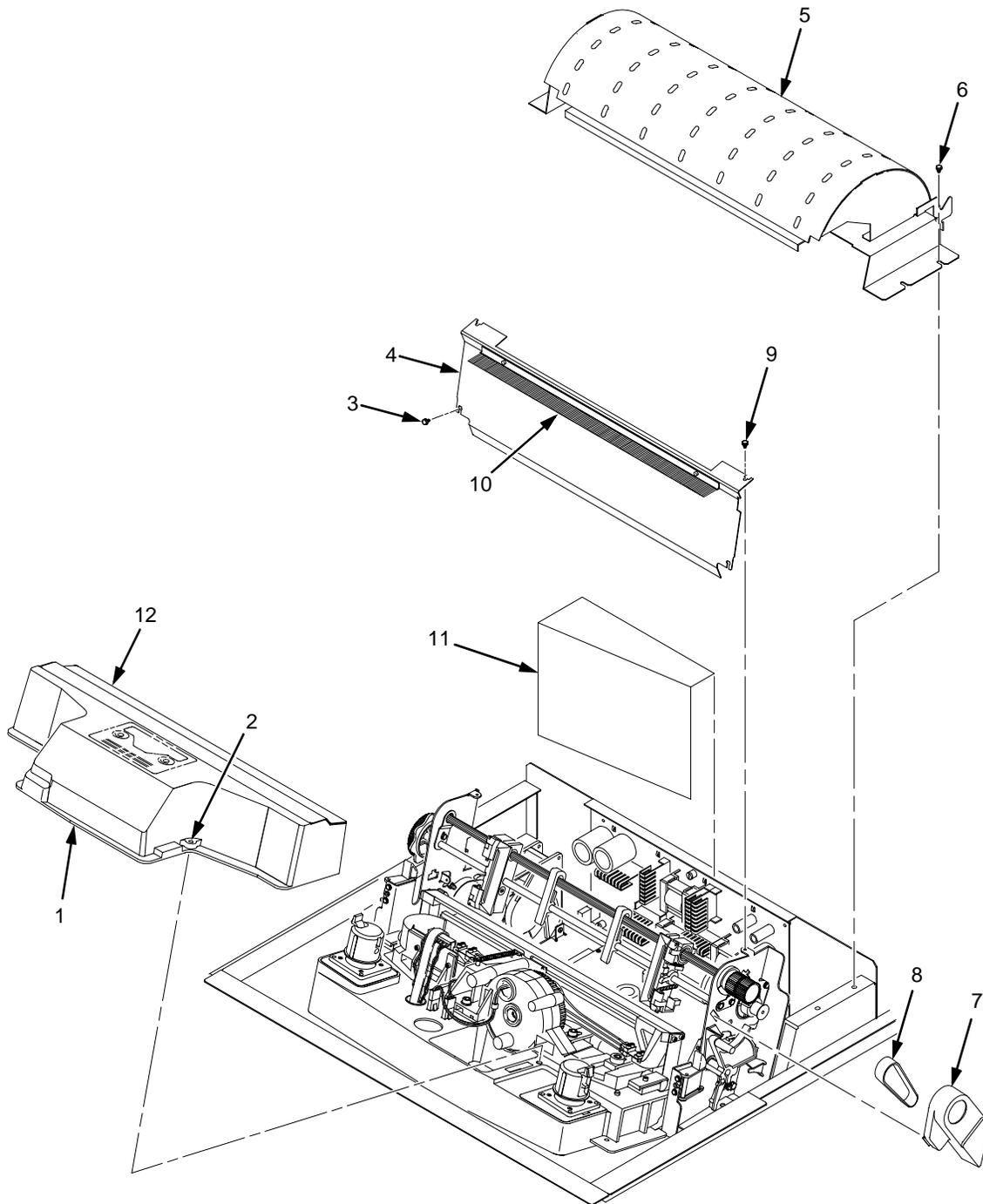


Figure 31. Inside Covers, Cabinet Models

Item No.	Part No.	Description	Notes
1	164295-001PX	Shuttle Cover	(Shroud Assembly, Air)
2	Ref	Screw, Captive (2)	10-24x.62 with O-ring, .125x.250x.06
3	Ref	Screw, Thread-forming (2)	6-32x.25 and #6 flat washer
4	Ref	Barrier Shield	
5	152290-901PX	Paper Path	
6	Ref	Screw, w/Lock Washer (3)	6-32.25 and #6 flat washer
7	153488-001PX	Platen/Paper Feed Cover Kit	
8	108664-903PX	Belt, Timing, .080 Pitch, 100 Teeth, .500 Wide	Paper Feed Belt
9	Ref	Screw, Thread-forming (2)	6-32x.25
10	152284-901PX	Anti-Static Brush Kit	
11	Ref	Power Supply Shield	Taped to upper edge of card cage
12	153528-901PX	Paper Scale	

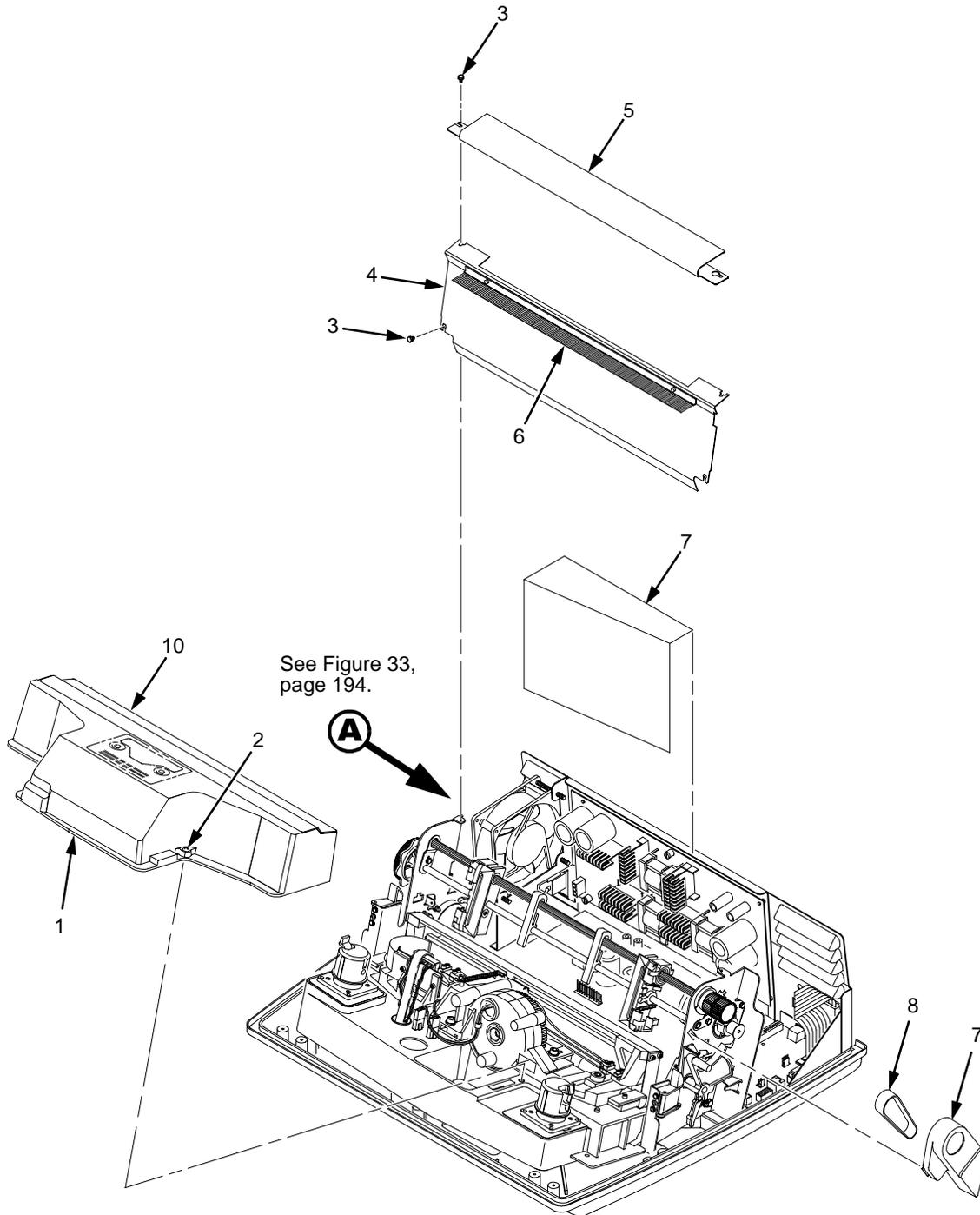


Figure 32. Inside Covers and Card Cage, Pedestal Models



Item No.	Part No.	Description	Notes
1	164295-001PX	Shuttle Cover	(Shroud Assembly, Air)
2	Ref	Screw, Captive (2)	10-24x.62 with O-ring, .125x.250x.06
3	Ref	Screw, Thread-forming (4)	6-32x.25 and #6 flat washer
4	Ref	Barrier Shield	
5	154286-001PX	Paper Path	
6	152284-901PX	Anti-Static Brush Kit	
7	Ref	Power Supply Shield	Taped to upper edge of card cage
8	108664-903PX	Belt, Timing, .080 Pitch, 100 Teeth, .500 Wide	Paper Feed Belt
9	153488-001PX	Platen/Paper Feed Cover Kit	Paper Feed Belt Cover
10	153528-901PX	Paper Scale	

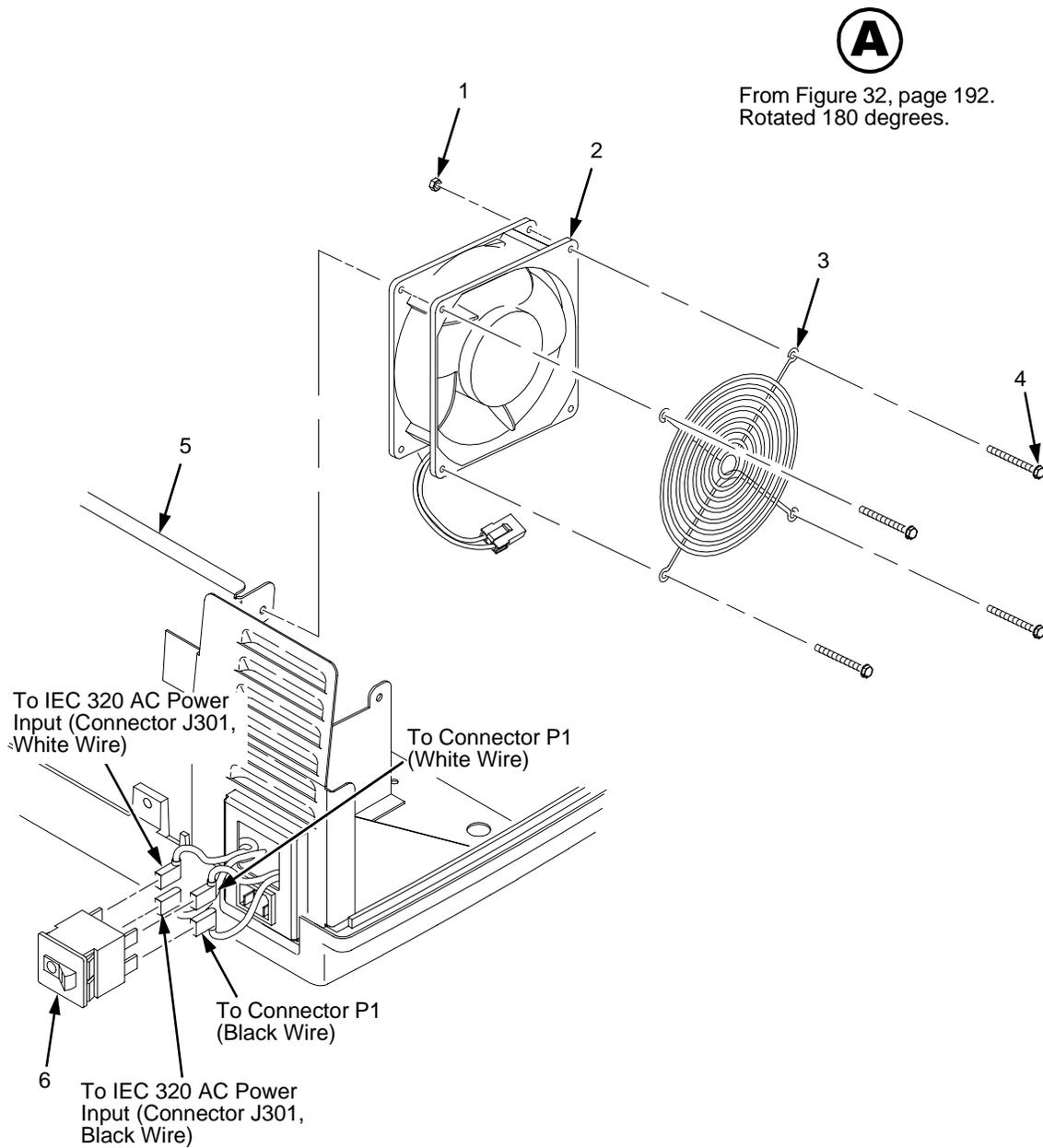


Figure 33. Card Cage Detail, Pedestal Models

Item No.	Part No.	Description	Notes
1	Ref	Nut, 6-32 (1)	Upper right fan corner only
2	150261-901PX	Card Cage Fan Assembly	Air flow is into card cage
3	Ref	Fan Guard	
4	Ref	Screw, w/Lock Washer (4)	6-32x1.75
5	Ref	Card Cage, Pedestal	
6	142013-901PX	Circuit Breaker	

Two places:  
Exploded to show  
assembly. Do not  
remove holddown  
clamps and  
screws.

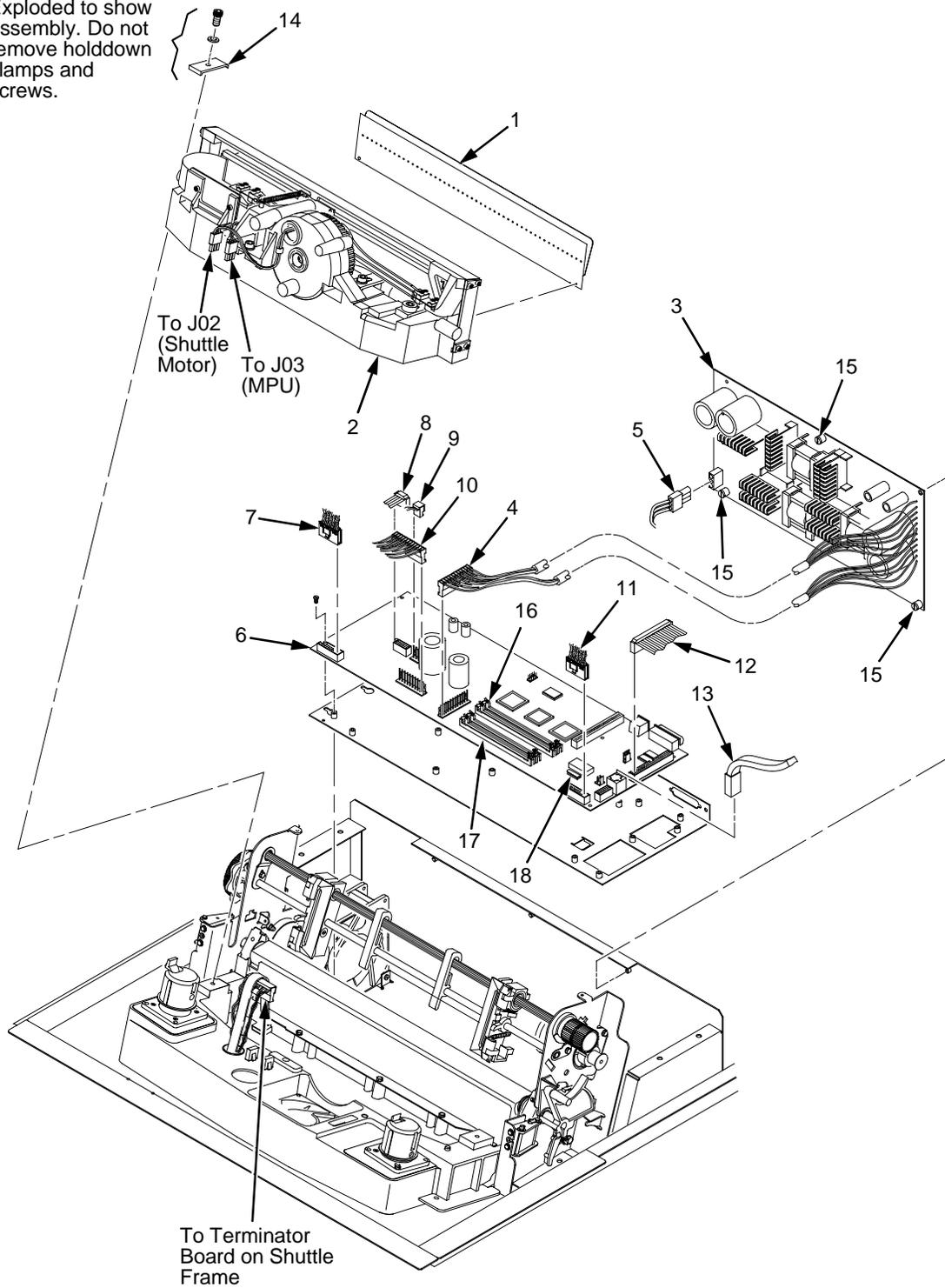


Figure 34. Print Mechanism and Circuit Boards: Early Models

Item No.	Part No.	Description	Notes
1	159766-901PX	Hammer Bank/Ribbon Mask Cover Assy	LP/Q 475, LP/Q 500
	159767-901PX	Hammer Bank/Ribbon Mask Cover Assy	LP/Q 800
	159768-901PX	Hammer Bank/Ribbon Mask Cover Assy	LPQ 1200 and LPQ 1400
2	153320-901PX	Shuttle Frame Assembly	LP/Q 475
	C3201-69001	475 LPM Exchange Shuttle	
	158338-901PX	Shuttle Frame Assembly	LP/Q 500
	C3201-69101	500 LPM Exchange Shuttle	
	153276-901PX	Shuttle Frame Assembly	LP/Q 800
	C3203-69001	800 LPM Exchange Shuttle	
	153321-901PX	Shuttle Frame Assembly	LPQ 1200
	C3205-69001	1200 LPM Exchange Shuttle	
	157282-901PX	Shuttle Frame Assembly	LPQ 1400
	C5640-69001	1400 LPM Exchange Shuttle	
	153969-001PX	Hammer Spring Assembly	LP/Q 475, LP/Q 500
	153970-001PX	Hammer Spring Assembly	LP/Q 800
	153971-001PX	Hammer Spring Assembly	LPQ 1200 and LPQ 1400
3	157102-901PX	Power Supply PCBA, V4	All models
	C3201-691003	Exchange Power Supply	
4	Ref	P101 Cable Connector	
5	Ref	Cable Assembly, AC In, Power Supply	Part of Field Kit, AC Assy, 153502-901PX
6	157450-901PX	Controller Board Assembly, CMX V5.5 40 MHz	All models
	C3201-69102	Exchange Controller Board	
7	202362-001PX	Connector Kit (P106/P107)	P106, Motor Sensor, Left
8	152421-901PX	Hammer Bank Logic Cable Assembly	See also Appendix A
9	152420-901PX	Shuttle Motor Cable Assembly	See also Appendix A
10	152423-901PX	Hammer Bank Power Cable Assembly	See also Appendix A
11	202362-001PX	Connector Kit (P106/P107)	P107, Motor Sensor, Right
12	152439-901PX	Centronics I/O Cable Assembly	See also Appendix A
13	Ref	Control Panel Cable Assembly	
14	150399-901PX	Clamp, Shaft, Receiving	
15	Ref	Screw, Captive, Power Supply (3)	
16	202417-001PX	SIMM, Flash Memory, 4 MB	See page 152
17	202412-001PX	SIMM, DRAM, 4 MB	See page 152
18	154141-007PX	Security Module, Base	See page 152

Two places:  
Exploded to show  
assembly. Do not  
remove holddown  
clamps and  
screws.

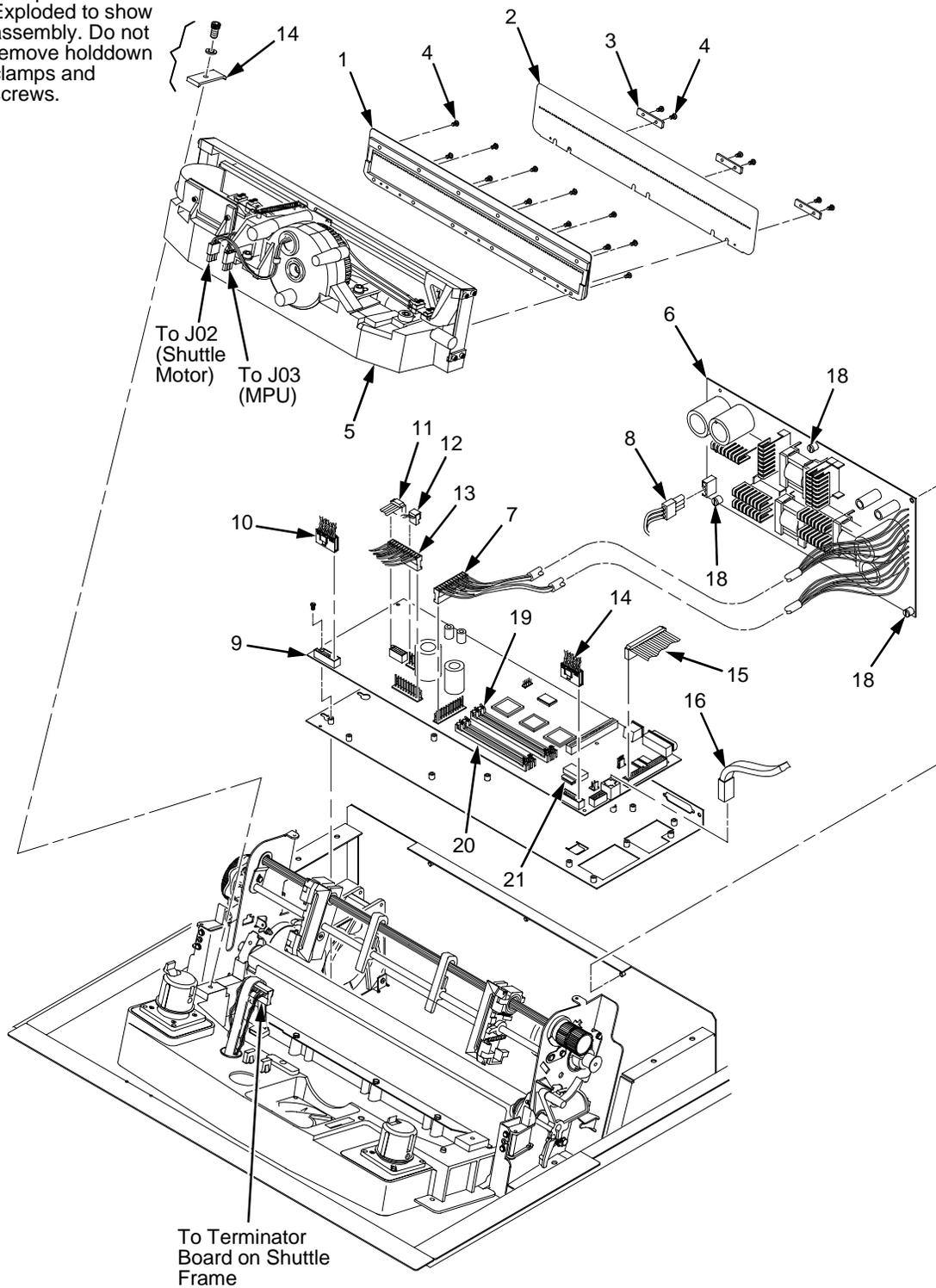


Figure 35. Print Mechanism and Circuit Boards: Later Models

Item No.	Part No.	Description	Notes
1	163802-901PX	Hammer Bank Cover	LP/Q 500 (C Models)
	163795-901PX	Hammer Bank Cover	LPQ 1000
	164216-901PX	Hammer Bank Cover	LPQ 1500
2	163789-901PX	Ribbon Mask, 500	LP/Q 500 (C Models)
	163797-901PX	Ribbon Mask, 1000	LPQ 1000
	164204-901PX	Ribbon Mask, 1500	LPQ 1500
3	163812-001PX	Ribbon Mask Clamp Plate	
4	Ref	Screw, Torx T-10	12 for hammer bank cover 6 for ribbon mask
5	163984-901PX	Shuttle Frame Assembly	LP/Q 500 (C Models)
	C3201-69203	500 "C" LPM Exchange Shuttle	
	163985-901PX	Shuttle Frame Assembly	LPQ 1000
	C3204-69003	1000 LPM Exchange Shuttle	
	157735-901PX	Shuttle Frame Assembly	LPQ 1500
	C3205-69003	1500 LPM Exchange Shuttle	
	164266-001PX	Hammer Spring Assembly Field Kit	LP/Q 500 (C Models)
	164267-001PX	Hammer Spring Assembly Field Kit	LPQ 1000
164269-001PX	Hammer Spring Assembly Field Kit	LPQ 1500	
6	157102-901PX	Power Supply PCBA, V4	
	C3201-69103	Exchange Power Supply	
7	Ref	P101 Cable Connector	
8	Ref	Cable Assembly, AC In, Power Supply	Part of Field Kit, AC Assy, 153502-901PX
9	157450-901PX	Cntrlr Brd Assembly, CMX V5.5 40 MHz	
	C3201-69102	Exchange Controller Board	
10	202362-001PX	Connector Kit (P106/P107)	P106, Motor Sensor, Left
11	152421-901PX	Hammer Bank Logic Cable Assembly	See also Appendix A
12	152420-901PX	Shuttle Motor Cable Assembly	See also Appendix A
13	152423-901PX	Hammer Bank Power Cable Assembly	See also Appendix A
14	202362-001PX	Connector Kit (P106/P107)	P107, Motor Sensor, Right
15	152439-901PX	Centronics I/O Cable Assembly	See also Appendix A
16	Ref	Control Panel Cable Assembly	
17	150399-901PX	Clamp, Shaft, Receiving	
18	Ref	Screw, Captive, Power Supply (3)	
19	202417-001PX	SIMM, Flash Memory, 4 MB	See page 152
20	202412-001PX	SIMM, DRAM, 4 MB	See page 152
21	154141-007PX	Security Module, Base	See page 152

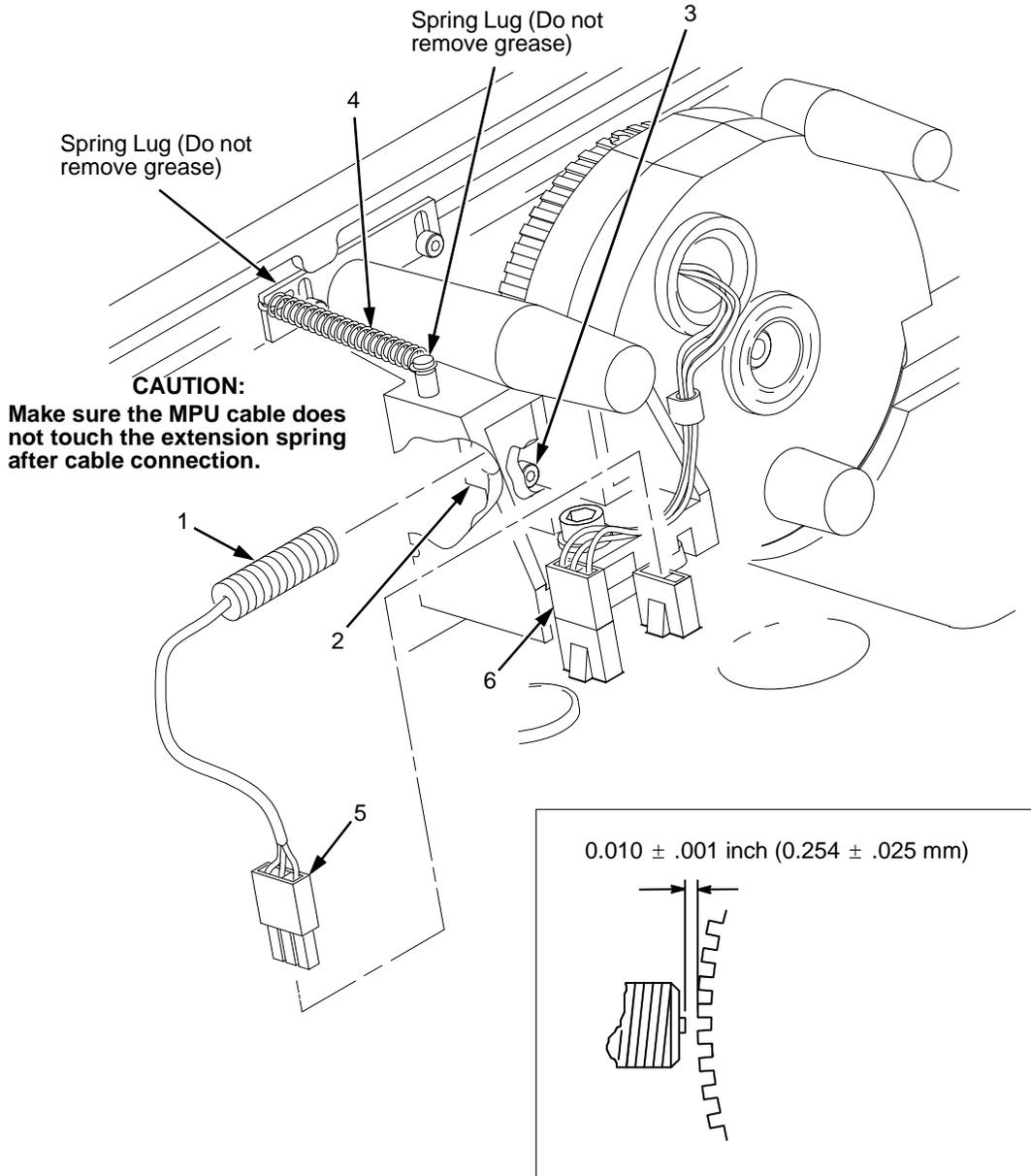
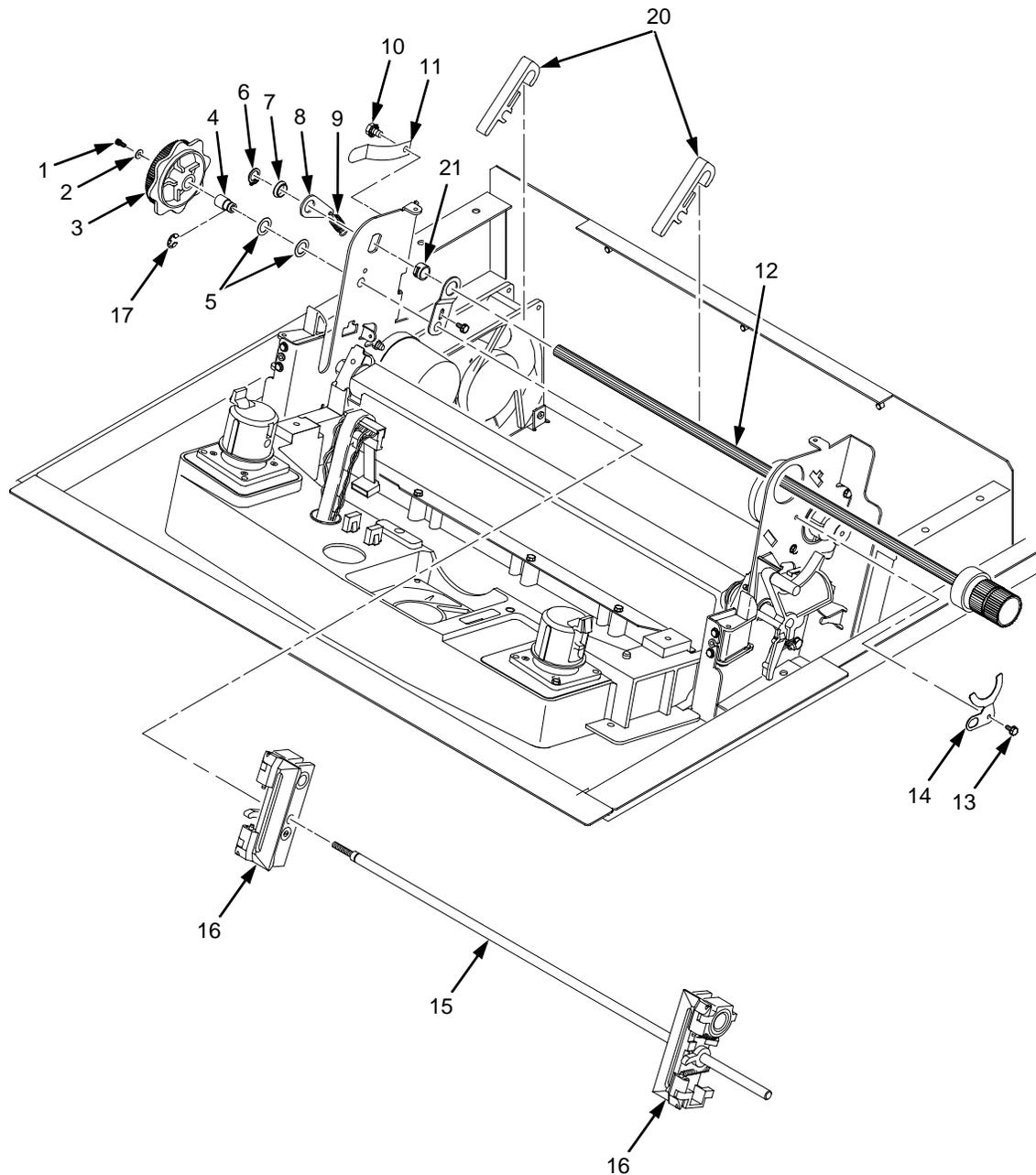


Figure 36. Magnetic Pickup (MPU) and Extension Spring



Item No.	Part No.	Description	Notes
1	150281-901PX	MPU Assembly	
2	Ref	Bracket, MPU	Part of item 1
3	Ref	Screw, Socket Cap	6-32x.38
4	153537-901PX	Extension Spring	
5	Ref	MPU Cable Connector (P03)	
6	Ref	Shuttle Motor Cable Connector (P02)	



**NOTE**

Item 18 (not shown): Tractor Shaft Hardware Kit, includes items 6, 7, 8, 9, 13, 14, and 21  
 Item 19 (not shown): Tractor Shaft Kit, includes items 1, 2, 3, 4, 5, 15, and 17

**Figure 37. Tractor Shafts**

Item No.	Part No.	Description	Notes
1	Ref	Screw, Socket Cap	Part of item 19
2	Ref	Washer, Flat #4	Part of item 19
3	Ref	Knob, Tractor Adjust	Part of item 19
4	Ref	Bushing, Tractor Adjust	Part of item 19
5	Ref	Washer, Curved Spring (2)	Part of item 19
6	Ref	Ring, Grip	Part of item 18
7	Ref	Bearing, Nylon .626	Part of item 18
8	Ref	Link, Spring	Part of item 18
9	Ref	Spring, Extension 1.00L	Part of item 18
10	Ref	Screw, Hex w/Lock Washer, 4-20x.50	Part of item 11
11	150784-901PX	Clip, Grounding	
12	150491-901PX	Splined Shaft Assembly	
13	Ref	Screw, Thread-forming	Part of item 18
14	Ref	Clamp, Bearing	Part of item 18
15	Ref	Tractor Shaft	Part of item 19
16	140716-903PX 158741-001PX	Tractor Set, RH & LH Tractor Assembly, Power Stacker, P5XXX	Used with power stacker
17	Ref	E-Ring	Part of item 19
18	153540-001PX	Tractor Shaft Hardware Kit	Includes items 6, 7, 8, 9, 13, 14, and 21
19	153431-001PX	Tractor Shaft Kit	Includes items 1, 2, 3, 4, 5, 15, and 17
20	155182-901PX	Paper Support	
21	Ref	Bushing	Part of item 18

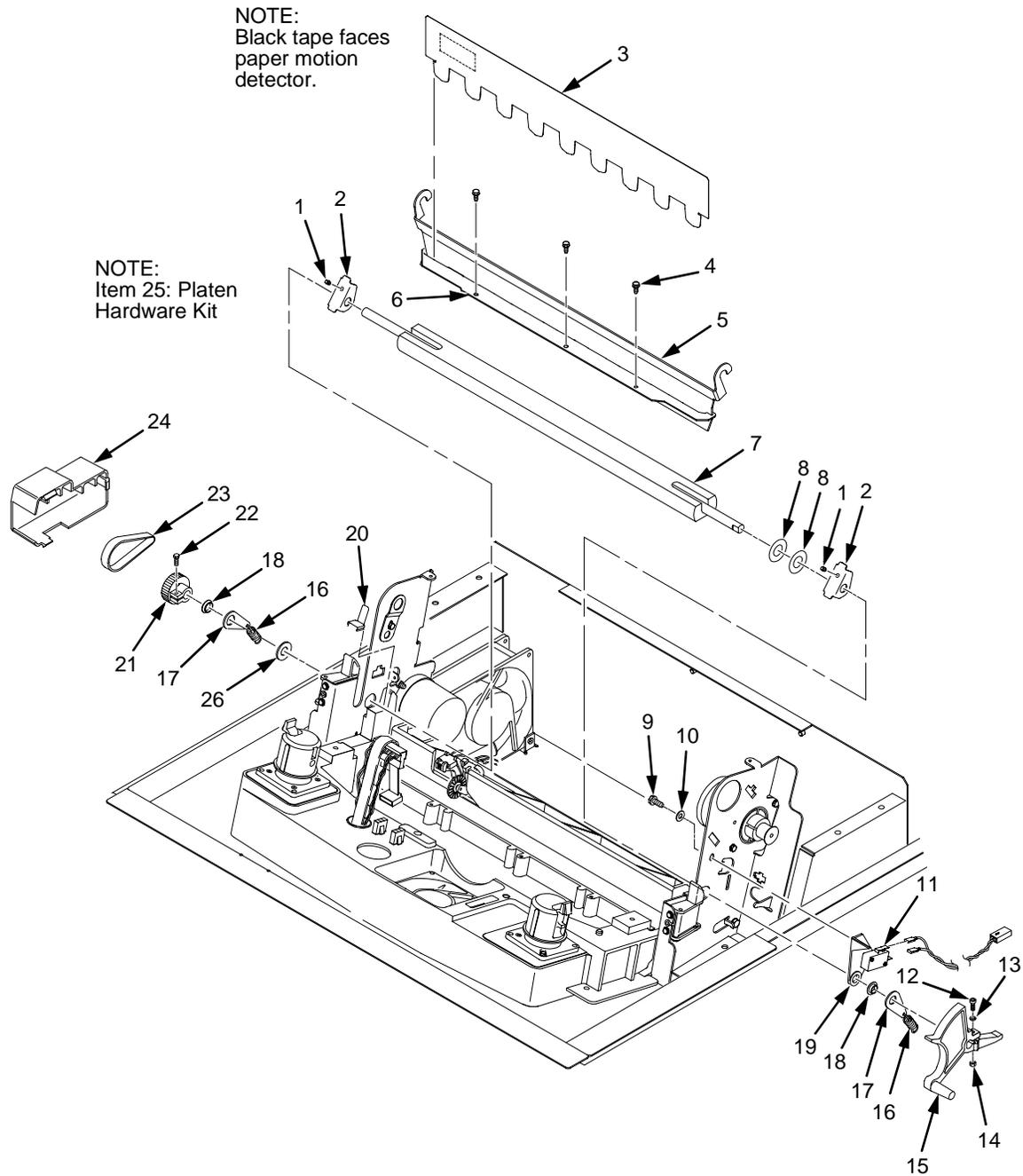


Figure 38. Platen

Item No.	Part No.	Description	Notes
1	Ref	Setscrew (2)	Part of item 25
2	Ref	Bracket, Platen (2)	Part of item 25
3	150957-901PX	Ironer, Paper	
4	Ref	Screw, Thread-forming (3)	6-32x.25
5	Ref	Bracket, Ironer	
6	Ref	Plate, Ironer	
7	112657-901PX	Platen Assembly	
8	Ref	Washer, Flat (2)	Part of item 25
9	Ref	Screw (2)	Part of item 11
10	Ref	Washer, Flat #4 (2)	Part of item 11
11	152417-901PX	Platen Switch Kit	Includes items 9, 10, 19
12	Ref	Screw, Socket Cap, 6-32x.75	Part of item 15
13	Ref	Washer	Part of item 15
14	Ref	Nut	Part of item 15
15	154650-901PX	Platen Lever Kit	Includes items 12, 13, 14
16	Ref	Spring, Extension 1.12L	Part of item 25
17	Ref	Link, Spring	Part of item 25
18	Ref	Bearing, Nylon .376	Part of item 25
19	Ref	Bracket, Switch Mount	Part of item 11
20	Ref	Wear Saddle, Platen (2)	Part of item 25
21	150703-902PX	Platen Pulley, Drive	
22	Ref	Screw, Socket Cap, 6-32x.44	Part of item 21
23	141516-901PX	Belt, Timing, .080 Pitch, .312 Wide	Platen Open Belt
24	153488-001PX	Platen/Paper Feed Cover Kit	(Cover, belt, platen open shown)
25	153430-001PX	Platen Hardware Kit	Includes items 1, 2, 8, 16, 17, 18, 20, 26
26	Ref	Platen Washer	Part of item 25

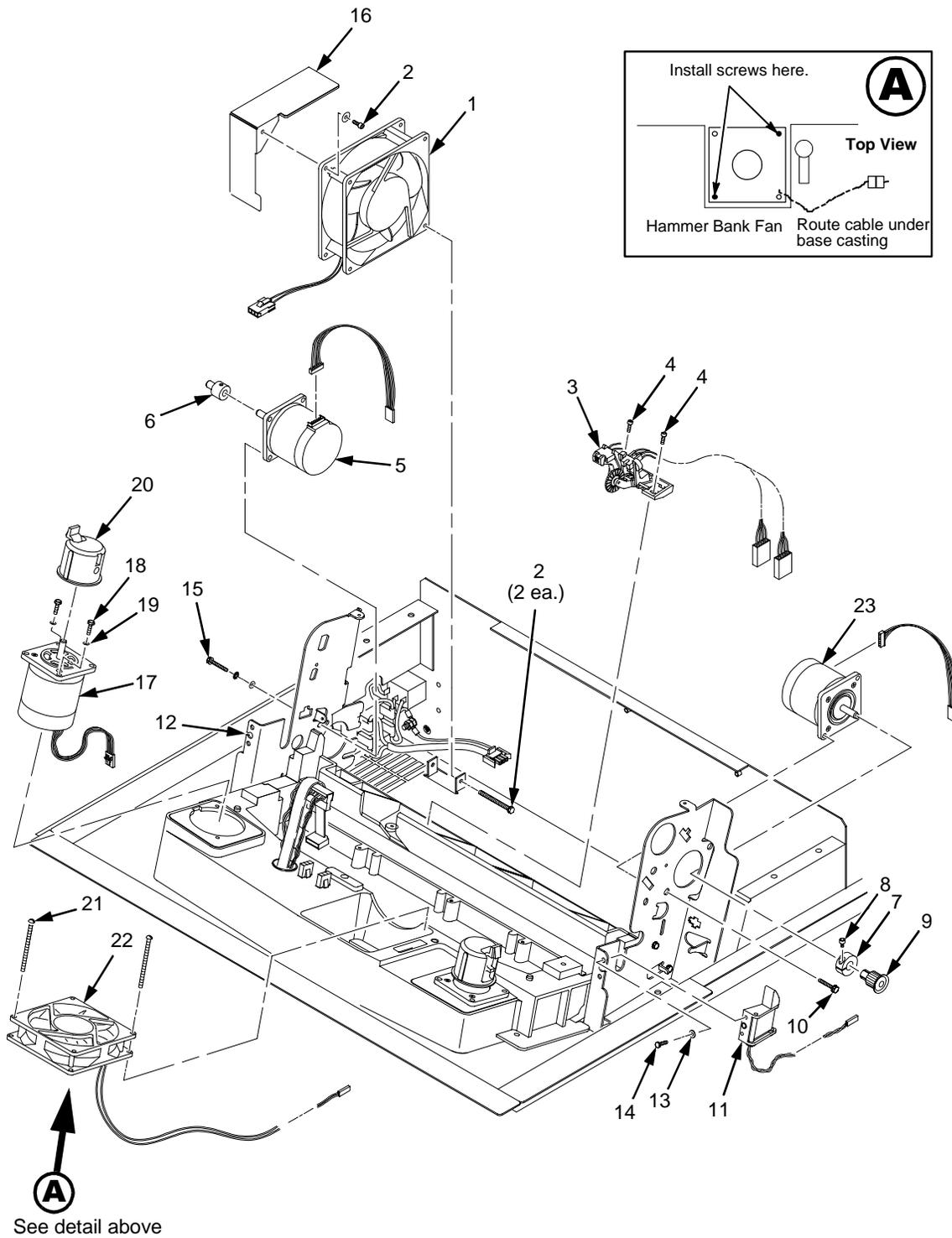


Figure 39. Motors, Fans, and Paper Detector Switch

Item No.	Part No.	Description	Notes
1	150261-901PX	Card Cage Fan Assembly	Air flow is into card cage
2	Ref	Screw, w/Lock Washer (3)	Two 6-32x1.75 on bottom, One 6-32x0.50 on top left
3	152415-901PX	Switch Assembly, Paper Detector	
4	Ref	Screw, Thread-forming, 6-32x.375 (2)	Part of item 3
5	152299-901PX	Motor Assembly, Platen	
6	155071-902PX	Platen Pulley, Drive Motor	With setscrew: 6-32x.25
7	Ref	Collar, Shaft	Part of item 9
8	Ref	Setscrew, 6-32x.51	Part of item 7
9	108627-901PX	Pulley, Paper Feed	
10	Ref	Screw, Hex w/Lock Washer, 10-24x.50 (2)	Part of item 23
11	163597-901PX	Ribbon Guide Kit	
12	Ref	Ribbon Guide Kit	Same as item 11
13	Ref	Washer, Flat #4	Part of item 12
14	Ref	Screw, w/Lock Washer, 4-40x.38	Part of item 12
15	Ref	Screw, w/Lock Washer, 10-32x.50 (2)	Part of item 5
16	Ref	Shield, Card Cage Fan	
17	154071-901PX	Motor Assembly, Ribbon	
18	Ref	Screw, Hex w/Lock Washer (2)	6-32x.50
19	Ref	Washer, Flat #6 (2)	
20	150868-001PX	Ribbon Hub Kit	
21	Ref	Screw, w/Lock Washer (2)	6-32x1.25
22	152416-901PX	Hammer Bank Fan Assembly	Air flow is up
23	154068-901PX	Motor Assembly, Paper Feed	

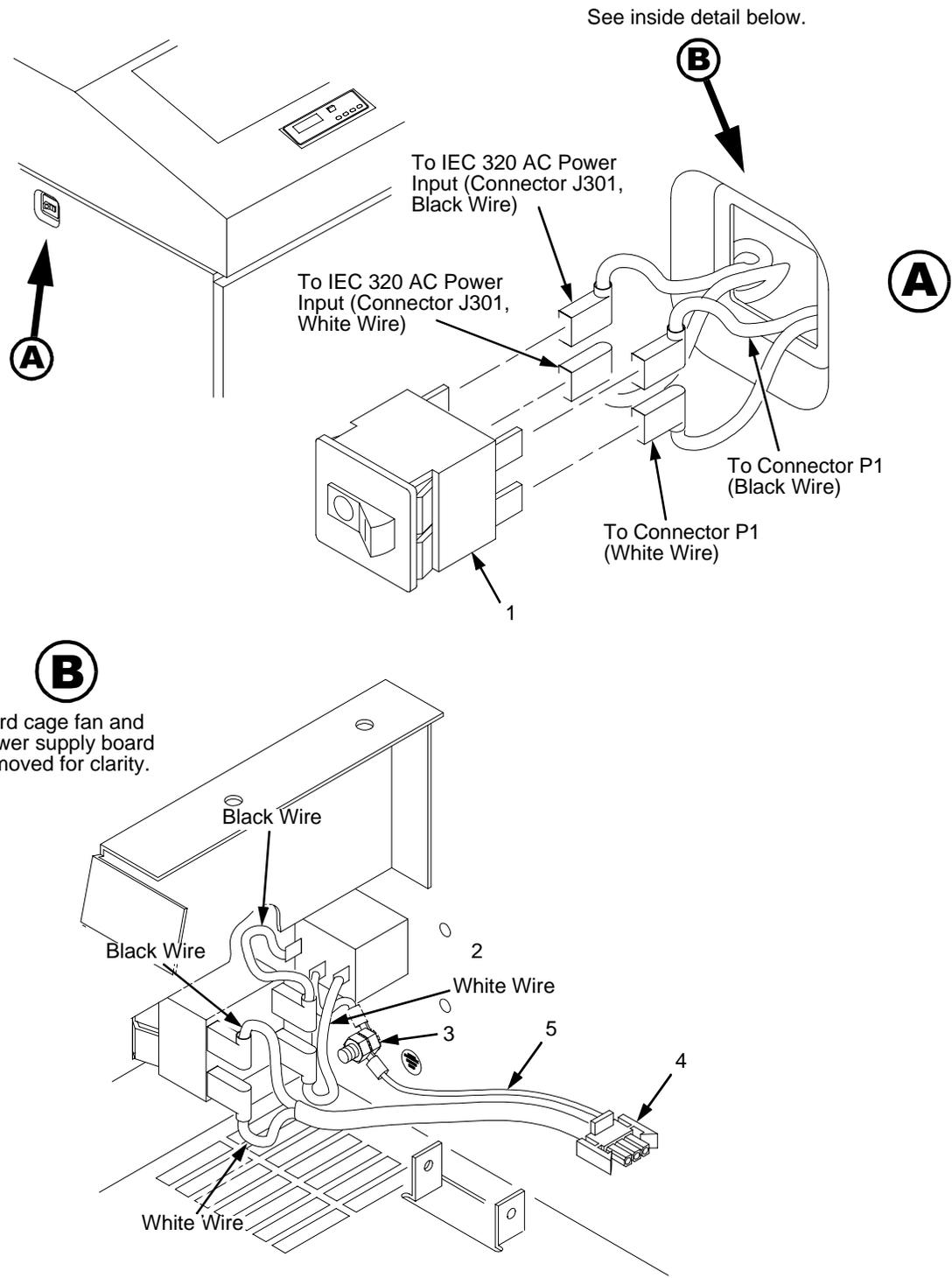


Figure 40. Circuit Breaker, Cabinet Models



Item No.	Part No.	Description	Notes
1	142013-901PX	Circuit Breaker	
2	Ref	IEC 320 AC Power Connector	Connector J301
3	Ref	Chassis Ground Stud	
4	Ref	Connector P1	To power supply board connector J1 AC
5	Ref	Cable Assembly, AC In, Power Supply	Part of Field Kit, AC Assy 153502-001PX



# 7

## *Principles of Operation*

### Line Matrix Printing

The printer creates characters and graphics by printing patterns of ink dots an entire line at a time. This technique is called line matrix printing.

Every text character is stored in printer memory as a pattern of dots on a logical grid called the dot matrix. (See Figure 41.) The ink dots are made by a row of small hammers mounted on a shuttle that sweeps rapidly back and forth. Logic circuits divide every line of incoming data into horizontal dot rows. The hammers put dots at the required positions for the entire line by striking an inked ribbon and the paper.

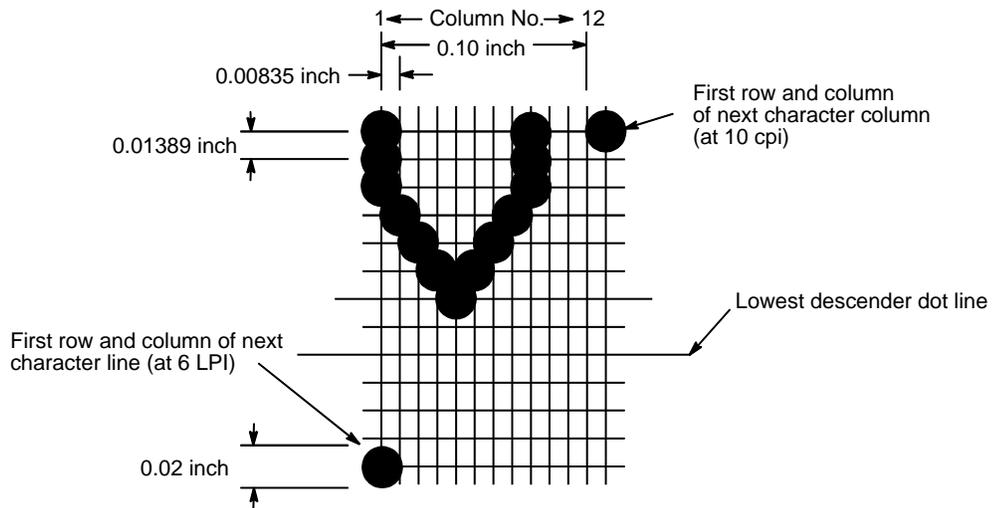


Figure 41. A Dot Matrix

When the shuttle reaches the end of a sweep, it reverses direction, the paper is advanced one dot row, and the hammers print the next row of dots as the shuttle sweeps in the opposite direction. After a line of characters is printed, hammer action stops and the paper advances to the first dot row of the next print line. The number of dot rows allowed for line separation depends on the vertical line spacing the user selects.

The dot matrix patterns of text characters vary according to the font the user selects. For example, in the data processing (DP) font at a line spacing of six lines per inch (lpi), a dot matrix contains 12 dot rows from the top of one character line to the top of the next. (See Figure 41 and Figure 42.) At eight lpi there are nine dot rows per character line, at nine lpi there are eight dot rows per character line, and so on.

Each individual hammer spring forms more than one character as the shuttle moves horizontally. This principle is illustrated in Figure 43.

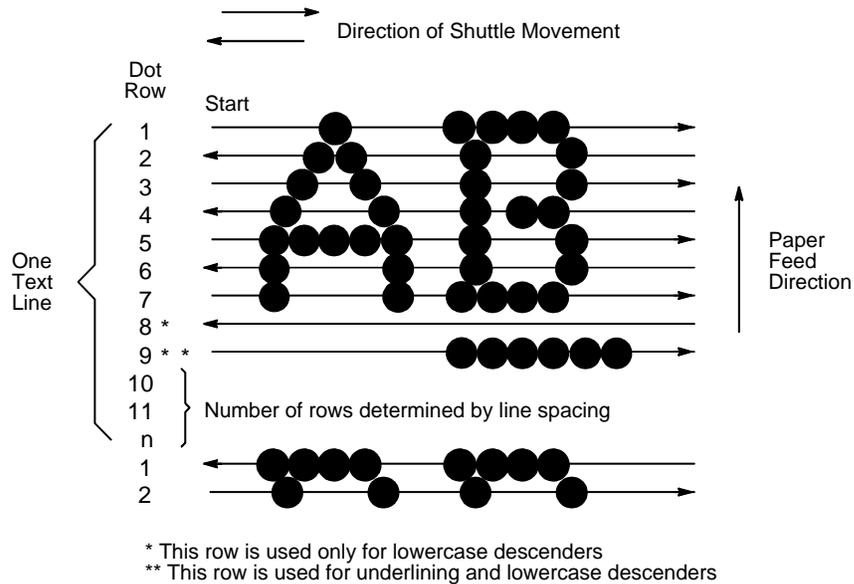
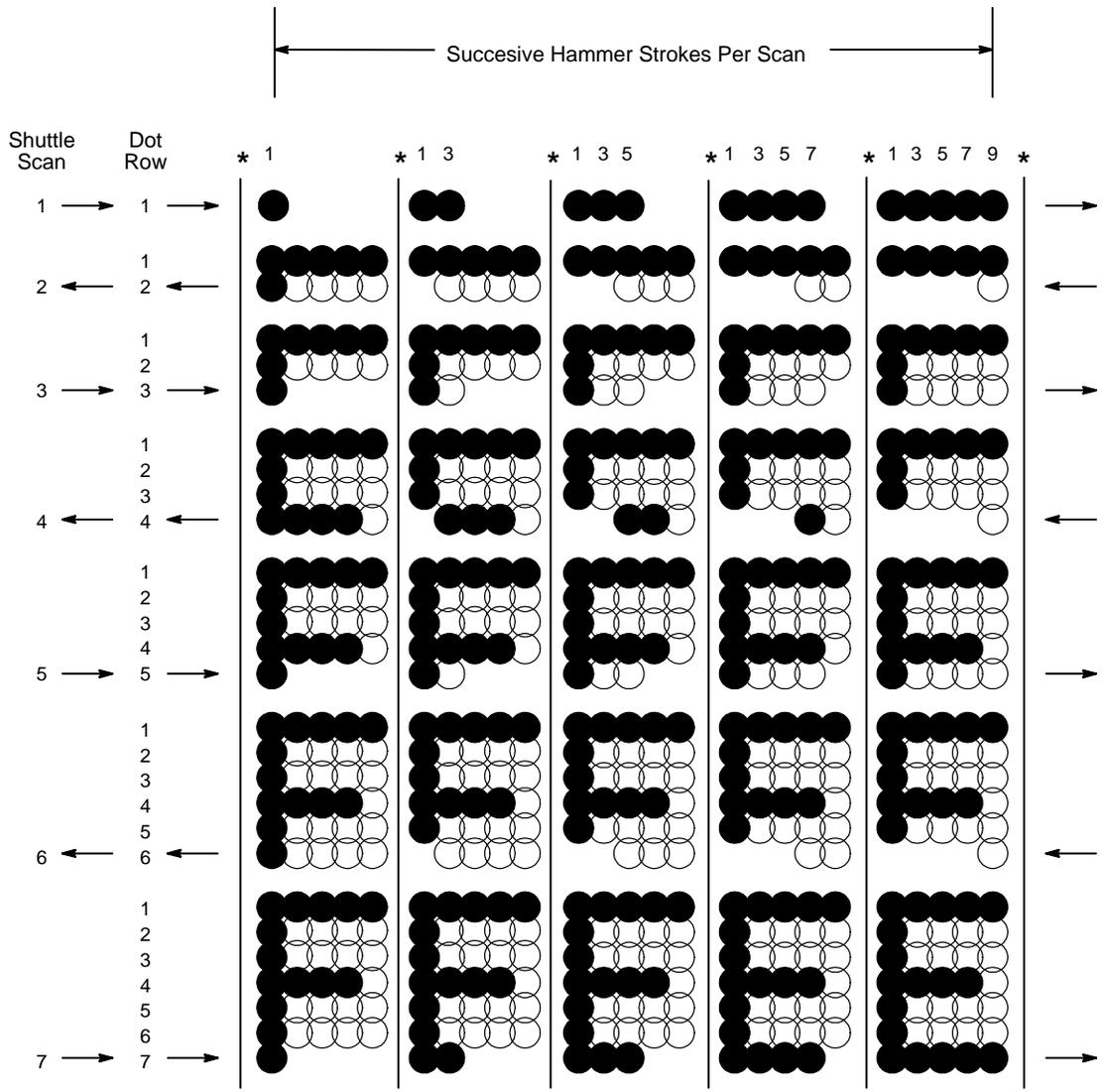


Figure 42. Standard Character Formation



\* Even column dot centers within the printed character area and character space hammer positions are not illustrated in this diagram.

NOTE: ● = Hammer Released and Dot Printed  
○ = Hammer Not Released; No Dot Printed

Figure 43. Action of One Hammer Spring in Text Printing

## Printing Mechanism

While the principles of line matrix printing are easy to state, the act of printing dots accurately from a rapidly oscillating shuttle onto a vertically moving piece of paper requires complex timing and coordination between printer logic and the printing mechanism. The printing mechanism consists of the shuttle frame assembly, the ribbon transport system, and the paper transport system.

### Shuttle Frame Assembly

The central element of the printing mechanism is the shuttle frame assembly, which houses the hammer bank assembly and the shuttle drive motor. (See Figure 44.)

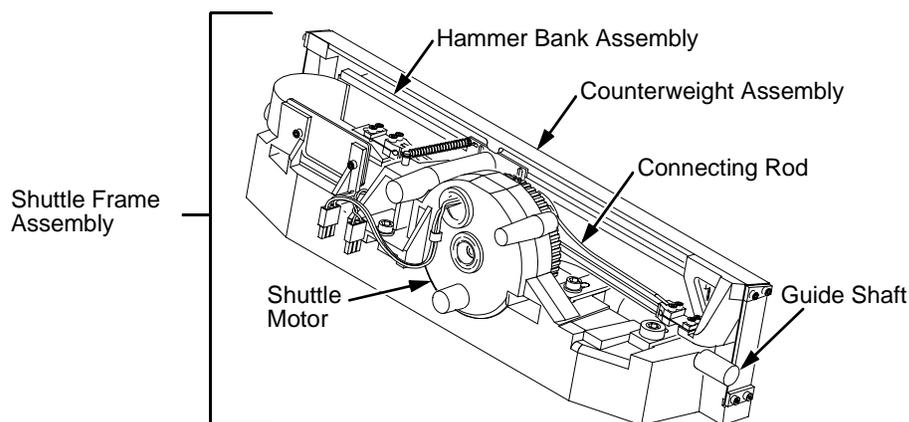


Figure 44. Shuttle Frame Assembly

### Hammer Bank Assembly

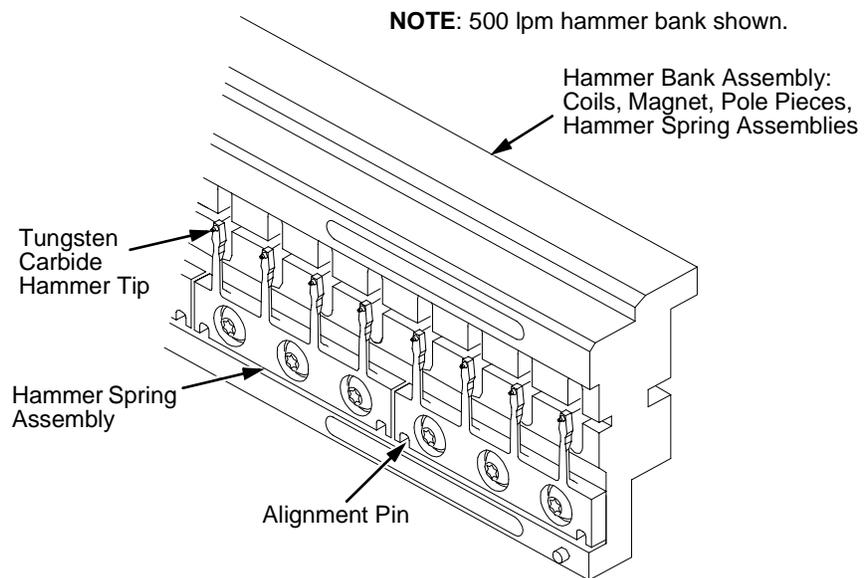
The hammer springs are grouped in comb-like assemblies mounted on a solid hammer bank. The number of hammer springs per hammer spring assembly and the number of hammer spring assemblies on the hammer bank vary according to printer model:

- 475 and 500 lpm models: seven 4-hammer assemblies, for a total of 28 hammer springs
- 800 lpm models: seven 7-hammer assemblies, for a total of 49 hammer springs
- 1000 lpm models: six 10-hammer assemblies, for a total of 60 hammer springs
- 1200 and 1400 lpm models: seven 13-hammer assemblies, for a total of 91 hammer springs
- 1500 lpm models: six 17-hammer assemblies, for a total of 102 hammer springs

## Shuttle Drive Motor

The shuttle drive motor is built into the shuttle assembly casting and drives two connecting rods on a crankshaft. The small end of one connecting rod attaches to the hammer bank; the small end of the other connecting rod attaches to a counterweight frame surrounding the hammer bank. (The hammer bank and the counterweight constitute the shuttle assembly.) The rotary motion of the shuttle drive motor converts to linear and opposing motion of the hammer bank assembly and the counterweight, in an arrangement similar to that of a horizontally-opposed gasoline engine. Mechanically, this design achieves the same benefits as this type of engine: perfect primary balance, low vibration, and durability.

Each hammer spring is a stiff leaf spring with a cylindrical tungsten carbide tip on the free end. (See Figure 45.) A permanent magnet is imbedded along the length of the hammer bank and acts on the hammer springs through individual pole pieces. The pole pieces magnetically attract and hold the free end of the hammer spring under tension. This is called the retracted state.

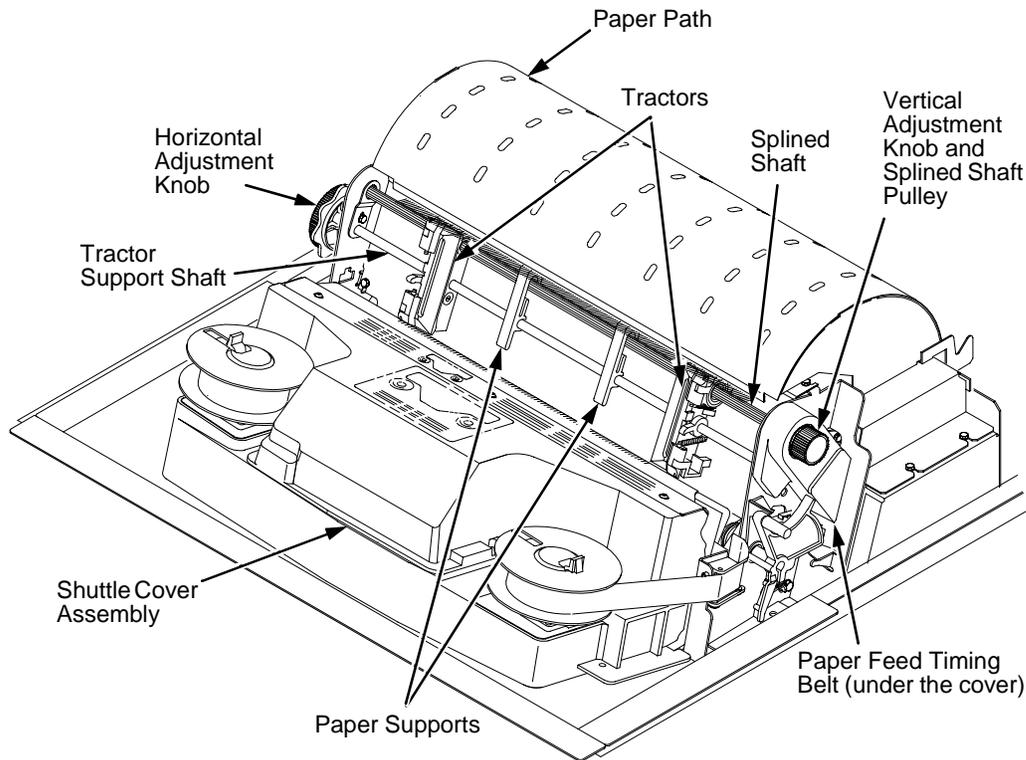


**Figure 45. Hammer Springs and Hammer Bank (Detail)**

Two electromagnetic coils are mounted behind each hammer and wound around each pole piece. The coils are normally de-energized. When hammer driver logic determines that a hammer must print a dot, a current pulse energizes the coils behind it. The polarity of the resulting magnetic field opposes the field of the permanent magnet, canceling its effect and releasing the hammer. The hammer springs forward, strikes the ribbon and paper, and leaves an impression of its tip (a "dot") on the paper.

While the hammer is in flight the coils are de-energized and their magnetic field collapses. After striking the ribbon and paper, the hammer rebounds and the permanent magnet recaptures it. When the shuttle reaches the end of a sweep, it reverses direction, the paper is moved up one dot row, and the hammer springs print the next row of dots as the shuttle sweeps in the opposite direction.

## Paper Transport System



**Figure 46. Paper Transport System**

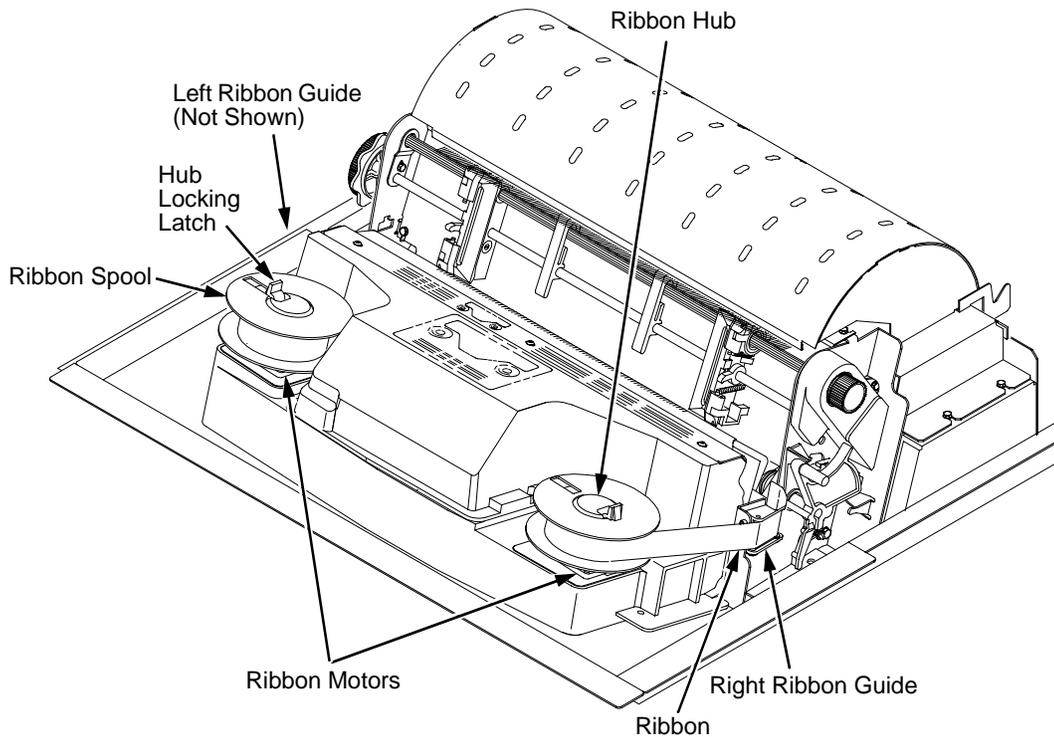
A two-phase DC stepper motor, directed by the engine controller (EC), drives two tractor sprockets by means of a toothed belt and splined shaft pulley. The stepper motor permits extremely accurate incremental vertical paper movement. This drive configuration is designed for continuous, fan-folded paper three to 17 inches wide and one to six sheets thick. For reverse paper feeding, the platen motor opens and closes the platen via a toothed belt. Opening the platen prevents paper jams when paper direction is reversed (moved downwards) after viewing the print area, setting top of form, or allowing applications to overprint forms.

Paper is positioned horizontally using the tractors and the horizontal adjustment knob. Each tractor is locked in position with a friction lock and engages the paper perforations with six sprocket pins. The horizontal adjustment knob allows vernier positioning of the left print margin.

The vertical adjustment knob is used to position paper vertically by hand.



## Ribbon Transport System



**Figure 47. Ribbon Transport System**

An inked ribbon winds and unwinds continuously on a pair of spools latched to hubs that are driven by the ribbon motors. The hubs and spools are offset vertically to equalize ribbon wear and prolong ribbon life. The ribbon motors operate only when the shuttle assembly is moving. Ribbon motion reverses when a metal strip at either end of the ribbon crosses the left or right ribbon guide, completing a circuit that causes both motors to reverse direction.

Constant ribbon tension is maintained by controlling each motor with a drive and a drag circuit. While the shuttle assembly is in motion, one motor acts as a drive motor, pulling the ribbon against the resistance exerted by the other motor—the drag motor. This system maintains constant motor speed and ribbon tension.

# Logical Control of the Printer

The printer comprises four functional elements: the control panel, the CMX controller board, the power supply board, and the print mechanism. See Figure 48.

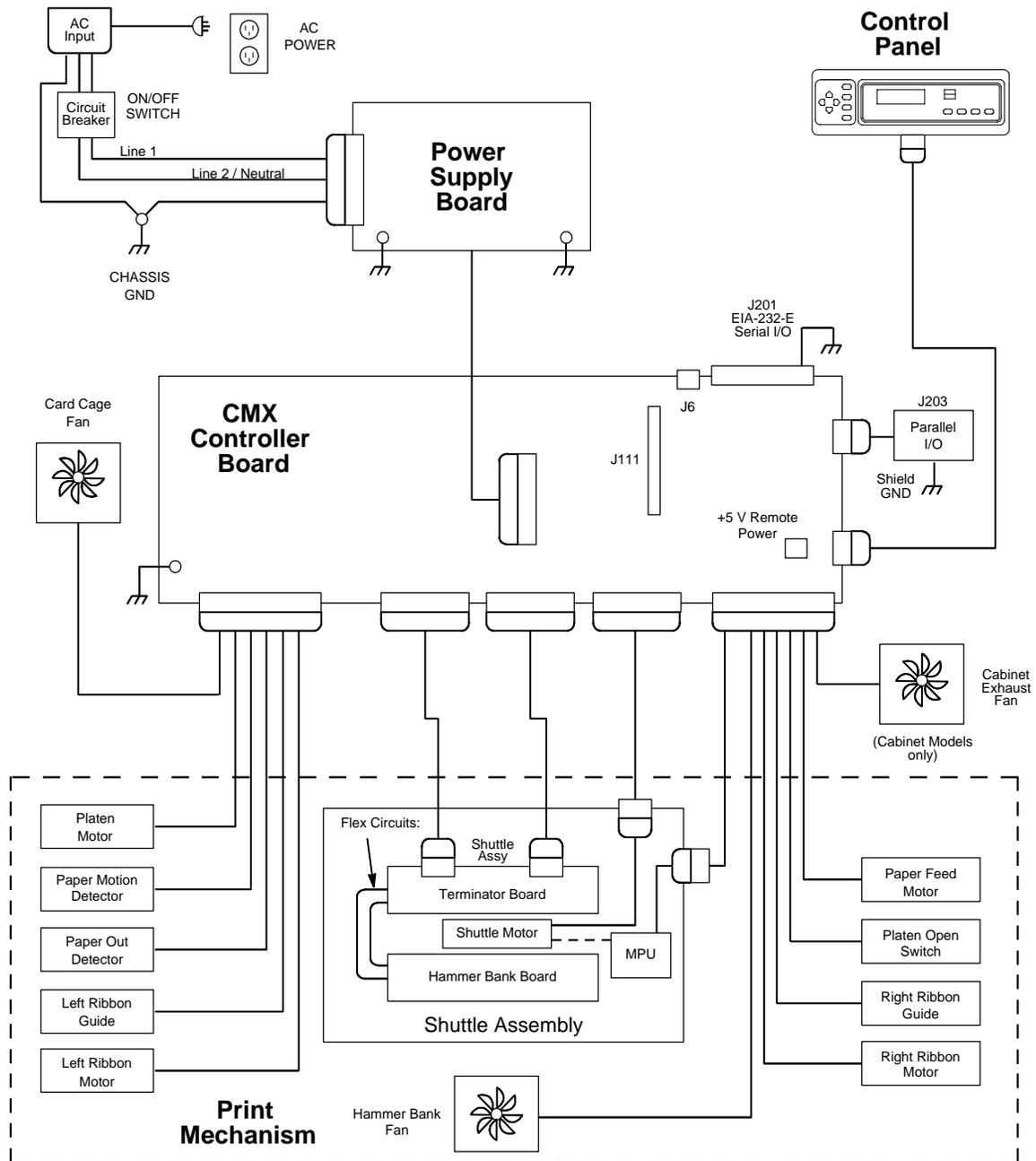


Figure 48. Functional Elements of the Printer

## Control Panel

The user communicates with the printer by pressing keys on the control panel. The keys are momentary contact switches. The control panel processes and sends key closure information to the controller board and displays information from the controller on the LCD. A status indicator next to the LCD also conveys printer status information to the user.

The LCD, status indicator, and keys are mounted on a printed circuit board assembly enclosed in a protective housing.

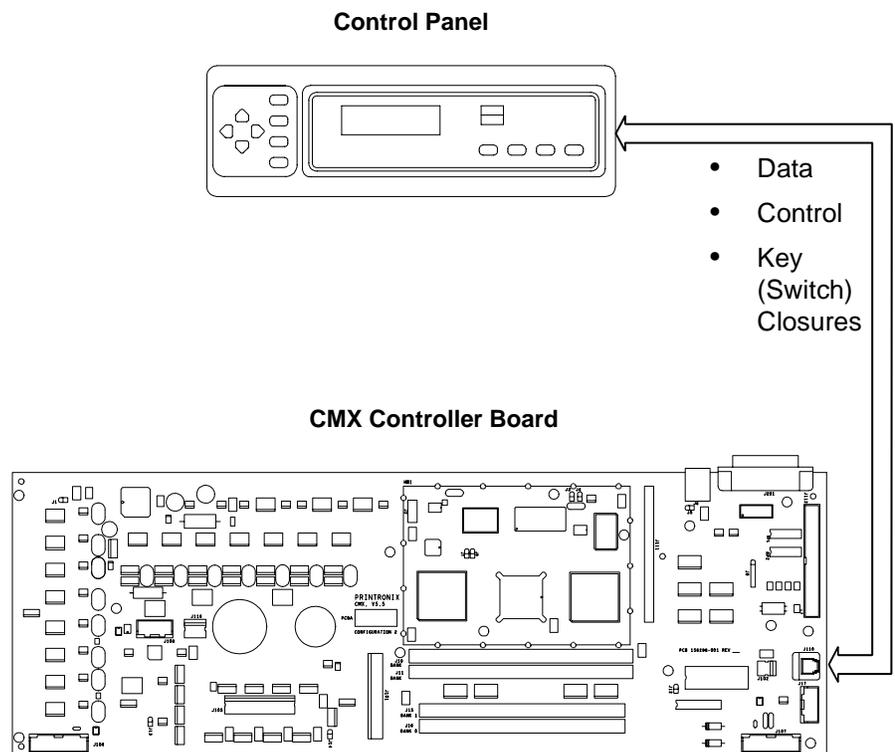


Figure 49. Control Panel Functional Overview

## CMX Controller Board

---

The heart of the printer is the CMX controller board, which monitors and directs all printer functions. The controller board receives and processes all data from the host computer, builds the printable images, controls all motors, and drives the hammer springs. Except for the power supply and final hammer drive circuits, all logic and drive circuitry for the printer are contained on the controller board.

The CMX controller board consists of two functional units: the DC (Data Controller) and the EC (Engine Controller).

The DC is responsible for:

- Host I/O (Input/Output)
- Operator I/O
- Security Interface
- Print Image Generation
- Overall High Level (Logical) Control

The EC is responsible for:

- Print Mechanism Operation
- Print Mechanism Fault Monitoring
- Power Shutdown/Power Saving Modes

The EC and DC communicate through semaphore registers. The DC receives host and operator input and returns dot images and LCD messages to buffers in memory. Image data are passed to the EC upon request, are processed, then sent to the hammer bank. The EC synchronizes paper, ribbon, platen, and shuttle motion as it feeds dot data to the hammer drivers. Figure 50 summarizes this architecture.

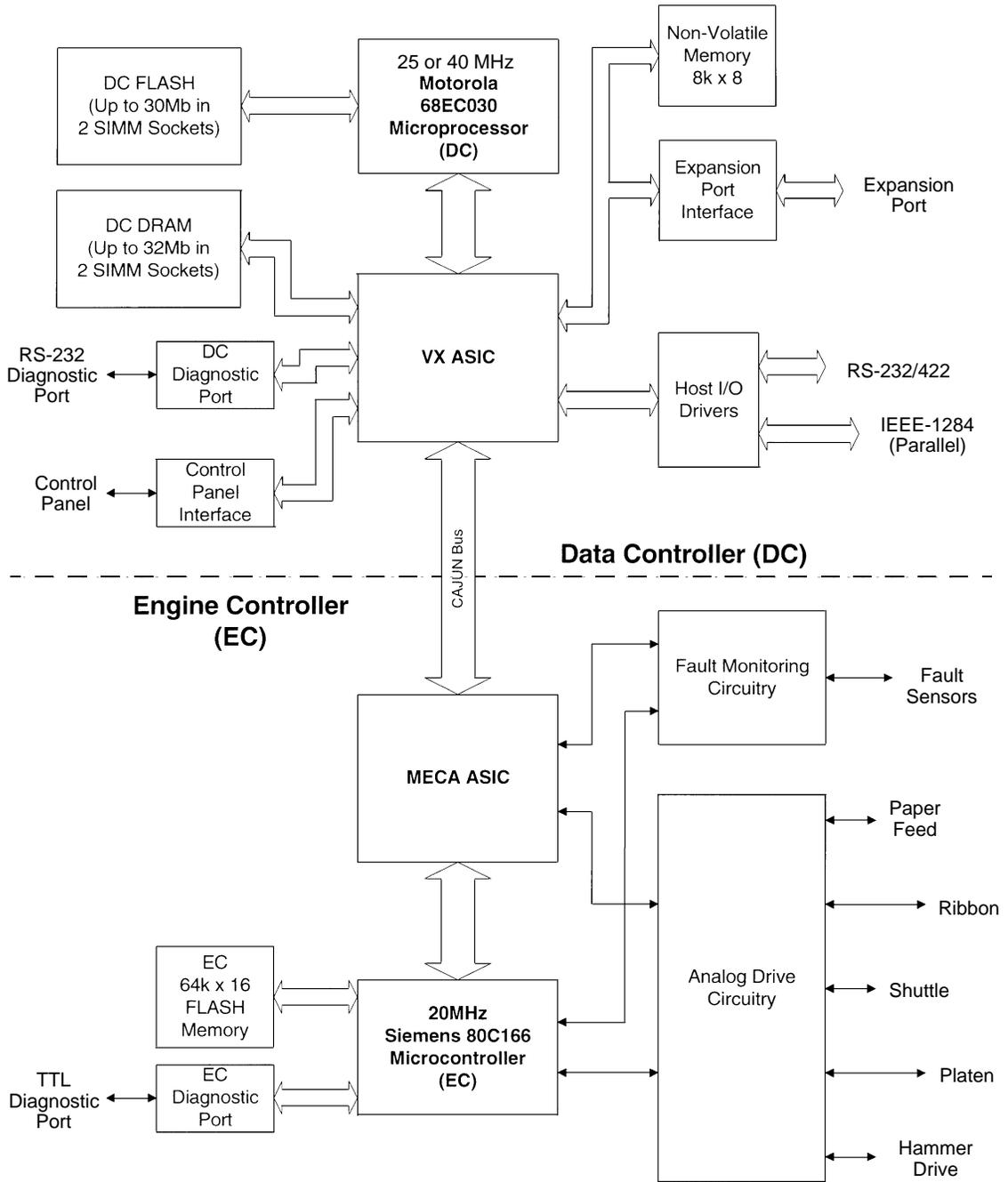


Figure 50. CMX Controller Board Block Diagram

## Data Controller

---

The data controller (DC) consists of the following elements:

- 68EC030 microprocessor
- Two flash SIMM sockets, used for up to 30MB of program memory
- Two DRAM SIMM sockets, used for up to 32MB of data memory
- 8K x 8 Non-Volatile Battery-Backed static RAM (NVRAM) for storage of configuration and system statistical data
- VX ASIC (Application-Specific Integrated Circuit)
- Host I/O Drivers/Termination

### 68EC030 Microprocessor

A Motorola 68EC030 microprocessor serves as the processor of the DC unit.

This processor runs at 25 MHz on 475, early 500, 800, and 1200 lpm printers. On 1000, 1400, 1500, and new 500 lpm printers the 68EC030 processor runs at 40 MHz, and is called the "CMX 040." The CMX 040 controller is backward compatible with any LP Series printer, but must be used in 1000, 1400, 1500, and 500 (C) lpm models.

This chapter refers to the DC microprocessor as simply the "030," but remember that two different clock speeds are available.

### Flash Memory

The DC stores program and emulation code in flash memory. Flash memory is erasable, non-volatile, and significantly faster than a disk drive.

The DC uses AMD 5.0V-only flash memory, which does not require higher programming and erasing voltages on the board (it has an internal charge pump to make these voltages itself). This memory supports at least 100,000 write/erase cycles. The flash memory is 32 bits wide. It is byte, word, and double word readable, but is always written as double words.

Two 80-pin SIMM sockets are provided for flash memory. Up to 30MB of flash (total), organized as up to four banks, may be installed in the two sockets on the controller board. The boot code for the 68EC030 processor must reside in bank 0.

Programs stored in flash memory are changed through the parallel or serial port.

### DRAM

System DRAM is used for program variables, image buffers, and input buffers. All DRAM supports page mode operation and is addressable by individual byte.

Two standard 72-pin DRAM SIMMs are used for expansion memory. The DC, through the VX ASIC, may address up to 32MB of DRAM in four banks.

### NVRAM

An 8K x 8 bit Non-Volatile battery-backed static RAM (NVRAM) device provides for the storage of configuration and system statistical data.

## **VX ASIC**

The VX is a multifunction custom gate array ASIC containing all the logic for the DC that is not contained in the 68EC030 processor. The VX provides the following services:

- Memory Access Controller
- DRAM Controller
- Flash Controller
- Two DMA Channels
- Operator Panel Interface
- “Dot Plucking” and Adjacent Dot Checking
- “Cajun” Bus Interface
- Host I/O and Diagnostic Port

### **Memory Access Controller**

All 030 addresses go through the VX ASIC. The VX handles all address decoding, chip selects, DTACKs, and so on.

### **DRAM Controller**

The VX supports up to four banks of page mode DRAM.

### **FLASH Controller**

The VX supports up to four banks of flash memory.

### **DMA Channels**

The VX provides two channels for direct memory access. These channels move data from the host interface or expansion bus to the DRAM and vice versa. One address is an I/O address, the other is a memory address with auto-increment.

### **Control Panel Interface**

The VX operator panel interface consists of five lines: serial clock, serial data, and three select lines. It is the VX that handles all parallel-to-serial (and vice versa) conversion to and from the panel, as well as any special timing needed when toggling select lines, etc.

### **“Dot Plucking” and Adjacent Dot Checking**

“Dot Plucking” is a specialized DMA function that removes dot data from a dot image buffer in DRAM in a programmable manner, serializes it, and sends it

to the hammer bank. This function is actually controlled by the EC (see page 225), which has access to the VX through the “Cajun” Bus Interface.

### “Cajun” Bus Interface

The “Cajun” bus connects the DC, the EC, and the expansion port. The EC uses this bus to access DC resources, including the semaphore registers. (The semaphore registers are the primary communications path between the EC and DC.)

### Ports

The VX ASIC controls the following I/O functions:

- Interface to IEEE® 1284 Level 2 host
- Interface to RS-232-E serial host
- Interface to RS-422-B serial host

All the circuitry required for these types of hosts is provided on the CMX board, except for the drivers themselves, ESD protection, and terminations.

### Host I/O Drivers and Termination

Beyond the 030 processor and VX ASIC, additional support circuitry completes the serial and parallel interfaces. These circuits include:

- RS-232 drivers and receivers. These circuits use internal charge pumps to eliminate the need for  $\pm 12V$  power.
- RS-422 differential drivers and receivers
- Parallel port pull-up and pull-down terminating resistors in DIP configuration for easy removal and installation.

All interface ICs and terminations have the following characteristics:

- Provide ESD protection to 15KV for all inputs.
- Less than 0.05V common mode ripple, measured at the power and ground of the interface ICs.
- Less than 0.02V common mode ripple, measured between chassis ground and the ground pins of the interface ICs.
- Greater than 200V/ $\mu s$  slew rate for all outputs.



## Engine Controller

---

The engine controller (EC) consists of four main elements:

- 80C166 Microcontroller
- 128KB 5.0V-only FLASH program memory, organized as 64K x 16 bits. This memory is not expandable.
- MECA (Mechanism Engine Control ASIC)
- Analog drive circuitry

### 80C166 Microprocessor

The Siemens SAB 80C166 is a high-integration microcontroller. It has many features that suit it extremely well to real-time control applications. This controller and the MECA ASIC provide the functionality of three separate processors used in earlier controller board architectures. In this manual, the 80C166 is referred to as either the EC or the 166.

### Bus Configuration

The 166 bus is configured for 18-bit address, 16-bit data, non-multiplexed and segmented operation. The flash memory runs with zero wait states. An external PAL is used for address decoding.

### Power Reduction

The 166 chip has two power reduction modes: idle and Energy Star. Idle mode is not used. In Energy Star® mode, +48V and all motors are de-energized, but the 166 operates as normal.

### EC Flash Memory

The EC stores all boot code, program code, and tables in its own local flash memory. This flash is organized as 64Kx16 bits and uses the same technology as the DC flash: it is +5.0V-only and is rated for a minimum of 100,000 write/erase cycles. EC memory is fixed; it is soldered to the controller board. Its contents can be updated through the DC (through the serial or parallel ports). At run time, the EC also stores tables in shared DRAM, which is accessed through the Cajun bus.

### MECA ASIC

The 166 uses numerous counters, PWM generators, and FIFOs in the MECA to control many printer motor functions. The MECA is a custom gate array, specifically designed to drive this system.

### Analog Drive Circuitry

The analog drive circuits convert +48 volts and +8.5 volts into the power used to drive the motors and hammers in the printer. Sensors are used to monitor the operation and status of critical components within the printer.

The printer uses five motors: two ribbon drive, one paper feed, one platen open, and one shuttle motor. The shuttle motor is a brushless DC motor driven by current control. The MPU encoder is used as feedback for motor commutations, hammer fire timing, and motor stall detection. The paper feed motor is a DC stepping motor driven by current control. The paper feed motor may be driven in full, half, or microsteps, depending on print requirements. The ribbon system uses two DC stepping motors that alternate drive and drag roles when the ribbon reaches turnaround. The drive ribbon motor is microstepped in voltage mode, while the drag motor is loaded and monitored to maintain correct linear speed and tension. The platen motor is driven in current mode and can be full or half stepped. The overall current level may be reduced for standby modes.

The paper feed, ribbon drive, and shuttle motors are driven in control loops containing power MOSFETs, voltage and current sensors, the MECA ASIC, and the EC processor. The platen motor is driven by a stepping motor controller IC and the EC processor.

Control of the hammer drive is split between the controller board and the hammer bank. Common circuits are located on the controller board, while hammer specific circuitry is contained on the hammer bank. The EC uses the MECA ASIC on the controller board to set timing and upper drive profiles for hammer fire events. The controller also contains diagnostic circuitry for the hammer system. The hammer bank contains HBA ASICs that interpret fire commands and data from the MECA and VX ASICs. The HBAs control lower drive MOSFETs on the hammer bank. These determine which hammers will participate in a fire event generated by the controller's upper drive.

## **Power Supply Board**

---

The printer power supply is contained on a printed circuit board mounted in the card cage. The power supply automatically senses and adjusts to any commercial electrical system that provides AC mains potential in 50 or 60 Hertz systems. In other words, the printer can operate anywhere in the world on local commercial power.

The power supply converts alternating current (AC) to direct current (DC) at three voltage levels and sends the DC voltages to the controller board. The controller board distributes all DC power to the logic and electromechanical circuits.

### **AC Power**

---

The power supply operates on AC voltages ranging from 88 volts to 270 volts. It can tolerate variations in frequency of 47 to 63 Hz. The power supply is designed to withstand an AC input overvoltage of 300 VAC for one second with no degradation of DC output voltage or damage to printer circuits.

## DC Power

---

The power supply board contains two DC power supply systems for the printer. The first is a +5 V bus for logic. The second consists of +48 V and +8.5 V buses for the hammer bank and all motors.

The +5 V supply has an isolated return line that connects to the +48 V return at the printer load. Both returns are tied together in a one-point ground. The +5 V power supply has its own inverter, separate from the +48 V and +8.5 V outputs.

There is an opto-isolated input on the power supply that will shut down and latch off the +48 V and +8.5 V supplies unless it is pulled up to +5V with a 1K  $\Omega$  resistor. This resistor is mounted on the controller board and may be pulled down or disconnected by software or internal cable interlocks. The +5 V output will remain stable for reporting and latching the fault condition. The return for this signal is the +5 V return. In addition, this shutdown circuit discharges and latches the +48 V down to a level lower than +15 V in less than 200 milliseconds and requires recycling of the circuit breaker (On/Off switch) to reset the latch.

Loss of +48 V is seen by the EC and reported as a fault.

## Printer Interface

---

The printer interface is the point where the data cable from the host computer plugs into the printer. The printer interface processes all signals and data to and from the host computer.

The printer is equipped with Centronics parallel, EIA®-232E serial, and EIA-422B serial interfaces. The interfaces are mounted on the CMX controller board, and the interface cable connectors are accessible through a cutout at the rear of the card cage. These interfaces accept data in the U.S. ASCII protocol.

Selection of the interface is controlled by configuration menus accessed at the control panel. It is possible to physically connect more than one interface, but only one interface at a time can be used electrically.

## Graphics

---

The Code V II programming language (a QMS graphics emulation) is an option that can be downloaded into flash memory on the CMX controller board.

This graphics programming language simplifies the job of creating forms, bar codes, logos, expanded characters, and other graphics. It enables the printer to print sideways, upside down, and to make forms combining graphics, alphanumeric data, and bar codes; all done in a single pass. Documents explaining configuration, operation, and programming are included with the option.

---

# A

## *Wire Data*

**NOTE:** Acronyms and signal mnemonics are defined in Appendix C.

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## Main Wire Harness Test Tables

### P106 Connector

1 3 5 7	9 11	13 15 17 19	Pin No. →
PLAT M	CCF	POD	
LRIB M	LRP	PMD	
2 4 6 8	10 12	14 16 18 20	

#### Resistance

Device	P106 Pins	Normal
LRIB M	2, 4 and 6,8	7.2 - 8.8 Ω
PLAT M	1, 3 and 5, 7	1.35 - 1.65 Ω
LRP	10, 12	Open across pins Short across post
CCF	9, 11	4.6 Ω
PMD	14, 16 18, 20	8 Meg Ω Open
POD	13, 15 17, 19	8 Meg Ω Open

CCF = Card Cage Fan  
 LRIB M = Left Ribbon Motor  
 LRP = Left Ribbon Guide  
 PLAT M = Platen Open Motor  
 PMD = Paper Motion Detector (Switch)  
 POD = Paper Out Detect (Switch)

### P107 Connector

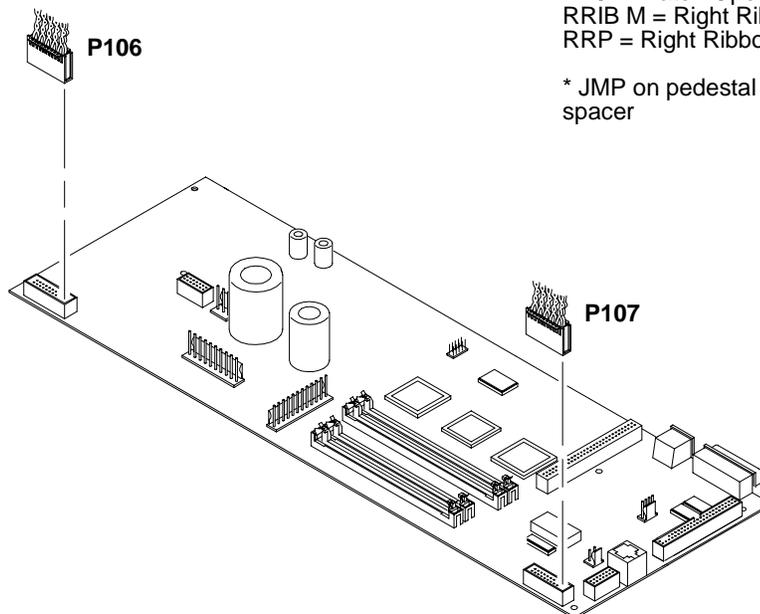
1 3 5 7	9 11	13 15 17 19
PAPR M	EHF	PLO
RRIB M	HBF	RRP
2 4 6 8	10 12	14 16 18 20

#### Resistance

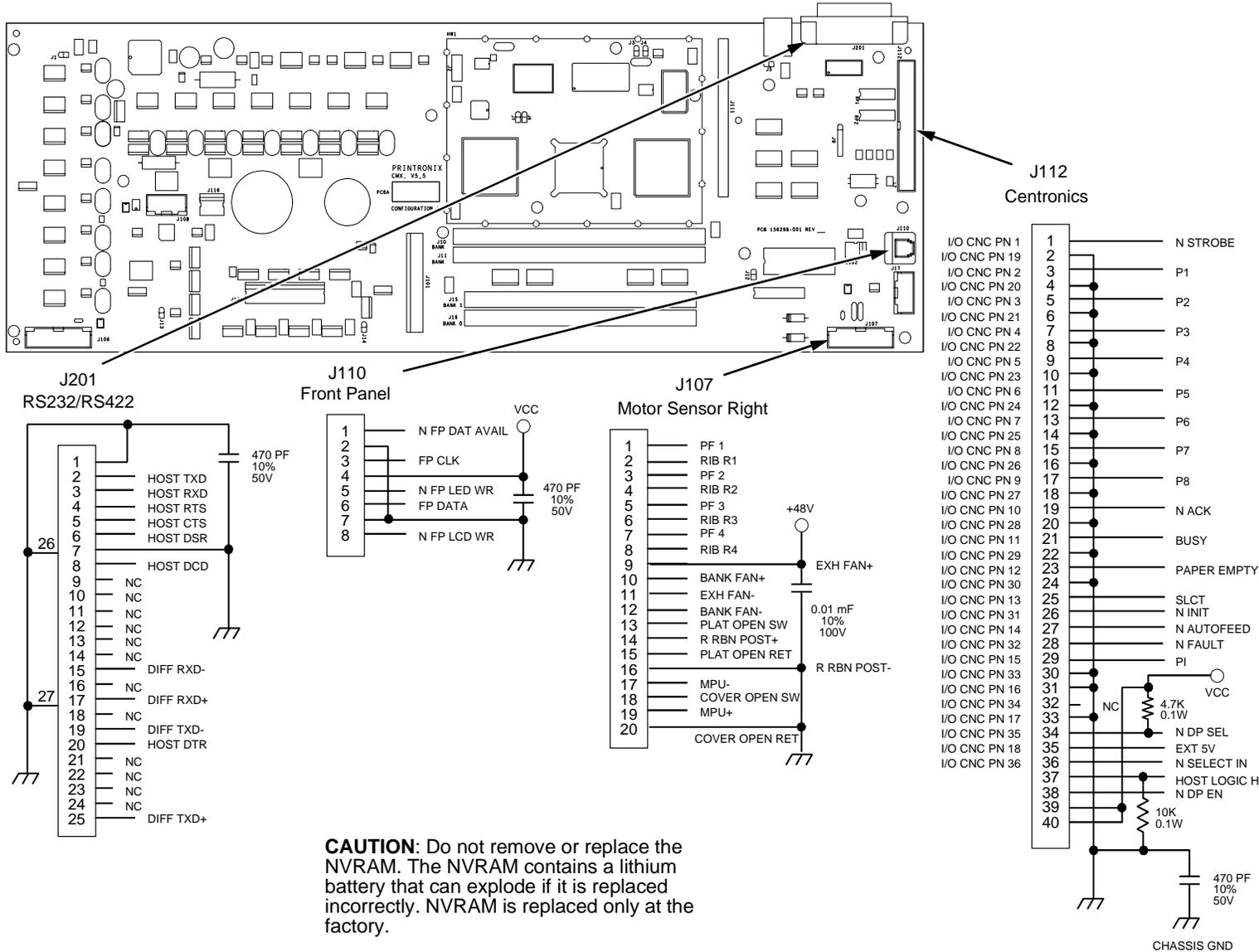
Device	P106 Pins	Normal
RRIB M	2, 4 and 6,8	7.2 - 8.8 Ω
PAPR M	1, 3 and 5, 7	0.417 - 0.681 Ω
HBF	10, 12	2.7 Ω
EHF	9, 11	4.6 Ω
RRP	14, 16	Open across pins Short across post
PLO	13, 15	Continuity: switch closed Open: switch open
JMP	18, 20	0.00 Ω
MPU	17, 19	670 Ω

EHF\* = Exhaust Fan  
 HBF = Hammer Bank Fan  
 JMP = Jumper Wire  
 MPU = Magnetic Pickup  
 PAPR M = Paper Feed Motor  
 PLO = Platen Open (Switch)  
 RRIB M = Right Ribbon Motor  
 RRP = Right Ribbon Guide

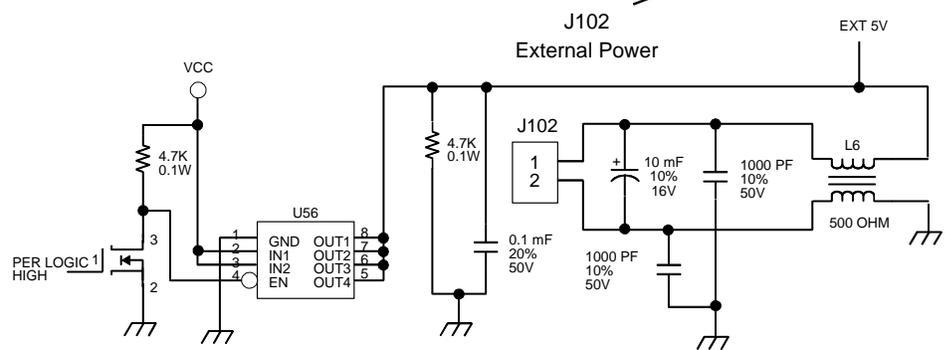
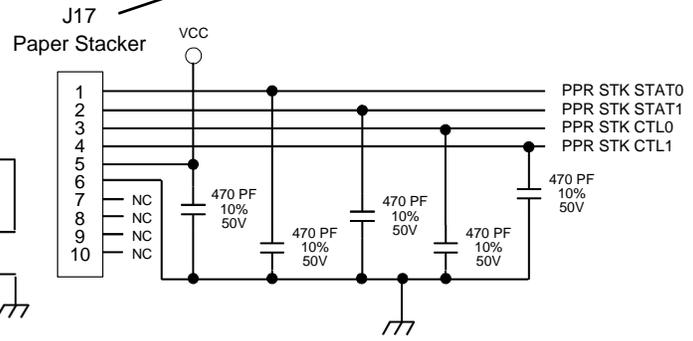
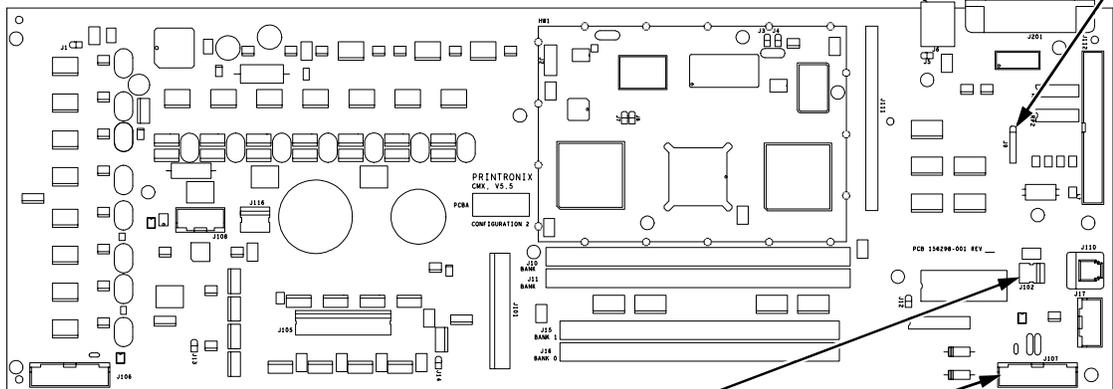
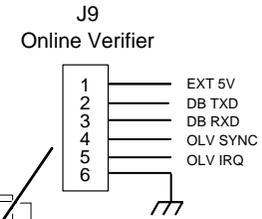
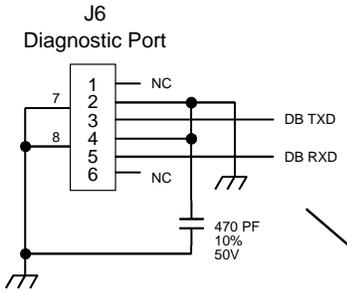
\* JMP on pedestal models: used as a spacer



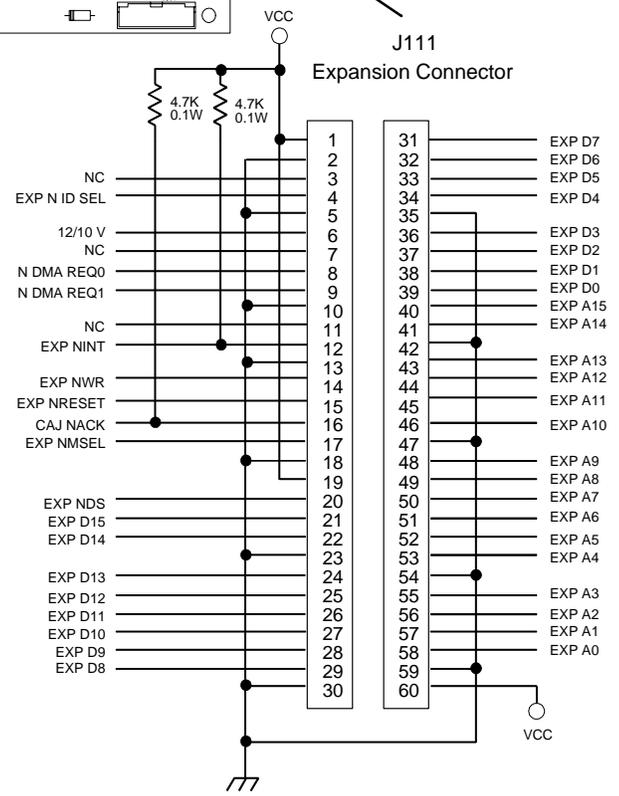
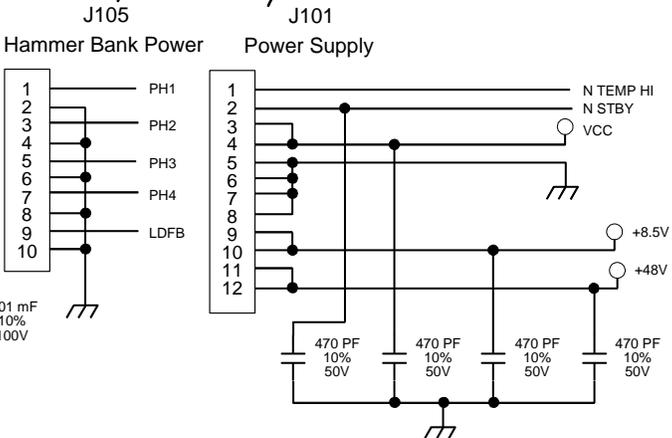
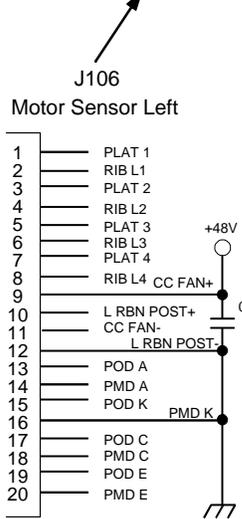
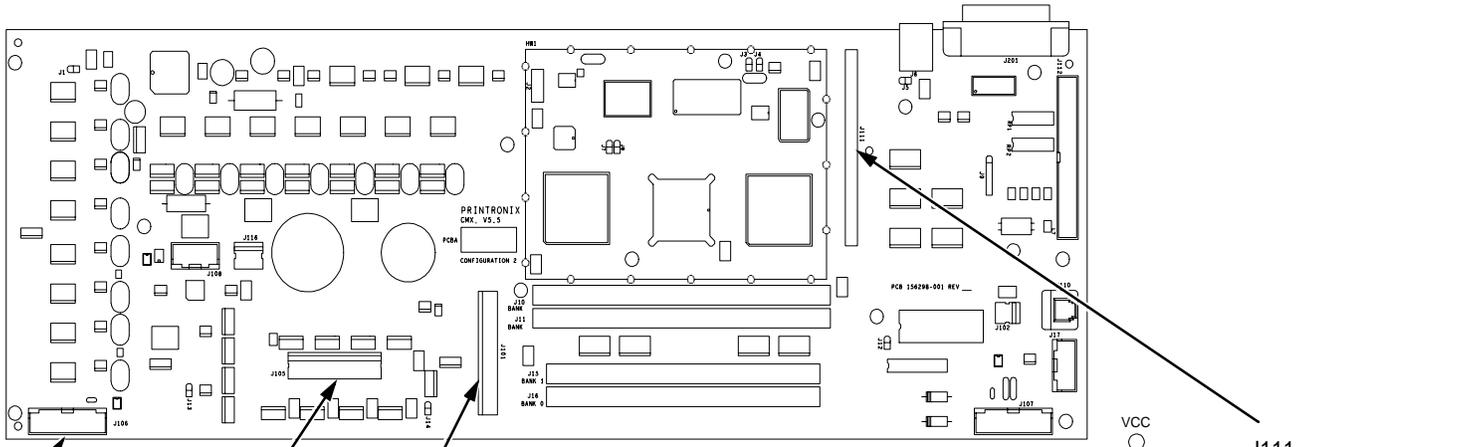
Controller, CMX



**CAUTION:** Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.

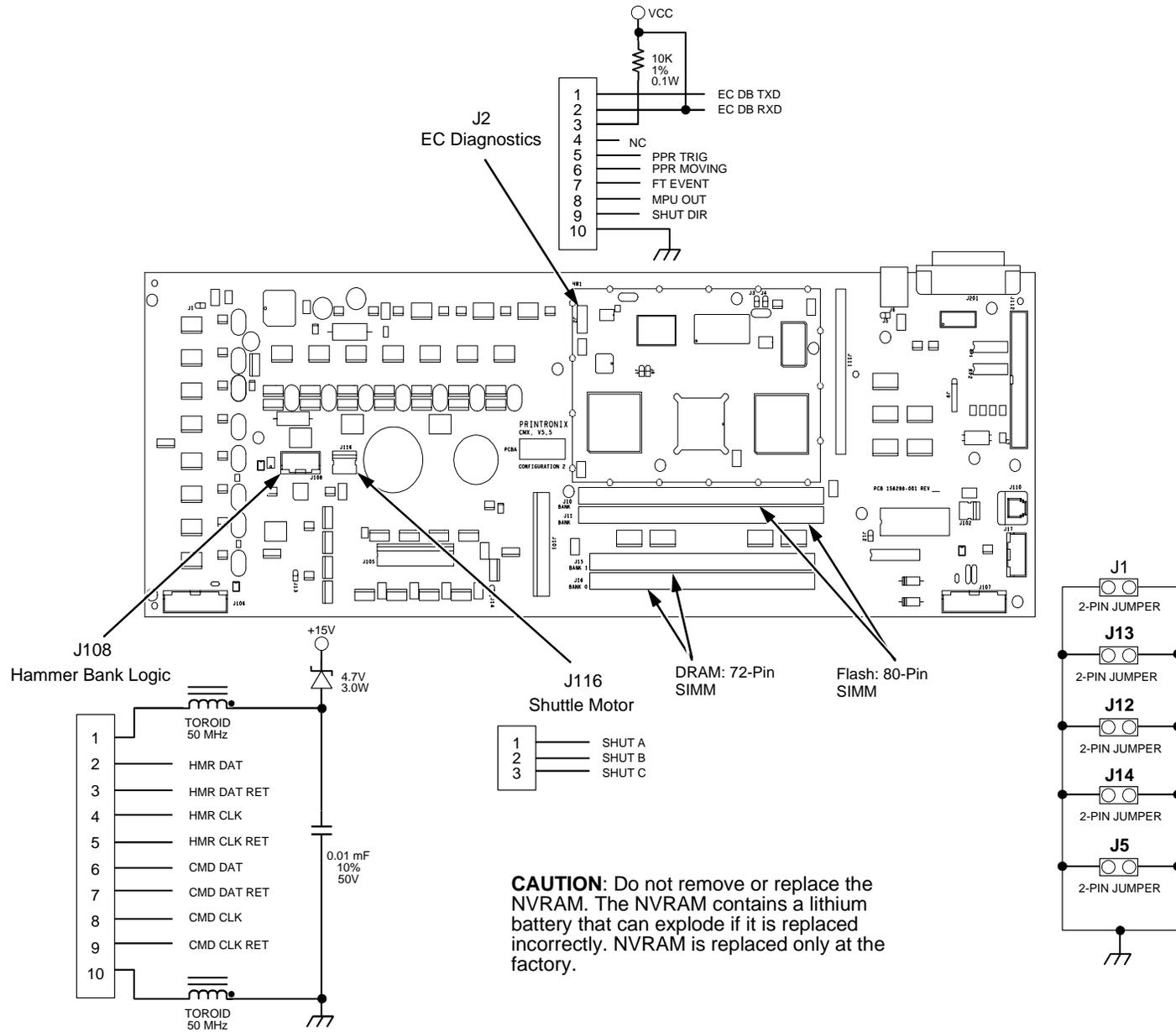


Controller (continued)



**CAUTION:** Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.

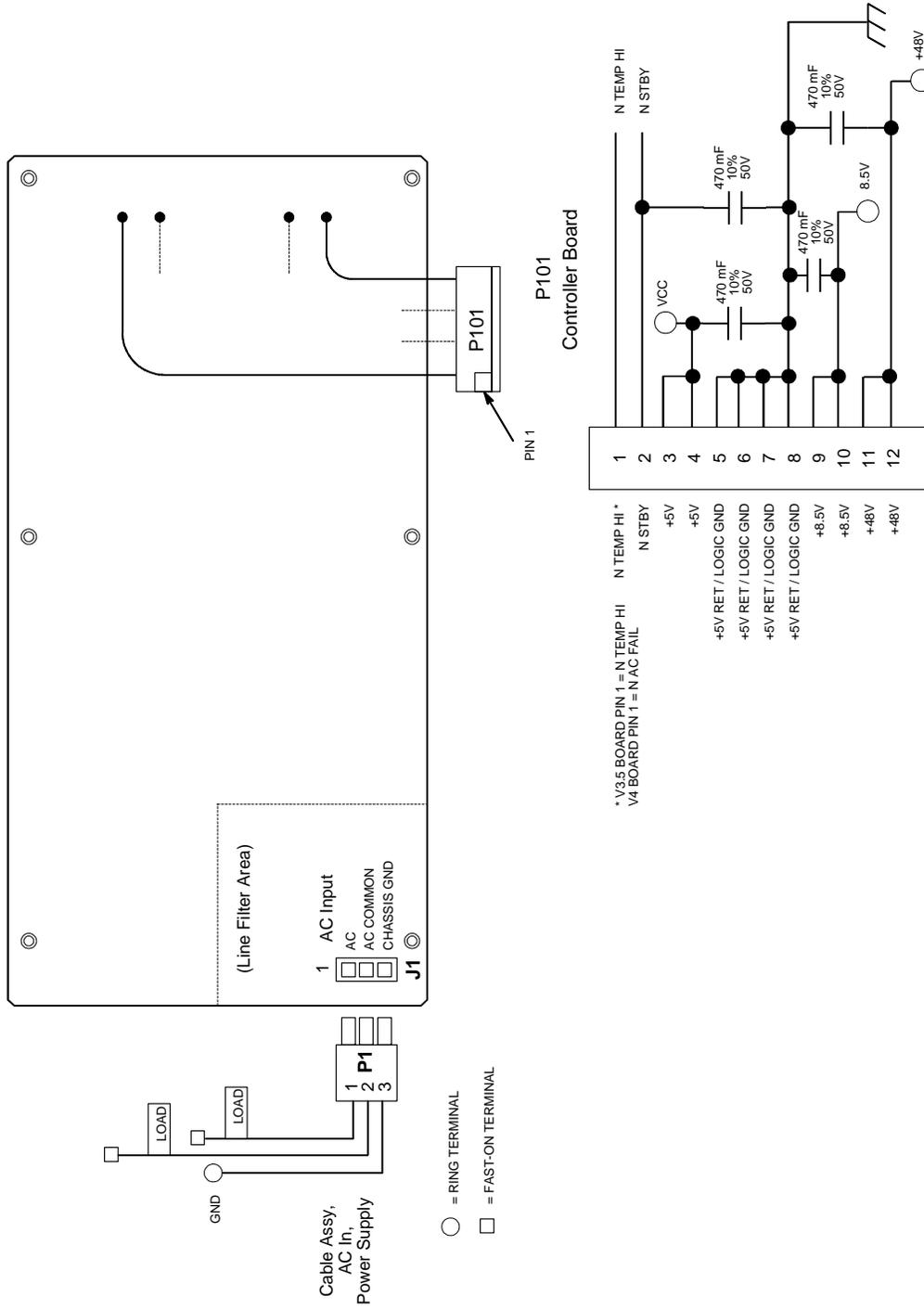
Controller (continued)



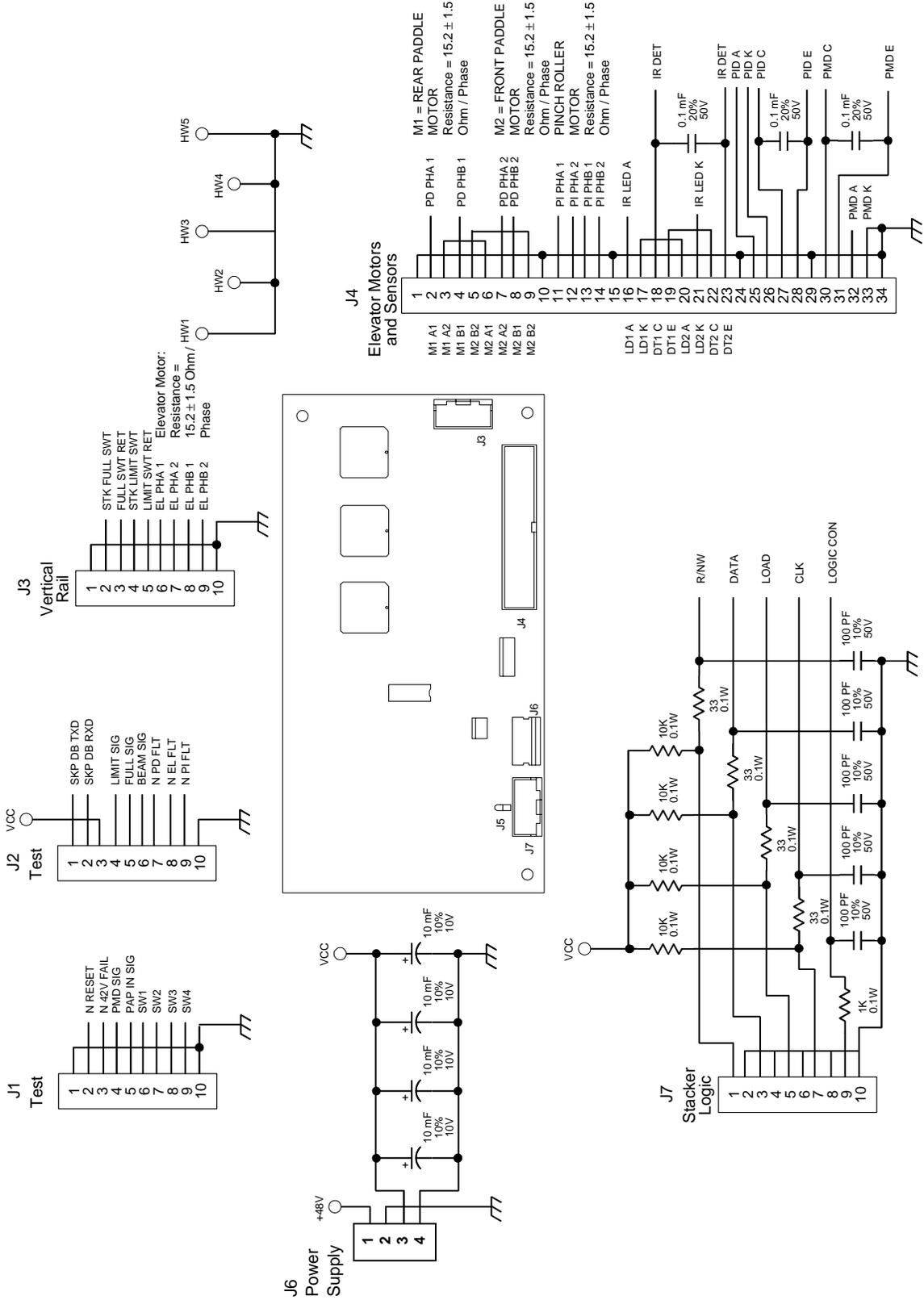
**CAUTION:** Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.

Controller (continued)

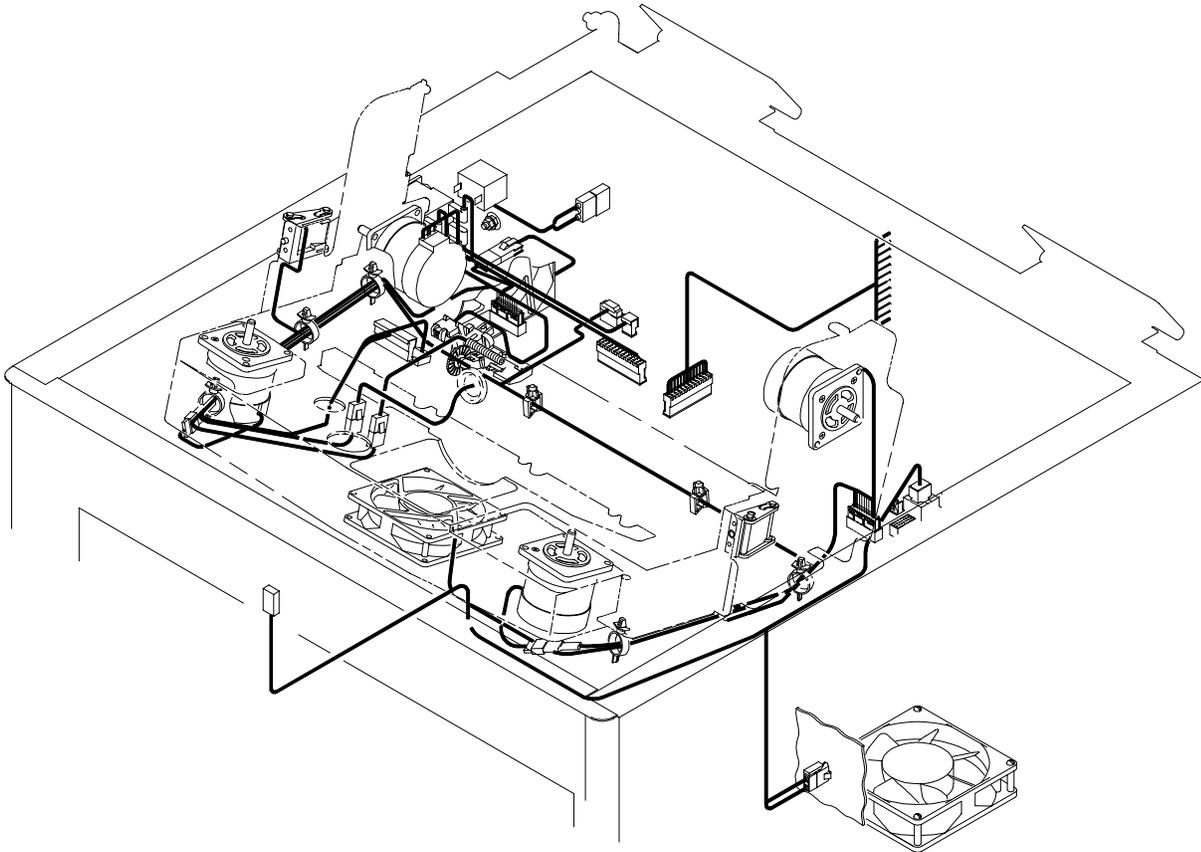
# Power Supply



# SureStak Power Stacker PCBA



## Cable Routing, Cabinet Model

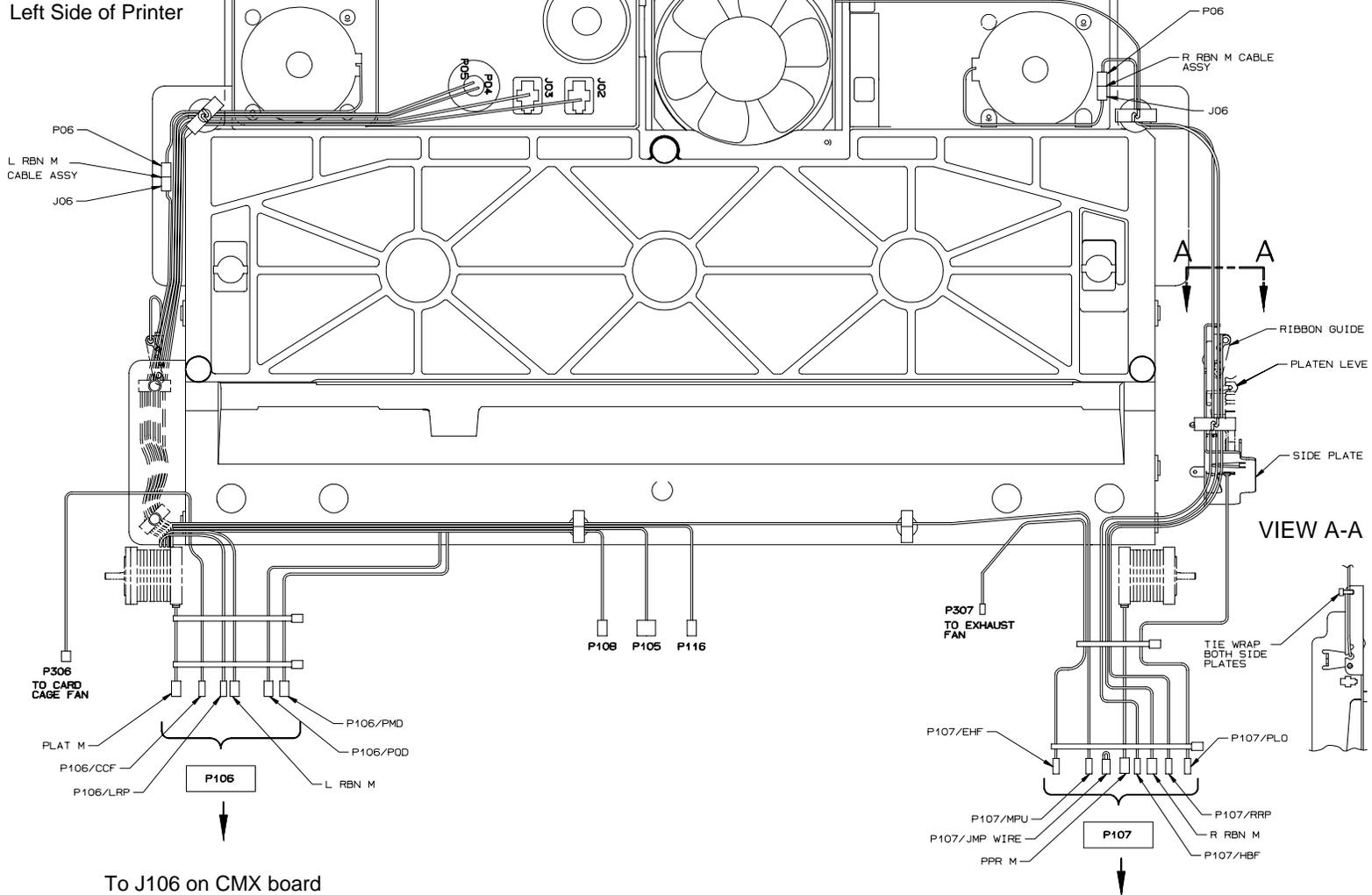




Front of Printer

Right Side of Printer

Left Side of Printer



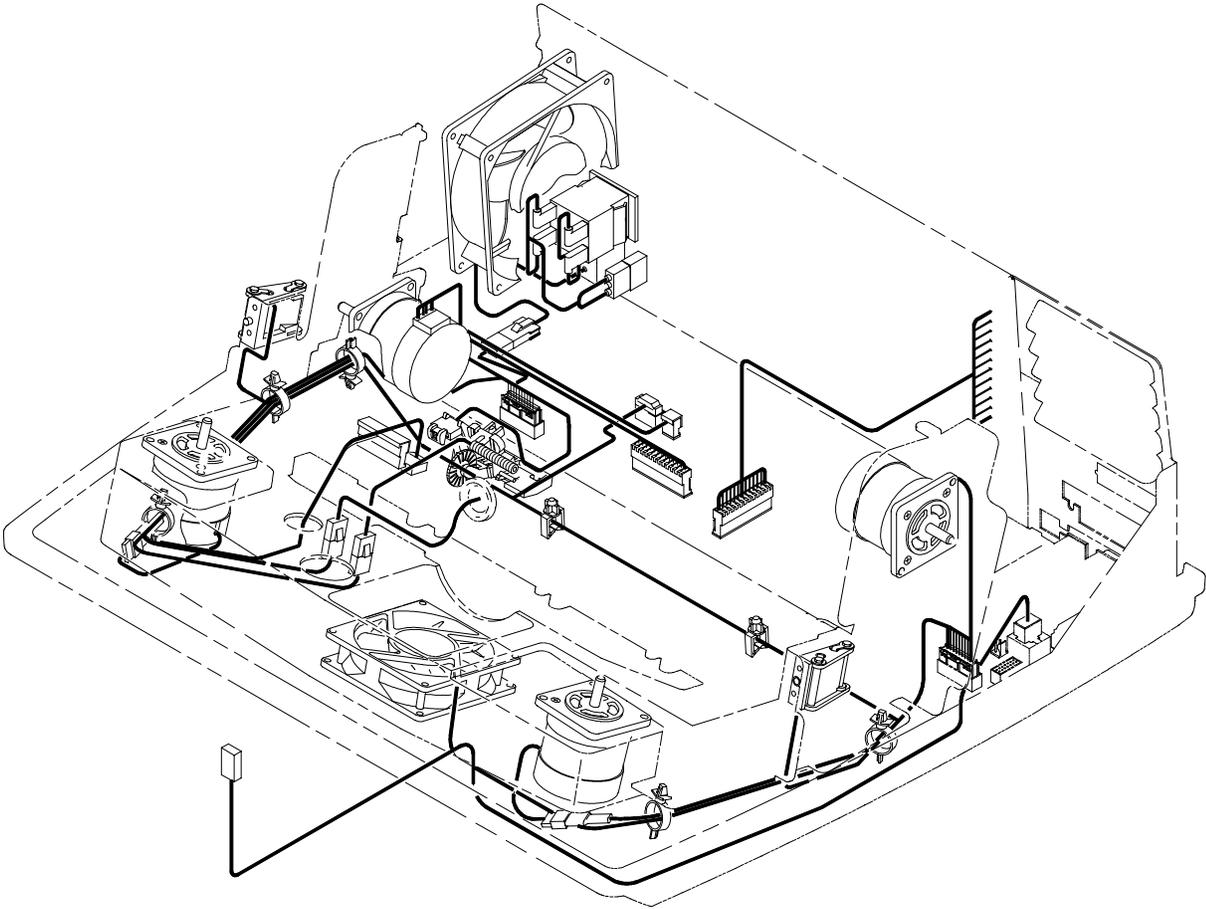
To J106 on CMX board

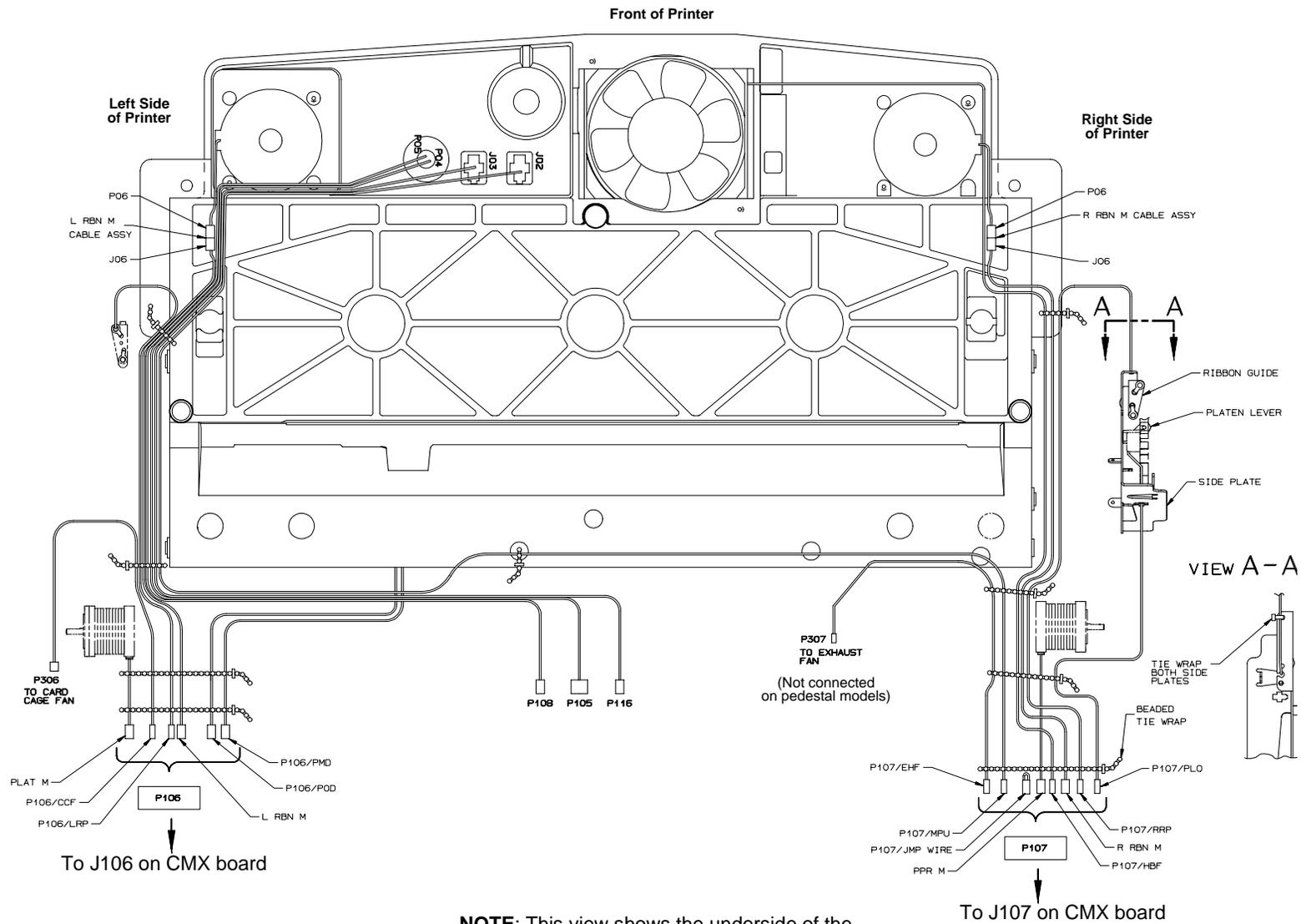
**NOTE:** This view shows the underside of the mechanism base.

To J107 on CMX board

Cable Routing, Mechanism Base, Cabinet Model

Cable Routing, Pedestal Model



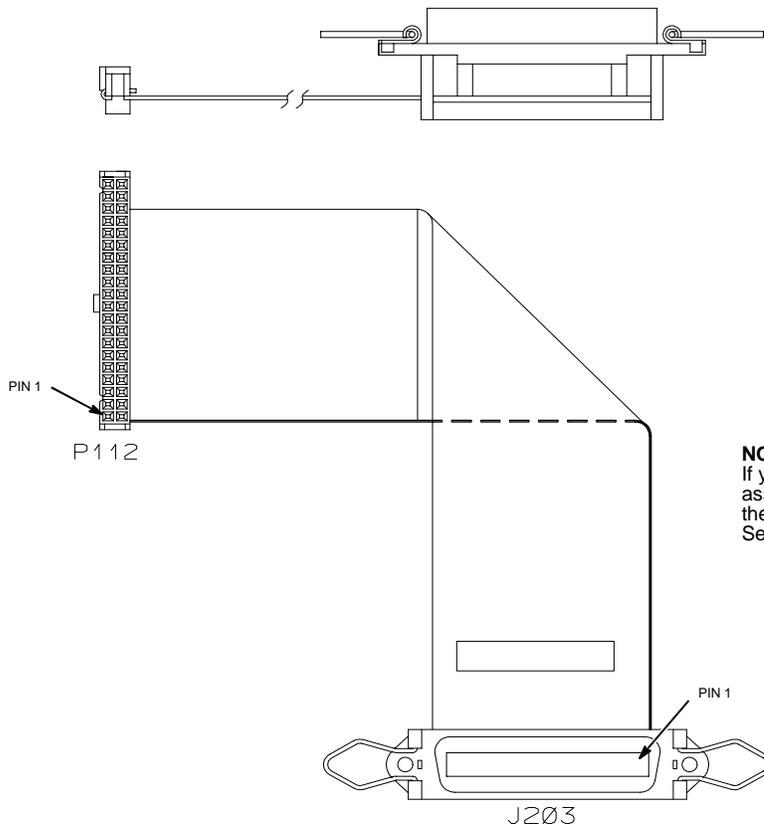


**NOTE:** This view shows the underside of the mechanism base.

**Cable Routing, Mechanism Base, Pedestal Model**

### Cable Assembly, Centronics I/O

152439-901PX

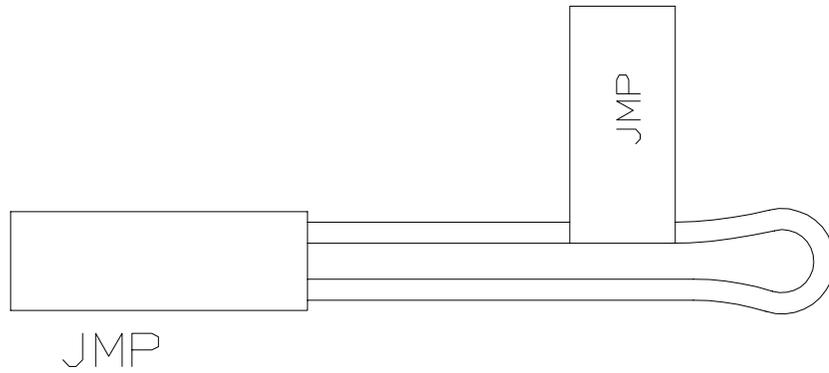


**NOTE:**  
If you replace the I/O cable assembly, you must install the ferrite clamp. See Appendix E.

---

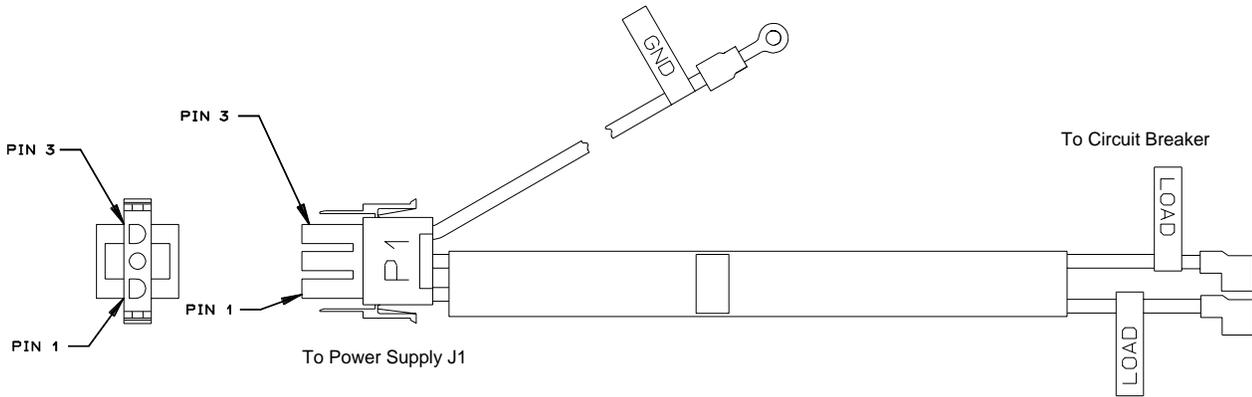
**Cable Assembly, 2-Pin Jumper, 0.1 Ctr**

154470-001



Cable Assembly, AC In, Power Supply

Kit No. 153502-901PX

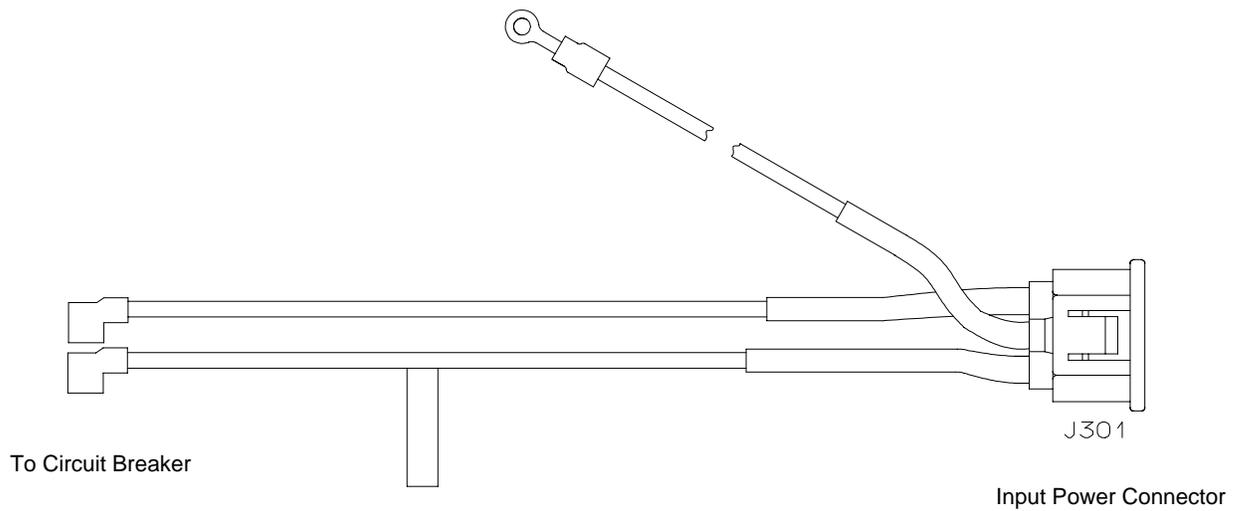


PIN	WIRE COLOR
1	BLACK
2	WHITE
3	GREEN/YELLOW

---

## Cable Assembly, AC Power Input

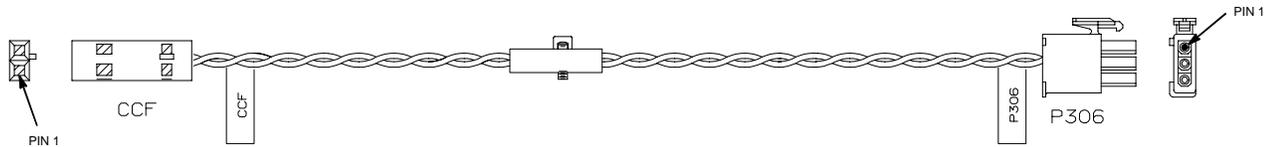
Kit No. 153502-901PX



PIN	WIRE COLOR
LINE	BLACK
NEUTRAL	WHITE
GROUND	GREEN/YELLOW

Cable Assembly, Card Cage Fan

152422-901PX



WIRE TABLE		
CCF	P306	WIRE COLOR
PIN 1	PIN 3	BLACK
PIN 2	PIN 2	GRAY
	PIN 1	N/C

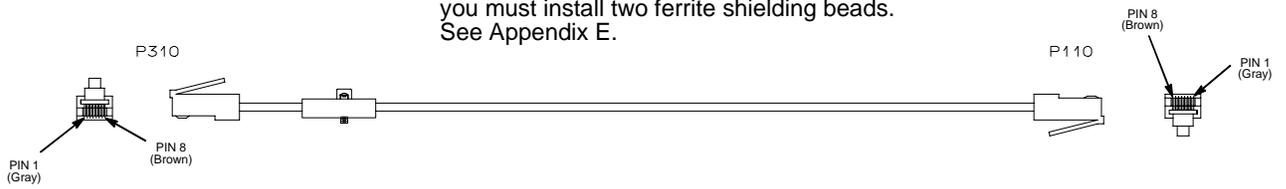


---

## Cable Assembly, Control Panel

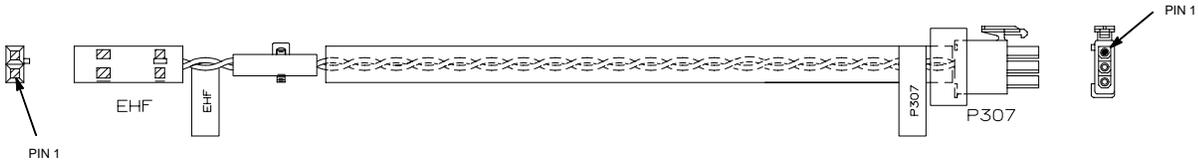
152440-901PX

**NOTE:** If you replace the control panel cable, you must install two ferrite shielding beads. See Appendix E.



### Cable Assembly, Exhaust Fan

152424-901PX

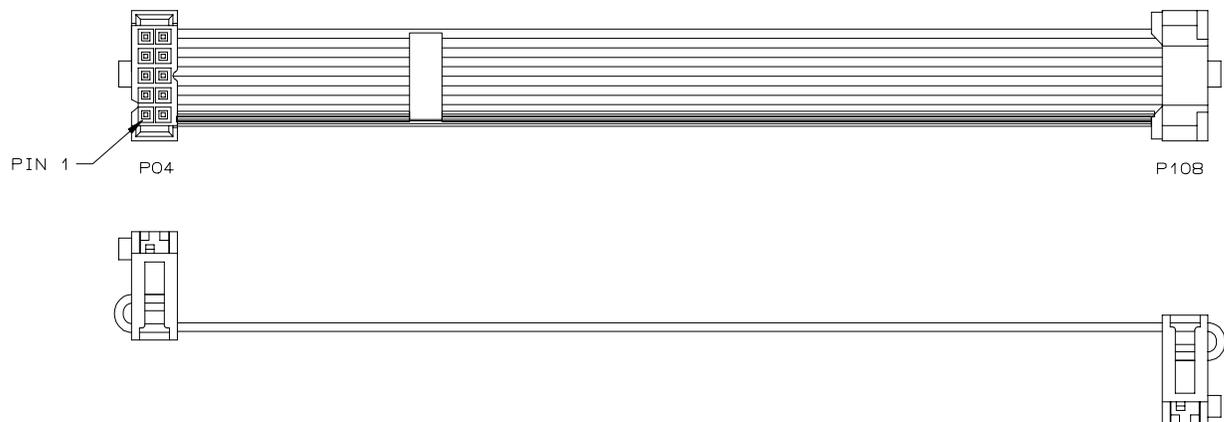


WIRE TABLE		
EHF	P307	WIRE COLOR
PIN 1	PIN 3	BLACK
PIN 2	PIN 2	GRAY
	PIN 1	N/C

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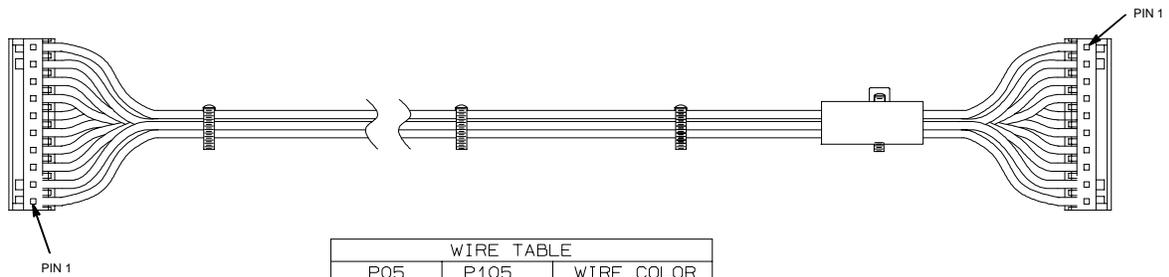
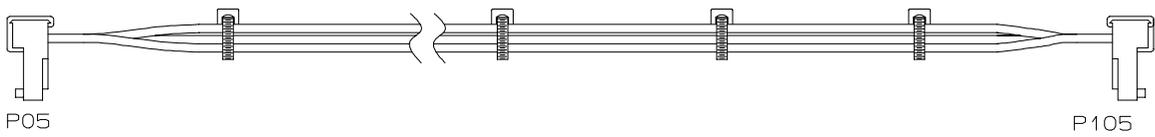
## Cable Assembly, Hammer Bank Logic

152421-901PX



### Cable Assembly, Hammer Bank Power

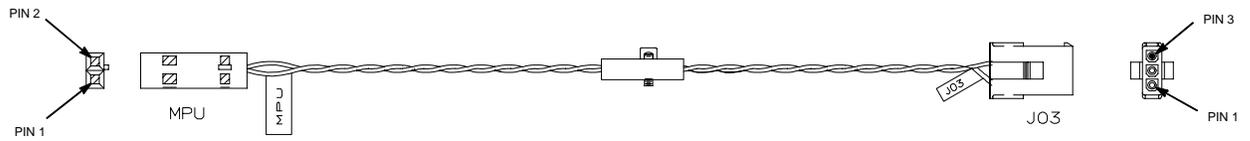
152423-901PX



WIRE TABLE		
P05	P105	WIRE COLOR
2	1	GRAY
1	2	BLACK
4	3	GRAY
3	4	BLACK
6	5	GRAY
5	6	BLACK
8	7	GRAY
7	8	BLACK
10	9	GRAY
9	10	BLACK

# Cable Assembly, MPU

152425-901PX

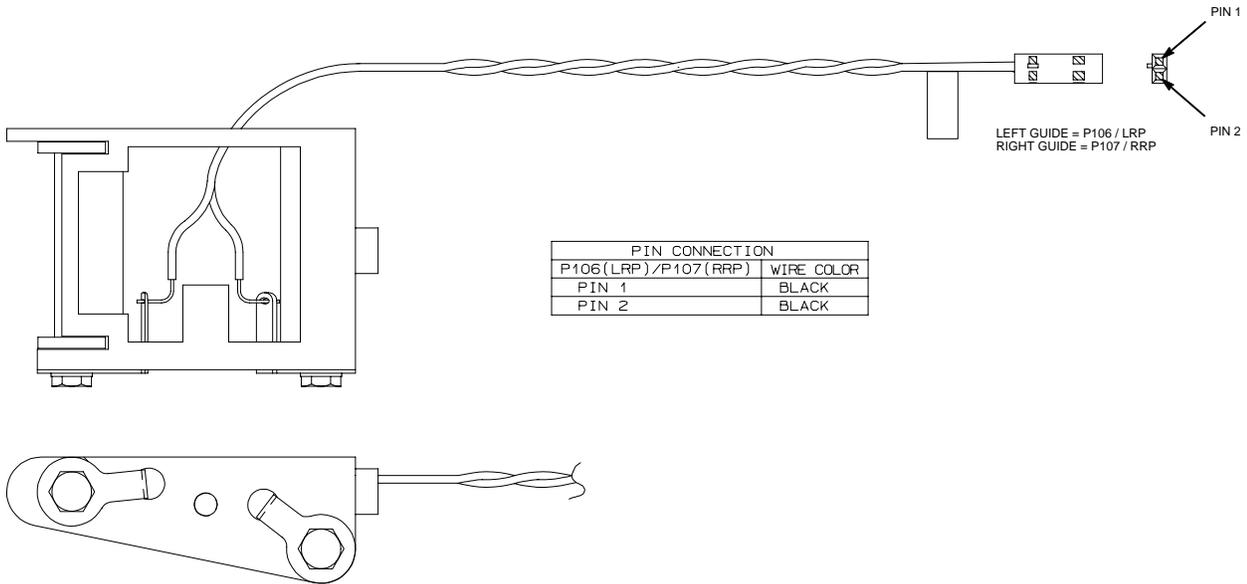


WIRE TABLE		
MPU	J03	WIRE COLOR
1	1	BLACK
2	2	GRAY
	3	N/C

### Ribbon Guide Kit

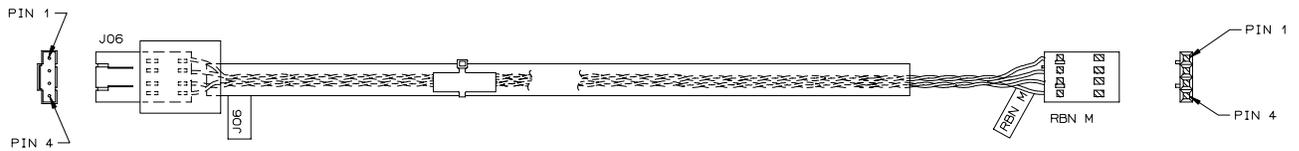
163597-901PX

**NOTE:** Left ribbon guide shown. Right is mirror image.



# Cable Assembly, Ribbon Motor, Extension

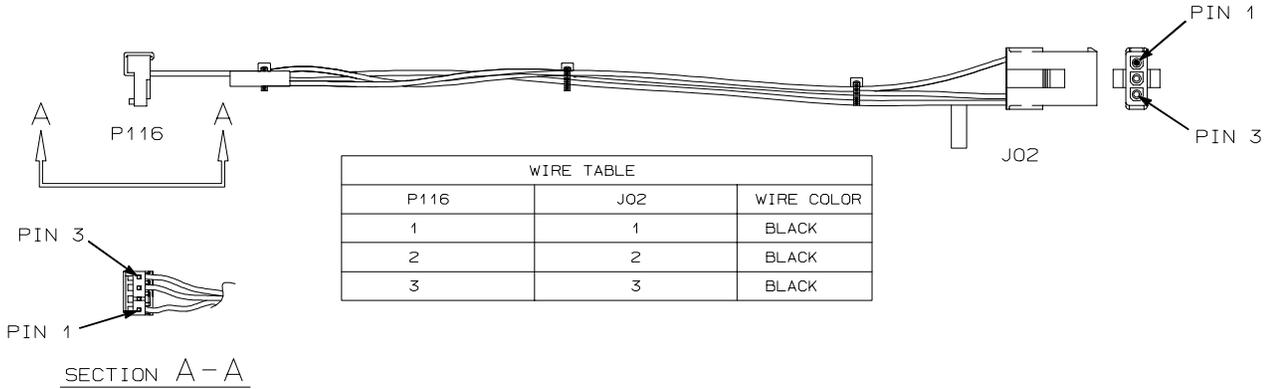
154067-901PX



PIN CONNECTION		
J06	RBN M	WIRE COLOR
PIN 1	PIN 1	BROWN
PIN 2	PIN 2	ORANGE
PIN 3	PIN 3	RED
PIN 4	PIN 4	YELLOW

Cable Assembly, Shuttle Motor Drive

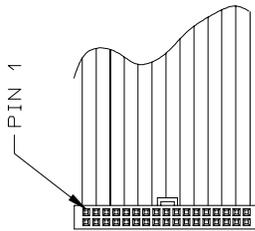
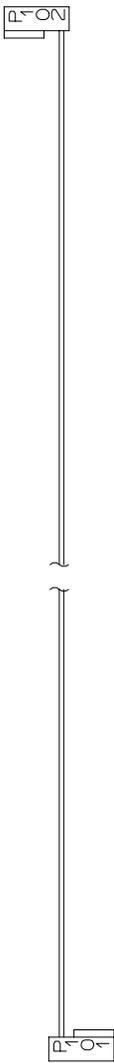
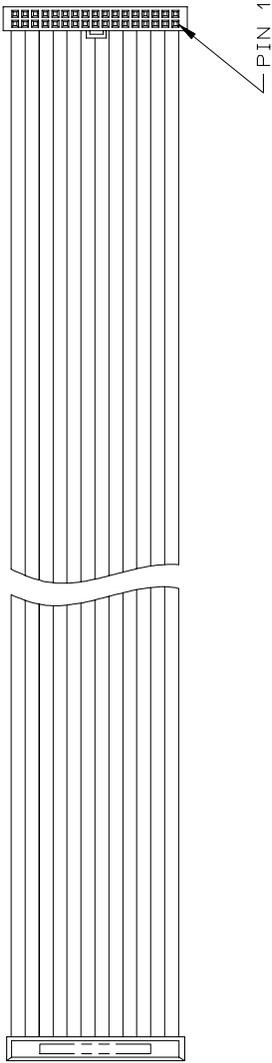
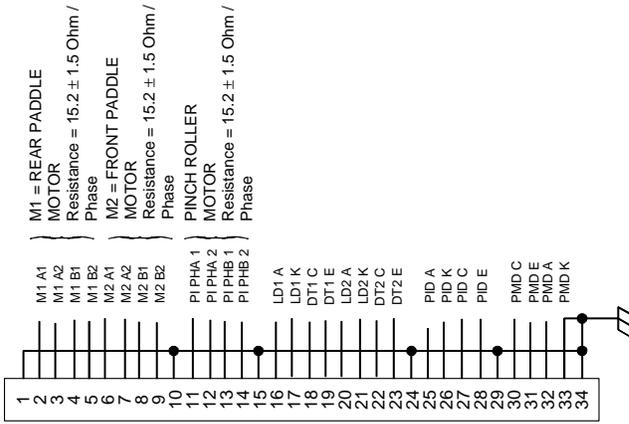
152420-001PX





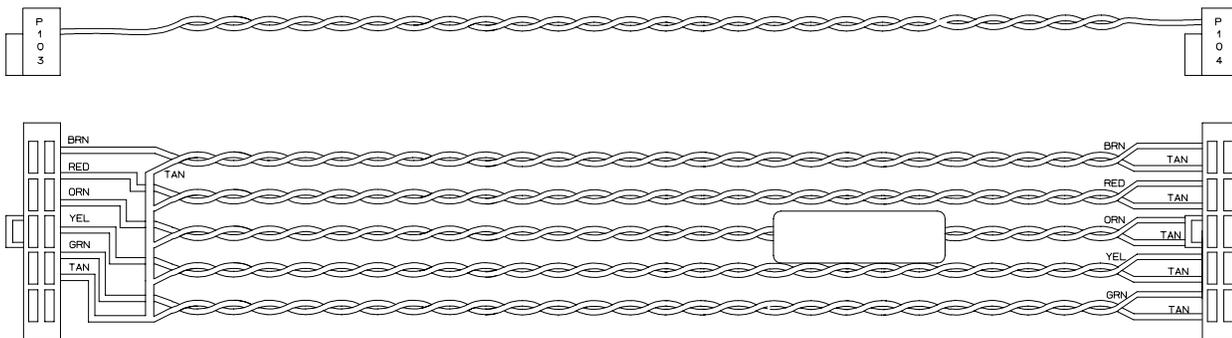
# Frame Cable, Power Stacker

158445-001PX



## Logic Cable, Power Stacker

158444-001PX

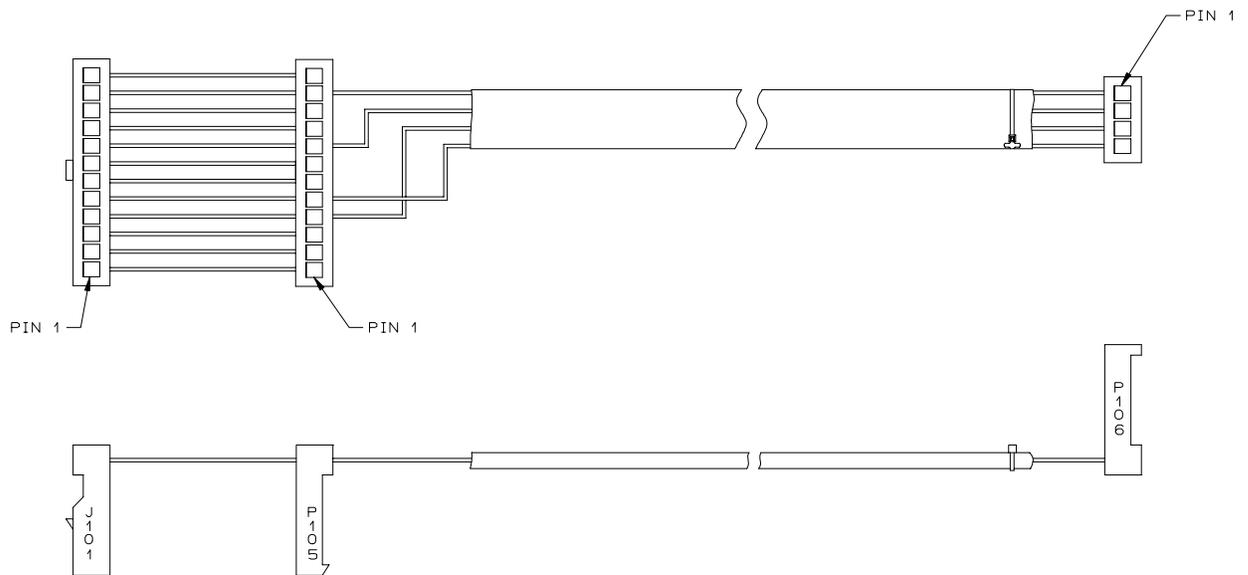


TWISTED PAIR COLOR CODING		
PAIR	LINE	COLOR
1	1	BRN
	2	TAN
2	3	RED
	4	TAN
3	5	ORN
	6	TAN
4	7	YEL
	8	TAN
5	9	GRN
	10	TAN

CONNECTION TABLE			
P103	LINE	P104	LINE
PIN 1	1/BRN	PIN 1	1/BRN
PIN 2	3/RED	PIN 2	2/TAN
PIN 3	5/ORN	PIN 3	3/RED
PIN 4	7/YEL	PIN 4	4/TAN
PIN 5	9/GRN	PIN 5	5/ORN
PIN 6	2, 4, 6, 8, 10	PIN 6	6/TAN
PIN 7	N/C	PIN 7	7/YEL
PIN 8	N/C	PIN 8	8/TAN
PIN 9	N/C	PIN 9	9/GRN
PIN 10	N/C	PIN 10	10/TAN

## Power Cable, Power Stacker

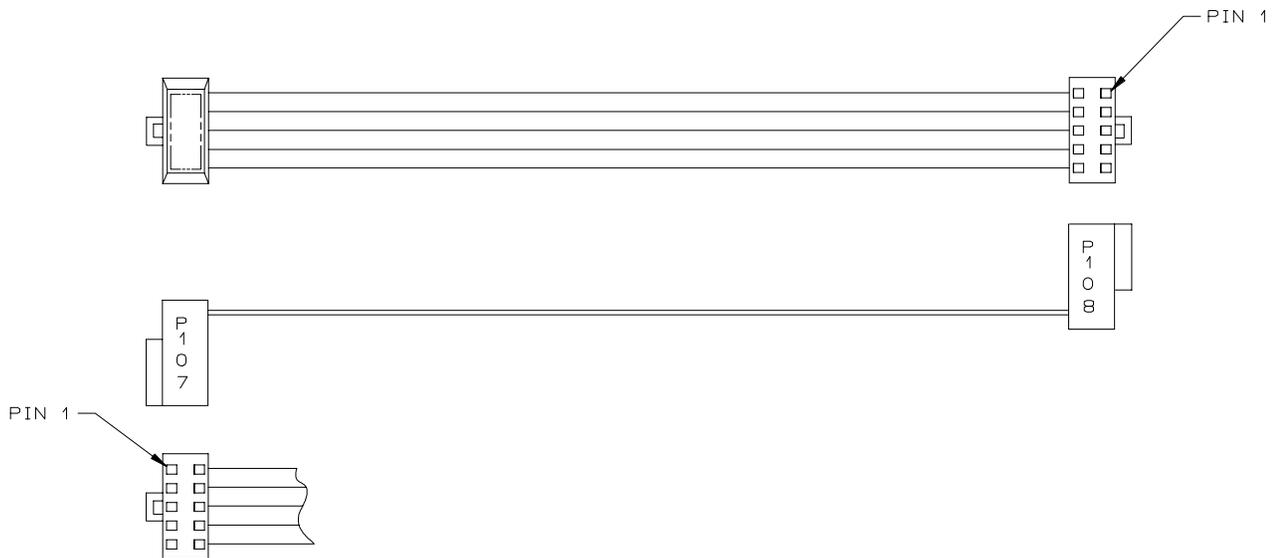
158443-001PX



CONNECTION TABLE			
J101	P105	P105	P106
PIN 1	PIN 1	PIN 11	PIN 1
PIN 2	PIN 2	PIN 8	PIN 2
⋮	⋮	PIN 4	PIN 3
PIN 11	PIN 11	PIN 5	PIN 4
PIN 12	PIN 12		

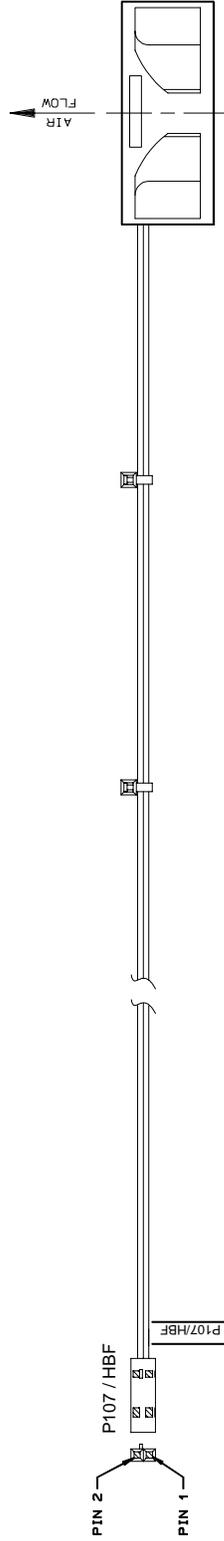
### Vertical Rail Cable, Power Stacker

158442-001PX



# Fan Assembly, Hammer Bank

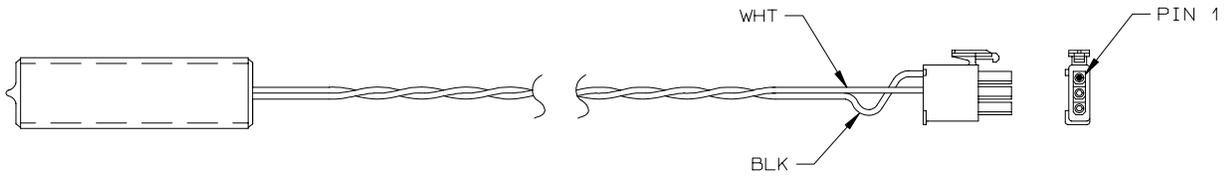
152416-901PX



WIRE TABLE		
P107	POLARITY	HBF (J)
PIN 2	-	BLACK
PIN 1	+	RED

### Magnetic Pickup (MPU) Assembly

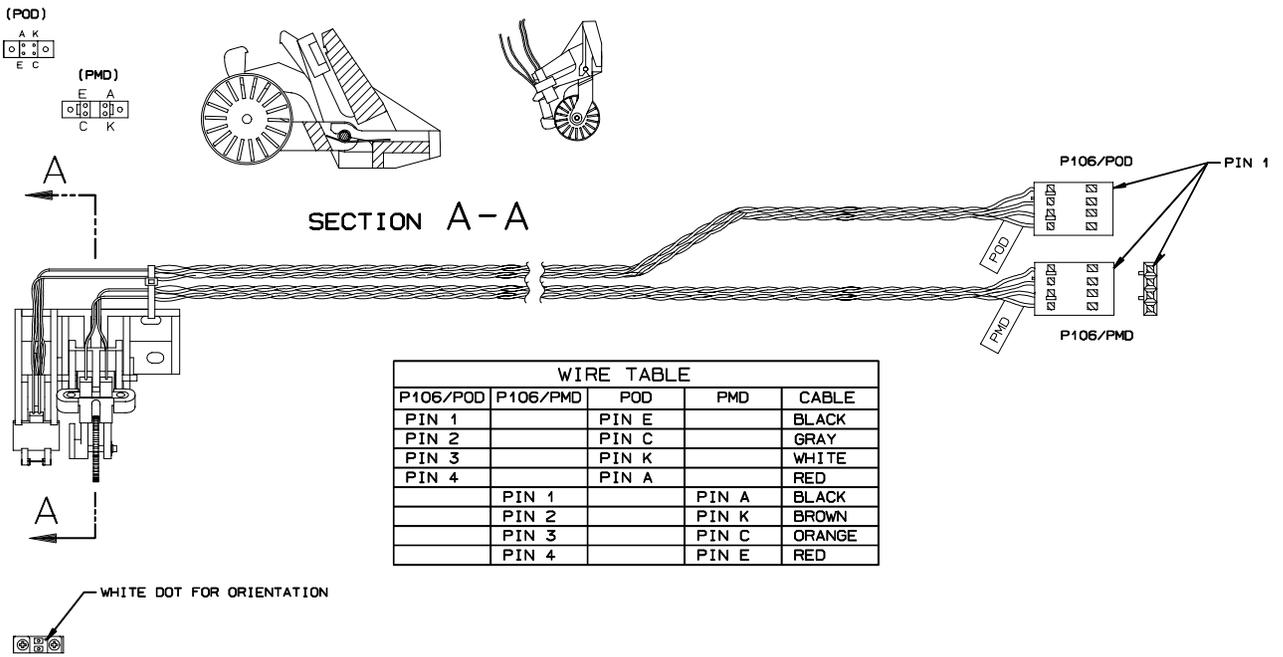
150281-901PX



WIRE TABLE	
CONN PIN NO.	WIRE COLOR
1	BLACK
2	WHITE
3	N/C

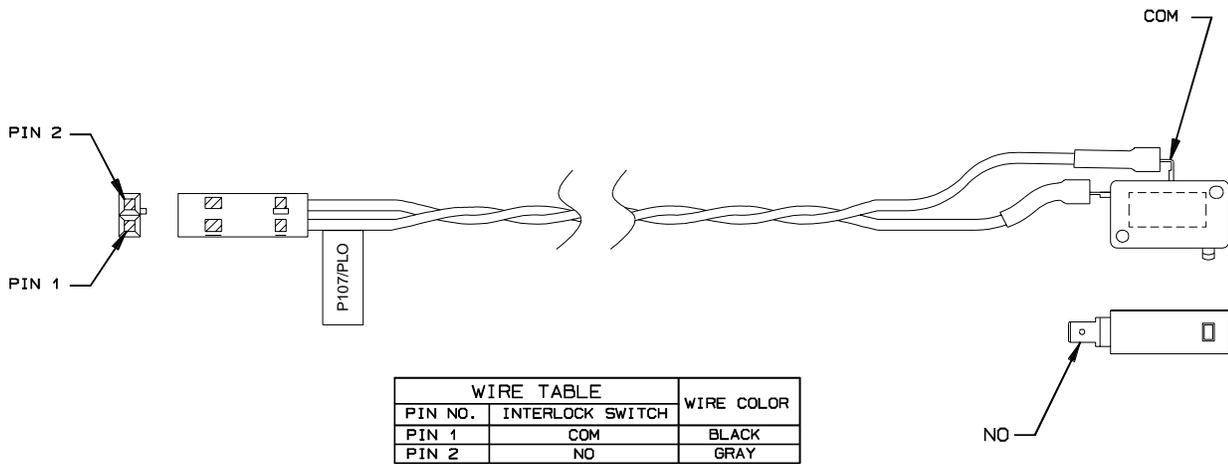
# Switch Assembly, Paper Detector

152415-901PX



Switch Assembly, Platen Interlock

152417-901PX





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# B

## *Printer Specifications and Regulatory Information*

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### **Ribbon Specifications**

Use only these Hewlett-Packard ribbon kits:

<b>Kit Number</b>	<b>Ribbon Type</b>	<b>Qty/ Kit</b>	<b>Part Number</b>
C3207A	60-yard text ribbon	6	C3207-60001
C3208A	100-yard text ribbon	6	C3208-60001
C3209A	60-yard bar code / OCR ribbon	6	C3209-60001
C3210A	100-yard bar code / OCR ribbon	6	C3210-60001

Printers are shipped with one box of six 60-yard bar code/OCR ribbons. 100-yard ribbons can only be used with LPQ (cabinet) models.

Additional supplies can be ordered in the USA by calling HP SafetyNet at 1-800-538-8787 (ask for "Ordering Supplies"). Outside the USA contact your local HP Sales Office.

### **Ribbon Life**

60-yard text ribbon yields up to 20M characters

100-yard text ribbon yields up to 33M characters

Bar code/OCR ribbon yields are less than text ribbon yields.

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### **Paper Specifications**

#### **Paper**

Type: Edge-perforated, fan-fold, 3 to 17 inches (7.62 to 43.18 cm) wide, 2 to 16 inches (5.08 to 40.64 cm) long. Power Paper Stacker option is 5 to 12 inches (12.7 to 30.48 cm) long.

Thickness: Single-part: 15 to 100 pound (6.80 to 45.36 kg) stock; Multi-part: 1- to 6-part forms (maximum 12 lb [5.44 kg] ply of upper plies)

Sheet Thickness: 0.025 inch (0.064 cm) maximum

Drive: Adjustable tractors (6-pin engagement)

<b>Slew Rates:</b>	<b>Fast:</b>	<b>Slow:</b>
LP475, LPQ 475	12 ips	8 ips
LP 500, LPQ 500	12 ips	8 ips
LP 800, LPQ 800	16 ips	8 ips
LPQ 1000	20 ips	12 ips
LPQ 1200	20 ips	10 ips
LPQ 1400	20 ips	10 ips
LPQ 1500	20 ips	16 ips

### Labels

On Backing: One-part continuous perforated fanfold back form. Labels must be placed at least 1/6 inch (0.42 cm) from the fan-fold perforation. Backing adhesive must not be squeezed out during printing.

Sheet Size: 3 to 17 inches (7.62 to 43.18 cm) wide, 3 to 16 inches (7.62 to 40.64 cm) wide for pedestal and LPQ 1500 with power stacker, which includes the two standard perforated tractor feed strips. A maximum sheet length of 16 inches (40.64 cm) between top and bottom perforations. Power Paper Stacker option is 5 to 12 inches (12.7 to 30.48 cm) long.

Thickness: Not to exceed 0.025 inch (0.064 cm) (including backing sheet)

## Printer Dimensions

---

### Cabinet Model:

Height: 42.5 inches (108 cm)

Width: 27 inches (68.6 cm)

Depth: 29 inches (73.7 cm)

Weight: 225 lbs. (102.1 kg) unpackaged  
285 lbs. (129.3 kg) packaged

### Cabinet Model with Power Stacker Option

Height: 42.5 inches (108 cm)

Width	27 inches (68.6 cm)
Depth:	32.5 inches (82.5 cm)
Weight:	246 lbs. (112 kg) unpackaged 306 lbs. (139 kg) packaged

**Pedestal Model:**

Height:	35 inches (88.9 cm)
Width:	24.6 inches (62.5 cm)
Depth:	20.7 inches (52.6 cm)
Weight:	105 lbs. (47.6 kg) unpackaged 115 lbs. (52.2 kg) packaged

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## Environmental Characteristics

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### Temperature

## Operating:

41° to 104° F (5° to 40° C) up to 5000 feet (1524 meters)

41° to 90° F (5° to 32° C) up to 8000 feet (2438 meters)

## Storage:

- 40° to 158° F (- 40° to 70° C)

### Relative Humidity

Operating: 15% to 80% (noncondensing)

Storage: 15% to 90% (noncondensing)

## ENERGY STAR®

LP series printers comply with the requirements of the ENERGY STAR® Office Equipment Program of the U.S. Environmental Protection Agency. When in the reduced power state, the printer displays "Power Saver Mode," and is activated at the control panel. (Refer to the *User's Guide*.)

## Electrical Characteristics

**NOTE:** Values for LP 475 and LPQ 475 printers are not available for the conditions described in this table.

<b>Current</b>				
	<b>LP 500</b>	<b>LPQ 500</b>	<b>LP 800</b>	<b>LPQ 800</b>
Printing, Typical <sup>1</sup>	2.15A	2.43A	2.60A	3.40A
Printing, Maximum <sup>2</sup>	3.60A	3.05A	3.55A	4.20A
Non-Printing <sup>3</sup>	0.90A	1.17A	1.00A	1.25A
<b>Power</b>				
Printing, Typical <sup>1</sup>	190W	191W	230W	300W
Printing, <sup>2</sup> Maximum	320W	244W	310W	370W
Non-Printing <sup>3</sup>	90W	84W	90W	110W
<b>Heat</b>				
Printing, Typical <sup>1</sup>	648 BTU/hr	652 BTU/hr	785 BTU/hr	1024 BTU/hr
Printing, maximum <sup>2</sup>	1092 BTU/hr	833 BTU/hr	1058 BTU/hr	1263 BTU/hr
Non-Printing <sup>3</sup>	307 BTU/hr	287 BTU/hr	307 BTU/hr	375 BTU/hr

<sup>1</sup> Printing, Typical = 120 VAC, 50/60 Hz, Shift Recycle (ASCII Swirl), High Speed Mode

<sup>2</sup> Printing, Maximum = 120 VAC, 50/60 Hz, All Black, High Speed Mode

<sup>3</sup> Non-Printing = 120 VAC, 50/60 Hz, Standby Mode

### ENERGY STAR®

All models below 1200 lpm are rated at 30W, 102 BTU/hr.

1200 lpm and above are rated at 45W, 154 BTU/hr.

<b>Current</b>					
	<b>LPQ 1000</b>	<b>LPQ 1200</b>	<b>LPQ 1400</b>	<b>LP 1500</b>	<b>LPQ 1500</b>
Printing, Typical <sup>1</sup>	3.28A	3.90A	3.95A	3.81A	4.37A
Printing, Maximum <sup>2</sup>	4.39A	5.40A	4.90A	4.58A	6.06A
Non-Printing <sup>3</sup>	1.19A	1.25A	1.20A	1.06A	1.16A
<b>Power</b>					
Printing, Typical <sup>1</sup>	271W	350W	340W	310W	364W
Printing, Maximum <sup>2</sup>	380W	490W	440W	383W	514W
Non-Printing <sup>3</sup>	86W	110W	110W	74W	84W
<b>Heat</b>					
Printing, Typical <sup>1</sup>	925 BTU/ hr	1195 BTU/ hr	1160 BTU/ hr	1058 BTU/ hr	1342 BTU/ hr
Printing, Maximum <sup>2</sup>	1297 BTU/ hr	1672 BTU/ hr	1502 BTU/ hr	1307 BTU/ hr	1754 BTU/ hr
Non-Printing <sup>3</sup>	294 BTU/ hr	375 BTU/ hr	375 BTU/ hr	253 BTU/ hr	287 BTU/ hr

<sup>1</sup> Printing, Typical = 120 VAC, 50/60 Hz, Shift Recycle (ASCII Swirl), High Speed Mode

<sup>2</sup> Printing, Maximum = 120 VAC, 50/60 Hz, All Black, High Speed Mode

<sup>3</sup> Non-Printing = 120 VAC, 50/60 Hz, Standby Mode

#### ENERGY STAR®

All models below 1200 lpm are rated at 30W, 102 BTU/hr.

1200 lpm and above are rated at 45W, 154 BTU/hr.

## Interfaces

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Logic Levels:	TTL / EIA-232E / EIA-422B
Data Format	ASCII
Transfer Rates	Up to 200 Kilobytes on parallel interface. Up to 19.2K baud on RS-232 serial interface. Up to 115.2K baud on RS-422 serial interface

## Material Safety Data Sheets

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If the customer site needs a Material Safety Data Sheet, provide the following information:

- HP part or product number
- Chemical substance description
- Customer name
- Customer address
- Customer telephone number
- Customer FAX number

**DECLARATION OF CONFORMITY**

according to ISO/IEC Guide 22 and EN 45014

**Manufacturer's Name:** Hewlett-Packard Company  
Internet & Applications Systems Division

**Manufacturer's Address:** 19420 Homestead Road  
Cupertino, CA 95014  
USA

**declares, that the product**

**Product Name:** Line Impact Dot Matrix Printer

**Model Number(s):** C3201C, C3202C, C3204C, C3205C, C5640C

**Product Options:** N/A

**conforms to the following Product Specifications:**

**Safety:** IEC 950:1991 + A1, A2, A3, A4 / EN 60950:1992 + A1, A2, A3, A4  
GB 4943-1995

**EMC:** CISPR 22:1993 / EN 55022:1994 - Class A<sup>1</sup>  
GB 9254-1988

EN 50082-1:1992

IEC 801-2:1991 / prEN 55024-2:1992, 4 kV CD, 8 kV AD

IEC 801-3:1984 / prEN 55024-3:1991, 3 V/m

IEC 801-4:1988 / prEN 55024-4:1993, 0.5 kV Signal Lines  
1 kV Power Lines

IEC 1000-3-2:1995 / EN 61000-3-2:1995, Class B, Harmonics

IEC 1000-3-3:1994 / EN 61000-3-3:1995, Flicker

**Supplementary Information:**

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC and carries the CE marking accordingly.

1) The Product was tested in representative computer systems.

Cupertino, March 22, 1999

European Contact: Your local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH, Department HQ-TRE, Herrenberger Straße 130, D-71034 Böblingen (FAX: + 49-7031-14-3143)

## Communication Notices

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**Federal Communications Commission (FCC) Statement:** This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. Hewlett-Packard Company is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

**Canadian Department of Communications Compliance Statement:**

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

**Avis de conformité aux normes du ministère des Communications du Canada:**

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

**European Union (EC) Electromagnetic Compatibility Directives:** This product is in conformity with the protection requirements of EC Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. Hewlett-Packard Company cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of non-Hewlett-Packard Company option cards.

Dieses Gerät ist berechtigt in Übereinstimmung mit dem deutschen EMVG vom 9.Nov.92 das EG-Konformitätszeichen zu führen.

Properly shielded and grounded cables and connectors must be used in order to reduce the potential for causing interference to radio and TV communication and to other electrical or electronic equipment.

This product has been tested and found to comply with limits for Class A Information Technology Equipment according to CISPR 22/European Standard EN 55022. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.



Warning: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Dieses Gerät erfüllt die Bedingungen der EN 55022 Klasse A. Für diese Klasse von Geräten gilt folgende Bestimmung nach dem EMVG:

Geräte dürfen an Orten, für die sie nicht ausreichend entstört sind, nur mit besonderer Genehmigung des Bundesministers für Post und Telekommunikation oder des Bundesamtes für Post und Telekommunikation betrieben werden. Die Genehmigung wird erteilt, wenn keine elektromagnetischen Störungen zu erwarten sind.

(Auszug aus dem EMVG vom 9.Nov.92, Para.3, Abs.4)

Hinweis: Dieses Genehmigungsverfahren ist von der Deutschen Bundespost noch nicht veröffentlicht worden.

**Japanese EMI:**

**注意**

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づく第一種情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づく第二種情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。  
取り扱い説明書に従って正しい取り扱いをして下さい。

## Printing Rates

---

The printing speed of text is measured in lines per minute (lpm), and is a function of the selected font and the vertical dot density. Printing speed is independent of the number of characters configured in the character set repertoire. Print rates for lines containing attributes such as bold or emphasized printing, superscripts, subscripts, or elongated attributes will decrease to not less than half the rates of the font without such attributes.

The plotting speed of graphics is measured in inches per minute (ipm).

To prevent damage from overheating when graphics plotting is done over extended periods, the hammer bank contains a thermal sensing feature that automatically reduces the print rate.

Typical printing rates are charted in Table 5.

**Table 5. Nominal Printing Rates**

PRINT QUALITY DOT DENSITY NOTE [1]	CPI	DOT MATRIX NOTE [2]	PERFORMANCE											
			UPPERCASE ONLY LPM				DESCENDERS & UNDERLINE LPM				PLOT MODE IPM			
			MODEL (LPM)	475	500	800	475	500	800	475	500	800		
NLQ 90 (180) X 96	10	7 (13) X 9 + 3												
	12	6 (11) X 9 + 3	190	200	320		147	154	247		20	21	33	
	15	5 (9) X 9 + 3												
DATA PROCESSING 60 (120) X 72	10	5 (9) X 7 + 2												
	12	4 (7) X 7 + 2												
	13.3	4 (7) X 7 + 2	356	375	600		285	300	480		40	42	67	
	15	3 (5) X 7 + 2												
	17.1	3 (5) X 7 + 2												
HIGH SPEED 60 (120) X 48	10	5 (9) X 5 + 1												
	12	4 (7) X 5 + 1	475	500	800		407	428	684		59	63	100	
	13.3	4 (7) X 5 + 1												
		<b>MODEL (LPM)</b>	<b>1000</b>	<b>1200</b>	<b>1400</b>	<b>1500</b>	<b>1000</b>	<b>1200</b>	<b>1400</b>	<b>1500</b>	<b>1000</b>	<b>1200</b>	<b>1400</b>	<b>1500</b>
NLQ 90 (180) X 96	10	7 (13) X 9 + 3												
	12	6 (11) X 9 + 3	400	480	560	600	306	370	432	459	42	50	58	61
	15	5 (9) X 9 + 3												
DATA PROCESSING 60 (120) X 72	10	5 (9) X 7 + 2												
	12	4 (7) X 7 + 2												
	13.3	4 (7) X 7 + 2	750	900	1050	1125	600	720	840	900	83	100	117	127
	15	3 (5) X 7 + 2												
	17.1	3 (5) X 7 + 2												
HIGH SPEED 60 (120) X 48	10	5 (9) X 5 + 1												
	12	4 (7) X 5 + 1	1000	1200	1400	1500	856	1026	1197	1284	125	150	175	187
	13.3	4 (7) X 5 + 1												

**NOTE:** [1] A (B) X C, where: A is maximum horizontal dot density  
B is horizontal dot placement density  
C is vertical dot density

**NOTE:** [2] D (E) X F + G, where: D is maximum number of dots that may be placed on  
E horizontal dot positions  
F is number of vertical dots for uppercase symbols  
G is number of dots available for descenders



---

# C

## *Abbreviations and Signal Mnemonics*

**NOTE:** Mnemonics with first letter “N” are negative true.

**Abbreviation  
or Mnemonic    Definition**

K $\Omega$	1,000 Ohms
Meg $\Omega$	1,000,000 Ohms
$\mu$ F	microfarad ( $10^{-6}$ farad)
$\mu$ s	microsecond ( $10^{-6}$ second)
$\mu$ sec	microsecond ( $10^{-6}$ second)
A0, A1, etc.	Address 0, Address 1, etc.
AC	Alternating Current
ACC	Access
ACK	Acknowledge
AMP	Amplitude; Ampere
AMPL	Amplitude
AN	Anode
ASIC	Application-Specific Integrated Circuit
ATTN	Attention
B	Buffered
BANK FAN	Hammer Bank Fan
BCOM	Buffered Communication
BCP	Bi-phase Communications Processor
BHSC	Buffered Hammer Shift Clock
BN	Buffered, Low True
BNLD	Buffered, Low True, Lower Driver
BPS	Bits Per Second
BSY	Busy

BTU	British Thermal Unit
BUD	Buffered Upper Driver
CA	Cathode
CC	Card Cage
CCF	Card Cage Fan
CHNG	Change
CIR	Circuit
CLK	Clock
CO	Cover Open
COLL	Collector
COMM	Communication
CONTLR	Controller
CMD	Command
CMX	The controller board
CNC	Connector, Connection
CPI	Characters Per Inch
CR	Carriage Return
CTL	Control
CTS	Clear to Send
CU	Control Unit
CUR	Current
D0, D1, etc.	Data Bit 0, Data Bit 1, etc.
DAT	Data
DC	Direct Current, Data Controller (a functional unit of the CMX controller board)
DCD	Data Carrier Detect
DIAG	Diagnostic
DIFF	Differential
DMA	Direct Memory Access
DP	Data Processing
DPEN	Dataproducts Enable
DPMC	Dot Plucker Memory Controller
DPU	Data Processing Unit
DRAM	Dynamic Random-Access Memory
DRV	Drive or Driver

---

DRVR	Driver
DSR	Data Set Ready
DTR	Data Terminal Ready
EC	Engine Controller (a functional unit of the CMX controller board)
EEPROM	Electrically Erasable/Programmable Read-Only Memory
EHF	Exhaust Fan
EL	Elevator (stacker)
EMI	ElectroMagnetic Interference
EMIT	Emitter
EPROM	Electrically Programmable Read-Only Memory
ERR	Error
ESD	Electrostatic Discharge
EX	Exhaust, Extra
EXH	Exhaust
EXF	Exhaust Fan
EXP	Expansion
EXPND	Expand
FD	Feed
FF	Form Feed
FIFO	First In, First Out
FLT	Fault
FLTR	Filter
FP	Front Panel (Control Panel)
FTIC	Fire Timer Integrated Circuit
GND	Ground
HB	Hammer Bank
HBA	Hammer Bank ASIC
HBF	Hammer Bank Fan
HBL	Hammer Bank, Left
HBP	Hammer Bank Power
HBR	Hammer Bank, Right
HD	Hammer Driver

HDIC	Hammer Driver Integrated Circuit
HDPH	Hammer Driver Phase
HLP	Hammer Bank Logic, Signals, and Power
IC	Integrated Circuit
ID	Identification
IGP	Intelligent Graphics Printing
INST	Instruction
INT	Interrupt
I/O	Input/Output
IRQ	Interrupt Request
(J)	Jack connector
L	Left
LAN	Local Area Network
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LF	Line Feed
LO	Low
LPI	Lines Per Inch
LPM	Lines Per Minute
LRIB	Left Ribbon
LRP	Left Ribbon Guide
M	Motor
MAIN	Maintenance Jack, RS-232 (Optional)
MECA	Mechanism Engine Control ASIC
MECH	Mechanism
MF	microfarad ( $10^{-6}$ farad)
MH	Mounting Hole, Main Harness
MOSFET	Metal Oxide Semiconductor Field Effect Transistor
MOT	Motor
MPU	Magnetic Pick-Up (Unit)
ms	millisecond ( $10^{-3}$ second)
MSL	Motor and Sensors, Left
MSR	Motor and Sensors, Right



---

N	Negative True
N/C	Not Connected
NC	Not Connected
NLQ	Near Letter Quality
No.	Number
NOVRAM	Nonvolatile Random-Access Memory
ns	nanosecond ( $10^{-9}$ second)
NT	Not
NVRAM	Nonvolatile Random-Access Memory
OLV	On Line Verify
OP	Operand
P5	+ 5 V dc
(P)	Pin connector
P(1), P(2), etc.	Parallel data 1, data 2, etc.
PAL	Programmable Array Logic
PAP	Paper
PAPR	Paper
PARM	Parameter
PCBA	Printed Circuit Board Assembly
PCB	Printed Circuit Board
PD	Paper Detect(or)
PE	Printer Error, Paper Empty
PER	Peripheral Device
PF	Paper Feed, picofarad ( $10^{-12}$ farad)
PFM	Paper Feed Motor
PHA	Phase A
PHB	Phase B
PI	Paper Instruction
PLAT	Platen
PLM	Platen Motor
PLO	Platen Open (Switch)
PMD	Paper Motion Detect
PN	Pin or Plug
P/N	Part Number

PO	Paper Out
POD	Paper Out Detect (Switch)
PPR	Paper
PROM	Programmable Read-Only Memory
PS	Power Supply
PS5	Power Supply + 5 Volt
PTR	Pointer, Printer, Printronix
PWM	Pulse Width Modulation
PWR	Power
R	Right
RBN	Ribbon
RD	Read
RET	Return
RIB	Ribbon
RG	Ribbon Guide
RGL	Ribbon Guide, Left
RGR	Ribbon Guide, Right
RM	Ribbon Motor
RML	Ribbon Motor, Left
RMR	Ribbon Motor, Right
RQ	Request
RRIB	Right Ribbon
RRP	Right Ribbon Guide
RSP	Ribbon and Shuttle Processor
RST	Reset
RTS	Request to Send
RXD	Receive Data
SEC	Security (Key)
SEL	Select
SEN	Sense, Sensor
SF	Structured Field
SG	Signal Ground
SHH	Shuttle Hall (Effect)
SHM	Shuttle Motor
SHUT	Shuttle

---

SHUTL	Shuttle
SIMM	Single Inline Memory Module
SLCT	Select (On-line)
Slew	Rapid vertical paper movement
SMD	Shuttle Motor Drive
SPU	Shuttle Processor Unit
SRAM	Static Random-Access Memory
STAT	Status or State
STBY	Standby
STK	Stacker
SW	Switch
SYNC	Synchronize
TCB	Task Control Block
TEMP	Temperature
TOF	Top of Form (first print line)
TP	Test Point
TTL	Transistor-Transistor Logic
TXD	Transmit Data
UART	Universal Asynchronous Receiver/Transmitter
UDPH	Upper Drive Phase
UNDEF	Undefined
USART	Universal Synchronous/Asynchronous Receiver/ Transmitter
V	Volts
V <sub>CC</sub>	Voltage at Collector
V <sub>DD</sub>	Voltage at Drain
V <sub>SS</sub>	Voltage at Source
VX	A special ASIC on the CMX controller board containing circuits that help the DC controller operate. The initials VX do not signify words; they serve only to identify this ASIC.
WR	Write
w/	With
w/o	Without

XMT

Transmit

---

# D

## *Firmware Download Procedure*

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### **Loading Flash Memory**

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Flash memory is contained in SIMMs (Single In-Line Memory Modules) located on the controller board. Printer emulation and operating system software are loaded into flash memory at the factory, but you will install software in some situations:

- The customer buys the VGL graphics option after the printer is installed
- The customer needs to upgrade printer software
- The customer needs different emulation software
- You have replaced the controller board
- You have added or replaced the flash memory SIMM

Emulation and operating system software are stored as a compressed file on a 3.5 inch floppy diskette. This file is “executable”; you will expand it and copy it into printer flash memory.

You can load software through the serial port or the parallel port of the printer. The load commands are different, depending on the port you use. These differences are explained in the note following step 18.

1. Make a printout of *all* saved configurations. (Refer to the *User's Guide*.) (Installing new software erases all saved configurations. You will use the printouts to restore printer configuration.)
2. Set the printer power switch to O (off).
3. If the printer is already connected to the serial or parallel port of a computer capable of running an MS-DOS® based PKZIP® self-extracting file, go to step 10. If not, go to step 4.
4. Unplug the AC power cord from the printer.
5. Disconnect all data input cables from the printer interface.

6. Connect a parallel data cable to the LPT1 port or a serial data cable to the COM1 port of an IBM-compatible computer that is using the PC-DOS™ or MS-DOS operating system.

---

### Note



You can connect the cable to the LPT2 port if the LPT1 port is already in use. The load commands are different if you use this port, as described in the note after step 18.

- 
7. Connect the data cable to the appropriate I/O port of the printer.
  8. Plug the AC power cord into the printer.
  9. Power on the computer.
  10. Insert the emulation or upgrade diskette into diskette drive A (or B) of the computer.
  11. Make the diskette drive the active drive by typing the following at the DOS prompt:  
**A:**<return> (If the diskette is in drive B, type **B:**<return>)
  12. Get the name of the compressed file on the diskette by listing the contents of the diskette; at the DOS prompt type:  
**DIR**<return>  
The compressed file on the diskette takes the form FILENAME.EXE  
Write down the complete name of the file with the .EXE extension.
  13. On the printer control panel, press and hold down the **ON LINE + FF** keys. Without releasing the keys, power the printer on. Continue holding the **ON LINE** and **FF** keys down.
  14. When you see "WAITING FOR PROGRAM DOWNLOAD" on the LCD, release the **ON LINE** and **FF** keys.

---

### Note



The port default is CENTRONICS; this is the standard load through the parallel port. If you want to use the default, continue at step 18.

- 
15. Press the ► (NEXT) key;  
"SELECT DOWNLOAD PORT=DATAPRODUCT" appears on the LCD.
  16. Press ► (NEXT) again to cycle through the download ports available in the printer:  
DATAPRODUCT (parallel)  
CENTRONICS\* (parallel) (this is the default port)  
RS232-9600 (RS-232 serial, 9600 baud)  
RS232-19.2K (RS-232 serial, 19200 baud)  
RS232-38.4K (RS-232 serial, 38400 baud)  
RS232-115K (RS-232 serial, 115000 baud)  
RS422-9600 (RS-422 serial, 9600 baud)  
RS422-19.2 (RS-422 serial, 19200 baud)

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RS422-38.4K (RS-422 serial, 38400 baud)  
RS422-115K (RS-422 serial, 115000 baud)

17. When the printer download port you want to use is displayed on the LCD, press **ENTER**. "WAITING DOWNLOAD / PORT = <your selection>" appears on the display.
18. At the DOS prompt on the computer type:  
**FILENAME.EXE -pb<return>**  
where FILENAME.EXE is the compressed file you noted in step 12. This command decompresses the file on the diskette and copies it as a binary file into the flash memory on the printer controller board.

---

## Note



If you are loading the file using the LPT2 port on the computer, enter the following DOS command:

**FILENAME.EXE -pb 2 <Return>**

The 9600 baud rate is the only selection older versions of DOS can use. The baud rate information entered in the following DOS commands must match the selection you made in step 16.

If you are loading the file through the printer serial port, enter the following DOS commands:

**MODE COM1:9600,N,8,1,P<Return>**

**FILENAME.EXE -pb c1<Return>**

---

19. While the file is copied into memory, the printer LCD informs you of the load process and status. (See Table 6: below.)
20. When the new program has successfully loaded into memory and the printer has reset itself, set the printer power switch to O (off).
21. Unplug the AC power cord from the printer.
22. Remove the diskette from the computer and store it with the printer.
23. Power off the computer.
24. If you had to install a data cable to the computer and printer in step 6, disconnect it from the computer and printer.
25. Reconnect the customer's data input cable(s) to the printer, if required.
26. Return the printer to normal operation (page 103).
27. Using the configuration printout(s) you made in step 1, reconfigure the printer. (Refer to the *User's Guide*.)

**Table 6: Flash Memory Message Guide**

<b>Message</b>	<b>Explanation</b>	<b>Required Action</b>
CLEARING PROGRAM FROM FLASH	The program successfully loaded into printer RAM and the checksum matched. The old program is now being deleted from flash memory.	None
DIAGNOSTIC PASSED	The printer passed its memory and hardware initialization tests.	None
ERROR: DC PROGRAM NOT VALID	Printer cannot find the data controller program or the validation checksum is corrupted.	Download the program again: Power off the printer and start over at step 13. If the message occurs again, replace the flash memory.
ERROR: DRAM AT ADDRESS XXXXXXXX	The printer found a defective memory location.	Replace the DRAM.
ERROR: EC PROGRAM NOT VALID	Printer cannot find the engine controller program or the validation checksum is corrupt.	Download the program again: Power off the printer and start over at step 13. If the message occurs again, replace the flash memory.
ERROR: EC STOPPED AT STATE XXXX	Hardware fault in the engine controller.	See page 52.
ERROR: FLASH DID NOT PROGRAM	The printer encountered an error trying to program flash memory.	Download the program again: Power off the printer and start over at step 13. If the message occurs again, replace the flash memory.
ERROR: FLASH NOT DETECTED	The printer could not find any flash memory.	Install flash memory before trying to download this program, or reseal the SIMMs if they are present.
ERROR: NO DRAM DETECTED	The printer could not find any DRAM.	Check DRAM on CMX. If present, reseal DRAM, If missing, install DRAM.
ERROR: NVRAM FAILURE	The non-volatile memory has failed.	Replace the CMX controller board. (Do NOT attempt to replace NVRAM.)
ERROR: PROGRAM NEEDS MORE DRAM	The printer requires more DRAM memory in order to run the downloaded program.	Add DRAM or use a smaller emulation program.



**Table 6: Flash Memory Message Guide**

<b>Message</b>	<b>Explanation</b>	<b>Required Action</b>
ERROR: PROGRAM NEEDS MORE FLASH	The printer requires more flash memory in order to run the downloaded program.	Add flash memory or use a smaller emulation program.
ERROR: PROGRAM NOT COMPATIBLE	The printer is not compatible with the downloaded program.	Use the correct emulation software option(s) for this model.
ERROR: PROGRAM NOT VALID	The printer does not see a program in flash memory.	There is no program in printer memory. Go to step 1.
ERROR: SECURITY PAL NOT DETECTED	The security PAL is not present or has failed.	Check the security PAL at location U54 on the CMX controller. If the PAL is absent, install correct PAL. If security PAL is present, replace the CMX controller board.
ERROR: SHORT AT ADDRESS XXXX	Hardware failure in DRAM or CMX controller circuitry.	Replace DRAM. If message occurs with new DRAM, replace CMX controller board.
ERROR: WRITING TO FLASH	Hardware or software fault in flash memory.	Download the program again: Power off the printer and start over at step 13. If the message occurs again, replace the flash memory.
ERROR: WRONG CHECKSUM	The printer received the complete program but the checksum did not match. The data were corrupted during download.	Download the program again: Power off the printer and start over at step 13.
LOADING PROGRAM FROM PORT XX%	The new program is loading into printer RAM. XX indicates how much of the program has loaded.	None
LOADING PROGRAM INTO FLASH	The printer has deleted the previous program from flash memory and is loading the new program into flash memory.	None
PLEASE WAIT... RESET IN PROGRESS	The printer finished loading the program into flash memory and is automatically resetting itself.	None
RESTORING BOOT CODE	Normal download initialization message.	None
SECURITY CODE VIOLATION	The software running or being downloaded does not match the security PAL code.	Install the correct PAL or program. (PAL and program must match.)

**Table 6: Flash Memory Message Guide**

<b>Message</b>	<b>Explanation</b>	<b>Required Action</b>
SENDING PROGRAM TO EC PROCESSOR	The printer is loading the engine controller program into the engine controller.	None
TABLE MISMATCH DOWNLOAD AGAIN	EC software update in process.	Download the program again: Power off the printer and start over at step 13.

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# E

## *Host Configurations and Drivers*

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### HP3000 / MPE-V

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#### **MPE-V Typical Configuration**

LOGICAL DEVICE #?      Provided by CE  
DEVICE NAME?          HPPCLATPFor use with ATP  
                             HPPCLADCCFor use with ADCC  
                             HPLPATPFor use with ATP  
                             HPLPADCCFor use with ADCC  
DRT #?                  Provided by CE  
UNIT #?                 Provided by CE  
SOFTWARE CHANNEL # = 0?  
TYPE = 32?  
SUB TYPE = 14?  
ENTER [TERM TYPE #], [DESCRIPTOR FILENAME] = 19?  
SPEED IN CHARACTERS PER SECOND = 240?  
RECORD WIDTH = 66?  
OUTPUT DEVICE = 0?  
ACCEPT JOB/SESSIONS = N?  
ACCEPT DATA = N?  
INTERACTIVE = N?  
DUPLICATIVE = N?  
INITIALLY SPOOLED = Y?  
AUTO REPLY = N?  
DRIVER NAME            = HIOASLP0For use with ATP  
                             = HIOASLP2For use with ADCC  
DEVICE CLASSES = LP?   User's choice

## HP3000 / MPE-XL / MPE / iX

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### MPE-XL / MPE / iX Typical Configuration

Within NMMGR follow the menu:

```
Open Config
DTS
Go to Profiles
Add or
Modify
Printer Type [18]          (18, 21, 22, or 26)
or Printer Type File Name _____
Line Speed [9600]         (300 through 38400)
Record Width [132]        (1 . . . 2048 bytes)
Modem Type [0]            (0-None, 1-US, 2-Europe)
Parity [NONE]             (None, Even, Odd, 0's, 1's)
Initially Spooled [Y]     (Y,N)
Device Class . . . user's choice
Save Data
Prior Screen . . . twice
Go to DTC
Config Card
Assign Profile to LDEV
Save Data
Validate Link/DTX
```

After successful Validation, run SYSGEN to cross-validate the DTS configuration with the system configuration. In order for any TIO changes to take effect, you must reboot the system.

```
Within SYSGEN
sysgen> io
io> LD
io> HO
sysgen> K . . . (Keep configuration)
```

---

# HP9000 / HP-UX®

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## HP-UX Typical Configuration

Printers set up on HP-PB & CIO computers

	Drivers Required		
Interface	HP-PB	CIO 6 CHANNEL MUX	CIO 16 CHANNEL MUX
Serial	mux2	mux0, cio_ca0	mux0_16, cio, ca0
Parallel	lpr2	N/A	N/A

The Drivers shown in this table should be installed in the Kernel Configuration.

## Configuration Guidelines

Within SAM follow the menu:

Printers and Plotters

Printers/Plotters

Printer/Plotter Manager menu . . . select Actions

Add Local Printer/Plotter

Add parallel Printer/Plotter or

Add serial Printer/Plotter

If parallel printer is selected:

Printer Name user's choice

Printer Model Interface user's choice

Printer Device File Name SAM creates a special file

Printer Class user's choice

If serial printer is selected:

The system displays the Serial Interface Hardware Paths

Port select a valid port

Printer Name user's choice

Printer Model Interface user's choice

Printer Device File Name SAM creates a special file

Printer Class user's choice



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# F

## *Paper Specifications*

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### Introduction

LP Series Printers use dot matrix line printing technology, which permits a high degree of printing flexibility. Dot matrix technology enables the user to print graphic images, line drawn characters, special characters, and multiple alphabets.

This appendix provides detailed specifications for selecting continuous form paper. These specifications will help ensure the highest quality and reliability of the printer. This appendix does not recommend particular brands or types of paper.

---

### Dot Matrix vs. Full Font Printers

A significant difference between dot matrix printers and full-font printers (chain-train, slug-train, and band printers) is the print gap. The print gap is the distance between a print hammer in its retracted position and the platen. While the hammers of full font printers fire only once to form a complete character, the hammer of a dot matrix printer fires an average of 13 times per character, and as many as 26 times to form a standard density character. The high repetition rates necessary to print dot matrix images require a significantly smaller print gap. See Figure 51.

For most standard paper and multi-part forms, the smaller print gap of dot matrix printers presents no problems. However, some specialty forms that perform satisfactorily in full font printers may cause unacceptable paper jam rates and print smearing when used in dot matrix printers. This appendix will help you identify paper that performs well in LP Series Printers. This appendix will also help you work with the forms vendors in designing and buying forms that provide optimum print quality and paper stacking.

---

#### Note



Always test your paper and forms for proper print quality, paper feeding, and paper stacking before buying a large quantity.

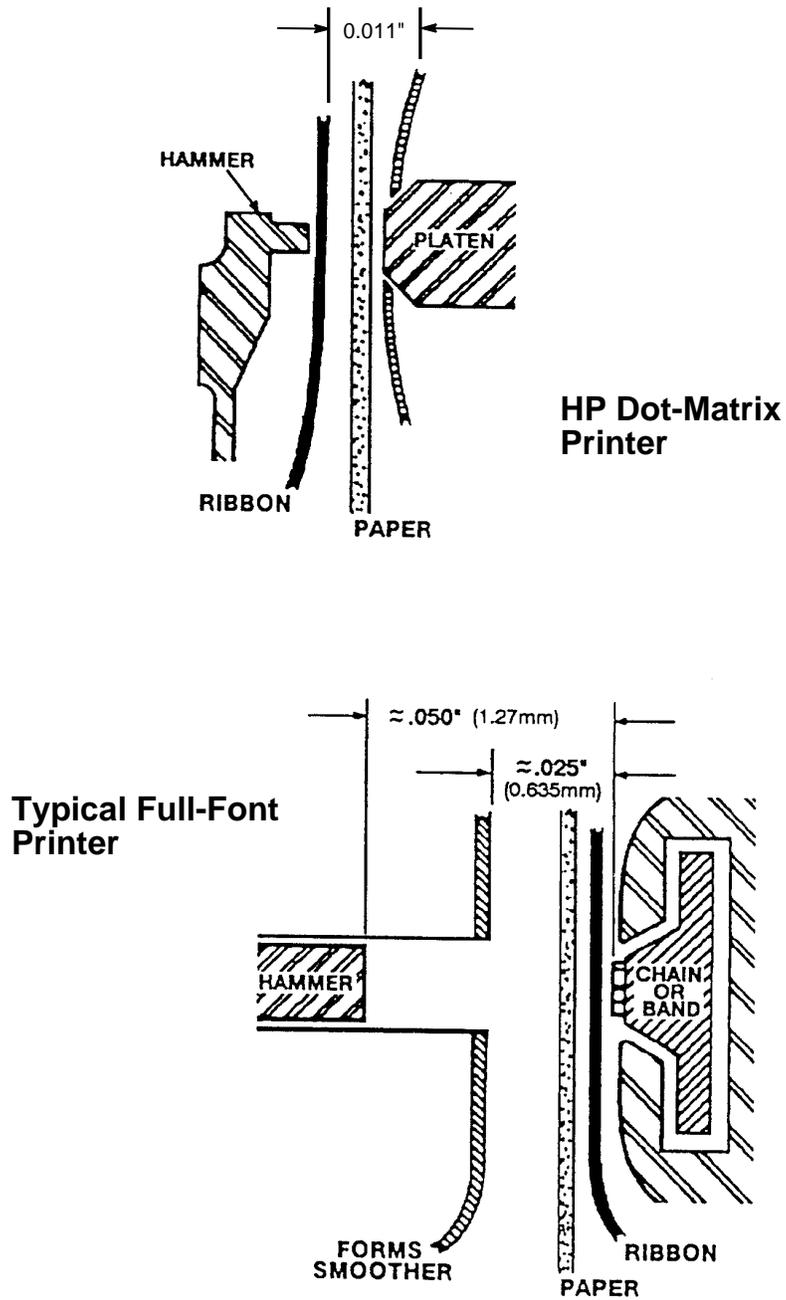


Figure 51. Dot Matrix and Full Font Print Gap Comparison



## General Paper Requirements

The printer uses continuous fan-folded, edge-perforated paper varying in width from 3.0 inches (7.62 cm) to 17 inches (43.18 cm). Although the printer accepts paper as wide as 17 inches, the farthest right it can print is 15.2 inches (38.6 cm). The printer will handle paper weights of 15 to 100 pounds (6.80 to 45.36 kg), with 18 to 60 pounds (8.17 to 27.24 kg) as the optimum weight range.

In general, any special application paper, such as multi-part forms, labels, etc., should be tested in the printer prior to purchase.

## Paper Specifications

This section describes the paper specifications that must be met to ensure optimum printer performance.

Hewlett-Packard conforms to ANSI® Standard X3.96-1983, "American National Forms Information Systems for Continuous Business Forms," and ISO Recommendation No. 2784, which cover common form widths and depths, standards for sprocket feed holes and margins, and other basic tolerances.

Make all measurements at 20° to 26° Celsius (68° to 78° Fahrenheit) and 45% to 55% relative humidity.

## Standard Forms Specifications

LP Series Printers perform adequately with forms that meet the following specifications:

Paper Sizes	
Maximum form width	17.0 inches (43.18. cm) edge to edge
Minimum form width	3.0 inches (7.62 cm) edge to edge
Maximum Printing Width	13.6 inches (34.54 cm)
Maximum Right Margin	1 to 13.6 inches (2.54 to 34.54 cm)
Maximum Left Margin	0 to 13.5 inches (0 to 34.29 cm)
Maximum Form Length	16 inches (40.64 cm)
Minimum Form Length	2 inches (5.08 cm)

Paper Weights	
<b>Single-Part Forms:</b>	
Standard	15 to 100 pound (57 to 380 gm/meter <sup>2</sup> )
Optimum Print Quality	18 to 60 pound (68 to 227 gm/meter <sup>2</sup> )
Optimum Paper Stacking	
<b>Multi-Part Forms:</b>	
Carbon Paper	12 pounds (46 gm/meter <sup>2</sup> ) up to 6 total pages
Carbons	8 pounds (30 gm/meter <sup>2</sup> ) up to 6 total pages
Pack Thickness	Maximum 0.025 inch (0.0635 mm) total
Carbonless	Up to 4-part forms

For forms other than single-part or simple carbon type multi-part forms, refer to the next section, “Specialty Forms Specifications.” The forms used in the printer should not vary in thickness across the printable surface.

Test the paper first if it will be used in environments with greater than 80% or less than 20% humidity. Test paper that will be used at high humidity for satisfactory feeding and handling. Test paper that will be used at low humidity to determine if static buildup must be eliminated for proper paper stacking.

### Specialty Forms Specifications

Due to variations in manufacturing processes, quality, and composition of forms, Hewlett-Packard cannot guarantee satisfactory performance with all paper and forms. This section alerts you to some of the characteristics of specialty forms that can cause unsatisfactory printer performance.

**Note**



The information in this specification is not a substitute for actual testing. Always test specialty forms—including special single-part paper, multi-part forms, forms with glue strips, carbonless forms, card stock, and labels—for satisfactory feeding, registration, and print quality before buying large quantities.

### Recycled Paper

Recycled paper is a combination of waste paper, pre-consumer waste, and post-consumer waste. Printed paper is usually washed to remove most of the inks and other contaminants. Recycled paper may contain dark specks or appear gray or dirty. You should choose a recycled paper that meets the same specifications as standard paper and that has an appearance suitable for your needs. Hewlett-Packard recommends that recycled paper contain no more than 5% groundwood.

## Forms Thickness Uniformity

Because of their small print gap, dot matrix line printers are less tolerant of forms thickness variations than are full font printers. Some thickness variations are caused by defects such as bubbles or wrinkles. Other thickness variations are due to varying paper composition or to a variable number of parts within the form.

Nominal differences in thickness and compressibility make it impossible to specify allowable thickness variations exactly. Use the following cases as a guide, but test all forms that have thickness variations. (In the cases that follow, T = maximum thickness.)

### Case 1: Form Defect

To avoid hammer dragging, the overall thickness of a form plus any defects should not exceed the measurement shown in Figure 52.

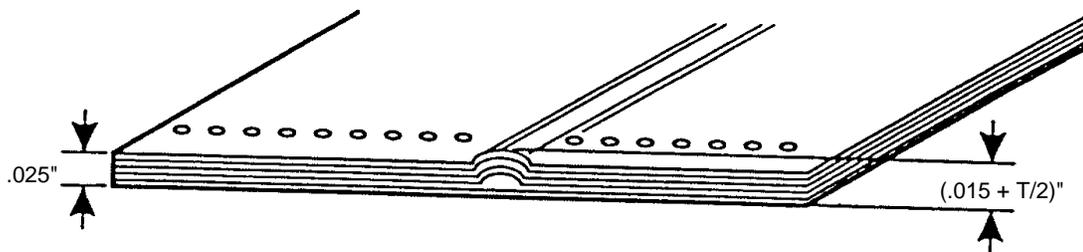


Figure 52. Maximum Height of Form Defects

### Case 2: Varying Thickness Forms: Printing on All Areas

To ensure satisfactory print quality on all areas of the form, the difference in thickness between the thickest and thinnest section of the form should be no more than 0.008 inch, as shown in Figure 53. Adjust the print gap to optimize print quality on all thicknesses of the form. Because dot matrix printing is optimized at a single gap size, print quality can be compromised in some cases when printing on forms of varying thickness. This is especially true on the copy sheets of multi-part forms. When printing on forms of varying thickness, the maximum depth of depression defects on the thick part of the form is also 0.008 inch.

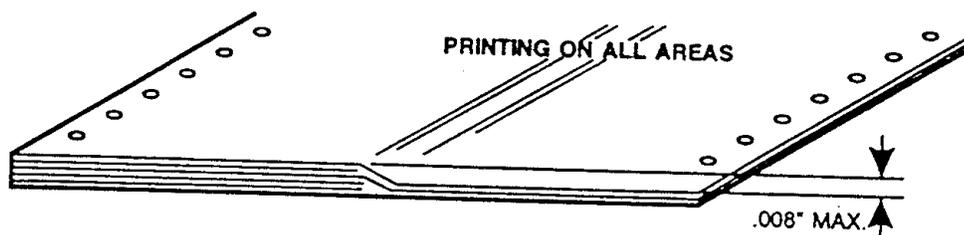


Figure 53. Maximum Thickness Variations for All Areas of a Special Form

### Case 3: Varying Thickness Forms: Printing on Thin Areas

To avoid print smearing on the thickest area of the form when printing on the thin area only, the difference in thickness between the thinnest area and the thickest area should be no more than that shown in Figure 54. ( $0.015 - T/2$  inch.) For forms with larger variations in thickness, the print gap can be opened beyond the optimum gap in order to reduce smearing, but print quality on the thinner areas will degrade accordingly.

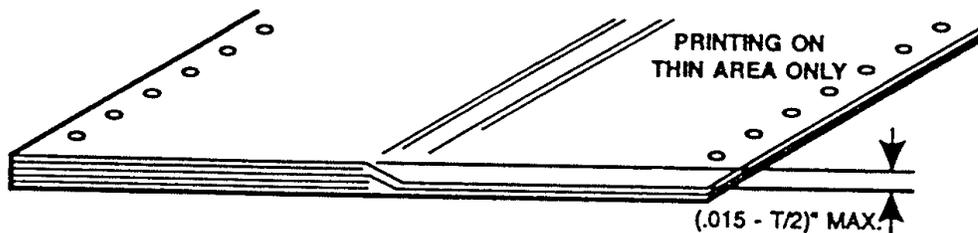


Figure 54. Maximum Thickness Variations for Thin Areas of a Special Form

### Case 4: Varying Thickness Forms: Printing on Thickest Areas

In this case, as long as the thickest area of a form does not exceed the specifications listed (see "Paper Weights," page 298), there is no lower limit to the thickness of the thinnest area, as long as it is sufficient to support the form as it is fed through the printer.

### Perforation Projection

Perforation projection (or perforation tent) is measured by laying the form on a flat surface, as shown in Figure 55. Perforation projections exceeding the value shown ( $0.015 + T/2$  inch) can result in excessive smearing at the perforations or an unacceptable jam rate. This happens because the perforations can snag on the hammers as the paper slews through the print area. Opening the print gap will reduce smearing or jamming, but may also degrade print quality.

Paper crimps should not come loose and tails should not show. If these occur, they will catch on the inward fold and cause paper jams.

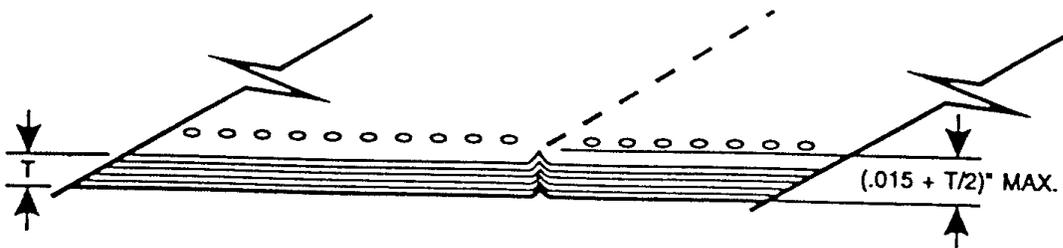


Figure 55. Maximum Allowable Form Perforation Projection

## Other Special Forms

Forms with windows, cutouts, flaps, or attached cards, and other specialized forms may jam excessively in the printer. The only way to ensure satisfactory performance of these forms is to test them thoroughly before purchase.

## Labels

Most standard labels work well in the printer, as long as they meet the specifications outlined in “Standard Forms Specifications,” page 297. However, due to variations in the label products offered, test all label stock thoroughly before purchase.

## Carbonless Forms

When using carbonless forms, poor print quality can be a result of the forms. The following considerations can result in poor print quality:

- Shelf life of the form has expired
- The chemical coating on the form is not evenly distributed
- Certain chemicals have longer development times (Development time of 24 hours after printing is usual for carbonless forms.)

## Conclusion

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It is impossible to test all possible forms available for use in the printer; therefore, Hewlett-Packard recommends that paper conform to the specifications outlined in this appendix for optimum printer performance.

Again, this specification is not a substitute for actual testing.

**Always test specialty forms—including special single-part paper, multi-part forms, forms with glue strips, carbonless forms, card stock, and labels—for satisfactory feeding, registration, and print quality prior to purchase.**

For best results in selecting standard or specialty forms, consult a forms vendor who can ensure conformance to this specification and can recommend cost-effective purchases.

## Paper Storage and Handling

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The performance of the printer depends on the condition of the paper used; therefore, the following recommendations for packaging, handling, and storage are included in this appendix.

### Packaging

To avoid damage during handling, use top and bottom fillers in continuous form cartons to hold the paper stack firmly in place. Because the physical condition of the paper affects printer reliability, proper packaging ensure that the paper remains flat and is not damaged along the edges.

## **Storage**

Do not store cartons directly on the floor, and do not stack cartons more than six high. Set each carton upright and squarely on the one underneath. Do not place anything else on the stack of paper, as this can damage the paper.

## **Preconditioning Forms**

Performance is also affected by the printing environment. Protect paper from temperature and humidity extremes. Store paper in the same environment as the printer for 48 hours before the paper is used. This conditioning allows the moisture content of the paper to stabilize.

LP Series Printers are used in a controlled environment. This environment consists of temperatures from 5° to 40° C (41° to 104° F) up to 1524 meters (5000 feet), from 5° to 32° C (41° to 90° F) up to 2438 meters (8000 feet), with a non-condensing relative humidity of 10% to 90%. For best results, however, store the paper cartons at 18° to 24° C (65° to 75° F), with a relative humidity of 40% to 50%.

If the printer is in an environment subject to extremes of temperature or humidity, store the forms in a better controlled environment and move them to the printer location as needed.

## **Shipping**

When shipping paper through different environments, wrap the entire palletized stack in plastic. When shipping paper across bodies of water, wrap each individual carton as well.

---

# G

## *Noise Suppression Devices*

Ferrite noise suppressors are installed in the printer to reduce radio frequency interference (RFI) to and from electronic equipment located near the printer.

Two kinds of ferrite noise suppressors are used:

1. Shielding Bead (P/N 141445-001PX) is a cylindrical core, through and around which the control panel cable assembly is wound. Two are required.
2. Ferrite Clamp (P/N 202049-001PX) is a noise suppression core in a hinged plastic case and attached to the wall of the card cage with adhesive. The parallel I/O cable assembly passes through this core.

Figure 56 shows how these devices are installed.

---

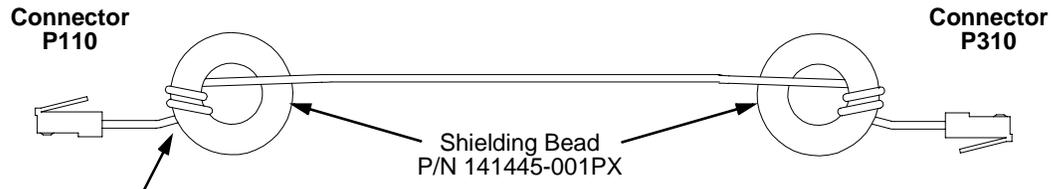
### Note



Duplicate the number of turns around the shielding beads when installing or replacing the control panel cable. See Figure 56.

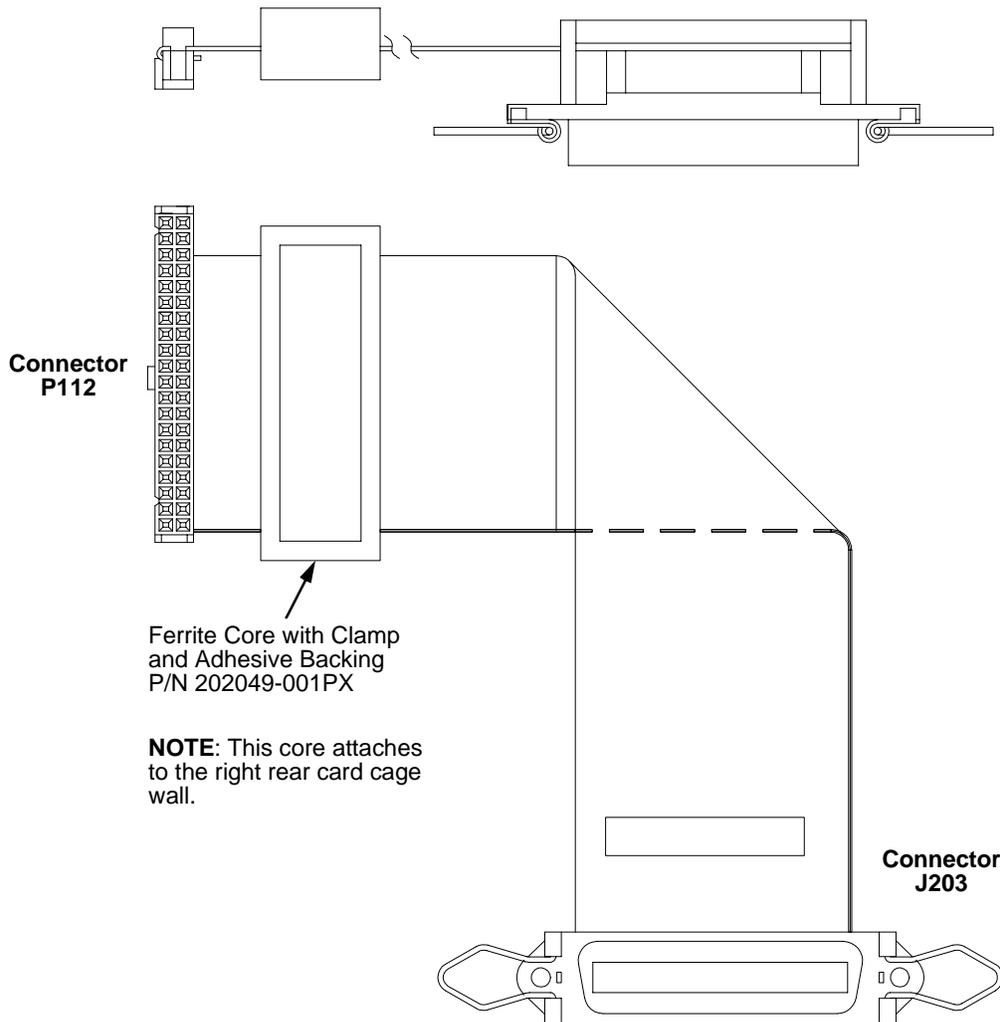
---

### Control Panel Cable Assembly



**NOTE:** Two turns around each bead.

### Parallel I/O Cable Assembly



**NOTE:** This core attaches to the right rear card cage wall.

Figure 56. Ferrite Core Installation



---

# H

# *SureStak Power Stacker*

---

## Contents

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Introduction	page 305
Removing the Power Stacker	page 306
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## Introduction

The SureStak Power Stacker is a factory-installed option for cabinet model printers.

Most of the stacker assembly is inside the cabinet, so you must remove the stacker assembly from the printer in order to service it or replace most of its components.

The power paper stacker is designed to work with forms from 5 to 12 inches (12.7 to 30.5 cm) long. Using longer or shorter paper can cause error messages and unpredictable behavior of the stacker.

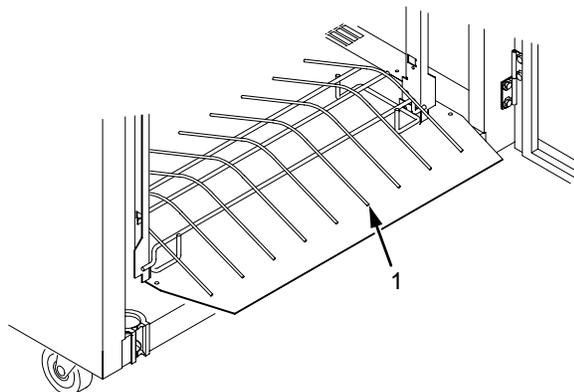
This appendix has two parts:

- Removal/installation instructions for the power stacker assembly and components that require the most frequent replacement.
- An illustrated parts breakdown (IPB) showing how the entire power stacker unit is assembled. The IPB also lists the part numbers for replaceable parts.

## Removing the Power Stacker

---

1. Set the printer power switch to O (off).
2. Unplug the power cord.
3. Unload paper from the stacker area. (Refer to the *User's Guide*.)
4. Remove the paper tent. (See Figure 57.)

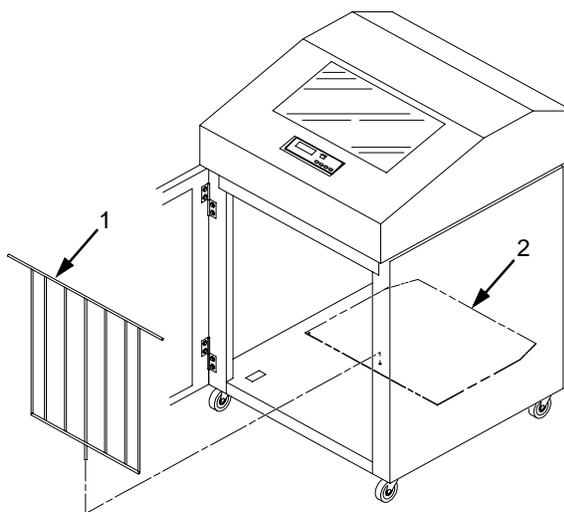


**Legend:**

1. Paper Tent

**Figure 57. Removing the Paper Tent**

5. Cut the tie wrap and remove the paper fence. (See Figure 58.)

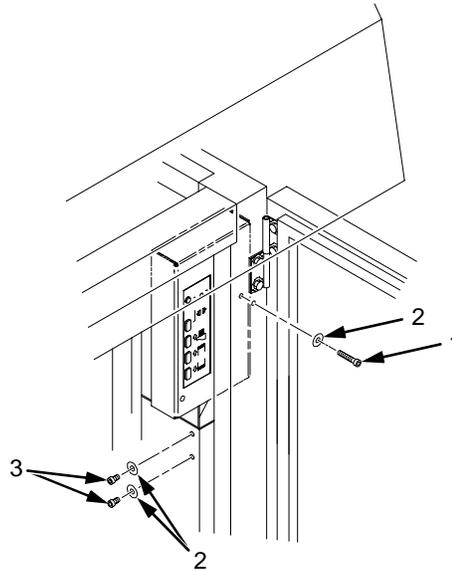


**Legend:**

1. Paper Fence
2. Stacker Base

**Figure 58. Removing the Paper Fence**

- 
6. Remove three screws and washers from the stacker control panel. (See Figure 59.)

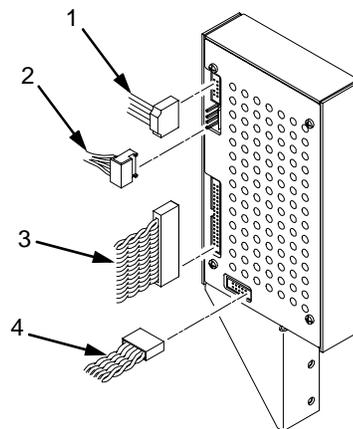


**Legend:**

- 1. Long Screw
- 2. Washer
- 3. Short Screw

**Figure 59. Removing the Stacker Control Panel**

7. Remove four cables from the stacker control panel, and remove the stacker control panel. (See Figure 60.)

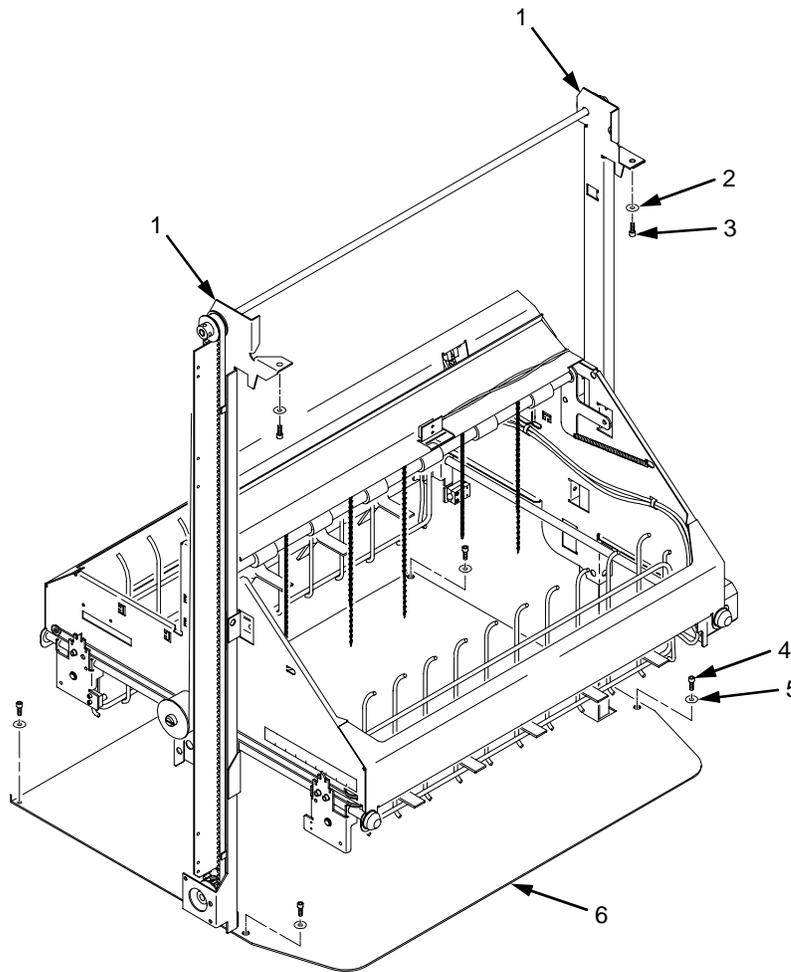


**Legend:**

- 1. Logic Cable (P104)
- 2. Power Cable
- 3. Frame Cable (P102)
- 4. Rail Cable (P107)

**Figure 60. Removing Cables from the Stacker Control Panel**

8. Remove the two 5/32 x 3/4 inch screws and washers securing the vertical rails to the upper frame cross-member at the rear of the cabinet. (See Figure 61.)
9. Raise the elevator assembly.
10. Remove the four 7/64 x 1/2 inch screws and washers (or Torx T-10 screws) securing the base plate to the cabinet floor. (See Figure 61.)

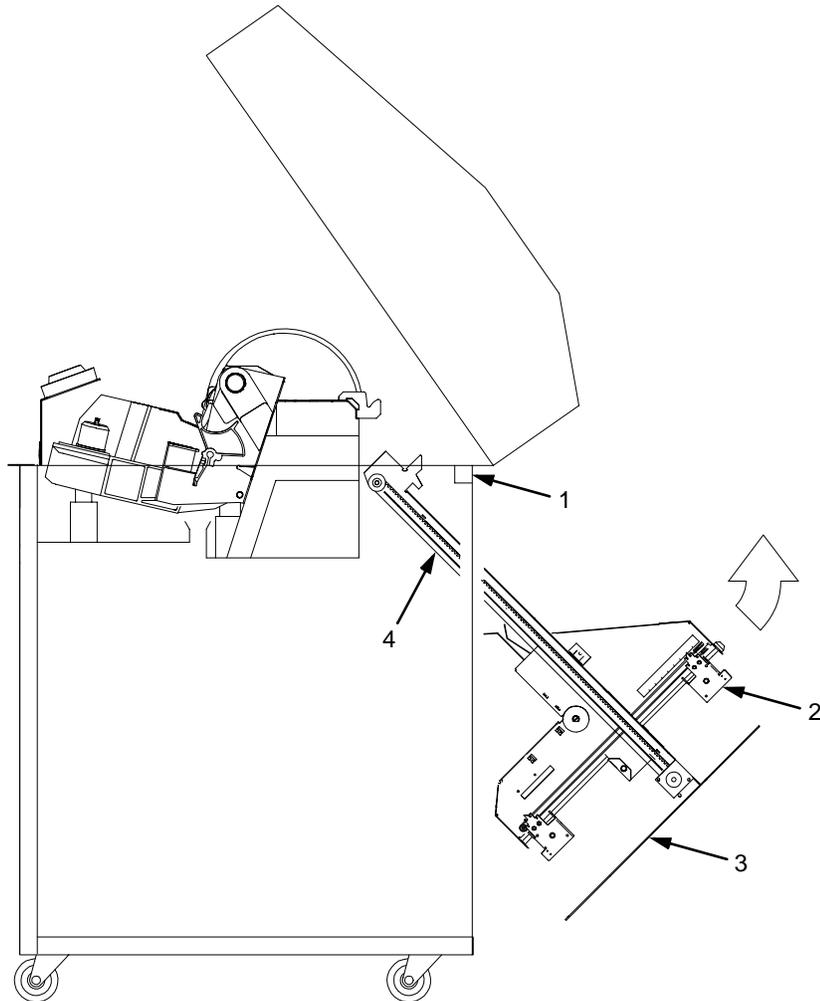


**Legend:**

1. Vertical Rail
2. Washer (2)
3. Screw, 5/32 x 3/4 inch (2)
4. Screw, 7/64 x 1/2 inch or Torx T-10 (4)
5. Washer (4) but no washers with Torx T-10 screws
6. Stacker Base

**Figure 61. Preparing the Stacker for Removal**

11. Lower the elevator assembly to its lowest position.
12. Slide the stacker assembly slightly to the right to clear the air exhaust duct. Tilt the vertical rails toward the front of the printer until they clear the upper frame cross-member. Slide the stacker assembly to rear and angle it out of the cabinet, as shown in Figure 62.



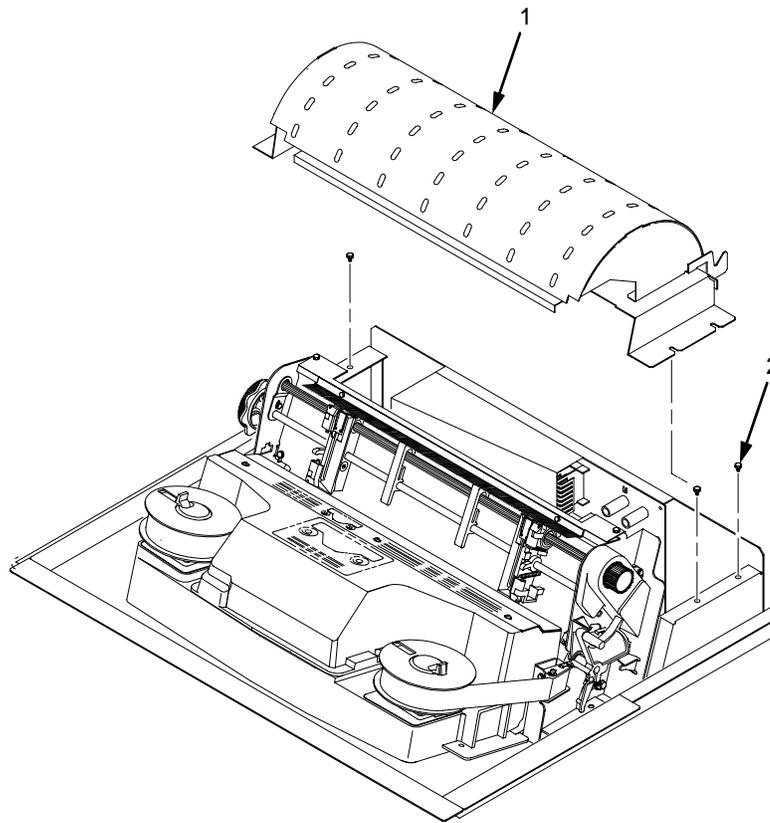
**Legend:**

1. Upper Frame Cross-Member
2. Elevator Assembly
3. Stacker Base
4. Vertical Rail

**Figure 62. Removing the Stacker Assembly**

## Installing the Power Stacker

1. Set the printer power switch to O (off).
2. Unplug the power cord.
3. Remove paper.
4. Loosen the three paper path hold-down screws. Slide the paper path to the left and lift it off the card cage. (See Figure 63.)

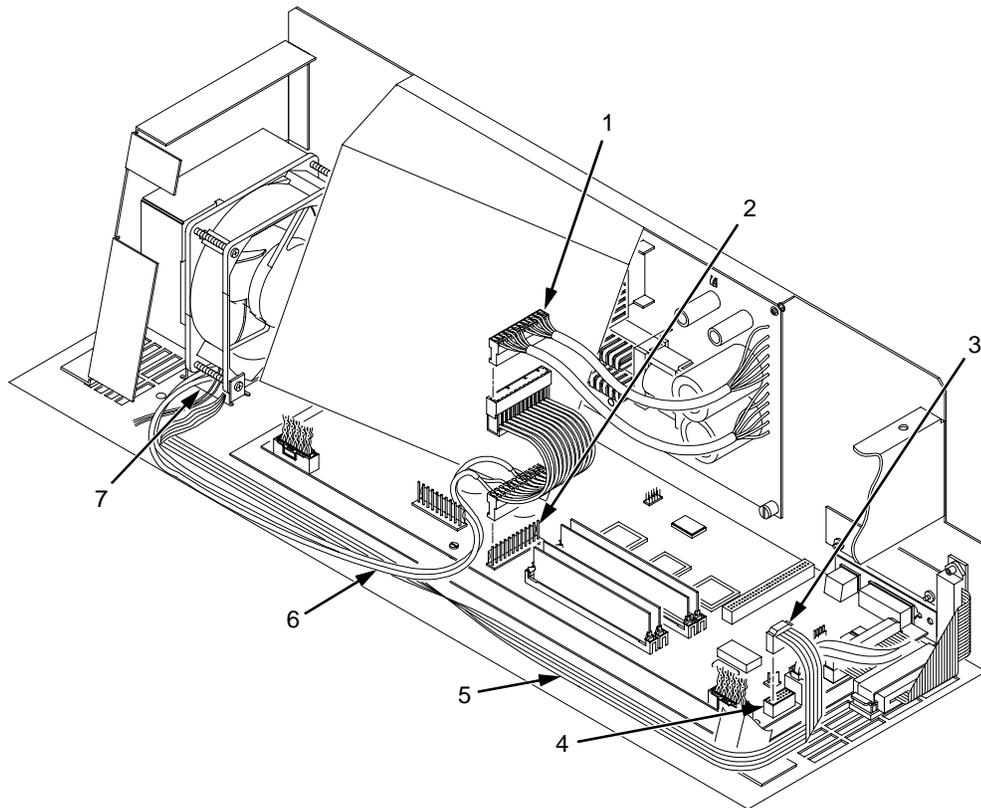


**Legend:**

1. Paper Path
2. Hold-Down Screw (3)

**Figure 63. Remove the Paper Guide**

5. Connect the power stacker logic cable P103 to connector J17 on the CMX controller board. (See Figure 64.)
6. Disconnect the power supply cable from connector J101 on the CMX controller board. (See Figure 64.)
7. Connect power supply cable connector P101 to the stacker power cable, then connect the stacker power cable to connector J101 on the CMX controller board. (See Figure 64.)
8. Route the stacker power cable and the stacker logic cable in front of the CMX board and through the cutout beneath the card cage fan, as shown in Figure 64.



**Legend:**

1. Power Supply Connector P101
2. CMX Board Connector J101
3. Connector P103
4. CMX Board Connector J17
5. Stacker Logic Cable
6. Stacker Power Cable
7. Cutout Beneath Card Cage Fan

**Figure 64. Stacker Power and Logic Connections on the CMX Controller Board**

**Caution**

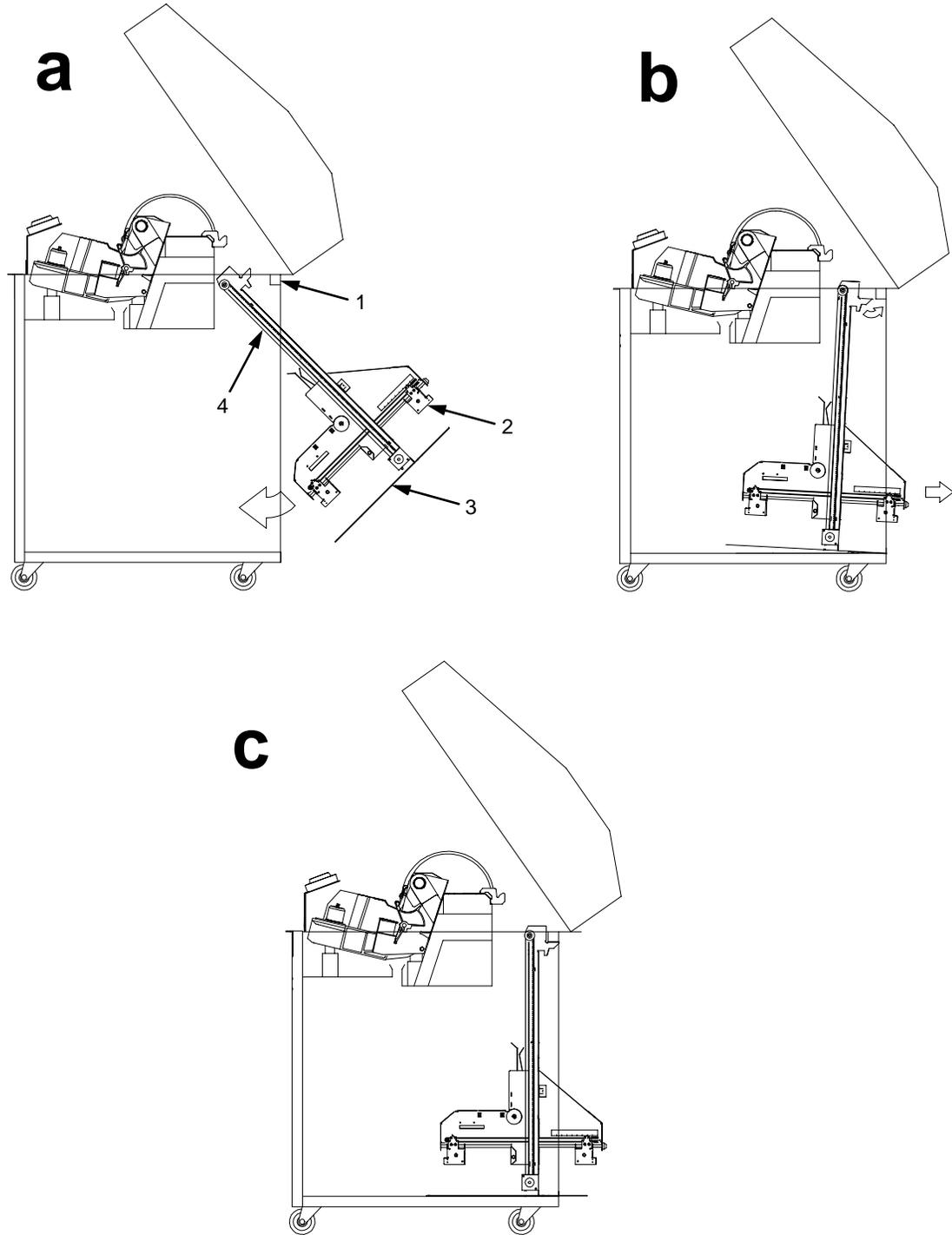


The paper stacker assembly mounts to the rear upper frame cross-member and to the cabinet floor. It is a snug fit. During installation, take care to avoid scratching painted surfaces or damaging the stacker.

---

9. Position the elevator assembly at the bottom of the vertical rails. (See Figure 65a.)
10. With the stacker assembly slightly to the right in order to clear the air exhaust duct, insert the vertical rails inside and under the upper frame cross-member, then slowly swing the base of the stacker assembly into the cabinet. (See Figure 65a.)
11. Work the stacker base rearward and engage the upper brackets of the vertical rails under the upper frame cross-member. (See Figure 65b.)
12. Align the holes in the vertical rail brackets with the holes in the upper frame cross-member.



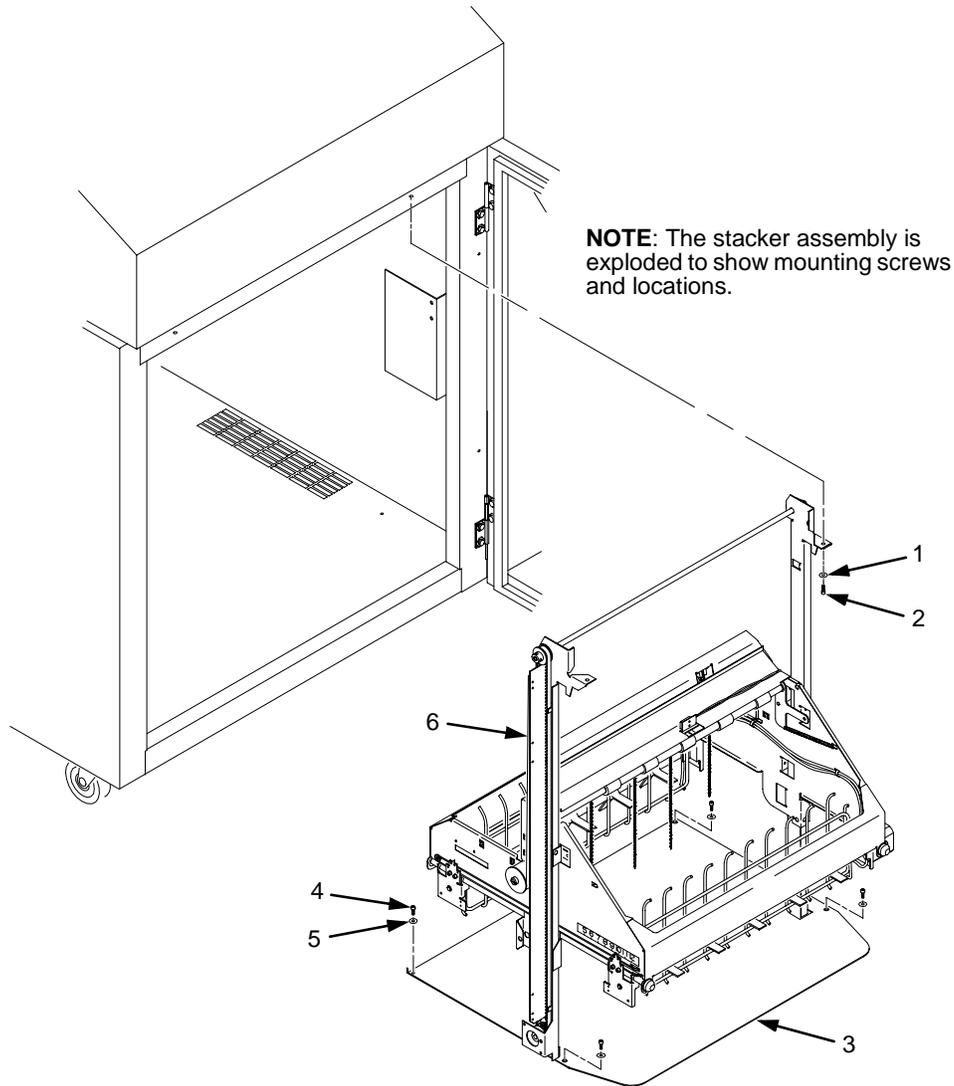


**Legend:**

- 1. Upper Frame Cross-Member
- 2. Elevator Assembly
- 3. Stacker Base
- 4. Vertical Rail

**Figure 65. Stacker Installation**

13. Align the holes in the stacker base with the holes in the cabinet floor. (See Figure 65c and Figure 66.)
14. Install but do not tighten the two 5/32 x 3/4 inch screws and washers to secure the vertical rails to the upper frame cross-member.
15. Install four 7/64 x 1/2 inch screws and washers (or Torx T-10 screws) to secure the stacker base to the cabinet floor. (See Figure 66.)
16. Tighten the two 5/32 x 3/4 inch screws and washers securing the vertical rails to the upper frame cross-member.



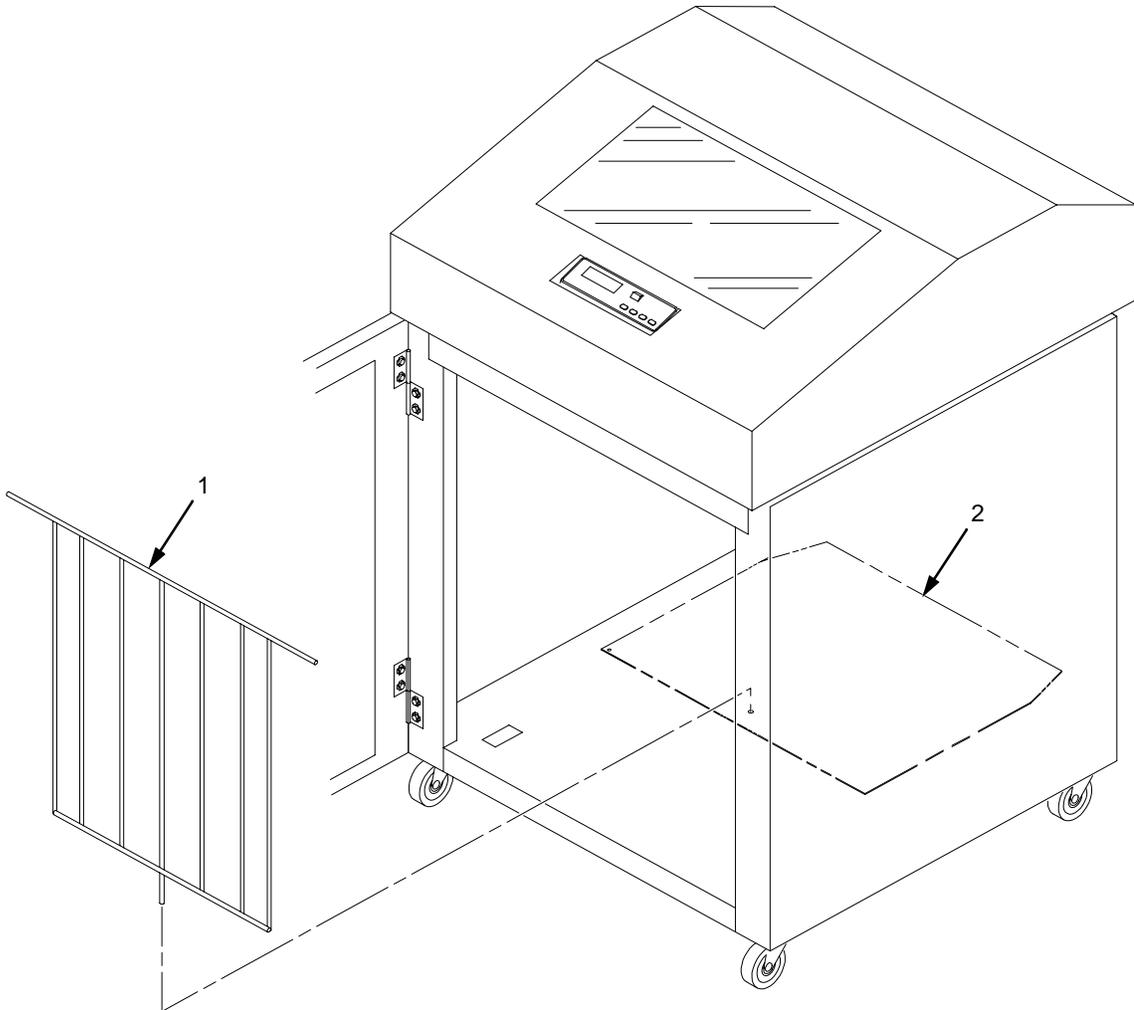
**Legend:**

1. Washer (2)
2. Screw, 5/32 x 3/4 inch (2)
3. Stacker Base
4. Screw, 7/64 x 1/2 inch or Torx T-10 (4)
5. Washer (4) but no washers with Torx T-10 screws
6. Vertical Rail

**Figure 66. Stacker Fasteners**

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17. Install the paper fence. (See Figure 67.)



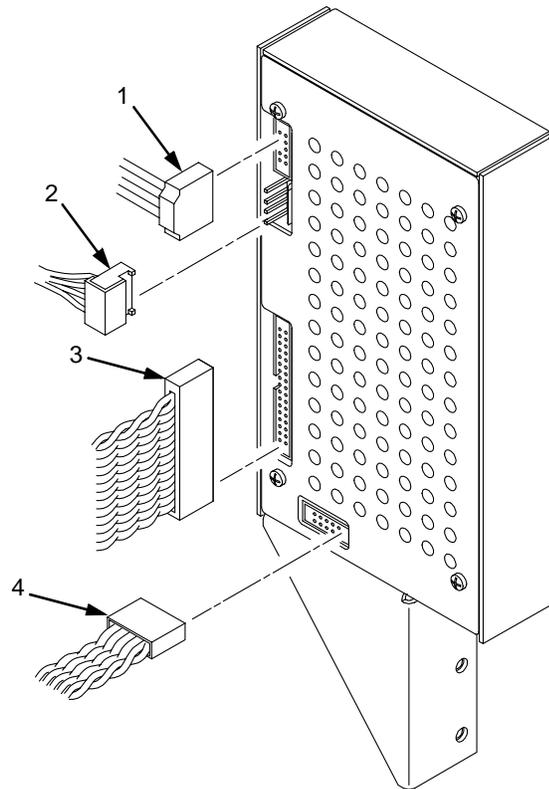
**Legend:**

- 1. Paper Fence
- 2. Stacker Base

**Figure 67. Paper Fence**

18. Gather the rail cable, frame cable, logic cable, and power cable. Make sure these cables are routed outboard of the elevator assembly.

19. Connect the stacker cables to the rear of the stacker control panel assembly, as shown in Figure 68.



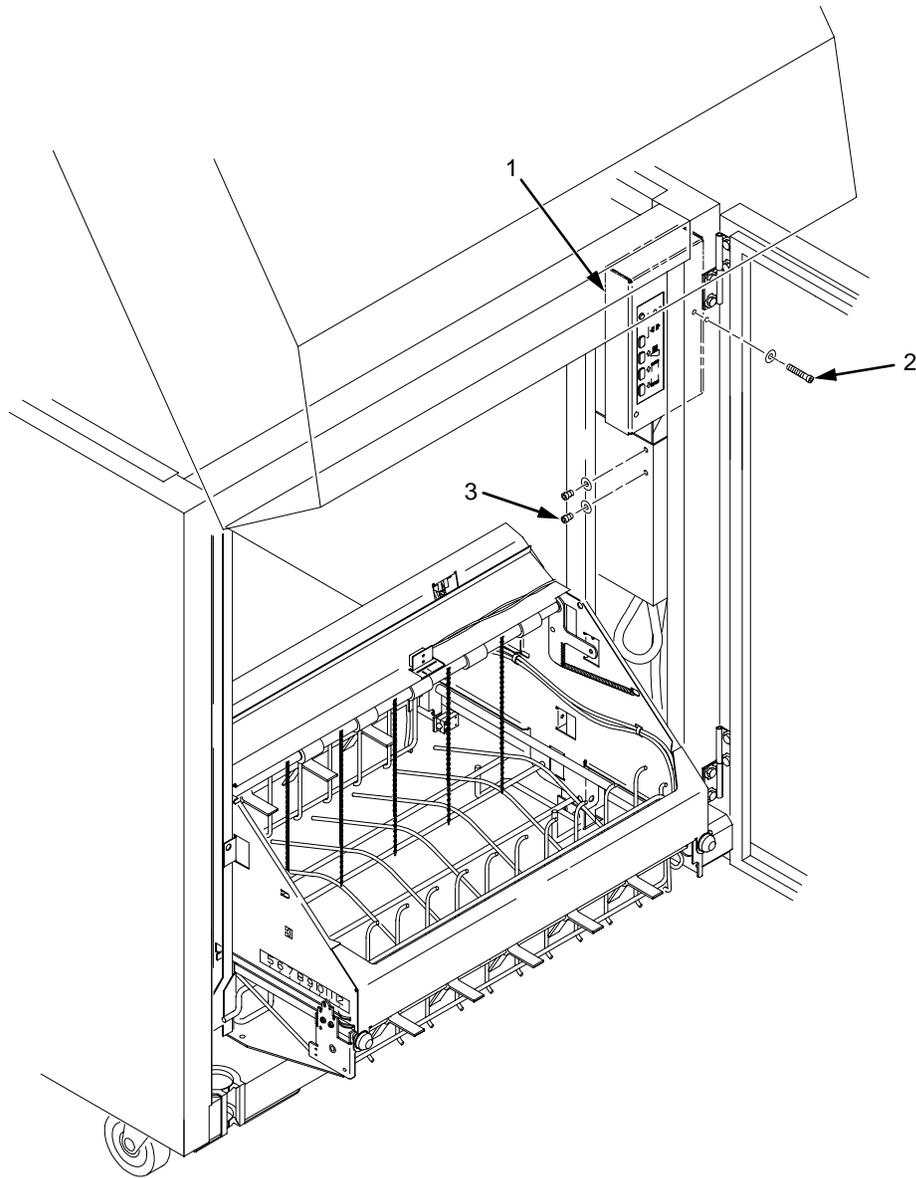
**Legend:**

1. Logic Cable (P104)
2. Power Cable
3. Frame Cable (P102)
4. Rail Cable (P107)

**Figure 68. Stacker Control Panel Cables**

20. Position the stacker control panel as shown in Figure 69, and install the mounting screws.

- 
21. Bundle the stacker control panel cables in the wire harness clips located under the card cage. Tie wrap the cables so they do not catch in the stacker mechanism as it moves up and down. Route the stacker rail and frame cables so they move without snagging as the elevator assembly moves up and down.



**Legend:**

- 1. Stacker Control Panel
- 2. Long Screw
- 3. Short Screw (2)

**Figure 69. Installing the Stacker Control Panel**

22. Install the paper path that you removed in step 4.  
23. Install paper and test stacker operation. (Refer to the *User's Guide*.)

## Replacing the Constant Force Spring

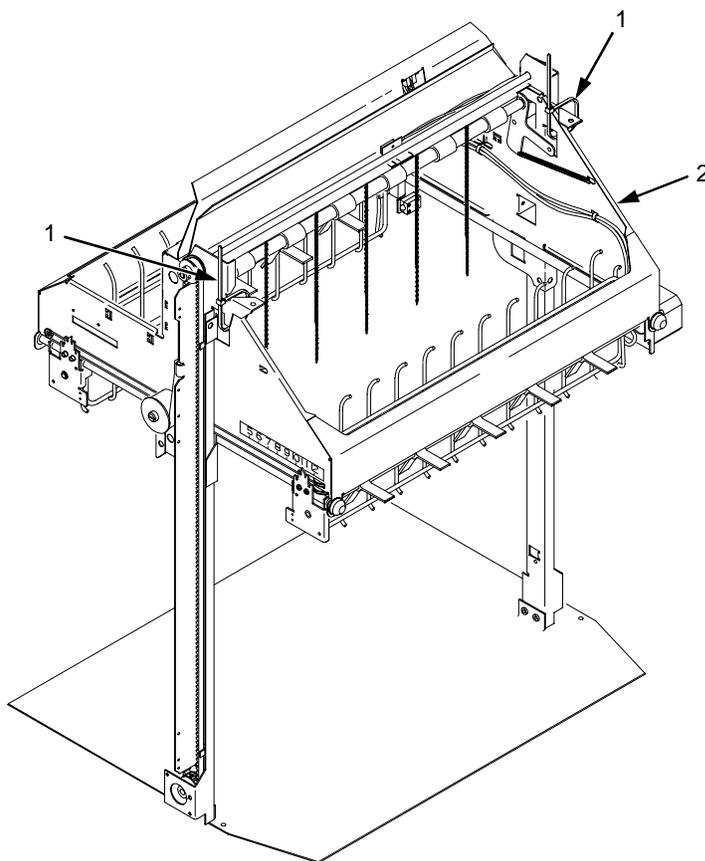
1. Remove the stacker assembly from the printer. (See page 306.)

### Caution



In the next step, do not over-tighten the tie wraps or string. Tighten the tie wraps or string just enough to hold the elevator up.

2. Raise the elevator assembly to its highest position and secure it to the vertical rails using tie wraps or string. (See Figure 70.)



**Legend:**

1. Tie Wrap
2. Elevator Assembly

**Figure 70. Securing the Elevator Assembly**

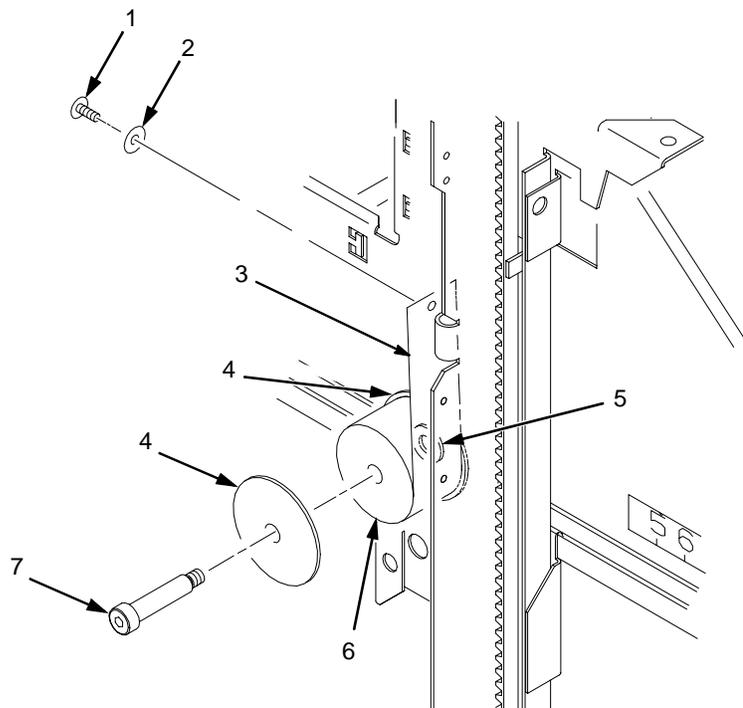
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**Warning**

The constant force spring is a high tension spring. To avoid pinching your fingers, coil the spring slowly and carefully. Do not let the spring twist or crimp.

---

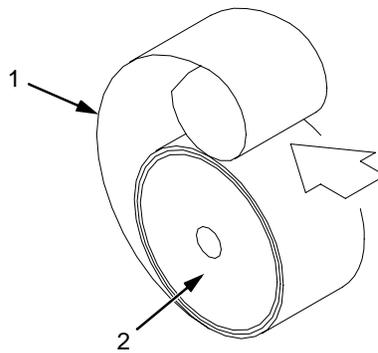
3. Remove the shoulder screw, washers, and spacer from the constant force spring and drum. Let the spring coil itself up until it reaches the screw that secures it to the vertical rail. (See Figure 71.)
4. Firmly gripping the spring and drum, remove the screw securing the spring to the vertical rail. (See Figure 71.)

**Legend:**

1. Rail Screw
2. Washer
3. Constant Force Spring
4. Large Washer
5. Spacer
6. Drum
7. Shoulder Screw

**Figure 71. Removing the Constant Force Spring**

5. Lift the loose end of the constant force spring and let it curl up on the outside of the remaining spring and drum. (See Figure 72.)
6. While holding the drum tightly, continue to curl the spring until it is completely unwound from the drum. (See Figure 72.)
7. To install a new constant force spring, reverse the steps of this procedure.



**Legend:**

1. Spring
2. Drum

**Figure 72. Removing the Constant Force Spring from the Drum**

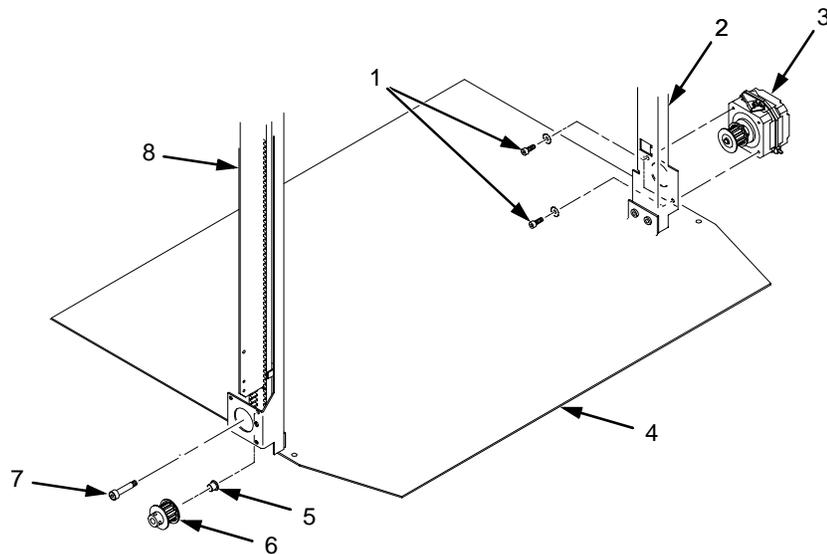


---

## Replacing the Timing Belts

---

1. Remove the stacker assembly from the printer. (See page 306.)
2. Raise the elevator assembly to its highest position and secure it to the vertical rails using tie wraps or string. (See Figure 70, page 318.)
3. If you are removing the left timing belt, remove the shoulder screw from the pulley at the bottom of the left vertical rail, and remove the pulley. (See Figure 73.) Go to step 6.
4. If you are removing the right timing belt, remove the two metric Allen screws that secure the timing belt motor to the right vertical rail. (See Figure 73.) Go to step 5.

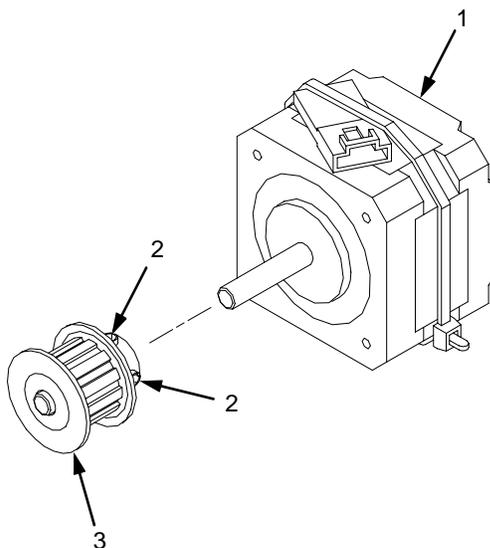


**Legend:**

1. Metric Allen Screw and Washer
2. Right Vertical Rail
3. Timing Belt Motor
4. Stacker Base
5. Bushing
6. Pulley
7. Shoulder Screw
8. Left Vertical Rail

**Figure 73. Removing the Timing Belt Pulley and Motor**

5. Loosen the two setscrews on the motor pulley and remove the pulley. Unplug the motor cable, if necessary. (See Figure 74.) Go to step 6.

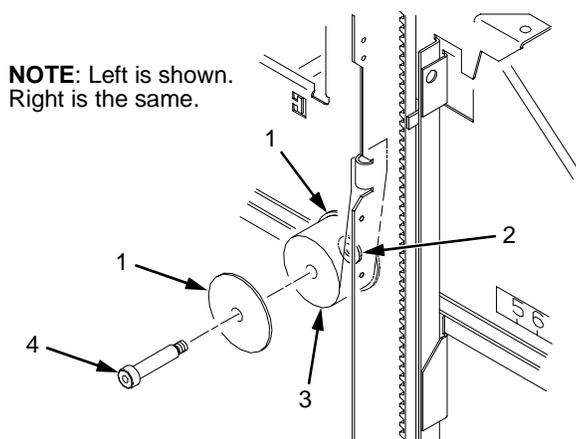


**Legend:**

1. Timing Belt Motor
2. Setscrew
3. Pulley

**Figure 74. Removing the Timing Belt Motor Pulley**

6. Remove the shoulder screw, washers, and spacer that secures the constant force spring to the vertical rail. (See Figure 75.)



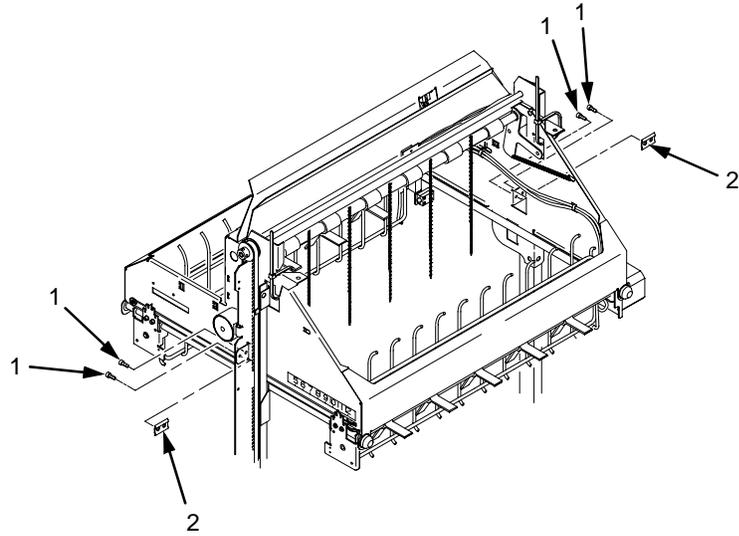
**NOTE:** Left is shown.  
Right is the same.

**Legend:**

1. Large Washer
2. Spacer
3. Constant Force Spring
4. Shoulder Screw

**Figure 75. Releasing the Constant Force Spring**

- 
7. Remove two Allen screws from the belt clamp that secures the timing belt to the stacker frame. (See Figure 76.)

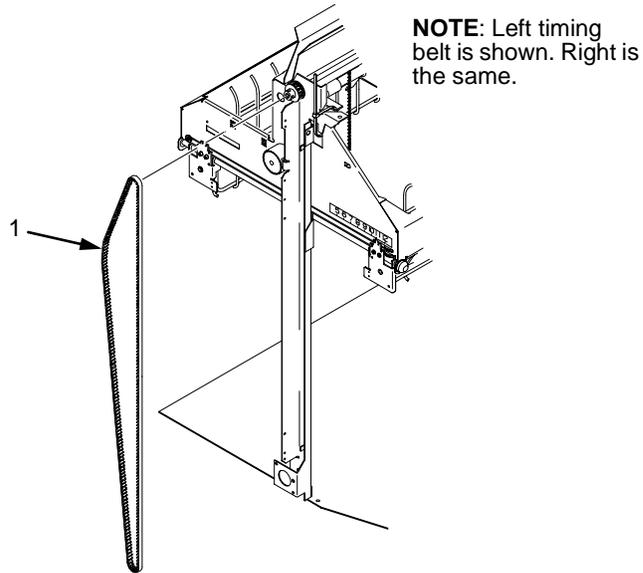


**Legend:**

- 1. Allen Screw
- 2. Belt Clamp

**Figure 76. Removing the Belt Clamps**

8. Remove the timing belt by working it around the vertical rail and constant force spring. (See Figure 77.)



**Legend:**

1. Timing Belt

**Figure 77. Removing the Timing Belt**

9. To install a timing belt, reverse the steps of this procedure.

---

## Illustrated Parts Breakdown

---

The Illustrated Parts Breakdown (IPB) consists of exploded drawings of the power stacker assembly and subassemblies. Each drawing also has a list of replaceable parts.

Only replaceable parts are assigned part numbers. If a part or assembly is damaged but does not have a part number, replace the entire power stacker assembly.

The IPB starts on the next page.

Detail: Figure 79, page 328.

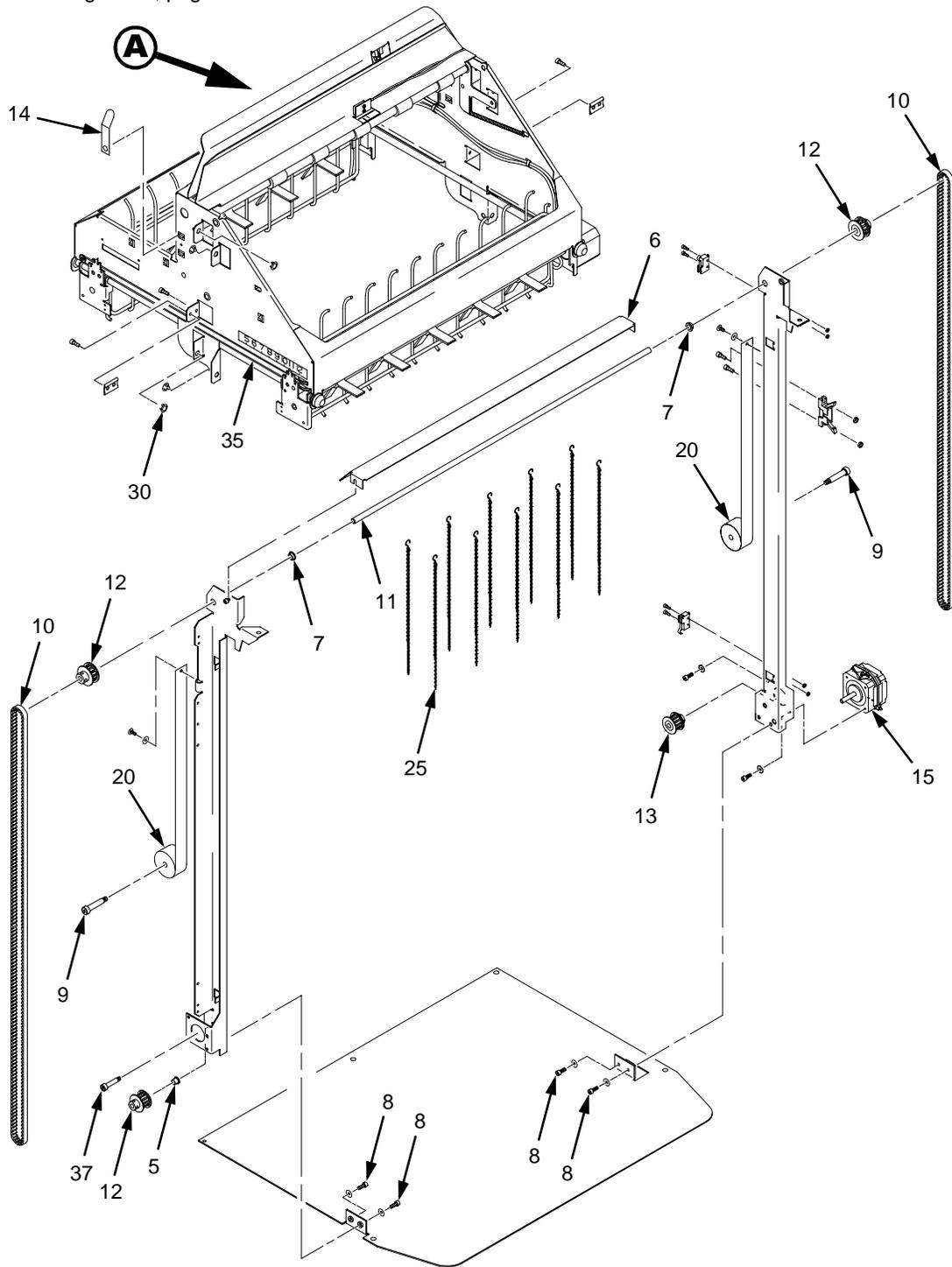


Figure 78. Stacker Assembly

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
5	202706-904PX	Flanged Bearing	Part of item 36
6	158342-001PX	Paper Deflector	
7	202721-901PX	Clip-On Bearing	Part of item 36
8	Ref	Screw, Torx, 6-32 x .25	Part of item 36
9	Ref	Screw, Shoulder, 10-32	Part of item 36
10	202716-001PX	Timing Belt	
11	156388-001PX	Shaft, Lift	
12	163992-001PX	Pulley, Timing Belt	
13	159398-001PX	Pulley, Motor	
14	150784-901PX	Clip, Grounding	
15	158446-001PX	Motor	
20	202713-001PX	Constant Force Spring	
25	151527-905PX	Chain	Mount chains outboard of shafts
30	202705-901PX	Nylon Plug	
35	202720-901PX	Cable	
36	164405-001PX	Stacker Hardware Kit	Kit not illustrated
37	Ref	Screw, Shoulder, 8-32	Part of item 36
	158732-901PX	Control Panel Assembly	Figure 68, page 316
	158442-001PX	Rail Cable, Power Stacker	See page 260
	158443-001PX	Power Cable, Power Stacker	See page 259
	158444-001PX	Logic Cable, Power Stacker	See page 258
	Ref	Frame Cable, Power Stacker	See page 257





<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
15	158446-001PX	Motor	
36	164405-001PX	Stacker Hardware Kit	Kit not illustrated
40	158313-001PX	Anti-Static Brush	
45	Ref	Shear Grommet	Part of item 36
46	Ref	Cap Nut	Part of item 36
47	156391-001PX	Shaft, Drive Roller	
48	156393-001PX	Spacer, Drive Roller	
49	202789-901PX	Bearing, Flanged	Part of item 36
50	202824-901PX	Bearing	Part of item 36
51	202708-001PX	Collar Clamp	
52	Ref	Collar, Setscrew	Part of item 36
53	156390-001PX	Support Shaft	
54	157598-001PX	Fence, Wireform	
55	203032-001PX	Extension Spring	
60	157275-001PX	Idler Roller	Five on early models
65	157054-001PX	Paddle, Power Stacker, P5XXX	

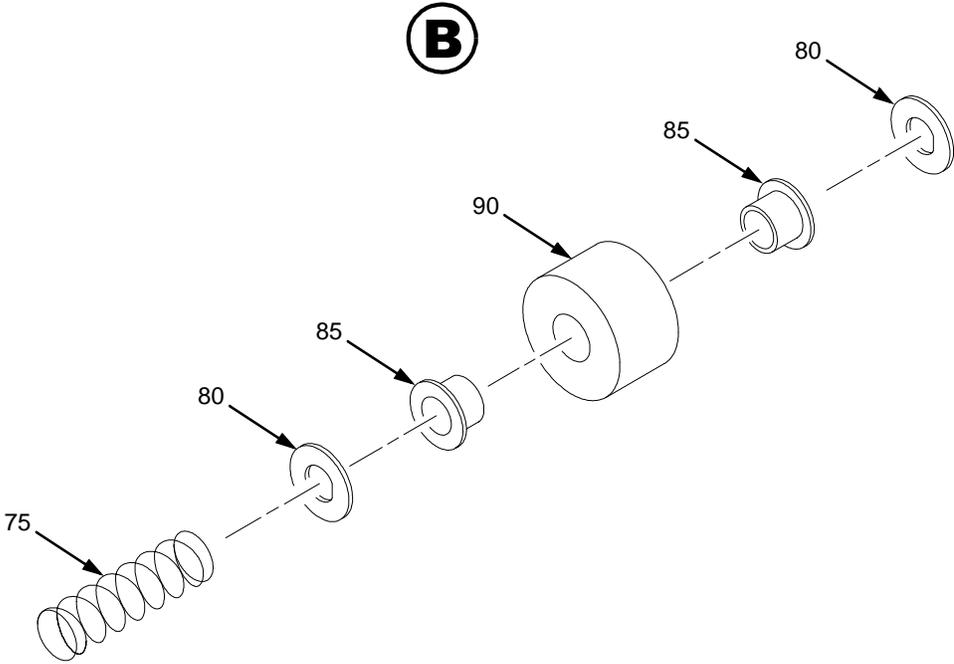


Figure 80. Stacker Detail: Rollers

---

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
36	164405-001PX	Stacker Hardware Kit	Kit not illustrated
75	159425-001PX	Compression Spring	On left end of shaft on early models
80	156392-901PX	Friction Washer	Part of item 36
85	Ref	Flanged Bushing	Part of item 36
90	157960-001PX	Drive Roller	Five on early models

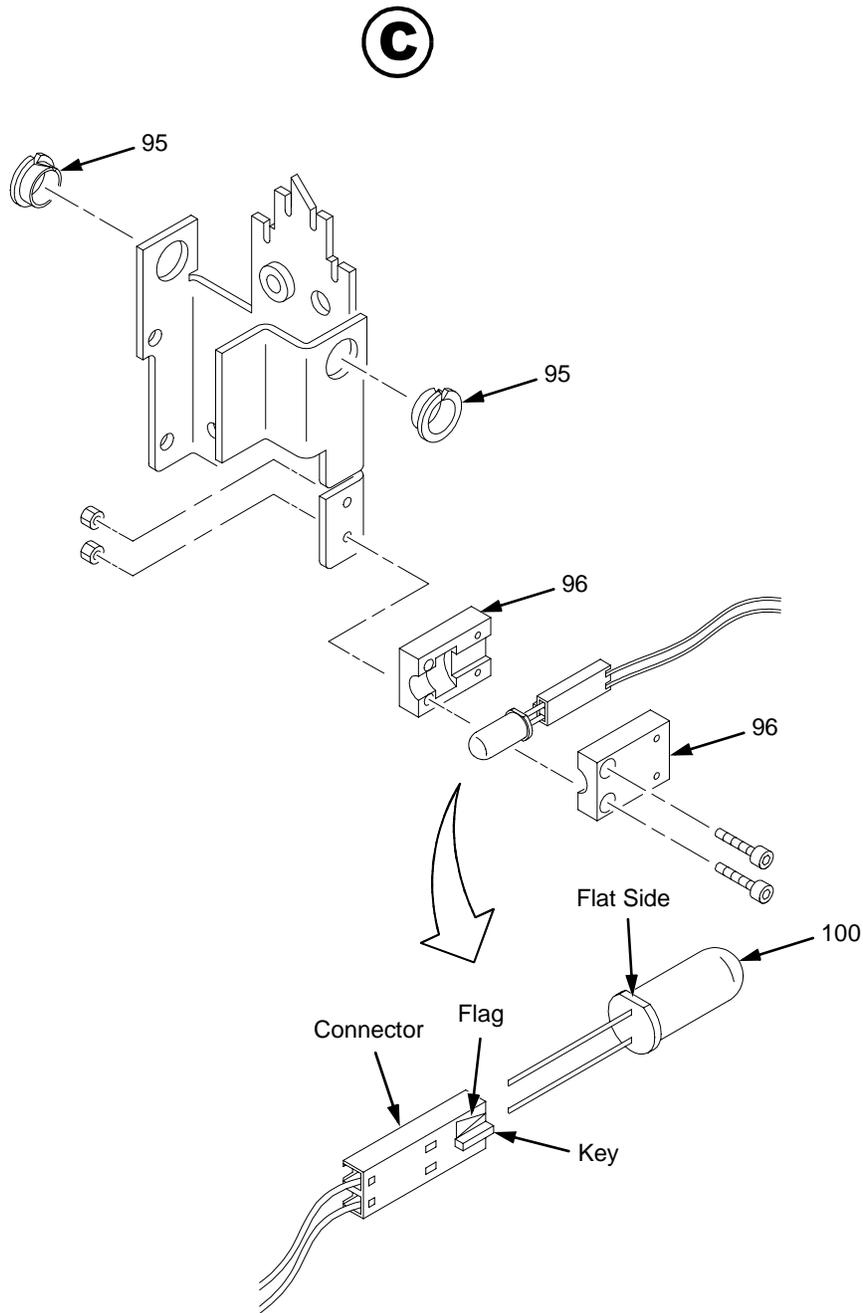


Figure 81. Stacker Detail: Motor Bracket

---

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
36	164405-001PX	Stacker Hardware Kit	Kit not illustrated
95	Ref	Clip-On Bearing	Part of item 36
96	158288-001PX	Holder, LED, Round	
100	202727-001PX	LED, IR, T-1, 3/4	

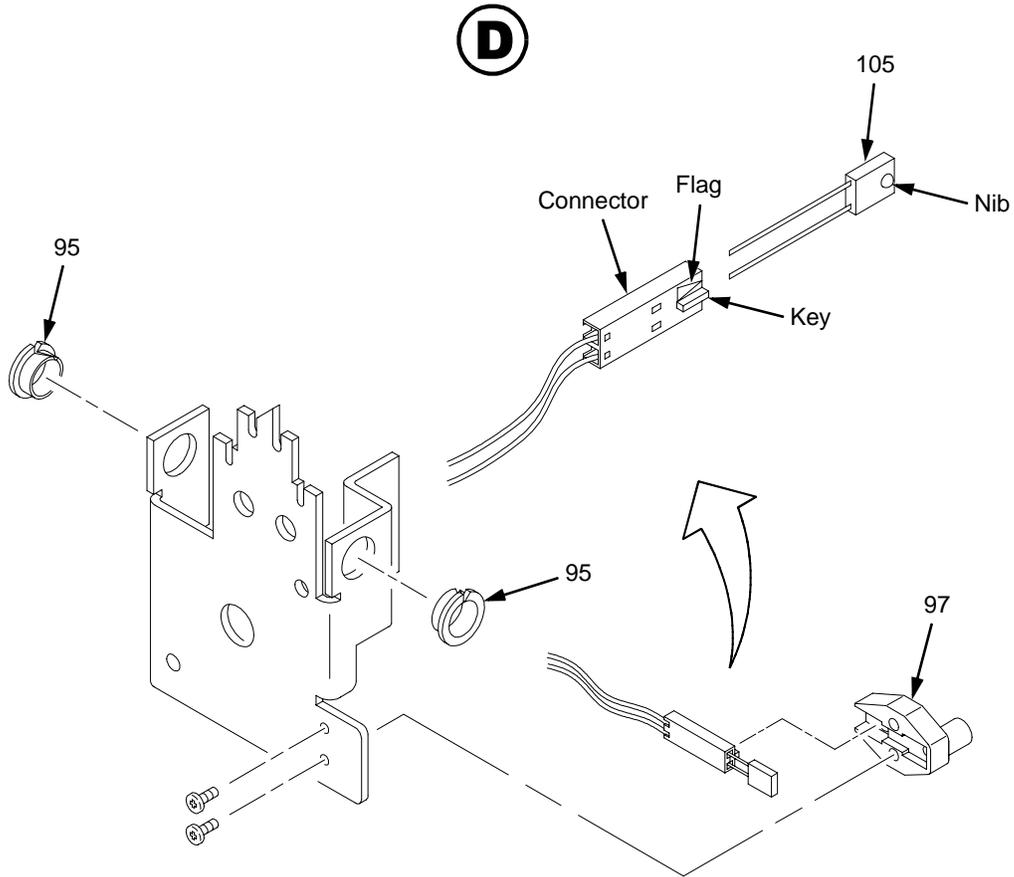


Figure 82. Stacker Detail: Elevator Bracket

---

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
36	164405-001PX	Stacker Hardware Kit	Kit not illustrated
95	Ref	Clip-On Bearing	Part of item 36
97	158290-001PX	Holder, LED, Flat	
105	202728-001PX	Photodarlington, NPN, Rectifier	

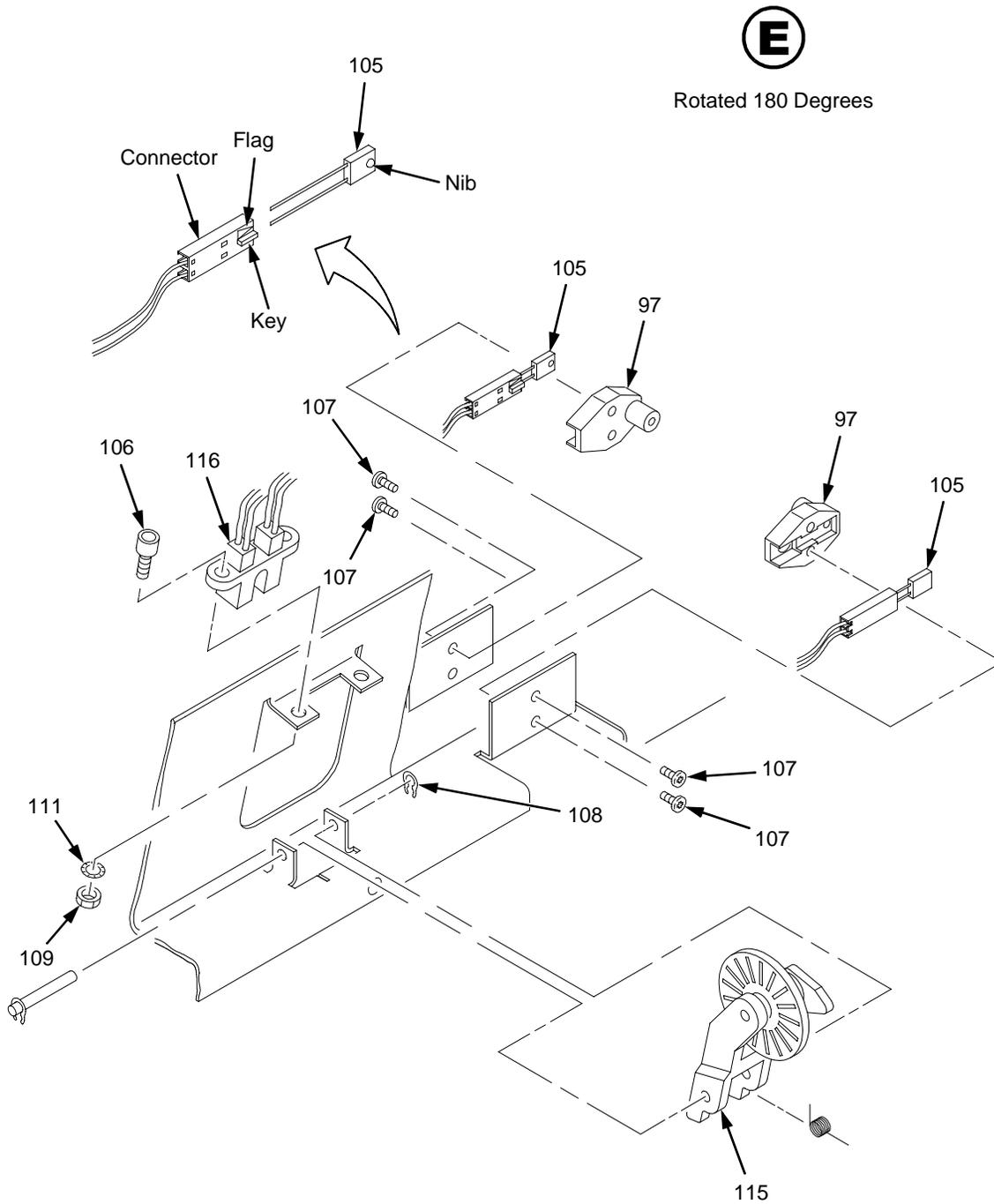


Figure 83. Stacker Detail: Paper Motion Detector



<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
36	164405-001PX	Stacker Hardware Kit	Kit not illustrated
97	158290-001PX	Holder, LED, Flat	
105	202728-001PX	Photodarlington, NPN, Rectifier	
106	Ref	Screw, Socket Cap, 4 x .25	Part of item 36
107	Ref	Screw, Panhead, Type B, 2 x 3/16	Part of item 36
108	Ref	Retaining Ring, .093	Part of item 36
109	Ref	Nut, Hex, 4-40	Part of item 36
110	202729-001PX	LED, IR, Rectangular	
111	Ref	Lock Washer, #4	Part of item 36
115	164413-001PX	Wheel Assembly, PMD	
116	158742-001PX	Sensor Assembly, PMD	



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