PRINTRONIX®

Maintenance Manual

P5220D and P5224D Line Matrix Printers

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Maintenance Manual

PRINTRONIX®

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1 *Maintenance Overview*

About The Printer

Printronix® P5220 and P5224 printers are high speed, dual hammer bank line matrix printers that use PSA™ (Printronix System Architecture). The P5220 makes use of PSA on the CFX controller board, while the P5224 printer uses PSA3™ (third generation PSA) on the PSA3 controller board.

Both controller boards constitute a specialized architecture that puts all data control and printer control electronics on one circuit board. These controller boards use flash memory, which permits rapid access to stored printer emulations and fast processing of print data. A variable-speed, dual hammer bank shuttle assembly and half-step paper control enable these printers to print a wide variety of high-volume jobs at very high speed with minimum maintenance and maximum reliability.

Although technologically advanced, the printers are easy to use. The operator can select every printer function either at the printer control panel or by sending control codes to the printer in the data stream from the host computer. For greater security and to protect special printer configurations, the operator can program which key combination locks and unlocks the ENTER key on the control panel.

These are also excellent graphics printers, with optional features that simplify the creation of images. The IGP® and Code V™ Printronix emulations, for example, are simple but versatile graphics programming languages that load into flash memory.

Order The Correct Spares

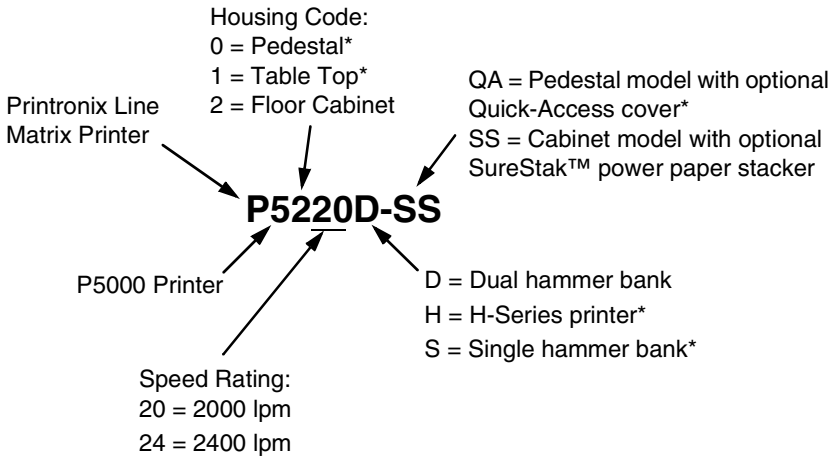
When you replace worn or damaged printer components, make sure you order the correct spares for the model you are servicing. The next section shows you how to identify which model you are working on.

How To Identify The Printer

NOTE: This manual covers only printers with dual hammer banks. Single hammer bank P5000 printers are covered in maintenance manuals 164253-001, 175455-001, and 176475-001. (See page 429.)

A P5224 printer is easily identified by the PSA3 trademark on the cover. But each printer also has a model number that provides important information. The model number is coded to indicate the printer type, family, maximum rated speed, housing, and certain options. Figure 1 shows how to interpret a model number.

Table 1 lists the models covered in this manual. Remember that the speeds listed in Table 1 are the highest attainable under controlled test conditions. The speed of printing for “real world” print jobs is determined by the interaction of many variables and varies from print job to print job. (For more information, see “Printing Rates” on page 280.)



* Not covered in this manual. (See page 429.)

Figure 1. How to Interpret Model Numbers

Table 1. P5220D and P5224D Printers

Model Number	Maximum Rated Print Speed	Enclosure	Hammer Bank	Controller Board[1]
P5220D™	2000 lpm* (at 60x48 dot density)	Cabinet	156 Hammers	CFX
P5220D-SS™	2000 lpm* (at 60x48 dot density)	Cabinet w/SureStak Paper Stacker	156 Hammers	CFX
P5224D™	2400 lpm* (at 60x48 dot density)	Cabinet	156 Hammers	PSA3
P5224D-SS™	2400 lpm* (at 60x48 dot density)	Cabinet w/SureStak Paper Stacker	156 Hammers	PSA3

[1] The controller boards are not interchangeable in these printers. The PSA3 and CFX controller boards and their respective card cages differ in physical dimensions and design.

Important Maintenance Notes

To ensure the best performance of the printer, remember these maintenance principles whenever you service it.

CAUTION **Failure to observe these guidelines can result in damage to the equipment.**

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

About This Manual

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

This manual does not explain how to install, operate, or configure the printer. That information is in the *User’s Manual.* This manual does not explain how to program application software for operation with the printer. Programming information for the protocols used by the printer is in the appropriate programmer’s reference manual:

- *Coax/Twinax Programmer's Reference Manual* — Covers the host control codes and character sets for the Coax and Twinax emulations.
- *Coax/Twinax Programmer's Reference Manual for the Simple Protocol Converter Option* — Covers the host control codes and character sets for the Coax and Twinax Simple Protocol Converter emulations.
- *LinePrinter Plus Programmer's Reference Manual* — Covers the host control codes for the LinePrinter Plus emulation.
- *IGP/PGL Programmer's Reference Manual* — Provides information used with the optional IGP Printronix emulation enhancement feature.
- *IGP/VGL Programmer's Reference Manual* — Provides information used with the optional Code V™ emulation enhancement feature.
- *ANSI Programmer's Reference Manual* — Provides host control codes and character sets for the ANSI emulation.

- *IPDS Twinax Emulation Programmer's Reference Manual* — Provides an overview of Intelligent Printer Data Stream™ (IPDS) features, commands, and diagnostics.
- *Character Sets Reference Manual* — Information about and examples of the character sets available in line matrix printers.
- *PrintNet User's Manual* — Information about network protocols, configuration, and operation.

How To Use This Manual

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

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

Notices

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

WARNING **Conditions that could hurt you and damage equipment.**

CAUTION **Conditions that could damage equipment.**

IMPORTANT **Information vital to proper operation and maintenance of the printer.**

NOTE: Tips for efficient operation, maintenance, and troubleshooting.

Printing Conventions In This Manual

Control panel keys and indicators are highlighted in **UPPERCASE BOLD PRINT**.
Example: Press the **CANCEL** key, then press the **ON LINE** key.

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

Control panel key combinations are indicated by the **+** (plus) symbol.
Example: Press **▲ + ▼**
means press the **▲(UP)** key and the **▼(DOWN)** key at the same time.

IMPORTANT **The Safety Notices on the next page apply at all times when you are working on the printer. Please read them now.**

Safety Notices

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

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

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

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

WARNING **Hold the printer cover securely while disengaging the dashpot.**

Hinweise zur Sicherheit

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

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

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

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

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

Controls And Indicators

Electrical Controls

Switch or Indicator	Function	Active On-line	Active Off-line
Power Switch	Turns printer on and off: 1 = on, 0 = off. This switch is also a circuit breaker.		
Status Indicator	On when the printer is on-line, off when the printer is off-line. Flashes to indicate a fault or warning.	✓	✓
LCD	Liquid Crystal Display. Displays printer status messages, fault messages, and menus which permit user to set various configurations.	✓	✓
ON LINE/CLEAR	Toggles the printer on-line and off-line. Clears the printer after a fault is corrected and returns the printer to off-line state.	✓	✓
PAPER ADVANCE	Prints any data in the buffer then moves paper up one line at the currently active line spacing. If pressed longer than 1/2 second, moves paper to the next Top Of Form as defined by the currently active form length.	✓	✓
VIEW / EJECT	Moves the current print position to the tractor area for viewing. When paper is in VIEW position, “Printer in View” displays and microstep adjustment feature is active. (See UP and DOWN keys.) Holding the key down for more than 1/2 second invokes EJECT and paper is advanced two pages. (EJECT can be disabled via the menus.) Pressing the key a second time moves paper back to the print position from either VIEW or EJECT position.	✓	✓
CANCEL	Clears all data from the print buffer (if enabled in the MAINT/MISC menu).		✓
▲ (UP)	Displays next higher level of a configuration menu. In VIEW mode, moves paper up 1/72 inch. (See VIEW / EJECT key.)	✓	✓
▼ (DOWN)	Displays next lower level of a configuration menu. In VIEW mode, moves paper down 1/72 inch. (See VIEW / EJECT key.)	✓	✓
▸ (NEXT)	Displays the next option in a configuration menu.		✓
◂ (PREV)	Displays the previous option in a configuration menu.		✓
SET TOF	Moves paper downward from TOF (Top Of Form) alignment mark to the print station and sets this as the first line of print on a page, independent of forms length. If there are data in the buffers, the printer slews to the page position where printing left off and prints the data.		✓
PRT CONFIG	Prints the current printer configuration.		✓
JOB SELECT/ PRINT MODE	Allows selection of the active configuration or print mode (typeface) of the printer. The functionality depends on the current setting of the “Job Select/Print Mode” under the “MAINT/MISC” menu. (Refer to the *User’s Manual*.)		✓
ENTER	Enters an option displayed on the LCD into printer non-volatile memory. Starts and stops printer tests, sets a value, or prints the configuration. This key is locked and unlocked by a user-selectable key combination. (Refer to the *User’s Manual*.)		✓
▲ + ON LINE (IPDS emulation only)	When pressed in off-line mode, if there are data in the printer buffer, the printer goes on-line, prints one page, then returns to the off-line mode. This can be repeated until the end of a print job. Only one page prints each time you press ▲ + ON LINE. If there are no data in the printer buffer, the printer is placed in on-line mode. This key combination does not work if the printer is in the fault state.		✓
◂+▸	Resets the printer by reloading the power-up configuration and resetting the internal state.		

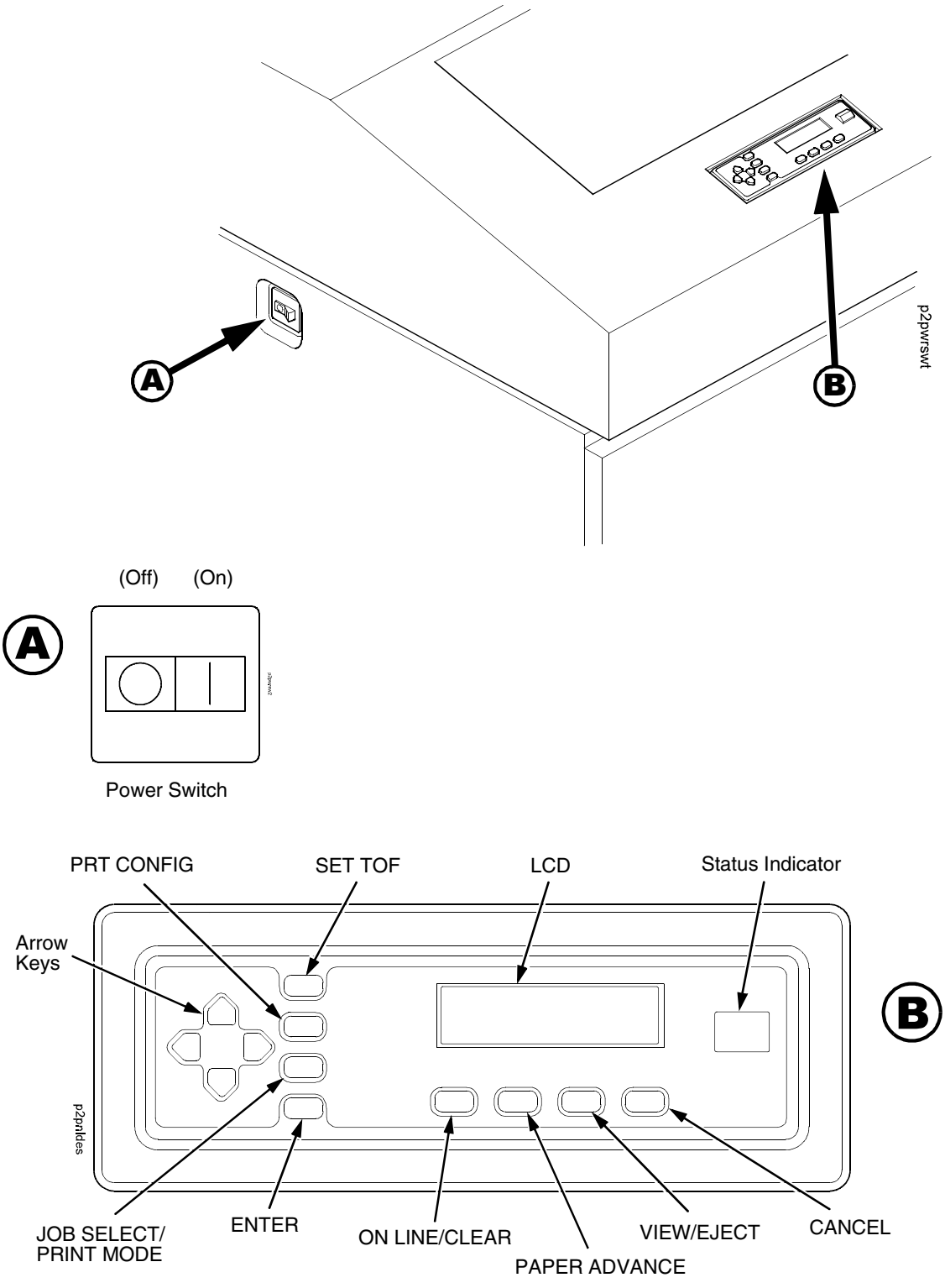
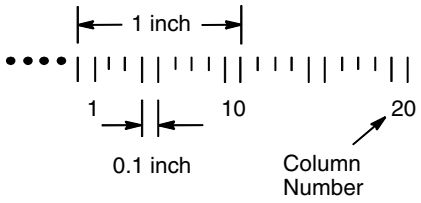


Figure 2. Electrical Controls

Mechanical Controls

Control or Indicator	Function
Forms Thickness Lever	Sets the platen for paper and forms of different thicknesses. Must be fully opened (raised) to load or unload paper.
Forms Thickness Pointer and Scale	Indicate relative thickness of forms and paper. Set the forms thickness lever at A for thin (single-part) forms, B for thicker forms, and so on.
Paper Supports (4)	Help prevent paper jams by supporting inner sections of paper. They are positioned manually by sliding them along the shafts.
Tractors (2)	Hold and feed paper. Used to set side margins and position the paper horizontally.
Tractor Locks (2)	Lock tractors in position.
Vertical Position Knob	Used to set top of form or first line to be printed. Rotate this knob to move paper vertically. Works when the forms thickness lever is open.
Ribbon Loading Path Diagrams	Written and graphic instructions showing how to load the ribbon correctly.
Ribbon Hub (2)	Supports and drives the ribbon spool.
Hub Latch (2)	Locks the ribbon spool to the ribbon hub.
Paper Scale	A horizontal scale graduated in tenths of an inch, useful for setting paper margins and counting text columns. (See below.)



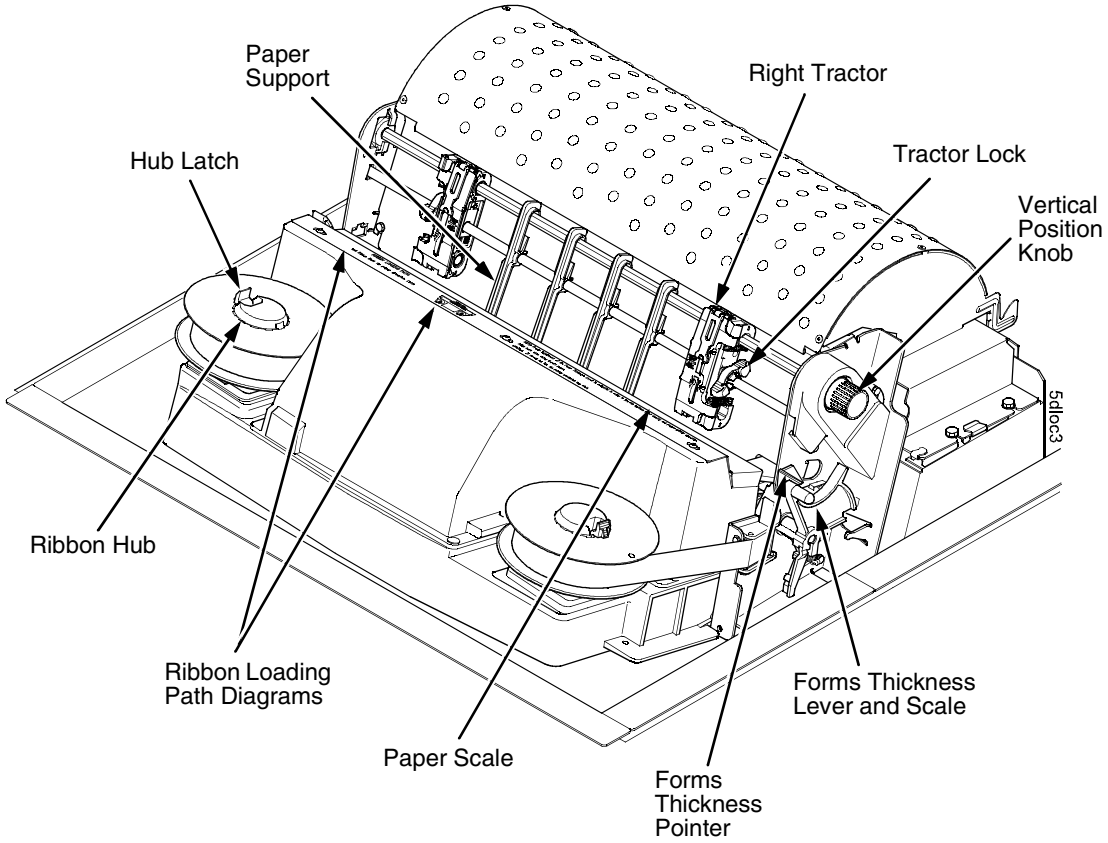


Figure 3. Mechanical Controls

Tools, Test Equipment, And Supplies

For field level maintenance of the printer, you will need these tools:

Adapter, 1/4 in. hex to 1/4 in. square, Utica® HW-18
Alcohol, anhydrous
Allen Wrench, 1/16 inch
Allen Wrench, 3/32 inch
Allen Wrench, 5/32 inch
Allen Wrench, 7/64 inch
Allen Wrench, 5/64 inch
ESD Wrist Strap
Feeler Gauge, .010 inch
Feeler Gauge, .012 inch
Feeler Gauge, .040 inch
Force Gauge, (Chatillon™ NY, Gauge-r, 0-20 lb., CAT 719-20)
Force Gauge, “Fish Scale” type, 0-16 oz.
Hex bit, 3/16 in., torque screwdriver
Hex bit, 3/32 in., torque screwdriver
Hex bit, 5/32 in., torque screwdriver
Hex bit, 5/64 in., torque screwdriver
Nut Driver, 1/4 inch
Nut Driver, 5/16 inch
Nut Driver or Open End Wrench, 7/32 inch
Open End Wrench, 5/16 inch
Pliers, Grip Ring, External
Screwdriver, flat tip
Screwdriver, Phillips, #1
Screwdriver, Phillips, #2
Screwdriver, Torque, Utica TS-35
Tie Wraps, 4 inch
Tip Alignment Tool Field Kit, P/N 174478-001
Long Alignment Tool Field Kit, P/N 175789-001
Torx® T-10, T-15 Driver

Plugging In The Printer

In compliance with international safety standards, this printer is equipped with a three-pronged electrical plug on the power cord. When this power cord is plugged into a correctly wired power outlet, the ground conductor ensures that the printer chassis is at ground (earth) electrical potential.

WARNING **Failure to properly ground the printer can result in electrical shock to the operator.**

Do NOT use adapter plugs or remove the grounding prong from the power cable plug. If an extension cord is required, make sure it is a three-wire cable with a properly grounded plug.

Printronix Customer Support Center

The Printronix Customer Support Center offers technical support with:

- Installation
- Configuration and setup
- Loading supplies and operating the printer
- Specifications of which papers and ribbons give the best results
- Answers to post-sale service support questions

Call the Printronix Customer Support Center at:

Americas — (714) 368-2686

Europe, Middle East, and Africa — (31) 24 6489 410

Asia Pacific — (65) 6548 4114

or visit the Printronix web page at **www.printronix.com**.

http://www.printronix.com/public/servicessupport/default.aspx

Maintenance Training Available For Printronix Products

Printronix offers Product Maintenance Training Classes designed to enhance the knowledge of your service personnel. Taught by a staff of highly experienced professional instructors, these structured classes include:

- Theory of operation
- Hands-on work with the products
- Diagnosis of equipment failures
- Preventive and corrective maintenance requirements and procedures

Customized classes designed to meet your specific needs are also available upon request. Call Customer Training at (714) 368-2332 or visit the Printronix web page at **www.printronix.com**.

2 *Preventive Maintenance*

Cleaning The Printer

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

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

Since there is no guarantee that the user will clean the printer regularly, you should clean the printer whenever you are called to service it. The cleaning procedures in this chapter pertain to all models.

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

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

Cleaning The Outside Surfaces

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

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

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

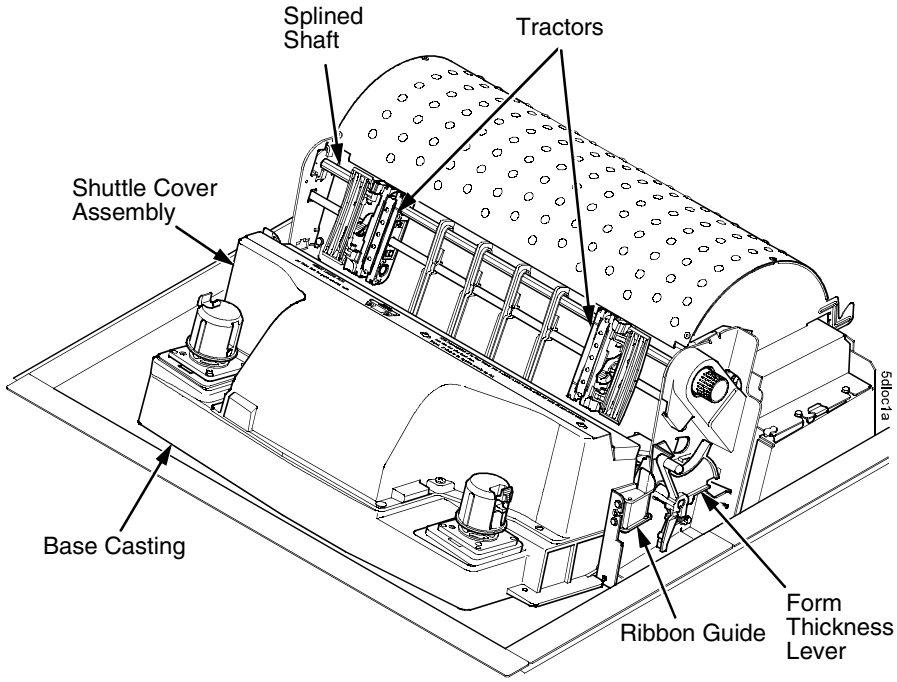


Figure 4. Cleaning Inside the Cabinet or Top Cover

Cleaning The Shuttle Frame Assembly

1. Remove the shuttle cover assembly (page 197).
2. Remove the shuttle frame assembly (page 235).
3. Remove the paper ironer (page 221).

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

4. Moisten a clean, soft cloth with alcohol. Wipe the paper ironer to remove lint, ink, and paper residue.
5. Install the paper ironer (page 221).
6. Remove the hammer bank / ribbon mask cover assembly (page 195).

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

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

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

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

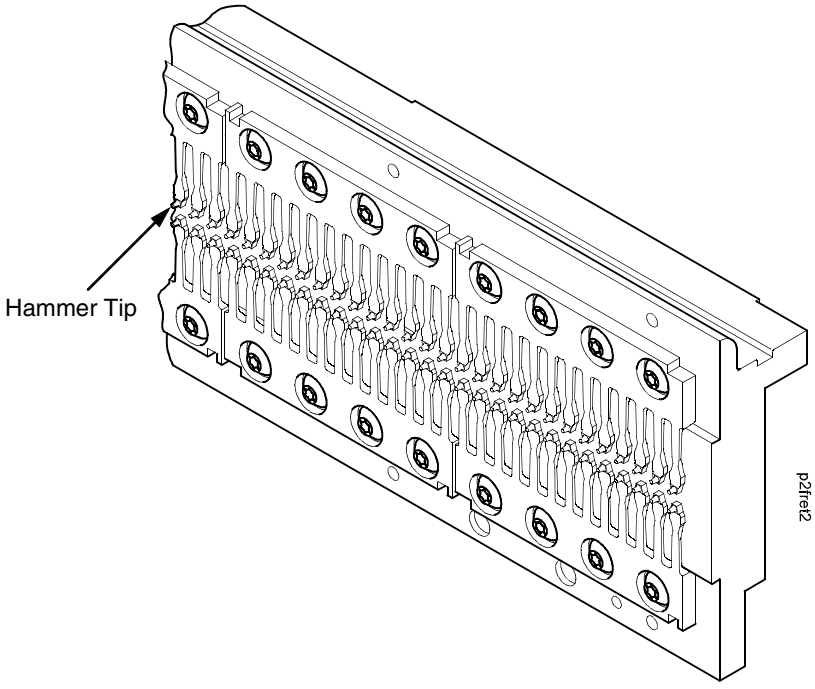


Figure 5. Cleaning the Hammer Tips

9. Install the hammer bank / ribbon mask cover assembly (page 195).
10. Install the shuttle frame assembly (page 235).
11. Install the shuttle cover assembly (page 197).
12. Clean the card cage fan assembly, as described in the next section.

Cleaning The Card Cage Fan Assembly

1. Remove the paper path (page 222).
2. Vacuum the card cage fan assembly and surrounding areas to remove paper particles, dust, and lint. (See Figure 6.)
3. Install the paper path (page 222).
4. Return the printer to normal operation (page 137).

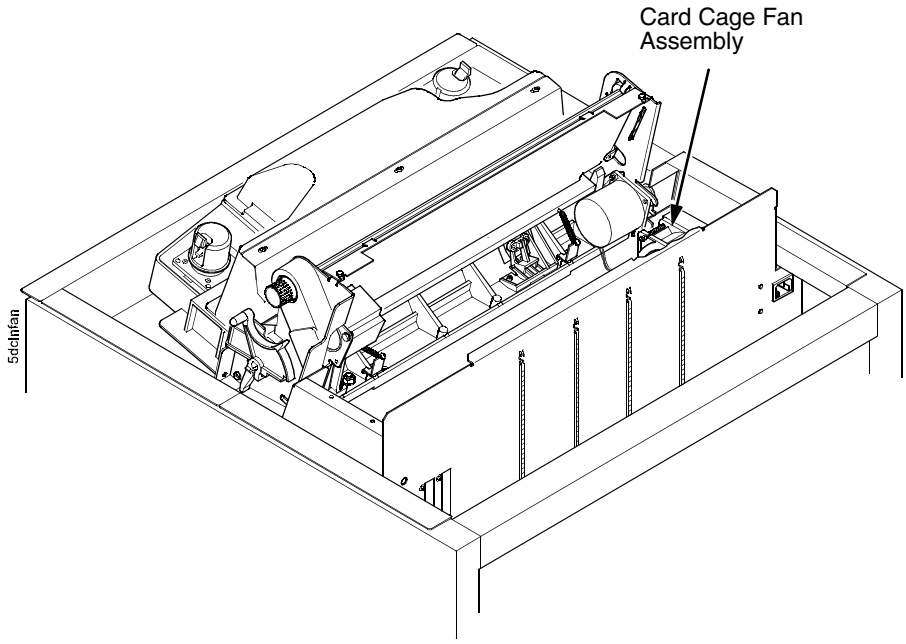


Figure 6. Cleaning the Card Cage Fan Assembly

3 *Troubleshooting*

Introduction

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

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

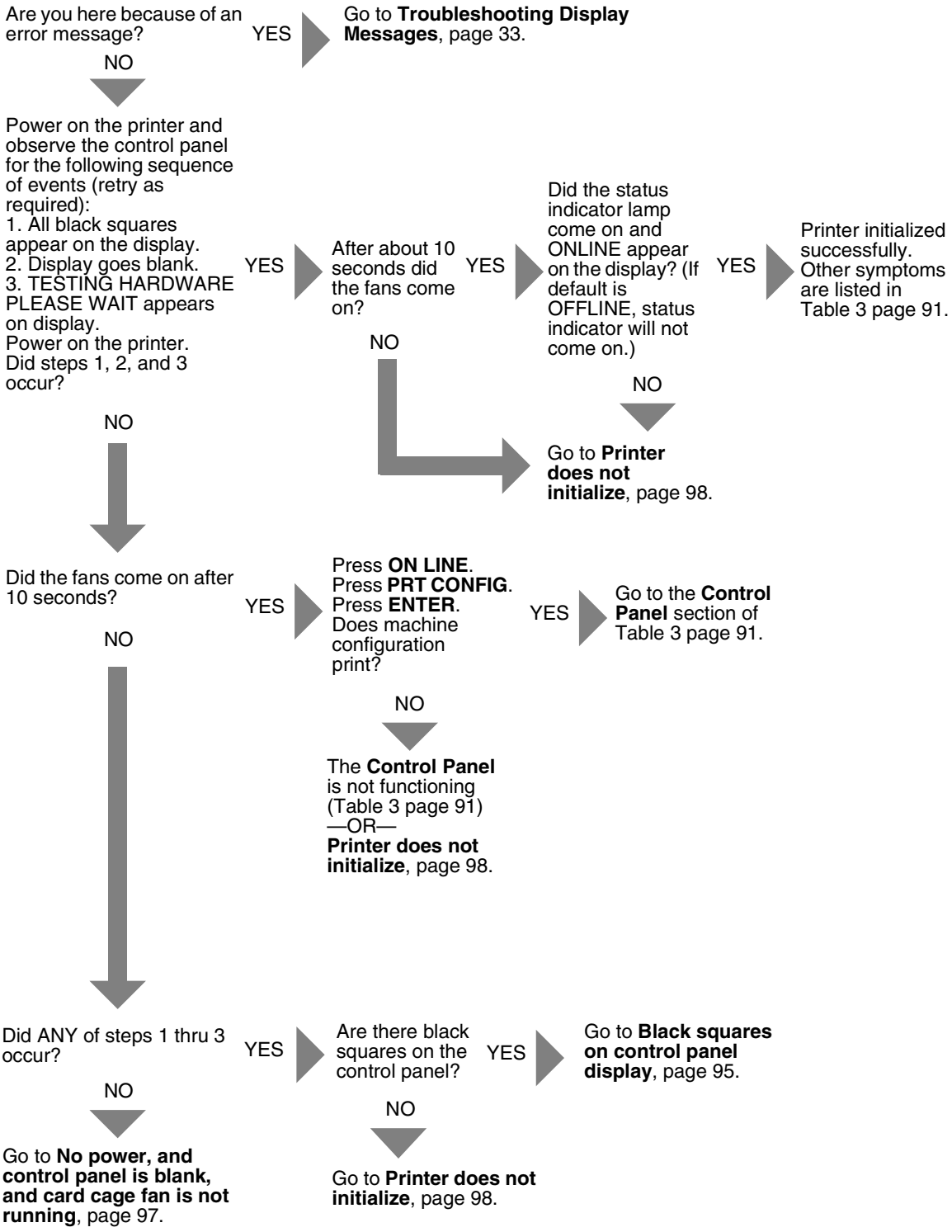
Troubleshooting Aids

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

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

- "Start Here" Logic Tree ..... page 32
- Troubleshooting Display Messages ..... page 33
- Message List ..... page 33
- Troubleshooting Other Symptoms ..... page 90
- General Symptom List ..... page 91
- Communications Failures ..... page 116
- Diagnostic Printer Tests ..... page 118
- Boot Diagnostics Menu ..... page 122
- Hex Code Printout ..... page 125
- ASCII Character Set ..... page 127
- The Power On Sequence ..... page 129
- Appendix A: Wire Data ..... page 303

Start Here...


Are you here because of an error message?
YES
Go to **Troubleshooting Display Messages**, page 33.
NO
Power on the printer and observe the control panel for the following sequence of events (retry as required):
1. All black squares appear on the display.
2. Display goes blank.
3. TESTING HARDWARE PLEASE WAIT appears on display.
Power on the printer.
Did steps 1, 2, and 3 occur?
YES
After about 10 seconds did the fans come on?
YES
Did the status indicator lamp come on and ONLINE appear on the display? (If default is OFFLINE, status indicator will not come on.)
YES
Printer initialized successfully. Other symptoms are listed in Table 3 page 91.
NO
NO
Go to **Printer does not initialize**, page 98.
NO
Did the fans come on after 10 seconds?
YES
Press **ON LINE**.
Press **PRT CONFIG**.
Press **ENTER**.
Does machine configuration print?
YES
Go to the **Control Panel** section of Table 3 page 91.
NO
NO
The **Control Panel** is not functioning (Table 3 page 91)
—OR—
Printer does not initialize, page 98.
Did ANY of steps 1 thru 3 occur?
YES
Are there black squares on the control panel?
YES
Go to **Black squares on control panel display**, page 95.
NO
NO
Go to **No power, and control panel is blank, and card cage fan is not running**, page 97.
Go to **Printer does not initialize**, page 98.

Troubleshooting Display Messages

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

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

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

Most fault messages are cleared from the LCD by correcting the fault condition then pressing the **CLEAR** key.

Some fault messages can only be cleared by shutting down and restarting the printer. These fault messages are indicated by an asterisk (*) appended to the message.

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

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

List Of Messages

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

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

Table 2. Message List

Message	Explanation	Solution
06 HOST REQUEST	Status message: in CT emulation, the host computer or printer controller requires attention.	Not a printer problem.
08 HOLD PRINT TIMEOUT	Status message: in CT emulation, the printer was off-line more than 10 minutes and the “Intervention Required” parameter is set to “Send to Host.”	Press **ON LINE**.

Table 2. Message List

Message	Explanation	Solution
8.5V POWER FAIL *	8.5 Volt Power Failed. Internal power failure.	1. Cycle power. If the message appears, replace the power supply board. 2. Check the shuttle for shorts (page 159). 3. Power on the printer. If the message appears, replace the controller board. Record the message and return it with defective board. 4. Power on the printer. If the message appears, replace the shuttle frame assembly.
15 COMM CHECK	Communication Check: a message that appears in the CT emulation meaning the line is not active on a twinax interface.	1. Power off the printer. Check/ reseat the twinax host data cable connection and twinax I/O cable connection at the CT board. 2. Disconnect the twinax auto-termination cable from the printer. Test the cable for the resistances shown in Appendix A. If resistances are not correct, replace the twinax auto-termination cable. 3. Power on the printer. Send a print job to the printer. Verify that all other devices on the twinax line are working properly. (Refer to line problem determination procedures, as recommended by the host system.) 4. If the message is gone, the host has reestablished communication with the printer. If all other twinax devices work properly and the message still appears, replace the expansion-CT board. Record the message and return it with defective board.

Table 2. Message List

Message	Explanation	Solution
15V CTL FAIL*	Controller Voltage Failure.	1. Cycle Power. Run the print job again. If the message appears, remove the hammer bank logic cable, inspect it for damage, and test it for continuity. (See Appendix A.) Replace the hammer bank logic cable if it is damaged or fails continuity test. 2. Cycle Power. Run the print job again. If the message appears, download the emulation software again (page 164). 3. Cycle power. Run the print job again. If the message appears, replace the flash memory. 4. Check the shuttle for shorts (page 159). 5. Power on the printer. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board. 6. Check the resistance of connectors P106/LRIB M and P107/RRIB M. (Refer to the Main Wire Harness Test Tables in Appendix A.) If ribbon motor resistance is not correct, replace the motor and/or the intermediate cable, if installed. 7. Power on the printer. Run the print job again. If the message appears, replace the power supply board. 8. Power on the printer. If the message appears, replace the shuttle frame assembly.
22 INVALID ADDR	Invalid Address: poll time-out on the twinax interface indicating the unit address is not recognized by printer.	Have the system administrator make sure the printer address is correct.

Table 2. Message List

Message	Explanation	Solution
23.5V CTL FAIL*	23.5 Volt Controller Failed: a voltage failure on the controller board.	1. Cycle Power. Run the print job again. If the message appears, download the emulation software again (page 164). 2. Cycle power. Run the print job again. If the message appears, replace the flash memory. 3. Check the shuttle for shorts (page 159). 4. Power on the printer. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board. 5. Power on the printer. Run the print job again. If the message appears, replace the power supply board. 6. Power on the printer. If the message appears, replace the shuttle frame assembly.
31 PAPER OUT TIMEOUT	In the CT emulation with a coax interface, a time-out message is sent to the host if paper is not loaded within 10 minutes after **CLEAR** was pressed to clear a paper out fault.	1. Load paper. Run a print test. If the message appears, replace the paper detector switch assembly. 2. Check the shuttle for shorts (page 159). 3. Run a print test. If the message appears, replace the controller board. Record the message and return it with defective board.

Table 2. Message List

Message	Explanation	Solution
32 PAPER JAM TIMEOUT	In the CT emulation with a coax interface, a time-out message is sent to the host if paper motion has not occurred for 10 minutes after **CLEAR** was pressed to clear a paper jam fault.	1. Clear the paper jam. Press **CLEAR**. 2. Press **PAPER ADVANCE** several times and check that forms feed without erratic motion, noise, or pin-hole damage. If forms do not feed, go to **Paper feeds poorly**, page 109. If forms feed, go to step 3. 3. Press **VIEW** once and check that forms move up. Make sure the forms thickness lever is not set too tightly. 4. Press **VIEW** again and check that the forms thickness lever rotates and the paper moves down. If the forms thickness lever does not rotate and/or the paper does not move down, refer to **Reverse paper feed: platen does not open**, page 111. 5. Check the paper tension between the tractors. Adjust the right tractor so that it does not pull paper too tightly or leave it too loose. The right tractor should hold the paper under “slight” tension. 6. Check the dynamic paper tension. 7. Inspect the ribbon mask for bends or deformation that block the paper path. Replace a damaged hammer bank cover assembly. 8. Check the condition and tension of the platen open belt. Adjust the platen open belt. Replace the belt if it is damaged.

Table 2. Message List

Message	Explanation	Solution
32 PAPER JAM TIMEOUT (continued)		9. Inspect the tractors and tractor door springs for damage, excessive wear, and equal door closing tension. If either tractor is worn, damaged, or exhibits uneven door closing tension, replace both tractor assemblies. 10. Check the condition and tension of the paper feed belt. Adjust the paper feed belt. Replace the belt if it is damaged. 11. Check the platen gap. Adjust the platen gap if necessary. 12. Clean the paper motion detector with a cotton swab and alcohol. At the control panel, set the paper motion detector (PMD) fault setting to DISABLE. Load paper. Run a print test and observe how the paper feeds. If the message appears, replace the controller board. Record the message and return it with defective board. If the message does not appear, replace the paper detector switch assembly and set the paper motion detector (PMD) to ENABLE.
33 PLATEN OPEN TIMEOUT	In the CT emulation with a coax interface, the forms thickness lever has been open for at least one minute.	1. Load paper. Close the forms thickness lever. Press **CLEAR**. 2. Run a print test. If a platen open or close platen message appears, power off the printer. Remove the paper path. Disconnect connector P107 from the controller board. Check continuity of the platen interlock switch cable from P107 to the switch. Replace the platen interlock switch assembly if it fails continuity test. 3. Run a print test. If a platen open or close platen message appears, replace the controller board. Record the message and return it with defective board.

Table 2. Message List

Message	Explanation	Solution
34 RIBBON STALL TIMEOUT	In the CT emulation with a coax interface, the ribbon has not moved for 10 minutes after **CLEAR** was pressed to clear the ribbon drive fault.	1. Set the forms thickness lever to match the thickness of the paper being used, but not too tightly. 2. Inspect the ribbon guides for ink buildup, which can inhibit ribbon movement. Clean the printer. 3. Inspect the hammer bank cover/ ribbon mask for bending or damage. Replace if bent or damaged. 4. Check the platen gap: if too small, it can inhibit ribbon movement. Adjust the platen gap. 5. Power off the printer. Remove the paper path. Disconnect P106 and P107 from the controller board. Check the resistance of LRIB M in P106 and RRIB M in P107. (Refer to the Main Wire Harness Test Tables in Appendix A.) If ribbon motor resistance is not correct, replace the motor. If the resistance is correct, disconnect the ribbon motor cables from the motors and check continuity. Replace a cable if it fails the continuity test. 6. Power on the printer. Run a diagnostic print test. If the RIBBON STALL message appears, replace the controller board. Record the message and return it with the defective board.
48V CIRCUIT* See Manual	The power supply is not generating a proper 48 Volts, or the controller board is not detecting a 48 Volt output from the power supply board.	1. Make sure the power supply board is correctly connected to the controller board. 2. Power on the printer. If the message appears, replace the power supply. 3. Power on the printer. If the message appears, replace the controller board. Record the message and return it with the defective board.

Table 2. Message List

Message	Explanation	Solution
48V PWR FAIL*	48 Volt Power Failed: an internal power failure.	1. Power off the printer. Remove the paper path. Check that power supply connector P101 is fully seated in connector J101 on the controller board. 2. If the printer has the expansion-CT board, make sure the 60-pin expansion adapter is correctly and fully seated in the controller board and the CT board. 3. Power on the printer. If the message appears, replace the hammer bank logic cable assembly (P108) and the power cable assembly (P105). (Shown in Appendix A.) 4. Power on the printer. If the message appears, replace the power supply board. 5. Power on the printer. If the message appears, replace the controller board. Record the message and return it with defective board. 6. Power on the printer. If the message appears, replace shuttle frame assembly.
733 DP FIFO Busy*	There is a timing problem in the Engine Controller firmware.	1. Cycle Power. Run the print job again. If the message appears, download the emulation software again (page 164). 2. Cycle power. Run the print job again. If the message appears, replace the flash memory. 3. Power on the printer. Run the print job again. If the message appears, replace the controller board. Record the message and return it with the defective board.

Table 2. Message List

Message	Explanation	Solution
ACCESS NULL PTR*	Access Null Pointer: The processor tried to access a pointer that contains nothing (null).	1. Cycle power. Run the print job again. If the message appears, download the emulation software again (page 164). 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.
ACTIVATE LOST	The printer detects a twinax protocol communication error and reports the error.	1. Power off the printer. Disconnect the AC power cord from the printer. Reseat the twinax host data cable connection and the twinax I/O cable connection at the expansion-CT board. 2. Disconnect the twinax auto-termination cable from the printer. Test the cable for the resistances shown in the Main Wire Harness Test Tables in Appendix A. If resistances are not correct, replace the twinax auto-termination cable. 3. Connect the power cord to the printer. Power on the printer. Send a print job to the printer. If the message appears, replace the twinax cable. 4. Send a print job to the printer. If the message appears, go to **Communications Failures**, page 116.
A TO D OVERRUN*	Analog to Digital Overrun. The analog-to-digital converter overflowed.	Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.

Table 2. Message List

Message	Explanation	Solution
B10 ERROR: NO DRAM DETECTED*	On the PSA3 controller board, boot-up routines did not detect the presence of the SDRAM DIMM.	1. Cycle power. If the message appears again, power down and check that there is an SDRAM DIMM installed on the controller board. If not, install the SDRAM. If so, reseat the SDRAM DIMM. 2. Power up the printer. If the message appears, replace the SDRAM DIMM. 3. Power up the printer. If the message appears, replace the controller board. Record the message and return it with the defective board.
B11 ERROR: RAM TEST FAILED*	On the PSA3 controller board, SDRAM failed the boot initialization test.	1. Cycle power. If the message appears again, reseat the SDRAM DIMM. 2. Power up the printer. If the message appears, replace the SDRAM DIMM. 3. Power up the printer. If the message appears, replace the controller board. Record the message and return it with the defective board.
B12 ERROR: PROGRAM MISSING*	On the PSA3 controller board, the printer does not see a program in flash memory.	There is no program in printer memory. Download an emulation.
B13 ERROR: NOT COMPATIBLE*	On the PSA3 controller board, the printer is not compatible with the downloaded program.	Load the correct emulation software option(s) for this printer.
B19 ERROR: DC RETURNED*	On the PSA3 controller board, this message indicates an incorrectly assembled and tested machine.	Cycle power. If the message appears again contact the printer manufacturer and report this message.

Table 2. Message List

Message	Explanation	Solution
B20 - STATUS: 00% DOWNLOAD MODE	On the PSA3 controller board, this is a status message informing the operator that software is being downloaded through the printer's parallel port using the three-key download activation (page 176). The percentage indicates the approximate amount loaded into the printer.	No action required.
B21 STATUS: PRINTER RESET	On the PSA3 controller board, this is a status message informing the operator that the printer is undergoing a system reset.	No action required.
B22 ERROR: DECOMPRESS SIZE*	On the PSA3 controller board, flash memory has not passed boot initialization tests.	1. Cycle power. If the message appears again, reseat the flash SIMM(s). 2. Power up the printer. If the message appears, replace the flash SIMM(s). 3. Power up the printer. If the message appears, replace the controller board. Record the message and return it with the defective board.
B23 ERROR: DECOMPRESS CKSUM*	On the PSA3 controller board, flash memory has not passed boot initialization tests.	1. Cycle power. If the message appears again, reseat the flash SIMM(s). 2. Power up the printer. If the message appears, replace the flash SIMM(s). 3. Power up the printer. If the message appears, replace the controller board. Record the message and return it with the defective board.

Table 2. Message List

Message	Explanation	Solution
B30 - STATUS: INITIALIZING	On the PSA3 controller board, this is a status message informing the operator that software is being downloaded through one of the printer's I/O ports using the two-key download activation (page 172).	No action required.
B40 ERROR: SDRAM EEPROM CKSUM BAD*	On the PSA3 controller board, flash memory has not passed boot initialization tests.	1. Cycle power. If the message appears again, reseat the flash SIMM(s). 2. Power up the printer. If the message appears, replace the flash SIMM(s). 3. Power up the printer. If the message appears, replace the controller board. Record the message and return it with the defective board.
B41 ERROR: DIMM MEMORY NOT SDRAM*	The DRAM DIMM installed on the PSA3 controller board is not Synchronous DRAM (SDRAM).	1. Cycle power. If the message appears again, reseat the DRAM DIMM. 2. Power on the printer. If the message appears, install a new SDRAM DIMM of the correct type and size. 3. Power on the printer. If the message appears, replace the controller board. Record the message and return it with the defective board.
B42 ERROR: SDRAM ROWS NOT ALLOWED*	On the PSA3 controller board, printer boot initialization tests detect incorrect SDRAM.	1. Cycle power. If the message appears again, reseat the DRAM DIMM. 2. Power on the printer. If the message appears, install a new SDRAM DIMM of the correct type and size. 3. Power on the printer. If the message appears, replace the controller board. Record the message and return it with the defective board.

Table 2. Message List

Message	Explanation	Solution
B43 ERROR: SDRAM TOO MANY BANKS*	On the PSA3 controller board, printer boot initialization tests detect incorrect SDRAM.	1. Cycle power. If the message appears again, reseat the DRAM DIMM. 2. Power on the printer. If the message appears, install a new SDRAM DIMM of the correct type and size. 3. Power on the printer. If the message appears, replace the controller board. Record the message and return it with the defective board.
B44 ERROR: SDRAM NOT 64 BITS WIDE*	On the PSA3 controller board, printer boot initialization tests detect incorrect SDRAM.	1. Cycle power. If the message appears again, reseat the DRAM DIMM. 2. Power on the printer. If the message appears, install a new SDRAM DIMM of the correct type and size. 3. Power on the printer. If the message appears, replace the controller board. Record the message and return it with the defective board.
B45 ERROR: SDRAM IS WRONG VOLTAGE*	On the PSA3 controller board, printer boot initialization tests detect incorrect SDRAM.	1. Cycle power. If the message appears again, reseat the DRAM DIMM. 2. Power on the printer. If the message appears, install a new SDRAM DIMM of the correct type and size. 3. Power on the printer. If the message appears, replace the controller board. Record the message and return it with the defective board.

Table 2. Message List

Message	Explanation	Solution
B46 ERROR: SDRAM HAS MIXED SIZES*	On the PSA3 controller board, printer boot initialization tests detect incorrect SDRAM.	1. Cycle power. If the message appears again, reseat the DRAM DIMM. 2. Power on the printer. If the message appears, install a new SDRAM DIMM of the correct type and size. 3. Power on the printer. If the message appears, replace the controller board. Record the message and return it with the defective board.
B47 ERROR: SDRAM LARGER THAN 256M*	On the PSA3 controller board, printer boot initialization tests detect incorrect SDRAM.	1. Cycle power. If the message appears again, reseat the DRAM DIMM. 2. Power on the printer. If the message appears, install a new SDRAM DIMM of the correct type and size. 3. Power on the printer. If the message appears, replace the controller board. Record the message and return it with the defective board.
B49 ERROR: SDRAM # LOGICAL BANKS*	On the PSA3 controller board, printer boot initialization tests detect incorrect SDRAM.	1. Cycle power. If the message appears again, reseat the DRAM DIMM. 2. Power on the printer. If the message appears, install a new SDRAM DIMM of the correct type and size. 3. Power on the printer. If the message appears, replace the controller board. Record the message and return it with the defective board.

Table 2. Message List

Message	Explanation	Solution
B50 ERROR: SDRAM LOGIC COMB BANKS*	On the PSA3 controller board, printer boot initialization tests detect incorrect SDRAM.	1. Cycle power. If the message appears again, reseat the DRAM DIMM. 2. Power on the printer. If the message appears, install a new SDRAM DIMM of the correct type and size. 3. Power on the printer. If the message appears, replace the controller board. Record the message and return it with the defective board.
BUFFER OVERRUN	The print buffer has overflowed on a serial interface. The printed output may contain random * (asterisk) characters. Make a configuration printout.	1. Verify that the printer matches the host serial interface configuration settings for Data Protocol, Baud Rate, Data Bits, Stop Bits, Parity, Data Terminal Ready, and Request to Send. Set printer serial interface parameters to match those of the host. 2. Send a print job to the printer. If the message appears, go to **Communications Failures**, page 116.

Table 2. Message List

Message	Explanation	Solution
CLEAR PAPER JAM	Paper jam.	1. Inspect the paper path for jams. Clear jams. Load paper. 2. Press **PAPER ADVANCE** several times and check that forms feed without erratic motion, noise, or pin-hole damage. If forms do not feed, go to **Paper feeds poorly**, page 109. If forms feed, go to step 3. 3. Press **VIEW** once and check that forms move up. Make sure the forms thickness lever is not set too tightly. 4. Press **VIEW** again and check that the forms thickness lever rotates and the paper moves down. If the forms thickness lever does not rotate and/or the paper does not move down, refer to **Reverse paper feed: platen does not open**, page 111. 5. Check the paper tension between the tractors. Adjust the right tractor so that it does not pull paper too tightly or leave it too loose. The right tractor should hold the paper under “slight” tension. 6. Check the dynamic paper tension. 7. Inspect the ribbon mask for bends or deformation. Replace if damaged. 8. Check and adjust the platen open belt. Replace the belt if it is damaged. 9. Inspect the tractors and tractor door springs for damage, excessive wear, and equal door closing tension. If either tractor is worn, damaged, or exhibits uneven door closing tension, replace both tractor assemblies.

Table 2. Message List

Message	Explanation	Solution
CLEAR PAPER JAM (continued)		10. Check the condition and tension of the paper feed belt. Adjust the paper feed belt. Replace the belt if it is damaged. 11. Check and adjust the platen gap. 12. Clean the paper motion detector with a cotton swab and alcohol. At the control panel, set the paper motion detector (PMD) fault setting to DISABLE. Load paper. Run a print test and observe how the paper feeds. If the message appears, replace the controller board. Record the message and return it with defective board. If the message does not appear, replace the paper detector switch assembly and set the paper motion detector (PMD) to ENABLE.
CLEARING PROGRAM FROM FLASH	Status message: emulation software successfully loaded into printer RAM and the checksum matched. The old program is now being deleted from flash memory.	No action required.

Table 2. Message List

Message	Explanation	Solution
CLOSE PLATEN	The forms thickness lever is open.	1. Load paper. Close the forms thickness lever. 2. Power off the printer. Remove the paper path. Disconnect connector P107 from the controller board. Check continuity of the platen interlock switch from P107/PLO to the switch. Replace the switch assembly if it fails the continuity test. (Refer to Appendix A, Switch Assembly, Platen Interlock.) 3. With the forms thickness lever closed (position A), hold a 0.011 inch (0.028 cm) feeler gauge between the switch and the body of the forms thickness lever, gently press down on the switch, and tighten the two screws. 4. Check and adjust the platen open belt. Replace the belt if it is damaged. 5. Disconnect connector P106 from the controller board. Check the resistance of connector P106/ PLAT M. (See the Main Wire Harness Test Tables in Appendix A.) Replace the platen open motor if it fails the resistance test. 6. Run a print test. If the message appears, replace the controller board. Record the message and return it with the defective board.

Table 2. Message List

Message	Explanation	Solution
COIL HOT	One or more hammer coils are overheating. Inspect printer environment for severity. The printer has sensor circuits that sample the operating temperature of key components of the print mechanism. When higher than normal temperatures are sensed, print speed is automatically reduced by 50% and a COIL HOT message is sent to the LCD to inform the operator. When the coil(s) cool down, print speed automatically returns to 100% and the message clears from the LCD. This message is normal for extremely dense print jobs, such as “All Black” plot. If the printer often prints at half speed, it may be operating in a severe environment. A severe environment is one with an ambient temperature at or above 40° Celsius (104° Fahrenheit) or that is dirty enough to create blockage of the cabinet fan vents. The printer must never be run at ambient temperatures greater than 40° Celsius (104° Fahrenheit). If the printer is located in such an environment, relocate it to a cooler, cleaner area.	1. Advise the user to move the printer to cooler, cleaner location. 2. Check the kinds of print jobs the user is running: look for very dense graphics and layouts. Advise the user to run jobs in smaller batches. 3. Power off the printer. Remove the paper path. Check all fan cable connections. 4. Power on the printer. Verify that all fans operate. Replace any fan that does not operate. 5. Inspect vents and fan airways for obstructions. Look underneath cabinet models for items blocking the cabinet exhaust vents. Remove any obstructions from vents and airways. 6. Install the paper path. Load paper. Run the “All E’s” print test for 5 to 10 minutes. If the message appears, replace the shuttle frame assembly. 7. Run the “All E’s” print test for 5 to 10 minutes. If the message appears, replace the controller board. Record the message and return it with defective board. 8. Set the coil temperature (page 154).

Table 2. Message List

Message	Explanation	Solution
CTL VOLT FAIL*	Controller Voltage Failure. 15 V failure on the controller board.	1. Cycle Power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the flash memory. 3. Power on the printer. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board. 4. Power on the printer. Run the print job again. If the message appears, replace the power supply board. 5. Power on the printer. If the message appears, replace the shuttle frame assembly.
DIAGNOSTIC PASSED	Status message: the printer passed its memory and hardware initialization tests.	No action required.
DP FIFO Busy*	There is a timing problem in the Engine Controller firmware.	1. Cycle Power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the flash memory. 3. Power on the printer. Run the print job again. If the message appears, replace the controller board. Record the message and return it with the defective board.

Table 2. Message List

Message	Explanation	Solution
DRVR CIR BAD*	Driver Circuit Bad: the hammer coil count test failed.	1. Cycle power. If the message appears, press **CLEAR**. 2. Power off the printer. Remove the shuttle cover. At the shuttle frame assembly, disconnect the hammer bank logic and power cables. Power on the printer. If “HB NOT INSTALLD” appears on the LCD, replace the shuttle frame assembly. If “HB NOT INSTALLD” does not appear on the LCD, replace the controller board.
E Net Test Unavailable	The Ethernet PCBA did not initialize correctly.	1. Power on the printer and set SW1-1 in the DOWN position on the Ethernet NIC. 2. Power off the printer, wait 20 seconds, then power the printer on again. This will re-initialize the NIC. (The display should read “ETHERNET ADAPTER BEING INITIALIZED.”) 3. When the printer comes to the Ready state, set SW1-1 back in the UP position. 4. Power the printer off, wait 20 seconds, then power the printer back on. 5. When the printer comes to the online state, re-enter the IP address, subnet mask, and default gateway address (if used). 6. Print the Ethernet Test Page (page 121). 7. Verify that the IP address, subnet mask, and default gateway address are correct in the printout. 8. Verify that the IP address can be “pinged.” 9. If the message still appears, replace the Ethernet NIC.

Table 2. Message List

Message	Explanation	Solution
ERROR: DC PROGRAM NOT VALID	The printer cannot find the data controller program or the validation checksum is corrupt.	1. Download the program again. 2. If the message appears, replace all flash memory SIMMs.
ERROR: DRAM AT ADDRESS XXXXXXXX	The printer found a defective memory location.	1. Replace the DRAM. 2. Power on the printer. If the message appears, replace the controller board. Record the message and return it with defective board.
ERROR: EC PROGRAM NOT VALID	The printer cannot find the engine controller program or the validation checksum is corrupt.	1. Download the program again (page 164). If the message occurs again, replace all flash memory SIMMs. 2. Power on the printer. Download the emulation. If the message appears, replace the controller board. Record the message and return it with defective board.
ERROR: EC STOPPED AT STATE XXXX	Where XXXX is a number from 0000 to 0010. The Engine Controller has stopped and is in the state identified by the number displayed. If the EC stops at state 0000 at power-up, replace the controller board. Record the message and return it with the defective board.	1. Power off the printer. Remove all flash memory and DRAM SIMMs. Inspect the SIMM sockets on the controller board. If any socket pins are bent or damaged, replace the controller board. 2. Install the flash and DRAM SIMMs, making sure they are fully and correctly seated. Power on the printer. Download the emulation (page 164). If the message appears, replace the flash SIMM(s). 3. Power on the printer. Download the emulation. If the message appears, replace the DRAM SIMM(s). 4. Check the shuttle for shorts (page 159). 5. Power on the printer. Download the emulation. If the message appears, replace the controller board. Record the message and return it with defective board.

Table 2. Message List

Message	Explanation	Solution
ERROR: FLASH TYPE IS NOT SUPPORTED	The printer boot code cannot write to the flash SIMM installed.	Install the correct pre-written flash SIMM for the emulation the customer is using (page 213).
ERROR: FLASH DID NOT PROGRAM	The printer encountered an error trying to program flash memory.	Download the program again (page 164). If the message occurs again, replace the flash memory.
ERROR: FLASH NOT DETECTED	The printer could not find flash memory.	Check flash memory on the controller board. If present, reseat the flash SIMMs; if missing, install flash SIMMs.
ERROR: NO DRAM DETECTED	The printer could not find any DRAM.	Check DRAM on the controller board. If present, reseat DRAM; if missing, install DRAM.
ERROR: NVRAM FAILURE	The non-volatile memory has failed.	1. Check the shuttle for shorts (page 159). 2. Replace the controller board. (Do NOT attempt to replace NVRAM.) Record the message and return it with defective board.
ERROR: PROGRAM NEEDS MORE DRAM	The printer requires more DRAM in order to run the downloaded program.	Add DRAM or use a smaller emulation program.
ERROR: PROGRAM NEEDS MORE FLASH	The printer requires more flash memory in order to run the downloaded program.	Add flash memory or use a smaller emulation program.
ERROR: PROGRAM NOT COMPATIBLE	The printer is not compatible with the downloaded program.	Use the correct emulation software option(s) for this model printer.
ERROR: PROGRAM NOT VALID	The printer does not see a program in flash memory.	There is no program in printer memory. Download the emulation.
ERROR: SECURITY PAL NOT DETECTED	The security module is not present or has failed. (PAL stands for Programmable Array Logic.)	1. Check the security module at location U54 on the controller board. If the module is absent, install the correct module. If a security module is present, replace it. 2. Power on the printer. If the message appears, replace the controller board. Record the message and return it with the defective board.

Table 2. Message List

Message	Explanation	Solution
ERROR: SHORT AT ADDRESS XXXX	Hardware failure in DRAM or controller circuitry.	1. Download the program again. 2. If the message occurs again, replace the DRAM. 3. If message occurs with new memory, replace the controller board. Record the message and return it with defective board.
ERROR: WRITING TO FLASH	Hardware or software fault in flash memory.	1. Replace flash memory. 2. If message occurs with new memory, replace the controller board. Record the message and return it with defective board.
ERROR: WRONG CHECKSUM	The printer received the complete program but the checksum did not match. The data may have been corrupted during download.	1. Power off the printer. Download the program again from the beginning. If the messages appears, replace the DRAM. 2. Download the program using a new software diskette. If the messages appears, replace the flash memory. 3. Download the program. If the messages appears, replace the controller board. Record the message and return it with defective board.
ERROR OCCURRED FLUSHING QUEUES *	An interim message that displays while the printer discards host data it cannot use because a fault condition exists. While this message displays, the asterisk (*) rotates.	Wait. When the asterisk (*) stops rotating, a different fault message will appear: troubleshoot the final message.
ETHERNET ADAPTER BEING INITIALIZED	Status message indicating that the PrintNet Ethernet interface is processing the boot procedure. (May occur with older versions of microcode.)	No action required.
ETHERNET DETECTED	Status message indicating that the PrintNet Ethernet interface has established communication.	No action required.

Table 2. Message List

Message	Explanation	Solution
EXHAUST FAN FLT	Exhaust Fan Fault. Sensors cannot detect current in the fan circuit.	1. Cycle power. If the message appears, press **CLEAR**. 2. Check that the exhaust fan is connected to exhaust fan cable connector J307. Connect the fan cable connector. 3. Power off the printer. Remove the paper path. Disconnect connector P107 from the controller board. Test connector P107/EHF for shorts or opens. (See the Main Wire Harness Test Tables in Appendix A.) Replace components that fail test. 4. Make sure connector P107/EHF has a good connection at J107 on the controller board. 5. Inspect for obstructions of airways and vents. Check for items beneath the printer blocking cabinet vents. Remove obstructions. Make sure cabinet exhaust fan vents are not blocked. 6. Power on the printer. Check for fan operation. If the message appears or the fan doesn't work, replace the exhaust fan. 7. Power on the printer. If the message appears, replace the controller board. Record the message and return it with defective board.

Table 2. Message List

Message	Explanation	Solution
FIRMWARE ERROR	Application software tried to perform an illegal printer function or damaged memory is detected on the controller board. If the message appears at power-up, replace the controller board. Record the message and return it with defective board.	1. Cycle power. Run the print job. If the message appears, download the emulation software again (page 164). 2. Cycle power. Run the print job again. If the message appears, replace the flash memory. 3. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board. 4. Power on the printer. Run the print job again. If the message still appears, there is an application software error. Use your local support procedure to request assistance.
FM HEADER ERROR	Frame Header Error. Application software has violated header parameters.	Not a printer problem. The system administrator should correct applications data or configuration.
FRAMING ERROR	The printed output may contain random ! (exclamation point) characters.	1. Make a configuration printout. Set printer serial interface parameters to match host configuration settings for Data Protocol, Baud Rate, Data Bits, Stop Bits, Parity, Data Terminal Ready, and Request to Send. 2. Send a print job to the printer. If the message appears, go to **Communications Failures**, page 116.
FREEFORM OFF	This message can appear if a control panel key is stuck in the down position. Check the control panel for stuck key(s).	1. Release stuck keys. Determine and correct what made the key(s) stick. 2. Cycle power: power off the printer, wait 15 seconds, power on the printer. If the message appears, replace the control panel.

Table 2. Message List

Message	Explanation	Solution
FREEFORM ON: OFF HOLD KEY @ PWRUP	This message appears if the freeform feature is enabled. This feature is for manufacturing use only and is never used by the customer or field maintenance personnel.	1. Power off the printer. Hold any control panel key down and power on the printer. Hold the key down until the printer powers up and the message FREEFORM OFF appears on the LCD. 2. If the message reappears after doing step 1, replace the controller board. Record the message and return it with defective board.
GRF CHK ERROR PRESS STOP	Graphic Check Error: in the CT emulation over a twinax interface, the printer received a non-printable character.	Press **CLEAR**, then press **ON LINE**.

Table 2. Message List

Message	Explanation	Solution
<Online, etc. ... .> Half Speed Mode	This is a status message, not an operational state. The controller samples the operating temperature of key components of the print mechanism. When higher than normal temperatures are sensed, the print speed is automatically reduced by 50% and the message sent the LCD. When the components cool down, the print speed returns to 100% and the message clears. This message is normal for extremely dense print jobs, such as “All Black” plot. If this message often appears, the printer may be operating in a severe environment. A severe environment has an ambient temperature at or above 40° Celsius (104° Fahrenheit) or is dirty enough to clog air vents. The printer must never be run at ambient temperatures greater than 40° Celsius (104° Fahrenheit). Inspect the printer environment for severity, and if the printer is located in such an environment relocate it to a cooler, cleaner area.	1. printer to cooler, cleaner location. 2. Check the kinds of print jobs the user is running: look for very dense graphics and layouts. Advise the user to run jobs in smaller batches. 3. Power off the printer. Remove the paper path. Check all fan cable connections. 4. Power on the printer. Verify that all fans operate. Replace any fan that does not operate. 5. Inspect vents and fan airways for obstructions. Look underneath cabinet models for items blocking the cabinet exhaust vents. Remove any obstructions from vents and airways. 6. Install the paper path. Load paper. Run the “All E’s” print test for 5 to 10 minutes. If the message appears, replace the shuttle frame assembly. 7. Run the “All E’s” print test for 5 to 10 minutes. If the message appears, replace the controller board. Record the message and return it with the defective board. 8. Set the coil temperature (page 154).
HAM. COIL OPEN*	Hammer Coil Open. Electrical malfunction of one or more hammer coils.	1. Cycle power. If the message appears, replace the shuttle frame assembly. 2. Power on the printer. Run a print test. If the message appears, replace the controller board. Record the message and return it with defective board.

Table 2. Message List

Message	Explanation	Solution
HAMMER COIL BAD #, #, #, #, ... etc.	Hammer coil(s) number #, #, etc. failed the current test at power-up. Check that the hammer bank cables are connected.	1. Cycle power. If the message appears, replace the shuttle frame assembly. Record the message and return it with the defective assembly. 2. Power on the printer. If the message appears, replace controller board. Record the message and return it with the defective assembly.
HB NOT INSTALLD*	Hammer Bank Not Installed. Self-test routines do not detect hammer coils at printer start-up. Power off the printer. Verify that the shuttle frame assembly is installed.	1. Install the shuttle frame assembly. 2. Remove the paper path. Verify that the hammer bank logic cable is connected to connector J108 on the controller board and to the shuttle frame assembly. 3. Power on the printer. If the message appears, replace the hammer bank logic cable. 4. Power on the printer. If the message appears, replace the shuttle frame assembly. 5. Power on the printer. If the message appears, replace the controller board. Record the message and return it with defective board.

Table 2. Message List

Message	Explanation	Solution
HMR BANK FAN FLT	Hammer Bank Fan Fault. Sensors cannot detect current in the fan circuit.	1. Cycle power. If the message appears, press **CLEAR**. If the message does not clear, go to step 2. 2. Power off the printer. Remove the paper path. Disconnect connector P107 from the controller board. Test connector P107/HBF for shorts or opens. (Refer to the Main Wire Harness Test Tables in Appendix A.) Replace components that fail test. 3. Make sure P107/HBF has a good connection at J107 on the controller board. 4. Inspect for obstructions of airways and vents. Remove obstructions. 5. Power on the printer. If the message appears, replace the controller board. Record the message and return it with defective board.
ILL EXT BUS ACC*	Illegal External Bus Access. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again (page 164). 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.
ILL INST ACCSS*	Illegal Instruction Accessed. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again (page 164). 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.

Table 2. Message List

Message	Explanation	Solution
ILLGL OPR ACCSS*	Illegal Operand Accessed. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again (page 164). 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.
INTAKE FAN FAULT	Sensors cannot detect current in the card cage fan circuit.	1. Cycle power. If the message appears, press **CLEAR**. If the message does not clear, go to step 2. 2. Power off the printer. Remove the paper path. Disconnect connector P106 from the controller board. Test connector P106/CCF for shorts or opens. (Refer to the Main Wire Harness Test Tables in Appendix A.) Replace components that fail test. 3. Make sure P106/CCF has a good connection at J106 on the controller board. 4. Inspect for obstructions of airways and vents. Remove obstructions. 5. Power on the printer. If the message appears, replace the controller board. Record the message and return it with defective board.

Table 2. Message List

Message	Explanation	Solution
INTERRUPT UNUSED VECTOR 00	This message is generated when the controller board gets an interrupt it does not understand. The problem can be created by electrical noise, by a software problem, or by a hardware problem.	1. Cycle power. If this message occurred once and never again, you can ignore it. If the message reappears or appears consistantly check the grounding of the printer and check for shuttle shorts (page 159). If the machine is correctly grounded, replace the controller board. 2. Power on the printer. Cycle power. If the message appears, suspect an application software error. Request assistance from your local support group. Install the original controller board.
INVALID ACTIVATE	The printer detects a twinax protocol communications error and reports the error. Power off the printer. Disconnect the AC power cord from the printer. Check the twinax host data cable and twinax I/O cable connection at the expansion-CT board.	1. Reseat the twinax host data cable connection and the twinax I/O cable connection at the expansion-CT board. 2. Disconnect the twinax auto-termination cable from the printer or from the last device on this twinax port. Test the cable for the resistances shown in the Main Wire Harness Test Tables in Appendix A. If resistances are not correct, replace the twinax auto-termination cable. 3. Connect the power cord to the printer. Power on the printer. Send a print job to the printer. If the message appears, replace the twinax cable. 4. Send a print job to the printer. If the message appears, go to **Communications Failures**, page 116.

Table 2. Message List

Message	Explanation	Solution
INVALID COMMAND	The printer detects a twinax protocol communications error and reports the error. Power off the printer. Disconnect the AC power cord from the printer. Check the twinax host data cable and twinax I/O cable connection at the expansion-CT board.	1. Reseat the twinax host data cable connection and the twinax I/O cable connection at the expansion-CT board. 2. Disconnect the twinax auto-termination cable from the printer. Test the cable for the resistances shown in the Main Wire Harness Test Tables in Appendix A. If resistances are not correct, replace the twinax auto-termination cable. 3. Connect the power cord to the printer. Power on the printer. Send a print job to the printer. If the message appears, replace the twinax cable. 4. Send a print job to the printer. If the message appears, go to **Communications Failures**, page 116.
LO DRV. SHORT*	Lower Driver Short. Circuit(s) on the hammer bank or in the hammer bank power cable are shorted to ground.	1. Cycle power. If the message appears, press **CLEAR**. If message does not clear, replace the hammer bank logic cable and the hammer bank power cable. 2. Power on the printer. If the message appears, replace the shuttle frame assembly. 3. Power on the printer. If the message appears, replace the controller board. Record the message and return it with defective board.

Table 2. Message List

Message	Explanation	Solution
LOAD PAPER	Printer is out of paper.	1. Load paper. Press **CLEAR**. If message does not clear, go to the next step. 2. Check for black or colored back on paper being used in printer. The paper out detector is optical and may not detect paper with a black or dark backing facing the detector. Try media with a white or light back. If media with white/ light back works and black/dark media does not, replace the paper detector switch with the optional black back forms switch assembly. (See page 262, item 3.) 3. Power off the printer. Remove the paper path. Remove the barrier shield. Check that the paper detector switch assembly is securely mounted in its bracket. 4. Check that connector P106/PMD is fully seated in connector J106 on the controller board. 5. Load paper. Power on the printer. Replace the paper detector switch assembly if message appears. 6. Load paper. Power on the printer. Replace the controller board if message appears. Record the message and return it with defective board.
LOADING PROGRAM FROM PORT XX%	Status message: the new emulation program is loading into printer RAM. XX% indicates how much of the program has loaded.	No action required.
LOADING PROGRAM INTO FLASH	The printer has deleted the previous program from flash memory and is loading the new program into flash memory.	No action required.

Table 2. Message List

Message	Explanation	Solution
NON VOLATILE MEMORY FAILED	Large emulations reduce the amount of space available for saving configurations, which means that sometimes fewer than 8 configurations can be saved. If this message appears when saving a configuration, it means the printer is out of memory. Previously saved configurations will still be available, but the one that was “saved” when the message appeared is not in memory. If this message appears at power-up, it means the flash memory is defective.	1. If the message appears at power-up, replace the flash memory. 2. If the message appears while saving a configuration, the printer is out of memory and will not save that or subsequent configurations. (Previously saved configurations are still okay.) 3. Replace the expansion C/T and adapter, if they are installed. 4. If the message appears after replacing/increasing memory, replace the controller controller board. (Do NOT attempt to replace NVRAM.)
ONLINE 28 CU NOT ENAB	Controller Unit Not Enabled. Poll time-out error. The printer was not polled for one minute across a coax interface.	Check cable connection and host system. (Refer to line problem determination procedures, as recommended by the host system.)
ONLINE 8344 FAILED	Link-level code test detects a hardware failure on the expansion-CT board.	Replace the expansion-CT board. Record the message and return it with defective board.
ONLINE CU TIMED OUT	Controller Unit Timed Out: the printer was not enabled for one minute or more on a coax interface.	Check cable connection and host system. (Refer to line problem determination procedures, as recommended by the host system.)
P00 ERROR: SYSTEM FAULT	Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with the defective board.

Table 2. Message List

Message	Explanation	Solution
PAP BAD TABLE*	Paper Bad Table. The paper feed process on the controller board has a corrupted table.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.
PAP BSY TOO LNG*	Paper Busy Too Long. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again (page 164). 2. Run the print job again. If the message appears, power off the printer. Remove the paper path. Make sure connectors P106 and P107 are fully seated on the controller board. Make sure the MPU cable, the hammer bank logic cable, and the hammer bank power cable are undamaged and have good connections. Replace as necessary. (Refer to Appendix A.) 3. Power on the printer. Run the print job again. If the message appears, replace the shuttle frame assembly. 4. Power on the printer. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.
PAP FD DRVR CIR* See Manual	Paper Feed Driver Circuit. The paper feed driver circuit on the controller board is drawing too much current.	1. Cycle power. If the message appears, replace the controller board. Record the message and return it with the defective board. 2. Power on the printer. If the message appears, replace the paper feed motor.

Table 2. Message List

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

Table 2. Message List

Message	Explanation	Solution
PAP ILLGL ST*	Paper Illegal State. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.
PAP INCMPL ENER*	Paper Incompletely Energized. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.
PAP INVLD CMD*	Paper Invalid Command. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.
PAP INVLD PARM*	Paper Invalid Parameter. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.

Table 2. Message List

Message	Explanation	Solution
PAP NOT SCHED*	Paper Not Scheduled. The paper feed process is not scheduling on the controller board, and the printer cannot feed paper.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the MPU cable assembly. 3. Power on the printer. Run the print job again. If the message appears, replace the power supply board. 4. Power on the printer. Run the print job again. If the message appears, replace the shuttle frame assembly. 5. Power on the printer. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.
PAP NT AT SPEED*	Paper Not At Speed. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.
PAP UNEXP INT*	Paper Unexpected Interrupt. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.

Table 2. Message List

Message	Explanation	Solution
PARAMETER ERROR	Illegal parameter value received in a command code over a coax/twinax interface.	1. Press **CLEAR** then press **ON LINE**. 2. Run the print job that generated the error message. If the message appears, check the host data for invalid characters. 3. Ask the system operator to verify that the printer's Device ID is set to the correct emulation with respect to the host configuration. 4. Run the print job that generated the error message. If the message appears, go to **Communications Failures**, page 116.
PARITY ERROR	The printed output may contain random ? (question mark) characters. Make a configuration printout.	1. Verify that the printer matches host serial configuration settings for Data Protocol, Baud Rate, Data Bits, Stop Bits, Parity, Data Terminal Ready, and Request to Send. 2. Send a print job to the printer. If the message appears, replace the serial data cable. 3. Send a print job to the printer. If the message appears, go to **Communications Failures**, page 116. 4. If the printer is in a twinax environment, check the error log for parity error entries and inspect the customer's cable hook-ups. Connect all communications cables correctly. 5. Send a print job to the printer. If the message appears, replace the twinax auto-termination cable ("T" connector). 6. Send a print job to the printer. If the message appears, replace the expansion-CT.

Table 2. Message List

Message	Explanation	Solution
PLAT INV CMD*	Platen Invalid Command. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.
PLAT INV PARM*	Platen Invalid Parameter. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.
PLAT INV STATE*	Platen Invalid State. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.
PLEASE WAIT... RESET IN PROGRESS	Status message: the printer finished loading the program into flash memory and is automatically resetting itself.	No action required.
POWER SAVER MODE	This is a status message. The printer is in low-energy idle state, all fans and higher voltages are off, only +5Vdc logic circuits are active.	No action required. Press the PAPER ADVANCE key to revive the printer from power saver mode.

Table 2. Message List

Message	Explanation	Solution
POWER SUPPLY HOT	The printer has sensor circuits that sample the operating temperature of key components of the power supply. When higher than normal temperatures are sensed, print speed is automatically reduced. If the printer runs at reduced speed for an extended period of time, the POWER SUPPLY HOT message is sent to the LCD and printing stops, allowing printer components to cool down. Pressing the **CLEAR** key resumes the print task. Check the operating environment. A severe environment is one with an ambient temperature at or above 40° Celsius (104° Fahrenheit) or is dirty enough to create blockage of the cabinet fan vents. The printer must never be run at ambient temperatures greater than 40° Celsius (104° Fahrenheit). If the printer is located in such an environment, relocate it to a cooler, cleaner area.	1. Inspect printer environment for severity. Advise the user to move the printer to cooler, cleaner location. 2. Check the kinds of print jobs the user is running: look for very dense graphics and layouts. Advise the user to run jobs in smaller batches. 3. Power off the printer. Remove the paper path. Check that the power supply guard/air deflector is correctly positioned over the power supply board. **WARNING: DO NOT TOUCH THE POWER SUPPLY**, but hold your hand close enough to check for heat radiating off the heat sinks and components of the power supply board. If the power supply is noticeably hot, replace it. 4. Check that all fan cables are connected. 5. Inspect vents and fan airways for obstructions. Look underneath cabinet models for items blocking the cabinet exhaust vents. 6. Install the paper path. Load paper. Power on the printer. Run the “All E’s” print test for 5-10 minutes. If the message appears, replace the controller board. Record the message and return it with defective board.

Table 2. Message List

Message	Explanation	Solution
PRINTER HOT	This message indicates internal temperatures over 60° Celsius (140° Fahrenheit). Print jobs will not create such temperatures, so immediately determine that the fans are operating and that all air vents are unobstructed. It is crucial that the exhaust vents on the floor of the cabinet remain unblocked, since hot air from inside the printer is vented through the cabinet floor. Nothing must be stored under the printer. Then check the operating environment. A severe environment is one with an ambient temperature at or above 40° Celsius (104° Fahrenheit) or is dirty enough to create blockage of the cabinet fan vents. The printer must never be run at ambient temperatures greater than 40° Celsius (104° Fahrenheit). If the printer is located in such an environment, relocate it to a cooler, cleaner area.	1. Controller board sensors report high temperatures on the board. Inspect printer environment for severity. Advise the user to move the printer to cooler, cleaner location. 2. Power off the printer. Remove the paper path. Check that all fan cables are connected. 3. Inspect vents and fan airways for obstructions. Look underneath cabinet models for items blocking the cabinet exhaust vents. Remove any obstructions from vents and airways. 4. Install the paper path. Load paper. Power on the printer. Run the “All Black” print test for 1/4 page. If the message appears, replace the controller board. Record the message and return it with defective board.
PROTECTED INSTR*	Protected Instruction. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.
PWR SUPP VOLT*	Power Supply Voltage. The power supply has failed.	Replace the power supply board.

Table 2. Message List

Message	Explanation	Solution
QUEUE OVERRUN	In the CT twinax emulation, the print buffer has overflowed. Send a print job to the printer.	1. If the message appears, replace the expansion-CT board. Record the message and return it with defective board. 2. Send a print job to the printer. If the message appears, replace the twinax data cable and the twinax auto-termination cable assembly (“Smart T”).
RBN DRVR CIR* See Manual	The ribbon driver circuit on the controller board is drawing too much current.	1. Cycle power. If the message appears, replace the controller board. Record the message and return it with the defective board. 2. Power on the printer. If the message appears, replace the ribbon motors.
RESTORING BOOT CODE	Normal download initialization message.	No action required.
RIB INVLD CMD*	Ribbon Invalid Command. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.
RIB INVLD STATE*	Ribbon Invalid State. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.

Table 2. Message List

Message	Explanation	Solution
RIBBON DRIVE	The controller board does not detect a ribbon drive motor.	1. Cycle power. If the message appears, power off the printer. Remove the paper path. Reseat the cable connections of both ribbon drive motors. 2. Power on the printer. Using a screwdriver, short across the ribbon guide screws to reverse ribbon hub motion. Check for a ribbon drive motor that will not wind the ribbon. If the ribbon will not wind in one or both directions, replace the defective ribbon drive motor(s). If the ribbon winds in both directions, replace the controller board. Record the message and return it with defective board.
RIBBON INK OUT CHANGE RIBBON	RibbonMinder™ software has determined that the ribbon is out of ink.	Install a new ribbon and set ribbon life to 100%.

Table 2. Message List

Message	Explanation	Solution
RIBBON STALL	The controller board does not detect ribbon movement.	1. Cycle power. If the message appears, power off the printer. Check that both ribbon hubs are securely mounted on the ribbon motor shafts. If either hub is cracked or otherwise damaged, replace both ribbon hubs. 2. The lower flange of the ribbon hub can interfere with the shuttle cover. Check that the cover is correctly installed on the locating pins. If necessary, file the locating holes so the cover is biased toward the rear of the machine. 3. Inspect the ribbon mask for excessive ink build-up or a torn/ bunched ribbon. Clean the ribbon mask and replace the ribbon as required to insure unobstructed movement of the ribbon between the ribbon mask and hammer bank cover. 4. Check the platen gap and adjust if required. If the gap is too narrow, it can restrict ribbon movement through the ribbon mask. 5. Remove the paper path. Reseat the cable connections of both ribbon drive motors. 6. Power on the printer. Using a screwdriver, short across the ribbon guide screws to reverse ribbon hub motion. Check for a ribbon drive motor that will not wind the ribbon. If the ribbon will not wind in one or both directions, replace the defective ribbon drive motor(s). If the ribbon winds in both directions, replace the controller board and download new function code. Record the message and return it with defective controller board.

Table 2. Message List

Message	Explanation	Solution
SCS COMMAND ERROR	In the CT emulation, the printer received undefined control character (hex 40).	1. The printer clears the error. 2. Run the print job that generated the error message. If the message appears, verify that there are no invalid control codes in the host data. 3. Ask the system operator to verify that the printer's Device ID is set to the correct emulation with respect to the host configuration. 4. Run the print job that generated the error message. If the message appears, go to **Communications Failures**, page 116.
SECURITY CODE VIOLATION	Security code of the security module or key on the controller board does not match the code of the firmware on the controller board.	1. Remove the paper path. Check that the security module/key is correctly installed. 2. Install correct module/key for the customer's emulations. 3. Run a print test. If the message appears, replace the controller board. Record the message and return it with defective board.
SECURITY PAL NOT DETECTED	The security module or key is not present or has failed. (PAL stands for Programmable Array Logic.)	1. Check the security module/key at location U54 on the controller board. If the module is absent, install the correct module/key. If a security module/key is present, replace it. 2. Power on the printer. If the message appears, replace the controller board. Record the message and return it with the defective board.
SENDING PROGRAM TO EC PROCESSOR	Status message: the printer is loading the engine controller program into the engine controller.	No action required.
SF ERROR	Structured Field Error. Application software has violated structured data field parameters.	Not a printer problem. Have the system administrator correct applications data or configuration.

Table 2. Message List

Message	Explanation	Solution
SHUT DRVR CIR* See Manual	The shuttle driver circuit on the controller board is drawing too much current.	1. Power down the printer. Remove the paper path to gain access to the card cage. Make sure the shuttle data and power cables are undamaged and have good connections at the shuttle and the controller board. 2. Power on the printer. If the message appears, replace the controller board. Record the message and return it with the defective board. 3. Power on the printer. If the message appears, replace the shuttle frame assembly.
SHUTL INV CMD*	Shuttle Invalid Command. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.
SHUTL INV PARM*	Shuttle Invalid Parameter. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.
SHUTL OVR SPEED*	The shuttle is oscillating too rapidly.	Adjust the gap between the MPU and the shuttle motor flywheel to 0.010 ± 0.001 inch (0.254 ± 0.025 mm). (See page 254.)

Table 2. Message List

Message	Explanation	Solution
SHUTTLE JAM	The shuttle is not moving or is moving at the wrong speed. Check the forms thickness lever: if it is set too tightly, it can slow the shuttle enough to trigger the fault message.	1. Set the forms thickness lever to match the thickness of paper, but not too tightly. 2. Check/adjust the platen gap. 3. Inspect the ribbon mask for deformation that snags and interferes with shuttle movement. Correctly install the hammer bank cover assembly or replace a deformed cover assembly. 4. Run a print test. If the message appears, power off the printer. 5. Remove the shuttle cover and paper path. Inspect the shuttle mechanism for obstructions. Check that all cables are attached at the shuttle and the controller board. Make sure the MPU cable is not pinched. (Refer to the Interconnection Diagrams in Appendix A.) Reseat all cables. Check the resistance of the MPU at connector P107. (Refer to the Main Wire Harness Test Tables in Appendix A.) Replace the MPU if it fails the test. 6. Run a print test. If the message appears, replace the power supply board. 7. Run a shuttle test and observe shuttle movement. If the shuttle oscillates too slowly, adjust the gap between the MPU assembly and the flywheel to 0.010 ± .001 inch (0.254 ± 0.025 mm). Torque the 7/16 inch MPU clamp screw to 18 ± 1 inch-pounds (2.03 ± 0.11 N•m). 8. Run a print test. If the message appears, replace the MPU and the MPU cable assembly.

Table 2. Message List

Message	Explanation	Solution
SHUTTLE JAM (continued)		9. Run a print test. If the message appears, replace the controller board. Record the message and return it with defective board. 10. Run a print test. If the message appears, replace the shuttle frame assembly.
SHUTTLE STALL	See SHUTTLE JAM (page 81).	See SHUTTLE JAM (page 81)
SHUTTLE TYPE NOT SUPPORTED*	The shuttle type was not detected at power-up.	1. Power down the printer. Remove the paper path to gain access to the card cage. Make sure the shuttle data and power cables are undamaged and have good connections at the shuttle and the controller board. 2. Power on the printer. If the message appears, replace the controller board. Record the message and return it with the defective board. 3. Power on the printer. If the message appears, replace the shuttle frame assembly.
SOFTWARE ERROR* CYCLE POWER	Application software tried to perform an illegal printer function or damaged logic circuits were detected on the controller board.	1. Cycle power. If the message appears, power off the printer. 2. Disconnect the input data line from the host computer. Power on the printer. If the message appears, download the emulation software again (page 164). 3. Cycle power. Run the print job again. If the message appears, replace the controller board. If the message is gone, there is an application software error. Request assistance from your local support group.

Table 2. Message List

Message	Explanation	Solution
STACK OVERFLOW*	Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.
STACK UNDERFLOW*	Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.

Table 2. Message List

Message	Explanation	Solution
STACKER FAULT	Two situations can trigger this message: 1. The stacker elevator is obstructed while attempting to move up or down. The message will always occur if the user presses the ELEVATOR UP key on the stacker control panel to move the elevator and the elevator is blocked so that it cannot move to the top of its travel. 2. Controller hardware tells firmware that an over-current condition exists. This will only occur if the controller board or the stacker motors are bad.	1. Open the cabinet rear door and check for obstructions preventing elevator movement. Remove any obstructions. 2. Power on the printer. Operate the power stacker and check that: a) all motors are operating, b) the paddles are rotating, c) the elevator moves smoothly and without obstruction, d) the timing belts are undamaged and the belt pulleys are not slipping, e) the extension springs are attached and undamaged (not bent or stretched), f) the drive rollers are not damaged, g) the constant force springs are tightly mounted and undamaged. Tighten pulley setscrews and/or replace damaged components as necessary. 3. Adjust the stacker rails if they are not vertical and parallel. 4. Check the stacker limit switches. (See page 102.) If the limit switches are OK, go to the next step. 5. Disable the power stacker unit under the Printer Control menu. (Refer to the *User's Manual.)* If the message occurs, replace the controller board and download new function code. 6. Power off the printer. Remove the paper path. Disconnect stacker cables from the controller board, stacker assembly, and the stacker control panel (see Figure 79, page 384). Check cables for cuts, breaks, or damaged pins. Check continuity of cables. (See Appendix A for pinouts.) Replace any cable that is damaged or fails continuity test. If the cables are okay, replace the stacker motors.

Table 2. Message List

Message	Explanation	Solution
STACKER FULL	Status message: the power paper stacker is full.	1. Unload the stacker. 2. Check the stacker limit switches. (See page 102.) If the limit switches are OK, go to the next step. 3. Power off the printer. Remove the paper path. Disconnect stacker cables from the controller board, stacker assembly, and the stacker control panel (see Figure 76, page 381). Check cables for cuts, breaks, or damaged pins. Check continuity of cables. (See Appendix A for pinouts.) Replace any cable that is damaged or fails continuity test.

Table 2. Message List

Message	Explanation	Solution
STACKER JAM	This message is triggered if there is paper inside the throat of the stacker elevator, but the elevator is not moving.	1. Open the cabinet rear door and check for obstructions preventing elevator movement. Remove any obstructions. 2. Check that the wheel of the stacker paper motion detector rests against the rear brace of the paper throat. Also make sure the wheel rotates freely. If necessary, gently bend the brace toward the paper motion detector wheel until the wheel contacts the brace. Clean the stacker paper motion detector. 3. Power on the printer. Operate the power stacker and check that: a) all motors are operating, b) the paddles are rotating, c) the elevator moves smoothly and without obstruction, d) the timing belts are undamaged and the belt pulleys are not slipping, e) extension springs are attached and not bent or stretched), f) drive rollers are not damaged. Tighten setscrews and replace damaged components as necessary. 4. Power off the printer. Remove the paper path. Disconnect stacker cables from the controller board, stacker assembly, and stacker control panel. Check cables for cuts, breaks, or damaged pins. Check continuity of cables. (See Appendix A for pinouts.) Replace any cable that is damaged or fails continuity test.

Table 2. Message List

Message	Explanation	Solution
TABLE MISMATCH DOWNLOAD AGAIN	This message indicates that an EC software update is in process.	1. Power off the printer. Download the program again from the beginning. 2. If the message appears, replace the flash memory and download the program again. 3. If the problem still exists, replace the hammer bank logic cable and the shuttle frame assembly. 4. If the problem still exists, replace the controller board. Record the message and return it with the defective board. 5. If the problem still exists, replace the power supply.
TCB CORRUPTED*	Task Control Block Corrupted. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.

Table 2. Message List

Message	Explanation	Solution
TCP Port Busy	Error message reported by the Printer Manager when Ethernet interface option is installed. The network address given in the printer properties was reached, but the printer port is "busy." When the port setting is "Serial" the Printer Manager software cannot interact with the Ethernet card, although the card will respond to other TCP/IP utilities.	1. Power on the printer. 2. If the printer is online, press the **ON LINE** key to place the printer offline. 3. On the control panel, press the ▲ + ▼ keys to unlock the **ENTER** key. 4. Press the ▲ + ▼ + ◀ + ▶ keys simultaneously to enter the Factory Menu. 5. Press ▶ until you reach the PRINTER MGMT menu, then press ▼. 6. Press ▶ until you reach the "Diagnostics Port" option, then press ▼. 7. Press ▶ until you reach "Debug Ethernet", then press **ENTER**. 8. Press **ON LINE** to return the printer to the online state. 9. Save the changes and set up a new power-up configuration, if necessary. The Printer Manager should now be able to access the printer. For other communication errors, print out the E-Net Test Page (page 121) and verify the IP address, subnet mask, gateway address, and TCP port settings.
UNDEF INTERRUPT*	Undefined Interrupt. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.

Table 2. Message List

Message	Explanation	Solution
UNDFNED OPCODE*	Undefined Opcode. Firmware error on the controller board.	1. Cycle power. Run the print job again. If the message appears, download the emulation software again (page 164). 2. Cycle power. Run the print job again. If the message appears, replace the controller board. Record the message and return it with defective board.
UP DRV. SHORT*	Upper Driver Short. Hammer driver circuits on the controller board are shorted to ground.	1. Cycle power. If the message appears, press **CLEAR**. If the message does not clear, replace the hammer bank logic cable and the hammer bank power cable assemblies. 2. Power on the printer. If the message appears, replace the controller board. Record the message and return it with defective board. 3. Power on the printer. If the message appears, replace the shuttle frame assembly.
WAITING FOR ETHERNET ADAPTER	This status message appears when the printer is first powered on if the optional PrintNet Ethernet interface is installed. An Ethernet adapter must be detected early in the power up sequence so the printer can tell the adapter it has been detected and continue with its own power up sequence. Compared to the printer, the Ethernet adapter takes a long time to complete its internal diagnostic tests, so the boot code allows the adapter to power up in parallel with the printer to reduce its effect on overall boot time	No action required.

Troubleshooting Other Symptoms

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

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

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

General Symptom List

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

If you encounter a problem that is not listed in Table 3, troubleshoot using the Half-Split Method described on page 90.

Table 3. General Symptom List

Symptom	Solution
Communications Failures	
Printer “hangs” during print job	1. Download the latest version of software. 2. Replace the platen open switch. 3. Refer to Table 4, “. Communications Problems,” on page 116.
Fails to print from host	Refer to Table 4, “. Communications Problems,” on page 116.
Prints incorrect characters	Refer to Table 4, “. Communications Problems,” on page 116.
Prints extra characters	Refer to Table 4, “. Communications Problems,” on page 116.
Drops characters	Refer to Table 4, “. Communications Problems,” on page 116.
Data Loss	Refer to Table 4, “. Communications Problems,” on page 116.
Cannot Ping (Ethernet interface)	Refer to Table 4, “. Communications Problems,” on page 116.
Cannot Print (Ethernet interface)	Refer to Table 4, “. Communications Problems,” on page 116.
Host cannot communicate with the printer when hooked up to TCP/IP to AS/400 with the Ethernet NIC installed	Refer to the Ethernet Interface User’s Manual.

Table 3. General Symptom List

Symptom	Solution
Cannot access the printer through Remote Management Software (Ethernet interface)	If the Ethernet port is not enabled, under the Debug Menu the following message will occur when you try to connect to a printer: "The network address given in the printer properties was reached, but the printer port is busy. This may occur when another user is accessing the same printer, or when another logical printer is connected to the same address." To solve this problem, the Debug Ethernet option must be enabled to allow the Printer Manager to establish communications with the Ethernet card. 1. Power on the printer. 2. If the printer is online, press the **ON LINE** key to place the printer offline. 3. On the control panel, press the ▲ + ▼ keys to unlock the **ENTER** key. 4. Press the ▲ + ▼ + ◀ + ▶ keys simultaneously to enter the Factory Menu. 5. Press ▶ until you reach the PRINTER MGMT menu, then press ▼. 6. Press ▶ until you reach the "Diagnostics Port" option, then press ▼. 7. Press ▶ until you reach "Debug Ethernet", then press **ENTER**. 8. Press **ON LINE** to return the printer to the online state. 9. Save the changes and set up a new power-up configuration, if necessary. The Printer Manager should now be able to access the printer. For other communication errors, print out the E-Net Test Page (page 121) and verify the IP address, subnet mask, gateway address, and TCP port settings.

Table 3. General Symptom List

Symptom	Solution
Jams	
CLEAR PAPER JAM message instead of LOAD PAPER when printer is out of paper	1. Power off the printer. Remove the paper path. Remove the barrier shield. Check that the paper detector switch assembly is securely mounted in its bracket. Clean the paper detector switch if necessary. 2. Check that connector P106/PMD is fully seated in connector J106 on the controller board. 3. Load paper. Power on the printer. Replace the paper detector switch assembly if either message appears. 4. Inspect the paper ironer. If the paper ironer has slipped up into the print line, reposition the paper ironer. 5. Load paper. Power on the printer. Replace the controller board if either message appears. Record the message and return it with defective board.
CLEAR PAPER JAM message will not clear and paper does not move	1. Remove the paper path. Make sure connector P107/PAPR M is fully seated in connector J107 on the controller board. 2. Check the condition and tension of the paper feed timing belt. Adjust the paper feed timing belt. Replace the belt if it is damaged. 3. Check the dynamic paper tension. 4. Load paper. Power on the printer. Press **PAPER ADVANCE** and **VIEW** several times and check that paper moves correctly in both directions. Replace the paper feed motor if the message appears or the paper moves erratically. 5. Power on the printer. Press **PAPER ADVANCE** and **VIEW** several times and check that paper moves correctly in both directions. Replace the controller board if the message appears or the paper moves erratically. Record the message and return it with defective board.

Table 3. General Symptom List

Symptom	Solution
CLEAR PAPER JAM message will not clear but paper moves	1. Power off the printer. Remove the paper path. Check that connector P106/PMD is fully seated in connector J106 on the controller board. 2. Remove the barrier shield. Check that the paper detector switch assembly is securely mounted in its bracket. Clean the paper detector switch if necessary. 3. Check that the paper detector switch assembly is securely mounted to the mechanism base. Tighten the two screws securing the paper detector switch assembly to the mechanism base. 4. Check that the motion detector wheel rotates. Replace the paper detector switch assembly if the wheel does not rotate. 5. Load paper. Power on the printer. Replace the paper detector switch assembly if the message appears. 6. Load paper. Power on the printer. Replace the controller board if the message appears. Record the message and return it with defective board.

Table 3. General Symptom List

Symptom	Solution
Control Panel	
Black squares on control panel	1. Power off the printer. Remove the paper path. Disconnect the control panel cable from the panel and from J110 on the controller board. Check continuity of the cable. (See Appendix A for pinouts.) Replace the control panel cable if it fails continuity test. Connect the cable. Power on the printer. If the symptom appears, go to step 2. 2. If the printer has the expansion-CT board, check the adapter connection to the controller board. Make sure the 60-pin expansion adapter is correctly seated in the controller board connector J111 and the expansion-CT board. 3. Power off the printer. Make sure the flash memory is seated properly in J10 and J11 on the controller board. Regardless of memory configuration, J11 must be used. 4. Power on the printer. If black squares appear on the LCD, the flash memory could be blank. Replace the flash SIMM in J11 with a new flash SIMM with the boot program installed. 5. Power on the printer. If the symptom appears, replace the control panel. 6. Power on the printer. If black squares appear on the LCD, replace the controller board. Record the message and return it with defective board. If the LCD displays characters correctly, download the emulation software again (page 164).
Control panel blank	1. Power off the printer. Remove the paper path. Check all cable connections into the controller board; make sure the control panel cable is seated in connector J110 on the controller board. 2. If the printer has the expansion-CT board, make sure the 60-pin expansion adapter is correctly seated in the controller board and the CT board. 3. Power on the printer. Inspect the control panel display and cooling fans. If the control panel is blank and the cooling fans come on, replace the control panel cable assembly and/or the control panel, as required. 4. Power on the printer. If the control panel is blank and the fans do not come on, replace the controller board. Record the message and return it with the defective board.

Table 3. General Symptom List

Symptom	Solution
Control panel keys do not work	1. Power on the printer. Check the operation of the control panel keys. Replace the control panel assembly if the keys do not work. 2. Power on the printer. Check the operation of the control panel keys. Replace the control panel cable assembly if the keys do not work. 3. Power on the printer. Check the operation of the control panel keys. Replace the controller board if the keys do not work.
Control panel display shows garbled, broken characters	1. Remove the paper path. Check cable connections into the controller board. Make sure the control panel cable is seated in connector J110 on the controller board. 2. Make sure the DRAM SIMM(s) or DIMM is/are seated properly in J15/J16. Reseat DRAM SIMM(s) or DIMM. 3. Power on the printer. Inspect the control panel display. If the control panel shows broken characters, replace the DRAM.

Table 3. General Symptom List

Symptom	Solution
Power Failures	
No power, and control panel blank, and card cage fan not running	1. Check that the AC power outlet has power. Restore AC power if necessary. 2. Unplug the printer AC power cord from the printer (leave it plugged into the power outlet) and check for AC power at the printer end of the cord. If there is no power through the AC power cord, replace it. Plug the AC power cord into the printer and power outlet. 3. Remove the paper path. Verify that the AC-In power cable and the AC power input cables are connected to the on/off switch-circuit breaker. (See Figure 47, page 264.) Make sure all ground connections are clean and tight. 4. Check that AC-in power cable connector P1 is connected to J1 on the power supply board. Reseat the connector. 5. Check that power supply cable connector P101 is connected to J101 on the controller board. Reseat the connector. 6. Check all cable connections on the controller board. 7. If the printer has the expansion-CT board, make sure the 60-pin expansion adapter is correctly seated in the controller board and the CT board. 8. Disconnect AC-in power supply cable connector P1. Set the circuit breaker to 1 (on). Measure AC voltage at pins 1 and 2 of connector P1. If no voltage, replace the circuit breaker. If there is voltage, replace the power supply board.

Table 3. General Symptom List

Symptom	Solution
Printer does not initialize	**NOTE:** Power-on initialization is explained on page 129. 1. Power off the printer. Remove the paper path. Reseat all cable connectors on the controller board, especially connectors P106 and P107. 2. Check the shuttle for electrical shorts (page 159). 3. If the printer has the expansion-CT board, verify that the user is running CT emulation software. Download CT emulation software if necessary. If the printer does not have the expansion-CT board, go to step 7. 4. If the printer has the expansion-CT board, check that the user has enough flash memory installed to handle the emulation software. (See Figure 34 on page 215, and the Boot Diagnostics Menu on page 122.) Install flash memory and download emulation software if necessary. 5. If the printer has the expansion-CT board, make sure the 60-pin expansion adapter is correctly seated in both the controller board and the CT board. 6. Power up the printer. If the fans run but the printer does not initialize, replace the expansion-CT board. 7. Power up the printer. If the fans run but the printer does not initialize, replace the power supply board. 8. Power up the printer. If the fans run but the printer does not initialize, replace the controller board. 9. Power up the printer. If the problem persists, replace the shuttle frame assembly. 10. Power up the printer. If the problem persists, replace the control panel and cable.

Table 3. General Symptom List

Symptom	Solution
Power Stacker	
Printer does not detect presence of power stacker	1. Check that the power stacker is enabled under the Printer Control menu. (Refer to the *Setup Guide.)* If the power stacker enable/disable option does not appear in the menu, go to the next step. 2. Open the rear cabinet door. Check that the ON/OFF indicator lamp is lit. If the ON/OFF indicator is not lit, go to step 3. If the ON/OFF indicator is lit, press the ON LINE key and check that the ON LINE indicator lights. If the ON LINE indicator comes on, the stacker is detected by the printer. If the ON LINE indicator does not come on, go to step 4. 3. a) Power off the printer. b) Unfasten the cable clamp holding the stacker control panel cables. c) Disconnect the stacker power cable from the back of the stacker control panel. (See ee Figure 76, page 381.) d) Locate pin 1 of connector P106. (See the cable assembly drawing in Appendix A.) e) Power on the printer. f) At connector P106 check for +48 volts DC between pins 1 and 2 and +5 volts DC between pins 3 and 4. If the voltages are correct, replace the stacker control panel. If the voltages are not correct, power off the printer, remove the paper path, and disconnect the stacker power cable from the controller board. (See Figure 79, page 384.) Check the continuity of the stacker power cable between P105 and P106. If the cable fails the continuity test, replace it. If the cable is OK, replace the controller board. 4. Power off the printer. Remove the paper path. Disconnect stacker cables from the controller board, stacker assembly, and the stacker control panel (see ee Figure 76, page 381). Check cables for cuts, breaks, or damaged pins. Check continuity of cables. (See Appendix A for pinouts.) Replace any cable that is damaged or fails continuity test. Reconnect all stacker cables to the controller board, stacker, and stacker control panel. 5. Power on the printer. Check that the ON LINE indicator lights on the stacker control panel. If the ON LINE indicator does not light, replace the stacker control panel. 6. Power on the printer. Check that the ON LINE indicator lights on the stacker control panel. If the ON LINE indicator does not light, replace the controller board.

Table 3. General Symptom List

Symptom	Solution
Stacker “chatters” at upper or lower limit	1. Power off the printer. Unload paper. Open the rear cabinet door and check that stacker motion is not obstructed by the control panel cable or other obstruction. Remove obstruction or reroute the stacker control panel cable as necessary. 2. Verify that the stacker rails are vertical and parallel. Adjust the stacker rails if necessary: they must be vertical and parallel. 3. Move the elevator up and down by hand and check that the limit switches are being tripped at the highest and lowest limits of elevator travel. If a swith does not trip, replace it. 4. Power on the printer. Operate the power stacker. While the stacker is operating, check that: a) all motors are operating b) the paddles are rotating c) the elevator moves smoothly and without obstruction d) the timing belts are undamaged and the belt pulleys are not slipping e) the extension springs are attached and undamaged (not bent or stretched) f) the drive rollers are not damaged g) the constant force springs are tightly mounted and undamaged Tighten pulley setscrews and/or replace damaged components as necessary.

Table 3. General Symptom List

Symptom	Solution
Stacker does not stack properly	1. Check for and removeobstructions preventing elevator movement. 2. Check for misaligned stacker rails. Adjust the stacker rails if they are not vertical and parallel. 3. Power on the printer. Operate the power stacker. While the stacker is operating, check that: a) all motors are operating b) the paddles are rotating c) the elevator moves smoothly and without obstruction d) the timing belts are undamaged and the belt pulleys are not slipping e) the extension springs are attached and undamaged (not bent or stretched) f) the drive rollers are not damaged g) the constant force springs are tightly mounted and undamaged Tighten pulley setscrews and/or replace damaged components as necessary. 4. Check the stacker limit switches. (See page 102.) If the limit switches are OK, go to the next step. 5. Check the stacker motors. (See page 103.) If the stacker motors are OK, go to the next step. 6. Remove the paper path. Disconnect stacker cables from the controller board, stacker assembly, and the stacker control panel (see ee Figure 76, page 381). Check cables for cuts, breaks, or damaged pins. Check continuity of cables. (See Appendix A for pinouts.) Replace any cable that is damaged or fails continuity test. Reconnect all stacker cables to the controller board, stacker, and stacker control panel.
Stacker elevator does not move	See “Stacker does not stack properly”
Stacker elevator moves by itself	1. Power off the printer. Inspect all stacker LEDs for dust, chaff, or dirt. (See Figure 104 through Figure 106, page 406 through page 410.) Clean the stacker LEDs and the sight tubes in the LED mounts. 2. Power on the printer. If the stacker elevator moves by itself, replace the stacker LEDs. (See Figure 104 through Figure 106, page 406 through page 410.)

Table 3. General Symptom List

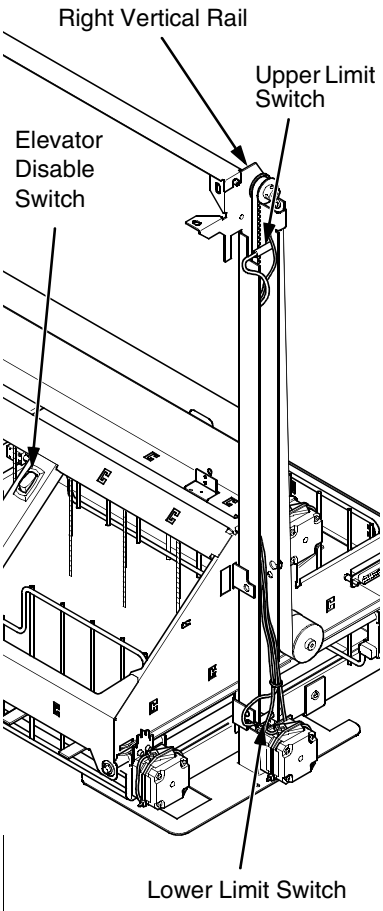
Symptom	Solution
Stacker limit switch check  	**NOTE:** This procedure tests the upper and lower limit switches on the right vertical rail. These magnetic switches are normally closed. You can quickly check their functionality with a small, powerful magnet. You will usually be referred to this procedure from other troubleshooting procedures. When you have completed this check procedure, return to the procedure that sent you here. 1. Power on the printer. Open the rear cabinet door. Unload the power stacker. 2. Press the Elevator Disable Switch and manually lift the elevator all the way to the top of its travel. 3. Position a small, powerful magnet between the belt and vertical rail so that it is in front of the exposed face of the lower limit switch. Tape or otherwise secure the magnet in position so that your hands are clear of the vertical rail and elevator. a. With the magnet secured next to the lower limit switch press the ELEVATOR DOWN key on the stacker control panel. b. If the elevator does NOT move, the lower limit switch is OK. Remove the magnet and go to step 4. c. If the elevator moves, release the ELEVATOR DOWN key, power down and unplug the printer, and replace the lower limit switch. 4. Press the Elevator Disable Switch and manually move the elevator all the way down to the bottom of its travel. 5. Position a small, powerful magnet between the belt and vertical rail so that it is in front of the exposed face of the upper limit switch. Tape or otherwise secure the magnet in position so that your hands are clear of the vertical rail and elevator. a. With the magnet secured next to the upper limit switch press the ELEVATOR UP key on the stacker control panel. b. If the elevator does NOT move, the upper limit switch is OK. Power down, unplug the printer, remove the magnet, and return to the procedure that sent you to this check procedure. c. If the elevator moves, release the ELEVATOR UP key, power down and unplug the printer, and replace the upper limit switch.

Table 3. General Symptom List

Symptom	Solution
Stacker motor check	**NOTE:** This procedure tests the four stacker motors and their cables. You will usually be referred to this procedure from other troubleshooting procedures. When you have completed this procedure, return to the procedure that sent you here. 1. Power off the printer. 2. Open the rear cabinet door. 3. Unfasten the cable clamp holding the stacker control panel cables. 4. Disconnect stacker rail cable connector P107 from connector J3 on the back of the stacker control panel. (See ee Figure 76, page 381.) 5. Disconnect stacker frame cable connector P102 from connector J4 on the rear of the stacker control panel. (See ee Figure 76, page 381.) 6. Locate pin 1 of connector P102 and connector P107. (See the cable assembly drawings in Appendix A, page 347 and page 351.) 7. Check both cables for pin damage, continuity, and shorts. 8. Check all motors for 15.2 ± 1.5 Ohms on both phases. (Refer to the power stacker control panel PCBA pinout drawing on page 327.) 9. Replace any cable that is damaged or fails continuity test. Replace any motor that fails the resistance test.
Stacker not operating	See “Printer does not detect presence of power stacker,” page 99.

Table 3. General Symptom List

Symptom	Solution
Print Quality	
Characters or dots are missing, smeared, too light, or too dark	1. Check the forms thickness lever: if it is set too loose or too tightly print quality can be affected. Set the forms thickness lever to match the thickness of the paper being used. 2. Check the paper tension between the tractors. Adjust the right tractor so that it does not pull paper too tightly or leave it too loose. The right tractor should hold the paper under “slight” tension. 3. Inspect the shuttle frame assembly for print chaff, debris, or ink residue that could be causing the problem. Clean the shuttle frame assembly. 4. Check the ribbon for folds or tears. Check that the ribbon guides are tight and the ribbon tracks straight across them. Rewind or install new ribbon. If the ribbon does not track straight across the ribbon guides, adjust the ribbon guides. If the ribbon guides are loose, tighten them. If the ribbon guides are damaged, replace them. 5. Power off the printer. Remove the shuttle cover. Remove the shuttle frame assembly. Inspect the ribbon mask for bends or deformation that adversely affect paper feeding. Make sure the hammer bank cover assembly is correctly installed on its mounting pegs. Check the shuttle frame assembly for broken hammer springs, hammer tips, or contaminations. Replace any damaged hammer spring assemblies. Replace the hammer bank cover assembly if it is deformed or damaged. 6. Check the platen gap. Adjust the platen gap if necessary. 7. Remove the paper path. Make sure Connectors P105 and P108 have good connections on the controller board. Make sure connectors P04 and P05 have good connections at the shuttle frame assembly. Reseat connectors P04, P05, P105, and P108. 8. Power on the printer. If the problem still occurs, replace the hammer bank logic cable and the hammer bank power cable. 9. Power on the printer. If the problem still occurs, replace the shuttle frame assembly. 10. Power on the printer. If the problem still occurs, replace the power supply board. 11. Check the shuttle for electrical shorts (page 159). 12. Power on the printer. If the problem still occurs, replace the controller board.

Table 3. General Symptom List

Symptom	Solution
Characters are compressed on first line of a form	1. Check the dynamic paper tension. 2. Adjust the tension of the tractor belts (page 158).
Horizontal misalignment of characters (Dots or characters move left or right from dot row to dot row or line to line)	1. Take the printer offline and print a test pattern of All H's. If characters shift left or right from line to line, there might be a proportional spacing problem. If the pattern of H's prints correctly (that is, all the columns line up), contact your support group or configuration help desk, because a configuration change may be necessary. If the pattern of H's did not print OK, go to the next step. 2. Check the hammer phasing. Adjust hammer phasing if necessary. 3. Inspect the shuttle frame assembly area for ink residue, paper chaff, or debris. Clean the shuttle frame assembly. 4. Check the MPU gap. Using a feeler gauge, adjust the gap between the MPU assembly and the flywheel to 0.010 ± .001 inch (0.254 ± 0.025 mm). Torque the 7/16 inch MPU clamp screw to 18 ± 1 inch-pounds (2.03 ± 0.11 N•m). 5. Power up the printer. Run a print test. If the symptom is not gone, replace the MPU. 6. Check the shuttle for shorts (page 159). 7. Power up the printer. Run a print test. If the symptom is not gone, replace the controller board. 8. Power up the printer. Run a print test. If the symptom is not gone, replace the shuttle frame assembly.

Table 3. General Symptom List

Symptom	Solution
Randomly misplaced dots	1. Power off the printer. Check the platen gap. Adjust the platen gap if necessary. 2. Remove the paper path. On the left rear wall of the card cage, make sure the nut which secures the line filter ground line and the AC In Power Supply cable lead to the ground stud is tight. (See Figure 47, page 264.) 3. Disconnect the AC power cord and check the ground leads for continuity. Replace the AC power cord if it fails continuity test. 4. Check the shuttle for shorts (page 159). 5. Make sure the printer is plugged in to a grounded power outlet. Power up the printer. Run a print test. If the problem occurs, replace the hammer bank logic cable. 6. Power up the printer. Run a print test. If the problem occurs, replace the flash memory and DRAM. Download the emulation software again. 7. Power up the printer. Run a print test. If the problem occurs, replace the controller board. 8. Power up the printer. Run a print test. If the problem occurs, replace the power supply board. 9. Power up the printer. Run a print test. If the problem occurs, replace the shuttle frame assembly.

Table 3. General Symptom List

Symptom	Solution
Vertical misalignment of characters: 1. Dots or characters move up or down from dot row to dot row or line to line 2. Incorrect spacing from dot row to dot row or line to line 3. Characters randomly compressed and/or enlarged	1. Load paper. Press **PAPER ADVANCE** and check that paper feeds smoothly. Press **VIEW** to verify that paper moves in both directions. Check the forms thickness lever: if it is set too loose or too tightly print quality can be affected. Set the forms thickness lever to match the thickness of the paper being used. 2. Check the condition and tension of the paper feed timing belt. Adjust the paper feed timing belt. Replace the belt if it is damaged. 3. Check the platen gap. Adjust the platen gap. 4. Inspect the tractors and tractor door springs for damage, excessive wear, and equal door closing tension. If either tractor is worn, damaged, or exhibits uneven door closing tension, replace both tractor assemblies. 5. Check the dynamic paper tension. 6. Remove the paper path. Make sure connector P107/PAPR M is fully seated in connector J107 on the controller board. 7. Load paper. Power on the printer. Run a print test. If the problem occurs, replace the paper feed motor. 8. Run a print test. If the problem occurs, replace the controller board. 9. Run a print test. If the problem occurs, replace the power supply board.

Table 3. General Symptom List

Symptom	Solution
Printer Operation	
Downloads consistently fail	**NOTE:** Most download problems are detected by software during the procedure and communicated by LCD messages. If downloads fail consistently with no messages or with erratic messages, suspect a hardware failure. 1. Power off the printer. Remove the paper path. Check the I/O cable connections from the host to the printer. Check the parallel cable connection at J112 on the controller board. Inspect all cables for damaged, bent, broken, or burnt pins. Replace any damaged cables. Reconnect all I/O cables; make sure all connections are clean and tight. 2. Remove the flash SIMMs. Inspect the flash SIMM sockets on the controller board. If any socket pins are bent or damaged, replace the controller board. 3. Check that customer has the right size SIMMs for the emulation. (See page 213) Install SIMMs that support the emulation software. 4. Power up the printer. Download the emulation (page 164). If the download fails, activate the Boot Diagnostics Menu (page 122) and run MISC UTILITIES / RUN MEMORY TESTS. If memory fails test, replace the DRAM. If memory tests OK, replace the flash SIMM(s). 5. Power up the printer. Download the emulation (page 164). If the download fails, replace the controller board.
Flash SIMM won't copy	1. Power off the printer. Remove the flash SIMMs. Inspect the flash SIMM sockets on the controller board. If any SIMM socket pins are bent or damaged, replace the controller board. 2. Make sure the blank SIMM is the same size as the SIMM to be copied. Install the SIMMs, making sure they are fully and correctly seated. Power on the printer. From the Boot Diagnostics menu, select and run MISC UTILITIES / COPY FLASH SIMMS. (See page 122.) If the DESTINATION NOT DETECTED message appears, the blank SIMM is not a type supported by the boot code on the original SIMM. If SOURCE LARGER THAN DESTINATION appears, the blank SIMM is not large enough to contain the code on the original SIMM. If the SIMM does not copy or the ERROR WRITING TO FLASH message appears, replace the blank SIMM. 3. Power on the printer. From the Boot Diagnostics menu, select and run MISC UTILITIES / COPY FLASH SIMMS. If the new SIMM does not copy, replace the controller board.

Table 3. General Symptom List

Symptom	Solution
Paper feeds poorly	1. Check the forms thickness lever: if it is set too tightly paper feeding can be affected. Set the forms thickness lever to match the thickness of the paper being used. 2. Power off the printer. Remove paper. Inspect the paper feed path for obstructions that could snag paper. Clear paper feed path of any obstructions. 3. Inspect the tractors and tractor door springs for damage, excessive wear, and equal door closing tension. If either tractor is worn, damaged, or exhibits uneven door closing tension, replace both tractor assemblies. 4. Check the condition and tension of the paper feed timing belt. Adjust the paper feed timing belt. Replace the belt if it is damaged. 5. Check the platen gap and adjust if necessary. 6. Remove the shuttle frame assembly and check the following: a. Inspect the hammer bank cover assembly for ribbon debris, paper debris, or other foreign matter. Make sure the four foam spacers on the ribbon mask are properly seated. If the ribbon mask or hammer bank cover is damaged or deformed, replace it. b. Inspect the paper ironer for distortion or misalignment. Reposition or replace it if necessary. c. Make sure the paper guides are properly seated on the splined and support shafts and that their lower ends are seated in the groove on the upper forward edge of the platen. d. Make sure the paper entrance guide pivots freely with minimal down force. Reposition the springs or the guide if necessary. e. Check for correct position and function of the paper motion detector assembly. Reposition or replace if necessary. 7. Inspect the paper path from above (below the paper ironer), and from below (above the paper entrance guide), for debris, foreign matter, or anything that could inhibit paper motion. Correct as necessary. 8. Check the dynamic paper tension. 9. Remove the paper path. Make sure connector P107/PAPR M is fully seated in connector J107 on the controller board. Check for a good paper feed motor connection to J103 on the controller board

Table 3. General Symptom List

Symptom	Solution
Paper feeds poorly (continued)	10. Load paper. Power on the printer. Press **PAPER ADVANCE** and **VIEW** several times and check that paper moves in both directions. Replace the paper feed motor if paper does not move in both directions. 11. Power on the printer. Press **PAPER ADVANCE** and **VIEW** several times and check that paper moves in both directions. Replace the controller board if paper does not move in both directions.
Power on “hang” condition	1. Remove the paper path. Reseat all cable connections to the controller board and the power supply board. 2. Power up the printer. If the printer “hangs,” replace the controller board. 3. Power up the printer. If the printer “hangs,” replace the power supply board.
Printer does not print from the host	1. Check the host data cable connection at the rear of the printer. Attach the data cable to the printer interface. 2. Make a configuration printout. Verify that the printer matches host interface settings. Set printer interface parameters to match those of the host. 3. Power up the printer. Send a print job from the host. If printer does not print and the interface is RS-232, interchange the wires to pins 2 and 3. (This is the most common cause of an inoperative RS-232 cable.) Verify that the host and printer have the same baud rate, number of data bits, number of stop bits, and parity. Configure the host for XON/XOFF if possible, since this requires the least complex cable. 4. Power up the printer. Send a print job from the host. If the printer does not print from the host, replace the data and interface cable assemblies. 5. Remove the paper path. Check all cable connections on the controller board. Reseat all cable connectors on the controller board. 6. Power up the printer. Send a print job from the host. If the printer still does not print from the host, replace the controller board.

Table 3. General Symptom List

Symptom	Solution
Printer does not print self tests	1. Power off the printer. Remove the paper path. Disconnect the control panel cable from connector J110 on the controller board. Disconnect the control panel cable from the control panel. Check continuity of the control panel cable assembly. Replace the control panel cable assembly if it fails continuity test. 2. Connect the control panel cable assembly to J110 on the controller board and to the control panel. Load paper. Power on the printer. Run a self test. If the self test does not run, replace the control panel assembly. 3. Power on the printer. Run a self test. If the self test does not run, replace the controller board.
Reverse paper feed: platen does not open	1. Raise the forms thickness lever and check that the platen opens. If the platen opens with difficulty, inspect for and remove jams or obstructions. 2. Check the condition and tension of the platen open belt. Adjust the platen open belt. Replace the belt if it is damaged. 3. Check the platen gap. Adjust the platen gap. 4. Power off the printer. Remove the paper guide assembly. Disconnect connector P106 from the controller board. Check the resistance of connector P106/PLAT M. (Refer to the Main Wire Harness Test Tables in Appendix A.) Replace the platen open motor if it fails the resistance test. 5. Power on the printer. Press **PAPER ADVANC**E and **VIEW** several times and check that paper moves in both directions. Replace the controller board if the platen does not open during paper reverse.

Table 3. General Symptom List

Symptom	Solution
TOF is lost repeatedly	1. Check that the customer is setting the forms length to match the size paper used. Set the forms length to match the length of paper being used. 2. If the customer is using multi-part forms, check that the forms thickness lever is not being set too tightly. Set the forms thickness lever to match the thickness of paper and provide satisfactory print quality, but not too tightly. 3. Check the condition and tension of the paper feed timing belt. Adjust the paper feed timing belt. Replace the belt if it is damaged. 4. Remove the paper path. Make sure connector P107/PAPR M is fully seated in connector J107 on the controller board. Connect P107/PAPR M to J107 on the controller board. 5. Check the dynamic paper tension. 6. Power on the printer. Load paper and set TOF. Press **PAPER ADVANCE** and **VIEW** several times and check that paper returns to TOF. Replace the paper feed motor if paper does not return to TOF. 7. Power on the printer. Press **PAPER ADVANCE** and **VIEW** several times and check that paper returns to TOF. Replace the controller board if paper does not return to TOF.

Table 3. General Symptom List

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

Table 3. General Symptom List

Symptom	Solution
Shuttle	
Shuttle does not move	1. Power down the printer. Remove the shuttle cover. Check the MPU gap. Adjust the gap between the MPU assembly and the flywheel to 0.010 ± .001 inch (0.254 ± 0.025 mm). Torque the 7/16 inch MPU clamp screw to 18 ± 1 inch-pounds (2.03 ± 0.11 N•m). 2. Check that the MPU cable is connected to J03 on the mechanism base. Check that the shuttle motor cable is connected to J02 on the mechanism base. Connect the MPU and the shuttle motor cables. 3. Remove the paper path. Check that the shuttle motor drive cable is connected to J116 on the controller board. 4. Check the platen gap. Adjust the platen gap. 5. Inspect the ribbon mask for bends or deformation that snag and interfere with shuttle movement. Make sure the hammer bank cover assembly is correctly installed on its mounting pegs. Reinstall the hammer bank cover assembly. Replace a damaged or deformed hammer bank cover assembly. 6. Check continuity of the shuttle motor drive cable assembly. Replace shuttle motor drive cable assembly if it fails continuity test. 7. Power up the printer. Run a Shuttle Slow or Shuttle Fast test. If the shuttle does not move, replace the shuttle frame assembly. 8. Power up the printer. Run a Shuttle Slow or Shuttle Fast test. If the shuttle does not move, replace the power supply board. 9. Power up the printer. Run a Shuttle Slow or Shuttle Fast test. If the shuttle does not move, replace the controller board.

Table 3. General Symptom List

Symptom	Solution
Shuttle is noisy	1. Check the bolts securing the mechanism base to the base pan. Tighten the mechanism base mounting bolts if they are loose enough to permit movement of the mechanism base. 2. Remove the shuttle cover. Check the shuttle frame assembly mounting/clamp screws for looseness. Torque the 5/32 inch socket head clamp screws to 30 ± 2 inch-pounds (3.39 ± 0.23 N•m). Torque the center captive 5/32 inch socket head screw to 30 ± 2 inch-pounds (3.39 ± 0.23 N•m). 3. Inspect the shuttle area for loose hardware. Tighten loose hardware. 4. Check that the hammer bank cover assembly is correctly installed, that it has not slipped off the mounting pegs. Check that the ribbon mask has not partially separated from the hammer bank cover. Check for debris trapped between the ribbon mask, hammer bank cover, and hammer bank. Clean the shuttle frame assembly and hammer bank cover assembly if you find debris. Replace the hammer bank cover assembly if you find any damage to the ribbon mask or hammer bank cover. 5. Power up the printer. Run a shuttle test. Replace the shuttle frame assembly if it is noisy or rattles.

Communications Failures

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

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

1. Print out the printer configuration, including the E-Net Test Page if the customer is using the Ethernet interface.
2. Obtain a copy of the Device Host Configuration if possible.
3. Call your support group for assistance in problem analysis.

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

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

Table 4. Communications Problems

Problem	Interface	Possible Causes & Solutions
Fails to print from host -or- Prints incorrect characters -or- Prints extra characters -or- Drops characters	Parallel	• Interface cable defective • Host/Network configuration • Printer logic • Terminating Resistors
	Serial	• Host/Printer interface cable pinouts incompatible • Host/Printer/Network configuration • Set DTR and RTS both True • Interface cable defective • Printer logic
	Twinax	• Interface cable defective • Host-Printer definition • Controller/Network configuration • Printer logic
	Coax	• Interface cable defective • Controller/Network configuration • Printer logic

Table 4. Communications Problems

	Ethernet	• Interface cable defective • Host/Printer/Network configuration • Printer logic

Ethernet PCBA responds to “ping” and “ telnet” utilities, and can print from “ftp”, but card cannot be accessed by a browser.	Ethernet	1. Open a telnet session using the IP address of the Ethernet card.
		2. Enter these commands:
		`config http on`
		`save`
		`reset`
		3. Wait up to two minutes for the Ethernet card to complete a reset cycle.
		4. Close the telnet session.
		
		You should be able to access the Ethernet card now through a browser by using the IP address as a URL, as for example http://xxx.xxx.xxx.xxx
		NOTE: If the Ethernet card cannot be accessed by the Printer Manager, do the steps listed under “TCP Port Busy” on page 88.

Ethernet PCBA responds to “ping,” “ telnet,” and “ftp” utilities, but will not communicate from the host computer.	Ethernet	1. Open a telnet session using the IP address of the Ethernet card.
		2. Enter these commands:
		`start fox prn`
		`stop prn`
		3. If the fox test prints, the host computer is not configured properly.

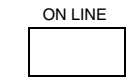
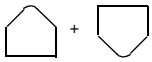
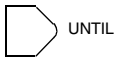
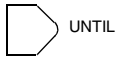
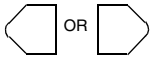
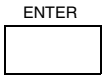
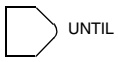
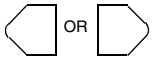
Diagnostic Printer Tests

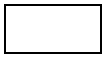
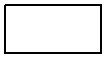
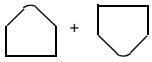
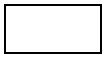
A set of printer tests is included in the configuration menu structure for use as diagnostic tools. Use these printer tests to check the print quality and basic operation of the printer. You will also use some of the tests in some adjustment procedures. The diagnostic printer tests are summarized below:

- **Shift Recycle** — A “sliding” alphanumeric pattern useful for identifying missing or malformed characters, improper vertical alignment, or vertical compression.
- **All E’s** — A pattern of all uppercase letter E’s useful for identifying missing characters, misplaced dots, smeared characters, improper phasing, or light/dark character variations.
- **E’s + TOF** — A pattern of all E’s repeated for ten lines and followed by a form feed to the top of the next page. This test is useful for identifying paper motion or paper feed problems.
- **All H’s** — A pattern of all uppercase letter H’s useful for detecting missing characters or dots, smeared characters, or improper phasing.
- **Underline Only** — An underline pattern useful for identifying hammer bank misalignment.
- **All Black** — Prints all dot positions, creating a solid black band. Exercises the shuttle and hammer bank at maximum capacity.
- **Shuttle Slow** — Exercises the shuttle and ribbon mechanisms at low speed. You can also use this test to check ribbon tracking and reversing.
- **Shuttle Fast** — Exercises the shuttle and ribbon mechanisms at high speed. You can also use this test to check ribbon tracking and reversing.
- **Shuttle Only** — Runs the shuttle mechanism with no ribbon movement.
- **Phase Printer** — A hammer timing test that permits you to adjust the hammer phase value. The hammer phase value is a timing parameter that controls the vertical alignment of dots in character printing. The numerical units are relative, they do not represent a physical measurement or value. There is no “correct” value or range. The factory prints the initial phase value on the casting of the shuttle assembly, next to the motor housing. Use this value as your starting point when adjusting hammer phasing.
- **Paperout Adj.** — Prints a vertical comb pattern. You use this pattern when you do the end of forms (paper out) adjustment procedure. The comb pattern lets you measure the number of dot rows from the completion of a paper out fault to the end of the paper.
- **Burnin Test** — Do not use. This test has no value as a maintenance tool. It is used by the printer manufacturer to burn in the printer prior to shipment.
- **Print Error Log** — Prints the current log of errors. Most non-routine faults (ribbon stall, voltage faults) are stored in the error log.
- **Clear Error Log** — Clears all entries from the error log.
- **E-NET Test Page** — Prints the Ethernet statistics stored in the Ethernet network adapter, if the adapter is installed. See page 121.

Selecting And Running Diagnostic Printer Tests

NOTE: You must set TOF after running any diagnostic test.

Step	Press	LCD Result	Notes
1.	Make sure the printer is on.		
2.	Load paper.		
3.	Set TOF. (Refer to the *User's Manual*.)		
4.		OFFLINE CONFIG. CONTROL	The printer must be off-line to run a print test.
5.		ENTER SWITCH UNLOCKED	Unlocks **ENTER** key and control panel.
		OFFLINE CONFIG. CONTROL	
6.		OFFLINE DIAGNOSTICS	
7.		DIAGNOSTICS Printer Tests	
8.		DIAGNOSTICS Test Width	
9.		Test Width Full Width*	
10.		Test Width X	Cycle through choices. X = Full Width or X = 80 columns.
11.		Test Width X*	Test width is selected.
12.		DIAGNOSTICS Test Width	
13.		DIAGNOSTICS Printer Tests	
14.		Printer Tests Shift Recycle*	
15.		Printer Tests All E's	Cycle through the choices.

Step	Press	LCD Result	Notes
16.	ENTER 	Printer Tests All E's*	Starts test.
17.	ENTER 	Printer Tests All E's*	Stops test.
18.		ENTER SWITCH LOCKED	Locks the **ENTER** key and control panel.
19.	ON LINE 	ONLINE LinePrinter+	Places the printer in on-line mode.
20.	Examine print quality. Characters should be fully formed and of uniform density.		
21.	Set TOF. (Refer to the *User's Manual*.)		

Printing The E-Net Test Page

NOTE: You must set TOF after printing the E-Net Test Page

Step	Press	LCD Result	Notes
1.	Make sure the printer is on.		
2.	Load paper.		
3.	Set TOF. (Refer to the *User's Manual*.)		
4.	ON LINE	OFFLINE CONFIG. CONTROL	The printer must be offline to run a print test.
5.	+	ENTER SWITCH UNLOCKED	Unlocks **ENTER** key and control panel.
		OFFLINE CONFIG. CONTROL	
6.	UNTIL	OFFLINE DIAGNOSTICS	
7.		DIAGNOSTICS Printer Tests	
8.		Printer Tests Shift Recycle	
9.	OR	Printer Tests E-Net Test Page	
10.	ENTER	Printer Tests E-Net Test Page*	Starts printing.
11.	ENTER	Printer Tests E-Net Test Page	Stops printing.
12.	+	ENTER SWITCH LOCKED	Locks the **ENTER** key and control panel.
13.	ON LINE	ONLINE LinePrinter+	Places the printer in online mode.
14.	Set TOF. (Refer to the *User's Manual*.)		

Boot Diagnostics Menu

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

The boot diagnostics menu is a multi-level menu that operates the same way as the user menus. The menu structure is shown in Figure 7 on page 123.

Activating The Boot Diagnostics Menu

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

Exiting The Boot Diagnostics Menu

Method 1: Resetting the printer from the Boot Diagnostics Menu

1. Using the directional keys, move to the MISC UTILITIES / RESET PRINTER menu option. (Refer to the menu map on page 123.)
2. Press the **ENTER** key.

Method 2: Cycling power

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

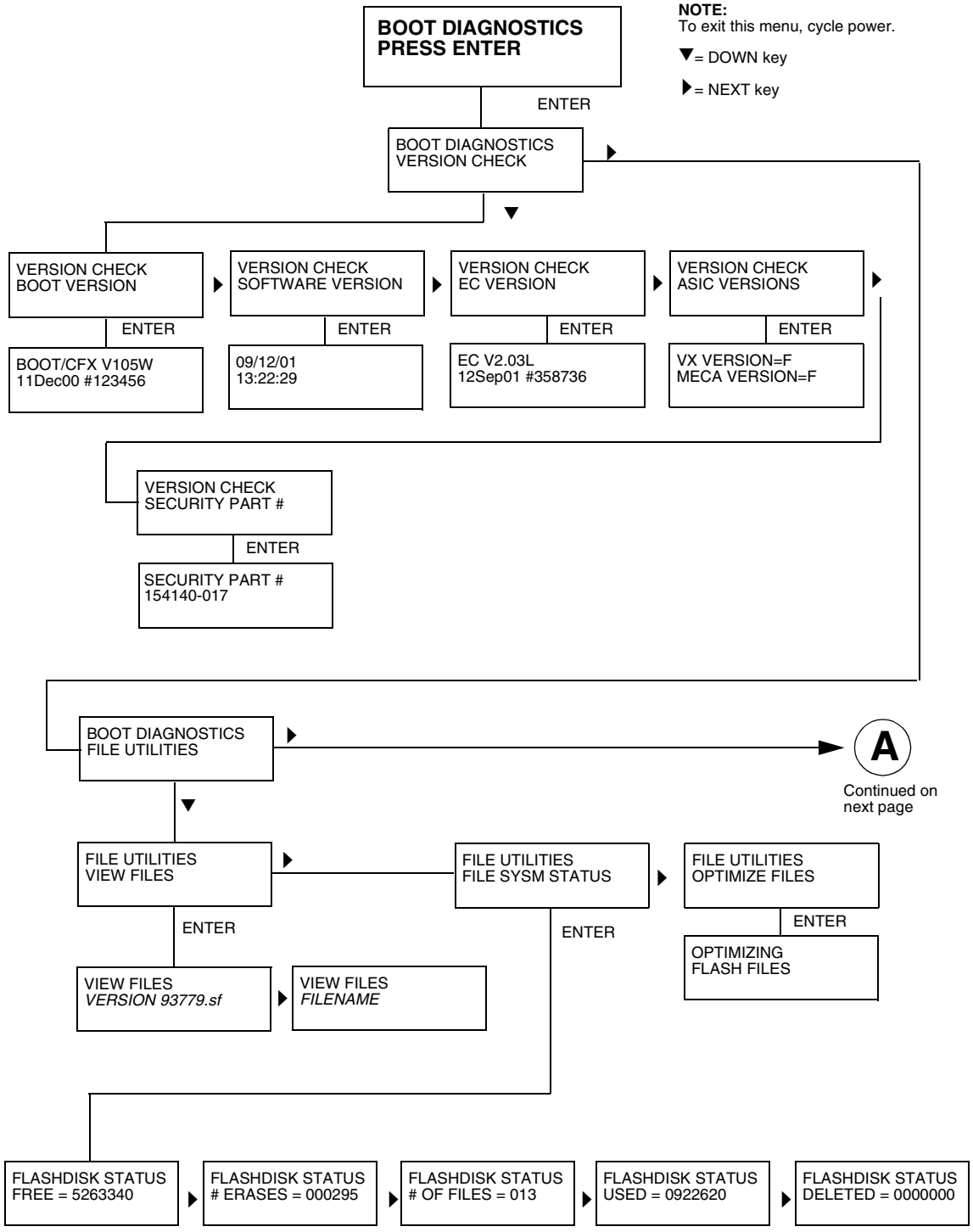


Figure 7. Boot Diagnostics Menu

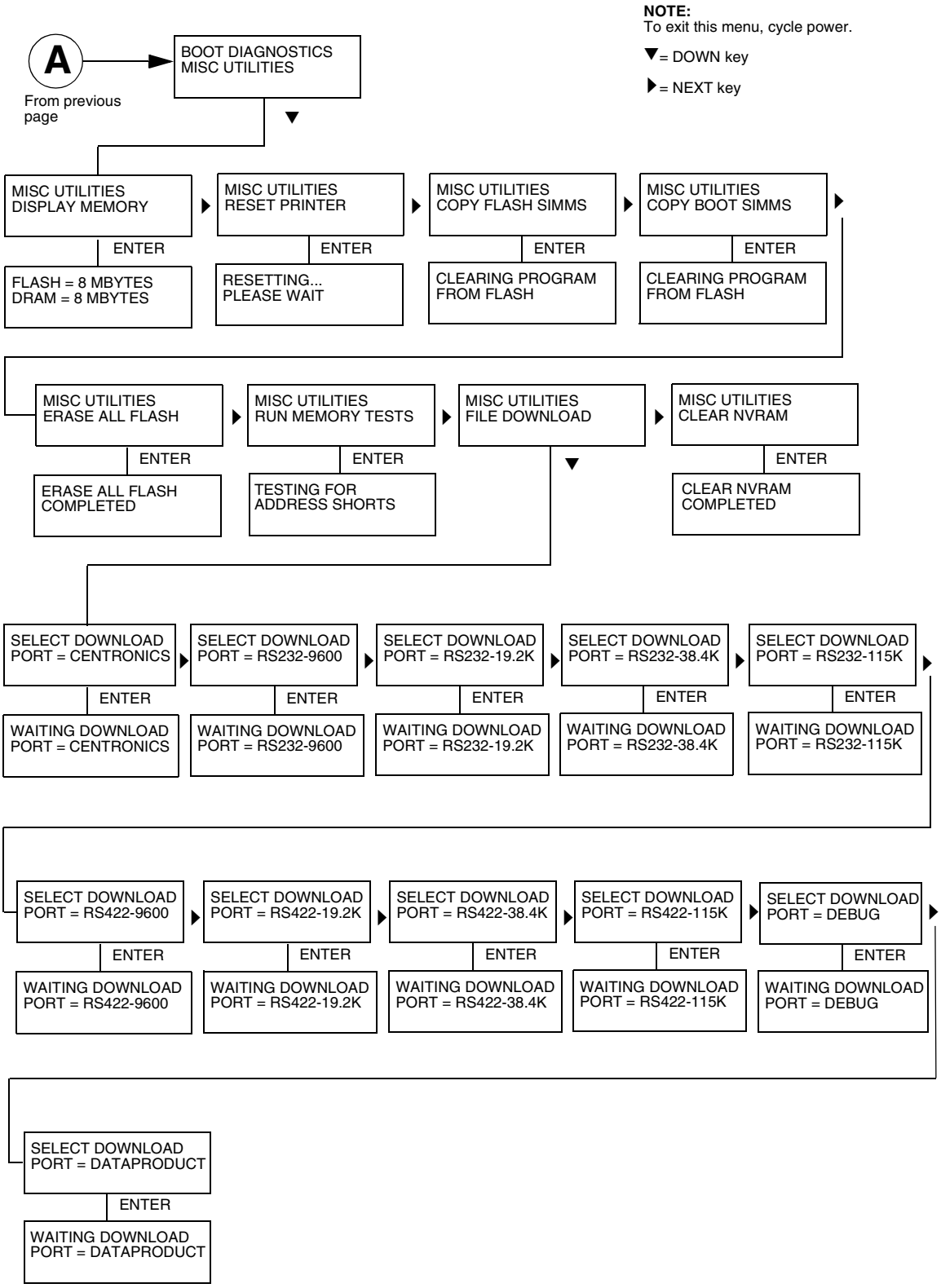


Figure 8. Boot Diagnostics Menu (continued)

Hex Code Printout

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

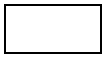
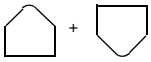
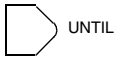
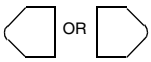
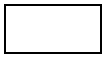
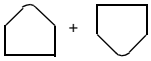
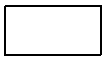
In a hex dump every printable character is printed both as its assigned symbol and as its hex equivalent. Every unprintable (ASCII control) character is printed out as a period (.) and its hex equivalent. If the printer is using a parallel interface, the letter “p” before a hex code indicates an active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

To convert an ASCII character to its corresponding hex code, or vice versa, refer to the ASCII code chart on page 127. To make a hex code printout, refer to the procedure on page 126.

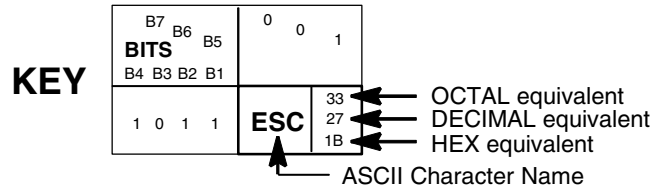
```
 !"#$%&'()*+,-./ 20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F
0123456789:;<=>? 30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F
@ABCDEFGHIJKLMNO 40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F
PQRSTUVWXYZ[\]^_ 50 51 52 53 54 55 56 57 58 59 5A 5B 5C 5D 5E 5F
`abcdefghijklmno 60 61 62 63 64 65 66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

Figure 8. Sample Hex Dump

How To Print A Hex Dump

Step	Press	LCD Result	Notes
1.	Make sure the printer is on.		
2.	ON LINE 	OFFLINE CONFIG. CONTROL	
3.		ENTER SWITCH UNLOCKED	Unlocks the **ENTER** key and control panel.
		OFFLINE CONFIG. CONTROL	
4.		OFFLINE MAINT / MISC	
5.		MAINT / MISC Hex Dump Mode	
6.		Hex Dump Mode Disable*	Default
7.		Hex Dump Mode Enable	Cycle through choices.
8.	ENTER 	Hex Dump Mode Enable*	Asterisk (*) indicates choice is active.
9.		ENTER SWITCH LOCKED	Locks the **ENTER** key and control panel.
10.	ON LINE 	ONLINE LinePrinter+	Places the printer in on-line mode.
11.	Send a file from the host computer. the printer outputs a hex dump. Refer to the ASCII chart on page 127.		
12.	When the hex dump is complete, take the printer off-line and change the Hex Dump Mode back to Disable. Follow the steps outlined above and select Disable.		

ASCII Character Set



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

Soft vs. Hard Reset

Soft Reset

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

The printer must be off-line to do a soft reset:

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

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

Hard Reset (“Cycle Power”)

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

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

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

The Power On Sequence

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

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

The power on sequence consists of two sets of routines:

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

The routines are listed below, in order of occurrence.

Controller Board Handshake Sequences

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

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

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

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

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

- **Jump Back into Flash and Clear DRAM** — Boot code jumps back into flash memory, then clears the DRAM that held the boot code.
- **Jump to MTOS** — Jump to start initialization of the MTOS (Multi-Tasking Operating System).

DC Software Initialization And Power Up

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

- Clear Uninitialized RAM Variables
- Set Initialized RAM Variables
- Configure RAM (allocated based upon amount in the printer)
- Jump to MTOS (Multi-Tasking Operating System)
- Initialize the Processor (cache, vector table, etc.)
- Partition RAM for Tasks
- Allocate Peripheral Interfaces (console driver, etc.)
- Start Main Task (supervisor)
- Verify and Initialize NVRAM (statistics are cleared if NVRAM is not valid)
- Initialize Libraries (fault, system, emulation)
- Load Front Panel Menus from ROM
- Initialize these tasks, then start them after all have initialized:

  Print Engine Driver Task

  CT Driver Task (send 8344 code to the CT expansion board)

  Serial Driver Task

  Parallel Driver Task

  CT Emulation Task

  IGP Task (PGL or VGL)

  Base Emulation Task:
  Initialize Fonts
  Initialize Graphics Library
  Complete Emulation Library Initialization
  Wait for all emulation tasks to initialize

  Front Panel Task
- Display “ONLINE” on control panel

4 *Adjustments and Test Procedures*

Introduction

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

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

Adjustments and Tests

Preparing the Printer for Maintenance ..... page 136
Returning the Printer to Normal Operation ..... page 137
Belt, Paper Feed Timing, Adjustment ..... page 138
Belt, Platen Open, Adjustment ..... page 140
Paper Drive Motor Pulley Alignment ..... page 142
Paper Scale Alignment ..... page 142
Platen Gap Adjustment ..... page 144
Ribbon Guide Alignment ..... page 146
Paper Out Adjustment ..... page 148
Hammer Phasing Adjustment ..... page 152
Coil Temperature Adjustment ..... page 154
Dynamic Paper Tension Adjustment ..... page 155
Tractor Belt Tension Adjustment ..... page 158
Shuttle Electrical Short Check ..... page 159
Hammer Bank Power Cable Shorts Test ..... page 160
Cable Shorts Test ..... page 160
Main Wire Harness Test Diagnostic ..... page 163
Loading Flash Memory in the P5220 ..... page 164
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Preparing The Printer For Maintenance

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

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

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

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

Returning The Printer To Normal Operation

When you are finished servicing the printer, test its operation and return it to service by doing the following steps:

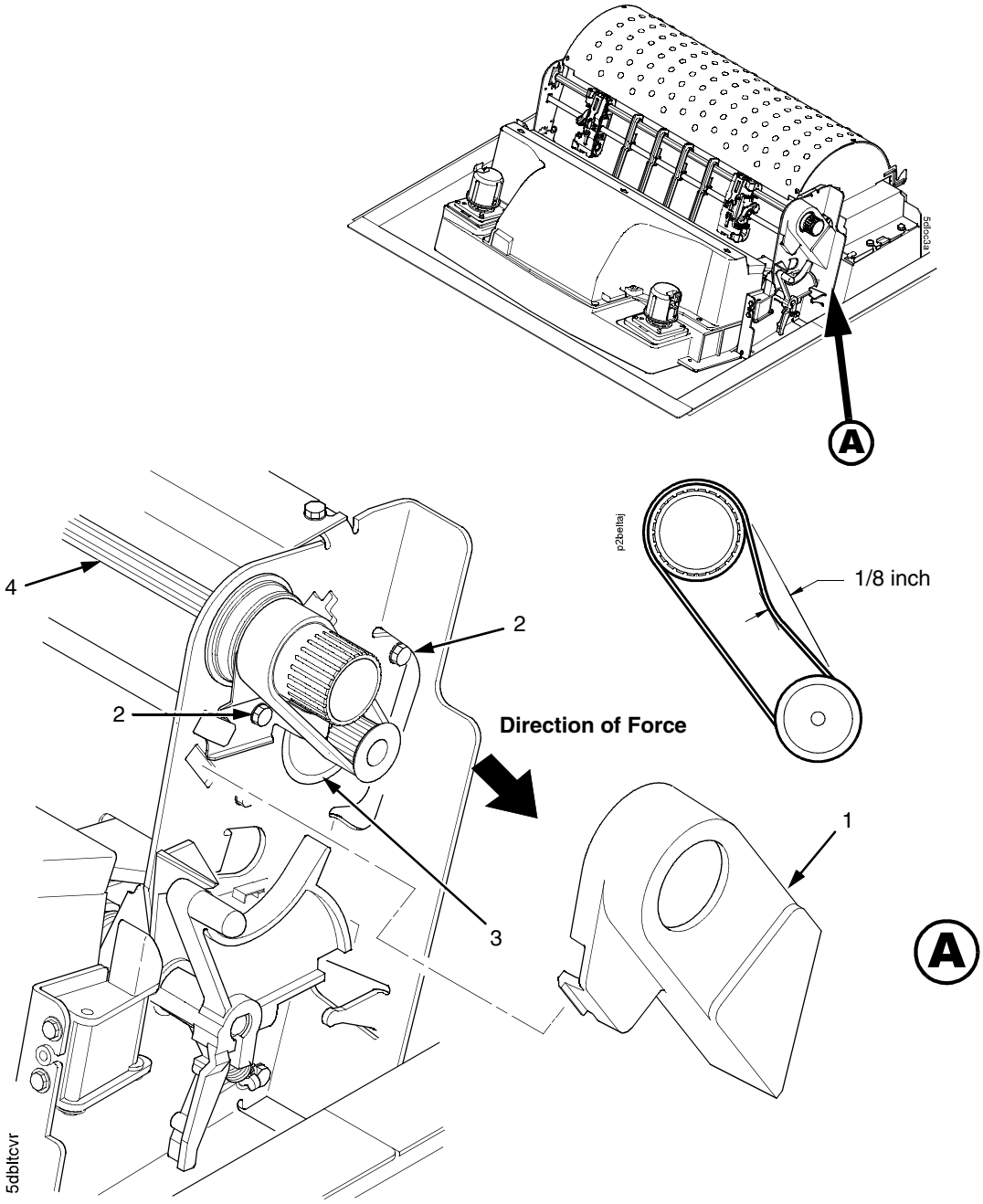
1. Install the ribbon.
2. Load paper.
3. Connect the data (signal) cable to the printer interface.
4. Plug the AC power cord into the printer and the power source.
5. Close the cabinet doors.
6. Set the printer power switch to | (on).
7. Test printer operation by selecting and running one of the operator print tests. (See page 118.)
8. Select the emulation. (Refer to the *User's Manual.)*
9. Set the top-of-form. (Refer to the *User's Manual.)*
10. Close the printer cover.

Belt, Paper Feed Timing, Adjustment

1. Prepare the printer for maintenance (page 136).
2. Remove the paper path (page 222).
3. Remove the timing belt cover (1) by squeezing the front and back to release the plastic tabs from the slots in the side plate.
4. Loosen (do not remove) the two 5/16 inch motor mount bolts (2).
5. Using the straight end of a force gauge, apply 15 pounds (66.7 N) of pressure to the paper feed drive motor (3). Use the splined shaft (4) to steady the gauge.
6. Reduce tension to 12 pounds (53.4 N) and torque the 5/16 inch paper feed motor mount bolts (2) to 18 ± 2 inch-pounds (2.03 ± 0.23 N•m).

NOTE: Belt tension is correct if the belt deflects 1/8 inch midway between the pulleys.

7. Snap the timing belt cover (1) into the slots in the side plate.
8. Install the paper path (page 222).
9. Return the printer to normal operation (page 137).



Legend:

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

Figure 9. Paper Feed Timing Belt Adjustment

Belt, Platen Open, Adjustment

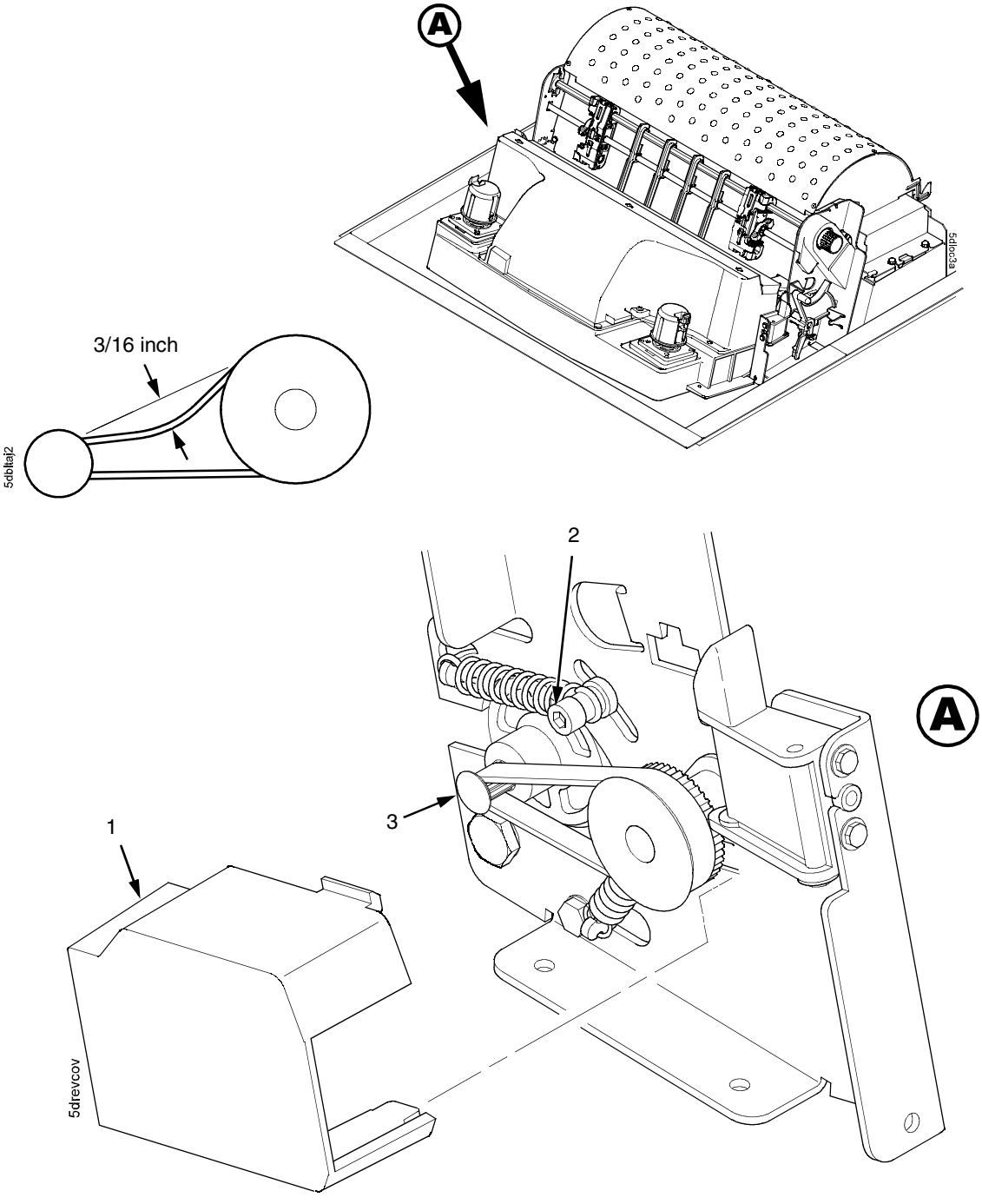
1. Prepare the printer for maintenance (page 136).
2. Remove the paper path (page 222).
3. Remove the platen open belt cover (1) by squeezing the top and bottom to release the plastic tabs from the slots in the side plate.
4. Using a 5/32 inch Allen wrench, *slowly* loosen the motor adjustment screw (2) just enough to permit movement of the platen open motor in the slotted side plate.
5. Close the forms thickness lever all the way.

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

6. The spring will automatically tension the belt.
7. *Slowly* tighten the motor adjustment screw (2).

NOTE: Belt tension is correct if the belt deflects 3/16 inch midway between the pulleys. If deflection is more or less than 3/16 inch, repeat steps 4 through 7.

8. Snap the platen open belt cover (1) into the slots in the side plate.
9. Install the paper path (page 222).
10. Return the printer to normal operation (page 137).



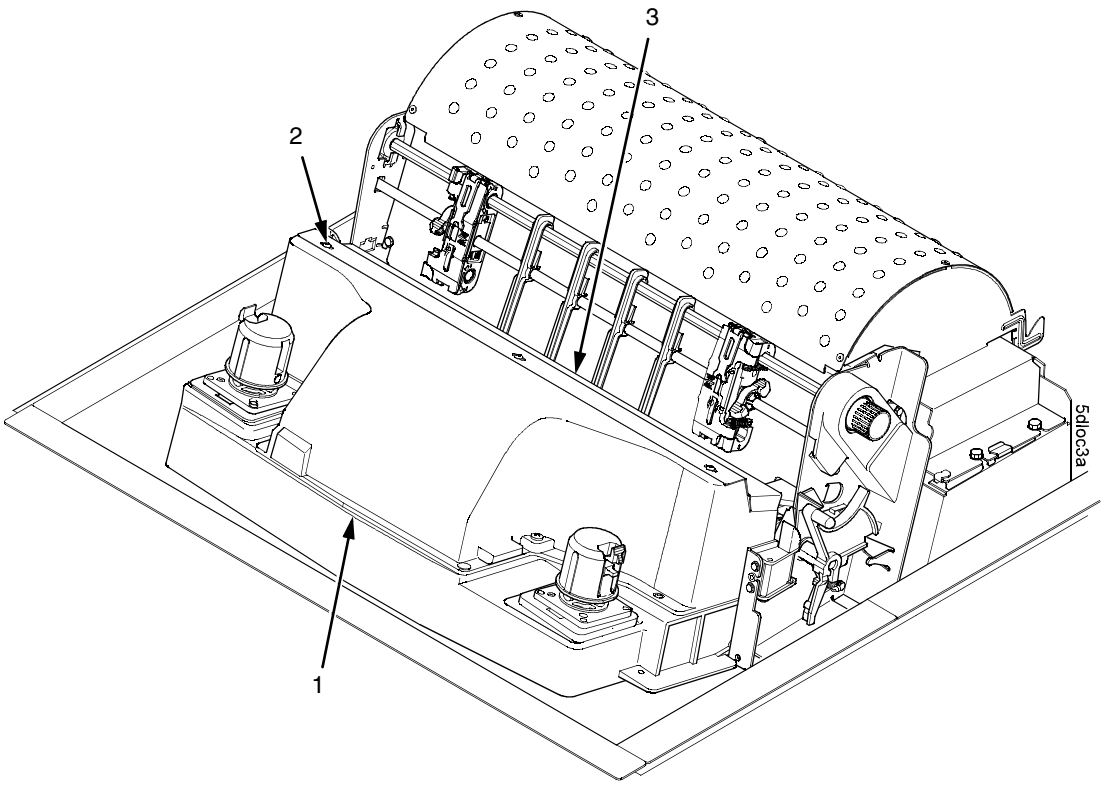
Legend:

1) Belt Cover
2) Motor Adjustment Screw
3) Platen Open Motor Shaft

Figure 10. Platen Open Belt Adjustment

Paper Scale Alignment

1. Open the printer cover.
2. Load paper and ribbon.
3. Connect the power cord to the AC power source.
4. Set the printer power switch to 1 (on).
5. Verify that the shuttle cover (1) is properly installed (page 197).
6. Print a full 136 column line by selecting and running one of the diagnostic self-tests. (See page 118.)
7. Check alignment of the scale to the print at column positions 1 and 136.
8. If adjustment is necessary, loosen the three 5/64 inch button-head hex screws (2).
9. Position the scale (3) so that column positions 1 and 136 line up with the first and last characters on the 136 character printout.
10. Tighten the 5/64 inch button-head hex screws (2).
11. Close the printer cover.



Legend:

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

Figure 11. Paper Scale Alignment

Platen Gap Adjustment

IMPORTANT **Only do this procedure if the original equipment shuttle frame assembly or platen has been replaced by a new or refurbished unit or if you are instructed to do so in another maintenance procedure.**

1. Prepare the printer for maintenance (page 136).
2. Remove the shuttle cover assembly (page 197).
3. Loosen the platen open belt (page 140, steps 2, 3, and 4).
4. Raise the forms thickness lever (1) to the fully open position.

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

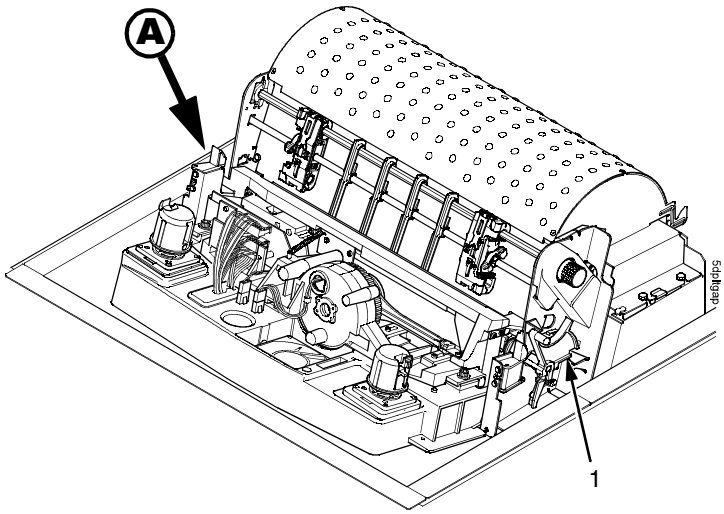
5. Insert a 0.012 inch (0.30 mm) flat feeler gauge (2) straight down between the hammer bank cover plate (3) and ribbon mask (4), about two inches from the left end of the hammer bank.

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

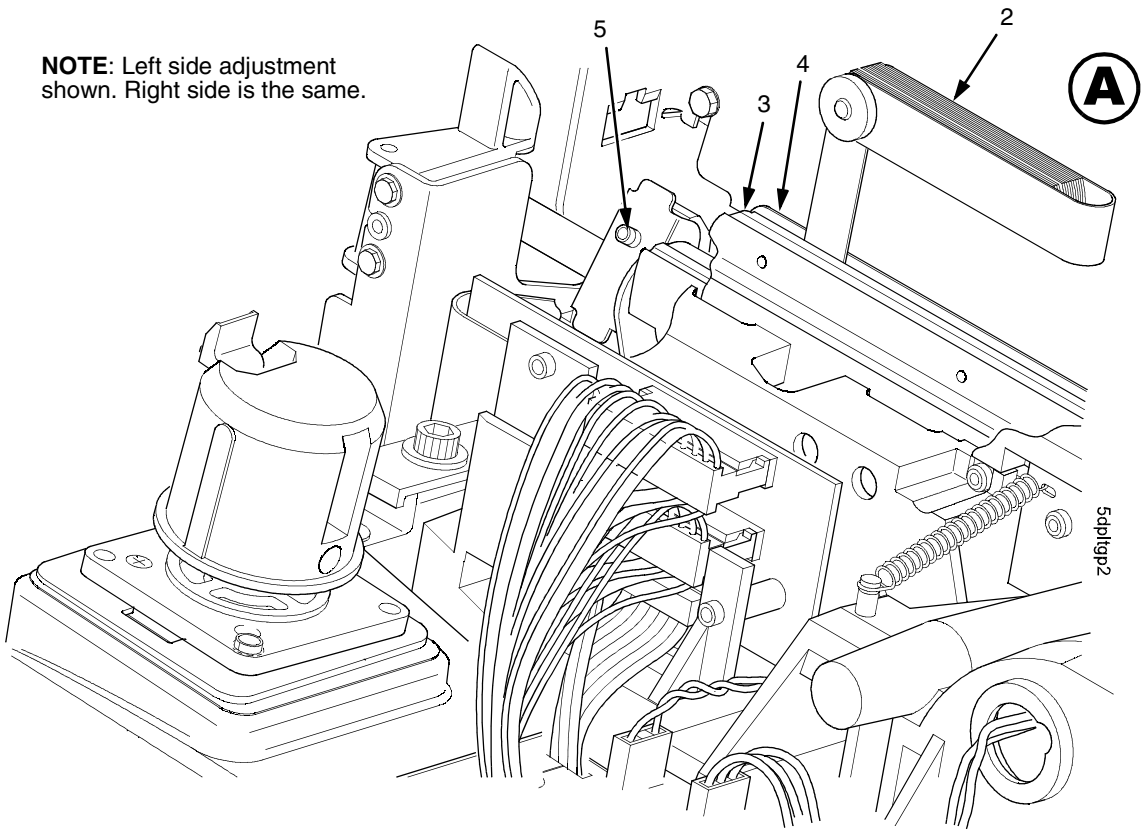
6. Gently close the forms thickness lever (1) all the way. As the platen is closing, gently slide the feeler gauge up and down, keeping it between the hammer tips and ribbon mask. If the feel is too tight when the platen is being closed, adjust the 3/32 inch setscrew (5) at the end of the platen counterclockwise. If the feel is too loose, adjust the setscrew clockwise. With the forms thickness lever closed all the way, the feeler gauge should contact both the hammer tips and the ribbon mask and move with light friction. Shift the gauge slightly to verify.
7. Repeat steps 4 through 6 at the right end of the hammer bank.
8. After adjusting both sides, check the gap again at both ends. Readjust if necessary.

NOTE: Gap widths other than 0.012 inch (0.30 mm) in the middle sections of the platen are okay, provided the gap at each end of the platen is 0.012 inch (0.30 mm).

9. When the platen gap is correct at both ends of the platen, adjust the platen open belt (page 140).
10. Install the shuttle cover assembly (page 197).
11. Check the hammer phasing adjustment (page 152).
12. Return the printer to normal operation (page 137).



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



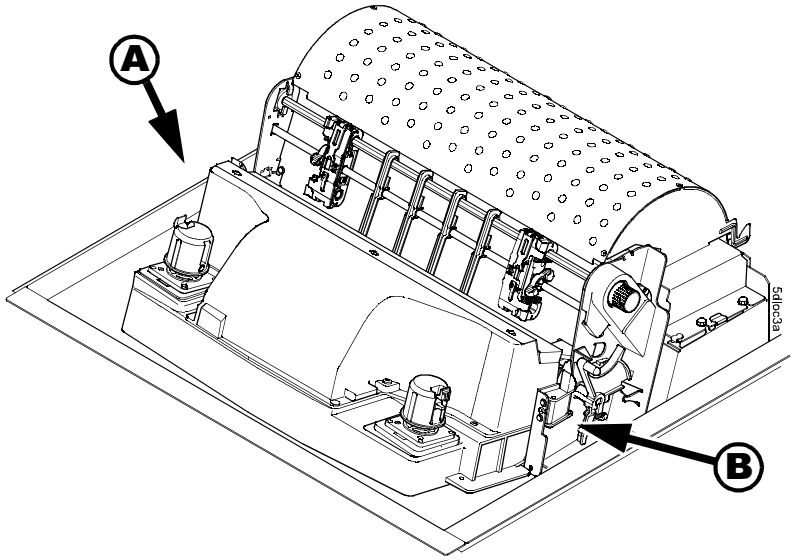
Legend:

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

Figure 12. Platen Gap Adjustment

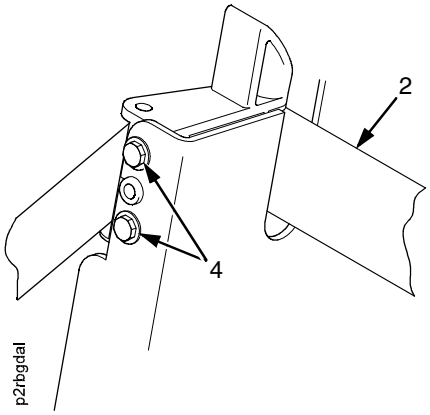
Ribbon Guide Alignment

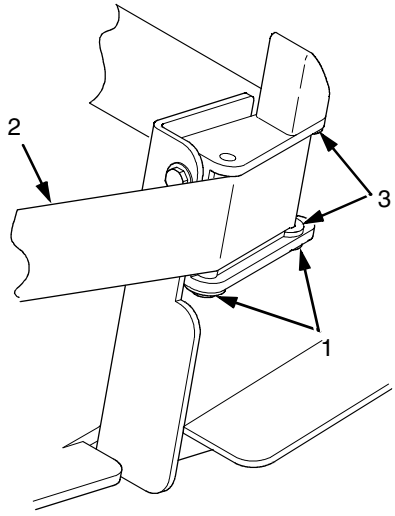
1. Open the printer cover.
2. Load paper and install the ribbon. To align a ribbon guide, wind the ribbon fully onto the ribbon spool on the opposite side. For example, to align the left ribbon guide, wind the ribbon until the right ribbon spool is full.
3. Check ribbon tracking by running a ribbon and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



A Left Ribbon Guide

Right Ribbon Guide B





Legend:

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

Figure 13. Ribbon Guide Alignment

Paper Out Adjustment

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

The measurement units in this procedure are dot rows. You will use the dot row patterns printed by the Paper Out Adjustment test to verify that this parameter is set correctly.

NOTE: Do this procedure only if a new paper detector switch assembly has been installed, the controller board has been replaced with a new or rebuilt board, or if you are sure the paper out adjustment is incorrect.

A paper out triggering distance of 1 or 2 dot rows above the perforation is acceptable and requires no further adjustment; a triggering distance of 5 to 7 dot rows above or any dot rows below the perforation indicate adjustment is required. Although not strictly required, it is highly advisable to test the paper out triggering distance with 6-part paper to verify correct printing with multi-part forms.

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

1. Open the printer cover.
2. Open the cabinet front door.
3. Load paper. Make sure the forms thickness lever is closed.
4. Plug the printer power cord into the printer and the power outlet.
5. Power on the printer.
6. On the sheet of paper just below the printer’s paper entrance slot, cut or tear a four inch square on the left side, immediately below the perforation. (See Figure 14.) This creates a hole that will trigger a LOAD PAPER message, but allows printing to the right of the hole. (Such printing in a true paper out condition would actually be on the platen).
7. If the printer is online, press the **ON LINE** key to place the printer offline.

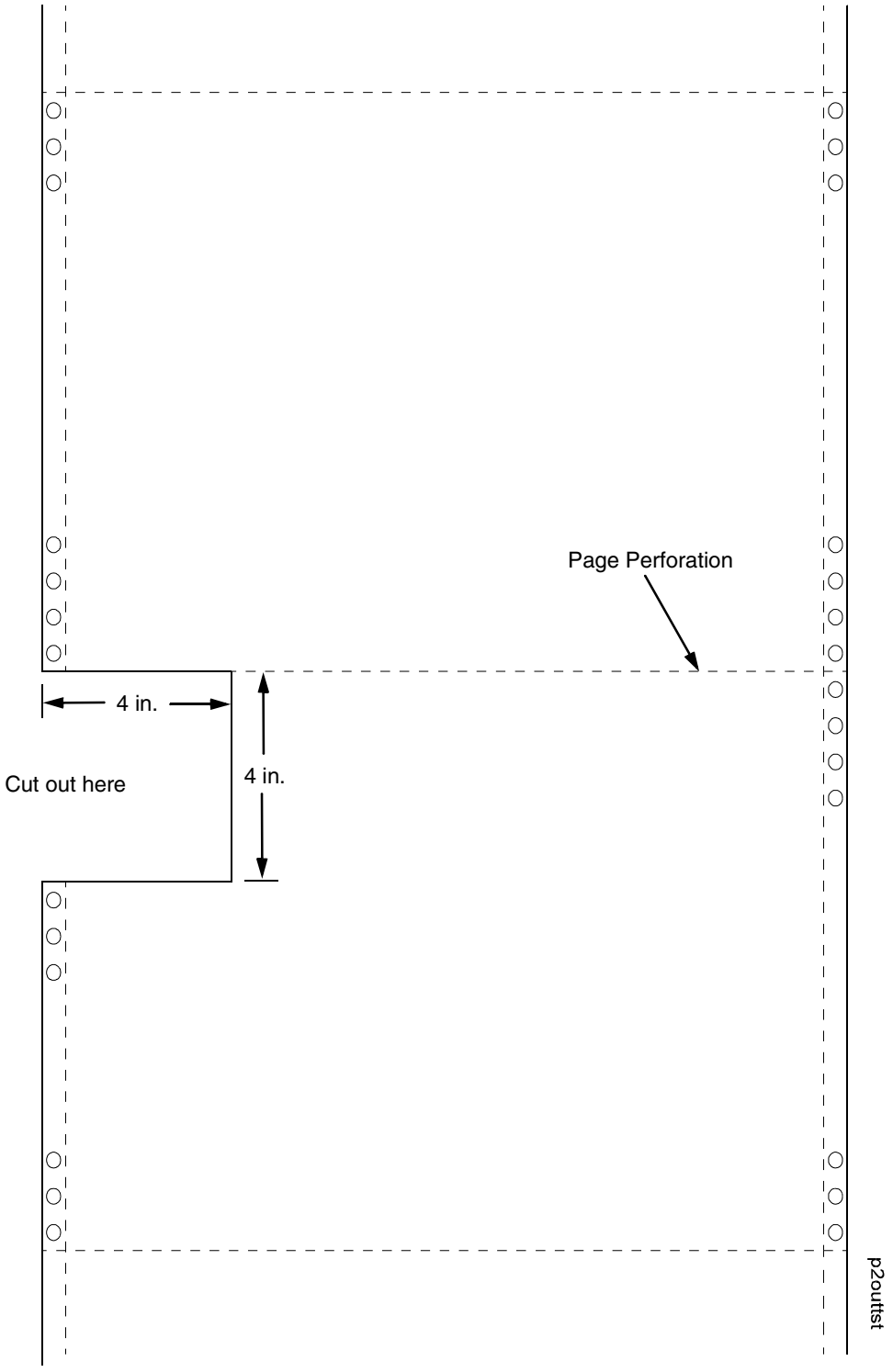


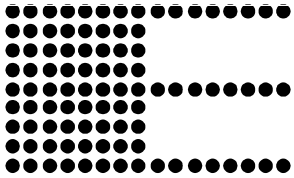
Figure 14. Paper Preparation for Paper Out Adjustment Test

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

NOTE: ▲ + ▼ is the default key combination to lock and unlock the **ENTER** key, but the combination can be changed by the user. (Ref.: *User's Manual*.) If ▲ + ▼ does not unlock the **ENTER** key, get the combination from the user.

9. Press the ◀ key. "DIAGNOSTICS" displays.
10. Press ▼. "DIAGNOSTICS / Printer Tests" displays.
11. Press ▼. "SHIFT / RECYCLE" displays.
12. Press ▶ until "Paper Out Adjustment" displays.

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



13. Press **ENTER** until the Paper Out Adjustment test starts. The comb pattern will print until the display shows "LOAD PAPER" and the audible alarm sounds.
14. Open the platen and move the paper up with the vertical position knob and examine the area of the page perforation.

    If a long bar just meets the perforation, the paper out adjustment distance is correct, skip to step 27. (1 or 2 dot rows above the perforation is OK; 5 to 7 dot rows above or any dots below the perforation mean adjustment of the Paper Out Dots value is required.)

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

15. Measure how short or long the comb pattern printed by counting the number of dot rows needed to reach the perforation, or the number of dot rows that printed beyond the perforation.

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

16. Close the platen.
17. Press **CLEAR** to remove the fault condition. "OFFLINE / CONFIG. CONTROL" displays.
18. Press the ◀ key. "DIAGNOSTICS" displays.
19. Press ▼. "DIAGNOSTICS / Printer Tests" displays.
20. Press ▶ until "Paper Out Dots" displays.

21. Press ▼. The top line of the display will show “Paper Out Dots” and the bottom line will show *XX* DOTS, where *XX* is the current setting for the number of dots.
22. Press ▼. The number of dots will move up to the top line of the display with an asterisk (*) next to it.
23. Using the ▶ or ◀ key, adjust the *XX* DOTS value up or down by the number of dots you counted in step 15. (If the comb pattern stopped short of the perforation, increase the number of dots. If the comb pattern printed beyond the perforation, decrease the number of dots.)
24. Press **ENTER** to select the new number of dots as the active value. (The asterisk that appears tells you that it is now the active value.)
25. Press **CLEAR** to place the printer off-line.
“OFFLINE / CONFIG. CONTROL” displays.
26. Run the Paper Out Dots and the Paper Out Adjustment tests until the comb pattern prints at an acceptable distance from the page perforation. (Return to step 10.)
27. When the paper out triggering distance is acceptable, reload the paper, feed it past any remaining unused holes that you tore in it, and set the top of form.
28. Press ▲ + ▼ (or the key combination set by the user). “ENTER SWITCH LOCKED” briefly displays.
29. Close the printer cover.
30. Press the **ON LINE** key to place the printer online.

Hammer Phasing Adjustment

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

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

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

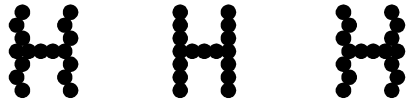
Phasing should be adjusted with the printer printing at maximum paper width.

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

1. Raise the printer cover.
2. Install the ribbon.
3. Plug the printer power cord into the printer and the power outlet.
4. Load full width (136 column) paper and set the top of form.
5. Power on the printer.
6. If the printer is on-line, press the **ON LINE** key to place the printer off-line. “OFFLINE / CONFIG. CONTROL.” displays.
7. On the control panel, press the ▲ + ▼ keys to unlock the **ENTER** key. “ENTER SWITCH UNLOCKED” briefly displays. (If “LOCKED” displays, simply press ▲ and ▼ again.)

NOTE: ▲ + ▼ is the default key combination to lock and unlock the **ENTER** key, but the combination can be changed by the user. (Ref.: *User’s Manual*.) If ▲ + ▼ does not unlock the **ENTER** key, get the combination from the user.

8. Press the ◀ key. “OFFLINE / DIAGNOSTICS” displays.
9. Press ▼. “DIAGNOSTICS / Printer Tests” displays.
10. Press ▼. “Printer Tests / Shift Recycle” displays.
11. Press ◀ until “Printer Tests / Phase Printer” displays.
12. Press **ENTER**. The display shows “Printer Tests / Phase Printer” and the test begins. The current phasing value is printed on the left of the printed pattern of all H’s. As the pattern prints, compare the H’s to the figure below. If the phasing needs adjustment, go to step 13. If the phasing is okay, go to step 16.



Needs Adjustment | **Correct** | Needs Adjustment

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

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

Coil Temperature Adjustment

Do this procedure **only** if the original controller board or shuttle frame assembly has been replaced or if you are instructed to do so in a troubleshooting procedure. Do **not** do this procedure if the original controller board or shuttle frame assembly were removed and reinstalled as part of other maintenance tasks.

IMPORTANT **The shuttle frame assembly must be at room temperature to do this procedure. If the shuttle was run prior to this procedure, allow it to cool for 1 to 2 hours before doing this procedure.**

1. Plug the AC power cord into the printer and the power source.
2. Power on the printer.
3. The printer must be offline to do this procedure. If the printer is online, press the **ON LINE** key. “OFFLINE / CONFIG. CONTROL” will display.
4. Raise the printer cover.
5. On the control panel, press the ▲ + ▼ keys to unlock the **ENTER** key. “ENTER SWITCH UNLOCKED” briefly displays. (If “LOCKED” displays, simply press ▲ and ▼ again. This is the default key combination. The lock/unlock key combination can be programmed by the user. If ▲ + ▼ does not unlock **ENTER**, get the combination from the user.)
6. Press ▲ + ▼ + ▶ + ◀ to enter the factory menu. (Press all four keys at the same time.) “Factory / Set Coil Temp” appears on the display.
7. Press **ENTER**. The display tells you to “PLEASE WAIT” while the coil temperature is set by an automatic calibration sequence in printer software.
8. When the display again reads “Factory / Set Coil Temp” press ▲ + ▼ to lock the **ENTER** key.
9. Press the **ON LINE** key to exit the Factory menu.
10. Coil temperature is now set. Power off the printer and close the printer cover.
11. Return the printer to normal operation (page 137).

Dynamic Paper Tension Adjustment

This procedure helps you identify and eliminate conditions that contribute to paper jams, excessive tension on the paper feed motor, and vertical dot compression or expansion.

1. Open the printer cover.
2. Unload paper. Make sure a ribbon is installed in the printer.
3. Unlock both tractors and move them outward to the sides as far as they will go.
4. Prepare a length of 14 inch wide paper consisting of three sheets that are still attached at the perforations. (The paper must be single part, 18 lb maximum weight, 0.0036 inch maximum thickness.) Open the cabinet front door and feed the paper up through the print station until the first page clears the ribbon mask by about one inch. (See Figure 15.)
5. Fold a two-inch piece of plastic tape over the top sheet, midway between the sides, as shown in Figure 15.

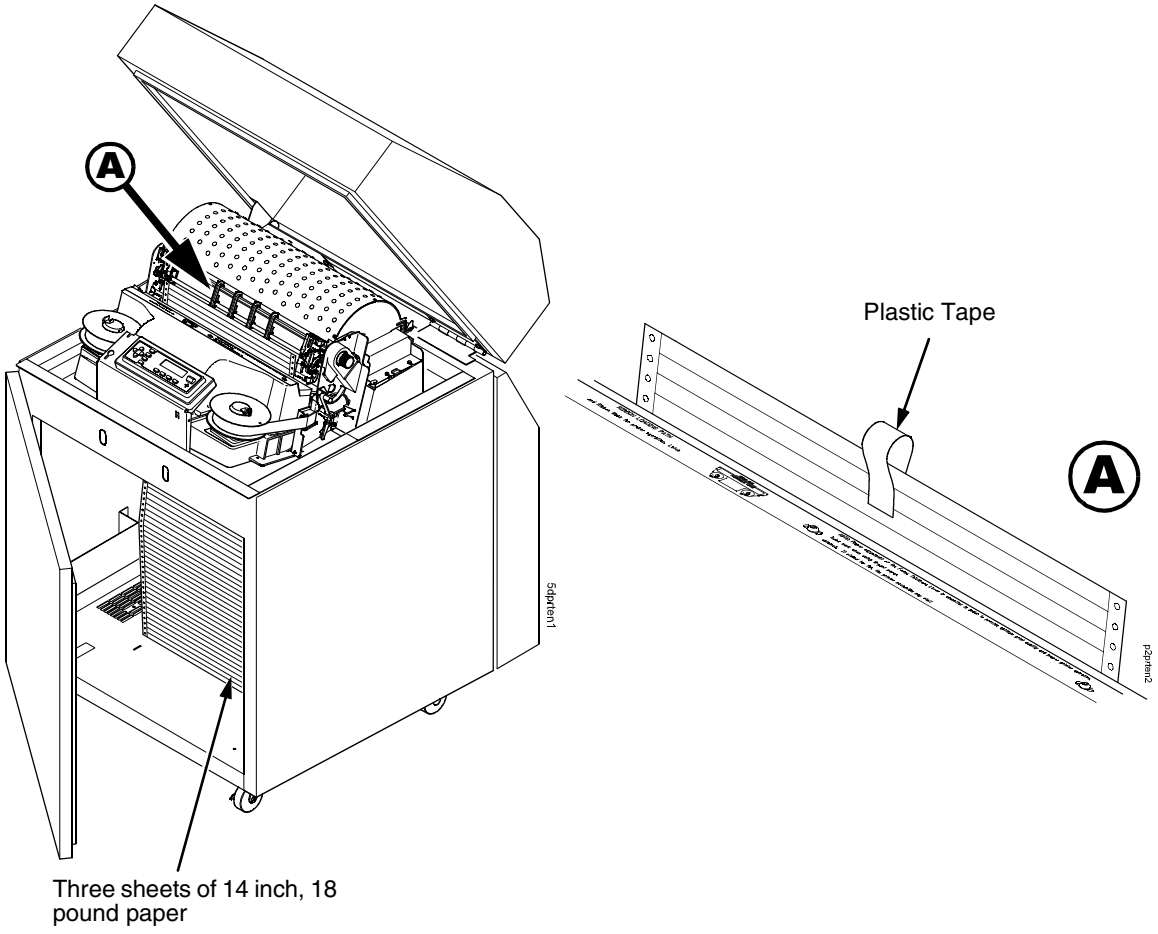


Figure 15. Preparing Paper for Tension Measurement

6. Close the forms thickness lever all the way (pointer at ‘A’).
7. Attach the hook of a “fish scale” force gauge through the tape you installed in setp 5.
8. Pull the paper slowly straight up through the print station for about six inches and note the maximum force exerted on the scale. Do not pull any page perforations through the print station. (See Figure 16.)

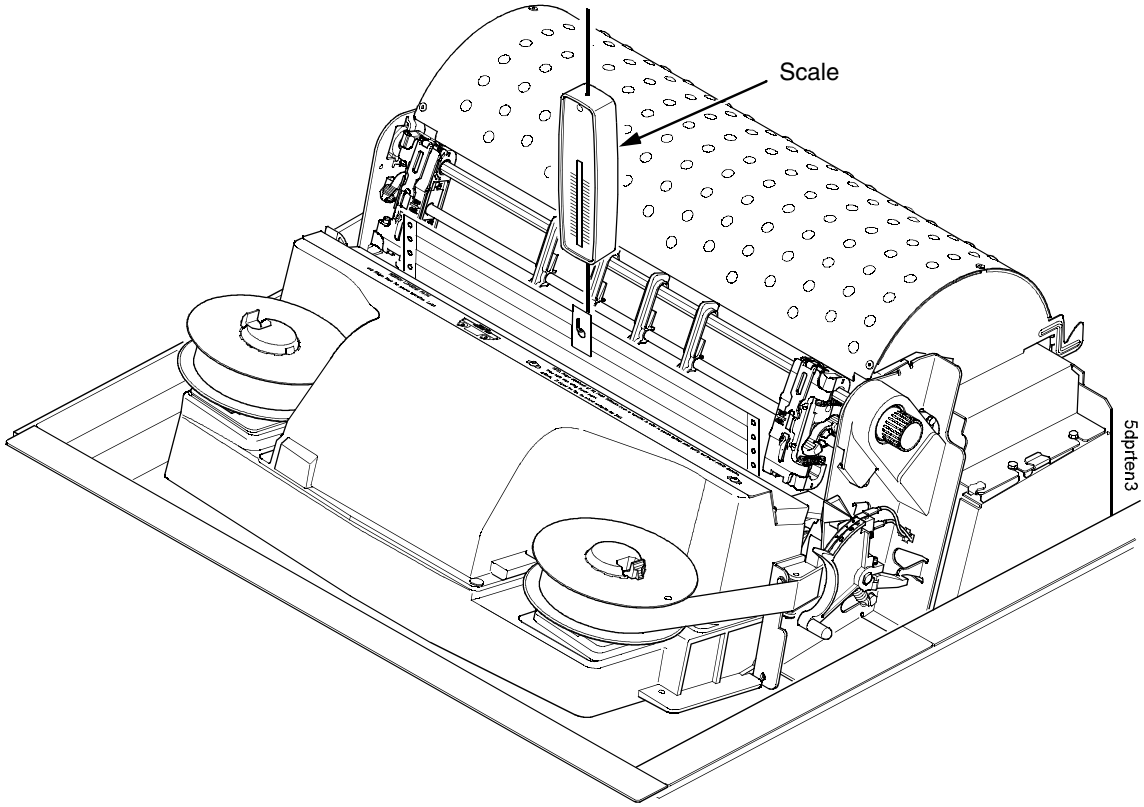


Figure 16. Measuring Paper Tension

9. Repeat steps 6 through 8 several times to get a consistent average value of force on the gauge.
10. The average tension should be 9 to 15 ounces. If the average value is greater than 16 ounces, paper handling and print quality problems are likely.
11. If the average value is greater than 16 ounces, check the platen gap (page 144), adjust if necessary, and recheck the dynamic paper tension.
12. If the platen gap is correct, remove the shuttle frame assembly (page 235) and check the following:
    a. Inspect the hammer bank cover assembly for ribbon debris, paper debris, or other foreign matter. Make sure the four foam spacers on the ribbon mask are properly seated. If the ribbon mask or hammer bank cover is damaged or deformed, replace it.

b. Inspect the paper ironer for distortion or misalignment. Reposition or replace it if necessary.

c. Make sure the paper guides are properly seated on the splined and support shafts and that their lower ends are seated in the groove on the upper forward edge of the platen.

d. Make sure the paper entrance guide pivots freely with minimal down force. Reposition the springs or the guide if necessary.

e. Check for correct position and function of the paper motion detector assembly. Reposition or replace if necessary.

f. Inspect the paper path from above (below the paper ironer), and from below (above the paper entrance guide), for debris, foreign matter, or anything that could inhibit paper motion. Correct as necessary.

Tractor Belt Tension Adjustment

Print compression can be reduced by adjusting the tension of the tractor belts. The procedure below removes the slack that might occur in some tractors.

IMPORTANT **Only do this procedure when the user reports that the first print line of forms is compressed and only after adjusting the dynamic paper tension (page 155). Always adjust both tractors.**

1. Prepare the printer for maintenance (page 136).
2. Adjust the dynamic paper tension (page 155).
3. Carefully note the initial position of the adjustment screws. (See Figure 17.)

CAUTION **Adjust tractors only ONE detent at a time. Over-tightening a tractor belt can cause other paper feed problems and result in premature wear in the tractors.**

4. On the inner side of the left tractor, use a Torx T-10 driver to rotate the adjustment screw one detent to increase tension. On the inner side of the right tractor, use a Torx T-10 driver to rotate the adjustment screw one detent to increase tension. (See Figure 17.)
5. Load paper, run a print test, and check for first line compression.
6. If compression still occurs, rotate the adjustment screws one more detent and test again.
7. If compression is not improved after adjusting the tension by two detents, return the adjustment screws to the initial positions you noted in step 3.
8. Return the printer to normal operation (page 137).

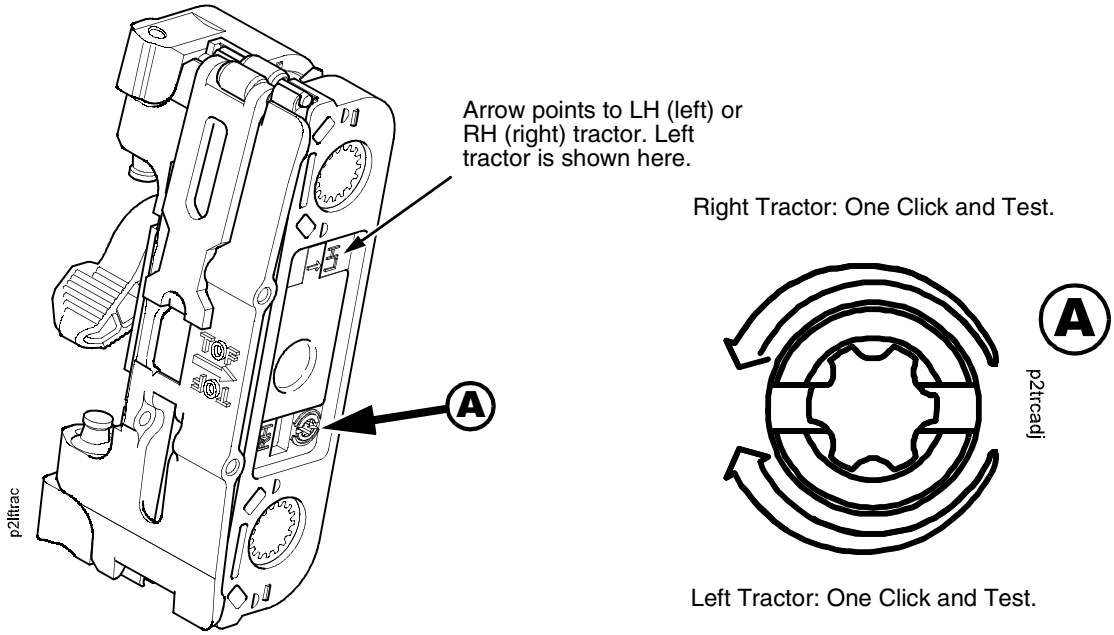


Figure 17. Tractor Belt Tension Adjustment

Shuttle Electrical Short Check

This procedure checks for metallic debris and checks for hammer coils shorting to the shuttle frame.

The hammer driver circuit board attached to the shuttle frame assembly can attract metal objects because of the magnets in the hammer bank. Such stray metal pieces can cause electrical shorting and damage to the shuttle assembly. (The hammer driver board does not have a protective cover because of concerns about component temperatures.)

IMPORTANT **Do this check —**
a) If you removed the shuttle cover during servicing and before you re-install the shuttle cover.
b) Before you replace the controller board.

1. Prepare the printer for maintenance (page 136).
2. Remove the shuttle cover assembly (page 197).
3. Check the shuttle driver circuit board area for any foreign metal parts or objects (paper clips, staples, screws, chips of metal, broken shuttle spring fragments, etc.).
4. If you find any foreign metal parts or objects, carefully remove them.
5. Disconnect the hammer bank logic cable (P04) and the hammer bank power cable (P05) at the shuttle.
6. Set your Ohmmeter to the 10K Ohm scale or the scale closest to 10K Ohms.
7. Hold the two meter leads apart from each other (not touching anything) and note how your meter indicates an open circuit. For example, some meters read OL (Over Load), -1, flashing display, infinite resistance, etc.
8. Attach the common meter lead (usually black) to the shuttle frame.
9. Touch the positive meter lead (usually red) to another part of the shuttle frame and verify continuity. (Continuity is a low resistance reading of less than 1 Ohms.)
10. Attach the common meter lead to the shuttle frame, touch the positive lead to pins 1 through 10 of both hammer bank power plugs J05 and J06 located on the terminator board on the shuttle assembly. Pin 1 of each plug is the right-most pin as you face the printer. Hold the positive lead for a few seconds on each pin allowing the meter to stabilize, then read the resistance:
    a. If the resistance of any pin is less than 1000 Ohms, replace the shuttle frame assembly (page 235).
    b. If pin resistances are 1000 Ohms or greater (including an “open” reading as in step 7), the shuttle passes the test and is probably okay. Reconnect hammer bank logic cable (P04) and hammer bank power cable (P05) to the shuttle
11. Install the shuttle cover assembly (page 197).
12. Return the printer to normal operation (page 137).

Hammer Bank Power Cable Shorts Test

This test determines if the hammer bank power cable is shorted.

1. Prepare the printer for maintenance (page 136).
2. Remove the paper path (page 222).
3. Disconnect hammer bank power cable connector P105 from J105 on the controller board. (See Figure 42, page 250, item 13.)
4. Attach or hold the common lead (usually black) of an Ohmmeter to the shuttle frame.
5. At the hammer bank power cable plug (P05) on the shuttle terminator board, touch each of the 10 pins with the positive (usually red) meter lead and test for shorts to ground. If you find any shorts to ground, replace the hammer bank power cable.
6. Disconnect the common meter lead from the shuttle frame.
7. Check the hammer bank power cable for shorts by checking pin-to-pin: touch pin 1 with one meter lead and pin 2 with the other meter lead. If there is continuity, it means there is a short. (Continuity is defined as a reading of less than 1 Ohm; in other words, very low resistance.) Repeat this process until you have tested all the pins in the cable. If you find any shorts, replace the cable.
8. Connect hammer bank power cable connector P105 to J105 on the controller board. (See Figure 42, page 250, item 13.)
9. Install the paper path (page 222).
10. Return the printer to normal operation (page 137).

Cable Shorts Test

This test determines if a cable has a short to ground or a pin-to-pin short (also called a wire-to-wire short). Such shorts can be caused by cables resting on or moving across sharp edges. The edges over time can wear away the plastic shielding of the cable, exposing the copper wire inside. A short occurs when the exposed wire touches another metal surface or conductor.

This procedure tests only the cables listed below that can be disconnected at both ends:

- Intermediate cables of devices in the Main Wire Harness Test Tables:

  Card Cage Fan

  Left Ribbon Motor

  Right Ribbon Motor

  Exhaust Fan (in cabinet models)

  Magnetic Pick-up Unit (MPU)
- Shuttle Motor Intermediate Cable
- Hammer Bank Power and Logic Intermediate Cables
- Control Panel Assembly Intermediate Cable
- Power Stacker Logic and Power (Intermediate) Cables

The Procedure:

1. Prepare the printer for maintenance (page 136).
2. Disconnect the cable to be tested at both ends, but leave the cable routing as it was before you started this procedure.
3. Set your Ohmmeter to the 10K Ohm scale or the scale closest to 10K Ohms.
4. Hold the two meter leads apart from each other (not touching anything) and note how your meter indicates an open circuit. For example, some meters read OL (Over Load), -1, flashing display, infinite resistance, etc. Record this indication for later reference.

Check for shorts to ground:

5. Attach the common meter lead (usually black) to a ground point on the printer (e.g., a bolt head on the shuttle casting).
6. Touch the positive meter lead (usually red) to another ground point and verify continuity. (Continuity is a low resistance reading of less than 1 Ohm.)

IMPORTANT **When making continuity checks, touch the meter leads to the test points for <u>at least</u> 2 to 3 seconds so your meter has time to display correctly.**

7. At one end of the cable, touch one of the pins with the positive (usually red) meter lead while the common lead (usually black) is still touching a ground point.

8. Check the pin for a short to ground, which is indicated by a meter reading of continuity (that is, a low resistance reading of less than 1 Ohm).
9. If you find a short to ground, replace the cable. If no short is detected, repeat steps 7 and 8 for the rest of the pins on the same end of the cable. If no shorts to ground are detected for any of the pins, proceed to the next section, which checks for pin-to-pin shorts.

Check for pin-to-pin shorts:

10. Disconnect the common (usually black) meter lead from the ground point.
11. Check for shorts within the cable by touching the common meter lead to pin 1 at one end of the cable and touching the positive (usually red) meter lead to pin 2 at the same end of the cable.
12. Check for a pin-to-pin short, which is indicated by a meter reading of continuity (that is, a low resistance of less than 1 Ohm). **For a properly functioning cable that has no pin-to-pin short, you will see the "open circuit" meter reading you recorded in step 4**.
13. If you find a short, replace the cable. If no short is detected, check for pin-to-pin shorts on all the remaining pairs on the same end of the cable. If no shorts are detected for any of the remaining pairs, return to the procedure that referred you to this diagnostic procedure.

Main Wire Harness Test Diagnostic

This is a procedure for extended testing of various printer components.

1. Prepare the printer for maintenance (page 136).
2. Remove the paper path (page 222).
3. Disconnect cable connectors P106 and P107 from the controller board.
4. Refer to the Main Wire Harness Test Tables on page 306 as you do the following substeps:
   a. Measure the resistance of the device(s) specified in the procedure you are working.
   b. If you have an extra 60-pin expansion-CT adapter you can break it down into a two-row by 10 pin (i.e., a 20-pin) connector, which you can insert into P106 and P107 for easier electrical measurements.
   c. On motors, use the table to test for winding continuity and for no shorts between windings and motor frame. Rotate the motor by hand and test for shorts. If you find any shorts in a motor, replace the motor.
   d. Replace any defective devices.
5. Shuttle Motor test:
   a. Remove the shuttle cover assembly (page 197).
   b. Disconnect cable P02
   c. At P02, check for approximately 0.7 Ohms per phase. Use this value to test for winding continuity and for no shorts between windings and the motor frame. Rotate the motor by hand and test for shorts.
   d. Replace the shuttle frame assembly if you find any shorts.

NOTE: A number of “intermediate” cables in the printer can be disconnected at both ends and tested using the Cable Shorts Test (page 161):

- Intermediate cables of devices in the Main Wire Harness Test Tables:

  Card Cage Fan

  Left Ribbon Motor

  Right Ribbon Motor

  Exhaust Fan (in cabinet models)

  Magnetic Pick-up Unit (MPU)
- Shuttle Motor Intermediate Cable
- Hammer Bank Power and Logic Intermediate Cables
- Control Panel Assembly Intermediate Cable
- Power Stacker Logic and Power (Intermediate) Cables

Loading Flash Memory In The P5220

Flash memory in the P5220 is contained in SIMMs (single in-line memory modules) located on the CFX controller board. Printer control languages ("emulations") and operating system software are loaded into flash memory at the factory, but you will install software in some situations:

- The customer buys the PGL or VGL graphics, Expansion-CT, or IPDS option after the printer is installed
- The customer needs to upgrade printer software
- The customer needs different emulation software
- You have replaced the controller board
- You have added or replaced the flash memory SIMM

Emulation and operating system software are stored on CD-ROM. You will copy the appropriate file from the CD-ROM to your computer's hard disk, then download that file to the printer.

You can load software through the serial, parallel, or Ethernet port of the printer:

- If you load memory through the serial or parallel port of the printer, see "Loading Through The Serial Or Parallel Port" below. Certain load commands differ, depending on which port you use. The different commands are explained in the note following step 21 (page 167).
- If the printer has the Ethernet interface installed, see "Loading Through the Network Interface Card (NIC)" on page 169.

Loading Through The Serial Or Parallel Port

1. Make a printout of all saved configurations. Installing new software erases all saved configurations. You will use the printouts to restore the printer configurations.
2. Set the printer power switch to O (Off).
3. If the printer is already connected to the serial or parallel port of an IBM-compatible computer running the PC-DOS™, MS-DOS, or Windows (3.1x, 95, 98, Me, NT, 2000, or XP) operating system, go to step 7. If not, go to the next step.
4. Disconnect all data input cables from the printer interfaces.
5. Connect a parallel data printer cable to the LPT1 port or a serial data printer cable to the COM1 port of an IBM-compatible computer running the PC-DOS, MS-DOS, or Windows (3.1x, 95, 98, Me, NT, 2000, or XP) operating system.

NOTE: You can connect the cable to the LPT2 port if the LPT1 port is already in use. The load commands are different if you use this port, as described in the note after step 21.

6. Connect the data cable to the appropriate I/O port of the printer.

7. On the printer control panel, press and hold down the **ON LINE + PAPER ADVANCE** keys. Without releasing the keys, power the printer on. Continue holding the **ON LINE** and **PAPER ADVANCE** keys down.
8. When you see “TESTING HARDWARE PLEASE WAIT” on the LCD, release the **ON LINE** and **PAPER ADVANCE** keys.
9. Wait until you see “WAITING FOR PROGRAM DOWNLOAD” on the LCD before doing the next step. This can take up to 30 seconds to appear, depending on the emulations and interfaces installed in the printer.
10. When you see “WAITING FOR PROGRAM DOWNLOAD” on the LCD, press the ▸ **(NEXT)** key.
    “SELECT DOWNLOAD PORT = DATAPRODUCT” appears on the LCD.

NOTE: The default port is CENTRONICS; this is the standard load through the parallel port. If you want to use the default, continue at step 12.

11. Press ▸ **(NEXT)** again to cycle through the download ports available in the printer:

    DATAPRODUCT (parallel)
    CENTRONICS* (parallel) (default port)
    RS232-9600 (RS-232 serial, 9600 baud)
    RS232-19.2K (RS-232 serial, 19200 baud)
    RS232-38.4K (RS-232 serial, 38400 baud)
    RS232-115K (RS-232 serial, 115000 baud)
    RS422-9600 (RS-422 serial, 9600 baud)
    RS422-19.2 (RS-422 serial, 19200 baud)
    RS422-38.4K (RS-422 serial, 38400 baud)
    RS422-115K (RS-422 serial, 115000 baud)
    DEBUG

NOTE: Do not select DEBUG as a download port.

12. When the printer download port you want to use is displayed on the LCD, press **ENTER.** “WAITING DOWNLOAD / PORT = <*your selection*> appears on the display.
13. Using Windows Explorer, create a directory named **download** at the root level of your C: hard drive.
14. Insert the printer emulation software CD-ROM into your computer’s CD-ROM drive.

Table 5. Emulations And Emulation Software Folder Names

Emulations							Emulation Software Folder Names
LP+	IGP	PGL	VGL	ANSI	CT	IPDS	
✓				✓			ANSI_PGL
✓		✓		✓			ANSI_PGL
✓			✓	✓			ANSI_VGL
✓					✓	✓	CT_IPDS_IGP

Table 5. Emulations And Emulation Software Folder Names

Emulations							Emulation Software Folder Names
LP+	IGP	PGL	VGL	ANSI	CT	IPDS	
✓	✓				✓	✓	CT_IPDS_IGP
✓		✓			✓	✓	CT_IPDS_IGP
✓			✓		✓	✓	CT_IPDS_IGP
✓					✓		CT_PGL_VGL
✓	✓				✓		CT_PGL_VGL
✓		✓			✓		CT_PGL_VGL
✓			✓		✓		CT_PGL_VGL
✓							PGL_VGL
✓	✓						PGL_VGL
✓		✓					PGL_VGL
✓			✓				PGL_VGL
✓						✓	TCP_IPDS_IGP
✓	✓					✓	TCP_IPDS_IGP
✓		✓				✓	TCP_IPDS_IGP
✓			✓			✓	TCP_IPDS_IGP

15. Reading left to right across Table 5, match the emulation(s) you need to the emulation folder listed in the rightmost column of Table 5.

    For example, if you need the LP+, PGL, and/or CT emulation, you will use the folder called CT_PGL_VGL.

16. Using Windows Explorer, navigate to the appropriate file on the CD based on the printer model number and desired emulation, e.g., P5000 ▸ PGL_VGL. (See Figure 18.)

17. Make note of the file name, which is a six digit number plus **.exe**, e.g., 123456.exe.
    This is the file you will download into the printer.

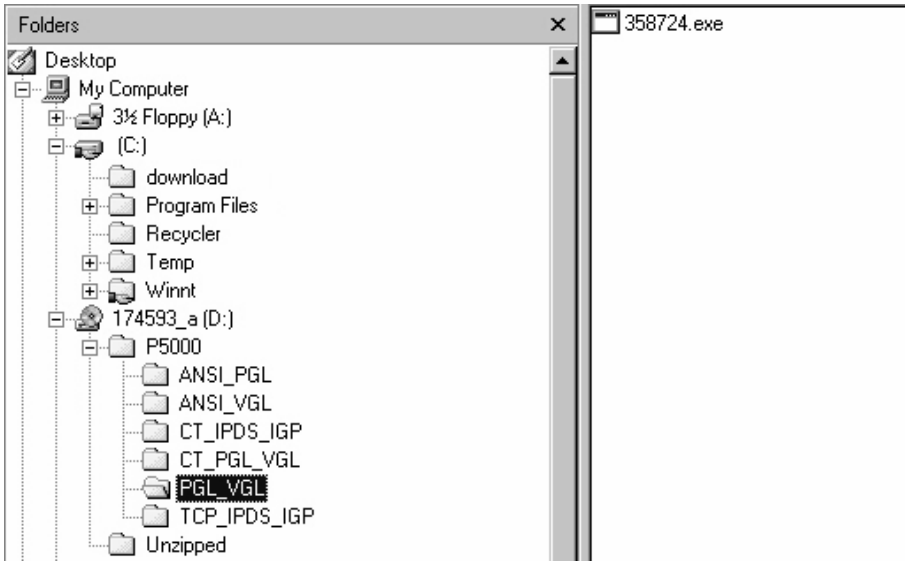


Figure 18. Navigating to the Appropriate Emulation File on the CD

18. Copy the file to the download directory. You may need to hold the **Ctrl** key to make sure a **+** appears to the right of the pointer. (See Figure 19.)

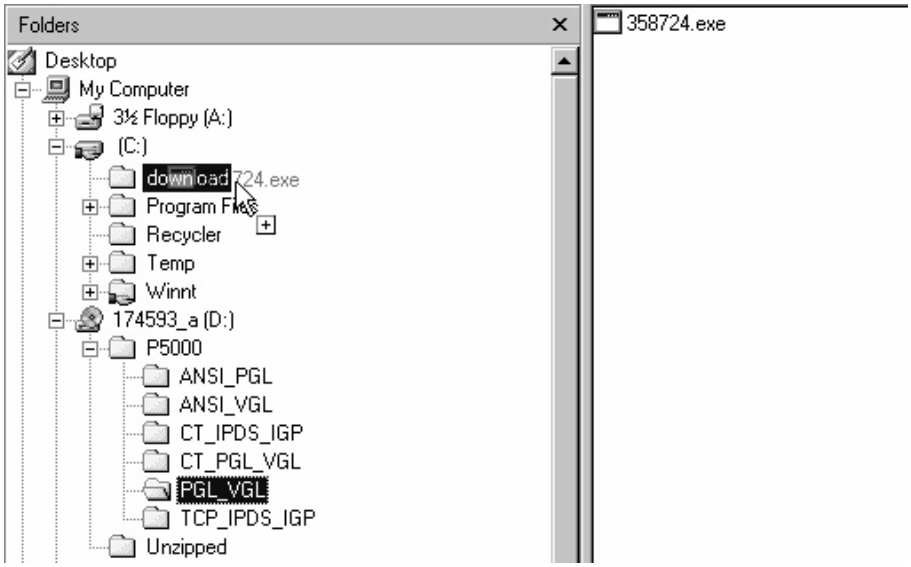


Figure 19. Copying the Emulation File to the Download Directory

19. Start a command prompt session. (The Start Menu icon is usually labeled MS-DOS Prompt or Command Prompt.)
20. At the command prompt type:
    `C:`<Enter>
    `cd \download`<Enter>
21. At the command prompt on the computer type:
    ***`filename`*`.exe -pb`**<Enter>

where *filename*.exe is the file name you noted in step 17. This command decompresses the file on the hard drive and copies it as a binary file into the flash memory on the printer controller board.

NOTE: If you are loading the file using the LPT2 port on the computer, enter the following command:
***filename*.exe -pb2** <Enter>

The 9600 baud rate is the only selection older versions of MS-DOS can use. The baud rate information entered in the following commands must match the selection you made in step 12.

If you are loading the file through the printer serial port, enter the following commands:
mode COM1:9600,N,8,1,P<Enter>
***filename*.exe -pbc1**<Enter>

CAUTION **Do not interrupt the downloading process once it has started. Interrupting a download will damage the flash memory on the controller board and NIC card.**

While the file is copied into memory, the printer LCD informs you of the load process and status.

22. When the new program has successfully loaded into memory and the printer has reset itself, set the printer power switch to O (Off).
23. Remove the CD-ROM from the host computer and store it with the printer.
24. Power off the computer.
25. If you had to install a data cable to the computer and printer in step 5, disconnect it from the computer and printer.
26. If required, reconnect the data input cable(s) to the printer.
27. Using the configuration printout(s) you made in step 1, reconfigure the printer.

Loading Through the Network Interface Card (NIC)

1. Make a printout of all saved configurations. Installing new software erases all saved configurations. You will use the printouts to restore the printer configurations.
2. Set the printer power switch to O (Off).
3. On the printer control panel, press and hold down the **ON LINE** and **PAPER ADVANCE** keys. Without releasing the keys, power the printer on. Continue holding the **ON LINE** and **PAPER ADVANCE** keys down.
4. When you see “TESTING HARDWARE PLEASE WAIT” on the LCD, release the **ON LINE** and **PAPER ADVANCE** keys.
5. Wait until you see “WAITING FOR PROGRAM DOWNLOAD” on the LCD before proceeding. This can take up to 30 seconds to appear, depending on the emulations and interfaces installed in the printer.
6. Using Windows Explorer, create a directory named **download** at the root level of your C: hard drive.
7. Insert the printer emulation software CD-ROM into your computer’s CD-ROM drive.

Table 6. Emulations And Emulation Software Folder Names

Emulations							Emulation Software Folder Names
LP+	IGP	PGL	VGL	ANSI	CT	IPDS	
✓				✓			ANSI_PGL
✓		✓		✓			ANSI_PGL
✓			✓	✓			ANSI_VGL
✓					✓	✓	CT_IPDS_IGP
✓	✓				✓	✓	CT_IPDS_IGP
✓		✓			✓	✓	CT_IPDS_IGP
✓			✓		✓	✓	CT_IPDS_IGP
✓					✓		CT_PGL_VGL
✓	✓				✓		CT_PGL_VGL
✓		✓			✓		CT_PGL_VGL
✓			✓		✓		CT_PGL_VGL
✓							PGL_VGL
✓	✓						PGL_VGL
✓		✓					PGL_VGL

Table 6. Emulations And Emulation Software Folder Names

Emulations							Emulation Software Folder Names
LP+	IGP	PGL	VGL	ANSI	CT	IPDS	
✓			✓				PGL_VGL
✓						✓	TCP_IPDS_IGP
✓	✓					✓	TCP_IPDS_IGP
✓		✓				✓	TCP_IPDS_IGP
✓			✓			✓	TCP_IPDS_IGP

8. Reading left to right across Table 6, match the emulation(s) you need to the emulation folder listed in the rightmost column of Table 6.

   For example, if you need the LP+, PGL, and/or CT emulation, you will use the folder called CT_PGL_VGL.

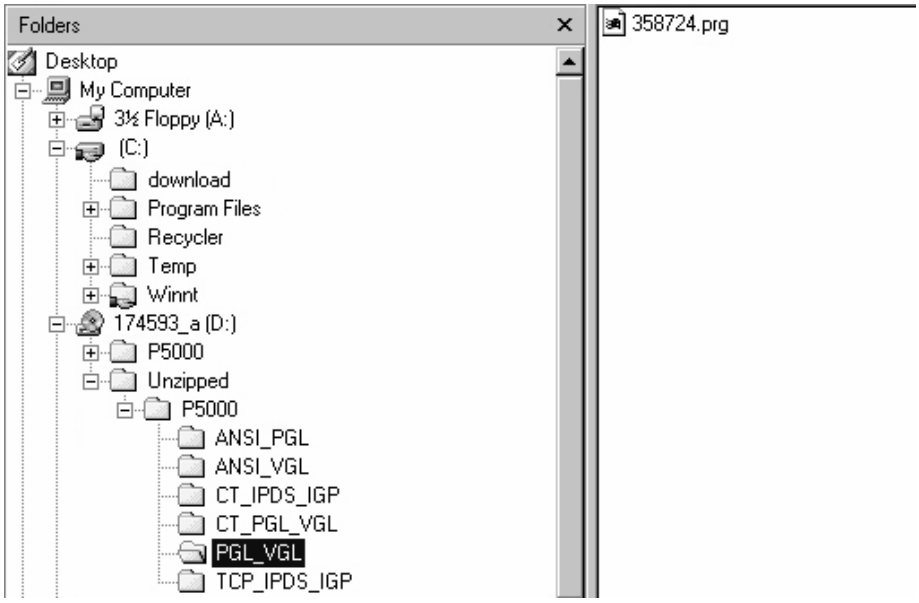


Figure 20. Navigating to the Appropriate Emulation File on the CD

9. Using Windows Explorer, navigate to the appropriate file on the CD (using the Unzipped directory) based on the printer type, model number, and desired emulation, e.g., Unzipped ▸ P5000 ▸ PGL_VGL. (See Figure 20.)

IMPORTANT **You must use the Unzipped directory, since this contains the uncompressed files necessary for NIC download.**

10. Make note of the file name, which is a six digit number plus **.prg**, e.g., 123456.prg.
    This is the file you will download into the NIC.

11. Copy the file to the download directory.

12. Start a command prompt session. (The Start Menu icon is usually labeled MS-DOS Prompt or Command Prompt.)
13. At the command prompt type:

    C:<Enter>
    cd \download<Enter>
14. Start the FTP protocol by typing:

    ftp *xxx.xxx.xxx.xxx*<Enter>
    (where *xxx.xxx.xxx.xxx* represents the IP Address of the printer.)
15. Log in to the printer by typing:

    root<Enter>

    You are given a password prompt.

NOTE: The default is no password. If the FTP program requires a password, contact your system administrator.

16. At the password prompt, press <Enter>.
17. Once logged in, type the following sequence at the command prompt to download the *filename*.prg file to the printer:

    cd dest<Enter>
    cd d1prn<Enter>
    bin<Enter>
    put *filename*.prg<Enter>
    (where *filename*.prg is the file name you noted in step 10.)

CAUTION **Do not interrupt the downloading process once it has started. Interrupting a download will damage the flash memory on the controller board and NIC card.**

18. As the file downloads, the FTP program shows the progress as a percentage. Once the download is complete, exit out of the FTP program by typing:

    quit<Enter>
19. When the new program has successfully loaded into flash memory and the printer has reset itself, set the printer power switch to O (off).
20. Unplug the AC power cord from the printer.
21. Remove the CD-ROM from the host computer and store it with the printer.
22. Using the configuration printout(s), reconfigure the printer and reload any optional font files.

Loading Flash Memory In The P5224

Flash memory in the P5224 is contained in SIMMs (single in-line memory modules) located on the PSA3 controller board. Printer control languages (the “emulations”) and printer operating system software are loaded into flash memory at the factory, but there are times when you may have to install this software:

- You have replaced the controller board
- You have added or replaced flash memory
- The customer needs to upgrade printer software
- The customer needs different emulation software
- The customer buys the PGL or VGL graphics language, the CT option, the IPDS option, or the NIC option after the printer is installed

Emulation and operating system software are included on CD-ROM. You will copy the appropriate file from the CD-ROM to your computer’s hard disk, then load that file into printer memory.

You can load software through the serial port, parallel port, or ethernet port of the printer:

- If you load memory through the serial port or parallel port the load commands differ depending on which port you use. The different commands are given in step 16 (page 175).
- If the printer has the ethernet network interface card (NIC) installed, you can load software through the ethernet port (page 177) if you know the IP Address of the printer and if the flash memory is operational and contains basic printer code (it cannot be a blank replacement SIMM). If the flash memory is blank or defective you must load through the parallel port (page 176).

Loading Through The Serial Or Parallel Port

1. Make a configuration printout of all saved configurations. (Refer to the *User’s Manual.)*
2. Set the printer power switch to O (Off).
3. Disconnect the data (signal) cable(s) from the printer interface connectors.
4. Connect a parallel data printer cable to the LPT1 port or a serial data printer cable to the COM1 port of an IBM-compatible computer running the PC-DOS, MS-DOS, or Windows (3.1x, 95, 98, Me, NT, 2000, or XP) operating system.

NOTE: You can connect the cable to the LPT2 port if the LPT1 port is in use. The load command is different if you use this port, so make sure you use the LPT2 commands in step 16.

5. Connect the data cable to the appropriate I/O port of the printer.
6. On the printer control panel, press and hold down the **ON LINE** and **PAPER ADVANCE** keys. Without releasing the keys, power the printer

on. When you see “B30 - STATUS: INITIALIZING” on the on the LCD, release the keys.

7. Wait until you see “WAITING FOR PROGRAM DOWNLOAD” on the LCD before doing the next step. This can take up to 30 seconds to appear, depending on the emulations and interfaces installed in the printer.
8. Using Windows Explorer, create a directory named **download** at the root level of your C: hard drive. (C:\download)
9. Insert the printer emulation software CD-ROM into your computer’s CD-ROM drive.

Table 7. Emulations And Emulation Software Folder Names

Emulations							Emulation Software Folder Names
LP+	IGP	PGL	VGL	ANSI	CT	IPDS	
✓				✓			ANSI_PGL
✓		✓		✓			ANSI_PGL
✓			✓	✓			ANSI_VGL
✓					✓	✓	CT_IPDS_IGP
✓	✓				✓	✓	CT_IPDS_IGP
✓		✓			✓	✓	CT_IPDS_IGP
✓			✓		✓	✓	CT_IPDS_IGP
✓					✓		CT_PGL_VGL
✓	✓				✓		CT_PGL_VGL
✓		✓			✓		CT_PGL_VGL
✓			✓		✓		CT_PGL_VGL
✓							PGL_VGL
✓	✓						PGL_VGL
✓		✓					PGL_VGL
✓			✓				PGL_VGL
✓						✓	TCP_IPDS_IGP
✓	✓					✓	TCP_IPDS_IGP
✓		✓				✓	TCP_IPDS_IGP
✓			✓			✓	TCP_IPDS_IGP

10. Reading left to right across Table 7, match the emulation(s) you need to the emulation folder listed in the rightmost column of Table 7.

For example, if you need the LP+, PGL, and/or CT emulation, you will use the folder called CT_PGL_VGL.

11. Using Windows Explorer, navigate to the file on the CD-ROM that matches the printer model and emulation you want. (For example: P5000 ▸ PGL_VGL is shown in Figure 21. Your printer and emulation may be different, of course.)
12. Note the filename, which is a six digit number plus **.exe**. (For example, 358724.exe is shown in Figure 21. Your filename may be different, of course.)
    This is the file you will download into the printer.

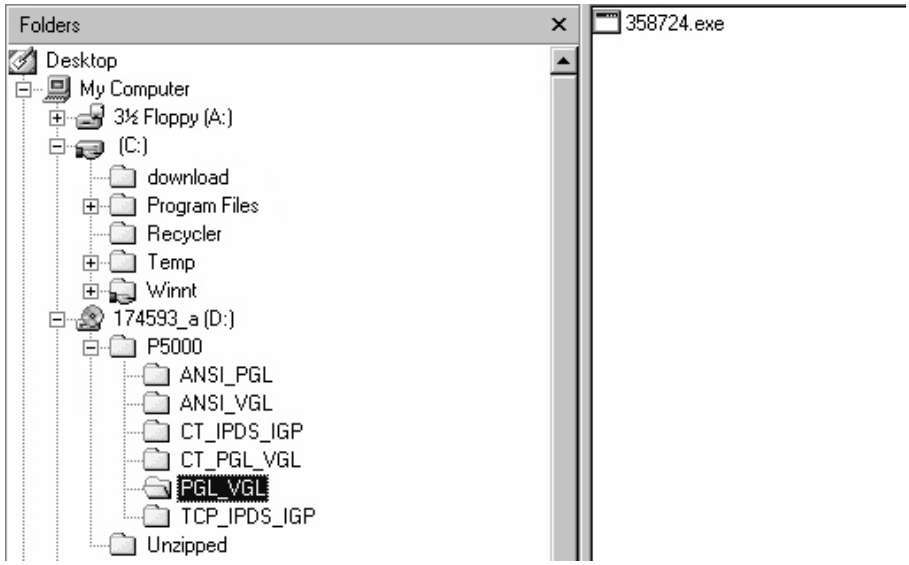


Figure 21. Navigating to the Appropriate Emulation File on the CD-ROM

13. Copy the file to the **download** directory you created in step 8. You may need to hold the **Ctrl** key to make sure a **+** (plus sign) appears to the right of the pointer. (See Figure 22.)

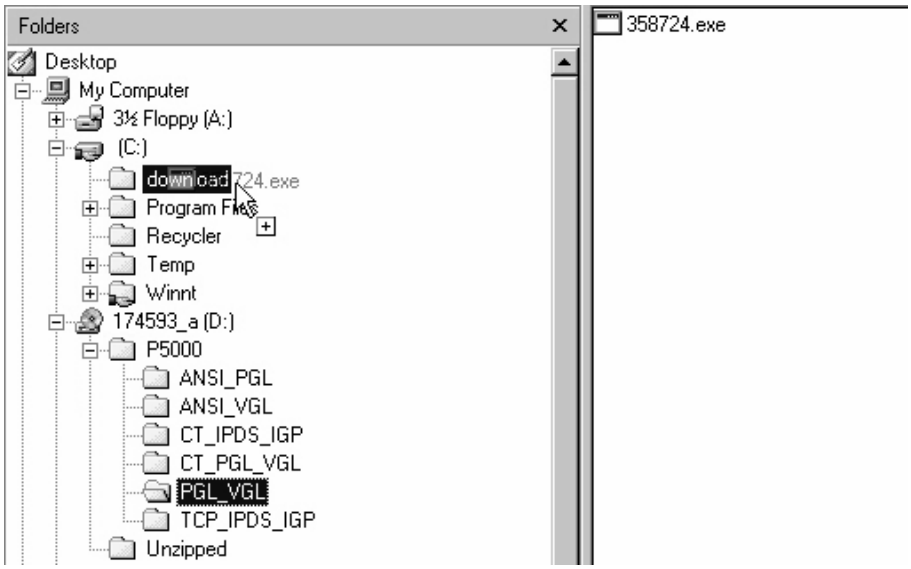


Figure 22. Copying the Emulation File to the Download Directory

14. Start a command prompt session. (The Start Menu icon is usually labeled **MS-DOS Prompt** or **Command Prompt**.)
15. At the command prompt type:
    `C:`<Enter>
    `cd \download`<Enter>
16. To load the file through the LPT1 parallel port on the computer, type the following at the command prompt on the computer:
    ***`filename`*`.exe -pb`**<Enter>
    where *filename*.exe is the file name you noted in step 12. This command decompresses the file on the hard drive and copies it as a binary file into the flash memory on the printer controller board.

    To load the file through the LPT2 port on the computer, enter the following command:
    ***`filename`*`.exe -pb2`** <Enter>

    To load the file through the serial port, enter the following commands:
    `mode COM1:9600,N,8,1,P`<Enter>
    ***`filename`*`.exe -pbc1`**<Enter>

NOTE: On a printer with a PSA3 controller board, when you power up in download mode (step 7) the printer is ready to accept data from all ports. When the printer receives data from one of the ports (based on the load command you give) the other ports shut down.

CAUTION **Do not interrupt the downloading process once it has started. Interrupting a download will damage the flash memory on the controller board.**

While the file is copied into memory, the display screen on the printer control panel informs you of the load process and status.

17. When the new software has successfully loaded into flash memory and the printer has reset itself, remove the CD-ROM from the host computer and store it with the printer.
18. If required, reconnect the data input cable(s) to the printer.
19. Using the configuration printout(s) you made in step 1 on page 172, restore the printer configurations. (Refer to the printer *User's Manual*.)

Loading Software When Flash Is Blank Or Defective

If the flash memory is blank (basic printer code missing) or defective on a PSA3 printer, you must download software through the printer's parallel port using a three-key initialization sequence.

1. Make sure the printer's parallel port is available. In some configurations, you may have to re-install the Centronics cable and connector in order to load basic software into the printer.
2. Do steps 1 through 5 of the Loading Through the Serial Or Parallel Port procedure on page 172, and remember to attach the computer to the printer's parallel port.
3. On the printer control panel, press and hold down the **ON LINE** + **PAPER ADVANCE + VIEW/EJECT** keys. Without releasing the keys, power the printer on. When you see "B20 - STATUS: 00% / DOWNLOAD MODE" on the LCD, release the keys and continue at step 8 of the Loading Through the Serial Or Parallel Port procedure on page 172. Remember to enter the command for loading through the parallel port.
4. When the software has successfully loaded into flash memory and the printer has reset itself, set the printer power switch to O (off).
5. Starting at step 7, repeat the Loading Through the Serial Or Parallel Port procedure (that is, load software again, using the two-key method). This will ensure that all necessary code is loaded into memory.

Loading Through the Network Interface Card (NIC)

IMPORTANT **To load software through the NIC you need the IP Address of the printer and the flash memory must be operational and contain basic printer code (it cannot be a blank replacement SIMM). If the flash memory is blank or defective you must load through the parallel port (page 176).**

1. Make a configuration printout of all saved configurations. (Refer to the *User's Manual.)*
2. Set the printer power switch to O (Off).
3. Connect the ethernet cable to the printer.
4. On the printer control panel, press and hold down the **ON LINE** and **PAPER ADVANCE** keys. Without releasing the keys, power the printer on. When you see "B30 - STATUS: INITIALIZING" on the on the LCD, release the keys.
5. Wait until you see "WAITING FOR PROGRAM DOWNLOAD" on the LCD before proceeding. This can take up to 30 seconds to appear, depending on the emulations and interfaces installed in the printer.
6. Using Windows Explorer, create a directory named **download** at the root level of your C: hard drive. (C:\download)
7. Insert the printer emulation software CD-ROM into your computer's CD-ROM drive.

Table 8. Emulations And Emulation Software Folder Names

Emulations							Emulation Software Folder Names
LP+	IGP	PGL	VGL	ANSI	CT	IPDS	
✓				✓			ANSI_PGL
✓		✓		✓			ANSI_PGL
✓			✓	✓			ANSI_VGL
✓					✓	✓	CT_IPDS_IGP
✓	✓				✓	✓	CT_IPDS_IGP
✓		✓			✓	✓	CT_IPDS_IGP
✓			✓		✓	✓	CT_IPDS_IGP
✓					✓		CT_PGL_VGL
✓	✓				✓		CT_PGL_VGL
✓		✓			✓		CT_PGL_VGL
✓			✓		✓		CT_PGL_VGL
✓							PGL_VGL

Table 8. Emulations And Emulation Software Folder Names

Emulations							Emulation Software Folder Names
LP+	IGP	PGL	VGL	ANSI	CT	IPDS	
✓	✓						PGL_VGL
✓		✓					PGL_VGL
✓			✓				PGL_VGL
✓						✓	TCP_IPDS_IGP
✓	✓					✓	TCP_IPDS_IGP
✓		✓				✓	TCP_IPDS_IGP
✓			✓			✓	TCP_IPDS_IGP

8. Reading left to right across Table 8, match the emulation(s) you need to the emulation folder listed in the rightmost column of Table 8.

   For example, if you need the LP+, PGL, and/or CT emulation, you will use the folder called CT_PGL_VGL.

9. Using Windows Explorer, navigate to the file in the Unzipped directory on the CD-ROM that matches the printer model number and emulation you want. (For example, Unzipped ▸ P5000 ▸ PGL_VGL is shown in Figure 23. Your printer and emulation may be different, of course.)

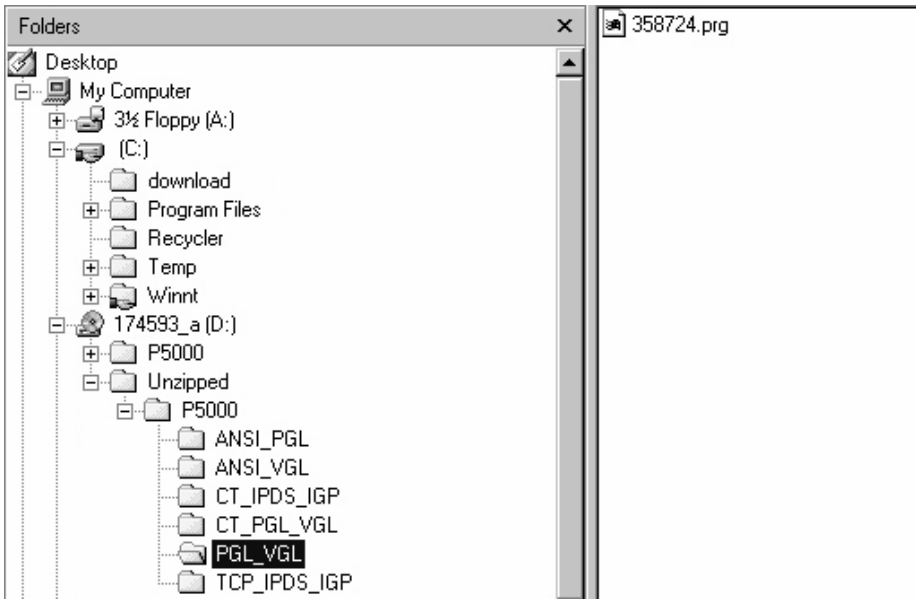


Figure 23. Navigating to the Appropriate Emulation File on the CD-ROM

IMPORTANT **You must use the Unzipped directory, since this contains the uncompressed files necessary for NIC download.**

10. Note the filename, which is a six digit number plus **.prg**. (For example, 358724.prg is shown in Figure 20. Your filename may be different, of course.)
    This is the file you will download into the NIC.
11. Copy the file to the **download** directory you created in step 6. You may need to hold the **Ctrl** key to make sure a **+** (plus sign) appears to the right of the pointer. (See Figure 22.)
12. Start a command prompt session in Windows. (The Start Menu icon is usually labeled **MS-DOS Prompt** or **Command Prompt**.)
13. At the command prompt type:

    C:<Enter>
    cd \download<Enter>
14. Start the FTP (file transfer protocol) program by typing:

    ftp *xxx.xxx.xxx.xxx*<Enter>
    (where *xxx.xxx.xxx.xxx* represents the IP Address of the printer.)
15. Log in to the printer by typing:

    root<Enter>

    You are given a password prompt.

NOTE: The default is no password. If the FTP program requires a password, contact the system administrator.

16. At the password prompt, press <Enter>.
17. Once logged in, type the following sequence at the command prompt to download the *filename*.prg file to the printer:

    cd dest<Enter>
    cd d1prn<Enter>
    bin<Enter>
    put *filename*.prg<Enter>
    (where *filename*.prg is the file name you noted in step 10)

CAUTION **Do not interrupt the downloading process once it has started. Interrupting a download will damage the flash memory on the controller board and NIC.**

18. As the file downloads, the display screen on the printer's control panel informs you of the load process and status. Once the download is complete, exit the FTP program by typing:

    quit<Enter>
19. When the new software has successfully loaded into flash memory and the printer has reset itself, remove the CD-ROM from the host computer and store it with the printer.
20. If required, reconnect the data input cable(s) to the printer.
21. Using the configuration printout(s) you made in step 1 on page 177, restore the printer configurations. (Refer to the printer *User's Manual*.)

5 *Replacement Procedures And Illustrated Parts Lists*

Organization Of This Chapter

This chapter is divided into two sections.

- **Section I: Replacement Procedures**

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

  Section I begins on page 182.

- **Section II: Illustrated Parts Lists**

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

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

Section II begins on page 241.

Section I: Replacement Procedures

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

IMPORTANT **The components specified in this chapter are field replaceable units (FRUs). FRUs must be repaired at the factory. Do not repair these items in the field.**
Do not attempt field repairs of electronic components or assemblies. Do not de-solder any circuit board components. Replace a malfunctioning electronic assembly with an operational spare. Most electronic problems are corrected by replacing the printed circuit board assembly, sensor, or cable that causes the fault indication. The same is true of failures traced to the hammer bank: it is not field repairable so you must replace the entire shuttle frame assembly. Hammer spring assemblies, the hammer bank cover, and the ribbon mask are the only replaceable components of the shuttle frame assembly.

List Of Removal / Installation Procedures

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Belt, Platen Open ..... page 185
Camshaft ..... page 186
Circuit Breaker ..... page 189
Connector Coupling Shrouds ..... page 190
Control Panel Assembly ..... page 192
Controller Board ..... page 193
Cover Assembly, Hammer Bank / Ribbon Mask ..... page 195
Cover Assembly, Shuttle ..... page 197
CT Board (Model P5224) ..... page 198
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Fan Assembly, Cabinet Exhaust ..... page 200
Fan Assembly, Card Cage ..... page 202
Fan Assembly, Hammer Bank ..... page 203
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Magnetic Pickup (MPU) Assembly ..... page 209
Memory and Security Key (Model P5224) ..... page 210
Memory And Security Module (Model P5220) ..... page 213
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Paper Feed Motor ..... page 220
Paper Ironer ..... page 221
Paper Path ..... page 222
Platen ..... page 223
Platen Open Motor ..... page 224
Power Supply Board ..... page 226
Resistors, Terminating ..... page 227
Ribbon Drive Motor ..... page 229
Ribbon Guide Assembly (L/R) ..... page 230
Ribbon Hub ..... page 231
Shaft, Splined ..... page 232
Shaft, Support ..... page 234
Shuttle Frame Assembly ..... page 235
Spring, Hammer Bank ..... page 237
Switch Assembly, Paper Detector ..... page 238
Switch Assembly, Platen Interlock ..... page 239
Tractor (L/R) ..... page 240

Belt, Paper Feed Timing

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the paper path (page 222).
3. Remove the timing belt cover by squeezing the front and back to release the plastic tabs from the slots in the side plate. (See page 139, item 1.)
4. Loosen (do not remove) the two 5/16 inch paper feed motor mount screws. (See page 139, item 2.)
5. Roll the paper feed timing belt off the paper feed motor pulley and splined shaft pulley.

Installation

1. Roll the paper feed timing belt onto the splined shaft pulley and the motor pulley.
2. Using the straight end of a force gauge, apply 15 pounds (66.7 N) of pressure to the paper feed drive motor. Use the splined shaft to steady the gauge.
3. Reduce tension to 12 pounds (53.4 N) and torque the 5/16 inch paper feed motor mount screws to 18 ± 2 inch-pounds (2.03 ± 0.23 N•m).
4. Snap the timing belt cover into the slots in the side plate. (See page 139, item 1.)
5. Install the paper path (page 222).
6. Return the printer to normal operation (page 137).

Belt, Platen Open

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the paper path (page 222).
3. Remove the platen open belt cover by squeezing the top and bottom to release the plastic tabs from the slots in the side plate. (See page 141, item 1.)
4. Using a 5/32 inch Allen wrench, *slowly* loosen the motor adjustment screw just enough to permit movement of the platen open motor in the slotted side plate. (See page 141, item 2.)
5. Push the platen open motor shaft toward the front of the printer to loosen the platen open belt. (See page 141, item 3.)
6. Remove the platen open belt from the motor pulley and platen open pulley.

Installation

1. Push the platen open motor shaft toward the front of the printer and install the platen open belt over the platen open pulley and the motor pulley. (See page 141, item 3.)
2. Release the platen open motor, allowing the spring to tension the belt.
3. *Slowly* tighten the motor adjustment screw. (See page 141, item 2.)

NOTE: Belt tension is correct if the belt deflects 3/16 inch midway between the pulleys. If deflection is more or less than 3/16 inch, slowly loosen the motor adjustment screw and repeat steps 2 and 3.

4. Snap the platen open belt cover into the slots in the side plate.
5. Install the paper path (page 222).
6. Return the printer to normal operation (page 137).

Camshaft

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the shuttle frame assembly (page 235).
3. Remove the paper ironer (page 221).
4. Remove the platen (page 223).
5. Remove the three 1/4 inch screws securing the paper ironer bracket assembly and remove the assembly. (See page 258, items 4, 5, and 6.)
6. Remove the platen open belt (page 185).
7. Remove the platen pulley (page 258, item 20), as follows:
   a. Loosen the 7/64 inch collar clamp screw.
   b. Pull the platen pulley off the platen shaft.
8. Pull the spring link and white plastic bushing off the camshaft and remove the spring link, bushing, and spring. (See page 258, items 15, 16, and 17.)
9. Remove the forms thickness lever by loosening the 7/64 inch clamp screw and pulling the lever off the platen shaft. (See page 258, item 14.)
10. Remove the right side platen support spring by repeating step 8 on the right side of the platen.
11. Remove the Phillips #1 screw and washer securing the forms thickness indicator plate from the inside of the right side bracket. (See page 258, items 8 and 9.)
12. Pull the indicator plate, with the interlock switch assembly attached, off the camshaft.
13. Remove the two 7/32 inch screws and washers securing the right ribbon guide assembly to the side plate. (See page 262, items 11, 13, and 14.)
14. Pull the right side of the camshaft toward the front of the printer and move the platen to the right and out of the left side plate. (Hold the black metal washer on the left side of the shaft as you remove the shaft. Make sure the wear saddles in the platen seat of the mechanism base stay in place.)

Installation

IMPORTANT **The camshaft must be installed with the flat on the right side.**

1. Wipe the camshaft clean of grease and debris.
2. Apply bearing lubricant to both ends of the camshaft.

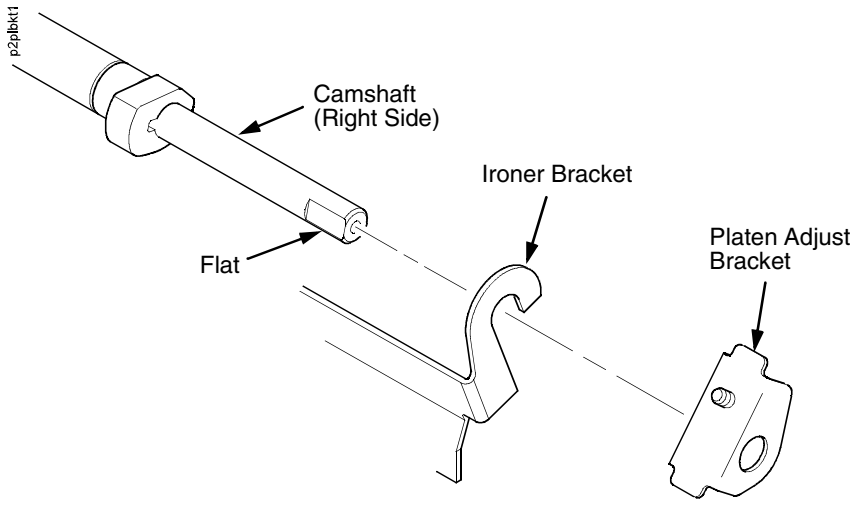


Figure 24. Installing the Platen Adjust Bracket

3. Make sure the two wear saddles are set flush into the corners of the mechanism base platen seat. (See page 258, item19.)
4. Apply a layer of bearing lubricant 1/4 inch high to the seat of each wear saddle, making the layer as wide as the saddle and touching the rear angled surface.
5. Install one platen adjust bracket onto one end of the camshaft, with the screw at the top of the bracket. (See Figure 24.)
6. Place the other bracket onto the left side mechanism base shaft seat so that the mechanism base shaft seat is between the flanges of the adjust bracket.
7. Insert the left end of the camshaft through the left adjust bracket and through the opening in the left side plate. Rotate the right end of the camshaft into the opening in the right side plate and position the adjustment brackets as shown in Figure 24.
8. Slide the right ribbon guide assembly into the side plate and install the two 7/32 inch screws and washers. (See page 262, items 11, 13, and 14.)
9. Install the forms thickness indicator plate:
   a. Slide the indicator plate, with the interlock switch assembly attached, onto the camshaft and up against the right side plate.
   b. Install the Phillips #1 screw and washer securing the indicator plate.
10. Install the black metal washer onto the left side of the camshaft. (See page 258, item 24.)

11. Apply bearing lubricant to the nylon bearings in the two spring links, slide the spring links onto the two platen shafts, and connect the springs to the spring hooks in the side plates. (See page 258, items 15, 16, and 17.)
12. Apply bearing lubricant to the camshafts on both sides, between the ends of the shaft and the platen adjustment brackets.
13. Install the paper ironer bracket. (See page 258, item 5.)
    a. With the flat part of the bracket facing the front of the printer, place the two hooks of the upper part of the paper ironer over the camshaft and inboard of the platen adjust brackets.
    b. Install and torque the three screws to 20 ± 2 inch-pounds (2.26 ± 0.23 N•m).
14. Push the camshaft to the left.
15. Install the forms thickness lever onto the right side of the camshaft, pressing the interlock switch out of the way as the lever slides past it. Tighten the 7/64 inch setscrew. (See page 258.) Open and close the forms thickness lever to make sure the setscrew does not touch the right ribbon guide.
16. Install the platen shaft pulley with the 7/64 inch setscrew facing up and tighten the setscrew. Open and close the forms thickness lever and check that the platen pulley setscrew does not hit the left ribbon guide.
17. Install, but do not adjust, the platen open belt and platen open motor pulley (page 258, items 20 and 22).
18. Install the platen (page 223).
19. Install the paper ironer with the black tape towards the rear of the printer (page 258, item 3).
20. Install the shuttle frame assembly (page 235).
21. Adjust the platen gap (page 144).
22. Adjust the platen open belt (page 140).
23. Check ribbon guide alignment (page 146).
24. Check the hammer phasing (page 152).
25. Return the printer to normal operation (page 137).

Circuit Breaker

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the card cage fan (page 202).
3. Disconnect the four circuit breaker electrical leads. (See page 264.)
4. Press in on the spring clips and remove the circuit breaker from the printer.

Installation

1. Press the circuit breaker into the cutout until the spring clips snap into place. (See page 264.)

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

2. Connect the four circuit breaker electrical leads. (See page 264.)
3. Install the card cage fan (page 202).
4. Return the printer to normal operation (page 137).

Connector Coupling Shrouds

Some of the cable connectors in the printer are grouped inside larger connector coupling shrouds. This procedure below explains how to remove and install cable assemblies from a connector coupling shroud.

NOTE: There is also a diagram of the P106 / P107 connector coupling shrouds on the plastic cover over the power supply.

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the paper path (page 222).
3. Disconnect the cable connector coupling shroud containing the cable assembly that you will replace.
4. Pull the side of the connector coupling shroud outward and gently pull the cable connector upward. (See Figure 25.) Notice that two-wire connectors are grouped across from two-wire connectors in a connector coupling shroud. Four-wire connectors are grouped across from four-wire connectors in a connector coupling shroud.
5. Disengage the key tab(s) on the cable connector from the slots in the side of the connector coupling shroud.
6. Remove the cable connector from the connector coupling shroud. (Remove only the cable connector for the cable you are replacing; leave the other cable connectors in the shroud.)

Installation

1. Position the cable connector in the connector coupling shroud. Two-wire connectors are always grouped across from two-wire connectors in a connector coupling shroud. Four-wire connectors are always grouped across from four-wire connectors in a connector coupling shroud. (See Figure 25.)
2. Pull the side of the connector coupling shroud outward and gently push the cable connector down into the shroud.
3. Engage the key tab(s) on the cable connector in the slots in the side of the connector coupling shroud. Press the sides of the connector coupling shroud inward to make sure all cable connector tabs are engaged in the shroud slots.
4. Connect the cable connector coupling shroud to its printer connection.
5. Install the paper path (page 222).
6. Return the printer to normal operation (page 137).

P106 Connector Configuration

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

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

Pin No.

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

P107 Connector Configuration

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

EHF* = Exhaust Fan
HBF = Hammer Bank Fan
JMP = Jumper Wire
MPU = Magnetic Pickup
4-Pin Spacer = P/N 174325-001*
PLO = Platen Open (Switch)
RRIB M = Right Ribbon Motor
RRP = Right Ribbon Guide

* For PAPR M, see J103 on page 311.

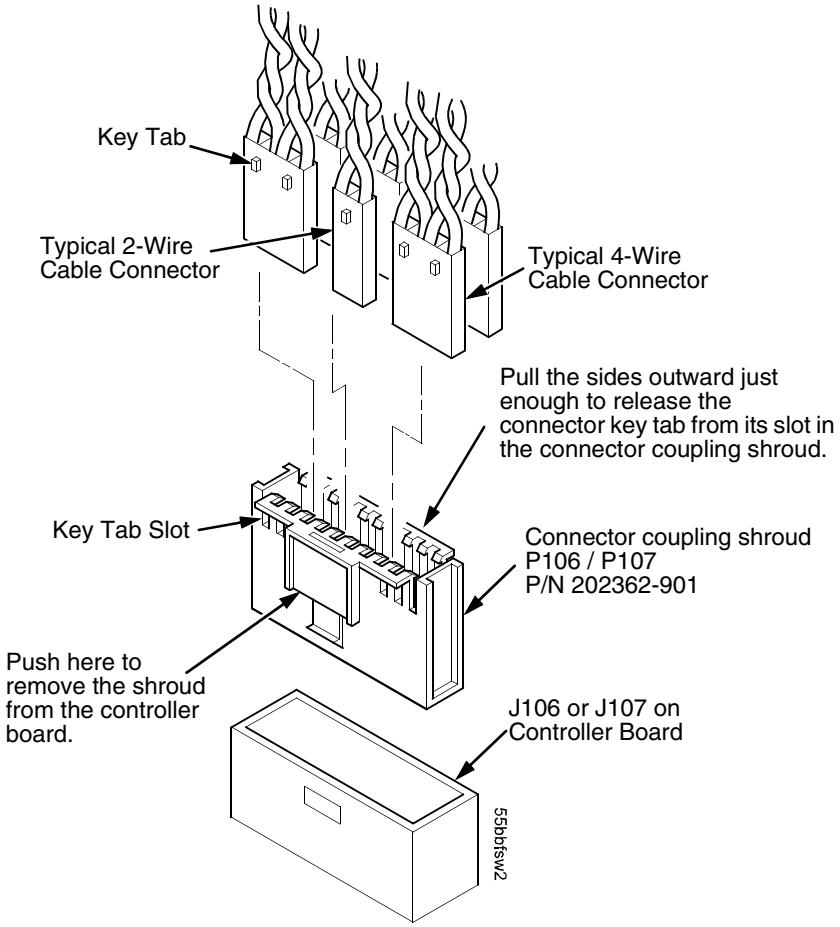


Figure 25. Connector Coupling Shroud, Disassembly/Assembly

Control Panel Assembly

Removal

1. Prepare the printer for maintenance (page 136).
2. Disconnect RJ11 connector P310 from connector J310 on the control panel.
3. Loosen four screws securing the control panel to the control panel bracket. (See page 246, item 1.)
4. Slide the control panel assembly up and out of the keyways in the control panel bracket.

Installation

1. Position the control panel assembly on the control panel bracket, engage the mounting screws in the keyways, and hand tighten the screws. (See page 246, item 1.)
2. Connect RJ11 connector P310 to connector J310 on the control panel.
3. Lower the printer cover and center the control panel assembly in the cutout of the printer cover.
4. Open the printer cover and tighten the four control panel mounting screws.
5. Return the printer to normal operation (page 137).

Controller Board

Removal

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

1. Make a configuration printout of all saved configurations. (Refer to the *User's Manual.)*
2. Prepare the printer for maintenance (page 136).
3. Remove the paper path (page 222).
4. Remove the expansion-CT board, if it is installed (page 200).
5. Remove the Ethernet Network Interface Card (NIC), if it is installed (page 217).
6. Disconnect all cable connectors from the controller board. (See the Interconnection Diagram on page 305.)
7. Loosen but do not remove the two screws securing the controller shield near serial cable connector J201.
8. Loosen but do not remove the screw securing the controller shield to the bottom of the card cage, on the left side near the card cage fan.

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

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

Installation

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

1. Position the controller board in the card cage, shield side down, component side up. Engage the screw on the bottom of the card cage in the keyway in the controller shield. Slide the board to the right until the serial cable connector J201 on the controller board lines up with the cutout in the card cage. (See page 250.)
2. Tighten the two screws securing the controller shield near serial cable connector J201.
3. Tighten the screw securing the controller shield to the bottom of the card cage.
4. Connect all cable connectors to the controller board, using the Interconnection Diagram on page 305 as your guide.
5. Install the expansion-CT board, if necessary (page 200).
6. Install the NIC, if necessary (page 217).
7. Install the paper path (page 222).

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

8. Load flash memory (page 164).
9. Adjust the hammer phasing (page 152).
10. Adjust the paper out distance (page 148).
11. Using the configuration printout(s) you made as step 1 of the removal procedure, reset and save the printer configuration(s). (Refer to the *User's Manual.)*

Cover Assembly, Hammer Bank / Ribbon Mask

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the shuttle frame assembly (page 235).
3. Using a Torx T-10 driver, remove the six screws and three ribbon mask clamp plates securing the ribbon mask to the hammer bank cover. Remove the ribbon mask. (See Figure 26.)

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

4. Using a Torx T-10 driver, remove the 12 screws securing the hammer bank cover to the hammer bank. Remove the hammer bank cover. (See Figure 26.)

Installation

1. Position the hammer bank cover on the alignment pins on the hammer bank. Make sure the hammer bank cover is properly positioned over the alignment pins and hammer tips and lies flat on the hammer bank.
2. Install all 12 hold-down screws finger tight. Using a Torx T-10 driver, torque the hold-down screws to 14 inch-pounds (1.58 N•m) in the sequence shown in Figure 26.
3. With the foam spacers on the upper edge of the ribbon mask facing inward (toward the hammer bank cover), position the ribbon mask on the alignment pins on the hammer bank cover. The ribbon mask is correctly installed when the angled ends of the ribbon mask match the angled ends of the hammer bank cover. Install the three clamp plates and six screws finger tight. Using a Torx T-10 driver, torque the six screws to 14 inch-pounds (1.58 N•m) in the sequence shown in Figure 26.
4. Install the shuttle frame assembly (page 235).
5. Return the printer to normal operation (page 137).

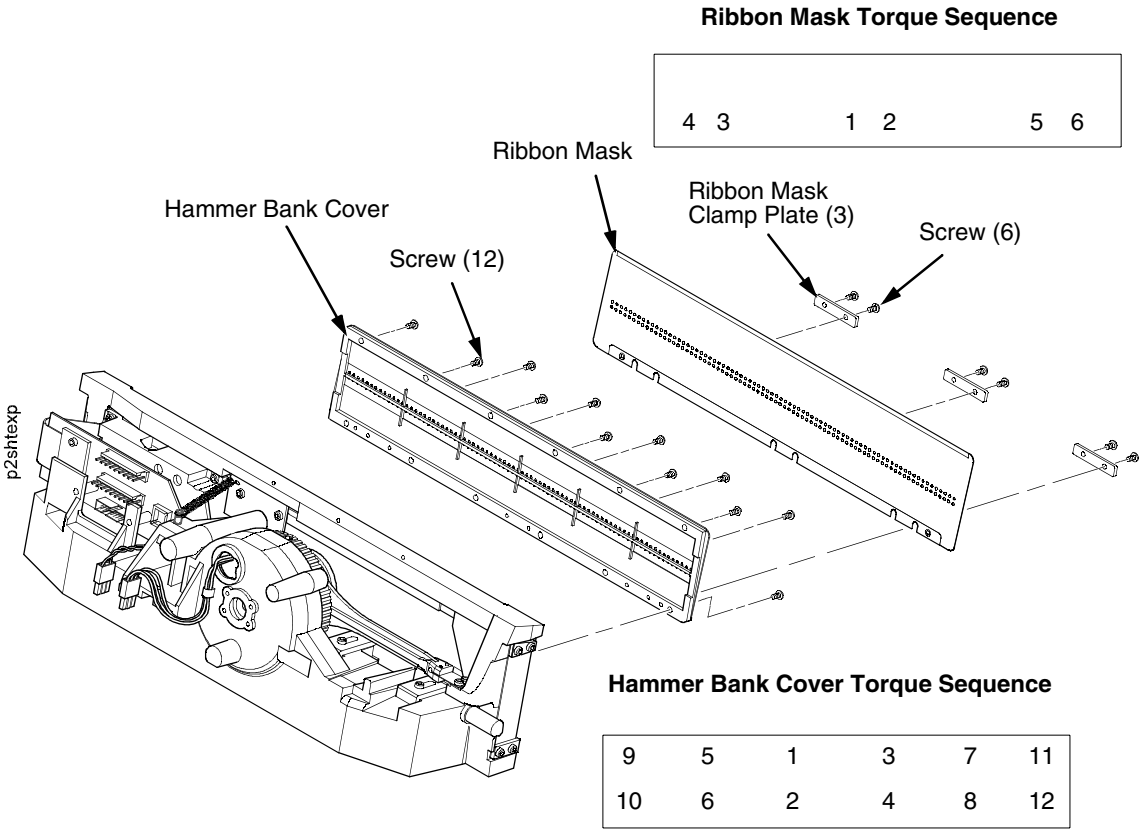


Figure 26. Hammer Bank Cover Assembly / Ribbon Mask

Cover Assembly, Shuttle

Removal

1. Prepare the printer for maintenance (page 136).
2. Loosen the shuttle cover screws (page 248, item 2).
3. Grasping the edges of the shuttle cover assembly, tilt the rear edge up and lift the shuttle cover assembly out of the printer.

Installation

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

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

2. Tighten the shuttle cover screws (page 248, item 2).
3. Return the printer to normal operation (page 137).

CT Board (Model P5224)

NOTE: CT is short for “Coax/Twinax.”

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the paper path (page 222)

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

3. Put on a static wrist strap and ground the lead to an unpainted part of the printer frame. Touch the printer frame with the hand wearing the wrist strap before you touch electronic components or the controller board.
4. Remove the screw securing the CT board connector plate to the rear of the card cage. (See page 266, item 4.)
5. Angle the CT board out of the card cage cutout as you lift the CT board off the expansion connector on the controller board. (See page 266, item 1.)

Installation

1. Reverse steps 2 through 5 of the removal procedure.

IMPORTANT **There are two expansion slots on the controller board. If the printer is a cabinet model with a power stacker installed, you must install the CT board in the outermost slot and leave the innermost slot empty.**

2. Return the printer to normal operation (page 136).

Dashpot

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

Removal

1. Prepare the printer for maintenance (page 136).
2. Open the cabinet rear door.
3. Pry back the spring retaining clips. (See Figure 40, page 246.)
4. Remove the dashpot from the ball studs.

Installation

CAUTION **The dashpot must be installed with the large cylinder uppermost.**

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

1. Position the dashpot against the ball studs on the upper and lower brackets with the large cylinder uppermost. (See Figure 40, page 246.)
2. Using external grip ring pliers to spread the retaining clips, push the dashpot onto the ball joints and slide the spring clips over the top (bottom) of the ball joint into the retaining grooves.
3. Close the printer cover.
4. Return the printer to normal operation (page 137).

Expansion-CT (Model P5220)

NOTE: CT is short for “Coax/Twinax.”

Removal

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

1. Prepare the printer for maintenance (page 136).
2. Remove the paper path (page 222).
3. Loosen, but do not remove, the two screws securing the coax/twinax I/O plate to the rear of the card cage. Loosen the thumbscrew on the expansion-CT board until the screw is released from the standoff on the controller board. (See page 268.)
4. Carefully lift the expansion-CT board out of the card cage cutout and off the expansion connector adapter that attaches the CT to the controller board.
5. Remove the expansion connector adapter from the controller board by carefully lifting it straight up and out of the controller connector.

Installation

1. Reverse steps 2 through 5 of the removal procedure.
2. Return the printer to normal operation (page 137).

Fan Assembly, Cabinet Exhaust

Removal

1. Prepare the printer for maintenance (page 136).
2. Open the front and rear cabinet doors and the printer cover.
3. Remove the paper fence/paper tray assembly. (See page 244.)
4. Remove the two 1/4 inch screws securing bottom of the air exhaust duct. (See page 246, item 4).
5. Remove the 1/4 inch screw directly below the forms thickness lever.
6. Disconnect the fan cable connector from connector P307 and remove the air exhaust duct.
7. Remove the two hex nuts securing the exhaust duct to the cabinet wall.
8. Disconnect the fan cable connector from the side of the air exhaust duct.
9. Remove the two 1/4 inch fan mounting screws and the cabinet exhaust fan assembly.

Installation

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

1. Reverse steps 2 through 9 of the removal procedure.
2. Return the printer to normal operation (page 137).

Fan Assembly, Card Cage

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the paper path (page 222).
3. Disconnect the card cage fan cable connector. (See page 262.)
4. Remove the two fan mounting screws from the bottom of the fan. (See page 262, item 2.)
5. Remove the card cage fan assembly from the card cage.

Installation

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

1. Reverse steps 3 through 5 of the removal procedure.
2. Return the printer to normal operation (page 137).

Fan Assembly, Hammer Bank

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the shuttle cover assembly (page 197).
3. Remove the paper path (page 222).
4. Trace the hammer bank fan cable assembly back to the controller board connector P107, releasing it from all cable constraints. (See the cable routing diagrams in Appendix A.)
5. Disconnect the fan connector from connector P107 on the controller board. (See page 190.)
6. Remove the two screws securing the fan to the base casting. Angle the hammer bank fan assembly up and out of the base casting and feed the motor wires and cable connector out from between the base casting and the base pan. (See page 262, items 21 and 22.)

Installation

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

1. Feed the hammer bank fan cable connector and motor wires between the fan well of the base casting and the base pan. Reach up under the base casting and route the fan cable to the right and angle the hammer bank fan assembly under the shuttle motor and down into the fan well. (See page 262.)
2. Route the fan motor wires (see cable routing diagrams, Appendix A) and connect the fan cable connector to J107 on the controller board. (See page 190.)
3. Install two screws in the locations shown in Figure 46 (page 262, item 21).
4. Install the paper path (page 222).
5. Install the shuttle cover assembly (page 197).
6. Return the printer to normal operation (page 137).

Hammer Spring Assembly

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the shuttle frame assembly (page 235).
3. Carefully vacuum the shuttle frame assembly.
4. Remove the hammer bank cover assembly (page 195).

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

IMPORTANT **If you remove and install <u>one</u> hammer spring assembly at a time, you will maintain correct alignment of the hammer springs and you can use short tip alignment tool (174478-001).**

If you remove <u>more</u> <u>than</u> <u>one</u> hammer spring assembly from a double hammer bank, note their positions on the hammer bank. You MUST use long tip alignment tool (175789-001) to install hammer spring assemblies if more than one has been removed from a double hammer bank.

5. Remove the mounting screws from the old hammer spring assembly. (See Figure 27.)
6. Handling the hammer spring assembly by the mounting base only, gently pry up the base with the stick included in the replacement spring kit. (See Figure 27.)

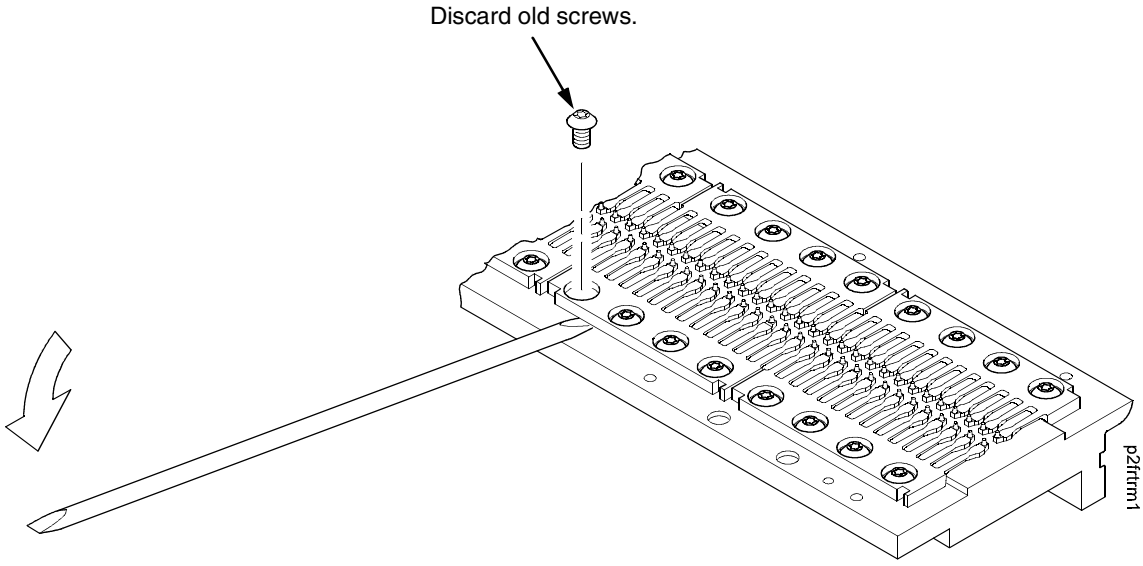


Figure 27. Hammer Spring Assembly, Removal

Installation Using The Short Tip Alignment Tool

This procedure is for installing one hammer spring assembly at a time, using short Tip Alignment Tool (kit no. 174478-001). To install more than one hammer spring assembly at a time, you must use long Tip Alignment Tool (kit no. 175789-001) (page 206).

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

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

2. Handling the hammer spring assembly by the mounting base only, remove the new assembly and mounting screws from the box.
3. Handling the hammer spring assembly by the mounting base only, position the new assembly on the hammer bank and install the mounting screws from the replacement kit finger tight. (See Figure 28.)
4. Gently position the short Tip Alignment Tool so that hammer tips from the new spring assembly and tips from the spring assembly “above” it are in the holes, as shown in Figure 28. Hold the new hammer spring in this position with the tool and use a Torx T-10 bit adapter to torque each screw to 14 in-lbs (1.58 N•m). Tighten the center screw(s) first. (See Figure 28.)
5. Install the hammer bank cover assembly (page 195).
6. Install the shuttle frame assembly (page 235).
7. Install the ribbon and load paper.

CAUTION **Do NOT attempt to adjust or “tweak” hammer springs.**

8. Run a Diagnostic Printer Test and check print quality (page 118):
   a. If print quality is acceptable, return the printer to normal operation (page 137).
   b. If print quality is still degraded, replace the shuttle frame assembly (page 235).

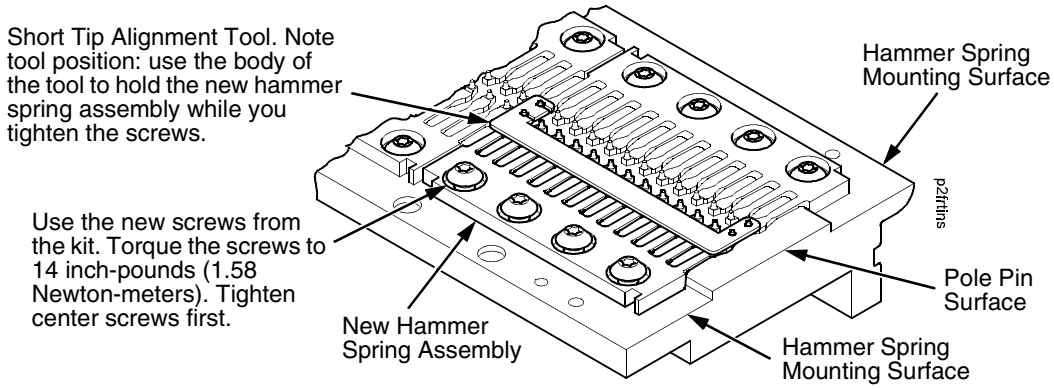


Figure 28. Hammer Spring Installation using Short Tip Alignment Tool

Installation Using The Long Tip Alignment Tool

This procedure is for installing more than one hammer spring assembly at a time, using long Tip Alignment Tool (kit no. 175789-001). To install one hammer spring assembly at a time, use the short Tip Alignment Tool (kit no. 174478-001) (page 205).

Always install the hammer spring assemblies in pairs that face each other. Install the pairs from either end of the hammer bank, and work toward the middle of the hammer bank.

NOTE: If the hammer spring assemblies are being removed for cleaning, note their locations on the hammer bank and return them to the same locations when you reinstall them. This minimizes the impact on print quality when the shuttle frame assembly is reinstalled.

1. Using a clean dry cloth, wipe the hammer spring mounting surface and pole pin surface on the hammer bank. Make sure the cloth does not leave lint on the hammer bank.
2. Place the hammer bank on a work surface with the alignment pins on the side nearest you. (The alignment pins are shown in Figure 30.)

CAUTION **Hammer springs and hammer tips are fragile. Handle hammer springs by the mounting base only and do not touch the hammer tips.**

3. Handling the hammer spring assemblies by the mounting base only, remove the new assemblies and mounting screws from their boxes. Arrange the hammer spring assemblies into pairs that will face each other on the hammer bank.
4. Handling the assemblies by the mounting bases only, position the first pair of new assemblies on the hammer bank in the available positions nearest (either) end of the hammer bank. Align the assemblies as closely as possible over their mounting screw holes. (See Figure 29.)

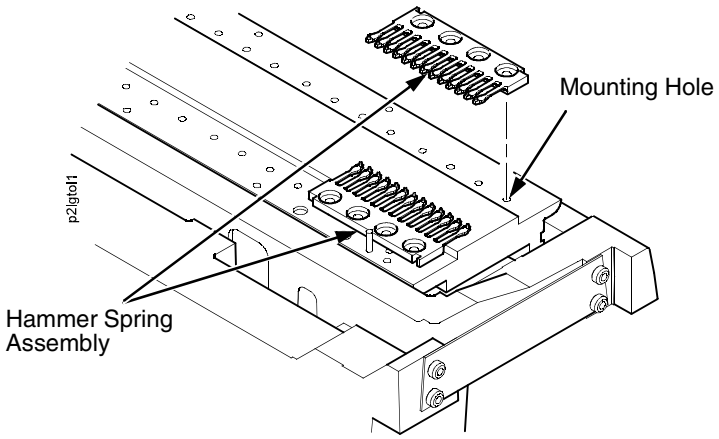


Figure 29. Pairing Hammer Spring Assemblies on the Hammer Bank

5. Gently position the long Tip Alignment Tool so the right alignment pin on the hammer bank is in the round hole in the tool, then lower the tool until its oblong hole fits over the alignment pin on the left side of the hammer bank. (See Figure 30.)

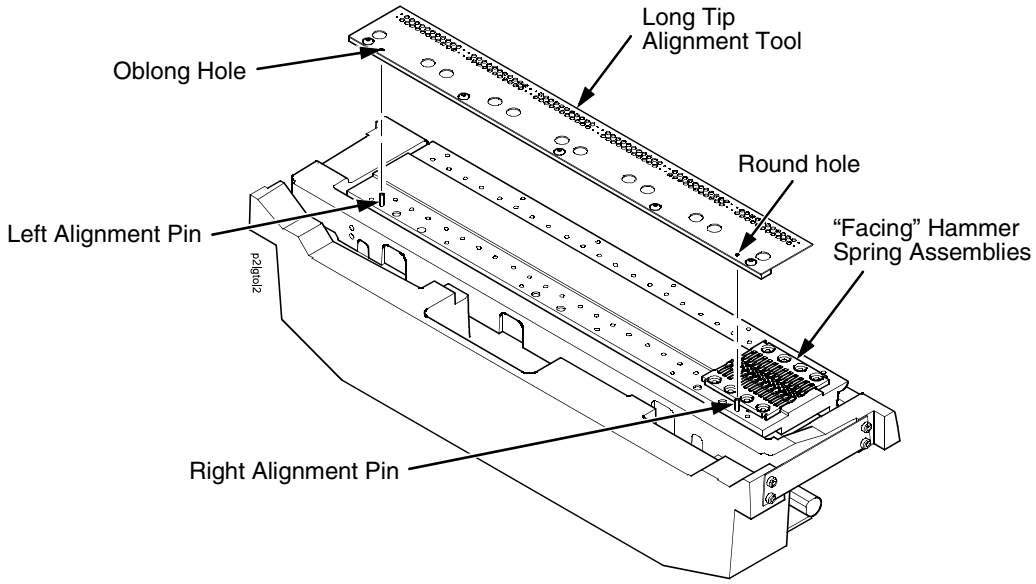


Figure 30. Positioning the Long Alignment Tool

CAUTION **In the next step, use ONLY the pick that comes with the long alignment tool to align the hammer spring assemblies. To avoid damaging threads, never insert any metallic tool into the hammer spring mounting holes in the hammer bank.**

6. Apply a slight, continuous downward pressure to the alignment tool and gently swivel the alignment pick in the hammer spring mounting holes to maneuver the hammer tips into the tiny holes in the alignment tool. You will feel/hear a small "click" when the hammer tips slip into the holes. Use the pick to set the outer hammer tips of both facing assemblies. (See Figure 31.)

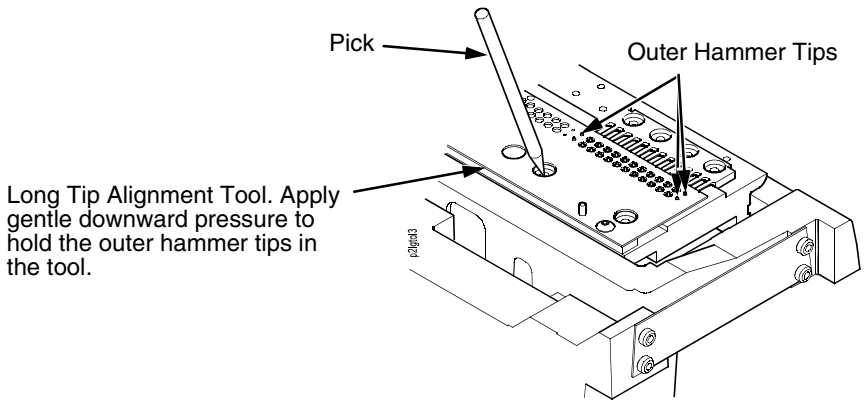


Figure 31. Using the Pick to Maneuver the Hammer Tips into the Alignment Tool Holes

7. Continue to apply a slight downward pressure on the tool and install the outer two mounting screws in the hammer spring assembly nearest you. Now install the outer mounting screws in the other hammer spring assembly. Torque each screw to 14 in-lbs (1.58 N•m). (See Figure 32 and use the 1-30 inch-pound Torque Screwdriver, IBM part number 16F1661.)

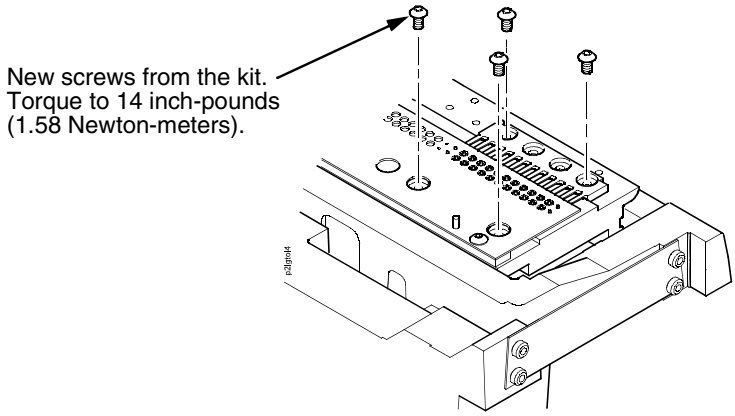


Figure 32. Installing the Torx T-10 Screws

8. Gently rock the alignment tool until the tool is released from the hammer tips.
9. Repeat steps 3 through 8 until all facing pairs of hammer spring assemblies are installed.
10. Install the middle mounting screws to all hammer spring assemblies and torque each middle screw to 14 in-lbs (1.58 N•m). (Use the 1-30 inch-pound Torque Screwdriver, IBM part number 16F1661.)
11. Install the hammer bank cover assembly (page 195).
12. Install the shuttle frame assembly (page 235).
13. Install the ribbon and load paper.

CAUTION **Do NOT attempt to adjust or "tweak" hammer springs.**

14. Run a print test and check print quality (page 118):
    a. If print quality is acceptable, return the printer to normal operation (page 137).
    b. If print quality is still degraded, replace the shuttle frame assembly (page 235).

Magnetic Pickup (MPU) Assembly

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the shuttle cover (page 197).
3. Disconnect the magnetic pickup (MPU) cable connector (page 254, item 5).
4. Loosen the 7/64 inch hex MPU clamp screw (page 254, item 3).
5. Unscrew the MPU assembly from the MPU bracket.

Installation

1. Install the MPU assembly by screwing it into the MPU bracket. (See Figure 43, page 254).
2. Using a feeler gauge, adjust the gap between the MPU assembly and the flywheel to 0.010 ± 0.001 inch (0.254 ± 0.025 mm). Torque the 7/16 inch MPU clamp screw to 18 ± 1 inch-pounds (2.03 ± 0.11 N•m).
3. Check the gap between the MPU assembly and the flywheel with a feeler gauge:
   a. If the gap is 0.010 ± 0.001 inch (0.254 ± 0.025 mm), go to step 4.
   b. If the gap is not 0.010 ± 0.001 inch (0.254 ± 0.025 mm), loosen the MPU clamp screw and go back to step 2.
4. Route the MPU cable under the extension spring and connect the MPU cable connector (page 254, item 5). Make sure the MPU cable does not touch the extension spring after cable connection.
5. Install the shuttle cover (page 197).
6. Adjust the hammer phasing (page 152).
7. Return the printer to normal operation (page 137).

Memory and Security Key (Model P5224)

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

NOTE: There are two versions of the PSA3 controller board, marked V3 and V4. The V3 board has two SIMM slots and the V4 board has one SIMM slot, as shown in Figure 33. Except for the difference in flash memory SIMM slots, the boards are fully interchangeable.

Removal

1. Make a configuration printout of all saved configurations. (Refer to the *User's Manual.)*
2. Prepare the printer for maintenance (page 136).
3. Remove the paper path (page 222).
4. Put on a static wrist strap and ground the lead to an unpainted part of the printer frame. Touch the printer frame with the hand wearing the wrist strap before you touch memory modules or the controller board
5. To remove a flash SIMM or SDRAM DIMM, gently open the side locks, angle the memory module upward, and remove it from the socket. (See Figure 33, page 212.)
6. If a new security is required, gently lift the locking tab on the top side of controller board connector J9 enough to release the security key, then lift and remove the old security key. (See Figure 33.)
7. Select the security key that matches the emulations the user will load. (See the table below.) The security key is a 3-pin semi-programmable EEPROM that enables the loading of microcode and emulation software.

Security Key Part Number	Emulations Supported
361699-001	CT / LP+
361700-001	CT / IGP
361701-001	CT / IPDS / LP+
361702-001	CT / IPDS / IGP
361703-001	CT / ANSI / LP+
361704-001	CT / ANSI / IGP
361705-001	HANZI GB LP+
361706-001	THAI LP+
361707-001	TN / IGP
361708-001	TN / LP+
361709-001	THAI IGP

Security Key Part Number	Emulations Supported
362029-001	HANGUL LP+
362030-001	HANZI B5 LP+
362031-001	HANZI TW LP+
362278-001	PCL2 / IGP
362279-001	PCL2 / LP+

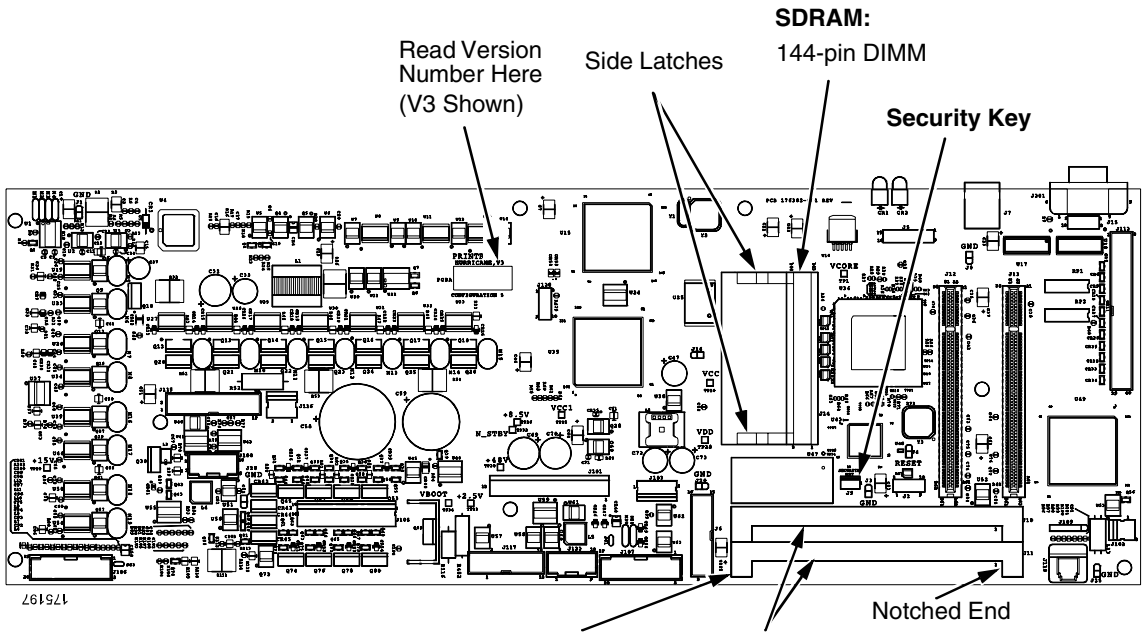
Installation

1. Put on a static wrist strap and ground the lead to an unpainted part of the printer frame. Touch the printer frame with the hand wearing the wrist strap before you touch memory modules or the controller board .
2. Position the new security key on controller board connector J9 so that the lock indentation is on the same side as the locking tab on connector J9. Gently press the security key down onto the pins until the locking tab engages the lock indentation and locks the key in place. (See Figure 33.)

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

3. Insert the memory module into the correct socket (see Figure 33) on the controller board at about a 45 degree angle:
   a. Position each flash memory SIMM in its socket with the notched end toward the right side of the controller board. Press the SIMM gently into the socket until the edge connectors are seated, then press the SIMM downward until the side latches lock the SIMM is place. (See Figure 33, page 212.)
   b. Position the SDRAM DIMM in socket J14 with the component side upward. Press the DIMM gently into the socket until the edge connectors are seated, then press the DIMM downward until the side latches lock it in place. (See Figure 33, page 212.)
4. Install the paper path (page 222).
5. Download the emulation (page 172).
6. Return the printer to normal operation (page 137).
7. Using the configuration printout(s) you made in step 1 of the removal procedure, reset and save the printer configuration(s). (Refer to the *User's Manual.)*

PSA3 Controller Board



Flash Memory in V4 Controller

One 72-pin SIMM slot
J11 is always filled
J10 is not used

Flash Memory in V3 Controller:

Two 72-pin SIMM slots
J11 = Always filled
J10 = Additional memory

If 1 Flash SIMM, use J11
If there are two Flash SIMMs, use both slots but put the pre-programmed SIMM in J11

IMPORTANT:
The controller board does not support EDO RAM.

4 MB SIMM = 204480-901
8 MB SIMM = 204480-902
16 MB SIMM = 204480-903
32 MB SIMM = 204480-904

32 MB SDRAM DIMM = 204535-001

Memory Requirements for Emulation Options

Emulation Options	LP+	IGP LP+	ANSI LP+	PGL ANSI LP+	VGL ANSI LP+	CT LP+	CT PGL LP+	CT VGL LP+	IPDS CT LP+	IPDS CT PGL LP+	IPDS CT VGL LP+	H-Series
Flash	4 MB	4 MB	4 MB	4 MB	4 MB	4 MB	4 MB	4 MB	8 MB	8 MB	8 MB	12 MB
SDRAM	32 MB	32 MB	32 MB	32 MB	32 MB	32 MB	32 MB	32 MB	32 MB	32 MB	32 MB	32 MB
CT Installed	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No

Figure 33. Memory Modules and Security Key in the P5224

Memory And Security Module (Model P5220)

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

Removal

1. Make a configuration printout of all saved configurations. (Refer to the *User's Manual.)*
2. Prepare the printer for maintenance (page 136).
3. Remove the paper path (page 222).
4. Gently pry the side locks open, angle the SIMM toward the front of the printer, and remove the SIMM from the socket. (See Figure 34, page 215.)
5. If a new security module is required, remove the old one. (See Figure 34, page 215.)

The printer uses one of six possible security modules, depending on the emulation and hardware options used by the customer:

PAL 1: LP+ / CT

PAL 2: LP+ / CT / IGP

PAL 3: IPDS

PAL 4: IPDS / IGP

PAL 5: ANSI

PAL 6: ANSI / IGP

Some emulations will run under more than one security module, as shown below:

Emulation	Security Module Number					
	1	2	3	4	5	6
LP+	✓	✓	✓	✓	✓	✓
LP+/PGL		✓		✓		✓
LP+/VGL		✓		✓		✓
ANSI (Genicom 4440)					✓	
ANSI/PGL						✓
ANSI/VGL						✓
CT/LP+	✓	✓	✓	✓	✓	✓
CT/PGL/LP+		✓		✓		✓
CT/VGL/LP+		✓		✓		✓

Emulation	Security Module Number					
	1	2	3	4	5	6
CT/IPDS/LP+			✓	✓		
CT/IPDS/PGL/LP+				✓		
CT/IPDS/VGL/LP+				✓		

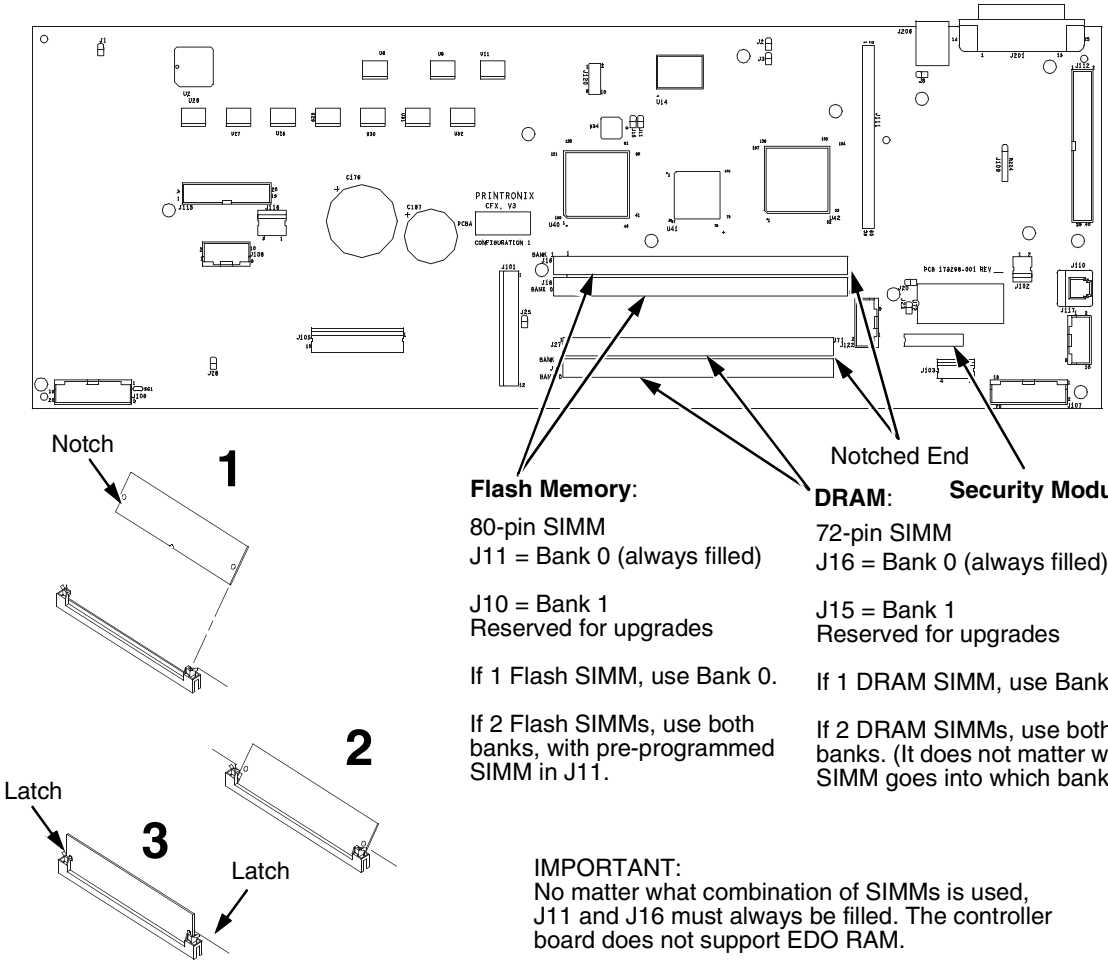
Installation

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

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

1. Observing the correct pin orientation, install the new security module, if required by the emulation. (See the chart on page 213 and Figure 34 on page 215.)
2. Insert the memory module into the correct socket on the controller board:
   a. Position the SIMM with the notched end toward the right side of the controller board. (See Figure 34, page 215.)
   b. Press the SIMM into the socket with the top of the SIMM angled *away* from the center of the board. When the SIMM is seated in the socket, gently push on the ends until it locks in the upright position.
3. Install the paper path (page 222).
4. Download the emulation (page 164).
5. Return the printer to normal operation (page 137).
6. Using the configuration printout(s) you made in step 1 of the removal procedure, reset and save the printer configuration(s). (Refer to the *User's Manual.)*

CFX Controller Board



Memory Requirements for Emulation Options

Emulation Options	LP+	IGP LP+	ANSI LP+	PGL ANSI LP+	VGL ANSI LP+	CT LP+	CT PGL LP+	CT VGL LP+	IPDS CT LP+	IPDS CT PGL LP+	IPDS CT VGL LP+
Flash	4 MB	4 MB	4 MB	4 MB	4 MB	4 MB	4 MB	4 MB	4 MB	4 MB	4 MB
DRAM	4 MB	4 MB	4 MB	4 MB	4 MB	4 MB	4 MB	4 MB	4 MB	4 MB	4 MB
CT Installed	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Figure 34. Memory and Security Modules in the P5220

NIC (Network Interface Card) Assembly (Model P5224)

The NIC option in the P5224 is a PCI card that plugs into one of the available PCI slots on the PSA3 controller board. This interface has no DIP switches.

Removal

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

1. Prepare the printer for maintenance (page 136).
2. Remove the paper path (page 222).
3. Put on a static wrist strap and ground the lead to an unpainted part of the printer frame. Touch the printer frame with the hand wearing the wrist strap before you touch electronic components or the controller board.
4. Remove the screw securing the NIC connector plate to the rear of the card cage. (See page 270, item 4.)
5. Angle the NIC out of the card cage cutout as you lift the NIC off the expansion connector on the controller board. (See page 270, item 1.

Installation

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

1. Reverse steps 2 through 5 of the removal procedure.
2. Return the printer to normal operation (page 137).

Testing NIC Operation

You can test the NIC by starting a telnet session (`telnet` *`IP address`*) and sending

`start fox prn`<Return>
`stop prn`<Return>

This command sequence sends consecutively numbered lines of text from the interface to the printer. The “fox” test is resident in the NIC and verifies that it can receive commands and can transfer data successfully to the printer.

NIC (Network Interface Card) Assembly (Model P5220)

The NIC option in the P5220 is a 10/100Base-T. This configuration can be installed at the factory or as a field kit. The functions of the DIP switches are described on page 217.

To convert an ethernet-equipped P5220 to a parallel interface, remove the NIC and install the Centronics connector in the slot the NIC occupied. (The Centronics cable joins the back of the NIC to the controller board.)

Removal

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

1. Prepare the printer for maintenance (page 136).
2. Remove the paper path (page 222).
3. Disconnect Centronics cable connector P112 from connector J112 on the controller board. (See page 272, item 5.)
4. Open the ferrite clamp and lift the Centronics cable out of the ferrite clamp.
5. Loosen the two screws securing the NIC assembly to the cutout at the rear of the card cage.
6. Slide the NIC assembly out of the cutout in the card cage and lift the assembly out of the card cage.

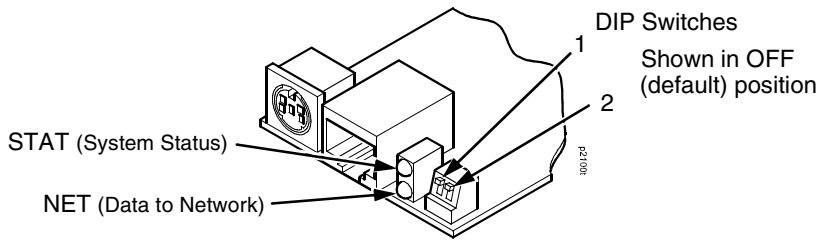
Installation

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

1. Reverse steps 2 through 6 of the removal procedure.
2. Return the printer to normal operation (page 137).

10/100Base-T LEDs And DIP Switches

The 10/100Base-T ethernet interface has two indicator lights and two DIP switches next to the interface cable connector, as shown below.



Inspect the two LEDs on the 10/100Base-T Ethernet interface:

1. When an IP address is configured into the printer via the control panel, the bottom LED should be blinking on and off at the same rate.
2. When a working network cable is installed, the top LED should be on steadily and will blink off for 1/3 second when data are received.

When these two conditions are met, you should be able to `ping` the printer from a network host.

You can test by starting a telnet session (`telnet` *`IP address`*) and sending

`start fox prn`<Return>
`stop prn`<Return>

This command sequence sends consecutively numbered lines of text from the interface to the printer. The “fox” test is resident in the network interface and verifies that it can receive commands and can transfer data successfully to the printer.

If no network cable is connected or the cable is defective and the IP address is configured from the control panel, the top LED will be off and the bottom LED will blink on/off.

STAT (Status) Indicator In Run And Auto Reset Modes

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

STAT	Rate	Indication
OFF	Flashes ON once per second	Normal Mode, IP address configured
OFF	Flashes ON 2 times per second	IP address not configured
ON	Flashes OFF once per second	Download (MOS)
ON	Flashes OFF twice per second	Error

NET (Network) Indicator

The NET LED displays the status of the network link:

NET	Rate	Indication
ON	Constantly	Indicates link integrity

NET	Rate	Indication
ON	Flashes OFF 1/3 second	Flashes off 1/3 second every time a data packet is transmitted
OFF	Constantly	Network connection has been severed

DIP Switches

On the back of the 10/100Base-T interface inside the printer, there are two DIP switches labeled 1 and 2. The functions of the DIP switches are explained in Table 9.

Table 9. 10/100Base-T DIP Switch Settings

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

Paper Feed Motor

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the paper path (page 222).
3. Remove the timing belt cover by squeezing the front and back to release the plastic tabs from the slots in the side plate (page 248, item 7).
4. Loosen, but do not remove, the two 5/16 inch paper feed motor mounting screws. (See page 262, item 6.)
5. Roll the paper feed timing belt off the paper feed motor pulley and splined shaft pulley.
6. Trace the paper feed motor cables back to the controller board, releasing it from tie wraps. (See the cable routing diagrams in Appendix A.)
7. Disconnect connector P107 from the controller board and remove the paper feed motor connector from connector P107. (See page 191.)

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

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

Installation

1. Position the paper feed motor assembly on the right side plate and install the motor mount bolts and nuts finger tight. (See page 262, items 6and 18.)
2. Connect the paper feed motor cable connector to connector P107, then connect P107 to J107 on the controller board. (See page 191.)
3. Roll the paper feed timing belt onto the splined shaft pulley and the motor pulley
4. Using the straight end of a force gauge, apply 15 pounds (66.7 N) of pressure to the paper feed motor. Use the splined shaft to steady the gauge.
5. Reduce pressure to 12 pounds (53.4 N) and torque the 5/16 inch motor mount screws to 18 ± 2 inch-pounds (2.03 ± 0.23 N•m).
6. Snap the timing belt cover into the slots in the side plate.
7. Install the paper path (page 222).
8. Return the printer to normal operation (page 137).

Paper Ironer

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

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the shuttle frame assembly (page 235).
3. Move the forms thickness lever to the open position.
4. Push the ends of the paper ironer toward the rear of the printer, disengage the tabs, then lift it up and out (page 258, item 3).

Installation

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

1. Position the paper ironer so the black tape is on the side that faces the rear of the printer, towards the paper detector switch assembly. (See page 258, item 3.)
2. Push the paper ironer down into the slots until the tabs engage.
3. Install the shuttle frame assembly (page 235).
4. Return the printer to normal operation (page 137).

Paper Path

Removal

1. Prepare the printer for maintenance (page 136).
2. Loosen the three screws that secure the paper path to the card cage. (Figure 35.)
3. Slide the paper path to the left and lift it off the card cage.

Installation

1. Position the paper path offset slightly to the left on the card cage with the keyway cutouts over the three loosened screws. (Figure 35.)
2. Slide the paper path to the right, engaging the three screws in the keyway slots. Slide the paper path to the right as far as it will go.
3. Make sure the paper path shims are aligned with edges of the paper path flanges and the two legs on each shim are sitting on the flanges of the card cage. (See page 248, items 13 and 14.)
4. Tighten the screws securing the paper path to the card cage. (Figure 35.)
5. Return the printer to normal operation (page 137).

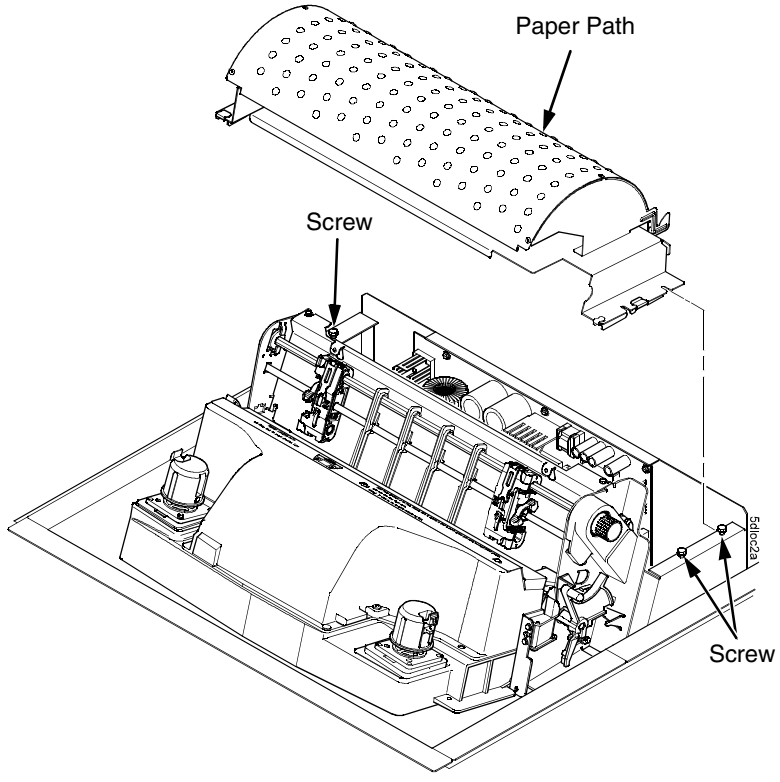


Figure 35. The Paper Path

Platen

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the paper path (page 222).
3. Remove the shuttle frame assembly (page 235).
4. Disconnect and remove the two platen springs. (See page 258, item 25.)
5. Slide the platen 1/2 inch to the left (out from under the platen bracket assembly), lift the left end of the platen slightly, and angle the platen forward and out of the printer. (See page 258, item 7.)

Installation

CAUTION **The pad and spring of the platen bracket assembly are delicate. (See page 258, items 29 and 30.) In the next step, do not let the platen contact these components when sliding the platen under the platen bracket assembly.**

1. Angle the right end of the platen onto the platen shaft and slightly to the left of the platen bracket assembly, rotate the left side of the platen back onto the shaft, then slide the platen about 1/2 inch to the right so that it slides under the platen angle adjustment pad. (See page 258, item 7.)
2. Check that the cams on the camshaft (page 258, item 36) are in contact with the cam followers on the ends of the platen, and that the pad (item 29) is aligned with the shim (item 34).
3. Install and connect the two platen springs. (See page 258, item 25.)
4. Open and close the forms adjustment lever a few times and make sure the platen opens and closes smoothly.
5. Install the shuttle frame assembly (page 235).
6. Check and adjust the platen gap (page 144).
7. Return the printer to normal operation (page 137).

Platen Open Motor

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the paper path (page 222).
3. Remove the card cage fan (page 202).
4. Remove the platen open belt cover by squeezing the top and bottom to release the plastic tabs from the slots in the side plate (page 258, item 24).
5. Using a 5/32 inch hex key, loosen the platen motor adjustment screw (page 262, item 24).
6. Remove the platen open belt.
7. Trace the platen open motor cables back to connector P106 on the controller board, releasing the cables from all tie-wraps. (See cable routing diagrams in Appendix A.)
8. Remove the platen open cable connector from connector P106. (See page 191.)
9. Remove the 5/32 inch upper motor mount screw, platen spring post, and platen belt spring (page 262, items 24 through 26).
10. Remove the 5/16 inch lower motor mount screw (page 262, item 15).
11. Remove the platen open motor assembly.

Installation

1. Position the platen open motor assembly with the wires toward the rear (page 262, item 5).
2. Install the 5/16 inch lower motor mount screw and torque it to 30 inch-pounds (3.39 N•m). (See page 262, item 15.)
3. Install the 5/32 inch upper motor mount screw, platen spring post, and platen belt spring (page 258, items 24 through 26) such that the screw is just loose enough to permit movement of the motor in the slotted side plate.
4. Rotate the motor all the way forward and install the platen open belt.
5. Connect the platen motor cable connector to connector coupling shroud P106.
6. Connect coupling shroud P106 to the controller board and install tie-wraps to secure the motor cable. (See the wire routing diagrams in Appendix A.)
7. Close the forms thickness lever all the way.

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

8. The spring automatically tensions the belt.
9. *Slowly* tighten the motor adjustment screw.

NOTE: Belt tension is correct if the belt deflects 3/16 inch midway between the pulleys. If deflection is more or less than 3/16 inch, repeat steps 7 through 9.

10. Snap the platen open belt cover into the slots in the side plate.
11. Install the card cage fan (page 202).
12. Install the paper path (page 222).
13. Return the printer to normal operation (page 137).

Power Supply Board

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

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the paper path (page 222).
3. Disconnect output connector P101 from the controller board and AC input connector P1 from the power supply board. (See page 250.)
4. Loosen the three captive screws securing the power supply board to the rear wall of the card cage. (See page 250, item 18.)
5. Carefully pry the power supply board off the three studs on the rear wall of the card cage.
6. Remove the power supply board from the card cage.

Installation

1. Reverse the steps of the removal procedure.
2. If the original power supply board was replaced, adjust the coil temperature (page 154).
3. Return the printer to normal operation (page 137).

Resistors, Terminating

For parallel interface configurations, the printer is equipped with 470 Ohm pull-up terminating resistors and 1K Ohm pull-down terminating resistors on the controller board. These are suitable for most applications. (See Figure 36, page 228.)

If the standard terminating resistor pack is not compatible with the particular interface driver requirements of the host computer, other values of pull-up and pull-down resistors may be required. 220 Ohm pull-up and 330 Ohm pull-down alternate terminating resistors are provided with the printer. The possible terminating resistor combinations are shown below, and must be installed in the pull-up/pull-down combinations shown.

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

Removal

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

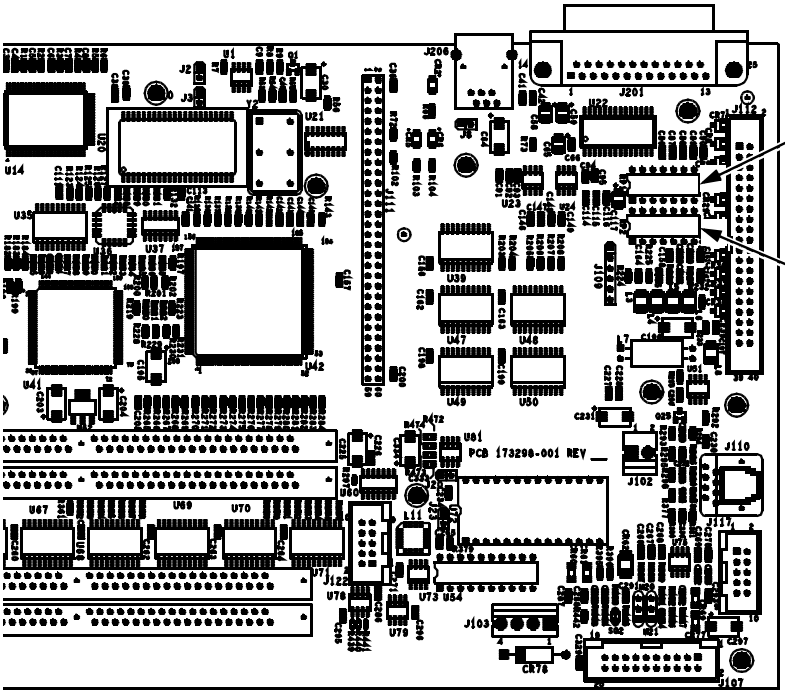
1. Prepare the printer for maintenance (page 136).
2. Remove the paper path (page 222).
3. Locate the terminating resistor packs. (See Figure 36 on page 228.)
4. Using a chip puller, remove the resistor packs.

Installation

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

1. Using a chip installation tool, install the resistor packs in the correct socket. (See Figure 36 on page 228.)
2. Install the paper path (page 222).
3. Return the printer to normal operation (page 137).

CFX Controller Board



PSA3 Controller Board

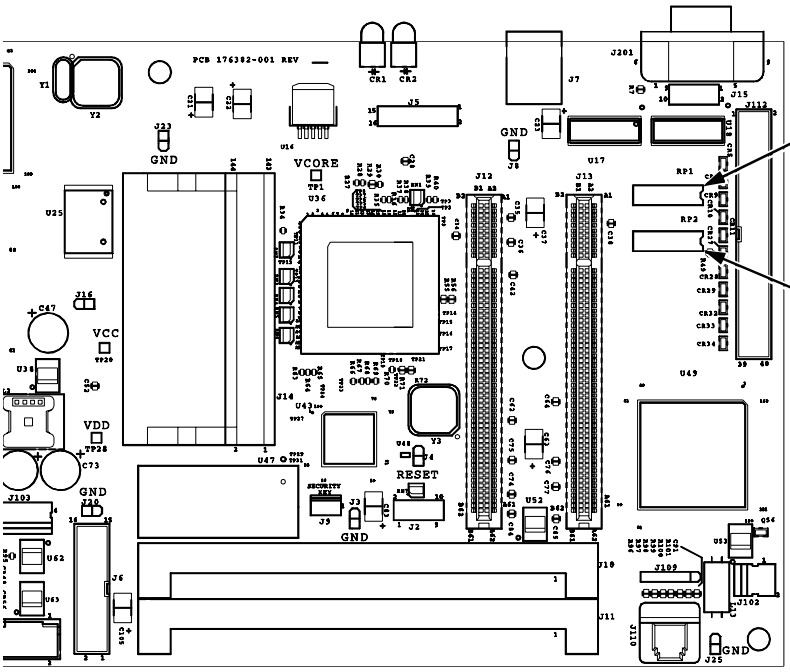


Figure 36. Terminating Resistors, Removal/Installation

Ribbon Drive Motor

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the ribbon hub (page 231).
3. Remove two screws and washers securing the ribbon drive motor to the base casting. (See page 262, items 13 and 14.)
4. Lift and rotate the ribbon drive motor until the motor cable is aligned with the slot on the base casting.
5. Disconnect the ribbon drive motor cable connector.
6. Remove the ribbon drive motor and note the position of the ribbon motor shim and its “TOP IN” mark.

NOTE: The thin shim is used with the left ribbon motor and marked with TOP IN > (See page 262, item 22.)
The thicker shim is used with the right ribbon motor and marked with TOP IN < (See page 262, item 23.)

Installation

1. Reverse steps 2 through 6 of the removal procedure above, following these guidelines:
   a. Ribbon drive motors are secured at the front right and rear left corners. (See page 262, item 12.)
   b. The thin shim is used with the left ribbon motor and is marked with TOP IN > (See page 262, item 22.)
   c. The thicker shim is used with the right ribbon motor and is marked with TOP IN < (See page 262, item 23.)
2. Return the printer to normal operation (page 137).

Ribbon Guide Assembly (L/R)

NOTE: Although the right ribbon guide is shown exploded in Figure 46 on page 262, the removal procedure is the same for both ribbon guides.

Removal

1. Prepare the printer for maintenance (page 136).
2. Cut and remove the tie-wrap from the tie wrap hole to free the ribbon guide cable. (See page 262, item 7.)
3. Remove the paper path (page 222).
4. Trace the ribbon guide cable back to the controller board, releasing it from the cable restraints. (See the cable routing diagrams in Appendix A.)
5. For the left ribbon guide, disconnect connector P106 from the controller board. For the right ribbon cable, disconnect connector P107 from the controller board.
6. Trace the ribbon guide wires to the connector coupling shroud, and remove the cable connector from the shroud (page 191).
7. Remove the two 7/32 inch screws and washers securing the ribbon guide assembly to the side plate. (See page 262, items 8 and 9.)
8. Slide the ribbon guide assembly out of the side plate.

Installation

1. Reverse steps 2 through 8 of the removal procedure above.
2. Align the ribbon guides (page 146).
3. Return the printer to normal operation (page 137).

Ribbon Hub

Removal

1. Prepare the printer for maintenance (page 136).
2. Loosen the Torx T-15 screw in the ribbon spool hub (page 262, item 20).
3. Remove the hub from the shaft of the ribbon drive motor.

Installation

1. Install the ribbon spool hub over the motor shaft (page 262, item 20).

CAUTION **Tightening the hub screw too much can crack the ribbon hub. Be careful not to over-tighten the hub screw.**

2. Tighten the Torx T-15 hub screw until it contacts the flat section of the motor shaft, then torque the hub screw to 25 inch-pounds (2.82 N•m). Make sure the ribbon hub is securely fastened to the motor shaft and there are no cracks in the ribbon hub around the hub screw.
3. Return the printer to normal operation (page 137).

Shaft, Splined

NOTE: The barrier panel must remain installed and fastened during this procedure.

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the paper supports from the splined shaft and support shaft. (See page 256, item 20.)
3. Remove the paper feed timing belt (page 184).
4. Unlock the left and right tractors and slide them to the center of the shaft.
5. Remove the screw securing the right tractor shaft plate and remove the plate (page 256, items 7 and 8).
6. Slide the splined shaft out of the sealed ball bearing in the left tractor shaft plate and remove the tolerance ring from the left end of the splined shaft (page 256, items 3, 5, and 6).
7. Hold the tractors so they do not fall, grasp the vertical adjustment knob, and slide the splined shaft to the right, out of the tractors and side plate.

Installation

1. Open the doors on the left and right tractors. Position the tractor belts so the alignment marks are at the top on both tractors. (See Figure 37.)
2. Slide the splined shaft through the right side plate and tractors. Make sure the same spline passes the marked groove on each tractor. (See Figure 37.)
3. Install the tolerance ring on the left end of the splined shaft (page 256, item 5).
4. Insert the tolerance ring lead-in portion into the sealed ball bearing in the left tractor shaft plate (page 256, items 3, 5, and 6) while sliding the ball bearing into the right side plate. Push the splined shaft to the left until the flange on the ball bearing is in solid contact with right side plate. The splined shaft will protrude about 1/16 inch from the ball bearing.
5. Install the right tractor shaft plate and screw (page 256, items 7 and 8) by first sliding the upper “fingers” up and against the flange on the ball bearing, then sliding the rectangular cutout over the support shaft end, then snapping the U-shaped “spring” behind the tab on the right side plate.
6. Install the paper feed timing belt (page 184).
7. Set the paper feed timing belt tension (page 138).
8. Install the paper supports on the splined and support shafts. (See page 256, item 4.)
9. Insert the lower ends of the paper supports into the groove in the upper forward edge of the platen.
10. Return the printer to normal operation (page 137).

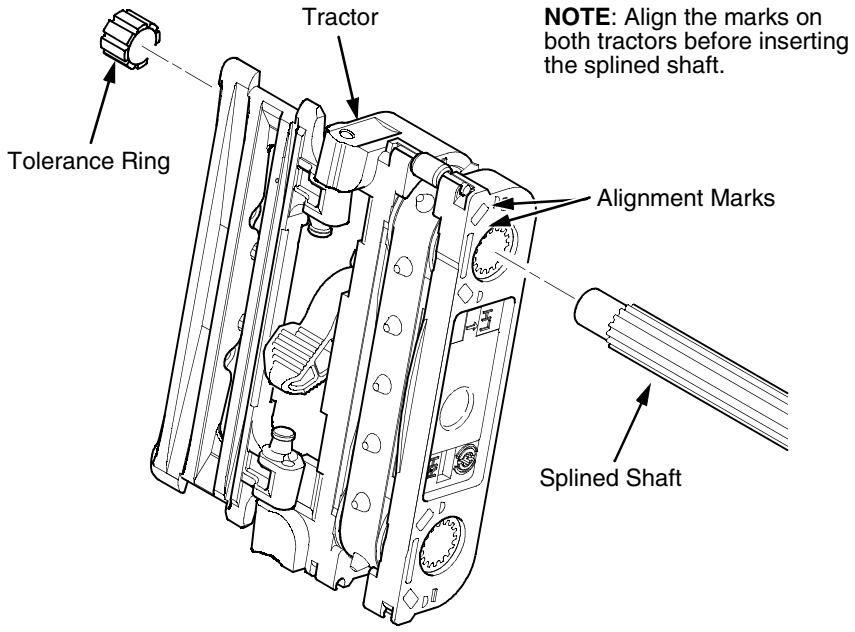


Figure 37. Splined Shaft and Tractor Installation

Shaft, Support

NOTE: The barrier panel must remain installed and fastened during this procedure.

Removal

1. Prepare the printer for maintenance (page 136).
2. Unlock the tractors and slide them to the far right.
3. Remove the paper supports from the splined shaft and support shaft. (See page 256, item 4.)
4. Remove the screw and right tractor shaft plate (page 256, items 7 and 8).

NOTE: Hold the tractors while removing the support shaft.

5. Slide the support shaft to the right, out of the tractors and the right side plate. (See page 256, items 9 and 10.)

Installation

1. Slide the support shaft into the right side plate and through the lower holes in the tractors. (See page 256, items 9, 10, and 11.)
2. Slide the support shaft through the left side plate until it bottoms in the left tractor shaft plate. (See page 256, items 2 and 12.)
3. Install the right tractor shaft plate and screw (page 256, items 7 and 8) by first sliding the upper “fingers” up and against the flange on the ball bearing, then sliding the rectangular cutout over the support shaft end, then snapping the U-shaped “spring” behind the tab on the right side plate.
4. Install the paper supports to the splined shaft and support shaft. (See page 256, item 4.)
5. Insert the lower ends of the paper supports into the groove in the upper forward edge of the platen.
6. Return the printer to normal operation (page 137).

Shuttle Frame Assembly

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the shuttle cover assembly (page 197).
3. Disconnect the MPU cable connector P03 and shuttle motor cable connector P02 (page 254, items 5 and 6).

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

4. Disconnect the hammer drive and logic cables from the terminator board on the shuttle frame assembly. (See page 250.)
5. Unlock and slide the tractors outward as far as they will go on the tractor support shaft.
6. Open the forms thickness lever all the way.
7. Loosen the side 5/32 inch socket head clamp screws on each end of the shuttle and pull the clamps back and off the guide shaft. Do not remove the clamps. Hand tighten the clamp screws to hold the clamps back.
8. Loosen the center 5/32 inch socket head screw enough to release the shuttle frame assembly from the base casting.
9. Grasp the support legs cast on both sides of the shuttle motor and lift the shuttle frame assembly out of the base casting, taking care not to snag the ribbon mask. Lift it slowly and carefully: the shuttle frame assembly is heavy.

Installation

1. Install the hammer bank / ribbon mask cover assembly if it was removed (page 195).

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

2. Open the forms thickness lever and move the tractors as far left and right as possible.
3. Holding the shuttle frame assembly by the support legs cast on both sides of the shuttle motor, set it into the base casting (page 250). **Use both hands: the shuttle frame assembly is heavy.**
4. Align the center 5/32 inch socket head screw in the base casting and hand turn the screw until only two or three threads have started.
5. Pull the shuttle frame assembly toward the front of the printer and hold it in this position while you do step 6.

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

6. Slide the side clamps over the guide shaft and torque the 5/32 inch socket head clamp screws to 30 ± 2 inch-pounds (3.39 ± 0.23 N•m).
7. Torque the center captive 5/32 inch socket head screw to 30 . 2 inch-pounds (3.39 ± 0.23 N•m).
8. Connect the hammer drive and logic cables to the terminator board on the shuttle frame assembly.
9. Connect the shuttle motor cable connector. (See page 254, item 6.)
10. Route the MPU cable under the extension spring and connect the MPU cable connector. (See page 254, item 5.) Make sure the MPU cable does not touch the extension spring after it is connected.
11. If the shuttle assembly is a new or refurbished unit, adjust the platen gap (page 144); otherwise, skip to step 12.
12. Install the shuttle cover assembly (page 197).
13. Adjust the hammer phasing (page 152).
14. Return the printer to normal operation (page 137).

Spring, Hammer Bank

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

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the shuttle cover assembly (page 197).
3. Unhook the hammer bank spring from the spring lugs on the hammer bank and shuttle frame. (See page 254, item 4.)

Installation

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

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

2. Hook the hammer bank spring over the spring lugs. (See page 254, item 4.)
3. Install the shuttle cover assembly (page 197).
4. Return the printer to normal operation (page 137).

Switch Assembly, Paper Detector

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the paper path (page 222).
3. Remove the two 1/4 inch screws securing the paper detector switch assembly. (See page 262, item 4.)
4. Trace the paper detector switch cables back to controller board connector P106, removing all tie wraps. (See the cable routing diagrams in Appendix A.)
5. Disconnect connector P106 from the controller board (page 191).
6. Trace the paper detector switch cables to the connector coupling shroud, and remove the PMD and POD cable connector from the shroud (page 190).
7. Remove the paper detector switch assembly.

Installation

1. Holding the slotted wheel against the PMD sensor, position the paper detector switch assembly and install the two 1/4 inch screws securing it to the printer base. (See page 262, item 4.)
2. Check PMD sensor arm range: make sure it travels freely and completely back into the sensing cavity.
3. Route the switch cables back to the controller board connector P106. (See the cable routing diagrams in Appendix A.)
4. Connect switch cables PMD and POD to the connector coupling shroud (page 191), then connect P106 to controller board connector J106.
5. Install the paper path (page 222).
6. Check the paper out adjustment (page 148).
7. Return the printer to normal operation (page 137).

Switch Assembly, Platen Interlock

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the paper path (page 222).
3. Fully close the forms thickness lever (position ‘A’).
4. Trace the platen interlock switch cable back to the controller board. Remove tie-wraps as necessary to free the cable. (See cable routing diagrams in Appendix A.)
5. Disconnect connector P107 from the controller board.
6. Remove the platen interlock cable connector from the connector coupling shroud (page 191).
7. Remove two Phillips #1 screws securing the platen interlock switch assembly. (See page 258, item 10.)
8. Remove the platen interlock switch assembly from the switch bracket.
9. Remove the switch cable from the cutout in the right side plate.

Installation

1. Reverse steps 2 through 9 of the removal procedure.
2. Return the printer to normal operation (page 137).

Tractor (L/R)

Removal

1. Prepare the printer for maintenance (page 136).
2. Remove the support shaft (page 234).
3. Remove the splined shaft (page 232).

Installation

1. Using the replacement tractors, install the support shaft (page 234).
2. Install the splined shaft (page 232).
3. Return the printer to normal operation (page 137).

Section II: Illustrated Parts Lists

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

Illustrations of Printer Components

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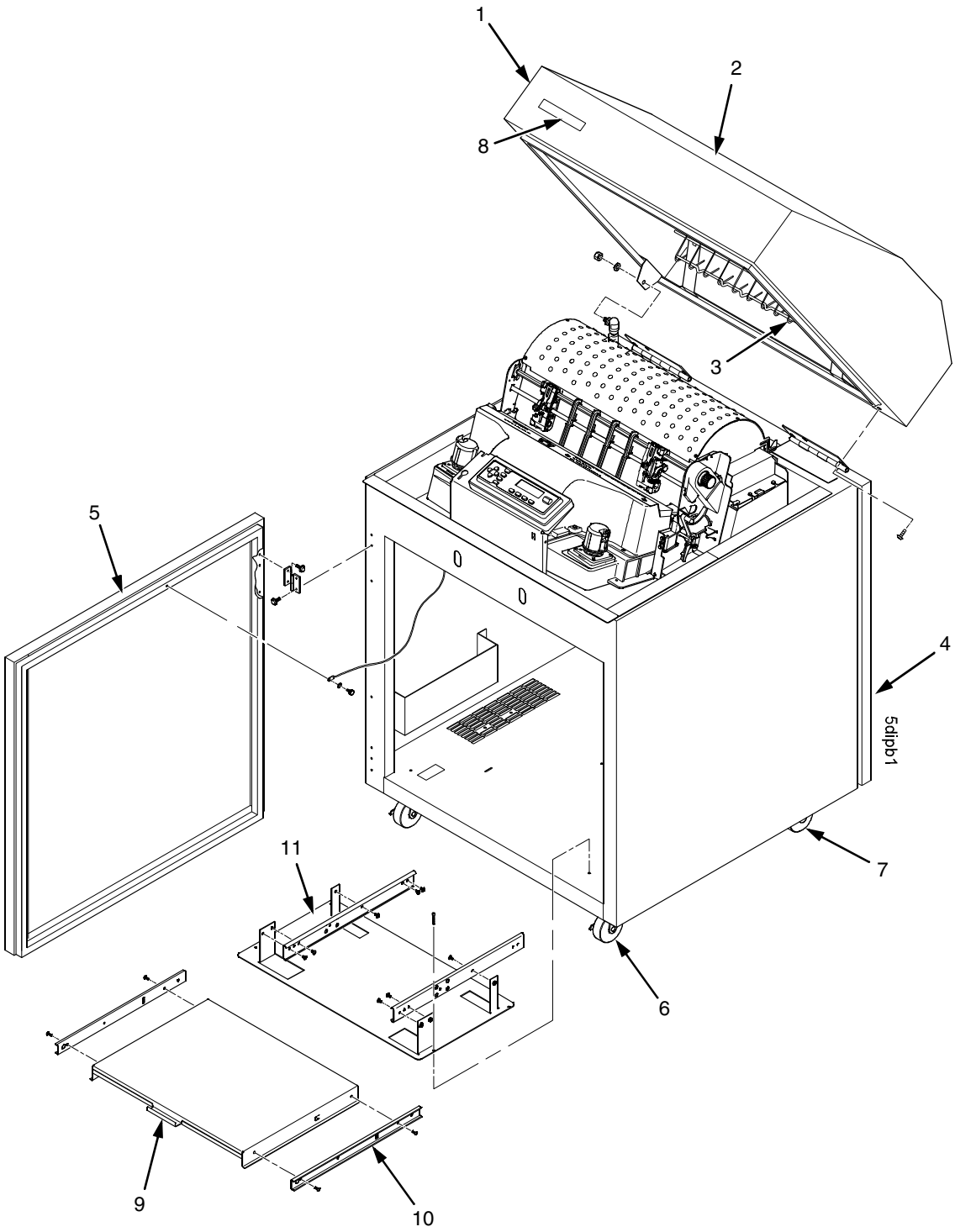

Figure 38. Top Cover, Doors, and Casters

Item No.	Part No.	Description	Notes
1	164212-905	Top Cover Kit, Cabinet	Includes mounting hardware
2	131803-901	Window, Top Cover	Not visible in Figure 38
3	153640-901	Wireform Paper Path	Includes mounting hardware (Part of 153997-001, Field Kit, Paper Path, Standard)
4	153084-902	Rear Door Kit	Includes mounting hardware (Not visible in Figure 38)
5	153084-903	Front Door Kit	Includes mounting hardware
6	141278-901	Caster, with Brake	Two at front
7	141278-902	Caster, without Brake	Two at rear
8	Ref	Logo	
9	175807-001	Tray	
10	174392-001	Slide, Ball Bearing	
11	175733-001	Plate, Front Tray Base	

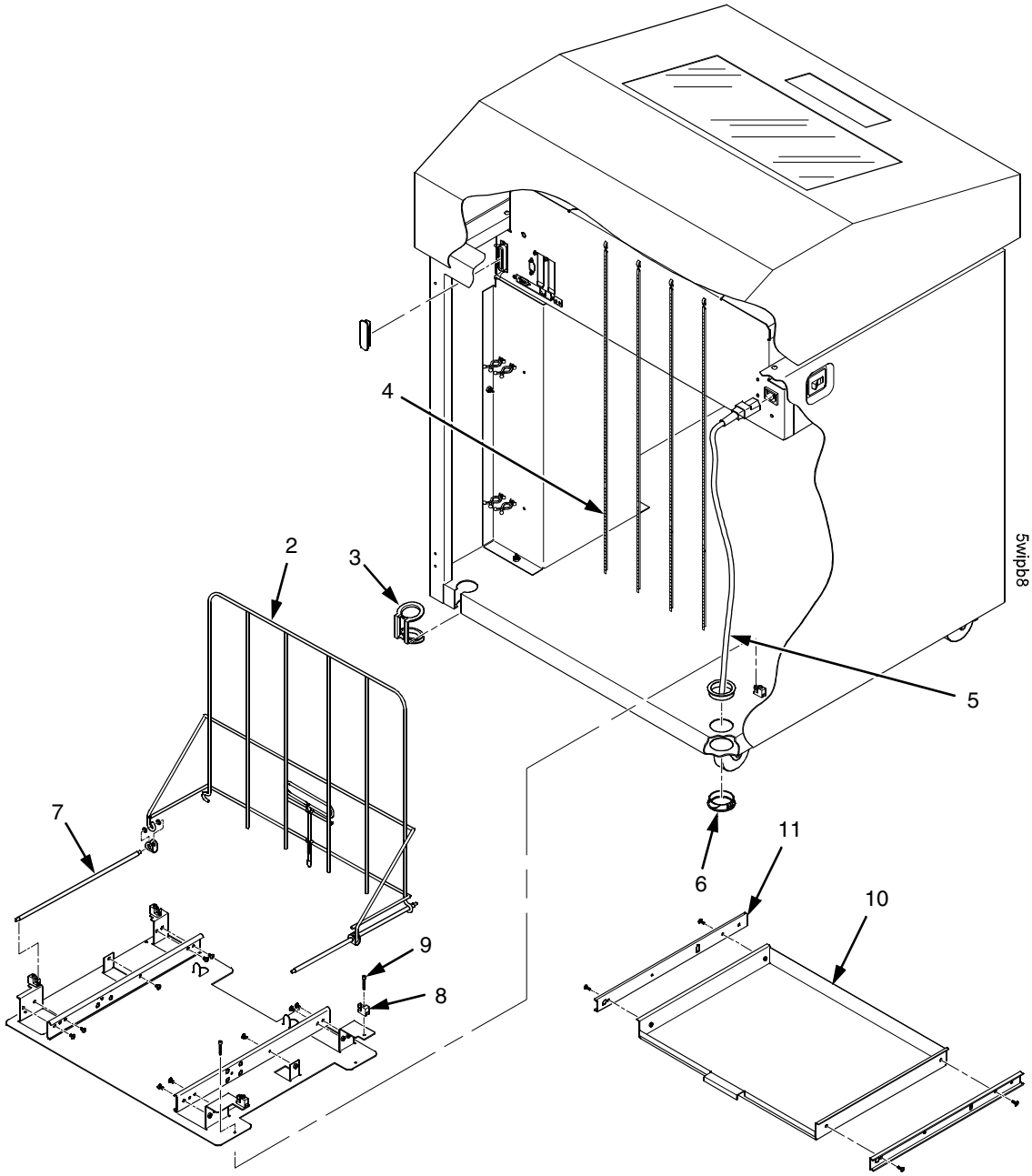

Figure 39. Paper Fence and Chains

Item No.	Part No.	Description	Notes
1	Ref	Paper Fence	On printers with power stacker. (Not shown)
2	158179-901	Passive Stacker Assembly	Not on printers with power stacker.
3	153503-001	Grommet Kit, Cabinet	
4	153778-001	Chain Assembly Kit	
5	Ref	AC Power Cord	
6	Ref	Grommet, Power Cord (2)	Included in item 3
7	Ref	Guide Rail, Stacker	Part of item 2
8	151831-001	Clip, Rail, Stacker	
9	Ref	Screw (4)	
10	175807-001	Tray	Field Kit, Tray Assembly, Rear: 175808-001 (Includes items 2, 7, 8, 9, 10, 11, and paper tent 173864-001)
11	174392-001	Slide, Ball Bearing	

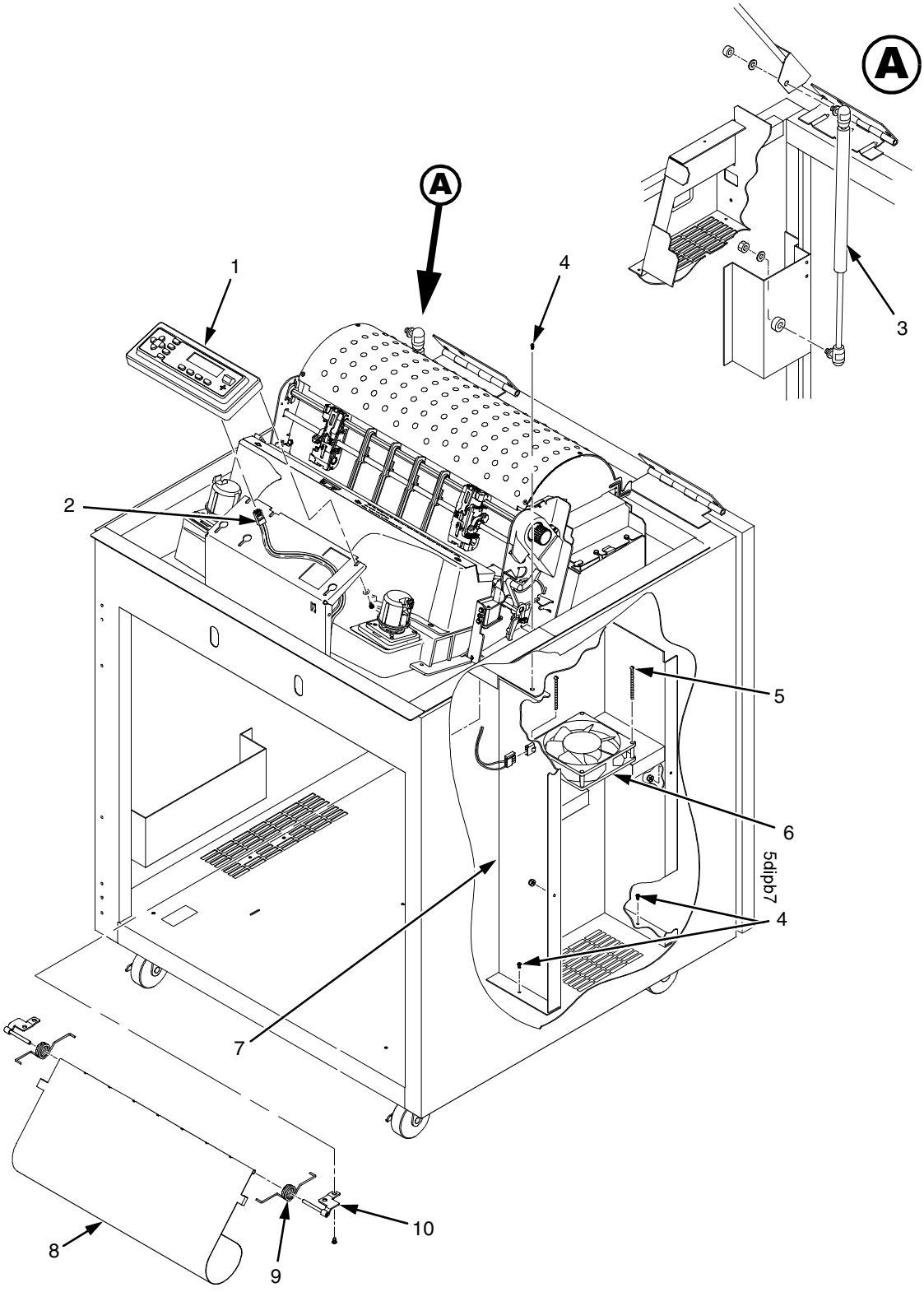

Figure 40. Control Panel and Cabinet Details

Item No.	Part No.	Description	Notes
1	175093-001	Control Panel Assembly Field Kit	Includes mounting bracket
2	152440-901	Cable Assembly, Control Panel	Installed with shielding beads: See Appendix E
3	107961-905	Dashpot Kit	Includes ball studs, spring clips, and mounting hardware
4	Ref	Screw, w/Lock Washer (2)	6-32x.375
5	Ref	Screw, w/Lock Washer (3)	6-32x2.00
6	150261-901	Fan Assembly	Includes mounting hardware
7	Ref	Duct, Air Exhaust	
8	173302-001	Paper Entrance Guide	
9	173428-001	Spring, Paper Entrance Guide (2)	
10	173351-001 173352-001	Bracket, Paper Entrance Guide, Right Bracket, Paper Entrance Guide, Left	

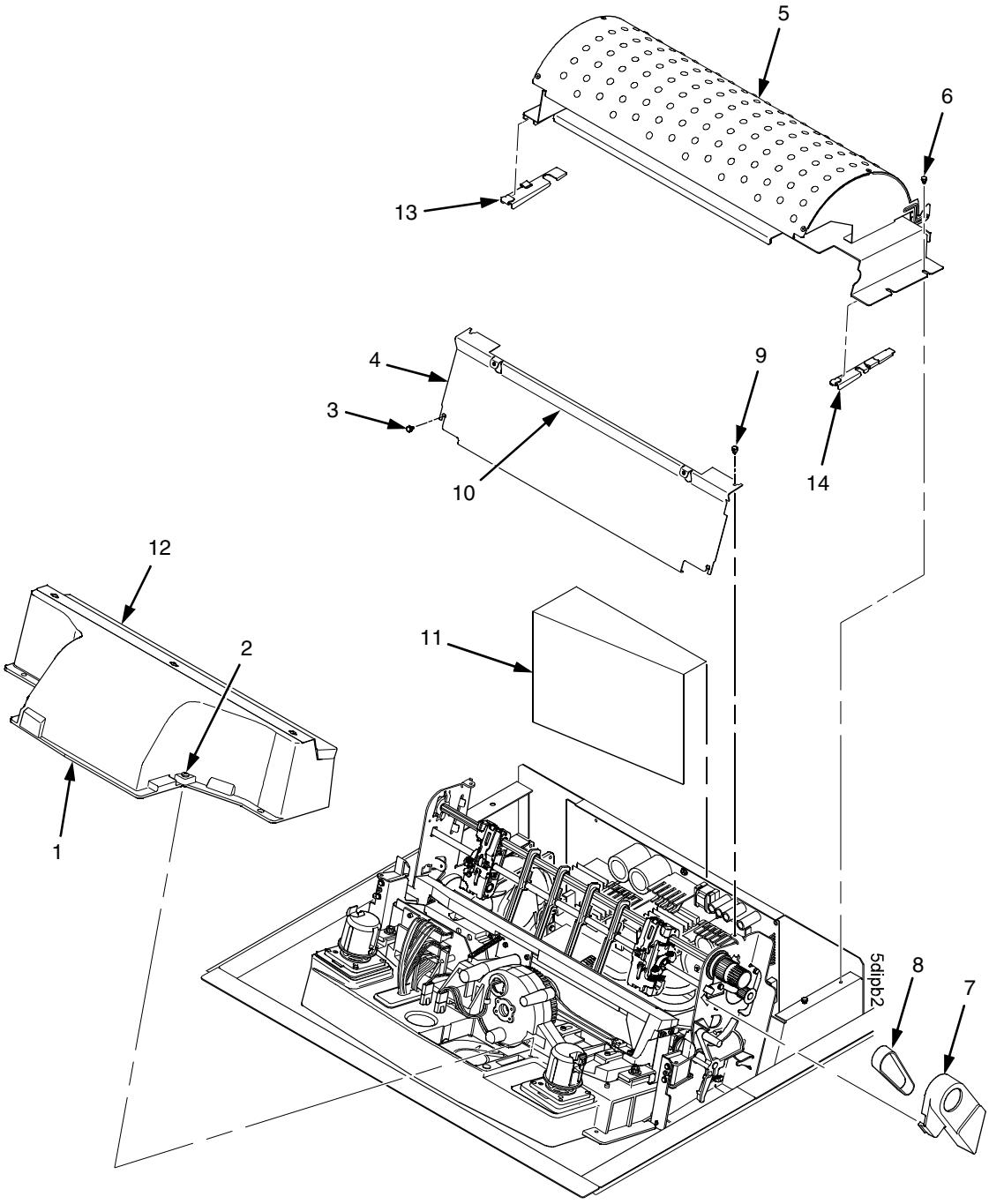

Figure 41. Inside Covers

Item No.	Part No.	Description	Notes
1	172186-901	Shuttle Cover Assembly (Shroud Assembly, Improved Cooling)	Includes items 2 and 12
2	Ref	Screw, Captive (2)	10-24x.62 with O-ring, .125x.250x.06
3	Ref	Screw, Thread-forming (2)	6-32x.25 and #6 flat washer
4	Ref	Barrier Shield	
5	173939-901	Paper Path	
6	Ref	Screw, w/Lock Washer (3)	6-32.25 and #6 flat washer
7	173434-001	Cover, Paper Feed Belt	
8	108664-001	BELT,.080P,103T,.50W	Paper Feed Belt
9	Ref	Screw, Thread-forming (2)	6-32x.315 Trilob
10	152284-901	Anti-Static Brush Kit	
11	174505-001	Insulator, Power Supply	Taped to card cage along upper edge
12	172762-901	Paper Scale	
13	172304-001	Shim, Paper Path, Left	
14	172303-001	Shim, Paper Path, Right	

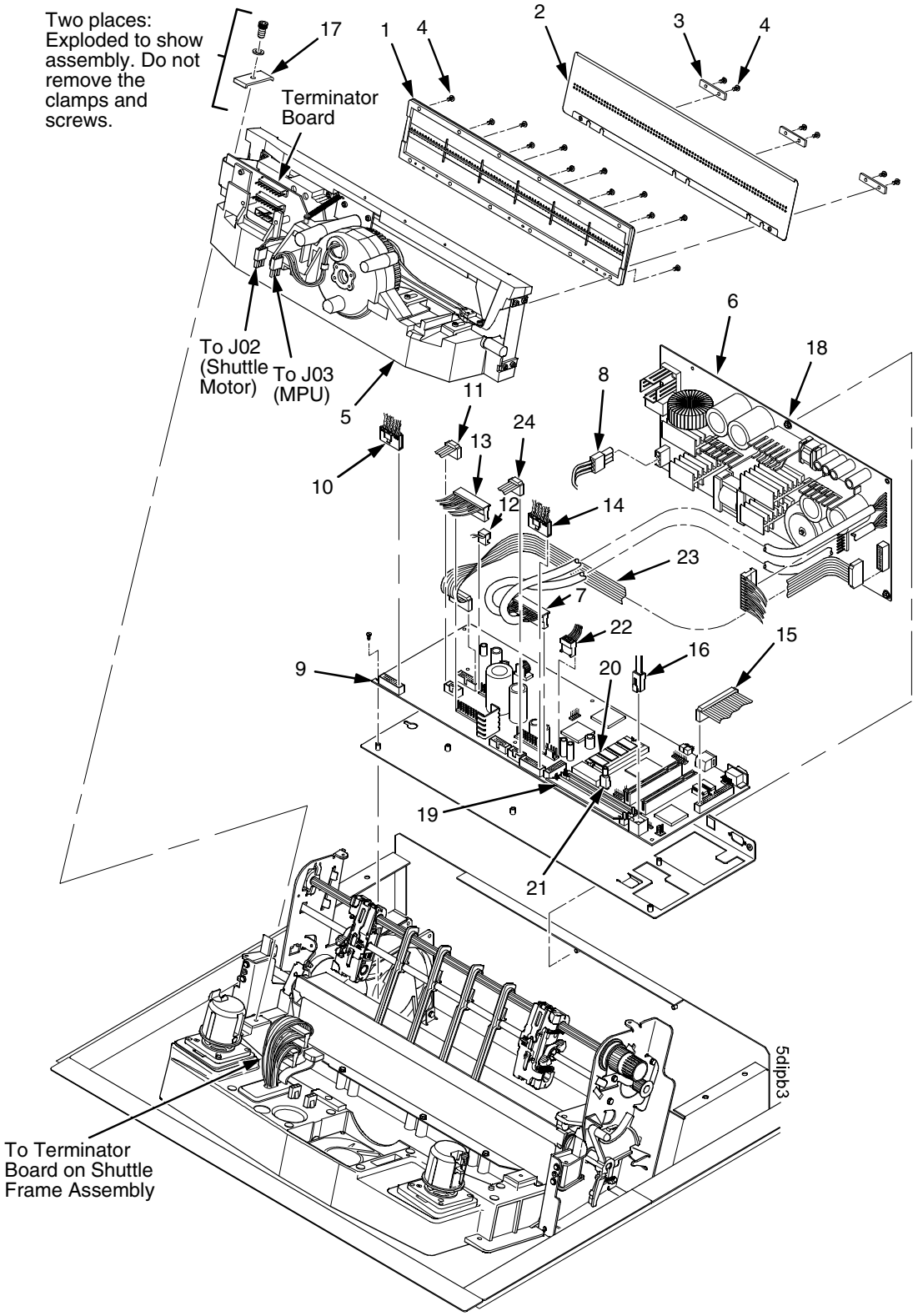

Figure 42. Print Mechanism and Circuit Boards

Item No.	Part No.	Description	Notes
1	172058-901	Hammer Bank Cover	
2	173797-901	Ribbon Mask	
3	163812-001	Ribbon Mask Clamp Plate (3)	
4	Ref	Screw, Torx T-10	12 for hammer bank cover 6 for ribbon mask
5	172178-901 172178-991 175928-901	Shuttle Assembly, Spare Shuttle Frame Assembly (Advance Exchange) Hammerspring Assembly, Spare	
6	173658-001 TBD	PCBA, P5220 Power Supply PCBA, P5224 Power Supply	
7	Ref	P101 Cable Connector	
8	Ref	Cable Assembly, AC-In, Power Supply	Part of Field Kit, AC Assy, 153502-901
9	173829-901 173829-991 175964-901	CFX Subassembly, V3 (P5220) CFX Subassembly, V3 (P5220) PCBA, Subassy, PPC, V3 (P5224)	Controller board Advance Exchange PSA3 Controller Board
10	202362-901	Connector Kit (P106/P107)	P106, Motor Sensor, Left
11	Ref	Hammer Bank Logic Cable Assembly	
12	Ref	Shuttle Drive Cable Assembly	
13	Ref	Hammer Bank Power Cable Assembly	
14	202362-001	Connector Kit (P106/P107)	P107, Motor Sensor, Right
15	152439-901	Centronics I/O Cable Assembly	
16	Ref	Control Panel Cable Assembly	
17	150399-901	Clamp, Shaft, Receiving	
18	Ref	Screw, Captive, Power Supply (3 Places)	
19	202417-001 204480-001 204480-002	SIMM, Flash Memory, 4 MB SIMM, Flash Memory, 4 MB SIMM, Flash Memory, 8 MB	P5220 P5224 P5224
20	202412-001 204535-001	SIMM, DRAM, 4MB, 1Mx32, 70 NS, 72 Pin DIMM, SDRAM, 32MB, 144 Pin	P5220 P5224

Item No.	Part No.	Description	Notes
21	Ref Ref	Security Module Security Key	P5220 P5224
22	Ref	Paper Feed Motor	
23	Ref	Hammer Phase Driver Control	
24	Ref	Hammer Bank Phase Driver Power	

(Parts lists continue on the next page.)

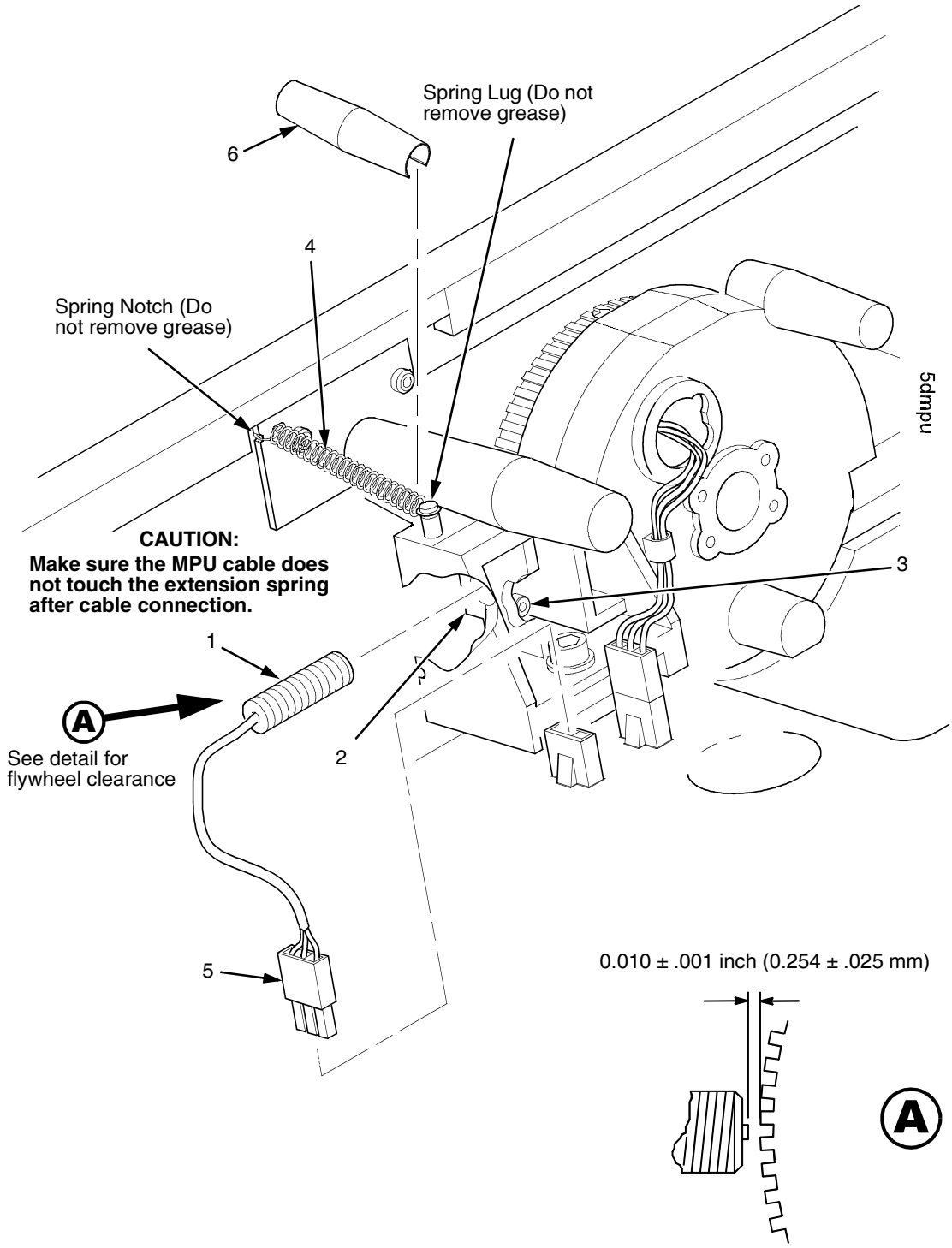

Figure 43. Magnetic Pickup (MPU) and Extension Spring

Item No.	Part No.	Description	Notes
1	150281-901	MPU Assembly	
2	Ref	Bracket, MPU	Part of item 1
3	Ref	Screw, Socket Cap	6-32x.38
4	153537-901	Spring, Hammer Bank	
5	Ref	MPU Cable Connector (P03)	
6	176507-001	Anti-Rotation Spring Constraint	Not used on the P5220D or P5224D

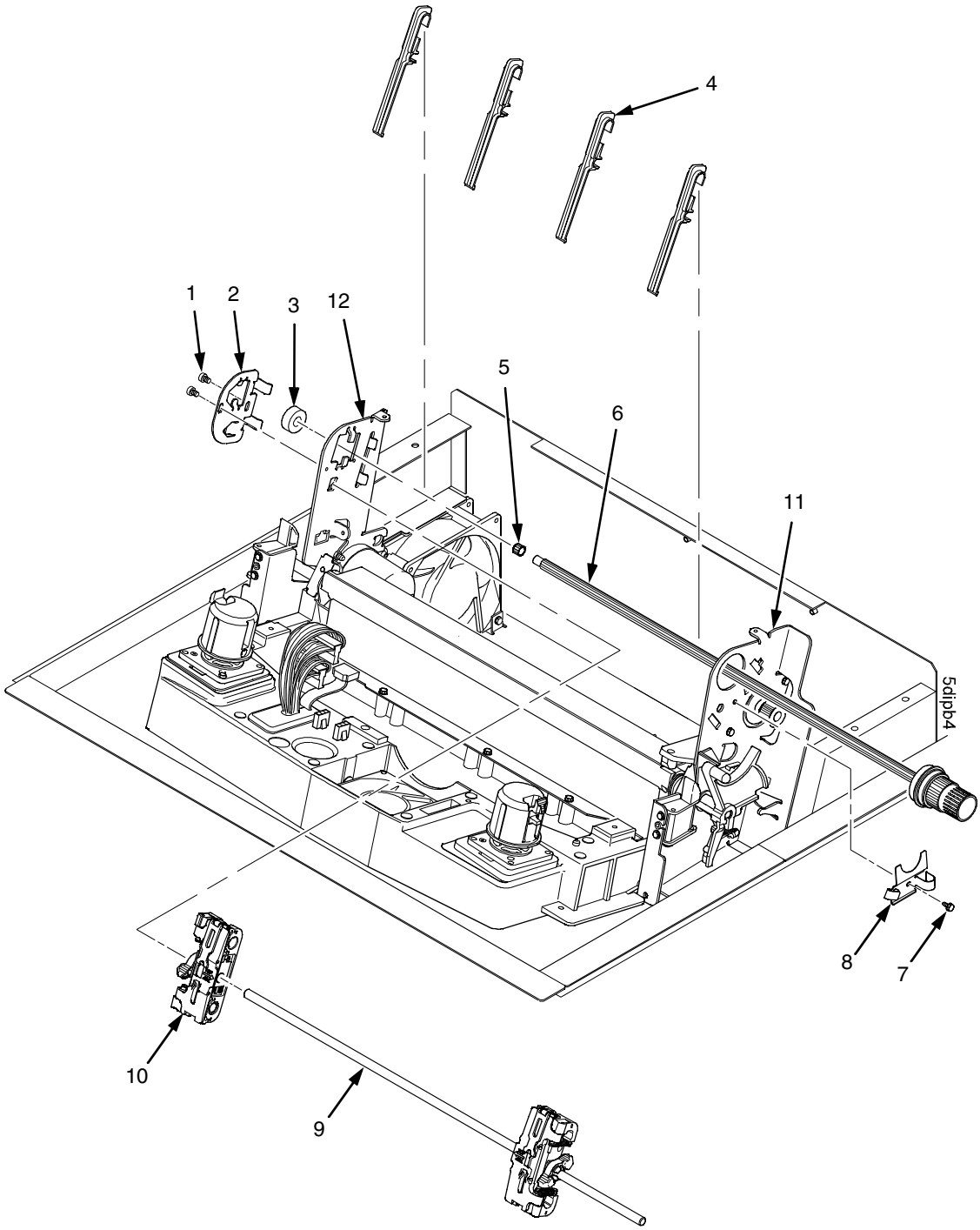

Figure 44. Tractor Shafts

Item No.	Part No.	Description	Notes
1	Ref	Screw, Socket Cap, 6-32x.312 Trilob (Self-Tapping) (2)	
2	173130-001	Plate, Tractor Shaft, Left	
3	151944-001	Bearing, Ball, Sealed	
4	173125-001	Guide, Paper Path (4)	
5	204155-001	Tolerance Ring,.37X.25,.006 THK,SS	
6	173272-001	Splined Shaft Assembly	
7	Ref	Screw, Socket Cap, 6-32x.312 Trilob (Self-Tapping)	
8	173217-001	Plate, Tractor Shaft, Right	
9	173137-001	Support Shaft	
10	173929-901	Tractor Set, Ironer Roller, LH & RH	
11	Ref	Right Side Plate	
12	Ref	Left Side Plate	

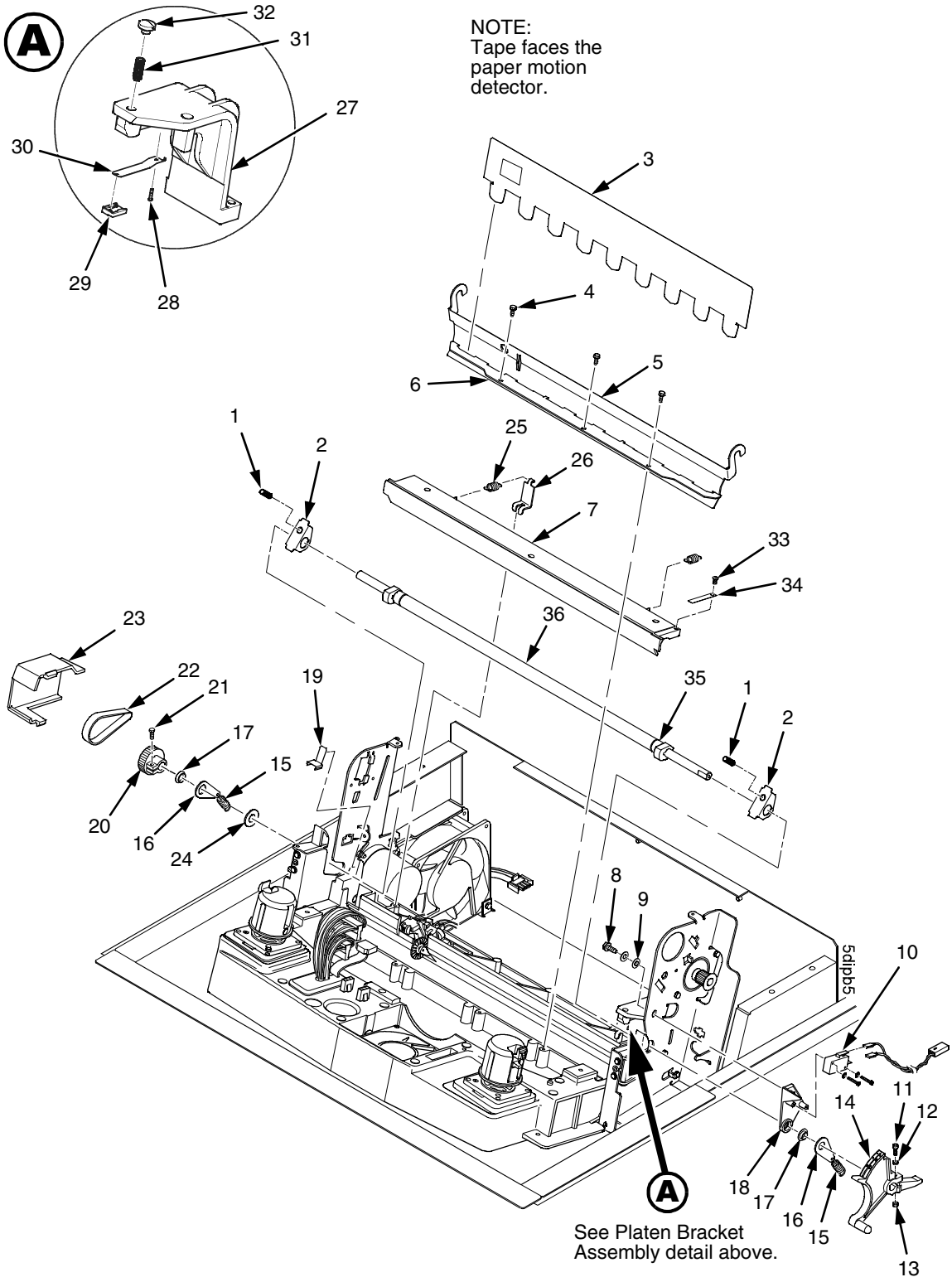

Figure 45. Platen

Item No.	Part No.	Description	Notes
1	101509-012	Setscrew (2)	
2	110245-001	Bracket, Platen (2)	
3	150957-901	Ironer, Paper	
4	Ref	Screw, Thread-forming (3)	6-32x.313 Trilob
5	174968-001	Ironer Bracket/Plate Field Kit	
6	Ref	Plate, Ironer	Part of item 5
7	173331-001	Platen, Machined	
8	Ref	Screw (2)	Part of item 10
9	Ref	Washer, Flat #4 (2)	Part of item 10
10	152417-901	Platen Switch Kit	Includes items 8, 9, 18
11	Ref	Screw, Socket Cap, 6-32x.75	Part of item 14
12	Ref	Washer	Part of item 14
13	Ref	Nut	Part of item 14
14	176000-901	Lever, Platen, V2, Spare	Includes items 11, 12, 13
15	Ref	Spring, Extension 1.12L	
16	Ref	Link, Spring	
17	Ref	Bearing, Nylon .376	
18	Ref	Bracket, Switch Mount	Part of item 10
19	173250-001	Wear Saddle, Platen (2)	
20	150703-902	Platen Pulley, Drive	
21	Ref	Screw, Socket Cap, 6-32x.44	Part of item 20
22	141516-901	Belt, Timing, .080 Pitch, .312 Wide	Platen Open Belt
23	173433-001	Cover, Platen Belt	
24	Ref	Platen Washer	
25	Ref	Platen Spring (2)	
26	173410-001	Retainer, Platen Spring (2)	
27	173826-001	Platen Bracket Assembly	
28	Ref	Screw, Metalic Drive (Stainless Steel)	Part of item 27

Item No.	Part No.	Description	Notes
29	Ref	Pad, Platen Adjust	Part of item 27
30	Ref	Spring, Skid	Part of item 27
31	Ref	Adjustable Stop Screw	Part of item 27
32	Ref	Screw, Slotted Nylon, Machine	Part of item 27
33	202100-001	Screw, Button Head, 6-32x.25	
34	173842-001	Shim, Platen Adjust Wear	
35	Ref	Bearing, Roller, Platen Shaft (2)	Part of item 36
36	173429-001	Camshaft Assembly	

(Parts lists continue on the next page.)

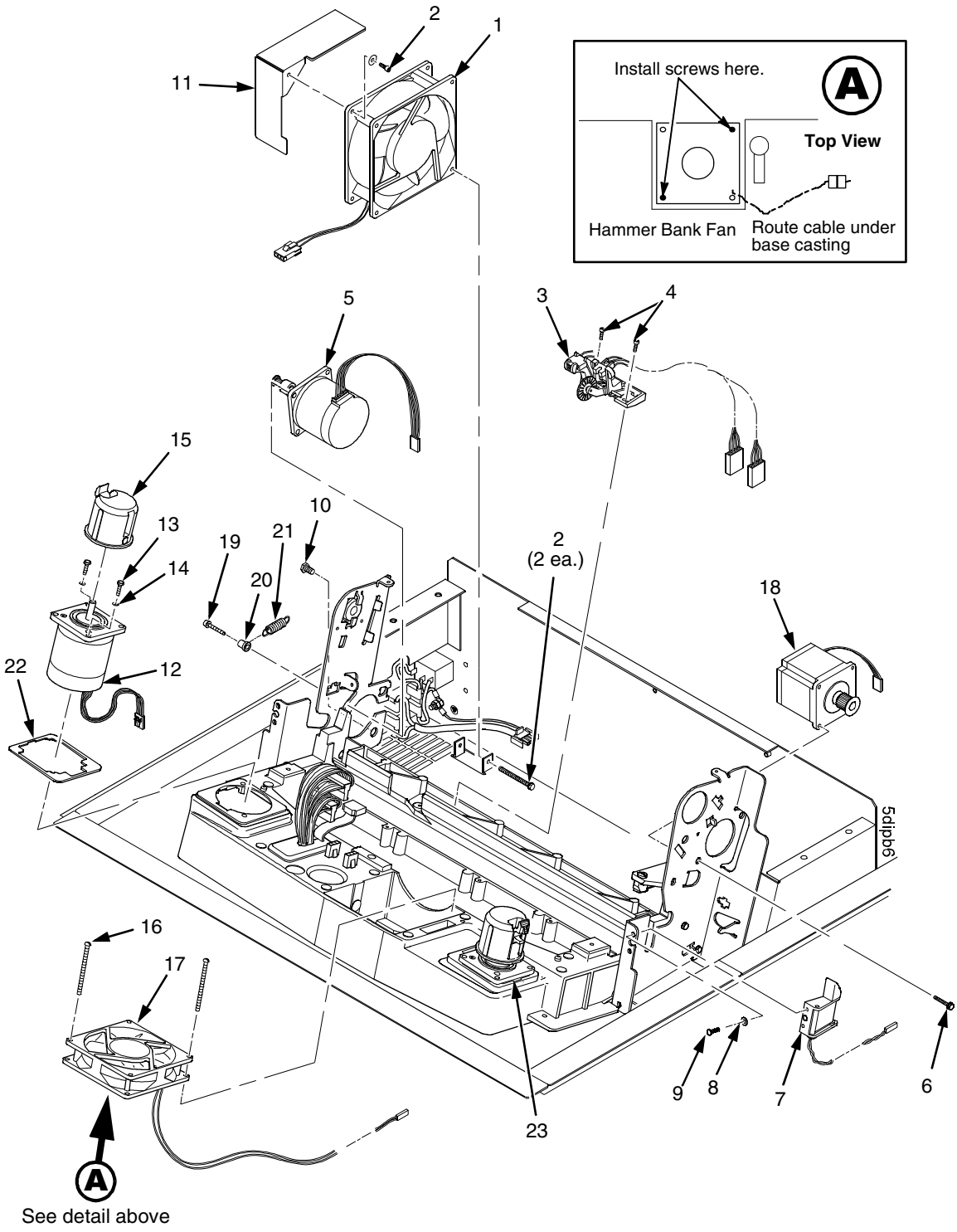

Figure 46. Motors, Fans, and Paper Detector Switch

Item No.	Part No.	Description	Notes
1	150261-901	Card Cage Fan Assembly	Air flow is into card cage
2	Ref	Screw, w/Lock Washer (3)	Two 6-32x1.75 on bottom, One 6-32x0.50 on top left
3	152415-901 170172-001	Switch Assembly, Paper Detector Field Kit, Slotted Black Back Form Switch	 Optional switch assembly used with black back forms
4	Ref	Screw, Thread-forming, 6-32x.375 (2)	Part of item 3
5	174949-001	Motor Assembly, Platen	Platen open motor
6	Ref	Screw, Hex w/Lock Washer, 10-24x.50 (2)	Part of item 18
7	163597-901	Ribbon Guide Kit	
8	Ref	Washer, Flat #4	Part of item 7
9	Ref	Screw, w/Lock Washer, 4-40x.38	Part of item 7
10	172809-001	Shoulder Screw, Motor Pivot	
11	Ref	Shield, Card Cage Fan	
12	154071-901	Motor Assembly, Ribbon	
13	Ref	Screw, Hex w/Lock Washer (2)	6-32x.75
14	Ref	Washer, Flat #6 (2)	
15	159520-901	Hub, Ribbon, P5220	
16	Ref	Screw, w/Lock Washer (2)	6-32x1.75
17	173427-901	Hammer Bank Fan Assembly	Air flow is up
18	173216-901	Motor Assembly, Paper Feed	
19	Ref	Screw, Socket Cap, 10-24x.75	
20	173422-001	Post, Platen Belt Spring	
21	203839-001	Spring, Platen Belt	
22	172189-001	Shim, Ribbon Motor, Left	
23	172188-001	Shim, Ribbon Motor, Right	

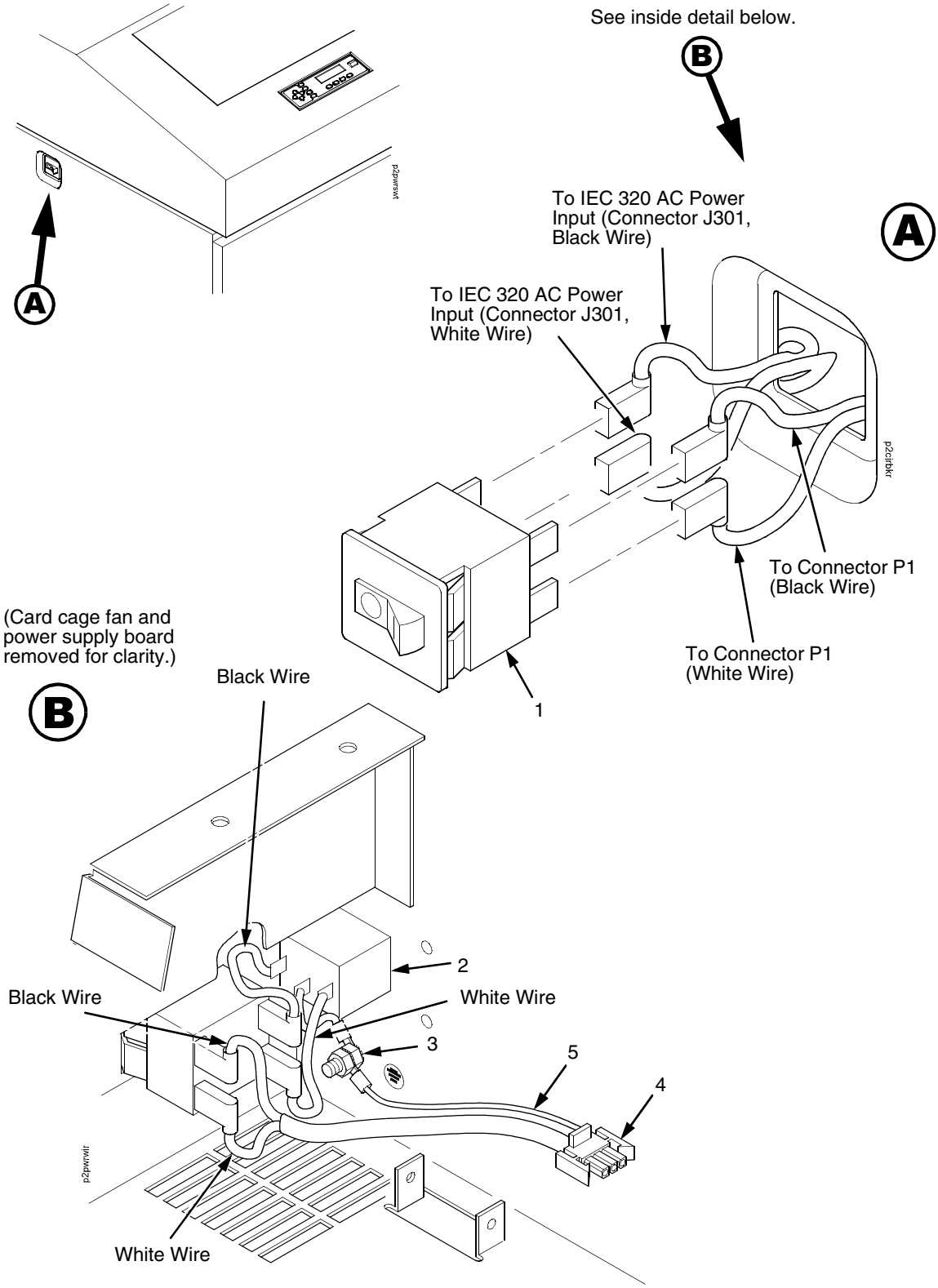

Figure 47. Circuit Breaker, Cabinet Models

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

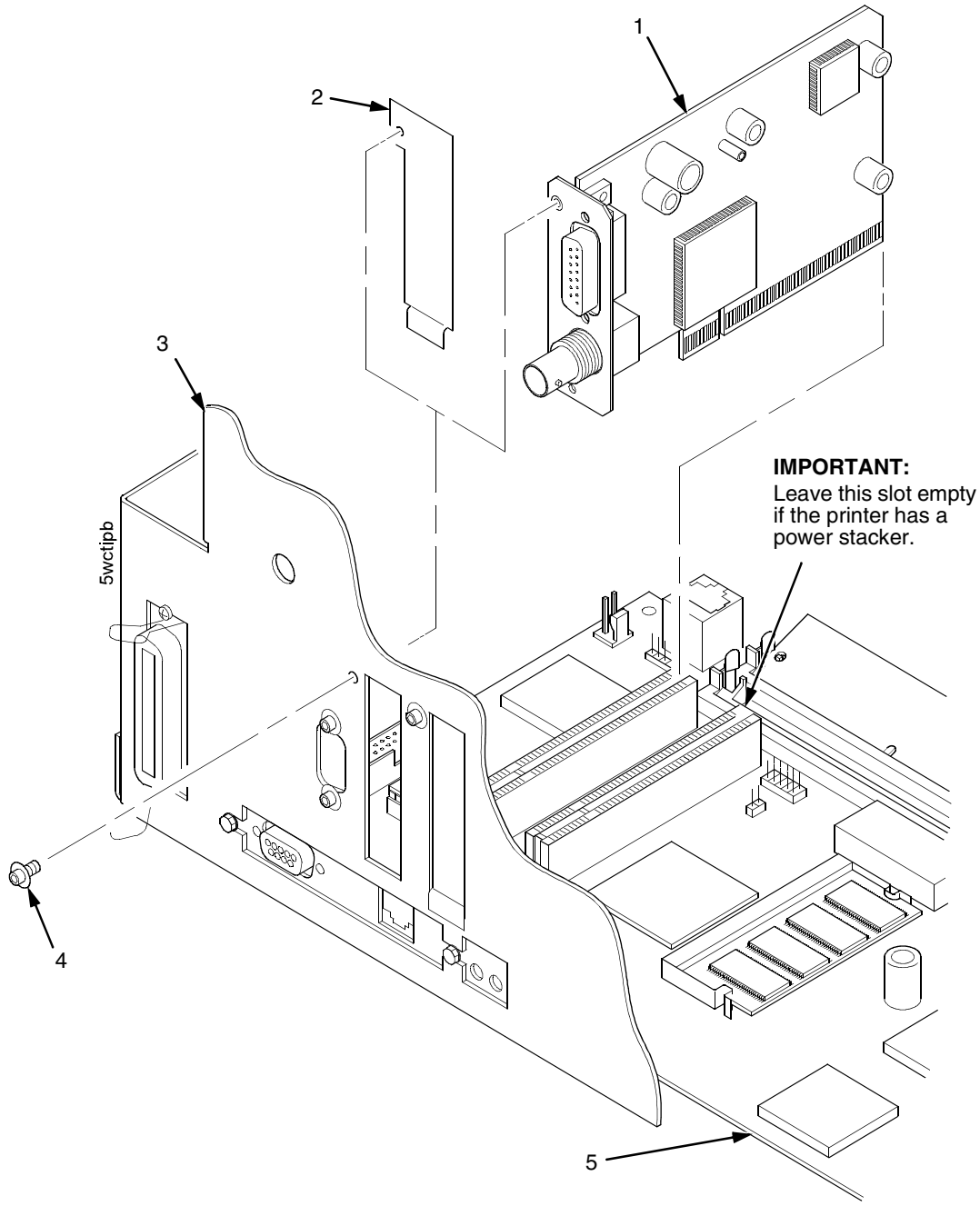

Figure 48. CT Board (Model P5224)

Item No.	Part No.	Description	Notes
1	175503-901 176561-001	PCBA, PCI-CT, V2 Field Kit, CT, P5, PSA3	
2	176257-001	Plate, PCI Cover	
3	Ref	Card Cage	
4	Ref	Screw	
5	Ref	Controller Board	

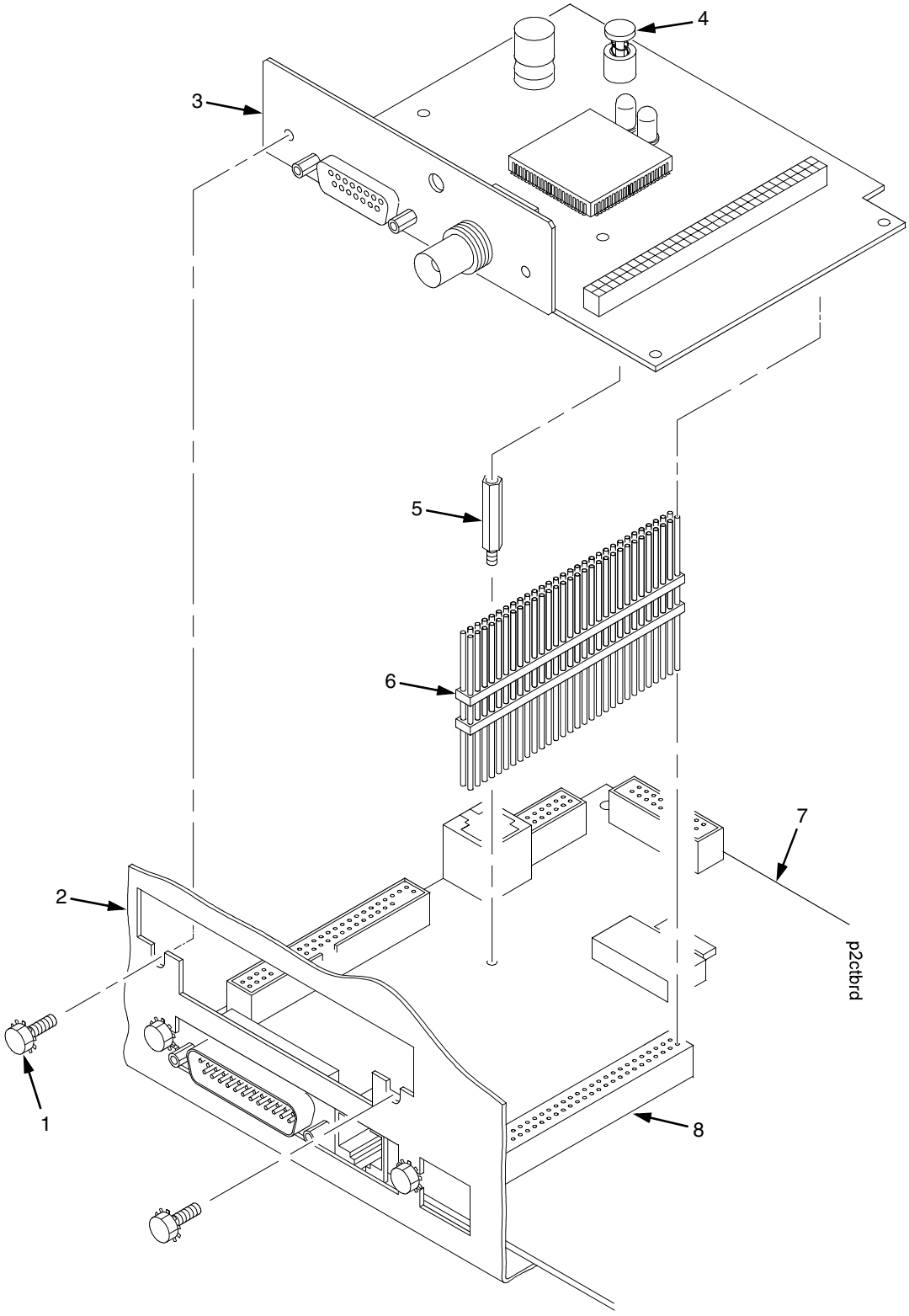

Figure 49. Expansion-CT Board (Model P5220)

Item No.	Part No.	Description	Notes
1	Ref	Screw (2)	
2	Ref	Card Cage	
3	164427-001	Expansion-CT Subassembly	CT V3
4	Ref	Screw, Captive	Part of item 3
5	Ref	Standoff, Hex, 3/16 inch, M/F, .813 Lg	Part of item 3
6	202485-001	Adapter, Expansion Connector, 60-pin	Part of item 3
7	Ref	Controller Board	
8	Ref	Controller Board Connector J111	

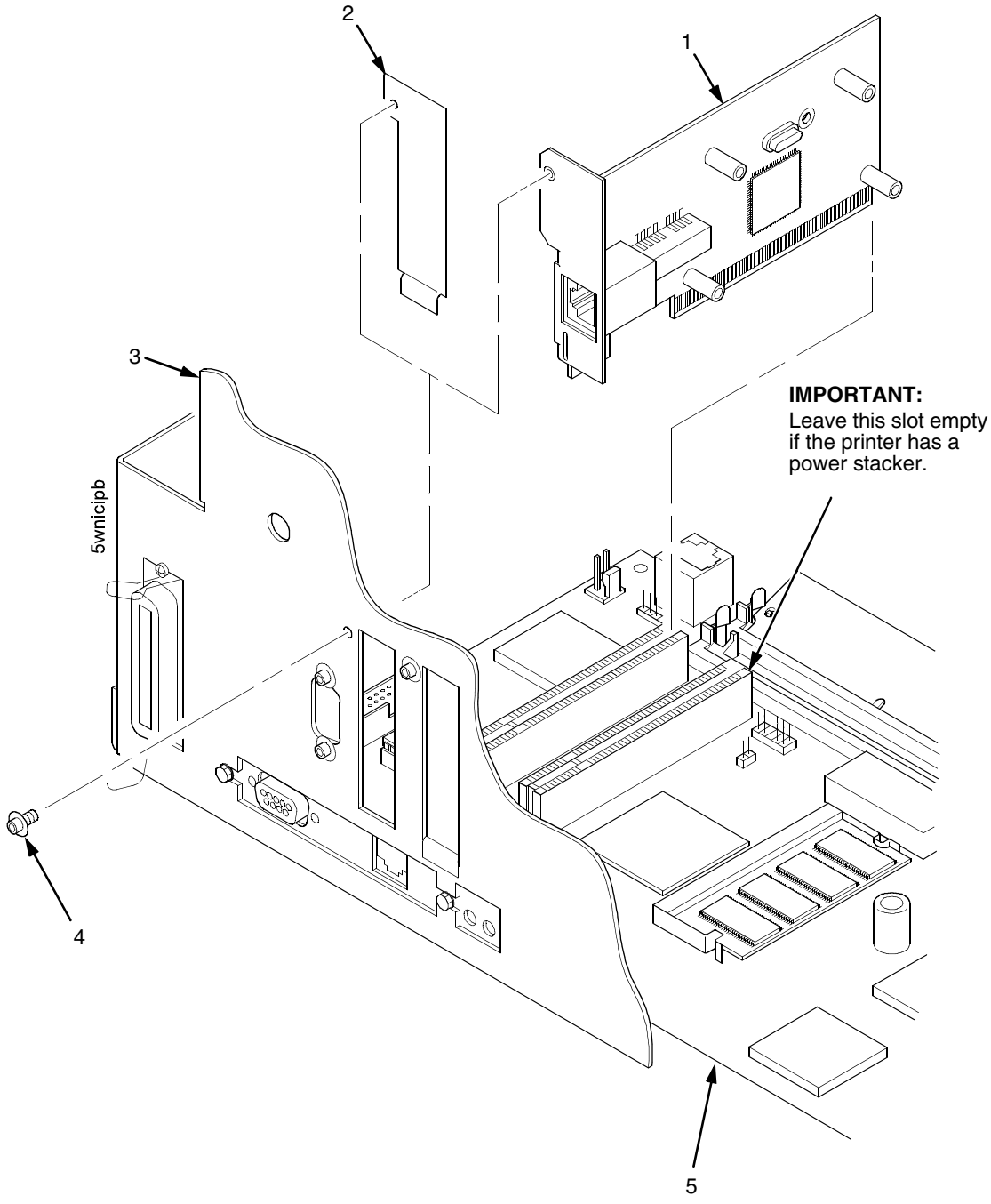

Figure 50. NIC (Network Interface Card) Assembly (Model P5224)

Item No.	Part No.	Description	Notes
1	175622-901	PCBA, PCI-NETWORK	
	176559-001	INTFC KIT,10/100 BASE T,P5,PSA3	PrintNet factory installed
	176560-001	FIELD KIT,10/100 BASE T,P5,PSA3	PrintNet field kit
	176562-001	FIELD KIT, IPDS, TCP, W/PRINTNET, P5, PSA3	PrintNet field kit
	176563-001	FIELD KIT, IPDS/IGP/TCP, W/ PRNTNET, P5, PSA3	PrintNet field kit
2	176257-001	Cover Plate, PCI	
3	Ref	Rear of Card Cage	
4	Ref	Screw	
5	Ref	Controller Board	

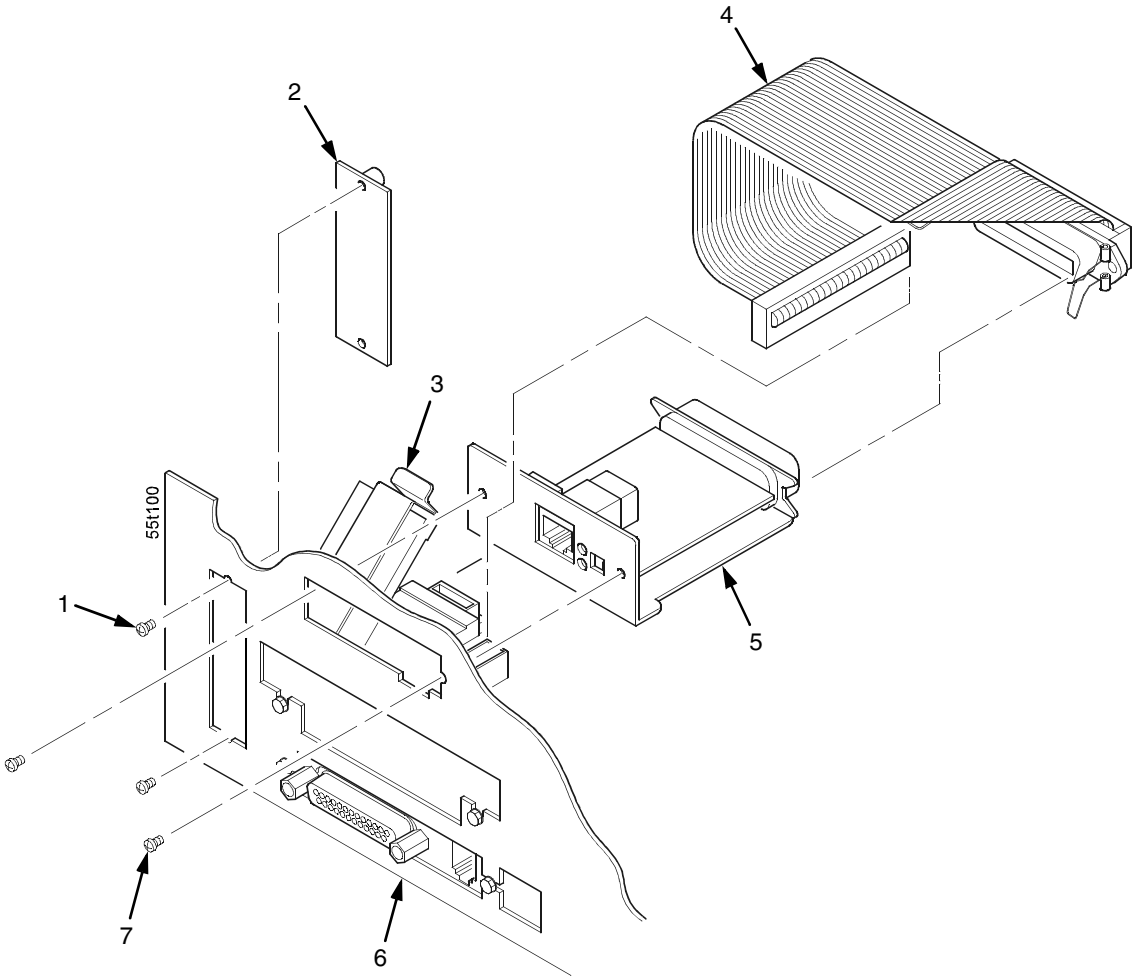

Figure 51. NIC (Network Interface Card) Assembly (Model P5220)

Item No.	Part No.	Description	Notes
1	Ref	Screw, Connector Cover (2)	
2	158295-001	Cover Plate, Centronics	
3	202049-001	Ferrite Clamp	See Appendix D
4	152439-901	Centronics I/O Cable Assembly	
5	170593-001 170613-001	Interface Kit, Dist, LAN 100Base-T Interface Kit, Dist, LAN 100Base-T	PrintNet factory installed PrintNet field kit
6	Ref	Rear of Card Cage	
7	Ref	Screw (2)	

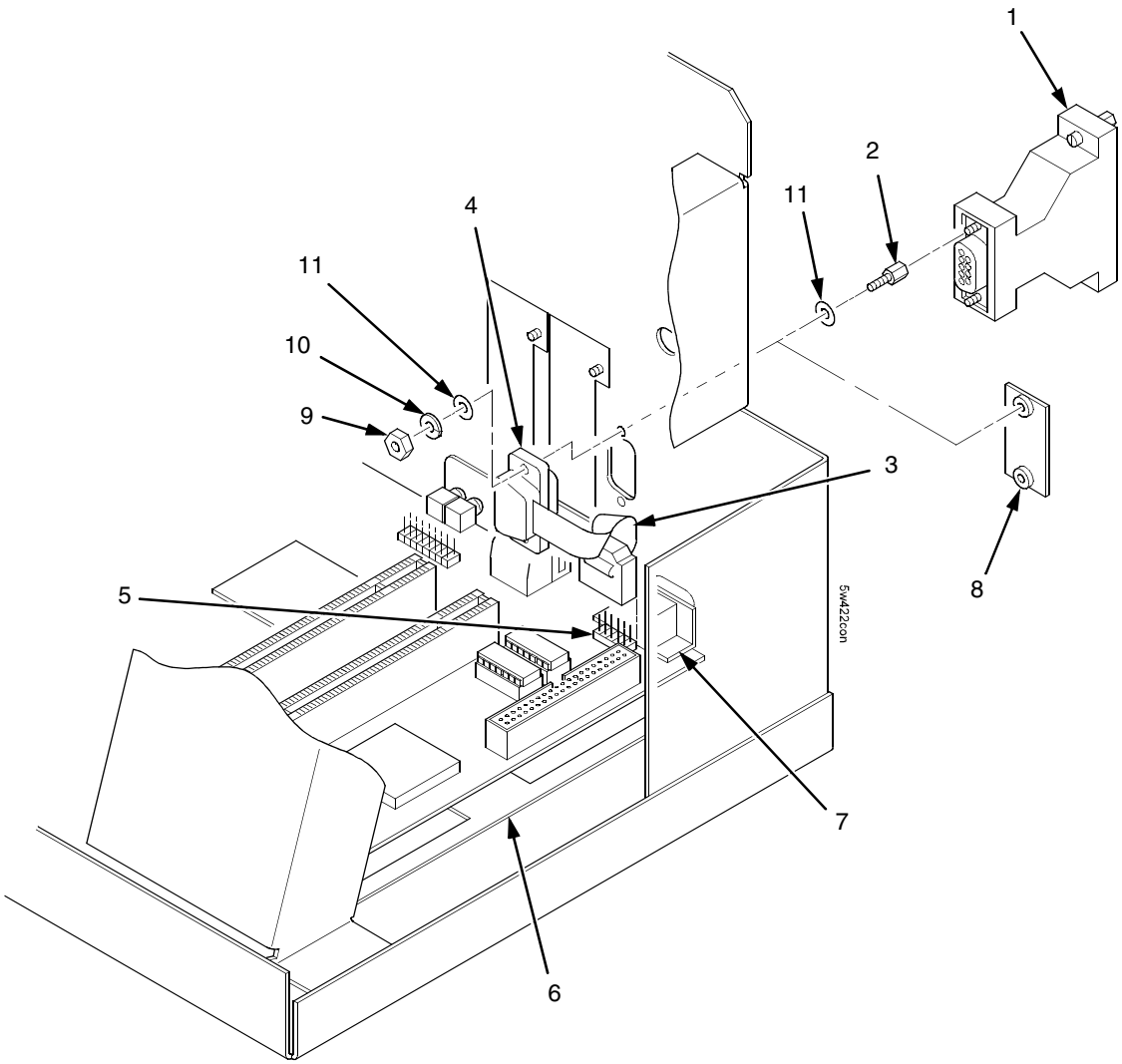

Figure 52. RS-422 Interface (Model P5224)

Item No.	Part No.	Description	Notes
1	176287-901	PCBA, RS422 ADAPTER, DB9/DB25	Part of Field Kit 176425-001
2	102922-001	Screwlock Kit, Female (2)	
3	176075-901	Cable Assembly, RS-422, I/O	Part of Field Kit 176425-001
4	Ref	RS-422 Connector, 9-Pin	Part of item 3
5	Ref	Connector J15	
6	Ref	Controller Board	
7	Ref	Connector J201, RS-232, 9-Pin	
8	Ref	Cover Plate	
9	Ref	Nut (2)	Part of item 2
10	Ref	Lock Washer (2)	Part of item 2
11	Ref	Flat Washer (4)	Part of item 2

6 *Principles Of Operation*

Line Matrix Printing

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

Every text character is stored in printer memory as a pattern of dots on a logical grid called the dot matrix. (Figure 53.) The ink dots are made by two rows of small hammers mounted on a shuttle that sweeps rapidly back and forth. Logic circuits divide every line of incoming data into horizontal dot rows. The hammers put dots at the required positions for the entire line by striking an inked ribbon and the paper.

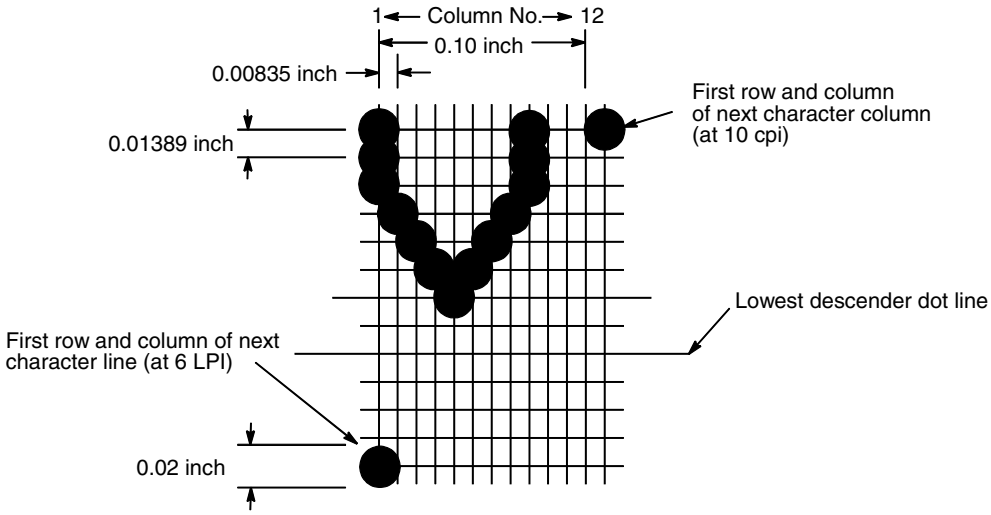

Figure 53. A Dot Matrix

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

The dot matrix patterns of text characters vary according to the font the user selects. For example, in the data processing (DP) font at a line spacing of six lines per inch (lpi), a dot matrix contains 12 dot rows from the top of one character line to the top of the next. (Figure 53 and Figure 54.) At eight lpi there are nine dot rows per character line, at nine lpi there are eight dot rows per character line, and so on.

Each individual hammer spring forms more than one character as the shuttle moves horizontally. This principle is illustrated in Figure 55.

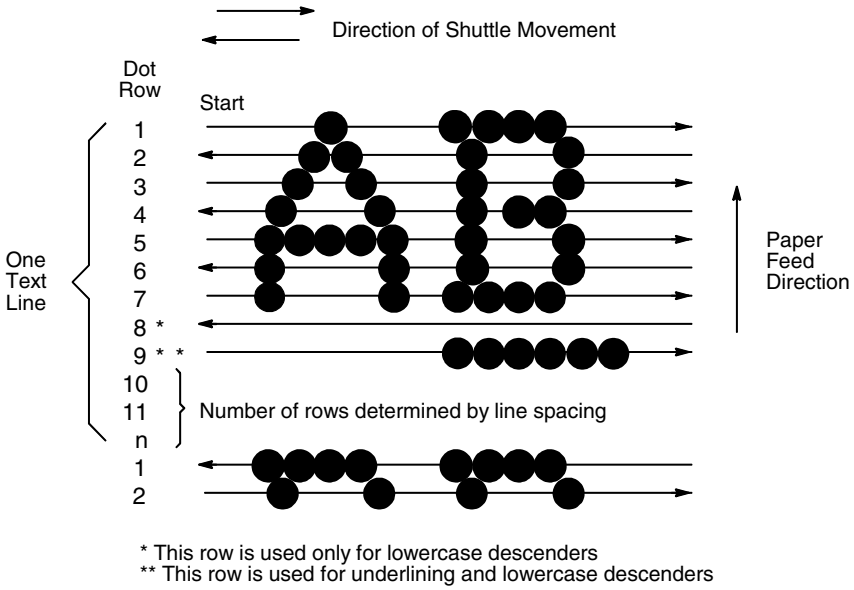

Figure 54. Standard Character Formation

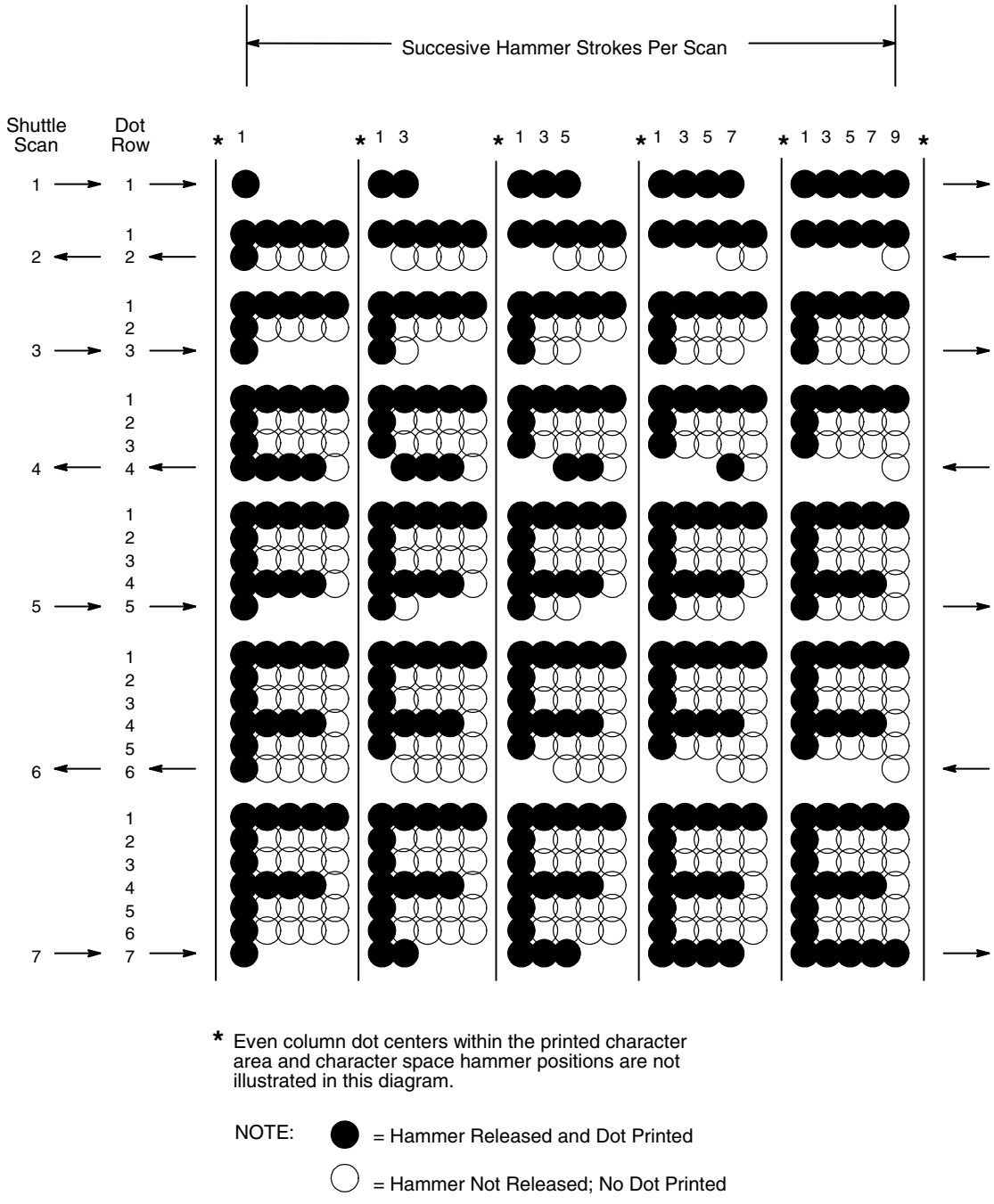

Figure 55. Action of One Hammer Spring in Text Printing

Printing Rates

Because a line matrix printer prints entire lines sequentially, it is faster than a moving-printhead printer, which prints single characters sequentially. The printing speed of text in a line matrix printer is measured in lines per minute (lpm) rather than characters per minute (cpm).

Many variables affect printing speed, the main ones being the selected font and the vertical dot density. Lines containing attributes such as bold or emphasized print, superscripts, subscripts, or elongated characters also reduce print speed, but the reduction is never less than half the rates of lines printed without such attributes. The actual printing rate of lines containing such attributes depends on the specific print job, but printer software maximizes the throughput by dynamically determining which dot rows contain adjacent dots and must be printed in two strokes.

Printing speed is not affected by the number of characters in a character set.

The printing speed of graphics (“plot mode”) is expressed in inches per minute (ipm).

The ability of the printer to feed paper downwards as well as upwards allows the printing of multiple densities on a single line. This is useful for printing forms and text together or for mixing fonts on the same print line. Use of multiple densities and reverse paper feed also affects the printing rate.

Printing Mechanism

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

The printing mechanism consists of three integrated subsystems:

- **Shuttle Frame Assembly**
- **Ribbon Transport System**
- **Paper Transport System**.

Shuttle Frame Assembly

The central element of the printing mechanism is the shuttle frame assembly, which houses the dual hammer bank assembly and the shuttle drive motor. (Figure 56.)

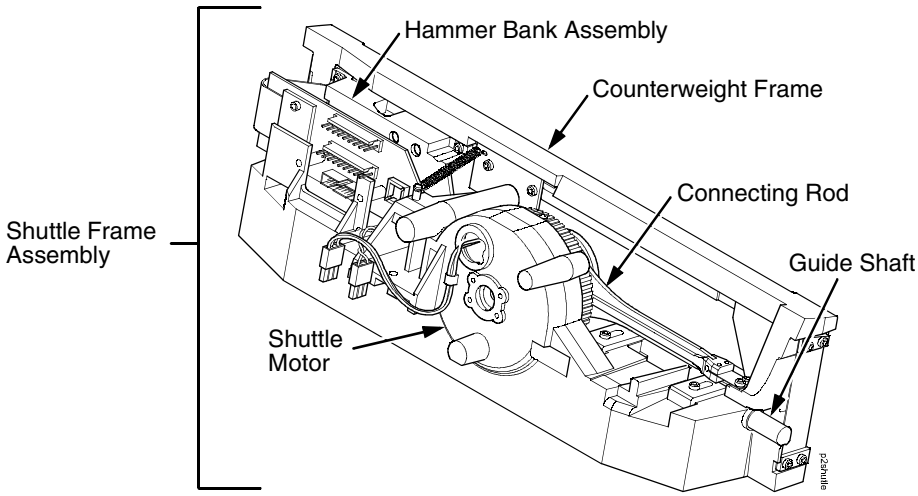

Figure 56. Shuttle Frame Assembly

Dual Hammer Bank Assembly

The printer has 156 hammer springs grouped in two horizontal rows of comb-like assemblies mounted on a solid hammer bank. Each row contains six hammer spring assemblies mounted side by side. The hammer springs on each row face each other along the centerline of the hammer bank. (Figure 57.)

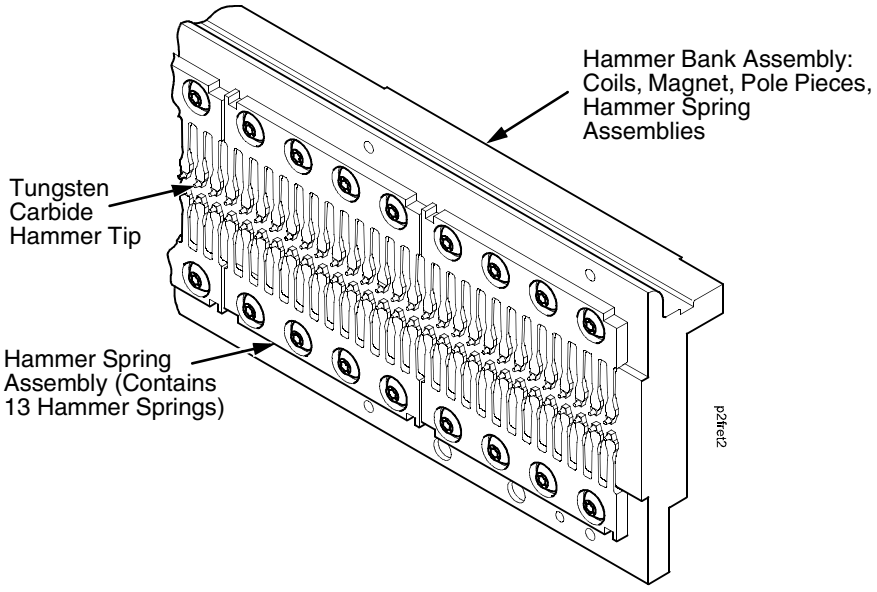

Figure 57. Hammer Springs and Hammer Bank (Detail)

A hammer spring assembly contains 13 hammer springs. Each hammer spring is a stiff leaf spring with a cylindrical tungsten carbide tip on the free end. (Figure 57.) A permanent magnet is imbedded along the length of the hammer bank and acts on the hammer springs through individual pole pieces. The pole pieces magnetically attract and hold the free end of the hammer spring under tension. This is called the retracted state.

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

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

Shuttle Drive Motor

The shuttle drive motor is built into the shuttle assembly casting and drives two connecting rods on a crankshaft. (Figure 56.) The small end of one connecting rod attaches to the hammer bank; the small end of the other connecting rod attaches to a counterweight frame surrounding the hammer bank. (The hammer bank and the counterweight constitute the shuttle assembly.) The rotary motion of the shuttle drive motor converts to linear and opposing motion of the hammer bank assembly and counterweight, in an arrangement similar to that of a horizontally-opposed gasoline engine. Mechanically, this design achieves the same benefits as this type of engine: perfect primary balance, low vibration, and durability.

Paper Transport System

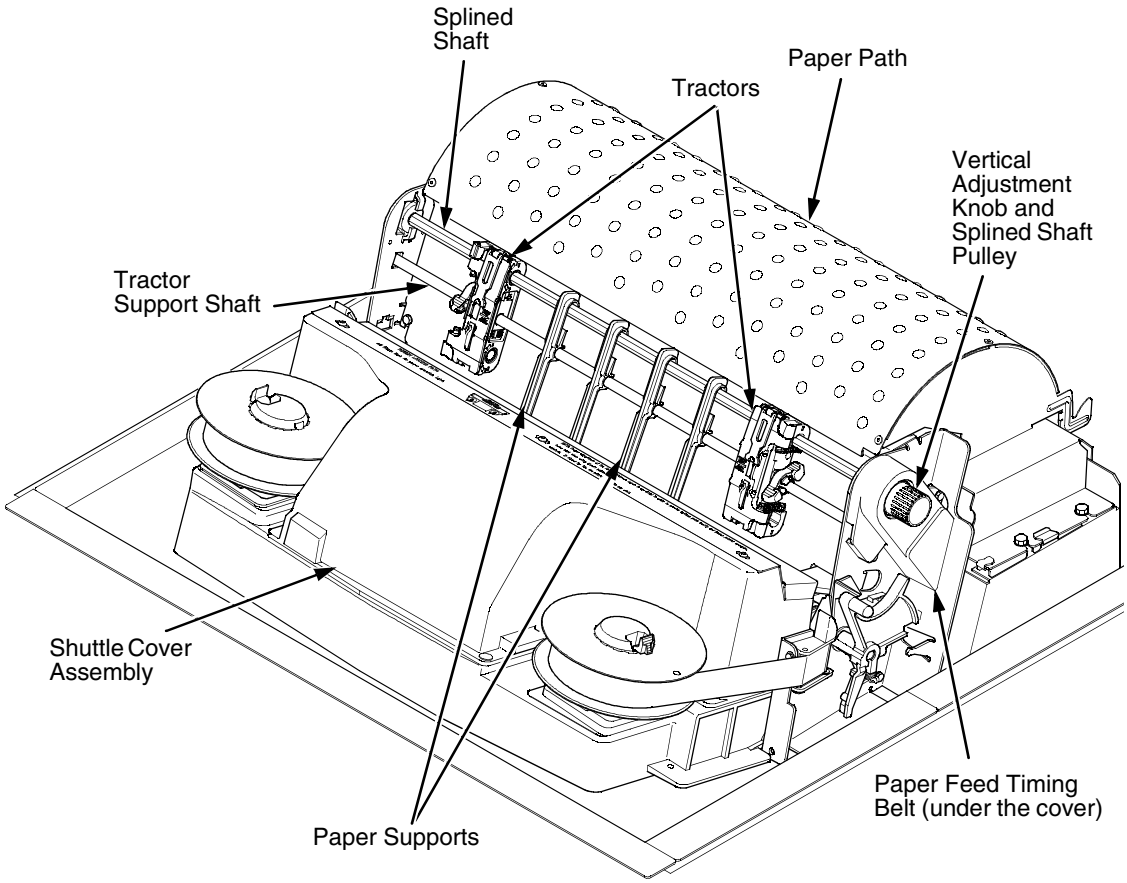

Figure 58. Paper Transport System

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

Paper is positioned horizontally using the tractors. Each tractor is locked in position with a friction lock and engages the paper perforations with six sprocket pins.

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

The paper supports help prevent paper jams by applying tension to the sections of the paper between the tractors. The supports are positioned manually by sliding them along the splined and support shafts.

Ribbon Transport System

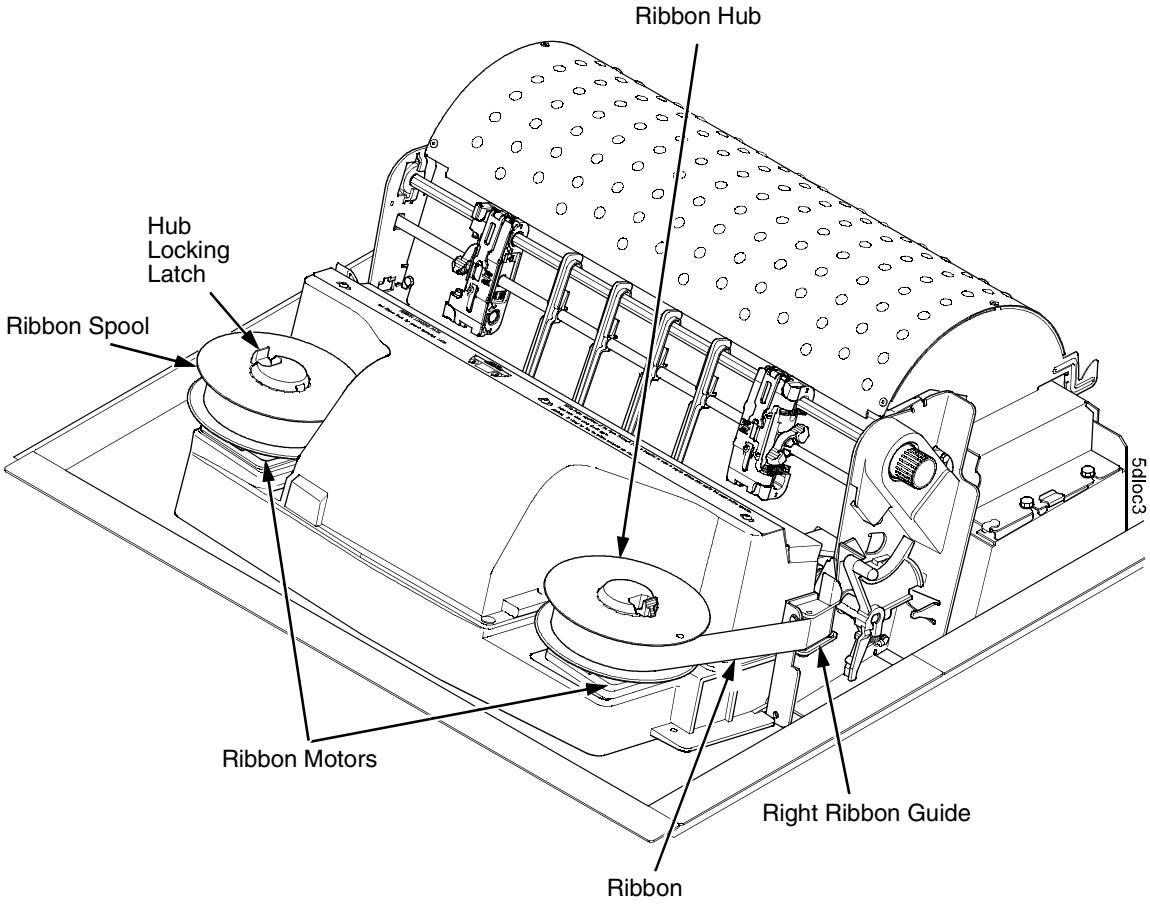

Figure 59. Ribbon Transport System

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

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

Logical Control Of The Printer

The printer consists of four subsystems: the control panel, the controller board, the power supply board, and the print mechanism.

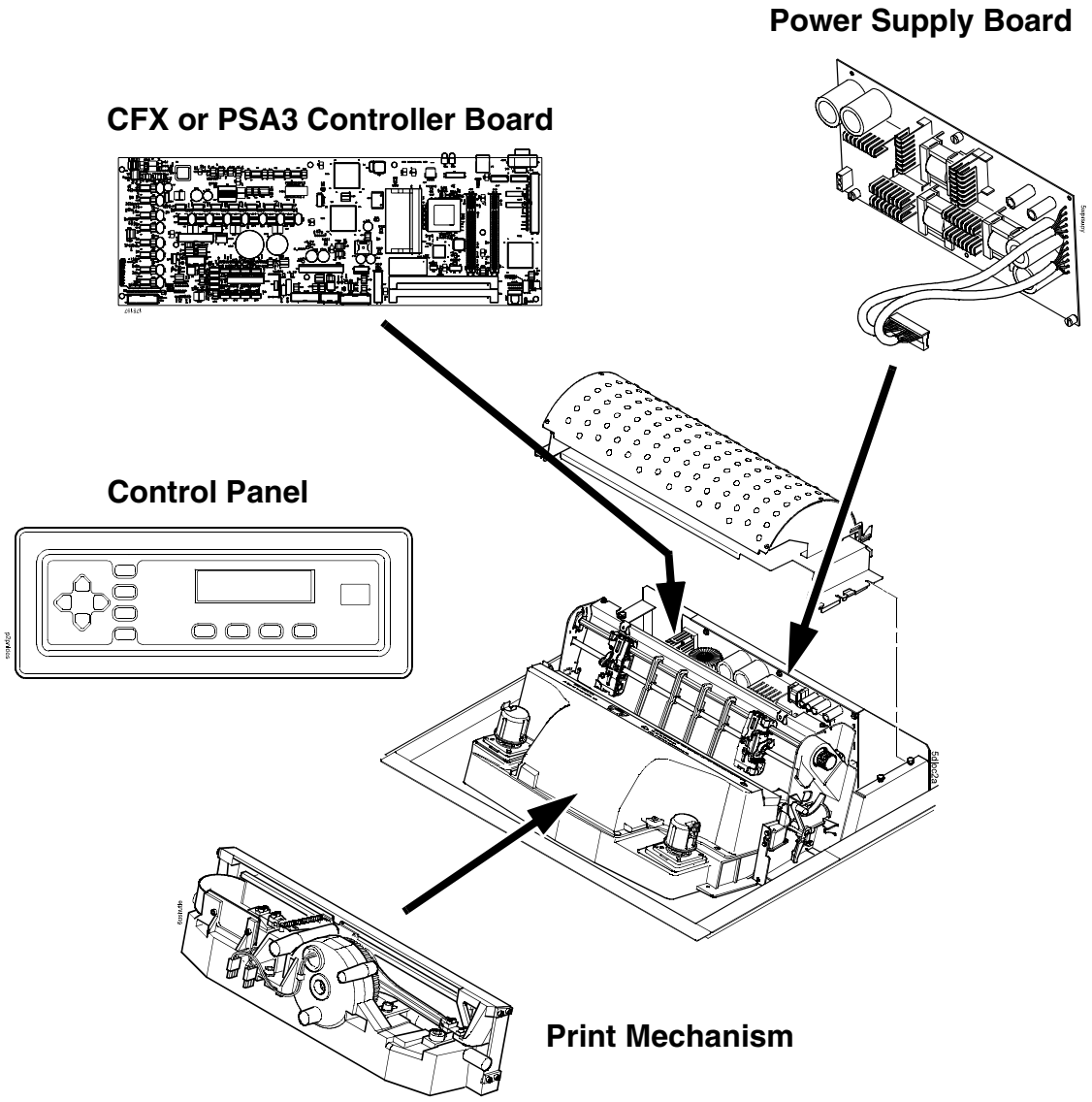

Figure 60. Functional Elements of the Printer

Control Panel

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

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

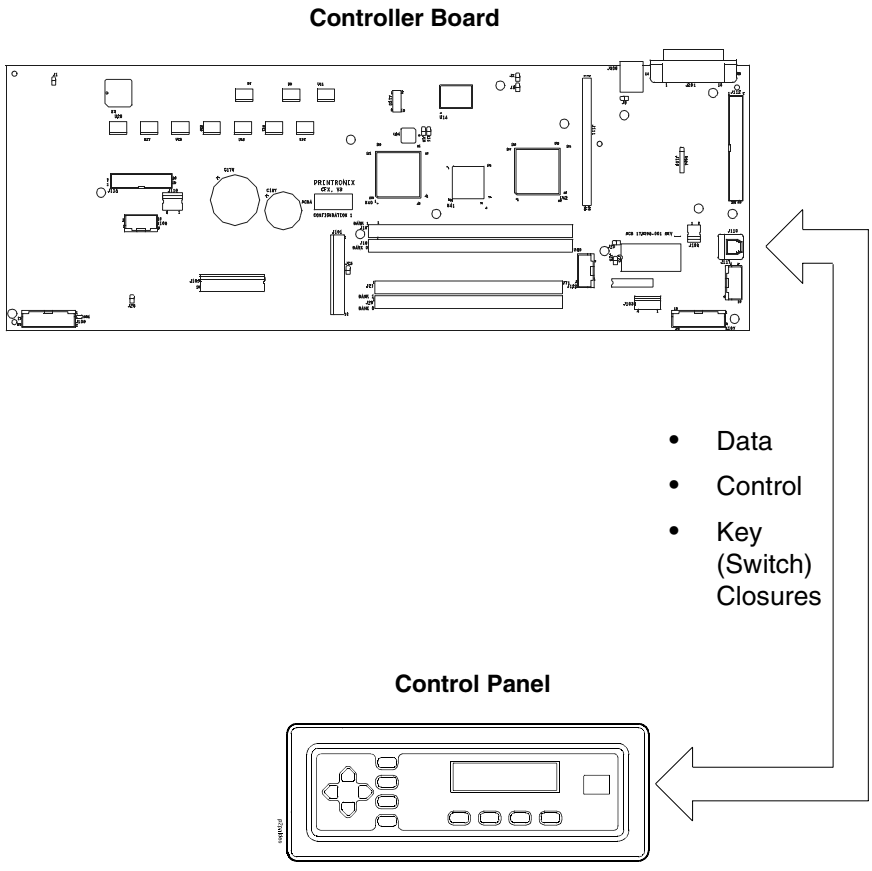

Figure 61. Control Panel Functional Overview

CFX Controller Board (Model P5220)

The heart of the P5220 dual-hammer bank printer is the CFX controller board, which monitors and directs all printer functions.

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

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

The DC is responsible for:

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

The EC is responsible for:

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

The EC and DC communicate through semaphore registers. The DC receives host and operator input and returns dot images and LCD messages to buffers in memory. Image data are passed to the EC upon request, are processed, then sent to the hammer bank. The EC synchronizes paper, ribbon, platen, and shuttle motion as it feeds dot data to the hammer drivers. Figure 62 summarizes this architecture.

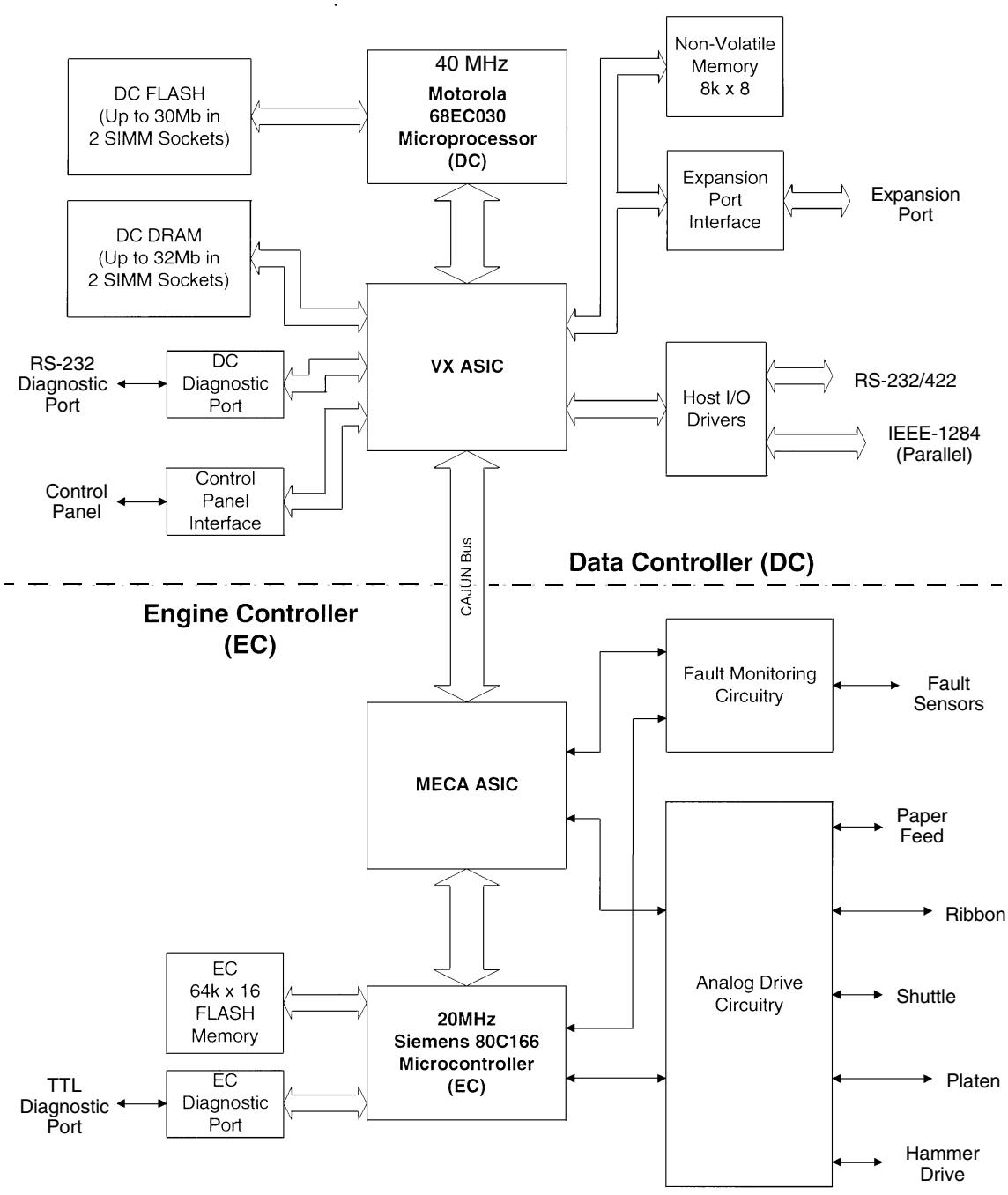

Figure 62. Controller Board Block Diagram

Data Controller

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

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

68EC030 Microprocessor

A Motorola 68EC030 microprocessor serves as the processor of the DC unit. This processor runs at 40 MHz.

Flash Memory

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

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

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

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

DRAM

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

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

NVRAM

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

VX ASIC

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

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

Memory Access Controller

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

DRAM Controller

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

Flash Controller

The VX supports up to four banks of flash memory.

DMA Channels

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

Control Panel Interface

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

“Dot Plucking” And Adjacent Dot Checking

“Dot Plucking” is a specialized DMA function that removes dot data from a dot image buffer in DRAM in a programmable manner, serializes it, and sends it to the hammer bank. This function is actually controlled by the EC (see page 291), which has access to the VX through the “Cajun” Bus Interface.

“Cajun” Bus Interface

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

Ports

The VX ASIC controls the following I/O functions:

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

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

Host I/O Drivers And Termination

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

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

All interface ICs and terminations have the following characteristics:

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

Engine Controller

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

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

80C166 Microprocessor

The Siemens SAB 80C166 is a high-integration microcontroller. It has many features that suit it extremely well to real-time control applications. This

controller and the MECA ASIC provide the functionality of three separate processors used in earlier controller board architectures. In this manual, the 80C166 is referred to as either the EC or the 166.

Bus Configuration

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

Power Reduction

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

EC Flash Memory

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

MECA ASIC

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

Analog Drive Circuitry

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

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

The paper feed, ribbon drive, and shuttle motors are driven in control loops containing power MOSFETs, voltage and current sensors, the MECA ASIC,

and the EC processor. The platen motor is driven by a stepping motor controller IC and the EC processor.

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

PSA3 Controller Board (Model P5224)

The heart of the P5224 dual hammer bank printer is the PSA3 controller board, which controls all printer functions.

IMPORTANT **The PSA3 controller board is not compatible with earlier P5000 single hammer bank printers nor with the P5220 dual hammer bank printer. It is physically different from the earlier CFX controller board and the card cage was revised to accommodate the differences. Printers that use the CFX controller board cannot use the PSA3 controller, and vice versa.**

The controller board receives and processes all data from the host computer, builds the printable images, controls all motors, and drives the hammer springs. Except for the power supply and in the case of dual hammer bank printers some of the hammer drive circuits, all logic and drive circuitry for the printer are contained on the controller board.

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

The DC is responsible for:

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

The EC is responsible for:

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

The EC and DC communicate through semaphore registers. The DC receives host and operator input and returns dot images and LCD messages to buffers in memory. Image data are passed to the EC upon request, are processed, then sent to the hammer bank. The EC synchronizes paper, ribbon, platen, and shuttle motion as it feeds dot data to the hammer drivers. Figure 62 summarizes this architecture.

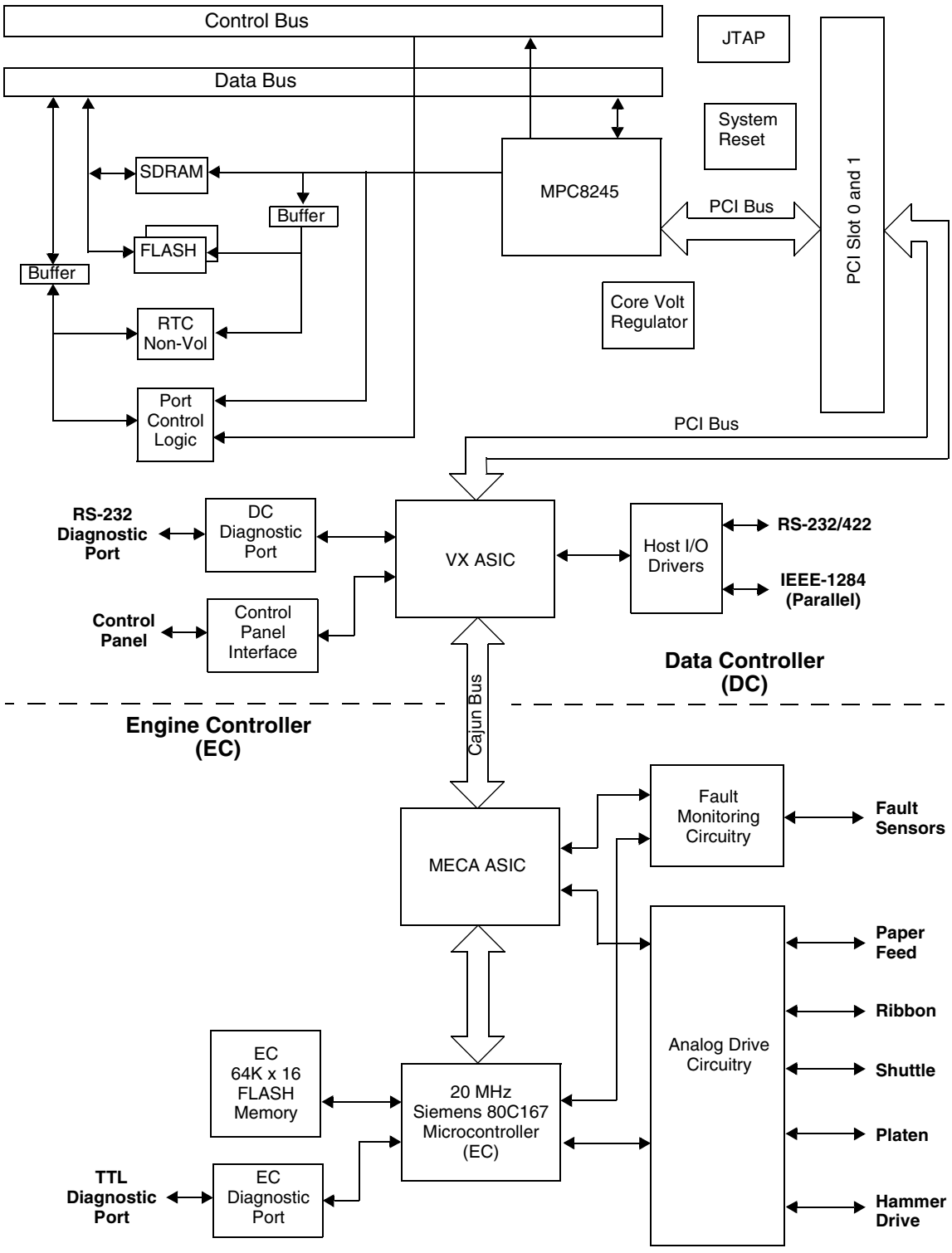

Figure 63. Controller Board Block Diagram

Data Controller

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

- MPC8245 microprocessor
- Two flash SIMM sockets, for up to 30MB of program memory
- One SDRAM DIMM socket, for up to 32MB of data memory
- 8K x 8 Non-Volatile Battery-Backed static RAM (NVRAM) for storage of configuration and system statistical data
- VX ASIC (Application-Specific Integrated Circuit)
- Host I/O Drivers/Termination

MPC8245 Microprocessor

A Motorola MPC8245 microprocessor serves as the processor of the DC unit.

Flash Memory

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

The DC uses AMD 5.0V-only flash memory, which does not require higher programming and erasing voltages on the board (it has an internal charge pump to make these voltages itself). This memory supports at least 100,000 write/erase cycles. The flash memory is 8 bits wide.

Two 72-pin SIMM sockets are provided for flash memory. Up to 30MB of flash (total) may be installed on the controller board. The boot code for the MPC8245 processor must reside in bank J11.

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

SDRAM

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

One 144-pin SDRAM DIMM (Dual Inline Memory Module) is used for expansion memory.

NVRAM

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

VX ASIC

The VX is a multi-function custom gate array ASIC containing all the logic for the DC that is not contained in the MPC8245 processor. The VX provides the following services:

- Memory Access Controller
- DRAM Controller

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

Memory Access Controller

All MPC8245 addresses go through the VX ASIC. The VX handles all address decoding, chip selects, DTACKs, and so on.

DRAM Controller

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

Flash Controller

The VX supports up to four banks of flash memory.

DMA Channels

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

Control Panel Interface

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

“Dot Plucking” And Adjacent Dot Checking

“Dot Plucking” is a specialized DMA function that removes dot data from a dot image buffer in DRAM in a programmable manner, serializes it, and sends it to the hammer bank. This function is actually controlled by the EC (see page 298), which has access to the VX through the “Cajun” Bus Interface.

“Cajun” Bus Interface

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

Ports

The VX ASIC controls the following I/O functions:

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

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

Host I/O Drivers And Termination

Beyond the MPC8245 processor and VX ASIC, additional support circuitry completes the serial and parallel interfaces. These circuits include:

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

All interface ICs and terminations have the following characteristics:

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

Engine Controller

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

- 80C167 Microcontroller
- 128KB 5.0V-only FLASH program memory, organized as 64K x 16 bits. This memory is not expandable.
- MECA (Mechanism Engine Control ASIC)
- Analog drive circuitry

80C167 Microprocessor

The Siemens SAB 80C167 is a high-integration microcontroller. It has many features that suit it extremely well to real-time control applications. This controller and the MECA ASIC provide the functionality of three separate processors used in earlier controller board architectures. In this manual, the 80C167 is referred to as either the EC or the 167.

Bus Configuration

The 80C167 bus is configured for 18-bit address, 16-bit data, non-multiplexed and segmented operation. The flash memory runs with zero wait states. An external PAL is used for address decoding.

Power Reduction

The 80C167 chip has two power reduction modes: idle and Energy Star. Idle mode is not used. In Energy Star mode, +48V and all motors are de-energized, but the 167 operates as normal.

EC Flash Memory

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

MECA ASIC

The 80C167 uses numerous counters, PWM generators, and FIFOs in the MECA to control many printer motor functions. The MECA is a custom gate array, specifically designed to drive this system.

Analog Drive Circuitry

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

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

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

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

hammers will participate in a fire event generated by the controller's upper drive.

Power Supply Board

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

The power supply converts alternating current (AC) to direct current (DC) voltages of +48 VDC, +8.5 VDC, and +5 VDC and sends these voltages to the controller board. The controller board distributes the DC power to the logic and electromechanical circuits.

AC Power

The power supply operates on AC voltages ranging from 88 volts to 270 volts without any manual switching or adjustments. It can tolerate variations in frequency of 48.5 to 61.8 Hz. The power supply is designed to withstand an AC input overvoltage of 300 volts AC for one second with no degradation of DC output voltage or damage to printer circuits.

DC Power

The power supply board contains two DC power supply systems for the printer. The first is a +5 V bus for logic. The second consists of +48 V and +8.5 V outputs for the electromechanical systems (i.e., hammer bank and motors). The maximum total continuous average DC load is 581 Watts, with peak power of up to 2093 Watts for several milliseconds.

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

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

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

Thermal Management

The power supply dissipates heat through convection cooling. A fan is mounted at the AC end of the power supply, drawing 130 linear feet per minute of air across the power supply.

The power supply monitors the temperature of critical semiconductor components to signal a temperature fault condition. (“Critical” components are those which have the hottest junction temperatures under all environmental and load conditions.) The N_TEMP_HI signal is pulled low to maintain a low TTL level when the junction temperature of critical components exceeds 110 degrees Celsius (230 degrees Fahrenheit), and stays on as long as the junction temperature is above 90 degrees Celsius (194 degree Fahrenheit).

Printer Interface

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

The printer supports a number of standard and optional interfaces to the host:

- Centronics parallel (standard)
- IEEE 1284 parallel (standard)
- EIA®-232-E serial (standard)
- EIA-422-B serial (standard)
- Dataproducts Long Lines parallel (optional)
- Coaxial/twinaxial Expansion-CT (optional)
- NIC (Network Interface Card; an optional 10/100Base-T Ethernet adapter)

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

Graphics

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

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

A Wire Data

NOTE: Acronyms and signal mnemonics are defined in Appendix B.

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Circuit Board Pinouts

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Cable Assemblies

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- Dataproducts Adapter ..... page 331
- Dataproducts Long Lines I/O ..... page 332
- Twinax Auto-Termination ..... page 333
- 2-Pin Jumper, 0.1 Ctr ..... page 334
- Power Supply I/O ..... page 335
- AC In, Power Supply ..... page 336
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Magnetic Pickup (MPU) Assembly..... page 354
Switch Assemblies
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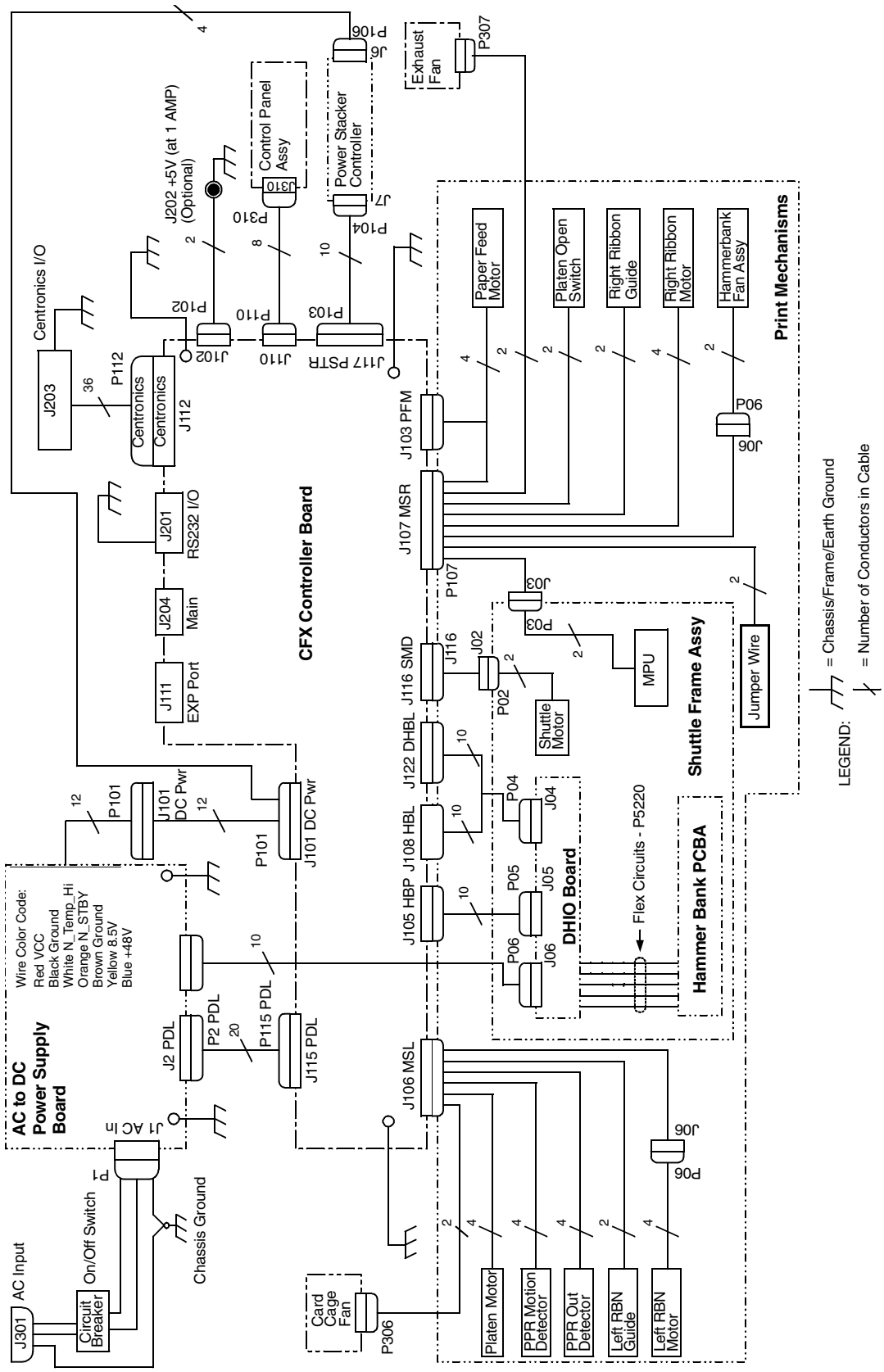
P5220 Interconnection Diagram



P5220 Main Wire Harness Test Tables

P106 Connector

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

Pin No.

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

P107 Connector

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

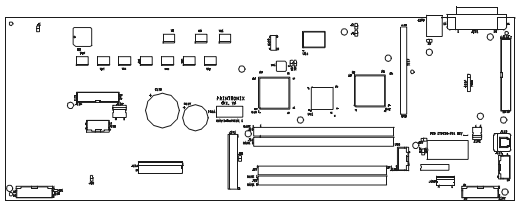
Resistance

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

Resistance

Device	P107 Pins	Normal
RRIB M	2, 4 and 6,8	7.2 - 8.8 Ω
4-Pin Spacer, P/N 174325-001	1, 3, 5, 7	NOTE: For PAPR M, see J103 on page 311.
HBF	10, 12	2.7 KΩ
EHF	9, 11	4.6 KΩ
RRP	14, 16	Open across pins Short across post
PLO	13, 15	Continuity: switch closed Open: switch open
JMP	18, 20	Jumper Wire
MPU	17, 19	670 Ω

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



J106 J107

NOTE: For cable connector coupling shroud assembly and disassembly, see page 190.

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

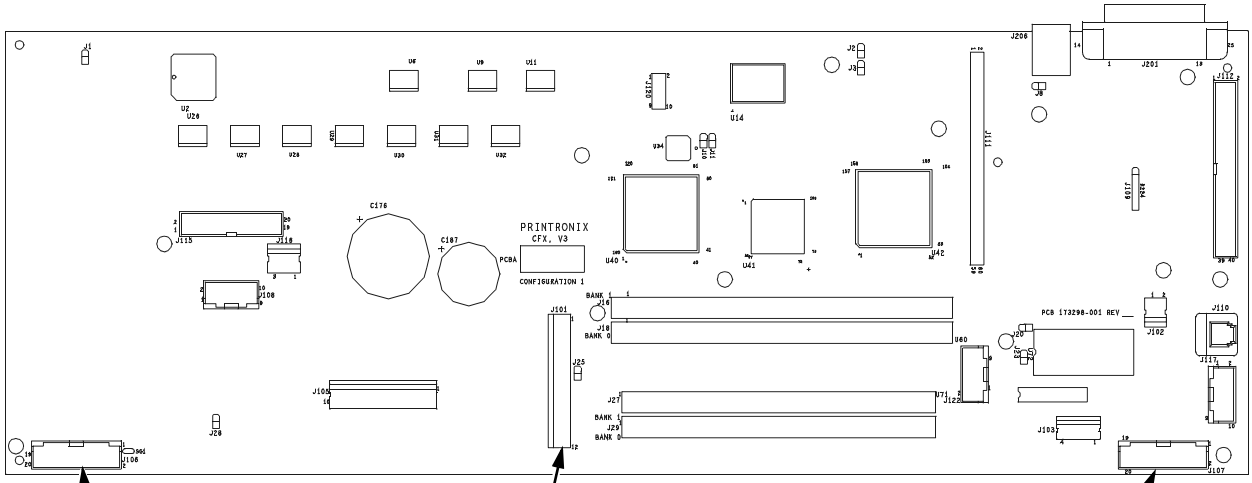
* Only in cabinet models

MOTOR NOTES:
All Motors: Use the table values to test for winding continuity and for no shorts between winding and the motor frame. Rotate the motor by hand and test for shorts; replace the motor if you find any shorts

Shuttle Motor = approx. 0.7 Ω phase to phase; infinite resistance phase to motor frame. Use this value to test for winding continuity and for no shorts between windings and the motor frame. Rotate the motor by hand and test for shorts; replace the shuttle frame assembly if you find any shorts.

All **fans** have brushless DC motors powered by solid-state circuits and controlled by feedback from a fan rotor position Hall Effect sensor. Fans driven by +48V measure 4 - 5 KΩ. Fans driven by +24V measure 2 - 3 KΩ. A very low reading can mean one of the winding drive transistors is shorted. An open circuit could indicate defective fan electronics or an open cable. Fans will run whenever +48V is present; failure to run can mean a defective cable, connector, or current sense resistor on the controller board. An open circuit current sense resistor (on the controller board) will prevent the fan from running but will not allow software to detect the fault.

CFX Controller Board



Motor Sensor Left

J106

1	PLAT 1
2	RIB L1
3	PLAT 2
4	RIB L2
5	PLAT 3
6	RIB L3
7	PLAT 4
8	RIB L4
9	CC FAN +
10	L RBN POST +
11	CC FAN -
12	L RBN POST -
13	POD A
14	PMD A
15	POD K
16	PMD K
17	POD C
18	PMD C
19	POD E
20	PMD E

+48V

.01µF
10%
100V

Power Supply

J101

1	N TEMP HI
2	N STDBY
3	VCC
4	
5	
6	
7	
8	
9	+48V
10	
11	+48V
12	

470 PF
10%
50V

470 PF
10%
50V

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

Motor Sensor Right

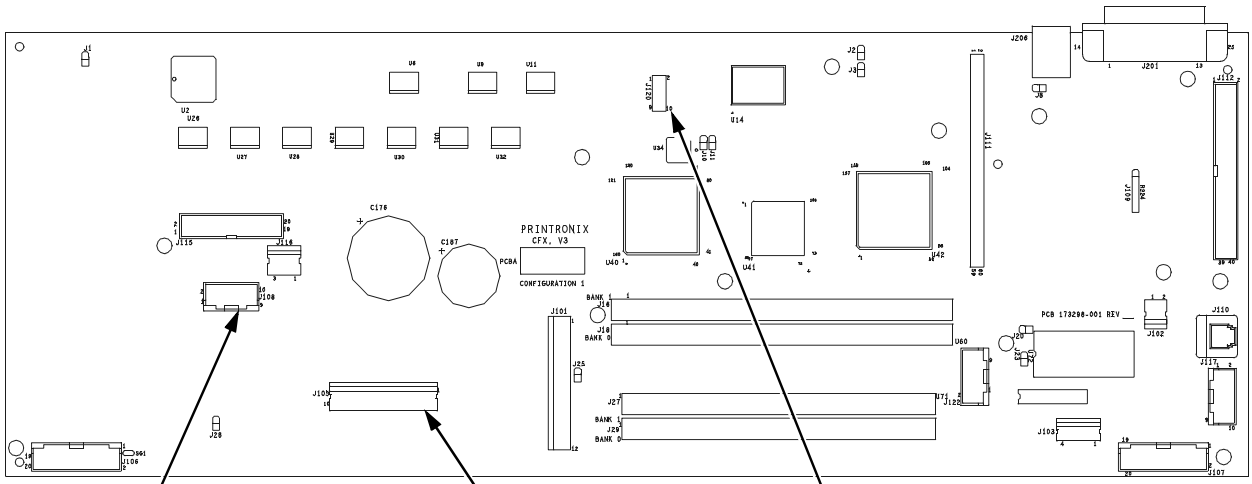
J107

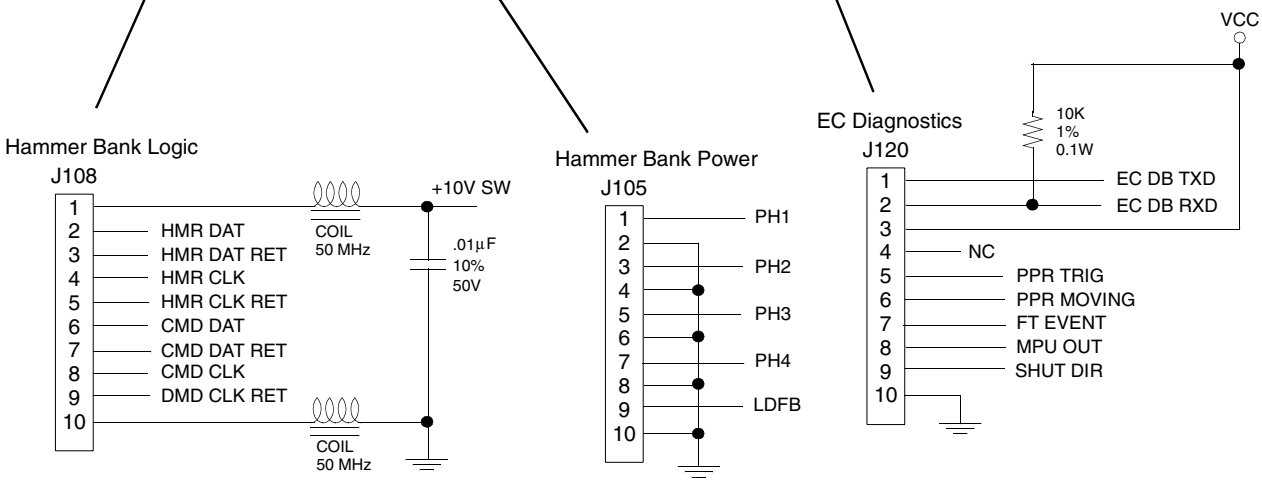
1	PF 1
2	RIB R1
3	PF 2
4	RIB R2
5	PF 3
6	RIB R3
7	PF 4
8	RIB R4
9	EXH FAN +
10	
11	EXH FAN -
12	BANK FAN
13	PLAT OPEN SW
14	R RBN POST +
15	PLAT OPEN RET
16	R RBN POST -
17	MPU -
18	COVER OPEN SW
19	MPU +
20	COVER OPEN RET

+48V

.01µF
10%
100V

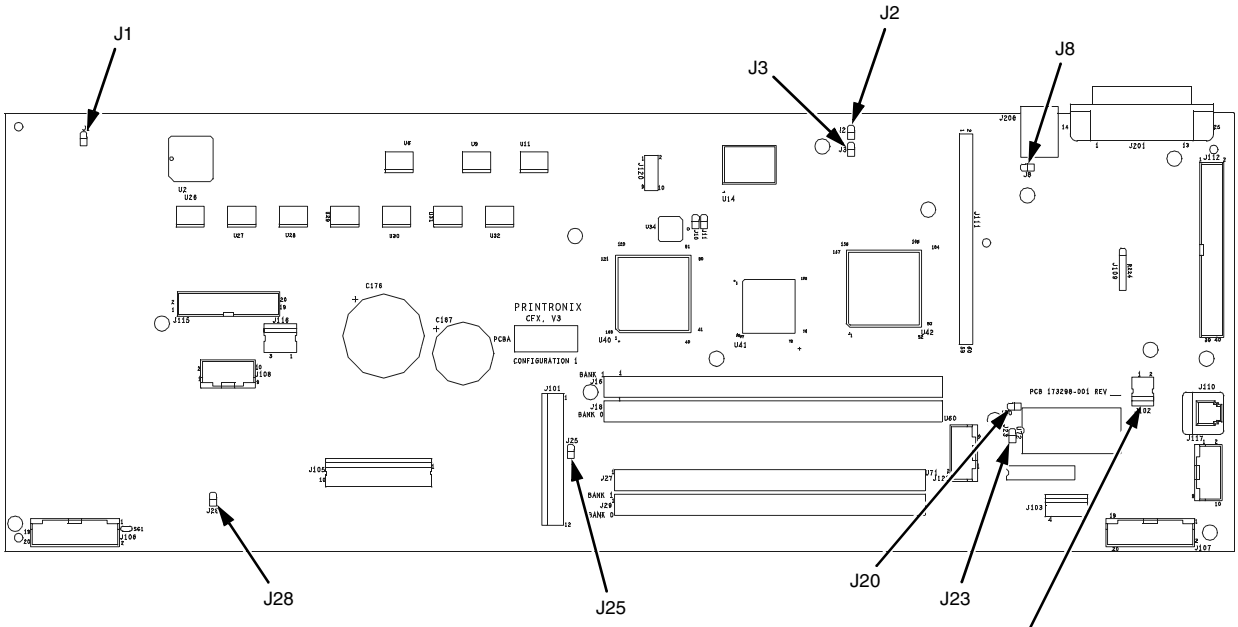
CFX Controller Board (continued)

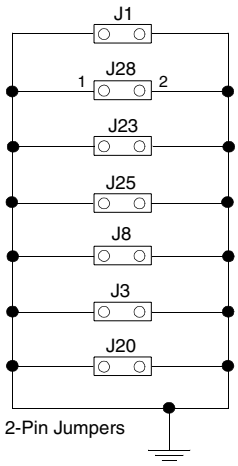




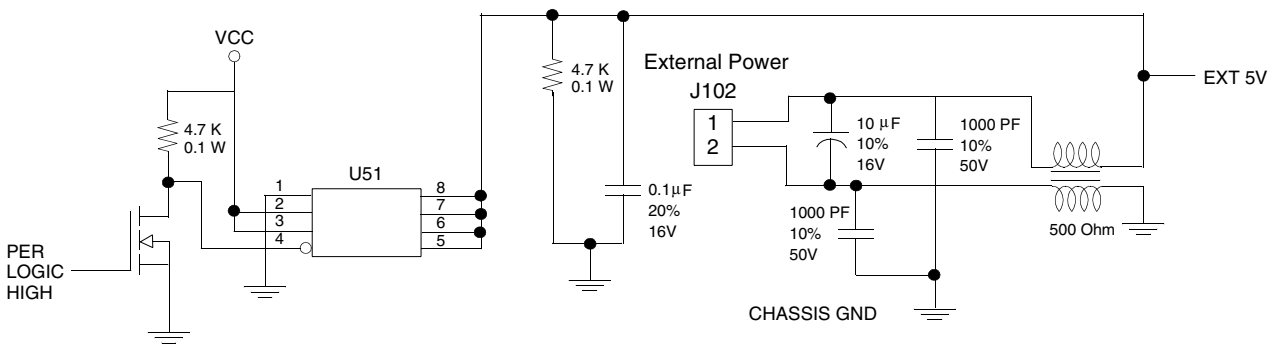
CAUTION: Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if replaced incorrectly. NVRAM is replaced only at the factory.

CFX Controller Board (continued)



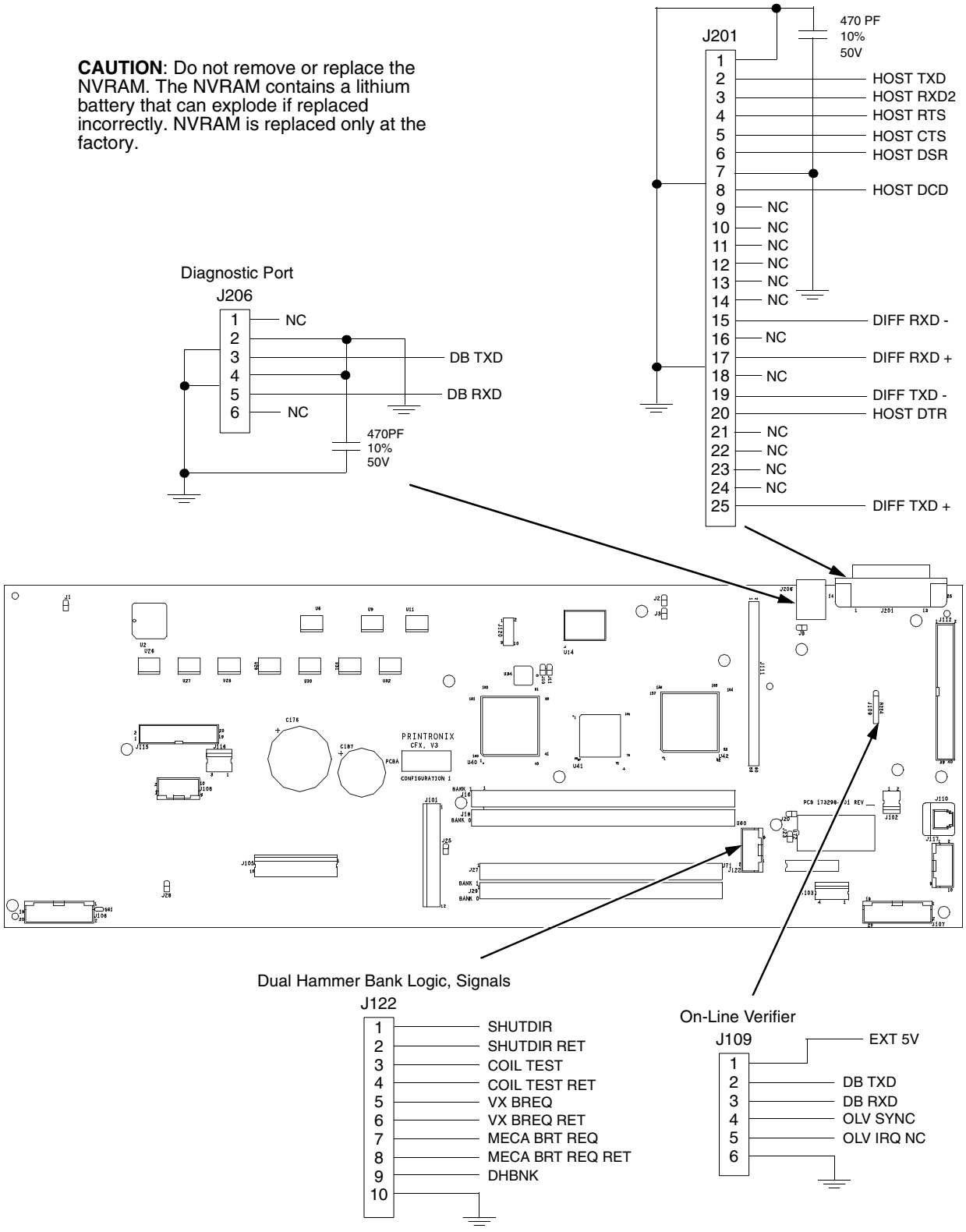


CAUTION: Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if replaced incorrectly. NVRAM is replaced only at the factory.

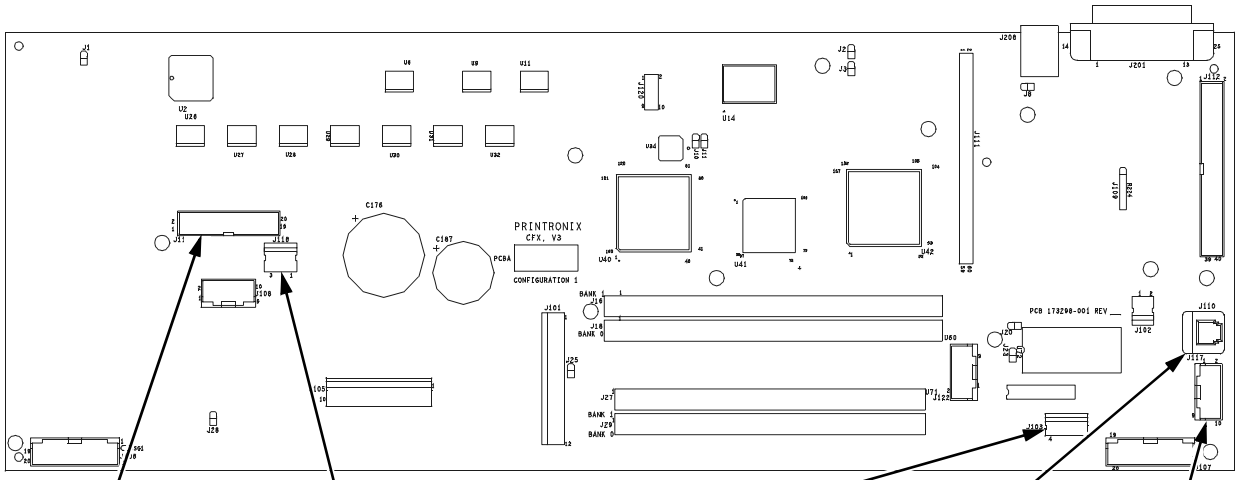


CFX Controller Board (continued)

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



CFX Controller Board (continued)



Paper Feed Motor
J103

1	PF 1
2	PF 2
3	PF 3
4	PF 4

Phase Driver Logic
J115

1	UD 1
2	UD 2
3	PH REF
4	
5	UD 3
6	UD 4
7	
8	DIODE 1
9	DIODE 2
10	
11	
12	DIODE 3
13	DIODE 4
14	N COILTEST
15	
16	CABLE DET
17	HD SENSE
18	LDFB
19	
20	

Shuttle Drive
J116

1	SHUT A
2	SHUT B
3	SHUT C

Front Panel (FP)
J110

1	N FP DATA AVAIL
2	
3	FP CLK
4	
5	N FP LED WR
6	FP DATA
7	
8	N FP LCD WR

470 PF 10% 50V

Paper Stacker
J117

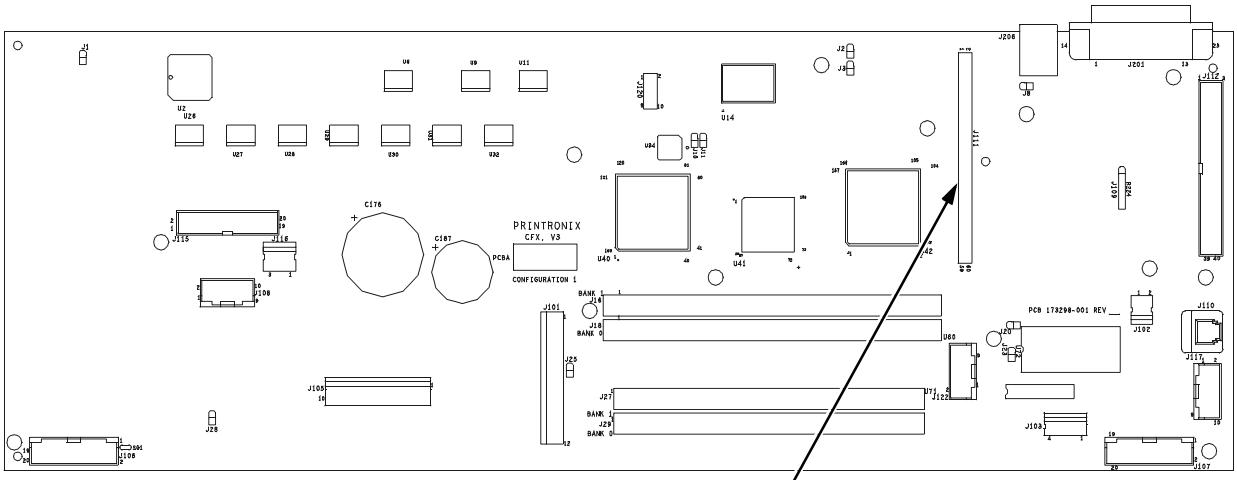
VCC

1	PPR STK STAT0
2	PPR STK STAT1
3	PPR STK CTLO
4	PPR STK CTL1
5	
6	
7	NC
8	NC
9	NC
10	NC

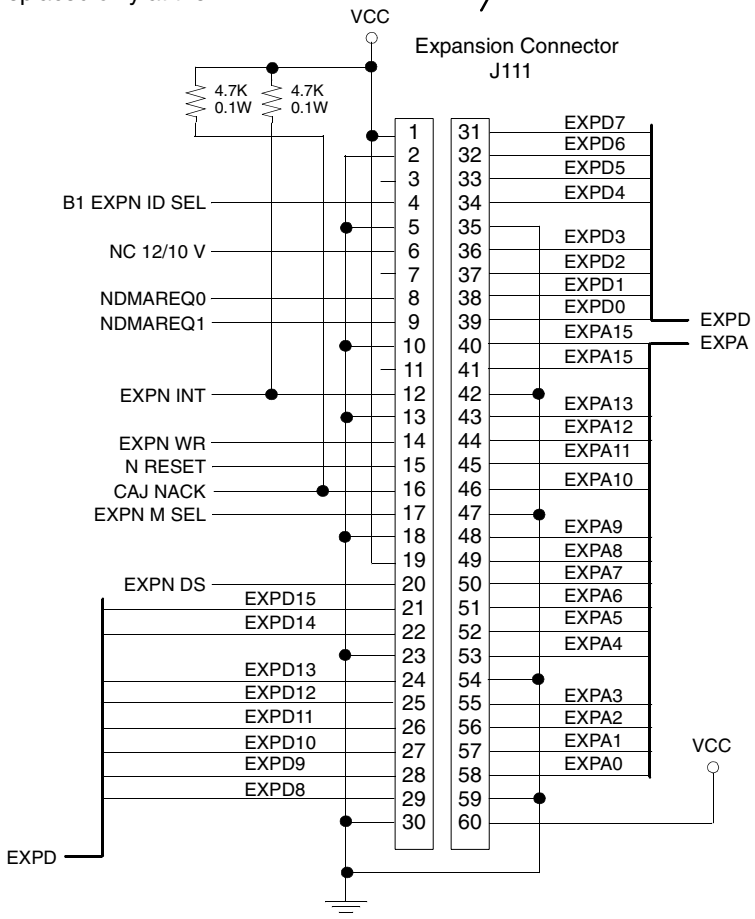
470 PF 10% 50V (x5)

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

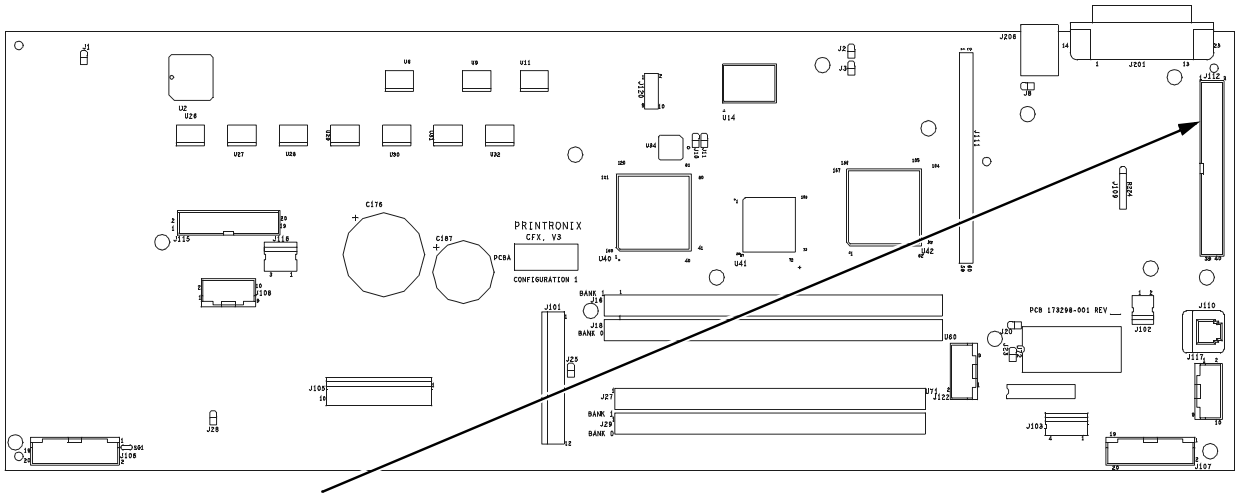
CFX Controller Board (continued)



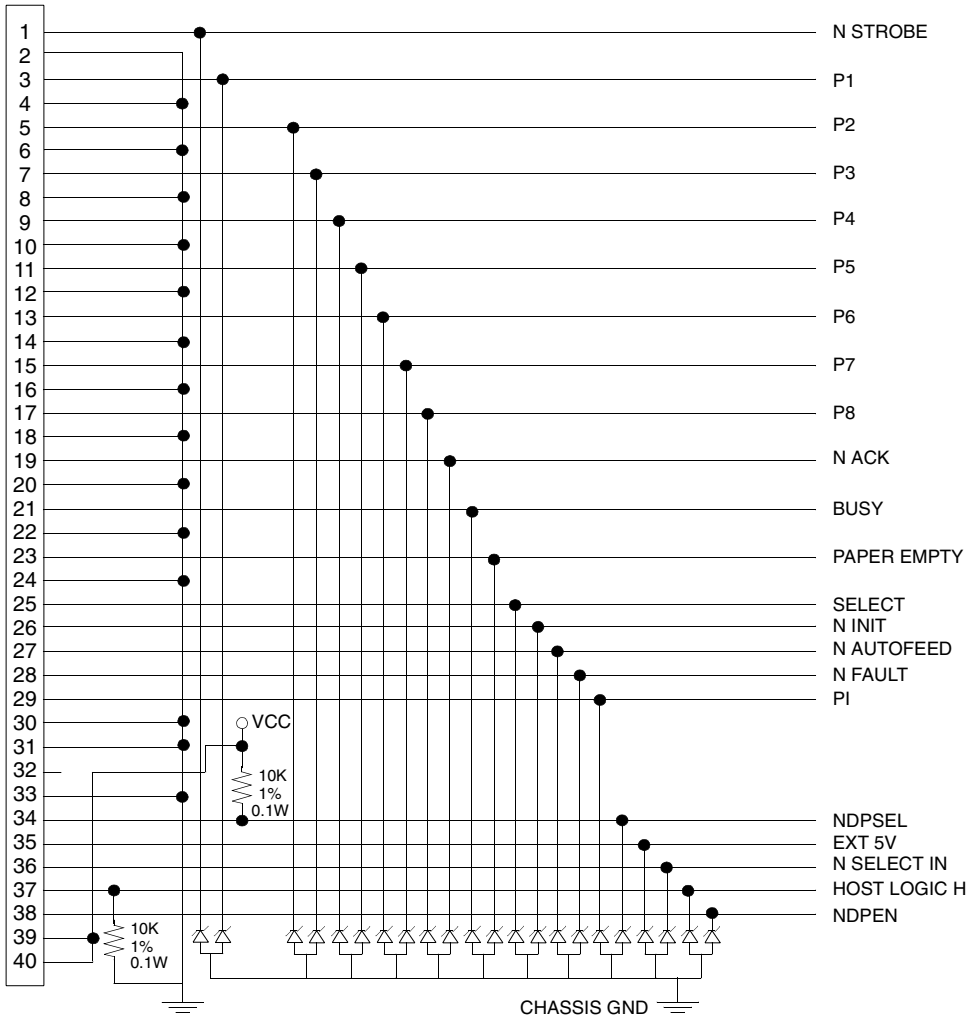
CAUTION: Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if replaced incorrectly. NVRAM is replaced only at the factory.



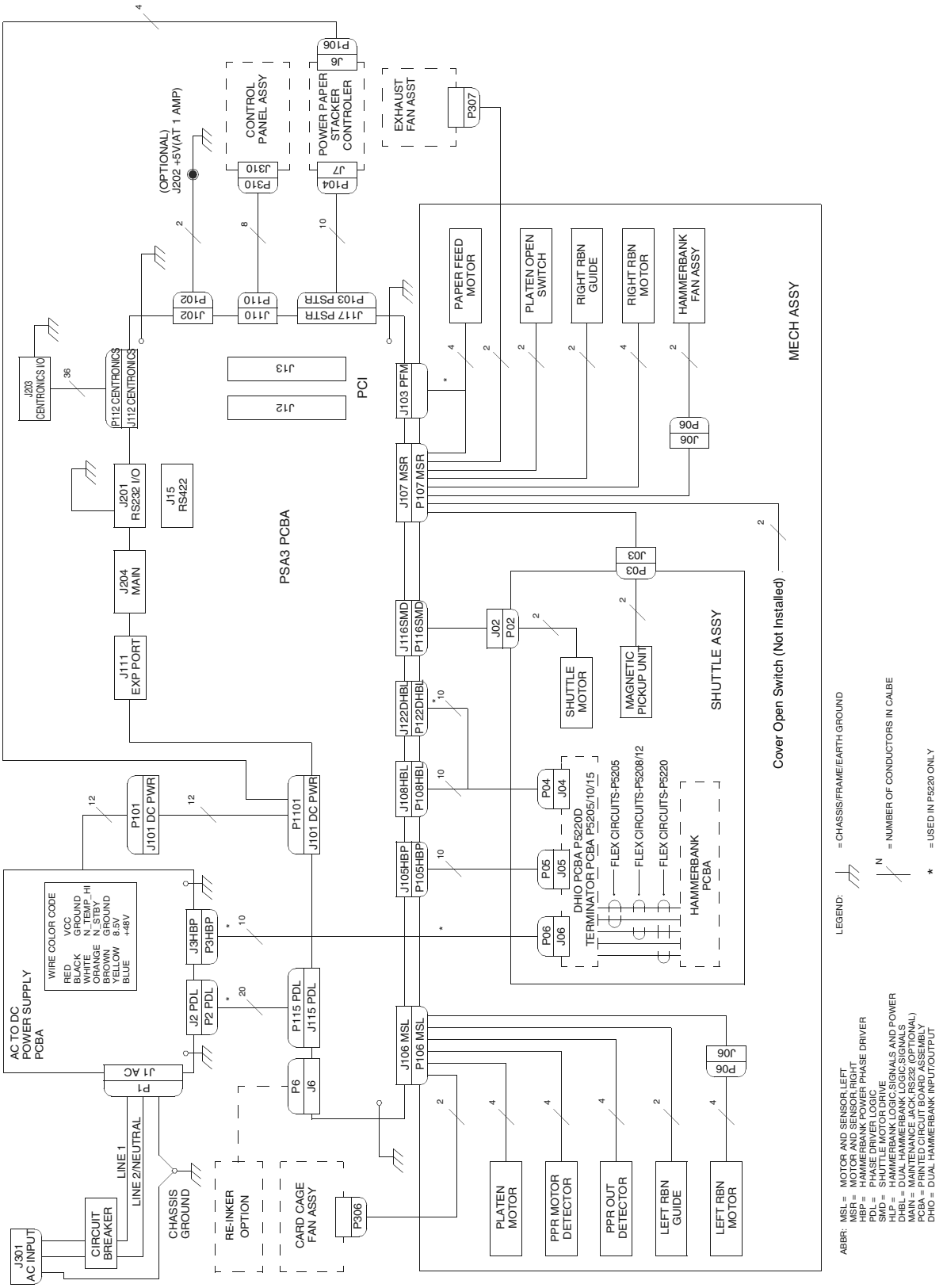
CFX Controller Board (continued)



Centronics Connector
J112



P5224 Interconnection Diagram



P5224 Main Wire Harness Test Tables

P106 Connector

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

Pin No.

Resistance

Connectors are viewed from the top, as seen when plugged into the controller board. For connector assembly and disassembly, see page 190.

P107 Connector

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

Resistance

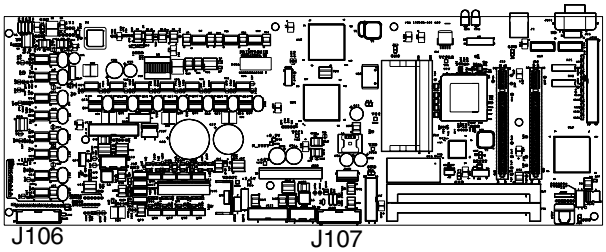
Device	P106 Pins	Normal
LRIB M	2, 4 and 6,8	7.2 - 8.8 Ω
PLAT M	1, 3 and 5, 7	1.35 - 1.65 Ω
LRP	10, 12	Open across pins Short across post
CCF	9, 11	4.6 KΩ
PMD	14, 16 18, 20	8 Meg Ω Open
POD	13, 15 17, 19	8 Meg Ω Open

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

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

CVO = Cover Open Switch (not installed)
EHF* = Exhaust Fan
HBF = Hammer Bank Fan
MPU = Magnetic Pickup
PAPR M = Paper Feed Motor
PLO = Platen Open (Switch)
RRIB M = Right Ribbon Motor
RRP = Right Ribbon Guide

* JMP on pedestal models, used as a spacer



J106 J107

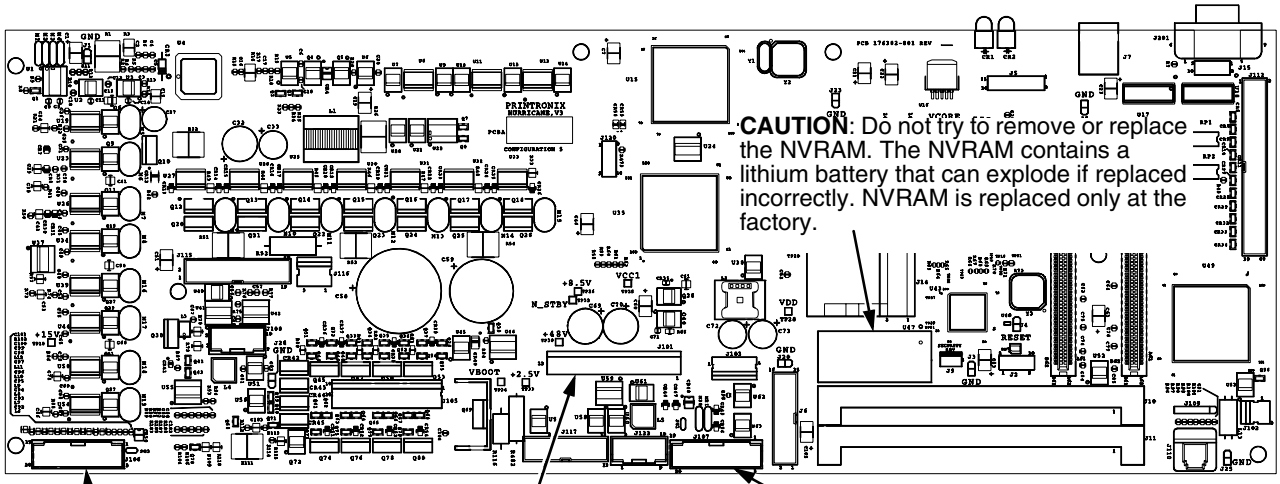
MOTOR NOTES:

All Motors: Use the table values to test for winding continuity and for no shorts between winding and the motor frame. Rotate the motor by hand and test for shorts; replace the motor if you find any shorts.

Shuttle Motor = approx. 0.7 Ω phase to phase; infinite resistance phase to motor frame. Use this value to test for winding continuity and for no shorts between windings and the motor frame. Rotate the motor by hand and test for shorts; replace the shuttle frame assembly if you find any shorts.

All **fans** have brushless DC motors powered by solid-state circuits and controlled by feedback from a fan rotor position Hall Effect sensor. Fans driven by +48V measure 4 - 5 KΩ. Fans driven by +24V measure 2 - 3 KΩ. A very low reading can mean one of the winding drive transistors is shorted. An open circuit could indicate defective fan electronics or an open cable. Fans will run whenever +48V is present; failure to run can mean a defective cable, connector, or current sense resistor on the controller board. An open circuit current sense resistor (on the controller board) will prevent the fan from running but will not allow software to detect the fault.

PSA3 Controller Board



Motor Sensor Left
J106

1	PLAT 1
2	RIB L1
3	PLAT 2
4	RIB L2
5	PLAT 3
6	RIB L3
7	PLAT 4
8	RIB L4
9	CC FAN +
10	L RBN POST +
11	CC FAN -
12	L RBN POST -
13	POD A
14	PMD A
15	POD K
16	PMD K
17	POD C
18	PMD C
19	POD E
20	PMD E

+48V
.01µF 10% 100V

Power Supply
J101

1	N TEMP HI
2	N STDBY
3	
4	VCC1
5	
6	
7	
8	
9	
10	+8.5V
11	+48V
12	

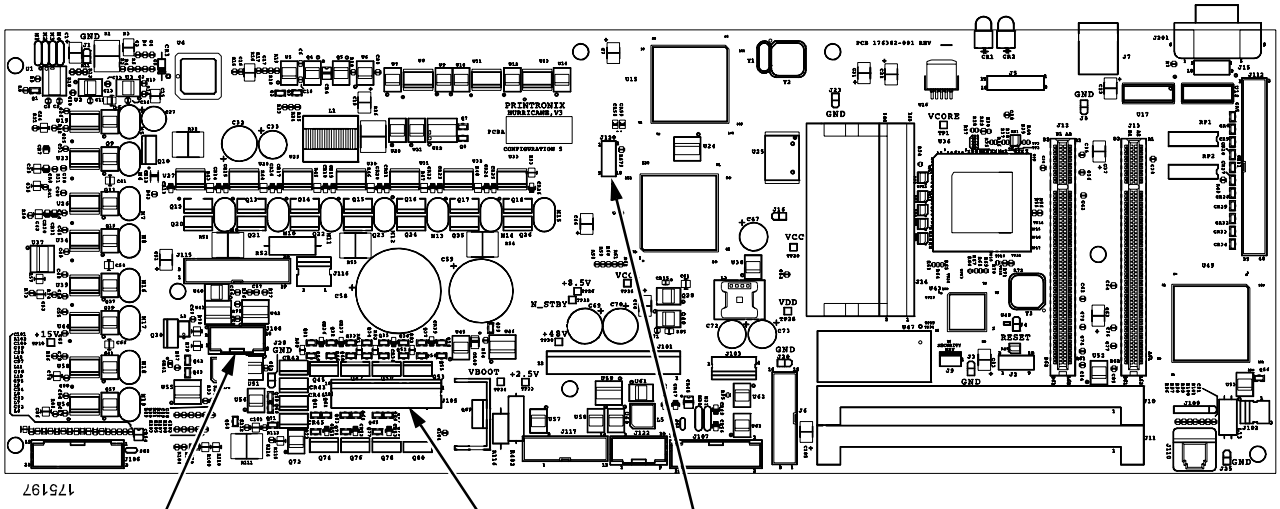
100 PF 10% 50V
.01µF 10% 100V
10 µF 10% 16V TANT
470 PF 10% 50V
470 PF 10% 50V

Motor Sensor Right
J107

1	PF 1
2	RIB R1
3	PF 2
4	RIB R2
5	PF 3
6	RIB R3
7	PF 4
8	RIB R4
9	EXH FAN +
10	
11	EXH FAN -
12	BANK FAN
13	PLAT OPEN SW
14	R RBN POST +
15	PLAT OPEN RET
16	R RBN POST -
17	MPU -
18	COVER OPEN SW
19	MPU +
20	COVER OPEN RET

+48V
.01µF 10% 100V

PSA3 Controller Board (continued)



Hammer Bank Logic

J108

1	
2	HMR DAT
3	HMR DAT RET
4	HMR CLK
5	HMR CLK RET
6	CMD DAT
7	CMD DAT RET
8	CMD CLK
9	DMD CLK RET
10	

COIL 50 MHz

+10V SW

.01µF 10% 50V

COIL 50 MHz

EC Diagnostics

J120

VCC

10K 1% 0.1W

0 Ohm 0.125W

EC BOOT STRAP

1	
2	C167 DB TXD
3	C167 DB RXD
4	NC
5	PPR TRIG
6	PPR MOVING
7	FT EVENT
8	MPU OUT
9	SHUT DIR
10	

Hammer Bank Power

J105

1	PH1
2	PH2
3	PH3
4	PH4
5	LDFB
6	
7	
8	
9	
10	

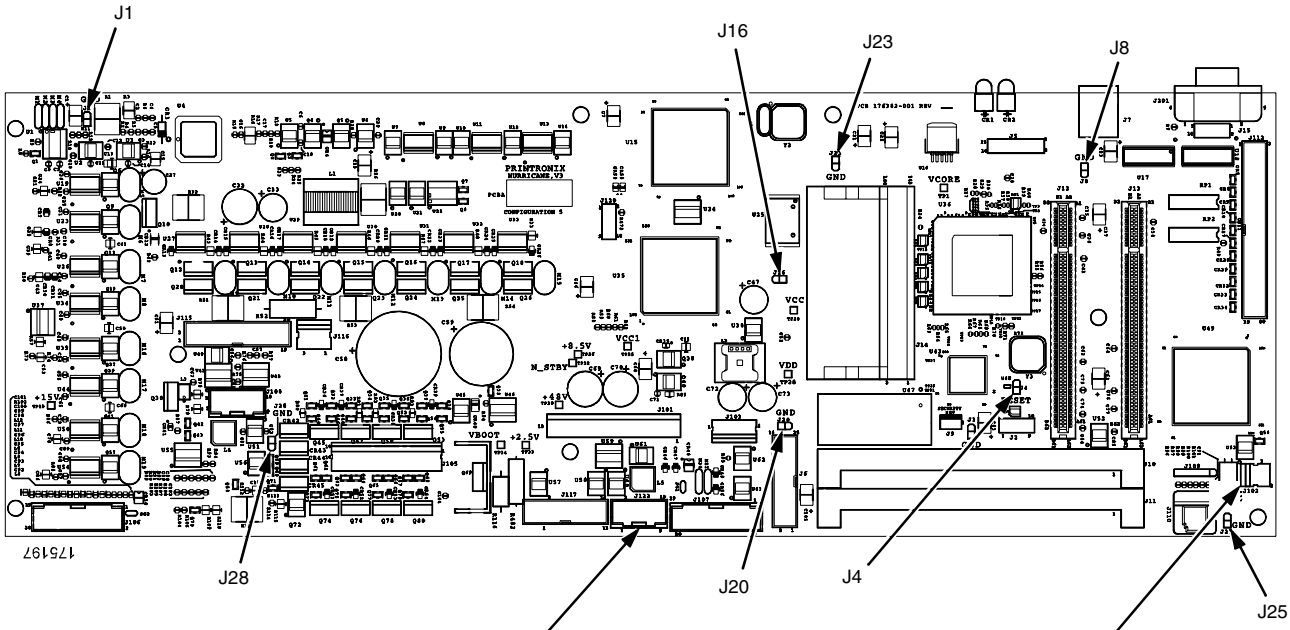
3300 PF 5% 100V

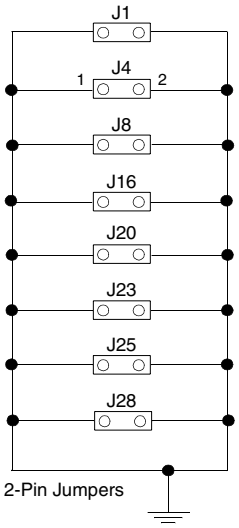
3300 PF 5% 100V

3300 PF 5% 100V

3300 PF 5% 100V

PSA3 Controller Board (continued)

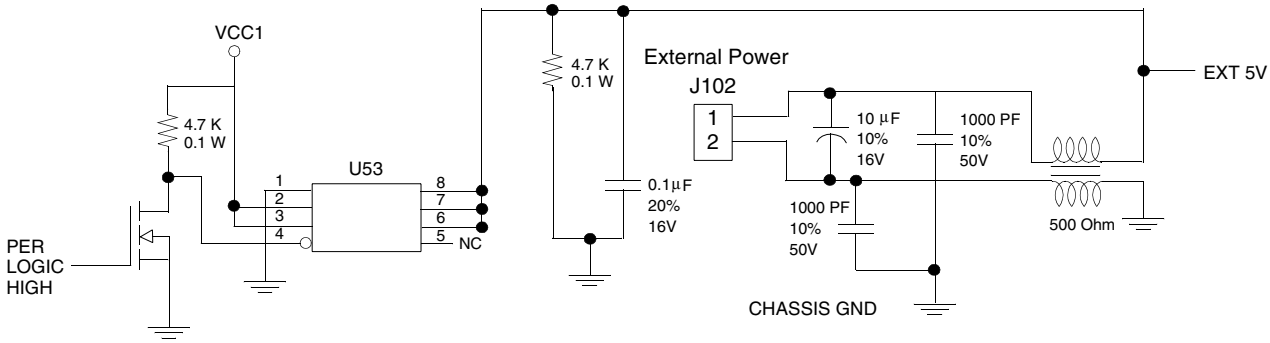




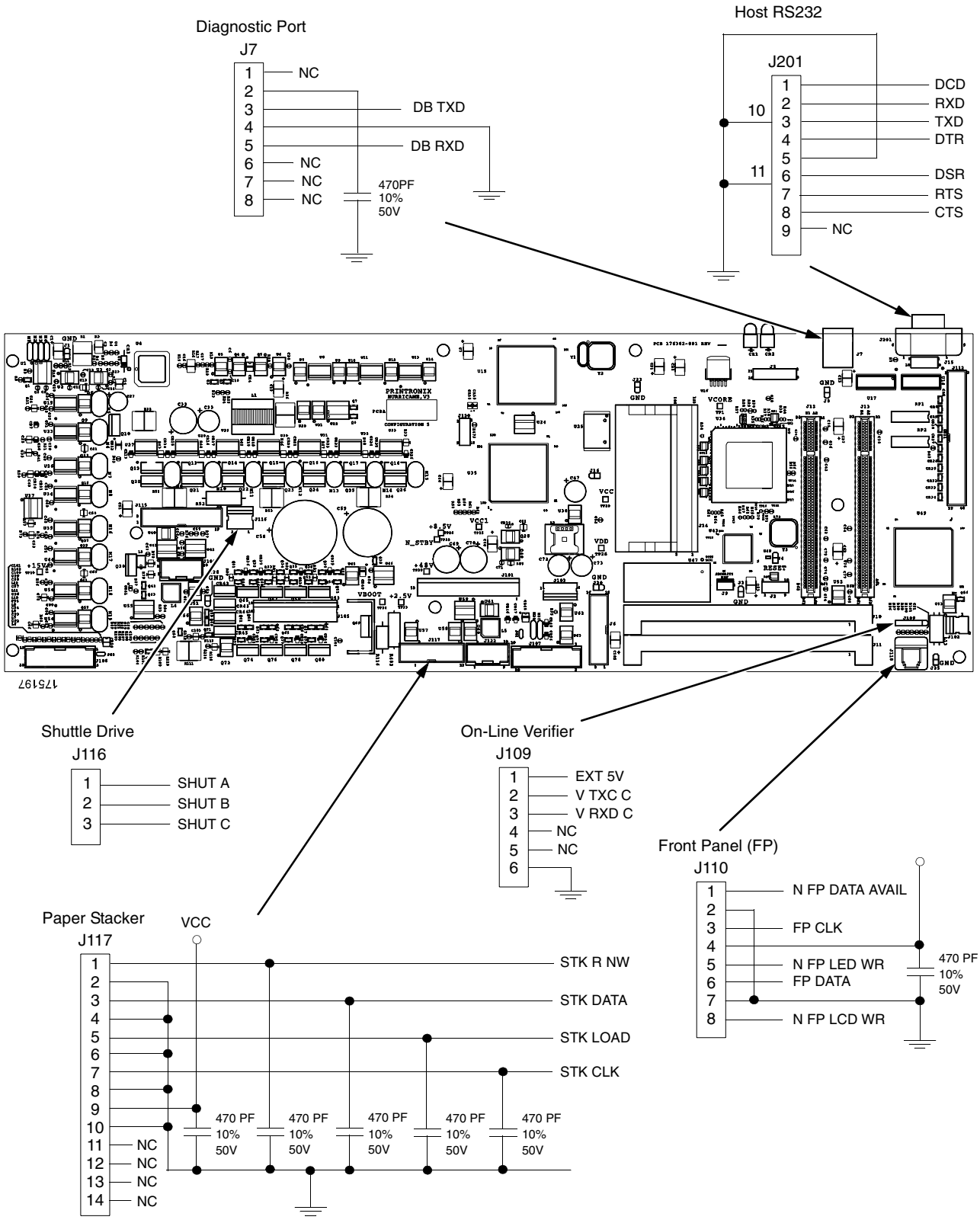
Hammer Bank Port

J122

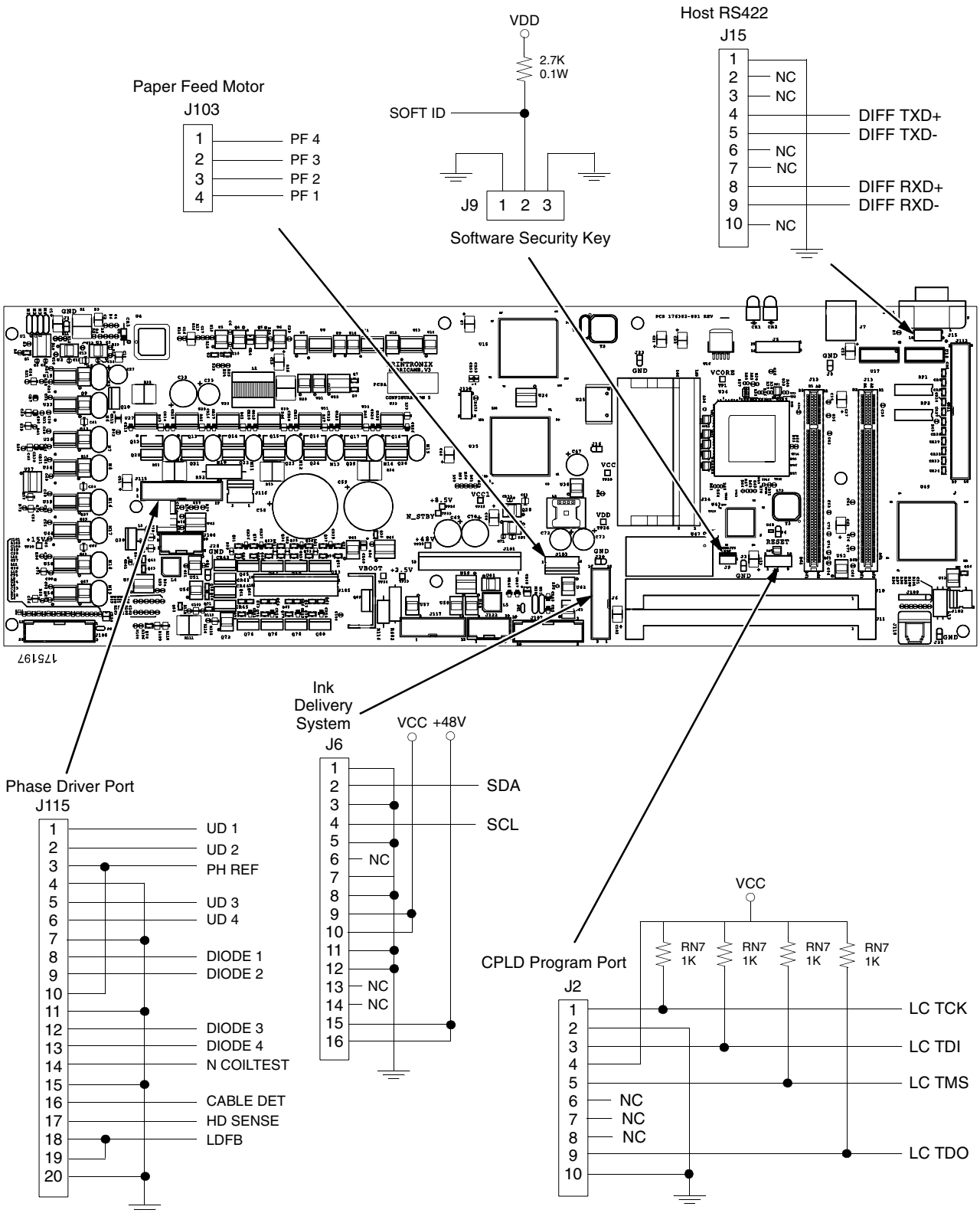
1	SHUTDIR
2	SHUTDIR RET
3	COIL TEST
4	COIL TEST RET
5	VX BREQ
6	VX BREQ RET
7	MECA BRT REQ
8	MECA BRT REQ RET
9	DHBNK
10	



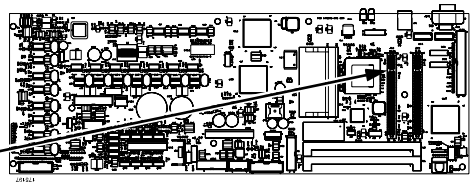
PSA3 Controller Board (continued)

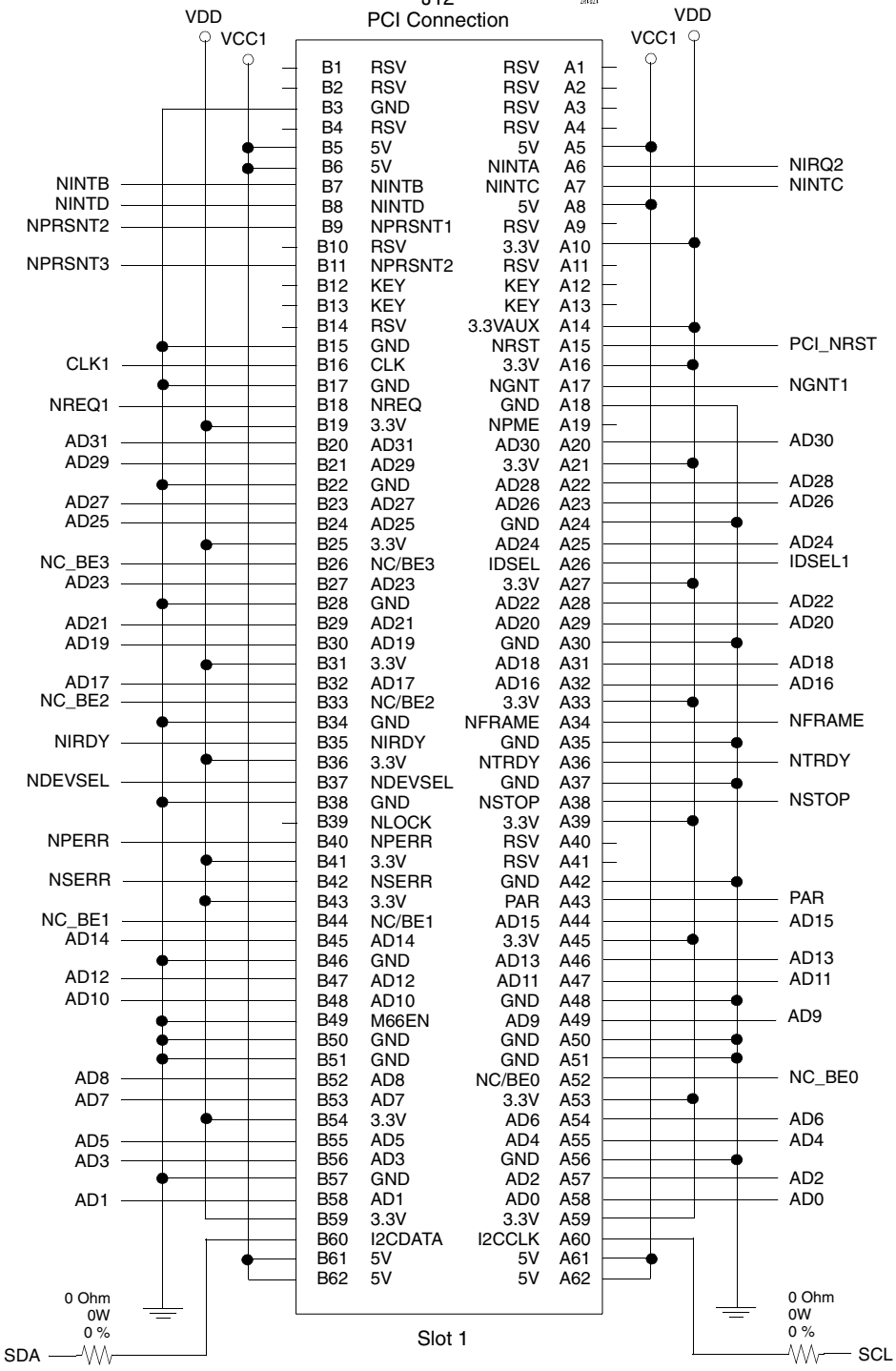


PSA3 Controller Board (continued)

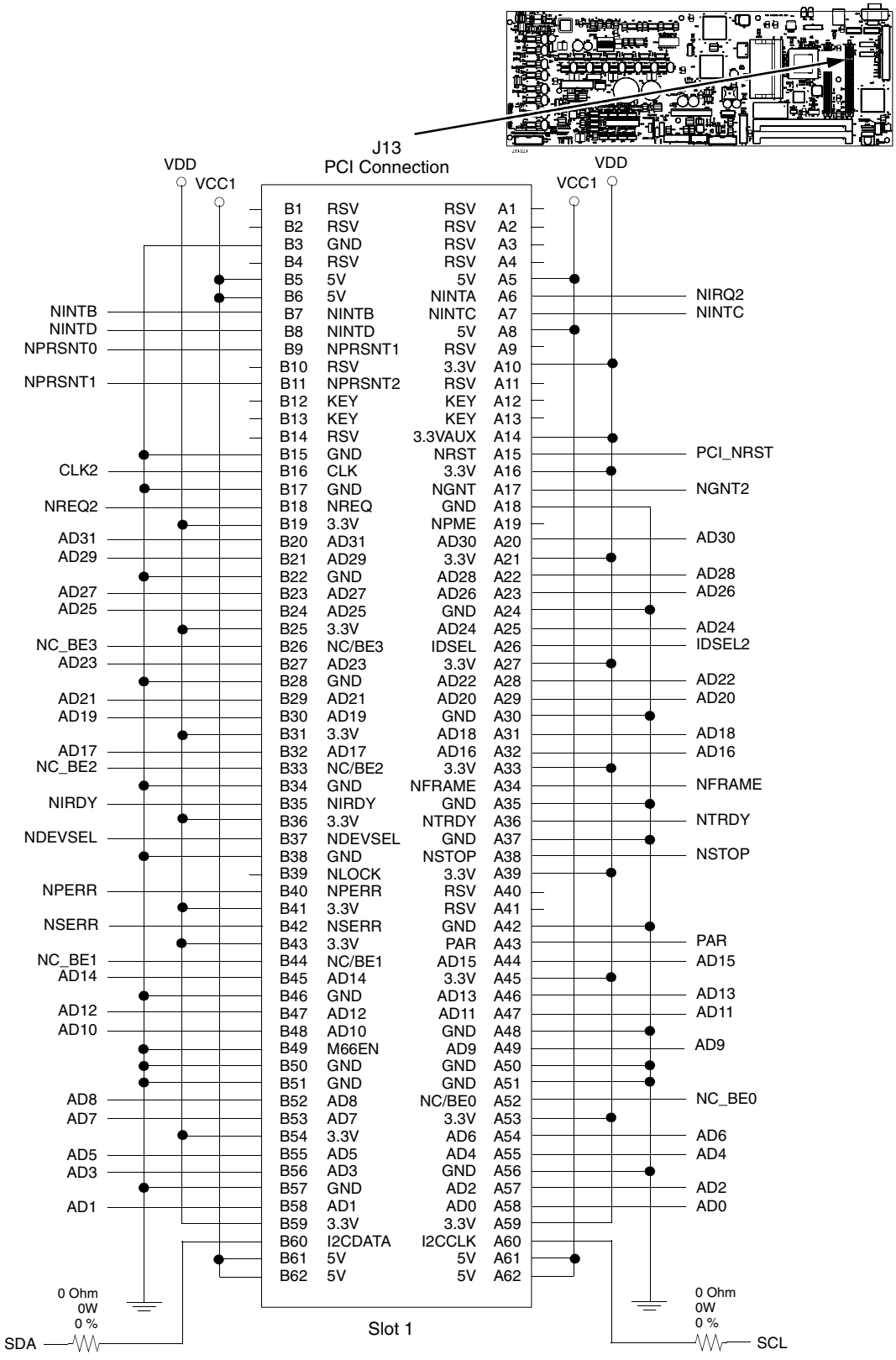


PSA3 Controller Board (continued)

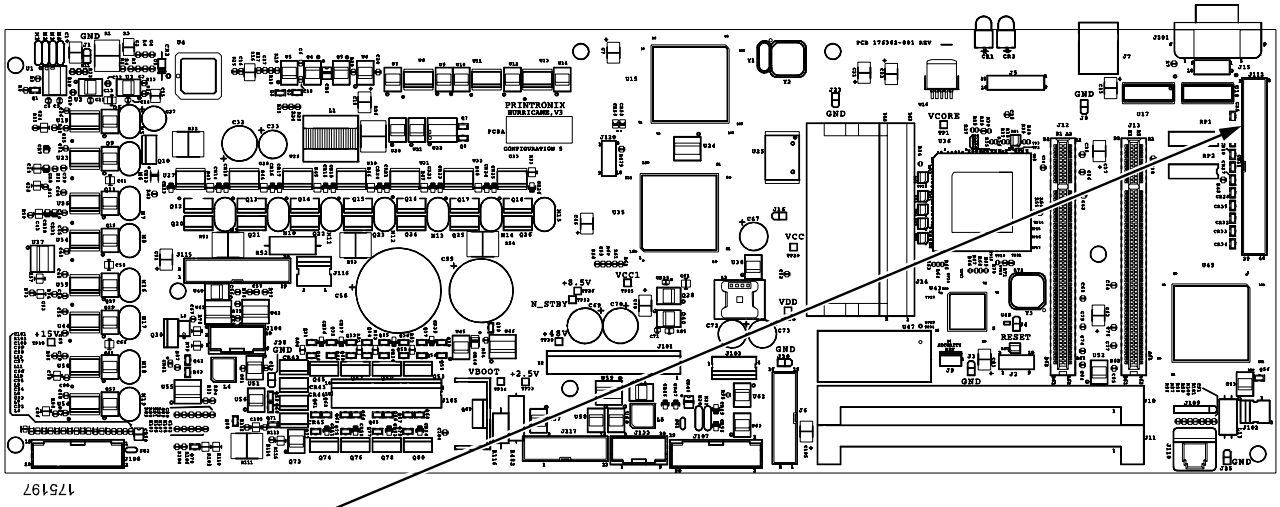


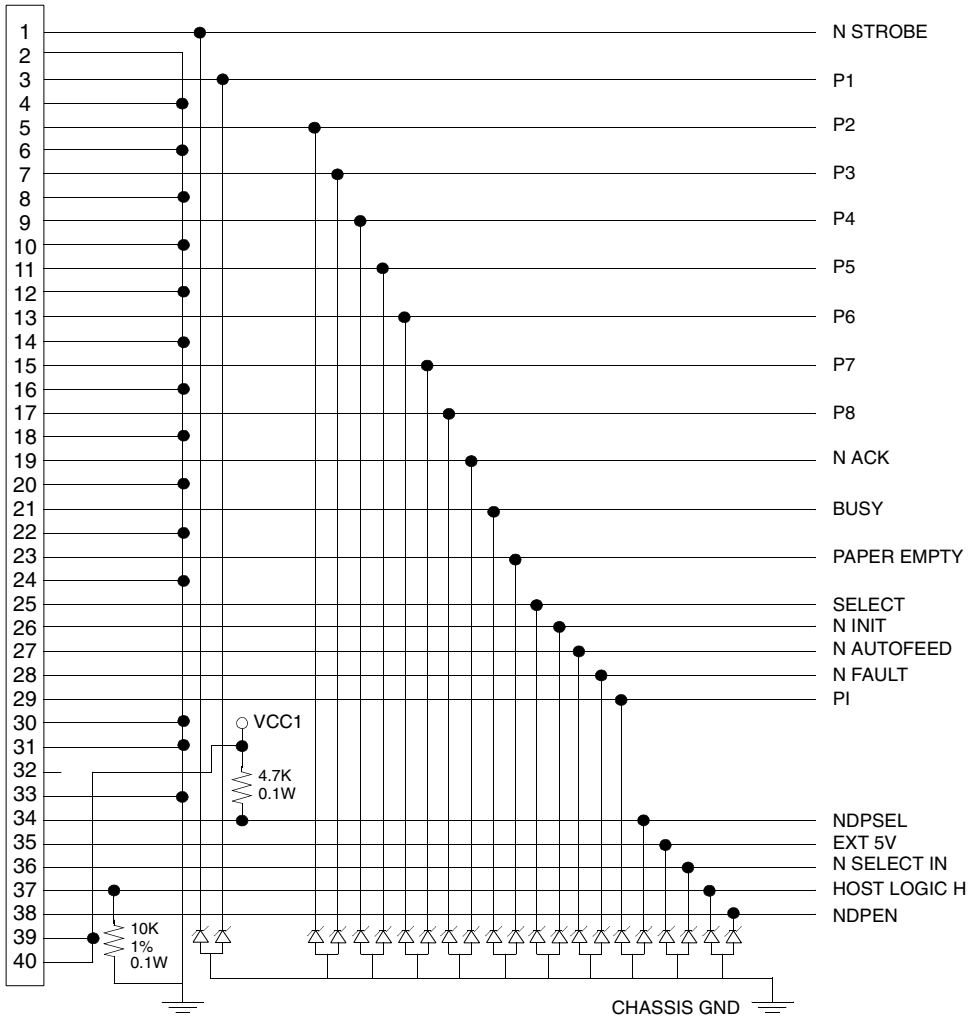


PSA3 Controller Board (continued)

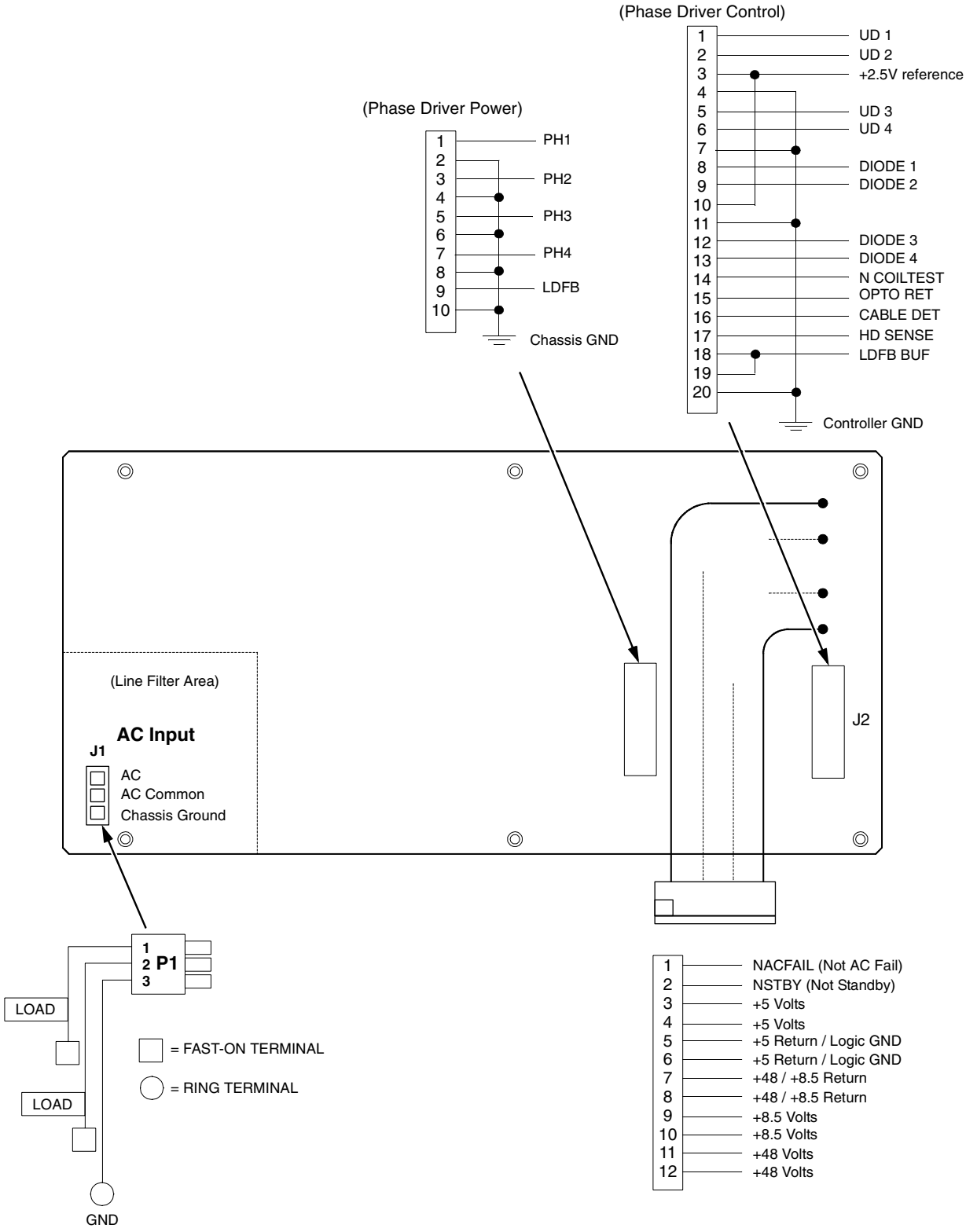


PSA3 Controller Board (continued)

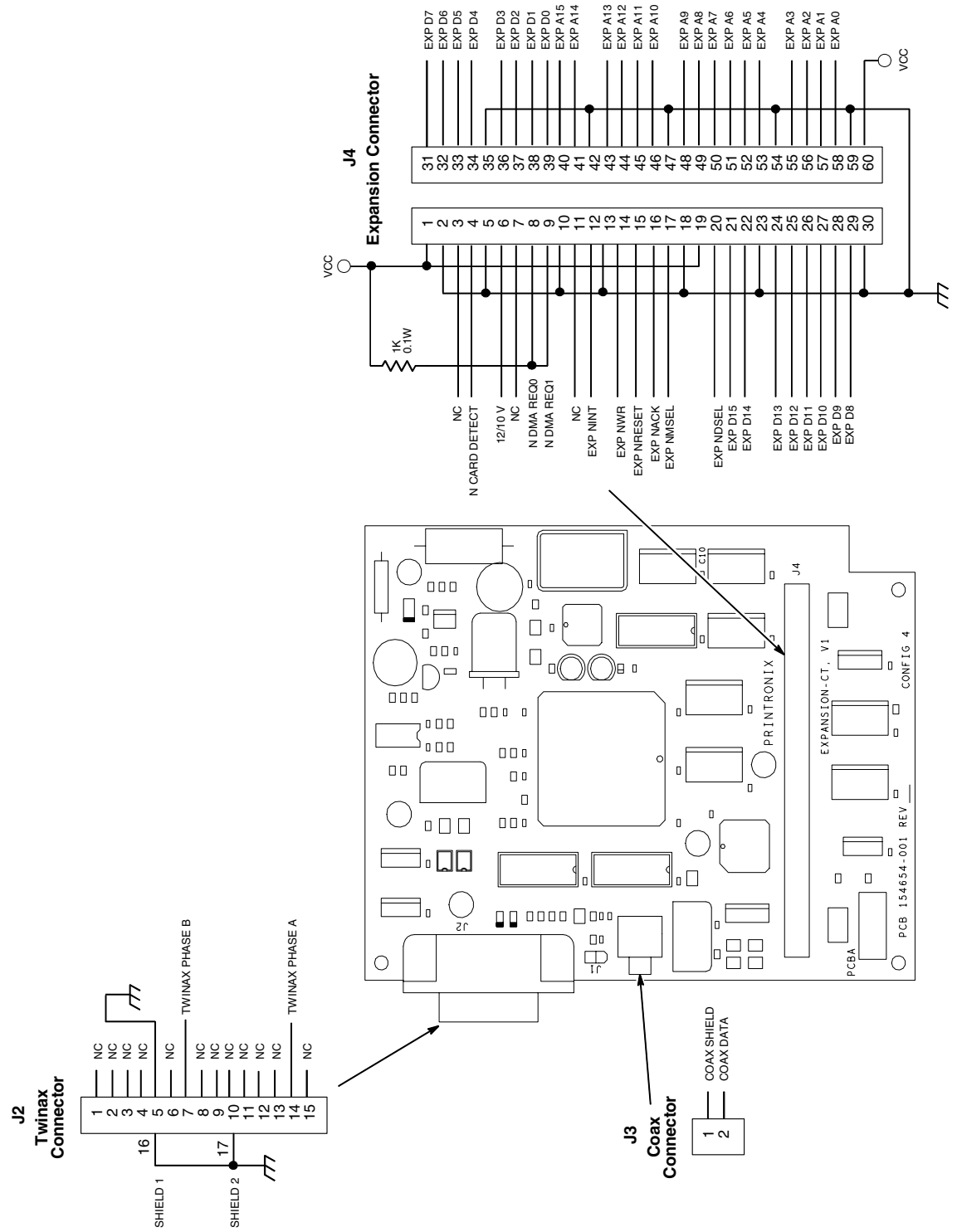




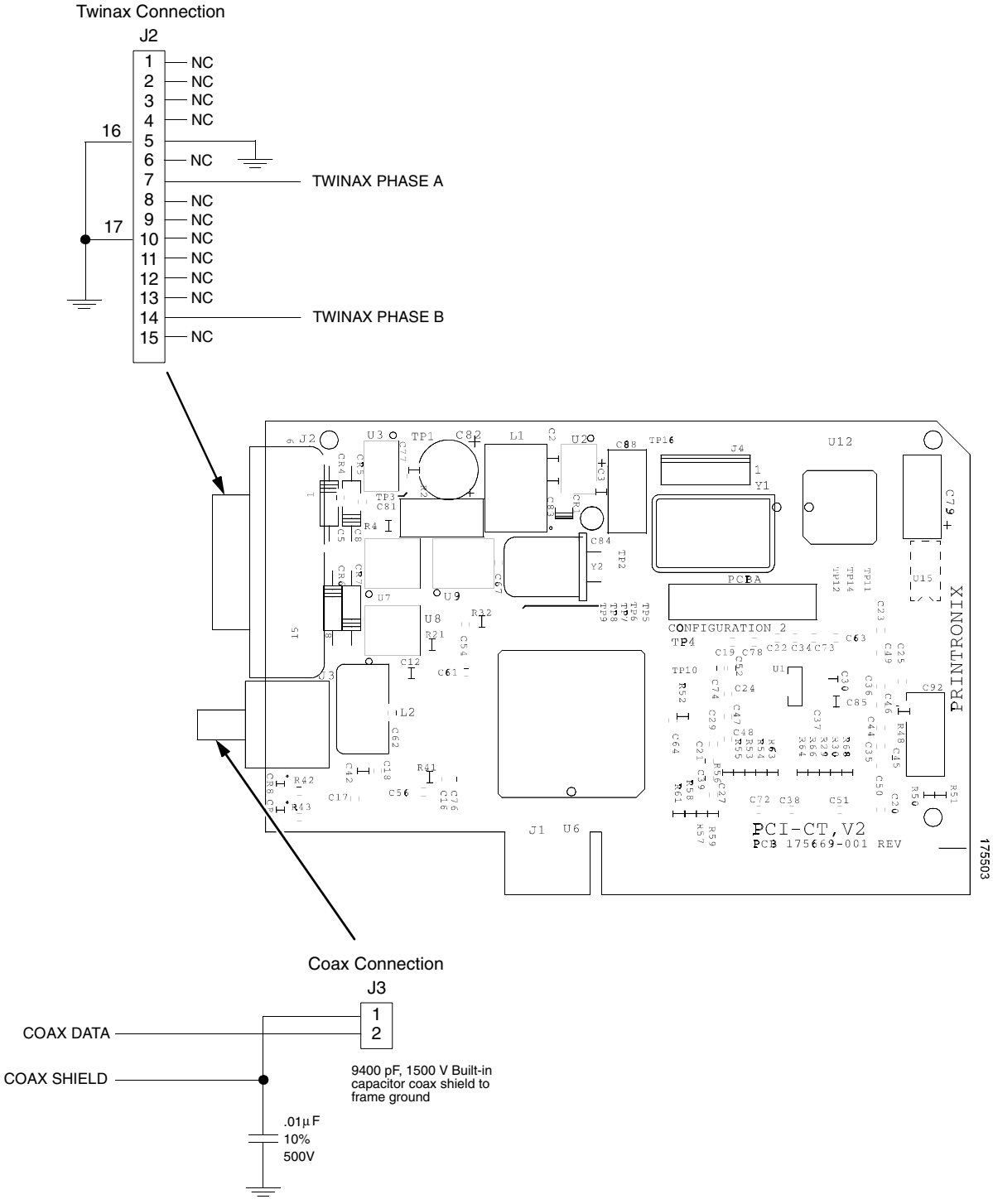
Power Supply



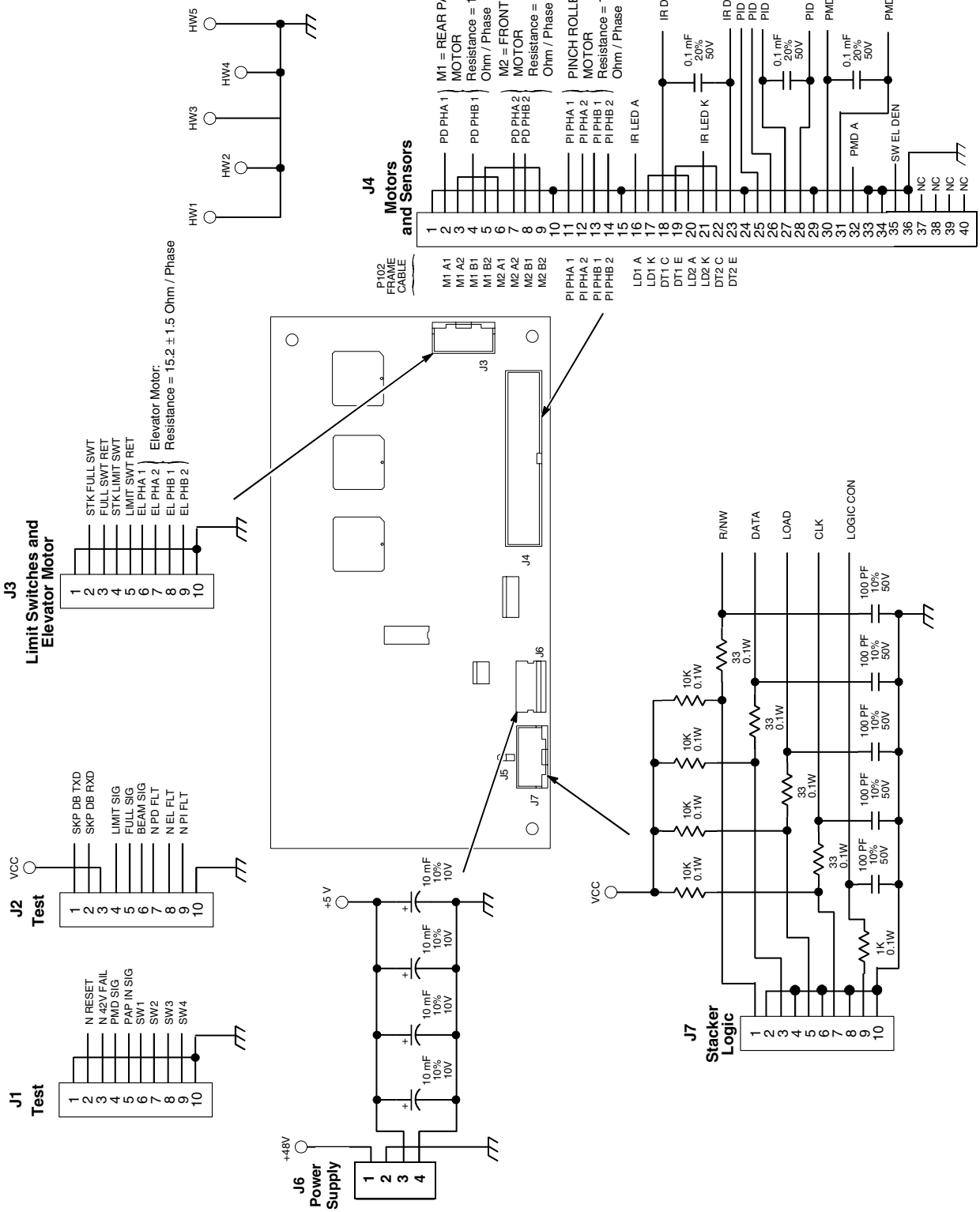
Expansion-CT (Model P5220)



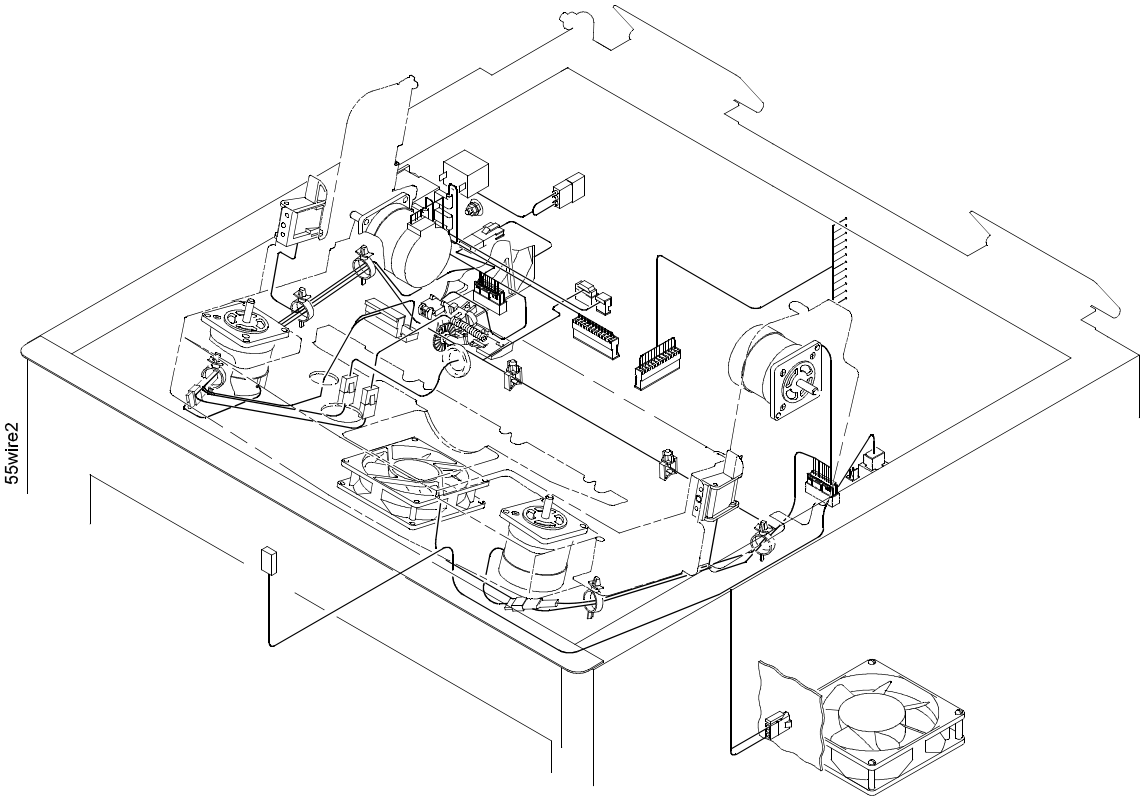
CT Board (Model P5224)



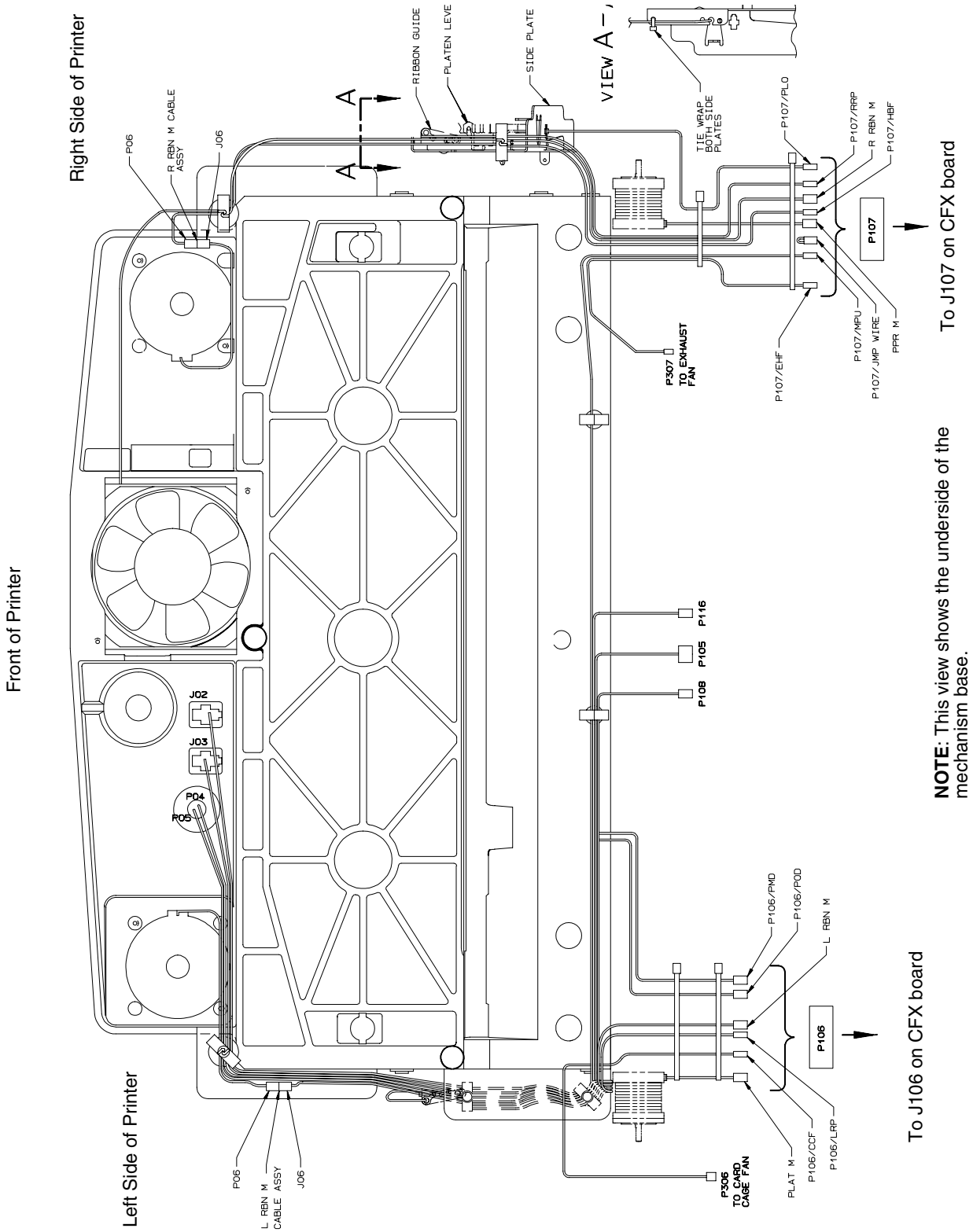
SureStak Power Stacker PCBA



Cable Routing

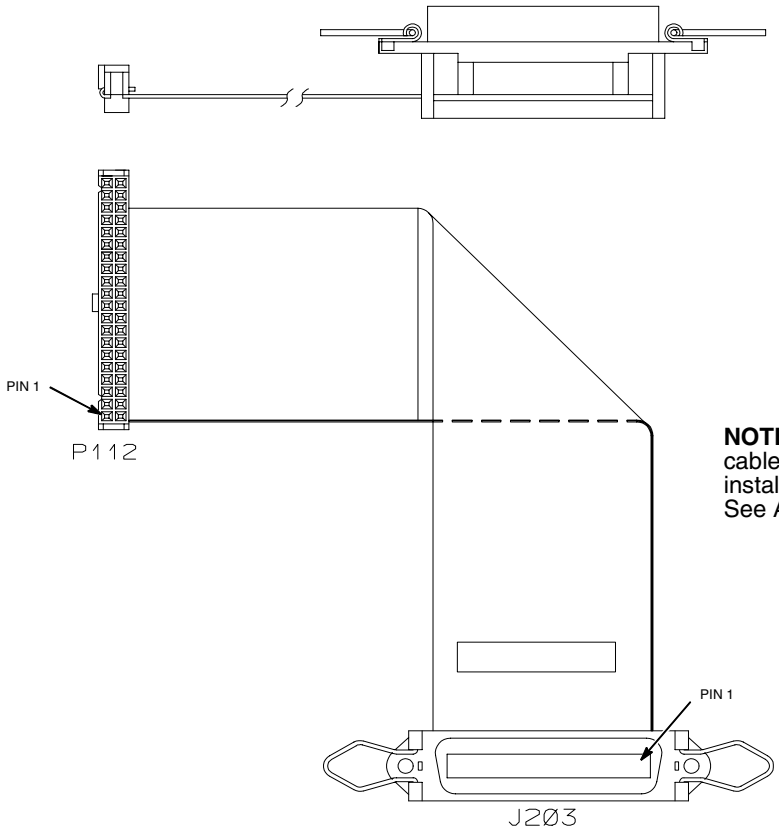


Cable Routing, Mechanism Base



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

Cable Assembly, Centronics I/O (P/N 152439-901)

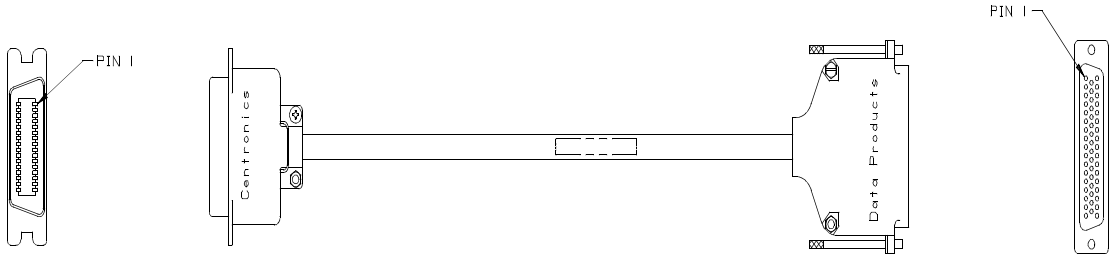


NOTE: If you replace this cable assembly, you must install the ferrite clamp. See Appendix D.

Cable Assembly, Dataproducts Adapter (P/N 154695-001)

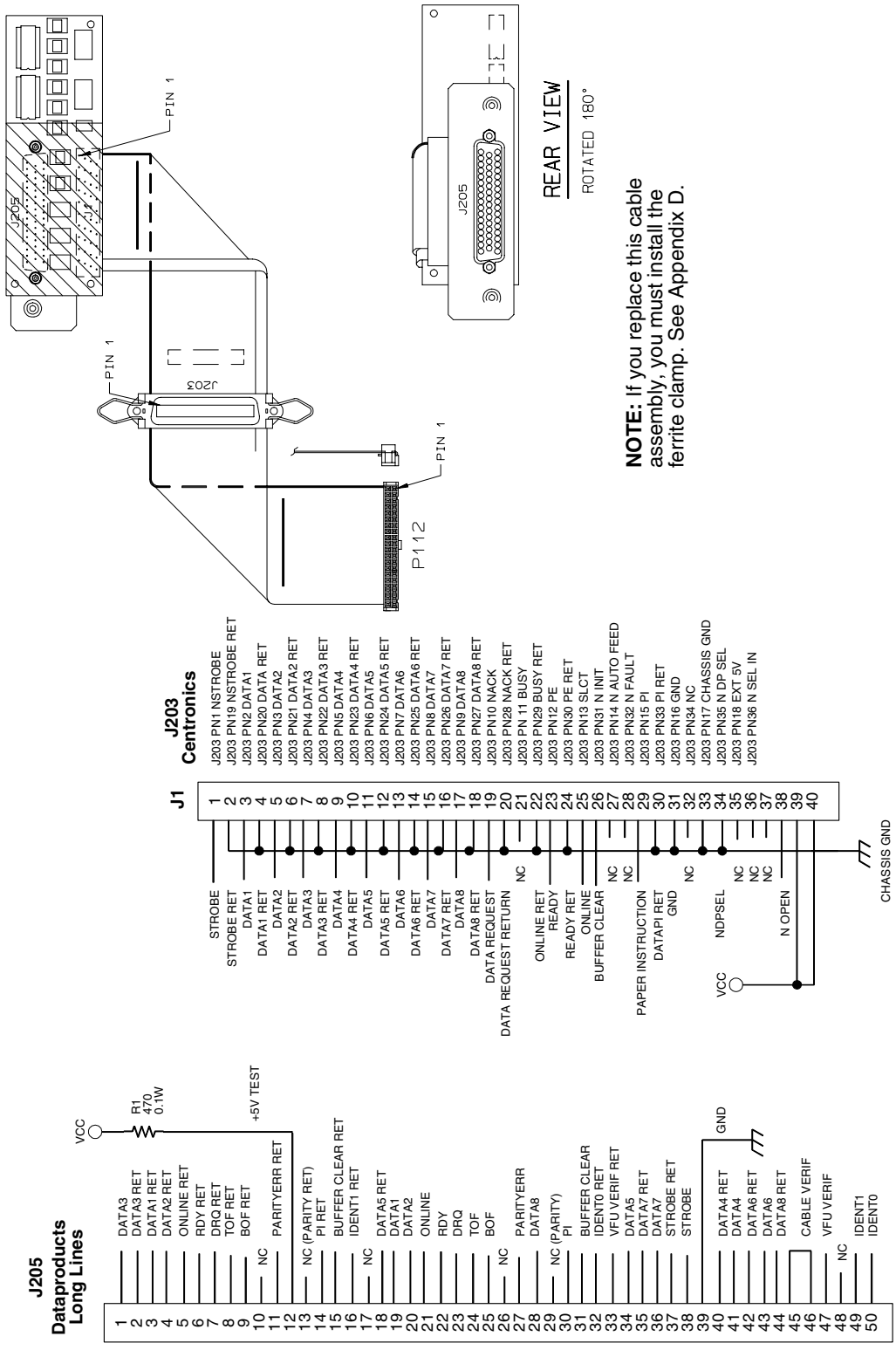
WIRING TABLE		
CENTRONICS	TWISTED PAIR	DATAPRODUCTS
PIN 1	#1	PIN 38
* PIN 19		* PIN 37
PIN 2	#2	PIN 19
* PIN 20		* PIN 3
PIN 3	#3	PIN 20
* PIN 21		* PIN 4
PIN 4	#4	PIN 1
* PIN 22		* PIN 2
PIN 5	#5	PIN 41
* PIN 23		* PIN 40
PIN 6	#6	PIN 34
* PIN 24		* PIN 18
PIN 7	#7	PIN 43
* PIN 25		* PIN 42
PIN 8	#8	PIN 36
* PIN 26		* PIN 35
PIN 9	#9	PIN 28
* PIN 27		* PIN 44
PIN 10	#10	PIN 23
* PIN 28		* PIN 7
PIN 12	#11	PIN 22
* PIN 30		* PIN 6
PIN 13	#12	PIN 21
* PIN 29		* PIN 5
PIN 15	#13	PIN 30
* PIN 33		* PIN 14
PIN 31	#14	PIN 31
* PIN 16		* PIN 15
* PIN 16,35	#15	* PIN 11,27
* PIN 17		* PIN 39
	JUMPER WIRE	PIN 45
* GROUND		* PIN 46

154695

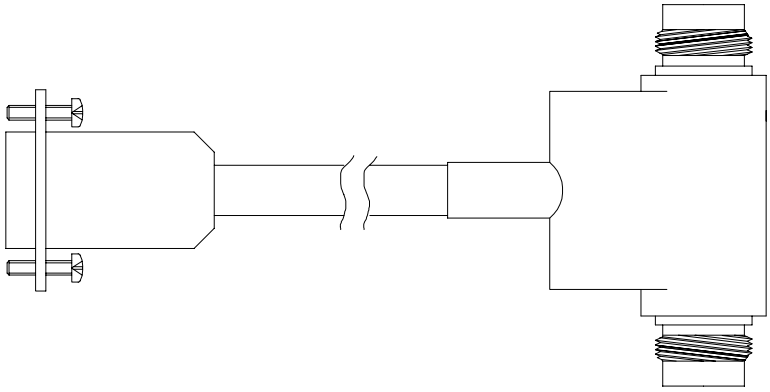


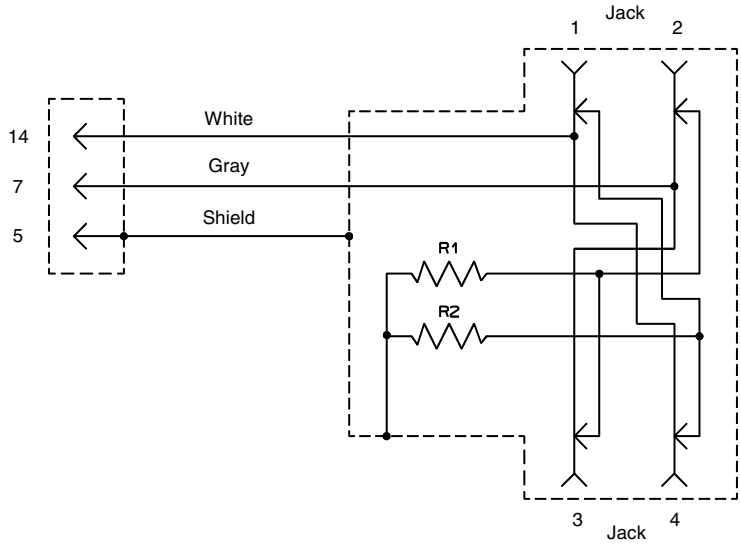
TAB BLOCK	
DASH NO.	DESCRIPTION
-001	STD
-901	SPARE

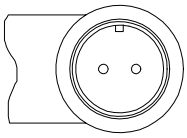
Cable Assembly, Dataproducts Long Lines I/O (P/N 154649-901)



Cable Assembly, Twinax Auto-Termination (P/N 140752-002)

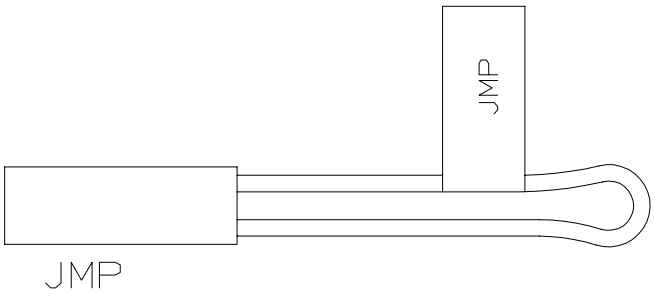




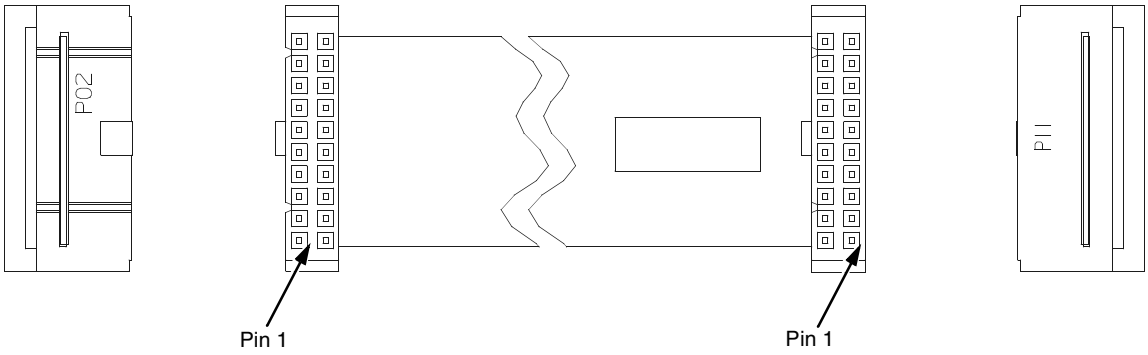


Resistance Chart		
Pin	**Pin**	**Ohms**
1	2	110
3	4	110
1, 2, 3, 4	Shield	55
5	Shield	0
14	1, 4	0
7	2, 3	0

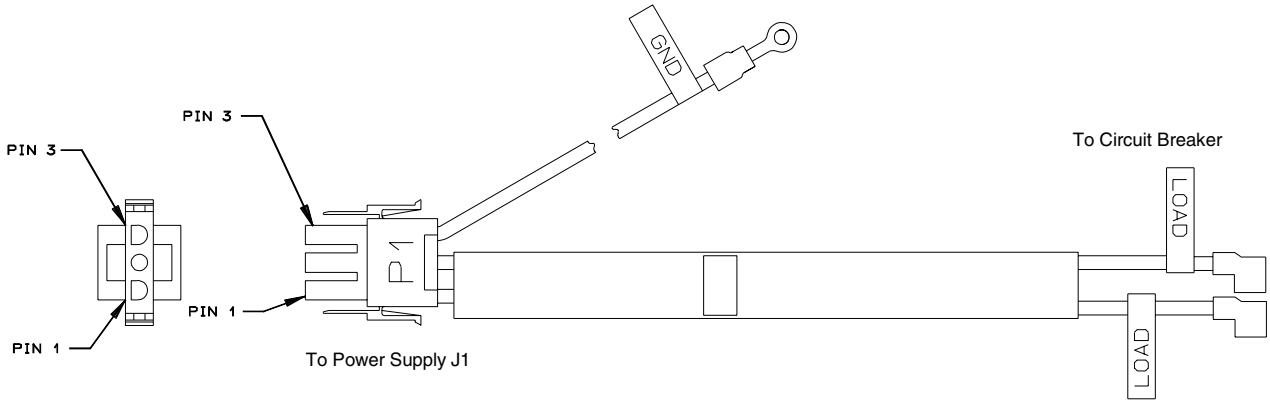
Cable Assembly, 2-Pin Jumper, 0.1 Ctr (P/N 154470-901)



Cable Assembly, Power Supply I/O (P/N 173164-901)

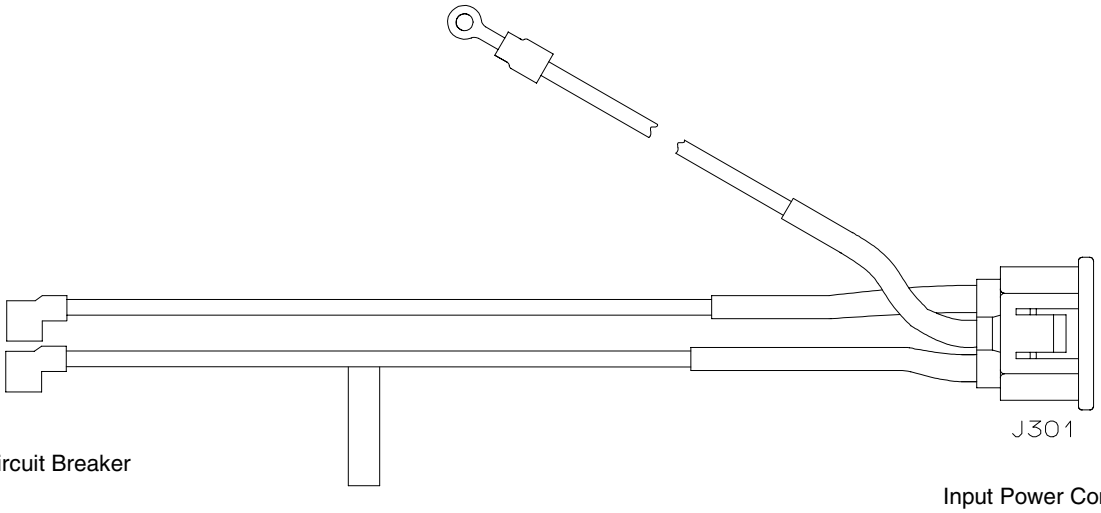


Cable Assembly, AC In, Power Supply
(AC Kit P/N 153502-901)



PIN	WIRE COLOR
1	BLACK
2	WHITE
3	GREEN/YELLOW

Cable Assembly, AC Power Input (AC Kit P/N 153502-901)

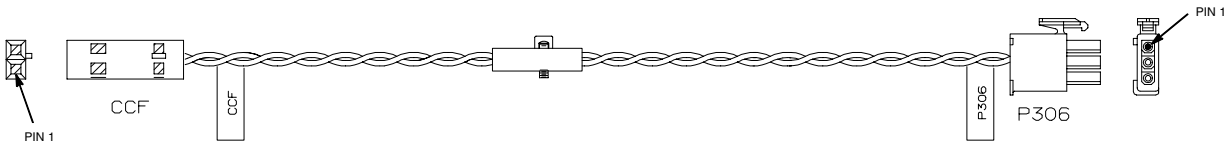


To Circuit Breaker

Input Power Connector

PIN	WIRE COLOR
LINE	BLACK
NEUTRAL	WHITE
GROUND	GREEN/YELLOW

Cable Assembly, Card Cage Fan (P/N 152422-901)

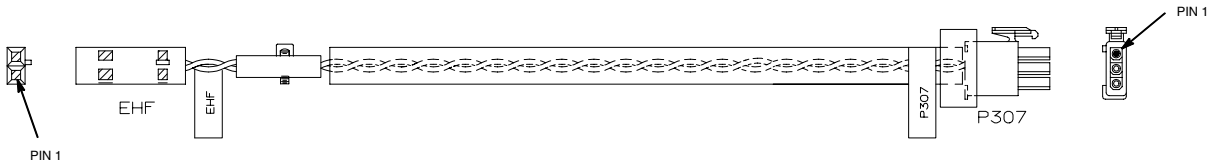


WIRE TABLE		
CCF	P306	WIRE COLOR
PIN 1	PIN 3	BLACK
PIN 2	PIN 2	GRAY
	PIN 1	N/C

Cable Assembly, Control Panel (P/N 152440-901)

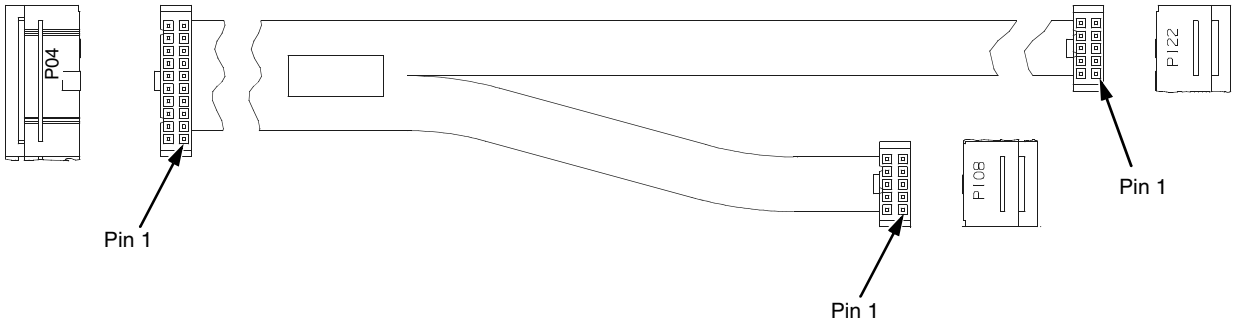
NOTE: If you replace the control panel cable, you must install two ferrite shielding beads. See Appendix D.

Cable Assembly, Exhaust Fan (P/N 152424-901)

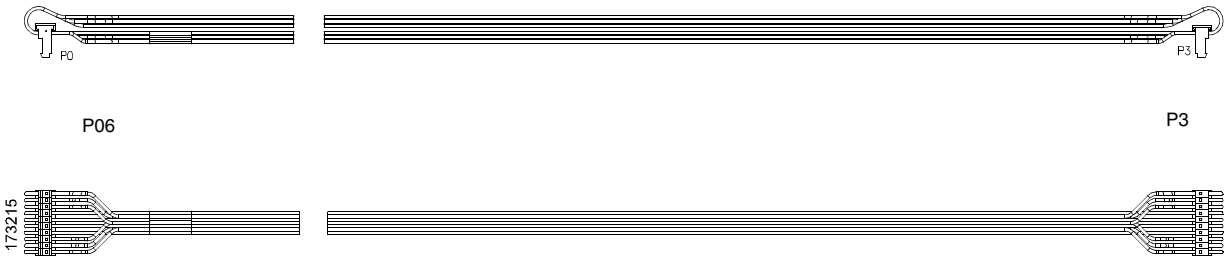


WIRE TABLE		
EHF	P307	WIRE COLOR
PIN 1	PIN 3	BLACK
PIN 2	PIN 2	GRAY
	PIN 1	N/C

Cable Assembly, Dual Hammer Bank Logic (P/N 173165-901)

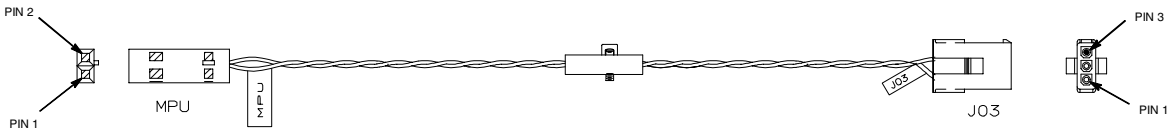


Cable Assembly, Dual Hammer Bank Power (P/N 173215-901)



Wire Table	
P06	**P3**
2	1
1	2
4	3
3	4
6	5
5	6
8	7
7	8
10	9
9	10

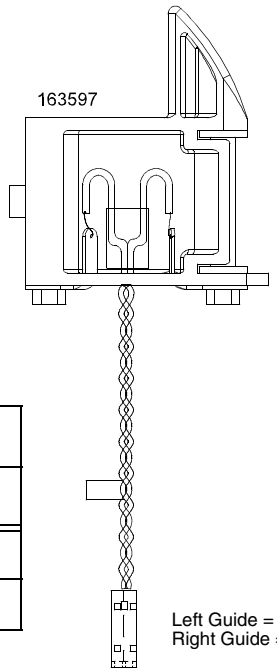
Cable Assembly, MPU (P/N 152425-901)



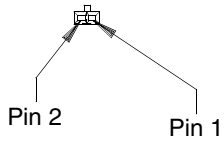
WIRE TABLE		
MPU	J03	WIRE COLOR
1	1	BLACK
2	2	GRAY
	3	N/C

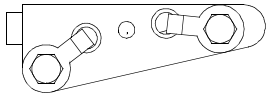
Cable Assembly, Ribbon Guide Kit (P/N 163597-901)

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

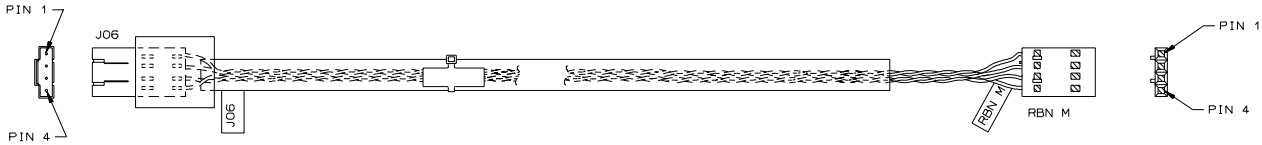


Pin Connection	
P106 (LRP) / P107 (RRP)	**Wire Color**
Pin 1	Black
Pin 2	Black



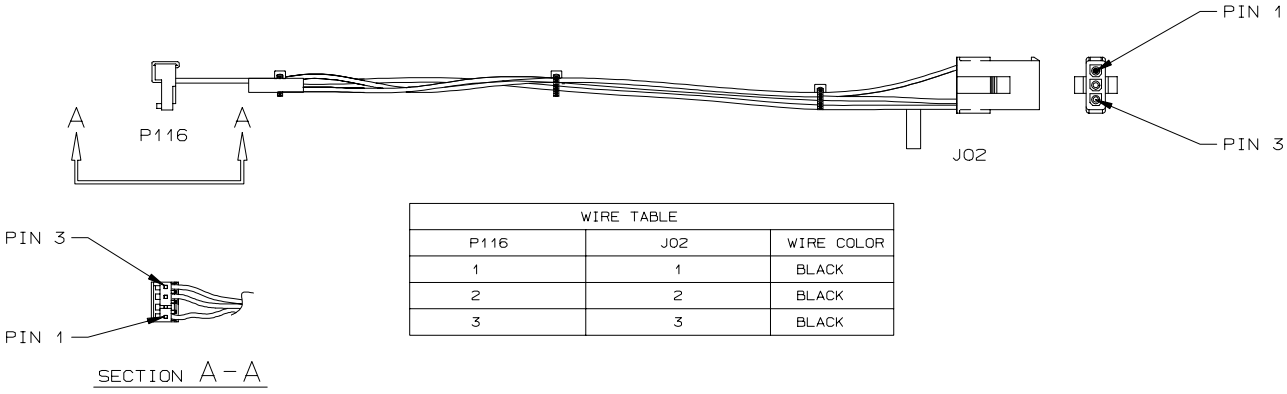


Cable Assembly, Ribbon Motor, Extension (P/N 154067-901)



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

Cable Assembly, Shuttle Motor Drive (P/N 152420-001)



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

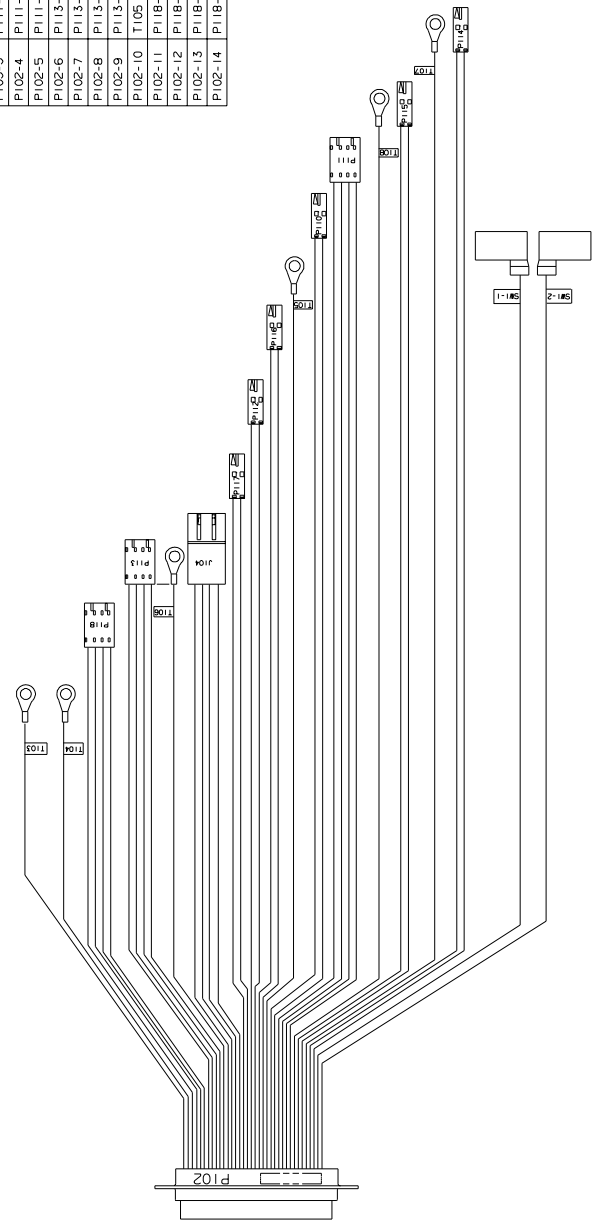
Frame Cable, Power Stacker (P/N 173824-001)

REF DES		ITEM	WIRE LG (XX±.25) (REF.)
FROM	TO	NO.	
P102-1	T104	11	6.00
P102-2	P111-1		
P103-3	P111-2	6	23.00
P102-4	P111-3		
P102-5	P111-4		
P102-6	P113-1		
P102-7	P113-2	6	11.50
P102-8	P113-3		
P102-9	P113-4		
P102-10	T105	11	21.50
P102-11	P118-2		
P102-12	P118-1	6	7.00
P102-13	P118-3		
P102-14	P118-4		

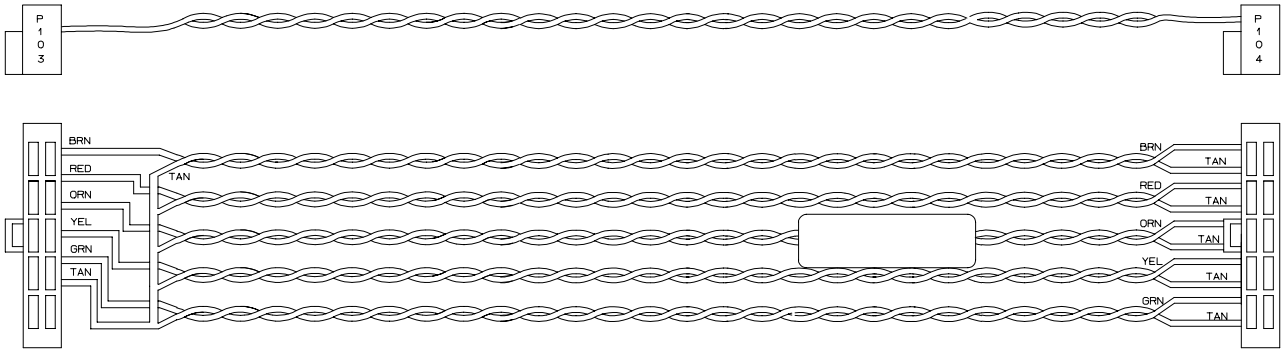
REF DES		ITEM	WIRE LG (XX±.25) (REF.)
FROM	TO	NO.	
P102-15	T106	11	11.50
P102-16	P110-2	3	22.50
P102-17	P110-1		
P102-18	P114-2	3	43.00
P102-19	P114-1		
P102-20	P112-2	3	12.50
P102-21	P112-1		
P102-22	P115-2	3	36.00
P102-23	P115-1		
P102-24	T107	11	43.00
P102-25	P117-2	3	12.00
P102-26	P117-1		
P102-27	P116-2	3	15.00
P102-28	P116-1		
P102-29	T108	11	36.00
P102-30	J104-3		
P102-31	J104-4	7	11.50
P102-32	J104-1		
P102-33	J104-2		
P102-34	T103	11	6.00
P102-35	SW1-1	9	22.00
P102-36	SW1-2		

TWIST WIRE TABLE	
TWIST GROUPS	WIRES
1	P102-2 THRU P102-5
2	P102-6 THRU P102-9
3	P102-10, P102-16, P102-17
4	P102-11 THRU P102-14
5	P102-15, P102-20, P102-21
6	P102-18, P102-19, P102-24
7	P102-22, P102-23, P102-29
8	P102-25, P102-26
9	P102-27, P102-28
10	P102-30 THRU P102-33
11	P102-35, P102-36

173824



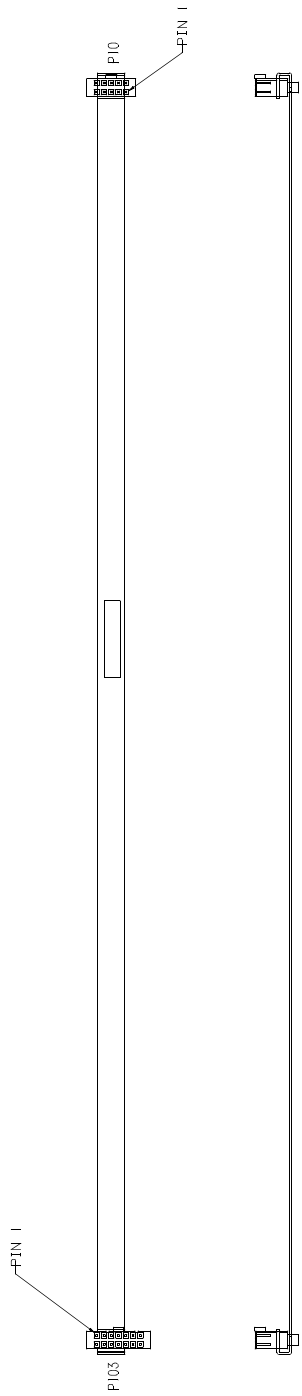
Logic Cable, Power Stacker, P5220 (P/N 158444-001)



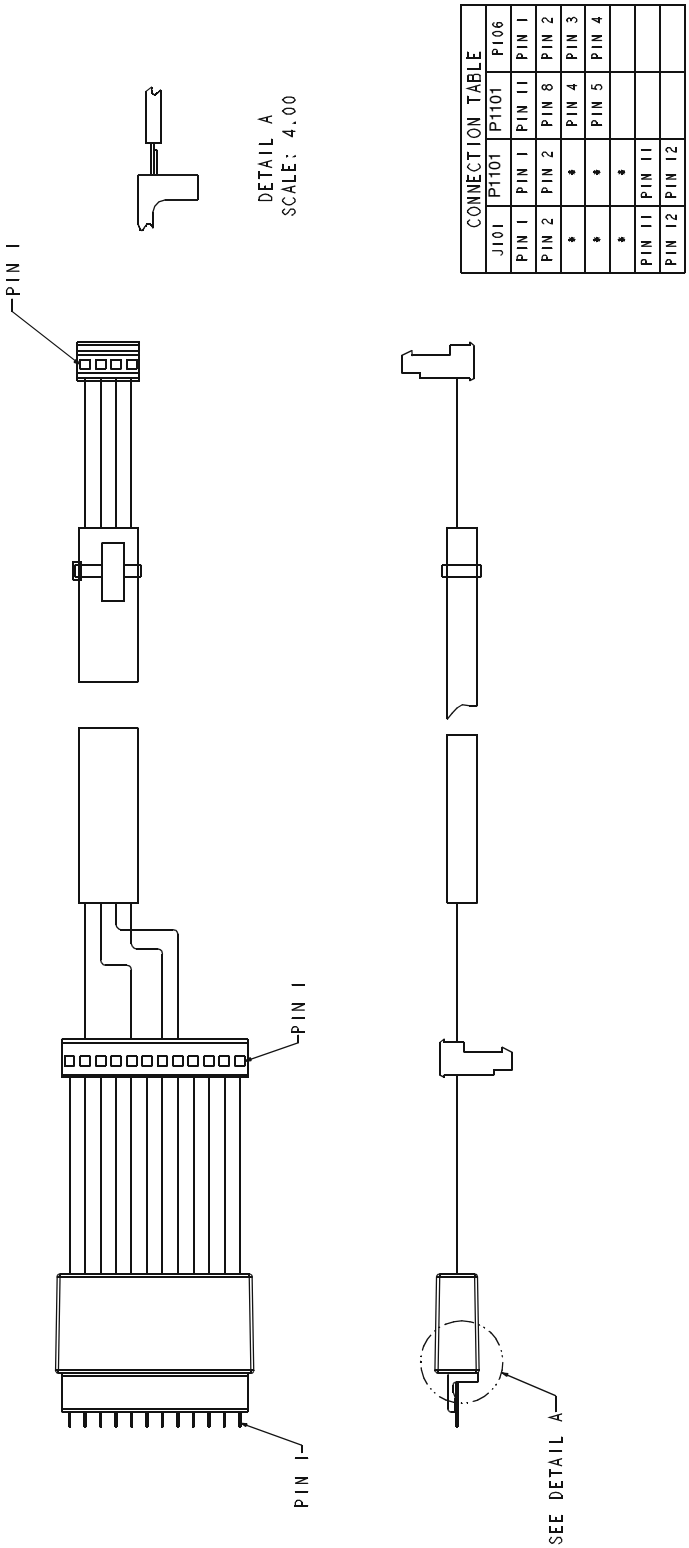
TWISTED PAIR COLOR CODING		
PAIR	LINE	COLOR
1	1	BRN
	2	TAN
2	3	RED
	4	TAN
3	5	ORN
	6	TAN
4	7	YEL
	8	TAN
5	9	GRN
	10	TAN

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

Logic Cable, Power Stacker, P5224 (P/N 176029-001)



Power Cable, Power Stacker (P/N 174414-001)



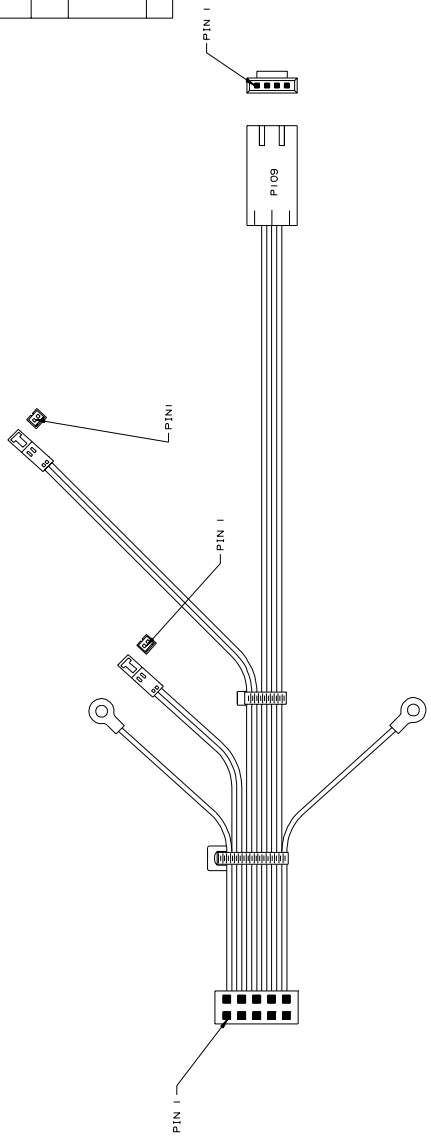
Rail Cable, Power Stacker (P/N 173823-001)

CONNECTION TABLE

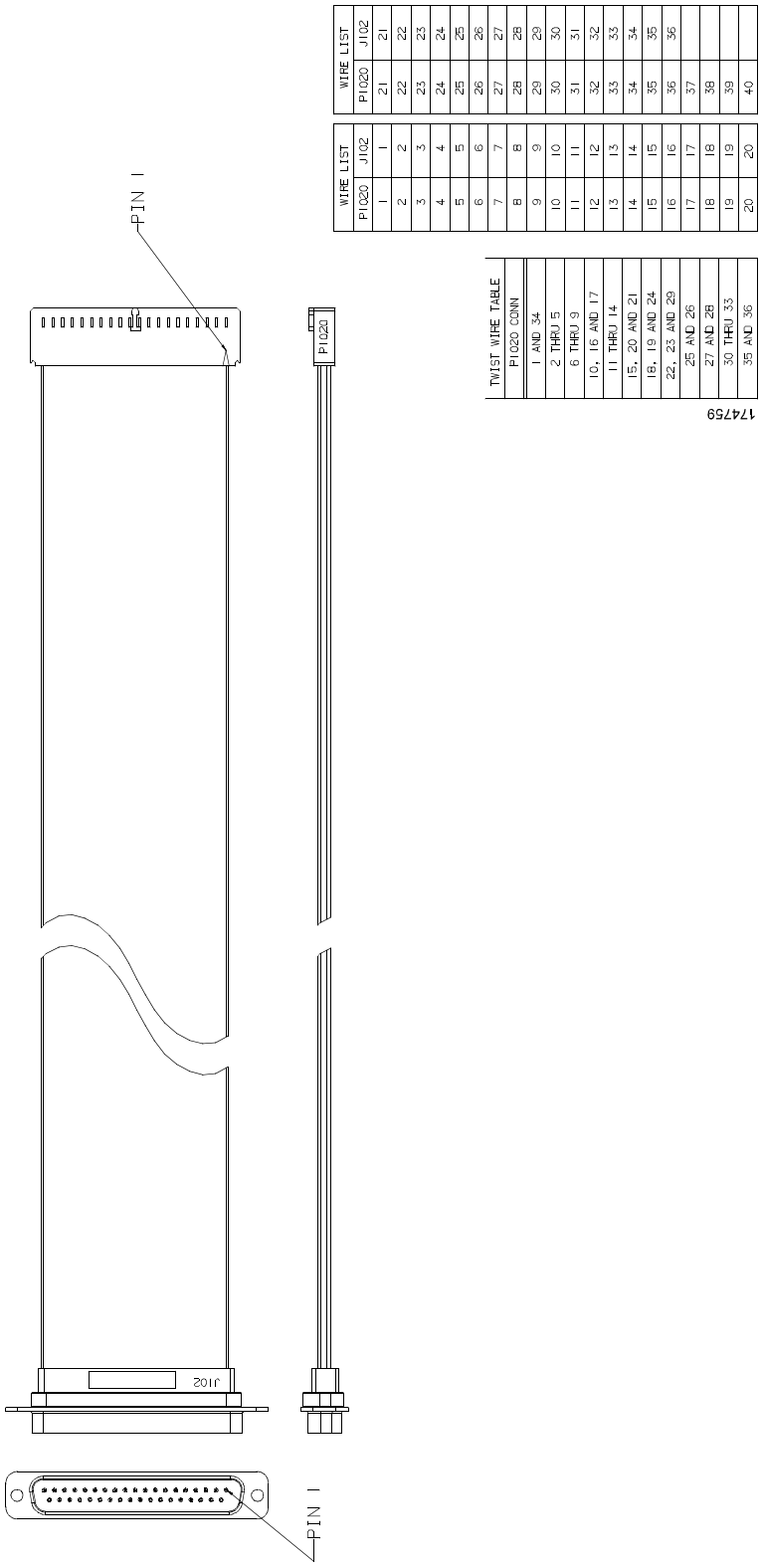
FROM	TO	COMPONENTS	WIRE LENGTH (+/- .25")
P108-1	T102	202746-001	10.00"
P108-2	J18A - PIN 1	203499-001	8.00"
P108-3	J18A - PIN 2		
P108-4	J18B - PIN 1	203499-001	19.80"
P108-5	J18B - PIN 2		
P108-6	P109 - PIN 1	202748-001	24.00"
P108-7	P109 - PIN 2		
P108-8	P109 - PIN 3	202361-001	
P108-9	P109 - PIN 4		
P108-10	T101	202746-001	10.00"

TWIST WIRE TABLE

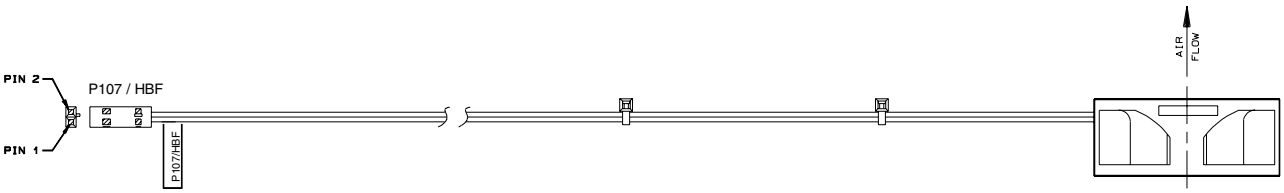
TWIST GROUP	WIRES
A	P108-1,P108-10
B	P108-2,P108-3
C	P108-4,P108-5
D	P108-6,P108-7, P108-8,P108-9,
E	P18-1,P18-2



Elevator I/O Cable, Power Stacker (P/N 174759-001)

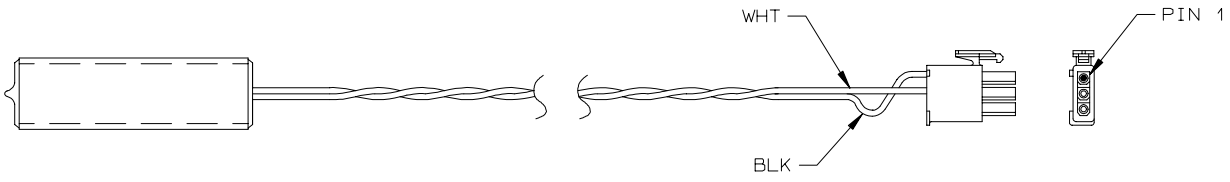


Fan Assembly, Hammer Bank (P/N 152416-901)



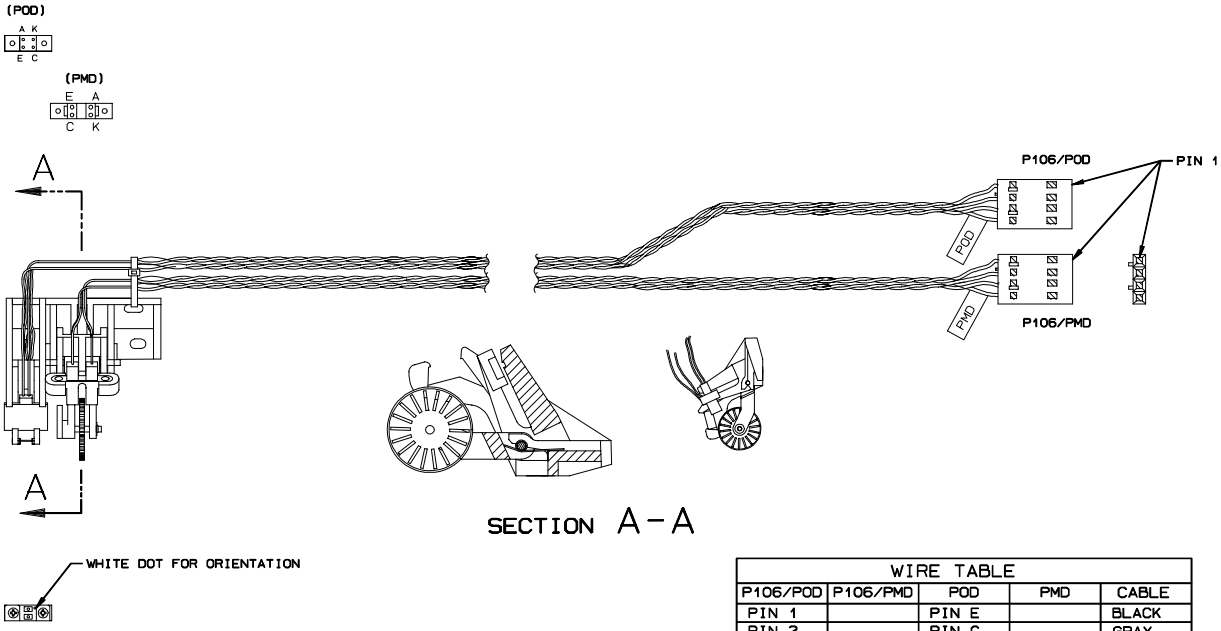
WIRE TABLE		
P107	POLARITY	HBF(J)
PIN 2	-	BLACK
PIN 1	+	RED

Magnetic Pickup (MPU) Assembly (P/N 150281-901)



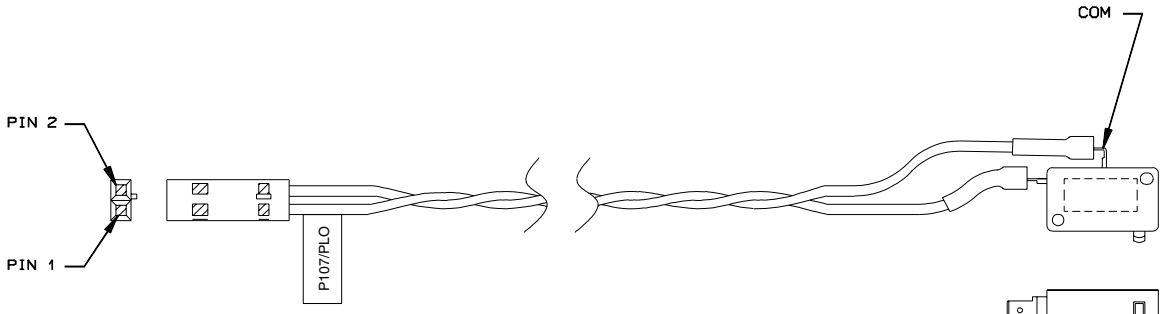
WIRE TABLE	
CONN PIN NO.	WIRE COLOR
1	BLACK
2	WHITE
3	N/C

Switch Assembly, Paper Detector (P/N 152415-901)



WIRE TABLE				
P106/POD	P106/PMD	POD	PMD	CABLE
PIN 1		PIN E		BLACK
PIN 2		PIN C		GRAY
PIN 3		PIN K		WHITE
PIN 4		PIN A		RED
	PIN 1		PIN A	BLACK
	PIN 2		PIN K	BROWN
	PIN 3		PIN C	ORANGE
	PIN 4		PIN E	RED

Switch Assembly, Platen Interlock (P/N 152417-901)



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

B *Abbreviations And Signal Mnemonics*

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

Abbreviation or Mnemonic	**Definition**
KΩ	1,000 (10^3) Ohms
MegΩ	1,000,000 (10^6) Ohms
µF	microfarad (10^{-6} farad)
µs	microsecond (10^{-6} second)
µsec	microsecond (10^{-6} second)
A0, A1, etc.	Address 0, Address 1, etc.
AC	Alternating Current
ACC	Access
ACK	Acknowledge
AMP	Amplitude; Ampere
AMPL	Amplitude
AN	Anode
ASIC	Application-Specific Integrated Circuit
ATTN	Attention
B	Buffered
BANK FAN	Hammer Bank Fan
BCOM	Buffered Communication
BCP	Bi-phase Communications Processor
BHSC	Buffered Hammer Shift Clock
BN	Buffered, Low True
BNLD	Buffered, Low True, Lower Driver
BPS	Bits Per Second
BSY	Busy

BTU	British Thermal Unit
BUD	Buffered Upper Driver
CA	Cathode
CC	Card Cage
CCF	Card Cage Fan
CD	Compact Disk
CE	Customer Engineer
CFX	Manufacturer's designation for the controller board used in the P5220 printer. The letters do not stand for anything; they simply identify this controller board.
CHNG	Change
CIR	Circuit
CLK	Clock
CO	Cover Open
Coax	Coaxial
COLL	Collector
COMM	Communication
CONTLR	Controller
CMD	Command
CNC	Connector, Connection
CPI	Characters Per Inch
CR	Carriage Return
CT	Coaxial/Twinaxial
CTL	Control
CTS	Clear to Send
CU	Control Unit
CUR	Current
D0, D1, etc.	Data Bit 0, Data Bit 1, etc.
DAT	Data
DC	Direct Current, Data Controller (a functional unit of the controller board)
DCD	Data Carrier Detect
DHBL	Dual Hammer Bank Logic, Signals
DHIO	Dual Hammer Bank Input/Output
DIAG	Diagnostic
DIFF	Differential

DIMM	Dual Inline Memory Module
DIP	Dual Inline Package
DMA	Direct Memory Access
DP	Data Processing, Dataproducts
DPEN	Dataproducts Enable
DPMC	Dot Plucker Memory Controller
DPU	Data Processing Unit
DRAM	Dynamic Random-Access Memory
DRV	Drive or Driver
DRVR	Driver
DSR	Data Set Ready
DTR	Data Terminal Ready
EC	Engine Controller (a functional unit of the controller board)
EEPROM	Electrically Erasable/Programmable Read-Only Memory
EHF	Exhaust Fan
EL	Elevator (stacker)
EMI	ElectroMagnetic Interference
EMIT	Emitter
EPROM	Electrically Programmable Read-Only Memory
ERR	Error
ESD	Electrostatic Discharge
EX	Exhaust, Extra
EXH	Exhaust
EXF	Exhaust Fan
EXP	Expansion
EXPND	Expand
FD	Feed
FF	Form Feed
FIFO	First In, First Out
FLT	Fault
FLTR	Filter
FP	Front Panel (Control Panel)
FTIC	Fire Timer Integrated Circuit

GND	Ground
HB	Hammer Bank
HBA	Hammer Bank ASIC
HBF	Hammer Bank Fan
HBL	Hammer Bank, Left
HBP	Hammer Bank Power Phase Driver
HBR	Hammer Bank, Right
HD	Hammer Driver
HDIC	Hammer Driver Integrated Circuit
HDPH	Hammer Driver Phase
HLP	Hammer Bank Logic, Signals, and Power
IC	Integrated Circuit
ID	Identification
IGP	Intelligent Graphics Printing
INST	Instruction
INT	Interrupt
I/O	Input/Output
IRQ	Interrupt Request
(J)	Jack connector
L	Left
LAN	Local Area Network
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LF	Line Feed
LH	Left Hand
LO	Low
LPI	Lines Per Inch
LPM	Lines Per Minute
LRIB	Left Ribbon
LRP	Left Ribbon Guide
M	Motor
MAIN	Maintenance Jack, RS-232 (Optional)

MECA	Mechanism Engine Control ASIC
MECH	Mechanism
MF	microfarad (10^{-6} farad)
MH	Mounting Hole, Main Harness
MOSFET	Metal Oxide Semiconductor Field Effect Transistor
MOT	Motor
MPU	Magnetic Pick-Up (Unit)
ms	millisecond (10^{-3} second)
MSL	Motor and Sensors, Left
MSR	Motor and Sensors, Right
N	Negative True
N/C	Not Connected
NC	Not Connected
NIC	(Ethernet) Network Interface Card
NLQ	Near Letter Quality
No.	Number
NOVRAM	Nonvolatile Random-Access Memory
ns	nanosecond (10^{-9} second)
NT	Not
NVRAM	Nonvolatile Random-Access Memory
OLV	On Line Verify
OP	Operand
P5	+ 5 V dc
(P)	Pin connector
P(1), P(2), etc.	Parallel data 1, data 2, etc.
PAL	Programmable Array Logic
PAP	Paper
PAPR	Paper
PARM	Parameter
PCBA	Printed Circuit Board Assembly
PCB	Printed Circuit Board
PCI	Peripheral Component Interconnect
PD	Paper Detect(or)
PDL	Phase Driver Logic

PE	Printer Error, Paper Empty
PER	Peripheral Device
PF	Paper Feed, picofarad (10^{-12} farad)
PFM	Paper Feed Motor
PHA	Phase A
PHB	Phase B
PI	Paper Instruction
PLAT	Platen
PLM	Platen Motor
PLO	Platen Open (Switch)
PMD	Paper Motion Detect
PN	Pin or Plug
P/N	Part Number
PO	Paper Out
POD	Paper Out Detect (Switch)
PPR	Paper
PROM	Programmable Read-Only Memory
PS	Power Supply
PS5	Power Supply + 5 Volt
PSA	Printronix System Architecture
PSA3	Printronix System Architecture, third generation. Also the manufacturer's designation of the controller board used in the P5224 printer.
PTR	Pointer, Printer, Printronix
PWM	Pulse Width Modulation
PWR	Power
R	Right
RBN	Ribbon
RD	Read
RET	Return
RIB	Ribbon
RG	Ribbon Guide
RGL	Ribbon Guide, Left
RGR	Ribbon Guide, Right
RH	Right Hand
RM	Ribbon Motor
RML	Ribbon Motor, Left

RMR	Ribbon Motor, Right
RQ	Request
RRIB	Right Ribbon
RRP	Right Ribbon Guide
RSP	Ribbon and Shuttle Processor
RST	Reset
RTS	Request to Send
RXD	Receive Data
SCS	SNA Character Stream
SEC	Security (Key)
SEL	Select
SEN	Sense, Sensor
SF	Structured Field
SG	Signal Ground
SHH	Shuttle Hall (Effect)
SHM	Shuttle Motor
SHUT	Shuttle
SHUTL	Shuttle
SIMM	Single Inline Memory Module
SLCT	Select (On-line)
Slew	Rapid vertical paper movement
SMD	Shuttle Motor Drive
SNA	Systems Network Architecture
SPU	Shuttle Processor Unit
SRAM	Static Random-Access Memory
STAT	Status or State
STBY	Standby
STK	Stacker
SW	Switch
SYNC	Synchronize
TCB	Task Control Block
TEMP	Temperature
TOF	Top Of Form (first print line)
TP	Test Point
TTL	Transistor-to-Transistor Logic

Twinax	Twinaxial
TXD	Transmit Data
UART	Universal Asynchronous Receiver/Transmitter
UDPH	Upper Drive Phase
UNDEF	Undefined
USART	Universal Synchronous/Asynchronous Receiver/ Transmitter
V	Volts
V_{CC}	Voltage at Collector
V_{DD}	Voltage at Drain
V_{SS}	Voltage at Source
VX	A special ASIC on the CFX controller board containing circuits that help the DC controller operate. The initials VX do not signify words; they serve only to identify this ASIC.
WAN	Wide Area Network
WR	Write
w/	With
w/o	Without
XMT	Transmit

C Metric Conversion Tables

Length

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

* Figure is exact.

Torque and Force

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

Mass and Density

Multiply	By	To Obtain
pound*	0.4535924	kilogram (kg)
ounce*	28.34952	gram (g)
kilogram	2.204622	pound*
gram	0.03527393	ounce*

* avoirdupois

Temperature

To Convert	To	Use Formula
temperature Celsius (t_c)	temperature Fahreheit (t_f)	$t_f = 1.8\ t_c + 32$
temperature Fahreheit (t_f)	temperature Celsius (t_c)	$t_c = (t_f - 32) / 1.8$

Power

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

D *Noise Suppression Devices*

Ferrite noise suppressors are installed in the printer to reduce radio frequency interference (RFI) to and from electronic equipment located near the printer.

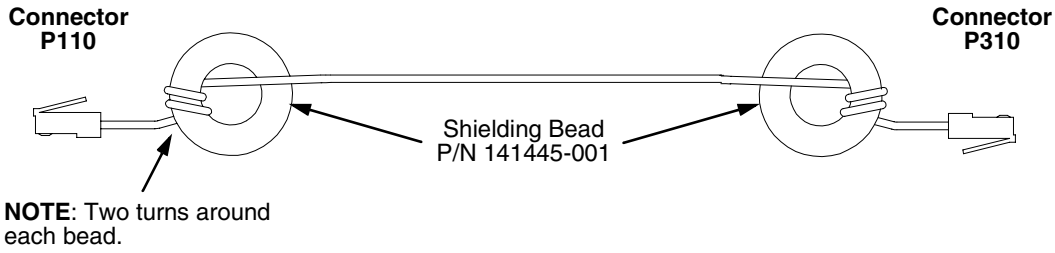
Two kinds of ferrite noise suppressors are used:

1. Shielding Bead (P/N 141445-001) is a cylindrical core, through and around which the control panel cable assembly is wound. Two are required.
2. Ferrite Clamp (P/N 202049-001) is a noise suppression core in a hinged plastic case and attached to the wall of the card cage with adhesive. The parallel I/O cable assembly passes through this core.

Figure 64 shows how these devices are installed.

IMPORTANT **Duplicate the number of turns around the shielding beads when installing or replacing the control panel cable. See Figure 64.**

Control Panel Cable Assembly



Parallel I/O Cable Assembly

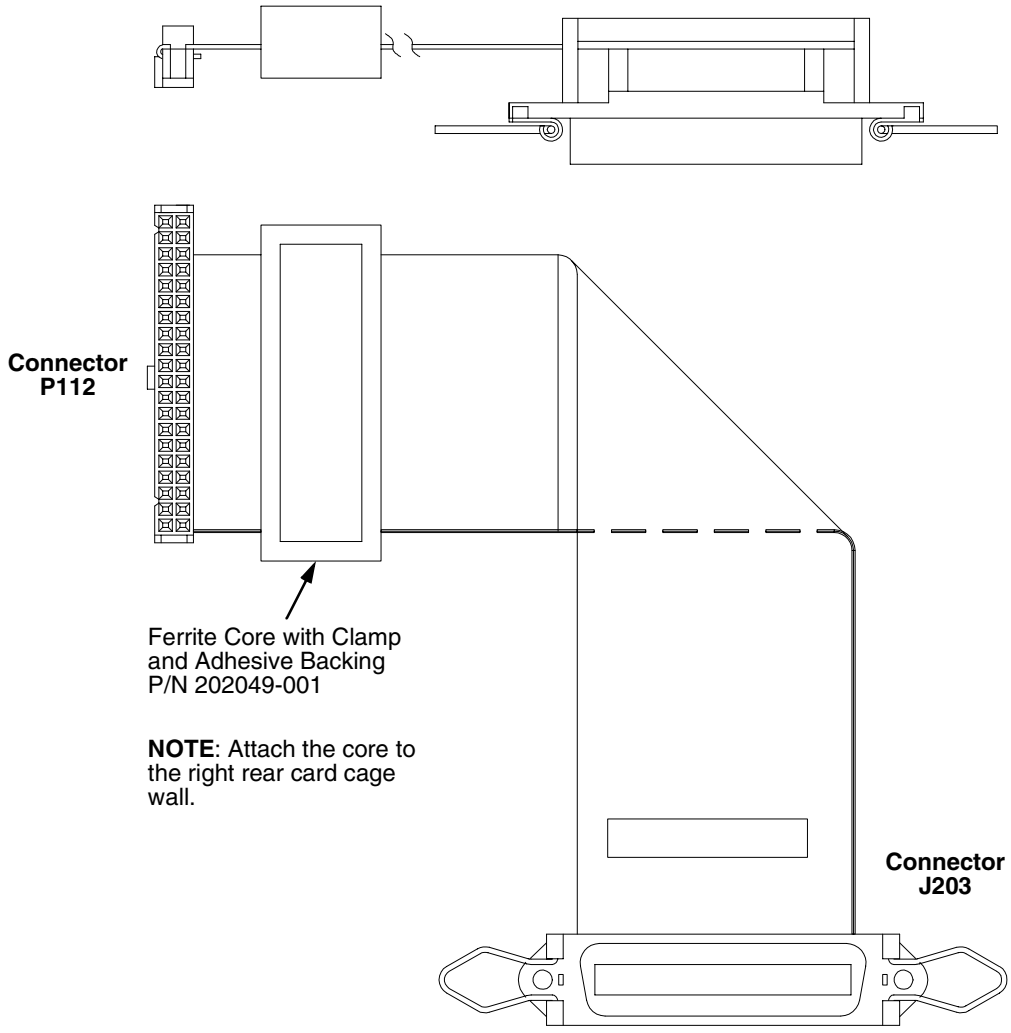


Figure 64. Ferrite Core Installation

E *SureStak™ Power Stacker*

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- Loading And Starting The Power Stacker ..... page 374
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Introduction

The SureStak Power Stacker is a factory-installed option that augments the paper feed system of cabinet model printers. It is designed to work with forms 5 to 12 inches long (12.7 to 30.5 cm) and up to 16 inches (41 cm) wide without the paper tent or 15.5 inches (39.5 cm) wide with the paper tent installed. (The paper tent is shown in Figure 65.) Using longer or shorter paper can cause error messages and unpredictable operation of the stacker.

Because most of the stacker assembly is inside the cabinet, you must remove the stacker assembly from the printer to service it or replace most of its components.

This appendix has three parts:

- An overview of stacker operation.
- Removal/installation instructions for the entire power stacker assembly and components that require the most frequent replacement.
- An illustrated parts breakdown (IPB) showing how the power stacker is assembled and listing the part numbers for replaceable parts.

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

Stacker Operation

The power stacker mechanically directs the paper from the printer to the paper stack. It is mounted in the rear of the cabinet and has its own control panel. Its main components are shown in Figure 65.

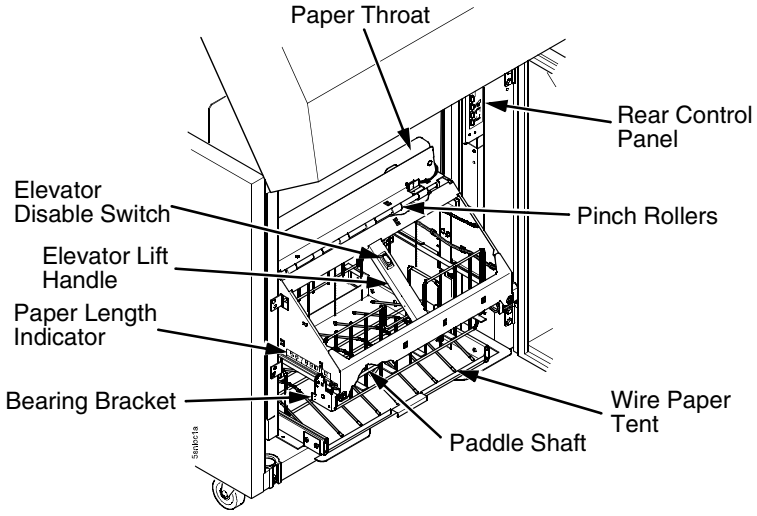


Figure 65. Power Stacker Component Locations

Setting Up The Power Stacker

1. Set the printer power switch to | (On).
2. Using the rear control panel, press the ON LINE key to take the printer offline. (Figure 66.)
3. Press the elevator disable switch, grasp the elevator lift handle, and raise the elevator to the top of its travel. (Figure 66.)

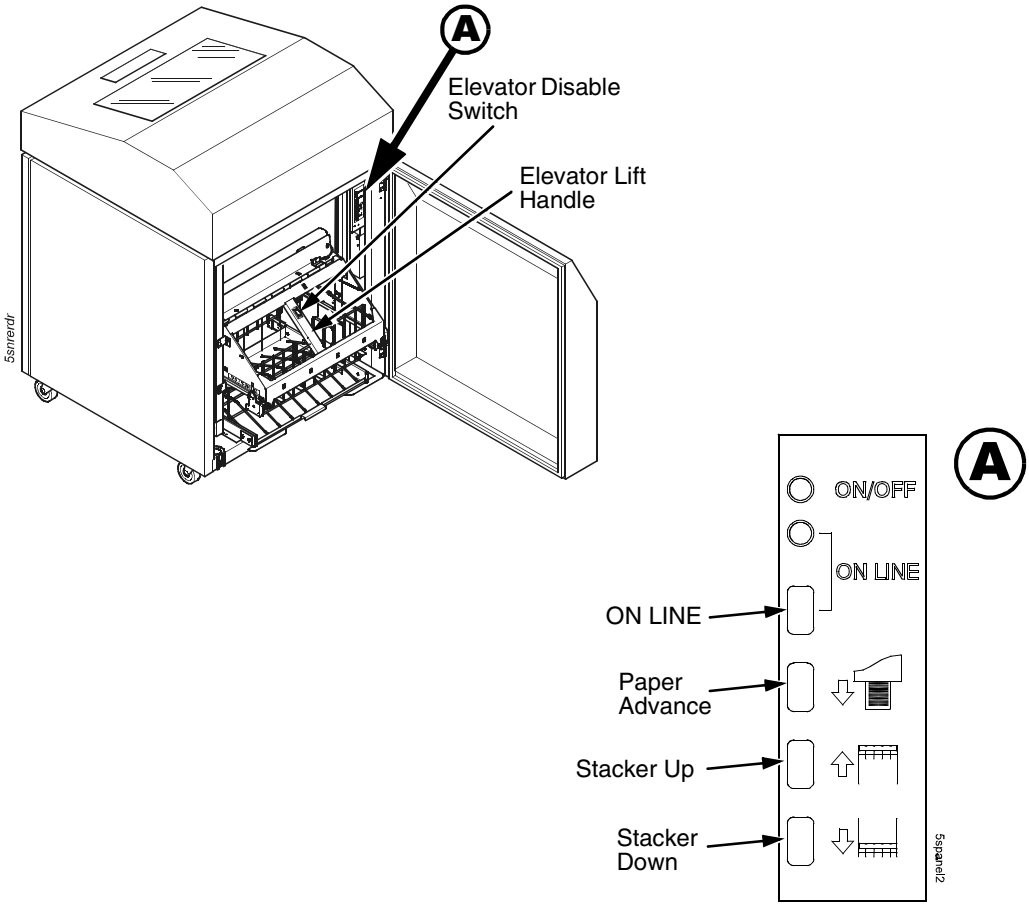


Figure 66. The Rear Control Panel

4. If the paper you will use is no wider than 15.5 inches (39.5 cm) install the wire paper tent in the pull out paper tray in the base of the stacker. If the paper is wider than 15.5 inches (39.5 cm) leave the paper tent out of the printer. (Figure 67.)

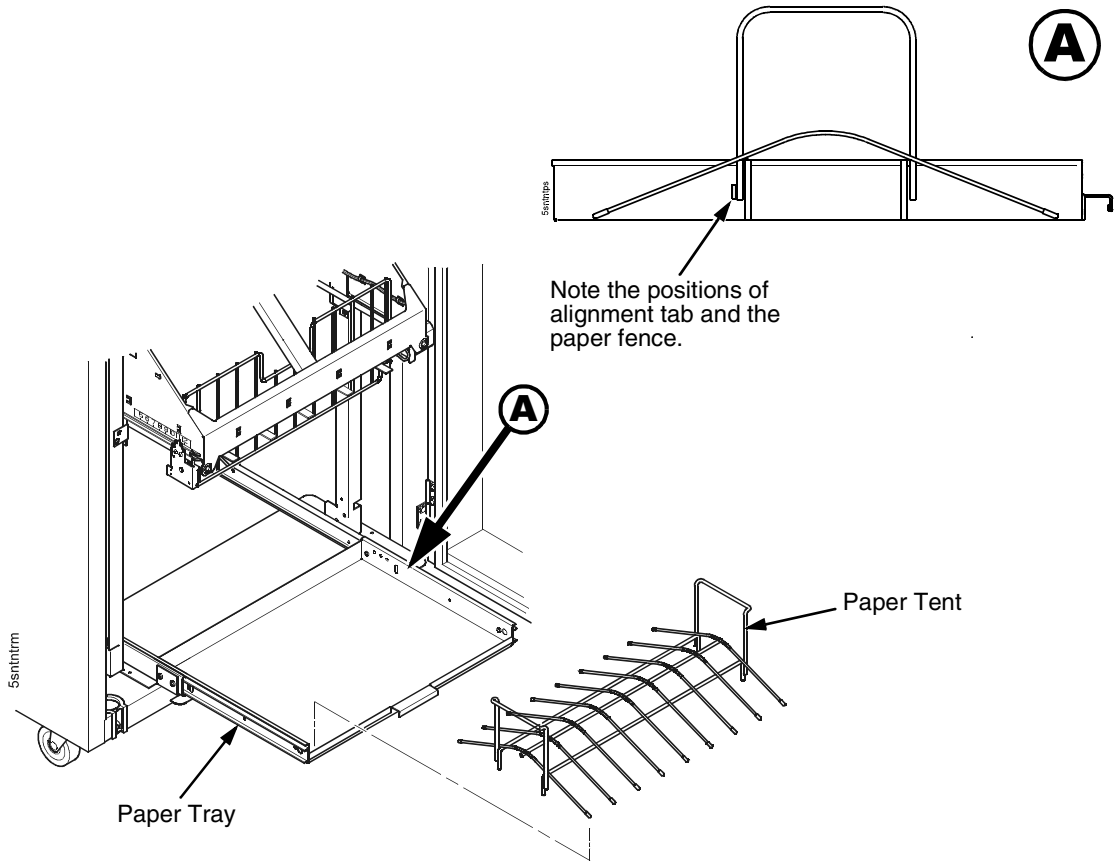


Figure 67. The Paper Tent

5. Push or pull the paddle shaft towards the front or the rear of the printer to set the desired paper length. Align the indicator notch on the bearing bracket with the paper length indicator. The power stacker can handle paper or forms from five to 12 inches long. (Figure 68.)

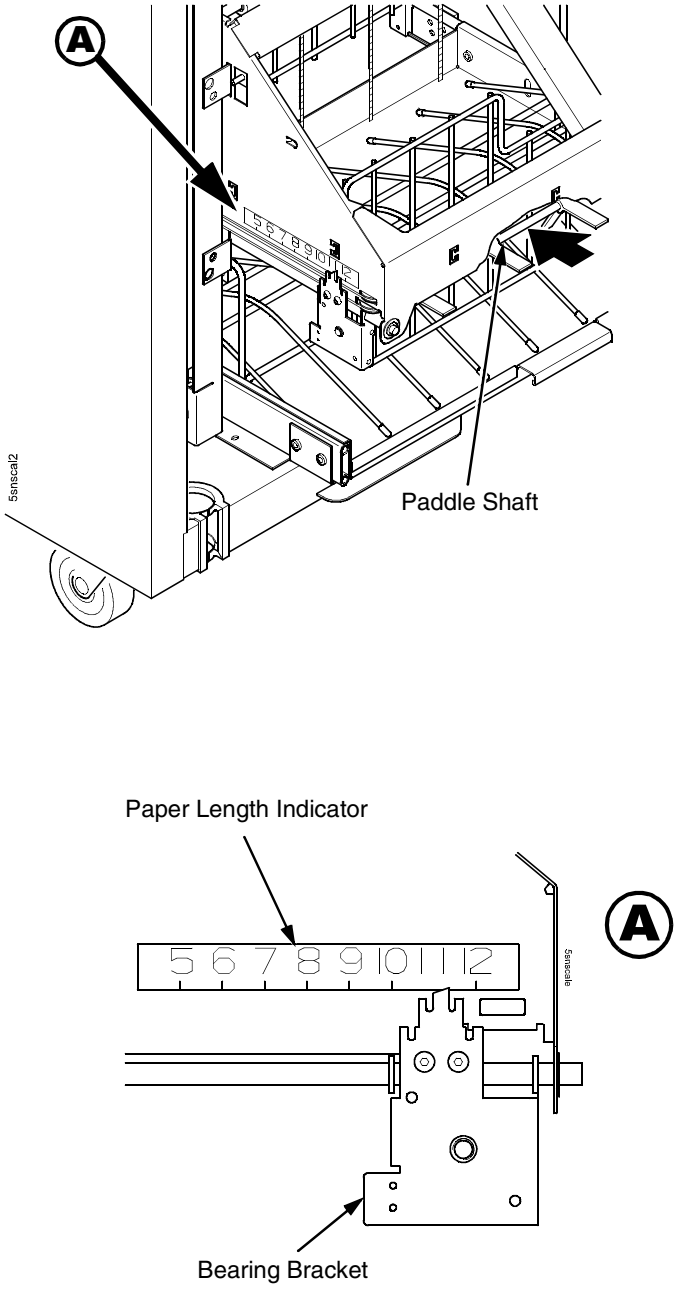


Figure 68. Setting the Paper Length

Loading And Starting The Power Paper Stacker

1. Press the PAPER ADVANCE key and hand feed the paper into the paper throat. Continue to advance the paper until it reaches the wire tent and feed three to five extra sheets in the stacker. Make sure the paper passes through the paper stacker throat. (Figure 69.)
2. Stack the extra pages on top of the wire paper tent, making sure the paper bends with the natural fold. (Figure 69.)
3. Press the ON LINE key on the (front or rear) control panel, to put the printer in the online state. The stacker elevator will return to its proper position for printing.
4. Check that the paper is still centered between the sides of the wire paper tent.
5. Close the cabinet rear door.
6. If necessary, set Top Of Form. (Refer to the *User's Manual*.)

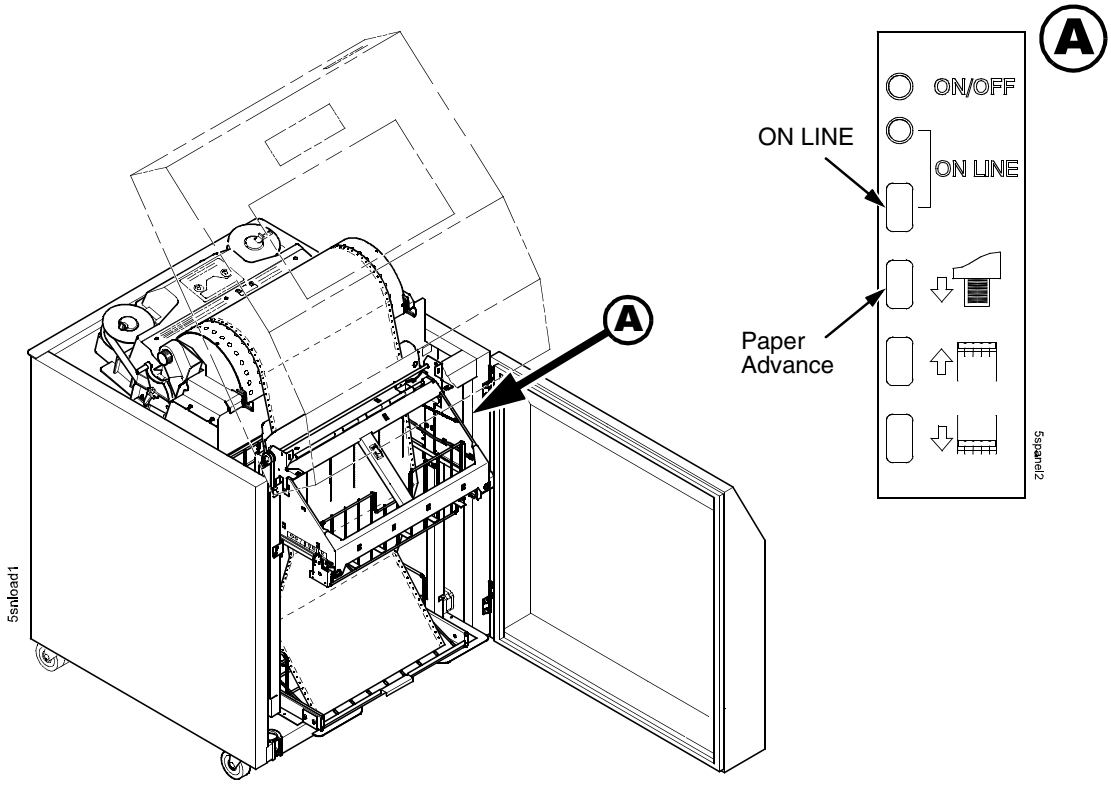


Figure 69. Stacking Paper on the Wire Paper Tent

Stacker Problems

The power stacker augments the paper feed system of the printer. The most frequently occurring problems in the paper feed system are paper jams. Because of the electromechanical nature of the system, other problems that can occur are worn or poor electrical connections and cabling, worn or defective feed motors, worn or damaged mechanical components, or incorrect installation of the stacker assembly. Table 10 shows some of the problems that can occur with the power stacker and the page where you can find the troubleshooting procedure.

Table 10. Power Stacker Problems

Symptom	Origin of Symptom	Explanation	Solution
Printer does not detect presence of power stacker	Reported by customer.	Various causes possible.	page 99
STACKER FAULT	Message on control panel LCD.	This message is triggered when the elevator cannot reach the top or bottom limit switch before timing out.	page 84
STACKER FULL	Message on control panel LCD.	Status message: the power paper stacker is full.	page 85
STACKER JAM	Message on control panel LCD.	Paper is bunching above the elevator or the paper motion detector is not working properly.	page 86
Stacker “chatters” at upper or lower limit	Reported by customer.	Various causes possible.	page 100
Stacker does not stack properly	Reported by customer.	Various causes possible.	page 101
Stacker elevator does not move	Reported by customer.	Various causes possible.	page 101
Stacker elevator moves by itself	Reported by customer.	Various causes possible.	page 101
Stacker limit switch check	Other troubleshooting procedures.	A procedure that tests the motion limit switches at the top and bottom of the vertical rails. You will usually be referred to this procedure from other troubleshooting procedures. When you have completed this procedure, return to the procedure that sent you there.	page 102

Table 10. Power Stacker Problems

Symptom	Origin of Symptom	Explanation	Solution
Stacker motor check	Other troubleshooting procedures.	A procedure that tests the four stacker motors and their cables. You will usually be referred to this procedure from other troubleshooting procedures. When you have completed the procedure, return to the procedure that sent you there.	page 103
Stacker not operating	Reported by customer.	Same symptom as “Printer does not detect presence of power stacker”	page 99

Removing The Power Stacker

1. Set the printer power switch to O (off).
2. Unplug the power cord.
3. Unload paper from the stacker area. (Refer to the *User's Guide.)*
4. Remove the paper tent. (Figure 70.)

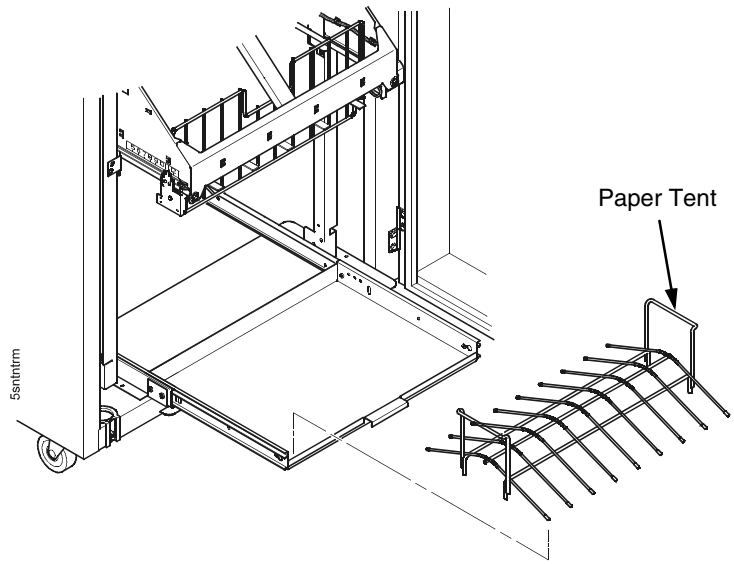


Figure 70. Removing the Paper Tent

5. Cut the tie wrap (if present) and remove the paper fence. (Figure 71.)

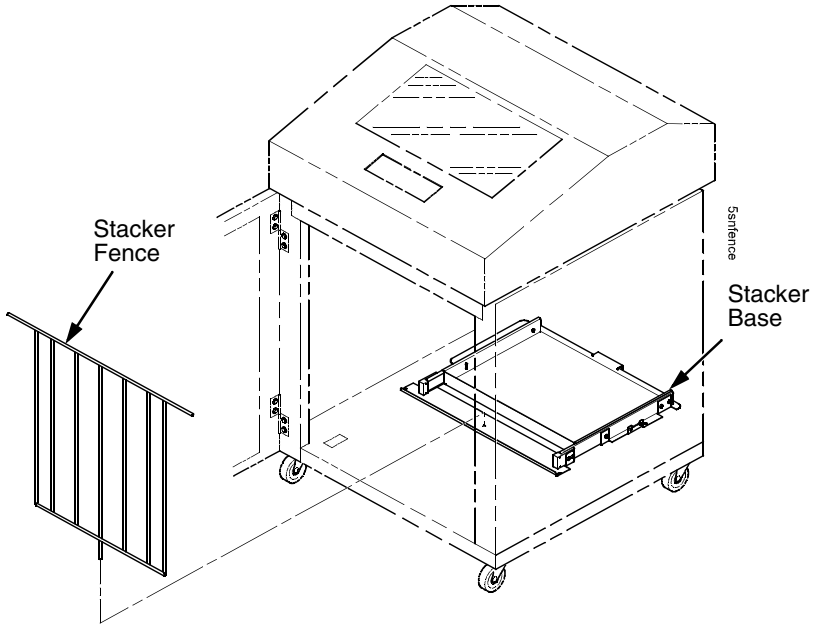


Figure 71. Removing the Paper Fence

6. Remove the two 10-32 x 5/32 inch buttonhead screws and washers securing the vertical rails to the upper frame cross-member at the rear of the cabinet. (Figure 72.)
7. Remove the two Torx T-10 screws securing the stacker base to the cabinet floor. (Figure 72.)
8. Remove the two Torx T-10 screws that secure the rail bracket to the cabinet floor. (Figure 72.)

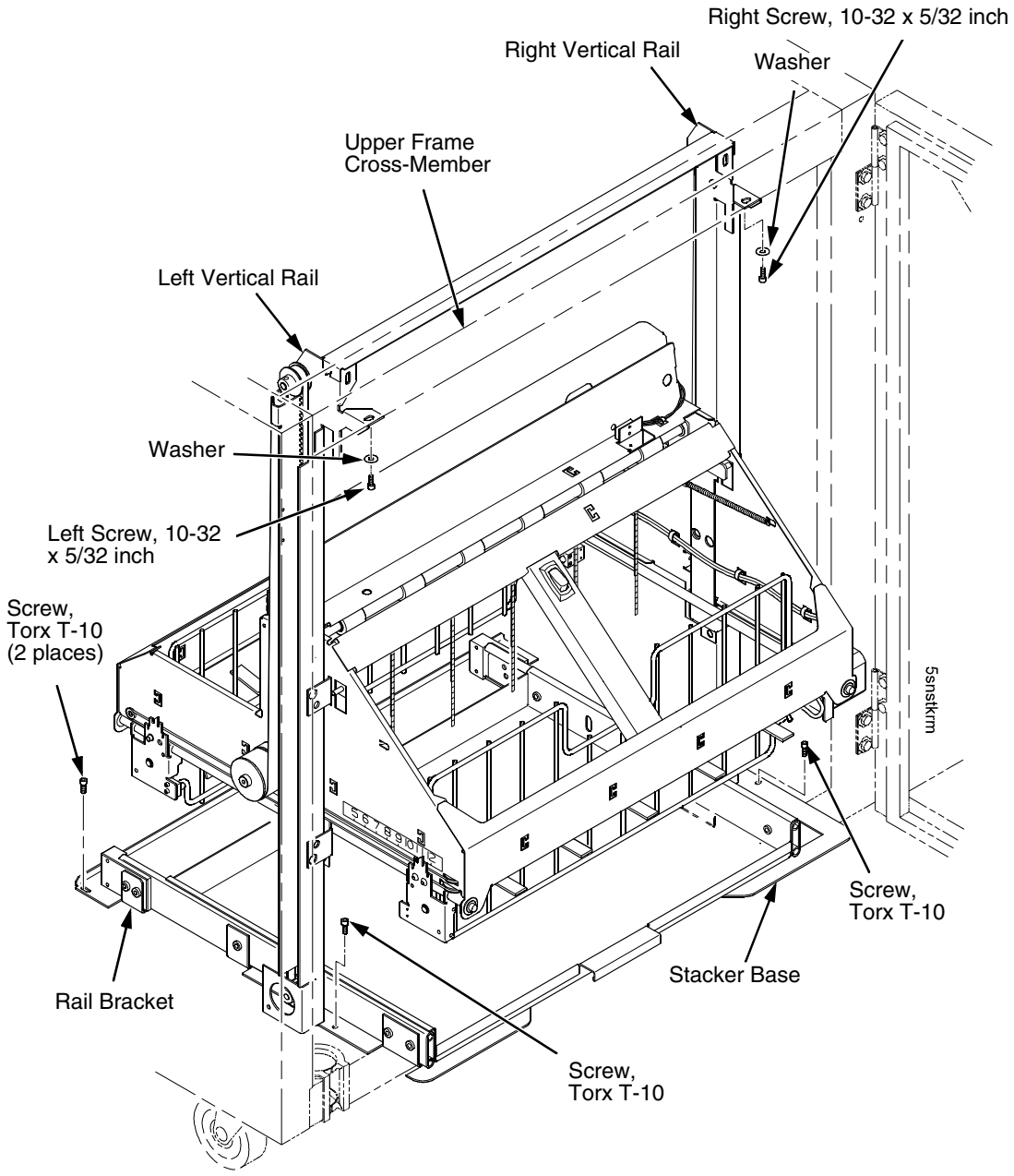


Figure 72. Preparing the Stacker for Removal

9. Pull the paper tray out until the holes in the rails permit access to the M3 buttonhead screws. (Figure 73.)
10. Loosen one turn—do not remove—the M3x6 screws securing the vertical rails to the stacker base. Each rail is secured by two screws. (Figure 73.)

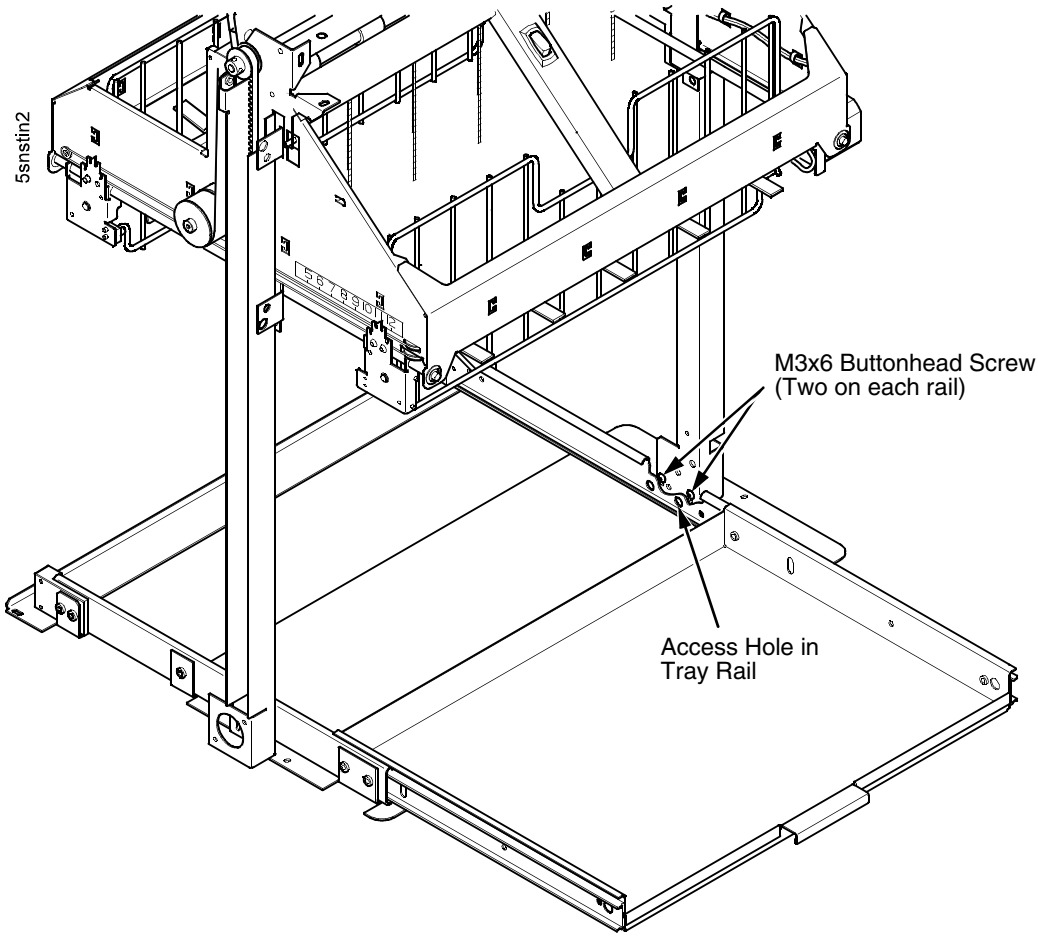


Figure 73. The Lower Screws in the Vertical Rails

11. Lower the elevator assembly to its lowest position.
12. Remove the two 4-40 x 1/4 inch screws securing the elevator I/O cable to the elevator assembly and disconnect the stacker I/O cable. (Figure 74.)

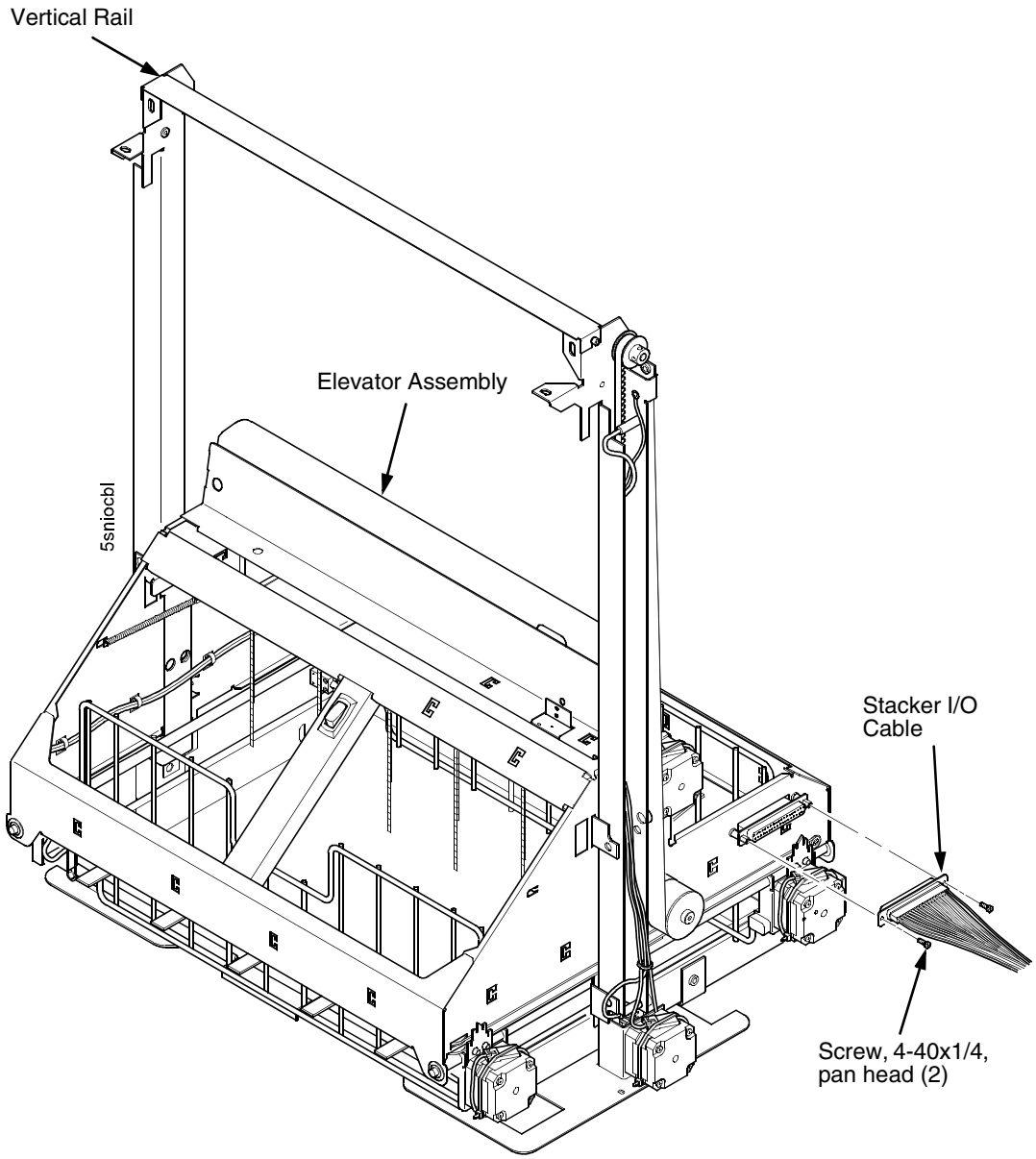


Figure 74. Disconnecting the Stacker I/O Cable

13. Remove two screws, washers, and the standoff from the stacker control panel. (Figure 75.)

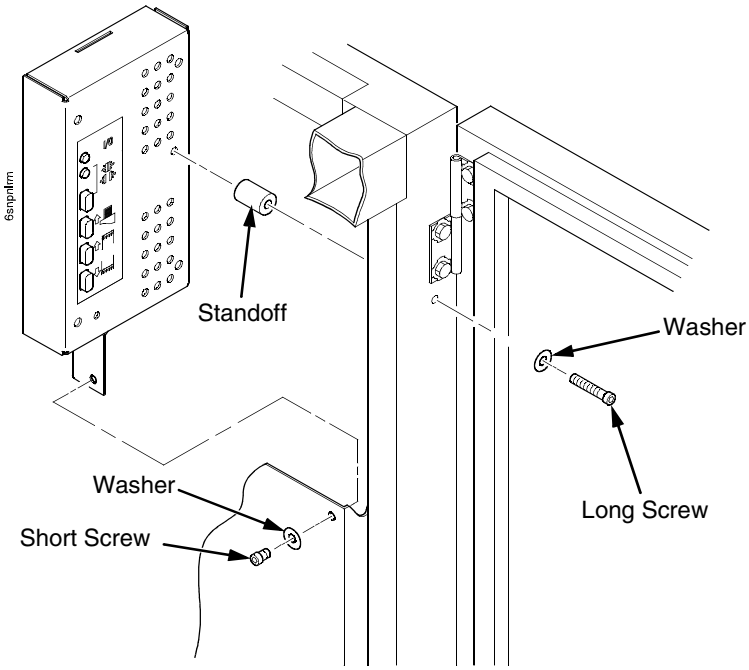


Figure 75. Removing the Stacker Control Panel

14. Remove four cables from the stacker control panel, and remove the stacker control panel. (Figure 76.)

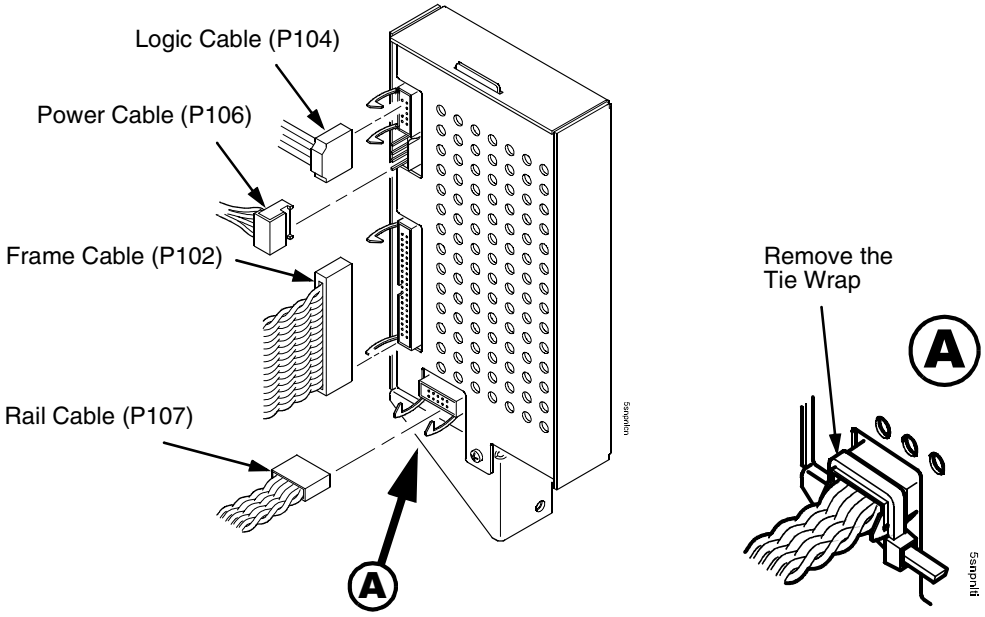


Figure 76. Removing Cables from the Stacker Control Panel

15. Slide the entire stacker assembly slightly to the right to clear the air exhaust duct. Tilt the vertical rails toward the front of the printer until they clear the upper frame cross-member. Lift and slide the stacker assembly to the rear and angle it out of the cabinet, as shown in Figure 77.

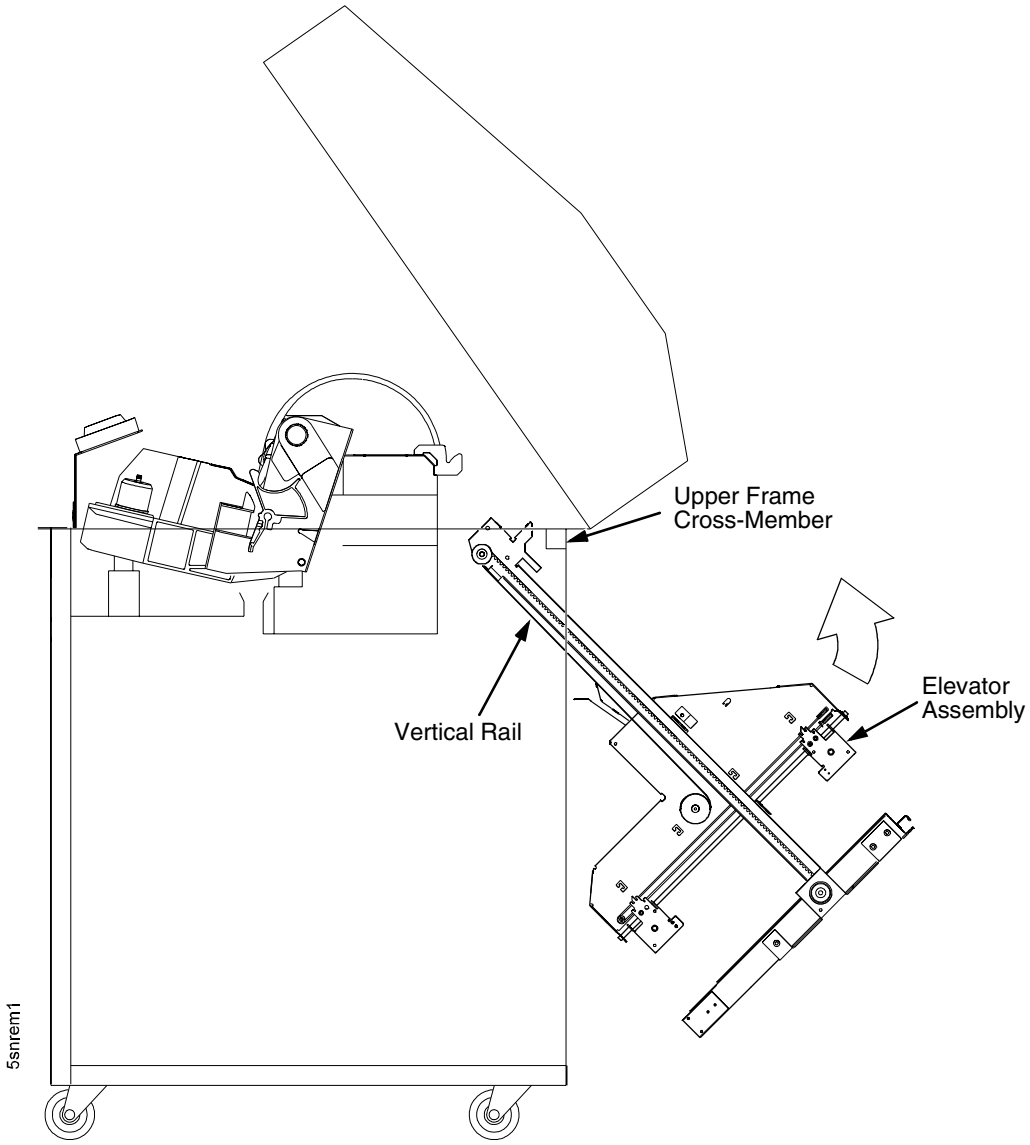


Figure 77. Removing the Stacker Assembly

Installing The Power Stacker

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

1. Set the printer power switch to O (off).
2. Unplug the power cord.

NOTE: Cables for this stacker differ in length and are routed differently than in earlier stackers. If older cables are still in place, remove them and install the cables that come with the new stacker.

The routing of the stacker cables from the card cage differs in printers with a CFX (P5220) or PSA3 (P5224) controller board. In the following steps, match the cable routing to the type of controller board shown.

3. Remove paper.
4. Loosen—do not remove—the three paper path hold-down screws. Slide the paper path to the left and lift it off the card cage. (Figure 78.)

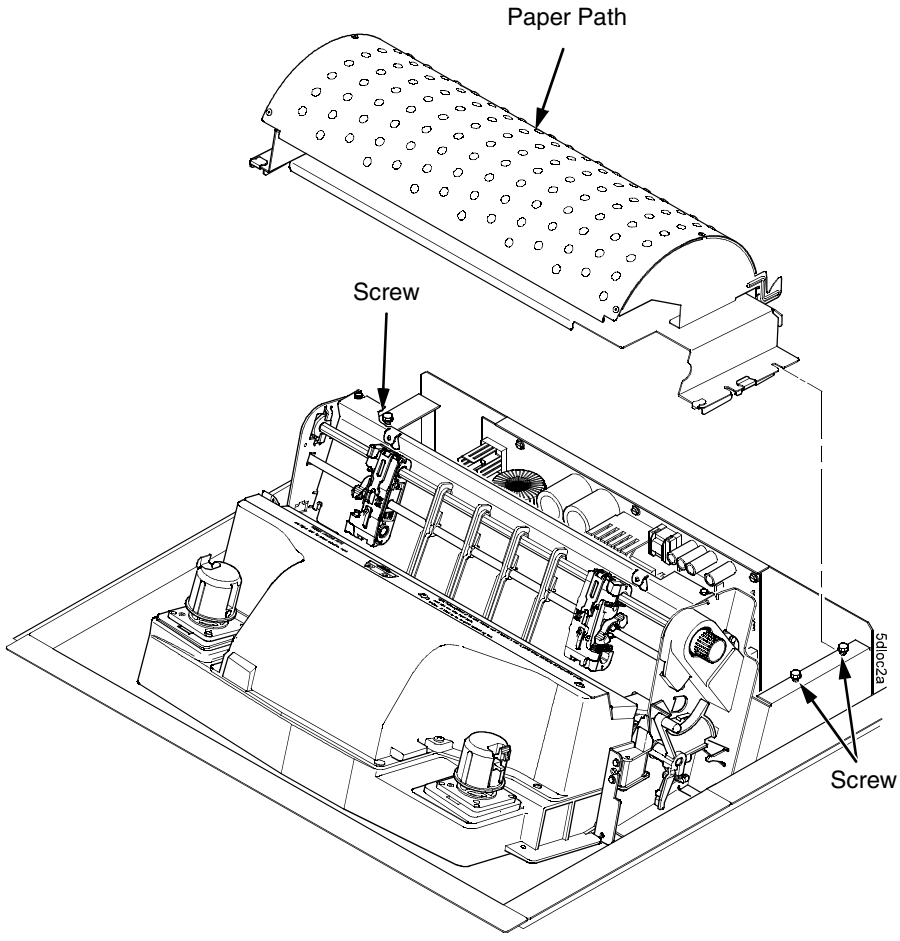


Figure 78. The Paper Path

CFX Controller Board (Model P5220)

1. Connect the power stacker logic cable P103 to connector J17 on the controller board. (Figure 79.)
2. Disconnect the power supply cable from connector J101 on the controller board. (Figure 79.)
3. Connect power supply cable connector P101 to the stacker power cable, then connect the stacker power cable to connector J101 on the controller board. (Figure 79.)
4. Route the stacker power cable in front of the controller board and down through the cutout under the card cage fan. (Figure 79.)
5. Route the stacker logic cable through the opening between the card cage and the cabinet frame and behind the card cage. (Figure 79.)

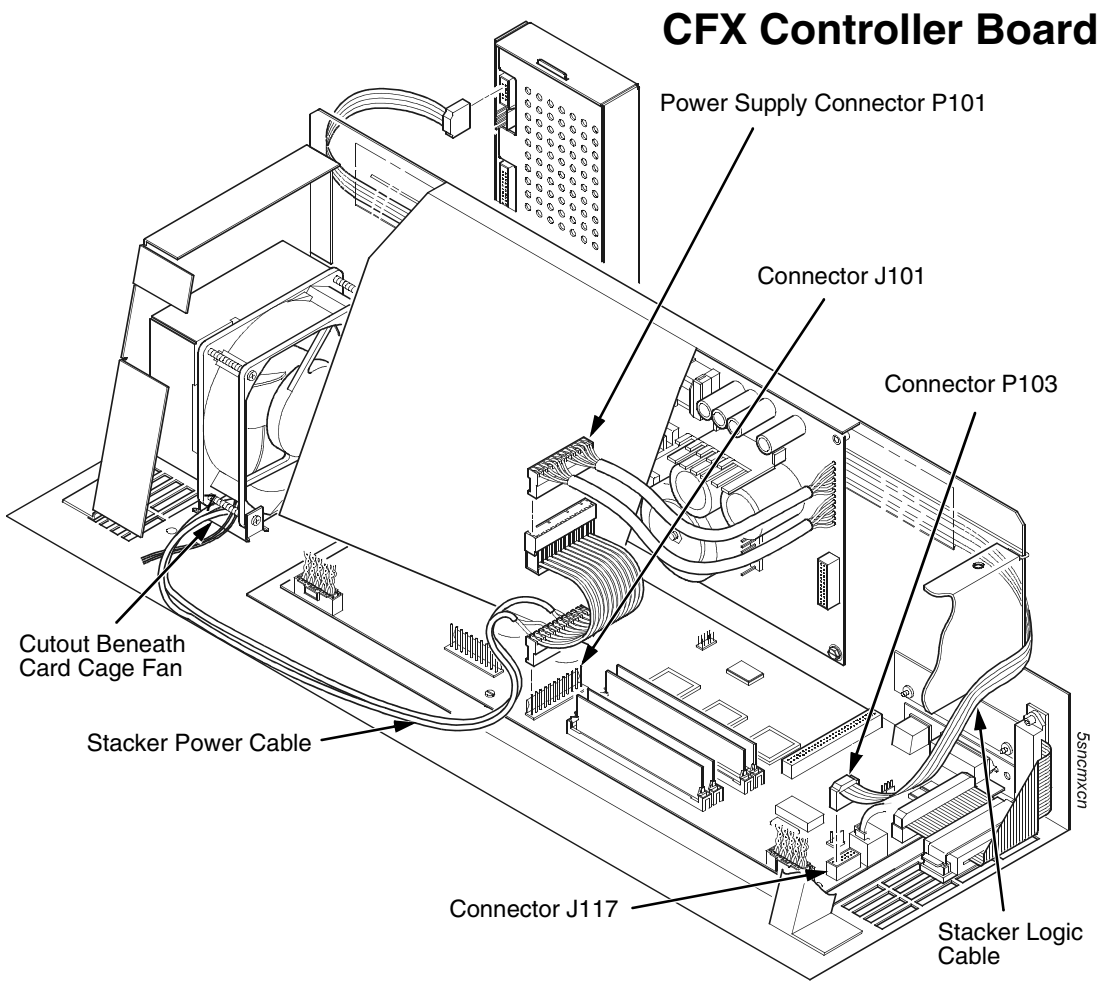


Figure 79. Stacker Power and Logic Connections on the Controller Board

6. Route the cable through the stacker logic cable straight through the routing guide, making sure that it is not twisted. (Figure 80.)
7. Position the cable routing guide so that the four chain hooks protrude through the holes in the guide. (Figure 80.)

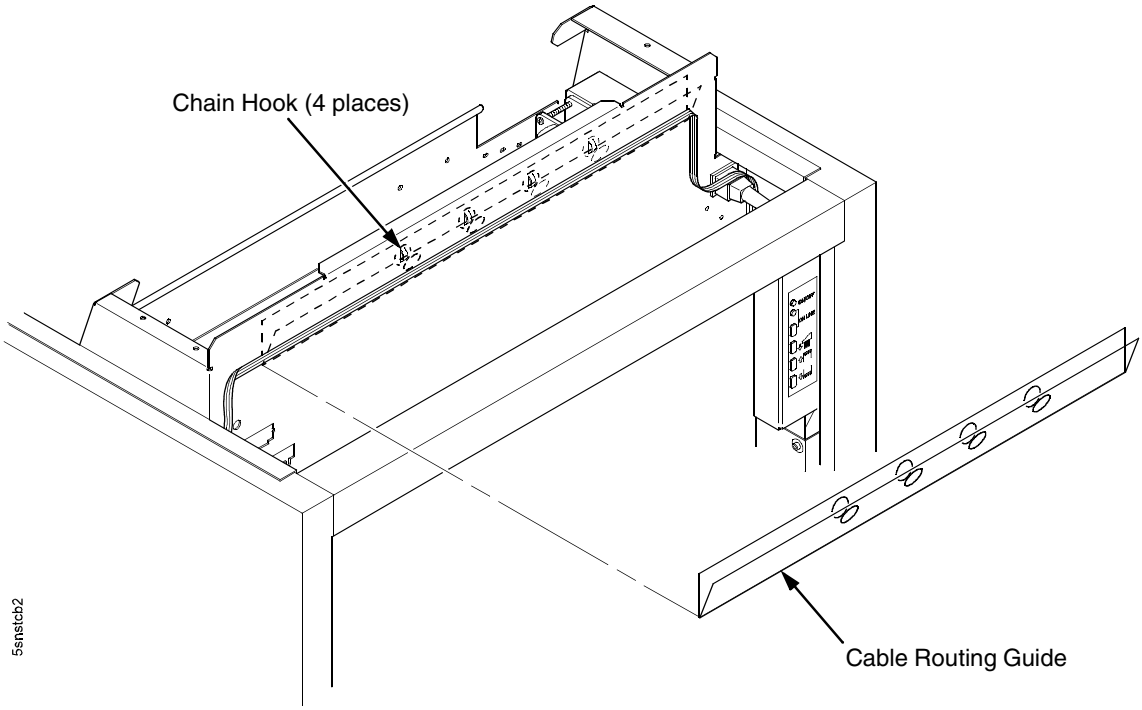


Figure 80. Installing the Cable Routing Guide in a CFX (P5220) Printer

8. Slide the retainer wire over the cable routing guide and through the four chain hooks. (Figure 82.)

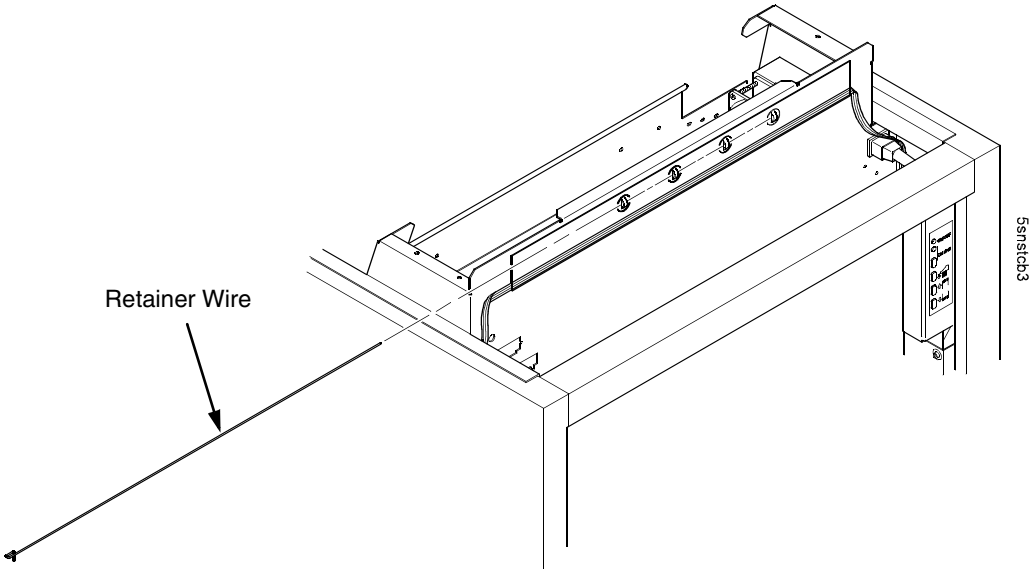


Figure 81. Installing the Cable Routing Guide Retainer in a CFX (P5220) Printer

9. Insert the bent end of the cable routing guide retainer into the card cage notch. (Figure 82, detail.)
10. Continue on page 388.

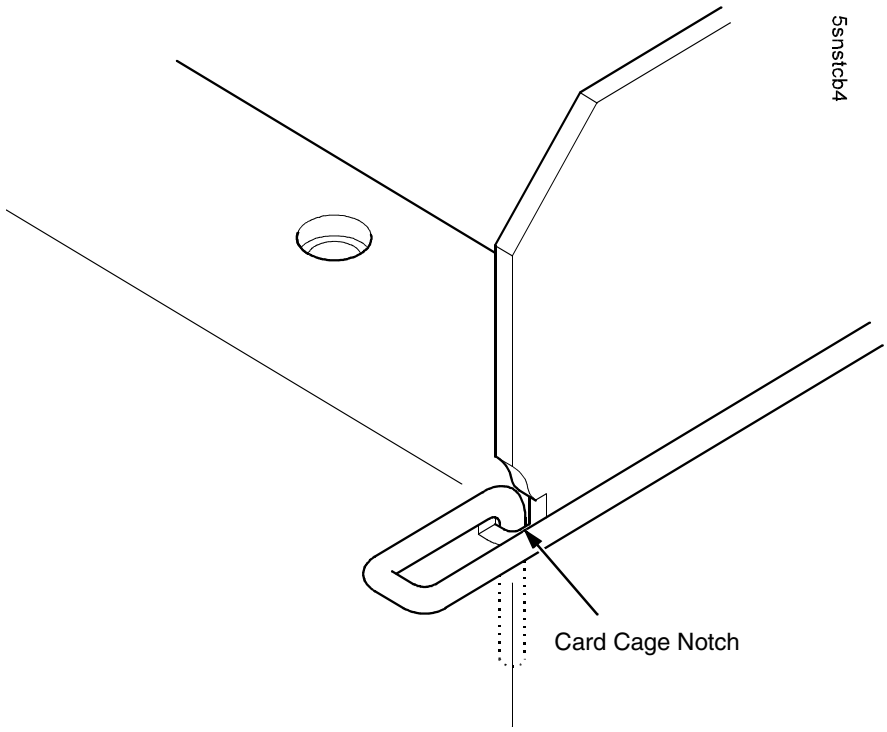


Figure 82. Locking the Cable Routing Guide Retainer Wire

PSA3 Controller Board (Model P5224)

5. Connect the power stacker logic cable P103 to connector J117 on the controller board. (Figure 83.)
6. Disconnect the power supply cable from connector J101 on the controller board. (Figure 83.)
7. Connect power supply cable connector P101 to the stacker power cable, then connect the stacker power cable to connector J101 on the controller board. (Figure 83.)
8. Route the stacker power cable in front of the controller board and down through the cutout under the card cage fan. (Figure 83.)
9. Route the stacker logic cable in front of the controller board and down through the cutout under the card cage fan. (Figure 83.)
10. Continue on page 388.

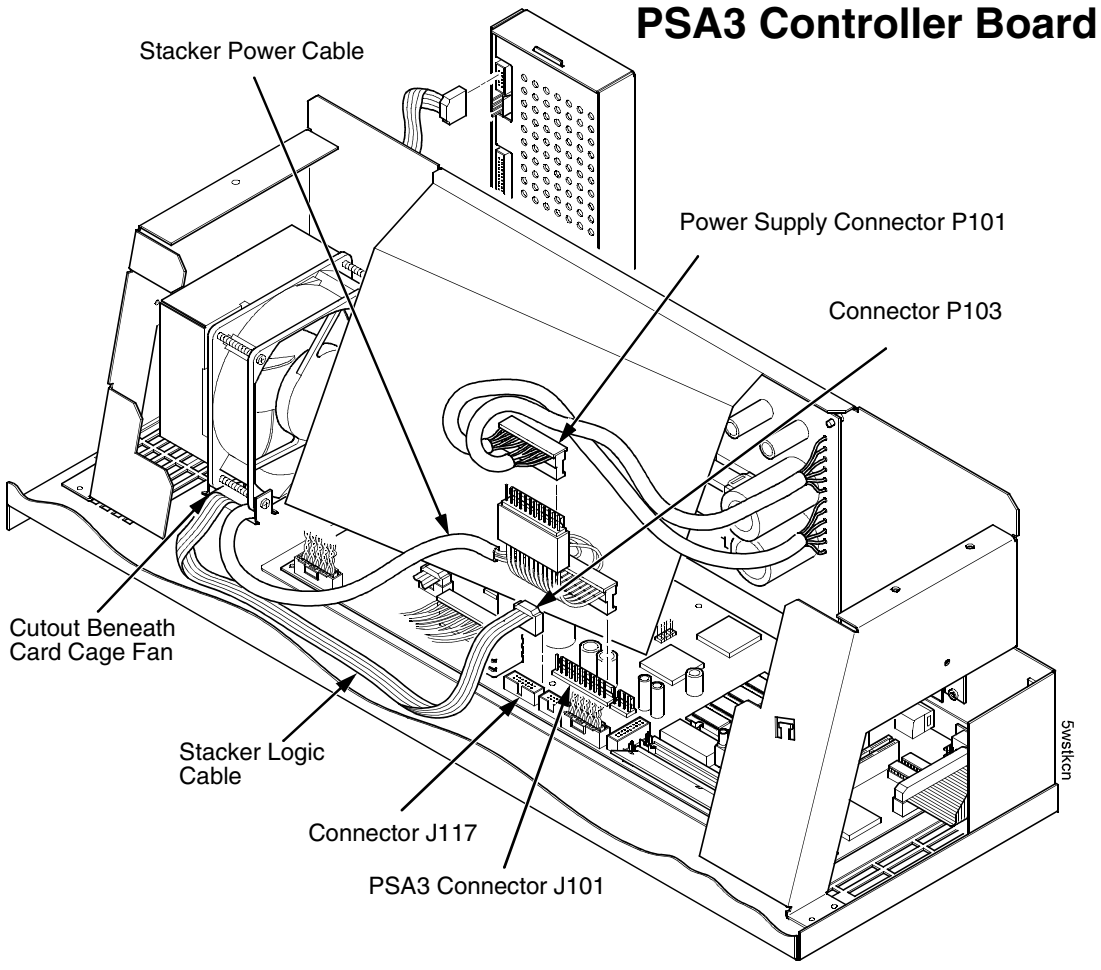


Figure 83. Stacker Power and Logic Connections on the PSA3 Controller Board

11. Pull the paper tray out until the holes in the rails permit access to the M3 buttonhead screws. (Figure 73.)
12. Loosen one turn—do not remove—the M3x6 screws securing the vertical rails to the stacker base. Each rail is secured by two screws. (Figure 73.)

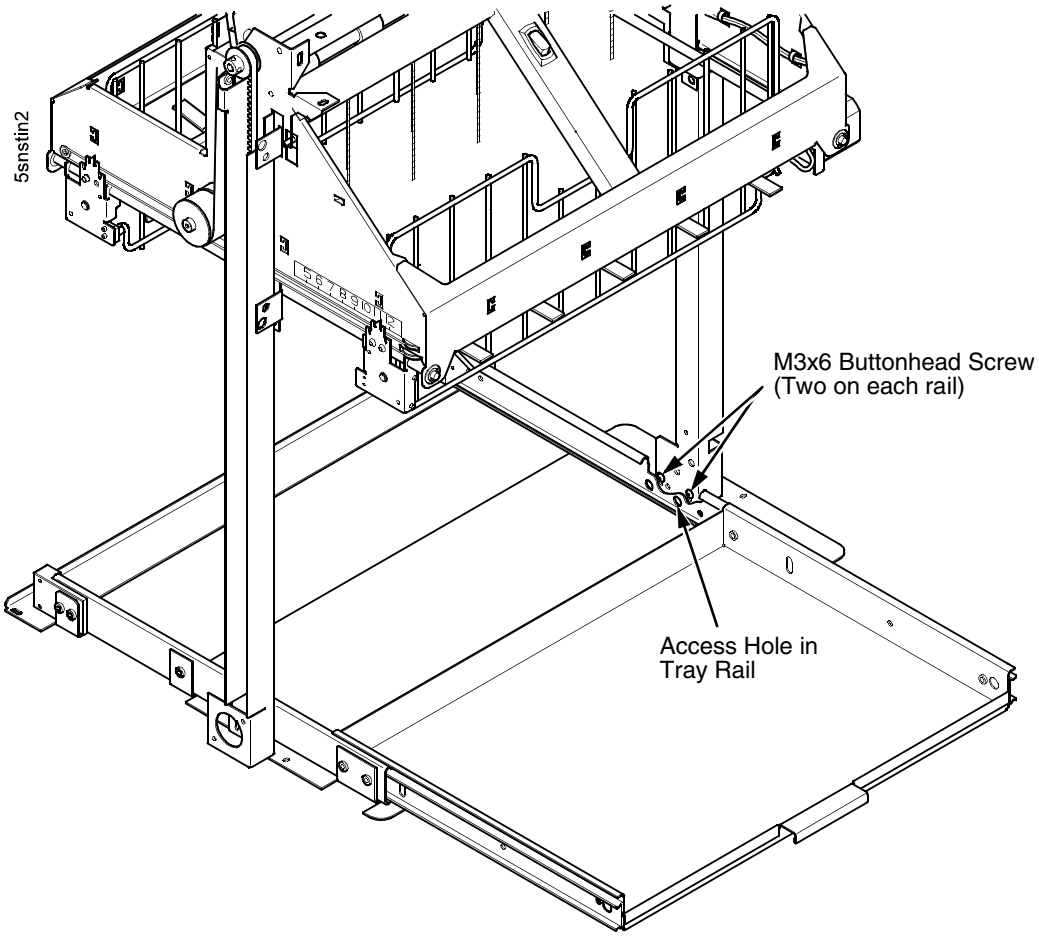


Figure 84. The Lower Screws in the Vertical Rails

13. Position the elevator assembly at the bottom of the vertical rails. (Figure 85.)
14. Connect the elevator I/O cable to the elevator assembly and install the two 4-40 x 1/4 inch screws, as shown in Figure 85.

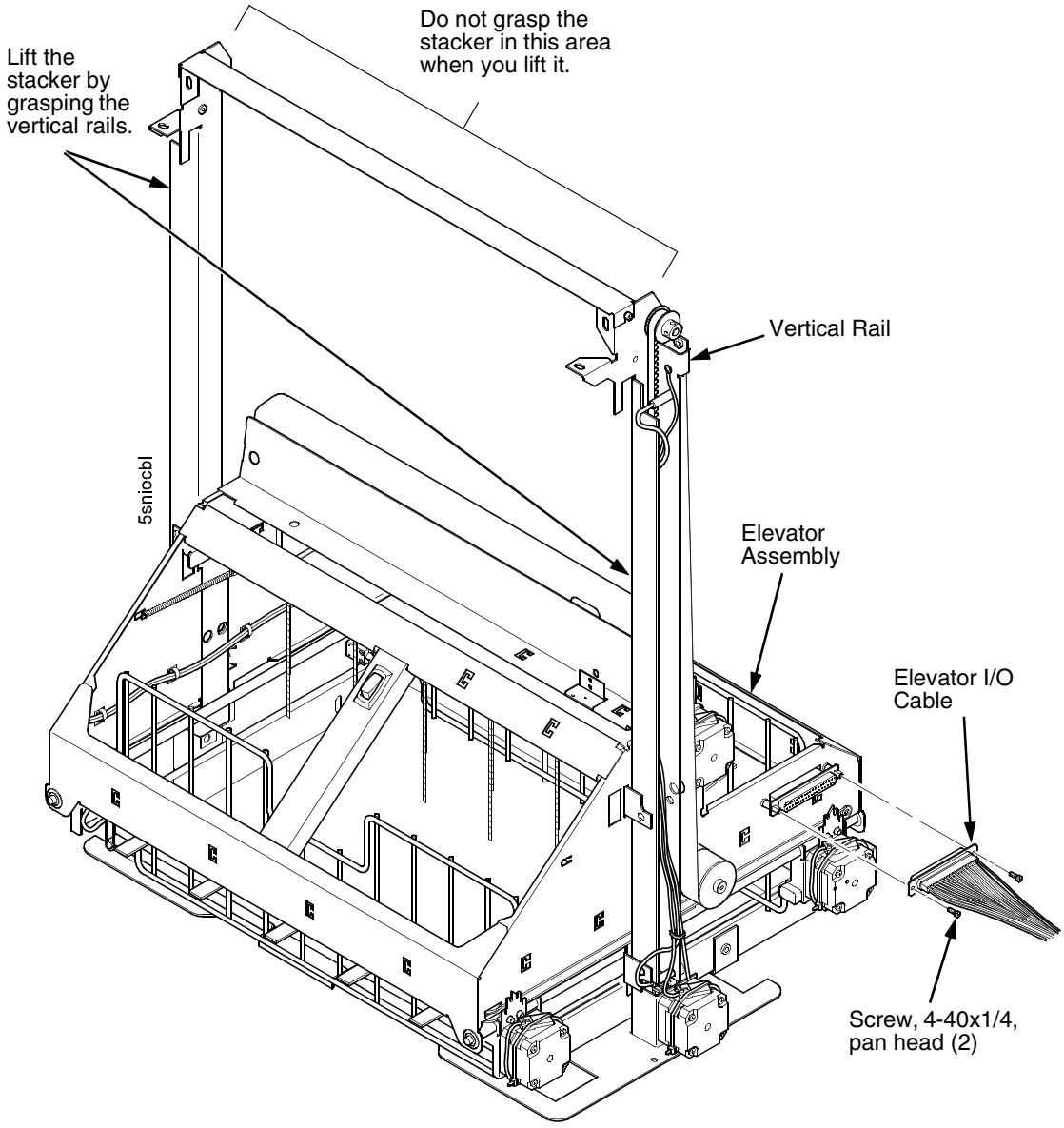


Figure 85. The Elevator I/O Cable

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

15. Position the stacker assembly slightly to the right in order to clear the air exhaust duct, insert the vertical rails inside and under the upper frame cross-member, then slowly swing the base of the stacker assembly into the cabinet. (Figure 86a.)
16. Work the stacker base rearward and engage the upper brackets of the vertical rails under the upper frame cross-member. (Figure 86b.)
17. Align the holes in the vertical rail brackets with the holes in the upper frame cross-member. (Figure 86c and Figure 87.)

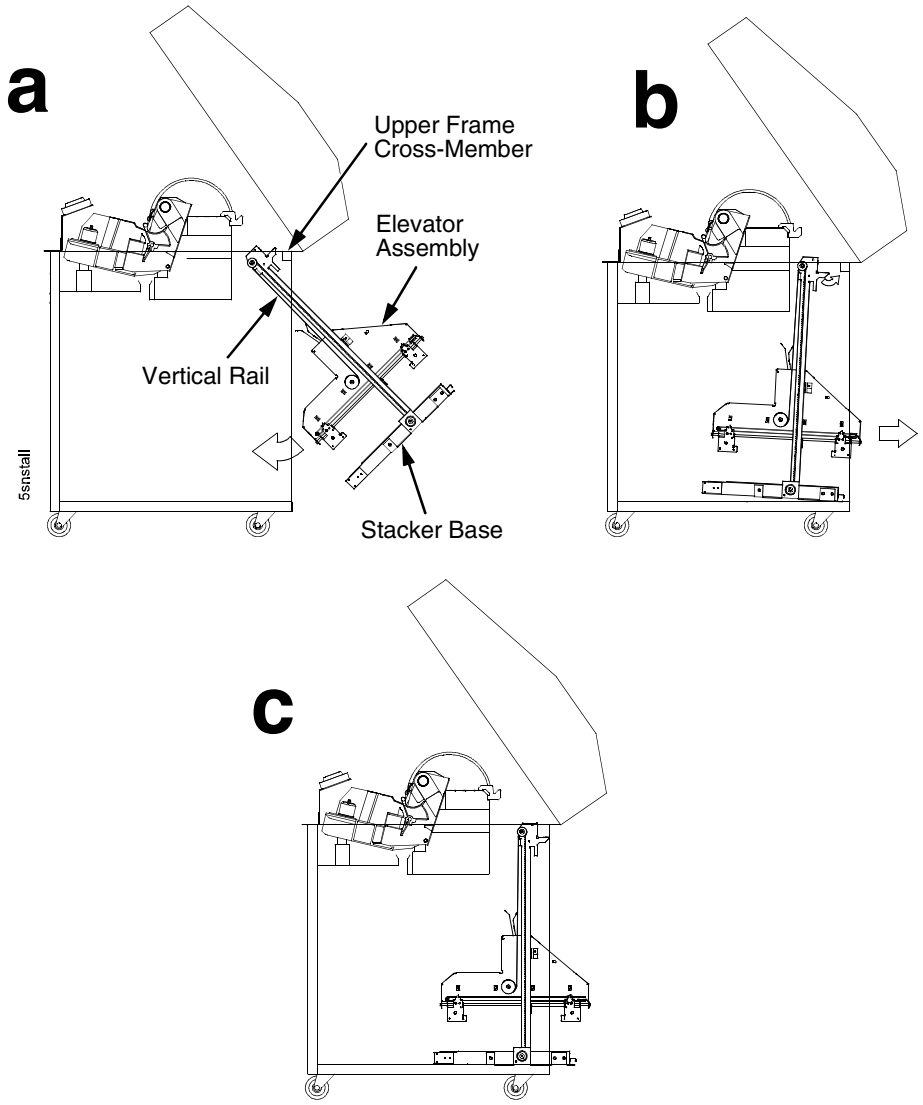


Figure 86. Stacker Installation

18. Align the holes in the stacker base with the holes in the cabinet floor. (Figure 86c and Figure 87)
19. Install finger tight the 10-32 x 5/32 inch buttonhead screw and washer securing the left vertical rail to the upper frame cross-member. (Do not install the right hand screw yet.) (Figure 87.)
20. Install and tighten the two Torx T-10 screws securing the stacker base to the cabinet floor. (Figure 87.)
21. Install and tighten the two Torx T-10 screws that secure the rail bracket to the cabinet floor. (Figure 87.)

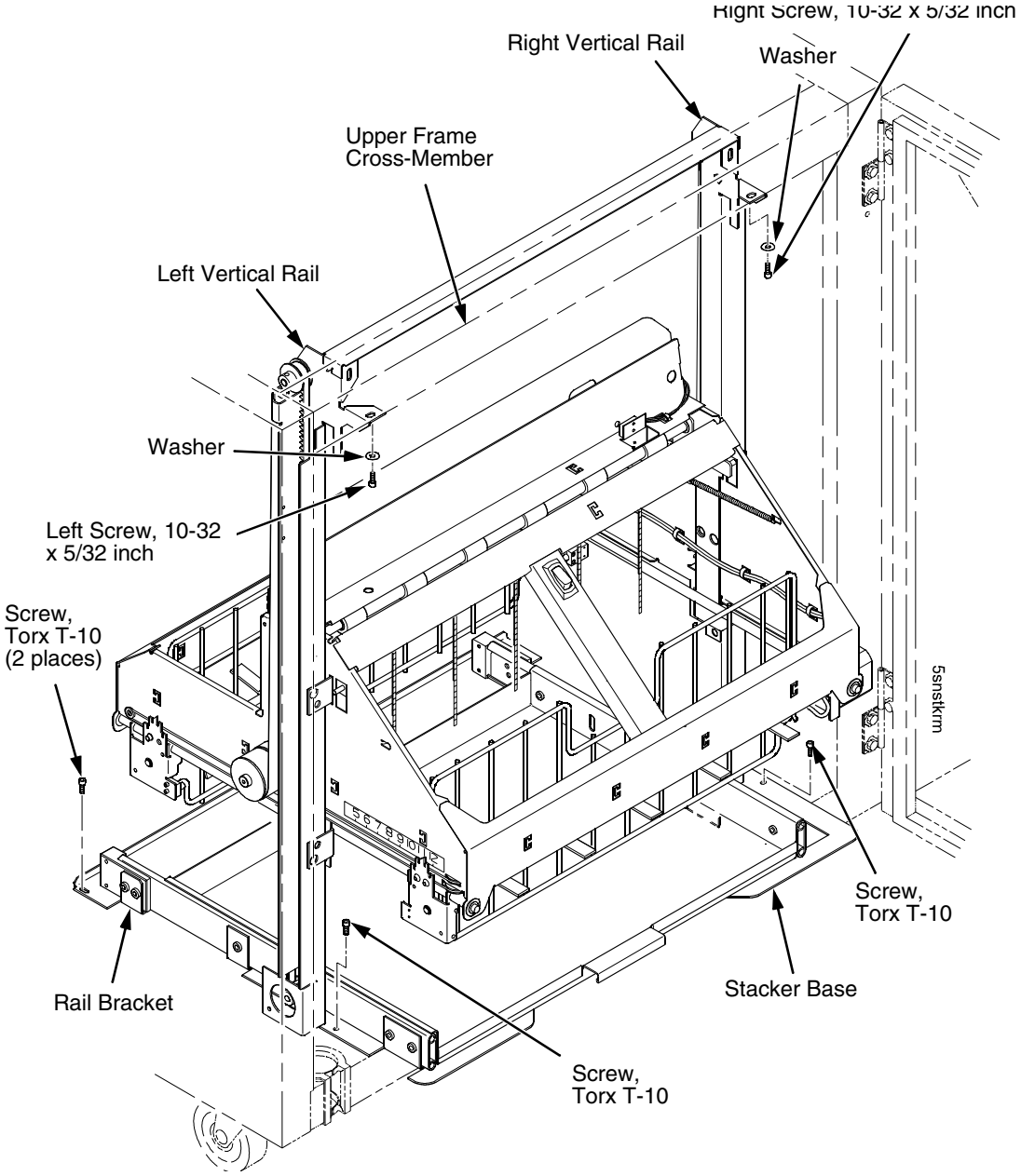


Figure 87. Stacker Fasteners

22. Gather the stacker rail cable, elevator I/O cable, logic cable, and power cable. Route the cables outboard of the elevator assembly. (Figure 88.)

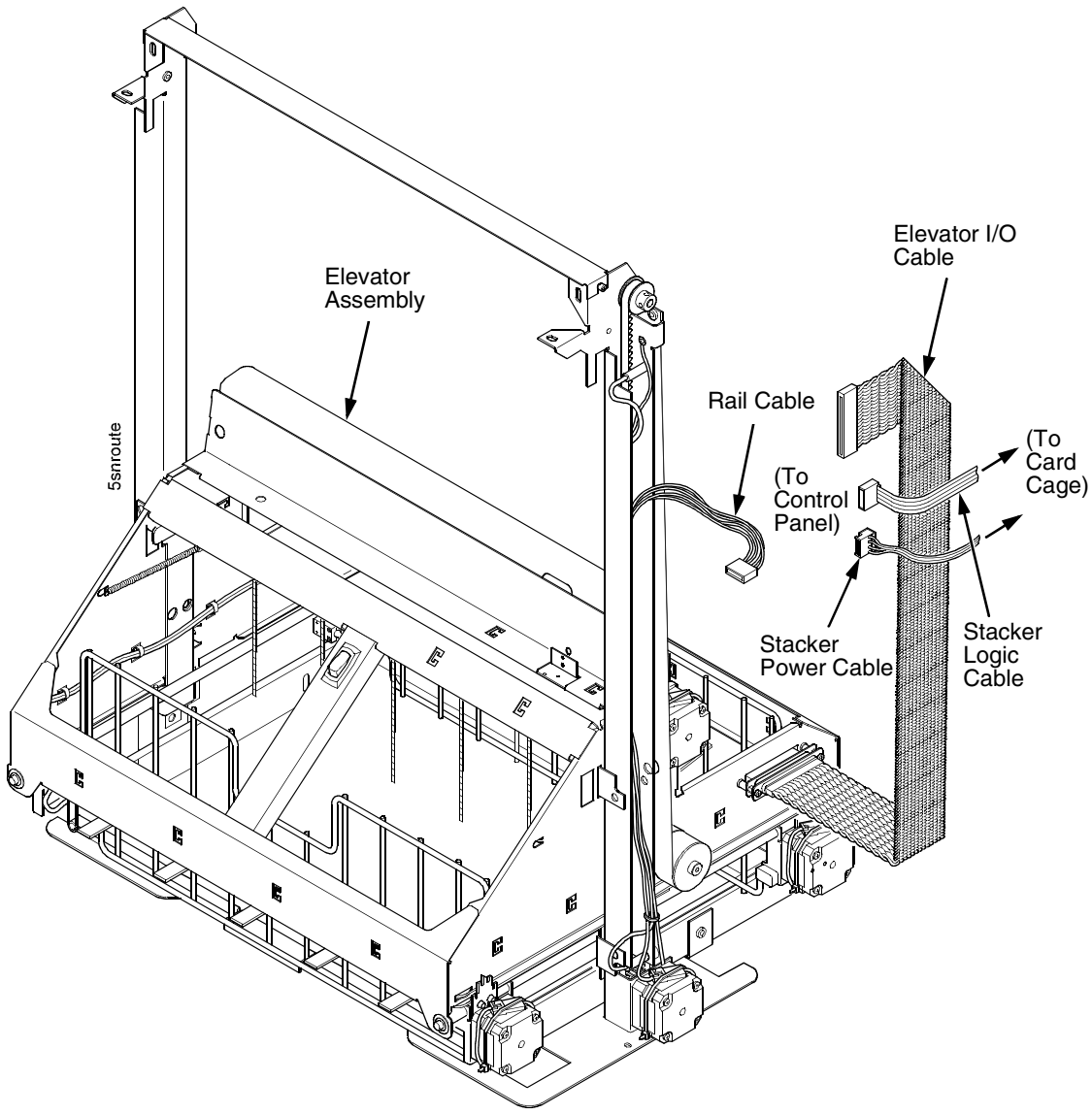


Figure 88. Stacker Cable Routing

23. Connect the stacker cables to the rear of the stacker control panel assembly and make sure the ejector levers close over the connectors. (Figure 89.)
24. Press rail cable connector P107 into the control panel until the ejectors are closed, then tie wrap the ejectors to the connector as shown in Figure 89, detail A.

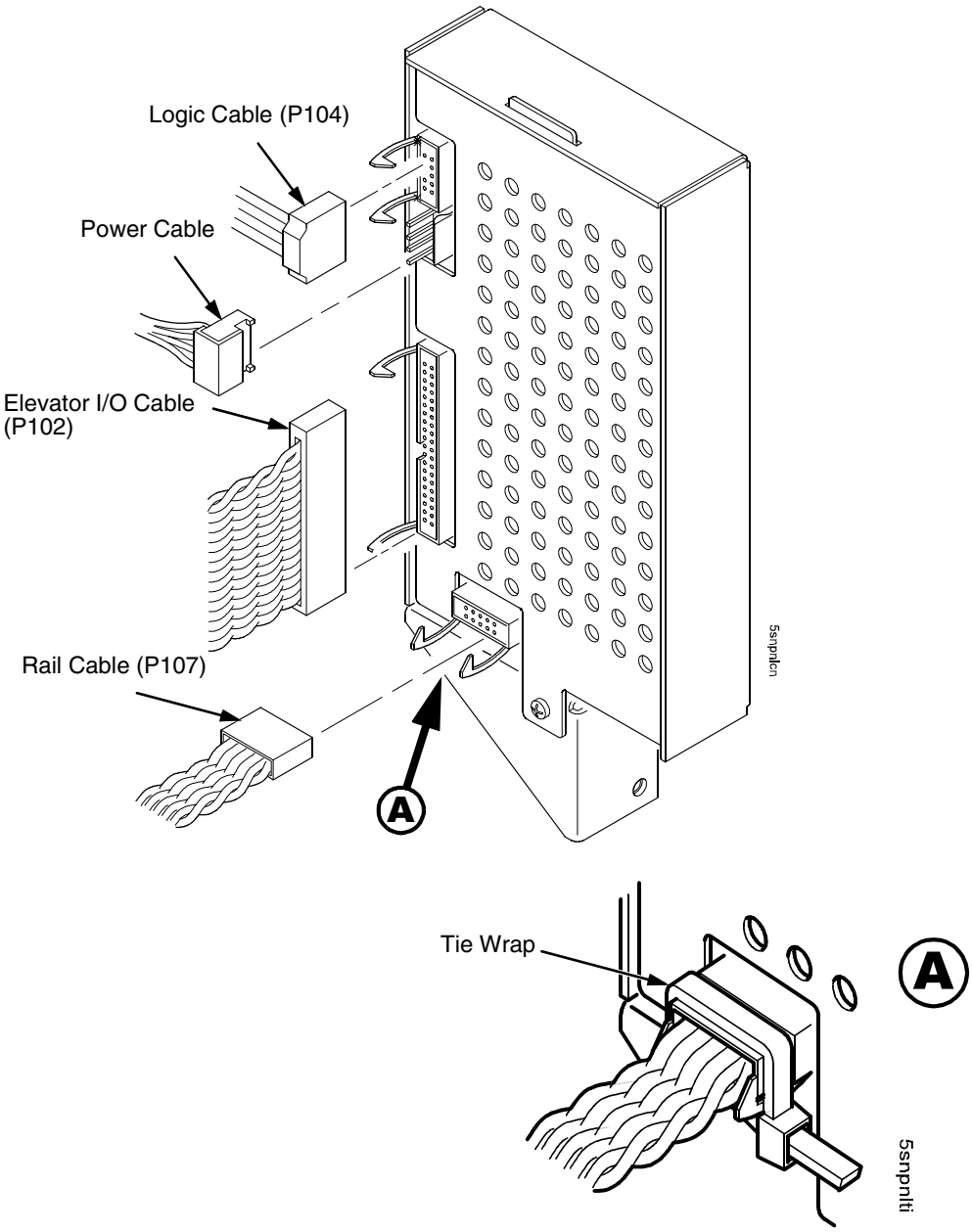


Figure 89. Stacker Control Panel Cables

25. Apply the double-sided tape to one end of the control panel standoff. Remove the paper backing and hold the standoff inside the cabinet as you insert the upper mounting screw and washer through the hole in the frame. Use the screw as a guide to align the standoff with the hole, then press the standoff against the inside wall and push the upper screw in as far as it will go. Now maneuver the control panel into position and install the upper mounting screw finger tight in the control panel. (Figure 90.)
26. Inspect the distance between the control panel lower bracket and the inner panel of the cabinet.
    a. If the control panel lower bracket is flush with the cabinet inner panel, proceed to step 27.
    b. If there is a gap between the control panel lower bracket and the cabinet inner panel, do the following:
        1) Peel the backing off the spacer adhesive. (Figure 90.)
        2) Align the spacer with the holes in the lower bracket and inner panel. (Figure 90.)
        3) Press the spacer adhesive against the inner panel. (Figure 90.)
27. Install the lower mounting screw and washer. Tighten the upper mounting screw. (Figure 90.)

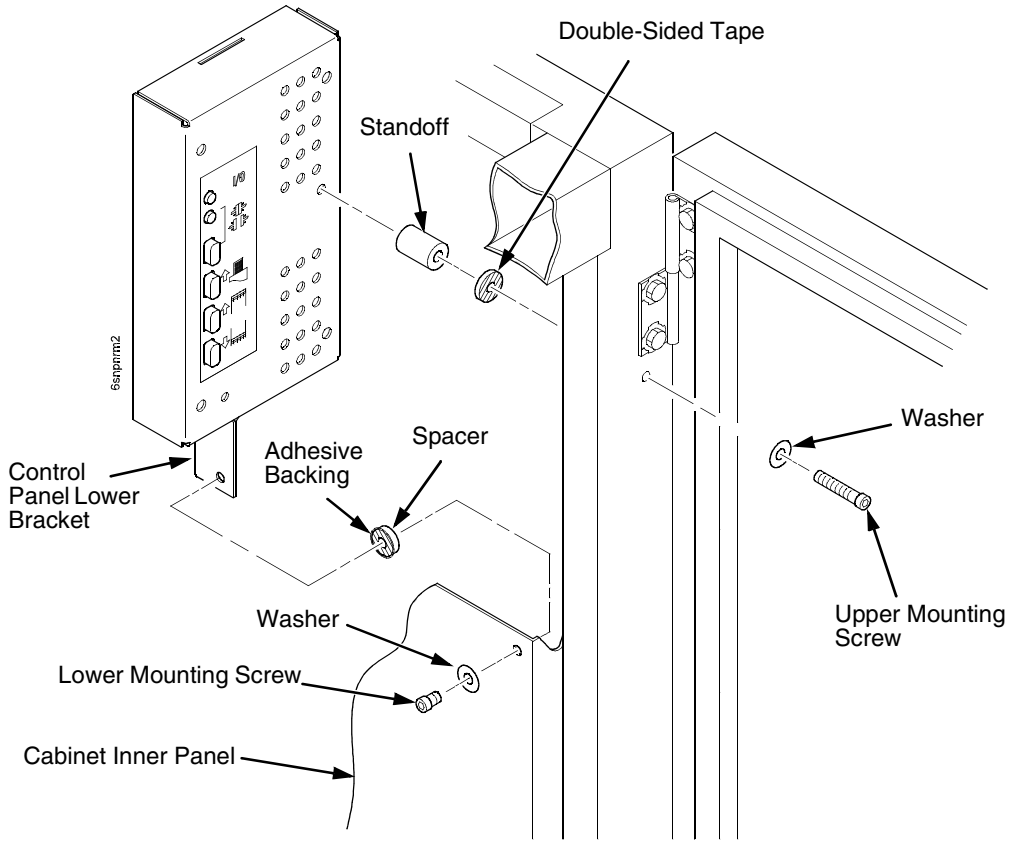


Figure 90. Installing the Stacker Control Panel

28. Install finger tight the 10-32 x 5/32 inch buttonhead screw and washer securing the right vertical rail to the upper frame cross-member. (Figure 87.)
29. Move the elevator assembly up and down on the vertical rails until it travels smoothly with no binding.
30. Tighten the two 10-32 x 5/32 inch buttonhead screws securing the vertical rails to the upper frame cross-member.
31. Pull the paper tray out until the holes in the rails permit access to the M3 screws. Tighten the M3 screws securing the vertical rails to the stacker base. Each rail is secured by two screws. (Figure 84.)
32. Move the elevator assembly up and down and make sure it travels smoothly with no binding. If the elevator binds or catches anywhere along its path of travel, *slightly* loosen the upper and lower rail screws and repeat steps 29 through 31 until the elevator moves smoothly.
33. Bundle the stacker control panel cables in the wire saddles located under the card cage. Tie wrap the cables so they do not catch in the stacker mechanism as it moves up and down. Route the stacker rail and frame cables so they move without snagging as the elevator assembly moves up and down. (CFX/P5220 Printer: see Figure 91. PSA3/P5224 Printer: see Figure 92.)

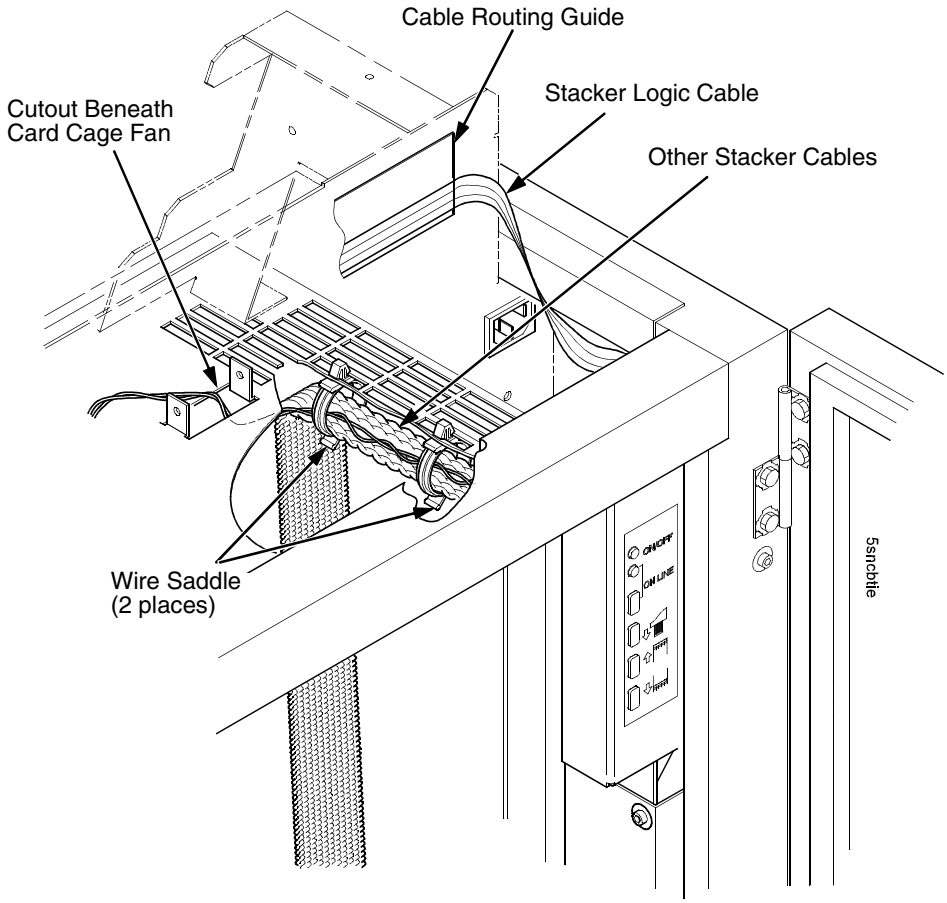


Figure 91. Securing Stacker Cables in a Printer With a CMX/CFX Controller Board

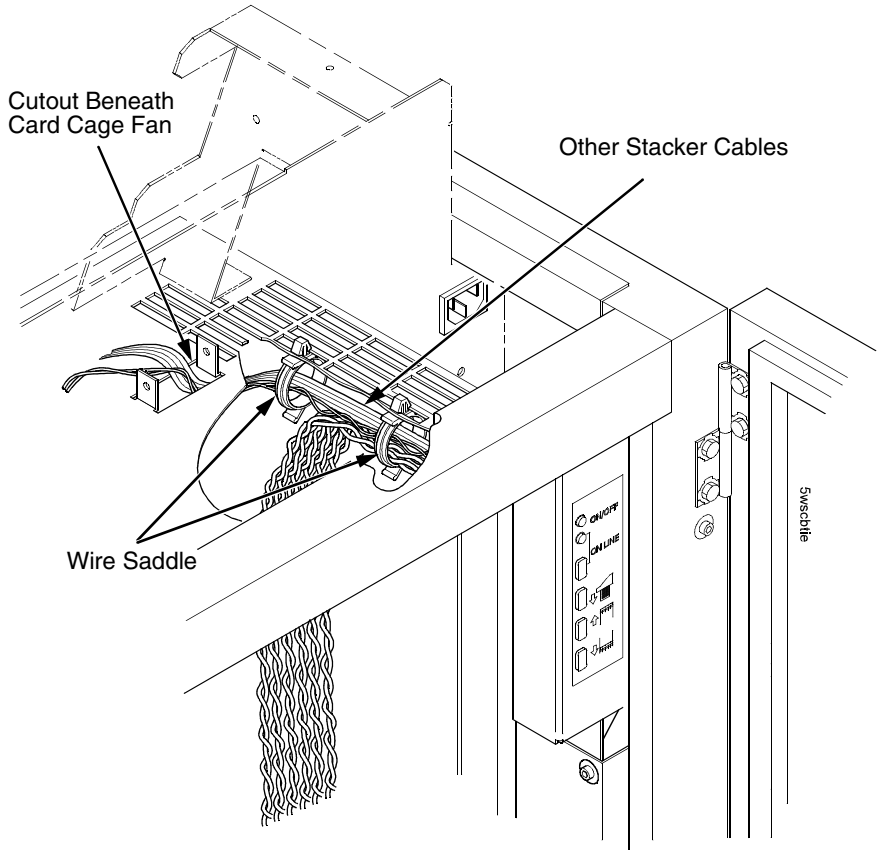


Figure 92. Securing Stacker Cables in a Printer With a PSA3 Controller Board

34. Install the paper fence. (Figure 93.)

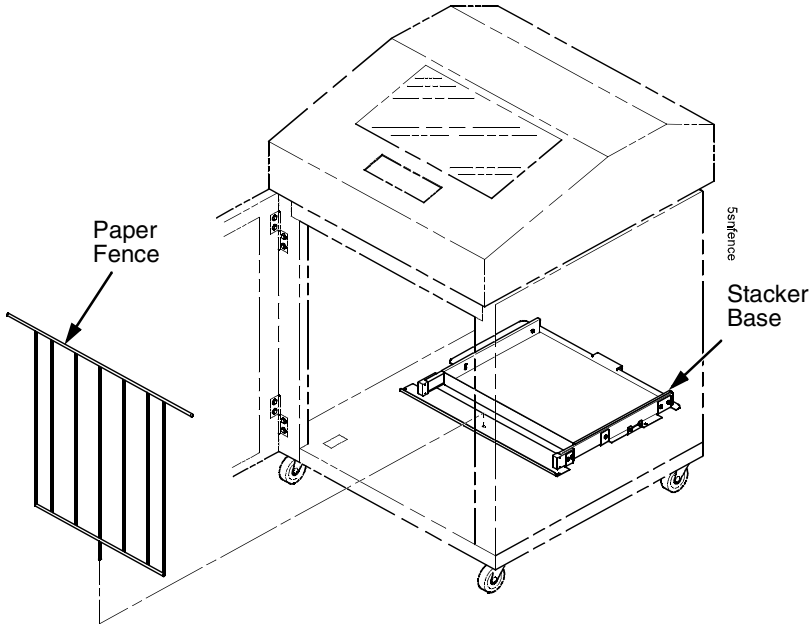


Figure 93. Paper Fence

35. Pull out the paper tray and install the paper tent. (Figure 94.)

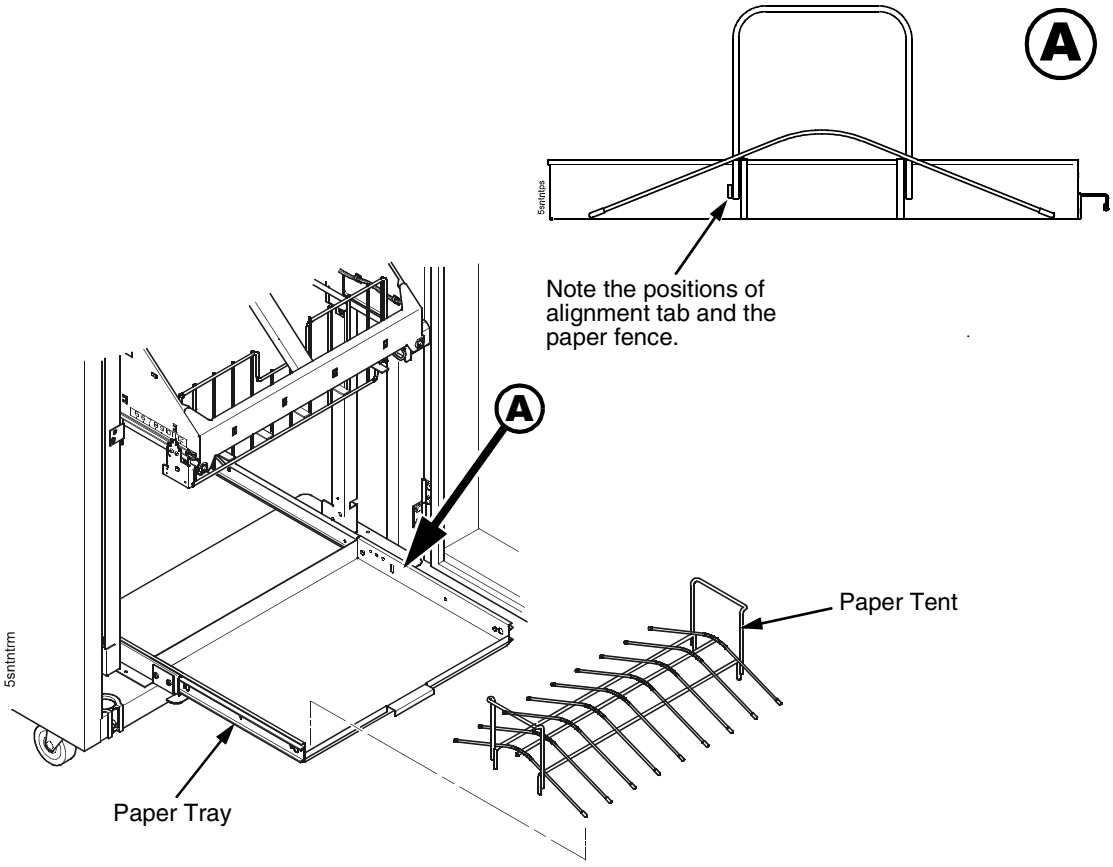


Figure 94. Paper Tent

36. Install the paper path that you removed in step 4.
37. Install paper and test stacker operation. (Refer to the *User's Manual.)*

NOTE: The SureStak Power Stacker will stack forms from five to 12 inches (12.7 to 30.5 cm) long. Using longer or shorter paper can cause error messages and unpredictable behavior of the stacker. The stacker can handle forms from 3 to 16 inches (7.6 to 40.6 cm) wide with no paper tent in the paper tray, and from 3 to 15.5 inches (7.6 to 39.4 cm) wide with the paper tent installed in the paper tray.

Replacing The Constant Force Spring

1. Remove the stacker assembly from the printer. (See page 377.)
2. Raise the elevator assembly to its highest position and secure it to the vertical rails using tie wraps or string. Do not over-tighten the tie wraps or string; tighten them just enough to hold the elevator up. (Figure 95)

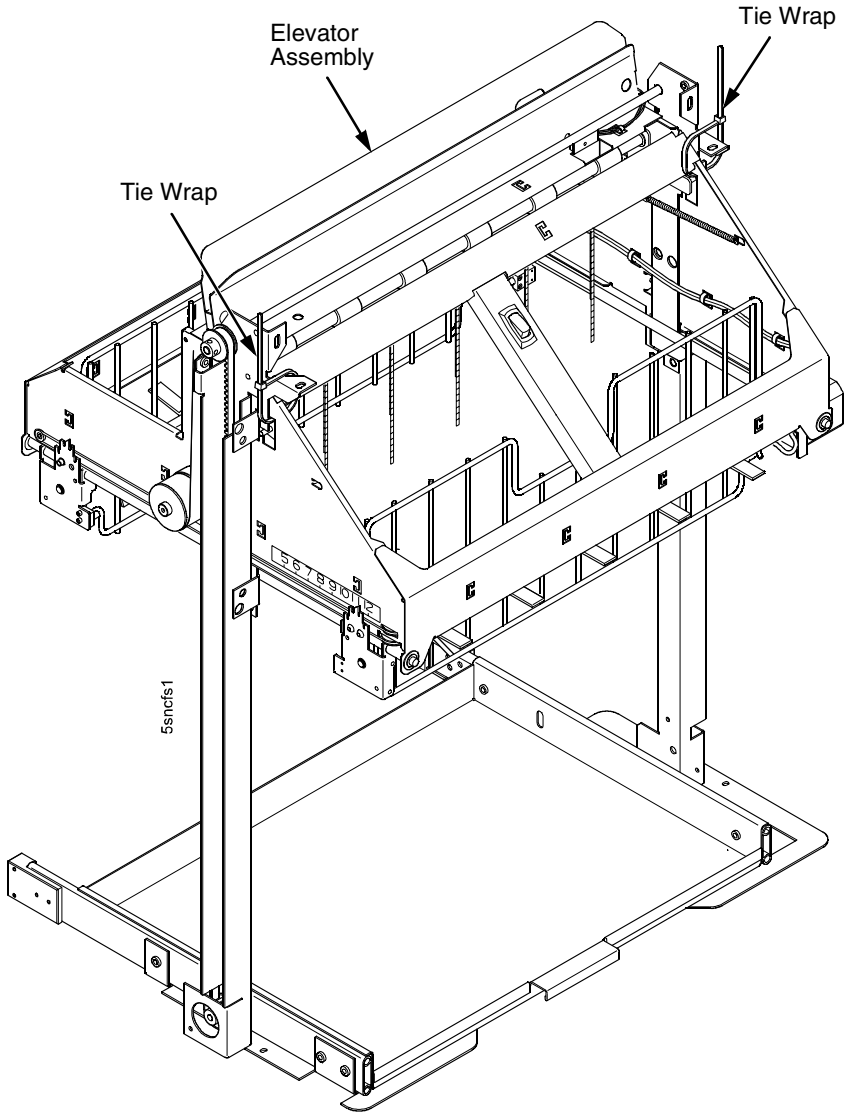


Figure 95. Securing the Elevator Assembly

WARNING **The constant force spring is a high tension spring. To avoid pinching your fingers, coil the spring slowly and carefully. Do not let the spring twist or crimp.**

3. Remove the shoulder screw and large washer from the constant force spring and drum. Let the spring coil itself up until it reaches the screw that secures it to the vertical rail. (Figure 96.)
4. Firmly gripping the spring and drum, remove the screw securing the spring to the vertical rail. (Figure 96.)

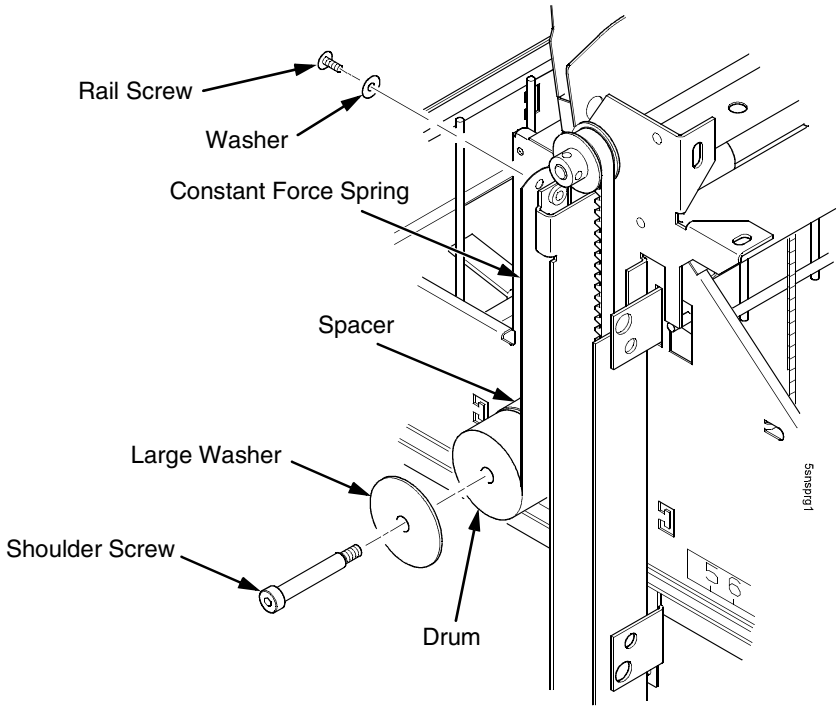


Figure 96. Removing the Constant Force Spring

5. Lift the loose end of the constant force spring and let it curl up on the outside of the remaining spring and drum. (Figure 97.)
6. While holding the drum tightly, continue to curl the spring until it is completely unwound from the drum. (Figure 97.)
7. To install a new constant force spring, reverse the steps of this procedure.

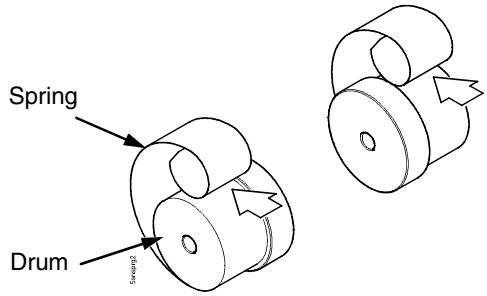


Figure 97. Removing the Constant Force Spring from the Drum

Replacing The Timing Belts

1. Remove the stacker assembly from the printer. (See page 377.)
2. Raise the elevator assembly to its highest position and secure it to the vertical rails using tie wraps or string. Do not over-tighten the tie wraps or string; tighten them just enough to hold the elevator up.
3. If you are removing the left timing belt, remove the screw and washer from the pulley at the bottom of the left vertical rail, and remove the pulley. (Figure 98.) Go to step 6.
4. If you are removing the right timing belt, remove the two metric Allen screws that secure the timing belt motor to the right vertical rail. (Figure 98.) Go to step 5.

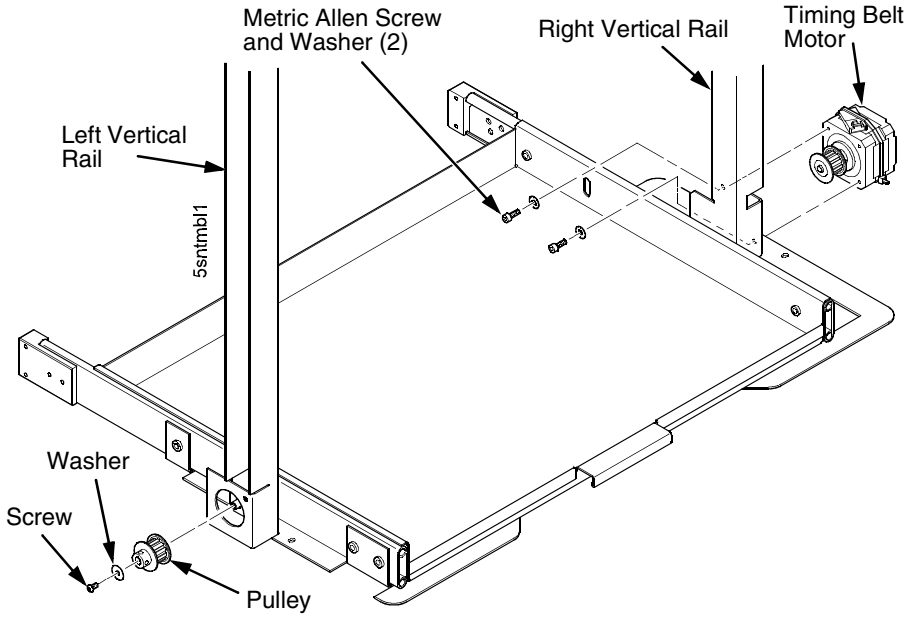


Figure 98. Removing the Timing Belt Pulley and Motor

5. Loosen the two setscrews on the motor pulley and remove the pulley. Unplug the motor cable, if necessary. (See Figure 99.) Go to step 6.

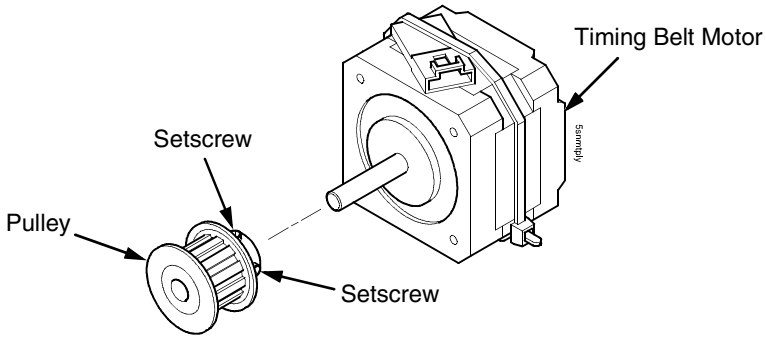


Figure 99. Removing the Timing Belt Motor Pulley

6. Remove the shoulder screw and large washer that secure the constant force spring to the vertical rail. (Figure 100.)

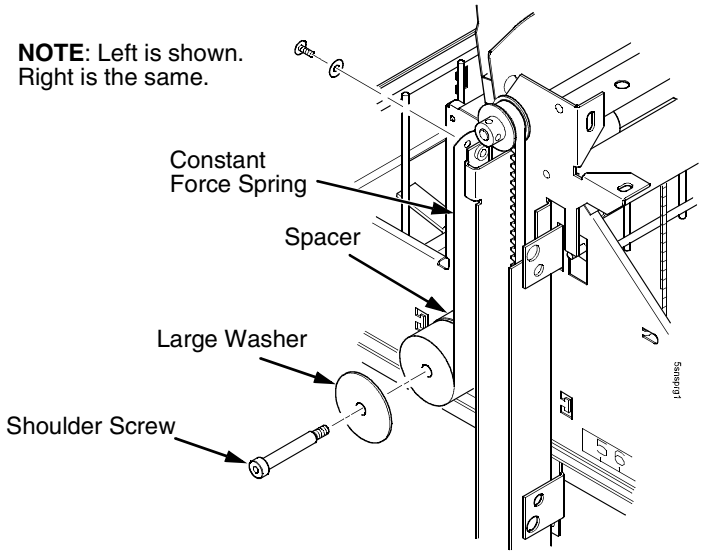


Figure 100. Releasing the Constant Force Spring

7. Remove two Allen screws from the belt clamp that secures the timing belt to the stacker frame. (Figure 101.)

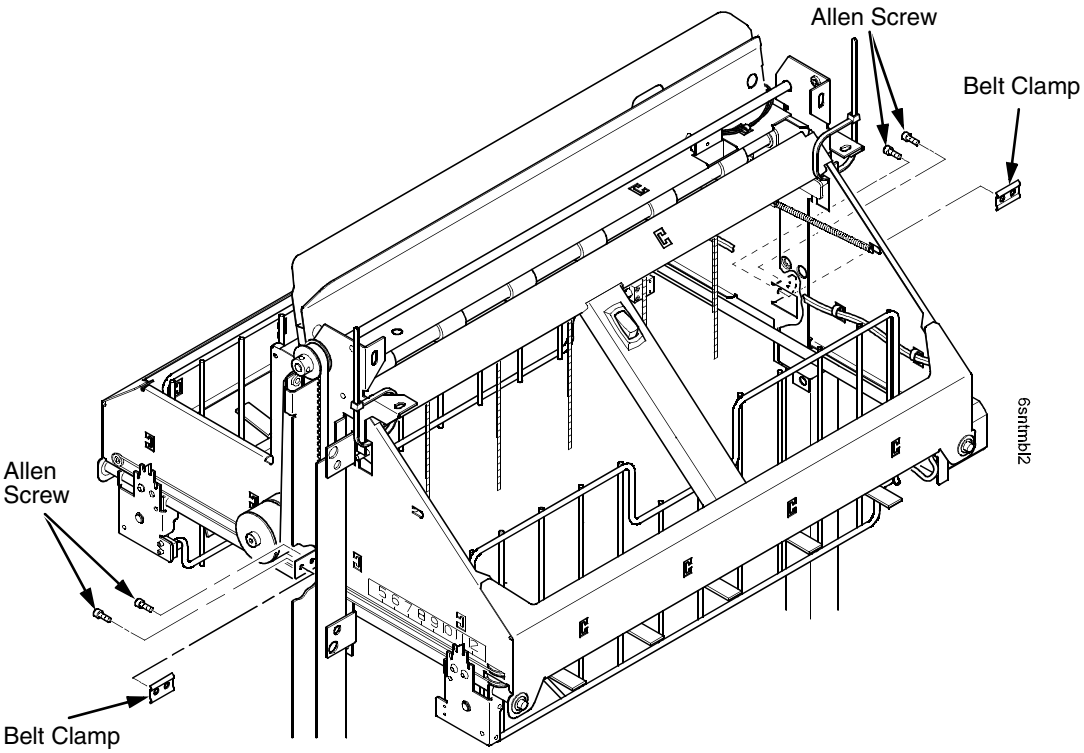


Figure 101. Removing the Belt Clamps

8. Remove the timing belt by working it around the vertical rail and constant force spring. (Figure 102.)
9. To install a timing belt, reverse the steps of this procedure.

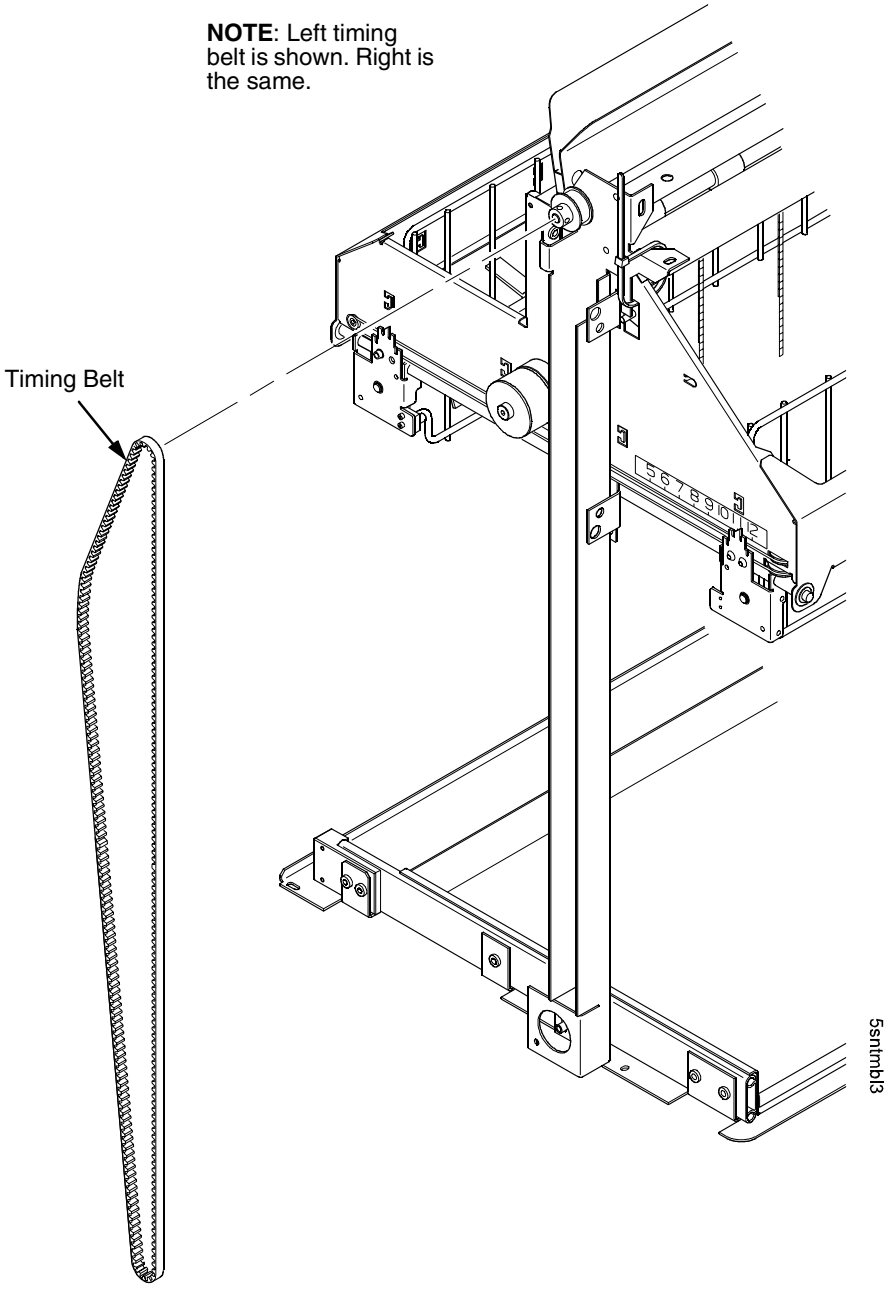


Figure 102. Removing the Timing Belt

Illustrated Parts Breakdown

The Illustrated Parts Breakdown (IPB) consists of exploded drawings of the power stacker assembly and subassemblies. Parts are listed next to each drawing.

Only replaceable parts are assigned part numbers. If a part or assembly is damaged but does not have a part number, replace the entire power stacker assembly.

The IPB starts on page 404.

List of Illustrations

Figure 103. Stacker Assembly ..... page 404

Figure 104. Elevator Detail: Motors, Rollers, and Paddles ..... page 406

Figure 105. Stacker Detail: Rollers ..... page 408

Figure 106. Stacker Detail: Motor Bracket ..... page 410

Figure 107. Stacker Detail: Elevator Bracket ..... page 412

Figure 108. Stacker Detail: Paper Motion Detector..... page 414

Stacker Parts Not Illustrated Here:

- Extended Door Kit:156300-901
- Reed Limit Switch Assembly (Phase III only): 204234-001
- Power Stacker Limit Switch Field Kit (Phase II only): 170285-001
- Rear Control Panel Assembly (Phase III): 174780-001 (Figure 90, page 394)
- Rear Control Panel Assembly (Phase II): 158732-901
- Stacker Hardware Kit: 173830-001
- Rail Cable, Power Stacker: 173823-001 (See page 351)
- Power Cable, Power Stacker: 174414-001 (See page 350)
- Logic Cable, Power Stacker, P5220: 158444-001 (See page 348)
- Logic Cable, Power Stacker, P5224: 1176029-001 (See page 349
- Frame Cable, Power Stacker: 173824-001 (See page 347)
- Elevator I/O Cable, Power Stacker: 174759-001 (See page 352)

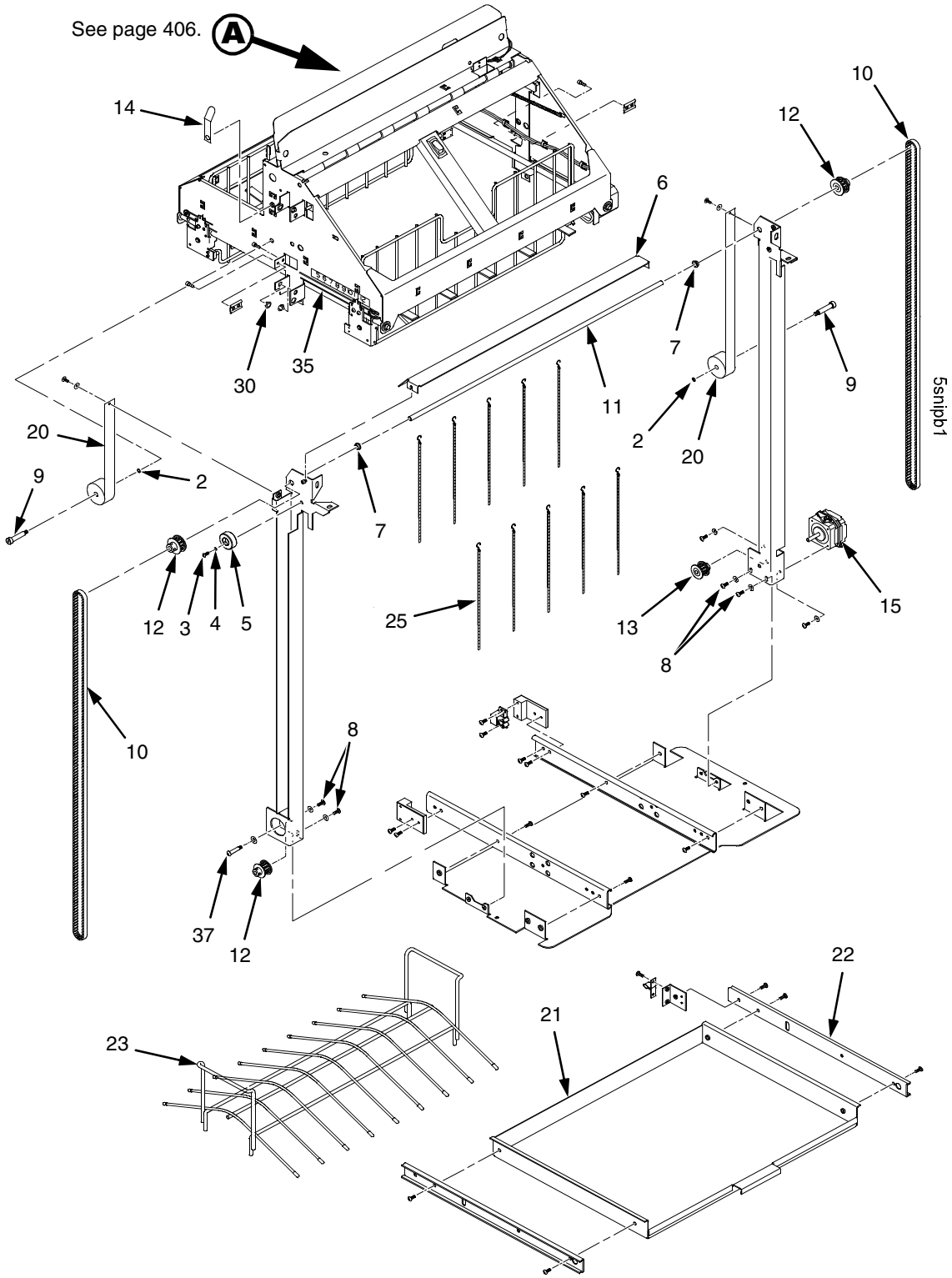


Figure 103. Stacker Assembly

Item No.	Part No.	Description	Notes
1	175273-991	Field Kit, Stacker Advance Exchange Kit	Replacement stacker; not illustrated
2	204476-001	Washer, Shim, 3/16 inch Bore X .016 inch Thick	
3	203251-001	Screw, Hex Skt Btn Hd, Zinc M3X8mm	
4	204458-001	Washer, Shim, .125 ID X .010 inch Thick	
5	173818-001	Timing Belt Tensioner Assy, Pwr Stkr	
6	170719-001	Paper Deflector	
7	202721-901	Clip-On Bearing	Part of item 36
8	Ref	Screw, Torx, 6-32 x .25	Part of item 36
9	Ref	Screw, Shoulder, 10-32	Part of item 36
10	202716-001	Timing Belt	
11	156388-001 173726-001	Shaft, Lift, Phase II Shaft, Lift, Phase III	 Phase III illustrated here
12	173725-001	Pulley, Timing Belt	
13	159398-001	Pulley, Motor	
14	150784-901	Clip, Grounding	
15 16	158446-001 173530-001	Motor Assembly, Power Stacker Motor, Stepper, Power Stacker	 Paper puller motor
20	202713-001	Constant Force Spring	
21	175807-001	Tray Assembly, Rear	Field Kit, Tray Assembly, Rear: 175808-001
22	174392-001	Slide, Ball Bearing, Rear Tray	
23	173864-001	Tent, Paper, Stacker	
25	151527-905	Chain	Mount outboard of shafts
30	202705-901	Nylon Plug	
35	202720-901	Cable	
36	173830-001	Stacker Hardware Kit	Kit not illustrated
37	Ref	Screw, Shoulder, 8-32	Part of item 36

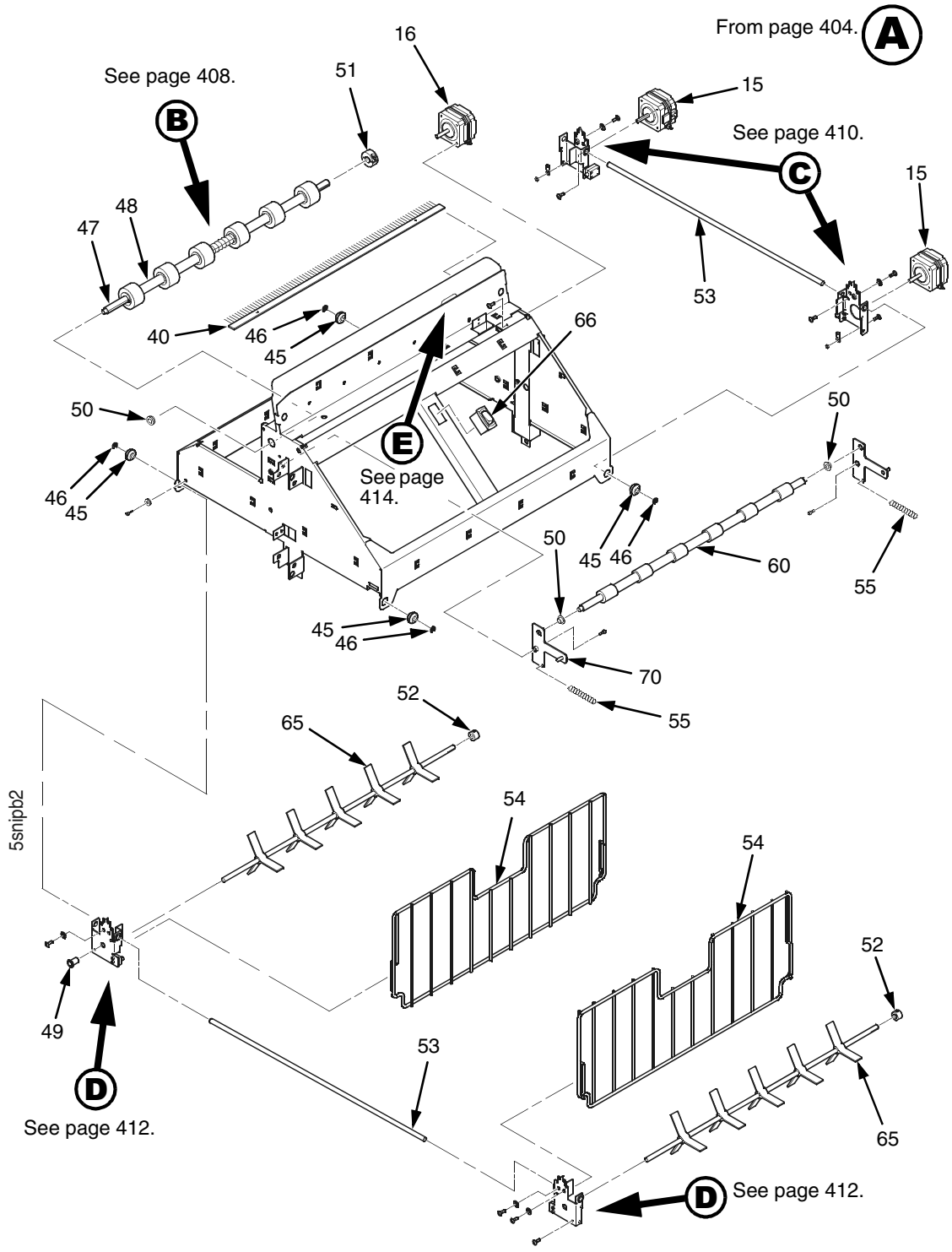


Figure 104. Elevator Detail: Motors, Rollers, and Paddles

Item No.	Part No.	Description	Notes
40	158313-001	Anti-Static Brush	
45	Ref	Shear Grommet	Part of item 36
46	Ref	Cap Nut	Part of item 36
47	156391-001	Shaft, Drive Roller	
48	156393-001	Spacer, Drive Roller	
49	202789-901	Bearing, Flanged	Part of item 36
50	202824-901	Bearing	Part of item 36
51	202708-001	Collar Clamp	
52	Ref	Collar, Setscrew	Part of item 36
53	156390-001	Support Shaft	
54	171209-001	Fence, Wireform	
55	203032-001	Extension Spring	
60	157275-001	Idler Roller	
65	157054-001	Paddle, Power Stacker	
66	204235-001	Switch, Rocker	Elevator Disable Switch

From page 406.

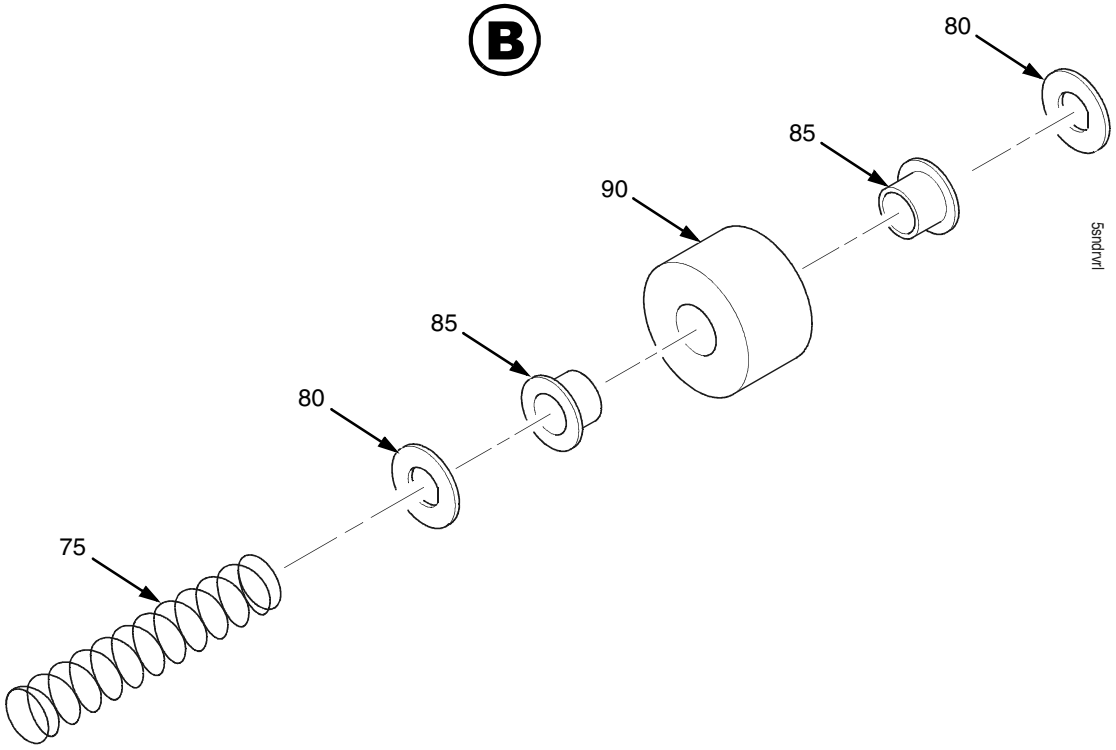


Figure 105. Stacker Detail: Rollers

Item No.	Part No.	Description	Notes
75	204255-001	Compression Spring	
80	156392-901	Friction Washer	Part of item 36
85	Ref	Flanged Bushing	Part of item 36
90	157960-001	Drive Roller	

From page 406.

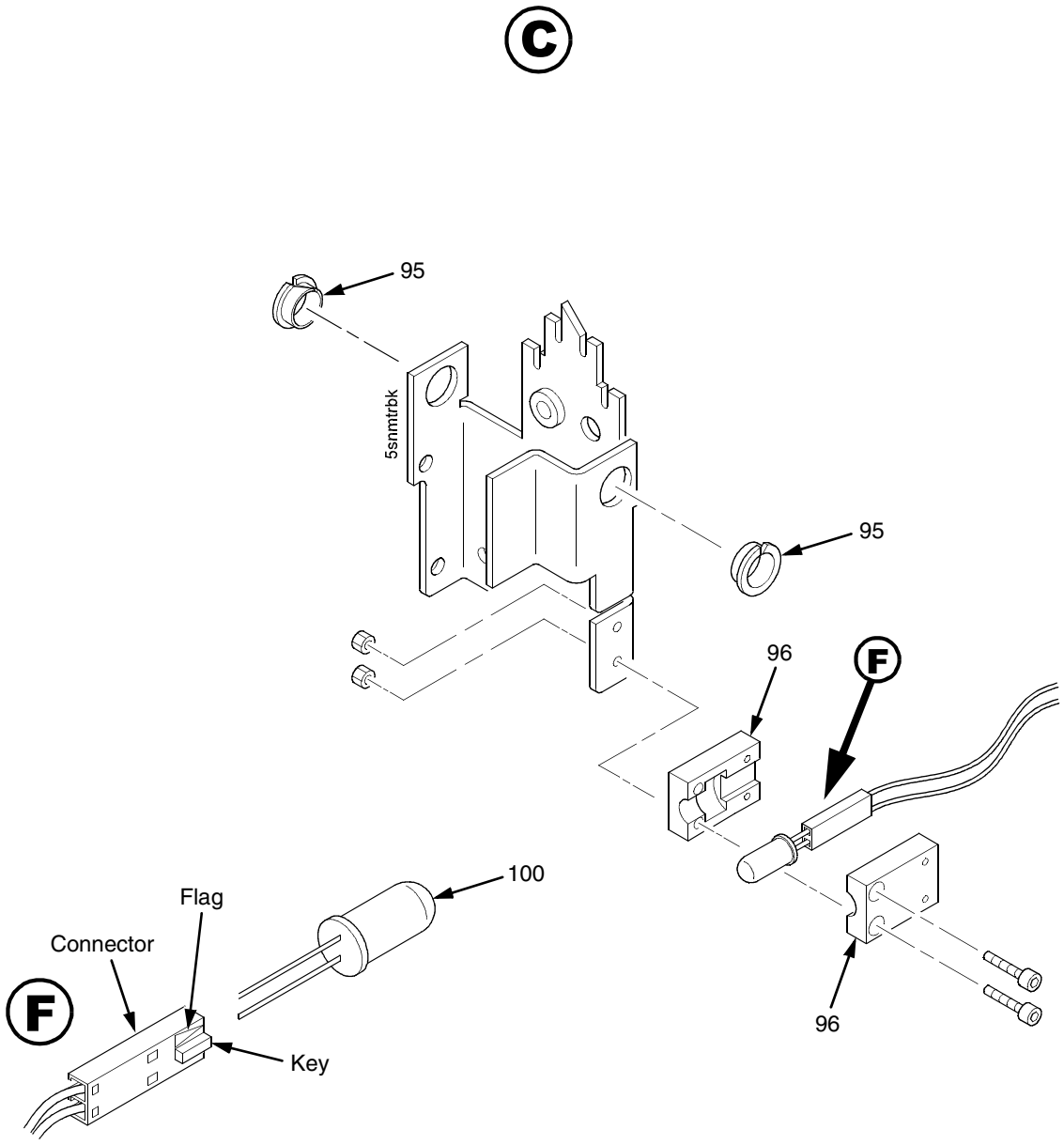


Figure 106. Stacker Detail: Motor Bracket

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

From page 406.

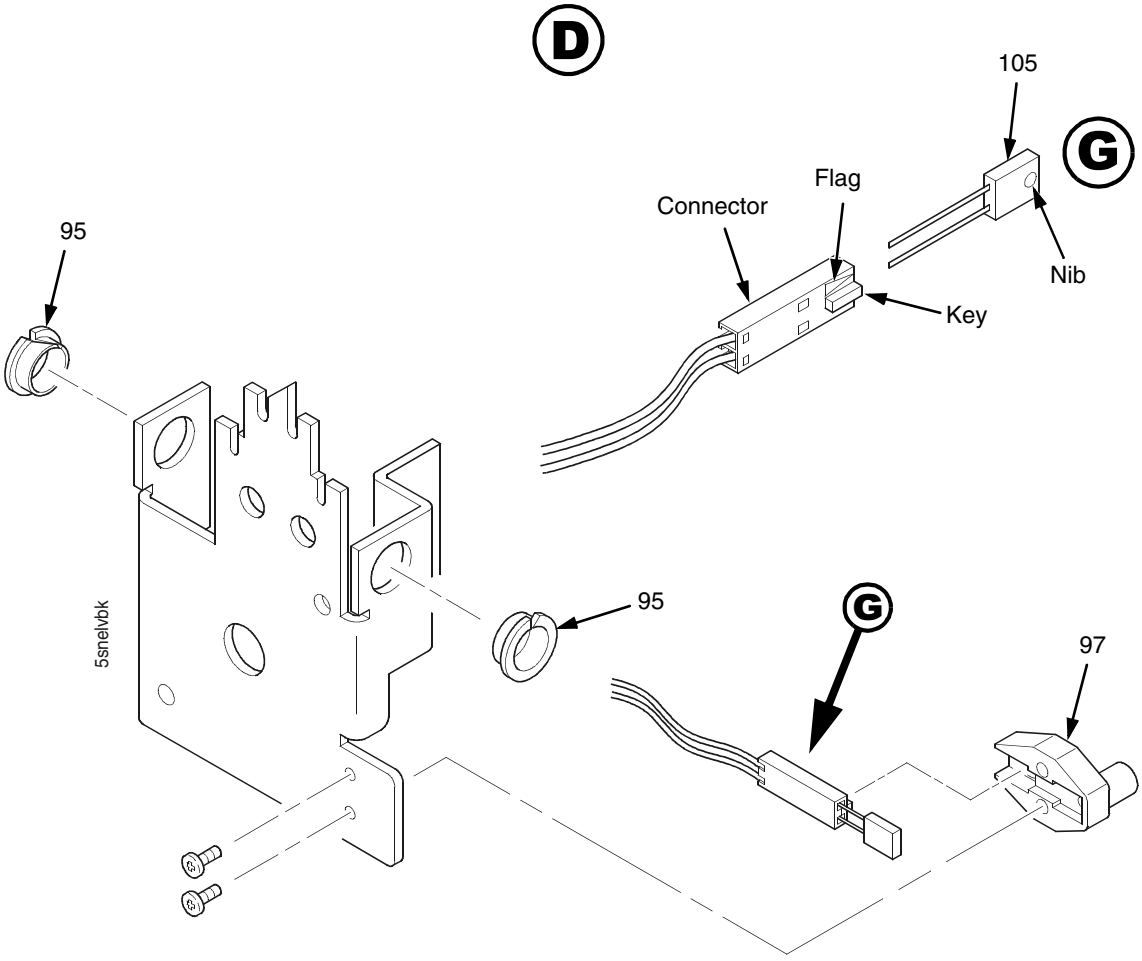


Figure 107. Stacker Detail: Elevator Bracket

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

From page 406.

E

Rotated 180 Degrees

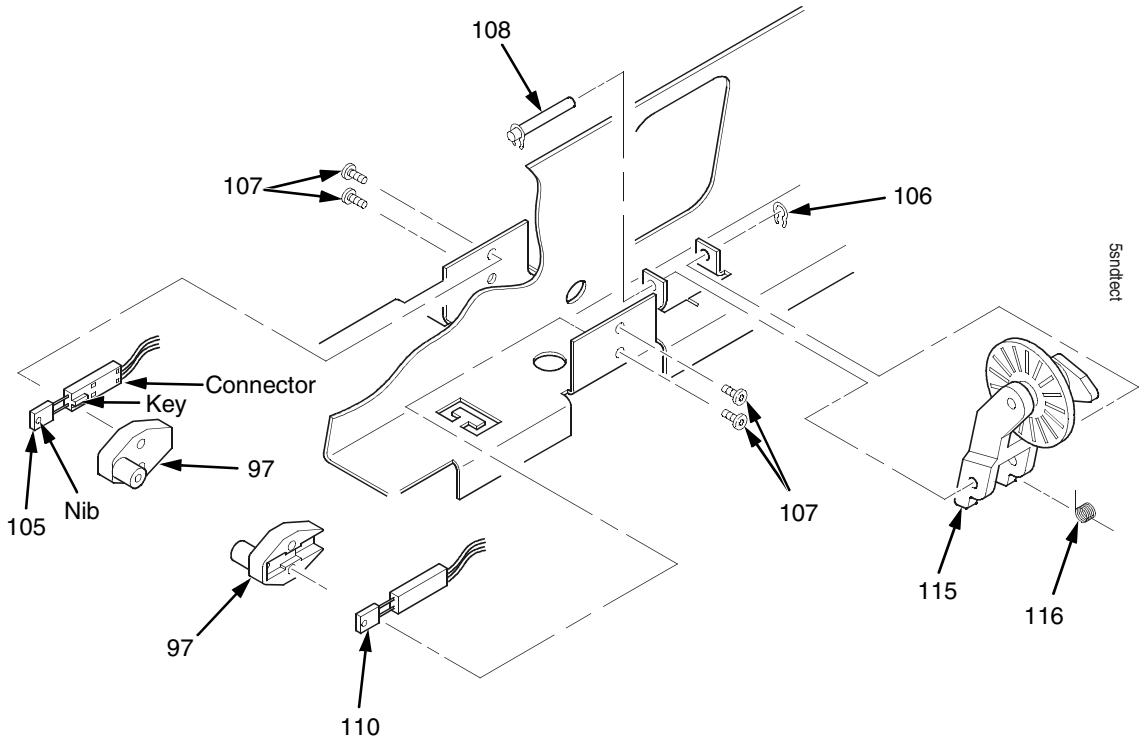


Figure 108. Stacker Detail: Paper Motion Detector

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

F *Paper Specifications And Forms Design*

Introduction

A line matrix printer permits a high degree of printing flexibility. Dot matrix technology enables the user to print graphic images, line drawn characters, special characters, and multiple alphabets.

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

The second section goes into more detail, providing definitions, guidelines, and a checklist you can use to design forms that will run smoothly through the printer.

General Paper Specifications

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

Always test paper and forms before buying large quantities. Make all measurements at 20° to 26° Celsius (68° to 78° Fahrenheit) and 45% to 55% relative humidity. The printer performs well with forms that meet the specifications listed in Table 11 and Table 12 below.

NOTE: Printronix conforms to ANSI® Standard X3.96-1983, "American National Forms Information Systems for Continuous Business Forms," and ISO Recommendation No. 2784, which cover common form widths and depths, standards for sprocket feed holes and margins, and other basic tolerances.

Table 11. Paper Sizes

Maximum Form Width	17.0 inches (43.18 cm) edge to edge
Minimum Form Width	3.0 inches (7.62 cm) edge to edge
Maximum Printing Width	13.6 inches (34.54 cm)
Maximum Right Margin	1 to 13.6 inches (2.54 to 34.54 cm)
Maximum Left Margin	0 to 13.5 inches (0 to 34.29 cm)
Maximum Form Length	16 inches (40.64 cm)
Minimum Form Length	2 inches (5.08 cm)

Table 12. Paper Weights

Single-Part Forms	
Standard	15 to 100 pound (57 to 380 gm/meter^2)
Best Print Quality	18 to 60 pound (68 to 227 gm/meter^2)
Multipart Forms	
Carbon Paper	12 pounds (46 gm/meter^2) up to 6 total pages
Carbons	8 pounds (30 gm/meter^2) up to 6 total pages
Pack Thickness	Maximum 0.025 inch (0.635 mm) total
Carbonless	Up to 4-part forms

Test the paper first if it will be used in environments with greater than 80% or less than 20% humidity. Test paper that will be used at high humidity for satisfactory feeding and handling. Test paper that will be used at low humidity to determine if static buildup must be eliminated for proper paper stacking.

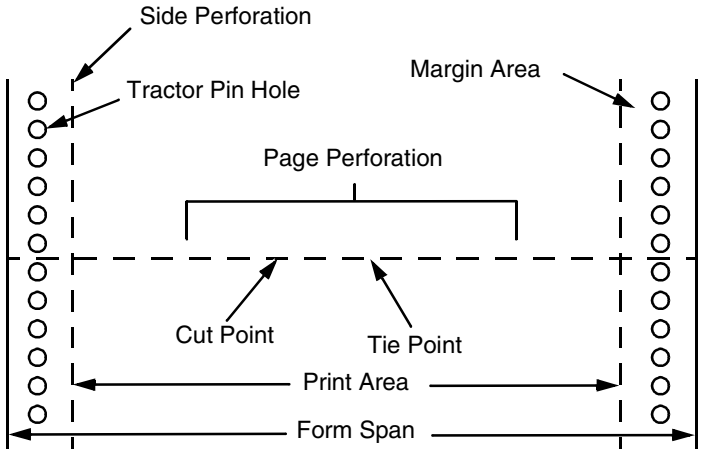
Paper Guidelines

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

Terms And Definitions

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

The figure below illustrates the terms used in this appendix.



Side View of Form

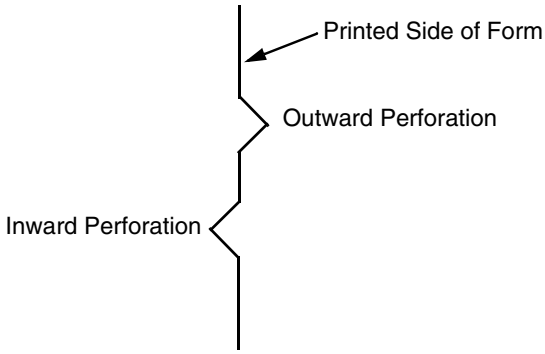


Figure 109. Basic Forms Terminology

Environmental Considerations

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

Form Types

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

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

For all forms, the width range is 3 to 17 inches, the length range is 2 to 12 inches.

Form Weight

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

Form Thickness

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

Form Evenness

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

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

Tractor Pin Engagement

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

Specification	Inches	Millimeters
Hole centerline (CL) to edge of form	0.236 ± 0.028	6.0 ± 0.10
Hole Diameter (Serrations or any occlusion due to incorrect registration of multipart forms cannot exceed this dimension.)	0.156 ± 0.004	4.0 ± 0.10
Distance between centers of two consecutive holes	0.500 ± 0.002	12.7 ± 0.05
Maximum deviation of holes from their centerline	0.004	0.10
Maximum deviation of lefthand hole to adjacent righthand hole (CL to CL)	0.006	0.15
Maximum parallel deviation of lefthand hole CL to righthand hole CL	0.006	0.15

Methods Of Forms Attachment

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

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

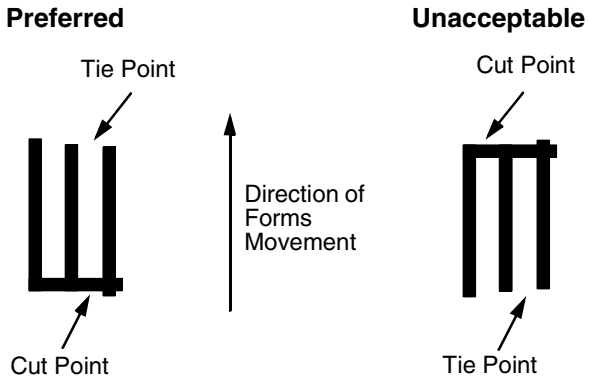
Gluing

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

Staples

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

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



Cut-To-Tie Ratio

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

Perforation Intersections

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

Chaff Content

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

Form Design Checklist

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

Environment

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

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

Type Of Form

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

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

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

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

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

Form Weight

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

Form Thickness

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

Form Evenness

The evenness of the form = _____
(Not to exceed 0.003 in. / 0.00762 cm)

Tenting due to buildup of perforation thickness must be minimized. A perforation thickness measured at the major perforation that exceeds 1.25 times the forms thickness measured in the print area will result in an unreliable and unpredictable form. Perforation thickness must not exceed the maximum form thickness of 0.025 in. / 0.0635 cm.

Tractor Pin Holes

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

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

Methods Of Forms Attachment

_____ Must not allow air entrapment between copies of the form

_____ Must not use hard brads or staples

_____ Must not coincide with major perforation or any horizontal perforation

_____ Gluing lines must not result in a form that exceeds 0.025 in. / 0.0635 cm thickness

_____ Staples must be used only in margin area of form

_____ Staple cuts must not be in the direction of form movement through the tractors

_____ Staples must not occur in-line with the path of the tractor holes

_____ Staples should be placed in the margins so that they coincide with areas of the form where printing will not occur

Cut-To-Tie Ratio

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

Thickness Buildup = _____ in. / cm

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

Perforation Intersections

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

Chaff Content

_____ Tractor holes are clear of chaff.

_____ There is no loose chaff in the box the paper is packed in.

Summary

Because it is impossible to test all possible forms available for the printer, Printronix recommends that paper conform to the specifications outlined in this appendix for the best printer performance. But the guidelines in this appendix are not a substitute for actual testing.

Always test forms—including special single-part paper, multipart forms, forms with glue strips, carbonless forms, card stock, and labels—for satisfactory feeding, registration, and print quality prior to purchase. For best results in selecting standard or specialty forms, consult a forms vendor who can ensure conformance to the guidelines in this appendix and who can recommend cost-effective purchases.

Storage And Handling

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

Packaging

To avoid damage during handling, use top and bottom fillers in continuous form cartons to hold the paper stack firmly in place. Proper packaging ensures that the paper remains flat and is not damaged along the edges.

Storage

Do not store cartons directly on the floor, and do not stack them more than six high. Set each carton upright and squarely on the one underneath. Do not place anything else on the stack of paper, as this can damage the paper.

Preconditioning Forms

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

The printer can be used at temperatures from 5° to 40° C (41° to 104° F) up to 1524 meters (5000 feet), from 5° to 32° C (41° to 90° F) up to 2438 meters (8000 feet), with a non-condensing relative humidity of 10% to 90%. For best results, however, store the printer paper at 18° to 24° C (65° to 75° F), with a relative humidity of 40% to 50%.

If the printer is in an environment subject to extremes of temperature or humidity, store the printer paper in a better environment and move it to the printer as needed.

G Maintenance Information About Other P5000 Printers

Table 13. Early P5000 Single Hammer Bank Printers: Use Maintenance Manual 164253-001

Model	Max Print Speed	Enclosure	Single Hammer Bank	Controller Board[1]
P50KA™	585 lpm	Pedestal	91 Hammers Kanji / Hanzi	25 MHz CMX
P500™	900 lpm	Pedestal	49 Hammers	25 MHz CMX
P5003H™	N/A	Pedestal	60 Hammers	40 MHz CFX
P5005™	475 lpm	Pedestal	28 Hammers	25 MHz CMX
P5005-QA™	475 lpm	Pedestal w/ Quick-Access Cover	28 Hammers	25 MHz CMX
P5005-12™	475 lpm	Pedestal	28 Hammers, 12 MIL tips	25 MHz CMX
P5005-12-QA™	475 lpm	Pedestal w/ Quick-Access Cover	28 Hammers, 12 MIL tips	25 MHz CMX
P5005A™	500 lpm	Pedestal	28 Hammers	25 MHz CMX
P5005A-QA™	500 lpm	Pedestal w/ Quick-Access Cover	28 Hammers	25 MHz CMX
P5005A-12™	500 lpm	Pedestal	28 Hammers, 12 MIL tips	25 MHz CMX
P5005A-12-QA™	500 lpm	Pedestal w/ Quick-Access Cover	28 Hammers, 12 MIL tips	25 MHz CMX

Table 13. Early P5000 Single Hammer Bank Printers: Use Maintenance Manual 164253-001

Model	Max Print Speed	Enclosure	Single Hammer Bank	Controller Board[1]
P5005B™	500 lpm	Pedestal	28 Hammers	40 MHz CMX
P5005B-QA™	500 lpm	Pedestal w/ Quick-Access Cover	28 Hammers	40 MHz CMX
P5005B-12™	500 lpm	Pedestal	28 Hammers, 12 MIL tips	40 MHz CMX
P5005B-12-QA™	500 lpm	Pedestal w/ Quick-Access Cover	28 Hammers, 12 MIL tips	40 MHz CMX
P5006H™	N/A	Pedestal	102 Hammers	40 MH CFX
P5008™	800 lpm	Pedestal	49 Hammers	25 MHz CMX
P5008-QA™	800 lpm	Pedestal w/ Quick-Access Cover	49 Hammers	25 MHz CMX
P5009-QA™	900 lpm	Pedestal w/ Quick-Access Cover	49 Hammers	25 MHz CMX
P5010™	1000 lpm	Pedestal	60 Hammers	40 MHz CMX
P5010-QA™	1000 lpm	Pedestal w/ Quick-Access Cover	60 Hammers	40 MHz CMX
P5015™	1500 lpm	Pedestal	102 Hammers	40 MHz CMX
P5015-QA™	1500 lpm	Pedestal w/ Quick-Access Cover	102 Hammers	40 MHz CMX
P51KA™	585 lpm	Table Top	91 Hammers Kanji / Hanzi	25 MHz CMX
P52KA™	585 lpm	Cabinet	91 Hammers Kanji / Hanzi	40 MHz CMX
P5203H™	N/A	Cabinet	60 Hammers	40 MHz CFX
P5205™	475 lpm	Cabinet	28 Hammers	25 MHz CMX
P5205-12™	475 lpm	Cabinet	28 Hammers, 12 MIL tips	25 MHz CMX
P5205A™	500 lpm	Cabinet	28 Hammers	25 MHz CMX

Table 13. Early P5000 Single Hammer Bank Printers: Use Maintenance Manual 164253-001

Model	Max Print Speed	Enclosure	Single Hammer Bank	Controller Board[1]
P5205A-12™	500 lpm	Cabinet	28 Hammers, 12 MIL tips	25 MHz CMX
P5205B™	500 lpm	Cabinet	28 Hammers	40 MHz CMX
P5205B-12™	500 lpm	Cabinet	49 Hammers, 12 MIL tips	40 MHz CMX
P5206H™	N/A	Cabinet	102 Hammers	40 MHz CFX
P5208™	800 lpm	Cabinet	49 Hammers	25 MHz CMX
P5209™	900 lpm	Cabinet	49 Hammers	25 MHz CMX
P5210™	1000 lpm	Cabinet	60 Hammers	40 MHz CMX
P5212™	1200 lpm	Cabinet	91 Hammers	25 MHz CMX
P5214™	1400 lpm	Cabinet	91 Hammers	40 MHz CMX
P5214-SS™	1400 lpm	Cabinet w/SureStak Paper Stacker	91 Hammers	40 MHz CMX
P5215™	1500 lpm	Cabinet	102 Hammers	40 MHz CMX
P5215-SS™	1500 lpm	Cabinet w/SureStak Paper Stacker	102 Hammers	40 MHz CMX

[1] The 40 MHz CMX controller board is also compatible with earlier models that use the 25 MHz CMX board and should be used if the CMX board is replaced in one of these earlier models. The CFX, V1, controller board was used only in early models P5003H, P5203H, P5006H, and P5206H.

Table 14. Later P5000 Single Hammer Bank Printers (The "P5B/10/15" Line): Use Maintenance Manual 175455-001

Model	Maximum Print Speed	Enclosure	Hammer Bank	Controller Board[1]
P5003H™	N/A	Pedestal	60 Hammers	40 MHz CFX
P5005B™	500 lpm	Pedestal	28 Hammers	40 MHz CMX
P5005B-QA™	500 lpm	Pedestal w/Quick-Access Cover	28 Hammers	40 MHz CMX
P5005B-12™	500 lpm	Pedestal	28 Hammers, 12 MIL tips	40 MHz CMX
P5005B-12-QA™	500 lpm	Pedestal w/Quick-Access Cover	28 Hammers, 12 MIL tips	40 MHz CMX
P5006H™	N/A	Pedestal	102 Hammers	40 MH CFX
P5010™	1000 lpm	Pedestal	60 Hammers	40 MHz CMX
P5010-QA™	1000 lpm	Pedestal w/Quick-Access Cover	60 Hammers	40 MHz CMX
P5015™	1500 lpm	Pedestal	102 Hammers	40 MHz CMX
P5015-QA™	1500 lpm	Pedestal w/Quick-Access Cover	102 Hammers	40 MHz CMX
P5203H™	N/A	Cabinet	60 Hammers	40 MHz CFX
P5205B™	500 lpm	Cabinet	28 Hammers	40 MHz CMX
P5205B-12™	500 lpm	Cabinet	49 Hammers, 12 MIL tips	40 MHz CMX
P5206H™	N/A	Cabinet	102 Hammers	40 MHz CFX
P5210™	1000 lpm	Cabinet	60 Hammers	40 MHz CMX
P5215™	1500 lpm	Cabinet	102 Hammers	40 MHz CMX
P5215-SS™	1500 lpm	Cabinet w/SureStak Paper Stacker	102 Hammers	40 MHz CMX

[1] The 40 MHz CMX controller board is compatible with all PSA P5XXX printers except the P5220S and H-Series (which use the CFX controller board) and printers that use the PSA3 controller board. The 40 MHz CFX, V3, controller board was used in PSA models P5003H, P5203H, P5006H, and P5206H until the H-Series line expanded and upgraded to the PSA3 controller board.

Table 15. P5000 PSA3 Single Hammer Bank Printers: Use Maintenance Manual 176475-001

Model	Maximum Print Speed	Printer Enclosure	Hammer Bank	Controller Board[1]
P5003H™	340 lpm	Pedestal	60 Hammers	PSA3
P5203H™	340 lpm	Cabinet	60 Hammers	PSA3
P5006H™	600 lpm	Pedestal	102 Hammers	PSA3
P5206H™	600 lpm	Cabinet	102 Hammers	PSA3
P5008H™	750 lpm	Pedestal	126 Hammers	PSA3
P5208H™	750 lpm	Cabinet	126 Hammers	PSA3
P5220S™	2000 lpm	Cabinet	126 Hammers	PSA3
P5220S-SS™	2000 lpm	Cabinet w/SureStak Paper Stacker	126 Hammers	PSA3
[1] The PSA3 controller board is the only controller board that can be used in these printers. Printers that use the PSA3 board cannot use the CMX or CFX controller boards.				

Table 16. Dual Hammer Bank Printers: Use This Maintenance Manual

Model	Maximum Print Speed	Printer Enclosure	Hammer Bank	Controller Board[1]
P5220D™	2000 lpm	Cabinet	156 Hammers	CFX
P5220D-SS™	2000 lpm	Cabinet w/SureStak Paper Stacker	156 Hammers	CFX
P5224D™	2400 lpm	Cabinet	156 Hammers	PSA3
P5224D-SS™	2400 lpm	Cabinet w/SureStak Paper Stacker	156 Hammers	PSA3
[1] The controller boards are not interchangeable in these printers. The PSA3 and CFX controller boards and their respective card cages differ in physical dimensions and design.				

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For technical assistance, contact your Distributor/VAR/Reseller for service.

For further assistance, contact the Printronix Customer Support Center.

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