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*LineJet™ Printers*

**Maintenance Manual**

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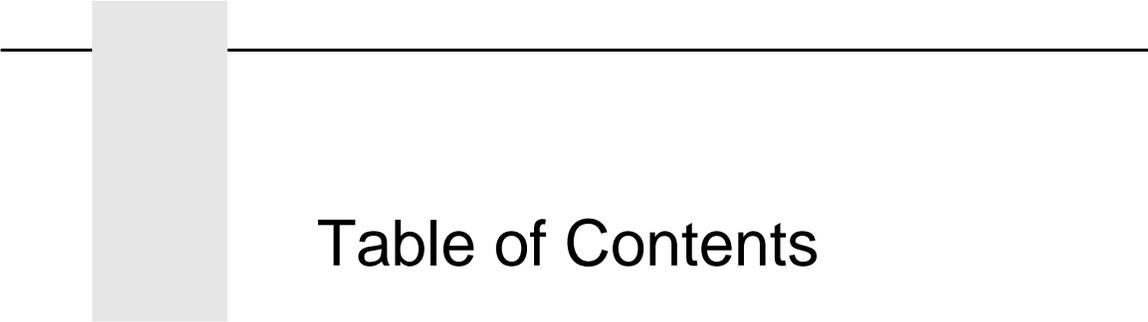
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# 1

## *Maintenance Overview*

### About the Printer

The Hewlett-Packard® LineJet™ series consists of five fast, reliable line matrix printers. The name of the printer indicates its speed rating and the type of printer housing, as shown below.

**Table 1. LineJet Printers**

<b>Model Name</b>	<b>Model Number</b>	<b>Print Speed<sup>1</sup> (LPM)</b>	<b>Housing</b>	<b>Hammer Bank</b>
LineJet 500P	C3201D	500	Pedestal	28 Hammers
LineJet 500Q	C3202D	500	Cabinet	28 Hammers
LineJet 1000Q	C3204D	1000	Cabinet	60 Hammers
LineJet 1500Q	C3205D	1500	Cabinet	102 Hammers
LineJet 1500Q	C5640D	1500	Cabinet & Power Stacker	102 Hammers

<sup>1</sup> Printing speed is determined by the interaction of many variables. The speeds listed in this table are the highest speeds attainable under controlled conditions.

LineJet printers use 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 these printers to print a wide variety of high-volume jobs with minimum maintenance and maximum reliability.

LineJet printers are excellent graphics printers. Code V™ II and PGL® are simple but versatile programming languages available as options for LineJet printers. The Code V II graphics language is a QMS® emulation. PGL is a Printronix® IGP® emulation

Although technologically advanced, the LineJet 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.

## Important Maintenance Notes

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To ensure the best performance of the LineJet 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.
- Never close the forms thickness lever too tightly. Incorrect closure of the forms thickness lever can lead to smearing, degraded print quality, paper jams, and damage to the platen and shuttle assembly.

## 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 notes and 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.

---

### Caution



Caution messages call attention to situations that could result in damage to equipment.

---

### Note



Notes contain important information set off from the text.

---

## 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.

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## Related Documents

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This manual does not explain how to set up, operate, or configure the printer. That information is covered in the following manuals:

- *LineJet Printers: User's Guide*  
(Part Number 171252-001PX)  
Explains how to configure the printer and provides simple troubleshooting guidelines.
- *LineJet Printers: Cabinet and Pedestal Model Installation Instructions*  
(Part Number 171253-001PX)  
Explains how to set up the printer for operation.
- *LineJet Printers: Quick Reference Guide*  
(Part Number 171248-001PX)  
Describes the keys on the control panel and provides quick reference information on daily printer operations such as loading paper and replacing ribbons.
- *LineJet Printers: PCL II/LinePrinter Plus Technical Reference Manual*  
(Part Number 171249-001PX)  
Describes the host control codes and character sets for the LinePrinter Plus® and PCL®-II emulations.
- *LineJet Printers: QMS Code V Technical Reference Manual*  
(Part Number 171251-001PX)  
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.
- *LineJet Printers: PGL Programmer's Reference Manual*  
(Part Number 171250-001PX)  
Explains how to write graphics programs using the optional PGL Printronix IGP 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.
- *LineJet Printers: LineJet Print Server User's Guide*  
(Part Number 170989-001PX)  
Explains how to use the 10/100Base-T Ethernet™ network interface.
- *LineJet Printer Manager User's Guide*  
(Part Number 170988-001PX)  
Explains how to use the printer management software with the 10/100Base-T Ethernet network interface.

## 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.

---

---

### Vorsicht



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

---

## 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.		✓

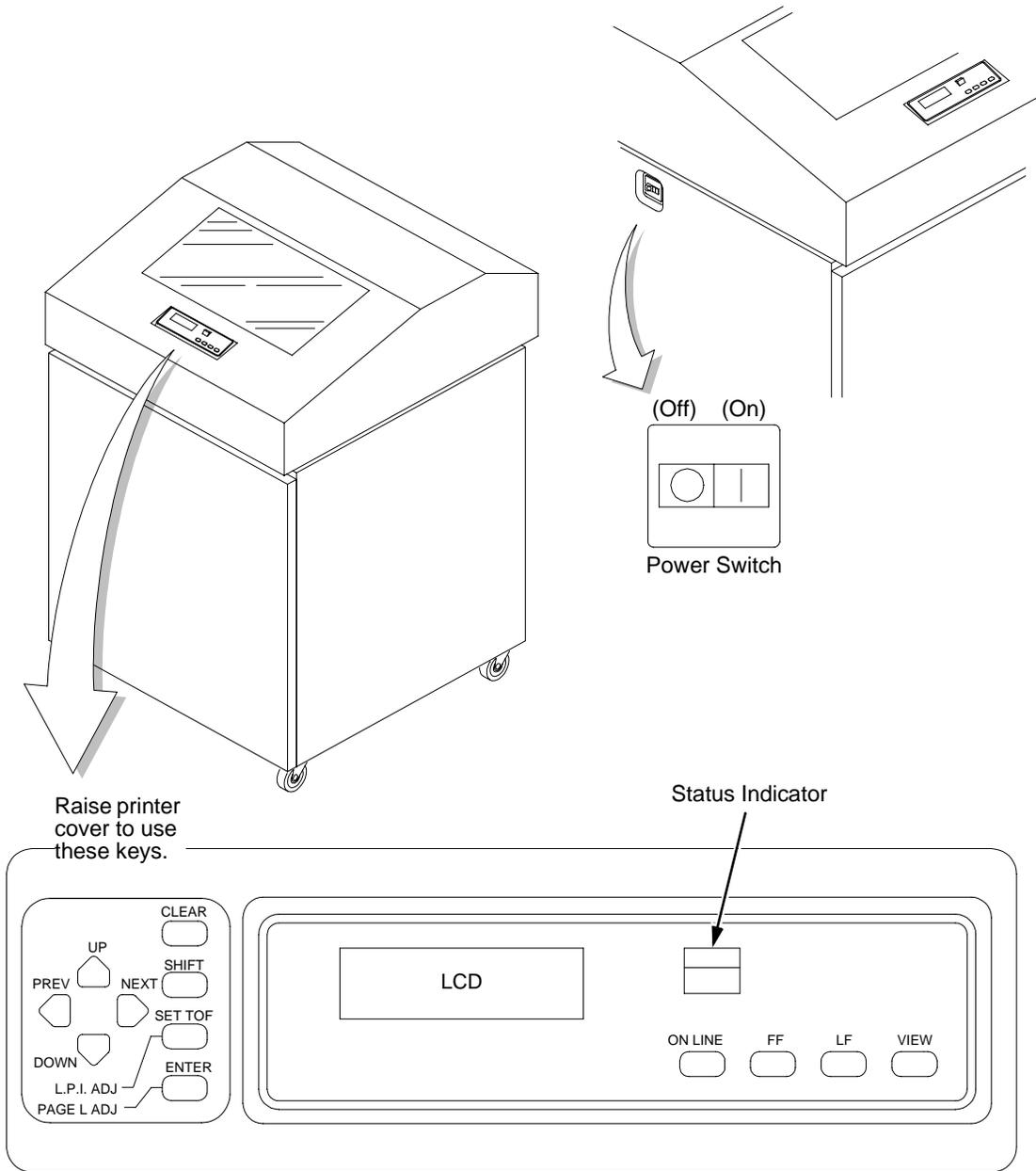


Figure 1. Electrical Controls, Cabinet Models

## 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.		✓

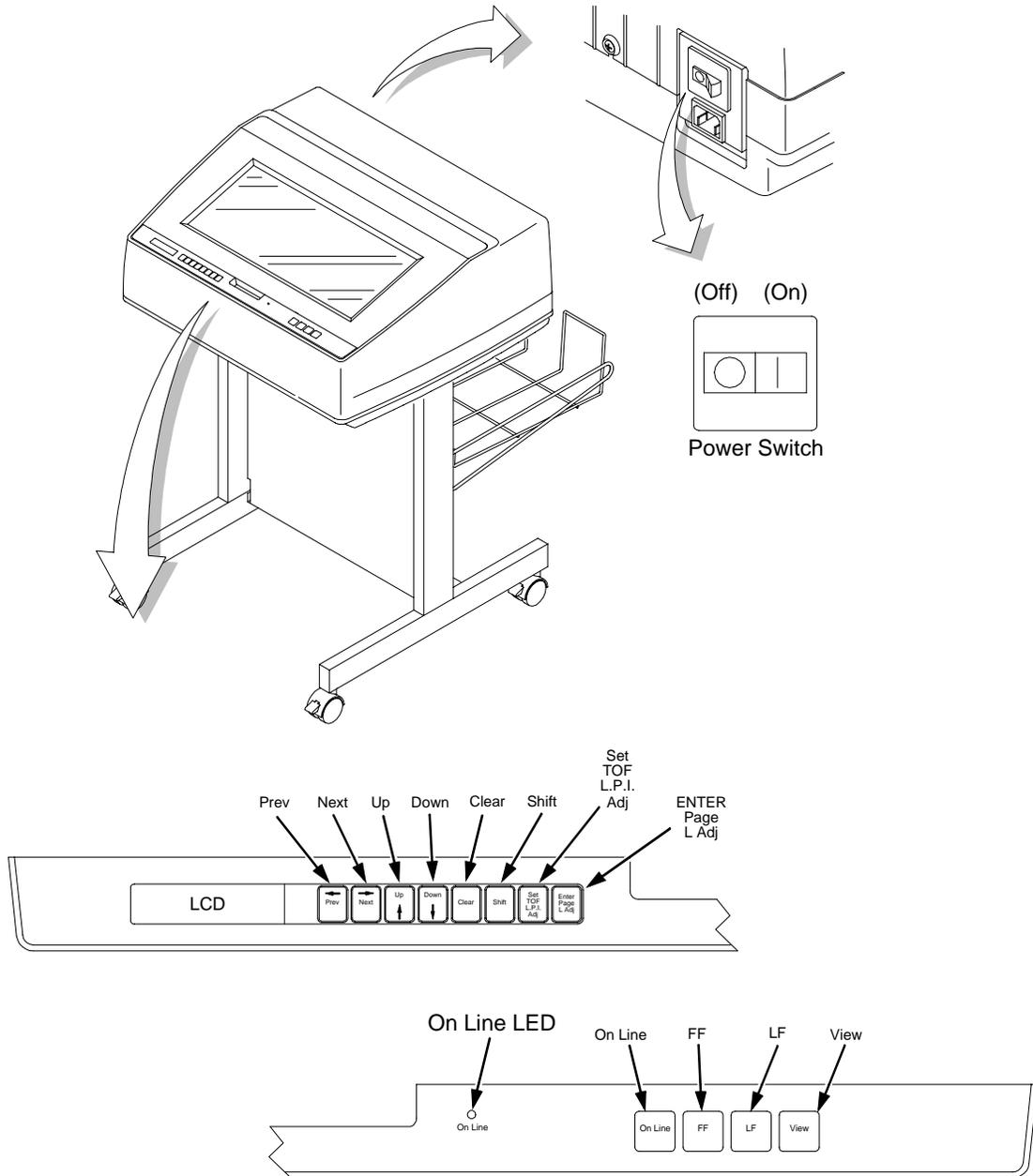
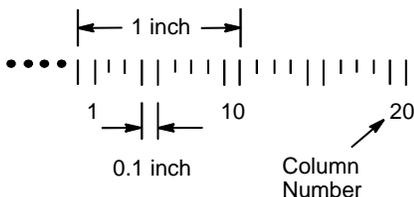
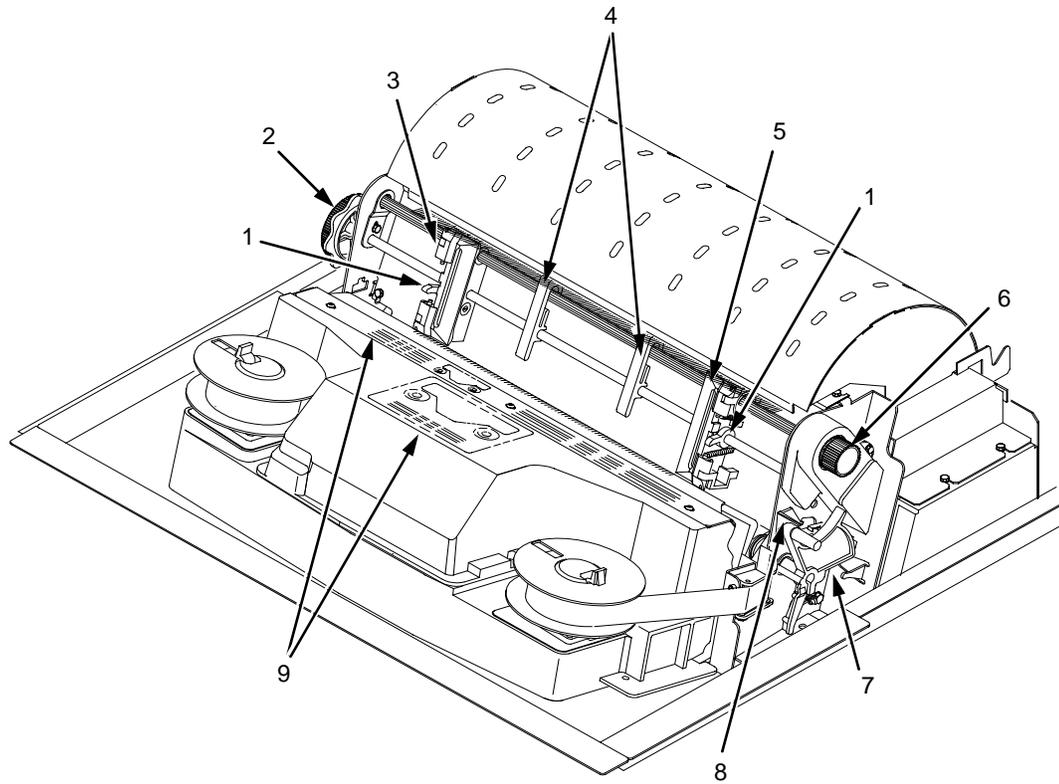


Figure 2. Electrical Controls, Pedestal Models

Mechanical Controls and Indicators, All Models (Figure 3)

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**

---

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

- *LineJet Printers: Cabinet and Pedestal Model Installation Instructions* (Part Number 171253-001PX)
- *LineJet Printers: User's Guide* (Part Number 171252-001PX)



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# 3

## *Preventive Maintenance*

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### **Cleaning the Printer**

---

The LineJet 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

---

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.

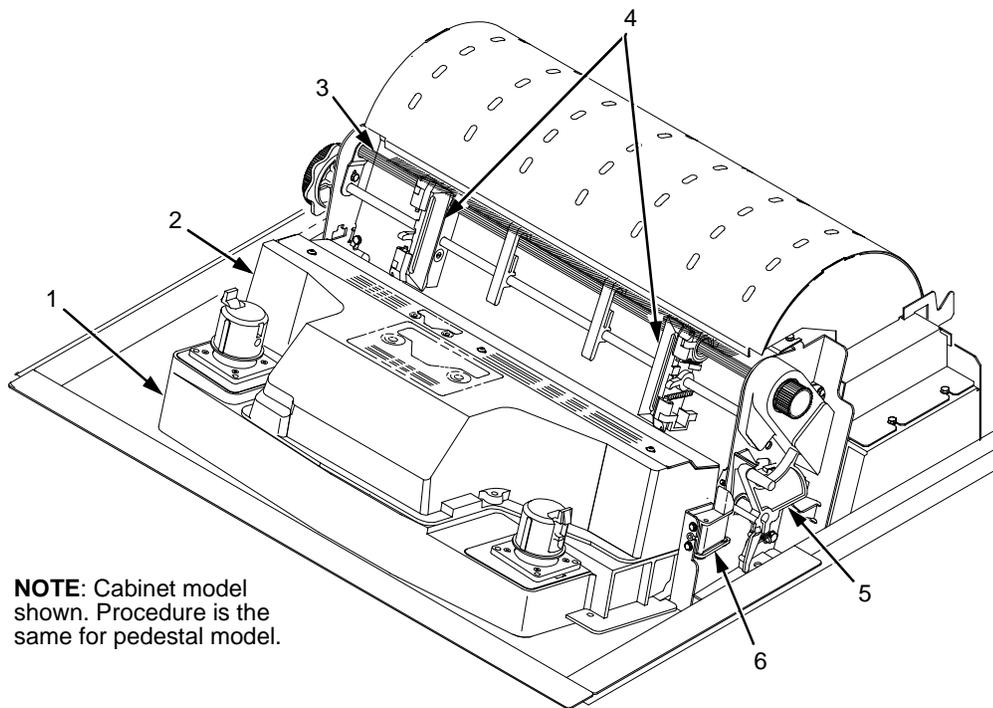
---

### 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 141).
2. Remove the shuttle frame assembly (page 177).
3. Remove the paper ironer (page 160).

---

### 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 160).
  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

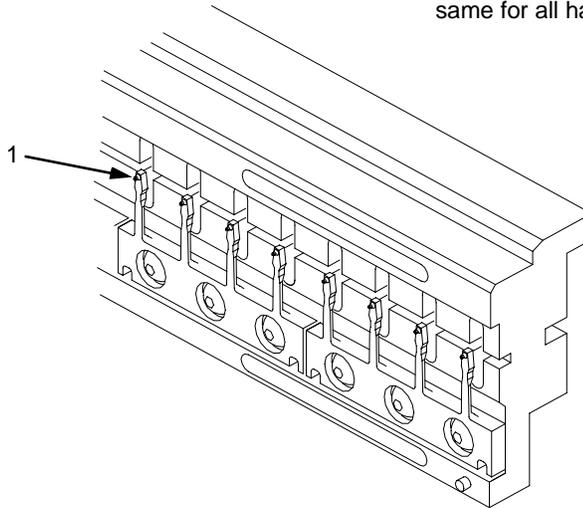


Do not use any solvents or liquids to clean the hammer tips. Clean the hammer tips gently—too much pressure can chip them.

- 
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:** LineJet 500Q 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**



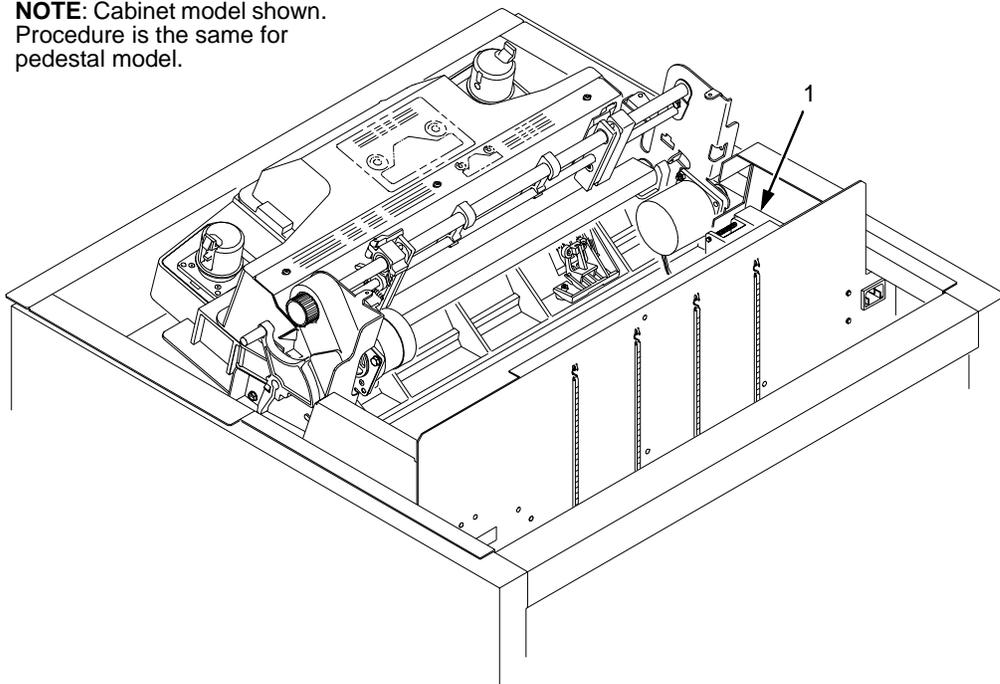
The hammer bank contains a strong magnet. To prevent damage to the hammer tips, do not let the hammer bank cover assembly snap into place as the hammer bank magnet attracts it. Any impact of the cover against the hammer bank can break hammer tips.

- 
9. Install the hammer bank / ribbon mask cover assembly (page 139).
  10. Install the shuttle frame assembly (page 177).
  11. Install the shuttle cover assembly (page 141).
  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 161).  
Pedestal Models: Remove the top cover assembly (page 142).
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 161)  
Pedestal Models: Install the top cover assembly (page 142).
4. Return the printer to normal operation (page 101).

**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**

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# 4

# Troubleshooting

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## 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.

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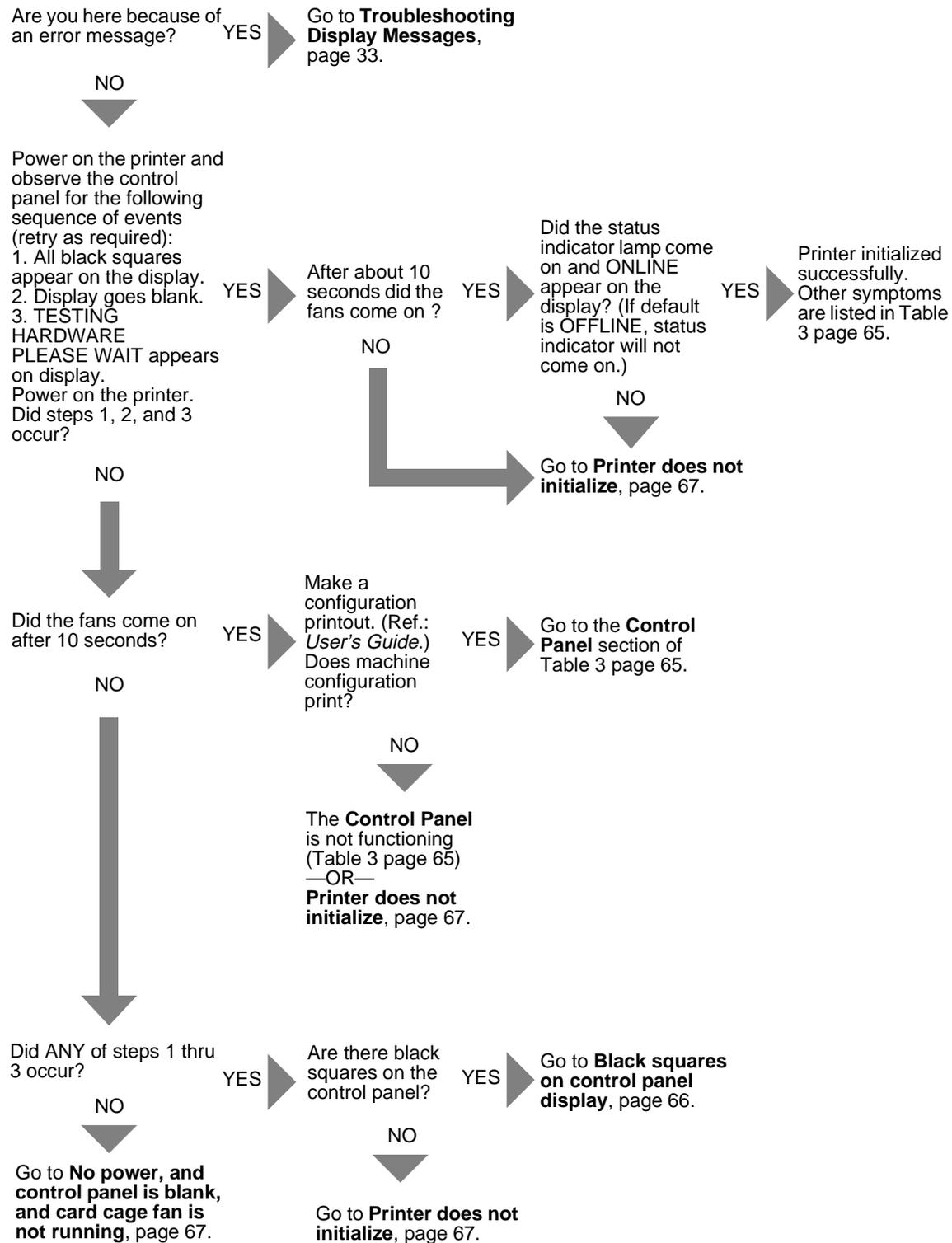
## Troubleshooting Aids

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 64
- General Symptom List ..... page 65
- Communications Failures ..... page 83
- Diagnostic Printer Tests ..... page 84
- Hex Code Printout ..... page 90
- ASCII Character Set ..... page 92
- The Power On Sequence ..... page 94
- Appendix A: Wire Data ..... page 233

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.

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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.

## List of Messages

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Find the message in the **Message List** below and follow the suggested procedure. After correcting an error, press the **CLEAR** key to clear the message and place the printer in the off-line state.

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

Message	Explanation	Solution
8.5V POWER FAIL *	8.5 Volt Power Failed. Internal power failure.	<ol style="list-style-type: none"> <li>1. Cycle power. If the message appears, replace the power supply board.</li> <li>2. Power on the printer. If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.</li> <li>3. Power on the printer. If the message appears, replace the shuttle frame assembly.</li> </ol>
15V CTL FAIL *	Controller Voltage Failure.	<ol style="list-style-type: none"> <li>1. Cycle Power. Run the print job again. If the message appears, remove the hammer bank logic cable, inspect it for damage, and test it for continuity. (See Appendix A.) Replace the hammer bank logic cable if it is damaged or fails continuity test.</li> <li>2. Cycle Power. Run the print job again. If the message appears, download the emulation software again.</li> <li>3. Cycle power. Run the print job again. If the message appears, replace the flash memory.</li> <li>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.</li> <li>5. 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.</li> <li>6. Power on the printer. Run the print job again. If the message appears, replace the power supply board.</li> <li>7. Power on the printer. If the message appears, replace the shuttle frame assembly.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
23.5V CTL FAIL*	23.5 Volt Controller Failed: a voltage failure on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle Power. Run the print job again. If the message appears, download the emulation software again (page 129).</li> <li>2. Cycle power. Run the print job again. If the message appears, replace the flash memory.</li> <li>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.</li> <li>4. Power on the printer. Run the print job again. If the message appears, replace the power supply board.</li> <li>5. Power on the printer. If the message appears, replace the shuttle frame assembly.</li> </ol>
48V PWR FAIL*	48 Volt Power Failed: an internal power failure.	<ol style="list-style-type: none"> <li>1. 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.</li> <li>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.)</li> <li>3. Power on the printer. If the message appears, replace the power supply board.</li> <li>4. Power on the printer. If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.</li> <li>5. Power on the printer. If the message appears, replace shuttle frame assembly.</li> </ol>
ACCESS NULL PTR*	Access Null Pointer: The processor tried to access a pointer that contains nothing (null).	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again (page 129).</li> <li>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.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
A TO D OVERRUN*	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.
BUFFER OVERRUN	The print buffer has overflowed on a serial interface. The printed output may contain random * (asterisk) characters. Make a configuration printout.	<ol style="list-style-type: none"> <li>1. 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.</li> <li>2. Send a print job to the printer. If the message appears, go to <b>Communications Failures</b>, page 83.</li> </ol>
CLEAR PAPER JAM	Paper jam.	<ol style="list-style-type: none"> <li>1. Inspect the paper path for jams. Clear jams. Load paper.</li> <li>2. Press <b>PAPER ADVANCE</b> several times and check that forms feed without erratic motion, noise, or pin-hole damage. If forms do not feed, go to <b>Paper feeds poorly</b>, page 77. If forms feed, go to step 3.</li> <li>3. Press <b>VIEW</b> once and check that forms move up. Make sure the forms thickness lever is not set too tightly.</li> <li>4. Press <b>VIEW</b> 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 <b>Reverse paper feed: platen does not open</b>, page 79.</li> <li>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.</li> <li>6. Inspect the ribbon mask for bends or deformation. Replace if damaged.</li> <li>7. Check and adjust the platen open belt. Replace the belt if it is damaged.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
CLEAR PAPER JAM (continued)		<ol style="list-style-type: none"> <li>8. Bottom out the platen open motor pulley on the motor shaft and torque the 1/16 inch set screw to <math>9 \pm 2</math> inch-pounds (<math>1.02 \pm 0.23 \text{ N}\cdot\text{m}</math>). 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.</li> <li>9. Inspect the tractors and tractor door springs for damage or excessive wear. If either tractor is worn or damaged, replace both tractor assemblies.</li> <li>10. Check the condition and tension of the paper feed belt. Adjust the paper feed belt. Replace the belt if it is damaged.</li> <li>11. Check and adjust the platen gap.</li> <li>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.</li> </ol>
CLEARING PROGRAM FROM FLASH	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.

Table 2. Message List

Message	Explanation	Solution
CLOSE PLATEN	The forms thickness lever is open.	<ol style="list-style-type: none"> <li>1. Load paper. Close the forms thickness lever.</li> <li>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 switch assembly if it fails the continuity test. (Refer to Appendix A, Switch Assembly, Platen Interlock.)</li> <li>3. Tighten the screws securing the platen interlock switch</li> <li>4. Check and adjust the platen open belt. Replace the belt if it is damaged.</li> <li>5. Bottom out the platen open motor pulley on the motor shaft and torque the 1/16 inch set screw to <math>9 \pm 2</math> inch-pounds (<math>1.02 \pm 0.23 \text{ N}\cdot\text{m}</math>). 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.</li> <li>6. Disconnect connector P106 from the CMX controller board. Check the resistance of connector P106/PLAT M. (See the Main Wire Harness Test Tables in Appendix A.) Replace the platen open motor if it fails the resistance test.</li> <li>7. Run a print test. If the message appears, replace the CMX controller board. Record the message and return it with the defective board.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
COIL HOT	<p>One or more hammer coils are overheating. Inspect printer environment for severity. 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.</p>	<ol style="list-style-type: none"> <li>1. Advise the user to move the printer to cooler, cleaner location.</li> <li>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.</li> <li>3. Power off the printer. Remove the paper path or pedestal top cover. Check all fan cable connections.</li> <li>4. Power on the printer. Verify that all fans operate. Replace any fan that does not operate.</li> <li>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.</li> <li>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.</li> <li>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.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
CTL VOLT FAIL*	Controller Voltage Failure. 15 V failure on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle Power. Run the print job again. If the message appears, download the emulation software again (page 129).</li> <li>2. Cycle power. Run the print job again. If the message appears, replace the flash memory.</li> <li>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.</li> <li>4. Power on the printer. Run the print job again. If the message appears, replace the power supply board.</li> <li>5. Power on the printer. If the message appears, replace the shuttle frame assembly.</li> </ol>
DIAGNOSTIC PASSED	Status message: the printer passed its memory and hardware initialization tests.	No action required.
DRV R CIR BAD*	Driver Circuit Bad: the hammer coil count test failed.	<ol style="list-style-type: none"> <li>1. Cycle power. If the message appears, press <b>CLEAR</b>.</li> <li>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.</li> </ol>
ERROR: DC PROGRAM NOT VALID	The printer cannot find the data controller program or the validation checksum is corrupt.	Download the program again. If the message appears, replace all flash memory SIMMs.
ERROR: DRAM AT ADDRESS XXXXXXXX	The printer found a defective memory location.	<ol style="list-style-type: none"> <li>1. Replace the DRAM.</li> <li>2. Power on the printer. If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
ERROR: EC PROGRAM NOT VALID	The printer cannot find the engine controller program or the validation checksum is corrupt.	<ol style="list-style-type: none"> <li>1. Download the program again (page 129). If the message occurs again, replace all flash memory SIMMs.</li> <li>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.</li> </ol>
ERROR: EC STOPPED AT STATE XXXX	Where XXXX is a number from 0000 to 0010. The Engine Controller has stopped and is in the state identified by the number displayed. 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.	<ol style="list-style-type: none"> <li>1. 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.</li> <li>2. Install the flash and DRAM SIMMs, making sure they are fully and correctly seated. Power on the printer. Download the emulation (page 129). If the message appears, replace the flash SIMM(s).</li> <li>3. Power on the printer. Download the emulation. If the message appears, replace the DRAM SIMM(s).</li> <li>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.</li> </ol>
ERROR: FLASH DID NOT PROGRAM	The printer encountered an error trying to program flash memory.	Download the program again (page 129). If the message occurs again, replace the flash memory.
ERROR: FLASH NOT DETECTED	The printer could not find flash memory.	Check flash memory on the CMX controller board. If present, reseat the flash SIMMs; if missing, install flash SIMMs.
ERROR: NO DRAM DETECTED	The printer could not find any DRAM.	Check DRAM on the CMX controller board. If present, reseat 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.) Record the message and return it with defective CMX board.
ERROR: PROGRAM NEEDS MORE DRAM	The printer requires more DRAM in order to run the downloaded program.	Add DRAM or use a smaller emulation program.

**Table 2. Message List**

Message	Explanation	Solution
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 printer.
ERROR: PROGRAM NOT VALID	The printer does not see a program in flash memory.	There is no program in printer memory. Download the emulation.
ERROR: SECURITY PAL NOT DETECTED	The security PAL is not present or has failed.	<ol style="list-style-type: none"> <li>1. 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.</li> <li>2. Power on the printer. If the message appears, replace the CMX controller board. Record the message and return it with the defective board.</li> </ol>
ERROR: SHORT AT ADDRESS XXXX	Hardware failure in DRAM or CMX controller circuitry.	Download the program again. 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	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	The printer received the complete program but the checksum did not match. The data may have been corrupted during download.	<ol style="list-style-type: none"> <li>1. Power off the printer. Download the program again from the beginning. If the messages appears, replace the DRAM.</li> <li>2. Download the program using a new software diskette. If the messages appears, replace the flash memory.</li> <li>3. Download the program. If the messages appears, replace the CMX controller board. Record the message and return it with defective CMX board.</li> </ol>
ERROR OCCURRED FLUSHING QUEUES *	An interim message that displays while the printer discards host data it cannot use because a fault condition exists. While this message displays, the asterisk (*) rotates.	Wait. When the asterisk (*) stops rotating, a different fault message will appear: troubleshoot the final message.

Table 2. Message List

Message	Explanation	Solution
ETHERNET ADAPTER BEING INITIALIZED	Status message indicating that the Ethernet interface is processing the boot procedure. (May occur with older versions of microcode.)	No action required.
ETHERNET DETECTED	Status message indicating that the PrintNet Ethernet interface has established communication.	No action required.
EXHAUST FAN FLT	Exhaust Fan Fault. Sensors cannot detect current in the fan circuit.	<ol style="list-style-type: none"> <li>1. Cycle power. If the message appears, press <b>CLEAR</b>.</li> <li>2. Check that the exhaust fan is connected to exhaust fan cable connector J307. Connect the fan cable connector.</li> <li>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. (See the Main Wire Harness Test Tables in Appendix A.) Replace components that fail test.</li> <li>4. Make sure connector P107/EHF has a good connection at J107 on the CMX controller board.</li> <li>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.</li> <li>6. Power on the printer. Check for fan operation. If the message appears or the fan doesn't work, replace the exhaust fan.</li> <li>7. Power on the printer. If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
FIRMWARE ERROR	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.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job. If the message appears, download the emulation software again (page 129).</li> <li>2. Cycle power. Run the print job again. If the message appears, replace the flash memory.</li> <li>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.</li> <li>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.</li> </ol>
FRAMING ERROR	The printed output may contain random ! (exclamation point) characters.	<ol style="list-style-type: none"> <li>1. Make a configuration printout. Set printer serial interface parameters to match host configuration settings for Data Protocol, Baud Rate, Data Bits, Stop Bits, Parity, Data Terminal Ready, and Request to Send.</li> <li>2. Send a print job to the printer. If the message appears, go to <b>Communications Failures</b>, page 83.</li> </ol>
FREEFORM OFF	This message can appear if a control panel key is stuck in the down position. Check the control panel for stuck key(s).	<ol style="list-style-type: none"> <li>1. Release stuck keys. Determine and correct what made the key(s) stick.</li> <li>2. Cycle power: power off the printer, wait 15 seconds, power on the printer. If the message appears, replace the control panel.</li> </ol>
FREEFORM ON: OFF HOLD KEY @ PWRUP	This message appears if the freeform feature is enabled. This feature is for manufacturing use only and is never used by the customer or field maintenance personnel.	<ol style="list-style-type: none"> <li>1. Power off the printer. Hold any control panel key down and power on the printer. Hold the key down until the printer powers up and the message FREEFORM OFF appears on the LCD.</li> <li>2. If the message reappears after doing step 1, replace the CMX controller board. Record the message and return it with defective CMX board.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
HAM. COIL OPEN*	Hammer Coil Open. Electrical malfunction of one or more hammer coils.	<ol style="list-style-type: none"> <li>1. Cycle power. If the message appears, replace the shuttle frame assembly.</li> <li>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.</li> </ol>
HAMMER COIL BAD #, #, #, #, ... etc.	Hammer coil(s) number #, #, etc. failed the current test at power-up. Check that the hammer bank cables are connected.	<ol style="list-style-type: none"> <li>1. Cycle power. If the message appears, replace the shuttle frame assembly. Record the message and return it with the defective assembly.</li> <li>2. Power on the printer. If the message appears, replace CMX controller board. Record the message and return it with the defective assembly.</li> </ol>
HB NOT INSTALLED*	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.	<ol style="list-style-type: none"> <li>1. Install the shuttle frame assembly.</li> <li>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.</li> <li>3. Power on the printer. If the message appears, replace the hammer bank logic cable.</li> <li>4. Power on the printer. If the message appears, replace the shuttle frame assembly.</li> <li>5. Power on the printer. If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
HMR BANK FAN FLT	Hammer Bank Fan Fault. Sensors cannot detect current in the fan circuit.	<ol style="list-style-type: none"> <li>1. Cycle power. If the message appears, press <b>CLEAR</b>. If the message does not clear, go to step 2.</li> <li>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.</li> <li>3. Make sure P107/HBF has a good connection at J107 on the CMX controller board.</li> <li>4. Inspect for obstructions of airways and vents. Remove obstructions.</li> <li>5. Power on the printer. If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.</li> </ol>
ILL EXT BUS ACC*	Illegal External Bus Access. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again (page 129).</li> <li>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.</li> </ol>
ILL INST ACCSS*	Illegal Instruction Accessed. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again (page 129).</li> <li>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.</li> </ol>
ILLGL OPR ACCSS*	<ol style="list-style-type: none"> <li>1. Illegal Operand Accessed. Firmware error on the CMX controller board.</li> </ol>	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again (page 129).</li> <li>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.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
INTAKE FAN FAULT	Sensors cannot detect current in the card cage fan circuit.	<ol style="list-style-type: none"> <li>1. Cycle power. If the message appears, press <b>CLEAR</b>. If the message does not clear, go to step 2.</li> <li>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.</li> <li>3. Make sure P106/CCF has a good connection at J106 on the CMX controller board.</li> <li>4. Inspect for obstructions of airways and vents. Remove obstructions.</li> <li>5. Power on the printer. If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.</li> </ol>
INTERRUPT UNUSED VECTOR 00	This message is generated when the CMX controller board gets an interrupt it does not understand. The problem can be created by electrical noise, by a software problem, or by a hardware problem.	<ol style="list-style-type: none"> <li>1. Cycle power. If this message occurred once and never again, you can ignore it. If the message reappears or appears consistently check the grounding of the printer. If the machine is correctly grounded, replace the CMX controller board.</li> <li>2. Power on the printer. Cycle power. If the message appears, suspect an application software error. Request assistance from your local support group. Install the original CMX controller board.</li> </ol>
LO DRV. SHORT*	Lower Driver Short. Circuit(s) on the hammer bank or in the hammer bank power cable are shorted to ground.	<ol style="list-style-type: none"> <li>1. Cycle power. If the message appears, press <b>CLEAR</b>. If message does not clear, replace the hammer bank logic cable and the hammer bank power cable.</li> <li>2. Power on the printer. If the message appears, replace the shuttle frame assembly.</li> <li>3. Power on the printer. If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
LOAD PAPER	Printer is out of paper.	<ol style="list-style-type: none"> <li>1. Load paper. Press <b>CLEAR</b>. If message does not clear, go to step 2.</li> <li>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.</li> <li>3. Check that connector P106/PMD is fully seated in connector J106 on the CMX controller board.</li> <li>4. Load paper. Power on the printer. Replace the paper detector switch assembly if message appears.</li> <li>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.</li> </ol>
LOADING PROGRAM FROM PORT XX%	Status message: the new emulation program is loading into printer RAM. XX% indicates how much of the program has loaded.	No action required.
LOADING PROGRAM INTO FLASH	The printer has deleted the previous program from flash memory and is loading the new program into flash memory.	No action required.
PAP BAD TABLE*	Paper Bad Table. The paper feed process on the CMX controller board has a corrupted table.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
PAP BSY TOO LNG*	Paper Busy Too Long. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again (page 129).</li> <li>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.)</li> <li>3. Power on the printer. Run the print job again. If the message appears, replace the shuttle frame assembly.</li> <li>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.</li> </ol>
PAP FIFO OVERFL*	Paper First In First Out Overflow. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
PAP FIFO UNDRFL*	Paper First In First Out Underflow.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.)</li> <li>3. Check hammer phasing. Try using a lower phasing value; sometimes this message indicates too high a hammer phase value.</li> <li>4. Power on the printer. Run the print job again. If the message appears, replace the shuttle frame assembly.</li> <li>5. Power on the printer. Run the print job again. If the message appears, replace the power supply board.</li> <li>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.</li> </ol>
PAP ILLGL ST*	Paper Illegal State. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.</li> </ol>
PAP INCMPL ENER*	Paper Incompletely Energized. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
PAP INVLD CMD*	Paper Invalid Command. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.</li> </ol>
PAP INVLD PARM*	Paper Invalid Parameter. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.</li> </ol>
PAP NOT SCHED*	Paper Not Scheduled. The paper feed process is not scheduling on the CMX controller board, and the printer cannot feed paper.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>2. Cycle power. Run the print job again. If the message appears, replace the MPU cable assembly.</li> <li>3. Power on the printer. Run the print job again. If the message appears, replace the power supply board.</li> <li>4. Power on the printer. Run the print job again. If the message appears, replace the shuttle frame assembly.</li> <li>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.</li> </ol>
PAP NT AT SPEED*	Paper Not At Speed. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
PAP UNEXP INT*	Paper Unexpected Interrupt. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.</li> </ol>
PARAMETER ERROR	Illegal parameter value received in a command code over a coax/twinax interface.	<ol style="list-style-type: none"> <li>1. Press <b>CLEAR</b> then press <b>ON LINE</b>.</li> <li>2. Run the print job that generated the error message. If the message appears, check the host data for invalid characters.</li> <li>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.</li> <li>4. Run the print job that generated the error message. If the message appears, go to <b>Communications Failures</b>, page 83.</li> </ol>
PARITY ERROR	The printed output may contain random ? (question mark) characters. Make a configuration printout.	<ol style="list-style-type: none"> <li>1. 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.</li> <li>2. Send a print job to the printer. If the message appears, replace the serial data cable.</li> <li>3. Send a print job to the printer. If the message appears, go to <b>Communications Failures</b>, page 83.</li> </ol>
PLAT INV CMD*	Platen Invalid Command. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
PLAT INV PARM*	Platen Invalid Parameter. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.</li> </ol>
PLAT INV STATE*	Platen Invalid State. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.</li> </ol>
PLEASE WAIT... RESET IN PROGRESS	Status message: the printer finished loading the program into flash memory and is automatically resetting itself.	No action required.
POWER SAVER MODE	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 PAPER ADVANCE key to revive the printer from power saver mode.

Table 2. Message List

Message	Explanation	Solution
POWER SUPPLY HOT	<p>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 <b>CLEAR</b> key resumes the print task. 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.</p>	<ol style="list-style-type: none"> <li>1. Inspect printer environment for severity. Advise the user to move the printer to cooler, cleaner location.</li> <li>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.</li> <li>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. <b>WARNING: DO NOT TOUCH THE POWER SUPPLY</b>, 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.</li> <li>4. Check that all fan cables are connected.</li> <li>5. Inspect vents and fan airways for obstructions. Look underneath cabinet models for items blocking the cabinet exhaust vents.</li> <li>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.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
PRINTER HOT	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.	<ol style="list-style-type: none"> <li>1. CMX controller board sensors report high temperatures on the board. Inspect printer environment for severity. Advise the user to move the printer to cooler, cleaner location.</li> <li>2. Power off the printer. Remove the paper path or pedestal top cover. Check that all fan cables are connected.</li> <li>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.</li> <li>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.</li> </ol>
PROTECTED INSTR*	Protected Instruction. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.</li> </ol>
PWR SUPP VOLT*	Power Supply Voltage. The power supply has failed.	Replace the power supply board.
RESTORING BOOT CODE	Normal download initialization message.	No action required.
RIB INVLD CMD*	Ribbon Invalid Command. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.</li> </ol>

**Table 2. Message List**

Message	Explanation	Solution
RIB INVLD STATE*	Ribbon Invalid State. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.</li> </ol>
RIBBON DRIVE	The CMX controller board does not detect a ribbon drive motor.	<ol style="list-style-type: none"> <li>1. 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.</li> <li>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.</li> </ol>
RIBBON INK OUT CHANGE RIBBON	RibbonMinder™ software has determined that the ribbon is out of ink.	Install a new ribbon and set ribbon life to 100%.
SECURITY CODE VIOLATION	Security code of the PAL on the CMX controller board does not match the code of the firmware on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Remove the paper path or pedestal top cover. Check that the security PAL is correctly installed.</li> <li>2. Install correct PAL for the customer's emulations with the notched end facing toward the flash and DRAM SIMM sockets.</li> <li>3. Run a print test. If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.</li> </ol>
SECURITY PAL NOT DETECTED	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.

Table 2. Message List

Message	Explanation	Solution
SENDING PROGRAM TO EC PROCESSOR	Status message: the printer is loading the engine controller program into the engine controller.	No action required.
SHUTL INV CMD*	Shuttle Invalid Command. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.</li> </ol>
SHUTL INV PARM*	Shuttle Invalid Parameter. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
SHUTTLE JAM	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.	<ol style="list-style-type: none"> <li>1. Set the forms thickness lever to match the thickness of paper, but not too tightly.</li> <li>2. Check/adjust the platen gap.</li> <li>3. Inspect the ribbon mask for deformation that snags and interferes with shuttle movement. Correctly install the hammer bank cover assembly or replace a deformed cover assembly.</li> <li>4. Run a print test. If the message appears, power off the printer.</li> <li>5. Remove the shuttle cover and 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.) Reseat 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.</li> <li>6. Run a print test. If the message appears, replace the power supply board.</li> <li>7. 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 <math>0.010 \pm .001</math> inch (<math>0.254 \pm 0.025</math> mm). Torque the 7/16 inch MPU clamp screw to <math>18 \pm 1</math> inch-pounds (<math>2.03 \pm 0.11</math> N•m).</li> <li>8. Run a print test. If the message appears, replace the MPU and the MPU cable assembly.</li> <li>9. Run a print test. If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.</li> <li>10. Run a print test. If the message appears, replace the shuttle frame assembly.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
SOFTWARE ERROR* CYCLE POWER	Application software tried to perform an illegal printer function or damaged logic circuits were detected on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. If the message appears, power off the printer.</li> <li>2. Disconnect the input data line from the host computer. Power on the printer. If the message appears, download the emulation software again (page 129).</li> <li>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.</li> </ol>
STACK OVERFLOW*	Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.</li> </ol>
STACK UNDERFLOW*	Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
STACKER FAULT	This message is triggered when the elevator cannot reach either the top or bottom position switch before timing out.	<ol style="list-style-type: none"> <li>1. Power on the printer. Operate the power stacker. Check for obstructions preventing elevator movement.</li> <li>2. Operate the power stacker, and check that: <ol style="list-style-type: none"> <li>a) all motors are operating,</li> <li>b) the paddles are rotating,</li> <li>c) the elevator moves smoothly and without obstruction,</li> <li>d) the timing belts are undamaged and the belt pulleys are not slipping,</li> <li>e) the extension springs are attached and undamaged (not bent or stretched),</li> <li>f) the drive rollers are not damaged,</li> <li>g) the constant force springs are tightly mounted and undamaged.</li> </ol> Tighten pulley setscrews and/or replace damaged components as necessary. </li> <li>3. Adjust the stacker rails if they are not vertical and parallel.</li> <li>4. Check the stacker limit switches. (See page 71.) If the limit switches are OK, go to the next step.</li> <li>5. Disable the power stacker unit under the Printer Control menu. (Refer to the <i>Setup Guide</i>.) If the message occurs, replace the CMX controller board.</li> <li>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 Figure 59, page 307). 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.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
STACKER FULL	Status message: the power paper stacker is full.	<ol style="list-style-type: none"> <li>1. Unload the stacker.</li> <li>2. Check the stacker limit switches. (See page 71.) If the limit switches are OK, go to the next step.</li> <li>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 Figure 59, page 307). 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.</li> </ol>
STACKER JAM	Paper is bunching above the elevator or the paper motion detector is not working properly.	<ol style="list-style-type: none"> <li>1. Remove the paper jam.</li> <li>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. If necessary, gently bend the brace toward the paper motion detector wheel until the wheel contacts the brace. Clean the stacker paper motion detector.</li> <li>3. Power on the printer. Operate the power stacker and check that: <ol style="list-style-type: none"> <li>a) all motors are operating,</li> <li>b) the paddles are rotating,</li> <li>c) the elevator moves smoothly and without obstruction,</li> <li>d) the timing belts are undamaged and the belt pulleys are not slipping,</li> <li>e) extension springs are attached and not bent or stretched),</li> <li>f) drive rollers are not damaged. Tighten setscrews and replace damaged components as necessary.</li> </ol> </li> <li>4. Power off the printer. Remove the paper path. Disconnect stacker cables from the CMX controller board, stacker assembly, and stacker control panel. 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.</li> </ol>
TABLE MISMATCH DOWNLOAD AGAIN	This message indicates that an EC software update is in process.	Power off the printer. Download the program again from the beginning.

Table 2. Message List

Message	Explanation	Solution
TCB CORRUPTED*	Task Control Block Corrupted. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.</li> </ol>
UNDEF INTERRUPT*	Undefined Interrupt. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again.</li> <li>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.</li> </ol>
UNDFNED OPCODE*	Undefined Opcode. Firmware error on the CMX controller board.	<ol style="list-style-type: none"> <li>1. Cycle power. Run the print job again. If the message appears, download the emulation software again (page 129).</li> <li>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.</li> </ol>
UP DRV. SHORT*	Upper Driver Short. Hammer driver circuits on the CMX controller board are shorted to ground.	<ol style="list-style-type: none"> <li>1. Cycle power. If the message appears, press <b>CLEAR</b>. If the message does not clear, replace the hammer bank logic cable and the hammer bank power cable assemblies.</li> <li>2. Power on the printer. If the message appears, replace the CMX controller board. Record the message and return it with defective CMX board.</li> <li>3. Power on the printer. If the message appears, replace the shuttle frame assembly.</li> </ol>

Table 2. Message List

Message	Explanation	Solution
WAITING FOR ETHERNET ADAPTER	This status message appears when the printer is first powered on if the optional PrintNet Ethernet interface is installed. 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. Compared to the printer, the 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	No action required.

## 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.

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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. 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.

## General Symptom List

Table 3 is a list of possible printer problems that are not indicated by messages on the LCD. Troubleshooting procedures are included for each symptom.

If you encounter a problem that is not listed in Table 3, troubleshoot using the Half-Split Method described on page 64.

**Table 3. General Symptom List**

Symptom	Solution
Communications Failures	See page 83.
<b>Jams</b>	
CLEAR PAPER JAM message instead of LOAD PAPER when printer is out of paper	<ol style="list-style-type: none"> <li>On 475 lpm and 500 lpm printers, check the shuttle speed (page 136). Adjust the shuttle speed to match the printer's rated speed.</li> <li>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.</li> <li>Check that connector P106/PMD is fully seated in connector J106 on the CMX controller board.</li> <li>Load paper. Power on the printer. Replace the paper detector switch assembly if either message appears.</li> <li>Inspect the paper ironer. If the paper ironer has slipped up into the print line, reposition the paper ironer.</li> <li>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.</li> </ol>
CLEAR PAPER JAM message will not clear and paper does not move	<ol style="list-style-type: none"> <li>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.</li> <li>Check the paper feed motor pulley for looseness. Hold the collar snug against the motor pulley and torque the 7/64 inch setscrew to <math>25 \pm 2</math> inch-pounds (<math>2.82 \pm 0.23</math> N•m).</li> <li>Check the condition and tension of the paper feed timing belt. Adjust the paper feed timing belt. Replace the belt if it is damaged.</li> <li>Load paper. Power on the printer. Press <b>PAPER ADVANCE</b> and <b>VIEW</b> 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.</li> <li>Power on the printer. Press <b>PAPER ADVANCE</b> and <b>VIEW</b> 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.</li> </ol>

**Table 3. General Symptom List**

Symptom	Solution
CLEAR PAPER JAM message will not clear but paper moves	<ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>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.</li> <li>4. Check that the motion detector wheel rotates. Replace the paper detector switch assembly if the wheel does not rotate.</li> <li>5. Load paper. Power on the printer. Replace the paper detector switch assembly if the message appears.</li> <li>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.</li> </ol>
<b>Control Panel</b>	
Black squares on control panel	<ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>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.</li> <li>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 129).</li> </ol>
Control panel blank	<ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>3. Power on the printer. If the control panel is blank and the fans do not come on, replace the CMX controller board.</li> </ol>

Table 3. General Symptom List

Symptom	Solution
Control panel keys do not work	<ol style="list-style-type: none"> <li>1. Power on the printer. Check the operation of the control panel keys. Replace the control panel assembly if the keys do not work.</li> <li>2. Power on the printer. Check the operation of the control panel keys. Replace the control panel cable assembly if the keys do not work.</li> <li>3. Power on the printer. Check the operation of the control panel keys. Replace the CMX controller board if the keys do not work.</li> </ol>
Control panel display shows garbled, broken characters	<ol style="list-style-type: none"> <li>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.</li> <li>2. Make sure the DRAM SIMM(s) is/are seated properly in J15/J16. Reseat DRAM SIMM(s).</li> <li>3. Power on the printer. Inspect the control panel display. If the control panel shows broken characters, replace the DRAM.</li> </ol>
<b>Power Failures</b>	
No power, and control panel blank, and card cage fan not running	<ol style="list-style-type: none"> <li>1. Check that the AC power outlet has power. Restore AC power if necessary.</li> <li>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.</li> <li>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 42, page 226.) Make sure all ground connections are clean and tight.</li> <li>4. Check that AC-in power cable connector P1 is connected to J1 on the power supply board. Reseat the connector.</li> <li>5. Check that power supply cable connector P101 is connected to J101 on the CMX controller board. Reseat the connector.</li> <li>6. Check all cable connections on the CMX controller board.</li> <li>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.</li> </ol>
Printer does not initialize	<p><b>NOTE:</b> Power-on initialization is explained on page 94.</p> <ol style="list-style-type: none"> <li>1. Power off the printer. Remove the paper guide or pedestal top cover. Reseat all cable connectors on the CMX controller board, especially connectors P106 and P107.</li> <li>2. Power up the printer. If the fans run but the printer does not initialize, replace the power supply board.</li> <li>3. Power up the printer. If the fans run but the printer does not initialize, replace the CMX controller board.</li> </ol>

Table 3. General Symptom List

Symptom	Solution
<b>Power Stacker</b>	
Printer does not detect presence of power stacker	<ol style="list-style-type: none"> <li>1. Check that the power stacker is enabled under the Printer Control menu. (Refer to the <i>Setup Guide</i>.) If the power stacker enable/disable option does not appear in the menu, go to the next step.</li> <li>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 ON LINE key and check that the ON LINE indicator lights. If the ON LINE indicator comes on, the stacker is detected by the printer. If the ON LINE indicator does not come on, go to step 4.</li> <li>3. <ol style="list-style-type: none"> <li>a) Power off the printer.</li> <li>b) Unfasten the cable clamp holding the stacker control panel cables.</li> <li>c) Disconnect the stacker power cable from the back of the stacker control panel. (See Figure 59, page 307.)</li> <li>d) Locate pin 1 of connector P106. (See the cable assembly drawing in Appendix A.)</li> <li>e) Power on the printer.</li> <li>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 312.) 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.</li> </ol> </li> <li>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 59, page 307). 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.</li> <li>5. Power on the printer. Check that the ON LINE indicator lights on the stacker control panel. If the ON LINE indicator does not light, replace the stacker control panel.</li> <li>6. Power on the printer. Check that the ON LINE indicator lights on the stacker control panel. If the ON LINE indicator does not light, replace the CMX controller board.</li> </ol>

**Table 3. General Symptom List**

Symptom	Solution
<p>Stacker “chatters” at upper or lower limit</p>	<ol style="list-style-type: none"> <li>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.</li> <li>2. Verify that the stacker rails are vertical and parallel. Adjust the stacker rails if necessary: they must be vertical and parallel.</li> <li>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.</li> <li>4. Power on the printer. Operate the power stacker. (Refer to the <i>User’s Guide</i>.) While the stacker is operating, check that:               <ol style="list-style-type: none"> <li>a) all motors are operating</li> <li>b) the paddles are rotating</li> <li>c) the elevator moves smoothly and without obstruction</li> <li>d) the timing belts are undamaged and the belt pulleys are not slipping</li> <li>e) the extension springs are attached and undamaged (not bent or stretched)</li> <li>f) the drive rollers are not damaged</li> <li>g) the constant force springs are tightly mounted and undamaged</li> </ol>               Tighten pulley setscrews and/or replace damaged components as necessary.             </li> </ol>

Table 3. General Symptom List

Symptom	Solution
Stacker does not stack properly	<ol style="list-style-type: none"> <li>1. Check for and remove obstructions preventing elevator movement.</li> <li>2. Check for misaligned stacker rails. Adjust the stacker rails if they are not vertical and parallel.</li> <li>3. Power on the printer. Operate the power stacker. (Refer to the <i>User's Guide</i>.) While the stacker is operating, check that: <ol style="list-style-type: none"> <li>a) all motors are operating</li> <li>b) the paddles are rotating</li> <li>c) the elevator moves smoothly and without obstruction</li> <li>d) the timing belts are undamaged and the belt pulleys are not slipping</li> <li>e) the extension springs are attached and undamaged (not bent or stretched)</li> <li>f) the drive rollers are not damaged</li> <li>g) the constant force springs are tightly mounted and undamaged</li> </ol> Tighten pulley setscrews and/or replace damaged components as necessary. </li> <li>4. Check the stacker limit switches. (See page 71.) If the limit switches are OK, go to the next step.</li> <li>5. Check the stacker motors. (See page 72.) If the stacker motors are OK, go to the next step.</li> <li>6. Remove the paper path. Disconnect stacker cables from the CMX controller board, stacker assembly, and the stacker control panel (see Figure 59, page 307). 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.</li> </ol>
Stacker elevator does not move	See "Stacker does not stack properly"
Stacker elevator moves by itself	<ol style="list-style-type: none"> <li>1. Power off the printer. Inspect all stacker LEDs for dust, chaff, or dirt. (See Figure 81 through Figure 83, page 332 through page 336.) Clean the stacker LEDs and the sight tubes in the LED mounts.</li> <li>2. Power on the printer. If the stacker elevator moves by itself, replace the stacker LEDs. (See Figure 81 through Figure 83, page 332 through page 336.)</li> </ol>

Table 3. General Symptom List

Symptom	Solution
Stacker limit switch check	<p><b>NOTE:</b> 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.</p> <ol style="list-style-type: none"> <li>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.)</li> </ol> <p><b>NOTE:</b> If the elevator assembly or the rails are bent or damaged, you must replace the entire power stacker assembly.</p> <ol style="list-style-type: none"> <li>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.</li> <li>3. <ol style="list-style-type: none"> <li>a) Unfasten the cable clamp holding the stacker control panel cables.</li> <li>b) Disconnect stacker rail cable connector P107 from connector J3 on the back of the stacker control panel. (See Figure 59, page 307.)</li> <li>c) Locate pin 1 of connector P107. (See the cable assembly drawing in Appendix A, page 257.)</li> <li>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 in Appendix A, page 264. STK FULL is the upper limit switch, STK LIMIT is the bottom switch.)</li> </ol> <p>Replace the stacker rail cable if it is damaged or fails continuity test. Replace any switch that fails continuity test.</p> </li> </ol>

Table 3. General Symptom List

Symptom	Solution
Stacker motor check	<p><b>NOTE:</b> 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.</p> <ol style="list-style-type: none"> <li>1. a) Power off the printer.</li> <li>b) Open the rear cabinet door.</li> <li>c) Unfasten the cable clamp holding the stacker control panel cables.</li> <li>d) Disconnect stacker rail cable connector P107 from connector J3 on the back of the stacker control panel. (See Figure 59, page 307.)</li> <li>e) Disconnect stacker frame cable connector P102 from connector J4 on the rear of the stacker control panel. (See Figure 59, page 307.)</li> <li>f) Locate pin 1 of connector P102 and connector P107. (See the cable assembly drawings in Appendix A, page 285 and page 288.)</li> <li>g) Check both cables for pin damage, continuity, and shorts. Check all motors for <math>15.2 \pm 1.5</math> Ohms on both phases. (Refer to the power stacker control panel PCBA pinout drawing on page 264.)</li> </ol> <p>Replace any cable that is damaged or fails continuity test. Replace any motor that fails the resistance test.</p>
Stacker not operating	See "Printer does not detect presence of power stacker"

Table 3. General Symptom List

Symptom	Solution
<b>Print Quality</b>	
<p>Characters or dots are missing, smeared, too light, or too dark</p>	<ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>3. Inspect the shuttle frame assembly for print chaff, debris, or ink residue that could be causing the problem. Clean the shuttle frame assembly.</li> <li>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.</li> <li>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.</li> <li>6. Check the platen gap. Adjust the platen gap if necessary.</li> <li>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.</li> <li>8. Power on the printer. If the problem still occurs, replace the hammer bank logic cable and the hammer bank power cable.</li> <li>9. Power on the printer. If the problem still occurs, replace the shuttle frame assembly.</li> <li>10. Power on the printer. If the problem still occurs, replace the power supply board.</li> <li>11. Power on the printer. If the problem still occurs, replace the CMX controller board.</li> </ol>

**Table 3. General Symptom List**

Symptom	Solution
<p>Horizontal misalignment of characters (Dots or characters move left or right from dot row to dot row or line to line)</p>	<ol style="list-style-type: none"> <li>1. Take the printer offline and print a test pattern of All H's. If characters shift left or right from line to line, there might be a proportional spacing problem. If the pattern of H's prints correctly (that is, all the columns line up), contact your support group or configuration help desk, because a configuration change may be necessary. If the pattern of H's did not print OK, go to the next step.</li> <li>2. Check the hammer phasing. Adjust hammer phasing if necessary.</li> <li>3. If the printer is a 500 lpm model, check the shuttle speed setting. Set the shuttle speed (page 132).</li> <li>4. Inspect the shuttle frame assembly area for ink residue, paper chaff, or debris. Clean the shuttle frame assembly.</li> <li>5. Check the MPU gap. Using a feeler gauge, adjust the gap between the MPU assembly and the flywheel to <math>0.010 \pm .001</math> inch (<math>0.254 \pm 0.025</math> mm). Torque the 7/16 inch MPU clamp screw to <math>18 \pm 1</math> inch-pounds (<math>2.03 \pm 0.11</math> N•m).</li> <li>6. Power up the printer. Run a print test. If the symptom is not gone, replace the MPU.</li> <li>7. Power up the printer. Run a print test. If the symptom is not gone, replace the CMX controller board.</li> <li>8. Power up the printer. Run a print test. If the symptom is not gone, replace the shuttle frame assembly.</li> </ol>
<p>Randomly misplaced dots</p>	<ol style="list-style-type: none"> <li>1. Power off the printer. Check the platen gap. Adjust the platen gap if necessary.</li> <li>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 42, page 226.)</li> <li>3. Disconnect the AC power cord and check the ground leads for continuity. Replace the AC power cord if it fails continuity test.</li> <li>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.</li> <li>5. Power up the printer. Run a print test. If the problem occurs, replace the flash memory and DRAM. Download the emulation software again.</li> <li>6. Power up the printer. Run a print test. If the problem occurs, replace the CMX controller board.</li> <li>7. Power up the printer. Run a print test. If the problem occurs, replace the power supply board.</li> <li>8. Power up the printer. Run a print test. If the problem occurs, replace the shuttle frame assembly.</li> </ol>

**Table 3. General Symptom List**

Symptom	Solution
<p>Vertical misalignment of characters:</p> <ol style="list-style-type: none"> <li>1. Dots or characters move up or down from dot row to dot row or line to line</li> <li>2. Incorrect spacing from dot row to dot row or line to line</li> <li>3. Characters randomly compressed and/or enlarged</li> </ol>	<ol style="list-style-type: none"> <li>1. Load paper. Press <b>PAPER ADVANCE</b> and check that paper feeds smoothly. Press <b>VIEW</b> 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.</li> <li>2. Check the paper feed motor pulley for looseness. Hold the collar snug against the motor pulley and torque the 7/64 inch setscrew to <math>25 \pm 2</math> inch-pounds (<math>2.82 \pm 0.23</math> N•m).</li> <li>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.</li> <li>4. Check the platen gap. Adjust the platen gap.</li> <li>5. Inspect the tractors and tractor door springs for damage or excessive wear. If either tractor is damaged or visibly worn, replace both tractor assemblies.</li> <li>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.</li> <li>7. Load paper. Power on the printer. Run a print test. If the problem occurs, replace the paper feed motor.</li> <li>8. Run a print test. If the problem occurs, replace the CMX controller board.</li> <li>9. Run a print test. If the problem occurs, replace the power supply board.</li> </ol>

Table 3. General Symptom List

Symptom	Solution
<b>Printer Operation</b>	
Downloads consistently fail	<p><b>NOTE:</b> Most download problems are detected by software during the procedure and communicated by LCD messages. If downloads fail consistently with no messages or with erratic messages, suspect a hardware failure.</p> <ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>3. Check that customer has the right size SIMMs for the emulation. (See page 166) Install SIMMs that support the emulation software.</li> <li>4. Power up the printer. Download the emulation (page 129). If the download fails, activate the Boot Diagnostics Menu (page 87) and run MISC UTILITIES / RUN MEMORY TESTS. If memory fails test, replace the DRAM. If memory tests OK, replace the flash SIMM(s).</li> <li>5. Power up the printer. Download the emulation (page 129). If the download fails, replace the CMX controller board.</li> </ol>
Flash SIMM won't copy	<ol style="list-style-type: none"> <li>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.</li> <li>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 87.) 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.</li> <li>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.</li> </ol>

Table 3. General Symptom List

Symptom	Solution
Paper feeds poorly	<ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>3. Inspect the tractors and tractor door springs for damage or excessive wear. If either tractor is damaged or visibly worn, replace both tractor assemblies.</li> <li>4. Check the paper feed motor pulley for looseness. Hold the collar snug against the motor pulley and torque the 7/64 inch setscrew to <math>25 \pm 2</math> inch-pounds (<math>2.82 \pm 0.23</math> N•m).</li> <li>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.</li> <li>6. Check the platen gap. Adjust the platen gap.</li> <li>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.</li> <li>8. Load paper. Power on the printer. Press <b>PAPER ADVANCE</b> and <b>VIEW</b> several times and check that paper moves in both directions. Replace the paper feed motor if paper does not move in both directions.</li> <li>9. Power on the printer. Press <b>PAPER ADVANCE</b> and <b>VIEW</b> several times and check that paper moves in both directions. Replace the CMX controller board if paper does not move in both directions.</li> </ol>
Power on “hang” condition	<ol style="list-style-type: none"> <li>1. Remove the paper path or pedestal top cover. Reseat all cable connections to the CMX controller board and the power supply board.</li> <li>2. Power up the printer. If the printer “hangs,” replace the CMX controller board.</li> <li>3. Power up the printer. If the printer “hangs,” replace the power supply board.</li> </ol>

**Table 3. General Symptom List**

Symptom	Solution
Printer does not print from the host	<ol style="list-style-type: none"> <li>1. Check the host data cable connection at the rear of the printer. Attach the data cable to the printer interface.</li> <li>2. Make a configuration printout. Verify that the printer matches host interface settings. Set printer interface parameters to match those of the host.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>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.</li> </ol>
Printer does not print self tests	<ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>3. Power on the printer. Run a self test. If the self test does not run, replace the CMX controller board.</li> </ol>

Table 3. General Symptom List

Symptom	Solution
Reverse paper feed: platen does not open	<ol style="list-style-type: none"> <li>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.</li> <li>2. Check the platen open pulley and the platen pulley for looseness. Bottom out the platen open motor pulley on the motor shaft and torque the 1/16 inch set screw to <math>9 \pm 2</math> inch-pounds (<math>1.02 \pm 0.23</math> N•m). 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.</li> <li>3. Check the condition and tension of the platen open belt. Adjust the platen open belt. Replace the belt if it is damaged.</li> <li>4. Check the platen gap. Adjust the platen gap.</li> <li>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.</li> <li>6. Power on the printer. Press <b>PAPER ADVANCE</b> and <b>VIEW</b> several times and check that paper moves in both directions. Replace the CMX controller board if the platen does not open during paper reverse.</li> </ol>
TOF is lost repeatedly	<ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>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 torque the 7/64 inch setscrew to <math>25 \pm 2</math> inch-pounds (<math>2.82 \pm 0.23</math> N•m). Replace the paper feed pulley if it does not have 25 teeth.</li> <li>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.</li> <li>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.</li> <li>6. Power on the printer. Load paper and set TOF. Press <b>PAPER ADVANCE</b> and <b>VIEW</b> several times and check that paper returns to TOF. Replace the paper feed motor if paper does not return to TOF.</li> <li>7. Power on the printer. Press <b>PAPER ADVANCE</b> and <b>VIEW</b> several times and check that paper returns to TOF. Replace the CMX controller board if paper does not return to TOF.</li> </ol>

**Table 3. General Symptom List**

Symptom	Solution
<b>Ribbon</b>	
Ribbon folding or feed problems	<ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>3. Inspect the paper print path for paper chaff, ink residue, and debris. Clean the shuttle frame assembly.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>7. Check the platen gap. Adjust the platen gap.</li> </ol>

Table 3. General Symptom List

Symptom	Solution
<b>Shuttle</b>	
Shuttle does not move	<ol style="list-style-type: none"> <li>1. Power down the printer. Remove the shuttle cover. Check the MPU gap. Adjust the gap between the MPU assembly and the flywheel to <math>0.010 \pm .001</math> inch (<math>0.254 \pm 0.025</math> mm). Torque the 7/16 inch MPU clamp screw to <math>18 \pm 1</math> inch-pounds (<math>2.03 \pm 0.11</math> N•m).</li> <li>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.</li> <li>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.</li> <li>4. Check the platen gap. Adjust the platen gap.</li> <li>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.</li> <li>6. Check continuity of the shuttle motor drive cable assembly. Replace shuttle motor drive cable assembly if it fails continuity test.</li> <li>7. Power up the printer. Run a Shuttle Slow or Shuttle Fast test. If the shuttle does not move, replace the shuttle frame assembly.</li> <li>8. Power up the printer. Run a Shuttle Slow or Shuttle Fast test. If the shuttle does not move, replace the power supply board.</li> <li>9. Power up the printer. Run a Shuttle Slow or Shuttle Fast test. If the shuttle does not move, replace the CMX controller board.</li> </ol>

Table 3. General Symptom List

Symptom	Solution
Shuttle is noisy	<ol style="list-style-type: none"><li>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.</li><li>2. Remove the shuttle cover. Check the shuttle frame assembly mounting/clamp screws for looseness. Torque the 5/32 inch socket head clamp screws to <math>20 \pm 2</math> inch-pounds (<math>2.26 \pm 0.23</math> N•m). Torque the center captive 5/32 inch socket head screw to <math>20 \pm 2</math> inch-pounds (<math>2.26 \pm 0.23</math> N•m).</li><li>3. Inspect the shuttle area for loose hardware. Tighten loose hardware.</li><li>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.</li><li>5. Power up the printer. Run a shuttle test. Replace the shuttle frame assembly if it is noisy or rattles.</li></ol>

## 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**

<b>Problems</b>	<b>Interface</b>	<b>Common Causes</b>
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
	Ethernet	- Interface cable defective - Host/Printer/Network configuration - 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 88.

### 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 88.)
2. Press the ENTER key.

**Method 2:** Cycling power

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

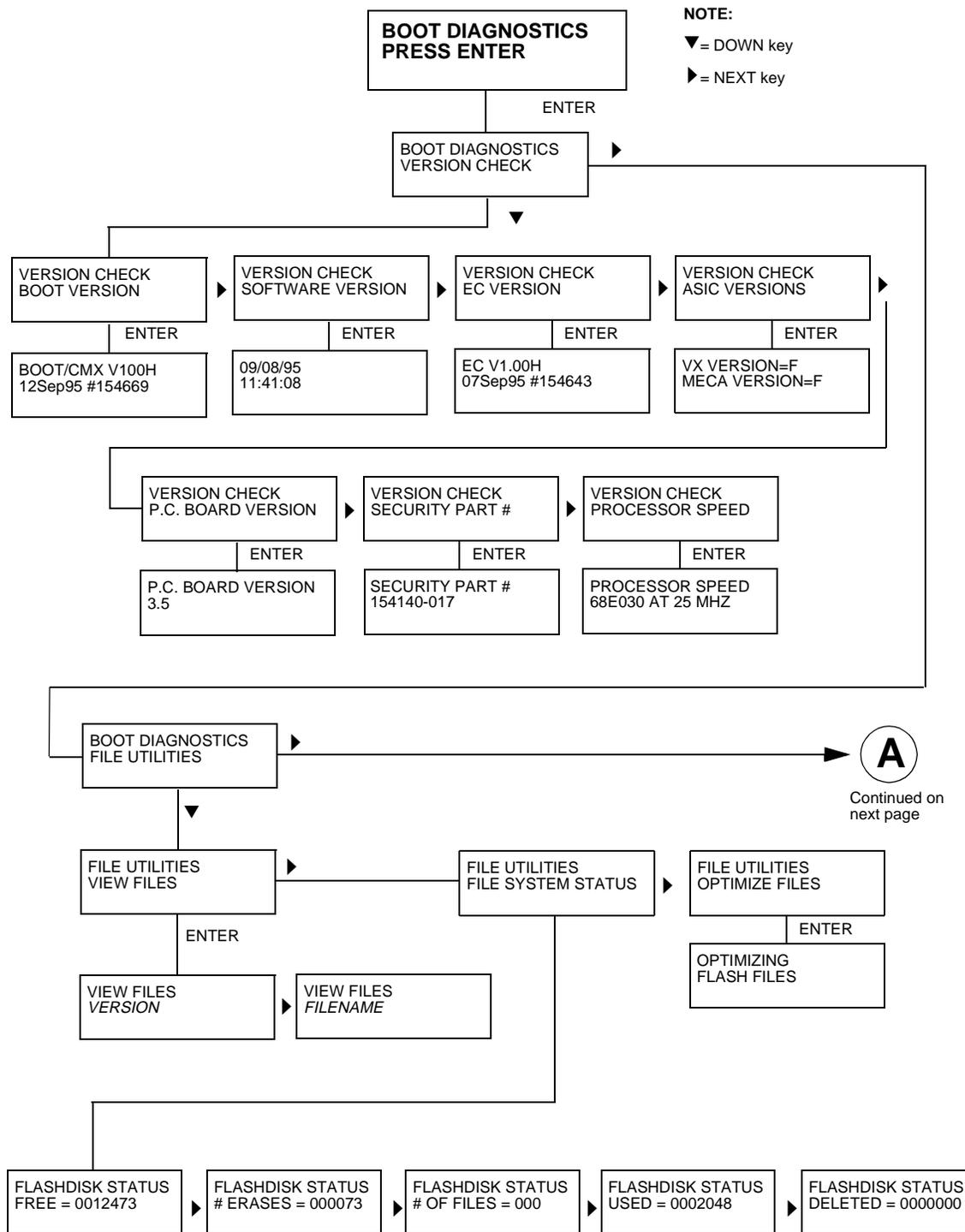


Figure 7. Boot Diagnostics Menu

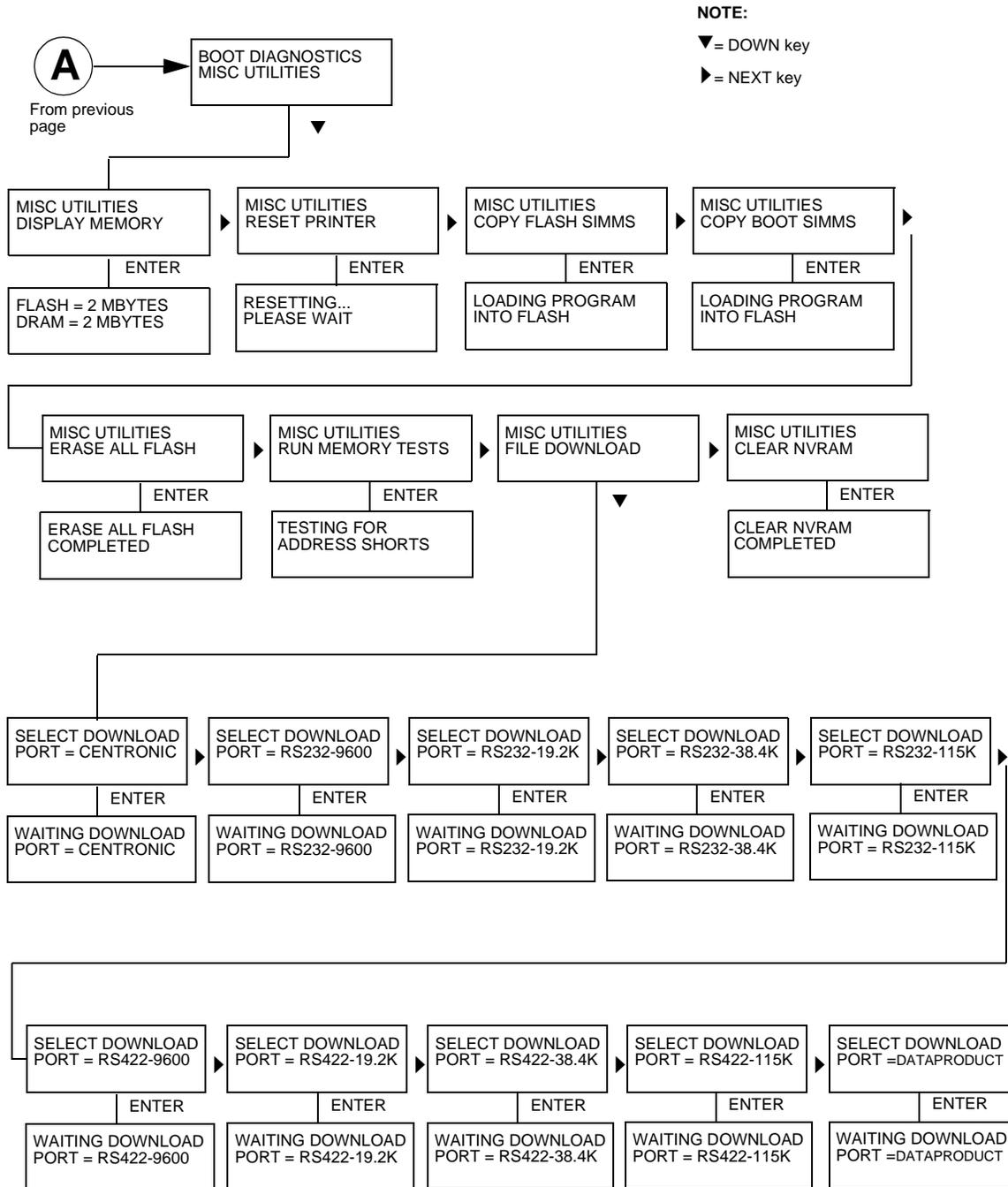


Figure 7. Boot Diagnostics Menu (continued)

## 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 92. To make a hex code printout, refer to the procedure on page 91.

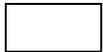
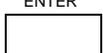
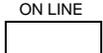
```

!"#$%&'()*+,-./ 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
!"#$%&'()*+,-./ 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F 30
123456789:;<=>?@ 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F 40
ABCDEFGHIJK...!"#$%& 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
GHIJKLMNOPQRSTUV 47 48 49 4A 4B 4C 4D 4E 4F 50 51 52 53 54 55 56
WXYZ[\]^_`abcdef 57 58 59 5A 5B 5C 5D 5E 5F 60 61 62 63 64 65 66
ghijklmnopqrstuv 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74 75 76
wxyz{|}~!"#$%&' 77 78 79 7A 7B 7C 7D 7E 20 21 22 23 24 25 26 27
'()*+,-./01234567 28 29 2A 2B 2C 2D 2E 2F 30 31 32 33 34 35 36 37
89:;<=>?@ABCDEFG 38 39 3A 3B 3C 3D 3E 3F 40 41 42 43 44 45 46 47
HI...!"#$%&'()*+,- 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
?@ABCDEFGHIJK...## 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

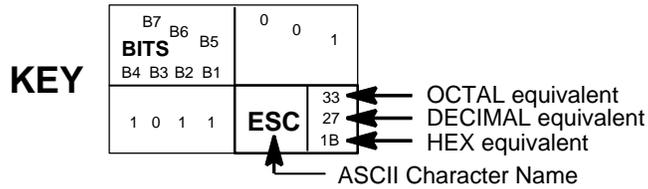
```

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 <b>ENTER</b> 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 92.		
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	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1				
B5	B4	B3	B2	B1	ROW	0		1		2		3		4		5					
0	0	0	0	0	0	<b>NUL</b>	0	<b>DLE</b>	20	<b>SP</b>	40	<b>0</b>	60	<b>@</b>	100	<b>P</b>	120	<b>\</b>	140	<b>p</b>	160
					0		0		16		32		48		64		80		96		112
					1	<b>SOH</b>	1	<b>DC1 (XON)</b>	21	<b>!</b>	41	<b>1</b>	61	<b>A</b>	101	<b>Q</b>	121	<b>a</b>	141	<b>q</b>	161
					1		1		17		33		49		65		81		97		113
					2	<b>STX</b>	2	<b>DC2</b>	22	<b>"</b>	42	<b>2</b>	62	<b>B</b>	102	<b>R</b>	122	<b>b</b>	142	<b>r</b>	162
					2		2		18		34		50		66		82		98		114
					3	<b>ETX</b>	3	<b>DC3 (XOFF)</b>	23	<b>#</b>	43	<b>3</b>	63	<b>C</b>	103	<b>S</b>	123	<b>c</b>	143	<b>s</b>	163
					3		3		19		35		51		67		83		99		115
					4	<b>EOT</b>	4	<b>DC4</b>	24	<b>\$</b>	44	<b>4</b>	64	<b>D</b>	104	<b>T</b>	124	<b>d</b>	144	<b>t</b>	164
					4		4		20		36		52		68		84		100		116
					5	<b>ENQ</b>	5	<b>NAK</b>	25	<b>%</b>	45	<b>5</b>	65	<b>E</b>	105	<b>U</b>	125	<b>e</b>	145	<b>u</b>	165
					5		5		21		37		53		69		85		101		117
					6	<b>ACK</b>	6	<b>SYN</b>	26	<b>&amp;</b>	46	<b>6</b>	66	<b>F</b>	106	<b>V</b>	126	<b>f</b>	146	<b>v</b>	166
					6		6		22		38		54		70		86		102		118
					7	<b>BEL</b>	7	<b>ETB</b>	27	<b>,</b>	47	<b>7</b>	67	<b>G</b>	107	<b>W</b>	127	<b>g</b>	147	<b>w</b>	167
					7		7		23		39		55		71		87		103		119
					8	<b>BS</b>	8	<b>CAN</b>	30	<b>(</b>	50	<b>8</b>	70	<b>H</b>	110	<b>X</b>	130	<b>h</b>	150	<b>x</b>	170
					8		8		24		40		56		72		88		104		120
					9	<b>HT</b>	9	<b>EM</b>	31	<b>)</b>	51	<b>9</b>	71	<b>I</b>	111	<b>Y</b>	131	<b>i</b>	151	<b>y</b>	171
					9		9		25		41		57		73		89		105		121
					10	<b>LF</b>	10	<b>SUB</b>	32	<b>*</b>	52	<b>:</b>	72	<b>J</b>	112	<b>Z</b>	132	<b>j</b>	152	<b>z</b>	172
					10		10		26		42		58		74		90		106		122
					11	<b>VT</b>	11	<b>ESC</b>	33	<b>+</b>	53	<b>;</b>	73	<b>K</b>	113	<b>[</b>	133	<b>k</b>	153	<b>{</b>	173
					11		11		27		43		59		75		91		107		123
					12	<b>FF</b>	12	<b>FS</b>	34	<b>,</b>	54	<b>&lt;</b>	74	<b>L</b>	114	<b>\</b>	134	<b>l</b>	154	<b> </b>	174
					12		12		28		44		60		76		92		108		124
					13	<b>CR</b>	13	<b>GS</b>	35	<b>-</b>	55	<b>=</b>	75	<b>M</b>	115	<b>]</b>	135	<b>m</b>	155	<b>}</b>	175
					13		13		29		45		61		77		93		109		125
					14	<b>SO</b>	14	<b>RS</b>	36	<b>.</b>	56	<b>&gt;</b>	76	<b>N</b>	116	<b>^</b>	136	<b>n</b>	156	<b>~</b>	176
					14		14		30		46		62		78		94		110		126
					15	<b>SI</b>	15	<b>US</b>	37	<b>/</b>	57	<b>?</b>	77	<b>O</b>	117	<b>_</b>	137	<b>o</b>	157	<b>DEL</b>	177
					15		15		31		47		63		79		95		111		127
							0		1F		2F		3F		4F		5F		6F		7F

## 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

---

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**

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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

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# 5

## *Adjustment Procedures*

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### **Introduction**

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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.

### **List of Adjustments**

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Preparing the Printer for Maintenance .....	page 100
Returning the Printer to Normal Operation.....	page 101
Belt, Paper Feed Timing, Adjustment .....	page 102
Belt, Platen Open, Adjustment .....	page 104
Paper Drive Motor Pulley Alignment .....	page 106
Paper Scale Alignment.....	page 108
Platen Gap Adjustment .....	page 110
Platen Open Motor Pulley Alignment .....	page 112
Ribbon Guide Alignment .....	page 114
Splined Shaft Skew Adjustment .....	page 116
Paper Out Adjustment.....	page 117
Hammer Phasing Adjustment .....	page 121
Set Shuttle Speed .....	page 123

## Preparing the Printer for Maintenance

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

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### 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.**

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### 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

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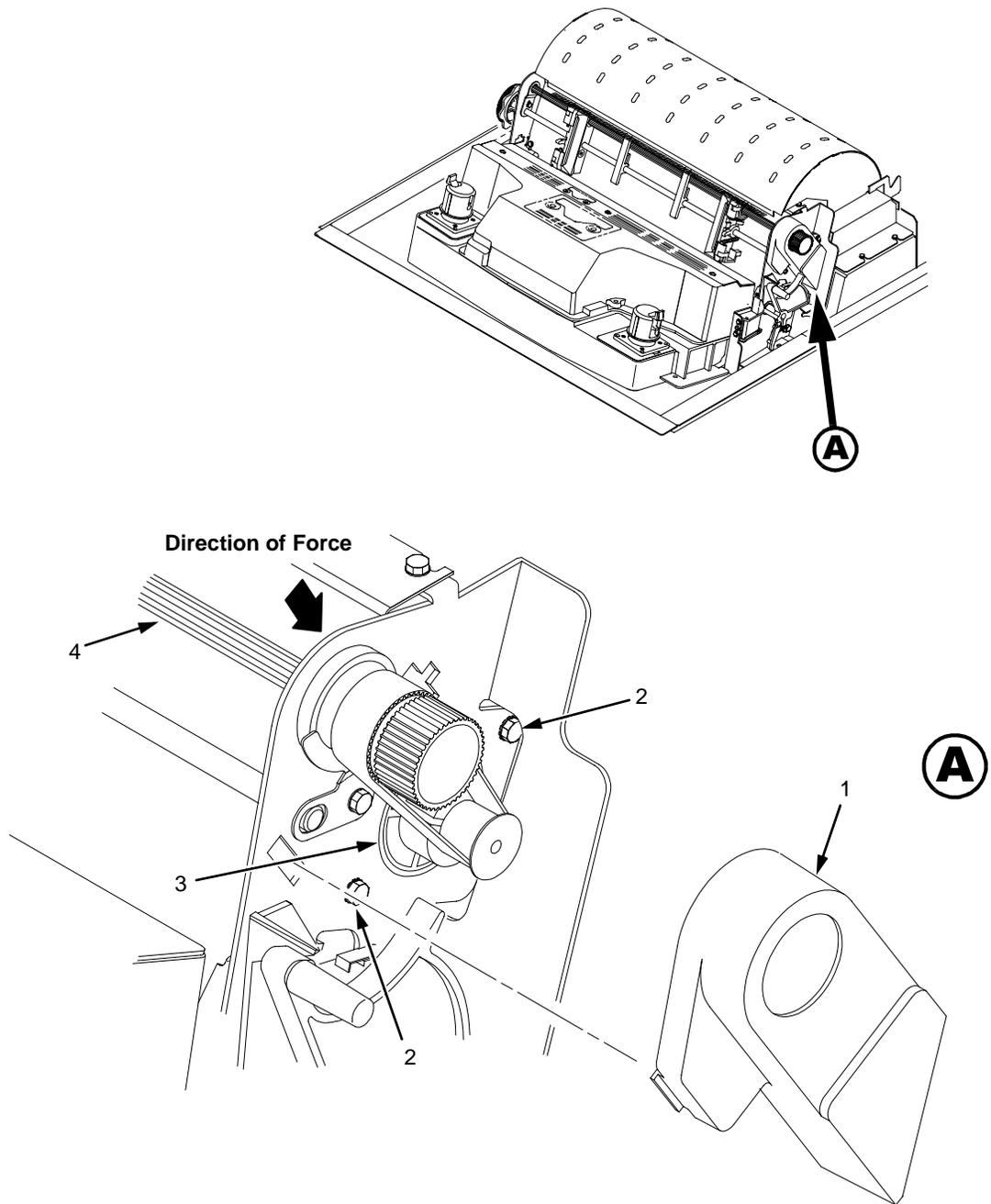
When you are finished servicing the printer, do the following steps:

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 85.)
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

---

1. Prepare the printer for maintenance (page 100).
2. Cabinet Models: Remove the paper path (page 161).  
Pedestal Models: Remove the top cover assembly (page 142).
3. Cabinet Models: Loosen four screws and remove the barrier shield. (See page 192, items 3, 4 and 9.)  
Pedestal Models: Loosen the four screws securing the paper guide and barrier shield and remove both. (See page 194, 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 192, items 3, 4 and 9.)  
Pedestal Models: Install the barrier shield and paper guide and tighten the four screws. (See page 194, items 3, 4, and 5.)
9. Cabinet Models: Install the paper path (page 161).  
Pedestal Models: Install the top cover assembly (page 142).
10. Return the printer to normal operation (page 101).



**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

---

1. Prepare the printer for maintenance (page 100).
2. Cabinet Models: Remove the paper path (page 161).  
Pedestal Models: Remove the top cover assembly (page 142).
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.

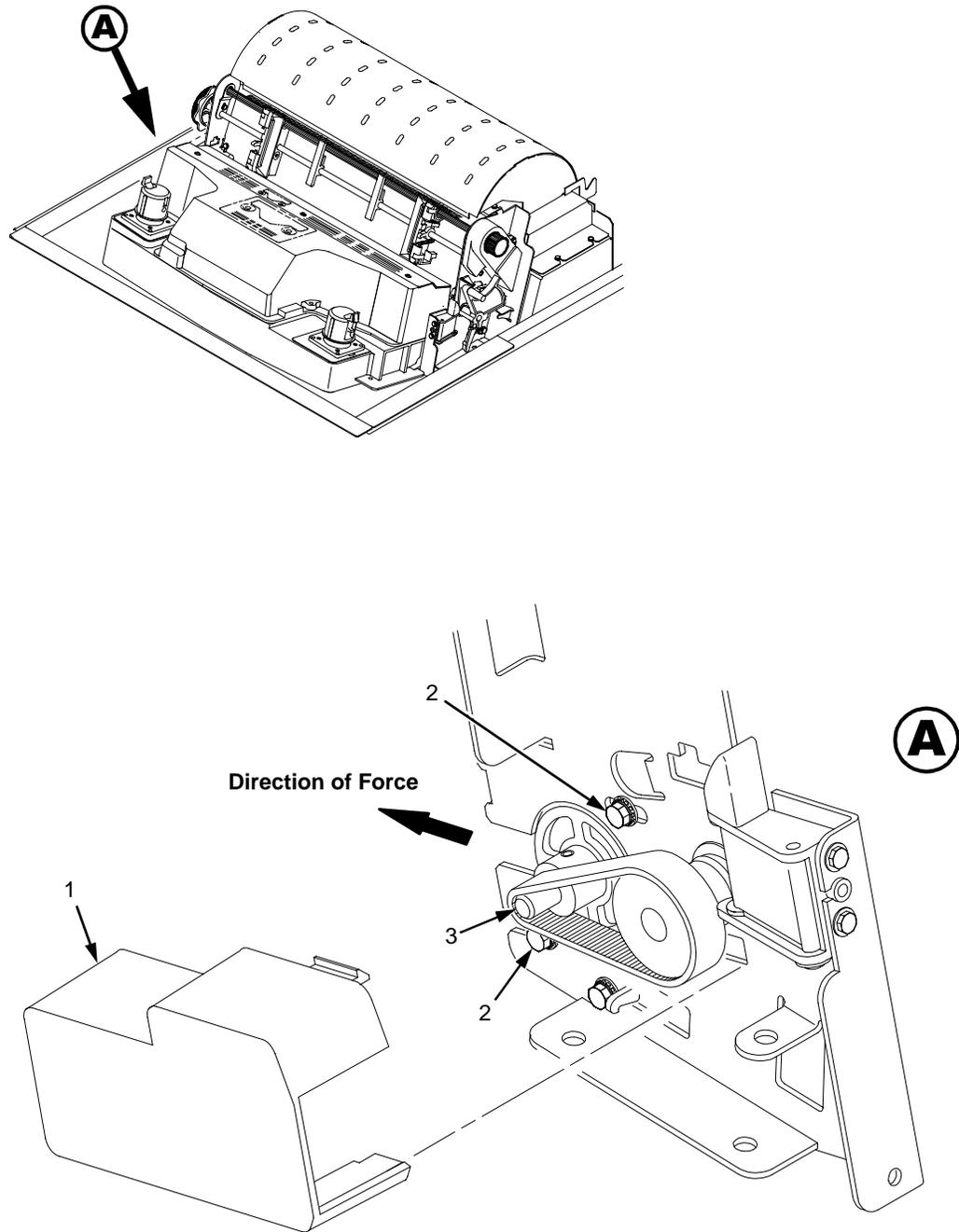
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### Caution



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 161).  
Pedestal Models: Install the top cover assembly (page 142).
  9. Return the printer to normal operation (page 101).



**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

---

1. Prepare the printer for maintenance (page 100).
2. Cabinet Models: go to step 3.  
Pedestal Models: Remove the top cover assembly (page 142).
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).

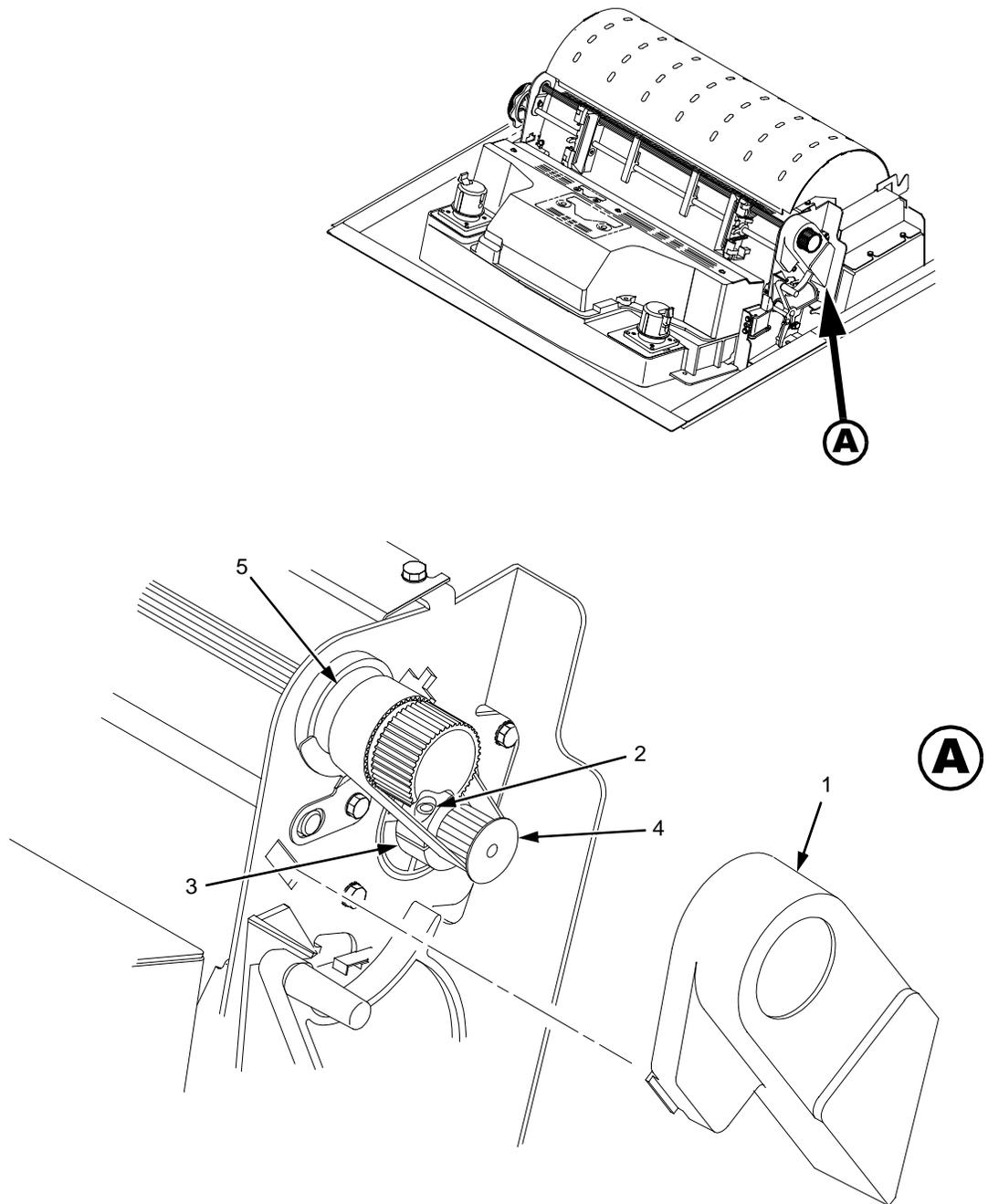
---

### 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 102). 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 142).
  10. Return the printer to normal operation (page 101).



**Legend:**

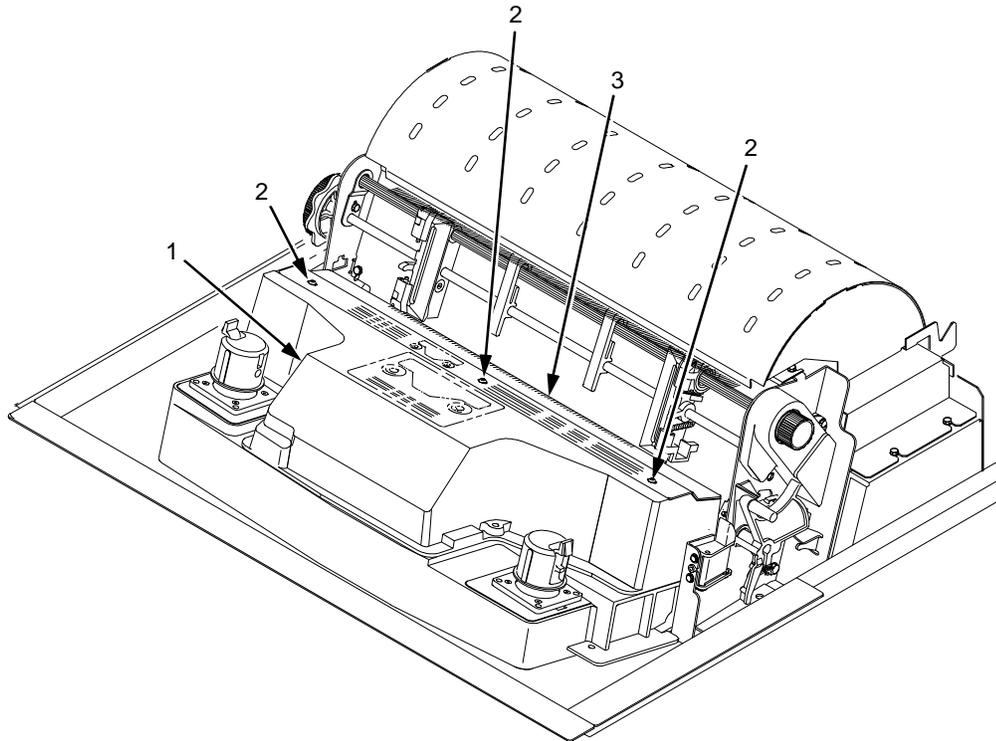
- 1) Belt Shield
- 2) Cap Screw
- 3) Motor Pulley Collar
- 4) Motor Pulley
- 5) Splined Shaft Pulley

**Figure 11. Paper Drive Motor Pulley Alignment**

## Paper Scale Alignment

---

1. Open the printer cover.
2. Load paper and ribbon.
3. Connect the power cord to the AC power source.
4. Set the printer power switch to 1 (on).
5. Verify that the shuttle cover (1) is properly installed (page 141).
6. Print a full 136 column line by selecting and running one of the diagnostic self-tests. (See page 85.)
7. Check alignment of the scale to the print at column positions 1 and 136.
8. If adjustment is necessary, loosen the three 5/64 inch button-head hex screws (2).
9. Position the scale (3) so that column positions 1 and 136 line up with the first and last characters on the 136 character printout.
10. Tighten the 5/64 inch button-head hex screws (2).
11. Close the printer cover.



**Legend:**

- 1) Shuttle Cover
- 2) Screw, Button-Head, 5/64 inch hex (3)
- 3) Paper Scale

**Figure 12. Paper Scale Alignment**

## Platen Gap Adjustment

### 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 100).
2. Remove the shuttle cover assembly (page 141).
3. Loosen the platen open belt (page 104, 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.

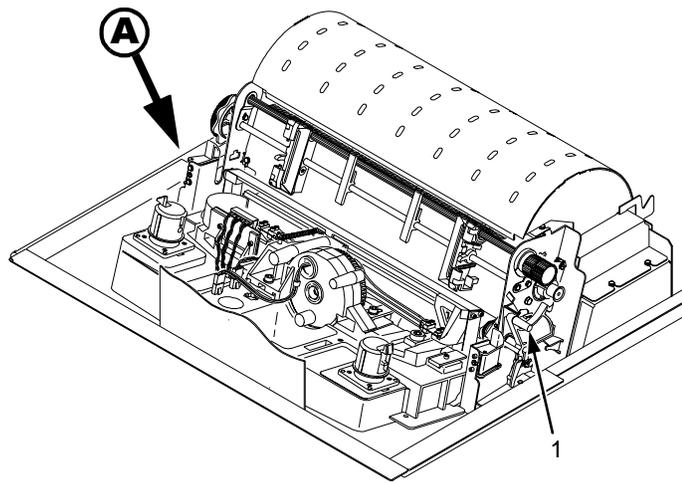
5. Insert a 0.011 inch (0.28 mm) flat feeler gauge (2) straight down between the hammer bank cover plate (3) and ribbon mask (4), within four hammer positions of the left end of the hammer bank.

### Caution

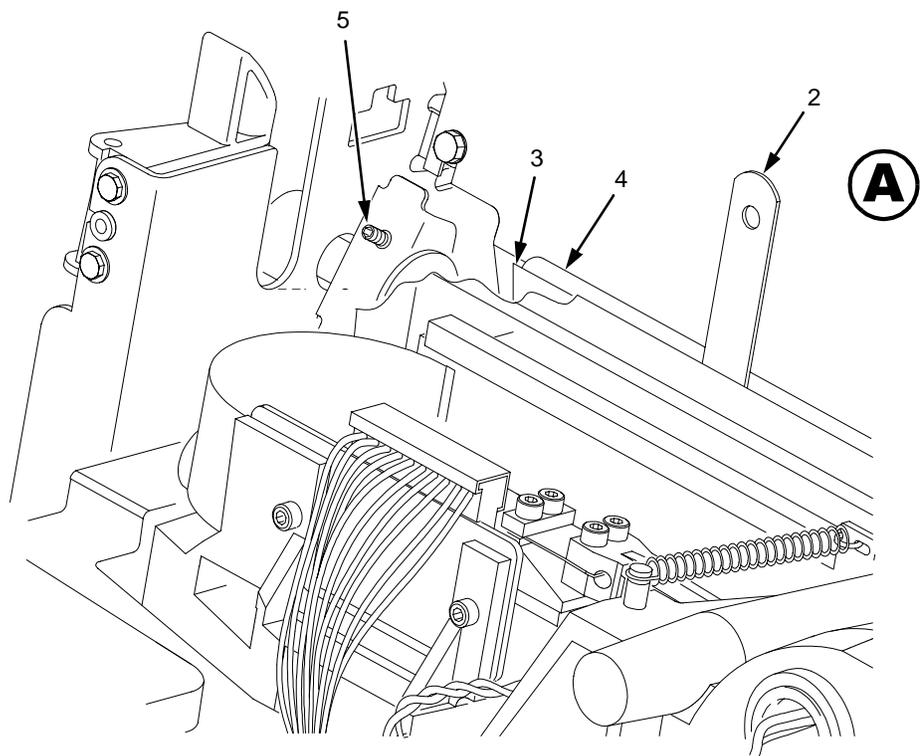


Adjust the platen set screws less than 1/4 turn on one side, then check the other side. Adjustment sensitivity is approximately 0.03 inch per revolution of the set screw. Also, insert the feeler gauge no more than 2 inches down from the top of the ribbon mask.

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 104).
10. Install the shuttle cover assembly (page 141).
11. Check the hammer phasing adjustment (page 121).
12. Return the printer to normal operation (page 101).



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



**Legend:**

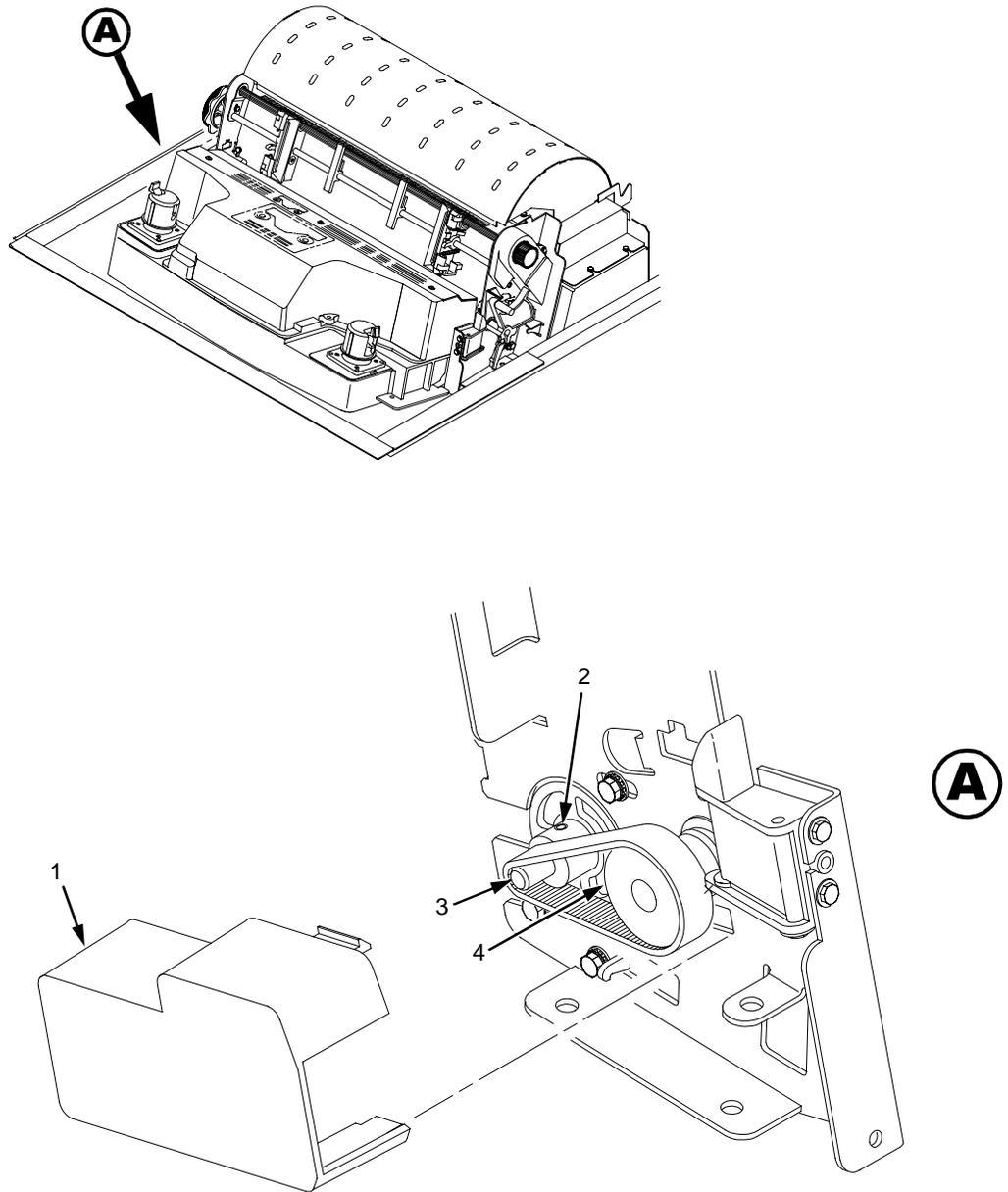
- 1) Forms Thickness Lever
- 2) Feeler Gauge
- 3) Hammer Bank Cover
- 4) Ribbon Mask
- 5) Set Screw, 3/32 inch hex (2)

**Figure 13. Platen Gap Adjustment**

## Platen Open Motor Pulley Alignment

---

1. Prepare the printer for maintenance (page 100).
2. Cabinet Models: Go to step 3.  
Pedestal Models: Remove the top cover assembly (page 142).
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 104). 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 142).
9. Return the printer to normal operation (page 101).



**Legend:**

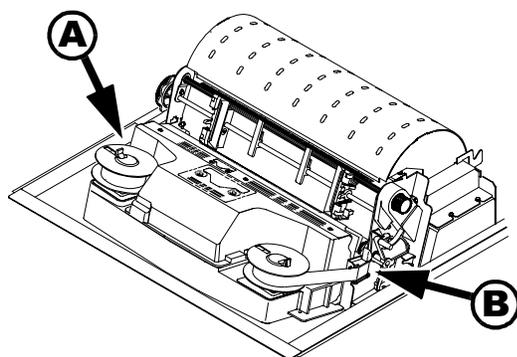
- 1) Belt Cover
- 2) Set Screw
- 3) Platen Open Motor Pulley
- 4) Platen Shaft Pulley

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

## Ribbon Guide Alignment

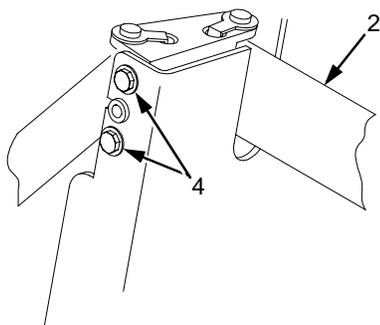
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1. Open the printer cover.
2. Load paper and install the ribbon. To align a ribbon guide, wind the ribbon fully onto the ribbon spool on the opposite side. For example, to align the left ribbon guide, wind the ribbon until the right ribbon spool is 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.

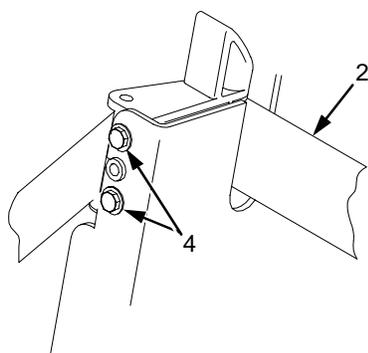
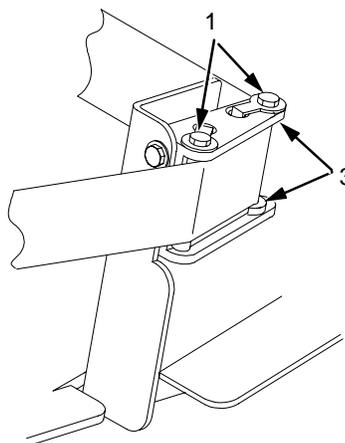


**A** Left Ribbon Guide

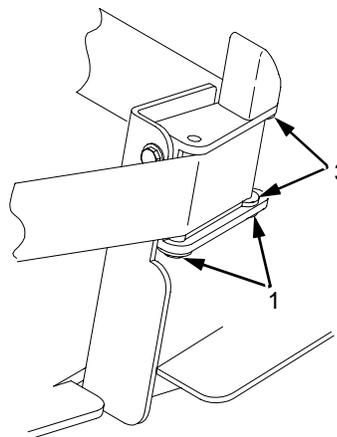
Right Ribbon Guide **B**



Early Models



Later Models



**Legend:**

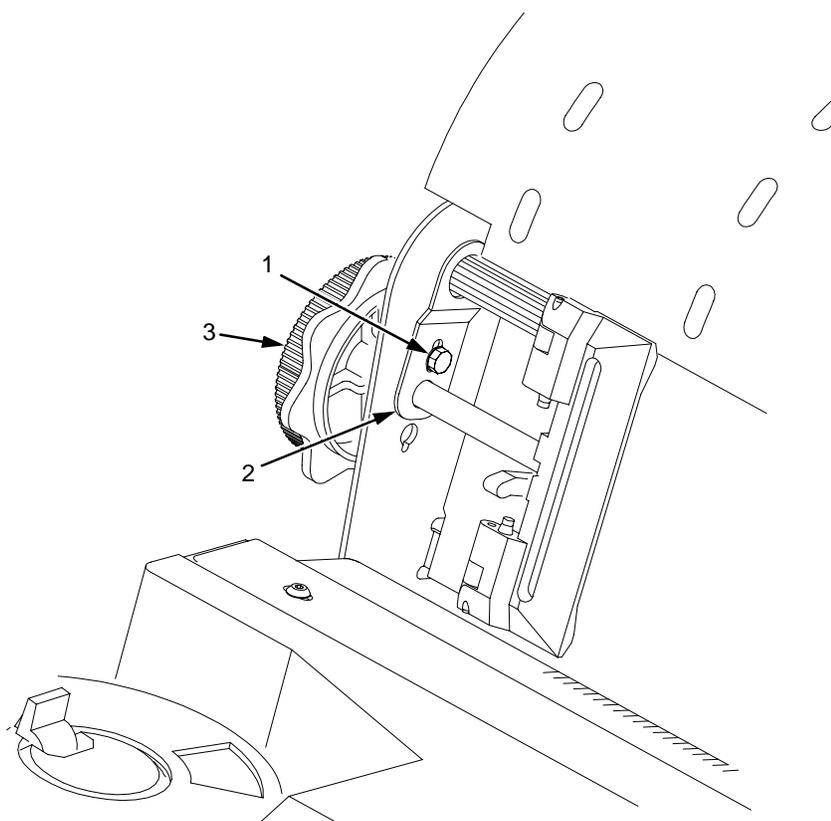
- 1) Screw, Skid (2)
- 2) Ribbon
- 3) White Nylon Washer
- 4) Screw, Retaining (2)

**Figure 15. Ribbon Guide Alignment**

## Splined Shaft Skew Adjustment

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 101).



**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.

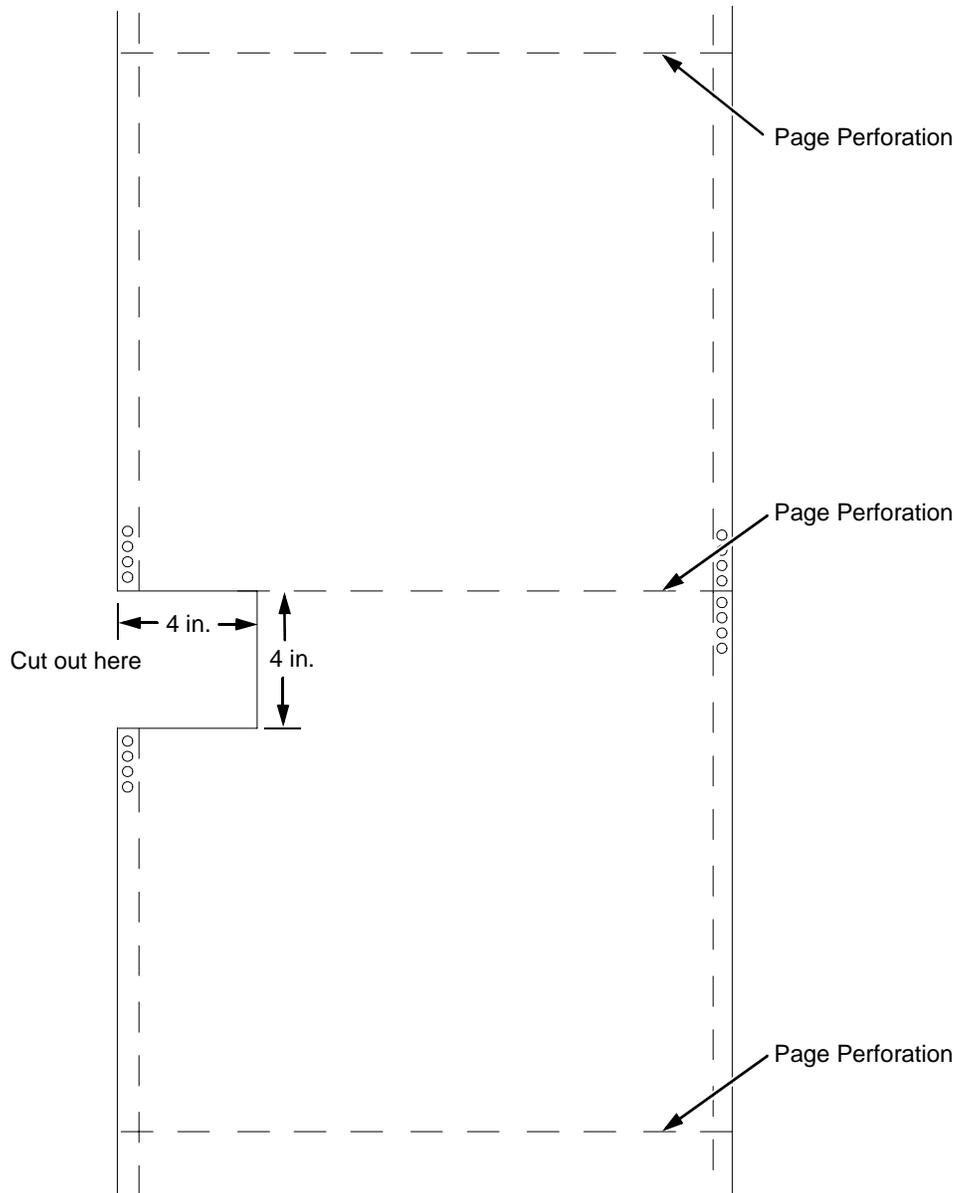
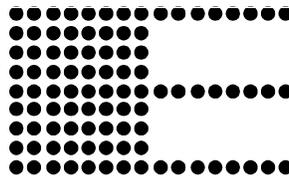


Figure 17. Paper Preparation for Paper Out Adjustment Test

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 “PAP 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.

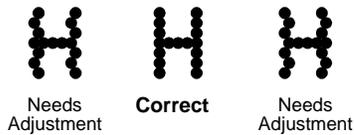
Phasing should be adjusted with the printer printing at full paper width.

### 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 LineJet 500 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 500 lpm printer as part of other maintenance tasks.

---

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 121).
13. Adjust the paper out distance (page 117).
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 101).



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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 126.

- **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 183.

## 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 100).
2. Cabinet Models: Remove the paper path (page 161).  
Pedestal Models: Remove the top cover assembly (page 142).
3. Cabinet Models: Loosen four screws and remove the barrier shield.  
(See page 192, items 3, 4, and 9.)  
Pedestal Models: Loosen four screws and remove the paper guide and barrier shield. (See page 194, 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 192, item 7.)
5. Loosen the 7/64 inch setscrew in the paper feed motor pulley collar. (See page 208, item 8.)
6. Loosen (do not remove) the two 5/16 inch paper feed motor mount screws. (See page 208, 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 192, item 7.)
5. Cabinet Models: Install the barrier shield and tighten the four screws.  
(See page 192, items 3, 4, and 9.)  
Pedestal Models: Install the barrier shield and paper guide and tighten the four screws. (See page 194, items 3, 4, and 5.)
6. Cabinet Models: Install the paper path (page 161).  
Pedestal Models: Install the top cover assembly (page 142).
7. Return the printer to normal operation (page 101).

---

## Belt, Platen Open

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Cabinet Models: Remove the paper path (page 161).  
Pedestal Models: Remove the top cover assembly (page 142).
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 206, item 24).
4. Loosen (do not remove) the two 5/16 inch mounting screws of the platen open motor (page 208, 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 208, 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 161).  
Pedestal Models: Install the top cover assembly (page 142).
7. Return the printer to normal operation (page 101).

## Circuit Breaker

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Remove the card cage fan (page 148).
3. Disconnect the four circuit breaker electrical leads.  
(Cabinet Models: See page 210.  
Pedestal Models: See page 196.)
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 210.  
Pedestal models: See page 196.)

---

### 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 210.  
Pedestal Models: See page 196.)
  3. Install the card cage fan (page 148).
  4. Return the printer to normal operation (page 101).

---

## 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 100).
2. Cabinet Models: Remove the paper path (page 161).  
Pedestal Models: Remove the top cover assembly (page 142).
3. Remove the stiffening clip (page 133).
4. Disconnect the cable connector shell containing the cable assembly that you will replace.
5. 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.
6. Disengage the key tab(s) on the cable connector from the slots in the side of the connector shell.
7. 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. Install the stiffening clip (page 133).
5. Connect the cable connector shell to its printer connection.
6. Cabinet Models: Install the paper path (page 161).  
Pedestal Models: Install the top cover assembly (page 142).
7. Return the printer to normal operation (page 101).

**P106 Connector Configuration**

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

Connectors are viewed from the top, as seen when plugged into CMX controller board.

Pin No.

**P107 Connector Configuration**

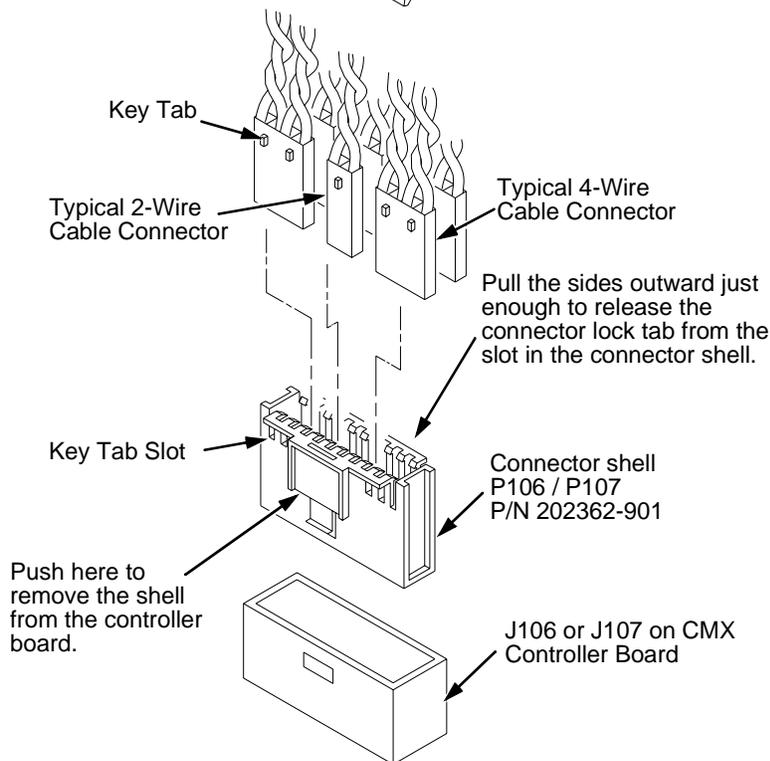
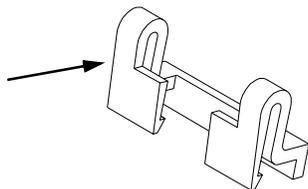
19	17	15	13	11	9	7	5	3	1
MPU		PLO		EHF		PAPR M			
CVO		RRP		HBF		RRIB M			
20	18	16	14	12	10	8	6	4	2

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

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

Connectors P106 and P107 have stiffening clips. See page 133.



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

## Connector Stiffening Clips

---

Connector stiffening clips are used on connectors P106 and P107 to help prevent accidental removal of wires when the connector shells are disconnected from the CMX board.

### Removal

1. Prepare the printer for maintenance (page 100).
2. Cabinet Models: Remove the paper path (page 161).  
Pedestal Models: Remove the top cover assembly (page 142).
3. Unsnap the front (open side) of the clip from the connector shell, release the back of the clip from the lip of connector shell P107, and work the stiffening clip off the cable bundle. (See Figure 19.)
4. Repeat step 3 for the P106 connector.
5. Cabinet Models: Install the paper path (page 161).  
Pedestal Models: Install the top cover assembly (page 142).
6. Return the printer to normal operation (page 101).

### Installation

1. Prepare the printer for maintenance (page 100).
2. Cabinet Models: Remove the paper path (page 161).  
Pedestal Models: Remove the top cover assembly (page 142).
3. Work the stiffening clip over the cable bundle, engage the back of the clip under the lip of connector shell P107, then snap the front (open side) of the clip down over the connector shell. (See Figure 19.)
4. Repeat step 3 for the P106 connector.
5. Cabinet Models: Install the paper path (page 161).  
Pedestal Models: Install the top cover assembly (page 142).
6. Return the printer to normal operation (page 101).

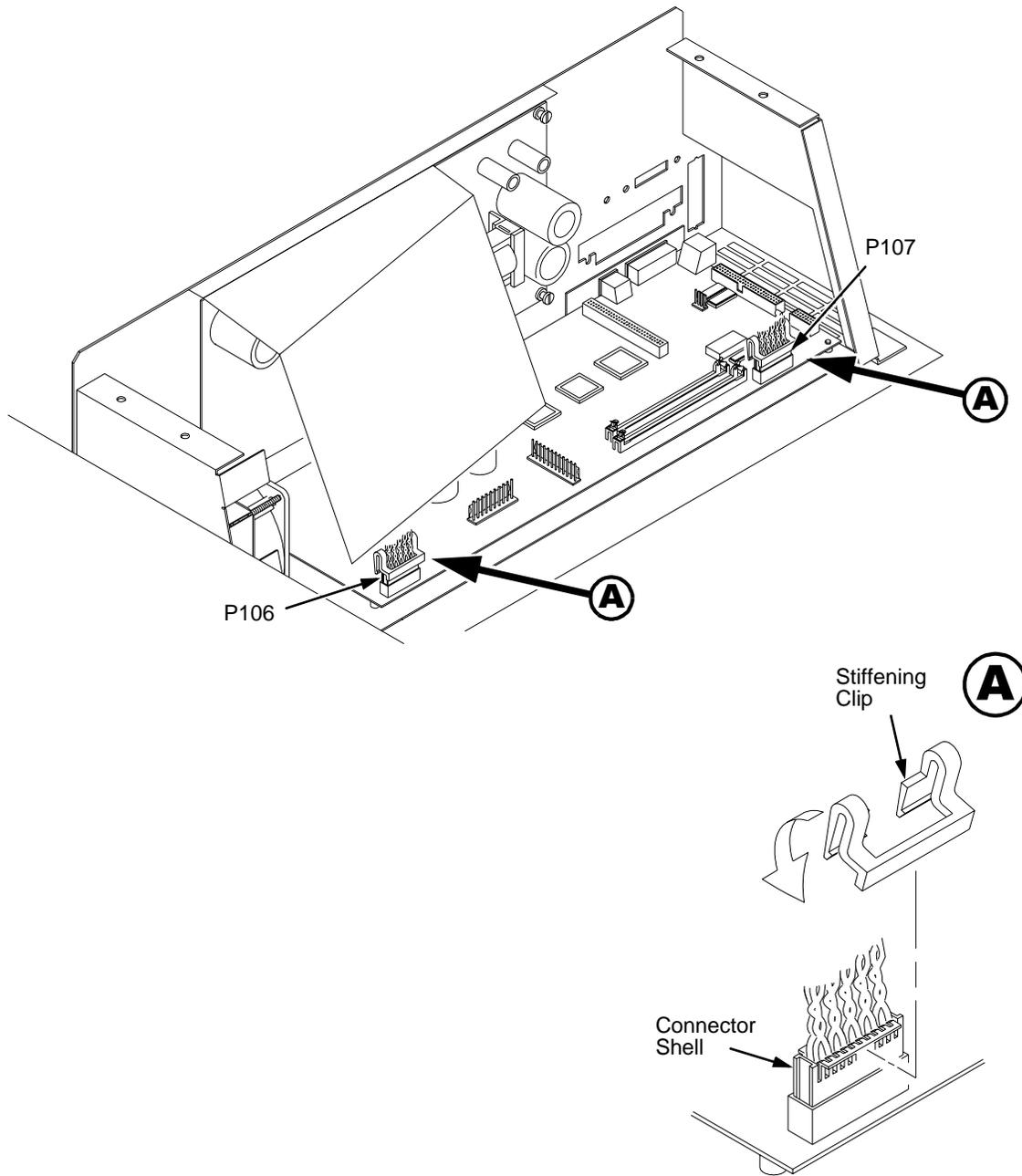


Figure 19. Connector Stiffening Clips

## Control Panel Assembly, Cabinet Models

---

### Removal

1. Prepare the printer for maintenance (page 100).
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 188, 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 188, 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 101).

## Control Panel Assembly, Pedestal Models

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Open the printer cover.
3. Loosen the four captive screws until the control panel is released from the printer top cover. (See page 190, item 2.)
4. Remove the two 5/16 inch screws securing the control panel ground straps. (See page 190, 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 101).

## 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 100).
  3. Cabinet Models: Remove the paper path (page 161).  
Pedestal Models: Remove the top cover assembly (page 142).
  4. Disconnect all cable connectors from the controller board. (See page 198.)
  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.

- 
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 198.)
  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 161).  
Pedestal Models: Install the top cover assembly (page 142).

---

### 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. 500 lpm models only: set shuttle speed if the original CMX board was replaced (page 123).
  8. Adjust the hammer phasing (page 121).
  9. Adjust the paper out distance (page 117).
  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 100).
2. Remove the shuttle frame assembly (page 177).
3. 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 20.)

---

### 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.

---

4. 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 20.)

### 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. 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.
2. 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 20.
3. 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 20.
4. Install the shuttle frame assembly (page 177).
5. Return the printer to normal operation (page 101).

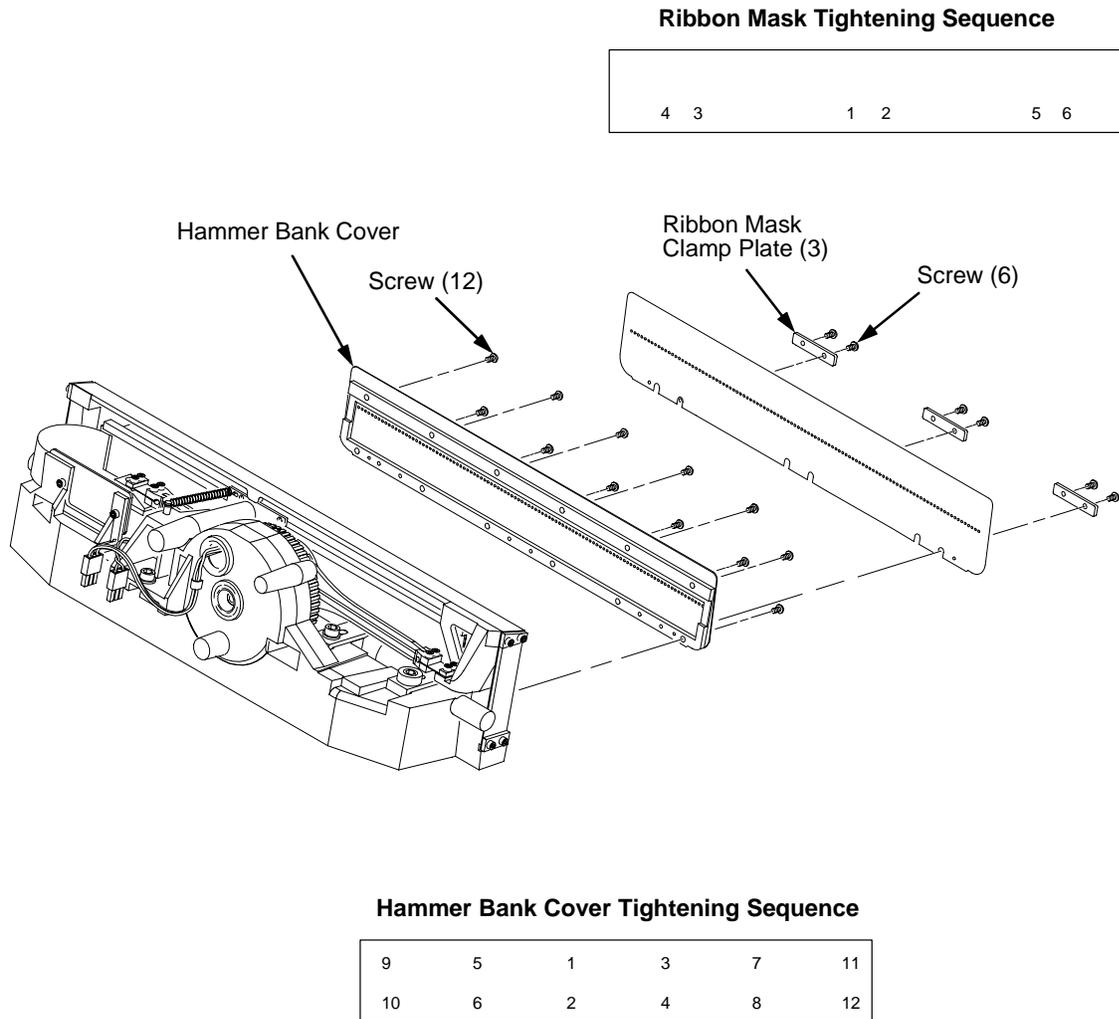


Figure 20. Hammer Bank Cover Assembly / Ribbon Mask

## Cover Assembly, Shuttle

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Loosen the shuttle cover screws (page 192, 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 192, item 2).
  3. Return the printer to normal operation (page 101).

## Cover Assembly, Top, Pedestal Models

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Loosen, but do not remove, the two #2 Phillips hold-down screws on the rear of the printer. (See page 190, 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 190, 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 190, 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 101).

---

## Dashpot

---

**Caution**

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

This procedure applies only to cabinet models.

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Open the cabinet rear door.
3. Pry back the spring retaining clips. (See Figure 30, page 188.)
4. Remove the dashpot from the ball studs.

### Installation

**Caution**

The dashpot must be installed with the large cylinder in the uppermost position.

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

---

1. Position the dashpot against the ball studs on the upper and lower brackets. (See Figure 30, page 188.) The large cylinder must be uppermost.
2. Using external grip ring pliers to spread the retaining clips, push the dashpot 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 101).

## Ethernet Interface Assembly

---

**NOTE:** The LineJet network board is an optional 10/100Base-T Ethernet adapter. This option is available factory installed or as a field kit. The functions of the LEDs and DIP switches on the Ethernet interface board are described on page 145.

To convert an Ethernet-equipped printer to a parallel interface, remove the Ethernet board assembly and install the Centronics connector in the slot the Ethernet board occupied. The Centronics cable joins the back of the Ethernet board to the controller board.

### 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 106).
2. Cabinet Models: Remove the paper path (page 161).  
Pedestal Models: Remove the top cover assembly (page 142).
3. Disconnect Centronics cable connector P112 from connector J112 on the CMX controller board. (See page 212, item 5.)
4. Open the ferrite clamp and lift the Centronics cable out of the ferrite clamp.
5. Loosen the two screws securing the LineJet Ethernet interface assembly to the cutout at the rear of the card cage.
6. Slide the Ethernet interface assembly out of the cutout in the card cage and lift the assembly out of the card cage.

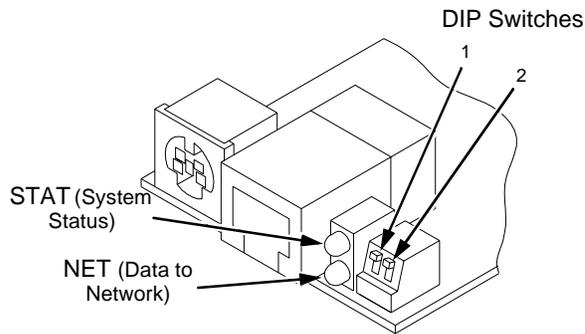
### Installation

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

1. Reverse steps 2 through 6 of the removal procedure.
2. Return the printer to normal operation (page 107).

## 10/100Base-T LEDs and DIP Switches

The 10/100Base-T Ethernet interface has two indicator lights and two DIP switches, as shown below.



### STAT (Status) Indicator in Run and Auto Reset Modes

Run Mode is the normal operating state of this interface. Auto Reset mode is entered when the watchdog timer is triggered and the print server resets itself. In either mode, the STAT LED flashes at a varying rate, depending on whether the unit IP address is configured. The Run Mode and Auto Reset Mode indicator descriptions are shown in Table 5.

**Table 5. Run Mode and Auto Reset Mode Indicator Descriptions**

STAT	Rate	Indication
OFF	Flashes ON once per second	Normal Mode, IP address configured
OFF	Flashes ON 2 times per second	IP address not configured
ON	Flashes OFF once per second	Download (MOS)
ON	Flashes OFF twice per second	Error
ON	Constantly	Indicates link integrity
ON	Flashes OFF 1/3 second	Flashes off 1/3 second every time a packet is transmitted

### NET (Network) Indicator

The NET LED displays the status of the network link. When the NET LED is on, this confirms link integrity. The NET LED flashes off for 1/3 second when a data packet is being transferred. When the NET LED is off, the network connection has been severed.

## DIP Switches

On the back of the 10/100Base-T interface inside the printer, there are two DIP switches labeled 1 and 2. The functions of the DIP switches are explained in Table 6.

**Table 6. 10/100Base-T DIP Switch Settings**

DIP Switch		Description
1	2	
OFF	OFF	Normal operation. With both DIP switches in the "OFF" position, the interface boots up using the settings in flash memory rather than the default settings.
ON	OFF	Factory default settings. With the DIP switches in this configuration, the interface boots up and all settings stored in flash memory are erased except the Ethernet address and key value.
OFF	ON	Default IP. With the DIP switches in this configuration, the interface boots up with factory default settings, but the stored settings in flash memory remain intact. Setting DIP switch 2 to "ON" does not clear any settings stored in flash memory, it boots the unit in a different state with the settings in flash memory temporarily ignored.
ON	ON	If the interface is connected to a network with link integrity and then reset to MOS, a download will be forced. If the unit is not connected to a network, it will print a test page.

## Fan Assembly, Cabinet Exhaust

---

### Note



This procedure applies only to cabinet models.

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Open the front and rear cabinet doors and the printer cover.
3. Remove the paper fence/paper tray assembly. (See page 186.)
4. Remove the two 1/4 inch screws securing bottom of the air exhaust duct. (See page 188, 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 101).

## Fan Assembly, Card Cage

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Cabinet Models: Remove the paper path (page 161).  
Pedestal Models: Remove the top cover assembly (page 142).
3. Disconnect the card cage fan cable connector. (See page 208.)
4. Cabinet Models: Remove the two fan mounting screws from the bottom of the fan. (See page 208, item 2.)  
Pedestal Models: Remove the four fan mounting screws and nut. (See page 196, 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 101).

## Fan Assembly, Hammer Bank

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Remove the shuttle cover assembly (page 141).
3. Cabinet Models: Remove the paper path (page 161).  
Pedestal Models: Remove the top cover assembly (page 142).
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 131.)
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 208, 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 208.)
  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 131.)
  3. Install two screws in the locations shown in Figure 39 (page 208, item 21).
  4. Cabinet Models: Install the paper path (page 161).  
Pedestal Models: Install the top cover assembly (page 142).
  5. Install the shuttle cover assembly (page 141).
  6. Return the printer to normal operation (page 101).

## Hammer Spring Assembly

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Remove the shuttle frame assembly (page 177).
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 21, page 151.)
  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 21, page 151.)
  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 177).
    - 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.

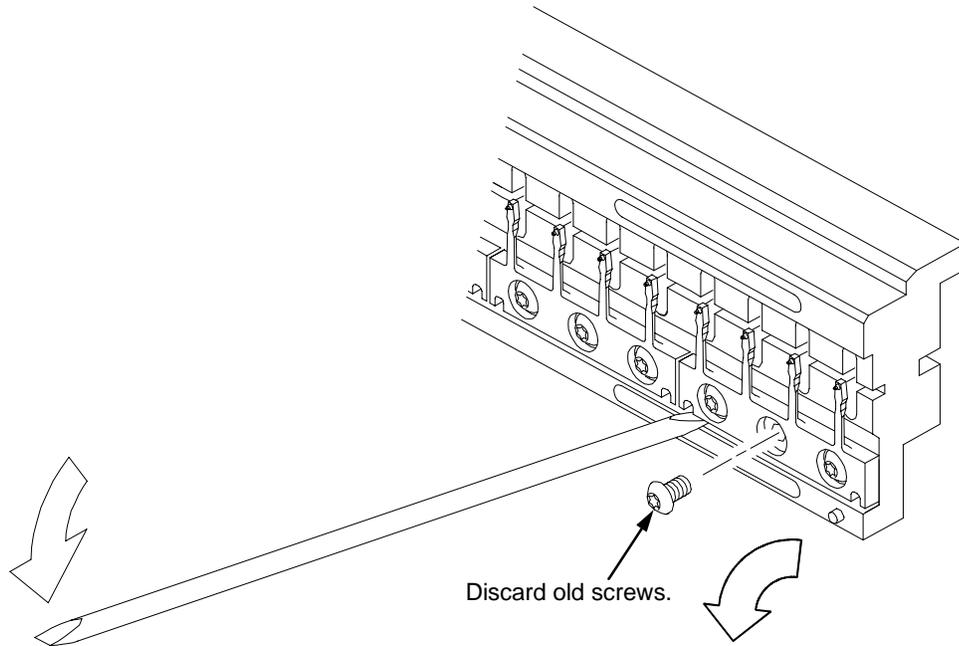
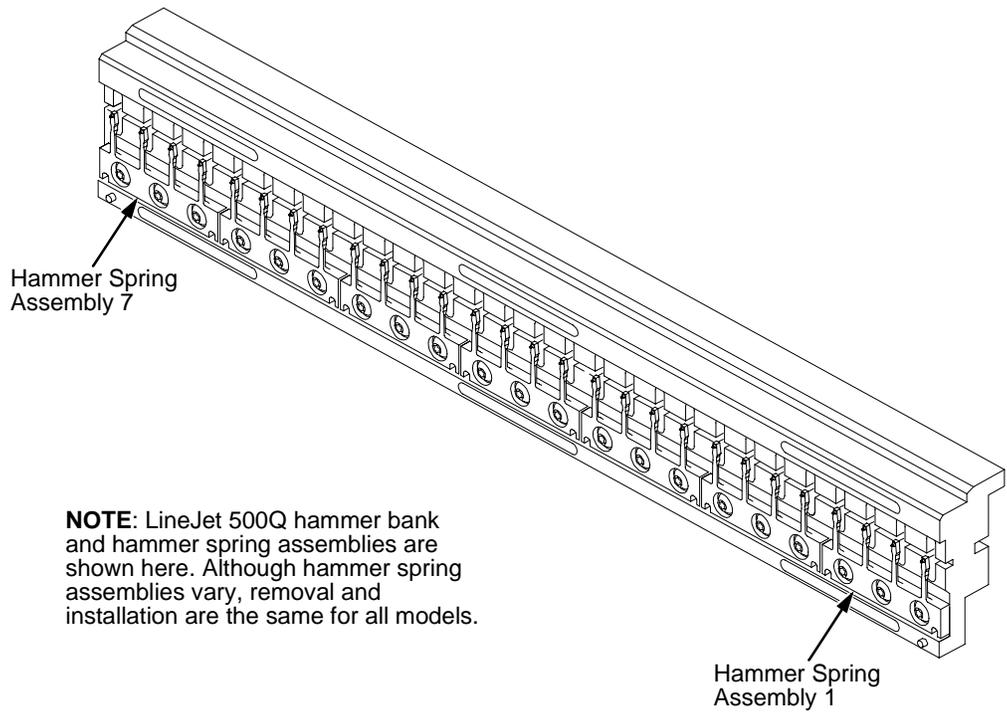


Figure 21. Hammer Spring Assembly, Removal

## 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 22, page 153.)
  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 22, page 153.)
  5. Install the hammer bank cover assembly (page 139).
  6. Install the shuttle frame assembly (page 177).
  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 84).
    - a. If print quality is acceptable, return the printer to normal operation (page 101).
    - b. If print quality is still degraded, replace the shuttle frame assembly (page 177).

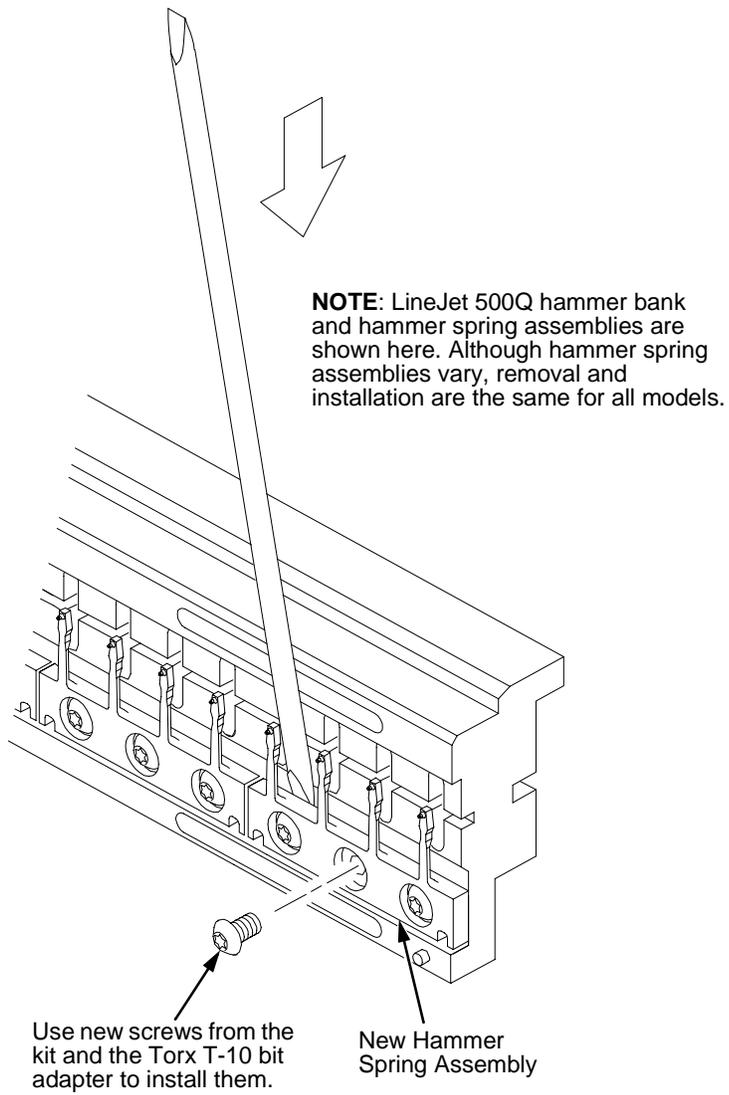


Figure 22. Hammer Spring Assembly, Installation

## Magnetic Pickup (MPU) Assembly

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Remove the shuttle cover (page 141).
3. Disconnect the magnetic pickup (MPU) cable connector (page 202, item 5).
4. Loosen the 7/64 inch hex MPU clamp screw (page 202, 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 202).
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 202, item 5). Make sure the MPU cable does not touch the extension spring after cable connection.
5. Install the shuttle cover (page 141).
6. Adjust the hammer phasing (page 121).
7. Return the printer to normal operation (page 101).

## 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 100).
3. Cabinet Models: Remove the paper path (page 161).  
Pedestal Models: Remove the top cover assembly (page 142).

---

### 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 23, page 157.)
  5. If the security PAL must be replaced, remove the old PAL. (See Figure 23, page 157.) The printer uses security PAL P/N 154141-007PX.

## Installation

---

### Caution



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

---

---

### 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 157) 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 23, page 157.)
  - 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 161).  
Pedestal Models: Install the top cover assembly (page 142).
4. Download the emulation (page 285).
5. Return the printer to normal operation (page 101).
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

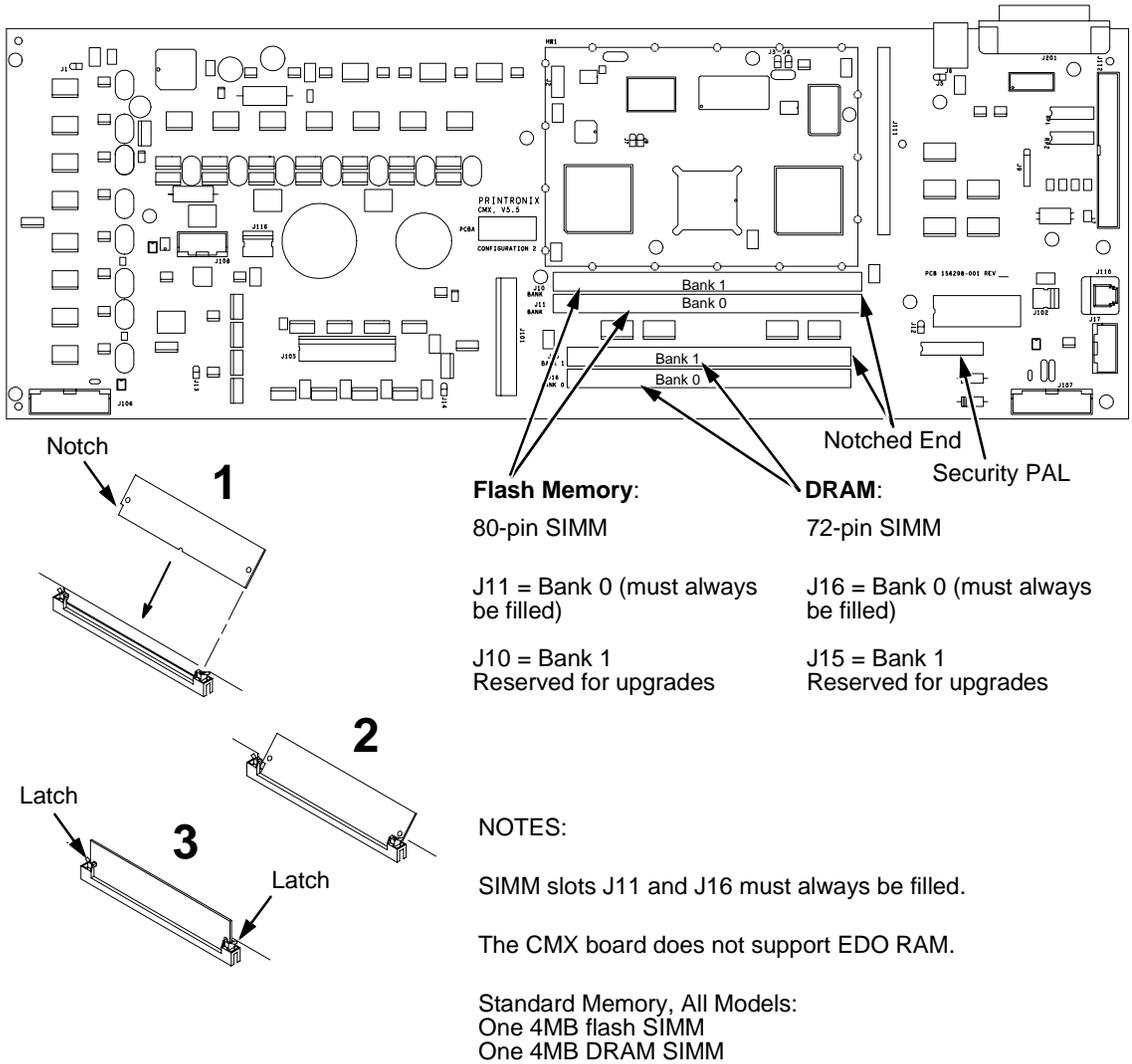


Figure 23. Memory Modules and Security PAL

## Paper Feed Motor

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Cabinet Models: Remove the paper path (page 161).  
Pedestal Models: Remove the top cover assembly (page 142).
3. Cabinet Models: Loosen four screws and remove the barrier shield. (See page 192, items 3, 4, and 9.)  
Pedestal Models: Loosen the four screws and remove the barrier shield and paper guide. (See page 194, 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 192, item 7).
5. Loosen, but do not remove, the two 5/16 inch paper feed motor mounting screws. (See page 208, 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 208, 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 132.)

---

**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 208, 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 132.)
3. Install the collar, paper feed motor pulley, and timing belt.
4. Align the paper feed motor pulley with the splined shaft pulley.

---

### 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 192, items 3, 4, and 9.)  
Pedestal Models: Install the barrier shield and paper guide and tighten the four screws. (See page 194, items 3, 4, and 5.)
  9. Cabinet Models: Install the paper path (page 161).  
Pedestal Models: Install the top cover assembly (page 142).
  10. Return the printer to normal operation (page 101).

## Paper Ironer

---

### 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 100).
2. Remove the shuttle frame assembly (page 177).
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 206, item 3).

### Installation

### Note



The black tape on the paper ironer faces toward the rear of the printer and 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 206, item 3.)
2. Push the paper ironer down into the slots until the tabs engage.
3. Install the shuttle frame assembly (page 177).
4. Return the printer to normal operation (page 101).

## Paper Path

---

**Note**

This procedure applies only to cabinet models.

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Loosen the three paper path hold-down screws (page 192, 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 192, Figure 32).
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 192, item 6).
4. Return the printer to normal operation (page 101).

## Platen

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Remove the shuttle frame assembly (page 177).
3. Remove the paper ironer (page 160).
4. Remove the three 1/4 inch screws securing the paper ironer bracket assembly and remove the assembly. (See page 206, items 4, 5, and 6.)
5. Remove the platen open belt (page 129).
6. Remove the platen pulley (page 206, 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 206, 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 206, 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 206, 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 208, 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.)

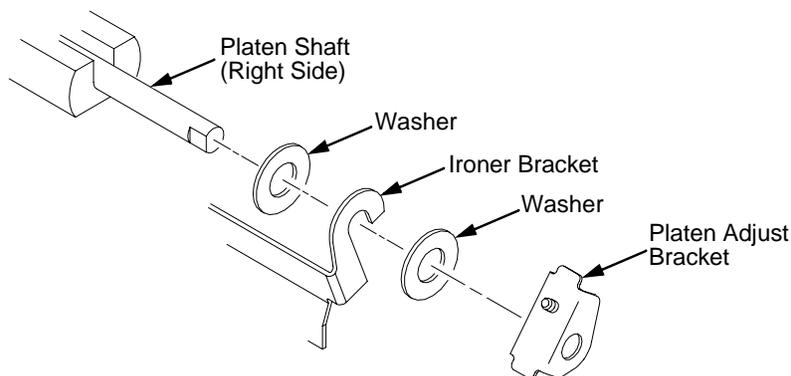
## Installation

### Note



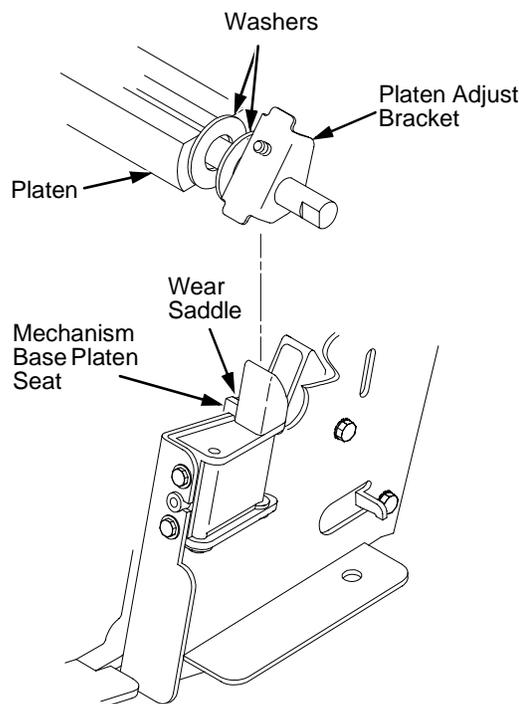
The dowel pins protruding from the ends of the platen are the platen shafts. The platen shafts are not of equal length. The platen must be installed with the longer shaft on the right side.

1. Wipe the platen shafts clean of grease and debris.
2. Install two washers on the longer (right) platen shaft. (See Figure 24 below.)
3. Apply bearing lubricant to both platen shafts.



**Figure 24. 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 25.)
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 25.



**Figure 25. 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 208, 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 206, 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 206, 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 24.)
  - 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 24.)

- 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 206, 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 206, items 21 and 23).
- 19. Install the paper ironer with the black tape towards the rear of the printer (page 206, item 3).
- 20. Install the shuttle frame assembly (page 177).
- 21. Adjust the platen gap (page 110).
- 22. Adjust the platen open belt (page 104).
- 23. Check ribbon guide alignment (page 114).
- 24. Check the hammer phasing (page 121).
- 25. Return the printer to normal operation (page 101).

## Platen Open Motor

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Cabinet Models: Remove the paper path (page 161).  
Pedestal Models: Remove the top cover assembly (page 142).
3. Cabinet Models: Remove the card cage fan (page 148).
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 206, item 24).
5. Loosen the two 5/16 inch motor mount screws (page 208, 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 132.)

---

### 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 208, 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.

---

### 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 148).
  11. Cabinet Models: Install the paper path (page 161).  
Pedestal Models: Install the top cover assembly (page 142).
  12. Return the printer to normal operation (page 101).

## 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 100).
2. Cabinet Models: Remove the paper path (page 161).  
Pedestal Models: Remove the top cover assembly (page 142).
3. Disconnect output connector P101 from the controller board and AC input connector P1 from the power supply board. (See page 198, items 7 and 8.)
4. Loosen the three captive screws securing the power supply board to the rear wall of the card cage. (See 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 101).

## 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 26, page 170.)

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 100).
2. Cabinet Models: Remove the paper path (page 161).  
Pedestal Models: Remove the top cover assembly (page 142).
3. Locate the terminating resistor packs. (See Figure 26, page 170.)
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 26, page 170.)

2. Cabinet Models: Install the paper path (page 161).  
Pedestal Models: Install the top cover assembly (page 142).
3. Return the printer to normal operation (page 101).

### CMX Controller Board

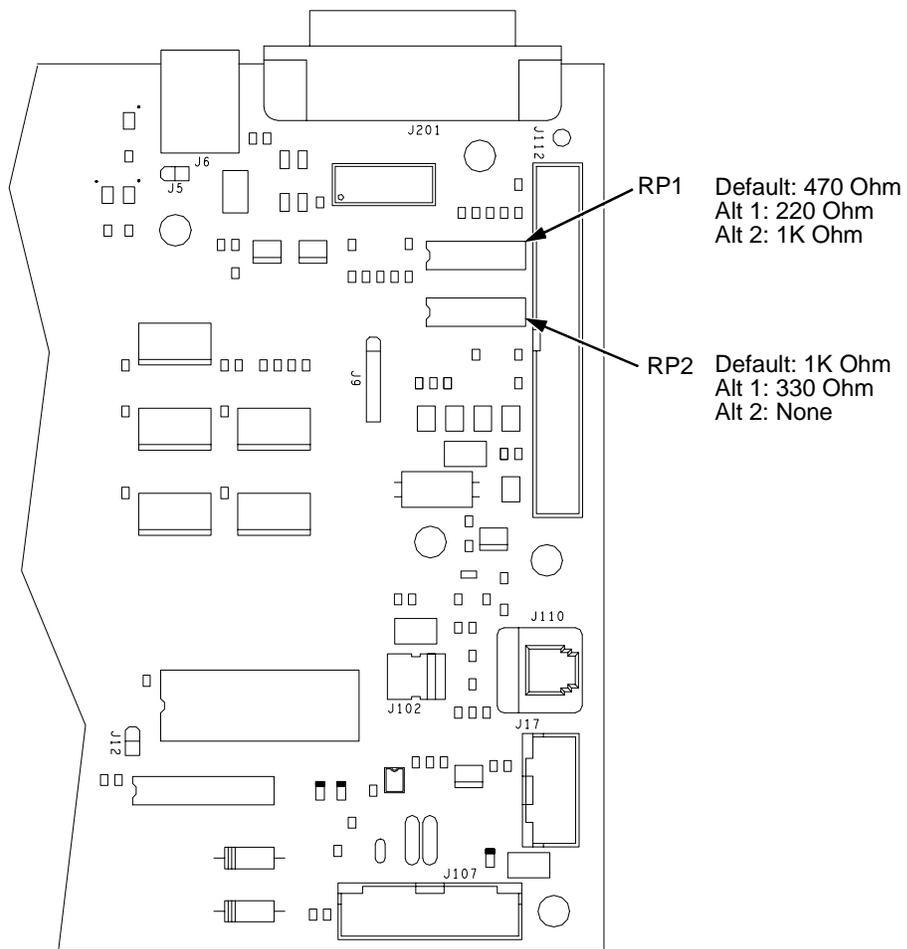


Figure 26. Terminating Resistors, Removal/Installation

## Ribbon Drive Motor

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Remove the ribbon hub (page 173).
3. Remove two screws and washers securing the ribbon drive motor to the base casting. (See page 208, 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 208, item 17.)

---

2. Return the printer to normal operation (page 101).

## Ribbon Guide Assembly (L/R)

---

### Note



The right ribbon guide is shown exploded in Figure 39 on page 208. The removal procedure is the same for both ribbon guides.

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Cut and remove the tie-wrap from the tie wrap hole to free the ribbon guide cable. (See page 208, item 11.)
3. Cabinet Models: Remove the paper path (page 161).  
Pedestal Models: Remove the top cover assembly (page 142).
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 132).
7. Remove the two 7/32 inch screws and washers securing the ribbon guide assembly to the side plate. (See page 208, 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 114).
3. Return the printer to normal operation (page 101).

## Ribbon Hub

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Loosen the Torx T-10 screw in the ribbon spool hub (page 208, 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 208, 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 101).

## Shaft, Splined

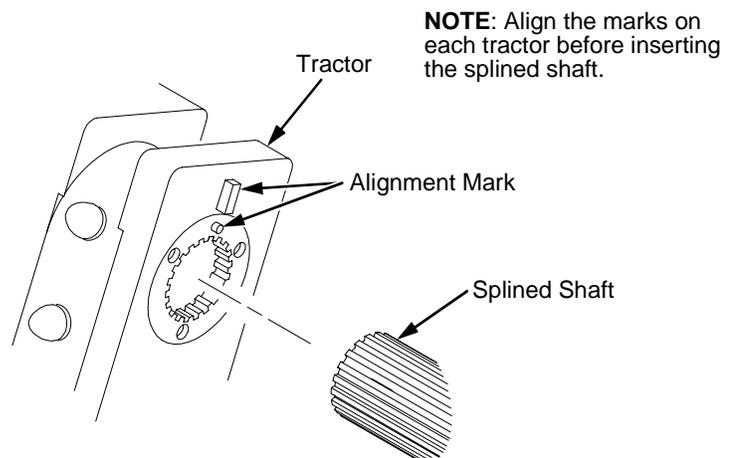
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### Removal

1. Prepare the printer for maintenance (page 100).
2. Remove the paper supports from the splined shaft and support shaft. (See page 204, item 20.)
3. Remove the paper feed timing belt (page 128).
4. Remove the 1/4 inch screw securing the ground clip, and remove the clip (page 204, items 10 and 11).
5. With grip ring pliers, remove the grip ring from left side of the splined shaft (page 204, item 6).
6. Pull the bearing and spring link with the spring off the left side of the splined shaft (page 204, 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 204, 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 27 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 204.) 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 128).
10. Set the paper feed timing belt tension (page 102).
11. Adjust splined shaft skew (page 116).
12. Install the paper supports on the splined shaft and support shaft. (See page 204, item 20.)
13. Return the printer to normal operation (page 101).



**Figure 27. Splined Shaft and Tractor Installation**

## Shaft, Support

---

### Removal

1. Prepare the printer for maintenance (page 100).
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 204, item 20.)
4. Remove the E-ring (page 204, item 17).

---

### Note



Hold the tractors while removing the support shaft. Be careful not to lose the curved spring washers. (See page 204, 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 204, 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 204, 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 204, item 20.)
6. Return the printer to normal operation (page 101).

## Shuttle Frame Assembly

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Remove the shuttle cover assembly (page 141).
3. Disconnect the MPU cable connector P03 and shuttle motor cable connector P02 (page 202, 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 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 the shuttle frame assembly slowly and carefully: it 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 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 202, item 6.)
  10. Route the MPU cable under the extension spring and connect the MPU cable connector. (See page 202, 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 110); otherwise, skip to step 12.
  12. Install the shuttle cover assembly (page 141).
  13. 500 lpm models only: set shuttle speed if original shuttle frame assembly was replaced (page 123).
  14. Adjust the hammer phasing (page 121).
  15. Return the printer to normal operation (page 101).

## Spring, Extension, Hammer Bank

---

---

### Caution



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

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Remove the shuttle cover assembly (page 141).
3. Unhook the extension spring from the spring lugs on the hammer bank and shuttle frame. (See page 202, 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 202, item 4.)
3. Install the shuttle cover assembly (page 141).
4. Return the printer to normal operation (page 101).

## Switch Assembly, Paper Detector

### Removal

1. Prepare the printer for maintenance (page 100).
2. Cabinet Models: Remove the paper path (page 161).  
Pedestal Models: Remove the top cover assembly (page 142).
3. Cabinet Models: Loosen four screws and remove the barrier shield.  
(See page 192, items 3, 4, and 9.)  
Pedestal Models: Loosen the four screws and remove the paper guide and barrier shield. (See page 194, items 3, 4, and 5.)
4. Remove the two 1/4 inch screws securing the paper detector switch assembly. (See page 208, 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 132).
7. Trace the paper detector switch cables to the connector shell, and remove the PMD and POD cable connector from the connector shell (page 131).
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 208, 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 132), then connect P106 to controller board connector J106.
5. Cabinet Models: Install the barrier shield and tighten the four screws. (See page 192, items 3, 4, and 9.)  
Pedestal Models: Install the barrier shield and paper guide and tighten the four screws. (See page 194, items 3, 4, and 5.)
6. Cabinet Models: Install the paper path (page 161).  
Pedestal Models: Install the top cover assembly (page 142).
7. Check the paper out adjustment (page 117).
8. Return the printer to normal operation (page 101).

## Switch Assembly, Platen Interlock

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Cabinet Models: Remove the paper path (page 161).  
Pedestal Models: Remove the top cover assembly (page 142).
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 132).
7. Remove two Phillips #1 screws securing the platen interlock switch assembly. (See page 206, 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 101).

## Tractor (L/R)

---

### Removal

1. Prepare the printer for maintenance (page 100).
2. Remove the support shaft (page 176).
3. Remove the splined shaft (page 174).

### Installation

1. Using the replacement tractors, install the support shaft (page 176).
2. Install the splined shaft (page 174).
3. Return the printer to normal operation (page 101).

## Section II: Illustrated Parts Lists

**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.

### Illustrations of Printer Components

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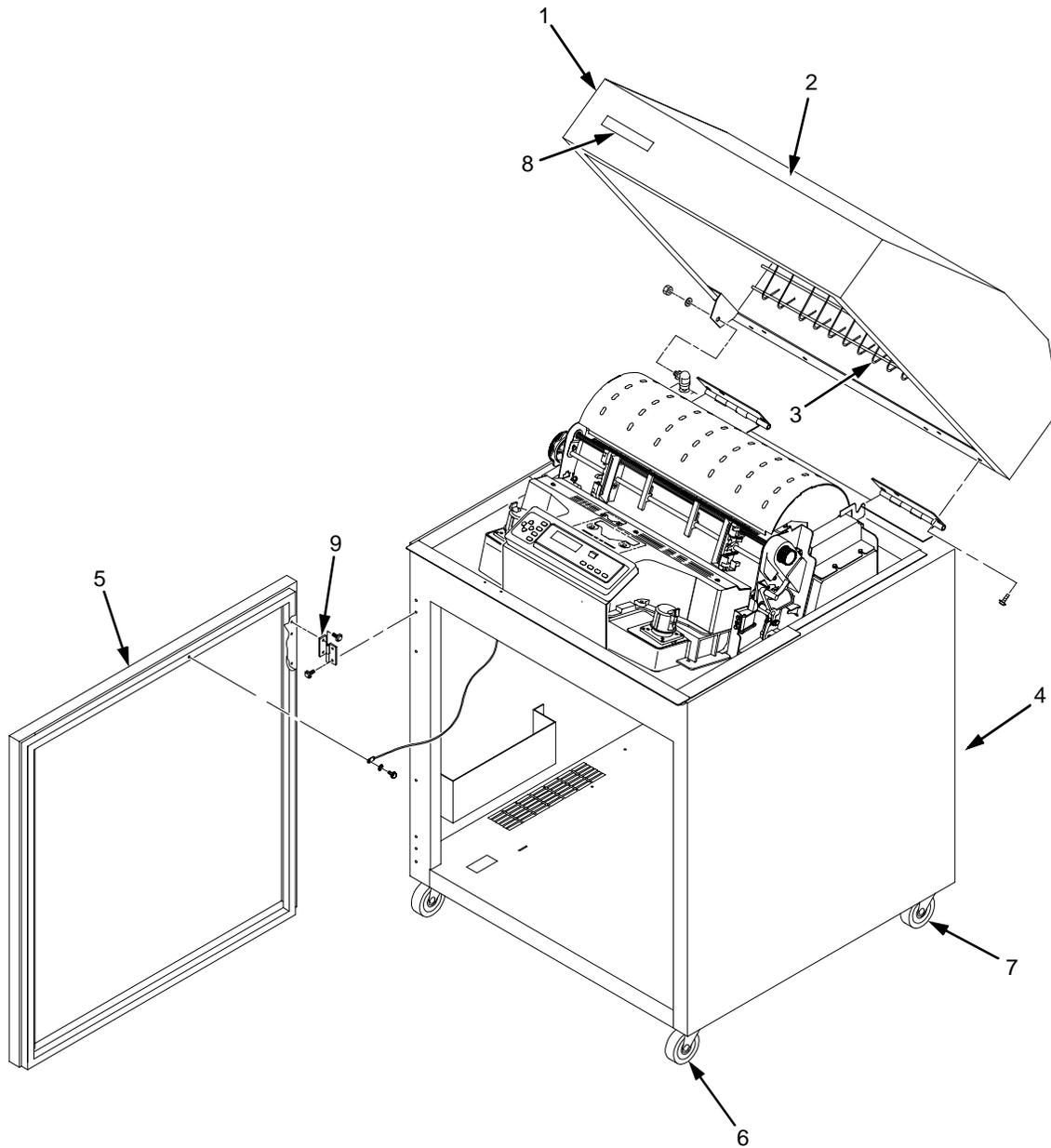


Figure 28. Top Cover, Doors, and Casters

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
1	164212-905PX	Top Cover Kit, Cabinet	Includes mounting hardware
2	131803-901PX	Window, Top Cover	Not visible in Figure 28
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	

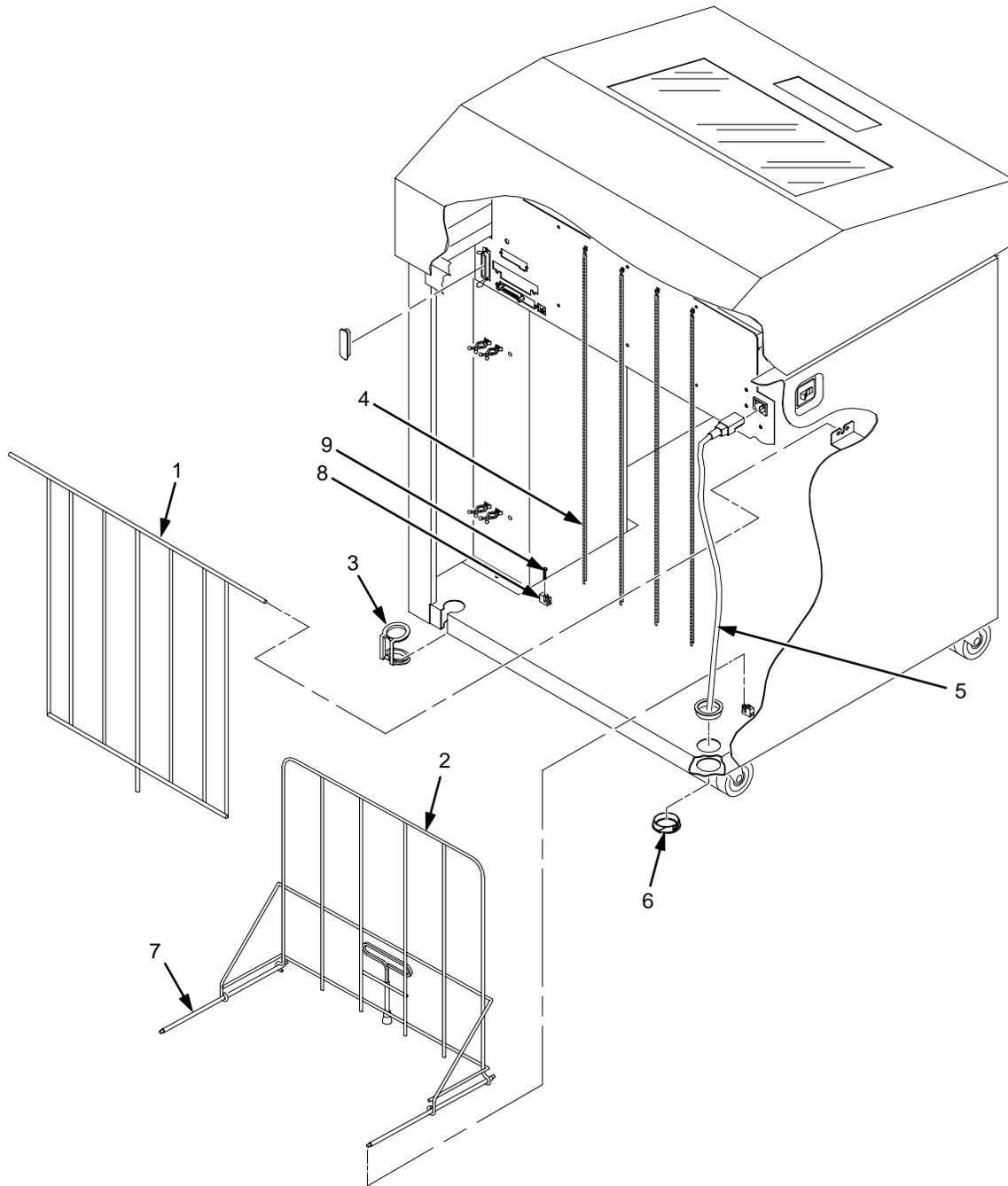


Figure 29. Paper Fence and Chains

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
1	Ref	Paper Fence	500 lpm models
2	134844-001PX	Stacker Option Kit	1000 and 1500 lpm cabinet models. Power Stacker Option available for cabinet models: see Appendix H.
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	151910-001PX	Rail, Stacker	
8	163559-001PX	Kit, Clip, Type 2	
9	Ref	Screw (4)	Part of item 8

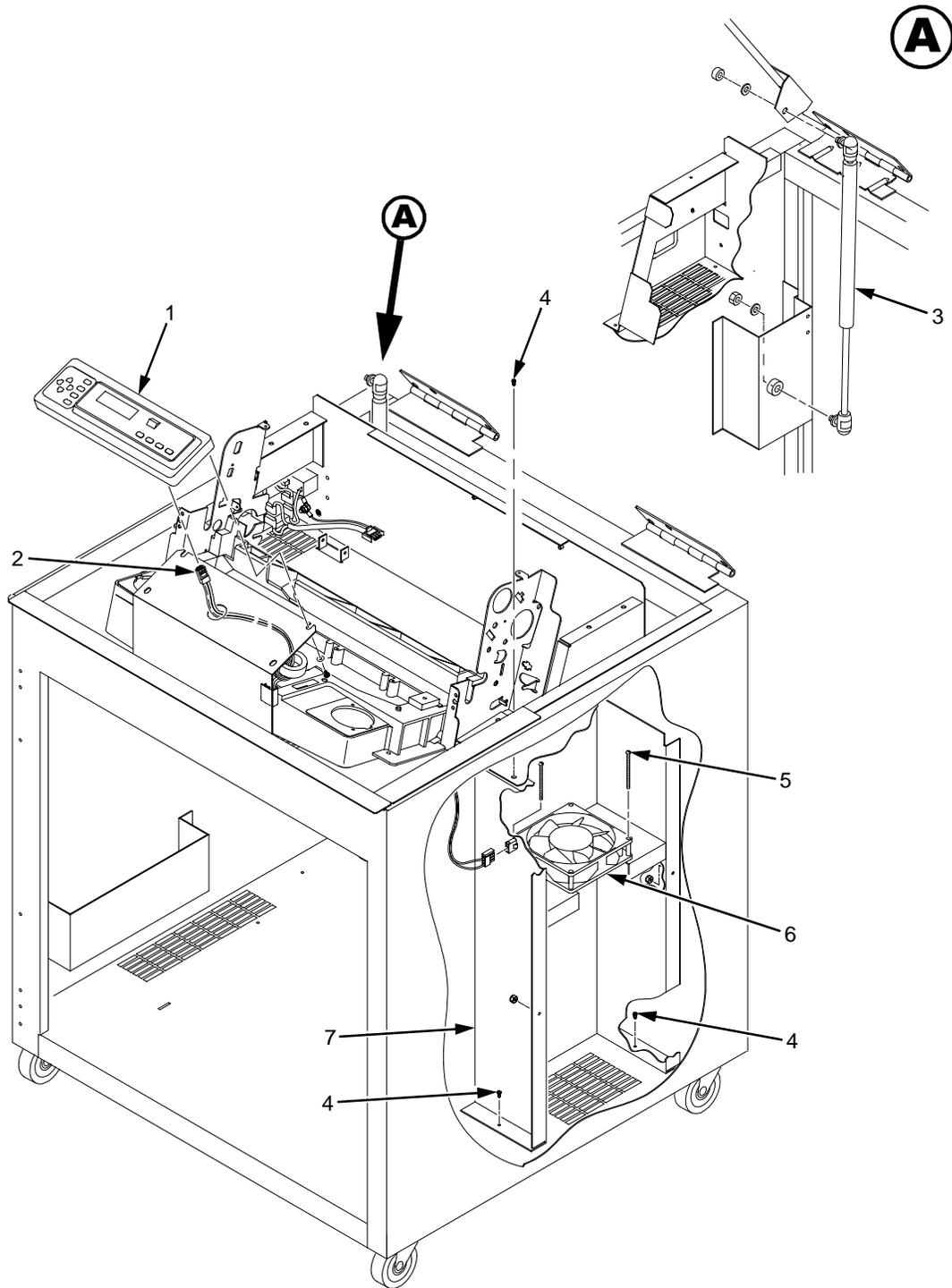


Figure 30. Control Panel and Cabinet Details

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
1	153700-901PX	Control Panel Assembly	Includes mounting hardware. Does not include language overlay.
1a	154249-901PX	Overlay Kit, Cabinet	Contains overlays in English, French, German, Italian, and Spanish
2	152440-901PX	Cable Assembly, Control Panel	Installed with shielding beads: See Appendix G
3	107961-905PX	Dashpot 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	

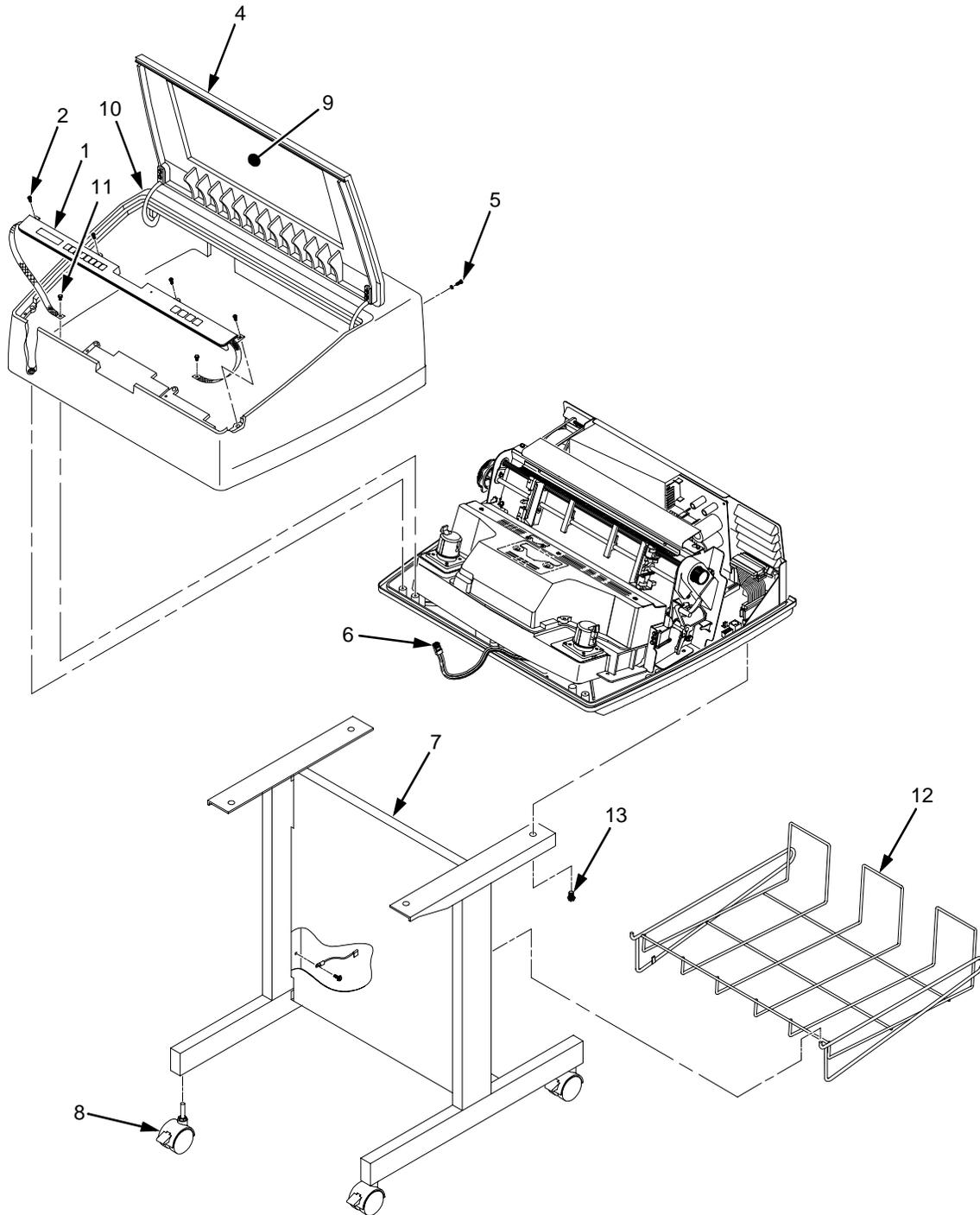


Figure 31. Pedestal Details

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
1	153366-901PX	Control Panel Assembly	Does not include language overlay.
1a	154249-902PX	Overlay Kit, Pedestal	Contains overlays in English, French, German, Italian, and Spanish.
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

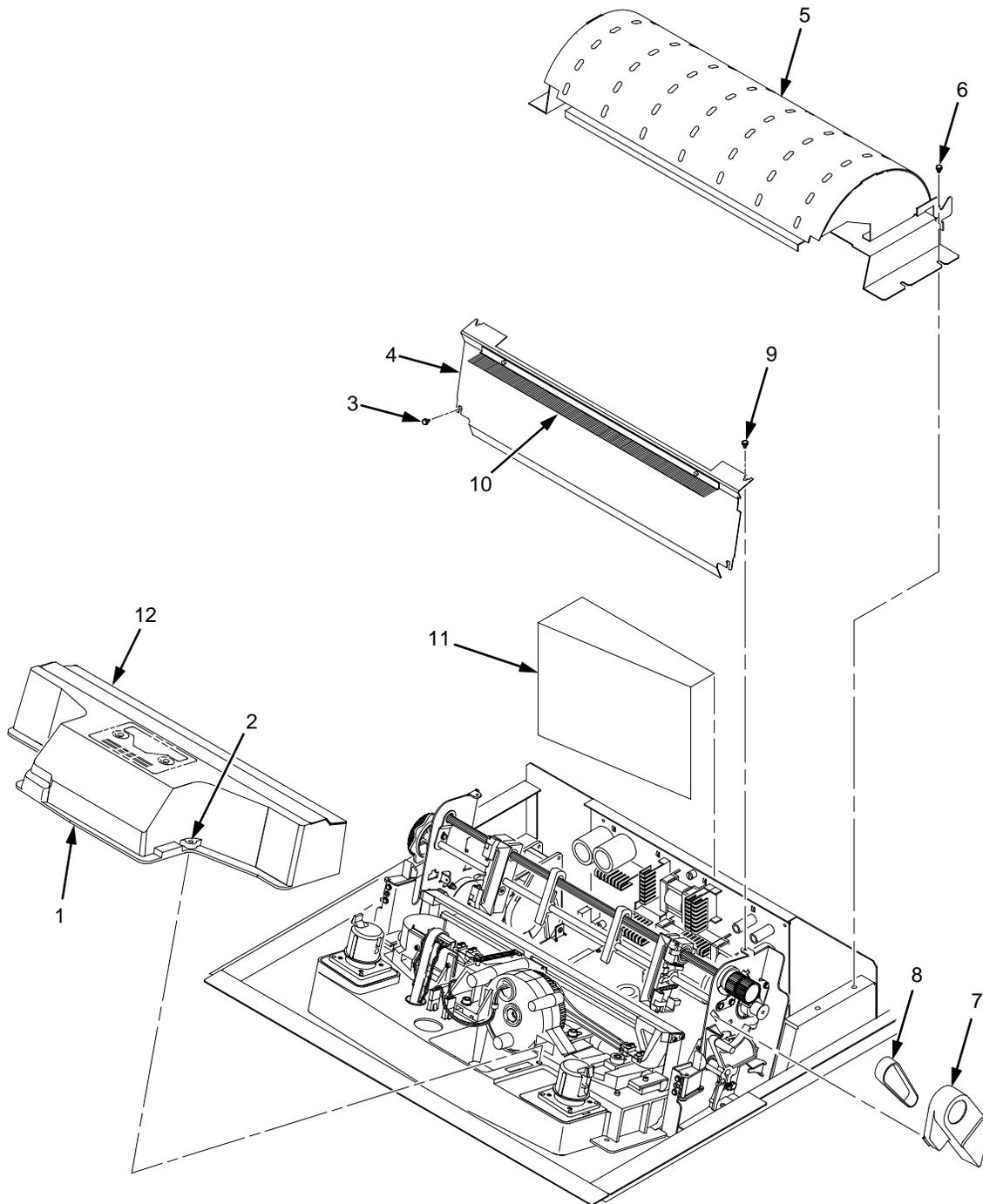


Figure 32. Inside Covers, Cabinet Models

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
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	

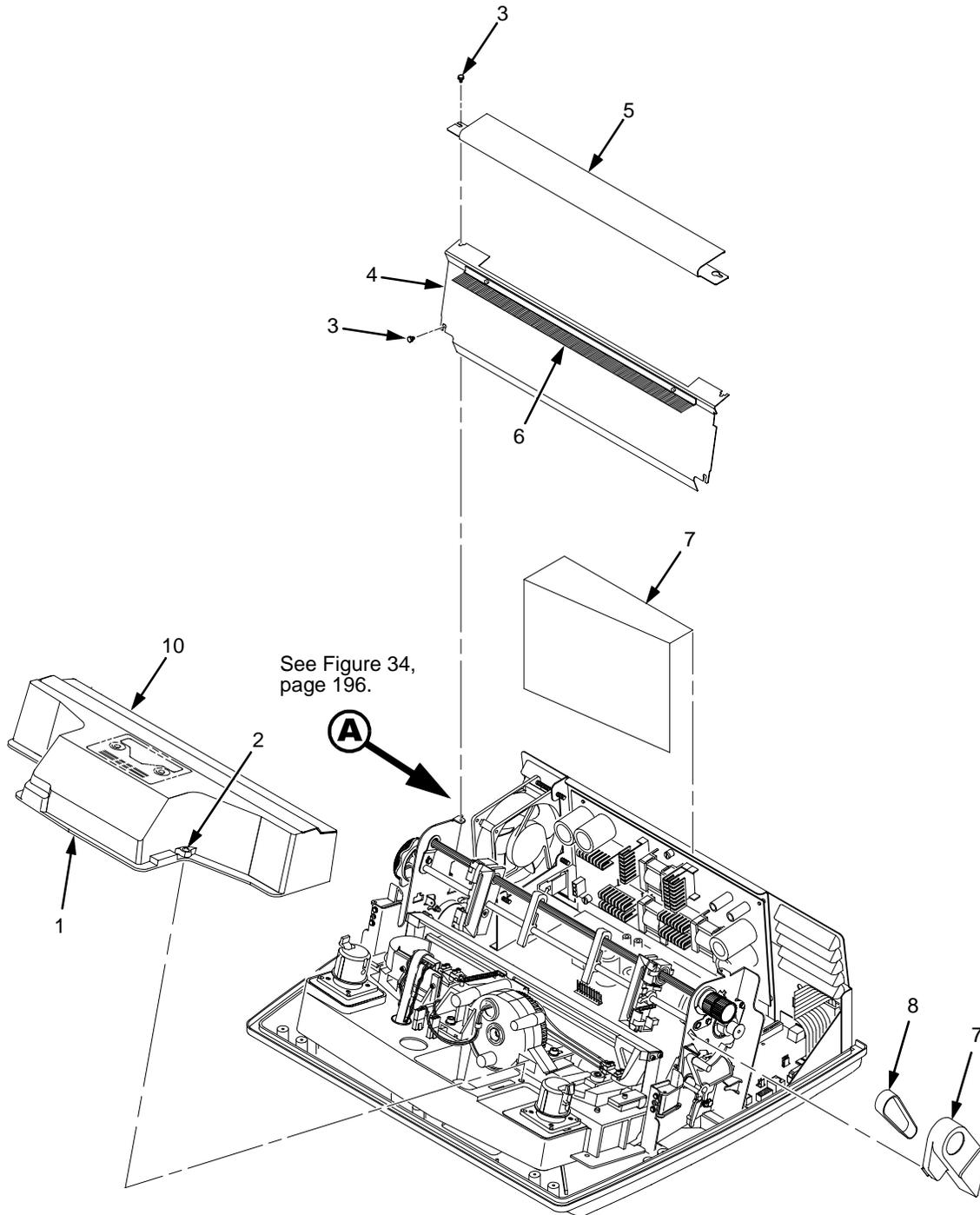


Figure 33. Inside Covers and Card Cage, Pedestal Models

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
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	

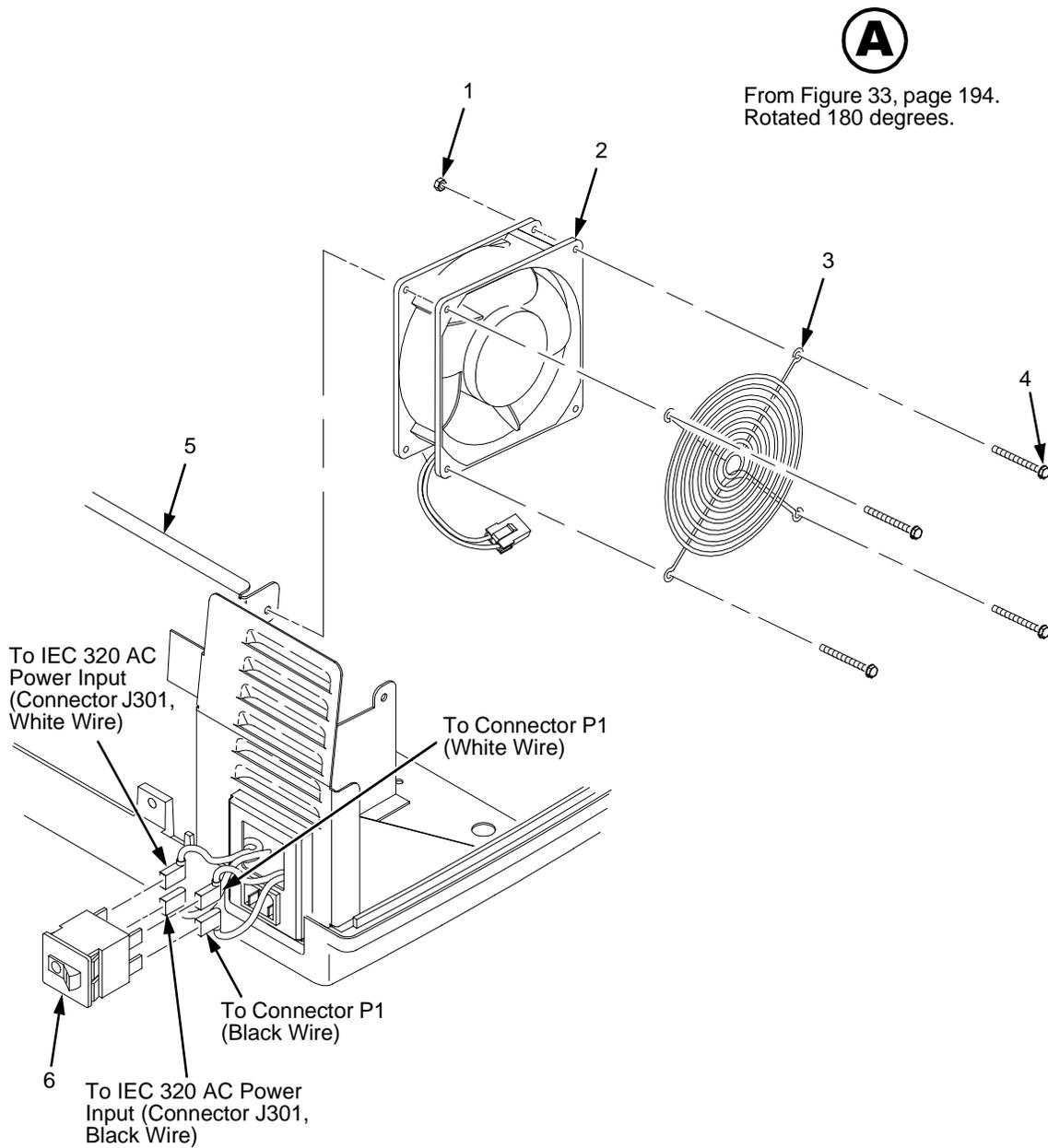


Figure 34. Card Cage Detail, Pedestal Models

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
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.

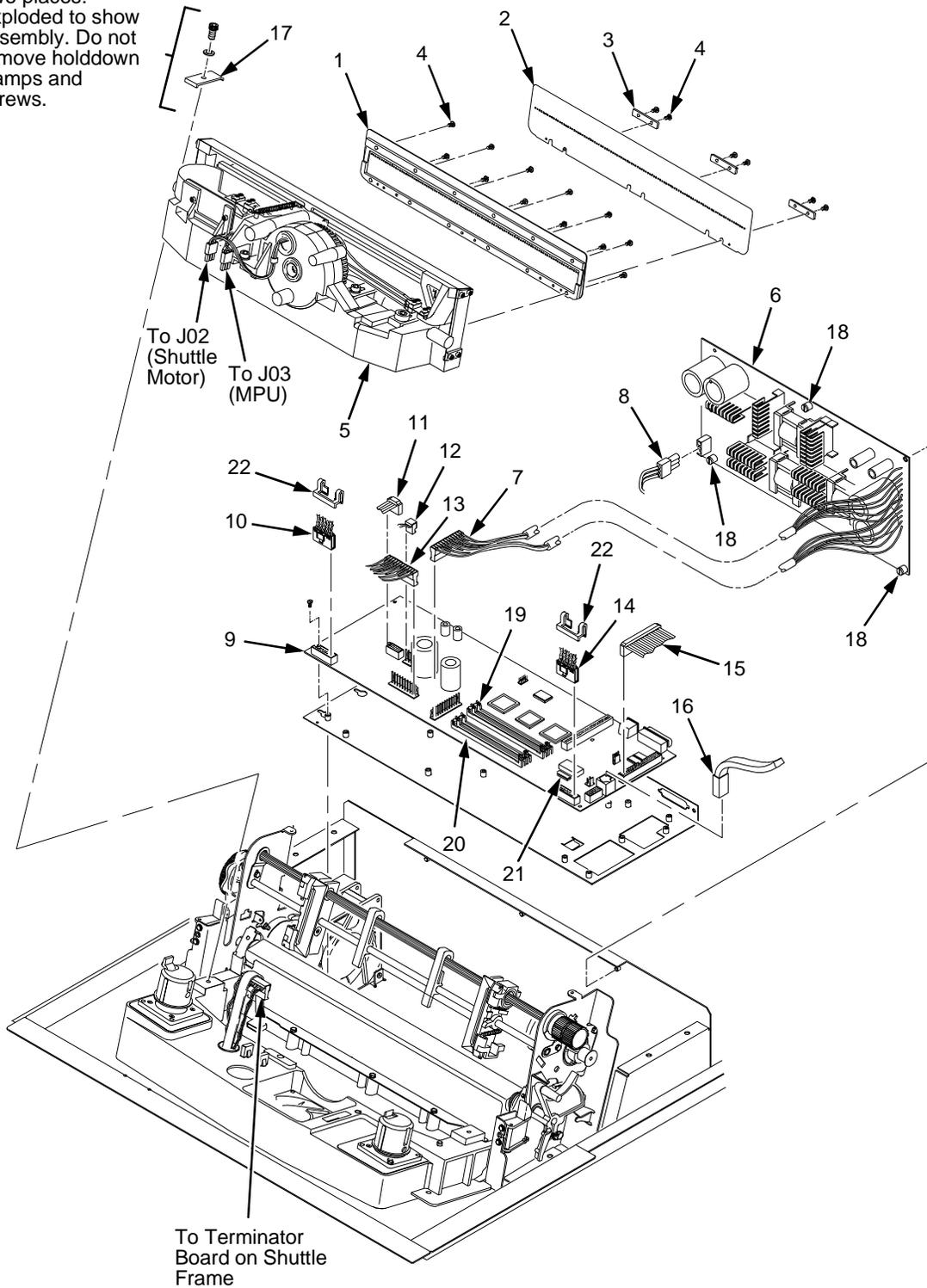


Figure 35. Print Mechanism and Circuit Boards

Item No.	Part No.	Description	Notes
1	163802-901PX	Hammer Bank Cover	500 lpm models
	163795-901PX	Hammer Bank Cover	1000 lpm models
	164216-901PX	Hammer Bank Cover	1500 lpm models
2	163789-901PX	Ribbon Mask, 500	500 lpm models
	163797-901PX	Ribbon Mask, 1000	1000 lpm models
	164204-901PX	Ribbon Mask, 1500	1500 lpm models
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	500 Shuttle Assembly, Spare	
	163984-991	500 Shuttle Assembly, Advance Exchange	
	C3201-69203	500 Shuttle Assembly, Europe only	
	163985-901PX	1000 Shuttle Assembly, Spare	
	163985-991	1000 Shuttle Assembly, Advance Exchange	
	C3204-69003	1000 Shuttle Assembly, Europe only	
	157735-901PX	1500 Shuttle Assembly, Spare	
	157735-991	1500 Shuttle Assembly, Advance Exchange	
	C3205-69003	1500 Shuttle Assembly, Europe only	
	164266-001PX	Hammer Spring Assembly Field Kit	500 lpm models
164267-001PX	Hammer Spring Assembly Field Kit	1000 lpm models	
164269-001PX	Hammer Spring Assembly Field Kit	1500 lpm models	
6	157102-901PX	Power Supply, Spare	
	157102-991	Power Supply, Advance Exchange	
	C3201-69103	Power Supply, Europe only	
7	Ref	P101 Cable Connector	
8	Ref	Cable Assembly, AC In, Power Supply	Part of Field Kit, AC Assy, 153502-901PX
9	157450-901PX	CMX Controller, Spare	
	157450-991	CMX Controller, Advance Exchange	
	C3201-69102	CMX Controller, Europe only	
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	164805-901PX	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	

(continued on next page)

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
18	Ref	Screw, Captive, Power Supply (3)	
19	202417-001PX	SIMM Socket, Flash Memory, 4 MB	See page 155
20	202412-001PX	SIMM Socket, DRAM, 4 MB	See page 155
21	154141-007PX	Security Module, Base	See page 155
22	163211-901PX	CMX Connector Clip Field Kit	



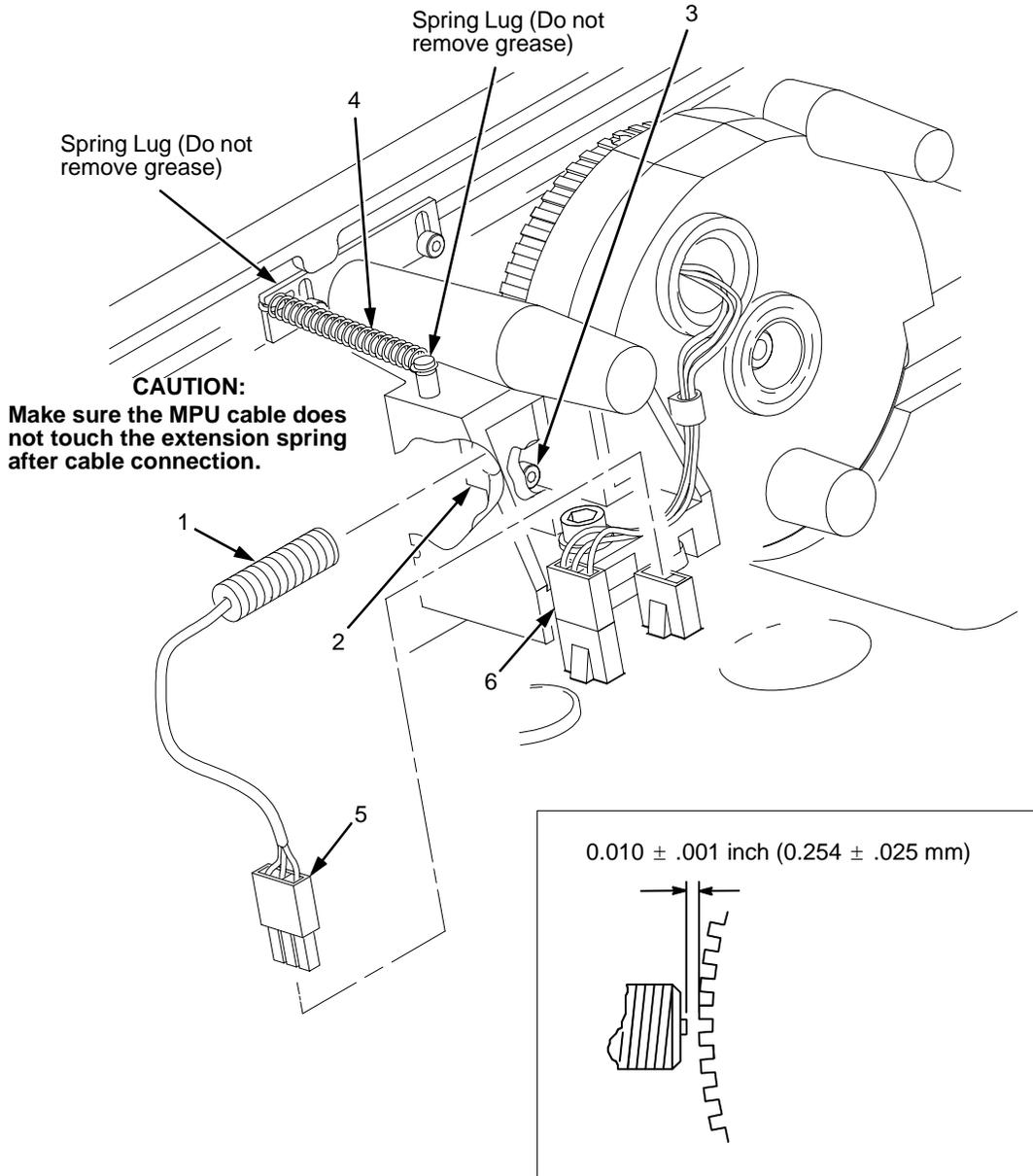
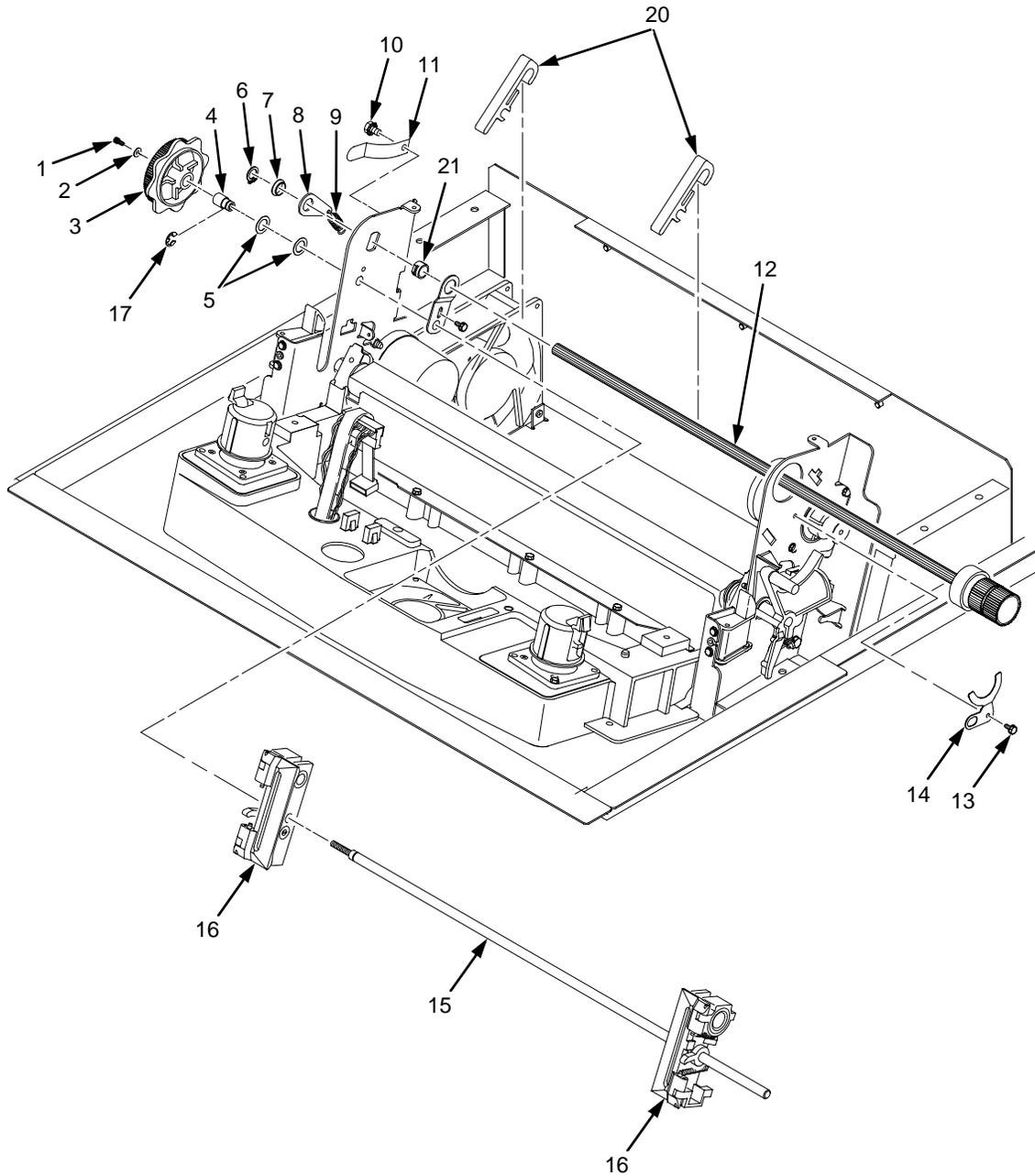


Figure 36. Magnetic Pickup (MPU) and Extension Spring

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
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	Installed at factory on models 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

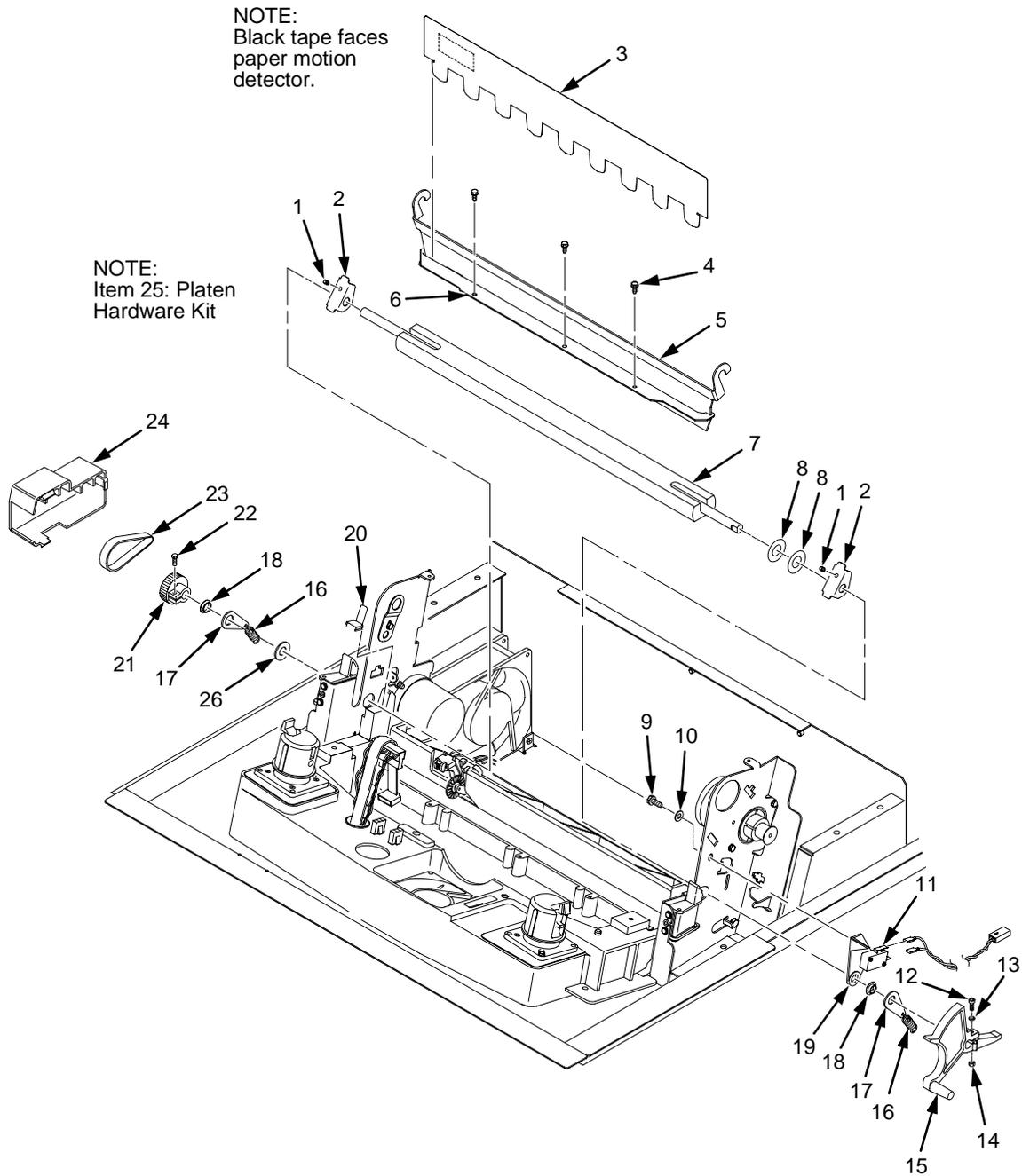


Figure 38. Platen

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

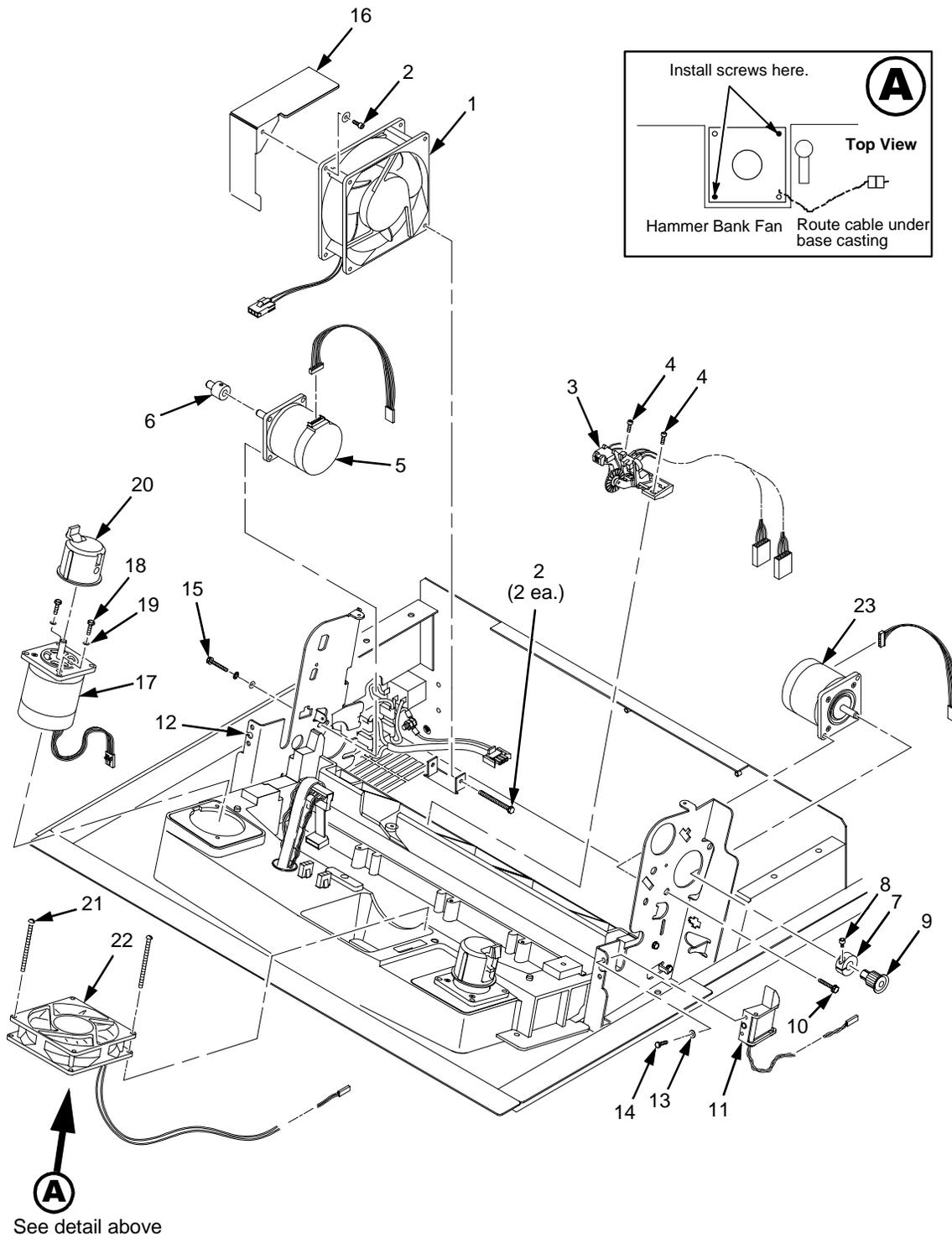


Figure 39. Motors, Fans, and Paper Detector Switch

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	

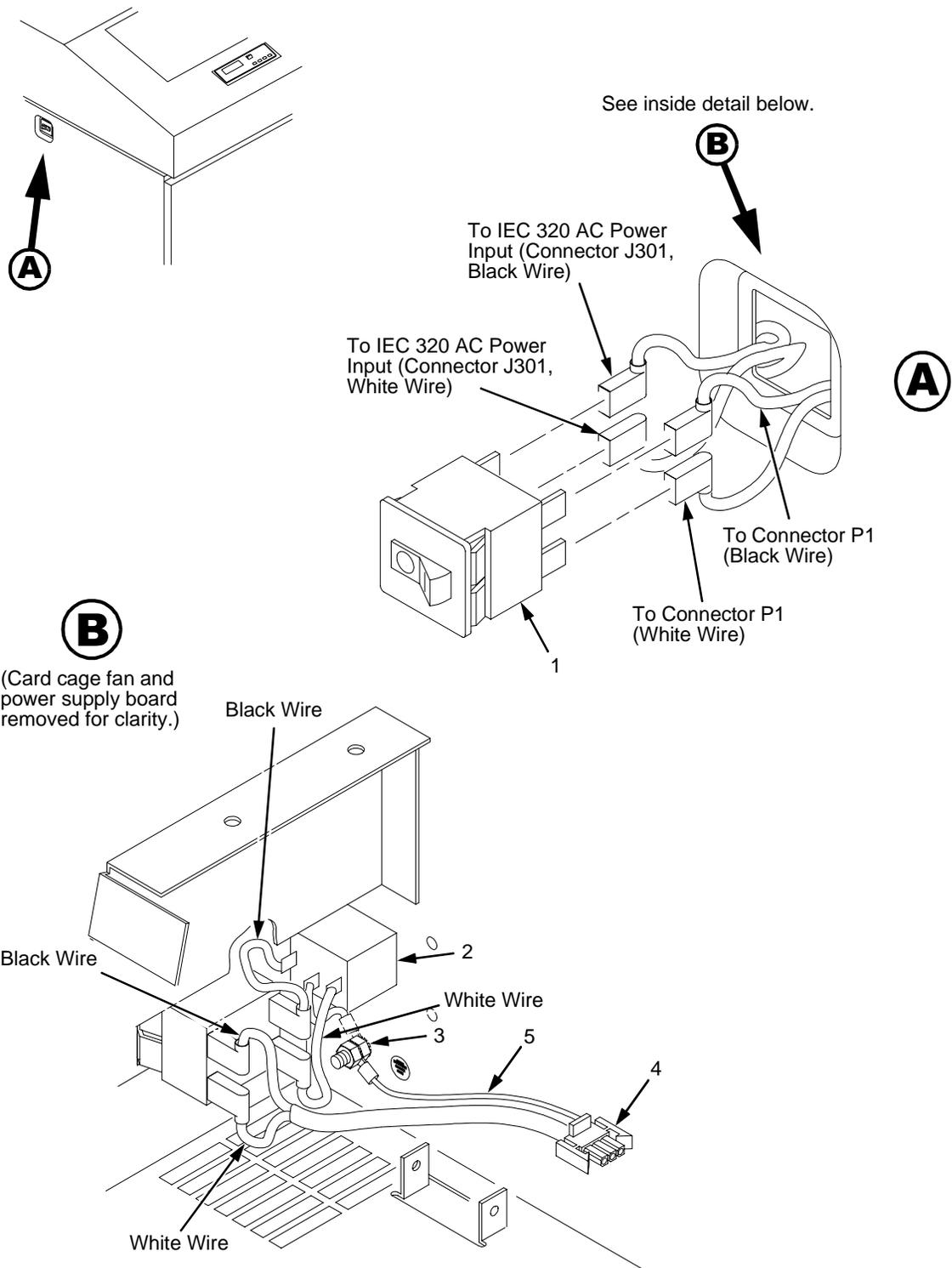


Figure 40. Circuit Breaker, Cabinet Models

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
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

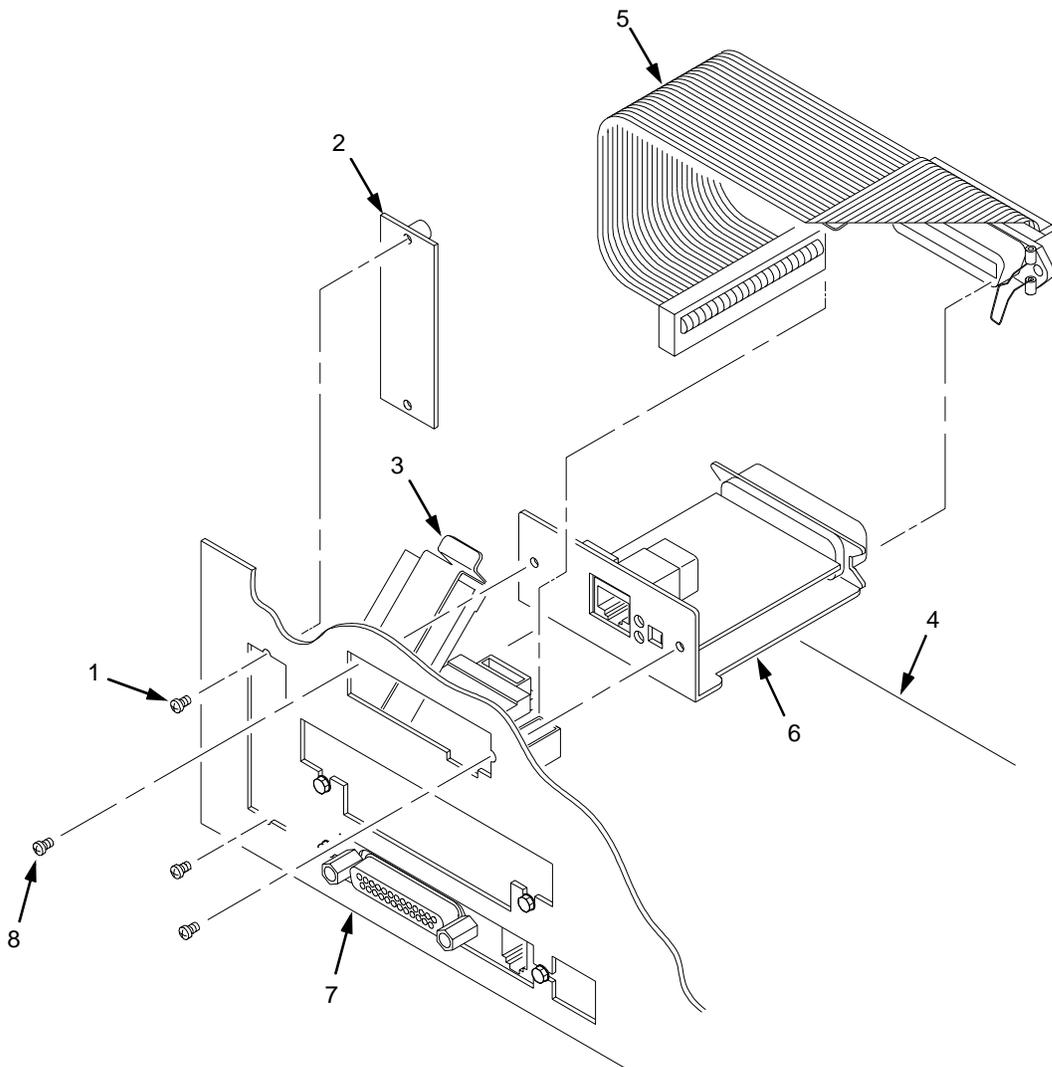


Figure 41. Ethernet Interface Assembly

Item No.	Part No.	Description	Notes
1	Ref	Screw, Connector Cover (2)	
2	Ref	Cover Plate, Centronics	
3	202049-001	Ferrite Clamp	See Appendix E
4	Ref	CMX Controller Board	
5	152439-901	Centronics I/O Cable Assembly	
6	170622-001	LineJet Print Server	
7	Ref	Rear of Card Cage	
8	Ref	Screw (2)	



# 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 42.) 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.

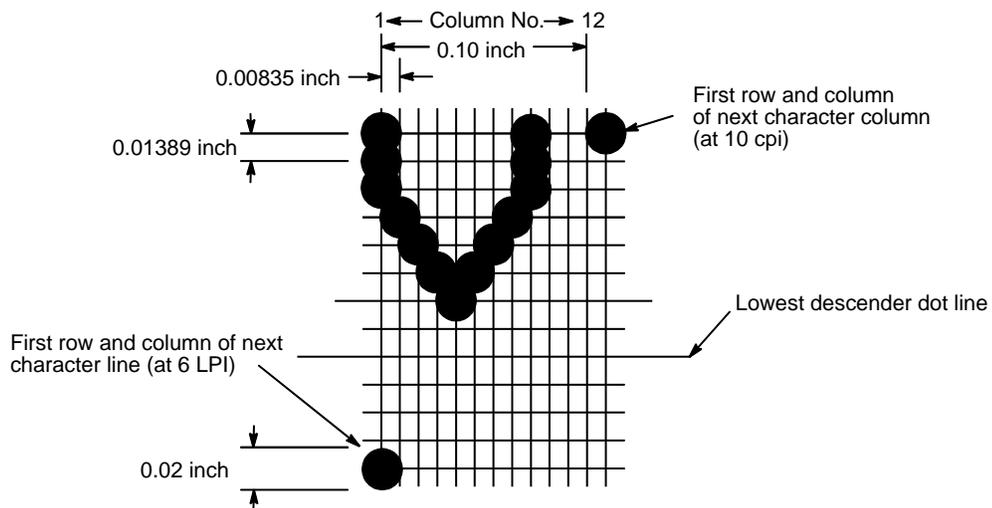


Figure 42. A Dot Matrix

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 42 and Figure 43.) 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 44.

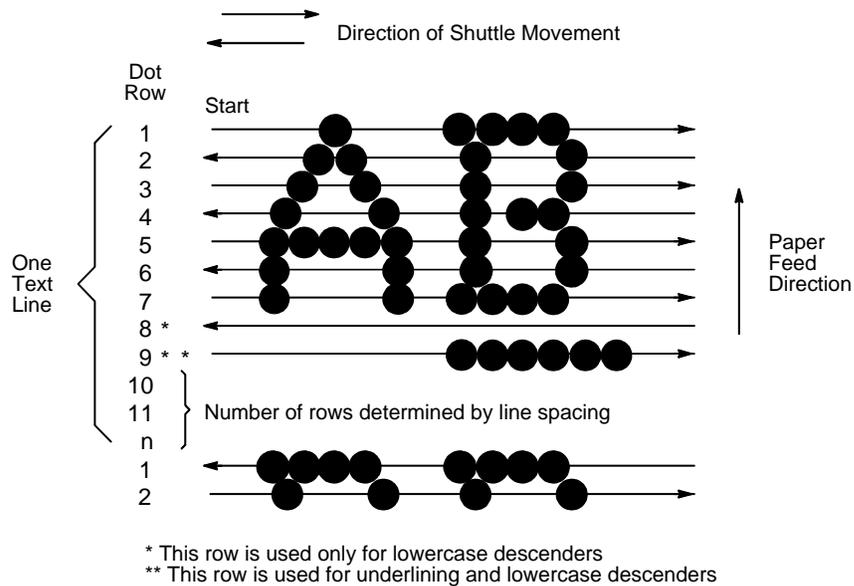
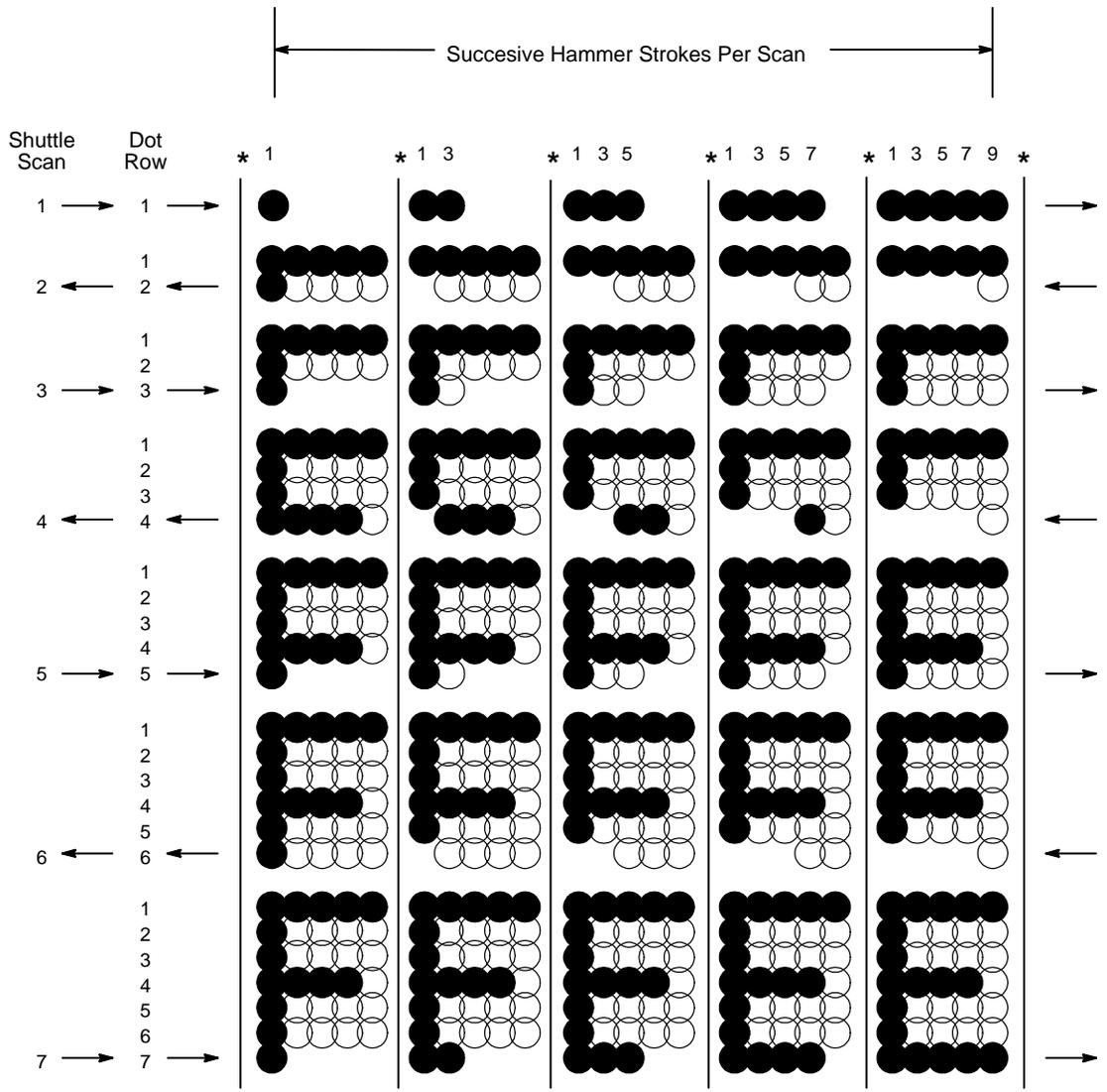


Figure 43. Standard Character Formation



\* 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 44. 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 45.)

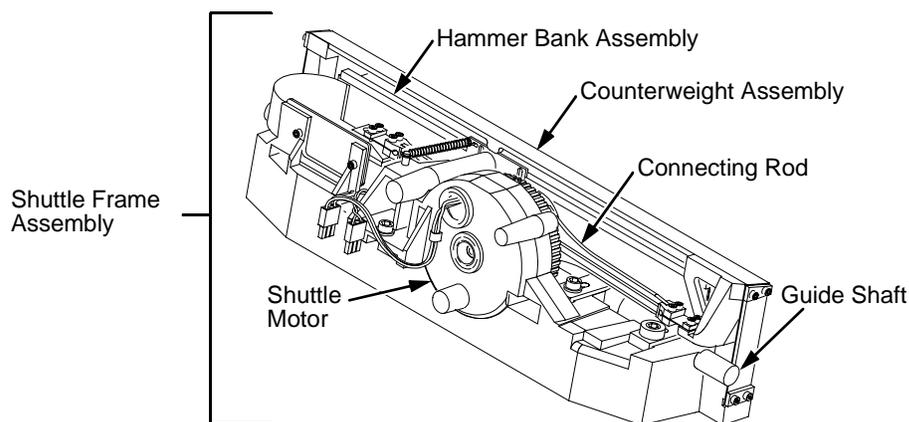


Figure 45. Shuttle Frame Assembly

### 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:

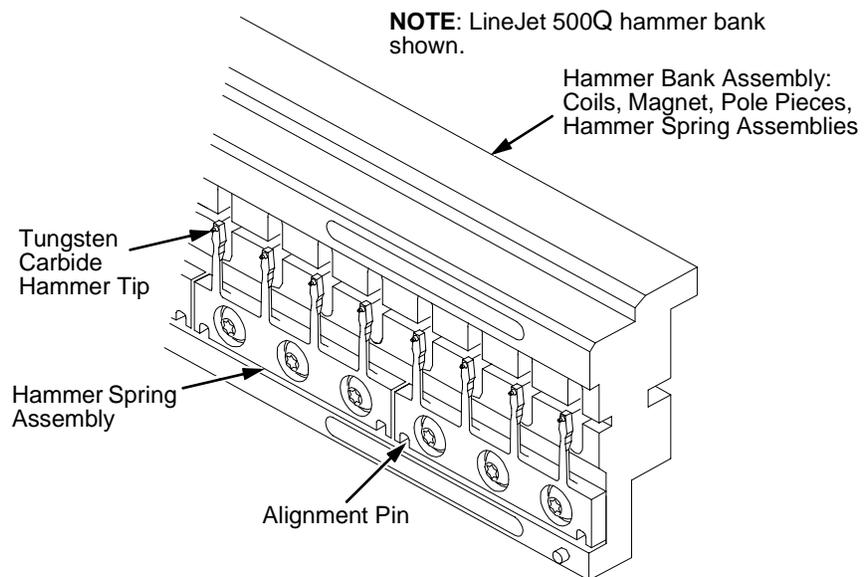
- LineJet 500Q and LineJet 500P: seven 4-hammer assemblies, for a total of 28 hammer springs
- LineJet 1000Q: six 10-hammer assemblies, for a total of 60 hammer springs
- LineJet 1500Q: six 17-hammer assemblies, for a total of 102 hammer springs

### 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 46.) 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.

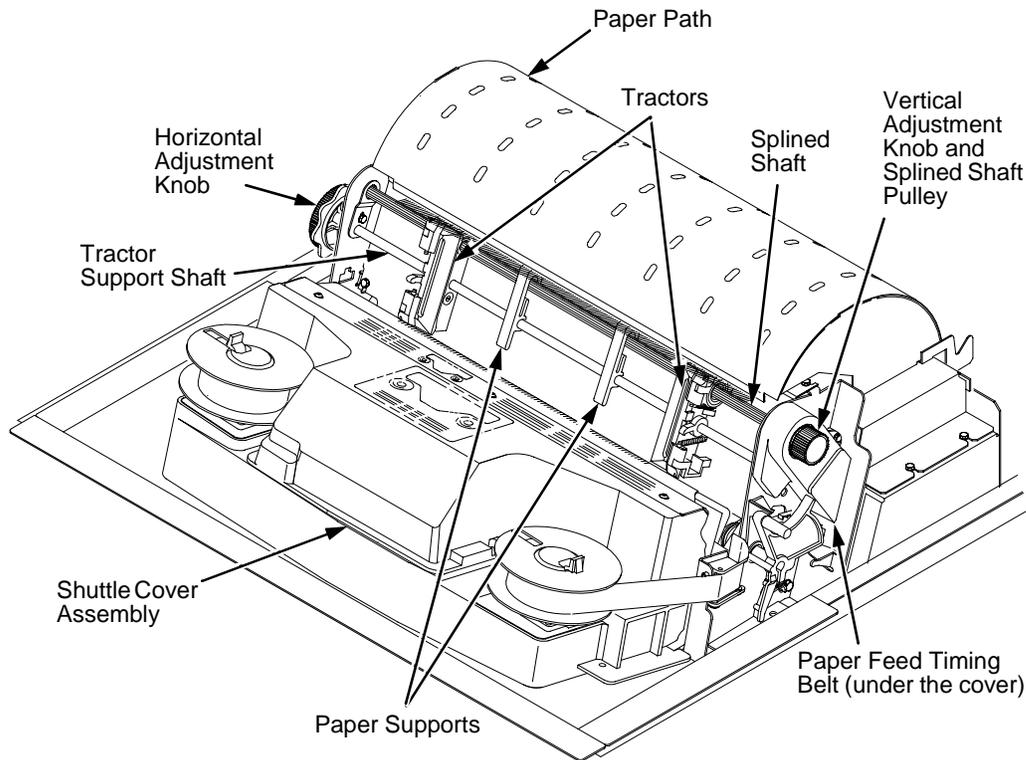


**Figure 46. Hammer Springs and Hammer Bank (Detail)**

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



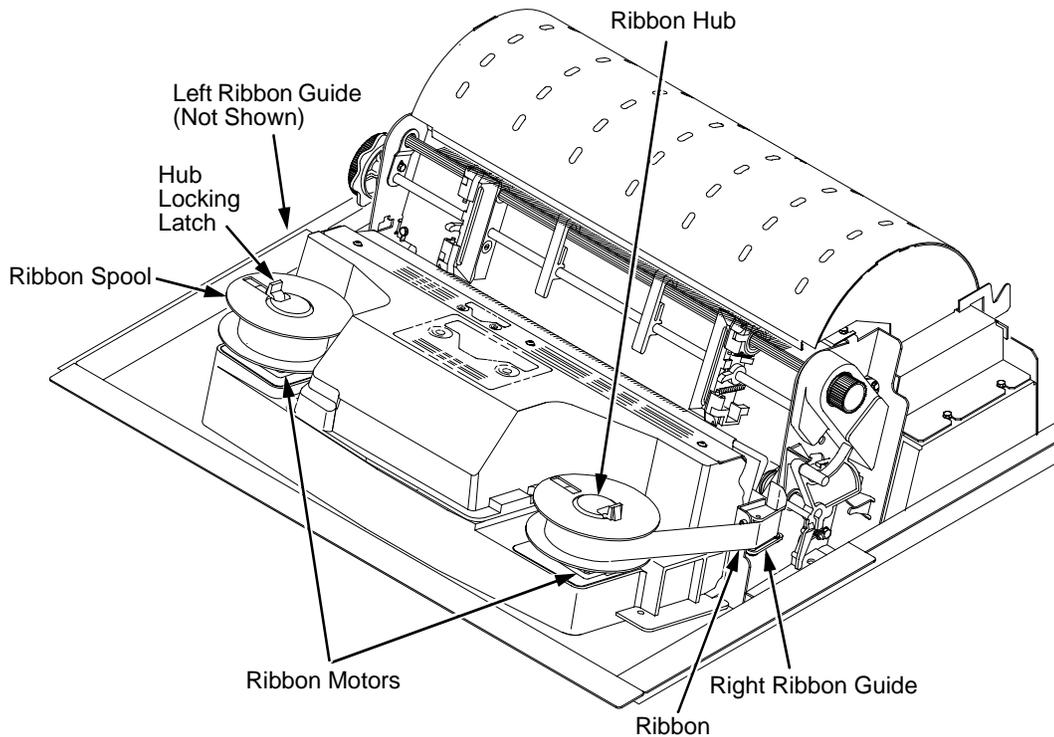
**Figure 47. Paper Transport System**

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 48. 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 49.

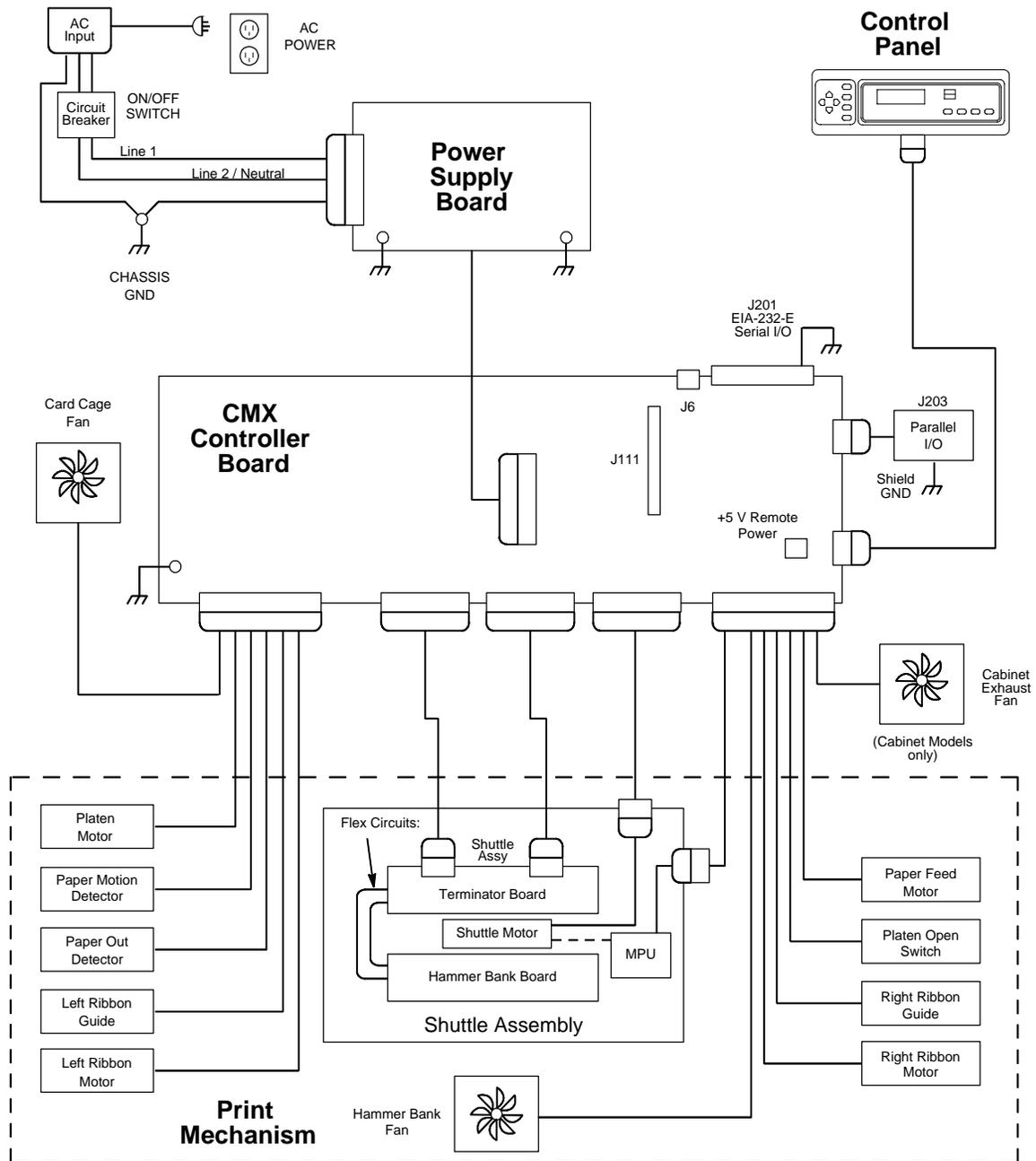


Figure 49. Functional Elements of the Printer



## 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 51 summarizes this architecture.

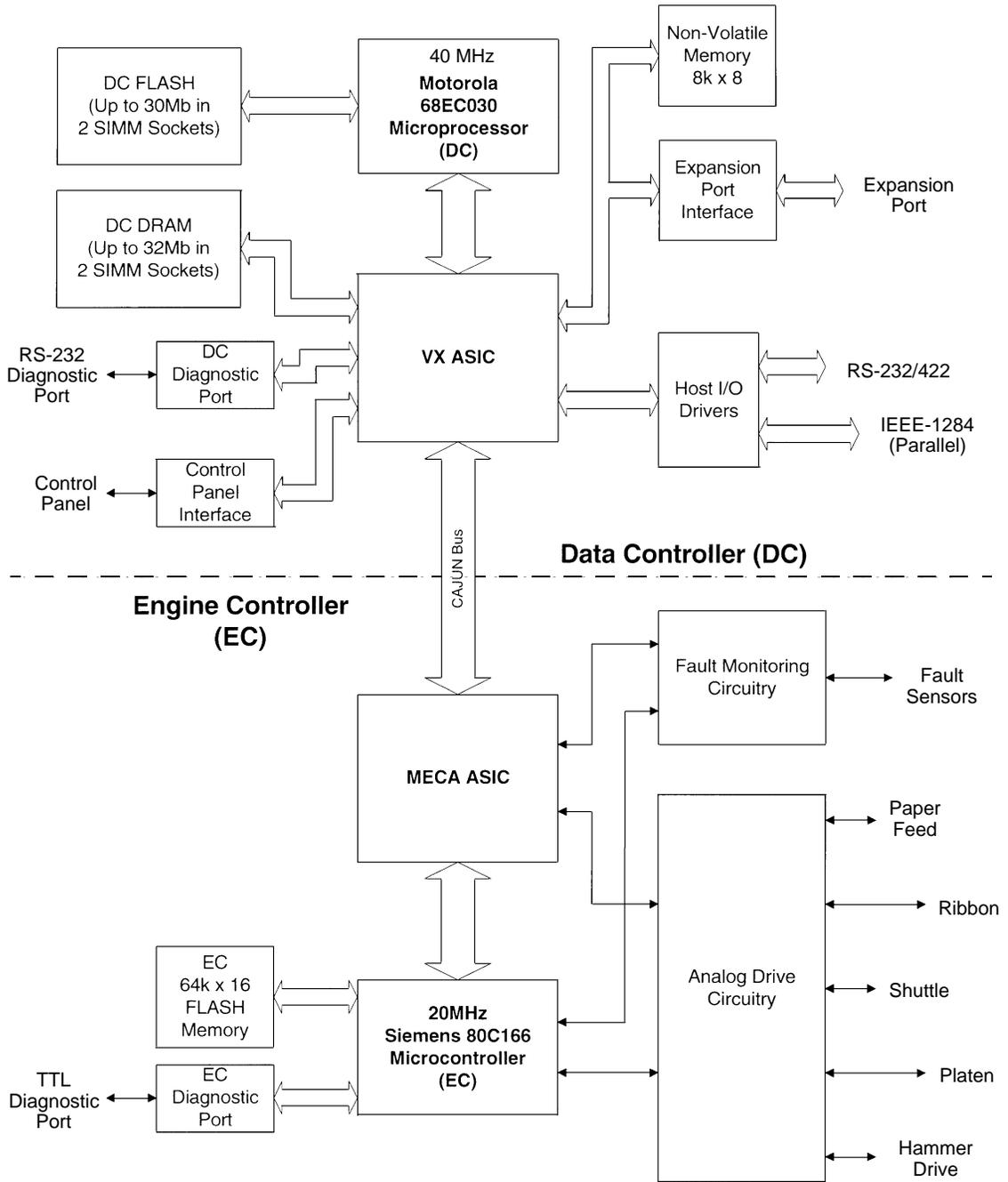


Figure 51. CMX Controller Board Block Diagram

## 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 40 MHz, and is called the “CMX 040.”

This chapter refers to the DC microprocessor as the “030.”

### 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 229), 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

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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

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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

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The *Code V II* programming language (a QMS graphics emulation) and the *PGL Advanced Graphics* programming language (a Printronix IGP emulation) are options that install in flash memory on the CMX controller board.

These programming languages simplify the job of creating forms, bar codes, logos, expanded characters, and other graphics. The languages enable the printer to print sideways, upside down, and to make forms combining graphics, alphanumeric data, and bar codes—all in a single pass. Documents explaining configuration, operation, and programming are included with each option.

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# A

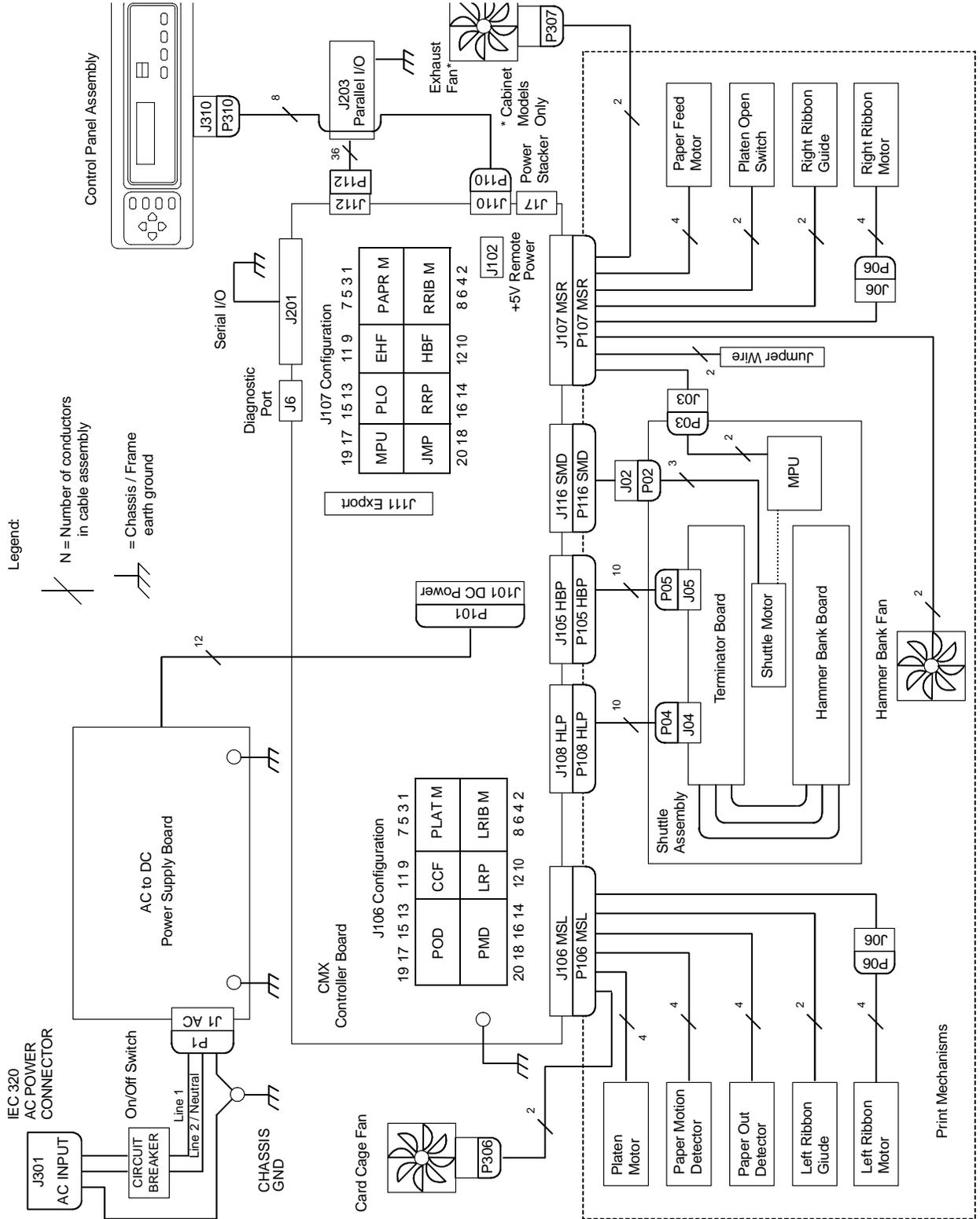
## *Wire Data*

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

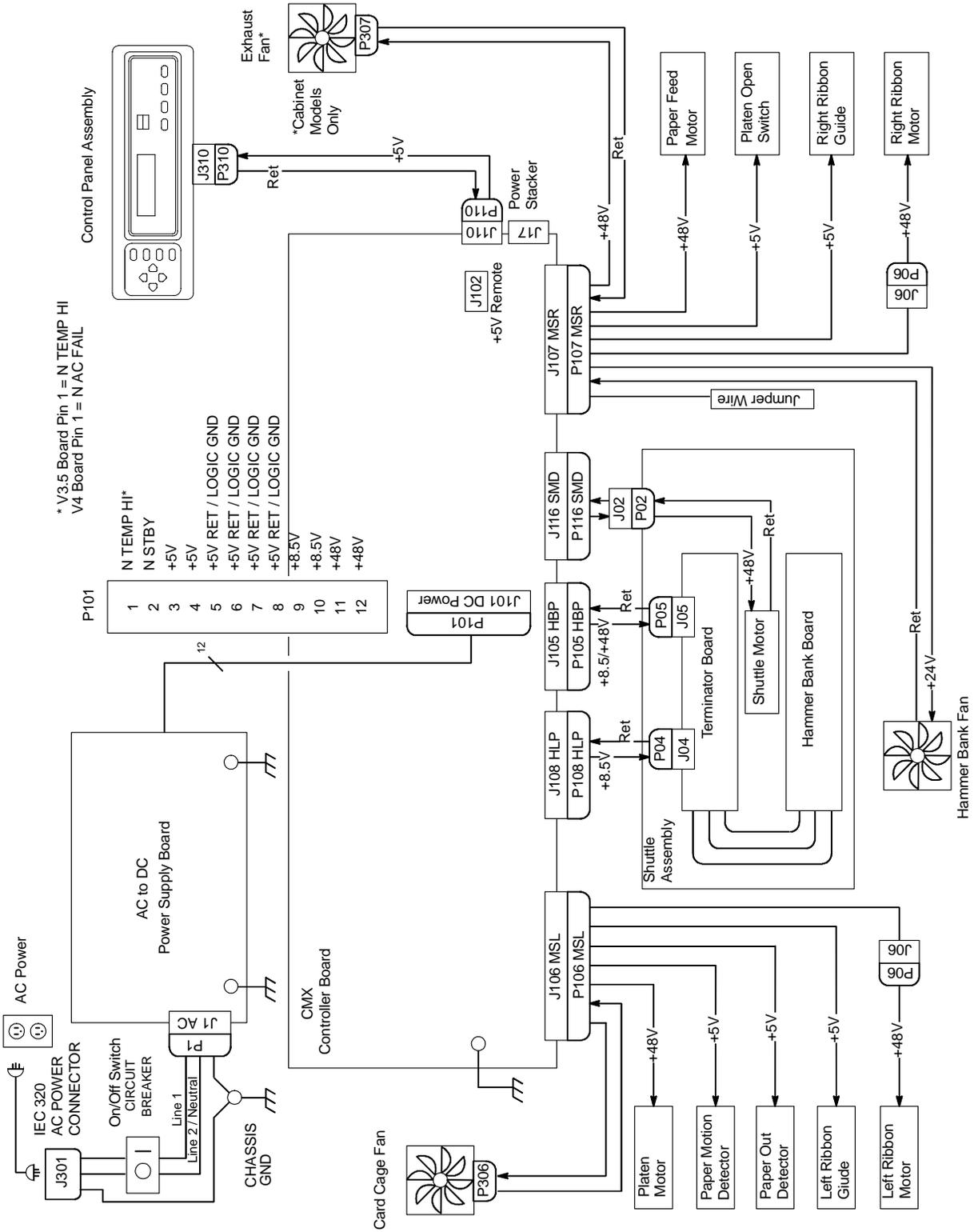
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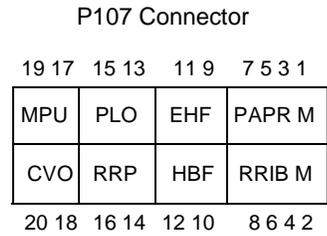
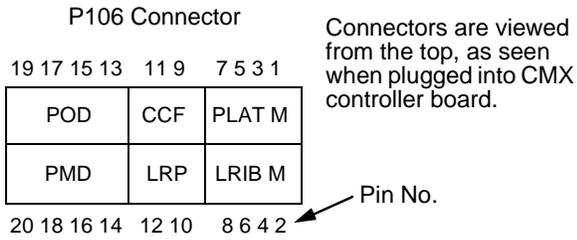
# Interconnection Diagram



## Power Distribution Diagram



## Main Wire Harness Test Tables



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 KΩ
PMD	14, 16 18, 20	8 Meg Ω Open
POD	13, 15 17, 19	8 Meg Ω Open

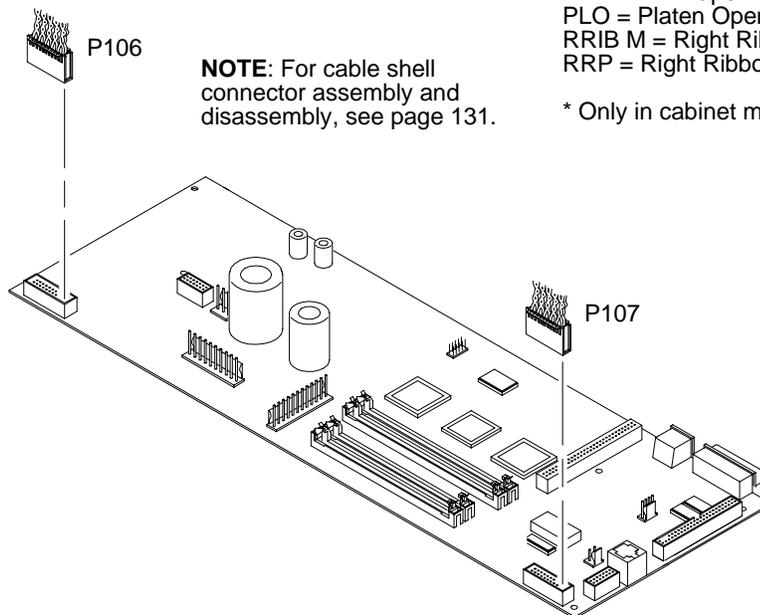
Resistance

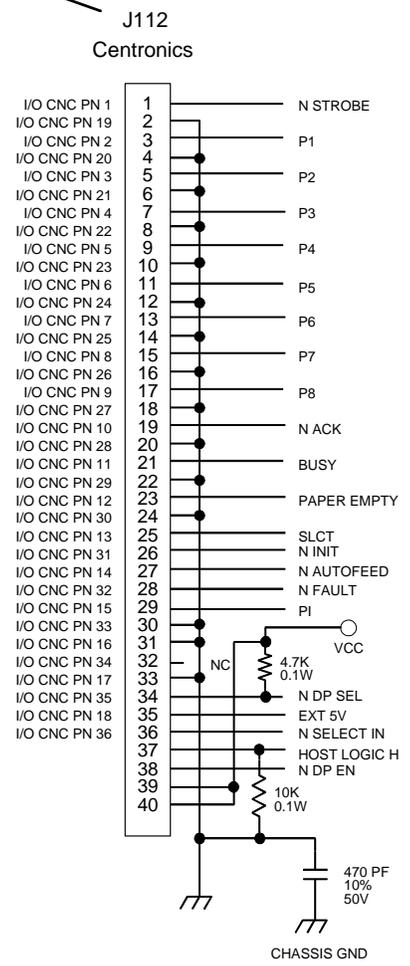
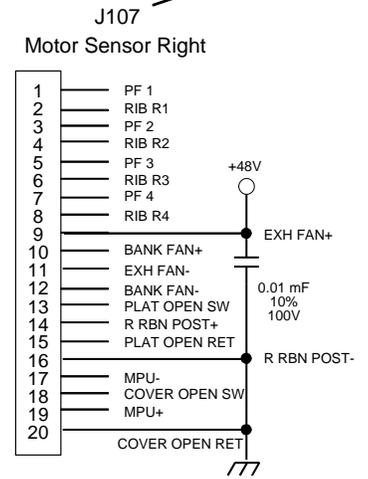
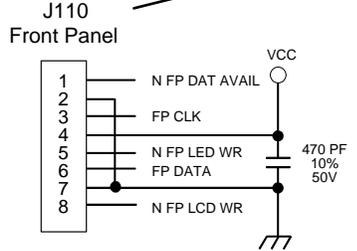
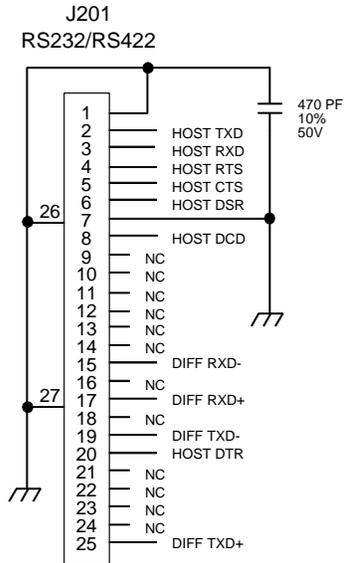
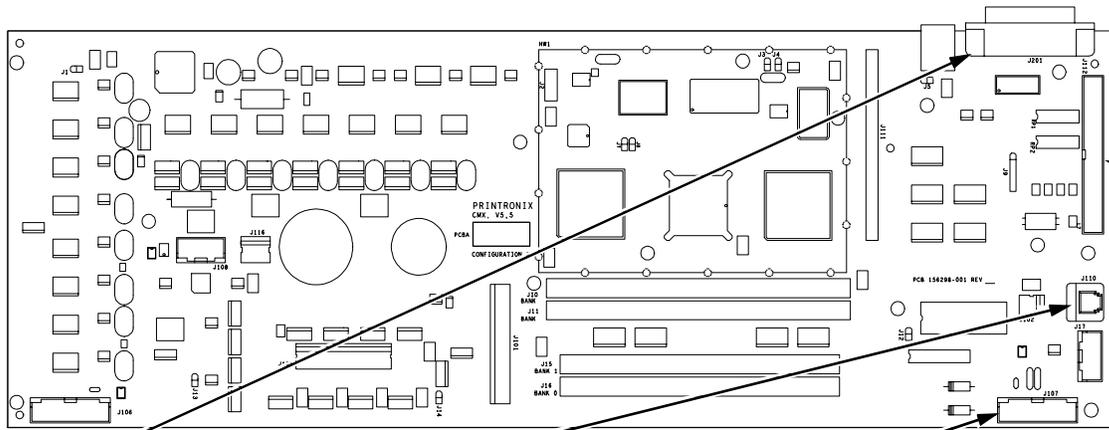
Device	P107 Pins	Normal
RRIB M	2, 4 and 6,8	7.2 - 8.8 Ω
PAPR M	1, 3 and 5, 7	0.417 - 0.681 Ω
HBF	10, 12	2.7 KΩ
EHF	9, 11	4.6 KΩ
RRP	14, 16	Open across pins Short across post
PLO	13, 15	Continuity: switch closed Open: switch open
CVO	18, 20	Continuity: switch closed Open: switch open
MPU	17, 19	670 Ω

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)

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

\* Only in cabinet models

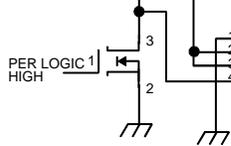
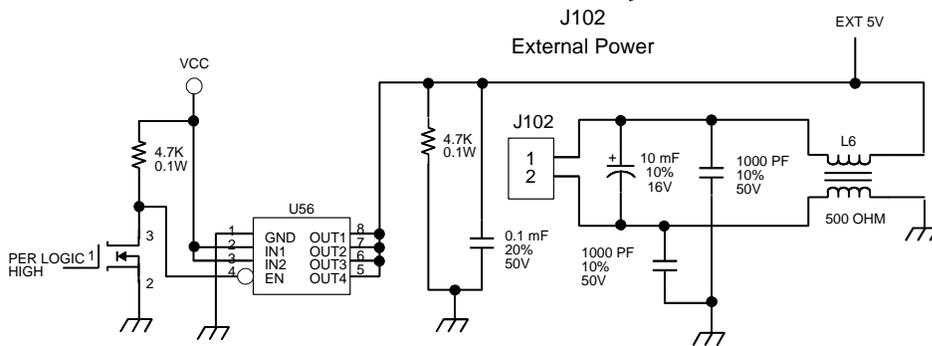
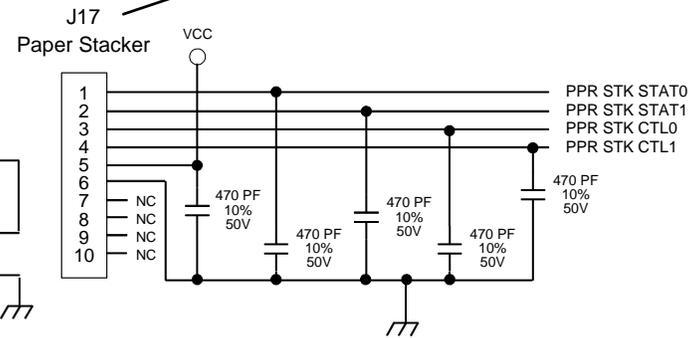
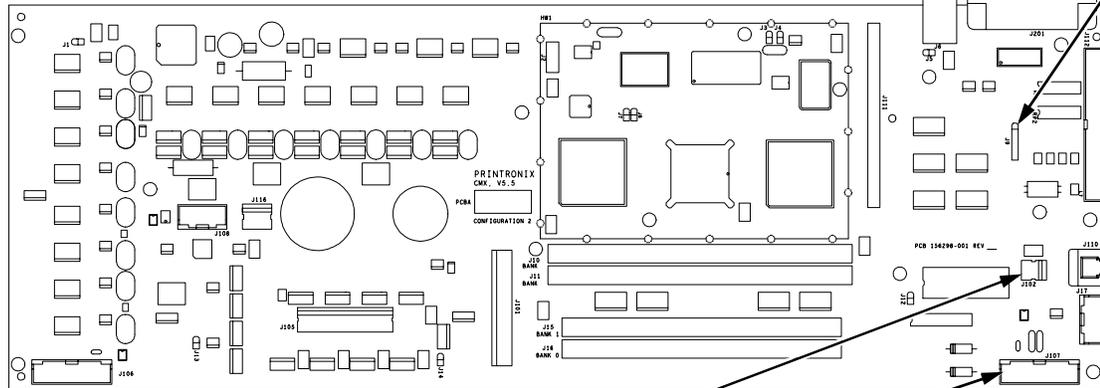
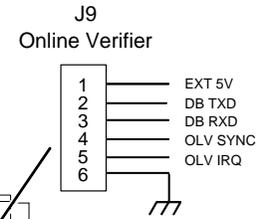
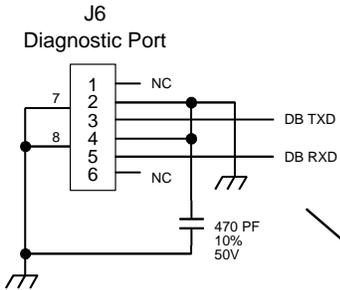




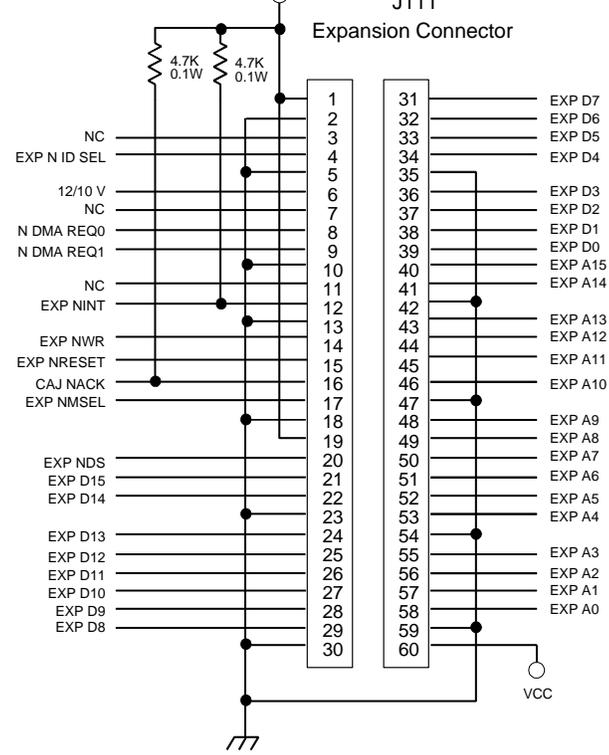
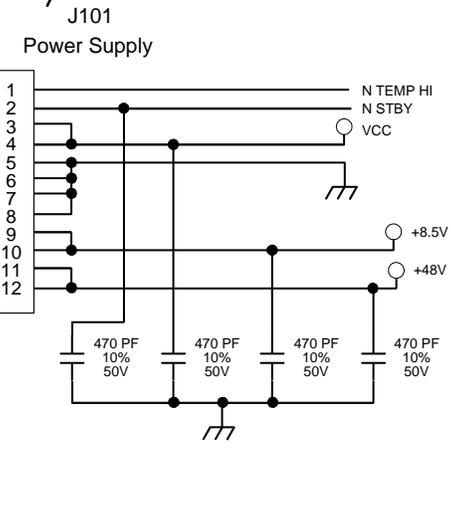
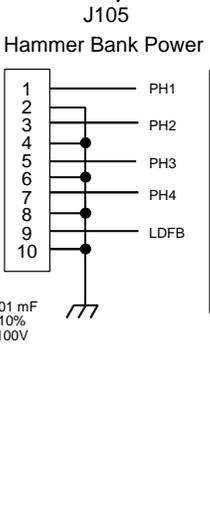
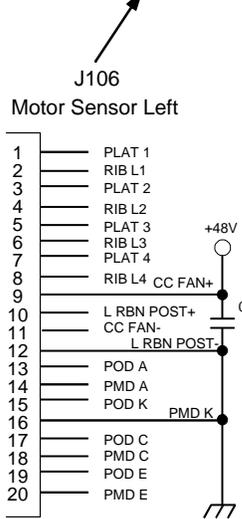
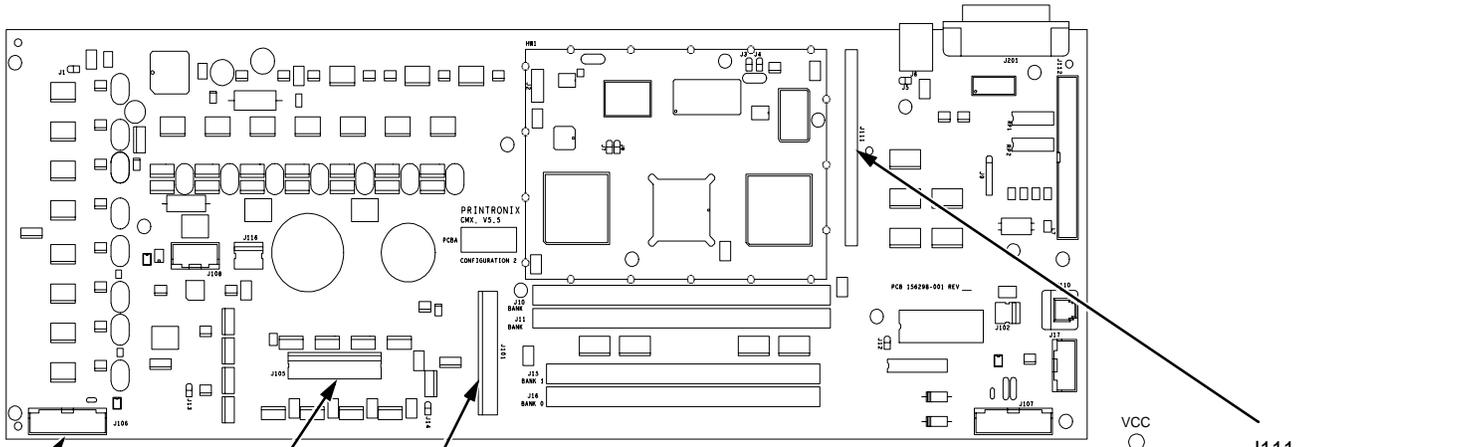
**CAUTION:** Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.

**Controller, 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.

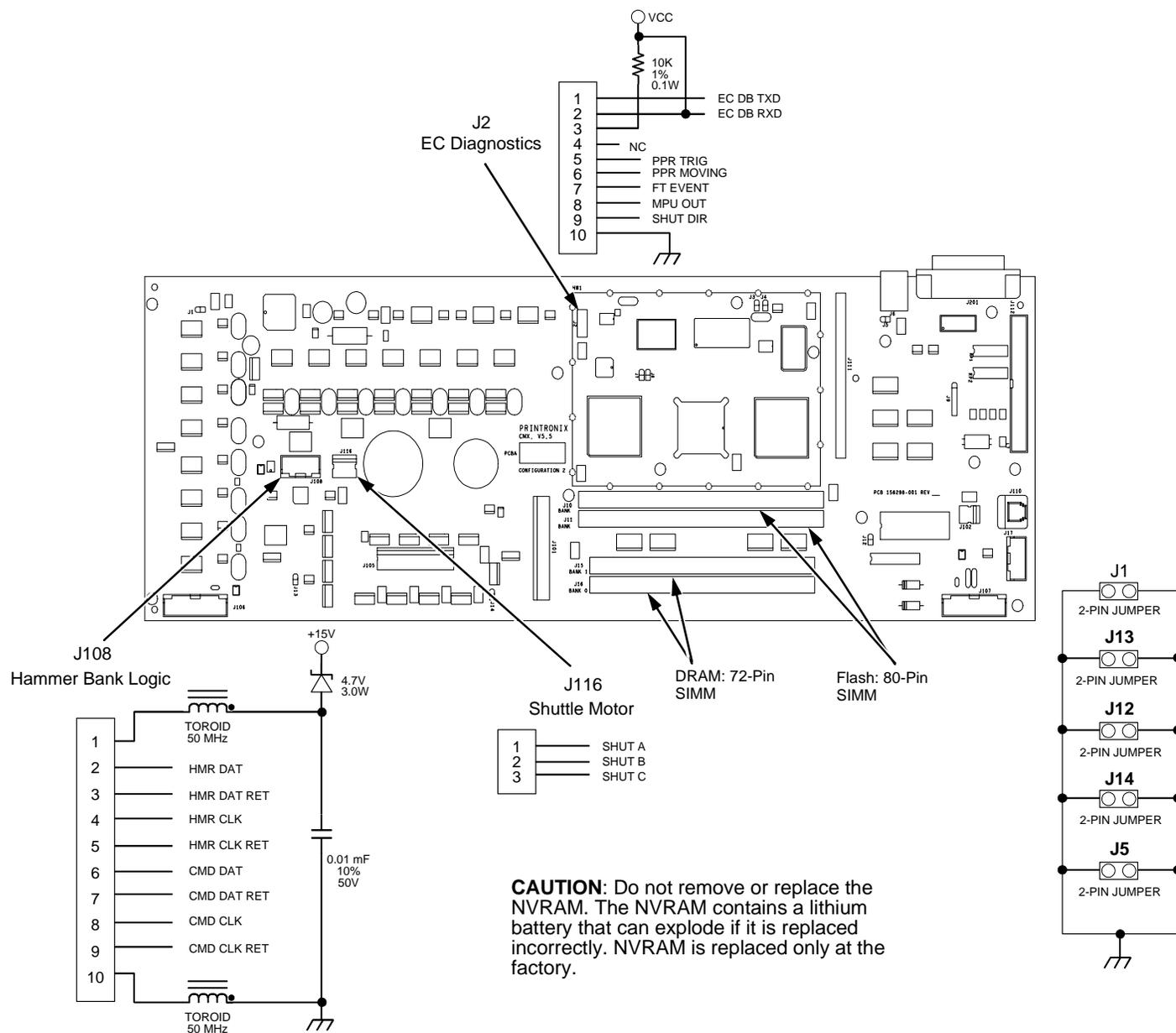


Controller (continued)

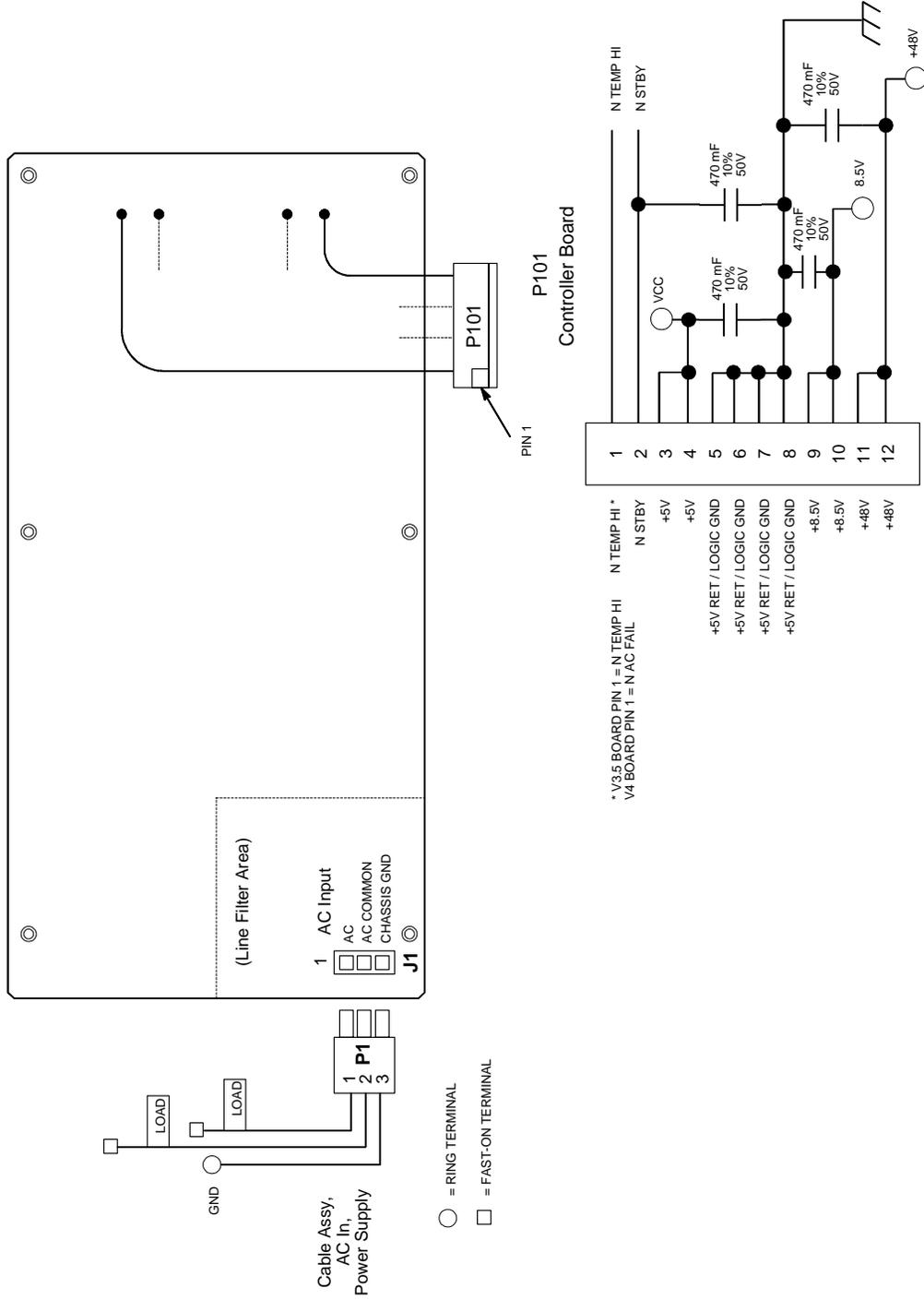


**CAUTION:** Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.

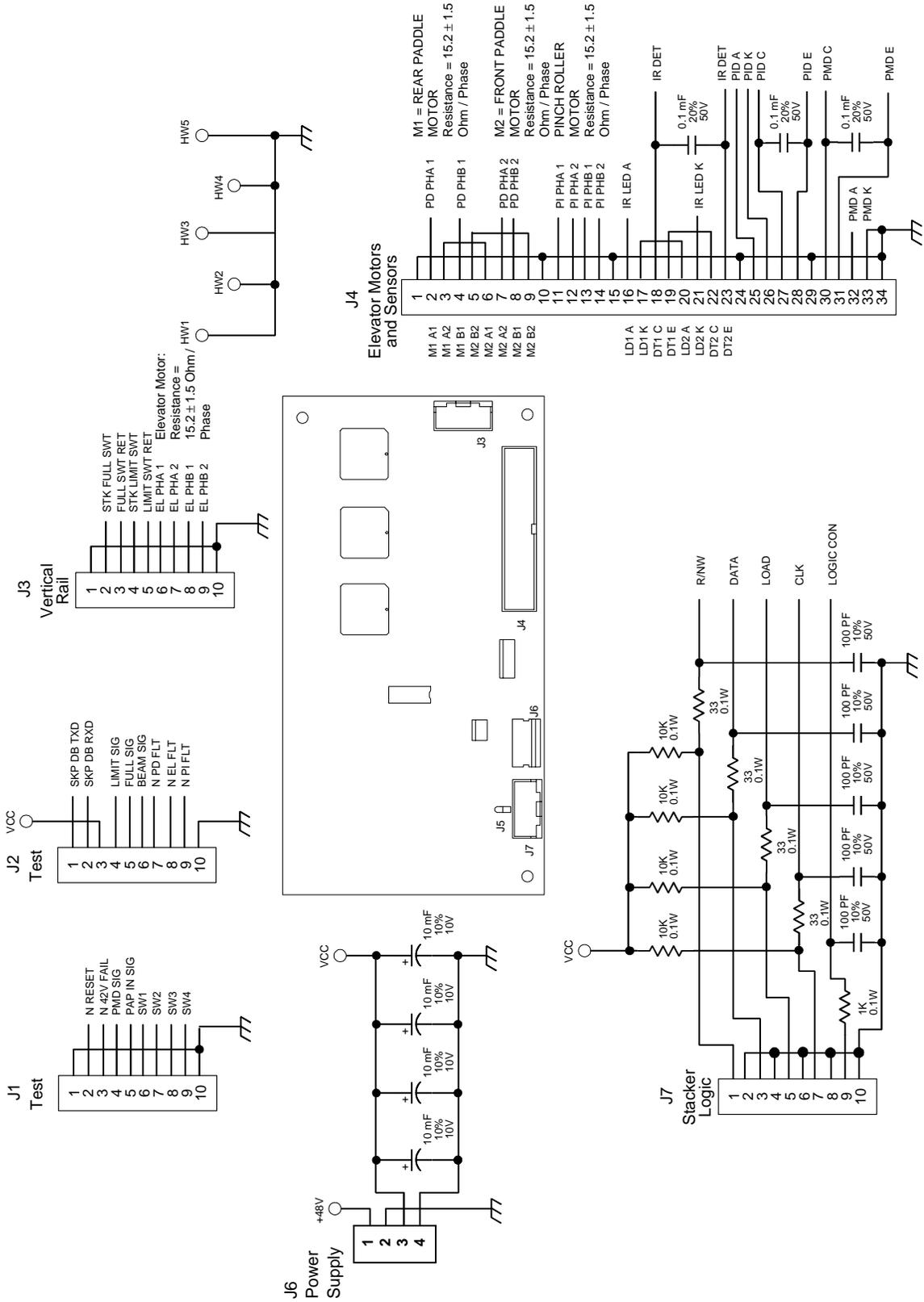
Controller (continued)



# Power Supply



# Power Stacker PCBA

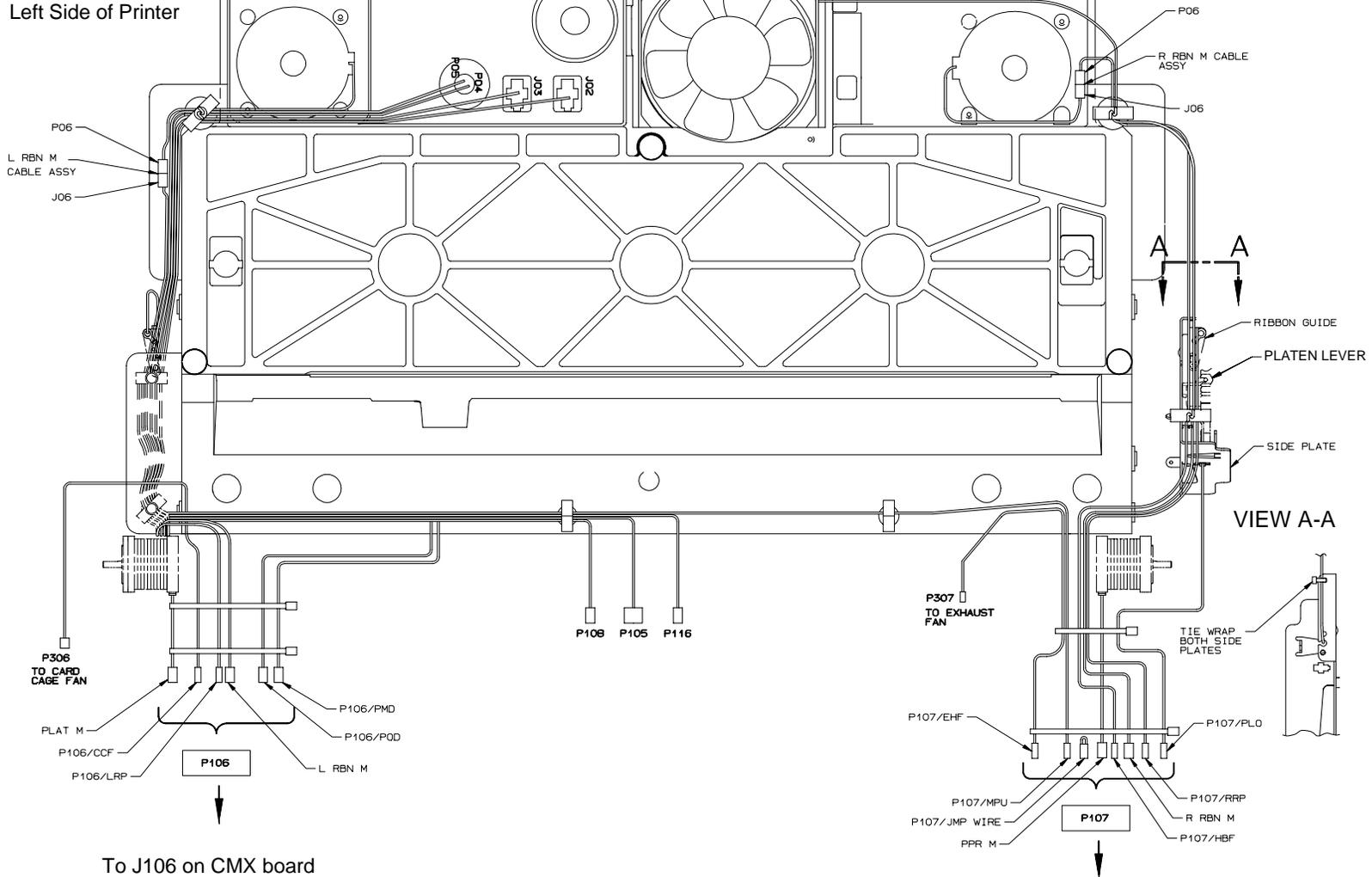




Front of Printer

Right Side of Printer

Left Side of Printer



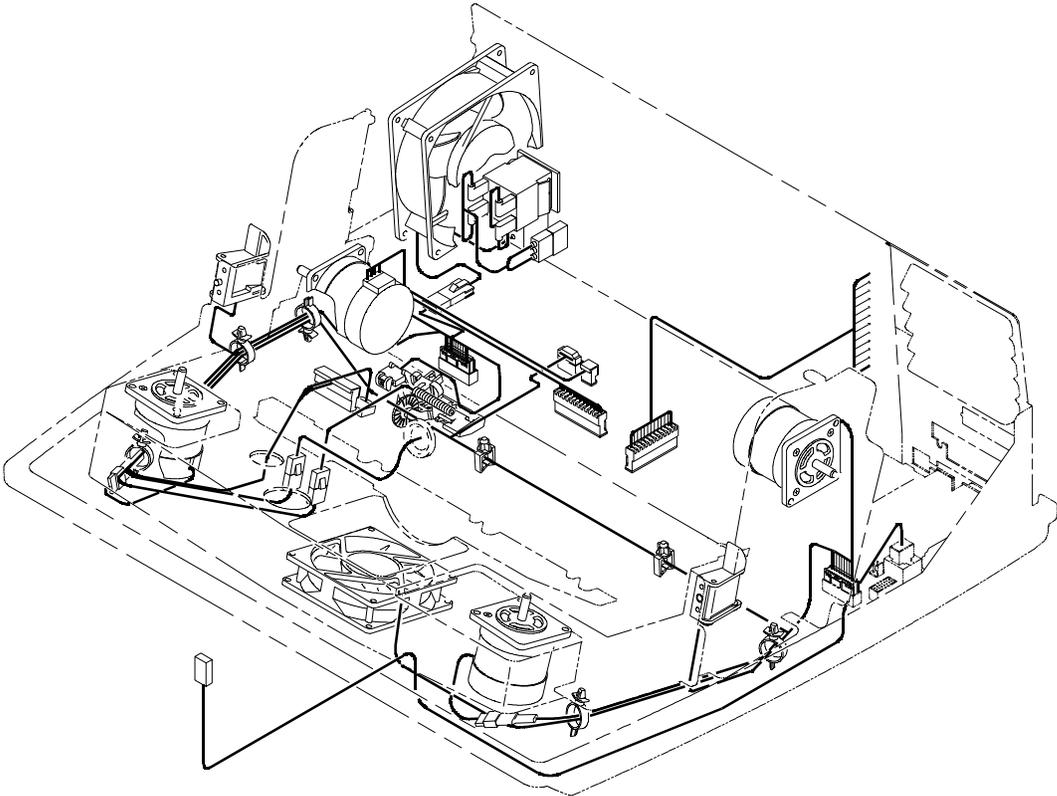
To J106 on CMX board

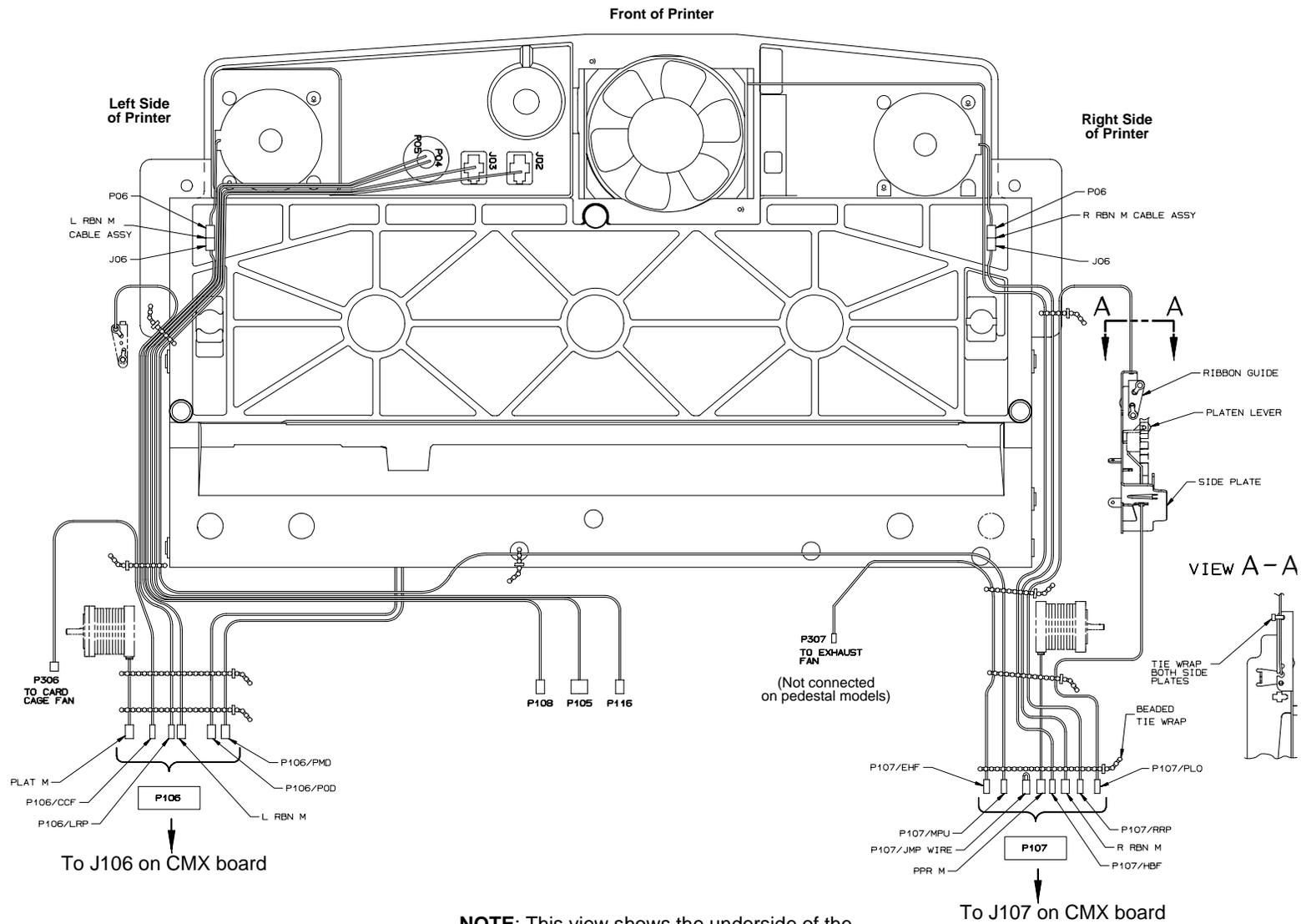
**NOTE:** This view shows the underside of the mechanism base.

To J107 on CMX board

Cable Routing, Mechanism Base, Cabinet Model

Cable Routing, Pedestal Model



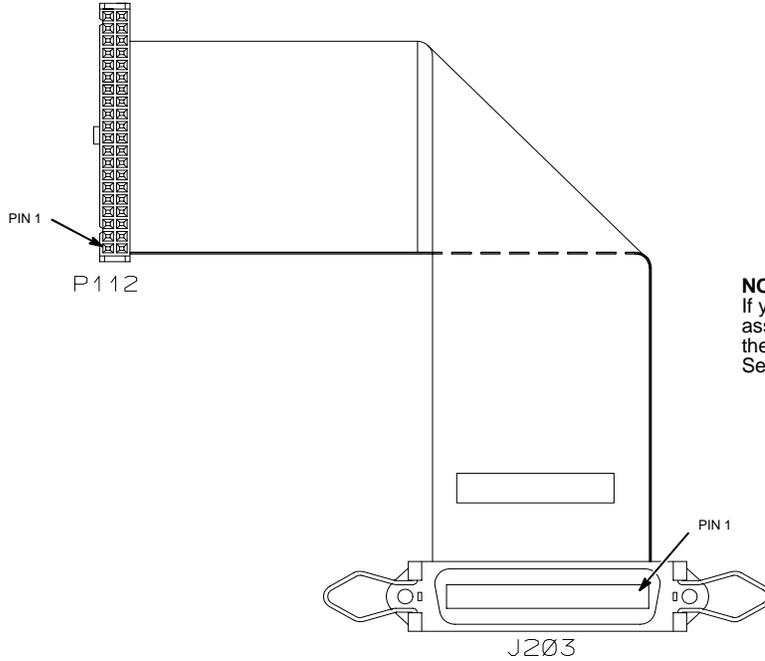
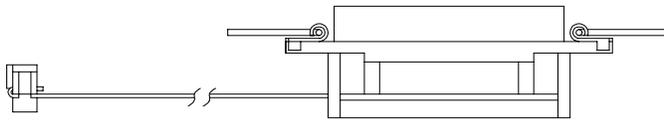


**NOTE:** This view shows the underside of the mechanism base.

Cable Routing, Mechanism Base, Pedestal Model

### Cable Assembly, Centronics I/O

152439-901PX

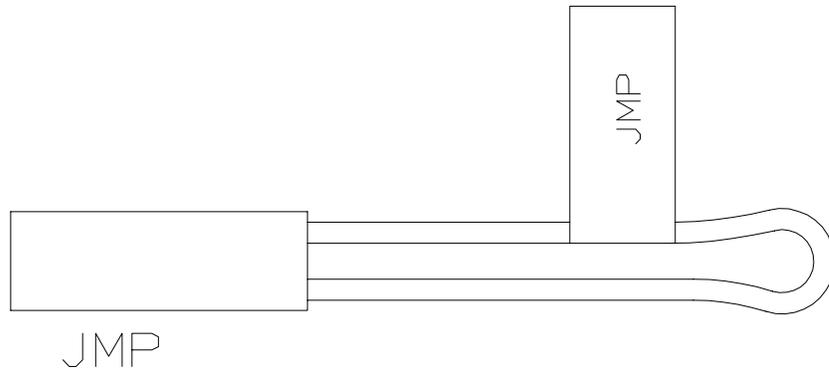


**NOTE:**  
If you replace the I/O cable assembly, you must install the ferrite clamp. See Appendix E.

---

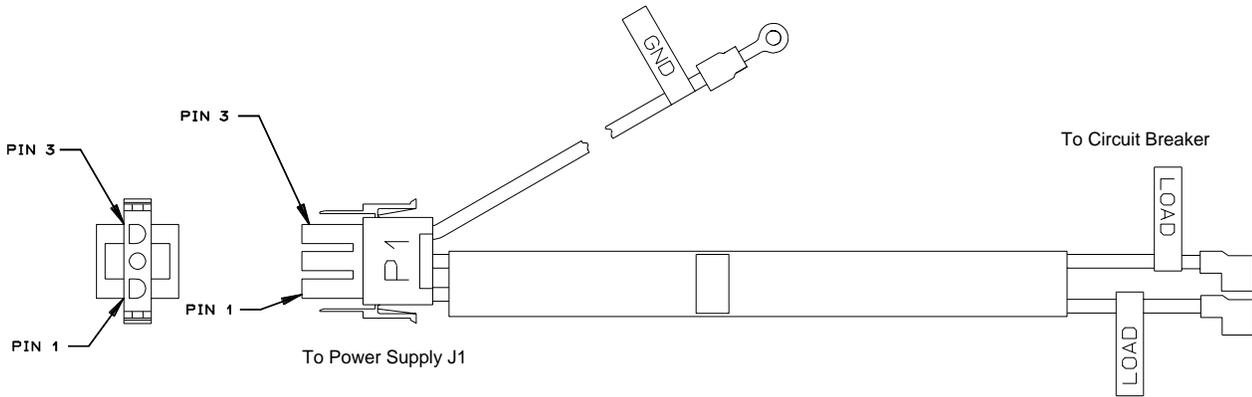
**Cable Assembly, 2-Pin Jumper, 0.1 Ctr**

154470-001



Cable Assembly, AC In, Power Supply

Kit No. 153502-001PX

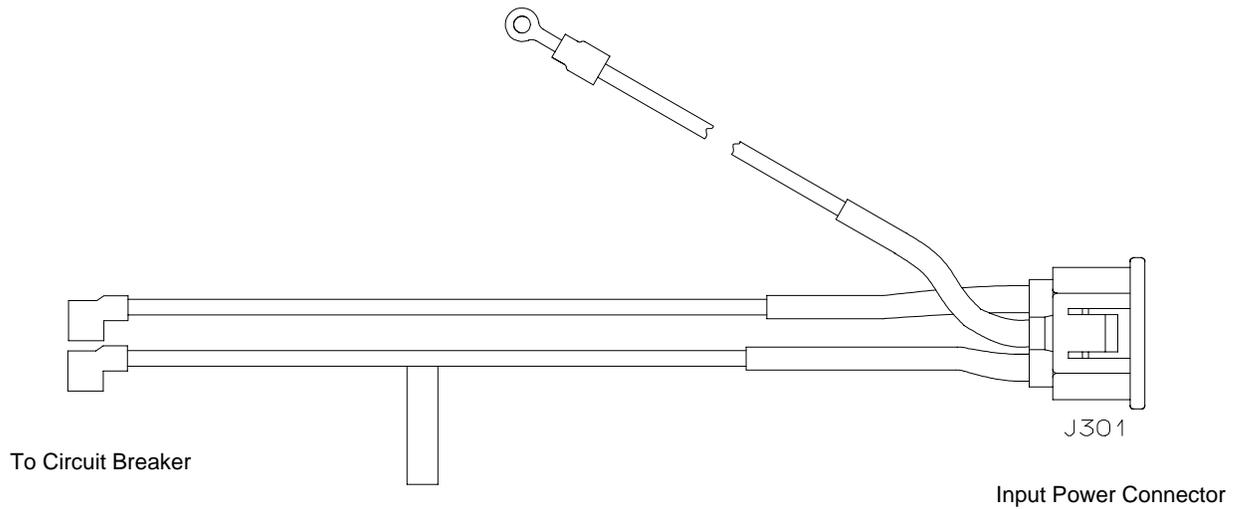


PIN	WIRE COLOR
1	BLACK
2	WHITE
3	GREEN/YELLOW

---

## Cable Assembly, AC Power Input

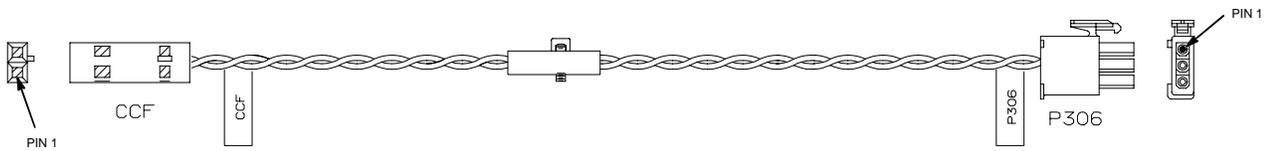
Kit No. 153502-001PX



PIN	WIRE COLOR
LINE	BLACK
NEUTRAL	WHITE
GROUND	GREEN/YELLOW

### Cable Assembly, Card Cage Fan

152422-901PX

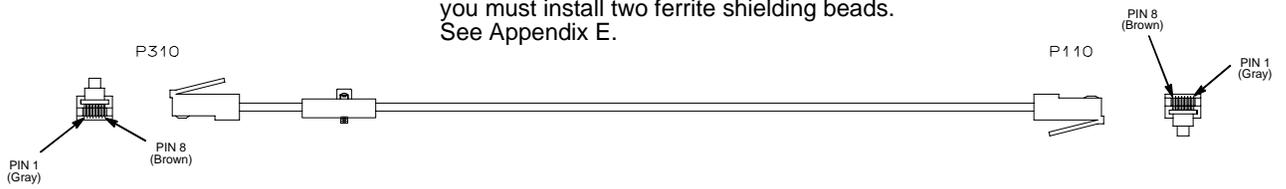


WIRE TABLE		
CCF	P306	WIRE COLOR
PIN 1	PIN 3	BLACK
PIN 2	PIN 2	GRAY
	PIN 1	N/C

## Cable Assembly, Control Panel

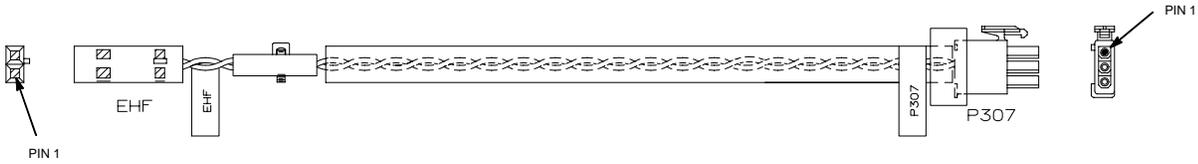
152440-901PX

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



### Cable Assembly, Exhaust Fan

152424-901PX

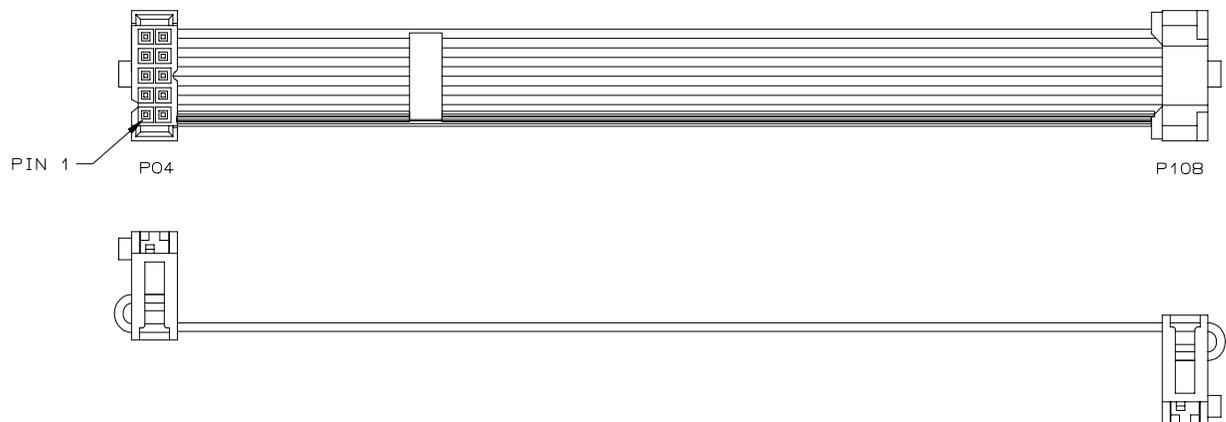


WIRE TABLE		
EHF	P307	WIRE COLOR
PIN 1	PIN 3	BLACK
PIN 2	PIN 2	GRAY
	PIN 1	N/C

---

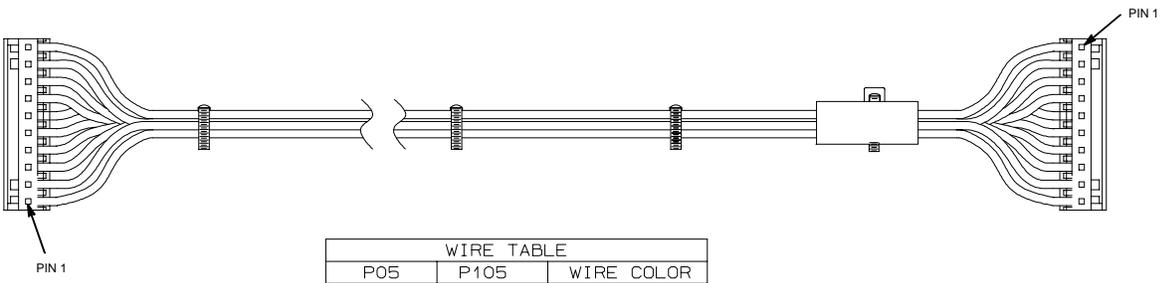
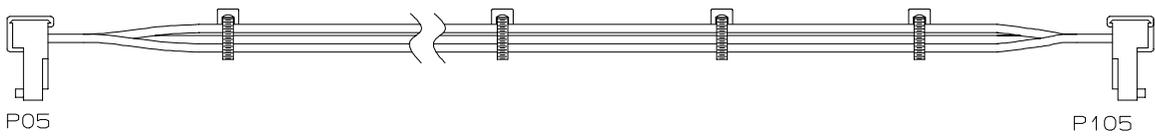
## Cable Assembly, Hammer Bank Logic

152421-901PX



### Cable Assembly, Hammer Bank Power

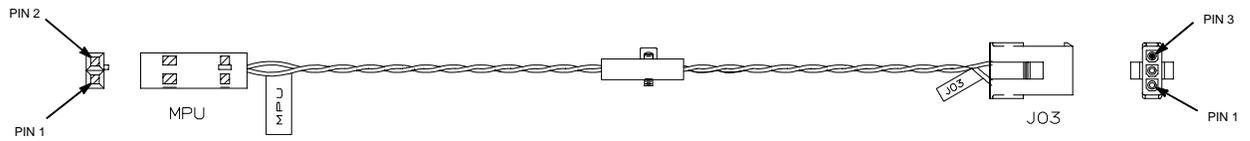
164805-901PX



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

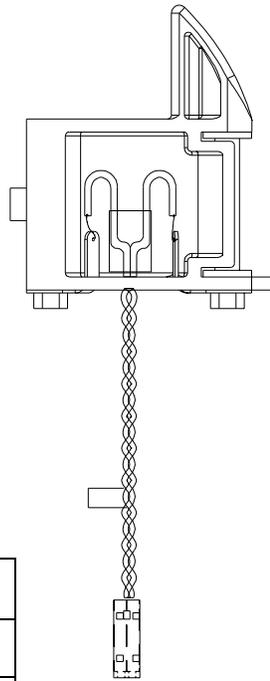
152425-901PX



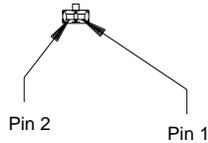
WIRE TABLE		
MPU	J03	WIRE COLOR
1	1	BLACK
2	2	GRAY
	3	N/C

### Ribbon Guide Kit

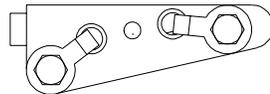
163597-901PX



Pin Connection	
P106 (LRP) / P107 (RRP)	Wire Color
Pin 1	Black
Pin 2	Black

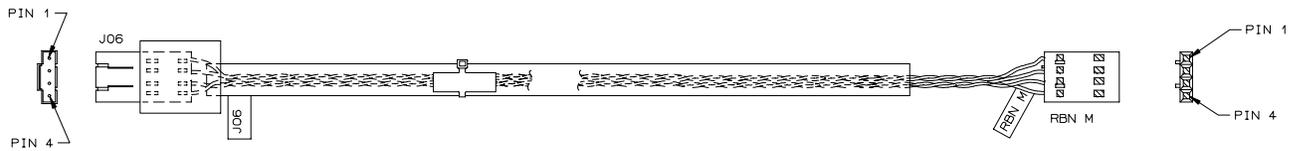


**NOTE:** Left ribbon guide shown. Right is mirror image.



# Cable Assembly, Ribbon Motor, Extension

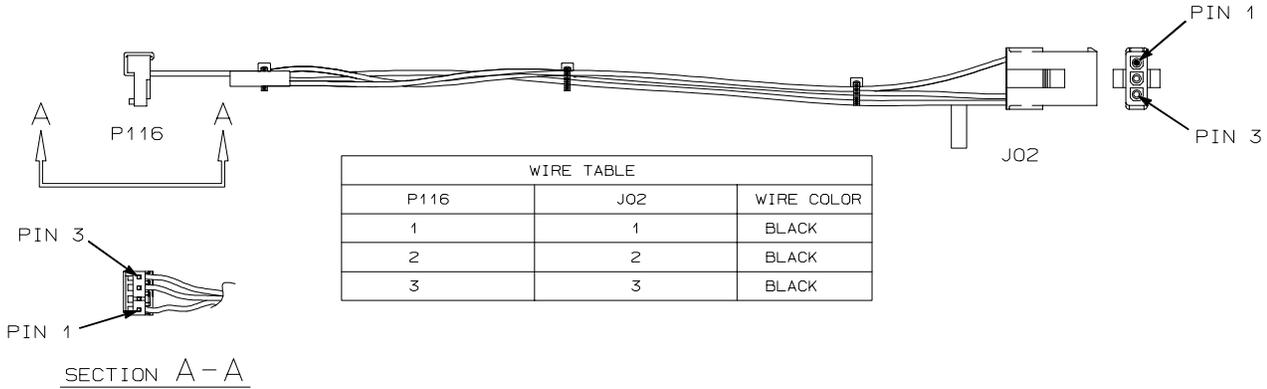
154067-001PX



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

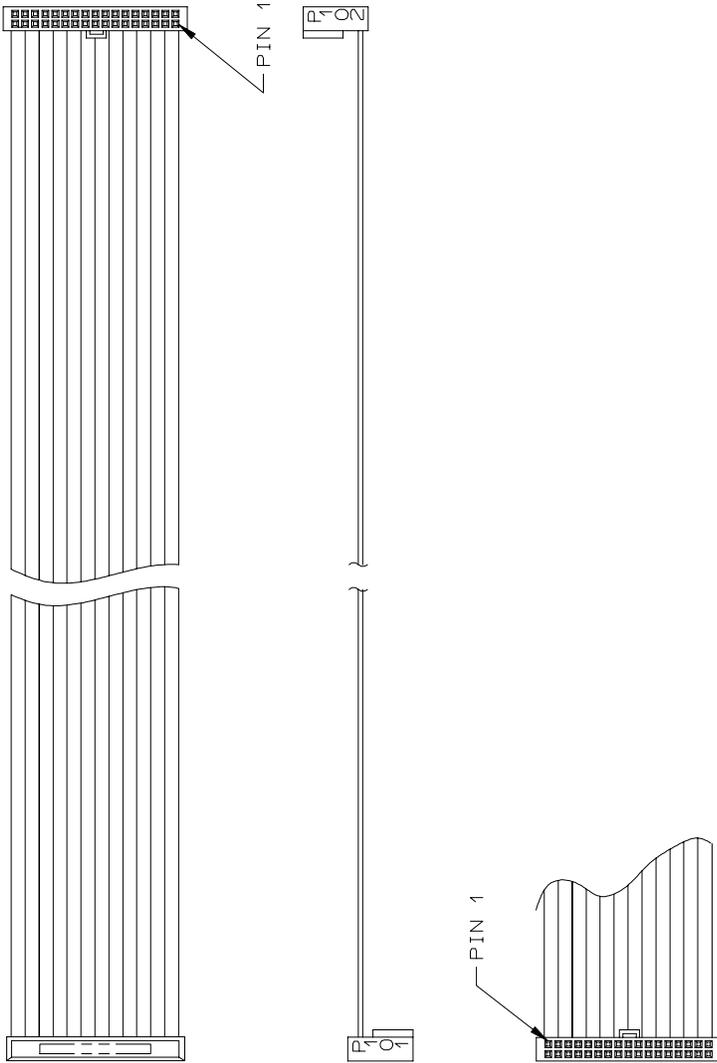
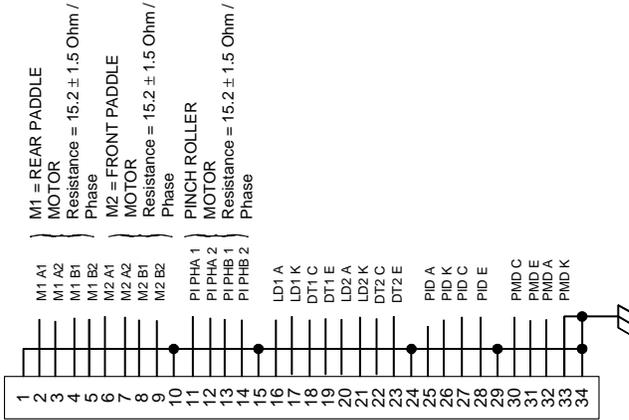
### Cable Assembly, Shuttle Motor Drive

152420-001PX



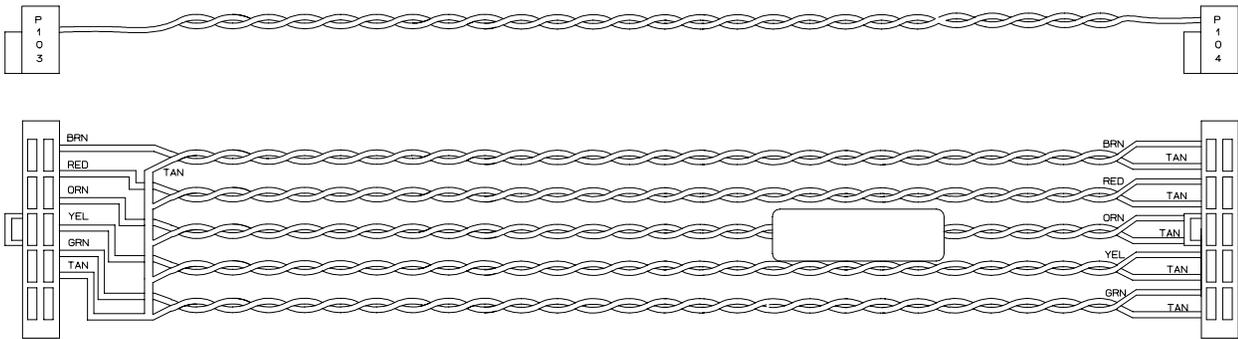
# Frame Cable, Power Stacker

158445-001PX



## Logic Cable, Power Stacker

158444-001PX

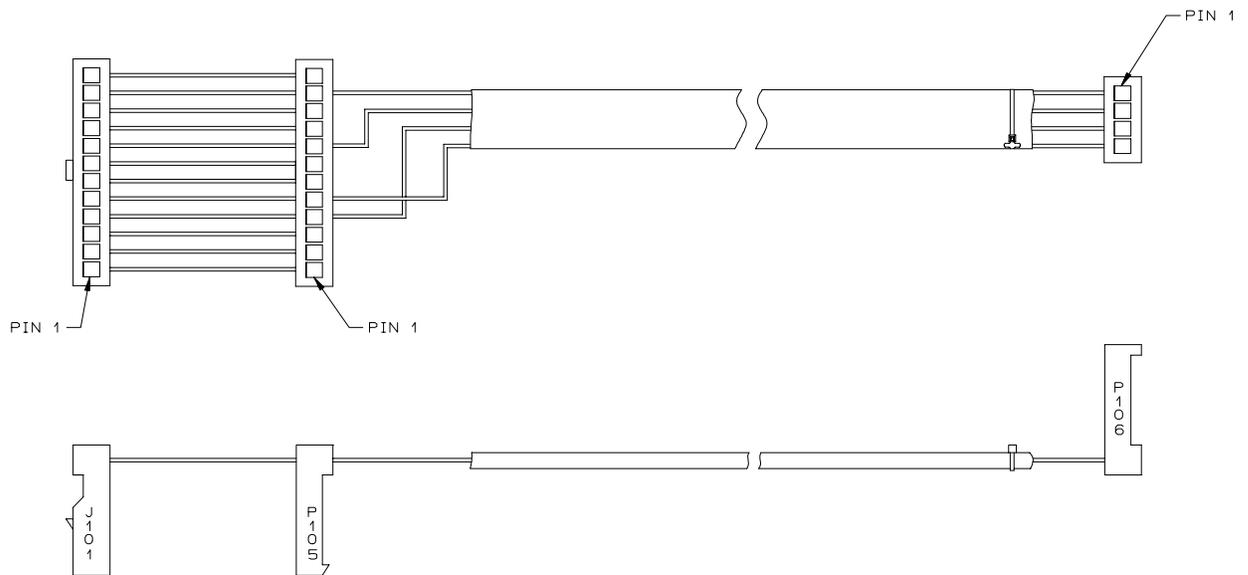


TWISTED PAIR COLOR CODING		
PAIR	LINE	COLOR
1	1	BRN
	2	TAN
2	3	RED
	4	TAN
3	5	ORN
	6	TAN
4	7	YEL
	8	TAN
5	9	GRN
	10	TAN

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		

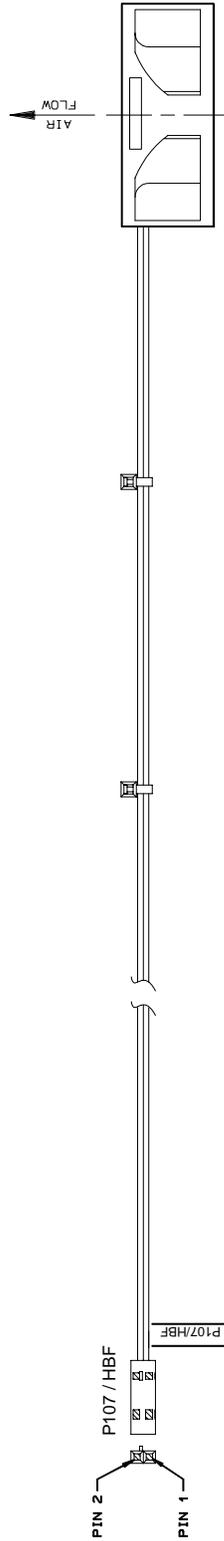
### Vertical Rail Cable, Power Stacker

158442-001PX



# Fan Assembly, Hammer Bank

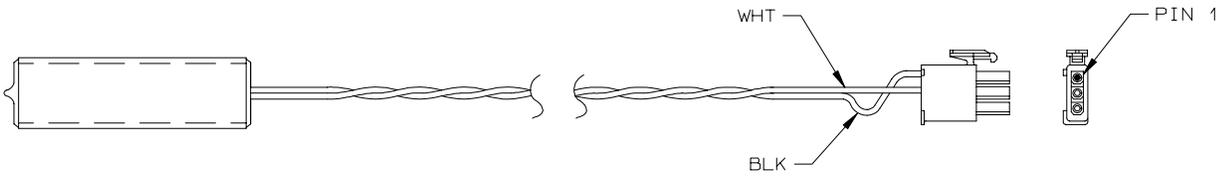
152416-901PX



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

### Magnetic Pickup (MPU) Assembly

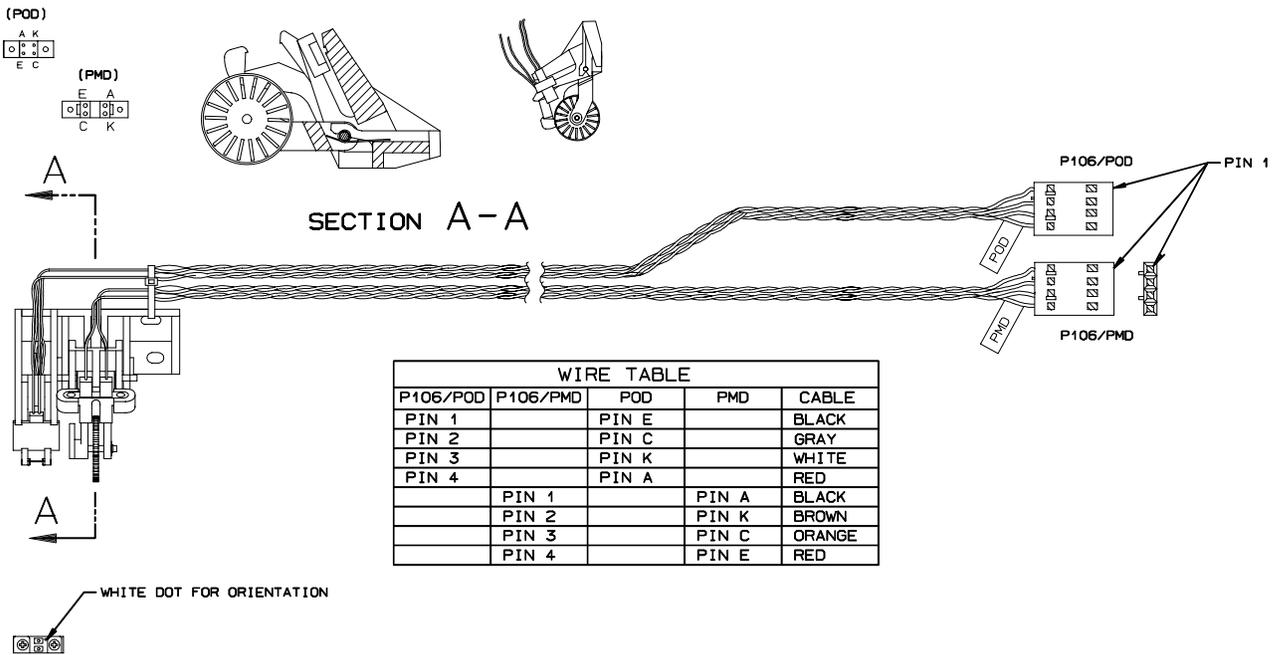
150281-901PX



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

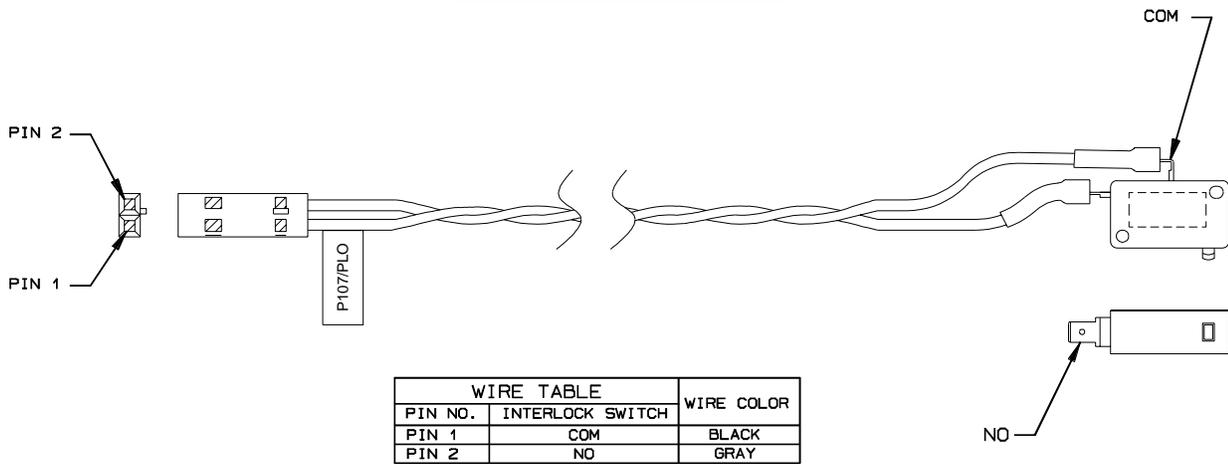
# Switch Assembly, Paper Detector

152415-901PX



### Switch Assembly, Platen Interlock

152417-901PX



WIRE TABLE		
PIN NO.	INTERLOCK SWITCH	WIRE COLOR
PIN 1	COM	BLACK
PIN 2	NO	GRAY

# B

## *Printer Specifications and Regulatory Information*

### **Ribbon Specifications**

Use only these Hewlett-Packard ribbon kits:

<b>Kit No.</b>	<b>Ribbon Type</b>	<b>Qty/Kit</b>	<b>Part No.</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
C3212A	60 yard security ribbon	1	C3212-60001

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

For more information please contact any of our worldwide sales offices of HP Channel Partners, or check out <http://www.hp.com/go/linejet>. For the location of the nearest office in the United States call: 1-800-637-7740.

### **Ribbon Life**

<b>Product Number</b>	<b>Description</b>	<b>For Use on Model</b>	<b>Product Lifetime</b>
C3206A	Box of six 60 yard non-inked security ribbons	All LineJet Models All HP LP Series Models	30 Million Characters
C3207A	Box of six 60 yard black text ribbons	All LineJet Models All HP LP Series Models	30 Million Characters

<b>Product Number</b>	<b>Description</b>	<b>For Use on Model</b>	<b>Product Lifetime</b>
C3208A	Box of six 100 yard black text ribbons	LineJet 500Q, LineJet 1000Q, LineJet 1500Q, LPQ475, LPQ500, LPQ800, LPQ1000, LPQ1200, LPQ1400, LPQ1500	50 Million Characters
C3209A	Box of six 60 yard OCR/Bar Code ribbons	All LineJet Models All HP LP Series Models	27 Million Characters or 2,800 shipping labels
C3210A	Box of six 100 yard OCR/Bar Code ribbons	LineJet 500Q, LineJet 1000Q, LineJet 1500Q, LPQ475, LPQ500, LPQ800, LPQ1000, LPQ1200, LPQ1400, LPQ1500	45 Million Characters or 4,667 shipping labels

## 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

## Environmental Characteristics

---

### 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®

LineJet 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

---

Current				
	LineJet 500P	LineJet 500Q	LineJet 1000Q	LineJet 1500Q
Printing, Typical <sup>1</sup>	2.15A	2.43A	3.28A	4.37A
Printing, Maximum <sup>2</sup>	3.60A	3.05A	4.39A	6.06A
Non-Printing <sup>3</sup>	0.90A	1.17A	1.19A	1.16A
Power				
Printing, Typical <sup>1</sup>	190W	191W	271W	364W
Printing, <sup>2</sup> Maximum	320W	244W	380W	514W
Non-Printing <sup>3</sup>	90W	84W	86W	84W

<b>Current</b>				
	<b>LineJet 500P</b>	<b>LineJet 500Q</b>	<b>LineJet 1000Q</b>	<b>LineJet 1500Q</b>
<b>Heat</b>				
Printing, Typical <sup>1</sup>	648 BTU/hr	652 BTU/hr	925 BTU/hr	1342 BTU/hr
Printing, maximum <sup>2</sup>	1092 BTU/hr	833 BTU/hr	1297 BTU/hr	1754 BTU/hr
Non-Printing <sup>3</sup>	307 BTU/hr	287 BTU/hr	294 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

## **Material Safety Data Sheets**

---

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

---

**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。



---

# C

## *Abbreviations & 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*

---

### **Loading Flash Memory from One Diskette**

---

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 PGL or Code V 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, parallel, or Ethernet ports of the printer.

---

#### **Note**



The following procedure is for loading software through the serial or parallel port. To download software through the Ethernet interface, refer to the *LineJet Print Server User's Guide*, 170989-001PX.

---

The load commands are different, depending on the printer 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*  
Now 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) (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)  
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 -pbc1<Return>
```

---

19. While the file is copied into memory, the printer LCD informs you of the load process and status. (See Table 2, page 34.)
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 101).
27. Using the configuration printout(s) you made in step 1, reconfigure the printer. (Refer to the *User's Guide*.)

## Loading Flash Memory from Multiple Diskettes

---

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 PGL or Code V 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 compressed files on more than one 3.5 inch floppy diskette. You will recombine the multiple files from the diskettes into one file on your computer's hard disk in order to download the file to the printer. To assist in this process, the MS-DOS® based program PKUNZIP® is included on the last diskette with the program file.

You can load software through the serial, parallel, or Ethernet ports of the printer.

---

### Note



The following procedure is for loading software through the serial or parallel port. To download software through the Ethernet interface, refer to the *LineJet Print Server User's Guide*, 170989-001PX.

---

The load commands are different, depending on the printer port you use. These differences are explained in the note following step 26.

1. Make a printout of *all* saved configurations. (Refer to the *User's Manual*.) (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 26.

- 
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. Create a directory on your computer hard drive where you will store the recombined files from the emulation diskettes by typing the following at the DOS prompt:  
MD DOWNLOAD<Return>
  11. Make the newly created directory the “active” directory by typing the following at the DOS prompt:  
CD DOWNLOAD<Return>
  12. Insert the last diskette in the series (e.g., 2 of 2, 3 of 3, etc.) into diskette drive A (or B) of the computer.
  13. Get the name of the compressed file on the diskette by typing the following at the DOS prompt:  
DIR A:<Return> (If the diskette is in drive B, type DIR B:<Return>)  
The compressed file on the diskette takes the form *FILENAME.ZIP*, where the filename is a six digit number (e.g., 123456.zip).
  14. At the DOS prompt type:  
A:\PKUNZIP A:\*FILENAME* (Replace A: with B: if you are using the B dirve), where *FILENAME* is the six digit number you noted in the previous step.
  15. The PKUNZIP program will execute, and the following message will appear on the computer screen:  
**Insert disk #1 - Press a key when ready**
  16. Remove the diskette in the disk drive and insert the diskette labeled  
Disk 1 of 2 (or 1 of 3, etc.)
  17. Press the <Return> key. After the file is decompressed to the hard drive, the following message will appear on the computer screen:  
**Insert disk #2 - Press a key when ready**
  18. Remove the diskette in the disk drive and insert the diskette labeled  
Disk 2 of 2 (or 2 of 3, etc.)
  19. Press the <Return> key. If there are only two diskettes for the emulation, you will be Returned to the DOS prompt when the decompression is

complete. If there are three diskettes, you will be asked to insert disk #3 and press a key.

20. When all diskettes have been decompressed, type the following at the DOS prompt:  
DIR<Return>  
You will see a directory listing containing the file **FILENAME.EXE**, where the filename is the six digit number (e.g., 123456.exe) you noted above.  
**This is the file you will download into the printer.**
21. 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.
22. 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.

- 
23. Press the ► **(NEXT)** key; "SELECT DOWNLOAD PORT=DATAPRODUCT" appears on the LCD.
  24. Press ► **(NEXT)** again to cycle through the download ports available in the printer:  
DATAPRODUCT (parallel)  
CENTRONICS\* (parallel) (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)  
RS422-38.4K (RS-422 serial, 38400 baud)  
RS422-115K (RS-422 serial, 115000 baud)
  25. 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.
  26. At the DOS prompt on the computer type:  
*FILENAME.EXE* -pb<Return>  
where *FILENAME.EXE* is the compressed file you noted in step 20. This command decompresses the file on the hard drive 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 25.

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 -pbc1<Return>
```

- 
27. While the file is copied into memory, the printer LCD informs you of the load process and status. (See Table 2, page 34.)
  28. When the new program has successfully loaded into memory and the printer has reset itself, set the printer power switch to O (off).
  29. Unplug the AC power cord from the printer.
  30. Remove the diskette from the computer and store it with the printer.
  31. Power off the computer.
  32. If you had to install a data cable to the computer and printer in step 6, disconnect it from the computer and printer.
  33. Reconnect the customer's data input cable(s) to the printer, if required.
  34. Return the printer to normal operation (page 101).
  35. Using the configuration printout(s) you made in step 1, reconfigure the printer. (Refer to the *User's Guide*.)



---

# E

## *Host Configurations and Drivers*

---

### **HP3000 / MPE-V**

---

#### **MPE-V Typical Configuration**

LOGICAL DEVICE #? Provided by CE  
DEVICE NAME? HPPCLATP For use with ATP  
HPPCLADCC For use with ADCC  
HPLPATP For use with ATP  
HPLPADCC For 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 = HIOASLP0 For use with ATP  
= HIOASLP2 For use with ADCC  
DEVICE CLASSES = LP? User's choice

## HP3000 / MPE-XL / MPE / iX

---

### 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®

---

## 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 Nameuser's choice

Printer Model Interfaceuser's choice

Printer Device File NameSAM creates a special file

Printer Classuser's choice

If serial printer is selected:

The system displays the Serial Interface Hardware Paths

Portselect a valid port

Printer Nameuser's choice

Printer Model Interfaceuser's choice

Printer Device File NameSAM creates a special file

Printer Classuser's choice



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# F

## *Paper Specifications and Forms Design*

### **Introduction**

---

LineJet 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.

The first section of this appendix lists general specifications for continuous form paper. (Specific brands or types of paper are not recommended.) Adherence to these specifications will ensure the best print quality and reliable operation.

The second section goes into more detail, providing definitions, guidelines, and a checklist to use for designing forms that will run smoothly through the print station of the HP LineJet printer.

## General Paper Specifications

This section describes the minimum paper specifications that must be met to ensure the best printer performance.

Always test paper and forms before buying large quantities. Make all measurements at 20° to 26° Celsius (68° to 78° Fahrenheit) and 45% to 55% relative humidity. LineJet printers perform well with forms that meet the specifications listed in Table 7 and Table 8 below.

### Note



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.

**Table 7. 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)

**Table 8. Paper Weights**

<b>Single-Part Forms</b>	
Standard	15 to 100 pound (57 to 380 gm/meter <sup>2</sup> )
Best Print Quality	18 to 60 pound (68 to 227 gm/meter <sup>2</sup> )
<b>Multipart 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

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.

## Paper Guidelines

The terms below are used to describe and discuss continuous form paper.

### Terms and Definitions

Chaff	Residual bits of paper not completely removed after the punch process that creates tractor pin holes, major and minor perforations, etc.
Cut Point	The area along a perforation where a cut has been made that extends through the entire form.
Cut-to-Tie	The ratio of cut points to tie points occurring along a perforation
Evenness	The amount of variation between the thickest and thinnest points measured across the print area (i.e., between the side perforations).
Form Thickness	Thickness measured at the thickest point of the entire form. This includes glue lines, compressed staples, perforations, etc., and is not limited to the printed region of the form.
Margin	The region outside the print area of the form. The margin is typically bounded by the outermost vertical perforations (i.e., where the tractor holes are located) and the edge of the form.
Print Area	The region where printing occurs, and which is always between the side perforations.
Print Station	The area in the printer where the actual impacts that constitute printing occur.
Staple	A punch-cut fastening stitch located along the vertical edge and within the side perforation region of a multipart form. (Note that this is <i>not</i> a metal staple.)
Tenting	The measured thickness between the print area of the form and the peak thickness of a major perforation. Tenting is typically caused by overly stiff perforations or incorrect registration of the inner parts of multipart forms.
Tie Point	The area along a perforation between the cut points (see above).

The figures below illustrate the terms used in this appendix.

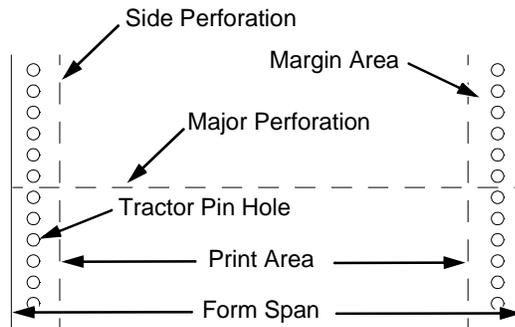


Figure 52. Basic Forms Terminology

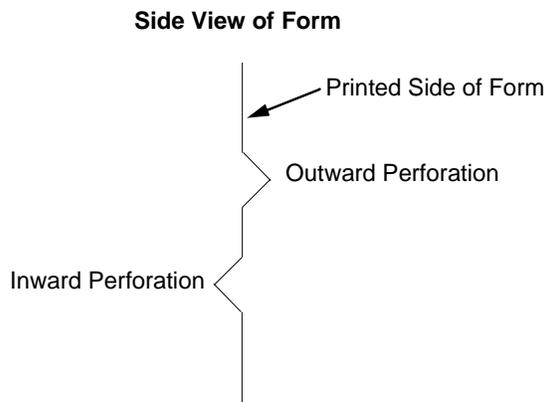


Figure 53. Inward and Outward Perforations

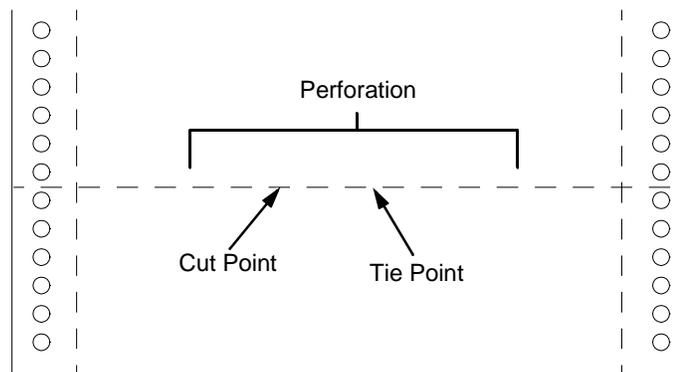


Figure 54. Cut Points and Tie Points

## Environmental Considerations

---

Before they are used, forms should be stored for at least 24 hours—preferably 48 hours—in the environment in which they will be used. This stabilizes the moisture content of the paper, resulting in better feeding and stacking. But forms should never be stored in environments that result in damage such as delamination of glues, creasing, folding, etc.

## Form Types

---

Three kinds of continuous form paper are specified for use with the printer:

- Edge-perforated, fanfolded, single-part forms
- 2- to 6-part multipart carbon forms
- 2- to 4-part multipart carbonless forms

For all forms, the width range is 3 to 16 inches, the length range is 3 to 12 inches.

## Form Weight

---

Use 15 to 100 pound (6.80 to 45.36 kg) stock. Light weight and recycled forms must be strong enough to assure that tractor holes and perforations do not tear or detach during form feed, skipping, and ejecting operations.

## Form Thickness

---

Forms must be no thicker than 0.025 inches (0.0635 cm). This figure is for the thickest point of the form—including glue lines, staples, perforations, etc.—and is not restricted to just the print area.

## Form Evenness

---

The evenness of forms must not exceed 0.003 inches (0.00762 cm) across the print area (between the side perforations).

Tenting caused by buildup of perforation thickness must be minimized. A perforation thickness measured at the major perforation that exceeds 1.25 times the forms thickness measured in the print area will result in an unpredictable and unreliable form. The perforation thickness must never exceed the maximum forms thickness of 0.025 inches (0.0635 cm).

## Tractor Pin Engagement

---

The printer uses tractors with 6-pin engagement. Detailed engagement specifications are given in ISO-2784, but are summarized in the table below.

<b>Specification</b>	<b>Inches</b>	<b>Millimeters</b>
Hole centerline (CL) to edge of form	0.236 ± 0.028	6.0 ± 0.1
Hole Diameter (Serrations or any occlusion due to incorrect registration of multipart forms cannot exceed this dimension.)	0.156 ± 0.004	4.0 ± 0.1
Distance between centers of two consecutive holes	0.500 ± 0.002	12.7 ± 0.05
Maximum deviation of holes from their centerline	0.004	0.1
Maximum deviation of lefthand hole to adjacent righthand hole (CL to CL)	0.006	0.15
Maximum parallel deviation of lefthand hole CL to righthand hole CL	0.006	0.15

## **Methods of Forms Attachment**

Any method of attachment (staples, crimps, gluing, etc.) must be designed in a way that does not permit air to be trapped between copies of a form. Hard or wire brads and staples must not be used.

Any attachment must not coincide with the major perforation or any horizontal perforation.

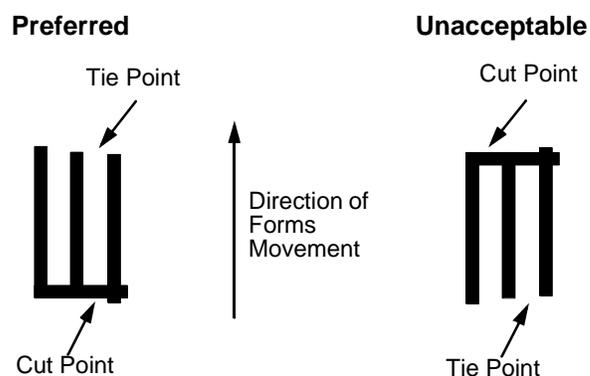
### **Gluing**

Gluing must be controlled and uniform, since it is a major contributor to the maximum form thickness. A form that meets the maximum forms thickness requirement in the print area but which exceeds the maximum thickness at a glue line is considered an unreliable and unpredictable form.

### **Staples**

Staples must be used only in the margin area of the form and must not be in line with the path of the tractor holes. Ideally, staples are placed in the margins so that they coincide with areas of the form where printing does not occur.

The figure below shows acceptable and unacceptable ways of fabricating staples.



### Cut-to-Tie Ratio

A common cut-to-tie ratio for bond forms is 4:1 (that is, 80% cut to 20% ties). This value is dictated chiefly by the application program that the form runs under. Lower cut-to-tie ratios will yield better form handling, but stacking may suffer due to increased stiffness of the perforations. Some level of experimentation is required to determine the best cut-to-tie ratio. But remember that a cut-to-tie ratio that causes a thickness buildup greater than 0.025 inch (0.635 mm) or that creates an evenness variation greater than 0.003 inch (0.0762 mm) will result in an unreliable and unpredictable form.

### Perforation Intersections

Whenever a horizontal perforation intersects with a vertical perforation, the point of intersection must be a tie point. Cut points at such intersections make the form unacceptable.

### Chaff Content

Tractors holes should be clear of chaff. As much as possible, there should not be loose chaff in the box in which the paper is packed.

## Form Design Checklist

Use this checklist to help you remember key areas of consideration when designing and ordering forms and paper stocks.

### Environment

\_\_\_\_\_ Before they are used, forms are given at least 24 hours of condensing time in the environment in which they will be used.

\_\_\_\_\_ Forms are not stored in environments that result in such damage as delamination of glue lines, creasing, folding, etc.

### Type of Form

Form Type (Check One)					
1 Part	2 Part	3 Part	4 Part	5 Part	6 Part

<----- Carbonless Range ----->

<----- Carbon Range ----->

Recycled Paper? Yes \_\_\_\_\_ No \_\_\_\_\_ If yes, assure adequate form strength to prevent tractor holes and perforations from tearing or detaching during form feeds and page ejects.

Security Form? Yes \_\_\_\_\_ No \_\_\_\_\_ If yes, the last page of the form should have a minimum 50% reflectance, and, if possible, the stiped page faces inward to the form.

### Form Weight

Form weight = \_\_\_\_\_  
 (Minimum = 15 lb. / 6.8 kg ; Maximum = 100 lb / 45.36 kg)

### Form Thickness

Form thickness = \_\_\_\_\_  
 (0.025 inches / 0.0635 cm maximum measured at the thickest point of the form, which includes perforations, compressed staples, glue lines, etc.)

### Form Evenness

The evenness of the form = \_\_\_\_\_  
 (Not to exceed 0.003 in. / 0.0635 cm)

Tenting due to buildup of perforation thickness must be minimized. A perforation thickness measured at the major perforation that exceeds 1.25 times the forms thickness measured in the print area will result in an

unreliable and unpredictable form. Perforation thickness must not exceed the maximum form thickness of 0.025 in. / 0.0635 cm.

### Tractor Pin Holes

The holes which engage the tractor pins must conform to the following specifications:

Specification	Inches	Millimeters
Hole centerline (CL) to edge of form	0.236 ± 0.028	6.0 ± 0.1
Hole Diameter (Serrations or any occlusion due to incorrect registration of multipart forms cannot exceed this dimension.)	0.156 ± 0.004	4.0 ± 0.1
Distance between centers of two consecutive holes	0.500 ± 0.002	12.7 ± 0.05
Maximum deviation of holes from their centerline	0.004	0.1
Maximum deviation of lefthand hole to adjacent righthand hole (CL to CL)	0.006	0.15
Maximum parallel deviation of lefthand hole CL to righthand hole CL	0.006	0.15

### Methods of Forms Attachment

- \_\_\_\_\_ Must not allow air entrapment between copies of the form
- \_\_\_\_\_ Must not use hard brads or staples
- \_\_\_\_\_ Must not coincide with major perforation or any horizontal perforation
- \_\_\_\_\_ Gluing lines must not result in a form that exceeds 0.025 in. / 0.0635 cm thickness
- \_\_\_\_\_ Staples must be used only in margin area of form
- \_\_\_\_\_ Staple cuts must not be in the direction of form movement through the tractors
- \_\_\_\_\_ Staples must not occur in-line with the path of the tractor holes
- \_\_\_\_\_ Staples should be placed in the margins so that they coincide with areas of the form where printing will not occur

### Cut-to-Tie Ratio

\_\_\_\_\_:\_\_\_\_\_ (Typical ratio is 4:1, or 80% cut to 20% tie)

Thickness Buildup = \_\_\_\_\_ in. / cm

**NOTE:** A cut-to-tie ratio that causes a thickness buildup greater than 0.025 in. / 0.0635 cm, or that creates an evenness variation greater than 0.003 in. / 0.00762 cm, will result in an unreliable and unpredictable form.

### **Perforation Intersections**

\_\_\_\_\_ Horizontal-vertical perforations are tie points. Cut points at such intersections are unacceptable.

### **Chaff Content**

\_\_\_\_\_ Tractor holes are clear of chaff.

\_\_\_\_\_ There is no loose chaff in the box the paper is packed in.

## Summary

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Because it is impossible to test all possible forms available for use in the printer, Hewlett-Packard recommends that paper conform to the specifications outlined in this appendix for the best printer performance.

But the guidelines in this appendix are not a substitute for actual testing. Always test forms—including special single-part paper, multipart 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 the guidelines in this appendix and who can recommend cost-effective purchases.

## Storage and Handling

---

The performance of the printer depends to a large degree on the condition of the paper used; therefore, the following principles for packaging, handling, and storage are recommended.

### Packaging

To avoid damage during handling, use top and bottom fillers in continuous form cartons to hold the paper stack firmly in place. Proper packaging ensures 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 them 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

Protect paper from temperature and humidity extremes. Store paper in the same environment as the printer for 24 to 48 hours before using the paper. This allows the moisture content of the paper to stabilize.

LineJet printers are used at 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 printer paper 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 printer paper in a better environment and move it to the printer as needed.



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# 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 55 shows how these devices are installed.

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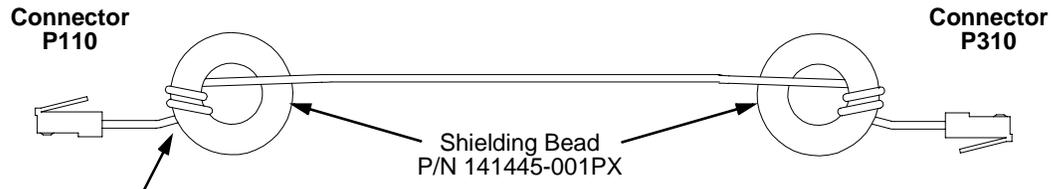
### Note



Duplicate the number of turns around the shielding beads when installing or replacing the control panel cable. See Figure 55.

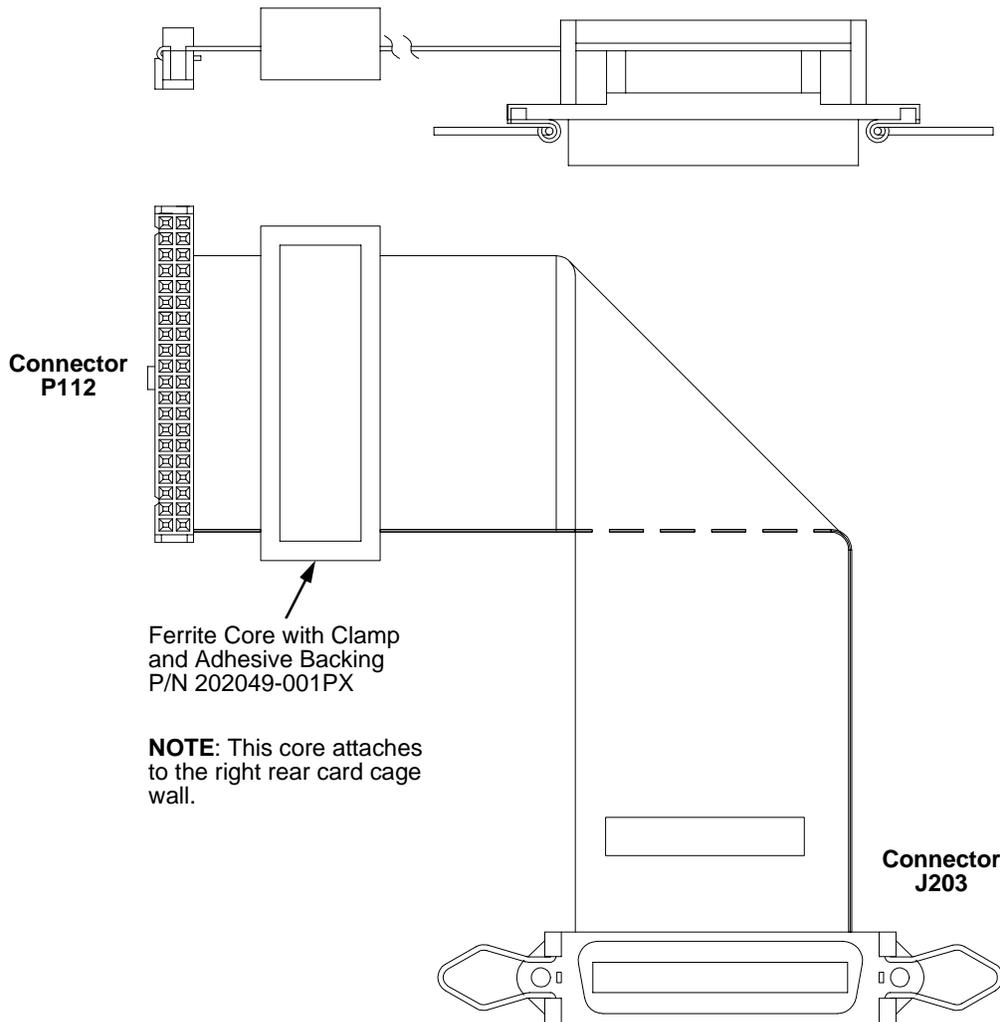
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### Control Panel Cable Assembly



**NOTE:** Two turns around each bead.

### Parallel I/O Cable Assembly



**NOTE:** This core attaches to the right rear card cage wall.

Figure 55. Ferrite Core Installation

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# H

# *Power Stacker*

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Installing the Power Stacker.....	page 317
Replacement Procedures	
Constant Force Spring.....	page 328
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## Introduction

The 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.

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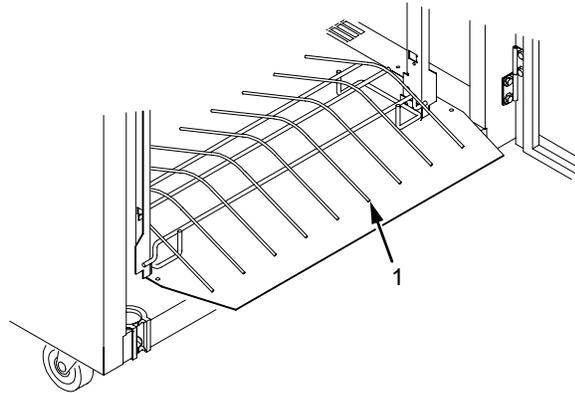
### Note



Only replaceable parts have part numbers in the IPB. If you need to replace a part for which no part number is shown, replace the entire power stacker assembly.

## 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 56.)

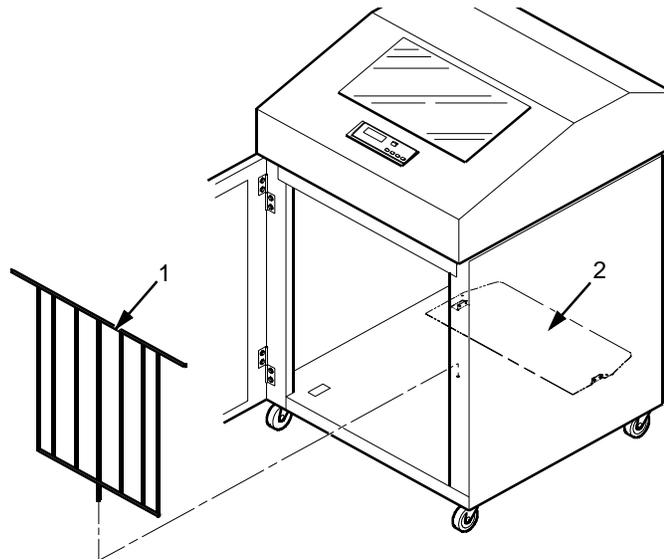


**Legend:**

1. Paper Tent

**Figure 56. Removing the Paper Tent**

5. Cut the tie wrap and remove the paper fence. (See Figure 57.)

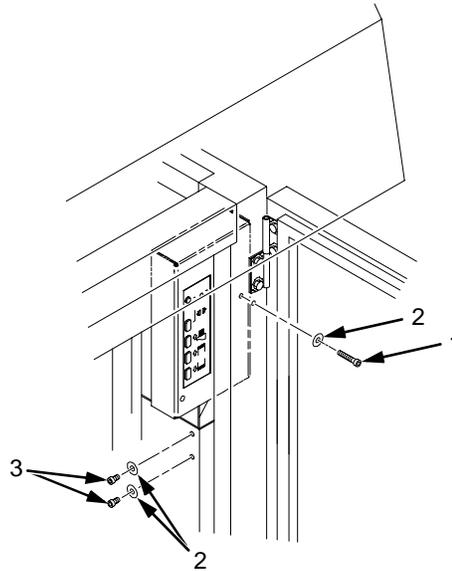


**Legend:**

1. Paper Fence
2. Stacker Base

**Figure 57. Removing the Paper Fence**

- 
6. Remove three screws and washers from the stacker control panel. (See Figure 58.)

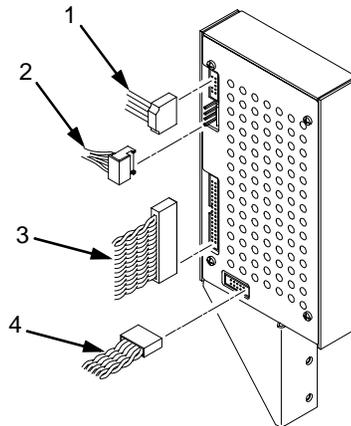


**Legend:**

1. Long Screw
2. Washer
3. Short Screw

**Figure 58. Removing the Stacker Control Panel**

7. Remove four cables from the stacker control panel, and remove the stacker control panel. (See Figure 59.)

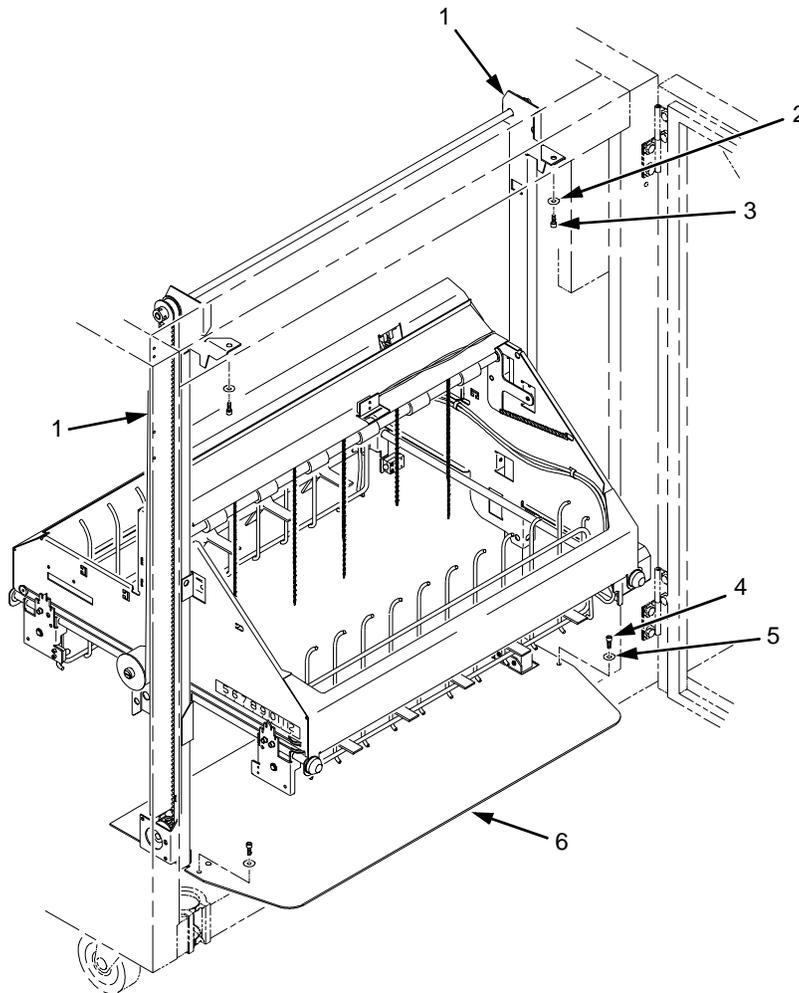


**Legend:**

1. Logic Cable (P104)
2. Power Cable
3. Frame Cable (P102)
4. Rail Cable (P107)

**Figure 59. 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 60.)
9. Raise the elevator assembly.

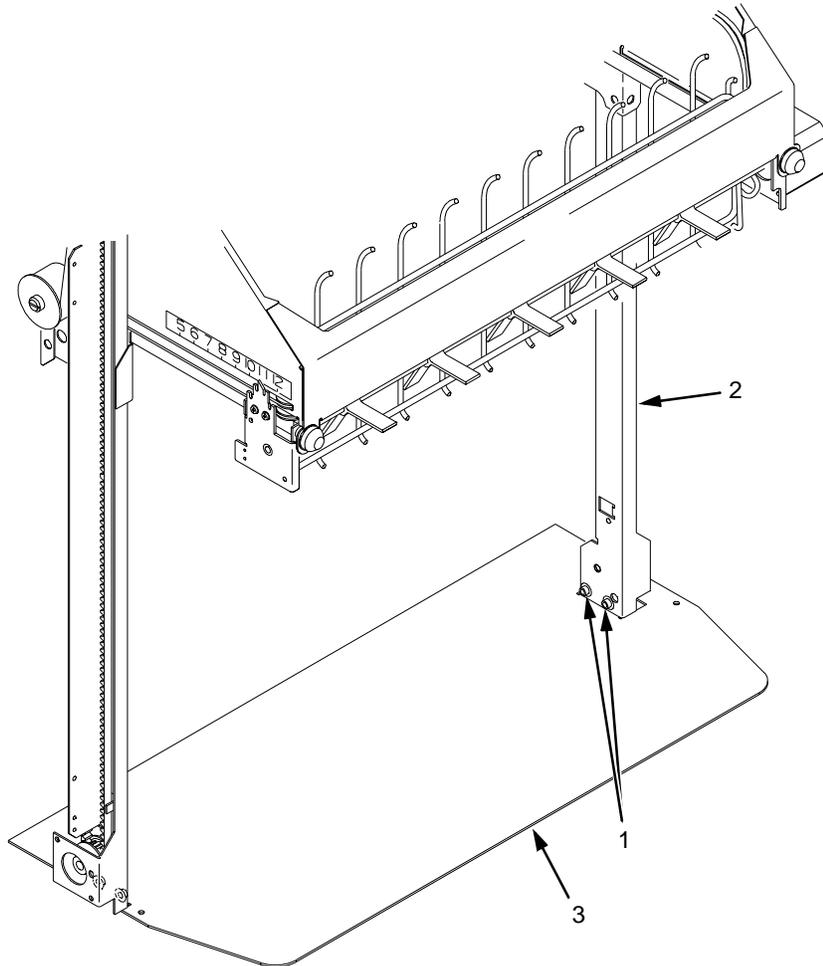


Legend:

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 (2)
5. Washer (2) but no washers with Torx T-10 screws
6. Stacker Base

Figure 60. Preparing the Stacker for Removal

- 
10. Loosen one turn—**DO NOT REMOVE**—the Torx T-10 screws securing the vertical rails to the stacker base. Each rail is secured by two screws. (See Figure 61.)

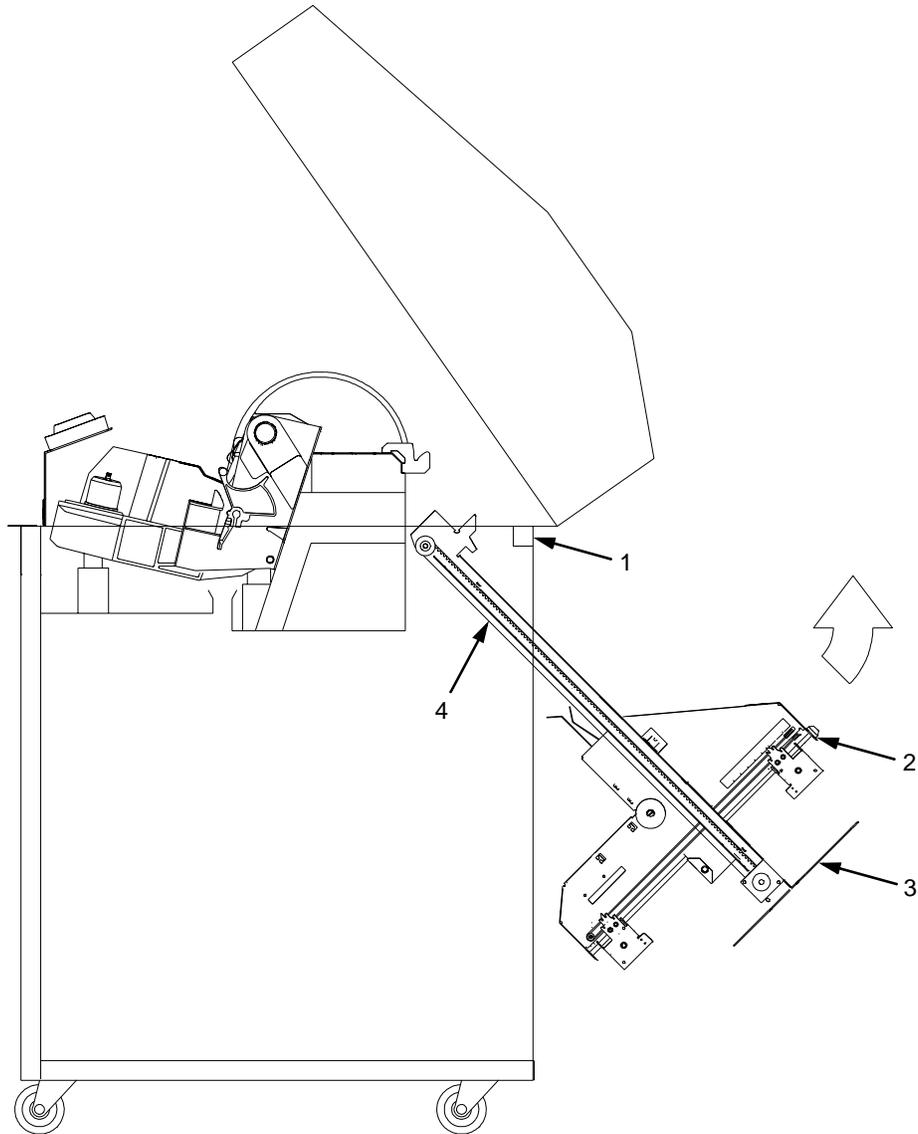


**Legend:**

- 1. Screw, 6-32x1/4, Torx T-10: two at bottom of each rail
- 2. Vertical Rail
- 3. Stacker Base

**Figure 61. Loosening the Lower Screws in the Vertical Rails**

- 11. Remove the 7/64 x 1/2 inch screws and washers (or Torx T-10 screws) securing the base plate to the cabinet floor. (See Figure 60.)
- 12. Lower the elevator assembly to its lowest position.
- 13. 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**

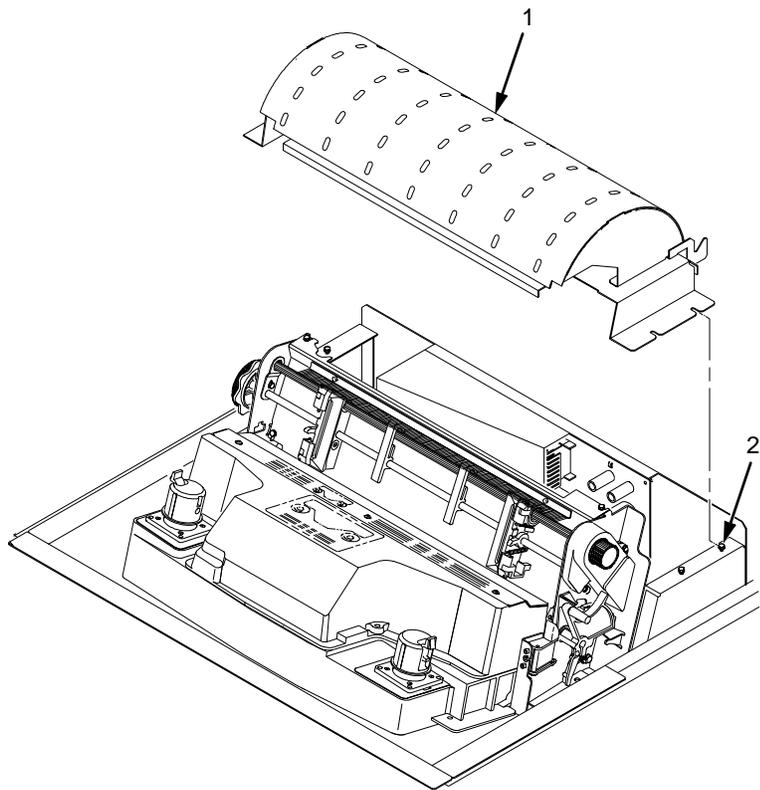
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## Installing the Power Stacker

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**NOTE:** This procedure is for complete installation of the power stacker, including cable assemblies and the stacker control panel.

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.)

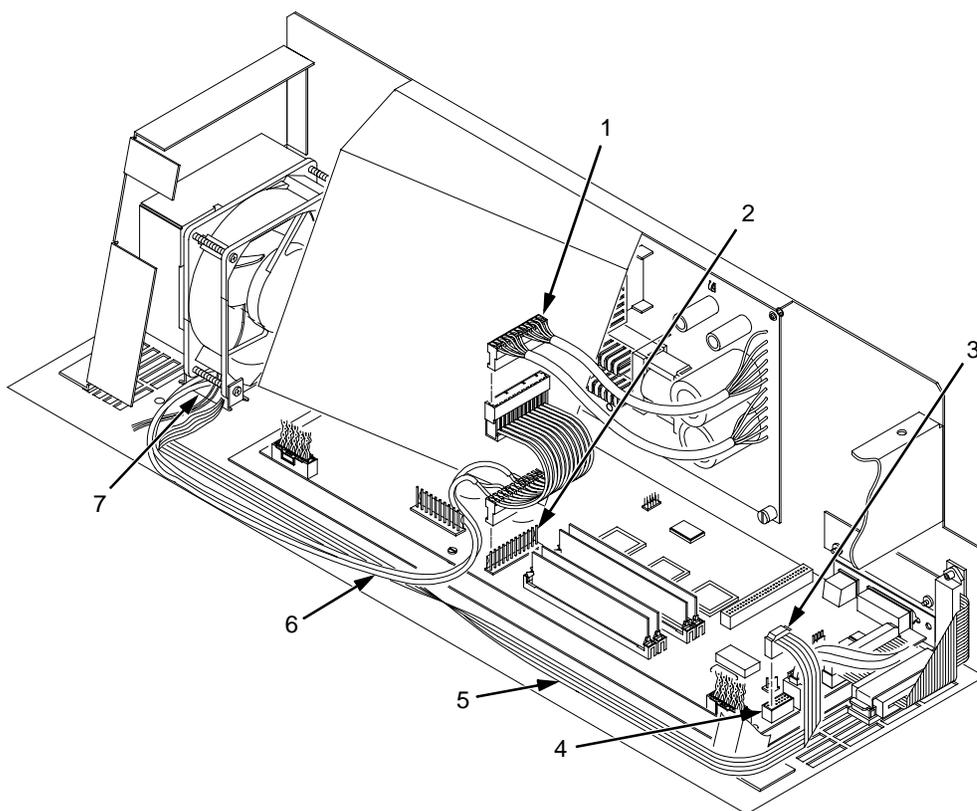


**Legend:**

1. Paper Path
2. Hold-Down Screw (3)

**Figure 63. Remove the Paper Path**

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**

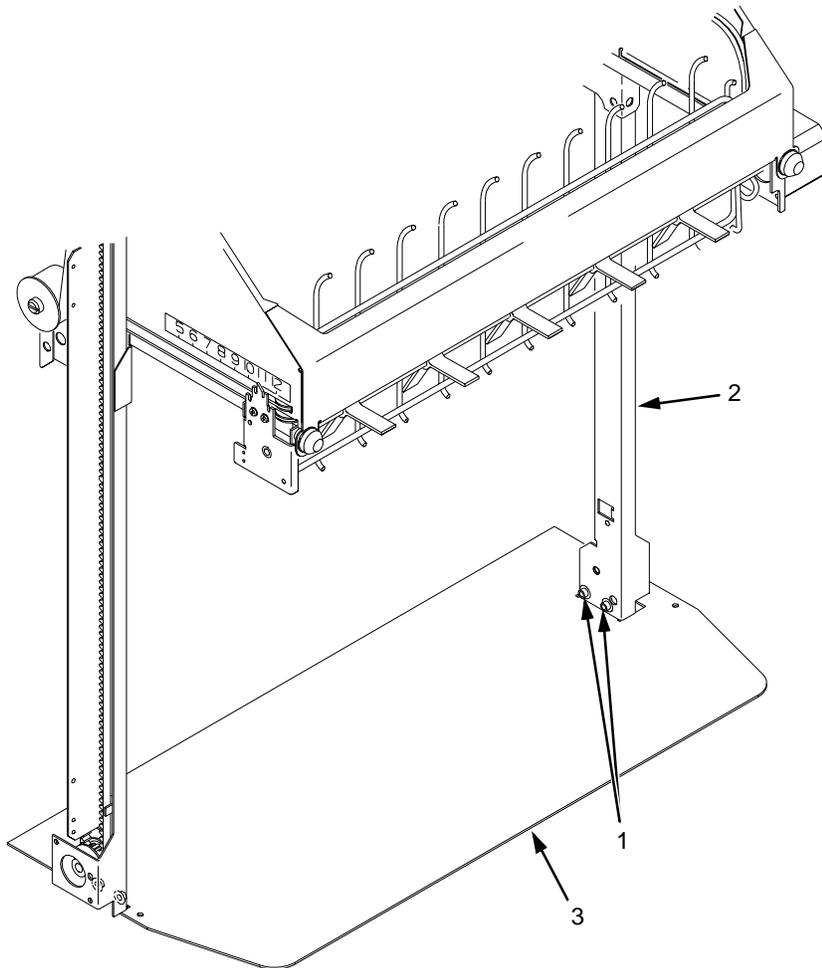
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**Caution**

The paper stacker assembly mounts to the rear upper frame cross-member and the cabinet floor. It is a snug fit. During installation, take care to avoid scratching painted surfaces or damaging the stacker.

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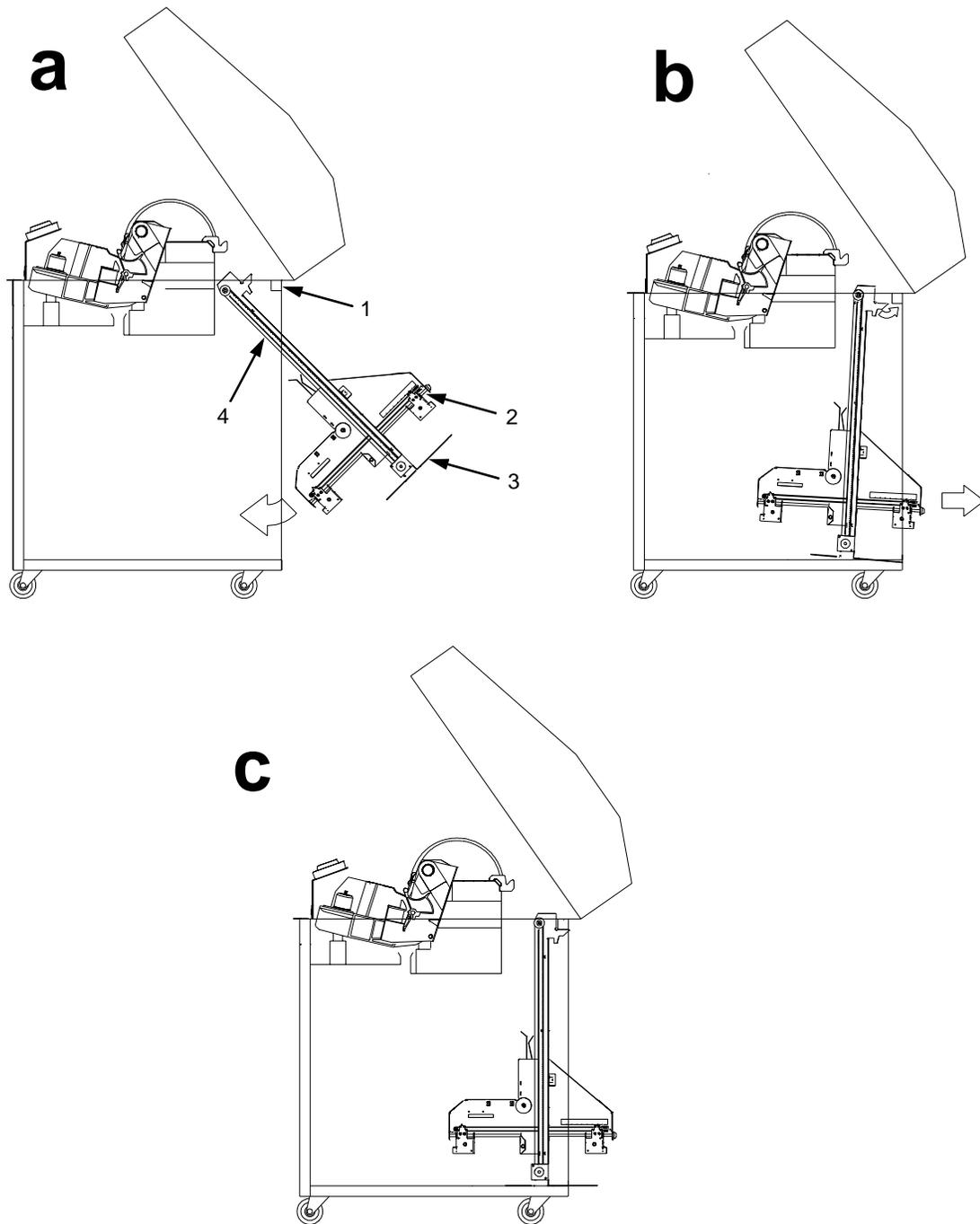
9. Loosen one turn—**DO NOT REMOVE**—the Torx T-10 screws securing the vertical rails to the stacker base. Each rail is secured by two screws. (See Figure 65.)

**Legend:**

1. Screw, 6-32x1/4, Torx T-10
2. Vertical Rail
3. Stacker Base

**Figure 65. Loosening the Lower Screws in the Vertical Rails**

10. Position the elevator assembly at the bottom of the vertical rails. (See Figure 66a.)
11. Position 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 66a.)
12. Work the stacker base rearward and engage the upper brackets of the vertical rails under the upper frame cross-member. (See Figure 66b.)
13. Align the holes in the vertical rail brackets with the holes in the upper frame cross-member. (See Figure 66c and Figure 67.)

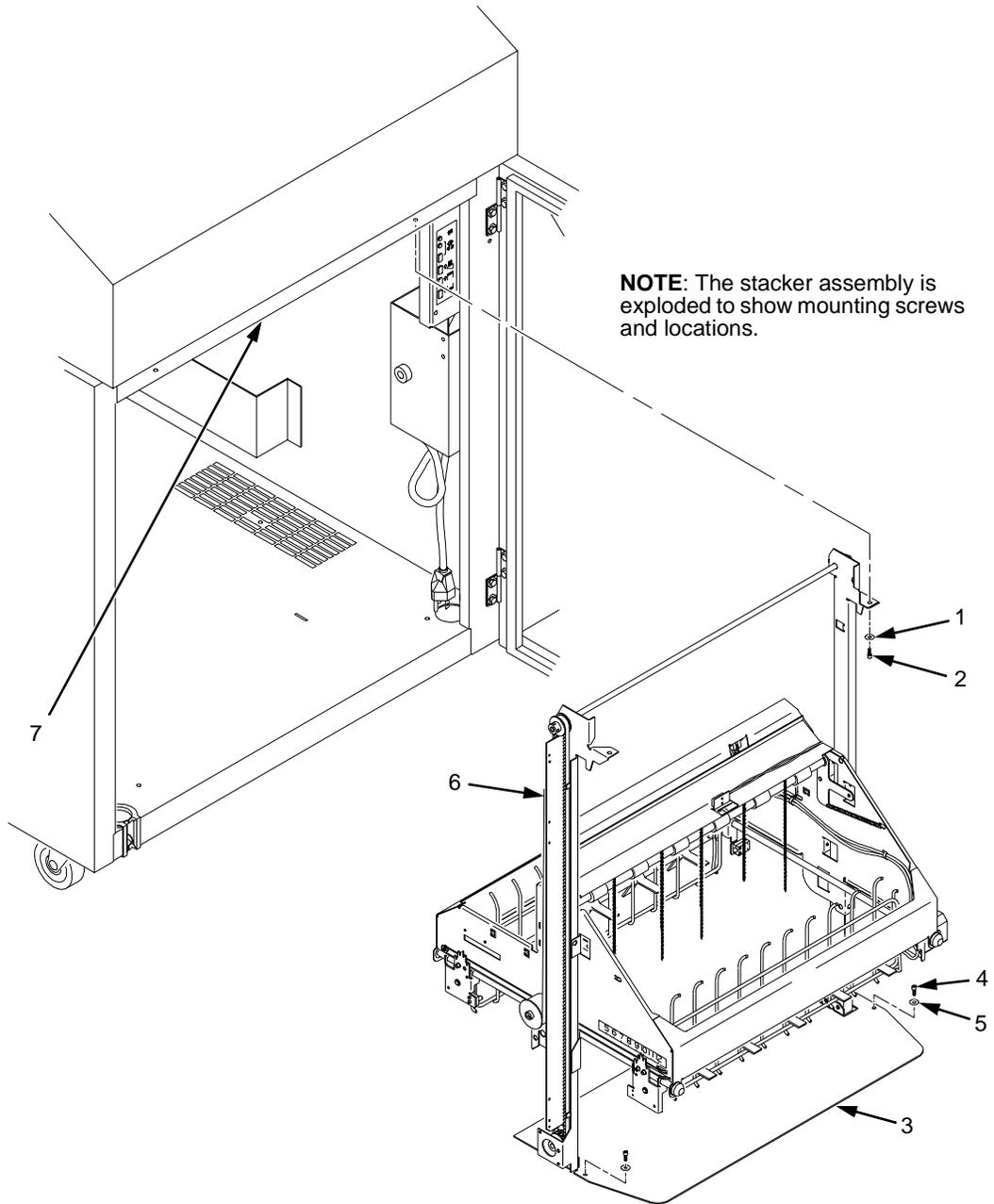


**Legend:**

- 1. Upper Frame Cross-Member
- 2. Elevator Assembly
- 3. Stacker Base
- 4. Vertical Rail

**Figure 66. Stacker Installation**

14. Align the holes in the stacker base with the holes in the cabinet floor. (See Figure 66c and Figure 67.)
15. Install finger tight the two 5/32 x 3/4 inch screws and washers securing the vertical rails to the upper frame cross-member.
16. Install and tighten the 7/64 x 1/2 inch screws and washers (or Torx T-10 screws) securing the stacker base to the cabinet floor. (See Figure 67.)
17. Move the elevator assembly up and down on the vertical rails until it travels smoothly with no binding.
18. Tighten the two 5/32 x 3/4 inch screws and washers securing the vertical rails to the upper frame cross-member.
19. Move the elevator assembly up and down again to make sure it travels smoothly with no binding.
20. Tighten the screws securing the vertical rails to the stacker base. Each rail is secured by two screws. (See Figure 65.)
21. Move the elevator assembly up and down to make sure it travels smoothly with no binding. If the elevator binds or catches anywhere along its path of travel, slightly loosen the upper and lower rail screws and repeat steps 17 through 20 until the elevator moves smoothly.

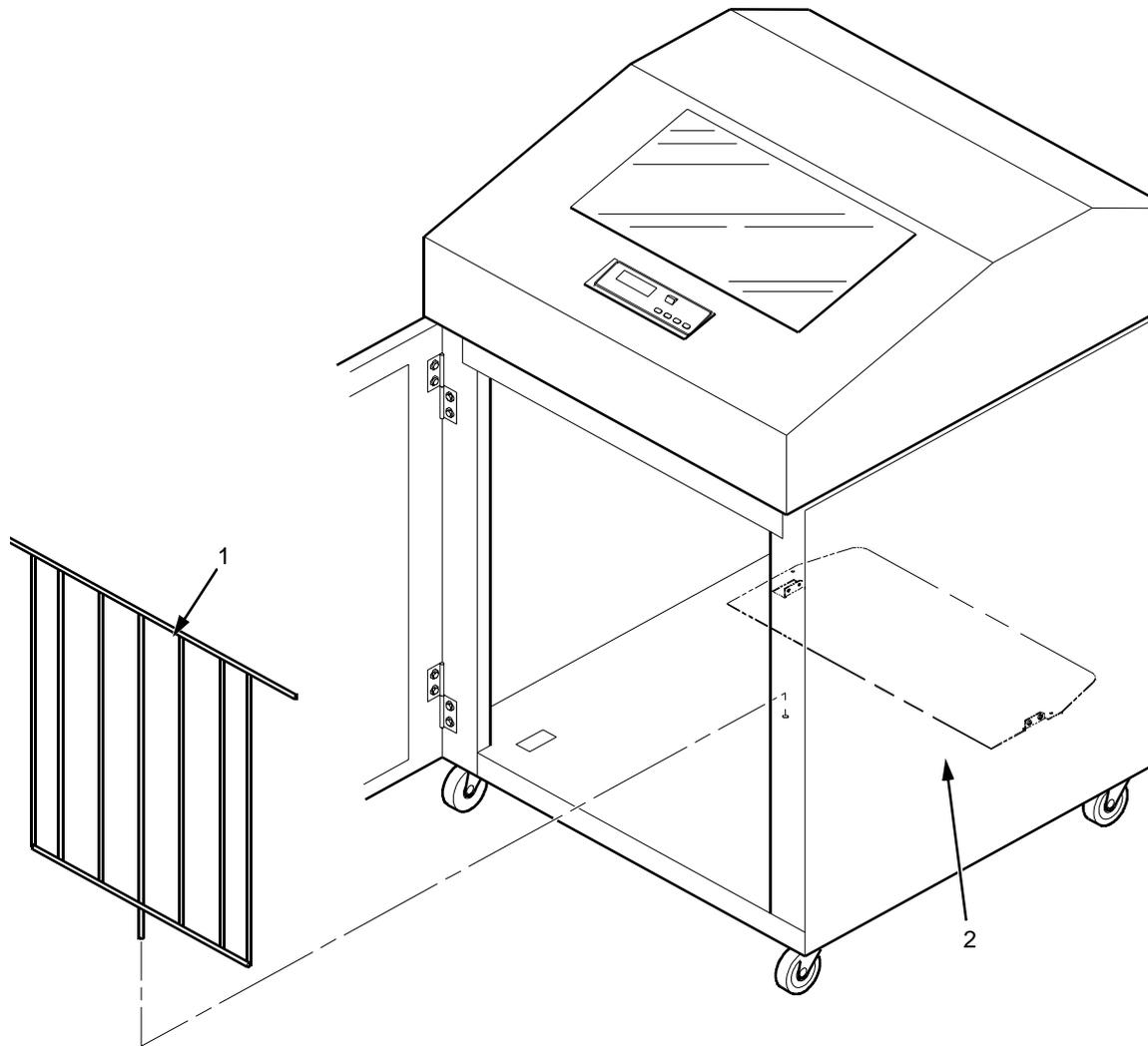


**Legend:**

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 (2)
5. Washer (2) but no washers with Torx T-10 screws
6. Vertical Rail
7. Upper Frame Cross-Member

**Figure 67. Stacker Fasteners**

22. Install the paper fence. (See Figure 68.)

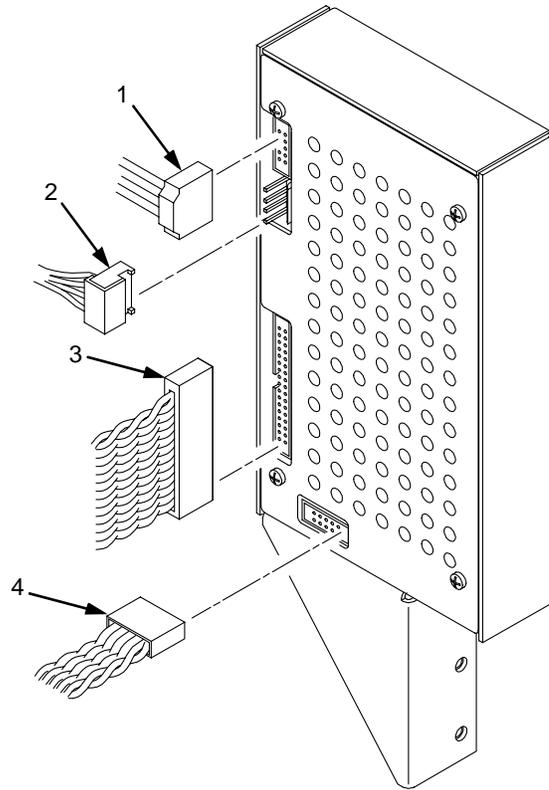


**Legend:**

- 1. Paper Fence
- 2. Stacker Base

**Figure 68. Paper Fence**

- 
23. Gather the rail cable, frame cable, logic cable, and power cable. Route the cables outboard of the elevator assembly.
  24. Connect the stacker cables to the rear of the stacker control panel assembly, as shown in Figure 69.

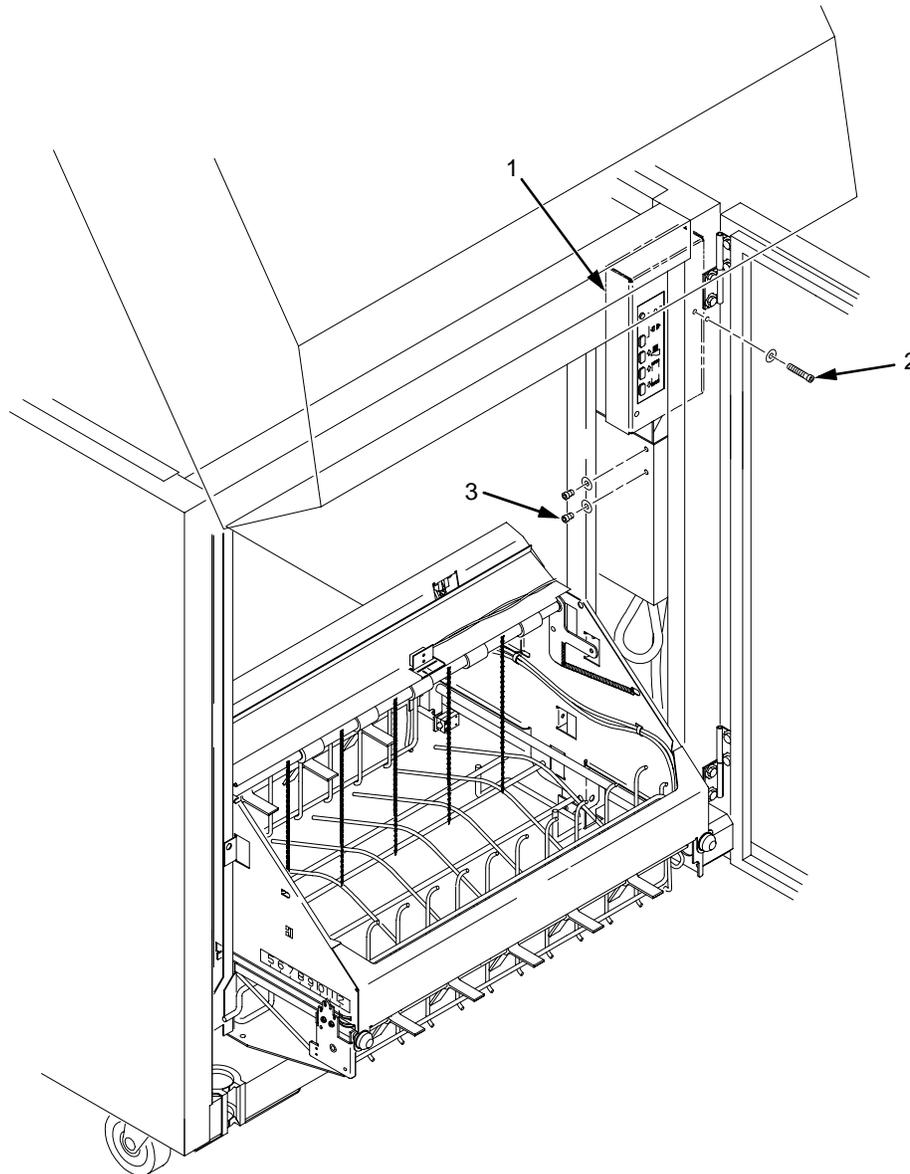


**Legend:**

1. Logic Cable (P104)
2. Power Cable
3. Frame Cable (P102)
4. Rail Cable (P107)

**Figure 69. Stacker Control Panel Cables**

25. Position the stacker control panel as shown in Figure 70, and install the mounting screws.

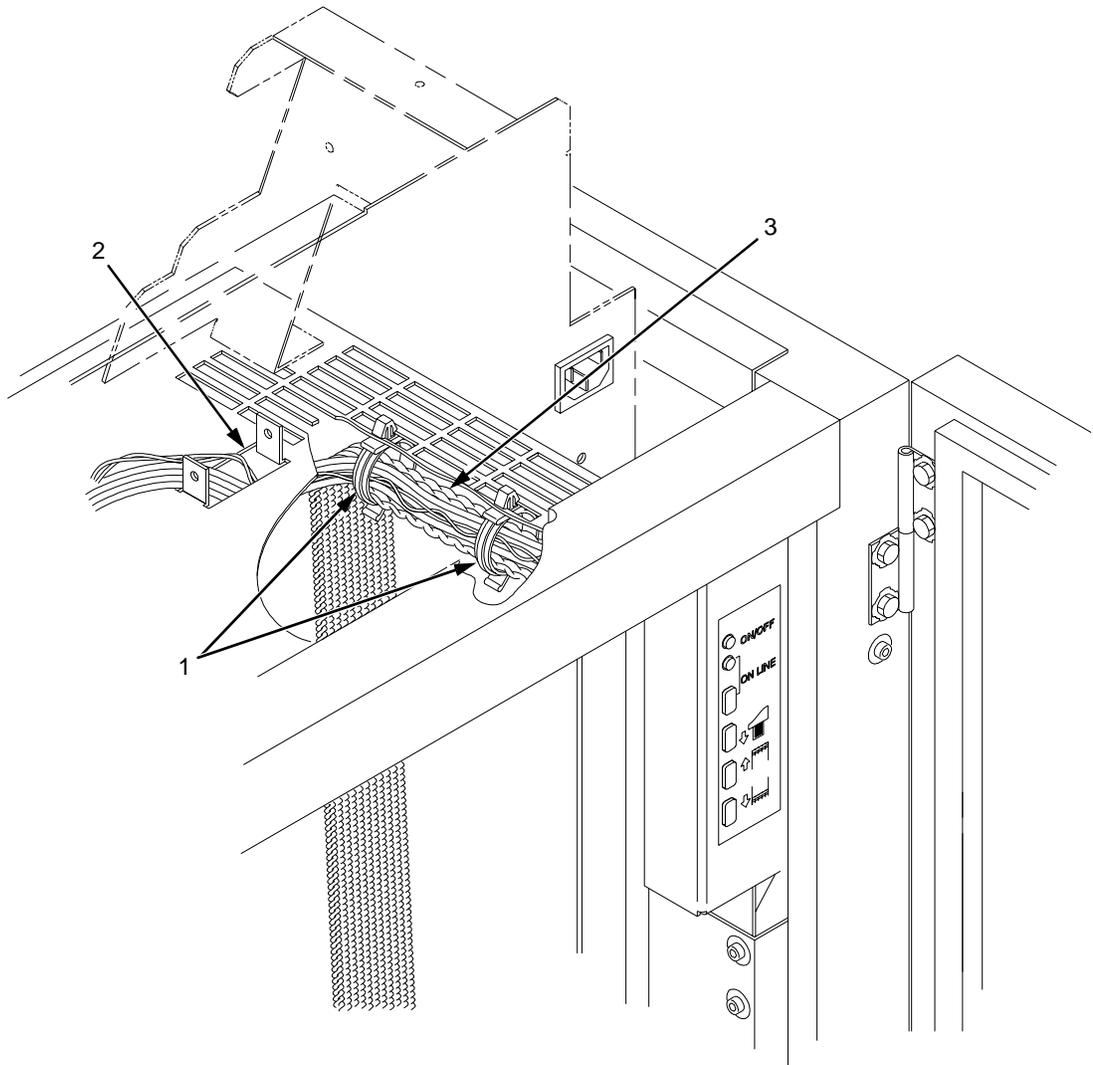


**Legend:**

- 1. Stacker Control Panel
- 2. Long Screw
- 3. Short Screw (2)

**Figure 70. Installing the Stacker Control Panel**

26. Bundle the stacker control panel cables in the wire harness clips located under the card cage. (See Figure 71.) 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. Wire Saddle (2)
- 2. Cutout Beneath Card Cage Fan
- 3. Cable Bundle

**Figure 71. Securing Stacker Cables**

27. Install the paper path that you removed in step 4.

28. Install paper and test stacker operation. (Refer to the *User's Guide*.)

## Replacing the Constant Force Spring

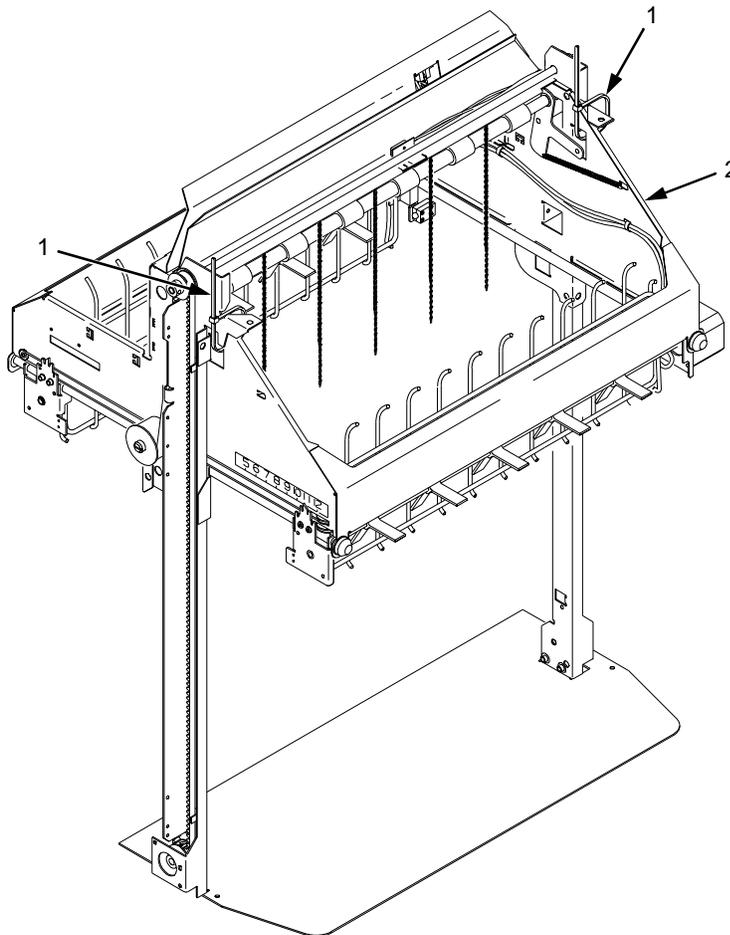
1. Remove the stacker assembly from the printer. (See page 312.)

### 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 72.)



#### Legend:

1. Tie Wrap
2. Elevator Assembly

**Figure 72. Securing the Elevator Assembly**

---

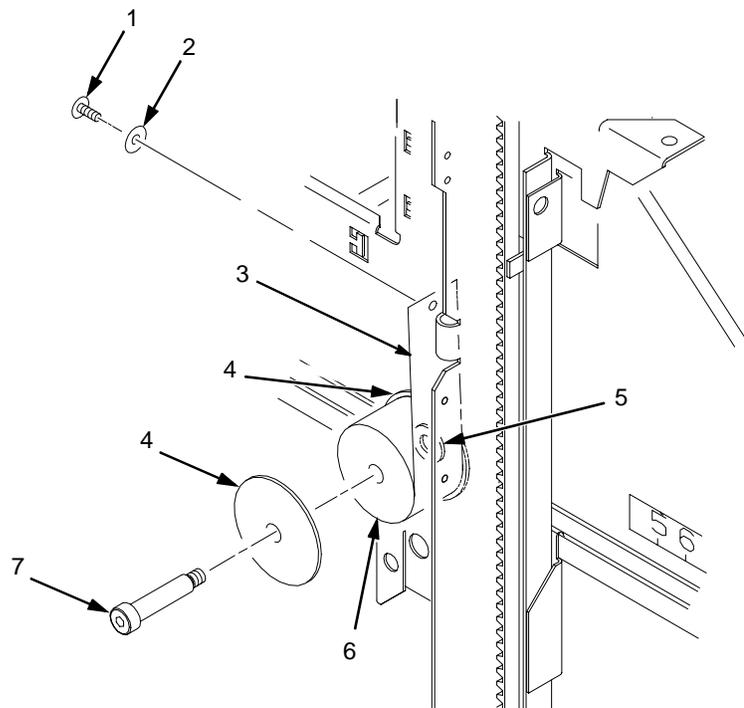
## Warning



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 73.)
4. Firmly gripping the spring and drum, remove the screw securing the spring to the vertical rail. (See Figure 73.)

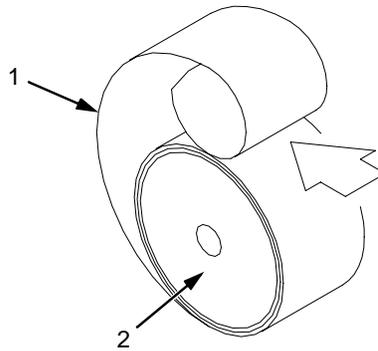


### Legend:

1. Rail Screw
2. Washer
3. Constant Force Spring
4. Large Washer
5. Spacer
6. Drum
7. Shoulder Screw

**Figure 73. 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 74.)
6. While holding the drum tightly, continue to curl the spring until it is completely unwound from the drum. (See Figure 74.)
7. To install a new constant force spring, reverse the steps of this procedure.



**Legend:**

1. Spring
2. Drum

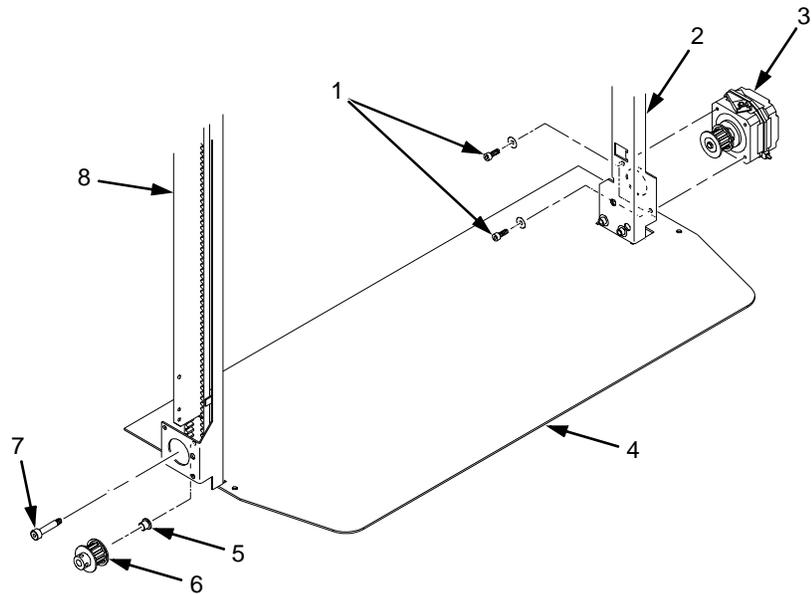
**Figure 74. Removing the Constant Force Spring from the Drum**

---

## Replacing the Timing Belts

---

1. Remove the stacker assembly from the printer. (See page 312.)
2. Raise the elevator assembly to its highest position and secure it to the vertical rails using tie wraps or string. (See Figure 72, page 328.)
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 75.) 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 75.) Go to step 5.

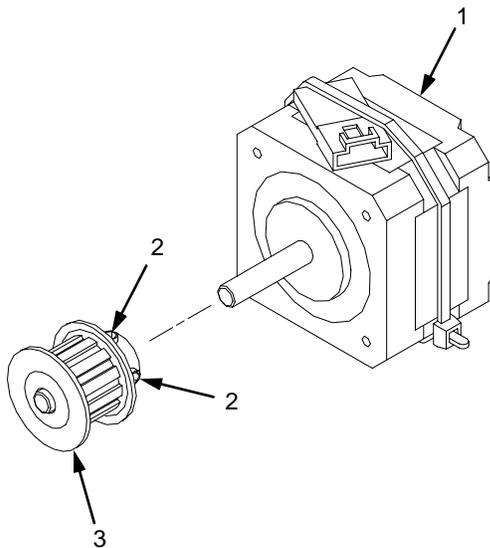


### Legend:

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 75. 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 76.) Go to step 6.

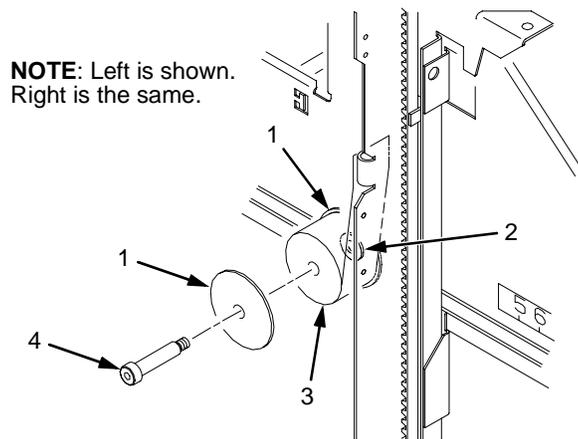


**Legend:**

1. Timing Belt Motor
2. Setscrew
3. Pulley

**Figure 76. 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 77.)

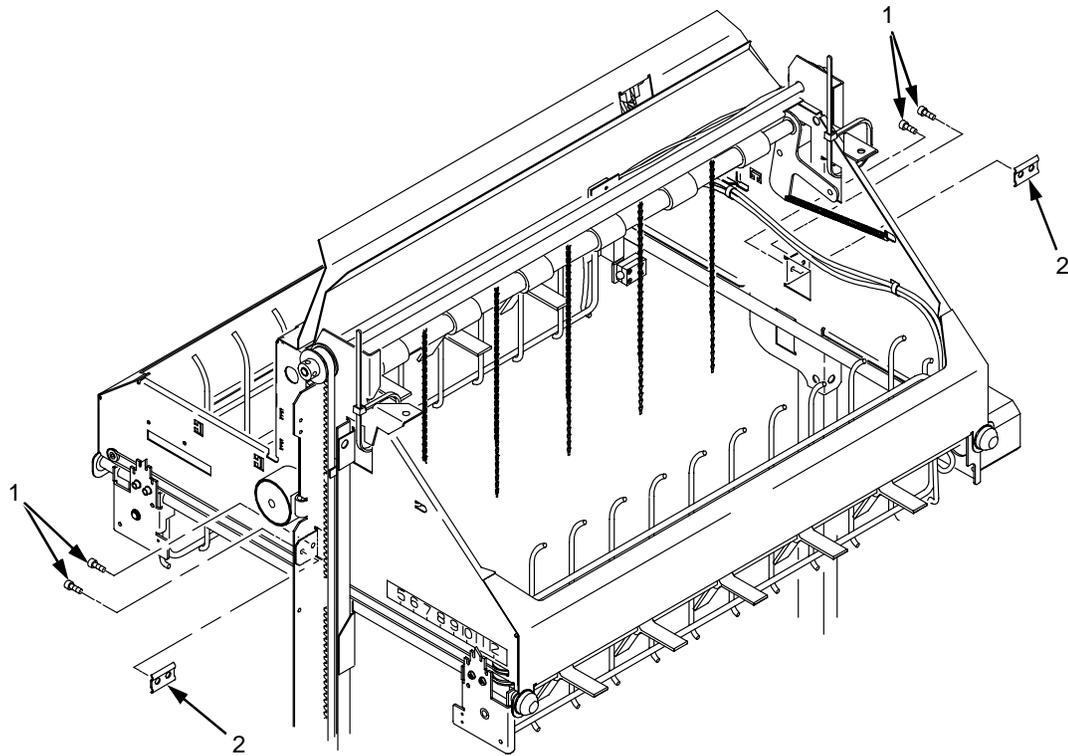


**Legend:**

1. Large Washer
2. Spacer
3. Constant Force Spring
4. Shoulder Screw

**Figure 77. 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 78.)



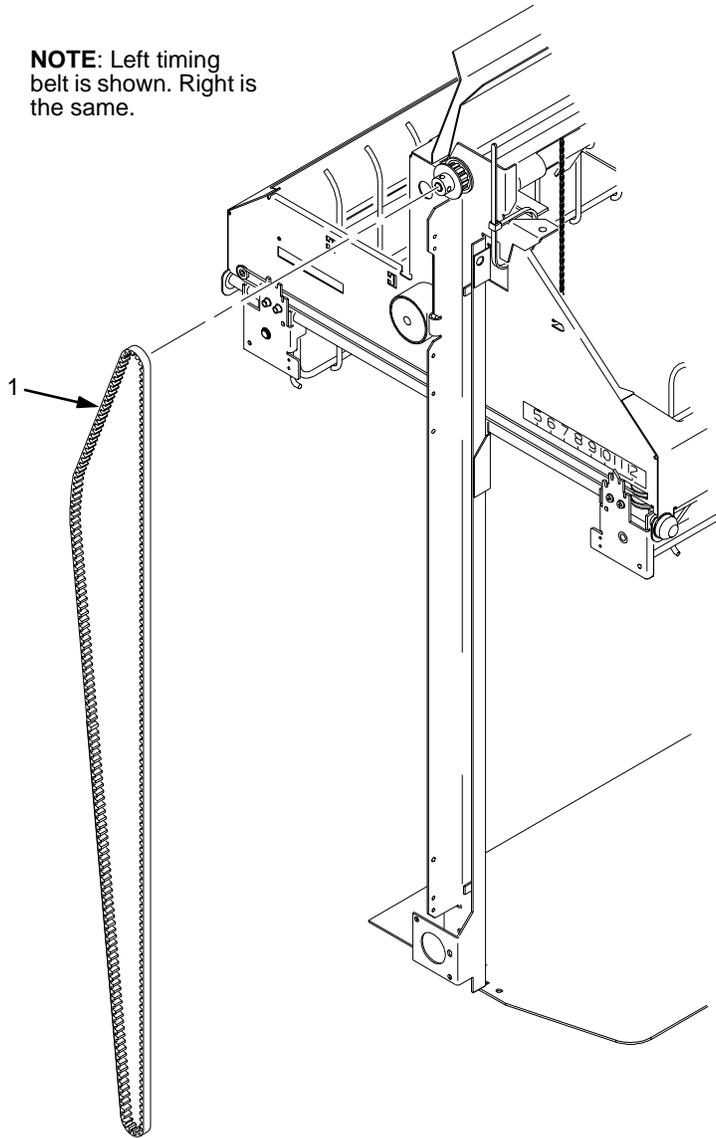
**Legend:**

1. Allen Screw
2. Belt Clamp

**Figure 78. Removing the Belt Clamps**

8. Remove the timing belt by working it around the vertical rail and constant force spring. (See Figure 79.)

**NOTE:** Left timing belt is shown. Right is the same.



**Legend:**

1. Timing Belt

**Figure 79. 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. Parts are listed next to each drawing.

---

### Note



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:

To replace the entire stacker assembly, order Field Kit, Stacker Advance Exchange Kit, 170690-991.

---

The IPB starts on the next page.

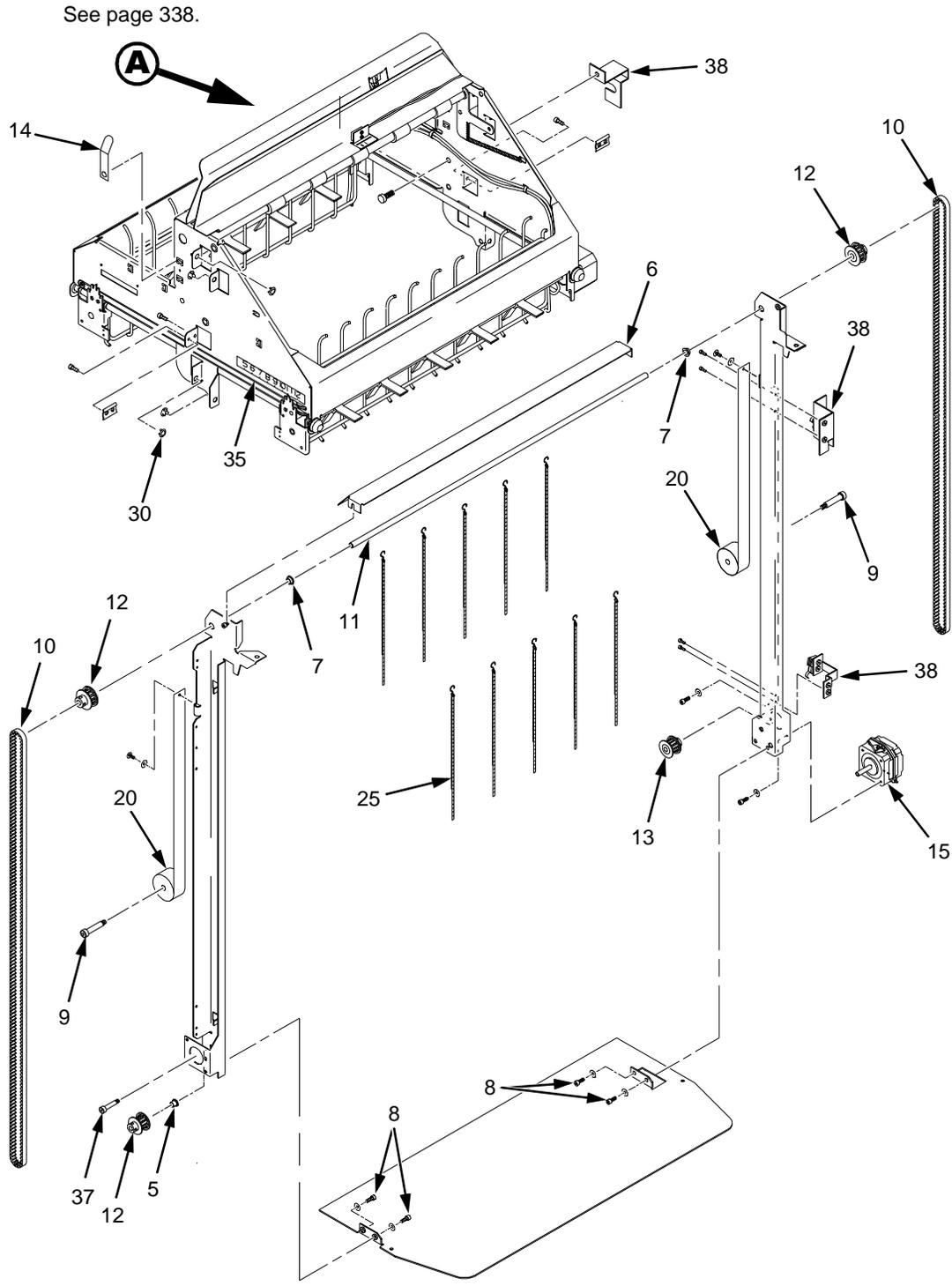


Figure 80. Stacker Assembly

Item No.	Part No.	Description	Notes
1	170690-991	Field Kit, Stacker Advance Exchange Kit	Replacement stacker; not illustrated
5	202706-904PX	Flanged Bearing	Part of item 36
6	158342-001PX 170719-001PX	Paper Deflector Paper Deflector	Early model stacker Later model stacker
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
38	170285-001PX	Power Stacker Limit Switch Field Kit	
	158732-901PX	Control Panel Assembly	Figure 69, page 325
	158442-001PX	Rail Cable, Power Stacker	See page 288
	158443-001PX	Power Cable, Power Stacker	See page 287
	158444-001PX	Logic Cable, Power Stacker	See page 286
	Ref	Frame Cable, Power Stacker	See page 285

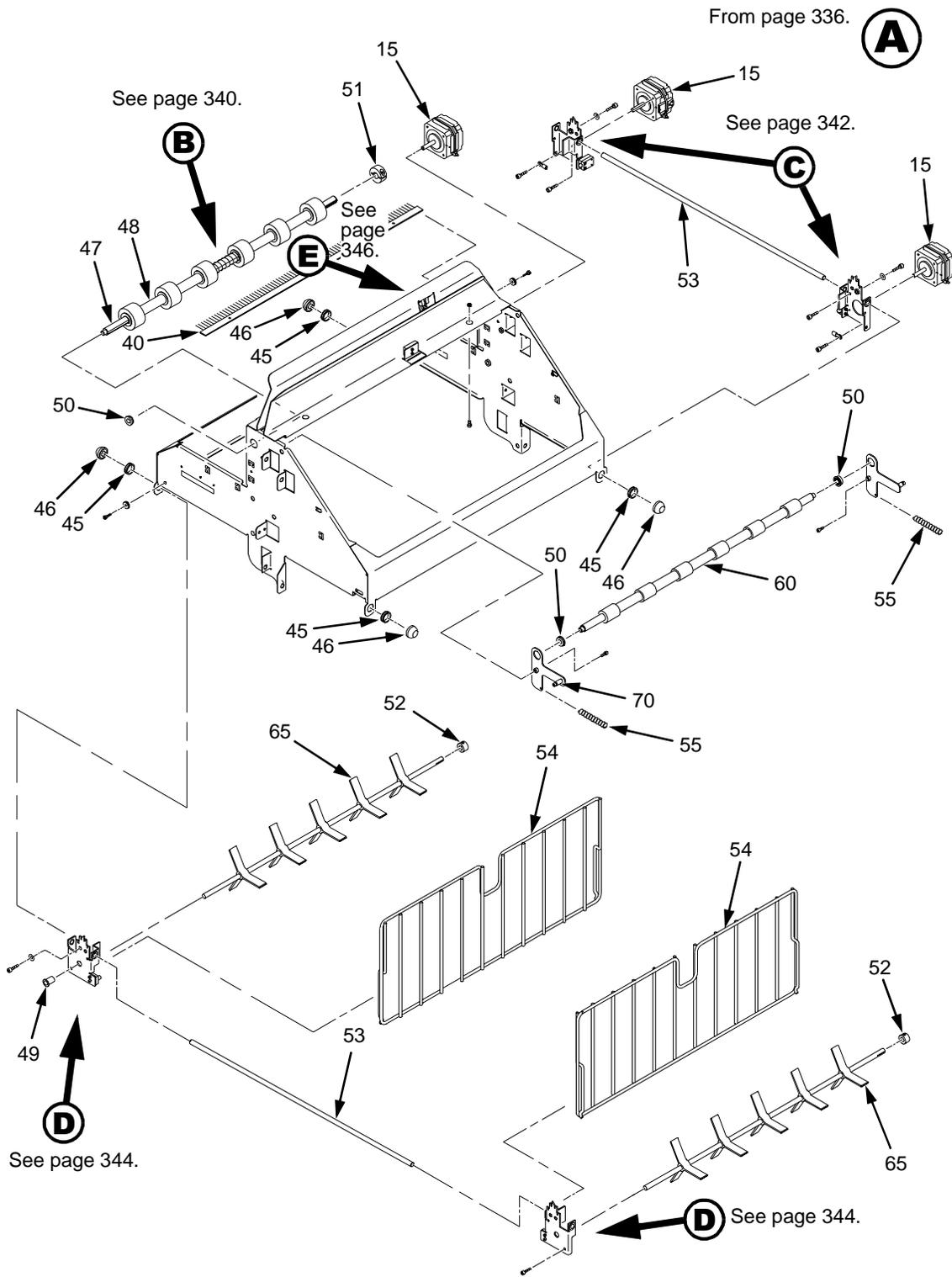


Figure 81. Elevator Detail: Motor, Roller, and Paddle Assemblies

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
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	171209-001PX	Fence, Wireform	
55	203032-001PX	Extension Spring	
60	157275-001PX	Idler Roller	Five on early models
65	157054-001PX	Paddle, Power Stacker	
70	170306-001PX	Power Stacker Pivot Arm Field Kit	Early models only; not illustrated

From page 338.

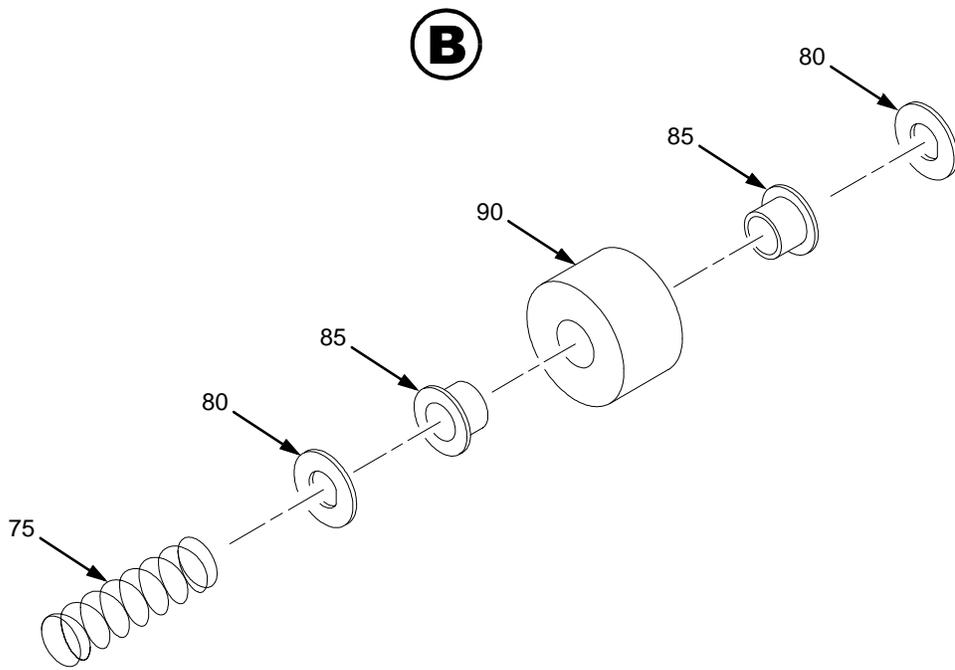


Figure 82. Stacker Detail: Rollers

---

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
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

From page 338.

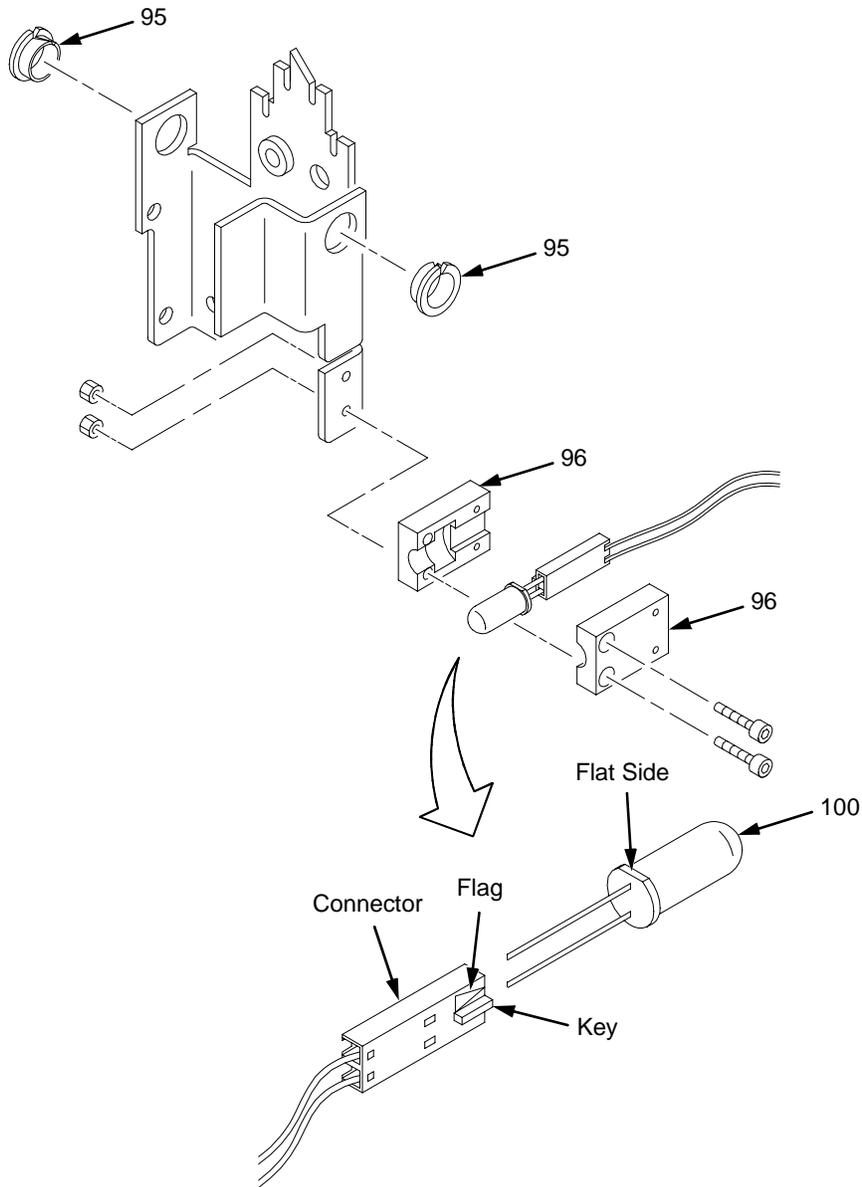


Figure 83. Stacker Detail: Motor Bracket

---

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
95	Ref	Clip-On Bearing	Part of item 36
96	158288-001PX	Holder, LED, Round	
100	202727-001PX	LED, IR, T-1, 3/4	

From page 338.

**D**

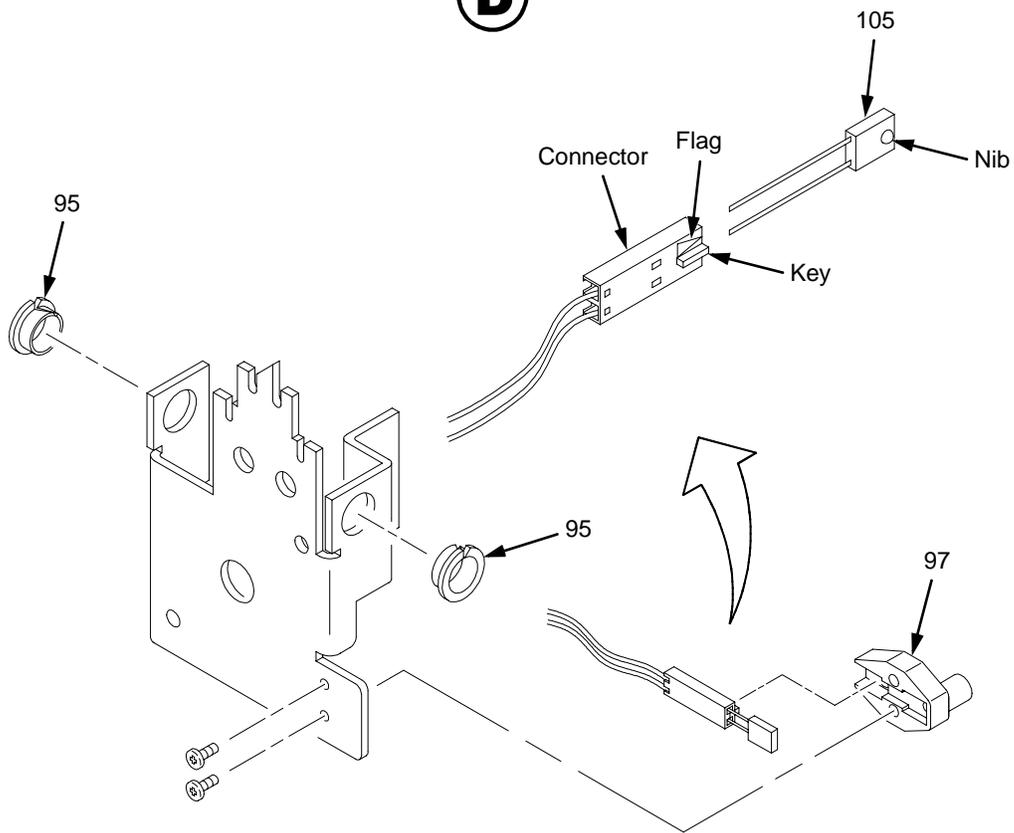


Figure 84. Stacker Detail: Elevator Bracket

---

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
95	Ref	Clip-On Bearing	Part of item 36
97	158290-001PX	Holder, LED, Flat	
105	202728-001PX	Photodarlington, NPN, Rectifier	

From page 338.



Rotated 180 Degrees

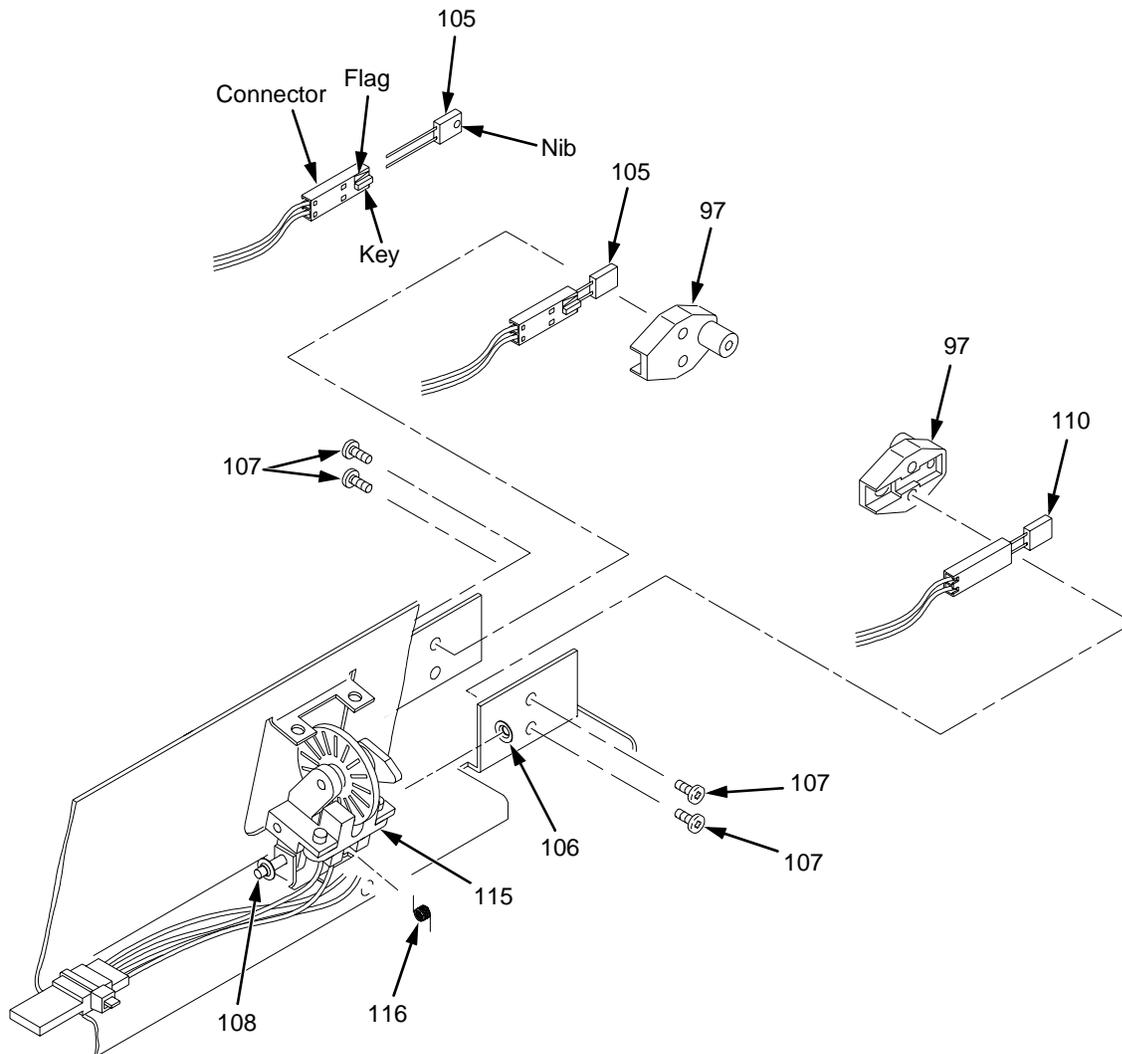


Figure 85. Stacker Detail: Paper Motion Detector

---

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Notes</b>
97	158290-001PX	Holder, LED, Flat	
105	202728-001PX	Photodarlington, NPN, Rectifier	
106	Ref	Retaining Ring, External, 0.093 inch	Part of item 115
107	Ref	Screw, Panhead, Type B, 2 x 3/16	Part of item 36
108	Ref	Shaft, Paper Detector Switch, Long	Part of item 115
110	202729-001PX	LED, IR, Rectangular	
115	170289-001PX	Field Kit, Power Stacker, PMD	
116	Ref	Spring, Torsion	Part of item 115



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