LG*plus* Series
Text and Graphics Printers

digital™

Maintenance Manual

Order Number: EK–LGPLE–MM.A01

Digital Equipment Corporation

FCC Notice

This equipment has been tested and found to comply with the limits of a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide a 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. Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

Installing this equipment in an FCC Level B composite system results in an FCC Level A Composite System as defined in the FCC Rules and Regulations.

Canadian Department of Communications compliance statement:

This equipment does not exceed Class A limits per radio noise emissions for digital apparatus as set out in the Radio Interference Regulation of the Canadian Department of Communications. Operation in a residential area may cause unacceptable interference to radio and TV reception requiring the owner or operator to take whatever steps are necessary to correct the interference.

Avis de conformite aux normes du ministere des Communications du Canada:

Cet equipment ne depasse pas les limites de Classe A d'emission de bruits radioelectriques pour les appareils numerriques tells que perscrites par le Reglement sur le brouillage radioelectriques etabli par le ministere des Communications du Canada. L'exploitation faite en milieu residentiel peut entrainer le brouillage des receptions radio et tele, ce qui obligerait le proprietaire ou l'operateur a prendre les dispositions necessarires pour en eliminer les cause.

The following statements are required in accordance with CISPR–22.

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 ist ein Gern der Funkstrgrenzwertklasse A. In Wohnbereichen knnen bei Betreib dieses Gertes Rundfunkstrungen auftreten, in welchen Fllen der Benutzer frentsprechende Gegenmahmen verantwortlich ist.

Ceci est un produit de Classe A. Dans un environment domestique, ce produit risque de crer des interfrences radiolectriques, il appartiesdra alors l'utilisateur de prendre les mesures specifiques appropries.

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1 Maintenance Overview

Chapter Contents

About the Printer

The LG*plus* Series is a family of line matrix printers: The LG04*plus* prints at a maximum rate of 475 lines per minute (lpm). The LG08*plus* prints at a maximum rate of 800 lpm, and the LG12*plus* has a maximum print rate of 1200 lpm. Each model is housed in a quiet floor cabinet. These rugged and reliable line printers represent the state of the art in line matrix printing technology.

LG*plus* Series printers feature a flash memory architecture that permits rapid access to stored printer emulations. All models use a variable–speed shuttle, half–step paper feed control, and system architecture contained on a single circuit board, enabling them to print high–volume jobs with minimum maintenance, maximum reliability, and an impressive variety of print options.

Although technologically advanced, LG*plus* Series printers are easy to use. The user 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

To maintain optimum printer performance, remember these important maintenance concepts when you service the printer:

- Use *only* the ribbons specified in Appendix B. Use of incorrect ribbons can lead to ink migration problems, degraded print quality, and expensive damage to the printer.
- Incorrect closure of the forms thickness lever can lead to smearing, degraded print quality, paper jams, and damage to the platen and shuttle assembly. Never close the forms thickness lever too tightly.
- The hammer springs and hammer tips on the hammer bank are extremely delicate and precisely aligned. *Never* bend or tweak hammer springs and always handle hammer springs by the thick mounting base of the fret.
- Do not adjust the platen gap unless a new shuttle frame assembly or platen was installed.

About This Manual

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

How to Use This Manual

1. Locate the procedure or information you need:

- Use the **Table of Contents** at the front of the manual.
- Use the **Chapter Contents** listed at the front each chapter.
- Use the **Index** at the back of the manual.

2. Read the entire procedure before you do it.

3. Gather the parts and tools you will need.

4. Read the Safety Notices on page 1–6. Make sure you understand all safety notices before you start a task. (Notes and notices are defined below.)

Notes and Notices

For your safety and to protect valuable equipment, read and comply with all information highlighted under notes and notices. The heading of a notice tells you the kind of information it contains:

WARNING

Conditions that could harm you as well as damage the equipment.

CAUTION

Conditions that could damage the printer or related equipment.

IMPORTANT

Vital information about proper operation of the printer.

NOTE: Tips for efficient operation and maintenance of the equipment.

Related Documents

This manual does not explain how to operate or configure the printer. For that information, refer to the following documents:

- *LG*plus *Series Operator's Guide*
  (Order Number EK–LGPLE–OG.A01)
- *LG*plus *Series Setup Guide*
  (Order Number EK–LGPLS–SG.A01)
- *LG*plus *Series Line Printer Plus Programmer's Reference Manual*
  (Order Number EK–LGPLE–RM.A01)
- *LG*plus *Series (LG) Programmer's Reference Manual*
  (Order Number EK–LGPLP–RM.A01)
- *LG*plus *Series PGL Programmer's Manual*
  (Order Number EK–LGPGL–PM.A01)
- *LG*plus *Series VGL Programmer's Manual*
  (Order Number EK–LGVGL–PM.A01)

Printing Conventions in This Manual

BOLD UPPERCASE print indicates control panel keys.
Example: Press the **CLEAR** key, then press the **ON LINE** key.

Quotation marks (“”) indicate messages you see on the Liquid Crystal Display (LCD).
Example: Press the **ON LINE** key. “Off Line” appears on the LCD.

The **+** (plus) symbol represents key combinations.
Example: “Press ▲ **+** ▼ ” means press the ▲ **(UP)** key and the ▼ **(DOWN)** key at the same time.

Some printer controls have no label on the printer. These controls are printed lowercase. Example: “Set the forms thickness lever to the fully open position.” (The control in this case is the forms thickness lever.)

Safety Notices

WARNING

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

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.

WARNING

Always disconnect the AC power cord before cleaning the printer.

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.

WARNING

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

WARNING

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

WARNING

Use caution when configuring the printer. Exposed moving parts can cause injury, and electrical currents are shock hazards.

Hinweise zur Sicherheit

GERMAN

VORSICHT

Um ernstliche 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.

VORSICHT

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

VORSICHT

Ziehen Sie das Netzkabel aus der Steckdose, bevor Sie den Drucker reinigen.

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.

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.

VORSICHT

Beim Konfigurieren des Druckers ist Vorsicht geboten. Hervorstehende, bewegliche Teile können Verletzungen und Elektroschocks verursachen.

Electrical Controls and Indicators (Figure 1–1)

Switch or Indicator	Function	Active when printer is: Online	Offline
Power Switch	Turns printer on and off: 1 = on, 0 = off. This switch is also a circuit breaker.		
Status Lamp	On when the printer is online, off when printer is offline. Flashes to indicate a fault or warning.		
LCD	Liquid Crystal Display. Displays printer status and error messages.		
ON LINE	Toggles the printer online and offline.	✓	✓
FF	Advances paper to top of form on next page.	✓	✓
LF	Advances paper to top of next print line.		✓
VIEW	Advances paper for viewing through cover window, then returns paper to print position.	✓	✓
CLEAR	Clears fault message from LCD after a fault is corrected and returns printer to off–line state. **CLEAR + ENTER** cancels a print job by flushing data from the print buffer. Clears “PLATEN OPEN” open fault message.		✓
R/S	Runs and stops configuration and self tests. Runs and stops hex dump. Makes a configuration printout when pressed with “OFFLINE/CONFIG. CONTROL” displayed.		✓
SET TOF	Sets location of first line of print on a page.		✓
ENTER	Enters displayed parameter into printer nonvolatile memory. Must be unlocked before using.		✓
▲ (UP)	Offline: displays next higher level of configuration menu. Online: moves paper up in 1/72 inch increments.	✓	✓
▼ (DOWN)	Offline: displays next lower level of configuration menu. Online: moves paper down in 1/72 inch increments.	✓	✓
◀ (PREV)	Displays previous parameter in a configuration or diagnostic test menu.		✓
▶ (NEXT)	Displays next parameter in a configuration or diagnostic test menu.		✓
▼ + ▲	Locks and unlocks the **ENTER** key.		✓
CLEAR + ENTER	“CANCEL DATA” command. Electrically clears the print buffer (no printout) and sets TOF at current position.		✓

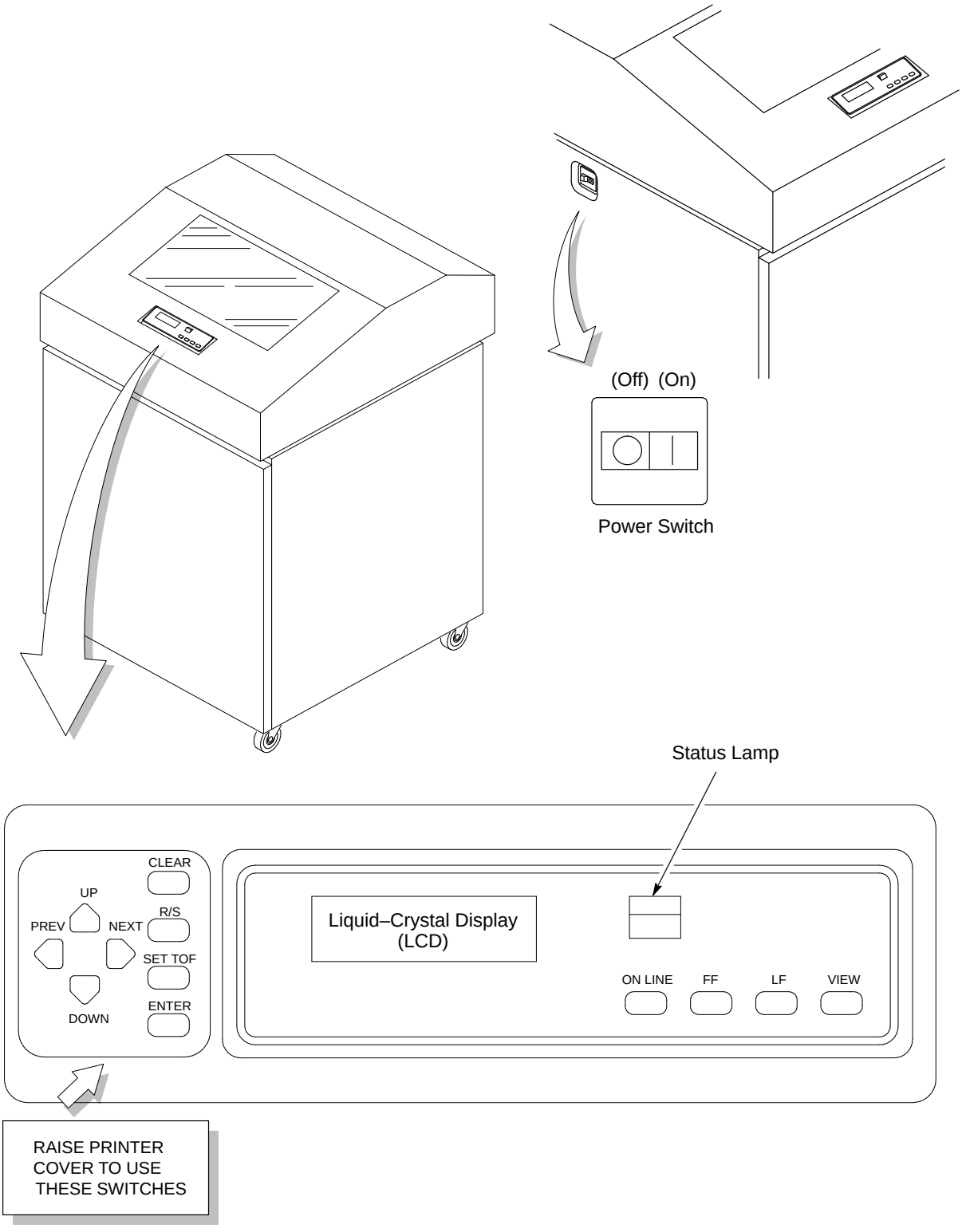
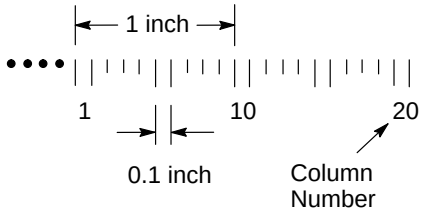


Figure 1–1. Electrical Controls and Indicators

Mechanical Controls and Indicators

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.
Forms Thickness Pointer and Scale	Indicates *relative* thickness of forms/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 to move paper vertically.
Ribbon Loading Path Diagram	A diagram that helps the operator load the ribbon correctly.
Paper Scale	A horizontal scale graduated in tenths of an inch, useful for setting paper margins and counting text columns. (See below.) 

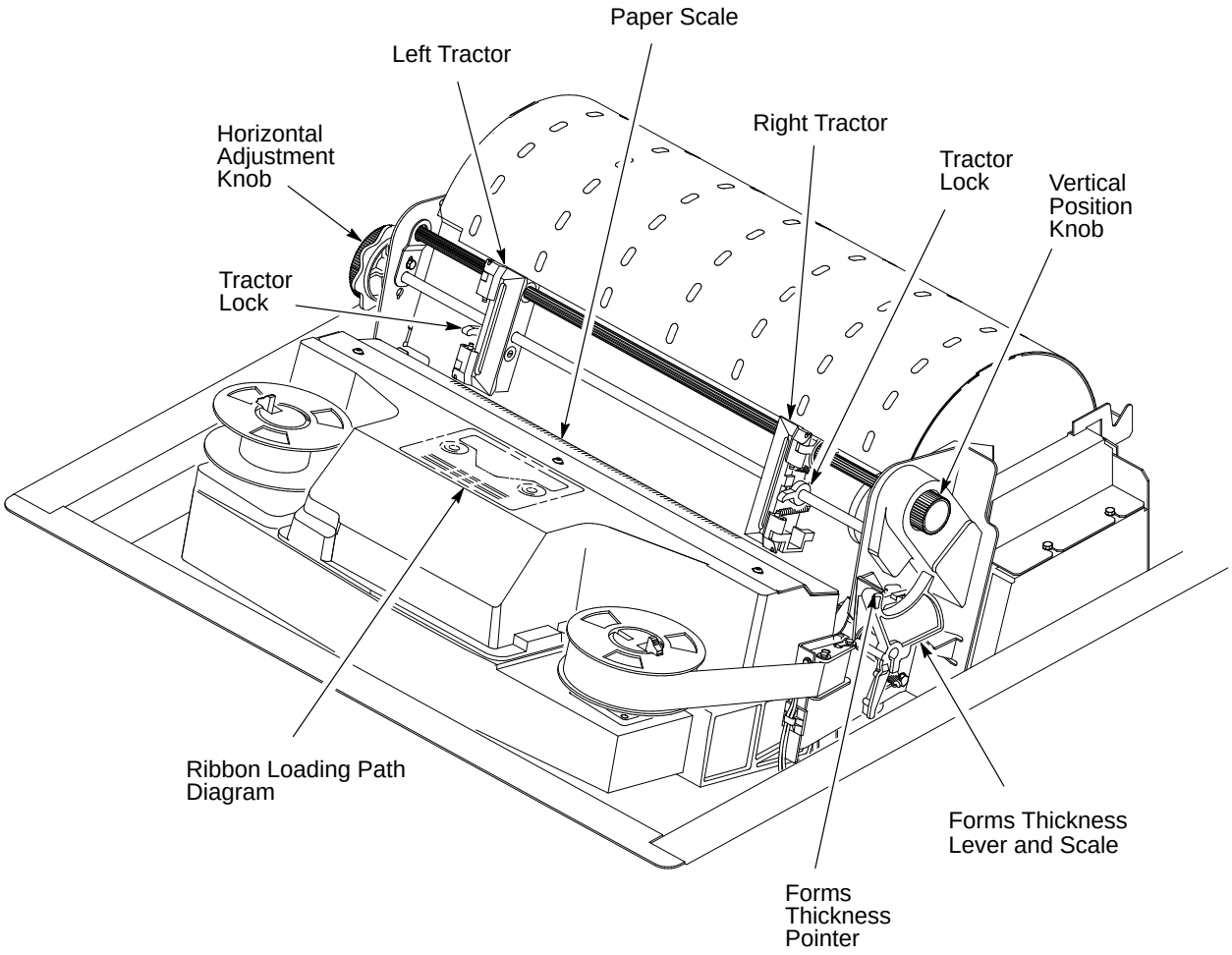


Figure 1–2. Mechanical Controls and Indicators

Tools, Test Equipment, and Supplies

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

Item	Part No.
Adapter, 1/4 in. hex to 1/4 in. square, Utica HW–18	29–24723–00
Alcohol	
Diagonal cutters	
Digital voltmeter	
ESD Wrist Strap	
Extension, 3 in., 3/8 in. drive	
Feeler gauge set	
Force Gauge, (Chatillon™ NY, Gauge–r, 0–20 lb.)	CAT 719–20
Hex bit, 3/16 in., torque screwdriver	29–20995–00
Hex bit, 3/32 in., torque screwdriver	29–18505–00
Hex bit, 5/32 in., torque screwdriver	29–18504–00
Hex bit, 5/64 in., torque screwdriver	
Magnet, small	
Nut driver set	
Pliers, chain nose	
Pliers, grip ring	
Ratchet, 3/8 in. drive	
Ruler, steel, 6 in.	
Screwdriver, Allen hex (set), w/extension	
Screwdriver, Phillips	
Screwdriver, flat tip	
Screwdriver, torque, Utica TS–35	29–17381–00
Socket, 7/16 in., 3/8 in. drive	
Tie Wraps	
Torque Screwdriver Adapter	
Tweezers	

2 Scheduled Maintenance

Chapter Contents

Preventive Maintenance Checks and Services

Perform preventive maintenance checks and services at the intervals specified in Table 2–1.

Do these checks more often if the printer is used for heavy–duty, continuous printing or is located in a dusty area.

WARNING

Always disconnect the AC power cord before performing scheduled maintenance. Failure to do so could result in injury to you or damage to equipment.

Table 2–1. Preventive Maintenance Checks and Services

Interval	Procedure	Page
Every 6 months* —or— Every 1000 hours of operation* —or— At every service call*	Inspect the printer.	2–3
	Clean the printer.	2–4
	Check and adjust the platen gap.	4–12
* Whichever occurs first.		

Inspecting the Printer

Correct any condition found during inspection that could affect printer performance or reliability.

Table 2–2. Physical Inspection

What to Inspect	What to Look For
Cabinet, base, frame	Check for damage, cracks, breaks, dents, gouges, scratches, delamination, warping, corrosion, and proper finish.
Attaching hardware	Inspect fasteners for thread damage, corrosion.
Nameplates	Inspect for legibility and damage.
Printer cover, cabinet door(s), gas spring assemblies	Inspect for damage and loose or missing hardware. Check that door(s) open/close without binding and stay closed. Check that printer cover opens/closes smoothly and the gas spring assemblies hold the cover open.
Hinges	Inspect for damage and loose or missing hardware.
Electrical connectors	Inspect for damage, bent or broken pins.
Controls and indicators	Inspect for damage.
Windows	Inspect for breaks, cracks, or discoloration.
Ribbon cables	Inspect for broken wires, damaged insulation, pinched wiring, etc.
Circuit boards	Inspect for breaks, warping, evidence of overheated components.
Fans and motors	Inspect for obvious damage.

Cleaning the Printer

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 Cabinet and Print Mechanism

1. Power off the printer.
2. Disconnect the ac power cord from the printer and the power source.
3. Remove paper and the ribbon.
4. Wipe down the outside of the cabinet with a clean, lint–free cloth dampened (not wet) with water and a mild detergent or window cleaning solution.
5. Dry the outside of the cabinet 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 2–1.)
8. Wipe the splined shaft with a soft cloth.

CAUTION

To avoid corrosion damage, use only alcohol when cleaning printer mechanical elements. 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.

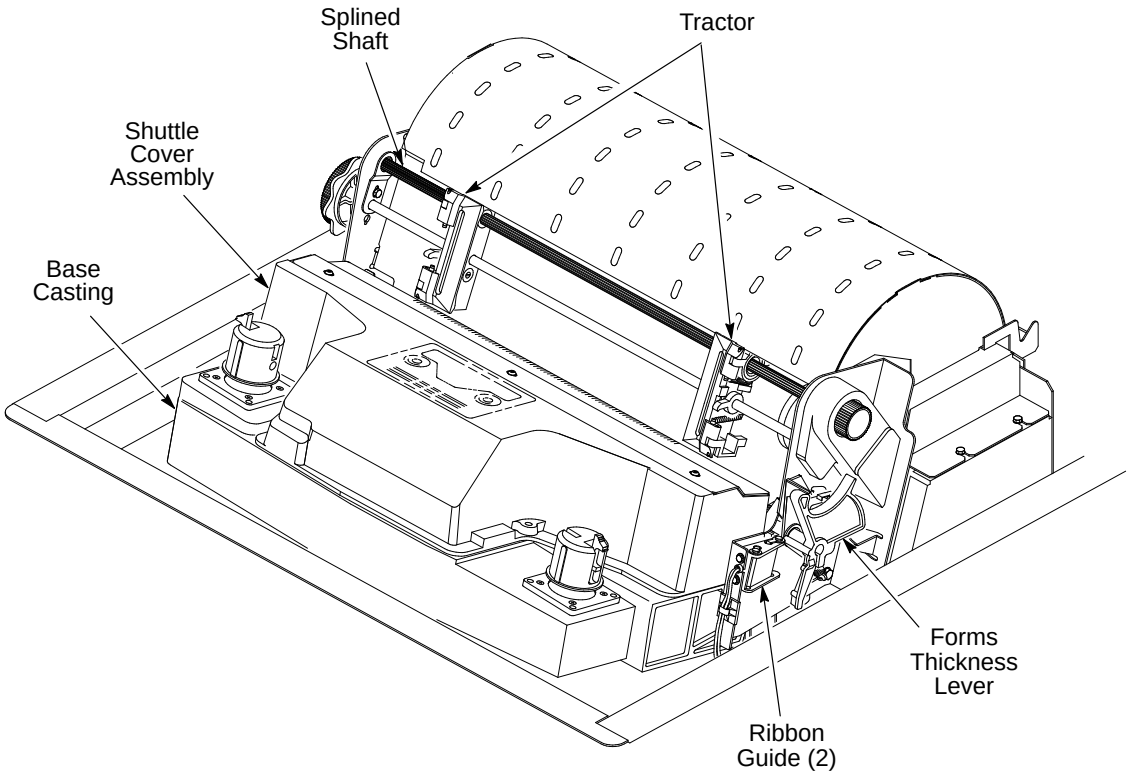


Figure 2–1. Cleaning the Print Mechanism

Cleaning the Shuttle Frame Assembly

1. Remove the shuttle cover assembly (page 5–16).
2. Remove the shuttle frame assembly (page 5–42).
3. Remove the paper ironer (page 5–28).

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 5–28).
6. Remove the hammer bank cover assembly (page 5–15).

CAUTION

The thin plate (ribbon mask) of the hammer bank cover assembly is fragile. Be careful not to over–bend or kink the ribbon mask when handling and cleaning the hammer bank cover assembly.

7. Moisten a clean, soft cloth with alcohol. Wipe the hammer bank cover assembly to remove lint, ink, and paper residue. Clean the holes in the cover strips. Carefully open the cover assembly and wipe between the hammer bank cover and the ribbon mask. (See Figure 2–2.)

CAUTION

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

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

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 cover assembly (page 5–15).
10. Install the shuttle frame assembly (page 5–42).
11. Install the shuttle cover assembly (page 5–16).
12. Clean the card cage fan assembly (page 2–8).

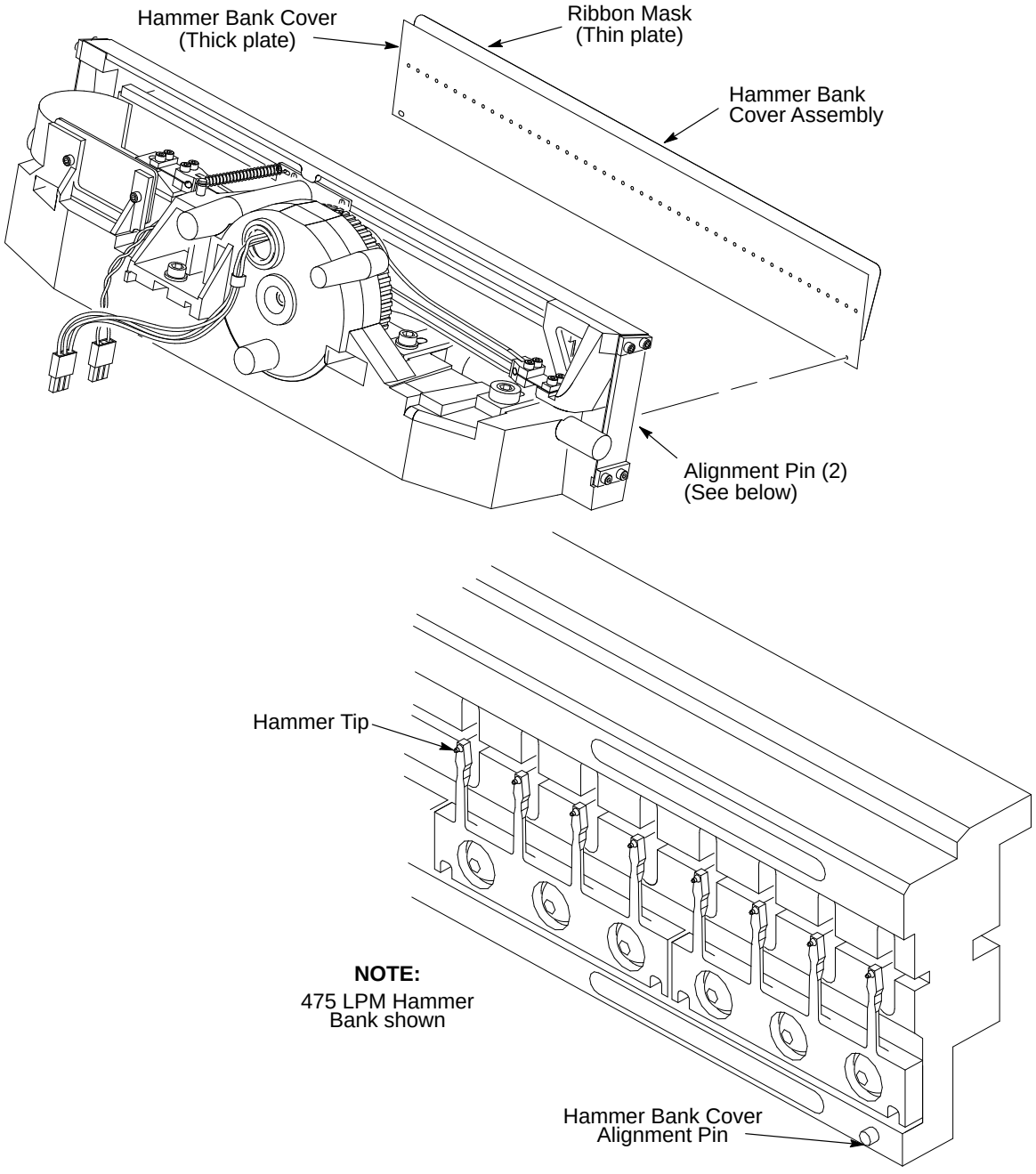


Figure 2–2. Cleaning the Shuttle Frame Assembly

Cleaning the Card Cage Fan Assembly

1. Remove the paper path (page 5–29).
2. Vacuum the card cage fan assembly and surrounding areas to remove paper particles, dust, and lint. (See Figure 2–3.)
3. Install the paper path (page 5–29).
4. Close the printer cover.
5. Connect the ac power cord to the printer and the power source.

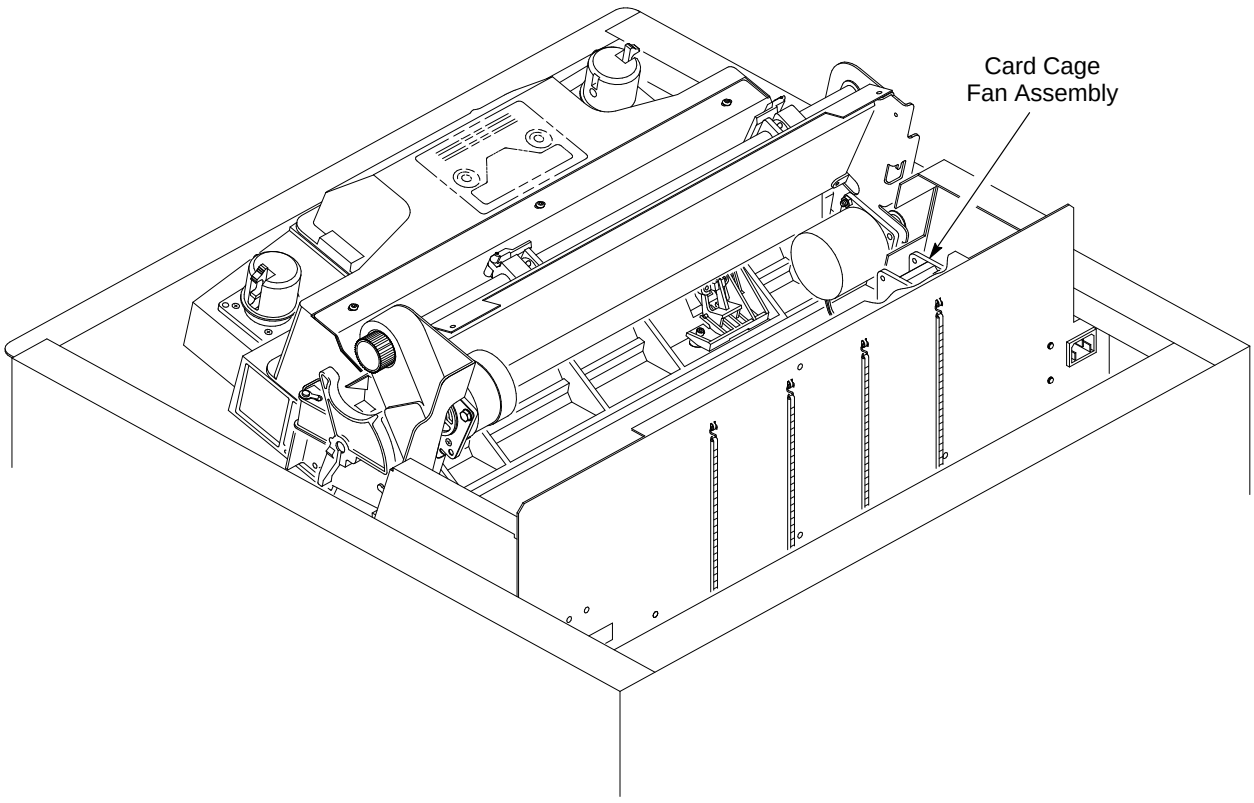


Figure 2–3. Cleaning the Card Cage Fan Assembly

3 Troubleshooting

Chapter Contents

Introduction

This chapter contains procedures for troubleshooting printer malfunctions.

This manual does not cover printer operation or configuration, but you must operate the printer to check its performance, and sometimes you may have to reconfigure the printer. Therefore, have the *Operator's Guide* and the *Setup Guide* handy when you troubleshoot the printer.

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:

- **LCD Message Troubleshooting Table** (Page 3–3)
  A troubleshooting symptom table of fault messages that can appear on the Liquid Crystal Display (LCD). The fault messages are defined and solutions provided.
- **Symptoms Not Indicated by Fault Messages** (Page 3–29)
  This section summarizes how to troubleshoot problems that are not indicated by LCD messages. This section includes a logic table for troubleshooting common problems.
- **Printer Confidence Check** (Page 3–34)
  A systematic check of printer operation in the form of a logic table. You can use this procedure to establish basic printer status or to troubleshoot imprecise or intermittent symptoms.
- **Diagnostic Printer Tests** (Page 3–35)
  A set of printer tests included in the configuration menu structure for use as diagnostic and maintenance tools.
- **Hex Code Printout** (Page 3–41)
  The procedure for printing data streams in hexadecimal format. This procedure can help you troubleshoot printer data reception problems.
- **ASCII Character Set** (Page 3–43)
  A chart of standard ASCII characters and their equivalent codes.
- **Appendix A: Wire Data**
  System interconnect and power distribution diagrams, circuit board pin–outs, and diagrams of the cable assemblies. Use as source material for tracing electrical problems.

LCD Messages

WARNING

Always disconnect the AC power cord from the power source before doing 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 so in the maintenance procedure.

Three kinds of messages appear on the LCD:

- Status messages
- Operator correctable fault messages
- Fault messages that require your attention: the LCD usually indicates these by adding an asterisk (*) to the message.

If a fault condition occurs, three things happen:

- The status lamps on the control panel flash on and off.
- The audible alarm sounds if it was enabled. (Press **CLEAR** to silence the alarm.)
- The control panel LCD displays a fault message.

Clearing LCD Messages

Refer to Table 3–1 and follow the instructions. After correcting an error, always press the **CLEAR** key to clear the message and place the printer in the offline state. (If an error is not cleared, the printer will try to print again but will display another error message until the error is cleared.)

Table 3–1. LCD Message Troubleshooting Table

Displayed Message	Explanation	Solution
8.5V PWR FAIL*	Internal power failure.	Cycle power. If message recurs, replace one at a time until message clears: a) power supply board b) controller board
15V CTL FAIL*	Controller voltage failure.	Cycle power. If message recurs, replace one at a time until message clears: a) controller board b) power supply board
23.5V CTL FAIL*	Controller voltage failure.	Cycle power. If message recurs, replace one at a time until message clears: a) controller board b) power supply board
48V PWR FAIL*	Internal power failure.	Cycle power. If message recurs, replace one at a time until message clears: a) power supply board b) controller board
A TO D OVERUN*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
ACCESS NULL PTR*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
BUFFER OVERFLOW	Host sends data after the printer buffer is full. (Serial interface.)	Page 3–25
CLEAR PAPER JAM	No paper motion.	Clear jam and reload paper. If message recurs, see page 3–10.
CLOSE PLATEN	The forms thickness lever is open.	Page 3–11
COIL HOT	One or more hammer coils are overheating.	Page 3–12

Displayed Message	Explanation	Solution
CTL VOLT FAIL*	Controller voltage failure.	Replace CMX controller board.
DRVR CIR BAD*	Hammer coil count test failed.	Page 3–14
EXHAUST FAN FLT	Sensors cannot detect current in fan circuit.	Page 3–15
FIRMWARE ERROR	Application software tried to perform an illegal printer function or damaged memory detected on CMX board.	Page 3–16
FRAMING ERROR	Serial framing error. (Serial interface.)	Page 3–25
HAM. COIL OPEN*	Electrical malfunction of one or more hammer coils.	Page 3–17
HB NOT INSTLD*	Self–test does not detect hammer coils.	Page 3–18
HMR BANK FAN FLT	Sensors cannot detect current in fan circuit.	Page 3–15
ILL EXT BUS ACC*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
ILL INST ACCSS*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
ILLGL OPR ACCSS*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
INTAKE FAN FAULT	Sensors cannot detect current in fan circuit.	Page 3–15
LO DRV. SHORT *	Circuit(s) on the hammer bank or in the hammer bank power cable shorted to ground.	Page 3–19

Displayed Message	Explanation	Solution
LOAD PAPER	Printer is out of paper.	Load paper. If message recurs, see page 3–20.
PAP BAD TABLE*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
PAP BSY TOO LNG*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
PAP FIFO OVERFL*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
PAP FIFO UNDRFL*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
PAP ILLGL ST*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
PAP INCMPL ENER*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
PAP INVLD CMD*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
PAP INVLD PARM*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
PAP NOT SCHED*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.

Displayed Message	Explanation	Solution
PAP NT AT SPEED*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
PAP UNEXP INT*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
PARITY ERROR	Parity error. (Serial interface.)	Page 3–25
PLAT INV CMD*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
PLAT INV PARM*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
PLAT INV STATE*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
POWER SAVER ON	Status message: printer is in low–energy idle state, all fans and higher voltages are off, only +5Vdc logic circuits are active.	No action required.
POWER SUPPLY HOT	Circuits are overheating on the power supply board.	Page 3–21
PRINTER HOT	Controller board sensors report high temperatures on the board.	Page 3–23
PROTECTED INSTR*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
PWR SUPP VOLT *	Power supply failed.	Replace power supply board.

Displayed Message	Explanation	Solution
RIB INVLD CMD*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
RIB INVLD STATE*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
RIBBON DRIVE	CMX controller does not detect ribbon drive motor.	Page 3–24
SECURITY VIOLATION	Security code of PAL on controller board does not match code of firmware on the CMX controller board.	Replace the CMX controller board.
SOFTWARE ERROR * Cycle power	Application software tried to perform an illegal printer function or damaged logic circuits detected on controller board.	Page 3–27
SHUTTLE JAM	No shuttle movement or shuttle moving at wrong speed.	Page 3–26
SHUTL INV CMD*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
SHUTL INV PARM*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
STACK OVERFLOW*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
STACK UNDERFLOW*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.

Displayed Message	Explanation	Solution
TCB CORRUPTED*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
UNDEF INTERRUPT*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
UNDFNED OPCODE*	Fatal firmware error on CMX controller board.	Cycle power and rerun print job. If message recurs, replace CMX controller board.
UP DRV. SHORT *	Hammer driver circuits on the CMX boards shorted to ground.	Page 3–28

CLEAR PAPER JAM

Instruction	Indication	Yes	No
1. a) Load paper. b) Press the **FF** key several times.	Forms feed without erratic motion, noise, or pin–hole damage.	Go to step 2.	If pin holes are damaged, go to step 4. For erratic motion or noise, go to step 6.
2. Press the **VIEW** key twice.	Forms move correctly in both directions, without jamming, tearing, or folding.	Suspect a false indication. Go to step 9.	Go to step 3.
3. Check the platen open belt.	Platen open belt OK.	Replace one at a time until message goes away: a) platen motor b) controller board	Replace platen open belt.
4. Check that the ribbon mask has not been deformed in such a way as to block the paper path.	Ribbon mask damaged or bent.	Replace the hammer bank cover assembly.	Go to step 5.
5. Check platen gap.	Platen gap incorrect.	Adjust platen gap. Go to step 6.	Go to step 6.
6. Check for damage to the paper feed belt.	Paper feed or belt damaged.	Replace the paper feed belt. Go to step 7.	Go to step 7.
7. Check the tractors and tractor door springs for damage or excessive wear.	Tractors are OK.	Replace CMX controller board. Go to step 8.	Replace tractors.
8. Run a print test.	“CLEAR PAPER JAM” message.	Replace paper feed motor. Go to step 9.	Return printer to normal operation.
9. a) Load paper. b) Do some line feeds and run a print test.	“CLEAR PAPER JAM” message.	Clean the paper motion detector with cotton swab and alcohol. Go to step 10.	Return printer to normal operation.
10. a) Set the paper motion detector fault setting to DISABLE (Ref: *Setup Guide*). b) Run a print test and check paper feeding as the printer prints.	“CLEAR PAPER JAM” message.	Replace the CMX controller board. Go to step 11.	Return printer to normal operation.
11. Run a print test.	“CLEAR PAPER JAM” message.	Replace paper detector switch assembly.	Return printer to normal operation.

CLOSE PLATEN

Instruction	Indication	Yes	No
1. Load paper. Close the forms thickness lever. Run an operator print test.	“CLOSE PLATEN” message.	Go to step 2.	Return printer to normal operation.
2. Power off the printer. Disconnect the platen interlock switch connector. Check the switch with a meter.	Switch is bad.	Replace platen interlock switch assembly.	Replace CMX controller board.

COIL HOT

NOTE: The printer has sensor circuits that sample the operating temperature of key print components. 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, a (UNIT) HOT message is sent to the LCD and printing stops, allowing printer components to cool down. Pressing the **CLEAR** key resumes the print task. 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 consistently above 40° Celsius (104° Fahrenheit) or is dirty enough to create blockage of the cabinet fan vents. If the printer is located in such an environment, consider relocating it to a cooler, cleaner area or reducing the size and duration of the print jobs.

Instruction	Indication	Yes	No
1. Press the **CLEAR** key.	"COIL HOT * " message.	Go to step 2.	Return printer to normal operation.
2. Cycle power: Power off printer. Wait 15 seconds. Power on printer.	"COIL HOT * " message.	Go to step 3.	Return printer to normal operation.
3. Run "All Black" print test for 1/4 page.	"COIL HOT * " message.	Go to step 4.	Return printer to normal operation.
4. a) Power off the printer. b) Remove the paper path. c) Verify that all fan cable connectors are connected. (See Appendix A, Interconnect Diagram.)	Fan cables are properly connected.	Go to step 6.	Connect fan cable connector(s).
5. a) Power on the printer. b) Verify that all fans operate. c) Power off printer.	Fans are OK.	Go to step 7.	Replace defective fan(s).
6. Check for obstruction of vents and fan airways.	Vents and airways are clear.	Go to step 8.	Remove obstructions. Make sure cabinet exhaust fan vents are not blocked. (Check for items beneath the printer blocking cabinet vents.)

Instruction	Indication	Yes	No
7. Examine printer environment for severity. (See NOTE above.)	Printer environment is OK.	Go to step 9.	Move printer to cooler, cleaner location.
8. Check the kinds of print jobs the user is running: look for very dense graphics and layouts.	Print jobs are dense enough to slow the printer.	Advise the user to run jobs in smaller batches.	Replace one at a time until the problem goes away: a) shuttle frame assembly b) CMX controller board

DRVR CIR BAD*

Instruction	Indication	Yes	No
1. Cycle power: Power off printer. Wait 15 seconds. Power on printer.	“DRVR CIR BAD*” message.	Go to step 2.	Return printer to normal operation.
2. Press the **CLEAR** key.	“DRVR CIR BAD*” message.	Go to step 3.	Return printer to normal operation.
3. a) Power off the printer. b) Remove the shuttle cover. c) At the shuttle frame assembly, disconnect the hammer bank logic and power cables. d) Power on the printer.	“HB NOT INSTALLD*” message.	Replace the shuttle frame assembly.	Replace the CMX controller board.

(EXHAUST) (HMR BANK) (INTAKE) FAN FLT

	Instruction	Indication	Yes	No
1.	Cycle power: Power off printer. Wait 15 seconds. Power on printer.	"_____ FAN FLT" message.	Go to step 2.	Return printer to normal operation.
2.	a) Power off the printer. b) Remove the paper path. c) Check that the fan cable connector is connected. (See Appendix A, Interconnect Diagram.)	Fan cable is properly connected.	Go to step 3.	Connect the fan cable connector.
3.	Check for obstruction of vents and fan airway.	Vents and airway are unobstructed.	Go to step 4.	Remove obstructions. Make sure cabinet exhaust fan vents are not blocked. (Check for items beneath the printer blocking cabinet vents.)
4.	a) Power on the printer. b) Check for rotation of fans as printer powers up. c) Power off the printer.	Fans are OK.	Go to step 5.	Replace defective fan(s).
5.	Power on the printer.	"_____ FAN FLT" message.	Replace CMX controller board.	Return printer to normal operation.

FIRMWARE ERROR

Instruction	Indication	Yes	No
1. Cycle power: Power off printer. Wait 15 seconds. Power on printer.	“FIRMWARE ERROR” message.	Replace the CMX controller board. Go to step 2.	Return printer to normal operation.
2. a) Power on the printer. b) Run the print job that was active when the fault message first occurred.	“FIRMWARE ERROR” message.	Application software error. Use your local support procedure to request assistance.	Return printer to normal operation.

HAM. COIL OPEN *

Instruction	Indication	Yes	No
1. Cycle power: Power off printer. Wait 15 seconds. Power on printer.	“HAM. COIL OPEN * ” message.	Go to step 2.	Return printer to normal operation.
2. Press the **CLEAR** key.	“HAM. COIL OPEN * ” message.	Replace the shuttle frame assembly. Go to step 3.	Return printer to normal operation.
3. a) Power on the printer. b) Run a diagnostic printer test.	“HAM. COIL OPEN * ” message.	Replace the CMX controller board.	Return printer to normal operation.

HB NOT INSTLD *

Instruction	Indication	Yes	No
1. a) Power off the printer. b) Remove the shuttle cover. c) Verify that the shuttle frame assembly is installed.	Shuttle frame assembly is installed in the printer.	Go to step 2.	Install the shuttle frame assembly.
2. a) Remove the paper path. b) Verify that the hammer bank logic cable is connected to connector J108 on the CMX controller board and to its connector on the shuttle frame assembly.	Hammer bank logic cable is connected to J108 on the controller board and to the shuttle frame assembly.	Go to step 3.	Connect hammer bank logic cable. Go to step 3.
3. Power on the printer.	“HB NOT INSTLD * ” message.	Replace the hammer bank logic cable. (See Appendix A.) Go to step 4.	Return printer to normal operation.
4. Power on the printer.	“HB NOT INSTLD * ” message.	Replace the CMX controller board. Go to step 5.	Return printer to normal operation.
5. Power on the printer.	“HB NOT INSTLD * ” message.	Replace the shuttle frame assembly.	Return printer to normal operation.

LO DRV. SHORT

Instruction	Indication	Yes	No
1. Cycle power: Power off printer. Wait 15 seconds. Power on printer.	“LO DRV. SHORT” message.	Go to step 2.	Return printer to normal operation.
2. Press the **CLEAR** key.	“LO DRV. SHORT” message.	Replace the shuttle frame assembly. Go to step 3.	Return printer to normal operation.
3. Power on the printer.	“LO DRV. SHORT” message.	Replace the CMX controller board. Go to step 4.	Return printer to normal operation.
4. Power on the printer.	“LO DRV. SHORT” message.	Replace hammer bank logic cable assembly and hammer bank power cable assembly.	Return printer to normal operation.

LOAD PAPER

Instruction	Indication	Yes	No
1. Load paper. Run a diagnostic printer test.	“LOAD PAPER” message.	Replace paper detector switch assembly. Go to step 2	Return printer to normal operation.
2. Run a diagnostic printer test.	“LOAD PAPER” message.	Replace the CMX controller board.	Return printer to normal operation.

POWER SUPPLY HOT

NOTE: The printer has sensor circuits that sample the operating temperature of key print components. 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, a (UNIT) HOT message is sent to the LCD and printing stops, allowing printer components to cool down. Pressing the **CLEAR** key resumes the print task. Check the operating environment. A severe environment is one with an ambient temperature consistently above 40° Celsius (104° Fahrenheit) or is dirty enough to create blockage of the cabinet fan vents. If the printer is located in such an environment, consider relocating it to a cooler, cleaner area or reducing the size and duration of the print jobs.

	Instruction	Indication	Yes	No
1.	Press the **CLEAR** key.	"POWER SUPPLY HOT" message.	Go to step 2.	Return printer to normal operation.
2.	Cycle power: Power off printer. Wait 15 seconds. Power on printer.	"POWER SUPPLY HOT " message.	Go to step 3.	Return printer to normal operation.
3.	Run a diagnostic printer test.	"POWER SUPPLY HOT" message.	Go to step 4.	Return printer to normal operation.
4.	a) Power off the printer. b) Remove the paper path. c) Check that the power supply guard/air deflector is correctly positioned over the power supply board. d) WARNING: DO NOT TOUCH the power supply, but hold your hand close enough to check for heat radiating off the board.	Power supply is noticeably hot.	Go to step 5.	Replace power supply board.
5.	Verify that all fan cable connectors are connected. (See Appendix A, Interconnect Diagram.)	Fan cables are properly connected.	Go to step 6.	Connect fan cable connector(s).
6.	a) Power on the printer. b) Verify that all fans operate. c) Power off printer.	Fans are OK.	Go to step 7.	Replace defective fan(s).

Instruction	Indication	Yes	No
7. Check for obstruction of vents and fan airways.	Vents and airways are clear.	Go to step 8.	Remove obstructions. Make sure cabinet exhaust fan vents are not blocked. (Check for items beneath the printer blocking cabinet vents.)
8. Examine printer environment for severity. (See NOTE above.)	Printer environment is OK.	Go to step 9.	Move printer to cooler, cleaner location.
9. Check the kinds of print jobs the user is running: look for very dense graphics and layouts.	Print jobs are dense enough to slow the printer.	Advise the user to run jobs in smaller batches.	Replace the CMX controller board.

PRINTER HOT

NOTE: This message indicates internal temperatures over 60° Celsius (140° Fahrenheit). Print jobs will not create such temperatures, so immediately determine that the fans are operating and that all air vents are unobstructed. It is crucial that the exhaust vents on the floor of the cabinet remain unblocked, since hot air from inside the printer is vented through the cabinet floor. Nothing should be stored under the printer. Then check the operating environment. A severe environment is one with an ambient temperature consistently above 40° Celsius (104° Fahrenheit) or is dirty enough to create blockage of the cabinet fan vents. If the printer is located in such an environment, consider relocating it to a cooler, cleaner area or reducing the size and duration of the print jobs.

Instruction	Indication	Yes	No
1. Press the **CLEAR** key.	"MECH DRIVER HOT" or "PRINTER HOT" message.	Go to step 2	Return printer to normal operation.
2. Cycle power: Power off printer. Wait 15 seconds. Power on printer.	"MECH DRIVER HOT" or "PRINTER HOT" message.	Go to step 3	Return printer to normal operation.
3. Verify that all fans operate.	Fans are OK.	Go to step 4	Replace defective fan(s).
4. a) Power off the printer. b) Check for obstruction of vents and fan airways.	Vents and airways are clear.	Go to step 5	Remove obstructions. Make sure cabinet exhaust fan vents are not blocked. (Check for items beneath the printer blocking cabinet vents.)
5. Examine printer environment for severity. (See NOTE above.)	Printer environment is OK.	Replace the CMX controller board.	Move printer to cooler, cleaner location.

RIBBON DRIVE

Instruction	Indication	Yes	No
1. Cycle power: Power off printer. Wait 15 seconds. Power on printer.	“RIBBON DRIVE” message.	Go to step 2.	Return printer to normal operation.
2. a) Power off printer. b) Check cable connections of both ribbon driver motors. (Refer to Appendix A.)	Ribbon drive motor cables connected properly.	Go to step 3.	Attach ribbon drive motor cables. Go to step 3.
3. a) Power on the printer. b) Using a screwdriver, short across the ribbon guide screws to reverse ribbon hub motion. c) Check for a ribbon drive motor that will not wind ribbon.	Both motors wind the ribbon.	Replace the CMX controller board.	Replace defective ribbon drive motor.

Serial Interface Messages

Instruction	Indication	Yes	No
1. a) Make a configuration printout. (Ref.: *Setup Guide*) b) Verify that host and printer serial interface configuration settings match for: — Baud Rate — Data Bits — Stop Bits — Parity	Host and printer serial interface parameters match.	Go to step 2	Set printer serial interface parameters to match those of the host. (Ref.: *Setup Guide*)
2. Send a print job to the printer.	Job prints OK and no serial interface fault messages appear.	Return printer to normal operation.	Replace the CMX controller board.

SHUTTLE JAM

Instruction	Indication	Yes	No
1. Check the forms thickness lever: if it is set too tightly, it can slow the shuttle enough to trigger the fault message.	Forms thickness lever set correctly.	Go to step 2.	Set forms thickness lever for thicker paper. Go to step 2.
2. Run a diagnostic printer test and check for shuttle obstruction.	“SHUTTLE JAM” message.	Go to step 3.	Return printer to normal operation.
3. a) Remove shuttle cover and paper path. b) Inspect shuttle area and mechanism for obstruction. c) Check that cable connectors are attached at MPU, shuttle motor, and controller board.	Shuttle movement blocked or cable(s) loose/disconnected.	Remove obstruction. Connect cable(s). Go to step 4.	Install shuttle cover. Go to step 4.
4. Run a diagnostic shuttle test and observe the shuttle.	Shuttle runs slowly.	Go to step 5.	Go to step 7.
5. Check MPU adjustment.	MPU adjustment OK.	Go to step 6.	Return printer to normal operation.
6. Run a diagnostic printer test.	“SHUTTLE JAM” message.	Replace the MPU. Go to step 7.	Return printer to normal operation.
7. Run a diagnostic printer test.	“SHUTTLE JAM” message.	Replace CMX controller board.	Replace shuttle frame assembly.

SOFTWARE ERROR *

Instruction	Indication	Yes	No
1. Cycle power: Power off printer. Wait 15 seconds. Power on printer.	“SOFTWARE ERROR * ” message.	Go to step 2	Return printer to normal operation.
2. Disconnect the input data line from the host computer. Cycle power: Power off printer. Wait 15 seconds. Power on printer.	“SOFTWARE ERROR * ” message.	Replace the CMX controller board.	Not a printer problem. Application software error. Request assistance from your local support group. Return printer to normal operation.

UP DRV. SHORT

Instruction	Indication	Yes	No
1. Cycle power: Power off printer. Wait 15 seconds. Power on printer.	“UP DRV. SHORT” message.	Go to step 2.	Return printer to normal operation.
2. Press the **CLEAR** key.	“UP DRV. SHORT” message.	Replace the CMX controller board. Go to step 3.	Return printer to normal operation.
3. Power on the printer.	“UP DRV. SHORT” message.	Replace the shuttle frame assembly. Go to step 4.	Return printer to normal operation.
4. Power on the printer.	“UP DRV. SHORT” message.	Replace hammer bank logic cable assembly and hammer bank power cable assembly.	Return printer to normal operation.

Symptoms Not Indicated by Fault Messages

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

1. Ask the operator to describe the problem.
2. Verify the fault by running diagnostic tests or replicating conditions reported by the user.
3. Look for a match in the "Symptoms Not Indicated by Fault Messages Troubleshooting Table" on page 3–30, and follow the instructions given.
4. Locate the malfunction using the half–split method:
    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 3–2.)
5. Replace the defective part or assembly.

IMPORTANT

DO NOT attempt field repairs of electronic components or assemblies. 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: replace the entire shuttle frame assembly. It is not field repairable.

6. Test printer operation after every corrective action.
7. Stop troubleshooting and return the printer to normal operation when the reported symptoms disappear.

Symptoms Not Indicated by Fault Messages Troubleshooting Table

Symptom	Instruction
No power, control panel LCD and LEDs blank, card cage fan not running.	1. +5 volt distribution problem to the controller board. (See Power Distribution Diagram, page A–3.)
Power on hang condition.	1. Replace one at a time until the problem is fixed: a) CMX controller board (page 5–10) b) power supply (page 5–12)
Blank or single line of black squares across top row of control panel LCD.	1. Power off printer. Remove the paper path. Check all cable connections into the controller board, especially that the control panel cable is seated in connector J110 on the controller board. Make sure the flash memory SIMM(s) is/are seated properly in J10/J11. Power on the printer. If the display is still blank or has a black line, go to step 2 2. (NOTE: If the panel is blank but the cooling fans come on, the control panel or control panel cable is bad. If the fans do not come on, the controller board is probably bad.) Replace one at a time until the problem is fixed: a) control panel assembly (page 5–14) b) control panel cable assembly (page 5–14) c) CMX controller board (page 5–10)
Control panel key failure.	1. Replace one at a time until the problem is fixed: a) control panel assembly (page 5–14) b) control panel cable assembly (page 5–14) c) CMX controller board (page 5–10)
Ribbon folding or feed problems.	1. Clean the shuttle frame assembly (page 2–6) 2. Check the left and right ribbon guide alignment (page 4–16) 3. Check the platen gap (page 4–12)
Printer appears normal, but does not print data sent from the host.	1. Perform a printer confidence check (page 3–34) 2. Check the host data cable connection at the rear of the printer. 3. If the printer interface is RS–232, interchange the wires to pins 2 and 3. This is the most common cause of a completely inoperative RS–232 cable. Make sure the printer and host have the same baud rate, number of data bits, number of stop bits, and parity. In RS–232, configure the host for XON/XOFF if possible; this requires the least complex cable. 4. Replace the CMX controller board (page 5–10)

Symptom	Instruction
Printer prints data sent from the host, but occasionally prints double characters, random ! or * characters, or loses blocks of data.	1. If the printer prints from the host, but occasionally loses blocks of data, the most likely cause is the host not responding to “send no more data” signals from the printer. With a Centronics interface, this means the host is ignoring BUSY; in RS–232, the host is ignoring the XOFF character or “Data Terminal Ready” signal (pin 20). Sometimes the cable is not conveying the necessary signals. Test this by using a serial line analyzer and software or test equipment that displays the data and handshake lines of the printer. A breakout box works, but will not debug XON/XOFF or other RS–232 data protocols. If the printer is sending XOFF with one stop bit, the host may not be receiving it if the host requires 1.5 or 2 stop bits. 2. a) If the printer prints from the host, but occasionally prints double characters, there is probably a noise problem at the interface or the host computer is sending an inverted strobe. This problem can occur on Centronics interfaces, never on RS–232. What happens is the strobe signal registers logic 1 more than once for a certain character. To fix this, change the strobe to trailing edge or invert the strobe polarity. (Refer to the *User’s Guide*.) b) Also check that the terminating resistors are present on the controller board (page 5–35). You can correct some noise problems by using a shielded data cable or by changing the terminating resistors. The standard terminating resistors are optimized for high speed data transfer for cables between 1 and 5 meters long; you can change them for slower operation, which will provide slightly more noise immunity. c) Noise is caused by static, a floating logic ground, unshielded cable, changes in ground voltage from nearby equipment, or capacitively– or magnetically–induced noise. On very long cables, capacitively–induced noise from the other signals of the cable (especially Centronics “ACK”) can cause false strobes. Unshielded and flat ribbon cables are much more prone to problems due to increased length. The best solution is to shorten cable, shield it, and reduce local electromagnetic noise. Also, make sure that both the printer and the host computer are properly grounded.

Print Quality Problems	
Missing, light, or smeared characters or dots:	1. Check the forms thickness lever setting. 2. Check the ribbon for folds or tears. 3. Clean the shuttle frame assembly (page 2–6). 4. Check the platen gap adjustment (page 4–12). 5. Replace one at a time until problem is fixed: a) shuttle frame assembly (page 5–42) b) controller board (page 5–10)
All characters or dots are too light or too dark.	1. Check the forms thickness lever setting. 2. Clean the shuttle frame assembly (page 2–6). 3. Check the platen gap adjustment (page 4–12). 4. Install a new ribbon. 5. Replace one at a time until problem is fixed: a) controller board (page 5–10) b) shuttle frame assembly (page 5–42)
Horizontal misalignment. (Dots or characters move left or right from dot row to dot row or line to line.)	1. If dots between alternate dot rows are misaligned, check hammer phasing (page 4–25). 2. Clean the shuttle frame assembly (page 2–6). 3. Check the MPU gap adjustment (Ref: page 5–20). 4. Replace one at a time until problem is fixed: a) MPU (page 5–20) b) controller board (page 5–10) c) shuttle frame assembly (page 5–42)
Vertical misalignment: 1. Dots or characters move up or down from dot row to dot row or line to line. 2. Incorrect spacing from dot row to dot row or line to line.	1. Check paper feed motor belt (page 4–4). 2. Check platen gap adjustment (page 4–12). 3. Replace one at a time until problem is fixed: a) tractors (page 5–50) b) controller board (page 5–10) c) paper feed motor (page 5–23) d) power supply board (page 5–12)
Randomly misplaced dots.	1. Check platen gap adjustment (page 4–12). 2. Check printer grounding. 3. Replace one at a time until problem is fixed: a) controller board (page 5–10) b) power supply board (page 5–12) c) shuttle frame assembly (page 5–42)

Print Quality Problems	
Garbled print or paper slews uncontrollably.	1. a) Put the printer in hex dump mode and analyze the binary data. One cause of garble is the host interface or cable not transmitting all 8 data bits. When this occurs, the Centronics interface receives a 1 on every unconnected data line. Uncontrolled slewing is often caused by enabling PI (Paper Instruction) in the printer when the host lacks a PI signal. (PI shows as “p” on the hex dump printout.) Some RS–232 interfaces only send 7 data bits. In this case, the eighth bit will be received as a one. b) In RS–232, a common cause of garble is the interface set to the wrong baud rate or parity. Sometimes the host sends 1.5 or 2 stop bits; in this case, the printer’s “1–stop–bit” setting will accept both 1.5 and 2 stop bit data. Sometimes the data may “fade” or “persist” from one character to the next. This reveals a problem with Centronics terminating resistors on the controller board—especially if they are absent. Garble also can result from failed terminating resistors or parallel logic, but this is rare. 2. Replace the controller board.
Missing print over a single hammer’s zone.	1. Replace one at a time until problem is fixed: a) shuttle frame assembly (page 5–42) b) controller board (page 5–10)
Missing print over every 4th hammer’s zone.	1. Replace one at a time until problem is fixed: a) controller board (page 5–10) b) shuttle frame assembly (page 5–42)
No hammers fire but paper advances.	1. Replace one at a time until problem is fixed: a) controller board (page 5–10) b) shuttle frame assembly (page 5–42)

Printer Confidence Check

Instruction	Indication	Yes	No
1. Check that printer is plugged into correct power source.	Power cable installed correctly to proper source.	Power off printer. Go to step 2.	Power off the printer. Connect printer to correct power source.
2. Power on the printer.	Printer initializes correctly and goes to online or offline state, depending on power–up configuration.	Go to step 3	Troubleshoot the fault message (page 3–3).
3. Run an operator print test (page 3–35).	Printer operates correctly.	Go to step 4	Troubleshoot the fault message (page 3–3).
4. Make a configuration printout. (Refer to the *Setup Guide.*)	a) Configuration is correct for the user's application. b) Host computer and printer are using the same protocol (emulation). c) Configuration has not been inadvertently changed by user.	Go to step 5	Reconfigure the printer. (Refer to the *Setup Guide.*)
5. a) Power off the printer. b) Check alignments and adjustments. (See Chapter 4.)	Assemblies and components are adjusted in accordance with Chapter 4.	Go to step 6	Adjust all assemblies that are out of spec.
6. a) Power off the printer. b) Remove paper path (page 5–29). c) Check all electrical connections.	Connections are clean and tight. Wires are not stripped, frayed, or out of connectors.	Go to step 7	Replace stripped, frayed, or broken wires.
7. Check that printed circuit boards are correctly installed and cable connections are correct. (See Appendix A.)	Printed circuit boards are correctly installed and all cables are correctly attached.	Go to step 8	Install each board correctly. Check and correct the cable attachments.
8. Inspect for debris that could cause short circuits (loose fasteners, foil, etc.).	Metallic debris found.	Remove debris. Clean the printer. (Chapter 2.)	Go to step 9
9. a) Install paper path (page 5–29). b) Power on the printer.	Printer powers up and initializes properly.	Printer appears to be OK. Fault may not be in printer. Check host computer, applications software, interface cabling, etc.	Troubleshoot the fault message (page 3–3).

Diagnostic Printer Tests

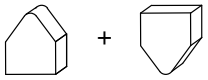
A set of printer tests is included in the configuration menu structure for use as diagnostic and maintenance tools. You can use these printer tests to check the print quality and basic operation of the printer. In addition, you will use some of these tests in various troubleshooting and adjustment procedures.

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 shuttle and hammer bank at maximum capacity.
- **Shuttle Slow** Verifies proper operation by exercising the shuttle and ribbon mechanisms at low speed. You can also use this test to check ribbon tracking and reversing.
- **Shuttle Fast** Verifies proper operation by exercising the shuttle and ribbon mechanisms at high speed. You can also use this test to check ribbon tracking and reversing.
- **Shuttle Only** This test runs only the shuttle mechanism, not the ribbon mechanism.

- **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 aluminum casting of the shuttle assembly, next to the motor housing. Use this value as your starting point when adjusting hammer phasing.
- **Paperout Adj.** This test prints a vertical comb pattern. You will 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** Use of this test is *not recommended*. 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

Step	Key	Result	Notes
1.	a) Load paper. b) Install the ribbon. c) Set top–of–form. (Refer to the *Operator's Guide.)*		
2.	Press: ON LINE 	OFFLINE CONFIG. CONTROL	The printer must be offline to select diagnostic tests.
3.		ENTER SWITCH UNLOCKED OFFLINE CONFIG. CONTROL	Allows you to make configuration changes.
4.	 UNTIL	OFFLINE DIAGNOSTICS	
5.		DIAGNOSTICS Printer Tests	
6.	 UNTIL	DIAGNOSTICS Test Width	
7.		Test Width Full Width*	
8.	 OR 	Test Width X	Cycle through the choices. X = Full Width or X = 80 columns.
9.	ENTER 	Test Width X*	Test width selected.
10.	 UNTIL	DIAGNOSTICS Test Width	
11.	 UNTIL	DIAGNOSTICS Printer Tests	

Step		Key	Result	Notes
12.			Printer Tests Shift Recycle*	
13.		 OR 	Printer Tests All E's	Cycle through the choices. Refer to page 3–35.
14.	To start test:	R/S 	Printer Tests All E's*	The test runs.
15.	To stop test:	R/S 	Printer Tests All E's*	Stops tests.
16.		 + 	ENTER SWITCH LOCKED	Locks the configuration parameters.
17.		CLEAR 	OFFLINE CONFIG. CONTROL	Moves the printer out of the menus to offline.
18.	Examine the print quality. The characters should be fully formed and of uniform density.			
19.	When the print quality is acceptable, close the printer cover; press ON LINE to enable printing.			

Hidden Diagnostic Menu

Printer boot–up software contains a hidden menu structure that you can access by holding down the ◀ (PREV) and ▼ (DOWN) keys while powering up the printer. These menus are not intended for the end user, but provide useful information for manufacturing and maintenance personnel. The hidden diagnostic menu is a multi–level menu that operates the same way as the user menus. The hidden diagnostic menu is depicted in Figure 3–1.

To exit the hidden diagnostic menu, you must recycle power.

Activating the Hidden Diagnostic Menu

1. Set the printer power switch to O (off). On cabinet models, raise the printer cover.
2. Press and hold down the ◀ (PREV) and ▼ (DOWN) keys.
3. While holding the ◀ (PREV) and ▼ (DOWN) keys, set the printer power switch to 1 (on).
4. When “BOOT DIAGNOSTICS / PRESS ENTER” appears on the LCD, release the ◀ (PREV) and ▼ (DOWN) keys.
5. Press the ENTER key. Menu options are shown in NO TAG.

Exiting the Hidden Diagnostic Menu

Recycle power: power off the printer, wait 15 seconds, the power on the printer.

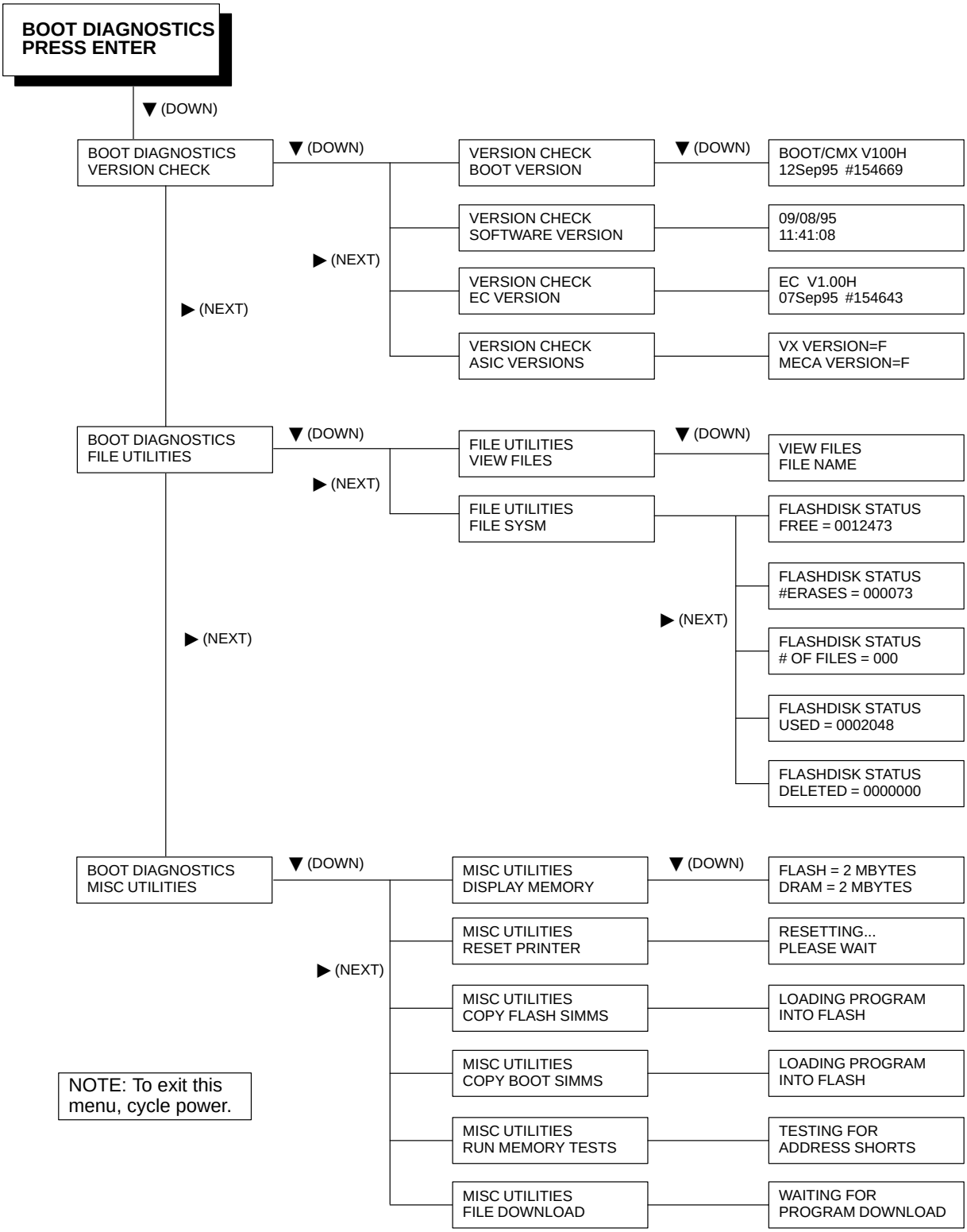


Figure 3–1. Diagnostics Menu

Hex Code Printout

A hex code printout (“hex dump”) lists each ASCII data character received from the host computer and lists its corresponding two-digit hexadecimal code. (See Figure 3–2.) Hex dumps can be used to troubleshoot some types of printer data reception problems.

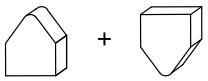
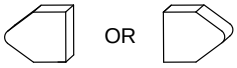
Every printable character prints both as its assigned symbol and as its hex equivalent. Every nonprintable (ASCII control) character prints both as a period (.) and as its hex equivalent. When using a parallel interface, the letter “p” before a hex code indicates an active Paper Instruction (PI) line and a blank space before a hex code indicates an inactive PI line.

To make a hex code printout, refer to the procedure on page 3–42. To convert an ASCII character to its corresponding hex code (or vice-versa), refer to the ASCII code chart on page 3–43.

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

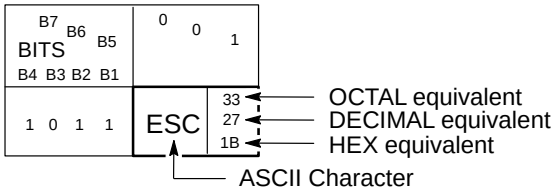
Figure 3–2. Hex Dump Sample

Making a Hex Code Printout

Step	Key	Result	Notes
1.	Make sure the printer is on. Raise the printer cover.		
2.	Press: ON LINE 	OFFLINE CONFIG. CONTROL	
3.		ENTER SWITCH UNLOCKED OFFLINE CONFIG. CONTROL	Allows you to make configuration changes.
4.	 UNTIL	OFFLINE MAINT / MISC	
5.		MAINT / MISC Hex Dump Mode	
6.		Hex Dump Mode Disable	
7.	 OR	Hex Dump Mode Enable	Cycle through the choices.
8.	ENTER 	Hex Dump Mode Enable *	Asterisk (*) indicates this choice is active.
9.		ENTER SWITCH LOCKED	Locks the configuration parameters.
10.	ON LINE 	ONLINE	
11.	Go to the host computer and send a file. The printer outputs a hex dump. Refer to the ASCII chart on page 3–43.		
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

KEY



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

4 Adjustment Procedures

Chapter Contents

Preparing the Printer for Maintenance

WARNING

Unplug the printer power cord from the 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 so in the maintenance procedure.

Always do the following *before* performing any maintenance:

1. Set the printer power switch to O (off).
2. Unplug the printer power cord from the AC power source.
3. Unload paper.
4. Read the entire maintenance procedure before you begin working on the printer.
5. Gather the necessary parts before you begin work.

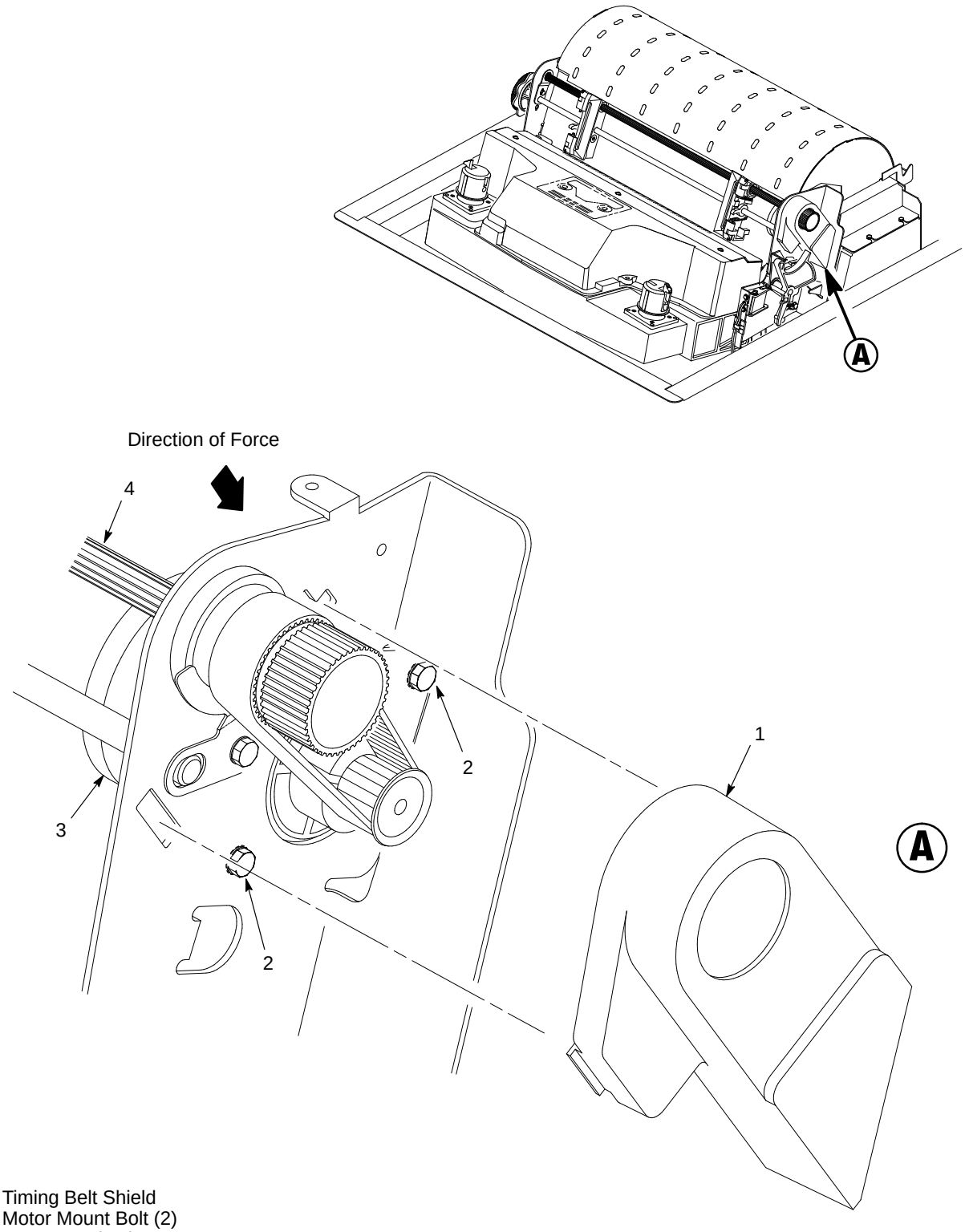
Returning the Printer to Normal Operation

When you have finished servicing the printer, restore it to operation by following the steps below:

1. Install the ribbon.
2. Plug the AC power cord into the printer and the power source.
3. Set the printer power switch to | (on).
4. Load paper.
5. Close the cabinet doors and the printer cover.
6. Test printer operation by selecting and running one of the diagnostic print tests. (See Chapter 3.)
7. Select the emulation. (Refer to the *Operator's Guide* or the *Setup Guide*.)
8. Set the top–of–form. (Refer to the *Operator's Guide* or the *Setup Guide*.)

Belt, Paper Feed Timing, Adjustment (Figure 4–1)

1. Prepare the printer for maintenance (page 4–2).
2. Open the printer cover.
3. Remove the paper path (page 5–29).
4. Loosen four screws and remove the barrier shield (page 5–59, Figure 5–10).
5. Remove the timing belt cover (1) by squeezing the top and bottom to release the plastic tabs from the slots in the side plate.
6. Loosen (do not remove) the motor mount bolts (2).
7. Using the straight end of a force gauge, apply 15 pounds (66.7 N) of pressure to the paper feed drive motor (3). Use the splined shaft (4) to steady the gauge.
8. Reduce tension to 12 pounds (53.4 N) and torque the paper feed motor mount bolts (2) to 18 ± 2 inch–pounds (2.03 ± 0.23 N•m).
9. Snap the timing belt cover (1) into the slots in the side plate.
10. Install the barrier shield and tighten the four screws (page 5–59, Figure 5–10).
11. Install the paper path (page 5–29).
12. Return the printer to normal operation (page 4–3).



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

Figure 4–1. Paper Feed Timing Belt Adjustment

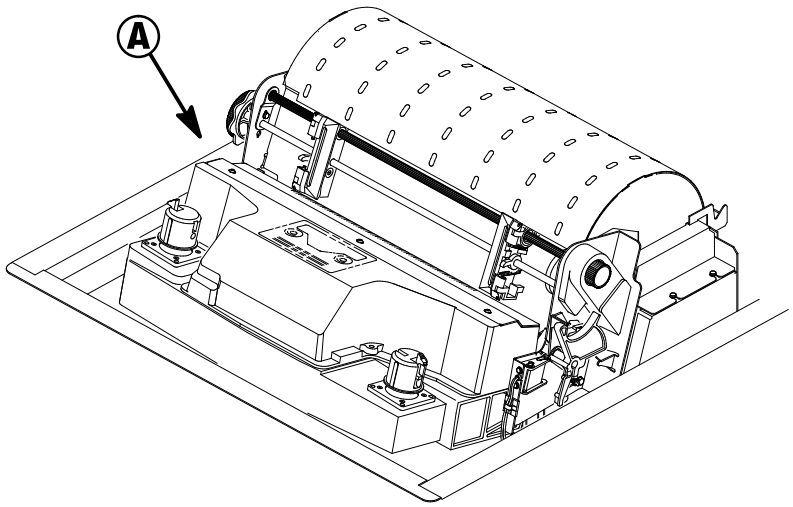
Belt, Platen Open, Adjustment (Figure 4–2)

1. Prepare the printer for maintenance (page 4–2).
2. Open the printer cover.
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 motor mount screws (2).
5. Close the forms thickness lever all the way.

CAUTION

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

6. Using a force gauge, apply 10 ± 1 pounds (44.48 ± 4.45 N) of tension to the shank of the platen drive pulley (3), pushing away from the large platen pulley.
7. Reduce tension to 5 ± 1 pounds (22.24 ± 4.45 N) and torque the motor mount screws (2) to 11 ± 2 inch–pounds (1.24 ± 0.23 N•m).
8. Snap the platen open belt cover (1) into the slots in the side plate.
9. Return the printer to normal operation (page 4–3).



1. Belt Cover
2. Motor Mount Screw
3. Platen Open Motor Shaft

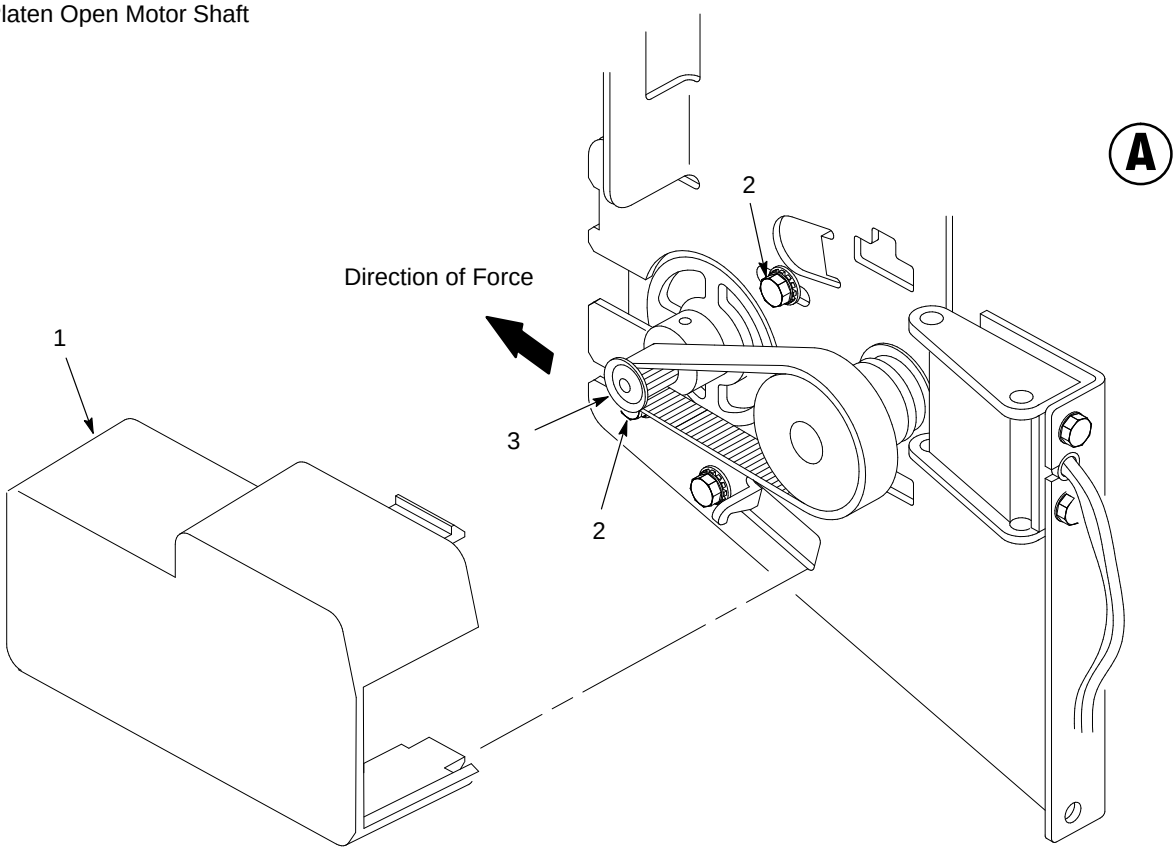


Figure 4–2. Platen Open Belt Adjustment

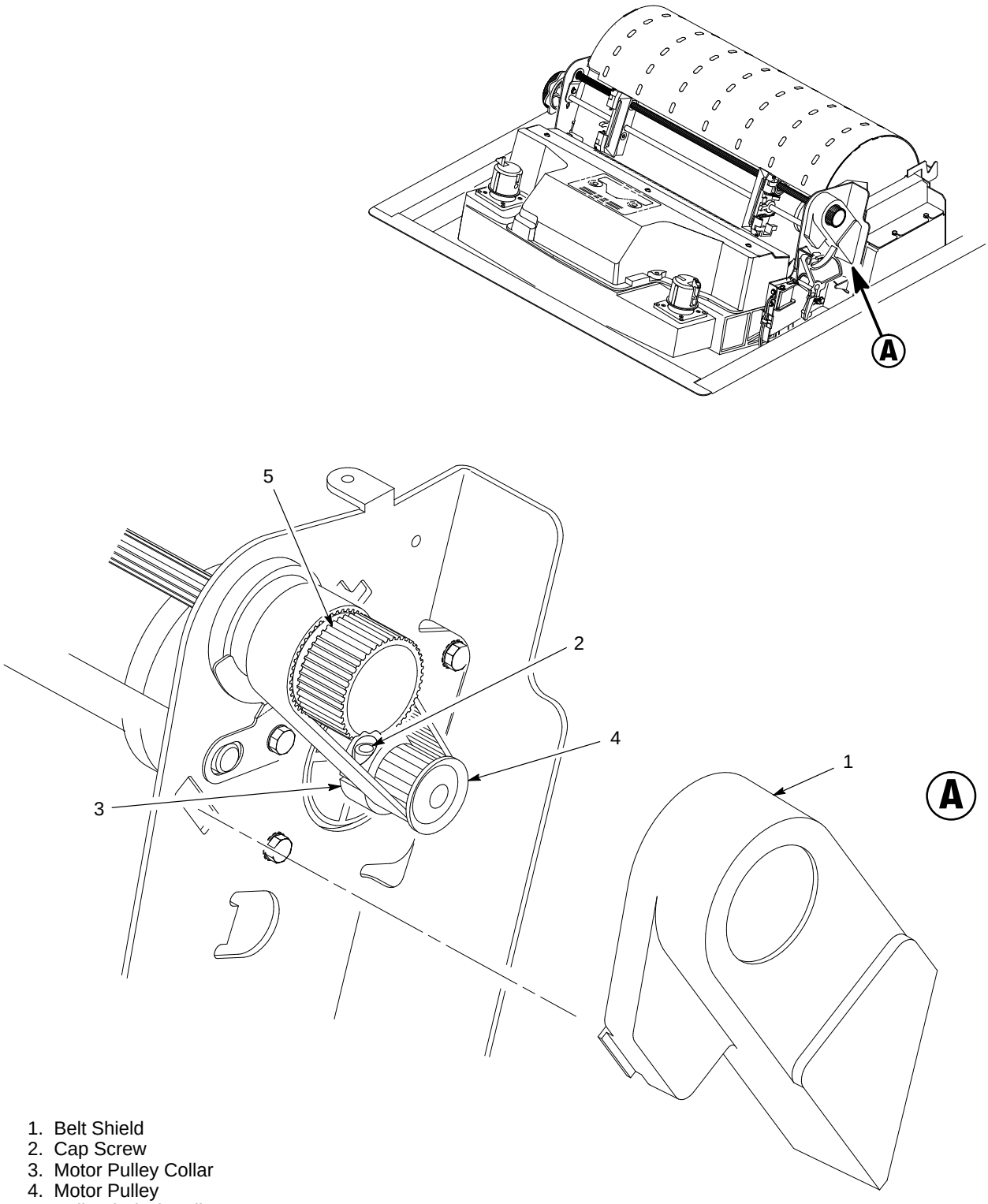
Paper Drive Motor Pulley Alignment (Figure 4–3)

1. Prepare the printer for maintenance (page 4–2).
2. Open the printer cover.
3. Remove the timing belt cover (1) by squeezing the top and bottom to release the plastic tabs from the slots in the side plate.
4. Loosen the 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 (3) and the motor face plate.

6. Hold the collar (3) flush against the motor pulley (4) and tighten the screw (2).
7. Check for correct tension on the paper feed timing belt (page 4–4). Adjust if necessary.
8. Snap the timing belt cover (1) into the slots in the side plate.
9. Return the printer to normal operation (page 4–3).

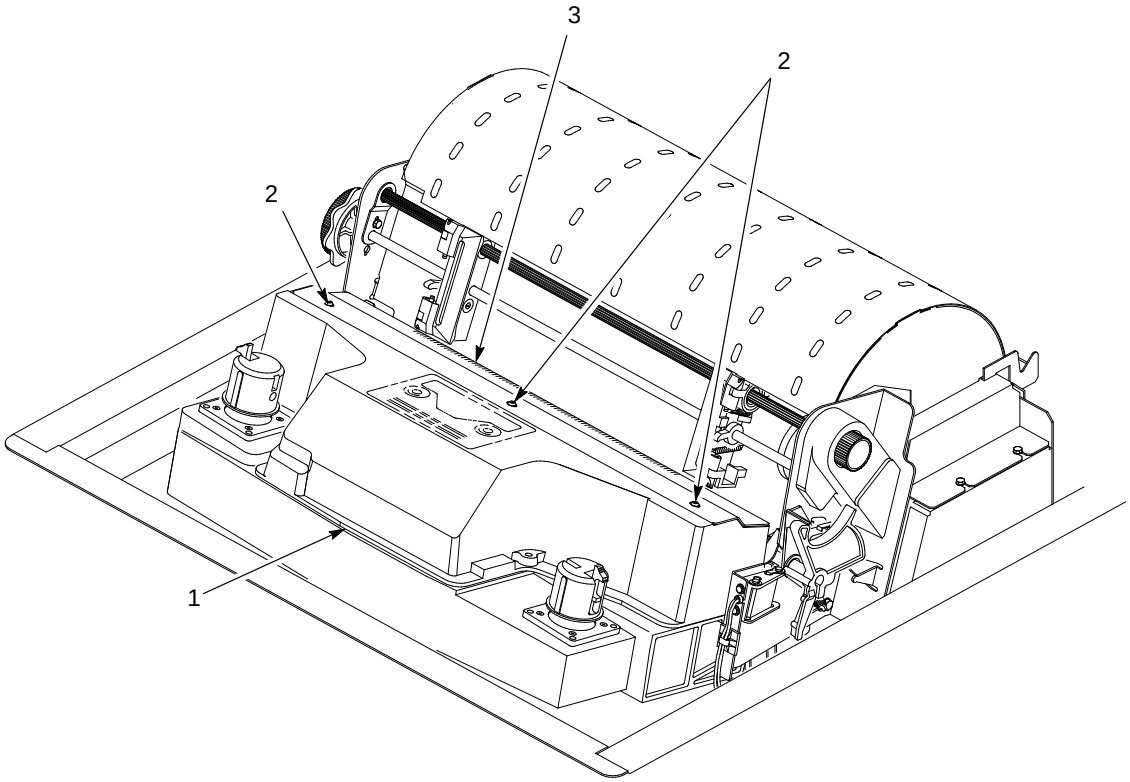


1. Belt Shield
2. Cap Screw
3. Motor Pulley Collar
4. Motor Pulley
5. Splined Shaft Pulley

Figure 4–3. Paper Drive Motor Pulley Alignment

Paper Scale Alignment (Figure 4–4)

1. Load paper and ribbon.
2. Connect the power cord to the AC power source.
3. Set the printer power switch to 1 (on).
4. Open the printer cover.
5. Verify that the shuttle cover (1) is properly installed (page 5–16).
6. Print a full 132 column line by selecting and running one of the diagnostic self–tests. (See Chapter 4.)
7. Check alignment of the scale to the print at column positions 1 and 132.
8. If adjustment is necessary, loosen the three button–head 5/64 inch hex screws (2).
9. Position the scale (3) so that column positions 1 and 132 line up with the first and last characters on the 132 character printout.
10. Tighten the button–head screws (2).
11. Close the printer cover.



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

Figure 4–4. Paper Scale Alignment

Platen Gap Adjustment (Figure 4–5)

IMPORTANT

Only do this procedure if the original equipment shuttle frame assembly or platen has been replaced by a new or refurbished unit.

1. Prepare the printer for maintenance (page 4–2).
2. Open the printer cover.
3. Remove the shuttle cover assembly (page 5–16).
4. Remove the ribbon.
5. Loosen the platen open belt (page 4–6, steps 3 and 4).
6. Raise the forms thickness lever (1) to the fully open position.

CAUTION

Do not force the platen against the feeler gauge. Damage to the hammer tips will result.

NOTE: The platen gap on the LG04 printer (0.011 inch) differs from the platen gap on the LG06 printer (0.010 inch).

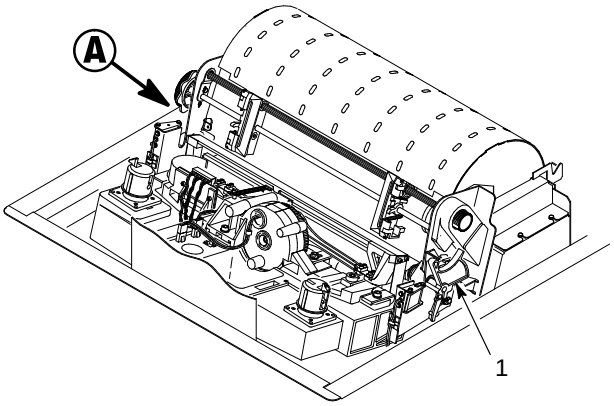
7. Insert a 0.011 inch (0.28 mm) flat feeler gauge (2) straight down between the hammer bank cover plate (3) and ribbon mask (4), within four hammer positions of the left end of the hammer bank.

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.

8. 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 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.

9. Repeat steps 6 through 8 at the right end of the hammer bank.
10. After adjusting both sides, check the gap again at both ends. Readjust if necessary.
11. When the platen gap is correct at both ends of the platen, adjust the platen open belt (page 4–6).
12. Install the shuttle cover assembly (page 5–16).
13. Check the hammer phasing adjustment (page 4–25).
14. Return the printer to normal operation (page 4–3).



1. Forms Thickness Lever
2. Feeler Gauge (0.011 inch or 0.28 mm)
3. Hammer Bank Cover Plate
4. Ribbon Mask
5. Set Screw, 3/32 inch hex (2)

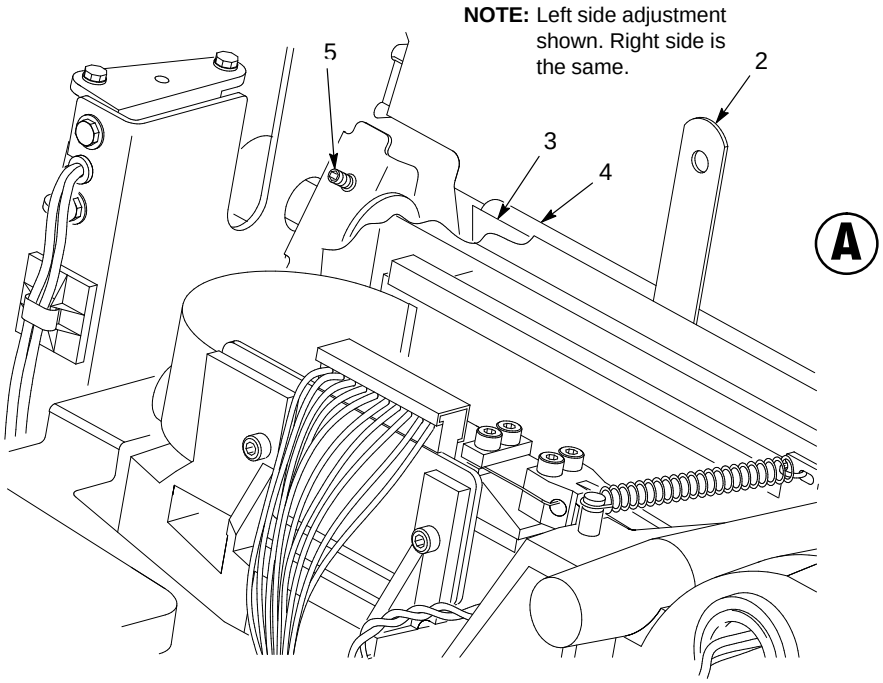
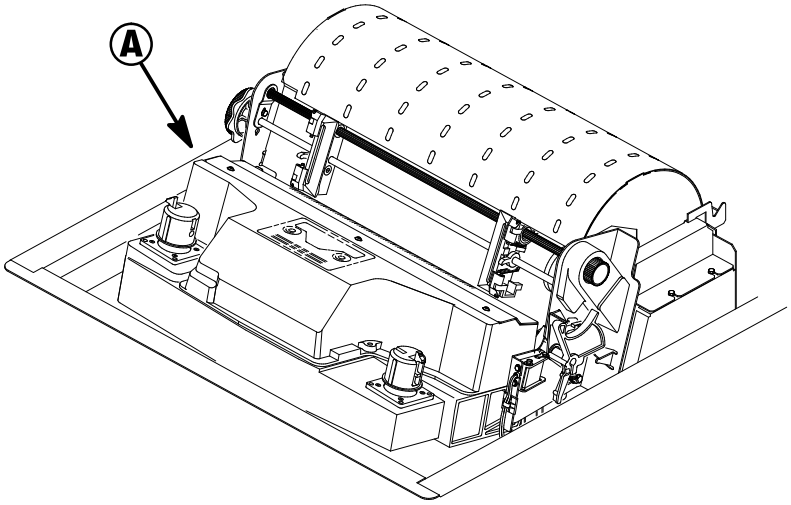


Figure 4–5. Platen Gap Adjustment

Platen Open Motor Pulley Alignment (Figure 4–6)

1. Prepare the printer for maintenance (page 4–2).
2. Open the printer cover.
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 set screw (2) in the motor pulley.
5. Bottom out the platen open motor pulley (3) on the motor shaft and torque the set screw (2) to 9 ± 2 inch–pounds (1.02 ± 0.23 N•m).
6. Check the platen open belt tension (page 4–6). Adjust if necessary.
7. Snap the platen open belt cover (1) into the slots in the side plate.
8. Return the printer to normal operation (page 4–3).



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

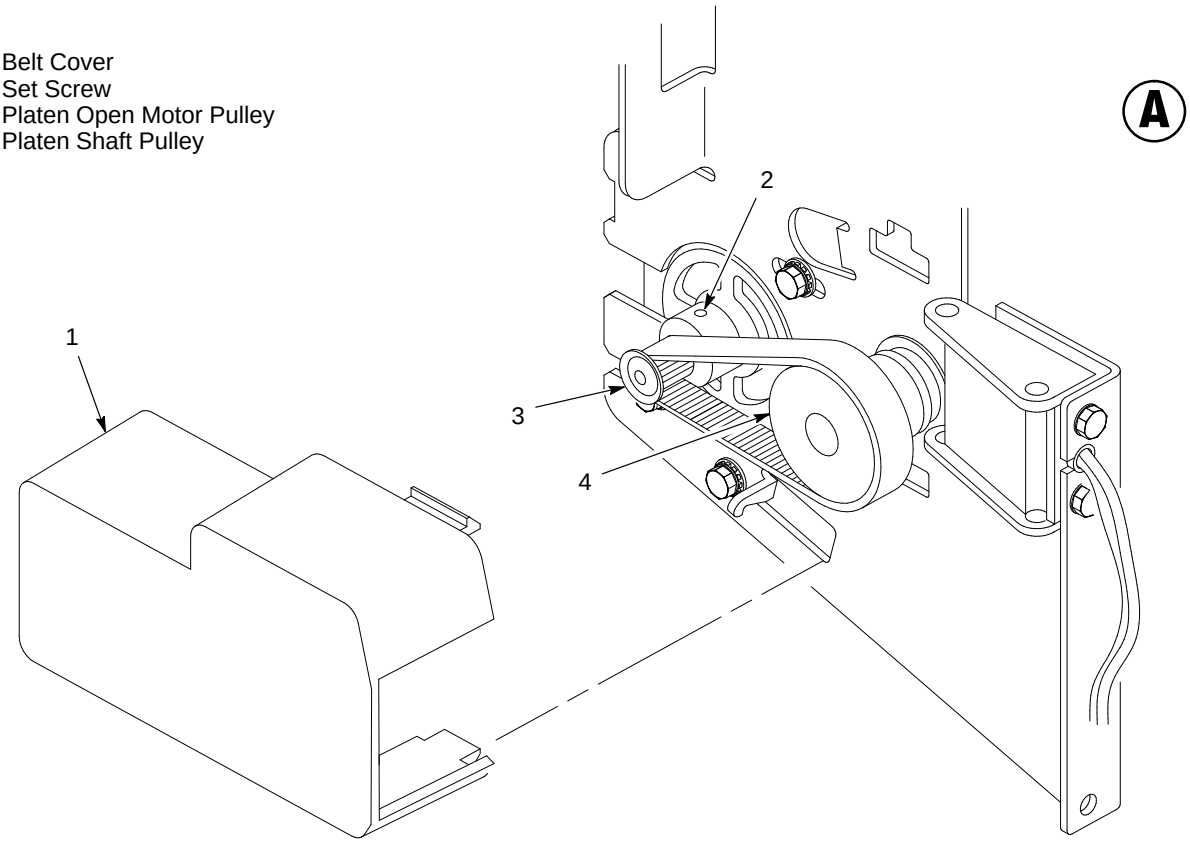
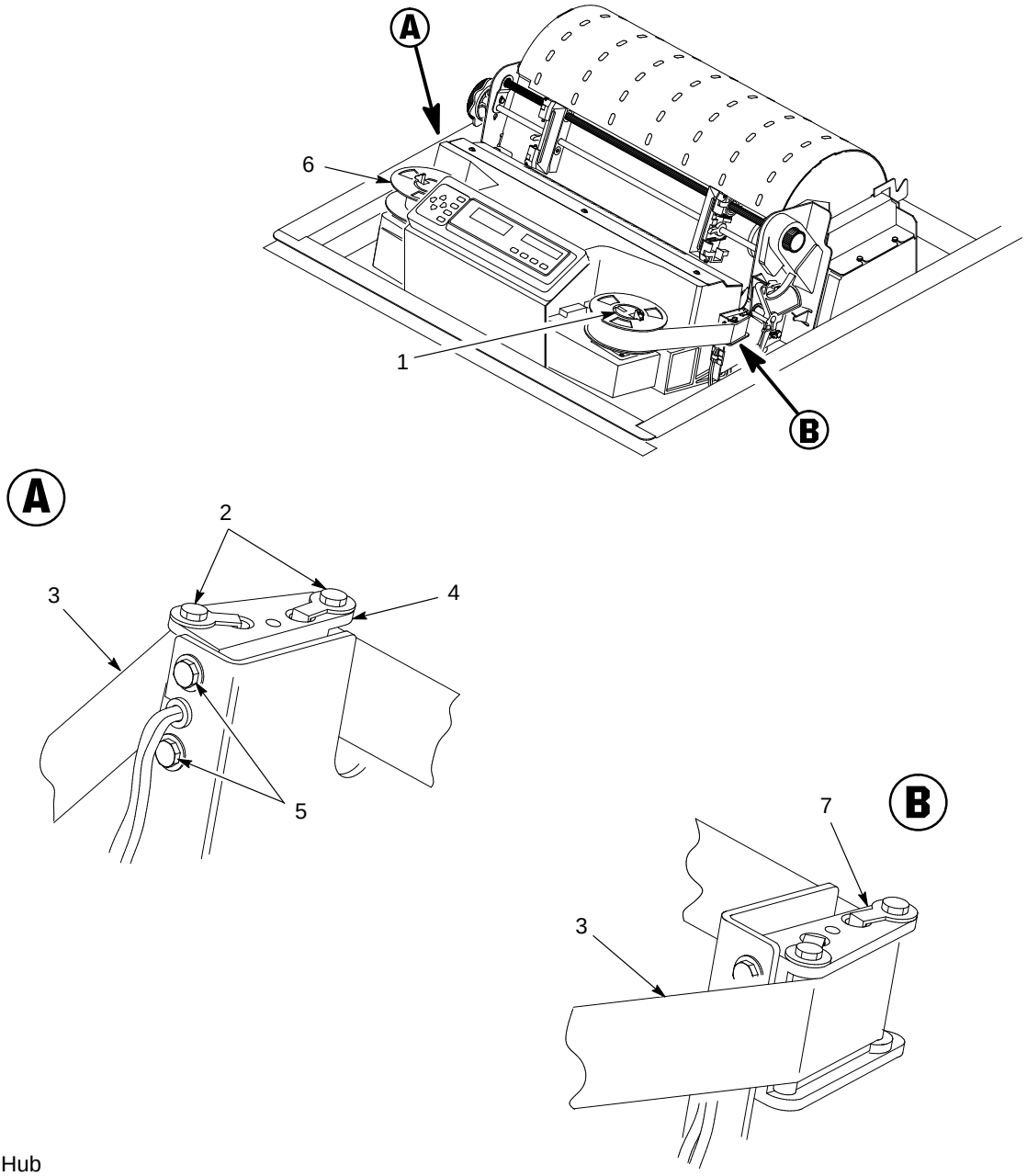


Figure 4–6. Platen Open Motor Pulley Alignment

Ribbon Guide Alignment (Figure 4–7)

1. Open the printer cover.
2. Load paper and install the ribbon. To adjust the left ribbon guide, the ribbon should have a full spool on the right hub (1).
3. Run a ribbon and shuttle diagnostic self–test. (See Chapter 4.)
4. To adjust the left ribbon guide, momentarily short between the left ribbon guide skid screws (2) to assure right to left motion of the ribbon.
5. Observe how the ribbon (3) is passing around the left ribbon guide (4). It should be centered and not folding against either of the two white nylon washers.
6. If the ribbon is not centered, loosen the retaining screws (5) just enough so that the ribbon guide (4) can be rotated to new positions, but remains in place once moved.
7. Rotate the ribbon guide (4) as necessary to center the ribbon (3).
8. Observe how the ribbon (3) is winding on the left spool (6). If the ribbon is interfering with the flange of the spool, make sure the ribbon hub and spool are mounted correctly.
9. Tighten the screws (5).
10. Allow most of the ribbon to accumulate on the left spool (6). Repeat steps 3 through 9 for the right ribbon guide (7).



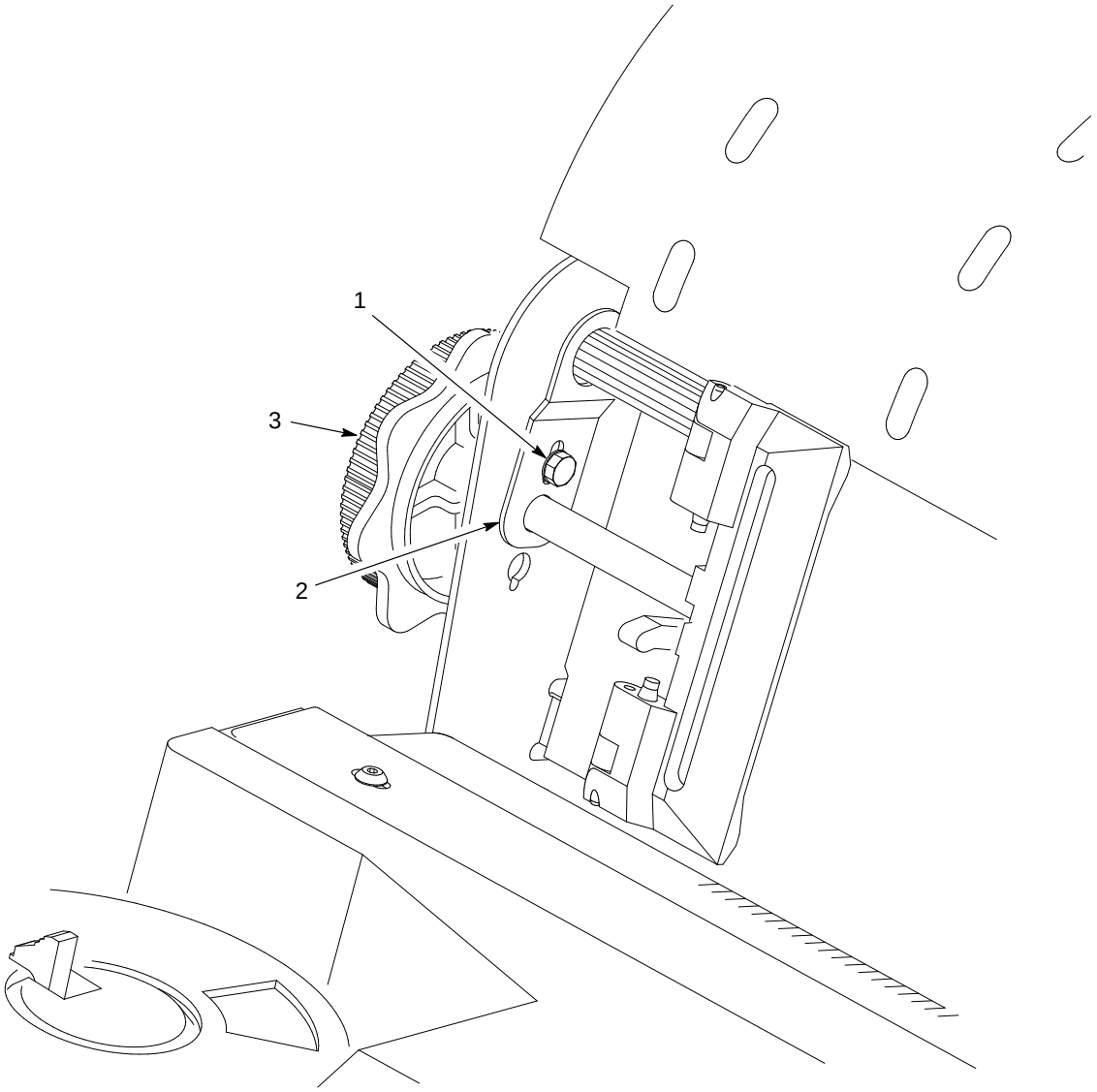
1. Right Hub
2. Screw, Left Ribbon Guide Skid (2)
3. Ribbon
4. Ribbon Guide, Left
5. Screw, Retaining (2)
6. Left Ribbon Spool
7. Ribbon Guide, Right

Figure 4–7. Ribbon Guide Alignment

Splined Shaft Skew Adjustment (Figure 4–8)

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

1. Prepare the printer for maintenance (page 4–2).
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 4–3).



1. Screw
2. Adjusting Link
3. Horizontal Adjustment Knob

Figure 4–8. Splined Shaft Skew Adjustment

Adjusting the End of Forms Distance

This procedure tests and sets the distance from the page perforation at which a LOAD PAPER 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 Dots printer test to verify that this parameter is set correctly.

NOTE: Do this procedure only if a new paper detector switch assembly has been installed, or if you are sure that the end of forms adjustment is incorrect. A paper out triggering distance of 1 or 2 dot rows from the perforation is acceptable; 5 to 7 dot rows off 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 Dots printer test and modify the paper out adjustment value.

1. Power on the printer.
2. Load paper and set the top of form. Make sure the forms thickness lever is closed.
3. On cabinet models, open the cabinet front door.
4. 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 4–9.) This creates a hole that will trigger a PAPER EMPTY fault message, but allows printing to the right of the hole (which would normally be on the platen).

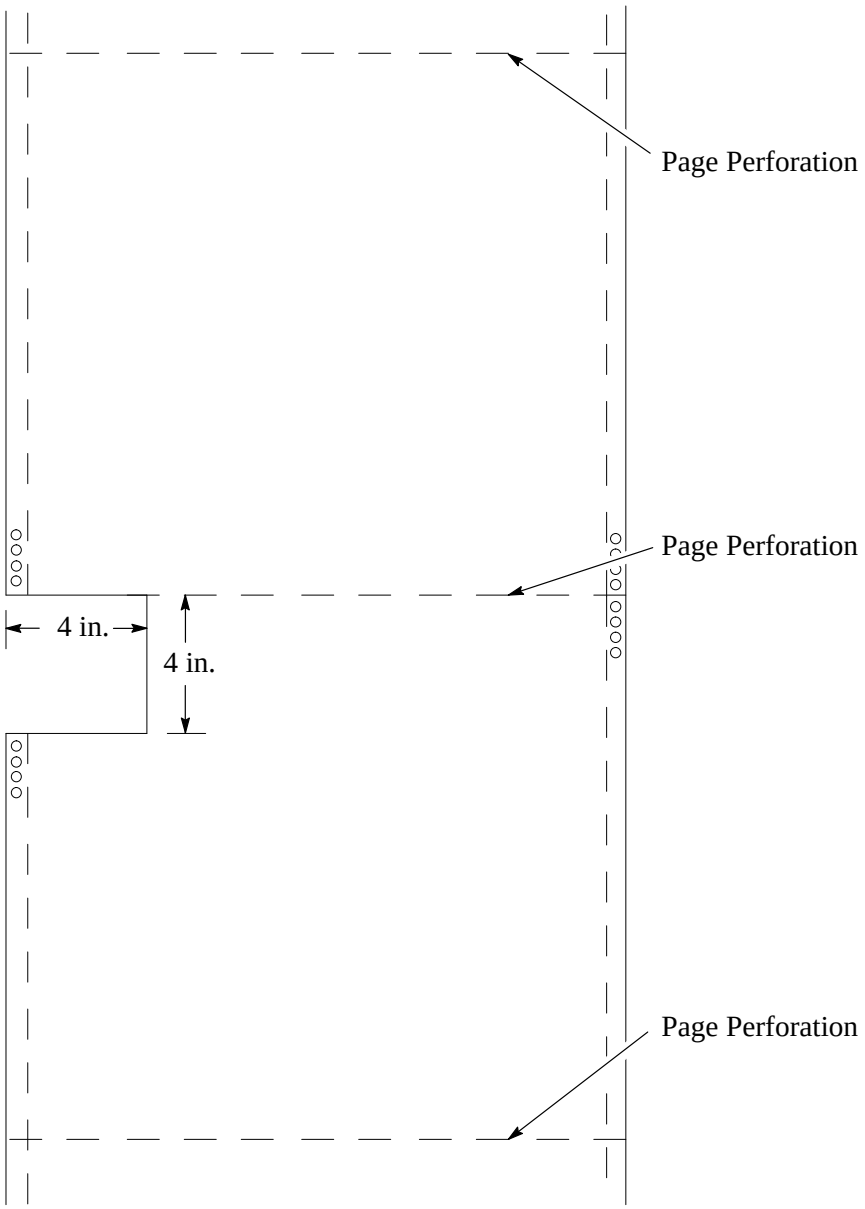


Figure 4–9. Paper Preparation for Paper Out Adjustment Test

5. Tear a four inch square in the manner described above, on every third sheet, until you have made 3 or 4 holes.

6. If the printer is online, press the **ON LINE** key to place the printer offline.

7. Raise the printer cover.

8. On the control panel, press the ▲ + ▼ keys to unlock the **ENTER** key. “ENTER SWITCH UNLOCKED” briefly displays. (If “LOCKED” displays, simply press ▲ + ▼ again.)

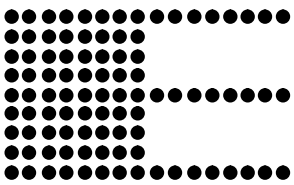
9. Press the ▼ key. “CONFIG CONTROL” displays.

10. Press the ◀ key. “DIAGNOSTICS” displays.

11. Press ▼. “DIAGNOSTICS / Printer Tests” displays.

12. Press ▶ until “Paper Out Adj.” 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.



13. Press **ENTER** until the Paper Out Dots test starts. The comb pattern will print until the display shows “END OF FORMS / LOAD PAPER” and (if enabled) the audible alarm sounds. If the alarm sounds, press **CLEAR** to silence it.

14. Remove the paper from the tractors and examine the area of the page perforation. (If the alarm sounds when you open the platen, press **CLEAR** to silence it.)

    If a long bar just meets the perforation, the end of forms adjustment distance is correct. (1 or 2 dot rows off is OK; 5 to 7 dot rows off is too much.) Unless you wish to restart the procedure with 6-part paper, you may stop the test here, and skip to step 27 (See the note at the beginning of this procedure.)

    If the comb pattern stopped short of the perforation or printed beyond the perforation, go to step 15

15. 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.

16. Reload the paper and set the top of form.
17. Press the ▼ key. “CONFIG CONTROL” displays.
18. Press the ◀ key. “DIAGNOSTICS” displays.
19. Press ▼. “DIAGNOSTICS / Printer Tests” displays.
20. Press ▶ until “DIAGNOSTICS / Paperout Dots” displays.
21. Press ▼**.** The top line of the display will show “Paperout Dots” and the bottom line will show the current setting for the number of dots.
22. Press ▼**.** The number of dots will move up to the top line of the display.
23. Using the ▶ or ◀ key, adjust the *XX* DOTS value up or down by the number of dots you counted in step 15 (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.)
24. 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.)
25. Press **CLEAR** to place the printer offline.
26. Run the Paper Out Dots and the Paperout Adj. tests until the comb pattern prints at an acceptable distance from the page perforation. (Return to step 9)
27. 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.
28. Press ▲ + ▼. “ENTER SWITCH LOCKED” briefly displays.

29. Close the printer cover.

30. Press the **ON LINE** key to place the printer online.

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.

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.

IMPORTANT

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.

The procedure is as follows:

1. Power on the printer.
2. Install the ribbon.
3. Load full width (132 column) paper and set the top of form.
4. If the printer is online, press the **ON LINE** key to place the printer offline.
5. Raise the printer cover.
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. “CONFIG CONTROL” displays.
8. Press the ◀ key until “DIAGNOSTICS” displays.
9. Press ▼. “DIAGNOSTICS / Printer Tests” displays.

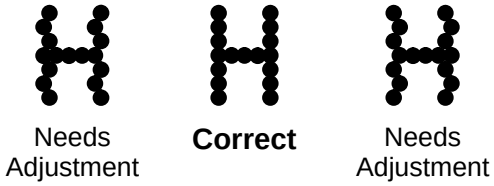
10. Press ▼. “Printer Tests / Shift Recycle” displays.

11. Press ◀ until “Printer Tests / Phase Printer” displays.

12. Press **ENTER**. The top line of the display will show “Phase Printer” and the bottom line will show the current phasing index value.

13. Press **ENTER.** The phasing index value (followed by an asterisk) will move up to the top line of the display. The printer begins printing all Hs, each line preceded by the phasing index value.

14. Press ▶ or ◀ to increase or decrease the phasing index value, then press **ENTER** to activate the value as it prints. Continue to increase or decrease the phasing index value until the pattern of Hs appears as shown below:



15. When the print pattern is acceptable, press **ENTER**. Printing stops, and the printer automatically enters the current phasing index value into NVRAM.

16. Press ▲ + ▼. “ENTER SWITCH LOCKED” briefly displays.

17. Close the printer cover.

18. Press the **ON LINE** key to place the printer online.

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.

Installing Software

Flash memory is contained in one or two single in–line memory modules (SIMMs) 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 the following situations:

- The customer needs to upgrade printer software
- The customer needs different emulation software
- You have replaced the controller board
- You have added or replaced flash memory

Emulation and operating system software are stored as a compressed file on a 3.5 inch, double–density floppy diskette. The file is “executable”: you will expand it, convert it to binary, and copy it into printer flash memory with a single command.

1. Make a printout of *all* saved configurations. (Refer to the *Setup Guide*.) (Installing new software erases all saved configurations. You will use the printouts to restore printer configuration.)

2. Connect the parallel data cable to the default parallel port (LPT1) of an IBM or IBM–compatible personal computer 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. You can also download software through the printer serial port. (The serial port is hard–wired at 9600 baud, 8 data bits, 1 stop bit, no parity.) The download commands are different if you use these ports, as described in the note after step 12.

3. Connect the parallel data cable to the parallel port of the printer.

4. Plug the AC power cord into the printer and the power source.

5. Power on the personal computer.

6. If the computer is running Windows 3.x, double–click on the MSDOS icon to obtain a DOS prompt.

7. Insert the emulation or upgrade diskette into diskette drive A (or B) of the personal computer.

8. 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>)

9. Get the name of the compressed file on the diskette by listing the contents of the diskette; at the DOS prompt type:
   DIR<return>
   The compressed file on the diskette takes the form *FILENAME.EXE*
   Write down the complete name of the file with the *.EXE* extension.

10. On the printer operator panel, press and hold down the **ONLINE + FF** keys. Without releasing the keys, power the printer on. Continue holding the keys down until "WAITING FOR PROGRAM DOWNLOAD" appears on the LCD.

11. When you see "WAITING FOR PROGRAM DOWNLOAD" on the LCD, release the **ONLINE + FF** keys.

12. At the DOS prompt on the computer type:
    FILENAME.EXE -pb<return>
    where FILENAME.EXE is the file you noted in step 9. This command expands the file and copies it as a binary file into the flash memory on the CMX controller board.

NOTE: If you are downloading the file using the LPT2 port on the PC, enter the following DOS command:
FILENAME.EXE -pb 2 <Return>

If you are downloading the file into the printer serial port, enter the following DOS commands:
MODE COM1:9600,N,8,1,P<Return>
FILENAME.EXE -PBC1<Return>

13. While the file is copied into memory, the printer LCD informs you of the load process and status. (See Table 1.)

14. When the file has successfully loaded into memory and the printer has reset itself, set the printer power switch to O (off).

15. Unplug the AC power cord from the printer.

16. Remove the diskette from the personal computer and store it with the printer.

17. Power off the personal computer.
18. If you had to install a parallel data cable to the computer and printer in step 2, disconnect it from the computer and printer.
19. Reconnect the data input cable(s) to the printer.
20. Return the printer to normal operation (page4–3).
21. Using the configuration printout(s) you made in step 1, reconfigure the printer. (Refer to the *Setup Guide*.)

Table 1. Flash Memory Message Guide

Message	Explanation	Required Action
CLEARING PROGRAM FROM FLASH	The program successfully loaded into printer RAM and the checksum matched. The old program is now being deleted from flash memory.	None
DIAGNOSTIC PASSED	The printer passed its memory and hardware initialiazation tests.	None
ERROR: DC PROGRAM NOT VALID	Printer cannot find the data controller program or the validation checksum is corrupt.	Download the DC program again. Go back to step 10. If the message occurs again, replace the flash memory.
ERROR: DRAM AT ADDRESS XXXXXXXX	The printer found a defective memory location.	Replace the DRAM.
ERROR: EC PROGRAM NOT VALID	Printer cannot find the engine controller program or the validation checksum is corrupt.	Download the EC program again. Go back to step 10. If the message occurs again, replace the flash memory.
ERROR: EC STOPPED AT STATE XXXX	Hardware fault in the engine controller.	Replace the CMX controller board.
ERROR: FLASH DID NOT PROGRAM	The printer encountered an error trying to program flash memory.	Download the program again. Go back to step 10. If the message occurs again, replace the flash memory.

Message	Explanation	Required Action
ERROR: FLASH NOT DETECTED	The printer could not find any flash memory.	Install flash memory before attempting to download this program.
ERROR: NO DRAM DETECTED	The printer could not find any DRAM.	Check DRAM on CMX. If present, reseat DRAM, If missing, install DRAM.
ERROR: NVRAM FAILURE	The security PAL is not present or the non–volatile memory has failted.	Check the security PAL at location U54 on the CMX controller. If the PAL is absent, install PAL. If security PAL is present, replace the CMX controller board. (Do NOT attempt to replace NVRAM.)
ERROR: PROGRAM NEEDS MORE DRAM	The printer requires more DRAM memory in order to run the downloaded program.	Add DRAM or use a smaller emulation program.
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. User tried to load CMX–compatible diskette in CBO–controlled printer, or vice versa.	Use the correct emulation software option(s) for this model.
ERROR: PROGRAM NOT VALID	The printer does not see a program in flash memory.	There is no program in printer memory. Go to step 2.
ERROR: SHORT AT ADDRESS XXXX	Hardware failure in DRAM or CMX controller circuitry.	Replace DRAM. If message occurs with new DRAM, replace CMX controller board.

Message	Explanation	Required Action
ERROR: WRITING TO FLASH	Hardware or software fault in flash memory.	Download the program again. Go back to step 10. If the message occurs again, replace the flash memory.
ERROR: WRONG CHECKSUM	The printer received the complete program but the checksum did not match. The data were corrupted during download.	Download the program again: Power off the printer and start over at step 10.
LOADING PROGRAM FROM PORT XX%	The new program is loading into printer RAM. XX indicates how much of the program has loaded.	None
LOADING PROGRAM INTO FLASH	The printer has deleted the previous program from flash memory and is loading the new program into flash memory.	None
RESETTING . . . PLEASE WAIT	The printer finished loading the program into flash memory and is automatically resetting itself.	None
RESTORING BOOT CODE	Normal download initialization message.	None
SECURITY CODE VIOLATION	The software running or being downloaded does not match the security PAL code.	Install the correct PAL or program. (PAL and program must match.)
SENDING PROGRAM TO EC PROCESSOR	The printer is loading the engine controller program into the engine controller.	None

5 Replacement Procedures and Illustrated Parts List

Chapter Contents

Organization of This Chapter

This chapter is divided into two sections.

- **Section I: Replacement Procedures**

  This section consists of written procedures for removing and installing the components that are replaceable at the field service level of maintenance. Section I begins on this page.

  The removal/installation procedures in this section will refer you to the illustrations in Section II.

- **Section II: Illustrated Parts List**

  This section consists of drawings of all the assemblies comprising the printer. On the left page facing each illustration is a list of the parts that are illustrated and their part numbers. Section II begins with a list of figures on page 5–51.

  In the parts lists, *Ref* means "Shown for reference only: the component is part of another assembly, is shown for clarity, or is not spared."

Section I: Replacement Procedures

WARNING

Unplug the printer power cord from the 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.

IMPORTANT

The components specified in this chapter are field replaceable units (FRUs). FRUs must be repaired at the factory. Do not try to 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, 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.

Belt, Paper Feed Timing

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Open the printer cover.
3. Remove the paper path (page 5–29).
4. Remove four screws, the barrier shield, and the anti–static brush (page 5–59, Figure 5–10).
5. Remove the timing belt cover by squeezing the top and bottom to release the plastic tabs from the slots in the side plate (page 5–59, Figure 5–10).
6. Loosen (do not remove) the 7/64 inch setscrew in the paper feed motor pulley collar.
7. Loosen (do not remove) the two 5/16 inch paper feed motor mount screws (page 5–69, Figure 5–15).
8. 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. Slide the motor pulley onto the paper feed motor shaft.
2. Holding a 0.040 inch feeler gauge between the pulley collar and the motor body, torque the 7/64 inch collar screw to 25 ± 2 inch–pounds (2.82 ± 0.23 N•m).
3. Using the straight end of a force gauge, apply 12 pounds (53.38 N) of pressure to the paper feed drive motor. Use the splined shaft to steady the gauge.
4. Reduce pressure to 9 pounds (40.03 N) and torque the 5/16 inch paper feed motor mount screws to 18 ± 2 inch–pounds (2.03 ± 0.23 N•m).
5. Snap the timing belt cover into the slots in the side plate (page 5–59, Figure 5–10).

NOTE: The anti–static brush bristles must face downward.

6. Install the barrier shield, anti–static brush, and four screws (page 5–59, Figure 5–10).
7. Install the paper path (page 5–29).
8. Return the printer to normal operation (page 4–3).

Belt, Platen Open

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Open the printer cover.
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 5–67, Figure 5–14).
4. Loosen (do not remove) the two 5/16 inch mounting screws of the platen open motor (page 5–69, Figure 5–15).
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.
7. Remove the platen open belt by sliding the platen motor pulley off the motor shaft and the belt off the platen open pulley.

Installation

1. Slide the platen open timing belt over the platen open pulley and the motor pulley. Slide the motor pulley onto the platen open motor shaft.

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.

2. Using a force gauge, apply 10 pounds (44.48 N) of tension to the motor shaft by pushing in the direction away from the large platen pulley.
3. Reduce tension to 5 pounds (22.24 N) and torque the two 5/16 inch motor mount screws to 11 ± 2 inch–pounds (1.24 ± 0.23 N•m).
4. Snap the platen open belt cover into the slots in the side plate.
5. Return the printer to normal operation (page 4–3).

Cable Connectors and Connector Shells

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

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

Removal

1. Remove the paper path (page 5–29).
2. Disconnect the cable connector shell containing the cable assembly that will be replaced.
3. Pull the side of the connector shell outward and gently pull the cable connector upward. (See Figure 5–1.) 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.
4. Disengage the key tab(s) on the cable connector from the slots in the side of the connector shell.
5. Remove the cable connector from the connector shell. (Remove only the cable connector for the cable you are replacing; leave the rest 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 5–1.)
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 on the cable connector in the slot in the side of the connector shell. Press the sides of the connector shell inward to make sure all cable connector tabs are engaged in the shell slots.
4. Connect the cable connector shell to its printer connection.
5. Install the paper path (page 5–29).

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

P106 Connector Configuration

PIN NO.

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

(See also page A–10.)

P107 Connector Configuration

PIN NO.

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

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

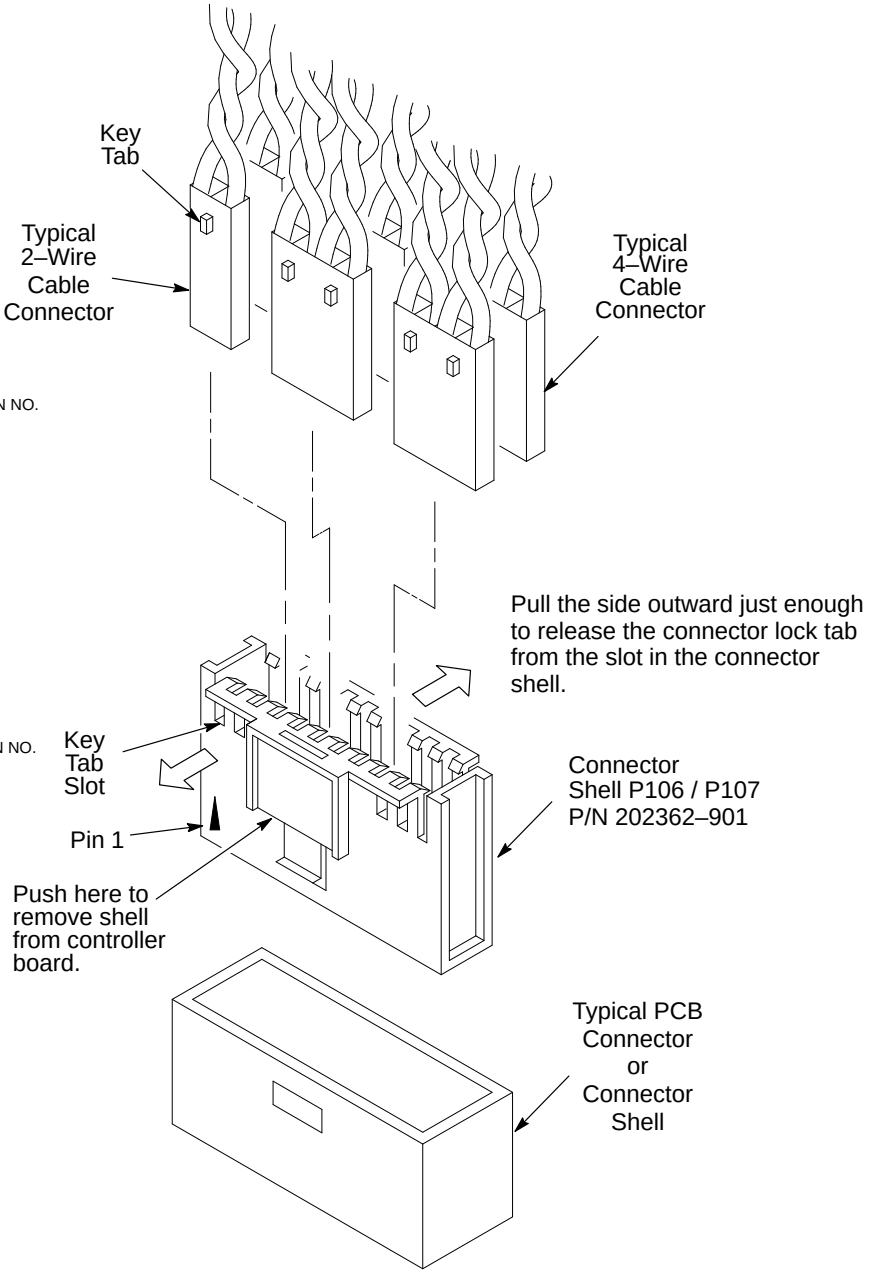


Figure 5–1. Cable Shell Connector, Disassembly/Assembly

Circuit Board: CMX Controller

CAUTION

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

Removal

1. Make a configuration printout of all configurations. (Refer to the *Operator's Guide*.)
2. Prepare the printer for maintenance (page 4–2).
3. Remove the paper path (page 5–29).
4. Disconnect all cable connectors from the controller board. (See page 5–61, Figure 5–11.)
5. From the rear of the printer, loosen but do not remove the 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.
7. Slide the controller board to left until the keyway clears the screw securing the controller board to the bottom 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. 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 hole in the side of the controller shield lines up with the hole in the card cage. (See page 5–61, Figure 5–11, item 13.)
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 on page A–2 as your guide.
5. Install the paper path (page 5–29).
6. Adjust the hammer phasing (page 4–25).
7. Adjust the end of forms distance (page 4–20).
8. Return the printer to normal operation (page 4–3).
9. Using the configuration printout you made as step 1 of the removal procedure, reset and save the printer configuration.

Circuit Board: Power Supply

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/installation. Handle the board by the its sides. Always wear a properly grounded static wrist strap when handling the power supply board.

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Remove the paper path (page 5–29).
3. Disconnect output connector P101 from the controller board and AC input connector P1 from the power supply board. (See 5–61, Figure 5–11.)
4. Loosen the three captive screws securing the power supply board to the rear wall of the card cage.
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. Position the power supply board over the three studs on the rear wall of the card cage and gently pop the board into position on the studs. (See 5–61, Figure 5–11, item 4.)
2. Tighten the three captive screws securing the power supply board to the rear wall of the card cage.
3. Connect output connector P101 to the controller board and AC input connector P1 to the power supply board. (See 5–61, Figure 5–11.)
4. Install the paper path (page 5–29).
5. Return the printer to normal operation (page 4–3).

Circuit Breaker

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Open the printer cover.
3. Remove the paper path (page 5–29).
4. Remove the card cage fan (page 5–17).
5. Disconnect the four circuit breaker electrical leads. (See page 5–71, Figure 5–16.)
6. Press in on the spring clips and remove the circuit breaker from the printer.

Installation

1. Press the circuit breaker into the cabinet wall until the spring clips snap into place. (See Figure 5–16, page 5–71.)

CAUTION

To prevent severe damage to the printer, the circuit breaker electrical leads must be connected as shown on page 5–71 (Figure 5–16).

2. Connect the four circuit breaker electrical leads as shown on page 5–71, Figure 5–16.
3. Install the card cage fan (page 5–17).
4. Install the paper path (page 5–29).
5. Return the printer to normal operation (page 4–3).

Control Panel Assembly

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Open the printer cover.
3. Disconnect RJ11 connector P310 from connector J310 on the control panel.
4. Loosen the four screws securing the control panel to the control panel bracket. (See Figure 5–9, page 5–57.)
5. 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 5–57, Figure 5–9.)
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 4–3).

Cover Assembly, Hammer Bank / Ribbon Mask

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Remove the shuttle frame assembly (page 5–42).
3. Lift the thick plate of the hammer bank cover assembly at one end, and peel the cover away from hammer bank magnets (page 5–61, Figure 5–11).

Installation

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.

1. With the thick plate facing the hammer bank, engage the bottom edge of the hammer bank cover assembly on the alignment pins. Engage the round hole first, then the oblong hole, to ensure that the cover lies flat on the hammer bank. (See Figure 5–11, page 5–61, item 1.)
2. Gently lower the hammer bank cover assembly until it lies flush on the hammer bank.
3. Check that the hammer bank cover assembly is properly positioned over the alignment pins and hammer tips.
4. Install the shuttle frame assembly (page 5–42).
5. Return the printer to normal operation (page 4–3).

Cover Assembly, Shuttle

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Open the printer cover.
3. Remove the ribbon spools.
4. Loosen the shuttle cover screws (page 5–59, Figure 5–10).
5. 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 (page 5–59, Figure 5–10).

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

2. Tighten the shuttle cover screws.
3. Return the printer to normal operation (page 4–3).

Fan Assembly, Card Cage

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Remove the paper path (page 5–29).
3. Disconnect the fan cable connector. (See Figure 5–15, page 5–69.)
4. Remove the mounting screws from the bottom of the fan.
5. Remove the card cage fan assembly from the card cage.

Installation

CAUTION

Air flow is INTO the card cage. Make sure to install the fan so the label faces toward the inside of the printer and the cable faces the front of the printer.

1. Install the shield and the screw securing it to the card cage fan (See Figure 5–15, page 5–69.)
2. Position the card cage fan assembly in the card cage and install the two fan mounting screws.
3. Connect the fan cable connector (page 5–69, Figure 5–15).
4. Install the paper path (page 5–29).
5. Return the printer to normal operation (page 4–3).

Fan Assembly, Cabinet Exhaust

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Open the floor cabinet doors and the printer cover.
3. Remove the paper fence. (See Figure 5–8, page Figure 5–8.)
4. Remove the two 1/4 inch screws securing the bottom of the air exhaust duct. (See page 5–57, Figure 5–9).
5. Remove the 1/4 inch screw directly below the forms thickness lever. (The screw is located near the right front of the card cage, in front of the square air holes in the printer base plate.)
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

Make sure to install the fan so that air flow is down.

1. Reverse steps 2 through 8 of the removal procedure.
2. Return the printer to normal operation (page 4–3).

Fan Assembly, Hammer Bank

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Remove the shuttle cover assembly (page 5–16).
3. Remove the control panel bracket assembly (page 5–57, Figure 5–9).
4. Remove the paper path (page 5–29).
5. Trace the hammer bank fan cable assembly back to the controller board connector P107, releasing it from all cable constraints. (See the cable routing diagram on page A–10.)
6. Disconnect the fan connector from connector shell J107 on the controller board.
7. 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 air shroud. (See Figure 5–15, page 5–69.)

Installation

CAUTION

Make sure to install the fan so the label faces up. Air flow is up.

1. Feed the hammer bank fan cable connector and motor wires between the fan well of the base casting and the air shroud. Reach up under the base casting and route the fan cable to the right and angle the hammer bank fan assembly down into the fan well. (See Figure 5–11, page 5–61.)
2. Route the motor wires as shown in Figure 5–11 (page 5–61) and connect the hammer bank fan cable connector to J107 on the controller board.
3. Install the paper path (page 5–29).
4. Install two screws in the locations shown in Figure 5–11 (page 5–61).
5. Install the control panel bracket assembly (page 5–57, Figure 5–9).
6. Install the shuttle cover assembly (page 5–16).
7. Return the printer to normal operation (page 4–3).

Magnetic Pick–up (MPU) Assembly

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Remove the shuttle cover (page 5–16).
3. Disconnect the magnetic pick–up (MPU) cable connector (page 5–63, Figure 5–12).
4. Loosen the 7/64 inch hex MPU clamp screw (page 5–63, Figure 5–12).
5. Unscrew the MPU assembly from the MPU bracket.

Installation

1. Install the MPU assembly by screwing it into the MPU bracket (page 5–63, Figure 5–12).
2. Using a feeler gauge, adjust the gap between the MPU assembly and the flywheel to 0.010 ± .001 inch (0.254 ± 0.025 mm). Torque the MPU clamp screw to 19 ± 1 inch–pounds (2.15 ± 0.11 N•m).
3. Check the gap between the MPU assembly and the flywheel with a feeler gauge:
   a. If the gap is 0.010 ± .001 inch (0.254 ± 0.025 mm), go to step 4.
   b. If the gap is not 0.010 ± 0.001 inch (0.254 ± 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 5–63, Figure 5–12). Make sure the MPU cable does not touch the extension spring after cable connection.
5. Install the shuttle cover (page 5–16).
6. Adjust the hammer phasing (page 4–25.)
7. Return the printer to normal operation (page 4–3).

Memory Modules and Security PAL

Removal

1. Make a printout of all printer configurations. (Refer to the *User's Guide*.)
2. Remove the paper path (page 5–29).

CAUTION

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

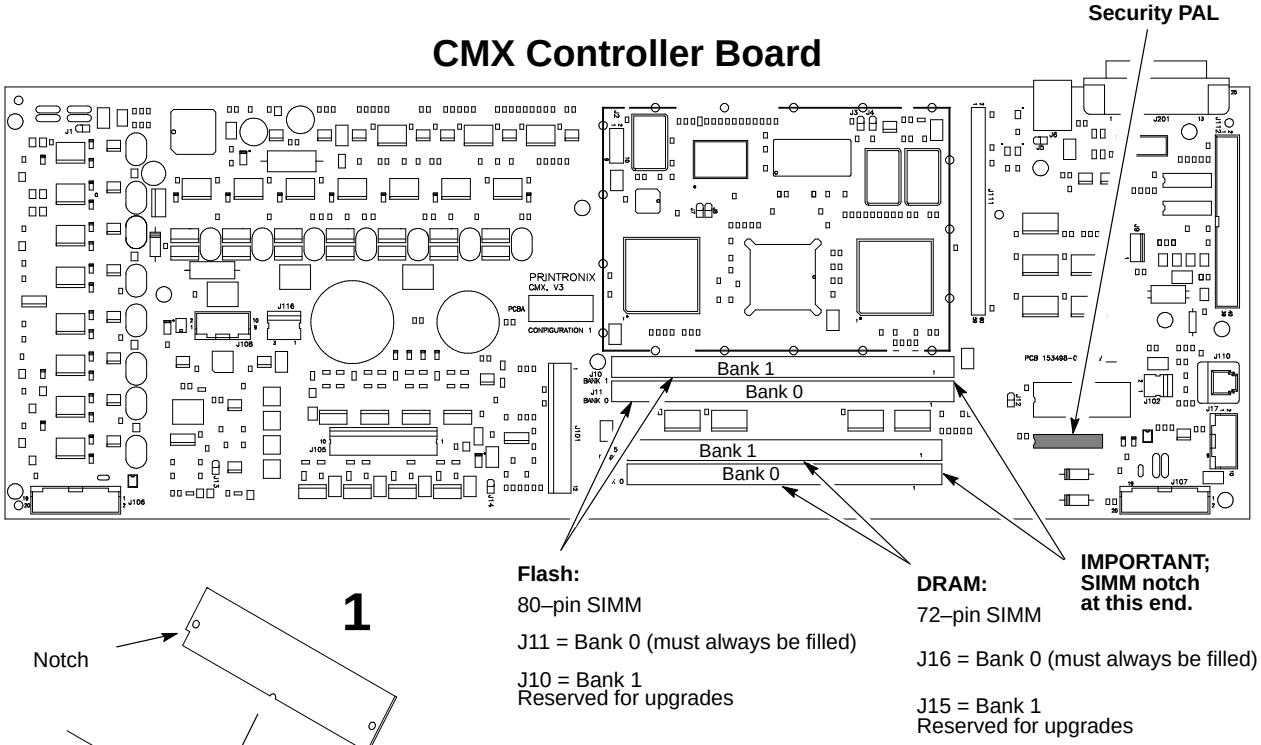
3. Gently pry the side locks open, allow the SIMM to angle 45 degrees toward the front of the printer, and remove the SIMM from the socket. (See Figure 5–2, page 5–22 for the locations of memory modules.)

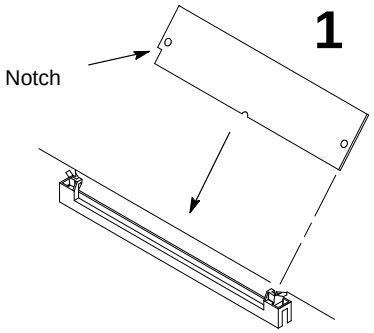
Installation

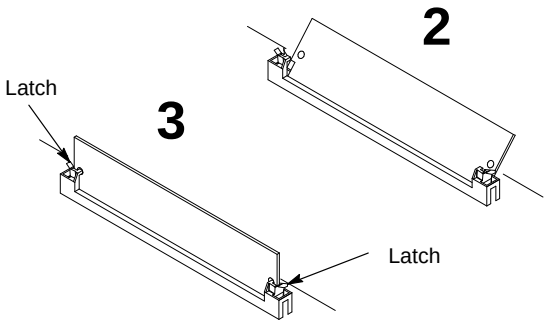
CAUTION

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

1. Insert the memory module into the correct socket on the CMX controller board:
   a. Position the SIMM so the notched end is towards the interface connectors. (See Figure 5–2.)
   b. Press the SIMM into the socket with the top of the SIMM angled 45 degrees *away* from the center of the board. When the SIMM is seated in the socket, *gently* push the *ends* (not the middle) until the SIMM is upright and locks in place. (See Figure 5–2.)
2. Install the paper path (page 5–29).
3. Download any required software (page 4–27).
4. Return the printer to normal operation (page 4–3).
5. Using the configuration printout you made as step 1 of the removal procedure, reset and save the printer configurations. (Refer to the *User's Guide*.)







IMPORTANT: No matter what combination of SIMMs is used, J11 and J16 must always be filled.

Memory Requirements

Emulation Options	LG/LP+	PGL	VGL
Kits	Flash Kit/ Memory LG FD–M6524–01	Flash Kit/ Memory LG/PGL FD–M6525–01	Flash Kit/ Memory LG/VGL FD–M6526–01
Flash Bank 0 (J11)	1 MB	1 MB	1 MB
Flash Bank 1 (J10)		1 MB	1 MB
DRAM Bank 0 (J16)	2MB	2MB	2MB
DRAM Bank 1 (J15)		1MB	1MB
Security PAL Vendor P/N	154142–001	154142–002	154142–002

Figure 5–2. Memory Modules and Security PAL

Motor Assembly, Paper Feed

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Open the printer cover.
3. Remove the paper path (page 5–29).
4. Loosen four screws and remove the barrier shield (page 5–59, Figure 5–10).
5. Remove the timing belt cover by squeezing the top and bottom to release the plastic tabs from the slots in the side plate (page 5–59, Figure 5–10).
6. Loosen, but do not remove, the two 5/16 inch paper feed motor mounting bolts (page 5–69, Figure 5–15).
7. Loosen the 7/64 inch shaft collar setscrew and remove the paper feed motor pulley, shaft collar, and paper feed timing belt (page 5–69, Figure 5–15).
8. Trace the paper feed motor cables back to the controller board, releasing the cables from the tie–wraps. (See cable routing diagram on page A–10.)
9. Disconnect connector shell P107 from the controller board.
10. Remove the paper feed motor cable connector from the connector shell (page 5–8).

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

11. Remove the motor mount bolts (and nuts, if present).
12. Remove the paper feed motor assembly.

Installation

1. Position the paper feed motor assembly on the right side plate and install the 5/16 inch motor mount bolts and nuts finger tight (page 5–69, Figure 5–15).
2. Connect the paper feed motor cable connector to connector shell P107 (page 5–8).
3. Connect shell connector P107 to J107 on the controller board. (See cable routing diagram on page A–10.)
4. Install the collar, paper feed motor pulley, and timing belt.
5. Align the paper feed motor pulley with the splined shaft pulley.

IMPORTANT

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 snug against the motor pulley and torque the 7/64 inch setscrew to 25 ± 2 inch–pounds (2.82 ± 0.23 N•m).
7. Using the straight end of a force gauge, apply 12 pounds (53.4 N) of pressure to the paper feed motor. Use the splined shaft to steady the gauge.
8. Reduce pressure to 9 pounds (40.0 N) and torque the 5/16 inch motor mount screws to 18 ± 2 inch–pounds (1.36 ± 0.23 N•m).
9. Snap the timing belt cover into the slots in the side plate.
10. Install the barrier shield and four screws (page 5–59, Figure 5–10).
11. Install the paper path (page 5–29).
12. Return the printer to normal operation (page 4–3).

Motor Assembly, Platen Open

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Remove the paper path (page 5–29).
3. Remove the card cage fan (page 5–17).
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 5–67, Figure 5–14).
5. Loosen the two 5/16 inch motor mount screws (page 5–69, Figure 5–15).
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 the controller board, releasing the cables from the tie–wraps. (See cable routing diagram on page A–10.)
8. Disconnect connector shell P106 from the controller board.
9. Remove the platen open motor cable connector from the connector shell (page 5–8).

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

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

Installation

1. Position the platen open motor assembly with the wires toward the rear (page 5–69, Figure 5–15).
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 setscrew to 9 ± 2 inch–pounds (1.24 ± 0.23 N•m).
4. Connect the platen motor cable connector to connector shell P106 (page 5–8).
5. Connect shell connector P106 to J106 on the controller board. Install tie–wraps to secure the motor cable. (See cable routing diagram on page A–10.)
6. Close the forms thickness lever all the way.

CAUTION

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

7. Using a force gauge, apply 10 pounds (44.48 N) of tension to the platen open motor shaft by pushing away from the large platen pulley, reduce tension to 5 pounds (22.24 N) and torque the 5/16 inch motor mount screws to 11 ± 2 inch–pounds (1.24 ± 0.23 N•m).
8. Snap the platen open belt cover into the slots in the side plate.
9. Install the card cage fan (page 5–17).
10. Install the paper path (page 5–29).
11. Return the printer to normal operation (page 4–3).

Motor Assembly, Ribbon Drive

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Remove the ribbon.
3. Remove the ribbon hub (page 5–38).
4. Remove two screws and washers securing the ribbon drive motor to the base casting (page 5–61, Figure 5–11).
5. Lift and rotate the ribbon drive motor until the motor cable is aligned with the slot on the base casting.
6. Disconnect the ribbon drive motor cable connector.

Installation

1. Reverse steps 3 through 6 of the removal procedure above.

NOTE: The ribbon drive motor should be secured at the front right and rear left corners. (See Figure 5–15, page 5–69.)

2. Return the printer to normal operation (page 4–3).

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. Remove the shuttle frame assembly (page 5–42).
2. Move the forms thickness lever to the open position.
3. Push the ends of the paper ironer toward the rear of the printer, disengage the tabs, then lift it up and out (page 5–67, Figure 5–14).

Installation

NOTE: The black tape on the paper ironer faces the paper detector switch assembly.

1. Position the paper ironer so that the black tape is on the side that faces the paper detector switch assembly. (See page 5–67, Figure 5–14.)
2. Push the paper ironer down into the slots until the tabs engage.
3. Install the shuttle frame assembly (page 5–42).
4. Return the printer to normal operation (page 4–3).

Paper Path

WARNING

Unless directed to do otherwise, always unplug the printer from the power source before performing a maintenance procedure. Failure to remove power could result in injury to persons or damage to equipment.

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Open the printer cover.
3. Loosen the three paper path hold–down screws (page 5–59, Figure 5–10, item 6).
4. 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 5–59, Figure 5–10).
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 5–59, Figure 5–10, item 6).
4. Return the printer to normal operation (page 4–3).

Platen

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Remove the shuttle frame assembly (page 5–42).
3. Remove the paper ironer (page 5–28).
4. Remove the three 1/4 inch screws securing the paper ironer bracket assembly and remove the assembly. (See Figure 5–14, page 5–67, items 4 through 6.)
5. Remove the platen open belt (page 5–7).
6. Remove the platen pulley (page 5–67, Figure 5–14, item 21):
   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 Figure 5–14, page 5–67, 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 Figure 5–14, page 5–67, 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 Figure 5–14, page 5–67, 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 Figure 5–15, page 5–69, item 12, 14, and 15.)
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 shaft as you remove the platen. Make sure the copper wear saddles in the platen seat of the mechanism base stay in place.)

Installation

IMPORTANT

The dowel pins protruding from the ends of the platen are the platen shafts, and are not equal in length. The platen must be installed with the <u>longer shaft</u> on the <u>right side</u>.

1. Wipe the platen shafts clean of grease and debris.
2. Install the washer on the longer platen shaft. (See Figure 5–3.)

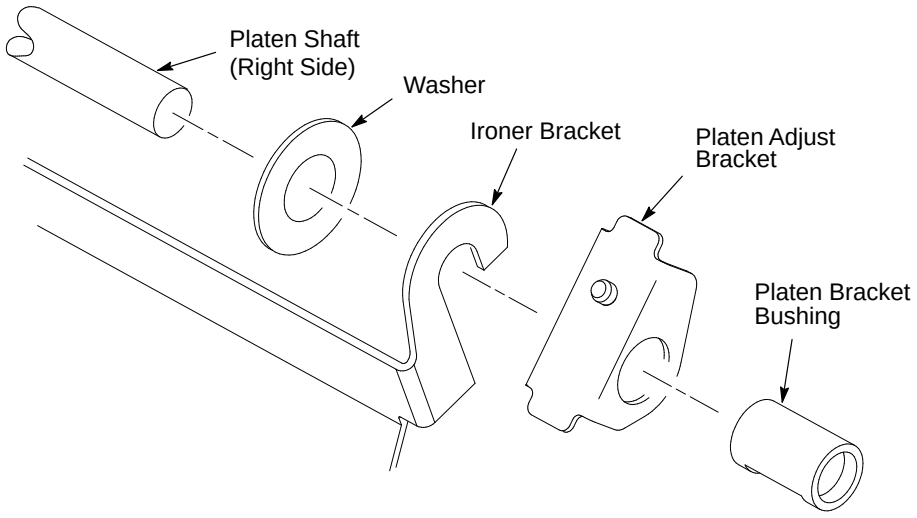


Figure 5–3. Installation of Platen Adjust Bracket Bushing

3. Apply bearing lubricant to both platen shafts and to the inside surface of the platen bracket bushings. (See Figure 5–3.)
4. Install the platen adjust bracket bushings as shown in Figure 5–3.
5. Make sure the two wear saddles are set flush into the corners of the mechanism base platen seat. (See Figure 5–4.)

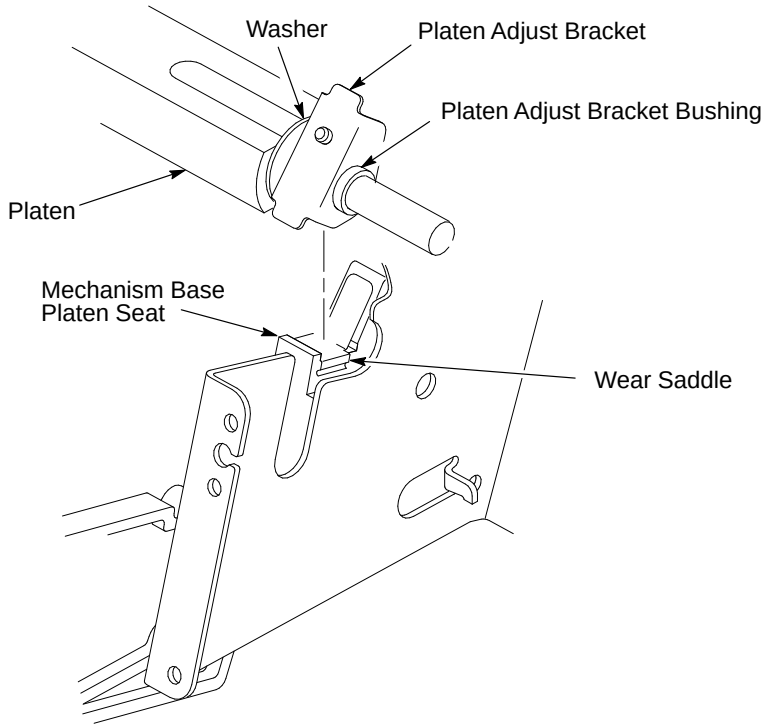


Figure 5–4. Alignment of Platen Adjust Bracket Bushing

6. 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.

7. Install one platen adjust bracket and platen adjust bracket bushing together onto the longer platen shaft, with the screw at the top of the bracket. Keep the bushing installed in the bracket with the open side of the bushing facing downward.

8. Place the remaining bracket and bushing onto the left side mechanism base platen seat so that the seat is between the flanges of the bracket and the bushing. The open side of the bushing should be facing downward.

9. Insert the shorter platen shaft through the bushing and 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 with the bushings as shown in Figure 5–4.

   The open side of each bushing must face down so the platen shafts can rest on the wear saddles and the machined base platen seats are between the two flanges of the bushing. Each bushing and bracket must also be centered relative to each other.

Platen Installation (continued)

10. Slide the right ribbon guide assembly into the side plate and install the two 7/32 inch screws and washers. (See Figure 5–15, page 5–69, item 12, 14, and 15.)

11. 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.

12. Install the black metal washer onto the left side of the platen shaft. (See Figure 5–14, page 5–67, item 26.)

13. 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 Figure 5–14 page 5–67, items 16, 17, and 18.)

14. Apply bearing lubricant to the two platen shafts on both sides, between the ends of the platen and the platen adjustment brackets.

15. Install the paper ironer bracket. (See Figure 5–3):

    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 goes between the left platen adjustment bracket and the platen.

       For the right side of the platen, the washer goes to the left of the paper ironer hook and the hook goes to the left of the right platen adjustment bracket. (See Figure 5–3.)

    b. Install and torque three screws to 20 ± 2 inch–pounds (2.26 ± 0.23 N•m).

16. Push the platen to the left.

17. 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 Figure 5–14, page 5–67.) Open and close the forms thickness lever to make sure the setscrew does not touch the right ribbon guide.

Platen Installation (continued)

18. 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.
19. Install, but do not adjust, the platen open belt and platen open motor pulley (page 5–7).
20. Install the paper ironer with the black tape towards the rear of the printer (page 5–28).
21. Install the shuttle frame assembly (page 5–42).
22. Adjust the platen gap (page 4–12).
23. Adjust the platen open belt (page 4–6).
24. Check ribbon guide alignment (page 4–16).
25. Check the hammer phasing (page 4–25).
26. Return the printer to normal operation (page 4–3).

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 5–5.)

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, wear a properly grounded static wrist strap when you handle circuit boards.

1. Remove the paper path (page 5–29).
2. Locate the terminating resistor packs. (See Figure 5–5.)
3. Using a chip puller, remove the packs.

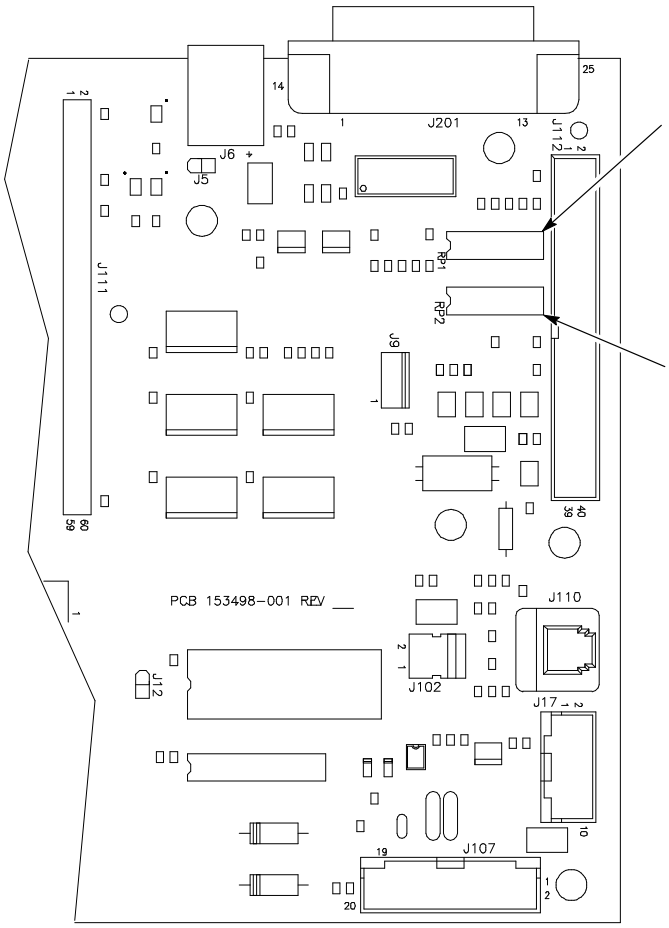
Installation

CAUTION

To prevent electrostatic damage to electronic components, 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 5–5.)
2. Install the paper path (page 5–29).
3. Return the printer to normal operation (page 4–3).

CMX Controller Board



RP1 Default: 470 ohm
Alt 1: 220 ohm
Alt 2: 1K ohm

RP2 Default: 1K ohm
Alt 1: 330 ohm
Alt 2: none

Figure 5–5. Resistors, Terminating, Removal/Installation

Ribbon Guide Assembly (L/R)

NOTE: The right ribbon guide is shown in Figure 5–15. The removal/installation procedure is the same for both ribbon guides.

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Remove the printer ribbon.
3. Cut and remove the tie–wrap from the tie wrap hole to free the ribbon guide cable (page 5–69, Figure 5–15).
4. Remove the paper path (page 5–29).
5. Trace the ribbon guide cable back to the controller board, releasing it from the cable restraints. (See cable routing diagram on page A–10.)
6. 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.
7. Trace the ribbon guide wires to the connector shell, and remove the cable connector from the connector shell (page 5–8).
8. Remove the two 7/32 inch screws and washers securing the ribbon guide assembly to the side plate.
9. Slide the ribbon guide assembly out of the side plate.

Installation

1. Reverse steps 3 through 9 of the removal procedure above.
2. Align the ribbon guides (page 4–16).
3. Return the printer to normal operation (page 4–3).

Ribbon Hub

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Remove the printer ribbon.
3. Loosen the #2 Phillips screw in the ribbon spool hub (page 5–69, Figure 5–15).
4. Remove the hub from the shaft of the ribbon drive motor.

Installation

1. Install the ribbon spool hub over the motor shaft (page 5–61, Figure 5–11).
2. Tighten the hub screw so that it contacts the flat section of the motor shaft.
3. Return the printer to normal operation (page 4–3).

Shaft, Splined

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Remove the paper feed timing belt (page 5–5).
3. Remove the 1/4 inch screw securing the ground clip, and remove the clip (page 5–65, Figure 5–13, items 10 and 11).
4. With grip ring pliers, remove the grip ring from left side of the splined shaft (page 5–65, Figure 5–13, item 6).
5. Pull the bearing and spring link with the spring off the left side of the splined shaft (page 5–65, Figure 5–13, items 7, 8, and 9).
6. Unlock the left and right tractors and slide them to the center of the shaft.
7. Remove the 1/4 inch screw securing the bearing clamp on the right side of the splined shaft, and remove the clamp (page 5–65, Figure 5–13, items 13 and 14).
8. 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 5–6.)
2. Grasp the vertical adjustment knob and slide the splined shaft through the right side plate, the tractors, and the left side plate (page 5–65, Figure 5–13). 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 splined shaft.
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 5–5).
10. Set the paper feed timing belt tension (page 4–4).
11. Adjust splined shaft skew (page 4–18.)
12. Return the printer to normal operation (page 4–3).

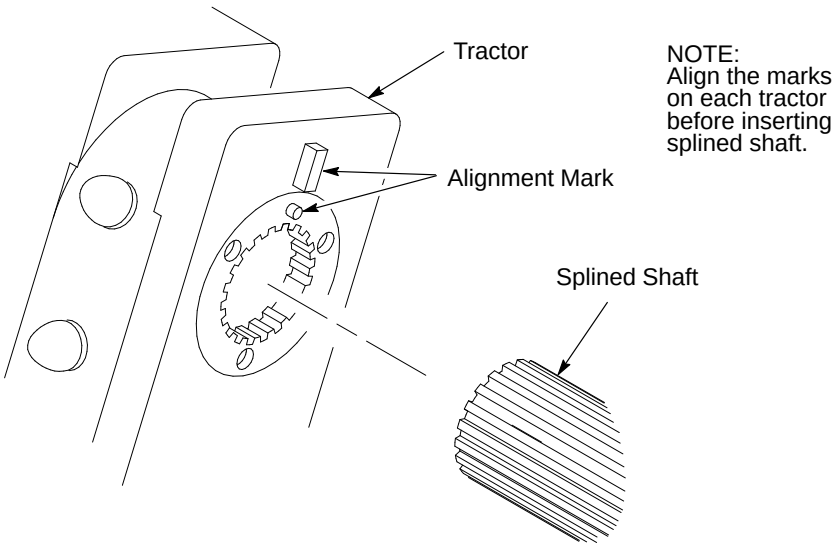


Figure 5–6. Splined Shaft and Tractor Installation

Shaft, Support

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Open the printer cover.
3. Unlock the tractors and slide them to the far right.
4. Remove the E–ring (page 5–65, Figure 5–13, item 17).

CAUTION

Hold the tractors while removing the support shaft, and be careful not to lose the two curved spring washers. (See Figure 5–13, page 5–65, 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 Figure 5–13, page 5–65, 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 5–65, Figure 5–13, 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. Return the printer to normal operation (page 4–3).

Shuttle Frame Assembly

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Remove the shuttle cover assembly (page 5–16).
3. Disconnect the MPU cable connector J03 and shuttle motor cable connector J02 (page 5–63, Figure 5–12, 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 cables connectors from the terminator board on the shuttle frame assembly. (See Figure 5–11, page 5–61.)
5. Loosen the side 5/32 inch socket head clamp screws and pull the clamps back and off the guide shaft. Do not remove the clamps.
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. Grasping the support legs cast on both sides of the shuttle motor, lift the shuttle frame assembly out of the base casting. Lift it slowly and carefully: the shuttle frame assembly is heavy.

Installation

1. Install the hammer bank / ribbon mask cover assembly (page 5–15), if it was removed.

CAUTION

To prevent electrostatic damage to electronic components, always 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 5–61, Figure 5–11).

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 hold–down screws.

6. Slide the side clamps over the guide shaft and torque the 5/32 inch socket head clamp screws to 20 ± 2 inch–pounds (2.26 ± 0.23 N•m).

7. Torque the center captive 5/32 inch socket head screw to 20 ± 2 inch–pounds (2.26 ± 0.23 N•m).

8. Connect the hammer drive and hammer logic cables connectors to the terminator board on the shuttle frame assembly.

9. Connect the shuttle motor cable connector.

10. Route the MPU cable under the extension spring and connect the MPU cable connector (page 5–63, Figure 5–12). 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 4–12); otherwise, skip to step 12.

12. Install the shuttle cover assembly (page 5–16).

13. Adjust the hammer phasing (page 4–25).

14. Return the printer to normal operation (page 4–3).

Spring Assembly, Gas

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

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Open the printer cover.
3. Open the floor cabinet rear door.
4. Pry back the spring retaining clips (page 5–57, Figure 5–9).
5. Remove the gas spring assembly from the ball studs.

Installation

CAUTION

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

1. Position the gas spring assembly against the ball studs on the upper and lower brackets (page 5–57, Figure 5–9). The large cylinder must be uppermost.
2. Using external grip ring pliers to spread the retaining clips, push the gas spring assembly onto the ball joints and slide the spring clips over the top (bottom) of the ball joint into the retaining grooves.
3. Close the printer cover. If necessary, adjust the position of the ball joint stud in the lower bracket to achieve smooth and complete closure.
4. Return the printer to normal operation (page 4–3).

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 4–2).
2. Open the printer cover.
3. Remove the shuttle cover assembly (page 5–16).
4. Unhook the extension spring from the spring lugs on the hammer bank and shuttle frame. (See Figure 5–12, page 5–63.)

Installation

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

CAUTION

Make sure the extension spring does not touch the MPU cable after installation.

2. Hook the extension spring over the spring lugs. (See Figure 5–12, page 5–63.)
3. Install the shuttle cover assembly (page 5–16).
4. Return the printer to normal operation (page 4–3).

Switch Assembly, Paper Detector

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Remove the paper path (page 5–29).
3. Loosen four screws and remove the barrier shield. (See page 5–59, Figure 5–10, items 3, 4, and 9.)
4. Remove the two 1/4 inch screws securing the paper detector switch assembly. (See Figure 5–15, page 5–69.)
5. Trace the paper detector switch cable back to the controller board, releasing the cable from the restraints under the base casting. (See cable routing diagram on page A–10.)
6. Disconnect connector shell P106 from the controller board.
7. Trace the paper detector switch wires to the connector shell, and remove the cable connector from the connector shell (page 5–8).
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 screws securing it to the printer base. (See Figure 5–15, page 5–69, item 4.)

2. Check PMD sensor arm range: make sure it travels freely and completely back into the sensing cavity.

3. Route the switch cable back to the controller board, installing the cable in the restraints under the base casting. (See cable routing diagram on page A–10.)

4. Connect the paper detector switch cable to the connector shell (page 5–8), then connect the connector shell P106 to the controller board.

5. Install the barrier shield and tighten the four screws. (See page 5–59, Figure 5–10, items 3, 4, and 9.)

6. Install the paper path (page 5–29).

7. Check and adjust the End of Forms Distance (page 4–20).

8. Return the printer to normal operation (page 4–3).

Switch Assembly, Platen Interlock

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Remove the paper path (page 5–29).
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 diagram on page A–10.)
5. Disconnect connector shell P107 from the controller board.
6. Remove the platen interlock cable connector from the connector shell (page 5–8).
7. Remove the two #1 Phillips screws securing the platen interlock switch assembly. (See Figure 5–14, page 5–67.)
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. Fully close the forms thickness lever (position ‘A’).
2. Position the platen interlock switch assembly on the switch bracket and install the two #1 Phillips screws securing it to the bracket. (See Figure 5–14, page 5–67.)
3. Route the switch cable through the cutout in the right side plate and to the controller board. (See cable routing diagram on page A–10.)
4. Connect the platen interlock switch cable to the connector shell P107 (see page 5–8), then connect the connector shell to the controller board.
5. Install the paper path (page 5–29).
6. Return the printer to normal operation (page 4–3).

Tractor (L/R)

Removal

1. Prepare the printer for maintenance (page 4–2).
2. Remove the splined shaft (page 5–39).
3. Remove the support shaft (page 5–41).

Installation

1. Using the replacement tractors, install the support shaft (page 5–41).
2. Install the splined shaft (page 5–40).
3. Return the printer to normal operation. (See page 4–3.)

Section II: Illustrated Parts List

List of Figures

Item No.	Part No. (Order No.)	Description	Notes
1	FD–51859–01	Top Cover Kit	Includes cover, logo, and mounting hardware
2	FD–51829–01	Window, Top Cover	(Not visible in Figure 5–7)
3	FD–51844–01	Wire Form Paper Path	Includes mounting hardware
4	FD–51860–01	Rear Door Kit	Includes mounting hardware (Not visible in Figure 5–7)
5	FD–51861–01	Front Door Kit	Includes mounting hardware
6	FD–51832–01	Caster, with Brake	Two at front
7	FD–51833–01	Caster, without Brake	Two at rear

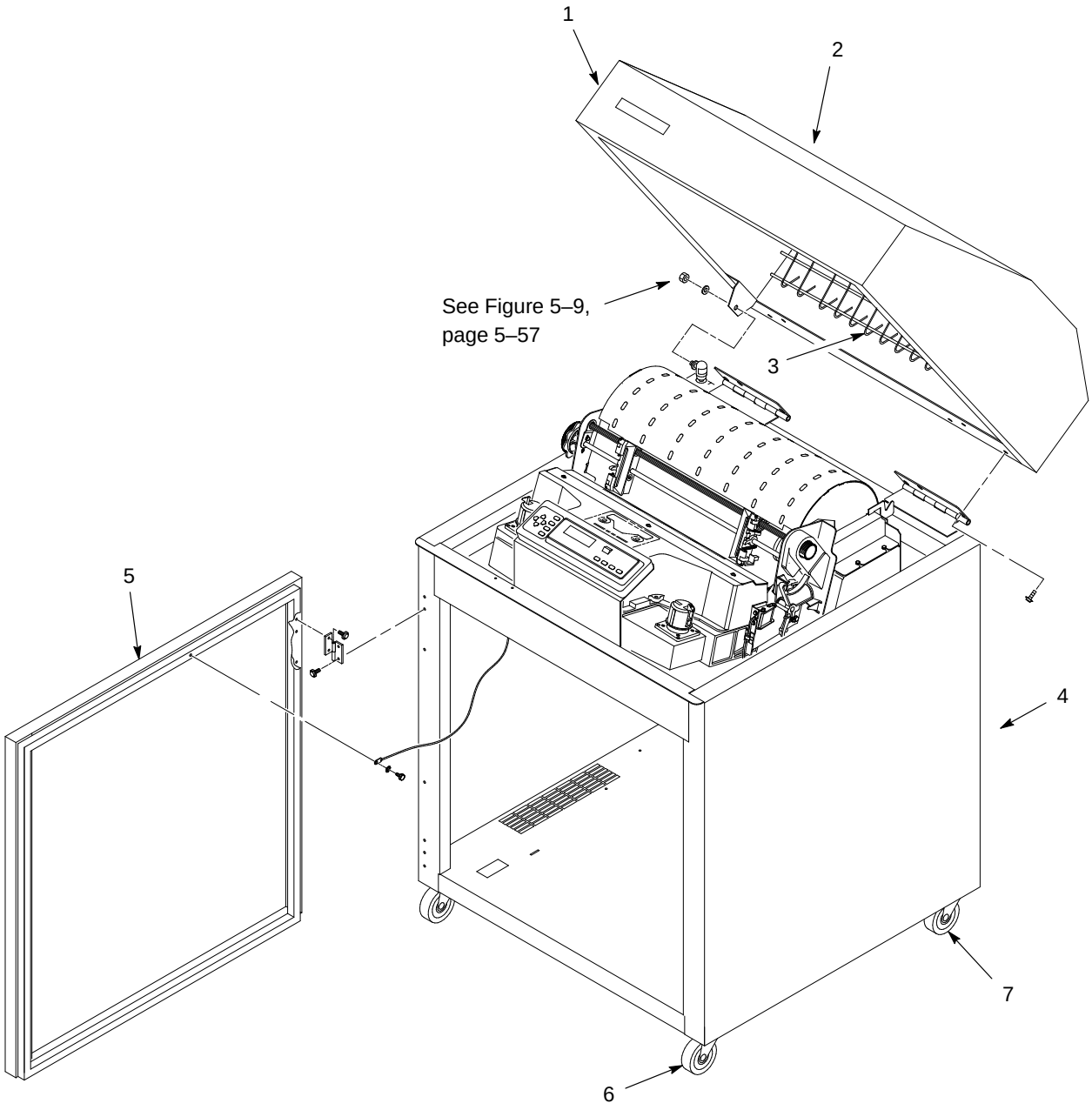


Figure 5–7. Top Cover, Doors, and Casters

Item No.	Part No. (Order No.)	Description	Notes
1	Ref	Paper Fence	475 lpm model only
2	Ref	Paper Tray Assembly	800 and 1200 models only
3	Ref	Grommet Kit, Cabinet	
4	FD–51830–01	Chain Assembly Kit	
5	Ref	AC Power Cord	See Chart Below
6	Ref	Grommet, Power Cord (2)	Part of item 3
7	Ref	Rail, Stacker	Part of item 2
8	Ref	Clip, Rail, Stacker	Part of item 2
9	Ref	Screw (4)	

Power Cords

Part No.	Country	Voltage
17–00606–10	U.S.A.	125V
17–00198–14	New Zealand	250V
17–00199–21	Germany	250V
17–00209–15	UK	250V
17–00210–13	Switzerland	250V
17–00310–08	Denmark	250V
17–00364–18	Italy	250V
17–00457–16	Israel	250V

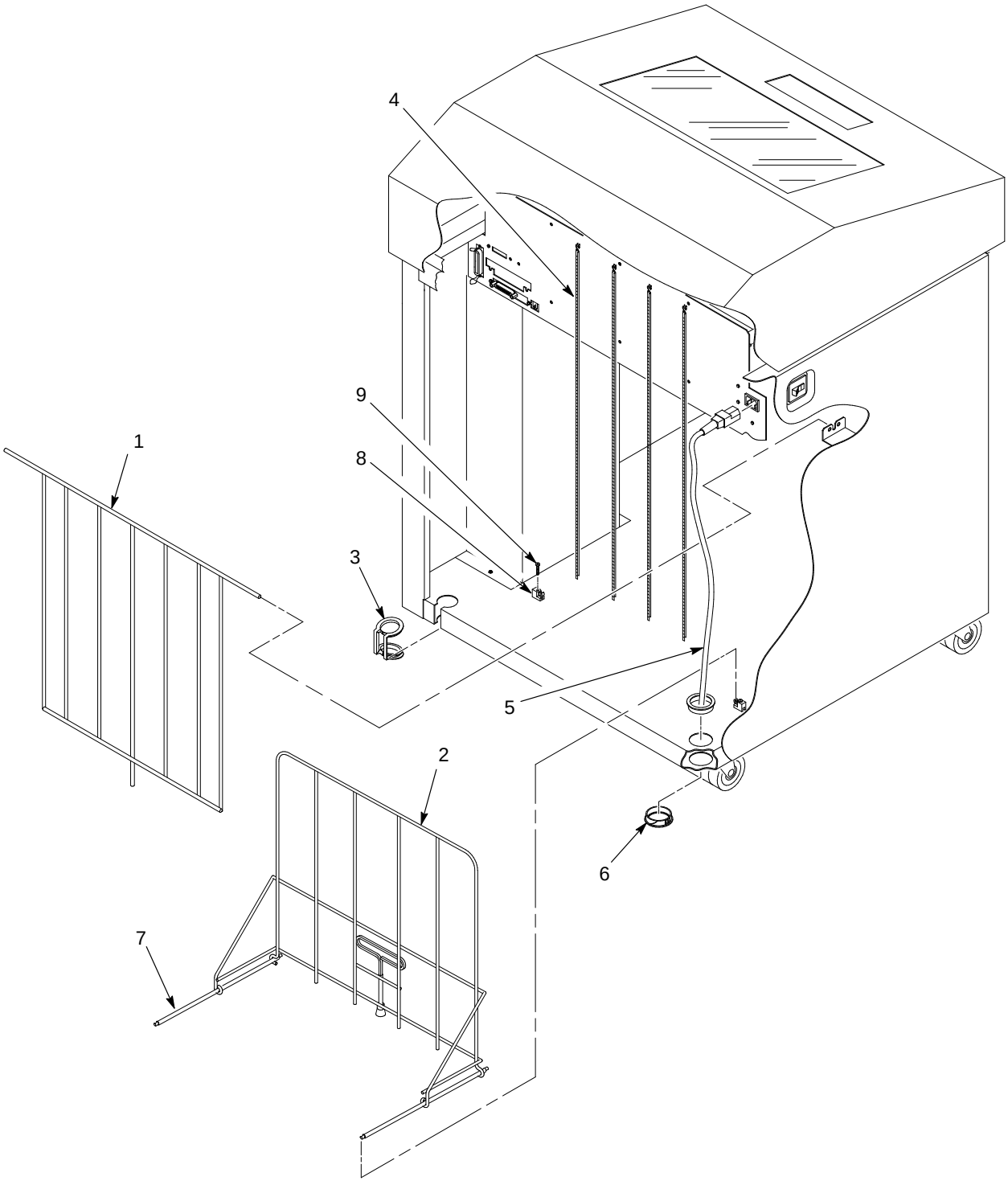


Figure 5–8. Paper Fence and Chains

Item No.	Part No. (Order No.)	Description	Notes
1	FD–51863–01	Control Panel Assy	Includes cable, mounting hardware, and all overlays
2	FD–51856–01	Cable Assy, Control Panel	Part of item 1. See also Appendix F.
3	FD–51826–01	Gas Spring Kit	Includes ball studs, spring clips, and mounting hardware
4	Ref	w/Lock Washer (3)	6–32x.375
5	Ref	Screw, w/Lock Washer (2)	6–32x2.00
6	FD–51837–01	Fan Assembly	Includes mounting hardware
7	Ref	Duct, Air Exhaust	

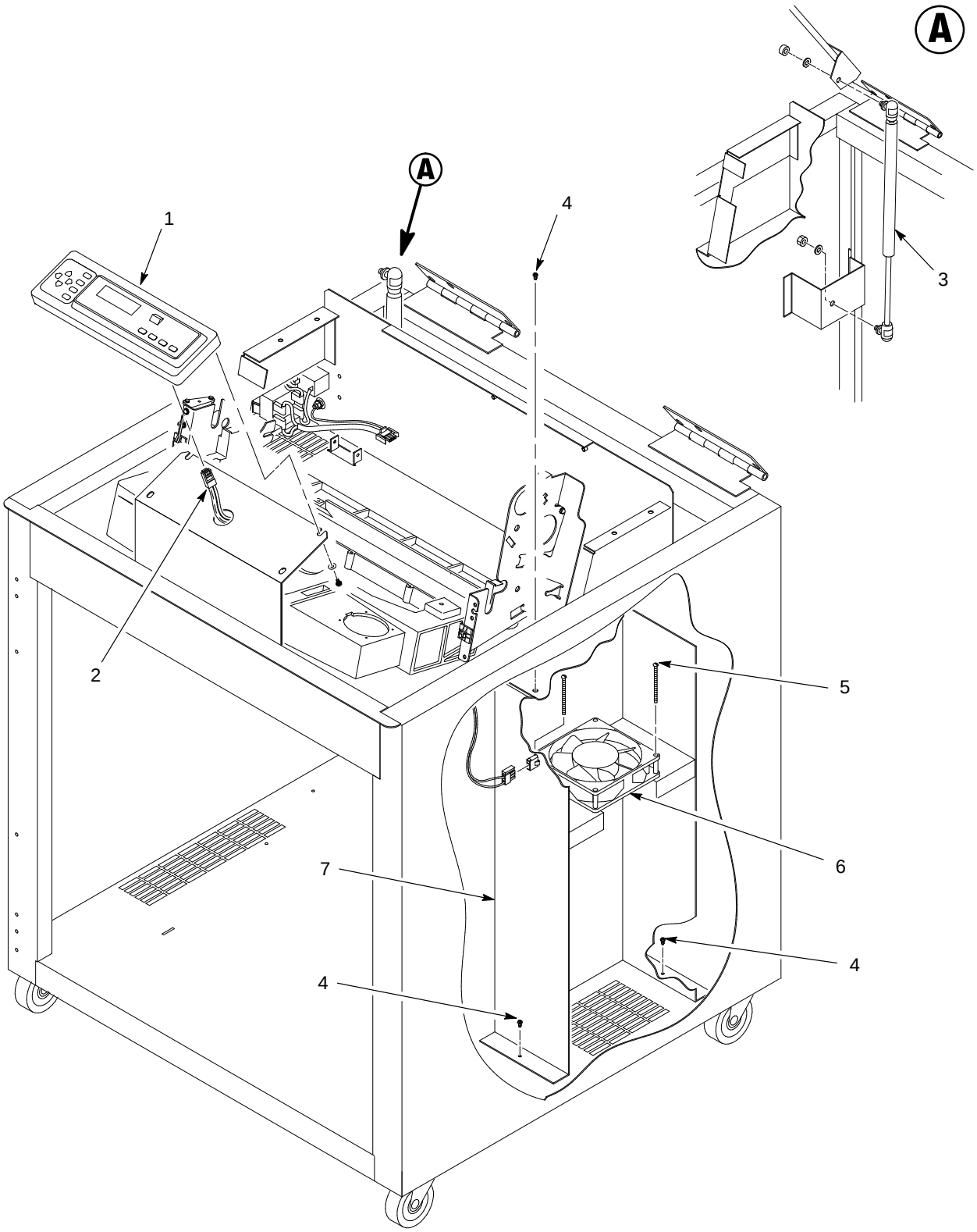


Figure 5–9. Control Panel and Cabinet Details

Item No.	Part No. (Order No.)	Description	Notes
1	FD–51836–01	Shuttle Cover	(Shroud Assembly, Air)
2	Ref	Screw, Captive (2), 10–24x.62	With O–ring, 125x.250x.06 (part of item 1)
3	Ref	Screw (4), 6–32x.25	Thread forming
4	Ref	Barrier Shield	
5	FD–51848–01	Paper Path	
6	Ref	Screw (3),Hex, w/Lock Washer, 6–32x.25, and #6 Flat Washer	Part of item 5
7	FD–51868–01	Platen/Paper Feed Cover Kit	
8	FD–51827–01	Belt, Platen Open	
9	FD–51847–01	Anti–Static Brush Kit	Includes mounting hardware
10	Ref	Power Supply Shield	Taped to card cage along upper edge

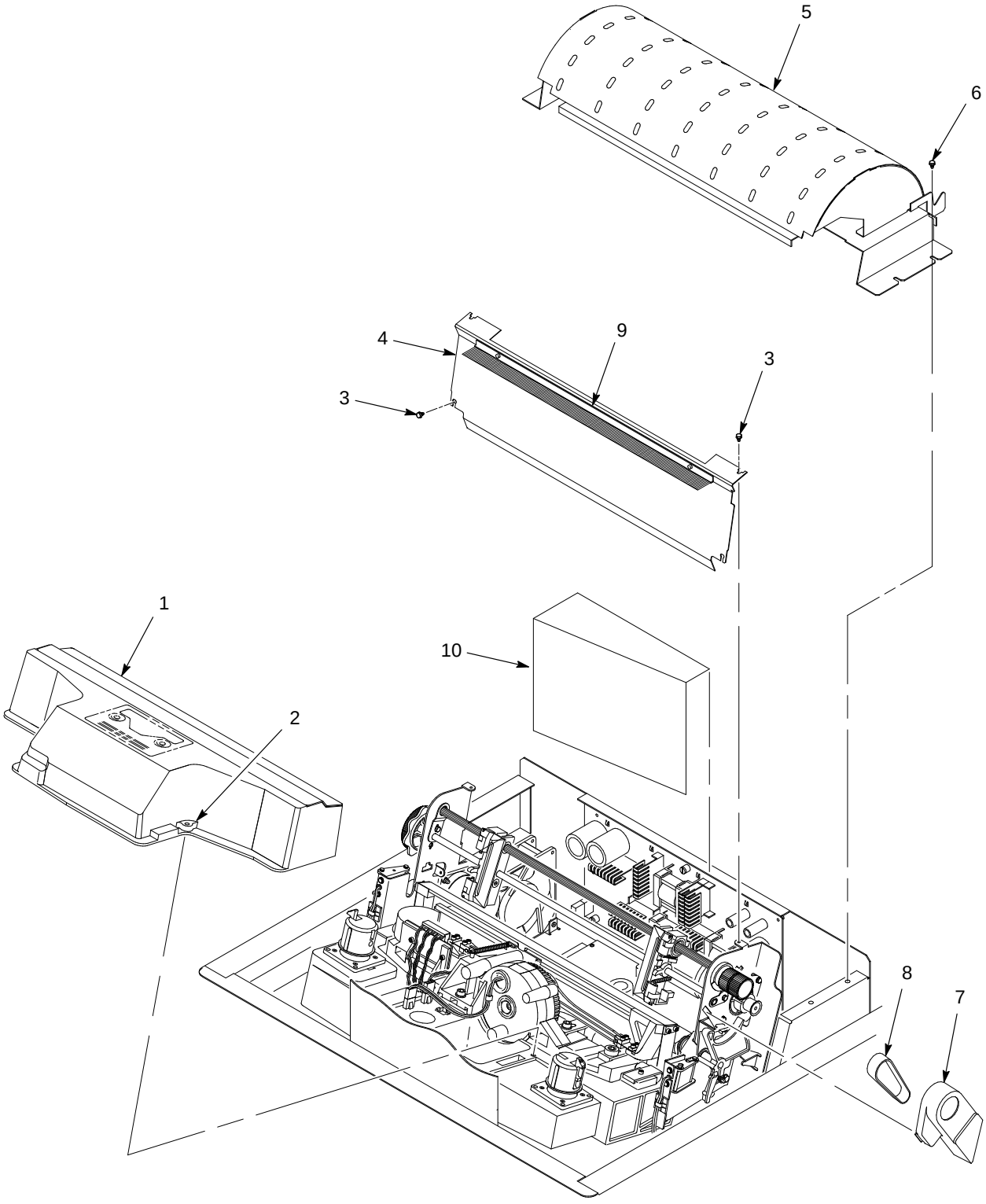


Figure 5–10. Covers

Item No.	Part No. (Order No.)	Description	Notes
1	FD–51857–01	Ham Bank/Rbn Mask Cover Assy	475 lpm
	FD–M6654–01	Ham Bank/Rbn Mask Cover Assy	800 lpm
	FD–M6521–01	Ham Bank/Rbn Mask Cover Assy	1200 lpm
2	FD–51846–01	Shuttle Frame Assembly	475 lpm
	FD–M6522–01	Shuttle Frame Assembly	800 lpm
	FD–M6523–01	Shuttle Frame Assembly	1200 lpm
3	FD–M6779–01	Power Supply PCBA	
4	Ref	P101 Cable Connector	
5	Ref	Cable Assy, AC In, Power Supply	
6	FD–M6780–01	CMX V5 Subassembly, LG	Controller Board
7	Ref	Connector Kit (P106 / P107)	
8	Ref	Hammer Bank Logic Cable Assy	
9	Ref	Shuttle Motor Cable Assy	
10	Ref	Hammer Bank Power Cable Assy	
11	Ref	Motor Sensor,Right, Cable Assy	
12	FD–51864–01	Centronics I/O Cable Assy	See also Appendix F
13	Ref	Control Panel Cable Assy	
14	Ref	Clamp, Shaft, Receiving	
15	Ref	Screw, Captive (3), Power Supply	
16	Ref	SIMM, Flash Memory, 512Kx32	See page 5–21.
17	Ref	SIMM, DRAM, 256Kx32	See page 5–21.

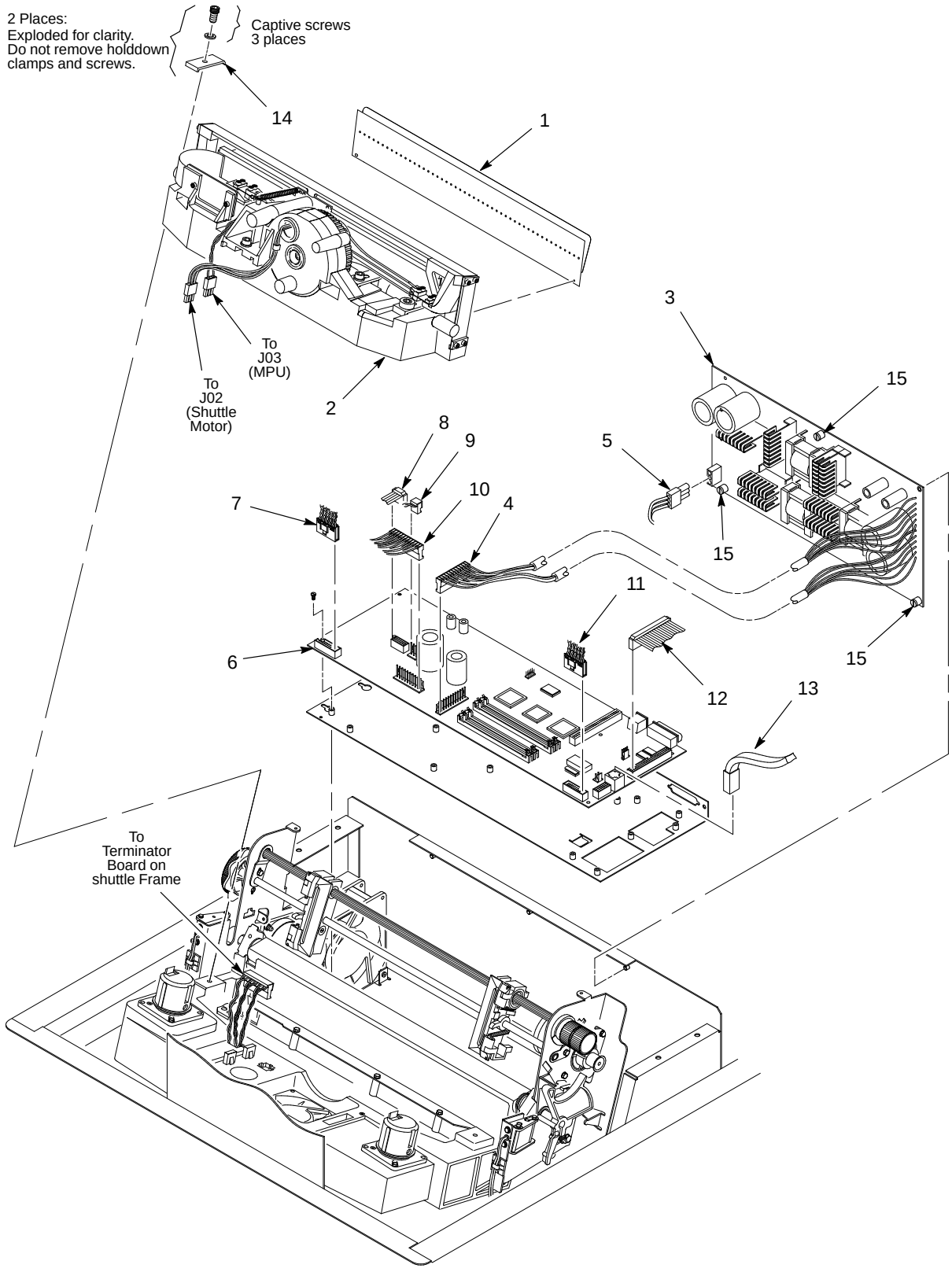


Figure 5–11. Print Mechanisms and Card Cage

Item No.	Part No. (Order No.)	Description	Notes
1	FD–51838–01	Magnetic Pickup Assy	
2	Ref	Bracket, MPU	Part of item 1
3	Ref	Screw, socket cap	6–32x.38
4	FD–51858–01	Extension Spring	
5	Ref	MPU Cable Connector (J03)	
6	Ref	Shuttle Motor Cable (J02)	

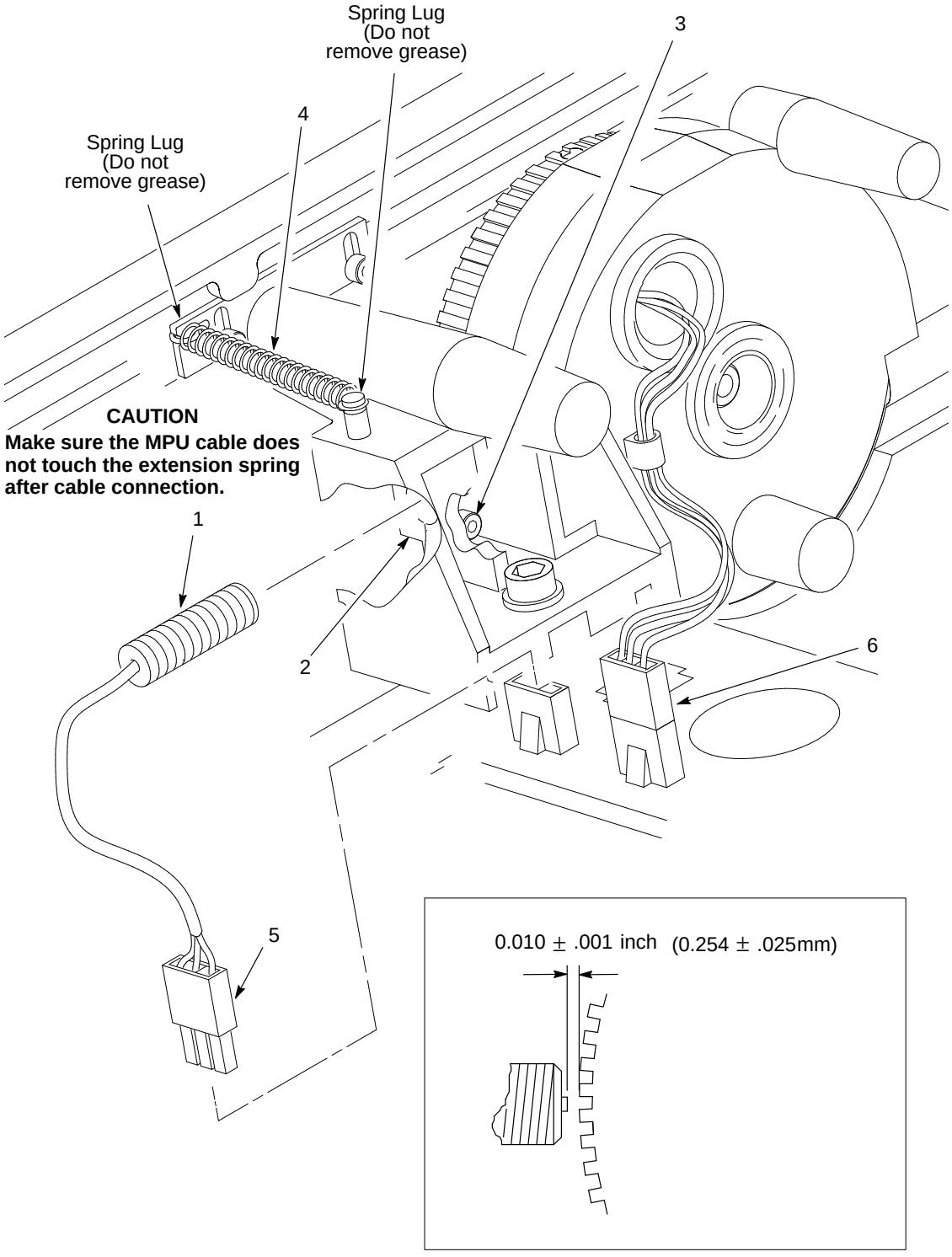


Figure 5–12. Magnetic Pickup Unit (MPU) and Extension Spring

Item No.	Part No. (Order No.)	Description	Notes
1	Ref	Screw, Socket Cap, 4–40x.25	Part of item 15
2	Ref	Washer, Flat #4	Part of item 15
3	Ref	Knob, Tractor Adjust	Part of item 15
4	Ref	Bushing, Tractor Adjust	Part of item 15
5	Ref	Washer, Curved Spring	Part of item 15
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	FD–51825–01	Spring, Extension 1.00L	
10	Ref	Screw, Hex w/Lock Washer, 4–20x.50	Part of item 11
11	FD–51841–01	Clip, Grounding	
12	FD–52473–01	Splined Shaft Kit	
13	Ref	Screw, Thread Forming, 6–32x.25	Part of item 18
14	Ref	Clamp, Bearing	Part of item 18
15	FD–51866–01	Tractor Shaft Kit	
16	FD–51831–01	Tractor Set	
17	Ref	E–Ring	Part of item 15
18	FD–52476–01	Tractor Shaft Hardware Kit	

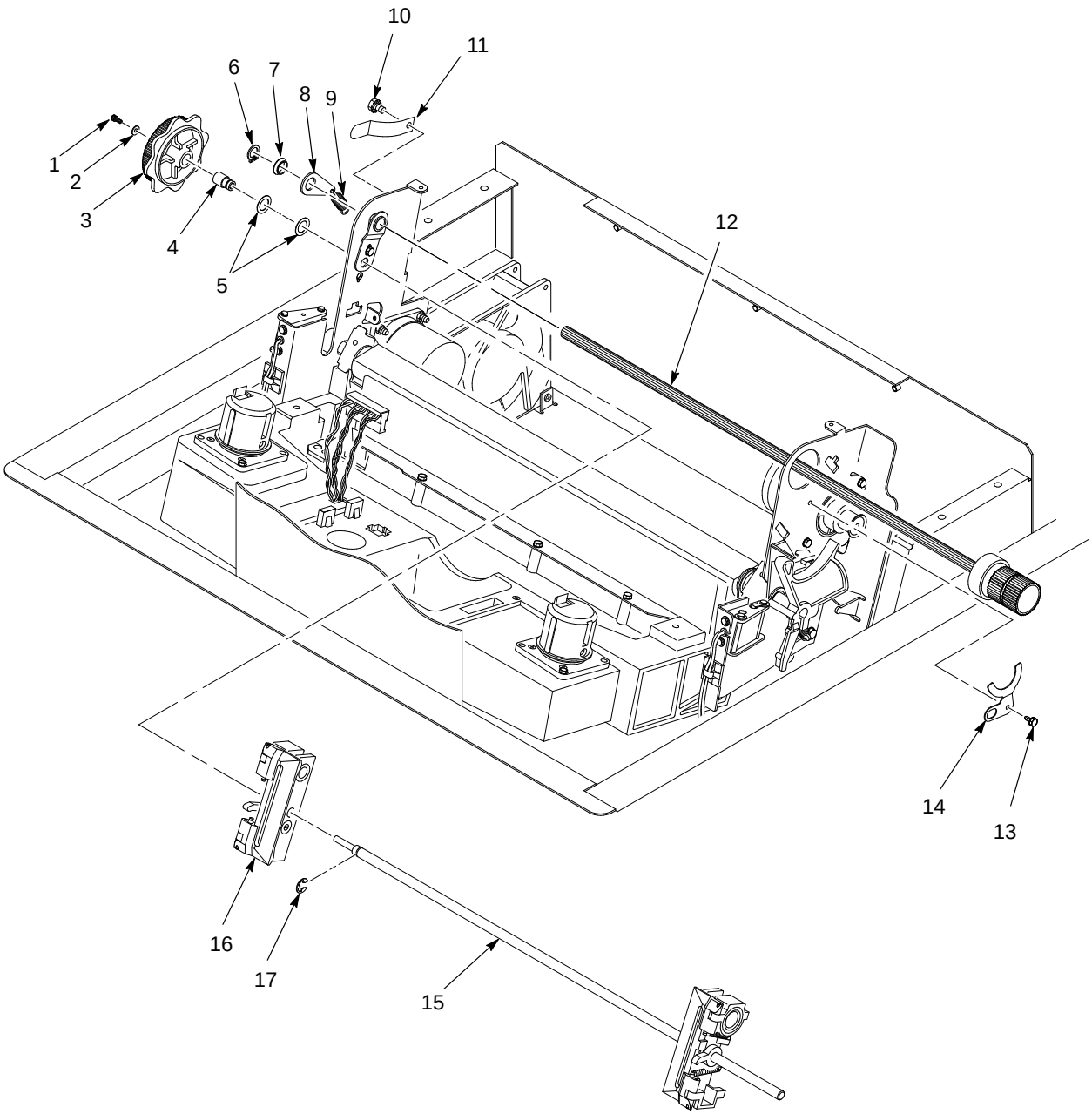


Figure 5–13. Tractor Shafts

Item No.	Part No. (Order No.)	Description	Notes
1	Ref	setscrew Part of item 25	
2	Ref	Bracket, Platen (2)	Part of item 25
3	FD–51843–01	Ironer, Paper	
4	Ref	Screw, Thread Forming (3), 6–32x.25	
5	Ref	Bracket, Ironer	
6	Ref	Plate, Ironer	
7	FD–51865–01	Platen Field Kit	
8	Ref	Washer, Flat	Part of item 7
9	Ref	Screw (2)	Part of item 11
10	Ref	Washer, Flat #4 (2)	Part of item 11
11	FD–51853–01	Platen Switch Kit	
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	FD–51828–01	Platen Lever Kit	
16	FD–51824–01	Spring, Extension 1.12L	Part of item 7
17	Ref	Link, Spring	Part of item 7
18	Ref	Bearing, Nylon .376	Part of item 7
19	Ref	Bracket, Switch Mount	Part of item 11
20	Ref	Wear Saddle, Platen (2)	Part of item 7
21	FD–51840–01	Platen Pulley, Driven	
22	Ref	Screw, Socket Cap, 6–32x.44	Part of item 21
23	FD–51835–01	Platen Open Belt	Belt, timing, 312W 87 teeth
24	FD–51868–01	Platen/Paper Feed Cover Kit	(Cover, belt, platen open shown)
25	Ref	Platen Washer	Part of item 7
26	Ref	Bushing, Platen Adjust Bracket	Part of item 7

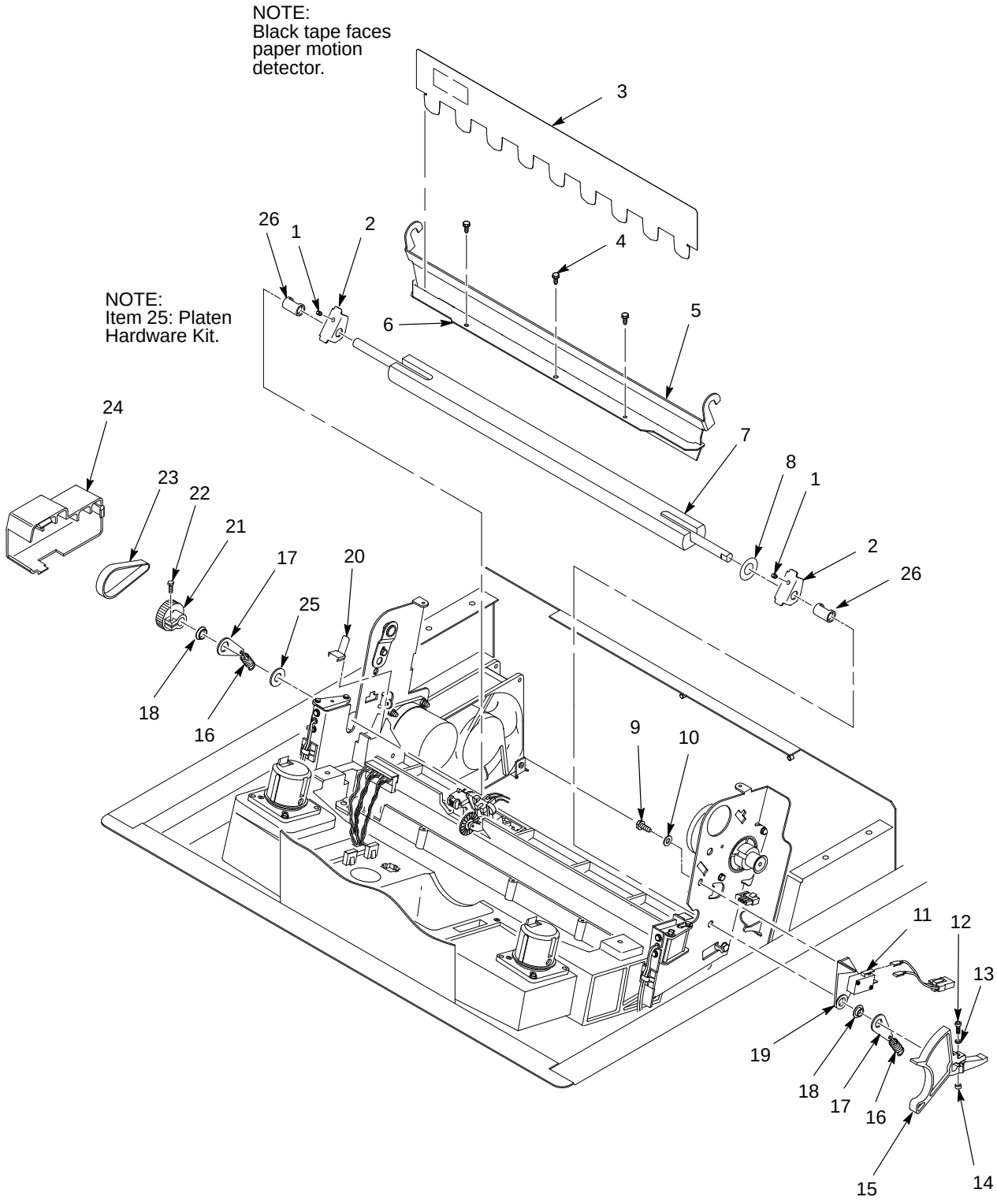


Figure 5–14. Platen

Item No.	Part No. (Order No.)	Description	Notes
1	FD–51837–01	Fan Assy, Card Cage	Air flow into card cage
2	Ref	Screw, w/Lock Washer (3)	6–32x1.75
3	FD–51851–01	Switch Assy, Paper Detector	
4	Ref	Screw, Thread Forming (2)	6–32x.377, Part of item 3
5	FD–51849–01	Motor Assy, Platen	
6	FD–51869–01	Platen Pulley, Drive Motor	With setscrew: 6–32x.25
7	Ref	Collar, Shaft	Part of item 10
8	Ref	setscrew, 6–32x.51	Part of item 8
9	FD–51839–01	Pulley, Paper Feed	
10	Ref	Screw, Hex w/Lock Washer (2)	10–32x.50, Part of item 5
11	FD–51855–01	Ribbon Guide Kit	Includes left and right ribbon guides
12	Ref	Ribbon Guide Kit	Same as item 11
13	Ref	Washer, Flat #4	Part of item 12
14	Ref	Screw, Hex w/Lock Washer	4–40x.38, Part of item 12
15	Ref	Screw, Hex w/Lock Washer (2)	10–32x.50, Part of item 5
16	Ref	Shield, Card Cage Fan	
17	FD–51850–01	Motor Assy, Ribbon	
18	Ref	Screw, Hex w/Lock Washer (2)	6–32x.50
91	Ref	Washer, Flat #6 (2)	
20	FD–51842–01	Ribbon Hub Kit	
21	Ref	Screw, Hex w/Lock Washer (2)	6–32x1.25
22	FD–51852–01	Hammer Bank Fan Assy	Air flow up
23	FD–54502–01	Motor Assy, Paper Feed	

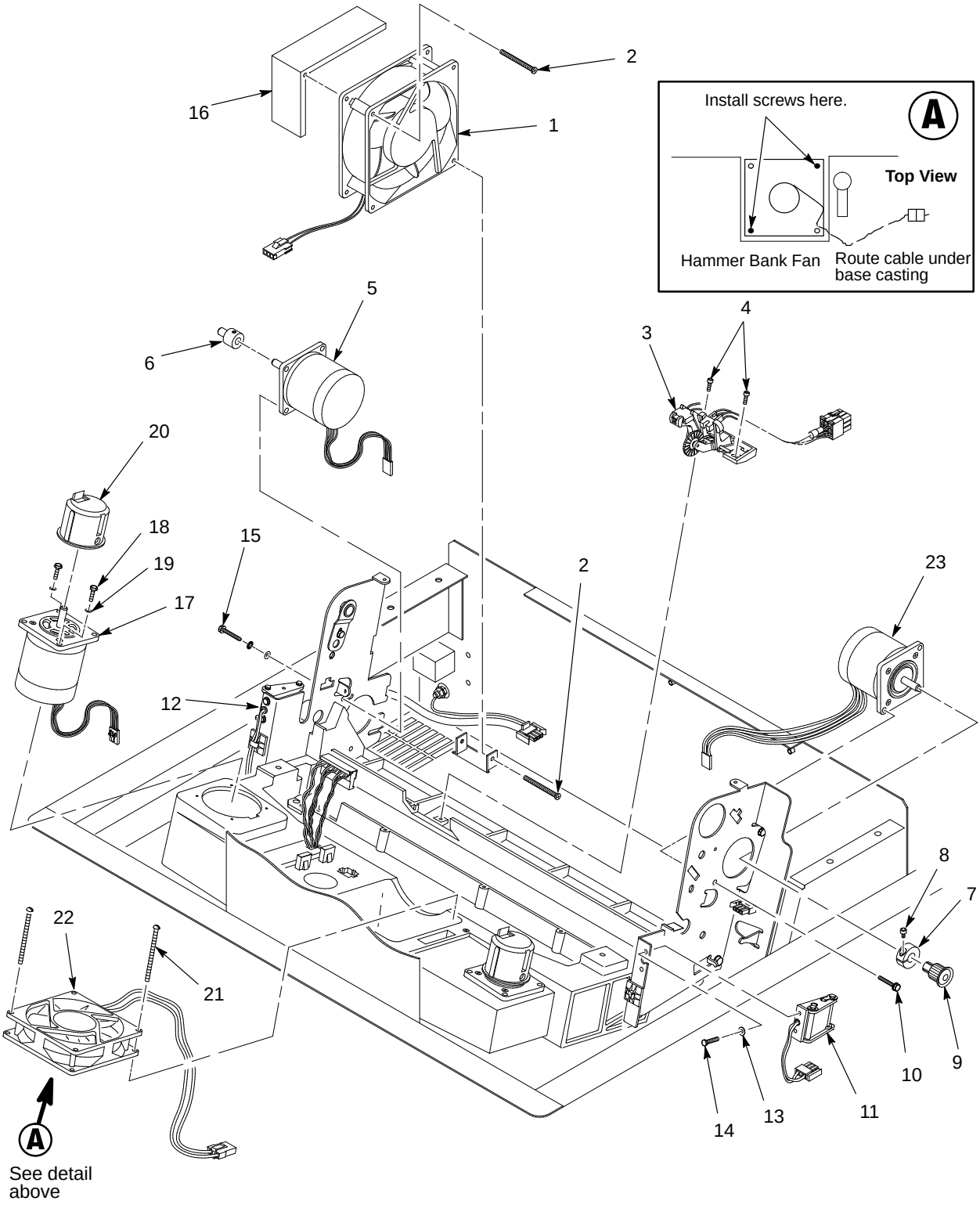


Figure 5–15. Motors, Fans, and Paper Detector Switch

Item No.	Part No. (Order No.)	Description	Notes
1	FD–51834–01	Circuit Breaker	
2	Ref	IEC 320 AC Power	Connector J301
3	Ref	Chassis Ground Stud	
4	Ref	Connector P1	To power supply board connector J1 AC
5	Ref	Cable Assy, AC In, Power Supply	

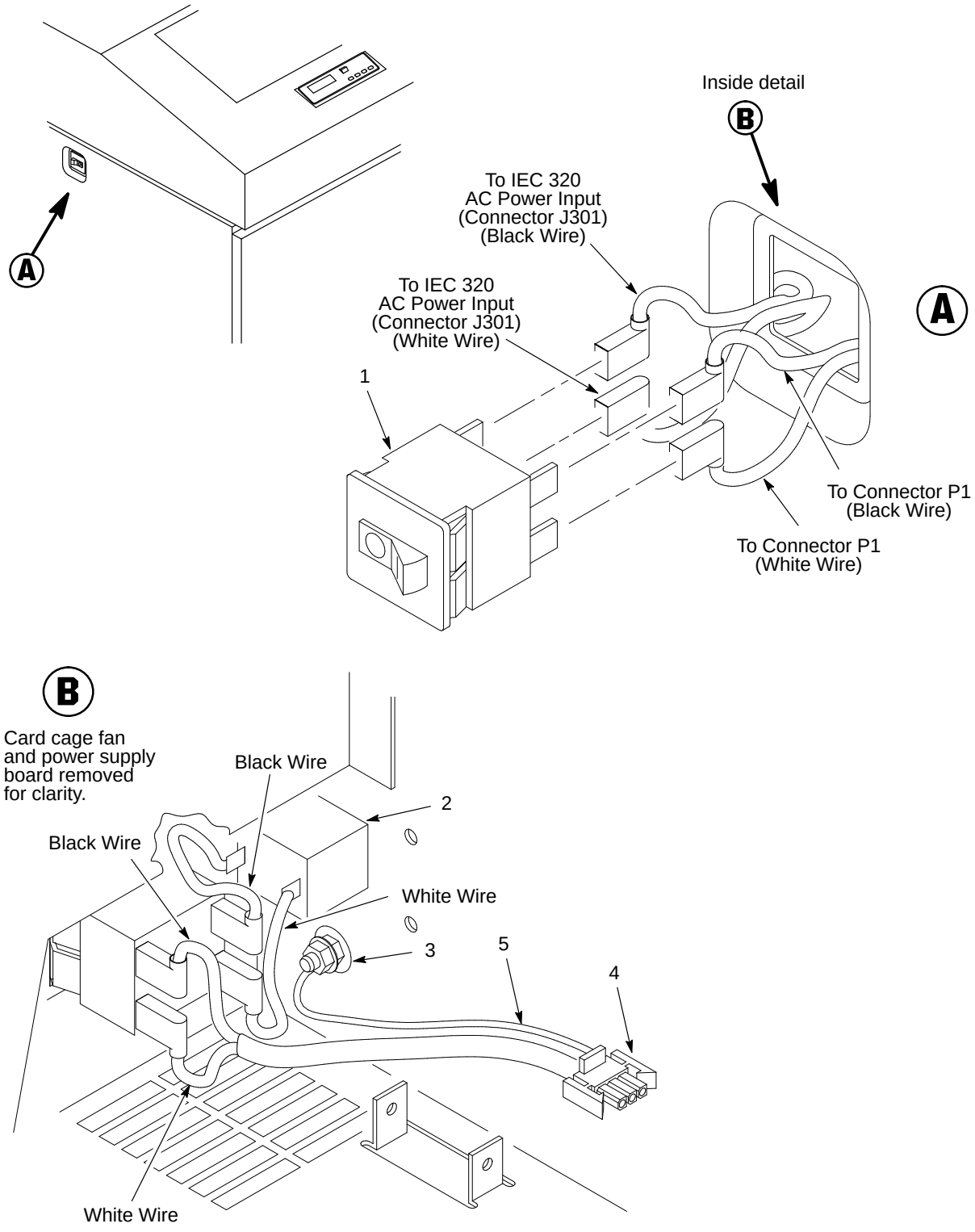


Figure 5–16. Circuit Breaker

6 Principles of Operation

Contents

Line Matrix Printing

The LG*plus* Series printer creates characters and graphics by printing patterns of ink dots on paper, 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 6–1.) The ink dots are made by a row of small hammers mounted on a shuttle that sweeps rapidly back and forth. Printer 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.

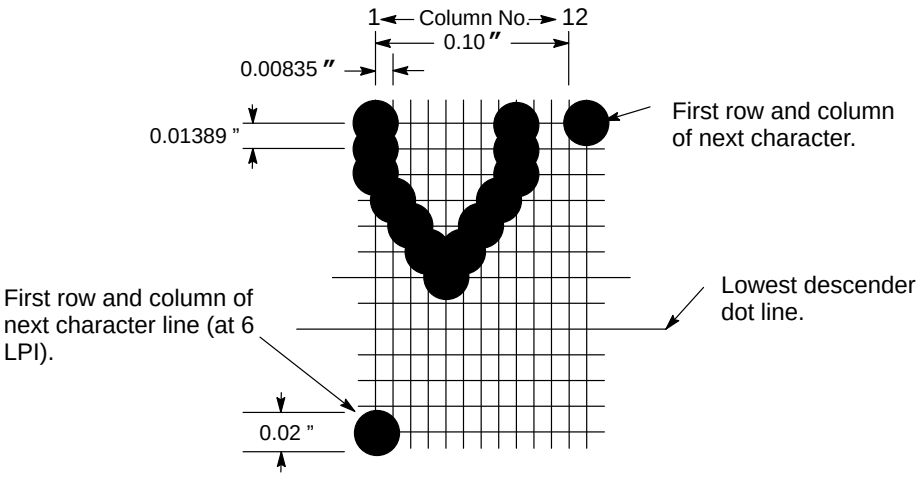


Figure 6–1. A Dot Matrix

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 6–1 and Figure 6–2.) At eight lpi there are nine dot rows per character line, at nine lpi eight dot rows per character line, and so on.

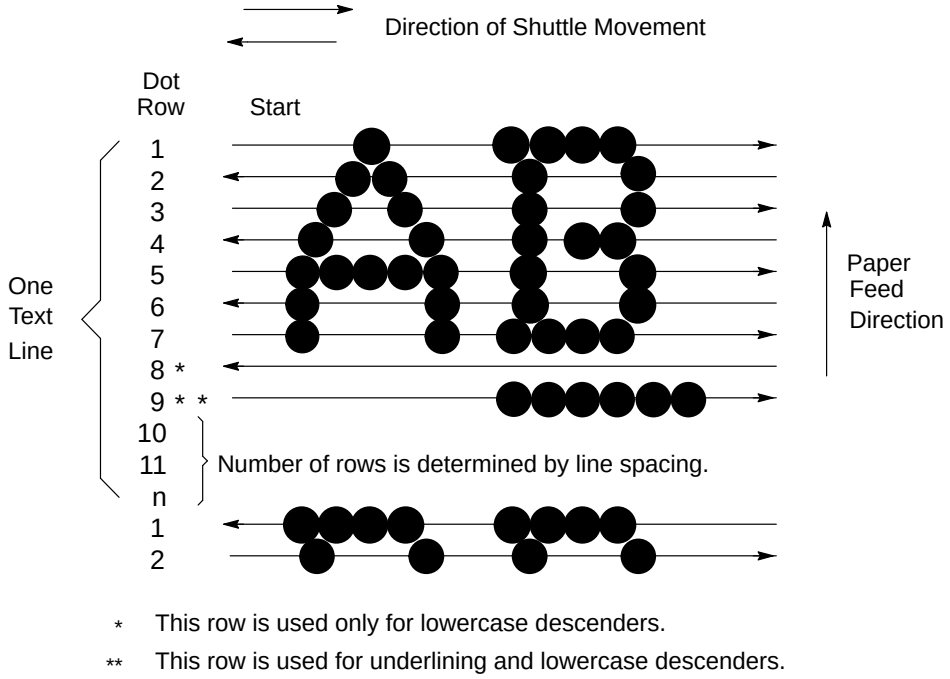


Figure 6–2. Standard Character Formation

Elongated characters are made by printing all but the first and last dot rows twice, as shown in Figure 6–3.

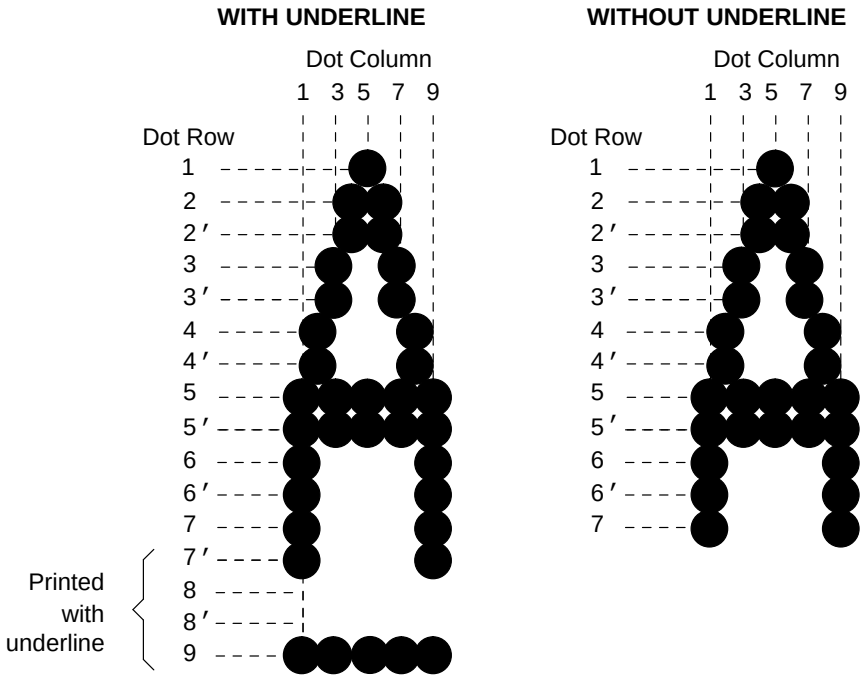
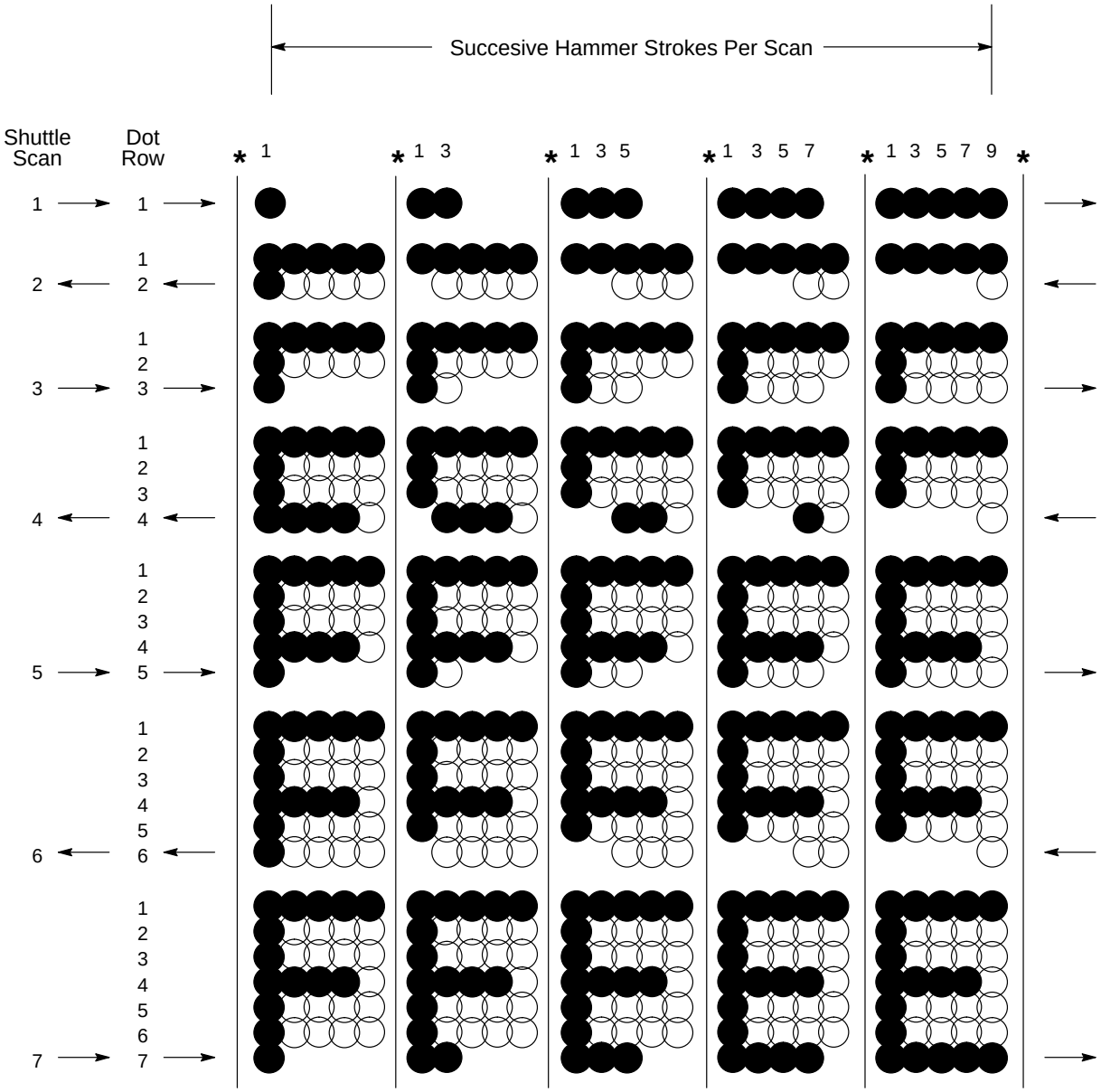


Figure 6–3. Elongated Character Formation

Figure 6–4 shows how each individual hammer spring forms characters as the shuttle scans horizontally.



* 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 6–4. 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 precise 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 shuttle drive motor and the shuttle assembly. (See Figure 6–5.) The hammer springs are grouped in comb–like assemblies called frets, and seven frets are bolted to the hammer bank. The LG04*plus* hammer bank has seven 4–hammer frets, the LG08*plus* hammer bank has seven 7–hammer frets, and the LG12*plus* hammer bank has seven 13–hammer frets. The shuttle drive motor is built into the shuttle assembly casting and drives a flywheel/crankshaft to which are attached two connecting rods. 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 + the counterweight = 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 piston engine. Mechanically, this design achieves the same benefits as such an engine—perfect primary balance, low vibration, and durability.

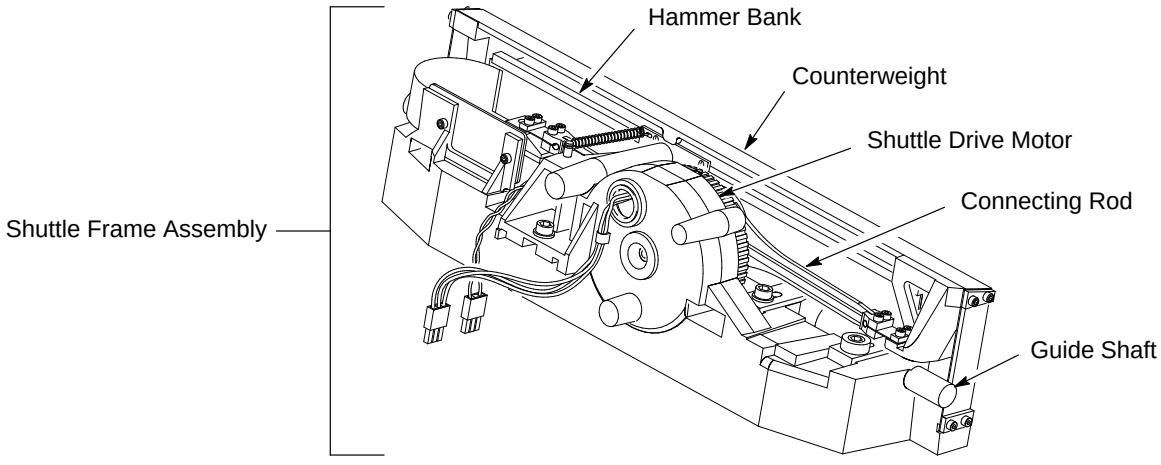


Figure 6–5. Shuttle Frame Assembly

Each hammer spring is a stiff leaf spring with a cylindrical, tungsten carbide tip on the free end. (See Figure 6–6.) A permanent magnet runs 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.

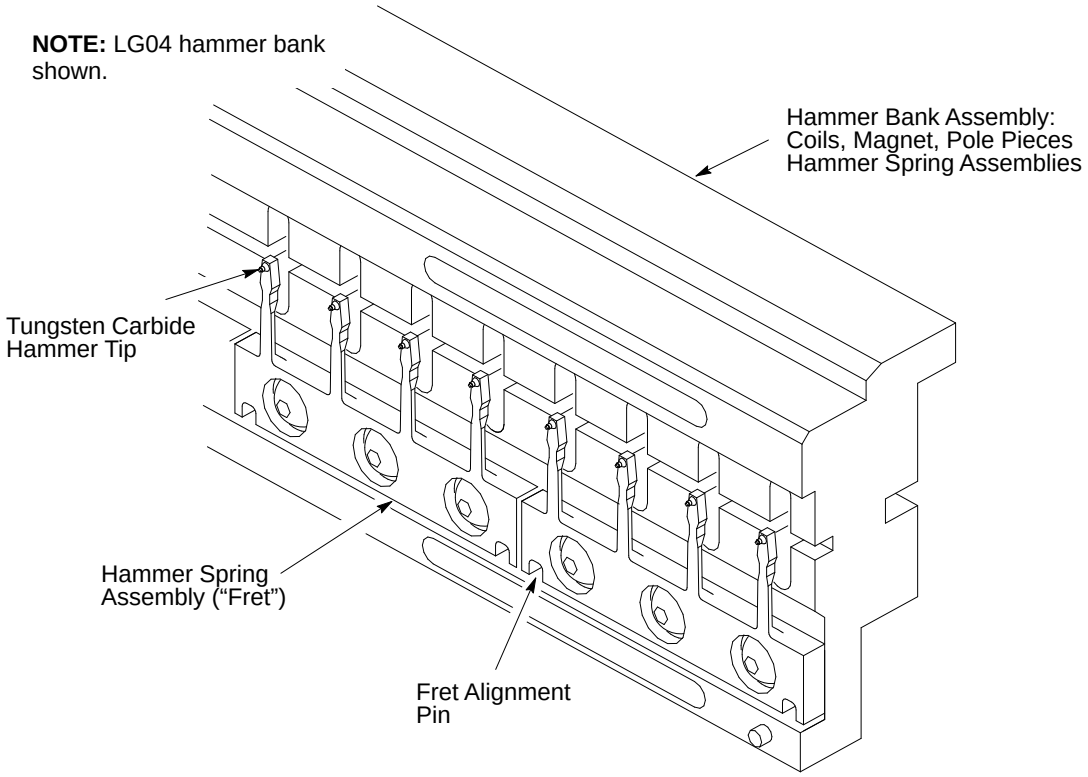


Figure 6–6. Hammer Springs and Hammer Bank (Detail)

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 the hammer must print a dot, a current pulse energizes the coils. 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 a dot impression of the hammer tip on the paper.

While the hammer is in flight the coil is de–energized and its 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

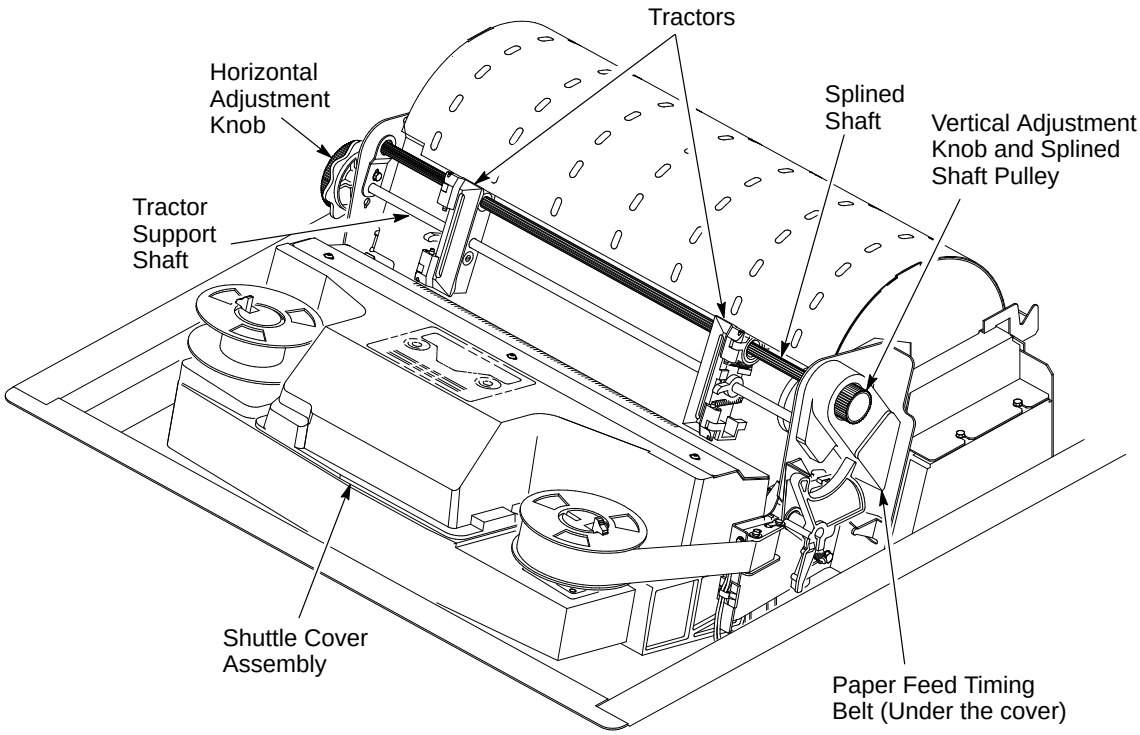


Figure 6–7. Paper Transport System

A two–phase DC stepper motor, directed by the PFC on the controller board, drives two tractor sprockets by means of a toothed belt and splined shaft pulley arrangement. The stepper motor permits extremely accurate incremental vertical paper movement. This drive configuration is designed for continuous, fan–folded paper three to 16 inches wide and one to six sheets thick. For reverse paper feeding, the platen open motor opens and closes the platen via a toothed belt. Opening the platen prevents paper jams when paper direction is reversed—that is, moved downwards—in order to view the print area, set top of form, or allow applications to overprint forms.

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

Paper can be moved vertically by hand with the vertical adjustment knob.

Ribbon Transport System

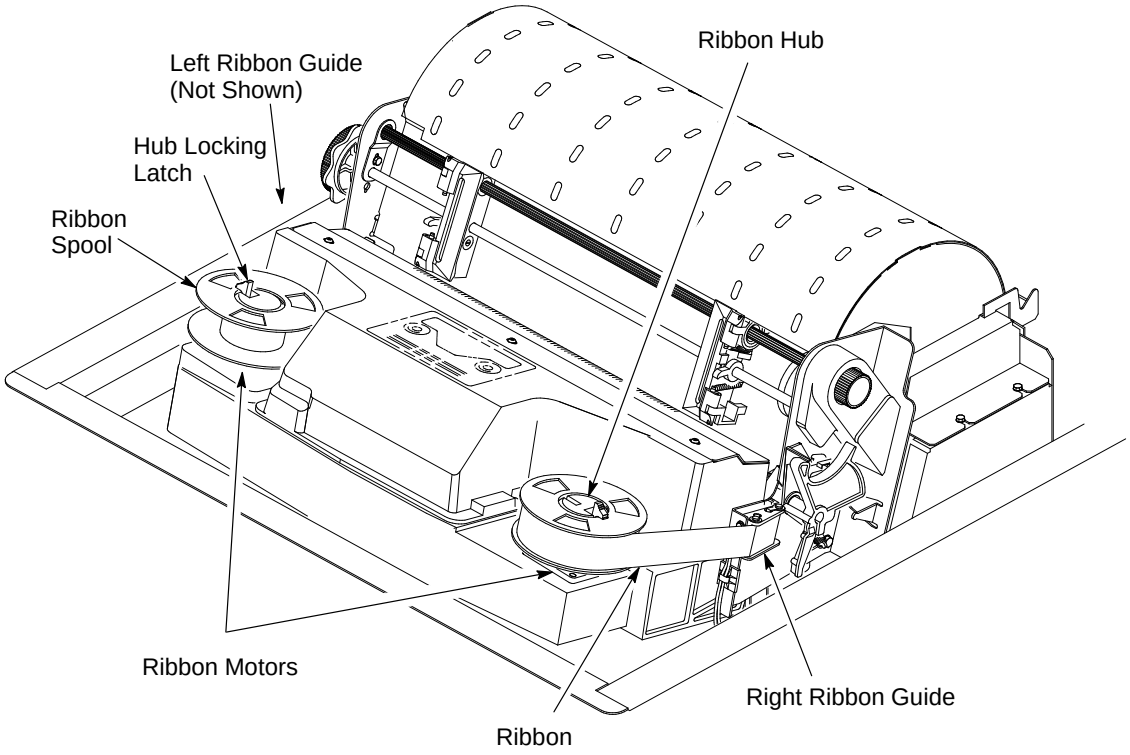


Figure 6–8. Ribbon Transport System

An inked ribbon winds and unwinds continuously on a pair of spools latched to hubs that are driven by the ribbon motors. The left and right ribbon hubs 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 or 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 a constant motor speed and ribbon tension.

Logical Control of the Printer

The printer is divided into four functional elements: the control panel, the controller board, the power supply, and the print mechanisms. See Figure 6–9.

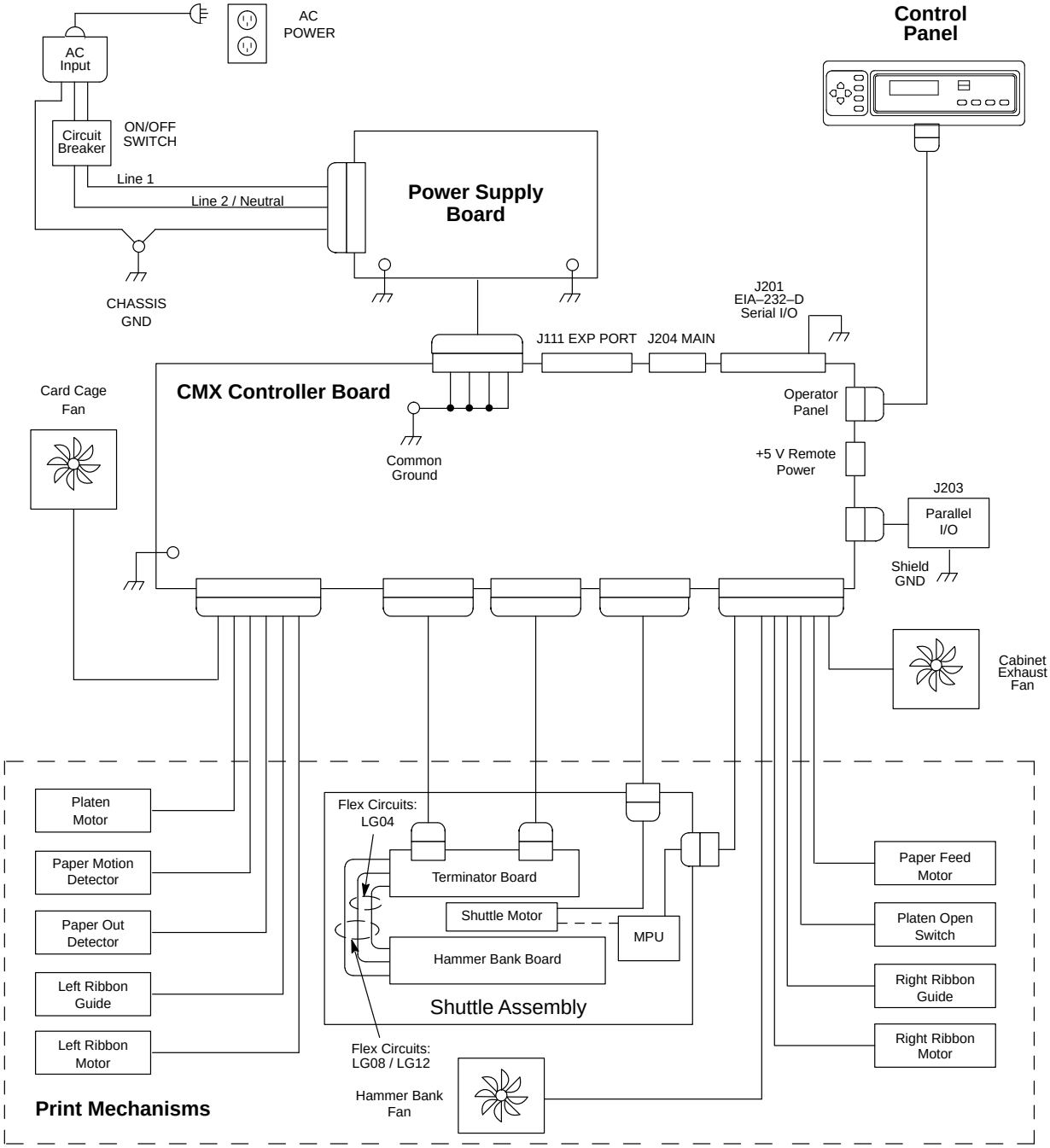


Figure 6–9. Functional Elements of the Printer

Control Panel

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

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

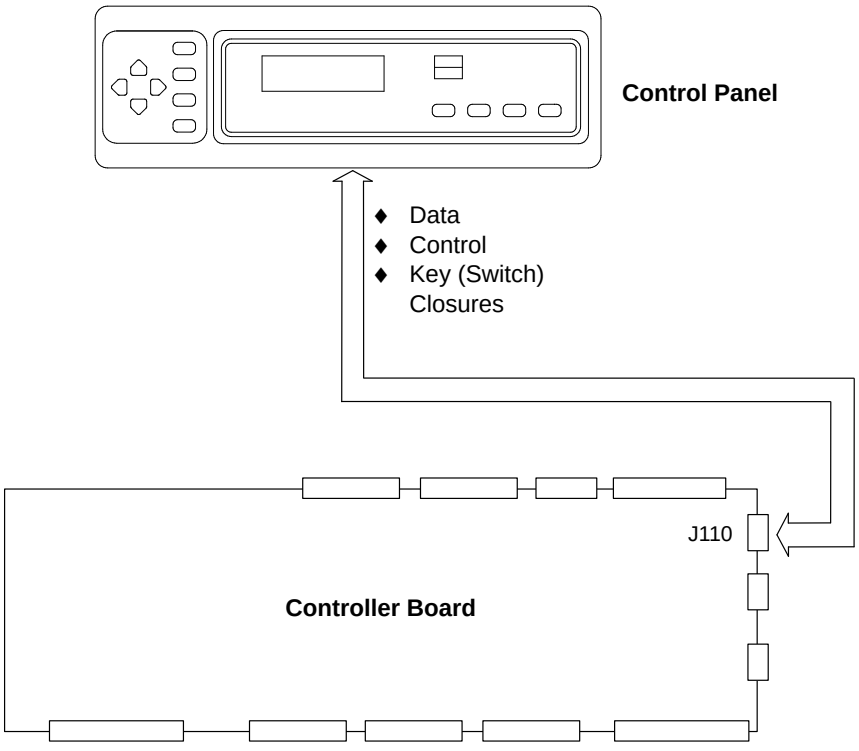


Figure 6–10. Operator Panel Functional Overview

CMX Controller Board

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

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

The DC is responsible for:

- Host I/O
- 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 6–11 summarizes this architecture.

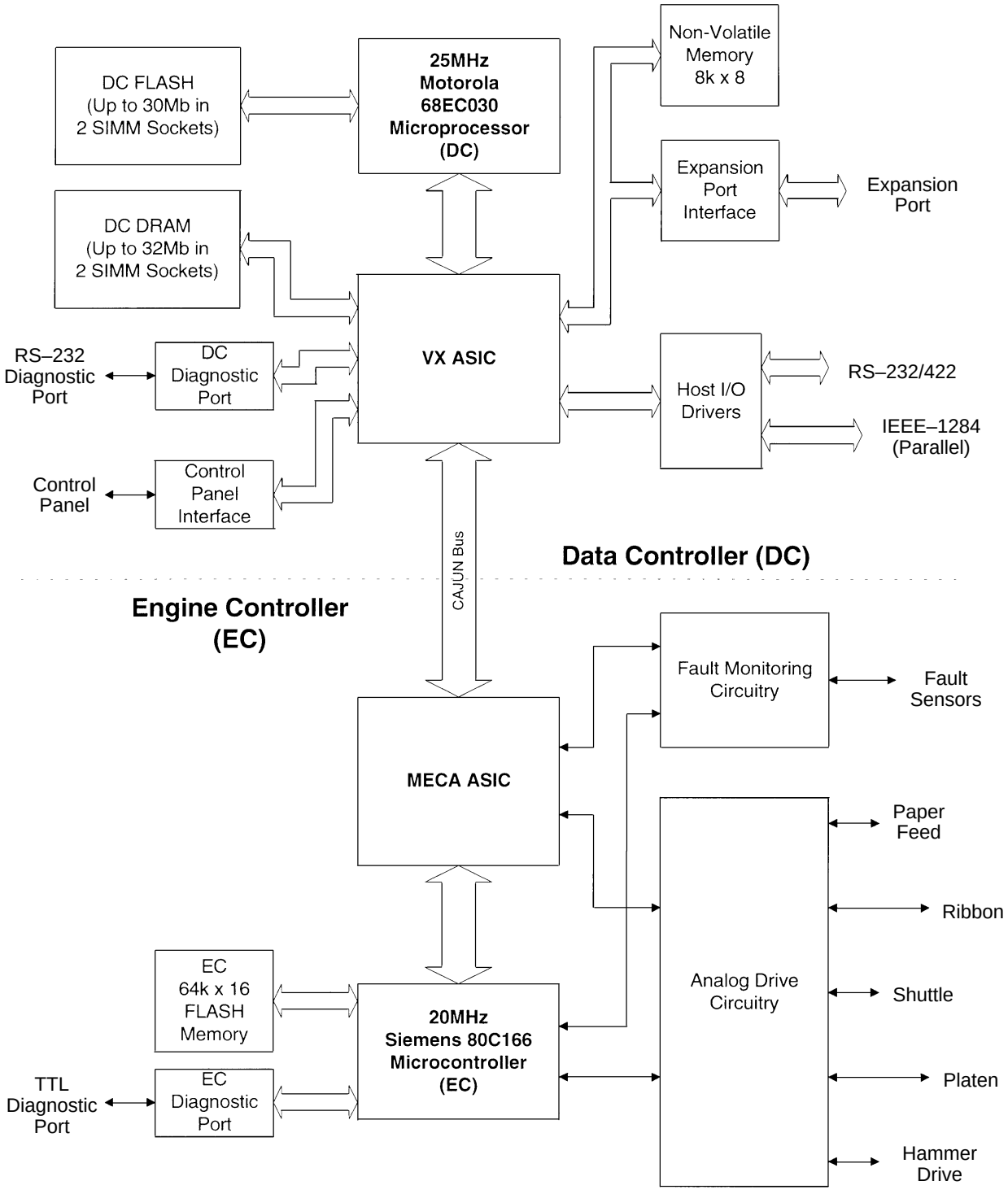


Figure 6–11. CMX Controller Board Block Diagram

Data Controller

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

- 68EC030 microprocessor
- 1MB base flash memory, organized as 256K x 32 bits
- One flash SIMM socket, for up to 16MB of additional program memory
- 2MB base DRAM data memory, organized as 256K x 32 bits
- One DRAM SIMM socket, for 2, 3, 8, or 16MB of additional data memory
- 8K x 8 Non–Volatile Battery–Backed SRAM (NVRAM) for storage of configuration and system statistical data
- VX ASIC
- Host I/O Drivers/Termination

68EC030 Microprocessor

A Motorola 68EC030 microprocessor serves as the processor of the DC unit. This processor runs at 25 MHz.

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 read byte by byte, but is written to as double words.

Two 80–pin flash SIMM sockets are provided for memory. Memory can be expanded up to 16MB (4MB x 32). (The maximum addressable range on the SIMM is 256MB, but the practical limit at current levels of flash technology is 16MB.)

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

DRAM Memory

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, addressable to 256MB, although 16MB is the practical upper DRAM limit.

NVRAM

A 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, DSACKs, and so on.

DRAM Controller The VX supports up to three banks of DRAM, including page mode operation.

FLASH Controller The VX supports up to three 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 6–16), which has access to the VX through the "Cajun" Bus Interface.

"Cajun" Bus Interface The "Cajun" bus interfaces 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 an IEEE 1284 Level 2 host
- Interface to RS–232E serial host
- Interface to RS–422 serial host

All the circuitry required for these host types 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 ±12V power.
- RS–422 differential drivers and receivers
- Parallel port pull up and pull down terminating resistors are DIP–socketed 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.
- Less than 200V/µs slew rate for all outputs.

Engine Controller

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

- 80C166 Microcontroller
- Address Decode PAL
- 256KB 5.0V–only FLASH program memory, organized as 64K x 16 bits. This memory is not expandable.
- MECA ASIC

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 provides 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.

The 166 used on the CMX board runs at 20MHz and is housed in a 100–pin plastic quad flat pack.

Bus Configuration The 166 uses a configurable external bus. The bus is an 18–bit address, 16–bit data, non–multiplexed and segmented bus. The flash memory runs at zero effective wait states.

Power Reduction Modes The 166 chip has two power reduction modes: idle and power down. When the 166 is in idle mode the CPU shuts down, but all on–board peripherals continue to operate. (Idle power reduction of the 166 is not the same as printer idle.) Any previously enabled interrupt will “wake up” the processor, even if global interrupts are turned off or the interrupt does not have the priority to actually execute. All I/O pins remain active in idle power reduction mode. Power down reduction mode capability exists but is not used because it requires an external hardware reset to exit this mode.

Watchdog Timer The 166 has an on–board watchdog timer. The Address Strobe of the 030 processor is fed into the watchdog input. If the 030 stops fetching addresses, something is seriously wrong and the 166 and its

peripherals are automatically reset. The timer interval is set through software and has a range of 25.6 μsec to 419 ms; default setting is 6.55 ms.

Analog Drive Circuitry

The analog drive functions convert 48 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.

Five motors are used on the printer: paper feed, two ribbon drive, shuttle, and platen open. 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 turn–around. 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 open 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 open motor is driven by a stepping motor controller IC and the EC processor.

Control of 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 controller board sets the timing and upper drive profile for driving a hammer fire event. 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 is fully operational from available commercial power anywhere in the world.

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

DC Power

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

The + 5 V supply has an isolated return line that connects to the + 48 V return at the printer load. Both returns are tied together in a single–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 Ω 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 RSP and reported as a fault.

Printer Interface

The printer interface is the point where the data line 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 buffered IEEE 1284 parallel, EIA–232–D serial, and EIA–422–A interfaces mounted on the CMX controller board. 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.

Only one of these interfaces can be used at a time, and is selected at the control panel from the configuration menus. Only one parallel host computer can be connected at a time.

Graphics

Two graphics programming languages that install in flash memory on the controller board are available to the customer as optional features:

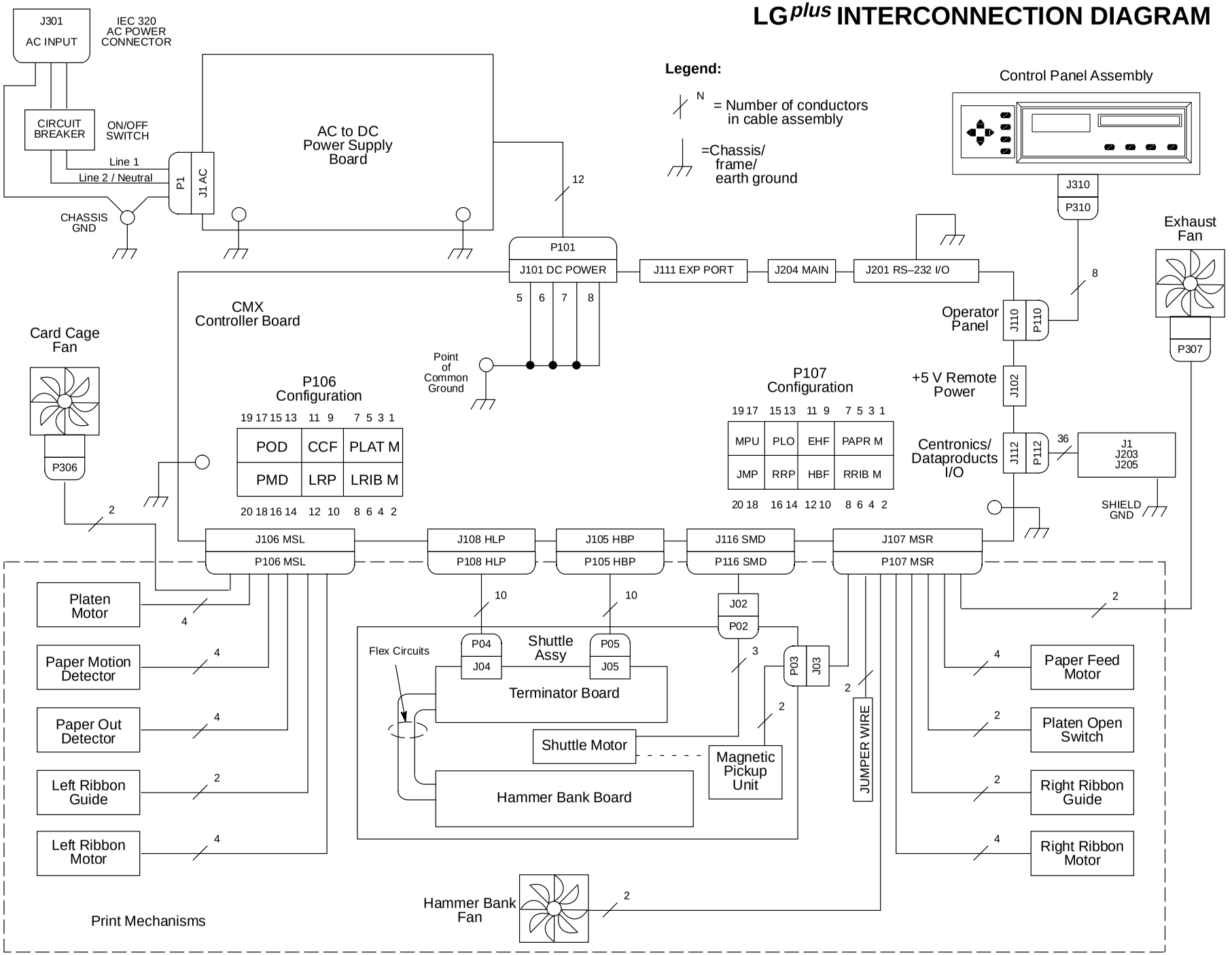
- *IGP/PGL Printronix Graphics Language* (a Printronix IGP graphics board emulation)
- *IGP/VGL Code V Graphics Language* (a QMS graphics board emulation)

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

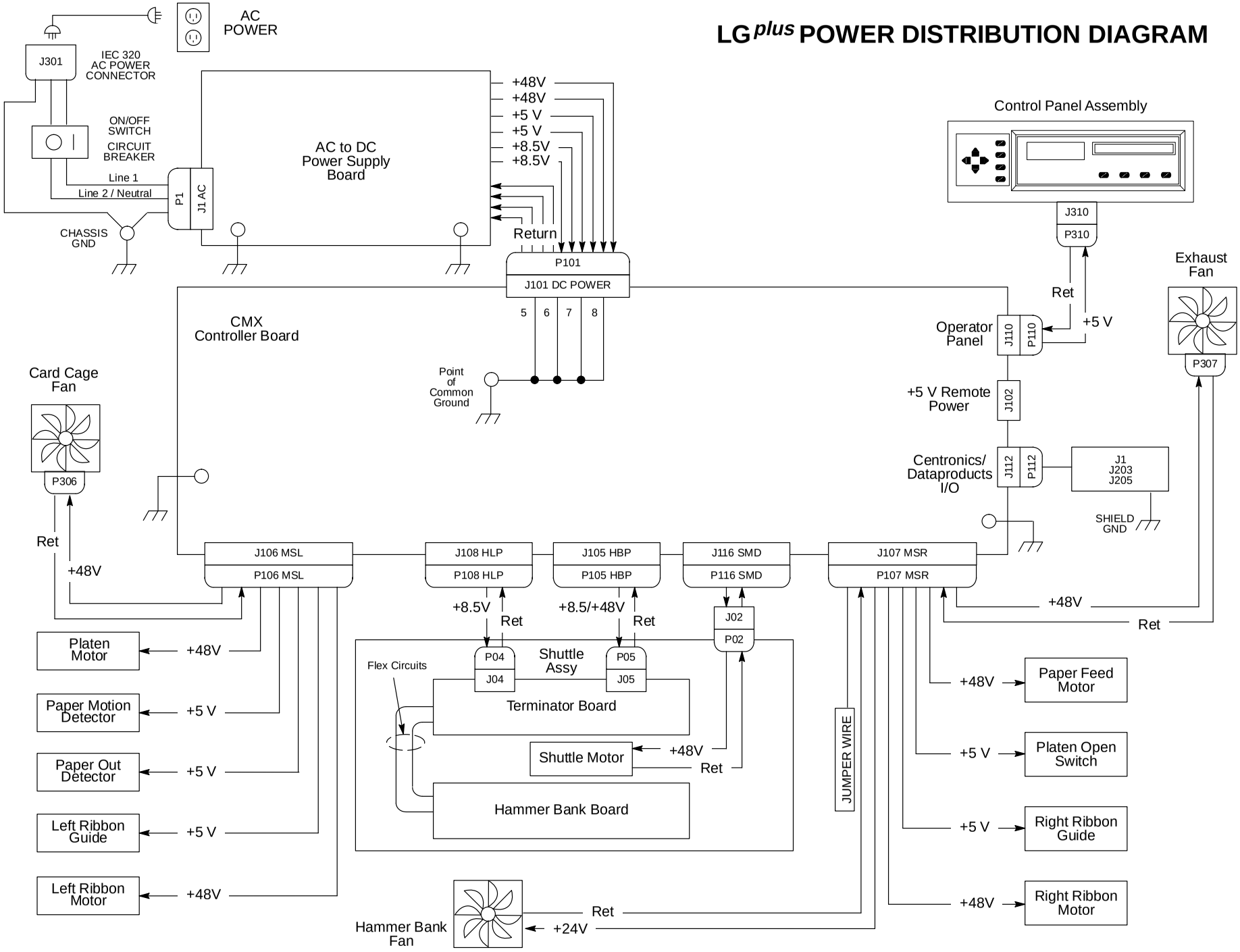
A Wire Data

NOTE: Acronyms and Signal mnemonics are defined in Appendix E.

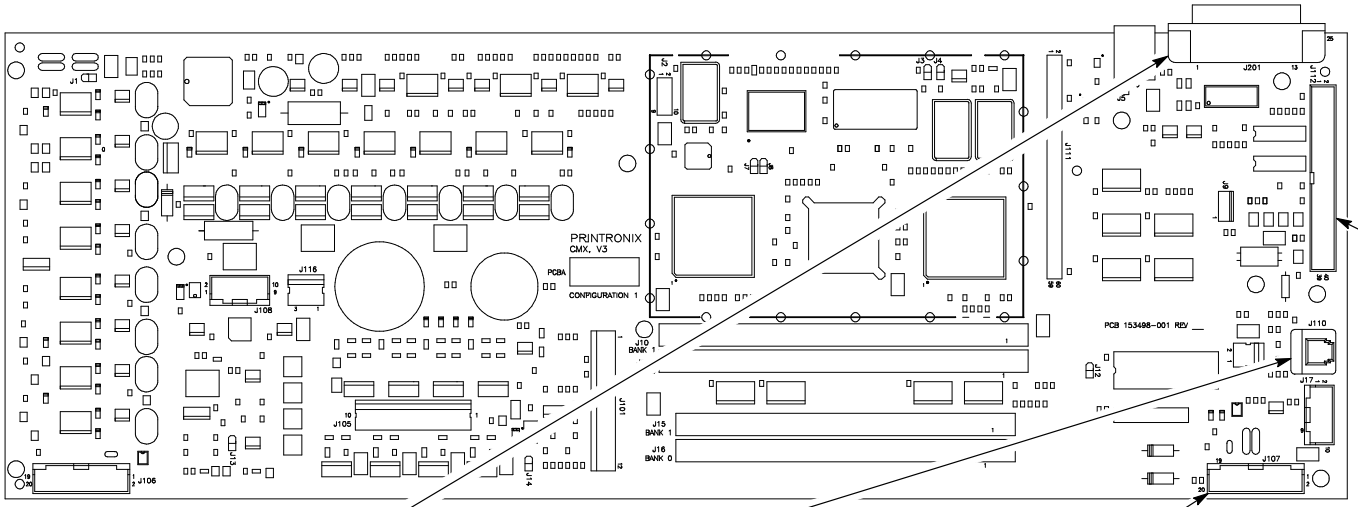
LG*plus* INTERCONNECTION DIAGRAM



LG *plus* POWER DISTRIBUTION DIAGRAM



Controller, CMX



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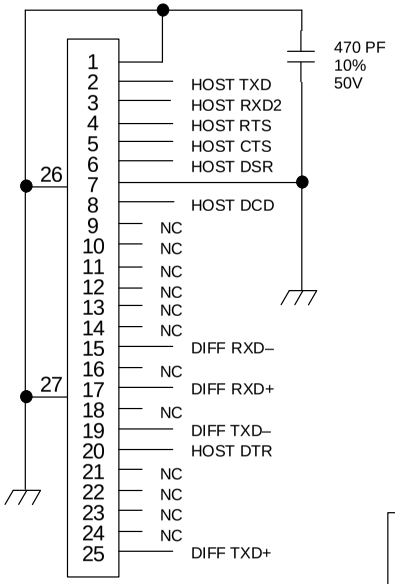
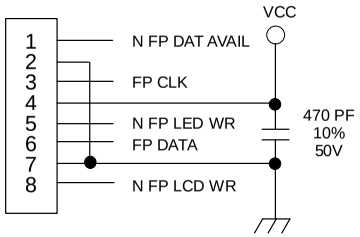
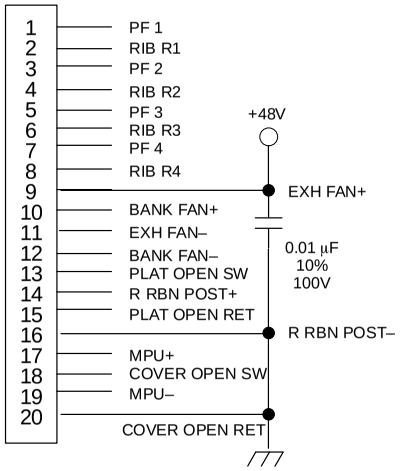
RS232/RS422



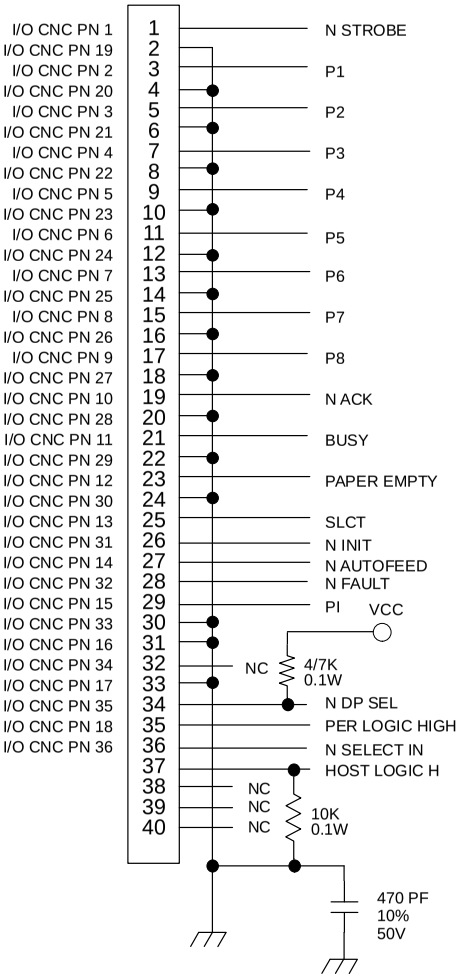
J110
Control Panel



J107
Motor Sensor Right



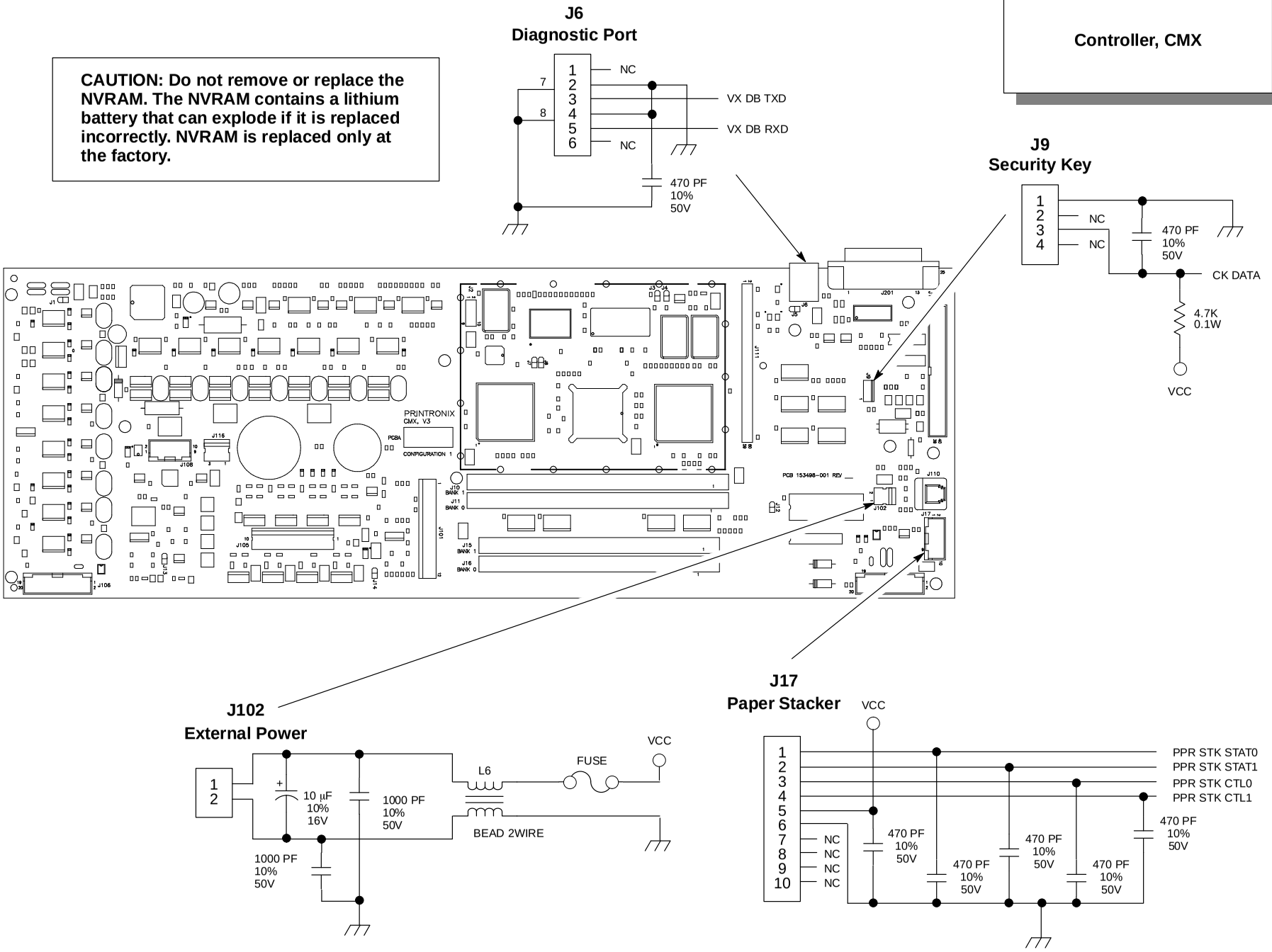
J112
Centronics

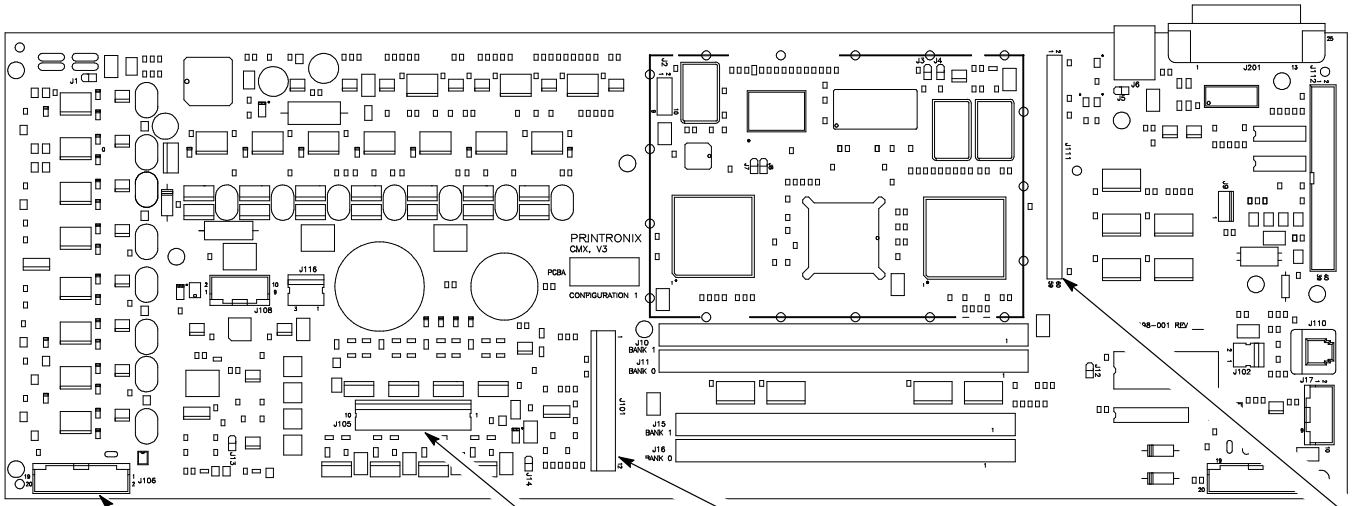


CAUTION: Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.

Controller, CMX

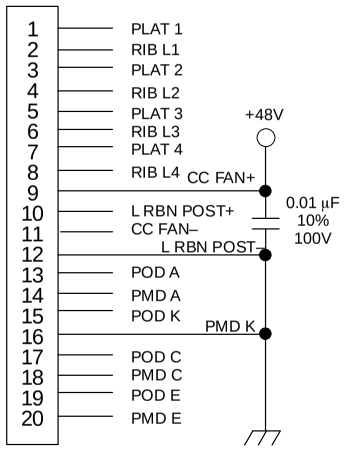
CAUTION: Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.



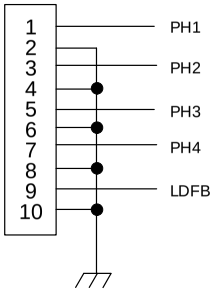


Controller, CMX

J106
Motor Sensor Left



J105
Hammer Bank Power



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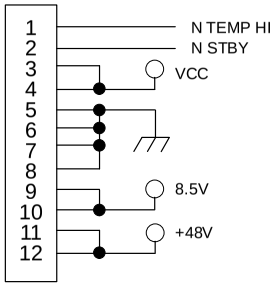
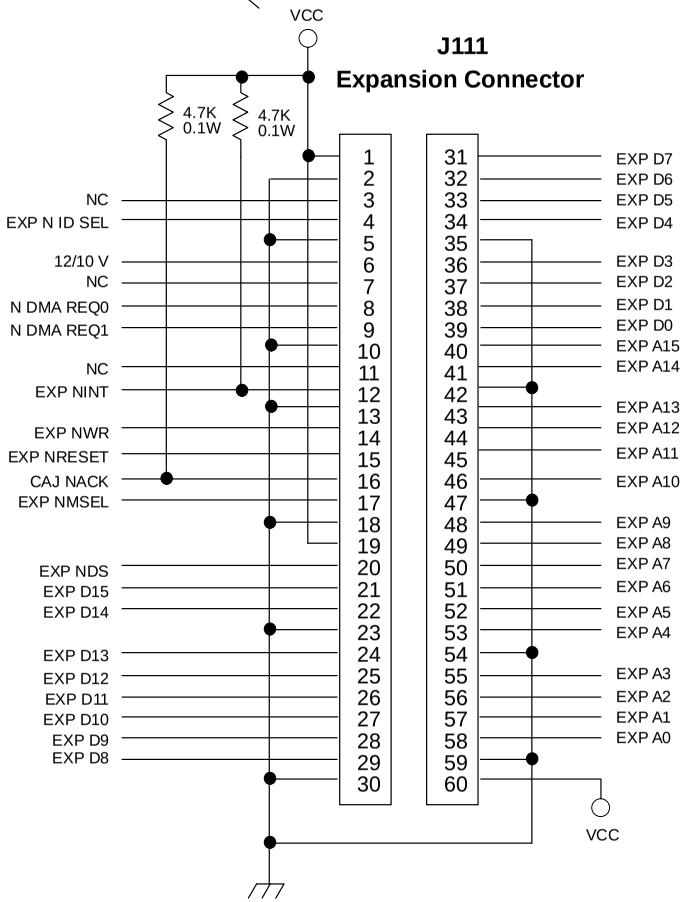
Power Supply

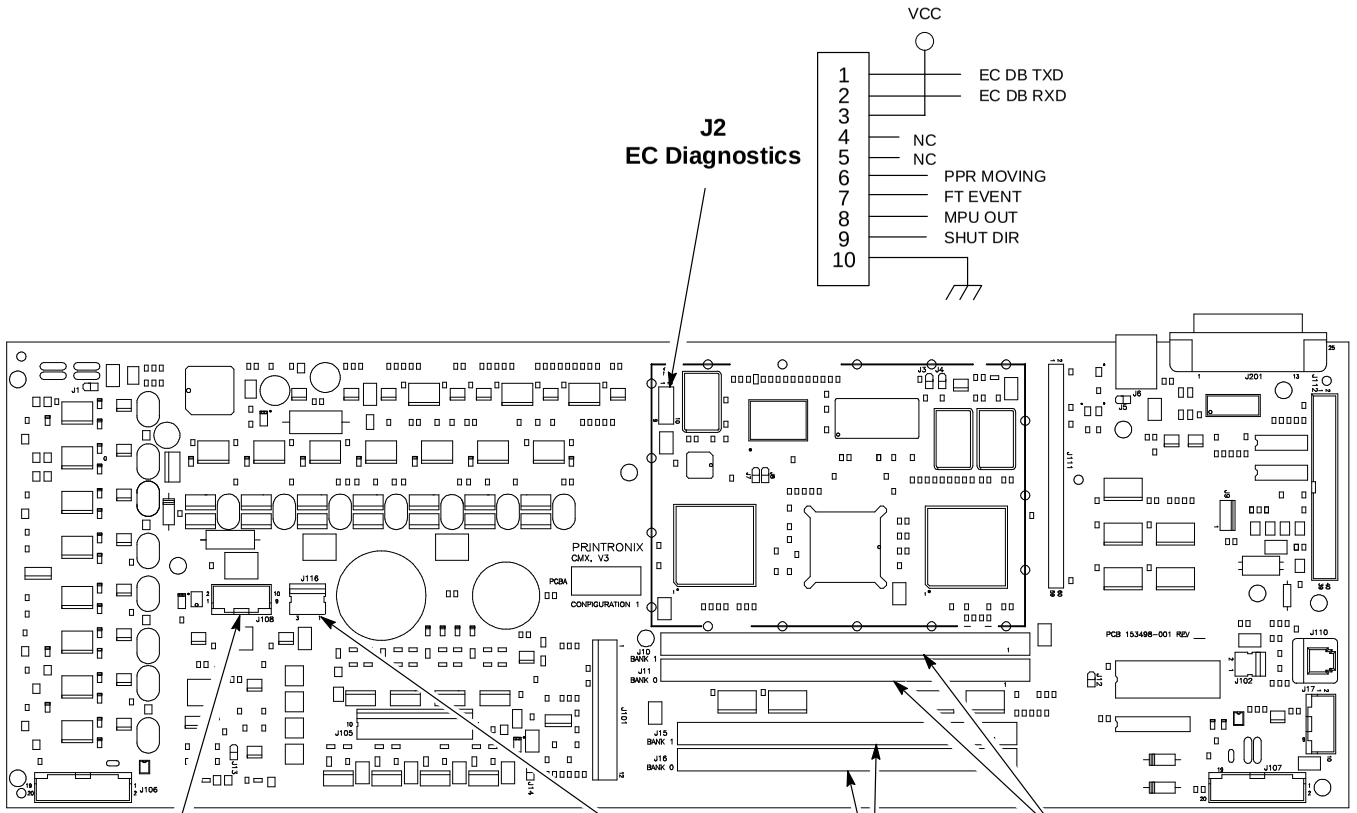


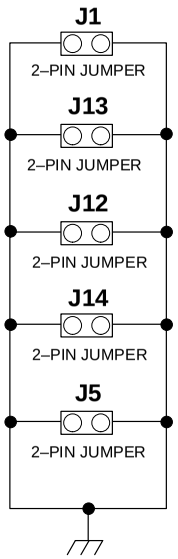
CAUTION: Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.

J111
Expansion Connector



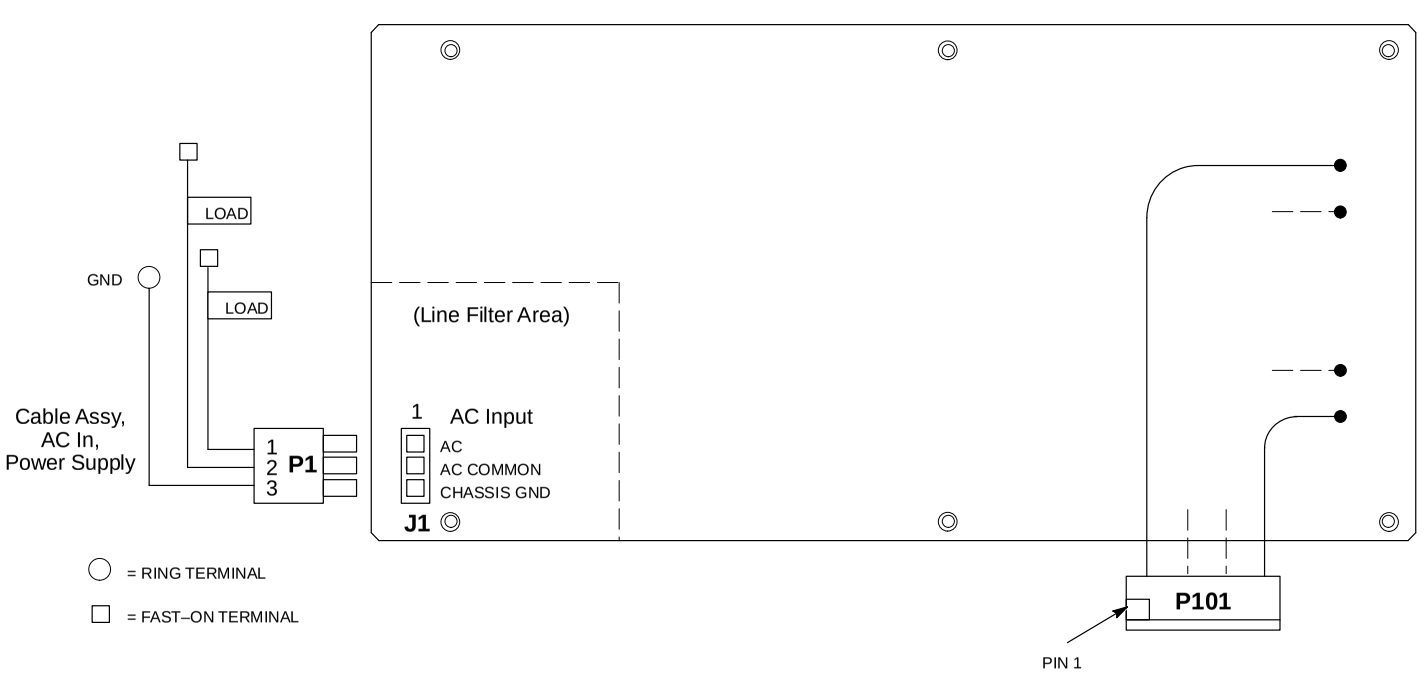
Controller, CMX



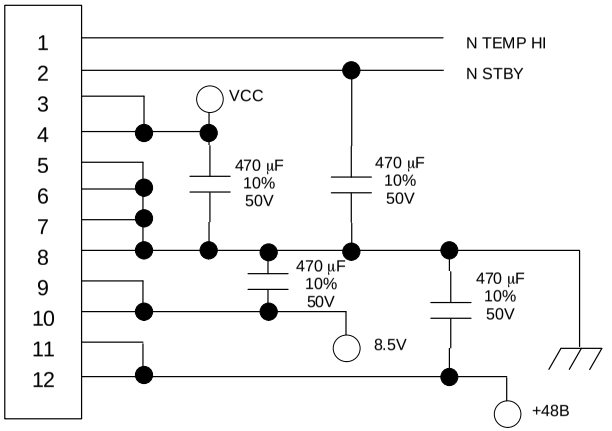


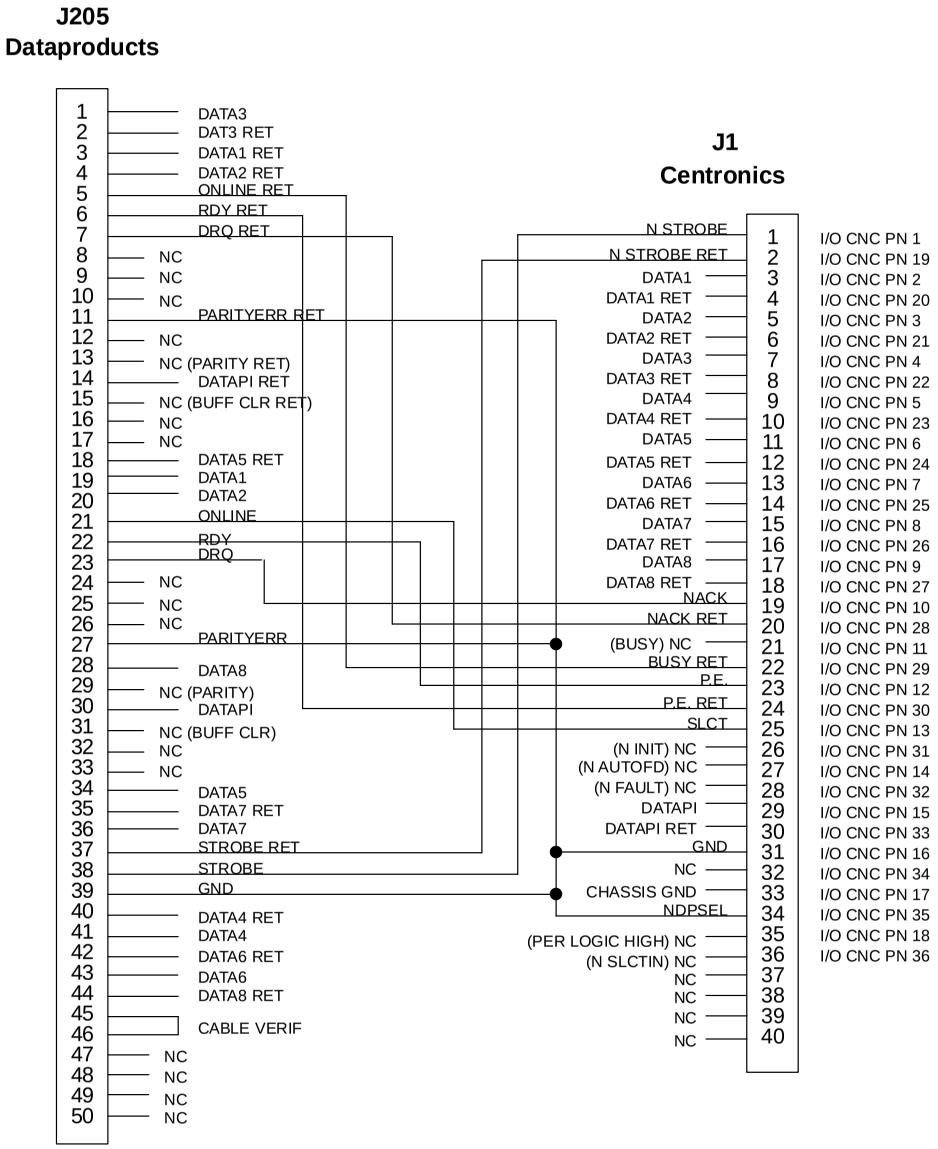
CAUTION: Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.

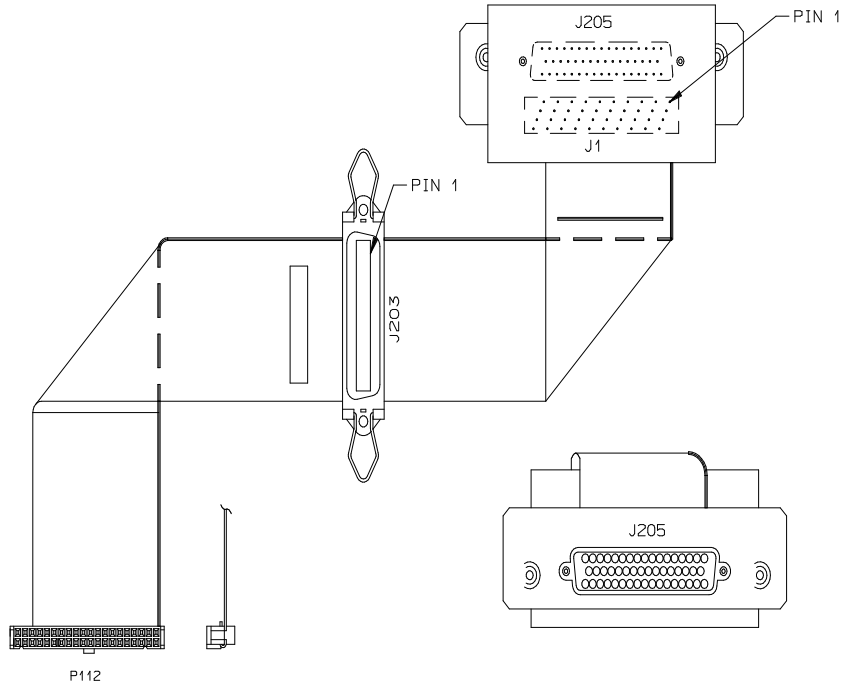
Power Supply



P101
Controller Board

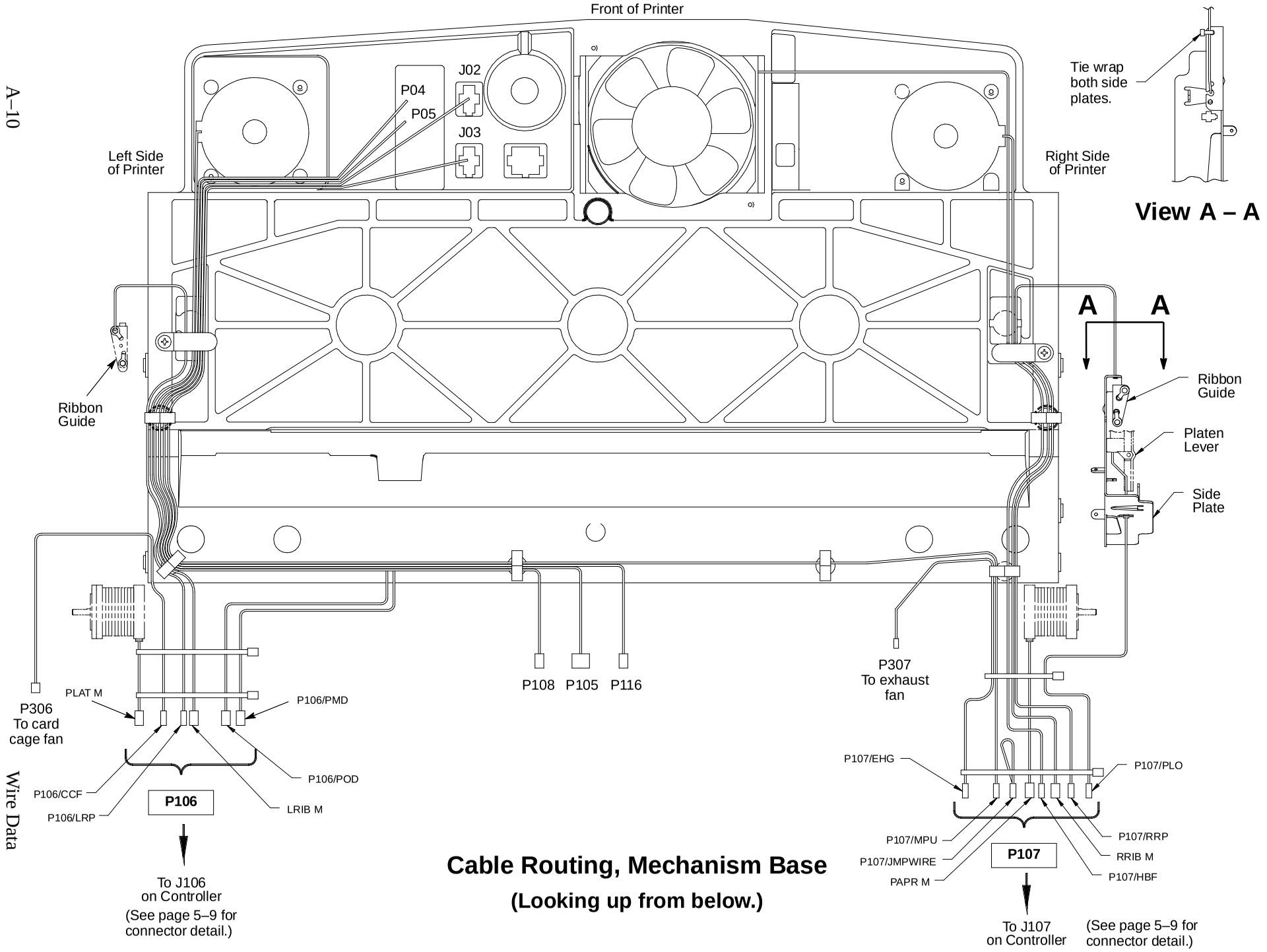






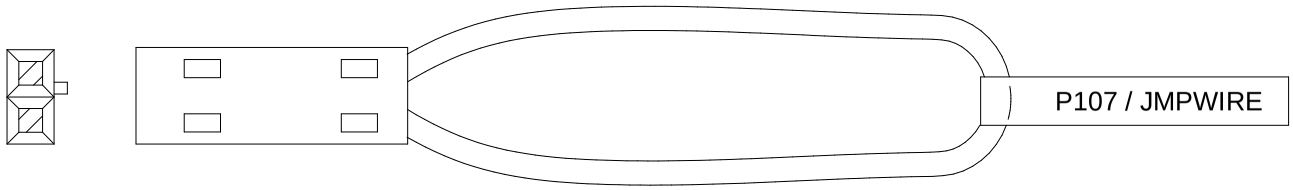
NOTE:
If you replace the I/O cable assembly, you must install the ferrite clamp.
See Appendix F.

Part No.	Description
153364–901	Cable Assembly, Centronics/Dataproducts I/O

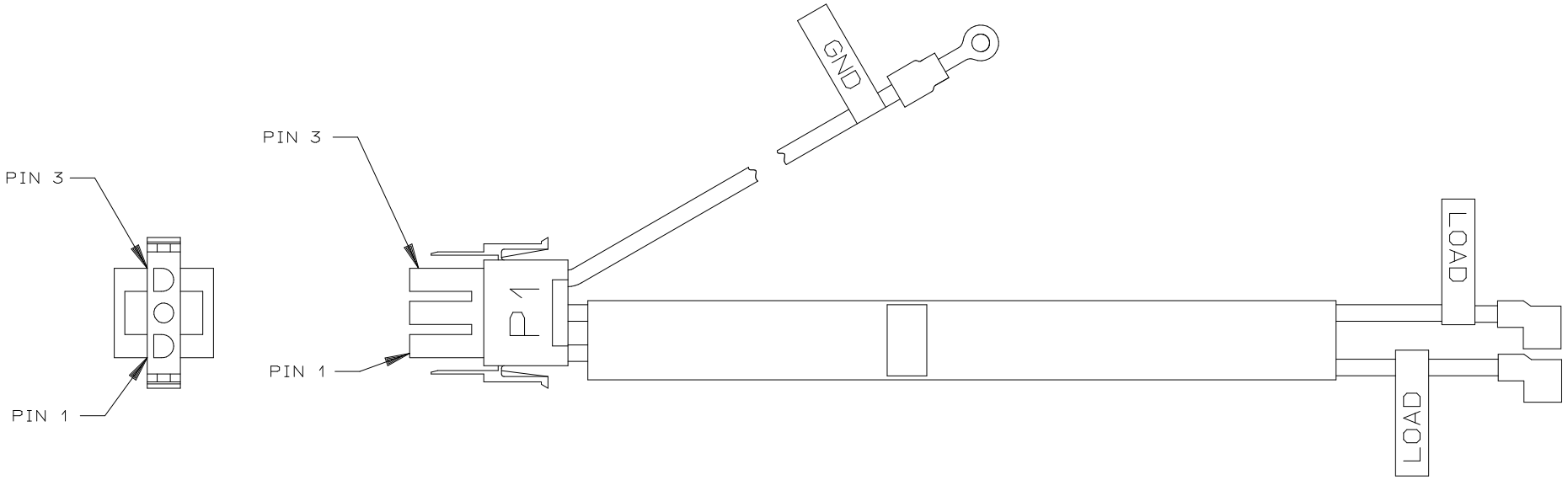


Cable Routing, Mechanism Base

(Looking up from below.)



Part No.	Description
154470–901	Cable Assembly, 2–Pin Jumper, 0.1 Ctr

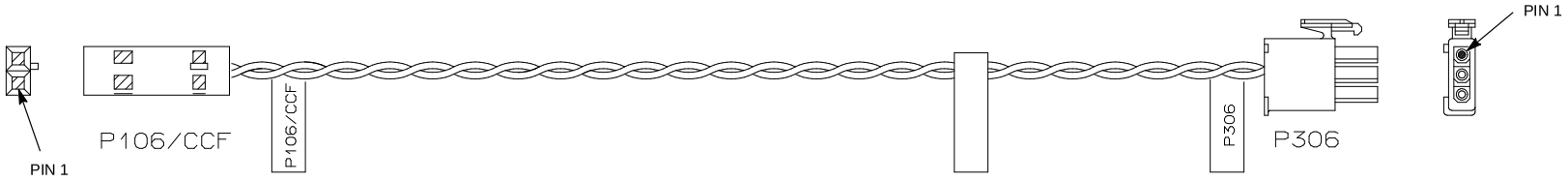


PIN	WIRE COLOR
1	BLACK
2	WHITE
3	GREEN/YELLOW

Part No.	Description
152625–901	Cable Assembly, AC In, Power Supply

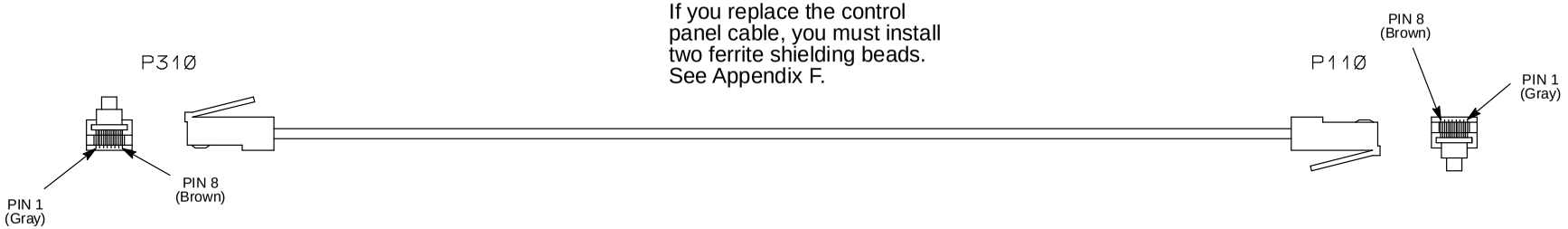
PIN	WIRE COLOR
LINE	BLACK
NEUTRAL	WHITE
GROUND	GREEN/YELLOW

Part No.	Description
152624–901	Cable Assembly, AC Power Connector



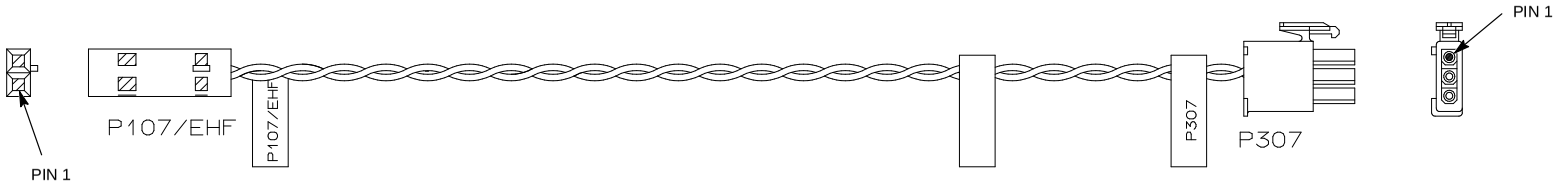
WIRE TABLE		
P106/CCF	P306	WIRE COLOR
PIN 1	PIN 3	BLACK
PIN 2	PIN 2	GRAY
	PIN 1	N/C

Part No.	Description
152422–901	Cable Assembly, Card Cage Fan



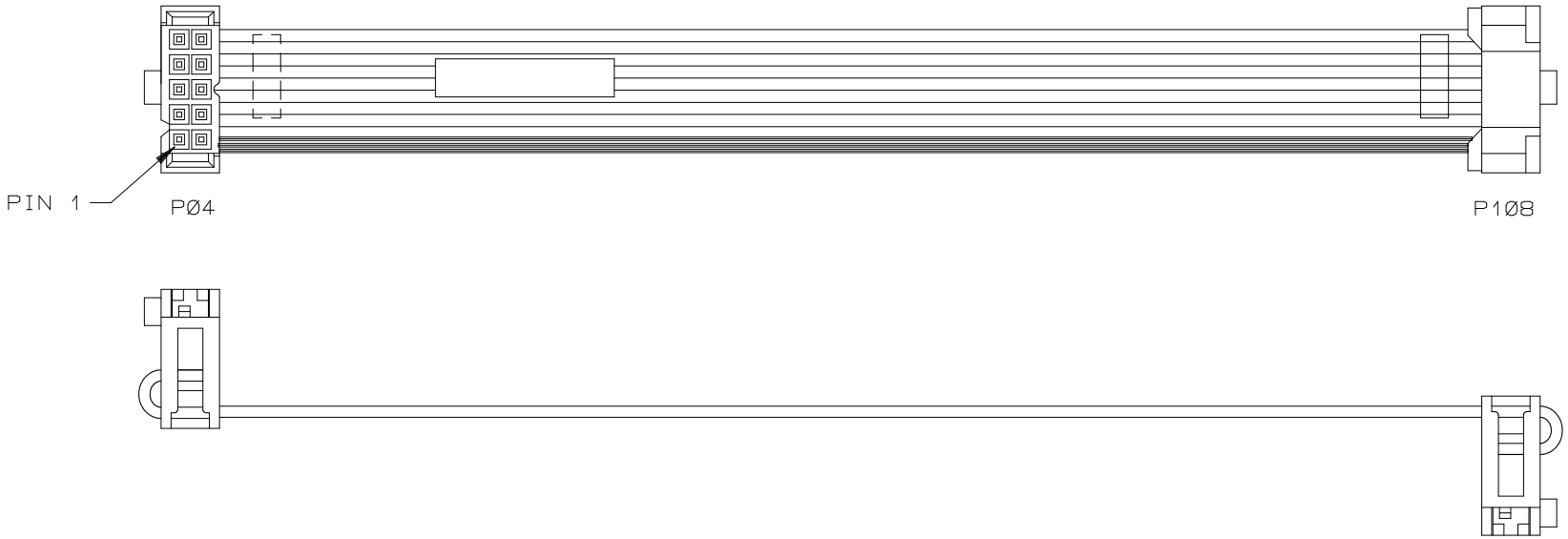
NOTE:
If you replace the control panel cable, you must install two ferrite shielding beads. See Appendix F.

Part No.	Description
152440–901	Cable Assembly, Control Panel

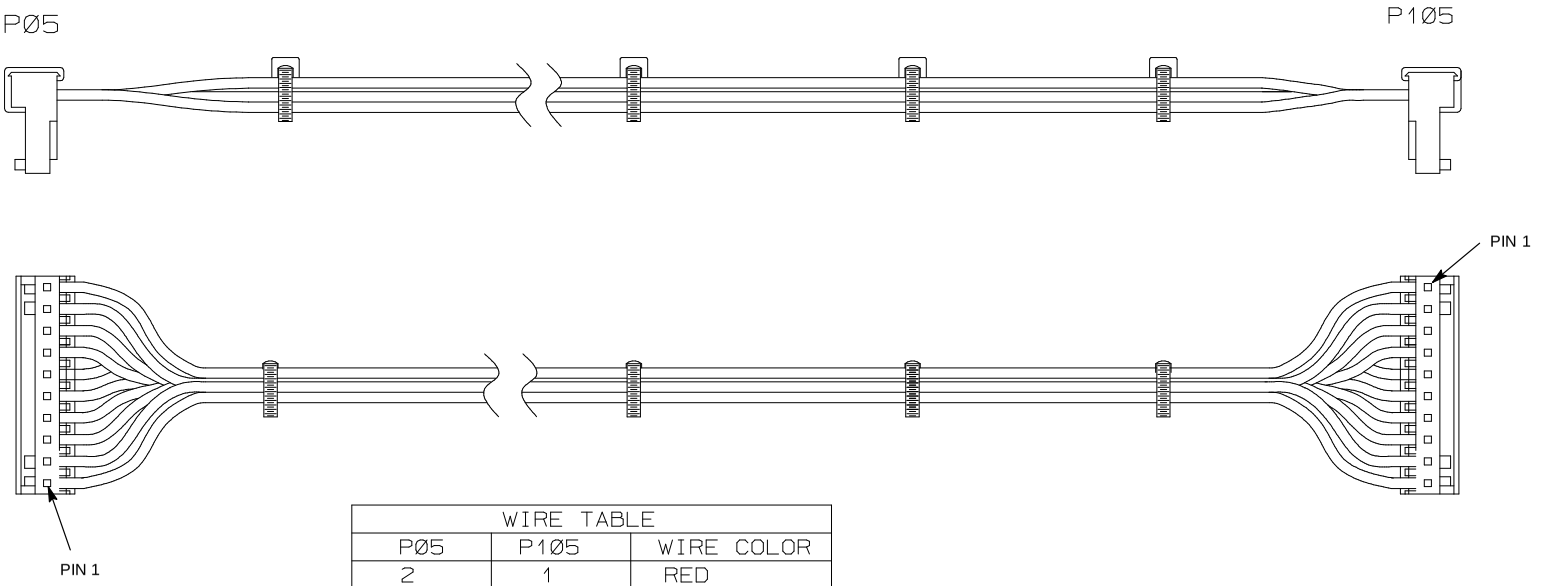


WIRE TABLE		
P107/EHF	P307	WIRE COLOR
PIN 1	PIN 3	BLACK
PIN 2	PIN 2	GRAY
	PIN 1	N/C

Part No.	Description
152424–901	Cable Assembly, Exhaust Fan

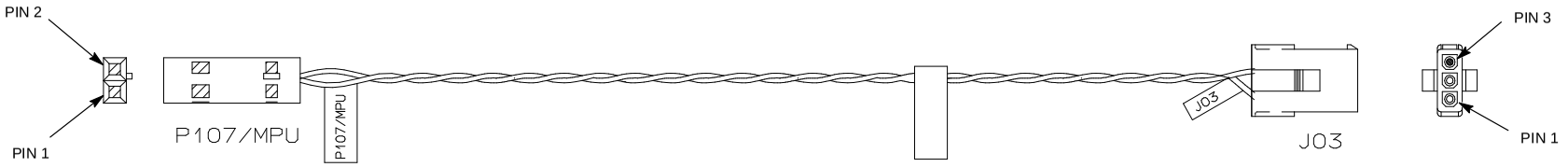


Part No.	Description
152421–901	Cable Assembly, Hammer Bank Logic



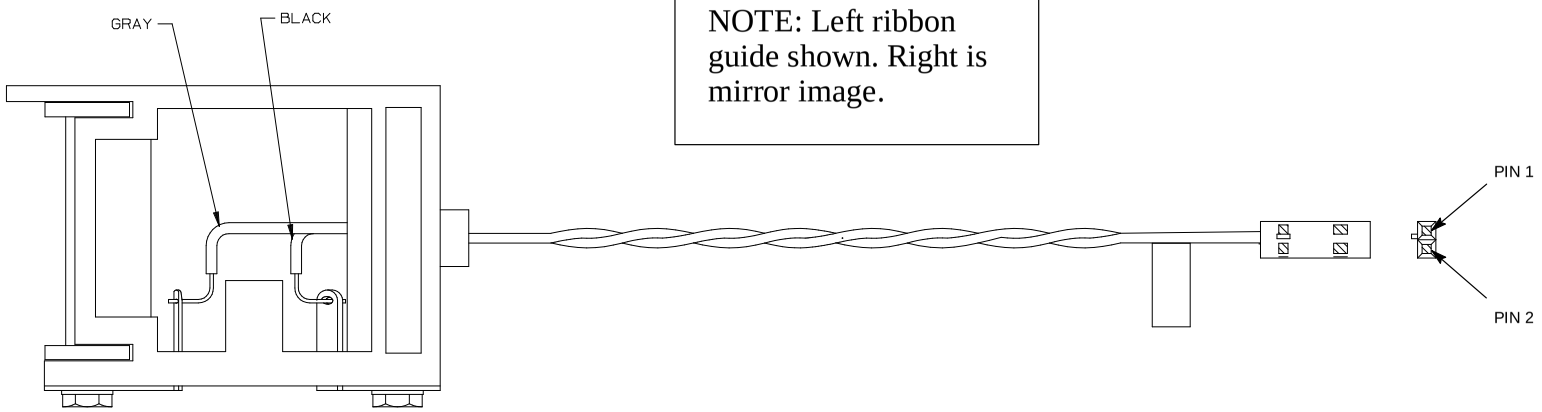
WIRE TABLE		
P05	P105	WIRE COLOR
2	1	RED
1	2	BLACK
4	3	RED
3	4	BLACK
6	5	RED
5	6	BLACK
8	7	RED
7	8	BLACK
10	9	RED
9	10	BLACK

Part No.	Description
152423–901	Cable Assembly, Hammer Bank Power

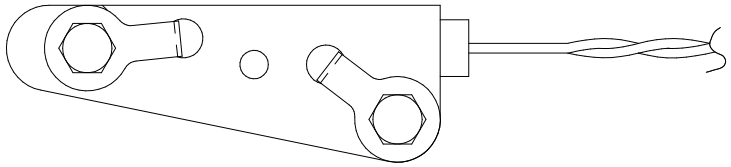


WIRE TABLE		
P107/MPU	J03	WIRE COLOR
1	1	BLACK
2	2	GRAY
	3	N/C

Part No.	Description
152425–901	Cable Assembly, MPU

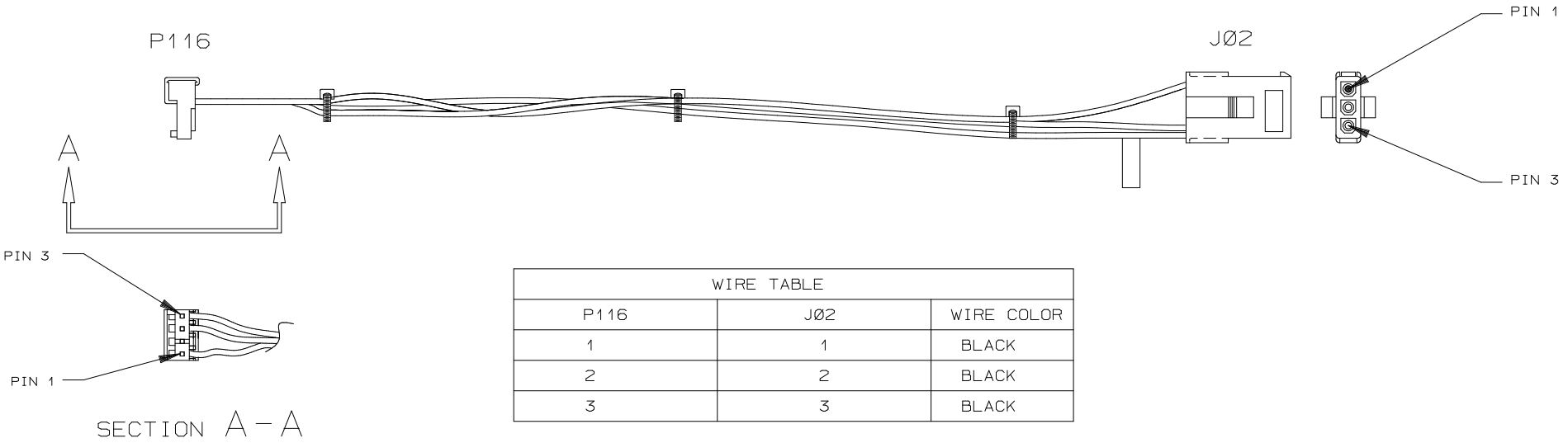


NOTE: Left ribbon guide shown. Right is mirror image.



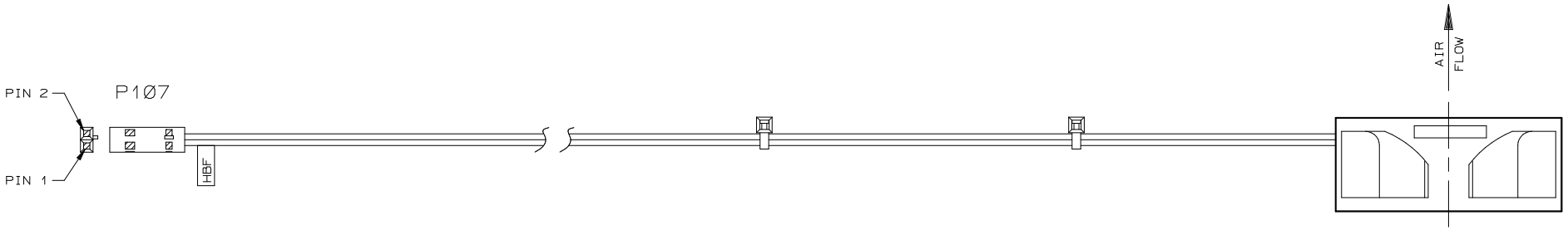
PIN CONNECTION	
	RGL/RGR(P)
PIN 1	GRAY
PIN 2	BLACK

Part No.	Description
FD–51855–01	Kit, Ribbon Guide* * includes left and right guides



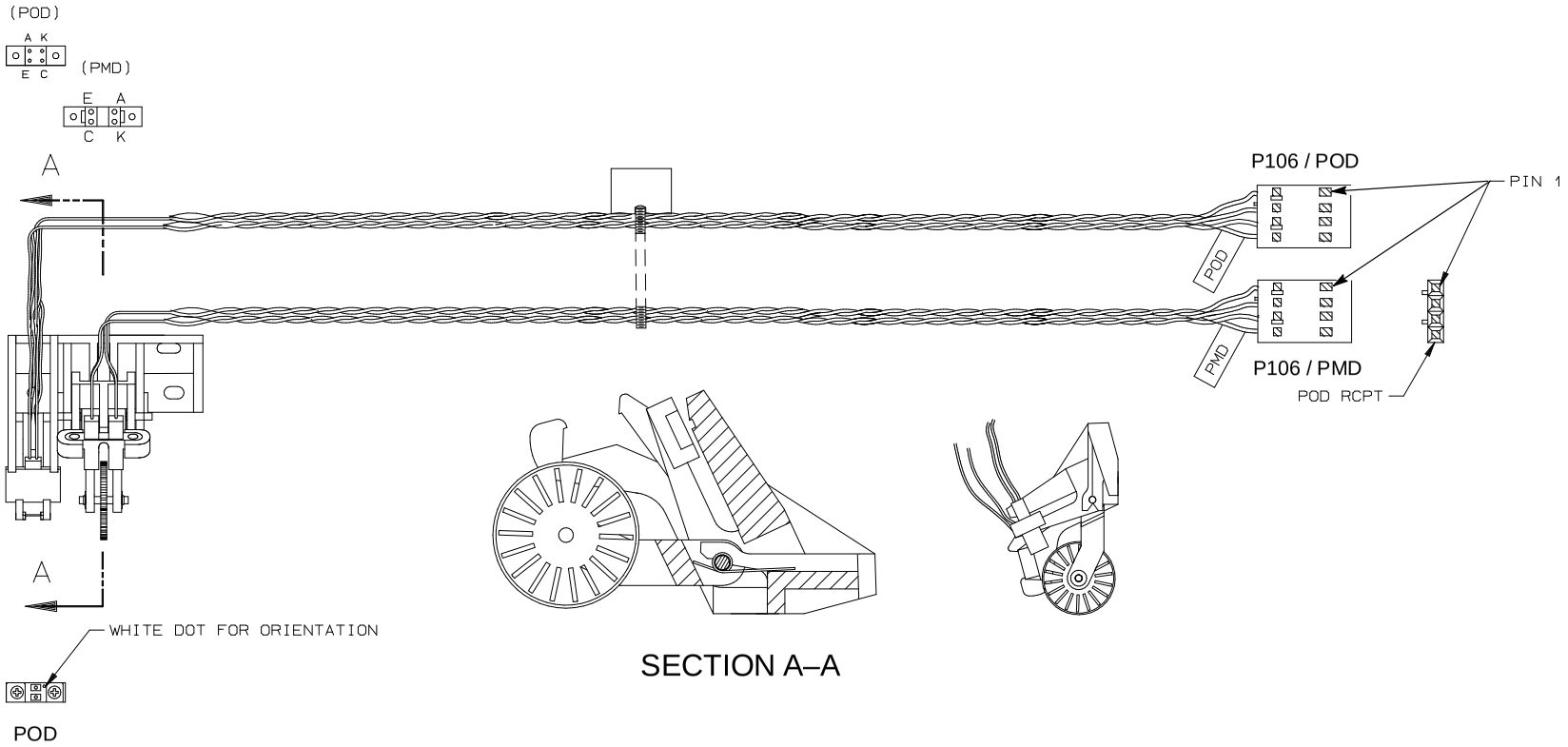
WIRE TABLE		
P116	J02	WIRE COLOR
1	1	BLACK
2	2	BLACK
3	3	BLACK

Part No.	Description
152420–901	Cable Assembly, Shuttle Motor Drive



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

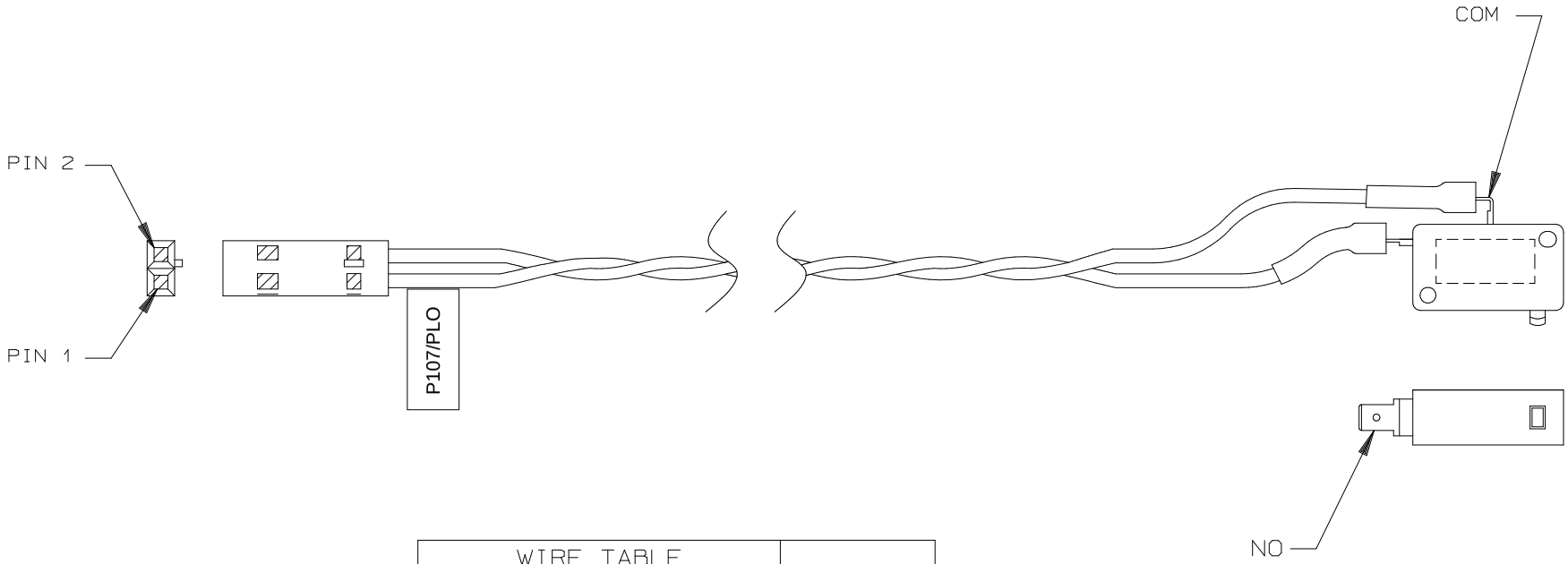
Part No.	Description
FD–51852–01	Fan Assembly, Hammer Bank



SECTION A–A

WIRE TABLE				
POD RCPT	PMD RCPT	POD	PMD	CABLE
PIN 1		PIN E		BLACK
PIN 2		PIN C		GRAY
PIN 3		PIN K		WHITE
PIN 4		PIN A		RED
	PIN 1		PIN A	BLACK
	PIN 2		PIN K	BROWN
	PIN 3		PIN C	ORANGE
	PIN 4		PIN E	RED

Part No.	Description
FD–51851–01	Switch Assembly, Paper Detector



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

Part No.	Description
FD–51853–01	Switch Assembly, Platen Interlock

B Printer Specifications

Contents

Duty Cycle

LG04*plus* prints 130, 000 pages per month
LG08*plus* prints 205, 000 pages per month
LG12*plus* prints 320, 000 pages per month
—under the following conditions:

- Uppercase text only
- 6 lines per inch (lpi)
- 10 characters per inch (cpi)
- 63% character density or 83 characters per line
- 63% line density or 42 lines per 11–inch page
- Single–part (18 lb) paper
- Printer is installed in accordance with the *Setup Guide*
- Printer is maintained in accordance with this maintenance manual

Ribbon Specifications

NOTE: Use only the Digital Equipment Corporation ribbons listed below:

Part Number	Description
LGxxR–SR	Carton of 1 OCR Application ribbon (LG04 ribbon) Length: 60 yards (54.84 m) Width: 1 inch (2.54 cm) Thickness: .0039 inches (.009906 cm)
LGxxR–LR	Carton of 1 OCR Application ribbon (LG04 ribbon) Length: 100 yards (91.4 m) Width: 1 inch (2.54 cm) Thickness: .0039 inches (.009906 cm)

To order replacement ribbons, call 1–800–DIGITAL.

Paper Specifications

Paper

Type:	Edge–perforated, fan–fold, 3 to 16 inches (7.62 to 40.64 cm) wide, 1 to 12 inches (2.54 to 30.48 cm) long
Thickness:	Single–part: 15 to 100 pound (6.80 to 45.36 kg) stock; Multi–part: 1– to 6–part forms (maximum 12 lb [5.44 kg] ply of upper plies)
Sheet Thickness:	0.025 inch (0.0635 cm) maximum
Drive:	Adjustable tractors (6–pin engagement)

Slew Rates:	Fast	Slow
LG04*plus*	12 ips	8 ips
LG08*plus*	16 ips	8 ips
LG12*plus*	20 ips	10 ips

Labels

On Backing:	One–part continuous perforated fanfold back form. Labels must be placed at least 1/6 inch (0.42 cm) from the fan–fold perforation. Backing adhesive must not be squeezed out during printing.
Sheet Size:	3 to 17 inches (7.62 to 40.64 cm) wide, including the two standard perforated tractor feed strips. A maximum sheet length of 16 inches (30.48 cm) between top and bottom perforations.
Thickness:	Not to exceed 0.025 inch (0.064 cm) (including backing sheet)

Printer Dimensions

Height: 41 inches (104.1 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

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)

Acoustic Noise Level

Acoustic Noise Levels per ISO 9296	
Printing	52 dB
	6.8 Bel
Standby	48 dB
	6.3 Bel
Geraeuschemission nach ISO 9296	
Druckend	52 dB
	6.8 Bel
Betriebsbereit	48 dB
	6.3 Bel

Energy Star

This printer complies with the requirements of the Energy Star Office Equipment Program of the U.S. Environmental Protection Agency.

Electrical Characteristics

Input Voltage

Line Voltage Design Range	Line Frequency	RMS Current		
		475 LPM	800 LPM	1200 LPM
88–135 V RMS	47–63 Hz	6A @ 100 V	6A @ 100 V	6A @ 100 V
178–270 V RMS	47–63 Hz	3A @ 200 V	3A @ 200 V	3A @ 200 V

Power Consumption

Operating Mode	Units	Power Consumption		
		475 LPM	800 LPM	1200 LPM
Standby	Watts	30	30	30
	BTU/Hour	100	100	100
Nominal*	Watts	180	220	275
	BTU/Hour	615	750	940
Maximum**	Watts	270	315	435
	BTU/Hour	920	1075	1485

Radio Frequency Interference (RFI)

Radio Frequency Interference tested/certified to RFI standards FCC Part 15, Subpart B, Class A; VDE 0871 Class B; CSA C108.8–M1983 Class A; EN 55022, Class B.

Interfaces

Type:	Two resident parallel host interfaces: Centronics and Dataproducts; One resident serial host interface (RS–232/RS–422); One resident serial diagnostic port.
Logic Levels:	TTL/EIA–232–D
Data Format:	ASCII or EBCDIC
Compatibility:	Centronics parallel, Dataproducts parallel, Serial EIA RS–232–D and RS–422–A.
Transfer Rates:	Up to 200 Kilobytes on parallel interfaces Up to 38.4K baud on RS–232 serial interface Up to 115K baud on RS–422 serial interface

Printing Rates

The printing speed of text is measured in lines per minute (lpm), and is a function of the selected font and the vertical dot density. Printing speed is independent of the number of characters configured in the character set repertoire. Print rates for lines containing attributes such as bold or emphasized printing, superscripts, subscripts, or elongated attributes will decrease to not less than half the rates of the font without such attributes. The exact print rate of lines containing these attributes depends on the specific print job, but software maximizes the throughput by dynamically determining which dot rows contain adjacent dots and must be printed in two strokes.

The reverse paper feed capability allows the printing of multiple densities on a single line. This is useful in printing forms and text together or in mixing different fonts on a print line. Use of multiple densities and reverse paper feed also affects throughput. (Due to paper path restrictions, pedestal models have only limited reverse paper capability.)

Table B–1. Printing Rates

PRINT QUALITY DOT DENSITY (DPI) NOTE 1	CHARACTERS PER INCH	DOT MATRIX NOTE 2	PERFORMANCE								
			UPPERCASE ONLY LPM			DESCENDERS & UNDERLINE LPM			PLOT MODE IPM		
			LG04	LG08	LG12	LG04	LG08	LG12	LG04	LG08	LG12
CORRESPONDENCE 90 (180) X 96	10 12 15	7 (13) X 9 + 3 6 (11) X 9 + 3 (9) x 9 + 3	190	320	480	147	246	370	19.8	33.3	50
DATA PROCESSING 60 (120) X 72	10 12 13.3 15 17.1	5 (9) X 7 + 2 4 (7) X 7 + 2 4 (7) X 7 + 2 3 (5) X 7 + 2 3 (5) X 7 + 2	356	600	900	285	480	720	39.6	67.7	100
HIGH SPEED 60 (120) X 48	10 12 13.3	5 (9) X 5 + 1 4 (7) X 5 + 1 4 (7) X 5 + 1	475	800	1200	407	912	1026	59.3	100	150

NOTE 1 A (B) X C, where:
A is maximum horizontal dot density
B is horizontal dot placement density
C is vertical dot density

NOTE 2 D (E) X F + G, where:
D is maximum number of dots that may be placed on E horizontal dot positions
F is number of vertical dots for uppercase symbols
G is number of dots available for descenders

C Metric Conversion Tables

Length

Multiply	By	To Obtain
foot	0.3048*	meter (m)
foot	30.48*	centimeter (cm)
foot	304.8*	millimeter (mm)
inch	0.0254*	meter (m)
inch	2.54*	centimeter (cm)
inch	25.4*	millimeter (mm)
meter	3.280840	foot
centimeter	0.03280840	foot
millimeter	0.003280840	foot
meter	39.37008	inch
centimeter	0.3937008	inch
millimeter	0.03937008	inch
	* Figure is exact.	

Torque and Force

Multiply	By	To Obtain
pound–inch	0.11298	Newton–meter (N•m)
pound–foot	1.3558	Newton–meter (N•m)
Newton–meter (N•m)	8.8511	pound–inch
Newton–meter (N•m)	0.7376	pound–foot
pound	4.4482	Newton (N)
Newton (N)	0.22481	pound

Mass and Density

Multiply	By	To Obtain
pound*	0.4535924	kilogram (kg)
ounce*	28.34952	gram (g)
kilogram	2.204622	pound*
gram	0.03527397	ounce*
	* avoirdupois	

Temperature

To Convert From	To	Use Formula
temperature Celsius (t_C)	temperature Fahrenheit (t_F)	$t_F = 1.8t_C + 32$
temperature Fahrenheit (t_F)	temperature Celsius (t_C)	$t_C = (t_F - 32)/1.8$

Power

Multiply	By	To Obtain
Btu (International Table)/hour	0.2930711	watt (W)
watt (W)	3.412141	Btu (International Table)/hour
watt (W)	0.001359621	horsepower (metric)
horsepower (metric)	735.499	watt (W)

D Torque Table

NOTE: The table below establishes the torque requirements for routine installation of threaded fasteners. These requirements apply to fasteners made of steel, at a minimum engagement of 3.5 threads, including chamfer and countersink. Fastener sizes are listed as Numbered Size – Threads Per Inch.

Torque Table

Carbon Steel Fasteners (ANSI B18.6.3 – 1972)				
Fastener Size	**Into Alum. or Brass** 25,000 psi ultimate tensile strength	**Into Steel** 60,000 psi ultimate tensile strength	**Into Weld/Press Studs or Nuts**	**Into Medium Carbon Steel Fasteners** 105,000 psi ultimate tensile strength
2–56	25 ± 2 in oz	36 ± 2 in oz	30 ± 2 in oz	—
4–40	62 ± 4 in oz	75 ± 5 in oz	70 ± 5 in oz	—
6–32	122 ± 7 in oz	150 ± 10 in oz	135 ± 10 in oz	—
8–32	11 ± 1 in lb	18 ± 1 in lb	18 ± 1 in lb	—
10–24	20 ± 1 in lb	25 ± 1.5 in lb	21 ± 1 in lb	—
10–32	15 ± 1 in lb	29 ± 2 in lb	29 ± 1 in lb	—
1/4 – 20	40 ± 3 in lb	62 ± 4 in lb	62 ± 4 in lb	105 ± 5 in lb

Fastener Size	**Torque for Routine Tightening of Threaded Fasteners**
4–40 UNC & 4–48 UNF	4 ± 1 in lb
6–32 UNC & 6–40 UNF	11 ± 1 in lb
8–32 UNC & 8–36 UNF	19 ± 1 in lb
10–24 UNC & 10–32 UNF	25 ± 1 in lb

E Abbreviations and Signal Mnemonics

NOTE: Mnemonics with first letter “N” are negative true.

ACRONYM/ MNEMONIC	DEFINITION
µF	microfarad (10^{-6} farad)
µs	microsecond (10^{-6} second)
µsec	microsecond (10^{-6} second)
A0, A1, etc.	Address 0, Address 1, etc.
AC	Alternating Current
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
BTU	British Thermal Unit
BUD	Buffered Upper Driver

CA	Cathode
CC	Card Cage
CCF	Card Cage Fan
CE	Customer Engineer
CHNG	Change
CLK	Clock
COLL	Collector
CONTLR	Controller
CMD	Command
CMX	Manufacturer’s designation of the controller board
CNC	Connector, Connection
CPI	Characters Per Inch
CTL	Control
CTS	Clear to Send
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 board)
DCD	Data Carrier Detect
DIAG	Diagnostic
DIFF	Differential
DMA	Direct Memory Access
DP	Data Processing, DataProducts
DPMC	Dot Plucker Memory Controller
DPU	Data Processing Unit
DRAM	Dynamic Random–Access Memory
DRVR	Driver
DSR	Data Set Ready
DTR	Data Terminal Ready
EC	Engine Controller (a functional unit of the CMX board)
EEPROM	Electrically Erasable/Programmable Read-Only Memory
EHF	Exhaust Fan
EMIT	Emitter
EPROM	Electrically Programmable Read-Only Memory

ERR . . . . . Error
ESD . . . . . Electrostatic Damage
EX . . . . . Exhaust, Extra
EXH . . . . . Exhaust
EXF . . . . . Exhaust Fan
EXP . . . . . Expansion

FD . . . . . Feed
FF . . . . . Form Feed
FLT . . . . . Fault
FLTR . . . . . Filter
FP . . . . . Front Panel (Operator Panel)
FTIC . . . . . Fire Timer Integrated Circuit

GND . . . . . Ground

HB . . . . . Hammer Bank
HBF . . . . . Hammer Bank Fan
HBL . . . . . Hammer Bank Logic
HD . . . . . Hammer Driver
HDIC . . . . . Hammer Driver Integrated Circuit
HDPH . . . . . Hammer Driver Phase
HBP . . . . . Hammer Bank Power

IC . . . . . Integrated Circuit
ID . . . . . Identification
IGP . . . . . Intelligent Graphics Processor
INT . . . . . Interrupt
I/O . . . . . Input/Output
IPS . . . . . Inches Per Second

(J) . . . . . Jack connector

L . . . . . Left
LCD . . . . . Liquid Crystal Display
LED . . . . . Light Emitting Diode
LPI . . . . . Lines Per Inch

LPM . . . . . Lines Per Minute
LRIB . . . . . Left Ribbon
LRP . . . . . Left Ribbon Guide

M . . . . . Motor
MAIN . . . . . Maintenance Jack, RS–232
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)
NVRAM . . . . . Nonvolatile Random–Access Memory

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
PCBA . . . . . Printed Circuit Board Assembly
PCB . . . . . Printed Circuit Board
PE . . . . . Printer Error, Paper Empty
PER . . . . . Peripheral Device
PF . . . . . Paper Feed, picofarad (10^{-12} farad)

PFC . . . . . Paper Feed Controller
PFM . . . . . Paper Feed Motor
PI . . . . . Paper Instruction
PLAT . . . . . Platen
PLM . . . . . Platen Motor
PLO . . . . . Platen Open (Switch)
PMD . . . . . Paper Motion Detect
PN . . . . . Pin
P/N . . . . . Part Number
PO . . . . . Paper Out
POD . . . . . Paper Out Detect
PPR . . . . . Paper
PROM . . . . . Programmable Read–Only Memory
PS . . . . . Power Supply
PS5 . . . . . Power Supply + 5 Volt
PWM . . . . . Pulse Width Modulation

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
RTPU . . . . . Real–Time Processing Unit
RTS . . . . . Request to Send
RXD . . . . . Receive Data

SCS . . . . . SNA Character Stream
SEC . . . . . Security (Key)
SEL . . . . . Select
SEN . . . . . Sense, Sensor
SHH . . . . . Shuttle Hall (Effect)
SHM . . . . . Shuttle Motor
SHUT . . . . . Shuttle
SIMM . . . . . Single Inline Memory Module
SLCT . . . . . Select (On–line)
SMD . . . . . Shuttle Motor Drive
SNA . . . . . Systems Network Architecture
SPU . . . . . Shuttle Processor Unit
SRAM . . . . . Static Random–Access Memory
STAT . . . . . Status
STBY . . . . . Standby
STK . . . . . Stacker
SW . . . . . Switch

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
USART . . . . . Universal Synchronous/Asynchronous Receiver/Transmitter

V . . . . . Volts
V_{CC} . . . . . Voltage at Collector
V_{DD} . . . . . Voltage at Drain
V_{SS} . . . . . Voltage at Source
VX . . . . . A special ASIC on the CMX board containing circuits that help the DC operate. The initials VX do not signify words; they serve only to identify this ASIC.

WR . . . . . Write

w/ . . . . . With
w/o . . . . . Without

XMT . . . . . Transmit

F 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.

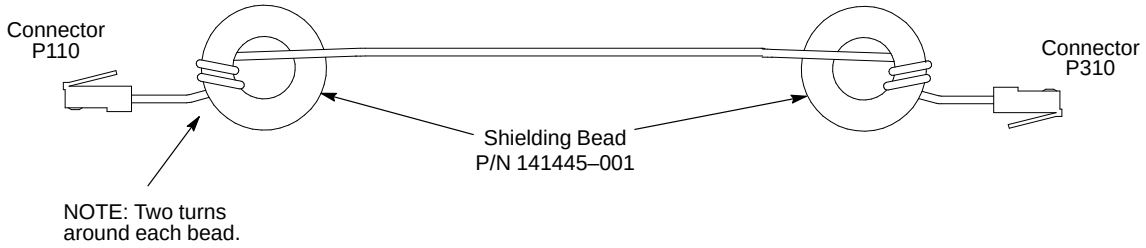
Two kinds of ferrite noise suppressors are used:
1. Shielding Bead (P/N 141445–001)—Cylindrical core through and around which the control panel cable assembly is wound. Two are required.
2. Ferrite Clamp (P/N 202049–001)—A noise suppression core housed in a hinged plastic case and attached with adhesive to the wall of the card cage. The parallel I/O cable assembly passes through this core.

Figure F–1 shows how these devices are installed.

IMPORTANT

Duplicate the number of turns around the shielding beads when installing or replacing the control panel cable. See NO TAG.

Control Panel Cable Assembly



Parallel I/O Cable Assembly

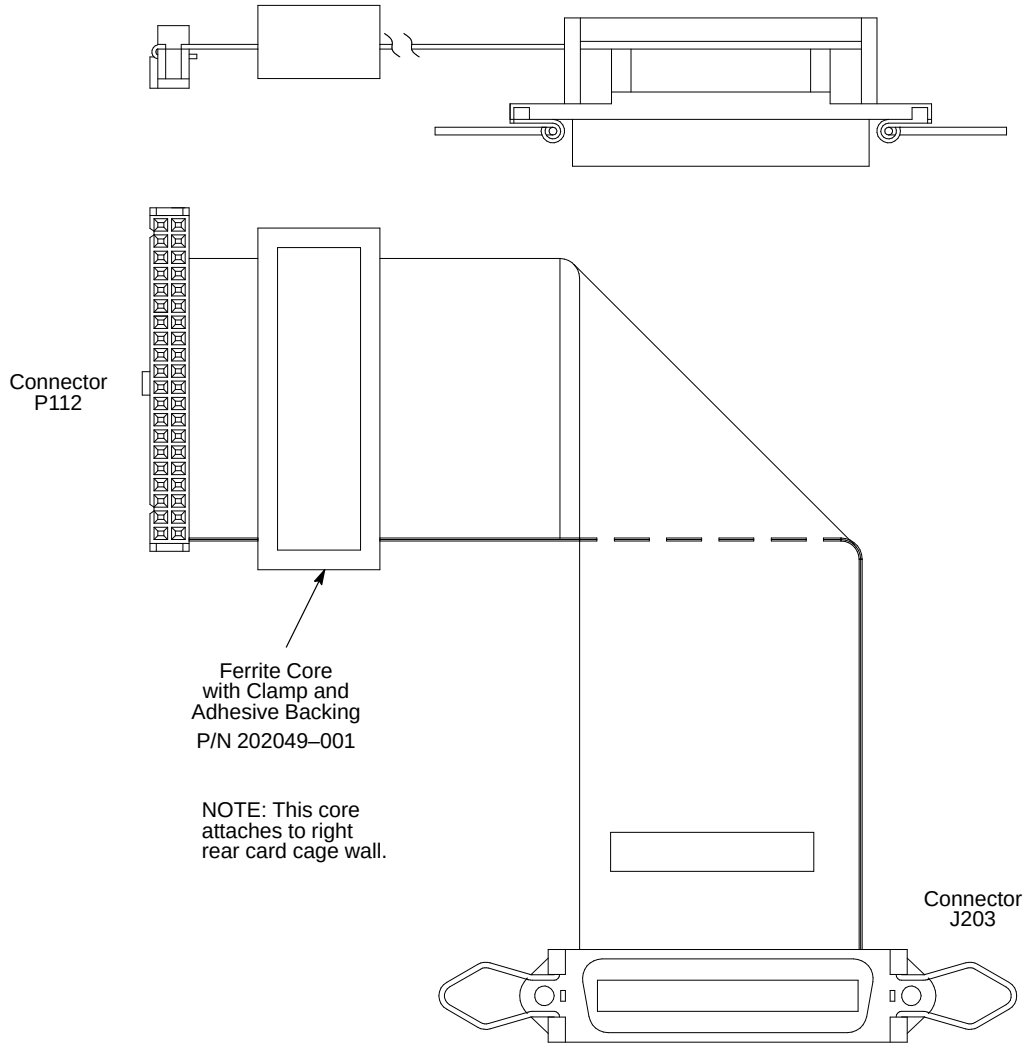


Figure F–1. Ferrite Core Installation

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