LG06
Text and Graphics Printer

Maintenance Manual

digital ™

LG06
Text and Graphics Printer

Maintenance Manual

Order Number: EK–ELG06–MG

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FCC USER STATEMENT

NOTICE:

This equipment generates, uses, and may emit radio frequency. The equipment has been type tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such radio frequency interference. Operation of this equipment in a residential area may cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

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1 Maintenance Overview

Chapter Contents

About This Manual

This manual explains how to maintain and repair the LG06 printer at the field service level of maintenance. This manual covers alignments and adjustments, preventive and corrective maintenance, troubleshooting, and basic principles of operation.

Related Documents

Information about operating the LG06 printer is in the *User's Manual*.

How to Use This Manual

This manual is designed so you can quickly find the information you need to maintain and repair the *Encore* printer. You can locate maintenance information three ways:

- Use the **Table of Contents** at the front of the manual.
- Use the **Chapter Contents** list on the first page of each chapter.
- Use the **Index** at the back of the manual.

Read the entire procedure before beginning any maintenance task. Gather all required tools and make sure you understand all warnings, cautions, and notes before you begin working on the printer.

Warnings and Special Information

Always read and comply with information highlighted by special headings. The headings reveal the nature of the information:

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

CAUTION
Conditions that could damage the printer or related equipment.

IMPORTANT
Information vital to proper operation of the printer.

NOTE: Information considered important enough to emphasize.

Printing Conventions in This Manual

Switches and indicators labeled on the printer are printed uppercase in this manual. Example: "Press the ON LINE switch to take the printer off–line."

If a control is not labeled on the printer, it is printed lowercase. Example: "Set the forms thickness lever to the fully open position."

Messages that appear on the control panel display are printed inside quotation marks in lowercase with the first letter capitalized. Example: "Save Config" appears on the message display.

Controls and Indicators

The locations of the printer cover, cabinet doors, and operator control panel are shown in Figure 1–1.

Electrical controls and indicators are described in Table 1–1 and illustrated in Figure 1–2.

Mechanical controls and indicators are described in Table 1–2 and illustrated in Figure 1–3.

Printer Cover
Lift to open

Operator
Control
Panel

See Detail **Ⓐ**

Floor Cabinet
Front Door

Hinged on left.
Magnetic latch.
Open by pulling
right edge.

Rear Door
(Not shown)

Hinged on left.
Magnetic latch.
Open by pulling
right edge.

Ⓐ **Operator Control Panel**

CLEAR

UP

R/S

PREV   NEXT

SET TOF

ENTER

DOWN

ON LINE   FF   LF   VIEW
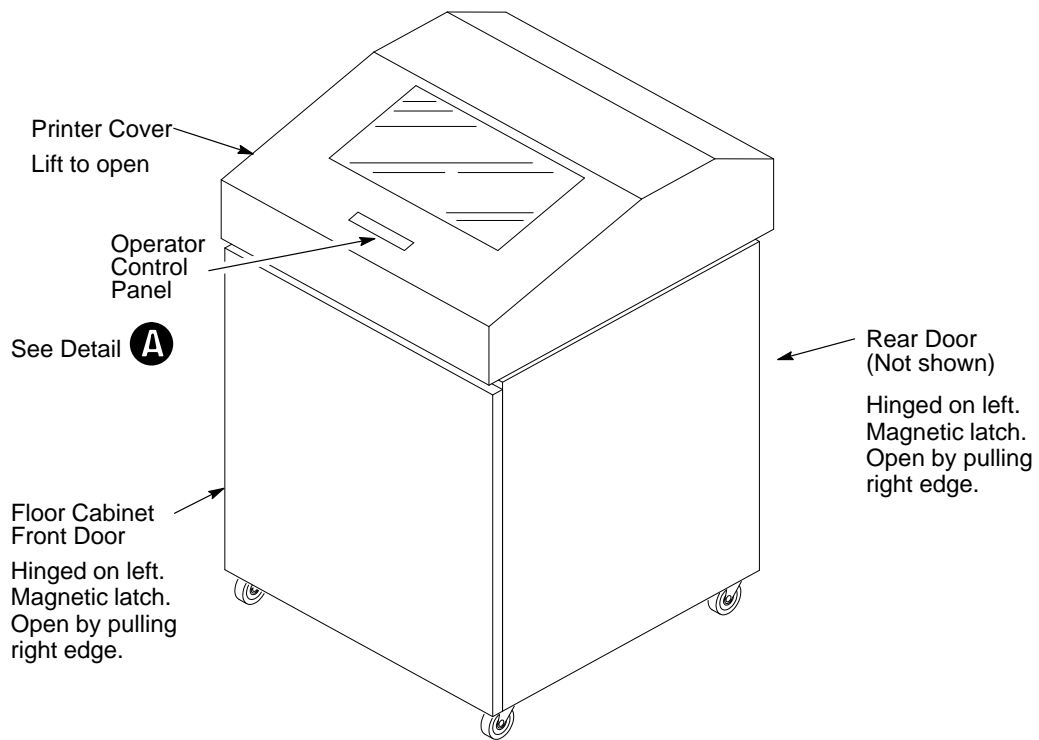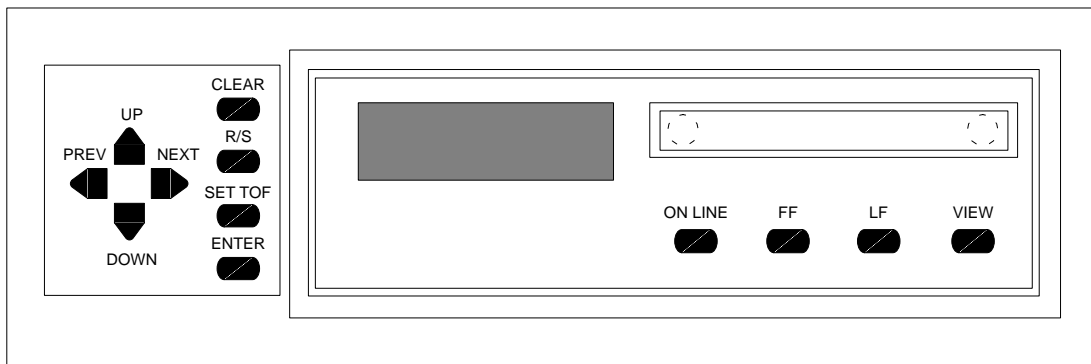
Figure 1–1. Printer Cover, Door(s), and Operator Control Panel

Table 1–1. Electrical Controls and Indicators

Switch or Indicator	Function
NOTE: Only the ON LINE switch operates when the printer is on–line. All other switches operate only in the off–line state.	
│ /O	│ = On O = Off Turns printer on and off. Switch is also a circuit breaker.
Status lamps	Illuminate when printer is on–line. Flash alternately to indicate fault. Off when printer is off–line.
Message display	Displays printer status and error messages.
ON LINE	Toggles the printer on–line and off–line.
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.
UP	Locks and unlocks ENTER switch when pressed simultaneously with DOWN switch. Also causes display of configuration menus, submenus, and diagnostic tests.
DOWN	See above.
PREV	Displays previous parameter in a configuration or diagnostic test menu.
NEXT	Displays next parameter in a configuration or diagnostic test menu.
CLEAR	Clears printer after a fault is corrected. Returns printer to off–line state from within a configuration menu. Resets printer when pressed simultaneously with R/S switch.
R/S	Runs and stops configuration and self tests. Runs and stops hex dump. Resets printer when pressed simultaneously with CLEAR switch.
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.

Power Switch

(On) (Off)

Message Display

Status Lamps

CLEAR
UP
PREV   NEXT
R/S
SET TOF
DOWN
ENTER

ON LINE   FF   LF   VIEW

A
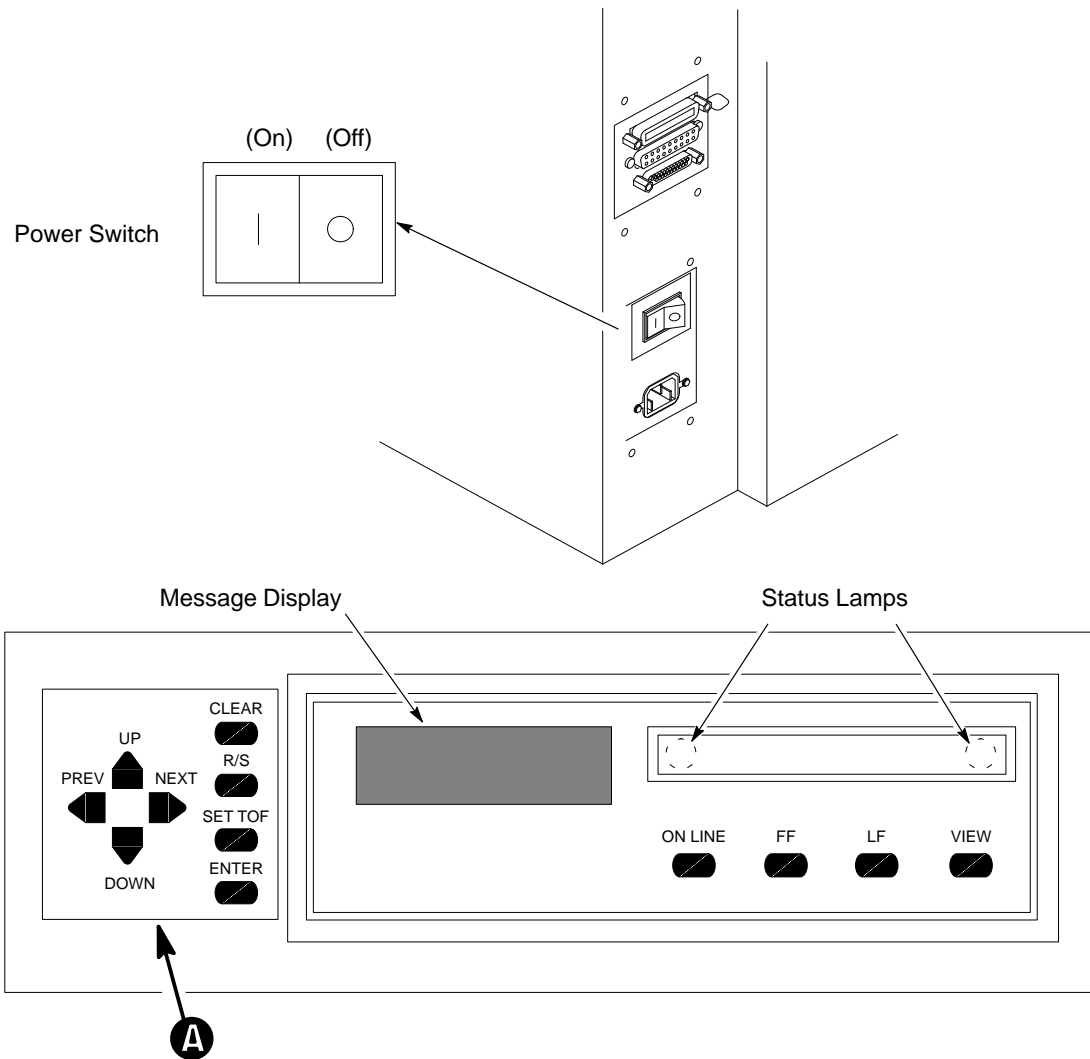
A   Raise Printer Cover to
Access These Switches

CLEAR
UP
PREV   NEXT
R/S
SET TOF
DOWN
ENTER
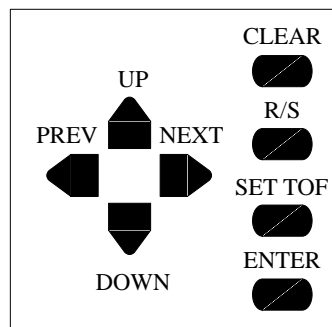
Figure 1–2. Electrical Controls and Indicators

Table 1–2. Mechanical Controls and Indicators

Control or Indicator (See Figure 1–3)	Function
Forms thickness lever	Sets platen for paper and forms of different thicknesses. Must be fully opened (raised) to load paper.
Forms thickness pointer and scale	Indicates *relative* thickness of forms or paper. Set the forms thickness lever at A for thin (single–part) forms, B for thicker forms, and so on.
Tractors (2)	Hold and feed paper. Used to set left margin. Left tractor moves about one inch. Right tractor moves full range.
Tractor locks (2)	Lock tractors in position.
Horizontal adjustment knob	Allows fine positioning of left print margins. Moves paper left or right.
Vertical position knob	Used to set top of form or first line to be printed. Rotate to move paper vertically.

Horizontal
Adjustment
Knob

Left Tractor Door

Right Tractor Door

Tractor
Lock

Vertical
Position
Knob

Tractor
Lock

Forms Thickness
Lever and Scale

Forms Thickness Pointer
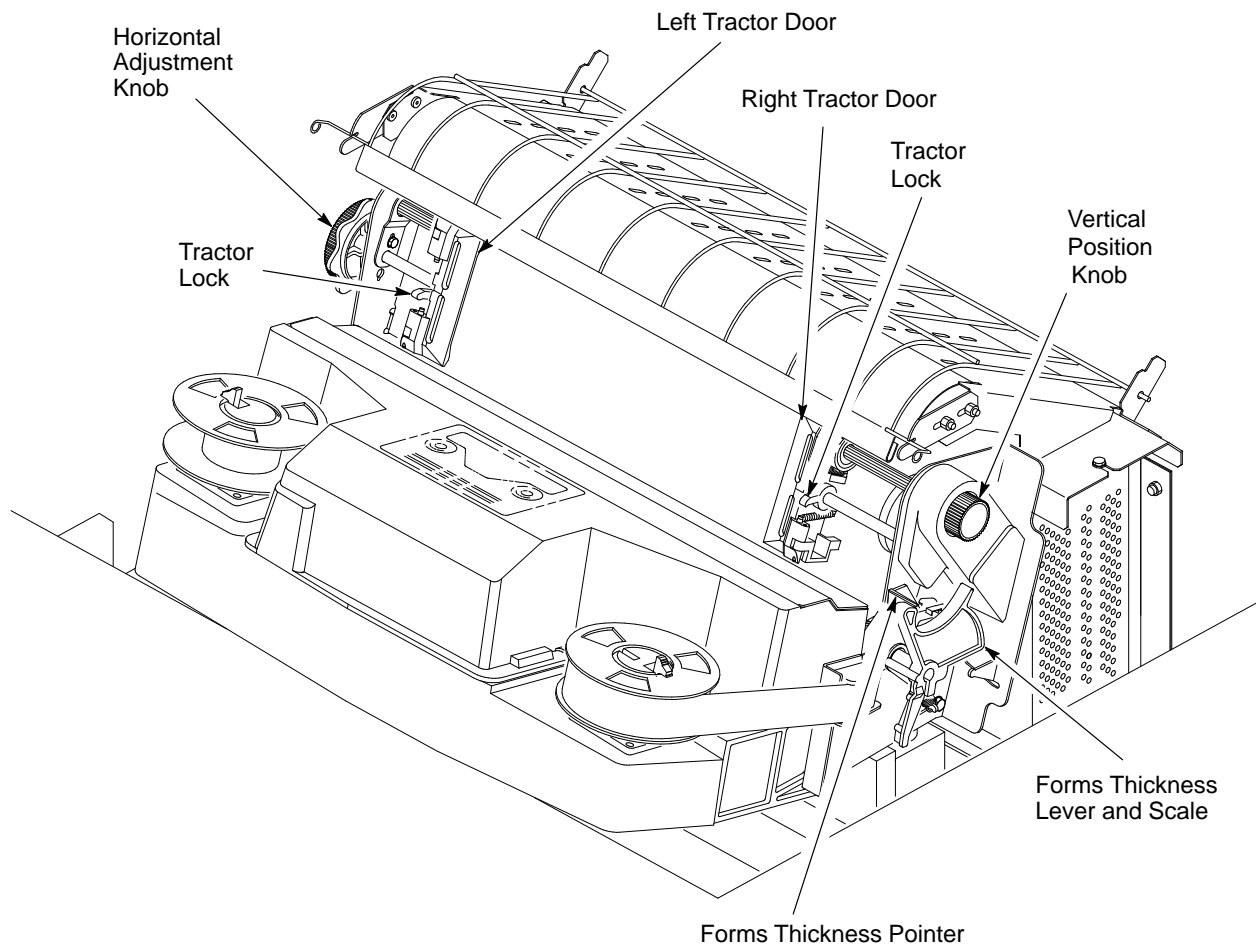
Figure 1–3. Mechanical Controls and Indicators

Tools, Test Equipment, and Supplies

The tools, test equipment, and supplies required for field level maintenance of LG06 printers are listed in Table 1–3.

Table 1–3. Tools, Test Equipment, and Supplies

Item	Part No.
Adhesive, Loctite™ (adhesive, methacryl)	101854–002
Alcohol, anhydrous (must contain no water)	–
RTV silicone sealant	101537–001
Adjustable wrench	–
Diagonal cutters	–
Digital voltmeter	–
Extension 3 in., 3/8 in. drive	–
Feeler gauge set	–
Force gauge (Chatillon™ NY, Gauge–R, 0–20 lb)	CAT 719–20
Gauge, platen position	996083–200
Kimwipes ™	–
Lubricant, bearing (Lubriko™ M–3, Master Lubricant Co.)	101805–001
Nut driver set	–
Oscilloscope and probes (35 MHz or better)	–
Pliers, grip ring	–
Pliers, chain nose	–
Ratchet, 3/8 in. drive	–
Rule, steel, 6 in.	–
Screwdriver, torque, Utica TS–35	29–17381–00
Adapter, 1/4 in. hex to 1/4 in. square, Utica HW–18	29–24723–00
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	24–18504–00
Hex bit, 5/64 in., torque screwdriver	–
Screwdriver, Allen hex (set), w/extension	–
Screwdriver, Phillips	–
Screwdriver, Phillips	–
Screwdriver, slot	–
Screwdriver, slot	–
Socket, 7/16 in., 3/8 in. drive	–
Tweezers	–

2 Scheduled Maintenance

Chapter Contents

Preventive Maintenance Checks and Services (PMCS)

Perform preventive maintenance checks and services (PMCS) every six months or after every 1000 hours of operation, whichever comes first.

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

PMCS are listed in Table 2–1.

WARNING

Disconnect the ac power cord before performing PMCS. 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 1000 hours of operation, whichever occurs first.	Inspect the printer.	2–3
	Clean the printer.	2–4
	Check and adjust platen gap.	4–18

Inspecting the Printer

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

Table 2–2. Physical Inspection

Item(s) 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

CAUTION

Do not use abrasive cleaners, particularly on the window. Do not drip water into the printer. Damage to the equipment will result. When using spray solutions, do not spray directly onto the printer; spray the cloth, then apply the dampened cloth to the printer.

Cleaning Outside the Cabinet

1. Wipe the cabinet with a clean, lint–free cloth dampened (not wet) with water and mild detergent or window cleaning solution.

2. Dry the cabinet with a clean, lint–free cloth.

3. Clean the inside of the cabinet. (See below.)

Cleaning Inside the Cabinet (Figure 2–1)

1. Set the power switch to the O (off) position.

2. Disconnect the ac power cord from the printer.

3. Open the printer cover.

4. Move the forms thickness adjustment lever (1) to the fully–open position.

5. Remove paper from the printer.

6. Squeeze the locking latch (2) and lift the ribbon spools (3) from the ribbon hubs (4).

7. Using a soft–bristled brush, wipe off paper dust and ribbon lint. Vacuum up the residue. Pay particular attention to the tractors (5), shuttle cover assembly (6), and base casting (7).

8. Wipe the splined shaft (8) with a soft cloth.

CAUTION

To avoid corrosion damage, use only anhydrous alcohol when cleaning printer mechanical elements. The cleaning solution must contain no water.

9. Using a cloth dampened with anhydrous alcohol, clean the ribbon guides (9).

10. Vacuum up dust or residue that has accumulated inside the lower cabinet.

11. Wipe the lower cabinet interior with a clean, lint–free cloth dampened with water and mild detergent or window cleaning solution.

12. Dry the cabinet interior with a clean, lint–free cloth.

13. Clean the shuttle assembly (page 2–6).

1. Forms Thickness Lever
2. Locking Latch (2)
3. Ribbon Spool (2)
4. Ribbon Hub (2)
5. Tractor (2)
6. Shuttle Cover Assembly
7. Base Casting
8. Splined Shaft
9. Ribbon Guide (2)
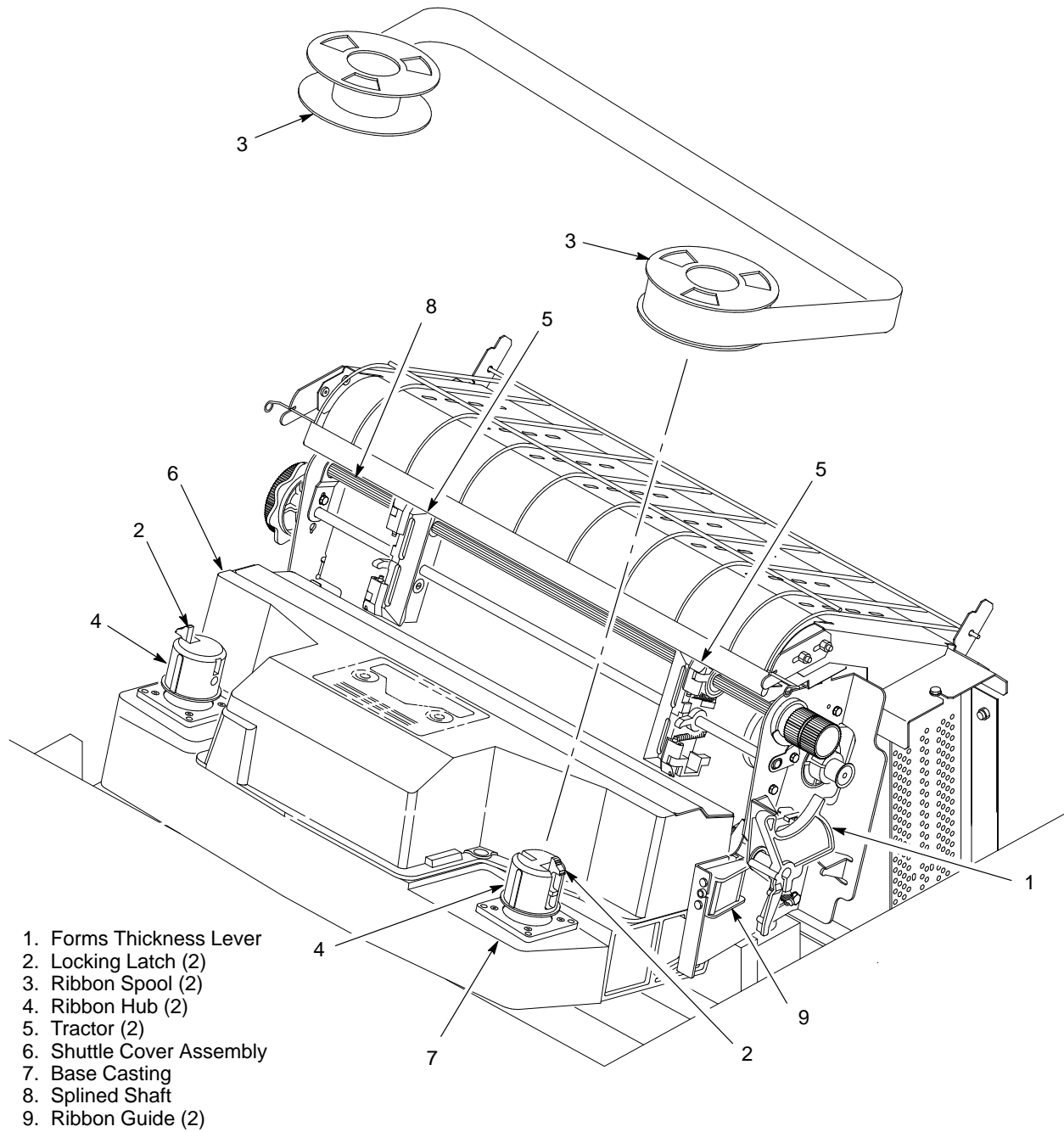
Figure 2–1. Cleaning Inside the Cabinet

Cleaning the Shuttle Frame Assembly (Figure 2–2)

1. Remove the shuttle cover assembly (page 5–24).

2. Remove the shuttle frame assembly (page 5–66).

3. Remove the paper ironer (page 5–44).

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 anhydrous alcohol. Wipe the paper ironer to remove lint, ink, and paper residue.

5. Install the paper ironer (page 5–44).

6. Remove the hammer bank cover assembly (1).

7. Moisten a clean, soft cloth with anhydrous alcohol. Wipe the hammer bank cover assembly to remove lint, ink, and paper residue. Clean the holes in the cover strips.

CAUTION

Use of excessive force can chip hammer tips.

8. Using a stiff, non–metallic brush (such as a toothbrush) and anhydrous alcohol, carefully brush the hammer tips (2) 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. With the thick plate facing the hammer bank, engage the hammer bank cover assembly (1) on the alignment pins (3).

10. Rotate the hammer bank cover assembly (1) until it lies flush on the hammer bank.

11. Check that the hammer bank cover assembly is properly positioned over the alignment pins (3) and hammer tips.

12. Install the shuttle frame assembly (page 5–66).

13. Install the shuttle cover assembly (page 5–24).

14. Clean the card cage fan assembly (page 2–8).

Hammer Tip

Thin plate

Thick plate

Hammer Bank
Cover Assembly

Roll pin (2)
(Not shown)
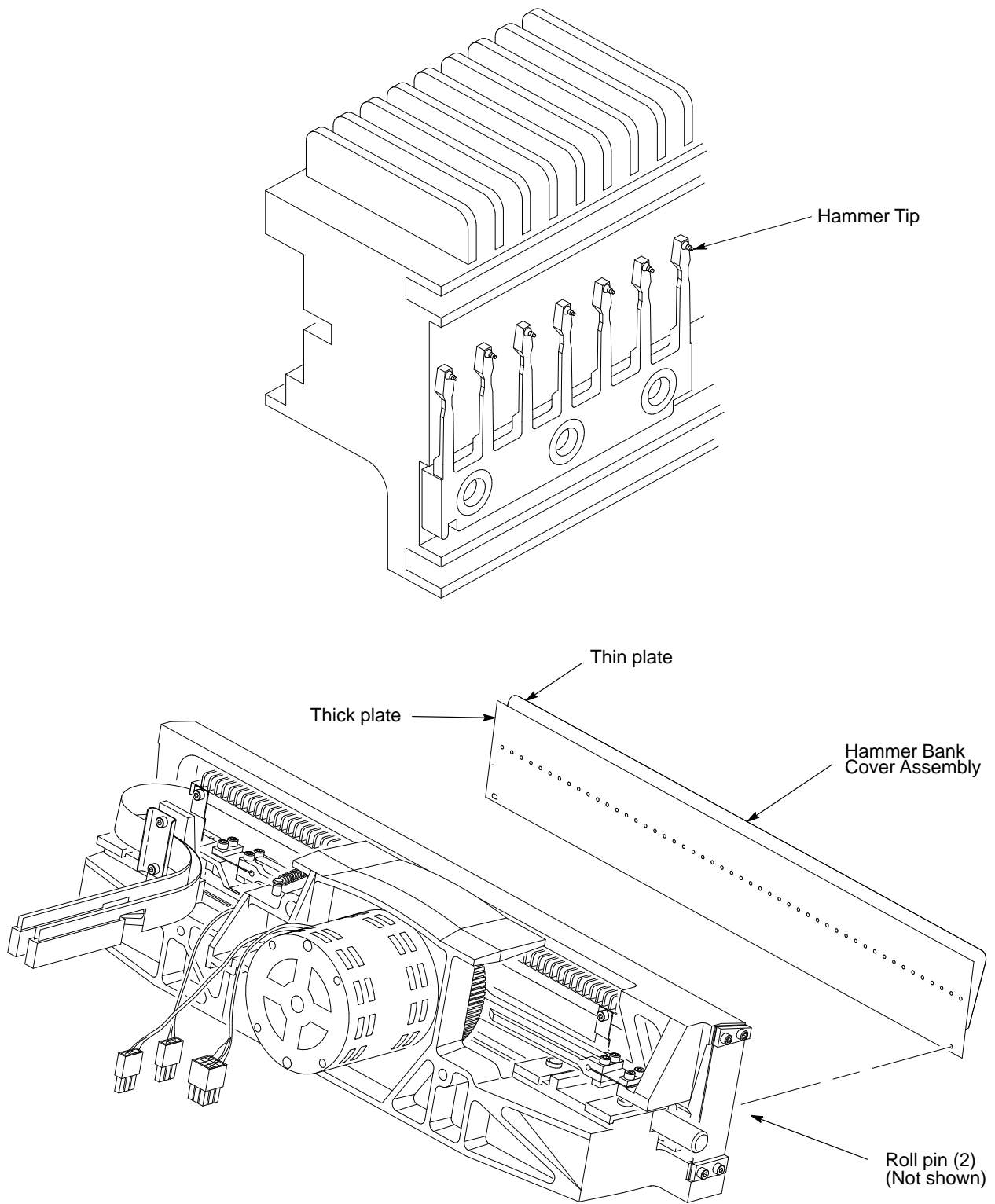
Figure 2–2. Cleaning the Shuttle Frame Assembly

Cleaning the Card Cage Fan Assembly (Figure 2–3)

1. Open the printer cover.

2. Remove the paper guide assembly (page 5–42).

3. Vacuum the card cage fan assembly (1) and surrounding areas to remove paper particles, dust, and lint.

4. Install the paper guide assembly (page 5–42).

5. Close the printer cover.

6. Connect the ac power cord to the printer.

Card Cage
Fan Assembly
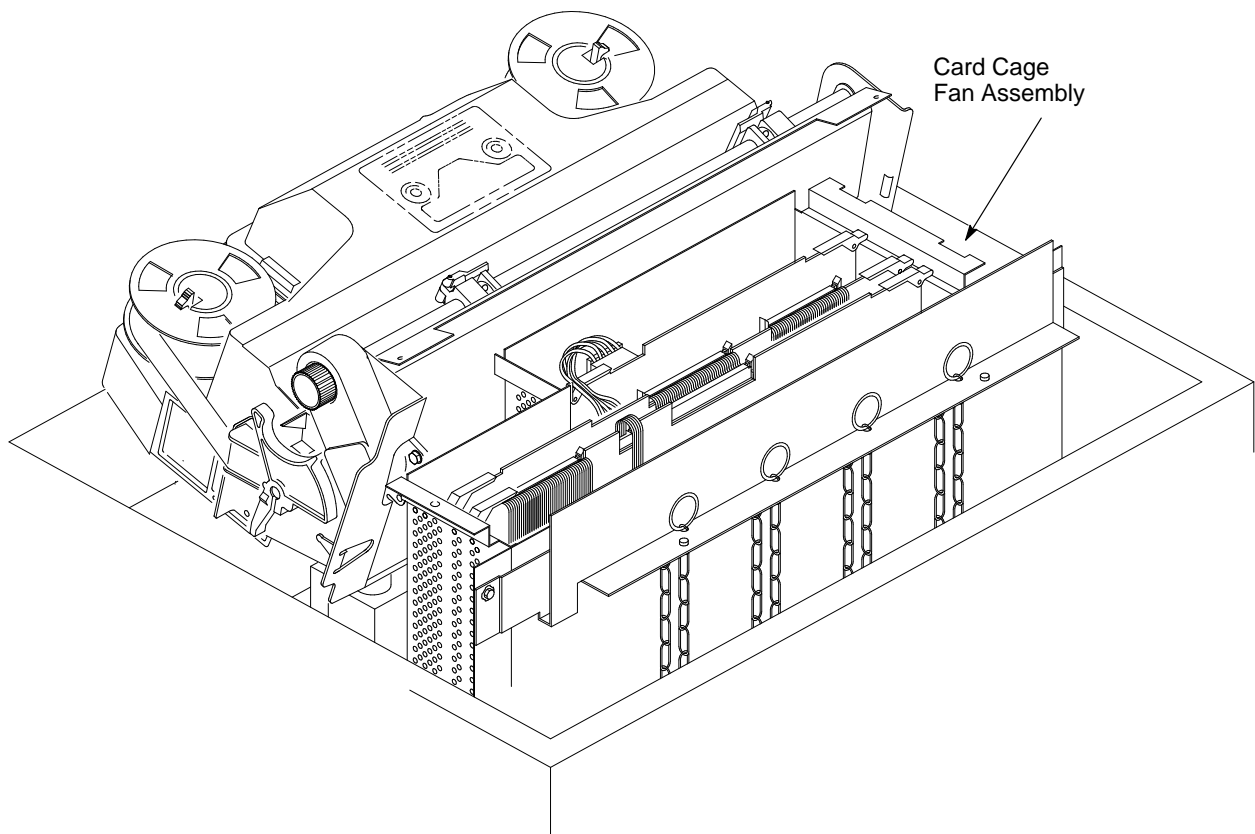
Figure 2–3. Cleaning the Card Cage Fan Assembly

3 Troubleshooting

Chapter Contents

Introduction

This chapter contains procedures for troubleshooting printer malfunctions.

You must operate the printer to check printer performance, so have the *User's Manual* at the printer site. Although diagnostic test procedures are covered in this chapter, basic printer operation is not covered.

Fault Messages

This section lists the fault messages that can appear on the control panel display. The messages are listed in alphabetical order, followed by a troubleshooting table.

If a fault condition occurs in the printer, the status lamps on the control panel flash on and off and the first line of the display indicates "Fault Condition." The second line of the display indicates the specific fault.

There are two types of displayed faults:

- Operator correctable
- Field–service required, indicated by an asterisk (*) next to the fault message

IMPORTANT

Test the printer after each corrective action. Stop maintenance when the symptom disappears. Always press the CLEAR switch after correcting a fault indicated by a fault message.

48 Volt Failed *

	Instruction	Indication	Yes	No
1.	Set power switch to O (off). Wait 15 seconds. Set power switch to 1 (on).	"48 Volt Failed * " message.	Step 2.	Return printer to normal operation.
2.	Press the CLEAR switch.	"48 Volt Failed * " message.	Step 3.	Return printer to normal operation.
3.	Remove paper guide assembly (page 5–42).	—	Step 4.	—

Instruction	Indication	Yes	No
4. Disconnect cable assembly W1, CCB/Mech Driver, from connector J1 on the CCB and connector J6 on the Mech Driver board.	—	Step 5.	—
5. Power up the printer.	Card cage fan comes on.	Replace the common controller PCBA (page 5–46).	Reattach cable assembly W1, CCB/Mech Driver, to connector J1 on the CCB and connector J6 on the Mech Driver board, and go to step 6.
6. Pull the Mech Driver board up so that it clears the bottom edge connectors.	—	Step 7.	
7. Disconnect +5Volt connector PS5 (cable assembly W2) from the power supply board and put a 1K Ohm resistor between pins 1 and 2.	—	Step 8.	
8. Remove the Mech. Driver board.	—	Step 9.	
9. Power up the printer. Check for +48 V at power supply cable W3 connector PS: pin 8 = +48 V, pin 15 = ground. (See Appendix D for cable interconnections.)	+ 48 Volts at pin 8.	Replace the mechanism driver PCBA (page 5–48) and go to step 10.	Replace the power supply PCBA (page 5–50) and go to step 10.
10. Cycle power and check for the fault message.	"48 Volt Failed * " message.	Replace cable assembly W2, +5V. (See Appendix D.) Go to step 11.	Return printer to normal operation.
11. Cycle power and check for the fault message.	"48 Volt Failed * " message.	Replace cable assembly W3, Hi Voltage. (See Appendix D.) Go to step 12.	Return printer to normal operation.
12. Cycle power and check for the fault message.	"48 Volt Failed * " message.	Replace cable assembly W6, P4980A Main Wire Harness. (See Appendix D.)	Return printer to normal operation.

Dynamic RAM Fault *

	Instruction	Indication	Yes	No
1.	Set power switch to O (off). Wait 15 seconds. Set power switch to 1 (on).	"Dynamic RAM Fault * " message.	Step 2.	Return printer to normal operation.
2.	Disconnect the input data line from the host computer. Set power switch to O (off). Wait 15 seconds. Set power switch to 1 (on).	"Dynamic RAM Fault * " message.	Step 3.	Return printer to normal operation.
3.	Make a Diagnostic Check of the Microprocessors (page 3–21).	—	—	—

Ham. Bank Hot *

	Instruction	Indication	Yes	No
1.	Set power switch to O (off). Wait 15 seconds. Set power switch to 1 (on).	"Ham. Bank Hot * " message.	Step 2.	Return printer to normal operation.
2.	Press the CLEAR switch.	"Ham. Bank Hot * " message.	Step 3.	Return printer to normal operation.
3.	Run diagnostic self–test "All Black" for 1/4 page (page 3–26).	"Ham. Bank Hot * " message.	Step 4.	Return printer to normal operation.
4.	Remove the shuttle cover (page 5–24).	—	Step 5.	—
5.	Install a magnet across the hole in the base casting where the cover open sensor is mounted.	—	Step 6.	—
6.	Run a diagnostic self–test (page 3–26).	Hammer bank fan operates.	Replace shuttle frame assembly (page 5–66).	Replace hammer bank fan assembly (page 5–30).

Ham. Coil Open *

	Instruction	Indication	Yes	No
1.	Set power switch to O (off). Wait 15 seconds. Set power switch to 1 (on).	"Ham. Coil Open * " message.	Step 2.	Return printer to normal operation.
2.	Press the CLEAR switch.	"Ham. Coil Open * " message.	Step 3.	Return printer to normal operation.
3.	Run a diagnostic self–test (page 3–26).	"Ham. Coil Open * " message.	Step 4.	Return printer to normal operation.
4.	Remove the shuttle cover (page 5–24).	—	Step 5.	—
5.	Install a magnet across the hole in the base casting where the cover open sensor is mounted.	—	Step 6.	—
6.	Run a diagnostic self–test (page 3–26) and observe where the non–printing hammer is located.	—	Step 7.	—
7.	Reverse the hammer bank flex circuit cables in the connectors on the base casting.	—	Step 8.	—
8.	Run a diagnostic self–test (page 3–26). Observe where the non–printing hammer is located. (NOTE: Hammer no. 48 is a permanently non–printing hammer. Keep this is mind when reversing cables.)	Position of the non–printing hammer remains the same.	Replace the shuttle frame assembly (page 5–66) then go to step 9.	If the non–printing hammer is now on the other side of the hammer bank, replace the mechanism driver PCBA (page 5–48) then go to step 9.
9.	Return the hammer bank flex circuit cables to their correct connectors on the base casting. Run a diagnostic self–test (page 3–26).	"Ham. Coil Open * " message.	Replace both hammer bank cable assemblies (page 5–8).	Return printer to normal operation.

Ham. Coil Short *

	Instruction	Indication	Yes	No
1.	Set power switch to O (off). Wait 15 seconds. Set power switch to 1 (on).	"Ham. Coil Short * " message.	Step 2.	Return printer to normal operation.
2.	Press the CLEAR switch.	"Ham. Coil Short * " message.	Step 3.	Return printer to normal operation.
3.	Run a diagnostic self–test (page 3–26).	"Ham. Coil Short * " message.	Step 4.	Return printer to normal operation.
4.	Remove the shuttle cover (page 5–24).	—	Step 5.	—
5.	Install a magnet across the hole in the base casting where the cover open sensor is mounted.	—	Step 6.	—
6.	Disconnect the hammer bank flex circuit cables from the connectors on the base casting.	—	Step 7.	—
7.	Run a diagnostic self–test (page 3–26).	"Ham. Coil Short * " message.	Replace the mechanism driver PCBA (page 5–48) then go to step 8.	Replace the shuttle frame assembly (page 5–66).
8.	Run a diagnostic self–test (page 3–26).	"Ham. Coil Short * " message.	Replace both hammer bank cable assemblies (page 5–8).	Return printer to normal operation.

Ham. Drv. Short *

Instruction	Indication	Yes	No
1. Set power switch to O (off). Wait 15 seconds. Set power switch to 1 (on).	"Ham. Drv. Short * " message.	Step 2.	Return printer to normal operation.
2. Press the CLEAR switch.	"Ham. Drv. Short * " message.	Step 3.	Return printer to normal operation.
3. Run a diagnostic self–test (page 3–26).	"Ham. Drv. Short * " message.	Replace the mechanism driver PCBA (page 5–48).	Return printer to normal operation.

Mech Driver Hot *

Instruction	Indication	Yes	No
1. Set power switch to O (off). Wait 15 seconds. Set power switch to 1 (on).	"Mech Driver Hot * " message.	Step 2.	Return printer to normal operation.
2. Press the CLEAR switch.	"Mech Driver Hot * " message.	Step 3.	Return printer to normal operation.
3. Run a diagnostic self–test (page 3–26).	"Mech Driver Hot * " message.	Step 4.	Return printer to normal operation.
4. Open printer cover and observe card cage fan.	Card cage fan operates.	Replace mechanism driver PCBA (page 5–48).	Replace card cage fan assembly (page 5–26).

Mech Driver Link *

	Instruction	Indication	Yes	No
1.	Set power switch to O (off). Wait 15 seconds. Set power switch to 1 (on).	"Mech Driver Link * " message.	Step 2.	Return printer to normal operation.
2.	Press the CLEAR switch.	"Mech Driver Link * " message.	Step 3.	Return printer to normal operation.
3.	Run a diagnostic self–test (page 3–26).	"Mech Driver Link * " message.	Step 4.	Return printer to normal operation.
4.	Remove paper guide assembly (page 5–42).	—	Step 5.	—
5.	Check ribbon cable connectors between common controller board (CCB) and mechanism driver board.	Connectors are attached properly.	Step 6.	Connect and latch ribbon connectors. Go to step 6.
6.	Check installation of common controller board (CCB) (page 5–46) and mechanism driver board (page 5–48).	Boards are installed correctly.	Step 7.	Reseat CCB and mechanism driver boards in their edge connectors at bottom of card cage. Go to step 7.
7.	Power up printer and check for fault message.	"Mech Driver Link * " message.	Replace the common controller PCBA (page 5–46) then go to step 8.	Return printer to normal operation.
8.	Power up printer and check for fault message.	"Mech Driver Link * " message.	Replace the mechanism driver PCBA (page 5–48) then go to step 9.	Return printer to normal operation.
9.	Power up printer and check for fault message.	"Mech Driver Link * " message.	Replace cable assembly W1, CCB/Mech. Dr. (See Appendix D.)	Return printer to normal operation.

Paper Jam

	Instruction	Indication	Yes	No
1.	Inspect paper path for bunched, torn, folded paper or labels.	Paper path is clear.	Step 2.	Remove paper and go to step 2.
2.	Inspect the narrow passageway between the face of the platen and the ribbon mask for bits of torn paper or ribbon lint. Check the holes in the ribbon mask surrounding each hammer tip.	Debris found.	Gently remove paper or lint particles with a wooden stick or pair of tweezers. CAUTION: Do not pry or apply force to the hammer tips. Go to step 3.	Step 3.
3.	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 (page 5–22). Go to step 5.	Step 5.
4.	Load paper.	—	Step 5.	—
5.	Run a diagnostic self–test (page 3–26).	"Paper Jam" message.	Clean the paper motion detector with cotton swab. Go to step 6.	Return printer to normal operation.
6.	Run a diagnostic self–test (page 3–26).	"Paper Jam" message.	Replace paper detector switch assembly (page 5–76). Go to step 7.	Return printer to normal operation.
7.	Run a diagnostic self–test (page 3–26).	"Paper Jam" message.	Replace the intermediate cable assembly (W5) (page 5–10). Go to step 8.	Return printer to normal operation.
8.	Run a diagnostic self–test (page 3–26).	"Paper Jam" message.	Replace the common controller PCBA (page 5–46).	Return printer to normal operation.

Paper Out

Instruction	Indication	Yes	No
1. Load paper.	—	Step 2.	—
2. Run a diagnostic self–test (page 3–26).	"Paper Out" message.	Replace paper detector switch assembly (page 5–76). Go to step 3.	Return printer to normal operation.
3. Run a diagnostic self–test (page 3–26).	"Paper Out" message.	Replace the intermediate cable assembly (W5) (page 5–10). Go to step 4.	Return printer to normal operation.
4. Run a diagnostic self–test (page 3–26).	"Paper Out" message.	Replace the common controller PCBA (page 5–46).	Return printer to normal operation.

Platen Open

Instruction	Indication	Yes	No
1. Load paper.	—	Step 2.	—
2. Close forms thickness lever.	—	Step 3.	—
3. Run a diagnostic self–test (page 3–26).	"Platen Open" message.	Replace platen interlock switch assembly (page 5–78).	Return printer to normal operation.

Ribbon Stall

	Instruction	Indication	Yes	No
1.	Check that forms thickness lever is not closed too tightly; this can jam the ribbon and shuttle.	Forms thickness lever is set correctly.	Step 2.	Readjust the setting of the forms thickness lever. Go to step 2.
2.	Run a diagnostic self–test (page 3–26) and check for shuttle obstruction.	"Ribbon Stall" message.	Step 3.	Return printer to normal operation.
3.	Check ribbon path for blockage or obstruction.	Ribbon path is clear	Step 5.	Remove obstructions from ribbon path and go to step 5.
4.	Wind ribbon by hand and inspect for folds, tears, holes, fraying.	Ribbon is OK. (Folds are permitted, if the ribbon is otherwise undamaged.)	Rewind and reinstall ribbon. Go to step 6.	Replace ribbon, if damaged. Unfold and rewind ribbon if it was folded. Go to step 6.
5.	Do a fast shuttle self–test (page 3–26) and check the alignment of the ribbon guides and hubs if the ribbon was folded.	Ribbon tracks OK.	Step 6.	Align ribbon guides (page 4–20). Go to step 6.
6.	Using a screwdriver, short across the ribbon guide screws to reverse ribbon hub motion. Check for a ribbon drive motor that will not wind ribbon.	Both motors wind the ribbon.	Replace the mechanism driver PCBA (page 5–48).	Replace the defective ribbon drive motor (page 5–36).

Shttl Cover Open

	Instruction	Indication	Yes	No
1.	Inspect shuttle cover for warping, damage, or missing magnet. (The magnet covers the sensor housing when the cover is installed.)	Shuttle cover damaged.	Replace the shuttle cover assembly (page 5–24).	Step 2.
2.	Check shuttle cover installation (page 5–24).	Shuttle cover installed correctly.	Step 3.	Install cover correctly. Make sure the cover lies flat and the two captive screws are fully seated. Go to step 3.
3.	Run a diagnostic self–test (page 3–26).	"Shttl Cover Open" message.	Replace the cover open switch assembly (page 5–74).	Return printer to normal operation.

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.	Step 2.	Set forms thickness lever for thicker paper. Go to step 2.
2.	Run a diagnostic self–test (page 3–26) and check for shuttle obstruction.	"Shuttle Jam" message.	Step 3.	Return printer to normal operation.
3.	Remove shuttle cover (page 5–24) and inspect shuttle area and mechanism for obstruction.	Shuttle movement blocked.	Remove obstruction. Go to step 4.	Install shuttle cover (page 5–24). Go to step 4.
4.	Run a diagnostic self–test (page 3–26).	"Shuttle Jam" message.	Replace the MPU (page 5–34).	Return printer to normal operation.
5.	Run a diagnostic self–test (page 3–26).	"Shuttle Jam" message.	Replace mechanism driver PCBA (page 5–48). Go to step 6.	Return printer to normal operation.
6.	Run a diagnostic self–test (page 3–26).	"Shuttle Jam" message.	Replace shuttle frame assembly (page 5–66).	Return printer to normal operation.

Software Error *

	Instruction	Indication	Yes	No
1.	Set power switch to O (off). Wait 15 seconds. Set power switch to 1 (on).	"Software Error * " message.	Step 2.	Return printer to normal operation.
2.	Disconnect the input data line from the host computer. Set power switch to O (off). Wait 15 seconds. Set power switch to 1 (on).	"Software Error * " message.	Step 3.	Problem is not in the printer. Return printer to normal operation.
3.	Make a Diagnostic Check of the Microprocessors (page 3–21).	—	—	—

Symptoms Not Indicated by Fault Messages

Troubleshoot malfunctions not indicated by fault messages using standard fault–isolation techniques:

1. Debrief the operator for a general description of the problem.

2. Verify the fault by running diagnostic self–tests or replicating conditions reported by the user.

3. Locate the malfunction using the half–split method:

    a. Isolate faults to half the remaining system at a time, until the final half is a field–replaceable part or assembly.

        *   Chapter 5 lists all field–replaceable assemblies.

        *   Troubleshooting aids are listed on the next page.

    b. Start at a general level and work down to details.

4. Replace the defective part or assembly.

IMPORTANT

Do NOT attempt field repairs on electroniccomponentsorassemblies— replace the entire assembly with an operational spare. Most electronic problems are corrected by replacing the printed circuit board assembly (PCBA), 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.

5. Test printer operation after every corrective action.

6. Stop troubleshooting and return the printer to normal operation when the reported symptoms disappear.

Troubleshooting Aids

- **Printer Confidence Check** (page 3–20). This procedure systematically checks basic printer operations and functions. Use it to establish basic printer status or for troubleshooting imprecise or intermittent symptoms.

- **Diagnostic Check of Microprocessors** (page 3–21). This procedure checks processor operations on the printed circuit board assemblies (PCBAs).

- **Diagnostic Self–Tests** (Page 3–26.)

- **Hex Code Printout** (Page 3–29.)

- **Appendix D: Cable Interconnections and Hammer Bank Wiring Diagram**

Printer Confidence Check

Instruction	Indication	Yes	No
1. Check that printer is plugged into correct power source. (Ref.: *User's Manual*)	Power cable installed correctly to proper source.	Step 2.	Connect printer to correct power source.
2. Disconnect the interface (data) cable from the host computer to isolate the printer, then run a diagnostic self–test (page 3–26.)	Printer operates correctly.	Fault is not in the printer. Check host computer, applications software, cabling, etc.	Step 3
3. Connect the interface (data) cable to host and printer.	—	Step 4	—
4. Make a configuration printout. (Appendix A.)	a) Configuration is correct for the user's application. b) Host computer and printer use the same protocol (emulation). c) Configuration has not been inadvertently changed by the user.	Step 5	Reconfigure the printer. (Appendix A.)
5. Check alignments and adjustments. (Chapter 4.)	Assemblies and components adjusted in accordance with Chapter 4.	Step 6	Adjust all assemblies that are out of spec.
6. Remove paper guide assembly (page 5–42).	—	Step 7	—
7. Check all electrical connectors.	Connections are clean and tight, wires are not stripped, frayed, or out of connectors.	Step 8.	Replace stripped, frayed, or broken wires.
8. Check that PCBAs are seated correctly in edge connectors (bottom of card cage).	PCBAs are firmly seated in edge connectors.	Step 9.	Reseat PCBAs.
9. Inspect for debris that could cause short circuits (loose fasteners, foil, etc.).	Metallic debris.	Remove debris. Clean printer (page 2–4).	Step 10.
10. Install paper guide assembly (page 5–42).	—	Step 11.	—
11. Set power switch to 1 (on).	Printer powers up and display goes to "Off–line/Emulation"	Return printer to normal operation.	Troubleshoot fault message (page 3–2).

Diagnostic Check of Microprocessors

This procedure checks the operation of the microprocessors and IC chips on the Common Controller (CCB) and Mechanism Driver boards. Do the steps in the order presented.

1. Set the power switch to O (off).

2. Remove the paper guide assembly (page 5–42).

3. Reseat the CCB and Mech Driver boards in the card cage.

4. Set the power switch to 1 (on). Wait at least 15 seconds; while you are waiting watch the 68010 LED at location A2 on the CCB (some boards may be silk–screened as "68000") and watch the display on the control panel. (NOTE: IC locations are shown on page 5–52.)

    a. When the CCB is operating correctly, the control panel displays "Diagnostic Tests in Progress," and the 68010 LED turns on for 1 to15 seconds, then turns off. The 68010 LED turns off after the 68010 successfully tests itself, RAM, 68010 ROM, and communication with the 64180 CPU. The more RAM or ROM installed in the printer, the longer the LED is on, but it *always* turns on then off when the CCB is functioning correctly. If the printer turns on normally, the CCB is okay. Install the EMI shield and return the printer to normal operation.

        If the 68010 LED turns on and off as described above, but the printer does work properly, or fails later, go to step 5.

        ("Dynamic RAM Fault" on the display can mean the 64180 has waited 15–20 seconds without getting its handshake from the 68010. The following substeps use the 68010 LED to fault isolate this message.)

    b. If the 68010 LED never turns on, it means the 68010 did not execute the first software instruction in its ROM. Go to step 6.

    c. If the 68010 LED stays on for 30 seconds but never blinks, it means RAM and ROM for the 68010 are okay, but the 64180 is not executing instructions. Go to step 7.

    d. If the 68010 LED blinks steadily at 1 blink per second, it means that the 68010 ROMs are bad. Turn off the printer, remove the

CCB (page 5–46), and check that all ROM chips are inserted in the correct position and with all pins inserted correctly.

This check will catch out–of–order ROMs and all single and multiple bit failures of floating–gate EPROMs (the type with the window, that erase with ultraviolet light).

If a ROM chip was inserted backwards, discard it. Even if it operates properly, a high current flowed through the backwards–biased transistors, and its service life is probably shortened due to thermal damage.

If ROMs appear correctly inserted, they may still be defective. Sometimes bits "fade" to one when internal floating gates discharge. This can occur from over–voltage programming, radiation damage, too many EPROM erasures, etc. Install new program PROMs.

e. If the 68010 LED blinks steadily 5 times per second, it means CCB RAM has failed. The most common cause of this failure during maintenance is turning off the printer too briefly for the 64180 to reset. The 64180 shares memory with the 68010, and writes to RAM if it is not completely reset. Turn the printer off, wait at least 15 seconds, then recycle power before accepting this indication of CCB RAM failure.

The RAM chips are at board coordinates N9 and P9. The sockets at N8 and P8 are normally empty; this will not cause a RAM failure. Inspect the RAM chips, sockets and traces for shorts or missing chips. Damaged traces or sockets call for replacement of the CCB.

A remote possibility is failure of the 64180 in the start–up handshake or in the code that programs the memory controller. Try changing the 64180 PROM.

5. The 68010 LED turns on, then off, but the printer doesn't work. Look at the control panel display:

a. If the display is blank, or has a single line of black squares across the top, the connector to the control panel probably needs to be plugged in or reseated. Turn off the printer, plug in the panel

cable to connector J3 on the CCB, and start over at step 1. If the display is still blank, or has a black line, and the 68010 LED lights and turns off, the control panel or its cable are defective.

b. If the display reads "Mech Driver Link," the 8032 at location J12 on the CCB may have failed. Check the 8032 and its PROM at location J10 for bent pins, misalignment, or backwards insertion. Also, make sure the clock–test jumper E2 at location J14 is installed. If everything appears okay, try reseating the PROM at location J10, the 8032 at J12, the clock jumper at J14, and the connector at J2—sometimes this message is caused by a failure to communicate with the 8032 on the Mech Driver board. If the problem persists, check the Mech Driver 8032, its clock jumper, and the PROM. Look for backwards insertion, misalignment, etc., and try reseating the parts. (NOTE: On some Mech Driver boards, the 8032 PROM correct orientation may be *upside down* in relation to the rest of the board. On these boards, the silk–screen will show the correct orientation.) Always replace PROMs and parts that were inserted backwards. If the problem persists, replace the 8032 PROMs on the CCB and Mech Driver boards. If the problem persists, replace the interconnect cable W1. (See Appendix D.)

c. If the printer appears normal, but does not print from the host, check the data cable to the host and reseat the cable that attaches to J1 of the CCB and A12. Then make sure the correct interface is selected and configured from the control panel. (See Appendix A.) Save the configuration and reset the printer. If the printer is running 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 and parity. In RS–232, configure the host for XON/XOFF if possible; this requires the least complex cable.

d. 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" (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 break–out box works, but will not debug XON/XOFF or other RS–232 data protocols. If the printer is sending XOFF, the host may not be receiving it if it requires 1.5 or 2 stop bits.

e. 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 or Dataproducts 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 Dataproducts strobe polarity. Also check that the terminating resistors are present at locations C12 and D12 on the CCB. You can correct noise problems by using a shielded data cable or by changing the terminating resistors. (See page 5–56.) The standard terminating resistors are optimized for high speed data transfer for cables between 1 and 5 meters long; you can change them to be slower and slightly more immune to noise. Noise is caused by static, 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" or Dataproducts data request "DRQ") 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.

f. If the printer prints garbled data or slews uncontrollably, put the printer into hex dump mode and analyze the binary data. One cause of garble is the host interface or cable is not transmitting all the data. When this occurs, the Centronics or Dataproducts interface receives a 1 on every unconnected data line. Uncontrolled slewing is often caused by enabling PI (Paper Instruction) when the host lacks a PI signal. (PI shows as "p" on the hex dump.) Some DEC RS–232 and Dataproducts interfaces only send 7 data bits. In this case, the eigth bit will be received as one. In RS–232, a common cause of garble is to set the interface 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 or Dataproducts terminating resistors

on the CCB at C12 and D12, especially if they are absent. Garble can also result from failed termination resistors or parallel logic, but this is rare.

6. The 68010 LED never lights. The 68010 has not run its first instruction.

   a. The first two programs PROMs may be malfunctioning or inserted wrong. Do the corrective actions listed in step 4.d.

   b. Check the power supply voltages: look at the control panel display. If it is not blank, the logic power supply is okay. If the display is blank, turn off the printer. Reseat the power supply cable on the Mech Driver board and the CCB/Mech. Driver cable assembly W1. Turn the printer on. If that does not correct the problem, check for logic supply voltage on the CCB board between the positive end of C4 (location A5) and TP1 (location A1).

   c. On the CCB, inspect the PROM sockets, the 68010 socket (if installed), and the oscillator module at location P6. Remove any obvious dirt or conductive dust.

   d. Test for voltage supplied to the 68010 LED. The LED may have failed.

   e. If the failure persists, replace the common controller board (CCB).

7. The 68010 LED lights, but never turns off. Look at the control panel display:

   a. If the top line of the display is blank, the control panel is probably unplugged or defective. Do the corrective actions listed in step 5.a.

   b. If the display has a single line of black squares on the top line, the 64180 has failed. Turn off the printer, remove the CCB, and check the 64180 PROM at location H8 for bent pins, pins not inserted, or backwards insertion. Discard any PROMs that were inserted backwards. Their transistors were reverse biased, and even if they work their service life has been shortened by thermal damage. Replace the 64180 PROM. Check that the 64180 is correctly inserted and completely seated in its socket.

c. If the display reads "Diagnostic Tests in Progress" and 68010 LED has been on for 20 seconds or more but is not blinking, it means the 64180 cannot communicate with the 8032 on the Mech Driver board. Turn off the printer, reseat the cable in J2 of the CCB and on the Mech Driver board. Check the 8032 on the Mech Driver, its PROM, and its clock jumper (E1–E2) for correct insertion, bent pins, etc. Reseat the jumper and socketed parts. If the problem persists, replace the Mech Driver's PROM and the CCB/Mech. Driver cable assembly W1.

Diagnostic Self–Tests

Run diagnostic self–tests to check the print quality and operation of the printer. The self–tests are listed below.

NOTE: Under the description of each diagnostic test is a list of items that may require field replacement or adjustment if the test produces a bad print pattern. Items are listed in the order they should be checked: simplest items first, moving to more complex components.

- **ASCII Swirl** A sliding alphanumeric pattern useful for identifying missing or malformed characters, improper vertical alignment, or vertical compression.

> Hammer bank cover
> Hammer spring
> Shuttle frame assembly

- **All Es** A pattern of all uppercase letter Es useful for identifying missing characters, misplaced dots, smeared characters, improper phasing, or light/dark character variations.

> Ribbon
> Hammer bank cover
> MPU sensor
> Hammer spring
> Hammer coil (shuttle frame assembly)
> Splined shaft skew adjustment

- **Es plus TOF** A pattern of all Es followed by a form feed to the next page top of form, useful for identifying paper motion or feeding problems.

> Hammer bank cover
> Power supply PCBA
> Mechanism Driver PCBA
> Paper motion sensor or cable
> Paper feed belt or motor
> Splined shaft bearings
> Tractors or tractor belts

- **All Hs** A pattern of all uppercase letter Hs useful for detecting missing characters or dots, smeared characters, or improper phasing.

> Ribbon
> Hammer bank cover
> MPU sensor
> Hammer spring
> Hammer coil (shuttle frame assembly)

- **All Underlines** An underline pattern useful for identifying hammer bank misalignment.

> Mechanism Driver PCBA
> Hammer bank cover
> Hammer tips
> Paper feed belt or motor
> Splined shaft bearings
> Tractor bearings or belts

- **All Black** All dot positions are printed, creating a solid black band. Exercises shuttle and hammer bank at maximum capacity.

> Mechanism Driver PCBA
> Power Supply PCBA
> Hammer bank cover
> Hammer spring
> Hammer coil (shuttle frame assembly)

- **Shuttle Slow** Verifies proper operation by exercising shuttle motion at low speed.

- **Shuttle Fast** Verifies proper operation by exercising shuttle motion at high speed.

- **Phasing** A hammer timing parameter that permits you to adjust the vertical alignment of dots in character printing. (See page 4–4.)

- **Test Width** Permits you to run tests at all available print widths.

Running the Diagnostic Self–Tests

To run a diagnostic self–test:

1. Press ON LINE to place the printer off–line. "Off–line/Emulation" displays.

2. Press UP and DOWN simultaneously to unlock the ENTER switch.

3. Raise the printer cover.

4. Press DOWN. "Emulation/LG06" displays.

5. Press NEXT until "Emulation/Self–Test" displays.

6. Press ENTER to select self–test. "Emulation/Self–Test * " displays.

7. To select one of the tests, press DOWN, then press NEXT or PREV until the appropriate test displays.

8. Press R/S to begin the selected self–test. Press R/S again to stop the test.

9. Examine the print quality.

10. Press CLEAR to place the printer off–line. The display reads "Off–line/Emulation".

11. Press UP and DOWN simultaneously to lock the ENTER switch.

12. Close the printer cover.

13. Press ON LINE to place the printer on–line.

Hex Code Printout

Hex dumps list all ASCII character data received from the host computer with their corresponding two–digit hexadecimal codes. You can use hex dumps to troubleshoot printer data reception problems.

Printable characters print as the assigned symbol; nonprintable characters are indicated by a period [.]. The letter [p] before a hex code indicates an active Paper Instruction (PI) line. A blank space before a hex code indicates an inactive PI line.

To make a hex printout:

1. Press ON LINE to place the printer off–line. "Off–line/Emulation" displays.

2. Raise the printer cover.

3. Simultaneously press the UP and DOWN switches to unlock the ENTER switch. "Unlocked" displays briefly.

4. Press DOWN. "Emulation/LG06" displays.

5. Press NEXT until "Emulation/Hex Dump" displays.

6. Press ENTER. "Emulation/Hex Dump * " displays.

7. Press on LINE. The display indicates that the printer is on–line in hex dump mode ("On–line/Hex Dump").

8. Send the data from the host — the data print in hex dump format. (Any data remaining in the buffer print before the hex code printout starts.)

9. Press on–LINE again to stop the hex dump. The display reads "Off–line/Emulation".

10. Press DOWN. "Emulation/LG06" displays.

11. Press ENTER to reselect LG06 emulation. "Emulation/LG06 * " displays.

12. Simultaneously press the UP and DOWN switches to lock the ENTER switch. "Locked" displays briefly.

13. Close the printer cover.

14. Press ON LINE to place the printer on–line.

4 Adjustment Procedures

Chapter Contents

Preparing the Printer for Maintenance

WARNING

Unless otherwise directed, do adjustment procedures with the printer disconnected from the power source. Failure to remove power could result in injury to personnel or damage to equipment.

The procedures in this chapter are written assuming the printer has been prepared for maintenance. To prepare the printer for maintenance, do the following *before* performing an adjustment or alignment:

1. Set the printer power switch to O (off).
2. Disconnect the power cord from the ac power source.
3. Unload paper.
4. Read through the entire maintenance procedure before you begin working on the printer.
5. Gather all necessary tools and parts before you begin working on the printer.

Adjustments

This chapter contains the adjustment procedures done at the field service maintenance level.

Paper Scale Adjustment (Figure 4–1)

1. Connect the power cord to the ac power source.
2. Set the printer power switch to 1 (on).
3. Load paper.
4. Open the printer cover.
5. Verify that the shuttle cover (1) is properly installed (page 5–24).
6. Loosen the three button–head screws (2). (It may be necessary to remove the shuttle cover to loosen the button–head screws.)
7. Position the scale (3) so that positions 1 and 132 are lined up with the first and last characters on a 132 character printout.
8. Tighten the button–head screws (2).
9. Close the printer cover.
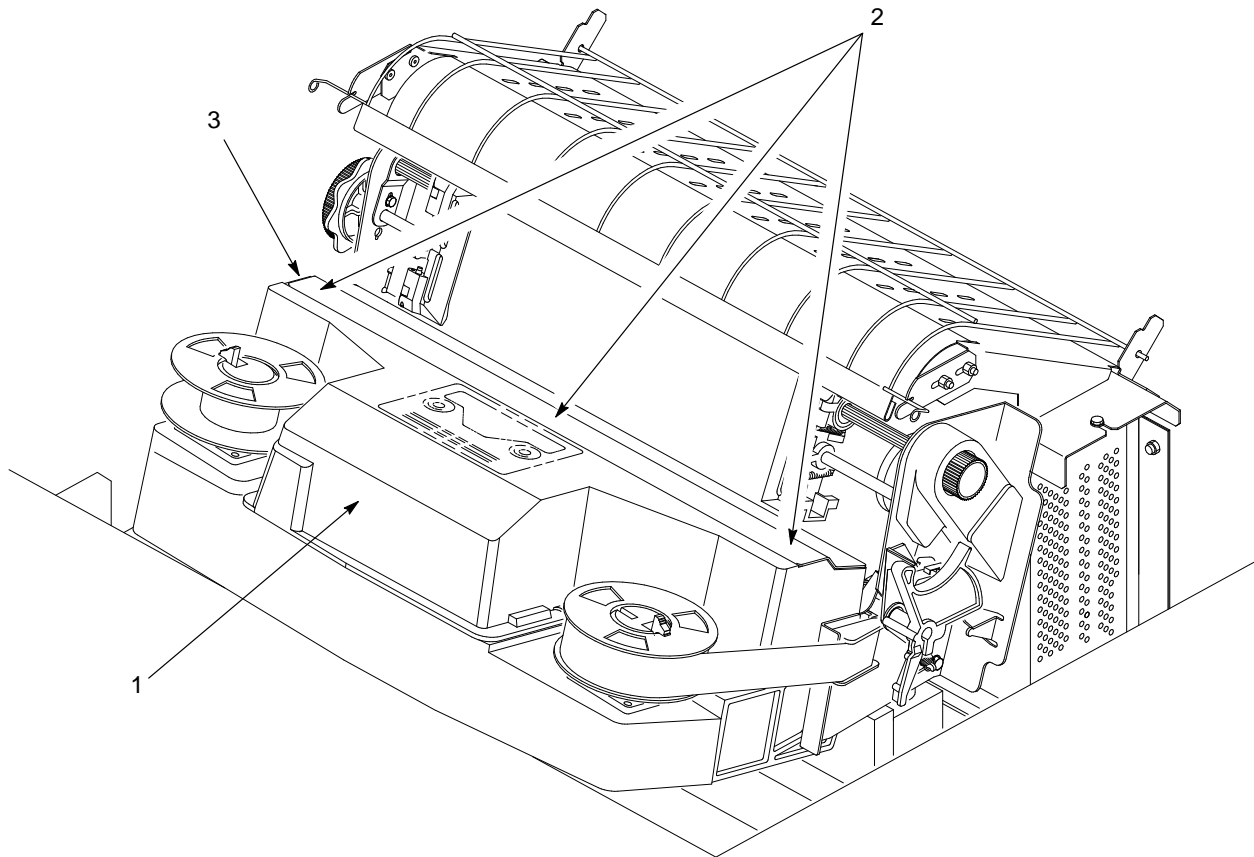
1. Shuttle Cover
2. Screw, Button–Head (3)
3. Paper Scale

Figure 4–1 . Paper Scale Adjustment

Adjustment Procedures

Hammer Phasing Adjustment (Figure 4–2)

NOTE: Hammer phasing must be checked and adjusted when PROMs on the common controller PCBA are replaced.

1. Connect the power cord to the ac power source.

2. Set the printer power switch to 1 (on).

3. Load paper.

4. Press the ON LINE switch to take the printer off–line. "Off–Line/Emulation" appears on the message display.

5. Open the printer cover.

6. Press the UP and DOWN switches simultaneously to unlock the ENTER switch. "Unlocked" appears briefly on the display.

7. Press the DOWN switch. "Emulation/LG06" appears on the display.

8. Press NEXT (or PREV) until "Emulation/Self–Test" appears on the display.

9. Press ENTER. "Emulation/Self–Test * " appears on the display.

10. Press DOWN, then press NEXT (or PREV) until "Self Test/Phasing" appears on the message display.

NOTE: Phasing adjustments should be made with the printer printing at full paper width.

11. Press the R/S switch. "Phasing" and the current phasing index number display. The printer begins printing all Hs in a data processing (DP) font, each line preceded by the phasing index number.

12. Press the NEXT or PREV switches to increase or decrease the phasing index until the pattern of Hs appears as shown in Figure 4–2 .

13. When the print pattern is acceptable, press the R/S switch. Printing stops, and the current phasing value is entered into nonvolatile memory.

14. Press the CLEAR switch. "Off–Line/Emulation" appears on the message display.

15. Press the UP and DOWN switches simultaneously to lock the ENTER switch. "Locked" appears briefly on the display.

16. Close the printer cover.

17. Press the ON LINE switch to place the printer on–line.
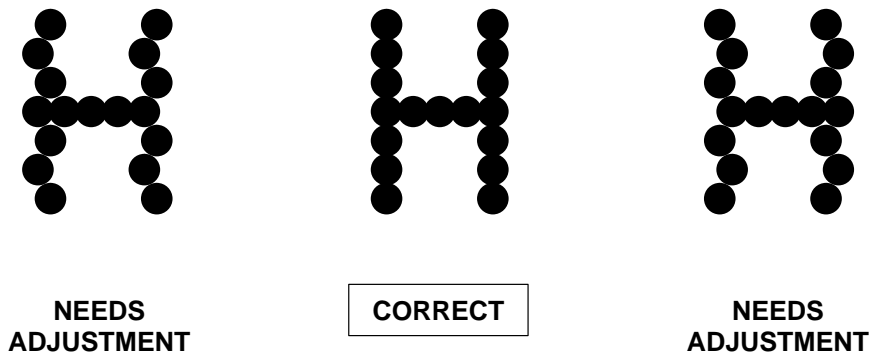
Figure 4–2 . Hammer Phasing Adjustment

Paper Feed Timing Belt Adjustment (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 motor mount bolts (2).

5. Using a force gauge, apply 12 pounds of tension to the paper feed drive motor (3).

6. Reduce tension to 9 pounds and torque the paper feed motor mount bolts (2) to 18 ± 1 inch–pounds.

7. Snap the timing belt cover (1) into the slots in the side plate.

8. Return the printer to normal operation (page 4–22).
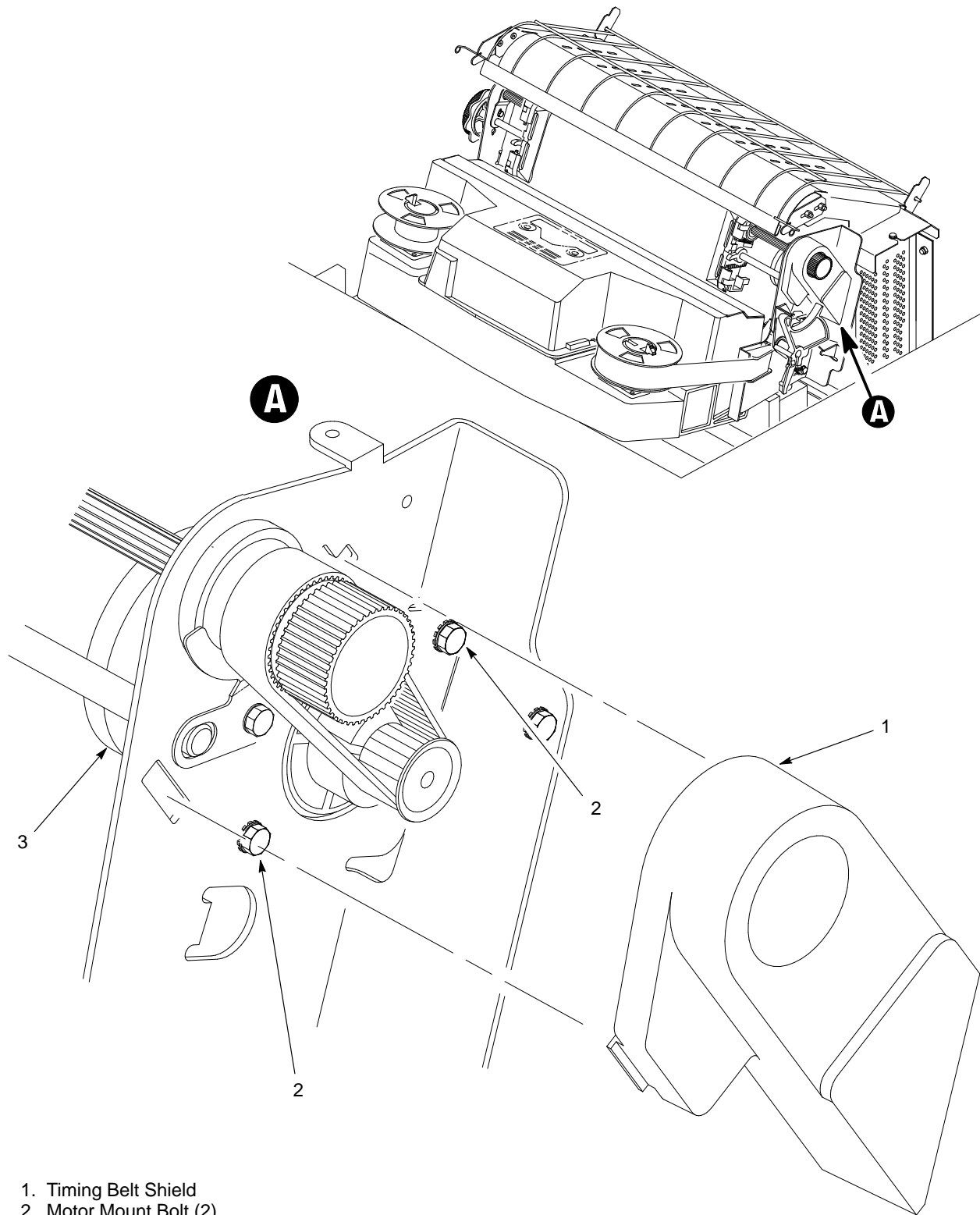
1. Timing Belt Shield
2. Motor Mount Bolt (2)
3. Paper Feed Drive Motor

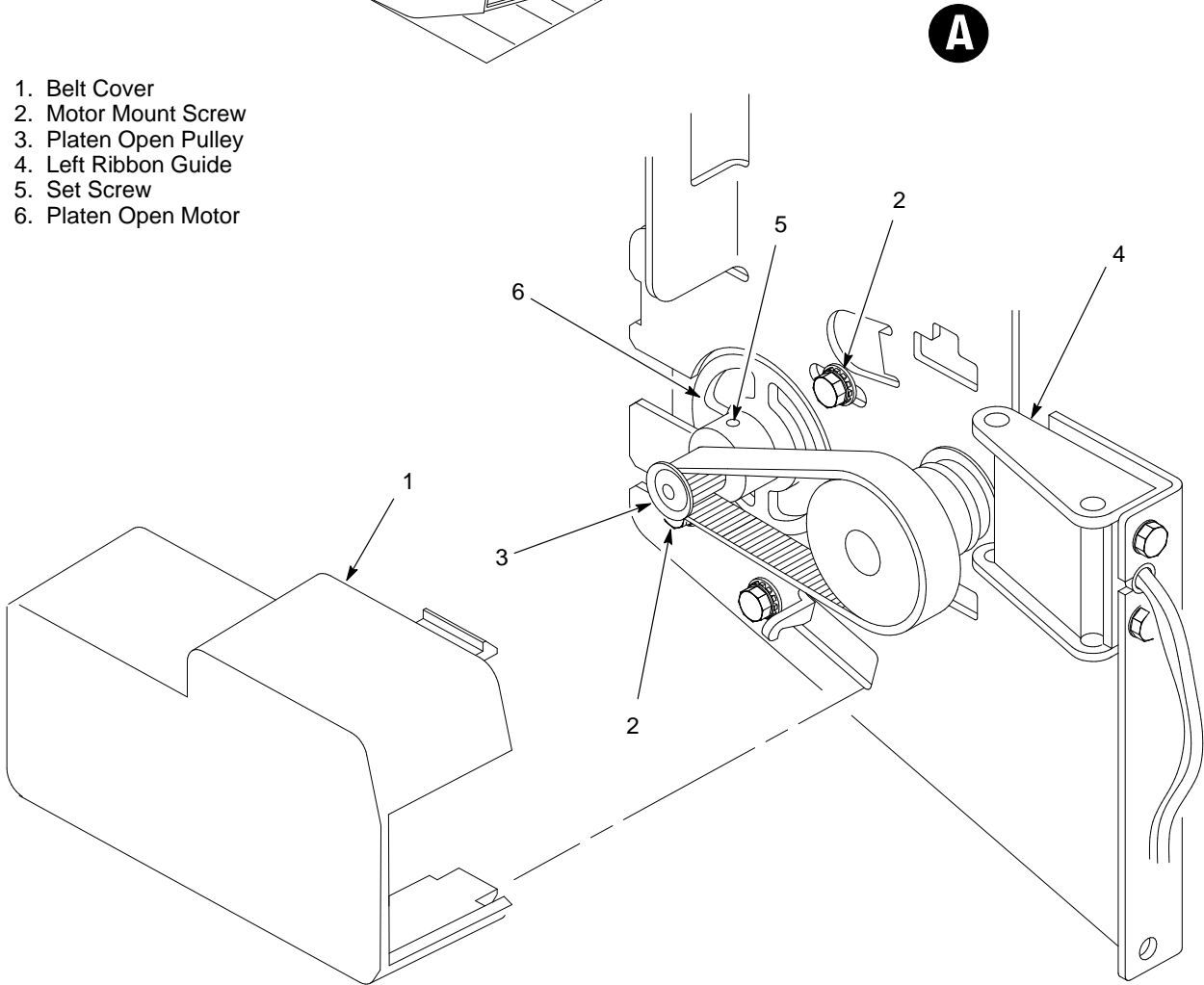**Figure 4–3 . Paper Feed Timing Belt Adjustment**

Platen Open Belt Adjustment (Figure 4–4)

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.

6. Make sure the collar of the platen open pulley (3) clears the left ribbon guide (4) with the platen fully closed.

   a. If not, rotate the platen open pulley (3) until the collar clears the left ribbon guide and tighten the set screw (5). Go to step 7.

   b. If the collar clears the ribbon guide with the forms thickness lever closed, go to step 7.

7. Using a force gauge, apply 10 pounds of tension to the platen open motor (6).

8. Reduce tension to 5 pounds and torque the motor mount screws (2) to 11 ± 1 inch–pounds.

9. Snap the platen open belt cover (1) into the slots in the side plate.

10. Return the printer to normal operation (page 4–22).
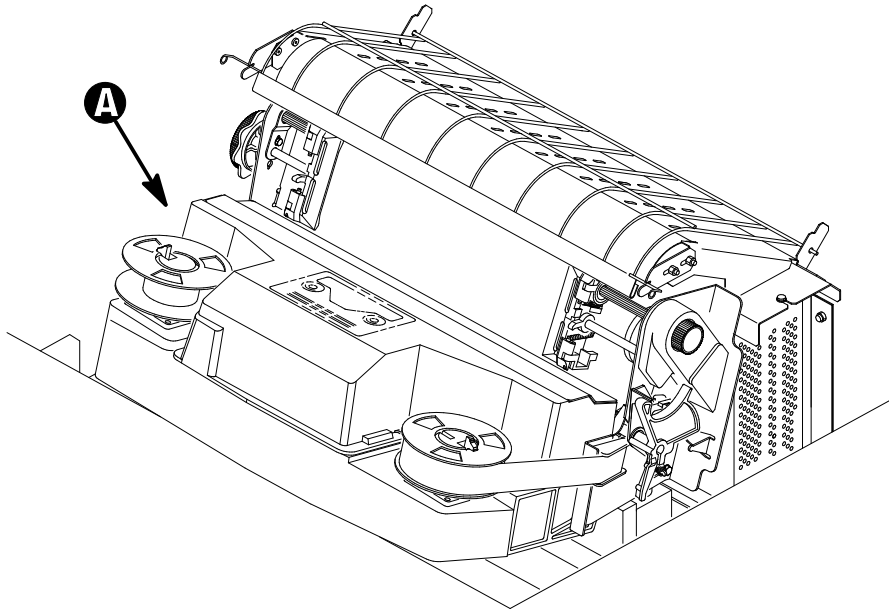
1. Belt Cover
2. Motor Mount Screw
3. Platen Open Pulley
4. Left Ribbon Guide
5. Set Screw
6. Platen Open Motor

Figure 4–4 . Platen Open Belt Adjustment

Adjustment Procedures 4–9

Paper Drive Motor Pulley Alignment (Figure 4–5)

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 set screw (2) in the motor pulley collar (3).

5. Align the paper drive motor pulley (4) with the splined shaft pulley (5).

6. Hold the collar (3) flush against the motor pulley (4) and tighten the set screw (2).

7. Snap the timing belt cover (1) into the slots in the side plate.
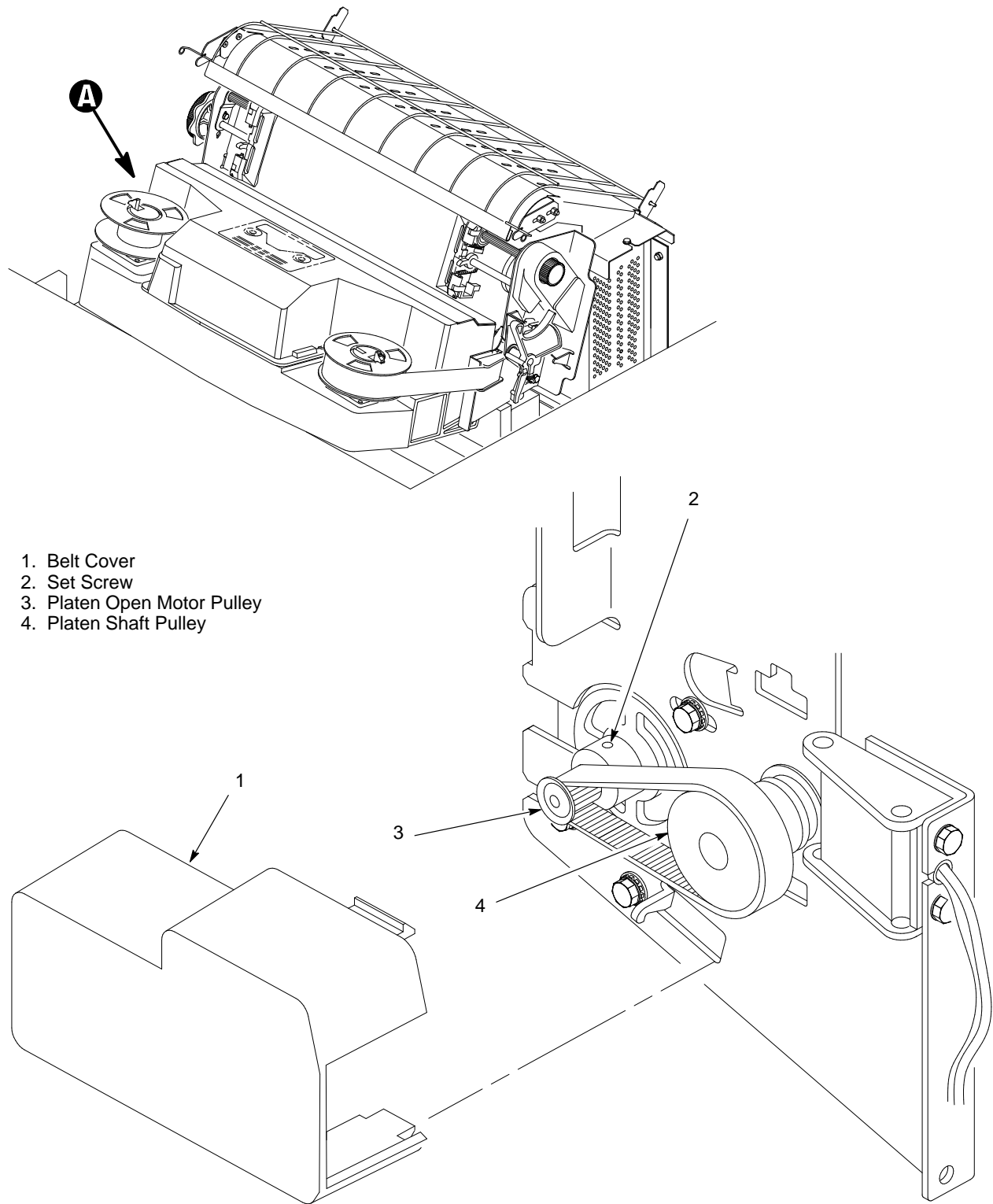
8. Return the printer to normal operation (page 4–22).

1. Belt Shield
2. Set Screw
3. Motor Pulley Collar
4. Motor Pulley
5. Splined Shaft Pulley
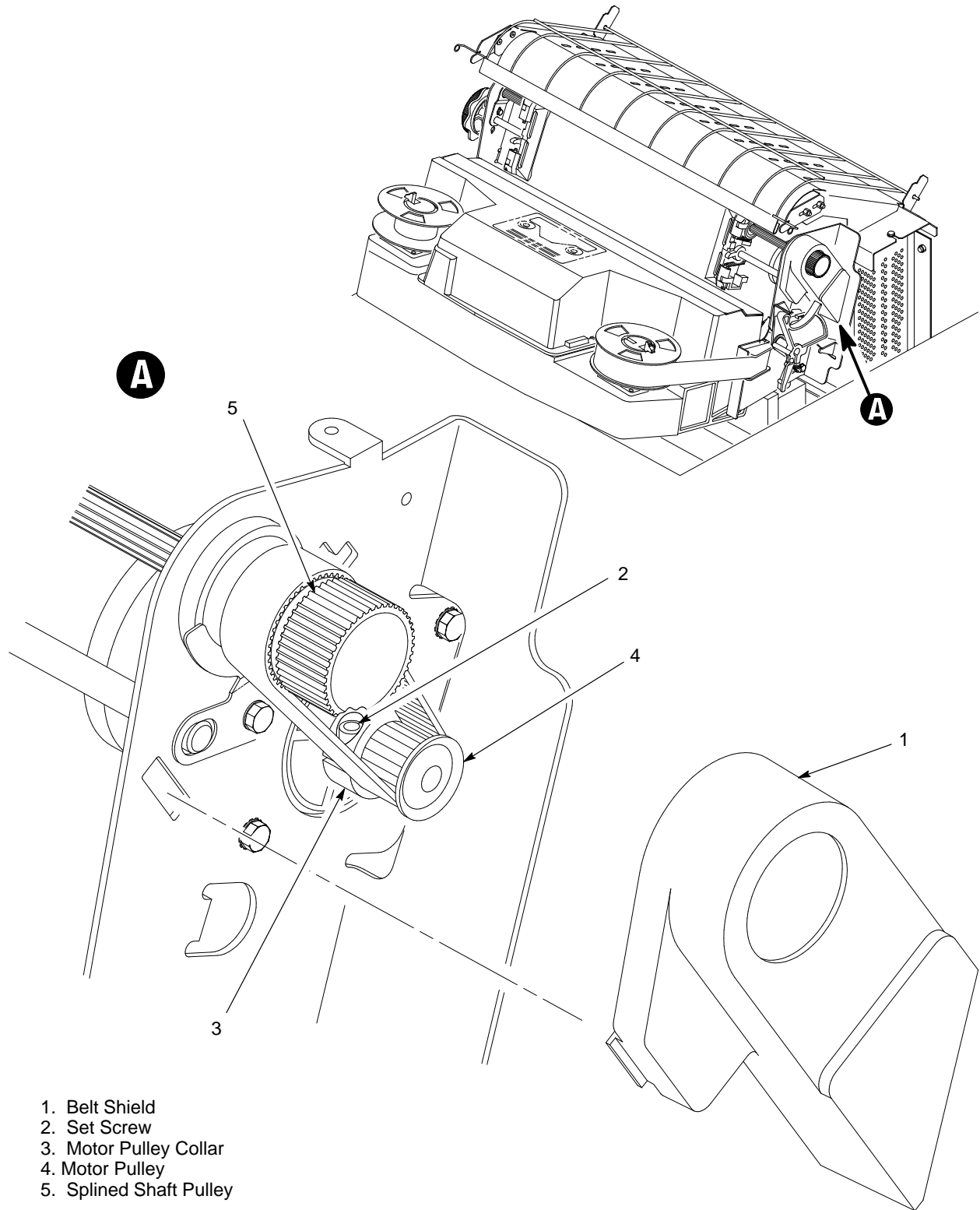
Figure 4–5 . Paper Drive Motor Pulley Alignment

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 collar.

5. Align the platen open motor pulley (3) with the platen shaft pulley (4) and tighten the set screw (2).

6. Snap the platen open belt cover (1) into the slots in the side plate.

7. Return the printer to normal operation (page 4–22).

Adjustment Procedures

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

Figure 4–6 . Platen Open Motor Pulley Alignment

Splined Shaft Skew Adjustment (Figure 4–7)

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) to obtain print parallel with paper perforations. Tighten the screw (1).

4. Return the printer to normal operation (page 4–22).
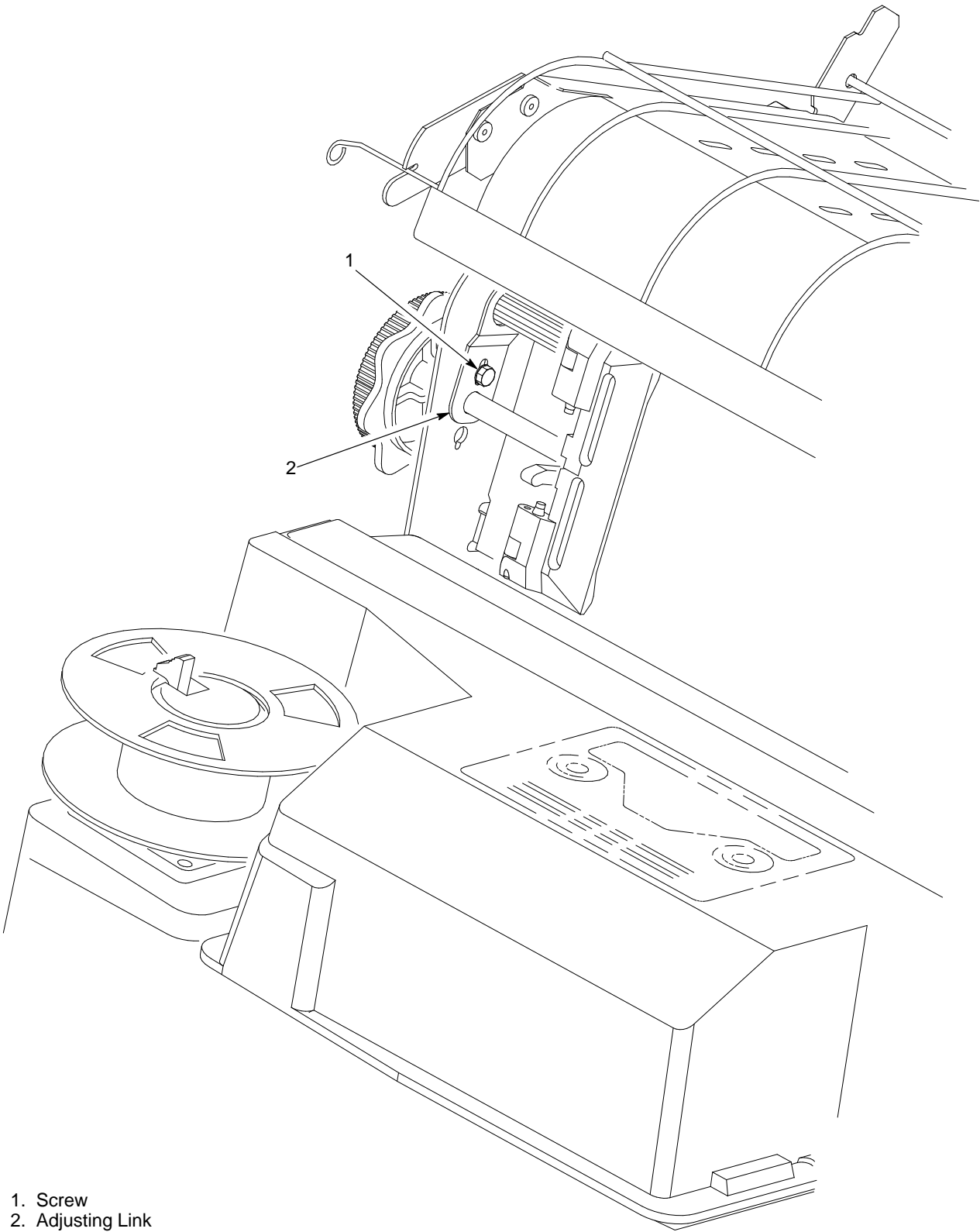
1. Screw
2. Adjusting Link

Figure 4–7 . Splined Shaft Skew Adjustment

Platen Angle Adjustment (Figure 4–8)

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

2. Remove the shuttle cover (page 5–24).

3. Close the forms thickness lever (1) all the way.

4. Install the platen position gauge (P/N 996083) (2) and check the angle of the platen (3).

   c. If the angle is correct, no adjustment is necessary. Go to step 8.

   d. If the angle is incorrect, loosen the clamp screw (4) and set screw (5).

5. Apply primer and loctite to the mating surfaces of the forms thickness lever (1) and platen shaft.

6. Position the platen (3) at the correct angle.

7. Slide the platen (3) to the right and the forms thickness lever (1) to the left to remove end play. Ensure that the forms thickness lever is fully closed. Tighten the clamp screw (4), then tighten the setscrew (5).

8. Remove the platen position gauge (P/N 996083) (2).

9. Install the shuttle cover (page 5–24).

10. Return the printer to normal operation (page 4–22).

Adjustment Procedures

1. Forms Thickness Lever
2. Platen Position Gauge (P/N 996083)
3. Platen
4. Clamp Screw
5. Setscrew
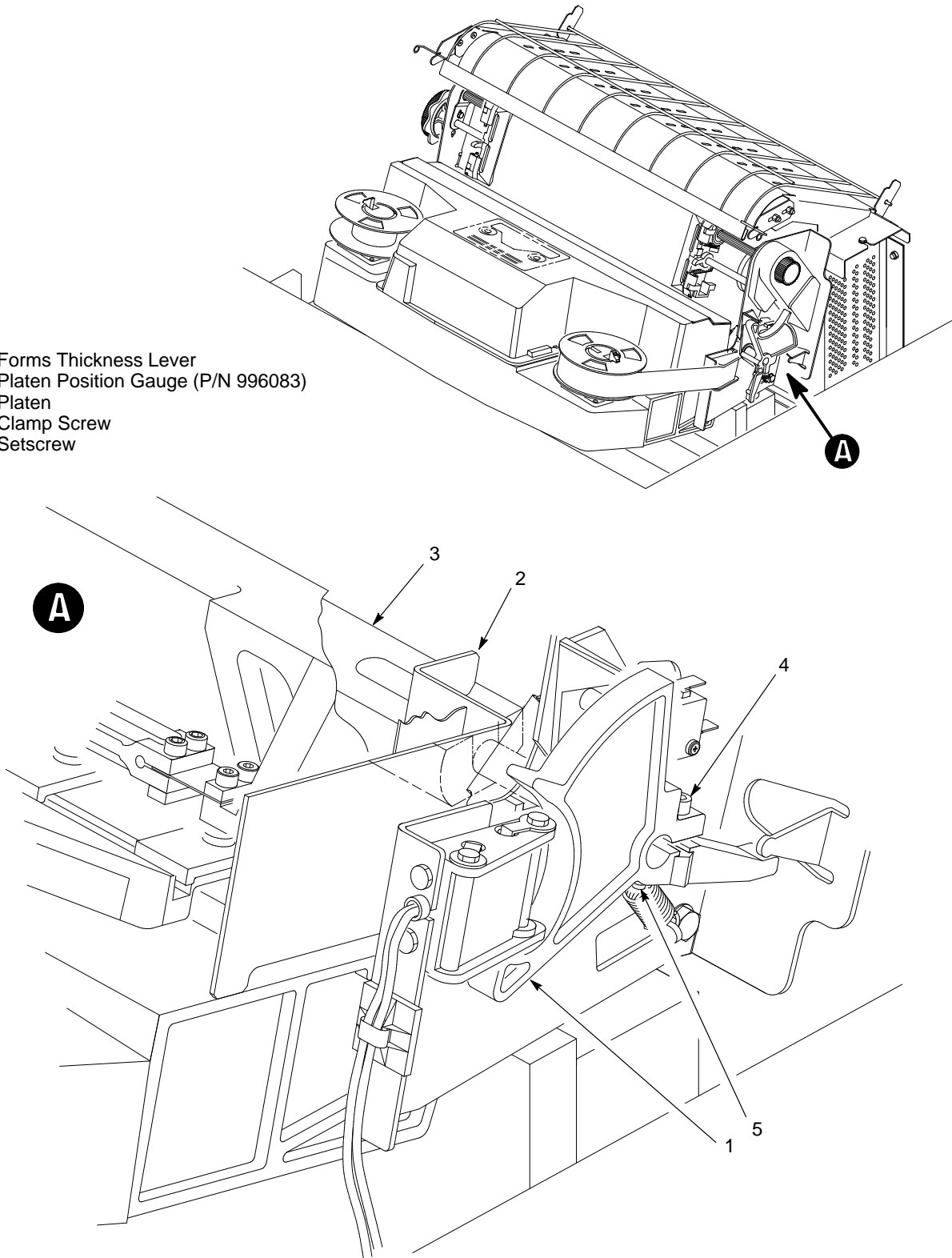
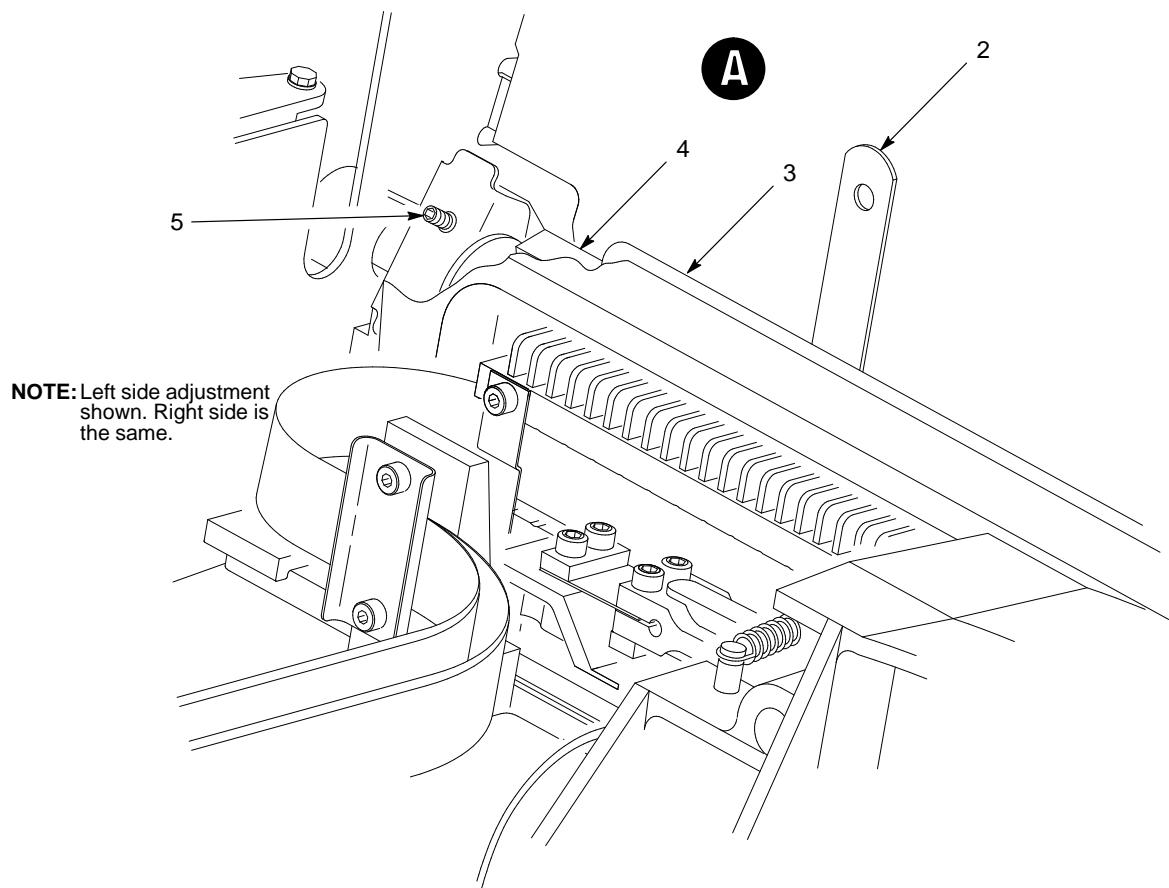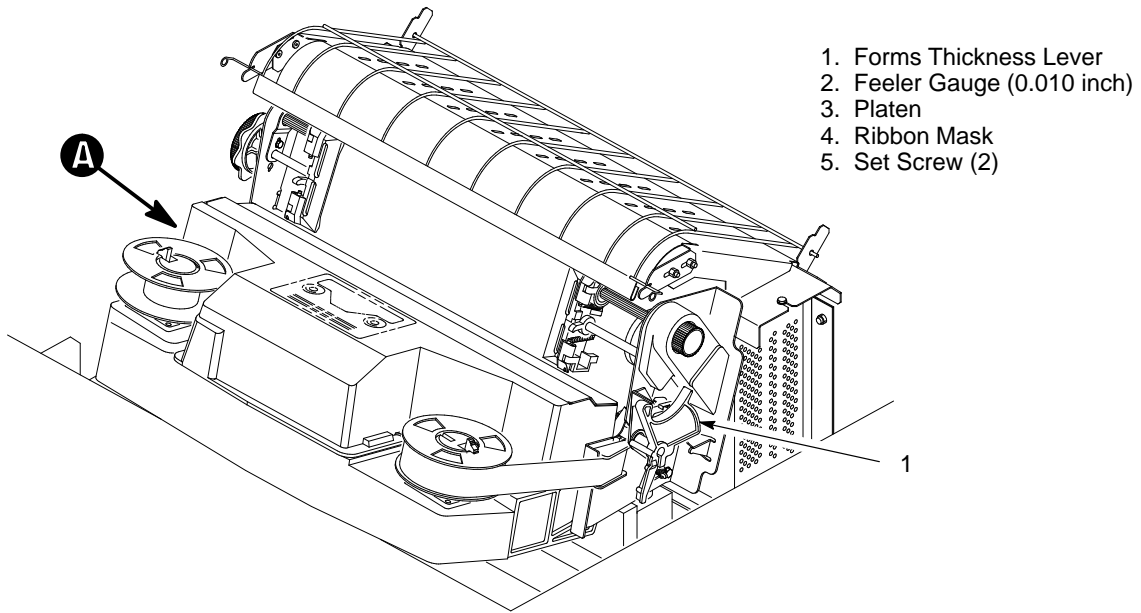**Figure 4–8 . Platen Angle Adjustment**

Platen Gap Adjustment (Figure 4–9)

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

2. Open the printer cover.

3. Remove the shuttle cover assembly (page 5–24).

4. Remove the ribbon.

5. Raise the forms thickness lever (1) to the fully open position.

CAUTION

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

6. Insert a 0.010 inch flat feeler gauge (2) straight down between the platen (3) and ribbon mask (4), within four hammer positions of the end of the hammer bank.

7. Gently close the forms thickness lever (1) until the hammer tips and platen contact the feeler gauge. With the forms thickness lever closed all the way, the feeler gauge should contact both the tips and the platen and move with light friction. Shift the gauge slightly to verify.

8. Adjust the gap as required by manipulating the set screw (5) located at each end of the platen (3). Check the gap at both ends of the platen after each adjustment of a set screw.

9. Repeat steps 4 through 7 at the other end of the hammer bank.

10. When the platen gap is correct at both ends of the platen, install the ribbon.

11. Install the shuttle cover assembly (page 5–24).

12. Adjust the platen open belt (page 4–8).

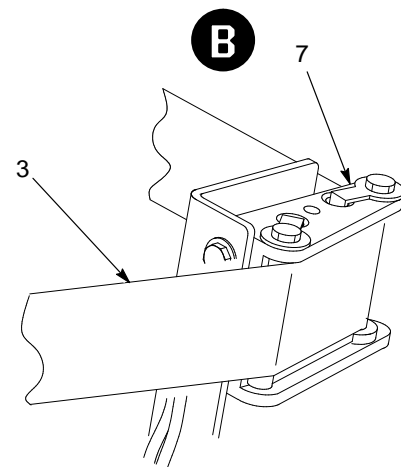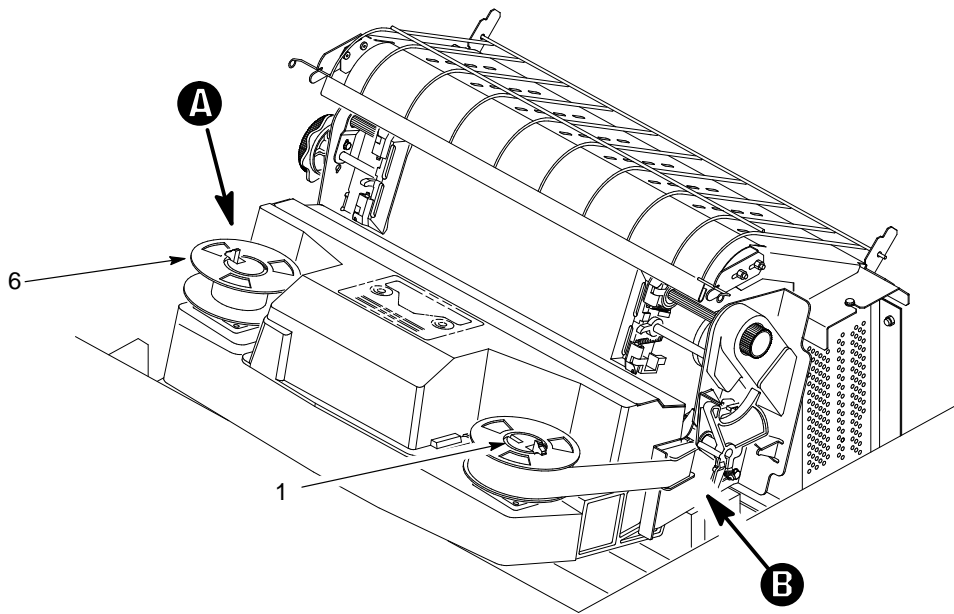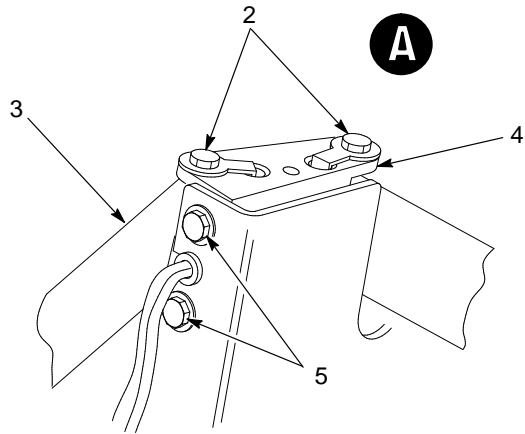13. Return the printer to normal operation (page 4–22).

Adjustment Procedures

1. Forms Thickness Lever
2. Feeler Gauge (0.010 inch)
3. Platen
4. Ribbon Mask
5. Set Screw (2)

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

Figure 4–9 . Platen Gap Adjustment

Ribbon Guide Alignment (Figure 4–10)

1. Open the printer cover.

2. Load paper and install the ribbon. The ribbon should have a full spool on the right hub (1).

3. Run a shuttle and ribbon diagnostic self–test (page 3–26).

4. 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.

6. If the ribbon is not centered, loosen the retaining screws (5) just enough so that the ribbon guide (4) can be moved to new positions, but remains in place once moved.

7. Reposition the ribbon guide (4) as necessary to center the ribbon (3).

8. Observe how the ribbon (3) is winding on the left spool (6). Reposition the ribbon guide (4) as necessary to allow the ribbon to wind up without interference.

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 Spool
7. Ribbon Guide, Right

Figure 4–10 . Ribbon Guide Alignment

Returning the Printer to Normal Operation

1. Load paper.

2. Install the ribbon.

3. Close floor cabinet doors and the printer cover.

4. Connect the ac power cord to the power source and the printer.

5. Set the power switch to 1 (on).

6. Test printer operation by selecting and running one of the diagnostic self–tests (page 3–26).

5 Replacement Procedures

Chapter Contents

Replacement Procedures

This chapter contains illustrated removal/installation procedures for components replaceable at the field service level of maintenance. The page locations of all removal/installation tasks are listed on pages 5–1 and 5–2.

Part Numbers

Part numbers for assemblies on the manufacturer's recommended spares list are next to the name of the assembly on the removal/installation illustration. (Procedures for gaining access to other assemblies do not include assembly part numbers.) To order electronic parts, call 1–800–234–1998.

Preparing the Printer for Maintenance

Replacement procedures in this chapter are written assuming the printer has been prepared for maintenance.

To prepare the printer for maintenance, do the following before performing a replacement task:

1. Set the printer power switch to O (off). (If power must be applied as part of a maintenance procedure, you will be instructed to do so in the procedure.)

2. Disconnect the 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 replacement parts before you begin working on the printer.

Belt, Paper Feed Timing (Figure 5–1)

Removal

1. Prepare the printer for maintenance (page 5–3).

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 paper feed motor mount bolts (2).

5. Remove the paper feed timing belt (3) by working the side of the belt onto the lip of the motor pulley (4) and rotating the pulleys until the belt rolls off.

Installation

1. Install the paper feed timing belt (3) over the splined shaft pulley (5) and the lip of the motor pulley (4) and rotate the pulleys until the belt rolls onto the motor pulley.

2. Using a force gauge, apply 12 pounds of tension to the paper feed drive motor (6).

3. Reduce tension to 9 pounds and torque the paper feed motor mount bolts (2) to 18 ± 1 inch–pounds.

4. Snap the timing belt cover (1) into the slots in the side plate.

5. Return the printer to normal operation (page 5–80).

1. Timing Belt Shield
2. Motor Mount Bolt (2)
3. Paper Feed Timing Belt (P/N 29–29283–01)
4. Motor Pulley
5. Splined Shaft Pulley
6. Paper Feed Drive Motor

Figure 5–1 . Belt, Paper Feed Timing, Removal/Installation
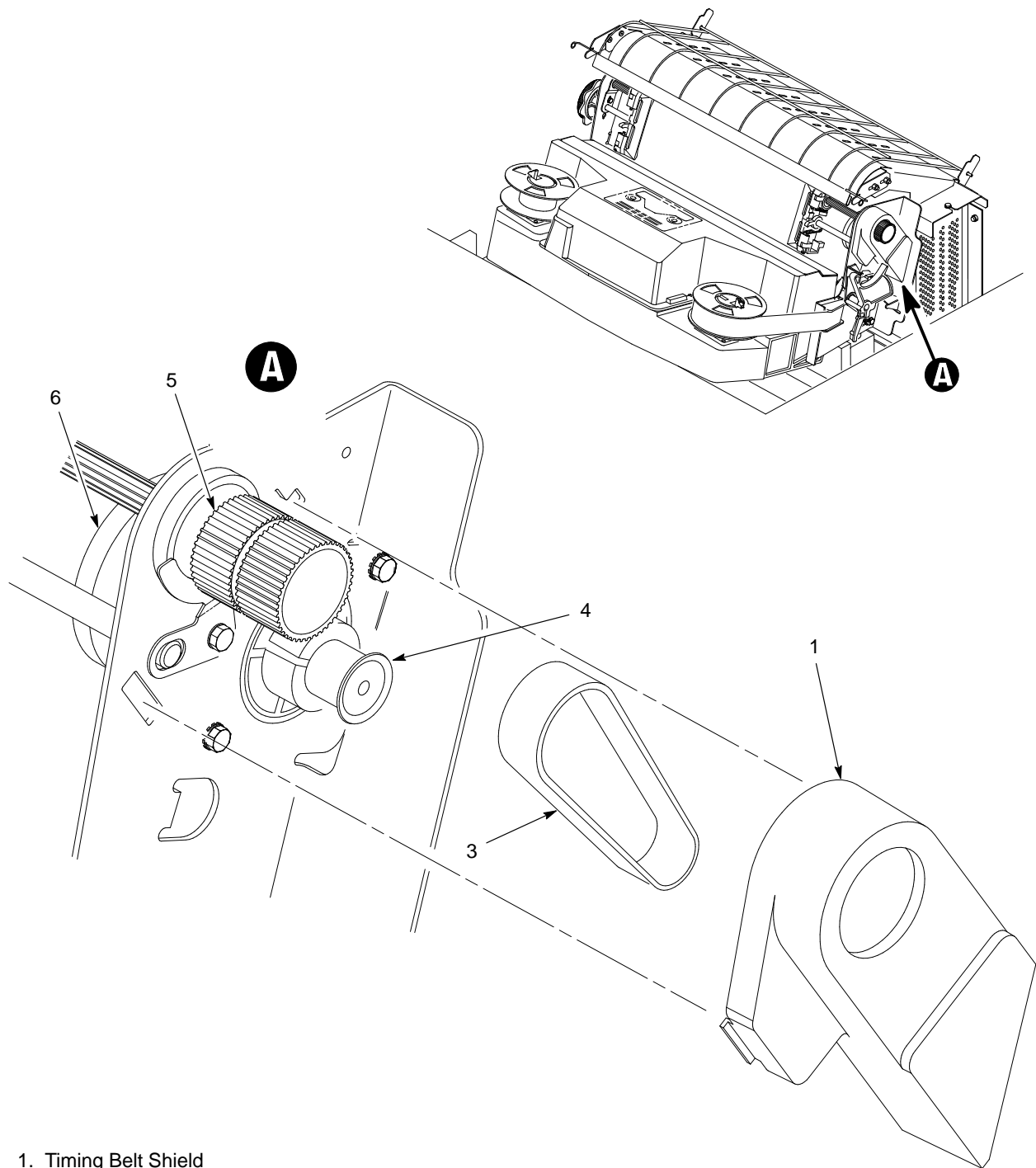
Belt, Platen Open (Figure 5–2)

Removal

1. Prepare the printer for maintenance (page 5–3).

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. Apply tension to the motor shaft to loosen the platen open belt (3).

6. Remove the platen open belt (3) from the motor pulley (4) and platen pulley (5).

Installation

1. Slide the platen open belt (3) over the motor pulley (4) and platen pulley (5).

2. Close the forms thickness lever all the way.

3. Make sure the collar of the platen pulley (5) clears the left ribbon guide with the platen fully closed.

   a. If not, rotate the platen pulley (5) until the collar clears the left ribbon guide and tighten the set screw (6). Go to step 4.

   b. If the collar clears the ribbon guide with the forms thickness lever closed, go to step 4.

4. Using a force gauge, apply 10 pounds of tension to the platen open motor.

5. Reduce tension to 5 pounds and torque the motor mount screws (2) to 11 ± 1 inch–pounds.

6. Snap the platen open belt cover (1) into the slots in the side plate.

7. Return the printer to normal operation (page).

1. Belt Cover
2. Motor Mount Screw
3. Platen Open Belt (P/N 29–29284–01)
4. Motor Pulley
5. Platen Pulley
6. Set Screw

Figure 5–2 . Belt, Platen Open, Removal/Installation

Cable Assembly, Hammer Bank (Figure 5–3)

Removal

> **NOTE:** This procedure removes the left hammer bank cable assembly. The procedure for removing the right cable assembly is the same.

1. Prepare the printer for maintenance (page 5–3).
2. Open the printer cover.
3. Remove the paper guide assembly (page).
4. Remove the common controller PCBA (page 5–46).
5. Remove the mechanism driver PCBA (page 5–48).
6. Remove the power supply PCBA (page 5–50).
7. Remove two screws (1) securing the connector (2) to the bottom of the card cage.
8. Remove two screws (3) securing the connector (4) to the base casting.
9. Note the location and number of tie wraps, then remove them.
10. Feed the hammer bank cable assembly (5) down through the base casting, then out of the card cage.

Installation

> **NOTE:** This procedure installs the left hammer bank cable assembly. The procedure for installing the right cable assembly is the same.

1. Feed the hammer bank cable assembly (5) down through card cage, around the printer, then up through the base casting.
2. Install two screws (3) securing the connector (4) to the base casting.
3. Install two screws (1) securing the connector (2) to the bottom of the card cage.
4. Install tie wraps to join left and right hammer bank cable assemblies.
5. Install the power supply PCBA (page 5–50).
6. Install the mechanism driver PCBA (page 5–48).
7. Install the common controller PCBA (page 5–46).
8. Install the paper guide assembly (page 5–42).
9. Return the printer to normal operation (page 5–80).

Printer viewed from above, PCBAs removed.

1. Screw (2)
2. Connector
3. Screw (2)
4. Connector
5. Hammer Bank Cable Assembly (P/N 29–29293–01)

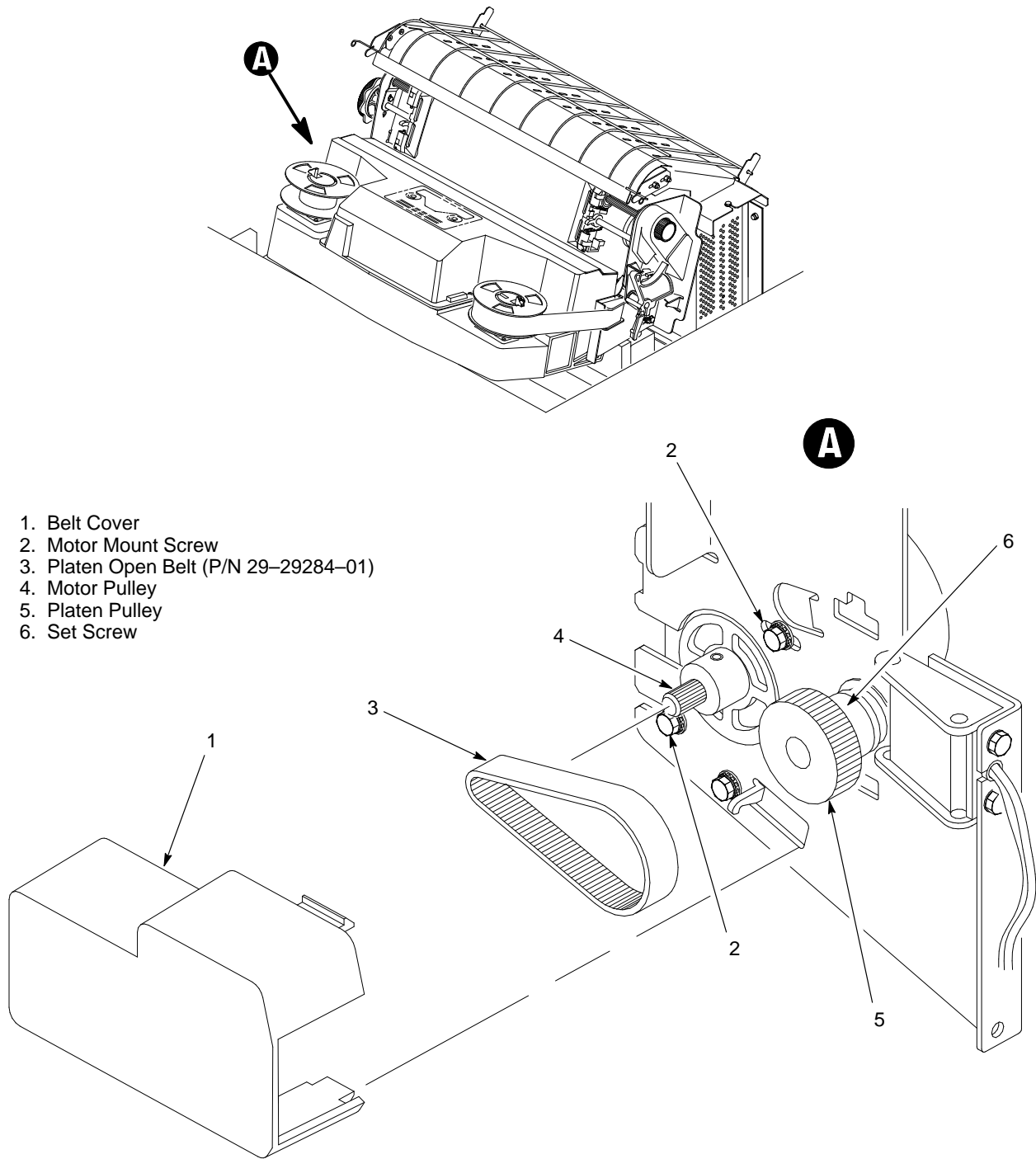**Figure 5–3 . Cable Assembly, Hammer Bank, Removal/Installation**

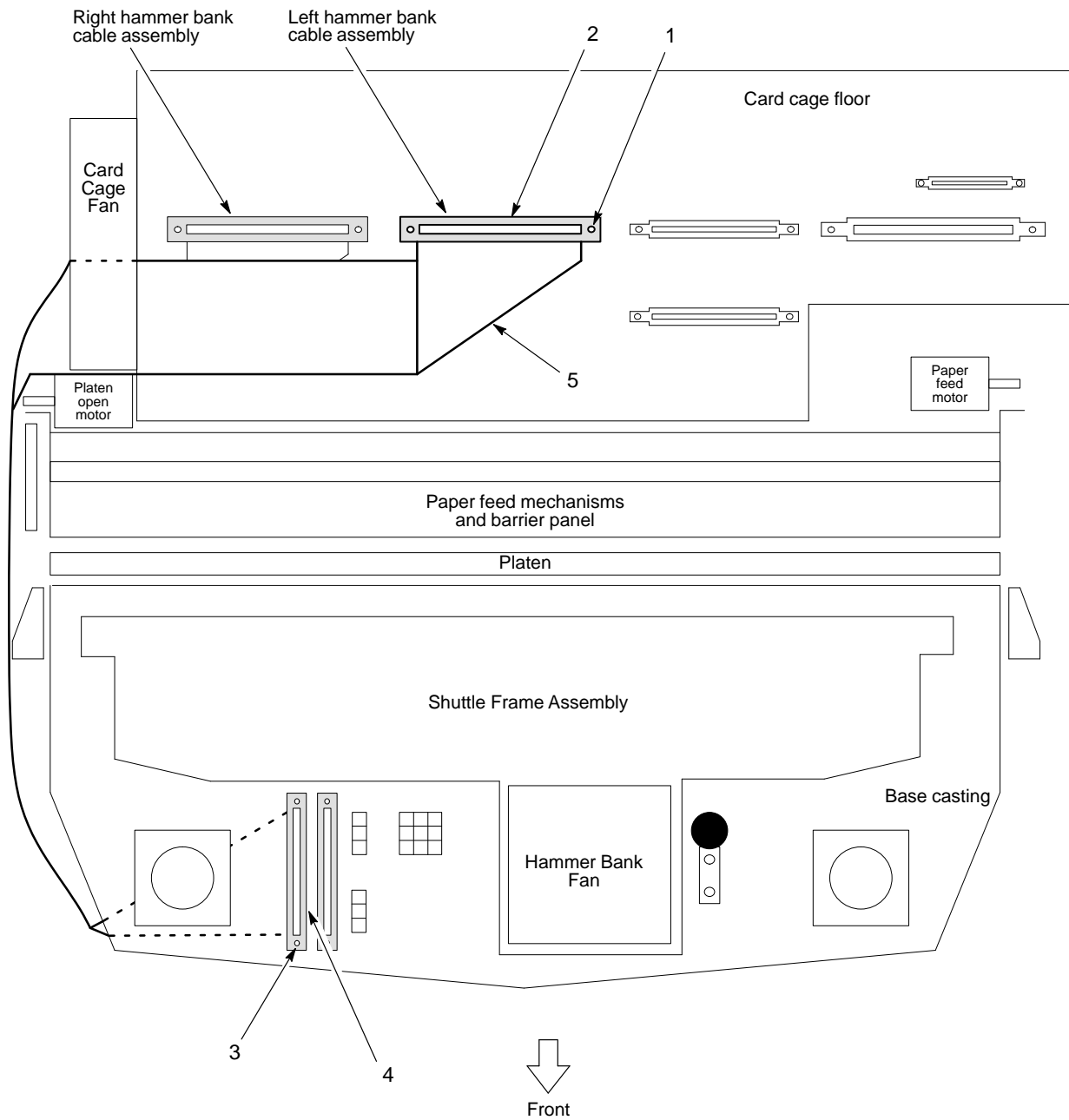# Cable Assembly, Intermediate (Figure 5–4)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Open the printer cover.

3. Remove the paper guide assembly (page 5–42).

4. Remove the common controller PCBA (page 5–46).

5. Remove the mechanism driver PCBA (page 5–48).

6. Remove screws (1) securing the main wire harness connector (2) to the bottom of the card cage. Move the main harness connector to one side.

7. Remove screws (3) securing the intermediate cable assembly connector P1 (4) to the bottom of the card cage.

8. Disconnect connector P1(P) (5) from platen interlock switch assembly (6).

9. Disconnect connector PMD (7) from paper detector switch assembly connector PMD(J) (8).

10. Remove the cover open switch assembly (9) and disconnect connectors CO+ and CO– (10 and 11).

11. Note the location of cable runs and restraints, cut tie wraps, and remove the intermediate cable assembly (12) through the card cage.

Printer viewed from above, PCBAs removed.

1. Screw (2)
2. Main Wire Harness Connector
3. Screw (2)
4. Intermediate Cable Assy Connector P1
5. Connector P1(P)
6. Platen Interlock Switch Assembly
7. Connector PMD
8. Connector PMD(J)
   (Paper Detector Switch Assembly)
9. Cover Open Switch Assembly
10. Connector CO+
11. Connector CO–
12. Intermediate Cable Assembly (P/N 29–29292–01)
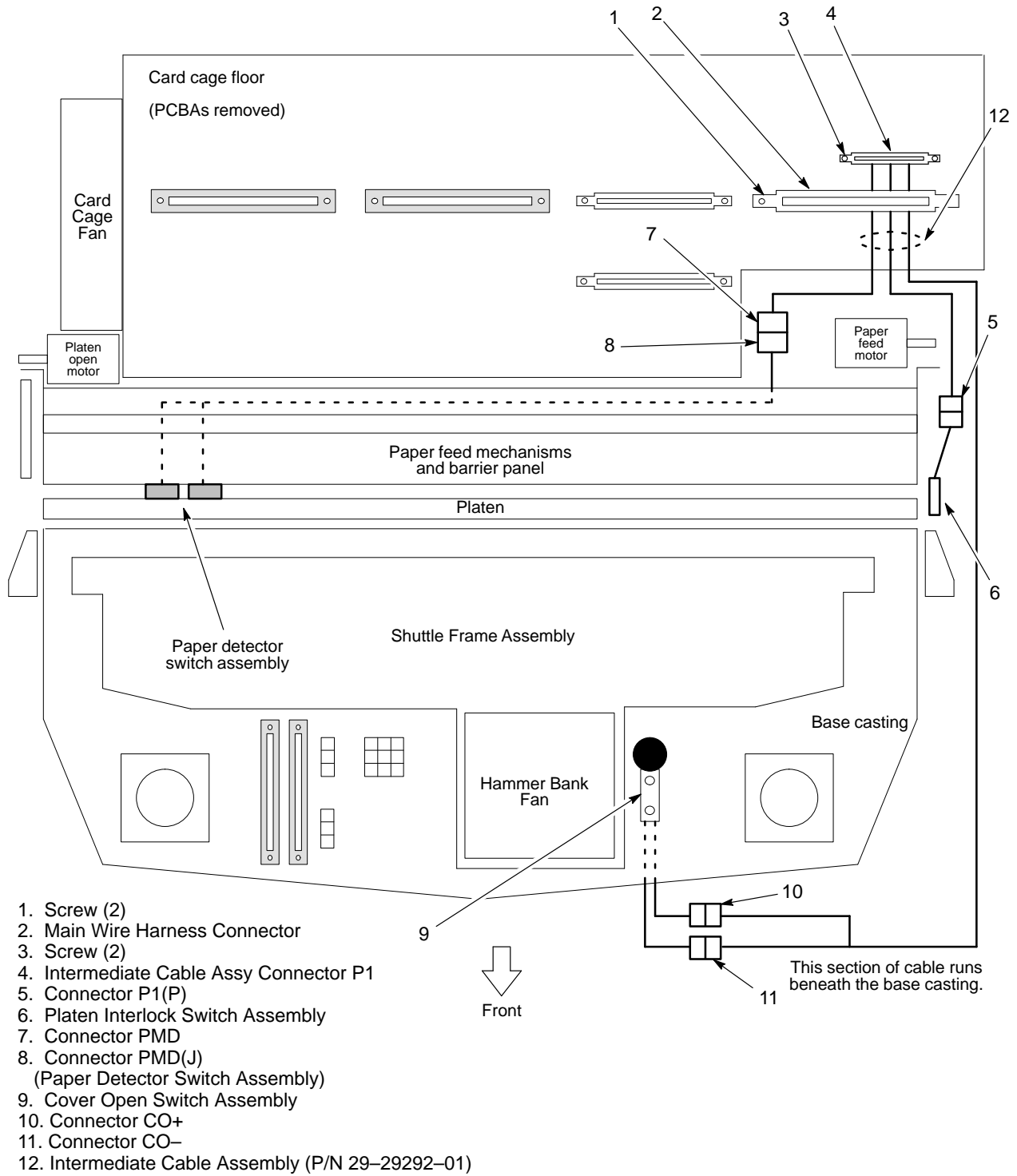
Figure 5–4 . Cable Assembly, Intermediate, Removal/Installation

Installation

1. Feed the intermediate cable assembly (12) through the card cage opening and install tie wraps and cable restraints.

2. Connect connectors CO+ and CO– (10 and 11) and install the cover open switch assembly (9).

3. Connect connector PMD (7) to paper detector switch assembly connector PMD(J) (8).

4. Connect connector P1(P) (5) to the platen interlock switch assembly (6).

5. Install the screws (3) securing the intermediate cable assembly connector P1 (4) to the bottom of the card cage.

6. Move the main harness connector (2) back into position and install the screws (1) securing the connector to the bottom of the card cage.

7. Install the mechanism driver PCBA (page 5–48).

8. Install the common controller PCBA (page 5–46).

9. Install the paper guide assembly (page 5–42).

10. Return the printer to normal operation (page 5–80).

Printer viewed from above, PCBAs removed.

1. Screw (2)
2. Main Wire Harness Connector
3. Screw (2)
4. Intermediate Cable Assy Connector P1
5. Connector P1(P)
6. Platen Interlock Switch Assembly
7. Connector PMD
8. Connector PMD(J)
   (Paper Detector Switch Assembly)
9. Cover Open Switch Assembly
10. Connector CO+
11. Connector CO–
12. Intermediate Cable Assembly (P/N 29–29292–01)
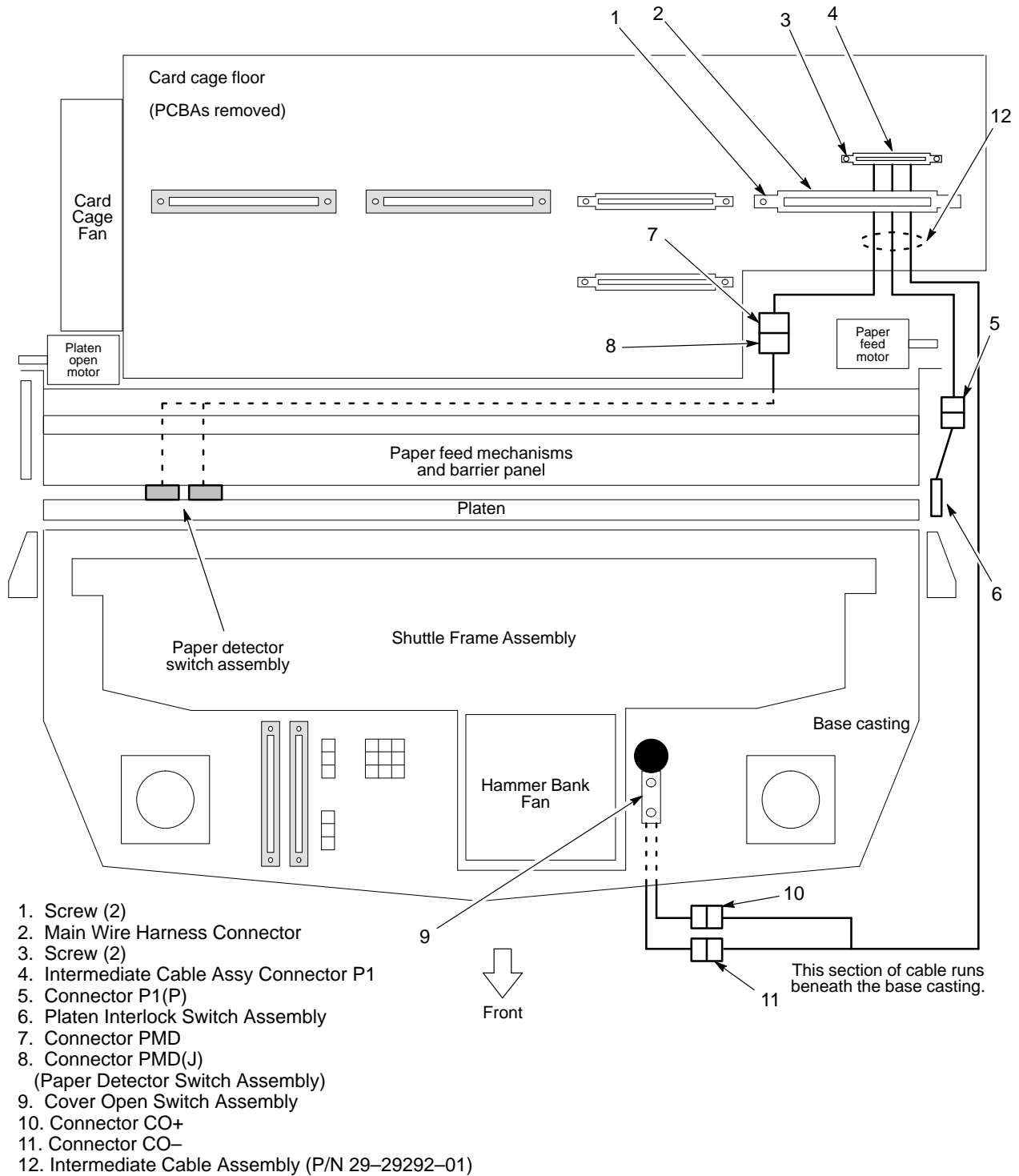
Figure 5–4. Cable Assembly, Intermediate, Removal/Installation

Cable Assembly, Multi I/O (Figure 5–5)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Open the printer cover.

3. Remove the paper guide assembly (page 5–42).

4. Open the rear cabinet door.

5. Remove six screws (1) and move the fan duct (2) aside.

6. Open the ribbon cable restraints (3) on the upper rear and upper right walls of the cabinet.

7. Open the latches (4) and disconnect the multi I/O ribbon cable connector (5) from connector J1 (6) on the common controller PCBA.

8. Release the multi I/O ribbon cable from the holders on the rear wall of the card cage.

9. Feed the multi I/O ribbon cable through the card cage and down into the cabinet.

10. Remove four screws (7) securing the multi I/O cable assembly mounting plate (8).

11. Remove the multi I/O cable assembly (9).

1. Screw (6)
2. Fan Duct
3. Ribbon Cable Restraints
4. Latch (2)
5. Ribbon Cable Connector
6. Common Controller Connector J1
7. Screw (4)
8. Mounting Plate
9. Multi I/O Cable Assembly (P/N 29–29291–01)
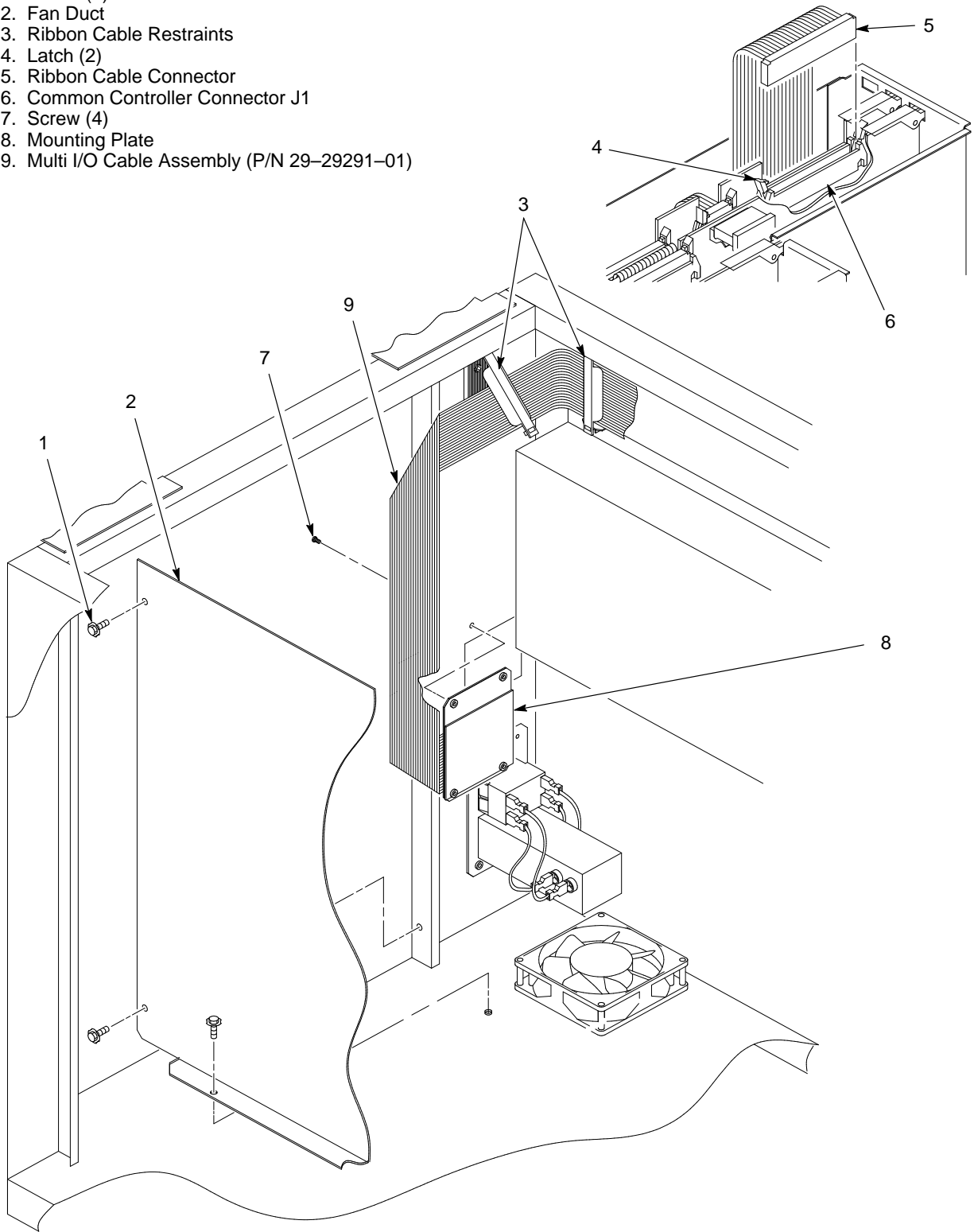
Figure 5–5. Cable Assembly, Multi I/O, Removal/Installation

Installation

1. Feed the multi I/O ribbon cable from the lower cabinet up into the opening at the right rear of the card cage. Route the ribbon cable outboard of the right gas spring assembly (the strut that holds the printer cover open).

2. Install four screws (7) securing the multi I/O cable assembly mounting plate (8).

3. Connect the multi I/O ribbon cable connector (5) to connector J1 (6) on the common controller PCBA and close the latches (4).

4. Latch the multi I/O ribbon cable into the cable restraints (3) located on the upper rear and upper right cabinet walls.

5. Engage the multi I/O ribbon cable in the holders on the rear wall of the card cage.

6. Move the fan duct (2) into position and install the six screws (1).

7. Close the rear cabinet door.

8. Install the paper guide assembly (page 5–42).

9. Return the printer to normal operation (page 5–80).

1. Screw (6)
2. Fan Duct
3. Ribbon Cable Restraints
4. Latch (2)
5. Ribbon Cable Connector
6. Common Controller Connector J1
7. Screw (4)
8. Mounting Plate
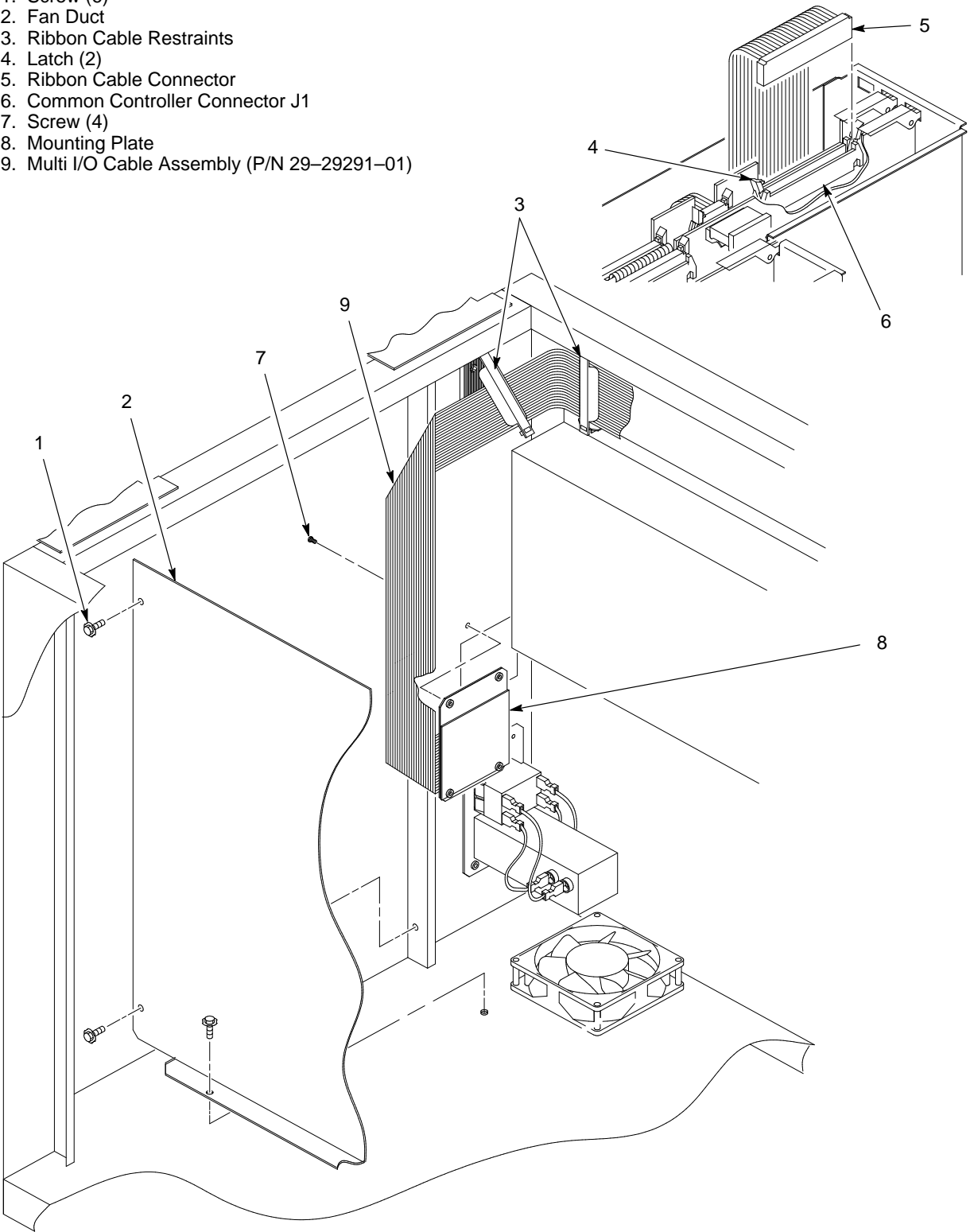9. Multi I/O Cable Assembly (P/N 29–29291–01)

Figure 5–5 . Cable Assembly, Multi I/O, Removal/Installation

Circuit Breaker (Figure 5–6)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Open the rear cabinet door.

3. Remove six screws (1) and move the fan duct (2) aside.

4. Tag and disconnect the four circuit breaker electrical leads (3).

5. Press in on the spring clips (4) and push the circuit breaker (5) out of the mounting plate (6).

Installation

1. Press the circuit breaker (5) into the mounting plate (6) until the spring clips (4) snap into place.

CAUTION

Make sure the four leads are connected as shown in Figure 5–6 .

2. Connect the four circuit breaker electrical leads (3) as shown in Figure 5–6 .

3. Move the fan duct (2) back into position and install the six screws (1).

4. Return the printer to normal operation (page 5–80).

1. Screw (6)
2. Fan Duct
3. Circuit Breaker Electrical Lead (4)
4. Spring Clip (4)
5. Circuit Breaker (P/N 29–29329–01)
6. Mounting Plate

WHITE

BLACK

BROWN

BLUE

6

3

5

1

2

4

1

1
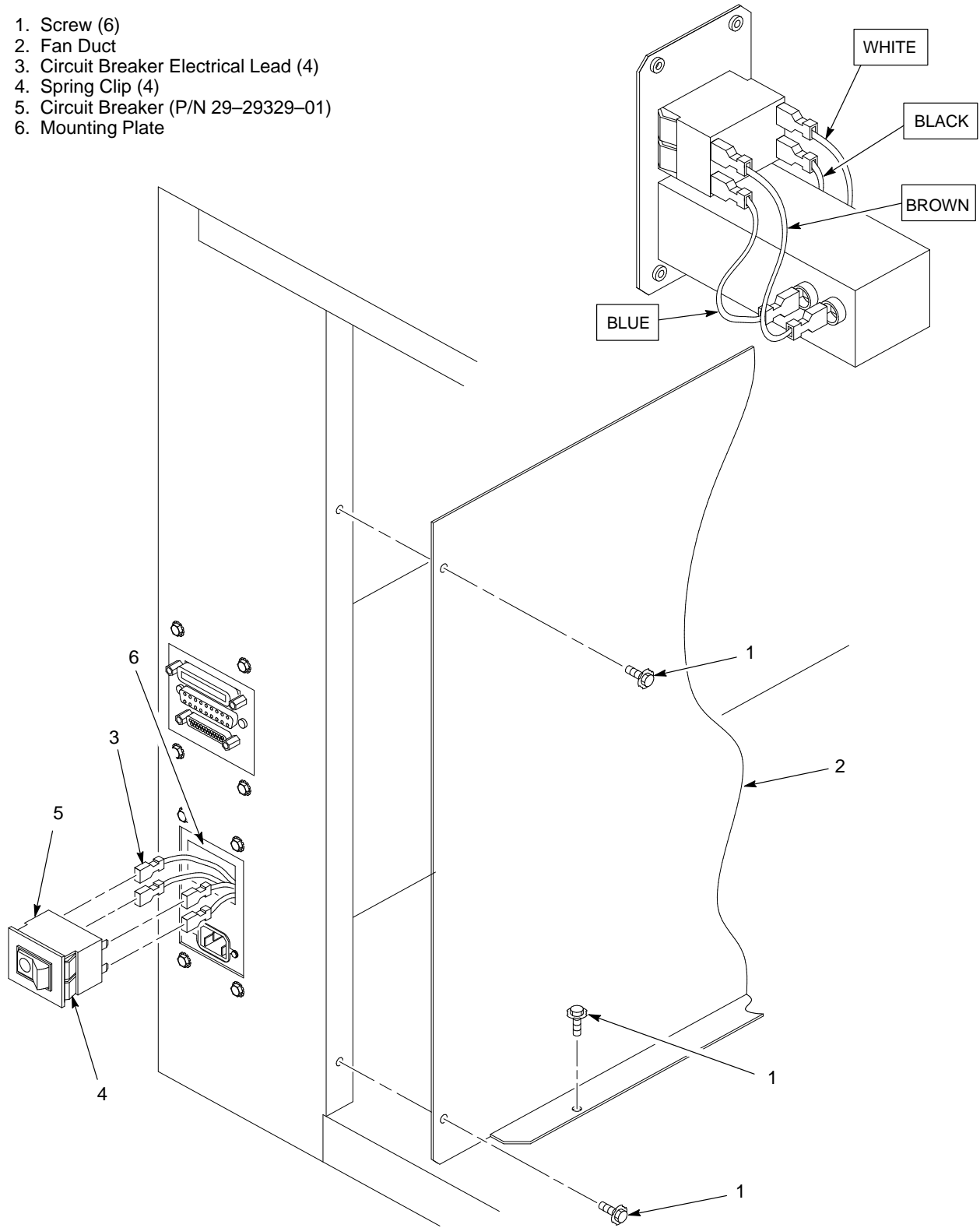
Figure 5–6 . Circuit Breaker Removal/Installation

Control Panel Assembly (Figure 5–7)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Open the printer cover.

3. Remove the paper guide assembly (page 5–42).

4. Open the connector latches and disconnect the control panel ribbon connector P1 (1) from connector J3 on the common controller PCBA (2).

5. Remove the control panel ribbon cable from the wire saddles (3) on the mechanism base pan.

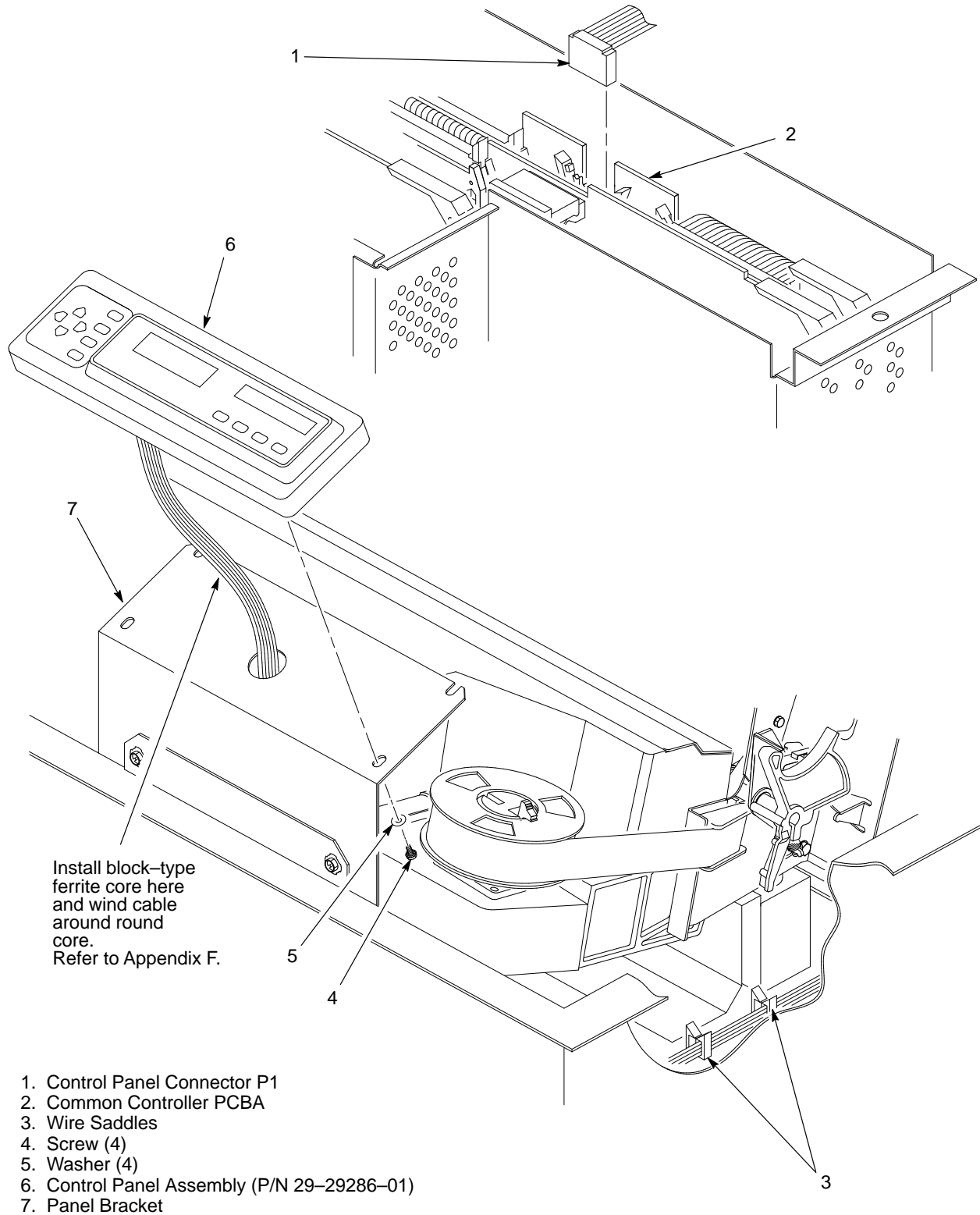6. Remove four screws (4) and washers (5).

7. Remove the control panel assembly (6) from the control panel bracket (7).

Installation

IMPORTANT

You must install two ferrite cores on the control panel cable assembly. Refer to Appendix F.

1. Feed ribbon connector (1) and the ribbon cable through the control panel bracket (7) and position the control panel assembly (6) on the bracket.

2. Install but do not tighten four washers (5) and screws (4).

3. Lower the printer cover and center the control panel assembly (6) in the cutout of the printer cover.

4. Open the printer cover and tighten the four screws (4).

5. Route the control panel ribbon cable along the right side of the printer. Feed the ribbon cable and ribbon connector (1) through the slot in the card cage below the card cage fan.

6. Connect the control panel ribbon connector P1 (1) to connector J3 on the common controller PCBA (2) and close the connector latches.

7. Insert the control panel ribbon cable into the wire saddles (3) on the mechanism base pan.

8. Install the paper guide assembly (page 5–42).

9. Return the printer to normal operation (page 5–80).

Install block–type
ferrite core here
and wind cable
around round
core.
Refer to Appendix F.

1. Control Panel Connector P1
2. Common Controller PCBA
3. Wire Saddles
4. Screw (4)
5. Washer (4)
6. Control Panel Assembly (P/N 29–29286–01)
7. Panel Bracket

Figure 5–7 . Control Panel Assembly Removal/Installation

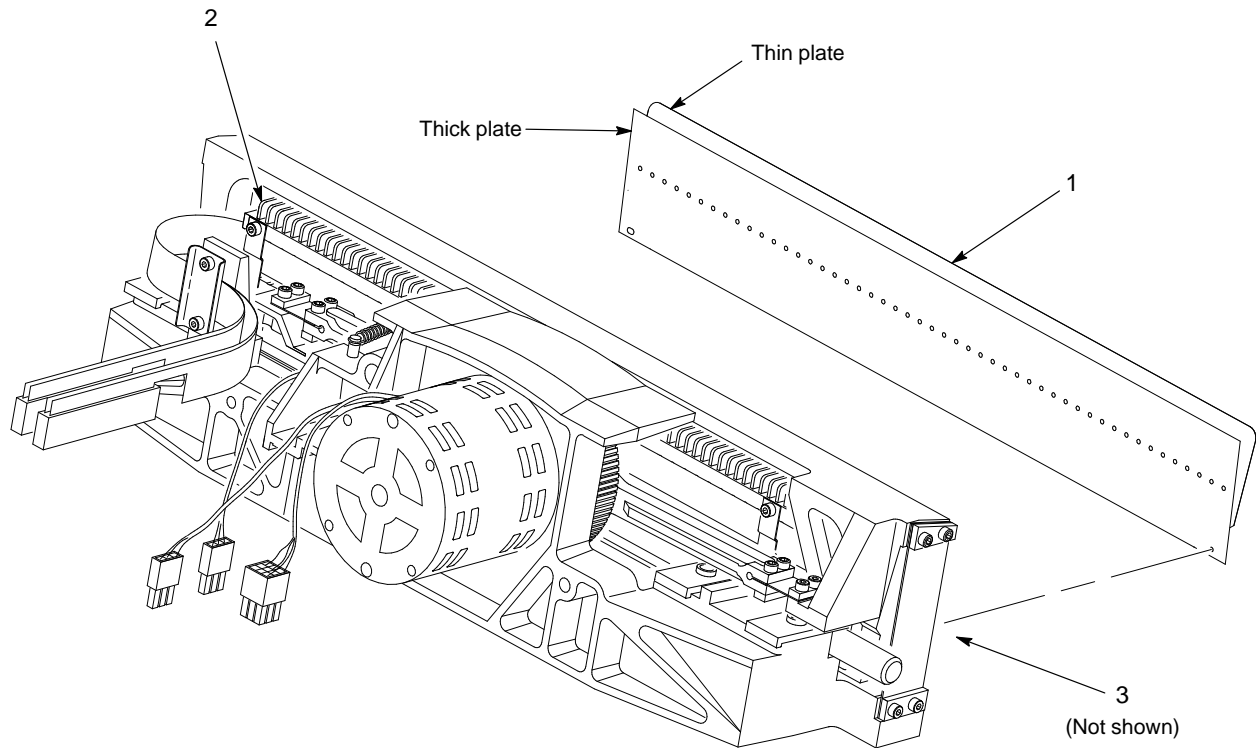# Cover Assembly, Hammer Bank (Figure 5–8)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Remove the shuttle frame assembly (page 5–66).

3. Rotate hammer bank cover assembly (1) away from hammer bank (2).

4. Remove hammer bank cover assembly (1) from alignment pins (3).

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 (2), engage the hammer bank cover assembly (1) on the alignment pins (3).

2. Rotate the hammer bank cover assembly (1) until it lies flush on the hammer bank (2). Check that the hammer bank cover assembly is properly positioned over the alignment pins (3) and hammer tips.

3. Install the shuttle frame assembly (page 5–66).

4. Return the printer to normal operation (page 5–80).

2

Thin plate

Thick plate

1

3
(Not shown)

1. Hammer Bank Cover Assembly (P/N 29–29280–01)
2. Hammer Bank
3. Alignment Pin (2)

Figure 5–8 . Cover Assembly, Hammer Bank, Removal/Installation

Cover Assembly, Shuttle (Figure 5–9)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Open the printer cover.

3. Loosen the shuttle cover screws (1).

4. Grasping the edges of the shuttle cover assembly (2), tilt up the rear edge and lift the shuttle cover assembly out of the printer.

Installation

1. Place the shuttle cover assembly (2) in the printer. Tilt the forward edge of the cover down slightly and work the cover into position.

2. Tighten the shuttle cover screws (1).

3. Return the printer to normal operation (page 5–80).
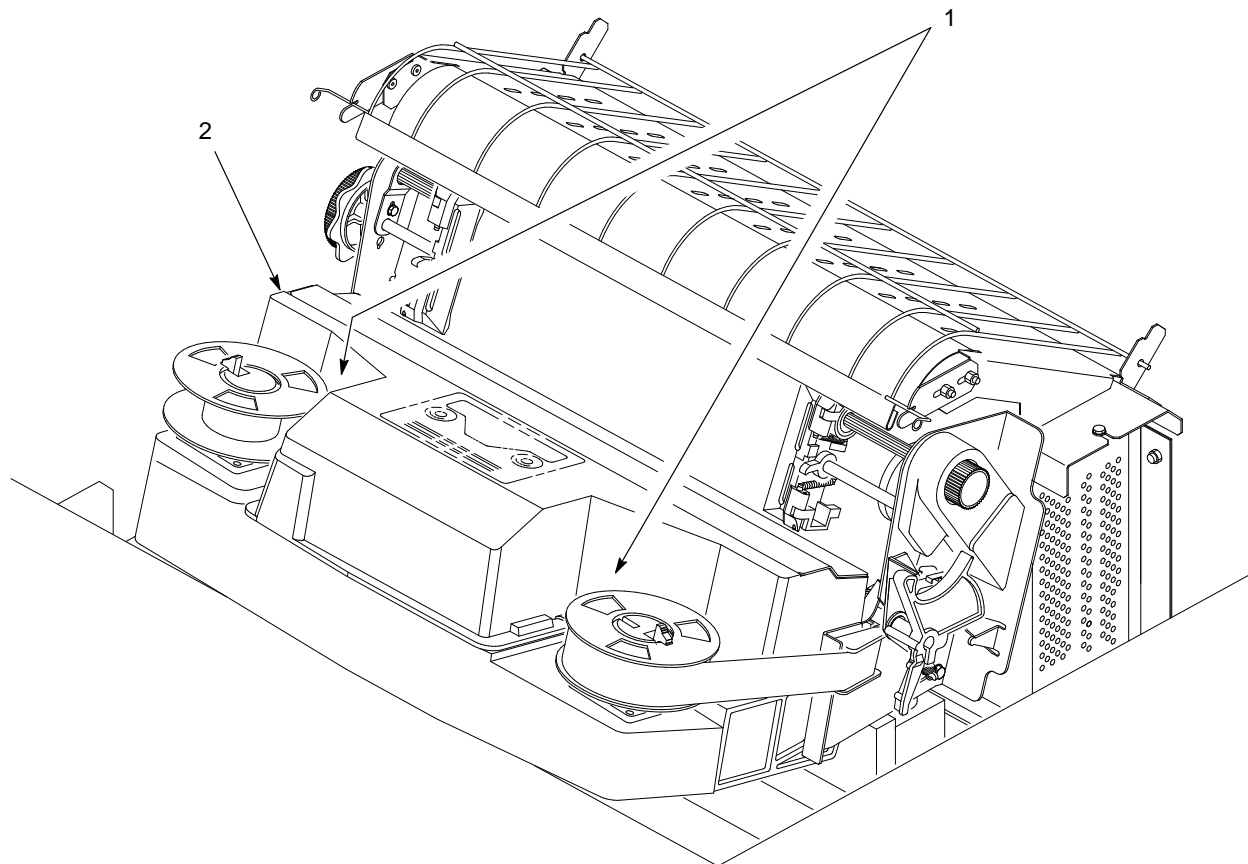
1. Screw, Captive, Shuttle Cover (2)
2. Shuttle Cover Assembly (Mfg. P/N 150123–011)

Figure 5–9 . Cover Assembly, Shuttle, Removal/Installation

Fan Assembly, Card Cage (Figure 5–10)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Open the printer cover.

3. Remove the paper guide assembly (page 5–42).

4. Remove the power supply PCBA (page 5–50).

5. Remove the nut (1) and ground wire (2).

6. Remove four screws (3).

7. Disconnect the fan cable connector (4).

8. Remove the card cage fan assembly (5) and fan guard (6) from the card cage (7).

Installation

1. Connect the fan cable connector (4).

2. Position the card cage fan assembly (5) and fan guard (6) in the card cage (7).

3. Install four screws (3).

4. Install the ground wire (2) and nut (1).

5. Install the power supply PCBA (page 5–50).

6. Install the paper guide assembly (page 5–42).

7. Return the printer to normal operation (page 5–80).
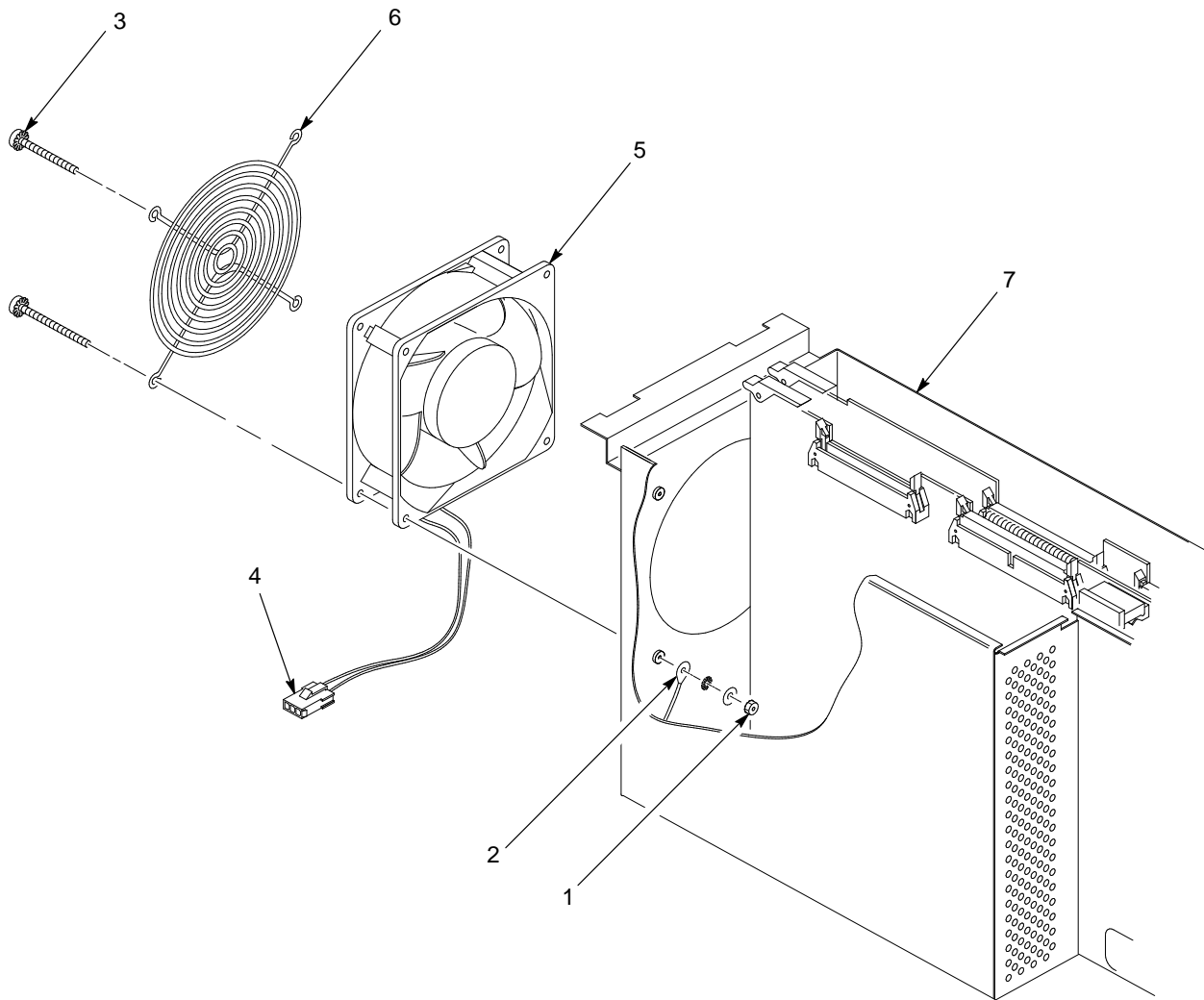
1. Nut
2. Ground Wire
3. Screw (4)
4. Fan Cable Connector
5. Card Cage Fan Assembly (P/N 29–29294–01)
6. Fan Guard
7. Card Cage

Figure 5–10 . Fan Assembly, Card Cage, Removal/Installation

Fan Assembly, Cabinet Exhaust (Figure 5–11)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Open the floor cabinet rear door.

3. Remove six screws (1) and move the fan duct (2) aside.

4. Remove four screws (3) securing the cabinet exhaust fan assembly (4).

5. Disconnect the fan cable connector (5).

6. Remove the cabinet exhaust fan assembly (4) and fan guard (6).

Installation

1. Connect the fan cable connector (5).

2. Position the cabinet exhaust fan assembly (4) and fan guard (6) on the cabinet floor.

3. Install six screws (3) securing the cabinet exhaust fan assembly (4).

4. Move the fan duct (2) back into position and install the four screws (1).

5. Return the printer to normal operation (page 5–80).

1. Screw (6)
2. Fan Duct
3. Screw (4)
4. Cabinet Exhaust Fan Assembly (P/N 29–29294–01)
5. Fan Cable Connector
6. Fan Guard
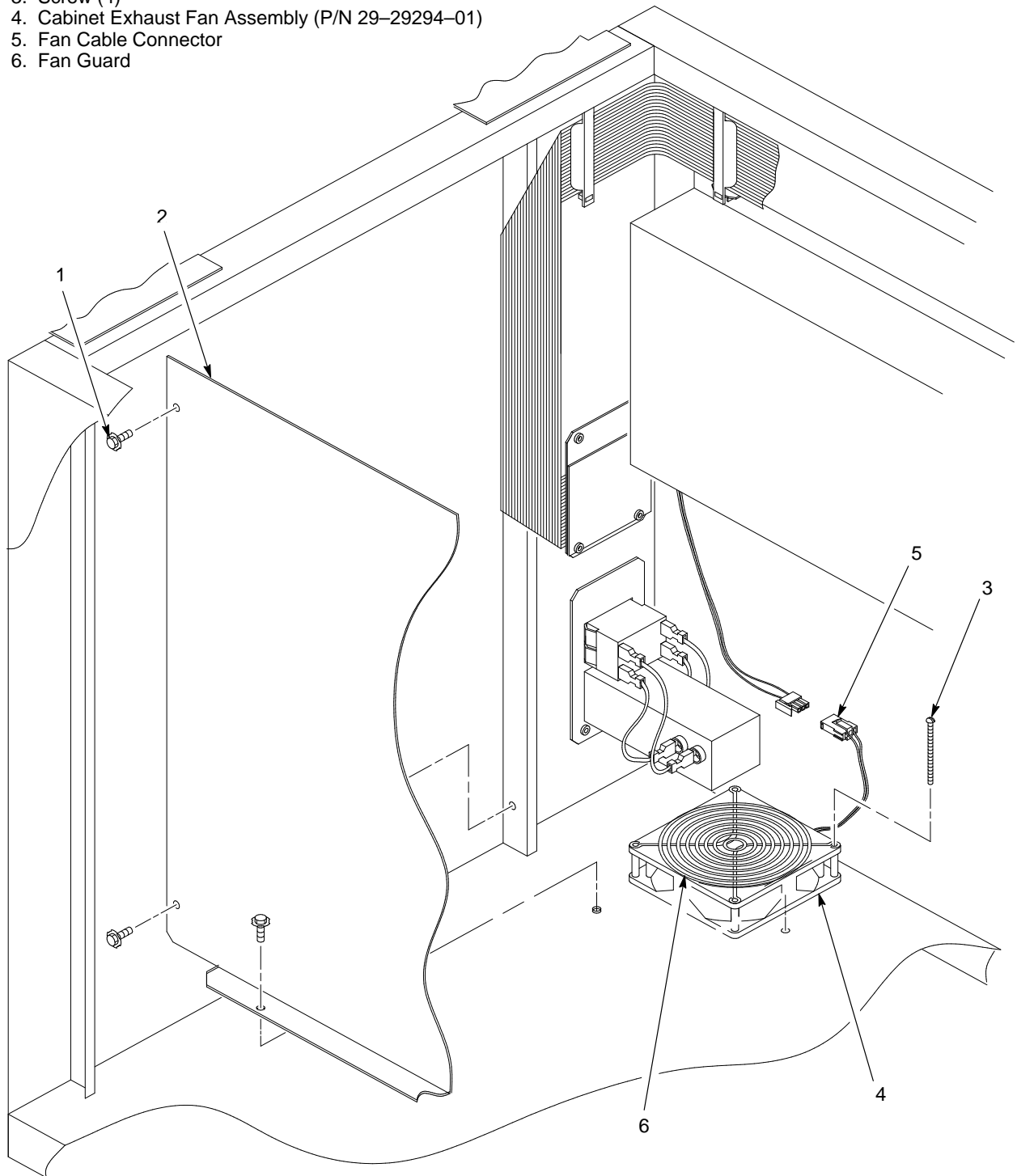
Figure 5–11 . Fan Assembly, Cabinet Exhaust, Removal/Installation

Fan Assembly, Hammer Bank (Figure 5–12)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Remove the shuttle cover assembly (page 5–24).

3. Remove three screws (1).

4. Reach under the base casting (2) and disconnect the hammer bank fan cable connector (3).

NOTE: The hammer bank fan assembly is removed by angling it up and out from beneath the shuttle motor.

5. Remove the hammer bank fan assembly (4) from the base casting (2).

Installation

NOTE: The hammer bank fan assembly is installed by angling it down and under the shuttle motor.

1. Feed the hammer bank fan cable connector (3) through the slot in the fan well of the base casting (2).

2. Open the floor cabinet front door.

3. Reaching up under the base casting (2) from inside the cabinet, route the fan cable to right and angle the hammer bank fan assembly (4) down into the fan well.

4. Connect the hammer bank fan cable connector (5).

5. Close the floor cabinet front door.

6. Install three screws (1).

7. Install the shuttle cover assembly (page 5–24).

8. Return the printer to normal operation (page 5–80).

Attach cable
connector here.

NOTE: Do not install
screw here.

Route cable under
base casting.

Hammer Bank

Fan

Front
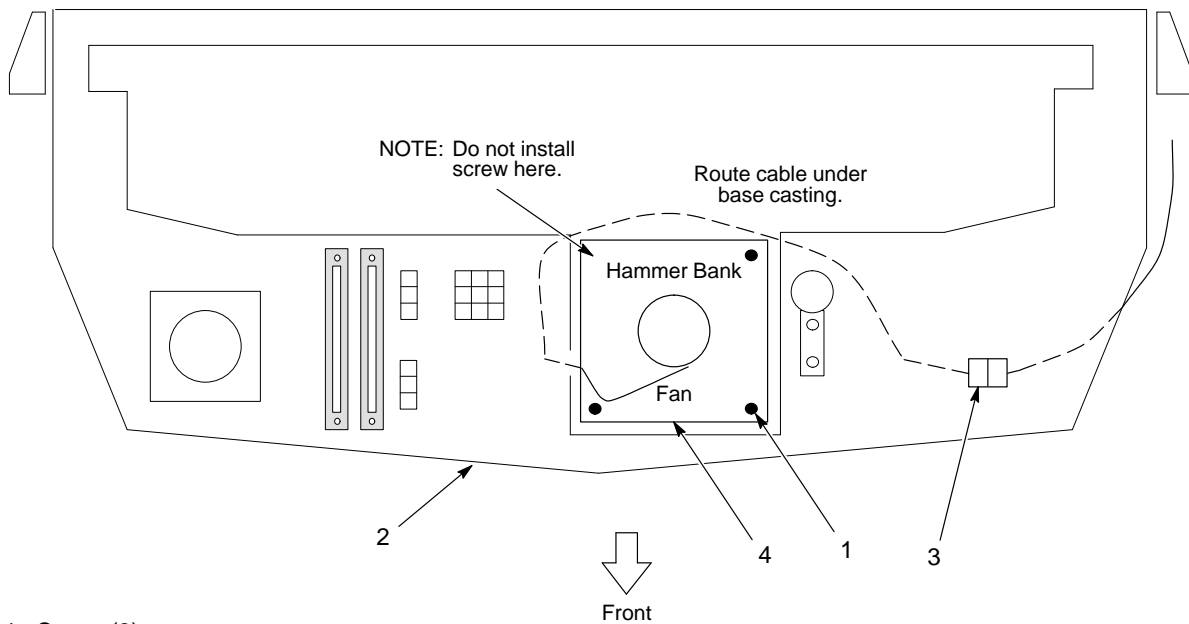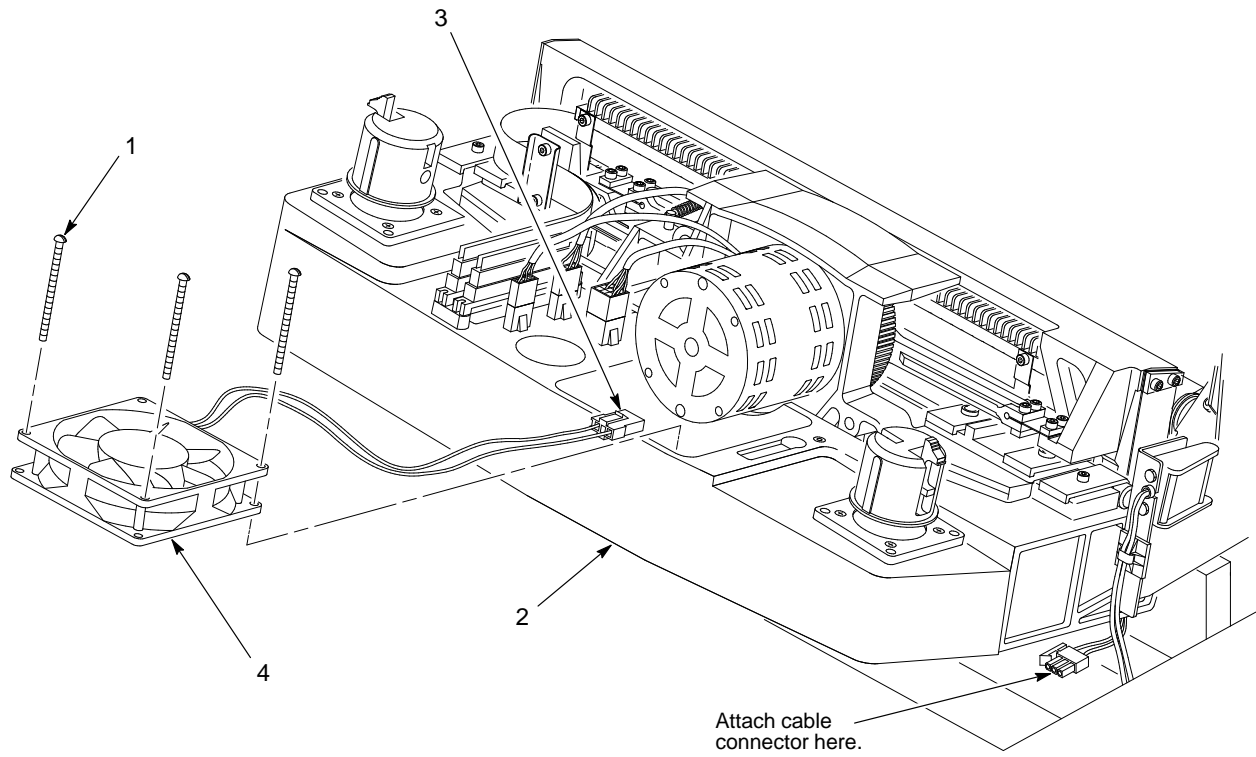
1. Screw (3)
2. Base Casting
3. Fan Cable Connector
4. Hammer Bank Fan Assembly (P/N 29–29295–01)

Figure 5–12 . Fan Assembly, Hammer Bank, Removal/Installation

Hammer Spring Assembly (Figure 5–13)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Remove the shuttle frame assembly (page 5–66).

3. Remove the hammer bank cover assembly (page 5–22).

4. Remove three 5/64 inch socket head screws from the old hammer fret.

5. Using the pointed end of the nylon stick supplied in the hammer spring replacement kit, carefully pry the old hammer fret off its mounting pins as shown in Figure 5–13 .

6. Discard the old hammer fret and mounting screws.

Installation

IMPORTANT

FRET ONE is on the RIGHT END of the hammer bank as you face the hammer springs. FRET SEVEN is the LEFT END of the hammer bank. If you accidently bend the wrong hammer, DO NOT attempt to rebend the hammer and do not install that fret.

1. If you are replacing one of the inner frets, go to step 2.
   If you are replacing fret seven, bend the left–most hammer spring as shown in Figure 5–13 *before* removing it from the box. If you are replacing fret one, bend the right–most hammer spring as shown in Figure 5–13 *before* removing it from the box. Go to step 2.

2. Remove the new fret and mounting screws from the box.

3. Install the new fret on the hammer bank mounting pins and press it into position with the flat end of the nylon stick supplied in the hammer spring replacement kit.

4. Install the screws from the replacement kit in the order shown in Figure 5–13 . Torque each screw to 8 in–lbs.

5. Install the hammer bank cover assembly (page 5–22).

6. Install the shuttle frame assembly (page 5–66).

7. Return the printer to normal operation (page 5–80).

Preparation – Frets 1 and 7 only

Right end

Hammer Bank

Left end

NOTE:

If you replace fret 1 or 7, bend the end hammer down BEFORE removing it from the box, as shown below. Do this ONLY for frets 1 and 7.

Bend this hammer if replacing fret 7.

Bend this hammer if replacing fret 1.

See NOTE.

Hammer Fret 1

See NOTE.

Hammer Fret 7

Bend hammer down until it touches the mounting base in the box.

Use these screws to install new fret.

Removal – Any Fret

Discard old screws.
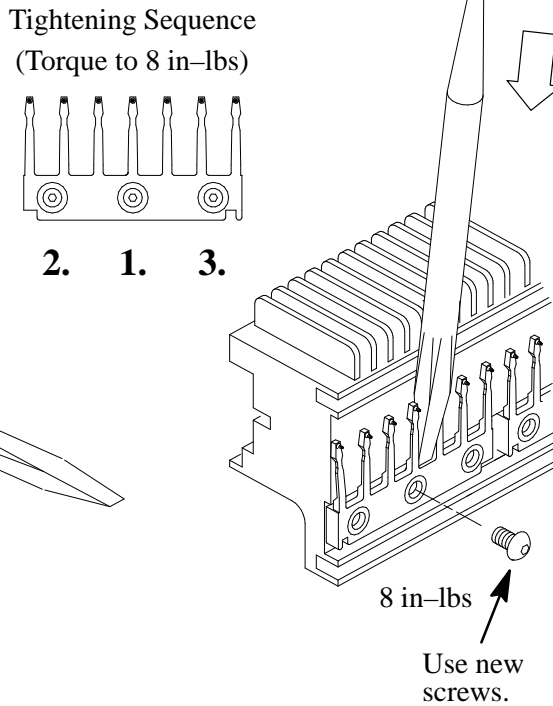
Hammer Spring Replacement Kit: P/N 29–29281–01

Installation – Any Fret

Tightening Sequence
(Torque to 8 in–lbs)

2.   1.   3.

8 in–lbs

Use new screws.

Figure 5–13 . Hammer Spring Assembly Removal/Installation

Magnetic Pick–up (MPU) Assembly (Figure 5–14)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Remove the shuttle cover (page 5–24).

3. Disconnect the magnetic pick–up (MPU) cable connector (1).

4. Loosen the MPU clamp screw (2).

5. Remove the MPU assembly (3) by unscrewing it from the MPU bracket (4).

Installation

1. Install the MPU assembly (3) by screwing it into the MPU bracket (4).

2. Using a feeler gauge, adjust the gap between the MPU assembly (3) and the flywheel (5) to $0.010 \pm .001$ inch. Torque the MPU clamp screw (2) to 19 ± 1 inch–pounds.

3. Check the gap between the MPU assembly (3) and the flywheel (5) with a feeler gauge:

   c. If the gap is $0.010 \pm .001$ inch, go to step 4.

   d. If the gap is not 0.010 ± 0.001 inch, loosen the MPU clamp screw (2) and go back to step 2.

4. Connect the magnetic pick–up (MPU) cable connector (1).

5. Install the shuttle cover (page 5–24).

6. Return the printer to normal operation (page 5–80).

0.010 + .001INCH
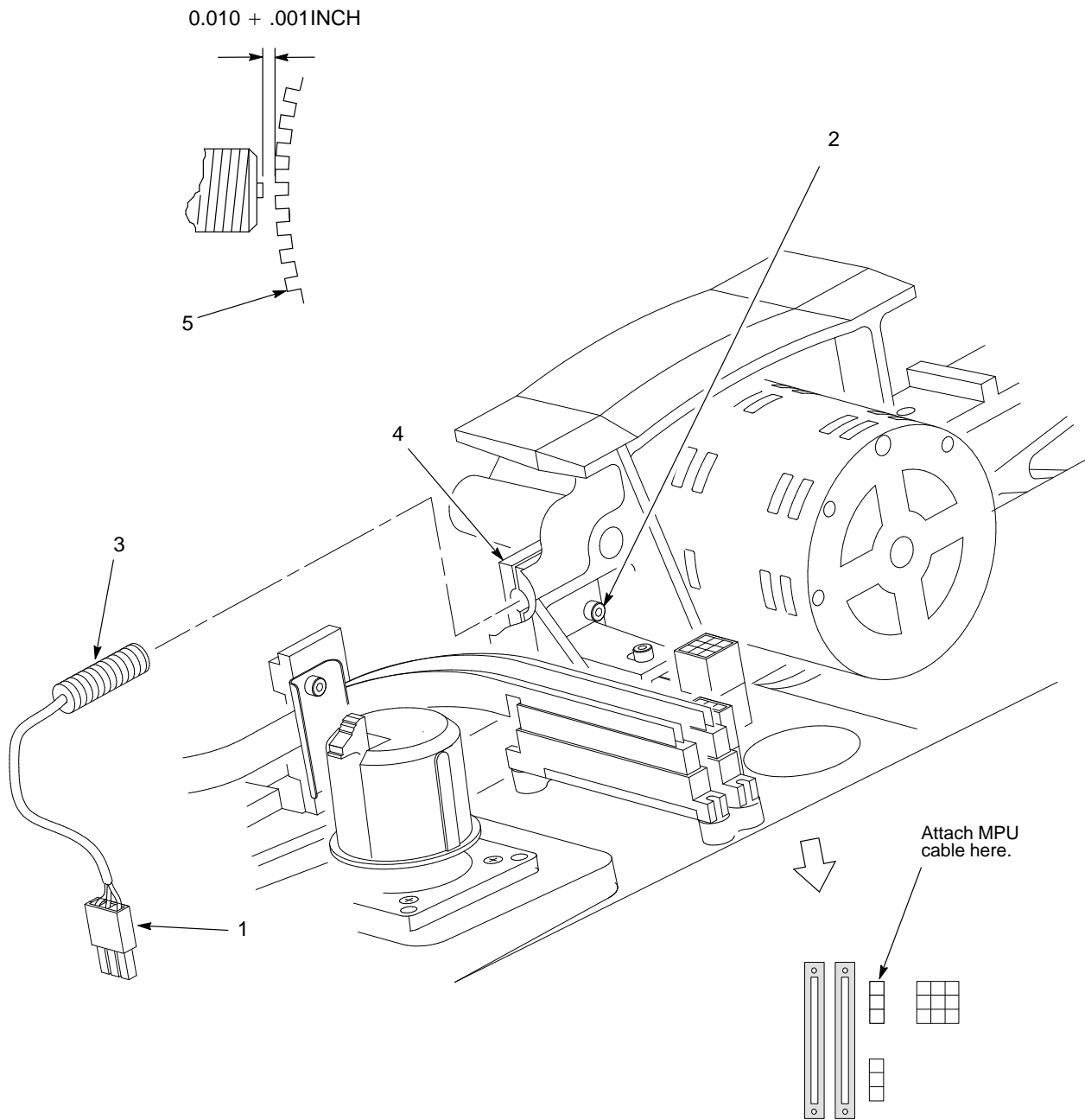
1. MPU Cable Connector
2. MPU Clamp Screw
3. Magnetic Pick–Up (MPU) Assembly (P/N 29–29277–001)
4. MPU Bracket
5. Flywheel

Figure 5–14 . Magnetic Pick–up (MPU) Assembly Removal/Installation

Motor Assembly, Ribbon Drive (Figure 5–15)

Removal

NOTE: The procedure below is the same for the left and right ribbon drive motor assemblies.

1. Prepare the printer for maintenance (page 5–3).
2. Remove the ribbon.
3. Remove the ribbon hub (page 5–58).
4. Remove two screws (1) and washers (2).
5. Lift the ribbon drive motor (3) and its cable from base casting (4).
6. Disconnect the ribbon motor cable connector (5).
7. Loosen the set screw (6) and remove the collar (7) and shaft extension (8).

Installation

IMPORTANT

You must install a ferrite core on the ribbon motor cable assembly. Refer to Appendix F.

NOTE: The procedure below is the same for the left and right ribbon drive motor assemblies.

1. Install the shaft extension (8) and collar (7), and tighten the set screw (6).
2. Connect the ribbon motor cable connector (5) and position the ribbon drive motor (3) in the base casting (4).
3. Install screws (1) and washers (2) to secure the upper right and lower left corners of the ribbon drive motor assembly (3).
4. Install the ribbon hub (page 5–58).
5. Return the printer to normal operation (page 5–80).

Install block–type
ferrite core here.
Refer to Appendix F.
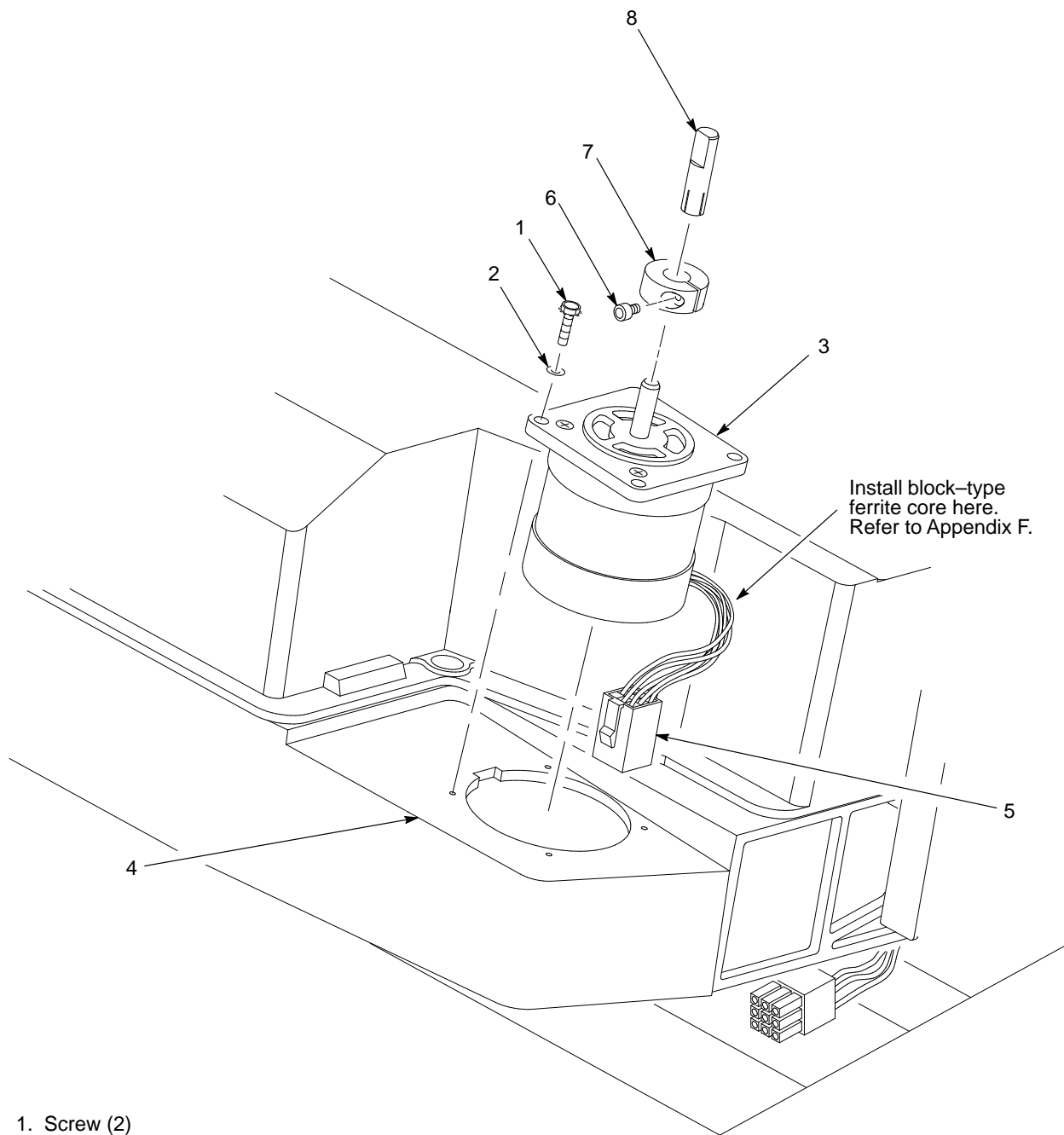
1. Screw (2)
2. Washer (2)
3. Ribbon Drive Motor (P/N 29–29282–01)
4. Base Casting
5. Ribbon Motor Cable Connector
6. Set Screw
7. Collar
8. Shaft Extension

Figure 5–15 . Motor Assembly, Ribbon Drive, Removal/Installation

Motor Assembly, Paper Feed (Figure 5–16)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Open the printer cover.

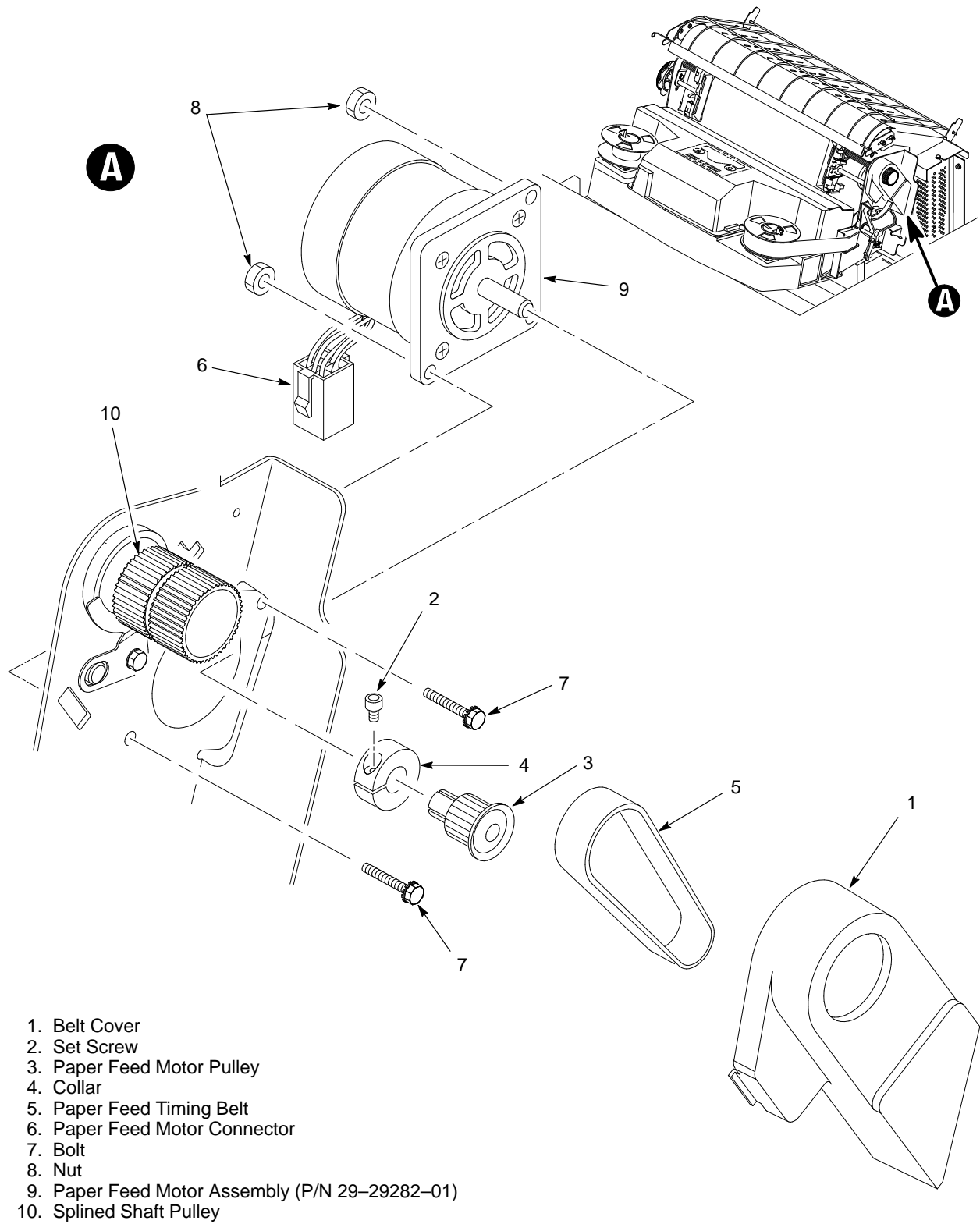3. Remove the platen open belt cover (1) by squeezing the top and bottom to release the plastic tabs from the slots in the side plate.

4. Loosen the set screw (2) and remove the paper feed motor pulley (3), collar (4), and paper feed timing belt (5).

5. Disconnect the paper feed motor electrical connector (6).

6. Remove the motor mount bolts (7) and nuts (8).

7. Remove the paper feed motor assembly (9).

Installation

1. Position the paper feed motor assembly (9) on the right side plate and install the motor mount bolts (7) and nuts (8) finger tight.

2. Connect the paper feed motor electrical connector (6).

3. Install the paper feed motor pulley (3), collar (4), and timing belt (5).

4. Align the paper feed motor pulley (3) with the splined shaft pulley (10).

5. Hold the collar (4) snug against the motor pulley (3) and tighten the set screw (2).

6. Using a force gauge, apply 12 pounds of tension to the paper feed motor assembly (12).

7. Reduce tension to 9 pounds and torque the motor mount bolts (7) to 18 ± 1 inch–pounds.

8. Snap the platen open belt cover (1) into the slots in the side plate.

9. Return the printer to normal operation (page 5–80).

1. Belt Cover
2. Set Screw
3. Paper Feed Motor Pulley
4. Collar
5. Paper Feed Timing Belt
6. Paper Feed Motor Connector
7. Bolt
8. Nut
9. Paper Feed Motor Assembly (P/N 29–29282–01)
10. Splined Shaft Pulley

Figure 5–16 . Motor Assembly, Paper Feed, Removal/Installation
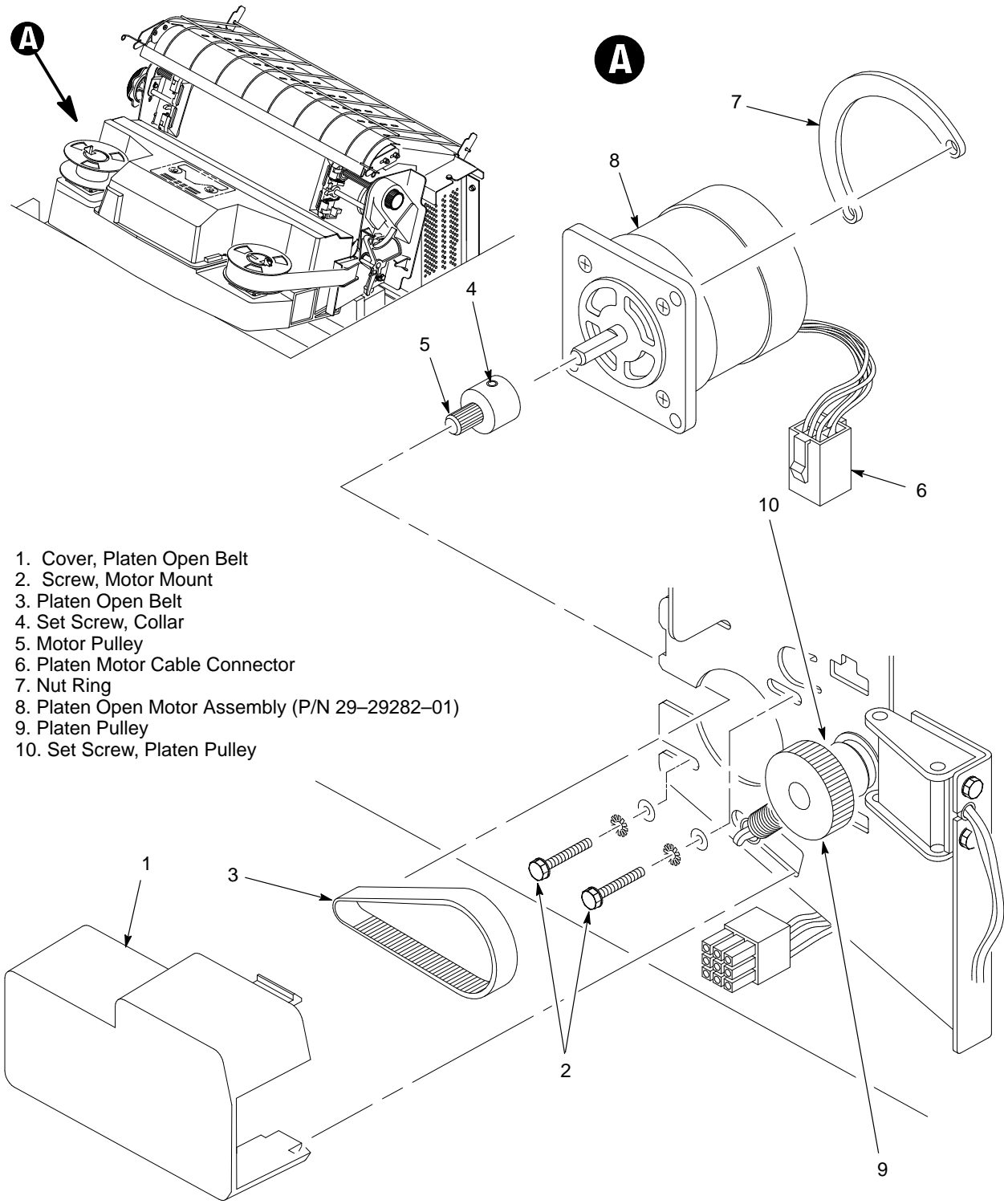
Motor Assembly, Platen Open (Figure 5–17)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Remove the card cage fan assembly (page 5–26).

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. Remove the platen open belt (3).

6. Loosen the collar set screw (4) and remove the motor pulley (5).

7. Disconnect the platen motor cable connector (6).

8. Remove the motor mount screws (2) and nut ring (7).

9. Remove the platen open motor assembly (8).

Installation

1. Position the platen open motor assembly (8) and nut ring (7) and install the motor mount screws (2).

2. Install the motor pulley (5), align it with the platen pulley (9), and tighten the collar set screw (4).

3. Connect the platen motor cable connector (6).

4. Install the platen open belt (3).

5. Close the forms thickness lever all the way.

6. Make sure the collar of the platen pulley (9) clears the left ribbon guide with the platen fully closed.

    a. If not, rotate the platen pulley (9) until the collar clears the left ribbon guide and tighten the platen pulley set screw (10). Go to step 7.

    b. If the collar clears the ribbon guide with the forms thickness lever closed, go to step 7.

7. Using a force gauge, apply 10 pounds of tension to the platen open motor assembly (8), reduce tension to 5 pounds and torque the motor mount screws (2) to 11 ± 1 inch–pounds.

8. Snap the platen open belt cover (1) into the slots in the side plate.

9. Install the card cage fan assembly (page 5–26).

10. Return the printer to normal operation (page 5–80).

A

A

1. Cover, Platen Open Belt
2. Screw, Motor Mount
3. Platen Open Belt
4. Set Screw, Collar
5. Motor Pulley
6. Platen Motor Cable Connector
7. Nut Ring
8. Platen Open Motor Assembly (P/N 29–29282–01)
9. Platen Pulley
10. Set Screw, Platen Pulley

Figure 5–17 . Motor Assembly, Platen Open, Removal/Installation

Paper Guide Assembly (Figure 5–18)

Removal

1. Prepare the printer for maintenance (page 5–3).
2. Open the printer cover.
3. Loosen—do not remove—the hold–down screw (1).
4. Slide the paper guide assembly (2) to the left and lift it off the card cage (3).

Installation

1. Position the paper guide assembly (2) offset slightly to the left on the card cage (3).
2. Slide the paper guide assembly (2) to the right and engage the tabs on the underside of the paper guide assembly with the left edge of the card cage.
3. Slide the paper guide assembly (2) to the right as far as it will go.
4. Tighten the hold–down screw (1).
5. Return the printer to normal operation (page 5–80).

NOTE: Loosen, do not remove, the hold–down screw.

1

Clips on card cage top. (Not shown.)

2

Engage clips here.

3

1. Hold–Down Screw
2. Paper Guide Assembly
3. Card Cage
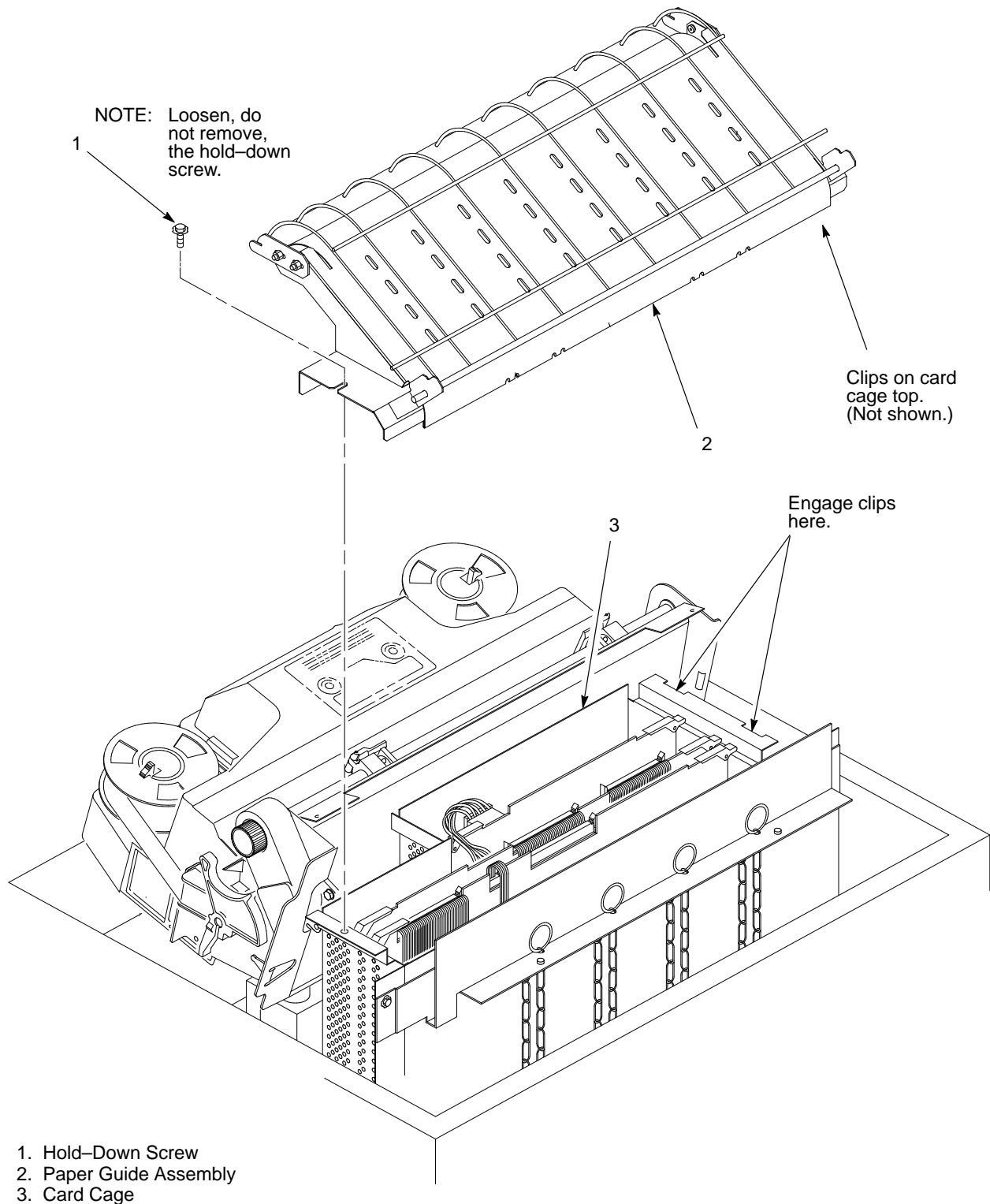
Figure 5–18 . Paper Guide Assembly Removal/Installation

Paper Ironer (Figure 5–19)

Removal

1. Remove the shuttle frame assembly (page 5–66).
2. Move the forms thickness lever (1) to the open position.

WARNING

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

3. Push back at the ends of the paper ironer (2) to disengage the tabs, then lift it up and out.

Installation

WARNING

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

1. Position the paper ironer (2) so that the lip on the upper edge faces the front of the printer.
2. Push the paper ironer (2) down into the slots until the tabs engage.
3. Install the shuttle frame assembly (page 5–66).
4. Return the printer to normal operation (page 5–80).

Figure 5–19 . Paper Ironer Removal/Installation
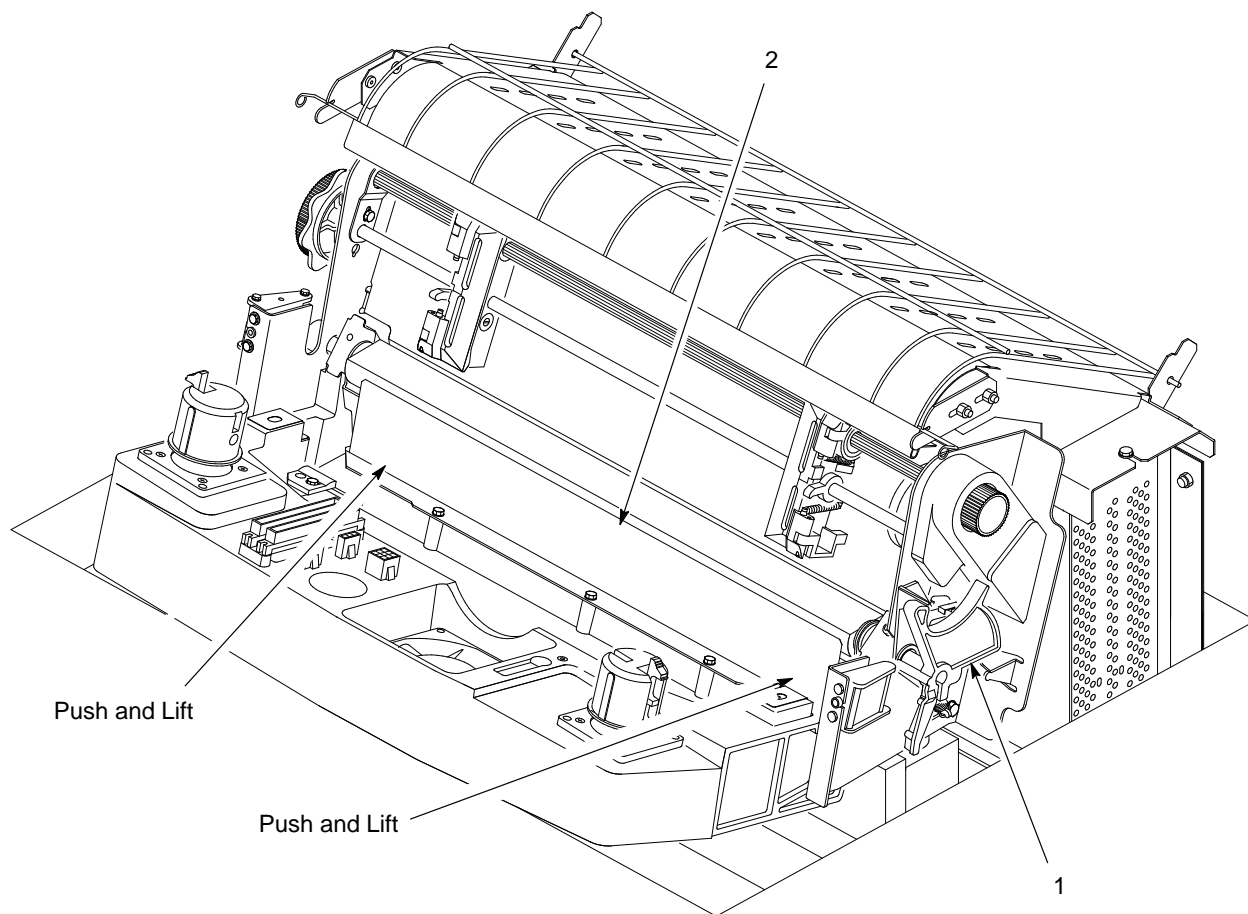
1. Forms Thickness Lever
2. Paper Ironer (Mfg. P/N 150724–001)

Push and Lift

Push and Lift

PCBA, Common Controller (Figure 5–20)

CAUTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling PCBAs.
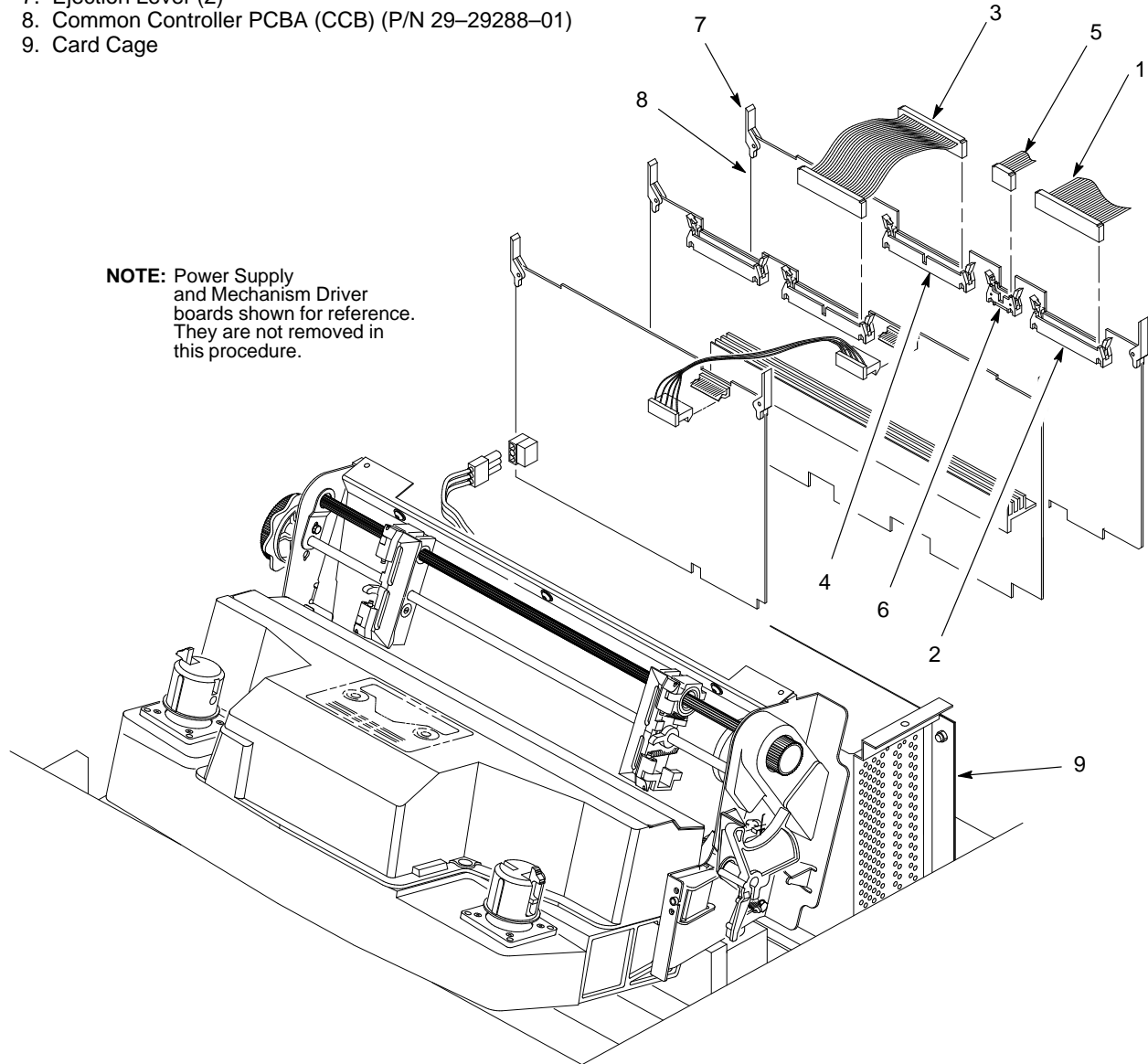
Removal

1. Prepare the printer for maintenance (page 5–3).
2. Open the printer cover.
3. Remove the paper guide assembly (page 5–42).
4. Open the connector latches and disconnect the multi I/O ribbon cable (1) from connector J1 (2).
5. Open the connector latches and disconnect the CCB/Mech. Driver cable connector (3) from connector J2 (4).
6. Open the connector latches and disconnect the control panel ribbon cable (5) from connector J3 (6).
7. Lift the ejection levers (7).
8. Grasp the common controller PCBA (8) by the ejection levers and pull it up and out of the card cage (9).
9. Remove the program PROMs, font PROMs, memory paging PROM (page 5–52), and host terminating resistors (page 5–56).

Installation

1. Install the program PROMs, font PROMs, memory paging PROM (page 5–52), and host terminating resistors (page 5–56) onto the replacement PCBA.
2. Slide the common controller PCBA (8) down into the card cage (9). Engage the card edge connectors in the connector at the bottom of the card cage (9).
3. Lower the ejection levers (7) to the closed position.
4. Connect the control panel ribbon cable (5) to connector J3 (6).
5. Connect the CCB/Mech. Driver cable connector (3) to connector J2 (4).
6. Connect the multi I/O ribbon cable (1) to connector J1 (2).
7. Install the paper guide assembly (page 5–42).
8. If PROMs were replaced, adjust the hammer phasing (page 4–4).
9. Return the printer to normal operation (page 5–80).

1. Multi I/O Ribbon Cable
2. Connector J1
3. CCB/Mech. Driver Cable
4. Connector J2
5. Control Panel Ribbon Cable
6. Connector J3
7. Ejection Lever (2)
8. Common Controller PCBA (CCB) (P/N 29–29288–01)
9. Card Cage

NOTE: Power Supply and Mechanism Driver boards shown for reference. They are not removed in this procedure.

Figure 5–20 . PCBA, Common Controller, Removal/Installation

Replacement Procedures

PCBA, Mechanism Driver (Figure 5–21)

CAUTION

**To prevent electrostatic damage to electronic components, wear a
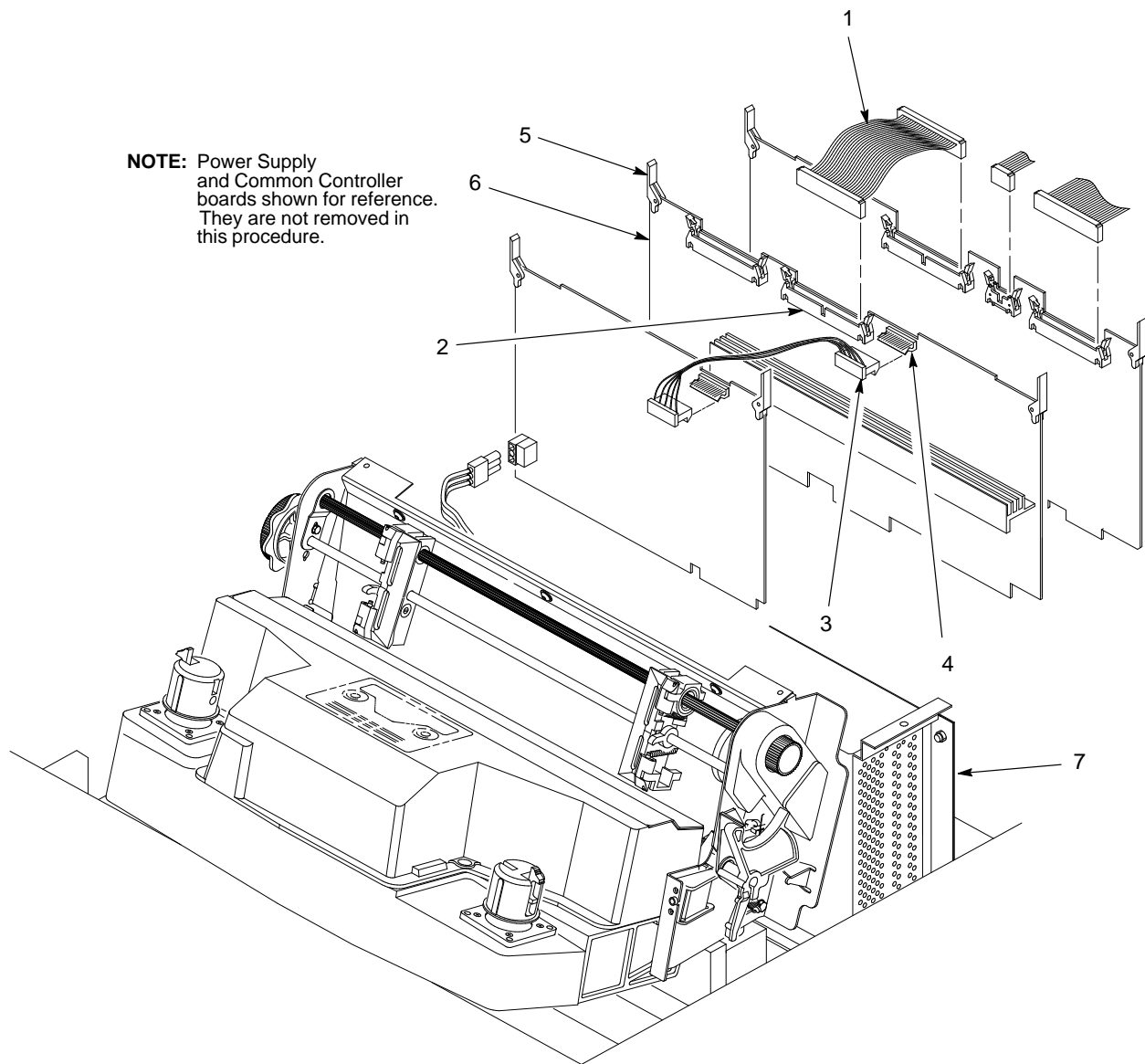properly grounded static wrist strap when handling PCBAs.**

**Do not flex the board or grasp components on the PCBA during
removal/installation. Damage to components may result. Handle the
board carefully by the ejections levers, sides, or the heat sink.**

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Open the printer cover.

3. Remove the paper guide assembly (page 5–42).

4. Open the connector latches and disconnect the CCB/Mech. Driver
   ribbon cable (1) from connector J6 (2).

5. Disconnect the power supply cable (3) from connector J7 (4).

6. Lift the ejection levers (5).

7. Grasp the mechanism driver PCBA (6) by the ejection levers and pull it
   up and out of the card cage (7).

Installation

1. Slide the mechanism driver PCBA (6) down into the card cage (7).
   Engage the card edge connectors in the connectors at the bottom of the
   card cage.

2. Lower the ejection levers (5) to the closed position.

3. Connect the power supply cable (3) to connector J7 (4).

4. Connect the CCB/Mech. Driver ribbon cable (1) to connector J6 (2) and
   close the connector latches.

5. Install the paper guide assembly (page 5–42).

6. Return the printer to normal operation (page 5–80).

NOTE: Power Supply and Common Controller boards shown for reference. They are not removed in this procedure.

1. CCB/Mech. Driver Ribbon Cable
2. Connector J6
3. Power Supply Cable
4. Connector J7
5. Ejection Lever (2)
6. Mechanism Driver PCBA (P/N 29–29289–01)
7. Card Cage

Figure 5–21 . PCBA, Mechanism Driver, Removal/Installation

PCBA, Power Supply (Figure 5–22)

WARNING

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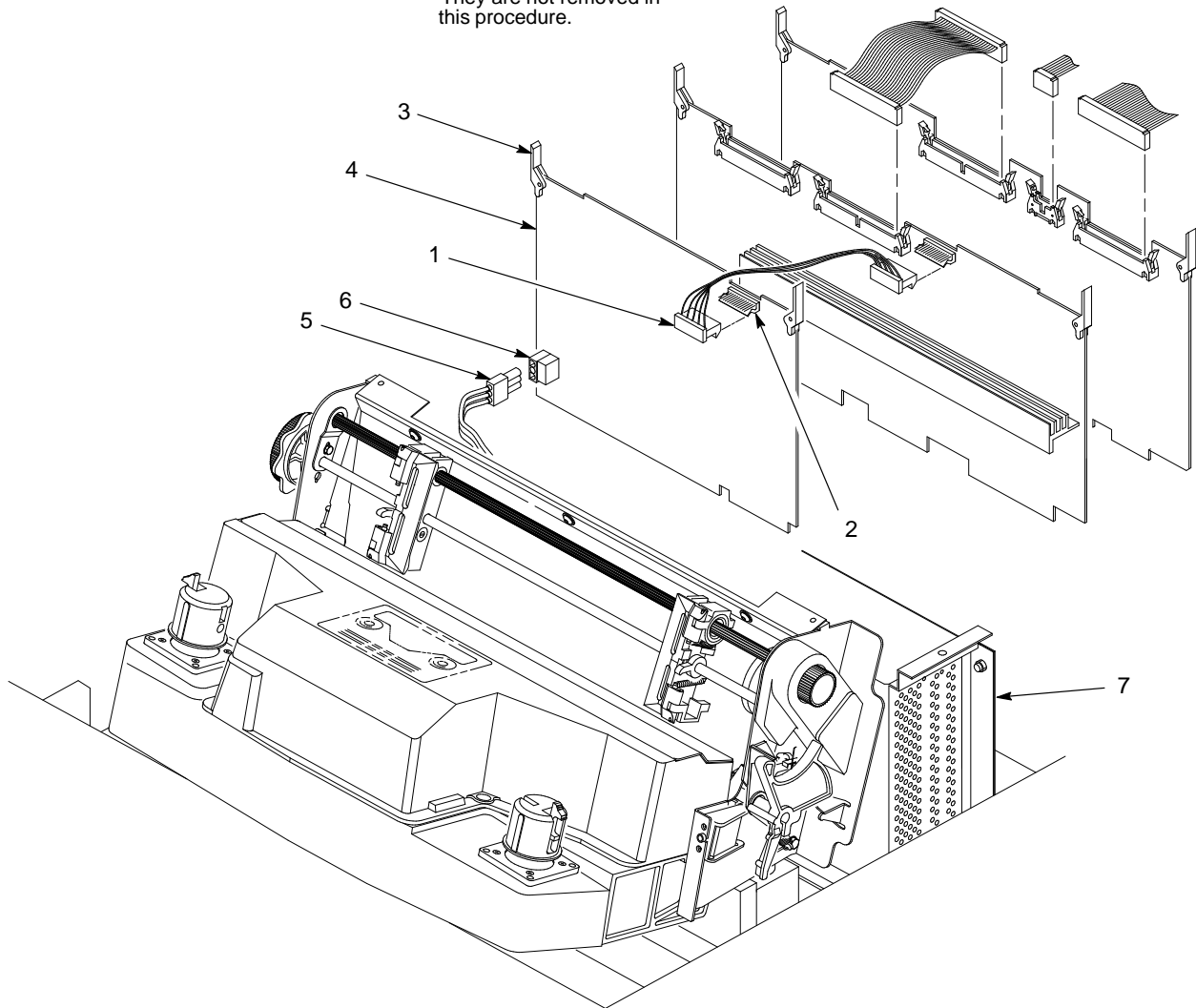
Removal

1.   Prepare the printer for maintenance (page 5–3).

2.   Open the printer cover.

3.   Remove the paper guide assembly (page 5–42).

4.   Disconnect the mechanism driver power supply cable (1) from connector J102 (2).

5.   Lift the ejection levers (3).

6.   Grasp the power supply PCBA (4) by the ejection levers and pull it up about four inches.

7.   Disconnect the circuit breaker cable (5) from connector J1 (6).

8.   Remove the power supply PCBA (4) from the card cage (7).

Installation

1.   Slide the power supply PCBA (4) into the card cage (7) about two inches.

2.   Connect the circuit breaker cable (5) to connector J1 (6).

3.   Slide the power supply PCBA (4) into the card cage (7), engaging the ejection levers (3) under the lip of the card cage (7).

4.   Slowly lower the ejection levers (3) to the closed position.

5.   Connect the mechanism driver power supply cable (1) to connector J102 (2).

6.   Install the paper guide assembly (page 5–42).

7.   Return the printer to normal operation (page 5–80).

NOTE: Mechanism Driver
and Common Controller
boards shown for reference.
They are not removed in
this procedure.

1. Mechanism Driver Power Supply Cable
2. Connector J102
3. Ejection Lever (2)
4. Power Supply PCBA (P/N 29–29290–01)
5. Circuit Breaker Cable
6. Connector J1
7. Card Cage

Figure 5–22 . PCBA, Power Supply, Removal/Installation

PROMs, Chips, and ICs on the CCB (Figure 5–23)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Remove the common controller PCBA (page 5–46).

CAUTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling PCBAs and components.

3. Using a chip puller, remove the defective chip(s). Locations are shown in Figure 5–23 .

Installation

CAUTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling PCBAs and components.

1. Using a chip installation tool, install chip(s). Locations are shown in Figure 5–23 .

2. Install the common controller PCBA (page 5–46).

3. If you changed DPU or font PROMs, adjust hammer phasing (page 4–4).

4. Return the printer to normal operation (page 5–80).

PROM Kit: P/N 29–29287–01, Rev B01

LEGEND

DPMC = Dot Plucker Memory Controller
DPU = Data Processing Unit
FTIC = Fire Timer IC
LED = Light–Emitting Diode
MPU = Magnetic Pick–up
NOVRAM = Nonvolatile Random Access Memory
PAL = Programmable Array Logic
PFC = Paper Feed Controller
RTPU = Real Time Processing Unit

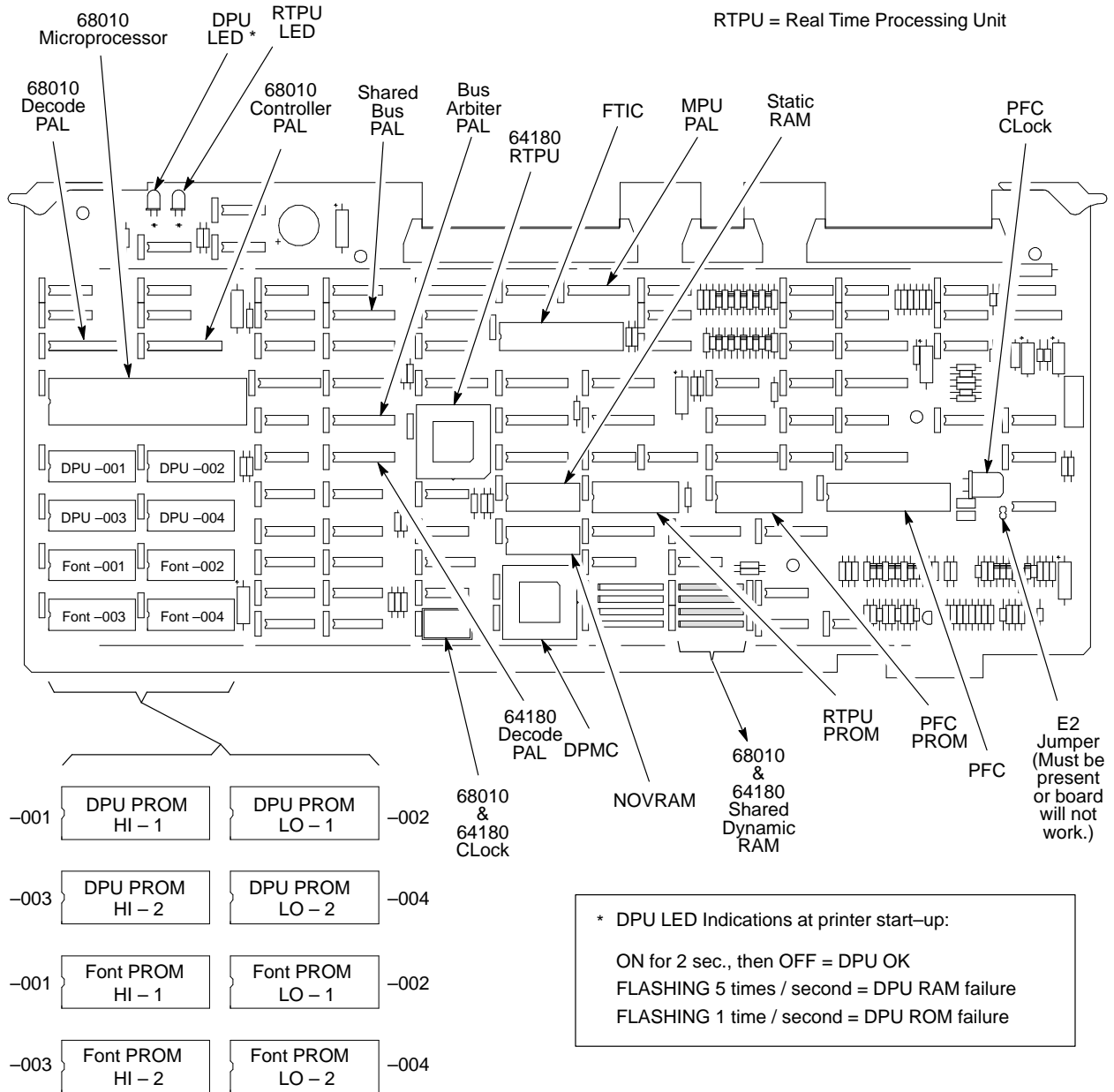**Figure 5–23 . PROM, DIP, and IC Locations on the CCB**

* DPU LED Indications at printer start–up:

  ON for 2 sec., then OFF = DPU OK
  FLASHING 5 times / second = DPU RAM failure
  FLASHING 1 time / second = DPU ROM failure

PROMs, Chips, and ICs on the Mechanism Driver (Figure 5–24)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Remove the mechanism driver PCBA (page 5–48).

CAUTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling PCBAs and components.

3. Using a chip puller, remove the defective chip(s). Locations are shown in Figure 5–24 .

Installation

CAUTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling PCBAs and components.

1. Using a chip installation tool, install chip(s). Locations are shown in Figure 5–24 .

2. Install the mechanism driver PCBA (page 5–48).

3. If you changed DPU or font PROMs, adjust hammer phasing (page 4–4).

4. Return the printer to normal operation (page 5–80).

Hammer Driver ASIC

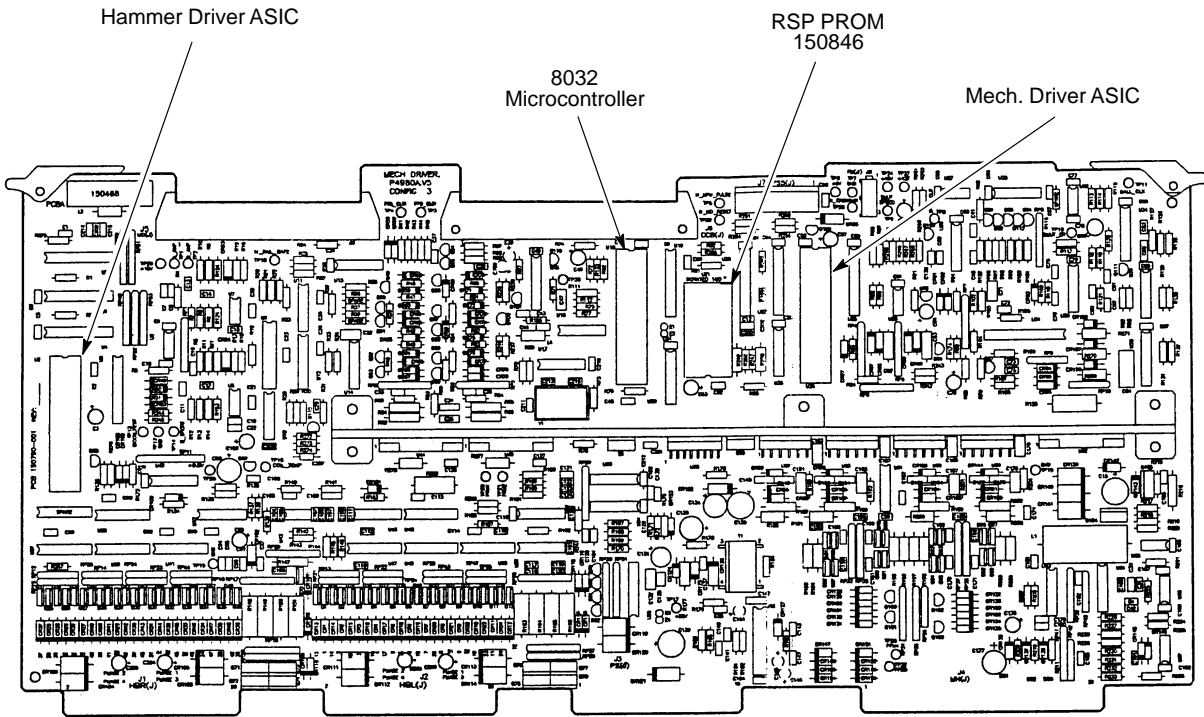8032
Microcontroller

RSP PROM
150846

Mech. Driver ASIC

Figure 5–24 . PROM, DIP, and IC Locations on the Mechanism Driver

Resistors, Terminating (Figure 5–25)

For parallel interface configurations, the LG06 printer is equipped with 1K ohm pullup terminating resistors, located at coordinates 12C on the Common Controller PCBA. The 1K ohm terminating resistors are suitable for most applications.

If the standard terminating resistor pack is not compatible with the particular interface driver requirements of the host computer, other values of pullup/pulldown resistors may be required. Digital provides the 330 ohm pullup and 220 ohm pulldown alternate terminating resistors. If the 330 ohm pullup resistor is installed, also install the 220 ohm pulldown resistor.

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Remove the Common Controller PCBA (page 5–46).

CAUTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling PCBAs and components.

3. Locate the terminating resistor pack (see Figure 5–25).

4. Using a chip puller, remove the pack.

Installation

CAUTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling PCBAs and components.
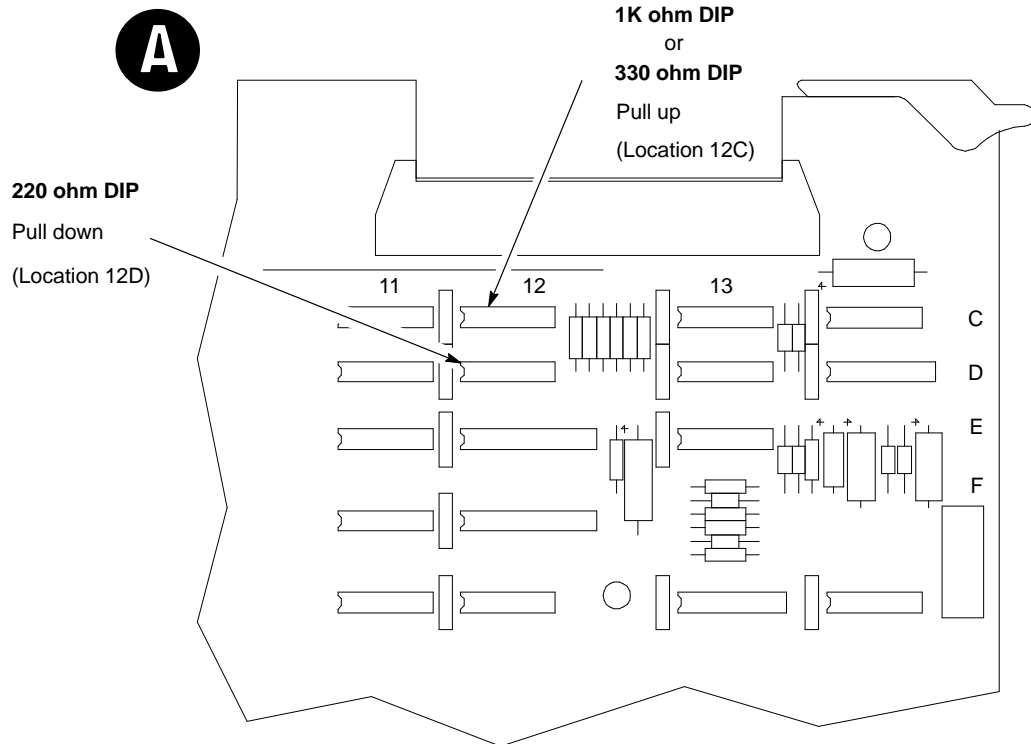
1. Using a chip installation tool, install the resistor pack in the correct socket (see Figure 5–25).

2. Install the Common Controller PCBA (page 5–46).

3. Return the printer to normal operation (page 5–80).

1K ohm DIP
or
330 ohm DIP
Pull up
(Location 12C)

220 ohm DIP
Pull down
(Location 12D)

11   12   13

C
D
E
F
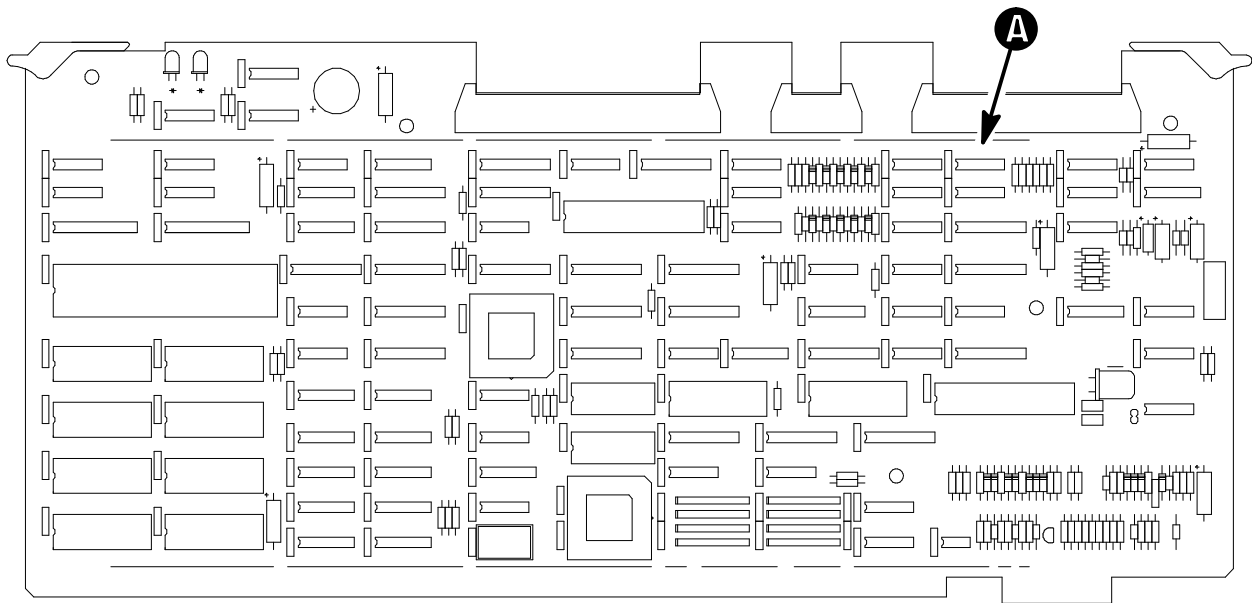
Figure 5–25 . Resistors, Terminating, Removal/Installation

Ribbon Hub (Figure 5–26)

Removal

1. Prepare the printer for maintenance (page 5–3).
2. Remove the printer ribbon.
3. Loosen the screw (1) in the ribbon spool hub (2).
4. Remove the hub (2) from the shaft adapter on the ribbon drive motor (3).

Installation

1. If the ribbon drive motor has a shaft extension and collar, go to step 2.

    If the ribbon drive motor does not have an extension shaft and collar, begin at step 4.
2. Loosen the collar screw (4).
3. Remove and discard the shaft extension (5) and collar (6).
4. Install the ribbon spool hub (2) over the motor shaft.
5. Tighten the hub screw (1) so that it contacts the flat section of the motor shaft. Do not overtighten the hub screw.
6. Return the printer to normal operation (page 5–80).

1. Hub Screw
2. Ribbon Spool Hub (Kit, P/N 29–29296–01)
3. Ribbon Drive Motor
4. Collar Screw
5. Shaft Extension
6. Collar
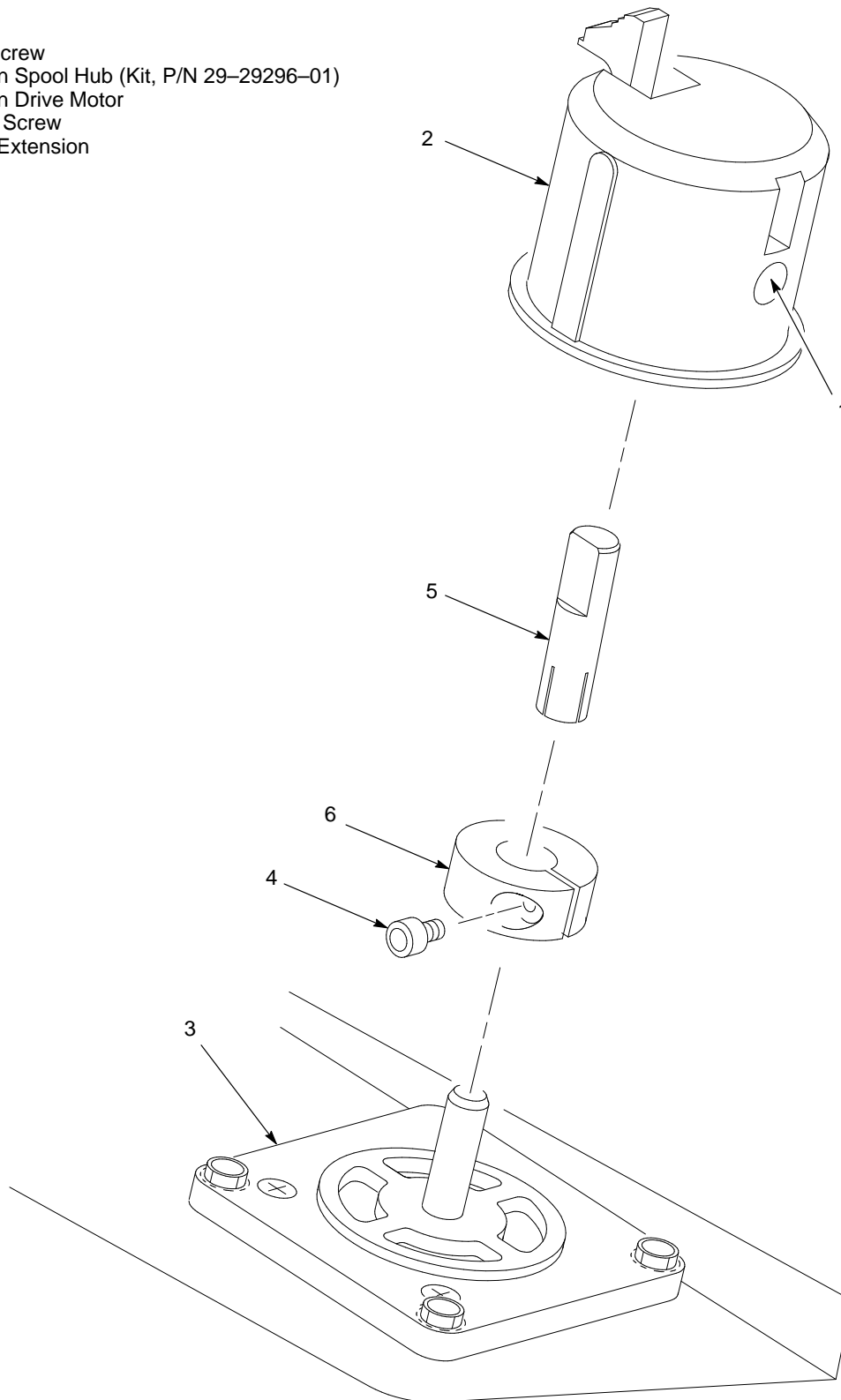
Figure 5–26 . Ribbon Hub Removal/Installation

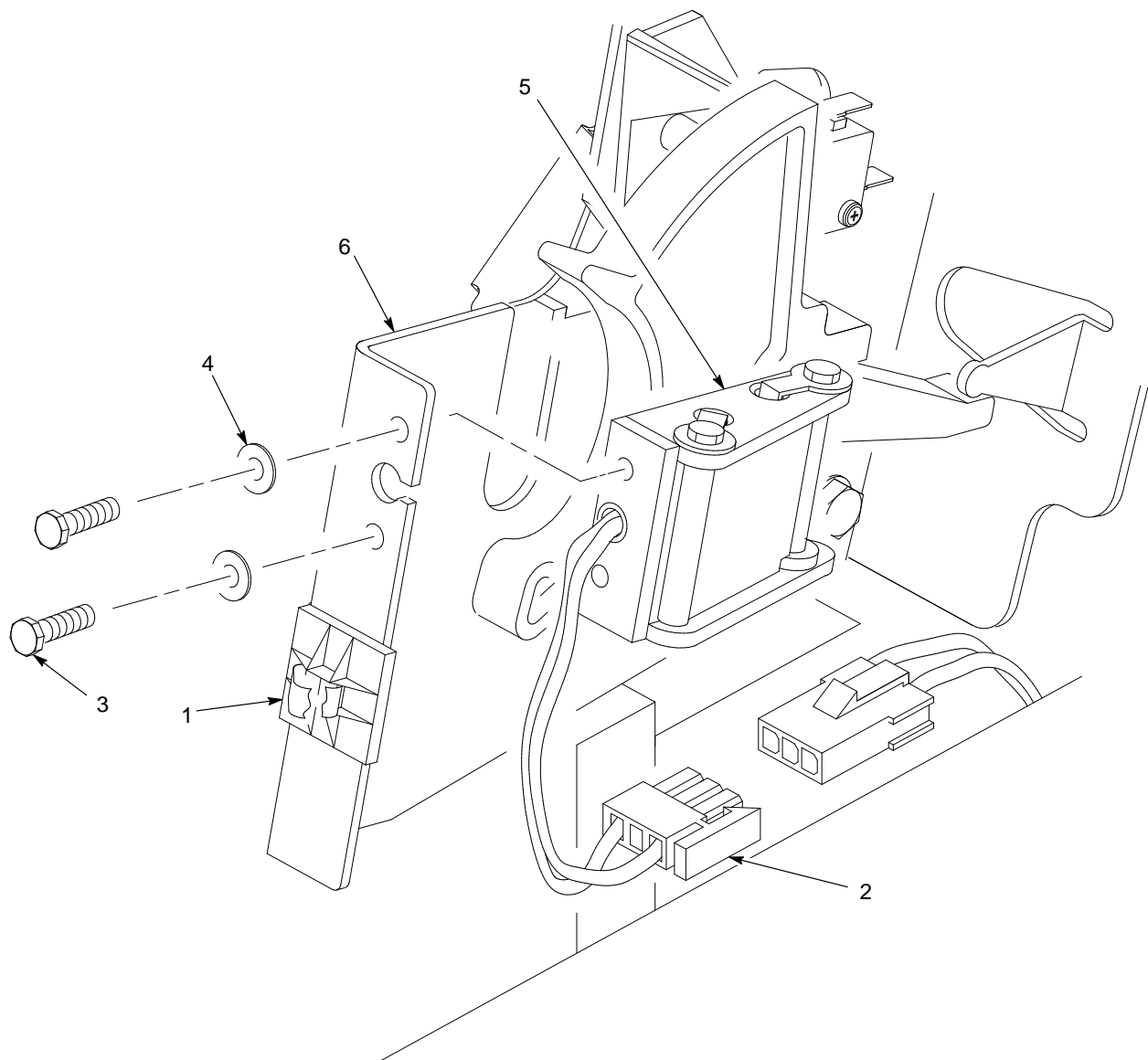# Ribbon Guide Assembly (L/R) (Figure 5–27)

Removal

NOTE: Although the right ribbon guide is shown in Figure 5–27 , the removal procedure is the same for the left ribbon guide.

1. Prepare the printer for maintenance (page 5–3).
2. Open the printer cover.
3. Remove the printer ribbon.
4. Cut the tie–wrap and remove it from the spot tie (1) to free the ribbon guide cable.
5. Disconnect the ribbon guide connector (2).
6. Remove the two screws (3) and washers (4).
7. Slide the ribbon guide assembly (5) out of the side plate (6).

Installation

NOTE: Although the right ribbon guide is shown in Figure 5–27 , the installation procedure is the same for the left ribbon guide.

1. Slide the ribbon guide assembly (5) into the side plate (6).
2. Install two screws (3) and washers (4).
3. Connect the ribbon guide connector (2).
4. Tie–wrap the cable to the spot tie (1).
5. Align the ribbon guides (page 4–20).
6. Return the printer to normal operation (page 5–80).

1. Spot Tie
2. Ribbon Guide Connector
3. Screw (2)
4. Washer (2)
5. Ribbon Guide Assembly, Right (P/N 29–29299–01)
    Ribbon Guide Assembly, Left (P/N 29–29278–01)
6. Side Plate

Figure 5–27 . Ribbon Guide Assembly (L/R), Removal/Installation
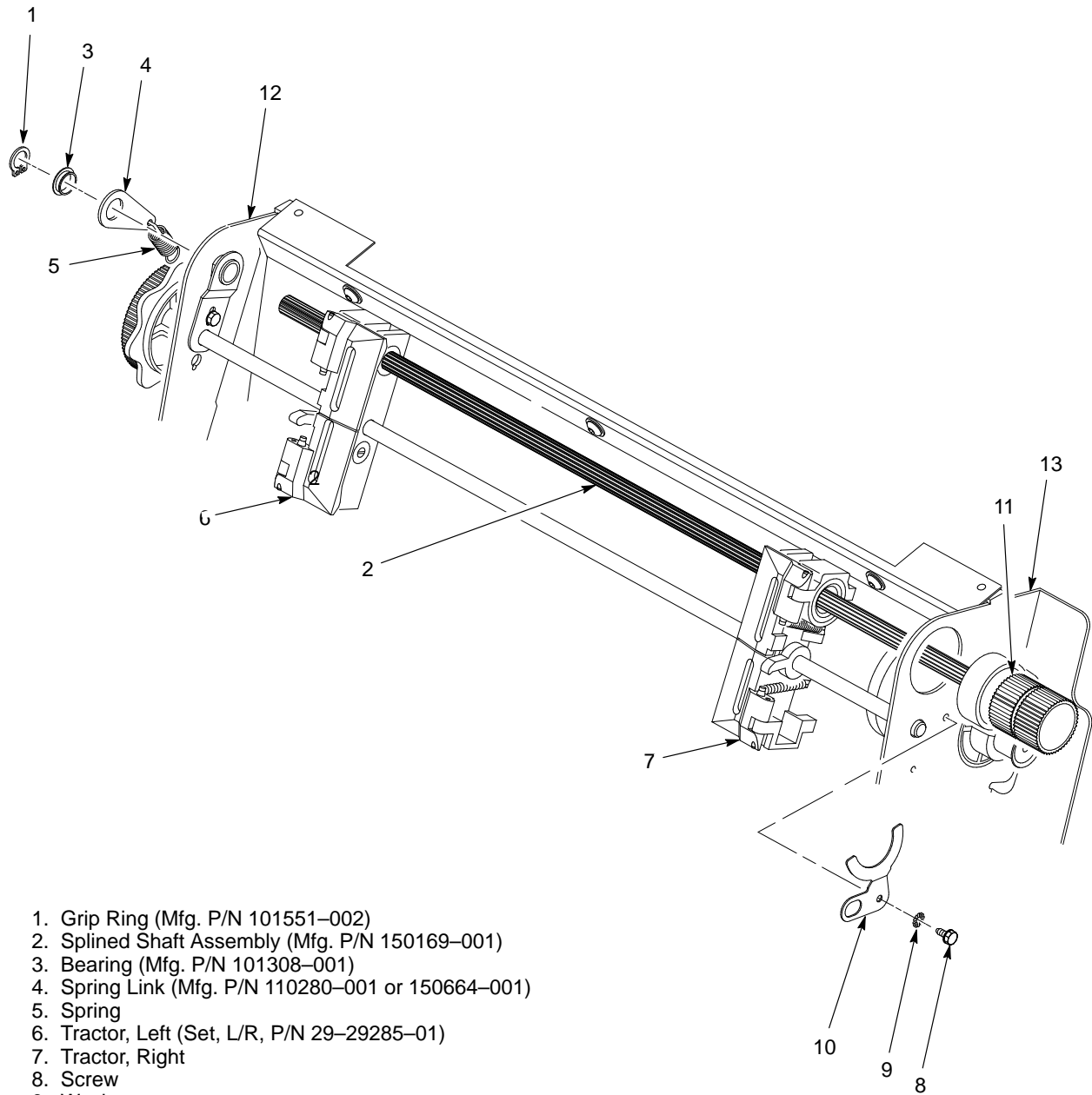
Shaft, Splined (Figure 5–28)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Open the printer cover.

3. Remove the paper feed timing belt (page 5–4).

4. With grip ring pliers, remove the grip ring (1) from the splined shaft (2).

5. Pull the bearing (3) and spring link (4) with the spring (5) off the splined shaft (2).

6. Unlock the left and right tractors (6 and 7) and slide them to the center.

7. Remove the screw (8), washer (9), and bearing clamp (10).

8. Grasping the vertical adjustment knob (11), slide the splined shaft (2) out of the left and right side plates (12 and 13).

Installation

1. Open the doors on the left and right tractors (6 and 7). Position the tractor belts so the alignment marks are at the top on both tractors.

2. Grasp the vertical adjustment knob (11) and slide the splined shaft (2) through the right side plate (13), tractors (6 and 7), and the left side plate (12). Make sure the same spline passes the marked groove on each tractor.

3. Install the bearing clamp (10), washer (9), and screw (8).

4. Apply a thin film of M–3 grease to the bearing (3).

5. Slide the spring link (4) and bearing (3) onto the splined shaft (2).

6. Attach the spring (5) to the left side plate (11) and the spring link (4).

7. Install the grip ring (1) on the splined shaft (2) with 0.010 inches of clearance between the grip ring and the left side plate (11).

8. Install the paper feed timing belt (page 5–4).

9. Set the paper feed timing belt tension (page 4–6, 5 through 7).

10. Adjust splined shaft skew (page 4–14).

11. Return the printer to normal operation (page 5–80).

1. Grip Ring (Mfg. P/N 101551–002)
2. Splined Shaft Assembly (Mfg. P/N 150169–001)
3. Bearing (Mfg. P/N 101308–001)
4. Spring Link (Mfg. P/N 110280–001 or 150664–001)
5. Spring
6. Tractor, Left (Set, L/R, P/N 29–29285–01)
7. Tractor, Right
8. Screw
9. Washer
10. Bearing Clamp (Mfg. P/N 110281–001)
11. Vertical Adjustment Knob (Splined Shaft Pulley) (Mfg. P/N 150289–001)
12. Left Side Plate
13. Right Side Plate

Figure 5–28 . Shaft, Splined, Removal/Installation

Shaft, Support (Figure 5–29)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Open the printer cover.

3. Unlock the tractors (1) and slide them to the far left.

4. Remove the E ring (2).

5. Slide the support shaft assembly — consisting of the support shaft (3), two spring washers (4), bushing (5), horizontal adjustment knob (6), washer (7) and screw (8) — to the left, out of the tractors (1) and the left side plate (9).

Installation

1. Slide the support shaft assembly — consisting of the support shaft (3), two spring washers (4), bushing (5), horizontal adjustment knob (6), washer (7), and screw (8) — into the left side plate (9).

2. Slide the tractors (1) onto the support shaft (3).

3. Slide the support shaft assembly through the right side plate (10).

4. Install the E ring (2).

5. Return the printer to normal operation (page 5–80).
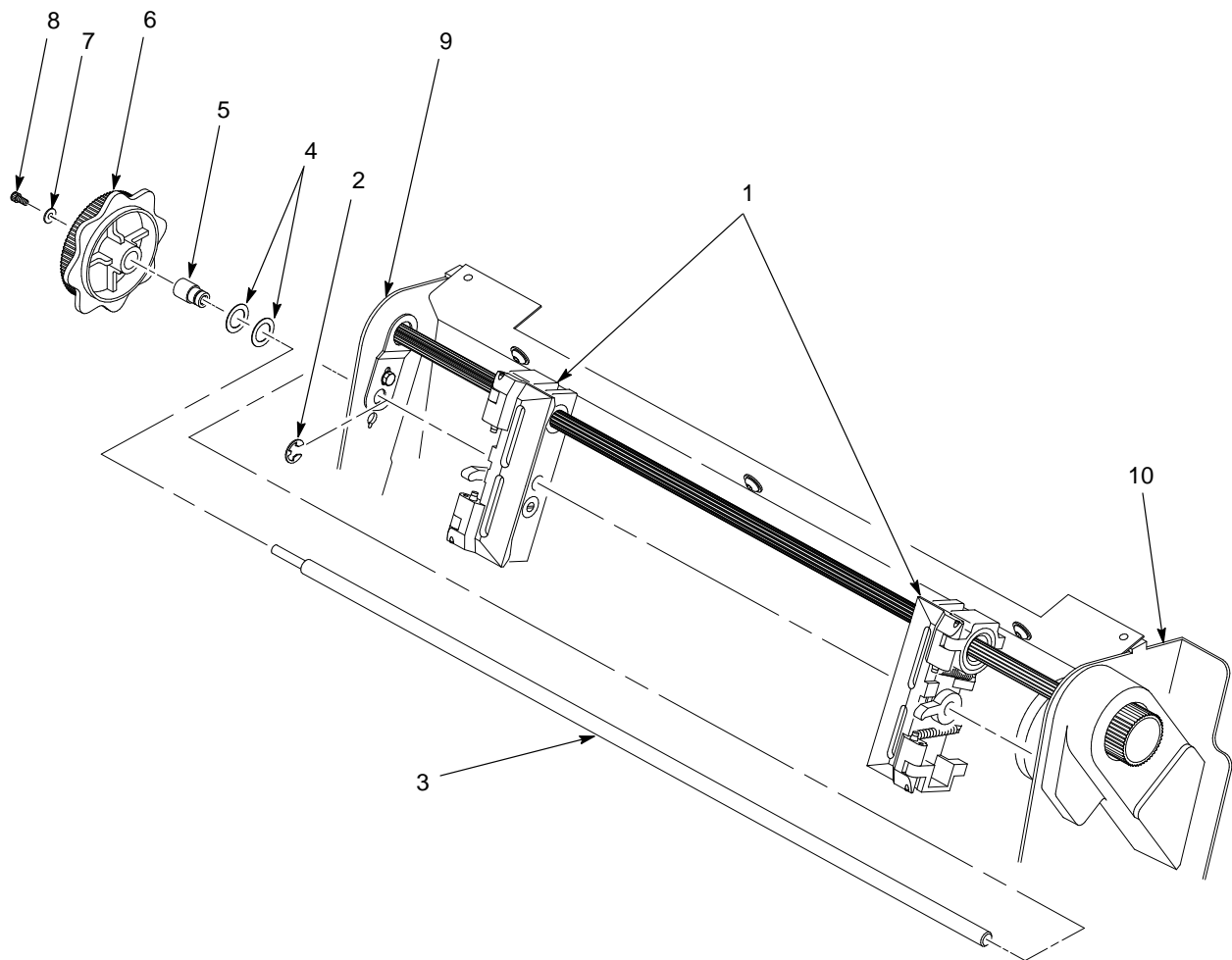
1. Tractor (2) (Set, L/R, P/N 29–29285–01)
2. E Ring (Mfg. P/N 105678–003)
3. Support Shaft (Mfg. P/N 111685–001)
4. Spring Washer (2)
5. Bushing
6. Horizontal Adjustment Knob
7. Washer
8. Screw
9. Left Side Plate
10. Right Side Plate

Figure 5–29 . Shaft, Support, Removal/Installation
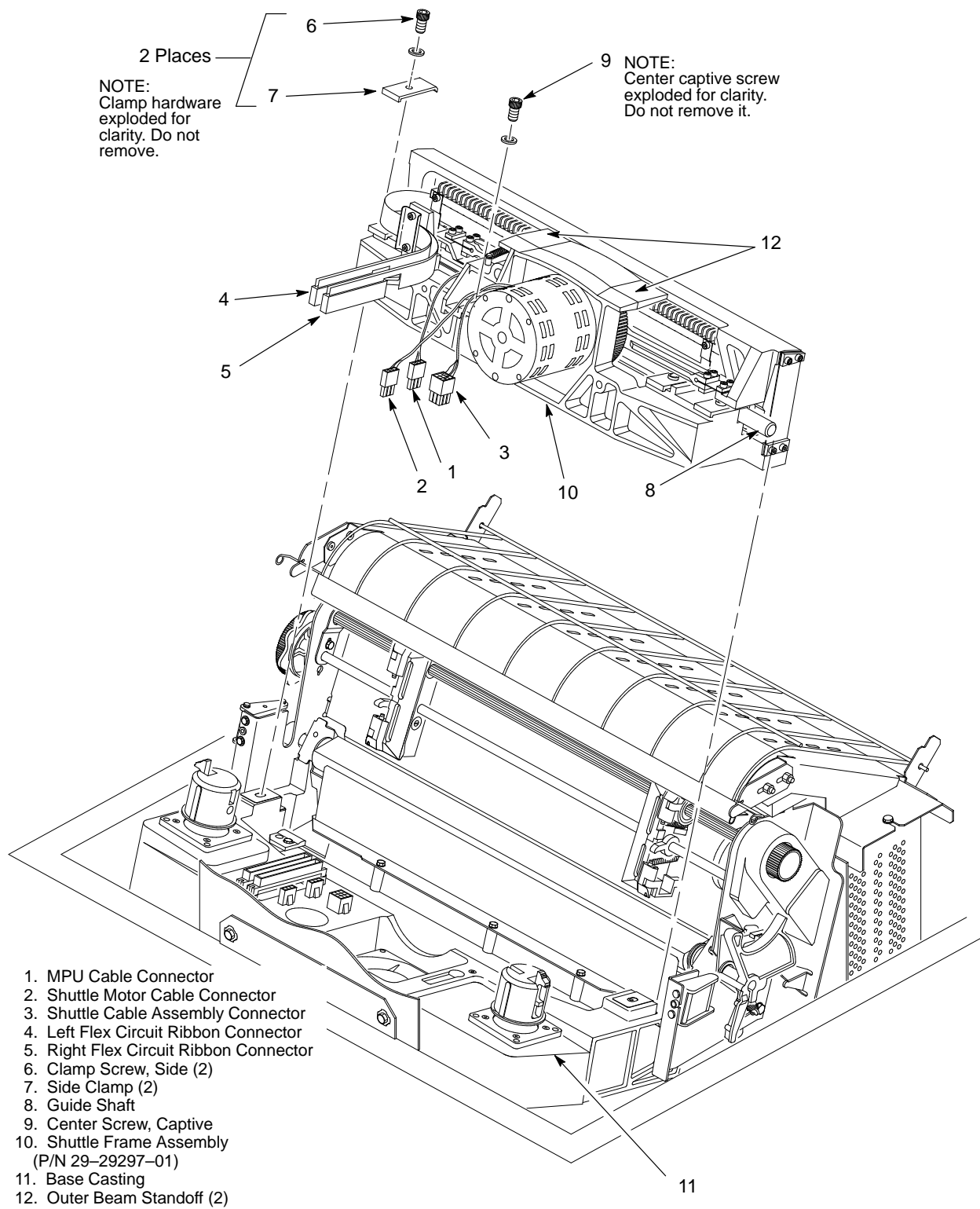
Shuttle Frame Assembly (Figure 5–30)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Remove the shuttle cover assembly (page 5–24).

3. Disconnect the MPU cable connector (1).

4. Disconnect the shuttle motor cable connector (2).

5. Disconnect the shuttle cable assembly connector (3).

CAUTION

The hammer bank flex circuit ribbon cables can tear if handled roughly. Do not pull on the cables; grasp the connectors to disconnect the flex circuit ribbon cables. In the next step, disconnect the left and right flex ribbon connectors gently, and do not bend the cables unnecessarily.

6. Disconnect the left and right hammer bank flex circuit ribbon connectors (4 and 5).

7. Loosen the side 5/32 inch socket head clamp screws (6) and pull the clamps (7) back and off the guide shaft (8).

8. Loosen the center 5/32 inch socket head screw (9) enough to release the shuttle frame assembly (10) from the base casting (11).

9. Slide the last three fingers of your hands under the outer beam standoffs (12) and hold the ribbon mask in place with you index fingers.

10. Lift the shuttle frame assembly (10) out of the base casting (11). Lift slowly and carefully: the shuttle frame assembly is heavy.

11. Remove the hammer bank cover (page 5–22).

6

2 Places

NOTE:
Clamp hardware
exploded for
clarity. Do not
remove.

7

9 NOTE:
Center captive screw
exploded for clarity.
Do not remove it.

12

4

5

2   1

3

10

8

11

1. MPU Cable Connector
2. Shuttle Motor Cable Connector
3. Shuttle Cable Assembly Connector
4. Left Flex Circuit Ribbon Connector
5. Right Flex Circuit Ribbon Connector
6. Clamp Screw, Side (2)
7. Side Clamp (2)
8. Guide Shaft
9. Center Screw, Captive
10. Shuttle Frame Assembly
    (P/N 29–29297–01)
11. Base Casting
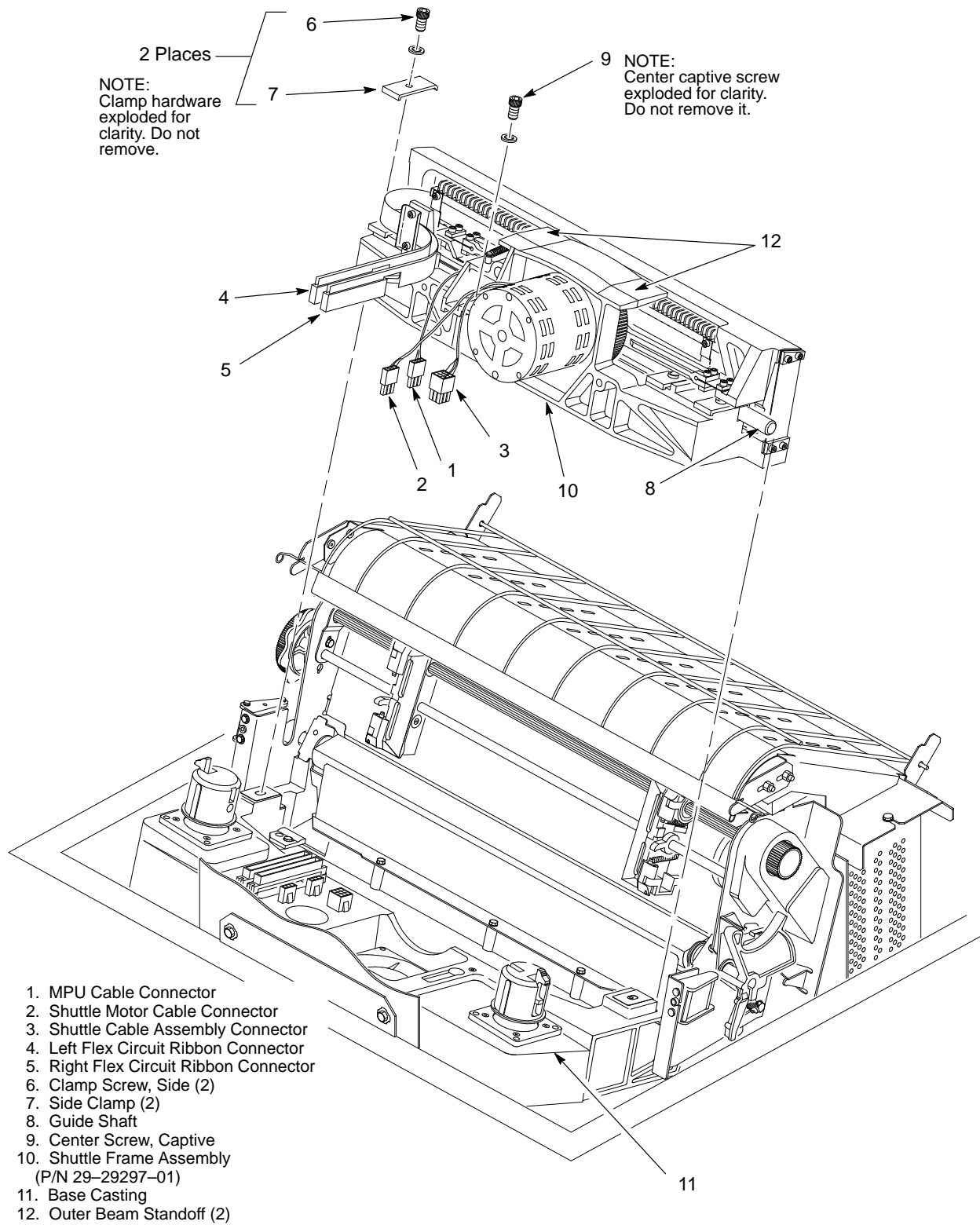12. Outer Beam Standoff (2)

Figure 5–30 . Shuttle Frame Assembly Removal/Installation

Installation

1. Install the hammer bank cover (page 5–22).

2. Holding the shuttle frame assembly (10) by the outer beam standoffs (12), set it into the base casting (11). Use both hands: the shuttle frame assembly is heavy.

3. Align the center 5/32 inch socket head screw (9) in the base casting (11) and hand turn the screw until only two or three threads have started.

4. Pull the shuttle frame assembly (10) toward the front of the printer.

5. Slide the side clamps (7) over the guide shaft (8) and torque the 5/32 inch socket head clamp screws (6) to 20 ± 1 inch–pounds.

6. Lift up on the shuttle motor, then gently set it down to align the center screw guide.

7. Torque the center captive 5/32 inch socket head screw (9) to 20 ± 1 inch–pounds.

8. Connect the left and right hammer bank flex circuit ribbon connectors (4 and 5).

9. Connect the shuttle cable assembly connector (3).

10. Connect the shuttle motor cable connector (2).

11. Connect the MPU cable connector (1).

12. Adjust the platen gap (page 4–18).

13. Install the shuttle cover assembly (page 5–24).

14. Adjust the platen open belt (page 4–8).

15. Return the printer to normal operation (page 5–80).

6
2 Places

NOTE:
Clamp hardware
exploded for
clarity. Do not
remove.

7

9

NOTE:
Center captive screw
exploded for clarity.
Do not remove it.

12

4

5

2   1   3   10   8

1. MPU Cable Connector
2. Shuttle Motor Cable Connector
3. Shuttle Cable Assembly Connector
4. Left Flex Circuit Ribbon Connector
5. Right Flex Circuit Ribbon Connector
6. Clamp Screw, Side (2)
7. Side Clamp (2)
8. Guide Shaft
9. Center Screw, Captive
10. Shuttle Frame Assembly
    (P/N 29–29297–01)
11. Base Casting
12. Outer Beam Standoff (2)

11

Figure 5–30. Shuttle Frame Assembly Removal/Installation
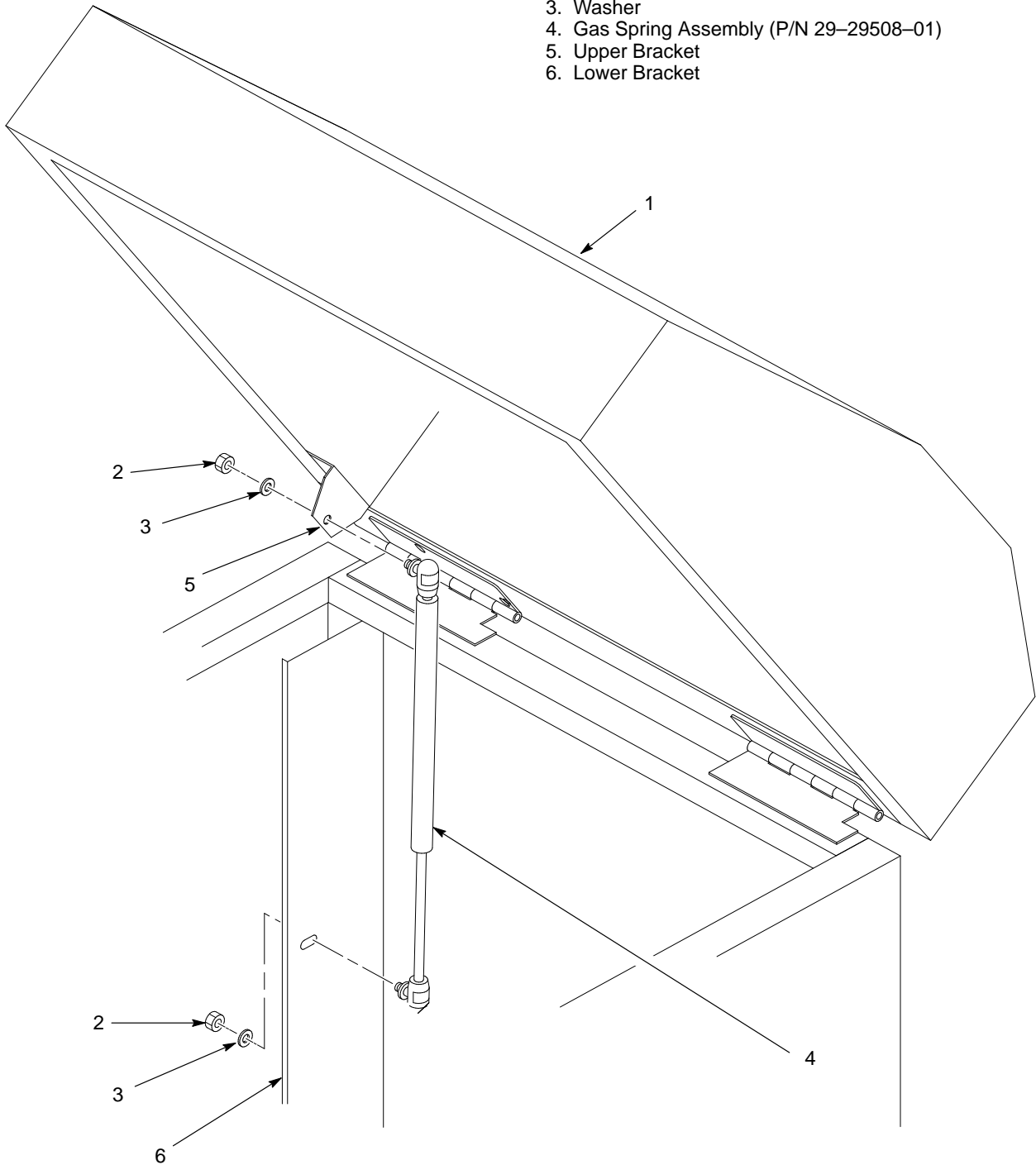
Spring Assembly, Gas (Figure 5–31)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Open the printer cover (1).

3. Open the floor cabinet rear door.

4. Remove two nuts (2) and washers (3).

5. Remove the gas spring assembly (4).

Installation

1. Position the gas spring assembly (4) on the upper and lower brackets (5 and 6).

2. Install two nuts (2) and washers (3).

3. Close the printer cover (1): make sure the cover closes all the way. If necessary, adjust the position of the stud in the lower bracket to achieve smooth and complete closure.

4. Return the printer to normal operation (page 5–80).

1. Printer Cover
2. Nut
3. Washer
4. Gas Spring Assembly (P/N 29–29508–01)
5. Upper Bracket
6. Lower Bracket

Figure 5–31 . Spring Assembly, Gas, Removal/Installation
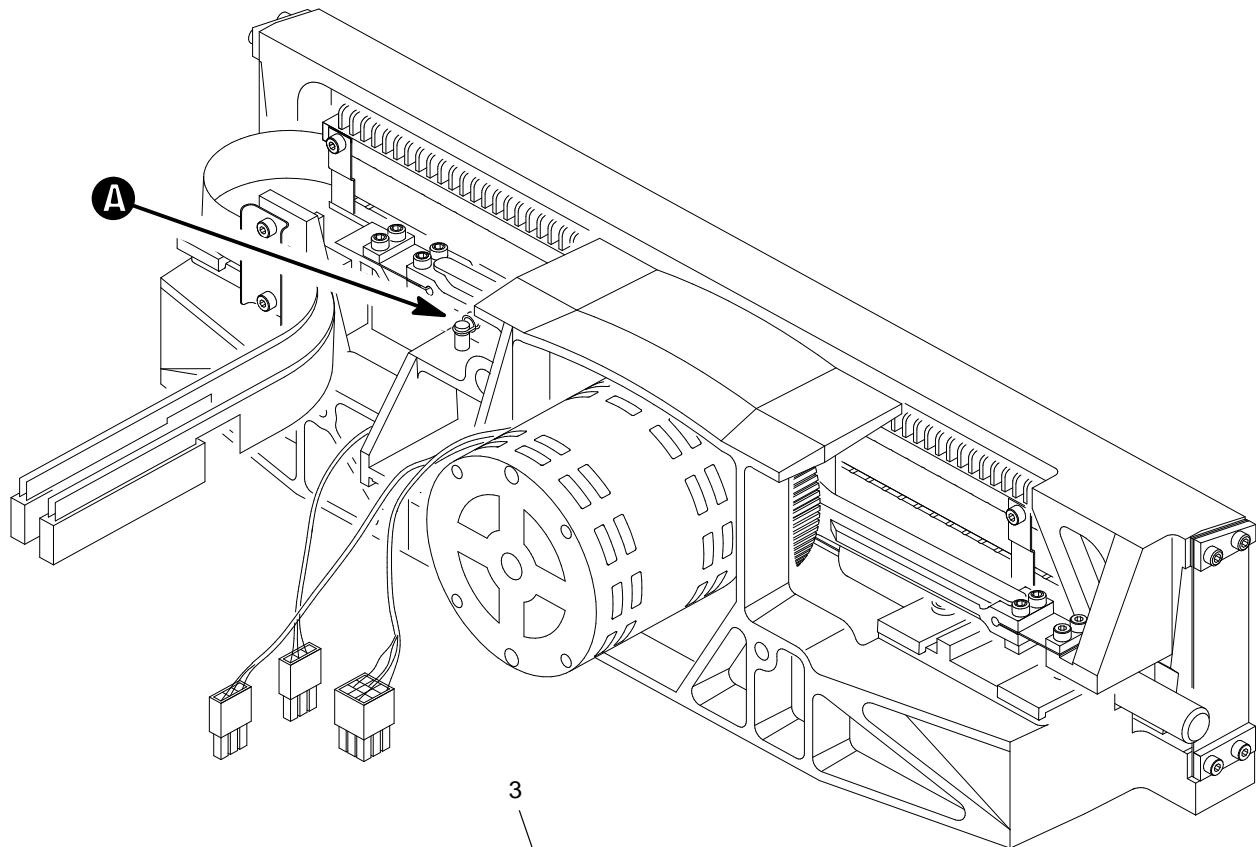
Spring, Extension (Figure 5–32)
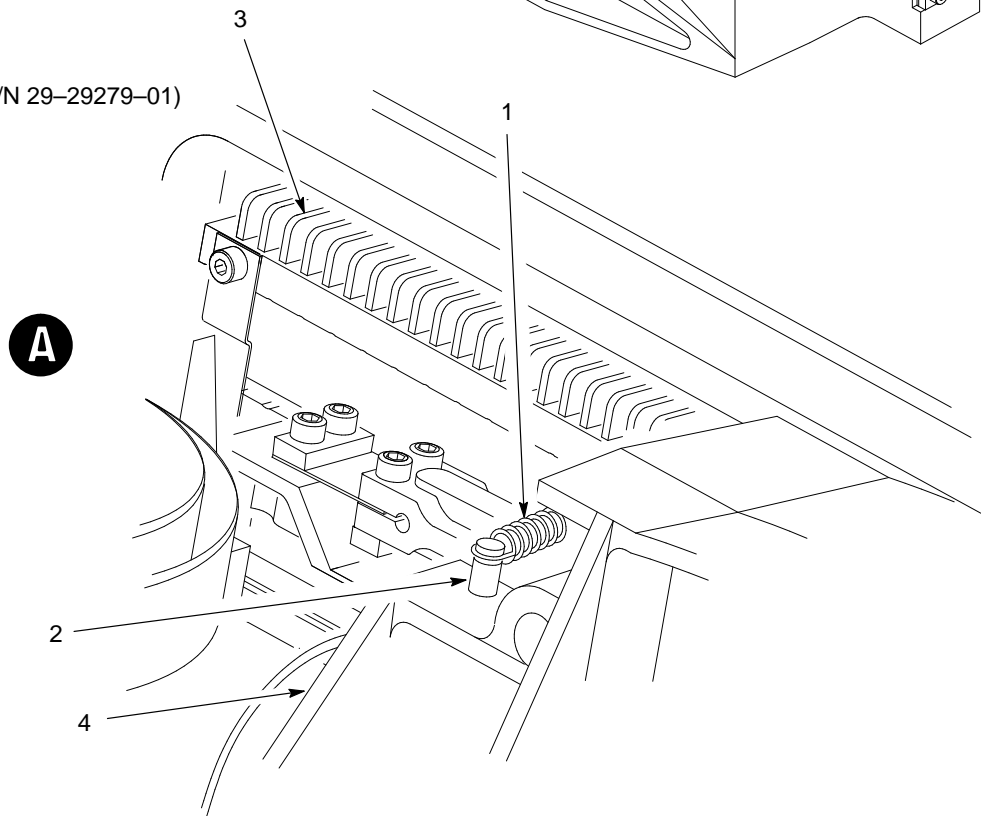
Removal

1. Prepare the printer for maintenance (page 5–3).

2. Open the printer cover.

3. Remove the shuttle cover assembly (page 5–24).

4. Unhook the extension spring (1) from the spring lugs (2) on the hammer bank (3) and shuttle frame (4).

Installation

1. Apply a dab of M–3 lubricant to both spring lugs (2).

2. Hook the extension spring (1) over the spring lugs (2).

3. Install the shuttle cover assembly (page 5–24).

4. Return the printer to normal operation (page 5–80).

1. Extension Spring (P/N 29–29279–01)
2. Spring Lug (2)
3. Hammer Bank
4. Shuttle Frame

Figure 5–32 . Spring, Extension, Removal/Installation
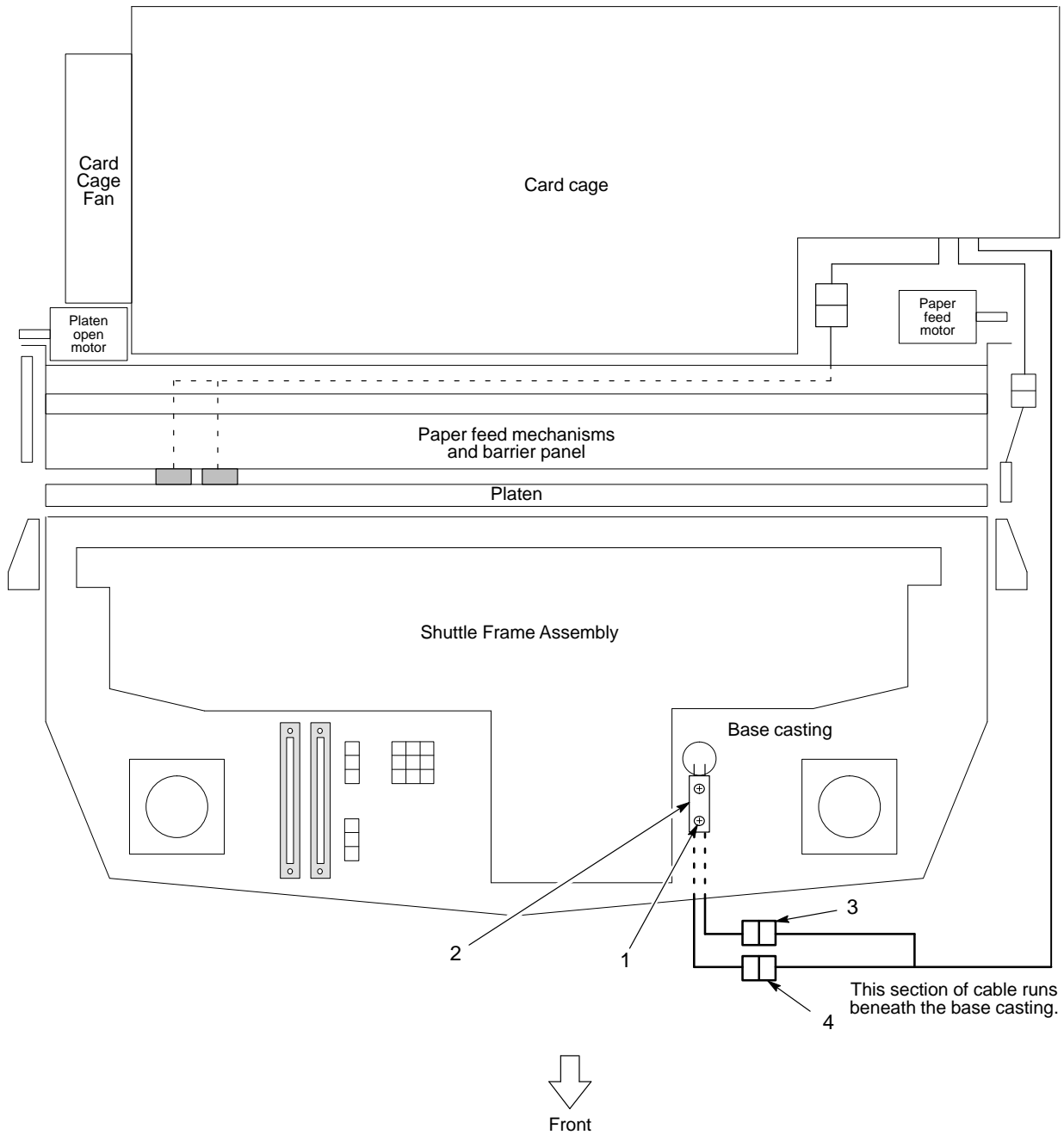
Switch Assembly, Cover Open (Figure 5–33)

Removal

1. Prepare the printer for maintenance (page 5–3).
2. Open the printer cover.
3. Remove the shuttle cover assembly (page 5–24).
4. Remove two screws (1) and lift the cover open switch assembly (2) out of the base casting.
5. Disconnect the switch connectors from intermediate cable assembly connector CO+ (3) and CO– (4).

Installation

1. Connect the switch connectors to intermediate cable assembly connector CO+ (3) and CO– (4).
2. Position the cover open switch assembly (2) in the base casting and install two screws (1).
3. Install the shuttle cover assembly (page 5–24).
4. Return the printer to normal operation (page 5–80).

Printer viewed from above.

Card Cage Fan

Card cage

Platen open motor

Paper feed motor

Paper feed mechanisms and barrier panel

Platen

Shuttle Frame Assembly

Base casting

2

1

3

4

This section of cable runs beneath the base casting.

Front

1. Screw (2)
2. Cover Open Switch Assembly (P/N 29–29274–01)
3. Connector CO+
4. Connector CO–

Figure 5–33 . Switch Assembly, Cover Open, Removal/Installation

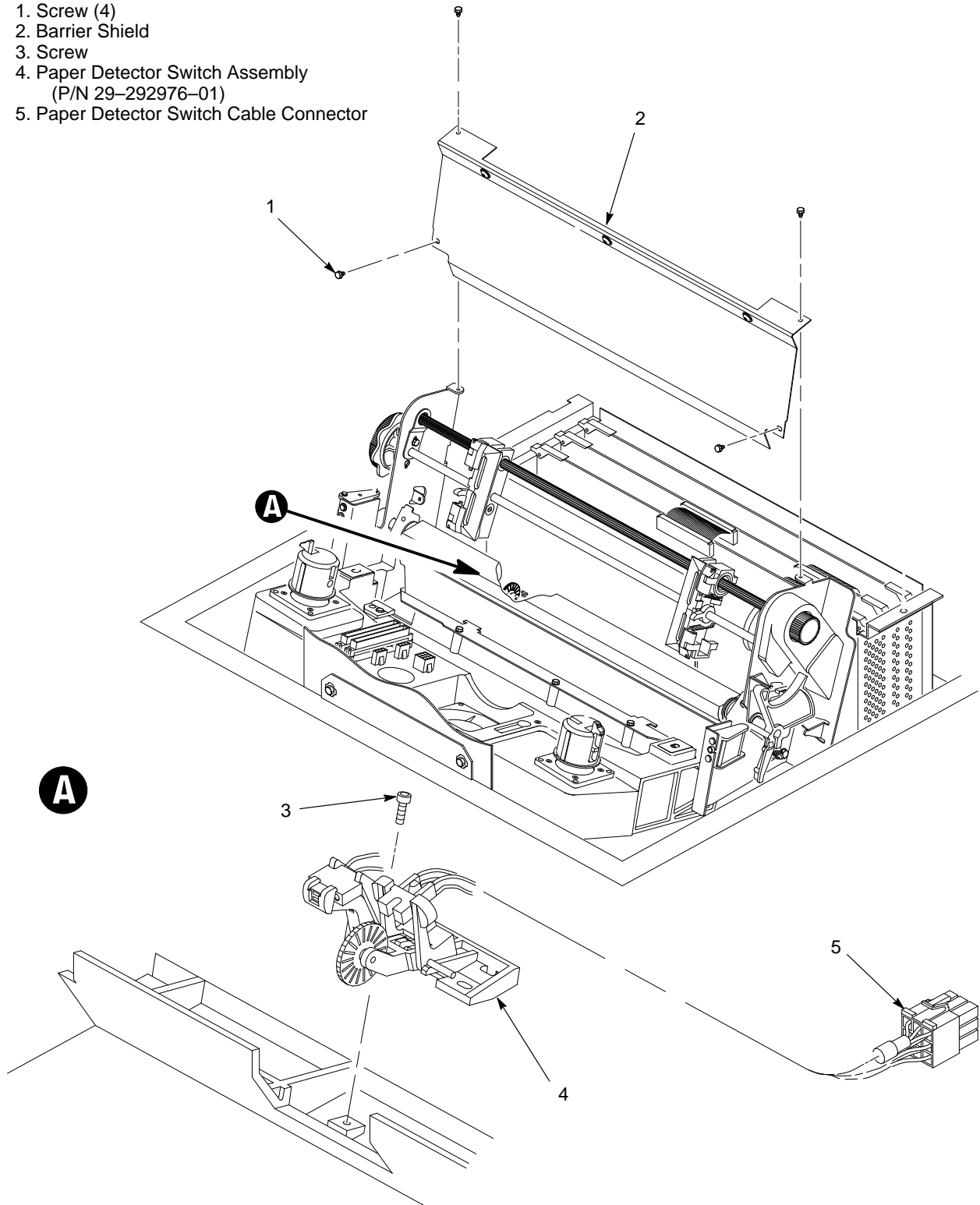## Switch Assembly, Paper Detector (Figure 5–34)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Remove the paper guide assembly (page 5–42).

3. Remove four screws (1) and the barrier shield (2).

4. Remove the shuttle frame assembly (page 5–66).

5. Remove the paper ironer (page 5–44).

6. Loosen the screws (3) securing the paper detector switch assembly (4).

7. Disconnect the paper detector switch cable connector (5) from the intermediate cable assembly connector PMD.

8. Cut the tie wraps securing the switch assembly cable to the front of the card cage and remove the paper detector switch assembly (4).

Installation

1. Position the paper detector switch assembly (4) and install the screw (3) securing it to the printer base.

2. Connect the paper detector switch cable connector (5) to the intermediate cable assembly connector PMD.

3. Install tie wraps securing the switch assembly cable to the front of the card cage.

4. Install the paper ironer (page 5–44).

5. Install the shuttle frame assembly (page 5–66).

6. Install the barrier shield (2) and four screws (1).

7. Install the paper guide assembly (page 5–42).

8. Return the printer to normal operation (page 5–80).

1. Screw (4)
2. Barrier Shield
3. Screw
4. Paper Detector Switch Assembly
   (P/N 29–292976–01)
5. Paper Detector Switch Cable Connector

Figure 5–34 . Switch Assembly, Paper Detector, Removal/Installation

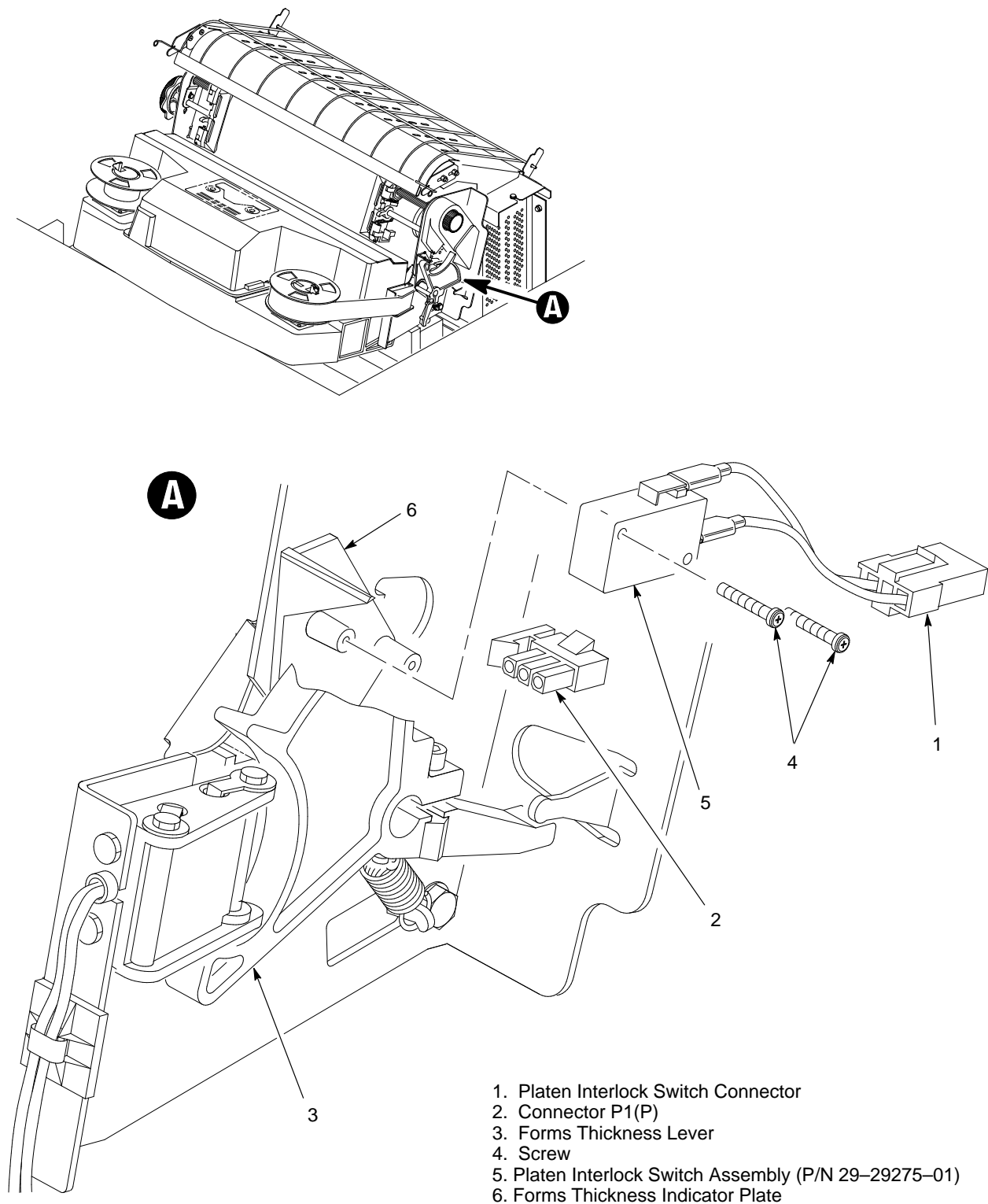## Switch Assembly, Platen Interlock (Figure 5–35)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Open the printer cover.

3. Disconnect the platen interlock switch connector (1) from connector P1(P) (2).

4. Fully close the forms thickness lever (3).

5. Remove two screws (4).

6. Remove the platen interlock switch assembly (5) from the forms thickness indicator plate (6).

Installation

1. Fully close the forms thickness lever (3).

2. Position the platen interlock switch assembly (5) on the forms thickness indicator plate (6).

3. Install two screws (4).

4. Connect the platen interlock switch connector (1) to connector P1(P) (2).

5. Return the printer to normal operation (page 5–80).

1. Platen Interlock Switch Connector
2. Connector P1(P)
3. Forms Thickness Lever
4. Screw
5. Platen Interlock Switch Assembly (P/N 29–29275–01)
6. Forms Thickness Indicator Plate

Figure 5–35 . Switch Assembly, Platen Interlock, Removal/Installation

Tractor (L/R)

Removal

1. Prepare the printer for maintenance (page 5–3).

2. Remove the splined shaft (page 5–62).

3. Remove the support shaft (page 5–64).

4. Remove the tractors from the support shaft.

Installation

1. Using the replacement tractors, install the support shaft (page 5–64).

2. Install the splined shaft (page 5–62).

3. Return the printer to normal operation (see below).

Returning the Printer to Normal Operation

1. Load paper.

2. Install the ribbon.

3. Close floor cabinet doors and the printer cover.

4. Connect the ac power cord to the power source and the printer.

5. Set the power switch to 1 (on).

6. Test printer operation by selecting and running one of the diagnostic self–tests (page 3–26).

A **Printer Configuration**

Contents

Printer Configuration

Configuration directly affects printer operation. Do not change printer configuration until you are thoroughly familiar with the procedures in this appendix.

Configuration refers to the operating properties that define how the printer responds to signals and commands received from the host computer. These properties, called configuration parameters, are set to match the operating characteristics of the host computer system.

You can set some configuration parameters either by a control code from the host computer or at the operator control panel. In such cases, a command from the host overrides the control panel selection. (If you save configuration values *after* such an override, the data stream control code value is saved instead of the value you selected at the control panel.)

Configuration Printout

The configuration printout lists the configuration parameters currently in use. When you exit configuration printout mode, the printer restores the previous font and line spacing (lpi) and all character attributes are canceled. All other format parameters remain unaffected.

To obtain a configuration printout:

1. Press the ON LINE switch to place the printer off–line.
2. Open the printer cover.
3. Press NEXT until "Off–Line/Print Config" appears on the message display.
4. Press the R/S (Run/Stop) switch. The configuration listing prints.
5. Press CLEAR and close the printer cover.
6. Press the ON LINE switch to place the printer on–line.

Configuration Procedure

Use the following procedure to configure the printer from the control panel:

1. Obtain a configuration printout (page A–2).

2. Determine the parameter values that must be changed to meet your requirements.

3. Take the printer off–line by pressing the ON LINE switch.

4. Open the printer cover.

NOTE: You must unlock the ENTER switch to change a configuration value. If you leave the ENTER switch locked you can examine — but not change — the current configuration.

5. Press UP and DOWN simultaneously to unlock the ENTER switch. "Unlocked" appears briefly on the message display.

6. Locate the desired menu by pressing DOWN and then NEXT or PREV until the menu name appears on the display. Use the Configuration Diagram (page A–7) as your "road map."

7. Locate the desired value in a menu by pressing DOWN, then pressing NEXT or PREV until the desired value appears on the display.

8. Press ENTER when the desired value is showing on the message display.

9. Press UP, then NEXT or PREV to move to the next desired menu. Repeat steps 7 and 8.

10. After you have made all required parameter changes, press CLEAR. The display goes to "Off–Line/Emulation." Press NEXT until "Off–Line/Save Config" displays. Press ENTER. This saves the parameter values as the power–up default values.

11. Lock the ENTER switch by pressing UP and DOWN simultaneously. "Locked" appears briefly on the message display.

12. Close the printer cover. Place the printer on–line by pressing ON LINE. Your selected values are now active.

Saving Configuration Values

When you save a set of configuration values they become active every time the printer is turned on.

To save a set of configuration values:

1. Press the ON LINE switch to take the printer off–line. "Off–Line/Emulation" appears on the message display.

2. Open the printer cover.

3. Press UP and DOWN simultaneously to unlock the ENTER switch. "Unlocked" appears briefly on the message display.

4. Press NEXT (or PREV) until "Off–Line/Save Config" appears on the display.

5. Press ENTER.
    The printer saves the parameters in nonvolatile memory then displays "Done."

6. Press CLEAR to return to "Off–Line/Emulation" display.

7. Press UP and DOWN simultaneously to lock the ENTER switch. "Locked" appears briefly on the message display.

8. Close the printer cover.

9. Press the ON LINE switch to place the printer on–line.

Loading Configuration Values

Configuration values saved using the "Save Config" menu (page A–4) become the power–up default configuration. The set of factory values remains permanently stored in printer memory, however.

The "Load Config" menu gives you the choice of loading either the saved or the factory configuration values.

NOTE: If you have not saved a set of configuration values, this procedure loads the factory value set.

To load a set of configuration values:

1. Press the ON LINE switch to take the printer off–line.
   "Off–Line/Emulation" appears on the message display.

2. Open the printer cover.

3. Press UP and DOWN simultaneously to unlock the ENTER switch.
   "Unlocked" appears briefly on the message display.

4. Press NEXT or PREV until "Off–Line/Load" appears on the display.

5. Press DOWN, then press NEXT or PREV to select either "Load/Saved" or "Load/Factory".

6. Press ENTER when the desired selection displays.
   The printer loads the parameters then displays "Done".

7. Press CLEAR to return to "Off–Line/Emulation".

8. Press UP and DOWN simultaneously to lock the ENTER switch.
   "Locked" appears briefly on the message display.

9. Close the printer cover.

10. Press the ON LINE switch to place the printer on–line.

Changing Printer Emulations

Emulation refers to the ability of the LG06 to execute the commands of DEC LG02/LG31/LN01 printers, an IBM Proprinter, or an Epson FX printer. (On the LG06 printer, the self–test and hex printout modes are also considered emulations.)

DEC emulation is the default mode, but you can select another emulation at any time.

To change printer emualtions:

1. Press ON LINE to place the printer in the off–line state. "Off–Line/Emulation" appears on the message display.

2. Open the printer cover.

3. Press UP and DOWN simultaneously to unlock the ENTER switch. "Unlocked" appears briefly on the message display.

4. Press DOWN. The current emulation displays. ("Emulation/LG06" is default.)

5. Press NEXT (or PREV) until the desired emulation displays.

6. Press ENTER. The printer sets all configuration values associated with that emulation. The values are those previously saved when that emulation was selected. If no values were altered, the factory default values are loaded.

7. Press CLEAR to return to "Off–Line/Emulation."

8. Press UP and DOWN simultaneously to lock the ENTER switch. "Locked" appears briefly on the message display.

9. Close the printer cover.

10. Press the ON LINE switch to place the printer on–line to the host computer.
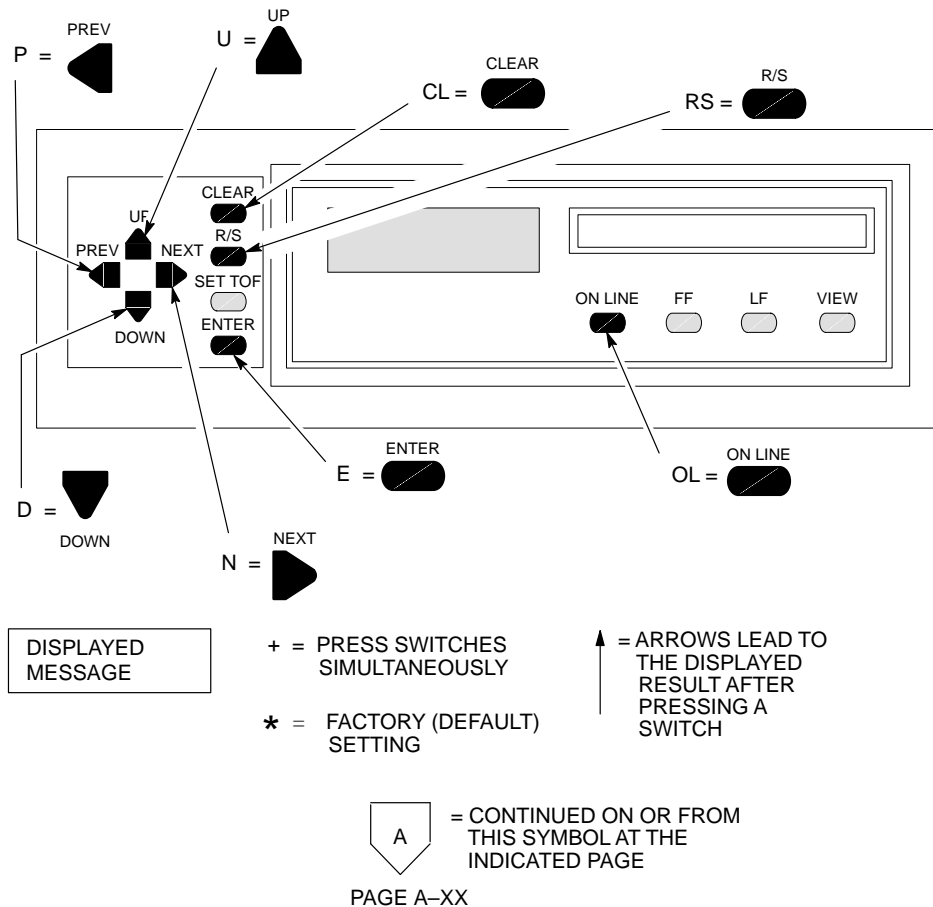
Configuration Diagram

The Configuration Diagram is a series of block diagrams showing the configuration menu structure and the parameter options available in each menu. The Configuration Diagram begins on page A–8.

How to Read the Configuration Diagram

Boxes on the diagram represent the message display. Messages that appear on the display are printed inside the boxes. The letters outside the boxes represent control panel switches. When a switch is pressed, an arrow points to the displayed result.
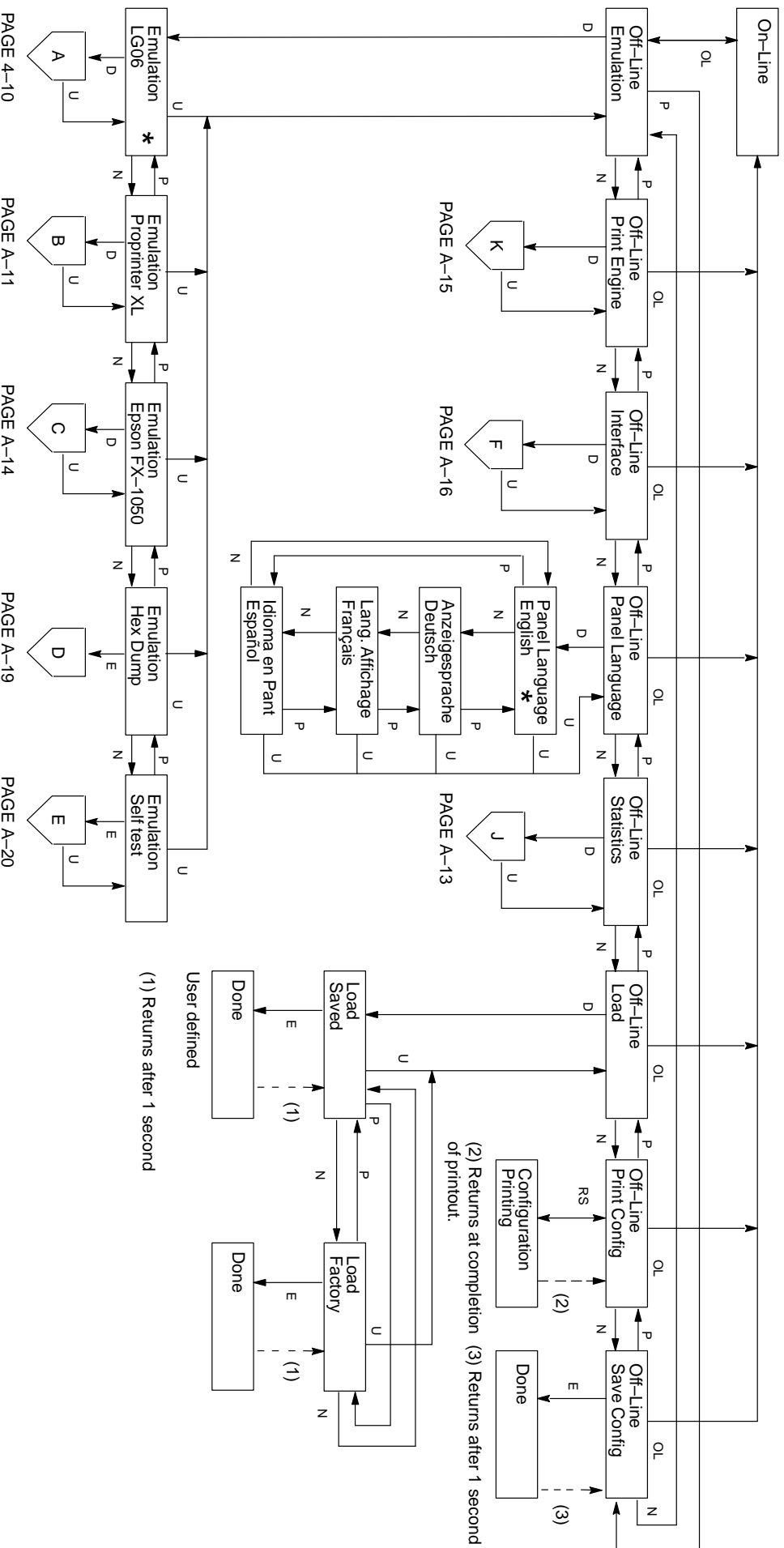
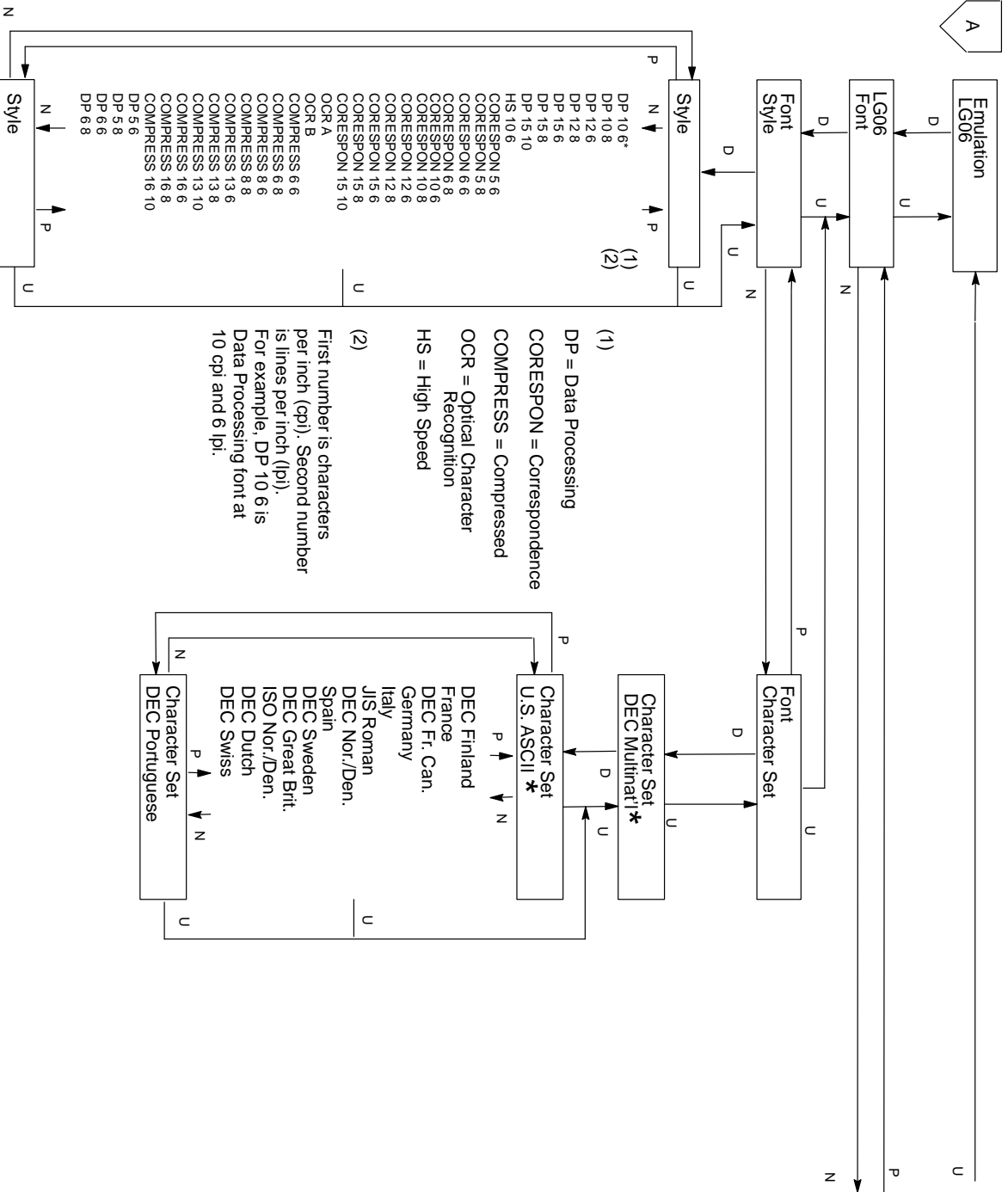The symbols used in the Configuration Diagram are shown in Figure A–1.

Figure A–1. Configuration Diagram Symbol Key

CONFIGURATION DIAGRAM

IMPORTANT: To make configuration changes, unlock the ENTER switch at "Off–Line Emulation" by simultaneously pressing UP and DOWN.

On–Line

Off–Line Emulation

Off–Line Print Engine — PAGE A–15 — K

Off–Line Interface — PAGE A–16 — F

Off–Line Panel Language

Panel Language English *

Anzeigesprache Deutsch

Lang. Affichage Français

Idioma en Pant Español

Off–Line Statistics — PAGE A–13 — J

Off–Line Load

Load Saved — Done

Load Factory — Done

User defined

(1) Returns after 1 second

Off–Line Print Config

Configuration Printing

Done

Off–Line Save Config

Done

(2) Returns at completion of printout. (3) Returns after 1 second

Emulation LG06 * — PAGE 4–10 — A

Emulation Proprinter XL — PAGE A–11 — B

Emulation Epson FX–1050 — PAGE A–14 — C

Emulation Hex Dump — PAGE A–19 — D

Emulation Self test — PAGE A–20 — E

A

Emulation LG06

LG06 Font

Font Style

Style

Style

(1)
(2)

DP 10*
DP 10 8
DP 12 6
DP 12 8
DP 15 6
DP 15 8
DP 15 10
HS 10 6
CORESPON 5 6
CORESPON 5 8
CORESPON 6 6
CORESPON 6 8
CORESPON 10 6
CORESPON 10 8
CORESPON 12 6
CORESPON 12 8
CORESPON 15 6
CORESPON 15 8
CORESPON 15 10
OCR A
OCR B
COMPRESS 6 6
COMPRESS 6 8
COMPRESS 8 6
COMPRESS 8 8
COMPRESS 13 6
COMPRESS 13 8
COMPRESS 13 10
COMPRESS 16 6
COMPRESS 16 8
COMPRESS 16 10
DP 5 6
DP 5 8
DP 6 6
DP 6 8

(1)
DP = Data Processing
CORESPON = Correspondence
COMPRESS = Compressed
OCR = Optical Character
Recognition
HS = High Speed

(2)
First number is characters
per inch (cpi). Second number
is lines per inch (lpi).
For example, DP 10 6 is
Data Processing font at
10 cpi and 6 lpi.

Font Character Set

Character Set DEC Multinat'l *

Character Set U.S. ASCII *

Character Set DEC Portuguese

DEC Finland
France
DEC Fr. Can.
Germany
Italy
JIS Roman
DEC Nor./Den.
Spain
DEC Sweden
DEC Great Brit.
ISO Nor./Den.
DEC Dutch
DEC Swiss

Continued
on next page

Continued from previous page

LG06 Vert. Forms

Vert Forms Bot. Frm n (1) (5)

Vert Forms Top Mrg n (1) (4)

Vert Forms Bot Mrg n (1) (4)

LG06 Horiz. Forms (4)

Horiz Forms Left Mrg n (2)

Horiz Forms Right Mrg n (2)

LG06 Autowrap

Autowrap Yes *

Autowrap No

LG06 CR

CR = CR *

CR = CR + LF

LG06 LF

LF = CR + LF *

LF = LF

LG06 Unsol. Reports? (3)

Unsol. Reports? No *

Unsol. Reports? Small

Unsol. Reports? Big
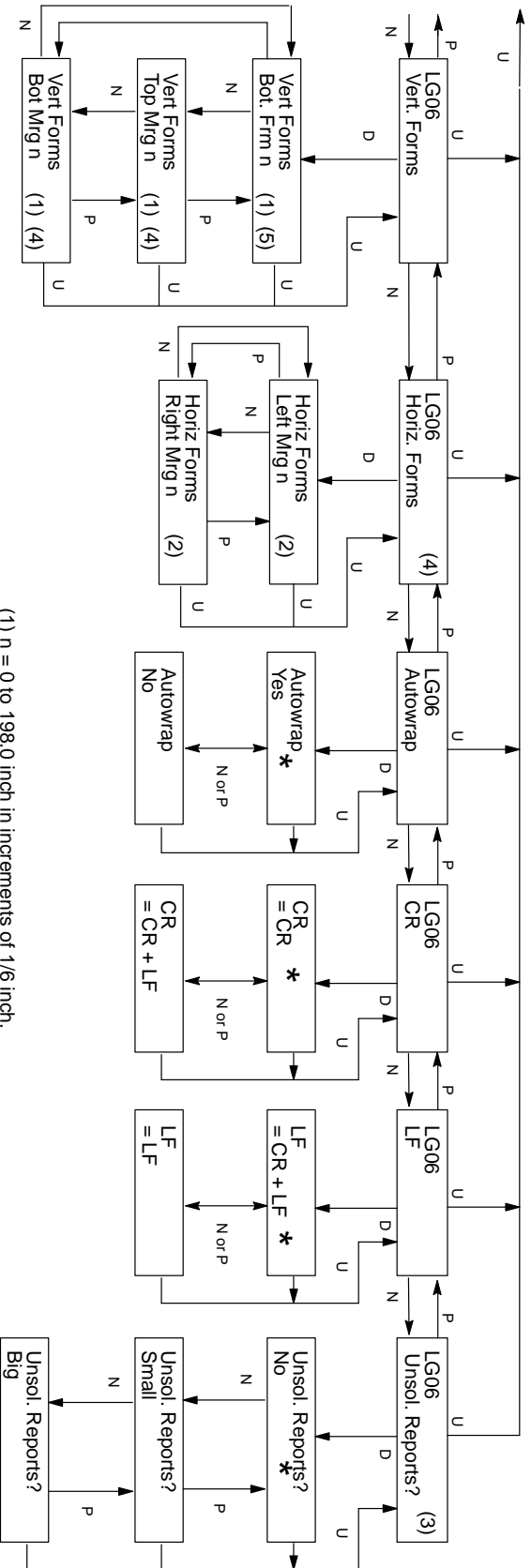
(1) n = 0 to 198.0 inch in increments of 1/6 inch. (Press DOWN to change units; NEXT increases, PREV decreases.)

(2) n = 0 to 13.6 inch in increments of 0.1 inch. (Press DOWN to change units; NEXT increases, PREV decreases.)

(3) Status reports are only sent when the RS–232 interface is selected.

(4) Margins will automatically adjust so that left/right and top/bottom margins cannot cross one another.

(5) Setting the Bot Frm n automatically sets the top margin to zero and the bottom margin to n. Setting Bot Mrg n does not affect the top margin.
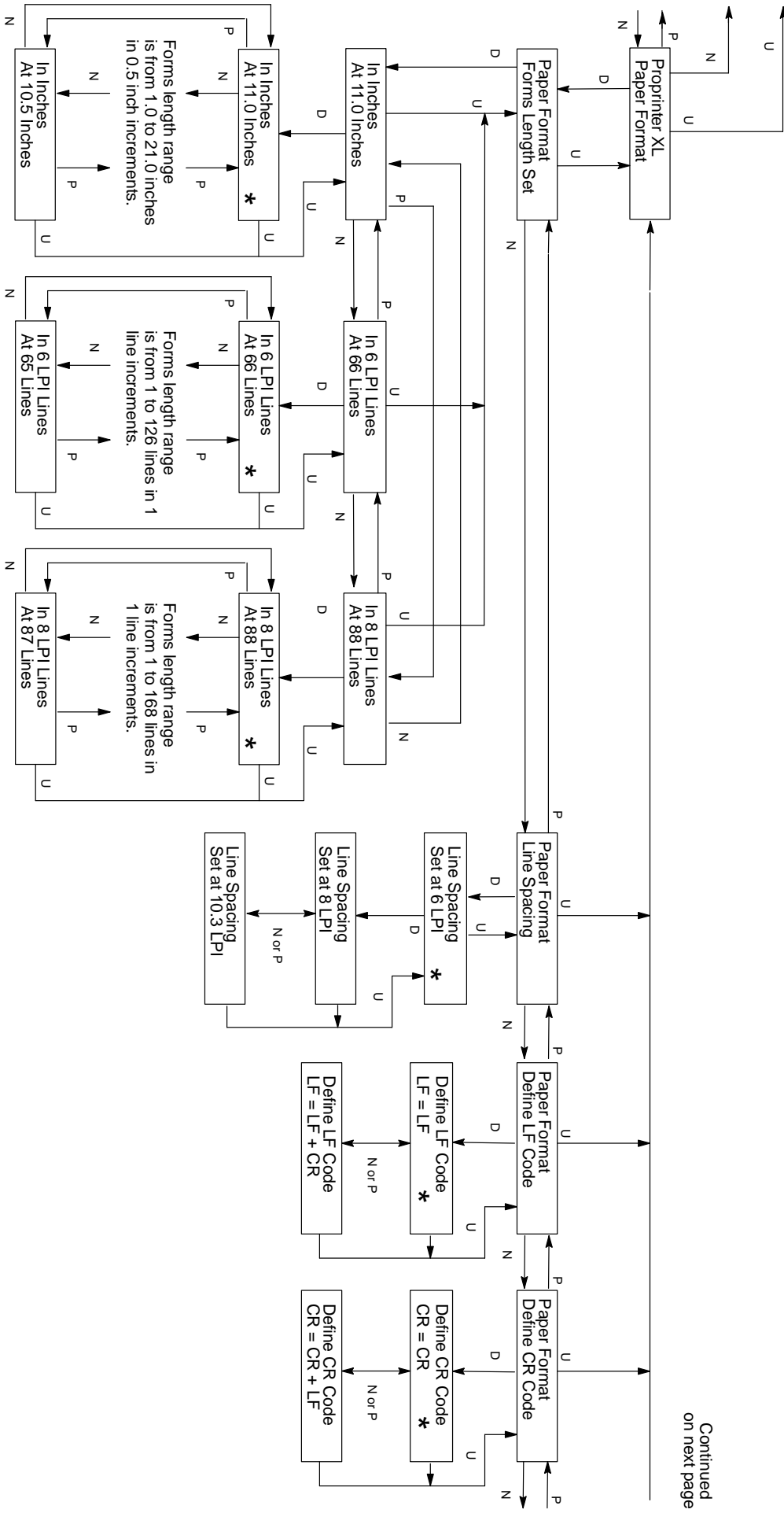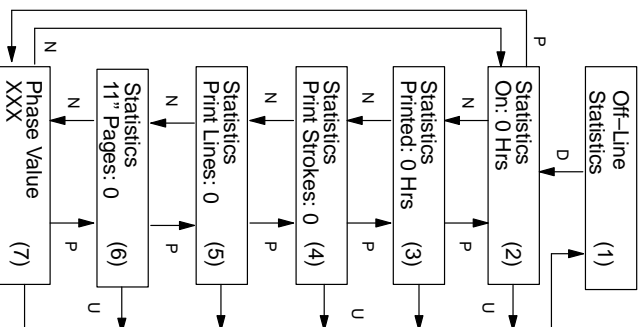
FROM PAGE A–8

B

Emulation
Proprinter XL

Proprinter XL
Font

Font
Draft at 10 CPI *

Font
Draft at 12 CPI

Font
NLQ at 10 CPI

Font
NLQ at 12 CPI

Proprinter XL
Character Set

Character Set
US 437

US 437
Graphic 1 (A) *

US 437
Graphic 2 (B)

N or P

Character Set
Mult 850

Mult 850
Graphic 1 (A)

Mult 850
Graphic 2 (B)

N or P

Proprinter XL
Compatibility

Compatibility
Compress 12 CPI

Compress 12 CPI
20 CPI *

Compress
12 CPI

N or P

Compatibility
Slashed Zero

Slashed Zero
Disable *

Slashed Zero
Enable

N or P

Continued
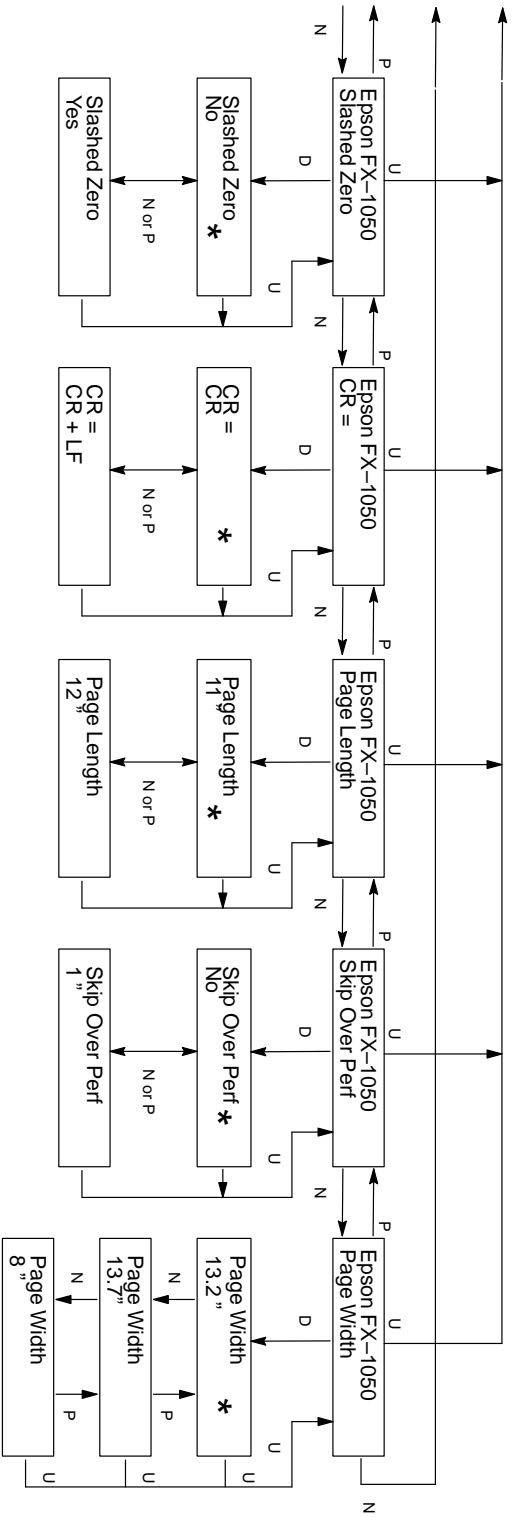on next page

Printer Configuration

Continued from previous page

Continued on next page

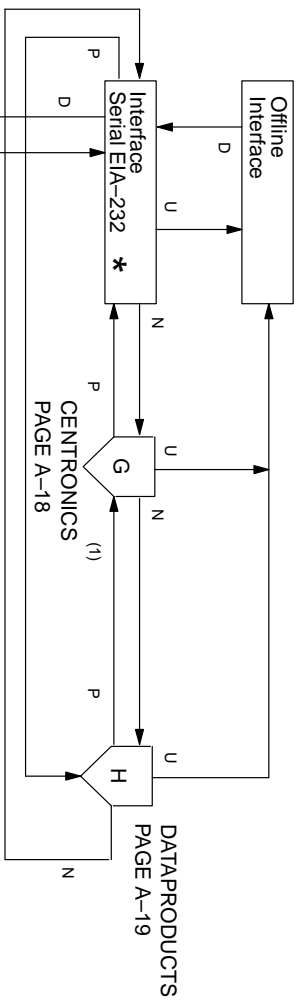Proprinter XL Paper Format

Paper Format Forms Length Set

In Inches At 11.0 Inches

In Inches At 11.0 Inches *

In Inches At 10.5 Inches

Forms length range is from 1.0 to 21.0 inches in 0.5 inch increments.

In 6 LPI Lines At 66 Lines

In 6 LPI Lines At 66 Lines *

In 6 LPI Lines At 65 Lines

Forms length range is from 1 to 126 lines in 1 line increments.

In 8 LPI Lines At 88 Lines

In 8 LPI Lines At 88 Lines *

In 8 LPI Lines At 87 Lines

Forms length range is from 1 to 168 lines in 1 line increments.

Paper Format Line Spacing

Line Spacing Set at 6 LPI *

Line Spacing Set at 8 LPI

Line Spacing Set at 10.3 LPI

Paper Format Define LF Code

Define LF Code LF = LF *

Define LF Code LF = LF + CR

Paper Format Define CR Code

Define CR Code CR = CR *

Define CR Code CR = CR + LF

N or P

Paper Format
Form Feed at TOF

Form Feed at TOF
Enable *

Form Feed at TOF
Disable

N or P

Paper Format
Print Width

Print Width
13.6 Inches *

Print Width
8.0 Inches

N or P

FROM PAGE A–8

J

Off–Line
Statistics (1)

Statistics
On: 0 Hrs (2)

Statistics
Printed: 0 Hrs (3)

Statistics
Print Strokes: 0 (4)

Statistics
Print Lines: 0 (5)

Statistics
11" Pages: 0 (6)

Phase Value
XXX (7)

(1) All set to zero after factory burn–in.

(2) 0 to 30,000

(3) 0 to 30,000

(4) 0 to 4,000,000,000

(5) 0 to 4,000,000,000

(6) 0 to 4,000,000,000; total inches of paper movement /11

(7) Phase Value range is 0 to 315.

Emulation
Epson FX-1050

Epson FX-1050
Font

Font HS Draft 10 *
Font HS Draft 12
Font HS Draft 15
Font Draft 10
Font Draft 12
Font Draft 15
Font NLQ 10
Font NLQ 12
Font NLQ 15

Epson FX-1050
Condensed

Condensed No *
Condensed Yes

Epson FX-1050
Draft Speed

Draft Speed High *
Draft Speed Low

Epson FX-1050
Character Set

Character Set Epson *
Character Set IBM Graphics

Epson FX-1050
International Set

International Set USA *

France
Germany
UK
Denmark I
Sweden
Italy
Spain I
Japan
Norway
Denmark II
Spain II

International Set Latin Am

Continued from
previous page

Epson FX–1050
Slashed Zero

Slashed Zero
No *

Slashed Zero
Yes

N or P

Epson FX–1050
CR =

CR =
*

CR =
CR + LF

N or P

FROM PAGE A–8

K

Epson FX–1050
Page Length

Page Length
11 *

Page Length
12"

N or P

Off–Line
Print Engine

Print Engine
Unidirectional

Unidirectional
No *

Unidirectional
Yes

N or P

Epson FX–1050
Skip Over Perf

Skip Over Perf
No *

Skip Over Perf
1"

N or P

Print Engine
PMD Fault

PMD Fault
Yes *

PMD Fault
No

N or P

Epson FX–1050
Page Width

Page Width
13.2" *

Page Width
13.7"

Page Width
8"

FROM PAGE A–8

F

Offline
Interface

Interface
Serial EIA–232 ✻

CENTRONICS
PAGE A–18

G

(1)

DATAPRODUCTS
PAGE A–19

H

Serial EIA–232
Data Rate

Data Rate
9600 Baud ✻

19200 Baud
150 Baud
300 Baud
600 Baud
1200 Baud
2400 Baud

Data Rate
4800 Baud

Serial EIA–232
Word Length 8

Serial EIA–232
Word Length 8 ✻

Serial EIA–232
Word Length 7

Serial EIA–232
Stop Bits 1

Serial EIA–232
Stop Bits 1 ✻

Serial EIA–232
Stop Bits 2

Serial EIA–232
Parity

Parity
None ✻

Parity
Odd

Parity
Even

Parity
Mark

Parity
Sense

Serial EIA–232
Data Term Ready

Data Term Ready
True ✻

Data Term Ready
On–Line and BNF

Date Term Ready
Off–Line or BF

Data Term Ready
False

Continued
on next page

Continued from previous page

N   P   N   U   U   P

Serial EIA–232
Request to Send

Serial EIA–232
Reverse Channel

Request to Send
True

Request to Send
False

Request to Send
Off–Line or BF

Request to Send
On–Line and BNF ✱

Reverse Channel
True

Reverse Channel
False

Reverse Channel
Off–Line or BF

Reverse Channel
On–Line and BNF ✱

N   P   U   D   N

G

Interface
Centronics

Centronics
Data Bit 8 — Data Bit 8
Yes ∗ — Data Bit 8
No

Centronics
Data Polarity — Data Polarity
Standard ∗ — Data Polarity
Inverted

Centronics
Response Pol. — Response Pol.
Standard ∗ — Response Pol.
Inverted

Centronics
Busy on Strobe — Busy on Strobe
Yes ∗ — Busy on Strobe
No

Centronics
Latch Data On — Latch Data On
Leading Edge ∗ — Latch Data On
Trailing Edge

Centronics
Prime Signal — Prime Signal
Enable ∗ — Prime Signal
Disable

Centronics
TOF Action — TOF Action
Reset ∗ — TOF Action
Do Nothing

D U N P N or P

Printer Configuration

D

Emulation
Hex Dump

E

Emulation
Hex Dump
*

OL

On–Line
Hex Dump

OL

Off–Line
Emulation

H

Interface
Dataproducts

D

Dataproducts
Data Bit 8

U

D

Data Bit 8
Yes
*

N or P

Data Bit 8
No

U

N

P

P

Dataproducts
PI Ignored

U

D

PI Ignored
Yes
*

N or P

PI Ignored
No

U

N

P

P

Dataproducts
Data Polarity

U

D

Data Polarity
Standard
*

N or P

Data Polarity
Inverted

U

N

P

P

Dataproducts
Data Request Pol.

U

D

Data Request Pol.
Standard
*

N or P

Data Request Pol.
Inverted

U

N

P

P

Dataproducts
Strobe Polarity

U

D

Strobe Polarity
Standard
*

N or P

Strobe Polarity
Inverted

U

N

P

FROM PAGE A–8

E

Emulation
Self Test

E

Emulation
Self Test

D

Emulation
Self Test ∗

U

P

Self Test
ASCII Swirl

N

Running
ASCII Swirl

RS

U

Self Test
Width: 13.2

N

U

P

Self Test
Width: 13.2 ∗

D

N or P

Self Test
Width: 8.0

U

U

P

Self Test
Phase Value

N

PhaseValue
XXX   (1)

RS

U

(1) Increase or decrease phase value
by pressing NEXT or PREV switch.
Range is 0 to 315.

Self Test
All E's

N

U

P

Running
All E's

RS

Self Test
Shuttle Fast

N

P

Running
Shuttle Fast

RS

U

Self Test
E's + TOF

N

U

P

Running
E's + TOF

RS

Self Test
Shuttle Slow

N

P

Running
Shuttle Slow

RS

U

Self Test
All H's

N

U

P

Running
All H's

RS

Self Test
All Black

N

P

Running
All Black

RS

U

Self Test
All Underlines

N

U

P

Running
All Underlines

RS

Self Test
All Underlines

N

U

P

B Printer Specifications

Contents

Cleaning Interval

Clean the LG06 every 6 months or 1000 hours of operation, whichever occurs first. (See page 2–4.)

Ribbon Specifications

NOTE: Use of ribbons that do meet digital specifications may void warranty.

Part Number: 36–36692–01

Type: OCR Application, carton of 1 ribbon

Dimensions: Length: 60 yards (54.84 m)
                    Width: 1 inch (2.54 cm)
                    Thickness: 0.0039 inches (.009906 cm)

To order replacement ribbons, call 1–800–DIGITAL

Paper Specifications

Paper

Type: Edge–perforated, fanfold, 7.62 to 40.64 cm (3 to 16 in) wide

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

Sheet Thickness: 0.0635 cm (0.025 in) maximum

Drive: Adjustable tractors (6–pin engagement)

Slew Rate: 40.64 cm/s (16 in/s) maximum

Labels

On Backing:	One–part continuous perforated fanfold back form. Labels must be placed at least 0.42 cm (1/6 in) from the fanfold perforation. Backing adhesive must not be squeezed out during printing.
Sheet Size:	7.62 to 40.64 cm (3– to 16–in) wide, including the two standard perforated tractor feed strips. A maximum sheet size of 30.48 cm (12 in) between top and bottom perforations.
Thickness:	Not to exceed 0.064 cm (0.025 in) (including backing sheet)

Printer Dimensions

Height:	108 cm (42.5 in)
Width:	68.6 cm (27 in)
Depth:	72.9 cm (28.7 in)
Weight:	Approximately 102 kg (225 lb) – Unpackaged Approximately 129 kg (285 lb) – Packaged for shipping

Interfaces

Type:	Two resident parallel, one resident serial
Logic Levels:	TTL/EIA–232D
Data Format:	ASCII
Compatibility:	Centronics, Dataproducts, EIA–232D
Buffer Size:	2 lines parallel, 1KB serial

Environmental Characteristics

Temperature

Operating   10° to 40° C (50° to 104° F)

Storage   – 40° to 70° C (–40° to 158° F)

Relative Humidity

Operating   10% to 90% (noncondensing)

Storage   5% to 95% (noncondensing)

Acoustic Noise Level

52 dBA (tested per ISO 7779)

Electrical Characteristics

Input Power

Voltage   120 Vac or 230 Vac (94 – 140 VRMS; 188 – 275 VRMS)

Phase   Single

Frequency   47 to 62 Hz

Max RMS Current   8A @ 120 V; 4A @ 230 V

Power Rating

Standby   165 VA 60 Hz (120 Watts)

Operating   480 VA 60 Hz (360 Watts)

Data Input Rate (maximum)

Dataproducts	Up to 30 000 characters per second
Centronics	Up to 30 000 characters per second
RS–232	Up to 19 200 baud

Radio Frequency Interference (RFI)

Radio Frequency Interference tested/certified to RFI standards FCC 15.J Class A; VDE 0871 Class A; CISPR–22.

Printing Rates

Printing speed of text is measured in lines/minute, and is a function of the selected font and 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. Typical printing rates for text are charted in Table B–1.

Plotting speed of graphics is measured in inches/minute, and is calculated as follows:

$$\frac{1}{\text{Shuttle Speed} \quad \text{x} \quad \text{Vertical Density}} \quad \text{x} \quad 60\ 000 \quad = \quad \text{Plotting speed in inches/minute}$$

Shuttle speed varies with the horizontal dot density:

	Horizontal Density (dots/inch)	Shuttle Speed (milliseconds/stroke)
	50	12.5
	60	12.5
	70	12.5
	80	12.5
	90	12.5
Selectable by	100	12.5
graphics	110	12.5
control codes	120	12.5
	130	13.5
	140	14.5
	150	15.6
	180	18.75
	200	20.8

To prevent damage from overheating when graphics plotting is done over extended periods, the hammer bank contains a thermal sensing feature that automatically reduces the print rate.

Printer Specifications

Table B–1. Text Printing Rates

Print Application			Performance	
Emulation, Font, and Characters /inch	Dot Density[1]	Dot Matrix[2]	Uppercase Only (lines/minute)	Descenders & Underline (lines/minute)
LG06 DP 5	60 (120) x 66.6	10 (18) x 7 + 2	600	480
LG06 DP 6	60 (120) x 66.6	8 (14) x 7 + 2	600	480
LG06 DP 10	60 (120) x 66.6	5 (9) x 7 + 2	600	480
Pro DP 10	60 (120) x 75	5 (9) x 7 + 2	600	480
LG06 DP 12	60 (120) x 66.6	4 (7) x 7 + 2	600	480
Pro[3] DP 12	60 (120) x 75	4 (7) x 7 + 2	600	480
LG06 DP 15	60 (120) x 100	3 (5) x 7 + 2	600	480
Pro DP 17	60 (120) x 75	3 (5) x 7 + 2	600	480
Pro DP 20	60 (120) x 75	3 (5) x 7 + 2	600	480
LG06 NLQ[4] 5	90 (180) x 85.7	14 (26) x 9 + 3	320	245
LG06 NLQ 6	90 (180) x 85.7	12 (22) x 9 + 3	320	245
LG06 NLQ 10	90 (180) x 85.7	7 (13) x 9 + 3	320	245
Pro NLQ 10	90 (180) x 100	7 (13) x 9 + 3	320	245
LG06 NLQ 12	90 (180) x 85.7	6 (11) x 9 + 3	320	245
Pro NLQ 12	90 (180) x 100	6 (11) x 9 + 3	320	245
LG06 NLQ 15	90 (180) x 85.7	5 (9) x 9 + 3	320	245
LG06 CMP 6.6	60 (120) x 85.7	4 (7) x 7 + 2	600	480
LG06 CMP 8.3	75 (150) x 85.7	4 (7) x 7 + 2	480	384
LG06 CMP 13.3	60 (120) x 85.7	4 (7) x 7 + 2	600	480
LG06 CMP 16.6	75 (150) x 85.7	4 (7) x 7 + 2	480	384
LG06 HS 10	60 (120) x 50	5 (9) x 5 + 1	800	685
LG06 OCR–A 10	120 (120) x 150	12 (12) x 15 + 1	300 (best) 155 (worst)	
LG06 OCR–B 10	120 (120) x 150	12 (12) x 15 + 1	300 (best) 155 (worst)	

[1] A (B) x C where: A = maximum horizontal dot density; B = horizontal dot placement density; C = vertical dot density.

[2] D (E) x F + G where: D = maximum number of dots to be placed on horizontal dot positions; E = horizontal dot positions; F = number of vertical dots for uppercase symbols; G = number of dots available for descenders.

[3] Pro = Proprinter emulation

[4] NLQ = correspondence, CMP = compressed, HS = high speed

Duty Cycle

The LG06 text and graphics printer is capable of printing 75 000 pages per month under the following conditions:

1. Uppercase only

2. 6 lines/inch

3. 10 characters/inch

4. 63% character density or 83 characters/line

5. 63% line density or 42 lines/11–inch page

6. Single part (18 lb) paper

7. Printer is maintained in accordance with the maintenance manual (document number EK–ELG06–MG)

8. Printer is installed in accordance with Chapter 2, "Installation" of the User's Manual (document number EK–ELG06–UG).

C Torque Table

IMPORTANT

Torque values specified in replacement procedures (Chapter 5) take precedence over Table C–1.

Table C–1 establishes the torque requirements for routine installation of threaded fasteners. The torque requirements in Table C–2 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.

Table C–1. 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

D

Cable Interconnections and Hammer Bank Wiring

Table D–1 lists the LG06 cable assemblies and their part numbers.

The LG06 Interconnection Diagram on page D–2 shows the electrical interconnections in block diagram form. Use this diagram as a troubleshooting aid.

The Hammer Bank Wiring Diagram on page D–3 is useful for tracing opens or shorts.

Table D–1. Interconnection Cables

Cable No.	Part No.	Description
W1	150551–001	Cable Assembly, CCB/Mech. Dr.
W2	150218–001	Cable Assembly, +5 V
W3	150216–001	Cable Assembly, Hi Voltage
W4	29–29293–01	Cable Assembly, Hammer Bank
W5	29–29292–01	Cable Assembly, Intermediate
W6	150376–001	Wire Harness, Main, P4980
W7	150487–001	Cable Assembly, AC/Ground, P4980

LG06 INTERCONNECTION DIAGRAM

LEGEND

CCB = Common Controller Board
CCF = Card Cage Fan
CO = Cover Open
GND = Ground
HB = Hammer Bank
HD = Hammer Driver
(J) = Jack connector
L = Left
MH = Main Harness
MPU = Magnetic Pick Up
(P) = Pin connector
PF = Paper Feed
PI = Platen Interlock
PLM = Platen Motor
PMD = Paper Motion Detector
PS = Power Supply
R = Right
RG = Ribbon Guide
RM = Ribbon Motor

Switch Assy, Platen Interlock
Switch Assy, Paper Detector
Cable Assy, Ribbon Guide, Right
Motor Assy, Ribbon (Right)
Fan Assy, Card Cage
Motor Assy, Platen Open
Magnetic Pick–up Assy.

RGR(J) RGR(P)
RMR(P)
CCF(P)
PLM(P)
MPU(J) MPU(P)

PI(P) PI(J)
PMD(J) PMD(P)

Switch Assy, Cover Open

Cable Assy, Ribbon Guide, Left
Motor Assy, Ribbon (Left)
Motor Assy, Paper Drive
Fan Assy, Hammer Bank
Motor Assy, Shuttle Driver
Wire Assy, Hammer Bank

RGL(J) RGL(P)
RML(P)
PFM(P)
HBF(J)   J17
SHH(J) SHH(P)
SHM(J) SHM(P)
HBL(J)
HBR(J)

CO+(P)
CO–(P)

W4: (twice) Cable Assy, Hammer Bank

AC Input

Filter, Power Line, EMI

GND
GND
GND

Circuit Breaker

Load
Load

Fan Assy, P4000 (Cabinet)

EXP(P)

W5: Cable Assy Intermediate

P1
P1

Control Panel Assy
Multi I/O Cable Assy

J3
J2
J1

Common Controller PCBA

CCB(J)

W1: Cable Assy, CCB/Mech. Dr.

W6: Wire Harness, Main, P4980A

MH(J)

Mechanism Driver PCBA

HD*(P)
HBL(J)
HBR(J)
HD*(P)

P/S Cond 1
P/S Cond 2

W3: Cable Assy, High Voltage

PS(J)   PS
P2   J101

Power Supply PCBA

J1   P1

PS5(J)
PS5(P)

W2: Cable Assy +5V

P1   J102

Cable Assy, AC/Ground, P4980

HD(J)   Not Used

Key:
⊙ = Unused hammer.
O = Hammer Coil.
○ = Hammer Spring.
▨ = Ribbon Cable.

NOTES:

1. Coil 48 is wired, but not used.

2. Hammer springs 1 and 49 are not used.

3. Hammer coil resistance = **4.7 Ohms**.

Hammer Bank Wiring Diagram

E Principles of Operation

Contents

Functional Elements of the Printer

The principal functional elements of the LG06 printer are the common controller board (CCB), the mechanism driver board, the power supply board, the operator control panel, and the components of the electromechanical print mechanism.

These elements are depicted at their most basic level in Figure E–1. The following sections of this appendix discuss these elements in more detail.
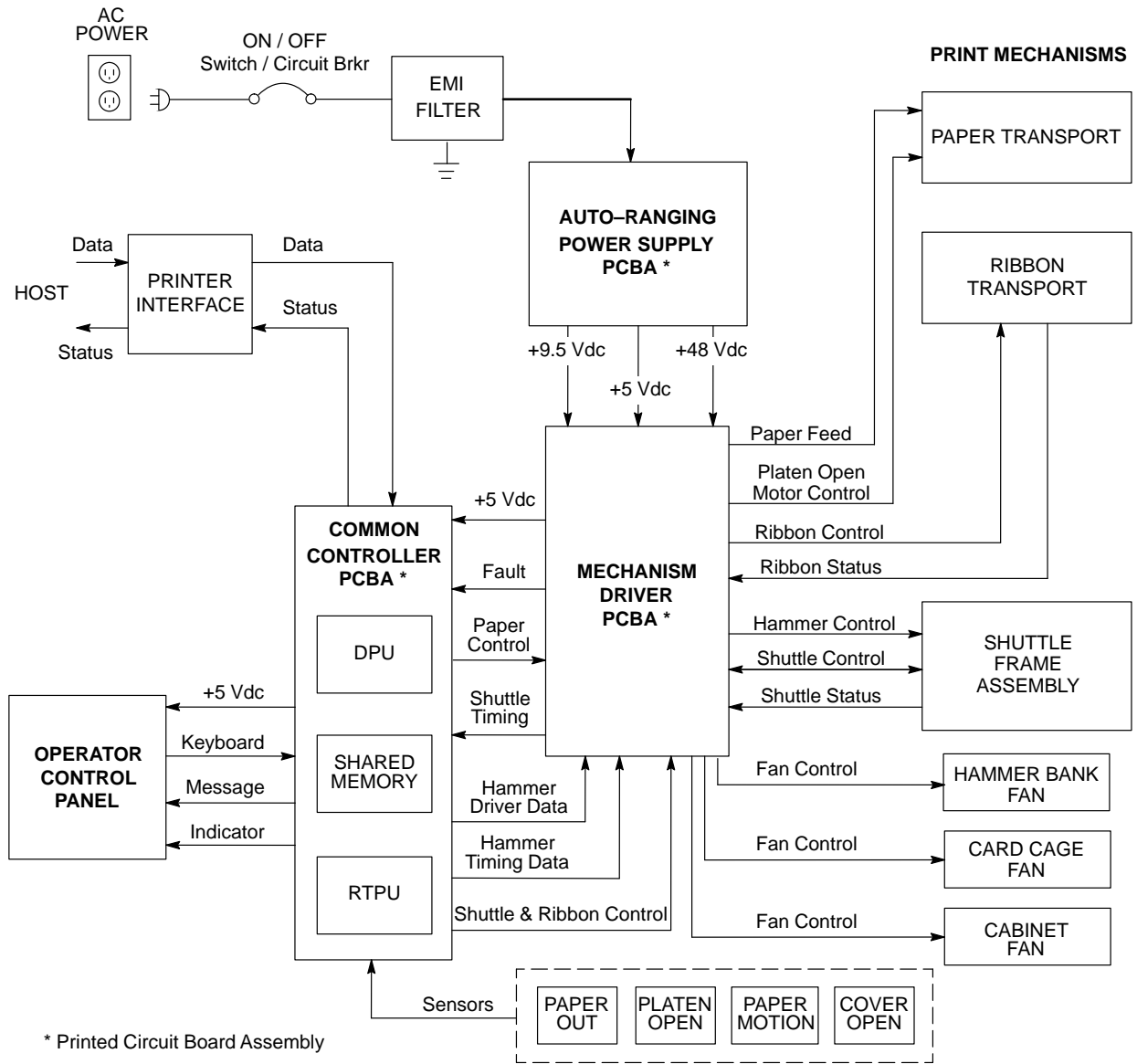
Figure E–1. Functional Elements of the LG06 Printer

Common Controller PCBA

The heart of the LG06 Text and Graphics printer is the common controller printed circuit board assembly (PCBA), also called the common controller board (CCB). The CCB oversees and coordinates all printer functions.

The CCB is functionally two units, the data processing unit (DPU) and the real–time processing unit (RTPU). The DPU converts all character data into printable dot images. The DPU is the high–level logical controller of the printer; it is not involved in real–time or hardware–dependent printer operation. The RTPU operates the host interfaces, operator control panel, and the print mechanism. The RTPU also monitors the fault circuitry in the mechanism.

The DPU and RTPU communicate by means of shared memory. The DPU gets host and operator input from buffers in memory which are filled by the RTPU, and returns dot images and operator messages to buffers in memory which the RTPU empties. Figure E–2 broadly summarizes the architecture of the CCB.
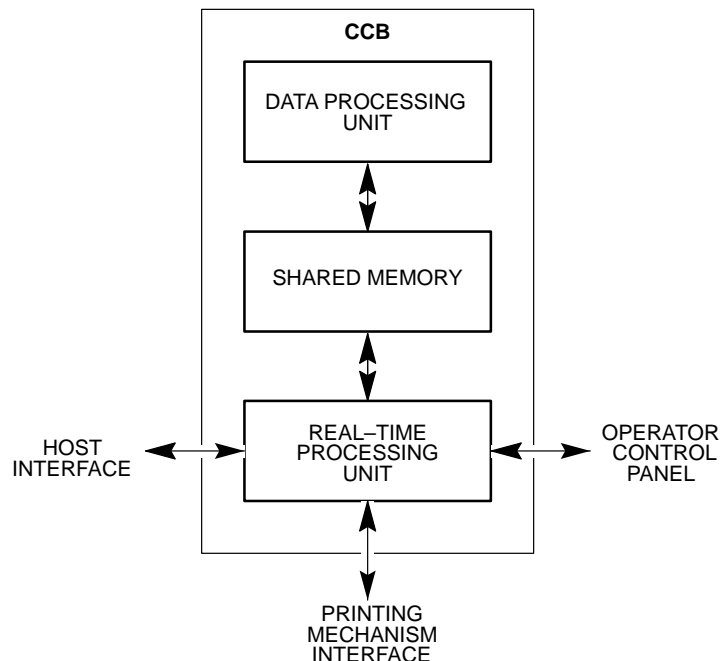
Figure E–2. Architectural Overview of the Common Controller Board (CCB)

Communicating with the Host Computer

The CCB processes three kinds of computer input: Centronics parallel, DataProducts parallel, and RS–232 serial data. The RTPU operates all three interfaces. The parallel interfaces are similar, and the RTPU contains direct–memory–access (DMA) hardware which loads parallel data directly into shared memory. The serial interface requires byte–by–byte intervention by the processor, since ACK/NACK and XON/XOFF protocols require that every byte be examined as it is received. The universal asynchronous receiver/transmitter (UART) is internal to the RTPU, which processes any protocol requirements then puts the data in shared memory, where the DPU can read it. To the DPU, all input data looks the same, regardless of the interface used to receive it.

Communicating with the Operator

All communication to and from the operator is done at the operator control panel. The control panel processes three types of operation: keystroke input, message display output, and indicator output. The RTPU handles the control panel interface requirements of shifting, clocking, etc., but the DPU processes all control panel data.

Printing

The RTPU coordinates printing of the dot images sent from the DPU. Printing is a complex process requiring many control functions, but is logically divided into two groups:

- Hammer driver interface functions
- Mechanical interface functions

Hammer Driver Interface

In order to print a dot image, two things must happen. First, the dots must get to the hammers one dot row at a time and in the correct sequence. Second, the hammers must be fired at the appropriate time in the stroke of the shuttle. The RTPU microprocessor controls both of these functions, but each is actually performed by an application–specific integrated circuit (ASIC) containing hardware dedicated to the function. These ASICs are the Dot Plucker Memory Controller (DPMC) and the Fire Timer IC (FTIC). The hammer driver interface functions of the RTPU are summarized in Figure E–3.
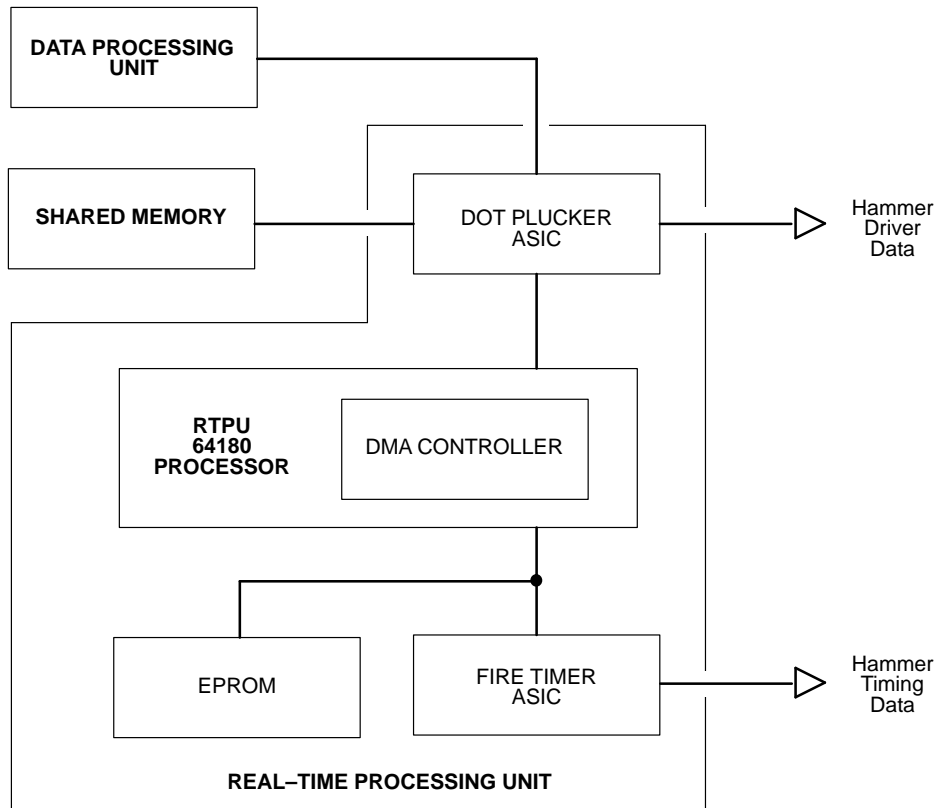
Figure E–3. Hammer Driver Interface Functions of the RTPU

Getting Dots to the Hammers Getting dots to the hammers consists of going into the shared memory and pulling bits out in a given order and shifting them to the hammer driver at the correct time. This process is called dot plucking. The order in which dots are plucked from memory depends on the dot density, the number of dots per hammer, the number of hammers on the hammer bank, the number of phases, and other factors. These factors are all considered by the RTPU processor as it programs the dot plucker for each dot row.

Synchronizing Dot Plucking and Hammer Firing Transfer of dots to the hammer driver must be synchronized with hammer firing. Dots are transferred to the hammer driver in bursts, serial streams of dots that tell which hammers will print when their phase is next fired. The bursts are timed precisely; they must occur neither too early nor too late. Synchronization is performed by having the FTIC request bursts from the dot plucker. The FTIC reads the magnetic pick–up unit (MPU) to determine when to request a burst. The time at which the burst request is made is contained in the fire timing tables.

Mechanical Interface

Three mechanical operations are coordinated in printing: paper motion, ribbon motion, and shuttle motion. Virtually all digital handling of paper motion is contained in the RTPU. The ribbon and shuttle are controlled by logic on the mechanism driver board, under the direction of the RTPU. Figure E–4 shows the mechanical interface section of the RTPU.
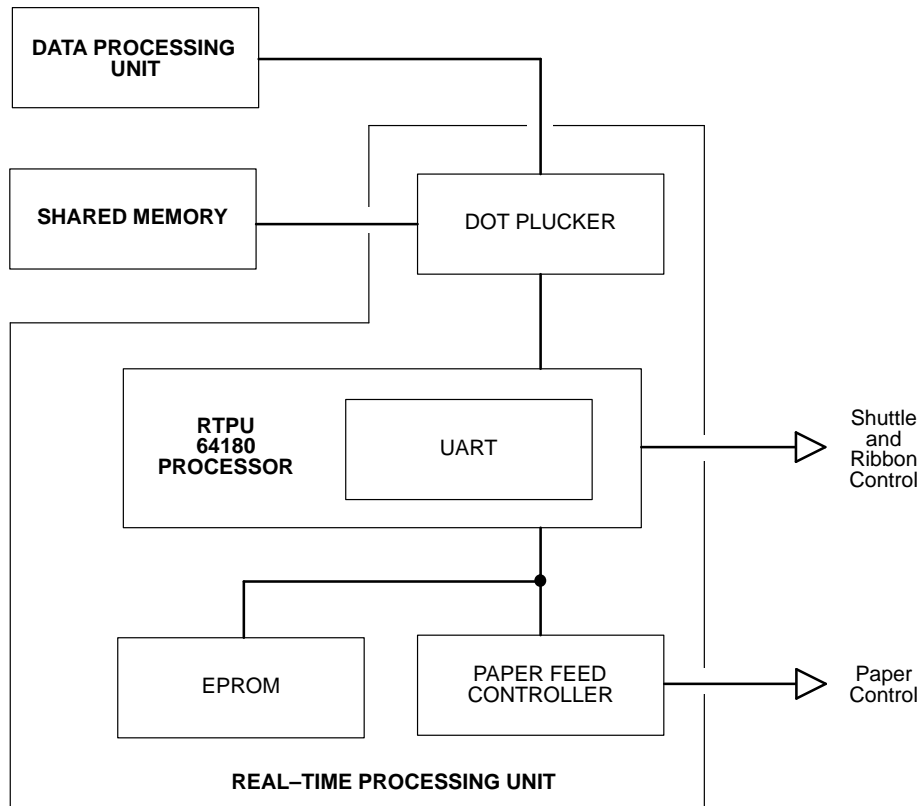
Figure E–4. Mechanism Driver Interface Functions of the RTPU

Paper Motion The DPU determines when paper must be moved and how far to move it. It communicates this to the RTPU through the shared memory. The RTPU processor performs some paper handling operations (such as holdback on slews), but most RTPU paper handling is done by a dedicated micro–controller called the paper feed controller (PFC).

The PFC moves paper by looking up motion profiles and driving a sequence of motor positions to the mechanism driver board. If the motion is a dot row or interline advance, it is synchronized to hammer firing by a signal from the FTIC that tell the PFC when to move.

Ribbon and Shuttle Motion The ribbon and shuttle motors are controlled by a micro–controller on the mechanism driver board. The RTPU interface to

the ribbon/shuttle processor (RSP) is a 2400 baud asynchronous serial line. A message protocol is used to communicate ribbon and shuttle information.

Fault Monitoring

The RTPU also monitors the hammer driver, mechanism driver, and the electro–mechanical sensors for fault conditions. Fault conditions are reported to the DPU.

Hammer Bank and Hammer Driver Faults

The FTIC works with the hammer driver ASIC to monitor coil shorts, opens, average upper driven phase current, and temperature conditions. The RTPU reads the FTIC registers to determine out–of–range conditions, and these are passed on to the DPU.

Paper Faults

Two kinds of paper faults can occur: paper out and paper jammed. Both of these conditions are monitored through optical sensors. The paper feed controller watches the paper out and paper motion sensors and reports errors to the RTPU. The RTPU passes this information on to the DPU.

Ribbon and Shuttle Faults

The mechanism driver ribbon and shuttle controller monitors fault conditions in the drive circuits and notifies the RTPU if it finds errors. The RTPU can also use the FTIC to measure time between magnetic pick–up (MPU) pulses, enabling it to monitor shuttle speed and thus detect some shuttle faults.

CCB Hardware Overview

A Motorola 68010 microprocessor performs the DPU functions, a 64180 microprocessor handles the RTPU functions, and an 8032 micro–controller serves as the paper feed controller (PFC), which is part of the RTPU. Actual implementation of this hardware blurs the distinctions between the DPU and RTPU, since the 68010 has access to the parallel port and the real–time functions of the dot plucker, which are RTPU resources, while the 64180 has access to the nonvolatile memory (NVRAM), which is a resource of the DPU. These possibilities exist because of efficiencies in the hardware design; software maintains the functional differences between the DPU and RTPU.

The CCB has four data buses. The 68010 has a local sixteen bit bus. The 64180 uses a local bus eight bits wide. A third bus is shared by the DPU and

RTPU; it is sixteen bits wide and is arbitrated on a cycle–by–cycle basis. The 8032 chip has its own eight bit local bus. The manner in which the CCB implements this hardware is depicted in Figure E–5.

The 64180 IC that oversees the RTPU processor contains a Z80 microprocessor with extended memory management, two DMA controllers, two asynchronous and one synchronous serial port, two counter timers, and an interrupt controller.

Communicating with the Host Computer

The 64180 processor runs both the parallel and serial interfaces.

Parallel Input Parallel input data is nine bits wide, and is transferred in one cycle from the parallel port to shared memory over the shared sixteen bit bus. Using the internal DMA controller of the 64180 to transfer parallel data requires some manipulation. The eight bit DMA controller in the 64180 performs either eight or sixteen bit DMA cycles, while the eight bit processor in the 64180 performs only eight bit memory access cycles. Sixteen bit DMA is achieved by hardware shifting of the DMA addresses one bit (effectively multiplying the address by two and changing the DMA auto–increment from byte to word) and by manipulating the control strobe. Software adjusts the addresses provided to the DMA controller when it is programmed for sixteen bit DMA. This manipulation saves both the added cost of a sixteen bit DMA controller and the second cycle that an eight bit transfer would require.

Serial Input One of the 64180 UARTs handles serial communication with the host. Additional modem control lines are provided in the 64180 hardware control register.

Communicating with the Operator

The synchronous serial port in the 64180 shifts data in and out of the operator control panel. The control register in the 64180 contains three other control panel bits: one samples the switches, one strobes the liquid–crystal display, and one strobes a light–emitting diode (LED) holding register.

Printing

Hammer Driver Interface The 64180 programs the dot plucker ASIC every dot row and programs the FTIC every stroke, after which the FTIC uses a DMA request line to control the movement of tables from EPROM to FTIC. The second DMA controller in the 64180 performs this transfer.

Mechanism Driver Interface The paper feed controller (PFC) directs all paper motion. During printing, it usually moves paper in response to a trigger

from the FTIC, which synchronizes paper motion with shuttle motion. The 64180 programs the PFC 8032 at the beginning of each dot row, telling the PFC how far to move when the trigger is received. The PFC sets up for the move, waits, then moves when the trigger occurs. The other method of starting paper motion is with a command passed through the inter–processor port (an eight bit parallel port between the 8032 and the 64180). This results in immediate movement. Other paper commands and status signals are also passed through this port.

Ribbon and Shuttle Motion The 64180 interfaces through its second UART to the ribbon / shuttle processor (RSP) on the mechanism driver board. The 64180 begins all transactions on the serial interface; the RSP sets a bit in the 64180 hardware status register when it needs service.

Fault Monitoring

The RTPU 64180, the PFC 8032, and the RSP monitor different functions for faults. The 64180 looks for hammer driver faults, shuttle stalls, and an open platen. The PFC 8032 monitors paper out and the paper motion detector. The RSP watches for faults in the motor drive circuits. The PFC and RSP report errors to the 64180, which collates fault status and passes it on to the DPU 68010 processor.

Hammer Bank and Hammer Driver Faults The 64180 and FTIC check the hammer driver and hammer bank for faults on every shuttle stroke. Faults are detected by circuits on the mechanism driver board and relayed to the CCB. Fault circuitry can detect shorted coils and rising temperatures in the coils. One coil is checked on every shuttle stroke; 48 shuttle strokes are required to check all coils. When the RTPU is notified of a fault, it sends a message to the 68010. If a coil shorts, the 64180 stops printing before firing another dot row.

Paper Faults The PFC 8032 monitors paper faults and reports them to the 64180 through the eight bit parallel port they share. The PFC works with a friction wheel paper motion detector and a reflective (optical) paper out sensor. The sensors interface directly to the CCB; there are analog circuits on the CCB to condition the sensor inputs.

Ribbon and Shuttle Faults The RSP monitors ribbon and shuttle faults and reports them to the 64180 over the serial interface.
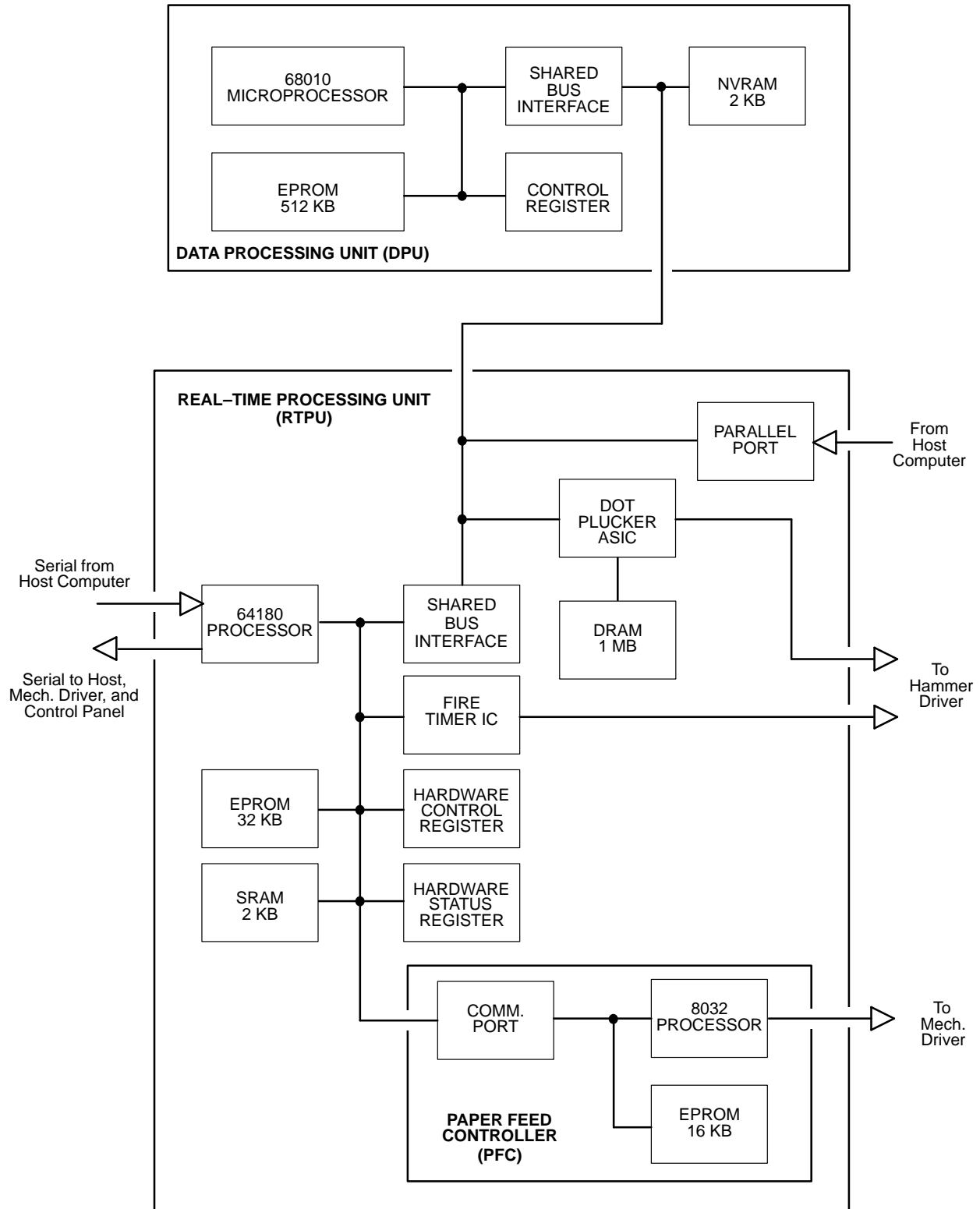
Figure E–5. Hardware Implementation of the CCB

Mechanism Driver PCBA

The mechanism driver board, acting on commands from the CCB, controls real–time operation of the electromechanical printer systems. Functionally, the board consists of nine subsystems:

- An 8032 micro–controller that controls ribbon drive and communication with the CCB.

- The interface to the power supply board.

- Pulse–width modulator (PWM) current mode / voltage mode full–bridge power amplifiers connected directly to the shuttle, ribbon, paper feed, and platen open motors. Current mode is used for the paper feed motor, voltage mode is used for the ribbon and shuttle motors.

- The paper feed controller (PFC) accepts control codes from the CCB for each motor phase to vector–control the paper feed motor.

- The shuttle drive controller receives speed commands from the CCB through the 8032 micro–controller and commands the speed of the three–phase dc shuttle motor.

- The ribbon drive controller, based around the 8032 micro–controller, receives speed commands from the CCB and drives two dc stepper motors, regulating the speed and tension of the ribbon and monitoring the end of ribbon sensors.

- The platen drive controller for reverse paper feed.

- Fault detection circuitry samples and senses heat sink temperature, ribbon speed, shuttle speed, hammer driver circuitry, hammer bank coil temperatures, power supply voltages, and fault communication with the CCB.

- Circuitry that registers magnetic pick–up unit (MPU) output, processes it for the logic interface, and sends it to the CCB for timing hammer fire.

The Ribbon Drive System

The ribbon drive system is controlled by the 8032 micro–controller. The CCB sends commands to the 8032 to start and stop the ribbon, set the ribbon speed, and apply slack or tension to the ribbon. The real–time control functions are done by the 8032, acting in accordance with firmware control algorithms and look–up tables. The 8032 communicates with an ASIC to

provide direct digital PWM drive signals for the ribbon motor PWM amplifier. The 8032 drives the ribbon motors through PWM generators in the mechanism driver integrated circuit (MDIC). Nearly all mechanical control functions are carried out through the MDIC ASIC. Digital I/O is done through latches connected to the 8032 I/O ports and MDIC. Ribbon faults are passed to the CCB.

Ribbon Velocity

Ribbon velocity is controlled by means of a closed–loop system that first measures the speed of the two ribbon drive motors. One motor is driven; the other motor is not driven and applies tension to the ribbon through its drag circuitry. The velocity of the driven motor is known, while the velocity of the tensioning motor is measured by converting the zero crossing of the back–EMF signal to a digital pulse signal. This signal is processed by the 8032 to determine the radius of the ribbon on the take–up reel. The processor monitors this information and adjusts the velocity of the driven motor to maintain constant linear speed. The roles of the two motors reverse at the end of ribbon travel, when a metallic strip crosses the ribbon guide of the emptying reel and closes a circuit that causes the RSP to reverse motor functions.

The four PWM amplifiers in the ribbon drive system are voltage mode to aid in system damping (as opposed to current mode). The 8032 input to the PWM amplifiers maintains a constant voltage/frequency ratio at the motor. The ribbon drive is protected from over current.

Ribbon Tension

The 8032 processor regulates tension in three discrete steps by using information gathered by the zero–crossing circuitry and ribbon information. Tension is adjusted by controlling the load on the drag motor back emf. This load generates drag torque on the ribbon hub that maintains tension.

Start / Stop Ribbon

The ribbon motors are started and stopped by a digital signal from the CCB. After a stop signal is received, the ribbon is locked to maintain tension. If the CCB sends a slack signal, the PWM amplifiers are tri–stated.

The Shuttle Drive System

The shuttle drive system is an analog closed–loop speed controller that accepts commands from the CCB through the 8032 micro–controller and

MDIC ASIC. The CCB writes a word to the 8032, which writes a word to the MDIC. The MDIC generates a clock signal based on this word.

The clock signal from the MDIC is the reference input to a phase detector. The other input to the phase detector is a logical combination of the pulses from three Hall–effect sensors in the brushless three–phase dc shuttle motor. The Hall–effect sensors are mounted to the motor stator 120 electrical degrees phase–shifted from each other. The phase detector is both a phase and frequency detector. It operates as a frequency detector when out of lock, and as a phase detector when the loop is phase–locked. During shuttle start, the frequency error from the phase frequency detector drives the servo system towards phase lock. At approximately 85% of final speed, the servo integrator resets to prevent overshoot. When the correct speed is reached, the system is in phase lock with the MDIC clock signal.

The shuttle is protected from overspeed, over current, missing hall–effect sensors, and out–of–sync hall–effect sensors.

The Paper Feed System

Dot row advance and slew tables are stored in the CCB. The paper feed drive circuit takes commands directly from the CCB to control the two–phase dc paper feed stepper motor. A CCB paper feed command is a digital word containing a value proportional to the desired current level in the paper feed motor, enabling the motor to be quarter stepped in LG06 mode. Two PWM current mode amplifiers, protected against overloads and short circuits, drive the paper feed motor. The paper feed motor is energized whenever printer power is on, unless the platen is open, in order to maintain tension and position of the paper. The paper feed motor is disabled in a platen open fault condition.

The Reverse Paper Feed System

To reverse paper motion, the printer must open the platen, move the paper backwards vertically, close the platen, and remove the slack in the paper. A platen open or close command is generated on the CCB and communicated to the RSP 8032 processor. The RSP generates control and step clock signals for the platen driver circuitry. The platen driver circuitry is connected to a stepper motor that drives the platen through a toothed belt. The platen motor is only energized during the open and close cycles. The platen driver is protected from over current.

The Magnetic Pick–up Unit (MPU)

The magnetic pick–up unit (MPU) is mounted next to the shuttle motor flywheel. It provides timing information to the hammer fire controller by way of the CCB. The rotation of the flywheel generates a pulse signal in the MPU. The output frequency is 100 times the shaft frequency of the shuttle motor. The MPU pulse train has one missing pulse in every revolution of the motor for indexing. The incoming signal from the MPU is processed with a zero–crossing detecting circuit to produce a clean signal, compatible with system logic. The clean signal is then sent directly to the CCB.

Power Supply PCBA

The printer power supply is contained on a printed circuit board assembly (PCBA) mounted in the card cage. It senses and adjusts to any commercial electrical system that provides ac mains potential in 50 or 60 Hertz systems. AC input power is converted to dc power and sent to the mechanism driver board for distribution to logic and electromechanical circuits.

AC Power

The power supply operates on ac voltages ranging from 86 to 264 V. It can tolerate variations in frequency of 47 or 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 PCBA 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 + 9.5 V buses for the electromechanical sections of the printer (that is, all drive motors and the hammer bank).

The maximum total continuous average DC load is 346 W. The + 5 V supply has a separate return line. Both returns are tied together in a single–point ground.

There is an opto–isolated logic level input from the printer that can shut down and latch off the + 48 V and + 9.5 V supplies while maintaining the + 5 V output. 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 (ac input) to reset the latch.

The + 5 V power supply has its own inverter, separate from the + 48 V and + 9.5 V outputs.

Printing Mechanism

The printing mechanism consists of the shuttle frame assembly, which carries the hammer bank assembly, the ribbon transport system, and the paper transport system. Figure E–6 shows the shuttle frame assembly.
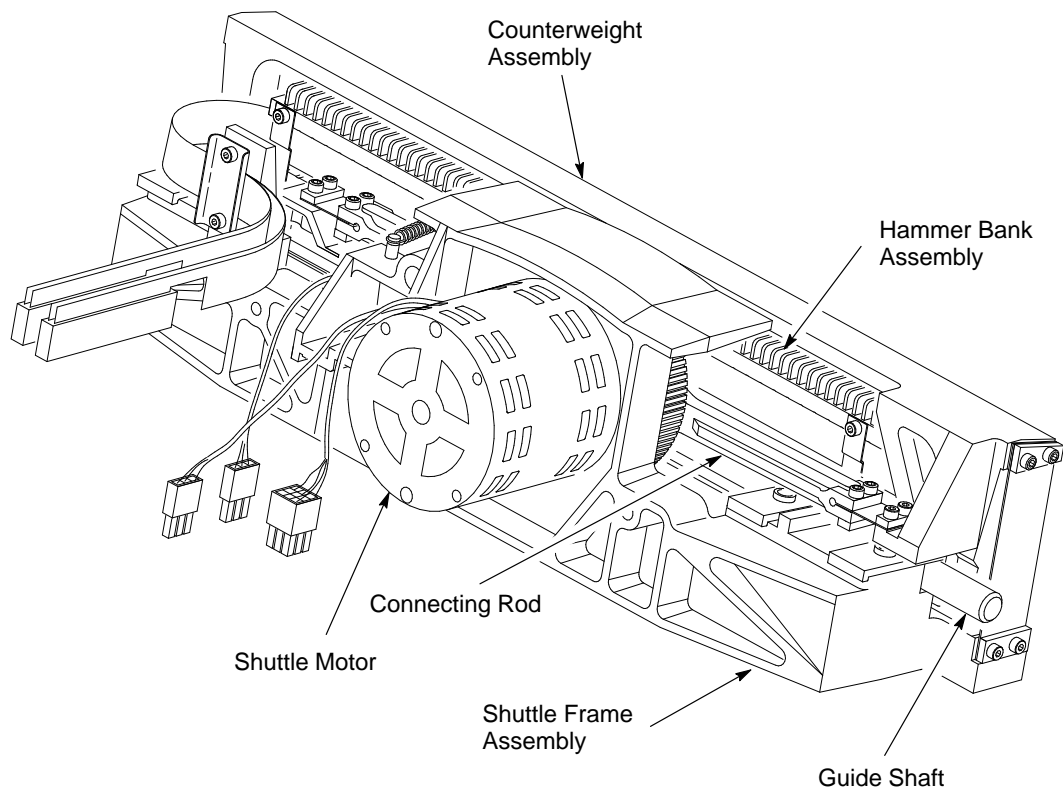
Figure E–6. Shuttle Frame Assembly

Shuttle Frame and Hammer Bank Assemblies

Dots are printed by 47 hammer springs mounted on the hammer bank. The hammers are arrayed in seven comb–like hammer spring assemblies, or frets. Each fret contains 7 hammers. Using 49 hammers balances the magnetic field characteristics of the hammer bank, while design parameters determine the use of 47 hammers for printing. (The first and 49th hammers do not print.) The frets mount to the hammer bank on alignment pins, eliminating the need for individual hammer alignment.

Each print hammer is a stiff leaf spring with a cylindrical, tungsten carbide tip on the free end. (See Figure E–7.) 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.
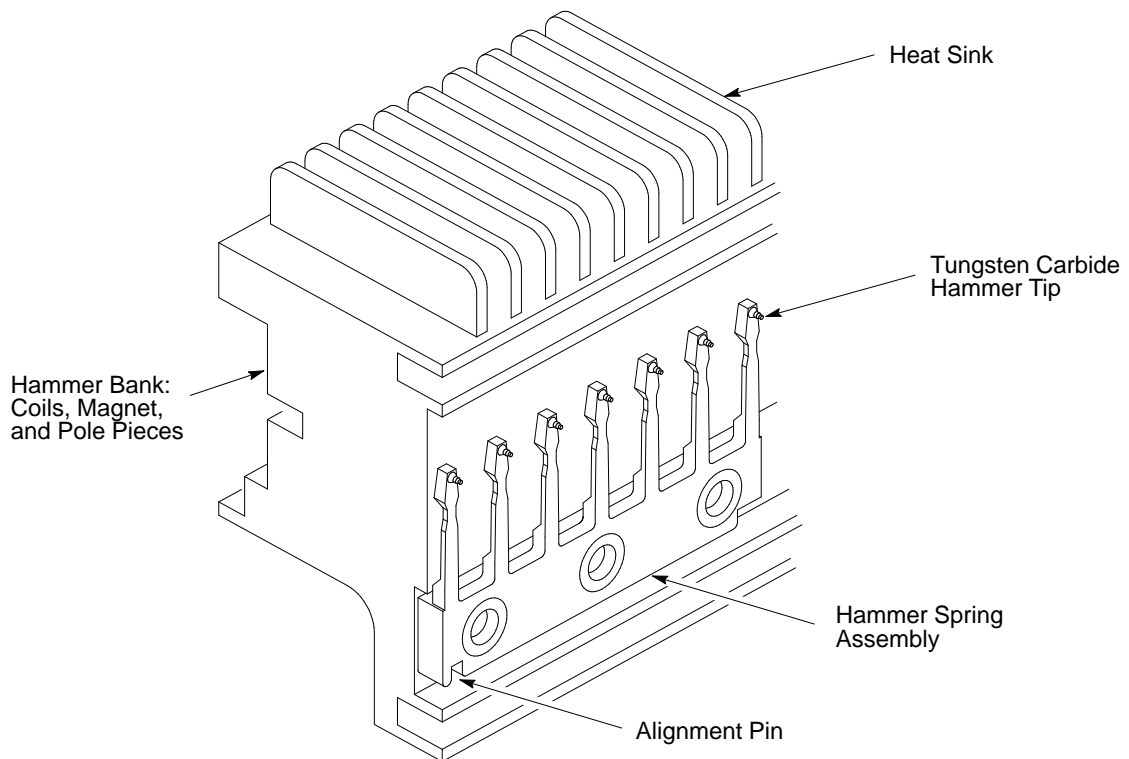
Figure E–7. Hammer Springs and Hammer Bank (Detail)

A pair of electromagnetic coils is 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, cancelling 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.

The coil is de–energized and its field collapses while the hammer is in flight. After striking the ribbon and paper, the hammer rebounds and the permanent magnet recaptures it.

A line of characters is created as the shuttle scans horizontally (See Figure E–8). All the dots in a given row of the character dot matrix are printed in a single scan as the shuttle moves through the character columns from one side to the other. Figure E–9 shows how a hammer forms a character as the shuttle scans horizontally.

Characters are formed inside dot matrices, the dimensions of which vary according to the selected font. The dot printing process continues for the number of dot matrix rows determined by the selected font. When an entire character line is printed, the paper feed system advances the paper to the top dot row of the next character line to be printed. During this line advance, the hammer bank assembly continues the right/left oscillation, but the hammers do not print.
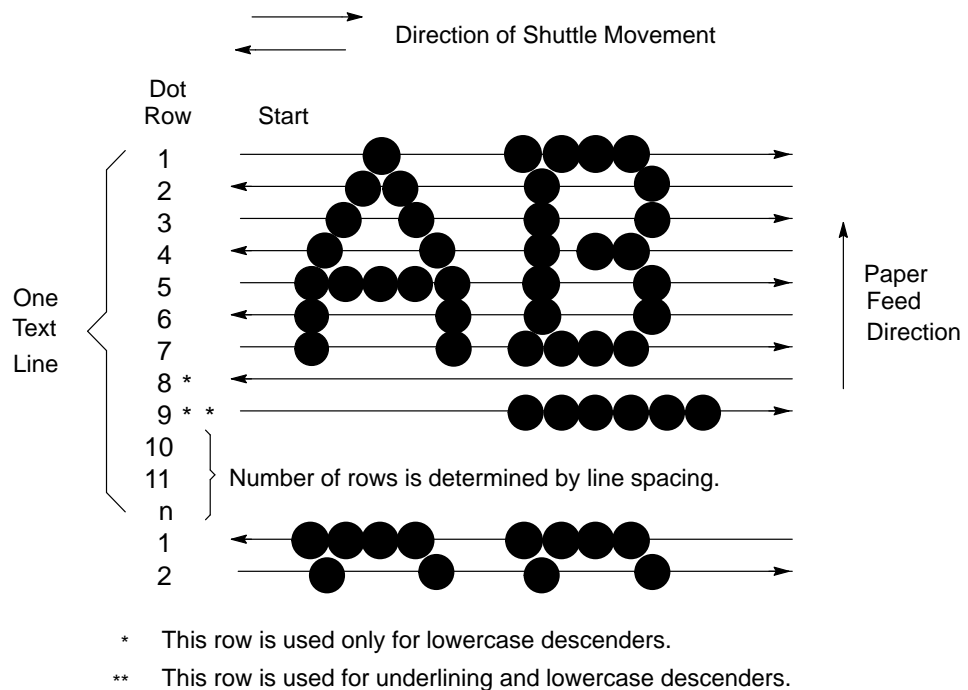
Figure E–8. Standard Character Formation

Succesive Hammer Strokes Per Scan

| Shuttle Scan | Dot Row | * 1 | * 1 3 | * 1 3 5 | * 1 3 5 7 | * 1 3 5 7 9 | * |
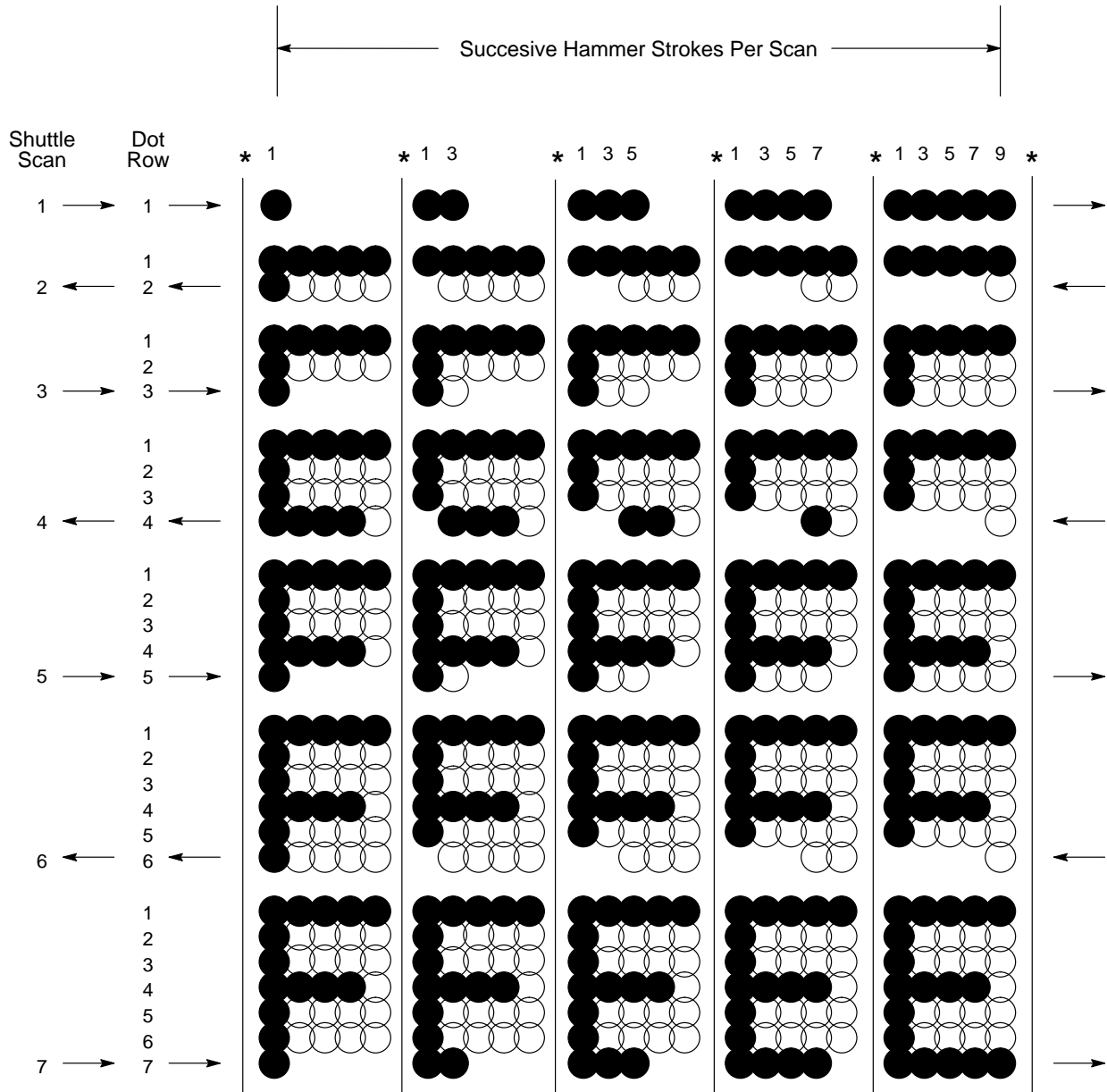
* Even column dot centers within the printed character area and character space hammer positions are not illustrated in this diagram.

NOTE: ● = Hammer Released and Dot Printed

○ = Hammer Not Released; No Dot Printed

Figure E–9. Typical Action of One Hammer in Text Printing

Paper Transport System

The paper transport system accepts continuous, fan–folded, edge–perforated paper from three to 16 inches wide and from one to six sheets thick. Horizontal positioning is provided by the horizontal adjustment knob and two tractors. The tractors are laterally adjustable along the splined and support shafts. Each tractor engages paper perforations with six pins and locks in place with a friction lock. During printing, the tractors are driven by the splined shaft, which is belt–driven by the paper feed drive motor. The paper feed drive motor is a two–phase step motor controlled by the paper feed sections of the mechanism driver board and the paper feed controller on the common controller board.

Paper may be manually advanced vertically with the vertical adjustment knob.
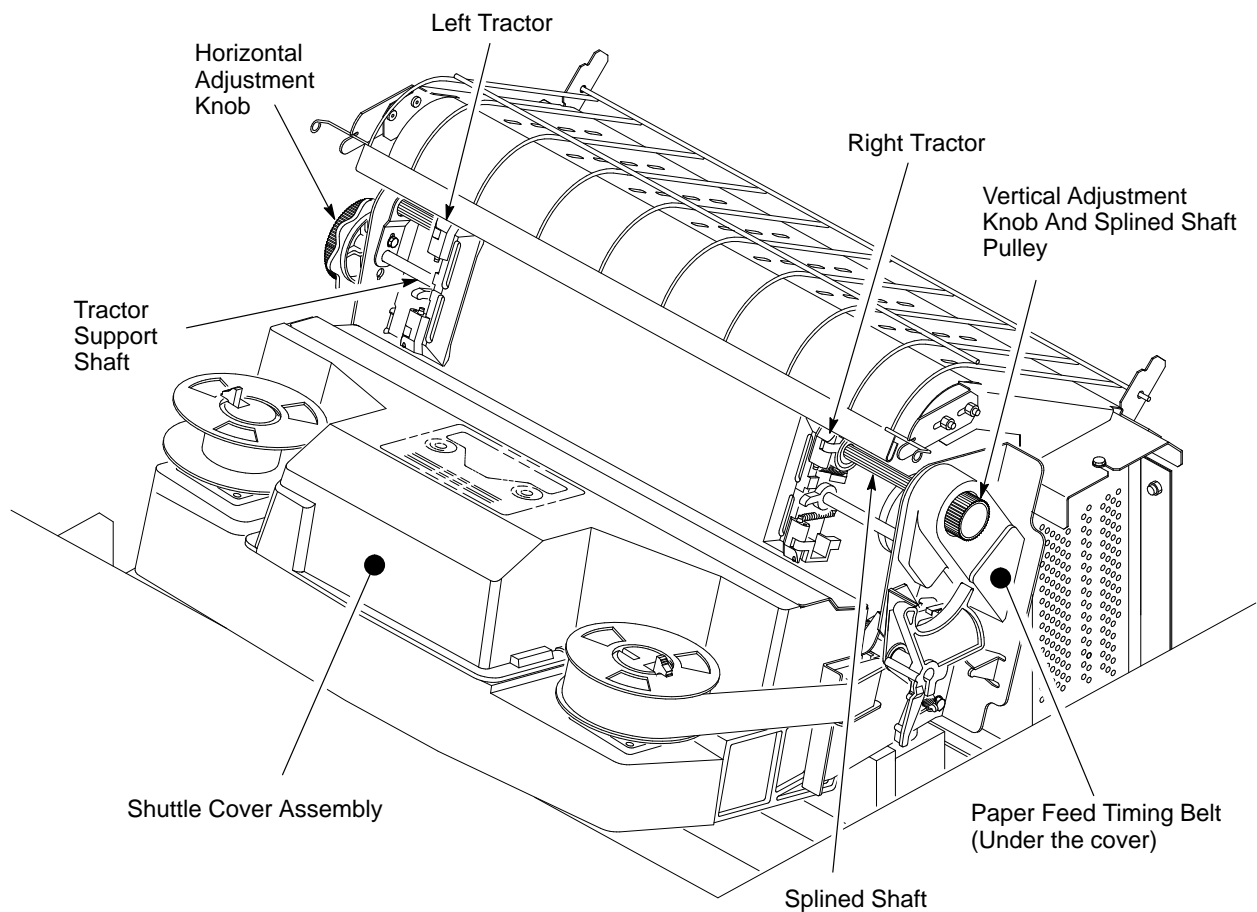
Figure E–10. Paper Transport System

Ribbon Transport System

The printer ribbon winds and unwinds continuously on a pair of spools latched to hubs which are driven by the ribbon motors. The ribbon motors operate only while the hammer bank assembly is running. Ribbon motion reverses when the 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 hammer bank assembly is in motion, one motor acts as a driving motor, drawing the ribbon against the resistance exerted by theothermotor—thedragmotor. This system maintains a constant motor speed and constant ribbon tension.
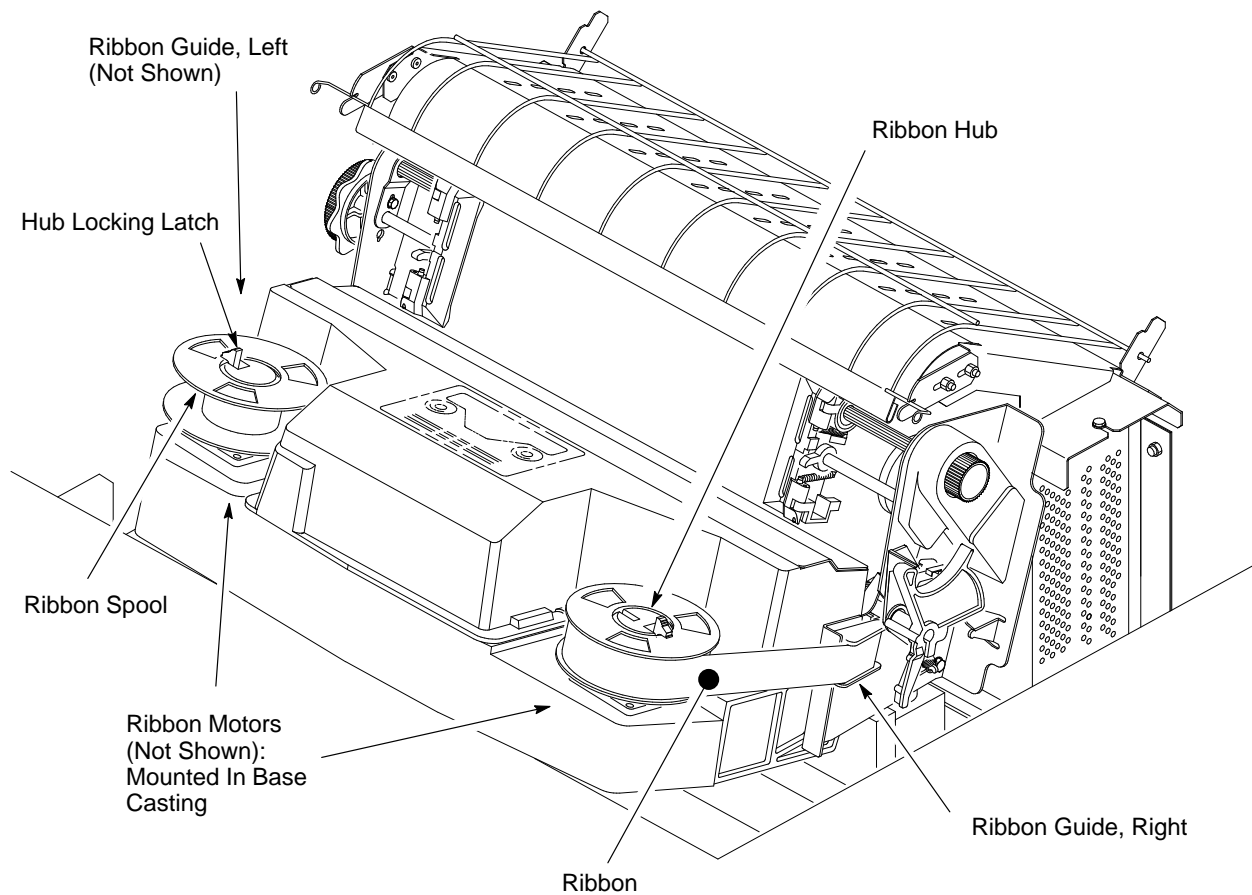
Figure E–11. Ribbon Transport System

F Ferrite Noise Suppression Cores

Ferrite cores reduce radio frequency interference (RFI) with electronic equipment located near the printer.

Two kinds of ferrite cores are used in the printer:
1. Cylindrical cores—Cables pass through the core or are wound around it.
2. Block cores—The core is housed in a hinged plastic case. Cables are laid in a groove in the core, and the plastic case is closed, securing the core to the cable.

Figure F–1 shows the location of the ferrite cores in the LG06 printer.

IMPORTANT

When removing cables that pass through or around ferrite cores, note the number of times the cable is wound around the core. You must duplicate these windings when you replace the cable. Use Figure F–1 as your guide.

Paper Feed Motor cable passes through core (no wrap) on its way to the card cage.

Round ferrite cores are tie–wrapped to the side of the card cage. (See the Maineance Tip below.)

Ribbon Motor cable wraps once around core before it enters the card cage.

Control Panel cable wraps 4 times around core before it enters the card cage.

Card Cage

Card Cage Fan

Maintenance TIp:
Route and wrap the cables first. Tie wrap the round ferrite cores to the card cage last.

Platen open motor

Paper feed motor

Paper feed mechanisms and barrier panel

Platen

Shuttle Frame Assembly

Ribbon motor cables are routed under the base casting.

Ribbon Drive Motor

Hammer Bank Fan

Base casting

Ribbon Drive Motor

Cable connector.

Round ferrite core.

Hinged, plastic wrapped ferrite core.

Fold the ribbon cable in half, then snap the ferrite core shut over the cable. Slide the core as close to the control panel as possible and flatten the ribbon cable to prevent the core from sliding down the cable.

Figure F–1. Ferrite Core Locations

Ferrite Noise Suppression Cores

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