IBM

6408–CTA Line Matrix Printer

G246-0084-01

Maintenance Information Manual

5 Adjustment Procedures

Chapter Contents

Preparing the Printer for Maintenance

DANGER

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

To prepare the printer for maintenance, do the following steps *before* making an adjustment:

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

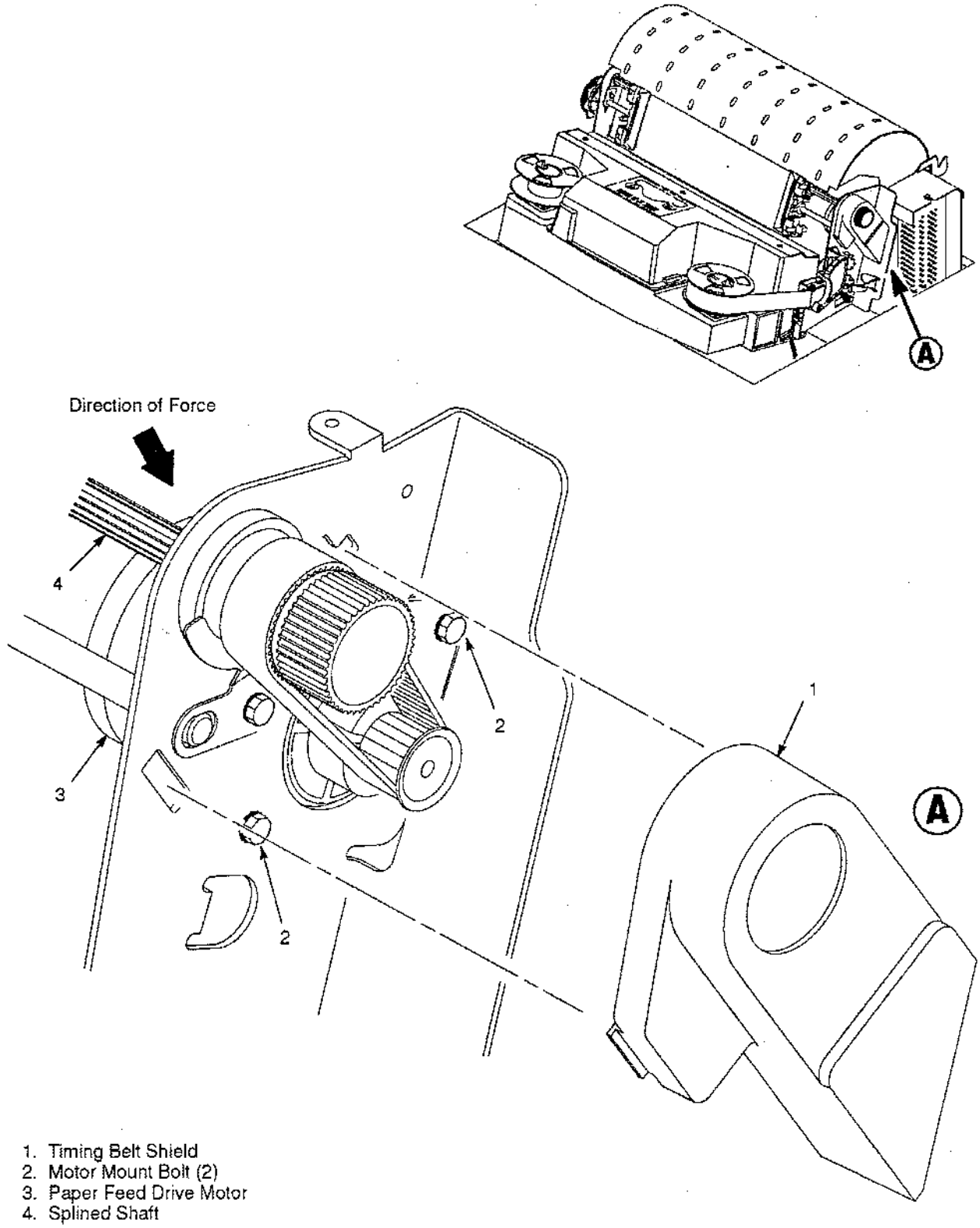
Returning the Printer to Normal Operation

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

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

Belt, Paper Feed Timing, Adjustment (Figure 5–1)

1. Prepare the printer for maintenance (page 5–2).
2. Open the printer cover.
3. Remove the paper guide assembly (page 6–40).
4. Remove four screws and the barrier shield (page 6–75, Figure 6–10).
5. Remove the timing belt cover (1) by squeezing the top and bottom to release the plastic tabs from the slots in the side plate.
6. Loosen (do not remove) the motor mount bolts (2).
7. Using the straight end of a force gauge, apply 12 pounds (53.4 N) of pressure to the paper feed drive motor (3). Use the splined shaft (4) to steady the gauge.
8. Reduce tension to 9 pounds (40.0 N) and torque the paper feed motor mount bolts (2) to 18 ±2 inch–pounds (2.03 ±0.23 N•m).
9. Snap the timing belt cover (1) into the slots in the side plate.
10. Install the barrier shield and four screws (page 6–75, Figure 6–10).
11. Install the paper guide assembly (page 6–40).
12. Return the printer to normal operation (page 5–3).



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

Figure 5–1. Paper Feed Timing Belt Adjustment

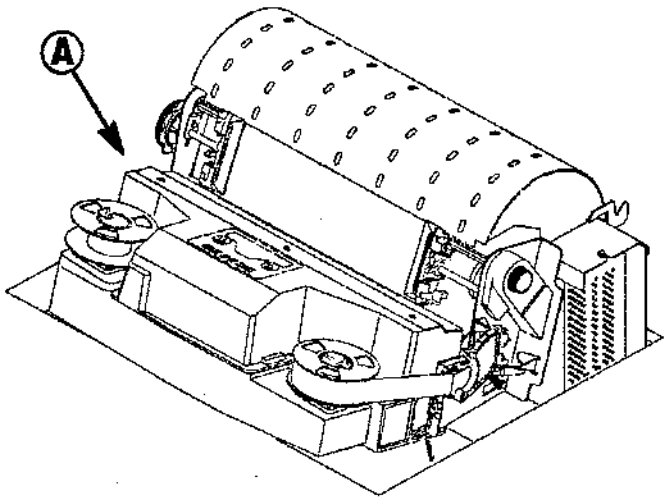
Belt, Platen Open, Adjustment (Figure 5–2)

1. Prepare the printer for maintenance (page 5–2).
2. Open the printer cover.
3. Remove the platen open belt cover (1) by squeezing the top and bottom to release the plastic tabs from the slots in the side plate.
4. Loosen the motor mount screws (2).
5. Close the forms thickness lever all the way.

WARNING

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

6. Using a force gauge, apply 10 ±1 pounds (44.48 ±4.45 N) of tension to the platen open motor shaft (3), pulling away from the large platen pulley.
7. Reduce tension to 5 ±1 pounds (22.24 ±4.45 N) and torque the motor mount screws (2) to 11 ±2 inch–pounds (1.24 ±0.23 N•m).
8. Check the platen gap (page 5–14). Loosen the belt and readjust the gap if necessary.
9. Snap the platen open belt cover (1) into the slots in the side plate.
10. Return the printer to normal operation (page 5–3).



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

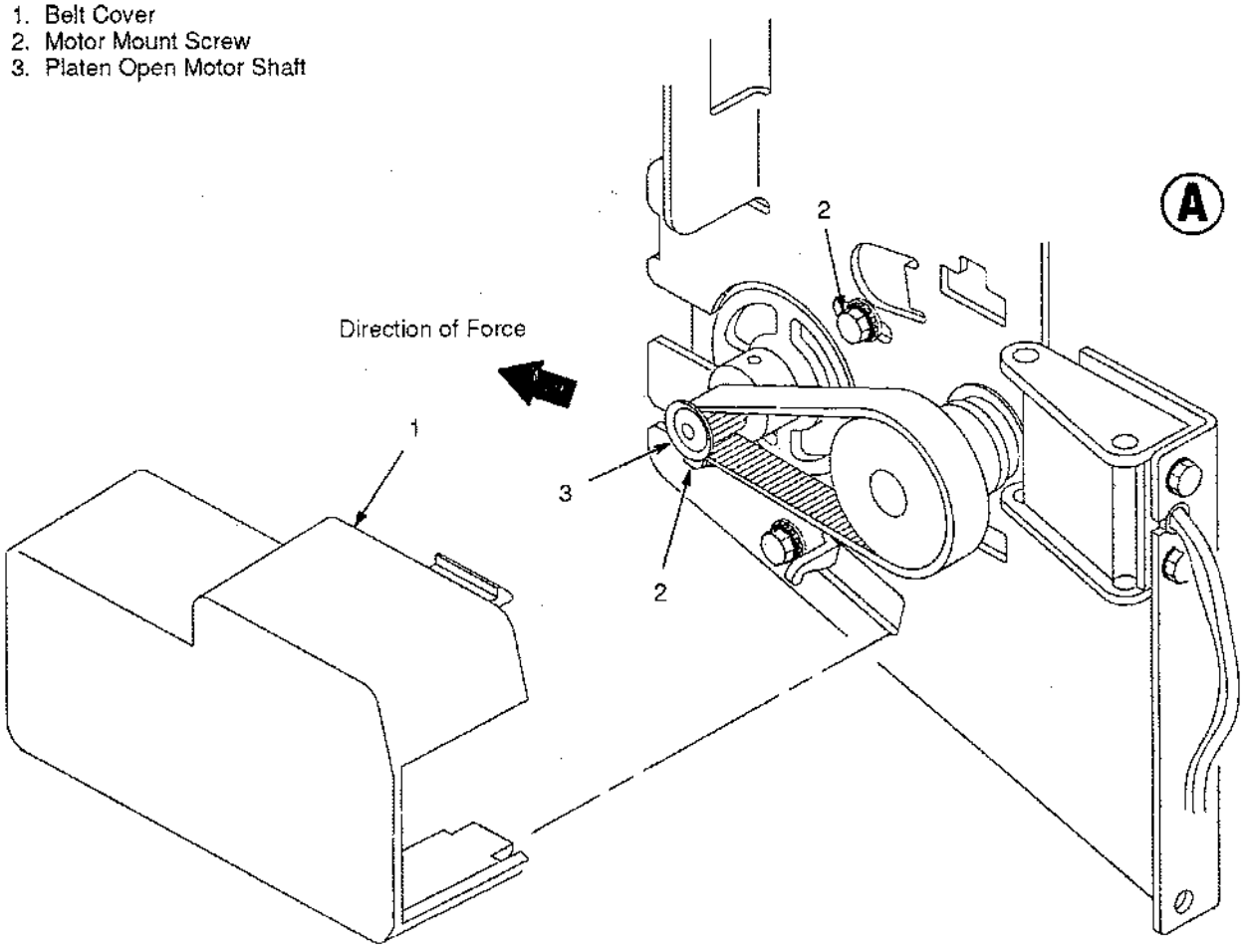


Figure 5–2. Platen Open Belt Adjustment

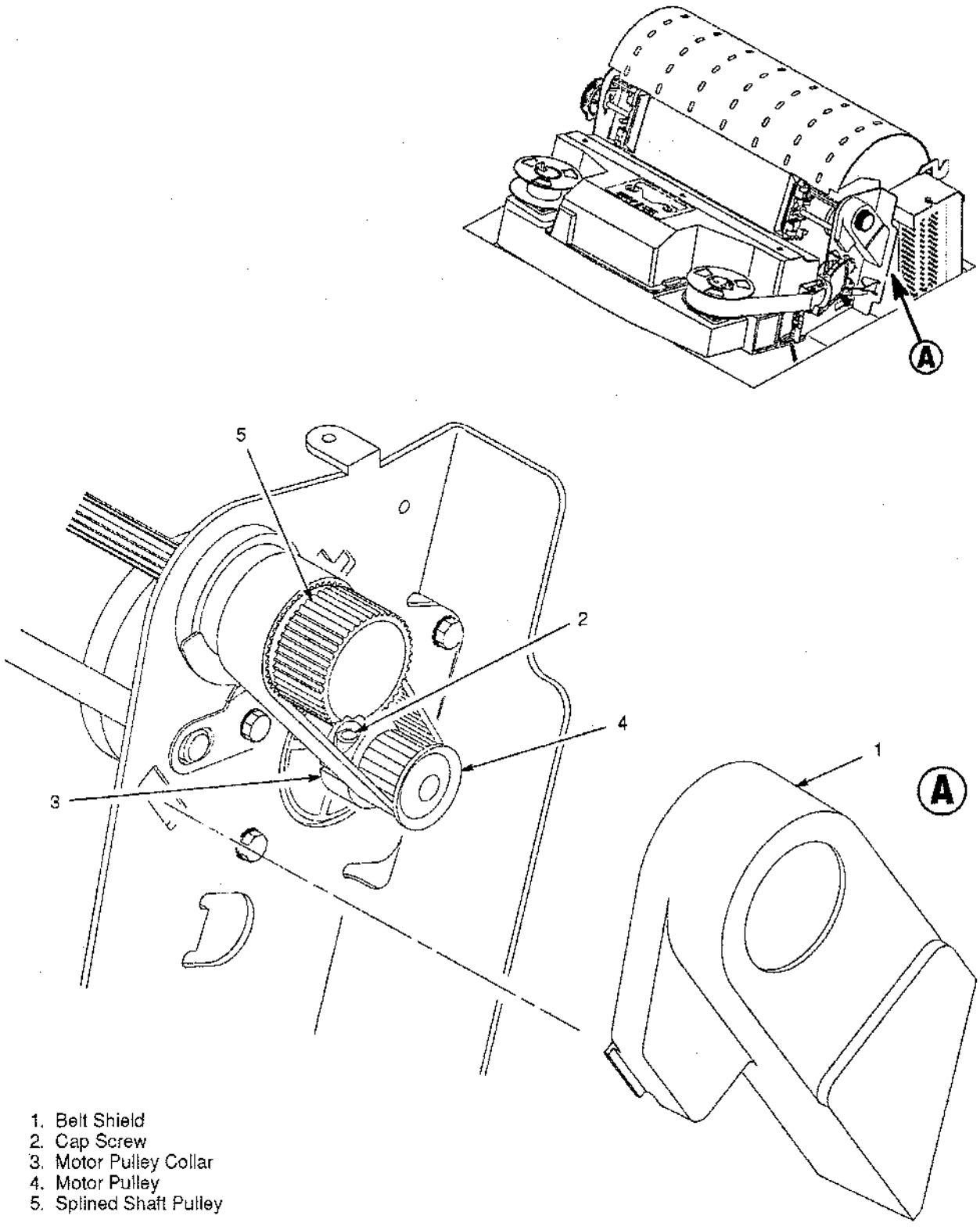
Paper Drive Motor Pulley Alignment (Figure 5–3)

1. Prepare the printer for maintenance (page 5–2).
2. Open the printer cover.
3. Remove the timing belt cover (1) by squeezing the top and bottom to release the plastic tabs from the slots in the side plate.
4. Loosen the set screw (2) in the motor pulley collar (3).
5. Align the paper drive motor pulley (4) with the splined shaft pulley (5).

WARNING

Make sure there is at least 0.010 inches (0.25 mm) of clearance between the collar/pulley and the motor face plate.

6. Hold the collar (3) flush against the motor pulley (4) and tighten the set screw (2):
   a. If the pulley (4) is black (aluminum), torque the set screw to 11 ±2 inch–pounds (1.24 ±0.23 N•m).
   b. If the pulley (4) is silver (steel), torque the set screw to 25 ±2 inch–pounds (2.82 ±0.23 N•m).
7. Check for correct tension on the paper feed timing belt (page 5–4). Adjust if necessary.
8. Snap the timing belt cover (1) into the slots in the side plate.
9. Return the printer to normal operation (page 5–3).

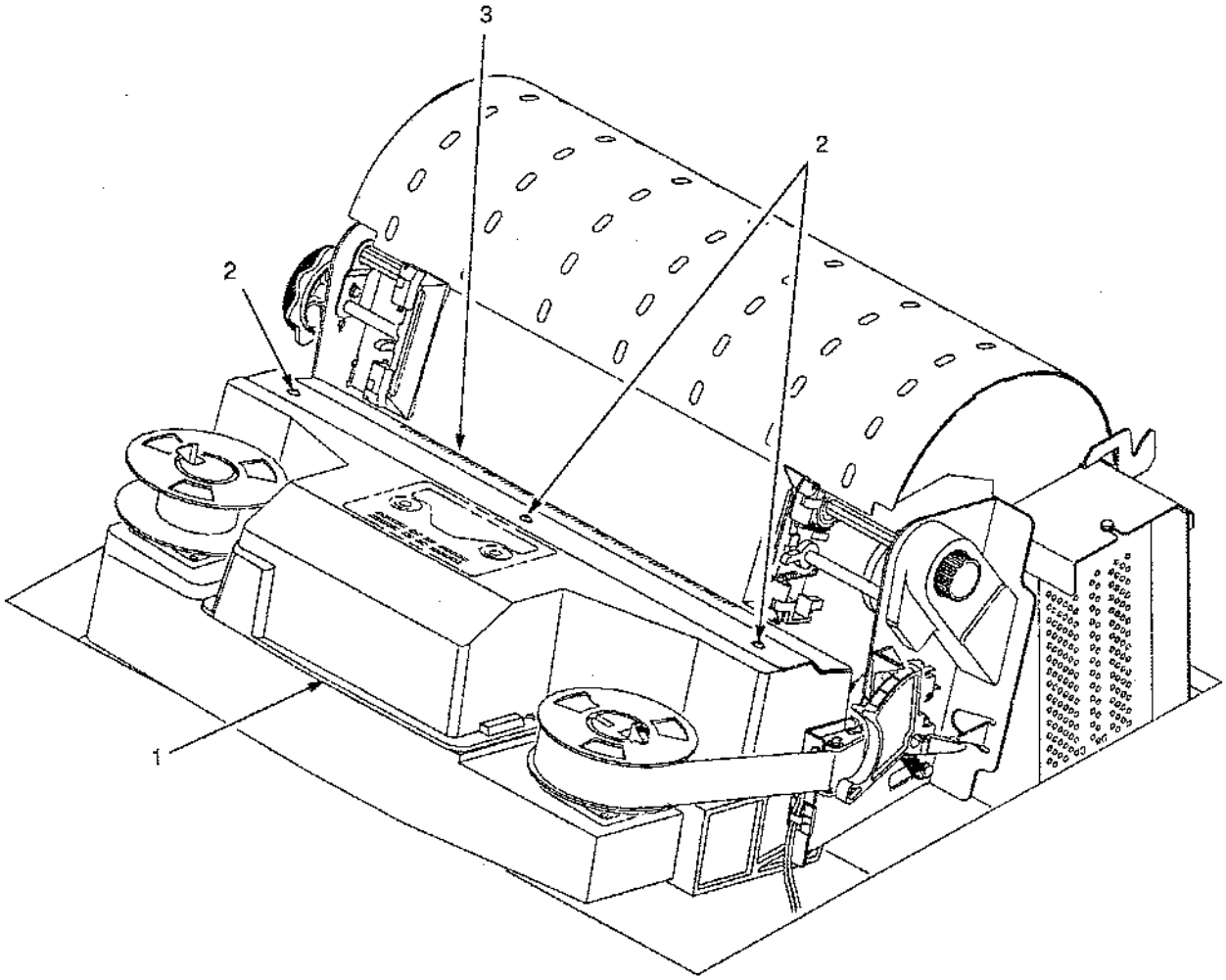


1. Belt Shield
2. Cap Screw
3. Motor Pulley Collar
4. Motor Pulley
5. Splined Shaft Pulley

Figure 5–3. Paper Drive Motor Pulley Alignment

Paper Scale Alignment (Figure 5–4)

1. Load paper and ribbon.
2. Connect the power cord to the AC power source.
3. Set the printer power switch to 1 (on).
4. Open the printer cover.
5. Verify that the shuttle cover (1) is properly installed (page 6–23).
6. Print a full 132 column line by selecting and running one of the diagnostic self–tests. (See Chapter 4.)
7. Check alignment of the scale to the print at column positions 1 and 132.
8. If adjustment is necessary, loosen the three button–head 5/64 inch hex screws (2).
9. Position the scale (3) so that column positions 1 and 132 line up with the first and last characters on the 132 character printout.
10. Tighten the button–head screws (2).
11. Close the printer cover.

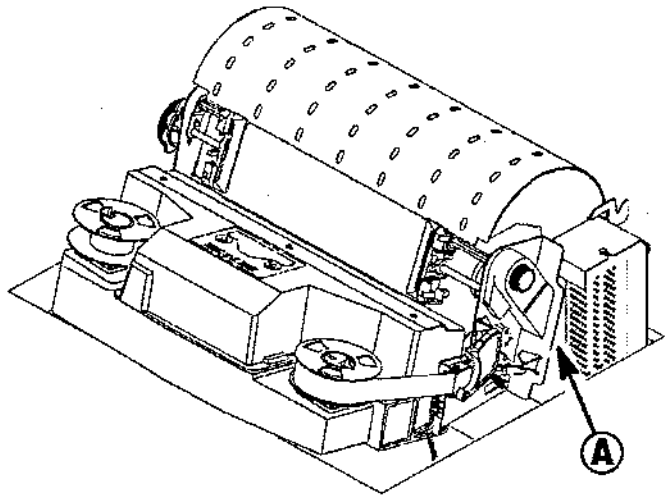


1. Shuttle Cover
2. Screw, Button–Head, 5/64 inch hex (3)
3. Paper Scale

Figure 5–4. Paper Scale Alignment

Platen Angle Adjustment (Figure 5–5)

1. Prepare the printer for maintenance (page 5–2).
2. Remove the shuttle frame assembly (page 6–55).
3. Close the forms thickness lever (1) all the way. (Position 'A' on the scale.)
4. Install the platen position gauge (2) and check the angle of the platen (3): forms thickness lever should be against the platen stop, the flat surface of the platen flush with the position gauge, and the position gauge flat on the mechanism base.
   a. If the angle is correct, no adjustment is necessary. Go to step 7.
   b. If the angle is incorrect, loosen the clamp screw (4) and set screw (5).
5. Position the platen (3) at the correct angle.
6. Slide the platen (3) to the right and the forms thickness lever (1) to the left to remove end play. Ensure that the forms thickness lever is fully closed. Tighten the clamp screw (4), then tighten the setscrew (5).
7. Remove the platen position gauge (2).
8. Check the platen gap adjustment (page 5–14).
9. Install the shuttle frame assembly (page 6–55).
10. Check the hammer phasing adjustment (page 5–27).
11. Return the printer to normal operation (page 5–3).



1. Forms Thickness Lever
2. Platen Position Gauge
3. Platen
4. Clamp Screw
5. Setscrew

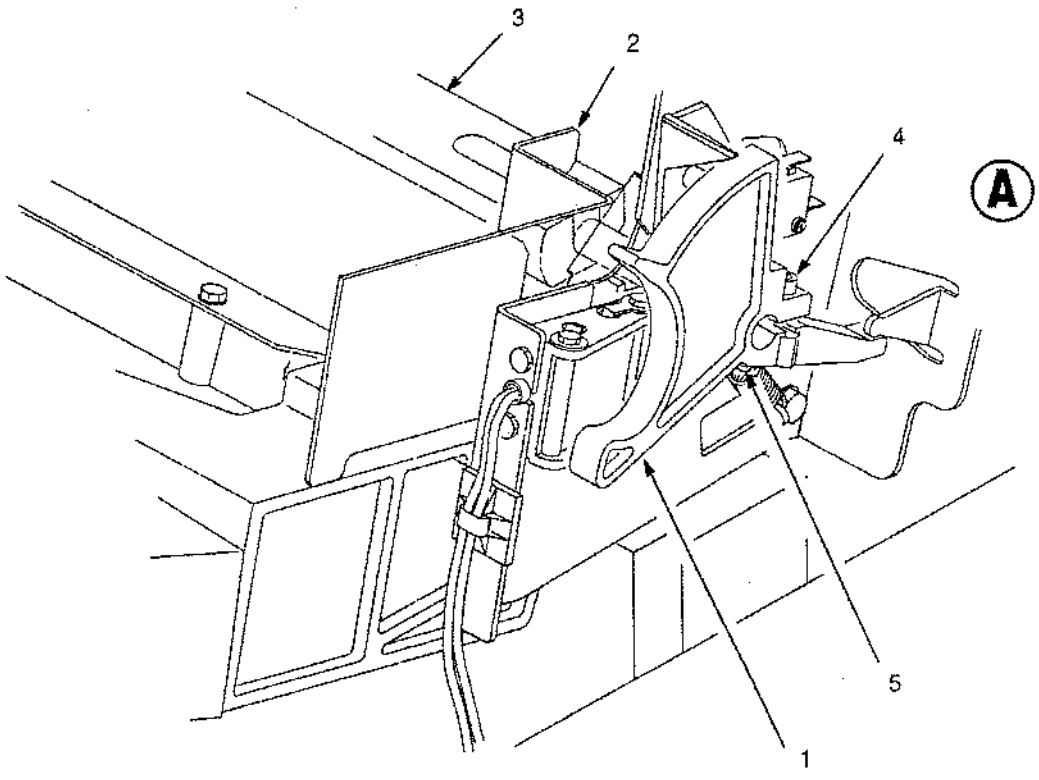


Figure 5–5. Platen Angle Adjustment

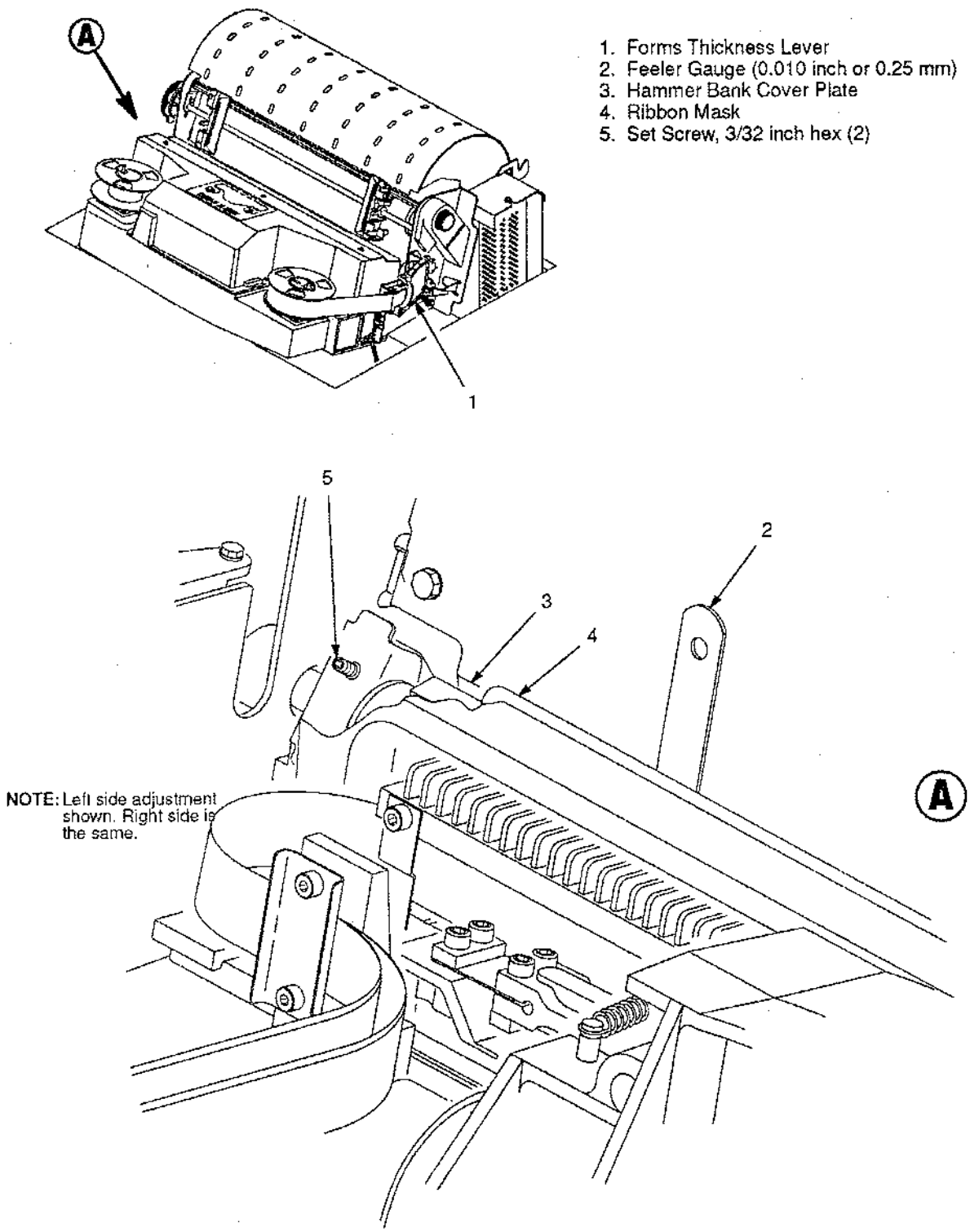
Platen Gap Adjustment (Figure 5–6)

1. Prepare the printer for maintenance (page 5–2).
2. Open the printer cover.
3. Remove the shuttle cover assembly (page 6–23).
4. Remove the ribbon.
5. Loosen the platen open belt (page 5–6, steps 3. and 4.).
6. Raise the forms thickness lever (1) to the fully open position.

WARNING

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

7. Insert a 0.010 inch (0.25 mm) flat feeler gauge (2) straight down between the hammer bank cover plate (3) and ribbon mask (4), within four hammer positions of the left end of the hammer bank.
8. Gently close the forms thickness lever (1). As the platen is closing, gently slide the feeler gauge up and down, keeping it between the hammer tip and ribbon mask. If the feel is too tight when the platen is being closed, adjust the set screw (5) at the end of the platen counterclockwise. If the feel is too loose, adjust the set screw clockwise. With the forms thickness lever closed all the way, the feeler gauge should contact both the tips and the ribbon mask and move with light friction. Shift the gauge slightly to verify.
9. Repeat steps 6. through 8. at the right end of the hammer bank.
10. After adjusting both sides, check the gap again at both ends. Readjust if necessary.
11. When the platen gap is correct at both ends of the platen, adjust the platen open belt (page 5–6).
12. Install the shuttle cover assembly (page 6–23).
13. Check the hammer phasing adjustment (page 5–27).
14. Return the printer to normal operation (page 5–3).



1. Forms Thickness Lever
2. Feeler Gauge (0.010 inch or 0.25 mm)
3. Hammer Bank Cover Plate
4. Ribbon Mask
5. Set Screw, 3/32 inch hex (2)

Figure 5–6. Platen Gap Adjustment

Platen Open Motor Pulley Alignment (Figure 5–7)

1. Prepare the printer for maintenance (page 5–2).
2. Open the printer cover.
3. Remove the platen open belt cover (1) by squeezing the top and bottom to release the plastic tabs from the slots in the side plate.
4. Loosen the set screw (2) in the motor pulley.
5. Align the platen open motor pulley (3) with the platen shaft pulley (4) and tighten the set screw (2) to 9 ±2 inch–pounds (1.02 ±0.23 N•m).
6. Check the platen open belt tension (page 5–6). Adjust if necessary.
7. Snap the platen open belt cover (1) into the slots in the side plate.
8. Return the printer to normal operation (page 5–3).

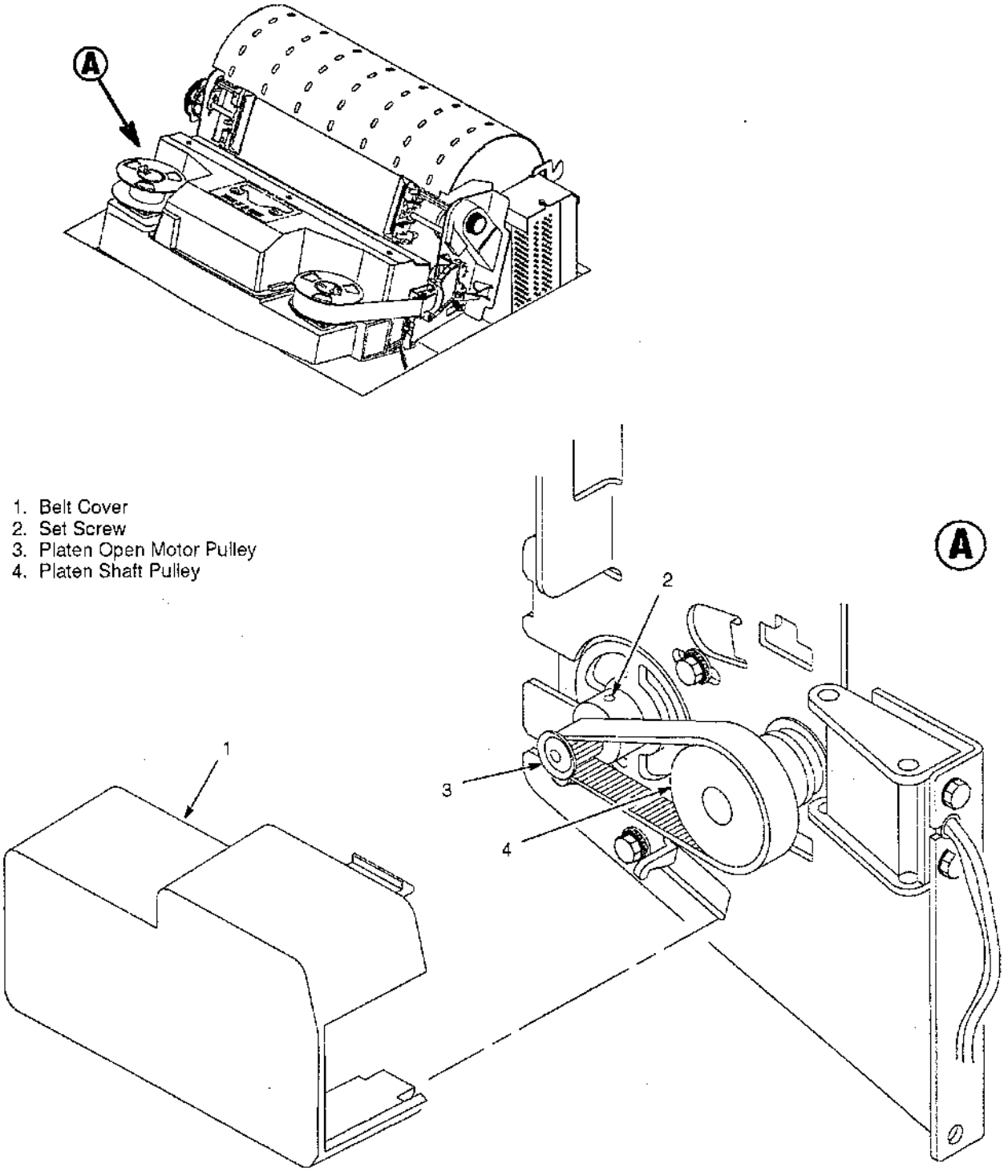
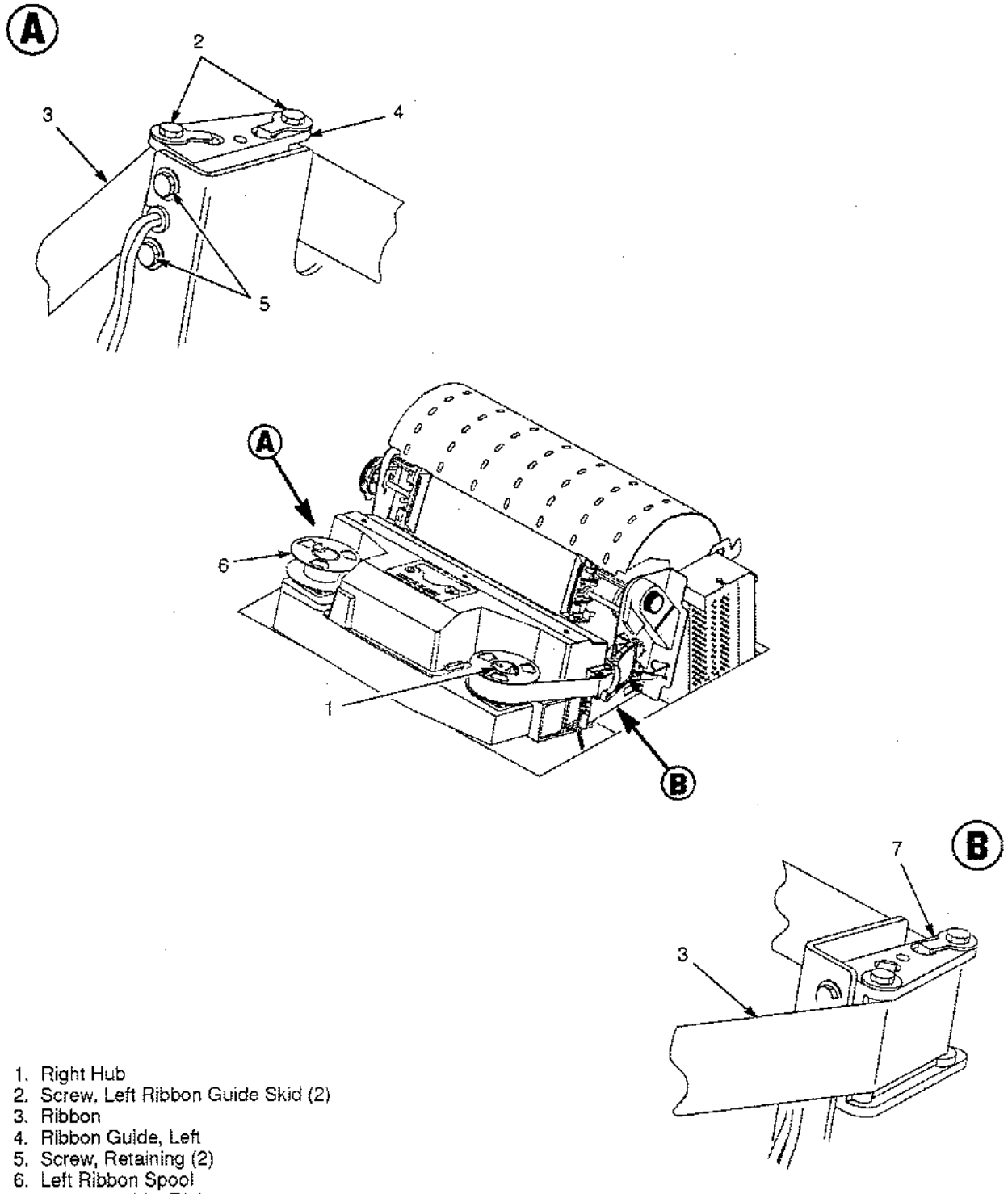


Figure 5–7. Platen Open Motor Pulley Alignment

Ribbon Guide Alignment (Figure 5–8)

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



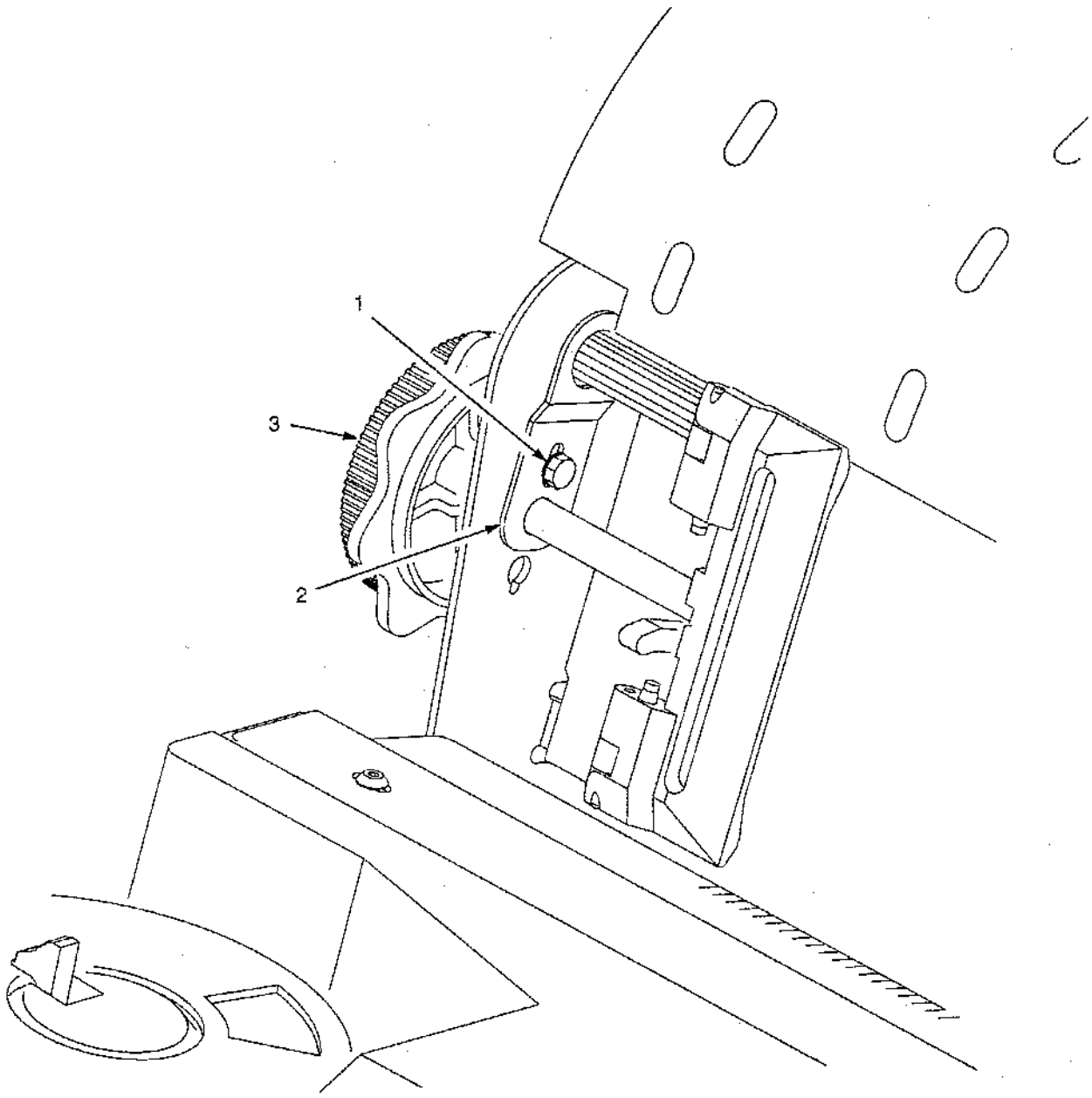
1. Right Hub
2. Screw, Left Ribbon Guide Skid (2)
3. Ribbon
4. Ribbon Guide, Left
5. Screw, Retaining (2)
6. Left Ribbon Spool
7. Ribbon Guide, Right

Figure 5–8. Ribbon Guide Alignment

Splined Shaft Skew Adjustment (Figure 5–9)

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

1. Prepare the printer for maintenance (page 5–2).
2. Loosen the screw (1) securing the adjusting link (2).
3. Adjust the link (2) by raising or lowering the horizontal adjustment knob (3) to obtain print parallel with paper perforations. Tighten the screw (1).
4. Return the printer to normal operation (page 5–3).



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

Figure 5–9. Splined Shaft Skew Adjustment

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 paper just below the paper entrance slot, tear a four-inch square on the left side, immediately below the perforation. (See Figure 5–10.) 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).

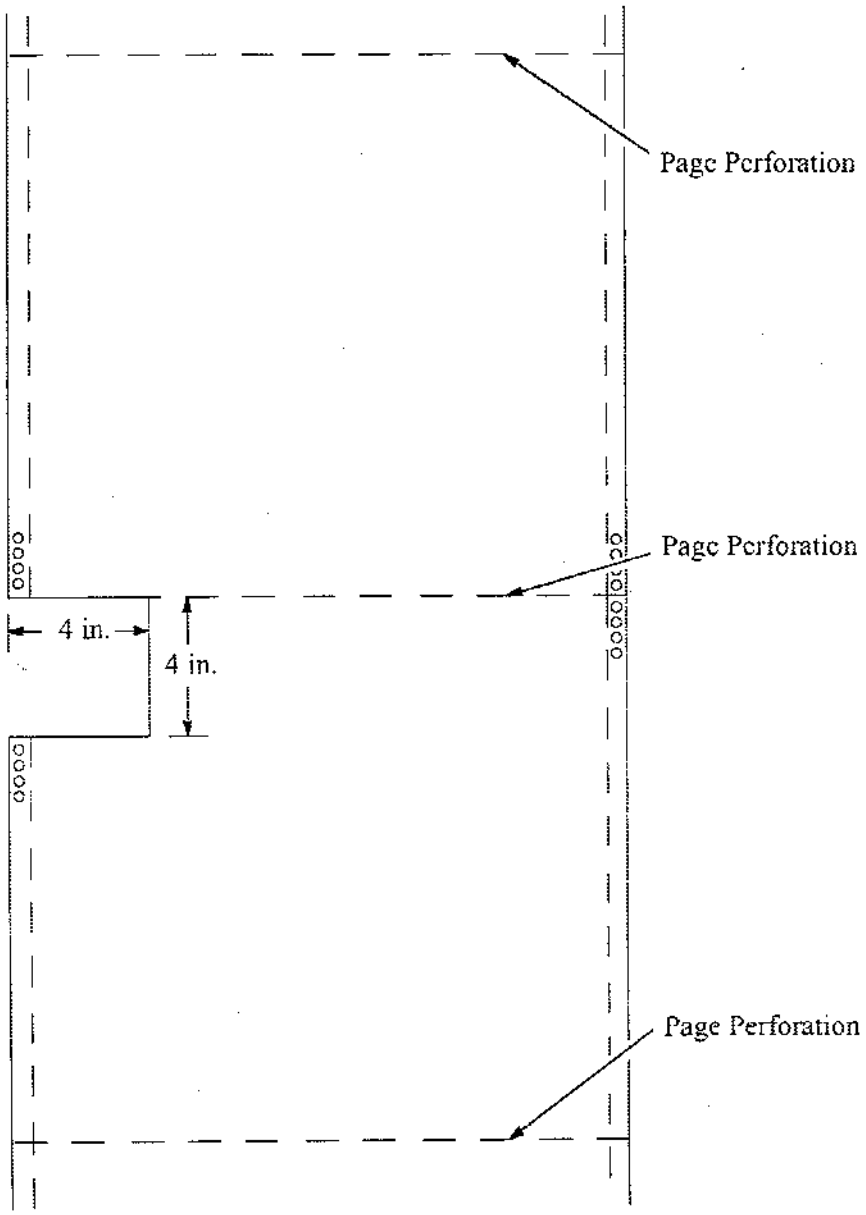


Figure 5–10. Paper Preparation for Paper Out Adjustment Test

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.

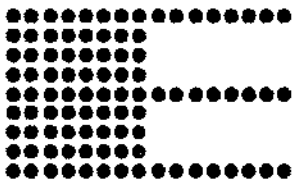
6. Press **Scroll↑ + Scroll↓** to unlock the **Enter** key.

7. Press **Scroll↑ + Scroll↓ + Return + Enter** to enter the CE Tests menu. (Press all four keys at the same time.)

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 4 dot rows. (An enlarged example of the comb pattern is shown below.)



10. Press **Enter** until the END OF FORMS ADJUST test starts. The comb patter 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 th platen, press **Stop** to silence it.)

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

Hammer phasing must be checked and adjusted if PROMs on the controller board are replaced.

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

The procedure is as follows:

1. Power on the printer.
2. Install the ribbon.
3. Load full width (132 column) paper and set the top of form.
4. 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 Hs, 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, followed by pressing **Enter**, which activate the value as it prints. Continue to increase or decrease the phasing index until the pattern of Hs appears as shown below:

Needs Adjustment | **Correct** | Needs Adjustment

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!

Before using the information and the product it works with, ensure that you read the general information under "Notices" on page vi.

First Edition (August 1994)

Second Edition (June 1995)

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Notices

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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.

Canadian Department of Communications Compliance Statement

This equipment does not exceed Class A limits per radio noise emission for digital apparatus, set out in the Radio Interference Regulation of the Canadian Department of Communications.

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Avis de conformité aux normes du ministère des Communications du Canada.

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New Zealand Compliance Statement

This is a Class A computing device and shall not be located at a distance closer than 20 meters from the boundary of a residential property.

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Safety Notices

DANGER

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

DANGER

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

DANGER

Always disconnect the AC power cord before cleaning the printer.

DANGER

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

CAUTION

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

CAUTION

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

DANGER

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

Sikkerhedsinstruktioner

DANISH

FARE

Hver gang De vil sætte ledningen, der forbinder computeren og printeren, i eller tage den ud, skal De først slukke for printeren og tage stikket ud af stikkontakten for at forebygge alvorlig personskade der forvoldes af elektriske stød.

FARE

Afbryd altid strømmen ved at tage stikket ud af kontakten inden De foretager nogen form for vedligeholdelsesprocedure. Undlader man at afbryde strømmen kan det føre til maskin– eller personskade. Dersom der skal bruges strøm under vedligeholdelseseftersyn, vil De blive instrueret om at slutte den til i vedligeholdelsesvejledningen.

FARE

Tag stikket ud af kontakten inden De gør printeren ren.

FARE

Til at forebygge skader, der forvoldes af elektriske stød, skal De vente mindst eet minut efter strømmen er blevet afbrudt med at udtage spændingslederpladen. Bær en antistatisk håndledsrem, der er korrekt jordforbundet, mens De håndterer spændingslederpladen. Tag kun på pladen ved udskydningsbeslagene og på siderne. Rør ikke ved komponenterne og vrid ikke pladen ved udtagning eller isætning.

FORSIGTIG

Med tiden kan overkanten af papirudglatteren blive skarp, så for ikke at skære sig, skal man kun holde papirudglatteren på siderne.

FORSIGTIG

Sørg for at printerdækslet holdes fast mens dækselpumpen frigøres.

FARE

Udvis forsigtighed mens printeren konfigureres. Blottede bevægelige dele kan forvolde skade og tændt strøm udgør risiko for stød.

Veiligheidsaanwijzingen

DUTCH

GEVAARLIJK

Om zwaar letsel door elektrische schok te voorkomen bij het aansluiten of loskoppelen van de signaalkabel, dient u de printer uit te schakelen en het netsnoer uit het stopcontact te nemen.

GEVAARLIJK

Neem het netsnoer altijd uit het stopcontact voordat u onderhoudswerkzaamheden gaat uitvoeren. Het niet afsluiten van de stroom kan persoonlijk letsel of beschadiging van de apparatuur tot gevolg hebben. Mocht u tijdens onderhoudswerkzaamheden toch netvoeding nodig hebben, dan worden daarover in de beschrijving van het onderhoud aanwijzingen gegeven.

GEVAARLIJK

Neem het netsnoer uit het stopcontact voordat u de printer gaat schoonmaken.

GEVAARLIJK

Om letsel door elektrische schok te voorkomen, dient u na het uitschakelen van de printer minstens één minuut te wachten voordat u de printplaat voor de voeding verwijdert. Maak gebruik van een op juiste wijze geaarde statische polsband als u de printplaat voor de voeding moet aanraken. Pak de plaat aan de zijkanten beet bij de daarvoor bestemde hendeltjes. Tijdens het demonteren/installeren geen onderdelen aanraken en de plaat niet verbuigen.

VOORZICHTIG

Na verloop van tijd kan de bovenkant van de papierstrijker scherp worden. Om te voorkomen dat u zich snijdt, dient u de papierstrijker bij de zijkanten beet te pakken.

VOORZICHTIG

Houd de printerkap goed op zijn plaats als u de gasveerconstructie loszet.

GEVAARLIJK

Ga bij het configureren van de printer voorzichtig te werk. Onbedekte bewegende onderdelen kunnen letsel veroorzaken en sommige onderdelen kunnen onder spanning staan.

Huomautuksia Turvallisuudesta

VAARA

Sähköisku voi aiheuttaa vakavia henkilövahinkoja. Tästä syystä täytyy kirjoittimesta aina katkaista virta ja irrottaa virtakaapeli, kun signaalikaapeli liitetään tai irrotetaan.

VAARA

Irrota aina vaihtovirtajohto virtalähteestä ennen huoltotoimenpiteitä. Laiminlyönti voi aiheuttaa henkilö– tai laitevahinkoja. Jos virtaa tarvitaan huollon aikana, huoltotoimenpiteiden ohjeissa on sitä koskevia neuvoja.

VAARA

Irrota vaihtovirtajohto ennen kirjoittimen puhdistamista.

VAARA

Sähköiskun estämiseksi odota ainakin yksi minuutti virran katkaisun jälkeen ennen kuin poistat virtapiirilevyn. Käytä oikein maadoitettua staattista ranneketta, kun käsittelet virtapiirilevyä. Tartu levyyn sen poistovivuista ja reunoista. Älä koske komponentteja tai taivuta levyä poiston tai asennuksen aikana.

VAROITUS

Ajan myötä voi paperinsilittäjän yläreuna terävöityä. Välttääksesi haavoja käsittele paperinsilittäjää sen reunoista.

VAROITUS

Tartu kirjoittimen kannesta tukevasti kiinni, kun irrotat kaasujousilaitetta.

VAARA

Noudata varovaisuutta kirjoitinta asennettaessa. Paljaat liikkuvat osat voivat aiheuttaa vahinkoja, ja sähköisissä osissa on sähköiskun vaara.

Consignes de Sécurité

FRENCH

DANGER

Afin d'éviter tout risque de blessure par électrocution lors du branchement ou du débranchement du câble de signal, mettre l'imprimante hors tension et débrancher le câble d'alimentation.

DANGER

Toujours débrancher le cordon d'alimentation en courant alternatif de la source d'alimentation avant d'effectuer toute opération d'entretien. Le fait de laisser le cordon branché peut provoquer des blessures ou endommager l'équipement. Si l'alimentation électrique est nécessaire durant l'entretien, les instructions à suivre vous renseigneront à ce sujet.

DANGER

Débrancher le cordon d'alimentation en courant alternatif avant de nettoyer l'imprimante.

DANGER

Afin d'éviter tout risque d'électrocution, attendre au moins une minute après avoir coupé l'alimentation pour retirer la carte d'alimentation électrique. Porter un bracelet statique correctement mis à la terre lors de la manipulation de la carte d'alimentation électrique. Manipuler la carte par les leviers d'éjection et les bords. Ne pas toucher les composants ou plier la carte pendant son retrait ou son installation.

ATTENTION

Après un certain temps, le bord supérieur du lisseur de papier peut devenir tranchant. Afin de ne pas se couper, manipuler le lisseur de papier par ses côtés.

ATTENTION

Bien tenir le couvercle de l'imprimante tout en désenclenchant le bloc–ressort à gaz.

DANGER

Prendre toutes les précautions nécessaires lors de la configuration de l'imprimante. Les pièces mobiles découvertes peuvent provoquer des blessures et les courants électriques présentent des dangers d'électrocution.

Hinweise zur Sicherheit

GERMAN

GEFAHR!

Um ernstliche körperliche Verletzungen durch Stromschlag beim Anschließen oder Trennen des Signalton-Kabels zu vermeiden, muß der Drucker auf jeden Fall ausgeschaltet und der Netzstecker herausgezogen werden.

GEFAHR

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

GEFAHR

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

GEFAHR

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

VORSICHT

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

VORSICHT

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

GEFAHR

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

Avvisi di sicurezza

ITALIAN

PERICOLO

Durante la connessione o la disconnesione del cavo dei segnali, spegnere la stampante e scollegare il cavo di potenza, in modo da prevenire seri infortuni causati da scosse elettriche.

PERICOLO

Per evitare danni alle persone o alle apparecchiature, disconnettere sempre l'alimentazione prima di eseguire le operazioni di manutenzione. Se sarà necessario alimentare le apparecchiature durante la manutenzione, questo sarà indicato nella procedura di manutenzione.

PERICOLO

Disconnettere l'alimentazione prima di pulire la stampante.

PERICOLO

Per prevenire incidenti a causa di scosse elettriche, dopo aver tolto l'alimentazione attendere almeno un minuto prima di rimuovere la scheda dell'alimentatore. Prima di maneggiare quest'ultima, indossare un bracciale antistatico; tenere la scheda dalle leve di espulsione e dai lati. Non toccare i componenti o flettere la scheda durante la rimozione o l'installazione.

ATTENZIONE

Col tempo la parte superiore della barra che fa pressione sulla carta può diventare tagliente. Per evitare di tagliarsi, maneggiare la barra tenendola dai lati.

ATTENZIONE

Tenere il coperchio della stampante ben saldo quando si smonta il dispositivo di ammortizzazione.

PERICOLO

Prestare attenzione durante la configurazione della stampante. Le parti mobili esposte possono causare danni alle persone e le correnti elettriche possono causare scosse elettriche.

安全上の注意点

JAPANESE

危険

保守作業を行なう前に、必ずAC電源ケーブルを抜いて、電源から切り離しておいてください。身体、または機器に損傷を与える場合があります。保守作業中に電源を必要とする場合は、その旨、保守作業操作手順に指示があります。

危険

プリンタを清掃する前に、AC電源ケーブルを抜いてください。

危険

感電事故を防ぐために、電気回路基盤を取り外す前に電源を切ってから少なくとも1分間待ってください。電気回路基盤を取り扱う際は、帯電防止リストストラップを着用してください。ボードを取り扱う際は、インジェクションレバーと両側面以外には触らないでください。また、ボードを着脱する際は、ボード上の部品に触ったり、ボードを曲げたりしないでください。

注意

時間が経つにつれて、用紙抑えの上端が鋭利になってくることがありますので、取り扱いには、十分に注意してください。

注意

ガススプリングアセンブリを取り外す際は、プリンタカバーをしっかりと抑えてください。

危険

プリンタの環境設定時は、必ず注意事項を守ってください。露出した部品によりケガをしたり、感電する危険があります。

危険

感電しないよう、シグナルケーブルを接続、または取りはずす際は、必ずプリンタの電源を切り、電源コードを抜いてください。

Sikkerhetsinformasjon

NORWEGIAN

ADVARSEL

Slå av skriveren og trekk ut strømledningens støpsel fra stikkontakten når du skal koble signalkabelen til eller fra, slik at alvorlige personskader unngås som følge av elektrisk støt.

ADVARSEL

Trekk alltid ut strømledningens støpsel fra stikkontakten før vedlikeholdsarbeid utføres på skriveren. Hvis man ikke bryter strømforbindelsen til lysnettet, kan det føre til skader på personer og utstyr. Hvis strømmen må stå på under vedlikeholdet, vil dette fremgå av vedlikeholdsprosedyren.

ADVARSEL

Trekk alltid ut strømledningens støpsel fra stikkontakten før skriveren rengjøres.

ADVARSEL

Vent i minst ett minutt etter at strømtilførselen er frakoplet før kretskortet med strømforsyningen tas ut, slik at personskader unngås. Man må ha en jordet stropp rundt håndleddet når man skal ta i strømforsyningskortet. Hold kortet i utløserarmene på sidene. Man må ikke berøre komponentene eller bøye kortet når det skal ut eller installeres.

OBS!

Med tiden kan den øvre kanten av papirutretteren bli skarp. Derfor må man ta tak i papirutretterens sider for ikke å skjære seg.

OBS!

Hold skriverdekslet på plass når den gassbaserte fjæropphengningen frigjøres.

ADVARSEL

Utvis forsiktighet under konfigureringen av skriveren. Bevegelige deler kan forårsake skader og elektrisk strøm kan gi støt.

Normas de Segurança

PERIGO

Quando ligar ou desligar o cabo de sinal, a fim de evitar ferimentos graves devido a choque eléctrico, desligue sempre a impressora e remova o cabo de energia da tomada.

PERIGO

Desligue sempre o fio de corrente alternada da tomada, antes de executar qualquer trabalho de manutenção a fim de evitar a ocorrência de acidentes pessoais ou danificar o equipamento. Se fôr absolutamente necessário utilizar corrente durante o trabalho de manutenção, ser–lhe–ão dadas instruções específicas para os procedimentos dessa manutenção.

PERIGO

Antes de começar a limpar a impressora, desligue sempre o fio de corrente alternada da tomada.

PERIGO

A fim de evitar a ocorrência de choques eléctricos, depois de desligar a corrente, espere pelo menos um minuto para remover a unidade de fornecimento de energia da placa de circuito impresso. Ao manusear a placa de fornecimento de energia, use sempre uma correia de pulso com isolamento estático. Toque apenas nos lados e nas alavancas de ejecção da placa. Não dobre nem toque nos componentes da placa durante a sua remoção ou instalação.

ATENÇÃO

Com o tempo, a parte superior do engomador de papel, pode tornar–se aguçada. Para não se cortar, manuseie o engomador de papel pelas partes laterais.

ATENÇÃO

Ao desmontar o conjunto de peças da mola de gás, agarre sempre na cobertura da impressora.

PERIGO

Preste atenção sempre que reconfigurar a sua impressora. Quando expostas, algumas das partes da impressora podem causar ferimentos e lembre–se de que componentes eléctricos constituem perigo de choque.

Avisos de seguridad

SPANISH

PELIGRO

Para evitar daños personales causados por descarga eléctrica al conectar o desconectar el cable de señal, apague la impresora y desenchufe el cable de alimentación.

PELIGRO

Desconecte siempre el cable del enchufe antes de realizar cualquier operación de mantenimiento. El no cumplimiento de esta condición puede derivar en lesiones personales o daños en el equipo. Si tiene que utilizar la corriente durante el mantenimiento, el procedimiento se lo indicará.

PELIGRO

Desenchufe el cable antes de limpiar la impresora.

PELIGRO

Para evitar una descarga eléctrica, espere por lo menos un minuto después que desconecte la corriente y antes que desmonte la tarjeta del circuito de alimentación eléctrica. Utilice una pulsera antiestática con toma de tierra, cuando manipule la tarjeta de alimentación. Sujete la tarjeta por las palancas de expulsión o por los lados. No toque sus componentes ni la doble, durante la operación de desmontaje/instalación.

PRECAUCION

Con el tiempo, el borde superior de la plancha de papel, puede hacerse afilado. Para evitar cortarse, manipule la plancha por los lados.

PRECAUCION

Sujete firmemente la cubierta de la impresora cuando desmonte los muelles de suspensión.

PELIGRO

Tenga cuidado al configurar la impresora. Las partes móviles, cuando quedan al descubierto, pueden provocar lesiones y provocar descargas eléctricas.

Säkerhetsföreskrifter

SWEDISH

FARA

Undvik allvarliga personskador från elektriska stötar när du ansluter eller kopplar loss signalkablen, genom att stänga av strömmen till skrivaren och koppla loss nätkabeln.

FARA

Koppla alltid loss nätkabeln från strömkällan innan du utför underhåll. Om strömmen inte är avstängd kan det uppstå personskador eller skador på utrustning. Om strömmen måste vara påkopplad vid underhållsarbete anges detta i underhållsanvisningarna.

FARA

Koppla loss nätkabeln innan du rengör skrivaren.

FARA

Undvik skador från elektriska stötar genom att vänta minst en minut efter att strömmen stängts av, innan du tar ut kretskortet med strömförsörjningen. Använd ett antistatiskt armband, som är rätt jordat, när du hanterar kretskortet med strömförsörjningen. Håll endast i kortets låshandtag och i dess sidor. Vidrör ej komponenter och böj ej kortet när du tar bort eller sätter in det.

VARNING

Efter längre tids användning kan papperspressen bli vass. Undvik skärsår genom att endast hålla i papperspressens sidor.

VARNING

Håll ordentligt i skrivarhuven när du kopplar loss gasfjädringsenheten.

FARA

Var försiktig när du utför ändringar på skrivaren. Rörliga delar som frilagts kan orsaka personskador. Dessutom kan elström ge upphov till elektriska stötar.

1 Maintenance Overview

Chapter Contents

About the Printer

The IBM 6408–CTA Printer is a high speed line printer featuring the latest refinements in line matrix printing technology. It is designed to perform a wide variety of high–volume printing tasks with minimum maintenance and maximum reliability.

The IBM 6408–CTA is very easy to use. The operator can select every printer function either at the operator panel or by sending commands from the host computer. It is a versatile printer. The user can load printer emulations into printer memory by means of a floppy diskette.

Figure 1–1. The IBM 6408–CTA Printer

About This Manual

This is a field service maintenance manual for the IBM 6408–CTA Printer. This manual is designed so that you can quickly locate maintenance information.

How to Use This Manual

1. Locate the procedure or information you need:

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

2. Read the entire procedure before you do it.
3. Gather the parts and tools you will need.
4. Make sure you understand all safety notices before you start a task. Notes and notices are defined below.

Notes and Notices

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

DANGER

A danger notice calls attention to a situation that is potentially lethal or extremely hazardous to people.

CAUTION

A caution notice calls attention to a situation that is extremely hazardous to people because of some existing condition.

WARNING

A warning notice indicates the possibility of damage to a program, device, system, or data.

IMPORTANT

Important draws your attention to information vital to proper operation of the printer.

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

Related Documents

This manual does not explain how to operate or configure the printer. For that information, refer to the *Operator's Guide* and *Set–Up Guide*:

- *6408–CTA / 6412–CTA Operator's Guide*
  (IBM Form Number G246–0057–01)
- *6408–CTA / 6412–CTA Set–Up Guide*
  (IBM Form Number G246–0065–01)

Information pertaining to printer control languages, emulations, and codes is in the applicable *Programmer's Reference Manual*:

- *ASCII Programmer's Reference Manual, 6408–CTA / 6412–CTA*
  (IBM Form Number G246–0075–01)
- *CT Programmer's Reference Manual, 6408–CTA / 6412–CTA*
  (IBM Form Number G246–0073–01)
- *IPDS Programmer's Reference Manual, 6408–CTA / 6412–CTA*
  (IBM Form Number G246–0074–01)

Information pertaining to the IGP** is in the applicable *IGP Reference Manual*:

- *Code V** Printronix** Emulation Reference Manual*
  (IBM Form Number G246–0086–01)
- *IGP Printronix Emulation Reference Manual*
  (IBM Form Number G246–0087–01)

Printing Conventions in This Manual

- **Operator panel keys and indicators** are highlighted in bold.

  Example: Press the **Cancel** key, then press the **Start** key.

- "Liquid Crystal Display (LCD) messages" are set off by 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 to press the **Scroll**↑ key and the **Scroll**↓ key at the same time.

Electrical Controls and Indicators (Figure 1–2)

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 power to the printer: (1 = on, 0 = off.) This switch is also a circuit breaker.
LCD	The Liquid Crystal Display (LCD) displays printer status messages.
Start	Puts the printer in the READY (on–line) mode. This key also clears fault conditions, exits program mode menus, and moves paper back to print position after View is pressed.
Stop	Puts the printer in the NOT READY (off–line) mode. This key also silences the audible alarm, and stops a Printer Test. 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 TOF 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	In READY mode, stops printing and moves page to tear–off position. In NOT READY mode, moves page to tear–off position and displays "003 FORMS EJECTED." In either mode, pressing the key again moves page back to print position.
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 last saved configuration in memory. Printer must be in NOT READY mode.
Scroll↑ + Scroll↓	Toggles the lock on the configuration menus.

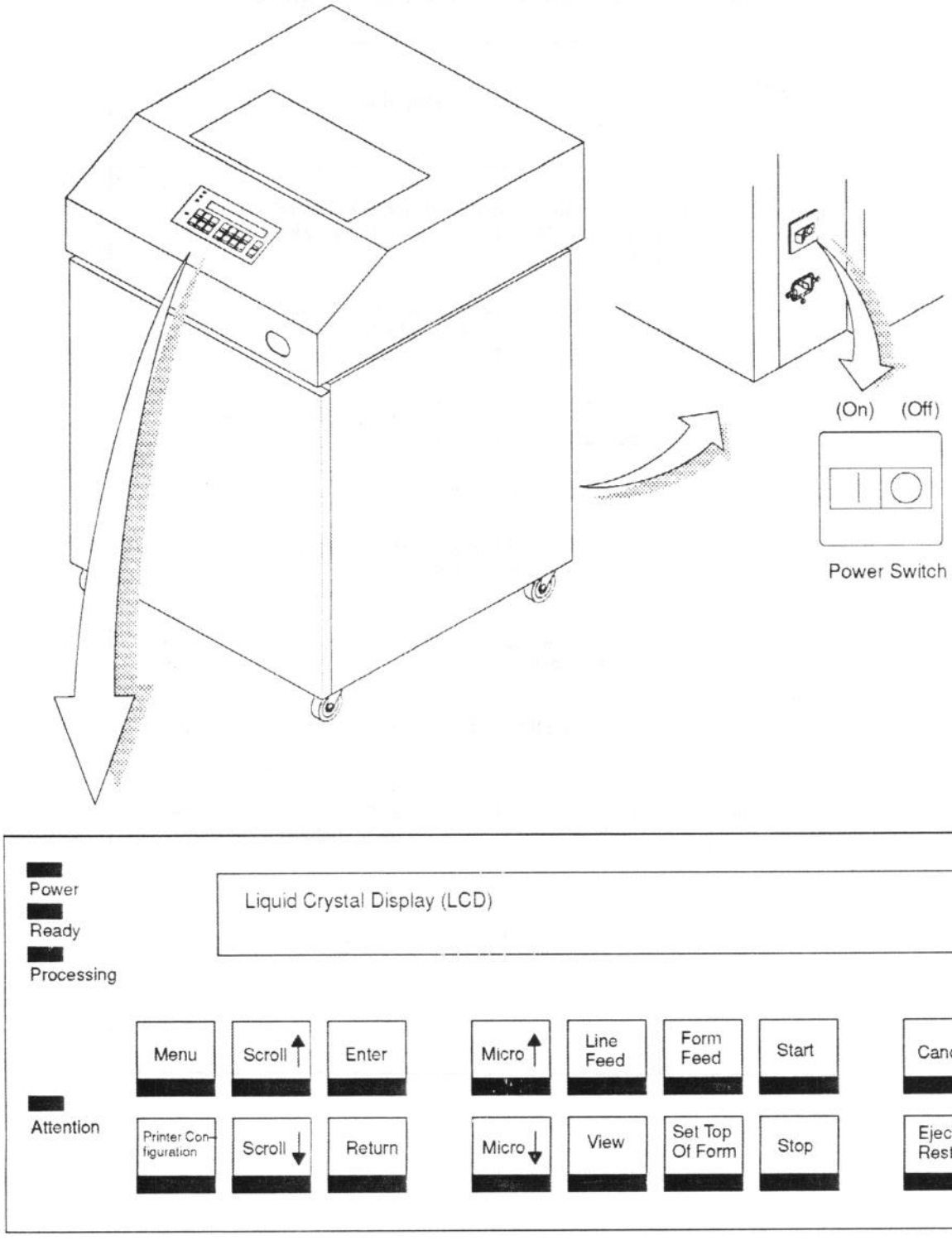
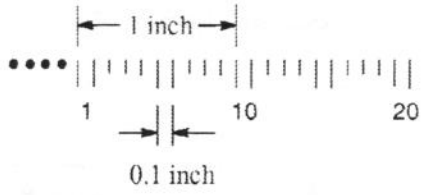


Figure 1–2. IBM 6408–CTA Electrical Controls and Indicators

Mechanical Controls and Indicators (Figure 1–3)

Control or Indicator	Function
Forms Thickness Lever	Sets platen for paper and forms of different thicknesses. Lever must be fully opened (raised) to load or unload paper.
Forms Thickness Pointer and Scale	Indicates the *relative* thickness of forms or paper. Set the forms thickness lever at A for thin (single–part) forms, B for thicker forms, and so on.
Tractors (2)	Hold and feed paper. Used to set side margin and position paper horizontally.
Tractor locks (2)	Lock tractors in position.
Horizontal Adjustment Knob	Allows fine positioning of left print margins. Moves paper and tractors left or right.
Vertical Position Knob	Used to set top of form or first line to be printed. Rotate to move paper vertically.
Ribbon Loading Path Diagram	A diagram that helps the operator load the ribbon correctly.
Paper Scale	A horizontal scale graduated in tenths of an inch, useful for setting paper margins and counting text columns. (See below.) 

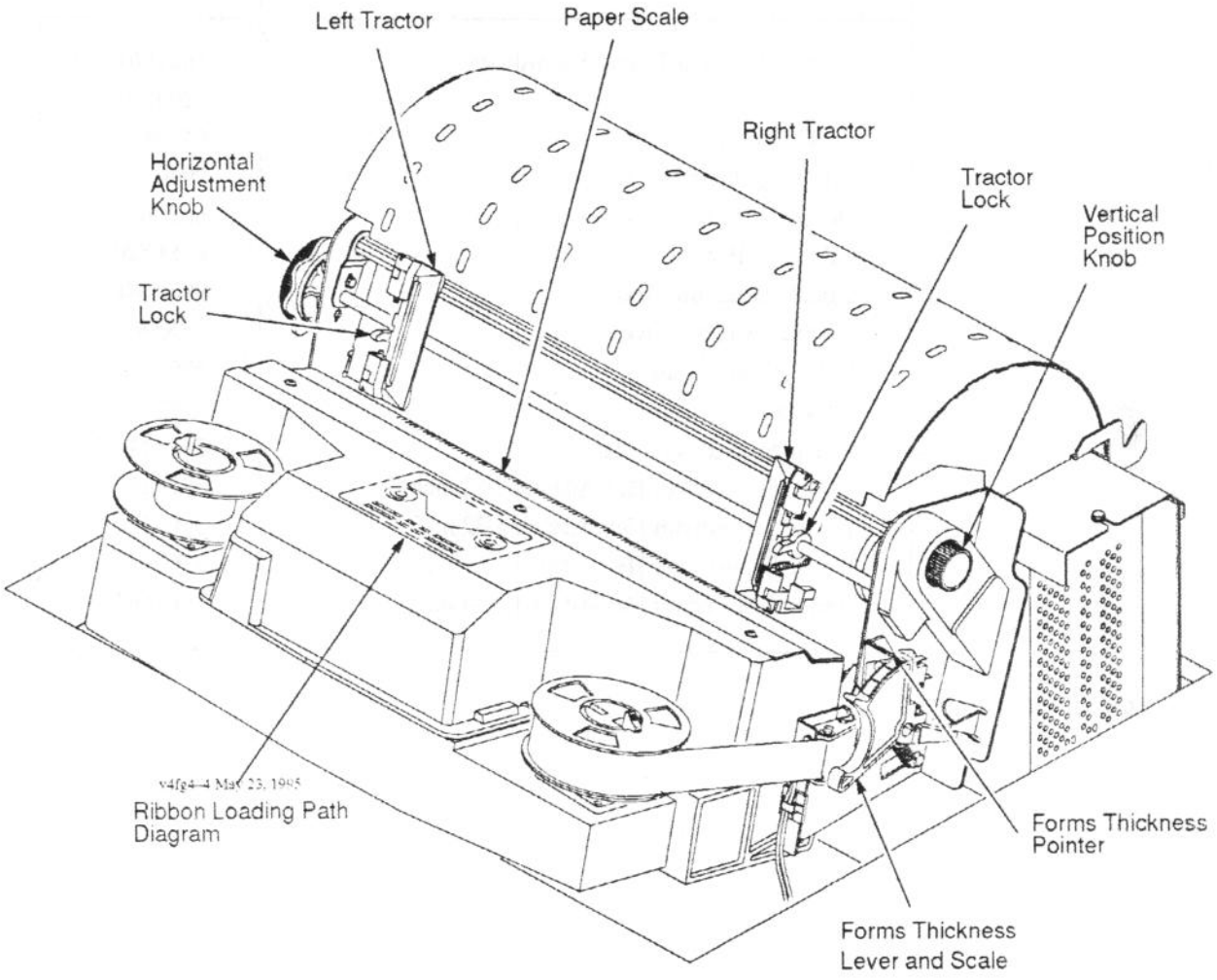


Figure 1–3. Mechanical Controls and Indicators

Tools, Test Equipment, and Supplies

The tools and equipment required for field level maintenance of IBM 6408 printers are listed below.

Item	Part No.
1 30 Inch pound Torque Screwdriver	16F1661
Alcohol	2200200
EDS Wrist Strap	6405959
Grip Ring Pliers	9900317
Floppy Drive Head Cleaning Kit	66E5655
Lubricant, Bearing	IBM #20
Module Extracting Tool	9900764
Module Extraction Tool	75X5893
Platen Position Gauge	57G1505
Tie Wraps	75X5972
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	73G1461
Torque Screwdriver Hex Adapter 5/64 inch	16F1662

2 Installation

Installation and configuration of the IBM 6408–CTA printer are covered in the *6408–CTA / 6412–CTA Set–Up Guide* (IBM Form No. G246–0065–01).

3 Preventive Maintenance

Chapter Contents

Overview

Aside from normal replenishment of paper and ribbons, the only preventive maintenance required of the IBM 6408–CTA printer is periodic cleaning.

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

However, since there is no guarantee that the user will clean the printer regularly, you should clean the printer whenever you are called to service it.

DANGER

Always unplug the printer power cord before cleaning the printer.

Cleaning the Printer

WARNING

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 Cabinet Exterior

1. Power off the printer.
2. Disconnect the AC power cord from the printer and the power source.
3. Wipe the cabinet with a clean, lint–free cloth dampened (not wet) with water and a mild detergent or window cleaning solution.
4. Dry the cabinet with a clean, lint–free cloth.
5. Clean the inside of the cabinet (page 3–4).

Cleaning the Cabinet Interior (Figure 3–1)

1. Power off the printer.
2. Disconnect the AC power cord from the power source and the printer.
3. Open the printer cover.
4. Open the forms thickness lever.
5. Remove paper from the printer.
6. Remove the ribbon.
7. 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.
8. Wipe the splined shaft with a soft cloth.

WARNING

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

9. Using a cloth dampened (not wet) with alcohol, clean the ribbon guides.
10. Vacuum up dust or residue that has accumulated inside the lower cabinet.
11. Wipe the interior of the lower cabinet with a clean, lint–free cloth dampened with water and a mild detergent or window cleaning solution.
12. Dry the cabinet interior with a clean, lint–free cloth.
13. Clean the shuttle frame assembly (page 3–6).

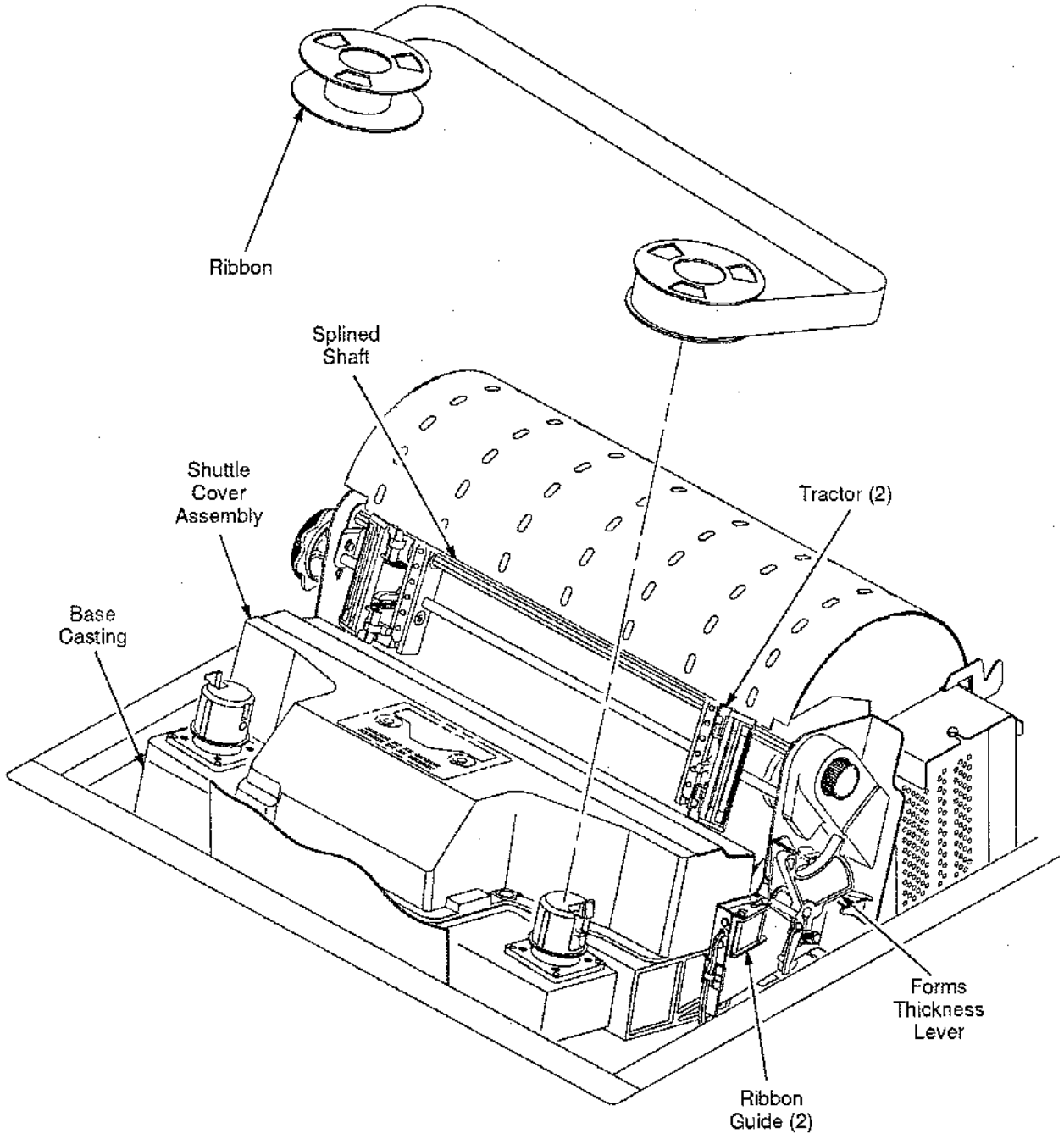


Figure 3–1. Cleaning Inside the Cabinet

Cleaning the Shuttle Frame Assembly (Figure 3–2)

1. Remove the shuttle cover assembly (page 6–23).
2. Remove the shuttle frame assembly (page 6–55).
3. Remove the paper ironer (page 6–41).

CAUTION

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

4. Moisten a clean, soft cloth with alcohol. Wipe the paper ironer to remove lint, ink, and paper residue.
5. Install the paper ironer (page 6–41).
6. Remove the hammer bank cover assembly (page 6–22).
7. Moisten a clean, soft cloth with alcohol. Wipe the hammer bank cover assembly to remove lint, ink, and paper residue. Clean the holes in the cover strips.

WARNING

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

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

WARNING

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

9. Install the hammer bank cover assembly (page 6–22).
10. Install the shuttle frame assembly (page 6–55).
11. Install the shuttle cover assembly (page 6–23).
12. Clean the card cage fan assembly (page 3–8).

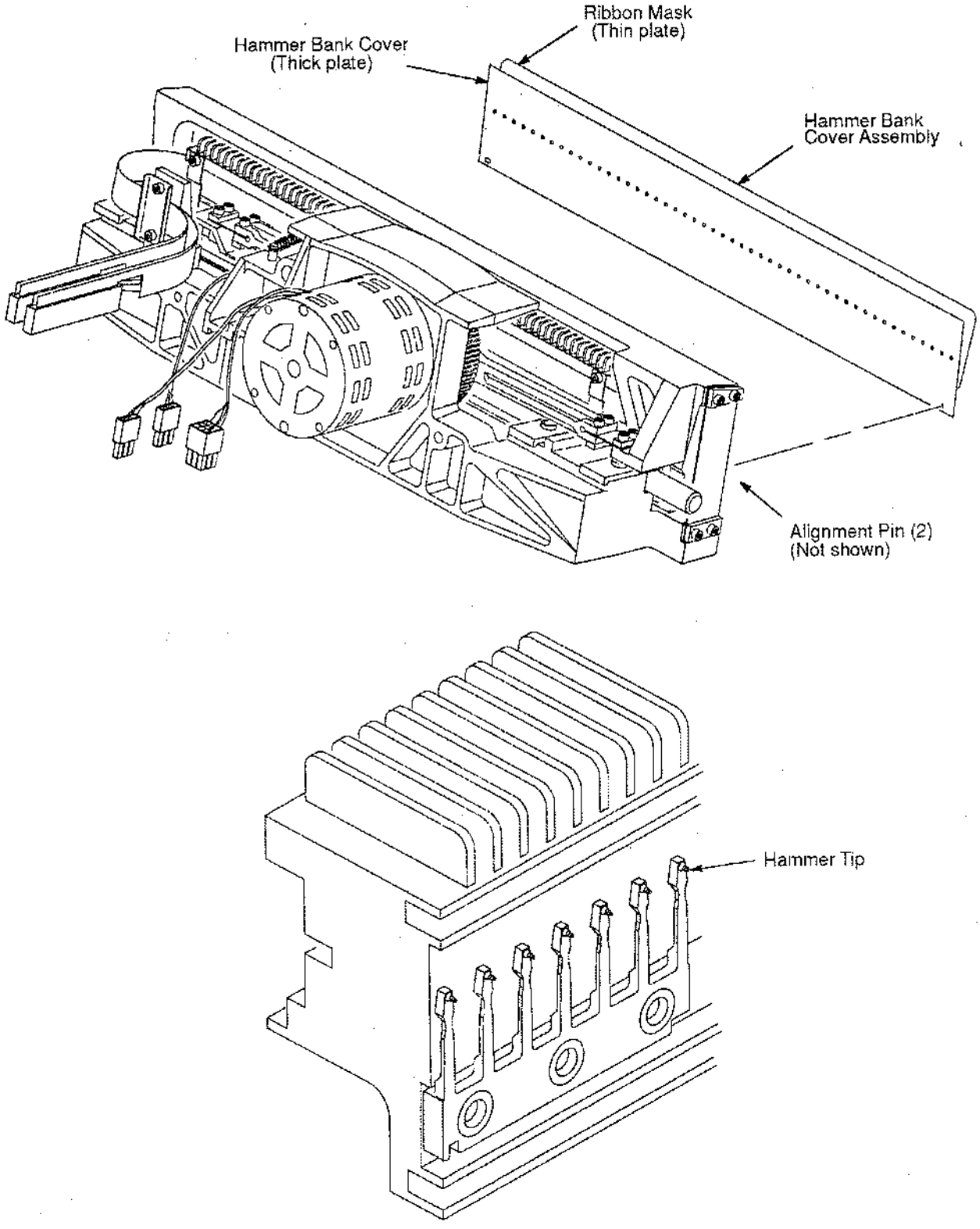


Figure 3–2. Cleaning the Shuttle Frame Assembly

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

1. Remove the paper guide assembly (page 6–40).
2. Vacuum the card cage fan assembly and surrounding areas to remove paper particles, dust, and lint.
3. Install the paper guide assembly (page 6–40).
4. Close the printer cover.
5. Connect the AC power cord to the printer and the power source.

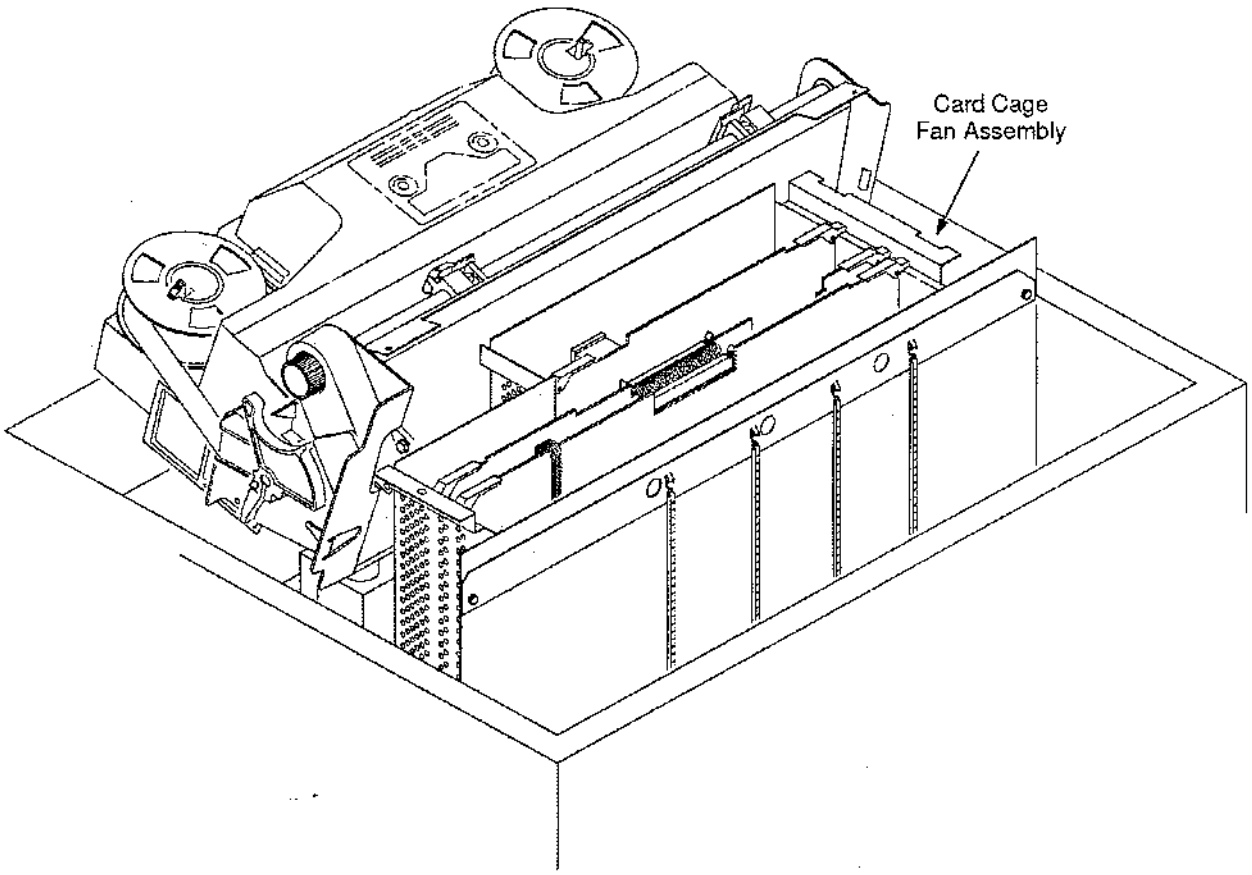


Figure 3–3. Cleaning the Card Cage Fan Assembly

4 Troubleshooting

Chapter Contents

Introduction

This chapter contains procedures for troubleshooting printer malfunctions.

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

Troubleshooting Aids

Troubleshooting is faster and more effective if you understand the equipment and make use of all available tools. This manual provides a number of troubleshooting aids to help you isolate printer malfunctions:

- **LCD Message Troubleshooting Table** — Page 4–4

  A troubleshooting symptom table for messages that can appear on the Liquid Crystal Display (LCD). LCD messages are defined and solutions provided.

- **Symptoms Not Indicated by Fault Messages** — Page 4–29

  Basic procedures for troubleshooting problems that are not indicated by LCD messages. Also included is a logic table for troubleshooting common problems.

- **Printer Confidence Check** — page 4–34

  A systematic check of printer operation in the form of a logic table. Use this procedure to establish basic printer status or to troubleshoot imprecise or intermittent symptoms.

- **Controller Board Diagnostic Check** — page 4–35

  Checks the operation of the microprocessors and IC chips on the controller board as the board starts and initializes.

- **Operator Print Tests** — Page 4–37

  A set of print tests included in the configuration menu structure for use as diagnostic tools.

- **Customer Engineer Tests** — Page 4–40

  A set of procedures included in the configuration menu structure for use as maintenance tools.

- **Hex Code Printout** — Page 4–43

  A procedure for printing data streams in hexadecimal format. Use to troubleshoot printer data reception problems.

- **Wire Data — Appendix A**

  A system interconnect diagram, circuit board pin–outs, and diagrams of the cable assemblies. Use as source material for tracing electrical problems.

Fault Messages

DANGER

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

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.
- The condition is automatically recorded in the error log buffer.

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*.

    a. *Recoverable* unit check conditions are errors detected in the electromechanical print mechanism that may be temporary and correctable by recycling power. The printer tries a number of times to correct the condition before posting the message to the LCD, so the first thing to do is cycle power. If the message reappears, classify the check condition unrecoverable. (See below.)

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

Clearing Errors

Refer to Table 4–1 and follow the instructions. After correcting an error, press the **Stop** key to clear the message and return the printer to the NOT READY state. Press **Start** to resume printing.

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

Table 4–1. LCD Message Troubleshooting Table

Power–On / Reset (POR) Messages	Explanation	Solution
ERROR: INCORRECT FONTS ON DISK	Diskette is corrupted; fonts cannot load.	Replace diskette with authorized IBM diskette.
LANGUAGE FILE NOT AVAILABLE	Translation menu for the desired foreign language is not on the diskette.	Obtain current diskette containing required language files.
LOADING FONTS FROM DISK	Startup status message: emulation font software loading.	No action required. If printer "hangs" while this message displays, go to page 4–27.
P01 INIT. RTPU–PFC COMMUNICATION	Startup status message: controller is testing RTPU to PFC communications.	Make a Controller Board Diagnostic Check (page 4–35).
P02 INIT. RTPU–RSP COMMUNICATION	Startup status message: controller is testing RTPU–to–RSP communications.	Make a Controller Board Diagnostic Check (page 4 35).
P03 STATIC RAM TEST	Startup status message: controller SRAM self–test in progress.	Make a Controller Board Diagnostic Check (page 4–35).
P04 WAITING FOR DPU	Startup status message: controller self–tests are in progress.	Make a Controller Board Diagnostic Check (page 4–35).
P05 DIAGNOSTIC TEST PASSED	Startup status message: initialization complete and controller electronics are operational.	No action required.
P06 ERROR: CANNOT READ DISK	Disk drive cannot read the emulation diskette.	Page 4–27.

Power–On / Reset (POR) Messages	Explanation	Solution
P07 LOADING PROGRAM FROM DISK	Startup status message: system and emulation software are loading.	No action required. If printer "hangs" while this message displays, go to page 4 27.
P08 ERROR: INCORRECT FILE FORMAT	Printer does not recognize the diskette.	Make sure an authorized IBM diskette is in the disk drive. If the message recurs, go to page 4–27.
P09 8344 DIAGNOSTIC FAILED	Link level code test detects hardware failure.	Replace the controller board (page 6–14).
P10 ERROR: EMULATION INIT. FAILED	Diskette is corrupted; emulation software cannot load.	Replace diskette with authorized IBM diskette. If the message recurs, go to page 4–27.
P14 FAULT CONDITION STATIC RAM*	SRAM failed power–on self–test.	Replace the controller board (page 6–14).
P15 FAULT CONDITION DPU TIMEOUT*	DPU cannot handshake with RTPU.	a) Replace RTPU PROM (page 6–46). b) Replace controller board (page 6–14).
P16 FAULT CONDITION 64180 OP CODE*	Failure of operational software on the controller board.	Replace the controller board (page 6 14).
P17 SECURITY VIOLATION	Part number mismatch of diskette and security module.	Match diskette and security module P/Ns (page 6–47).
Printer State Messages	**Explanation**	**Solution**
006 HOST SYSTEM REQUEST ATTENTION	Attention signal sent from host computer.	Check host computer system. Printer is OK.
008 HOLD PRINT TIMEOUT PRESS START	Printer was off–line more than 10 minutes and the "Intervention Required" parameter is set to "Send To Host."	Press **Start** to put printer in READY state.
A97 GRAPHIC CHECK ERROR PRESS STOP THEN START	The printer received a character that cannot be printed and the graphic check option is set to enable.	Page 4–25.

Communications Messages	Explanation	Solution
ACTIVATE LOST	Twinax protocol communications errors.	Page 4–26.
INVALID ACTIVATE	Twinax protocol communications errors.	Page 4–26.
INVALID COMMAND	Twinax protocol communications errors.	Page 4–26.
PARAMETER ERROR	Illegal parameter value received in command code.	Press **Stop** to clear fault. Press **Start** to go on–line. See also page 4–28.
SCS COMMAND ERROR	Printer received undefined control character (hex 40).	Printer clears the error. See also page 4–28.
015 COMMUNICATIONS CHECK CHECK CABLE	Line not active. (Twinax interface)	Page 4–13.
017 COMMUNICATIONS CHECK CHECK CABLE	Line parity check. (Twinax interface)	Page 4–13.
021 SERIAL BUFFER OVERRUN VERIFY CONFIGURATION	Receive overrun. (Serial interface)	Page 4–28.
022 UNIT ADDRESS NOT RECEIVED CHECK PRINTER ADDRESS	Unit address poll timeout. (Twinax interface)	Make sure the printer address is correct.
024 SERIAL LINE PARITY ERROR VERIFY CONFIGURATION	Parity error. (Serial interface)	Page 4 28.
025 SERIAL FRAMING ERROR VERIFY CONFIGURATION	Framing error. (Serial interface)	Page 4–28.
027 COMMUNICATIONS CHECK CALL SYSTEM OPERATOR	Enable poll timeout. The printer was not enabled for one minute. (Coax interface)	Page 4–14.
028 COMMUNICATIONS CHECK CALL SYSTEM OPERATOR	Poll timeout error. The printer was not polled for one minute. (Coax interface)	Page 4–14.

Attention Messages	Explanation	Solution
FM HEADER ERROR	Applications software has violated header parameters.	This is not a printer problem. The system administrator should correct applications data or configuration.
STRUCTURED FIELD ERROR	Applications software has violated structured data field parameters.	This is not a printer problem. The system administrator must correct applications data or configuration.
001 END OF FORMS LOAD FORMS	Printer is out of paper.	Load paper. If message recurs, see page 4–10.
002 FORMS JAMMED CLEAR JAM AND RELOAD FORMS	No paper motion.	Clear jam and reload paper. If message recurs, see page 4–11.
031 END OF FORMS TIMEOUT LOAD FORMS	A timeout message is sent to the host if paper is not loaded 10 minutes after **Stop** was pressed to clear the paper out fault.	Load paper. If the message recurs, see page 4–10.
032 FORMS JAMMED TIMEOUT CLEAR JAM AND RELOAD FORMS	A timeout message is sent to the host if no paper motion has occurred for 10 minutes after **Stop** was pressed to clear the jam fault.	Clear the jam and reload paper. If the message recurs, see page 4–11.
057 CLOSE PLATEN	Forms thickness lever is raised to open position.	Page 4–21
090 CLOSE SHUTTLE COVER	Shuttle cover is missing, damaged, or not correctly installed.	Page 4 22
Recoverable Unit Checks	**Explanation**	**Solution**
058 SHUTTLE JAM SEE USER'S GUIDE	No shuttle movement or shuttle moving at wrong speed.	Page 4–21
089 RIBBON JAM	No ribbon movement.	Page 4–23
091 DISKETTE WRITE ERROR CHECK DISKETTE	Printer cannot write to the diskette.	Make sure an authorized IBM diskette is used, is not write–protected, and is correctly inserted in diskette drive. If problem persists, replace diskette.

Unrecoverable Unit Checks	Explanation	Solution
051 HAMMER DRIVER SHORT	Electrical malfunction of hammer driver system.	Page 4–15
052 MECHANISM DRIVER HOT	Mechanism driver board is overheating.	Page 4–16
053 48 VOLTS FAILED	Internal power failure.	Page 4–17
054 HAMMER COIL SHORT	Electrical malfunction of one or more hammer coils.	Page 4–18
055 MECHANISM DRIVER LINK FAILURE	Electronic fault between controller board and mechanism driver board.	Page 4 19
056 HAMMER COIL OPEN	Electrical malfunction of one or more hammer coils.	Page 4–20
159 HAMMER BANK HOT	One or more hammer coils are overheating.	Page 4–24
160 SHUTTLE FAN FAILURE	Shuttle is overheating.	Page 4–24

001 END OF FORMS (TIMEOUT)
LOAD FORMS

Instruction	Indication	Yes	No
1. Load paper. Run an operator print test.	"001 END OF FORMS" message.	Replace paper detector switch assembly. Go to step 2.	Return printer to normal operation.
2. Run an operator print test.	"001 END OF FORMS" message.	Replace the controller board. Go to step 3.	Return printer to normal operation.
3. Run an operator print test.	"001 END OF FORMS" message.	Replace the intermediate cable assembly (W5).	Return printer to normal operation.

002 FORMS JAMMED (TIMEOUT)
CLEAR JAM AND RELOAD FORMS

	Instruction	Indication	Yes	No
1.	Check for a failure to sense End of Forms.	End of Forms (last form) is past the hammer area.	Do one at a time until the problem is gone: a) Clean the paper detector sensor with a cotton swab and alcohol. b) Replace the paper detector switch assembly. c) Replace the controller board. d) Replace intermediate cable assembly (W5).	Go to step 2.
2.	Inspect paper guide assembly for frayed, torn, folded paper or labels.	Paper guide assembly is clear.	Go to step 3.	Remove paper and go to step 3.
3.	Inspect the narrow passageway between the face of the platen and the ribbon mask for bits of torn paper or ribbon lint. Check the holes in the ribbon mask surrounding each hammer tip.	Debris found.	Gently remove paper or lint particles with a wooden stick or pair of tweezers. WARNING: Do not pry on or apply force to the hammer tips. Go to step 4.	Go to step 4.
4.	Load paper. Press the **Form Feed** key several times.	Forms feed without erratic motion, noise, or pin–hole damage.	Go to step 5.	If pin holes are damaged, go to step 7. For erratic motion or noise, go to step 9.
5.	Press the **View** key twice.	Forms move correctly in both directions, without jamming, tearing, or folding.	Suspect a false indication. Go to step 13.	Go to step 6.
6.	Check the platen motor belt.	Platen motor belt OK.	Replace one at a time until message goes away: a) platen motor b) mechanism driver board	Replace platen motor belt.
7.	Check that the ribbon mask has not been deformed in such a way as to block the paper guide assembly.	Ribbon mask damaged or bent.	Replace the hammer bank cover assembly.	Go to step 8.

	Instruction	Indication	Yes	No
8.	Check to platen gap adjustment.	Plate gap incorrect.	Adjust platen gap. Go to step 9.	Go to step 9.
9.	Check for damage to the paper feed belt.	Paper feed or belt damaged.	Replace the paper feed belt. Go to step 10.	Go to step 10.
10.	Check the tractors and tractor door springs for damage or excessive wear.	Tractors are OK.	Replace mech driver board. Go to step 11.	Replace defective tractor.
11.	Run an operator print test.	Paper Jam message.	Replace paper feed motor. Go to step 12.	Return printer to normal operation.
12.	Run an operator print test.	Paper Jam message.	Replace cable assembly W6. Go to step 13.	Return printer to normal operation.
13.	Load paper. Do some line feeds and run a diagnostic print test.	Paper Jam message.	Clean the paper motion detector with cotton swab and alcohol. Go to step 14.	Return printer to normal operation.
14.	Set the paper motion detector fault setting to DISABLE (Ref: *Setup Guide*). Run a print test and check paper feeding as the printer prints.	Paper Jam message.	Replace the mechanism driver board. Go to step 15.	Return printer to normal operation.
15.	Run an operator print test.	Paper Jam message.	Replace paper detector switch assembly. Go to step 16.	Return printer to normal operation.
16.	Run an operator print test.	Paper Jam message.	Replace the controller board. Go to step 17.	Return printer to normal operation.
17.	Run an operator print test.	Paper Jam message.	Replace the intermediate cable assembly (W5).	Return printer to normal operation.

015 or 017 COMMUNICATIONS CHECK CHECK CABLE

DANGER

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

Instruction	Indication	Yes	No
1. a) Power off the printer. b) Disconnect the AC power cord from the printer. (See DANGER notice above.) c) Check the twinax host data cable connection.	Twinax host data cable connection is OK.	Check and reseat the twinax I/O cable connection at J1 on the controller board (page 6–77). Go to step 2.	Check and reseat the twinax host data cable connection. Go to step 2.
2. a) Disconnect twinax auto–termination cable from printer and host. b) Check twinax auto–termination cable for resistances shown on page NO TAG.	Twinax auto–termination cable checks out OK.	Connect twinax auto–termination cable to host and printer. Go to step 3.	Replace twinax auto–termination cable assembly.
3. a) Connect AC power cable to the printer. b) Power on the printer. c) Send a print job to the printer.	Job prints OK and no communications check messages appear.	Return printer to normal operation.	Go to step 4.
4. a) Verify that all other devices on the twinax line are working properly. (Refer to line problem determination procedures, as recommended by host system documentation.) b) Send a print job to the printer.	Twinax line devices work properly, but message still appears.	Replace one a time until message is gone: a) controller board b) multi I/O assembly c) LP30 backplane board.	Problem is not in the printer. Correct twinax line device malfunction or replace twinax line.

027 or 028 COMMUNICATIONS CHECK CALL SYSTEM OPERATOR

DANGER

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

	Instruction	Indication	Yes	No
1.	a) Power off the printer. b) Disconnect the AC power cord from the printer. (See DANGER notice above.) c) Check the coax host data cable connection.	Coax host data cable connection is OK.	Check and reseat the coax I/O cable connection at J1 on the controller board. Go to step 2.	Check and reseat the twinax host data cable connection. Go to step 2.
2.	a) Connect AC power cable to the printer. b) Power on the printer. c) Send a print job to the printer.	Job prints OK and no communications check messages appear.	Return printer to normal operation.	Go to step 4.
3.	a) Refer to line problem determination procedures, as recommended by host system documentation. b) Send a print job to the printer.	Coax line OK.	Replace one a time until message is gone: a) controller board b) multi I/O assembly	Problem is not in the printer. Correct coax line device malfunction or replace coax line.

051 HAMMER DRIVER SHORT

<table>
<tr><th>Instruction</th><th>Indication</th><th>Yes</th><th>No</th></tr>
<tr><td>1. Cycle power: Power off printer. Wait 15 seconds. Power on printer.</td><td>"051 HAMMER DRIVER SHORT" message.</td><td>Go to step 2.</td><td>Return printer to normal operation.</td></tr>
<tr><td>2. a) Remove the hammer bank cover.

b) On the shuttle frame assembly, disconnect the left and right flex circuit ribbon connectors (HBL and HBR) from the connectors on the base casting. (See Appendix A.)

c) Install the hammer bank cover.

d) Power on the printer and observe the card cage fan.</td><td>The card cage fan comes on and stays on.

(NOTE: Any of a number of error messages may display during this check. Disregard them during this check.)</td><td>Go to step 3.</td><td>Replace the mechanism driver board.

(NOTE: If the card cage fan never starts at all, replace the power supply board.)</td></tr>
<tr><td>3. a) Power off the printer.

b) One at a time, test HBL and HBR in both the left and right base casting connector, power up, and monitor the card cage fan. Before each test, replace the hammer bank cover before powering on the printer. Power off the printer after each test. (WARNING: Never connect or disconnect cables with power on.)

c) Keep track of the test results, as follows:
OK = card cage fan comes on and stays on.
Fail = card cage fan starts, then stops.

d) Compare your test results with the charts shown at right, and take the action shown in the Yes column.</td><td colspan="3"><table><tr><th></th><th>Left Cable (HBL)</th><th>Right Cable (HBR)</th></tr><tr><td>Left Base</td><td>OK</td><td>OK</td></tr><tr><td>Right Base</td><td>Fail</td><td>Fail</td></tr></table>Replace the mechanism driver board.

<table><tr><th></th><th>Left Cable (HBL)</th><th>Right Cable (HBR)</th></tr><tr><td>Left Base</td><td>Fail</td><td>Fail</td></tr><tr><td>Right Base</td><td>OK</td><td>OK</td></tr></table>Replace the mechanism driver board.

<table><tr><th></th><th>Left Cable (HBL)</th><th>Right Cable (HBR)</th></tr><tr><td>Left Base</td><td>Fail</td><td>OK</td></tr><tr><td>Right Base</td><td>Fail</td><td>OK</td></tr></table>Flex cable HBL is bad. Replace the shuttle frame assembly.

<table><tr><th></th><th>Left Cable (HBL)</th><th>Right Cable (HBR)</th></tr><tr><td>Left Base</td><td>OK</td><td>Fail</td></tr><tr><td>Right Base</td><td>OK</td><td>Fail</td></tr></table>Flex cable HBR is bad. Replace the shuttle frame assembly.</td></tr>
</table>

052 MECHANISM DRIVER HOT

Instruction	Indication	Yes	No
1. Cycle power: Power off printer. Wait 15 seconds. Power on printer.	"052 MECHANISM DRIVER HOT " message.	Go to step 2.	Return printer to normal operation.
2. Press the **Stop** key.	"052 MECHANISM DRIVER HOT" message.	Go to step 3.	Return printer to normal operation.
3. Run an operator print test.	"052 MECHANISM DRIVER HOT" message.	Go to step 4.	Return printer to normal operation.
4. Open printer cover and observe card cage fan.	Card cage fan operates.	Replace mechanism driver board.	Replace card cage fan assembly.

053 48 VOLTS FAILED

Instruction	Indication	Yes	No
1. Cycle power: Power off printer. Wait 15 seconds. Power on printer.	"053 48 VOLTS FAILED" message.	Go to step 2.	Return printer to normal operation.
2. Press the **Stop** switch.	"053 48 VOLTS FAILED" message.	Go to step 3.	Return printer to normal operation.
3. Power off printer. Remove the paper guide assembly. Disconnect cable assembly W1, CCB/Mech Driver, from connector J3 on the controller and connector J6 on the Mech Driver board. (See Appendix A.) Power on the printer.	Card cage fan comes on.	Power off printer. Replace the controller board. Go to step 4.	Power off printer. Replace the Mech Driver board. Go to step 4.
4. Cycle power: Power off printer. Wait 15 seconds. Power on printer.	"053 48 VOLTS FAILED" message.	Replace the power supply board. Go to step 5.	Return printer to normal operation.
5. Cycle power and check for the fault message.	"053 48 VOLTS FAILED" message.	Replace cable assembly W2. +5V. (See Appendix A.) Go to step 6.	Return printer to normal operation.
6. Cycle power and check for the fault message.	"053 48 VOLTS FAILED" message.	Replace cable assembly W3, Hi Voltage. (See Appendix A.) Go to step 7.	Return printer to normal operation.
7. Cycle power and check for the fault message.	"053 48 VOLTS FAILED" message.	Replace cable assembly W6, Main Wire Harness. (See Appendix A.)	Return printer to normal operation.

054 HAMMER COIL SHORT

Instruction	Indication	Yes	No
1. Cycle power: Power off printer. Wait 15 seconds. Power on printer.	"054 HAMMER COIL SHORT" message.	Go to step 2.	Return printer to normal operation.
2. Press the **Stop** key.	"054 HAMMER COIL SHORT" message.	Go to step 3.	Return printer to normal operation.
3. Run an operator print test.	"054 HAMMER COIL SHORT" message.	Go to step 4.	Return printer to normal operation.
4. Remove the shuttle cover. Install a magnet across the hole in the base casting where the cover open sensor is mounted. Disconnect the hammer bank flex circuit cables from the connectors on the base casting. Run a diagnostic print test.	"054 HAMMER COIL SHORT" message.	Replace the mechanism driver board, then go to step 5.	Replace the shuttle frame assembly.
5. Run an operator print test.	"054 HAMMER COIL SHORT" message.	Replace both hammer bank cable assemblies.	Return printer to normal operation.

055 MECHANISM DRIVER LINK FAILURE

Instruction	Indication	Yes	No
1. Cycle power: Power off printer. Wait 15 seconds. Power on printer.	"055 MECHANISM DRIVER LINK FAILURE" message.	Go to step 2.	Return printer to normal operation.
2. Press the **Stop** key.	"055 MECHANISM DRIVER LINK FAILURE" message.	Go to step 3.	Return printer to normal operation.
3. Power on printer and check for fault message.	"055 MECHANISM DRIVER LINK FAILURE" message.	Go to step 4.	Return printer to normal operation.
4. Power off printer. Remove paper guide assembly. Check ribbon cable connectors between controller board and mechanism driver board.	Connectors are attached properly.	Go to step 5.	Connect and latch ribbon connectors. Go to step 5.
5. Check installation of controller board and mechanism driver board.	Boards are installed correctly.	Go to step 6.	Reseat controller and mechanism driver boards in their edge connectors at bottom of card cage. Go to step 6.
6. Power on printer and check for fault message.	"055 MECHANISM DRIVER LINK FAILURE" message.	Replace the controller board then go to step 7.	Return printer to normal operation.
7. Power on printer and check for fault message.	"055 MECHANISM DRIVER LINK FAILURE" message.	Replace the mechanism driver board, then go to step 8.	Return printer to normal operation.
8. Power on printer and check for fault message.	"055 MECHANISM DRIVER LINK FAILURE" message.	Replace cable assembly W1, CCB/Mech. Dr. (See Appendix A.)	Return printer to normal operation.

056 HAMMER COIL OPEN

Instruction	Indication	Yes	No
1. Cycle power: Power off printer. Wait 15 seconds. Power on printer.	"056 HAMMER COIL OPEN" message.	Go to step 2.	Return printer to normal operation.
2. Press the **Stop** key.	"056 HAMMER COIL OPEN" message.	Go to step 3.	Return printer to normal operation.
3. Run an operator print test.	"056 HAMMER COIL OPEN" message.	Go to step 4.	Return printer to normal operation.
4. Remove the shuttle cover.	—	Go to step 5.	—
5. Install a magnet across the hole in the base casting where the cover open sensor is mounted.	—	Go to step 6.	—
6. Run an operator print test and observe where the non–printing hammer is located.	—	Go to step 7.	—
7. Reverse the hammer bank flex circuit cables in the connectors on the base casting.	—	Go to step 8.	—
8. Run an operator print test. Observe where the non–printing hammer is located. (NOTE: Hammer number 48 is a permanently non–printing hammer. Keep this is mind when reversing cables.)	Position of the non–printing hammer remains the same.	Replace the shuttle frame assembly, then go to step 9.	If the non–printing hammer is now on the other side of the hammer bank, replace the mechanism driver board, then go to step 9.
9. Return the hammer bank flex circuit cables to their correct connectors on the base casting. Run an operator print test.	"056 HAMMER COIL OPEN" message.	Replace both hammer bank cable assemblies.	Return printer to normal operation.

057 CLOSE PLATEN

Instruction	Indication	Yes	No
1. Load paper. Close the forms thickness lever. Run an operator print test.	"057 CLOSE PLATEN" message.	Go to step 2.	Return printer to normal operation.
2. Power off the printer. Disconnect the platen interlock switch connector. Check the switch with a meter.	Switch is bad.	Replace platen interlock switch assembly.	Replace one at a time until the message is gone: a) controller board b) intermediate cable assembly (W5)

058 SHUTTLE JAM

Instruction	Indication	Yes	No
1. Check the forms thickness lever: if it is set too tightly, it can slow the shuttle enough to trigger the fault message.	Forms thickness lever set correctly.	Go to step 2.	Set forms thickness lever for thicker paper. Go to step 2.
2. Run an operator print test and check for shuttle obstruction.	"058 SHUTTLE JAM" message.	Go to step 3.	Return printer to normal operation.
3. Remove shuttle cover and inspect shuttle area and mechanism for obstruction.	Shuttle movement blocked.	Remove obstruction. Go to step 4.	Install shuttle cover. Go to step 4.
4. Run an operator print test and observe the shuttle.	Shuttle moves.	Go to step 5.	Go to step 7.
5. Check MPU adjustment.	MPU adjustment OK.	Go to step 6.	Return printer to normal operation.
6. Run an operator print test.	"058 SHUTTLE JAM" message.	Replace the MPU. Go to step 5.	Return printer to normal operation.
7. Run an operator print test.	"058 SHUTTLE JAM" message.	Replace mechanism driver board. Go to step 8.	Return printer to normal operation.
8. Run an operator print test.	"058 SHUTTLE JAM" message.	Replace shuttle frame assembly.	Replace main wire harness W6.

090 CLOSE SHUTTLE COVER

	Instruction	Indication	Yes	No
1.	Inspect shuttle cover for warping, damage, or missing magnet. (The magnet covers the sensor housing when the cover is installed.)	Shuttle cover damaged.	Replace the shuttle cover assembly.	Go to step 2.
2.	Check shuttle cover installation.	Shuttle cover installed correctly.	Go to step 3.	Install cover correctly. Make sure the cover lies flat and the two captive screws are fully seated. Go to step 3.
3.	Run an operator print test.	"090 CLOSE SHUTTLE COVER" message.	Replace the cover open switch assembly.	Replace one at a time until message is gone: a) controller board b) intermediate cable assembly W5

089 RIBBON JAM

Instruction	Indication	Yes	No
1. Using a screwdriver, short across the ribbon guide screws to reverse ribbon hub motion. Check for ribbon failing to reverse motion.	Ribbon fails to reverse.	Go to step 2.	Go to step 3.
2. Check for missing foil strip at end of ribbon.	Foil strip missing.	Replace the ribbon.	Go to step 8.
3. Check that forms thickness lever is not closed too tightly; this can jam the ribbon and shuttle.	Forms thickness lever is set correctly.	Go to step 4.	Readjust the setting of the forms thickness lever. Go to step 4.
4. Run a ribbon and shuttle CE Test and check for shuttle obstruction.	Ribbon fault message.	Go to step 5.	Return printer to normal operation.
5. Check ribbon path for blockage or obstruction.	Ribbon path is clear	Go to step 6.	Remove obstructions from ribbon path and go to step 6.
6. Wind ribbon by hand and inspect for folds, tears, holes, fraying.	Ribbon is OK.	Rewind and reinstall ribbon. Go to step 7.	Replace ribbon, if damaged. Unfold and rewind ribbon if it was folded. Go to step 7.
7. Run the "Shuttle Fast" CE Test and check the alignment of the ribbon guides and hubs if the ribbon was folded.	Ribbon tracks OK.	Go to step 8.	Align ribbon guides. Go to step 8.
8. Using a screwdriver, short across the ribbon guide screws to reverse ribbon hub motion. Check for a ribbon drive motor that will not wind ribbon.	Both motors wind the ribbon.	Replace the mechanism driver board.	Replace one at a time until message is gone: a) defective ribbon drive motor b) mechanism driver board c) main wire harness W6

159 HAMMER BANK HOT

NOTE: The printer has protective circuits designed to sense conditions that can lead to overheating. When such conditions are sensed, print speed is reduced 50%. If the printer consistently prints at half speed, it may be printing long jobs of very dense graphics or operating in a severe environment. A severe environment is consistently above 90° Fahrenheit (32° Celsius) or is dirty enough to create blockage of the blower ducts. If the printer is located in such an environment, consider relocating it to a cooler, cleaner area or reducing the size and duration of the print jobs.

Instruction	Indication	Yes	No
1. Cycle power: Power off printer. Wait 15 seconds. Power on printer.	"159 HAMMER BANK HOT" message.	Go to step 2.	Return printer to normal operation.
2. Press the **Stop** key.	"159 HAMMER BANK HOT" message.	Go to step 3.	Return printer to normal operation.
3. Run "Plot Test" CE Test for 1/4 page.	"159 HAMMER BANK HOT" message.	Go to step 4.	Return printer to normal operation.
4. Remove the shuttle cover. Install a magnet across the hole in the base casting where the cover open sensor is mounted. Run a diagnostic print test.	Hammer bank fan operates.	Replace shuttle frame assembly.	Replace hammer bank fan assembly.

160 SHUTTLE FAN FAILURE

Instruction	Indication	Yes	No
1. Remove the shuttle cover. Install a magnet across the hole in the base casting where the cover open sensor is mounted. Check for inoperative hammer bank or card cage fan, or obstructed airflow.	"160 SHUTTLE FAN FAILURE" message.	Replace one at at time until message is gone: a) inoperative fan(s) b) mech driver board c) controller board	Return printer to normal operation.

A97 GRAPHICS CHECK

Instruction	Indication	Yes	No
1. Make a hex code printout (page 4–43), using the same print job that generated the error message.	"A97 GRAPHICS CHECK" message.	Go to step 2.	Return printer to normal operation.
2. Have the system operator verify: a) Host data are correct. b) There are no invalid characters. c) The printer's World Trade Language is correct.	Host data contain no invalid characters and World Trade Language correct.	Go to step 3.	Have the system operator make the necessary corrections to data or configuration.
3. a) Access the Coax or Twinax Interface configuration menu (Ref.: *Setup Guide*) b) Print the Character Table for the interface being used and check the characters.	"A97 GRAPHICS CHECK" message.	Replace one at a time until message is gone: a) controller board b) coax or twinax cable.	Return printer to normal operation.

ACTIVATE LOST
INVALID ACTIVATE
INVALID COMMAND

DANGER

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

Instruction	Indication	Yes	No
1. Print the Error Log (page 4–37). (A few parity errors in the log are acceptable.)	Host communication error message display logged.	Go to step 2.	Return printer to normal operation.
2. a) Power off the printer. b) Disconnect the power cord. c) Check coax/twinax cable terminations at the I/O plate.	Coax and twinax cables are properly attached.	Go to step 3.	Attach cables correctly.
3. Check coax and twinax I/O cable grounding and connections at controller board.	Cables are grounded and attached to controller board correctly.	Go to step 4.	Attach cables correctly.
4. Check that external coax/twinax cable is undamaged and is not longer than 4921.5 feet (1500 meters).	Cable is OK.	Go to step 5.	Replace cable.
5. a) Connect power cord to printer. b) Power on the printer. c) Send data from host.	Error message displays.	Power off printer. Replace one at a time until message is gone: a) coax or twinax cable b) controller board	Return printer to normal operation.

Diskette and Disk Drive Messages

	Instruction	Indication	Yes	No
1.	a) Power off printer. b) Verify that the system diskette is not read/write protected. c) Insert the diskette in the diskette drive. Power on printer.	Diskette or disk driver error message.	Go to step 2.	Return printer to normal operation.
2.	a) Power off printer. b) Insert the diskette in the diskette drive. c) Power on printer and observe the diskette drive LED.	Diskette drive LED comes on.	Go to step 3.	Go to step 5.
3.	The diskette may have been altered or corrupted: Replace the diskette with an authorized IBM diskette.	Diskette or disk driver error message.	Go to step 4.	Return printer to normal operation.
4.	Clean the diskette drive heads. Use a commercially-available floppy drive head cleaning kit. Follow the instructions included with the kit.	Diskette or disk driver error message.	Go to step 5.	Return printer to normal operation.
5.	a) Power off printer. b) Check connections of the floppy interface cable assembly and floppy power cable assembly at the disk drive unit and at the LP30 backplane board. (See Appendix A.)	Connections are correct, clean, and tight.	Replace* one at a time until the message is gone: a) diskette drive assembly b) controller board c) floppy interface cable assembly d) floppy power cable assembly e) LP30 backplane board * After a replacement, verify disk drive read/write functionality by changing and saving a configuration parameter. (Refer to the *Setup Guide*.)	Reseat the cable(s). Verify disk drive read/write functionality by changing and saving a configuration parameter. (Refer to the *Setup Guide*.)

PARAMETER ERROR
SCS COMMAND ERROR

Instruction	Indication	Yes	No
1. Run the same job that generated the error message.	SCS COMMAND or PARAMETER ERROR message.	Verify host data are correct and there are no invalid characters.	Return printer to normal operation.
2. Ask the system operator to verify printer's Device ID is set to the correct emulation with respect to the host configuration.	SCS COMMAND or PARAMETER ERROR message.	Replace one at a time until message is gone: a) coax or twinax cable b) controller board	Return printer to normal operation.

Serial Interface Messages

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

Symptoms Not Indicated by Fault Messages

Use standard fault–isolation techniques to troubleshoot malfunctions not indicated by fault messages:

1. Ask the operator to describe the problem.
2. Verify the fault by running diagnostic tests or replicating conditions reported by the user.
3. Look for a match in the "Symptoms Not Indicated by Fault Messages Troubleshooting Table" (page 4–30), and follow the instructions given.
4. Locate the malfunction using the half–split method:
   a. Start at a general level and work down to details.
   b. Isolate faults to half the remaining system at a time, until the final half is a field–replaceable part or assembly. (Troubleshooting aids are listed on page 4–3.)
5. Replace the defective part or assembly.

IMPORTANT

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

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

Symptoms Not Indicated by Fault Messages Troubleshooting Table

Symptom	Instruction
No power, operator panel LCD and LEDs blank, card cage fan not running.	1. +5 volt distribution problem to the LP30 backplane board. (Refer to the Power Distribution Diagram on page NO TAG.)
Power on hang condition.	1. Perform a diagnostic check of the controller board (page 4–35).
Blank or single line of black squares across top row of operator panel LCD.	1. Perform a diagnostic check of the controller board (page 4–35). 2. Power off printer. Check that the operator panel cable is fully seated in connector J3 on the LP30 backplane board. Do step 1 again. If the display is still blank, or has a black line, and the DPU LEDs light and turn off, the operator panel or its cable are defective.
Operator Panel key failure.	1. Replace one at a time until the problem is fixed: a) operator panel assembly b) controller board c) LP30 backplane board c) operator panel cable assembly
Ribbon folding or feed problems.	1. Clean the shuttle frame assembly (page 3–3). 2. Check the left and right ribbon guide alignment (page 5–18).
Printer appears normal, but does not print data sent from the host.	1. Perform a printer confidence check (page 4–34). 2. Power off printer and disconnect the AC power cable. 3. Check the host data cable connection at the rear of the printer. 4. If the printer interface is RS–232, interchange the wires to pins 2 and 3. This is the most common cause of a completely inoperative RS–232 cable. Make sure the printer and host have the same baud rate, number of data bits, number of stop bits, and parity. In RS–232, configure the host for XON/XOFF if possible; this requires the least complex cable. 5. Replace one at a time until the problem is fixed: a) controller board b) multi I/O assembly c) LP30 backplane board

Symptom	Instruction
Printer prints data sent from the host, but occasionally prints double characters or loses blocks of data.	1. Perform a diagnostic check of the controller board (page 4–35). 2. If the printer prints from the host, but occasionally loses blocks of data, the most likely cause is the host not responding to "send no more data" signals from the printer. With a PC Parallel interface, this means the host is ignoring BUSY; in RS–232, the host is ignoring the XOFF character or "Data Terminal Ready" signal (pin 20). Sometimes the cable is not conveying the necessary signals. Test this by using a serial line analyzer and software or test equipment that displays the data and handshake lines of the printer. A breakout box works, but will not debug XON/XOFF or other RS–232 data protocols. If the printer is sending XOFF with one stop bit, the host may not be receiving it if the host requires 1.5 or 2 stop bits. 3. a) If the printer prints from the host, but occasionally prints double characters, there is probably a noise problem at the interface or the host computer is sending an inverted strobe. This problem can occur on PC Parallel or Dataproducts interfaces, never on RS–232. What happens is that the strobe signal registers logic 1 more than once for a certain character. To fix this, change the strobe to trailing edge or invert the strobe polarity. (Refer to the *Setup Guide*.) b) Also check that the terminating resistors are present on the controller board (page 6–47). You can correct some noise problems by using a shielded data cable or by changing the terminating resistors. The standard terminating resistors are optimized for high speed data transfer for cables between 1 and 5 meters long; you can change them for slower operation, which will provide slightly more noise immunity. c) Noise is caused by static, a floating logic ground, unshielded cable, changes in ground voltage from nearby equipment, or capacitively– or magnetically–induced noise. On very long cables, capacitively–induced noise from the other signals of the cable (especially PC Parallel "ACK" or Dataproducts "DEMAND") can cause false strobes. Unshielded and flat ribbon cables are much more prone to problems due to increased length. The best solution is to shorten cable, shield it, and reduce local electromagnetic noise. Also, make sure that both the printer and the host computer are properly grounded.

Print Quality Problems	
Missing, light, or smeared characters or dots:	1. Check the forms thickness lever setting. 2. Check the ribbon for folds or tears. 3. Clean the shuttle frame assembly (page 3–3). 4. Check the platen gap adjustment (page 5–14). 5. Reverse the hammer bank flex circuit cables in the connectors on the base casting. NOTE: Hammer number 48 is a permanently non–printing hammer. Keep this in mind when reversing cables. 6. Run an operator print test. If the failing position(s) move, replace the mechanism driver board (page 6–18). 7. Return the hammer bank flex cables to the original positions. 8. Swap hammer spring assemblies for the failing position(s) with one from working position(s). 9. Run an operator print test. If the failing position(s) move, replace the hammer spring assembly. 10. Replace the shuttle frame assembly (page 6–55).
All characters or dots are too light or too dark.	1. Check the forms thickness lever setting. 2. Clean the shuttle frame assembly (page 3–3). 3. Check the platen gap adjustment (page 5–14). 4. Install a new ribbon. 5. Replace one at a time until problem is fixed: a) mechanism driver board (page 6–18) b) shuttle frame assembly (page 6–55)
Horizontal misalignment. (Dots or characters move left or right from dot row to dot row or line to line.)	1. If all dots between alternate rows are misaligned, check hammer phasing (page 5–27). 2. Clean the shuttle frame assembly (page 3–3). 3. Check the MPU gap adjustment (Ref: page 6–32). 4. Replace one at a time until problem is fixed: a) MPU (page 6–32) b) mechanism driver board (page 6–18) c) shuttle frame assembly (page 6–55)
Vertical misalignment: 1. Dots or characters move up or down from dot row to dot row or line to line. 2. Incorrect spacing from dot row to dot row or line to line.	1. Check paper feed motor belt (page 5–4). 2. Check platen gap adjustment (page 5–14). 3. Replace one at a time until problem is fixed: a) tractors (page 6–62) b) mechanism driver board (page 6–18) c) paper feed motor (page 6–34) d) controller board (page 6–14) e) power supply board (page 6–20)

Print Quality Problems	
Randomly misplaced dots.	1. Check platen gap adjustment (page 5–14). 2. Check printer grounding (page NO TAG). 3. Replace one at a time until problem is fixed: a) controller board (page 6–14) b) power supply board (page 6–20) c) shuttle frame assembly (page 6–55)
Garbled print or paper slews uncontrollably.	1. Perform a diagnostic check of the controller board (page 4–35). 2. a) Put the printer into hex dump mode and analyze the binary data. One cause of garble is the host interface or cable not transmitting all 8 data bits. When this occurs, the PC Parallel or Dataproducts interface receives a 1 on every unconnected data line. Uncontrolled slewing is often caused by enabling PI (Paper Instruction) in the printer when the host lacks a PI signal. (PI shows as "p" on the hex dump.) Some RS–232 and Dataproducts interfaces only send 7 data bits. In this case, the eighth bit will be received as a one. b) In RS–232, a common cause of garble is the interface set to the wrong baud rate or parity. Sometimes the host sends 1.5 or 2 stop bits; in this case, the printer's "1–stop–bit" setting will accept both 1.5 and 2 stop bit data. Sometimes the data may "fade" or "persist" from one character to the next. This reveals a problem with PC Parallel or Dataproducts terminating resistors on the controller board—especially if they are absent. Garble also can result from failed termination resistors or parallel logic, but this is rare.

Printer Confidence Check

Instruction	Indication	Yes	No
1. Check that printer is plugged into correct power source.	Power cable installed correctly to proper source.	Power off printer. Go to step 2.	Set power switch to O (off). Connect printer to correct power source.
2. Power on the printer.	Printer goes READY.	Go to step 3.	Troubleshoot the fault message (page 4–4).
3. Run an operator print test (page 4–37).	Printer operates correctly	Go to step 4.	Troubleshoot the fault message (page 4–4).
4. Make a configuration printout. (Ref.: *Setup Guide*)	a) Configuration is correct for the user's application. b) Host computer and printer are using the same protocol (emulation). c) Configuration has not been inadvertently changed by user.	Go to step 5.	Reconfigure the printer. (Ref.: *Setup Guide*)
5. a) Power off printer. b) Check alignments and adjustments. (Chapter 5.)	Assemblies and components are adjusted in accordance with Chapter 5.	Go to step 6.	Adjust all assemblies that are out of spec.
6. a) Power off printer. b) Remove paper guide assembly (page 6–40). c) Check all electrical connectors.	Connections are clean and tight. Wires are not stripped, frayed, or out of connectors.	Go to step 7.	Replace stripped, frayed, or broken wires.
7. Check that all printed circuit boards are seated correctly and cable connections are correct. (Ref.: Appendix A)	Printed circuit boards are firmly seated and all cables are correctly attached.	Go to step 8.	Unseat and reseat each board, one board at a time. Check and correct the cable attachments.
8. Inspect for debris that could cause short circuits (loose fasteners, foil, etc.).	Metallic debris.	Remove debris. Clean the printer. (Chapter 3.)	Go to step 9.
9. a) Install paper guide assembly (page 6–40). b) Power on printer.	Printer powers up and initializes properly.	Printer checks out OK. Fault may not be in printer. Check host computer, applications software, cabling, etc.	Troubleshoot the fault message (page 4–4).

Controller Board Diagnostic Check

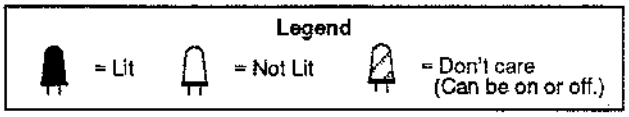
You can check the operation of the controller board by monitoring its six diagnostic LEDs as the printer powers up. (These LEDs are *only* valid during system startup.) The LEDs are mounted along the top right edge of the board. (See Table 4–2.)

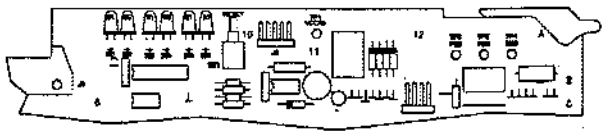
The DPU, RTPU, and the BCP each control two LEDs. The lighting patterns of the LEDs as the printer powers up indicate the status of the board.

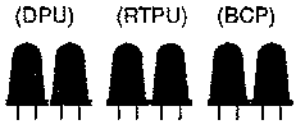
Follow the steps below to make a diagnostic check of the controller board.

1. Power off the printer.
2. Remove the paper guide assembly (page 6–40).
3. Make sure all cable connections to the controller board are correct. (See Appendix A.)
4. Power on the printer and watch the diagnostic LEDs as the printer initializes:
   a. Note the final on/off pattern of LEDs.
   b. Using Table 4–2, find the LED pattern you observed and follow the instructions for solving the problem.
5. Install the paper guide assembly (page 6–40).
6. Return the printer to normal operation.

Table 4–2. Controller Board Diagnostic LED During Power–Up





LED Pattern	Explanation	Solution
	DPU failed to execute startup code.	Replace: 1) boot ROM (page 6–46) 2) Controller board (page 6–14)
	RTPU could not handshake with DPU. Handshake is done in DPMC shared memory.	Replace: 1) RTPU PROM (page 6–46) 2) Controller board (page 6–14)
	DPU failed memory test or floppy memory failure.	Replace controller board (page 6–14)
	PFC failed.	Replace: 1) PFC PROM (page 6–46) 2) Controller board (page 6–14)
	RTPU cannot communicate with RSP on the mechanism driver board.	Replace: 1) RSP PROM (page 6–48) 2) Mech Driver Board 3) Controller board
	Diskette failed to load data and programs properly.	1) Verify that diskette installs properly in drive. 2) Replace diskette
	BCP failed.	Replace controller board (page 6–14)
	Problem exists in diagnostic code, or the BCP did not finish internal diagnostics or request normal operating code from DPU.	Replace controller board (page 6–14)
	Controller components initialized correctly.	None required. Board is operational.

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. You can use these print 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 of the tests is a list of items that may need to be adjusted or replaced if the test produces a bad print pattern. Items are listed in the order you should check them: simplest items first, complex items last.

- **Printer Demonstration** Prints a sample of the printer's capabilities.
- **Print Error Log** Prints the contents of the error log. The error log automatically records error conditions as they occur in the printer, and save them in NVRAM. Errors are printed from the oldest to most recent, in the order in which they occurred.
- **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 spring
  Hammer coil (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 spring
Hammer coil (shuttle frame assembly)

- **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
  Mechanism Driver 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.

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

Selecting and Running Operator Print Tests

Step	Key	Displayed Result	Notes
1.	Make sure that the printer ribbon is installed in the printer and the printer is powered on and is loaded with paper.		
2.	Press: Stop	NOT READY	Places the printer in Not Ready mode.
3.	Press: Scroll ↑ + Scroll ↓	UNLOCKED OPERATOR MENU	Press both keys at the same time. Unlocking the **Enter** key allows you to test your printer.
4.	Press: Menu	CONFIGURATION MENU PRINTER CONTROL	First of the series of configuration menus.
5.	Press: Scroll ↑ UNTIL	CONFIGURATION MENU OPERATOR PRINT TESTS	Advances to the Operator Printer Tests menu.
6.	Press: Enter	OPERATOR PRINT TESTS PRINTER DEMONSTRATION*	Advances to Printer Demonstration, the first option in Operator Printer Tests menu.
7.	Press: Scroll ↑ UNTIL	OPERATOR PRINT TESTS [TEST NAME]	Cycles through the list of Printer Tests. Stop when the name of the test you wish to run displays (will print at either 80 or 132 columns, as specified).
8.	Press: Enter	OPERATOR PRINT TESTS [TEST NAME]	The printer test you have selected starts printing.
9.	Press: Stop	NOT READY	The printer test stops printing.

Customer Engineer Tests

A set of printer tests is included in the configuration menu structure for use as maintenance tools. These tests are called the "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.

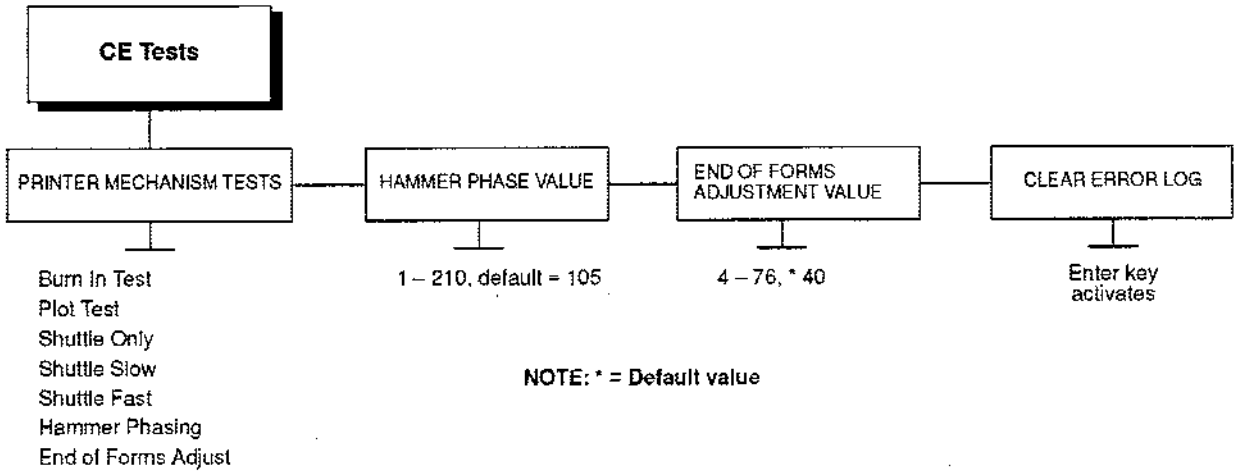


Figure 4–1. CE Tests Menu

Figure 4–1 illustrates the CE Tests, which 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 prior to shipment, and has no value as a maintenance tool.
- **Plot Test** Prints all dot positions, creating a solid black band. Exercises shuttle and hammer bank at maximum capacity.

  Mechanism Driver board
  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.

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 attention and unit check conditions as they occur in the printer.)

Selecting and Running CE Tests

1. If the **Ready** indicator is on, press the **Stop** key. The printer must be in NOT READY state to access the CE Tests.
2. Press **Scroll↑ + Scroll↓** to unlock the **Enter** key.
3. Press **Scroll↑ + Scroll↓ + Return + Enter**. (Press all four keys at the same time.)
4. The first menu item is "PRINTER MECHANISM TESTS." To view the different mechanism tests, press **Enter**.
5. Scroll to the desired test by using the **Scroll↑** or **Scroll↓** key.
6. Press **Enter**. The selected test begins. You can select other tests by going back to step 5. To end the test, press the **Enter** key.

NOTE: See Chapter 5 for special instructions in the use of the Hammer Phasing and End of Forms Adjust tests.

7. Press **Stop** to halt any test, exit the menu, perform a warm start, and put the printer in the NOT READY state.
8. Press **Start** to halt any test, exit the menu, perform a warm start, and put the printer in the READY state.

Hex Code Printout

A hex code printout ("hex dump") lists each ASCII data character received from the host computer, along with its corresponding two-digit hexadecimal code. Hex dumps can be used to troubleshoot some types of printer data reception problems.

To convert an ASCII character to its corresponding hex code (or vice-versa), refer to the ASCII code chart on page 4–45.

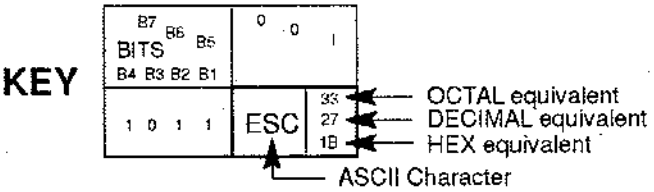
Every printable character is printed both as its assigned symbol and as its hex equivalent. Each nonprintable (ASCII control) character prints both as a period (.) and as its hex equivalent.

When using a parallel interface, the letter "p" before a hex code indicates an active Paper Instruction (PI) line and a blank space before a hex code indicates an inactive PI line.

Step	Key	Displayed Result	Notes
1. Press:	Stop	NOT READY	Places the printer in Not Ready mode.
2. Press:	Scroll ↑ + Scroll ↓	UNLOCKED	Press both keys at the same time. Unlocking the **Enter** key allows you to test the printer.
3. Press:	Menu	PRINTER CONTROL	First of the series of configuration menus.
4. Press:	Enter	PRINTER CONTROL INTERFACE SELECTION	Moves down to the Interface Selection option.
5. Press:	Scroll ↑ UNTIL	PRINTER CONTROL HEX PRINT MODE	Moves down to the Hex Print Mode option.
6. Press:	Enter	HEX PRINT MODE DISABLE*	Moves down to Disable, the active option.

Step	Key	Displayed Result	Notes
7. Press:	Scroll ↑	HEX PRINT MODE ENABLE	Moves down to Enable, the alternate option.
8. Press:	Enter	HEX PRINT MODE ENABLE*	Asterisk (*) indicates this choice is now active.
9. Press:	Stop	NOT READY	Returns the printer to Not Ready mode.
10. Press:	Scroll ↑ + Scroll ↓	LOCKED	Press both keys at the same time to relock the **Enter** key.
11. Press:	Start	READY	Puts the printer back to Ready mode.

ASCII Character Set



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

Soft vs. Hard Reset

Soft Reset

A soft(ware) reset clears printer memory and reloads the most recently saved configuration into memory. 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 most recent printer configuration.

You must put the printer in the NOT READY state to perform a soft reset:

Step	Key	Displayed Result	Notes
1. Press:	Stop	NOT READY	Takes the printer off–line from the host.
2. Press:	Stop + Enter	STANDBY . . . SOFT RESET	Printer loads most recently saved configuration from diskette.

Hard Reset

A hard(ware) reset runs all initialization and diagnostic routines. To do a hard reset, power off the printer, wait 15 seconds, then power the printer on.

5 Adjustment Procedures

Chapter Contents

Preparing the Printer for Maintenance

DANGER

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

To prepare the printer for maintenance, do the following steps *before* making an adjustment:

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

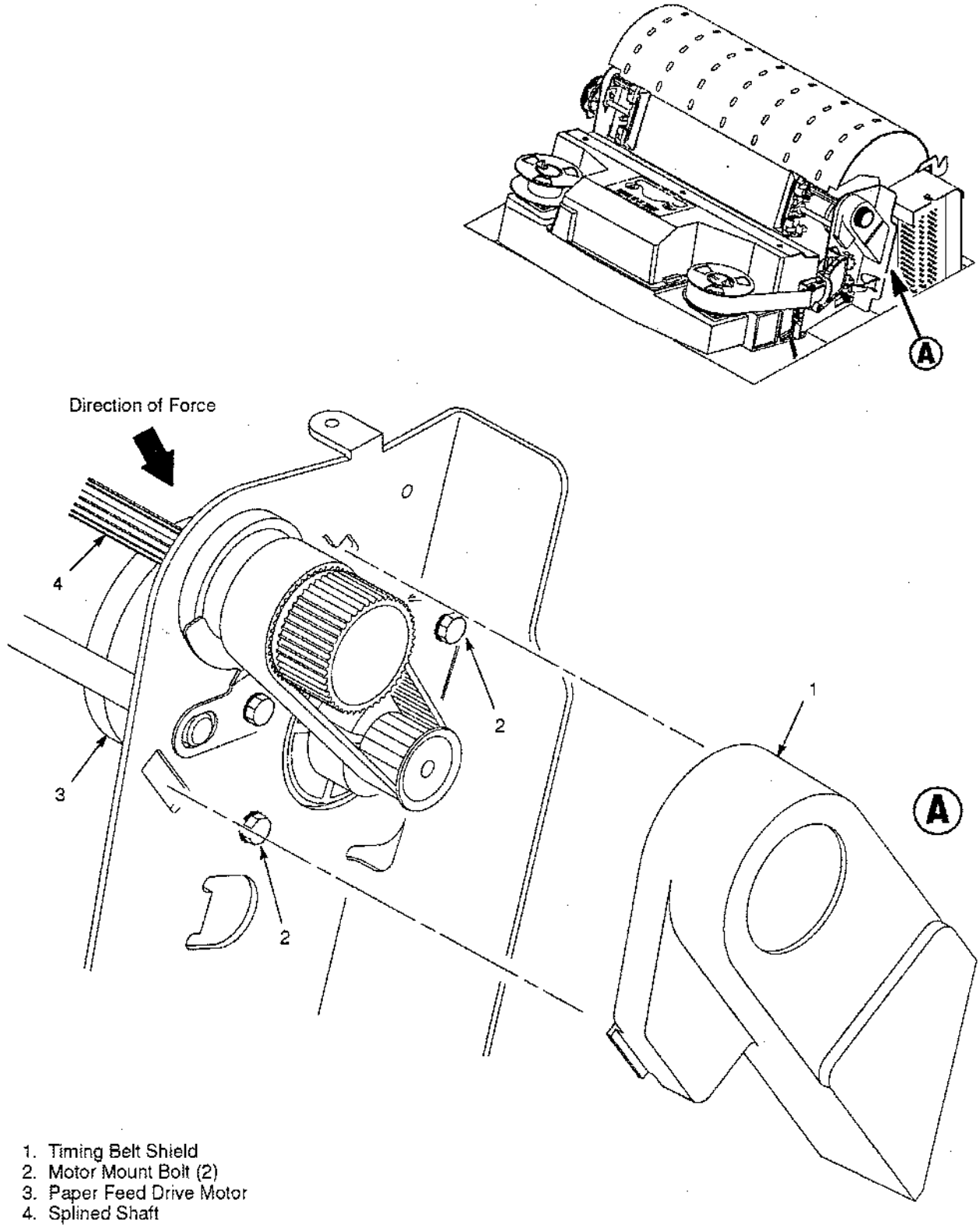
Returning the Printer to Normal Operation

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

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

Belt, Paper Feed Timing, Adjustment (Figure 5–1)

1. Prepare the printer for maintenance (page 5–2).
2. Open the printer cover.
3. Remove the paper guide assembly (page 6–40).
4. Remove four screws and the barrier shield (page 6–75, Figure 6–10).
5. Remove the timing belt cover (1) by squeezing the top and bottom to release the plastic tabs from the slots in the side plate.
6. Loosen (do not remove) the motor mount bolts (2).
7. Using the straight end of a force gauge, apply 12 pounds (53.4 N) of pressure to the paper feed drive motor (3). Use the splined shaft (4) to steady the gauge.
8. Reduce tension to 9 pounds (40.0 N) and torque the paper feed motor mount bolts (2) to 18 ±2 inch–pounds (2.03 ±0.23 N•m).
9. Snap the timing belt cover (1) into the slots in the side plate.
10. Install the barrier shield and four screws (page 6–75, Figure 6–10).
11. Install the paper guide assembly (page 6–40).
12. Return the printer to normal operation (page 5–3).



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

Figure 5–1. Paper Feed Timing Belt Adjustment

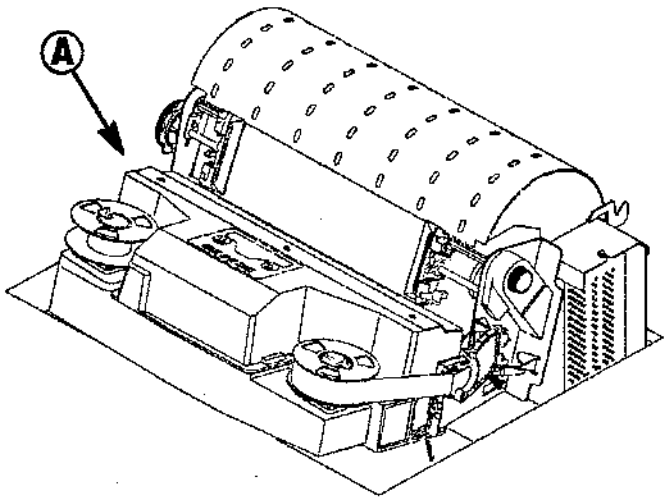
Belt, Platen Open, Adjustment (Figure 5–2)

1. Prepare the printer for maintenance (page 5–2).
2. Open the printer cover.
3. Remove the platen open belt cover (1) by squeezing the top and bottom to release the plastic tabs from the slots in the side plate.
4. Loosen the motor mount screws (2).
5. Close the forms thickness lever all the way.

WARNING

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

6. Using a force gauge, apply 10 ±1 pounds (44.48 ±4.45 N) of tension to the platen open motor shaft (3), pulling away from the large platen pulley.
7. Reduce tension to 5 ±1 pounds (22.24 ±4.45 N) and torque the motor mount screws (2) to 11 ±2 inch–pounds (1.24 ±0.23 N•m).
8. Check the platen gap (page 5–14). Loosen the belt and readjust the gap if necessary.
9. Snap the platen open belt cover (1) into the slots in the side plate.
10. Return the printer to normal operation (page 5–3).



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

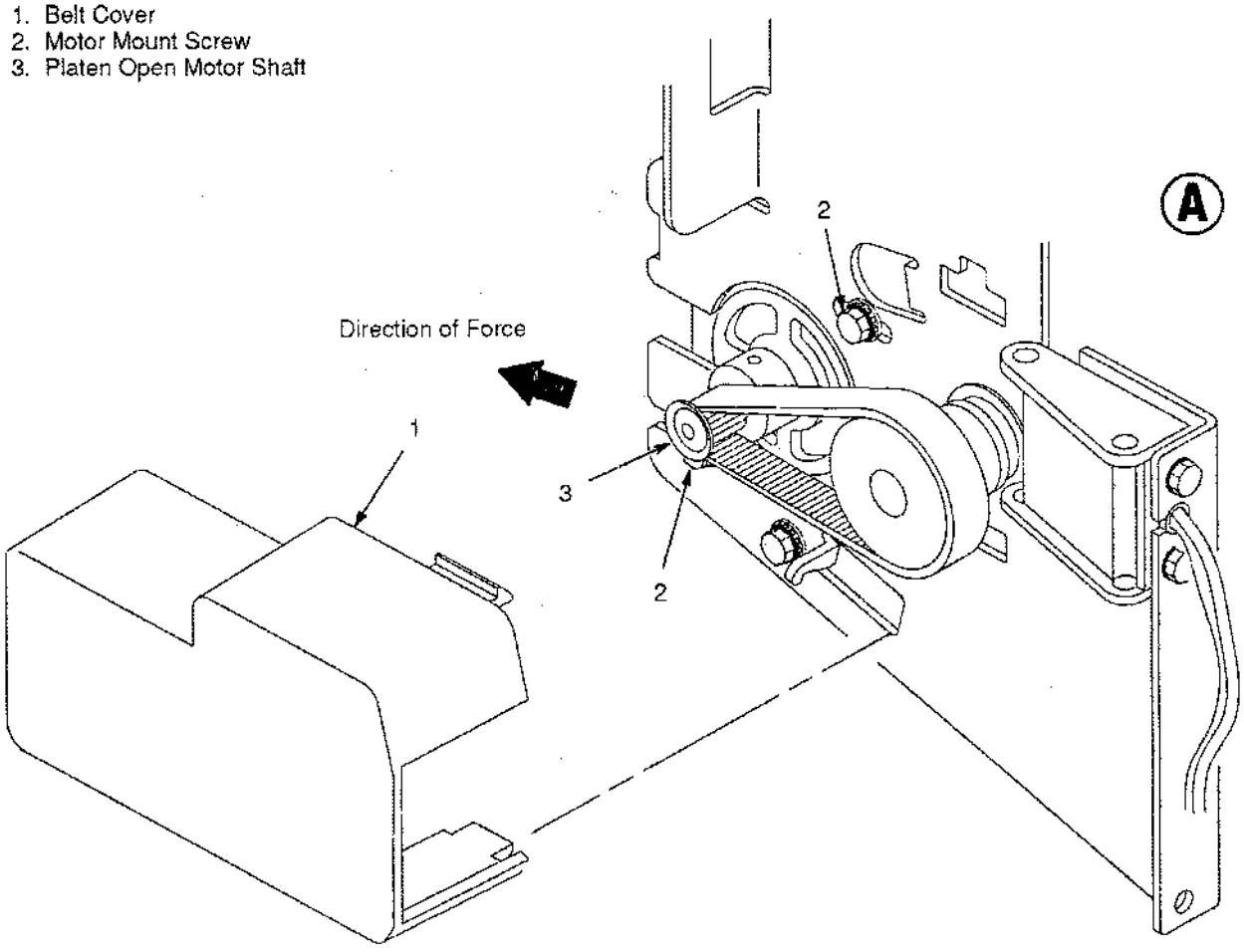


Figure 5–2. Platen Open Belt Adjustment

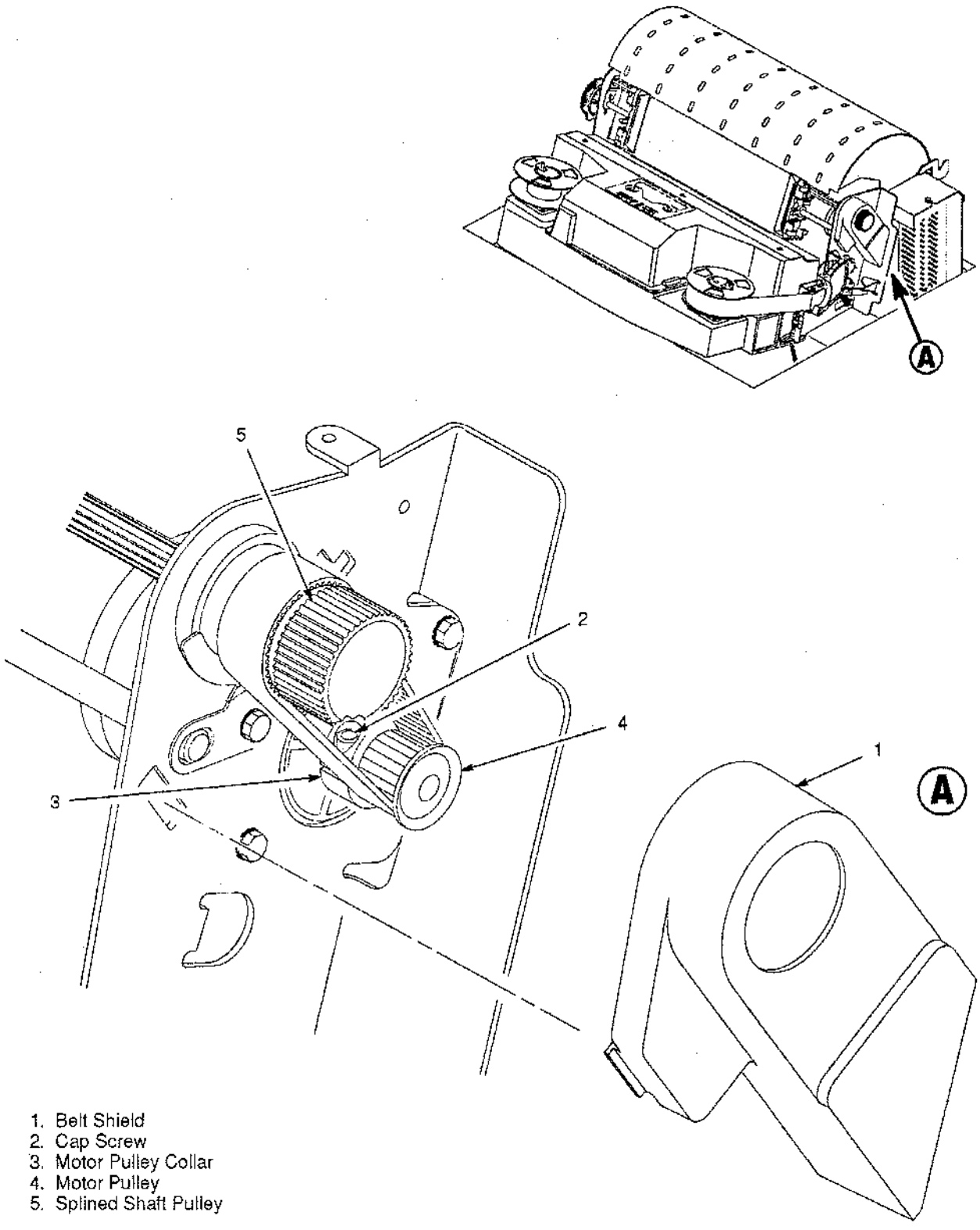
Paper Drive Motor Pulley Alignment (Figure 5–3)

1. Prepare the printer for maintenance (page 5–2).
2. Open the printer cover.
3. Remove the timing belt cover (1) by squeezing the top and bottom to release the plastic tabs from the slots in the side plate.
4. Loosen the set screw (2) in the motor pulley collar (3).
5. Align the paper drive motor pulley (4) with the splined shaft pulley (5).

WARNING

Make sure there is at least 0.010 inches (0.25 mm) of clearance between the collar/pulley and the motor face plate.

6. Hold the collar (3) flush against the motor pulley (4) and tighten the set screw (2):
   a. If the pulley (4) is black (aluminum), torque the set screw to 11 ±2 inch–pounds (1.24 ±0.23 N•m).
   b. If the pulley (4) is silver (steel), torque the set screw to 25 ±2 inch–pounds (2.82 ±0.23 N•m).
7. Check for correct tension on the paper feed timing belt (page 5–4). Adjust if necessary.
8. Snap the timing belt cover (1) into the slots in the side plate.
9. Return the printer to normal operation (page 5–3).

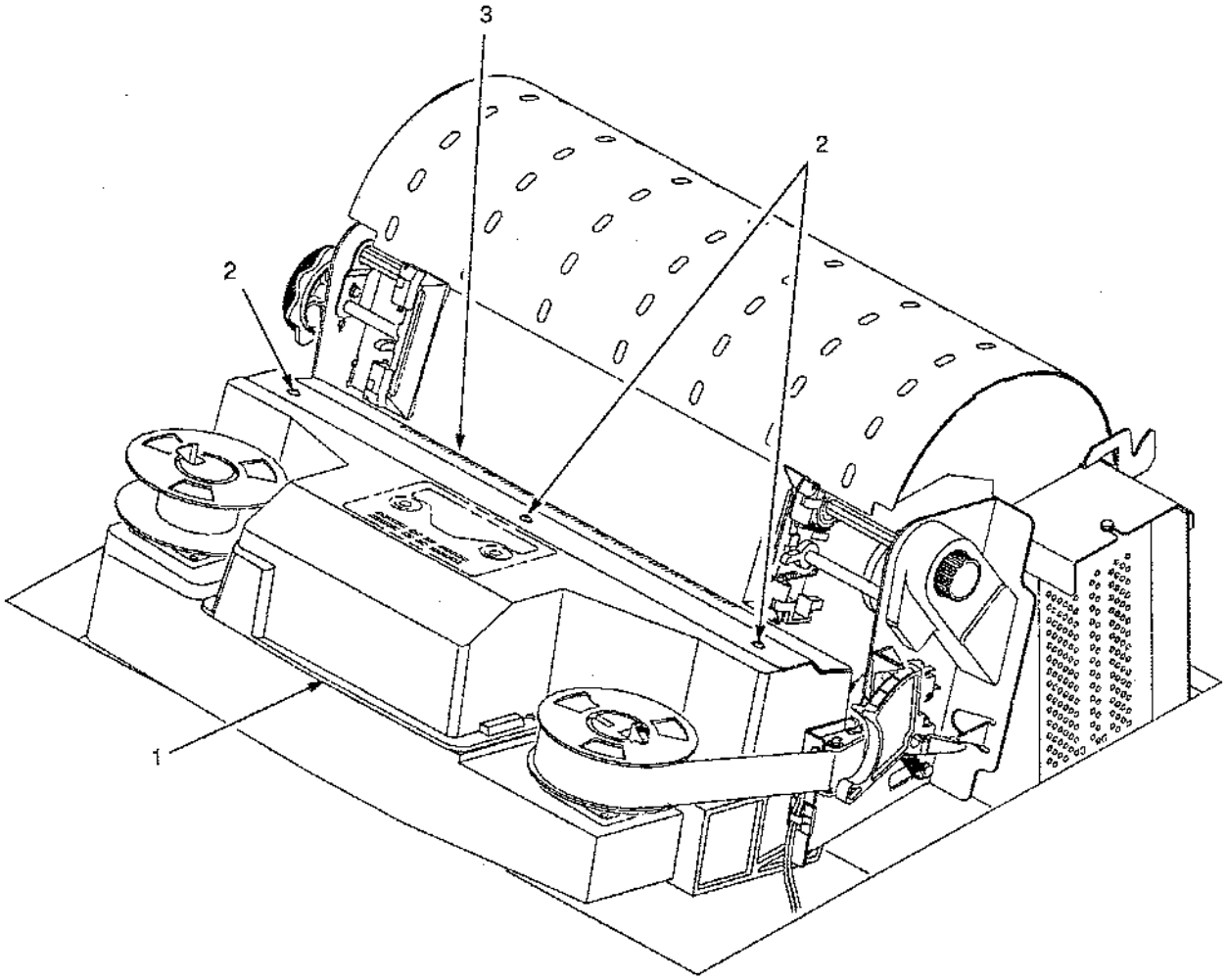


1. Belt Shield
2. Cap Screw
3. Motor Pulley Collar
4. Motor Pulley
5. Splined Shaft Pulley

Figure 5–3. Paper Drive Motor Pulley Alignment

Paper Scale Alignment (Figure 5–4)

1. Load paper and ribbon.
2. Connect the power cord to the AC power source.
3. Set the printer power switch to 1 (on).
4. Open the printer cover.
5. Verify that the shuttle cover (1) is properly installed (page 6–23).
6. Print a full 132 column line by selecting and running one of the diagnostic self–tests. (See Chapter 4.)
7. Check alignment of the scale to the print at column positions 1 and 132.
8. If adjustment is necessary, loosen the three button–head 5/64 inch hex screws (2).
9. Position the scale (3) so that column positions 1 and 132 line up with the first and last characters on the 132 character printout.
10. Tighten the button–head screws (2).
11. Close the printer cover.

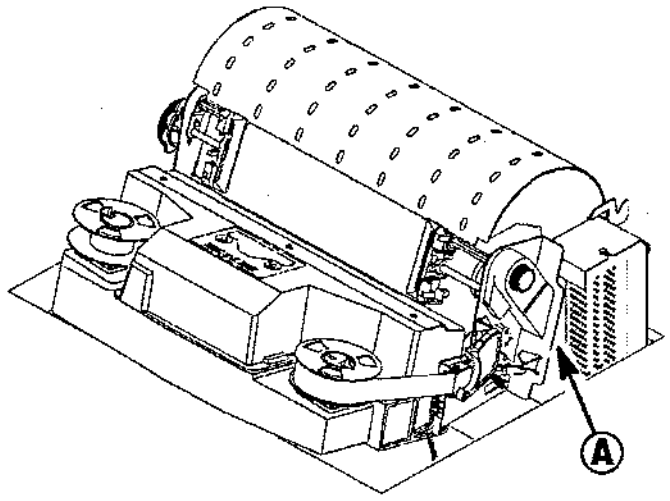


1. Shuttle Cover
2. Screw, Button–Head, 5/64 inch hex (3)
3. Paper Scale

Figure 5–4. Paper Scale Alignment

Platen Angle Adjustment (Figure 5–5)

1. Prepare the printer for maintenance (page 5–2).
2. Remove the shuttle frame assembly (page 6–55).
3. Close the forms thickness lever (1) all the way. (Position 'A' on the scale.)
4. Install the platen position gauge (2) and check the angle of the platen (3): forms thickness lever should be against the platen stop, the flat surface of the platen flush with the position gauge, and the position gauge flat on the mechanism base.
   a. If the angle is correct, no adjustment is necessary. Go to step 7.
   b. If the angle is incorrect, loosen the clamp screw (4) and set screw (5).
5. Position the platen (3) at the correct angle.
6. Slide the platen (3) to the right and the forms thickness lever (1) to the left to remove end play. Ensure that the forms thickness lever is fully closed. Tighten the clamp screw (4), then tighten the setscrew (5).
7. Remove the platen position gauge (2).
8. Check the platen gap adjustment (page 5–14).
9. Install the shuttle frame assembly (page 6–55).
10. Check the hammer phasing adjustment (page 5–27).
11. Return the printer to normal operation (page 5–3).



1. Forms Thickness Lever
2. Platen Position Gauge
3. Platen
4. Clamp Screw
5. Setscrew

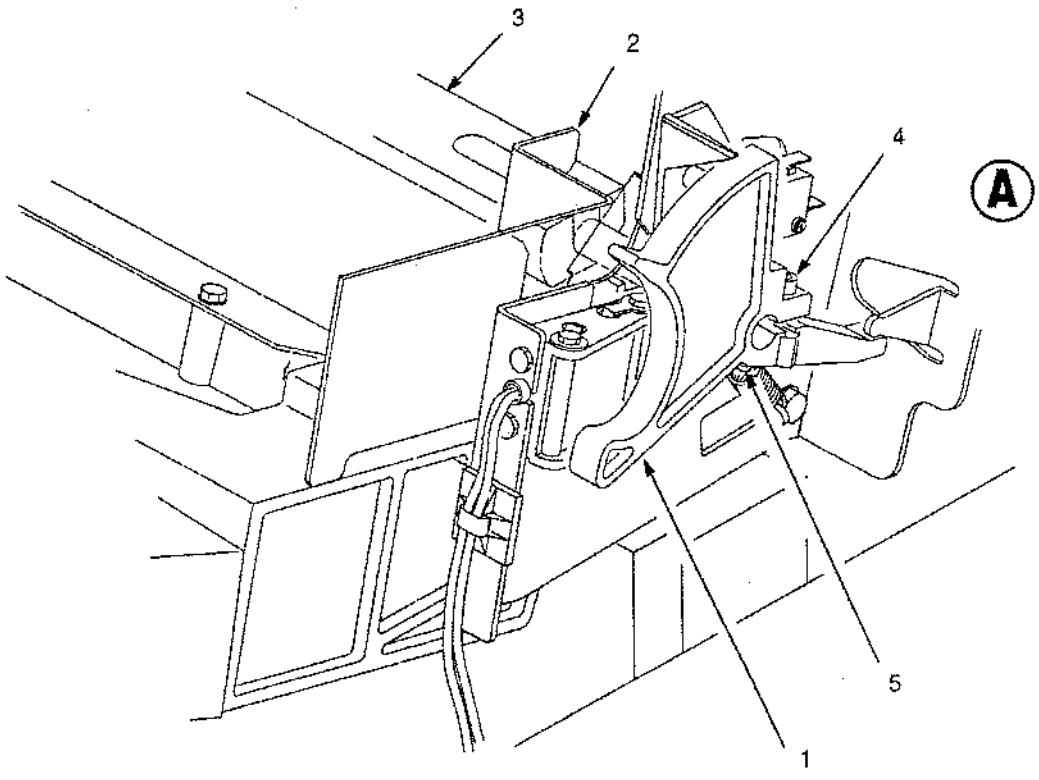


Figure 5–5. Platen Angle Adjustment

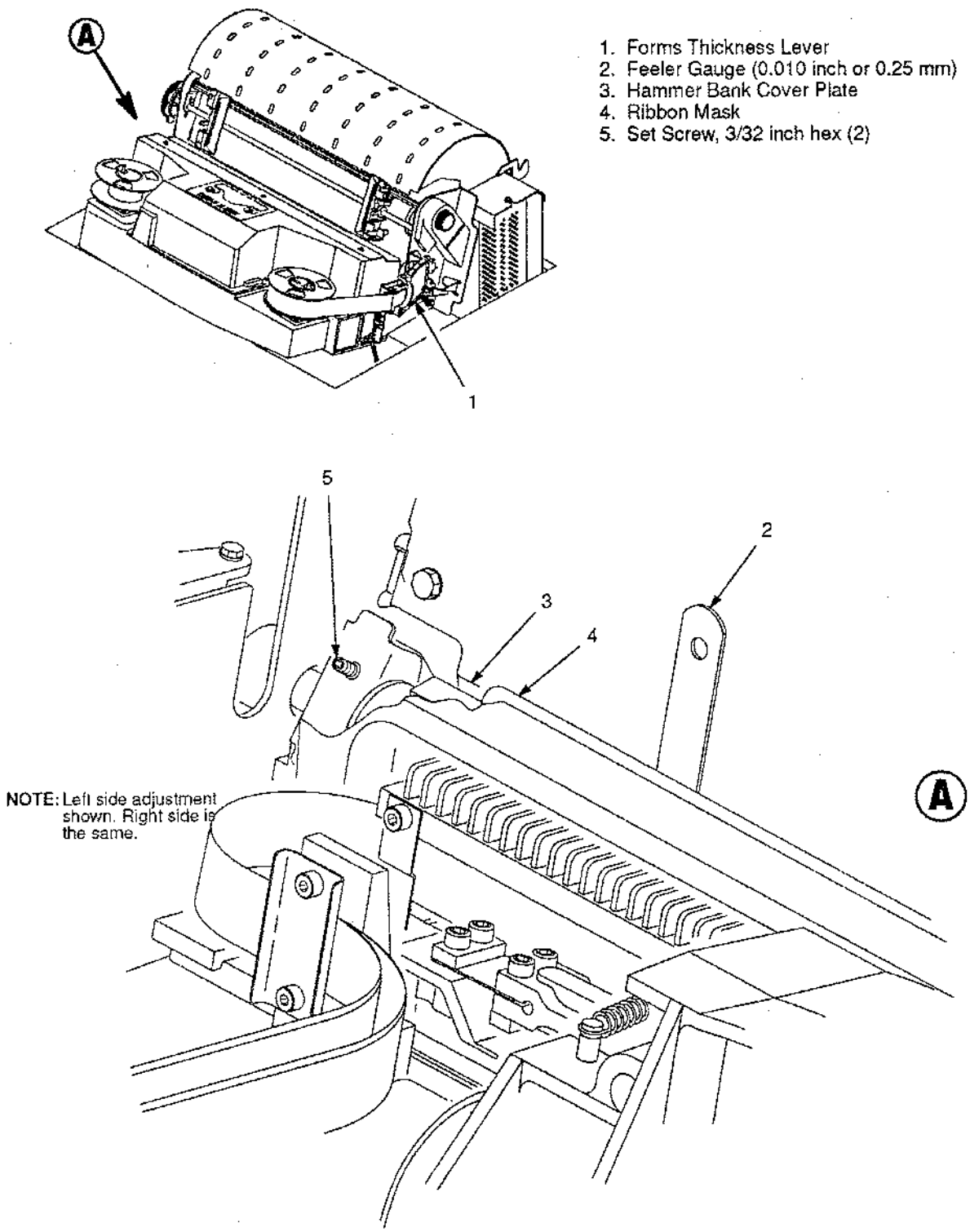
Platen Gap Adjustment (Figure 5–6)

1. Prepare the printer for maintenance (page 5–2).
2. Open the printer cover.
3. Remove the shuttle cover assembly (page 6–23).
4. Remove the ribbon.
5. Loosen the platen open belt (page 5–6, steps 3. and 4.).
6. Raise the forms thickness lever (1) to the fully open position.

WARNING

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

7. Insert a 0.010 inch (0.25 mm) flat feeler gauge (2) straight down between the hammer bank cover plate (3) and ribbon mask (4), within four hammer positions of the left end of the hammer bank.
8. Gently close the forms thickness lever (1). As the platen is closing, gently slide the feeler gauge up and down, keeping it between the hammer tip and ribbon mask. If the feel is too tight when the platen is being closed, adjust the set screw (5) at the end of the platen counterclockwise. If the feel is too loose, adjust the set screw clockwise. With the forms thickness lever closed all the way, the feeler gauge should contact both the tips and the ribbon mask and move with light friction. Shift the gauge slightly to verify.
9. Repeat steps 6. through 8. at the right end of the hammer bank.
10. After adjusting both sides, check the gap again at both ends. Readjust if necessary.
11. When the platen gap is correct at both ends of the platen, adjust the platen open belt (page 5–6).
12. Install the shuttle cover assembly (page 6–23).
13. Check the hammer phasing adjustment (page 5–27).
14. Return the printer to normal operation (page 5–3).



1. Forms Thickness Lever
2. Feeler Gauge (0.010 inch or 0.25 mm)
3. Hammer Bank Cover Plate
4. Ribbon Mask
5. Set Screw, 3/32 inch hex (2)

Figure 5–6. Platen Gap Adjustment

Platen Open Motor Pulley Alignment (Figure 5–7)

1. Prepare the printer for maintenance (page 5–2).
2. Open the printer cover.
3. Remove the platen open belt cover (1) by squeezing the top and bottom to release the plastic tabs from the slots in the side plate.
4. Loosen the set screw (2) in the motor pulley.
5. Align the platen open motor pulley (3) with the platen shaft pulley (4) and tighten the set screw (2) to 9 ±2 inch–pounds (1.02 ±0.23 N•m).
6. Check the platen open belt tension (page 5–6). Adjust if necessary.
7. Snap the platen open belt cover (1) into the slots in the side plate.
8. Return the printer to normal operation (page 5–3).

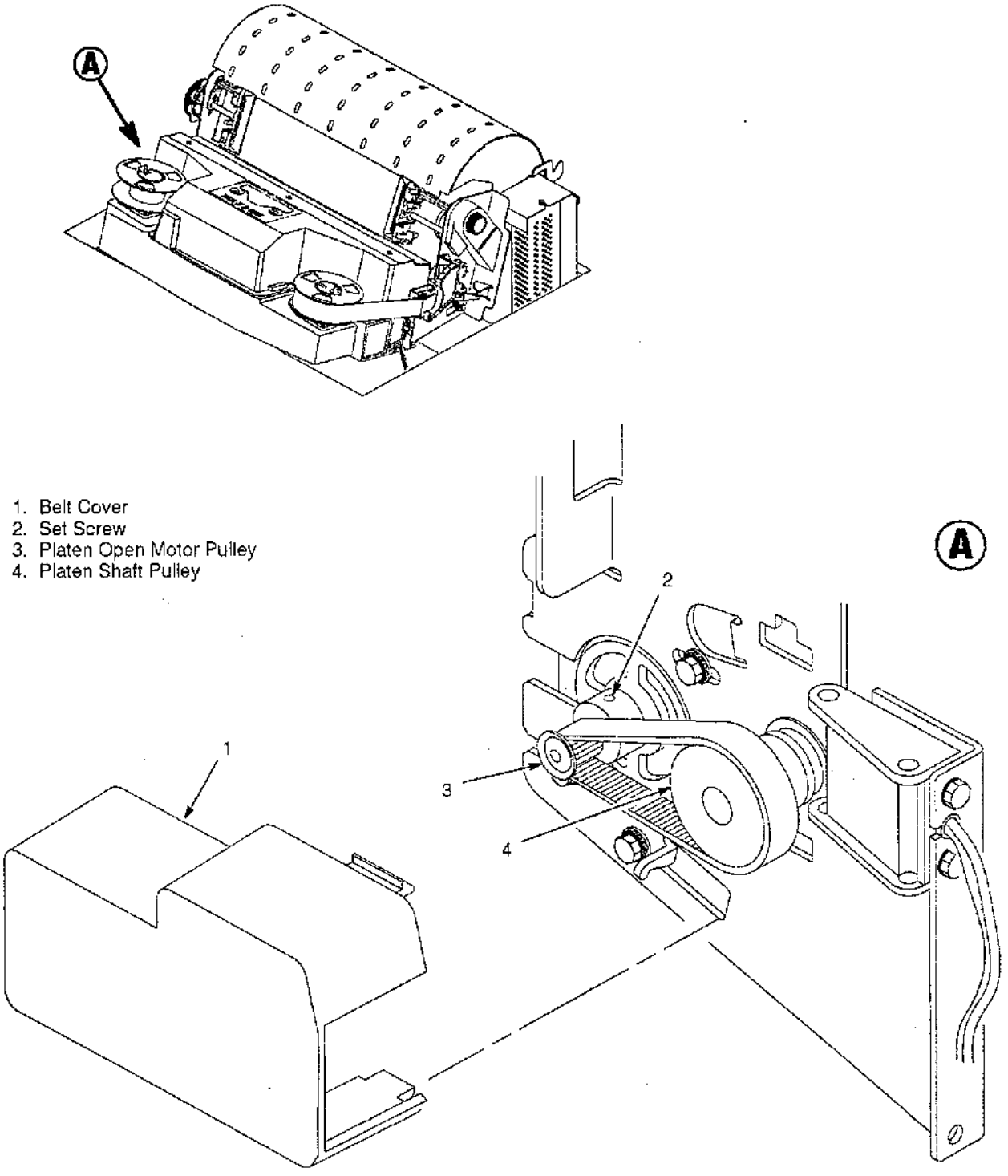
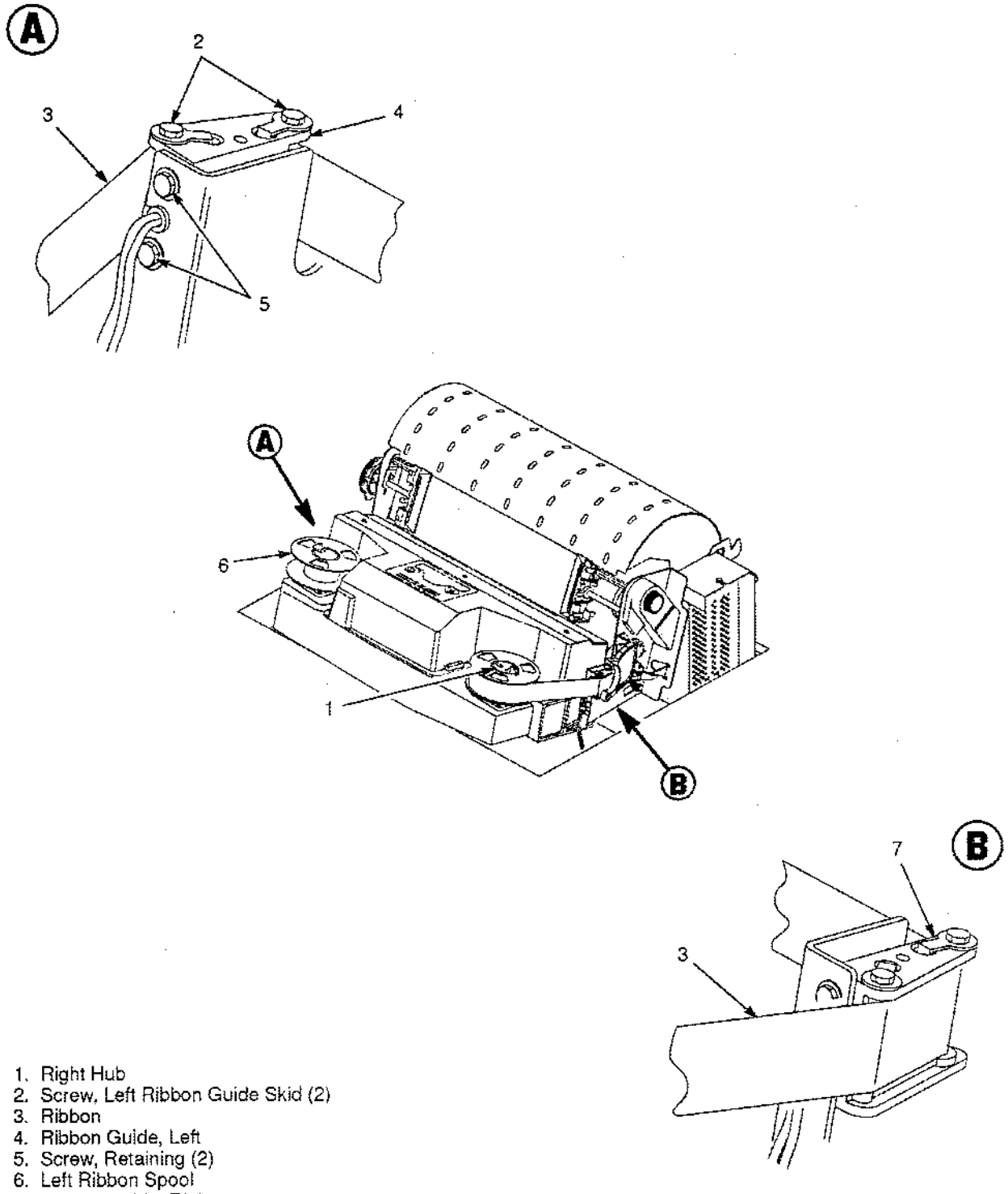


Figure 5–7. Platen Open Motor Pulley Alignment

Ribbon Guide Alignment (Figure 5–8)

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



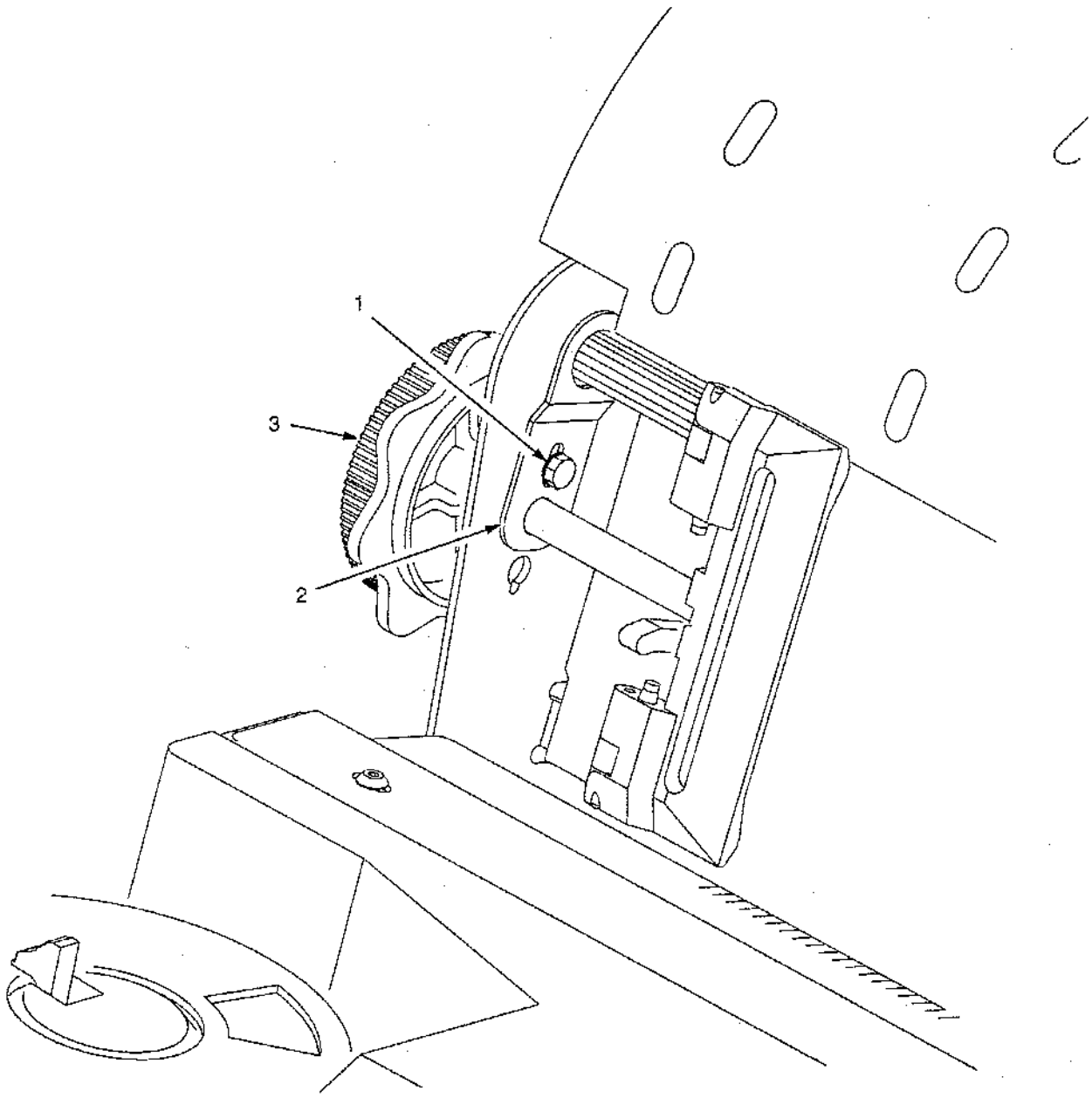
1. Right Hub
2. Screw, Left Ribbon Guide Skid (2)
3. Ribbon
4. Ribbon Guide, Left
5. Screw, Retaining (2)
6. Left Ribbon Spool
7. Ribbon Guide, Right

Figure 5–8. Ribbon Guide Alignment

Splined Shaft Skew Adjustment (Figure 5–9)

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

1. Prepare the printer for maintenance (page 5–2).
2. Loosen the screw (1) securing the adjusting link (2).
3. Adjust the link (2) by raising or lowering the horizontal adjustment knob (3) to obtain print parallel with paper perforations. Tighten the screw (1).
4. Return the printer to normal operation (page 5–3).



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

Figure 5–9. Splined Shaft Skew Adjustment

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 paper just below the paper entrance slot, tear a four-inch square on the left side, immediately below the perforation. (See Figure 5–10.) 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).

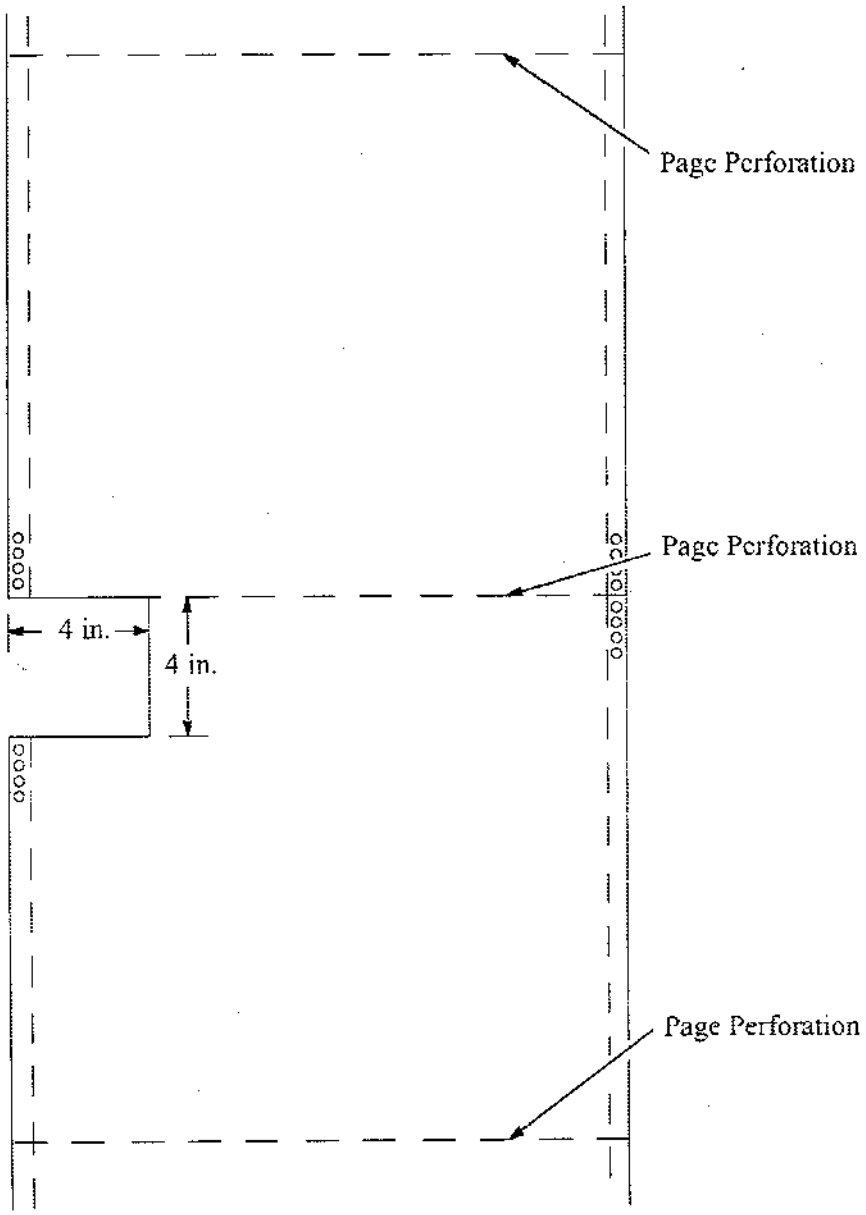


Figure 5–10. Paper Preparation for Paper Out Adjustment Test

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.

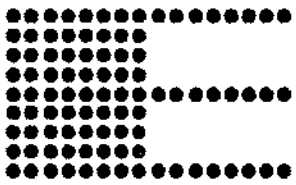
6. Press **Scroll↑ + Scroll↓** to unlock the **Enter** key.

7. Press **Scroll↑ + Scroll↓ + Return + Enter** to enter the CE Tests menu. (Press all four keys at the same time.)

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 4 dot rows. (An enlarged example of the comb pattern is shown below.)



10. Press **Enter** until the END OF FORMS ADJUST test starts. The comb patter 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 th platen, press **Stop** to silence it.)

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

Hammer phasing must be checked and adjusted if PROMs on the controller board are replaced.

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

The procedure is as follows:

1. Power on the printer.
2. Install the ribbon.
3. Load full width (132 column) paper and set the top of form.
4. 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 Hs, 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, followed by pressing **Enter**, which activate the value as it prints. Continue to increase or decrease the phasing index until the pattern of Hs appears as shown below:

Needs Adjustment | **Correct** | Needs Adjustment

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.

6 Replacement Procedures and Illustrated Parts List

Chapter Contents

Organization of This Chapter

This chapter is divided into two sections.

- **Section I: Replacement Procedures**

  Written procedures for removing and installing components that are replaceable at the field service level of maintenance. Section I begins on page 6–4.

  The procedures refer you to the illustrations in Section II.

- **Section II: Illustrated Parts List**

  Drawings of all assemblies comprising the printer. On the page facing each illustration is a list of the illustrated parts and their part numbers. Section II begins on page 6–65.

Section I: Replacement Procedures

IMPORTANT

The components specified in this chapter are field replaceable units (FRUs). FRUs must be repaired at the factory. Do not attempt field repair of these items.

Preparing the Printer for Maintenance

DANGER

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

1. Set the printer power switch to O (off).
2. Unplug the printer power cord from the AC power source.
3. Open the printer cover.
4. Unload paper.
5. Read the entire replacement procedure before you begin working on the printer. The procedure refers you to the appropriate illustration.
6. Gather the necessary replacement part(s) before you begin the procedure.

Belt, Paper Feed Timing

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Open the printer cover.
3. Remove the paper guide assembly (page 6–40).
4. Remove four screws and the barrier shield (page 6–75, Figure 6–10).
5. Remove the timing belt cover by squeezing the top and bottom to release the plastic tabs from the slots in the side plate (page 6–75, Figure 6–10).
6. Loosen (do not remove) the paper feed motor mount screws (page 6–87, Figure 6–16).
7. Remove the paper feed timing belt by working the side of the belt onto the lip of the motor pulley and rotating the pulleys until the belt rolls off.

Installation

1. Install the paper feed timing belt over the splined shaft pulley and the lip of the motor pulley and rotate the pulleys until the belt rolls onto the motor pulley.
2. Using the straight end of a force gauge, apply 12 pounds (53.38 N) of pressure to the paper feed drive motor. Use the splined shaft to steady the gauge.
3. Reduce pressure to 9 pounds (40.03 N) and torque the paper feed motor mount screws to 18 $\pm$2 inch–pounds (2.03 $\pm$0.23 N•m).
4. Snap the timing belt cover into the slots in the side plate (page 6–75, Figure 6–10).
5. Install the barrier shield and four screws.
6. Install the paper guide assembly (page 6–40).
7. Return the printer to normal operation (page 6–63).

Belt, Platen Open

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Open the printer cover.
3. Remove the platen open belt cover by squeezing the top and bottom to release the plastic tabs from the slots in the side plate (page 6–85, Figure 6–15).
4. Loosen (do not remove) the two motor mount screws (page 6–87, Figure 6–16).
5. Push the motor toward the front of the printer to loosen the platen open belt.
6. Remove the platen open belt from the motor pulley and platen pulley.

Installation

1. Slide the platen open belt over the motor pulley and platen pulley.
2. Close the forms thickness lever all the way.
3. Make sure the collar of the platen pulley clears the left ribbon guide with the platen fully closed.
   a. If it does not, rotate the platen pulley until the collar clears the left ribbon guide and tighten the set screw to 11 ±2 inch–pounds (1.24 ± 0.23 N•m). Go to step 4.
   b. If the collar clears the ribbon guide with the forms thickness lever closed, go to step 4.

WARNING

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

4. Using a force gauge, apply 10 pounds (44.48 N) of tension to the motor shaft by pulling away from the large platen pulley.
5. Reduce tension to 5 pounds (22.24 N) and torque the motor mount screws to 11 ±2 inch–pounds (1.24 ±0.23 N•m).
6. Check the platen gap (page 5–14). Loosen the belt and readjust if necessary.
7. Snap the platen open belt cover into the slots in the side plate.
8. Return the printer to normal operation (page 6–63).

Cable Assembly (W4), Hammer Bank

Removal

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

1. Prepare the printer for maintenance (page 6–4).
2. Open the printer cover.
3. Remove the shuttle cover assembly (page 6–23).
4. Remove the paper guide assembly (page 6–40).
5. Remove the controller board (page 6–14).
6. Remove the mechanism driver board (page 6–18).
7. Remove the power supply board (page 6–20).
8. Remove two screws securing the connector to the bottom of the card cage (page 6–91, Figure 6–18).
9. Remove two screws securing the connector to the base casting.
10. Note the location and number of tie wraps, then remove them.
11. Feed the hammer bank cable assembly down through the base casting, then out of the card cage.

Installation

WARNING

Be careful not to damage the ribbon cable on the card cage or base casting. Make sure the protective barrier is on top of the ribbon cables at the card cage bottom.

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

1. Feed the hammer bank cable assembly down through card cage, around the printer, then up through the base casting.
2. Install two screws securing the connector to the base casting (page 6–91, Figure 6–18).
3. Install two screws securing the connector to the bottom of the card cage.
4. Install tie wraps to join left and right hammer bank cable assemblies. (See Removal step 10.)
5. Install the power supply board (page 6–20).
6. Install the mechanism driver board (page 6–18).
7. Install the controller board (page 6–14).
8. Install the paper guide assembly (page 6–40).
9. Install the shuttle cover assembly (page 6–23).
10. Return the printer to normal operation (page 6–63).

Cable Assembly W5, Intermediate

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Open the printer cover.
3. Remove the paper guide assembly (page 6–40).
4. Remove the controller board (page 6–14).
5. Remove the mechanism driver board (page 6–18).
6. Remove the screws securing the intermediate cable assembly connector P1 to the bottom of the card cage. Loosen the screw securing the ground lug, and remove the ground lug (page 6–93, Figure 6–19).
7. Disconnect connector P1(P) from the platen interlock switch assembly.
8. Disconnect connector PMD from paper detector switch assembly connector PMD(P).
9. Remove the cover open switch assembly and disconnect connectors CO+ and CO– (page 6–59).
10. Note the location of cable runs and restraints, cut the tie wraps, and remove the intermediate cable assembly through the card cage.

Installation

1. Feed the intermediate cable assembly through the card cage opening and install tie wraps and cable restraints. (See removal step 10.)
2. Connect connectors CO+ and CO– and install the cover open switch assembly (page 6–59).
3. Connect connector PMD to paper detector switch assembly connector PMD(P).
4. Connect connector P1(P) to the platen interlock switch assembly.
5. Install the screws securing the intermediate cable assembly connector P1 to the bottom of the card cage (page 6–93, Figure 6–19).
6. Insert the ground lug under the screw and tighten the screw.
7. Install the mechanism driver board (page 6–18).
8. Install the controller board (page 6–14).
9. Install the paper guide assembly (page 6–40).
10. Return the printer to normal operation (page 6–63).

Cable Assembly, Multi I/O

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Disconnect the host interface cables from the printer.
3. Remove the paper guide assembly (page 6–40).
4. Open the cabinet doors.
5. Remove the paper stacker assembly (page 6–42).
6. Remove screws and move the service panel aside. (See Figure 6–8, page 6–71.)
7. Remove the I/O cable from the restraints on the upper right and upper rear walls of the cabinet.
8. Remove the controller board (page 6–14).
9. Disconnect the parallel/serial cable connector P4 from connector J4 on the LP30 backplane board. (See Figure 6–11, page 6–77.)
10. Release the I/O cable from the holders on the rear wall of the card cage.
11. Feed the I/O cable through the card cage and down into the cabinet.
12. Remove four screws securing the I/O cable assembly mounting plate.
13. Remove the multi I/O cable assembly.

Installation

1. Feed the multi I/O cable from the lower cabinet up into the opening at the right rear of the card cage. Route the cable against the right rear wall of the cabinet. (See Figure 6–8, page 6–71.)
2. Install four screws securing the multi I/O cable assembly mounting plate.
3. Slide the I/O cable carefully into the cable restraints located on the upper rear and upper right cabinet walls.
4. Engage the I/O cable in the holders on the rear wall of the card cage. Remove the mechanism driver board if necessary to gain clearance (page 6–18).
5. Connect the parallel/serial cable connector P4 to connector J4 on the LP30 backplane board. (See Figure 6–11, page 6–77.)
6. Install the controller board (page 6–14).
7. Connect the I/O cable connector to connector J1 on the controller board. (See Figure 6–11, page 6–77, detail C.)
8. Move the service panel into position and install the screws.
9. Install the paper stacker assembly (page 6–42).
10. Close the cabinet doors.
11. Install the paper guide assembly (page 6–40).
12. Return the printer to normal operation (page 6–63).

Circuit Board: Controller

WARNING

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

Removal

1. Make a configuration printout. (Refer to the *Operator's Guide.*)
2. Prepare the printer for maintenance (page 6–4).
3. Remove the paper guide assembly (page 6–40).
4. Disconnect the CCB/Mech Driver cable from connector J3 (page 6–77, Figure 6–11, item 5).
5. Disconnect the I/O cable connector from connector J1 on the controller board.
6. Grasp the controller board by the ejection levers and pull it up and out of the card cage. (See page 6–77, Figure 6–11, item 13.)
7. Remove the Boot PROM, RTPU PROM, and PFC PROM from the controller board from the controller board (page 6–46).
8. If there is optional memory on the controller board (IPDS models only), remove this memory using module extraction tool 75X5893 (page 6–46).

Installation

WARNING

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

1. Make sure the Boot PROM, RTPU PROM, PFC PROM and any optional memory are installed on the replacement controller board (page 6–46).
2. Slide the controller board down into the card cage. Engage edge connector J5 in connector J8 of the LP30 backplane and connector P1 in connector P1 of intermediate cable assembly W5. (See page 6–77, Figure 6–11, item 13.)
3. Gently push the controller board down until it is fully seated in the edge connectors.
4. Connect the CCB/Mech Driver cable connector to connector J3. (See page 6–77, Figure 6–11, item 5.)
5. Connect the I/O cable connector to connector J1 on the controller board. (See also the connector detail on pages 6–77 and NO TAG.)
6. Install the paper guide assembly (page 6–40).
7. Adjust the hammer phasing (page 5–27).
8. Return the printer to normal operation (page 6–63).
9. Using the configuration printout you made as step 1 of the removal procedure, reset and save the printer configuration.

Circuit Board: LP30 Backplane

WARNING

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

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Remove the paper guide assembly (page 6–40).
3. Remove the controller board (page 6–14).
4. Remove the mechanism driver board (page 6–18).
5. Disconnect the cables from the LP30 backplane board: (See page 6–77, Figure 6–11, item 14.)
   a. Disconnect Power Supply connector P5 from LP30 backplane connector J2.
   b. Disconnect floppy drive connector J6 from LP30 backplane connector J5.
   c. Disconnect multi I/O interface connector J1 from LP30 backplane connector J4.
   d. Disconnect floppy power connector P9 from LP30 backplane connector J1.
   e. Disconnect control panel connector P1 from LP30 backplane connector J3
   f. Disconnect security backplane cable connector P1 from LP30 backplane connector J6.
6. Remove four screws and the LP30 backplane board.

Installation

WARNING

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

1. Position the LP30 backplane board over the mounting studs on the card cage floor and install the four screws. (See page 6–77, Figure 6–11, item 14.)
2. Connect the cable assemblies to the LP30 backplane board:
   a. Connect security backplane cable connector P1 to LP30 backplane connector J6.
   b. Connect control panel connector P1 to LP30 backplane connector J3.
   c. Connect floppy power connector P9 to LP30 backplane connector J1.
   d. Connect multi I/O interface connector J1 to LP30 backplane connector J4.
   e. Connect floppy drive connector J6 to LP30 backplane connector J5.
   f. Connect PSA/Power Supply connector P5 to LP30 backplane connector J2.
3. Install the mechanism driver board (page 6–18).
4. Install the controller board (page 6–14).
5. Install the paper guide assembly (page 6–40).
6. Return the printer to normal operation (page 6–63).

Circuit Board: Mechanism Driver

WARNING

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

Do not flex the mechanism driver board or grasp components on the board as you remove it. Damage to components may result. Handle the board carefully by the ejections levers, sides, or the heat sink.

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Remove the paper guide assembly (page 6–40).
3. Disconnect the CCB/Mech Driver ribbon cable from connector J6. (See page 6–77, Figure 6–11, item 5.)
4. Grasp the mechanism driver board by the ejection levers and pull it up and out of the card cage. (See page 6–77, Figure 6–11, item 12.)
5. Remove the RSP PROM (page 6–48).

Installation

WARNING

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

Do not flex the mechanism driver board or grasp components on the board as you install it. Damage to components may result. Handle the board carefully by the ejections levers, sides, or the heat sink.

1. Install the RSP PROM (page 6–48) onto the replacement mechanism driver board.
2. Slide the mechanism driver board down into the card cage. Engage the card edge connectors in the connectors at the bottom of the card cage. (See page 6–77, Figure 6–11, item 12.)
3. Gently push the mechanism driver board down until it is fully seated in the edge connectors.
4. Connect the CCB/Mech Driver ribbon cable to connector J6. (See page 6–77, Figure 6–11, item 5.)
5. Install the paper guide assembly (page 6–40).
6. Return the printer to normal operation (page 6–63).

Circuit Board: Power Supply

CAUTION

To prevent injury from electric shock, wait at least one minute after shutting off power before removing the power supply board. Do not touch components or flex the board during removal/installation. Handle the board by the 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 6–4).
2. Remove the paper guide assembly (page 6–40).
3. Disconnect the + 5V power supply cable from connector J102 on the power supply board. (See 6–77, Figure 6–11, item 11.)
4. Grasp the power supply board by the ejection levers and pull it up approximately four inches. (See 6–77, Figure 6–11, item 4.)
5. Disconnect the AC/ground cable from connector J1 on the power supply board. (See 6–77, Figure 6–11, item 3.)
6. Remove the power supply board from the card cage.

Installation

1. Connect the AC/ground cable to connector J1 on the power supply board. (See 6–77, Figure 6–11, item 3.)
2. Slide the power supply board into the card cage, engaging the card edge connector at the bottom of the card cage. (See 6–77, Figure 6–11, item 4.)
3. Connect the + 5V power supply cable to connector J102. (Make sure the locking edge is oriented properly to connector J102.) (See 6–77, Figure 6–11, item 11.)
4. Seat the power supply board in the edge connector on the bottom of the card cage.
5. Install the paper guide assembly (page 6–40).
6. Return the printer to normal operation (page 6–63).

Circuit Breaker

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Open both cabinet doors.
3. Remove the paper stacker assembly (page6–42).
4. Remove six screws and move the service panel aside. (See Figure 6–17, page 6–89.)
5. Disconnect the four circuit breaker electrical leads.
6. Press in on the spring clips and push the circuit breaker out of the cabinet.

Installation

1. Press the circuit breaker (5) into the cabinet until the spring clips (4) snap into place. (See Figure 6–17, page 6–89.)

WARNING

Make sure the four leads are connected as shown on page 6–89 (Figure 6–17).

2. Connect the four circuit breaker electrical leads (3) as shown on page 6–89, Figure 6–17.
3. Move the service panel back into position and install the six screws.
4. Install the paper stacker assembly (page 6–42).
5. Return the printer to normal operation (page 6–63).

Cover Assembly, Hammer Bank

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Remove the shuttle frame assembly (page 6–55).
3. Lift the thick plate of the hammer bank cover assembly at one end, and peel the cover away from hammer bank magnets (page 6–77, Figure 6–11).

Installation

WARNING

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

1. With the thick plate facing the hammer bank, engage the bottom edge of the hammer bank cover assembly on the alignment pins (page 6–77, Figure 6–11).
2. Gently lower the hammer bank cover assembly until it lies flush on the hammer bank. Check that the hammer bank cover assembly is properly positioned over the alignment pins and hammer tips.
3. Install the shuttle frame assembly (page 6–55).
4. Return the printer to normal operation (page 6–63).

Cover Assembly, Shuttle

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Open the printer cover.
3. Remove the ribbon spools.
4. Loosen the shuttle cover screws (page 6–75, Figure 6–10).
5. 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 6–75, Figure 6–10).

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

2. Tighten the shuttle cover screws.
3. Return the printer to normal operation (page 6–63).

Diskette Drive Assembly

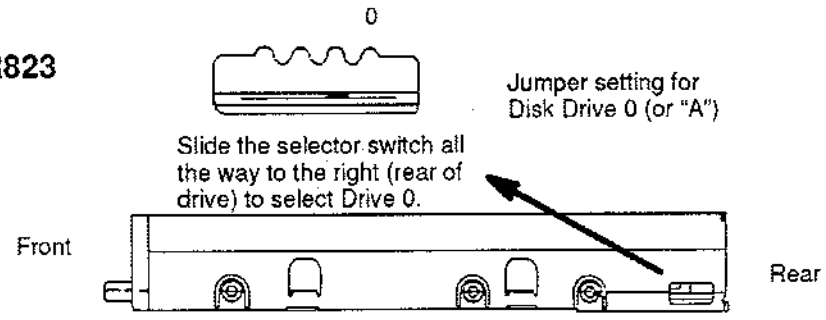
Removal

1. Prepare the printer for maintenance (page 6–4).
2. Open the cabinet rear door.
3. Loosen, but do not remove, four screws securing the disk drive mounting bracket to the printer frame. The mounting bracket has keyways which enable you to remove it without removing the mounting screws. (See Figure 6–9, page 6–73.)
4. Slide the disk drive mounting bracket off the mounting screws.
5. Disconnect the floppy interface cable connector from the rear of the floppy diskette drive assembly.
6. Disconnect the floppy power cable connector from the rear of the floppy diskette drive assembly.
7. Remove four screws securing the diskette drive assembly to the mounting bracket.

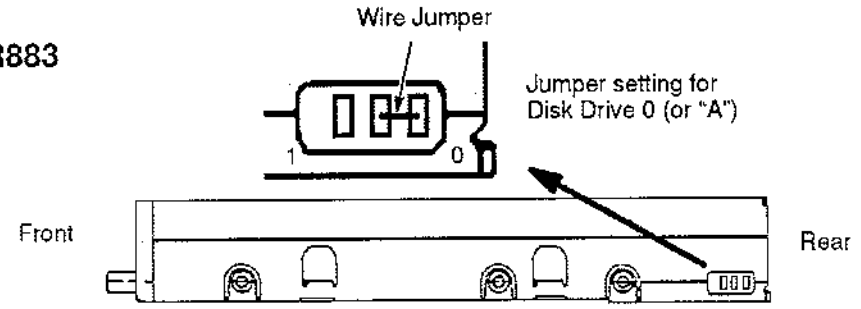
Installation

1. On the disk drive unit, set the jumpers for Drive 0, according to the manufacturer's pattern shown in Figure 6–1.
2. Position the diskette drive assembly in the mounting bracket and install four screws securing the drive to the bracket. (See Figure 6–9, page 6–73.)
3. Connect the floppy interface cable connector to the rear of the floppy diskette drive assembly. (See Figure 6–9, page 6–73.)
4. Connect the floppy power cable connector to the rear of the floppy diskette drive assembly. (See Figure 6–9, page 6–73.)
5. Slip the bracket keyways over the mounting screws on the underside of the printer frame and slide the bracket to lock it in position.
6. Tighten the four bracket mounting screws.
7. Return the printer to normal operation (page 6–63).

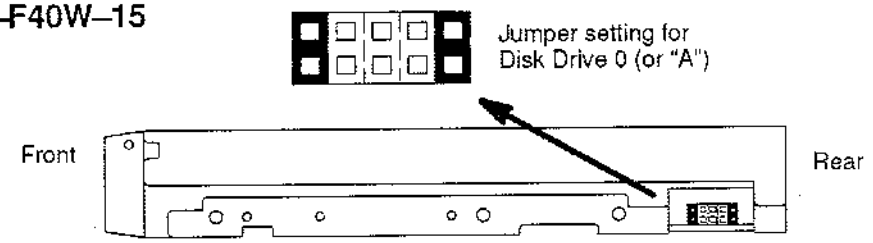
Alps
Model DFR823



Alps
Model DFR883



Sony
Model MP–F40W–15



Teac
Model FD–235J

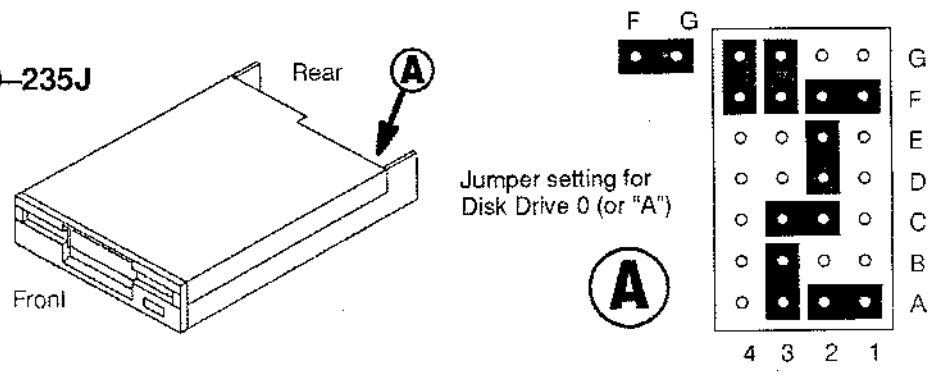


Figure 6–1. Disk Drive Jumper Locations

Fan Assembly, Card Cage

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Open the printer cover.
3. Remove the paper guide assembly (page 6–40).
4. Remove the two fan mounting screws (page 6–87, Figure 6–16).
5. Disconnect the fan cable connector.
6. Remove the card cage fan assembly and fan guard from the card cage.

Installation

WARNING

Make sure to install the fan so the label is against the card cage. Air flow is INTO the card cage.

1. Connect the fan cable connector (page 6–87, Figure 6–16).
2. Position the card cage fan assembly and fan guard in the card cage.
3. Install the two fan mounting screws.
4. Install the paper guide assembly (page 6–40).
5. Return the printer to normal operation (page 6–63).

Fan Assembly, Cabinet Exhaust

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Open the floor cabinet doors.
3. Remove the stacker assembly (page 6–42).
4. Remove six screws and move the service panel aside (page 6–71, Figure 6–8).
5. Remove the two fan mounting screws.
6. Disconnect the fan cable connector.
7. Remove the cabinet exhaust fan assembly and fan guard.

Installation

WARNING

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

1. Connect the fan cable connector (page 6–71, Figure 6–8).
2. Position the cabinet exhaust fan assembly and fan guard on the cabinet floor.
3. Install the two fan mounting screws.
4. Move the service panel back into position and install the six screws.
5. Install the stacker assembly (page 6–42).
6. Return the printer to normal operation (page 6–63).

Fan Assembly, Hammer Bank

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Remove the shuttle cover assembly (page 6–23).
3. Remove the operator panel bracket assembly (page 6–71, Figure 6–8).
4. Remove the two screws securing the fan to the base casting (page 6–77, Figure 6–11).
5. Reach under the base casting and disconnect the hammer bank fan cable connector.
6. Angle the hammer bank fan assembly up and out from under the shuttle motor and feed the motor wires and cable connector out from between the base casting and the foam air shroud.

Installation

WARNING

Make sure to 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 and motor wires between the fan well of the base casting and the foam air shroud (page 6–77, Figure 6–11).
2. Reach up under the base casting and route the fan cable to the right and angle the hammer bank fan assembly down into the fan well.
3. Route the motor wires as shown in Figure 6–11 (page 6–77) connect the hammer bank fan cable connector.
4. Install two screws in the locations shown in Figure 6–11 (page 6–77).
5. Install the operator panel bracket assembly (page 6–71, Figure 6–8).
6. Install the shuttle cover assembly (page 6–23).
7. Return the printer to normal operation (page 6–63).

Hammer Spring Assembly

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Remove the shuttle frame assembly (page 6–55).
3. Remove the hammer bank cover assembly (page 6–22).
4. Remove the three socket head screws from the old hammer fret.
5. Using the pointed end of the nylon stick supplied in the hammer spring replacement kit, gently pry the old hammer fret off its mounting pins. (See Figure 6–2, below.)
6. Discard the old hammer fret and mounting screws.

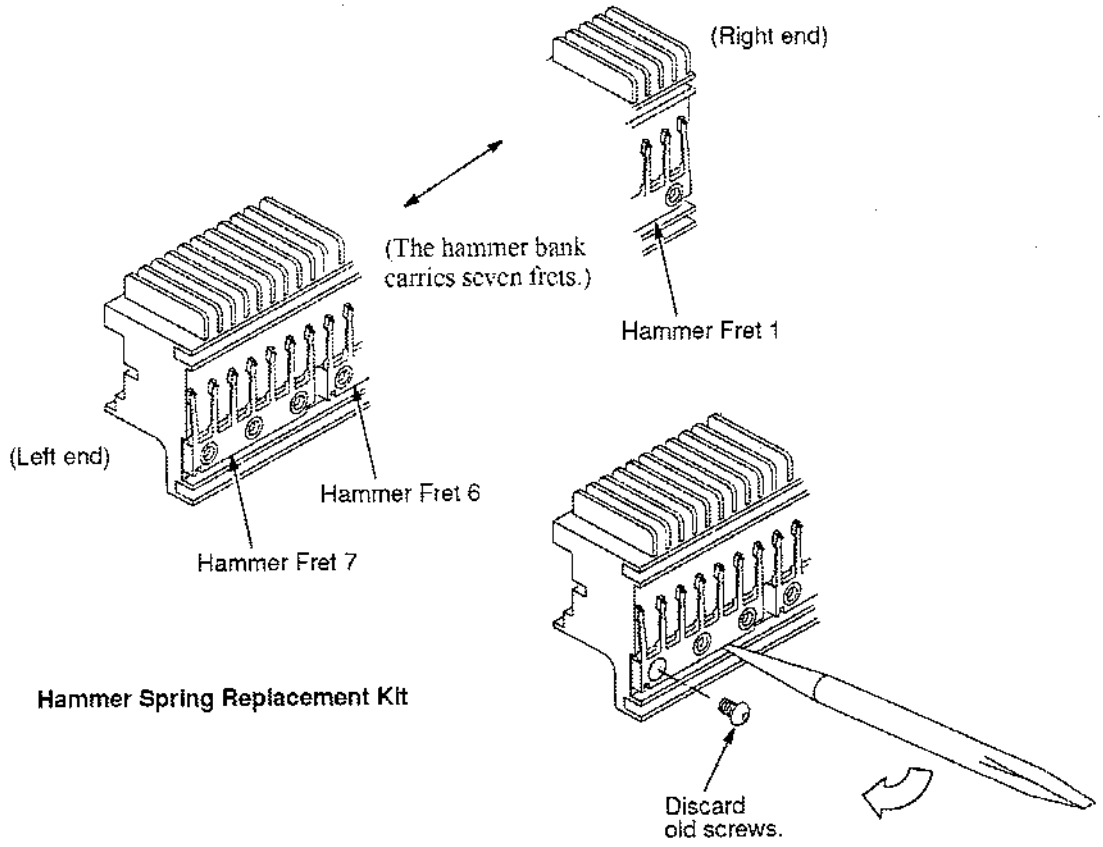


Figure 6–2. Hammer Spring Assembly, Removal

Installation

IMPORTANT

Fret one is mounted on the right end of the hammer bank as you face the hammer springs. Fret seven is mounted on the left end of the hammer bank.

1. If you are replacing an inner fret (frets 2 through 6), go to step 2.
   If you are replacing fret 1 or 7:

   a. Remove the hammer spring fret from the box. Hold the fret by the thick portion, and grab the hammer to be removed with a set of chain–nose pliers in the thin section, as shown in Figure 6–3 (overleaf).

   b. Bend the hammer downward 90°, as shown in Figure 6–3.

   c. Without removing the pliers, bend the hammer up, past the straight position approximately 45°, as shown in Figure 6–3.

   d. Bend the hammer down again, as in substep b, and it will break off.

   e. Go to step 3.

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

WARNING

Clean the hammer bank surface under the fret before installing a new fret. Dirt or debris between the fret and hammer bank can cause misalignment, degraded performance, or damage to the hammer springs.

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

4. Install the screws from the replacement kit. Using a Torx® T–10 bit adapter, torque each screw to 14 in–lbs (1.58 N•m) in the order shown in Figure 6–3.

5. Install the hammer bank cover assembly (page 6–22).

6. Install the shuttle frame assembly (page 6–55).

7. Return the printer to normal operation (page 6–63).

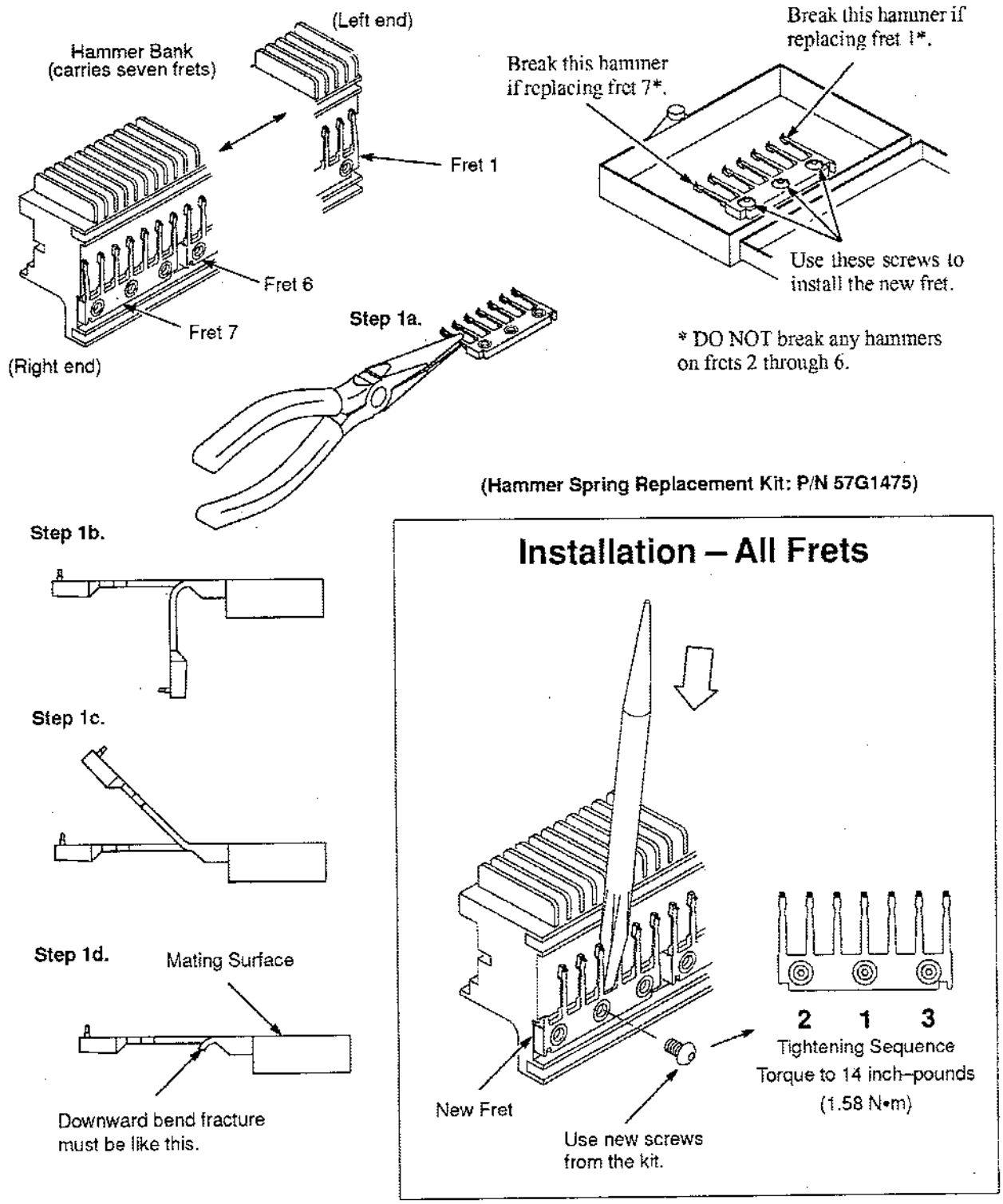


Figure 6–3. Hammer Spring Assembly, Installation

Magnetic Pick–up (MPU) Assembly

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Remove the shuttle cover (page 6–23).
3. Disconnect the shuttle cable assembly connector (page 6–77, Figure 6–11).
4. Disconnect the magnetic pick–up (MPU) cable connector (page 6–77, Figure 6–11).
5. Loosen the 7/64 inch hex MPU clamp screw (page 6–81, Figure 6–13).
6. Unscrew the MPU assembly from the MPU bracket.

Installation

1. Install the MPU assembly by screwing it into the MPU bracket (page 6–81, Figure 6–13).
2. Using a feeler gauge, adjust the gap between the MPU assembly and the flywheel to 0.010 ±.001 inch (0.254 ±0.025 mm). Torque the MPU clamp screw to 19 ±1 inch–pounds (2.15 ±0.11 N•m).
3. Check the gap between the MPU assembly and the flywheel with a feeler gauge:
   a. If the gap is 0.010 ±.001 inch (0.254 ±0.025 mm), go to step 4.
   b. If the gap is not 0.010 ±0.001 inch (0.254 ±0.025 mm), loosen the MPU clamp screw and go back to step 2.

WARNING

In the next step, route the MPU cable <u>under</u> the extension spring and make sure it <u>does not touch</u> the spring after cable connection.

4. Connect the magnetic pick–up (MPU) cable connector.
5. Connect the shuttle cable assembly connector.
6. Install the shuttle cover (page 6–23).
7. Adjust the hammer phasing (page 5–27.)
8. Return the printer to normal operation (page 6–63).

Motor Assembly, Ribbon Drive

Removal

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

1. Prepare the printer for maintenance (page 6–4).
2. Remove the ribbon.
3. Remove the ribbon hub (page 6–50).
4. Remove two screws and washers (page 6–77, Figure 6–11).
5. Lift the ribbon drive motor and its cable from base casting.
6. Disconnect the ribbon motor cable connector.
7. Remove the ferrite with clamp from the motor cable.

Installation

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

WARNING

You must install a ferrite core on the ribbon motor cable assembly. Refer to Appendix C. Make sure the ferrite core does not pinch the ribbon motor cable wires and take care not to damage the cable wires when inserting the motor into the base casting.

1. Install the ferrite with clamp to the motor cable.
2. Connect the ribbon motor cable connector and position the ribbon drive motor in the base casting (page 6–77, Figure 6–11).
3. Install the screws and washers to secure the front right and rear left corners of the ribbon drive motor assembly.
4. Install the ribbon hub (page 6–50).
5. Return the printer to normal operation (page 6–63).

Motor Assembly, Paper Feed

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Open the printer cover.
3. Remove the paper guide assembly (page 6–40).
4. Remove four screws and the barrier shield (page 6–75, Figure 6–10).
5. Remove the timing belt cover by squeezing the top and bottom to release the plastic tabs from the slots in the side plate (page 6–75, Figure 6–10).
6. Loosen the paper feed motor mount screws (page 6–87, Figure 6–16).
7. Loosen the set screw (page 6–87, Figure 6–16, item 10) and remove the paper feed motor pulley, shaft collar, and paper feed timing belt.
8. Disconnect the paper feed motor electrical connector.
9. Remove the motor mount bolts and nuts.
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 6–87, Figure 6–16).
2. Connect the paper feed motor electrical connector.
3. Install the collar, paper feed motor pulley, and timing belt.
4. Align the paper feed motor pulley with the splined shaft pulley.

IMPORTANT

Make sure there is at least 0.010 inches (0.25 mm) of clearance between the collar/pulley and the motor face plate.

5. Hold the collar snug against the motor pulley and torque the set screw: If the pulley is black (aluminum), torque the set screw to 11 ±2 inch–pounds (1.24 ±0.23 N•m). If the pulley is silver (steel), torque the set screw to 25 ±2 inch–pounds (2.82 ±0.23 N•m).
6. Using the straight end of a force gauge, apply 12 pounds (53.4 N) of pressure to the paper feed motor. Use the splined shaft to steady the gauge.

7. Reduce pressure to 9 pounds (40.0 N) and torque the motor mount screws to 18 ±2 inch–pounds (1.36 ±0.23 N•m).

8. Snap the timing belt cover into the slots in the side plate.

9. Install the barrier shield and four screws (page 6–75, Figure 6–10).

10. Install the paper guide assembly (page 6–40).

11. Return the printer to normal operation (page 6–63).

Motor Assembly, Platen Open

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Remove the card cage fan assembly (page 6–26).
3. Remove the platen open belt cover (1) by squeezing the top and bottom to release the plastic tabs from the slots in the side plate (page 6–85, Figure 6–15).
4. Loosen the motor mount screws (page 6–87, Figure 6–16).
5. Remove the platen open belt.
6. Loosen the 1/16 hex pulley set screw and remove the motor pulley.
7. Disconnect the platen motor cable connector.
8. Remove the motor mount screws and nuts.
9. Remove the platen open motor assembly.

Installation

1. Position the platen open motor assembly with wires toward the rear.
2. Install the motor mount screws and nuts finger tight (page 6–87, Figure 6–16).
3. Install the motor pulley, align it with the platen pulley, and tighten the set screw to 9 ±2 inch–pounds (1.24 ±0.23 N•m).
4. Connect the platen motor cable connector.
5. Install the platen open belt.
6. Close the forms thickness lever all the way.
7. Make sure the collar of the platen pulley clears the left ribbon guide with the platen fully closed.
   a. If not, loosen the platen pulley set screw, rotate the platen pulley until the collar clears the left ribbon guide and tighten the set screw. Go to step 8.

b. If the collar clears the ribbon guide with the forms thickness lever closed, go to step 8.

8. Using a force gauge, apply 10 pounds (44.48 N) of tension to the platen open motor shaft by pulling away from the large platen pulley, reduce tension to 5 pounds (22.24 N) and torque the motor mount screws to 11 ±2 inch–pounds (1.24 ±0.23 N•m).

9. Check the platen gap (page 5–14), and adjust if necessary.

10. Snap the platen open belt cover into the slots in the side plate.

11. Install the card cage fan assembly (page 6–26).

12. Return the printer to normal operation (page 6–63).

Operator Panel Assembly

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Open the printer cover.
3. Remove the paper guide assembly (page 6–40).
4. Remove the controller board (page 6–14).
5. Remove the mechanism driver board (page 6–18).
6. Disconnect the operator panel connector P1 from connector J3 on the LP30 backplane. (See page 6–77, Figure 6–11, item 14.)
7. Remove the operator panel ribbon cable from the card cage.
8. Remove the operator panel ribbon cable from the wire saddles on the mechanism base pan.
9. Remove the ferrite cores from the ribbon cable. (Note the number of turns.)
10. Slide the blade of a flat tip screwdriver between the operator panel plate and the latch on the rear top of the operator panel. (See Figure 6–8, page 6–71.)
11. Press the latch and slide the operator panel down and off the operator panel bracket.

Installation

IMPORTANT

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

1. Feed ribbon connector and the ribbon cable through the control panel bracket. (See page 6–71, Figure 6–8.)
2. Position the control panel assembly on the bracket and slide it upwards to engage the latch.
3. Route the control panel ribbon cable along the right side of the printer.
4. Install the ferrite cores. (Refer to Appendix C.)
5. Feed the ribbon cable and ribbon connector through the slot in the card cage. Tie wrap the round ferrite core to the card cage.
6. Connect the control panel connector P1 to connector J3 on the LP30 backplane. (See page 6–77, Figure 6–11, item 14.)
7. Insert the control panel ribbon cable into the wire saddles on the mechanism base pan.
8. Install the mechanism driver board (page 6–18).
9. Install the controller board (page 6–14).
10. Install the paper guide assembly (page 6–40).
11. Return the printer to normal operation (page 6–63).

Paper Guide Assembly

DANGER

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

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Open the printer cover.
3. Remove the paper guide assembly hold–down screw (page 6–75, Figure 6–10).
4. Slightly lift the right end and slide the paper guide assembly to the left. Lift the paper guide assembly off the card cage.

Installation

1. Position the paper guide assembly offset slightly to the left on the card cage (page 6–75, Figure 6–10).
2. While holding the right end slightly elevated, slide the paper guide assembly to the right and engage the tabs on the underside of the paper guide assembly with the left edge of the card cage.
3. Slide the paper guide assembly to the right as far as it will go.
4. Lower the right end of the paper guide assembly and install the hold–down screw.
5. Return the printer to normal operation (page 6–63).

Paper Ironer

CAUTION

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 6–55).
2. Move the forms thickness lever to the open position.

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

3. Push the ends of the paper ironer toward the rear of the printer, disengage the tabs, then lift it up and out (page 6–85, Figure 6–15).

Installation

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

1. Position the paper ironer so that the black tape is on the side that faces the paper detector switch assembly. (See page 6–85, Figure 6–15.)
2. Push the paper ironer down into the slots until the tabs engage.
3. Install the shuttle frame assembly (page 6–55).
4. Return the printer to normal operation (page 6–63).

Paper Stacker Assembly

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Open the floor cabinet rear door.
3. Remove the stacker rails from the stacker runner risers. (See Figure 6–7, page 6–69.)
4. If required, remove the stacker runner risers by removing the screw holding each riser to the cabinet.
5. Remove the stacker wire frame assembly and stacker rails.

Installation

1. If required, install the stacker runner risers using the screw to hold each to the cabinet.
2. Install the stacker rails in the loops on the stacker wire frame assembly.
3. Place the stacker assembly and stacker rails in position and snap the rails into the stacker runner risers. (See Figure 6–7, page 6–69.)
4. Return the printer to normal operation (page 6–63).

Platen

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Remove the shuttle frame assembly (page 6–55).
3. Remove the paper ironer (page 6–41).
4. Remove the paper ironer bracket assembly (page 6–85, Figure 6–15).
5. Remove the platen open belt (page 6–6).
6. Remove the platen pulley (page 6–85, Figure 6–15):
   a. Loosen the collar clamp screw.
   b. Pull the platen pulley off the platen shaft.
7. Remove the left side platen support spring:
   a. Disconnect the left platen support spring from the spring hook on the side plate.
   b. Pull the spring link and left platen support spring off the platen shaft.
8. Remove the forms thickness lever by loosening the set and clamp screws and pulling the lever off the platen shaft. (The lever may be hard to remove due to adhesive applied during factory assembly.)
9. Remove the right side platen support spring by repeating step 7. on the right side of the platen.
10. Remove the forms thickness indicator plate:
    a. Disconnect the platen interlock switch connector from the connector in the right side plate.
    b. Remove the screws securing the indicator plate.
    c. Pull the indicator plate, with the interlock switch assembly attached, off the platen shaft.
11. Rotate 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.

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.

1. Install two washers on the longer platen shaft (page 6–85, Figure 6–15).
2. Apply bearing lubricant to both platen shafts and to the mating diameters of the platen adjustment brackets.
3. Install the platen adjustment brackets onto the platen shafts with the set screws at the top of the brackets.
4. Make sure the two wear saddles are set flush into the corners of the mechanism base platen seat.
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. Insert the shorter platen shaft through the opening in the left side plate. Rotate the shaft into the opening in the right side plate and position the adjustment brackets so the mechanism base platen seats are between the flanges of the brackets.
7. 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 washers and screws securing the indicator plate.
   c. Connect the platen interlock switch connector to the connector in the right side plate.
8. Apply bearing lubricant to the two platen shafts at the following locations:
   a. On the left side, between the end of the platen and the platen adjustment bracket.
   b. On the right end, between the two washers.
9. 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.

Installation (continued)

10. Install the paper ironer bracket:

    a. With the flat piece of the bracket facing the front of the printer, place the two hooks of the upper piece over the platen shafts. The left hook goes between the left platen adjustment bracket and the platen. The right hook goes between the two washers to the left of the right platen adjustment bracket (page 6–85, Figure 6–15).

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

11. Install the forms thickness lever onto the right side platen shaft. (See Figure 6–15, page 6–85.)

12. Adjust the platen angle (page 5–12).

13. Install the platen shaft pulley.

14. Loosen the set screw in the platen open motor pulley.

WARNING

To prevent breakage, be careful not to overtighten the set screw in step 15.

15. Align the platen open motor pulley with the platen shaft pulley and tighten the set screw to 9 ±2 inch–pounds (1.02 ±0.23 N•m).

16. Install, but do not adjust, the platen open belt (page 6–6).

17. Install the paper ironer (page 6–41).

18. Install the shuttle frame assembly (page 6–55).

19. Adjust the platen gap (page 5–14).

20. Adjust the platen open belt (page 5–6).

21. Return the printer to normal operation (page 6–63).

PROMs and Modules on the Controller Board

WARNING

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

Removal

1. Make a configuration printout. (Refer to the *Setup Guide*.)
2. Prepare the printer for maintenance (page 6–4).
3. Remove the controller board (page 6–14).
4. Using a chip puller, carefully remove the defective or incorrect PROM(s). Locations are shown in Figure 6–4, page 6–47.
5. If there is optional memory on the controller board (IPDS models only), remove this memory using module extraction tool 75X5893.

Installation

WARNING

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

1. Using a chip installation tool, install PROM(s). Locations are shown in Figure 6–4, page 6–47.
2. Install the controller board (page 6–14).
3. If you are installing a new controller board, adjust hammer phasing (page 5–27).
4. Return the printer to normal operation (page 6–63).
5. Using the configuration printout you made as step 1 of the removal procedure, reset and save the printer configuration. (Refer to the *Setup Guide*.)

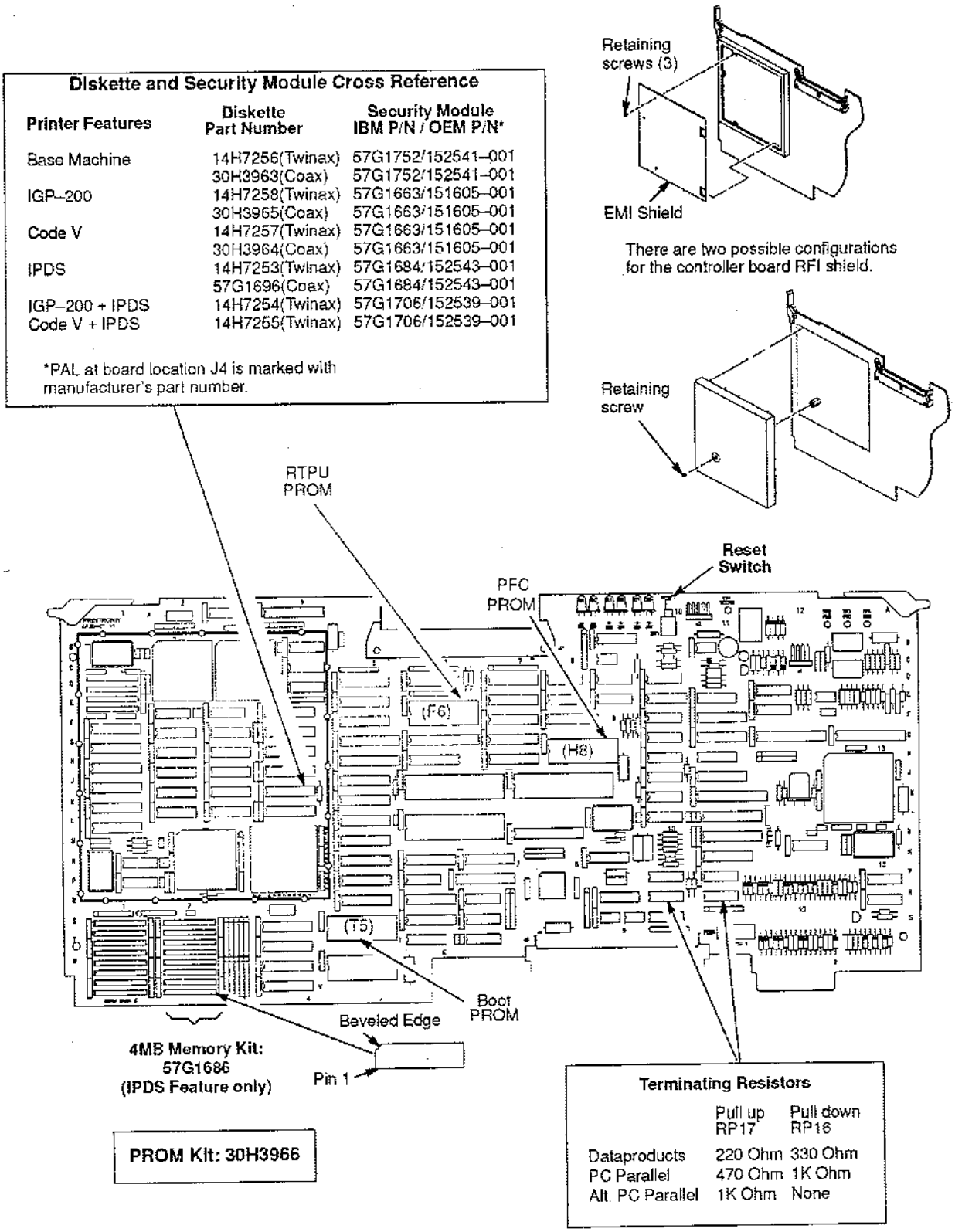


Figure 6–4. PROMs and Modules on the Controller Board

PROMs and Chips on the Mechanism Driver Board

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Remove the mechanism driver board (page 6–18).

WARNING

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

3. Using a chip puller, remove the defective chip(s). Locations are shown in Figure 6–5, page 6–49.

Installation

WARNING

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

1. Using a chip installation tool, install chip(s). Locations are shown in Figure 6–5, page 6–49.
2. Install the mechanism driver board (page 6–18).
3. Return the printer to normal operation (page 6–63).

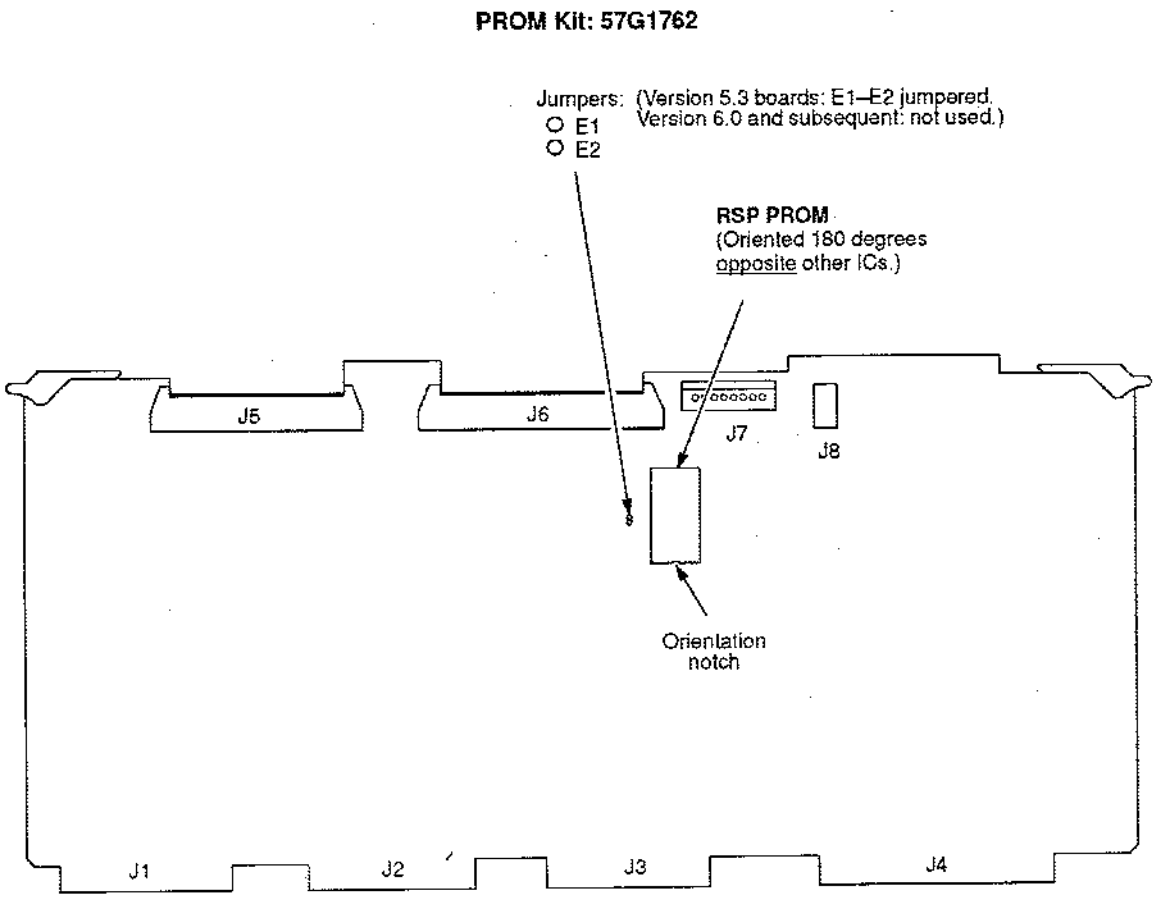


Figure 6–5. PROMs and Chips on the Mechanism Driver

Ribbon Hub

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Remove the printer ribbon.
3. Loosen the screw in the ribbon spool hub (page 6–77, Figure 6–11).
4. Remove the hub from the shaft of the ribbon drive motor.

Installation

1. Install the ribbon spool hub over the motor shaft (page 6–77, Figure 6–11).
2. Tighten the hub screw so that it contacts the flat section of the motor shaft.
3. Return the printer to normal operation (page 6–63).

Ribbon Guide Assembly (L/R)

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Open the printer cover.
3. Remove the printer ribbon.
4. Cut the tie–wrap and remove it from the tie wrap hole to free the ribbon guide cable (page 6–87, Figure 6–16).

NOTE: The right ribbon guide is shown in Figure 6–16. The removal procedure is the same for the left ribbon guide.

5. Disconnect the ribbon guide connector.
6. Remove the two screws and washers securing the ribbon guide assembly to the side plate.
7. Slide the ribbon guide assembly out of the side plate.

Installation

1. Slide the ribbon guide assembly into the side plate (page 6–87, Figure 6–16).

NOTE: The right ribbon guide is shown in Figure 6–16. The installation procedure is the same for the left ribbon guide.

2. Install two screws and washers securing the ribbon guide assembly to the side plate.
3. Connect the ribbon guide connector.
4. Tie–wrap the cable to the tie wrap hole.
5. Align the ribbon guides (page 5–18).
6. Return the printer to normal operation (page 6–63).

Shaft, Splined

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Open the printer cover.
3. Remove the paper feed timing belt (page 6–5).
4. Remove the ground clip (page 6–83, Figure 6–14).
5. With grip ring pliers, remove the grip ring from the splined shaft.
6. Pull the bearing and spring link with the spring off the splined shaft.
7. Unlock the left and right tractors and slide them to the center.
8. Remove the bearing clamp.
9. Grasping the vertical adjustment knob, slide the splined shaft out of the left and right side plates and the tractors.

Installation

1. Open the doors on the left and right tractors. Position the tractor belts so the alignment marks are at the top on both tractors.
2. Grasp the vertical adjustment knob and slide the splined shaft through the right side plate, the tractors, and the left side plate (page 6–83, Figure 6–14). Make sure the same spline passes the marked groove on each tractor.
3. Install the bearing clamp and screw.
4. Apply a thin film of bearing lubricant to the bearing.
5. Slide the spring link and bearing onto the splined shaft.
6. Attach the spring to the left side plate and the spring link.
7. Install the grip ring on the splined shaft with 0.010 inches of clearance between the grip ring and the nylon bearing.
8. Install the ground clip and screw.
9. Install the paper feed timing belt (page 6–5).
10. Set the paper feed timing belt tension (page 5–4).
11. Adjust splined shaft skew (page 5–20.)
12. Return the printer to normal operation (page 6–63).

Shaft, Support

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Open the printer cover.
3. Unlock the tractors and slide them to the far right.
4. Remove the E–ring (page 6–83, Figure 6–14).
5. Slide the support shaft assembly — consisting of the support shaft, two curved washers, bushing, horizontal adjustment knob, washer and screw — to the left, out of the tractors and the left side plate.

Installation

1. Slide the support shaft assembly — consisting of the support shaft, two curved washers, bushing, horizontal adjustment knob, washer, and screw — into the left side plate. (See page 6–83, Figure 6–14.)
2. Slide the tractors onto the support shaft.
3. Slide the support shaft assembly through the right side plate.
4. While pushing on the knob to compress the curved washers, install the E–ring in the groove on the bushing.
5. Return the printer to normal operation (page 6–63).

Shuttle Frame Assembly

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Remove the shuttle cover assembly (page 6–23).
3. Disconnect the MPU cable connector (page 6–81, Figure 6–13).
4. Disconnect the shuttle motor cable connector.
5. Disconnect the shuttle cable assembly connector.

WARNING

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

6. Disconnect the left and right hammer bank flex circuit ribbon connectors.
7. 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.
8. Loosen the center 5/32 inch socket head screw enough to release the shuttle frame assembly from the base casting.
9. Unlock and slide the tractors outward as far as they will go on the tractor support shaft.
10. Grasping the outer beam standoffs, lift the shuttle frame assembly out of the base casting. Lift it slowly and carefully: the shuttle frame assembly is heavy.

Installation

1. Install the hammer bank cover (page 6–22), if it was removed.
2. Holding the shuttle frame assembly by the outer beam standoffs, set it into the base casting. Use both hands: the shuttle frame assembly is heavy (page 6–77, Figure 6–11).
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 5.

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

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

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

8. Connect the left and right hammer bank flex circuit ribbon connectors.

9. Connect the shuttle cable assembly connector.

10. Connect the shuttle motor cable connector.

WARNING

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

11. Connect the MPU cable connector (1).

12. Loosen the platen open belt (page 5–6, steps 3. and 4.).

13. Adjust the platen gap (page 5–14).

14. Adjust the platen open belt (page 5–6).

15. Check the platen gap again. Readjust if necessary (page 5–14).

16. Install the shuttle cover assembly (page 6–23).

17. Return the printer to normal operation (page 6–63).

Spring Assembly, Gas

Removal

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

1. Prepare the printer for maintenance (page 6–4).
2. Open the printer cover.
3. Open the floor cabinet rear door.
4. Pry back the spring retaining clips (page 6–71, Figure 6–8).
5. Remove the gas spring assembly from the ball studs.

Installation

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

1. Position the gas spring assembly against the ball studs on the upper and lower brackets (page 6–71, Figure 6–8).
2. Push the gas spring assembly onto the ball joints.
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 6–63).

Spring, Extension

WARNING

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

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Open the printer cover.
3. Remove the shuttle cover assembly (page 6–23).
4. Unhook the extension spring from the spring lugs on the hammer bank and shuttle frame. (See Figure 6–13, page 6–81.)

Installation

1. Apply a dab of IBM #20 bearing lubricant to both spring lugs.

WARNING

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

2. Hook the extension spring over the spring lugs. (See Figure 6–13, page 6–81.)
3. Install the shuttle cover assembly (page 6–23).
4. Return the printer to normal operation (page 6–63).

Switch Assembly, Cover Open

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Open the printer cover.
3. Remove the shuttle cover assembly (page 6–23).
4. Carefully lift and pry the cover open switch assembly out of the base casting (page 6–93, Figure 6–19).
5. Disconnect the switch connectors from intermediate cable assembly connector CO+ and CO– .

Installation

1. Connect the switch connectors to intermediate cable assembly connector CO+ and CO– (page 6–93, Figure 6–19).
2. Remove the protective covering from the adhesive backing on the cover open switch assembly.
3. Position the cover open switch assembly in the base casting and press it into place.
4. Install the shuttle cover assembly (page 6–23).
5. Return the printer to normal operation (page 6–63).

Switch Assembly, Paper Detector

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Remove the paper guide assembly (page 6–40).
3. Remove four screws and the barrier shield (page 6–75, Figure 6–10).
4. Remove the screws securing the paper detector switch assembly (page 6–87, Figure 6–16).
5. Disconnect the paper detector switch cable connector from the intermediate cable assembly connector PMD.
6. Cut the tie wraps securing the switch assembly cable to the front of the card cage and 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 (page 6–87, Figure 6–16).
2. Connect the paper detector switch cable connector to the intermediate cable assembly connector PMD.
3. Install tie wraps securing the switch assembly cable to the front of the card cage.
4. Install the barrier shield and four screws (page 6–75, Figure 6–10).
5. Install the paper guide assembly (page 6–40).
6. Check and adjust the End of Forms Distance (page 5–22).
7. Return the printer to normal operation (page 6–63).

Switch Assembly, Platen Interlock

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Open the printer cover.
3. Disconnect the platen interlock switch connector from connector P1(P) (page 6–85, Figure 6–15).
4. Fully close the forms thickness lever (position 'A').
5. Remove two screws securing the platen interlock switch assembly.
6. Remove the platen interlock switch assembly from the forms thickness indicator plate.
7. Remove the connector from the right side plate.

Installation

1. Fully close the forms thickness lever (position 'A').
2. Position the platen interlock switch assembly on the forms thickness indicator plate (page 6–85, Figure 6–15).
3. Install two screws securing the platen interlock switch assembly.
4. Install the connector to the right side plate.
5. Connect the platen interlock switch connector to connector P1(P).
6. Return the printer to normal operation (page 6–63).

Tractor (L/R)

Removal

1. Prepare the printer for maintenance (page 6–4).
2. Remove the splined shaft (page 6–52).
3. Remove the support shaft (page 6–54).
4. Remove the tractors.

Installation

1. Using the replacement tractors, install the support shaft (page 6–54).
2. Install the splined shaft (page 6–53).
3. Return the printer to normal operation. (See page 6–63.)

Returning the Printer to Normal Operation

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

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

Section II: Illustrated Parts List

List of Figures

Item No.	Part Number	Description	Notes
	57G1594	6408–CTA Ship Kit	
1	57G1525	Top Cover	Order a new IBM logo (item 17)
2	30H3962	Window, Top Cover	Part of item 1
3		Nut, Hex	312–18
4		Washer, Split Lock	5/16
5	57G1566	Wireform Paper Path	
6		Brush	Attaches to item 5 Not visible in Figure 6–6
7		Screw, w/Washer (6)	10–24x.50
8	57G1489	Rear Door Assy 30H4009	Not visible in Figure 6–6
9	57G1488	Front Door Assy 30H4008	
10	57G1484	Door Hinge	Two on each door
11		Screw, w/Lock Washer (16)	10–24X.50
12	Ref	Retaining Cable (2)	One at top of each door
13		Screw, Hex w/Lock Washer (4)	6–32x.375
14		Star Washer (4)	#6
15	57G1485	Caster, with Brake	Two at front
16	57G1486	Caster, without Brake	Two at rear
17	08H7926	IBM Logo	

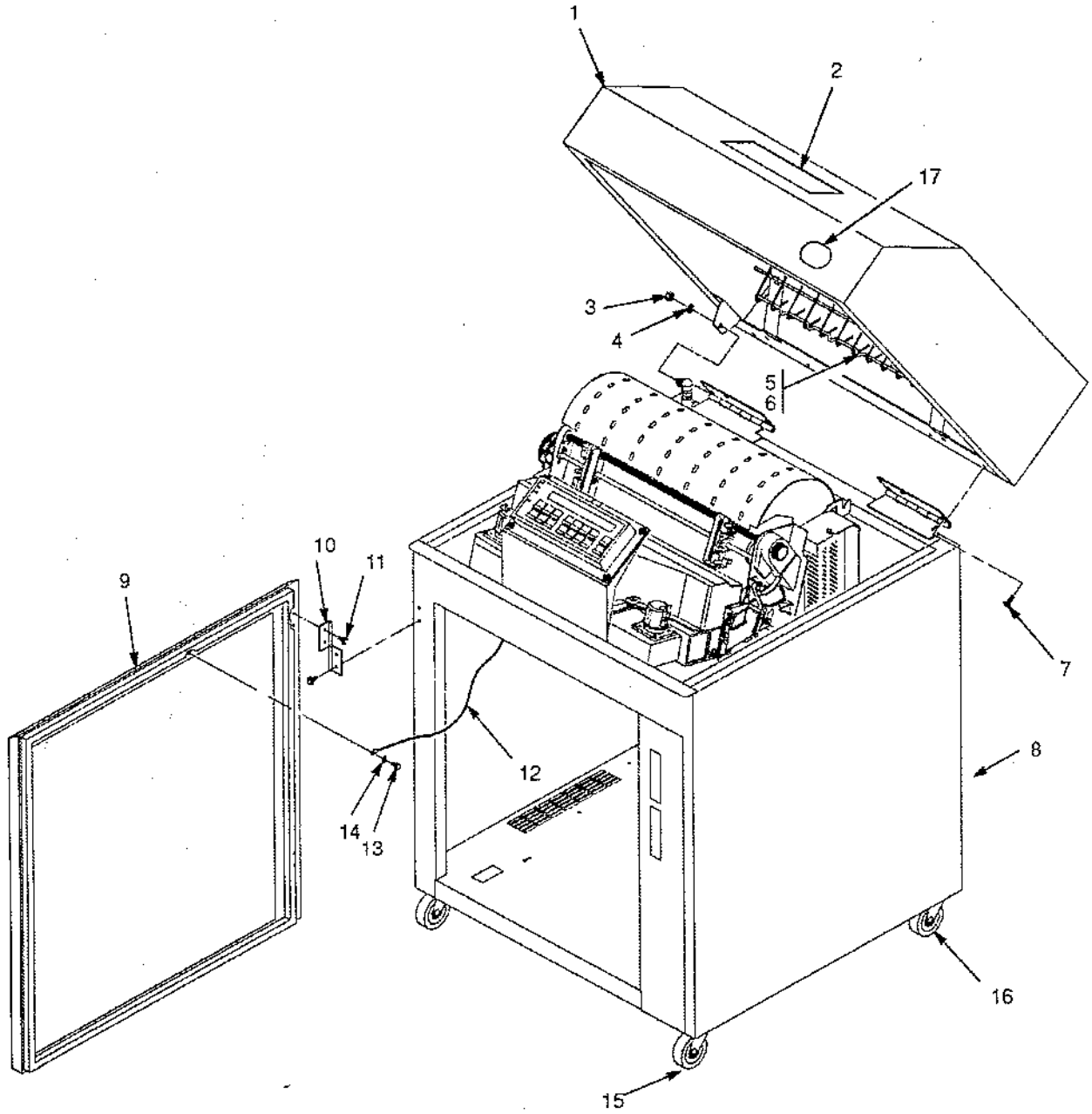


Figure 6–6. Top Cover, Doors, and Casters

Item No.	Part Number	Description	Notes
1	57G7176	Stacker Assembly	
2	30H3981	Runner, Stacker	
3	04H4779	Riser, Stacker Runner	
4		Screw (4)	6–32x.375
5	08H7956	Chain Assy, Stacker Inner	
6	57G1564	Chain Assy, Stacker Outer	
7	08H7955	Hanger, Chain Assy	Not shown in Figure 6–7
8	57G1582	Label, Forms Length	

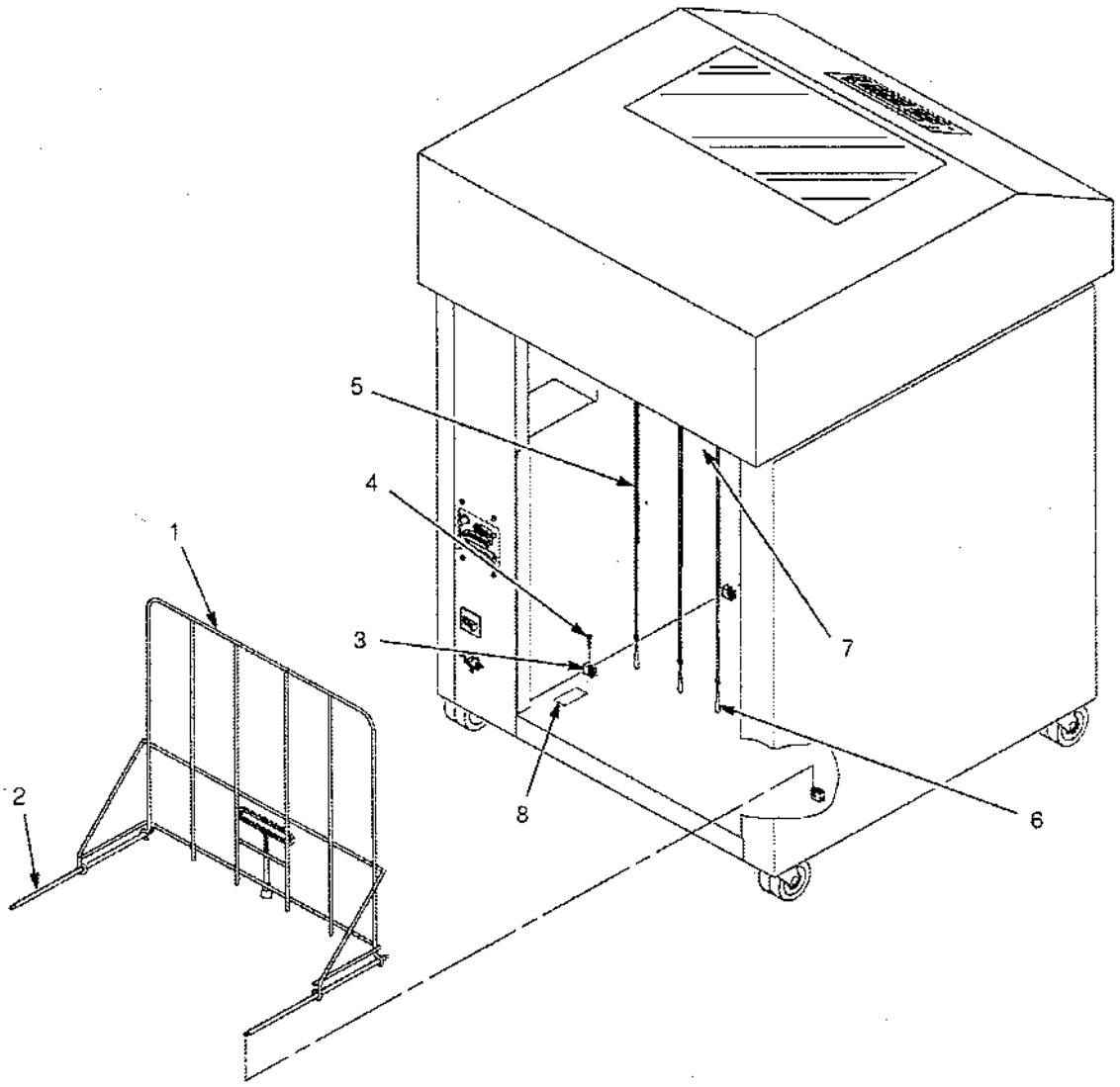


Figure 6–7. Paper Stacker Tray Assembly and Paper Chains

Item No.	Part Number	Description	Notes
1	57G1418	Operator Panel Assembly	
2	57G1598	Operator Panel Overlay	English
	57G1599		Spanish
	57G1600	op I	French
	57G1601		Italian
	57G1602		German
	57G1603		Dutch
	57G1604	2 57G7265- short op panel cable	Brazilian / Portuguese
	57G1573	op panel cable-long- conn to LP30	
3	57G1526	Operator Panel Plate	
4		Screw, w/Lock Washer (4)	6–32x.375
5	57G1441	Panel Bracket	
6		Nut, Hex (2)	.312–18
7		Washer (2)	Split Lock, 5/16
8	57G1481	Gas Spring Assembly	Includes two spring retaining clips
9	57G1483	Ball Stud (2)	
10		Screw, w/Washer (6)	10–24x.50
11	Ref	Service Panel	
12	14H7231	Multi I/O Cable Assembly	
	42F1814	Clip, Parallel Port	
13		Screw, w/Lock Washer (4)	10–24x.38
14	43F1678	Fan Guard	
15		Screw, w/Lock Washer (4)	6–32x2.00
16	57G1440	Fan Assembly	

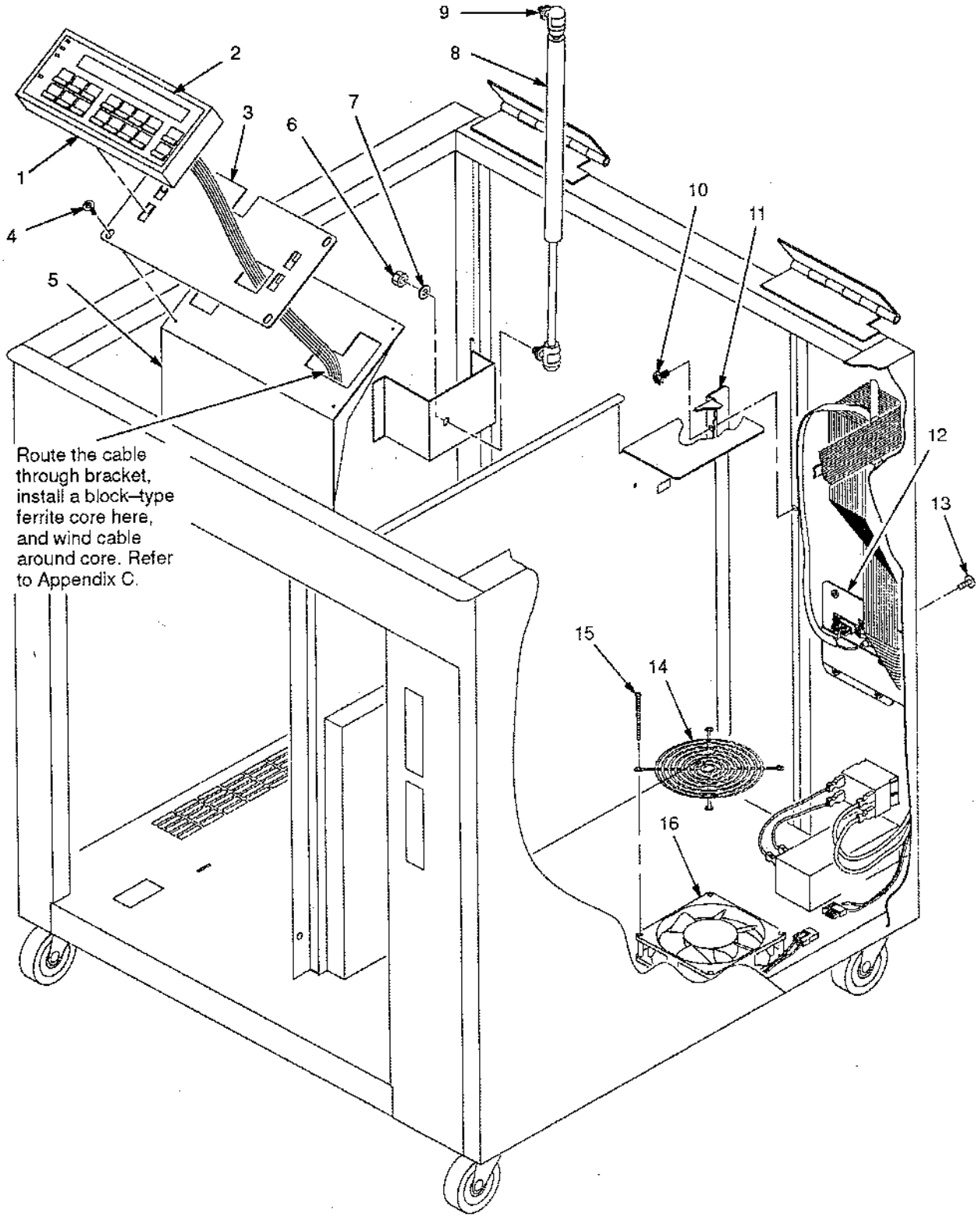


Figure 6–8. Control Panel and Cabinet Details

Item No.	Part Number	Description	Notes
1	57G1753	Cable Assy, Floppy Power	
2	57G1764	Cable Assy, Floppy Data	
3	57G1750	Disk Drive, Floppy 3.5, 2.88MB	
4	57G1765	Disk Drive Bracket	
5		Screw w/Lockwasher (4)	6–32x.50. Not shown in Figure 6–9. Holds disk drive to the bracket.
6		Screw, thread–forming (4)	6–32x.3125
7	57G1751	Diskette, Base Machine	Not shown in Figure 6–9. Security modules listed on page 6–47 and in Appendix I.
	57G1664	Diskette, IGP–200	
	57G1674	Diskette, Code V	
	57G1685	Diskette, IPDS Twinax	
	57G1696	Diskette, IPDS Coax	
	57G1705	Diskette, IGP–200 + IPDS Twinax	
	57G1713	Diskette, IGP–200 + IPDS Coax	
	57G1720	Diskette, Code V + IPDS Twinax	
	57G1727	Diskette, Code V + IPDS Coax	

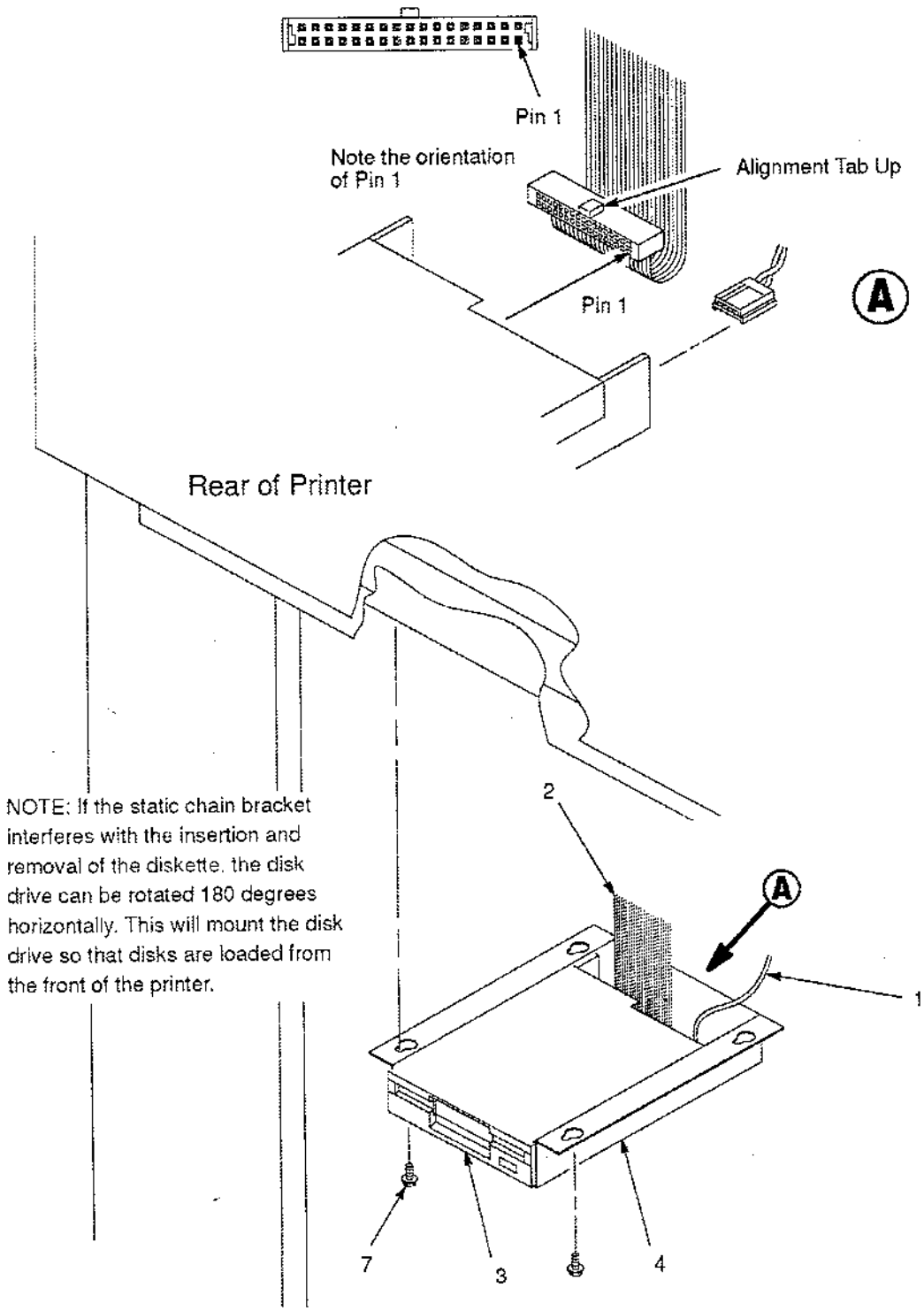


Figure 6–9. Floppy Diskette Drive

Item No.	Part Number	Description	Notes
1	57G1508	Shuttle Cover Assembly	(Air Shroud Assembly)
2		Screw, Captive (2)	10–24x.62 with O–ring, .125x.250x.06
3		Screw, Thread forming (4)	6–32x.25
4	Ref	Barrier Shield	
5	08H7954	Static Brush	Part of item 4.
	08H7950	RH Bracket	Part of static brush assy.
	08H7951	LH Bracket	Part of static brush assy.
6	Ref	Screw (2)	Part of item 4
7	57G1568	Paper Guide Assembly	
8		Screw, Hex, w/Lock Washer	6–32x.25, with #6 Flat Washer
9	57G1512	Timing Belt Cover	
10	57G1468	Paper Feed Timing Belt	
11	Ref	Magnet	Part of item 1

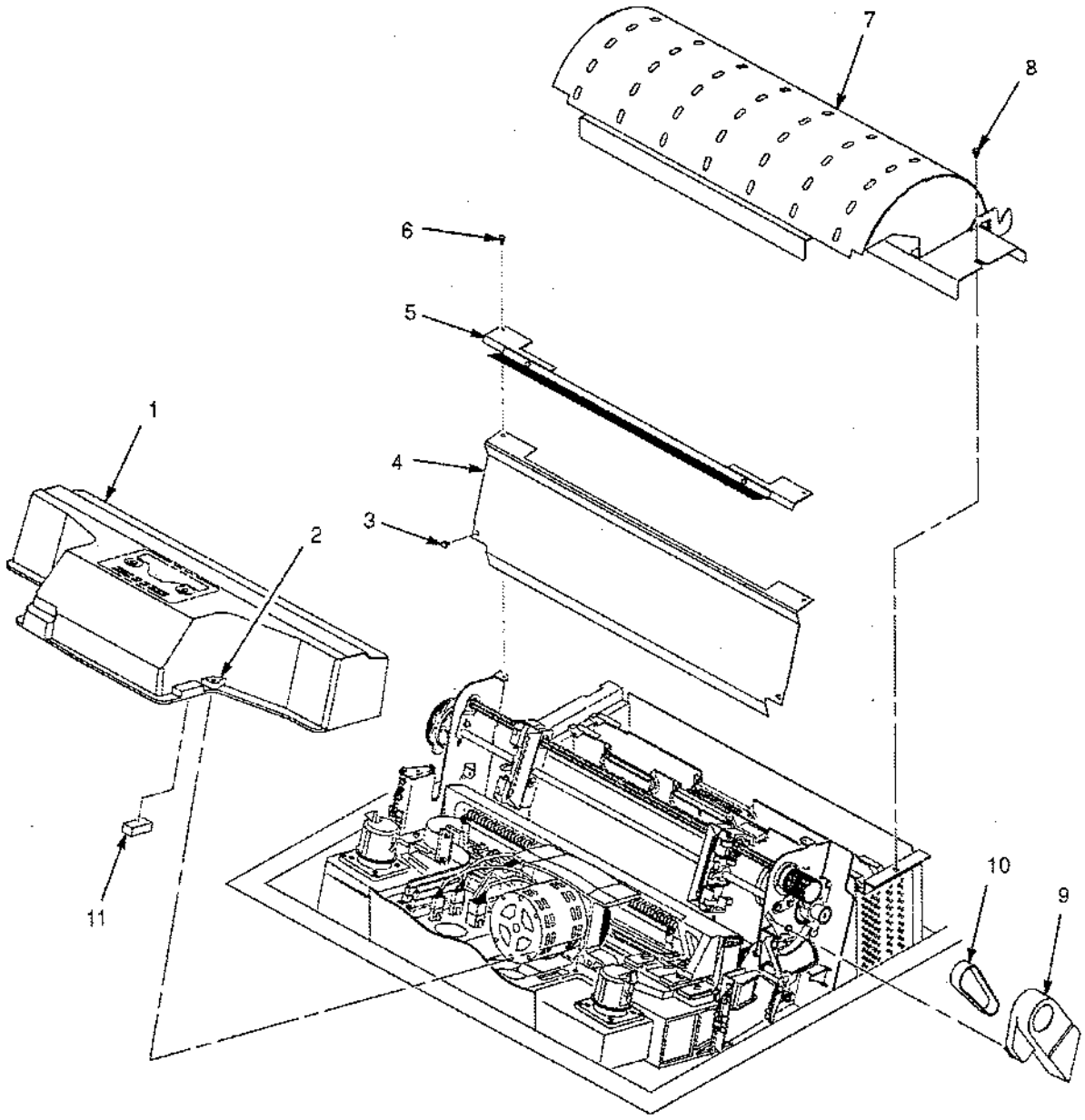


Figure 6–10. Covers

Item No.	Part Number	Description	Notes
1	57G1477	Hammer Bank Cover Assy	
2	57G1443	Shuttle Frame Assembly	Hammer Spring Replacement Kit: 57G1475
3	57G1456	Cable Assy, AC/Ground	
4	57G1437	PCBA, Power Supply	
5	57G1454	CCB/Mech. Driver Cable Assy	Cable Assy W1
6	57G1464	Hammer Bank Fan Assy	
7	57G1577	Ribbon Drive Motor (2)	
8		Screw, Hex w/Lock Washer	6–32x.50, two per motor
9		Washer, Flat #6	Two per motor
10	57G1479	Ribbon Spool Hub Kit	Kit includes 6–19x.50 set screw
11	08H7828	Cable Assy, +5V Power Supply	
12	57G1446	PCBA, Mechanism Driver	
13	57G1768	PCBA, Controller	
14	57G1769	PCBA, LP30 Backplane	
15		Screw, Hex w/Lock Washer (2)	6–32x1.25
16	57G3753	PCBA Rail	Not shown in Figure 6–11.
17		Screw, w/Hex Lock Washer (4)	6–32x.50
18	1445211	SIDE CLAMP	

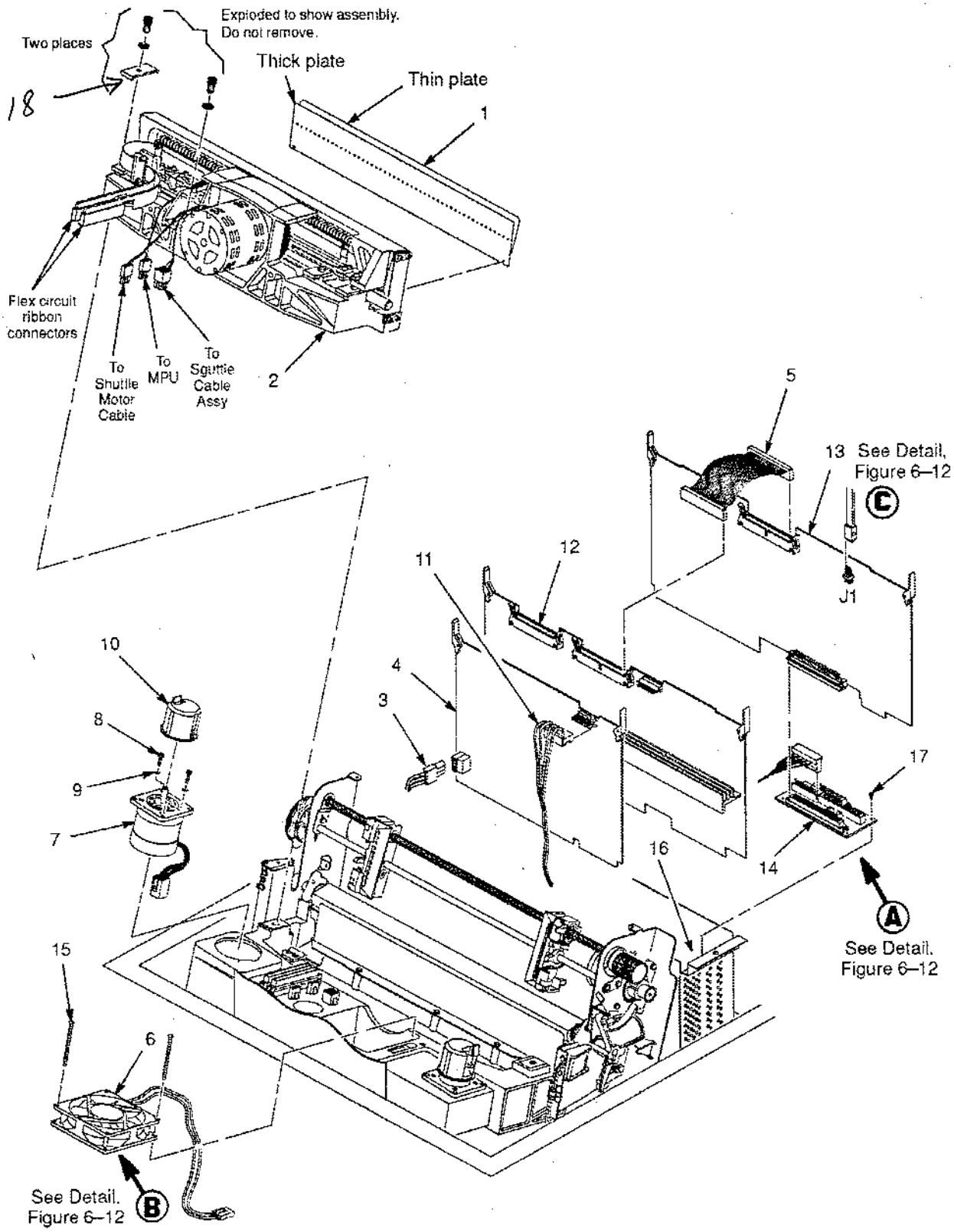


Figure 6–11. Print Mechanisms and Card Cage

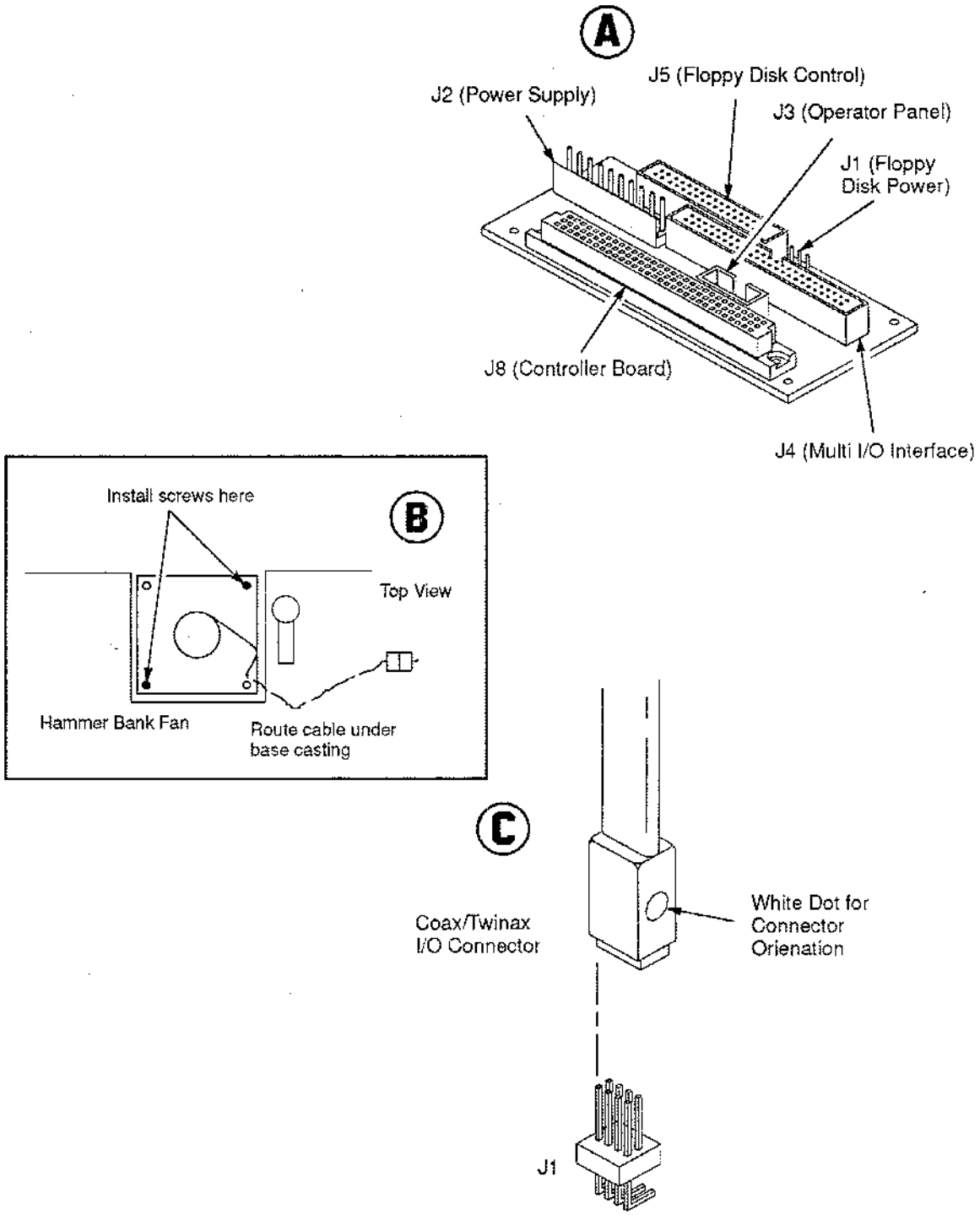


Figure 6–12. Print Mechanisms and Card Cage Details

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Item No.	Part Number	Description	Notes
1	57G1476	Magnetic Pickup Assy (MPU)	
2	57G1572	Bracket, MPU	
3		Screw, socket cap	6–32x.38
4	30H3985	Extension Spring	

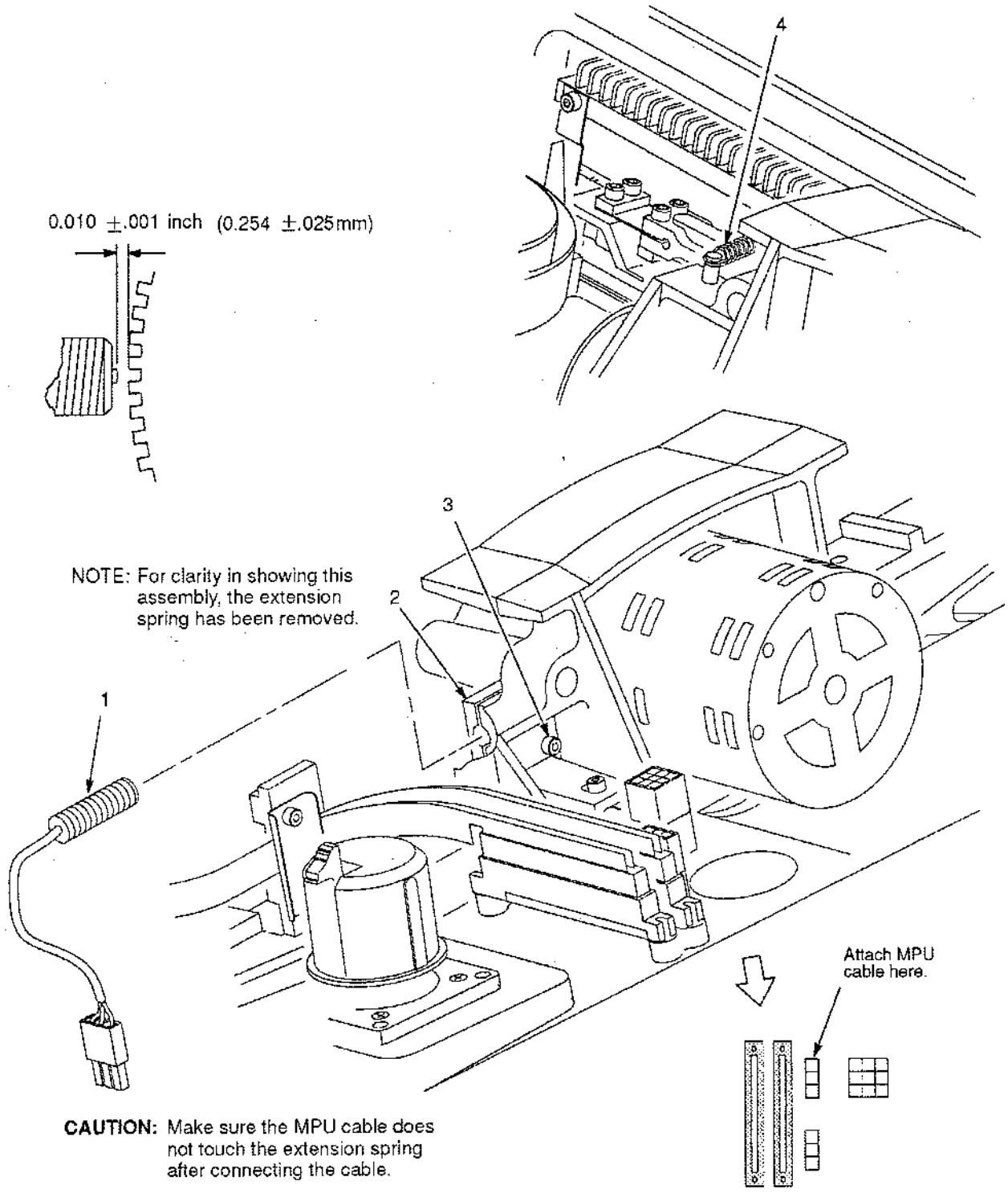


Figure 6–13. Magnetic Pickup Unit (MPU) and Extension Spring

Item No.	Part Number	Description	Notes
1		Screw, Socket Cap	4–40x.25
2		Washer	Flat #4
3	57G1517	Knob, Tractor Adjust	
4	57G1520	Bushing, Tractor Adjust	
5	57G1516	Washer, Curved Spring (2)	
6	0311072	Ring, Grip	
7	57G1510	Bearing, Nylon .376	
8	57G1473	Link Spring	
9	57G1524	Spring, Extension 1.00L	
10		Screw, Hex w/Lock Washer	4–20x.50
11	57G1521	Clip, Grounding	
12	57G1460	Shaft Assy, Splined	Includes vertical adjust knob (splined shaft pulley) 57G1461
13		Screw, Thread Forming	6–32x.25
14	57G1474	Clamp, Bearing	
15	57G1519	Tractor Support Shaft	
16	57G1466	Tractor Set, L/R	
17	0264641	E–Ring	
18	3044017	Bushing	

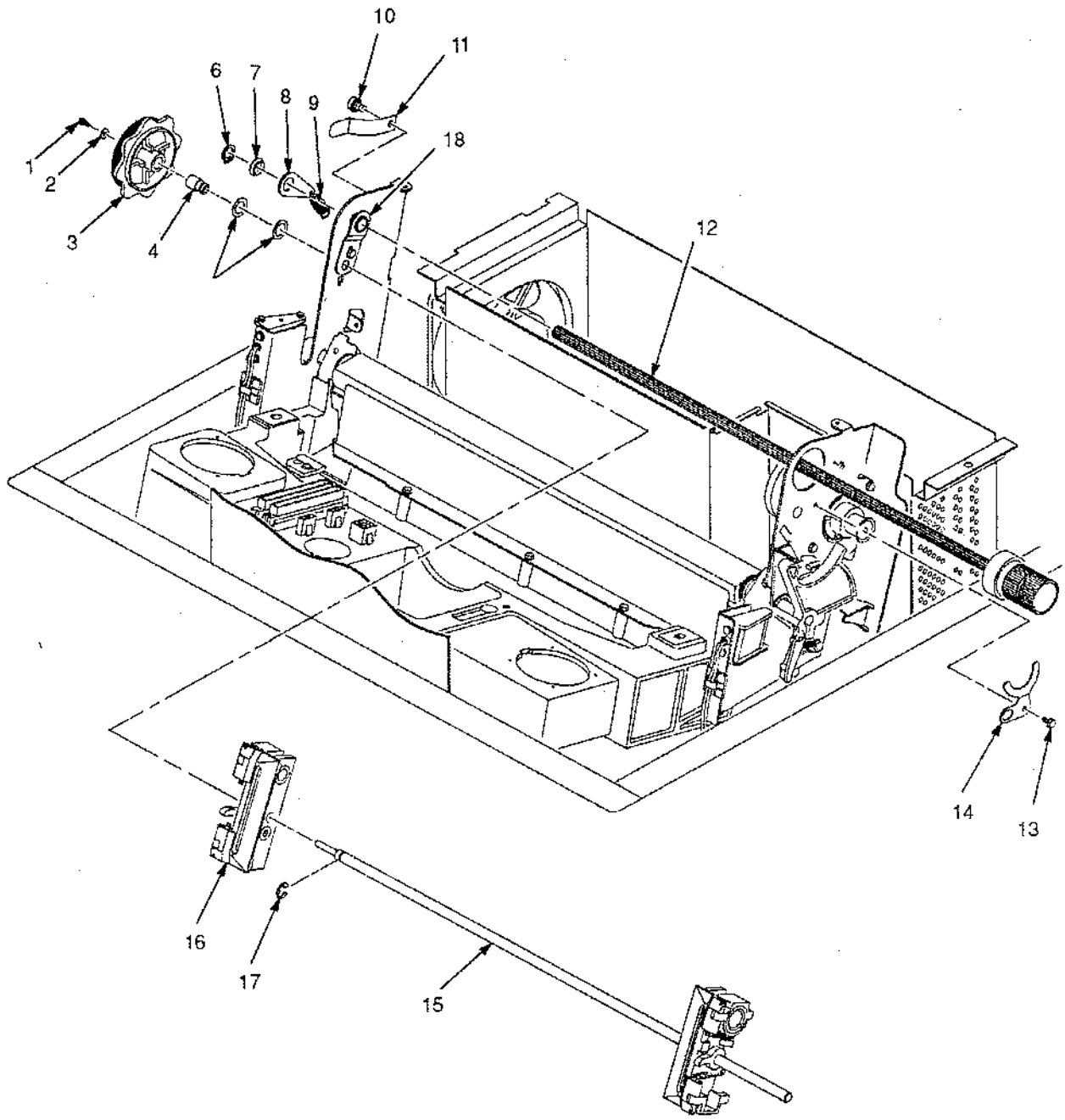


Figure 6–14. Tractor Shafts

Item No.	Part Number	Description	Notes
1		Set Screw (2)	Part of item 2
2	57G1472	Bracket, Platen (2)	
3	57G1469	Ironer, Paper	
4		Screw, Thread Forming (3)	6–32x.25
5	57G1571	Bracket, Ironer	Ironer Bracket Assy includes item 7.
6		Plate, Ironer	Part of item 6.
7	08H7936	Platen	
8		Washer (2)	Flat #5/16
9		Screw (2)	6–32x.250
10		Washer (2)	Flat #4
11	57G1451	Platen Interlock Switch Assy	Mounting screws: two 2–32x.625
12		Screw, Socket Cap	6–32x.75
13		Washer	#6
14		Nut	6–32
15	57G3899	Lever, Platen	Forms Thickness Lever
16	57G1522	Spring, Extension 1.12L (2)	
17	57G1523	Link, Spring (2)	
18	57G1510	Bearing, Nylon .376	
19	57G1518	Bracket, Switch Mount	
20	Ref	Wear Saddle, Platen (2)	
21	57G1514	Pulley, Platen Open	Includes item 23
22		Screw, Socket Cap	6–32x.44
23	57G1467	Platen Open Belt	
24	57G1513	Cover, Platen Open	

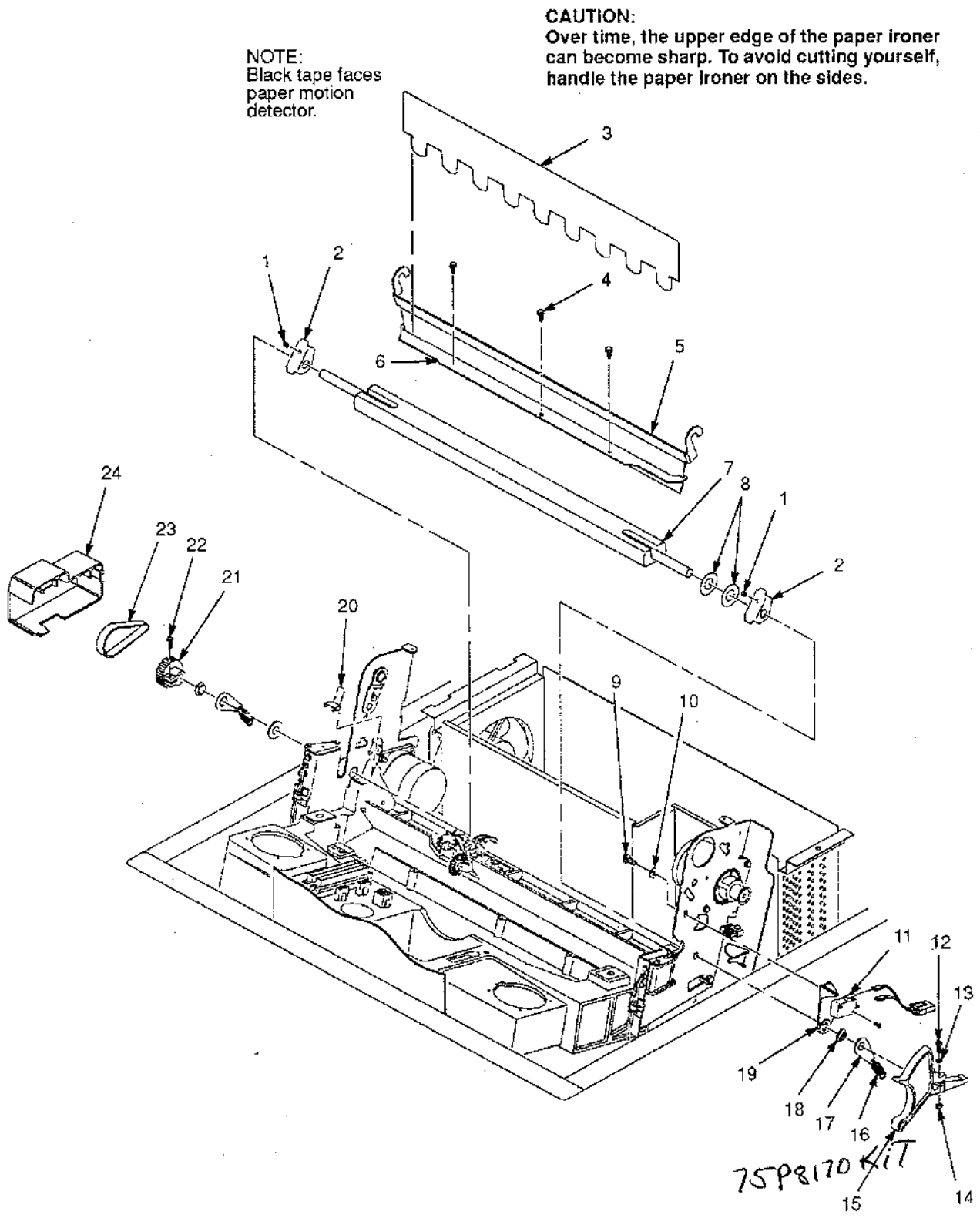


Figure 6–15. Platen

Item No.	Part Number	Description	Notes
1		Screw, w/Lock Washer (4)	6–32x2.00
2	43F1678	Fan Guard	
3	57G1440	Fan Assembly, Card Cage	
4		Motor Pulley, Platen Open	Part of Platen Open Motor Assy (57G1509) and includes collar set screw 6–32x.25
5	57G1463	Platen Open Motor	Platen Open Motor Assy (57G1509) includes items 4 and 5
6		Nut, Hex (2)	10–32
7	57G1453 57G3889	Paper Detector Switch Assy Paper Detector Switch Assy	 Black back forms
8		Screw, Thread Forming	6–32x.375
9	Ref	Card Cage	
10		Nut, Hex (2)	10–32
11	57G1463	Paper Feed Motor	Paper Feed Motor Assy (155005–001) includes items 11–13
12		Set Screw	6–32x.51
13	57G1507	Collar	
14	57G1421 57G7190	Motor Pulley, Paper Feed 25 TOOTH " " 24 TOOTH - NO MARKINGS - SHINY NOT DULL SILVER	
15		Screw, Hex w/Lock Washer (2)	10–32x.50
16	57G1449 57G1450	Ribbon Guide Assy, Left Ribbon Guide Assy, Right	
17		Washer (2)	Flat #4
18		Screw, Hex w/Lock Washer (2)	4–40x.38
19		Screw, Hex w/Lock Washer (2)	10–32x.50

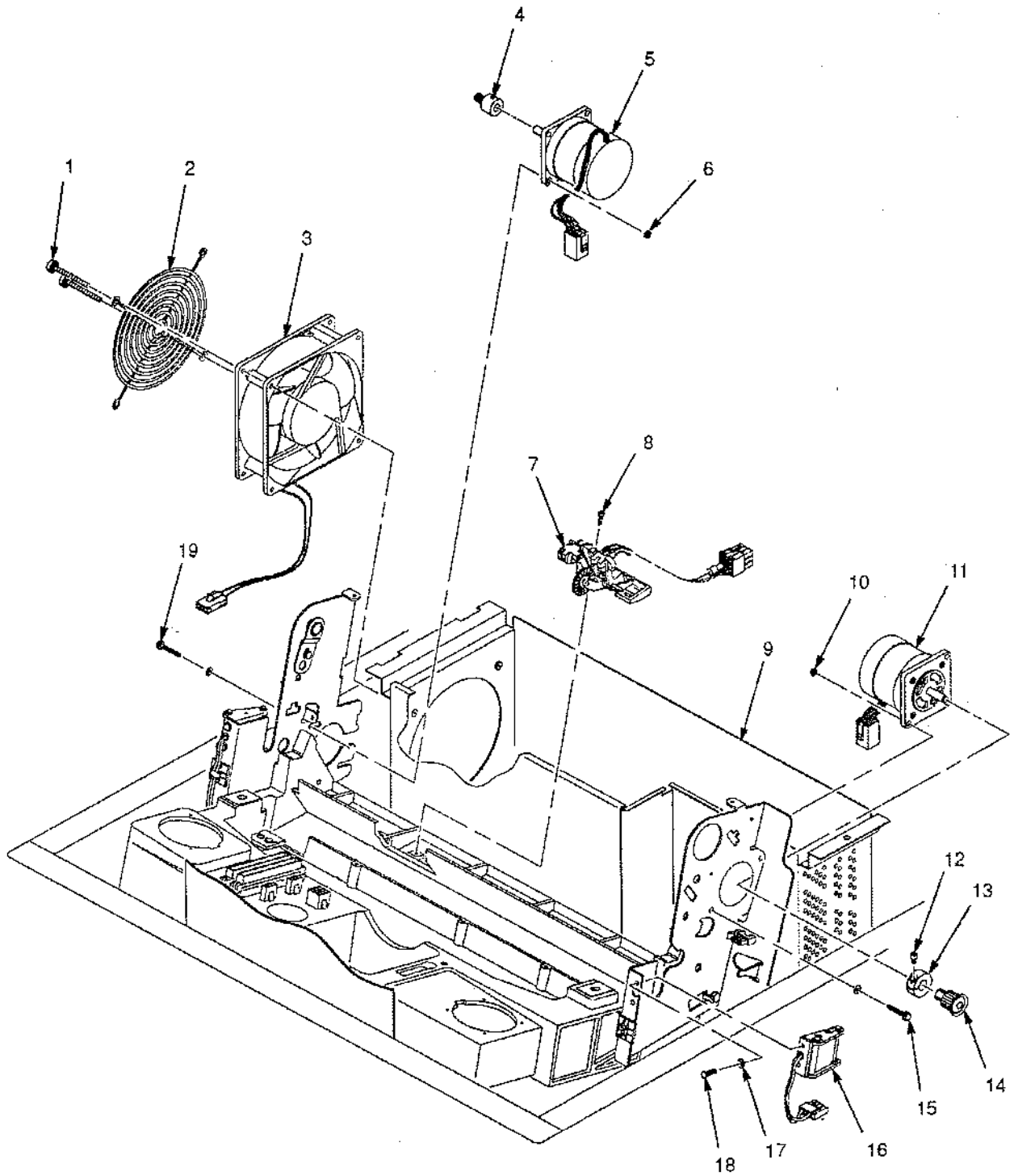


Figure 6–16. Motors, Card Cage Fan, and Paper Detector Switch

Item No.	Part Number	Description	Notes
1		Screw, w/Washer (6)	10–24x.50
2	Ref	Service Panel	
3	Ref	Electrical Lead (4)	See detail in Figure 6–17 for attachment
4		Spring Clip (4)	Part of item 5
5	57G1438	Circuit Breaker	
6		Screw, w/Lock Washer (3)	6–32x.375
7	57G3752	Line Filter	

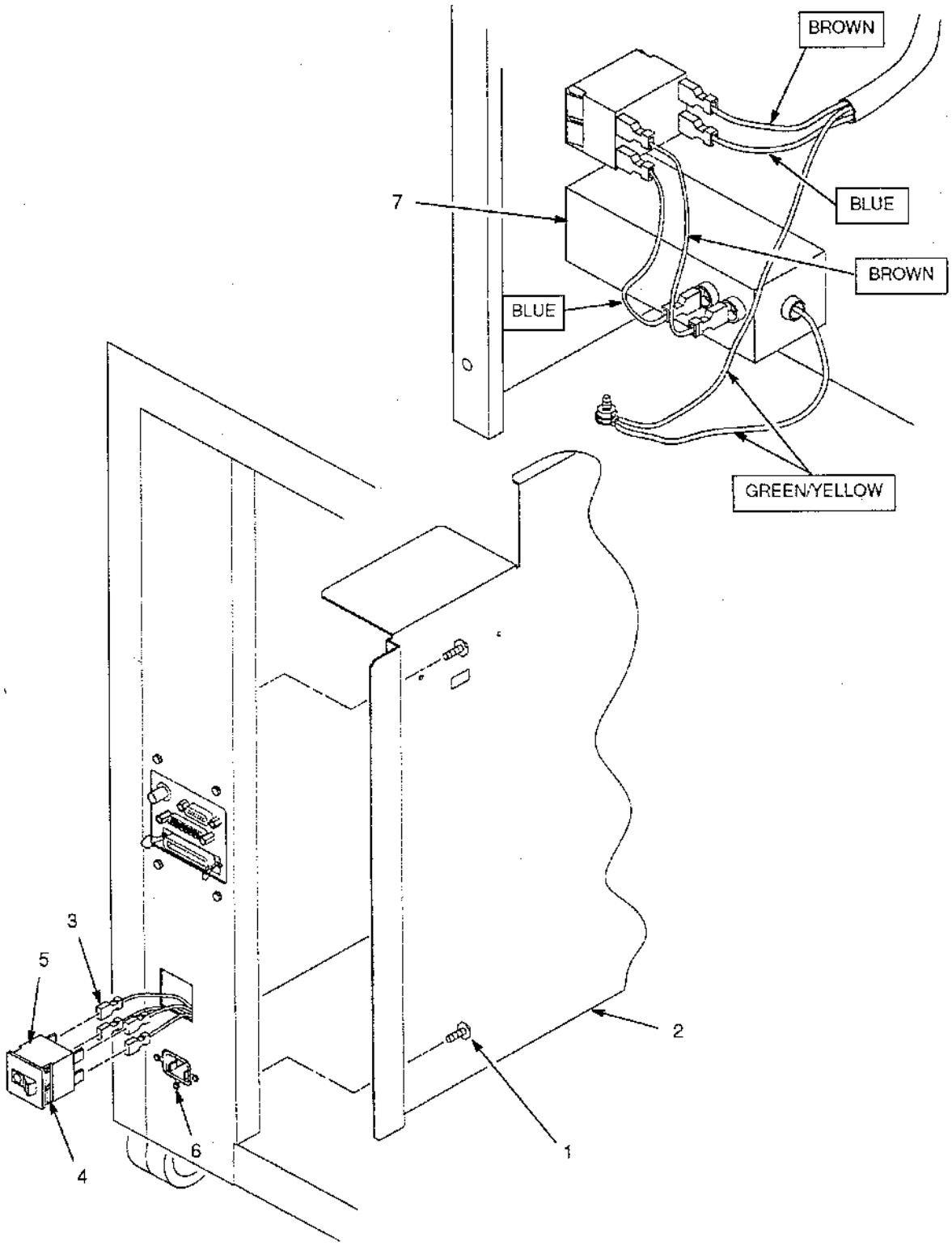


Figure 6–17. Circuit Breaker and Line Filter

Item No.	Part Number	Description	Notes
1	57G1448	Cable Assy, Hammer Bank (2)	
2		Screw, w/Lock Washer (4)	4–40x.75 and #4 Flat Washer

Printer viewed from above, circuit boards removed.

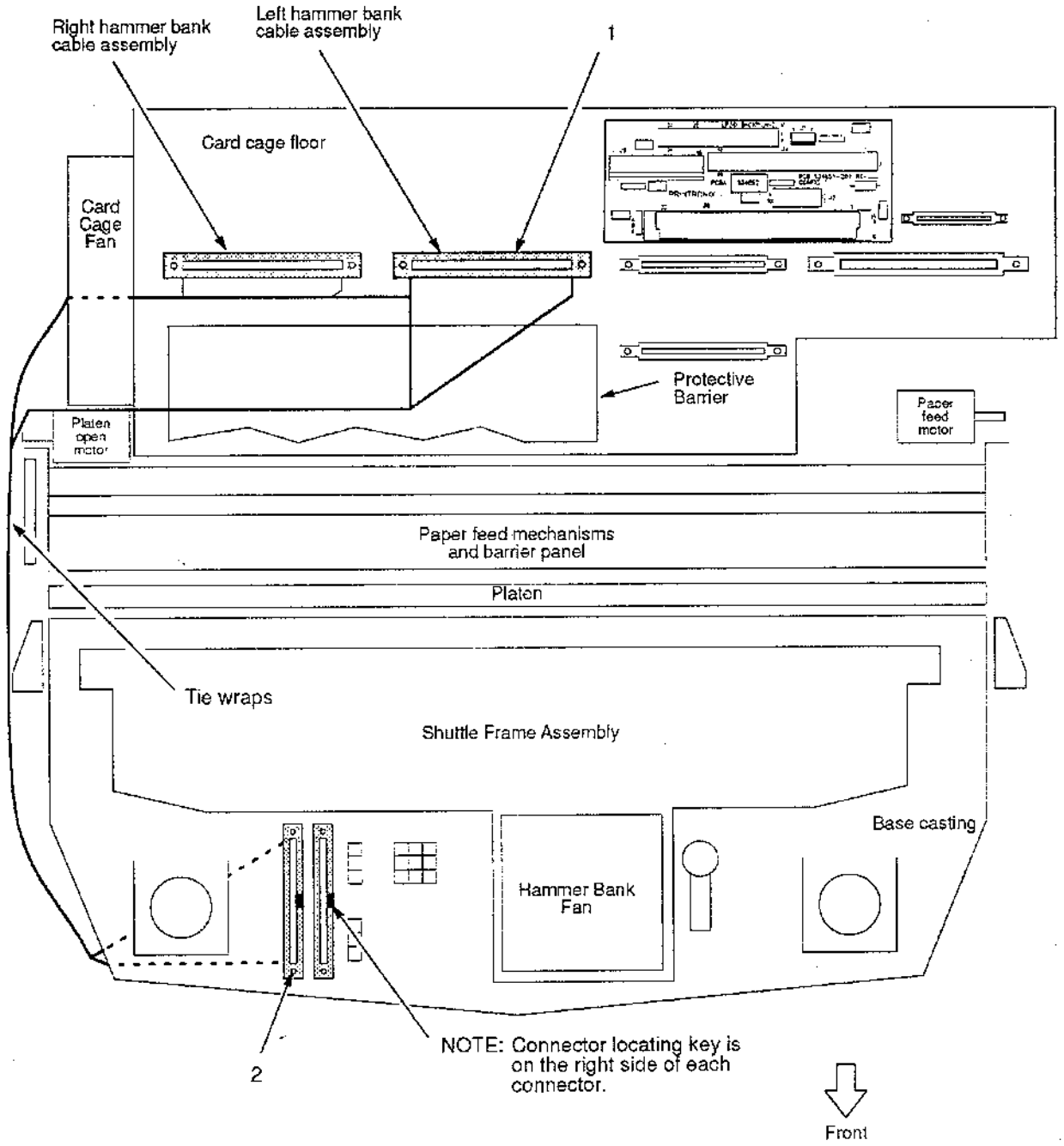


Figure 6–18. Cable Assembly W4, Hammer Bank

Item No.	Part Number	Description	Notes
1		Screw, w/Lock Washer (2)	4–40x.75 and #4 Flat Washer
2		Connector P1	Part of item 10
3		Connector P1(P)	Part of item 10
4	57G1451	Platen Interlock Switch Assy	
5		Connector PMD(J)	Part of item 10
6		Connector PMD(P)	Part of Paper Detect Switch Assembly
7	57G1465	Cover Open Switch Assy	
8		Connector CO+	Part of item 10
9		Connector CO–	Part of item 10
10	57G1452	Intermediate Cable Assy W5	

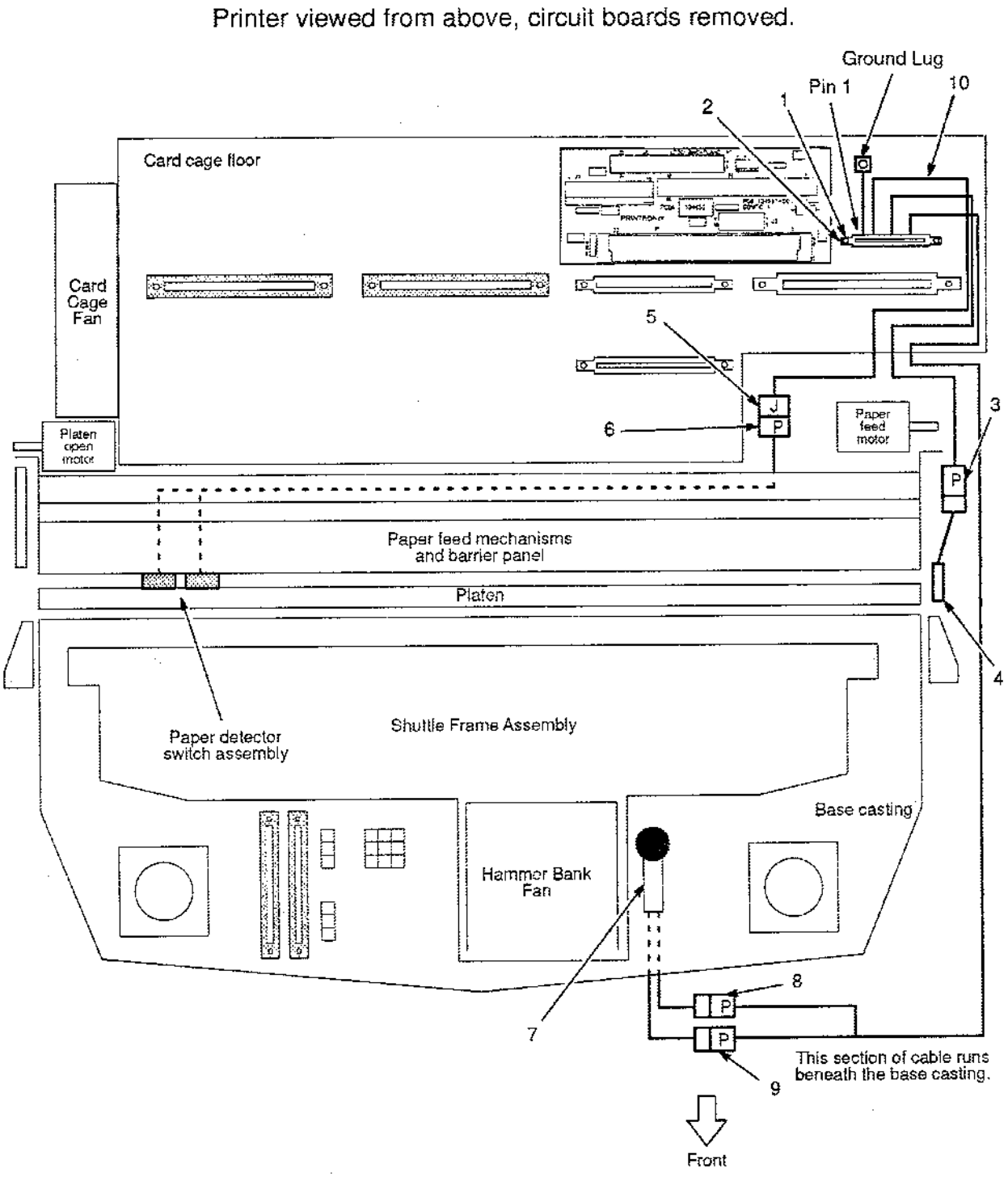


Figure 6–19. Cable Assembly W5, Intermediate, and Cover Open Switch Assembly

7 Principles of Operation

Contents

Functional Elements of the Printer

The printer consists of five functional elements:

- Operator panel
- Controller board
- Mechanism driver board
- Power supply
- Print mechanisms

Figure 7–1 shows how these elements are interrelated.

The rest of this chapter discusses these systems in more detail.

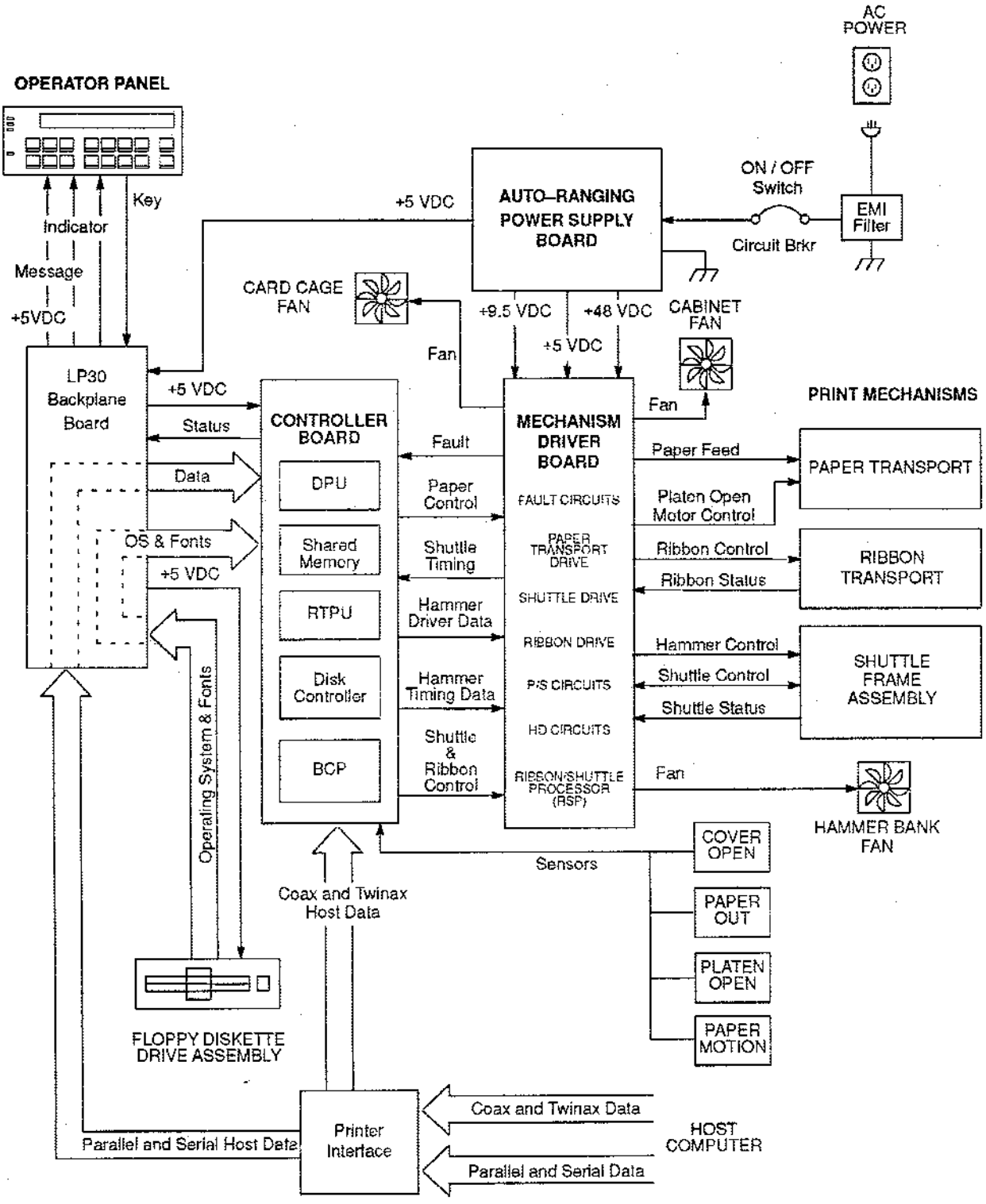


Figure 7–1. Functional Elements of the 6408–CTA Printer

Operator Panel

The operator panel assembly is the user's interface with the printer. LED indicators, contact switches, and a liquid crystal display (LCD) are mounted on a printed circuit board enclosed in a protective housing.

The operator panel processes and sends key closure information to the controller board via the backplane board and displays status information from the controller on the LCD.

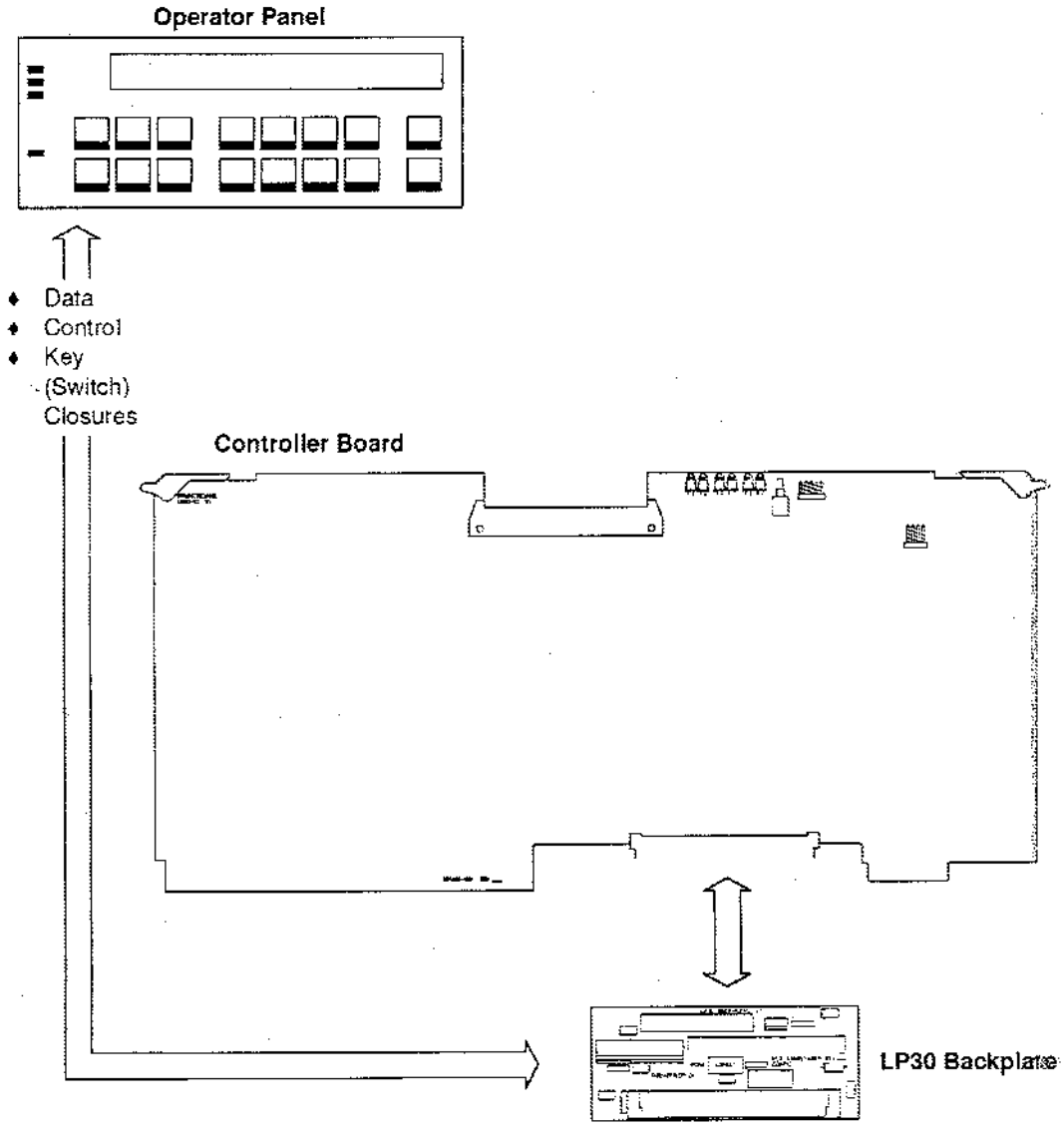


Figure 7–2. Operator Panel Functional Overview

Controller Board

The central element of the printer is the controller board, which controls and coordinates all printer functions.

The controller board functions as two units: the data processing unit (DPU) and the real–time processing unit (RTPU). The DPU converts all character data into printable dot images. The DPU is the high–level logical controller of the printer; it is not involved in real–time or hardware–dependent printer operation. The RTPU operates the printer (host) interface, the operator panel, the print mechanism, and monitors the fault circuitry in the mechanism.

The DPU and RTPU communicate by means of shared memory. The DPU gets host and operator input from buffers in memory which are filled by the RTPU, and returns dot images and operator messages to buffers in memory which the RTPU empties. Figure 7–3 summarizes the architecture of the controller board.

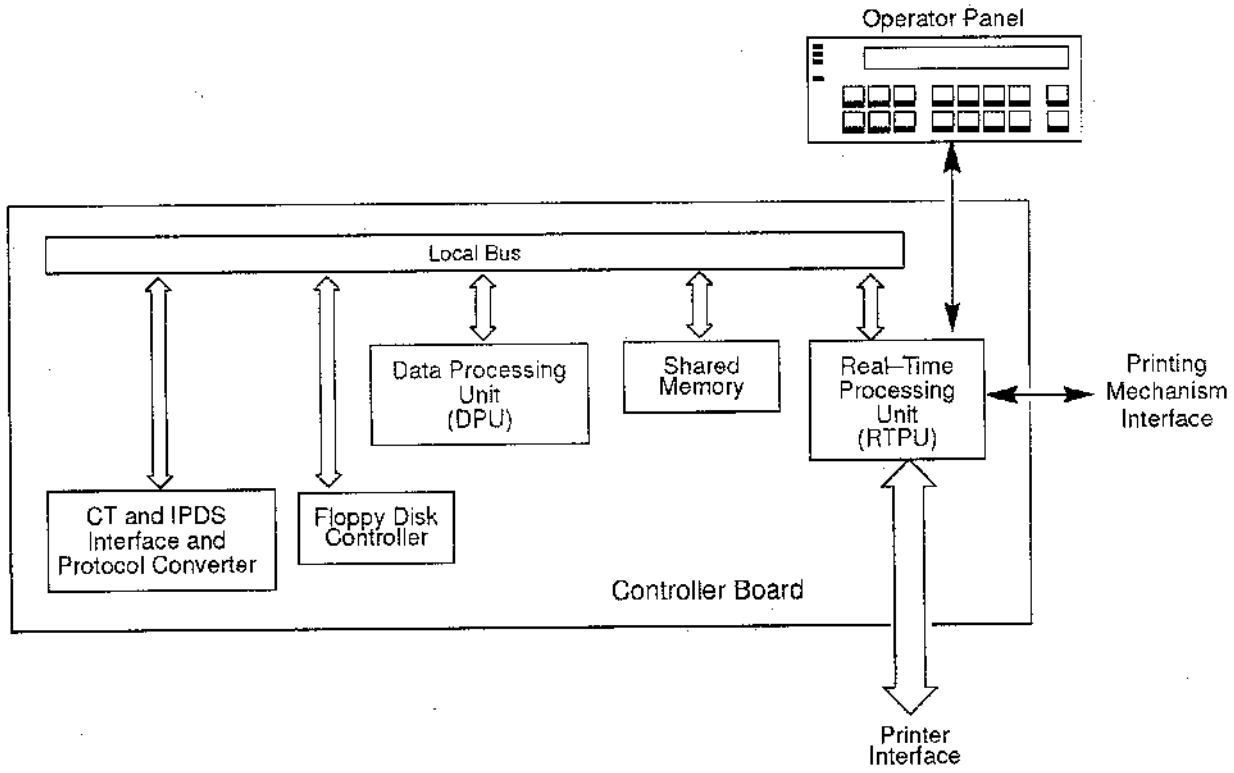


Figure 7–3. Architectural Overview of the Controller Board

Controller Communication with Host Computer and Operator

The controller board processes fives kinds of computer input:

- PC parallel
- Dataproducts parallel
- RS–232 serial
- IBM 3270 protocol (also called "coax," because the signals are delivered over a coaxial line)
- IBM 5250 protocol (also called "twinax," because the signals are delivered over a twinaxial line)

The RTPU operates all interfaces. The PC and Dataproducts interfaces are similar, and the RTPU uses direct memory access (DMA) hardware to load parallel data directly into shared memory.

The serial interface requires byte–by–byte intervention by the processor, since ACK/NACK and XON/XOFF protocols require that every byte be examined as it is received. The universal asynchronous receiver/transmitter (UART) is internal to the RTPU, which processes any protocol requirements then puts the data in shared memory, where the DPU can read it.

IBM protocols are handled by the RTPU through a Bi–phase Communication Processor (BCP); the data are then placed in shared memory.

To the DPU, therefore, all input data look the same, regardless of the interface used to receive the data. The interface functions of the RTPU are summarized in Figure 7–4.

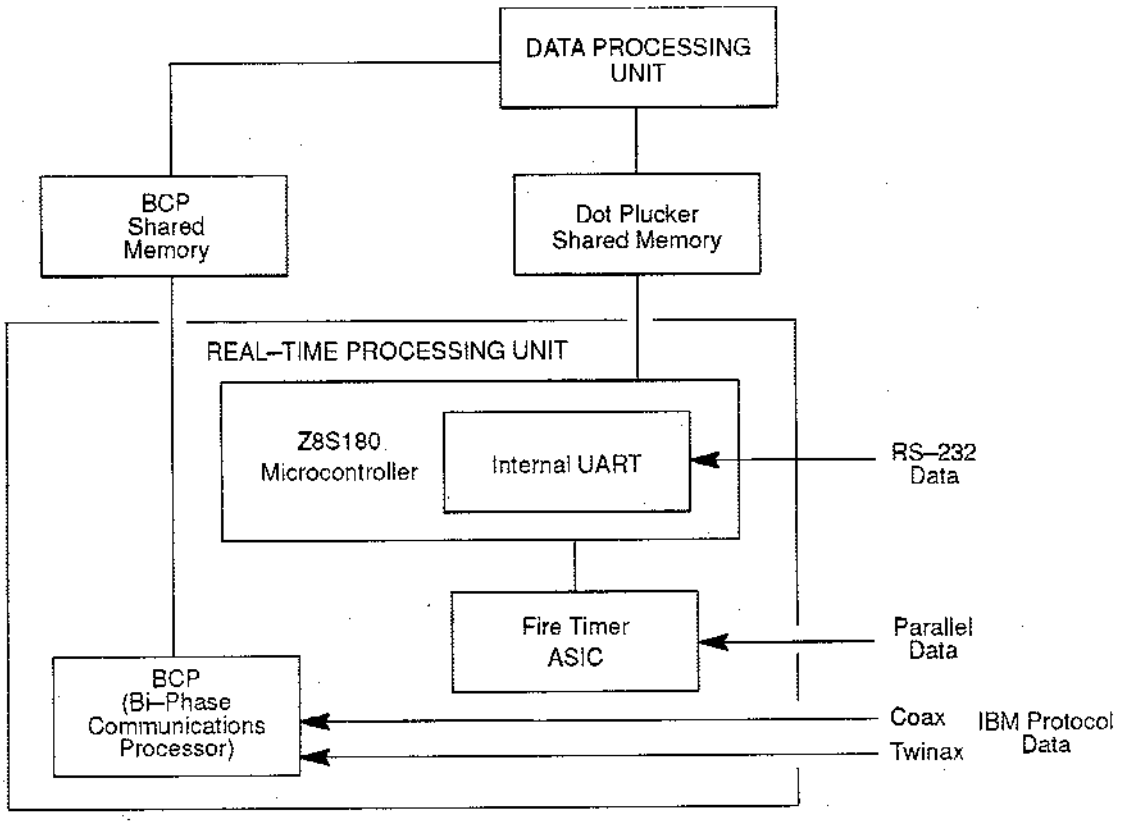


Figure 7–4. Host Interface Functions of the RTPU

Operator Panel

The printer communicates with the operator by means of the Liquid Crystal Display (LCD) and Light Emitting Diode (LED) indicators on the operator panel. The operator communicates with printer by pressing keys on the operator panel. (See Figure 7–2.)

Thus there are three kinds of operator panel operation: keystroke input, display output, and indicator output. The RTPU handles the operator panel interface requirements of shifting and clocking operator panel data, but it is the DPU that processes the data.

Floppy Disk Controller Module

The floppy disk controller module is part of the controller board; it controls the flow of DPU program data from a standard 3.5 inch floppy diskette to the DPU program memory. The DPU controls this floppy drive.

Printing

The RTPU coordinates printing of the dot images sent from the DPU. Printing is a complex process requiring many control functions, but is logically divided into two groups:

- Hammer driver interface functions
- Mechanical interface functions

Hammer Driver Interface

In order to print a dot image, two things must happen. First, the dots must get to the hammers one dot row at a time and in the correct sequence. Second, the hammers must fire at the appropriate time in the stroke of the shuttle. The RTPU processor controls both of these functions, but each is actually performed by an application-specific integrated circuit (ASIC) containing hardware dedicated to the function. These ASICs are the Dot Plucker Memory Controller (DPMC) and the Fire Timer IC (FTIC). The hammer driver interface functions of the RTPU are summarized in Figure 7–5.

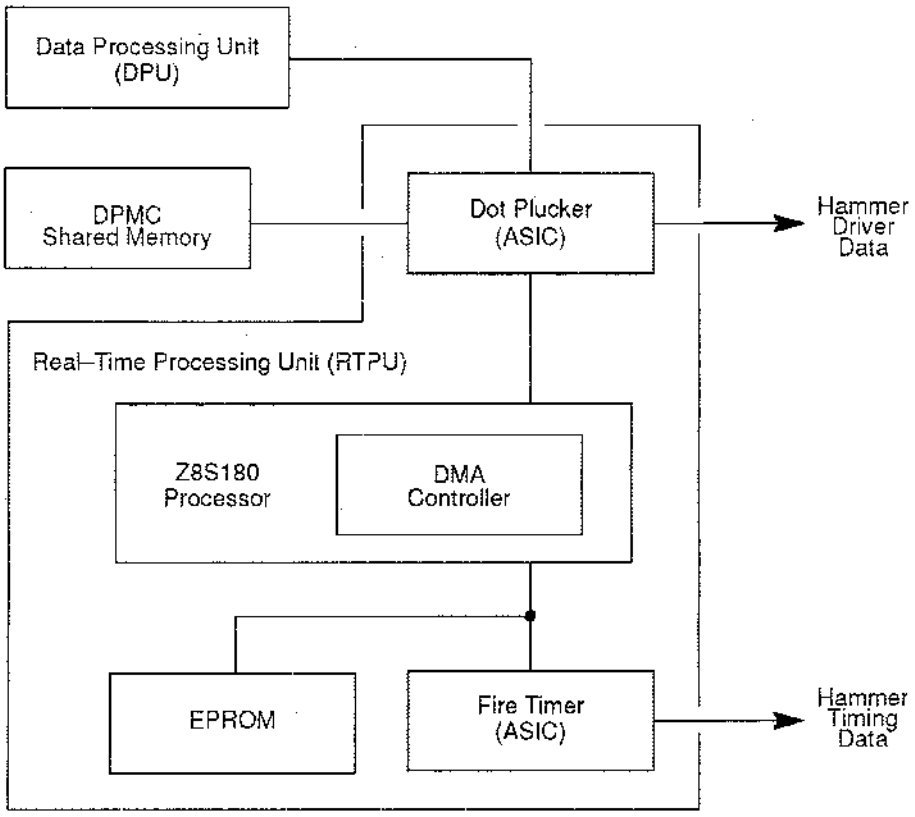


Figure 7–5. Hammer Driver Interface Functions of the RTPU

Getting Dots to the Hammers Getting dots to the hammers consists of going into the shared memory and pulling bits out in a given order and shifting them to the hammer driver at the correct time. This process is called "dot plucking." The order in which dots are plucked from memory depends on the dot density, the number of dots per hammer, the number of hammers on the hammer bank, the number of phases, and other factors. These factors are all considered by the RTPU processor as it programs the dot plucker and the FTIC for each dot row.

Hammer Fire Control Hammer fire control consists of synchronizing the firing of different sections of the hammer bank with the position of the shuttle. This synchronization varies with the dot density, the number of dots per hammer, the number of hammers on the hammer bank, the number of phases, and so on. The Fire Timer IC (FTIC) performs this synchronization, but it is such a complex procedure that most synchronization factors are programmed into the fire timing tables which are transferred (by DMA) from EPROM to FTIC while printing. The FTIC's fire control responsibility is thus reduced to tracking the MPU pulses that tell shuttle position, timing hammer firing between MPU pulses, and sending a pattern to the hammer driver telling it which phases to fire.

Synchronizing Dot Plucking and Hammer Firing Transfer of dots to the hammer driver must be synchronized with hammer firing. Dots are transferred to the hammer driver in serial streams of dots that tell which hammers will print when their phase is next fired. These serial streams are called bursts. The bursts are timed precisely: they must occur neither too early nor too late. Synchronization is accomplished by having the FTIC request bursts from the dot plucker. The FTIC reads the magnetic pick–up unit (MPU) to determine when to request a burst. The time at which the burst request is made is contained in the fire timing tables.

Mechanical Interface

Three mechanical operations are coordinated in printing: paper motion, ribbon motion, and shuttle motion. Virtually all digital handling of paper motion is contained in the RTPU. The ribbon and shuttle are controlled by logic on the mechanism driver board, under the direction of the RTPU. Figure 7–6 shows the mechanical interface section of the RTPU.

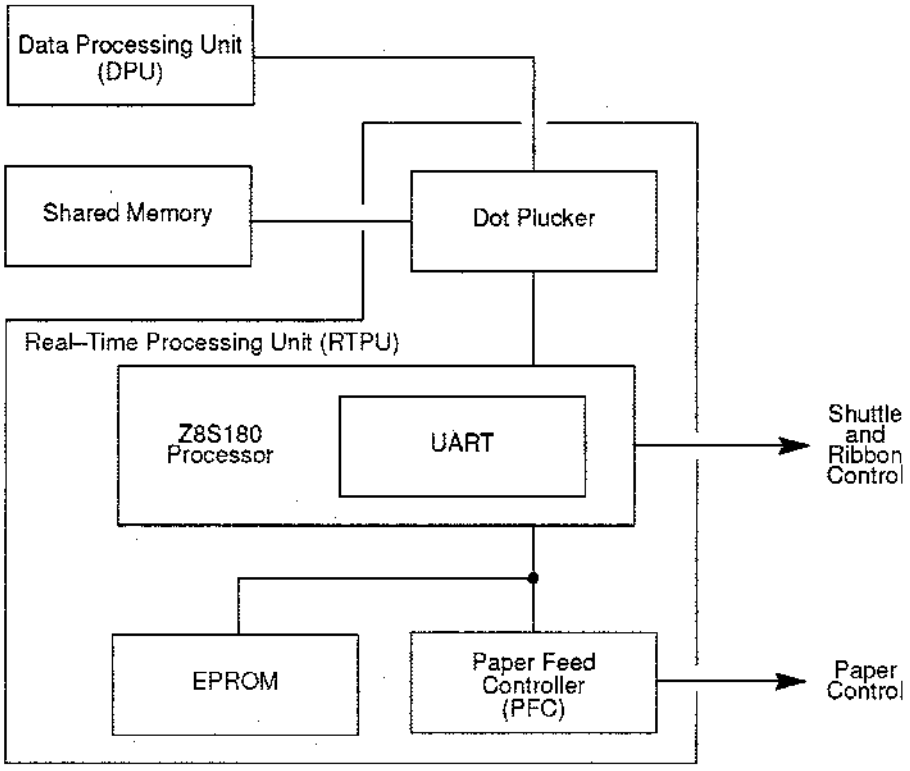


Figure 7–6. Mechanism Driver Interface Functions of the RTPU

Paper Motion The DPU determines when to move the paper and how far to move it. It communicates this to the RTPU through the shared memory. The RTPU processor performs some paper handling operations (such as holdback on slews), but most paper handling is done by a dedicated micro–controller called the paper feed controller (PFC).

The PFC is part of the RTPU and moves paper by looking up motion profiles and driving a sequence of motor positions to the mechanism driver board. If the motion is a dot row or interline advance, it is synchronized to hammer firing by a signal from the FTIC that tell the PFC when to move.

Ribbon and Shuttle Motion The ribbon and shuttle motors are controlled by a micro–controller on the mechanism driver board called the ribbon and shuttle processor (RSP). The RTPU interface to the RSP is a 2400 baud asynchronous serial line. A message protocol is used to communicate ribbon and shuttle information.

Fault Monitoring

The RTPU also monitors the hammer driver, mechanism driver, and the electro–mechanical sensors for fault conditions. Fault conditions are reported to the DPU.

Hammer Bank and Hammer Driver Faults

The FTIC works with the hammer driver ASIC (on the mechanism driver board) to monitor hammer driver shorts, average upper driven phase current, and temperature conditions. The RTPU reads the FTIC registers to determine out–of–range conditions, and these are passed on to the DPU.

Paper Faults

Two kinds of paper faults can occur: paper out and paper jammed. Both of these conditions are monitored through optical sensors. The paper feed controller (PFC) watches the paper out and paper motion sensors and reports errors to the RTPU processor. The RTPU then forwards the information to the DPU.

Ribbon and Shuttle Faults

The ribbon and shuttle processor (RSP) on the mechanism driver board monitors fault conditions in the drive circuits and notifies the RTPU if it finds errors. The RTPU processor can also use the FTIC to measure time between magnetic pick–up (MPU) pulses, enabling it to monitor shuttle speed and thus detect some shuttle faults.

Security Interface

The controller board contains a programmable array logic (PAL) chip called the security module. This PAL stores a 3–bit security code that is read by system software when the printer is powered on. The stored 3–bit code is compared to a security code on the emulation diskette. The program instructions that read this security code and set the lock–out mechanism must be executed out of the boot PROM or the 68EC030 will crash. This is because the lock–out mechanism enables the use of the DRAM and disables the reading of the security PAL. Conversely, when the security lock–out is reset, the code bits may be read but the DRAM may not be accessed. Therefore, if the instruction that resets the lock–out is fetched from DRAM, the next instruction will not be accessible from DRAM.

Controller Board Hardware Summary

A Motorola 68EC030 microprocessor performs the DPU functions and a Zilog Z80180 or Z8S180 microprocessor (a "Z180") is the RTPU processor. An 8032 micro–controller serves as the paper feed controller (PFC), which is part of the RTPU.

Actual implementation of this hardware blurs the distinctions between the DPU and RTPU, since the 68EC030 has access to the parallel port and the real–time functions of the dot plucker, which are RTPU resources, while the Z80180 has access to the nonvolatile memory (NVRAM), which is a resource of the DPU. These possibilities exist because of efficiencies in the hardware design; software maintains the functional differences between the DPU and RTPU.

Figure 7–7 illustrates how the controller board implements this hardware, and shows the seven data buses on the controller board:

- Z8S180 local bus: an 8–bit data path
- Z8S180 local buffered I/O bus: an 8–bit data path
- 8032 local bus: an 8–bit data path
- Common or shared bus: 16–bit data path shared by the DPU and Z8S180, arbitrated cycle by cycle
- Floppy controller bus: 8–bit data path from floppy disk to buffer memory
- DPU local bus
- Dot Plucker DRAM bus

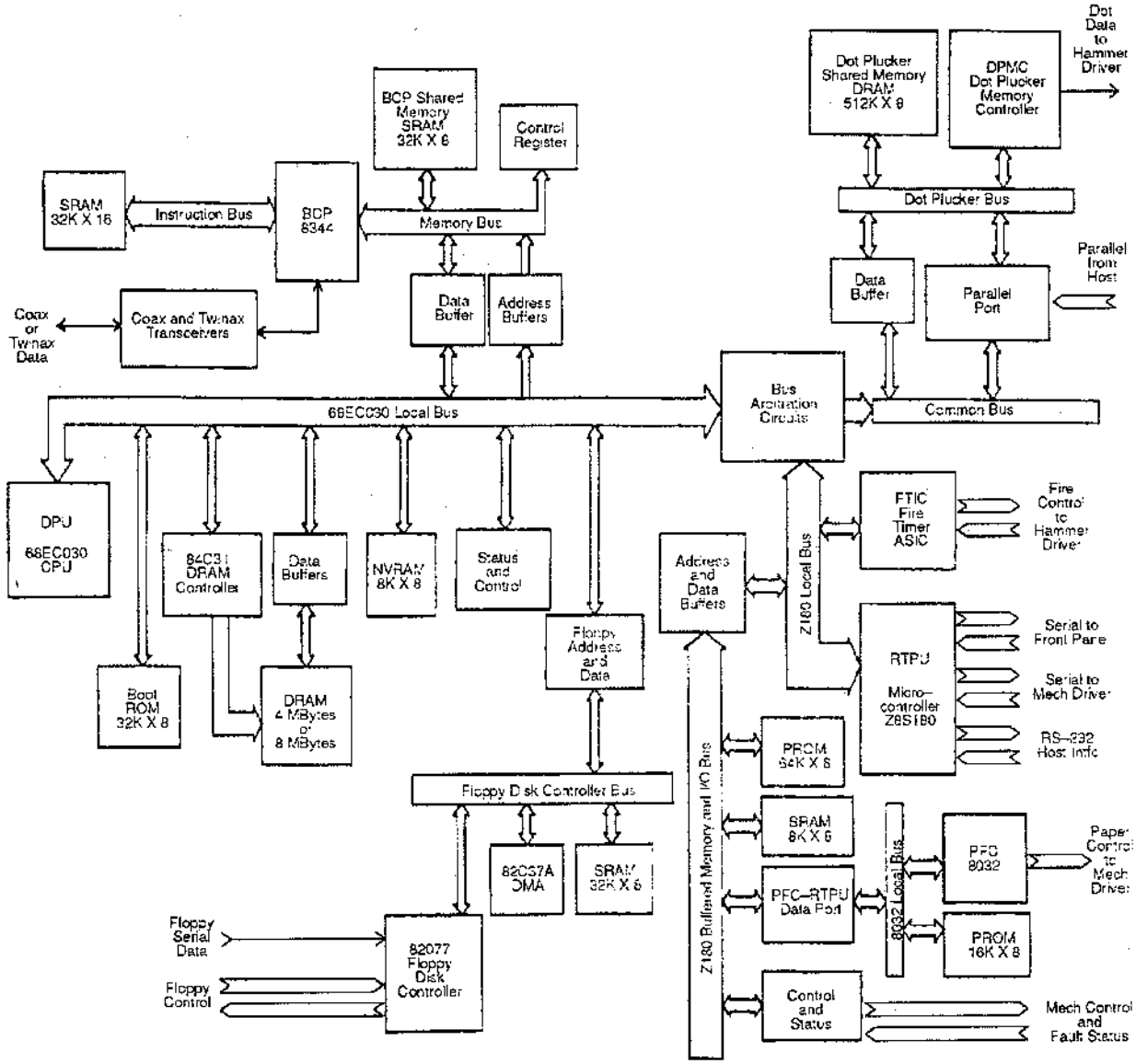


Figure 7–7. Hardware Implementation of the Controller Board

Communicating with the Host Computer

The Z8S180 processor runs both the parallel and serial interfaces.

Host Parallel Input Parallel inputs are nine bits wide, but the Z8S180 direct memory access (DMA) used to make the transfer is only eight bits. Transfer is achieved by having hardware shift the DMA addresses by one bit—effectively multiplying the address by two and changing the DMA's auto–increment from byte to word. Software adjusts the addresses provided to the DMA controller when it is programmed for sixteen bit DMA. This manipulation saves the cost of a separate sixteen bit DMA controller and eliminates the extra clock cycle that would be required if the Z8S180 eight bit DMA were used without this modification.

Host Serial Input Serial communication with the host is done with one of the Z180 processor's internal UARTs. Additional modem control lines are provided in the Z180's control/status register.

IBM Protocol Serial Input Coax and twinax communication is accomplished using a National 8344 Bi–phase Communications Processor (BCP). This is a reduced instruction set (RISC) processor optimized for data communications. The 8344 has external circuitry that conditions data inputs for the processor's analog front end. When data are captured by the 8344, it strips the actual character data from the bit stream and places the data in SRAM to which the 68EC030 (DPU) has access. Access to this memory is arbitrated by a Remote Interface Arbitration System (RIAS) built into the 3844.

Communicating With the Operator

Operator Panel The controller is designed to communicate with the operator panel through the Control Panel ASIC (CPIC), but also supports older discrete IC operator panels. The synchronous serial port in the Z8S180 shifts data in and out of the operator panel. The control register in the RTPU contains three other operator panel bits: one samples the key switches, one strobes the LCD, and one strobes an LED holding register.

Floppy Disk Controller Module The controller board has an on–board floppy disk control module overseen by the DPU.

Printing

Hammer Driver Interface Dot plucking is handled by the Dot Plucker ASIC (DPMC), which runs at 18.432 or 24.576 MHz using the RTPU input clock. The Z8S180 programs the dot plucker ASIC and the FTIC on every dot row, after which the FTIC uses a DMA request line to control the movement of tables from EPROM to FTIC. The second DMA controller in the Z8S180 performs this transfer.

Fire Timing The RTPU programs the FTIC on every shuttle stroke, after which the FTIC uses a DMA request line to control the movement of tables from EPROM to FTIC. The Z180 microprocessor's second DMA does the transfer. The FTIC is synchronized to the RTPU by using the Z180's output clock signal (PHI).

Mechanism Driver Interface The paper feed controller (PFC) directs all paper motion. During printing, it usually moves paper in response to a trigger from the FTIC, which synchronizes paper motion with shuttle motion. The Z8S180 programs the PFC 8032 through an eight bit parallel port between processors at the beginning of each dot row, telling the PFC how far to move when the trigger is received. The PFC sets up for the move, waits, then moves when the trigger occurs. The other method of starting paper motion is with a command passed through the inter–processor parallel port. This results in paper movement that begins immediately. Other paper commands and status signals are also passed between processors through this port.

Ribbon and Shuttle Motion The Z8S180 interfaces through its internal UART to the ribbon / shuttle processor (RSP) on the mechanism driver board. The Z8S180 begins all transactions on the serial interface, so there is a bit in the Z8S180 hardware status register that the RSP sets to tell the Z8S180 when it needs service. The Z8S180 polls this bit regularly; if it is true, the Z8S180 initiates service over the serial interface by asking the RSP what it needs.

Fault Monitoring

The Z180, the PFC 8032, and the RSP monitor different functions for faults. The Z180 looks for hammer driver faults, shuttle stalls, interlock switch openings, fan failure, and paper out. The PFC 8032 monitors the paper out and paper motion detectors. The RSP on the mechanism driver board watches for faults in the motor drive circuits. The PFC and RSP report errors to the Z180, which collates fault status and passes the information to the DPU.

Hammer Faults The Z8S180 and FTIC check the hammer driver and hammer bank for faults on every shuttle stroke. Faults are detected by circuits on the mechanism driver board and relayed to the controller.

Fault circuitry can detect rising temperatures in the coils. One coil is checked on every shuttle stroke; therefore, 49 shuttle strokes are required to check all coils. When the RTPU is notified of a fault, it sends a message to the 68EC030.

The mechanism driver board also continuously monitors for shorts in hammer driver circuits and cables. If it detects currents that can harm the hammer bank, the +48 volt power supply is shut down within 70 milliseconds by "crowbar" circuitry.

Paper Faults The PFC 8032 monitors paper faults and reports them to the Z180 through the eight bit parallel port they share. The PFC works with a friction wheel paper motion detector and a reflective (optical) paper out sensor. The sensors interface directly to the controller board, where analog circuits condition the sensor inputs.

Ribbon and Shuttle Faults The RSP monitors ribbon and shuttle faults and reports them to the Z180 over the serial interface.

Mechanism Driver Board

The mechanism driver board, acting on commands from the controller board, controls real–time operation of the electromechanical printer systems. Functionally, nine subsystems comprise the mechanism driver board:

- An 8032 micro–controller that controls ribbon drive and communication with the controller.
- The interface to the power supply board.
- Pulse–width modulator (PWM) current mode / voltage mode full–bridge power amplifiers connected directly to the shuttle, ribbon, paper feed, and platen open motors. Current mode is used for the paper feed motor, voltage mode is used for the ribbon and shuttle motors.
- The paper feed drive accepts control codes from the paper feed controller (PFC) on the controller for each motor phase to vector–control the paper feed motor.
- The shuttle drive controller receives speed commands from the controller through the 8032 micro–controller and commands the speed of the three–phase DC shuttle motor.
- The ribbon drive controller, based around the 8032 micro–controller, receives speed commands from the controller board and drives two DC stepper motors, regulating the speed and tension of the ribbon and monitoring the end of ribbon sensors.
- For reverse paper feed, the RTPU commands the ribbon and shuttle processor (RSP) to open and close the platen with the platen open motor.
- Fault detection circuitry samples and senses heat sink temperature, ribbon speed, shuttle speed, hammer driver circuitry, hammer bank coil temperatures, power supply voltages, and fault communication with the controller.
- Circuitry that registers magnetic pick–up unit (MPU) output, processes it for the logic interface, and sends it to the controller for timing hammer fire.

Ribbon Drive System

The ribbon drive system is controlled by the 8032 micro–controller. The controller sends commands to the 8032 to start and stop the ribbon, set the ribbon speed, and apply slack or tension to the ribbon. The real–time control functions are done by the 8032, acting in accordance with firmware control

algorithms and look–up tables. The 8032 communicates with an ASIC to provide direct digital PWM drive signals for the ribbon motor PWM amplifier. The 8032 drives the ribbon motors through PWM generators in the mechanism driver integrated circuit (MDIC). Nearly all mechanical control functions are carried out through the MDIC ASIC. Digital input/output is done through latches connected to the 8032 I/O ports and MDIC. The ribbon stall error message is generated when the drag motor does not turn as expected. Ribbon faults are passed to the controller board.

Ribbon Velocity

One motor is driven; the other motor is not driven and applies tension to the ribbon through its drag circuitry. Ribbon velocity is controlled by means of a closed–loop system that first measures the speed of the two ribbon drive motors. The velocity of the driven motor is known, while the velocity of the tensioning motor is measured by converting the zero crossing of the back–EMF signal to a digital pulse signal. This signal is processed by the 8032 to determine the radius of the ribbon on the take–up reel. The processor monitors this information and adjusts the velocity of the driven motor to maintain constant linear speed. The roles of the two motors reverse at the end of ribbon travel, when a metallic strip crosses the ribbon guide of the emptying reel and closes a circuit that causes the RSP to reverse motor functions.

The four PWM amplifiers in the ribbon drive system are voltage mode (as opposed to current mode) to aid in system damping. The 8032 input to the PWM amplifiers maintains a constant voltage/frequency ratio at the motor. The ribbon drive is protected from over current.

Ribbon Tension

The 8032 processor regulates tension in three discrete steps by using information gathered by the zero–crossing circuitry and ribbon information. Tension is adjusted by controlling the load on the drag motor back EMF. This load generates drag torque on the ribbon hub that maintains tension.

Start / Stop Ribbon

The ribbon motors are started and stopped by a digital signal from the controller. When a stop signal is received, the ribbon is locked to maintain tension. If the controller sends a slack signal, the PWM amplifiers are tri–stated.

Shuttle Drive System

The shuttle drive system is an analog closed–loop speed controller that accepts commands from the controller through the 8032 micro–controller and MDIC ASIC. The controller writes a word to the 8032, which in turn writes a word to the MDIC. The MDIC generates a clock signal based on this word.

The clock signal from the MDIC is the reference input to a phase detector. The other input to the phase detector is a logical combination of the pulses from three Hall–effect sensors in the brushless three–phase DC shuttle motor. The Hall–effect sensors are mounted to the motor stator 120 electrical degrees phase–shifted from each other. The phase detector is both a phase and frequency detector. It operates as a frequency detector when out of lock, and as a phase detector when the loop is phase–locked. During shuttle start, the frequency error from the phase frequency detector drives the servo system towards phase lock. At approximately 85% of final speed, the servo integrator resets to prevent overshoot. When the correct speed is reached, the system is in phase lock with the MDIC clock signal.

The shuttle is protected from overspeed, over current, missing Hall–effect sensors, and out–of–sync Hall–effect sensors.

Paper Feed System

Dot row advance and slew tables are stored on the controller board. The paper feed drive circuit takes commands directly from the controller to control the two–phase DC paper feed stepper motor. A paper feed command is a digital word containing a value proportional to the desired current level in the paper feed motor, enabling the motor to be quarter–stepped. Two PWM current mode amplifiers, protected against overloads and short circuits, drive the paper feed motor. In order to maintain the position of the paper, it must be kept under tension. To do this, the controller keeps the paper feed motor energized whenever printer power is on. During a fault condition (platen open, paper jam, etc.), this "holding current" is reduced to 5% of its normal value.

Reverse Paper Feed System

In order to reverse paper motion, the printer must open the platen, move the paper backwards vertically, close the platen, and remove the slack in the paper. A platen open or close command is generated on the controller board and communicated to the RSP 8032 processor. The RSP generates control and step clock signals for the platen driver circuitry. The platen driver circuitry is connected to a stepper motor that drives the platen through a toothed belt. The platen motor is only energized during the open and close cycles. The platen driver is protected from overcurrent.

Magnetic Pick–up Unit (MPU)

The magnetic pick–up unit (MPU) is mounted next to the shuttle motor flywheel. It provides timing information to the hammer fire controller by way of the controller. The rotation of the flywheel generates a pulse signal in the MPU. The output frequency is 100 times the shaft frequency of the shuttle motor. The MPU pulse train has one missing pulse in every revolution of the motor for indexing. The incoming signal from the MPU is processed with a zero–crossing detecting circuit to produce a clean signal, compatible with system logic. The clean signal is then sent directly to the controller.

Power Supply Board

The power supply is contained on a printed circuit board mounted in the card cage. The power supply senses and adjusts to any commercial electrical system that provides AC mains potential in 50 or 60 Hertz systems.

The power supply converts alternating current (AC) input power to direct current (DC) power and sends it to the mechanism driver and controller backplane boards for distribution to logic and electromechanical circuits.

AC Power

The power supply operates on AC voltages ranging from 86 to 264 V. It can tolerate variations in frequency of 47 to 62 Hz. The power supply is designed to withstand an AC input overvoltage of 300 VAC for one second with no degradation of DC output voltage or damage to printer circuits.

DC Power

The power supply PCBA contains two DC power supply systems for the printer. The first is a + 5 V bus for logic. The second consists of + 48 V and + 9.5 V buses for the electromechanical sections of the printer (that is, all drive motors and the hammer bank).

The maximum total continuous average DC load is 346 W. The + 5 V supply has a separate return line. Both returns are tied together in a single–point ground.

There is an opto–isolated input on the power supply that will shut down and latch off the + 48 V and + 9.5 V supplies unless it is pulled up to 5V with a 1K Ω resistor. This resistor is mounted on the mech driver board and may be pulled down or disconnected by mech driver hardware, controller board software, or internal cable interlocks. The + 5 V output will remain stable for reporting and latching the fault condition. The return for this signal is the + 5 V return. In addition, this shutdown circuit discharges and latches the + 48 V down to a level lower than 15 V in less than 200 milliseconds and requires recycling of the circuit breaker (On/Off switch) to reset the latch.

The + 5 V power supply has its own inverter, separate from the + 48 V and + 9.5 V outputs.

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

Printing Mechanism

The printing mechanism consists of the shuttle frame assembly, the ribbon transport system, and the paper transport system.

Shuttle Frame Assembly

Dots are printed by 47 hammer springs. Seven comb–like assemblies called frets, each fret containing seven hammer springs, are mounted on the hammer bank. Using 49 hammers balances the magnetic field characteristics of the hammer bank, while design parameters determine the use of 47 hammers for printing. (The first and 49th hammers are broken off so they cannot print.) The frets mount to the hammer bank on alignment pins, eliminating the need for individual hammer alignment. Figure 7–8 shows the shuttle frame assembly.

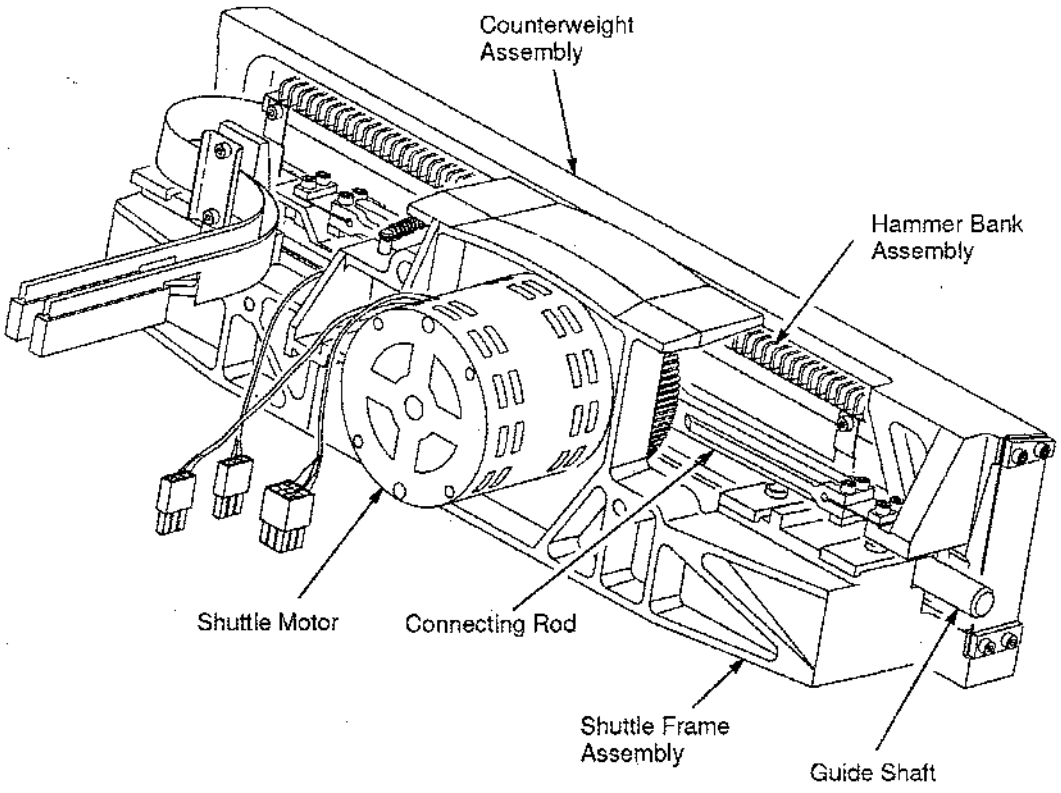


Figure 7–8. Shuttle Frame Assembly

Each hammer spring is a stiff leaf spring with a cylindrical, tungsten carbide tip on the free end. (See Figure 7–9.) A permanent magnet runs the length of the hammer bank and acts on the hammer springs through individual pole pieces. The pole pieces magnetically attract and hold the free end of the hammer spring under tension. This is called the retracted state.

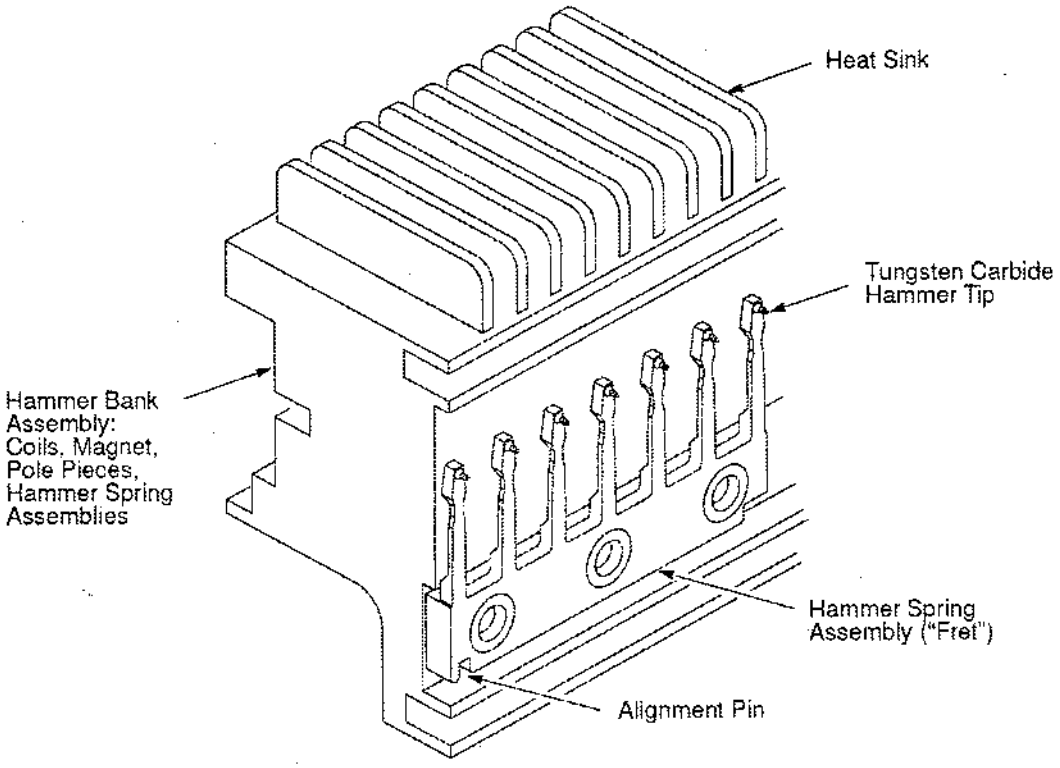


Figure 7–9. Hammer Springs and Hammer Bank (Detail)

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

The coil is de–energized and its field collapses while the hammer is in flight. After striking the ribbon and paper, the hammer rebounds and the permanent magnet recaptures it.

Every text character is stored in memory as a pattern of dots on a logical grid called the dot matrix. Printer logic divides every printable line into horizontal

dot rows. The hammer springs put dots at the required positions for the entire line by striking a moving ink ribbon and the paper.

When the shuttle reaches the end of a sweep, it reverses direction, the paper is advanced one dot row, and the hammer springs print the next row of dots as the shuttle sweeps in the opposite direction. After a line of characters is printed, hammer action stops and the paper advances to the first dot row of the next print line. (See Figure 7–10.)

The dot patterns of characters vary according to the character set and font the user selects. The number of dot rows allowed for line separation depends on the vertical line spacing the user selects.

Figure 7–11 shows how each individual hammer spring forms characters as the shuttle scans horizontally.

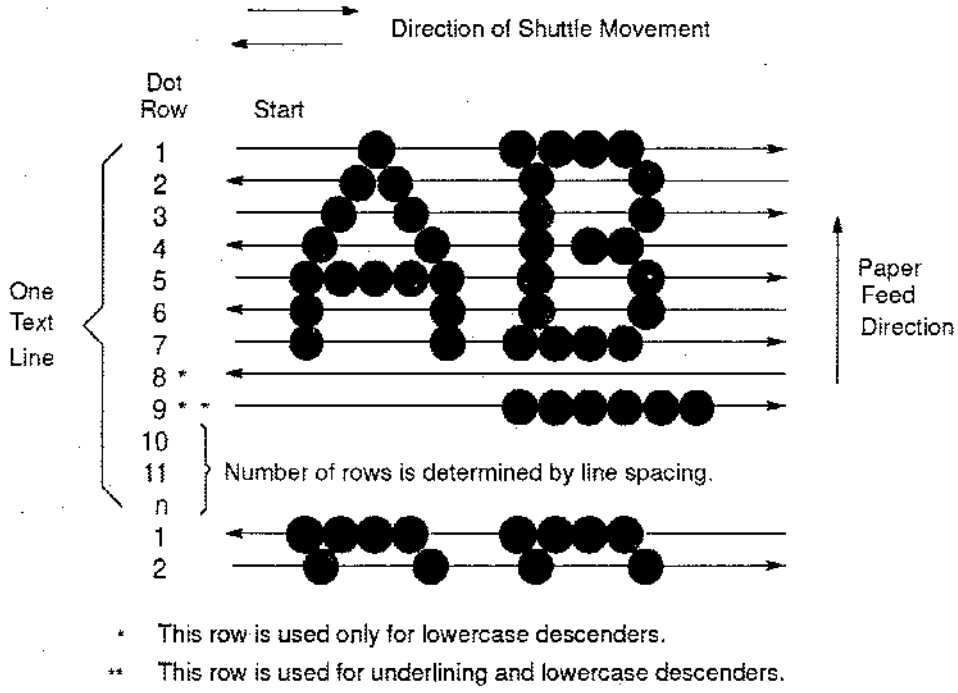


Figure 7–10. Standard Character Formation

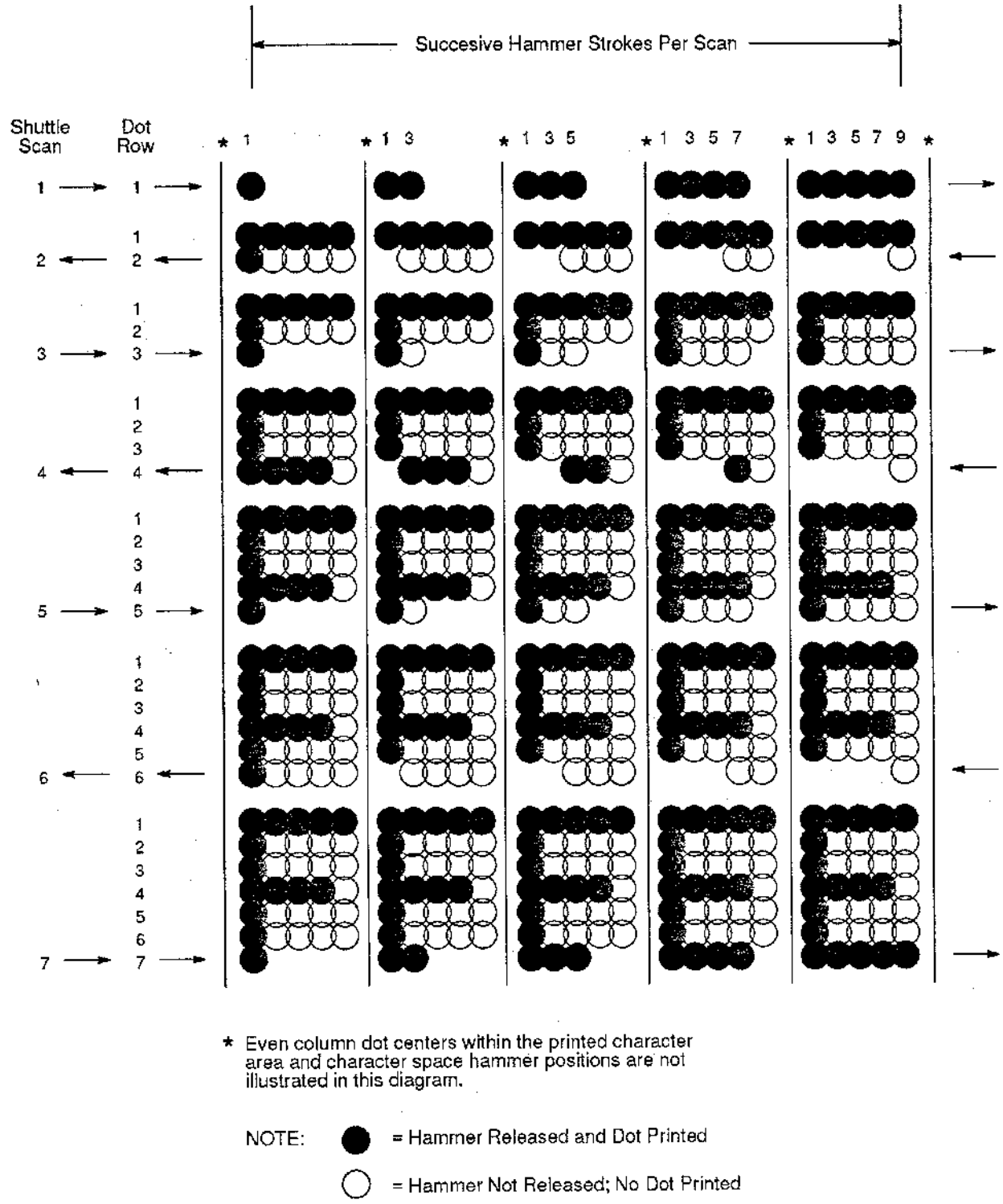


Figure 7–11. Action of One Hammer Spring in Text Printing

Paper Transport System

The paper transport system accepts continuous, fan–folded, edge–perforated paper from three to 16 inches wide and from one to six sheets thick. Horizontal positioning is provided by the horizontal adjustment knob and two tractors. The tractors are laterally adjustable along the splined shaft and tractor support shaft. Each tractor engages paper perforations with six pins and locks in place with a friction lock. During printing, the tractors are driven by the splined shaft, which is belt–driven by the paper feed drive motor. The paper feed drive motor is a two–phase step motor controlled by the paper feed sections of the mechanism driver board and the paper feed controller on the common controller board.

Paper may be manually advanced with the vertical adjustment knob.

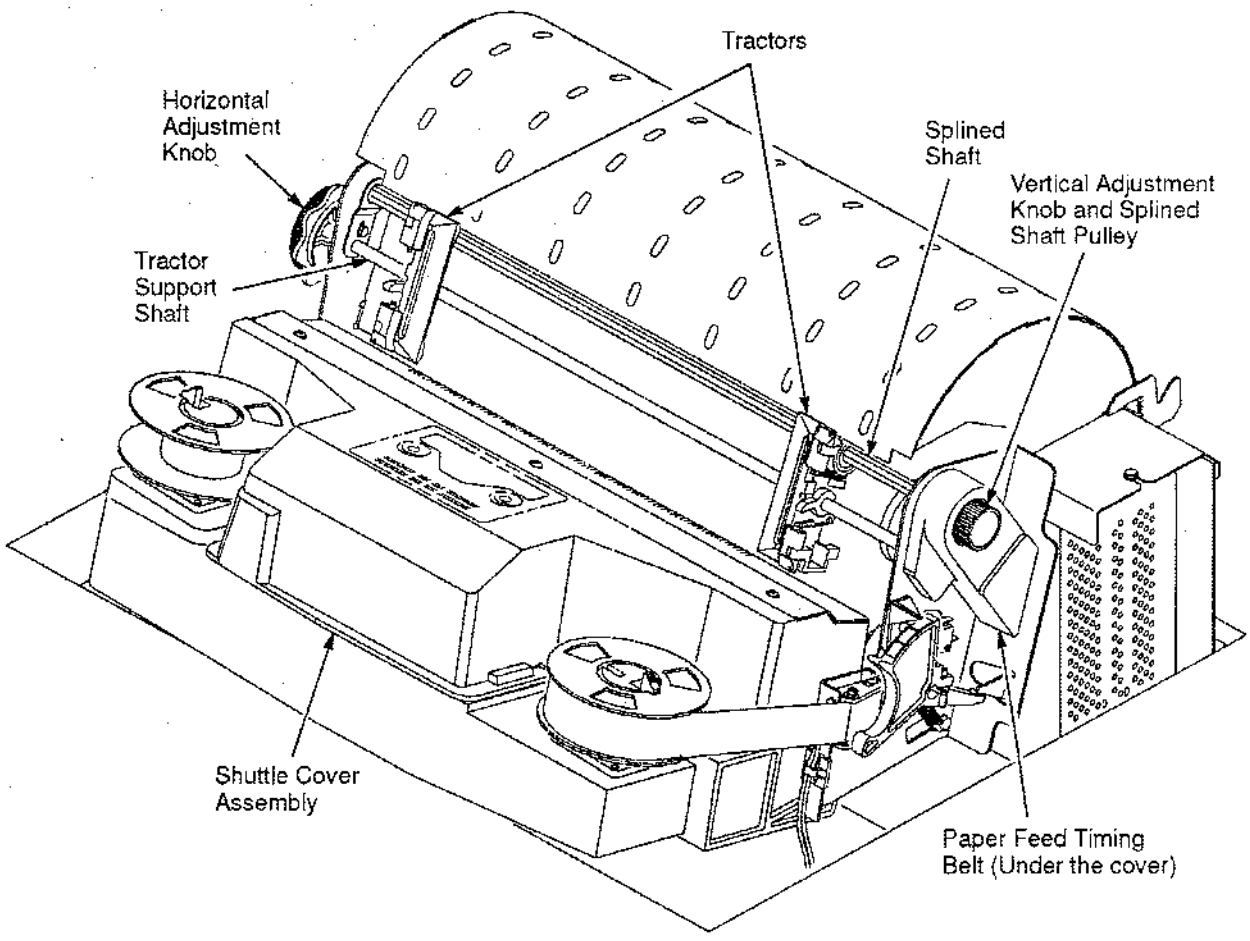


Figure 7–12. Paper Transport System

Ribbon Transport System

The printer ribbon winds and unwinds continuously on a pair of spools latched to hubs which are driven by the ribbon motors. The ribbon motors operate only while the hammer bank assembly is running. Ribbon motion reverses when the metal strip at either end of the ribbon crosses the left or right ribbon guide, completing a circuit that causes both motors to reverse direction.

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

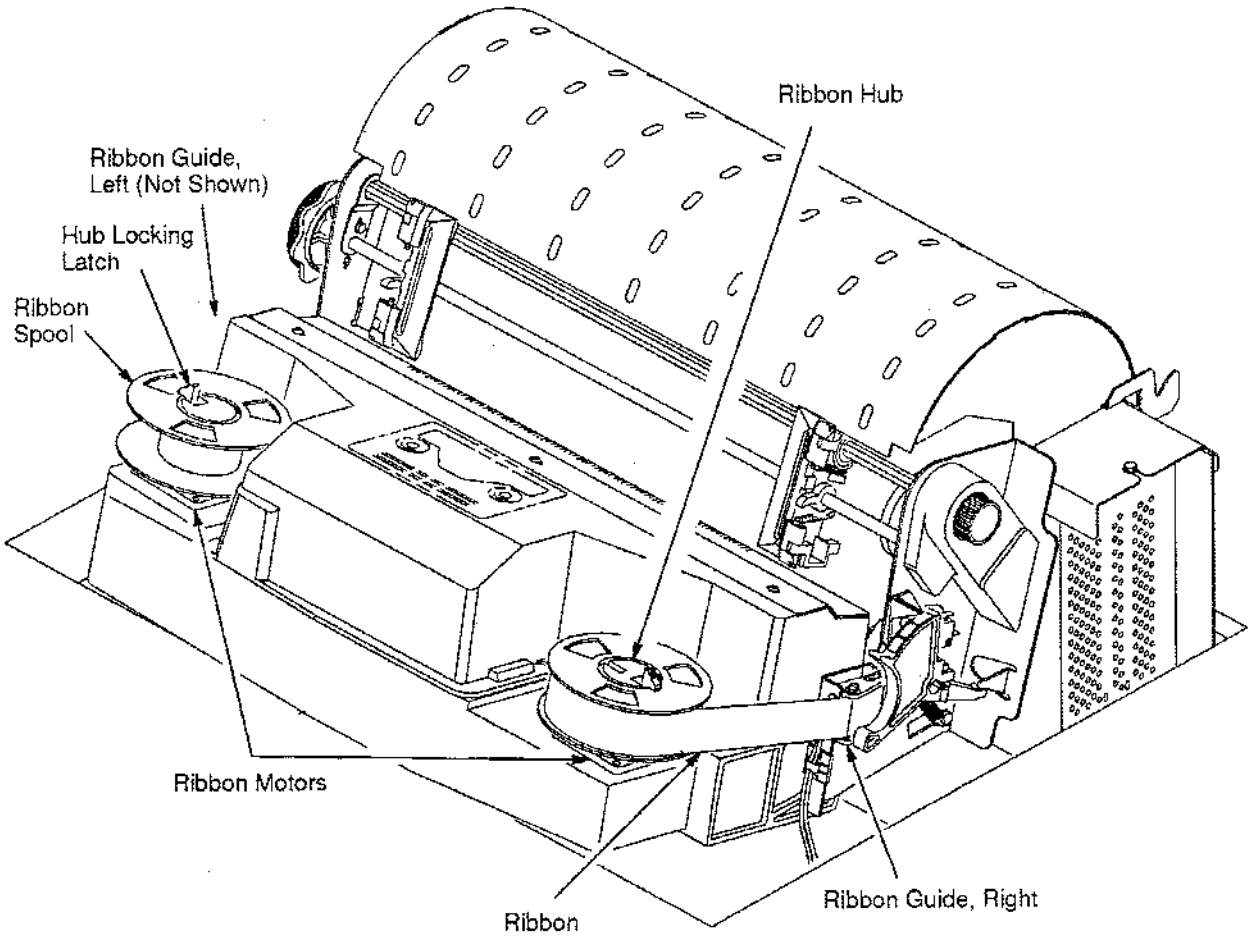


Figure 7–13. Ribbon Transport System

Printer Interface and the IGP

The printer interface is the point where the data line from the host computer plugs into the printer. The printer interface, which processes all signals and data to and from the host computer, consists of a printed circuit board assembly and cable connector(s) for the data line.

Parallel and Serial Interface

The IBM 6408–CTA printer is equipped with buffered PC parallel, Dataproducts parallel, EIA–232–D serial, and EIA–422–A interfaces mounted on a single interface plate. These interfaces accept data in the U.S. ASCII protocol.

Only one of these interfaces can be used at a time, and is selected via operator panel configuration. Only one parallel host computer can be connected at a time.

Coax / Twinax Interface

The coax/twinax interface connectors enable the printer to emulate IBM 5225 Models 1, 2, 3, and 4 and 4234 Model 2 printers. The printer can be attached directly to an IBM network. These interfaces are also selected via operator panel configuration.

IBM data and protocols are processed by the Bi–phase Communication Processor (BCP) on the controller board, then sent to shared memory.

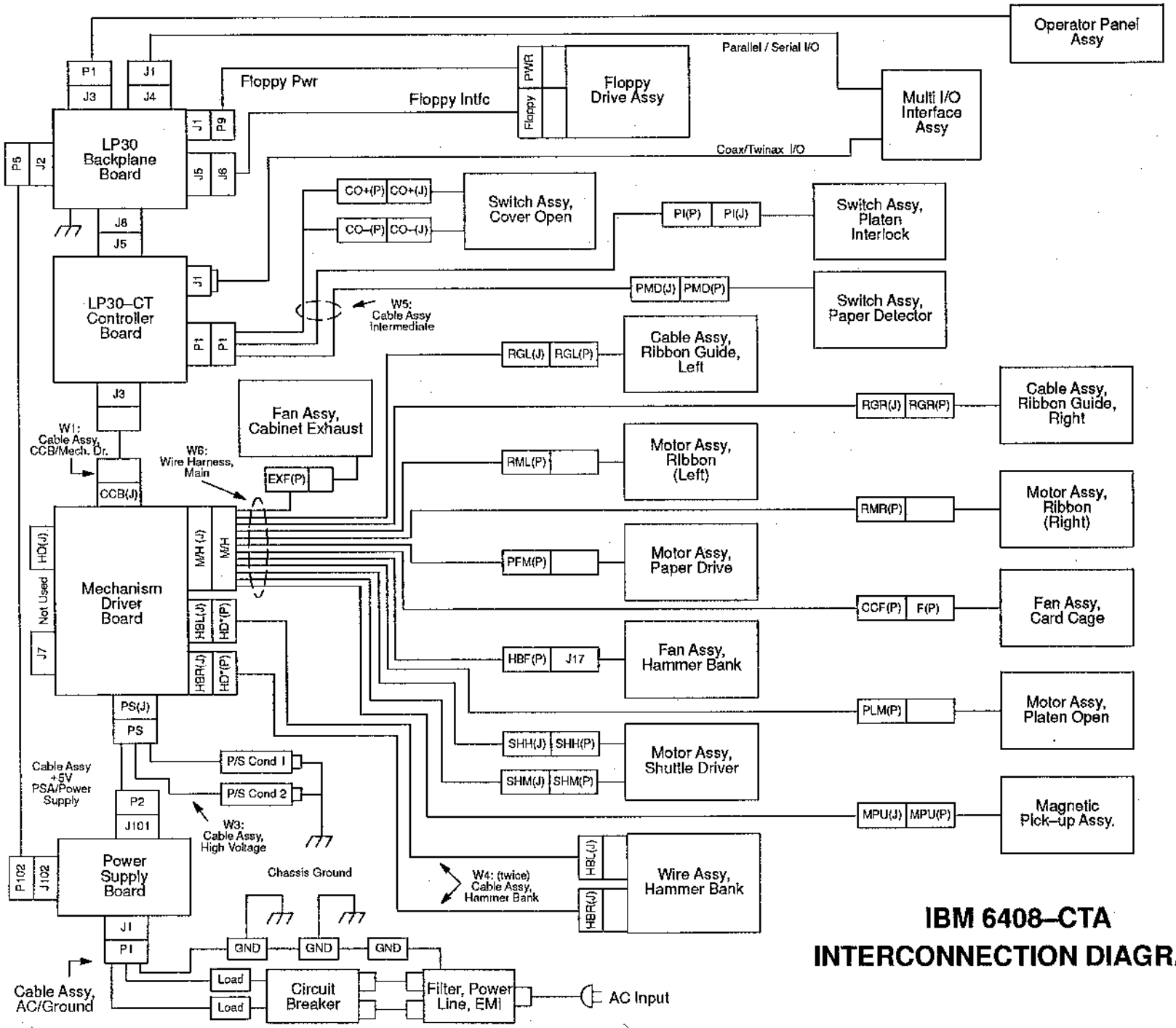
Intelligent Graphics Processor (IGP)

The Intelligent Graphics Processor (IGP) is a graphics protocol included on the controller board.

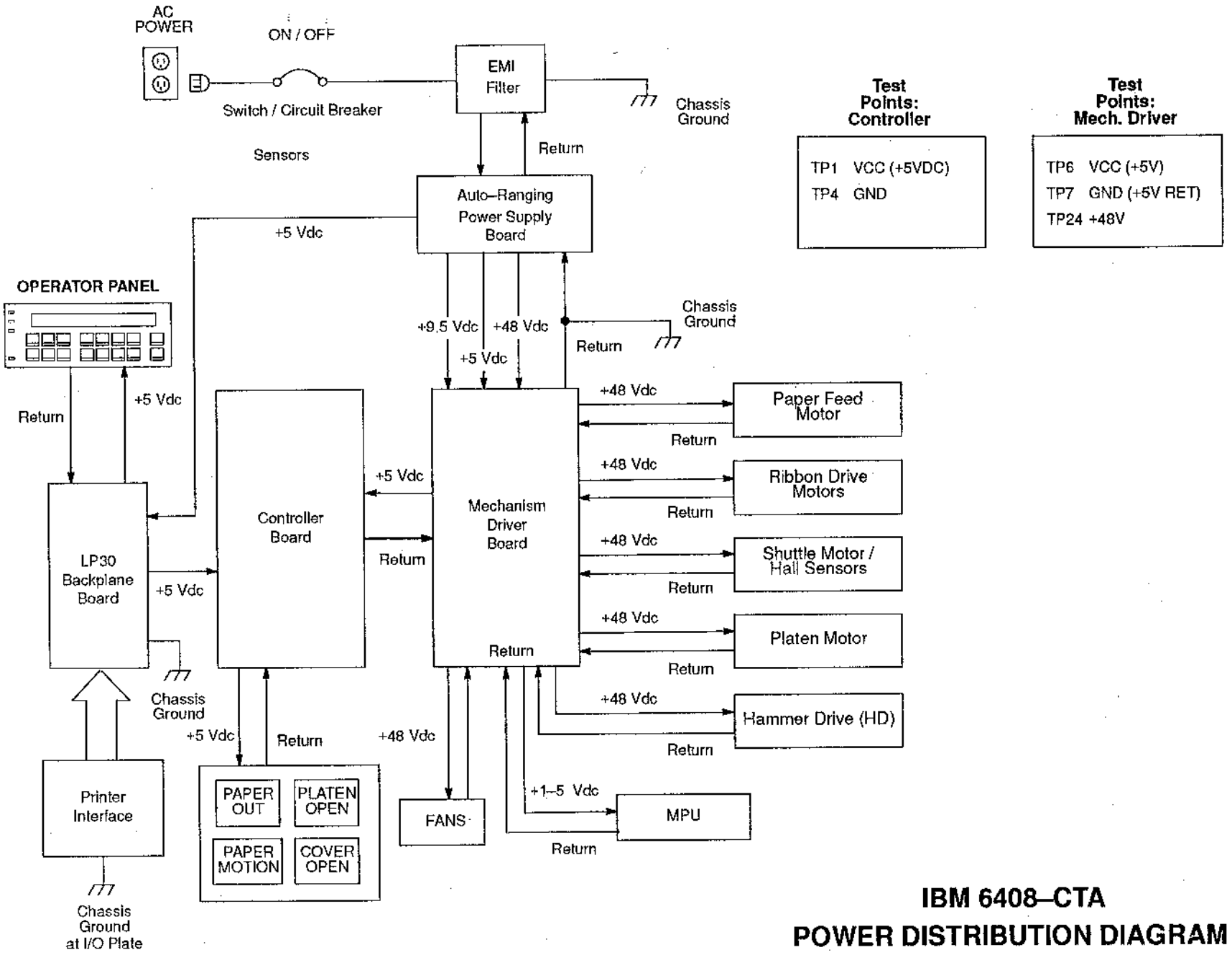
Using a simple programming language, the user can create forms, bar codes, logos, expanded characters, and other graphics. The IGP enables the printer to print sideways, upside down, and make forms combining graphics, alphanumeric data, and bar codes, all in a single pass. Documents explaining configuration, operation, and programming are included with the printer.

A Wire Data

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

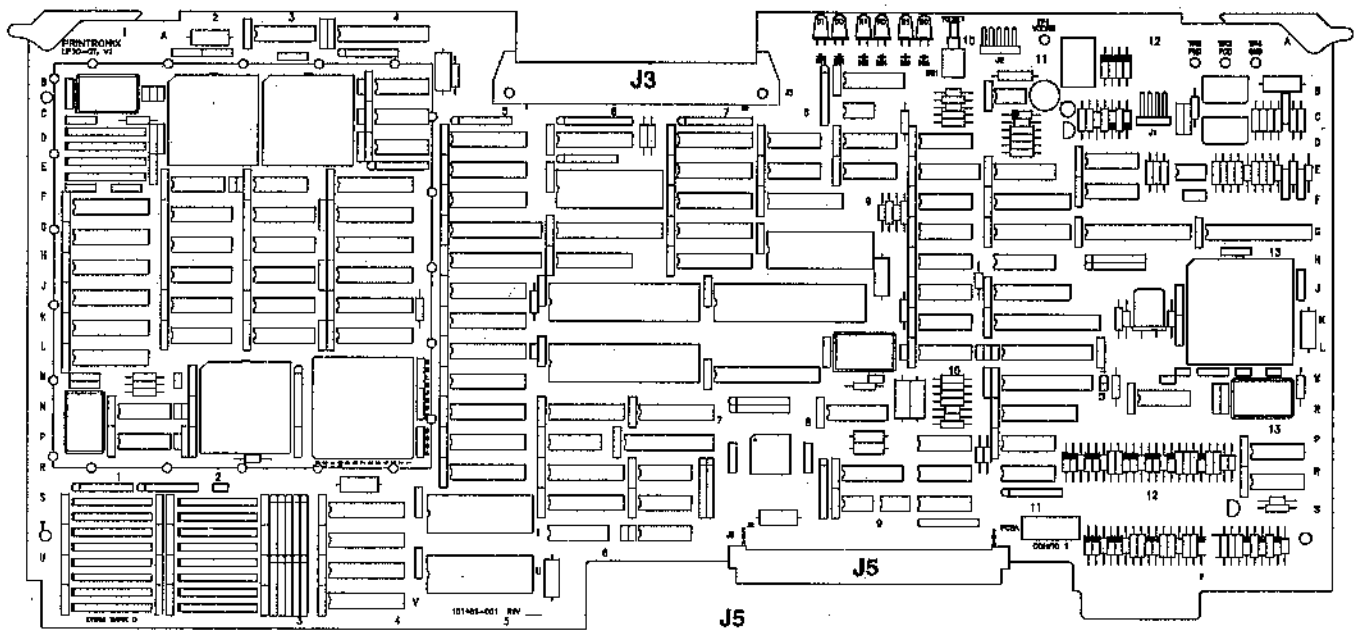


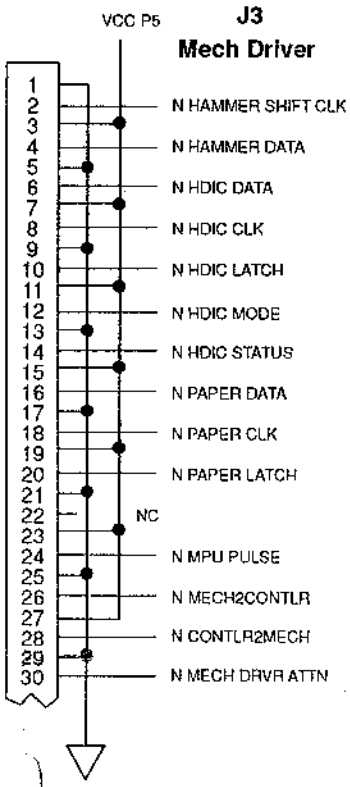
IBM 6408–CTA
INTERCONNECTION DIAGRAM

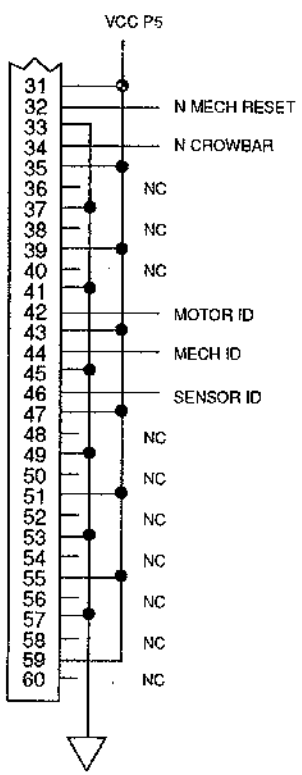


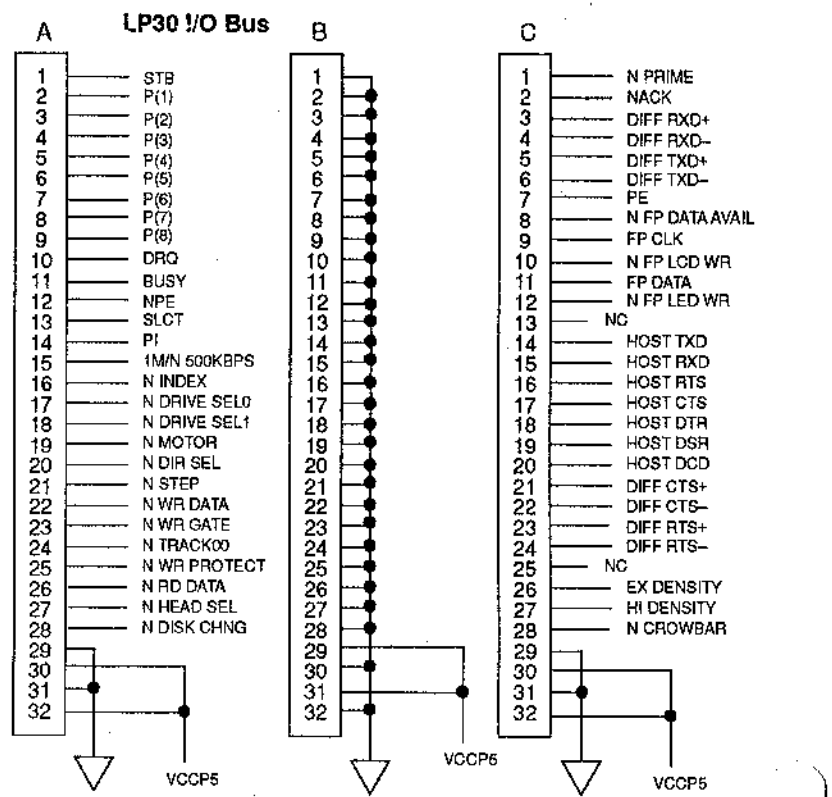
IBM 6408–CTA
POWER DISTRIBUTION DIAGRAM

Controller, LP30–CT
57G1768

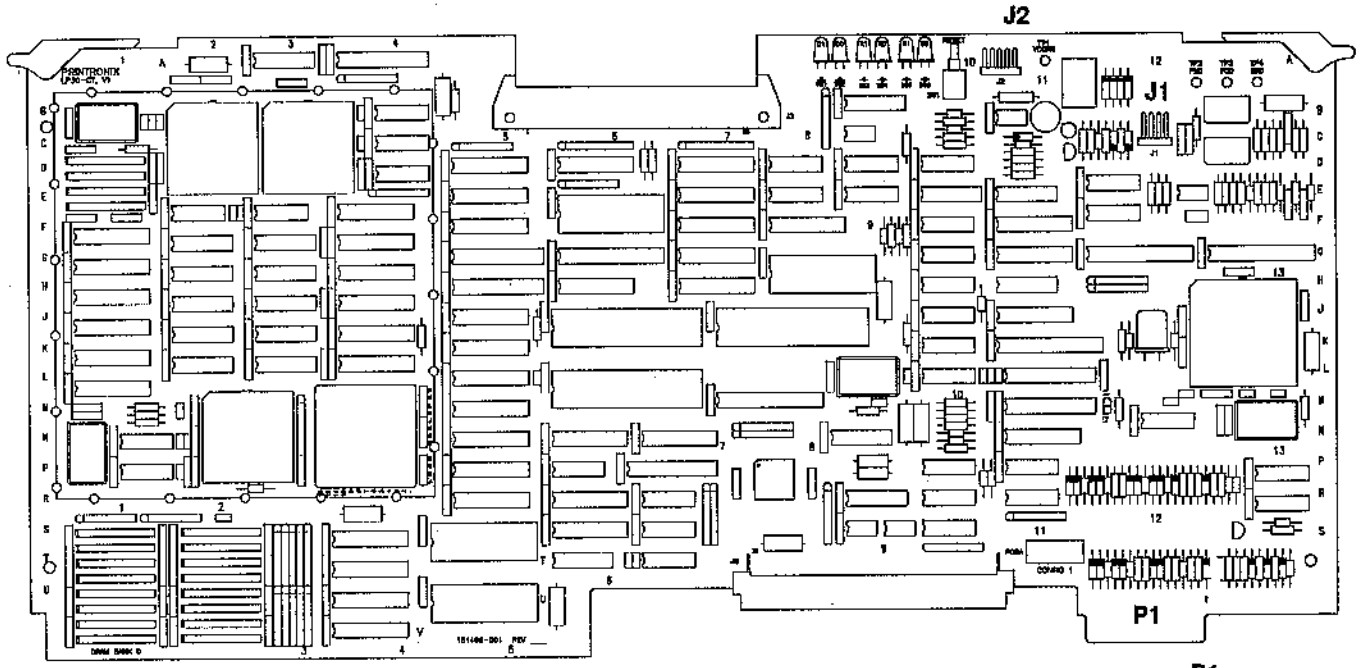




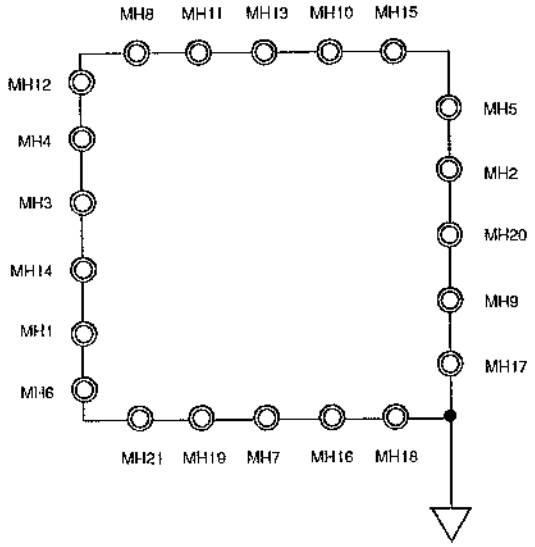




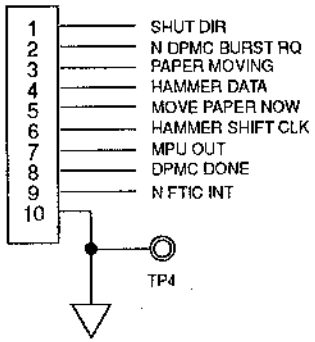
Controller, LP30–CT
57G1768



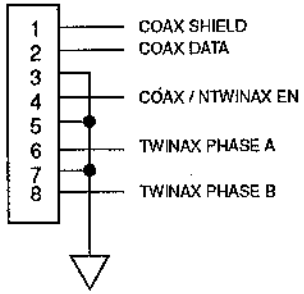
RFI Fence Mounting Holes



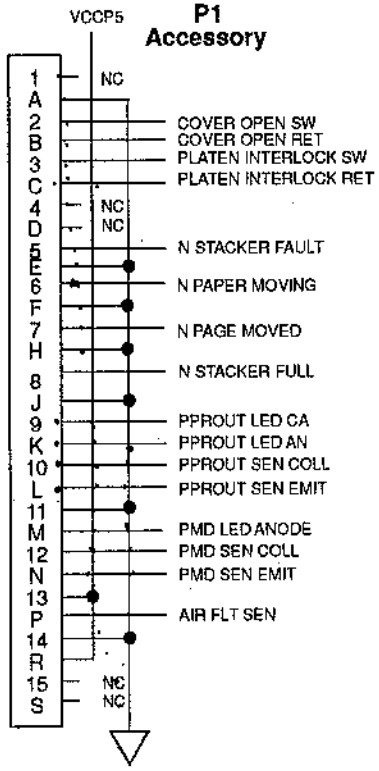
J2 Test Points



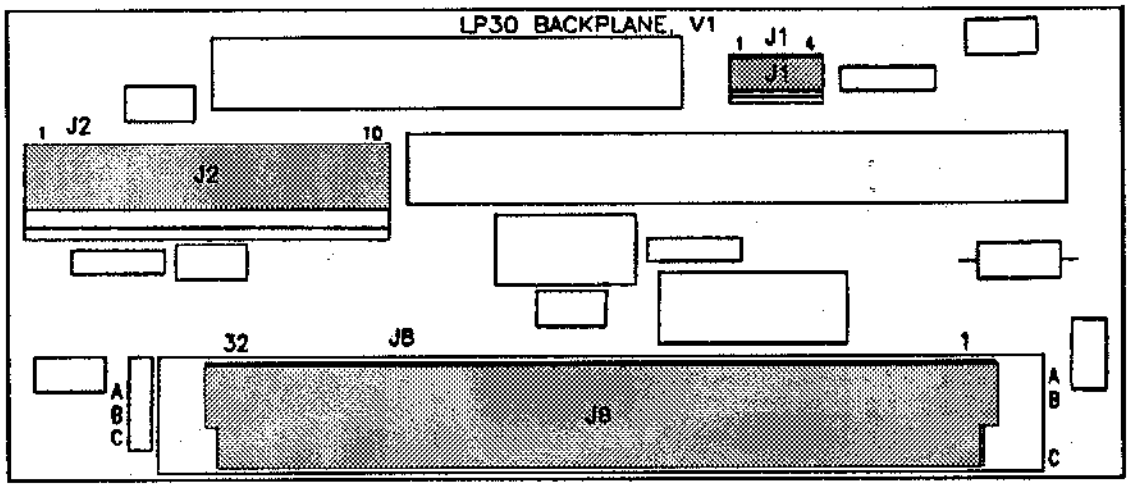
J1 Coax/Twinax I/O



P1 Accessory



LP30 Backplane, V1
57G1769



J8
Controller Board

A		B		C	
1	STB	1		1	N PRIME
2	P(1)	2		2	NACK
3	P(2)	3		3	DIAG TXD
4	P(3)	4		4	DIAG DCD
5	P(4)	5		5	DIAG CTS
6	P(5)	6		6	DIAG DSR
7	P(6)	7		7	PE
8	P(7)	8		8	N FP SWITCH RD
9	P(8)	9		9	FP CLK
10	DRQ	10		10	N FP LCD WR
11	BUSY	11		11	FP DATA
12	NPE	12		12	N FP LED WR
13	SLCT	13		13	HOST REV CHNL
14	PI	14		14	HOST TXD
15	1M/N 500KBPS	15		15	HOST RXD
16	N INDEX	16		16	HOST RTS
17	N DRIVE SEL0	17		17	HOST CTS
18	N DRIVE SEL1	18		18	HOST DTR
19	N MOTOR	19		19	HOST DSR
20	N DIR SEL	20		20	HOST DCD
21	N STEP	21		21	DIAG RXD
22	N WR DATA	22		22	DIAG RTS
23	N WR GATE	23		23	DIAG DTR
24	N TRACK00	24		24	NC
25	N WR PROTECT	25		25	NC
26	N RD DATA	26		26	EX DENSITY
27	N HEAD SEL	27		27	NC
28	N DISK CHNG	28		28	N CROWBAR
29		29		29	
30		30		30	
31		31		31	
32	VCC P5	32	VCC P5	32	VCC P5

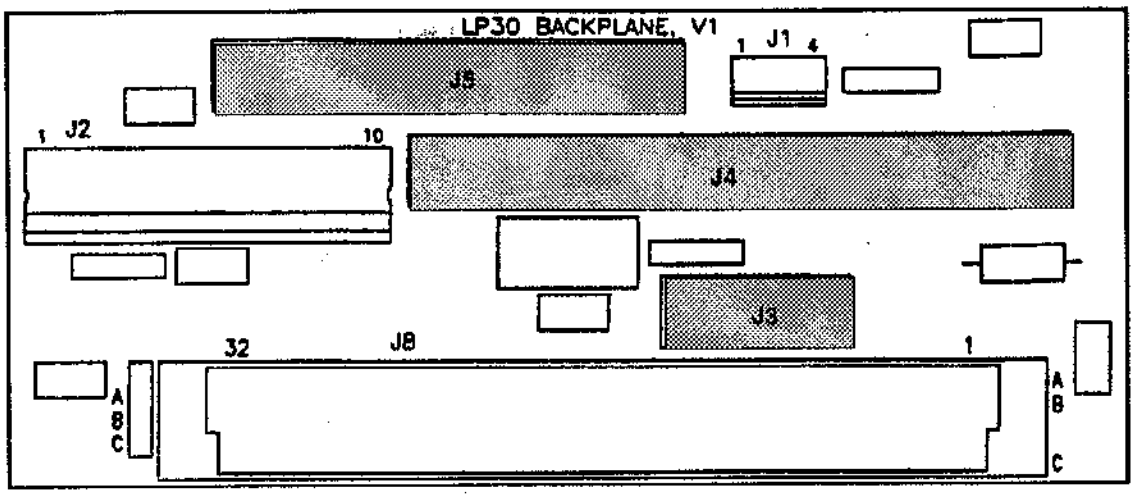
J2
Main Power

N CROWBAR	
1	VCC P5
2	VCC P5
3	VCC P5
4	
5	CHASSIS GND
6	
7	
8	
9	SENSE RET
10	5V SENSE

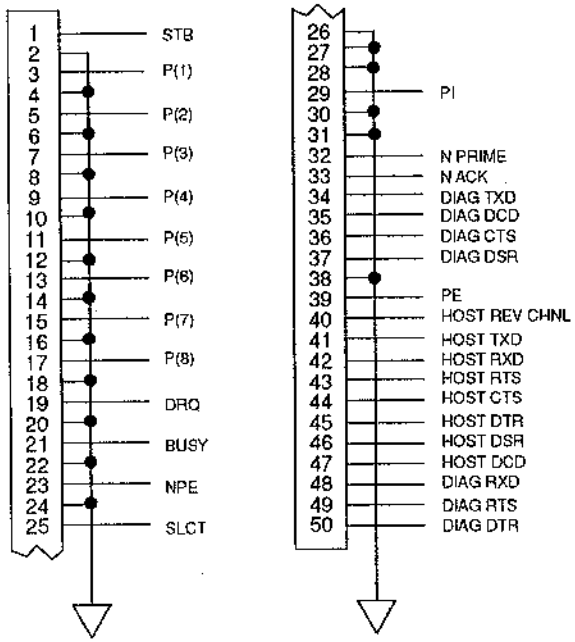
J1
Floppy
Power

1	
2	
3	NC
4	NC

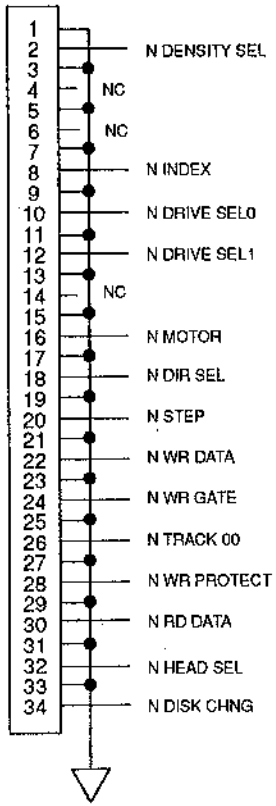
LP30 Backplane, V1
57G1769



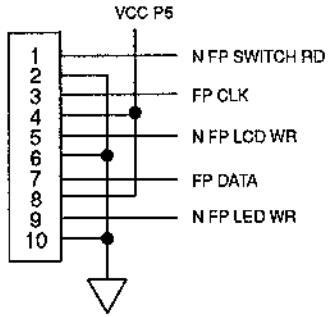
J4
Multi I/O

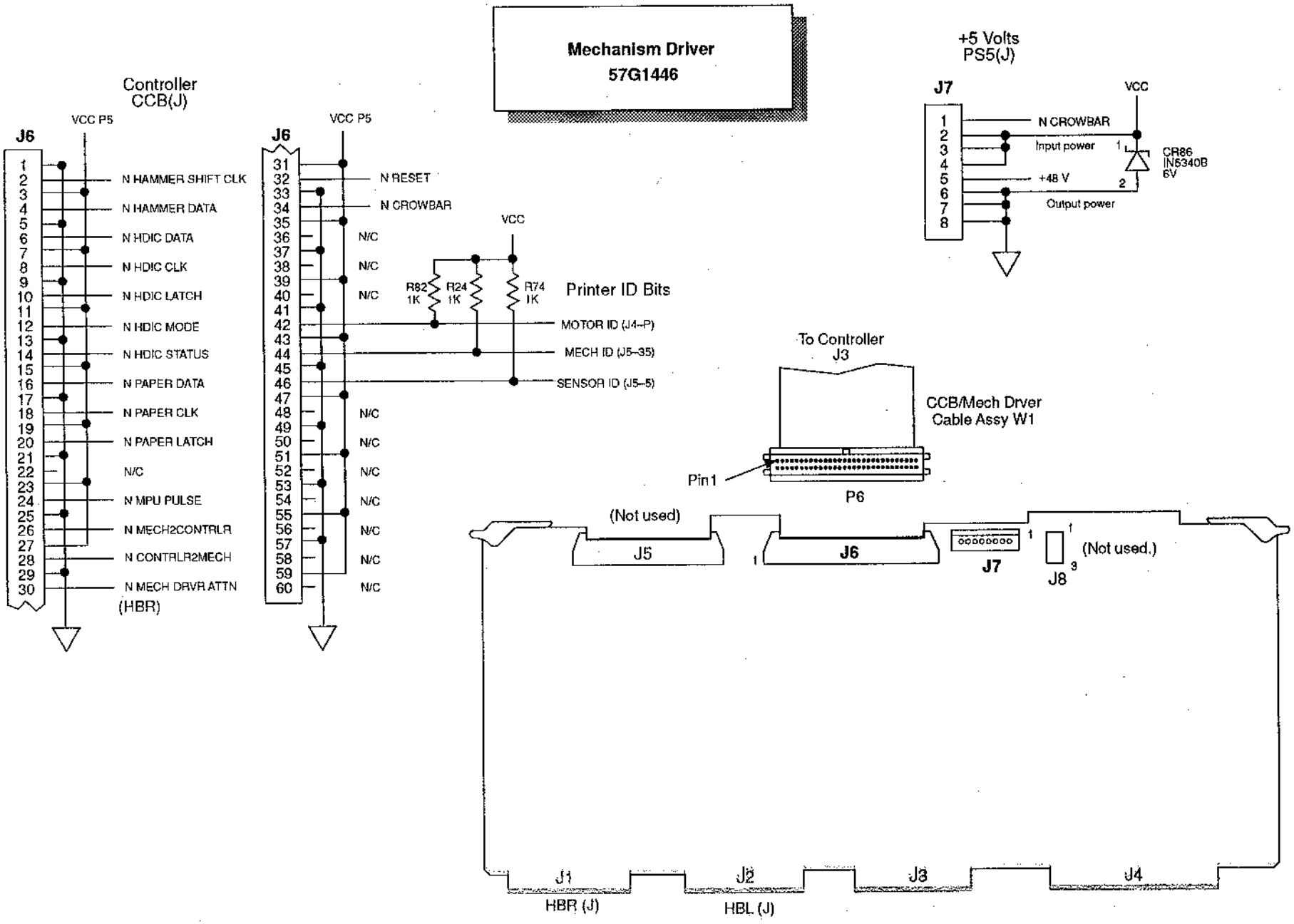


J5
Floppy

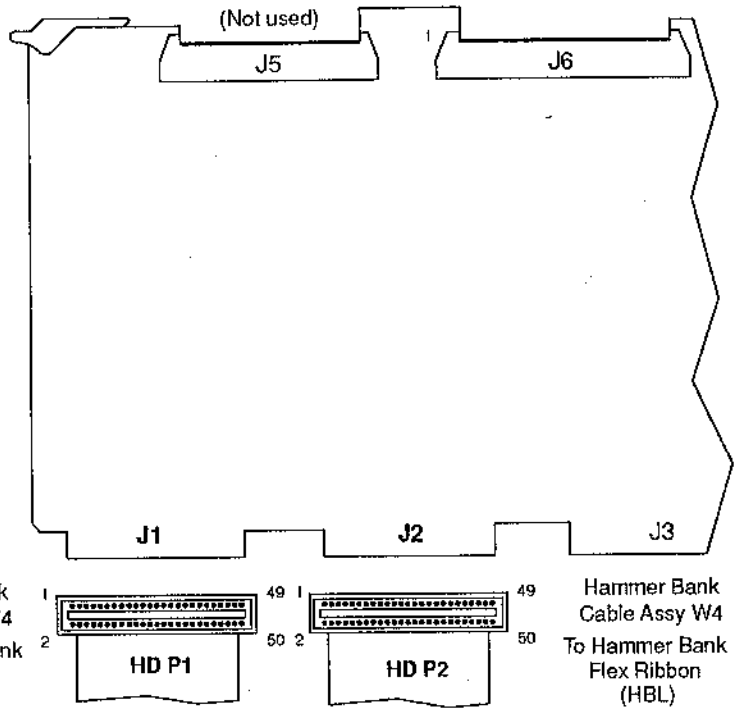


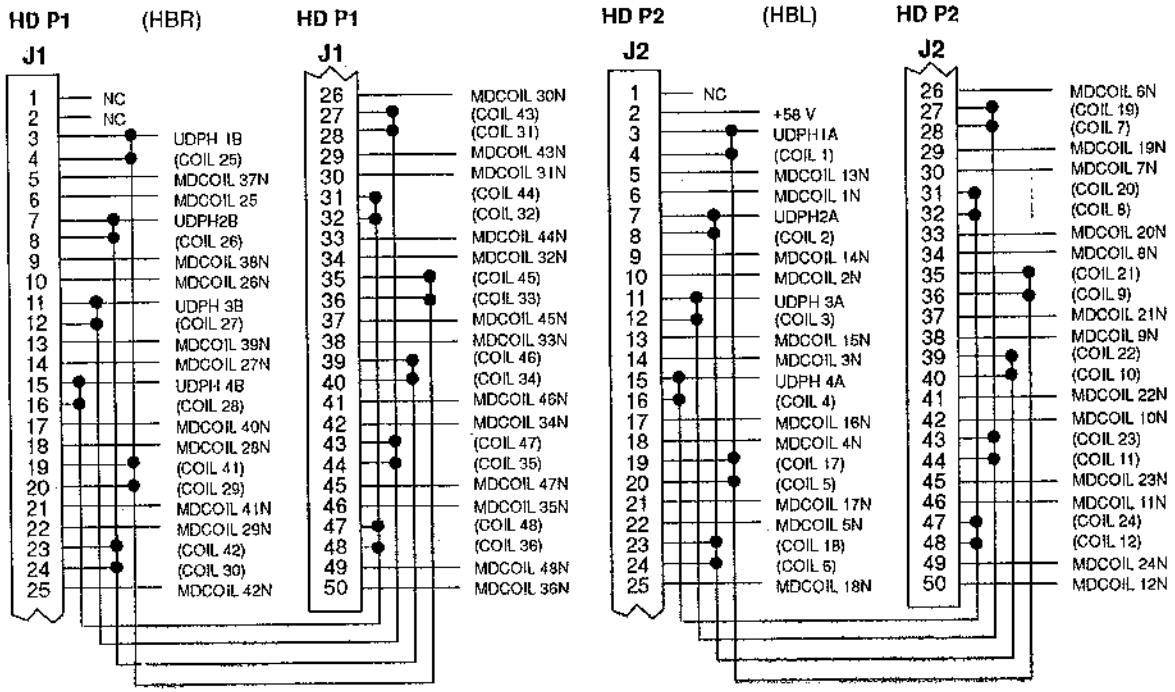
J3
Operator Panel

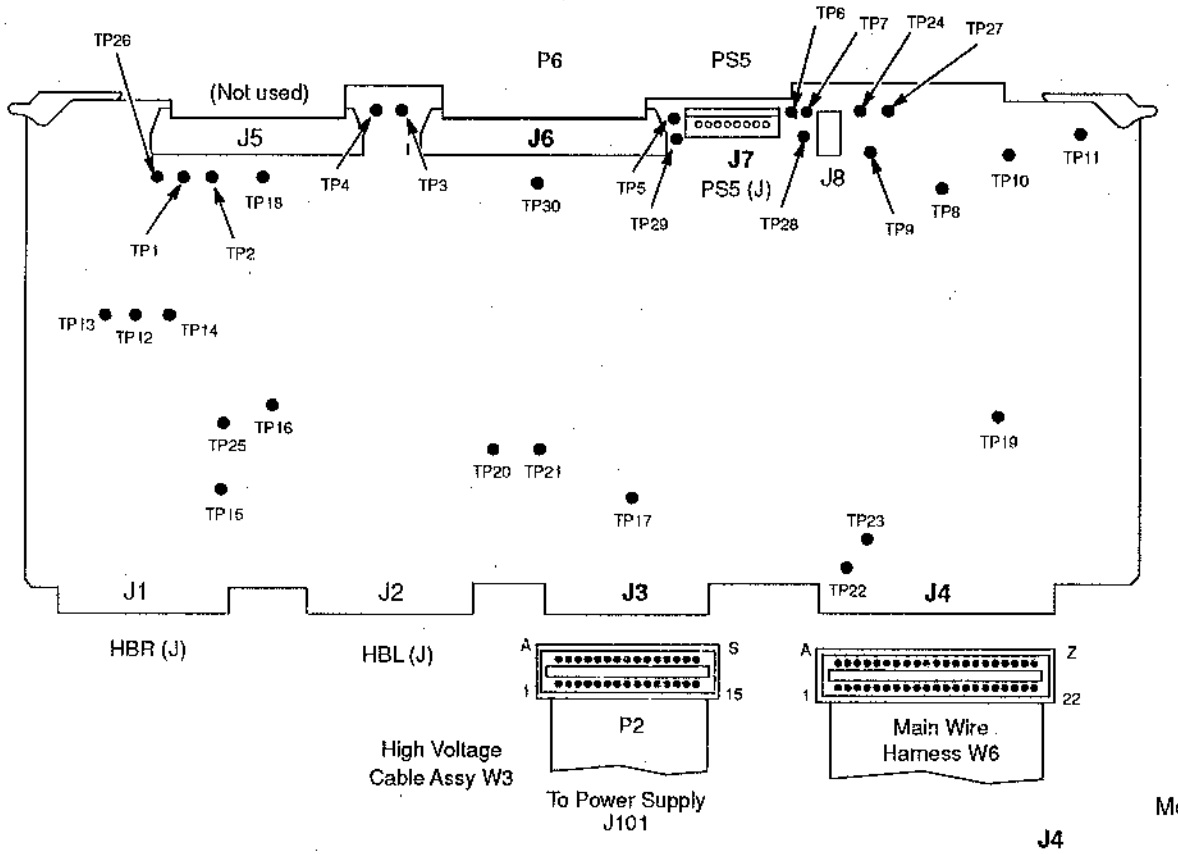



Mechanism Driver
57G1446
Controller
CCB(J)
J6
VCC P5
1 N HAMMER SHIFT CLK
2 N HAMMER DATA
3 N HDIC DATA
4 N HDIC CLK
5 N HDIC LATCH
6 N HDIC MODE
7 N HDIC STATUS
8 N PAPER DATA
9 N PAPER CLK
10 N PAPER LATCH
11 N/C
12 N MPU PULSE
13 N MECH2CONTRLR
14 N CONTRLR2MECH
15 N MECH DRVR ATTN
(HBR)
J6
VCC P5
31 N RESET
32 N CROWBAR
33 N/C
34 N/C
35 N/C
36 N/C
37 N/C
38 N/C
39 N/C
40 N/C
41 N/C
42 N/C
43 N/C
44 N/C
45 N/C
46 N/C
47 N/C
48 N/C
49 N/C
50 N/C
51 N/C
52 N/C
53 N/C
54 N/C
55 N/C
56 N/C
57 N/C
58 N/C
59 N/C
60 N/C
VCC
R82 1K
R24 1K
R74 1K
Printer ID Bits
MOTOR ID (J4–P)
MECH ID (J5–35)
SENSOR ID (J5–5)
+5 Volts
PS5(J)
J7
VCC
1 N CROWBAR
2 Input power
3
4
5 +48 V
6 Output power
7
8
CR86
IN5340B
6V
To Controller
J3
CCB/Mech Drver
Cable Assy W1
Pin1
P6
(Not used)
J5
J6
J7
J8
(Not used.)
J1
HBR (J)
J2
HBL (J)
J3
J4

Mechanism Driver
57G1446





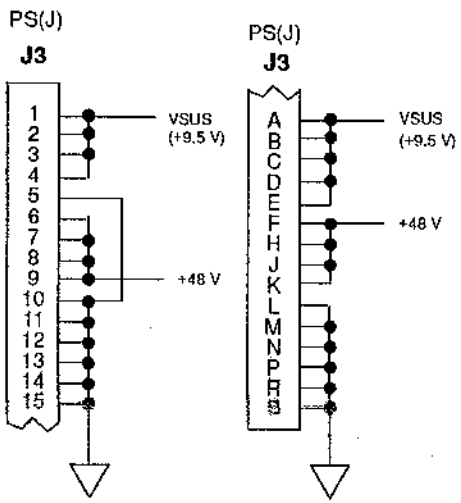


Mechanism Driver
57G1446

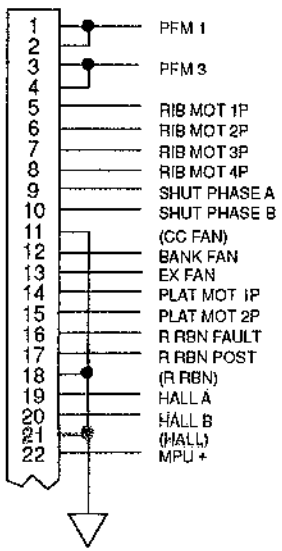
Test Points: Mech. Driver

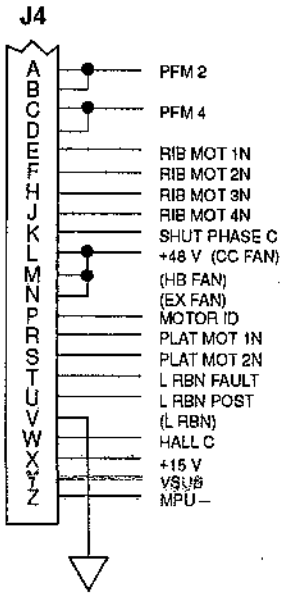
TP1	PAPER B AMPLITUDE
TP2	PAPER A AMPLITUDE
TP3	PAPER B CURRENT
TP4	PAPER A CURRENT
TP5	N MPU PULSE
TP6	VCC (+5V)
TP7	GND (+5V RET)
TP8	SHUT CLK
TP9	SHUT SPEED
TP10	SHUT ERR
TP11	HALL CLK
TP12	GND (PAPER FEED)
TP13	N COIL TEST
TP14	N SHORT
TP15	GND (HAMMER PWR)
TP16	COIL TEMP
TP17	+58V
TP18	N FAIL SAFE
TP19	GND (SHUTTLE)
TP20	PFM1
TP21	PFM2
TP22	PFM3
TP23	PFM4
TP24	+48V
TP25	+9.5V
TP26	+15V
TP27	+42V
TP28	N CROWBAR
TP29	N MD RESET
TP30	N FAULT

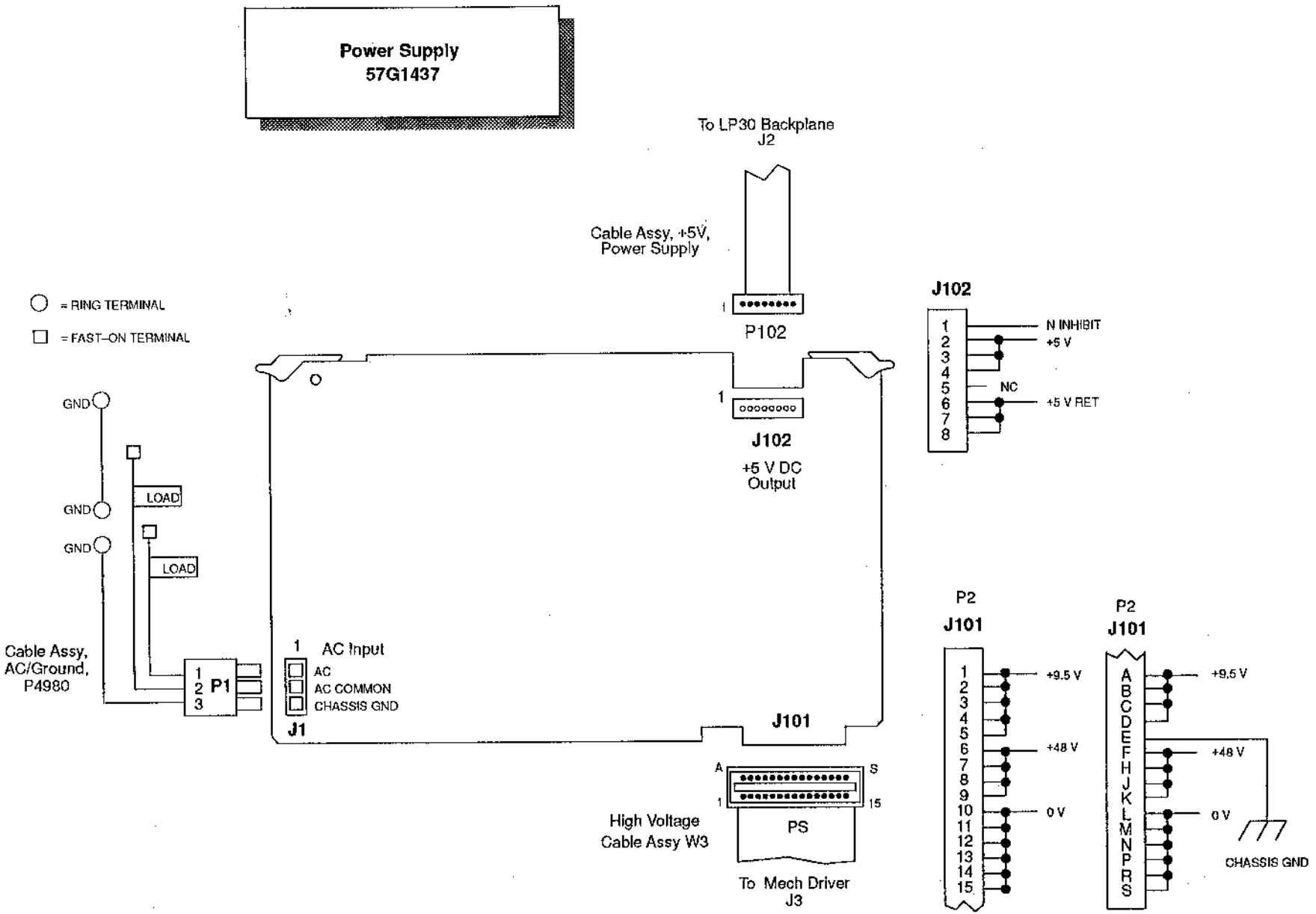
Main Power



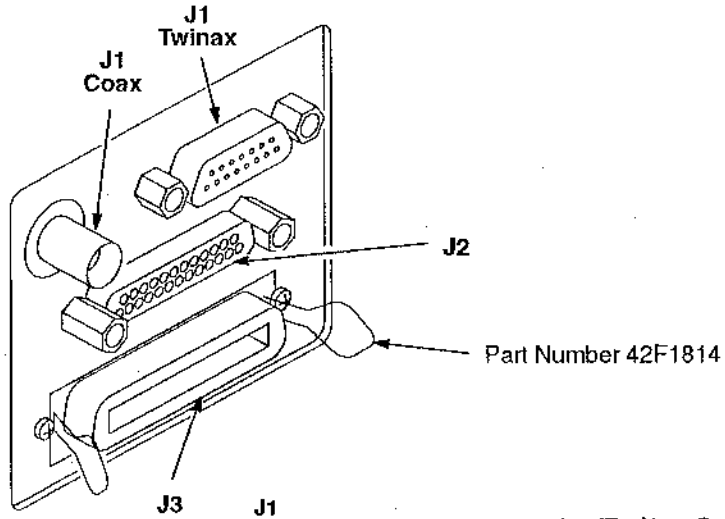
Motor/Sensor MH(J)

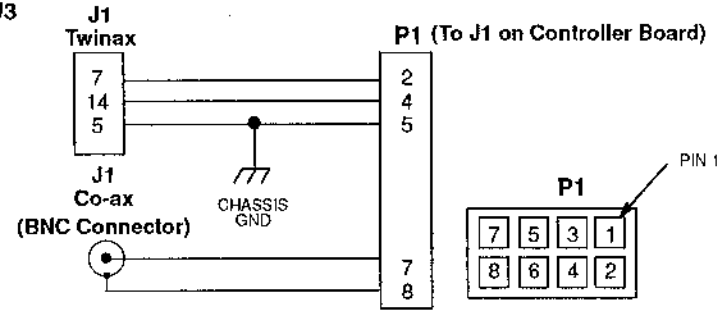


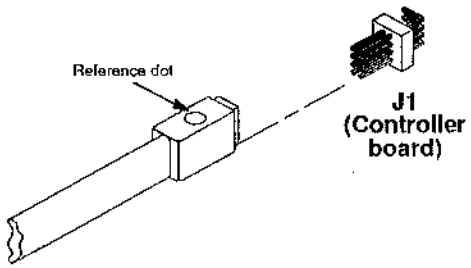



Power Supply
57G1437
To LP30 Backplane
J2
Cable Assy, +5V,
Power Supply
P102
J102
+5 V DC
Output
J102
1 N INHIBIT
2 +5 V
3
4
5 NC
6 +5 V RET
7
8
= RING TERMINAL
= FAST–ON TERMINAL
GND
GND
GND
LOAD
LOAD
Cable Assy,
AC/Ground,
P4980
P1
1 AC Input
AC
AC COMMON
CHASSIS GND
J1
J101
High Voltage
Cable Assy W3
PS
To Mech Driver
J3
P2
J101
1 +9.5 V
2
3
4
5
6 +48 V
7
8
9
10 0 V
11
12
13
14
15
P2
J101
A +9.5 V
B
C
D
E
F
H
J
K
L +48 V
M
N
P
R
S 0 V
CHASSIS GND

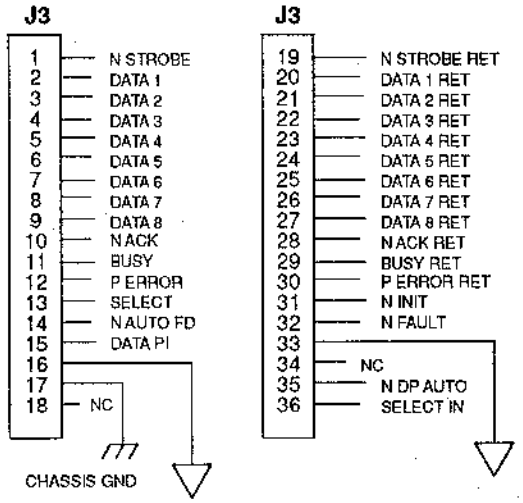
Multi-I/O Assembly
14H7231



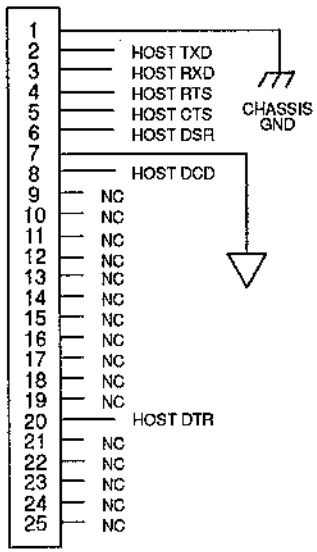




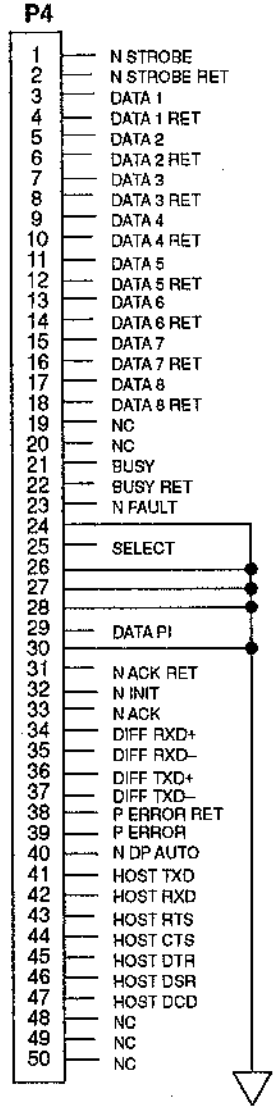
PC Parallel

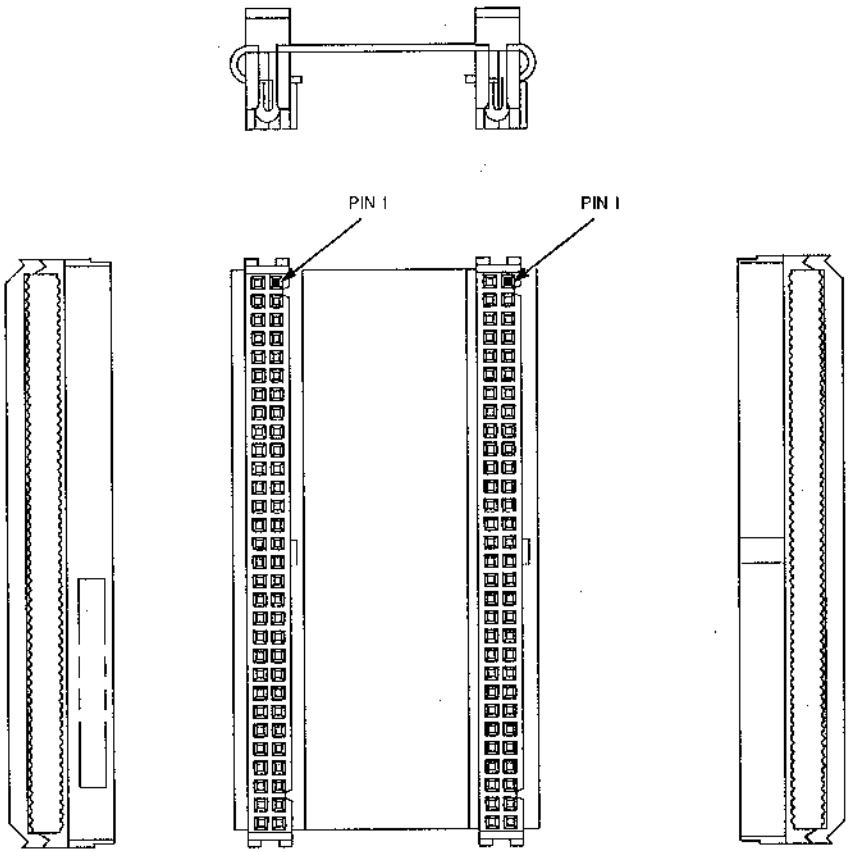


Serial

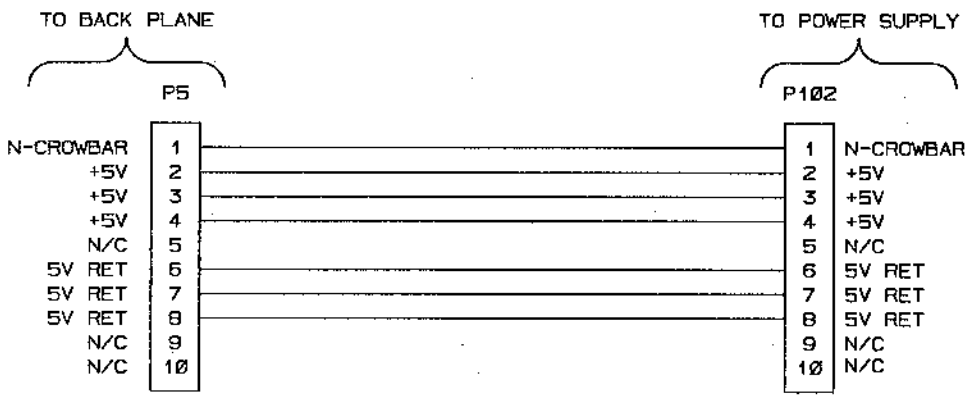


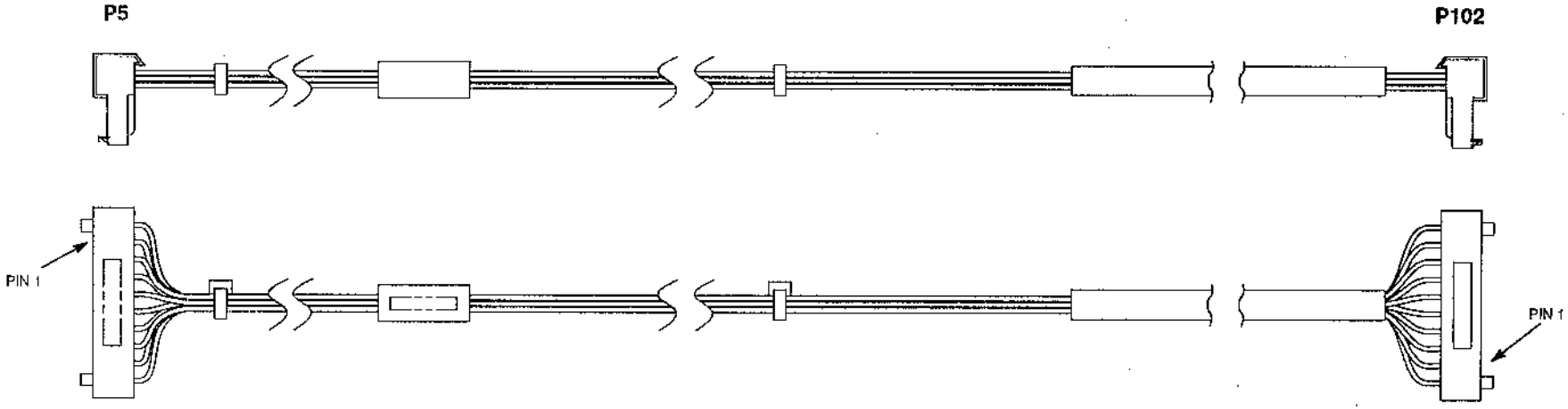
(To J4 on Backplane)



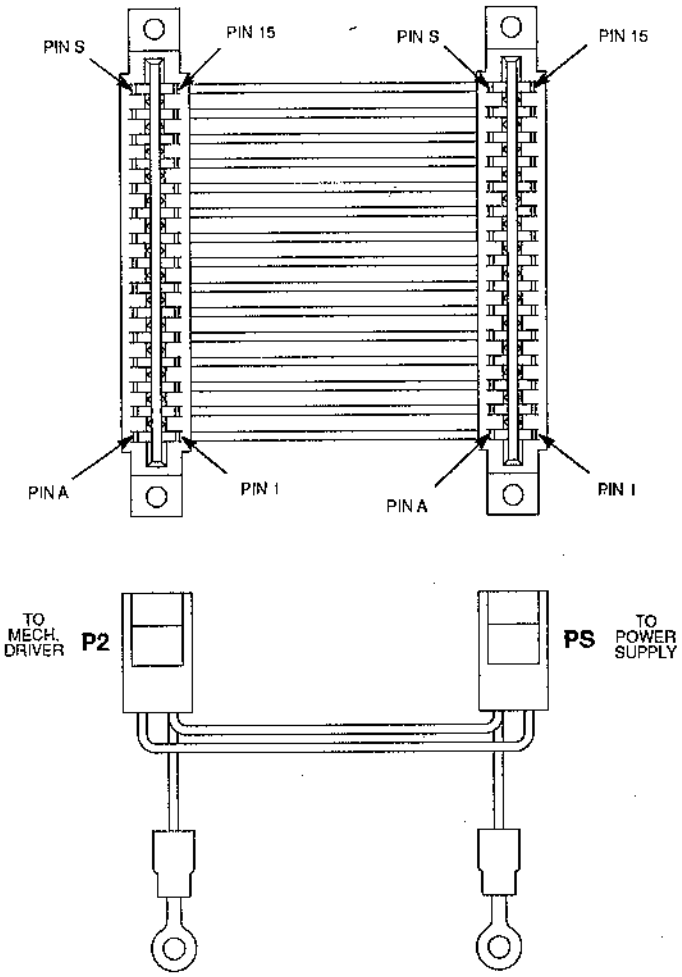


Cable No.	Part No.	Description
W1	57G1454	Cable Assembly, CCB/Mech. Dr.



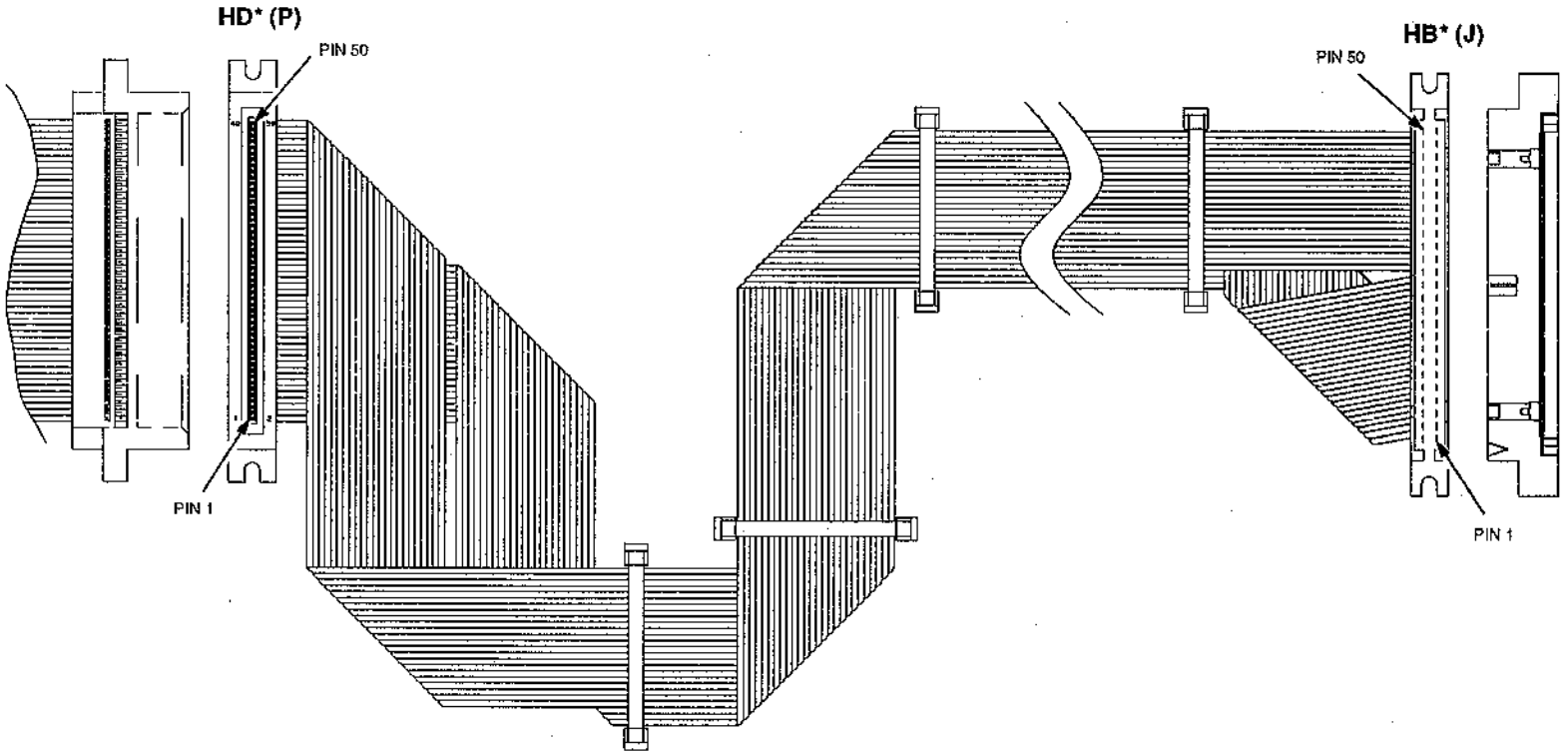


Cable No.	Part No.	Description
W2	08H7828	Cable Assembly, +5 V, Power Supply

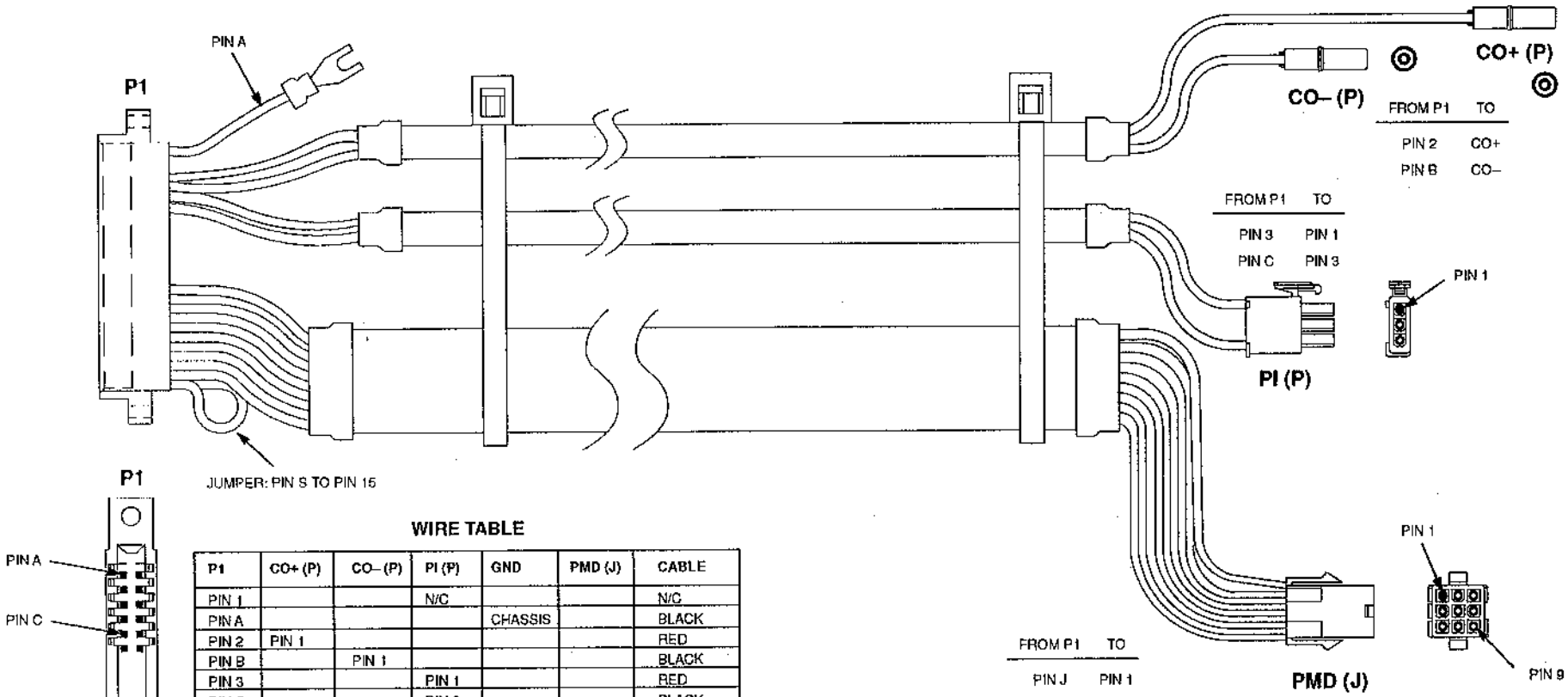


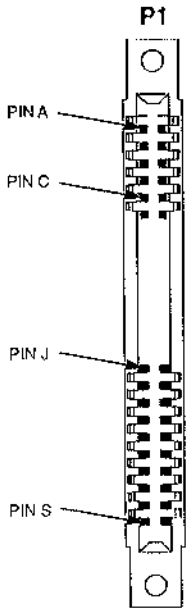
Cable No.	Part No.	Description
W3	57G1457	Cable Assembly, Hi Voltage

WIRE TABLE	
HDR(P)/HDL(P)	HBR(J)/HBL(J)
PIN 1	PIN 1
PIN 2	PIN 2
PIN 3	PIN 3
PIN 4	PIN 4
PIN 5	PIN 5
PIN 6	PIN 6
PIN 7	PIN 7
PIN 8	PIN 8
PIN 9	PIN 9
PIN 10	PIN 10
PIN 11	PIN 11
PIN 12	PIN 12
PIN 13	PIN 13
PIN 14	PIN 14
PIN 15	PIN 15
PIN 16	PIN 16
PIN 17	PIN 17
PIN 18	PIN 18
PIN 19	PIN 19
PIN 20	PIN 20
PIN 21	PIN 21
PIN 22	PIN 22
PIN 23	PIN 23
PIN 24	PIN 24
PIN 25	PIN 25
PIN 26	PIN 26
PIN 27	PIN 27
PIN 28	PIN 28
PIN 29	PIN 29
PIN 30	PIN 30
PIN 31	PIN 31
PIN 32	PIN 32
PIN 33	PIN 33
PIN 34	PIN 34
PIN 35	PIN 35
PIN 36	PIN 36
PIN 37	PIN 37
PIN 38	PIN 38
PIN 39	PIN 39
PIN 40	PIN 40
PIN 41	PIN 41
PIN 42	PIN 42
PIN 43	PIN 43
PIN 44	PIN 44
PIN 45	PIN 45
PIN 46	PIN 46
PIN 47	PIN 47
PIN 48	PIN 48
PIN 49	PIN 49
PIN 50	PIN 50



Cable No.	Part No.	Description
W4	57G1448	Cable Assembly, Hammer Bank

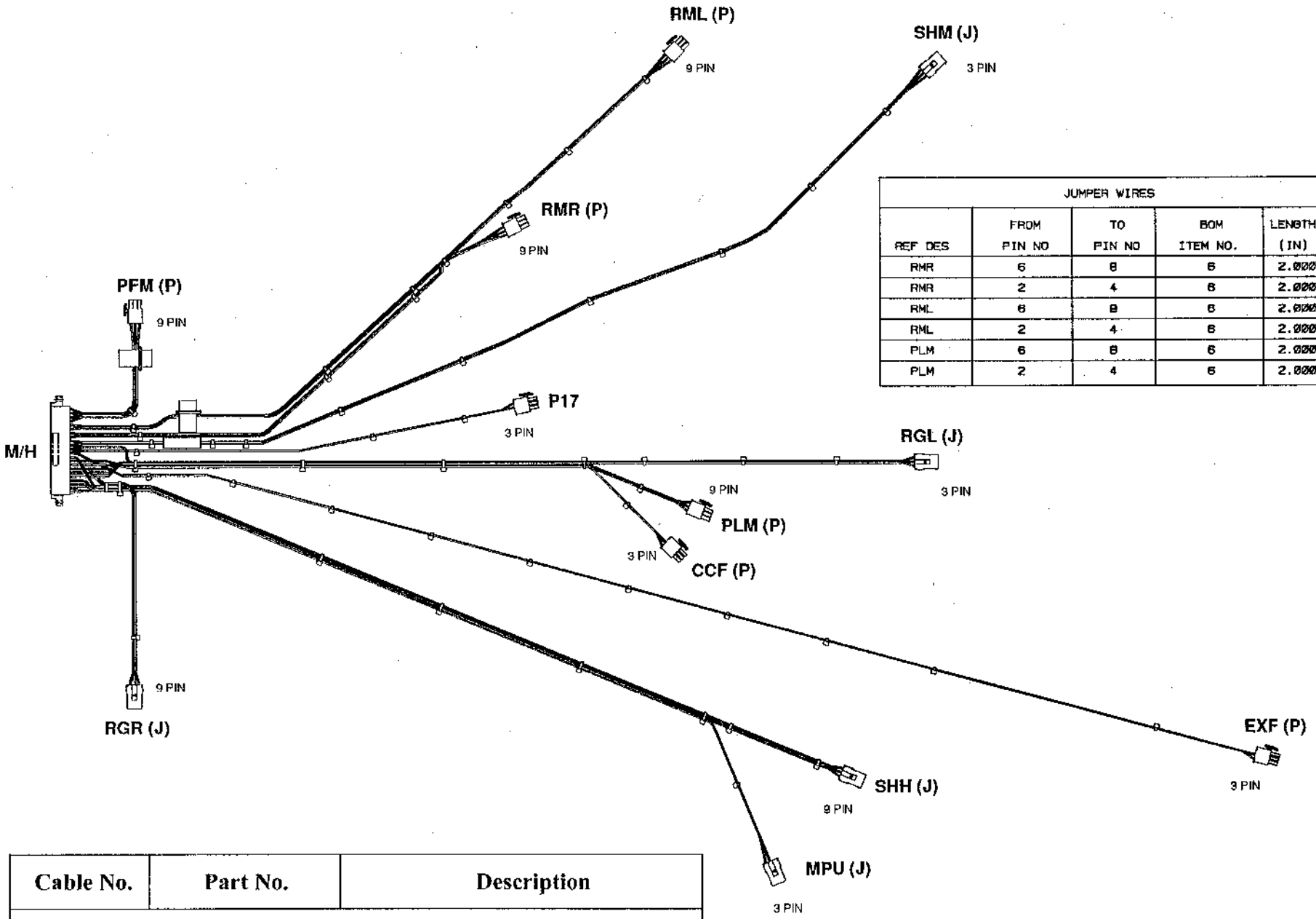




WIRE TABLE

P1	CO+ (P)	CO– (P)	PI (P)	GND	PMD (J)	CABLE
PIN 1			N/C			N/C
PIN A				CHASSIS		BLACK
PIN 2	PIN 1					RED
PIN B		PIN 1				BLACK
PIN 3			PIN 1			RED
PIN C			PIN 3			BLACK
PIN 4						N/C
PIN D						N/C
PIN 5						N/C
PIN E						N/C
PIN 6						N/C
PIN F						N/C
PIN 7						N/C
PIN H						N/C
PIN 8						N/C
PIN J					PIN 1	DRAIN
PIN 9					PIN 2	YELLOW
PIN K					PIN 3	GREEN
PIN 10					PIN 4	BLUE
PIN L					PIN 5	VIOLET
PIN 11					PIN 6	BROWN
PIN M					PIN 7	BLACK
PIN 12					PIN 8	ORANGE
PIN N					PIN 9	RED
PIN 13						N/C
PIN P						N/C
PIN 14						N/C
PIN R						N/C
PIN 15						N/C
PIN S						N/C

Cable No.	Part No.	Description
W5	57G1452	Cable Assembly, Intermediate



JUMPER WIRES				
REF DES	FROM PIN NO	TO PIN NO	BOM ITEM NO.	LENGTH (IN)
RMR	6	8	6	2.000
RMR	2	4	6	2.000
RML	6	8	6	2.000
RML	2	4	6	2.000
PLM	6	8	6	2.000
PLM	2	4	6	2.000

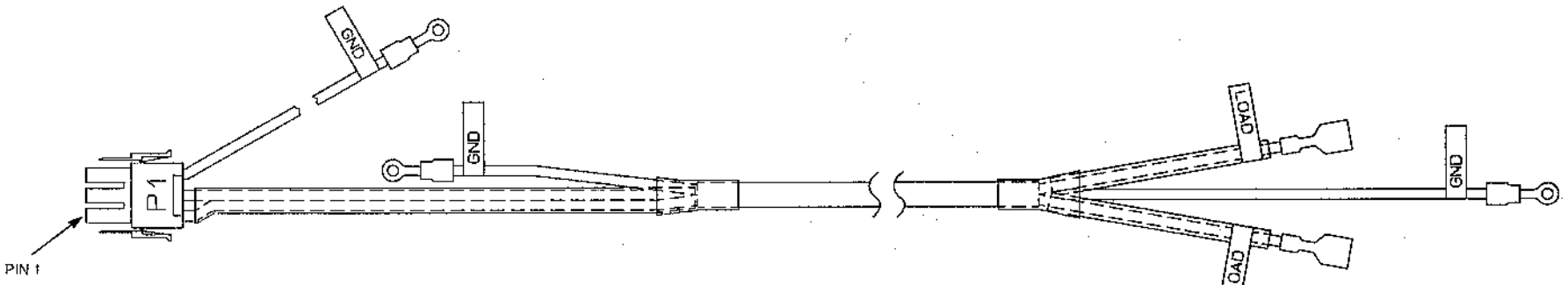
Cable No.	Part No.	Description
W6	57G1447	Wire Harness, Main (continued on next page)

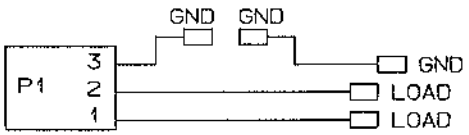
WIRE TABLE

CONNECTOR													WIRE LENGTH (+/- .25")	MAIN HARNESS WIRE COLOR	MATE TO WIRE COLOR
M/H	PFM	RML	RMR	SHM	CCF	P17	EXF	SHH	PLM	RGR	RBL	MPU			
1	1												7.37"	BLACK	BROWN
A	3												7.37"	BLACK	ORANGE
2	2												7.37"	BLACK	BLUE
B	4												7.37"	BLACK	BLACK
3	5												7.37"	BLACK	YELLOW
C	7												7.37"	BLACK	RED
4	6												7.37"	BLACK	WHITE
D	8												7.37"	BLACK	GREEN
5		5											32.00"	BLACK	YELLOW
E		7											32.00"	BLACK	RED
6		3											32.00"	BLACK	ORANGE
F		1											32.00"	BLACK	BROWN
7			7										19.50"	BLACK	RED
H			5										19.50"	BLACK	YELLOW
8			3										19.50"	BLACK	ORANGE
J			1										19.50"	BLACK	BROWN
9				2									30.00"	BLACK	BLACK
K				3									30.00"	BLACK	RED
10				1									30.00"	BLACK	BLUE
L					2								24.50"	BLACK	RED
11					3								24.50"	BLACK	BLACK
M						2							17.50"	BLACK	RED
12						1							17.50"	BLACK	BLACK
N							2						29.35"	BLACK	RED
13							3						29.35"	BLACK	BLACK
P								6					32.75"	BLACK	BLACK
14									7				24.50"	BLACK	RED
R									5				24.50"	BLACK	YELLOW
15									3				24.50"	BLACK	ORANGE
S									1				24.50"	BLACK	BROWN
16										2			10.50"	BLACK	BLACK
T											2		33.00"	BLACK	BLACK
17										3			10.50"	BLACK	BLACK
U											3		33.00"	BLACK	BLACK
18										1			10.50"	BLACK	BLACK
V											1		33.00"	BLACK	BLACK
19								5					32.75"	BLACK	BROWN
W								2					32.75"	BLACK	YELLOW
20								4					32.75"	BLACK	ORANGE
X								3					32.75"	BLACK	WHITE
21								1					32.75"	BLACK	PURPLE
Y												N/C	33.00"	DRAIN	
22												2	33.00"	RED	WHITE
Z												1	33.00"	BLACK	BLACK

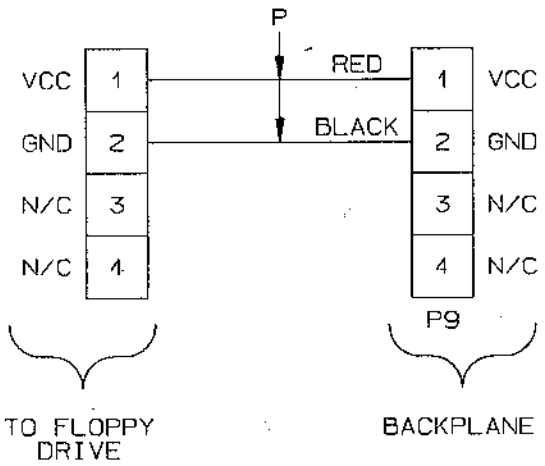
PIN ASSIGNMENT

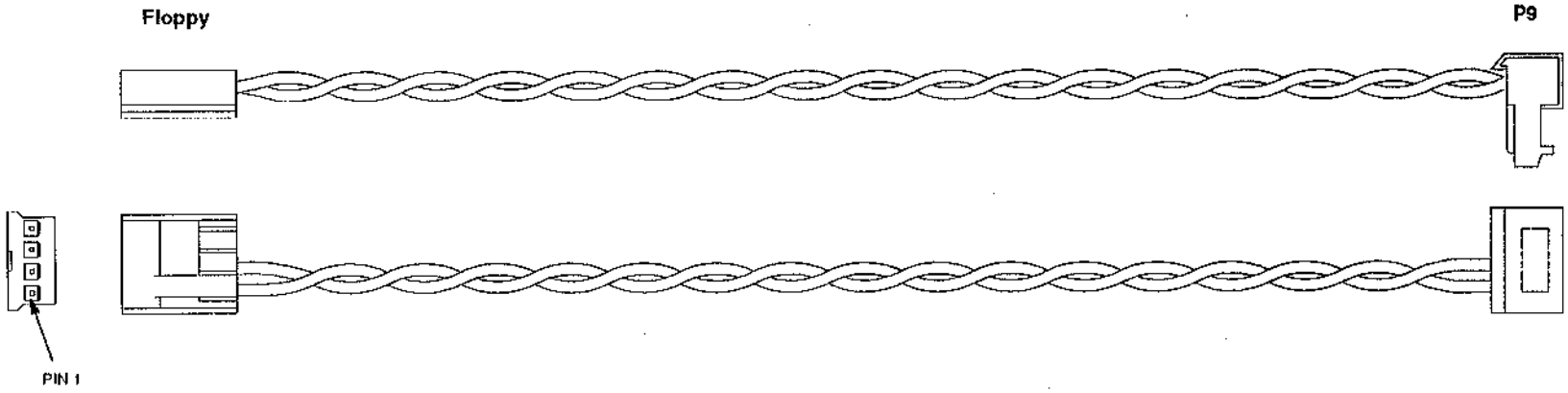
Cable No.
W6
Part No.
57G1447
Description
Wire Harness, Main (continued from previous page)



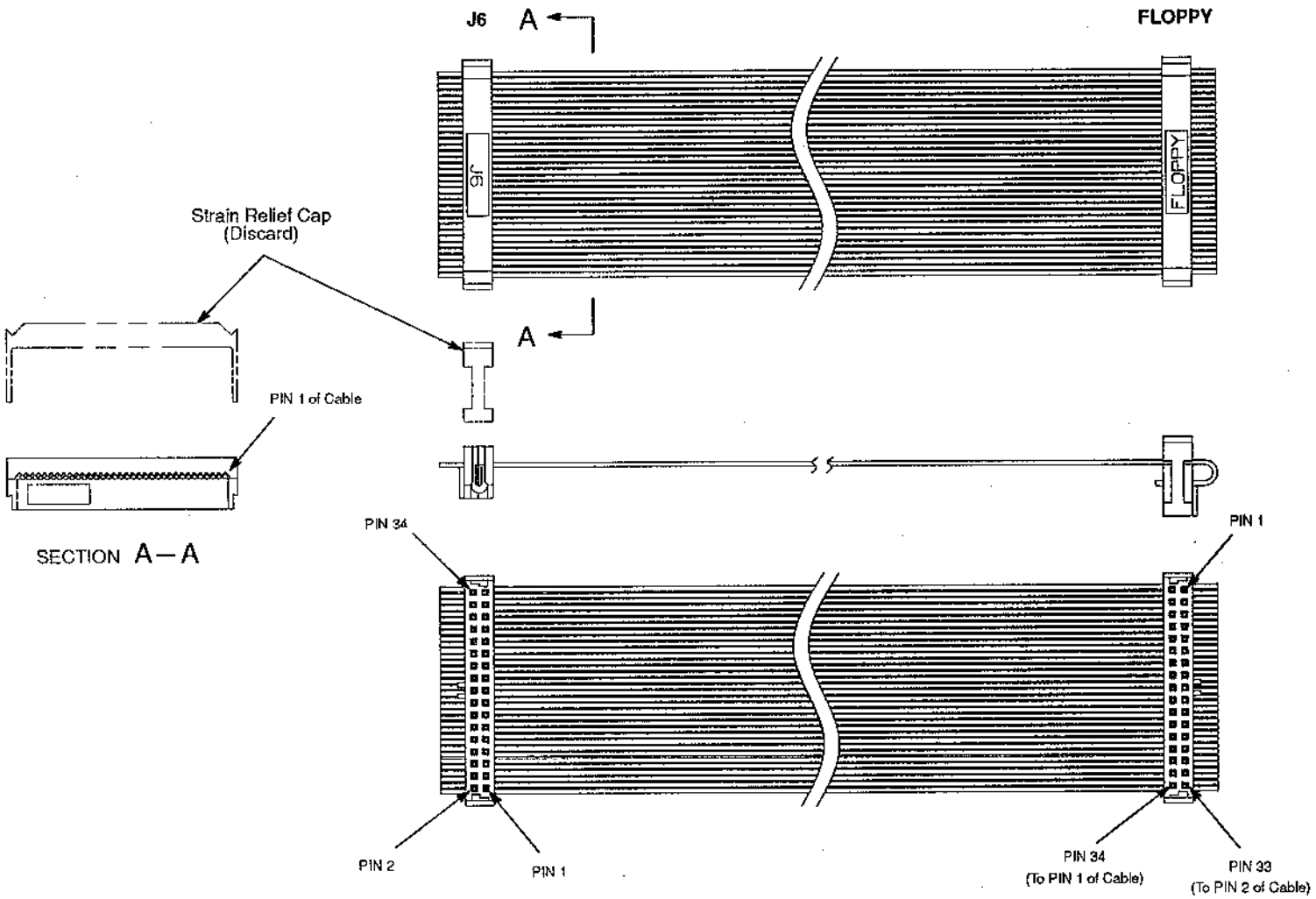


Cable No.	Part No.	Description
W7	57G1456	Cable Assembly, AC/Ground

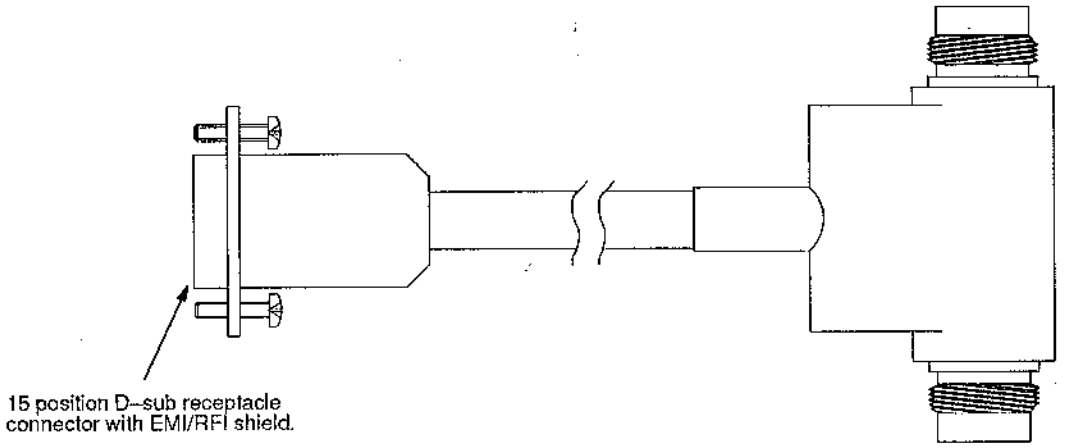


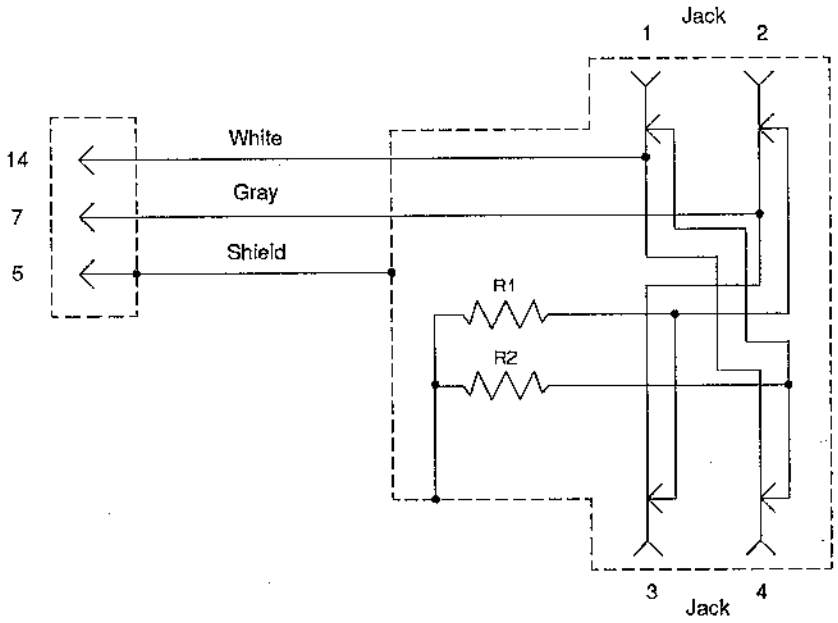


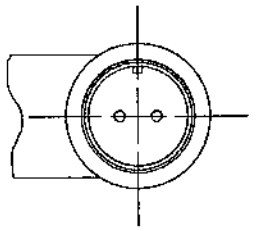
Part No.	Description
57G1753	Cable Assembly, Floppy Power, Single



Part No.	Description
57G1764	Cable Assembly, Floppy Interface





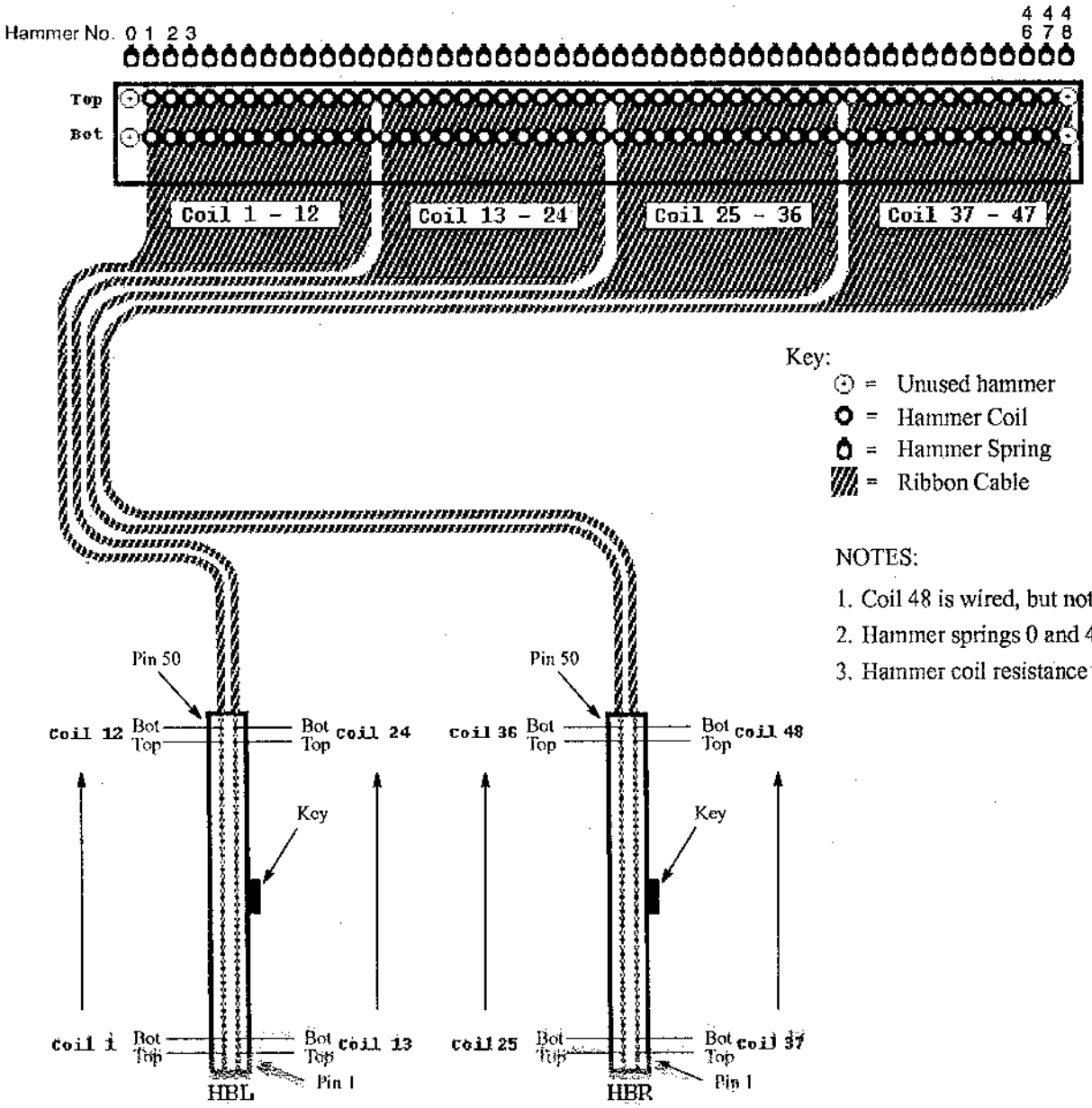


Resistance Chart

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

Part No.	Description
38F8254	Cable Assembly, Twinax Auto–Termination

Hammer Bank Wiring Diagram



Key:

- ⊙ = Unused hammer
- O = Hammer Coil
- = Hammer Spring
- = Ribbon Cable

NOTES:

1. Coil 48 is wired, but not used.
2. Hammer springs 0 and 48 are not used.
3. Hammer coil resistance = **4.7 Ohms**.

B Printer Specifications

Contents

Duty Cycle

The IBM 6408 printer will print 75, 000 pages per month under the following conditions:

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

Ribbon Specifications

NOTE: Use only the ribbons listed below:

IBM General Purpose Ribbon	Part No. 1040990
IBM High Contrast Ribbon	Part No. 1040993

Call IBM Direct to order ribbons:

1–800–IBM–2468 (USA)

1–800–465–1234 ext. 478 (Canada)

Paper Specifications

Paper

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

Labels

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

Printer Dimensions

Height:	41 inches (104.1 cm)
Width:	27 inches (68.6 cm)
Depth:	29 inches (73.7 cm)
Weight:	190 pounds (86.2 kg) (Unpacked)

Environmental Characteristics

Temperature

Operating	41° to 104° F (5° to 40° C) up to 5000 feet (1524 meters) 41° to 90° F (5° to 32° C) up to 8000 feet (2438 meters)
Storage	–40° to 158° F (–40° to 70° C)

Relative Humidity

Operating	10% to 90% (noncondensing)
Storage	5% to 95% (noncondensing)

Acoustic Noise Level

52 dBA (tested per ISO 7779)

Electrical Characteristics

Input Power

Voltage (RMS)	120 VAC or 230 VAC (100 to 120 VAC or 200 to 240 VAC)
Phase	Single
Frequency	47 to 62 Hz
Max RMS Current	6A @ 100 V; 3A @ 200 V

Power Rating

120 VAC 60 Hz	Operating (DP Mode) All H's	 Max. Typical	 Standby
Watts	340	260	135
BTU per hour	1160	890	460
VA	535	400	200

220 VAC 50 Hz	Operating (DP Mode) All H's	Max. Typical	Standby
Watts	320	275	130
BTU per hour	1090	940	445
VA	545	445	220

Radio Frequency Interference (RFI)

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

Interfaces

Type:	Two resident parallel, two resident serial, one resident coax, one resident twinax
Logic Levels:	TTL/EIA–232–D
Data Format:	ASCII EBCDIC
Compatibility:	PC Parallel, DataProducts, EIA–232–D, EIA–422–A, Twinax, Coax
Transfer Rates:	Up to 200K bytes on parallel interfaces Up to 19,200 baud on serial interface

Printing Rates

Printing speed of text is measured in lines/minute, and is a function of the selected font and dot density. Printing speed is independent of the number of characters configured in the character set repertoire. Print rates for lines containing attributes such as bold or emphasized printing, superscripts, subscripts, or elongated attributes will decrease to not less than half the rates of the font without such attributes. Typical printing rates are charted in Table B–1.

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

$$\frac{1}{\text{Shuttle Speed} \times \text{Vertical Density}} \times 60\,000 = \text{Plot Speed in } \frac{\text{inches}}{\text{minute}}$$

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

Table B–1. Nominal Printing Rates

Print Dimensions			Performance		
Dot Density (DPI)	Characters per Inch	Dot Matrix	Uppercase Only	Descenders & Underline	Plot Mode *NOTE 3*
NOTE 1	(CPI)	*NOTE 2*	LPM*	LPM*	IPM**
OCR A and B 120 (120) X 144	10	10 (10) X 14 + 2	165	145	33
Near Letter Quality 90 (180) X 96	10 12 12.9 15 16.4	7 (13) X 9 + 3 6 (11) X 9 + 3 6 (11) X 9 + 3 5 (9) X 9 + 3 5 (9) X 9 + 3	320	245	33
DP Quality 60 (120) X 72	10 12 13.3 15 17.1	5 (9) X 7 + 2 4 (7) X 7 + 2 4 (7) X 7 + 2 3 (5) X 7 + 2 3 (5) X 7 + 2	600	480	66
Draft Quality 60 (120) X 48	10 12 13.3 15 17.1	5 (9) X 5 + 1 4 (7) X 5 + 1 4 (7) X 5 + 1 3 (5) X 5 + 1 3 (5) X 5 + 1	800	685	100
NLQ Sans Serif 90 (180) X 96	10 12 12.9 15 16.4	7 (13) X 9 + 3 6 (11) X 9 + 3 6 (11) X 9 + 3 5 (9) X 9 + 3 5 (9) X 9 + 3	320	245	33

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

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

NOTE 3 The Plot Mode graphics described here are provided for IGP or Code V emulations. Plot speeds are obtained if the dot count per row does not exceed 85% of the maximum dots allowed for that mode, and the steps per dot row do not exceed the vertical density of that mode.

* LPM = Lines Per Minute

** IPM = Inches Per Minute

C Ferrite Noise Suppression Cores

IMPORTANT

Before removing a cable that passes through or around a shielding bead (cylindrical ferrite core), count the number of times the cable is wound around the bead. You must duplicate these windings when you replace the cable. Use Figure C–1 as your guide.

Ferrite cores reduce radio frequency interference (RFI) to and from electronic equipment located near the printer.

The IBM 6408–CTA printer is equipped with two kinds of ferrite core:

- Shielding beads are round cores that resemble large iron washers. Cables pass through a shielding bead or are wound around it.
- Ferrites with clamp are rectangular in section, split down the center and the halves are housed in a hinged plastic case. Cables are folded into a groove cut into the center of the core, and the plastic case is closed, securing the core to the cable.

Figure C–1 shows the location of the ferrite cores.

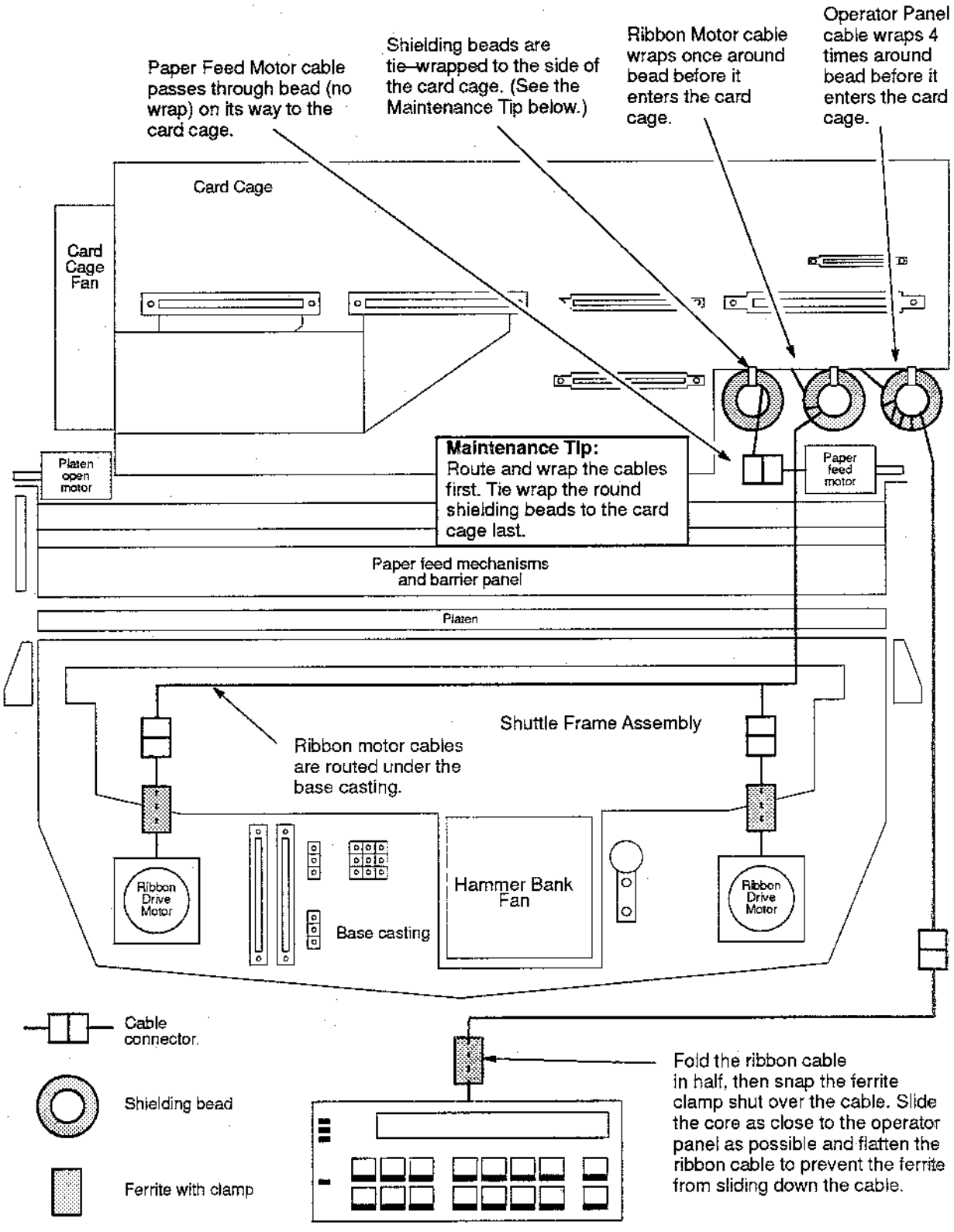


Figure C–1. Ferrite Core Locations

D Metric Conversion Tables

Length

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

Torque and Force

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

Mass and Density

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

Temperature

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

Power

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

E 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. Fastener sizes are listed as Numbered Size – Threads Per Inch.

Torque Table

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

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

F Safety Inspection Guide

Safety Inspections

The IBM 6408–CTA printer incorporates safety items installed to protect customers, operators, and service personnel from injury. Use this inspection guide as an aid in identifying possible unsafe conditions in the printer.

Perform the inspection steps outlined in this guide 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.

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

Preparation

You must have completed the "Electrical Safety Training Course for IBM Customer Engineers" (self–study course 77170 or existing level) to do the Safety Inspection.

Have the following items available:

1. *Electrical Safety for IBM Customer Engineers*, Order No. S229–8124.
2. A Fluke** meter (P/N 8496278) or similar device for resistance and voltage measurements.
3. 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

DANGER

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

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 Doors

1. Inspect the top cover:
   a. Open the top cover. Make sure the gas spring assembly holds the cover up in the open position.
   b. Close the top cover. Make sure the operator panel is centered in the opening of the cover.
   c. Make sure the window is not cracked or broken.
   d. Make sure the seal around the top cover is not cracked or broken.
   e. 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.
   f. Make sure there are no exposed or sharp edges.
   g. Make sure the wireform paper path is undamaged.
2. 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 or sharp edges.

3. Open the rear cabinet door and inspect the lower rear paper path:

   a. Make sure the service panel permitting access to the I/O plate and circuit breaker (on/off switch) is installed.

   b. Make sure the paper stacker tray assembly 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 NO TAG.)

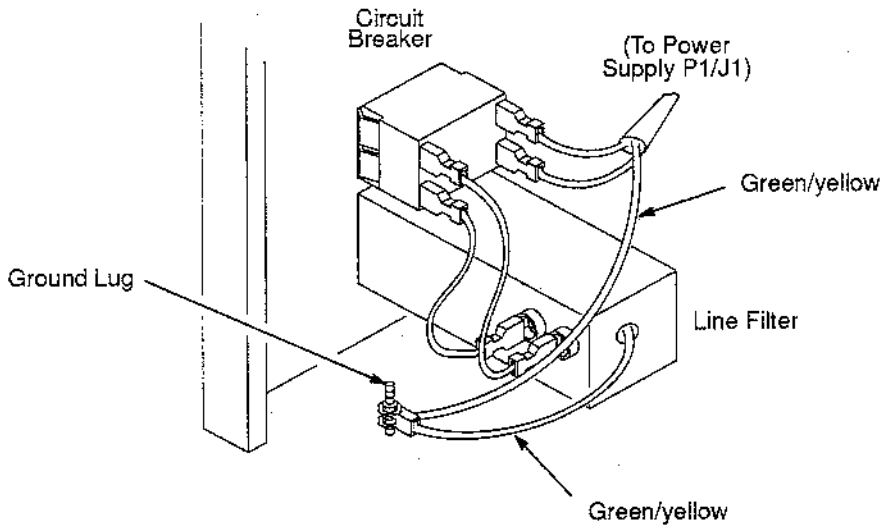
3. Make sure the paper path is correctly installed and undamaged. (See page NO TAG.)

Inspect Electrical Parts

Safety Ground Path

NOTE: Ground paths are summarized in Figure F–1.

1. Make sure the printer power cord is unplugged.
2. Remove the paper stacker tray assembly (page NO TAG).
3. Remove six screws and the service panel. (Refer to NO TAG, page NO TAG.)
4. Make sure the yellow/green cables from the line filter and circuit breaker power leads are undamaged and firmly attached to the ground lug on the floor of cabinet, as shown below.



5. 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.
6. Install the service panel. (Refer to NO TAG, page NO TAG.)
7. Install the paper stacker tray assembly (page NO TAG).

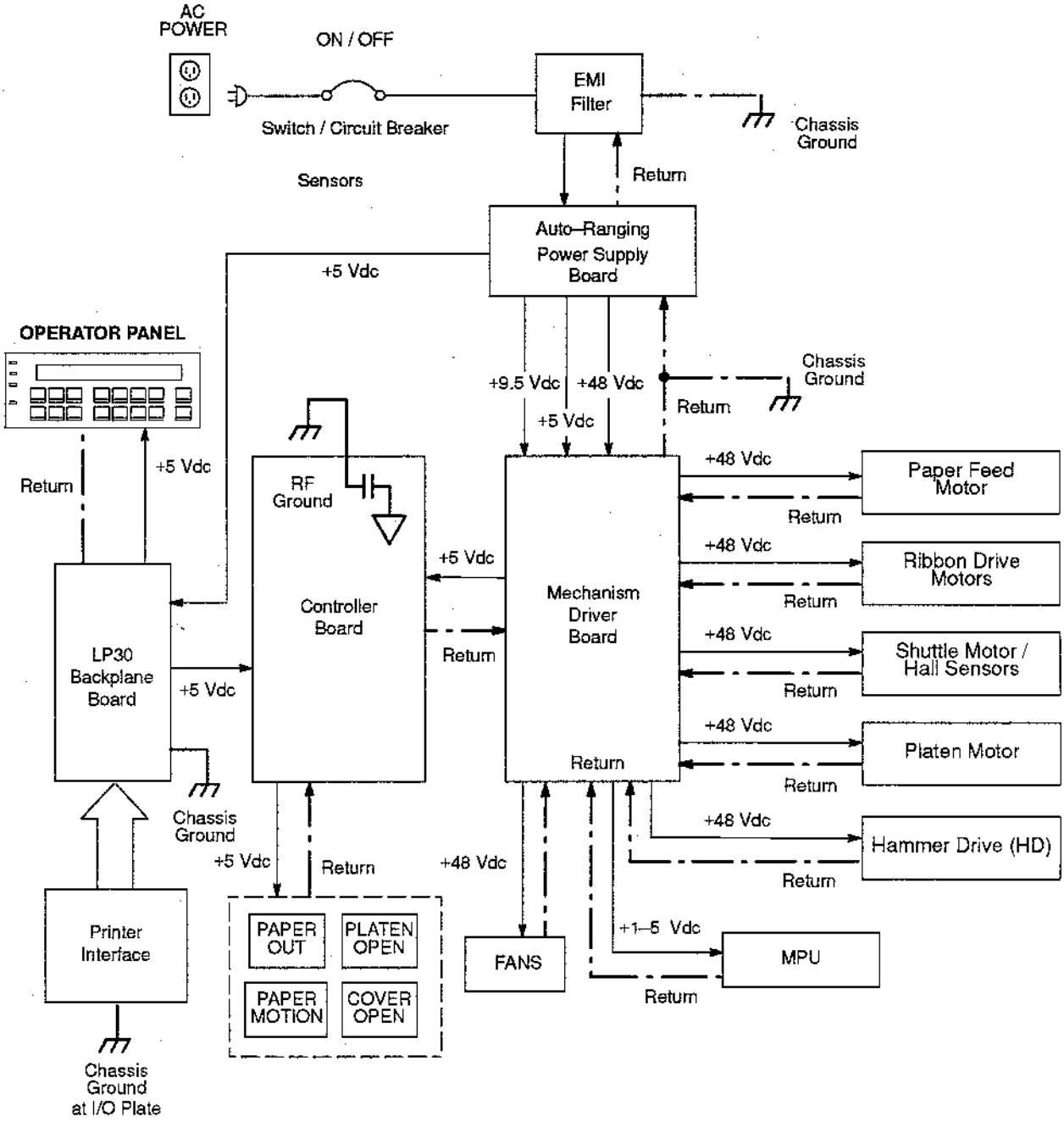


Figure F–1. Ground Path Diagram

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:

1. Wiring errors
2. Low voltage
3. Neutral to ground short
4. Ground path impedance
5. Neutral impedance

NOTE: The customer is responsible for correcting problems with the power source. Inform the IBM Installation Planning Representative (IPR) of any problems with the customer's 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 *not* a neutral.

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 a CLOSE PLATEN message 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.
6. Loosen the shuttle cover screws and lift the shuttle cover enough to pull the magnet away from the cover open switch.
   The LCD should display 090 CLOSE SHUTTLE COVER and the audible alarm should sound if it is enabled.
7. Press **Stop**. The audible alarm should stop.
8. Reseat the shuttle cover and tighten the cover screws. The fault message should clear.

G Acronyms and Signal Mnemonics

NOTE: Mnemonics with initial letter "N" are negative true.

ACRONYM/ MNEMONIC	DEFINITION
AC	Alternating Current
ACK	Acknowledge
AMP	Amplitude; Ampere
AN	Anode
ASIC	Application–Specific Integrated Circuit
ATTN	Attention
B	Buffered
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
BUD	Buffered Upper Driver
CA	Cathode
CC	Card Cage
CCB	Common Controller Board
CCF	Card Cage Fan
CE	Customer Engineer
CHNG	Change
CLK	Clock

CO ..... Cover Open
COLL ..... Collector
CONTLR ..... Controller
CPI ..... Characters Per Inch
CTS ..... Clear to Send
CUR ..... current

DC ..... Direct Current
DCD ..... Data Carrier Detect
DIAG ..... Diagnostic
DIFF ..... Differential
DMA ..... Direct Memory Access
DP ..... Data Processing, DataProducts
DPMC ..... Dot Plucker Memory Controller
DPU ..... Data Processing Unit
DRAM ..... Dynamic Random–Access Memory
DRVR ..... Driver
DSR ..... Data Set Ready
DTR ..... Data Terminal Ready

EMIT ..... Emitter
EPROM ..... Electrically Programmable Read-Only Memory
ERR ..... Error
EX ..... Exhaust, Extra
EXF ..... Exhaust Fan

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

GND ..... Ground

HB ..... Hammer Bank
HBF ..... Hammer Bank Fan
HBL ..... Hammer Bank, Left
HBR ..... Hammer Bank, Right

HD ..... Hammer Driver
HDIC ..... Hammer Driver Integrated Circuit
HDPH ..... Hammer Driver Phase

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

(J) ..... Jack connector

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

MECH ..... Mechanism
MH ..... Mounting Hole, Main Harness
MOT ..... Motor
MPU ..... Magnetic Pick–Up (Unit)

N ..... Negative True
N/C ..... Not Connected
NC ..... Not Connected
No ..... Number
NOVRAM ..... Nonvolatile Random–Access Memory
NVRAM ..... Nonvolatile Random–Access Memory

P5 ..... + 5 V dc
(P) ..... Pin connector
P(1), P(2), etc. ..... Parallel data 1, data 2, etc.
PAL ..... Programmable Array Logic
PCBA ..... Printed Circuit Board Assembly
PCB ..... Printed Circuit Board
PE ..... Printer Error, Paper Empty

PER ..... Peripheral Device
PFC ..... Paper Feed Controller
PFM ..... Paper Feed Motor
PI ..... Paper Instruction
PLAT ..... Platen
PLM ..... Platen Motor
PMD ..... Paper Motion Detect
PO ..... Paper Out
PPR ..... Paper
PROM ..... Programmable Read–Only Memory
PS ..... Power Supply
PS5 ..... Power Supply + 5 Volt
PWM ..... Pulse Width Modulation

R ..... Right
RBN ..... Ribbon
RD ..... Read
RET ..... Return
RG ..... Ribbon Guide
RGL ..... Ribbon Guide, Left
RGR ..... Ribbon Guide, Right
RM ..... Ribbon Motor
RML ..... Ribbon Motor, Left
RMR ..... Ribbon Motor, Right
RQ ..... Request
RSP ..... Ribbon and Shuttle Processor
RST ..... Reset
RTPU ..... Real–Time Processing Unit
RTS ..... Request to Send
RXD ..... Receive Detect

SCS ..... SNA Character Stream
SEC ..... Security (Key)
SEL ..... Select
SEN ..... Sense, Sensor
SHH ..... Shuttle Hall (Effect)
SHM ..... Shuttle Motor

SHUT ..... Shuttle
SLCT ..... Select (On–line)
SNA ..... Systems Network Architecture
SRAM ..... Static Random–Access Memory
SW ..... Switch

TXD ..... Transmit Detect

UART ..... Universal Asynchronous Receiver/Transmitter
UDPH ..... Upper Drive Phase
USART ..... Universal Synchronous/Asynchronous Receiver/Transmitter

V ..... Volts
V_{CC} ..... 5 Volts DC
V_{DD} ..... Voltage at Drain
V_{SS} ..... Voltage at Source

WR ..... Write

XMT ..... Transmit

H Power Cords

Part No.	Units	Description
57G7261	1	Power Cord, 110V 6 Feet Non–Lock, U.S., Canada
46F2112	1	Power Cord, 220V 6 Feet Non–Lock, U.S., Canada
57G7260	1	Power Cord, 110V 12 Feet Non–Lock, U.S., 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
1838573	1	Power Cord, 220V 12 Feet Non–Lock, U.S., Canada, Honduras, Nicaragua, Peru, Phillipines, Saint Lucia, Taiwan, Thailand, Tobago, Panama
80F7277	1	Power Cord, 110V 6 Feet Twist–Lock, U.S., Canada
80F7278	1	Power Cord, 220V 6 Feet Twist–Lock, U.S., Canada
7842142	1	Power Cord, 110V 12 Feet Twist–Lock, U.S., Canada
7842124	1	Power Cord, 220V 12 Feet Twist–Lock, U.S., Canada
46F5893	1	Power Cord, 110V 6 Feet Watertight, U.S., Canada
73F5157	1	Power Cord, 220V 6 Feet Watertight, U.S., Canada
46F5894	1	Power Cord, 110V 12 Feet Watertight, U.S., Canada
73F4932	1	Power Cord, 220V 12 Feet Watertight, U.S., Canada
13F9941	1	Power Cord, 12 Feet, Argentina, Australia, Colombia, New Guinea, New Zealand, Paraguay, Samoa, Uraguay
13F9979	1	Power Cord, 9 Feet, Afghanistan, Algeria, Angola, Austria, Belgium, Benin Republic/Dahomey, Bulgaria, Burundi, Cameroon, Chad, Congo/Brazzaville, Central Africa Empire, Czechoslovakia, East Germany, Egypt, Finland, France, Greece, Guinea, Hungary, Iceland, Indonesia, Iran, Ivory Coast, Jordan, Korea, Lebanon, Luxembourg, Mali, Madagascar, Mauritania, Monaco, Morocco, Mozambique, Netherlands, Norway, Poland, Portugal, Rhodesia, Romania, Spain, Sudan, Sweden, Syria, Togo, Tunisia, Turkey, Upper Volta, USSR, West Germany, Yugoslavia, Zaire
13F9997	1	Power Cord, 9 Feet, Denmark
14F0015	1	Power Cord, 9 Feet, Bangladesh, Burma, Pakistan, South Africa, Sri Lanka
14F0033	1	Power Cord, 9 Feet, Bahrain, Brunei, Channel Islands, PRC, Cyprus, Hong Kong, India, Iraq, Ireland, Kenya, Kuwait, Malaysia, Malta, Nepal, Nigeria, Oman, Polynesia, Qatar, Sierra Leone, Singapore, Tanzania, Uganda, United Arab Emirates, U.K., Zambia
14F0051	1	Power Cord, 9 Feet, Switzerland, Liechtenstein
14F0069	1	Power Cord, 9 Feet, Chile, Ethiopia, Italy, Libya
14F0087	1	Power Cord, 9 Feet, Israel
1332167	1	Power Cord, 12 Feet, Japan
57G7262	1	Power Cord, No Plug
38F8254	1	Twinax Auto–Termination Cable

I Part Numbers

Part Number	Page	Description
0264641	NO TAG	E–Ring
0311072	NO TAG	Ring, Grip
04H4779	NO TAG	Riser, Stacker Runner
08H7828	NO TAG A–14	Cable Assembly, +5V Power Supply
08H7926	NO TAG	IBM Logo
08H7936	NO TAG	Platen
08H7954	NO TAG	Static Brush
08H7950	NO TAG	RH Bracket
08H7951	NO TAG	LH Bracket
08H7955	NO TAG	Hanger, Chain Assembly
08H7956	NO TAG	Chain Assembly, Stacker Inner
14H7231	NO TAG, A–12	Multi I/O Assembly
14H7253	NO TAG	Diskette, IPDS Twinax
14H7254	NO TAG	Diskette, IGP–200 + IPDS Twinax
14H7255	NO TAG	Diskette, Code V + IPDS Twinax
14H7256	NO TAG	Diskette, Base Machine, Twinax
14H7257	NO TAG	Diskette, Code V, Twinax
14H7258	NO TAG	Diskette, IGP–200, Twinax

Part Number	Page	Description
30H3962	NO TAG	Window, Top Cover
30H3963	NO TAG	Diskette, Base Machine, Coax
30H3964	NO TAG	Diskette, Code V, Coax
30H3965	NO TAG	Diskette, IGP–200, Coax
30H3966	NO TAG	PROM Kit
30H3981	NO TAG	Runner, Stacker
30H3985	NO TAG	Extension Spring
38F8254	A–23	Cable Assembly, Twinax Auto–Termination
42F1814	NO TAG	Clip, Parallel Port
43F1678	NO TAG	Fan Guard
43F1678	NO TAG	Fan Guard
57G1418	NO TAG	Operator Panel Assembly
57G1421	NO TAG	Motor Pulley, Paper Feed
57G1437	NO TAG A–11	PCBA, Power Supply
57G1438	NO TAG	Circuit Breaker
57G1440	NO TAG	Fan Assembly, Cabinet exhaust
57G1440	NO TAG	Fan Assembly, Card Cage
57G1441	NO TAG	Panel Bracket
57G1443	NO TAG	Shuttle Frame Assembly
57G1446	NO TAG A–8	PCBA, Mechanism Driver
57G1447	A–18	Wire Harness, Main (W6)
57G1448	NO TAG A–16	Cable Assembly, Hammer Bank (W4)
57G1449	NO TAG	Ribbon Guide Assembly, Left

Part Number	Page	Description
57G1450	NO TAG	Ribbon Guide Assembly, Right
57G1451	NO TAG	Platen Interlock Switch Assembly
57G1452	NO TAG A–17	Cable Assembly, Intermediate (W5)
57G1453	NO TAG	Paper Detector Switch Assembly
57G1454	NO TAG A–13	CCB/Mech. Driver Cable Assembly (W1)
57G1456	NO TAG A–20	Cable Assembly, AC/Ground
57G1457	A–15	Cable Assembly, High Voltage (W3)
57G1460	NO TAG	Shaft Assembly, Splined
57G1461	NO TAG	Splined Shaft Pulley (Vertical Adjustment Knob)
57G1463	NO TAG	Platen Open Motor
57G1463	NO TAG	Paper Feed Motor
57G1464	NO TAG	Hammer Bank Fan Assembly
57G1465	NO TAG	Cover Open Switch Assembly
57G1466	NO TAG	Tractor Set, L/R
57G1467	NO TAG	Platen Open Belt
57G1468	NO TAG	Paper Feed Timing Belt
57G1469	NO TAG	Ironer, Paper
57G1472	NO TAG	Bracket, Platen
57G1473	NO TAG	Link Spring
57G1474	NO TAG	Clamp, Bearing
57G1475	NO TAG	Hammer Spring Replacement Kit
57G1476	NO TAG	Magnetic Pickup Assembly (MPU)

Part Number	Page	Description
57G1477	NO TAG	Hammer Bank Cover Assembly
57G1479	NO TAG	Ribbon Spool Hub Kit (includes 6–19x.50 set screw)
57G1481	NO TAG	Gas Spring Assembly
57G1483	NO TAG	Ball Stud
57G1484	NO TAG	Door Hinge
57G1485	NO TAG	Caster, with Brake
57G1486	NO TAG	Caster, without Brake
57G1488	NO TAG	Front Door Assembly
57G1489	NO TAG	Rear Door Assembly
57G1507	NO TAG	Collar
57G1508	NO TAG	Shuttle Cover Assembly (Air Shroud Assembly)
57G1509	NO TAG	Platen Open Motor Assembly
57G1510	NO TAG, NO TAG	Bearing, Nylon .376
57G1512	NO TAG	Timing Belt Cover
57G1513	NO TAG	Cover, Platen Open
57G1514	NO TAG	Pulley, Platen Open
57G1516	NO TAG	Washer, Curved Spring
57G1517	NO TAG	Knob, Tractor Adjust
57G1518	NO TAG	Bracket, Switch Mount
57G1519	NO TAG	Tractor Support Shaft
57G1521	NO TAG	Clip, Grounding
57G1522	NO TAG	Spring, Extension 1.12L
57G1523	NO TAG	Link, Spring

Part Number	Page	Description
57G1524	NO TAG	Spring, Extension 1.00L
57G1525	NO TAG	Top Cover
57G1526	NO TAG	Operator Panel Plate
57G1564	NO TAG	Chain Assembly, Stacker Outer
57G1566	NO TAG	Wireform Paper Path
57G1568	NO TAG	Paper Guide Assembly
57G1571	NO TAG	Bracket, Ironer
57G1572	NO TAG	Bracket, MPU
57G1577	NO TAG	Ribbon Drive Motor
57G1582	NO TAG	Label, Forms Length
57G1594	NO TAG	6408–CTA Ship Kit
57G1598	NO TAG	Operator Panel Overlay (English)
57G1599	NO TAG	Operator Panel Overlay (Spanish)
57G1600	NO TAG	Operator Panel Overlay (French)
57G1601	NO TAG	Operator Panel Overlay (Italian)
57G1602	NO TAG	Operator Panel Overlay (German)
57G1603	NO TAG	Operator Panel Overlay (Dutch)
57G1604	NO TAG	Operator Panel Overlay (Brazilian / Portuguese)
57G1663	NO TAG	Security Module, IGP–200 Security Module, Code V
57G1664	NO TAG	Diskette, IGP–200
57G1684	NO TAG	Security Module, IPDS Twinax Security Module, IPDS Coax
57G1686	NO TAG	4MB Memory Kit (IPDS Feature only)
57G1696	NO TAG	Diskette, IPDS Coax

Part Number	Page	Description
57G1706	NO TAG	Security Module, IGP–200 + IPDS Twinax Security Module, IGP–200 + IPDS Coax Security Module, Code V + IPDS Twinax Security Module, Code V + IPDS Coax
TBD	NO TAG	Diskette, IGP–200 + IPDS Coax
TBD	NO TAG	Diskette, Code V + IPDS Coax
57G1750	NO TAG	Disk Drive, Floppy 3.5, 2.88MB
57G1752	NO TAG	Security Module, Base Machine
57G1753	NO TAG A–21	Cable Assembly, Floppy Power
57G1764	NO TAG A–22	Cable Assembly, Floppy Interface
57G1765	NO TAG	Disk Drive Bracket
57G1768	NO TAG A–4	PCBA, Controller
57G1769	NO TAG A–6	PCBA, LP30 Backplane
57G3752	NO TAG	Line Filter
57G3753	NO TAG	PCBA Rail
57G3889	NO TAG	Paper Detector Switch Assembly (Black back forms)
57G3899	NO TAG	Lever, Platen (Forms Thickness Lever)
57G7176	NO TAG	Stacker Assembly

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