



6400i Line Matrix Printers

Form No. G544-5864-01

Models 6400-i05, -i5P, -i10, -i1P, -i15, -i20, -i24, and -i2s

Maintenance Information Manual

Note!

Before using this information and the product it supports, read the information in “Notices” on page 10.

Second Edition (July 2003)

This edition applies to the IBM 6400-i Line Matrix Printer.

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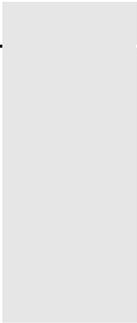


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This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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WARNING

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Cet appareil numérique de la classe A conform à la norme NMB-003 du Canada.

Statement of CISPR 22 Edition 2 Compliance

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在这种情况下, 可能需要用户对其
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Anmerkung:

Um die Einhaltung des EMVG sicherzustellen sind die Geräte, wie in den Handbüchern angegeben, zu installieren und zu betreiben.

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Warning: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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(Auszug aus dem EMVG vom 9.Nov.92, Para.3, Abs.4)

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The printers are inspected and listed by recognized national testing laboratories: Underwriters Laboratories, Inc. (UL**) in the U.S.A., Canadian Standards Association (CSA**) in Canada, and TUV Rheinland. Listing of a product by a national testing laboratory indicates that the product is designed and manufactured in accordance with national requirements intended to minimize safety hazards. Remember, however, that this product operates under conditions of high electrical potentials and heat generation, both of which are functionally necessary.

Lightning Safety

To avoid personal risk, do not install or reconfigure a communication port or a teleport during a lightning storm.

Safety And Notices

For your safety and to protect valuable equipment, it is very important that you read and comply with all information highlighted under notes and notices:



<#> This symbol indicates the presence of a hazard that could cause death or serious injury. Danger and Caution notices are numbered to help you find the translated versions in the *IBM 6400 Safety Notices* booklet.



<#> This symbol indicates the presence of a hazard that could cause moderate or minor injury.



<#> This symbol indicates a heavy assembly that requires two or more persons to lift or hold.



<#> This symbol indicates a part or assembly that is hot enough to burn you.



<#> This symbol indicates a part or assembly that is sharp enough to cut you.

ATTENTION

“Attention” indicates the possibility of damage to a program, device, system, or data.

IMPORTANT

“Important” indicates information vital to proper operation of the printer.

NOTE: A note gives you helpful information and tips about printer operation and maintenance.

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EIA	Electronic Industries Association
Energy Star	United States Environmental Protection Agency
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IGP	Printronix, Inc.
LinePrinter Plus	Printronix, Inc.
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Torx	Camcar/Textron Inc.
UL	Underwriter's Laboratories, Inc.
Windows	Microsoft Corporation

Safety Inspection

Safety devices to protect customers, operators, and service personnel from injury are installed in all IBM printers. Use this inspection guide as an aid in identifying possible unsafe conditions in a 6400 series printer.

Do the inspection steps outlined in this section before the normal inspection for Maintenance Agreement Qualification, or any time you are instructed to make a safety inspection.

If you find any unsafe conditions, determine the severity of the hazard and whether or not you can continue the inspection without first correcting the problem.

IMPORTANT The correction of any unsafe condition is the customer's responsibility.

Preparation

You must have completed the "CE Basic Electricity" training course (self-study course number BOPS08XS or current level) to do the Safety Inspection.

Have the following items available:

- *Electrical Safety for IBM Customer Engineers*, Order No. S229-8124.
- A Fluke** meter (P/N 8496278) or similar device for measuring electrical resistance and voltage.
- An ECOS** Electrical Safety Tester (P/N 6339695) in the United States or a similar safety tester in other countries.

For each safety check on the following pages, do the steps in the order presented. Do not omit any steps.

Prepare The Printer For Inspection

To prepare the printer for a safety inspection, read the safety notices below, then do all the steps that follow.



- | | |
|------------------|---|
| <3> | Hazardous voltages are present in the printer with the power cord connected to the power source. Switch off printer power and unplug the printer power cord before proceeding. |
| <4> | Do not connect or disconnect any communication port, teleport, attachment connector, or power cord during an electrical storm. |
| <5> | Power off the printer and disconnect the power cord <i>before</i> connecting or disconnecting a communication port, teleport, or attachment cable connector. |

1. Have the operator take the printer off-line.
2. Power off the printer.
3. Unplug the printer power cord from the customer's power outlet.

Inspect Mechanical Parts

Top Cover And Cabinet Doors

1. Inspect the top cover:
 - a. Open the top cover. On cabinet models, make sure the gas spring assembly holds the cover up in the open position.
 - b. Make sure the window is not cracked or broken.
 - c. Make sure the seal around the top cover is not cracked or broken.
 - d. Make sure there are no exposed sharp edges.
 - e. Make sure the wireform paper guide assembly is undamaged.
 - f. Make sure the electrostatic discharge (ESD) fingers are not loose or damaged. Make sure they touch the contact strips on the frame when the cover is closed.
 - g. Close the top cover. Make sure the operator panel is centered in the opening of the cover.
2. On cabinet models, inspect the front and rear cabinet doors:
 - a. Make sure the seals and magnetic strips are not loose or damaged.
 - b. Make sure the restraining cable is attached and unbroken.
 - c. Make sure there are no exposed sharp edges.
 - d. Open the rear cabinet door and inspect the lower rear paper path for the following:
Make sure the paper stacker tray assembly or optional power stacker is in place and undamaged.

Print Mechanism

1. Open the printer top cover.
2. Make sure the shuttle cover is correctly installed and undamaged. (See page 357.)
3. Make sure the paper guide assembly is correctly installed and undamaged. (See page 391.)

Inspect Electrical Parts

Safety Ground Path

1. Make sure the printer power cord is unplugged.
2. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
3. Make sure the ground cable from the circuit breaker power leads is undamaged and firmly attached to the ground lug on the wall of the card cage, as shown in Figure 1.

NOTE: Ground paths for the printer are summarized in Figure 2 and Figure 3.

NOTE: The card cage fan and power supply board are removed here for clarity.

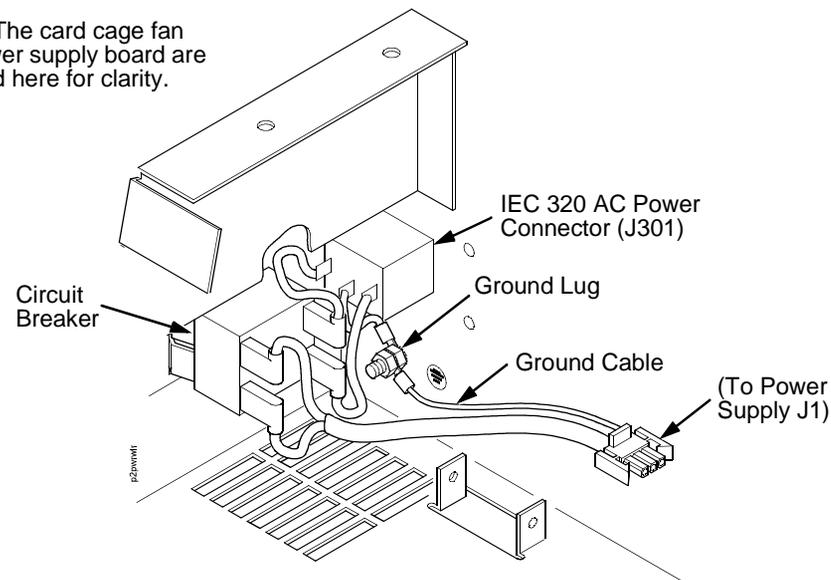


Figure 1. Detail showing the ground lug for the circuit breaker of cabinet models.

4. Set a Fluke meter (P/N 8496278) or similar device to the lowest resistance scale. Measure the resistance between the power cable ground pin and the printer frame: safety ground circuits should measure 0.1 Ohm or less.
5. Cabinet Model: Install the paper guide assembly (page 391).
Pedestal Model: Install the top cover assembly (page 358).

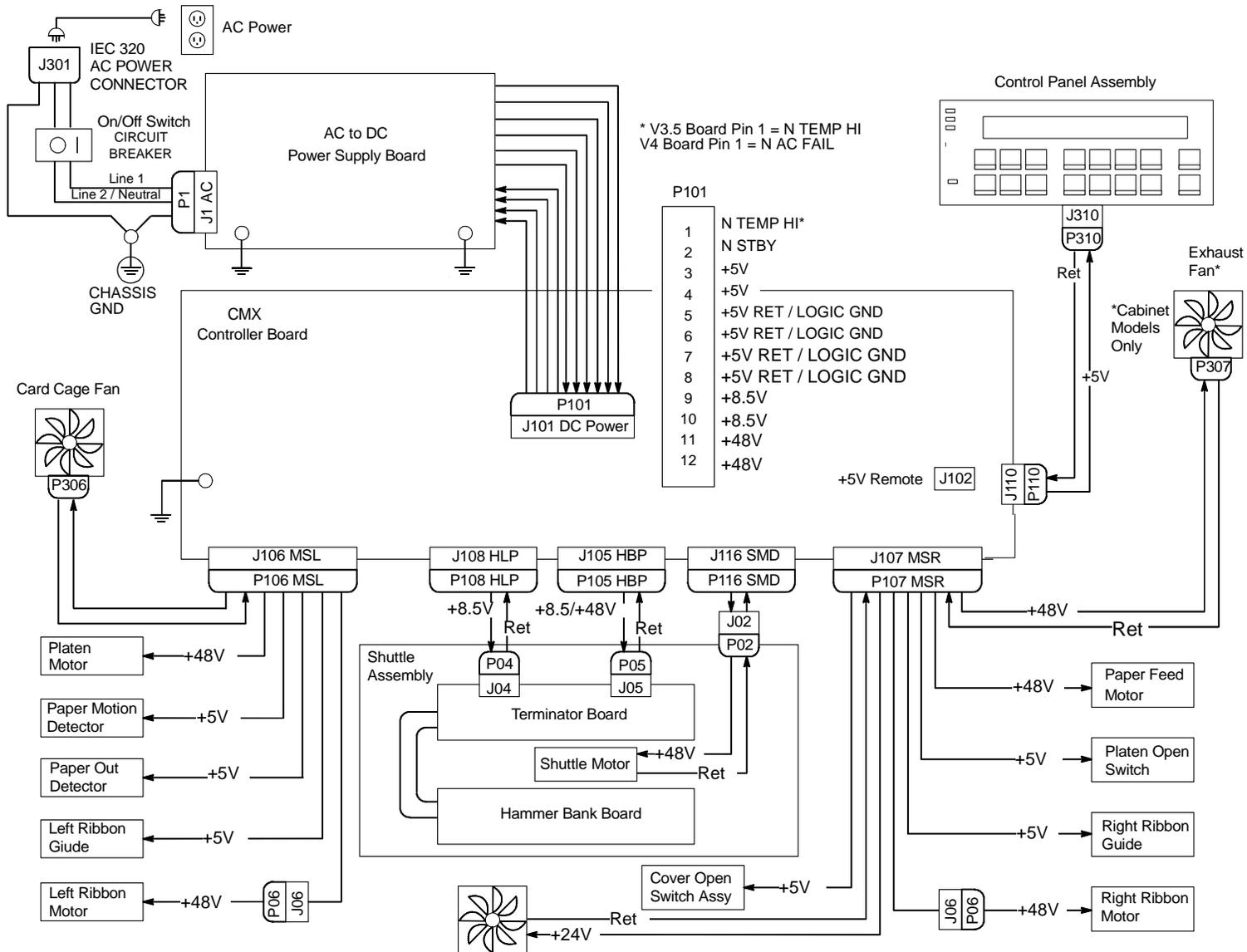


Figure 2. Ground Path Diagram for All Models Except 6400-i20, -i2s, and -i24.

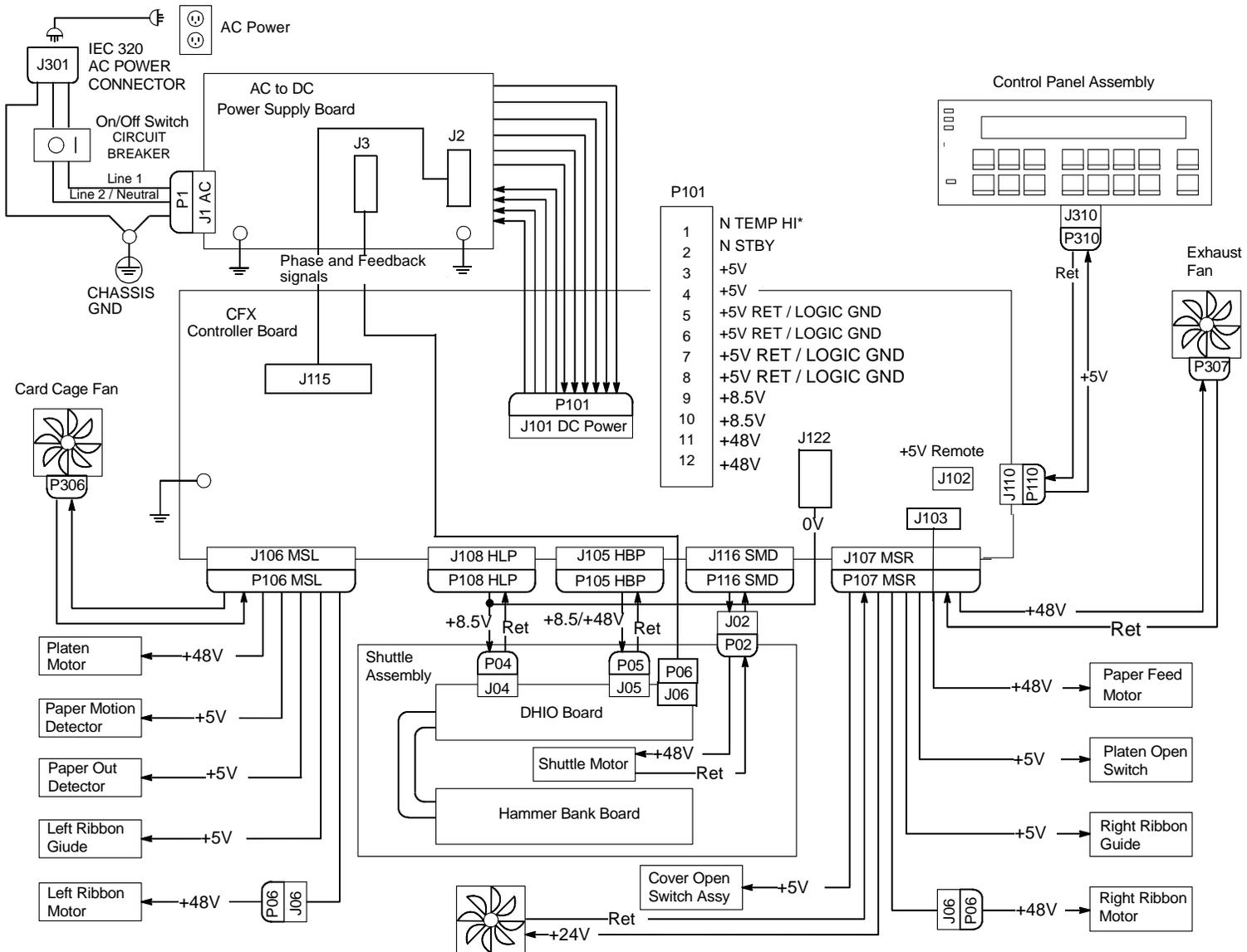


Figure 3. Ground Path Diagram for 6400-i20 model printer.

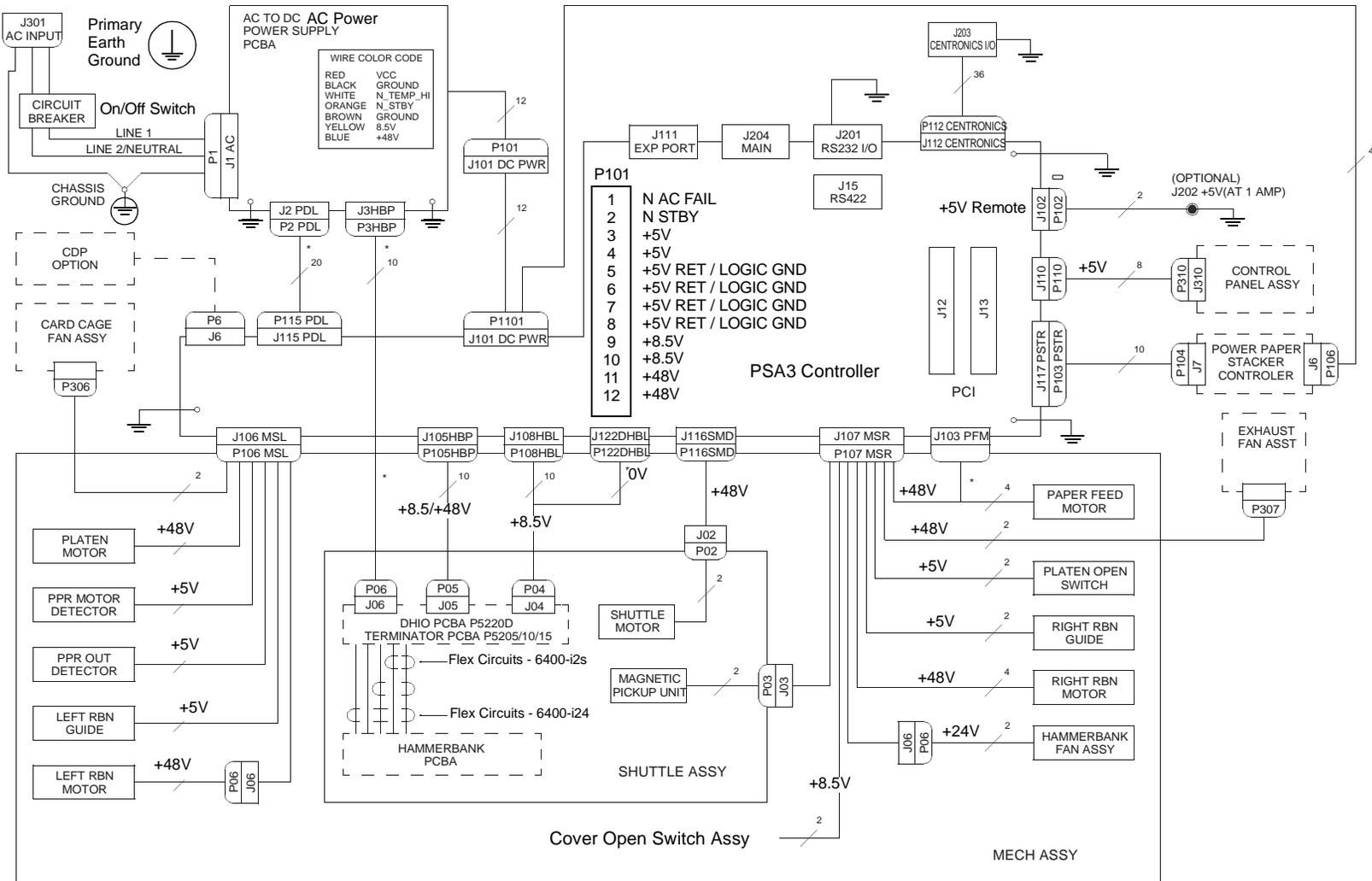


Figure 4. Ground Path Diagram for 6400-i24, -i2s models.

Customer Power Source Service Check

Use an ECOS Electrical Safety Tester (P/N 6339695) in the United States or a similar safety tester in other countries.

NOTE: The ECOS tester will trip ground fault detector protected outlets. This is a good test of the ground fault detector. Reset the outlet as needed.

Plug the ECOS meter into the customer's outlet. Follow the instructions supplied with the meter to test for the following:

- Wiring errors
- Low voltage
- Neutral to ground short
- Ground path impedance
- Neutral impedance

NOTE: The customer is responsible for correcting problems with the power source.

Each branch circuit must be grounded for safety and correct operation of the printer. This ground must be connected either to the electrical service ground or to a suitable building ground. The printer power cable has a green or green/yellow insulated grounding conductor. This is a ground line, *not* a neutral line.

Power Cable

1. Make sure the power cable is not damaged.
2. Make sure the power plug is the correct type.

Power On / Off Verification

1. Make sure all covers are installed.
2. Plug the power cable into the customer's power outlet.
3. Power on the printer and watch the LCD.
4. Verify that the power-on diagnostic tests and initialization routines are successful.
5. After successful initialization, the printer should cycle automatically to either the READY or NOT READY mode, depending on which power on state was selected when the printer was configured.
6. Power off the printer. Verify that the LCD goes completely blank and all fans stop.

Print Interlock Service Check

1. Power on the printer.
2. Open the printer top cover.
3. Open the forms thickness lever. The LCD should display "057 CLOSE PLATEN" and the audible alarm should sound if it is enabled.
4. Press **Stop**. The audible alarm should stop.
5. Close the forms thickness lever. The fault message should clear.

Preface

This publication explains how to maintain and repair IBM 6400-i line matrix printers.

THIS MANUAL IS INTENDED FOR USE BY TRAINED SERVICE PERSONNEL ONLY.

About This Manual

This is a field service maintenance manual for IBM 6400-i line matrix printers. Refer to the Table of Contents or the Index to locate the maintenance information you need.

How To Replace Parts

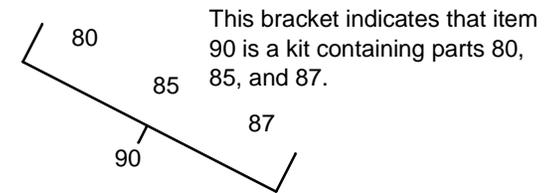
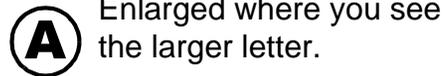
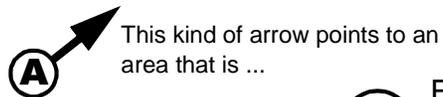
1. Go to Removals and Adjustments on page 336.
2. Find the removal procedure for the part you want to replace.
3. Read the entire procedure *before* you do the procedure. This is important for two reasons:
 - Notes and notices provide important information. (Notices are defined on page 17.)
 - There are different models in the 6400-i family; procedures and parts can differ depending on the model.
4. Gather the tools you will need.
5. Do the procedure.

How To Order Parts

Go to the Parts Catalog on page 436, which contains drawings of all printer assemblies. Locate the part you need. Following each illustration is a list of the parts shown and their part numbers.

When locating parts, note the following:

- If a part number is listed you can order that part or assembly. If a component is part of a field kit, order the kit.
- Parts marked “Ref” (reference) are not spared or are part of another assembly.
- Part numbers are not listed for common fasteners.
- Look for the following features in the illustrations:



Printing Conventions In This Manual

Operator panel keys and LCD messages are set off from regular text in this manual:

- Operator panel keys and indicators are printed **boldface**.
Example: Press the **Cancel** key, then press the **Start** key.
- Liquid Crystal Display (LCD) messages are printed in capital letters inside quotation marks (“ ”).
Example: Press the **Stop** key. “NOT READY” appears on the LCD.
- Key combinations are denoted by the + (plus) symbol.
Example: Press **Scroll** ↑ + **Scroll** ↓
means *Press the Scroll* ↑ *key and the Scroll* ↓ *key at the same time.*

Related Documents

This manual does not explain how to configure and operate the printer, or how to program application software for operation with the printer. That information is in the following manuals:

Manual	Form Number or Part Number
IBM 6400-i Line Matrix Printer Operator's Guide, English	S544-5641-02
IBM 6400-i Line Matrix Printer Setup Guide, English	S544-5640-03
IBM 6400 ANSI Programmer's Reference	S544-5681
IBM 6400 ASCII Programmer's Reference	S544-5635
IBM 6400 CTA Programmer's Reference	S544-5636
IBM 6400 IPDS Programmer's Reference	S544-5637
IBM 6400 Code V User's Manual	S544-5638
IBM 6400 IGP User's Manual	S544-5639
Print Server User's Guide	30H4056
Ethernet Interface User's Manual	S544-5830

About The Printer

The entire system architecture of an IBM 6400-i line matrix printer is contained on a single controller board. The use of SDRAM, flash memory, and PCI expansion slots on the controller board permits rapid access to stored printer emulations and fast processing of print data. A variable-speed shuttle and half-step paper control enables the printer to print a wide variety of high-volume jobs with minimum maintenance and maximum reliability.

IBM 6400-i printers are excellent graphics printers, with optional features that simplify the creation of dot images. The IGP** and Code V** Printronix** emulations are simple but versatile graphics programming languages that load into flash memory.

Although technologically advanced, a 6400-i printer is easy to use. The operator can select every printer function at the control panel or by sending printer control codes in the data stream from the host computer.

The IBM 6400-i Series Printer Family

The IBM 6400-i line matrix printer family consists of pedestal mount and floor cabinet models that print at the speeds shown in Table 2 on page 31. The print speeds listed in Table 2 are the maximum attainable under controlled test conditions. Actual print speed is determined by the interaction of many variables.

The IBM 6400-i05, -i5P, -i10, -i1P, and -i15 models have redesigned shuttle components, tractors, and ribbon hubs. These models have the serial numbers shown in Table 1. The 6400-i05, -i5P, -i10, -i1P, and -i15 printers use the CMX controller board.

Some early 6400-i05, -i5P, -i10, -i1P, and -i15 models have an older tractor shaft design which includes a horizontal adjustment knob (see page 38). Where appropriate throughout this manual, these printers will be referred to as “early” 6400-i05, -i10, and -i15 models. These early models have the serial numbers below the new serial number sequences shown in Table 1.

The IBM 6400-i20 printer looks similar to other 6400 i-cabinet models, but contains a number of unique parts: a dual-hammer-bank shuttle frame assembly, platen, ribbon, ribbon hubs, tractors, tractor shafts, a CFX controller board, a unique power supply, new logic and control cables for the hammer bank, a redesigned hammer bank fan, new motors, and interior hardware to allow for faster operation and better cooling.

The new IBM 6400-i24 and 6400-i2s take this evolution even further. The 6400-i24 features a dual hammer bank and the all-new PSA3 controller board, which uses faster memory, streamlined architecture, and PCI expansion slots, permitting a top speed of 2400 lines per minute. The 6400-i2s is a single hammer bank printer that makes use of the new PSA3 controller for a top speed of 2000 lines per minute. These new printers have a redesigned card cage and input/output ports, so the PSA3 controller and associated electronic components are not compatible with earlier 6400-i printers.

IMPORTANT When replacing components, be careful to order the correct spares for the model you are servicing.

Table 1. Serial Number Sequences for 6400-i05, -i5P, -i10, -i1P, and -i15 Printers

Models	Shipped from Irvine, CA, USA	Shipped from Singapore with Standard Power Supply (Most AP Countries)	Shipped from Singapore with PFC Power Supply (Japan and EMEA)
6400-i05, -i10, -i15 (Cabinet)	01PAXXX	01TAXXX	01QAXXX
6400-i5P and -i1P (Pedestal)	01GAXXX	01FAXXX	01RAXXX
Note: For the double-alpha ranges, the second alpha will become the next available letter except E, I, J, O, Q, S, and U.			

Table 2. The IBM 6400-i Series Printer Family

Model Number	Print Speed in Draft Mode	Enclosure	Hammer Bank	Controller Board
6400-i05	500 lpm	Cabinet	28 Hammers	CMX
6400-i5P	500 lpm	Pedestal	28 Hammers	CMX
6400-i10	1000 lpm	Cabinet	60 Hammers	CMX
6400-i1P	1000 lpm	Pedestal	60 Hammers	CMX
6400-i15	1500 lpm	Cabinet	102 Hammers	CMX
6400-i20	2000 lpm	Cabinet	156 Hammers	CFX
6400-i2s	2000 lpm	Cabinet	126 Hammers	PSA3
6400-i24	2400 lpm	Cabinet	156 Hammers	PSA3

How To Identify The Printer

The model number of the printer indicates the printer family, speed, and type of enclosure. (See Figure 5.)

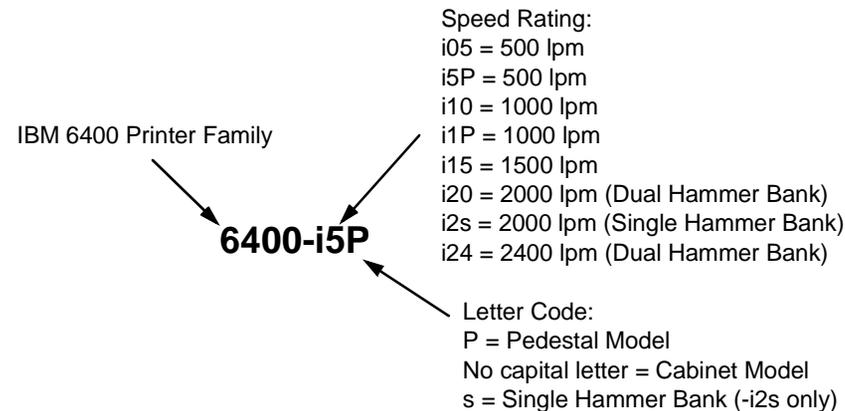


Figure 5. How to Interpret Model Numbers.

Important Maintenance Notes

To ensure the best performance of the printer, remember these important maintenance concepts when you service the printer.

ATTENTION

Failure to observe the guidelines below can result in damage to the equipment.

- Do not adjust the platen gap unless the original shuttle frame assembly or platen has been replaced with a new or rebuilt unit, or unless you are instructed to do so in the troubleshooting chapter.
- Never bend or “tweak” hammer springs.
- Always handle the hammer springs by the thick mounting base. The hammer springs are precisely aligned and the hammer tips are delicate.
- Stress to the customer the importance of using only the genuine IBM ribbons specified in the *Operator’s Guide*. Use of low quality ribbons often leads to ink migration problems, degraded print quality, and expensive damage to the printer—problems that do not occur if the correct ribbons are used.
- 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.

Controls And Indicators

Electrical Controls: For Cabinet Models see Figure 6; For Pedestal Models see Figure 7

Key or Indicator	Function
Power Indicator	Lit when the printer is on.
Ready Indicator	Lit when the printer is in READY mode (on-line), no errors are pending, and the printer is ready to process data. Off when the printer is in NOT READY mode (off-line).
Processing Indicator	Flashes when the printer is receiving data from the host.
Attention Indicator	Flashes when an error occurs. After correcting the error, press Stop to turn off this LED.
Power Switch	Applies AC power to the printer: (1 = on, 0 = off.) This switch is also a circuit breaker.
LCD	The LCD (Liquid Crystal Display) displays printer status messages.
Start	Puts the printer in the READY (on-line) mode. This key also clears fault conditions, exits program mode menus, moves paper back to print position after View is pressed, and restores print position after an eject.
Stop	Puts the printer in the NOT READY (off-line) mode. This key also silences the audible alarm, stops a Printer Test, and restores after an eject. Stop + Enter resets the printer.
Form Feed	Advances paper to next Top-Of-Form, as defined by the current page length.
Set Top Of Form	Sets Top-Of-Form and moves paper downward from the tractor alignment notches to the print position.
Line Feed	Moves paper up one line, as determined by current line spacing.
View	Press to move the current print position up to the tractor area for viewing. Press again to return paper to original print position.
Cancel	Cancels a print job.
Eject / Restore	Moves paper for viewing or tear-off. This key is configurable: refer to the <i>Operator's Guide</i> .

Key or Indicator	Function
Menu	If in the NOT READY mode, this key puts the printer in the PROGRAM mode. If the configuration menus are locked, the LCD indicates the operator panel is locked.
Enter	Selects the option displayed on the LCD. This action either sets a value, moves to the next lower level of configuration, or starts a self-test. Stop + Enter resets the printer.
Return	Returns to the next higher level of a configuration menu.
Micro ↑	In the NOT READY mode, moves the paper upward 1/72 inch ("micro-step" function).
Micro ↓	In the NOT READY mode, moves the paper downward 1/72 inch ("micro-step" function).
Scroll ↑	In the PROGRAM mode, this key moves to the next menu ("Scroll" function).
Scroll ↓	In the PROGRAM mode, this key moves to the previous menu ("Scroll" function).
Printer Configuration	Prints the current configuration.
Stop + Enter	Soft reset: load power on configuration in memory. Printer must be in NOT READY mode.
Scroll ↑ + Scroll ↓	Toggles the lock on the configuration menus.

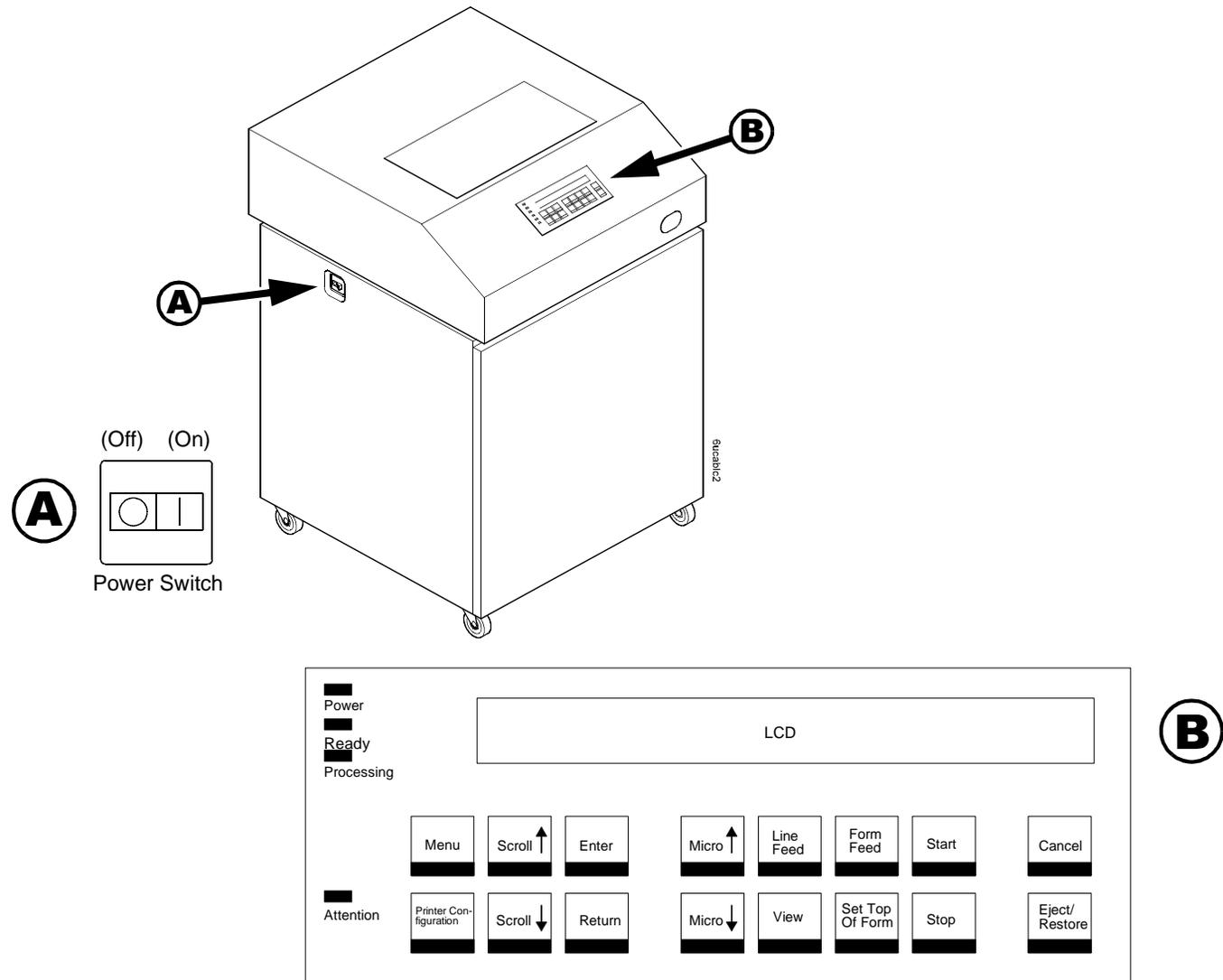


Figure 6. This figure shows the locations of the electrical controls on cabinet models.

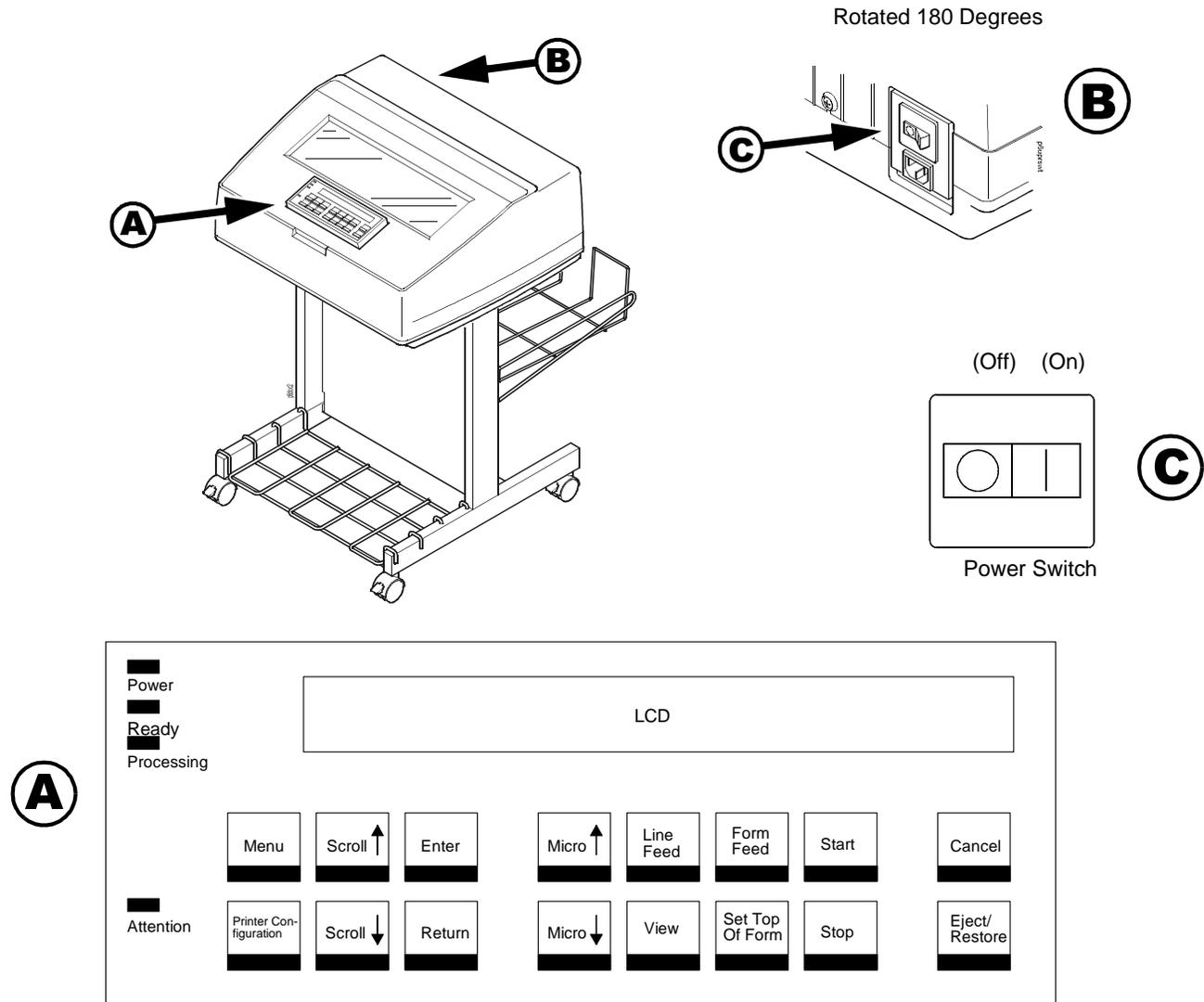
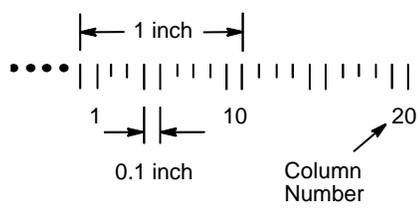


Figure 7. This figure shows the locations of the electrical controls on pedestal models.

Mechanical Controls: Figure 8 and Figure 9

Control or Indicator	Function
Forms Thickness Lever	Sets the platen for paper and forms of different thicknesses. Lever must be fully opened (raised) to load or unload paper.
Paper Supports	Help prevent paper jams by supporting the paper between the tractors. The supports are positioned manually by sliding them along the tractor shafts.
Forms Thickness Pointer and Scale	Indicates relative thickness of forms and paper. Set this lever at A for thin (single-part) forms, B for thicker forms, and so on.
Tractors (2)	Hold and feed paper. Used to set side margin and position paper horizontally.
Tractor Locks (2)	Lock tractors in position.
Horizontal Adjustment Knob	Allows fine positioning of left print margin. Moves paper and tractors left or right. This knob is not on newer models.
Vertical Position Knob	Used to set top of form or first line to be printed. Rotate this knob to move paper vertically. Works when forms thickness lever is open.
Ribbon Loading Path Diagrams	Instructions showing how to load the ribbon correctly. One diagram is cast in relief on the shuttle cover, and another is printed on the paper scale.
Paper Scale	<p>A horizontal scale graduated in tenths of an inch, useful for setting paper margins counting text columns. (See below.)</p> 

Note: 6400-i20, -i2s, -i24, and newer 6400-i05, -i10, -i15 models do not have the horizontal adjustment knob. (See Figure 9.)

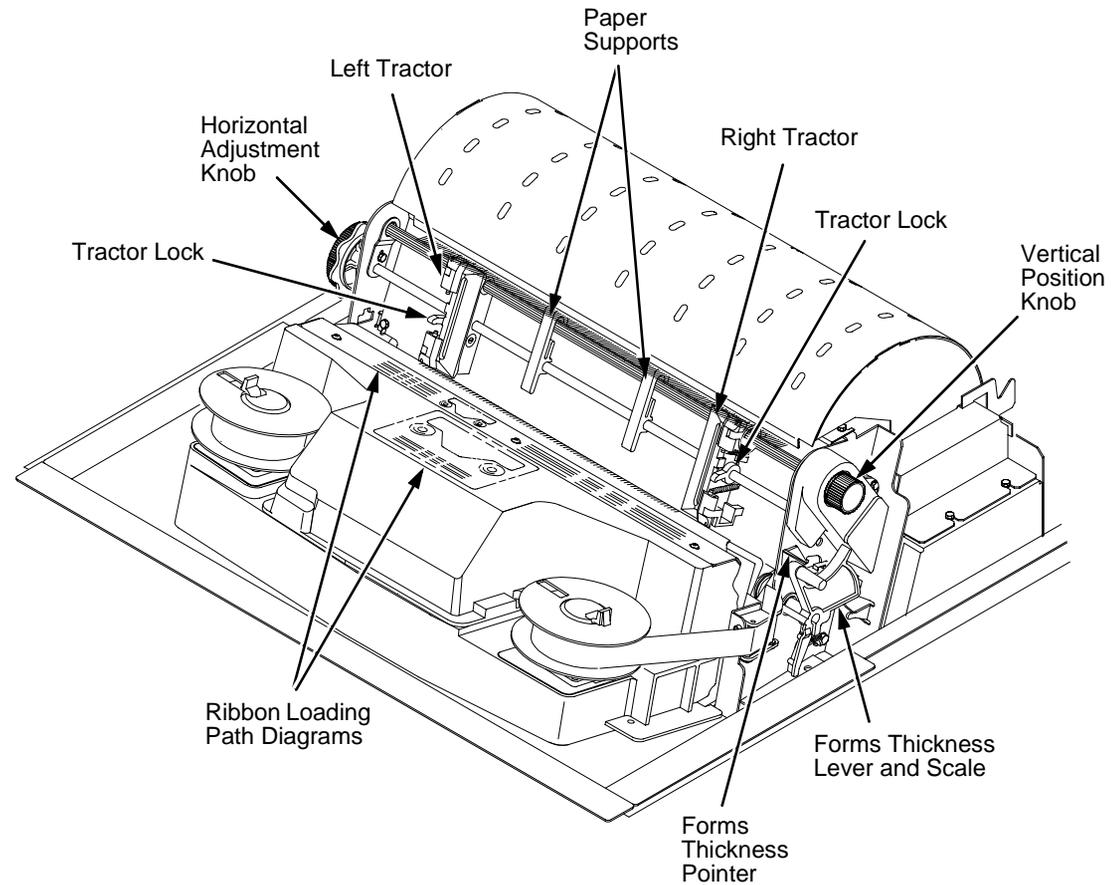


Figure 8. This figure shows the locations of the mechanical controls on early 6400-i05, -i5P, -i10, -i1P, and -i15 models.

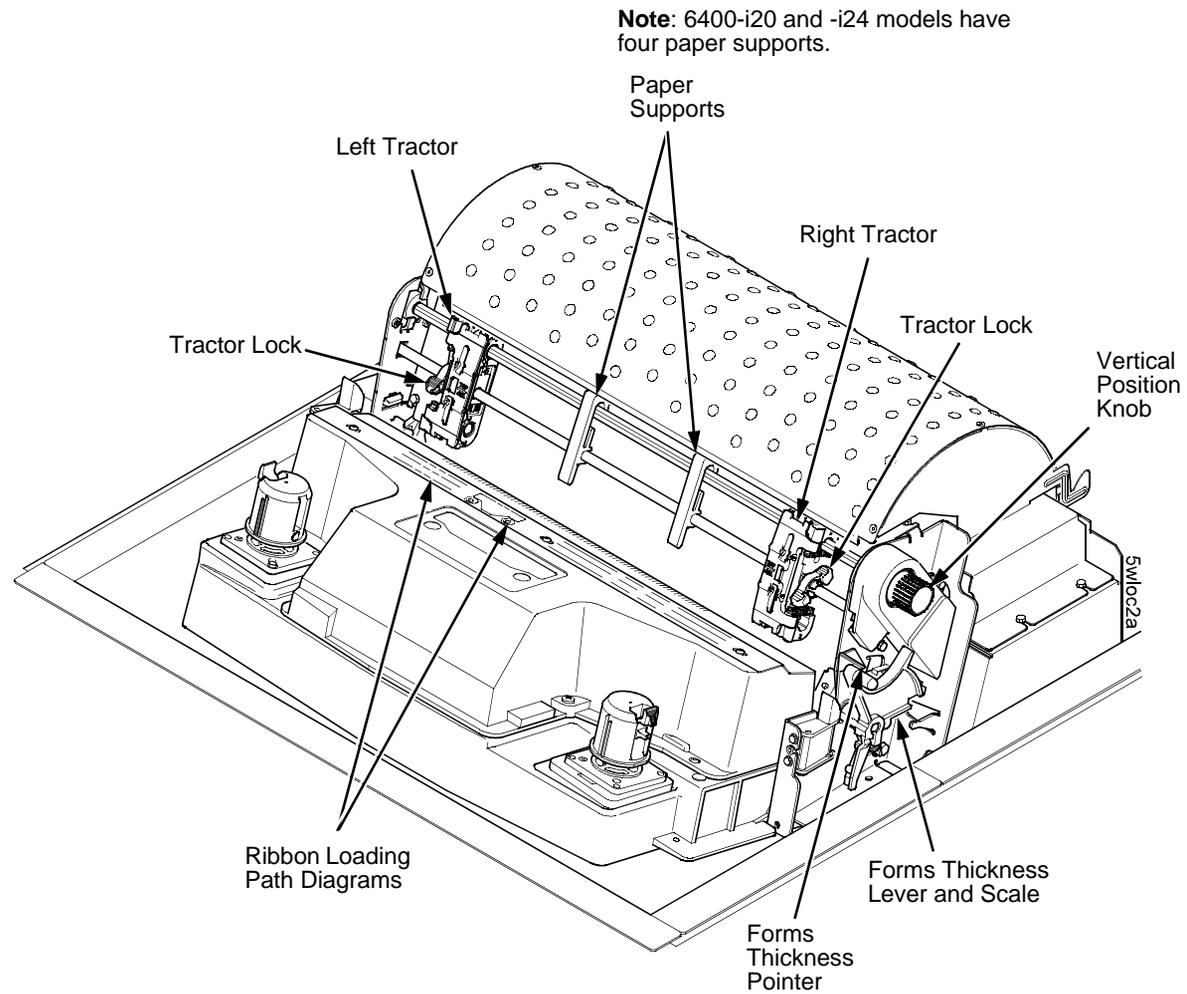


Figure 9. This figure shows the locations of the mechanical controls on the newer 6400-i05, -i5P, -i10, -i1P, -i15, -i20, -i2s, and -i24 Models.

1

Diagnosing Problems

Introduction

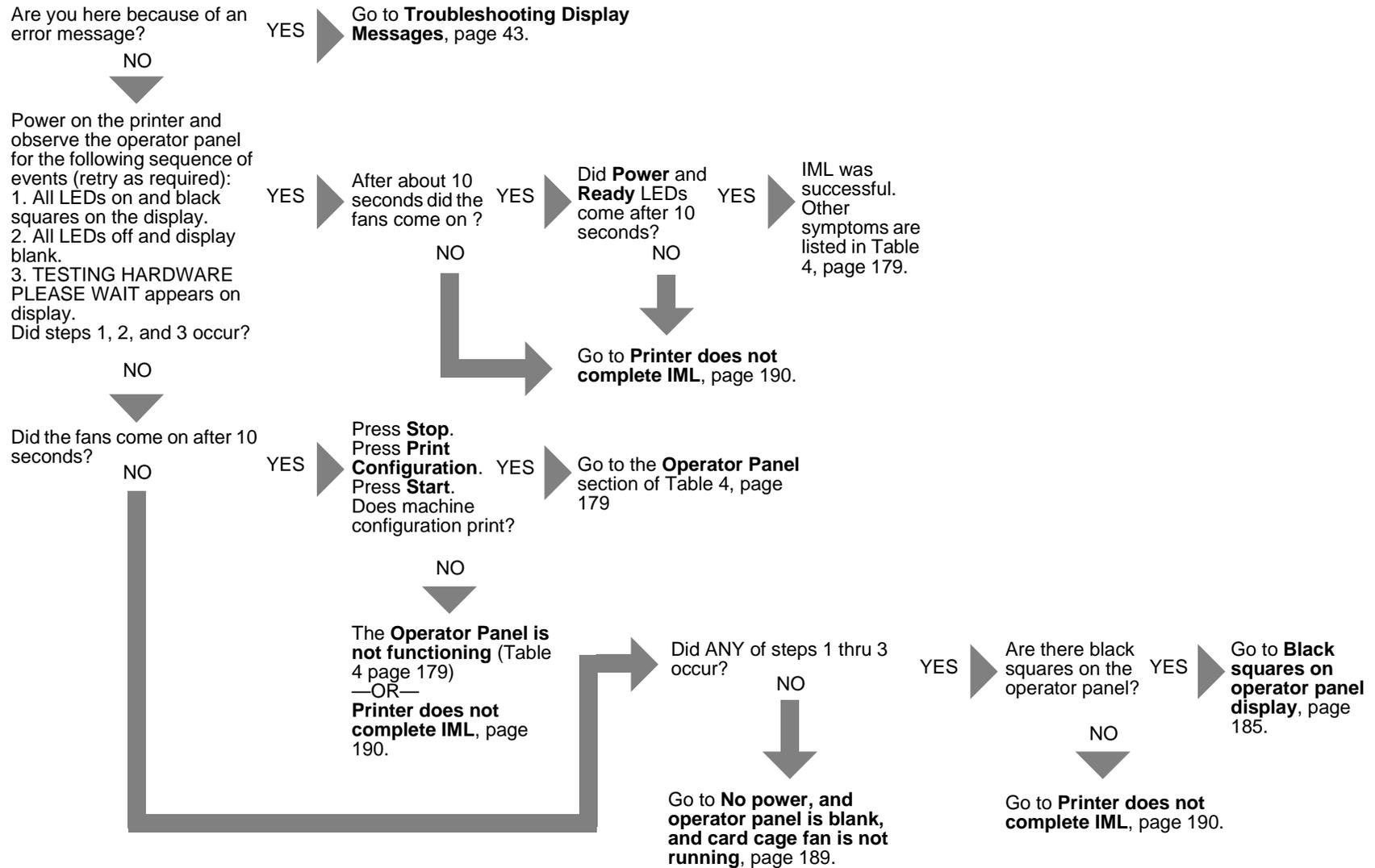
This chapter lists fault messages and symptoms, and gives procedures for troubleshooting printer malfunctions.

You must operate the printer to check its performance and you may have to reconfigure it. This manual does not cover printer operation or configuration, so always have the *Setup Guide* handy when you troubleshoot.

Troubleshooting At A Glance ...

Start Of Call.....	page 41
How To Troubleshoot.....	page 42
Troubleshooting Display Messages	page 43
Display Messages	page 43
Troubleshooting Other Symptoms	page 178
General Symptom List.....	page 179
Communications Failures.....	page 219
Device Handshaking	page 221
The Printer Interface	page 221

Start Of Call



How To Troubleshoot



- <3> **Hazardous voltages are present in the printer with the power cord connected to the power source. Switch off printer power and unplug the printer power cord before proceeding.**
- <4> **Do not connect or disconnect any communication port, teleport, attachment connector, or power cord during an electrical storm.**
- <5> **Power off the printer and disconnect the power cord *before* connecting or disconnecting a communication port, teleport, or attachment cable connector.**

You will be more successful in troubleshooting printer problems if you use standard fault isolation techniques. 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 the conditions reported by the user.
3. Look for a matching message or symptom in Table 3 on page 44 or Table 4 on page 179. If you find a match, follow the troubleshooting instructions in the table.
4. If you do not find the symptom in either troubleshooting table, 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.

IMPORTANT

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

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.
6. Test printer operation immediately after every corrective action.
7. Install 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.

Troubleshooting Display Messages

If a fault condition occurs in the printer, four things happen:

- The **Attention** indicator on the operator panel flashes on and off.
- If enabled, the audible alarm sounds. (Press **Stop** to silence the alarm.)
- A message describing the fault condition appears on the LCD.
- Certain *Unit Check* conditions (see below) are automatically recorded in the error log. The error log is a buffer in non-volatile memory (NVRAM) that stores up to 50 messages as a list. The most recent message is stored at the top of the list, the oldest message at the bottom of the list. The bottom message drops away if the count reaches more than 50 error messages before the log is cleared. (The list can never contain more than 50 error messages.) You can print the error log and clear it. (See page 223.)

The LCD displays two kinds of printer conditions:

- An *Attention* condition halts printing until the operator replenishes supplies, clears paper jams, corrects a problem of communication between the printer and host computer, etc.
- A *Unit Check* condition is a failure detected by self-test and fault circuitry. Unit check conditions are either *recoverable* or *unrecoverable*.

Recoverable unit check conditions are errors detected in the electromechanical print mechanism that may be temporary and correctable by cycling power. The printer tries a number of times to correct the condition before posting the message to the operator panel. The first thing to do in such cases is to power the printer off, wait 15 seconds, then power the printer back on. If the message reappears, classify the unit check condition unrecoverable.

Unrecoverable unit check conditions are “hard” failures such as overcurrent, component failure, or microcode failures that prevent printing until the conditions are corrected. Unrecoverable conditions require that the printer be powered off and the condition corrected before powering the printer back on.

Display Messages

Find the message in the **Message List** below and follow the suggested procedure. After correcting an error, press the **Start** key to clear the message.

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 3. Message List

Operator Panel Message	Explanation	Corrective Action
001 END OF FORMS LOAD FORMS	Attention message: the printer is out of paper.	<ol style="list-style-type: none"> 1. Load paper. Press Stop. If message does not clear, go to the next step. 2. Check forms for dark backs or holes/perforations large enough to cause false End Of Forms messages. Consider ordering the black back paper detector switch assembly. 3. 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. 4. Power off and unplug the printer. Remove the paper guide assembly or pedestal top cover. Remove the barrier shield (cabinet model) or the barrier shield and paper guide (pedestal model). Make sure the sensors are securely snapped into the bracket, the mounting screws hold the paper detector switch assembly securely, and clean the sensors if they are dirty. 5. Check that connector P106/PMD is fully seated in connector J106 on the controller board. 6. Plug in the printer and power it on. Load paper. Replace the paper detector switch assembly if the message appears. 7. Plug in the printer and power it on. Load paper. If the problem reappears, the controller board or microcode is suspect. Do the following: 8. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 9. Clear NVRAM (page 246). 10. Download and install the latest code from IBM First (page 245).

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
001 END OF FORMS LOAD FORMS (continued)		11. Power on the printer in download mode and load flash memory (page 247). <ul style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 12. Download and install the latest code from IBM First (page 245). 13. Power on the printer in download mode and load flash memory (page 247). 14. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>002 FORMS JAMMED CLEAR JAM AND RELOAD FORMS</p>	<p>Attention message: the printer cannot detect paper motion. Inspect the paper path for jams.</p>	<ol style="list-style-type: none"> 1. Clear jams. Load paper. 2. Press Form Feed 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 208. If forms feed, go to the next step. 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 211. 5. Check the paper tension between the tractors. Adjust the right tractor so that it does not pull paper too tightly or leave it too loose. The right tractor should hold the paper under “slight” tension. 6. Inspect the ribbon mask for bends or deformation that block the paper path or prevent paper from exiting the pedestal top cover. Replace a damaged hammer bank cover assembly. 7. Check and adjust the platen open belt. Replace the belt if it is damaged. 8. On an older printer, check the platen open pulley and the platen pulley for looseness. (Newer printers have pressed on pulleys that do not get loose.) Bottom out the platen open motor pulley on the motor shaft and torque the 1/16 inch set screw to 11 ± 2 inch-pounds ($1.24 \pm 0.23 \text{ N}\cdot\text{m}$). Tighten the 7/64 inch setscrew in the platen shaft pulley, then open and close the forms thickness lever and check that the platen pulley setscrew does not hit the left ribbon guide. 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 3. Message List

Operator Panel Message	Explanation	Corrective Action
002 FORMS JAMMED CLEAR JAM AND RELOAD FORMS (continued)		<ol style="list-style-type: none"> 10. Check and 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 problem reappears, the controller board or microcode is suspect. Do the following: 13. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 14. Clear NVRAM (page 246). 15. Download and install the latest code from IBM First (page 245). 16. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 17. Download and install the latest code from IBM First (page 245). 18. Power on the printer in download mode and load flash memory (page 247). 19. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support. 20. If the problem reappears, replace the paper detector switch assembly and set the paper motion detector (PMD) to ENABLE.
003 FORMS EJECTED PRESS EJECT/RESTORE	Non-error status message.	Press Eject/Restore key to return paper to print position.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
004 VIEW FORMS PRESS VIEW KEY0	Non-error status message.	Press View key to return paper to print position.
006 HOST SYSTEM REQUEST ATTENTION	Host attention message: the host computer or printer controller requires attention.	Not a printer problem.
007 FM HEADER ERROR	Applications software has violated header format parameters.	Not a printer problem. Have the system administrator correct applications data or configuration.
008 HOLD PRINT TIMEOUT PRESS START	Status message: the printer was offline more than 10 minutes and the "Intervention Required" parameter is set to "Send to Host."	Press Start to put the printer in the READY state.
009 INVALID KEY PRESS	Attention message informing the operator that the wrong key was pressed.	No action required.
010 PARAMETER ERROR	The printer received an illegal parameter value in the command code.	<ol style="list-style-type: none"> 1. Press Stop to clear fault. Press Start to go to the READY state. 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 219.
011 SCS COMMAND ERROR	The printer received an undefined control character (hex 40) through the coax/twinax interface.	<ol style="list-style-type: none"> 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 219.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
012 STRUCTURED FIELD ERROR	Application software has violated structured data field parameters.	Not a printer problem. Have the system administrator correct applications data or configuration.
013 ACTIVATE LOST	The printer detects a twinax protocol communication error and reports the error.	<ol style="list-style-type: none"> 1. Power off and unplug the printer. Check the twinax host data cable and twinax I/O cable connection at the CT board. Reseat the twinax host data cable connection and the 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 on page 310. If resistances are not correct, replace the twinax auto-termination cable. 3. Plug in the printer and power it on. 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 219.
014 INVALID ACTIVATE	The printer detects a twinax protocol communications error and reports the error.	<ol style="list-style-type: none"> 1. Power off and unplug the printer. Check the twinax host data cable and twinax I/O cable connection at the CT board. Reseat the twinax host data cable connection and the twinax I/O cable connection at the 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 on page 271. If the resistances are not correct, replace the twinax auto-termination cable. 3. Plug in the printer and power it on. 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 219.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
015 COMMUNICATIONS CHECK CHECK CABLE	The line is not active on a twinax interface.	<ol style="list-style-type: none"> 1. Power off and unplug the printer. Check the twinax host data cable connection and twinax I/O cable connection at the CT board. Reseat the twinax host data cable connection and the 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 on page 310. If resistances are not correct, replace the twinax auto-termination cable. 3. Plug in the printer and power it on. 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.) 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 coax/twinax expansion board. Record the message and return it with the defective board.
016 INVALID COMMAND	The printer detects a twinax protocol communications error and reports the error.	<ol style="list-style-type: none"> 1. Power off and unplug the printer. Check the twinax host data cable and twinax I/O cable connection at the CT board. Reseat the twinax host data cable connection and the 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 on page 271. If resistances are not correct, replace the twinax auto-termination cable. 3. Plug in the printer and power it on. 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 219.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>017 STACKER JAM CHECK STACKER</p>	<p>This message is triggered if there is paper inside the throat of the stacker elevator, but the elevator is not moving.</p>	<ol style="list-style-type: none"> 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: <ol style="list-style-type: none"> 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 and unplug the printer. Remove the paper guide assembly. Disconnect stacker cables from the controller board, stacker assembly, and stacker operator panel. Check cables for cuts, breaks, or damaged pins. Check continuity of cables. Replace any cable that is damaged or fails continuity test.
<p>018 STACKER FULL CHECK STACKER</p>	<p>Status message: the power paper stacker is full.</p>	<ol style="list-style-type: none"> 1. Unload the stacker. 2. Check the stacker limit switches. (See page 197.) If the limit switches are OK, go to the next step. 3. Power off and unplug the printer. Remove the paper guide assembly. Disconnect stacker cables from the controller board, stacker assembly, and the stacker operator panel. Check cables for cuts, breaks, or damaged pins. Check continuity of cables. Replace any cable that is damaged or fails continuity test. Reconnect all stacker cables to the controller board, stacker, and stacker operator panel.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>019 STACKER FAULT CHECK STACKER</p>	<p>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 operator 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.</p>	<ol style="list-style-type: none"> 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: <ol style="list-style-type: none"> 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 197.) If the limit switches are OK, go to the next step. 5. Power off and unplug the printer. Remove the paper guide assembly. Disconnect stacker cables from the controller board, stacker assembly, and the stacker operator panel. Check cables for cuts, breaks, or damaged pins. Check continuity of cables. Replace any cable that is damaged or fails continuity test. 6. Plug in the printer and power it on. Disable the power stacker unit under the Printer Control menu. (Refer to the <i>Setup Guide</i>.) If the problem reappears, the controller board or microcode is suspect. Do the following: 7. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 8. Clear NVRAM (page 246). 9. Download and install the latest code from IBM First (page 245). 10. Power on the printer in download mode and load flash memory (page 247).

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
019 STACKER FAULT CHECK STACKER (continued)		<ul style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. <ul style="list-style-type: none"> 11. Download and install the latest code from IBM First (page 245). 12. Power on the printer in download mode and load flash memory (page 247). 13. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support. 14. If the problem reappears, replace the stacker motors.
021 RECEIVE BUFFER OVERRUN VERIFY CONFIGURATION	The print buffer has overflowed on a serial interface. The printed output may contain random * (asterisk) characters.	<ul style="list-style-type: none"> 1. Make a configuration printout. Verify that the printer matches the host serial interface configuration settings for Data Protocol, Baud Rate, Data Bits, Stop Bits, Parity, Data Terminal Ready, and Request to Send. 2. Set printer serial interface parameters to match those of the host. 3. Send a print job to the printer. If the message appears, go to Communications Failures, page 219.
022 UNIT ADDRESS NOT RECEIVED CHECK PRINTER ADDRESS	Poll timeout on the twinax interface indicating the unit address is not recognized by the printer.	Have the system administrator make sure the printer address is correct.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
024 SERIAL LINE PARITY ERROR VERIFY CONFIGURATION	The printed output may contain random ? (question mark) characters.	<ol style="list-style-type: none"> 1. Make a configuration printout. Verify that the printer matches host serial configuration settings for Data Protocol, Baud Rate, Data Bits, Stop Bits, Parity, Data Terminal Ready, and Request to Send. Set printer serial interface parameters to match those of the host. 2. Send a print job to the printer. If the message appears, replace the serial data cable. 3. Send a print job to the printer. If the message appears, go to Communications Failures, page 219. 4. If the printer is in a twinax environment, check the error log for 024 errors 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 coax/twinax multi-platform interface. (Refer to the <i>Coax/Twinax Multi-Platform Interface Feature Installation and Operation Guide</i>, Form Number S246-0149.)
025 SERIAL FRAMING ERROR VERIFY CONFIGURATION	The printed output may contain random ! (exclamation point) characters.	<ol style="list-style-type: none"> 1. Make a configuration printout. Verify that the printer matches host configuration settings for Data Protocol, Baud Rate, Data Bits, Stop Bits, Parity, Data Terminal Ready, and Request to Send. Set printer serial interface parameters to match those of the host. 2. Send a print job to the printer. If the message appears, go to Communications Failures, page 219.
026 HEX DUMP MODE	Printer attach status message.	No action required.
027 COMMUNICATIONS CHECK CALL SYSTEM OPERATOR	Enable poll timeout. The printer was not enabled for one minute over a coax interface	Power off and unplug the printer. Check data cable connection and host system. (Refer to line problem determination procedures, as recommended by the host system.)

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
028 COMMUNICATIONS CHECK CALL SYSTEM OPERATOR	Poll timeout error. The printer was not polled for one minute over a coax interface.	Power off and unplug the printer. Check data cable connection and host system. (Refer to line problem determination procedures, as recommended by the host system.)
029 8344 DIAGNOSTIC TEST FAILED	Link-level code test detects a hardware failure on the coax/twinax expansion board. This message can also occur if the software in flash memory is corrupted.	<ol style="list-style-type: none"> 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 coax/twinax expansion board. Record the message and return it with the defective board.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>031 END OF FORMS TIMEOUT LOAD FORMS</p>	<p>On a coax interface, a timeout message is sent to the host if paper is not loaded within 10 minutes after Stop was pressed to clear an end of forms fault.</p>	<ol style="list-style-type: none"> 1. Load paper. Press Stop. 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, suggest to the customer that they order the black-back forms RPQ, which will replace the paper detector switch with a black-back forms switch assembly. 3. Power off and unplug the printer. Remove the paper guide assembly or pedestal top cover. Remove the barrier shield (cabinet model) or the barrier shield and paper guide (pedestal model). Check that the paper detector switch assembly is securely mounted in its bracket. 4. Check that connector P106/PMD is fully seated in connector J106 on the controller board. 5. Plug in the printer and power it on. Load paper. Replace the paper detector switch assembly if the message appears. 6. Plug in the printer and power it on. Load paper. If the problem reappears, the controller board or microcode is suspect. Do the following: 7. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 8. Clear NVRAM (page 246). 9. Download and install the latest code from IBM First (page 245). 10. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
031 END OF FORMS TIMEOUT LOAD FORMS (continued)		<p>b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step</p> <ol style="list-style-type: none"> 11. Download and install the latest code from IBM First (page 245). 12. Power on the printer in download mode and load flash memory (page 247). 13. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
032 FORMS JAMMED TIMEOUT CLEAR JAM AND RELOAD FORMS	On a coax interface, a timeout message is sent to the host if paper motion has not occurred for 10 minutes after Stop was pressed to clear a paper jam fault.	<ol style="list-style-type: none"> 1. Clear the paper jam. Press Stop. 2. Press Form Feed 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 208. 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 211. 5. Check the paper tension between the tractors. Adjust the right tractor so that it does not pull paper too tightly or leave it too loose. The right tractor should hold the paper under “slight” tension. 6. Inspect the ribbon mask for bends or deformation that block the paper path or prevent paper from exiting the pedestal top cover. Replace a damaged hammer bank cover assembly. 7. Check and adjust the platen open belt. Replace the belt if it is damaged. 8. On an older printer, check the platen open pulley and the platen pulley for looseness. (Newer printers have pressed on pulleys that do not get loose.) Bottom out the platen open motor pulley on the motor shaft and torque the 1/16 inch set screw to 11 ± 2 inch-pounds ($1.24 \pm 0.23 \text{ N}\cdot\text{m}$). Tighten the 7/64 inch setscrew in the platen shaft pulley, then open and close the forms thickness lever and check that the platen pulley setscrew does not hit the left ribbon guide. 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 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>032 FORMS JAMMED TIMEOUT CLEAR JAM AND RELOAD FORMS (continued)</p>		<ol style="list-style-type: none"> 10. 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 problem reappears, the controller board or microcode is suspect. Do the following: 13. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 14. Clear NVRAM (page 246). 15. Download and install the latest code from IBM First (page 245). 16. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 17. Download and install the latest code from IBM First (page 245). 18. Power on the printer in download mode and load flash memory (page 247). 19. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support. 20. Power on the printer in download mode and load flash memory (page 247). 21. If the message does not appear, replace the paper detector switch assembly and set the paper motion detector (PMD) to ENABLE.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
041 BUFFER OVERFLOW	The print buffer has overflowed on a serial interface. The printed output may contain random * (asterisk) characters.	<ol style="list-style-type: none"> 1. Make a configuration printout. Verify that the printer matches the host serial interface configuration settings for Data Protocol, Baud Rate, Data Bits, Stop Bits, Parity, Data Terminal Ready, and Request to Send. Set printer serial interface parameters to match those of the host. 2. Send a print job to the printer. If the message appears, go to Communications Failures, page 219.
042 CUSTOM SET DOES NOT EXIST SAVE FIRST	Printer configuration: the custom configuration set does not exist.	Save the custom configuration set.
043 CUSTOM SET ALREADY EXISTS DELETE EXISTING SET FIRST	Printer configuration: custom set is write-protected.	Delete the existing custom configuration set, then save the new set.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>044 EC FIRMWARE/HARDWARE ERROR</p>	<p>Application software tried to perform an illegal printer function or damaged memory is detected on the controller board.</p> <p>If this message appears at power-up, replace the controller board. Record the message and return it with the defective board. After replacing the controller board, DO NOT make the printer READY, but immediately download the latest code from IBM First (page 245), then power on in download mode and load the flash memory (page 247).</p>	<ol style="list-style-type: none"> 1. Cycle power. Run the print job. 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 with blank flash with boot code and then download code. 3. Plug in the printer and power it on. Run the print job again. If the problem reappears, the controller board or microcode is suspect. Do the following: <ol style="list-style-type: none"> 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, there is an application software error. Reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>046 EC STOPPED AT STATE <state></p>	<p>Where <state> is a number from 0000 to 0010. The Engine Controller processor 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 (page 347). Record the message and return it with the defective board. After replacing the controller board, DO NOT make the printer READY, but immediately download the latest code from IBM First (page 245), then power on in download mode and load the flash memory (page 247).</p>	<ol style="list-style-type: none"> 1. Power off and unplug 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 (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 2. Download the latest code from IBM First (page 245). 3. Power on the printer in download mode and load flash memory (page 247). 4. Power on the printer in download mode and load flash memory (page 247). If the message appears, replace the flash memory with blank flash containing boot code, then load flash memory (page 247). 5. If the message appears, replace the DRAM SIMM(s), then load flash memory (page 247). 6. Plug in the printer and power it on. Load paper. If the problem reappears, the controller board or microcode is suspect. Do the following: 7. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 8. Clear NVRAM (page 246). 9. Download and install the latest code from IBM First (page 245). 10. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 11. Download and install the latest code from IBM First (page 245).

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
046 EC STOPPED AT STATE <state> (continued)		12. Power on the printer in download mode and load flash memory (page 247). 13. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
057 CLOSE PLATEN	The forms thickness lever is open.	<ol style="list-style-type: none"> 1. Load paper. Close the forms thickness lever. If message does not clear, go to the next step. 2. Power off and unplug the printer. Remove the paper guide assembly or pedestal top cover. Disconnect connector P107 from the controller board. Check continuity of the platen interlock switch cable from P107/PLO to the switch. Replace the platen interlock switch assembly if it fails the continuity test. 3. Check that the platen interlock switch is not loose. 4. Check and adjust the platen open belt. Replace the belt if it is damaged. 5. On an older printer, check the platen open pulley and the platen pulley for looseness. (Newer printers have pressed on pulleys that do not get loose.) Bottom out the platen open motor pulley on the motor shaft and torque the 1/16 inch set screw to 11 ± 2 inch-pounds ($1.24 \pm 0.23 \text{ N}\cdot\text{m}$). Tighten the 7/64 inch setscrew in the platen shaft pulley, then open and close the forms thickness lever and check that the platen pulley setscrew does not hit the left ribbon guide. 6. Disconnect connector P106 from the controller board. Check the resistance of connector P106/PLAT M. (Refer to the Main Wire Harness Test Tables in Chapter 3.) Replace the platen open motor if it fails the resistance test. 7. Plug in the printer and power it on. Run a print test. If the problem reappears, the controller board or microcode is suspect. Do the following: 8. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 9. Clear NVRAM (page 246). 10. Download and install the latest code from IBM First (page 245). 11. Power on the printer in download mode and load flash memory (page 247).

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
057 CLOSE PLATEN (continued)		<ul style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. <ol style="list-style-type: none"> 12. Download and install the latest code from IBM First (page 245). 13. Power on the printer in download mode and load flash memory (page 247). 14. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>058 SHUTTLE JAM SEE SETUP GUIDE</p>	<p>The shuttle is not moving or is moving at the wrong speed.</p>	<ol style="list-style-type: none"> 1. Check the forms thickness lever: if it is set too tightly, it can slow the shuttle enough to trigger the fault message. Set the forms thickness lever to match the thickness of paper and provide satisfactory print quality, but not too tightly. 2. Check and adjust the platen gap. 3. Inspect the ribbon mask for bends or deformation that may snag and interfere with shuttle movement. Make sure the hammer bank cover assembly is correctly installed on its mounting pegs. 4. Run a print test. If the message appears, power off the printer, unplug the printer, and go to the next step. 5. Remove the shuttle cover. Remove the paper guide assembly or the pedestal top cover. 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 on page 269, page 277, and page 288.) Remove obstructions and reseat all cables. Check the resistance of MPU in P107. (Refer to the Main Wire Harness Test Tables on page 271, page 279, and page 290.) Replace the MPU if it fails the test. 6. Plug in the printer and power it on. Run a shuttle test and observe shuttle movement. If the shuttle oscillates too slowly, adjust the gap between the MPU assembly and the flywheel to $0.010 \pm .001$ inch (0.254 ± 0.025 mm). Torque the 7/16 inch MPU clamp screw to 18 ± 1 inch-pounds (2.03 ± 0.11 N•m). If the shuttle does not move go to Shuttle Short Tests (page 260) and follow the steps exactly as listed. 7. Run a print test. If the message appears, replace the MPU intermediate cable assembly.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>058 SHUTTLE JAM SEE SETUP GUIDE (continued)</p>		<ol style="list-style-type: none"> 8. Run a print test. If the problem reappears, the controller board or microcode is suspect. Do the following: 9. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 10. Clear NVRAM (page 246). 11. Download and install the latest code from IBM First (page 245). 12. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 13. Download and install the latest code from IBM First (page 245). 14. Power on the printer in download mode and load flash memory (page 247). 15. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support. 16. Run a print test. If the message appears, remove the shuttle frame assembly and place it on a hard, flat surface. Rotate the flywheel by hand and check for any binding. The flywheel should spin more than one turn. If it fails this test, replace the shuttle frame assembly. 17. Run a print test. If the message appears, replace the power supply PCBA. Write down the error and return it with the defective board. 18. Run a print test. If the message appears, contact your Local District Support person.
<p>059 CANCEL PRINT ACTIVE</p>	<p>Non-error status message.</p>	<p>No action required.</p>

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
060 PRINTER HOT	<p>Controller board sensors report high temperatures on the board. This message indicates internal temperatures over 60° Celsius (140° Fahrenheit). Print jobs do 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 above 40° Celsius (104° Fahrenheit) or is dirty enough to create blockage of the cabinet fan vents. The printer must never be run at ambient temperatures greater than 40° Celsius (104° Fahrenheit). If the printer is located in such an environment, relocate it to a cooler, cleaner area.</p>	<ol style="list-style-type: none"> 1. Inspect printer environment for severity. Advise the user to move the printer to cooler, cleaner location. 2. Power off and unplug the printer. Remove the paper guide assembly or pedestal top cover. 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. Remove the shuttle cover and Check the shuttle for electrical shorts (page 257). 5. Install the paper guide assembly or pedestal top cover. Plug in the printer and power it on. Load paper. Run the Plot Test for 1/4 page. If the problem reappears, the controller board or microcode is suspect. Do the following: <ol style="list-style-type: none"> 6. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 7. Clear NVRAM (page 246). 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 10. Download and install the latest code from IBM First (page 245). 11. Power on the printer in download mode and load flash memory (page 247).

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
060 PRINTER HOT (continued)		12. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
062 EXHAUST FAN FAULT	Sensors cannot detect current in the fan circuit.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears, press Stop. 2. If the message occurs on a pedestal model, check that the correct operator panel is installed. The operator panel for a pedestal model has resistors R18 and R19 next to the operator panel cable connector. 3. Check that the exhaust fan is connected to exhaust fan cable connector J307 and verify that the connector is not installed backwards. 4. Power off and unplug the printer. Remove the paper guide assembly. Disconnect connector P107 from the controller board. Test connector P107/EHF for shorts or opens. (Refer to the Main Wire Harness Test Tables in Chapter 3.) Replace components that fail test. 5. Make sure connector P107/EHF has a good connection at J107 on the controller board. 6. Inspect for obstructions of airways and vents. Check for items beneath the printer blocking cabinet vents. Make sure cabinet exhaust fan vents are not blocked. 7. Plug in the printer and power it on. Check for fan operation. If the message appears or the fan doesn't work, replace the exhaust fan. 8. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 9. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 10. Clear NVRAM (page 246). 11. Download and install the latest code from IBM First (page 245). 12. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
062 EXHAUST FAN FAULT (continued)		<ul style="list-style-type: none"> <li data-bbox="1125 310 1908 435">b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. <li data-bbox="1079 448 1871 477">13. Download and install the latest code from IBM First (page 245). <li data-bbox="1079 490 1871 553">14. Power on the printer in download mode and load flash memory (page 247). <li data-bbox="1079 566 1871 659">15. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
065 HAMMER BANK FAN FAULT	Hammer Bank Fan Fault. Sensors cannot detect current in the fan circuit.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears, press Stop. 2. Power off and unplug the printer. Remove the paper guide assembly or pedestal top cover. Verify that the connector is not installed backwards. 3. Disconnect connector P107 from the controller board. Test connector P107/HBF for shorts or opens. (Refer to the Main Wire Harness Test Tables in Chapter 3 and the Main Wire Harness Test Diagnostic in Chapter 2.) Replace components that fail test. 4. Make sure P107/HBF has a good connection at J107 on the controller board. 5. Inspect airways and vents for obstructions. 6. Check the shuttle for electrical shorts (page 260). 7. Plug in the printer and power it on. If the problem reappears, the controller board or microcode is suspect. Do the following: 8. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 9. Clear NVRAM (page 246). 10. Download and install the latest code from IBM First (page 245). 11. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 12. Download and install the latest code from IBM First (page 245).

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
065 HAMMER BANK FAN FAULT (continued)		13. Power on the printer in download mode and load flash memory (page 247). If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.
069 DATA CLEARED	This message appears when data are cleared out of printer after Cancel key has been pressed.	No action required.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
080 POWER SUPPLY HOT	<p>The printer has sensor circuits that sample the operating temperature of key components of the power supply. When higher than normal temperatures are sensed, print speed is automatically reduced. If the printer runs at reduced speed for an extended period of time, the POWER SUPPLY HOT message is sent to the LCD and printing stops, allowing printer components to cool down. Pressing the Start key resumes the print task. Check the operating environment. A severe environment is one with an ambient temperature at or above above 40° Celsius (104° Fahrenheit) or is dirty enough to create blockage of the cabinet fan vents. The printer must never be run at ambient temperatures greater than 40° Celsius (104° Fahrenheit). If the printer is located in such an environment, relocate it to a cooler, cleaner area.</p>	<ol style="list-style-type: none"> 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 and unplug the printer. Remove the paper guide assembly or pedestal top cover. Check that the power supply guard/air deflector is correctly positioned over the power supply board. <p> CAUTION: DO NOT TOUCH THE POWER SUPPLY, but hold your hand close enough to check for heat radiating off the power supply board. If the power supply is noticeably hot, replace it.</p> <ol style="list-style-type: none"> 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. Replace the power supply if you did not do so earlier. 7. Install paper guide assembly or pedestal top cover. Plug in the printer and power it on. Load paper. Run the “All E’s” print test for 5 to 10 minutes. If the problem reappears, the controller board or microcode is suspect. Do the following: 8. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 9. Clear NVRAM (page 246). 10. Download and install the latest code from IBM First (page 245). 11. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
080 POWER SUPPLY HOT (continued)		<ul style="list-style-type: none"> <li data-bbox="1125 310 1892 431">b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. <li data-bbox="1079 448 1871 475">12. Download and install the latest code from IBM First (page 245). <li data-bbox="1079 492 1871 548">13. Power on the printer in download mode and load flash memory (page 247). <li data-bbox="1079 565 1871 654">14. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
081 POWER SUPPLY VOLTAGE FAILURE	The power supply has failed.	<ol style="list-style-type: none"> 1. Replace the power supply board. 2. Check the shuttle for electrical shorts (page 260). 3. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
082 POWER SUPPLY 8.5V FAILED	8.5 Volt Power Failed. Internal power failure.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears, replace the power supply board. 2. Check the shuttle for electrical shorts (page 260). 3. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support. 11. Power on the printer. If the message appears, replace the shuttle frame assembly.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
083 INTAKE FAN FAULT	Sensors cannot detect current in the card cage fan circuit.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears, press Stop. 2. Power off and unplug the printer. Remove the paper guide assembly or pedestal top cover. Verify that the connector is not installed backwards. 3. Disconnect connector P106 from the controller board. Test connector P106/CCF for shorts or opens. (Refer to the Main Wire Harness Test Tables in Chapter 3.) Replace components that fail test. 4. Make sure P106/CCF has a good connection at J106 on the controller board. 5. Inspect for obstructions of airways and vents. 6. Check the shuttle for electrical shorts (page 260). 7. Plug in the printer and power it on. If the problem reappears, the controller board or microcode is suspect. Do the following: 8. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 9. Clear NVRAM (page 246). 10. Download and install the latest code from IBM First (page 245). 11. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 12. Download and install the latest code from IBM First (page 245). 13. Power on the printer in download mode and load flash memory (page 247). If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>084 POWER SUPPLY 48V FAILED</p>	<p>48 Volt Power Failed. Internal power failure.</p> <p>NOTE: Before going to the customer account, obtain a power supply, controller board (CMX, CFX, or PSA3), hammer bank power and logic cables appropriate for the printer model you will be working on. If the customer account is a long distance away, also obtain a shuttle assembly. You will return for credit any component that is not used.</p>	<ol style="list-style-type: none"> 1. If the printer is operational, print the Error Log. Check the error log for 065 HAMMER BANK FAN FAULT or other errors that occurred before the 084 error. Investigate these errors as appropriate, because they may be the cause of the 084 error. 2. Power off and unplug the printer. Remove the paper guide assembly or pedestal top cover. Before handling circuit boards, put on a static wrist strap. 3. Remove the power supply (PS) and inspect it for any burn marks. Replace the PS if you find any signs of burning or overheating. 4. If the printer has a CT-expansion board, inspect the adapter connection to the controller board. Make sure the 60-pin expansion adapter is correctly seated between the controller board and CT-expansion board. 5. Reinstall the PS. Check that PS connector P101 is correctly and fully seated in connector J101 on the controller board. Verify that pin 1 on P101 goes into pin 1 on the controller board. If P101 is ever plugged in backwards with the power on, the controller board will probably be damaged. 6. Check the shuttle for shorts by conducting the Shuttle Electrical Shorts Test on page 260. This is IMPORTANT! Replace the shuttle if it is defective. If it passes the shorts test, remove the shuttle frame assembly and place it on a hard, flat surface. Spin the flywheel by hand. The flywheel should spin more than one turn and there should be no binding anywhere in its spin. If it fails this test, replace the shuttle frame assembly. 7. Replace the hammer bank power and logic cables. (Refer to 086 CONTROLLER 15V, steps 4 through 7.) Plug in the printer and power it on. <ol style="list-style-type: none"> a. If the printer comes to READY, go to step 13. b. If the 084 message appears, power off and unplug the printer, and go to step 8.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>084 POWER SUPPLY 48V FAILED (continued)</p>		<p>8. In the normal power-on sequence, the card cage fan (CCF) will turn on after "TESTING HARDWARE, PLEASE WAIT" displays on the operator panel. If the CCF turns on, this means the power supply (PS) +48 volts is OK. During the following substeps, you will try to determine if +48V works by removing most external cables and components from the controller and PS boards.</p> <ul style="list-style-type: none"> a. Disconnect all connections to the controller board except the P101 power connector and P110 op panel connector. b. Remove the two-pin CCF connector from the P106 shell and plug it onto J106 pins 9 and 11 on the controller board. If the printer has a CFX controller, remove P02 and P03 from the PS. c. Power on the printer. If the operator panel lights up, this indicates PS +5V is working. If the CCF runs momentarily (about 2 seconds), the PS +48V is working and you can go to step 9. d. The CCF did not come on in step 8c. Do CCF resistance and wiring checks. Replace the CCF or any wiring found defective. e. Power on the printer. If the operator panel lights up, the PS +5V is working. If the CCF runs momentarily (about 2 seconds), the PS +48V is working and you can go to step 9. f. If the CCF did not come in step 8e, the controller or PS board is defective. It is easier to swap out the PS first. Power down and unplug the printer. Replace the PS. g. Power on the printer. If the operator panel lights up, the PS +5V is working. If the CCF runs momentarily (about 2 seconds), the PS +48V is working. Go to step 9. h. If the CCF did not come on in step 8f after replacing the PS, power down and replace the controller (page 347).

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>084 POWER SUPPLY 48V FAILED (continued)</p>		<ul style="list-style-type: none"> i. Plug in the printer and power it on. If the operator panel lights up, the PS +5V is working. If the CCF runs momentarily (about 2 seconds), the PS +48V is working. j. If, after replacing the PS and controller in steps 8f and 8g, the CCF did not come on, contact DDS and Boulder support. Exit this procedure. IMPORTANT: Be sure to install the original PS and controller back into the printer if the new part is NOT required. k. Replacing the PS and controller fixed the initial errors. To make sure that the PS was also defective, do the following <ul style="list-style-type: none"> 1) Replace the original PS. 2) Retest. 3) If OK, return the new PS that is not required. Go to step 9. 4) If not OK, reinstall the new PS. If OK after installing the new PS, go to step 9. If not OK, contact DDS and Boulder support. Exit this procedure. <p>9. In step 8, you determined that the PS +48V is working; therefore, an external cable or component connecting to the controller board or the PS is pulling down the PS +48V. Reconnect all cables to the controller board and PS. Verify that the 084 message still occurs when you power on the printer.</p> <p>In the table steps below, you are trying to determine which external cable or component is defective. Disconnect one cable at a time in accordance with the following table. If the 084 error still occurs with the cable disconnected, the defective component is on another cable. If the 084 error does <i>not</i> occur with the cable disconnected, then the 084 error <i>is</i> associated with that cable — perform diagnostics on the cable and its connecting components.</p> <p>Always reconnect the cable before disconnecting the next cable in the table. When connecting hammer bank power P105, make sure pin 1 on P105 connects to pin 1 on the controller board.</p>

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>084 POWER SUPPLY 48V FAILED (continued)</p>		<div data-bbox="1075 407 1873 553" style="border: 1px solid black; padding: 5px;"> <p><3> Hazardous voltages are present in the printer with the power cord connected to the power source. Switch off printer power and unplug the the printer power cord before proceeding.</p> </div> <p>Before unplugging or plugging in any cable, power off and unplug the printer. Do NOT put your hands or tools inside the printer when it is plugged in.</p>

Table 3. Message List

Operator Panel Message	Explanation		Corrective Action	
084 POWER SUPPLY 48V FAILED (continued)	Disconnect Plug under test. All others are connected.	Expected Fan result if +48 V is OK	Expected Operator Panel Result	Comments
	P105	CCF momentarily on (2 seconds) CCF on (020 and i20 models)	Table Mismatch Ready (020 and i20 models)	+48 V is OK. Do hammer bank logic cable and shuttle checks.
	P106	Shuttle fan comes on	083 Intake Fan Fault	+48 V is OK. Do P106 wire harness, platen motor, and other component checks.
	P107	CCF comes on	090 Shuttle Open	+48 V is OK. Do P107 wire harness, hammer bank fan, and other component checks.
	P108	CCF momentarily on (2 seconds)	Table Mismatch	+48 V is OK. Do P108 cable harness, hammer bank logic, and shuttle checks.
	P103 (Stacker Logic Cable)	CCF comes on	Ready	+48 V is OK. Do stacker logic cable and stacker checks
	P105 (Stacker Power Cable) Keep P101 plugged into the controller.	CCF comes on	Ready	+48 V is OK. Do stacker power cable and stacker checks.
	P105 and P103	CCF comes on	Ready	+48 V is OK. Do stacker check.
	P116	CCF comes on	Ready	+48 V is OK. Do P116 cable harness and shuttle motor check.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action		
084 POWER SUPPLY 48V FAILED (continued)	Disconnect Plug under test. All others are connected.	Expected Fan result if +48 V is OK	Expected Operator Panel Result	Comments
	P122 for models 020 and i20	CCF comes on	Ready or Table Mismatch	Do hammer bank and shuttle checks.
	P02 on PS, ribbon cable for models 020 and i20	CCF on momentarily (1 second)	Table Mismatch Download Again	+48 V is OK. Do P02 cable checks.
	P03 on PS for models 020 and i20	CCF comes on	Hammer Bank Not Installed message (momentarily). Table Mismatch / Download Again	+48 V is OK. Do P03 cable and shuttle checks.
	<ol style="list-style-type: none"> 10. The 084 message still occurred when each of the above cables were individually unplugged during step 9. 11. Power off and unplug the printer. Reconnect all cables to the controller board and PS. 12. Plug in the printer and power it on. If the 084 message appears, contact DDS and Boulder support. Exit this procedure. 13. The printer comes on READY. If the controller was not replaced during the above procedure, print the error log. Look for the the last errors that are not the 084 message. Investigate the other reported errors by following the appropriate procedure in this manual. 14. Go to "OPERATOR PRINT TESTS" in the configuration menu and print a full 136 character width test pattern of All H's. If there is any print quality issue, go to the appropriate procedure in this manual. 			

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
085 CONTROLLER VOLTAGE	Controller voltage failure.	<ol style="list-style-type: none"> 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 with blank flash with boot code and download code. 3. Check the shuttle for electrical shorts (page 260). 4. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 5. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 6. Clear NVRAM (page 246). 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 9. Download and install the latest code from IBM First (page 245). 10. Power on the printer in download mode and load flash memory (page 247). 11. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support. 12. Power on the printer. Run the print job again. If the message appears, replace the power supply board.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
086 CONTROLLER 15V	Controller voltage failure.	<ol style="list-style-type: none"> 1. Make a configuration printout and note the customer's code load (if possible). 2. Power down and unplug the printer. 3. Replace the hammer bank logic cable. There may be damage you cannot see. 4. Power on the printer. If the problem persists, do the cable shorts test (page 263) on the hammer bank (HB) power cable. Replace the cable if necessary. <p>NOTE: When reconnecting the HB power cable, make sure pin 1 on the cable connector matches pin 1 on the PCBA connector. Plugging the HB power cable in backwards can result in a "Table Mismatch" error.</p> <ol style="list-style-type: none"> 5. Make sure the cables are properly tie-wrapped away from the reciprocating shuttle. Spin the shuttle motor by hand to check that the cables are clear of the shuttle as it moves. 6. You can easily verify that when the shuttle cover is installed, the hammer bank logic cable is clear of the shuttle by removing the paper scale on the shuttle cover, as follows: <ol style="list-style-type: none"> a. Remove the paper scale BEFORE installing the cover to reduce the chance of losing a screw in the machine. Mark a location reference line with a pencil across the paper scale and cover. Remove the three screws holding the paper scale. b. Install the shuttle cover and fasten it in place. Look in past the shuttle cover to verify the position of the hammer bank logic cable. If it is near the shuttle, remove the cover and push or tie the cable back. c. When the cable position is OK, install the paper scale, being careful not to drop any of the three screws. Erase the pencil line.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
086 CONTROLLER 15V (continued)		<p>7. Power on the printer. If the problem persists, refer to the Main Wire Harness Test Diagnostic (page 265) to complete the following substeps:</p> <ul style="list-style-type: none"> a. Power down and unplug the printer. b. Measure the resistance of the following motors: left and right ribbon motors, platen motor, paper feed motor. Compare the readings with the values in the two tables mentioned in the test diagnostic. Replace any defective motors. c. Inspect all cables going from the above motors to the controller board. Replace any damaged cables. d. If no problems are found, do a cable shorts test (page 263) on the intermediate cables of the ribbon motors and shuttle motor. Replace any damaged cables. <p>8. Power on the printer. If the problem persists, check the shuttle for electrical shorts (page 260). Replace the shuttle if it is defective.</p> <p>9. Power on the printer. If the problem persists, refer to the Main Wire Harness Test Diagnostic (page 265) and check the shuttle motor. Replace the shuttle assembly if the motor is out of spec.</p> <p>10. Power on the printer. If the problem persists, inspect the controller board for burned components. If any are found, contact Level 2 support for possible isolation of an additional failing component (e.g., a motor) that may be damaging the board. Also inspect the DRAM SIMM sockets for bent/damaged pins.</p> <p>NOTE: If Level 2 directs you to replace the controller board remember that you must power up in download mode, obtain the latest code from IBM First (page 245), then load flash memory (page 247).</p> <p>11. Power on the printer. If the problem persists, replace the shuttle frame assembly.</p> <p>12. Power on the printer. If the problem persists, replace the power supply.</p>

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
086 CONTROLLER 15V (continued)		13. Power on the printer. If the problem persists, contact your DDS and open a PMH with Level 2 for further assistance.
087 PLATEN OPEN TIMEOUT CLOSE PLATEN	On a coax interface, the forms thickness lever has been open for at least one minute. Load paper.	<ol style="list-style-type: none"> 1. Close the forms thickness lever. Press Stop. 2. Run a print test. If a platen open or close platen message appears, Power off and unplug the printer. Remove the paper guide assembly or pedestal top cover. 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. Check that the platen interlock switch is not loose. 4. Check and adjust the platen open belt. Replace the belt if it is damaged. 5. On an older printer, check the platen open pulley and the platen pulley for looseness. (Newer printers have pressed on pulleys that do not get loose.) Bottom out the platen open motor pulley on the motor shaft and torque the 1/16 inch set screw to 11 ± 2 inch-pounds ($1.24 \pm 0.23 \text{ N}\cdot\text{m}$). Tighten the 7/64 inch setscrew in the platen shaft pulley, then open and close the forms thickness lever and check that the platen pulley setscrew does not hit the left ribbon guide. 6. Disconnect connector P106 from the controller board. Check the resistance of connector P106/PLAT M. (Refer to the Main Wire Harness Test Tables in Chapter 3.) Replace the platen open motor if it fails the resistance test. 7. Check the shuttle for electrical shorts (page 260). 8. Plug in the printer and power it on. Run a print test. If the problem reappears, the controller board or microcode is suspect. Do the following: 9. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 10. Clear NVRAM (page 246). 11. Download and install the latest code from IBM First (page 245).

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
087 PLATEN OPEN TIMEOUT CLOSE PLATEN (continued)		<ol style="list-style-type: none"> 12. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 13. Download and install the latest code from IBM First (page 245). 14. Power on the printer in download mode and load flash memory (page 247). 15. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
088 CONTROLLER 23.5V	Controller Voltage Failure.	<ol style="list-style-type: none"> 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 with blank flash with boot code. 3. Download the latest code from IBM First (page 245). 4. Power on the printer in download mode and load flash memory (page 247). 5. Check the shuttle for electrical shorts (page 260). 6. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 7. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 8. Clear NVRAM (page 246). 9. Download and install the latest code from IBM First (page 245). 10. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 11. Download and install the latest code from IBM First (page 245). 12. Power on the printer in download mode and load flash memory (page 247). If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support. 13. Power on the printer. Run the print job again. If the message appears, replace the power supply board.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
088 CONTROLLER 23.5V (continued)		14. Power on the printer. If the message appears, replace the shuttle frame assembly.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
089 RIBBON STALL	This message occurs when the ribbon fails to move while printing.	<ol style="list-style-type: none"> 1. The lower flange of the ribbon hub may be interfering with the shuttle cover. Check that the shuttle cover is properly installed on both locating pins. If possible, bias the cover toward the rear of the machine to clear the ribbon hub. If this does not work, try filing material out of the cover locating hole to bias the cover enough to clear the ribbon hub. 2. Check the forms thickness lever: if it is set too tightly it can inhibit ribbon movement. Set the forms thickness lever to match the thickness of the paper being used, but not too tightly. 3. Inspect the ribbon motor intermediate cables. Make sure they are seated correctly in the controller board and at the ribbon motor cable. 4. Inspect the ribbon guides for ink buildup, which can inhibit ribbon movement. Clean the printer. 5. Inspect the hammer bank cover/ribbon mask for bending or damage, which can inhibit ribbon movement. Replace the hammer bank cover assembly if it is bent or damaged. 6. Check the platen gap. If the gap is too small, it can inhibit ribbon movement. Adjust the platen gap. 7. Power off and unplug the printer. Remove the paper guide assembly or pedestal top cover. Check the resistance of connectors P106/LRIB M and P107/RRIB M. (Refer to the Main Wire Harness Test Tables in Chapter 3 and the Main Wire Harness Test diagnostic in Chapter 2.) If ribbon motor resistance is not correct, replace the motor and/or the intermediate cable, if installed. 8. Check the shuttle for electrical shorts (page 260). 9. Plug in the printer and power it on. Run an Operator Print Test. (See page 223.) If the 089 RIBBON STALL message appears, the controller board or microcode is suspect. Do the following:.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
089 RIBBON STALL (continued)		<ol style="list-style-type: none"> 10. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 11. Clear NVRAM (page 246). 12. Download and install the latest code from IBM First (page 245). 13. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 14. Download and install the latest code from IBM First (page 245). 15. Power on the printer in download mode and load flash memory (page 247). 16. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
090 SHUTTLE COVER OPEN CLOSE SHUTTLE COVER	The shuttle cover is missing, damaged, or not correctly installed.	<ol style="list-style-type: none"> 1. Power off and unplug the printer. Inspect shuttle cover for warping, damage, or missing magnet. (The magnet covers the sensor housing when the cover is installed.) If the shuttle cover is warped, damaged, or the magnet is missing, replace the shuttle cover assembly. 2. Check shuttle cover installation. Make sure the cover lies flat and the two captive screws are fully seated. 3. Plug in the printer and power it on. If the message appears, power off and unplug the printer. Remove the paper guide assembly or pedestal top cover. Disconnect P107 on the controller board and check the CVO switch by testing for continuity across pins 18 and 20. (Refer to the Main Wire Harness Test Tables in Chapter 3.) Replace the cover open switch assembly, as required. 4. Check the shuttle for electrical shorts (page 260). 5. Plug in the printer and power it on. If the problem reappears, the controller board or microcode is suspect. Do the following: 6. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 7. Clear NVRAM (page 246). 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 10. Download and install the latest code from IBM First (page 245).

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
090 SHUTTLE COVER OPEN CLOSE SHUTTLE COVER (continued)		11. Power on the printer in download mode and load flash memory (page 247). If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.
092 RIBBON DRIVER CIRCUIT	The controller board does not detect a ribbon drive motor.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears, power off and unplug the printer. Remove the paper guide assembly or pedestal top cover. Reseat the cable connections of both ribbon drive motors. 2. Check the shuttle for electrical shorts (page 260). 3. Plug in the printer and power it on. 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, the controller board or microcode is suspect. Do the following: <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
094 SHUTTLE DRIVER CIRCUIT FAILED SEE SETUP GUIDE	The shuttle driver circuit on the controller board is drawing too much current.	<ol style="list-style-type: none"> 1. Power off and unplug the printer. Remove the paper guide assembly or top cover 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. Check the shuttle for electrical shorts (page 260). 3. Plug in the printer and power it on. If the message appears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support. 11. Power on the printer. If the message appears, replace the shuttle frame assembly.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>095 PAPER FEED DRIVER CIRCUIT FAILED SEE SETUP GUIDE</p>	<p>Paper Feed Driver Circuit. The paper feed driver circuit on the controller board is drawing too much current.</p>	<ol style="list-style-type: none"> 1. Power off and unplug the printer. Refer to the Main Wire Harness Test Diagnostic (page 265) to complete the following substeps: <ol style="list-style-type: none"> a. Measure the resistance of the paper feed motor. Compare the readings with the values in the two tables mentioned in the test diagnostic. Replace any defective motors. b. Inspect the cable going from the paper feed motor to the controller board. Replace the cable if you find any damage. 2. Plug in the printer and power it on. If the message appears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>096 48 VOLTS CIRCUIT FAILED SEE SETUP GUIDE</p>	<p>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.</p>	<ol style="list-style-type: none"> 1. Power off and unplug the printer. Remove the paper guide assembly or top cover to gain access to the card cage. 2. Make sure the power supply board is correctly connected to the controller board. 3. Plug in the printer and power it on. If the message appears, replace the power supply. 4. Power on the printer. If the message appears, reinstall the original power supply. The controller board or the code is suspect. Do the following: 5. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 6. Clear the NVRAM. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
101 UPPER DRIVER SHORT	Hammer driver circuits on the controller board are shorted to ground.	<ol style="list-style-type: none"> 1. If this message flashes just before “084 POWER SUPPLY 48V FAILED” appears, the controller board or microcode is suspect. Do the following: <ol style="list-style-type: none"> 2. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 3. Clear NVRAM (page 246). 4. Download and install the latest code from IBM First (page 245). 5. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). 8. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support. 9. Cycle power. If the message appears, press Stop. If the message does not clear, replace the hammer bank logic cable and the hammer bank power cable assemblies. 10. Check the shuttle for electrical shorts (page 260).

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
101 UPPER DRIVER SHORT (continued)		<ul style="list-style-type: none">11. Power on the printer. If the problem appears and you have not previously replaced the controller board, the controller board or microcode is suspect. Do the following:12. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.)13. Clear NVRAM (page 246).14. Download and install the latest code from IBM First (page 245).15. Power on the printer in download mode and load flash memory (page 247).<ul style="list-style-type: none">a. If you encounter loading problems, go to the appropriate error code for resolution.b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step.16. Download and install the latest code from IBM First (page 245).17. Power on the printer in download mode and load flash memory (page 247).18. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and have them contact Second Level Support. Second Level will then conference PE in with CE on site and DDS.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
102 LOWER DRIVER SHORT	Circuit(s) on the hammer bank or in the hammer bank power cable are shorted to ground.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears, press Stop. If the message does not clear, replace the hammer bank logic cable and the hammer bank power cable. 2. Check the shuttle for electrical shorts (page 260). 3. Power on the printer. If the message appears, replace the shuttle frame assembly. 4. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 5. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 6. Clear NVRAM (page 246). 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 9. Download and install the latest code from IBM First (page 245). 10. Power on the printer in download mode and load flash memory (page 247). 11. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>104 DP FIFO BUSY SEE SETUP GUIDE</p>	<p>There is a timing problem in the Engine Controller firmware.</p>	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the latest code from IBM First (page 245). 2. Power on the printer in download mode and load flash memory (page 247). 3. If the message appears, replace flash memory SIMMs with a blank flash containing the boot code. 4. Load flash memory (page 247). 5. If the message appears, the controller board or microcode is suspect. Do the following: 6. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 7. Clear NVRAM (page 246). 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 10. Download and install the latest code from IBM First (page 245). 11. Power on the printer in download mode, and load flash memory (page 247). 12. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
105 HAMMER COIL <number> OPEN	Electrical malfunction of one or more hammer coils.	<ol style="list-style-type: none"> 1. Check the shuttle for electrical shorts (page 260). 2. Cycle power. If the message appears, replace the shuttle frame assembly. 3. Power on the printer. Run a print test. If the problem reappears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode, and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
110 STACK OVERFLOW SEE SETUP GUIDE	System stack has run out of room and overflowed into other memory.	<ol style="list-style-type: none"> 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 problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
111 STACK UNDERFLOW SEE SETUP GUIDE	Firmware error on the controller board.	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>112 UNDEFINED OPCODE SEE SETUP GUIDE</p>	<p>Firmware error on the controller board.</p>	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>113 PROTECTED INSTRUCTION SEE SETUP GUIDE</p>	<p>Protected Instruction. Firmware error on the controller board.</p>	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
114 ILLEGAL OPERAND ACCESS SEE SETUP GUIDE	Illegal Operand Accessed. Firmware error on the controller board.	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>115 ILLEGAL INSTRUCTION ACCESS SEE SETUP GUIDE</p>	<p>Illegal Instruction Accessed. Firmware error on the controller board.</p>	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM. (page 246) 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
116 ILLEGAL EXTERNAL BUS ACCESS SEE SETUP GUIDE	Illegal External Bus Accessed. Firmware error on the controller board.	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>117 A TO D OVERRUN SEE SETUP GUIDE</p>	<p>The analog-to-digital converter on the controller board has overflowed.</p>	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
118 UNDEFINED INTERRUPT SEE SETUP GUIDE	Firmware error on the controller board.	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
119 TCB CORRUPTED SEE SETUP GUIDE	Task Control Block on the controller board has been corrupted.	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>120 ACCESS NULL POINTER SEE SETUP GUIDE</p>	<p>The processor tried to access a pointer that contains nothing (null).</p>	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
121 PAPER NOT AT SPEED SEE SETUP GUIDE	Firmware error on the controller board.	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
122 PAPER NOT SCHEDULED SEE SETUP GUIDE	The paper feed process is not scheduling on the controller board, and the printer cannot advance paper.	<ol style="list-style-type: none"> 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. If the problem reappears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode, and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>123 PAPER BUSY TOO LONG SEE SETUP GUIDE</p>	<p>Firmware error on the controller board.</p>	<ol style="list-style-type: none"> 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 and unplug the printer. Remove the paper guide assembly or pedestal top cover. Make sure connectors P106 and P107 are fully seated on the controller board. 3. Plug in the printer and power it on. Run the print job again. If the message appears, power off and unplug the printer. 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. (See the Cable Shorts Test on page 263.) 4. Check the shuttle for electrical shorts (page 260). 5. Plug in the printer and power it on. If the problem reappears, the controller board or microcode is suspect. Do the following: 6. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 7. Clear NVRAM (page 246). 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 10. Download and install the latest code from IBM First (page 245). 11. Power on the printer in download mode, and load flash memory (page 247). If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>124 PAPER FIFO OVERFLOW SEE SETUP GUIDE</p>	<p>Paper First In First Out Overflow. Firmware error on the controller board.</p>	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>125 PAPER FIFO UNDERFLOW SEE SETUP GUIDE</p>	<p>Paper First In First Out Underflow. Firmware error on the controller board.</p>	<ol style="list-style-type: none"> 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 and unplug the printer. Remove the paper guide assembly or pedestal top cover. Make sure connectors P106 and P107 are fully seated on the controller board. Plug in the printer. 3. Check hammer phasing (page 427). Try using a lower phasing value; sometimes this message indicates too high a hammer phase value. 4. Run the print job again. If the message appears, power off and unplug the printer. Make sure the MPU cable, the hammer bank logic cable, and the hammer bank power cable are undamaged and have good connections. Replace as needed. (Refer to the Cable Shorts Test on page 263.) 5. Check the shuttle for shorts (page 260). 6. Plug in the printer and power it on. Run the print job again. If the message appears, replace the shuttle frame assembly. 7. Plug in the printer and power it on. If the problem reappears, the controller board or microcode is suspect. Do the following: 8. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 9. Clear NVRAM (page 246). 10. Download and install the latest code from IBM First (page 245). 11. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>125 PAPER FIFO UNDERFLOW SEE SETUP GUIDE (continued)</p>		<ol style="list-style-type: none"> 12. Download and install the latest code from IBM First (page 245). 13. Power on the printer in download mode, and load flash memory (page 247). 14. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support. 15. Power on the printer. Run the print job again. If the message appears, replace the power supply board.
<p>126 PAPER FEED BAD TABLE SEE SETUP GUIDE</p>	<p>The paper feed process on the controller board has a corrupted table. If this message appears during a software download, do the download again. If the message appears on the second try, replace the controller board. Record the message and return it with the defective board. After replacing the controller board, DO NOT make the printer READY, but immediately download the latest code from IBM First (page 245), then power up in download mode and load the flash memory (page 247).</p>	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>127 PAPER FEED ILLEGAL STATE SEE SETUP GUIDE</p>	<p>Firmware error on the controller board.</p>	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
128 PAPER FEED INVALID COMMAND SEE SETUP GUIDE	Paper Invalid Command. Firmware error on the controller board.	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
129 PAPER FEED INVALID PARAMETER SEE SETUP GUIDE	Paper Invalid Parameter. Firmware error on the controller board.	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
130 PAPER FEED PARTLY ENERGIZED SEE SETUP GUIDE	Firmware error on the controller board.	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>131 PAPER FEED INTERRUPT SEE SETUP GUIDE</p>	<p>Unexpected interrupt in the paper feed process on the controller board.</p>	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
132 RIBBON INVALID COMMAND SEE SETUP GUIDE	Firmware error on the controller board.	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
133 RIBBON INVALID STATE SEE SETUP GUIDE	Firmware error on the controller board.	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>134 PLATEN INVALID COMMAND SEE SETUP GUIDE</p>	<p>Firmware error on the controller board.</p>	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears,, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>135 PLATEN INVALID STATE SEE SETUP GUIDE</p>	<p>Firmware error on the controller board.</p>	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
136 PLATEN INVALID PARAMETER SEE SETUP GUIDE	Firmware error on the controller board.	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode, and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>137 SHUTTLE INVALID COMMAND SEE SETUP GUIDE</p>	<p>Firmware error on the controller board.</p>	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Check the shuttle for electrical shorts (page 260). 3. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode, and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>138 SHUTTLE INVALID PARAMETER SEE SETUP GUIDE</p>	<p>Firmware error on the controller board.</p>	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Check the shuttle for electrical shorts (page 260). 3. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode, and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>139 SHUTTLE OVERSPEED SEE SETUP GUIDE</p>	<p>Firmware error on the controller board.</p>	<ol style="list-style-type: none"> 1. Cycle power. Run the print job again. If the message appears, download the emulation software again. 2. Remove the shuttle cover. Remove the paper guide assembly or the pedestal top cover. Make sure the MPU cable (P/N 14H5329) is not pinched. Check both the section of MPU cable coming from the sensor and the intermediate cable extension that runs to the controller board. (Refer to the Interconnection Diagram in Chapter 3.) Check the resistance of the MPU at connector P107. (Refer to the Main Wire Harness Test Tables in Chapter 3.) Replace the MPU if it fails the test. Adjust the gap between the MPU and the shuttle motor flywheel to 0.010 inch (0.254 mm). 3. Check the shuttle for electrical shorts (page 260). 4. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 5. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 6. Clear NVRAM (page 246). 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 9. Download and install the latest code from IBM First (page 245). 10. Power on the printer in download mode, and load flash memory (page 247). If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
990 MACHINE CHECK	Host status message.	No action required.
998 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.	<ol style="list-style-type: none"> 1. Clear NVRAM (page 246). 2. Make sure the printer has at least 8MB of flash memory and at least 8MB of DRAM. 3. Replace the coax/twinax board and adapter. 4. If the message appears at power-up, clear NVRAM (page 246), then replace the flash memory. After replacing the controller board, DO NOT make the printer READY, but go immediately to the next step. 5. Download the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). 7. 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.) 8. If the message appears after replacing or increasing memory, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 9. Download and install the latest code from IBM First (page 245). 10. Power on the printer in download mode, and load flash memory (page 247). If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.
A97 GRAPHIC CHECK ERROR PRESS STOP THEN START	The printer received a non-printable character over a twinax interface.	Press Stop then Start .

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
B10 ERROR: NO DRAM DETECTED*	Boot-up routines did not detect the presence of the SDRAM DIMM.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears again, power down, unplug the printer, and check that there is an SDRAM DIMM installed on the controller board. If not, install the SDRAM. If so, reseal the SDRAM DIMM. 2. Plug in the printer and power it on. If the message appears, replace the SDRAM DIMM. 3. Plug in the printer and power it on. If the message appears, replace the controller board (page 347). Record the message and return it with the defective board.
B11 ERROR: RAM TEST FAILED*	SDRAM failed the boot initialization test.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears again, power down, unplug the printer, and reseal the SDRAM DIMM. 2. Plug in the printer and power it on. If the message appears, replace the SDRAM DIMM. 3. Plug in the printer and power it on. If the message appears, replace the controller board (page 347). Record the message and return it with the defective board.
B12 ERROR: PROGRAM MISSING*	The printer does not see a program in flash memory.	There is no program in printer memory. Download an emulation.
B13 ERROR: NOT COMPATIBLE*	The printer is not compatible with the downloaded program.	Load the correct emulation software option(s) for this printer.
B19 ERROR: DC RETURNED*	This message indicates an incorrectly assembled and tested machine.	Cycle power. If the message appears again contact the printer manufacturer and report this message.
B20 STATUS: 00% DOWNLOAD MODE	Status message informing the operator that software is being downloaded. Percentage figure indicates approximate amount loaded into the printer.	No action required.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
B21 STATUS: PRINTER RESET	Status message informing the operator that the printer is undergoing a system reset.	No action required.
B22 ERROR: DECOMPRESS SIZE*	Flash memory has not passed boot initialization tests.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears again, power down, unplug the printer, and reseat the flash SIMM(s). 2. Plug in the printer and power it on. If the message appears, replace the flash SIMM(s). 3. Plug in the printer and power it on. If the message appears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode, and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
B23 ERROR: DECOMPRESS CKSUM*	Flash memory has not passed boot initialization tests.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears again, power down, unplug the printer, and reseal the flash SIMM(s). 2. Plug in the printer and power it on. If the message appears, replace the flash SIMM(s). 3. Plug in the printer and power it on. If the message appears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode, and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
B40 ERROR: SDRAM EEPROM CKSUM BAD*	Flash memory has not passed boot initialization tests.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears again, power down, unplug the printer, and reseal the flash SIMM(s). 2. Plug in the printer and power it on. If the message appears, replace the flash SIMM(s). 3. Plug in the printer and power it on. If the message appears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode, and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
B41 ERROR: DIMM MEMORY NOT SDRAM*	The DRAM DIMM installed on the controller board is not Synchronous DRAM (SDRAM).	<ol style="list-style-type: none"> 1. Cycle power. If the message appears again, power down, unplug the printer, and reseal the DRAM DIMM. 2. Plug in the printer and power it on. If the message appears, install a new SDRAM DIMM of the correct type and size. 3. Plug in the printer and power it on. If the message appears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode, and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
B42 ERROR: SDRAM ROWS NOT ALLOWED*	Printer boot initialization tests detect incorrect SDRAM.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears again, power down, unplug the printer, and reseal the DRAM DIMM. 2. Plug in the printer and power it on. If the message appears, install a new SDRAM DIMM of the correct type and size. 3. Plug in the printer and power it on. If the message appears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode, and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
B43 ERROR: SDRAM TOO MANY BANKS*	Printer boot initialization tests detect incorrect SDRAM.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears again, power down, unplug the printer, and reseal the DRAM DIMM. 2. Plug in the printer and power it on. If the message appears, install a new SDRAM DIMM of the correct type and size. 3. Plug in the printer and power it on. If the message appears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode, and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
B44 ERROR: SDRAM NOT 64 BITS WIDE*	Printer boot initialization tests detect incorrect SDRAM.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears again, power down, unplug the printer, and reseal the DRAM DIMM. 2. Plug in the printer and power it on. If the message appears, install a new SDRAM DIMM of the correct type and size. 3. Plug in the printer and power it on. If the message appears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode, and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
B45 ERROR: SDRAM IS WRONG VOLTAGE*	Printer boot initialization tests detect incorrect SDRAM.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears again, power down, unplug the printer, and reseal the DRAM DIMM. 2. Plug in the printer and power it on. If the message appears, install a new SDRAM DIMM of the correct type and size. 3. Plug in the printer and power it on. If the message appears, replace the controller board (page 347). Record the message and return it with the defective board.
B46 ERROR: SDRAM HAS MIXED SIZES*	Printer boot initialization tests detect incorrect SDRAM.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears again, power down, unplug the printer, and reseal the DRAM DIMM. 2. Plug in the printer and power it on. If the message appears, install a new SDRAM DIMM of the correct type and size. 3. Plug in the printer and power it on. If the message appears, replace the controller board (page 347). Record the message and return it with the defective board.
B47 ERROR: SDRAM LARGER THAN 256M*	Printer boot initialization tests detect incorrect SDRAM.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears again, power down, unplug the printer, and reseal the DRAM DIMM. 2. Plug in the printer and power it on. If the message appears, install a new SDRAM DIMM of the correct type and size. 3. Plug in the printer and power it on. If the message appears, replace the controller board (page 347). Record the message and return it with the defective board.
B49 ERROR: SDRAM # LOGICAL BANKS*	Printer boot initialization tests detect incorrect SDRAM.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears again, power down, unplug the printer, and reseal the DRAM DIMM. 2. Plug in the printer and power it on. If the message appears, install a new SDRAM DIMM of the correct type and size. 3. Plug in the printer and power it on. If the message appears, replace the controller board (page 347). Record the message and return it with the defective board.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
B50 ERROR: SDRAM LOGIC COMB BANKS*	Printer boot initialization tests detect incorrect SDRAM.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears again, power down, unplug the printer, and reseal the DRAM DIMM. 2. Plug in the printer and power it on. If the message appears, install a new SDRAM DIMM of the correct type and size. 3. Plug in the printer and power it on. If the message appears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode, and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.
BOOT DIAGNOSTICS	Non-error status message.	No action required.
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 3. Message List

Operator Panel Message	Explanation	Corrective Action
DRIVER CIRCUIT BAD	The hammer coil count test failed.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears, press Stop. 2. Check the shuttle for electrical shorts (page 260). 3. Power off and unplug the printer. Remove the shuttle cover. At the shuttle frame assembly, disconnect the hammer bank logic and power cables. Plug in the printer and power it on. If "HB NOT INSTALLD" appears on the LCD, the controller board or microcode is suspect. Do the following: <ol style="list-style-type: none"> 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.
ENERGY SAVER MODE ACTIVE	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.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
E Net Test Unavailable	The Ethernet PCBA did not initialize correctly.	<ol style="list-style-type: none"> 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 will read "Initializing ENET.") 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 Ready state, follow the <i>Setup Guide</i> and re-enter the IP address, subnet mask, and default gateway address (if used). 6. Print the Ethernet Test Page from the Operator Print Tests. 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.
ERROR: DRAM AT ADDRESS <hex>	The printer found a defective memory location.	<ol style="list-style-type: none"> 1. Replace the DRAM. After replacing the controller board, DO NOT make the printer READY. Immediately download the latest code from IBM First (page 245). 2. Power on the printer in download mode and load flash memory (page 247). 3. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245).

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>ERROR: DRAM AT ADDRESS <hex> (continued)</p>		<ol style="list-style-type: none"> 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
ERROR: DRAM NOT DETECTED	DRAM is defective or missing.	<ol style="list-style-type: none"> 1. Check DRAM on the controller board. If present, reseal DRAM; if missing, install DRAM. After replacing the controller board, DO NOT make the printer READY. Immediately download the latest code from IBM First (page 245). 2. Power on the printer in download mode and load flash memory (page 247). 3. Power on the printer. If the message appears, replace the DRAM. 4. Power on the printer. If the message reappears, the controller board or microcode is suspect. Do the following: 5. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 6. Clear NVRAM (page 246). 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 9. Download and install the latest code from IBM First (page 245). 10. Power on the printer in download mode and load flash memory (page 247). 11. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
ERROR: FLASH DID NOT PROGRAM	The printer encountered an error trying to program flash memory.	<ol style="list-style-type: none"> 1. Download the latest code from IBM First (page 245). 2. If the message occurs again, replace the flash memory with blank flash containing boot code. 3. Download the latest code from IBM First (page 245). 4. Power on the printer in download mode and load flash memory (page 247). 5. If the message appears, the controller board or microcode is suspect. Do the following: 6. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 7. Clear NVRAM (page 246). 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 10. Download and install the latest code from IBM First (page 245). 11. Power on the printer in download mode and load flash memory (page 247). 12. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
ERROR OCCURRED FLUSHING QUEUES*	An interim message that displays while the printer discards host data it cannot use because a fault condition exists. While this message displays, the asterisk (*) rotates.	Wait. When the asterisk (*) stops rotating, a different fault message will appear: troubleshoot the final message.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
ERROR: PROGRAM NOT VALID	The printer does not see a program in flash memory.	<ol style="list-style-type: none"> 1. There is no program in printer memory. Download the latest code from IBM First (page 245). 2. Power on the printer in download mode and load flash memory (page 247). 3. If the message appears, replace the flash memory and reload code. 4. If the problem reappears, the controller board or microcode is suspect. Do the following: <ol style="list-style-type: none"> 5. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 6. Clear NVRAM (page 246). 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 9. Download and install the latest code from IBM First (page 245). 10. Power on the printer in download mode, and load flash memory (page 247). 11. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
ERROR: SECURITY PAL NOT DETECTED	The security PAL is missing or has failed. Power off and unplug the printer. Remove the paper guide assembly or pedestal top cover.	<ol style="list-style-type: none"> 1. Power off and unplug the printer. Check the security PAL at location U54 on the controller board. If the PAL is absent, install the correct PAL. If a security PAL is present, replace it. 2. Plug in the printer and power it on. If the problem reappears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
ERROR: SHORT AT ADDRESS XXXX	Hardware failure in DRAM or controller board circuitry.	<ol style="list-style-type: none"> 1. Download the program again (page 245). 2. Check the shuttle for electrical shorts (page 260). 3. Power on the printer. If the message appears again, replace the DRAM. If message occurs with new memory, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.
ETHERNET ADAPTER BEING INITIALIZED	Status message that indicates that the internal Network Interface Card is processing the boot procedure. (May occur with older versions of microcode.)	No action required.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
ETHERNET DETECTED	Status message that indicates that the internal Network Interface Card has established communication.	No action required.
FLASH TYPE IS NOT SUPPORTED	The printer boot code cannot write to the flash SIMM installed.	<ol style="list-style-type: none"> 1. Install the correct blank flash SIMM with boot code (page 379). 2. Download the latest code from IBM First (page 245). 3. Power on the printer in download mode and load flash memory (page 247). 4. If the message appears again, the controller board or microcode is suspect. Do the following: 5. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 6. Clear NVRAM (page 246). 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 9. Download and install the latest code from IBM First (page 245). 10. Power on the printer in download mode and load flash memory (page 247). 11. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
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.
FREEFORM OFF	This message can appear if an operator panel key is stuck in the down position. Check the operator panel for stuck key(s).	<ol style="list-style-type: none"> 1. Release any 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. The message should be gone. If the message appears, replace the operator panel.
FREEFORM ON: OFF HOLD KEY @ PWRUP	This message appears if the freeform feature is enabled. This feature is for manufacturing use only and is never used by the customer or field maintenance personnel.	<ol style="list-style-type: none"> 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. Cycle power. If the message reappears, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY—proceed to the next step 3. Download the latest code from IBM First (page 245). 4. Power on the printer in download mode and load flash memory (page 247).

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
HAMMER BANK NOT INSTALLED	Self-test routines do not detect hammer coils at printer start-up.	<ol style="list-style-type: none"> 1. Power off and unplug the printer. Verify that the shuttle frame assembly is installed. Install the shuttle frame assembly. 2. Remove the paper guide assembly or pedestal top cover. Verify that the hammer bank logic cable is connected to connector J108 on the controller board and to the shuttle frame assembly. 3. Plug in the printer and power it on. If the message appears, test the hammer bank logic cable for shorts (page 263). 4. Check the shuttle for electrical shorts (page 260). 5. Power on the printer. If the message appears, replace the hammer bank logic cable. 6. Plug in the printer and power it on. If the message appears, replace the shuttle frame assembly. 7. Plug in the printer and power it on. If the message appears again, the controller board or microcode is suspect. Do the following: 8. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 9. Clear NVRAM (page 246). 10. Download and install the latest code from IBM First (page 245). 11. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 12. Download and install the latest code from IBM First (page 245). 13. Power on the printer in download mode and load flash memory (page 247). If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>HAMMER COIL BAD #, #, #, #, ... etc.</p>	<p>Hammer coil(s) number #, #, etc. failed the current test at power-up. Check that the hammer bank cables are connected.</p>	<ol style="list-style-type: none"> 1. Check the shuttle for electrical shorts (page 260). 2. Cycle power. If the message appears, replace the shuttle frame assembly. Record the message and return it with the defective assembly. 3. Power on the printer. If the message appears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
H/B CONTROL MODE	<p>H/B = Hammer Bank. The printer has sensor circuits that continually sample the operating temperature of key components of the print mechanism. When higher than normal temperatures are sensed in one or more coils, print speed is automatically reduced by 50% and the H/B CONTROL MODE 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 the Plot Test. 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 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, or reduce the size and duration of the print jobs.</p>	<ol style="list-style-type: none"> 1. If the printer is a 1500 or 2000 lpm model set the coil temperature (page 429). 2. Inspect the printer environment for severity. Advise the user to move the printer to cooler, cleaner location. 3. 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. 4. Power off and unplug the printer. Remove the paper guide assembly or pedestal top cover. Check all fan cable connections. 5. Plug in the printer and power it on. Verify that all fans operate. Replace any fan that does not operate. 6. 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. 7. Check the shuttle for electrical shorts (page 260). 8. Install the paper guide assembly or pedestal top cover. Load paper. Run the “All E’s” print test for 5 to 10 minutes. If the message appears, replace the shuttle frame assembly. If the printer is a 1500 or 2000 lpm model set the coil temperature (page 429). 9. Run the “All E’s” print test for 5 to 10 minutes. If the problem reappears, the controller board or microcode is suspect. Do the following: 10. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 11. Clear NVRAM (page 246). 12. Download and install the latest code from IBM First (page 245).

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
H/B CONTROL MODE (continued)		<p>13. Power on the printer in download mode and load flash memory (page 247).</p> <ul style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. <p>14. Download and install the latest code from IBM First (page 245).</p> <p>15. Power on the printer in download mode and load flash memory (page 247).</p> <p>16. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.</p> <p>17. If the printer is a 1500 or 2000 lpm model set the coil temperature (page 429).</p>

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
INTERRUPT UNUSED VECTOR 00	This message is generated when the controller board gets an interrupt that it does not understand. This problem can be created by electrical noise, a software problem, or by a hardware problem.	<ol style="list-style-type: none"> 1. Cycle power. If this message occurred once and never again, you can ignore it. 2. Check the shuttle for electrical shorts (page 260). 3. If the message reappears or appears consistently check the grounding of the printer. If the machine is correctly grounded, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, suspect and application software error. Reinstall the original controller board and contact your DDS and Second Level Support.
LOADING PROGRAM FROM PORT XX%	The new emulation program is loading into printer RAM. XX% indicates how much of the program has loaded.	No action required.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
LOADING PROGRAM INTO FLASH	The printer has deleted the previous emulation program from flash memory and is loading the new program into flash memory.	No action required.
NOT READY	Printer state message: printer is offline, not in communication with host.	No action required.
OPERATOR MENU <menu item>	Non-error status message.	No action required.
OPERATOR MENU LOCKED	Non-error status message.	No action required, unless you want to unlock the Enter key.
OPERATOR MENU UNLOCKED	Non-error status message.	No action required, unless you want to lock the Enter key.
PA1 SELECTED	Attach status message.	No action required.
PA2 SELECTED	Attach status message.	No action required.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
P00 ERROR: SYSTEM FAULT	Firmware error on the controller board.	<ol style="list-style-type: none"> 1. Download the latest code from IBM First (page 245). If the message appears, replace the flash memory with blank flash containing boot code. 2. Load flash memory (page 247). 3. If the message appears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.
P05 DIAGNOSTIC TEST PASSED	Non-error status message: the printer passed its memory and hardware initialization tests.	No action required, but if the printer “hangs” with this message displayed go to Printer does not complete IML , page 190.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
P17 SECURITY VIOLATION	Security code of the PAL on the controller board does not match the code of the firmware on the controller board.	<ol style="list-style-type: none"> 1. Power off and unplug the printer. Remove the paper guide assembly or pedestal top cover. Check that the security PAL is correctly installed. Install the correct PAL for the customer's emulations with the notched end toward the flash and DRAM SIMM sockets. 2. Plug in the printer and power it on. If the message appears, the controller board or microcode is suspect. Do the following: 3. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 4. Clear NVRAM (page 246). 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>P60 ERROR: DRAM AT ADDRESS <hex></p>	<p>The printer found a defective memory location.</p>	<ol style="list-style-type: none"> 1. Replace the DRAM. 2. Check the shuttle for electrical shorts (page 260). 3. Power on the printer. If the message appears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
P61 ERROR: FLASH NOT DETECTED	The printer could not find flash memory.	<ol style="list-style-type: none"> 1. Power off and unplug the printer. Check flash memory on the controller board. If present, reseal the flash SIMMs; if missing, install new flash SIMMs. After replacing the controller board, DO NOT make the printer READY, but go to the next step immediately. 2. Download the latest code from IBM First (page 245). 3. Plug in the printer and power it on in download mode and load flash memory (page 247). If the message appears again, replace flash memory SIMMs. 4. Load flash memory (page 247). 5. Power on the printer. If the message appears, the controller board or microcode is suspect. Do the following: 6. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 7. Clear NVRAM (page 246). 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 10. Download and install the latest code from IBM First (page 245). 11. Power on the printer in download mode, and load flash memory (page 247). 12. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>P62 ERROR: DC PROGRAM NOT VALID</p>	<p>The printer cannot find the data controller program or the validation checksum is corrupt.</p>	<ol style="list-style-type: none"> 1. Download the latest code from IBM First (page 245). 2. Power on the printer in download mode and load flash memory (page 247). 3. If the message appears, replace flash memory SIMMs with a blank flash containing the boot code. 4. Load flash memory (page 247). 5. If the message appears, the controller board or microcode is suspect. Do the following: 6. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 7. Clear NVRAM (page 246). 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 10. Download and install the latest code from IBM First (page 245). 11. Power on the printer in download mode, and load flash memory (page 247). 12. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
P63 ERROR: PROGRAM NOT COMPATIBLE	The printer is not compatible with the downloaded program.(The user may have tried to load a CMX/CFX-compatible diskette in a CBO-controlled printer, or vice versa.)	Use the correct emulation software option(s) for this model printer (page 245). If the printer is an IBM 6400-i20, the controller is a CFX board. If the printer is a 6400-i24 or -i2s, the controller is a PSA3 board. All other 6400 and 6400-i models use a CMX controller board.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>P64 ERROR: CHECKSUM WRONG <hex></p>	<p>The printer received the complete program but the checksum did not match. The data may have been corrupted during download.</p>	<ol style="list-style-type: none"> 1. Power off the printer. Download the program again from the beginning. If the message appears, replace the DRAM. 2. Download the latest code from IBM First (page 245). If the message appears, replace the flash memory with blank flash containing boot code. 3. Load flash memory (page 247). 4. If the message appears, the controller board or microcode is suspect. Do the following: 5. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 6. Clear NVRAM (page 246). 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 9. Download and install the latest code from IBM First (page 245). 10. Power on the printer in download mode and load flash memory (page 247). 11. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.
<p>P65 ERROR: PROGRAM NEEDS MORE FLASH</p>	<p>The printer requires more flash memory in order to run the downloaded program.</p>	<p>Add flash memory or use a smaller emulation program (page 245). NOTE: The printer requires 8MB of flash memory for the latest level of code to work correctly.</p>

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
P66 ERROR: PROGRAM NEEDS MORE DRAM	The printer requires more DRAM memory in order to run the downloaded program.	Add DRAM or use a smaller emulation program (page 245). NOTE: The printer requires 8MB of DRAM for the latest level of code to work correctly.
P67 ERROR: WRITING TO FLASH	Hardware or software fault in flash memory.	<ol style="list-style-type: none"> 1. Replace flash memory with blank flash containing boot code. 2. Load flash memory (page 247). 3. If the message appears with new memory, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
P68 ERROR: EC PROGRAM NOT VALID	The printer cannot find the engine controller program or the validation checksum is corrupt.	<ol style="list-style-type: none"> 1. Download the latest code from IBM First (page 245) and load flash memory (page 247). If the message occurs again, replace all flash memory SIMMs with blank flash containing boot code. 2. Load flash memory (page 247). 3. If the message appears, the controller board or microcode is suspect. Do the following: <ol style="list-style-type: none"> 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>P69 ERROR: EC STOPPED AT STATE XXXX</p>	<p>Where XXXX is a number from 0000 to 0010. The Engine Controller hung at a process indicated by XXXX. (Refer to “The Power On Sequence” in Chapter 2 for descriptions of the different states.)</p> <p>If the state is 0000, replace the controller board. Record the message and return it with the defective board. After replacing the controller board, DO NOT make the printer READY, but immediately download the latest code from IBM First (page 245), then power up in download mode and load the flash memory (page 247).</p>	<ol style="list-style-type: none"> 1. Power off and unplug 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 (page 347). After replacing the controller board, DO NOT make the printer READY—proceed to the next step 2. Download the latest code from IBM First (page 245). 3. Plug in the printer and power it on in download mode and load flash memory (page 247). 4. Install the flash and DRAM SIMMs, making sure they are fully and correctly seated. Power on the printer. Load the flash memory. If the message appears, replace the flash memory with blank flash containing boot code. 5. Plug in the printer and power it on. Load the flash memory. If the message appears, replace the DRAM SIMM(s). 6. Plug in the printer and power it on. If the message appears, the controller board or microcode is suspect. Do the following: 7. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 8. Clear NVRAM (page 246). 9. Download and install the latest code from IBM First (page 245). 10. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board if it was not previously replaced (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 11. Download and install the latest code from IBM First (page 245).

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
P69 ERROR: EC STOPPED AT STATE XXXX (continued)		12. Power on the printer in download mode and load flash memory (page 247). 13. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.
PLEASE WAIT... RESET IN PROGRESS	Status message: the printer finished loading the program into flash memory and is automatically resetting itself.	No action required.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
RBN DRVR CIR* See Manual	The ribbon driver circuit on the controller board is drawing too much current.	<ol style="list-style-type: none"> 1. Cycle power. If the message appears, the controller board or microcode is suspect. Do the following: 2. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 3. Clear NVRAM (page 246). 4. Download and install the latest code from IBM First (page 245). 5. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). 8. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support. 9. Power on the printer. If the message appears, replace the ribbon motors.
READY	Printer state message: the printer is online.	No action required.
RESETTING... PLEASE WAIT	Status message: the printer is resetting itself.	No action required.
RESTORING BOOT CODE	Status message when downloading boot code. Code is checked then saved in flash memory.	No action required.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
RIBBON OUT OF INK CHANGE RIBBON	RibbonMinder** software has determined that the ribbon is out of ink.	Install a new ribbon and set ribbon life to 100%.
SENDING PROGRAM TO EC PROCESSOR	Status message: the printer is loading the engine controller program into the engine controller.	No action required.
SERVICE <service test>	Non-error status message.	No action required.
SHUTTLE TYPE NOT SUPPORTED*	The shuttle type was not detected at power-up.	<ol style="list-style-type: none"> 1. Power off and unplug the printer. Remove the paper guide assembly or top cover 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. Plug in the printer and power it on. 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.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
<p>SOFTWARE ERROR* Cycle power</p>	<p>Application software tried to perform an illegal printer function or damaged logic circuits were detected on the controller board.</p>	<ol style="list-style-type: none"> 1. Cycle power. If the message appears, power off and unplug the printer. 2. Disconnect the input data line from the host computer. Plug in the printer and power it on. If the message appears, download the latest code from IBM First (page 245). 3. Cycle power. Run the print job again. If the message reappears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, there is an application software error. Reinstall the original controller board and contact your DDS and Second Level Support.

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
TABLE MISMATCH DOWNLOAD AGAIN	An engine controller (EC) software update is in process.	<ol style="list-style-type: none"> 1. Power off and unplug the printer. 2. Reseat the DRAM SIMMs or SDRAM DIMM, and the flash SIMMs. 3. Plug in the printer, power it on, and download the program again from the beginning. 4. If the problem persists, replace the (S)DRAM and flash memory, and download the code again. 5. Check the shuttle for electrical shorts (page 260). 6. Check that connector P105 is not connected upside down. Compare pin 1 to pin 1. 7. Do a cable shorts test on the hammer bank logic and power cables (page 263). 8. Plug in the printer and power it on. If the problem still exists, the controller board or microcode is suspect. Do the following: 9. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 10. Clear NVRAM (page 246). 11. Download and install the latest code from IBM First (page 245). 12. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 13. Download and install the latest code from IBM First (page 245). 14. Power on the printer in download mode and load flash memory (page 247).

Table 3. Message List

Operator Panel Message	Explanation	Corrective Action
TABLE MISMATCH DOWNLOAD AGAIN (continued)		<p>15. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.</p> <p>16. If the problem still exists, replace the power supply board.</p>
TESTING HARDWARE PLEASE WAIT	Status message when printer runs self-tests and initialization routines.	No action required, but if the printer “hangs” at this message, refer to “Printer does not complete IML,” page 190.
TOP OF FORM SET	Non-error status message.	No action required.
WAITING FOR ETHERNET ADAPTER	Status message that appears when printer is first powered on if the internal Network Interface Card 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, but if the printer “hangs” with this message displayed, refer to the ethernet reset procedures in the <i>Ethernet User's Manual</i> .
WAITING FOR PROGRAM DOWNLOAD	Emulation download mode has been activated, but program download has not yet begun.	No action required.

Troubleshooting Other Symptoms



- <3> Hazardous voltages are present in the printer with the power cord connected to the power source. Switch off printer power and unplug the printer power cord before proceeding.
- <4> Do not connect or disconnect any communication port, teleport, attachment connector, or power cord during an electrical storm.
- <5> Power off the printer and disconnect the power cord before connecting or disconnecting any communication port, teleport, or attachment cable connector.

Use standard fault isolation techniques to troubleshoot malfunctions that are 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** that begins on page 179. If you find a match, go to the troubleshooting procedure and follow the numbered instructions.
4. If you do not 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.

IMPORTANT

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

5. Replace the defective part or assembly.
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 4 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 4, troubleshoot using the Half-Split Method described on the previous page.

Table 4. General Symptom List

Symptom	Corrective Action
Communications Failures	
Printer “hangs” during print job	<ol style="list-style-type: none"> 1. Reload the latest level of code (page 245). 2. Replace the platen open switch. 3. Refer to Table 5, “. Common Communications Problems,” on page 220.
Fails to print from host	Refer to Table 5, “. Common Communications Problems,” on page 220.
Prints incorrect characters	Refer to Table 5, “. Common Communications Problems,” on page 220.
Prints extra characters	Refer to Table 5, “. Common Communications Problems,” on page 220.
Drops characters	Refer to Table 5, “. Common Communications Problems,” on page 220.
Data Loss	Refer to Table 5, “. Common Communications Problems,” on page 220.
Cannot Print (Ethernet interface)	Refer to Table 5, “. Common Communications Problems,” on page 220.
Host cannot communicate with 6400 printer when hooked up to TCP/IP to AS/400 with the Ethernet NIC installed	Refer to the appropriate Ethernet Interface User’s Manual.

Table 4. General Symptom List

Symptom	Corrective Action
Cannot access the printer through PMU (Ethernet Interface)	<p>If the Ethernet port is not enabled under the Debug Menu, the following message will occur when you try to connect to a printer:</p> <p>“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.”</p> <p>To solve this problem, the Debug Ethernet option must be enabled to allow the PMU to establish a connection with the Ethernet Interface.</p> <ol style="list-style-type: none"> 1. Make sure a successful “ping” can be performed. 2. If the Ready indicator is on, press the Stop key. The printer must be in the NOT READY state to do this procedure. 3. Press Scroll ↑ + Scroll ↓ + Return + Enter. (Press all four keys at the same time.) “SERVICE / PRINTER MECHANISM TESTS” appears on the display. 4. Press Scroll ↑ + Scroll ↓ to unlock the Enter key. 5. Press the Scroll ↑ or Scroll ↓ key until “SERVICE / PRINTER MGMT” appears on the display. 6. Press Enter. “PRINTER MGMT / DIAGNOSTIC PORT” appears on the display. 7. Press Enter. “DIAGNOSTIC PORT” (and the current diagnostic port setting) appears on the display. If the current setting is “DEBUG ETHERNET*”, go to step 10. 8. Press Scroll ↑ until “DIAGNOSTIC PORT / DEBUG ETHERNET” appears on the display. 9. Press Enter. An asterisk (*) appears next to the selection, indicating it is now the diagnostic port. 10. Press Scroll ↑ + Scroll ↓ to lock the Enter key. 11. Press Stop to exit the menu and put the printer in the NOT READY state. 12. Power off the printer, wait a few seconds, then power on the printer to activate the new diagnostic port. The PMU will now establish a connection with the Ethernet Interface.

Table 4. General Symptom List

Symptom	Corrective Action
Jams	
CLEAR JAM message instead of LOAD FORMS when printer is out of paper	<ol style="list-style-type: none"> 1. Power off and unplug the printer. Remove the paper guide assembly or pedestal top cover. Remove the barrier shield (cabinet model) or the barrier shield and paper guide (pedestal model). Check that the paper detector switch assembly is securely mounted in its bracket. 2. Check that connector P106/PMD is fully seated in connector J106 on the controller board. 3. Plug in the printer and power it on. Load paper. Replace the paper detector switch assembly if either message appears. 4. Check the shuttle for electrical shorts (page 260). 5. Plug in the printer and power it on. If either message appears, the controller board or microcode is suspect. Do the following: <ol style="list-style-type: none"> 6. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 7. Clear NVRAM (page 246). 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 10. Download and install the latest code from IBM First (page 245). 11. Power on the printer in download mode and load flash memory (page 247). 12. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 4. General Symptom List

Symptom	Corrective Action
CLEAR JAM message will not clear and paper does not move	<ol style="list-style-type: none"> 1. Remove the paper guide assembly or pedestal top cover. Make sure connector P107/PAPR M is fully seated in connector J107 on the controller board. For -i20 models, check connector J103 on the controller board. 2. If the platen gap is correct, remove the shuttle frame assembly and check the following: <ol style="list-style-type: none"> 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. 3. On an older printer, check the paper feed motor pulley for looseness. (Newer printers have pressed on pulleys that do not come loose.) Hold the collar snug against the motor pulley and torque the 7/64 inch setscrew to 25 ± 2 inch-pounds ($2.82 \pm 0.23 \text{ N}\cdot\text{m}$). 4. Check and adjust the paper feed timing belt. Replace the belt if it is damaged. 5. Power on the printer. Load paper. Press Form Feed 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. 6. Check the shuttle for electrical shorts (page 260). 7. Power on the printer. Press Form Feed and View several times and check that paper moves correctly in both directions. If the message appears or the paper moves erratically, the controller board or microcode is suspect. Do the following: 8. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.)

Table 4. General Symptom List

Symptom	Corrective Action
CLEAR JAM message will not clear and paper does not move (continued)	<ol style="list-style-type: none"> 9. Clear NVRAM (page 246). 10. Download and install the latest code from IBM First (page 245). 11. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 12. Download and install the latest code from IBM First (page 245). 13. Power on the printer in download mode and load flash memory (page 247). 14. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 4. General Symptom List

Symptom	Corrective Action
CLEAR JAM message will not clear but paper moves	<ol style="list-style-type: none"> 1. Power off and unplug the printer. Remove the paper guide assembly or pedestal top cover. Check that connector P106/PMD is fully seated in connector J106 on the controller board. 2. Remove the barrier shield (cabinet model) or the barrier shield and paper guide (pedestal model). Check that the paper detector switch assembly is securely mounted in its bracket. 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. Plug in the printer and power it on. Load paper. Replace the paper detector switch assembly if the message appears. 6. Plug in the printer and power it on. If the problem reappears, the controller board or microcode is suspect. Do the following: <ol style="list-style-type: none"> 7. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 8. Clear NVRAM (page 246). 9. Download and install the latest code from IBM First (page 245). 10. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 11. Download and install the latest code from IBM First (page 245). 12. Power on the printer in download mode and load flash memory (page 247). 13. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 4. General Symptom List

Symptom	Corrective Action
Operator Panel	
Black squares on operator panel display	<ol style="list-style-type: none"> 1. Power off and unplug the printer. Remove the paper guide assembly or pedestal top cover. Disconnect the operator panel cable from the panel and from J110 on the controller board. Check continuity of the cable. Replace the operator panel cable if it fails continuity test. Connect the cable. 2. If the printer has the coax/twinax expansion 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 coax/twinax expansion board. 3. Make sure the flash memory is seated properly in J10 and J11. Regardless of memory configuration, J11 must be used. Reseat flash memory. 4. Plug in the printer and power it on. If black squares appear on the LCD, the flash memory could be blank. Replace the flash SIMM in J11 with a new flash SIMM and reload code (page 245). 5. Make sure the controller board has a security module installed. 6. Check the shuttle for electrical shorts (page 260). 7. Plug in the printer and power it on. If black squares appear on the LCD, replace the operator panel. 8. Plug in the printer and power it on. If black squares appear on the LCD, replace the controller board (page 347). After replacing the controller board, do NOT make the printer READY, but proceed immediately to the next step. 9. Download and install the latest code from IBM First (page 245). 10. Power on the printer in download mode and load flash memory (page 247). 11. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 4. General Symptom List

Symptom	Corrective Action
Operator panel blank	<ol style="list-style-type: none"> <li data-bbox="684 310 1881 399">1. Power off and unplug the printer. Remove the paper guide assembly or pedestal top cover. Check all cable connections into the controller board; make sure the control panel cable is seated in connector J110 on the controller board. <li data-bbox="684 415 1881 505">2. If the printer has the coax/twinax expansion board, check the adapter connection to the controller board. Make sure the 60-pin expansion adapter is correctly seated in the controller board and the coax/twinax expansion board. <li data-bbox="684 521 1881 610">3. Plug in the printer and power it on. Inspect the operator panel display and cooling fans. If the operator panel is blank and the cooling fans come on, replace the operator panel cable assembly and/or the operator panel, as required. <li data-bbox="684 626 1310 651">4. Check the shuttle for electrical shorts (page 260). <li data-bbox="684 667 1829 724">5. Plug in the printer and power it on. If the operator panel is blank and the fans do not come on, replace the power supply board. <li data-bbox="684 740 1881 829">6. Plug in the printer and power it on. If the operator panel is blank, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. <li data-bbox="684 846 1472 870">7. Download and install the latest code from IBM First (page 245). <li data-bbox="684 886 1608 911">8. Power on the printer in download mode and load flash memory (page 247). <li data-bbox="684 927 1881 984">9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 4. General Symptom List

Symptom	Corrective Action
Operator panel display shows garbled, broken characters	<ol style="list-style-type: none"> 1. Remove the paper guide assembly or pedestal top cover. Check cable connections into the controller board. Make sure the control panel cable is seated in connector J110 on the controller board. 2. Replace the flash memory. 3. Download the latest code from IBM First (page 245). 4. Power on the printer in download mode and load flash memory (page 247). 5. Make sure the DRAM SIMM(s) is/are seated properly in J15/J16. Reseat DRAM SIMM(s). 6. Power on the printer. If the control panel shows broken characters, replace the DRAM. 7. Power on the printer in download mode and load flash memory (page 247). 8. Do a cable shorts test on the operator panel cable (page 263). 9. If the problem reappears, replace the operator panel and operator panel cable assembly. 10. Power on the printer. If the problem reappears, the controller board or microcode is suspect. Do the following: 11. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 12. Clear NVRAM (page 246). 13. Download and install the latest code from IBM First (page 245). 14. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 15. Download and install the latest code from IBM First (page 245). 16. Power on the printer in download mode and load flash memory (page 247). 17. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 4. General Symptom List

Symptom	Corrective Action
Operator panel keys do not work	<ol style="list-style-type: none"><li data-bbox="684 310 1894 370">1. Power on the printer. Check the operation of the operator panel keys. Replace the operator panel if keys do not work.<li data-bbox="684 383 1894 443">2. Power on the printer. Check the operation of the operator panel keys. Replace the operator panel cable assembly if keys do not work.<li data-bbox="684 456 1894 548">3. Power on the printer. Check the operation of the operator panel keys. If the keys do not work, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step.<li data-bbox="684 561 1894 591">4. Download and install the latest code from IBM First (page 245).<li data-bbox="684 604 1894 633">5. Power on the printer in download mode and load flash memory (page 247).<li data-bbox="684 646 1894 706">6. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 4. General Symptom List

Symptom	Corrective Action
Power / IML Failures	
<p>No power, and the operator panel is blank, and the card cage fan is not running</p> 	<ol style="list-style-type: none"> 1. Check that the AC power outlet has power. Restore AC power as required. 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 guide assembly or pedestal top cover. Verify that the AC-in power cable and the AC power input cables are connected to the on/off switch/circuit breaker. Connect the AC-in power supply cable and AC power input cables to the on/off switch-circuit breaker. Make sure all ground connections are clean and tight. 4. Check that AC-in power cable connector P1 is connected to J1 on the power supply board. 5. Check that power supply cable connector P101 is connected to J101 on the controller board. 6. Check all cable connections on the controller board. Reseat all cables, making sure that none of the cables are connected upside down. 7. If the printer has the coax/twinax expansion board, make sure the 60-pin expansion adapter is correctly seated in the controller board and the coax/twinax expansion 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 there is no voltage, replace the circuit breaker. If there is voltage, replace the power supply board.
<p>Printer loops IML</p>	<ol style="list-style-type: none"> 1. If the printer is using the coax/twinax interface, check that the coax/twinax card is correctly installed. If it is installed, reseat the card and all connectors and try again. If the problem still occurs, replace the coax/twinax interface and reload code. 2. If the printer is using the Ethernet NIC, download the latest code from IBM First (page 245). 3. Go to "Printer does not complete IML" (page 190).

Table 4. General Symptom List

Symptom	Corrective Action
Printer does not complete IML	<p>NOTE: Power-on initialization is explained on page 239.</p> <ol style="list-style-type: none"> 1. Verify that the customer's power supply is within the specification of the printer. 2. Power off and unplug the printer. Remove the paper guide or pedestal top cover. Check that all cables are connected to the controller board. Reseat all cable connectors on the controller board, especially connectors P106 and P107. Also reseat flash and DRAM SIMMs. 3. If the printer has the coax/twinax expansion board, verify that the correct microcode is loaded in the machine. Download CT emulation software. If the printer does not have the coax/twinax expansion board, go to step 8. 4. Power off and unplug the printer. Check that the user has enough flash memory installed to handle his emulation software. If necessary, install flash memory and DRAM and download the latest code from IBM First (page 245). Power on the printer in download mode and load flash memory (page 247). 5. Plug in the printer and power it on. If the problem persists, replace the flash memory and DRAM. Following replacement, power up the printer in download mode and load flash memory (page 247). 6. Check the coax/twinax adapter connection to the controller board. Make sure that J111 is correctly seated between the controller board and the coax/twinax expansion board. 7. Plug in the printer and power it on. If the printer does not successfully complete IML, replace the coax/twinax expansion board. 8. Plug in the printer and power it on. If the printer does not successfully complete IML, replace the power supply board. 9. Plug in the printer and power it on. If the printer does not successfully complete IML, the controller board or microcode is suspect. Do the following: 10. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 11. Clear NVRAM (page 246). 12. Download and install the latest code from IBM First (page 245). 13. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution.

Table 4. General Symptom List

Symptom	Corrective Action
Printer does not complete IML (continued)	<ul style="list-style-type: none">b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step14. Download and install the latest code from IBM First (page 245).15. Power on the printer in download mode and load flash memory (page 247).16. If you encounter the failure after replacing the controller board, reinstall the original controller board and replace the shuttle frame assembly.17. Plug in the printer and power it on. If the problem persists, replace the operator panel and cable.18. Plug in the printer and power it on. If the problem persists, contact your DDS and Second Level Support.

Table 4. General Symptom List

Symptom	Corrective Action
Printer Power On Resets (POR) by itself	<ol style="list-style-type: none"> 1. Download the latest code from IBM First (page 245). Power on the printer in download mode and load flash memory (page 247). 2. Verify that the customer's power supply is within the specification of the printer. 3. Reseat the flash and DRAM SIMMs. 4. Power on the printer. If the problem persists, replace the power supply. 5. Power on the printer. If the problem persists, the controller board or microcode is suspect. Do the following: 6. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 7. Clear NVRAM (page 246). 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 10. Download and install the latest code from IBM First (page 245). 11. Power on the printer in download mode and load flash memory (page 247). 12. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 4. General Symptom List

Symptom	Corrective Action
Power Stacker	
<p>Printer does not detect presence of power stacker</p> <p>-or-</p> <p>Stacker not working</p>	<ol style="list-style-type: none"> 1. Check that the power stacker is enabled under the Printer Control menu. (Refer to the <i>Setup Guide</i>.) If the power stacker enable/disable option does not appear in the menu, go to the next step. 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. <ol style="list-style-type: none"> a) Power off the printer. b) Unfasten the cable clamp holding the stacker operator panel cables. c) Disconnect the stacker power cable from the back of the stacker operator panel. (See Figure 79, page 527.) 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 operator panel. If the voltages are not correct, power off and unplug the printer, remove the paper guide assembly, and disconnect the stacker power cable from the controller board. (See Figure 85, page 534.) 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, go to the next step. 4. Power off and unplug the printer. Remove the paper guide assembly. Disconnect the stacker cables from the controller board, stacker assembly, and the stacker operator panel (see Figure 85, page 534). Check cables for cuts, breaks, or damaged pins. Check continuity of cables. Replace any cable that is damaged or fails continuity test. Reconnect all stacker cables to the controller board, stacker, and stacker operator panel. 5. Plug in the printer and power it on. Check that the ON LINE indicator lights on the stacker operator panel. If the ON LINE indicator does not light, replace the stacker operator panel. 6. Power on the printer. Check that the ON LINE indicator lights on the stacker operator panel. If the ON LINE indicator does not light, suspect the controller board. Do the following: 7. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 8. Clear NVRAM (page 246).

Table 4. General Symptom List

Symptom	Corrective Action
Printer does not detect presence of power stacker -or- Stacker not working (continued)	<ol style="list-style-type: none"> 9. Download and install the latest code from IBM First (page 245). 10. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure that brought you to this procedure, replace the controller board if it was not replaced earlier in this procedure (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 11. Download and install the latest code from IBM First (page 245). 12. Power on the printer in download mode and load flash memory (page 247). 13. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 4. General Symptom List

Symptom	Corrective Action
Stacker chatters at upper or lower limit	<ol style="list-style-type: none"> 1. Power off and unplug the printer. Unload paper. 2. Open the rear cabinet door, press the elevator disable switch and manually move the elevator up and down, through its entire range of motion. Check that elevator motion is not blocked or hindered by the operator panel cable or other obstruction. The elevator mechanism is sensitive to binding and obstructions, so do all adjustments and servicing very carefully. Remove any obstructions or reroute the stacker operator panel cable as necessary. Check the following areas for possible binding: <ol style="list-style-type: none"> a) Cables adjacent to the elevator and vertical rails. b) Make sure the paper tent is positioned correctly. c) Make sure the paper fences in the elevator slide freely. d) Check for obstructions near the upper and lower limit switches. 3. Verify that the stacker rails are vertical and parallel. Adjust the stacker rails if necessary: they must be vertical and parallel. 4. Make sure the elevator is parallel to the printer. 5. Plug in the printer and power it on. Operate the power stacker. While the stacker is operating, check that: <ol style="list-style-type: none"> 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. 6. While the stacker is operating, observe if assisting the motion of the elevator helps prevent chattering. If so, binding is suspected. Inspect the vertical rails for foreign material (grease, dirt, adhesive residue, etc.) that might cause binding. Clean the rails if necessary. Check that the elevator pulleys (item 12, Figure 106) are not mounted so tightly to the vertical rails that they can cause binding. From 0.005 to 0.020 inches of clearance between the pulleys and the vertical rails is desirable.

Table 4. General Symptom List

Symptom	Corrective Action
<p>Stacker does not stack properly</p> <p>-or-</p> <p>Stacker elevator does not move</p>	<ol style="list-style-type: none"> 1. Power off and unplug the printer. 2. Check for and remove any obstructions preventing elevator movement. 3. Check for misaligned stacker rails Adjust the stacker rails if they are not vertical and parallel. 4. Plug in the printer and power it on. Operate the power stacker. While the stacker is operating, check that: <ol style="list-style-type: none"> 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. 5. Check the stacker limit switches. (See page 197.) If the limit switches are OK, go to the next step. 6. Check the stacker motors. (See page 198.) If the stacker motors are OK, go to the next step. 7. Remove the paper guide assembly. Disconnect stacker cables from the controller board, stacker assembly, and the stacker operator panel (see Figure 85, page 534). Check cables for cuts, breaks, or damaged pins. Check continuity of cables. Replace any cable that is damaged or fails continuity test. Reconnect all stacker cables to the controller board, stacker, and stacker operator panel.
<p>Stacker elevator moves by itself</p>	<ol style="list-style-type: none"> 1. Power off and unplug the printer. Inspect all stacker LEDs for dust, chaff, or dirt. Clean the stacker LEDs and the sight tubes on the LED mounts. 2. Plug in the printer and power it on. If the stacker elevator moves by itself, replace the stacker LEDs.

Table 4. General Symptom List

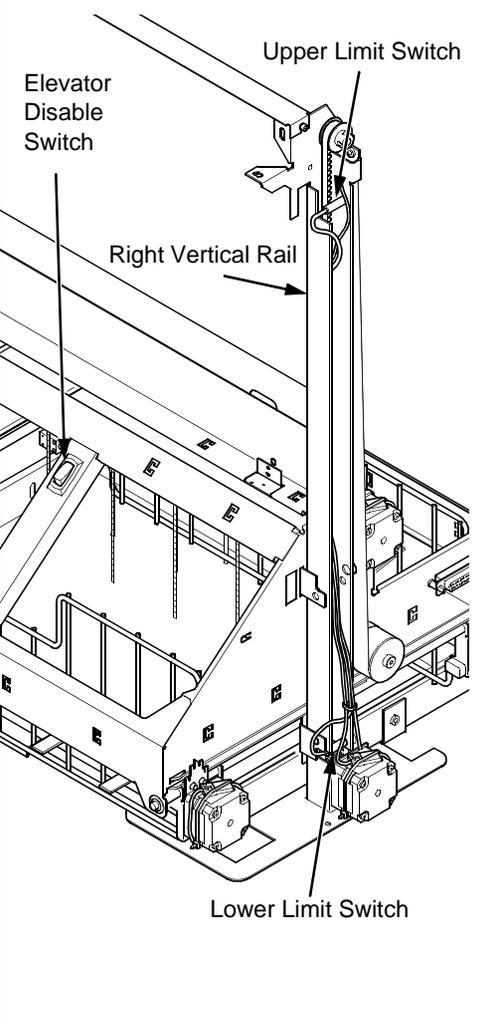
Symptom	Corrective Action
<p>Stacker limit switch check</p> 	<p>NOTE: This procedure tests the upper and lower limit switches on the right vertical rail. These magnetic switches are normally closed. You can quickly check their functionality with a small, powerful magnet.</p> <p>You will usually be referred to this procedure from other troubleshooting procedures. When you have completed this check procedure, return to the procedure that sent you here.</p> <ol style="list-style-type: none"> 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. <ol style="list-style-type: none"> a. With the magnet secured next to the lower limit switch press the ELEVATOR DOWN key on the stacker operator 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. <ol style="list-style-type: none"> a. With the magnet secured next to the upper limit switch press the ELEVATOR UP key on the stacker operator 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 4. General Symptom List

Symptom	Corrective Action
Stacker motor check	<p>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.</p> <ol style="list-style-type: none"> 1. Power off and unplug the printer. 2. Open the rear cabinet door. 3. Unfasten the cable clamp holding the stacker operator panel cables. 4. Disconnect stacker rail cable connector P107 from connector J3 on the back of the stacker operator panel. (See Figure 79, page 527.) 5. Disconnect stacker frame cable connector P102 from connector J4 on the rear of the stacker operator panel. (See Figure 79, page 527.) 6. Locate pin 1 of connector P102 and connector P107. (See page 325 and page 328.) 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 operator panel PCBA pinout drawing on page 302.) 9. Replace any cable that is damaged or fails continuity test. Replace any motor that fails the resistance test.

Table 4. General Symptom List

Symptom	Corrective Action
Print Quality	
<p>Characters or dots are missing, smeared, too light, or too dark, or the output is missing entire dot rows</p>	<ol style="list-style-type: none"> 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. Verify that the customer's forms are within specifications. 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 an approved IBM 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. If the printer is a model 6400-i20 or -i24, go to page 600 and check for "banding." 6. Power off and unplug 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. 7. Inspect the paper ironer. If the paper ironer has slipped up into the print line, reposition the paper ironer. 8. Check the shuttle for electrical shorts (page 260). 9. Check and adjust the platen gap. 10. For -i20 machines, run the operator print test "All H's" and if entire dot rows are missing check the P3 connector at the power supply and P122 and P108 connectors on the controller board.

Table 4. General Symptom List

Symptom	Corrective Action
Characters or dots are missing, smeared, too light, or too dark, or the output is missing entire dot rows (continued)	<ol style="list-style-type: none"> 11. Remove the paper guide assembly or pedestal top cover. Make sure connectors P105 and P108 (and P115 and P122 on -i20/-i24 models) have good connections at the shuttle frame assembly. For i20 and i24 models, make sure connectors P3 and P2 have good connections on the power supply board. 12. Print out the printer's configuration (refer to the <i>Setup Guide</i>). Call support to confirm the correct microcode levels, especially the EC and DC levels. If the code levels are incorrect, download the correct microcode (page 245). 13. Power on the printer. If the problem still occurs, check the hammer bank logic cable and the hammer bank power cable for shorts (page 263). 14. Plug in the printer and power it on. If the problem still occurs, replace the shuttle frame assembly. 15. Plug in the printer and power it on. If the problem still occurs, the controller board or microcode is suspect. Do the following: 16. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 17. Clear NVRAM (page 246). 18. Download and install the latest code from IBM First (page 245). 19. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 20. Download and install the latest code from IBM First (page 245). 21. Power on the printer in download mode and load flash memory (page 247). 22. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 4. General Symptom List

Symptom	Corrective Action
Horizontal misalignment of characters (Dots or characters move left or right from dot row to dot row or line to line)	<ol style="list-style-type: none"> 1. Check and adjust hammer phasing. 2. Check the dynamic paper tension. 3. Remove the shuttle frame assembly and place it on a hard, flat surface. Spin the flywheel by hand and check for binding. The flywheel should spin more than one turn. If it fails this test, replace the shuttle frame assembly. If it passes this test, inspect the shuttle frame assembly area for ink residue, paper chaff, or debris and clean the area and components as necessary. 4. Check the shuttle for electrical shorts (page 260). 5. Check the MPU gap. Using a feeler gauge, adjust the gap between the MPU assembly and the flywheel to $0.010 \pm .001$ inch (0.254 ± 0.025 mm). Torque the 7/16 inch MPU clamp screw to 18 ± 1 inch-pounds (2.03 ± 0.11 N•m). 6. Power on the printer. Run a print test. If the symptom is not gone, replace the MPU. 7. Power on the printer. Run a print test. If the symptom is not gone, replace the shuttle frame assembly. 8. Power on the printer. Run a print test. If the problem reappears, the controller board or microcode is suspect. Do the following: 9. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 10. Clear NVRAM (page 246). 11. Download and install the latest code from IBM First (page 245). 12. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 13. Download and install the latest code from IBM First (page 245). 14. Power on the printer in download mode and load flash memory (page 247). 15. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 4. General Symptom List

Symptom	Corrective Action
Randomly misplaced dots	<ol style="list-style-type: none"> 1. Power off and unplug the printer. Check and adjust the platen gap. 2. Remove the paper guide assembly or pedestal top cover. On the left rear wall of the card cage, make sure the nut which secures the line filter ground line and the AC-In Power Supply cable leads to the ground stud is tight. 3. Disconnect the AC power cord and check the ground leads for continuity. Replace the AC power cord if it fails continuity test. 4. Make sure the printer is plugged in to a grounded power outlet. Power on the printer. Run a print test. If the problem occurs, replace the hammer bank logic cable. 5. Check the shuttle for electrical shorts (page 260). 6. Plug in the printer and power it on. Run a print test. If the problem occurs, replace the flash memory with blank flash with boot code. Replace the DRAM. Download the code (page 245). 7. Plug in the printer and power it on. Run a print test. If the problem occurs, replace the security module. 8. Plug in the printer and power it on. Run a print test. If the problem occurs, the controller board or microcode is suspect. Do the following: 9. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 10. Clear NVRAM (page 246). 11. Download and install the latest code from IBM First (page 245). 12. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 13. Download and install the latest code from IBM First (page 245). 14. Power on the printer in download mode and load flash memory (page 247). 15. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support. 16. Plug in the printer and power it on. Run a print test. If the problem occurs, replace the power supply board.

Table 4. General Symptom List

Symptom	Corrective Action
Randomly misplaced dots (continued)	17. Plug in the printer and power it on. Run a print test. If the problem occurs, replace the shuttle frame assembly.
Incorrect output	<ol style="list-style-type: none"><li data-bbox="684 394 1850 457">1. Check the printer configuration for the proper values of CPI, LPI, print quality, forms length, and width.<li data-bbox="684 461 1430 498">2. Refer to the reset command description in the <i>Setup Guide</i>.

Table 4. General Symptom List

Symptom	Corrective Action
<p>Vertical misalignment of characters:</p> <ol style="list-style-type: none"> 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 	<ol style="list-style-type: none"> 1. Load paper. Press Form Feed 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 and adjust the paper feed timing belt. Replace the belt if it is damaged. 3. Check and adjust the platen gap. 4. Check and adjust the dynamic paper tension (page 430). 5. Check and adjust the tractor belt tension (page 433). 6. 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. 7. Remove the paper guide assembly or pedestal top cover. Make sure connector P107/PAPR M is fully seated in connector J107 on the controller board. 8. Power on the printer. Load paper. Run a print test. If the problem occurs, replace the paper feed motor. 9. Check the shuttle for electrical shorts (page 260). 10. Power on the printer. Run a print test. If the problem occurs, the controller board or microcode is suspect. Do the following: 11. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 12. Clear NVRAM (page 246). 13. Download and install the latest code from IBM First (page 245). 14. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step.

Table 4. General Symptom List

Symptom	Corrective Action
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 (continued)	15. Download and install the latest code from IBM First (page 245). 16. Power on the printer in download mode and load flash memory (page 247). 17. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support. 18. Run a print test. If the problem occurs, replace the power supply board. 19. Run a print test. If the problem occurs, replace the shuttle frame assembly.
Columns of blank spaces	NOTE: You may also be getting "Table Mismatch" errors. 1. Check the hammer bank logic cable for shorts (page 263). 2. Run the operator print test "All H's." If the print test shows horizontally compressed characters arranged in 12 columns with approximately 8 mm of blank space between columns, the flex cable to the shuttle driver card may have cold solder joints. 3. Replace shuttle frame assembly.

Table 4. General Symptom List

Symptom	Corrective Action
Printer Operation	
Downloads consistently fail	<p>NOTE: Most download problems are detected by software during the download procedure and communicated by LCD messages. If downloads fail consistently with no messages or with erratic messages, suspect a hardware failure.</p> <ol style="list-style-type: none"> 1. Power off and unplug the printer. Remove the paper guide assembly or pedestal top cover. Check the I/O cable connections from the host to the printer. Check the parallel cable connection at J112 on the 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. After replacing the controller board, DO NOT make the printer READY, but go to the next step immediately after replacing the controller board. 3. Download the latest code from IBM First (page 245). Plug in the printer and power it on in download mode and load flash memory (page 247). 4. Check that customer has the right size SIMMs for the emulation. Install SIMMs that support the emulation software. 5. Power on the printer in download mode and load flash memory (page 247). If the download fails, activate the Boot Diagnostics Menu (page 230) and run MISC UTILITIES / RUN MEMORY TESTS. If memory fails test, replace the DRAM. If memory tests OK, replace the flash memory with blank flash containing boot code and load flash memory again. 6. If the download fails, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode and load flash memory (page 247). 9. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 4. General Symptom List

Symptom	Corrective Action
Flash SIMM won't copy	<ol style="list-style-type: none"> 1. Power off and unplug 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. After replacing the controller board, DO NOT make the printer READY—go to the next step immediately after replacing the controller board. 2. Download the latest code from IBM First (page 245). 3. Plug the printer in and power it on in download mode and load flash memory (page 247). 4. 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. Activate the Boot Diagnostic menu (page 230). From the Boot Diagnostics menu, select and run MISC UTILITIES / COPY FLASH SIMMS. 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. 5. Activate the Boot Diagnostic menu (page 230). From the Boot Diagnostics menu, select and run MISC UTILITIES / COPY FLASH SIMMS. If the new SIMM does not copy, replace the controller board (page 347) if it was not replaced earlier in this procedure. After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). 8. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.
Slow throughput	Have the customer check the printer and host configurations.

Table 4. General Symptom List

Symptom	Corrective Action
Paper feeds poorly	<ol style="list-style-type: none"> 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 and unplug 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. On an older printer, check the paper feed motor pulley for looseness. (Newer printers have a pressed on pulley that does not get loose.) Hold the collar snug against the motor pulley and torque the 7/64 inch setscrew to 25 ± 2 inch-pounds (2.82 ± 0.23 N•m). 5. Check and adjust the paper feed timing belt. Replace the belt if it is damaged. 6. Check and adjust the platen gap. 7. Check the dynamic paper tension. 8. If the platen gap is correct, remove the shuttle frame assembly (page 405) and check the following: <ol style="list-style-type: none"> 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.

Table 4. General Symptom List

Symptom	Corrective Action
Paper feeds poorly (continued)	<ol style="list-style-type: none"> <li data-bbox="684 310 1894 402">9. Remove the paper guide assembly or pedestal top cover. Make sure connector P107/PAPR M is fully seated in connector J107 on the controller board. For i20 models, check connector J103 on the controller board. <li data-bbox="684 415 1894 508">10. Plug in the printer and power it on. Load paper. Press Form Feed 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. <li data-bbox="684 521 1894 613">11. Plug in the printer and power it on. Press Form Feed and View several times and check that paper moves in both directions. If paper does not move in both directions, the controller board or microcode is suspect. Do the following: <li data-bbox="684 626 1497 657">12. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) <li data-bbox="684 670 1045 701">13. Clear NVRAM (page 246). <li data-bbox="684 714 1476 745">14. Download and install the latest code from IBM First (page 245). <li data-bbox="684 758 1614 938">15. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> <li data-bbox="730 802 1738 833">a. If you encounter loading problems, go to the appropriate error code for resolution. <li data-bbox="730 846 1894 938">b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. <li data-bbox="684 951 1476 982">16. Download and install the latest code from IBM First (page 245). <li data-bbox="684 995 1614 1026">17. Power on the printer in download mode and load flash memory (page 247). <li data-bbox="684 1039 1894 1094">18. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 4. General Symptom List

Symptom	Corrective Action
Printer does not print self tests	<ol style="list-style-type: none"> 1. Power off and unplug the printer. Remove the paper guide assembly or pedestal top cover. 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. Power on the printer. Load paper. Run a self test. If the self test does not run, replace the control panel assembly. 3. Check the shuttle for electrical shorts (page 260). 4. Plug in the printer and power it on. Run a self test. If the self test does not run, the controller board or microcode is suspect. Do the following: 5. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 6. Clear NVRAM (page 246). 7. Download and install the latest code from IBM First (page 245). 8. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 9. Download and install the latest code from IBM First (page 245). 10. Power on the printer in download mode and load flash memory (page 247). 11. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.
Print format parameters change between print jobs.	<ol style="list-style-type: none"> 1. Check the printer configuration for the proper values of CPI, LPI, print quality, forms length, and width. 2. Refer to the reset command description in the <i>Setup Guide</i>.

Table 4. General Symptom List

Symptom	Corrective Action
Reverse paper feed: platen does not open	<ol style="list-style-type: none"> 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. On an older printer, check the platen open pulley and the platen pulley for looseness. (Newer printers have pressed on pulleys that do get loose.) Bottom out the platen open motor pulley on the motor shaft and torque the 1/16 inch set screw to 11 ± 2 inch-pounds ($1.24 \pm 0.23 \text{ N}\cdot\text{m}$). Tighten the 7/64 inch setscrew in the platen shaft pulley, then open and close the forms thickness lever and check that the platen pulley setscrew does not hit the left ribbon guide. 3. Check and adjust the platen open belt. Replace the belt if it is damaged. 4. Check and adjust the platen gap. 5. Power off and unplug the printer. Remove the paper guide assembly. Check that connector P106 is not connected upside down. 6. Disconnect connector P106 from the controller board. Check the resistance of connector P106/ PLAT M. Replace the platen open motor if it fails the resistance test. (Refer to the Main Wire Harness Test diagnostic in Chapter 2.) 7. Check the shuttle for electrical shorts (page 260). 8. Plug in the printer and power it on. Press Form Feed and View several times and check that paper moves in both directions. If the platen does not open during paper reverse, the controller board or microcode is suspect. Do the following: <ol style="list-style-type: none"> 9. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 10. Clear NVRAM (page 246). 11. Download and install the latest code from IBM First (page 245). 12. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 13. Download and install the latest code from IBM First (page 245). Power on the printer in download mode and load flash memory (page 247). 14. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 4. General Symptom List

Symptom	Corrective Action
TOF is lost repeatedly	<ol style="list-style-type: none"> 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. On an older printer, check the paper feed motor pulley for looseness. (Newer printers have a pressed on pulley that does get loose.) Make sure the correct pulley is being used: it should have 25 teeth. Hold the collar snug against the motor pulley and torque the 7/64 inch setscrew to 25 ± 2 inch-pounds ($2.82 \pm 0.23 \text{ N}\cdot\text{m}$). Replace the paper feed pulley if it does not have 25 teeth. 4. Check and adjust the paper feed timing belt. Replace the belt if it is damaged. 5. Check the dynamic paper tension. 6. If the platen gap is correct, remove the shuttle frame assembly (page 405) and check the following: <ol style="list-style-type: none"> 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. 7. Remove the paper guide assembly or pedestal top cover. 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. For i20 models, check connector J103 on the controller board. 8. Power on the printer. Load paper and set TOF. Press Form Feed and View several times and check that paper returns to TOF. Replace the paper feed motor if paper does not return to TOF.

Table 4. General Symptom List

Symptom	Corrective Action
TOF is lost repeatedly (continued)	<ol style="list-style-type: none"> 9. Power on the printer. Press Form Feed and View several times and check that paper returns to TOF. If paper does not return to TOF, the controller board or microcode is suspect. Do the following: 10. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 11. Clear NVRAM (page 246). 12. Download and install the latest code from IBM First (page 245). 13. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 14. Download and install the latest code from IBM First (page 245). 15. Power on the printer in download mode and load flash memory (page 247). 16. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 4. General Symptom List

Symptom	Corrective Action
Printer resets to factory defaults	<ol style="list-style-type: none"> 1. Check the printer configuration for the proper values of CPI, LPI, print quality, forms length, and width. 2. Refer to the reset command description in the <i>Setup Guide</i>. 3. If the problem reappears, the controller board or microcode is suspect. Do the following: 4. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 5. Clear NVRAM (page 246). 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 8. Download and install the latest code from IBM First (page 245). 9. Power on the printer in download mode and load flash memory (page 247). 10. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 4. General Symptom List

Symptom	Corrective Action
Ribbon	
Ribbon folding or feed problems	<ol style="list-style-type: none"> 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 guide assembly or pedestal top cover. 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. Replace a ribbon post that fails the continuity test. 7. Check and adjust the platen gap.

Table 4. General Symptom List

Symptom	Corrective Action
Shuttle	

Table 4. General Symptom List

Symptom	Corrective Action
Shuttle does not move	<ol style="list-style-type: none"> 1. Power down the printer. Remove the shuttle cover. Adjust the gap between the MPU assembly and the flywheel to $0.010 \pm .001$ 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. 3. Remove the paper guide assembly or pedestal top cover. Check that the shuttle motor drive cable is connected to J116 on the controller board. 4. Check the shuttle for electrical shorts (page 260). 5. Check and adjust the platen gap. 6. 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. 7. Check continuity of the shuttle motor drive cable assembly. Replace shuttle motor drive cable assembly if it fails continuity test. 8. Power on the printer. Run a Shuttle Slow or Shuttle Fast test. If the shuttle does not move, replace the shuttle frame assembly. 9. Power on the printer. Run a Shuttle Slow or Shuttle Fast test. If the shuttle does not move, replace the power supply board. 10. Power on the printer. Run a Shuttle Slow or Shuttle Fast test. If the shuttle does not move, the controller board or microcode is suspect. Do the following: 11. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 12. Clear NVRAM (page 246). 13. Download and install the latest code from IBM First (page 245). 14. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). After replacing the controller board, DO NOT make the printer READY, but proceed immediately to the next step. 15. Download and install the latest code from IBM First (page 245).

Table 4. General Symptom List

Symptom	Corrective Action
Shuttle does not move (continued)	<p>16. Power on the printer in download mode and load flash memory (page 247).</p> <p>17. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.</p>
Shuttle is noisy	<ol style="list-style-type: none"> 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. Check the shuttle for electrical shorts (page 260). 4. Inspect the shuttle area for loose hardware. Tighten loose hardware. 5. 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. 6. Power on 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 background experience, and the cause of the problem is not readily apparent, do the following:

1. Print out the printer configuration.
2. Verify that you have the latest level of code. If not, load the latest level of code.
3. Obtain a copy of the Device Host Configuration if possible.
4. Call your support group for assistance in problem analysis.

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

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

Table 5. Common Communications Problems

Problem	Interface	Common Causes
Fails to print from host -or-	parallel	<ul style="list-style-type: none"> - Interface cable defective - Host/Network configuration - Printer logic - Terminating Resistors - Incorrect printer configuration. Refer customer to the <i>Setup Guide</i>.
Prints incorrect characters -or-	serial	<ul style="list-style-type: none"> - Host/Printer interface cable pinouts incompatible - Host/Printer/Network configuration - Set DTR = READY BUFFER NOT FULL; RTS = TRUE - Interface cable defective - Printer logic - Incorrect printer configuration. Refer customer to the <i>Setup Guide</i>.
Prints extra characters -or-	twinax	<ul style="list-style-type: none"> - Interface cable defective - Host-Printer definition - Controller/Network configuration - Printer logic - Incorrect printer configuration. Refer customer to the <i>Setup Guide</i>.
Drops characters -or-	coax	<ul style="list-style-type: none"> - Interface cable defective - Controller/Network configuration - Printer logic - Incorrect printer configuration. Refer customer to the <i>Setup Guide</i>.
Data loss	ethernet	<ul style="list-style-type: none"> - Interface cable defective - Host/Printer/Network configuration - Printer logic - Incorrect printer configuration. Refer the customer to the <i>Setup Guide</i>. - Incorrect ethernet configuration. Refer customer to the <i>Setup Guide</i>.

Device Handshaking

Handshaking is the exchange of signals between the host computer and the printer to indicate the status of the data being transferred. In serial data transfer, the printer uses both hardware and software handshaking and transmits both forms simultaneously when the input buffer is full.

The printer can be used with either serial or parallel host interfaces. Parallel interfaces are usually straightforward, with no special settings required. Serial interfaces, however, have a variety of possible communication parameter settings.

There are two methods of handshaking:

- **Hardware Handshaking**
This is an electrical signal controlled by the logic state on pin 20 of the serial interface connector J2 at the back of the printer. The signal goes high when the printer is ready to receive data. The signal goes low when the printer is in the busy state, which indicates that the input buffer is full and can no longer receive data.
- **Software Handshaking**
XON and XOFF are software signals that control serial data flow between the printer and the host system. When the printer input buffer is full, the printer transmits the XOFF (CTRL S) character, which signals the host to stop sending data. When space becomes available in the input buffer, the printer sends the XON (CTRL Q) character, which tells the host that the printer is ready to receive more data.

The Printer Interface

The printer will not function properly if an incorrectly wired interface cable or the wrong interface cable is installed.

When the printer is first turned on, it resets itself to the following default serial communication parameters:

PARAMETER	DEFAULT VALUE
Baud	9600
Data Bits	8
Parity	NONE
Stop Bits	1

Use the Serial Port configuration menu to change serial interface parameters. (Refer to the *Setup Guide*.)

2

Diagnostics

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Cable Shorts Test.....	page 263
Main Wire Harness Test Diagnostic.....	page 265

Operator Print Tests

A set of print tests is included in the configuration menu structure for use as diagnostic tools. These are called the “Operator Print Tests” because they are available to the user. Use these tests to check the print quality and basic operation of the printer.

The Operator Print Tests are summarized below.

NOTE: Under the description of some tests is a list of items that may need to be adjusted or replaced if the test produces a bad print pattern. The items are listed in the order you should check them: simplest items first, complex items last.

- **Printer Demonstration** Prints a sample page showing every print mode, font, and pitch available in the printer.
- **Print Error Log** Prints the contents of the error log. The error log automatically records certain unit check conditions in a buffer in NVRAM that stores up to 50 messages. The most recent message is stored at the top of the list, the oldest message at the bottom of the list. If more than 50 messages occur before the log is cleared, the oldest messages are deleted, so that the log never contains more than 50 messages.
- **Ripple Print** A “sliding” alphanumeric pattern useful for identifying missing or malformed characters, improper vertical alignment, or vertical compression.
Hammer bank cover
Hammer spring
Shuttle frame assembly
- **All 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.
Ribbon
Splined shaft skew adjustment
Hammer bank cover
MPU sensor
Hammer springs
Hammer coils (shuttle frame assembly)
- **All H's** A pattern of all uppercase letter H's useful for detecting missing characters or dots, smeared characters, or improper phasing.
Ribbon
Hammer bank cover
MPU sensor
Hammer springs
Hammer coils (shuttle frame assembly)
- **All E's + FF** 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.
Hammer bank cover

Power supply board
Paper motion sensor or cable
Paper feed belt or motor
Splined shaft bearings
Tractors or tractor belts

- **Underlines** An underline pattern useful for identifying hammer bank misalignment.
Hammer bank cover
Hammer tips
Paper feed belt or motor
Splined shaft bearings
Tractor bearings or belts
- **E Net Test Page** Prints the ethernet statistics stored in the ethernet Network Interface Card (NIC), if installed.

Selecting And Running Tests

To run Operator Print Tests you use the printer configuration menus, as shown below:

Step	Press	Displayed Result	Notes
1.	Install the ribbon, load paper, and power on the printer.		
2.		NOT READY	Printer must be in NOT READY mode to access the tests.
3.	 + 	OPERATOR MENU UNLOCKED	Unlocking ENTER key allows you to test the printer.
4.		OPERATOR MENU PRINTER CONTROL	First of series of configuration menus.
5.	 UNTIL	OPERATOR MENU OPERATOR PRINT TESTS	Advances to the Operator Printer Tests menu.
6.		OPERATOR PRINT TESTS PRINTER DEMONSTRATION*	Advances to first option in Operator Printer Tests menu.
7.	 UNTIL	OPERATOR PRINT TESTS [TEST NAME]	Cycles through list of tests. Stop when your test displays.
8.		OPERATOR PRINT TESTS [TEST NAME]	The test you selected starts printing.
9.		NOT READY	The printer test stops printing.

Customer Engineer (CE) Tests

A set of printer tests is included in the configuration menu structure for use as maintenance tools. These are called “Customer Engineer Tests” (CE Tests) because they are for your use; they are not available to the user through his documentation. You will use these tests in various troubleshooting and adjustment procedures. CE tests do not run at the rated speed of the printer.

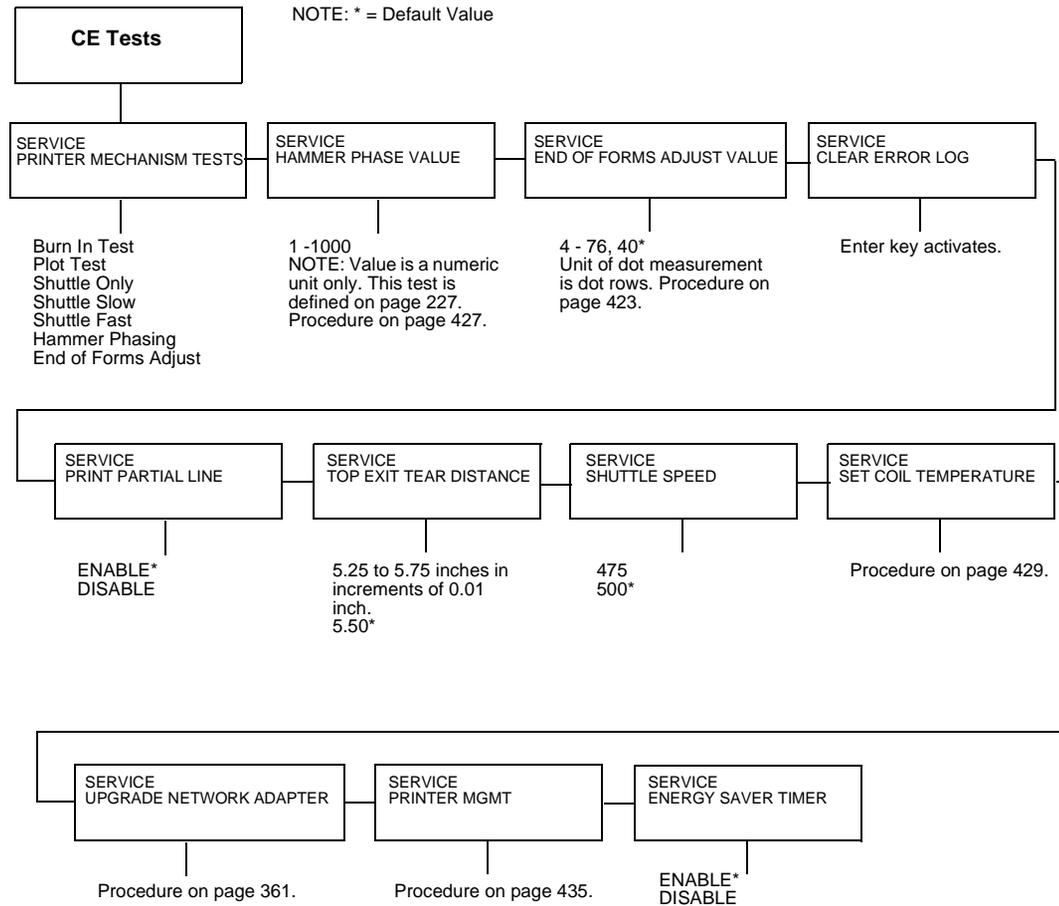


Figure 10. This figure shows the menu structure of the Customer Engineer Tests.

The CE Tests shown in Figure 10 are summarized below:

Printer Mechanism Tests

- **Burn In Test** Use of this test is *not recommended*. This test is used by the manufacturer to burn in the printer before it is shipped to the customer and has no value as a maintenance tool.
- **Plot Test** Prints all dot positions, creating a solid black band. Exercises the shuttle and hammer bank at maximum capacity.
Power Supply board
Hammer bank cover
Hammer springs
Hammer coils (the shuttle frame assembly)
- **Shuttle Only** This test runs only the shuttle.
- **Shuttle Slow** Verifies proper operation by exercising the shuttle and ribbon mechanisms at low speed. You can also use this test to check ribbon tracking and reversing.
- **Shuttle Fast** Verifies proper operation by exercising the shuttle and ribbon mechanisms at high speed. You can also use this test to check ribbon tracking and reversing.
- **Hammer Phasing** A hammer timing parameter that permits you to adjust the vertical alignment of dots in character printing.
- **End of Forms Adjust** A vertical comb pattern used to determine the number of dot rows from the completion of a paper out fault to the end of the paper.

Hammer Phase Value

The hammer phase value is a timing parameter that permits you to adjust the vertical alignment of dots in character printing. The numerical units are relative; they do not represent a physical measurement or value. There is no “correct” value or range.

The factory prints the initial phase value on the aluminum casting of the shuttle assembly, next to the motor housing. Use this value as your starting point when adjusting hammer phasing.

End of Forms Adjustment Value

This parameter determines where on the paper the printer will stop printing when an out of paper fault is detected. The unit of measurement is dot rows. The number of dot rows may be adjusted up or down 1/2 inch from the factory default of 40 dots.

Clear Error Log

This menu selection enables you to delete the stored contents of the error log. The error log automatically records certain unit check conditions in a buffer in NVRAM that stores up to 50 messages. The most recent message is stored at the top of the list, the oldest message at the bottom of the list. If more than 50 messages occur before the log is cleared, the oldest messages are deleted, so that the log never contains more than 50 messages.

Print Partial Line

If the final line of a data stream has no line feed or carriage return character it is retained in the buffer. DISABLE holds the line in the buffer; ENABLE permits the line to be printed after a timeout.

Top Exit Tear Distance

This parameter allows adjustment in 0.01 inch increments of the final location of page perforations when the top paper exit is used.

Shuttle Speed

Does not apply to the models covered in this manual. (Sets shuttle speed in 6400-004, -04P, -005, and -05P printers.)

Set Coil Temperature

An automatic sequence in printer software that recalibrates hammer coil temperature. This procedure applies only to 6400-i15,-i20, -i24, and -i2s printers. See page 429.

Selecting And Running CE Tests

To run CE Tests you use the printer configuration menus, as shown below:

Step	Press	Displayed Result	Notes
1.	Install the ribbon, load paper, and power on the printer.		
2.		NOT READY	Printer must be in NOT READY mode to access the tests.
3.	 +   + 	SERVICE PRINTER MECHANISM TESTS	Press all four keys at the same time.
4.		PRINTER MECHANISM TESTS Burn In Test	Press Enter to view the different mechanism tests.
5.	 UNTIL	PRINTER MECHANISM TESTS Plot Test	Cycles through list of tests. Stop when your test displays.
6.	 + 	OPERATOR MENU UNLOCKED	Unlocking ENTER key allows you to test the printer.
7.		Plot Test Running	The test you selected starts printing. See Chapter 6 for instructions in the use of the Hammer Phasing and End of Forms Adjust tests.
8.	 -OR- 	NOT READY	Stop halts the test, exits the menu, and puts the printer in the NOT READY state. Start halts the test, exits the menu, and puts the printer in the READY state.

Boot Diagnostics Menu

Printer boot-up software contains a menu structure that you can access by holding down the **Eject/Restore** and **Stop** keys while powering up the printer. These menus are not intended for the end user, but provide useful information for manufacturing and maintenance personnel. The boot diagnostic menu structure is depicted in Figure 11.

Activating The Boot Diagnostic Menu

1. Set the printer power switch to O (off).
2. Press and hold down the **Eject/Restore** and **Stop** keys.
3. While holding the **Eject/Restore** and **Stop** keys, set the printer power switch to 1 (on).
4. When “BOOT DIAGNOSTICS / PRESS ENTER” appears on the LCD, release the **Eject/Restore** and **Stop** keys.
5. Press the **Enter key**. Menu options are shown in Figure 11.

Exiting The Boot Diagnostic Menu

Method 1: Reset the printer from the Menu

1. Using the directional keys, move to the MISC UTILITIES / RESET PRINTER menu option. (See the menu map beginning on page 231.)
2. Press the **ENTER** key.

Method 2: Cycle power

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

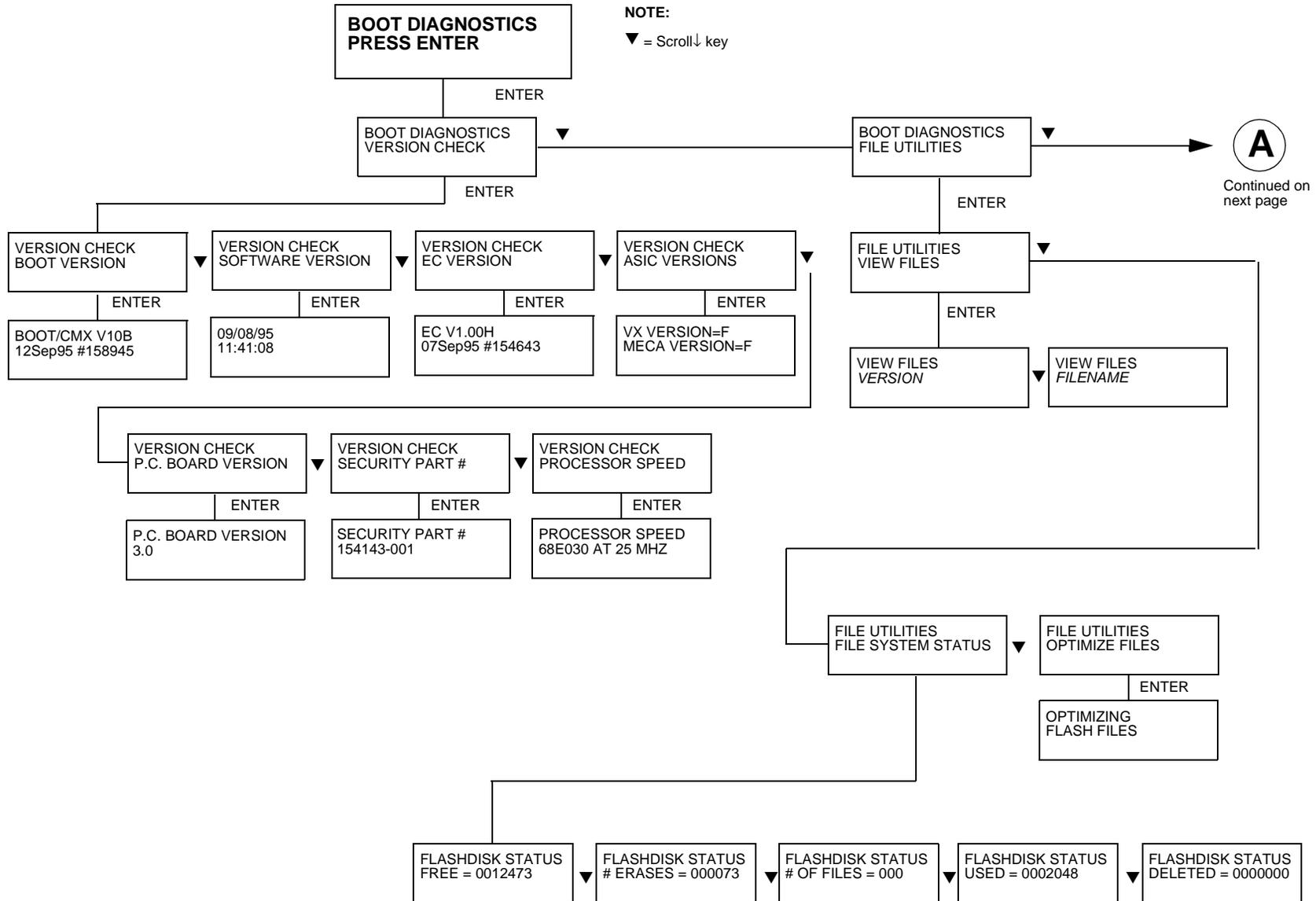


Figure 11. This figure shows the Boot Diagnostics Menu, and continues on the next page.

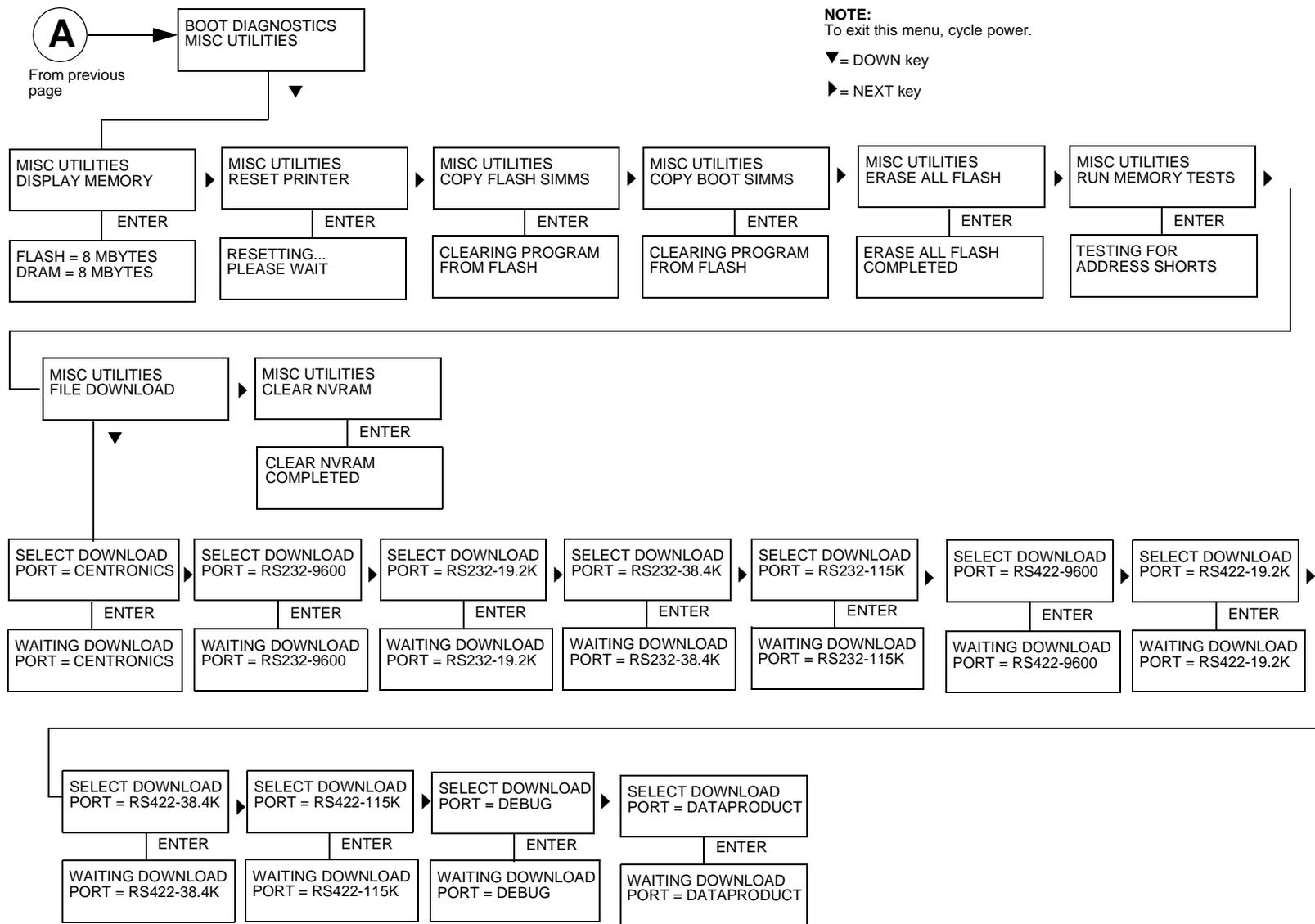


Figure 11. This figure shows the Boot Diagnostics Menu, and is continued from the previous page.

Hex Code Printout

A hex code printout (“hex dump”) prints every ASCII character received from the host computer with its corresponding two-digit hexadecimal code. Hex dumps are used to troubleshoot printer data reception problems by comparing the printed hex data to the data sent from the host.

In a hex dump, every character is printed as its assigned ASCII symbol and as the hexadecimal value of the character. A character that does not have a printed symbol (for example, a control character) is printed as a period (.) and the hex value of the control character.

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 510.

Step	Press	Displayed Result	Notes
1.	Install the ribbon, load paper, and power on the printer.		
2.		NOT READY	Puts printer in NOT READY mode.
3.	 + 	OPERATOR MENU UNLOCKED	Unlocking ENTER key gives you access to the configuration menus.
4.		OPERATOR MENU PRINTER CONTROL	First of series of configuration menus.
5.		PRINTER CONTROL INTERFACE SELECTION	Moves down to Interface Selection option.
6.	 UNTIL	PRINTER CONTROL HEX PRINT MODE	Moves down to the Hex Print Mode option.
7.		HEX PRINT MODE DISABLE*	Moves down to Disable, the active option.

Step	Press	Displayed Result	Notes
8.		HEX PRINT MODE ENABLE	Moves to Enable, the alternate option.
9.		HEX PRINT MODE ENABLE*	Asterisk (*) indicates this choice is now active.
10.		NOT READY	Returns printer to NOT READY mode.
11.	 + 	OPERATOR MENU UNLOCKED	Relocks the ENTER key.
12.		READY	Puts printer in READY mode.
13.	Send a file from the host computer. The printer outputs a hex dump. Refer to the ASCII chart on page 510.		
14.	When the hex dump is complete, take the printer offline and change the Hex Dump Mode back to Disable. Follow the steps outlined above and select Disable.		

Printer Information Menu

You can view various printer statistics, such as hours of usage, and refer to these figures for preventive maintenance purposes. Printer statistics accumulate continuously; they do not reset when you power off the printer.

All of the printer statistics are set to zero at the factory after burn-in testing.

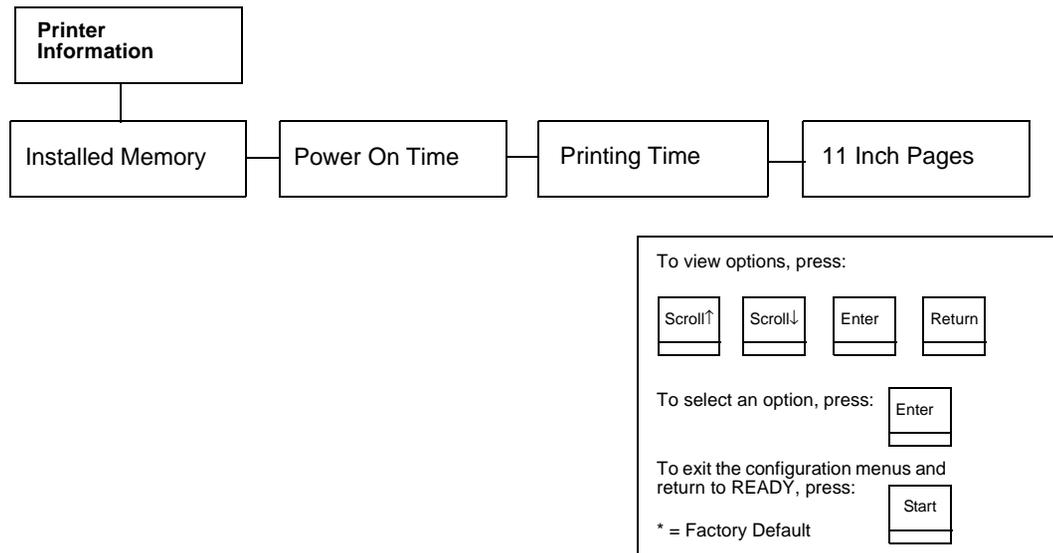


Figure 12. This figure shows the Printer Information Menu.

Installed Memory

Displays the amount of RAM in Megabytes installed in the printer.

Power-on Time

The cumulative time in hours that the printer has been powered on. The range is 0 to 30,000 hours.

Printing Time

The cumulative time in hours that the printer has actually been printing. The range is 0 to 30,000 hours.

Print Strokes

The cumulative number of back-and-forth shuttle strokes the printer has made during normal operation. The range is 0 to 4,000,000,000 shuttle strokes.

11 Inch Pages

The cumulative number of pages the printer has printed. The range is 0 to 363,000,000 pages.

Displaying Printer Information

You can get printer information by using the configuration menus, as shown below:

Step	Press	Displayed Result	Notes
1.	Install the ribbon, load paper, and power on the printer.		
2.		NOT READY	Puts printer in NOT READY mode.
3.	 + 	OPERATOR MENU UNLOCKED	Unlocking ENTER key gives you access to the configuration menus.
4.		OPERATOR MENU PRINTER CONTROL	First of series of configuration menus.
5.	 UNTIL	OPERATOR MENU PRINTER INFORMATION	Advances to the Printer Information menu.
6.		PRINTER INFORMATION INSTALLED MEMORY	Advances to the first of the Printer Information menus.

Step	Press	Displayed Result	Notes
7.		PRINTER INFORMATION [MENU NAME]	Stop when the menu you want is displayed.
8.		[MENU NAME] [STATISTICS OR INFO]	Your selection displays the information.
9.		NOT READY	Returns printer to NOT READY mode.

Soft vs. Hard Reset

Resetting the printer returns it to a previous configuration. There are two kinds of reset.

Soft Reset

A soft(ware) reset clears printer memory then loads the power-up configuration into memory. (The procedure for saving configurations is described in the *Setup Guide*.) 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.

Put the printer in the NOT READY state to do a soft reset:

1. Press the **Stop** key to put the printer in the NOT READY state.
2. Press the **Stop + Enter** keys.
The LCD displays “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 READY (or NOT READY, 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

The first power-up routines are the handshaking sequences which sample and test the condition of the controller board. The sequences occur as follows:

- **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 operator 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 Operator Panel Keys** — The operator 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 **Cancel** and **Start** are pressed during start-up, the printer is placed in download mode. If **Eject/Restore** and **Stop** 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 operator 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 **Cancel** and **Start** 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 **Eject/Restore** and **Stop** keys were pressed at power up. If so, the printer enters the Boot Diagnostics menu. If not, the printer continues the boot routines.
- **Check for Remote Download Mode** — Boot code checks if the user remotely requested the printer to enter download mode. If so, the printer enters download mode. If not, the printer continues boot routines.
- **Check for Flash Optimize** — Boot code checks if the user requested the flash file system to be optimized at power up. If so, flash memory is optimized at this time. If not, the printer continues boot routines.
- **Check EC Program** — The EC calculates a checksum of the program stored in its flash memory. If there is problem with its program, the EC puts the message “nopg” in the ECDC communications register. If the boot code detects this message, it displays “ERROR: EC PROGRAM NOT VALID” on the LCD. If the EC processor does not respond within three seconds, the boot code sends “EC STOPPED AT STATE XXXX” to the LCD, where XXXX is one of these states:

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

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

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

- **Test for Powerup File** — Boot code checks for a DC executable file called powerup.sbr. If found, it executes the file, then returns to boot routines. If the file is not found, boot routines are resumed. If any key was held down during power up, boot code does not look for the powerup file and continues the boot sequence.
- **Automatic EC Update** — Boot code checks whether the automatic EC update feature is enabled by the DC program. If so, it looks for a copy of the EC program in the Flash File System. If it has a copy, it compares the program in EC flash to the program in the Flash File System, and updates the EC program if they are different. If the automatic EC update was not enabled, or if any key was held down during power up, automatic EC update is skipped and the boot sequence continues normally.
- **Debug SIMM** — The debug SIMM contains fast static RAM that automatically replaces the flash memory. Boot code checks for the debug SIMM and, if found, copies the contents of flash memory into the SIMM, then remaps the address of the SIMM to the location of flash. This allows breakpoints and single-stepping from the MTOS** debugger. When the debug SIMM is found, boot code displays “DEBUG SIMM ACTIVATED” on the panel and out the debug port.
- **Verify DC Program** — Boot code calculates a checksum at every power up to verify that the program has not been corrupted. If the checksum does not match, boot code displays “ERROR: DC PROGRAM NOT VALID”.
- **Check Security** — The security check verifies that security PAL (CMX/CFX controller) or security key (PSA3 controller) supports the software that is loaded in flash memory. If the PAL or key 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 “P05 DIAGNOSTIC TEST PASSED”. At this point, the ribbon motors engage. Boot code then jumps to the start address of the DC software.
- **Display DC Program Information** — Boot code sends the following information out the debug port: the compile time, date, and the address it will jump to to start the DC program.
- **Waiting Ethernet** — If boot code earlier detected an Ethernet adapter, it places the message “WAITING FOR THE ETHERNET ADAPTER” on the LCD so the user will not think the printer has crashed.
- **Jump Back into Flash and Clear DRAM** — Boot code jumps back into flash memory, then clears the DRAM that held the boot code.
- **Jump to MTOS** — Jump to start initialization of the MTOS (Multi-Tasking Operating System).

DC Software Initialization And Power Up

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

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

Troubleshooting A New Installation

Customers with new printers sometimes report “problems” that reflect unfamiliarity with the printer and manuals rather than true fault conditions. If a customer reports general printer problems and the printer was recently installed, check the following:

Printer Configuration

Many customers have difficulty configuring new printers for operation with their computer system. There are so many system configurations and parameter options, configuration can be challenging to those who do not do it often. Check the customer’s host interface to the printer and make sure the printer configuration conforms to the host. If the customer has not yet made a configuration printout, show him how to print and store his printer’s configuration. (Refer to the *Setup Guide*.)

Documentation

Stress the importance of consulting the documents that come with printer. These manuals explain how to operate, care for, and troubleshoot the printer. The manuals also have helpful tips about how to choose media and ribbons, and how to obtain the best print quality.

Downloading Microcode From IBM First

This section explains how to obtain microcode for the 6400 printer. This process is done through the Lotus Notes IBM First R5 data base.

When updating earlier models to the latest level of microcode, upgrade the flash memory and DRAM to 8MB flash and 8MB DRAM. You can order the 4MB flash SIMM (P/N 24H9009) and insert it into slot 1 of a CMX or CFX controller board. (This requirement does not apply to PSA3 controller boards, which have sufficient memory.) If the printer has a CMX or CFX board with less than 4MB flash installed or has two 2MB SIMMs installed, order two of P/N 24H9009. You may also need to order and install 8MB DRAM (P/N 24H9010) if the printer has less than 8MB DRAM. All existing DRAM in the printer must be removed and the 8MB DRAM installed into slot 0 of the DRAM sockets on a CMX or CFX controller board. (This is unnecessary on the PSA3 controller because it comes with a 32MB SDRAM DIMM.)

IMPORTANT

Do NOT exceed 8MB flash and 8MB DRAM on a CMX or CFX controller board. Add or subtract flash and/or DRAM as necessary so there is only 8MB flash and 8MB DRAM. This requirement does not apply to PSA3 controller boards.

1. Create a directory named *6400* on the laptop to hold your 6400 code downloads. (If you do not know how to create directories, see your ESPI or someone familiar with PCs.)
2. Open Lotus Notes.
3. Open the IBM First R5 data base.
4. Click on the “Machines” button at the left of your screen.
5. Click on the “Microcode” button at the left of your screen.
6. Click on the “All Microcode” button at the left of your screen.
7. When the next screen reads “PSD Machine Microcode,” scroll down to the 6400 machine type and click on the icon. This will take you to the 6400 microcode page.
8. Under the “6400 - All Models” tab, find the code you need in the list, move your mouse pointer so it points to the icon of the needed file, and double-click with the left mouse button.
9. At the prompt “Unknown File Type” click **Save File...**
10. At the “Save As...” dialog box, point to the down arrow just to the right of the “Save In” pane and select the folder (the directory; e.g., the 6400 folder) in which to save the file.
11. After you select the folder to receive the file, verify that the “File name” window has the correct name, then click **Save**.

NOTE: Do NOT change the *filename*.

12. The file will download to the directory you requested. You can now load this code into the printer’s flash memory, as explained in the next section.

Clear NVRAM

This procedure will erase any custom configuration sets the customer may have saved and may change the hammer phasing value.

1. If possible, make a configuration printout of all configurations. (Refer to the *Setup Guide*.)
2. Set the printer power switch to O (off).
3. Press and hold down the **Eject/Restore** and **Stop** keys.
4. While holding down the **Eject/Restore** and **Stop** keys, set the printer power switch to 1 (on). Do not release the keys, but go immediately to the next step.
5. When "BOOT DIAGNOSTICS / PRESS ENTER" appears on the LCD, release the **Eject/Restore** and **Stop** keys.
6. Press the **Enter** key.
7. Scroll down to "MISC UTILITIES" and press the **Enter** key.
8. Scroll down to "CLEAR NVRAM" and press the **Enter** key.
9. The operator panel will then display "CLEAR NVRAM, COMPLETED" and you may hear a high-pitched tone.
10. Set the printer power switch to O (off).
11. Wait 15 seconds.
12. Power on the printer in download mode and proceed immediately to the next step. (A high-pitched tone may be heard but will stop when the operator panel displays "WAITING FOR PROGRAM DOWNLOAD". If the printer cannot be put into code download mode, got to step 17.)
13. Load microcode to the printer.
14. Using the configuration printouts, restore the customer's custom configurations if any had been established.
15. Adjust the hammer phasing if necessary (page 427).
16. Return the printer to normal operation (page 339).
17. Proceed to the next troubleshooting step in the MIM procedure you are working.

Loading Flash Memory

Emulation and operating system software are loaded into flash memory at the factory, but you will install software when . . .

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

Emulation and operating system software are stored as a compressed file. The file is “executable;” you will expand it and copy it into printer flash memory with a single command.



- | |
|---|
| <p><4> Do not connect or disconnect any communications port, teleport, attachment connector, or power cord during an electrical storm.</p> <p><5> Power off the printer and disconnect the power cord before connecting or disconnecting a communication port, teleport, or attachment cable connector.</p> |
|---|

1. Download the correct level of microcode from IBM First (page 245).
2. If the printer has an internal Ethernet Network Interface Card (NIC), use the loading procedure on page 257. If you are loading flash memory through the parallel or serial port, continue with this procedure.
3. Make a printout of *all* saved configurations. (Refer to the *Setup Guide*.) Installing new software erases all saved configurations. You will use these printouts to restore printer configuration.
4. Set the printer power switch to O (off).
5. Unplug the AC power cord from the printer.
6. If the printer's parallel data cable is connected to the parallel port of an IBM-compatible computer using the PC-DOS* or MS-DOS** operating system or Windows** command prompt, skip to step 10. If not, go to step 7.
7. Disconnect all data input cables from the printer interface.
8. Connect the parallel data cable to the default parallel port (LPT1) of an IBM-compatible computer using the PC-DOS or MS-DOS operating system or Windows command prompt.

NOTE: You can connect the data cable to the LPT2 port if the LPT1 port is already in use. You can also download software through the printer serial port. The download commands are different if you use these ports, as described in the note after step 17.

9. Connect the parallel data cable to the parallel port of the printer.
10. Plug the AC power cord into the printer.
11. Power on the computer.
12. On the printer control panel, press and hold down the **Start + Cancel** keys. Without releasing the keys, power the printer on. Continue holding the **Start** and **Cancel** keys down for five seconds, then release them.

NOTE: The port default is IEEE-1284; this is the standard download through the parallel port. If you want to use the default, continue at step 17.

13. When you see “WAITING FOR PROGRAM DOWNLOAD” on the LCD, press the **Scroll**↑ key; “SELECT DOWNLOAD PORT=DATAPRODUCT” appears on the LCD.

14. Press **Scroll**↑ again to cycle through the download ports available in the printer:

DATAPRODUCT	(parallel)
IEEE-1284*	(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)
RS422-19.2K	(RS-422 serial, 19200 baud)
RS422-38.4K	(RS-422 serial, 38400 baud)
RS422-115K	(RS-422 serial, 115000 baud)

15. Press **Scroll**↑ + **Scroll**↓ to unlock the Enter key.
16. 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.
17. At the DOS prompt on the computer type:
FILENAME.EXE -pb<return>
 where *FILENAME.EXE* is the file you downloaded from the World Wide Web. This command expands the file and copies it as a binary file into the flash memory on the controller board.

NOTE: If you are downloading the file using the LPT2 port on the computer, enter the following DOS command:

FILENAME.EXE -pb 2 <Return>

If you are downloading the file into the printer serial port, enter the following DOS commands:

MODE COM1:9600,N,8,1,P<Return>

FILENAME.EXE -PBC1<Return>

18. While the file is copied into memory, the printer LCD informs you of the load process and status. (See Table 6 below.)

19. When the file has successfully loaded into 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. Power off the personal computer.
22. If you had to install a parallel data cable to the computer and printer in step 8, disconnect it from the computer and printer.
23. Reconnect the customer's data input cable(s) to the printer, if required.
24. Return the printer to normal operation (page 339).
25. Using the configuration printout(s) you made in step 3, reconfigure the printer. (Refer to the *Setup Guide*.)

NOTE: A continuous IML cycle indicates coax/twinax code is being loaded into a printer with a missing, defective, or improperly installed Coax/Twinax board. If the printer is supposed to have this feature, reseal the Coax/Twinax board. If the printer is not supposed to have this feature, install new emulation code without the Coax/Twinax feature.

Table 6. Flash Memory Message Guide

Message	Explanation	Required Action
CLEARING PROGRAM FROM FLASH	The program successfully loaded into printer RAM and the checksum matched. The old program is now being deleted from flash memory.	None
DIAGNOSTIC PASSED	The printer passed its memory and hardware initialization tests.	None
ERROR: DC PROGRAM NOT VALID	Printer cannot find the data controller program or the validation checksum is corrupted.	Download the program again: Power off the printer and start over at step 12. If the message occurs again, replace the flash memory.
ERROR: DRAM AT ADDRESS XXXXXXXX	The printer found a defective memory location.	Replace the DRAM.
ERROR: EC PROGRAM NOT VALID	Printer cannot find the engine controller program or the validation checksum is corrupt.	Download the program again: Power off the printer and start over at step 12. If the message occurs again, replace the flash memory.

Table 6. Flash Memory Message Guide

Message	Explanation	Required Action
ERROR: EC STOPPED AT STATE XXXX	Hardware fault in the engine controller.	<ol style="list-style-type: none"> 1. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 2. Clear NVRAM (page 246). 3. Download and install the latest code from IBM First (page 245). 4. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). Do NOT make the printer READY, but proceed immediately to the next step. 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). 7. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 6. Flash Memory Message Guide

Message	Explanation	Required Action
ERROR: FLASH DID NOT PROGRAM	The printer encountered an error trying to program flash memory.	Download the program again: Power off the printer and start over at step 12. If the message occurs again, replace the flash memory.
ERROR: FLASH NOT DETECTED	The printer could not find any flash memory.	Install flash memory before attempting to download this program.
ERROR: NO DRAM DETECTED	The printer could not find any DRAM.	Check DRAM on the controller board. If present, reseal DRAM, If missing, install DRAM.

Table 6. Flash Memory Message Guide

Message	Explanation	Required Action
ERROR: NVRAM FAILURE	The non-volatile memory has failed.	<ol style="list-style-type: none"> 1. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 2. Clear NVRAM (page 246). 3. Download and install the latest code from IBM First (page 245). 4. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). Do NOT make the printer READY, but proceed immediately to the next step. 5. Download and install the latest code from IBM First (page 245). 6. Power on the printer in download mode and load flash memory (page 247). 7. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.

Table 6. Flash Memory Message Guide

Message	Explanation	Required Action
ERROR: PROGRAM NEEDS MORE DRAM	The printer requires more DRAM memory in order to run the downloaded program.	Add DRAM or use a smaller emulation program.
ERROR: PROGRAM NEEDS MORE FLASH	The printer requires more flash memory in order to run the downloaded program.	Add flash memory or use a smaller emulation program.
ERROR: PROGRAM NOT COMPATIBLE	The printer is not compatible with the downloaded program. User tried to load CMX/CFX-compatible diskette in CBO-controlled printer, or vice versa.	Use the correct emulation software option(s) for this model. If the printer is an IBM 6404-B01, the controller is a CBO board. If the printer is an IBM 6400, the controller is a CMX or CFX board.
ERROR: PROGRAM NOT VALID	The printer does not see a program in flash memory.	There is no program in printer memory. Go to step 4.

Table 6. Flash Memory Message Guide

Message	Explanation	Required Action
ERROR: SECURITY PAL NOT DETECTED	The security PAL is not present or has failed.	<ol style="list-style-type: none"> 1. Check the security PAL at location U54 on the controller. If the PAL is absent, install the correct PAL. If the correct security PAL is present, go to the next step. 2. Save the printer configuration values. (Refer to the <i>Setup Guide</i>.) 3. Clear NVRAM (page 246). 4. Download and install the latest code from IBM First (page 245). 5. Power on the printer in download mode and load flash memory (page 247). <ol style="list-style-type: none"> a. If you encounter loading problems, go to the appropriate error code for resolution. b. If you encounter the failure or message that brought you to this procedure, replace the controller board (page 347). Do NOT make the printer READY, but proceed immediately to the next step. 6. Download and install the latest code from IBM First (page 245). 7. Power on the printer in download mode and load flash memory (page 247).

Table 6. Flash Memory Message Guide

Message	Explanation	Required Action
ERROR: SECURITY PAL NOT DETECTED (continued)		8. If you encounter the failure after replacing the controller board, reinstall the original controller board and contact your DDS and Second Level Support.
ERROR: SHORT AT ADDRESS XXXX	Hardware failure in DRAM or controller circuitry.	Replace DRAM. If message occurs with new DRAM, replace controller board.
ERROR: WRITING TO FLASH	Hardware or software fault in flash memory.	Download the program again: Power off the printer and start over at step 12. If the message occurs again, replace the flash memory.
ERROR: WRONG CHECKSUM	The printer received the complete program but the checksum did not match. The data were corrupted during download.	Download the program again: Power off the printer and start over at step 12.
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.
LOADING PROGRAM FROM PORT XX%	The new program is loading into printer RAM. XX indicates how much of the program has loaded.	None
LOADING PROGRAM INTO FLASH	The printer has deleted the previous program from flash memory and is loading the new program into flash memory.	None
RESETTING . . . PLEASE WAIT	The printer finished loading the program into flash memory and is automatically resetting itself.	None
RESTORING BOOT CODE	Normal download initialization message.	None

Table 6. Flash Memory Message Guide

Message	Explanation	Required Action
SECURITY CODE VIOLATION	The software running or being downloaded does not match the security PAL code.	Install the correct PAL or program. (PAL and program must match.)
SENDING PROGRAM TO EC PROCESSOR	The printer is loading the engine controller program into the engine controller.	None
TABLE MISMATCH DOWNLOAD AGAIN	EC software update in process.	Download the program again: Power off the printer and start over at step 12.

Loading Through the Network Interface Card (NIC)

IMPORTANT

You need the IP Address of the printer to load software through the NIC.

1. Make a configuration printout of all saved configurations. (Refer to the *Setup Guide*.)
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 **Start** and **Cancel** keys. Without releasing the keys, power the printer on. Continue holding the **Start** and **Cancel** keys down.
5. When you see “TESTING HARDWARE PLEASE WAIT” on the LCD, release the **Start** and **Cancel** keys.
6. 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.
7. Using Windows Explorer, create a directory named **download** at the root level of your C: hard drive. (C:\download)
8. Insert the printer emulation software CD-ROM into your computer.

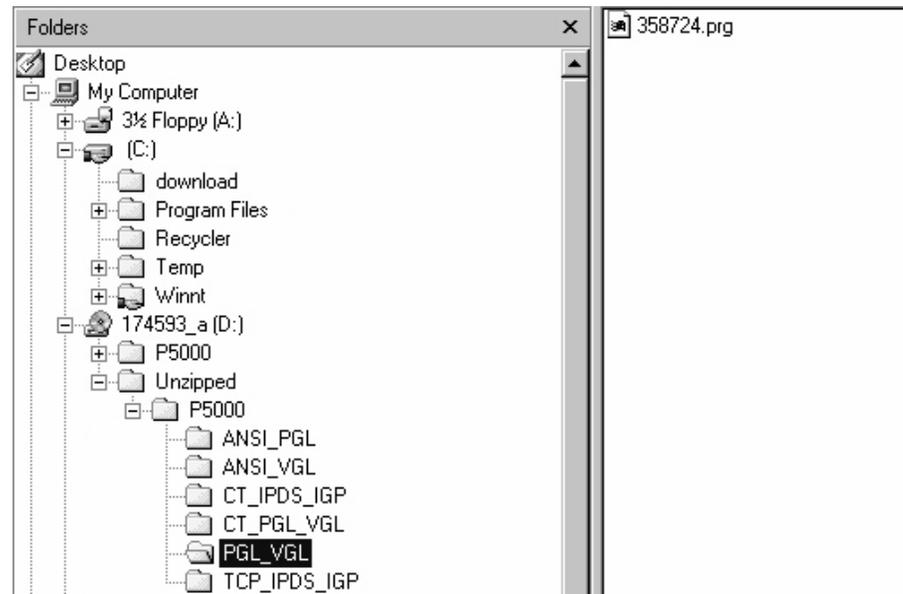


Figure 13. Navigating to the Appropriate Emulation File on the CD-ROM

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 13. Your printer and emulation will be different, of course.)

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 13. Your filename may be different, of course.)

This .prg file is the file you will download into the NIC.

11. Copy the file to the **download** directory you created in step 7.
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 dlprn<Enter>
bin<Enter>
put filename.prg<Enter>
(where filename.prg is the file name you noted in step 10)
```

ATTENTION 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 FTP program shows the progress as a percentage. 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, 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. If required, reconnect the data input cable(s) to the printer.
23. Plug the AC power cord into the printer.
24. Set the printer power switch to | (on).
25. Using the configuration printout(s) you made in step 1 on page 257, restore the printer configurations. (Refer to the printer *Setup Guide*.)

Shuttle Electrical Shorts Test

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 338).
2. Remove the shuttle cover (page 357).
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. Follow the sub-step below that pertain to the printer model you are working on:
 - a. **On all models except the 6400-i20 and -i24**, attach the common meter lead to the shuttle frame, touch the positive lead to pins 2, 4, 6, 8, and 10 of hammer bank power plug J05 located on the terminator board on the shuttle. (Pin 1 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:
 - 1) If the resistance of any pin is less than 1000 Ohms, replace the shuttle frame assembly (page 405).
 - 2) 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.
 - b. **On models 6400-i20 and -i24**, attach the common meter lead to the shuttle frame, touch the positive lead to pins 2, 4, 6, 8, and 10 of both hammer bank power plugs J05 and J06 located on the terminator board on the shuttle. 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:

- 1) If the resistance of any pin is less than 1000 Ohms, replace the shuttle frame assembly (page 405).
- 2) 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 357).
12. Return the printer to normal operation (page 339).

Hammer Bank Power Cable Shorts Test

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

1. Prepare the printer for maintenance (page 338).
2. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
3. Disconnect hammer bank power cable connector P105 from J105 on the controller board. (See Figure 50, page 453, item 13 and Figure 51, page 456, 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 pins 2, 4, 6, 8, and 10 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 50, page 453, item 13 and Figure 51, page 456, item 13.)
9. Cabinet Model: Install the paper guide assembly (page 391).
Pedestal Model: Install the top cover assembly (page 358).
10. Return the printer to normal operation (page 339).

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). On the 6400 printer, 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 338).
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 at least 2 - 3 seconds so that your meter will have 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 338).
2. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
3. Disconnect cable connectors P106 and P107 from the controller board.
4. Refer to the Main Wire Harness Test Tables as you do the following substeps:
 - a. Measure the resistance of the device(s) specified in the procedure you are working. (CMX Controller = page 271; CFX Controller = page 279; PSA3 Controller = page 290)
 - b. If you have an extra 60-pin coax/twinax expansion connector (P/N 24H8535) 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, wait until the motor you are testing has cooled to room temperature, then 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 357).
 - b. Wait until the shuttle motor has cooled to room temperature.
 - c. Disconnect cable P02
 - d. 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.
 - e. 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 263):

- 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

3

Circuit Diagrams, Cables, and Switches

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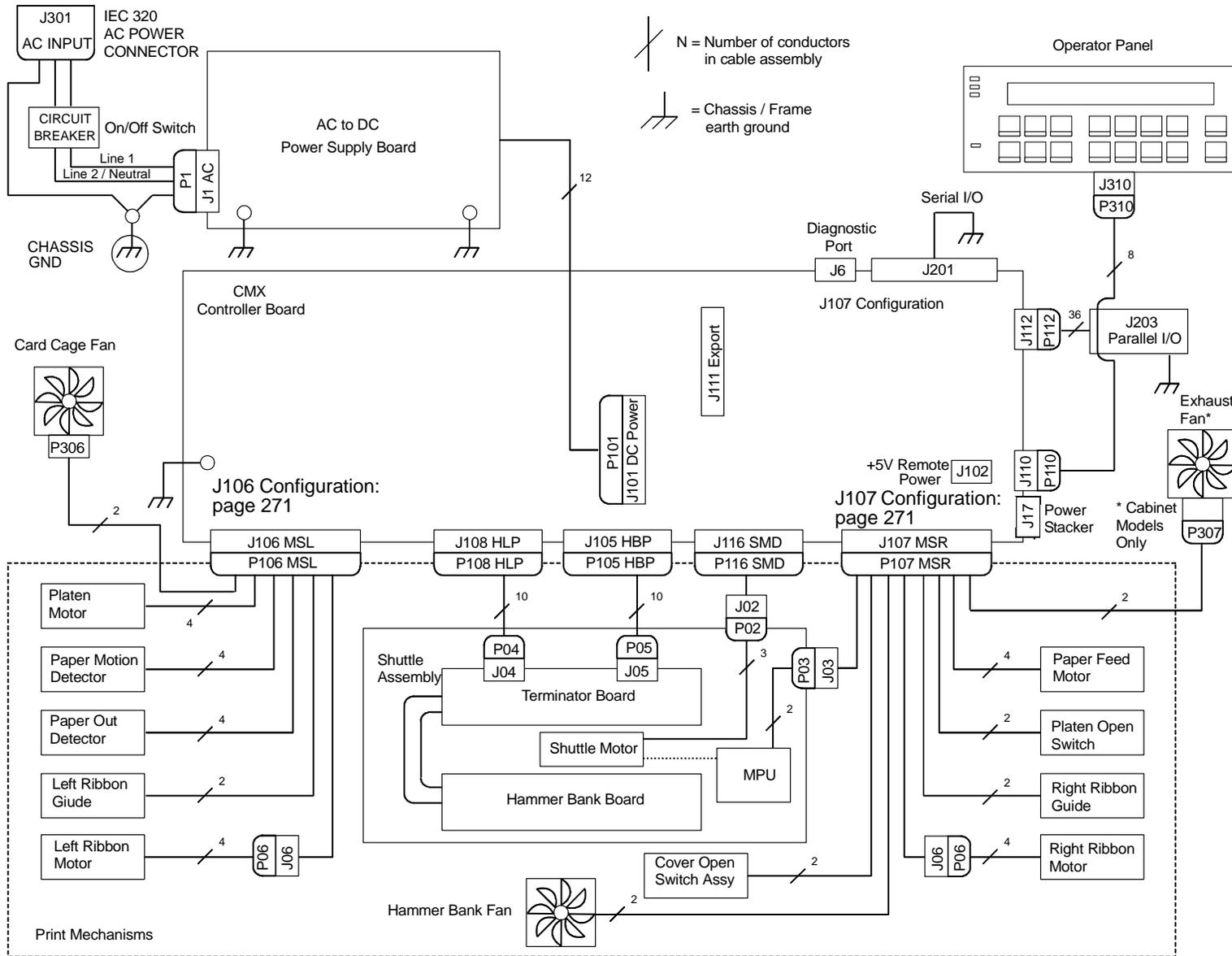
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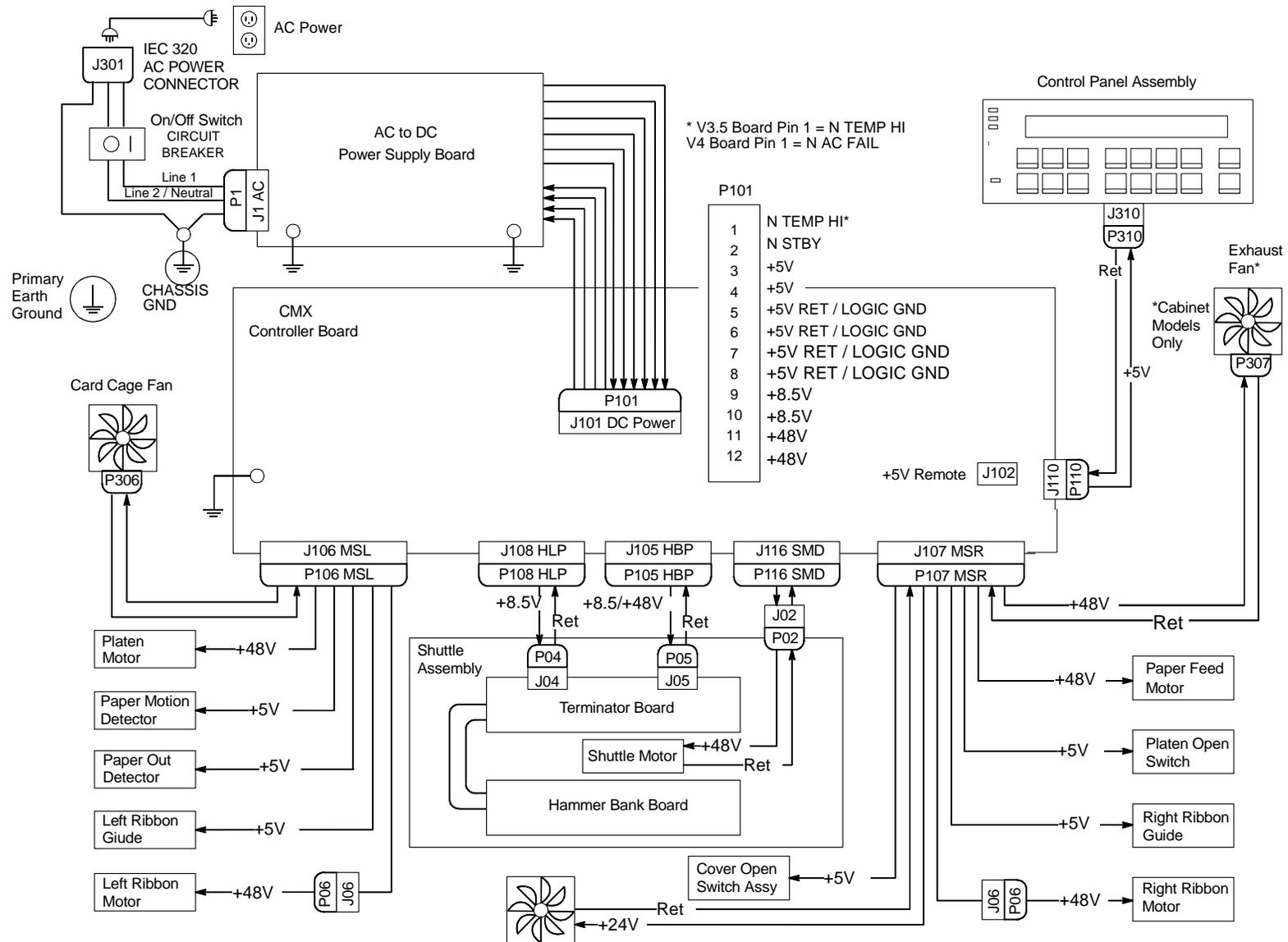
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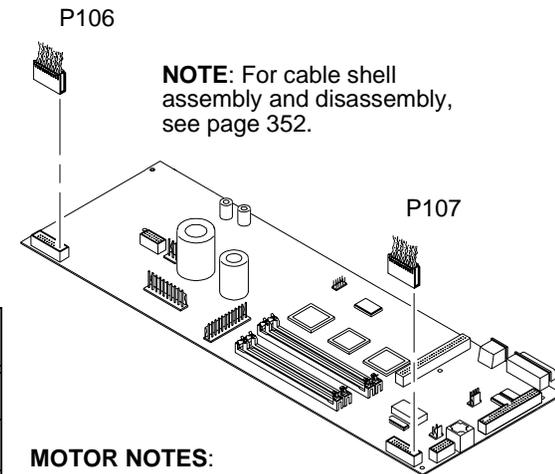
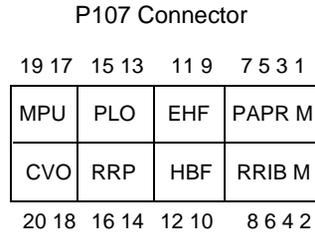
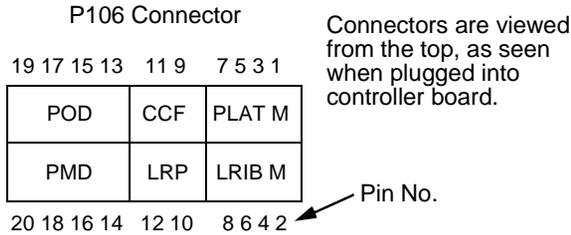
Interconnection Diagram, 6400-i05, -i5P, -i10, -i1P, and -i15 Models



Power Distribution Diagram, 6400-i05, -i5P, -i10, -i1P, and -i15 Models



Main Wire Harness Test Tables, CMX Controller Board



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 - 5 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)

Resistance

Device	P107 Pins	Normal
RRIB M	2, 4 and 6,8	7.2 - 8.8 Ω
PAPR M	1, 3 and 5, 7	0.417 - 0.681 Ω
HBF	10, 12	2 - 3 KΩ
EHF	9, 11	4 - 5 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
 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

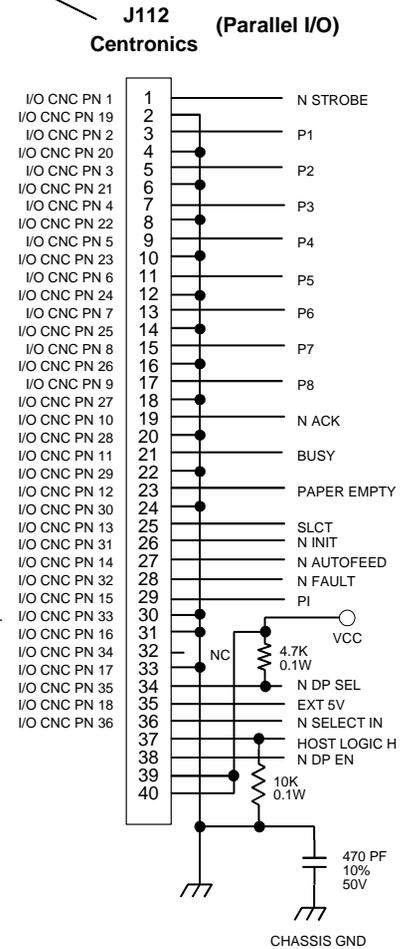
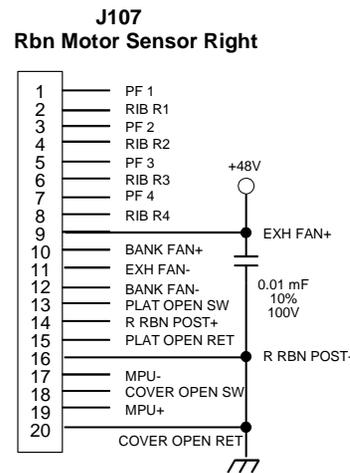
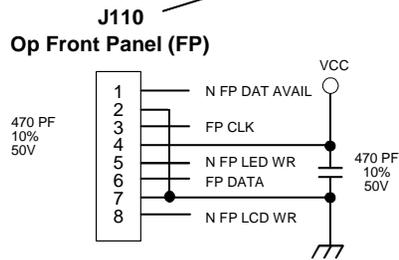
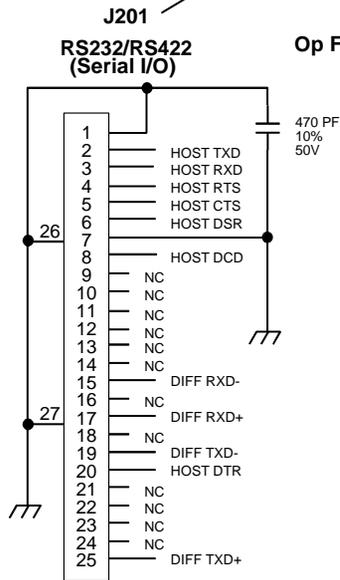
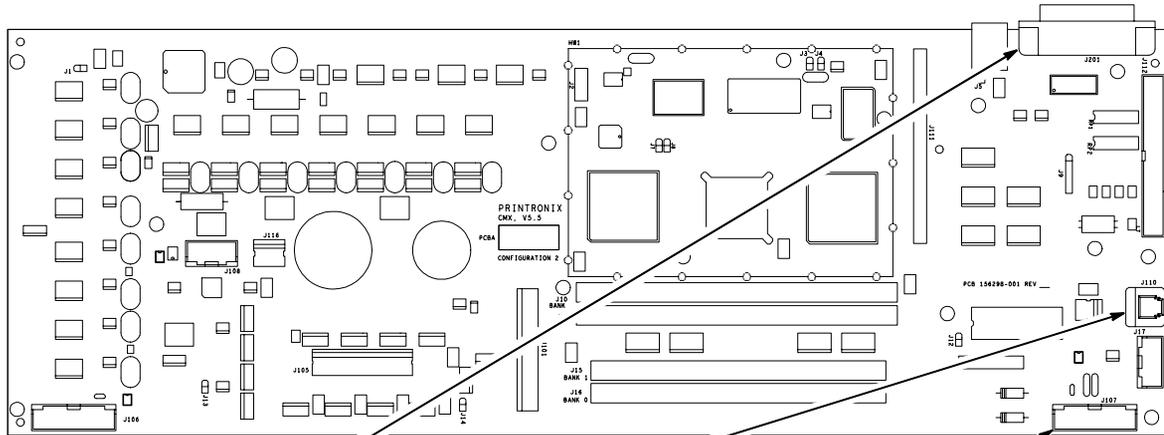
MOTOR NOTES:

All Motors: Let the motor cool to room temperature before you test it. 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 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; replace shuttle frame assy 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

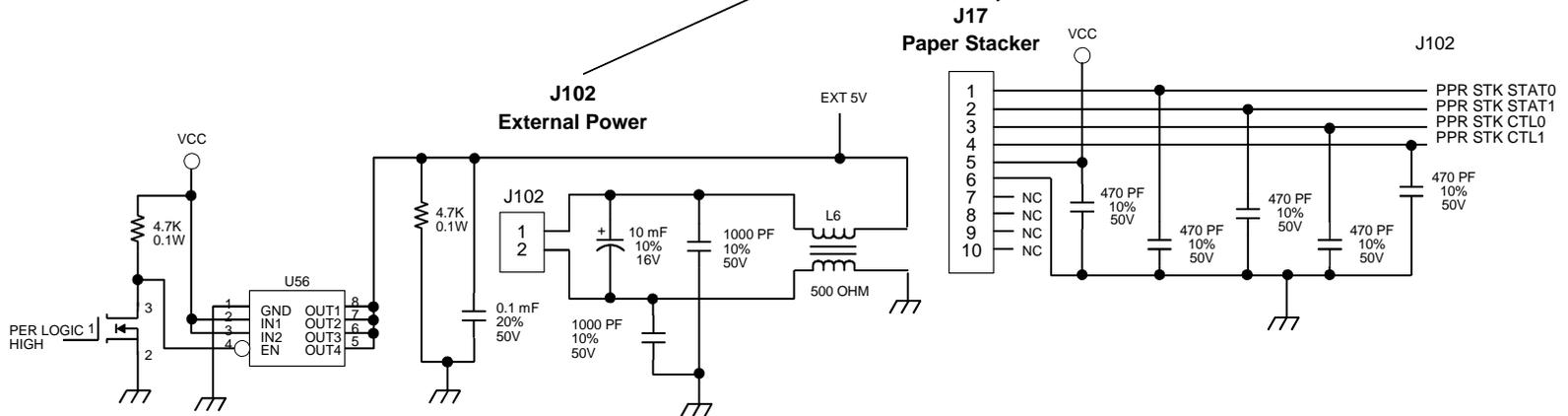
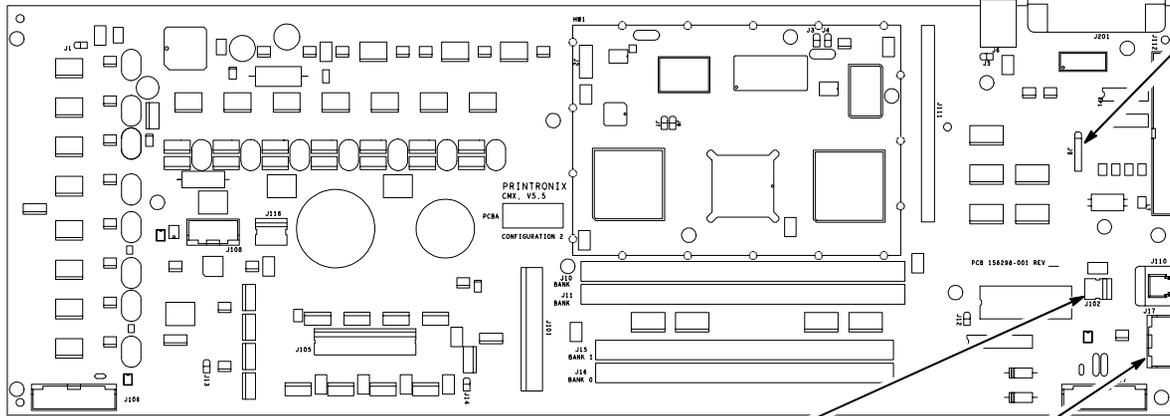
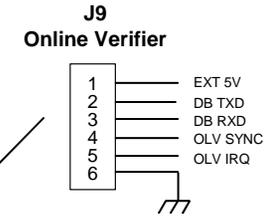
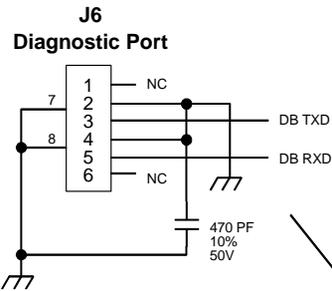
CMX Controller



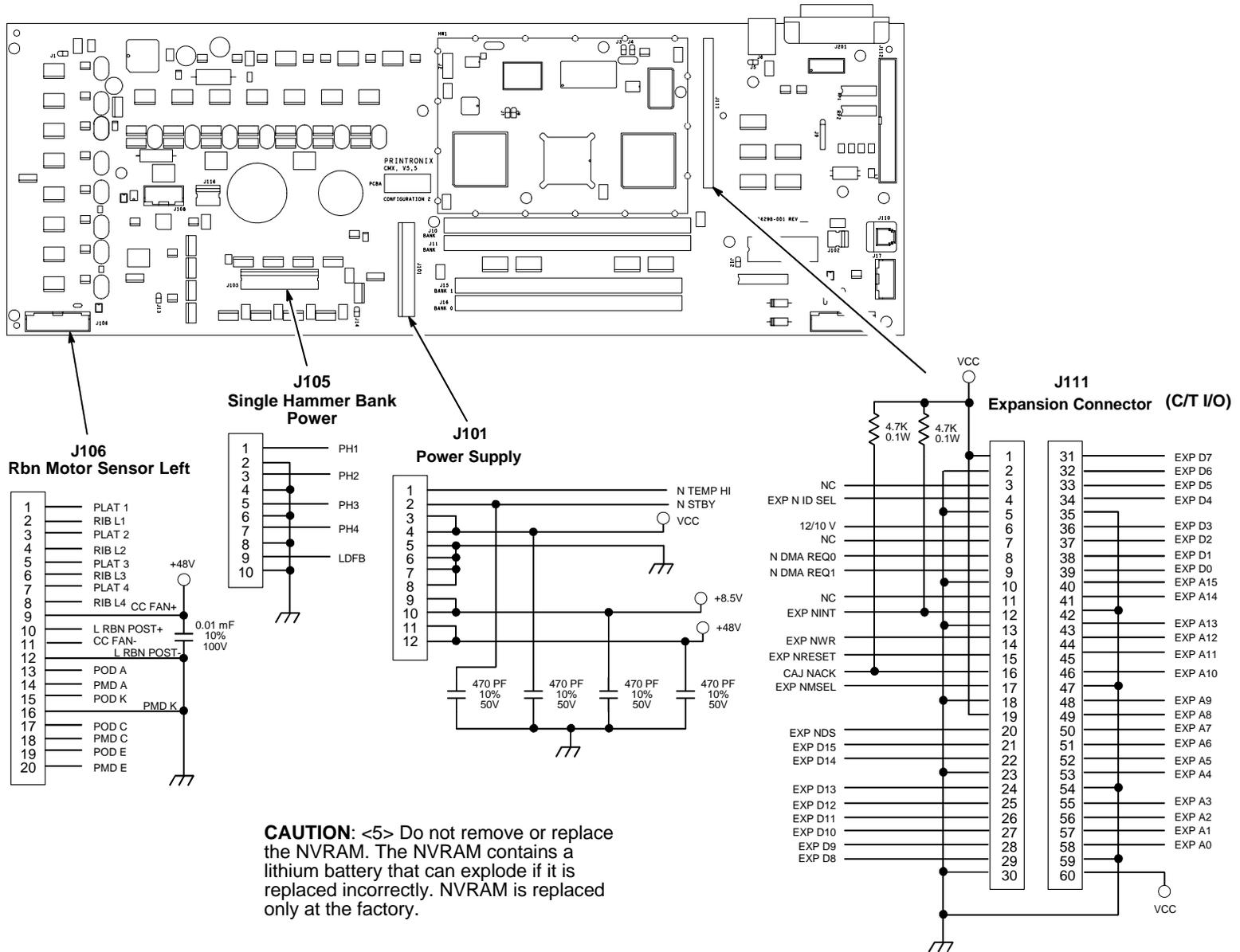
CAUTION: <5> Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.

CMX Controller (continued)

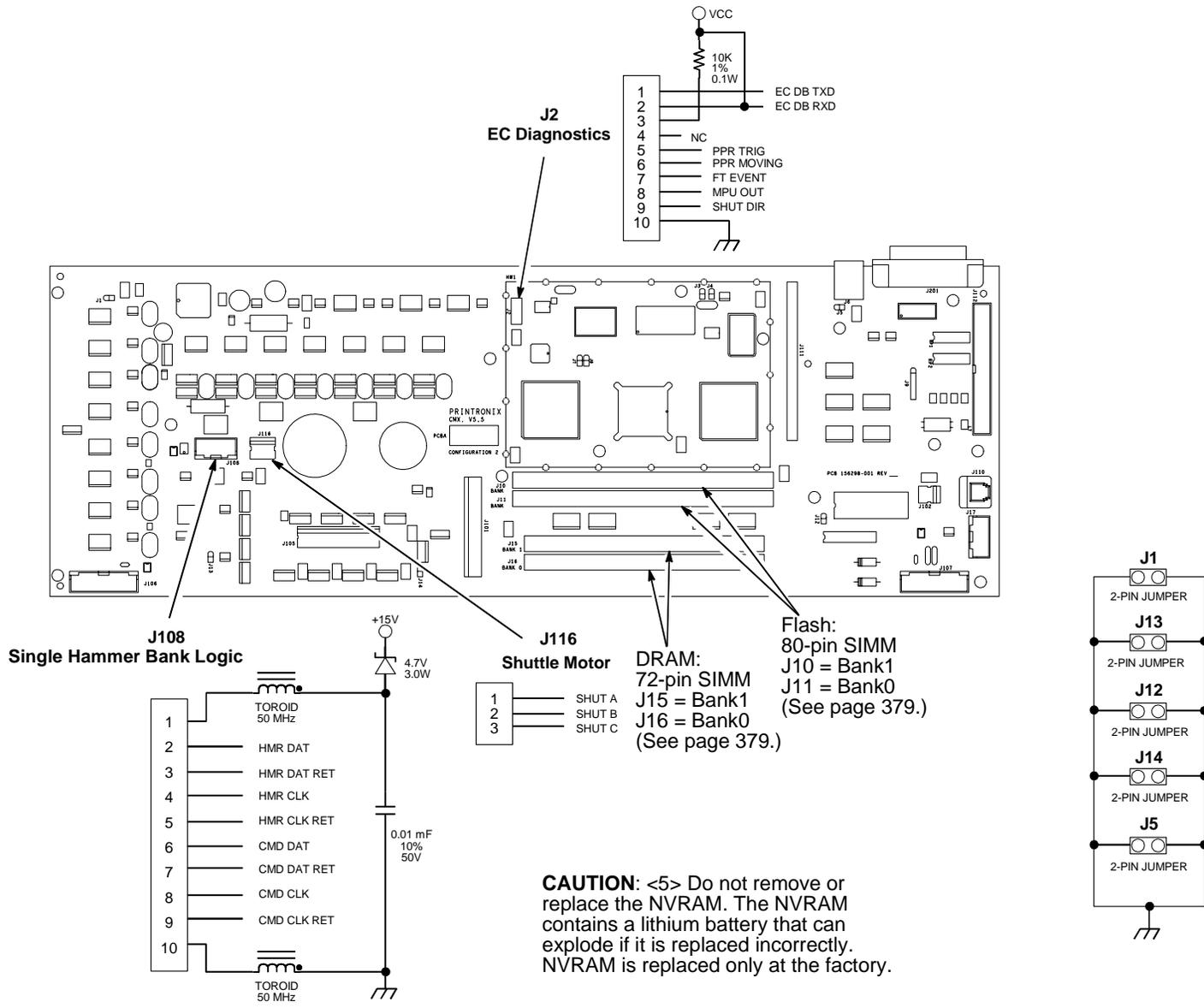
CAUTION: <5> Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.



CMX Controller (continued)

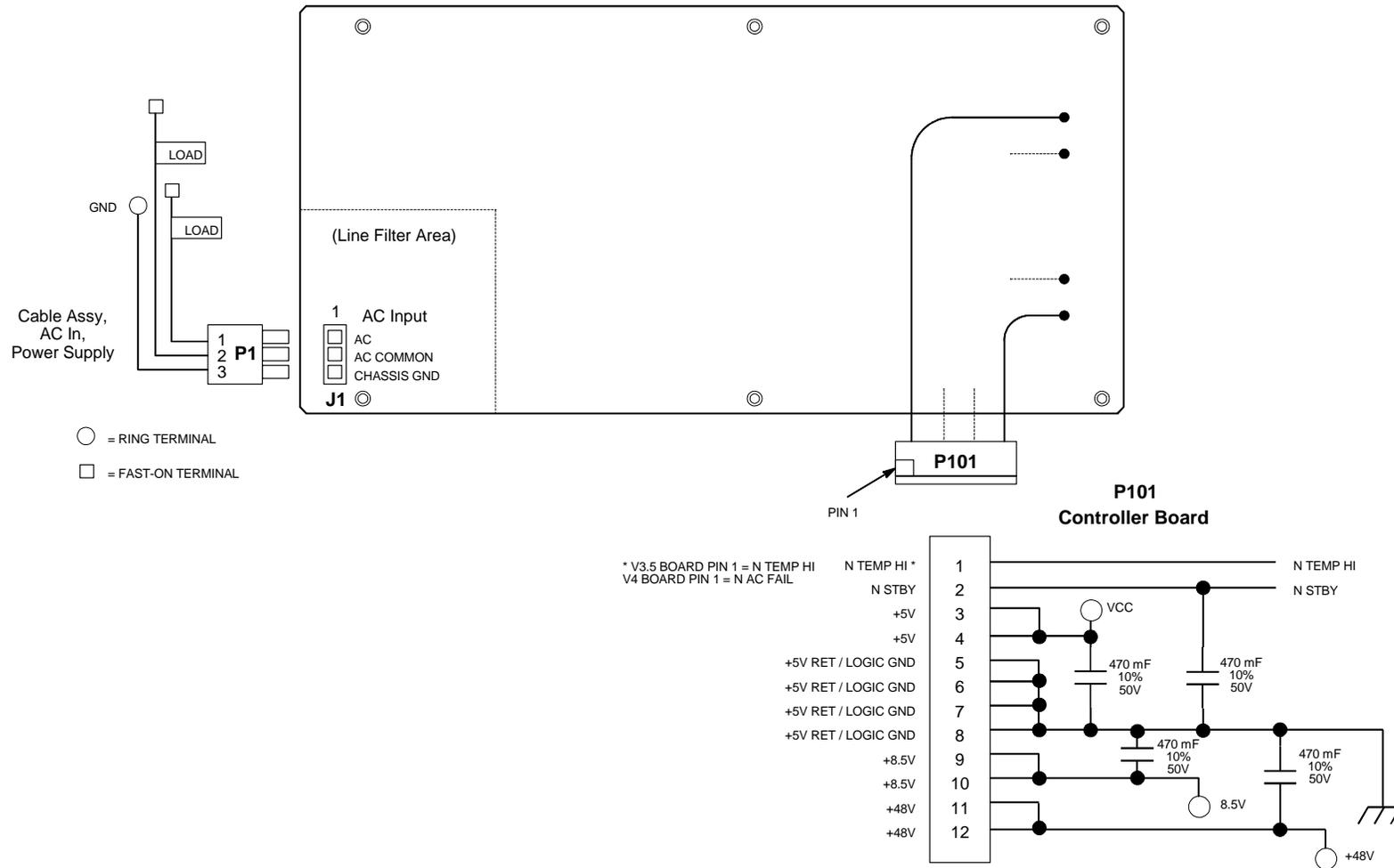


CMX Controller (continued)

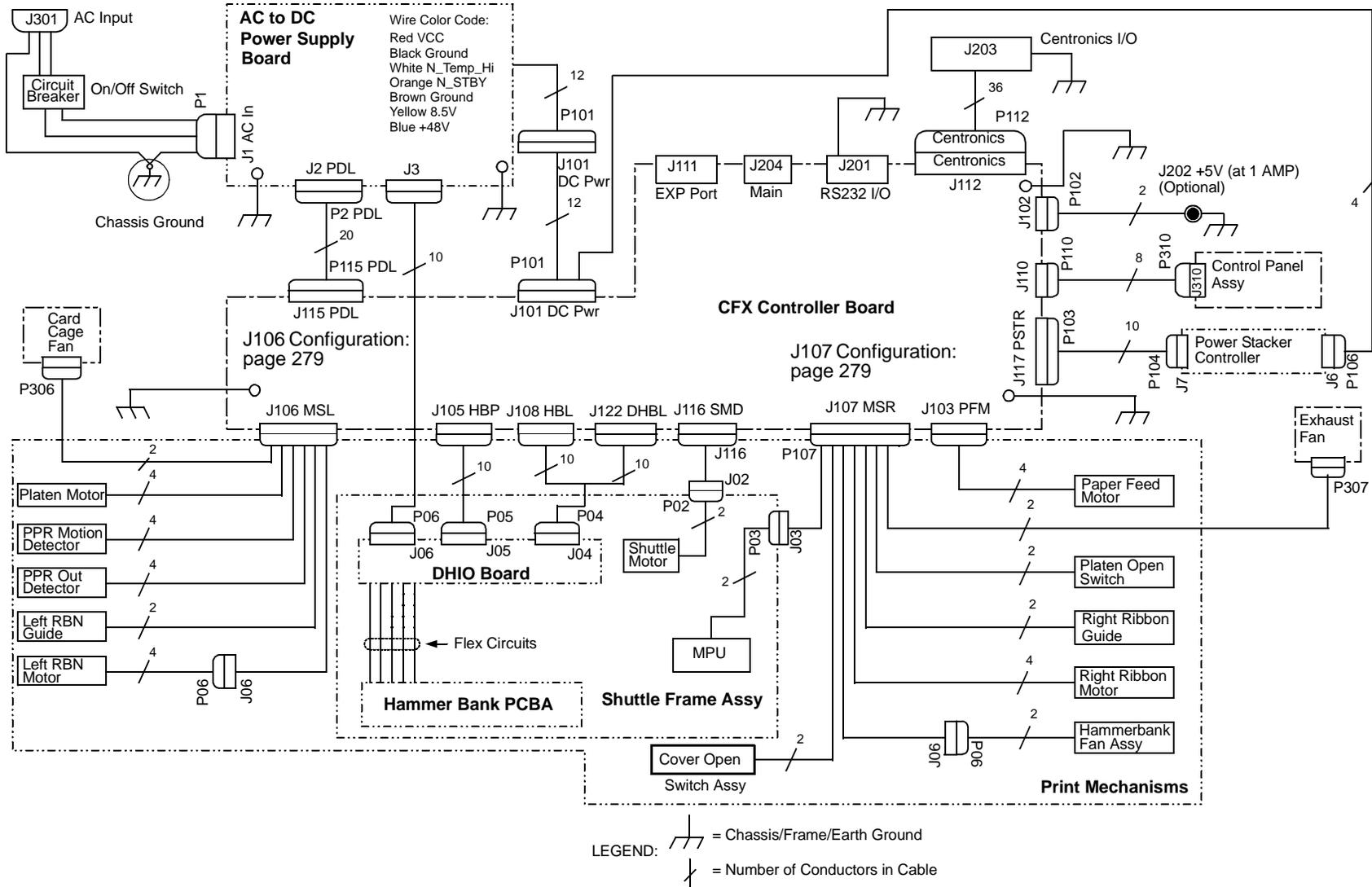


CAUTION: <5> Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.

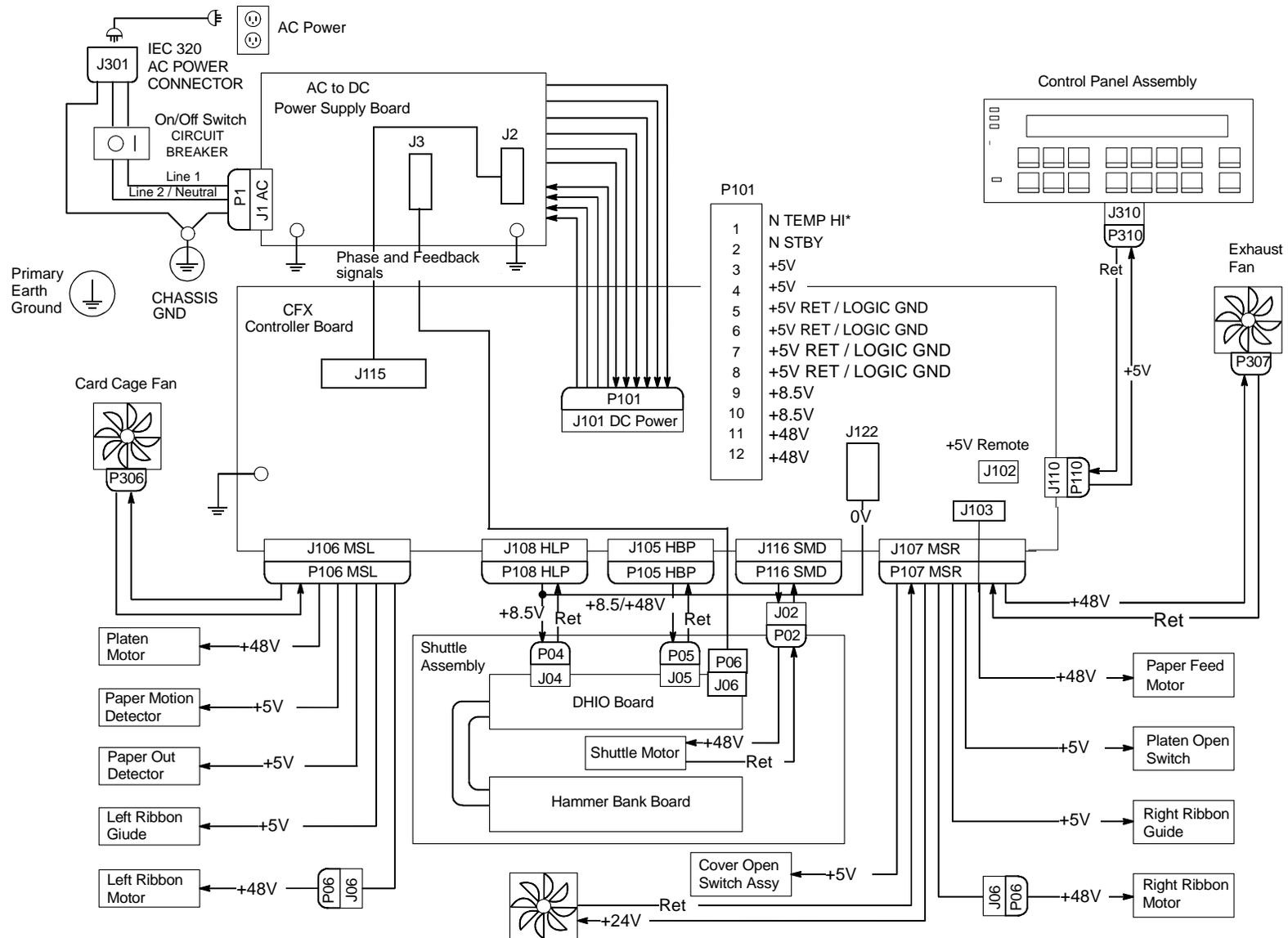
Power Supply, All Except 6400-i20, -i24, -i2s



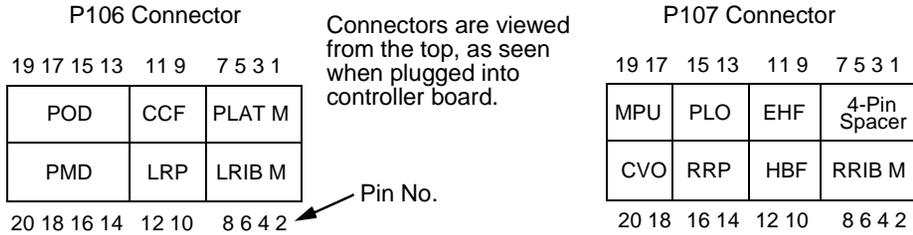
Interconnection Diagram, 6400-i20



Power Distribution Diagram, 6400-i20



Main Wire Harness Test Tables, CFX Controller Board



MOTOR NOTES:

All Motors: Let the motor cool to room temperature before you test it. 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 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; replace shuttle frame assy 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.

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

* Only in cabinet models

Resistance

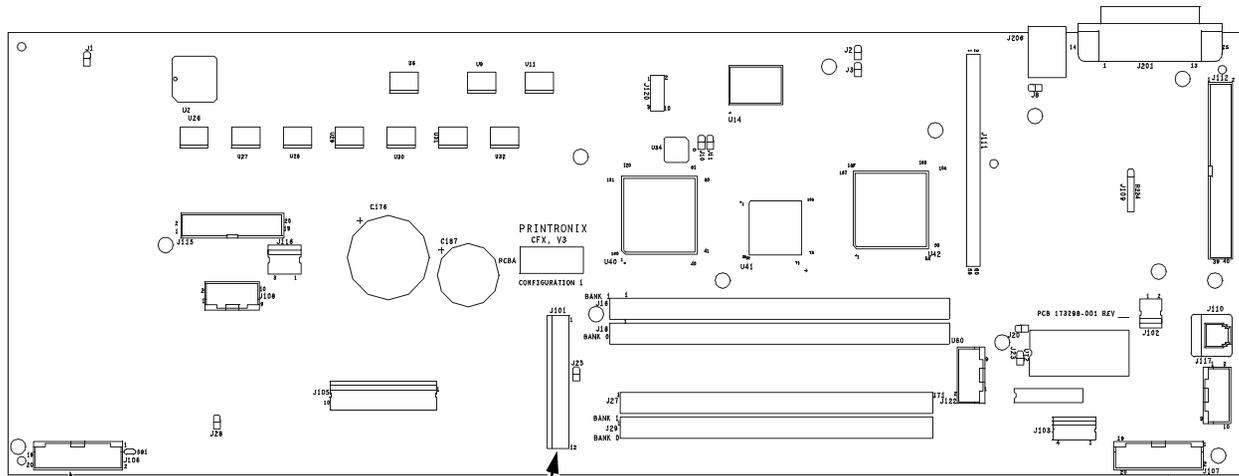
Device	P106 Pins	Normal
LRIB M	2, 4 and 6,8	7.2 - 8.8 Ω
PLAT M	1, 3 and 5, 7	1.35 - 1.65 Ω
LRP	10, 12	Open across pins 0 - 0.7 Ω across post
CCF	9, 11	4 - 5 KΩ
PMD	14, 16 18, 20	6 Meg Ω open Open
POD	13, 15 17, 19	6 Meg Ω open Open

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)

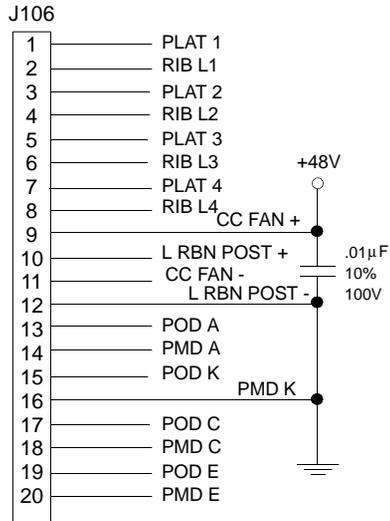
Resistance

Device	P107 Pins	Normal
RRIB M	2, 4 and 6,8	7.2 - 8.8 Ω
4-Pin Spacer	(PAPR M to connector J103, page 284.)	(PAPR M cable to J103 on CFX board: between pins 1, 3 and 5, 7 0.417 - 0.681 Ω is normal.)
HBF	10, 12	2 - 8 KΩ
EHF	9, 11	4 - 5 KΩ
RRP	14, 16	Open across pins 0 - 0.5 Ω across post
PLO	13, 15	0 - 0.4 Ω: switch closed Open: switch open
CVO	18, 20	0 - 0.4 Ω: switch closed Open: switch open
MPU	17, 19	600 - 700 Ω

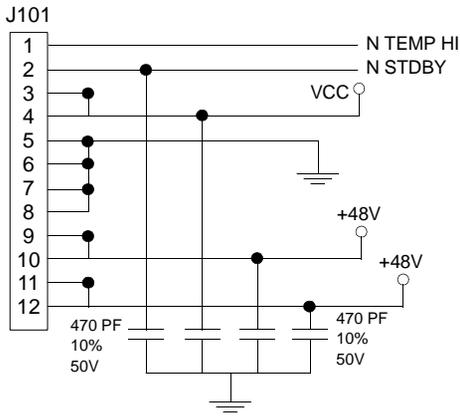
CFX Controller



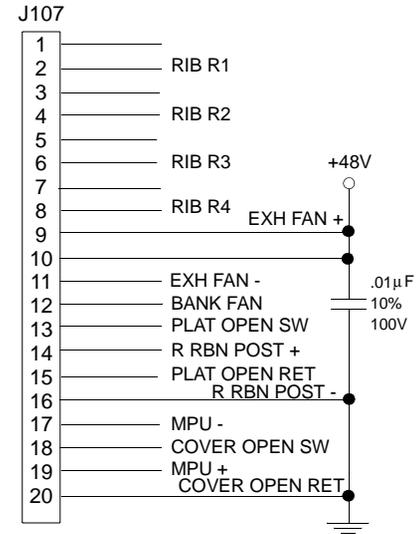
Rbn Motor Sensor Left



Power Supply

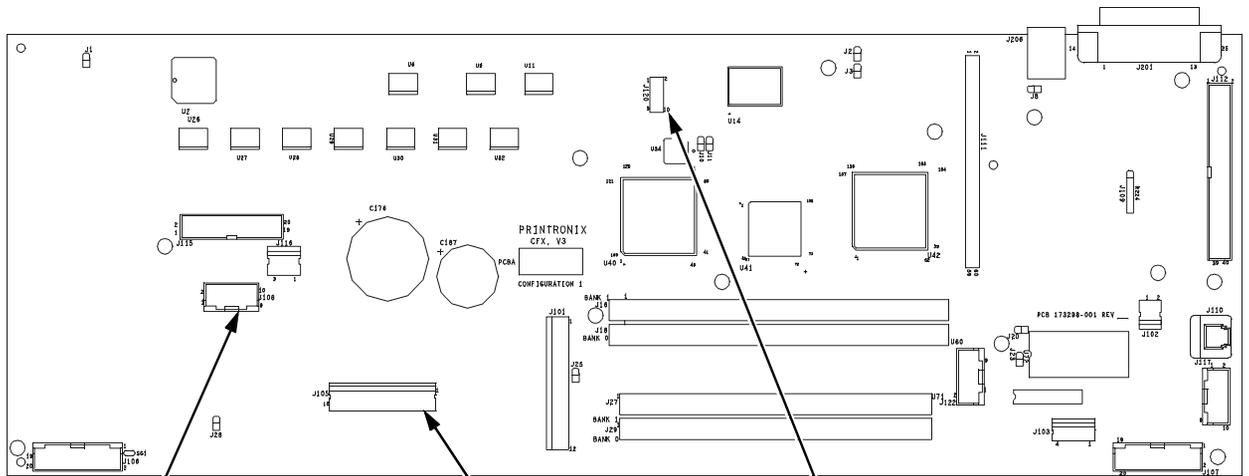


Rbn Motor Sensor Right

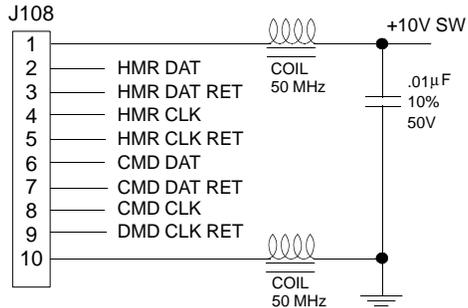


CAUTION: <5> Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.

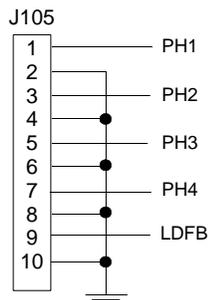
CFX Controller (continued)



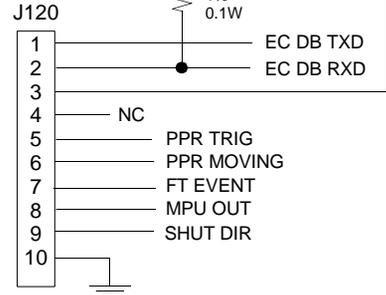
Single Hammer Bank Logic



Single Hammer Bank Power

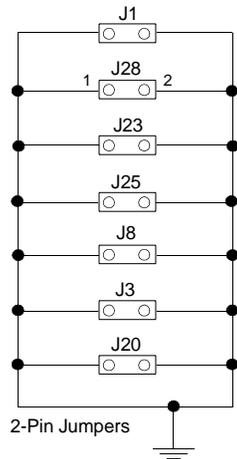
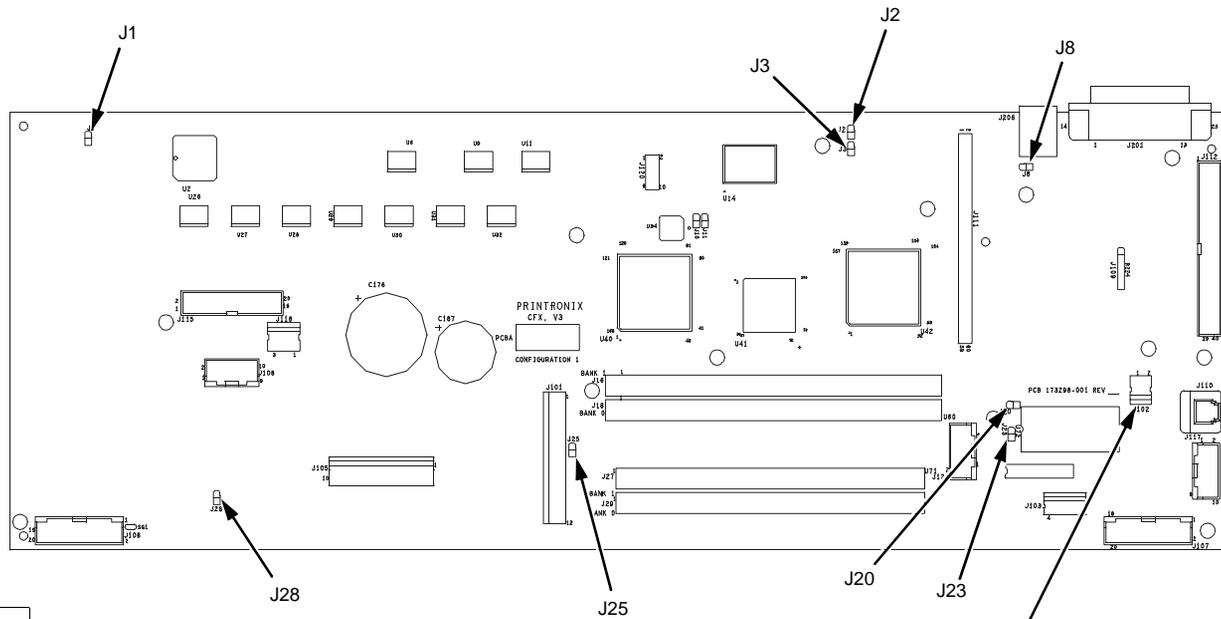


EC Diagnostics

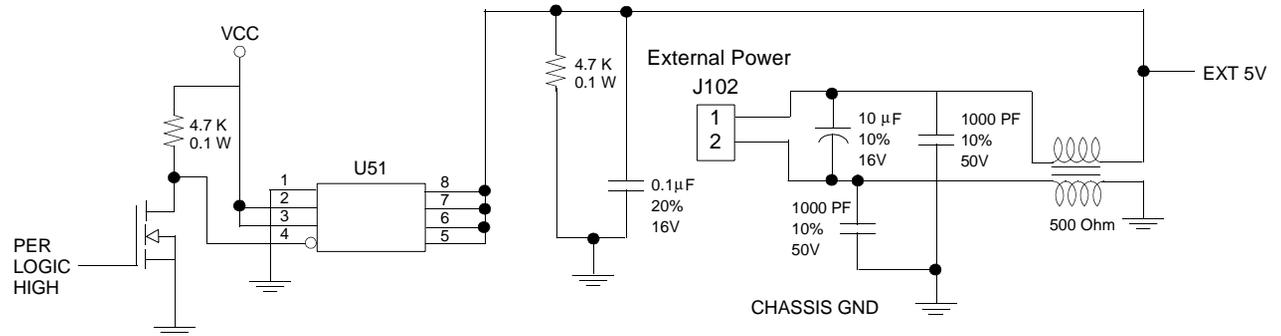


CAUTION: <5> Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.

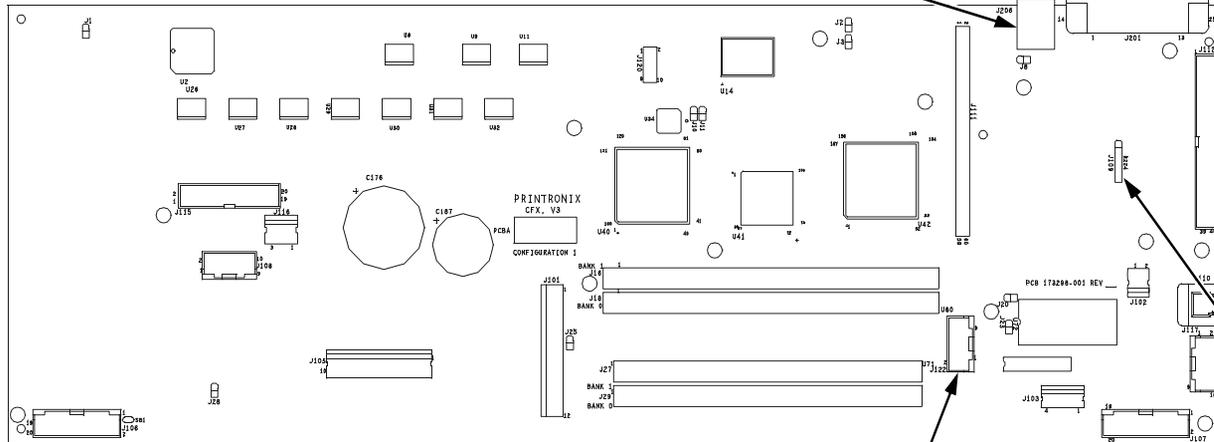
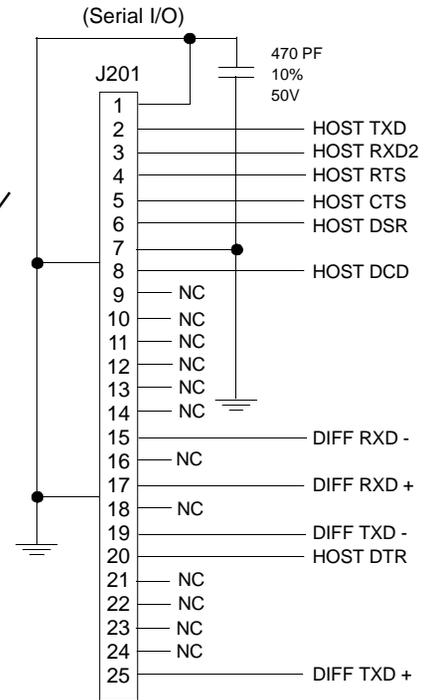
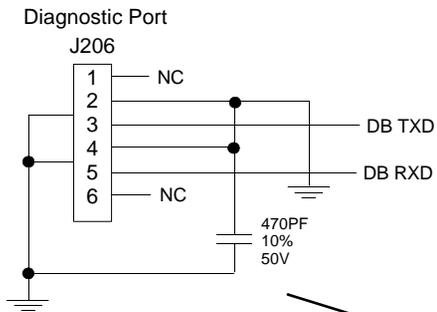
CFX Controller (continued)



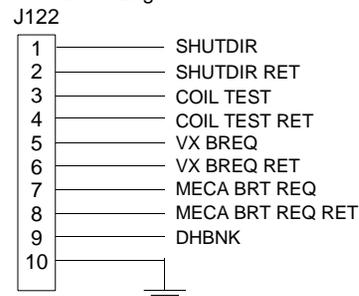
CAUTION: <5> Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.



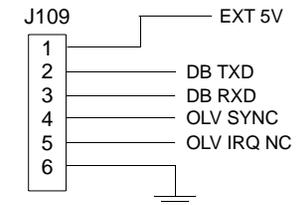
CFX Controller (continued)



Dual Hammer Bank Logic

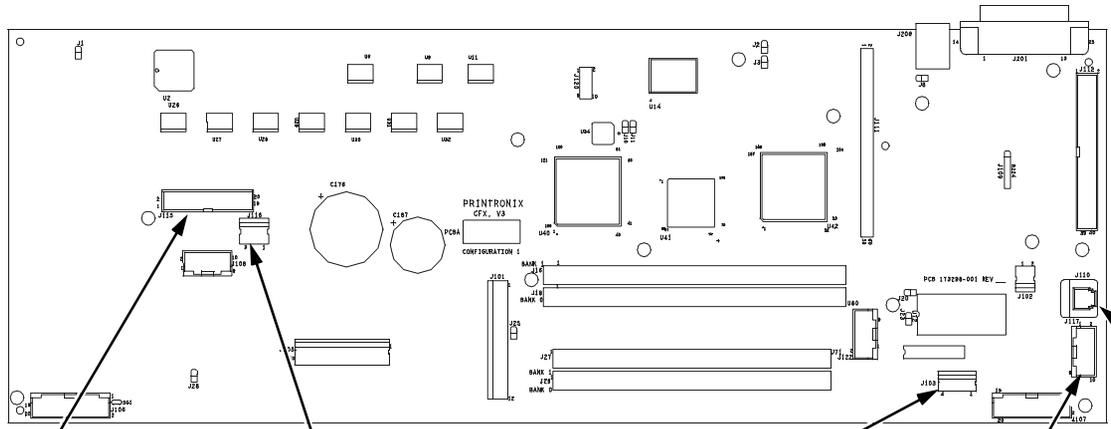


On-Line Verifier

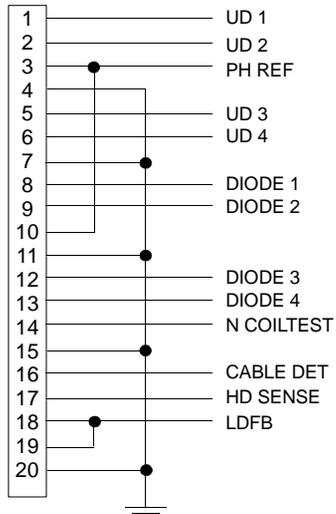


CAUTION: <5> Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.

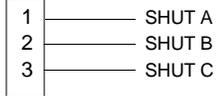
CFX Controller (continued)



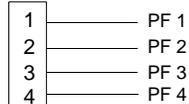
Dual Hammer Bank
Power Control
J115



Shuttle Drive
J116



Paper Feed Motor
J103

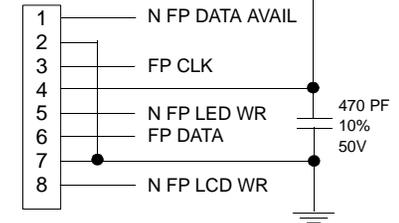


(Cable Pins 1, 3 and 5, 7:
0.417 - 0.681 Ω is normal.)

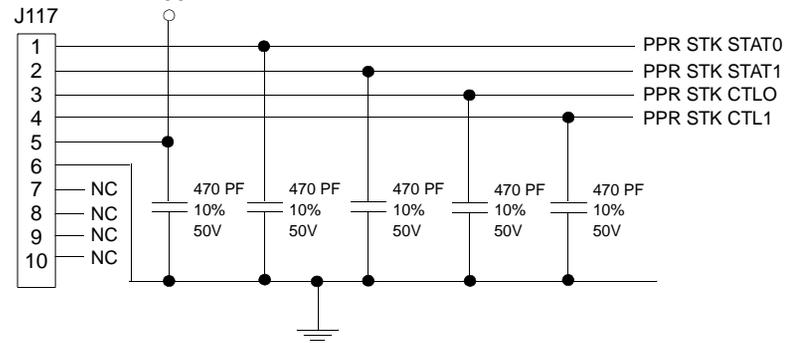
CAUTION: <5> Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.

Operator Front Panel (FP)

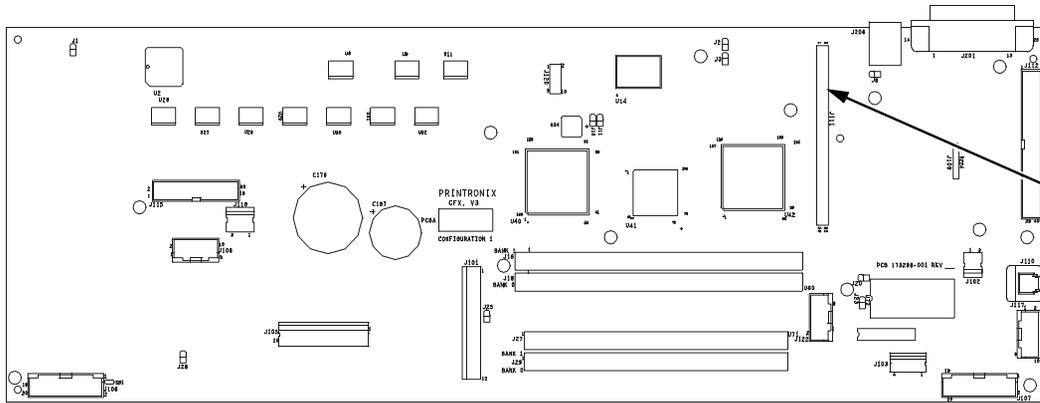
J110



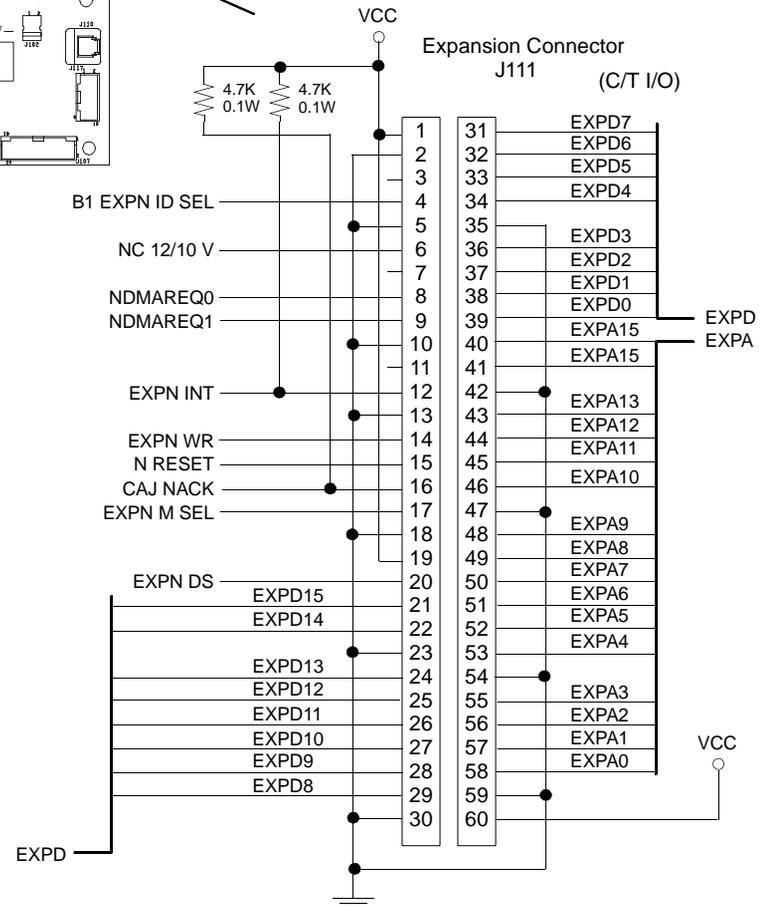
Paper Stacker
J117



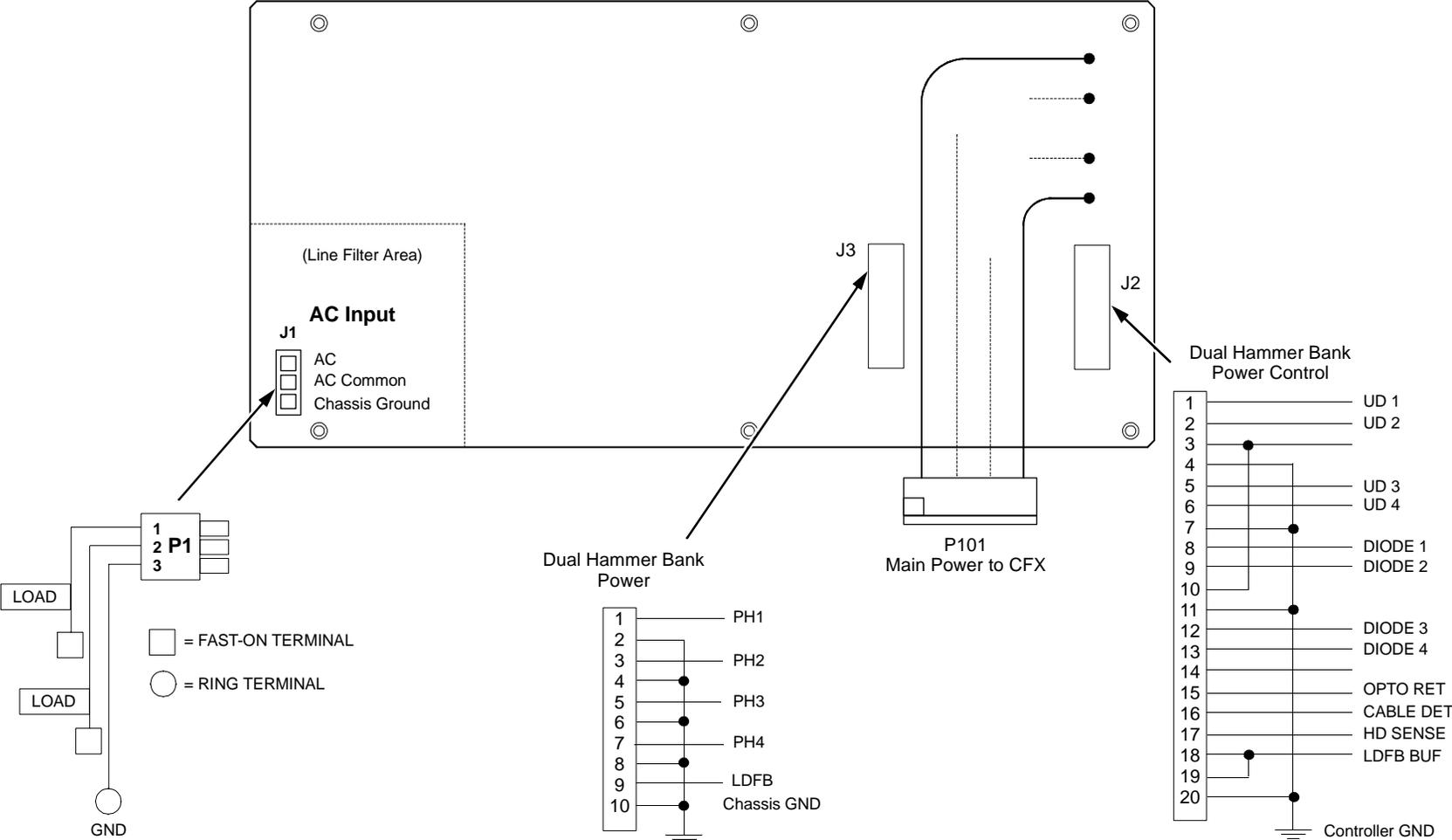
CFX Controller (continued)



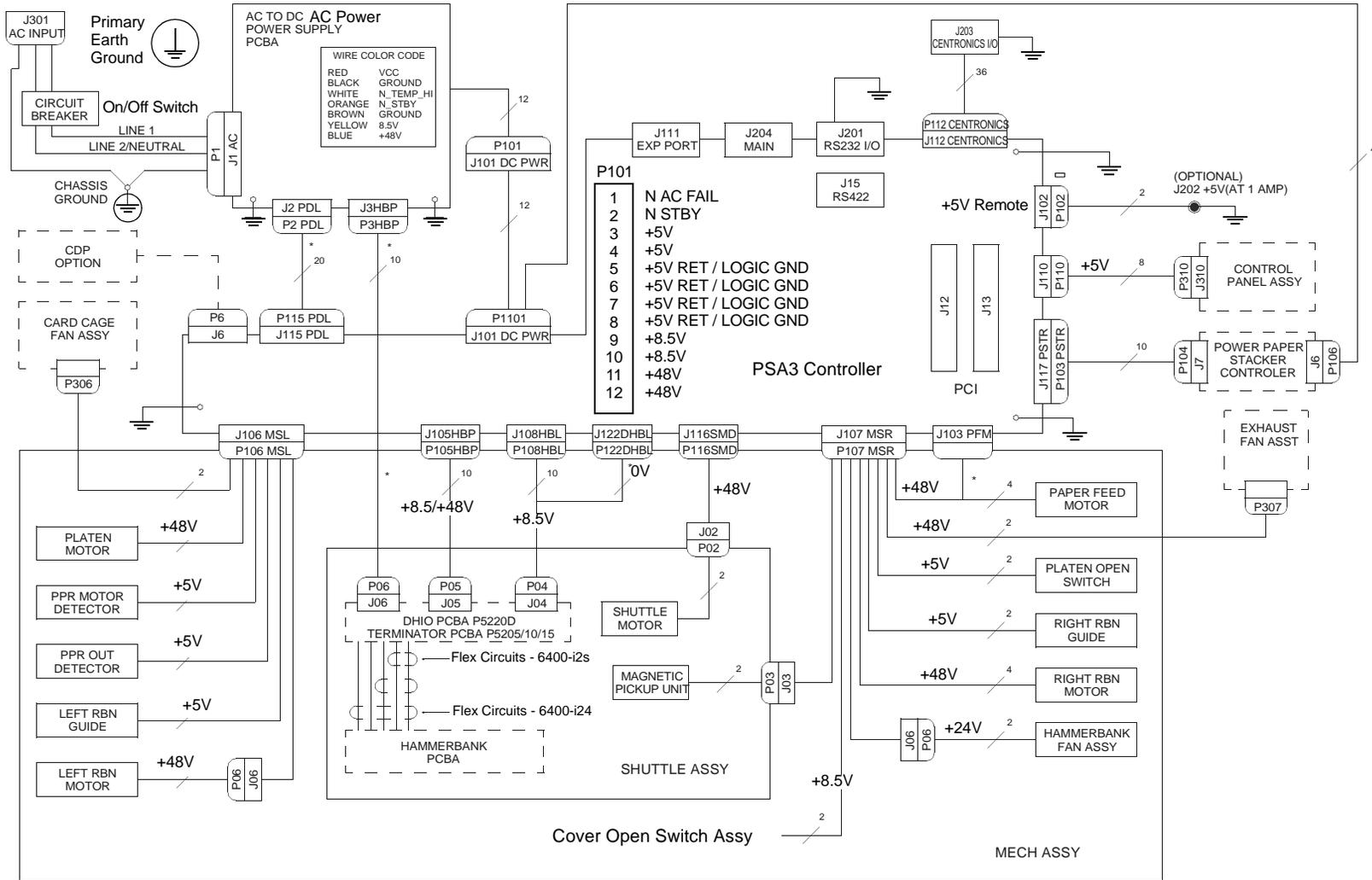
CAUTION: <5> Do not remove or replace the NVRAM. The NVRAM contains a lithium battery that can explode if it is replaced incorrectly. NVRAM is replaced only at the factory.



Power Supply (6400-i20)



Power Distribution Diagram, 6400-i24, -i2s Models



Main Wire Harness Test Tables, PSA3 Controller Board



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

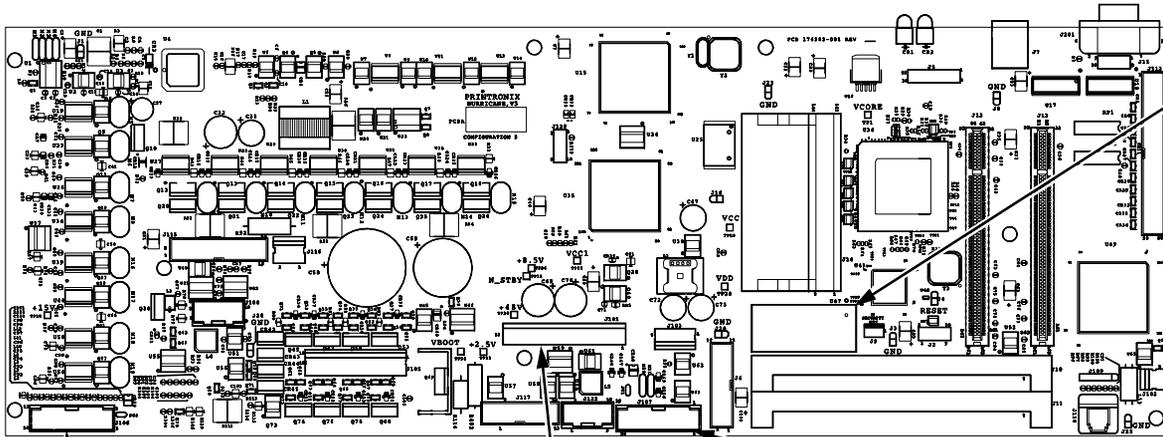
MOTOR NOTES:

All Motors: Let the motor cool to room temperature before you test it. 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 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; 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



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

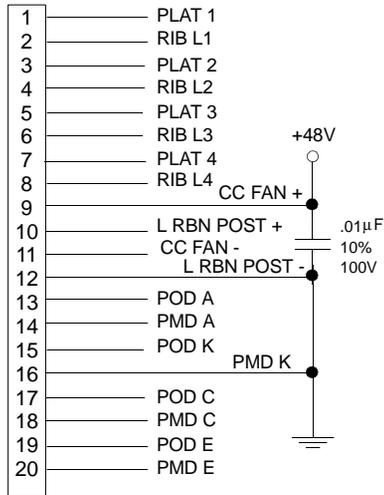


Motor Sensor Left



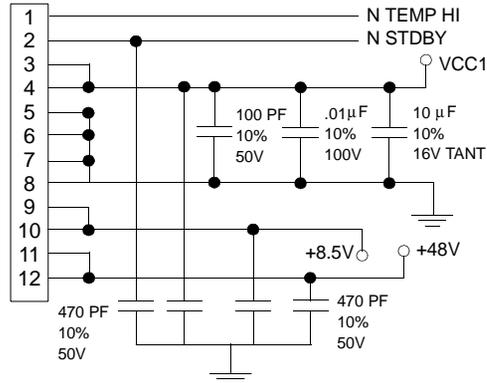
Motor Sensor Right

J106

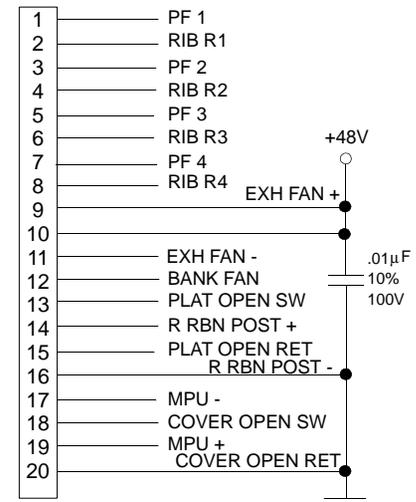


Power Supply

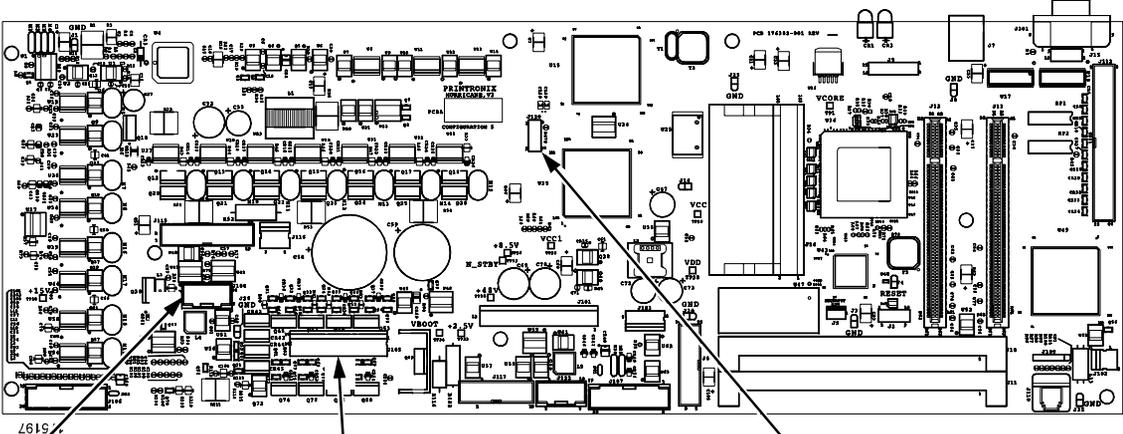
J101



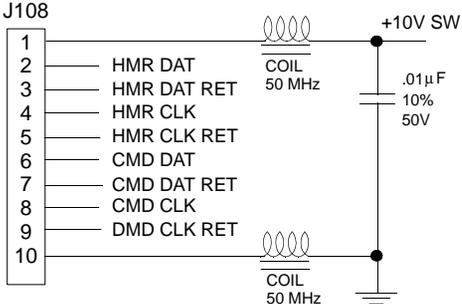
J107



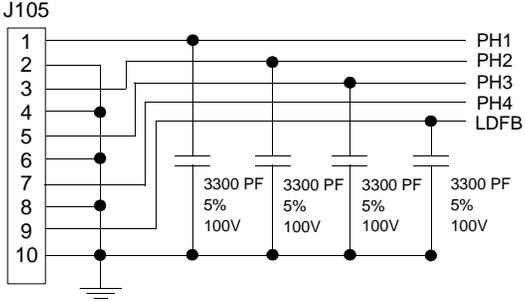
PSA3 Controller (continued)



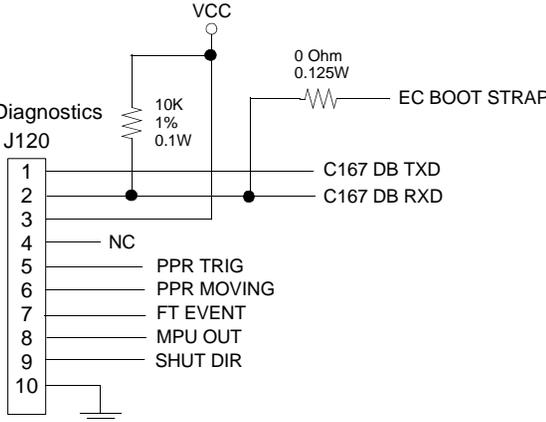
Hammer Bank Logic



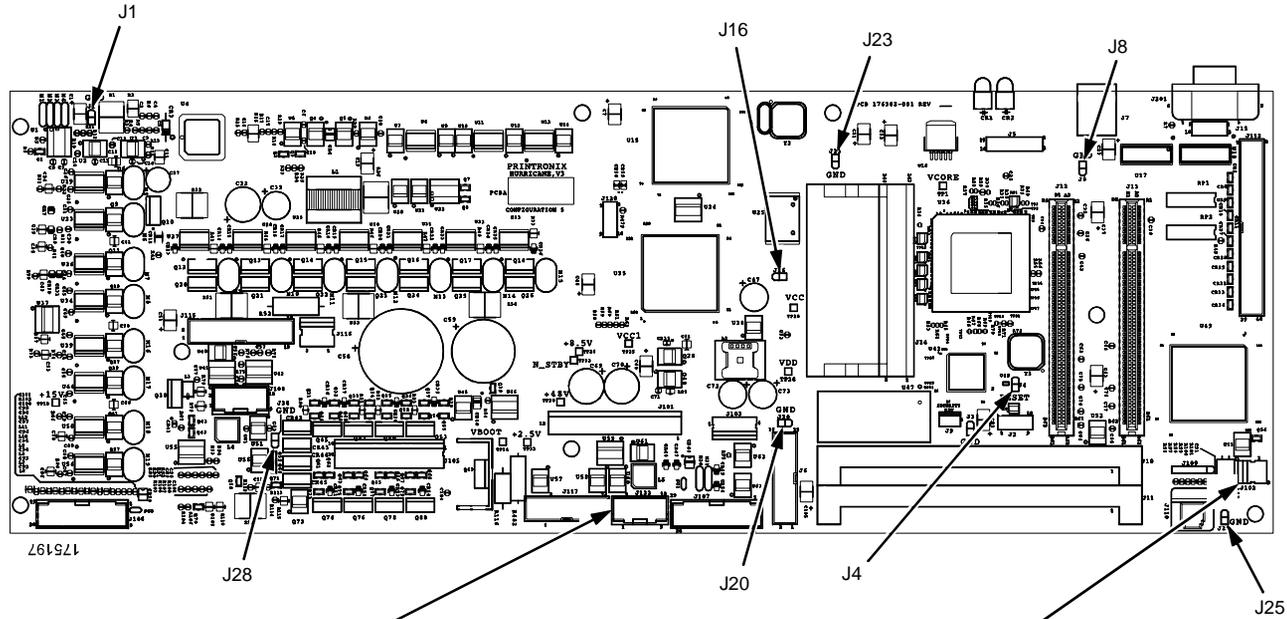
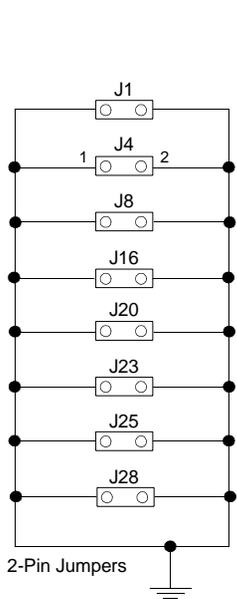
Hammer Bank Power



EC Diagnostics

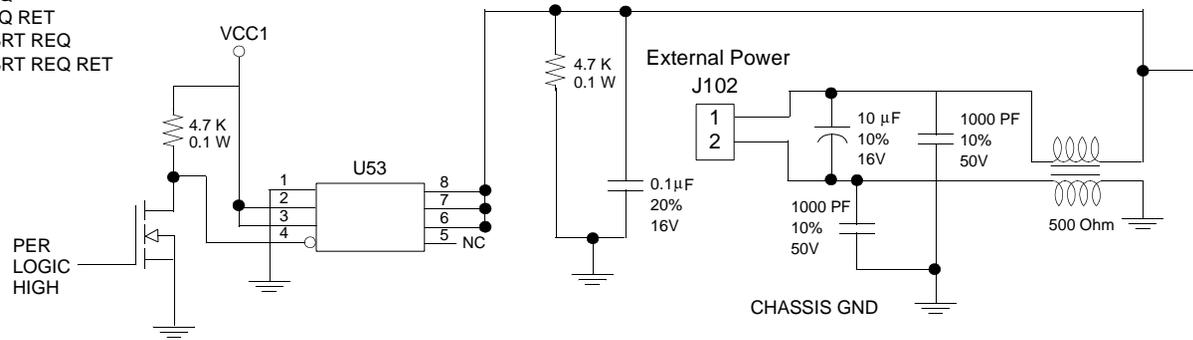
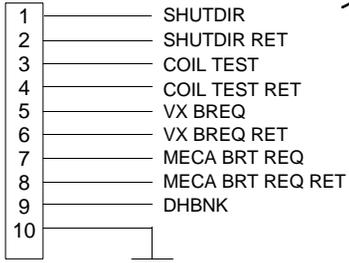


PSA3 Controller (continued)

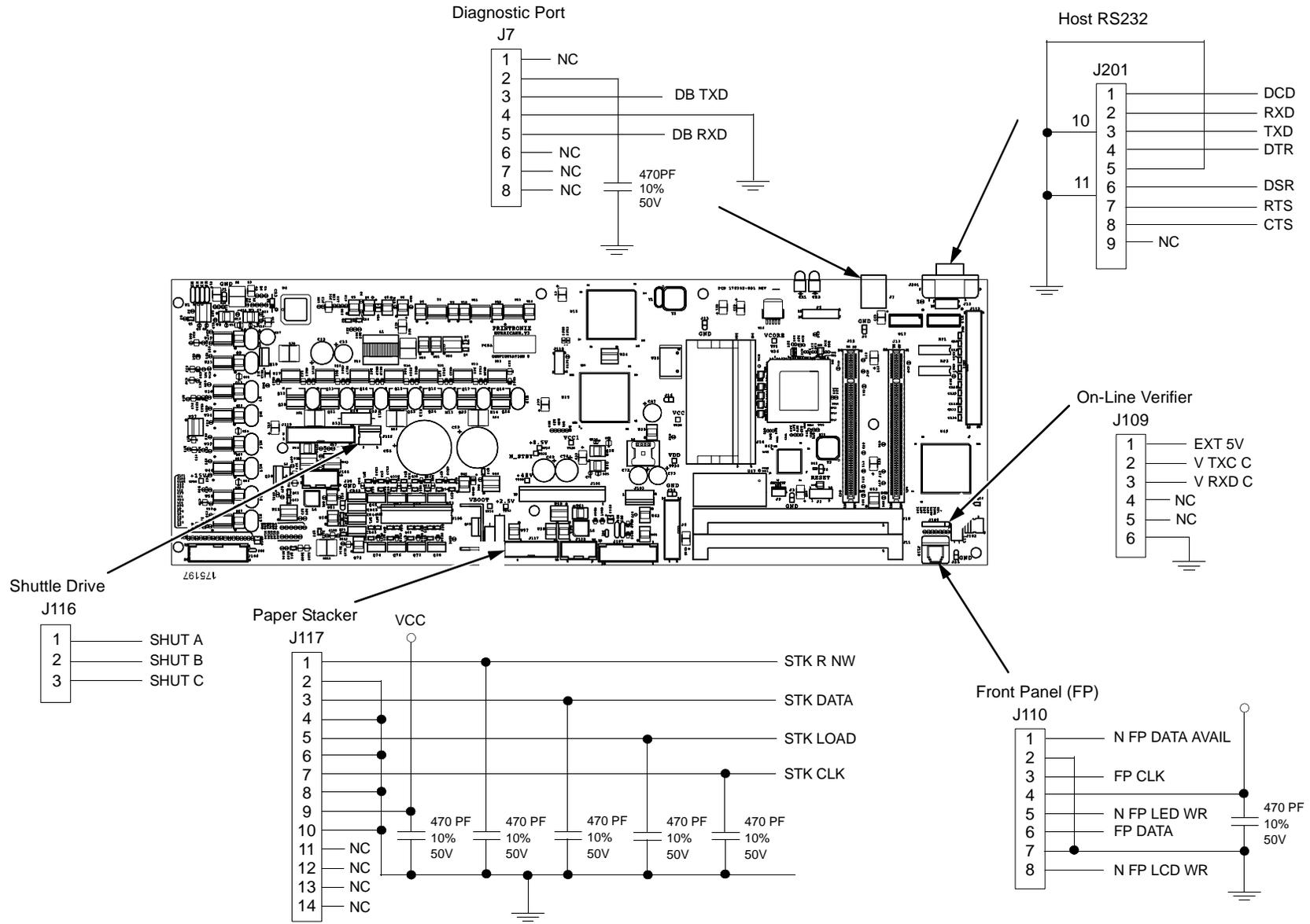


Hammer Bank Port

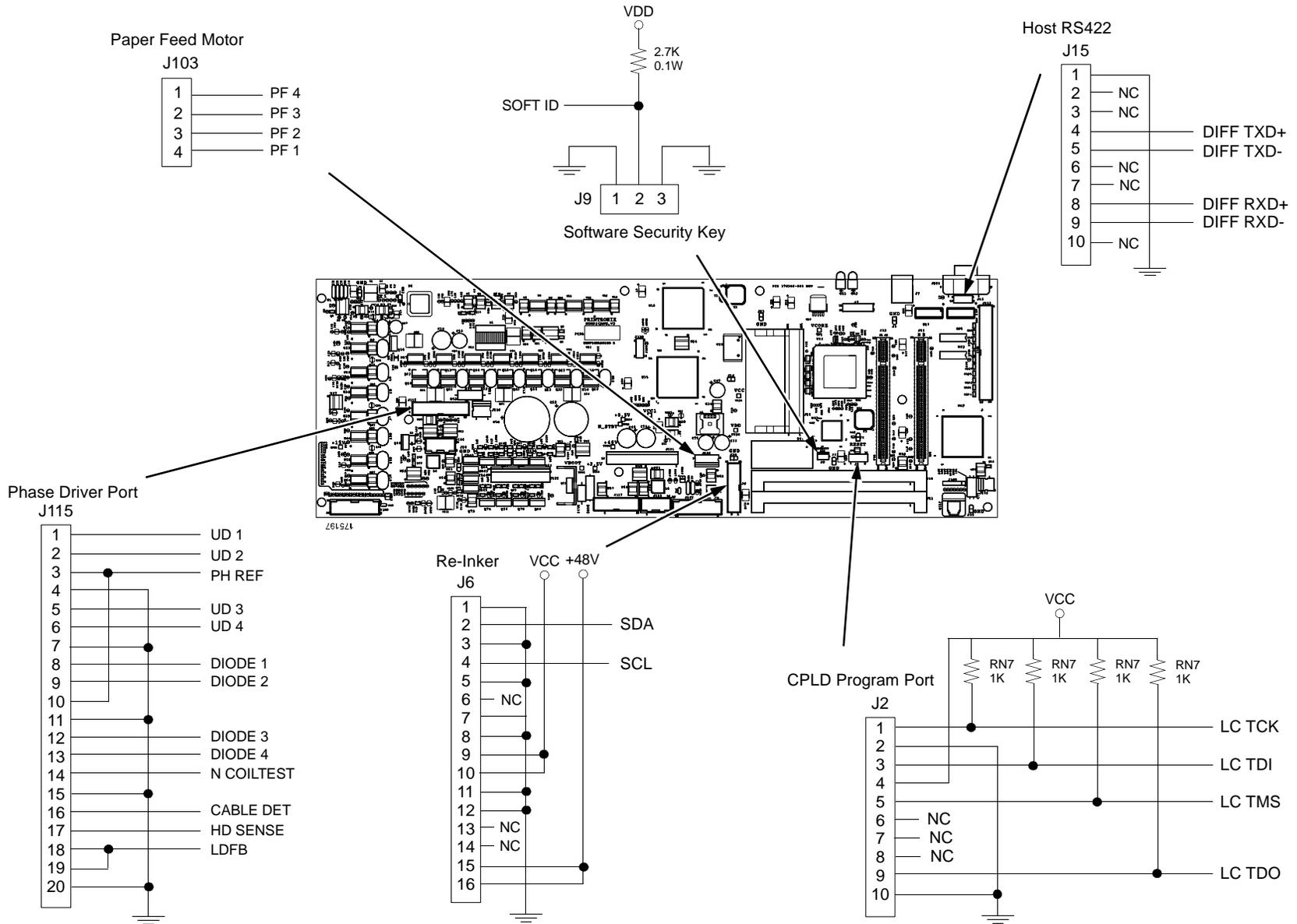
J122



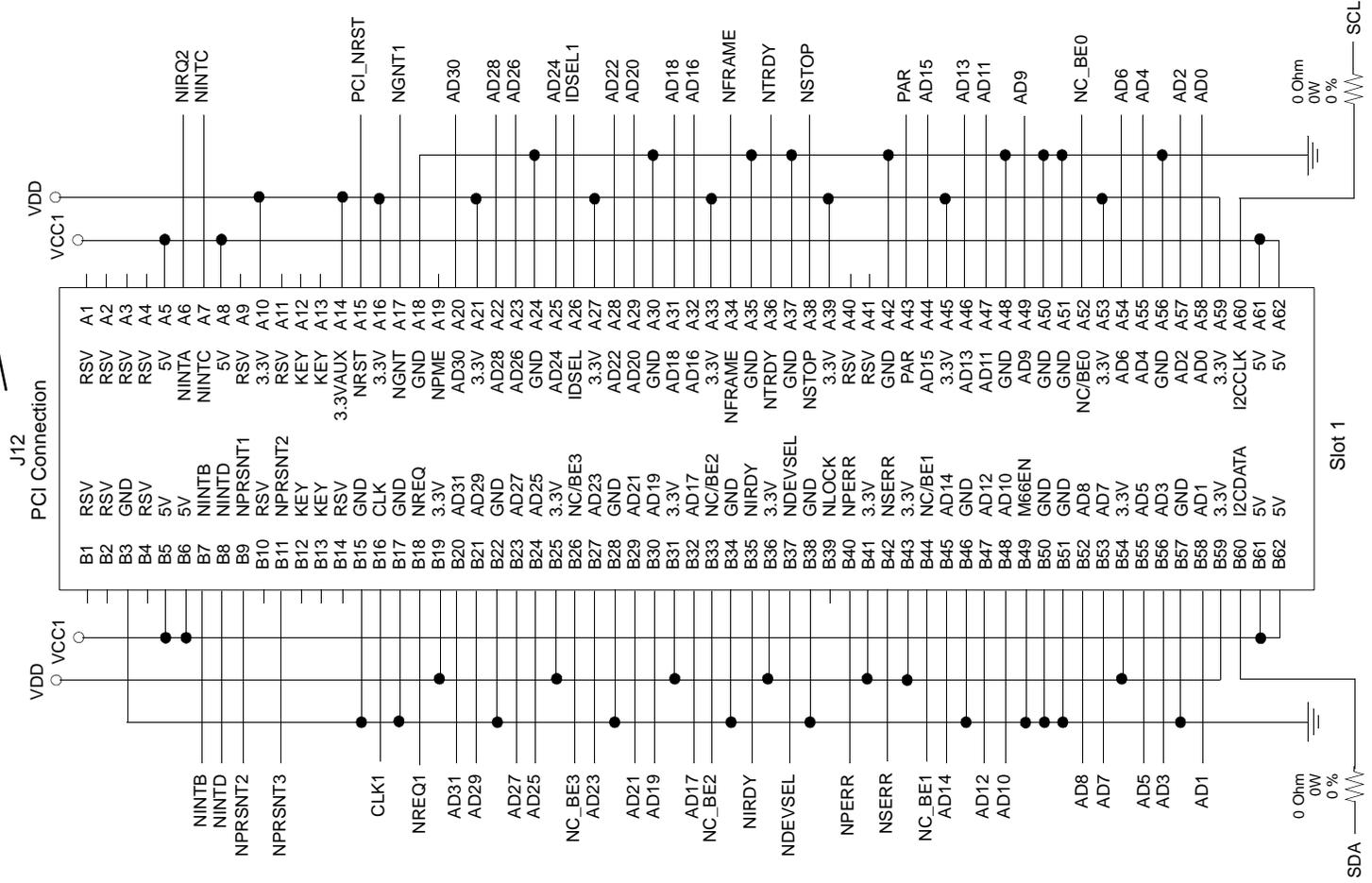
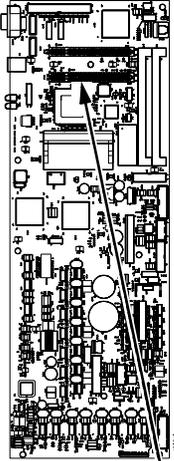
PSA3 Controller (continued)



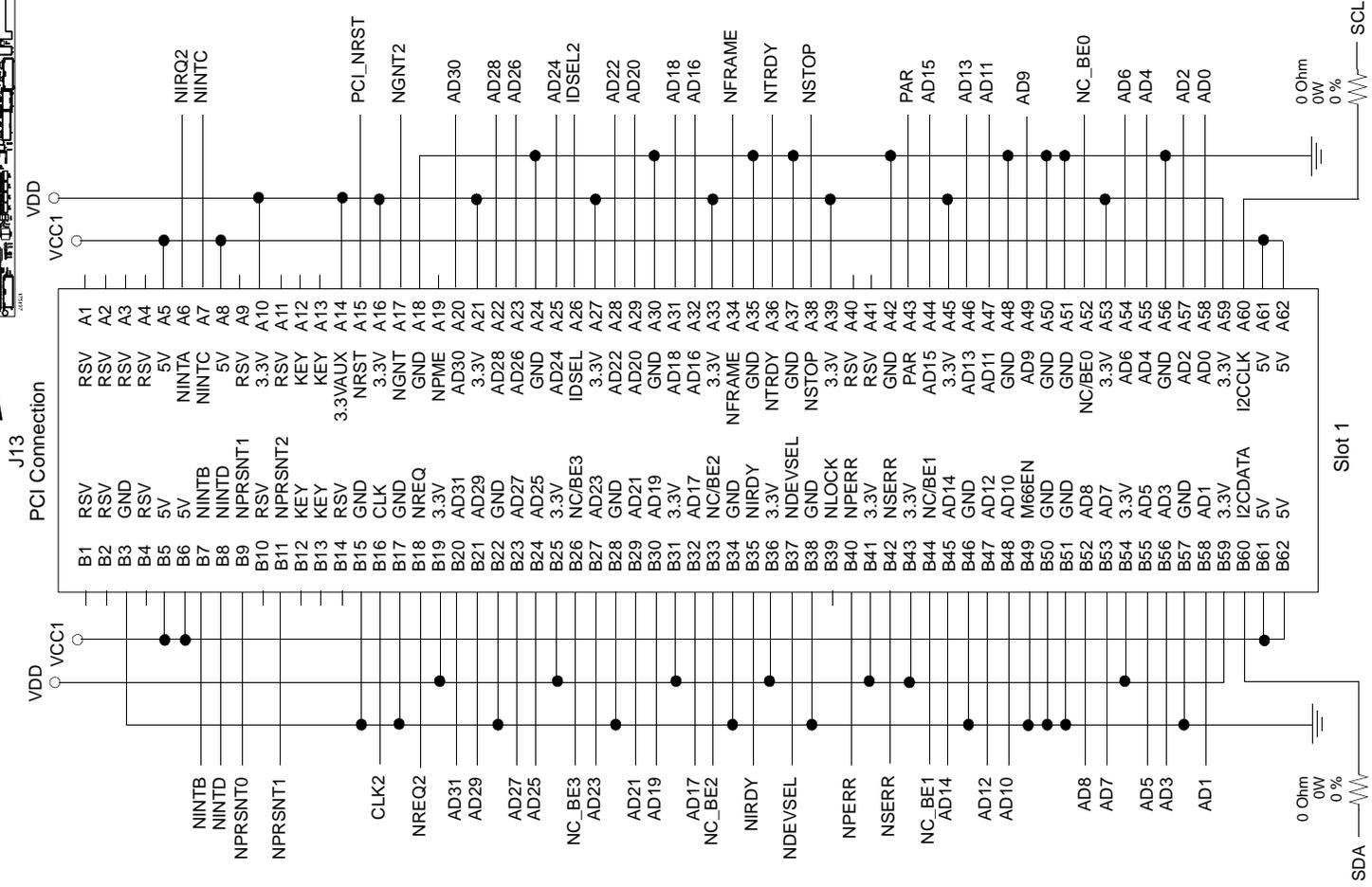
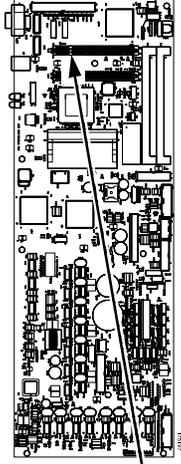
PSA3 Controller (continued)



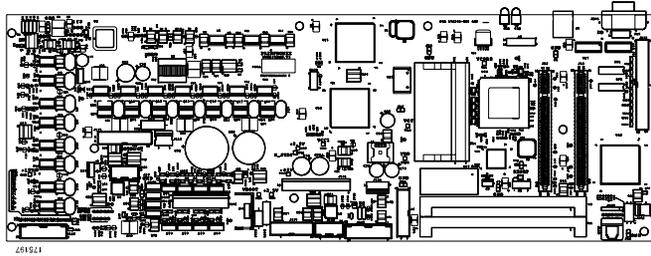
PSA3 Controller (continued)



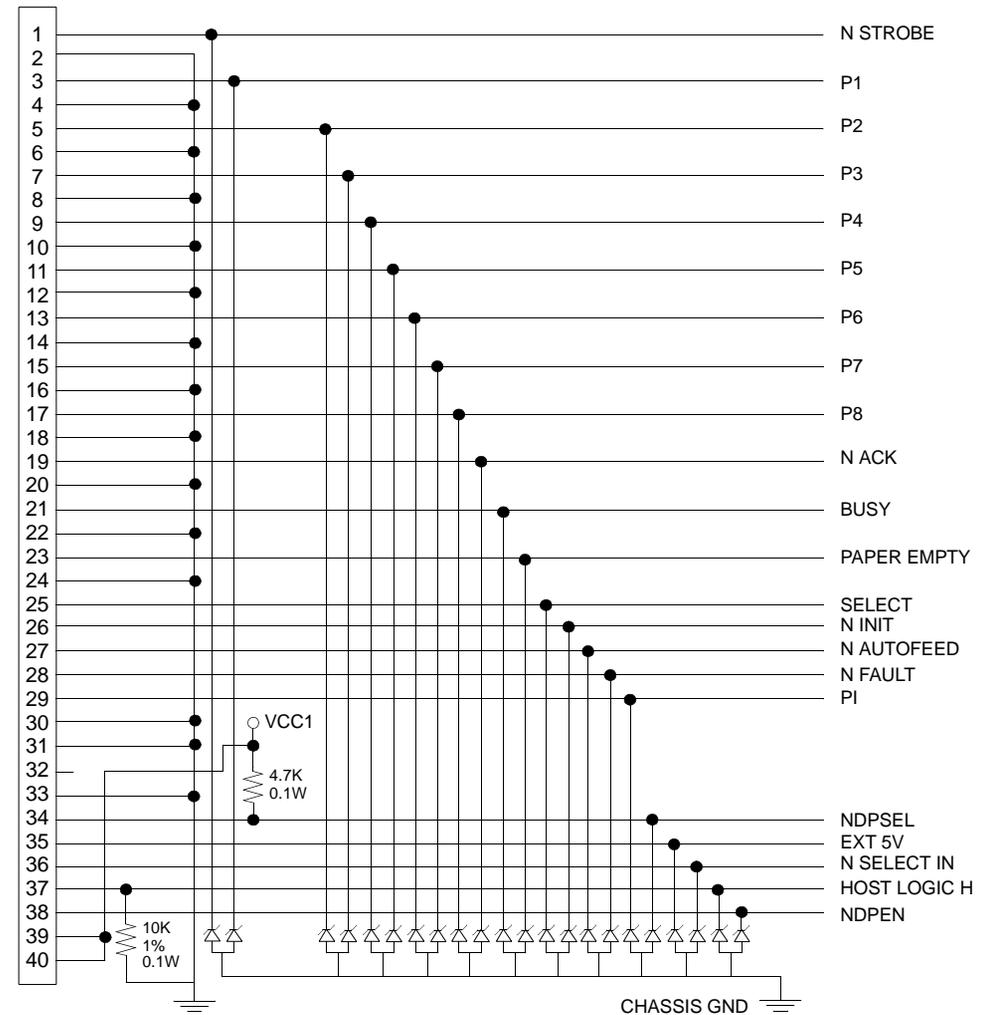
PSA3 Controller (continued)



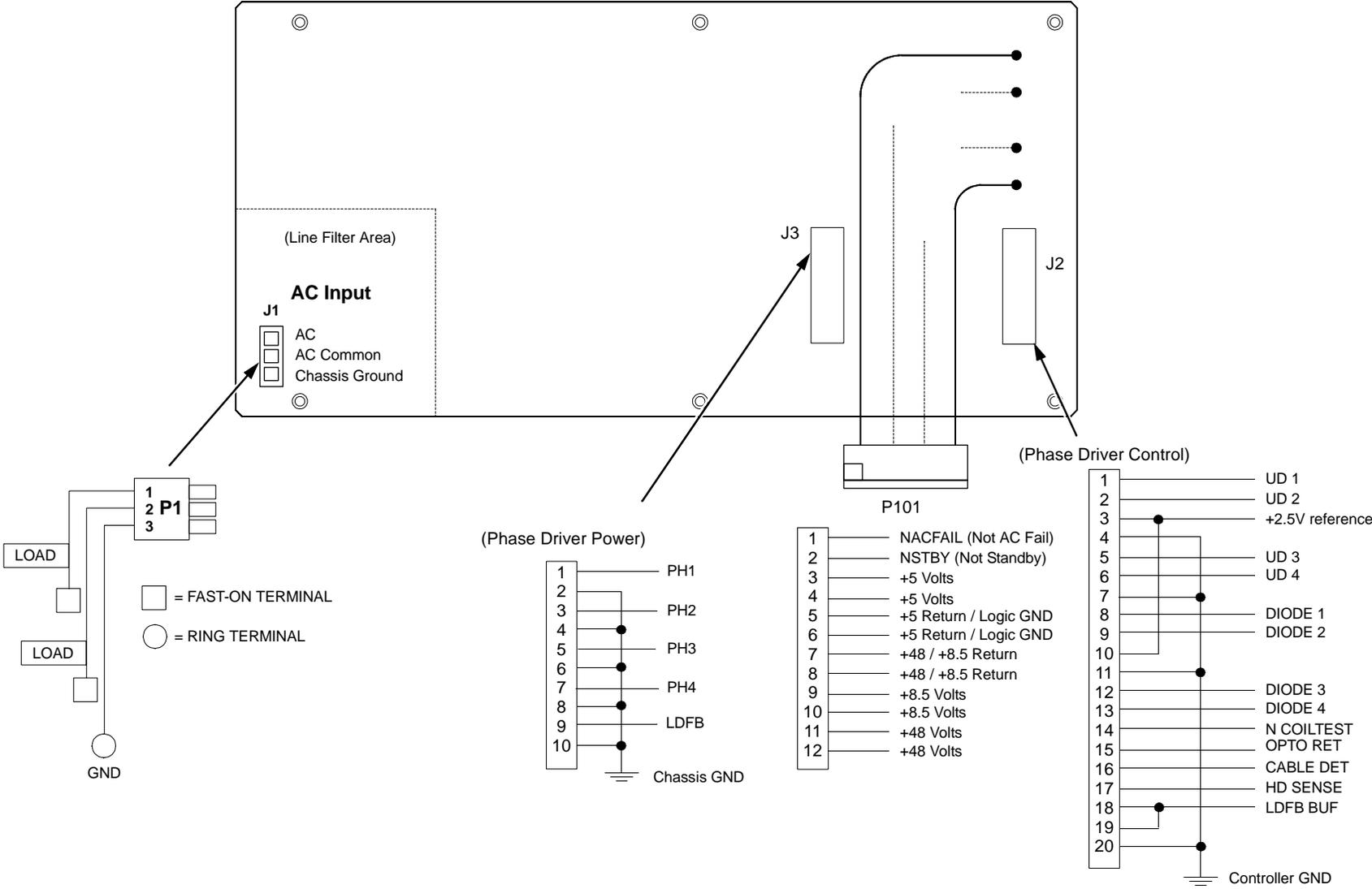
PSA3 Controller (continued)



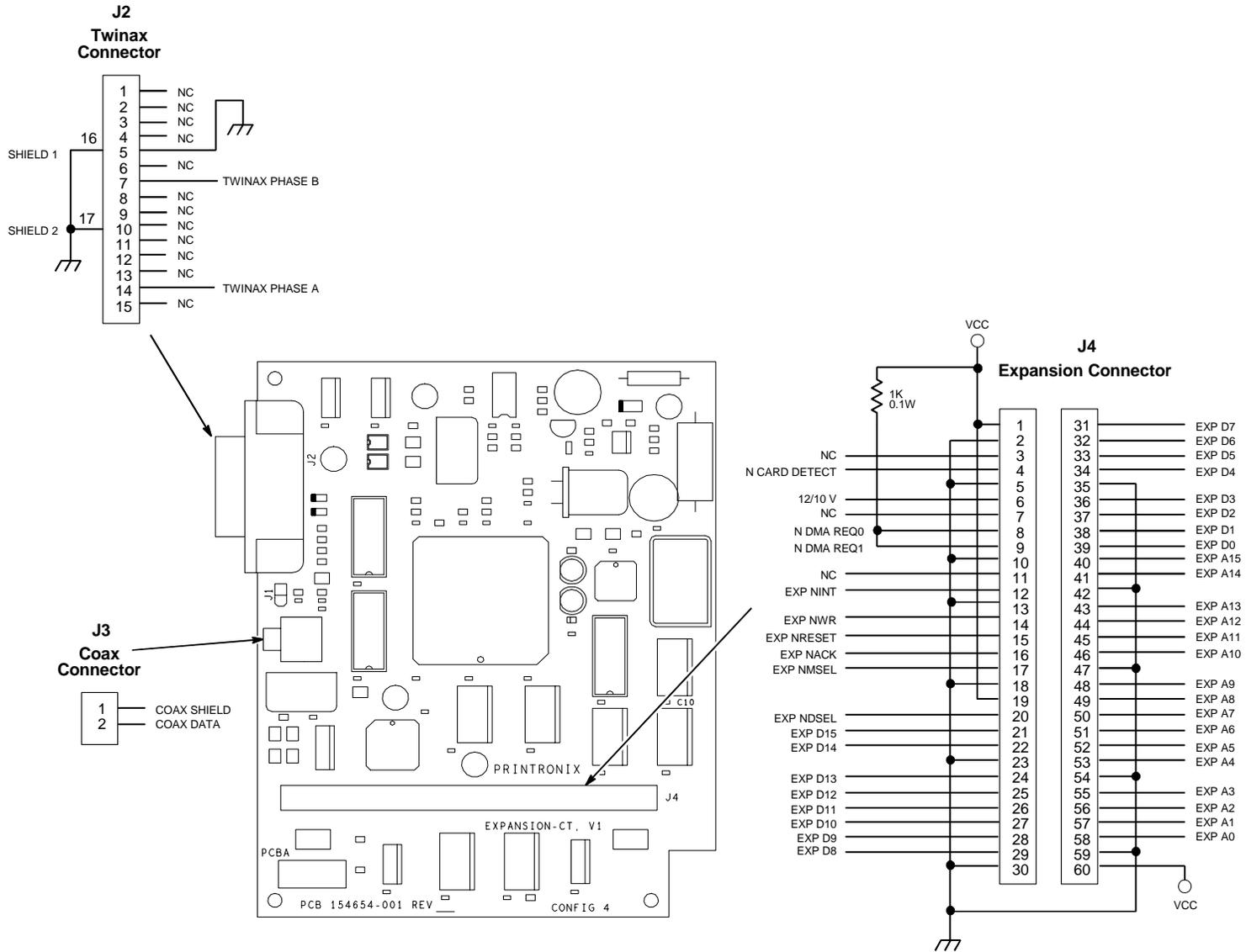
Centronics Connector
J112



Power Supply (6400-i24, -i2s)

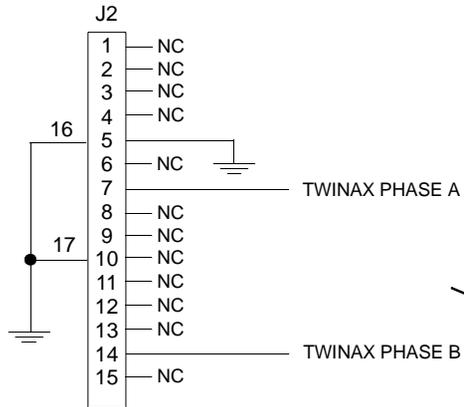


IBM Coax/Twinax Expansion Board for CMX / CFX Controllers

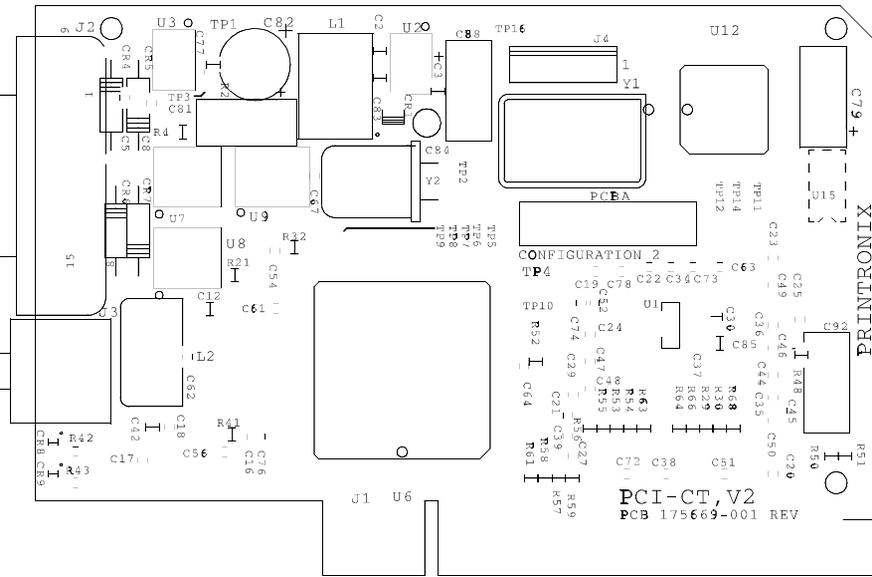
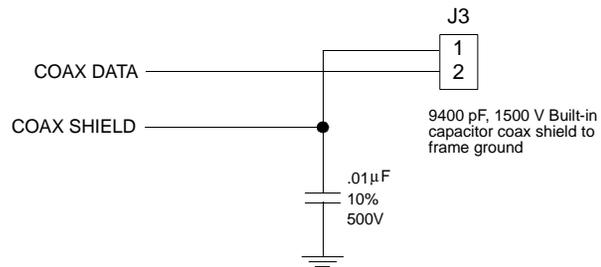


IBM Coax/Twinax Expansion Board for PSA3 Controllers

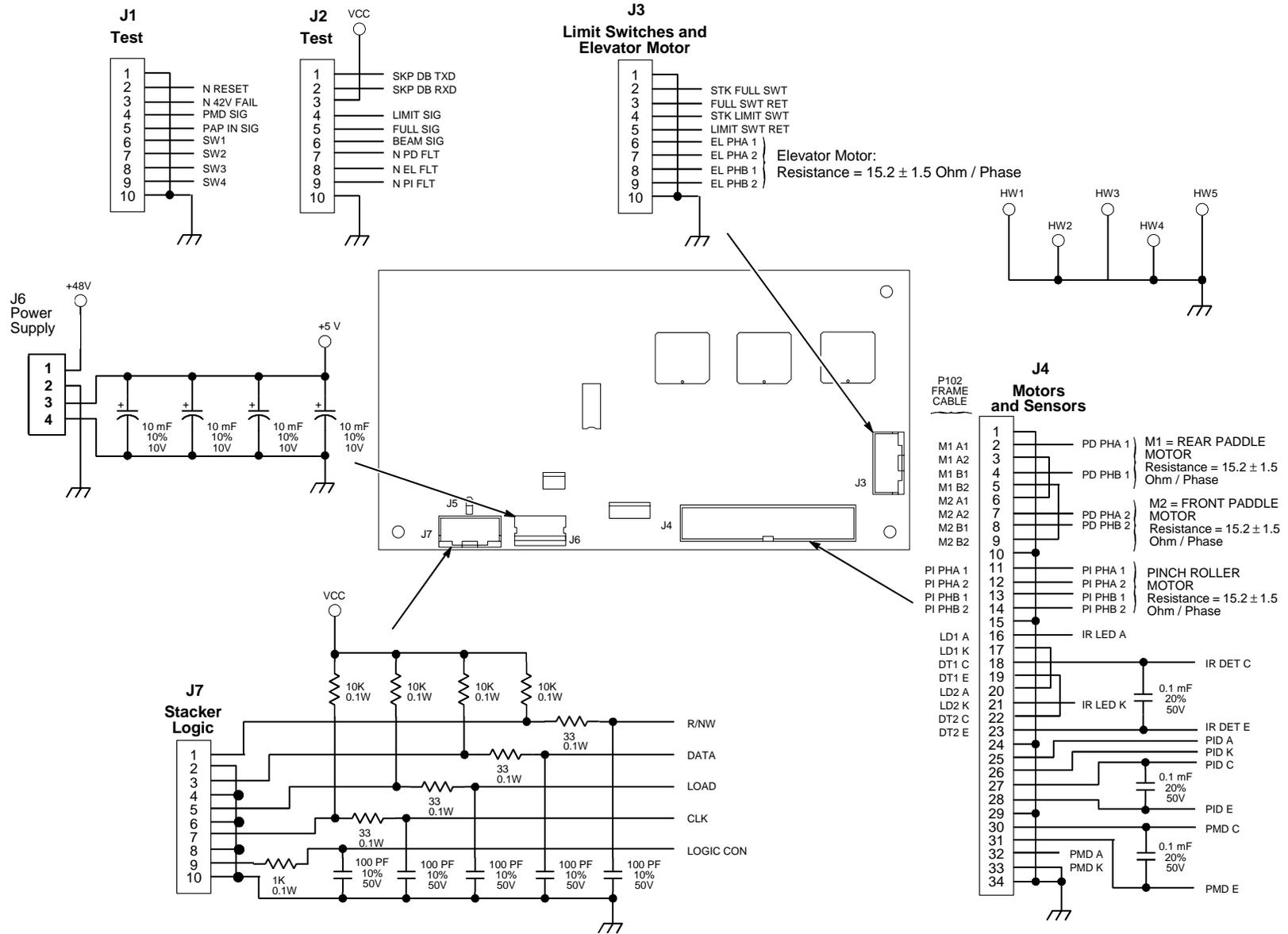
Twinax Connection



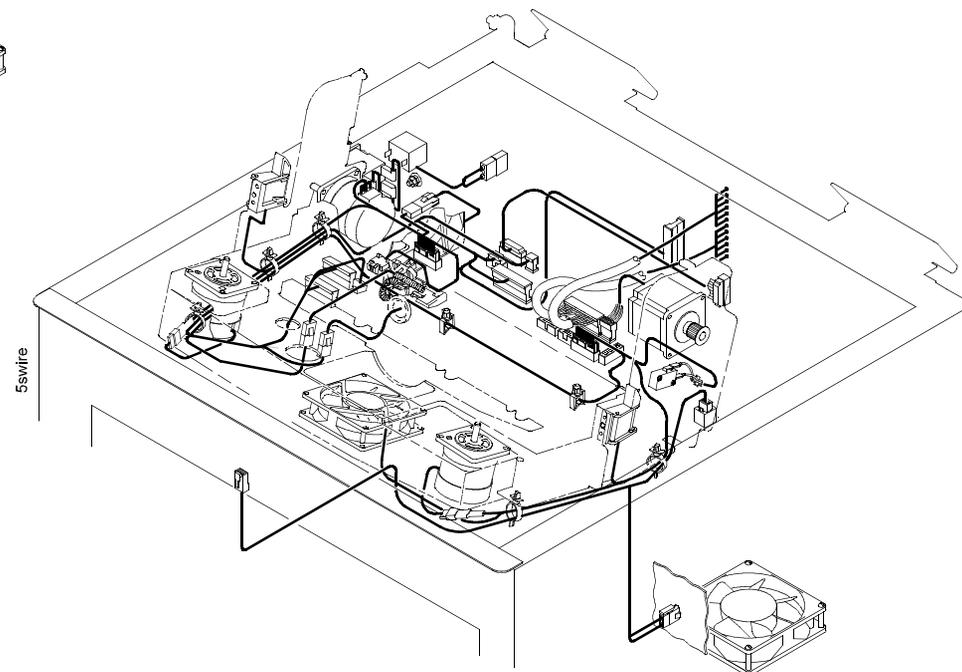
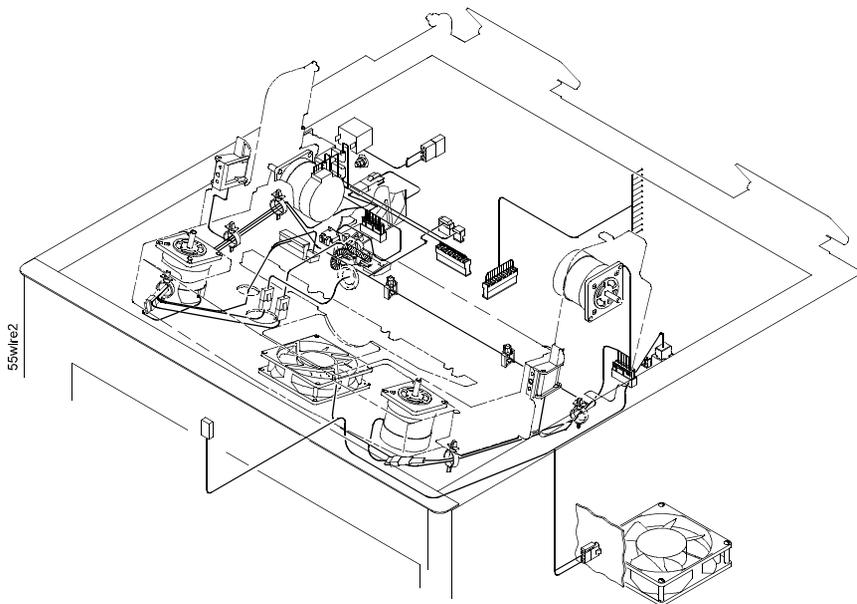
Coax Connection



SureStak Power Stacker PCBA

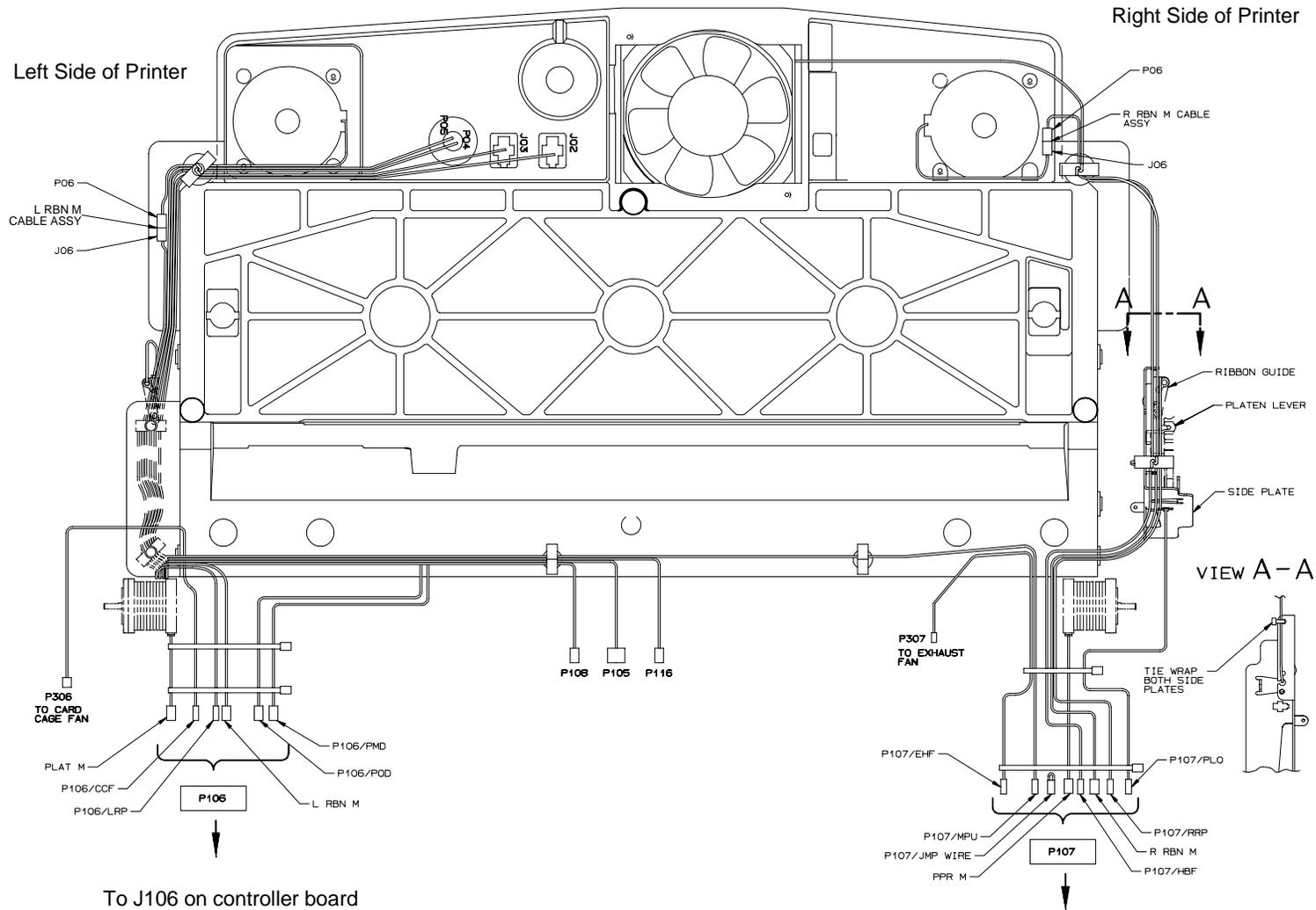


Cable Routing, Cabinet Models



Cable Routing, Mechanism Base, Cabinet Model

Front of Printer

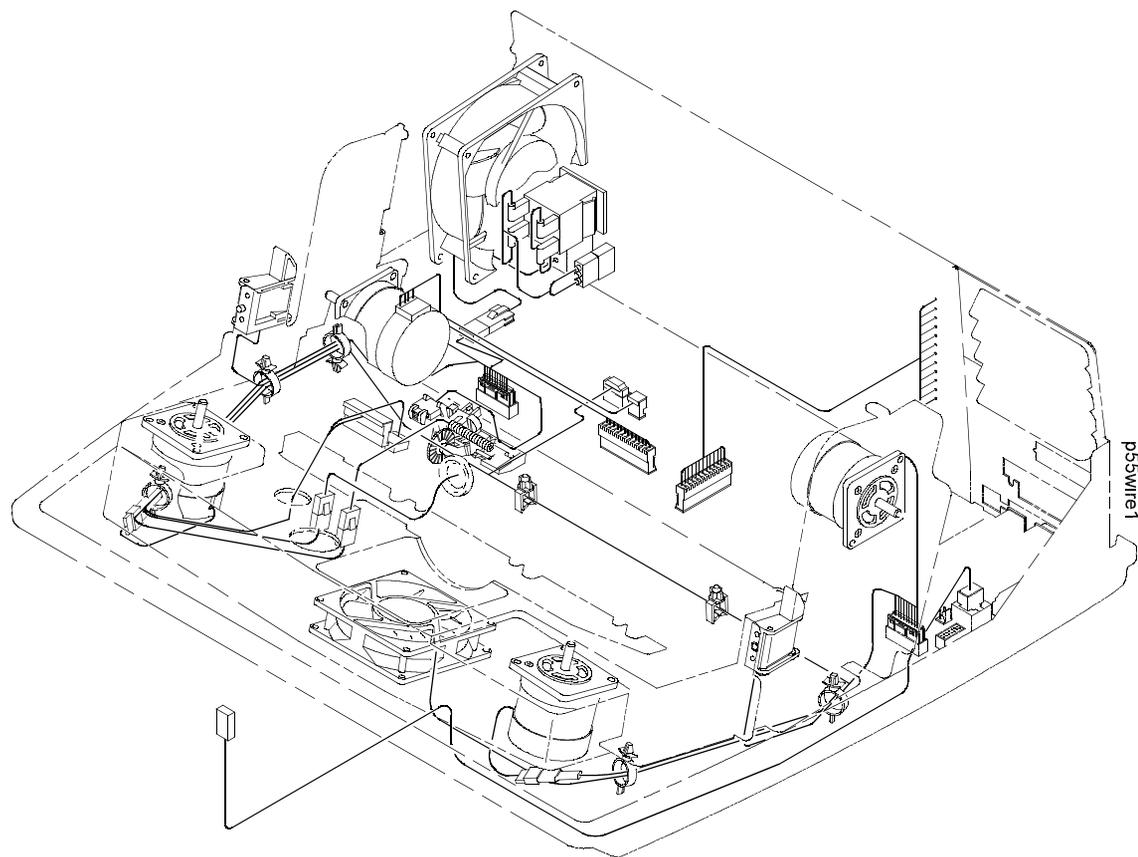


To J106 on controller board

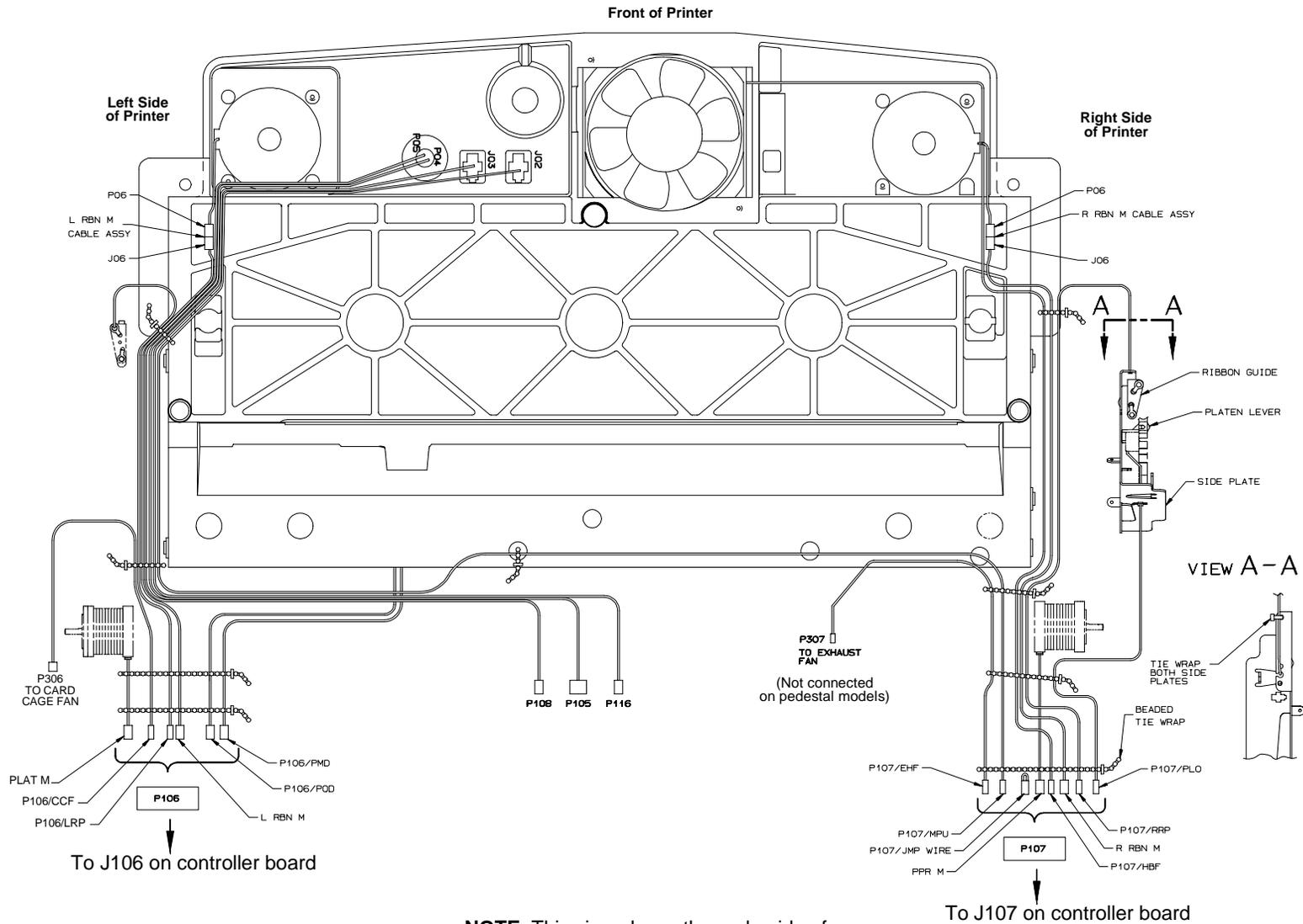
NOTE: This view shows the underside of the mechanism base.

To J107 on controller board

Cable Routing, Pedestal Model



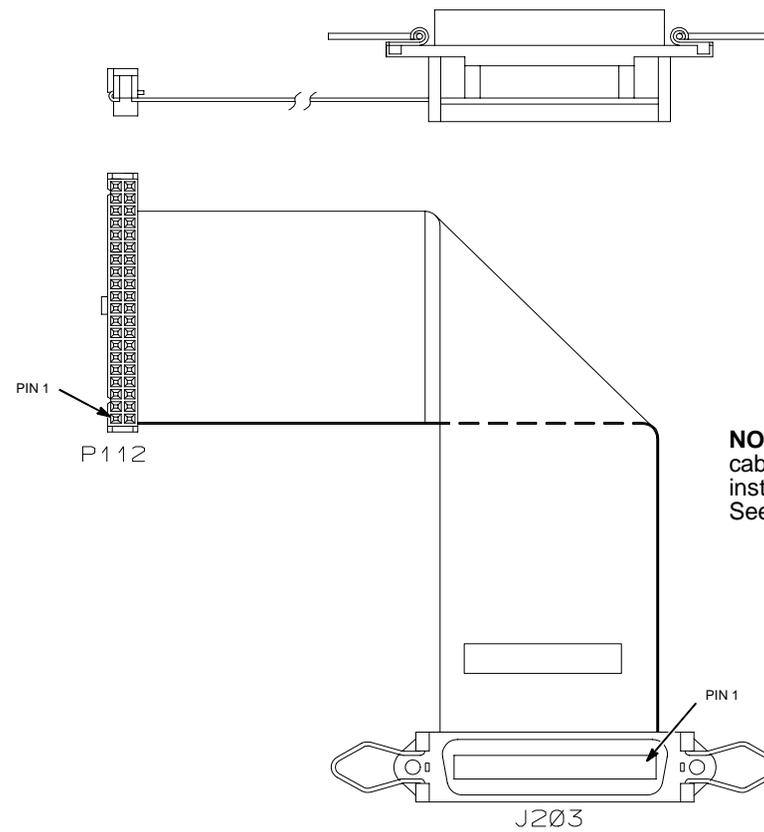
Cable Routing, Mechanism Base, Pedestal Model



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

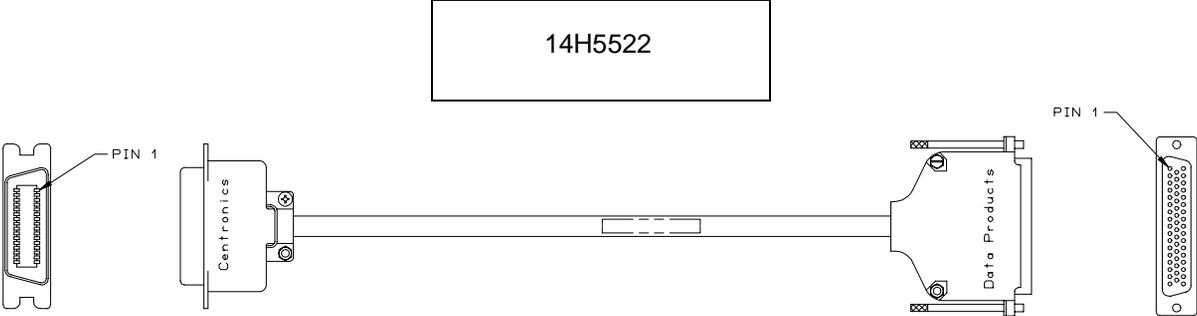
Cable Assembly, Centronics I/O

14H5287



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

Cable Assembly, Centronics/Dataproducts Adapter



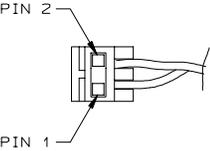
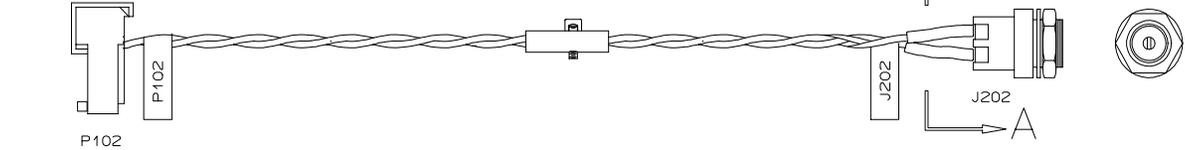
WIRING TABLE		
CENTRONICS	TWISTED PAIR	DATAPRODUCTS
PIN 1	#1	PIN 38
* PIN 19		* PIN 37
PIN 2	#2	PIN 19
* PIN 20		* PIN 3
PIN 3	#3	PIN 20
* PIN 21		* PIN 4
PIN 4	#4	PIN 1
* PIN 22		* PIN 2
PIN 5	#5	PIN 41
* PIN 23		* PIN 40
PIN 6	#6	PIN 34
* PIN 24		* PIN 18
PIN 7	#7	PIN 43
* PIN 25		* PIN 42
PIN 8	#8	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
		PIN 45
		* PIN 46

* GROUND JUMPER WIRE

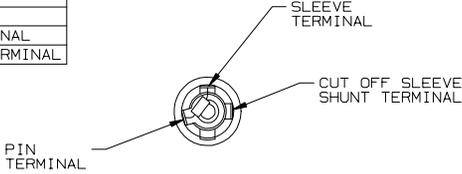
Cable Assembly, +5V Remote Power

14H5589

To Controller Board



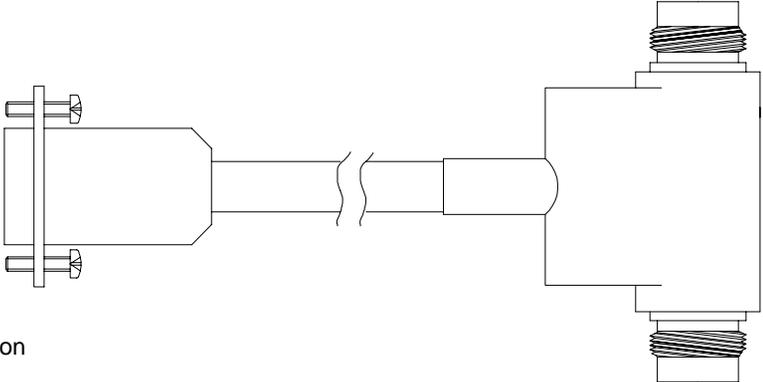
WIRE TABLE		
P102	DESCRIPTION	J202
PIN 1	GRAY	PIN TERMINAL
PIN 2	BLACK	SLEEVE TERMINAL



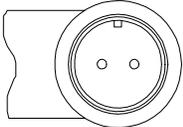
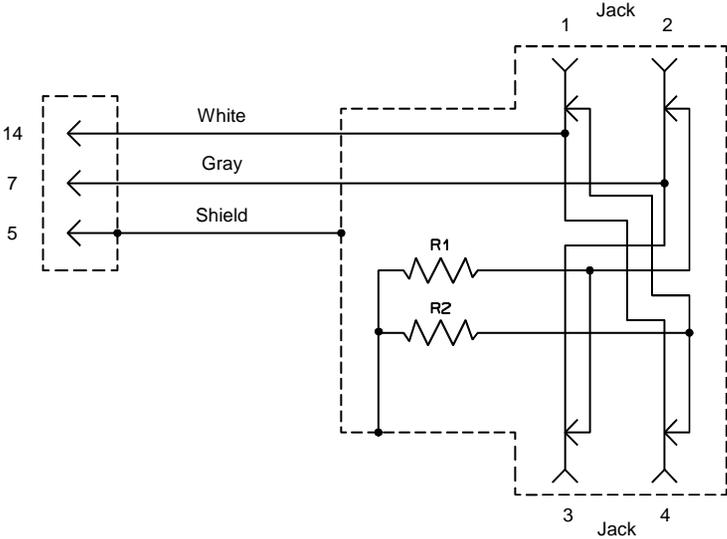
VIEW A-A

Cable Assembly, Twinax Auto-Termination

38F8254



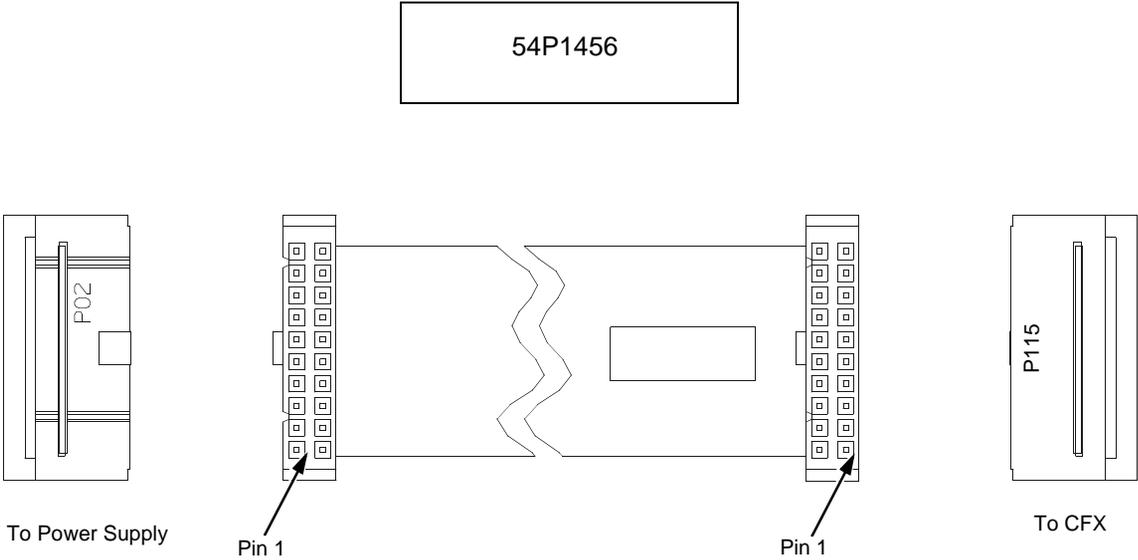
NOTE: If the printer has a PSA3 controller and power stacker, Smart-T Cable Extension 204806-001 is also required. (See also Figure 65 on page 490.)



Resistance Chart

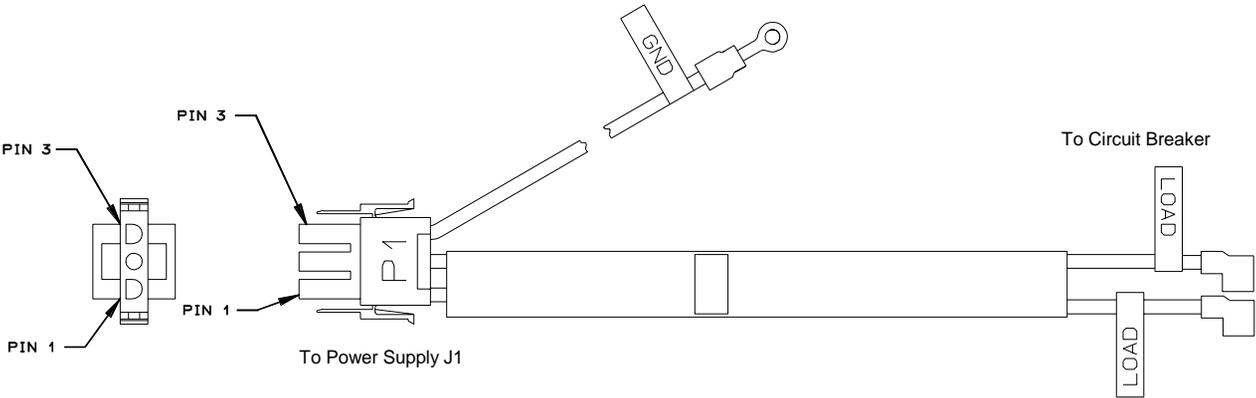
Pin	Pin	Ohms
1	2	110
3	4	110
1, 2, 3, 4	Shield	55
5	Shield	0
14	1, 4	0
7	2, 3	0

Cable Assembly, Dual Hammer Bank Power Control



Cable Assembly, AC In, Power Supply

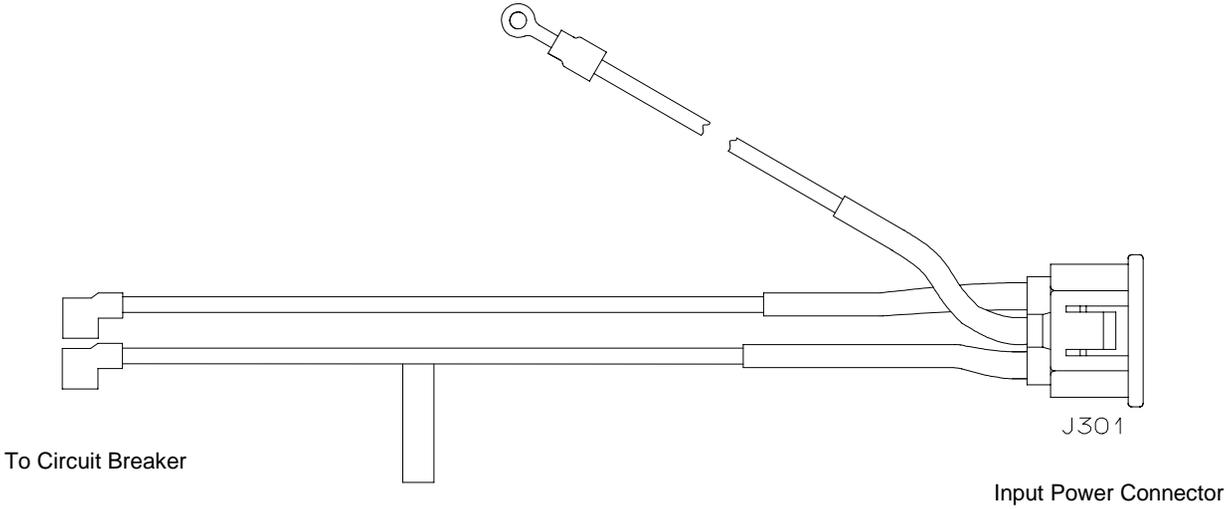
AC Kit: 14H5289



PIN	WIRE COLOR
1	BLACK
2	WHITE
3	GREEN/YELLOW

Cable Assembly, AC Power Input

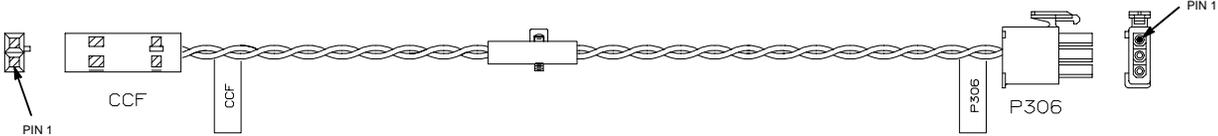
AC Kit: 14H5289



PIN	WIRE COLOR
LINE	BLACK
NEUTRAL	WHITE
GROUND	GREEN/YELLOW

Cable Assembly, Card Cage Fan

14H5285



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

Cable Assembly, Operator Panel

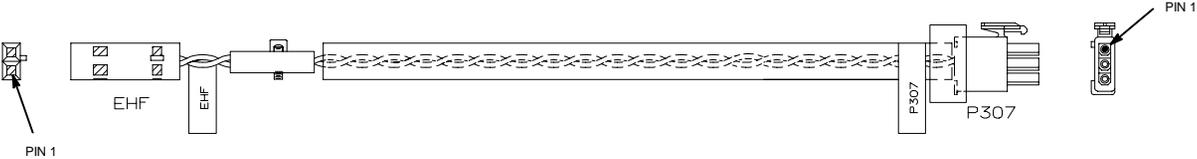
14H5300

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



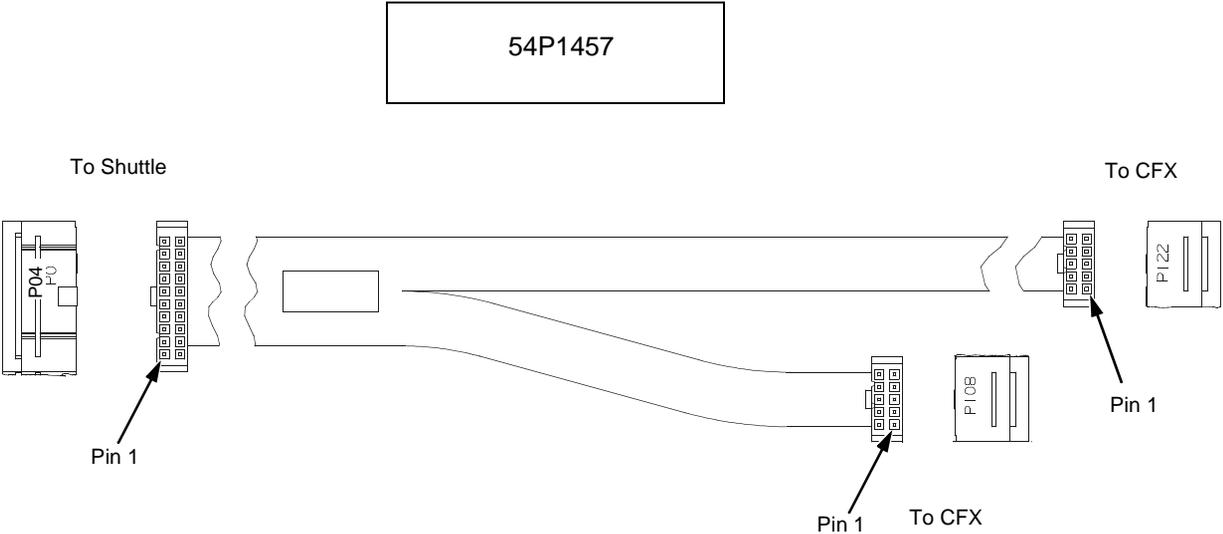
Cable Assembly, Exhaust Fan

14H5286



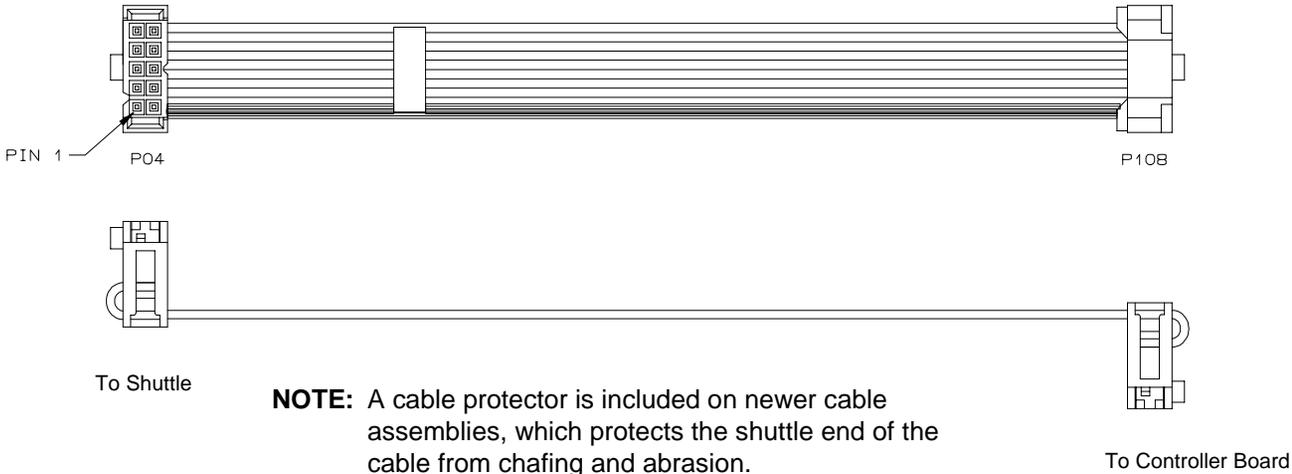
WIRE TABLE		
EHF	P307	WIRE COLOR
PIN 1	PIN 3	BLACK
PIN 2	PIN 2	GRAY
	PIN 1	N/C

Cable Assembly, Dual Hammer Bank Logic



Cable Assembly, Single Hammer Bank Logic

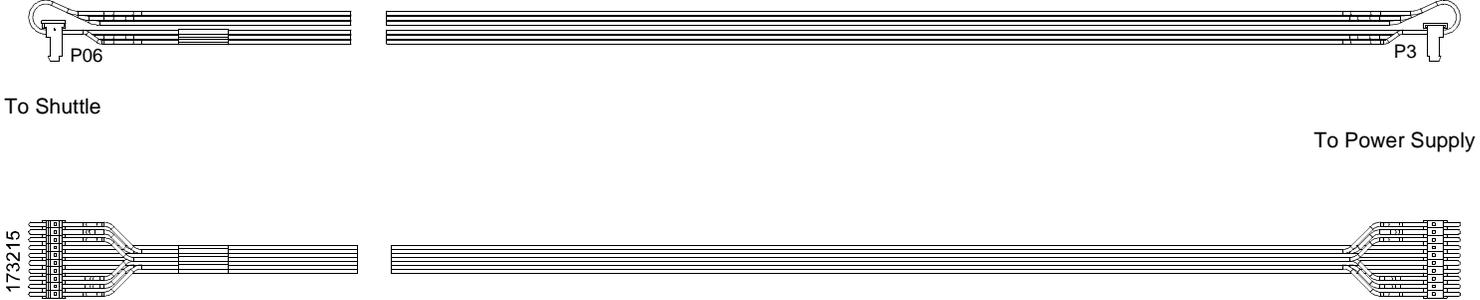
14H5279



NOTE: A cable protector is included on newer cable assemblies, which protects the shuttle end of the cable from chafing and abrasion.

A bag of 10 protectors is available under part number 75P8157, which also includes installation instructions.

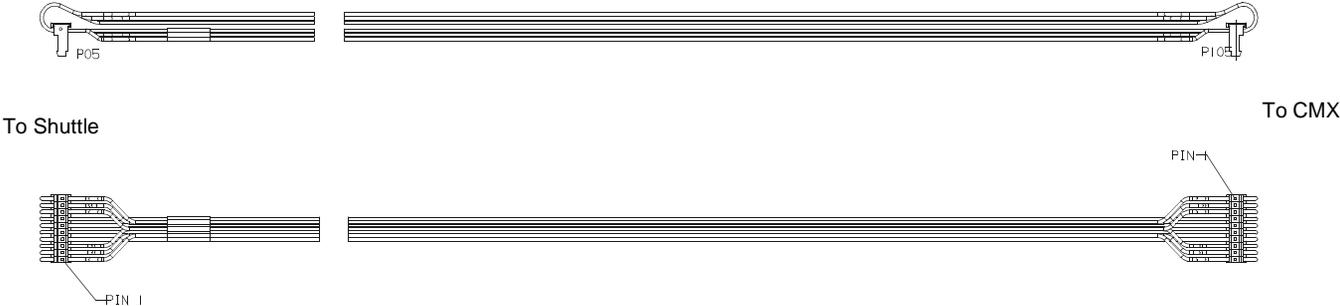
Cable Assembly, Dual Hammer Bank Power



54P1455

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, Single Hammer Bank Power

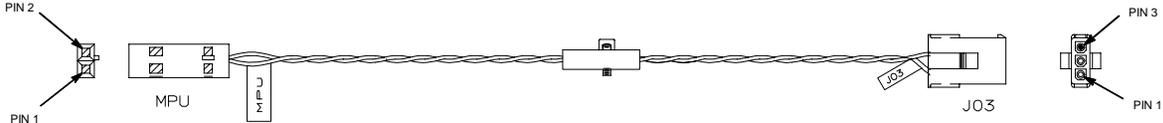


02N6214

Wire Table	
P05	P105
2	1
1	2
4	3
3	4
6	5
5	6
8	7
7	8
10	9
9	10

Cable Assembly, MPU

14H5329

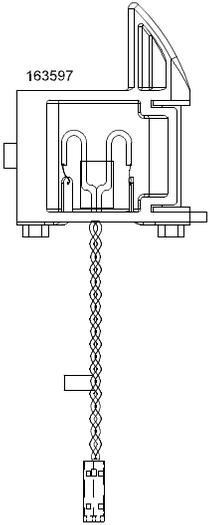


WIRE TABLE		
MPU	J03	WIRE COLOR
1	1	BLACK
2	2	GRAY
	3	N/C

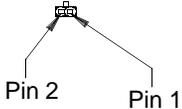
Cable Assembly, Ribbon Guide Kit

24H8894

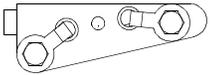
NOTE: Left ribbon guide is shown. Right is mirror image.



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

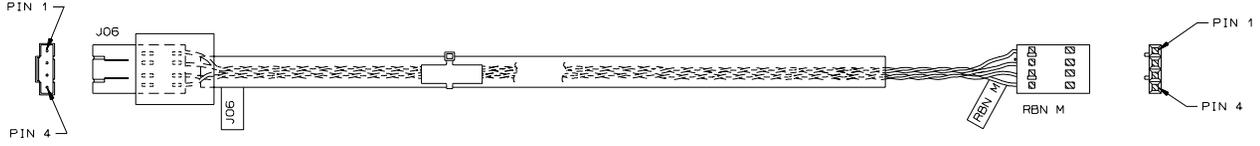


Left Guide = P106 / LRP
Right Guide = P107 / RRP



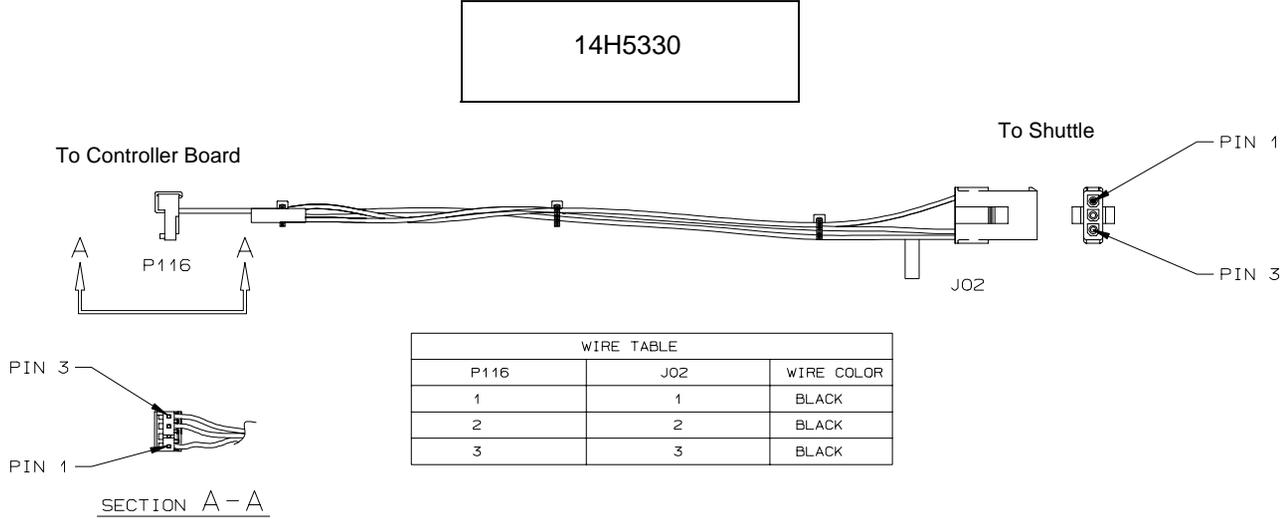
Cable Assembly, Ribbon Motor, Extension

63H7464



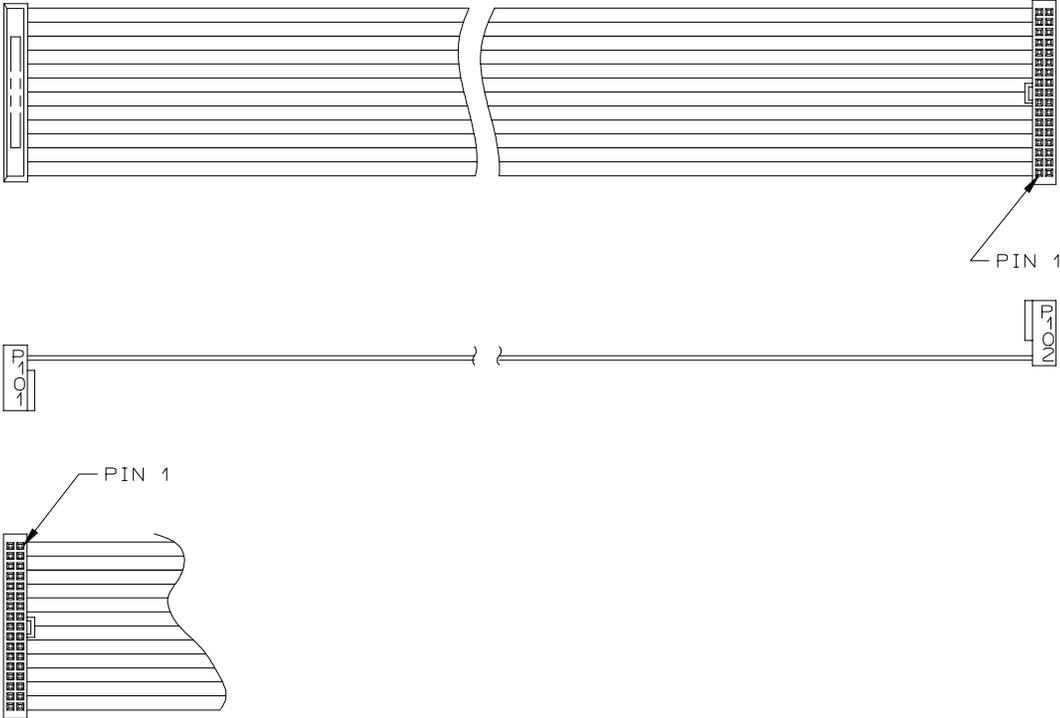
PIN CONNECTION		
JO6	RBN M	WIRE COLOR
PIN 1	PIN 1	BROWN
PIN 2	PIN 2	ORANGE
PIN 3	PIN 3	RED
PIN 4	PIN 4	YELLOW

Cable Assembly, Shuttle Motor Drive



Frame Cable, Power Stacker

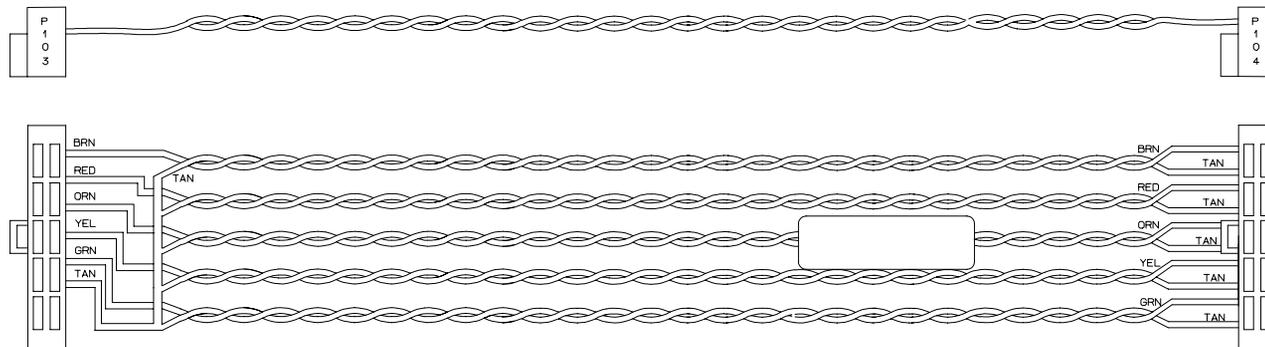
Reference Only: Not spared



1		
2		
3	M1 A1	M1 = REAR PADDLE MOTOR Resistance = 15.2 ± 1.5 Ohm / Phase
4	M1 A2	
5	M1 B1	
6	M1 B2	M2 = FRONT PADDLE MOTOR Resistance = 15.2 ± 1.5 Ohm / Phase
7	M2 A1	
8	M2 A2	
9	M2 B1	PINCH ROLLER MOTOR Resistance = 15.2 ± 1.5 Ohm / Phase
10	M2 B2	
11	PI PHA 1	LD1 A LD1 K DT1 C DT1 E LD2 A LD2 K DT2 C DT2 E PID A PID K PID C PID E PMD C PMD E PMD A PMD K
12	PI PHA 2	
13	PI PHB 1	
14	PI PHB 2	
15		
16	LD1 A	
17	LD1 K	
18	DT1 C	
19	DT1 E	
20	LD2 A	
21	LD2 K	
22	DT2 C	
23	DT2 E	
24		
25	PID A	
26	PID K	
27	PID C	
28	PID E	
29		
30	PMD C	
31	PMD E	
32	PMD A	
33	PMD K	
34		

Logic Cable, Power Stacker

57P1377

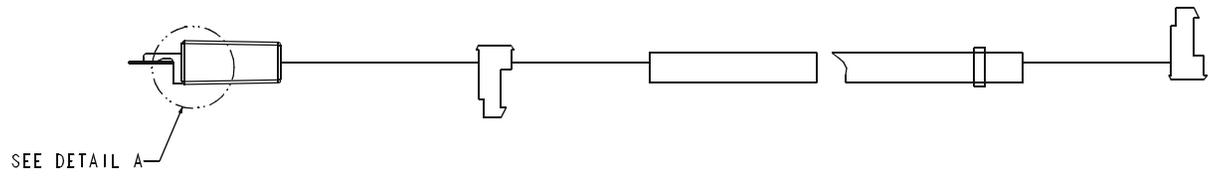
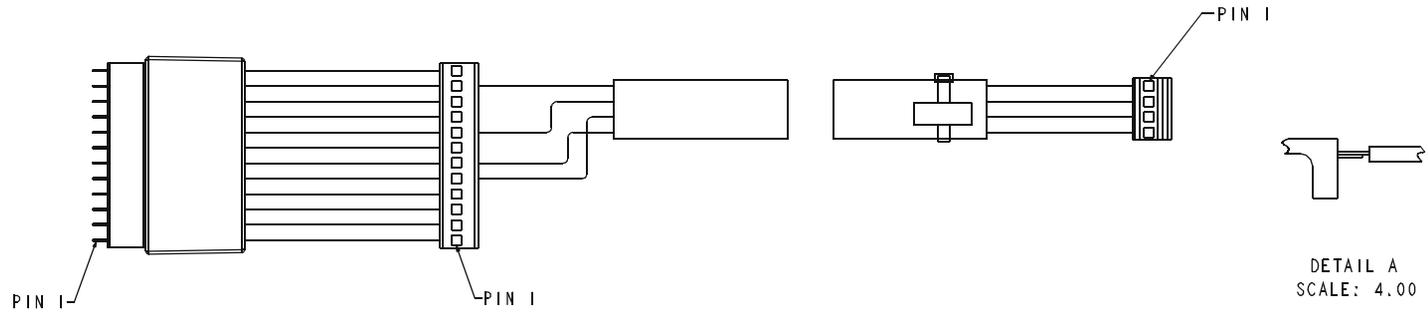


TWISTED PAIR COLOR CODING		
PAIR	LINE	COLOR
1	1	BRN
	2	TAN
2	3	RED
	4	TAN
3	5	ORN
	6	TAN
4	7	YEL
	8	TAN
5	9	GRN
	10	TAN

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

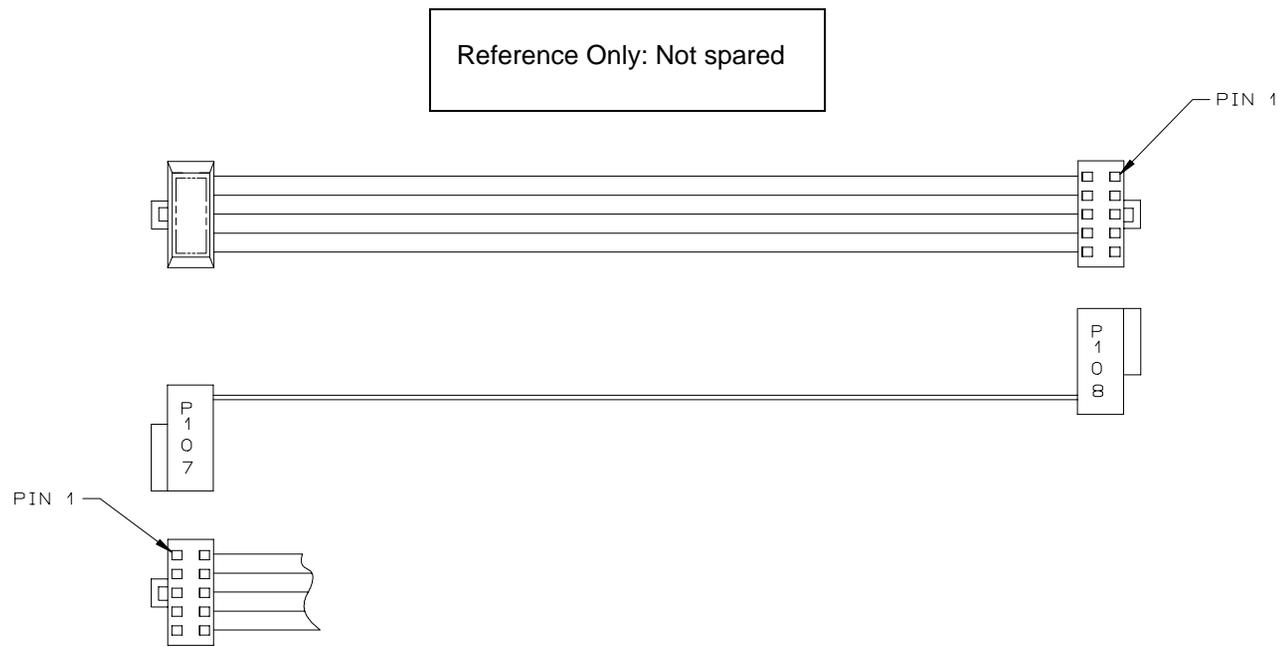
Power Cable, Power Stacker

57P1376

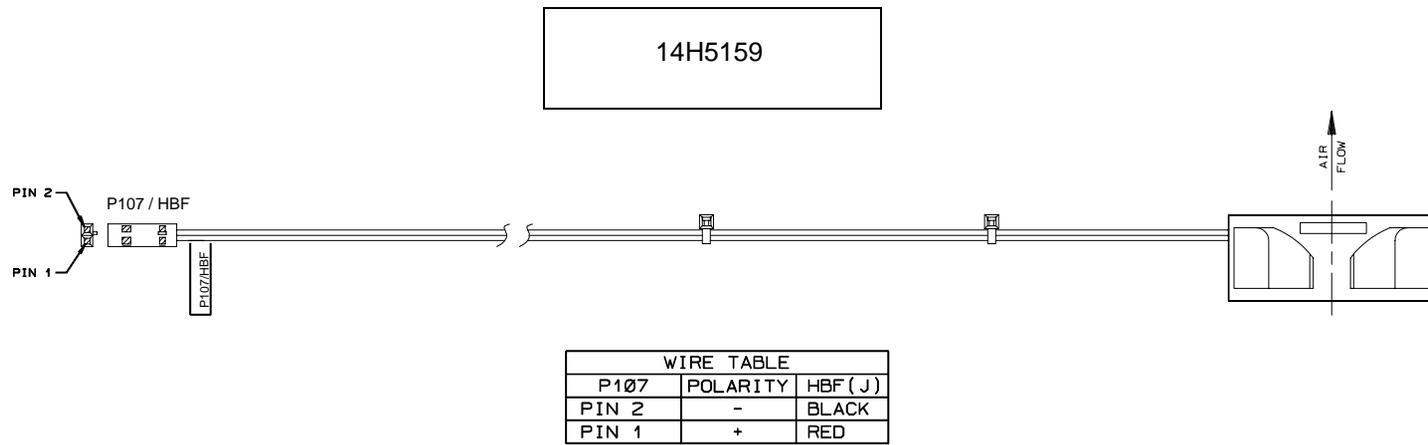


CONNECTION TABLE			
J101	P105	P105	P106
PIN 1	PIN 1	PIN 11	PIN 1
PIN 2	PIN 2	PIN 8	PIN 2
*	*	PIN 4	PIN 3
*	*	PIN 5	PIN 4
*	*		
PIN 11	PIN 11		
PIN 12	PIN 12		

Vertical Rail Cable, Power Stacker

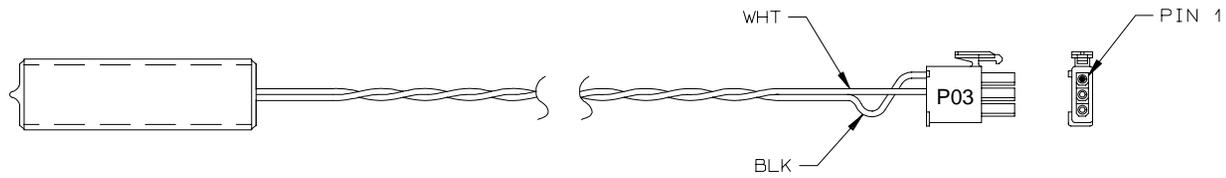


Fan Assembly, Hammer Bank



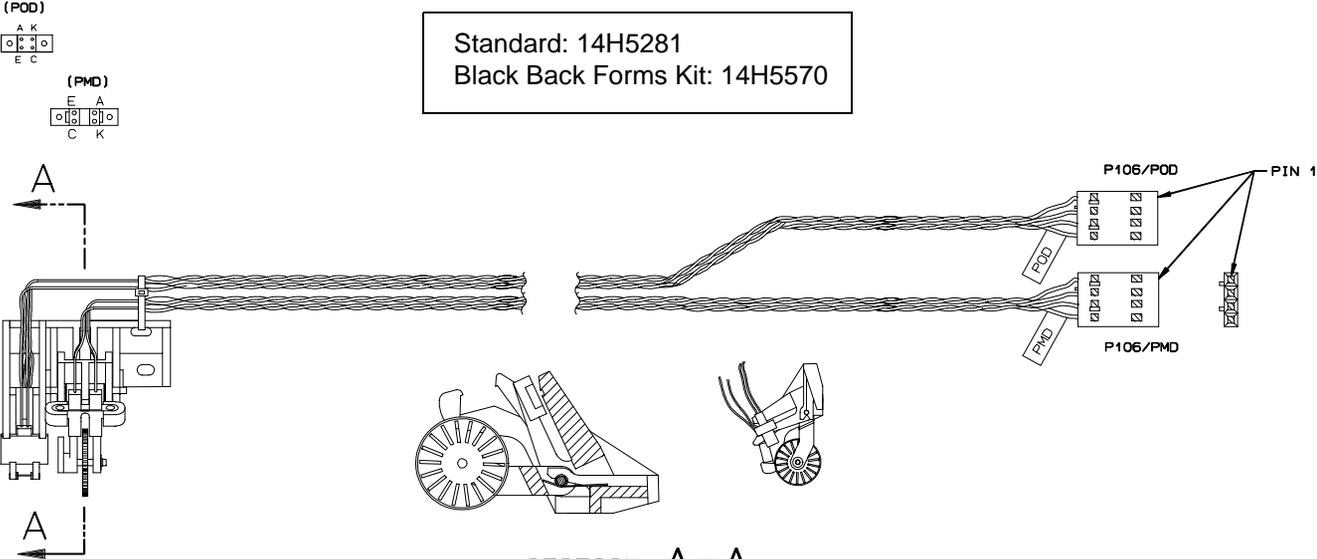
Magnetic Pickup (MPU) Assembly

57G1476



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

Switch Assembly, Paper Detector

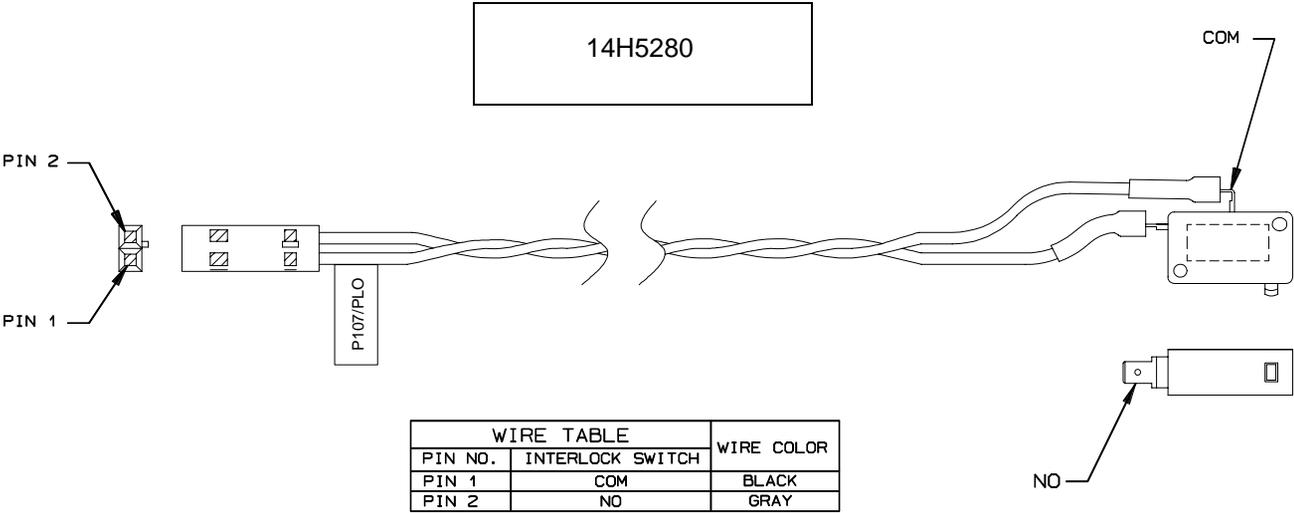


SECTION A-A

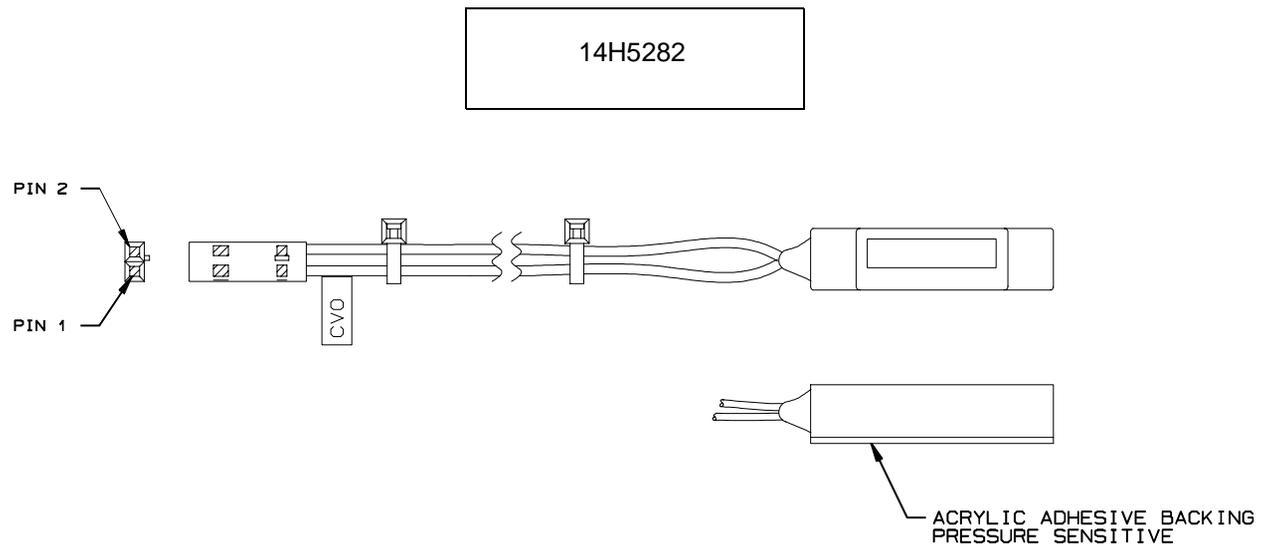
WIRE TABLE

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



Switch Assembly, Cover Open



4

Locations

Locations Of Components And Assemblies

Belt, Paper Feed Timing	page 447, Figure 47, item 7
Belt, Platen Open	page 469, Figure 56, item 24
Camshaft, Models 6400-i20 and 6400-i24	page 472, Figure 57, item 30
Circuit Board: Controller	page 453, Figure 50, item 9 and page 456, Figure 51, item 9
Circuit Board: Power Supply	page 453, Figure 50, item 18 and page 456, Figure 51, item 18
Circuit Breaker	page 478, Figure 59, item 1 and page 451, Figure 49, item 6
Coax/Twinax Multi-Platform Interface	page 480, Figure 60, item 3
Connector Shells	page 353, Figure 15
Cover Assembly, Hammer Bank / Ribbon Mask	page 356, Figure 17
Cover Assembly, Shuttle	page 447, Figure 47, item 2
Cover Assembly, Top, Pedestal Model	page 444, Figure 46, item 9
Dashpot	page 442, Figure 45, item 5
Doors, Cabinet	page 438, Figure 43, item 5
Ethernet Interface Assembly in CMX/CFX Printers	page 484, Figure 62, item 5
Ethernet Interface Assembly in PSA3 Printers	page 486, Figure 63, item 1
Fan Assembly, Cabinet Exhaust	page 442, Figure 45, item 8
Fan Assembly, Card Cage	page 475, Figure 58, item 1 and page 451, Figure 49, item 2
Fan Assembly, Hammer Bank	page 475, Figure 58, item 22
Hammer Spring Assembly, Single Hammer Bank	page 367, Figure 18
Hammer Spring Assembly, Double Hammer Bank	page 370, Figure 20

IBM Coax/Twinax Expansion Board..... page 480, Figure 60, item 3

Magnetic Pick-up (MPU) Assembly..... page 462, Figure 53, item 1

Memory and Security Modules on CMX and CFX Controller Boards page 381, Figure 26

Memory Modules and Security Key on the PSA3 Controller Board page 383, Figure 27

Motor Assembly, Paper Feed..... page 475, Figure 58, item 5

Motor Assembly, Platen Open page 475, Figure 58, item 12

Motor Assembly, Ribbon Drive..... page 475, Figure 58, item 17

Operator Panel Assembly, Cabinet Model page 442, Figure 45, item 1

Operator Panel Assembly, Pedestal Model page 444, Figure 46, item 1

Paper Guide Assembly page 447, Figure 47, item 5

Paper Scale..... page 447, Figure 47, item 11

Paper Ironer page 469, Figure 56, item 3

Platen, All Except 6400-i20 and -i24 page 469, Figure 56, item 7

Platen, Models 6400-i20 and -i24 page 472, Figure 57, item 7

Resistors, Terminating page 399, Figure 30

Ribbon Guide Assembly (L/R)..... page 475, Figure 58, item 11

Ribbon Hub page 475, Figure 58, item 20

Security Module page 381, Figure 26

Shaft, Splined..... page 467, Figure 55, item 6

Shaft, Support) page 467, Figure 55, item 9

Shuttle Frame Assembly, All Except 6400-i20, -i24, and -i2s page 453, Figure 50, item 2

Shuttle Frame Assembly, Models 6400-i20 and -i24 page 456, Figure 51, item 5

Shuttle Frame Assembly, Model 6400-i2s page 459, Figure 52, item 2

Spring, Extension page 462, Figure 53, item 3

Switch Assembly, Cover Open..... page 453, Figure 50, item 23 and page 456, Figure 51, item 24

Switch Assembly, Paper Detector..... page 475, Figure 58, item 3

Switch Assembly, Platen Interlock page 469, Figure 56, item 11

Tractor (L/R)..... page 467, Figure 55, items 10, 13

5

Removals and Adjustments

About This Chapter

This chapter contains removal, installation, and adjustment procedures for the parts and assemblies that you can replace at the field service level of maintenance.

Removal and installation procedures are combined. These procedures begin on page 340.

Adjustment procedures begin on page 412.

Part numbers for replacement parts are listed in the Parts Catalog, which begins on page 436.

Tools And Materials

You need the following tools and materials to service the printer:

Item	Part No.
6400 Line Matrix Printer Configuration Utility Disk	63H7379
1-30 Inch-pound Torque Screwdriver	16F1661
ESD Wrist Strap	6405959
Feeler Gauge, .010 inch	
Feeler Gauge, .011 inch	
Feeler Gauge, .040 inch	
Force Gauge, 20 lb.	25F9687

Item	Part No.
Grip Ring Pliers	9900317
Lubricant, Bearing, IBM #20	117397
DIP Module Extracting Tool	9900764
Nut Driver, 1/4 inch	
Nut Driver, 5/16 inch	
Open End Wrench, 7/32 inch	1650843
Open End Wrench, 5/16 inch	9900005
PLCC Module Pick Extraction Tool	73G5523
PLCC Module Plier Extraction Tool	10G3902
Screwdriver, Phillips, #1	73G5362
Screwdriver, Phillips, #2	73G5363
Spring Hook, Heavy Duty	
Tie Wraps	75X5972
Tip Alignment Tool, Short, Model 6400-i20	54P1470
Tip Alignment Tool, Long, Model 6400-i20	75P1219
Torque Screwdriver Adapter	39F8449
Torque Screwdriver Hex Adapter 3/32 inch	39F8451
Torque Screwdriver Hex Adapter 5/32 inch	39F8450
Torque Screwdriver Hex Adapter 3/16 inch	39F8455
Torque Screwdriver Hex Adapter 5/64 inch	16F1663
Torx** Bit Set (T7, T8, T9, T10, T15, T20, T25)	93F2830

Preparing The Printer For Maintenance

Always do the following steps *before* you do any maintenance procedure:



- <3> Hazardous voltages are present in the printer with the power cord connected to the power source. Switch off printer power and unplug the printer power cord before proceeding.
- <4> Do not connect or disconnect any communication port, teleport, attachment connector, or power cord during an electrical storm.
- <5> Power off the printer and disconnect the power cord *before* connecting or disconnecting a communication port, teleport, or attachment cable connector.

ATTENTION

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.

1. Power off the printer.
2. Unplug the printer power cord from the AC power source.
3. Disconnect the host data cable from the printer interface.
4. Open the printer cover.
5. Unload paper.
6. Remove the ribbon.
7. Read the entire adjustment procedure before you begin working on the printer.
8. Gather the necessary parts before you begin working on the printer.

Restoring The Printer To Operation

When you are finished servicing the printer, restore it to operation by following these steps:

1. Connect the host data cable to the printer interface.
2. Install the ribbon.
3. Load paper.
4. Plug the AC power cord into the power source.
5. Close the cabinet doors.
6. Power on the printer.
7. Set the top-of-form. (Refer to the *Operator's Guide*.)
8. Select the emulation. (Refer to the *Operator's Guide*.)
9. Test printer operation by selecting and running one of the operator print tests (page 223).
10. Close the printer cover.

Removal And Replacement Procedures

This section contains removal/installation procedures for components that are replaceable at the field service maintenance level. These procedures are listed below.

IMPORTANT Do not try to repair electronic components or assemblies in the field. Replace a malfunctioning electronic assembly with an operational spare. Most electronic problems are corrected by replacing the circuit board, sensor, or cable that causes the fault indication. The same is true of failures traced to the hammer bank coils and electronics: you must replace the entire shuttle frame assembly. It is not field repairable. (Hammer spring assemblies are the only replaceable components of the shuttle frame assembly.)

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Belt, Paper Feed Timing

Removal

1. Prepare the printer for maintenance (page 338).
2. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
3. Cabinet Model: Loosen four screws and remove the barrier shield. (See page 447, Figure 47, items 3 and 4.)
Pedestal Model: Loosen the four screws securing the paper guide and barrier shield. Remove the paper guide and barrier shield. (See page 449, Figure 48, items 3, 4, and 5.)
4. Remove the timing belt cover by squeezing the front and back to release the plastic tabs from the slots in the side plate (page 447, Figure 47, item 7).
5. Loosen (do not remove) the paper feed motor mount screws (page 475, Figure 58, item 10).
6. Work the paper feed timing belt off the paper feed motor pulley and the splined shaft pulley.

Installation

1. Work the paper feed timing belt onto the paper feed motor pulley and the splined shaft pulley.
2. Using the straight end of a force gauge, apply 15 pounds (66.7 N) of pressure to the paper feed drive motor near the mounting base of the motor. Use the splined shaft to steady the gauge.
3. Reduce tension to 12 pounds (53.4 N) and torque the paper feed motor mount bolts 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.

4. Snap the timing belt cover into the slots in the side plate (page 447, Figure 47).
5. Cabinet Model: Install the barrier shield and tighten the four screws. (See page 447, Figure 47, items 3 and 4.)
Pedestal Model: Install the barrier shield and paper guide and tighten the four screws. (See page 449, Figure 48, items 3, 4, and 5.)
6. Cabinet Model: Install the paper guide assembly (page 391).
Pedestal Model: Install the top cover assembly (page 358).
7. Return the printer to normal operation (page 339).

Belt, Platen Open

Removal

1. Prepare the printer for maintenance (page 338).
2. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
3. Remove the platen open belt cover by squeezing the top and bottom to release the plastic tabs from the slots in the side plate (page 472, Figure 57, item 23).
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 (page 475, Figure 58, item 15).
5. Push the motor toward the front of the printer to loosen the platen open belt.
6. Remove the platen open belt by sliding the belt off the platen open pulley.

Installation

1. Slide the platen open timing belt over the platen open pulley and the motor pulley and tighten the 1/16 inch setscrew.
2. Slide the motor pulley onto the platen open motor shaft and tighten the pulley setscrew.

ATTENTION

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.

3. Slide the platen open timing belt over the platen open pulley and the motor pulley.
4. The spring will automatically tension the belt.
5. *Slowly* tighten the motor adjustment screw (page 475, Figure 58, item 15).

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 3 through 5.

6. Snap the platen open belt cover into the slots in the side plate (page 472, Figure 57, item 23).
7. Install the paper guide assembly (page 391).
8. Return the printer to normal operation (page 339).

Camshaft, Model 6400-i20 and 6400-i24

Removal

1. Prepare the printer for maintenance (page 338).
2. Remove the shuttle frame assembly (page 405).
3. Remove the paper ironer (page 392).
4. Remove the platen (page 397).
5. Remove the three 1/4 inch screws securing the paper ironer bracket assembly and remove the assembly. (See page 472, items 4, 5, and 6.)
6. Remove the platen open belt (page 343).
7. Remove the platen pulley (page 472, 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 472, 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 472, 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 472, 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 475, 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 platen. 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.

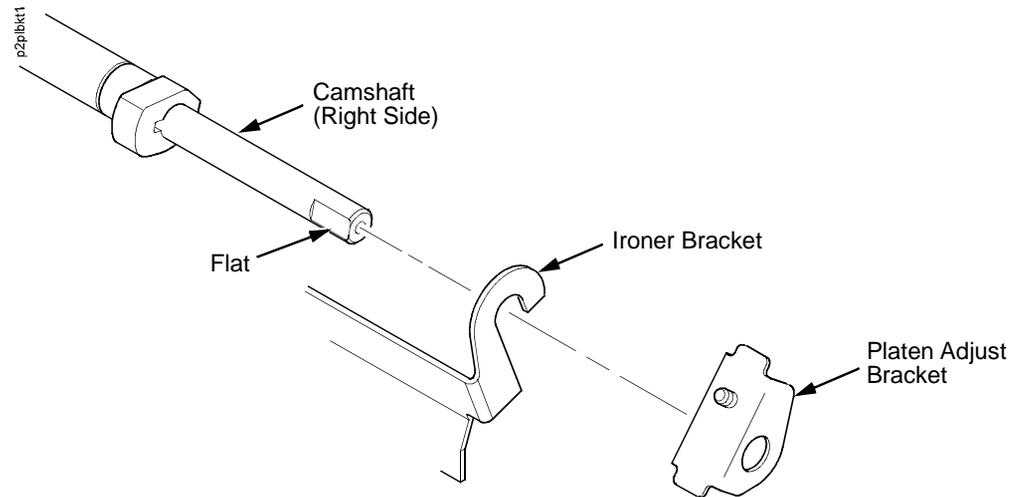


Figure 14. This figure shows how to install the platen adjust bracket onto the right side of the camshaft.

3. Make sure the two wear saddles are set flush into the corners of the mechanism base platen seat. (See page 472, 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 14.)
6. Place the other adjust 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 14.
8. Slide the right ribbon guide assembly into the side plate and install the two 7/32 inch screws and washers. (See page 475, 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 472, 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 472, 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 472, 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 472.) 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 472, items 20 and 22).
18. Install the platen (page 397).
19. Install the paper ironer with the black tape towards the rear of the printer (page 472, item 3).
20. Install the shuttle frame assembly (page 405).
21. Adjust the platen gap (page 397).
22. Adjust the platen open belt (page 419).
23. Check ribbon guide alignment (page 421).
24. Check the hammer phasing (page 427).
25. Return the printer to normal operation (page 339).

Circuit Board: Controller

IMPORTANT 6400-i2s and 6400-i24 printers are equipped with the PSA3 controller board. 6400-i20 printers are equipped with the CFX controller board. All other 6400-i models are equipped with the CMX controller board.

ATTENTION To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

Removal

1. Read the “Shuttle Electrical Shorts Check” on page 260.
2. Make a configuration printout of all configurations. (Refer to the *Operator’s Guide*.)
3. Prepare the printer for maintenance (page 338).
4. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
5. Disconnect all cable connectors from the controller board. (See page 453, Figure 50 or page 456, Figure 51.)
6. Loosen, but do not remove, the screws securing the controller shield near serial cable connector J201.
7. 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.
8. Slide the controller board to left until the keyway clears the screw securing the controller board to the bottom of the card cage.
9. Remove the controller board.
10. Remove the DRAM SIMM (DIMM on PSA3 boards), FLASH SIMM, and Security PAL (Security Key on PSA3 boards) from the controller board (page 379). These will be installed on the replacement controller board. The Security PAL/key must be installed on the replacement controller board to ensure the printer functions correctly.

NOTE: When Flash SIMMs are removed from one controller board and placed on another controller board, the SIMMs must be placed on the new board in the same order and location as on the original board.

Installation

ATTENTION To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

1. Install the DRAM SIMM (DIMM on PSA3 a controller), Flash Memory, and Security PAL (Security Key on a PSA3 controller) on the controller board. (See page 379 for a CMX or CFX controller board. See page 382 for a PSA3 controller board.)
2. Position the controller board assembly 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 right until the serial cable connector J201 on the board lines up with the cutout in the card cage.
3. Tighten the screw securing the controller shield near serial cable connector J201.
4. Tighten the screw securing the controller shield to the bottom of the card cage.
5. Connect all cable connectors to the controller board. (See page 453, Figure 50 or page 456, Figure 51.)
6. Cabinet Model: Install the paper guide assembly (page 391).
Pedestal Model: Install the top cover assembly (page 358).

IMPORTANT If the original controller 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.

7. Do NOT make the printer READY. You will download code in the next step.
8. Load flash memory (page 247).
9. Models -i15, -i20, -i24, and -i2s: adjust the coil temperature if the original controller board was replaced (page 429).
10. Adjust the hammer phasing (page 427).
11. Adjust the end of forms distance (page 423).
12. Return the printer to normal operation (page 339).
13. Using the configuration printout you made as step 2 of the removal procedure, reset and save the printer configuration.

Circuit Board: Power Supply



<4> To prevent injury from electric shock, wait at least one minute after powering off before removing the power supply board.

ATTENTION

Do not touch components or flex the board during removal/installation. Handle the board by the ejection levers and the sides. Wear a properly grounded static wrist strap when handling the power supply board.

Removal

1. Prepare the printer for maintenance (page 338).
2. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
3. Mark then disconnect all cable assemblies going to and from the power supply board. (See page 453, Figure 50 or page 456, Figure 51.)
4. Loosen three captive screws securing the power supply board to the rear wall of the card cage. (See page 453, Figure 50, item 18 or page 456, Figure 51, item 18.)
5. Carefully disengage the power supply board from the three standoffs on the rear wall of the card cage.
6. Remove the power supply board from the card cage.

Installation

1. Position the power supply board over the three standoffs on the rear wall of the card cage and gently push the board until it engages fully on the standoffs.
2. Install three screws securing the power supply board to the rear wall of the card cage. (See page 453, Figure 50, item 18 or page 456, Figure 51, item 18.)
3. Connect the cable assemblies to and from the power supply board. (See page 453, Figure 50 or page 456, Figure 51.)
4. Models -i20, -i24, and -i2s: adjust the coil temperature if the original power supply board was replaced (page 429).
5. Cabinet Model: Install the paper guide assembly (page 391).
Pedestal Model: Install the top cover assembly (page 358).
6. Return the printer to normal operation (page 339).

Circuit Breaker

Removal

1. Prepare the printer for maintenance (page 338).
2. Open the printer cover.
3. Remove the card cage fan (page 364).
4. Disconnect the four circuit breaker electrical leads.
(Cabinet Model: See Figure 59, page 478.
Pedestal Model: See Figure 49, page 451.)
5. Press in on the spring clips and remove the circuit breaker from the printer.

Installation

6. Press the circuit breaker into the cutout until the spring clips snap into place.
(Cabinet Model: See Figure 59, page 478.
Pedestal Model: See Figure 49, page 451.)

ATTENTION Make sure the four leads are connected as shown on page 478 and page 451.

7. Connect the four circuit breaker electrical leads.
(Cabinet Model: See Figure 59, page 478.
Pedestal Model: See Figure 49, page 451.)
8. Install the card cage fan (page 364).
9. Return the printer to normal operation (page 339).

Connector Shells

Some of the printer cable connectors are grouped inside connector shells (P/N 14H5288) that plug into connectors J106 and J107 on the controller board. The procedure below explains how to remove and install cable assemblies from any connector shell in the printer.

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

Removal

1. Prepare the printer for maintenance (page 338).
2. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
3. Disconnect the cable connector shell containing the cable assembly that will be replaced.
4. Pull the side of the connector shell outward and gently pull the cable connector upward. (See Figure 15.) Notice that two-wire connectors are grouped across from two-wire connectors in a connector shell. Four-wire connectors are grouped across from four-wire connectors in a connector shell.
5. Disengage the lock tab(s) on the cable connector from the slots in the side of the connector shell.
6. Remove the cable connector from the connector shell. (Remove only the cable connector for the cable you are replacing; leave the rest in the shell.)

Installation

1. Position the cable connector in the connector shell. Two-wire connectors are always grouped across from two-wire connectors in a connector shell. Four-wire connectors are always grouped across from four-wire connectors in a connector shell. (See Figure 15.)
2. Pull the side of the connector shell outward and gently push the cable connector down into the connector shell.
3. Engage the tabs on the cable connector in the slots in the side of the connector shell. Press the sides of the connector shell inward to make sure all cable connector tabs are engaged in the shell slots.
4. Connect the cable connector shell to its printer connection.
5. Cabinet Model: Install the paper guide assembly (page 391).
Pedestal Model: Install the top cover assembly (page 358).
6. Return the printer to normal operation (page 339).

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

(Top View: As seen when plugged into the 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	PAPR M						
CVO	RRP	HBF	RRIB M						
20	18	16	14	12	10	8	6	4	2

(Top View: As seen when plugged into the controller board.)

- 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

* JMP on pedestal models: used as a spacer

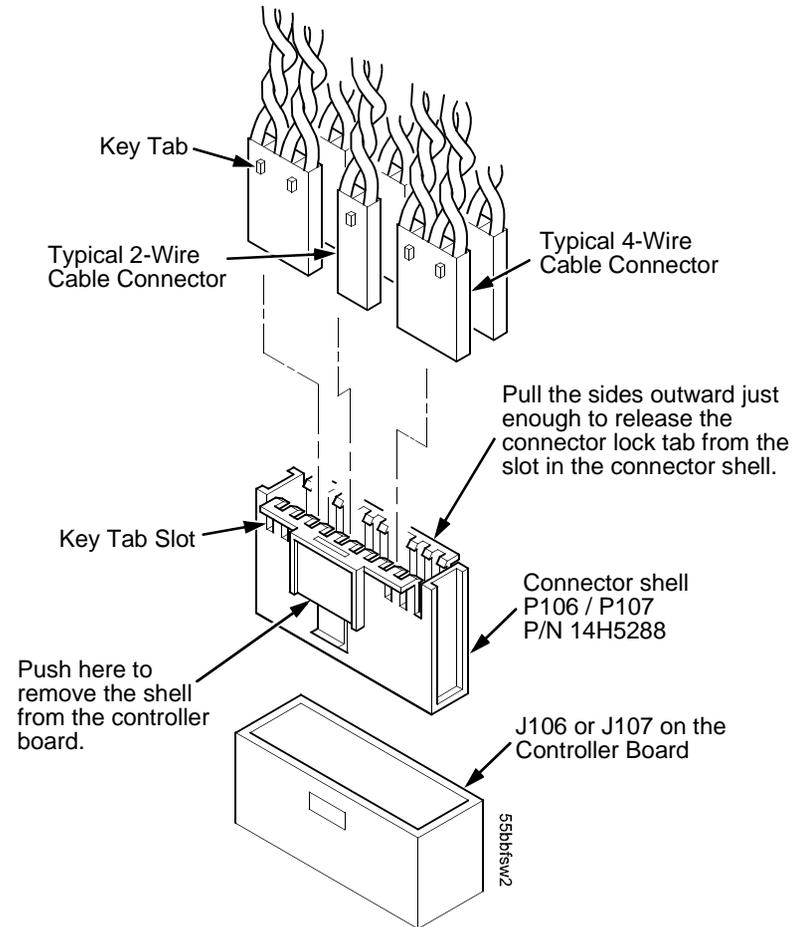


Figure 15. This figure shows how to assemble a cable connector shell.

Cover Assembly, Hammer Bank / Ribbon Mask

Removal

1. Prepare the printer for maintenance (page 338).
2. Remove the shuttle frame assembly (page 405).
3. All 6400-i models except 6400-i20 and -i24:
Lift the thick plate of the hammer bank cover assembly at one end, and peel the cover away from hammer bank magnets. (See Figure 16, page 355.)
4. Model 6400-i20 and 6400-i24:
 - a. Using a Torx T-10 driver, remove the six screws and three ribbon mask clamp plates securing the ribbon mask to the hammer bank cover. Remove the ribbon mask. (See Figure 17, page 356.)

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

- b. Using a Torx T-10 driver, remove the 12 screws securing the hammer bank cover to the hammer bank. Remove the hammer bank cover. (See Figure 17, page 356.)

Installation

ATTENTION

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

1. All 6400-i models except 6400-i20 and -i24:
 - a. With the thick plate facing the hammer bank, hold the hammer bank cover assembly at a slight angle and engage the bottom edge on the alignment pins. First engage the center (round) hole, then the left (oblong) hole, to ensure that the cover lies flat on the hammer bank. (See Figure 16, page 355.)
 - b. Gently lower the hammer bank cover assembly until it lies flush on the hammer bank.
 - c. Check that the hammer bank cover assembly is positioned over the alignment pins and the hammer tips.
2. Model 6400-i20 and 6400-i24:
 - a. Position the hammer bank cover on the alignment pins on the hammer bank. Make sure the hammer bank cover is properly positioned over the alignment pins and hammer tips and lies flat on the hammer bank.
 - b. Install all 12 hold-down screws finger tight. Using a Torx T-10 driver, torque the 12 hold-screws to 14 inch-pounds (1.58 N•m) in the sequence shown in Figure 17 on page 356.

NOTE: Use the 1-30 inch-pound Torque Screwdriver, IBM part number 16F1661.

- c. With the seam of the folded lower edge of the ribbon mask facing inward (toward the hammer bank cover), position the ribbon mask on the alignment pins on the hammer bank cover. The ribbon mask is correctly installed when the angled ends of the ribbon mask match the angled ends of the hammer bank cover. Install the three clamp plates and six screws finger tight. Using a Torx T-10 driver, torque the six screws to 14 inch-pounds (1.58 N•m) in the sequence shown in Figure 17 on page 356.

NOTE: Use the 1-30 inch-pound Torque Screwdriver, IBM part number 16F1661.

3. Install the shuttle frame assembly (page 405).
4. Return the printer to normal operation (page 339).

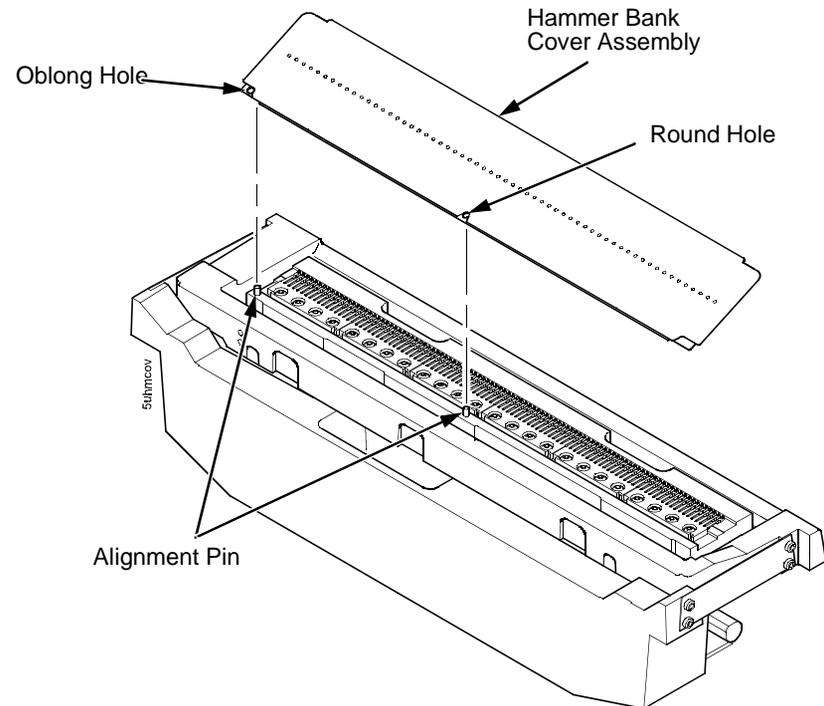


Figure 16. This figure shows how to install the new one-piece hammer bank cover assembly on single hammer bank printers.

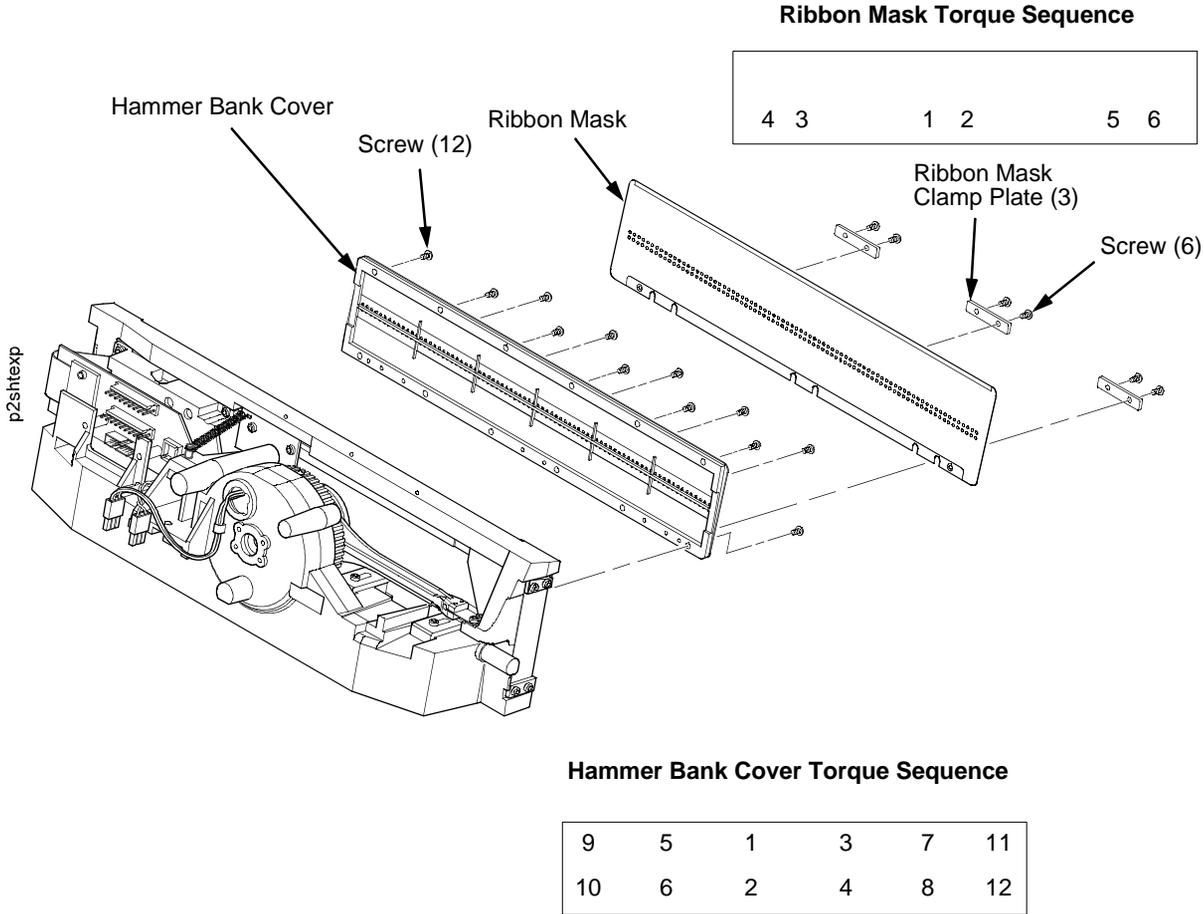


Figure 17. This figure shows how to install the hammer bank cover assembly and the ribbon mask on dual hammer bank printers.

Cover Assembly, Shuttle

Removal

1. Prepare the printer for maintenance (page 338).
2. Loosen the shuttle cover screws (page 447, Figure 47, item 2).
3. Grasping the edges of the shuttle cover assembly, tilt up the rear edge and lift the shuttle cover assembly out of the printer.

Installation

1. Place the shuttle cover assembly in the printer. Tilt the forward edge of the cover down slightly and work the cover into position (page 447, Figure 47).

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

2. Tighten the shuttle cover screws (page 447, Figure 47, item 2).
3. Return the printer to normal operation (page 339).

Cover Assembly, Top, Pedestal Model

Removal

1. Prepare the printer for maintenance (page 338).
2. Remove the operator panel (page 390).
3. Remove five screws and the control panel bracket. (See Figure 46, page 444, items 3 and 4.)
4. Loosen the two captive #2 Phillips screws in the lower front corners of the top cover. (See Figure 46, page 444, item 14.)
5. Loosen (do not remove) the two #2 Phillips hold-down screws on the rear of the printer. (See Figure 46, page 444, item 8.)
6. Lift the top cover assembly off the printer base.

Installation

1. To install the top cover assembly, reverse steps 2 through 6 of the removal procedure.
2. Return the printer to normal operation (page 339).

Dashpot

This procedure applies only to cabinet models.

Removal



<3> **Two persons may be required to do this procedure. Prop or hold the top cover securely open while disengaging the dashpot.**

1. Prepare the printer for maintenance (page 338).
2. Open the printer cover.
3. Open the floor cabinet rear door.
4. Pry back the spring retaining clips (page 442, Figure 45).
5. Remove the dashpot from the ball studs.

Installation

ATTENTION

The dashpot must be installed with the large cylinder uppermost.

1. Position the dashpot against the ball studs on the upper and lower brackets (page 442, Figure 45). The large cylinder must be uppermost.
2. Push the dashpot onto the ball joints and install the spring clips.
3. Close the printer cover. If necessary, adjust the position of the ball joint stud in the lower bracket to achieve smooth and complete closure.
4. Return the printer to normal operation (page 339).

Doors, Cabinet, Reversing

NOTE: Floor cabinet printers are assembled with the front door hinged on the left side so that it opens at the right side. The rear door is hinged on the right side so that it opens on the left side. This procedure enables you to reverse this door configuration.

This procedure does not apply to models that have the power paper stacker.

1. Open the front and rear cabinet doors.
2. Mark the top of each door.
3. Remove the screws and wire ropes from the doors and cabinet frame. (See Figure 43, page 438, item 9.)
4. Lift each door up and off the hinge pins of the upper and lower cabinet hinge plates. Do not remove the hinge plates from the doors.
5. Remove two screws and the paper fence from the original rear door.
6. Remove the screws securing the hinge pin plates to the front and rear of the cabinet. Remove the hinge plates and the pads beneath the plates.
7. Install pads and hinge pin plates to the right front side of the frame, with the hinge pins up and toward the outside edge of the printer frame.
8. Install pads and hinge pin plates to the left rear side of the frame, with the hinge pins up and toward the outside edge of the printer frame.
9. Move the original rear door to the front of the printer. With the marked top uppermost, slide the door hinges down onto the hinge pins. Adjust the position of the hinge pin plates as necessary so the door closes squarely against the frame.
10. Move the original front door to the rear of the printer. With the marked top uppermost, slide the door hinges down onto the hinge pins. Adjust the position of the hinge pin plates as necessary so the door closes squarely against the frame.
11. Install the paper fence to the “new” rear door with the two screws.
12. Install the wire ropes to the doors and the cabinet frame.

Ethernet Interface Assembly in Printers with CMX/CFX Controller Boards

NOTE: The ethernet LAN option is available in 10/100Base-T configuration. This option can be installed at the factory or as a field kit. The functions of the LEDs and DIP switches on the ethernet interface assembly are described in Appendix B.

When an ethernet interface assembly is installed, the Centronics (parallel) cable plugs into the back of the network interface card (NIC) and into the controller board. To restore the printer to a parallel interface, simply remove the ethernet interface assembly and install the Centronics cable connector in the card cage cutout that the NIC occupied.

Removal

ATTENTION To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

1. Prepare the printer for maintenance (page 338).
2. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
3. Disconnect Centronics cable connector P112 from connector J112 on the controller board. (See Figure 62, page 484.)
4. Open the ferrite clamp and lift the Centronics cable out of the ferrite clamp.
5. Loosen the two screws securing the ethernet interface assembly to the cutout at the rear of the card cage.
6. Slide the ethernet interface assembly out of the cutout in the card cage and lift the assembly out of the card cage.

Installation

ATTENTION To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

1. Reverse steps 2 through 6 of the removal procedure.
2. Initialize the ethernet interface (page 435).
3. Return the printer to normal operation (page 339).

Ethernet Interface Assembly in Printers with PSA3 Controller Boards

Removal

ATTENTION 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 338).
2. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
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 486, 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 486, item 1.)

Installation

ATTENTION 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 339).

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.

Fan Assembly, Cabinet Exhaust

This procedure applies only to cabinet models.

Removal

1. Prepare the printer for maintenance (page 338).
2. Open the cabinet doors and the printer cover.
3. Remove the paper stacker. (See Figure 44, page 440.)
4. Remove the three screws securing the air exhaust duct. (The top screw is located near the right front of the card cage, in front of the square air holes in the printer base plate.) (See Figure 45, page 442.)
5. Disconnect the fan cable connector from connector P307 and remove the air exhaust duct.
6. Remove the fan cable connector from the cutout in the side of the air exhaust duct.
7. Remove the two fan mounting screws and the cabinet exhaust fan assembly.

Installation

ATTENTION Install the fan so that air flow is **DOWN**.

1. Position the cabinet exhaust fan assembly in the air exhaust duct so that air flow is down, and install the two screws securing the fan to the duct. (See Figure 45, page 442.)
2. Snap the fan cable connector into the cutout in the side of the air exhaust duct.
3. Move the air exhaust duct back into position and install the three screws.
4. Connect the cabinet exhaust fan cable connector to connector P307.
5. Install the paper stacker. (See Figure 44, page 440.)
6. Return the printer to normal operation (page 339).

Fan Assembly, Card Cage

Removal

1. Prepare the printer for maintenance (page 338).
2. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
3. Disconnect the fan cable connector:
Cabinet Model, Figure 58, page 475.
Pedestal Model, Figure 49, page 451.
4. Cabinet Model: Remove the two fan mounting screws from the bottom of the fan. (See Figure 58, page 475, item 2.)
Pedestal Model: Remove the four fan mounting screws and nuts. (See Figure 49, page 451, items 1 through 4.)
5. Remove the card cage fan assembly from the card cage.
6. Remove the screw securing the shield to the card cage fan.

Installation

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

1. Reverse steps 2 through 6 of the removal procedure.
2. Return the printer to normal operation (page 339).

Fan Assembly, Hammer Bank

Removal

1. Prepare the printer for maintenance (page 338).
2. Remove the shuttle cover assembly (page 357).
3. Pedestal Model: Remove the top cover assembly (page 358).
4. Trace the hammer bank fan cable assembly back to the controller board connector J107, releasing it from all cable constraints. (See the cable routing diagrams on page 303 and page 305.)
5. Disconnect connector P107 from the controller board and remove the fan connector (HBF) from on the controller board. (See page 353.)
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 Figure 58, page 475.)

Installation

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

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

1. Feed the hammer bank fan cable connector (HBF) 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 Figure 58, page 475.)
2. Route the fan motor wires as shown on page 303 and page 305, connect fan cable connector (HBF) to P107, then connect P107 to J107 on the controller board. (See page 353.)
3. Install two screws in the locations shown in Figure 58 on page 475.
4. Pedestal Model: Install the top cover assembly (page 358).
5. Install the shuttle cover assembly (page 357).
6. Return the printer to normal operation (page 339).

Hammer Spring Assembly, Single Hammer Bank

All models except the 6400-i20 and -i24 have a single hammer bank. To replace hammer springs on a 6400-i20 or -i24 printer, see page 370.

Removal

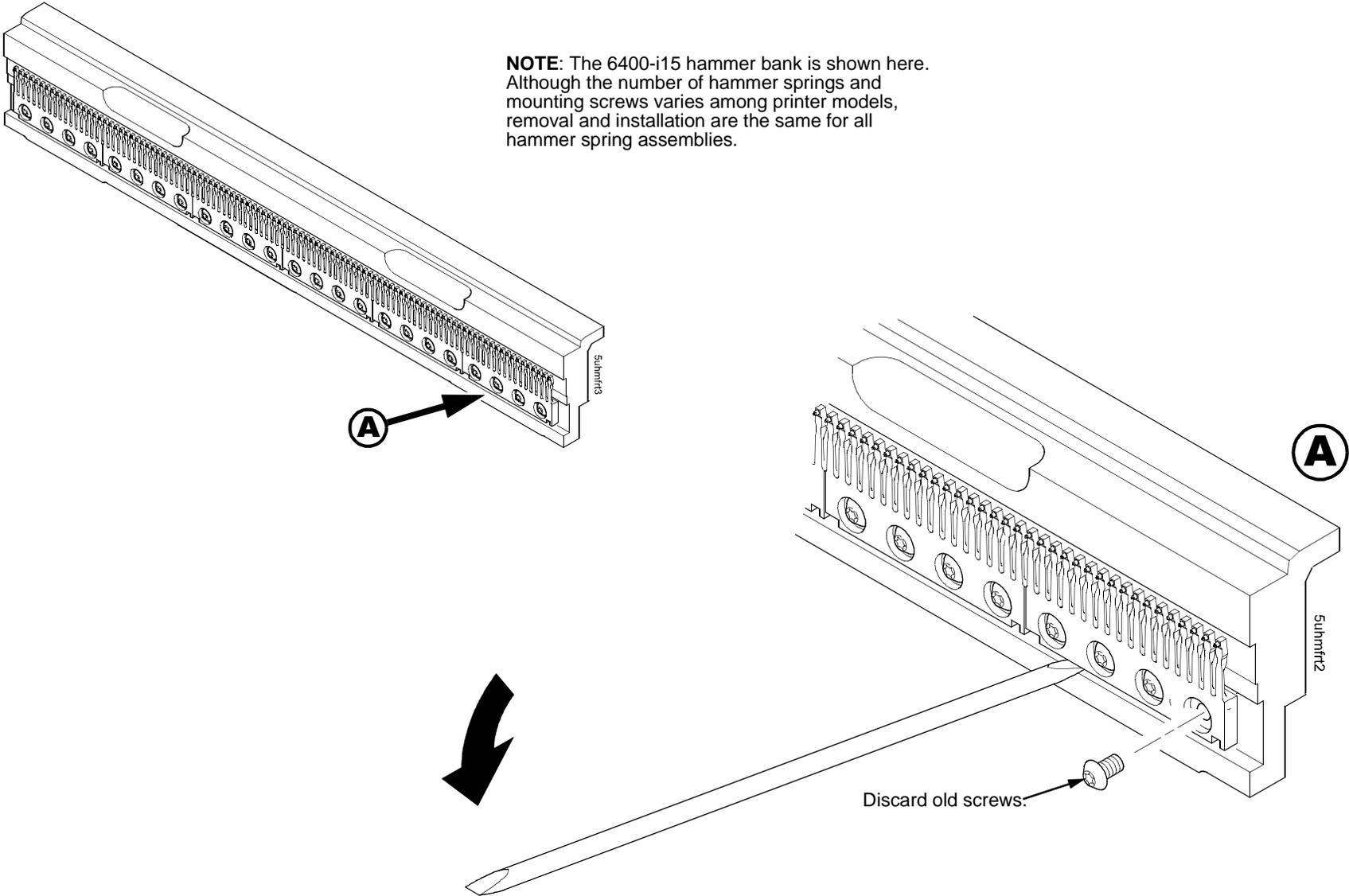
1. Prepare the printer for maintenance (page 338).
2. Remove the shuttle frame assembly (page 405).
3. Carefully vacuum the shuttle frame assembly.
4. Remove the hammer bank cover assembly (page 354).

ATTENTION

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

NOTE: Replace a hammer spring assembly only if there is visible damage or broken parts can be seen in the assembly.

5. Remove the mounting screws from the old hammer spring assembly. (See Figure 18, page 367.)
6. Handling the hammer spring assembly by the mounting base only, gently pry the old hammer spring assembly off its mounting pins. (See Figure 18, page 367.)
7. Inspect the hammer bank and the old hammer spring assembly:
 - a. If there is ink on the hammer bank mounting surface, the hammer spring assembly mounting surface, or the hammer spring neck or tines, reinstall the old hammer spring assembly and replace the shuttle frame assembly (page 405).
 - b. If the old hammer spring assembly and the hammer bank are free of ink, install the new hammer spring assembly (page 368).



NOTE: The 6400-i15 hammer bank is shown here. Although the number of hammer springs and mounting screws varies among printer models, removal and installation are the same for all hammer spring assemblies.

Figure 18. This figure shows how to remove a hammer spring assembly from a single hammer bank.

Installation

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

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

NOTE: Replace a hammer spring assembly only if there is visible damage or you see broken parts in the assembly.

2. Handling it by the mounting base only, remove the new hammer spring assembly and mounting screws from the box.
3. Handling the hammer spring assembly by the mounting base only, carefully position it on the hammer bank mounting pins. then gently press the mounting base down against the alignment pins. (See Figure 19, page 369.)
4. Continue pressing down on the mounting base of the the new hammer spring assembly as you install the mounting screws from the replacement kit. Using a Torx T-10 bit adapter, torque each screw to 14 inch-pounds (1.58 N•m). Tighten the center screw(s) first. (See Figure 19, page 369.)

NOTE: Use the 1-30 inch-pound Torque Screwdriver, IBM part number 16F1661.

5. Install the hammer bank cover assembly (page 354).
6. Install the shuttle frame assembly (page 405).
7. Install the ribbon and load paper.

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

8. Run an operator print test and check print quality (page 223):
 - a. If print quality is acceptable, return the printer to normal operation (page 339).
 - b. If print quality is still degraded, replace the shuttle frame assembly (page 405).

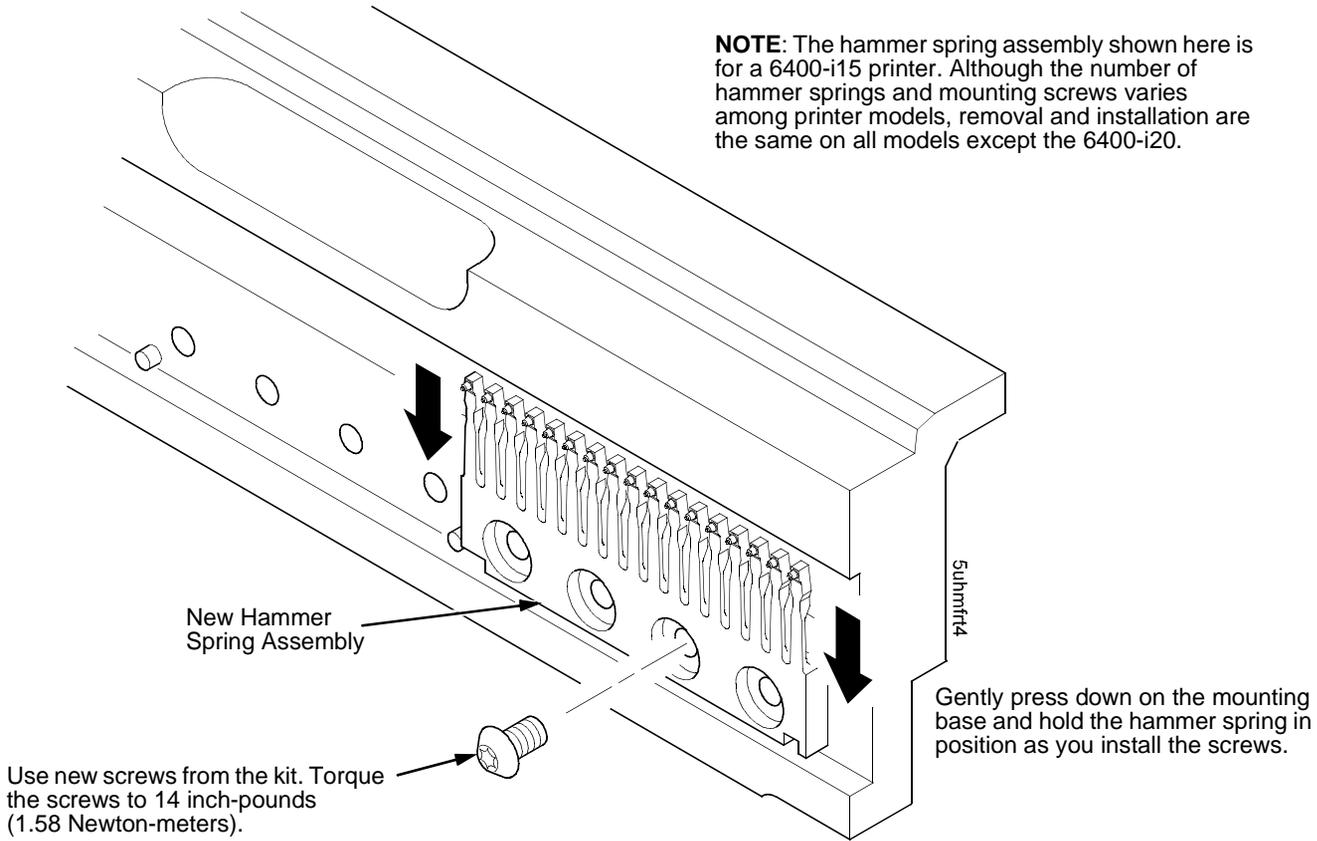


Figure 19. This figure shows how to install a hammer spring assembly onto a single hammer bank.

Hammer Spring Assembly, Double Hammer Bank

Model 6400-i20 and -i24 have a double hammer bank. All other models have a single hammer bank (page 366).

Removal

1. Prepare the printer for maintenance (page 338).
2. Remove the shuttle frame assembly (page 405).
3. Carefully vacuum the shuttle frame assembly.
4. Remove the hammer bank cover assembly (page 354).

ATTENTION

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 one hammer spring assembly at a time, you will maintain correct alignment of the hammer springs and you can use short alignment tool 54P1470.

If you remove more than one hammer spring assembly from a double hammer bank, note their positions on the hammer bank. You **MUST** use long alignment tool 75P1219 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 20.)
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 20.)

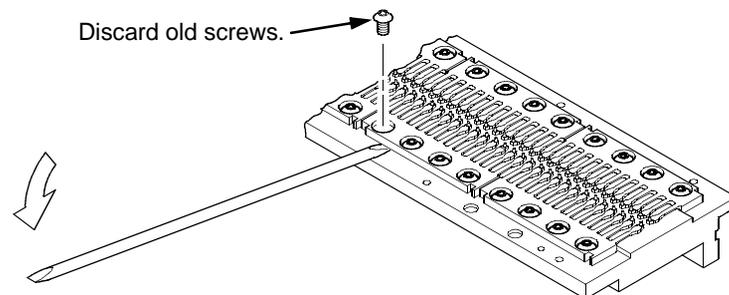


Figure 20. This figure shows how to remove a hammer spring assembly from a dual hammer bank.

Installation Using The Short Tip Alignment Tool

This procedure is for installing one hammer spring assembly at a time, using short Tip Alignment Tool 54P1470. To install more than one hammer spring assembly at a time using long Tip Alignment Tool 75P1219, see page 373.

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.

ATTENTION

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 21.)
4. Gently position Tip Alignment Tool 54P1470 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 21. 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 21.)

NOTE: Use the 1-30 inch-pound Torque Screwdriver, IBM part number 16F1661.

5. Install the hammer bank cover assembly (page 354).
6. Install the shuttle frame assembly (page 405).
7. Install the ribbon and load paper.

ATTENTION

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

8. Run an operator print test and check print quality (page 223):
 - a. If print quality is acceptable, return the printer to normal operation (page 339).
 - b. If print quality is still degraded, replace the shuttle frame assembly (page 405).

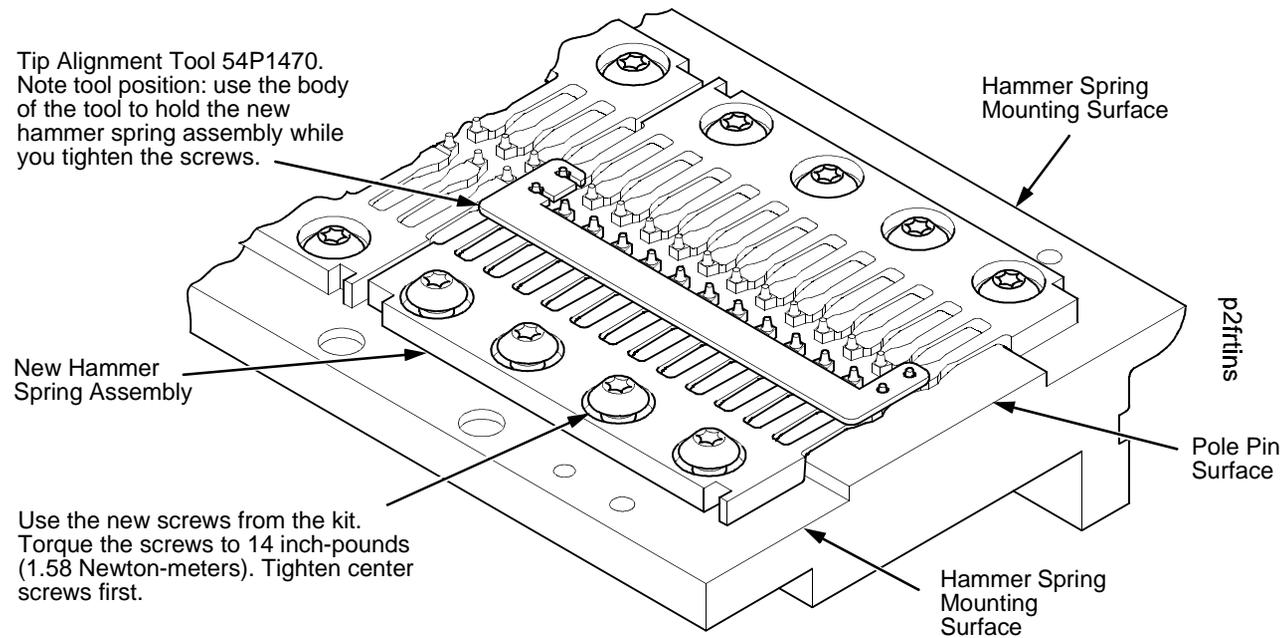


Figure 21. This figure shows how to use the short tip alignment tool to install hammer spring assemblies on a dual hammer bank.

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 75P1219. To install one hammer spring assembly at a time using short Tip Alignment Tool 54P1470, see page 371.

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 those locations when you reinstall them. This will minimize 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 23.)

ATTENTION 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 22.)

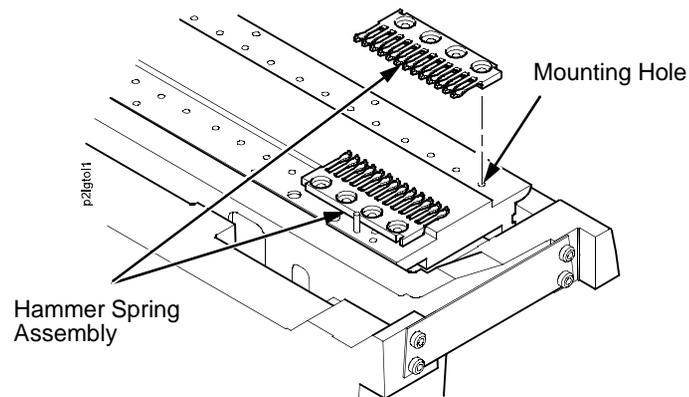


Figure 22. This figure shows how to pair hammer spring assemblies on the double hammer bank.

5. Gently position long Tip Alignment Tool 75P1219 so the right side 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 23.)

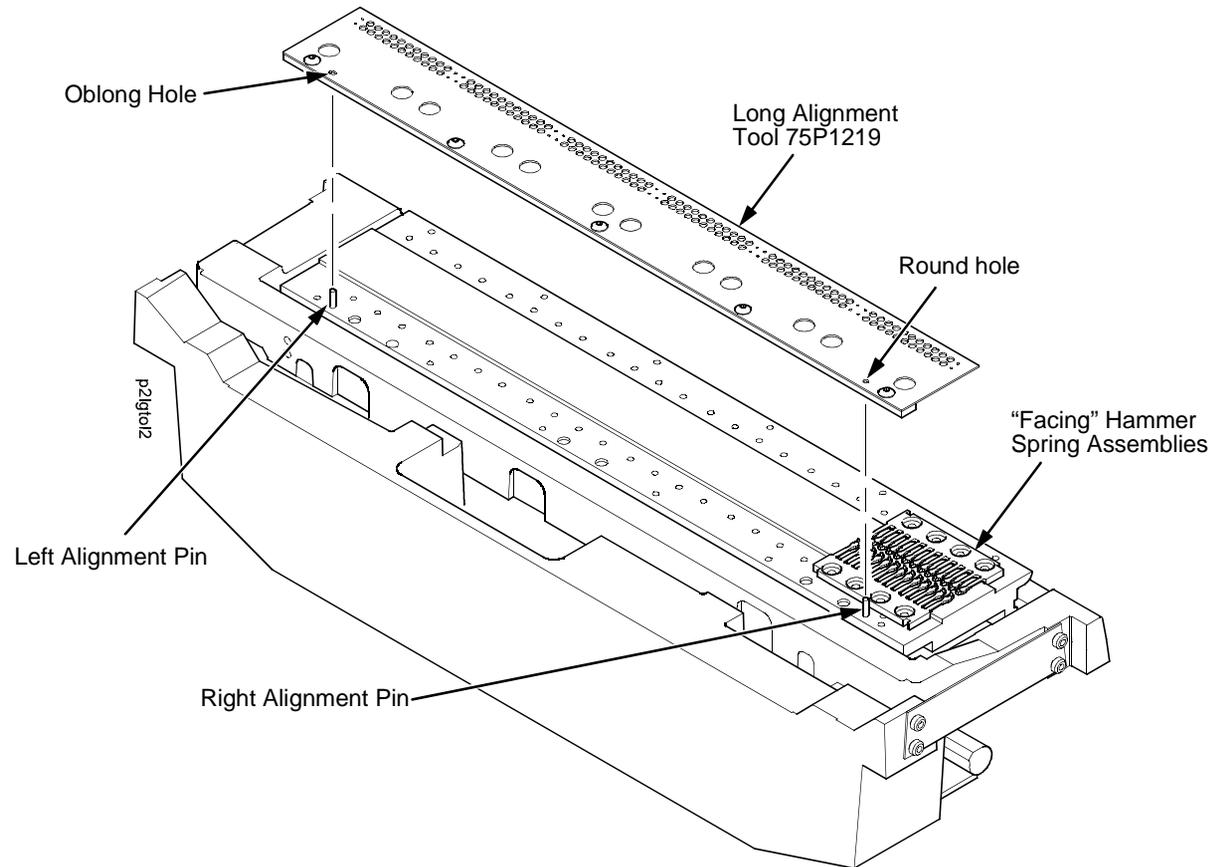


Figure 23. This figure shows how to position the long tip alignment tool when using it to install more than one hammer spring assembly on a dual hammer bank.

ATTENTION 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 24.)

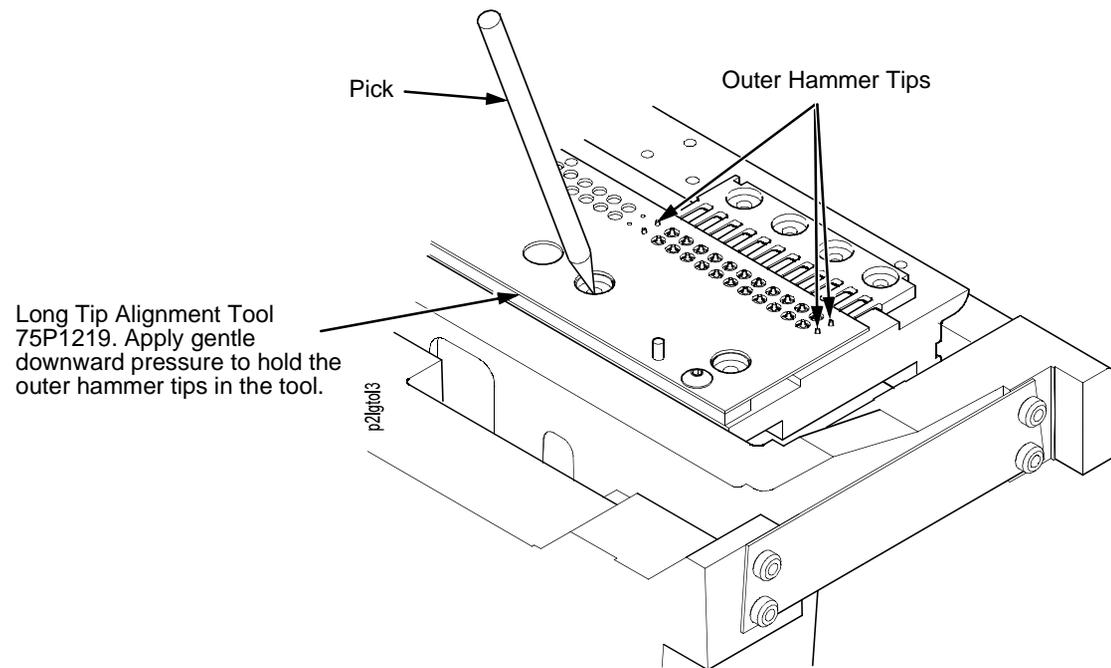


Figure 24. This figure shows how to use the pick to maneuver the hammer tips into the holes in the long tip alignment tool.

- 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 25 and use the 1-30 inch-pound Torque Screwdriver, IBM part number 16F1661.)

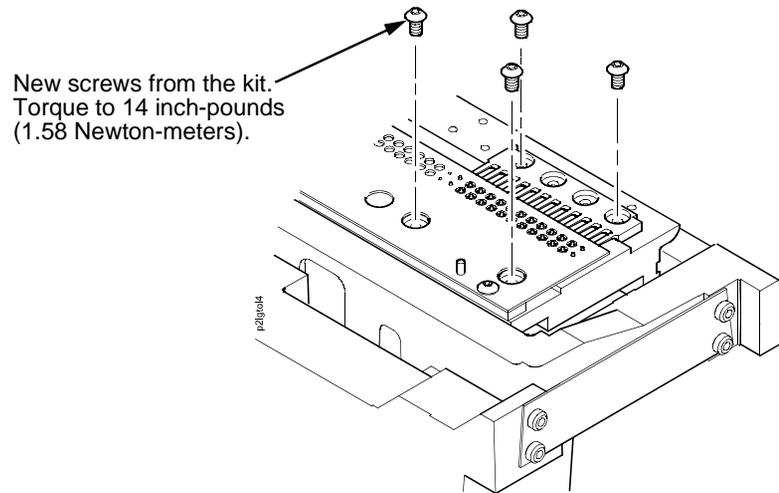


Figure 25. This figure shows how to install the Torx T-10 screws in more than one hammer spring assembly on a dual hammer bank.

- Gently rock the alignment tool until the tool is released from the hammer tips.
- Repeat steps 3 through 8 until all facing pairs of hammer spring assemblies are installed.
- 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.)
- Install the hammer bank cover assembly (page 354).
- Install the shuttle frame assembly (page 405).
- Install the ribbon and load paper.

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

- Run an operator print test and check print quality (page 223):
 - If print quality is acceptable, return the printer to normal operation (page 339).
 - If print quality is still degraded, replace the shuttle frame assembly (page 405).

IBM Coax/Twinax Expansion Board

Removal

ATTENTION To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

1. Prepare the printer for maintenance (page 338).
2. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).

Printer with CMX / CFX Controller Board:

3. Loosen—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 Figure 60, page 480.)
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.

Printer with PSA3 Controller Board:

3. Remove the screw securing the coax/twinax I/O plate to the rear of the card cage. (See Figure 61, page 482, item 4.)
4. Carefully work the PCI-CT board upward and out of the expansion slot on the controller board. (See Figure 61, page 482, item 1.)

Installation

1. Reverse the steps of the removal procedure.
2. Return the printer to normal operation (page 339).

IMPORTANT If the printer has the PSA3 controller, uses the twinax interface, and has a power stacker, install the Smart-T cable extension between the twinax interface connector on the PCI-CT board and the twinax auto-termination (Smart-T) cable. (See Figure 65 on page 490.) The Smart-T cable extension cable permits the twinax auto-termination cable to clear the stacker elevator.

Magnetic Pick-up (MPU) Assembly

Removal

1. Prepare the printer for maintenance (page 338).
2. Remove the shuttle cover (page 357).
3. Disconnect the shuttle cable assembly connector (page 462, Figure 53).
4. Disconnect the magnetic pick-up (MPU) cable connector (page 462, Figure 53).
5. Loosen the 7/64 inch hex MPU clamp screw (page 462, Figure 53).
6. Unscrew the MPU assembly from the MPU bracket.

Installation

1. Install the MPU assembly by screwing it into the MPU bracket (page 462, Figure 53).

NOTE: In the next step use the 1-30 inch-pound Torque Screwdriver, IBM part number 16F1661.

2. Using a feeler gauge, adjust the gap between the MPU assembly and the flywheel to $0.010 \pm .001$ inch (0.254 ± 0.025 mm). Torque the MPU clamp screw to 18 ± 2 inch-pounds (2.03 ± 0.23 N•m).
3. Check the gap between the MPU assembly and the flywheel with a feeler gauge:
 - a. If the gap is $0.010 \pm .001$ inch (0.254 ± 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.

ATTENTION

Make sure the MPU cable is below the extension spring and does not touch the spring after the cable is connected.

4. Connect the magnetic pick-up (MPU) cable connector.
5. Connect the shuttle cable assembly connector (page 462, Figure 53).
6. Install the shuttle cover (page 357).
7. Adjust the hammer phasing (page 427).
8. Return the printer to normal operation (page 339).

Memory and Security Modules on CMX and CFX Controller Boards

Removal

1. Make a configuration printout of all configurations. (Refer to the *Setup Guide*.)
2. Prepare the printer for maintenance (page 338).
3. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).

ATTENTION To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

NOTE: If flash SIMMs are removed from one controller board and placed on another controller board, the SIMMs must be placed on the new board in the same order and location as on the original board.

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 26, page 381 for the locations of memory modules.)
5. Using a module extraction tool, remove the security module. (See Figure 26, page 381.)

Installation

ATTENTION To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

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.

NOTE: Part numbers for security modules are listed in Table 7.

1. Insert the memory module into the correct socket on the controller board:
 - a. Position the SIMM so the notched end is toward the right-hand side of board. (See Figure 26, page 381.)
 - 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.
2. Install the security module. (See Figure 26, page 381.)
3. Cabinet Model: Install the paper guide assembly (page 391).
Pedestal Model: Install the top cover assembly (page 358).
4. Download the emulation (page 245).

5. Return the printer to normal operation (page 339).
6. Using the configuration printouts you made as step 1 of the removal procedure, reset and save the printer configurations. (Refer to the *Setup Guide*.)

Table 7. Security Modules, All Models

Code Load Description	Security Module IBM P/N (Vendor P/N)
Base ASCII/ANSI	14H5509 (154143-002)
ASCII/ANSI + CV/IGP	14H5490 (154143-001)
Ethernet IPDS for ASCII/ANSI	14H5509 (154143-002)
Ethernet IPDS + CV/IGP for ASCII/ANSI	14H5490 (154143-001)
Base CTA/ANSI	14H5509 (154143-002)
Base CTA + CV/IGP	14H5490 (154143-001)
Coax/Twinax (Ethernet) IPDS/ANSI	14H5509 (154143-002)
Coax/Twinax (Ethernet) IPDS/ANSI + CV/IGP	14H5490 (154143-001)
Telnet	75P2532 (154143-010)
Telnet + IGP	75P2296 (154143-009)

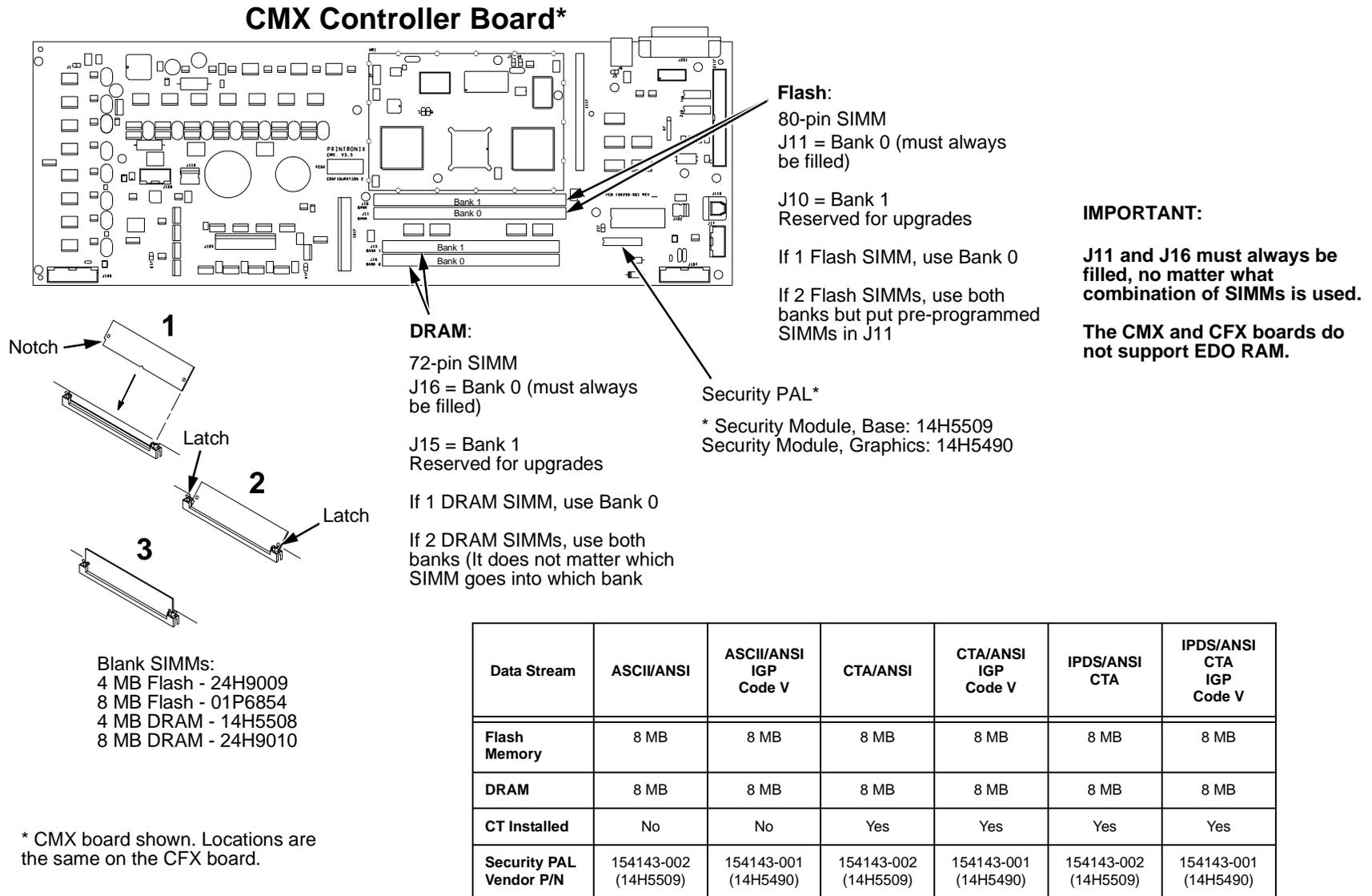


Figure 26. This figure shows the locations of Memory and Security Modules on CMX and CFX controller boards.

Memory Modules and Security Key on the PSA3 Controller Board

ATTENTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

Removal

1. Make a configuration printout of all saved configurations. (Refer to the *Setup Guide*.)
2. Prepare the printer for maintenance (page 338).
3. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
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 27, page 383.)

Installation

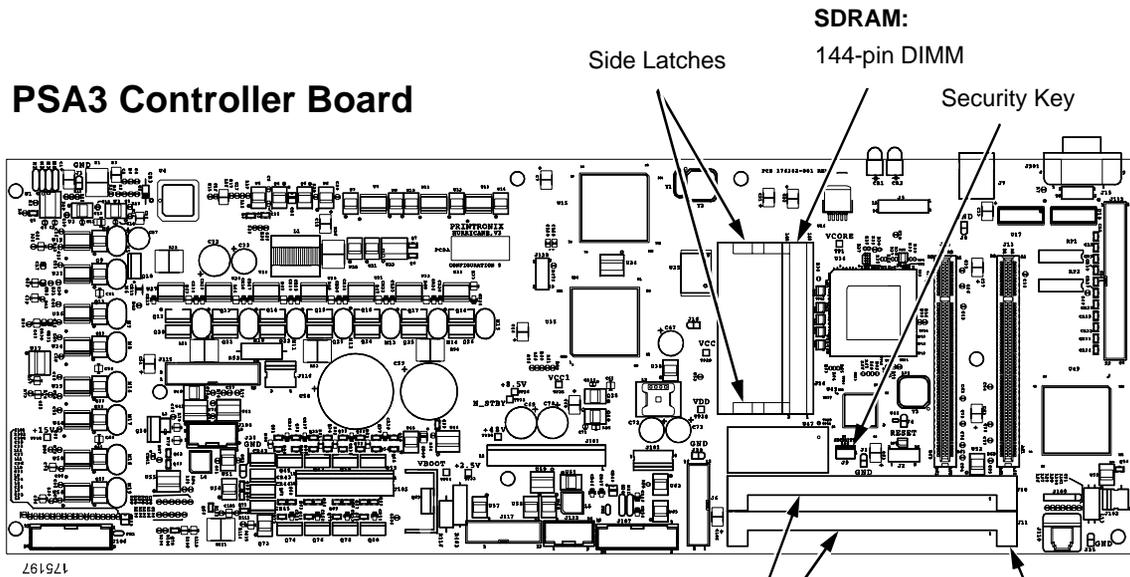
NOTE: Flash SIMMs from one controller board must be placed in the same slot on a replacement controller board. Installing flash memory from one controller board to another does not transfer all operating system software, so you must download the emulation again.

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. Insert the memory module into the correct socket (see Figure 27) 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 in place. (See Figure 27, page 383.)
 - 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 27, page 383.)
3. Make sure the Security Key is installed at connector J9. (The security key is a 3-pin semi-programmable EEPROM that works the same way as the security PAL on earlier controller boards.)
4. Cabinet Model: Install the paper guide assembly (page 391).
Pedestal Model: Install the top cover assembly (page 358).

5. Download the emulation (page 245).
6. Return the printer to normal operation (page 339).
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 *Setup Guide*.)

IMPORTANT:
The controller board does not support EDO RAM.

SIMM, Flash Memory, 4 MB = 204480-001
SIMM, Flash Memory, 8 MB = 204480-002
DIMM, SDRAM, 32 MB = 204535-001



Memory Requirements for Emulation Options

Data Stream	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

Flash Memory:

72-pin SIMM
J10 = Always filled)

J11 = For upgrades or expansion

If 1 Flash SIMM, always use J10

If there are two Flash SIMMs, use both slots but put the pre-programmed SIMM in J10

Notched End on this side

Figure 27. This figure shows the locations of Memory Modules and Security Key on the PSA3 controller board.

Motor Assembly, Paper Feed

Removal

1. Prepare the printer for maintenance (page 338).
2. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
3. Cabinet Model: Loosen four screws and remove the barrier shield. (See Figure 47, page 447, items 3 and 4.)
Pedestal Model: Remove the four screws, barrier shield, and paper guide. (See Figure 48, page 449, items 3, 4, and 5.)
4. Remove the timing belt cover by squeezing the top and bottom to release the plastic tabs from the slots in the side plate (page 447, Figure 47).
5. Model 6400-i2s only: take note of how heat sink 176908-001 is installed on the paper feed motor. Remove and retain the screws securing the heat sink to the paper feed motor. Remove the heat sink and retain it for installation on the new paper feed motor.
6. Loosen the paper feed motor mount screws (page 475, Figure 58, item 10).
7. Trace the paper feed motor cables back to the controller board, releasing it from tie wraps. (See the cable routing diagrams on page 303 and page 305.)
8. Disconnect connector P107 from the controller board and remove the paper feed motor connector from connector P107. (See page 352.)

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

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

Installation

1. Position the paper feed motor assembly on the right side plate and install the motor mount bolts and nuts finger tight (page 475, Figure 58).
2. Connect the paper feed motor cable connector to connector P107, then connect P107 to J107 on the controller board. (See page 352.)
3. Model 6400-i2s only: install heat sink 176908-001 to the base of the paper feed motor so that the heat sink is flush with the top edge of the motor and protrudes down toward the card cage. Torque the heat sink mounting screws to 18 inch-pounds (2.03 N•m).
4. Work the paper feed timing belt onto the paper feed motor pulley and the splined shaft pulley.
5. Using the straight end of a force gauge, apply 15 pounds (66.7 N) of pressure to the paper feed drive motor near the mounting base of the motor. Use the splined shaft to steady the gauge.
6. Reduce tension to 12 pounds (53.4 N) and torque the motor mount bolts to 18 ± 2 inch-pounds (2.03 ± 0.23 N•m). Use the 1-30 inch-pound Torque Screwdriver, IBM part number 16F1661.

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

7. Snap the timing belt cover into the slots in the side plate.
8. Cabinet Model: Install the barrier shield and four screws. (See Figure 47, page 447, items 3 and 4.)
Pedestal Model: Install the barrier shield, paper guide, and four screws. (See Figure 48, page 449, items 3, 4, and 5.)
9. Cabinet Model: Install the paper guide assembly (page 391).
Pedestal Model: Install the top cover assembly (page 358).
10. Return the printer to normal operation (page 339).

Motor Assembly, Platen Open

Removal

1. Prepare the printer for maintenance (page 338).
2. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
3. Cabinet Model: Remove the card cage fan (page 364).
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 469, Figure 56, item 24).
5. Using a 5/32 inch hex key, loosen the upper motor mount screw (page 475, Figure 58, item 24).
6. 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 on page 303 and page 305.)
7. Remove the platen open cable connector from connector P106. (See page 352.)
8. Remove the 5/32 inch upper motor mount screw, platen spring post, and platen belt spring (page 475, Figure 58, items 24 through 26).
9. Remove the 5/16 inch lower motor mount screw (page 475, Figure 58, item 15).
10. Remove the platen open motor assembly.

Installation

1. Position the platen open motor assembly with the wires toward the rear (page 475, Figure 58, item 12).
2. Install the 5/16 inch lower motor mount screw and torque it to 30 inch-pounds (3.39 N•m). (See page 475, item 15.)
3. Install the 5/32 inch upper motor mount screw, platen spring post, and platen belt spring (page 475, 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 and motor pulley.
5. Connect the platen motor cable connector to connector shell P106.
6. Connect shell connector P106 to the controller board and install tie-wraps to secure the motor cable. (See the wire routing diagrams on page 303 and page 305.)
7. Close the forms thickness lever all the way.
8. Adjust the platen open belt (page 415).
9. Snap the platen open belt cover into the slots in the side plate.
10. Cabinet Model: Install the card cage fan (page 364).
11. Cabinet Model: Install the paper guide assembly (page 391).
Pedestal Model: Install the top cover assembly (page 358).
12. Return the printer to normal operation (page 339).

Motor Assembly, Ribbon Drive

Removal

1. Prepare the printer for maintenance (page 338).
2. Remove the ribbon hub (page 401).
3. Remove two screws and washers securing the ribbon drive motor to the base casting (page 475, Figure 58).
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. Cabinet models: remove the heat boot from the motor. You will install the boot on the replacement motor.

Installation

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

NOTE: The ribbon drive motor should be secured at the right front and left rear corners. (See page 475, Figure 58.)

2. Return the printer to normal operation (page 339).

Operator Panel Assembly, Cabinet Model

Removal

1. Prepare the printer for maintenance (page 338).
2. Open the printer cover.
3. Remove the four screws securing the operator panel plate to the panel bracket. (See Figure 45, page 442.)
4. Press down on the plastic tab at the upper rear of the panel and slide the operator panel downward on the mounting plate until the tabs on the panel housing slide out of the cutouts.
5. Lift the operator panel assembly and disconnect the phone-style cable connector.

Installation

1. Connect the phone-style operator panel cable to the bottom of the operator panel. (See Figure 45, page 442.)
2. Position the operator panel over the cutouts in the panel plate. Slide the panel upward until the plastic tab at the upper rear of the panel locks into the mounting plate.
3. Position the operator panel and plate on the bracket and install the four screws finger tight. (See Figure 45, page 442.)
4. Slowly lower the printer cover and align the operator panel in the cover cutout. Open the printer cover and tighten the panel plate screws.
5. Return the printer to normal operation (page 339).

Operator Panel Assembly, Pedestal Model

Removal

1. Prepare the printer for maintenance (page 338).
2. Open the printer cover.
3. Tilt the operator panel toward the front of the printer.
4. Disconnect the phone-style cable connector at the rear of the operator panel.
5. Press down on the plastic tab at the upper rear of the panel and slide the operator panel downward on the mounting plate until the tabs on the panel housing slide out of the cutouts.

Installation

1. Tilt the operator panel mounting plate toward the front of the printer.
2. Position the operator panel over the cutouts in the mounting plate and slide the panel upward until the plastic tab at the upper rear of the panel locks into the mounting plate.
3. Connect the phone-style operator panel cable to the bottom of the operator panel.
4. Close the printer cover.
5. Return the printer to normal operation (page 339).

Paper Guide Assembly

This procedure applies only to cabinet models.

Removal

1. Prepare the printer for maintenance (page 338).
2. Open the printer cover.
3. Loosen the three paper guide assembly hold-down screws (page 447, Figure 47, item 6).
4. Slide the paper guide assembly to the left and lift it off the card cage.

Installation

1. Position the paper guide assembly offset slightly to the left on the card cage with the keyway cutouts over the three loosened hold-down screws (page 447, Figure 47, item 6).
2. Slide the paper guide assembly to the right, engaging the three hold-down screws in the keyway slots. Slide the paper guide assembly to the right as far as it will go.
3. Tighten the three hold-down screws (page 447, Figure 47, item 6).
4. Return the printer to normal operation (page 339).

Paper Ironer



- <2> Over time the upper edge of the paper ironer can become sharp. To avoid cutting yourself, handle the paper ironer on the sides.

Removal

1. Remove the shuttle frame assembly (page 405).
2. Move the forms thickness lever to the open position.
3. Push the ends of the paper ironer toward the rear of the printer, disengage the tabs, then lift it up and out (page 469, Figure 56, item 3).
4. 6400-i2s model only: remove the auxiliary paper ironer, which is directly in front of the standard paper ironer

Installation

NOTE: The black tape on the paper ironer faces the paper detector switch assembly (toward the front of the printer).

1. Position the paper ironer so that the black tape is on the side that faces the paper detector switch assembly. (See page 469, Figure 56, item 3.)
2. Push the paper ironer down into the slots until the tabs engage.
3. 6400-i2s model only: install the auxiliary paper ironer in front of the standard paper ironer. (See also the NOTE on page 469, next to item 3.)
4. Install the shuttle frame assembly (page 405).
5. Return the printer to normal operation (page 339).

Platen, All Except 6400-i20 and 6400-i24

Removal

1. Prepare the printer for maintenance (page 338).
2. Remove the shuttle frame assembly (page 405).
3. Remove the paper ironer (page 392).
4. Remove the three 1/4 inch screws securing the paper ironer bracket assembly and remove the assembly. (See page 469, Figure 56, items 4 through 6.)
5. Remove the platen open belt (page 343).
6. Remove the platen pulley page 469, Figure 56, item 21):
 - a. Loosen the 7/64 inch collar clamp screw.
 - b. Pull the platen pulley off the platen shaft.
7. Pull the spring link and white plastic bushing off the platen shaft and remove the spring link, bushing, and spring. (See page 469, Figure 56, items 16, 17, and 18.)
8. Remove the forms thickness lever by loosening the 7/64 inch clamp screw and pulling the lever off the platen shaft. (See page 469, Figure 56, item 15.)
9. Remove the right side platen support spring by repeating step 7 on the right side of the platen.
10. Remove the Phillips #1 screw and washer securing the forms thickness indicator plate from the inside of the right side bracket. (See page 469, Figure 56, items 9 and 10.)
11. Pull the indicator plate, with the interlock switch assembly attached, off the platen shaft.
12. Remove the two 7/32 inch screws and washers securing the right ribbon guide assembly to the side plate. (See Figure 58, page 475, item 11, 13, and 14.)
13. Slide the ribbon guide assembly out of the side plate.
14. Pull the right side of the platen toward the front of the printer and move the platen to the right and out of the left side plate. (Hold the black metal washer on the left side shaft as you remove the platen. Make sure the copper wear saddles in the platen seat of the mechanism base stay in place.)

Installation

IMPORTANT

The dowel pins protruding from the ends of the platen are the platen shafts, and are not equal in length. The platen must be installed with the **longer** shaft on the right side as you face the printer from the front.

1. Wipe the platen shafts clean of grease and debris.
2. Install two washers on the longer (right) platen shaft. (See Figure 28.)
3. Apply bearing lubricant to both platen shafts.

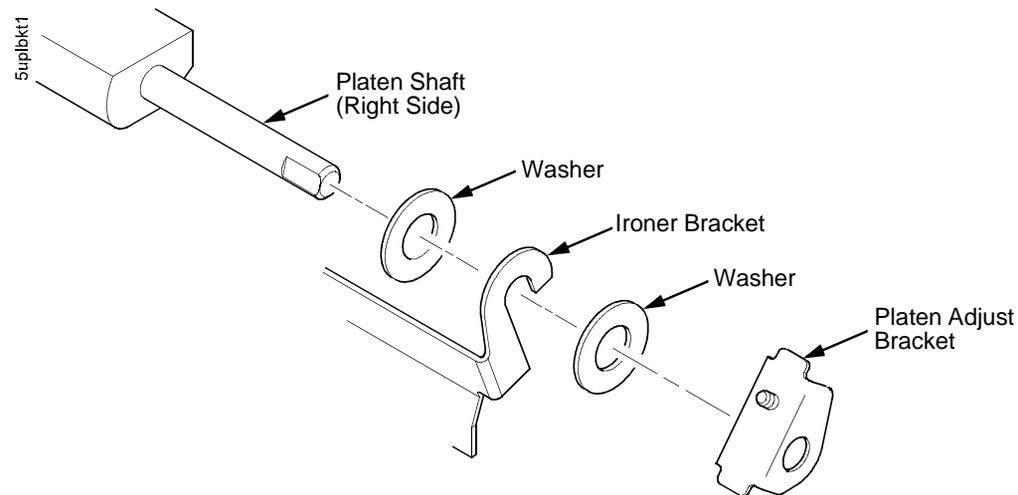


Figure 28. This figure shows how to install the platen adjust bracket on the right side platen shaft.

4. Make sure the two wear saddles are set flush into the corners of the mechanism base platen seat. (See Figure 29.)
5. Apply a layer of bearing lubricant 1/4 inch high to the seat of each wear saddle, making the layer as wide as the saddle and touching the rear angled surface.
6. Install one platen adjust bracket onto the longer platen shaft, with the screw at the top of the bracket.
7. Place the other bracket onto the left side mechanism base platen seat so that the mechanism base platen seat is between the flanges of the bracket.
8. Insert the shorter platen shaft through the left adjust bracket and through the opening in the left side plate. Rotate the longer shaft into the opening in the right side plate and position the adjustment brackets as shown in Figure 28.

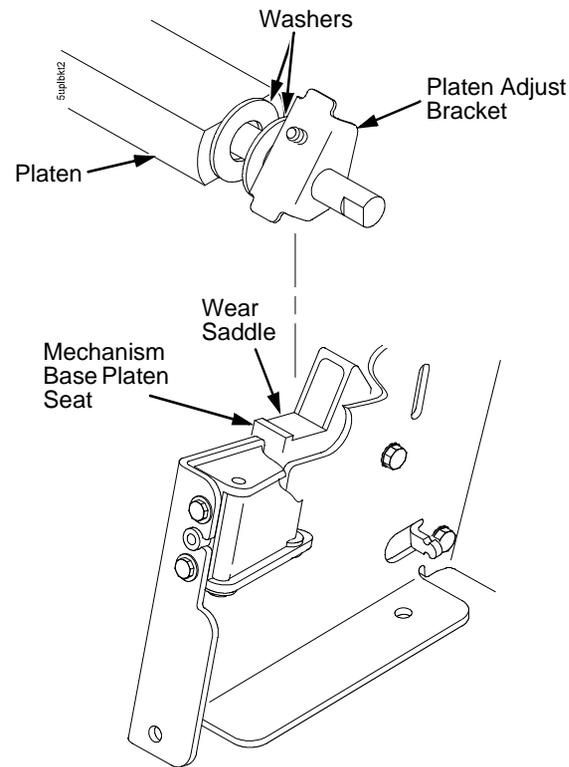


Figure 29. This figure shows how to position the platen adjust brackets on the mechanism base and wear saddles.

9. Slide the right ribbon guide assembly into the side plate and install the two 7/32 inch screws and washers. (See Figure 58, page 475, items 11, 13 and 14.)
10. Install the forms thickness indicator plate:
 - a. Slide the indicator plate, with the interlock switch assembly attached, onto the platen shaft and up against the right side plate.
 - b. Install the Phillips #1 screw and washer securing the indicator plate.
11. Install the black metal washer onto the left side of the platen shaft. (See Figure 56, page 469, item 26.)
12. Apply bearing lubricant to the nylon bearings in the two spring links, slide the spring links onto the two platen shafts, and connect the springs to the spring hooks in the side plates. (See Figure 56, page 469, items 16, 17, and 18.)

13. Apply bearing lubricant to the two platen shafts on both sides, between the ends of the platen and the platen adjustment brackets.
14. Install the paper ironer bracket. (See Figure 28, page 394):
 - a. With the flat part of the bracket facing the front of the printer, place the two hooks of the upper part of the paper ironer over the platen shafts.

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

For the right side of the platen, a washer goes on both sides of the paper ironer hook and the hook goes to the left of the right platen adjustment bracket. (See Figure 28, page 394.)
 - b. Install and torque three screws to 20 ± 2 inch-pounds (2.26 ± 0.23 N•m).
15. Push the platen to the left.
16. Install the forms thickness lever onto the right side platen shaft, pressing the interlock switch out of the way as the lever slides past it. Tighten the 7/64 inch setscrew. (See Figure 56, page 469.) Open and close the forms thickness lever to make sure the setscrew does not touch the right ribbon guide.
17. Install the platen shaft pulley with the 7/64 inch setscrew facing up and tighten the setscrew. Open and close the forms thickness lever and check that the platen pulley setscrew does not hit the left ribbon guide.
18. Install, but do not adjust, the platen open belt and platen open motor pulley (page 343).
19. Install the paper ironer with the black tape towards the rear of the printer (page 392).
20. Install the shuttle frame assembly (page 405).
21. Adjust the platen gap (page 419).
22. Adjust the platen open belt (page 415).
23. Check ribbon guide alignment (page 421).
24. Check the hammer phasing (page 427).
25. Return the printer to normal operation (page 339).

Platen, Model 6400-i20 and 6400-i24

Removal

1. Prepare the printer for maintenance (page 338).
2. Remove the paper guide assembly (page 391).
3. Remove the shuttle frame assembly (page 405).

NOTE: You may need to loosen—but do not remove—the two rearward retention screws for the tractor shaft plates in order to complete the next step.

4. Loosen four screws and remove the barrier shield. (See page 447, items 3, 4, and 9.)
5. Disconnect and remove the two platen springs. (See page 472, item 25.)
6. Lift the left end of the platen slightly, slide the platen 1/2 inch to the left (out from under the platen bracket assembly), and angle the platen forward and out of the printer. (See page 472, item 7.)

Installation

ATTENTION

The pad and spring of the platen bracket assembly are delicate. 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 camshaft, then slide the platen about 1/2 inch to the right so that it slides under the platen angle adjustment pad. (See page 472, item 7.)
2. Check that the cams on the camshaft (page 472, item 30) are in contact with the cam followers on the ends of the platen, and that the pad is aligned with the shim.
3. Install and connect the two platen springs. (See page 472, item 25.)
4. Install the barrier shield and four screws. (See page 447, items 3, 4, and 9.)
5. Open and close the forms thickness lever a few times and make sure the platen opens and closes smoothly.
6. Install the shuttle frame assembly (page 405).
7. Check and adjust the platen gap (page 419).
8. Return the printer to normal operation (page 339).

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 30, page 399.)

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

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

Removal

ATTENTION To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

1. Prepare the printer for maintenance (page 338).
2. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
3. Locate the terminating resistor packs. (See Figure 30, page 399.)
4. Using a chip puller, remove the packs.

Installation

ATTENTION To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

1. Using a chip installation tool, install the resistor packs in the correct socket. (See Figure 30, page 399.)
2. Cabinet Model: Install the paper guide assembly (page 391).
Pedestal Model: Install the top cover assembly (page 358).
3. Return the printer to normal operation (page 339).

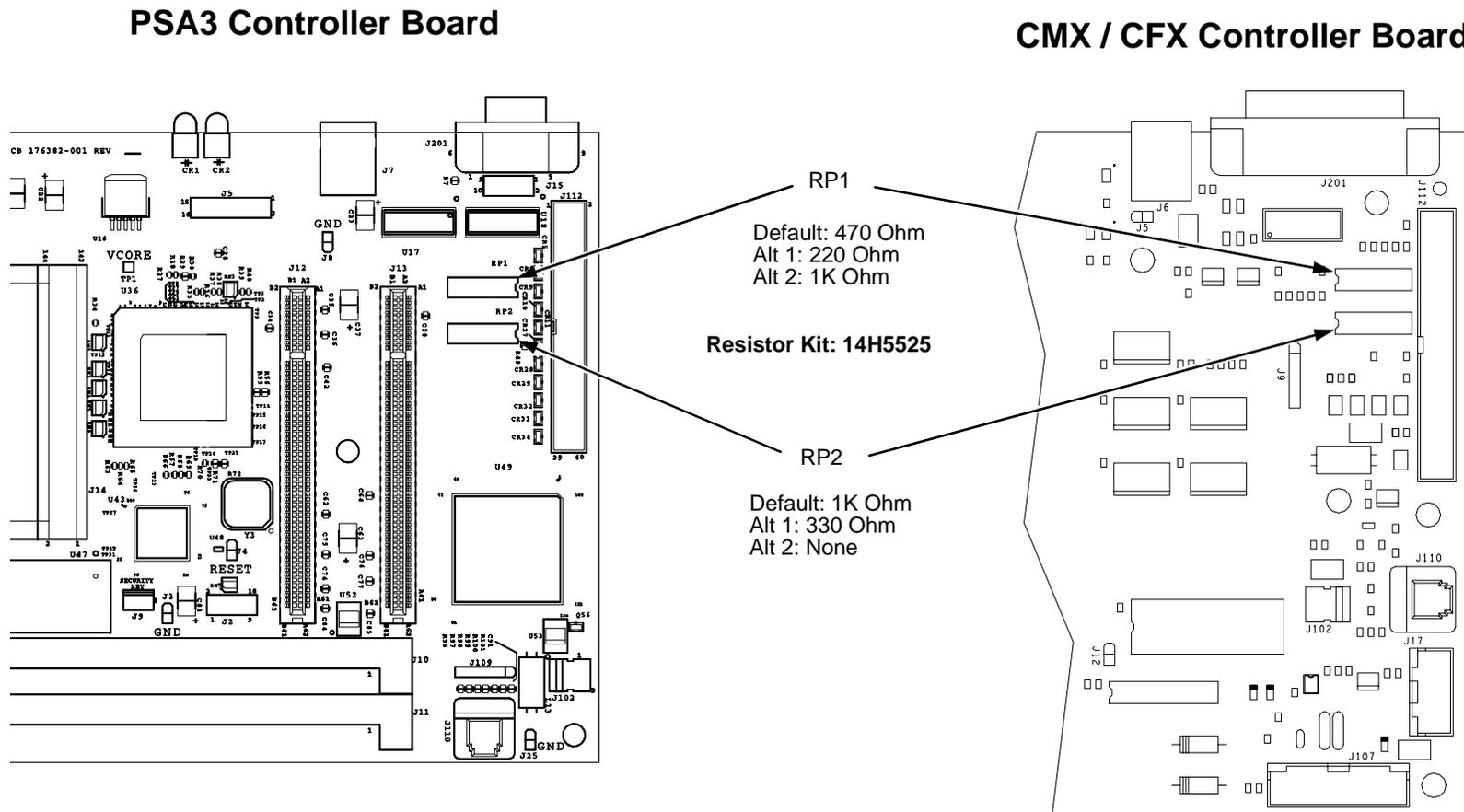


Figure 30. This figure shows the size and location of the terminating resistors on the controller board.

Ribbon Guide Assembly (L/R)

Removal

1. Prepare the printer for maintenance (page 338).

NOTE: The right ribbon guide is shown in Figure 58. The removal procedure is the same for the left ribbon guide.

2. Cut and remove the tie wrap from the tie wrap hole to free the ribbon guide cable (page 475, Figure 58).
3. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
4. Trace the ribbon guide cable back to the controller board, releasing it from the cable restraints. (See cable routing diagrams on page 303 and page 305.)
5. For the left ribbon guide, disconnect connector shell P106 from the controller board. For the right ribbon cable, disconnect connector shell P107 from the controller board.
6. Trace the ribbon guide wires to the connector shell, and remove the cable connector from the connector shell (page 352).
7. Remove the two screws and washers securing the ribbon guide assembly to the side plate.
8. Slide the ribbon guide assembly out of the side plate.

Installation

NOTE: The right ribbon guide is shown in Figure 58. The installation procedure is the same for the left ribbon guide.

1. Reverse steps 2 through 8 of the removal procedure above.
2. Align the ribbon guides (page 421).
3. Return the printer to normal operation (page 339).

Ribbon Hub

Removal

1. Prepare the printer for maintenance (page 338).
2. Loosen the Torx T-15 screw in the ribbon spool hub (page 475, Figure 58).
3. Remove the hub from the shaft of the ribbon drive motor.

Installation

1. Install the ribbon spool hub over the motor shaft (page 475, Figure 58).

ATTENTION

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

2. 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 339).

Shaft, Splined

IMPORTANT

NOTE: In order to preserve correct alignment of the side plates, the barrier panel must remain installed and fastened during this procedure.

Removal

1. Prepare the printer for maintenance (page 338).
2. Remove the static brush assembly.
3. Remove the paper supports from the splined shaft and support shaft. (See page 467, item 4.)
4. Remove the paper feed timing belt (page 342).
5. Unlock the left and right tractors and slide them to the center of the shaft.
6. Remove the screw securing the right tractor shaft plate and remove the plate (page 467, items 7 and 8).
7. 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 467, items 3, 5, and 6).
8. Hold the tractors so they do not fall, grasp the vertical adjustment knob, and slide the splined shaft to the right, out of the 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 31.)
2. Grasping the vertical adjustment knob, 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 31.)
3. Install the tolerance ring on the left end of the splined shaft (page 467, item 5).
4. Insert the tolerance ring lead-in portion into the sealed ball bearing in the left tractor shaft plate (page 467, 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 467, 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 342).
7. Set the paper feed timing belt tension (page 413).

8. Install the paper supports on the splined and support shafts. (See page 467, item 4.)
9. Install the static brush assembly.
10. Insert the lower ends of the paper supports into the groove in the upper forward edge of the platen.
11. Return the printer to normal operation (page 339).

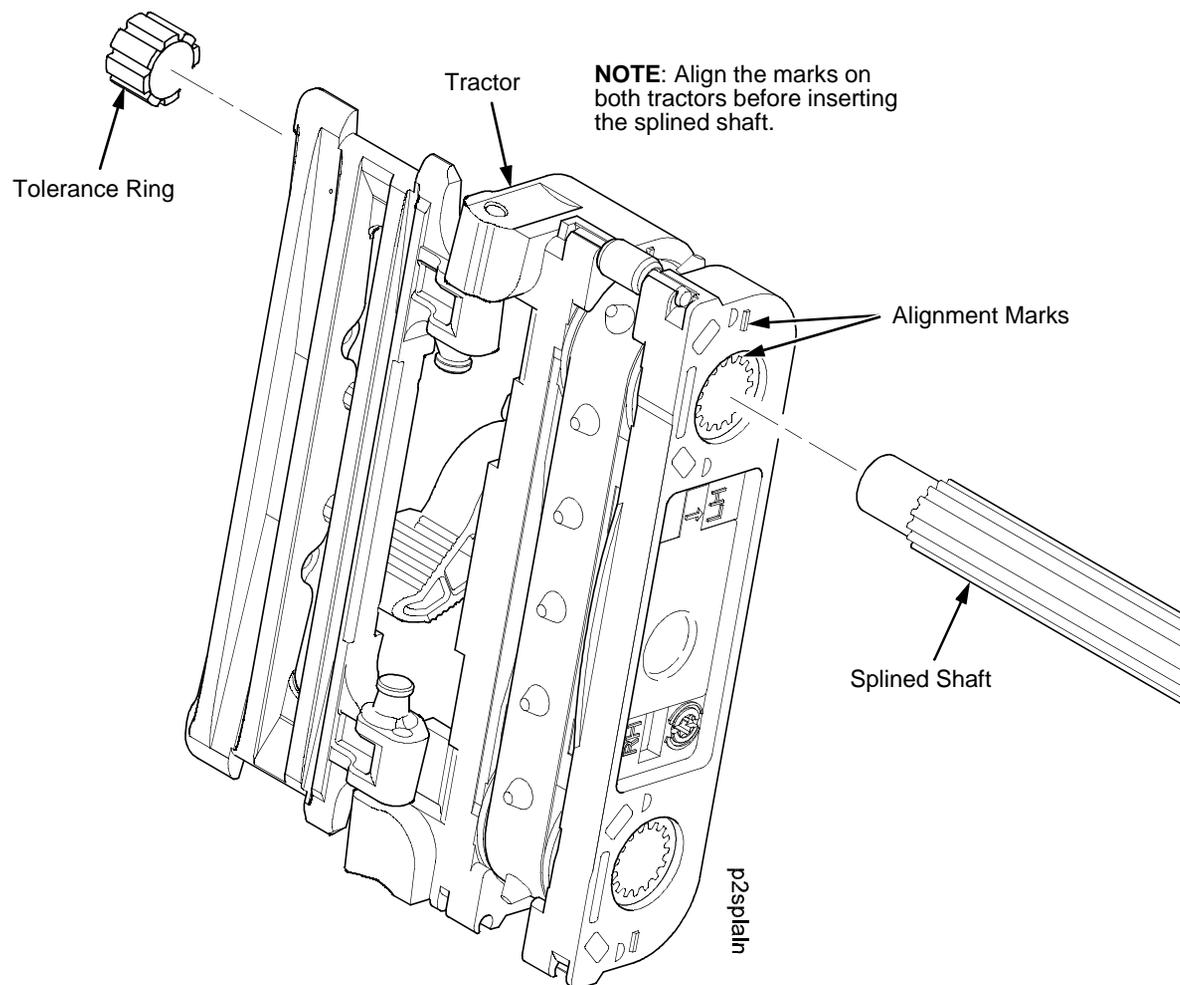


Figure 31. This figure shows how to install the splined shaft into the paper feed tractors.

Shaft, Support

IMPORTANT

NOTE: In order to preserve correct alignment of the side plates, the barrier panel must remain installed and fastened during this procedure.

Removal

1. Prepare the printer for maintenance (page 338).
2. Unlock the tractors and slide them to the far right.
3. Remove the static brush assembly.
4. Remove the paper supports from the splined shaft and support shaft. (See page 467, item 4.)
5. Remove the screw and right tractor shaft plate (page 467, items 7 and 8).

NOTE: Hold the tractors while removing the support shaft.

6. Slide the support shaft to the right, out of the tractors and the right side plate. (See page 467, 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 467, 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 467, items 2 and 12.)
3. Install the right tractor shaft plate and screw (page 467, 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 467, item 4.)
5. Install the static brush assembly.
6. Insert the lower ends of the paper supports into the groove in the upper forward edge of the platen.
7. Return the printer to normal operation (page 339).

Shuttle Frame Assembly

Removal

1. Prepare the printer for maintenance (page 338).
2. Remove the shuttle cover assembly (page 357).
3. Disconnect the MPU cable connector (page 453, Figure 50).

ATTENTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

4. Disconnect the shuttle motor cable connector (page 453, Figure 50).
5. Disconnect the hammer drive and hammer logic cables connectors from the terminator board on the shuttle frame assembly.
6. Loosen the side 5/32 inch socket head clamp screws and pull the clamps back and off the guide shaft. Do not remove the clamps.
7. Loosen the center 5/32 inch socket head screw enough to release the shuttle frame assembly from the base casting.
8. Unlock and slide the tractors outward as far as they will go on the tractor support shaft.
9. Grasping the support legs cast on both sides of the shuttle motor, lift the shuttle frame assembly out of the base casting.
Lift it slowly and carefully: the shuttle frame assembly is heavy. (It weighs about 18 pounds, or 8 Kg.)

Installation

1. Install the hammer bank / ribbon mask cover assembly (page 354), if it was removed.

ATTENTION

To prevent electrostatic damage to electronic components, wear a properly grounded static wrist strap when handling circuit boards, the shuttle frame assembly, and any other electronic component.

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

2. Holding the shuttle frame assembly by the support legs cast on both sides of the shuttle motor, set it into the base casting. **Use both hands: the shuttle frame assembly is heavy** (page 453, Figure 50).
3. 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.
4. Pull the shuttle frame assembly toward the front of the printer and hold it in this position while you do step the next step.

IMPORTANT

Do not over tighten the shuttle frame assembly hold-down screws.

5. Slide the side clamps over the guide shaft and torque the 5/32 inch socket head clamp screws to 30 ± 2 inch-pounds ($3.39 \pm 0.23 \text{ N}\cdot\text{m}$).

NOTE: Use the 1-30 inch-pound Torque Screwdriver, IBM part number 16F1661.

6. Torque the center captive 5/32 inch socket head screw to 30 ± 2 inch-pounds ($3.39 \pm 0.23 \text{ N}\cdot\text{m}$).
7. Connect the hammer drive and hammer logic cable connectors to the terminator board on the shuttle frame assembly.
8. Connect the shuttle motor cable connector.
9. Route the MPU cable under the extension spring and connect the MPU cable connector. (See Figure 53, page 462, item 4.) Make sure the MPU cable does not touch the extension spring after it is connected.
10. If the shuttle frame assembly is a new or refurbished unit, adjust the platen gap (page 419); otherwise, skip to step 11.
11. Install the shuttle cover assembly (page 357).
12. Models -i15, -i20, -i24, and -i2s: adjust the coil temperature if the original shuttle frame assembly was replaced (page 429).
13. Adjust the hammer phasing (page 427).
14. Return the printer to normal operation (page 339).

Spring, Extension, Hammer Bank

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

Removal

1. Prepare the printer for maintenance (page 338).
2. Open the printer cover.
3. Remove the shuttle cover assembly (page 357).
4. Unhook the extension spring from the spring lugs on the hammer bank and shuttle frame. (See Figure 53, page 462.)

Installation

1. Put a dab of IBM #20 bearing lubricant on both spring lugs.

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

2. Hook the extension spring over the spring lugs. (See Figure 53, page 462.)
3. Install the shuttle cover assembly (page 357).
4. Return the printer to normal operation (page 339).

Switch Assembly, Cover Open

Removal

1. Prepare the printer for maintenance (page 338).
2. Remove the shuttle cover assembly (page 357).
3. Carefully lift and pry the cover open switch assembly out of its well in the base casting to the right of the shuttle motor. (See Figure 50, page 453, item 23.)
4. Trace the cover open switch cable back to the controller board, releasing the cable from the restraints under the base casting. (See cable routing diagrams on page 303 and page 305.)
5. Disconnect connector shell P107 (P7) from the controller board.
6. Trace the ribbon motor wires to the connector shell, and remove the cable connector from the connector shell (page 352).

Installation

1. Remove the protective covering from the adhesive backing on the cover open switch assembly.
2. Feed the switch cable down into the cover open switch well to the right of the shuttle motor. Position the cover open switch assembly in the base casting and press it into place. (See Figure 50, page 453, item 23.)
3. Route the cover open switch cable back to the controller board, installing the cable in the restraints under the base casting. (See cable routing diagrams on page 303 and page 305.)
4. Connect the cover open cable to the connector shell (page 352), then connect the connector shell P107 (P7) to the controller board.
5. Install the shuttle cover assembly (page 357).
6. Return the printer to normal operation (page 339).

Switch Assembly, Paper Detector

Removal

1. Prepare the printer for maintenance (page 338).
2. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
3. Cabinet Model: Loosen four screws and remove the barrier shield. (See Figure 47, page 447, items 3 and 4.)
Pedestal Model: Remove the four screws, barrier shield, and paper guide. (See Figure 48, page 449, items 3, 4, and 5.)
4. Remove the two screws securing the paper detector switch assembly. (See Figure 58, page 475, items 3 and 4.)
5. Trace the paper detector switch cables back to the controller board, releasing the cables from the restraints under the base casting. (See cable routing diagrams on page 303 and page 305.)
6. Disconnect connector shell P106 from the controller board.
7. Remove switch cable connectors PMD and POD from connector P106 (page 352).
8. Remove the paper detector switch assembly.

Installation

1. Holding the slotted wheel against the PMD sensor, position the paper detector switch assembly and install the screws securing it to the printer base. (See Figure 58, page 475, items 3 and 4.)
2. Check the PMD sensor arm range: make sure it travels freely and completely back into the sensing cavity.
3. Route switch cables PMD and POD back to the controller board, installing the cables in the restraints under the base casting. (See cable routing diagrams on page 303 and page 305.)
4. Connect switch cables PMD and POD to the connector P106 (page 352), then connect P106 to controller board connector J106.
5. Cabinet Model: Install the barrier shield and tighten the four screws. (See Figure 47, page 447, items 3 and 4.)
Pedestal Model: Install the paper guide, barrier shield, and four screws. (See Figure 48, page 449, items 3, 4, and 5.)
6. Cabinet Model: Install the paper guide assembly (page 391).
Pedestal Model: Install the top cover assembly (page 358).
7. Check and adjust the End of Forms Distance (page 423).
8. Return the printer to normal operation (page 339).

Switch Assembly, Platen Interlock

Removal

1. Prepare the printer for maintenance (page 338).
2. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
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 on page 303 and page 305.)
5. Disconnect connector shell P107 (P7) from the controller board.
6. Remove the platen interlock cable connector from the connector shell (page 352).
7. Remove two screws securing the platen interlock switch assembly. (See Figure 56, page 469.)
8. Remove the platen interlock switch assembly from the switch bracket.
9. Remove the switch cable from the cutout in the right side plate.

Installation

1. Fully close the forms thickness lever (position 'A').
2. Position the platen interlock switch assembly on the switch bracket and install finger tight the two screws securing it to the bracket. (See Figure 56, page 469, item 11.)
3. Insert a 0.011 inch (0.028 cm) feeler gauge between the bottom of the interlock switch assembly and the shaft of the forms thickness lever, gently push down on the interlock switch, and torque the mounting screws to 8 inch-pounds (0.9 N•m). Remove the feeler gauge.
4. Route the switch cable through the cutout in the right side plate and to the controller board. (See cable routing diagrams on page 303 and page 305.)
5. Connect the platen interlock switch cable to the connector shell P107 (P7) (see page 352), then connect the connector shell to the controller board.
6. Cabinet Model: Install the paper guide assembly (page 391).
Pedestal Model: Install the top cover assembly (page 358).
7. Return the printer to normal operation (page 339).

Tractor (L/R)

Removal

1. Prepare the printer for maintenance (page 338).
2. Remove the splined shaft (page 402).
3. Remove the support shaft (page 404).
4. Remove the tractors.

Installation

1. Using the replacement tractors, install the support shaft (page 404).
2. Install the splined shaft (page 402).
3. Return the printer to normal operation (page 339).

Adjustment Procedures

The IBM 6400 printers are durable, low-maintenance machines, but some components and systems require occasional adjustment.

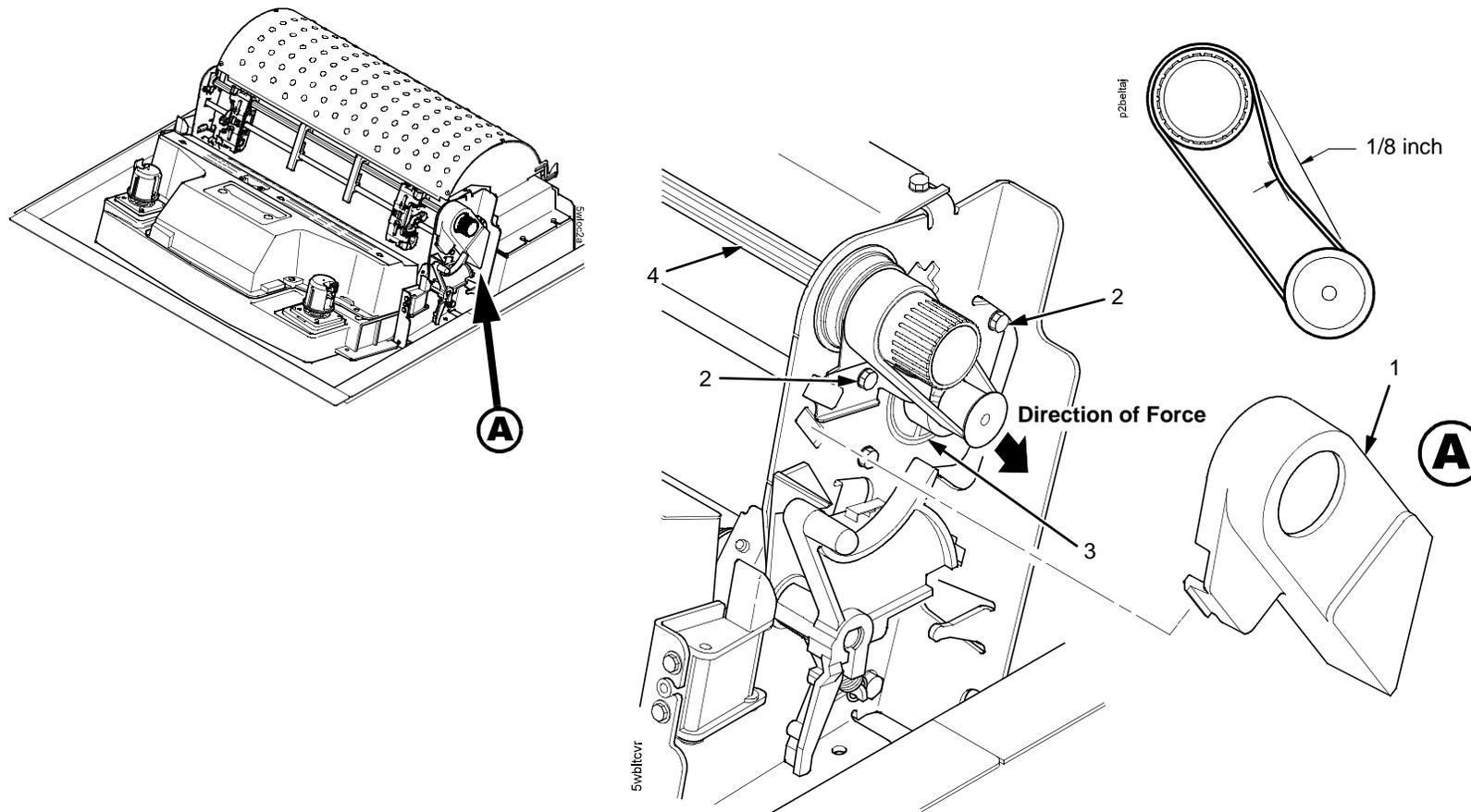
Usually, you will be referred to this chapter by a troubleshooting procedure, or as part of a removal/installation procedure.

List Of Adjustments

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Belt, Paper Feed Timing, Adjustment (Figure 32)

1. Prepare the printer for maintenance (page 338).
 2. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
 3. Cabinet Model: Loosen four screws and remove the barrier shield. (See Figure 47, page 447, items 3 and 4.)
Pedestal Model: Remove the four screws, barrier shield, and paper guide. (See Figure 48, page 449, items 3, 4, and 5.)
 4. Remove the timing belt cover (1) by squeezing the front and back to release the plastic tabs from the slots in the side plate.
 5. Loosen (do not remove) the motor mount bolts (2).
 6. Using the straight end of a force gauge, apply 15 pounds (66.7 N) of pressure to the paper feed drive motor (3) near the mounting base of the motor. Use the splined shaft (4) to steady the gauge.
 7. Reduce tension to 12 pounds (53.4 N) and torque the paper feed motor mount bolts (2) to 18 ± 2 inch-pounds ($2.03 \pm 0.23 \text{ N}\cdot\text{m}$).
- NOTE:** Belt tension is correct if the belt deflects 1/8 inch midway between the pulleys, using a deflection force of 2 to 4 pounds (approximately 9 to 18 Newtons).
8. Snap the timing belt cover (1) into the slots in the side plate.
 9. Cabinet Model: Install the barrier shield and tighten the four screws. (See Figure 47, page 447, items 3 and 4.)
Pedestal Model: Install the paper guide, barrier shield, and four screws. (See Figure 48, page 449, items 3, 4, and 5.)
 10. Cabinet Model: Install the paper guide assembly (page 391).
Pedestal Model: Install the top cover assembly (page 358).
 11. Return the printer to normal operation (page 339).



Legend:

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

Figure 32. This figure shows how to adjust the paper feed timing belt.

Belt, Platen Open, Adjustment (Figure 33)

1. Prepare the printer for maintenance (page 338).
2. Cabinet Model: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
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.

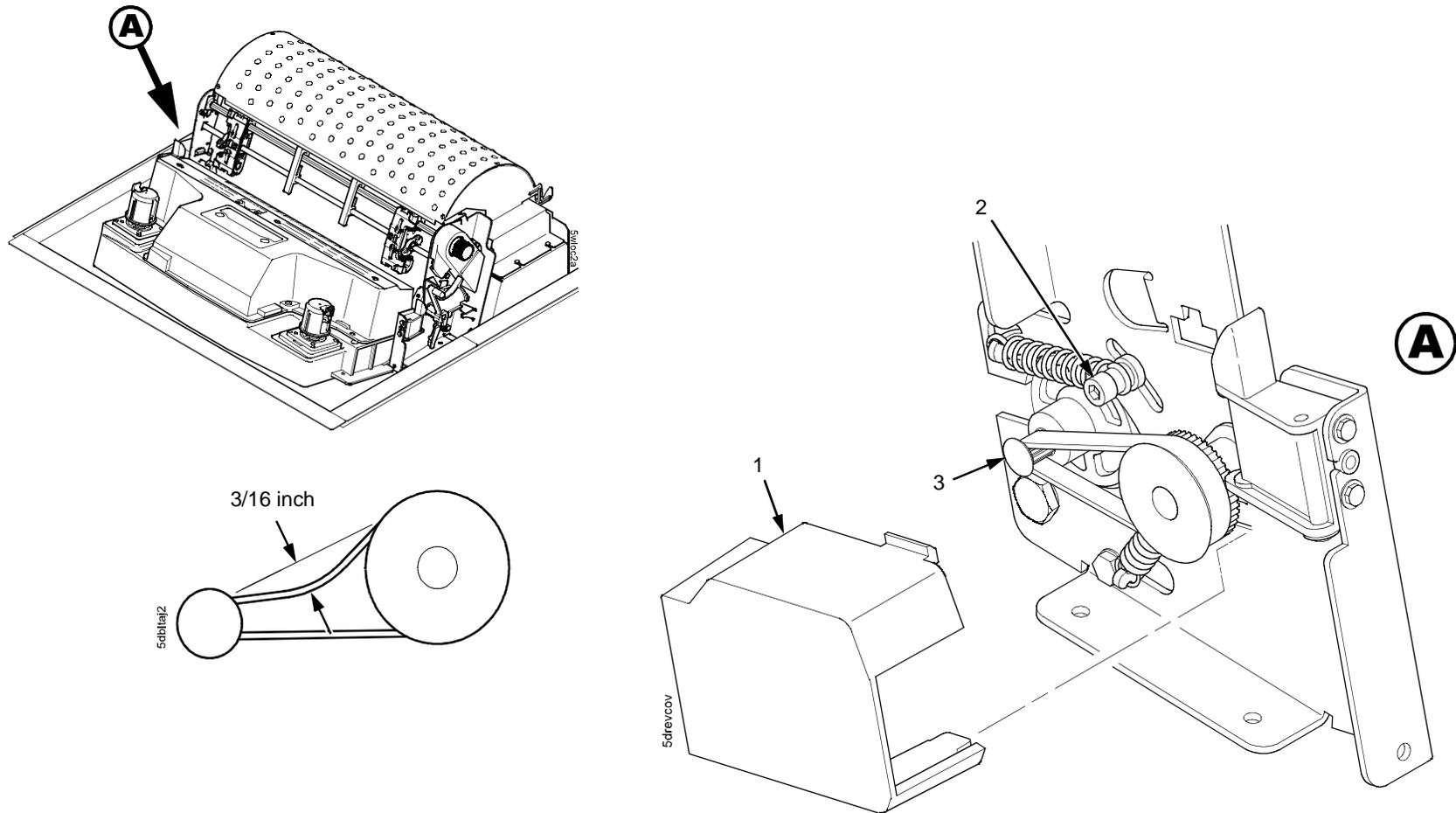
ATTENTION

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

6. 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, using a deflection force of 2 to 4 pounds (approximately 9 to 18 Newtons). 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. Cabinet Model: Install the paper guide assembly (page 391).
Pedestal Model: Install the top cover assembly (page 358).
10. Return the printer to normal operation (page 339).



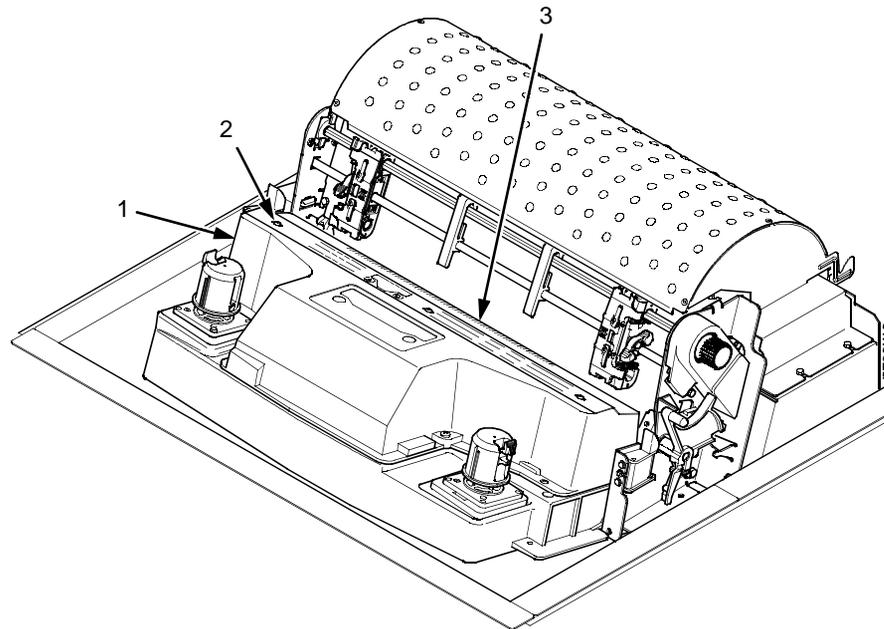
Legend:

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

Figure 33. This figure shows how to adjust the platen open belt.

Paper Scale Alignment (Figure 34)

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 357).
6. Print a full 136 column line by selecting and running one of the operator print tests (page 223).
7. Check alignment of the scale to the print at column positions 1 and 136.
8. If adjustment is necessary, loosen the three button-head 5/64 inch hex screws (2).
9. Position the scale (3) so that column positions 1 and 136 line up with the first and last characters on the 136 character printout.
10. Tighten the 5/64 inch button-head screws (2).
11. Close the printer cover.



Legend:

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

Figure 34. This figure shows how to adjust the paper scale.

Platen Gap Adjustment (Figure 35)

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

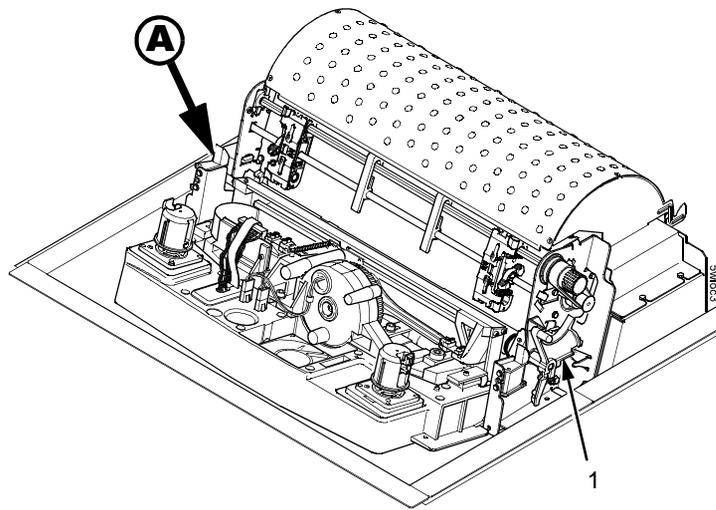
1. Prepare the printer for maintenance (page 338).
2. Remove the shuttle cover assembly (page 357).
3. Loosen the platen open belt (page 415, steps 2, 3, and 4).
4. Raise the forms thickness lever (1) to the fully open position.
5. If you are adjusting any model except the 6400-i20, select a 0.011 inch (0.28mm) flat feeler gauge.
If you are adjusting a 6400-i20, select a 0.012 inch (0.30 mm) flat feeler gauge.

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

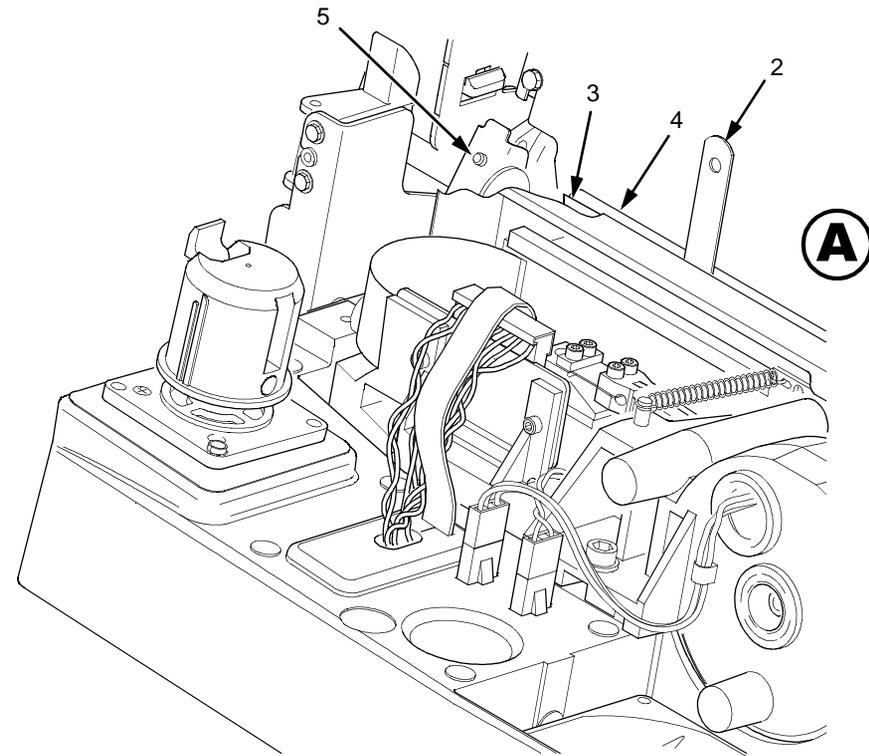
6. Insert the feeler gauge (2) straight down between the hammer bank cover plate (3) and ribbon mask (4), within four hammer positions of the left end of the hammer bank.

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

7. Gently close the forms thickness lever (1). As the platen is closing, gently slide the feeler gauge up and down, keeping it between the hammer tips and ribbon mask. If the feel is too tight as the platen closes, adjust the 3/32 inch set screw (5) counterclockwise. If the feel is too loose, adjust the set screw clockwise. With the forms thickness lever closed all the way, the feeler gauge should contact both the tips and the ribbon mask and move with light friction. Shift the gauge slightly to verify.
8. Repeat steps 4 through 7 at the right end of the hammer bank.
9. After adjusting both sides, check the gap again at both ends. Readjust if necessary.
10. When the platen gap is correct at both ends of the platen, adjust the platen open belt (page 415).
11. Install the shuttle cover assembly (page 357).
12. Check the hammer phasing adjustment (page 427).
13. Return the printer to normal operation (page 339).



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



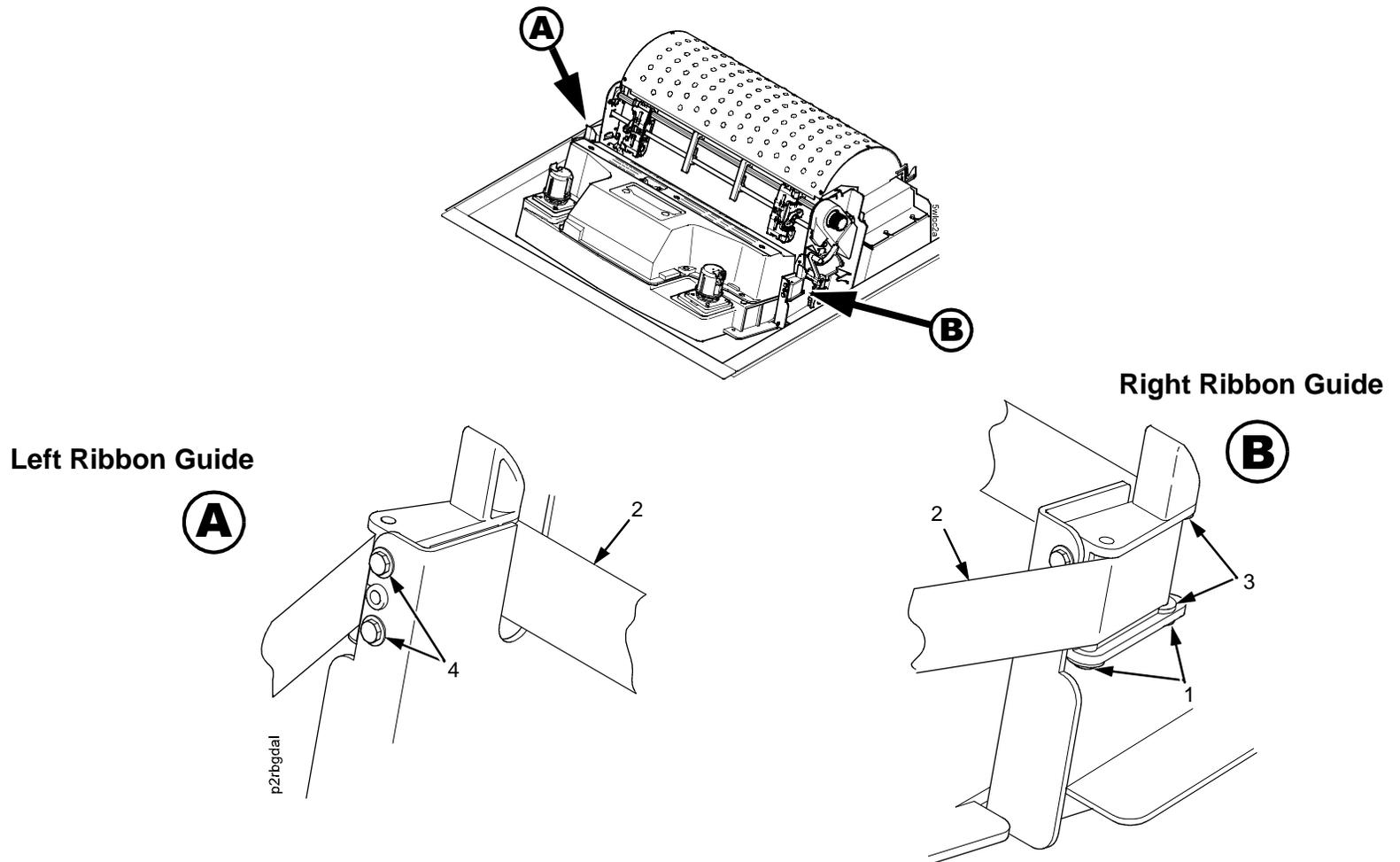
Legend:

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

Figure 35. This figure shows how to adjust the platen gap.

Ribbon Guide Alignment (Figure 36)

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 the PRINTER MECHANISM TESTS: Shuttle Slow (page 226).
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.



Legend:

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

Figure 36. This figure shows how to align Ribbon Guide Alignment

Adjusting The End Of Forms Distance

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

You will use the dot row patterns printed by the END OF FORMS ADJUST self-test to verify that this parameter is set correctly.

NOTE: Do this procedure only if a new paper detector switch assembly has been installed, or if you are sure that the end of forms adjustment is incorrect. An END OF FORMS triggering distance of 1 or 2 dot rows from the perforation is acceptable; 5 to 7 dot rows off indicates adjustment is required.

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

The procedure below describes how to run the END OF FORMS ADJUST printer test and modify the END OF FORMS ADJUSTMENT VALUE.

1. Power on the printer.
2. Load paper and set the top of form. Make sure the forms thickness lever is closed. Open the cabinet front door.
3. On the sheet of paper just below the paper entrance slot, tear a four-inch square on the left side, immediately below the perforation. (See Figure 37.) This creates a hole that will trigger an END OF FORMS condition, but allows printing to the right of the hole (which would normally be on the platen).
4. Tear a four inch square in the manner described above, on every third sheet, until you have made 3 or 4 holes.
5. If the printer is in READY mode, press **Stop** to put it into NOT READY mode.
6. Press **Scroll**↑ + **Scroll**↓ to unlock the Enter key.
7. Press **Scroll**↑ + **Scroll**↓ + **Return** + **Enter** to enter the CE Tests menu. (Press all four keys at the same time.)

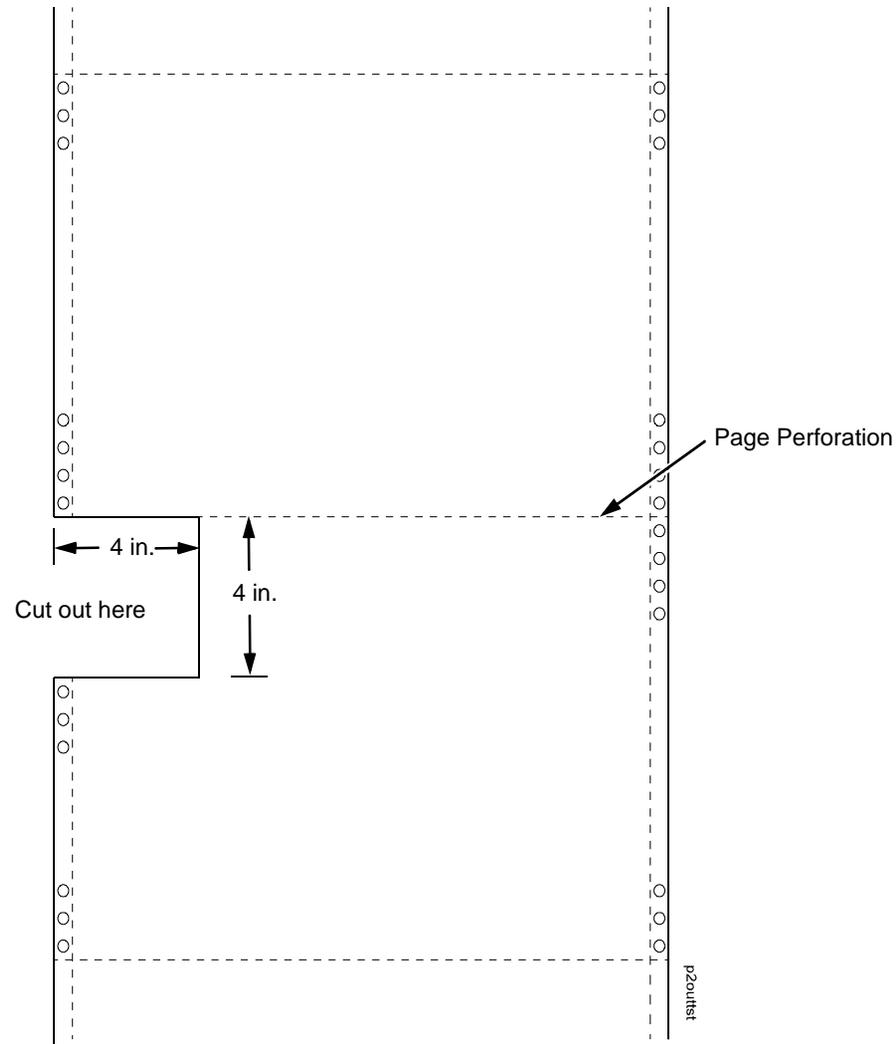


Figure 37. This figure shows how to prepare paper for the paper out adjustment test.

8. The display will show "SERVICE / PRINTER MECHANISM TESTS", the first menu item. Press **Enter** to enter the mechanism tests menu.
9. Press **Scroll**↑ or **Scroll**↓ until "PRINTER MECHANISM TESTS / END OF FORMS ADJUST" is on the display.

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.

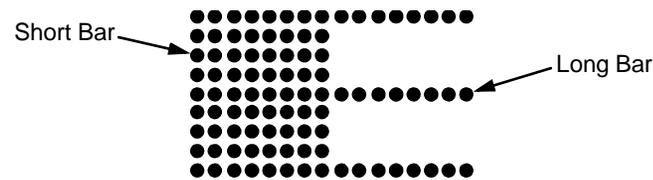


Figure 38. This figure shows the long and short bars on the vertical comb pattern that prints for the forms adjustment test.

10. Press **Enter** until the END OF FORMS ADJUST test starts.
The comb pattern will print until the display shows "001 END OF FORMS / LOAD FORMS" and (if enabled) the audible alarm sounds. If the alarm sounds, press **Stop** to silence it.
11. Remove the paper from the tractors and examine the area of the page perforation. (If the alarm sounds when you open the platen, press **Stop** to silence it.)

If a bar from the comb pattern just meets the perforation, the end of forms adjustment distance is correct. (A bar exactly on perforation is ideal; 1 or 2 dot rows off is OK; 5 to 7 dot rows off is too much.) Unless you wish to restart the procedure with 6-part paper, you may stop the test here, and skip to step 22. (See the note at the beginning of this procedure.)

If the comb pattern stopped short of the perforation or printed beyond the perforation, go to step 12.
12. 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.
13. Reload the paper and set the top of form.
14. Press **Scroll**↑ + **Scroll**↓ + **Return** + **Enter** to enter the CE Tests menu. (Press all four keys at the same time.)

15. The display will show "SERVICE / PRINTER MECHANISM TESTS," the first menu item. Press **Scroll**↑ or **Scroll**↓ until "SERVICE / END OF FORMS ADJUSTMENT VALUE" is on the display.
16. Press **Enter**. The top line of the display will show "END OF FORMS ADJUSTMENT VALUE" and the bottom line will show the current setting for the number of dots.
17. Press **Enter**. The number of dots will move up to the top line of the display.
18. Using the **Scroll**↑ or **Scroll**↓ key, adjust the XX DOTS value up or down by the number of dots you counted in step 12. (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.)
19. 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.)
20. Press **Stop** to put the printer into NOT READY mode.
21. Run the END OF FORMS ADJUST and the END OF FORMS ADJUSTMENT VALUE tests until the comb pattern prints at an acceptable distance from the page perforation. (Return to step 7.)
22. When the End of Forms Adjustment is acceptable, reload the paper, feed it past any remaining unused holes that you tore in it, and set the top of form.
23. Press **Scroll**↑ + **Scroll**↓ to lock the **Enter** key.
24. Press **Start** to put the printer into READY mode.

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 horizontal alignment of dots in character printing. The phase value numerical units are relative; they do not represent a physical measurement or value. Thus there is no “correct” value or range. But, if the phasing value is far enough from the theoretical ideal value on a particular printer, errors can occur. If, for example, you are adjusting phasing and an error such as 124 PAPER FIFO UNDERFLOW occurs, the phase value may be too high. Try a lower value.

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

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

IMPORTANT

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

1. Install the ribbon.
2. Load full width (136 column) paper.
3. Power on the printer and set top of form.
4. Press **Stop** to put the printer into NOT READY mode.
5. Press **Scroll** ↑ + **Scroll** ↓ to unlock the Enter key.
6. Press **Scroll** ↑ + **Scroll** ↓ + **Return** + **Enter** to enter the CE Tests menu. (Press all four keys at the same time.)
7. The display will show “SERVICE / PRINTER MECHANISM TESTS”, the first menu item. Press **Enter** to enter the mechanism tests menu.
8. Press **Scroll** ↑ or **Scroll** ↓ until “PRINTER MECHANISM TESTS / HAMMER PHASING” is on the display.
9. Press **Enter**. The printer begins printing all H’s, each line preceded by the phasing index number.
10. Press **Return**. The display will show “SERVICE / PRINTER MECHANISM TESTS”.
11. Press **Scroll** ↑ or **Scroll** ↓ until “SERVICE / HAMMER PHASE VALUE” is on the display.

12. Press **Enter**. The top line of the display will show "HAMMER PHASE VALUE" and the bottom line will show the current phasing index number.
13. Press **Enter**. The phasing index (followed by an asterisk) will move up to the top line of the display.
14. Press **Scroll** ↑ or **Scroll** ↓ to increase or decrease the phasing index, then press **Enter** to activate the value as it prints. Continue to increase or decrease the phasing index until the pattern of H's appears as shown below:

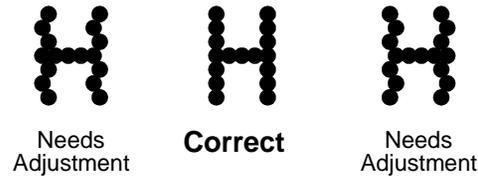


Figure 39. This figure shows incorrect and correct H patterns to illustrate vertical misalignment of text characters.

15. When the print pattern is acceptable, press **Stop**. Printing stops, and the printer automatically enters the current phase index value into NVRAM. The display shows "NOT READY".
 16. Press **Scroll** ↑ + **Scroll** ↓ to lock the **Enter** key.
 17. Close the printer cover. Press **Start** to put the printer into READY mode.
- 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

This procedure applies only to models 6400-i15, -i20, -i24, and -i2s.

On 6400-i15 models, do this procedure if either the original shuttle frame assembly or controller board have been replaced.

On 6400-i20, -i24, and -i2s models, do this procedure if either the original controller board, power supply board, or shuttle frame assembly have been replaced.

Do not do this procedure if the controller board, power supply 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.**

1. Raise the printer cover.
2. Power on the printer.
3. If the **Ready** indicator is on, press the **Stop** key. The printer must be in the NOT READY state to do this procedure.
4. Press **Scroll** ↑ + **Scroll** ↓ + **Return** + **Enter**. (Press all four keys at the same time.) “SERVICE / PRINTER MECHANISM TESTS” appears on the display.
5. Press **Scroll** ↑ + **Scroll** ↓ to unlock the **Enter** key.
6. Press the **Scroll** ↑ or **Scroll** ↓ key until “SERVICE / SET COIL TEMPERATURE” 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 “SERVICE / SET COIL TEMPERATURE” press **Scroll** ↑ + **Scroll** ↓ to lock the **Enter** key.
9. Press **Stop** to exit the menu and put the printer in the NOT READY state.

- OR -

10. Press **Start** to exit the menu and put the printer in the READY state.
11. Coil temperature is now set. Power off the printer and close the printer cover.

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 40.)
5. Fold a two-inch piece of plastic tape over the top sheet, mid way between the sides, as shown in Figure 40.

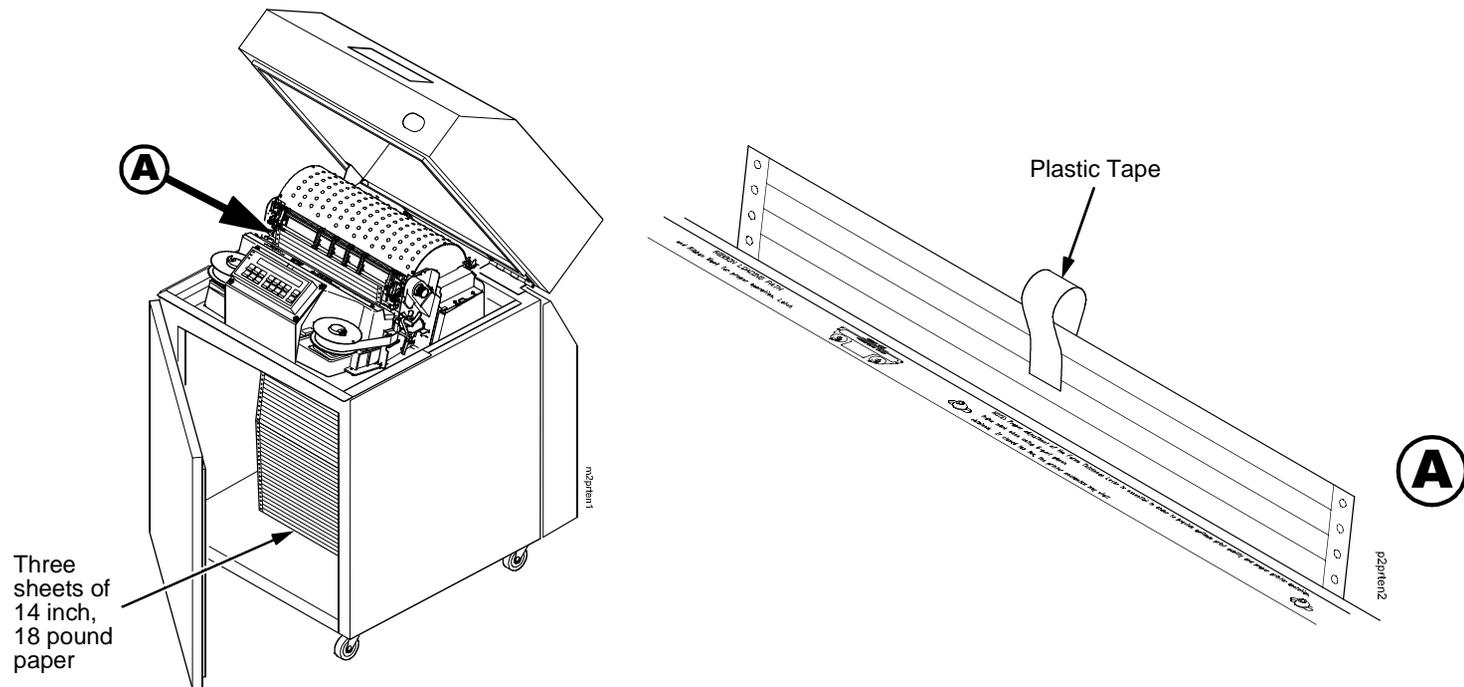


Figure 40. This figure shows how to prepare paper for measuring dynamic paper tension.

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 step 5. (See Figure 41.)
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 41.)

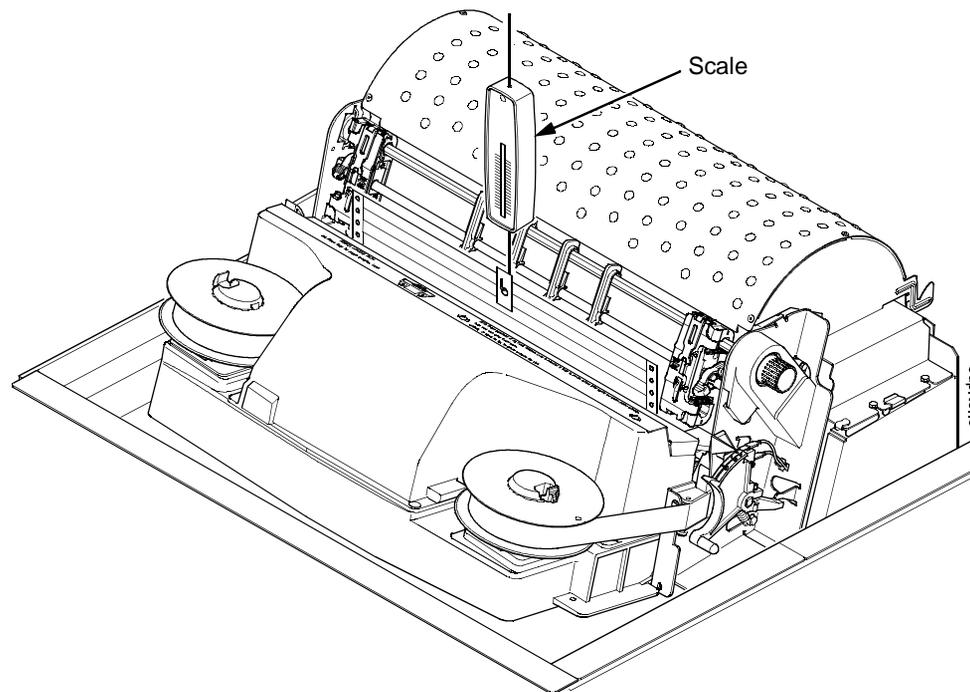


Figure 41. This figure shows how to use the "fish scale" to measure paper tension.

9. Repeat steps 6 through 8 several times and calculate the average value of force on the gauge.
10. The average tension should be 9 to 14 ounces (255 to 397 grams). If the average value is greater than 15 ounces (425 grams), paper handling and print quality problems are likely to occur.

11. If the average value is greater than 15 ounces, check the platen gap (page 419), adjust if necessary, and recheck the dynamic paper tension.
12. If the platen gap is correct, remove the shuttle frame assembly (page 405) 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. (See Figure 58, page 475.)
 - 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.

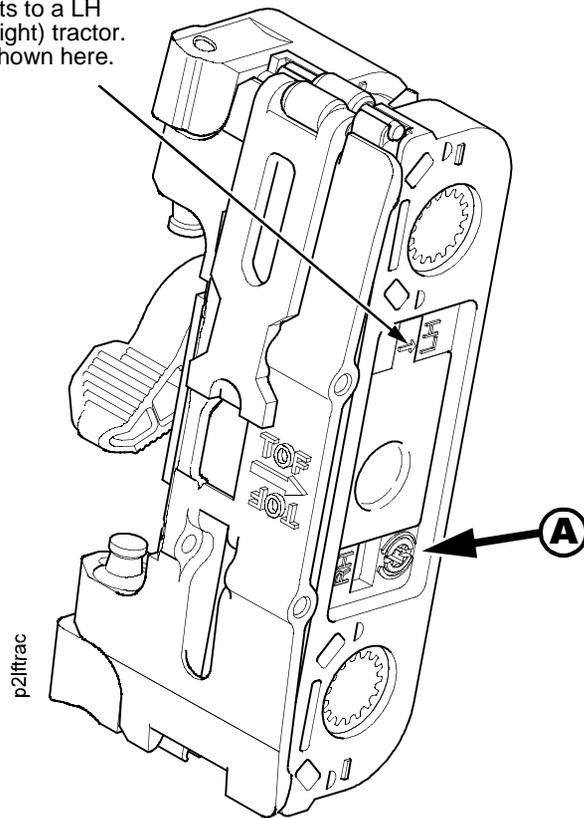
IMPORTANT Only do this procedure when the user reports that the first print line of forms is compressed and only after adjusting the dynamic paper tension (page 430). Always adjust both tractors.

1. Prepare the printer for maintenance (page 338).
2. Adjust the dynamic paper tension (page 430).
3. Carefully note the initial position of the adjustment screws. (See Figure 42.)

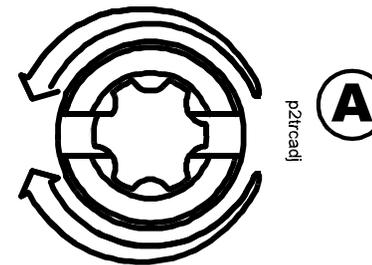
ATTENTION Adjust tractors only **ONE** detent at a time. Over-tightening a tractor belt can cause other paper feed problems and result in premature wear in the tractors.

4. On the inner side of the left tractor, use a Torx T-10 driver to rotate the adjustment screw clockwise one detent to increase tension. On the inner side of the right tractor, use a Torx T-10 driver to rotate the adjustment screw counter-clockwise one detent to increase tension. (See Figure 42.)
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 and call support for further assistance.
8. Return the printer to normal operation (page 339).

The arrow points to a LH (left) or a RH (right) tractor. Left tractor is shown here.



Right Tractor: One Click and Test.



Left Tractor: One Click and Test.

Figure 42. This figure shows how to adjust the tension of a tractor belt.

Ethernet Initialization

To initialize the ethernet interface, do the following steps:

1. Power on the printer.
2. Wait for “READY / ETHERNET ADAPTER IS READY” to display on the LCD.
3. If the **Ready** indicator is on, press the **Stop** key. The printer must be in the NOT READY state to do this procedure.
4. Press **Scroll** ↑ + **Scroll** ↓ + **Return** + **Enter**. (Press all four keys at the same time.)
“SERVICE / PRINTER MECHANISM TESTS” appears on the display.
5. Press **Scroll** ↑ + **Scroll** ↓ to unlock the **Enter** key.
6. Press the **Scroll** ↑ or **Scroll** ↓ key until “SERVICE / PRINTER MGMT” appears on the display.
7. Press **Enter**. “PRINTER MGMT / DIAGNOSTIC PORT” appears on the display.
8. Press **Enter**. “DIAGNOSTIC PORT” (and the current diagnostic port setting) appears on the display. If the current setting is “DEBUG ETHERNET*”, go to step 11.
9. Press **Scroll** ↑ until “DIAGNOSTIC PORT / DEBUG ETHERNET” appears on the display.
10. Press **Enter**. An asterisk (*) appears next to the selection, indicating it is now the diagnostic port.
11. Press **Scroll** ↑ + **Scroll** ↓ to lock the **Enter** key.
12. Press **Stop** to exit the menu and put the printer in the NOT READY state.
13. Power off the printer, wait a few seconds, then power on the printer to activate the new diagnostic port.

6

Parts Catalog

Organization Of This Chapter

This chapter contains drawings of the electromechanical assemblies comprising the printer. Following each illustration is a list of the illustrated parts and their part numbers. Items marked “Ref” (reference) are not spared, or are part of another assembly, or are shown elsewhere.

Illustrated Parts Breakdown

Figure 43. Top Cover, Doors, Casters, and Shipping Kit for Cabinet Model.....	page 438
Figure 44. Paper Stacker and Chains	page 440
NOTE: Parts for the power paper stacker are listed in Appendix E.	
Figure 45. Operator Panel and Cabinet Details	page 442
Figure 46. Pedestal Details, including Shipping Kit.....	page 444
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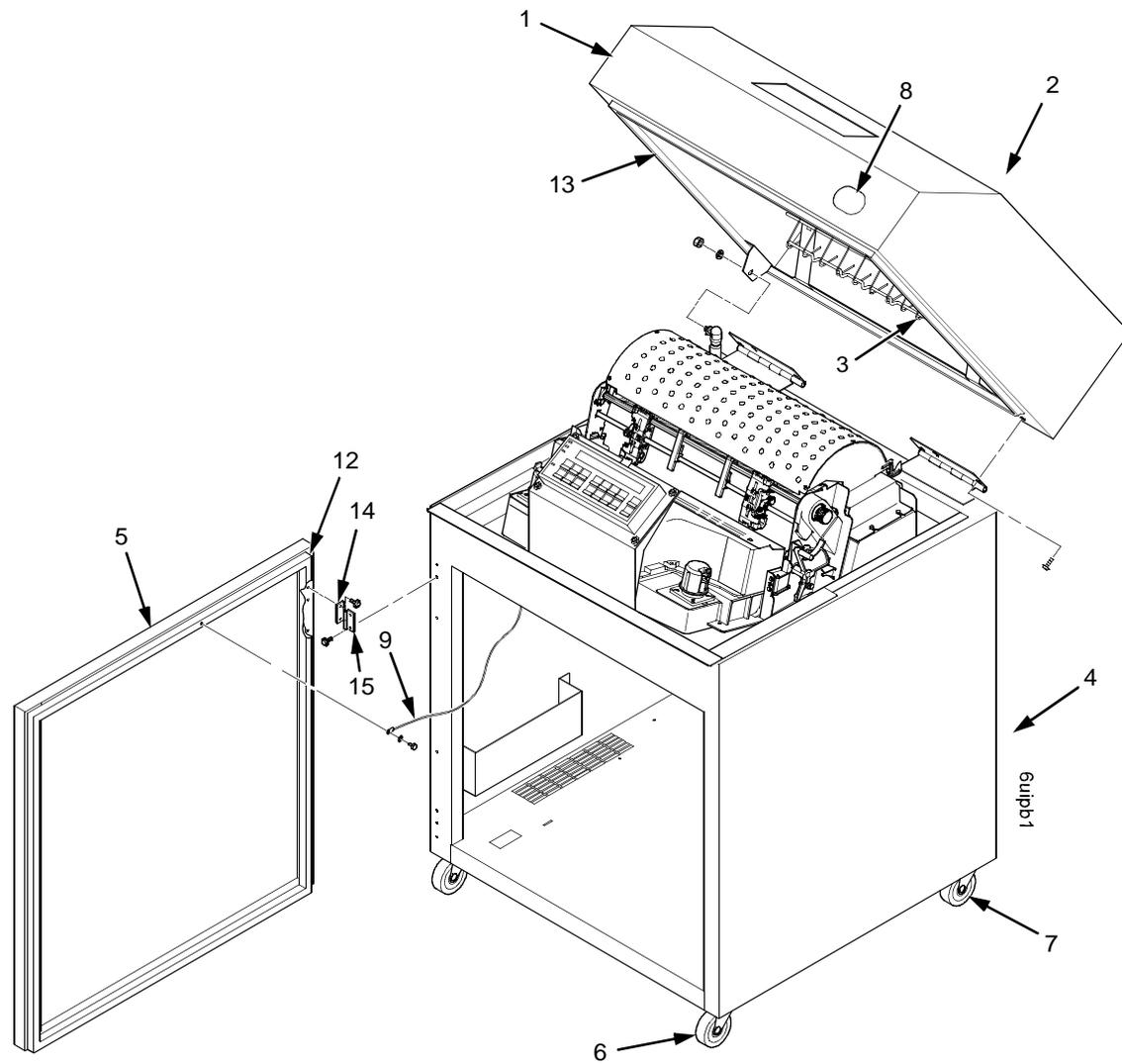


Figure 43. This illustrated parts breakdown shows the top cover, doors, casters, and shipping kit on a cabinet model.

(Figure 43)

Item No.	Part No.	Description	Notes
1	24H8961	Top Cover Kit	Includes mounting hardware
2	57G1492	Window, Top Cover	Not visible in Figure 43
3	14H5567	Wireform Paper Guide Assembly	Includes mounting hardware
4	24H8960	Rear Door Kit	Includes item 14
5	24H8959	Front Door Kit	Includes item 14
6	57G1485	Caster, with Brake	Two at front
7	57G1486	Caster, without Brake	Two at rear
8	14H5603	Logo, 6400	
9	30H4008	Wire Rope, Front and Rear	One on each door (Rear not shown in Figure 43)
10	30H3986	Re-Ship Kit, Cabinet Model, without power stacker	Not shown in Figure 43
	24H8963	Re-Ship Kit, Cabinet Model, with power stacker	Not shown in Figure 43
11	14H5572	Hardware Kit	Not shown in Figure 43. Contains all of the SAE fasteners used in the printer.
12	63H7510	Door Seal Kit	
13	63H7398	Top Cover Seal Kit	Foam only, three pieces
	30H4010	Magnetic Seal	Foam with magnet, one piece
14	93F7037	Hinge Plate, Top	Included in items 4 and 5
15	57G1484	Hinge Plate, Bottom	

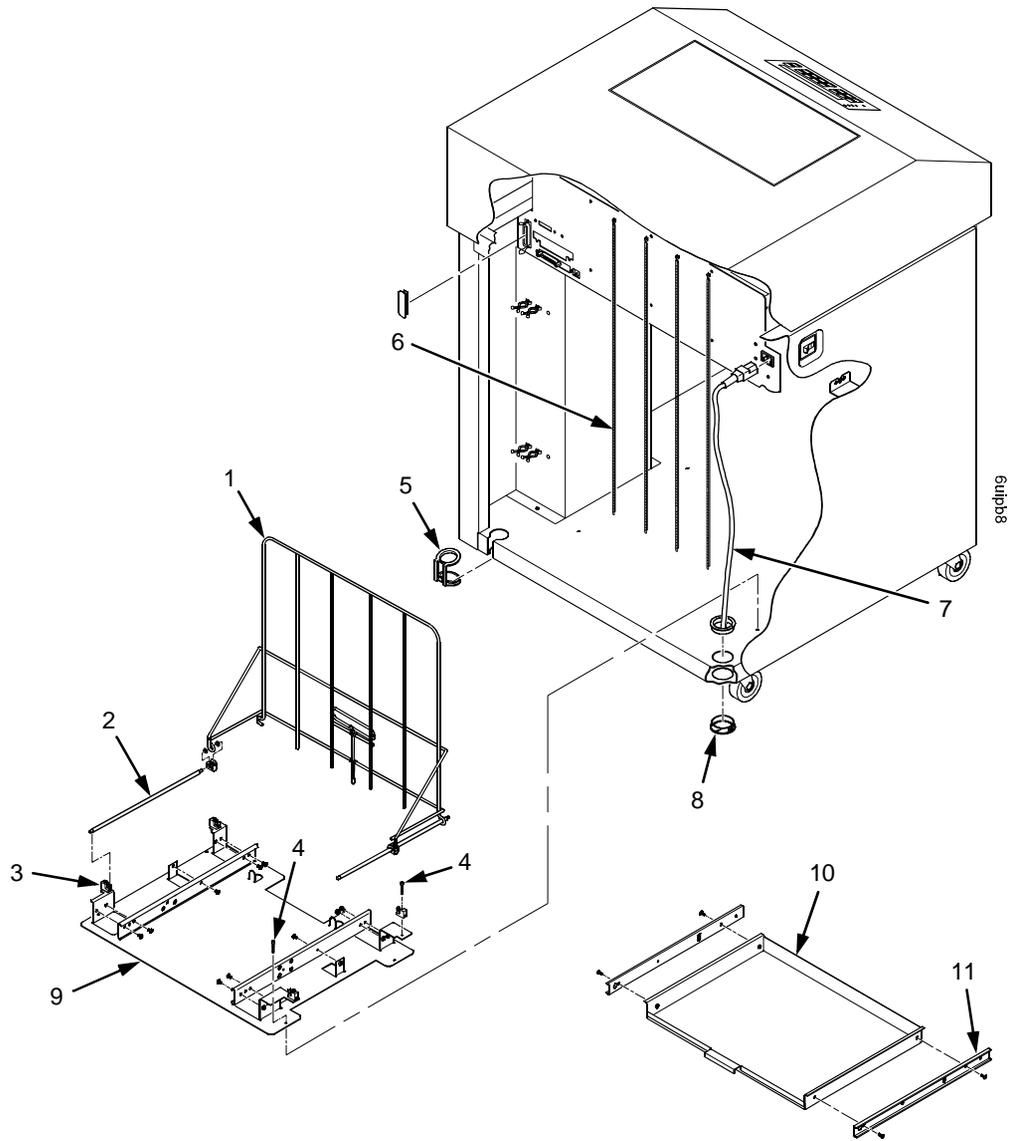


Figure 44. This illustrated parts breakdown shows the passive paper stacker and paper chains in a cabinet model.

(Figure 44)

Item No.	Part No.	Description	Notes
1	57G7176	Passive Stacker	
2	30H3981	Rail	
3	04H4779	Clip, Rail	
4	Ref	Screw, 6-32 x 0.875 (4)	
5	14H5296	Spares Kit, Grommet	
6	14H5272	Chain Assembly Kit	Kit contains eight chains
7	57G7260	Power Cord, U.S.	
8	Ref	Grommet, Power Cord (2)	Included in item 5
9	Ref	Field Kit, Rear Tray Assembly	Factory or field option. Includes items 10, 11, and power stacker paper tent 75P1183
10	75P1181	Rear Tray	
11	75P1182	Slide, Ball Bearing, Rear Tray	

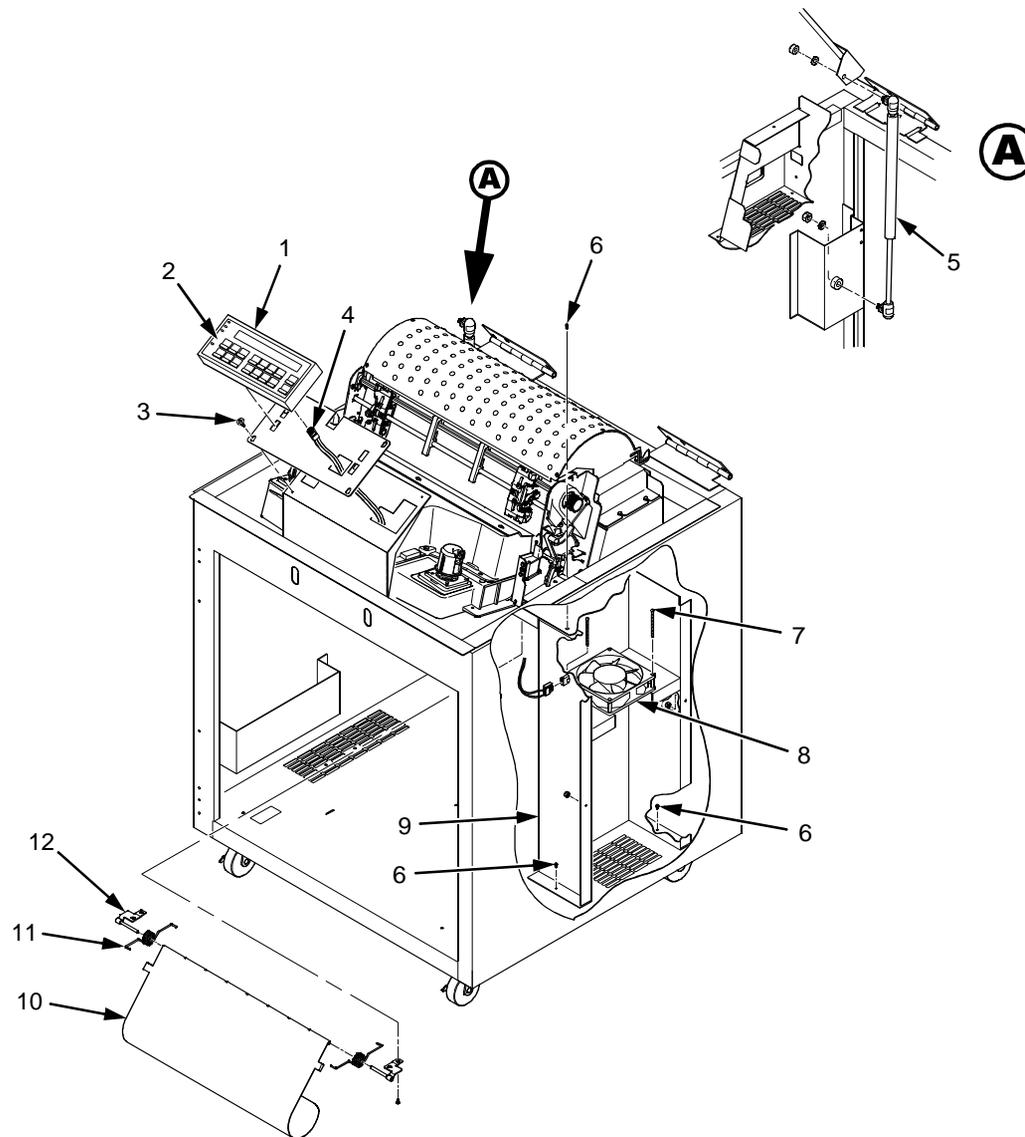


Figure 45. This illustrated parts breakdown shows the operator panel and cabinet details in a cabinet model.

(Figure 45)

Item No.	Part No.	Description	Notes
1	14H5299	Operator Panel, Cabinet	Includes mounting hardware
2	57G1598	Operator Panel Overlay, English	
	57G1599	Operator Panel Overlay, Spanish	
	57G1600	Operator Panel Overlay, French	
	57G1601	Operator Panel Overlay, Italian	
	57G1602	Operator Panel Overlay, German	
	57G1603	Operator Panel Overlay, Dutch	
	57G1604	Operator Panel Overlay, Brazilian Portuguese	
3	Ref	Screw, Hex w/Lock Washer (4)	6-32x.375
4	14H5300	Cable Assy, Operator Panel	
5	57G1481	Dashpot Kit	Includes ball studs, spring clips, and mounting hardware
6	Ref	Screw w/Lock Washer (3)	6-32x.375
7	Ref	Screw w/Lock Washer (2)	6-32x.175
8	57G1440	Fan Assembly	
9	Ref	Duct, Air Exhaust	
10	173302-001	Paper Entrance Guide	Models i20, i24, and i2s
11	173428-001	Spring, Paper Entrance Guide (2)	Models i20, i24, and i2s
12	173351-001	Bracket, Paper Entrance Guide, Right	Models i20, i24, and i2s
	173352-001	Bracket, Paper Entrance Guide, Left	Models i20, i24, and i2s

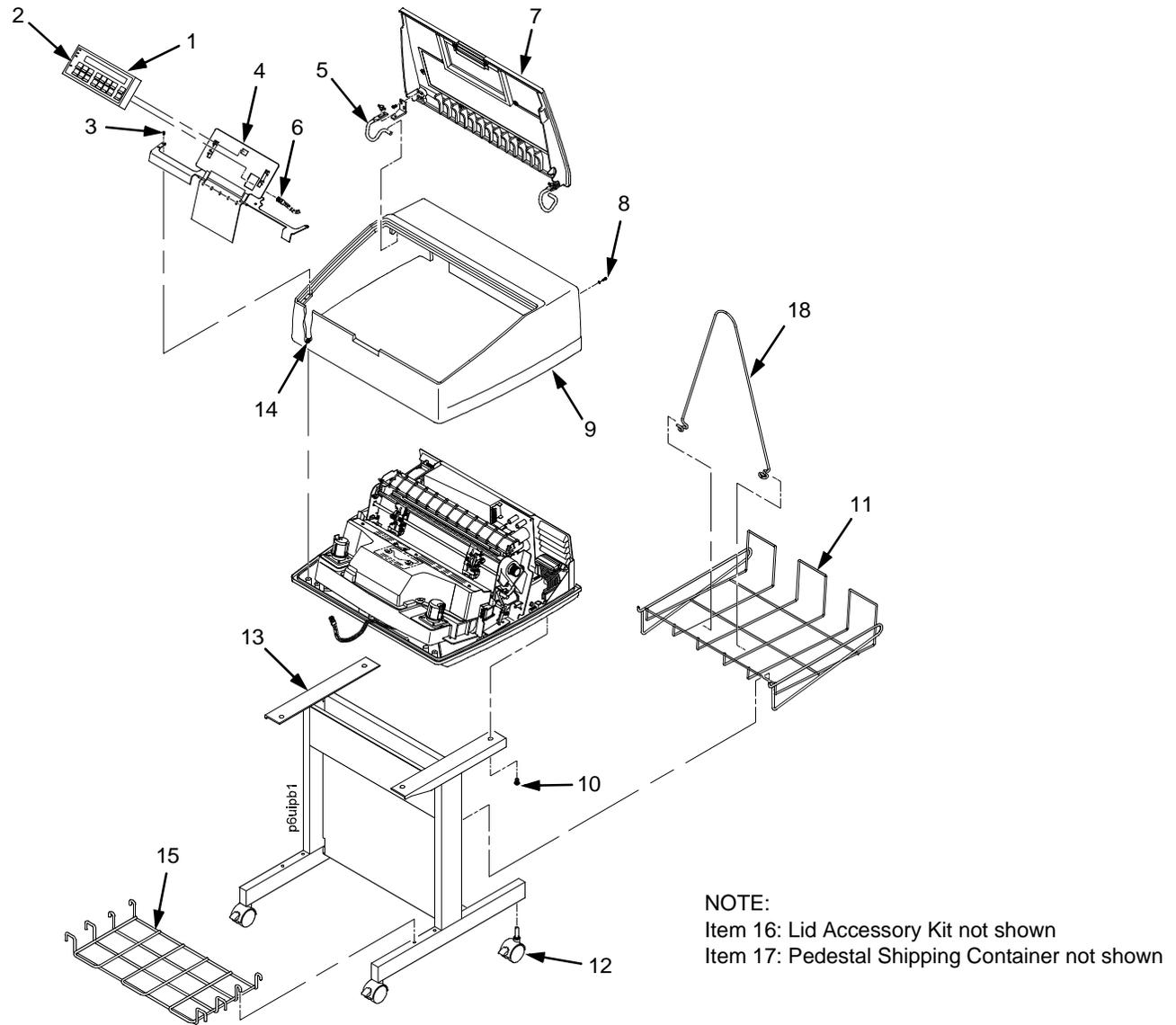


Figure 46. This illustrated parts breakdown shows the main assemblies of a pedestal model and the shipping kit.

(Figure 46)

Item No.	Part No.	Description	Notes
1	63H5124	Operator Panel, Pedestal	Models i5P, i1P
2	57G1598	Operator Panel Overlay, English	
	57G1599	Operator Panel Overlay, Spanish	
	57G1600	Operator Panel Overlay, French	
	57G1601	Operator Panel Overlay, Italian	
	57G1602	Operator Panel Overlay, German	
	57G1603	Operator Panel Overlay, Dutch	
	57G1604	Operator Panel Overlay, Brazilian Portuguese	
3	Ref	Screw (5)	6-32x.50
4	63H5125	Bracket, Operator Panel	Models i5P, i1P
5	63H5121	Hinge Lid Kit	Models i5P, i1P
6	14H5300	Cable Assy, Operator Panel	
7	63H5119	Lid, Pedestal Model	Models i5P, i1P
8	Ref	Screw (2)	
9	63H5120	Top Cover	Models i5P, i1P
10	Ref	Screw (4)	10-32x.625
11	63H5118	Paper Basket	Models i5P, i1P
12	63H7509	Caster, Pedestal	Models i5P, i1P
13	63H5117	Pedestal Kit	Models i5P, i1P
14	Ref	Screw, Captive (2)	
15	24H8533	Input Tray	Optional item on models i5P, i1P
16	63H5122	Lid Accessory Kit	Replacement acoustic seals (Not shown in Figure 46)

Item No.	Part No.	Description	Notes
17	63H5123	Shipping Container, Pedestal	For models i5P, i1P (Not shown in Figure 46)
18	28P0595	Fence, Rear Paper Tray	

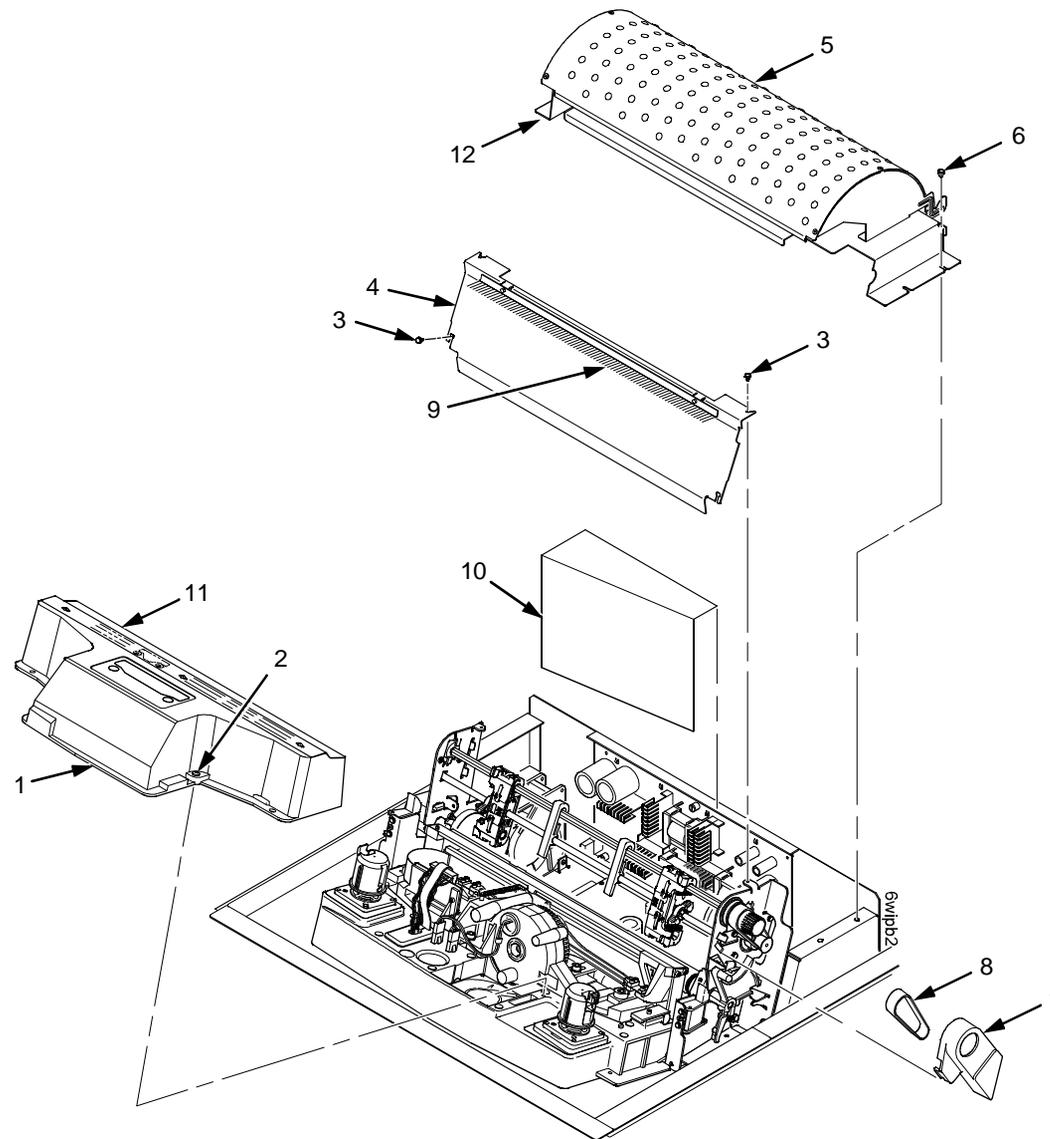


Figure 47. This illustrated parts breakdown shows the internal covers of a cabinet model.

(Figure 47)

Item No.	Part No.	Description	Notes
1	54P1464	Shuttle Cover Assembly (Shroud Assembly, Improved Cooling)	-i20 Only. Includes items 2 and 11
	14H5235	Shuttle Cover Assembly	All others. Includes items 2 and 11
2	Ref	Screw, Captive (2)	10-24x.62 with O-ring, .125x.250x.06
3	Ref	Screw, Thread Forming (4)	6-32x.25
4	Ref	Barrier Shield	
5	54P0729	Paper Guide Assembly, V2	All cabinet models
6	Ref	Screw, w/Lock Washer (3)	6-32x.25 and #6 Flat Washer
7	54P1379	Platen/Paper Feed Cover Kit	Paper feed belt cover shown in Figure 47. Platen open belt cover: item 24, page 469.
8	57G1468	Belt, Timing, 050P, 100 Teeth	Paper Feed Belt
9	08H7954	Anti-Static Brush Kit	Mounts to top of item 4
10	Ref	Power Supply Shield	Taped to card cage along upper edge
11	14H5179	Paper Scale	All except -i20 and -i24
	54P1458	Paper Scale, Improved Cooling	-i20 and -i24
12	Ref	Shim, Paper Path	Inserted between item 5 and card cage on -i20 and i24 models only. (Not shown in Figure 47.)

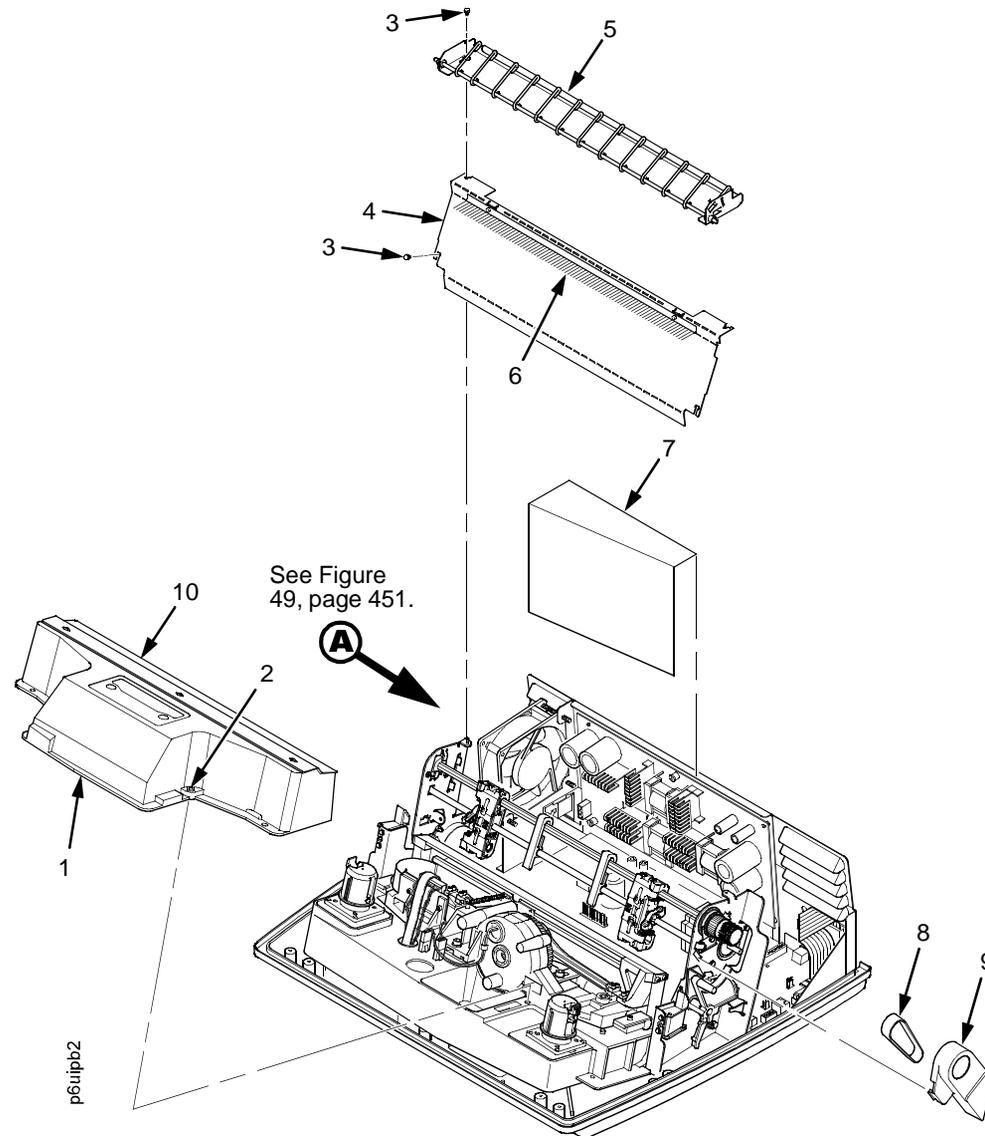


Figure 48. This illustrated parts breakdown shows the inside covers and card cage of a pedestal model.

(Figure 48)

Item No.	Part No.	Description	Notes
1	14H5235	Shroud Assembly, Air	Shuttle Cover Assembly
2	Ref	Screw, Captive (2)	10-24x.62 with O-ring, .125x.250x.06
3	Ref	Screw, Thread Forming (4)	6-32x.25
4	Ref	Barrier Shield	
5	63H5116	Paper Path Assembly	Pedestal models
6	08H7954	Anti-Static Brush Kit	
7	Ref	Power Supply Shield	Taped to card cage along upper edge
8	57G1468	Belt, Timing, 050P, 100 Teeth	Paper Feed Belt
9	54P1379	Platen/Paper Feed Cover Kit	Paper feed belt cover shown in Figure 48. Platen open belt cover: item 24, page 469.
10	14H5179	Paper Scale	

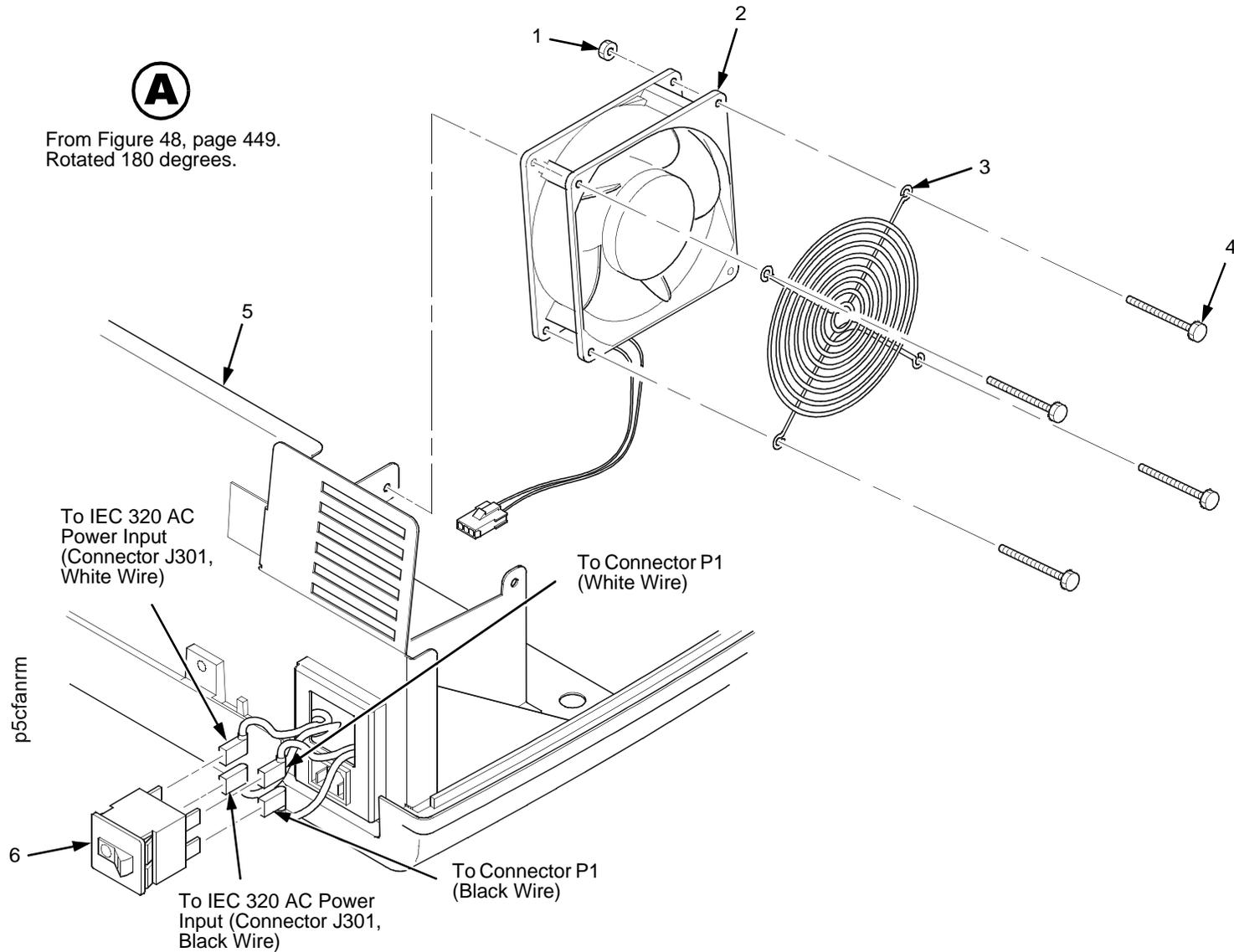


Figure 49. This illustrated parts breakdown shows the card cage fan assembly of a pedestal model.

(Figure 49)

Item No.	Part No.	Description	Notes
1	Ref	Nut, 6-32 (1)	Upper right fan corner only
2	57G1440	Card Cage Fan Assembly	Air flow is into card cage
3	Ref	Fan Guard	
4	Ref	Screw, w/Lock Washer (4)	6-32x.1.75
5	Ref	Card Cage, Pedestal	
6	14H5571	Circuit Breaker	

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

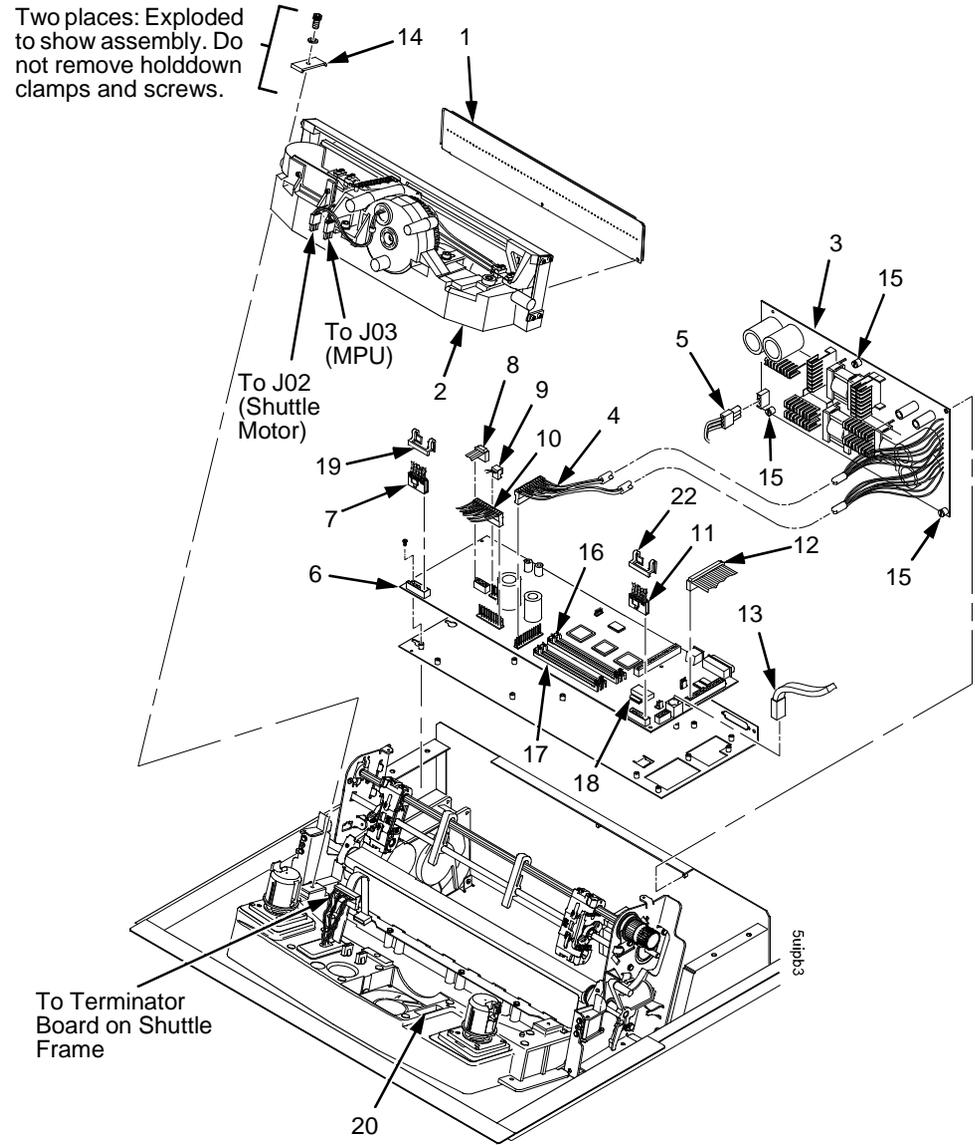


Figure 50. This parts breakdown shows the shuttle assembly and circuit boards on all models except the 6400-i20, -i24, and i2s.

(Figure 50)

Item No.	Part No.	Description	Notes
1	54P1530	Ribbon Mask/Hammer Bank Cover Assy, 500	Models i05, i5P
	54P1531	Ribbon Mask/Hammer Bank Cover Assy, 1000	Models i10, i1P
	54P1532	Ribbon Mask/Hammer Bank Cover Assy, 1500	Model i15
2	54P1536	Shuttle Frame Assembly, 500, Spare	Models i05, i5P
	54P1537	Shuttle Frame Assembly, 1000, Spare	Models i10, i1P
	54P1538	Shuttle Frame Assembly, 1500, Spare	Model i15
	54P1527	Hammer Spring Field Kit, 500	Models i05, i5P
	54P1528	Hammer Spring Field Kit, 1000	Models i10, i1P
	54P1529	Hammer Spring Field Kit, 1500	Model i15
3	90H3268	Power Supply PCBA	For EMEA, Japan, China, and Taiwan
	53P6657	Power Supply PCBA, PFC	
4	Ref	P101 Cable Connector	Part of item 6
5	Ref	Cable Assy, AC-In, Power Supply	Part of Field Kit AC Assy 14H5289
6	90H3271	Controller Board, CMX, V5.5	All except i20, i2s, i24
7	14H5288	Connector Kit (P106/P107)	P106, Motor Sensor, Left
8	14H5279	Single Hammer Bank Logic Cable Assembly	See also page 318.
	75P8157	Single Hammer Bank Logic Cable Protector	Use on older models; not shown in Figure 50. (See NOTE on page 318.)
9	14H5330	Shuttle Motor Cable Assembly	
10	02N6214	Single Hammer Bank Power Cable Assy	See also page 320.
11	14H5288	Connector Kit (P106/P107)	P107, Motor Sensor, Right
12	14H5287	Centronics I/O Cable Assembly	See also page 307.
	14H5522	Centronics/Dataproducts Adapter	Optional. See also page 308.
13	14H5300	Control Panel Cable Assembly	See also page 315.

Item No.	Part No.	Description	Notes
14	14H5211	Clamp, Shaft, Receiving	
15	Ref	Screw, Captive, Power Supply (3)	
16	01P6854	SIMM, Flash Memory, 8 MB	See also page 381.
17	24H9010	SIMM, DRAM, 8 MB	See also page 381
18	14H5509 14H5490	Security Module, Base Security Module, Graphics	See also page 381
19	02N8261	Connector Clip	
20	14H5282	Switch Assembly, Cover Open	

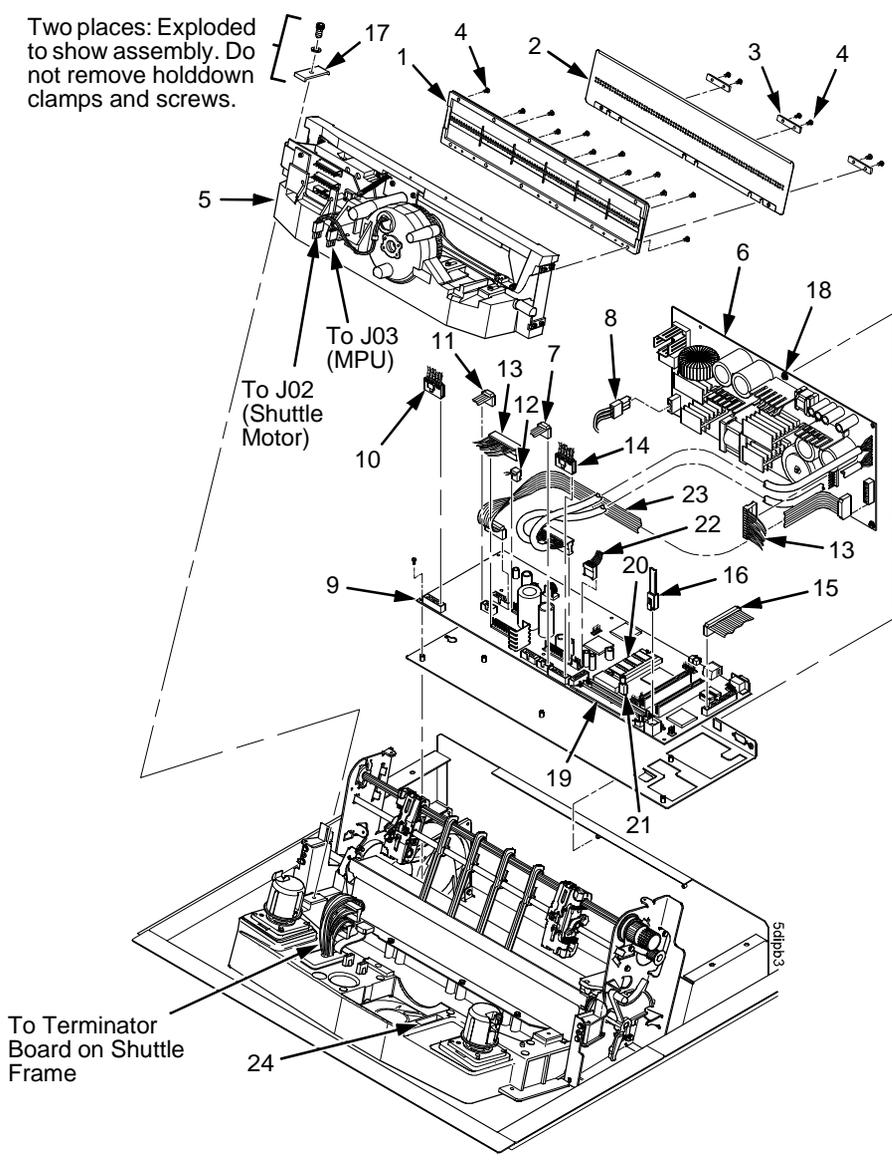


Figure 51. This illustrated parts breakdown shows the shuttle assembly and circuit boards on models 6400-i20 and -i24.

(Figure 51)

Item No.	Part No.	Description	Notes
1	54P1466	Hammer Bank Cover Assembly, i20 and i24	Includes items 3 and 4
2	54P1465	Ribbon Mask, i20 and i24	
3	Ref	Ribbon Mask Clamp Plate (3)	
4	Ref	Screw, Torx T-10	12 for hammer bank cover 6 for ribbon mask
5	54P1472 54P1467	Shuttle Frame Assembly, Spare Hammerspring Assembly, Spare, -i20 and -i24	Model i20 and -i24 Not shown in Figure 51
6	54P1463	Power Supply PCBA	
7	Ref	Hammer Bank Port	
8	Ref	Cable Assembly, AC-In, Power Supply	Part of Field Kit, AC Assy, 14H5289
9	75P2661 75P2814	CFX Controller Board, V3, Spare PCBA, Subassembly, PPC, V3.0, Spare	Model i20 PSA3 controller for model i24
10	14H5288	Connector Kit (P106/P107)	P106, Motor Sensor, Left
11	54P1457	Hammer Bank Logic Cable Assembly	
12	14H5330	Shuttle Drive Cable Assembly	See also page 324.
13	54P1455	Hammer Bank Power Cable Assy	
14	14H5288	Connector Kit (P106/P107)	P107, Motor Sensor, Right
15	14H5287	Centronics I/O Cable Assembly	See also page 307.
16	14H5300	Operator Panel Cable Assembly	See also page 315.
17	14H5211	Clamp, Shaft, Receiving	
18	Ref	Screw, Captive, Power Supply (3 Places)	

Item No.	Part No.	Description	Notes
19	01P6854	SIMM, Flash Memory, 8 MB	Model i20 (See page 381)
	75P2810	SIMM, Flash Memory, 8 MB	Model i24 (See page 383)
20	24H9010	SIMM, DRAM, 2Mx32, 60 NS, 72 Pind FPM, 8 MB	Model i20 (See page 381)
	75P2809	DIMM, SDRAM, 32MB, 144 Pin	Model i24 (See page 383)
21	14H5509	Security Module, Base	Model i20 (See page 381)
	14H5490	Security Module, Graphics	Model i20 (See page 381)
	Ref	Security Key (Comes with emulation)	Model i24 (See page 383)
22	Ref	Paper Feed Motor	
23	54P1456	Phase Driver Control	
24	14H5282	Switch Assembly, Cover Open	

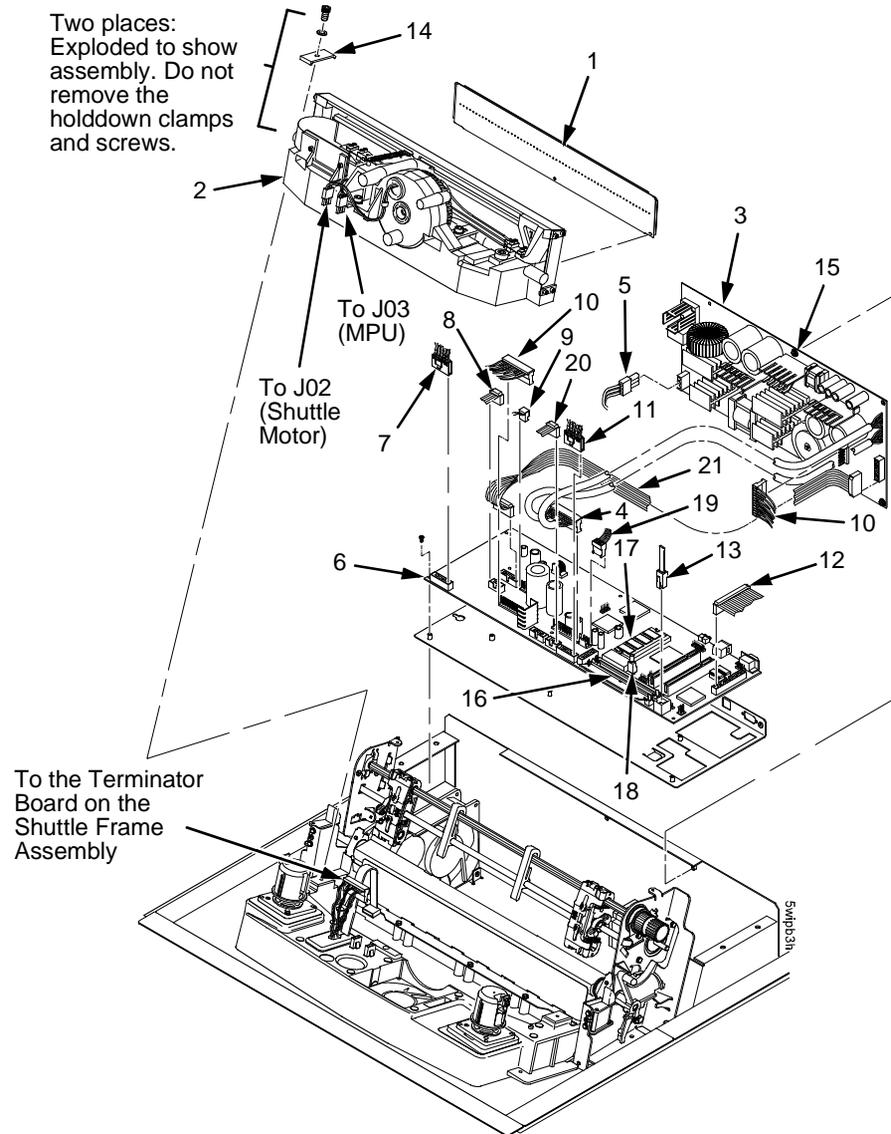


Figure 52. This illustrated parts breakdown shows the shuttle assembly and circuit boards on model 6400-i2s.

(Figure 50)

Item No.	Part No.	Description	Notes
1	75P2816	Ribbon Mask/Hammer Bank Cover Assy, 2000	Model i2s
2	75P2815 75P2817	Shuttle Frame Assembly, 2000, Spare Hammer Spring Field Kit, 2000	Model i2s Model i2s
3	54P1463	Power Supply PCBA	
4	Ref	P101 Cable Connector	Part of item 6
5	Ref	Cable Assy, AC-In, Power Supply	Part of Field Kit AC Assy 14H5289
6	75P2814	PCBA, Subassembly, PPC, V3.0, Spare	PSA3 Controller for model i2s
7	14H5288	Connector Kit (P106/P107)	P106, Motor Sensor, Left
8	75P1623	Hammer Bank Logic Cable Assembly	See also page 318.
9	Ref	Shuttle Drive Cable Assembly	
10	54P1455	Hammer Bank Power Cable Assembly	See also page 320.
11	14H5288	Connector Kit (P106/P107)	P107, Motor Sensor, Right
12	14H5287	Centronics I/O Cable Assembly	See also page 307.
13	14H5300	Control Panel Cable Assembly	See also page 315.
14	14H5211	Clamp, Shaft, Receiving	
15	Ref	Screw, Captive, Power Supply (3)	
16	75P2810	SIMM, Flash Memory, 8 MB	See also page 383.
17	75P2809	DIMM, SDRAM, 32MB, 144 Pin	See also page 383
18	Ref	Security Key (Comes with emulation)	See also page 383
19	Ref	Paper Feed Motor	

Item No.	Part No.	Description	Notes
20	Ref	Hammer Bank Port	
21	Ref	Hammer Phase Driver Control	
22	14H5282	Switch Assembly, Cover Open	

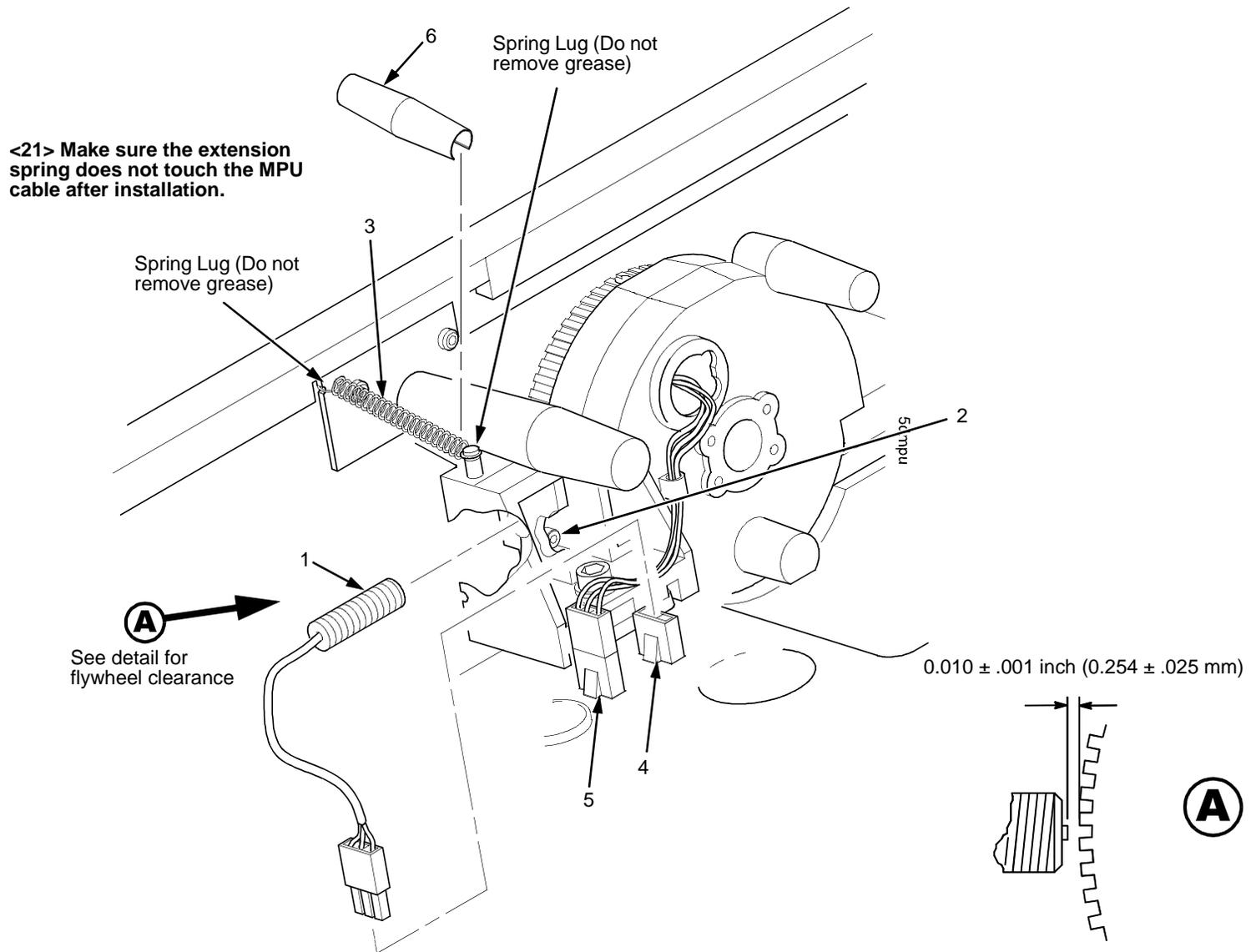
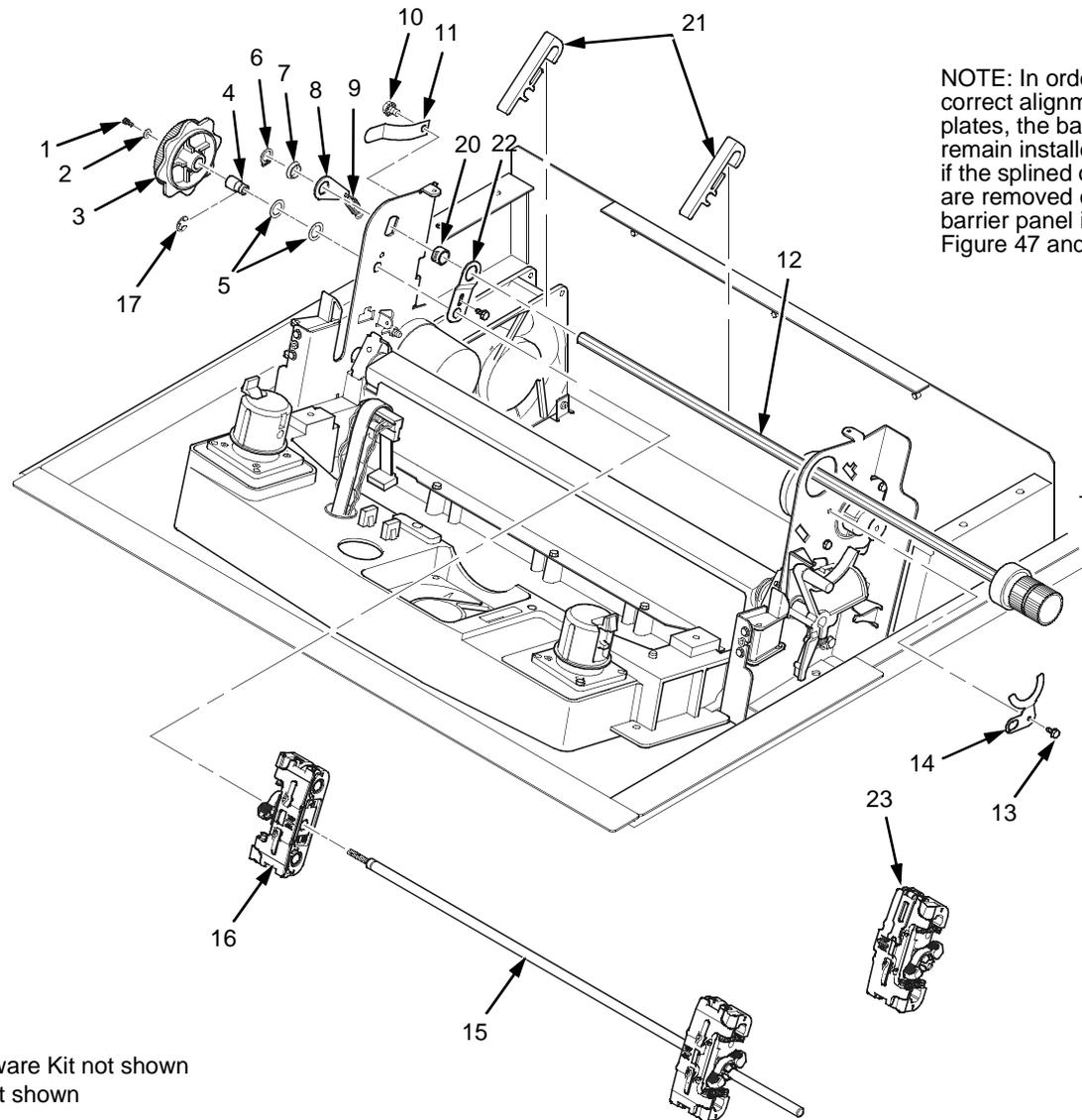


Figure 53. This illustrated parts breakdown shows the magnetic pickup unit (MPU) and extension spring.

(Figure 53)

Item No.	Part No.	Description	Notes
1	57G1476	Magnetic Pickup Assy (MPU)	
2	Ref	Screw, Socket Cap, 6-32x.38	
3	30H3985	Spring, Hammer Bank	
4	14H5329	Cable Assembly, MPU	
5	Ref	Shuttle Motor Cable Connector	
6	176507-001	Anti-Rotation Spring Constraint	Model 6400-i2s only



NOTE: In order to preserve correct alignment of the side plates, the barrier panel must remain installed and fastened if the splined or support shafts are removed or replaced. The barrier panel is shown in Figure 47 and Figure 48.

NOTE
 Item 18: Tractor Shaft Hardware Kit not shown
 Item 19: Tractor Shaft Kit not shown

Figure 54. This illustrated parts breakdown shows the tractor shafts on early 6400-i050, -i10, and -i15 models.

(Figure 54)

Item No.	Part No.	Description	Notes
1	Ref	Screw, Socket Cap, 4-40x.25	Part of item 19
2	Ref	Washer, Flat #4	Part of item 19
3	Ref	Knob, Tractor Adjust	Part of item 19
4	Ref	Bushing, Tractor Adjust	Part of item 19
5	Ref	Washer, Curved Spring (2)	Part of item 19
6	Ref	Ring, Grip	Part of item 18
7	Ref	Bearing, Nylon .626	Part of item 18
8	Ref	Link Spring	Part of item 18
9	Ref	Spring, Extension 1.00L	Part of item 18
10	Ref	Screw, Hex w/Lock Washer, 4-20x.50	Part of item 11
11	57G1521	Ground Clip, Splined Shaft	Early i05, i10, i15 models
12	57G1460	Splined Shaft Assembly	Early i05, i10, i15 models
13	Ref	Screw, Thread Forming, 6-32x.25	Part of item 18
14	Ref	Clamp, Bearing	Part of item 18
15	Ref	Tractor Support Shaft	Part of item 19. Early i05, i10, i15 models.
16	57G1466	Tractor Set	Early i05, i10, i15 models without Power Stacker. Includes L and R tractors. Will sub to 54P1450 at a future date.
17	Ref	E-Ring	Part of item 19
18	14H5217	Tractor Shaft Hardware Kit	Not shown in Figure 54

Item No.	Part No.	Description	Notes
19	14H5214	Tractor Shaft Kit	Not shown in Figure 54
20	Ref	Bushing	Part of item 18
21	24H8593	Paper Support (2)	Used on early and newer i05 and i10 models
22	Ref	Link, Splined Shaft Skew Adjustment	
23	54P1451	Tractor Set, Ironer Roller, LH & RH	Installed at factory on all i10 and i15 models with Power Stacker.

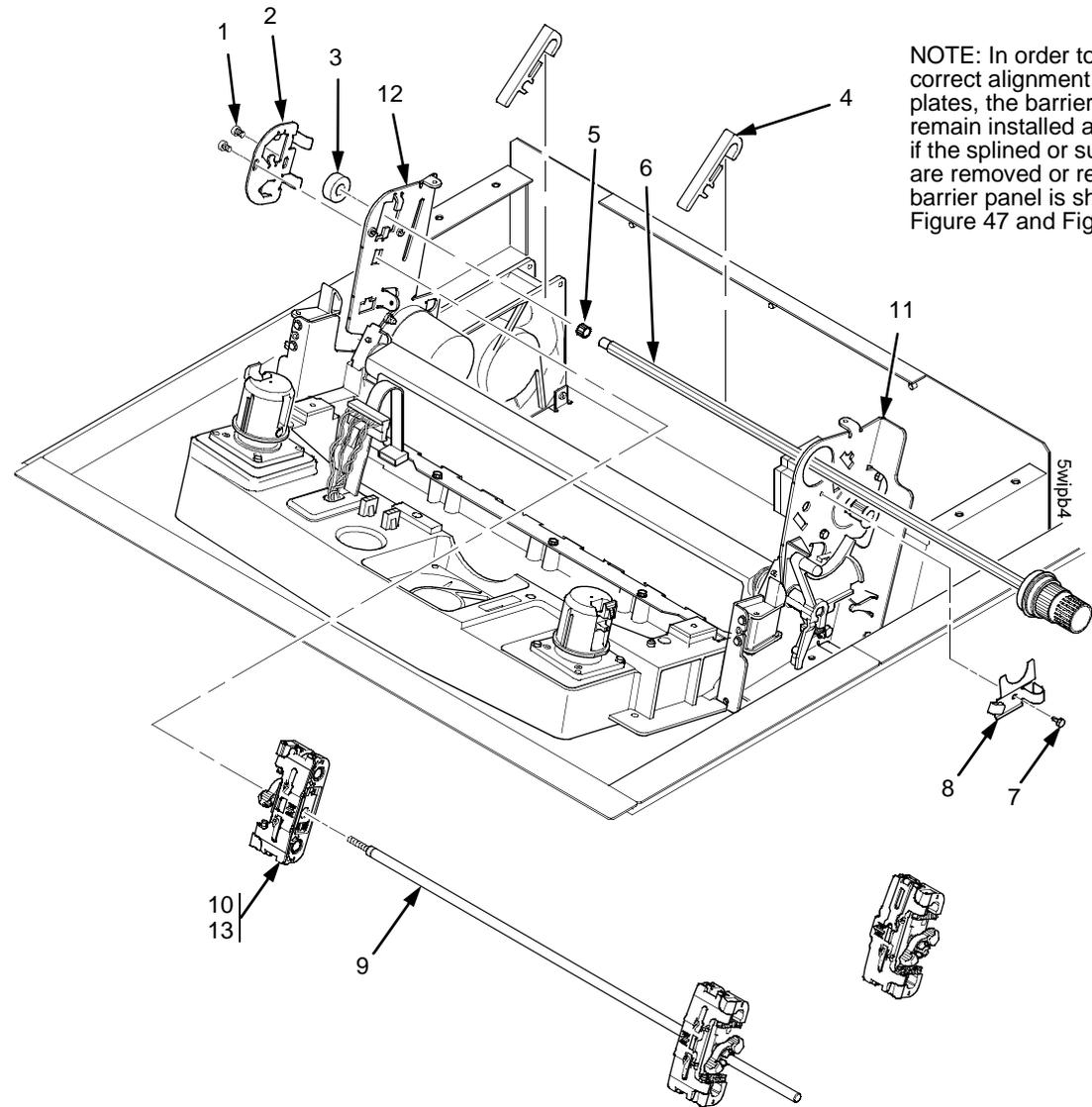


Figure 55. This parts breakdown shows the tractor shafts on newer 6400-i05, -i10, -i15 models, and on 6400-i20, -i24, and -i2s models.

(Figure 55)

Item No.	Part No.	Description	Notes
1	Ref	Screw, Socket Cap, 6-32x.312 Trilob (Self-Tapping) (2)	
2	Ref	Plate, Tractor Shaft, Left	
3	54P1474	Bearing, Ball, Sealed	Models i20, i24, i2s, and newer i05, i10, i15
4	54P1459 24H8593	Guide, Paper Path (4) Paper Support (2)	Models i20, i24, i2s, and newer i05, i10, i15
5	54P1475	Tolerance Ring,.37X.25,.006 THK,SS	Models i20, i24, i2s, and newer i05, i10, i15
6	54P1468	Splined Shaft	Models i20, i24, i2s, and newer i05, i10, i15
7	Ref	Screw, Socket Cap, 6-32x.312 Trilob (Self-Tapping)	
8	Ref	Plate, Tractor Shaft, Right	
9	57P1181	Support Shaft	Models i20, i24, i2s, and newer i05, i10, i15
10	54P1451 57G1466	Tractor Set, Ironer Roller Tractor Set	Models i20, i24, i2s with or without power stacker. Includes L&R tractors. Newer i05, i10, i15 without Power Stacker. Includes L&R tractors. Will sub to 54P1450 in future.
11	Ref	Right Side Plate	
12	Ref	Left Side Plate	

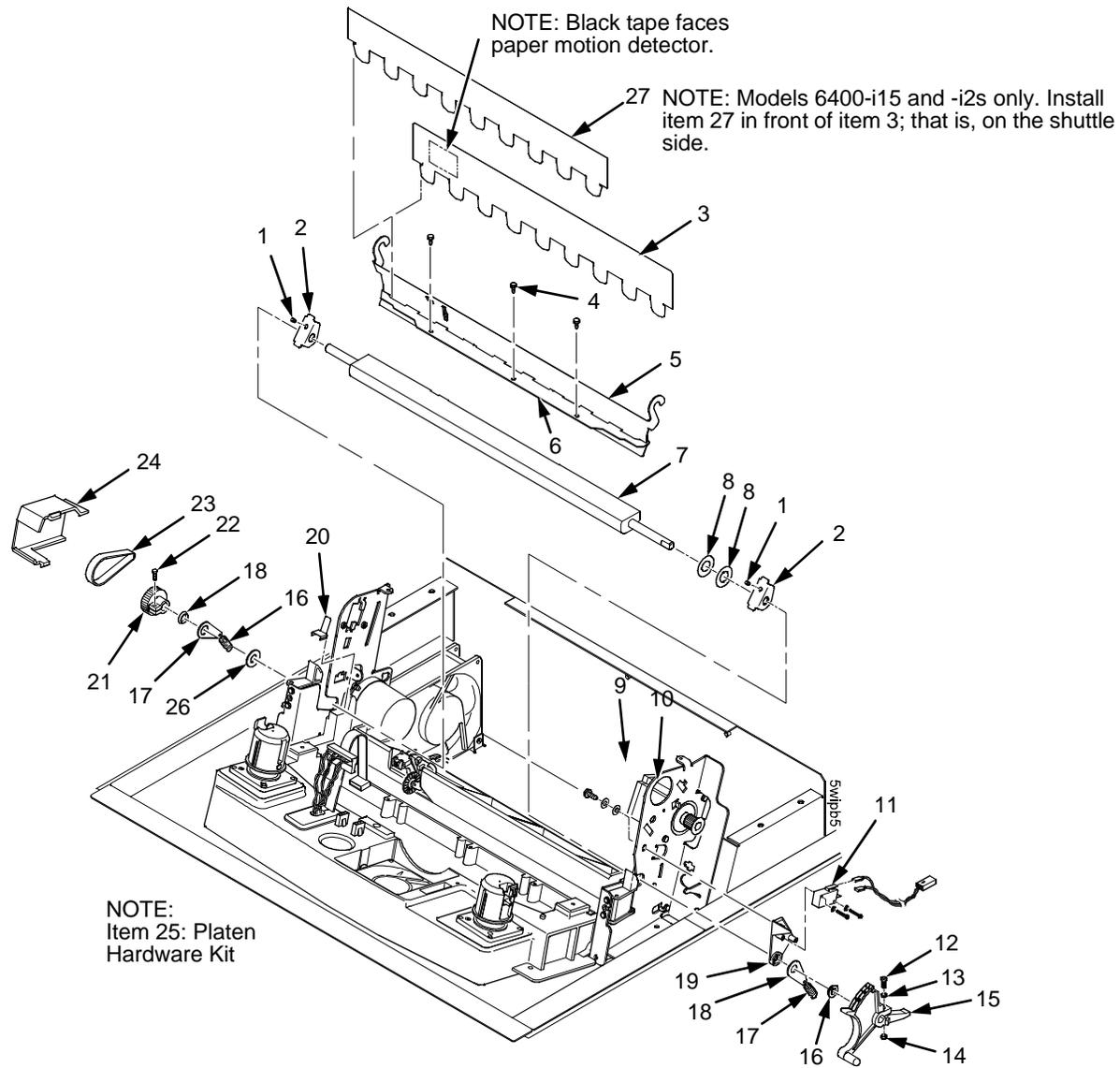


Figure 56. This illustrated parts breakdown shows the platen on all models except the 6400-i20 and -i24.

(Figure 56)

Item No.	Part No.	Description	Notes
1	Ref	Setscrew	Part of item 25
2	Ref	Bracket, Platen (2)	Part of item 25
3	57G1469	Ironer Assembly, Reverse Paper Feed	
4	Ref	Screw, Thread Forming (3)	6-32x.25
5	54P1476	Ironer Bracket/Plate Field Kit	
6	Ref	Plate, Ironer	Part of item 5
7	08H7936	Platen Assembly	
8	Ref	Washer, Flat (2)	Part of item 25
9	Ref	Screw (2)	Part of item 11
10	Ref	Washer, Flat #4 (2)	Part of item 11
11	14H5280	Platen Switch Kit	Platen Interlock Switch
12	Ref	Screw, Socket Cap, 6-32x.75	Part of item 15
13	Ref	Washer	Part of item 15
14	Ref	Nut	Part of item 15
15	75P8170	Platen Lever Assembly	
16	Ref	Spring, Extension 1.12L	Part of item 25
17	Ref	Link, Spring	Part of item 25
18	Ref	Bearing, Nylon .376	Part of item 25
19	Ref	Bracket, Switch Mount	Part of item 11
20	Ref	Wear Saddle, Platen (2)	Part of item 25

Item No.	Part No.	Description	Notes
21	57G1514	Platen Pulley, Driven	
22	Ref	Screw, Socket Cap, 6-32x.44	Part of item 21
23	57G1467	Belt, Timing, 312W, 87 Teeth	Platen Open Belt
24	54P1379	Platen/Paper Feed Cover Kit	Platen open belt cover shown in Figure 56. Paper feed belt cover: page 447, item 7.
25	14H5169	Platen Hardware Kit	
26	Ref	Platen Washer	Part of item 25
27	75P8169	Paper Ironer, Auxiliary	On models 6400-i15 and -i2s only, install this part in front of item 3; that is, on the shuttle side

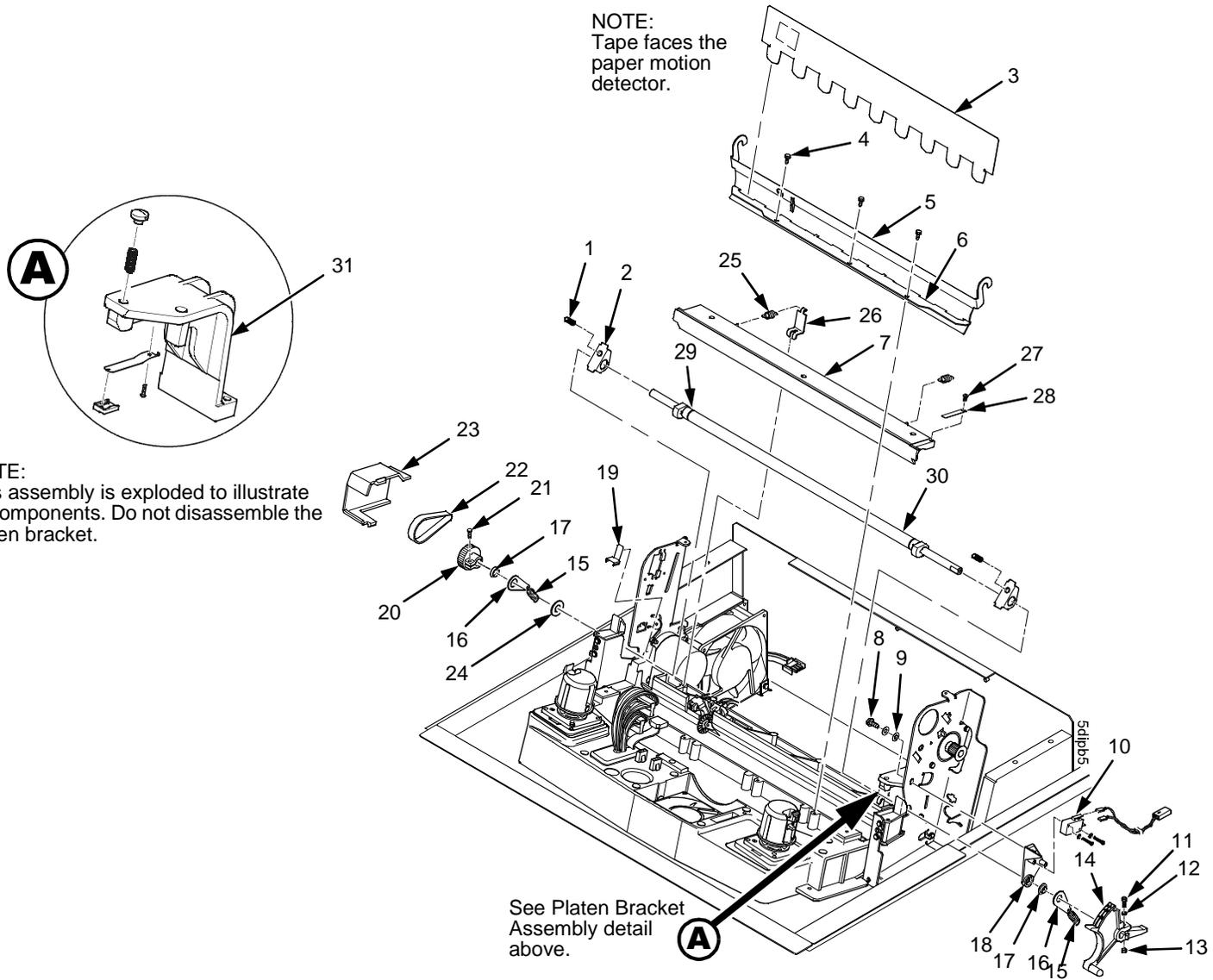


Figure 57. This illustrated parts breakdown shows the platen on model 6400-i20 and -i24.

(Figure 57)

Item No.	Part No.	Description	Notes
1	Ref	Setscrew (2)	Part of item 30
2	Ref	Bracket, Platen Adjust (2)	Part of item 30
3	57G1469	Ironer, Paper	
4	Ref	Screw, Thread-forming (3)	6-32x.313 Trilob
5	54P1476	Ironer Bracket/Plate Field Kit	
6	Ref	Plate, Ironer	Part of item 5
7	54P1477	Platen	Includes items 25, 26, 27, and 28
8	Ref	Screw (2)	Part of item 10
9	Ref	Washer, Flat #4 (2)	Part of item 10
10	14H5280	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	75P8170	Platen Lever Assembly	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	Ref	Wear Saddle, Platen (2)	Part of item 30
20	Ref	Platen Drive Pulley	

Item No.	Part No.	Description	Notes
21	Ref	Screw, Socket Cap, 6-32x44	
22	57G1467	Belt, Timing, .080 Pitch, .312 Wide	Platen Open Belt
23	Ref	Cover, Platen Belt	Part of platen/paper feed cover kit 54P1379
24	Ref	Platen Washer	
25	Ref	Platen Spring (2)	Part of item 7
26	Ref	Anchor, Platen Spring (2)	Part of item 7
27	Ref	Screw, Button Head, 6-32x.25	Part of item 7
28	Ref	Shim, Platen Adjust Wear	Part of item 7
29	Ref	Bearing, Roller, Platen Shaft (2)	
30	57P1473	Camshaft Kit	Includes items 1, 2, and 19
31	75P2177	Platen Bracket Kit	

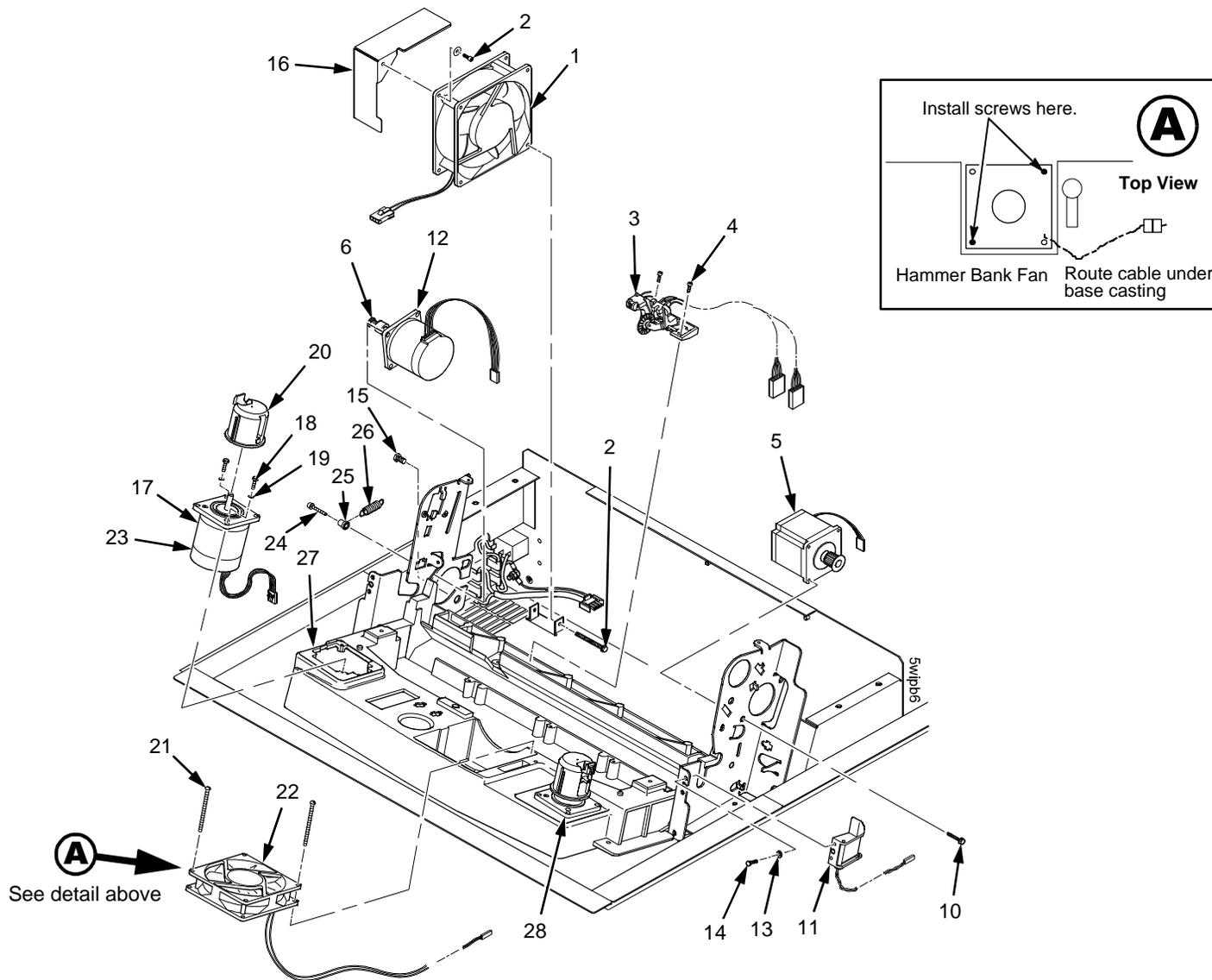


Figure 58. This illustrated parts breakdown shows the motors, cooling fans, and the paper detector switch.

(Figure 58)

Item No.	Part No.	Description	Notes
1	57G1440	Fan Assembly	Air flow is into card cage
2	Ref	Screw, w/Lock Washer (3)	Two 6-32x1.75 on botton One 6-32x0.50 on top left
3	14H5281 02N7169	Paper Detector Switch Assy Paper Detector Switch Assy	Standard switch Black Back forms
4	Ref	Screw, Thread Forming, 6-32x.375 (2)	
5	14H5520 54P1462	Paper Feed Motor Assy, Models i05, i10, and i15 Paper Feed Motor Assy, Model i20, i24, and i2s	Model i2s only: Re-use the original heat sink. Install it on the motor base and torque the mounting screws to 18 inch-pounds (2.03 N•m). (The heat sink is not shown in Figure 58.)
6	Ref	Motor Pulley, Platen Open, Driver	
7	Ref	Deleted	
8	Ref	Deleted	
9	Ref	Deleted	
10	Ref	Screw, Hex w/Lock Washer (2)	10-32x.50
11	24H8894	Ribbon Guide Kit	Includes left and right ribbon guides
12	54P1453	Platen Open Motor Assembly	Includes item 6
13	Ref	Washer, Flat #4 (2)	
14	Ref	Screw, Hex w/Lock Washer (2)	4-40x.38
15	Ref	Screw, Hex w/Lock Washer (2)	10-32x.50
16	Ref	Shield, Card Cage Fan	

Item No.	Part No.	Description	Notes
17	14H5521	Motor Assembly, Ribbon	
18	Ref	Screw, Hex w/Lock Washer (2)	6-32x.50
19	Ref	Washer, Flat #6 (2)	
20	75P1180 54P1452 75P1480	Ribbon Hub Kit, i50, i10, i15 Ribbon Hub Kit, i20 and i24 Ribbon Hub Kit, i2s	
21	Ref	Screw, w/Lock Washer (2)	6-32x1.25
22	14H5159 54P1454	Hammer Bank Fan Assembly, i05, i10, i15 Hammer Bank Fan Assembly, i20, i24, i2s	Air flow is up. Air flow is up.
23	Ref	Boot	Cabinet models only
24	Ref	Screw, Socket Cap, 10-24x.75	
25	Ref	Post, Platen Belt Spring	
26	Ref	Spring, Platen Belt	
27	Ref	Shim, Ribbon Motor, Left	Thin shim
28	Ref	Shim, Ribbon Motor, Right	Thick shim

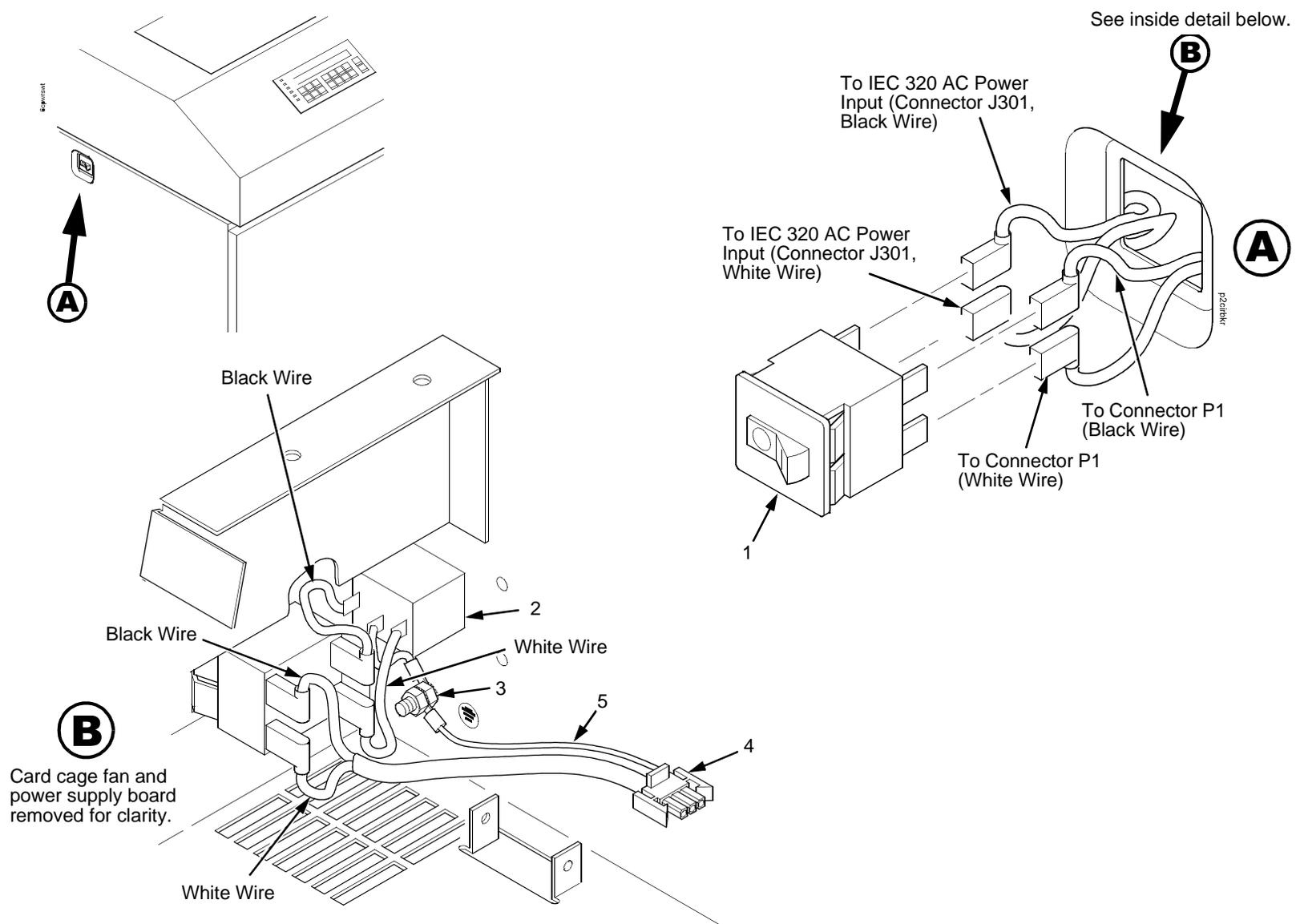


Figure 59. This illustrated parts breakdown shows the circuit breaker in cabinet models.

(Figure 59)

Item No.	Part No.	Description	Notes
1	14H5571	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 Assy, AC-In, Power Supply	Part of Field Kit, AC Assy 14H5289

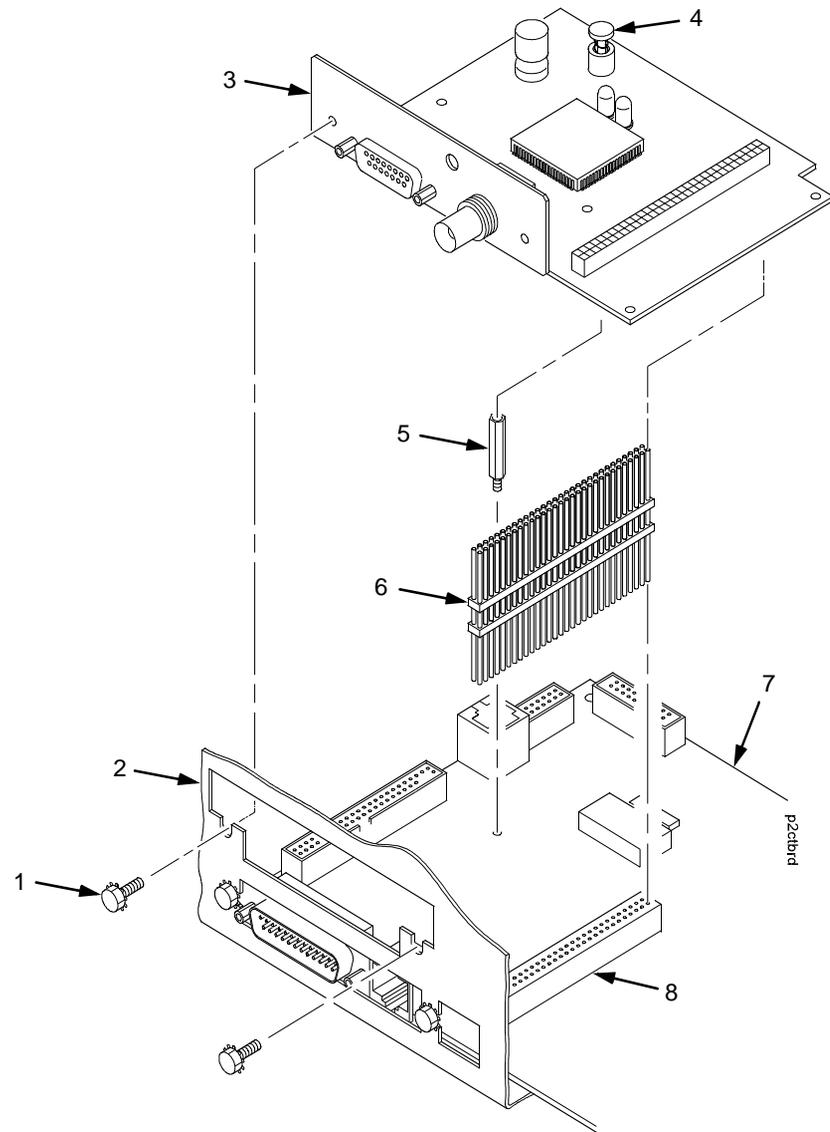


Figure 60. This illustrated parts breakdown shows the IBM coax/twinax expansion board for CMX/CFX controllers.

(Figure 60)

Item No.	Part No.	Description	Notes
1	Ref	Screw (2)	
2	Ref	Card Cage	
3	24H9011	IBM Coax/Twinax Expansion	
4	Ref	Screw, Captive	
5	Ref	Standoff, Hex, 3/16 inch	M/F, .813 Lg.
6	24H8535	Adapter, Expansion Connector	60-pin
7	Ref	Controller Board	
8	Ref	Controller Board Connector J111	

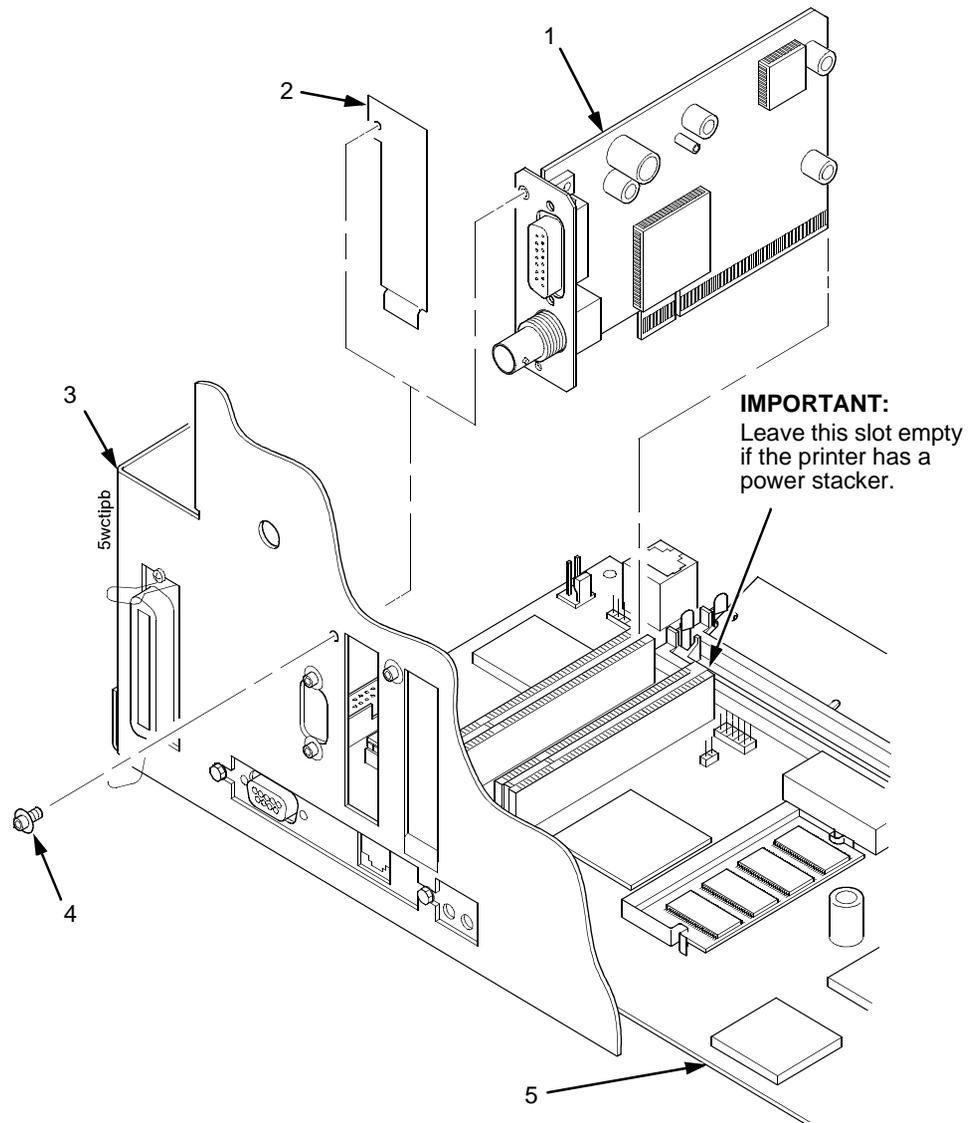


Figure 61. This illustrated parts breakdown shows the IBM coax/twinax expansion board for PSA3 controllers.

(Figure 61)

Item No.	Part No.	Description	Notes
1	75P2811	PCBA, PCI-CT, V2	
2	Ref	Plate, PCI Cover	
3	Ref	Card Cage	
4	Ref	Screw	
5	Ref	Controller Board	

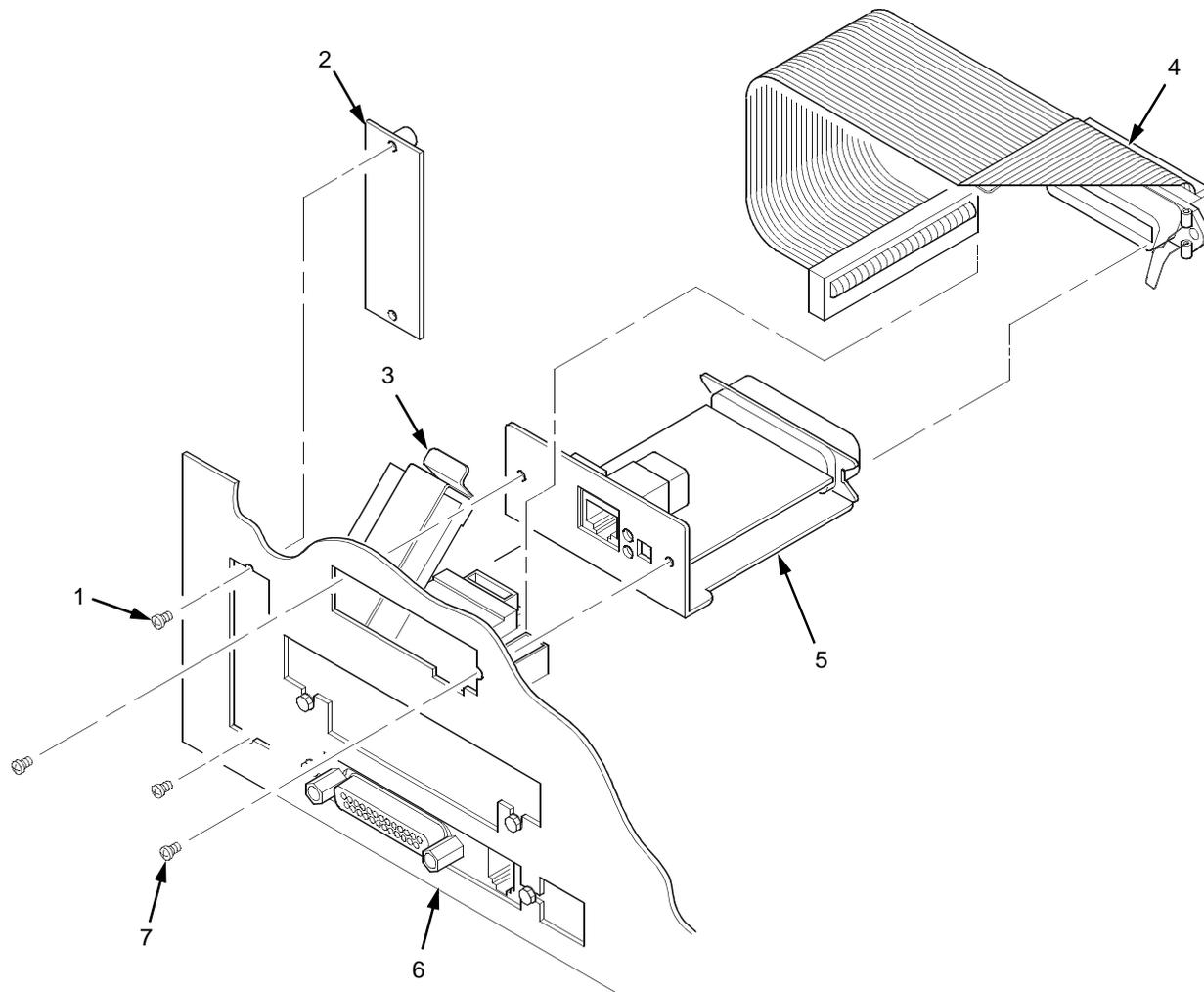


Figure 62. This illustrated parts breakdown shows the ethernet interface assembly for printers with CMX/CFX controllers.

(Figure 62)

Item No.	Part No.	Description	Notes
1	Ref	Screw, Connector Cover (2)	
2	Ref	Cover Plate, Centronics	
3	Ref	Ferrite Clamp	Used on CMX/CFX controller boards only. See also Appendix I
4	14H5287	Centronics I/O Cable Assembly	
5	01P8301	Ethernet LAN PCBA, 10/100Base-T	
6	Ref	Rear of Card Cage	
7	Ref	Screw (2)	

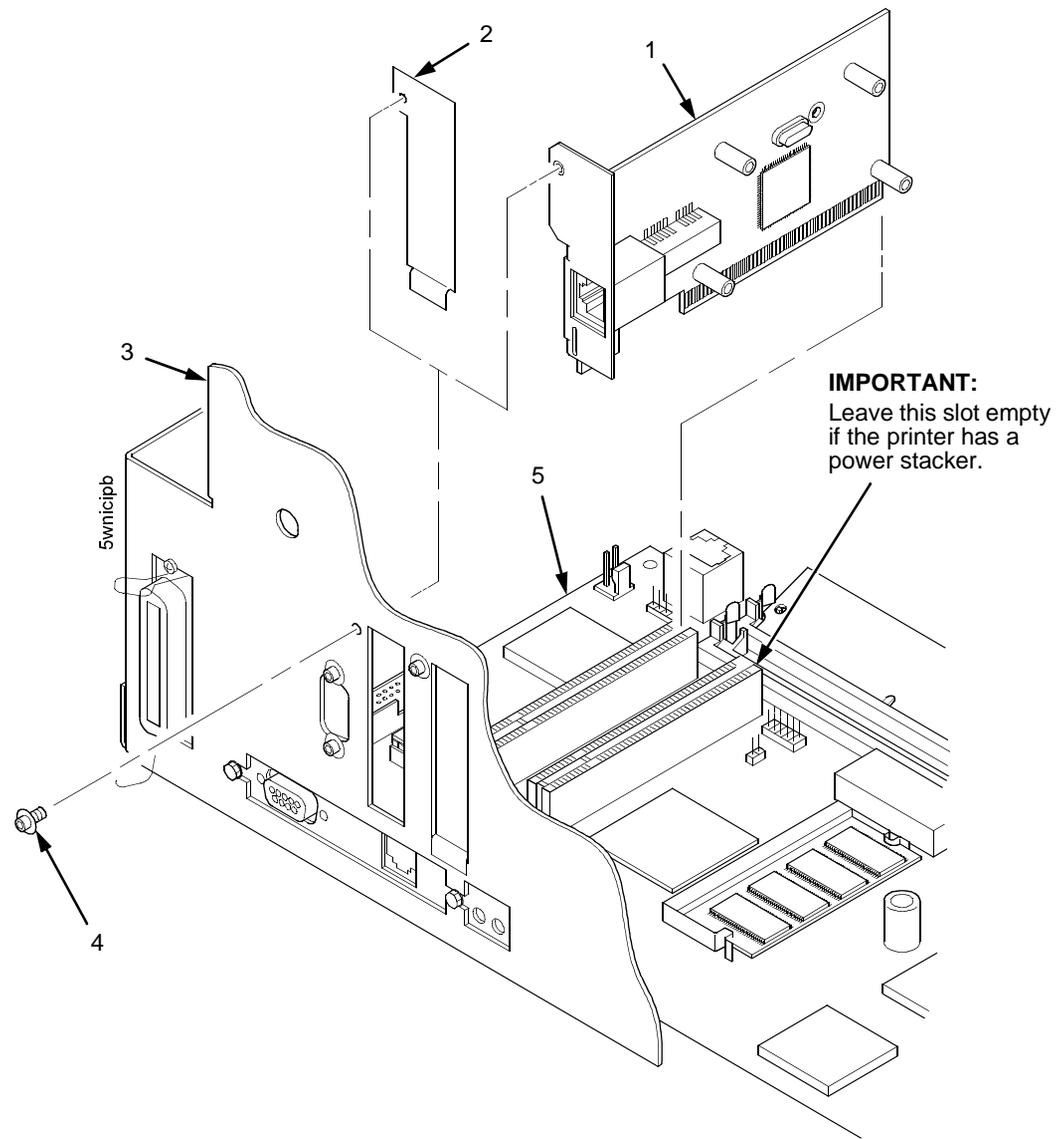


Figure 63. This illustrated parts breakdown shows the ethernet interface assembly for printers with PSA3 controllers.

(Figure 63)

Item No.	Part No.	Description	Notes
1	75P2812	PCBA, PCI-NETWORK	
2	Ref	Plate, PCI Cover	
3	Ref	Rear of Card Cage	
4	Ref	Screw	
5	Ref	Controller Board	

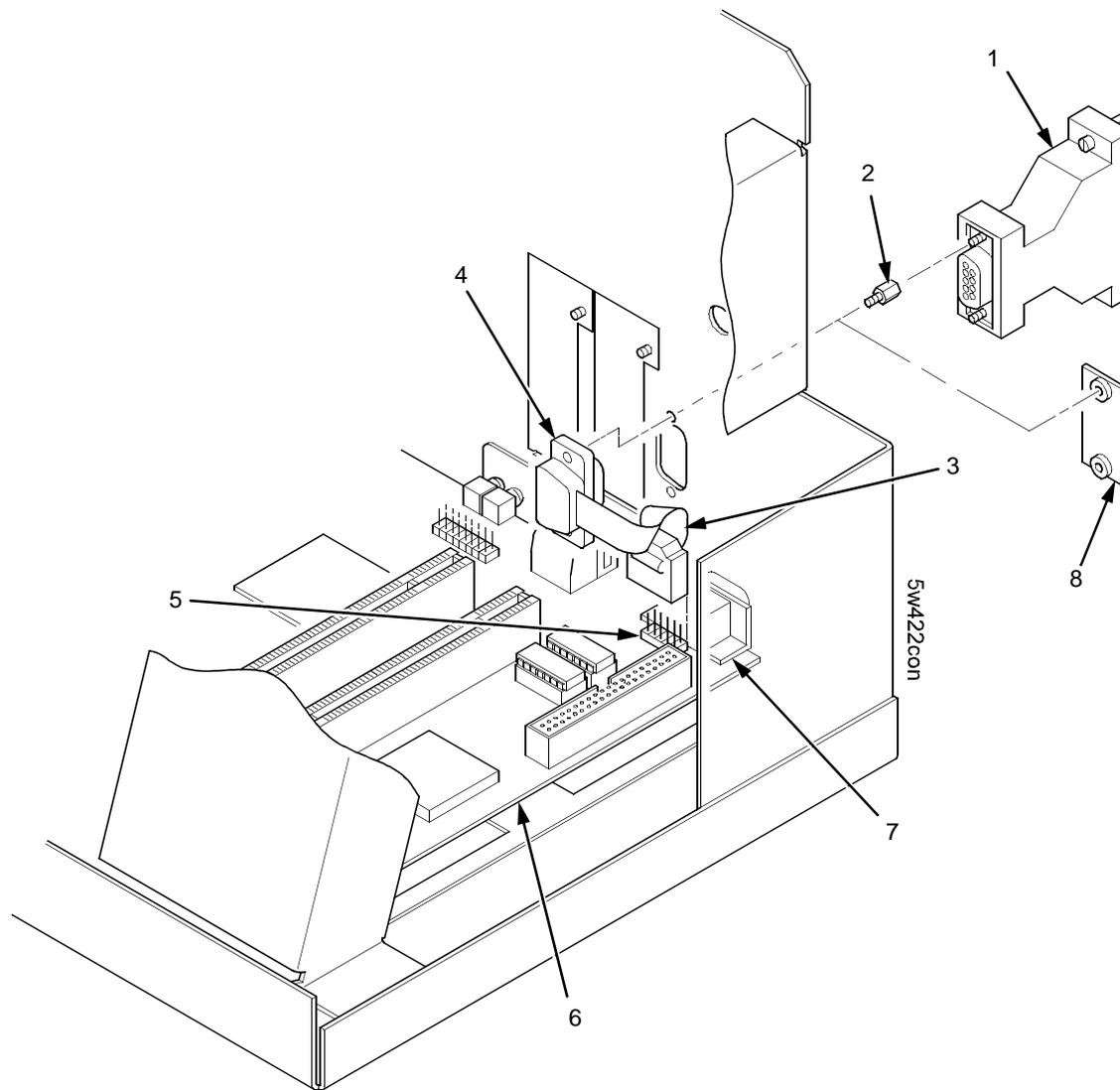


Figure 64. This illustrated parts breakdown shows the RS-422 interface for printers with the PSA3 controller.

(Figure 64)

Item No.	Part No.	Description	Notes
1	75P1621	PCBA, RS422 ADAPTER, DB9/DB25	
2	Ref	Screw	
3	75P1625	Cable Assembly, RS-422, I/O	
4	Ref	RS-422 Connector, 9-Pin	
5	Ref	Connector J15	
6	Ref	Controller Board	
7	Ref	Connector J201, RS-232, 9-Pin	
8	Ref	Cover Plate	

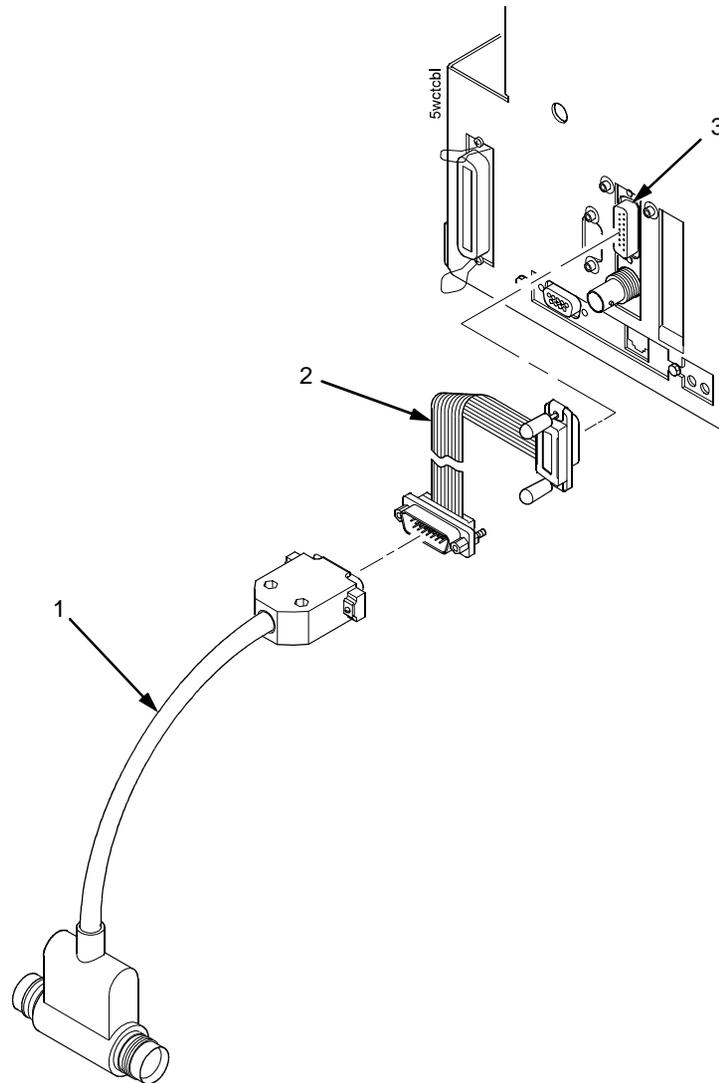


Figure 65. This illustrated parts breakdown shows the twinax extension cable required if the printer has a PSA3 controller, uses the twinax interface, and has the power stacker.

(Figure 65)

Item No.	Part No.	Description	Notes
1	38F8254	Twinax Auto-Termination Cable ("Smart-T")	
2	75P2813	Cable, Extension, Smart-T	Required in printers with the power stacker so the twinax auto-termination cable will clear the stacker elevator.
3	Ref	PCI-CT Twinax Connector	

7

Preventive Maintenance

Contents

Cleaning The Printer	page 493
Cleaning The Exterior	page 493
Cleaning The Interior.....	page 494
Cleaning The Shuttle Frame Assembly.....	page 495
Cleaning The Card Cage Fan Assembly.....	page 497

Cleaning The Printer

Aside from normal replenishment of paper and ribbons, the only preventive maintenance required for the printer is periodic cleaning.

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

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



<2> **Switch off printer power and unplug the printer power cord before cleaning the printer.**

ATTENTION

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 circuit boards.

Cleaning The Exterior

1. Power off the printer.
2. Disconnect the AC power cord from the power source.
3. Wipe the outside of the enclosure with a clean, lint-free cloth dampened (not wet) with water and a mild detergent or window cleaning solution.
4. Dry the enclosure with a clean, lint-free cloth.
5. Clean the inside of the printer, as described below.

Cleaning The Interior

1. Power off the printer.
2. Disconnect the AC power cord from the power source.
3. Open the printer cover.
4. Remove paper from the printer.
5. Remove the ribbon.
6. Using a soft-bristled, non-metallic brush, wipe paper dust and ribbon lint off the tractors, shuttle cover assembly, base casting, and ribbon guides. Vacuum up the residue. (See Figure 66.)
7. Wipe the splined shaft and the ribbon guides with a soft cloth.
8. Vacuum up dust or residue that has accumulated inside the lower cabinet.
9. Wipe the interior of the lower cabinet with a clean, lint-free cloth dampened with water and a mild detergent or window cleaning solution.
10. Dry the cabinet interior with a clean, lint-free cloth.
11. Clean the shuttle frame assembly, as described below.

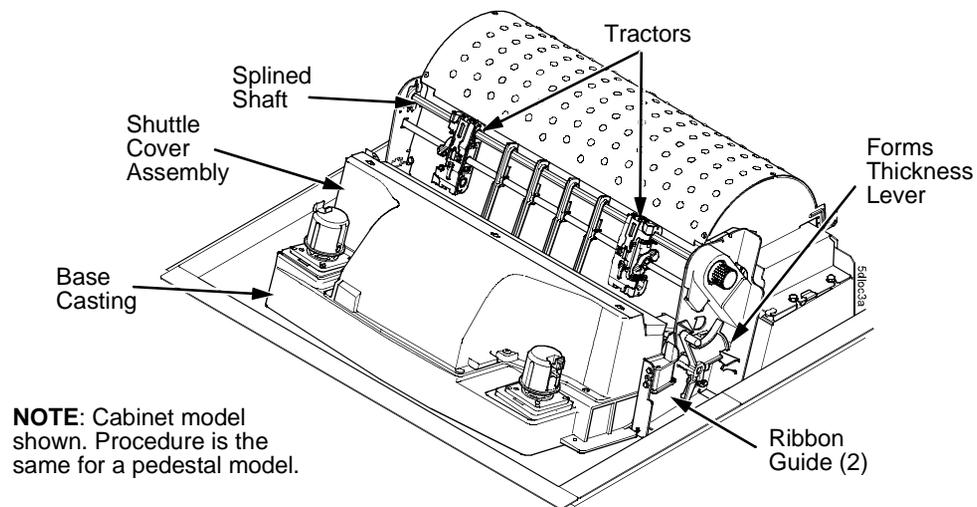


Figure 66. This figure shows where to clean inside the cabinet or top cover.

Cleaning The Shuttle Frame Assembly

1. Remove the shuttle cover assembly (page 357).
2. Remove the shuttle frame assembly (page 405).
3. Remove the paper ironer (page 392).



<2> **Over time the upper edge of the paper ironer can become sharp. To avoid cutting yourself, always handle the paper ironer on the sides.**

4. Wipe the paper ironer with a soft cloth to remove lint, ink, and paper residue.
5. Install the paper ironer (page 392).
6. Remove the hammer bank / ribbon mask cover assembly (page 354).

ATTENTION

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

7. Using a clean soft cloth, wipe the hammer bank cover and ribbon mask to remove lint, ink, and paper residue. Clean the holes in the cover strips. Carefully wipe between the hammer bank cover and the ribbon mask (early models).

ATTENTION

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

8. Using a stiff, non-metallic brush (such as a toothbrush), gently brush the hammer tips to remove lint and ink accumulations. (See Figure 67.) Vacuum up any residue.

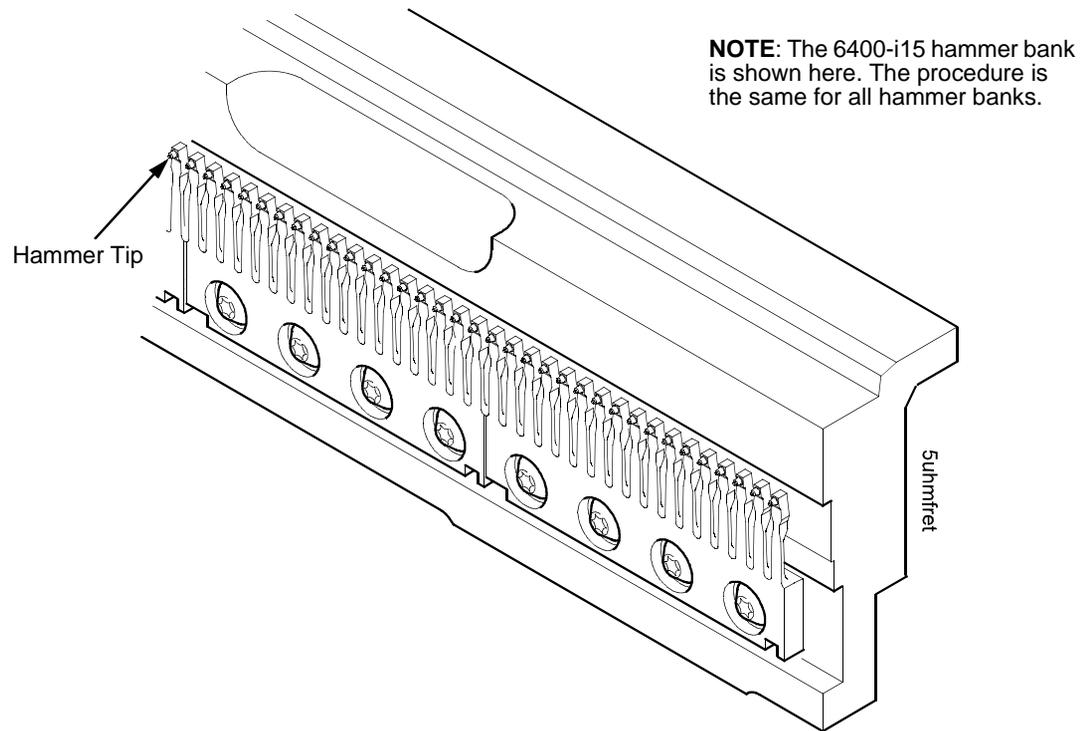


Figure 67. This figure shows a hammer tip for cleaning.

ATTENTION

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

9. Install the hammer bank / ribbon mask cover assembly (page 354).
10. Install the shuttle frame assembly (page 405).
11. Install the shuttle cover assembly (page 357).
12. Clean the card cage fan assembly, as described on the next page.

Cleaning The Card Cage Fan Assembly

1. Cabinet Models: Remove the paper guide assembly (page 391).
Pedestal Model: Remove the top cover assembly (page 358).
2. Vacuum the card cage fan assembly and surrounding areas to remove paper particles, dust, and lint. (See Figure 68.)
3. Cabinet Models: Install the paper guide assembly (page 391).
Pedestal Model: Install the top cover assembly (page 358).
4. Close the printer cover.
5. Connect the AC power cord to the power source.

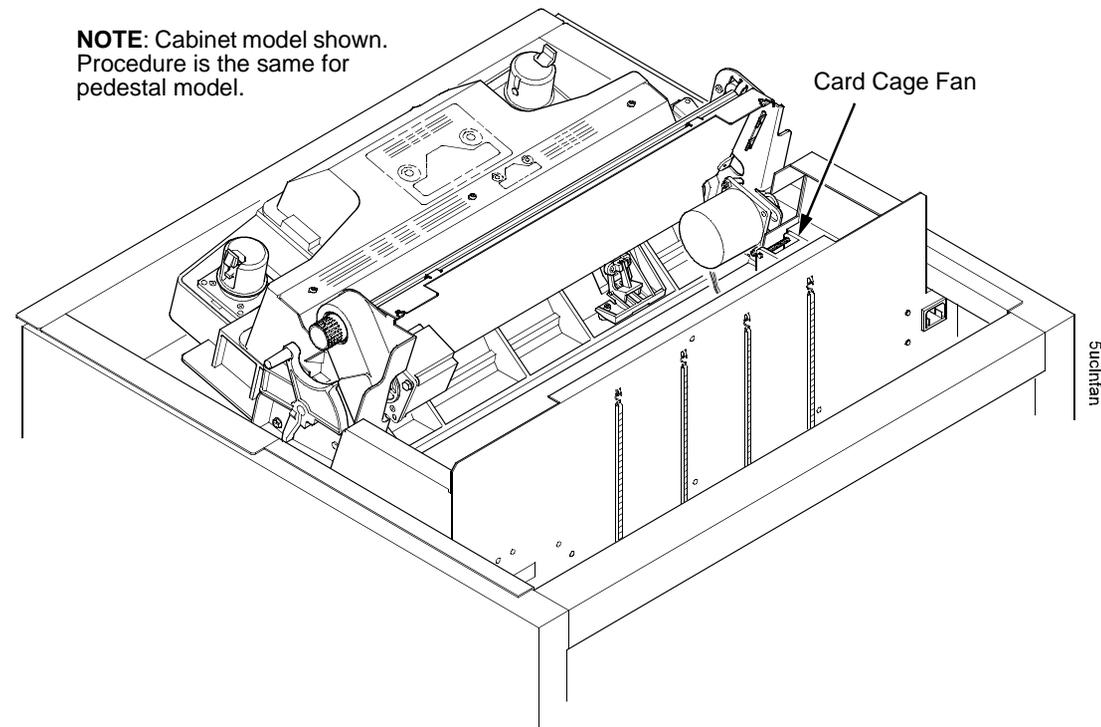


Figure 68. This figure points out the card cage fan assembly for cleaning.

A

Installing And Relocating The Printer

Installing And Configuring The IBM 6400i Printer

Installation and configuration of the printer are covered in the *6400i Line Matrix Printer Set-Up Guide*, Form No. S544-5640.

Installation, operation, and replacement parts for the optional coax/twinax interface are covered in the *Coax/Twinax Multi-Platform Interface Option Installation and Operation Guide*, Form No. S246-0149.

Installation, configuration, and troubleshooting of the Network Print Server are covered in three documents:

- *IBM Network Print Server Ethernet Administrator's Guide*, Form No. S246-0111
- *IBM Network Print Server Token-Ring Administrator's Guide*, Form No. S246-0112
- The *Network Print Server Technical Reference Manual* is included on a diskette that comes with the Network Print Server. This "softcopy" document is in Adobe** Acrobat** Reader format.

Installation, configuration, and troubleshooting of the 10/100Base-T Network Interface Card is covered in the *Ethernet Interface User's Manual*, Form No. S544-5830.

Relocating The IBM 6400i Printer

Kits containing shipping and packing material are available for cabinet and pedestal model printers. These kits are detailed in Figure 43 (page 438) and Figure 46 (page 444).

B

Communication Adapters

Contents

Ethernet Interface Assemblies	page 500
10/100Base-T LEDs And DIP Switches For CMX and CFX Controller Boards	page 500
Ethernet Troubleshooting Tips	page 503
IBM Coax/Twinax Expansion Board.....	page 506

Ethernet Interface Assemblies

The ethernet LAN option is a 10/100Base-T network interface card (NIC) that can be installed at the factory or ordered as a field kit. The NIC used on printers with a PSA3 controller plugs directly into a PCI slot on the controller board. This NIC does not have LEDs or DIP switches. (See Figure 63 on page 486.)

The NIC used on printers with a CMX or CFX controller board attaches to the controller board by means of the Centronics interface cable. (See Figure 62 on page 484.) This NIC has two indicator lights and two DIP switches, as shown and described in the next section.

NOTE: To remove and install the ethernet interface, see page 361. To convert the printer from an ethernet back to a parallel interface, remove the NIC from its I/O slot and install the Centronics connector that formerly plugged into the rear of the NIC into the slot.

10/100Base-T LEDs And DIP Switches For CMX/CFX Controller Boards

This section describes the LEDs and DIP switches found on the NIC used in printers with a CMX or CFX controller board. (The NIC used on printers with a PSA3 controller board has no LEDs or DIP switches.)

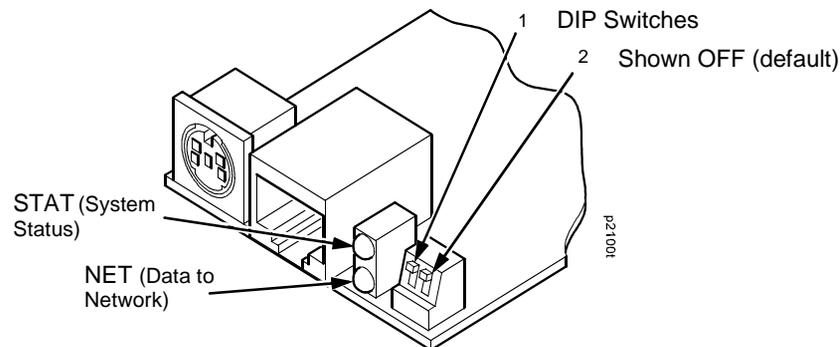


Figure 69. This figure shows the LEDs and DIP switches on older 10/100 Base-T ethernet cards.

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

1. When an IP address is configured into the printer at the control panel, the NET (bottom) LED should be blinking on and off at the same rate.
2. When a working network cable is installed, the STAT (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 the network interface 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 STAT (top) LED will be off and the NET (bottom) LED will blink on/off.

The 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 (top) LED flashes at a varying rate, depending on whether the unit IP address is configured, as shown in Table 8.

Table 8. STAT LED

STAT LED	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 (bottom) LED displays the status of the network link:

Table 9. NET LED

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

DIP Switches

Two DIP switches, labeled 1 and 2, are mounted on the 10/100Base-T interface inside the printer. The functions of these switches are explained below.

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

DIP Switch		Description
1	2	
UP (off)	UP (off)	Normal operation. The interface boots up using the settings in flash memory rather than the default settings.
DOWN (on)	UP (off)	Factory default settings. The interface boots up and all settings stored in flash memory are erased except the ethernet address and key value.
UP (off)	DOWN (on)	Default IP. The interface boots up with factory default settings, but the stored settings in flash memory remain intact. Setting 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.
DOWN (on)	DOWN (on)	If the interface is connected to a network with link integrity and then reset to MOS, a download will be forced. If the unit is not connected to a network, it will print a test page.

Ethernet Troubleshooting Tips

Tip 1: 6400 IPDS Communication Failure

Problem: the customer can “ping” the printer but cannot print to it from an IPDS host, or under certain conditions IPDS is disabled even though the customer can “ping” the printer.

Due to enhancements in the latest microcode update, the ethernet card may need to be reset. Do the following:

1. Power on the printer.
2. Telnet into the printer.
3. Type the following: `list pserver` and press the Enter key.
 - a. A bad printer says `d4prn for port 5001`.
 - b. A good printer says `dipdsprn for port 5001`.
4. Type `list dest` and press the Enter key.
 - a. A bad printer has “-” next to `d4prn`.
 - b. A good printer has `prn` next to `dipdsprn`.
5. For a bad printer, type `store pserver from default` and press the Enter key.
6. Type `reset` and press the Enter key. The printer should drop the telnet connection.

Tip 2: Ethernet Port Not Enabled, PMU Not Communicating

Problem: if the ethernet port is not enabled, under the Debug menu the following message will occur when trying 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 PMU to establish communication with the ethernet card.

1. Power on the printer.
2. Wait for “READY / ETHERNET ADAPTER IS READY” to display on the LCD.
3. If the **Ready** indicator is on, press the **Stop** key. The printer must be in the NOT READY state to do this procedure.
4. Press **Scroll** ↑ + **Scroll** ↓ + **Return** + **Enter**. (Press all four keys at the same time.)
“SERVICE / PRINTER MECHANISM TESTS” appears on the display.

5. Press **Scroll** ↑ + **Scroll** ↓ to unlock the **Enter** key.
6. Press the **Scroll** ↑ or **Scroll** ↓ key until “SERVICE / PRINTER MGMT” appears on the display.
7. Press **Enter**. “PRINTER MGMT / DIAGNOSTIC PORT” appears on the display.
8. Press **Enter**. “DIAGNOSTIC PORT” (and the current diagnostic port setting) appears on the display. If the current setting is “DEBUG ETHERNET*”, go to step 11.
9. Press **Scroll** ↑ until “DIAGNOSTIC PORT / DEBUG ETHERNET” appears on the display.
10. Press **Enter**. An asterisk (*) appears next to the selection, indicating it is now the diagnostic port.
11. Press **Scroll** ↑ + **Scroll** ↓ to lock the **Enter** key.
12. Press **Stop** to exit the menu and put the printer in the NOT READY state.
13. Power off the printer, wait a few seconds, then power on the printer to activate the new diagnostic port.

Tip 3: Ethernet Communications Problem (NIC Is Installed)

Problem: Any communications failure or problem on models 6400-050, -P50, -010, -P10, and -015 with the NIC installed.

The problem is most likely in the network interface card (NIC) itself. Try the following as an action plan:

1. Power on the printer and try to enter the SERVICE menu by pressing **Scroll** ↑ + **Scroll** ↓ + **Return** + **Enter** at the same time. Press **Scroll** ↑ + **Scroll** ↓ to unlock the **Enter** key. Now scroll to the UPGRADE NETWORK ADAPTER menu and press **Enter**. This should force a load of the Network Card Microcode.
2. If step 1 did not solve the problem, power off the printer and set Switch 1 on the ethernet card to the ON (down) position. Power on the printer and wait several minutes. This should reset the NIC to default values. Then power off the printer and return the switch to the OFF (up) position.
3. If the preceding steps did not solve the problem, replace the NIC.

Tip 4: Connecting Laptop to Printer via Ethernet Port for Diagnosing Communication Problems

Problem: An increasing need to test 6400 ethernet printers for communications problems. This process also pertains to Printronix P5000 printers.

NOTE: If you support the 2710 printers using this ethernet port, write down the IP address information before you make any changes. This will ensure that you can re-enter the address information when you are done. You must write this information down because there is no way to set up a second ethernet connection.

1. Obtain an ethernet cross-over cable from a computer or electronics shop, or order one using IBM P/N 09J7206.
2. Power up the laptop and open a command prompt.
3. At the prompt, change directories to the following location: C:\WINNT\system32

NOTE: If you do not have the socks.cnf file on your laptop, skip step 4. You can find out by typing `dir socks.cnf` at the command prompt. If you do have the file, do step 4.

4. Rename the socks.cnf file to socks.old by typing the following at the C:\WINNT\system32 prompt:
`ren socks.cnf socks.old`
Press the Enter key.
 5. Click on START/SETTINGS/NETWORK AND DIALUP CONNECTIONS.
 6. Right click on Local area connection for the ethernet port.
 7. Click on properties in the pop-up window.
 - a. Select the Internet Protocol (TCP/IP) option.
 - b. Click on the Properties button.
 - c. Select the "use the following IP address" bullet.
 8. Enter the IP address of the printer plus or minus 1 in the last numeric octet.
Example: if the printer's IP address is 192.078.067.192, enter 192.078.067.193
 9. Enter the subnet mask address of the printer.
 10. Enter the default gateway address of the printer.
 11. Click on OK.
 12. Verify the IP address in the printer is correct by printing an ethernet test page.
 13. Connect the cross-over cable from the laptop to the printer.
 14. Reboot the laptop, then the printer.
 15. Make the printer READY.
 16. Open a command prompt on the laptop.
 17. Ping the printer by typing the following and press Enter:
`ping xxx.xxx.xxx.xxx`
where xxx.xxx.xxx.xxx = IP address of the printer
- NOTE:** Do not enter the zeroes (0) in the IP address when pinging. Example: 192.78.67.192
18. If you get a reply of request timed out, reboot the printer and try again. If you still get the timed out error, refer to the ethernet User's Guide for further diagnostics, or call your DDS for assistance.
 19. Disconnect the laptop, change directories back to the C:\WINNT\system32 directory, and rename the socks.old file back to socks.cnf.
 20. Reboot the laptop and all should be back to normal.

Tip 5: Telnet to the Printer

Only do this procedure after you have successfully pinged the NIC by following the steps in Tip 4 above.

1. At the command prompt, type the following:

```
telnet xxx.xxx.xxx.xxx
```

where xxx.xxx.xxx.xxx is the IP address of the printer.

You should get a logon request. If not, reset the NIC in accordance with the NIC *User's Guide*.

If you get a logon request, refer to the NIC *User's Guide* for the userid and password.

2. Logon to the NIC using the proper userid and password.

For 6400 and 4400 NIC's, there is no password; you only have use the userid `root`.

For the 4247-003 and V03, userid = `root`, password = `pass`

3. If steps 1 and 2 are successful, you have verified that communication is established and the NIC is working.

IBM Coax/Twinax Expansion Board

This is the CT interface. To remove and install this board, see page 377.

C

Power Cords And Adapters

Part Number	Description
1332167	Line Cord, IBM, Japan
1838573	Line Cord, IBM, 12 Feet, United States, 220 Volt
1838574	Line Cord, 220V 6 Feet Non-Lock, United States, Canada
6952299	Power Cord, 110V 12 Feet Non-Lock, United States, Canada, Brazil, Cayman Islands, Costa Rica, Dominican Republic, El Salvador, Guatemala, Mexico, Liberia, Panama, Saudi Arabia, Phillipines, Honduras, Peru, Columbia, Nicaragua, Bermuda, Bahamas, Barbados, Bolivia, Guyana, Ecuador, Haiti, Jamaica, Venezuela, Netherlands, Antilles, Trinidad, Suriname, Taiwan, Tobago, Saint Lucia, Indonesia
8509386	Cable, PC RS-232, IBM
08H7968	Coax Adapter Cable for use with Multi-Platform Interface
13F9941	Line Cord, IBM, Australia
13F9980	Line Cord, IBM, Europe (EMEA)
13F9998	Line Cord, IBM, Denmark
14F0016	Line Cord, IBM, Pakistan, South Africa
14F0034	Line Cord, IBM, India, United Kingdom
14F0052	Line Cord, IBM, Switzerland
14F0070	Line Cord, IBM, Chile, Italy
14F0088	Line Cord, 9 Feet, Israel
14H5301	Line Cord, 6400, 12 Foot, United States, 125 Volt

Part Number	Description
14H5303	Line Cord, 6400, 8 Foot, Chicago
14H5305	Line Cord, 6400, 12 Foot, United States, 220 Volt
14H5309	Line Cord, 6400, Denmark
14H5311	Line Cord, 6400, Israel
14H5313	Line Cord, 6400, Chile, Italy
14H5315	Line Cord, 6400, Switzerland
14H5317	Line Cord, 6400, India, United Kingdom
14H5319	Line Cord, 6400, Europe (EMEA)
14H5321	Line Cord, 6400, Pakistan, South Africa
14H5323	Line Cord, 6400, Australia
14H5325	Line Cord, 6400, Japan
14H5335	Twinax Auto-Termination Cable (47 Inches)
14H5541	DP Adapter, 6400
21F4342	Cable, AS/400*, RS-232, IBM
38F8254	Twinax Auto-Termination Cable
54P1399	Power Cord, IEC 320, Twist-Locking 10 Amp, 14 Feet
57G7261	Power Cord, 6 Feet, Non-Lock, United States, Canada, 110 Volt
58F2861	Conn, Cable, RISC System/6000*, IBM
63H7362	Cable, RISC System/6000
63H7364	Cable, AS/400, RS-232
63H7366	Cable, PC Parallel
63H7368	Cable, PC RS-232

Part Number	Description
63H7456	LAN Power Coupling
92F3176	Cable, PC Parallel, IBM
13F9940	Power Cord, China, Detach
57G7260	Power Cord, 125V, 10A, 8 ft.

D

ASCII Codes

Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex
NUL	0	00	DLE	16	10		32	20	0	48	30
SOH	1	01	DC1	17	11	!	33	21	1	49	31
STX	2	02	DC2	18	12	+	34	22	2	50	32
EXT	3	03	DC3	19	13	#	35	23	3	51	33
EOT	4	04	DC4	20	14	\$	36	24	4	52	34
ENQ	5	05	NAK	21	15	%	37	25	5	53	35
ACK	6	06	SYN	22	16	&	38	26	6	54	36
BEL	7	07	ETB	23	17	+	39	27	7	55	37
BS	8	08	CAN	24	18	(	40	28	8	56	38
HT	9	09	EM	25	19	)	41	29	9	57	39
LF	10	0A	SUB	26	1A	*	42	2A	:	58	3A
VT	11	0B	ESC	27	1B	+	43	2B	;	59	3B
FF	12	0C	FS	28	1C	,	44	2C	<	60	3C
CR	13	0D	GS	29	1D	-	45	2D	=	61	3D
SO	14	0E	RS	30	1E	.	46	2E	>	62	3E
SI	15	0F	US	31	1F	/	47	2F	?	63	3F

Appendix D

Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex
@	64	40	V	86	56	l	108	6C	é	130	82
A	65	41	W	87	57	m	109	6D	â	131	83
B	66	42	X	88	58	n	110	6E	ä	132	84
C	67	43	Y	89	59	o	111	6F	à	133	85
D	68	44	Z	90	5A	p	112	70	á	134	86
E	69	45	[	91	5B	q	113	71	ç	135	87
F	70	46	\	92	5C	r	114	72	ê	136	88
G	71	47	]	93	5D	s	115	73	ë	137	89
H	72	48	^	94	5E	t	116	74	è	138	8A
I	73	49	_	95	5F	u	117	75	ï	139	8B
J	74	4A	`	96	60	v	118	76	î	140	8C
K	75	4B	a	97	61	w	119	77	ì	141	8D
L	76	4C	b	98	62	x	120	78	Ë	142	8E
M	77	4D	c	99	63	y	121	79	Ï	143	8F
N	78	4E	d	100	64	z	122	7A	É	144	90
O	79	4F	e	101	65	{	123	7B	æ	145	91
P	80	50	f	102	66	|	124	7C	Æ	146	92
Q	81	51	g	103	67	}	125	7D	ô	147	93
R	82	52	h	104	68	~	126	7E	ö	148	94
S	83	53	i	105	69		127	7F	ò	149	95
T	84	54	j	106	6A	Ç	128	80	û	150	96
U	85	55	k	107	6B	ü	129	81	ù	151	97

Appendix D

Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex
ÿ	152	98		174	AE		196	C4		218	DA
Ö	153	99		175	AF		197	C5		219	DB
Ü	154	9A		176	B0	_	198	C6		220	DC
°	155	9B		177	B1	+	199	C7		221	DD
£	156	9C	@	178	B2		200	C8	+	222	DE
+	157	9D	#	179	B3		201	C9		223	DF
x	158	9E		180	B4		202	CA	+	224	E0
_	159	9F	+	181	B5		203	CB	_	225	E1
á	160	A0	+	182	B6		204	CC	+	226	E2
í	161	A1	+	183	B7		205	CD	+	227	E3
ó	162	A2	_	184	B8		206	CE	_	228	E4
ú	163	A3	1	185	B9		207	CF	+	229	E5
ñ	164	A4		186	BA	_	208	D0		230	E6
Ñ	165	A5	»	187	BB	+	209	D1	•	231	E7
ª	166	A6		188	BC	+	210	D2	_	232	E8
_	167	A7	¢	189	BD	+	211	D3	+	233	E9
¿	168	A8	¥	190	BE	+	212	D4	_	234	EA
«	169	A9		191	BF		213	D5	+	235	EB
	170	AA		192	C0	_	214	D6	_	236	EC
1/2	171	AB		193	C1	+	215	D7	_	237	ED
1/4	172	AC		194	C2	+	216	D8		238	EE
ï	173	AD		195	C3		217	D9		239	EF

Appendix D

Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex
	240	F0		244	F4	°	248	F8		252	FC
_	241	F1		245	F5	¿	249	F9		253	FD
	242	F2	_	246	F6	!	250	FA		254	FE
3/4	243	F3		247	F7		251	FB		255	FF

NOTE: For the hardware handshake XON/XOFF commands:
XON = Ctrl Q (DC1)
XOFF = Ctrl S (DC3)

E

SureStak™ Power Stacker

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Introduction

The SureStak** Power Stacker is a factory-installed option for cabinet model printers that mechanically directs the paper from the print area to the paper stack. The power stacker is mounted in the rear of the cabinet and has its own operator panel. It is designed to work with 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 power stacker can handle forms from 3 to 16 inches (76 to 406 mm) wide with no paper tent in the pull-out tray, and from 3 to 15.5 inches (76 to 394 mm) wide with the paper tent installed in the pull-out tray.

IMPORTANT Access to the stacker assembly is restricted within the cabinet. You must remove the stacker assembly from the printer to service it.

This appendix has three sections:

- How to identify and operate the Type III power stacker.
- Removal/installation instructions for the entire 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.

How To Identify And Operate The Type III Power Stacker

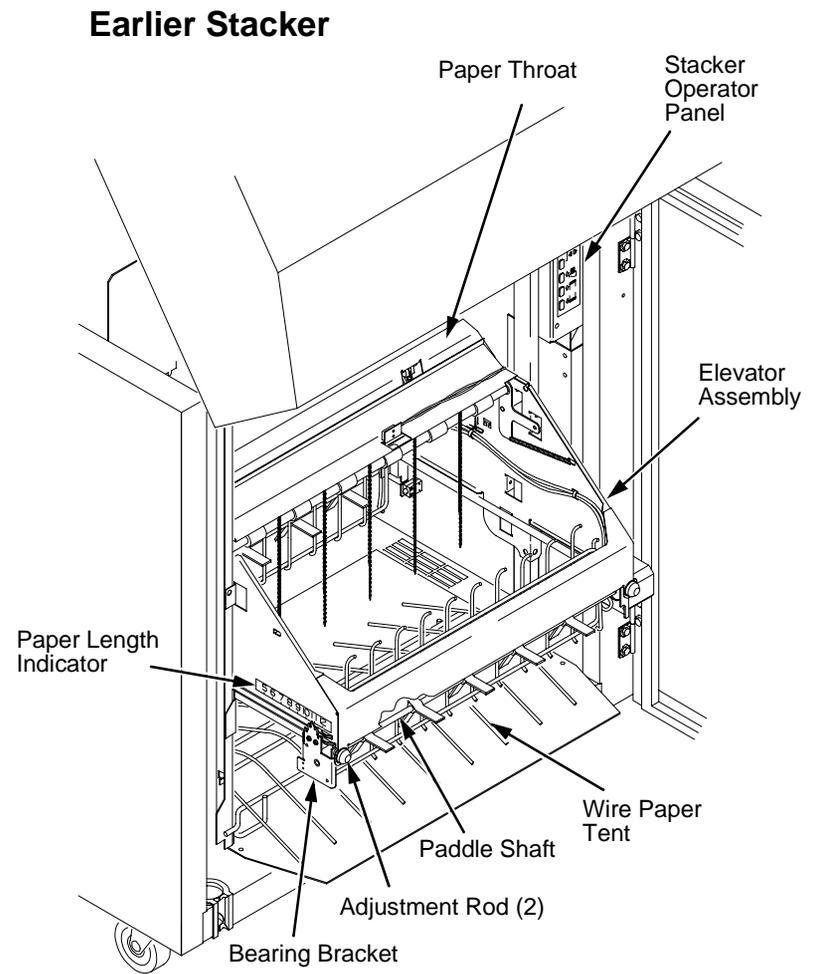
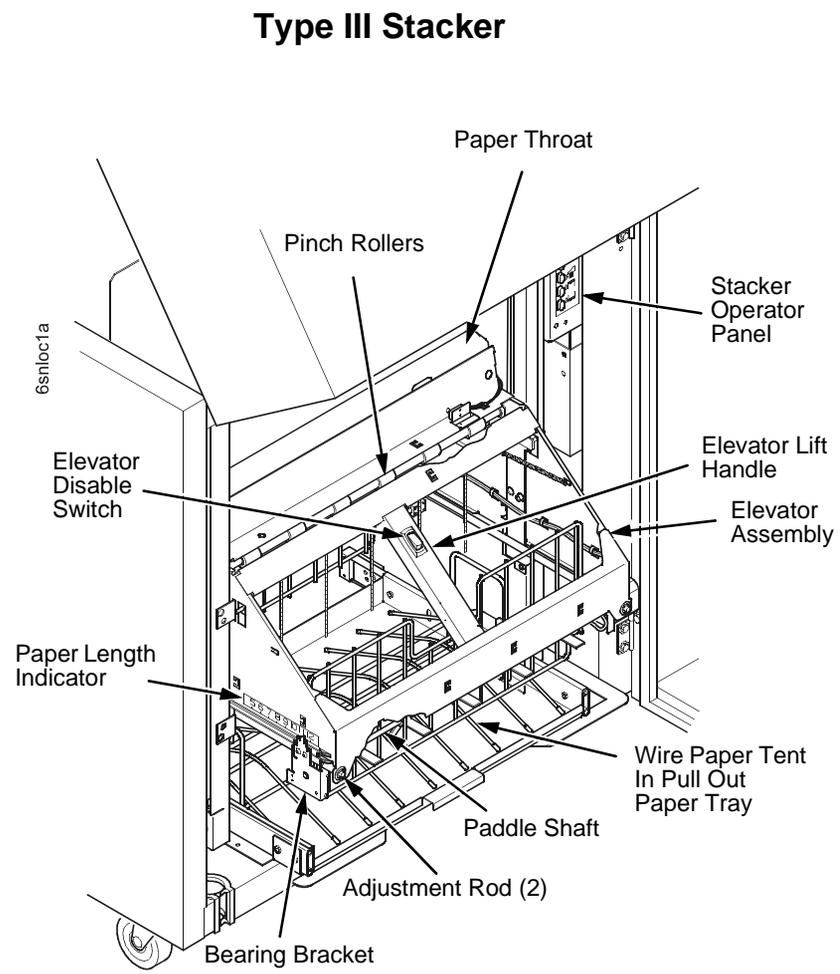
IBM 6400-i model printers use the Type III power stacker, which differs from earlier models. This section explains how to distinguish the Type III stacker from earlier models and how to operate the power stacker.

Component Locations

Figure 70 shows the locations of the principal components of the power stacker on both Type III and earlier stackers.

If you have a Type III stacker, use the instructions in this chapter.

If you have an earlier stacker, refer to the service information for the model printer you are working on. We also recommend that you contact your DDS and Second Level Support.



NOTE: Earlier stackers do not have the elevator lift handle, the elevator disable switch, or the pull out paper tray. Note also the different paper fences in the elevator.

Figure 70. This figure shows the locations of the main parts of the power stacker.

Stacker Operator Panel

The stacker operator panel is behind the rear door of the cabinet. (Figure 71.)

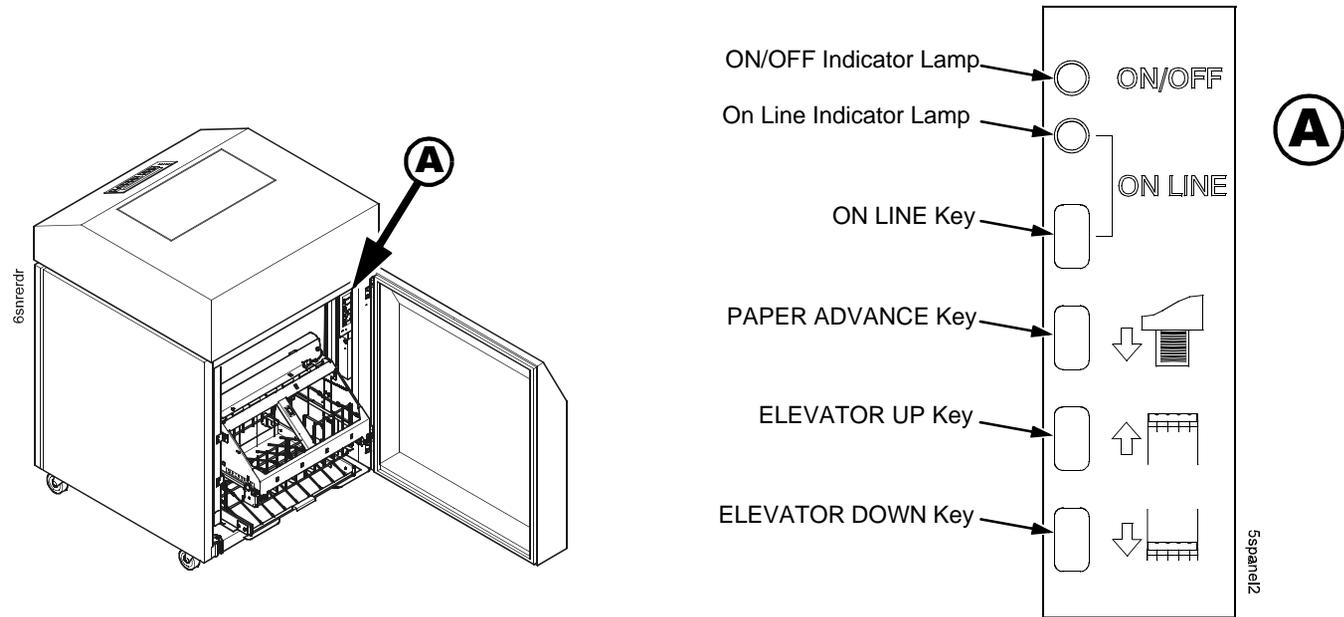


Figure 71. This figure shows the location of the power stacker operator panel and the keys on the operator panel.

- **ON/OFF Indicator Lamp**—Lit when printer power is on. Unlit when printer power is off.
- **ON LINE Indicator Lamp**—Lit when printer is online to host computer. Unlit when printer is offline.
- **ON LINE Key**—Toggles the printer between the online and offline states. Functionally, it is identical to the ONLINE key on the front operator panel.
- **PAPER ADVANCE Key**—Moves paper one form length as defined by the currently active form length. This key is active only when the printer is offline.
- **ELEVATOR UP Key**—Moves the elevator to its highest position. This key is active only when the printer is offline.
- **ELEVATOR DOWN Key**—Moves the elevator to its lowest position. This key is active only when the printer is offline.

Using The Power Stacker

1. Set the printer power switch to | (On).
2. Open the rear door of the cabinet.
3. On the stacker operator panel, press **ON LINE** to take the printer offline. (Figure 71.)
4. Press the **ELEVATOR UP** key and wait for the stacker to reach the top of its travel. (Figure 71.)
5. Make sure the wire paper tent is in the base of the stacker with the alignment rods against the vertical rails. (Figure 72.)

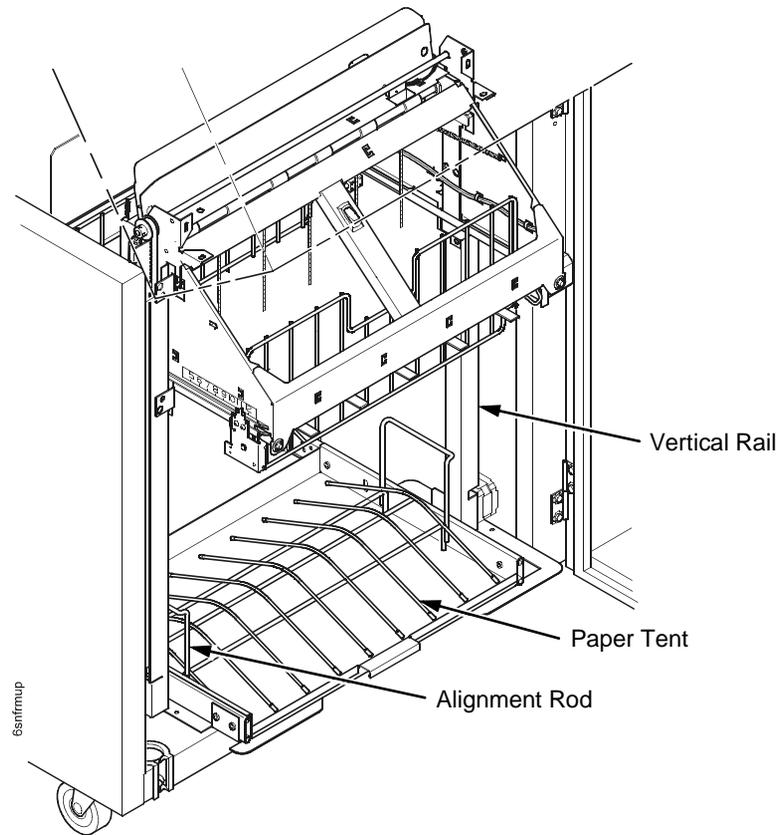


Figure 72. This figure shows where to place the the paper tent.

6. Push or pull the paddle shaft toward the front or the rear of the printer and set the paper length by aligning indicator notch on the bearing bracket with the paper length indicator. (Length range: 5 to 12 inches.) (Figure 73.)

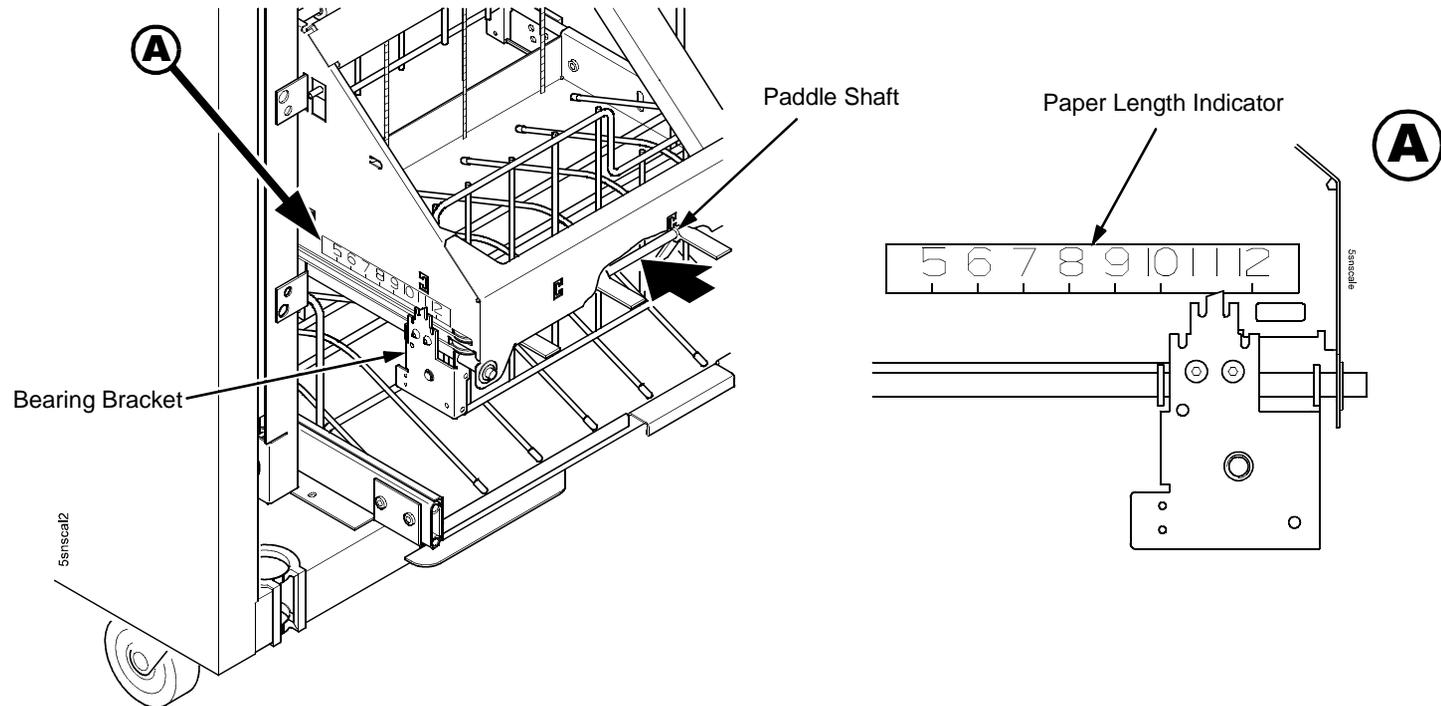


Figure 73. This figure shows how to set the paper length on the power stacker.

Loading and Starting the Power Stacker

1. Press the **PAPER ADVANCE** key on the the stacker operator panel and hand feed the paper down into the paper throat. Continue to advance the paper until it reaches the wire tent and there are 3 to 5 extra sheets in the stacker. Make sure the paper passes through the throat of the paper stacker. (Figure 74.)
2. Stack the three to five sheets of paper on top of the wire paper tent, making sure the paper lies with the natural fold.

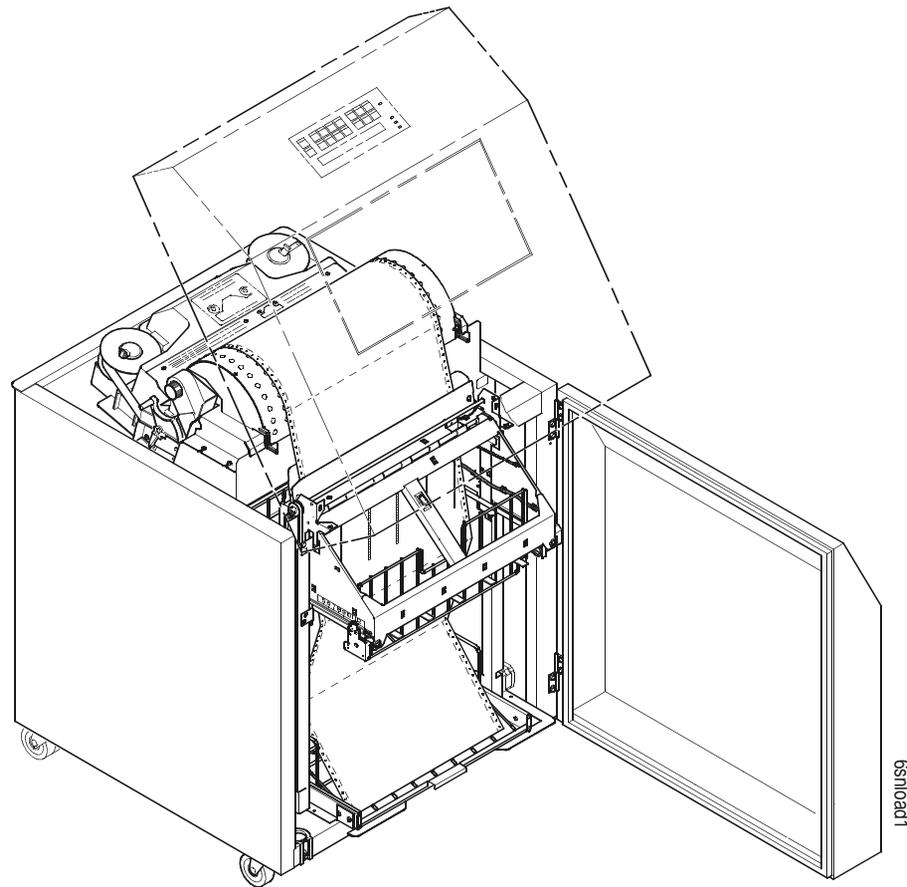


Figure 74. This figure shows the path of paper as it moves through the power stacker.

3. Press the **ON LINE** key on the front or rear operator panel to put the printer in the online state. The stacker elevator will descend to its lowest position. (Figure 75.)

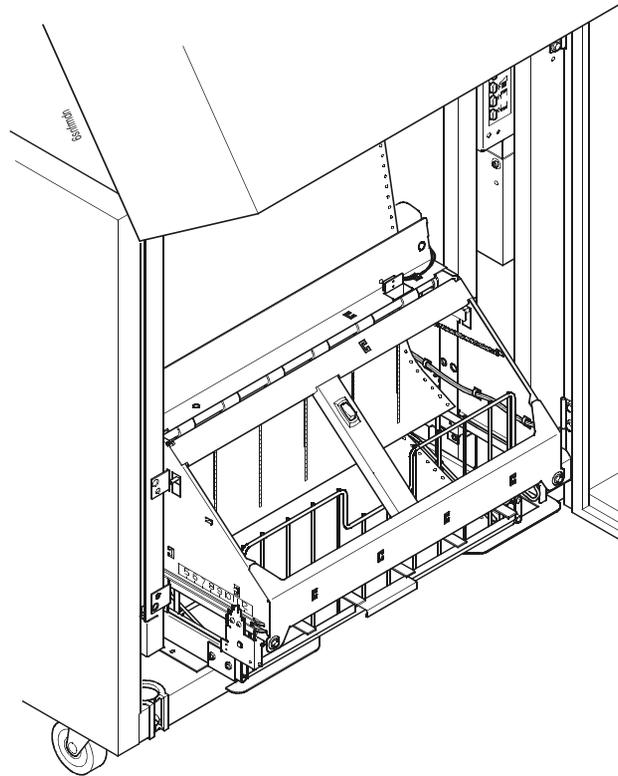


Figure 75. This figure shows the power stacker in the print position.

4. Check that the paper is still centered between the paper guides.
5. Close the cabinet rear door.
6. If necessary, set Top Of Form. (Refer to the *User's Guide*.)

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 11 shows some of the problems that can occur with the power stacker and the page where you can find the troubleshooting procedure.

Table 11. Power Stacker Problems

Symptom	Origin of Symptom	Explanation	Solution
Printer does not detect presence of power stacker	Reported by customer.	Various causes possible.	page 193
017 STACKER JAM CHECK STACKER	Message on operator panel LCD.	This message is triggered when the elevator cannot reach the top or bottom limit switch before timing out.	page 51
018 STACKER FULL CHECK STACKER	Message on operator panel LCD.	Status message: the power paper stacker is full.	page 51
019 STACKER FAULT CHECK STACKER	Message on operator panel LCD.	1. The stacker elevator may be obstructed. The message will always occur if the user presses the ELEVATOR UP key on the stacker operator 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.	page 52
Stacker "chatters" at upper or lower limit	Reported by customer.	Various causes possible.	page 195
Stacker does not stack properly	Reported by customer.	Various causes possible.	page 196

Table 11. Power Stacker Problems

Symptom	Origin of Symptom	Explanation	Solution
Stacker elevator does not move	Reported by customer.	Various causes possible.	page 196
Stacker elevator moves by itself	Reported by customer.	Various causes possible.	page 196
Stacker limit switch check	Other troubleshooting procedures.	This procedure tests the motion limit switches at the top and bottom of the vertical rails. You will usually be referred to this procedure from other troubleshooting procedures. When you have completed this procedure, return to the procedure that sent you there.	page 197
Stacker motor check	Other troubleshooting procedures.	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 the procedure, return to the procedure that sent you there.	page 198
Stacker not operating	Reported by customer.	Same as "Printer does not detect presence of power stacker"	page 193

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 76.)

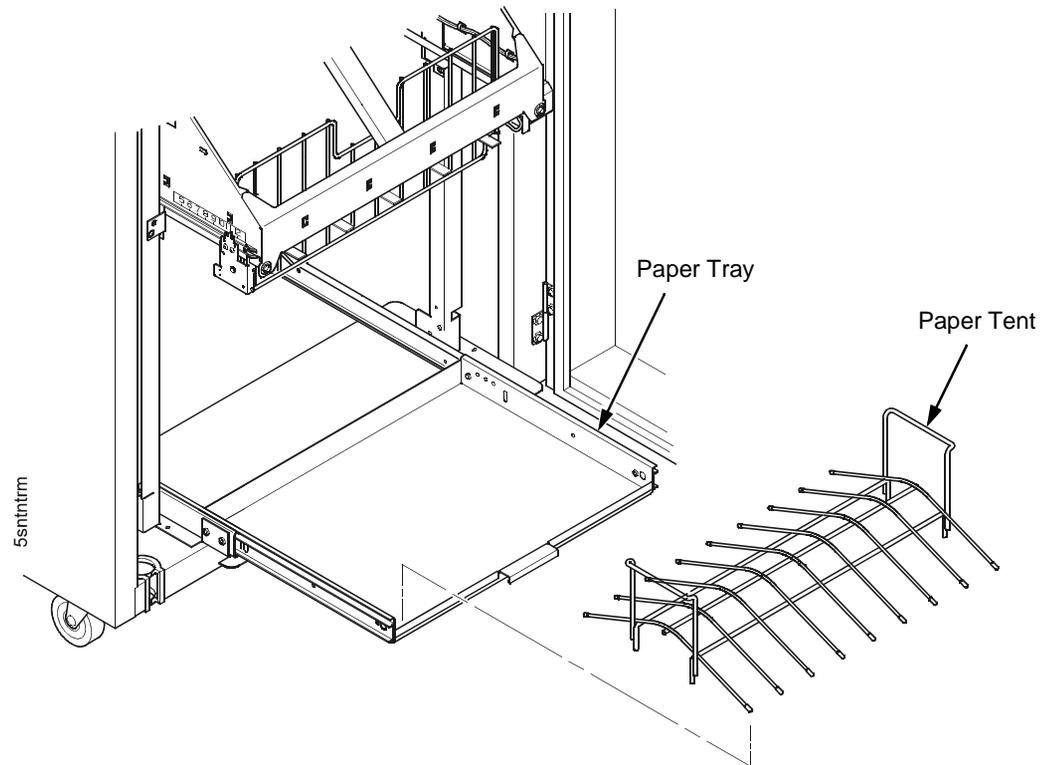


Figure 76. This figure shows how to remove the paper tent.

5. Cut the tie wrap (if present) and remove the paper fence. (Figure 77.)

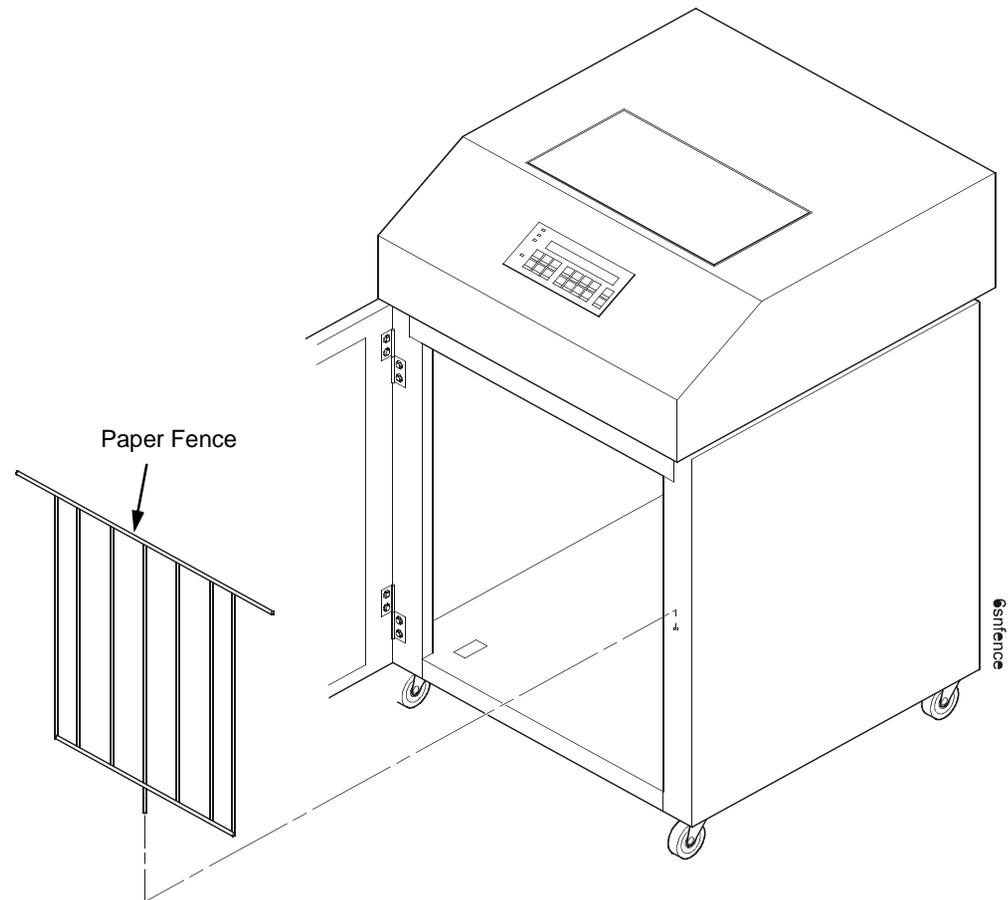


Figure 77. This figure shows how to remove the paper fence.

6. Remove the screws, washers, and standoff from the stacker operator panel. (Figure 78.)

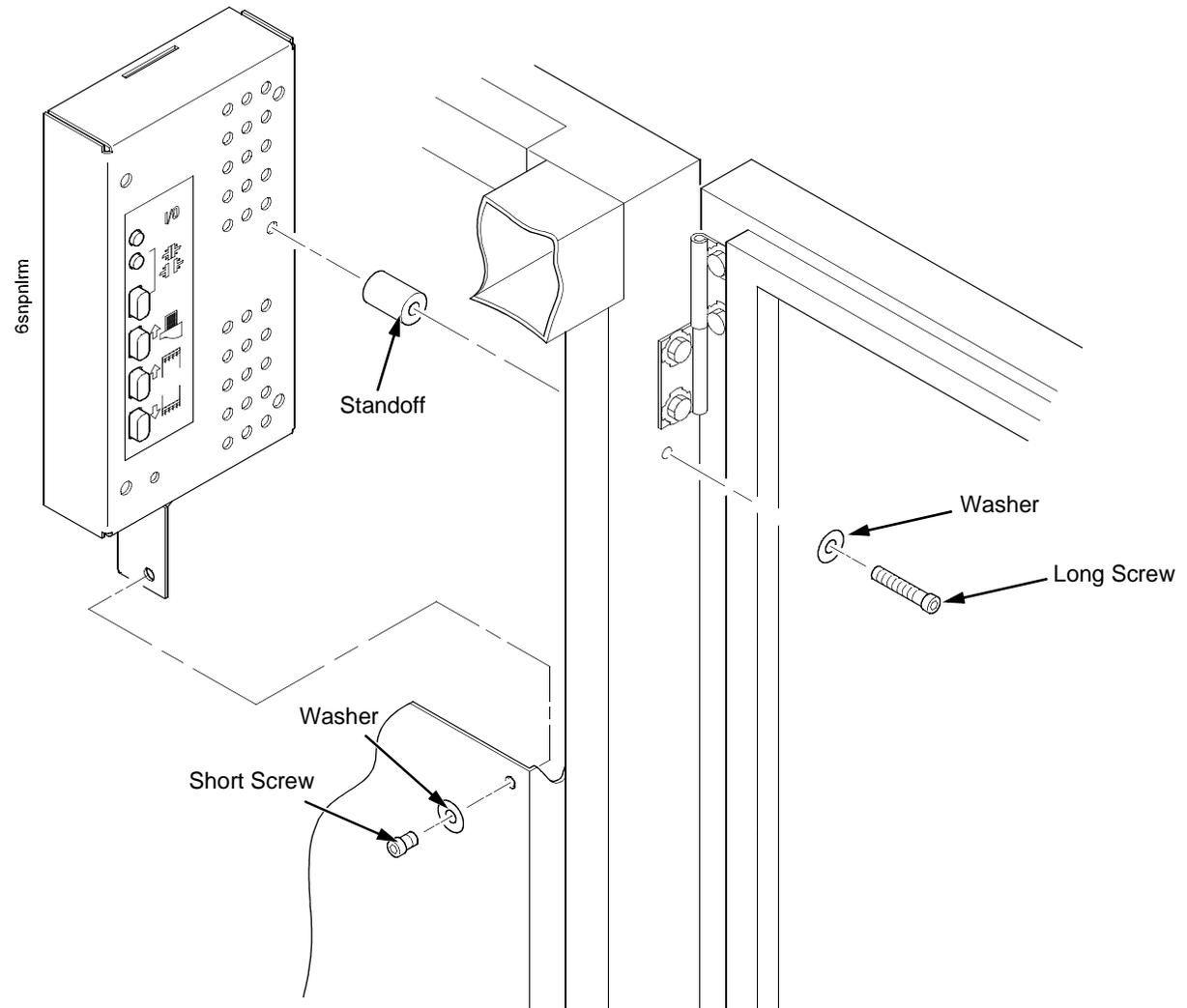


Figure 78. This figure shows how to remove an early stacker operator panel from the cabinet frame.

7. Remove four cables from the stacker operator panel, and remove the stacker operator panel. (Figure 79.)

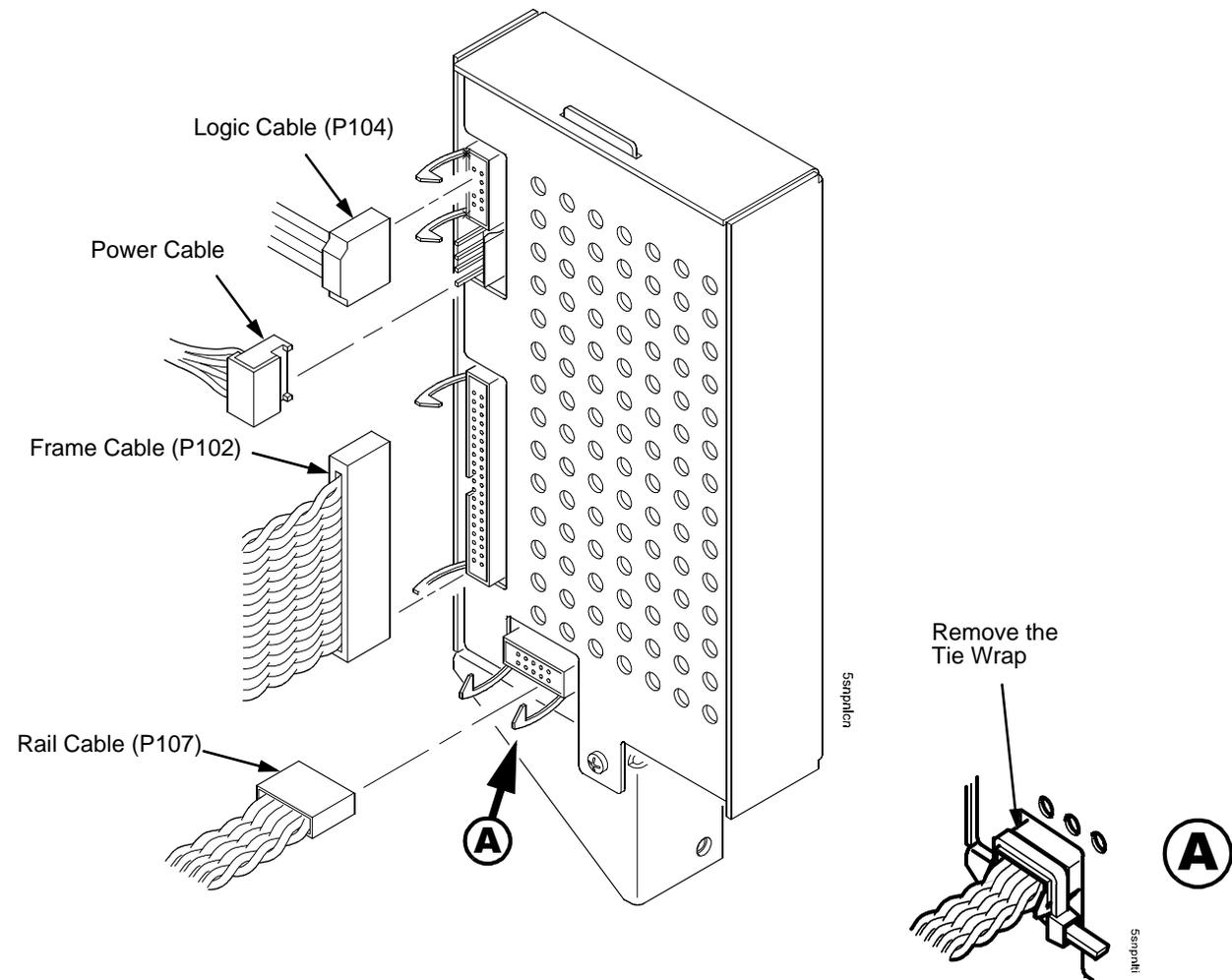


Figure 79. This figure shows how to remove the cables from the rear of the stacker operator panel.

8. 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 80.)
9. Remove the two Torx T-10 screws securing the stacker base to the cabinet floor. (Figure 80.)
10. Remove the two Torx T-10 screws that secure the rail bracket to the cabinet floor. (Figure 80.)

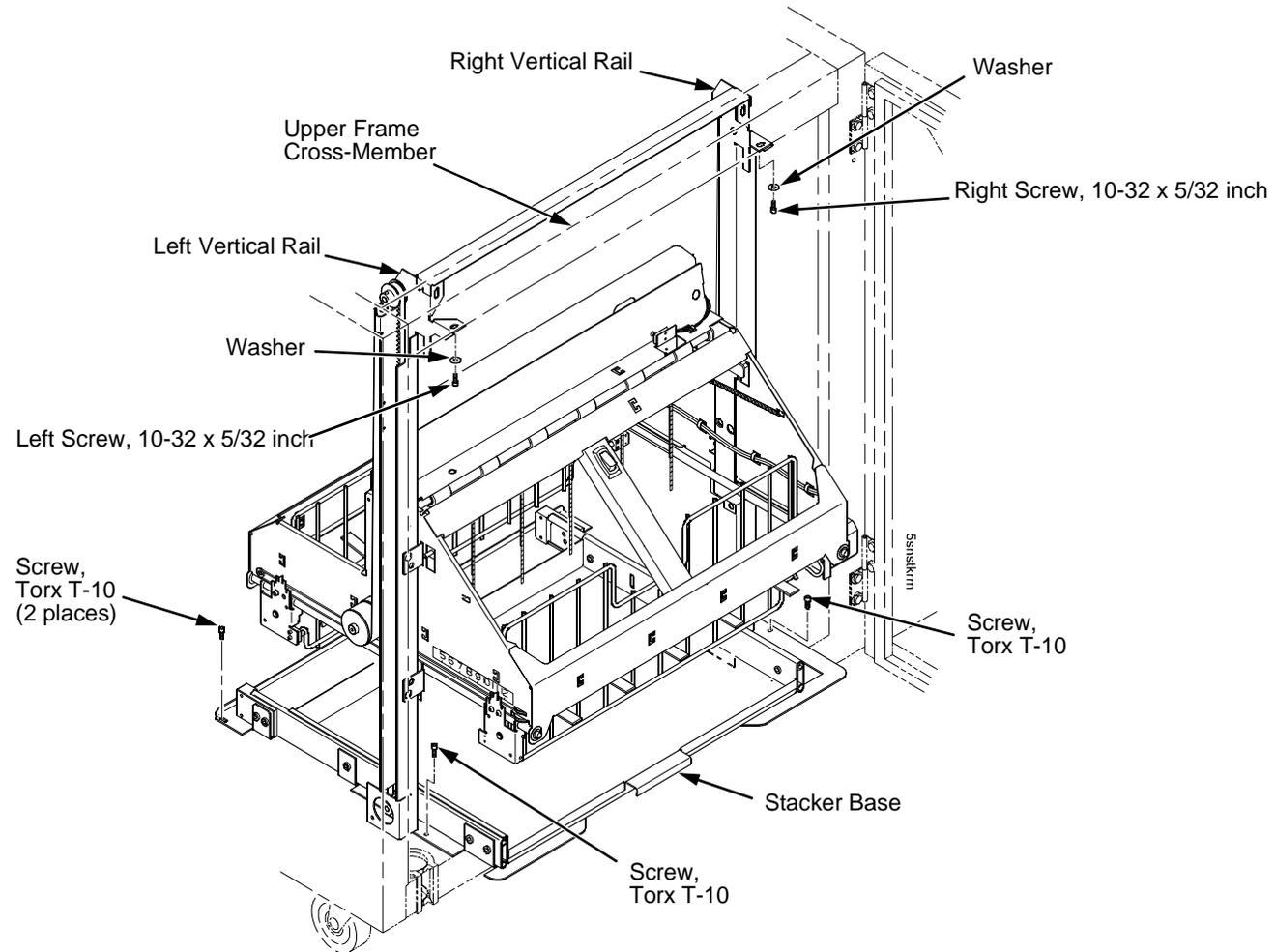


Figure 80. This figure shows which screws to remove to prepare the stacker for removal from the cabinet.

-
11. Pull the paper tray out until the holes in the rails permit access to the M3 buttonhead screws. (Figure 81)
 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 81.)

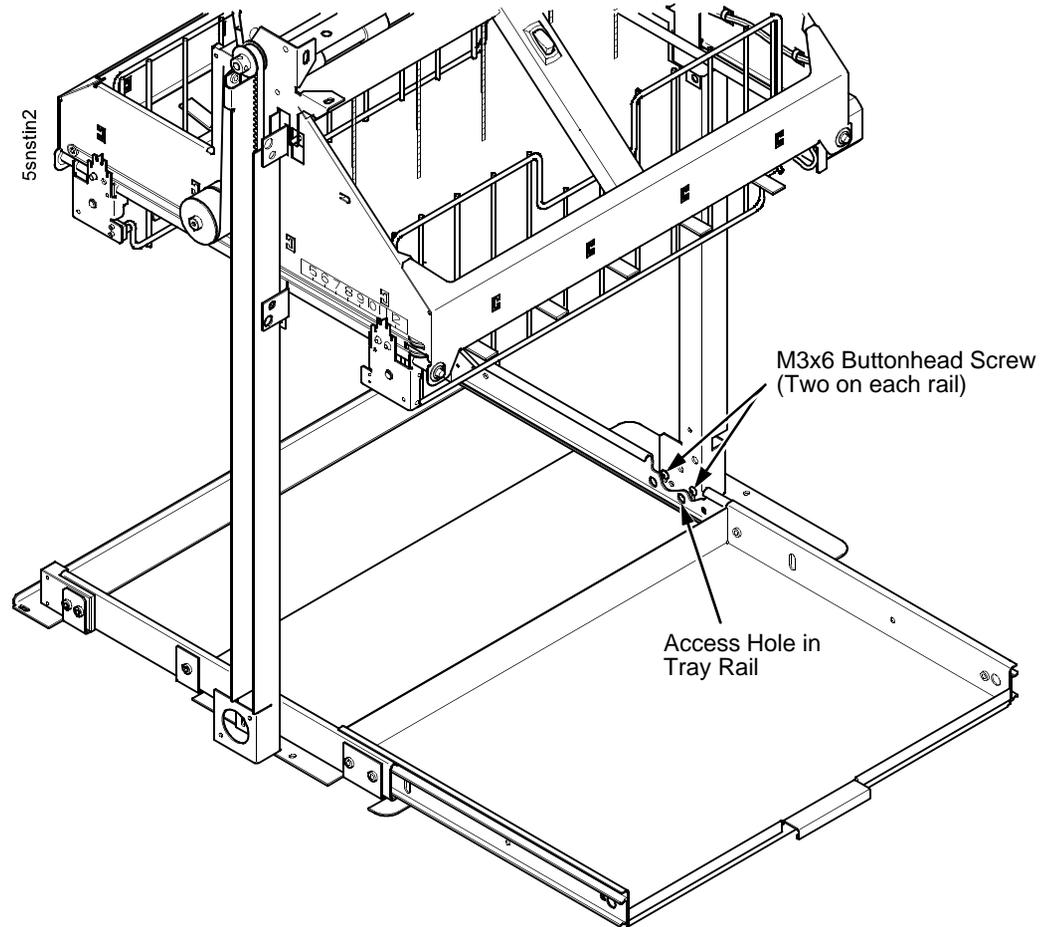


Figure 81. This figure shows how to loosen the lower screws in the vertical rails of the stacker.

13. Lower the elevator assembly to its lowest position.
14. 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 82.)

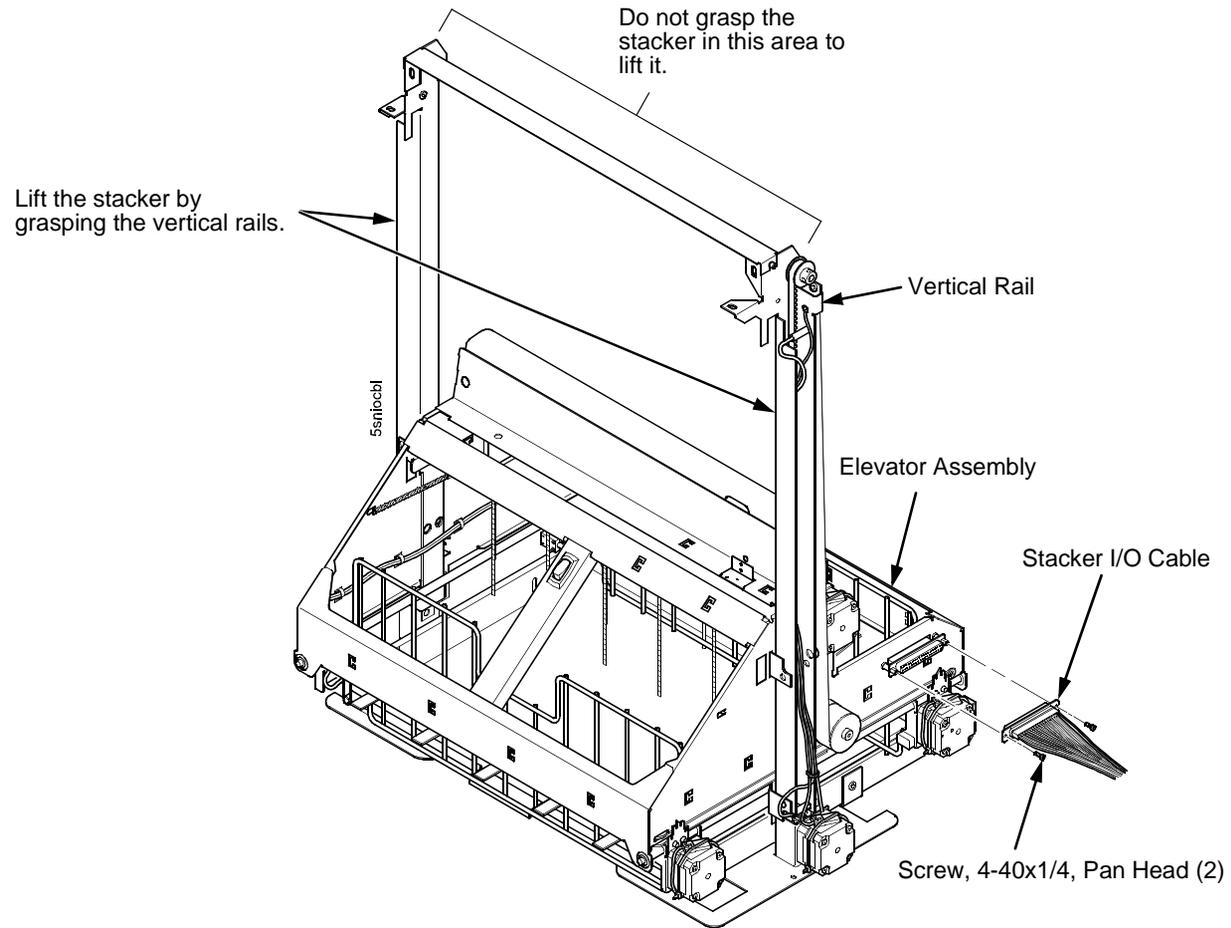


Figure 82. This figure shows where to disconnect the stacker I/O cable from the stacker elevator.

NOTE: It may be easier to wear gloves for the next step.

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. Slide the stacker assembly to the rear and angle it out of the cabinet, as shown in Figure 83.

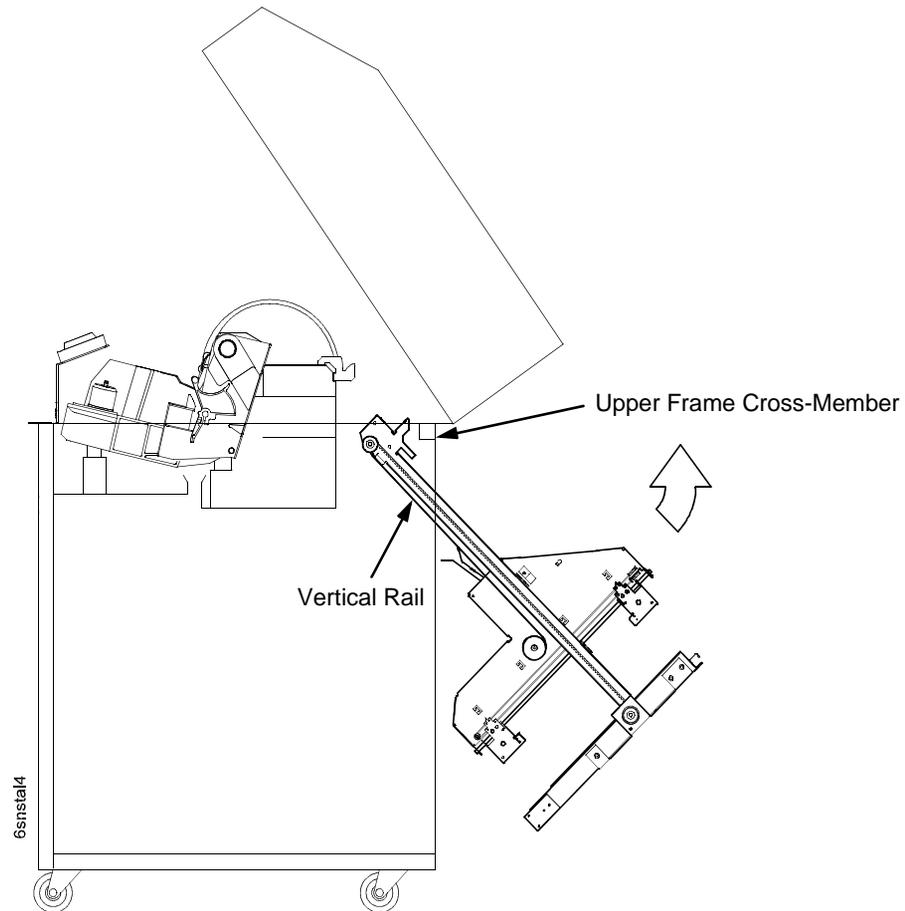


Figure 83. This figure shows how to remove the stacker assembly from the rear of the printer cabinet.

Installing The Power Stacker

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

1. Set the printer power switch to O (off).
2. Unplug the power cord.
3. Remove paper.
4. Loosen—do not remove—the three screws that secure the paper guide assembly. Slide the paper guide assembly to the left and lift it off the card cage. (Figure 84.)

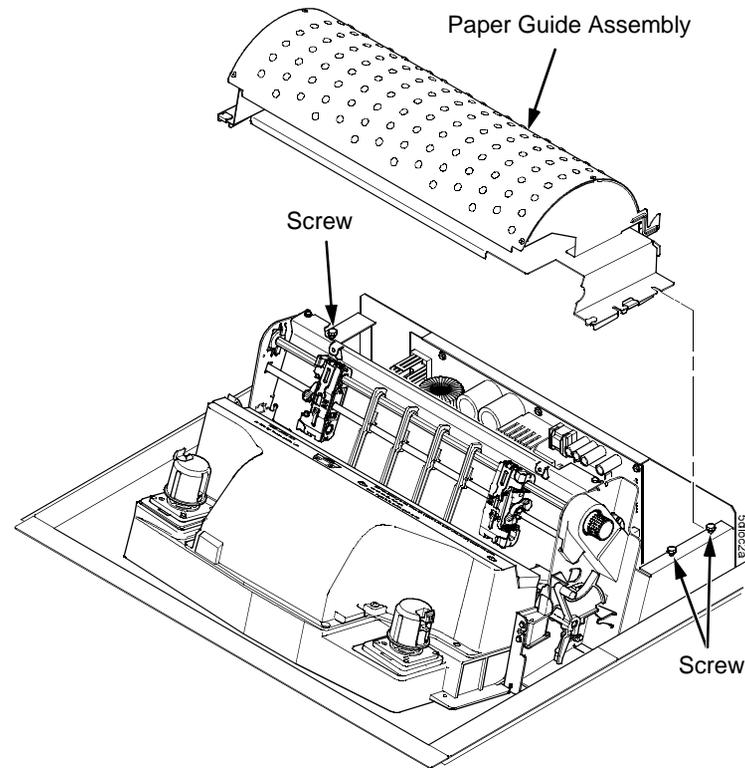


Figure 84. This figure shows how to remove the paper guide assembly from the card cage.

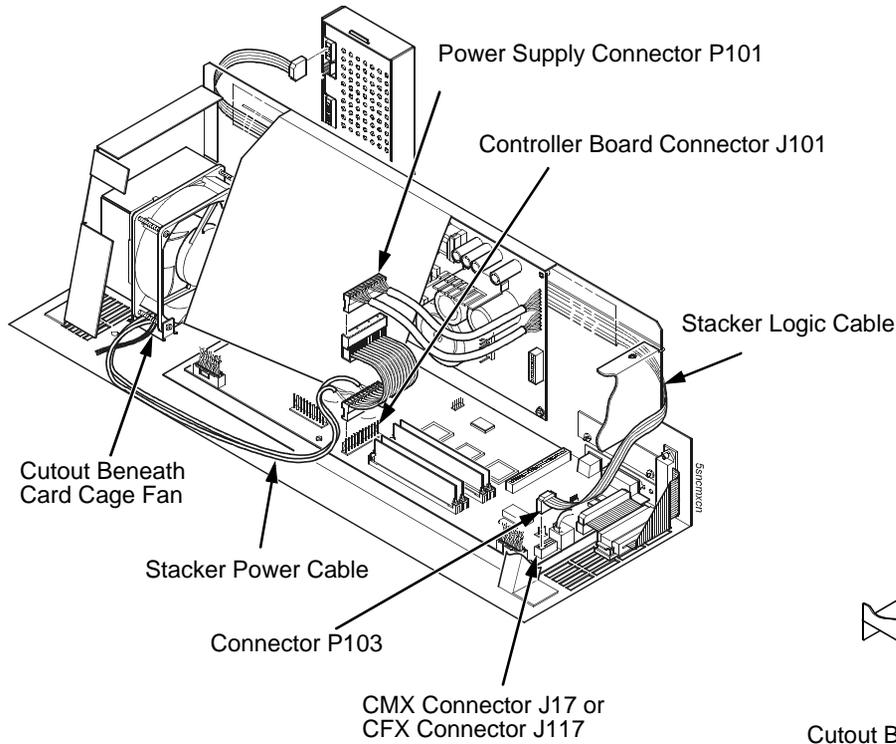
All Models Except 6400-i24 and 6400-i2s

5. Connect the power stacker logic cable P103 to connector J17 or J117 on the controller board. (Figure 85.)
6. Disconnect the power supply cable from connector J101 on the controller board. (Figure 85.)
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 85.)
8. Route the stacker power cable in front of the controller board and down through the cutout under the card cage fan.
9. Route the stacker logic cable through the opening between the card cage and the cabinet frame and behind the card cage. (Figure 85.)

Models 6400-i24 and 6400-i2s

5. Connect the power stacker logic cable P103 to connector J117 on the controller board. (Figure 85.)
6. Disconnect the power supply cable from connector J101 on the controller board. (Figure 85.)
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 85.)
8. Route the stacker power cable in front of the controller board and down through the cutout under the card cage fan. (Figure 85.)
9. Route the stacker logic cable in front of the controller board and down through the cutout under the card cage fan. (Figure 85.)
10. Skip ahead to step 15.

All except 6400-i24 and 6400-i2s



Models 6400-i24 and 6400-i2s

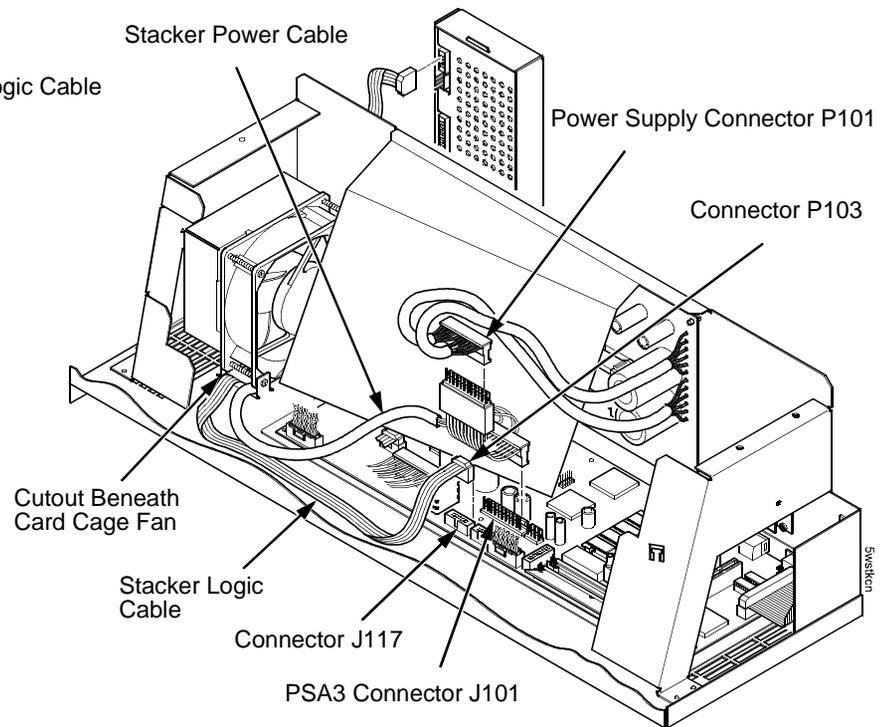


Figure 85. This figure shows where to attach the stacker power and logic cables on the CMX, CFX, or PSA3 controller board.

-
11. Route the stacker logic cable straight through the routing guide, making sure that it is not twisted. (Figure 86.)
 12. Position the cable routing guide so that the four chain hooks protrude through the holes in the guide. (Figure 86.)

All except 6400-i24 and 6400-i2s

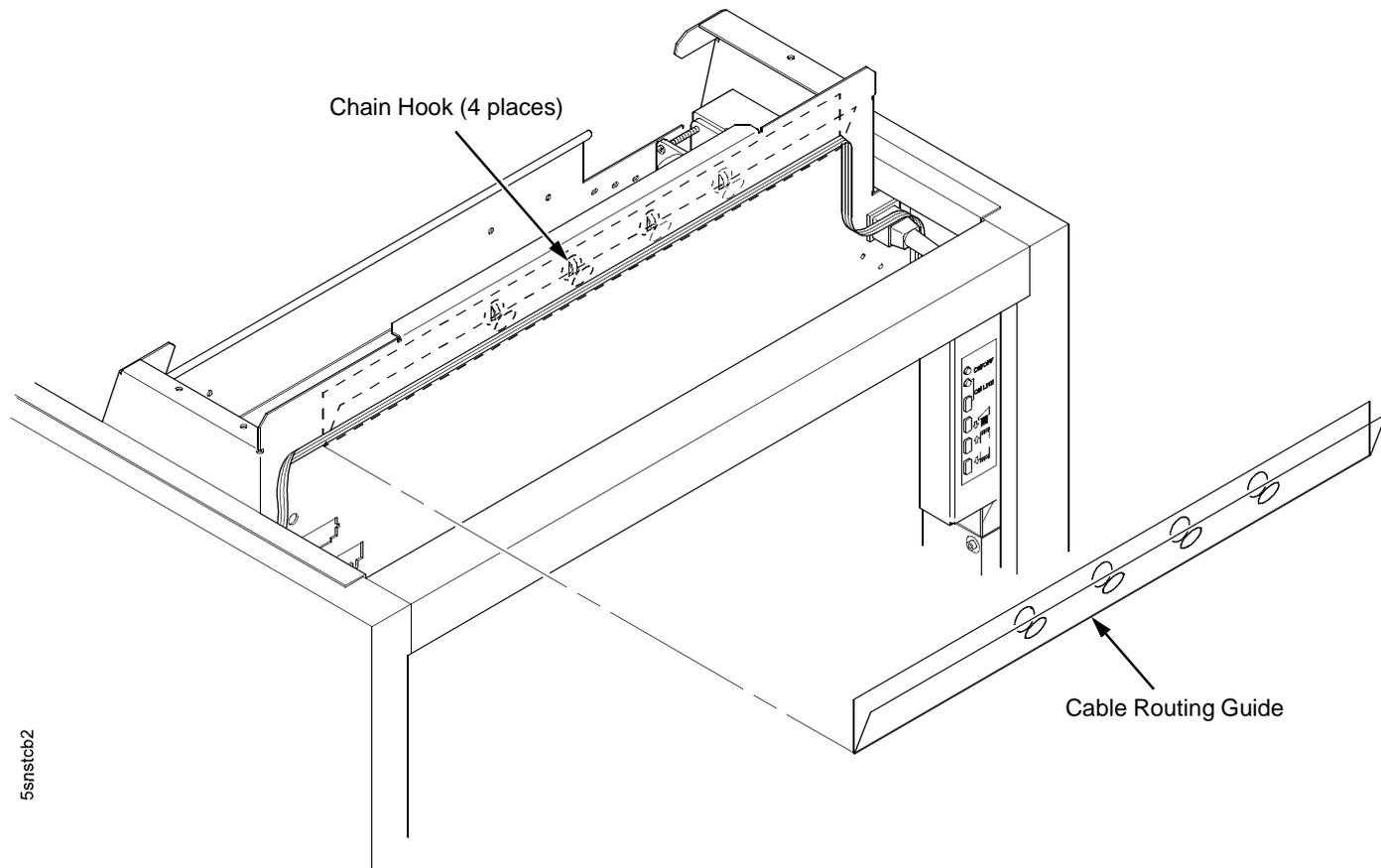


Figure 86. This figure shows how to install the cable routing guide behind the card cage on printers using the CMX or CFX controller board.

13. Slide the retainer wire over the cable routing guide and through the four chain hooks. (Figure 87.)
14. Insert the bent end of the retainer wire into the card cage notch. (Figure 87, detail.)

All except 6400-i24 and 6400-i2s

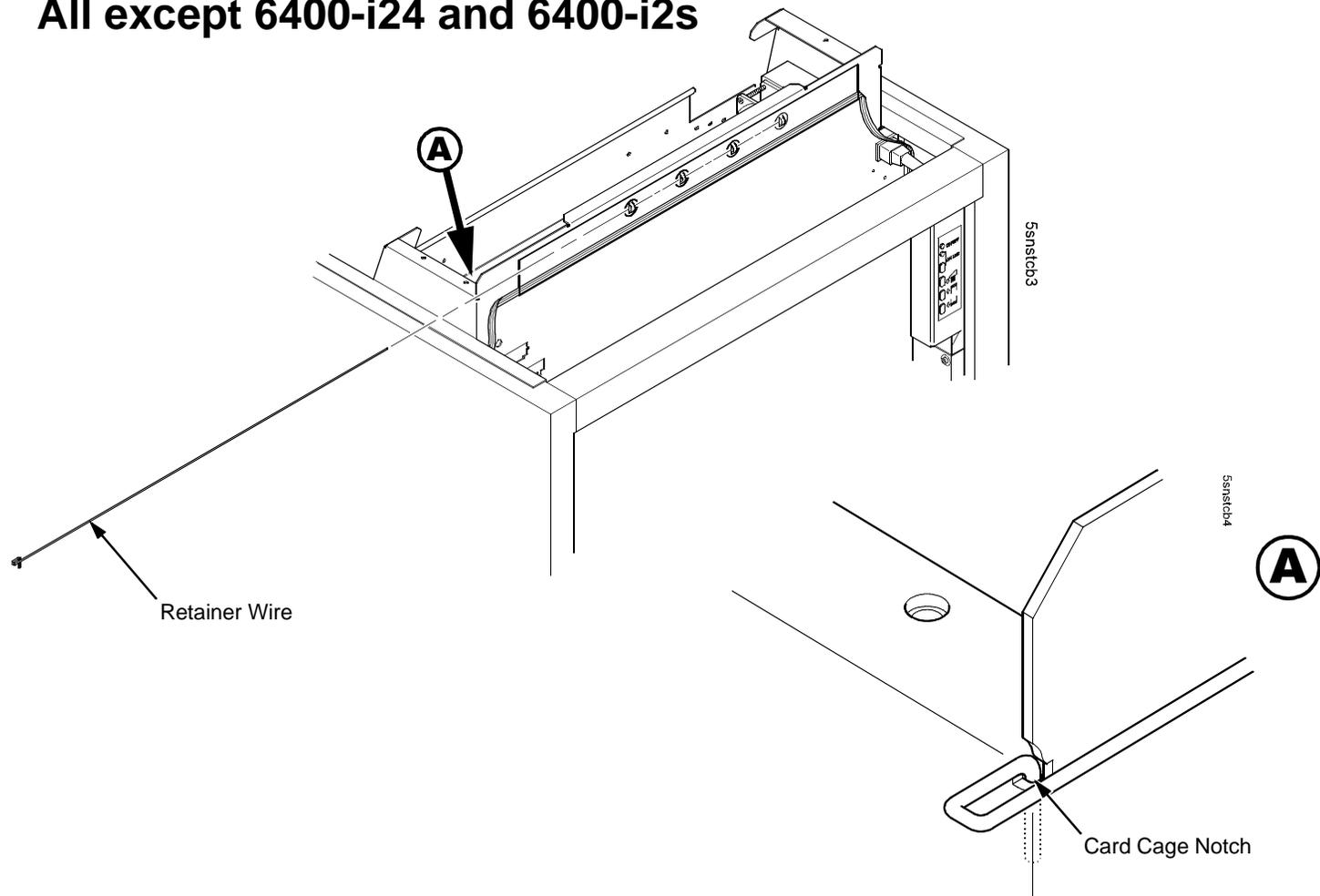


Figure 87. This figure shows how to install the cable routing guide retainer in the cable routing guide on printers using the CMX or CFX controller board.

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15. Pull the paper tray out until the holes in the rails permit access to the M3 buttonhead screws. (Figure 88.)
 16. 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 88.)

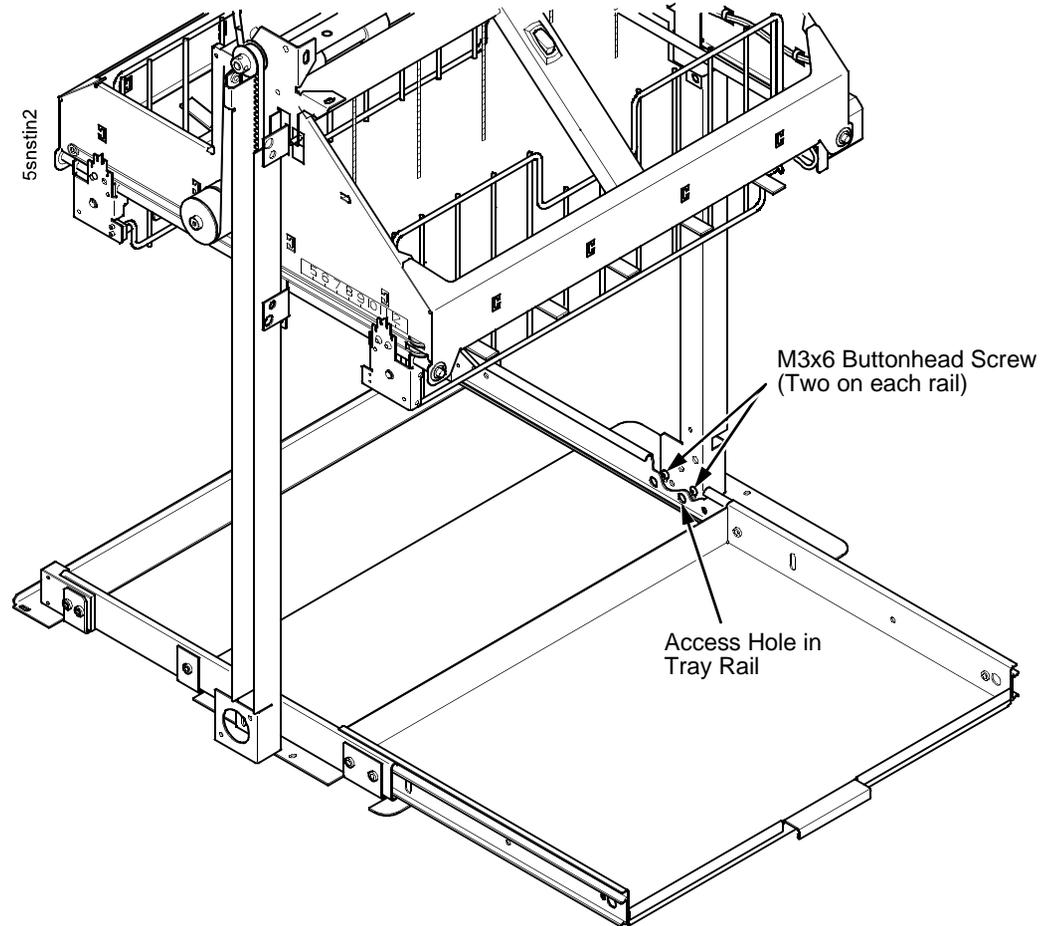


Figure 88. This figure shows how to loosen the lower screws in the vertical rails of the stacker.

17. Position the elevator assembly at the bottom of the vertical rails. (Figure 89.)

18. 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 89.

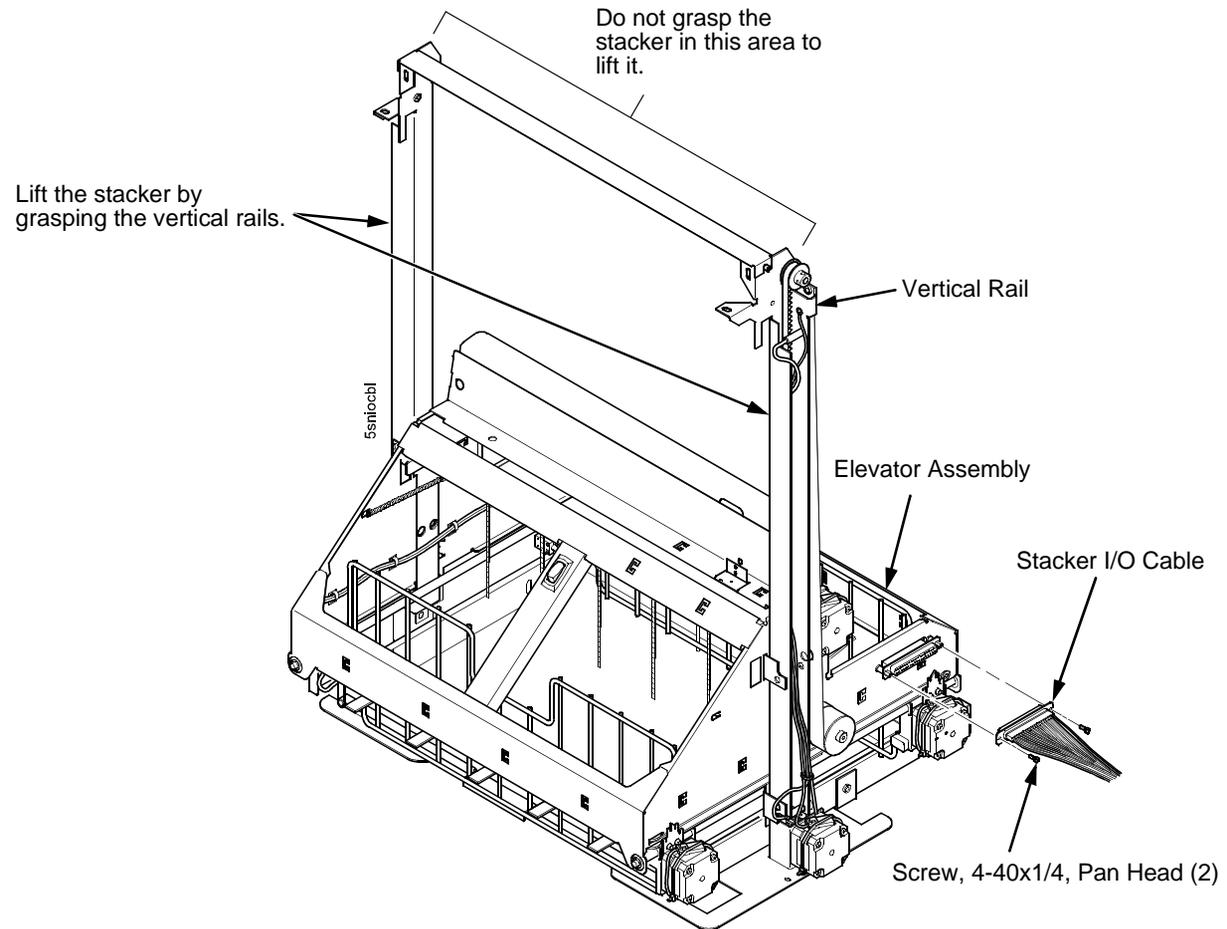


Figure 89. This figure shows where to connect the stacker I/O cable to the stacker elevator.

ATTENTION The power 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.

NOTE: It may be easier to wear gloves for the next step.

19. 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. (Refer to Figure 93a.) Leave the stacker loose in the rear of the cabinet.
20. Gather the stacker rail cable, elevator I/O cable, logic cable, and power cable. Route the cables outboard of the elevator assembly. (Figure 90.)

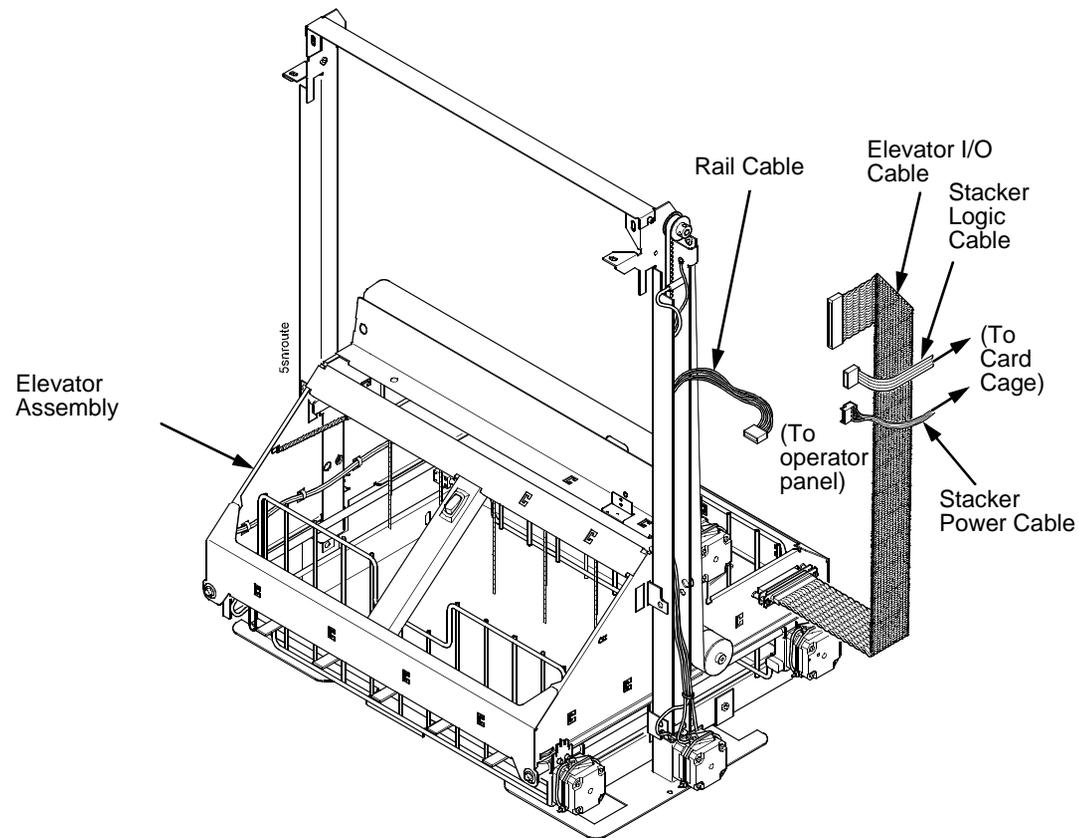


Figure 90. This figure shows how to route the stacker cables from the elevator and frame rail to the card cage.

21. Connect the stacker cables to the rear of the stacker operator panel assembly and make sure the ejector levers close over the connectors. (Figure 91.)
22. Press rail cable connector P107 into the operator panel until the ejectors close, then tie wrap the ejectors to the connector. (Figure 91, detail.)

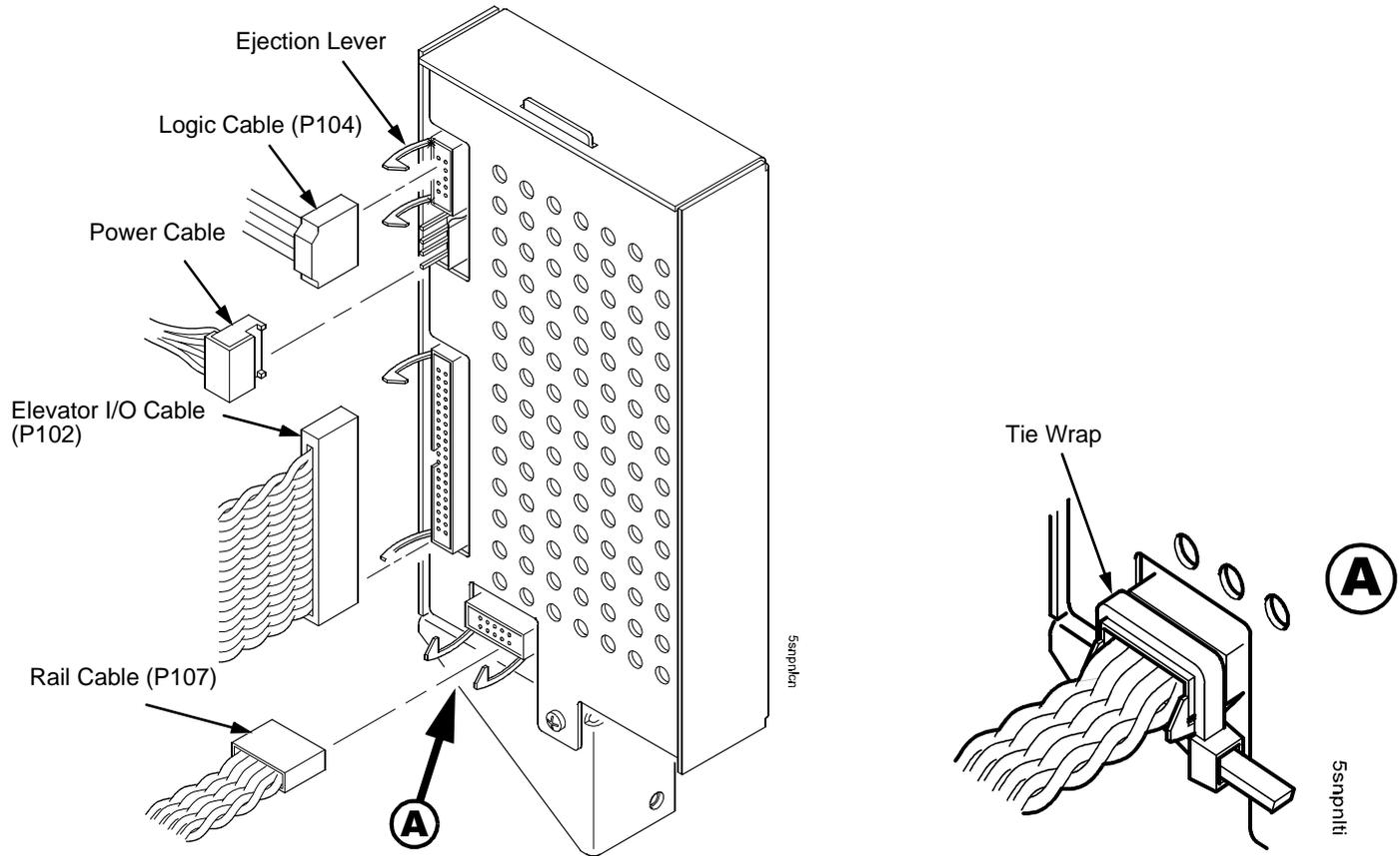


Figure 91. This figure shows how to install the operator panel cables to the rear of the stacker operator panel.

-
23. Apply the double-sided tape to one end of the operator panel standoff. Remove the paper backing and hold the standoff inside the cabinet while 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 operator panel into position and install the upper mounting screw finger tight in the operator panel. (Figure 92.)
24. Inspect the distance between the operator panel lower bracket and the inner panel of the cabinet.
- If the operator panel lower bracket is flush with the cabinet inner panel, proceed to step 25.
 - If there is a gap between the operator panel lower bracket and the cabinet inner panel, do the following:
 - Peel the backing off the spacer adhesive. (Figure 92.)
 - Align the spacer with the holes in the lower bracket and inner panel. (Figure 92.)
 - Press the spacer adhesive against the inner panel. (Figure 92.)
25. Install the lower mounting screw and washer. Tighten the upper mounting screw. (Figure 92.)

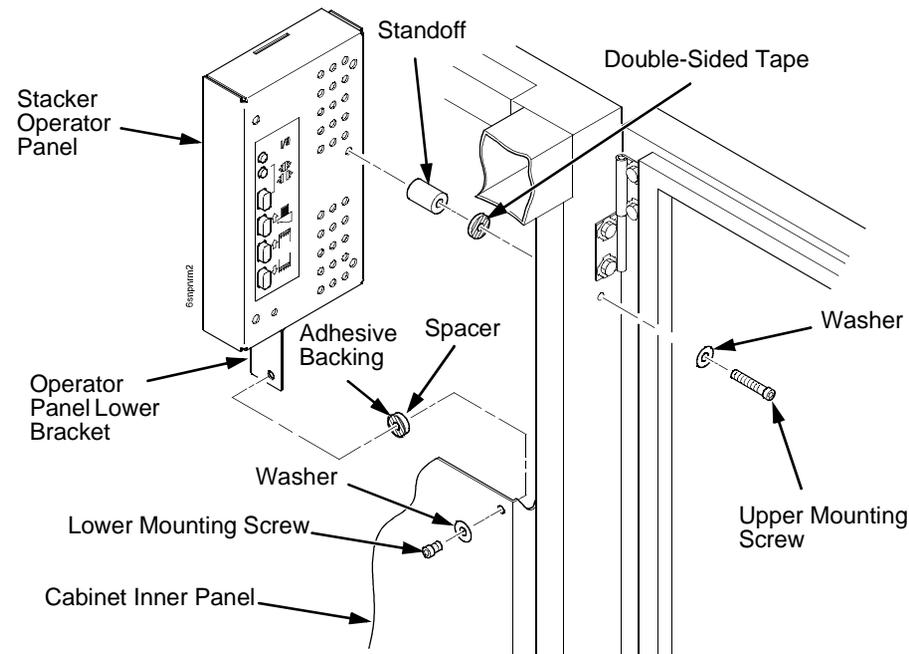


Figure 92. This figure shows how to install the stacker operator panel in the rear of the cabinet.

NOTE: It may be easier to wear gloves for the next three steps.

26. Work the stacker base rearward and engage the upper brackets of the vertical rails under the upper frame cross-member. (Figure 93b.)

27. Align the holes in the vertical rail brackets with the holes in the upper frame cross-member. (Figure 93c and Figure 94.)

28. Align the holes in the stacker base with the holes in the cabinet floor. (Figure 93c and Figure 94.)

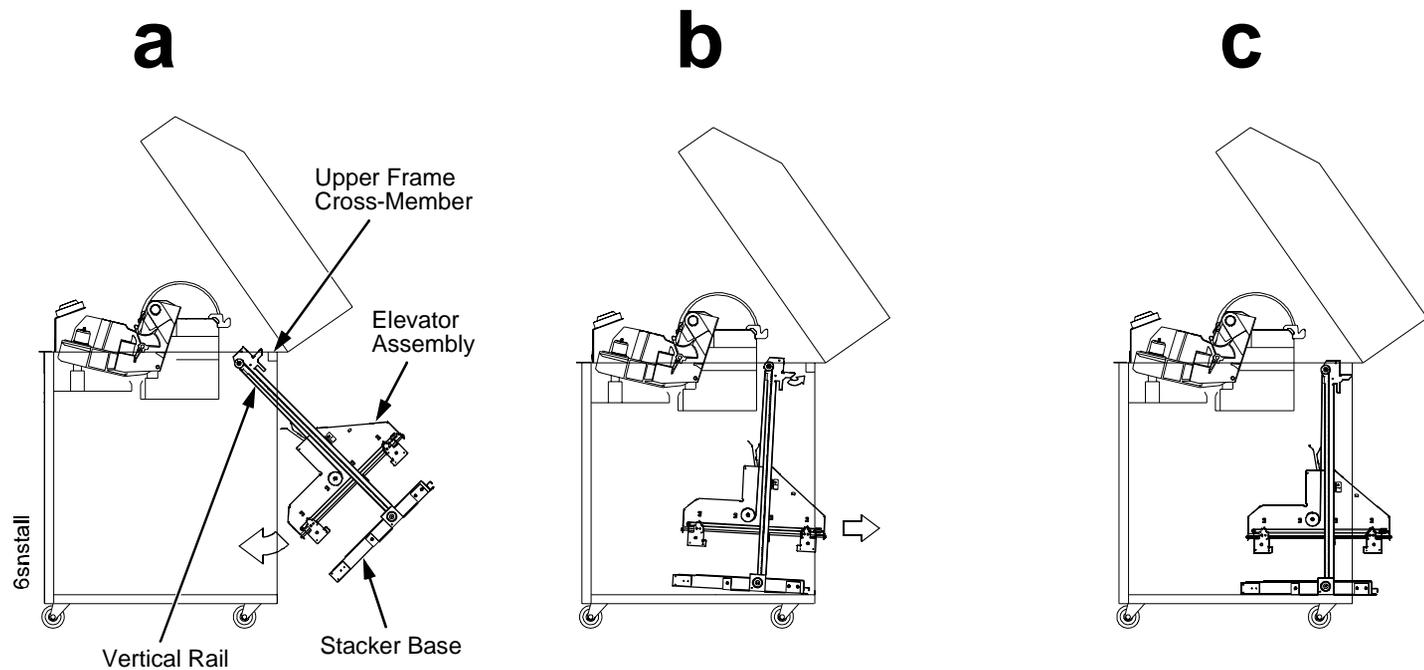


Figure 93. This figure shows how to position the stacker assembly in the rear of the cabinet.

29. 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 94.)
30. Install and tighten the two Torx T-10 screws securing the stacker base to the cabinet floor. (Figure 94.)
31. Install and tighten the two Torx T-10 screws that secure the rail bracket to the cabinet floor. (Figure 94.)

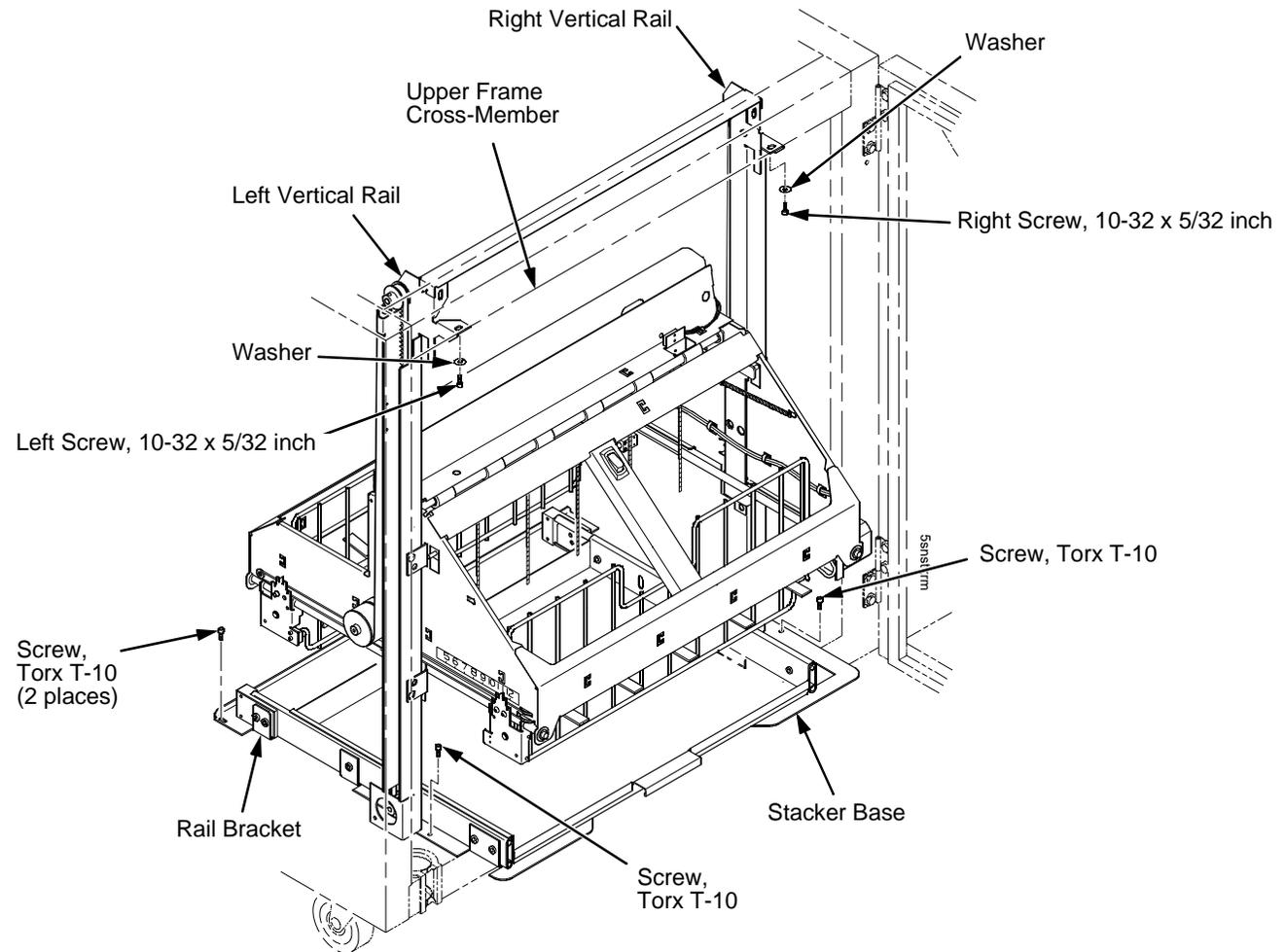
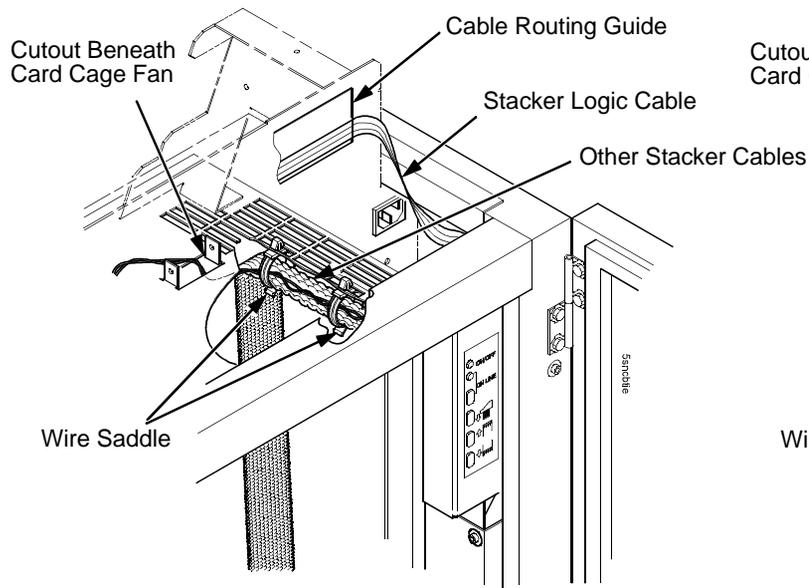


Figure 94. This figure shows which screws to install to secure the stacker assembly in the rear of the cabinet.

32. 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 94.)
33. Move the elevator assembly up and down on the vertical rails until it travels smoothly with no binding.
34. Tighten the two 10-32 x 5/32 inch buttonhead screws securing the vertical rails to the upper frame cross-member.
35. Pull the paper tray out until the holes in the rails permit access to the M3x6 screws. Tighten the M3 screws securing the vertical rails to the stacker base. Each rail is secured by two screws. (Figure 88.)
36. 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 rail screws and repeat steps 33 and 34 until the elevator moves smoothly.
37. Bundle the stacker operator 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. (Figure 95.)

All except 6400-i24 and 6400-i2s



Models 6400-i24 and 6400-i2s

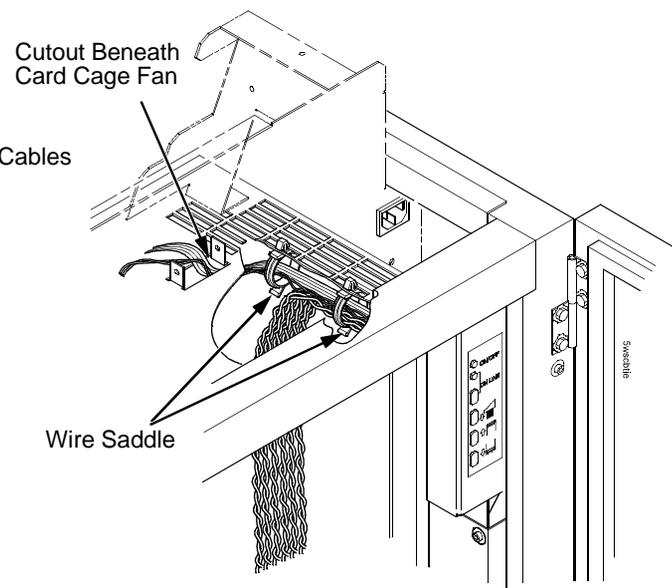


Figure 95. This figure shows how to bundle and route the stacker cables beneath the card cage and behind the operator panel.

38. Install the paper fence. (Figure 96.)

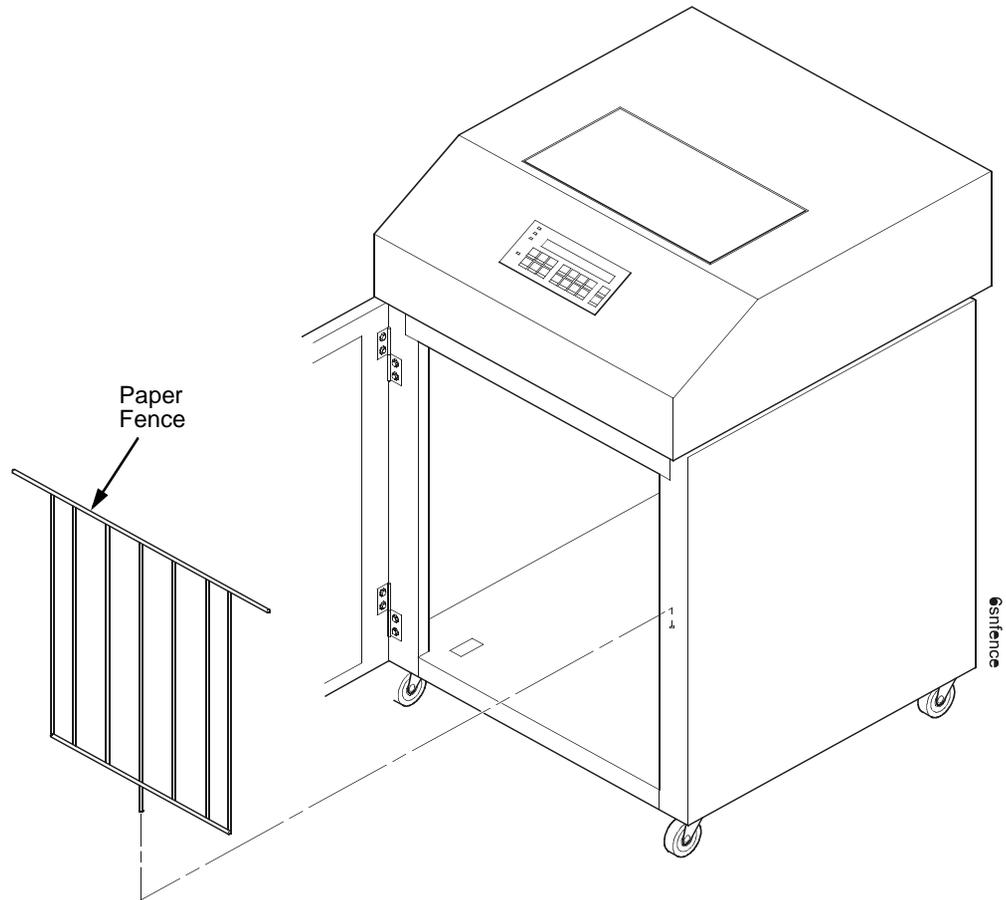


Figure 96. This figure shows how to install the paper fence in the cabinet.

39. Pull out the paper tray and install the paper tent. (Figure 97.)

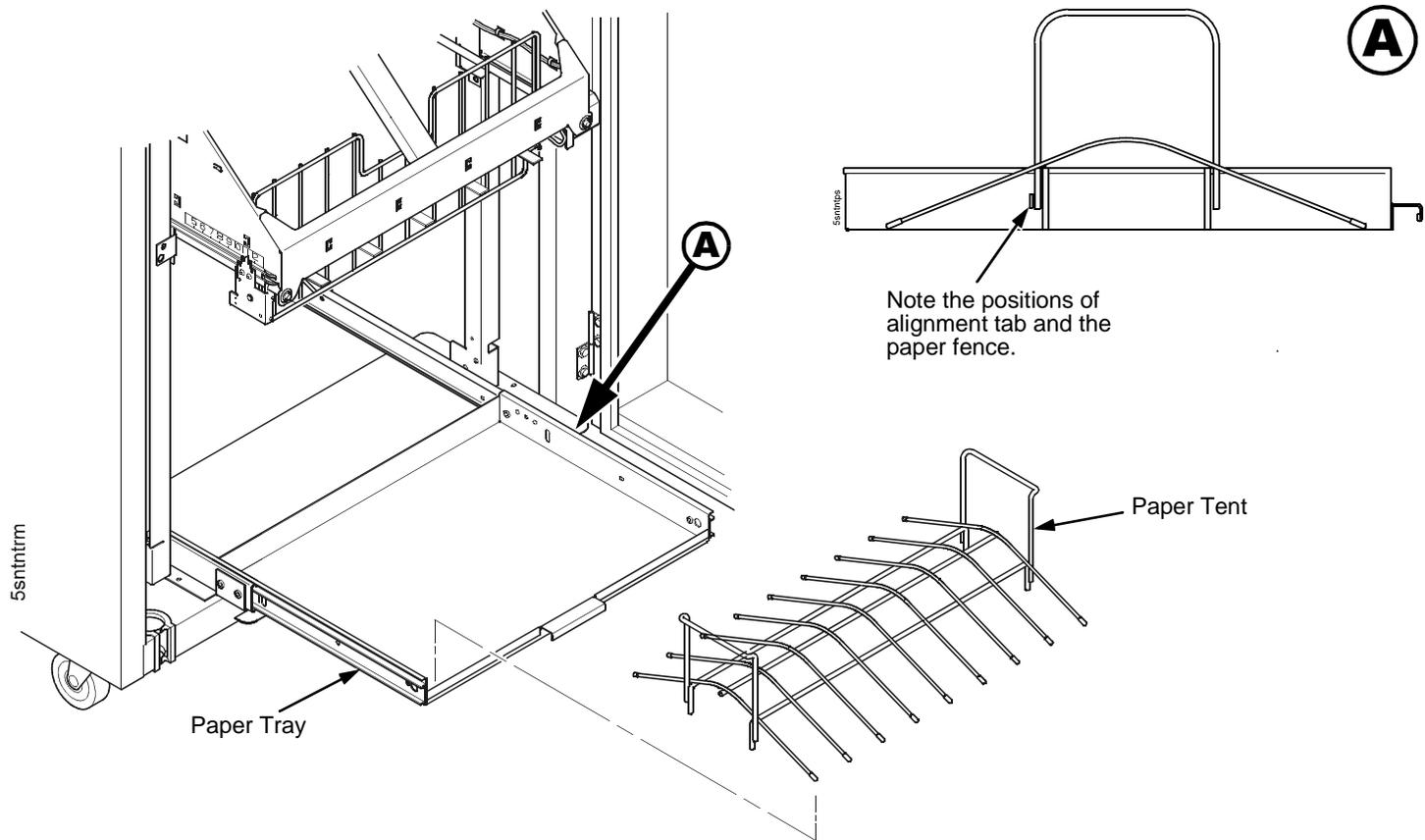


Figure 97. This figure shows how to install the paper tent in the paper tray.

40. Install the paper path that you removed in step 4.
41. Install paper and test stacker operation.

Replacing The Constant Force Spring

1. Remove the stacker assembly from the printer (page 524).

ATTENTION

In the next step, do not over-tighten the tie wraps or string. Tighten the tie wraps or string just enough to hold the elevator up.

2. Raise the elevator assembly to within approximately 1/4 inch (0.6 cm) of its highest position. Secure it to the vertical rails using tie wraps or string. (Figure 98.)

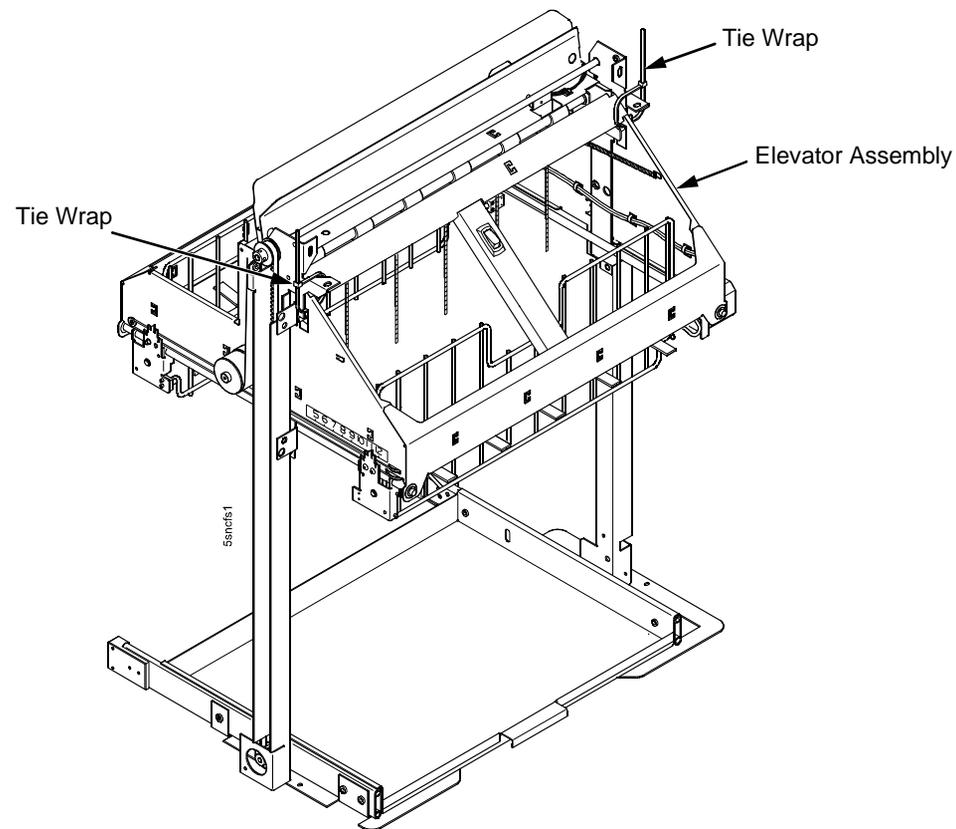


Figure 98. This figure shows how to tie the elevator assembly preparatory to removing the constant force spring.



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.

NOTE: It may be easier to wear gloves while handling the constant force spring.

3. Remove the shoulder screw, washers, and spacer from the constant force spring and drum. Let the spring coil itself up until it reaches the screw that secures it to the vertical rail. (Figure 99.)
4. Firmly gripping the spring and drum, remove the screw securing the spring to the vertical rail. (Figure 99.)

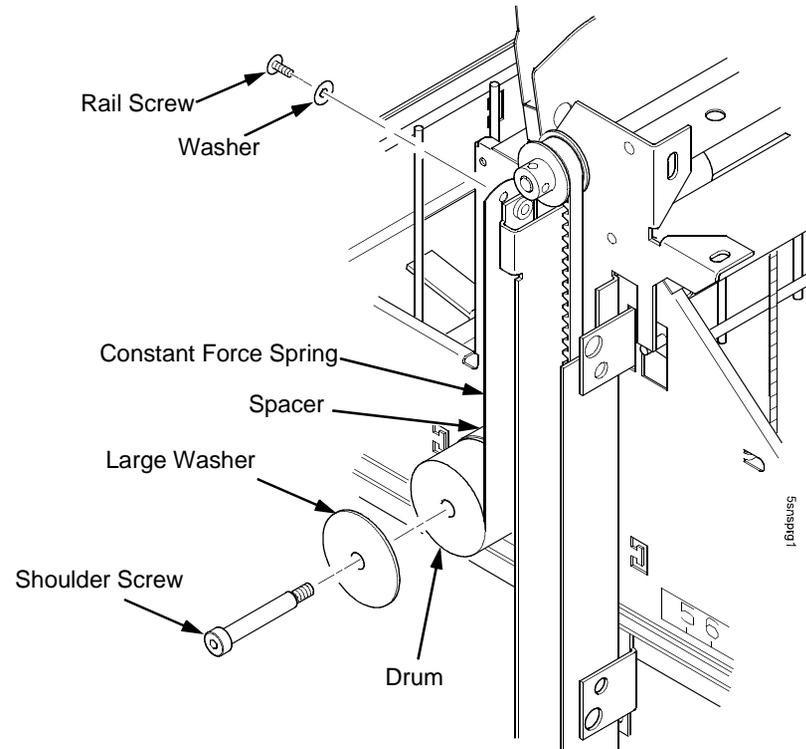


Figure 99. This figure shows how to remove the constant force spring from the stacker assembly.

-
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 100.)
 6. While holding the drum tightly, continue to curl the spring until it is completely unwound from the drum. (Figure 100.)
 7. To install a new constant force spring, reverse the steps of this procedure.

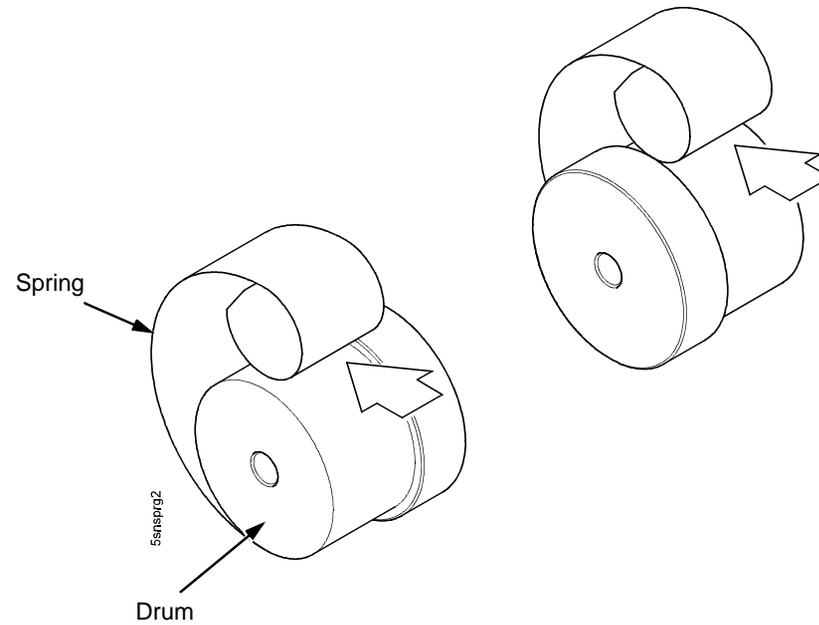


Figure 100. This figure shows how to unwind the constant force spring from the drum.

Replacing The Timing Belts

1. Remove the stacker assembly from the printer (page 524).
2. Raise the elevator assembly to its highest position and secure it to the vertical rails using tie wraps or string. (Figure 98, page 547.)
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 101.) 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 101.) Go to step 5.

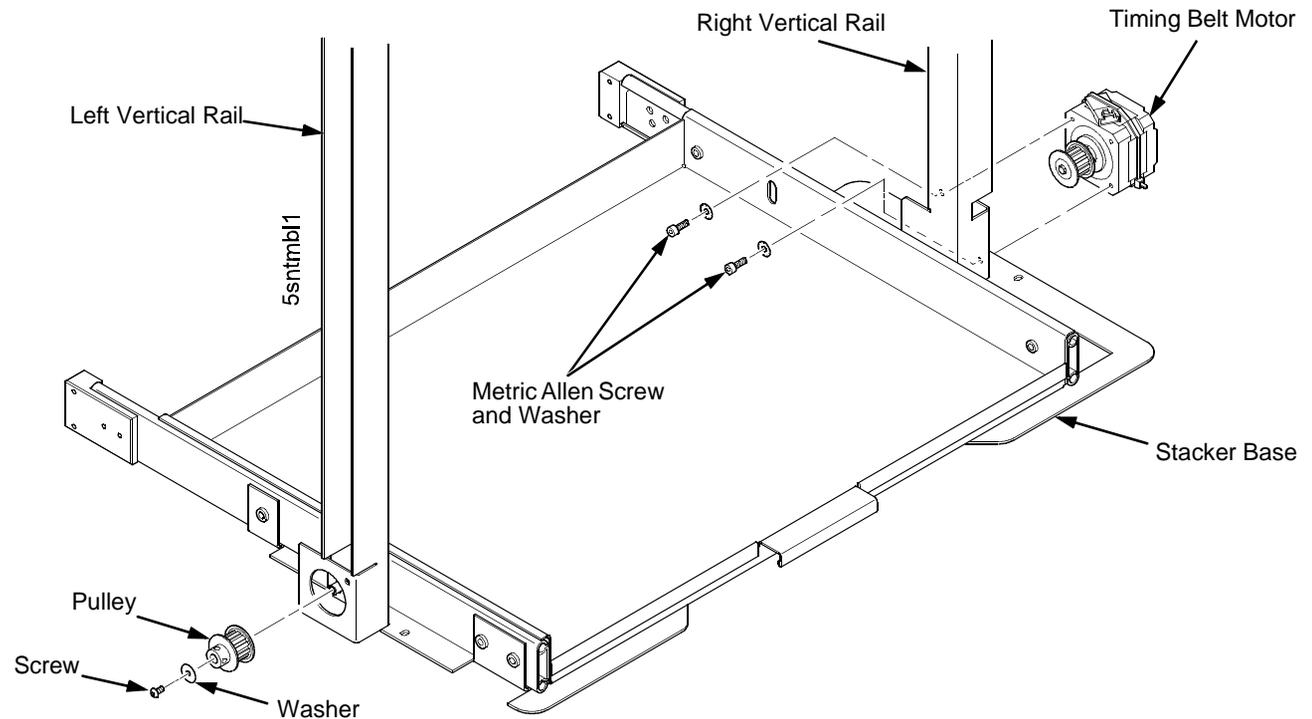


Figure 101. This figure shows how to remove the timing belt pulley and timing belt motor.

-
5. Loosen the two setscrews on the motor pulley and remove the pulley. Unplug the motor cable, if necessary. (Figure 102.)
Go to step 6.

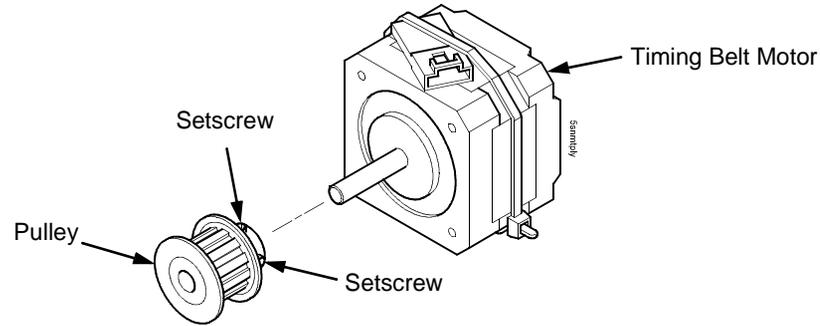


Figure 102. This figure shows how to remove the pulley from the timing belt motor.

6. Remove the shoulder screw, washers, and spacer that secures the constant force spring to the vertical rail. (Figure 103.)

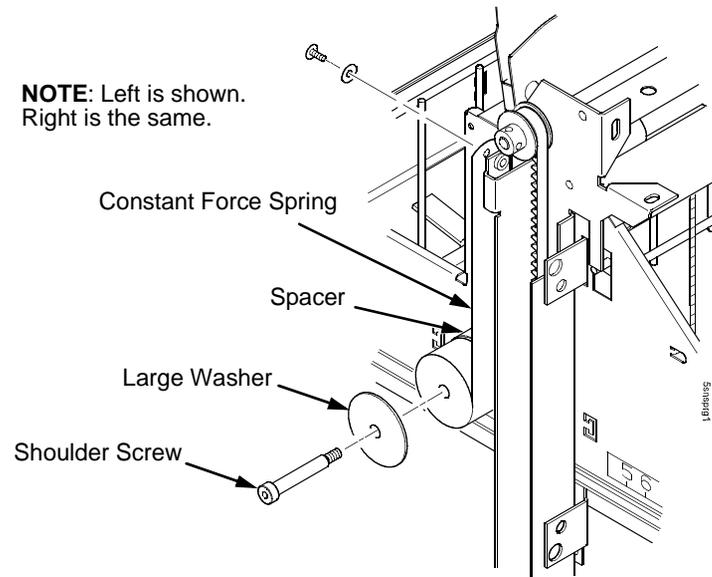


Figure 103. This figure shows how to release the constant force spring.

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7. Remove two Allen screws from the belt clamp that secures the timing belt to the stacker frame. (Figure 104.)

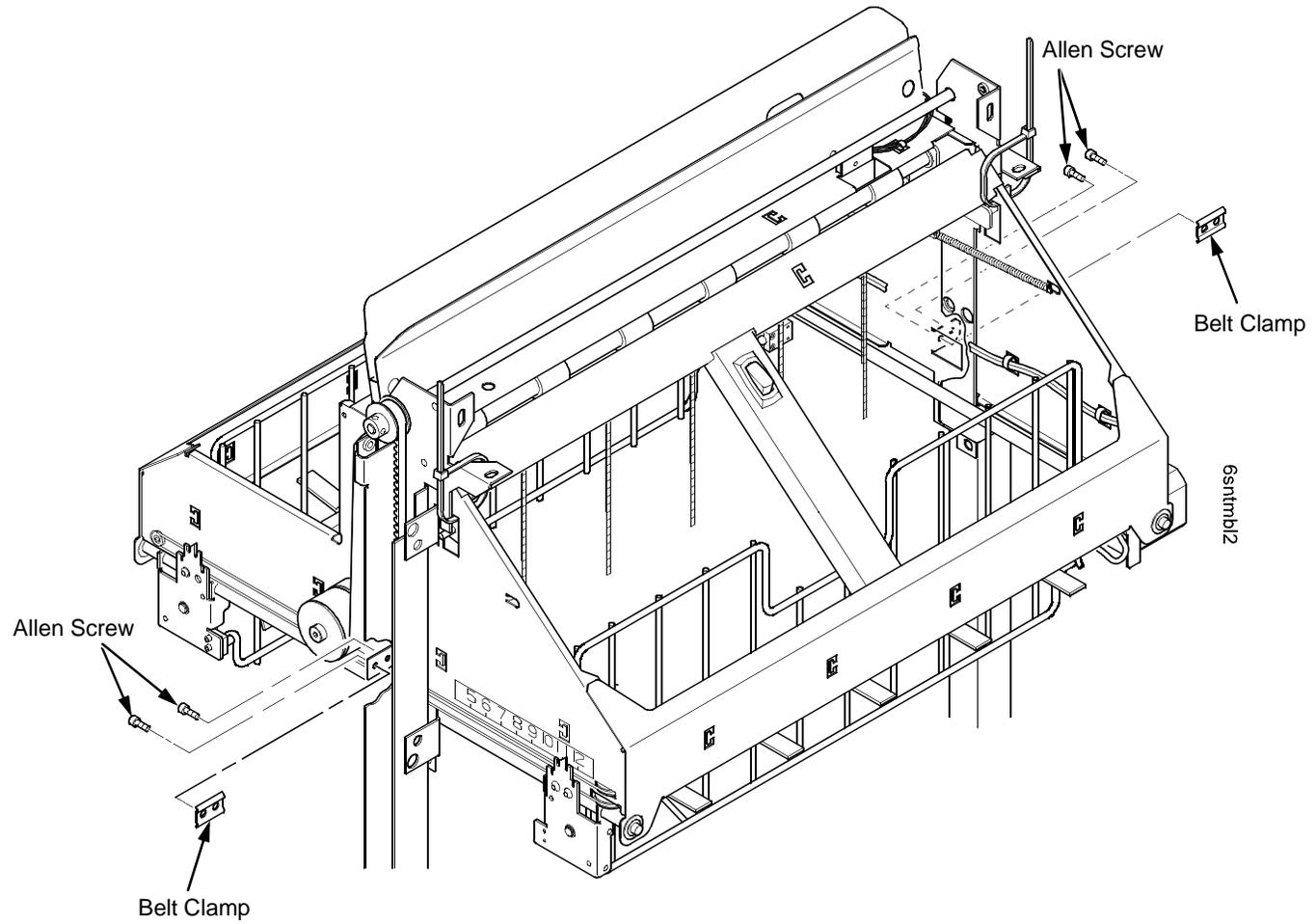


Figure 104. This figure shows how to remove the timing belt clamps.

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8. Remove the timing belt by working it around the vertical rail and constant force spring. (Figure 105.)

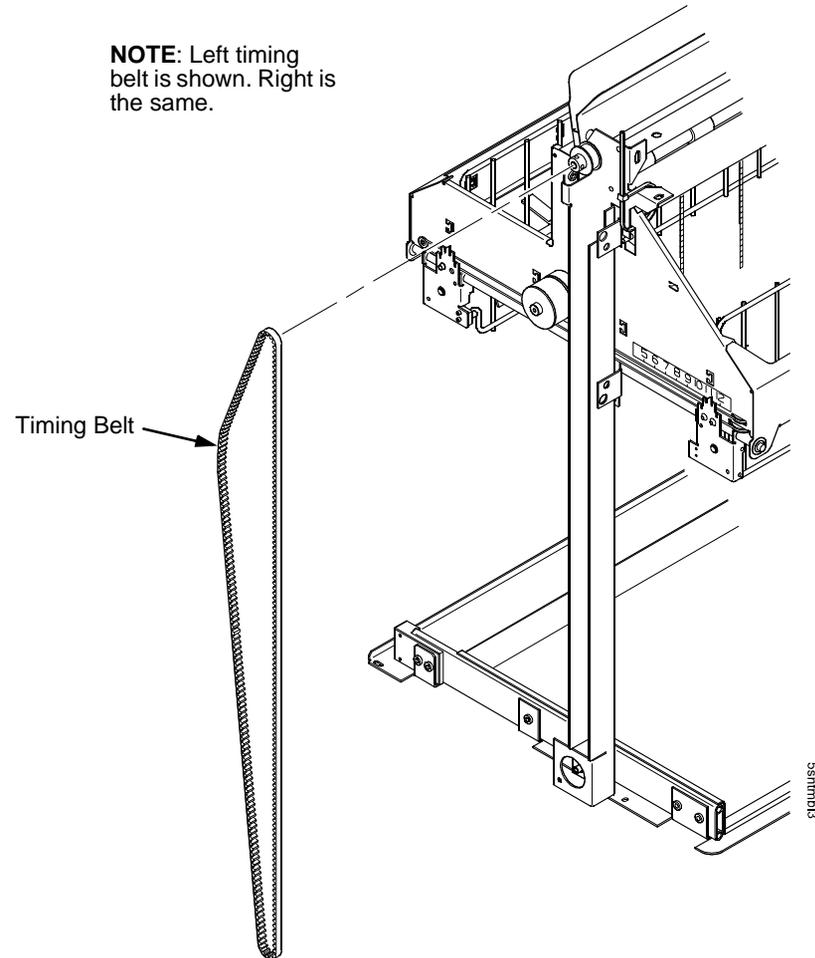


Figure 105. This figure shows how to remove the timing belt.

9. To install a timing belt, reverse the steps of this procedure.

Illustrated Parts Breakdown

The Illustrated Parts Breakdown (IPB) consists of exploded drawings of the power stacker assembly and subassemblies. Parts are listed next to each drawing.

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 555.

List of Illustrations

Figure 106. Stacker Assembly	page 555
Figure 107. Elevator Detail: Motors, Rollers, and Paddles	page 558
Figure 108. Stacker Detail: Rollers	page 560
Figure 109. Stacker Detail: Motor Bracket	page 562
Figure 110. Stacker Detail: Elevator Bracket	page 564
Figure 111. Stacker Detail: Paper Motion Detector.....	page 566

NOTE: The stacker operator panel and stacker cables are not illustrated but are listed on page 557.

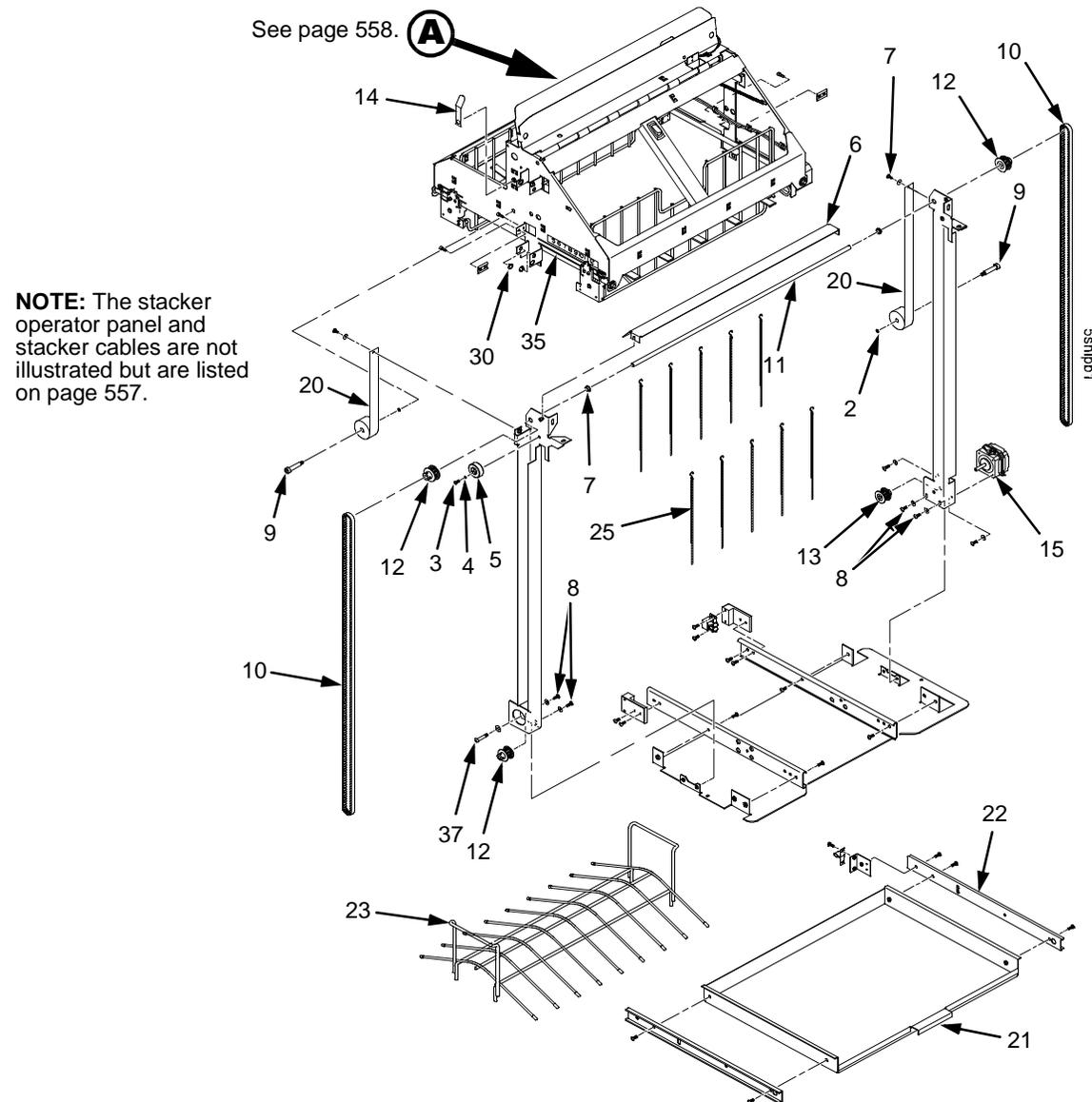


Figure 106. This illustrated parts breakdown shows how the vertical rails attach the elevator to the stacker base and tray.

(Figure 106)

Item No.	Part No.	Description	Notes
1	75P8255 75P8347	Replacement Stacker Assembly (Type III) Replacement Stacker Assembly (Before Type III)	Type III stacker is illustrated here. Not illustrated in this section
2	Ref	Washer, Shim, 3/16 inch Bore X .016 inch Thick	
3	Ref	Screw, Hex Skt Btn Hd, Zinc M3X8mm	
4	Ref	Washer, Shim, .125 ID X .010 inch Thick	
5	Ref	Timing Belt Tensioner Assy, Pwr Stkr	
6	24H8966	Paper Deflector	
7	Ref	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	24H8968	Timing Belt	
11	24H8996	Shaft, Lift	
12	24H9002 54P1539	Pulley, Timing Belt Pulley, Timing Belt, V3	Early -i05, -i10, and -i15 models Newer models
13	24H9001	Pulley, Motor	
14	57G1521	Clip, Grounding	
15	24H8969	Motor Assembly, Power Stacker	Elevator motor, all models (Figure 106) Paddle motor, all models (Figure 107)
16	24H8969 54P1469	Motor, Stepper, Power Stacker Motor, Stepper, Power Stacker	Paper puller motor, models -i10 and -i15 (shown in Figure 107) Paper puller motor, models -i20, -i2s, and -i24 (shown in Figure 107)
20	24H8970	Constant Force Spring	

Item No.	Part No.	Description	Notes
21	75P1181	Rear Tray	
22	75P1182	Slide, Ball Bearing, Rear Tray	
23	75P1183	Tent, Paper, Stacker	
25	24H8971	Chain	Mount chains outboard of shafts
30	Ref	Nylon Plug	
35	24H8973	Cable	
36	24H9004	Stacker Hardware Kit	Kit not illustrated
37	Ref	Screw, Shoulder, 8-32	Part of item 36
38	02N8328	Power Stacker Limit Switch Kit	Replaces limit switches on early -050, -010, and -015 models. (Not illustrated.)
39a	01P4699	Limit Switch Assembly	Replacement switch if item 38 is installed
39b	54P1541	Switch Assy, Reed Limit, V3	All models
39c	54P1478	Switch Assy, Rocker, V3	All models
	24H8974	Operator Panel Assembly	-i10, and -i15 models. (Not illustrated.)
	54P1540	Operator Panel Assembly, V3	-i10, -i15, and -i20, -i24, -i2s models (See Figure 91, page 540.)
	Ref	Rail Cable, Power Stacker	See page 328
	57P1376	Power Cable, Power Stacker	See page 327
	57P1377	Logic Cable, Power Stacker	See page 326
	Ref	Frame Cable, Power Stacker	See page 325
	24H8962	Rear Door, Extended, Power Stacker	Not illustrated
	24H8963	Re-Ship Kit, Printer w/Power Stacker	Not illustrated

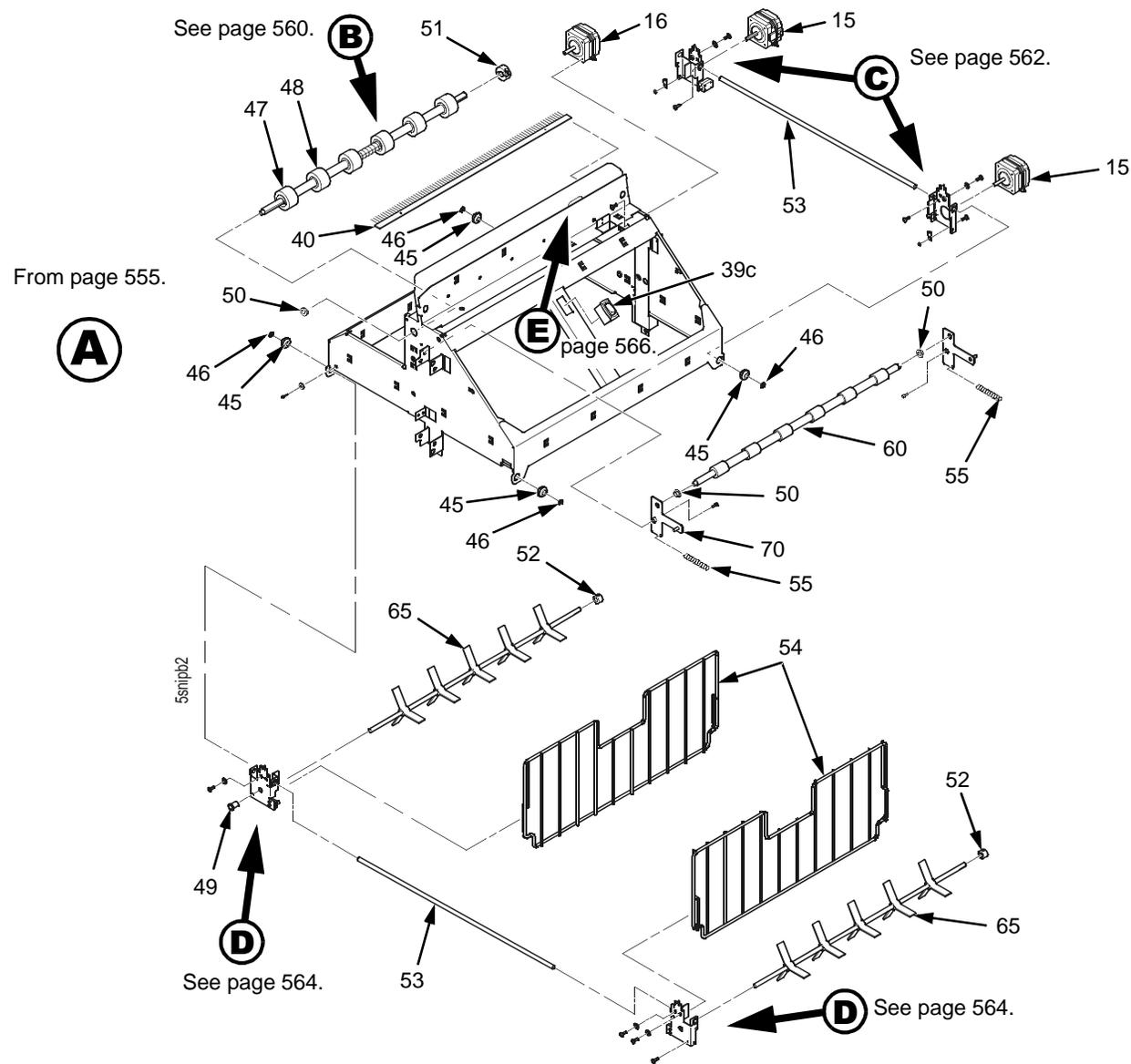


Figure 107. This illustrated parts breakdown is an exploded view of the stacker elevator, showing the motors, rollers, and paddles.

(Figure 107)

Item No.	Part No.	Description	Notes
36	24H9004	Stacker Hardware Kit	Kit not illustrated
39c	54P1478	Switch Assy, Rocker, V3	All models
40	24H8978	Anti-Static Brush	
45	Ref	Shear Grommet	Part of item 36
46	Ref	Cap Nut	Part of item 36
47	24H9005	Shaft, Drive Roller	
48	24H9006	Spacer, Drive Roller	
49	Ref	Bearing, Flanged	Part of item 36
50	Ref	Bearing	Part of item 36
51	24H9003	Collar Clamp	
52	Ref	Collar, Setscrew	Part of item 36
53	24H8997	Support Shaft	
54	01P4698	Fence, Wireform	
55	24H8981	Extension Spring	
60	24H8982	Idler Roller	Five on early models
65	24H8983	Paddle, Power Stacker	
70	02N8329	Power Stacker Pivot Arm Field Kit	Early models only; kit contents not illustrated

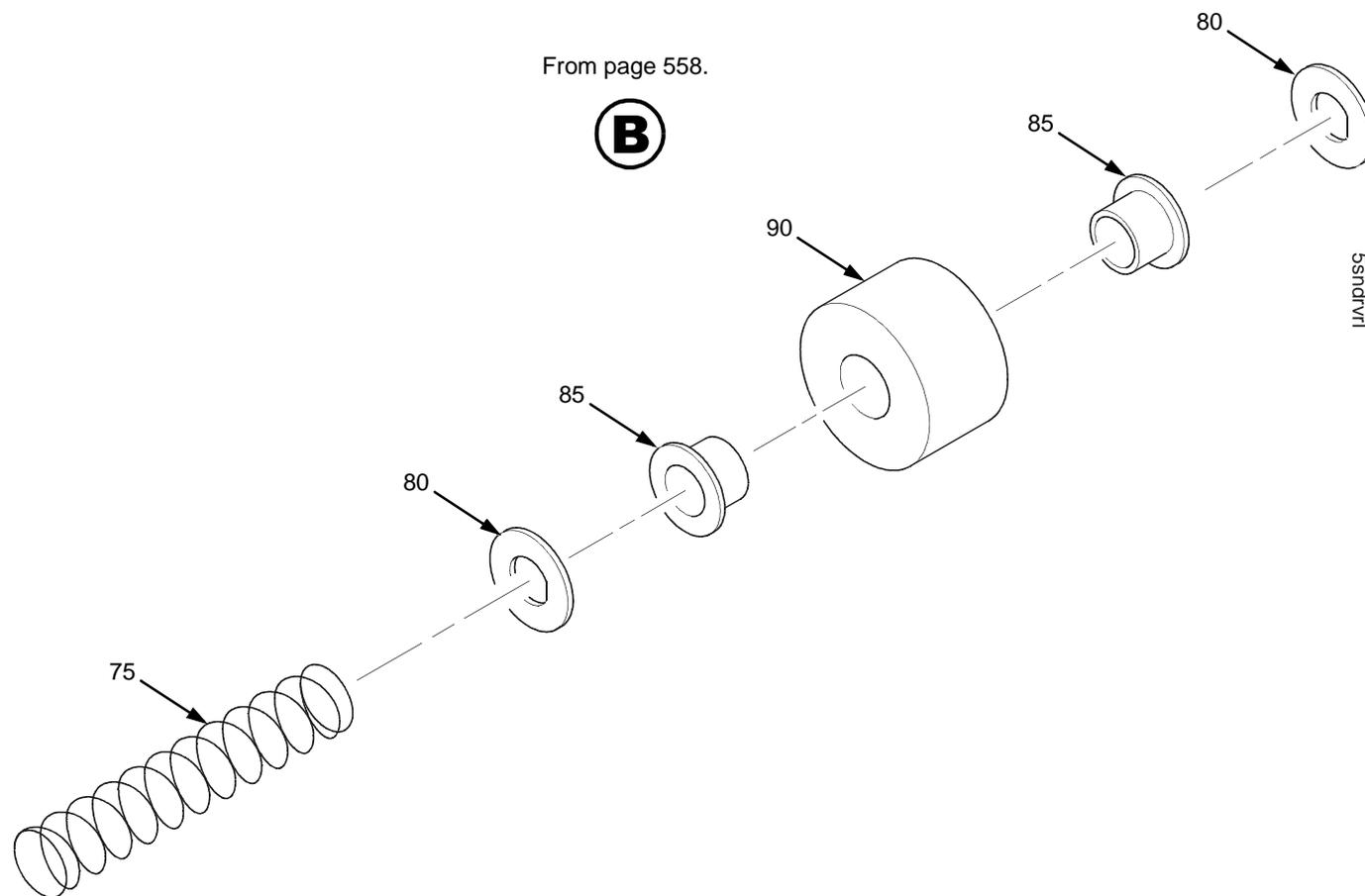


Figure 108. This illustrated parts breakdown is an exploded detail view of the paper drive rollers.

(Figure 108)

Item No.	Part No.	Description	Notes
36	24H9004	Stacker Hardware Kit	Kit not illustrated
75	24H8985	Compression Spring	On left end of shaft on early models
80	Ref	Friction Washer	Part of item 36
85	Ref	Flanged Bushing	Part of item 36
90	24H8988	Drive Roller	Five on early models

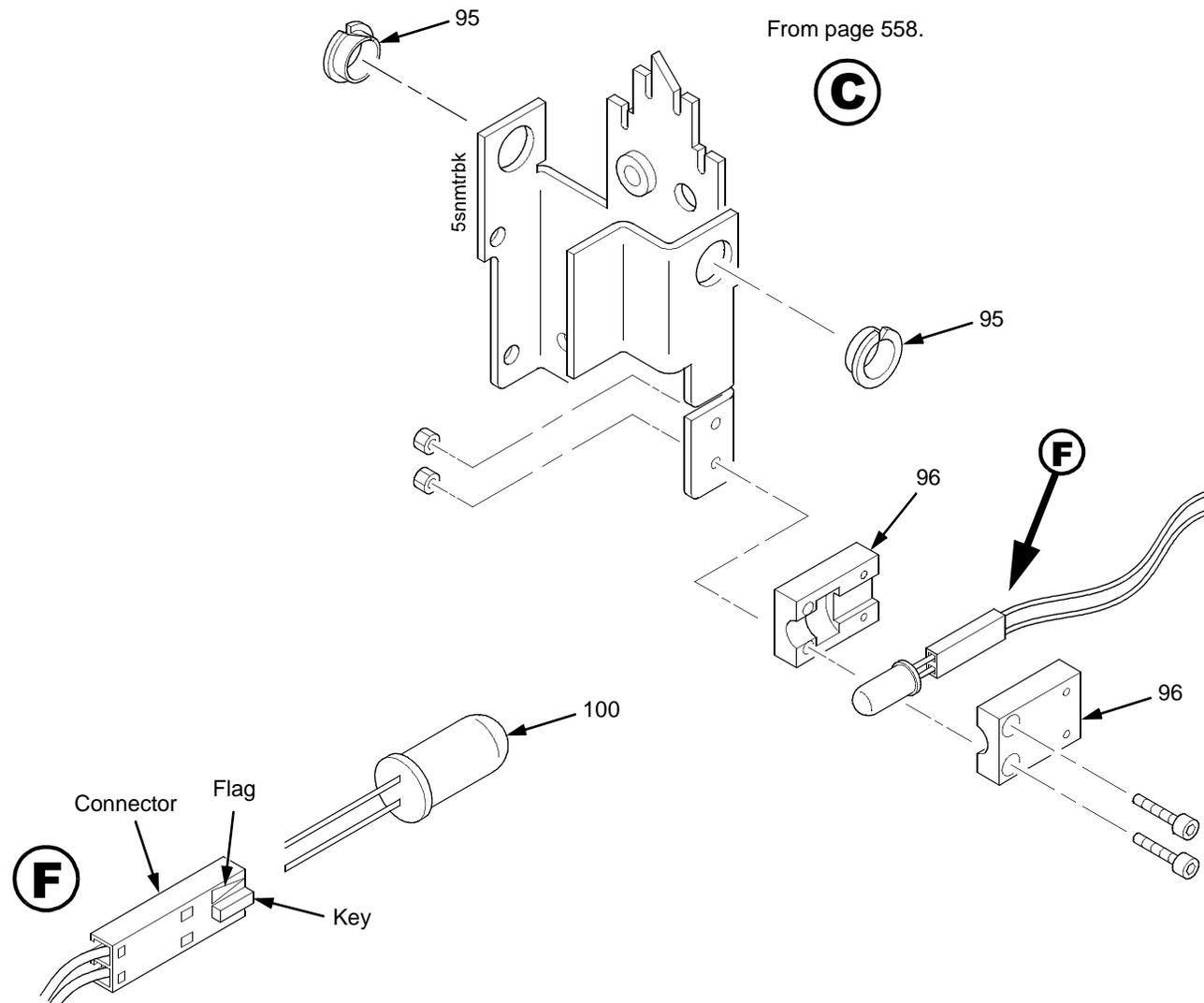


Figure 109. This illustrated parts breakdown is an exploded detail view of a motor bracket with its infrared LED.

(Figure 109)

Item No.	Part No.	Description	Notes
36	24H9004	Stacker Hardware Kit	Kit not illustrated
95	Ref	Clip-On Bearing	Part of item 36
96	24H8999	Holder, LED, Round	
100	24H8989	LED, IR, T-1, 3/4	

From page 558.

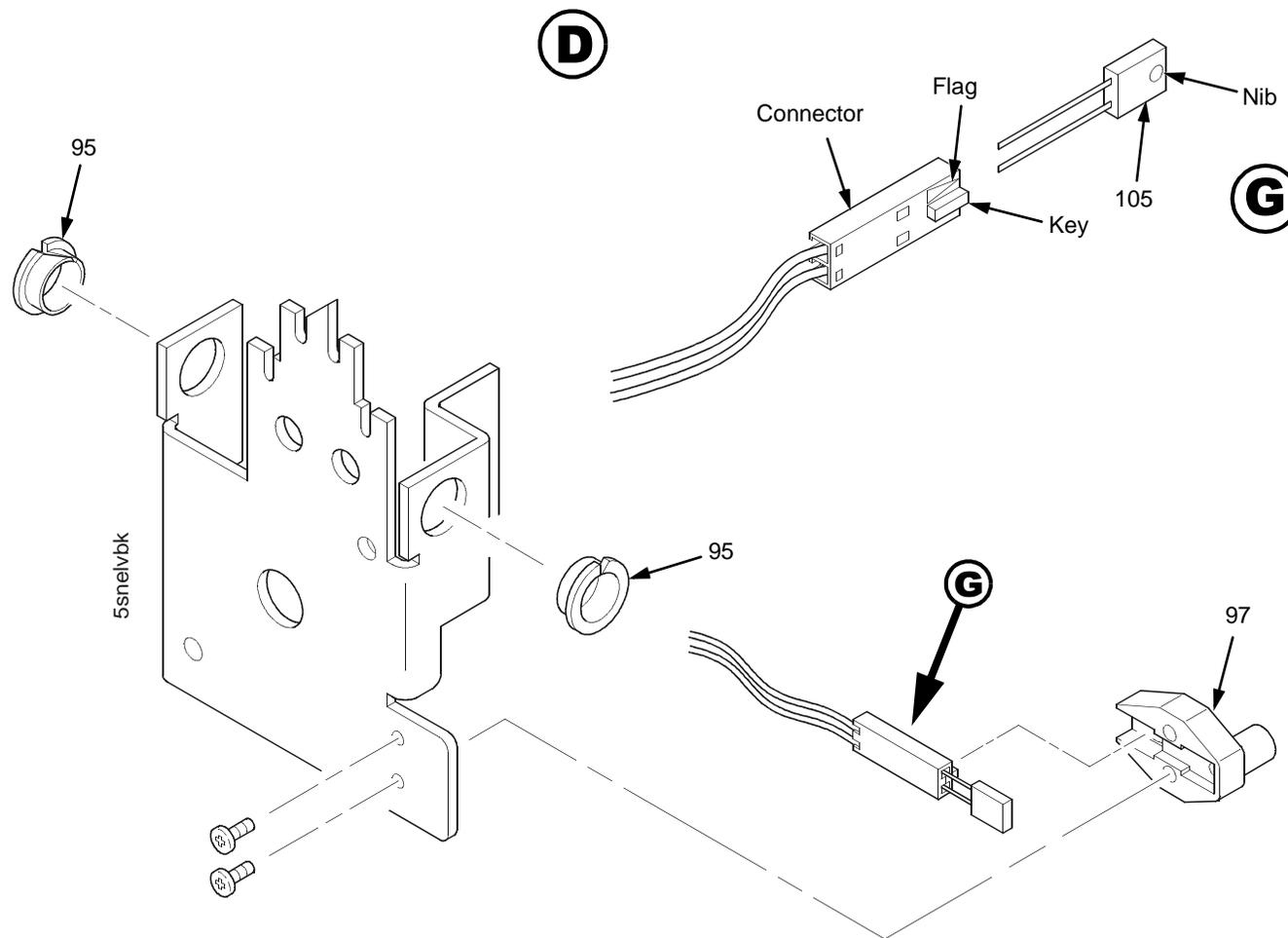


Figure 110. This illustrated parts breakdown is an exploded detail view of an elevator bracket with its rectifier and LED.

(Figure 110)

Item No.	Part No.	Description	Notes
36	24H9004	Stacker Hardware Kit	Kit not illustrated
95	Ref	Clip-On Bearing	Part of item 36
97	24H9000	Holder, LED, Flat	
105	24H8990	Photodarlington, NPN, Rectifier	

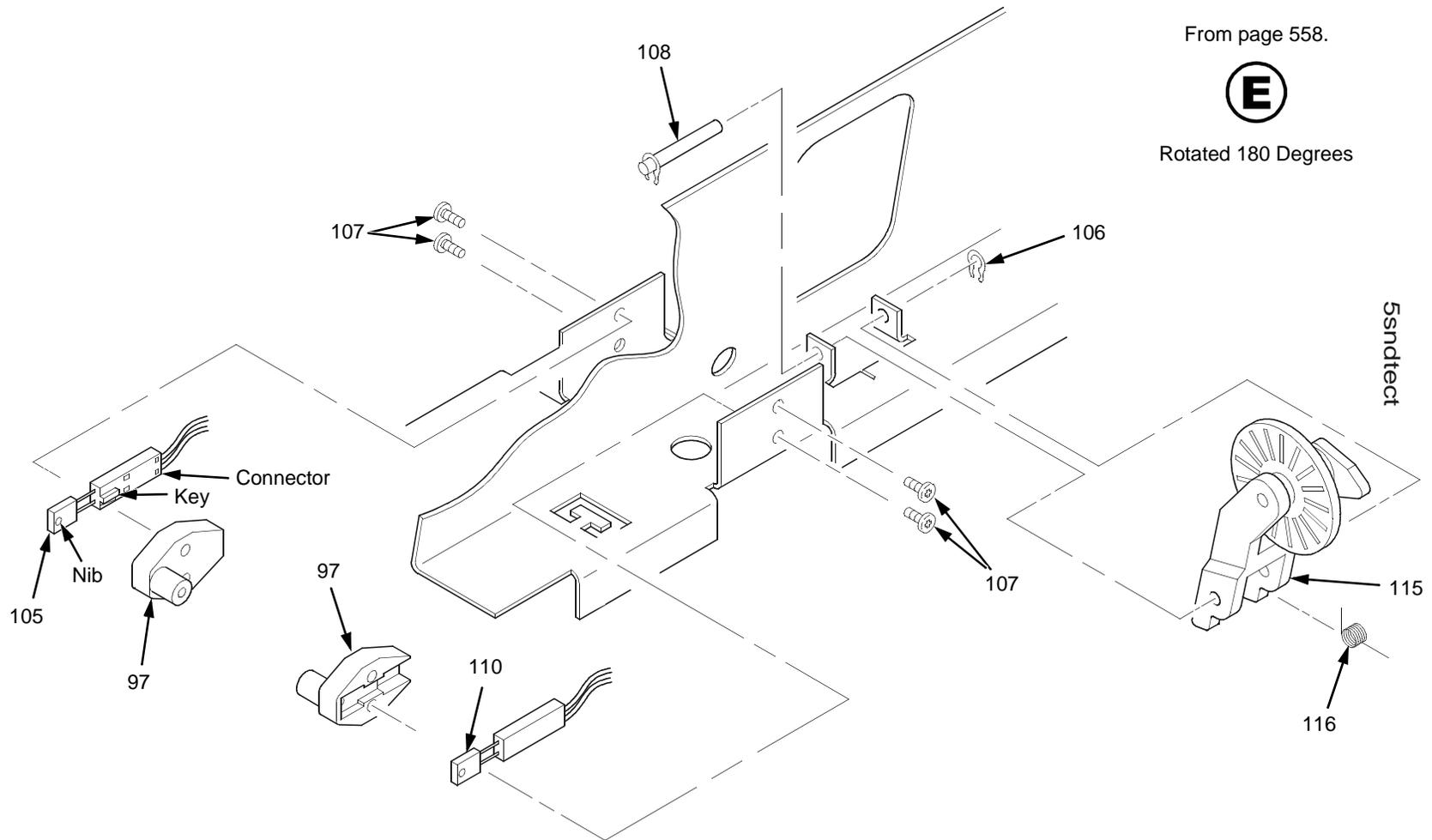


Figure 111. This illustrated parts breakdown is an exploded detail view of the paper motion detector.

(Figure 111)

Item No.	Part No.	Description	Notes
36	24H9004	Stacker Hardware Kit	Kit not illustrated
97	24H9000	Holder, LED, Flat	
105	24H8990	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	24H8991	LED, IR, Rectangular	
115	02N8327	Field Kit, Power Stacker, PMD	
116	Ref	Spring, Torsion	Part of item 115

F

Noise Suppression Devices

Ferrite noise suppressors are installed in printers using the CMX or CFX controller board to reduce radio frequency interference (RFI) to and from electronic equipment located near the printer.

NOTE: Do not install these noise suppressors in printers that use the PSA3 controller board.

Two kinds of ferrite noise suppressors are used:

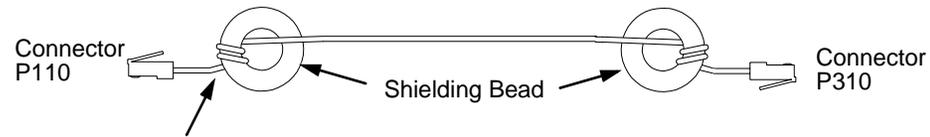
1. Shielding Bead: a cylindrical core, through and around which the control panel cable assembly is wound. Two are required.
2. Ferrite Clamp: a noise suppression core in a hinged plastic case and attached to the wall of the card cage with adhesive. The parallel I/O cable assembly passes through this core.

Figure 112 shows how these devices are installed.

ATTENTION

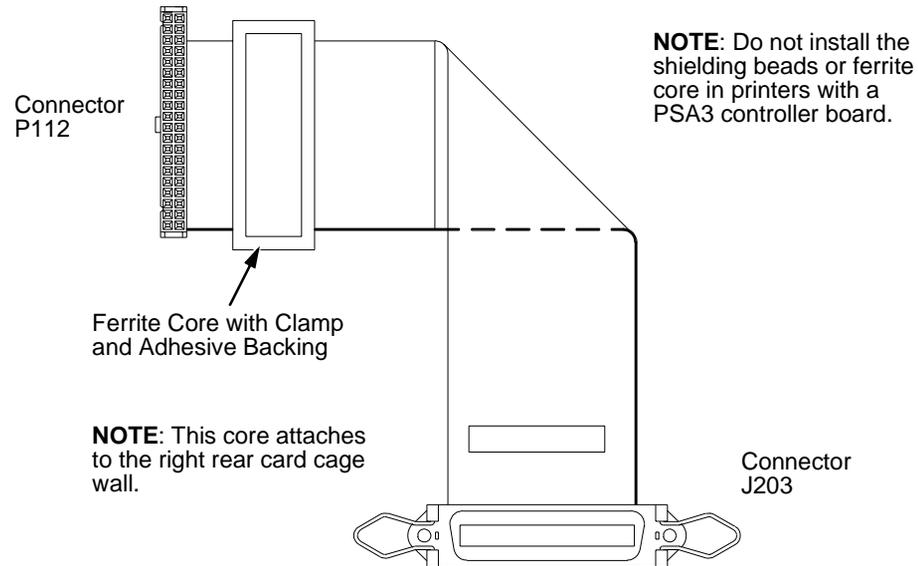
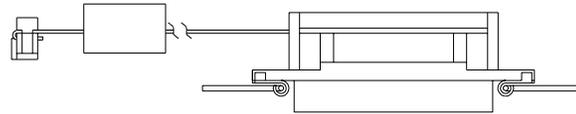
Make sure to duplicate the number of turns around the shielding beads when installing or replacing the control panel cable. See Figure 112.

Operator Panel Cable Assembly



NOTE: Two turns around each bead.

Parallel I/O Cable Assembly



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

Figure 112. Ferrite Core Installation

G

Printer Specifications

Contents

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Paper Specifications	page 573
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Electrical Characteristics.....	page 576
Interfaces	page 581
Cables	page 582
Printing Rates.....	page 582

Ribbon Specifications

Use only the ribbons listed below.

NOTE: The ribbon life figures listed below are based on IBM tests conducted in accordance with ANSI Standard X3A.182. Actual ribbon life may vary depending upon the user quality criteria, printer condition, machine settings, paper quality, and bar code requirements. Label yield depends on label format, bar code symbology, and other parameters. Label yield with high-performance scanning equipment may exceed these yields. Use only the ribbons listed below.

All Models Except 6400-i20 and 6400-i24

IBM Premium 20, P/N 54P2309

Used for general Text Printing as well as OCR, graphics, and bar code printing. Average yield: 20 million DRAFT characters, 4667 AIAG-B3 labels with visible light source scanning equipment, or 2500 AIAG-B3 labels with infrared light source scanning equipment.

IBM Premium 30, P/N 57P2308

Used for general Text Printing as well as OCR, graphics, and bar code printing. Average yield: 30 million DRAFT characters, 4667 AIAG-B3 labels with visible light source scanning equipment, or 2500 AIAG-B3 labels with infrared light source scanning equipment.

6400-i20 and 6400-i24 Models

IBM Premium 2000 Ribbon (box of 12), P/N 54P1095

Used for general text printing as well as Optical Character Recognition (OCR), graphics, and bar code printing. Average yield 60 million DRAFT characters, 4700 AIAG-B3 labels with visible light source scanning equipment. This ribbon is not recommended for use with infrared (IR) scanning equipment.

Ordering Ribbons

IBM Printing Supplies are distributed through Priority Fulfillment Services (PSFweb) and a worldwide network of dealers. Please contact one of the following numbers to place an order for IBM 6400-i ribbons or to locate an IBM Printing Supplies Dealer in your area:

United States and Canada

Please call 1-888-IBM-PRINT

EMEA

IBM Supplies Fulfillment Operations (ISFO) at 31-43-350 2756 (within the Netherlands call: 043-350 2756.) Toll free numbers to ISFO have been established in the following countries:

Belgium	0800 71950	Germany	0800 18 18 005
Denmark	800 15534	Norway	800 11389
Finland	08001 13110	Spain	900 983131
France	0800 905 5871	Sweden	0207 94270
Italy	800 820094	UK	08009 68679

AP and LA

Please call 1-972-881-0733 ext. 3234

Warranty Information

The approximate average yields are not a warranty or guarantee of minimum life and are provided to assist in initial supplies planning. Actual usage should be used to establish the supply's life in the end user's application. Many factors such as print coverage per page, machine settings, paper type and size, and environmental conditions can affect supply life.

Supply warranties are only for defects in materials and workmanship at the time of shipment and installation. They are not for print count life or normal wear and tear, nor for any print count minimum. Contact your place of purchase for warranty return instructions.

Paper Specifications

The following paper specifications are general guidelines. Always test paper stock applications to determine print quality.

Paper

Type of Paper	<ul style="list-style-type: none"> Edge-perforated, fan-fold, 3 to 17 inches (7.62 to 43.18 cm) wide*, 3 to 16 inches with stacker, 2 to 24 inches (5.08 to 60.96 cm) long**, 5 to 12 inches with stacker. Single-part: 15 pound (57 g/m²) to 100 pound (377 g/m²) stock. Multi-part carbon: 1 to 6 part forms, maximum 12 pound (45 g/m²) ply of upper plies. Multi-part carbonless, maximum of 6-part forms. Test readability of greater than 4-part forms. Recycled paper not recommended for use with the power stacker. 	
Sheet Thickness	0.025 inches (0.064 cm) maximum	
Paper Drive	Adjustable tractors (6-pin engagement)	
Slew Rate	Fast	Slow
6400-i05	12 ips	10.4 ips
6400-i5P	12 ips	10.4 ips
6400-i10	20 ips	10.4 ips
6400-i1P	16 ips	10.4 ips
6400-i15	25 ips	10.4 ips
6400-i20	36 ips	18 ips
6400-i24	36 ips	18 ips
6400-i2s	36 ips	18 ips

Labels

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

Sheet Size: 3 to 17 inches (7.62 to 43.18 cm) wide*, including the two standard perforated tractor feed strips. A maximum sheet length of 16 inches (40.64 cm) between top and bottom perforations.**

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

*On pedestal models, when using the rear paper exit, the maximum form width is 16 inches (40.64 cm).

**On cabinet models, forms longer than 12 inches can be used by opening the front and rear printer doors.

Printer Dimensions and Weight

Cabinet Models

Height: 41 inches (103.3 cm)

Width: 27 inches (68.6 cm)

Depth: 29 inches (73.7 cm)
32.5 inches (82.6 cm) with optional power stacker

Weight: 225 lbs. (102.1 kg) unpackaged
237 lbs. (112. kg) unpackaged with optional power stacker
285 lbs. (129.3 kg) packaged
297 lbs. (139 kg) packaged with optional power stacker

Pedestal Models

Height: 35.5 inches (90.2 cm)

Width: 24.6 inches (62.5 cm)

Depth: 30 inches (76.2 cm)

Weight: 120 pounds. (54.4 kg) unpackaged
160 pounds. (72.6 kg) packaged

Environmental Characteristics

Temperature

Operating: 50° to 104° F (10° to 40°C) up to 5000 feet (1524 meters), 50° to 90° F (10° to 32°C) up to 8000 feet (2438 meters)

Storage: -40° to 158° F (- 40° to 70°C)

Relative Humidity

Operating: 15% to 80% (noncondensing)

Storage: 15% to 90% (noncondensing)

Acoustic Noise Level

	Cabinet Models			Pedestal Models	
Acoustic Noise Levels per ISO 9296	-i05 -i10	-i15	-i20 -i2s -i24	-i5P	-i1P
Printing	50 dB	52 dB	55 dB	62 dB	66 dB
	6.7 Bel	7.0 Bel	7.1 Bel	7.8 Bel	8.2 Bel
Standby	46 dB	46 dB	42 dB	46 dB	46 dB
	6.3 Bel	6.3 Bel	5.8 Bel	6.3 Bel	6.3 Bel
<p>NOTE: Cabinet model noise levels listed are with the cabinet doors closed. Levels will be higher if the doors are open. Pedestal model noise levels listed are for rear paper exit. Levels will be higher for top paper exit.</p>					

Electrical Characteristics

Input Voltage

Line Voltage Design Range	Line Frequency	RMS Current			
		500 LPM	1000 LPM	1500 LPM	2000 LPM 2400 LPM
88-140 V RMS	47-63 Hz	6A @ 100 V	6A @ 100 V	8A @ 100 V	9A @ 100V
178-270 V RMS	47-63 Hz	3A @ 200 V	3A @ 200 V	5A @ 200 V	9A @ 100V

Power Consumption

6400-i05

6400-i5P

120 VAC 60 Hz	Operating DP Mode		Standby	
	All H's	ECMA132*	Not Energy Star	Energy Star
Watts	210	167	80	21
BTU/Hour	717	570	273	71
VA	300	291	120	36

220 VAC 50 Hz	Operating DP Mode		Standby	
	All H's	ECMA132*	Not Energy Star	Energy Star
Watts	210	176	80	22
BTU/Hour	717	601	273	75
VA	340	194	130	41

*ECMA132 Standard Spread Sheet Pattern (ISO 10561)

6400-i10

6400-i1P

120 VAC 60 Hz	Operating DP Mode		Standby	
	All H's	ECMA132* ^I	Not Energy Star	Energy Star
Watts	300	197	80	25
BTU/Hour	1025	673	273	85
VA	530	342	140	48

220 VAC 50 Hz	Operating DP Mode		Standby	
	All H's	ECMA132*	Not Energy Star	Energy Star
Watts	290	198	80	25
BTU/Hour	990	676	273	85
VA	600	227	150	55

*ECMA132 Standard Spread Sheet Pattern (ISO 10561)

6400-i15

120 VAC 60 Hz	Operating DP Mode		Standby	
	All H's	ECMA132*	Not Energy Star	Energy Star
Watts	440	231	90	27
BTU/Hour	1502	788	307	92
VA	740	388	160	50

220 VAC 50 Hz	Operating DP Mode		Standby	
	All H's	ECMA132*	Not Energy Star	Energy Star
Watts	420	243	90	27
BTU/Hour	1434	829	307	92
VA	830	277	170	58

*ECMA132 Standard Spread Sheet Pattern (ISO 10561)

6400-i20
6400-i2s
6400-i24

120 VAC 60 Hz	Operating DP Mode		Standby	
	All H's	ECMA132*	Not Energy Star	Energy Star
Watts	637	251	119	28
BTU/Hour	2175	857	406	95.6
VA	690	291	120	30.7

220 VAC 50 Hz	Operating DP Mode		Standby	
	All H's	ECMA132*	Not Energy Star	Energy Star
Watts	604	268	111	28
BTU/Hour	2062	915	379	95.6
VA	686	280	122	30.7

*ECMA132 Standard Spread Sheet Pattern (ISO 10561)

Interfaces

Type	Standard	IEEE 1284 Parallel, Centronics Parallel, RS-232/RS-422 Serial, Dataproducts Parallel
	Optional	Expansion-CT (coax/twinax), Dataproducts Long Line, Ethernet 10/100Base-T
Logic Levels	TTL/EIA-232-E, EIA-422-B	
Data Format	ASCII	
Compatibility	EIA-232-E, EIA-422-B, PC Parallel, Dataproducts, IEEE 1284, Twinaxial, Coaxial, Ethernet	
Transfer Rates	Up to 200K bytes/sec on parallel interfaces Up to 19.2 K baud on RS-232 serial interface Up to 115.2K baud on RS-422 serial interface	
Buffer	16 kilobytes on serial and parallel interfaces	

Cables

A power line cord is provided with the printer, but no data cables. The following paragraphs provide data cable requirements and ordering information.

ASCII Serial/Parallel: The 6400i printer connects to personal computers and controllers via industry standard EIA-232-E and PC-parallel printer cables. For Dataproducts interfaces, you will need a Dataproducts cable. Contact your IBM service representative to order the following:

- EIA-232-E Cable
- PC-Parallel Cable
- Dataproducts Adapter Feature

AS/400: The 6400i connects to the AS/400 ASCII Workstation Controller via the following IBM cables, available through your IBM service representative:

- 20 ft. RS-232
- 40 ft. RS-232

RISC System/6000: For RS-232 attachment to the IBM RISC System/6000, the following cables are required:

- IBM Async cable EIA-232/V.24
- Printer/terminal interposer EIA-232
- Serial Cable Kit (PN 12H1204)

Coax/Twinax Interface Feature: Contact your IBM service representative for attachment requirements.

Printing Rates

The printing speed of text is measured in lines per minute (lpm) and is a function of the selected font and the vertical dot density. The printing speed of text is independent of the number of characters configured in the character set repertoire. Print rates for lines containing attributes such as bold or emphasized printing, superscripts, subscripts, or elongated attributes will decrease to not less than half the rates of the font without such attributes. The exact print rate of lines containing these attributes depends on the specific print job, but software maximizes the throughput by dynamically determining which dot rows contain adjacent dots which must be printed in two strokes. Table 12 lists the nominal printing rates for 6400-i printers.

The reverse paper feed capability allows the printing of multiple densities on a single line. This is useful in printing forms and text together or in mixing different fonts on a print line. Use of multiple densities and reverse paper feed also affects throughput.

Table 12. 6400-i Nominal Print Rates (1 of 2)

Print Quality Dot Density (DPI) Note 1	Characters Per Inch	Dot Matrix Note 2	Performance									
			Uppercase Only LPM Note 3					Descenders & Underline LPM Note 3				
			500	1000	1500	2000s	2400	500	1000	1500	2000s	2400
Correspondence 90 (180) x96	10 12 15	7(13) x 9+3 6(11) x 9+3 (9) x 9+3	200	400	600	842	960	500	306	459	648	738
Data Processing 60(120) x72	10 12 13.3 15 17.1	5(9) x 7+2 4(7) x 7+2 4(7) x 7+2 3(5) x 7+2 3(5) x 7+2	375	750	1125	1500	1800	300	600	900	1200	1400
High Speed 60(120) x 48	10 12 13.3	5(9) x 5+1 4(7) x 5+1 4(7) x 5+1	500	1000	1500	2000	2400	428	865	1284	1714	2000
Note 1	A (B) x C, where:		A is maximum horizontal dot density B is horizontal dot placement density C is vertical dot density									
Note 2	D (E) x F + G, where:		D is maximum number of dots that may be placed on E horizontal positions F is number of vertical dots for uppercase symbols G is number of dots available for descenders									
Note 3	LPM = Lines Per Minute											

Table 12. 6400-i Nominal Print Rates (2 of 2)

Print Quality Dot Density (DPI) Note 1	Characters Per Inch	Dot Matrix Note 2	Performance				
			Plot Mode IPM Note 3				
			500	1000	1500	2000	2400
Correspondence 90 (180) x 96	10 12 15	7(13) x 9+3 6(11) x 9+3 (9) x 9+3	21	42	61	87	94
Data Processing 60(120) x 72	10 12 13.3 15 17.1	5(9) x 7+2 4(8) x 7+2 4(8) x 7+2 3(5) x 7+2 3(5) x 7+2	42	83	127	167	185
High Speed 60(120) x 48	10 12 13.3	5(9) x 5+1 4(7) x 5+1 4(7) x 5+1	62	124	186	250	266
Note 1	A (B) x C, where:		A is maximum horizontal dot density B is horizontal dot placement density C is vertical dot density				
Note 2	D (E) x F + G, where:		D is maximum number of dots that may be placed on E horizontal positions F is number of vertical dots for uppercase symbols G is number of dots available for descenders				
Note 3	IPM = Inches Per Minute						

H

Metric Conversion Tables

Length

Multiply	By	To Obtain
foot	0.3048*	meter
foot	30.48*	centimeter
foot	304.8*	millimeter
inch	0.0254*	meter
inch	2.54*	centimeter
inch	25.4*	millimeter
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
inch-pound	0.11298	Newton-meter
foot-pound	1.3558	Newton-meter
Newton-meter	8.8511	inch-pound
Newton-meter	0.7376	foot-pound
pound	4.4482	Newton
Newton	0.22481	pound

Mass and Density

Multiply	By	To Obtain
pound*	0.4535924	kilogram
ounce*	28.34952	gram
kilogram	2.204622	pound
gram	0.03527397	ounce
* avoirdupois		

Temperature

From	To	Use Formula
temperature Celsius (tc)	temperature Fahrenheit (tf)	$tf = 1.8tc + 32$
temperature Fahrenheit (tf)	temperature Celsius (tc)	$tc = (tf - 32)/1.8$

Power

Multiply	By	To Obtain
<u>Btu (International Table)</u> hour	0.2930711	Watt
Watt	3.412141	<u>Btu (International Table)</u> hour
Watt	0.001359621	horsepower (metric)
horsepower (metric)	735.499	Watt

I

Torque Table

The table below establishes the torque requirements for routine installation of threaded fasteners. These requirements apply to fasteners made of steel, at a minimum engagement of 3.5 threads, including chamfer and countersink. For the most accurate torquing, apply anti-seize compound to fastener threads before you torque the fastener.

Fastener sizes are listed as *Numbered Size - Threads Per Inch*. (For example, 2-56 means “a No. 2 screw with 56 threads per inch.”)

Carbon Steel Fasteners (ANSI B18.6.3 - 1972)				
Fastener Size	Into Alum. or Brass 25,000 psi ultimate tensile strength	Into Steel 60,000 psi ultimate tensile strength	Into Weld/Press Studs or Nuts	Into Medium Carbon Steel Fasteners 100,000 psi ultimate tensile strength
2-56	25 ± 2 in oz	36 ± 2 in oz	30 ± 2 in oz	*
4-40	62 ± 4 in oz	75 ± 5 in oz	70 ± 5 in oz	*
6-32	122 ± 7 in oz	150 ± 10 in oz	135 ± 10 in oz	*
8-32	11 ± in lb	18 ± 1 in lb	18 ± 1 in lb	*
10-24	20 ± 1 in lb	25 ± 1.5 in lb	21 ± 1 in lb	*
10-32	15 ± 1 in lb	29 ± 2 in lb	29 ± 1 in lb	*
1/4 - 20	40 ± 3 in lb	62 ± 4 in lb	62 ± 4 in lb	105 ± 5 in lb

Carbon Steel Fasteners (ANSI B18.6.3 - 1972)				
Fastener Size	Into Alum. or Brass 25,000 psi ultimate tensile strength	Into Steel 60,000 psi ultimate tensile strength	Into Weld/Press Studs or Nuts	Into Medium Carbon Steel Fasteners 100,000 psi ultimate tensile strength
Fastener Sizes		Torque for Routine Tightening of Threaded Fasteners		
4-40 UNC & 4-48 UNF		4 ± 1 in lb		
6-32 UNC & 6-40 UNF		11 ± 1 in lb		
8-32 UNC & 8-36 UNF		19 ± 1 in lb		
10-24 UNC & 10-32 UNF		25 ± 1 in lb		

J

Abbreviations And Signal Mnemonics

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

Abbreviation or Mnemonic	Definition
K Ω	1,000 Ohms
Meg Ω	1,000,000 Ohms
μ F	microfarad (10^{-6} farad)
μ s	microsecond (10^{-6} second)
μ sec	microsecond (10^{-6} second)
A0, A1, etc.	Address 0, Address 1, etc.
AC	Alternating Current
ACC	Access
ACK	Acknowledge
AMP	Amplitude; Ampere
AMPL	Amplitude
AN	Anode
ASIC	Application-Specific Integrated Circuit
ATTN	Attention
B	Buffered
BANK FAN	Hammer Bank Fan

BCOM	Buffered Communication
BCP	Bi-phase Communications Processor
BHSC	Buffered Hammer Shift Clock
BN	Buffered, Low True
BNLD	Buffered, Low True, Lower Driver
BPS	Bits Per Second
BSY	Busy
BTU	British Thermal Unit
BUD	Buffered Upper Driver
CA	Cathode
CC	Card Cage
CCF	Card Cage Fan
CE	Customer Engineer
CFX	Manufacturer's designation for the controller board used in 6400-i20 printers
CHNG	Change
CIR	Circuit
CLK	Clock
CO	Cover Open
COLL	Collector
COMM	Communication
CONTLR	Controller
CMD	Command
CMX	Manufacturer's designation of the controller board used in 6400-i05, -i5P, -i10, -i1P, and -i15 printers
CNC	Connector, Connection
CPI	Characters Per Inch
CR	Carriage Return

CT	Coaxial/Twinaxial
CTL	Control
CTS	Clear to Send
CUR	Current
CVO	Cover Open (Switch)
D0, D1, etc.	Data Bit 0, Data Bit 1, etc.
DAT	Data
DC	Direct Current, Data Controller (a functional unit of the CMX controller board)
DCD	Data Carrier Detect
DIAG	Diagnostic
DIFF	Differential
DIMM	Dual Inline Memory Module
DHIO	Dual Hammerbank Input/Output
DMA	Direct Memory Access
DP	Data Processing, DataProducts
DPMC	Dot Plucker Memory Controller
DPU	Data Processing Unit
DRAM	Dynamic Random-Access Memory
DRV	Drive or Driver
DRVR	Driver
DSR	Data Set Ready
DTR	Data Terminal Ready
EC	Engine Controller (a functional unit of the CMX board)
EEPROM	Electrically Erasable/Programmable Read-Only Memory
EHF	Exhaust Fan

EL	Elevator (motor), Power 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 (Operator Panel)
FTIC	Fire Timer Integrated Circuit
GND	Ground
HB	Hammer Bank
HBA	Hammer Bank ASIC
HBF	Hammer Bank Fan
HBL	Hammer Bank, Left
HBP	Hammer Bank Power

HBR	Hammer Bank, Right
HD	Hammer Driver
HDIC	Hammer Driver Integrated Circuit
HDPH	Hammer Driver Phase
HLP	Hammer Bank Logic, Signals and Power
IC	Integrated Circuit
ID	Identification
IGP	Intelligent Graphics Processor
IML	Initial Microcode Load
INST	Instruction
INT	Interrupt
IPM	Inches Per Minute
I/O	Input/Output
IRQ	Interrupt Request
(J)	Jack connector
L	Left
LAN	Local Area Network
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LF	Line Feed
LO	Low
LPI	Lines Per Inch
LPM	Lines Per Minute
LRIB	Left Ribbon

LRP	Left Ribbon Guide
M1	Rear Paddle Motor, Power Stacker
M2	Front Paddle Motor, Power Stacker
M	Motor
MAIN	Maintenance Jack, RS-232 (Optional)
MECA	Mechanism Engine Control ASIC
MECH	Mechanism
MF	microfarad (10^{-6} farad)
MH	Mounting Hole
MOSFET	Metal Oxide Semiconductor Field Effect Transistor
MOT	Motor
MPU	Magnetic Pickup (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	Network Interface Card (an optional Ethernet interface)
NLQ	Near Letter Quality
No.	Number
NOVRAM	Non-volatile Random-Access Memory
ns	nanosecond (10^{-9} second)
NVRAM	Non-volatile Random-Access Memory
NT	Not

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
PE	Printer Error, Paper Empty
PER	Peripheral Device
PF	picofarad (10^{-12} farad)
PFC	Paper Feed Controller
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 (Switch)
PN	Pin

P/N	Part Number
PO	Paper Out
POD	Paper Out Detect (Switch)
PPR	Paper
PROM	Programmable Read-Only Memory
PS	Power Supply
PSA3	Manufacturer's designation of the controller board used in 6400-i24 and 6400-i2s printers
PS5	Power Supply + 5 Volt
PTR	Pointer or Printer
PWM	Pulse Width Modulation
PWR	Power
R	Right
RBN	Ribbon
RD	Read
RET	Return
RIB	Ribbon
RG	Ribbon Guide
RGL	Ribbon Guide, Left
RGR	Ribbon Guide, Right
RM	Ribbon Motor
RML	Ribbon Motor, Left
RMR	Ribbon Motor, Right
RQ	Request
RRIB	Right Ribbon
RRP	Right Ribbon Guide
RSP	Ribbon and Shuttle Processor

RST	Reset
RTPU	Real-Time Processing Unit
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
STBY	Standby
STK	Power Stacker
SW	Switch
SYNC	Synchronize

TCB	Task Control Block
TEMP	Temperature
TOF	Top of Form (first print line)
TP	Test Point
TTL	Transistor-Transistor Logic
TXD	Transmit Data
UART	Universal Asynchronous Receiver/Transmitter
UDPH	Upper Drive Phase
UNDEF	Undefined
USART	Universal Synchronous/Asynchronous Receiver/Transmitter
V	Volts
V _{CC}	Voltage at Collector
V _{DD}	Voltage at Drain
V _{SS}	Voltage at Source
VX	A special ASIC containing circuits that help the DC controller operate. The letters VX do not stand for anything; they simply designate this ASIC.
WAN	Wide Area Network
WR	Write
w/	With
w/o	Without
XMT	Transmit

K

The “Banding” Phenomenon

Models 6400-i20 and 6400-i24 have a dual hammer bank. Dual hammerbank technology can present a print quality phenomenon known as “banding.” Banding appears as light-to-dark variations in print density within a single line, and is due to the mechanical layout of the dual hammerbank and the resulting pattern of ink-depletion of the ribbon. If ink is printed onto every line of the paper, darker print (similar to “bolding”) will appear at one end of the line on every other line of print, and will appear at the opposite end of the line on the alternate lines of print. If ink is not printed onto every line of the paper, the darker areas will appear more scattered, but are always nearer the ends of the lines of print than the middle of the lines. Banding can first be noticed as early as at 25% depletion of the ribbon life, but it occurs most noticeably by 50% depletion, and does not disappear until 75% depletion of the ribbon life.

If the customer complains about print quality, follow this procedure:

1. Ask the customer to describe how the print looks. Does it match the description above AND the print sample shown in Figure 113 on page 601?
 - a. If not, treat this call as you would any other call about print quality and return to normal troubleshooting.
 - b. If so, proceed to Step 2.
2. Explain that this is a phenomenon of dual hammerbank printing technology, and is not something that can be fixed.
3. Ask the customer if the phenomenon is acceptable, since it is an inherent part of the machine’s design.
 - a. If it is not acceptable, mention that the customer can replace the ribbon, but that the phenomenon will reappear at 50% to 75% of ribbon life. Will that be acceptable?
 - b. If acceptable, the call is complete.
 - c. If not acceptable, advise the customer that you will have to involve another level of assistance:
 - 1) Call your district and have them put you in touch with Level II Support.
 - 2) Request to speak with the team lead in Level II Support, note that you have followed this process, and request that a CMT Proactive Record be opened.
 - 3) Level II Support is aware of this process and will open the CMT Proactive Record.

We have found that this set of documents serves well as guidance to the Secretariat staff, as well as to the several working subgroups, members and officers.

You had asked for a partial listing of the Standing Documents. I am pleased to provide them as follows:

X3/SD-0	Informational Brochure - January 1989
X3/SD-1	Master Plan - January 1988
X3/SD-1B	Master Plan (Operational) - April 1989
X3/SD-2	Organization and Procedures - July 1987
X3/SD-3	Project Proposal Guide - May 1987
X3/SD-4	Projects Manual - August 1988
X3/SD-5	Standards Criteria - September 1984

Perhaps a few more words of explanation about the last document would be helpful to you.

X3 subgroups produce a required annual report to X3 using the format described in this report. They do so according to the schedule defined in X3/SD-6, Membership and Officers.

I hope that this additional information is helpful to you. Should you wish to obtain copies of the listed documents, I will be pleased to provide them to you.

Figure 113. This figure shows an example of the print banding sometimes seen on dual hammer bank printers.

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