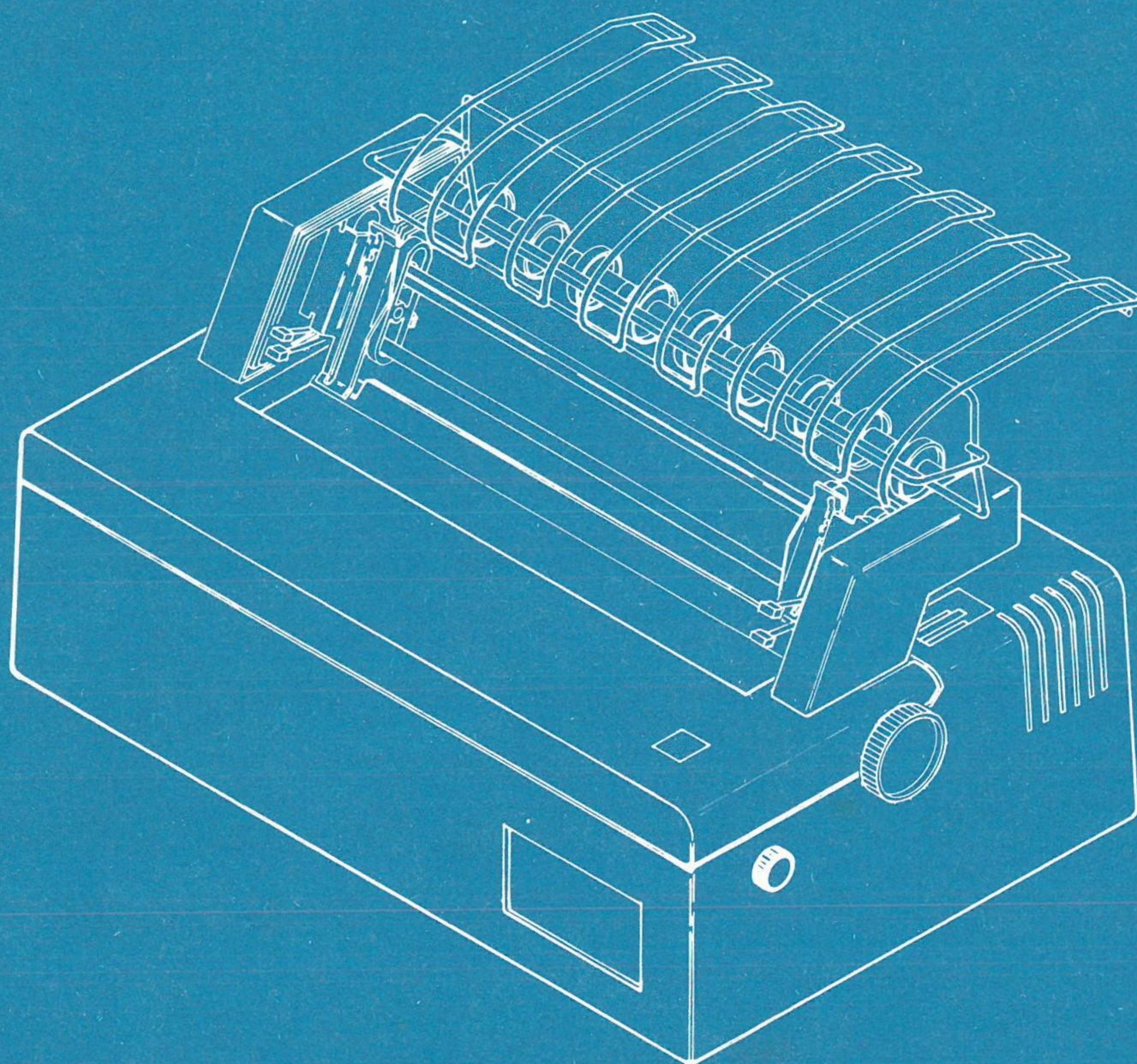




**IBM 5103  
Printer  
Maintenance Information Manual**



*IBM 5103  
Printer  
Maintenance Information Manual*



#### **Fourth Edition (February 1979)**

This is a major revision of and obsoletes, SY31-0414-2. Changes or additions to the text and illustrations are indicated by a vertical line to the left of the change or addition. Changes are periodically made to the information herein; changes will be reported in technical newsletters or in new editions of this publication.

Use this publication only for the purposes stated in the *Preface*.

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## Preface

This maintenance information manual is intended to be used for servicing the IBM 5103 Printer. Service personnel using this manual are assumed to have completed the IBM 5103 Printer training course.

To service the IBM 5103 Printer, use this manual with the MAPs contained in the MDI (MAP diagnostic integration) diagnostic program. A description of MDI and how it is used is in the *IBM 5100 Maintenance Information Manual*, SY31-0405, and the *IBM 5110 Maintenance Information Manual*, SY31-0550. Always begin service calls with the Start MAP.

This manual has three major sections:

- **Maintenance:** Contains location drawings, maintenance procedures (remove, replace, adjust, etc.), and graphics for each functional unit within the 5103. Each drawing, procedure, or graphic has a 3-digit reference number assigned to it for referencing from the MDI MAPs.
- **Circuits:** Contains high level logic diagrams and cable charts to enable service personnel to understand specific operational details of the IBM 5103 functional units.
- **Theory:** Contains detailed information about the individual functional units within the IBM 5103. This information contains operational details for further defining failures when the MAPs do not find the cause of the failure.

This manual has four appendixes. Each of the following items is a separate appendix:

- Installation procedures
- Print character information
- Preventive maintenance
- Glossary

The operating procedures for the IBM 5103 Printer are located in the following manuals:

*IBM 5100 BASIC Reference Manual*, SA21-9217  
*IBM 5100 APL Reference Manual*, SA21-9213  
*IBM 5110 BASIC Reference Manual*, SA21-9307  
*IBM 5100 APL Reference Manual*, SA21-9303

## CE SAFETY PRACTICES

All Customer Engineers are expected to take every safety precaution possible and observe the following safety practices while maintaining IBM equipment:

1. You should not work alone under hazardous conditions or around equipment with dangerous voltage. Always advise your manager if you **MUST** work alone.
2. Remove all power, ac and dc, when removing or assembling major components, working in immediate areas of power supplies, performing mechanical inspection of power supplies, or installing changes in machine circuitry.
3. After turning off wall box power switch, lock it in the Off position or tag it with a "Do Not Operate" tag, Form 229-1266. Pull power supply cord whenever possible.
4. When it is absolutely necessary to work on equipment having exposed operating mechanical parts or exposed live electrical circuitry anywhere in the machine, observe the following precautions:
  - a. Another person familiar with power off controls must be in immediate vicinity.
  - b. Do not wear rings, wrist watches, chains, bracelets, or metal cuff links.
  - c. Use only insulated pliers and screwdrivers.
  - d. Keep one hand in pocket.
  - e. When using test instruments, be certain that controls are set correctly and that insulated probes of proper capacity are used.
  - f. Avoid contacting ground potential (metal floor strips, machine frames, etc.). Use suitable rubber mats, purchased locally if necessary.
5. Wear safety glasses when:
  - a. Using a hammer to drive pins, riveting, staking, etc.
  - b. Power or hand drilling, reaming, grinding, etc.
  - c. Using spring hooks, attaching springs.
  - d. Soldering, wire cutting, removing steel bands.
  - e. Cleaning parts with solvents, sprays, cleaners, chemicals, etc.
  - f. Performing any other work that may be hazardous to your eyes. **REMEMBER — THEY ARE YOUR EYES.**
6. Follow special safety instructions when performing specialized tasks, such as handling cathode ray tubes and extremely high voltages. These instructions are outlined in CEMs and the safety portion of the maintenance manuals.
7. Do not use solvents, chemicals, greases, or oils that have not been approved by IBM.
8. Avoid using tools or test equipment that have not been approved by IBM.
9. Replace worn or broken tools and test equipment.
10. Lift by standing or pushing up with stronger leg muscles — this takes strain off back muscles. Do not lift any equipment or parts weighing over 60 pounds.
11. After maintenance, restore all safety devices, such as guards, shields, signs, and grounding wires.
12. Each Customer Engineer is responsible to be certain that no action on his part renders products unsafe or exposes customer personnel to hazards.
13. Place removed machine covers in a safe out-of-the-way place where no one can trip over them.
14. Ensure that all machine covers are in place before returning machine to customer.
15. Always place CE tool kit away from walk areas where no one can trip over it; for example, under desk or table.

16. Avoid touching moving mechanical parts when lubricating, checking for play, etc.
17. When using stroboscope, do not touch **ANYTHING** — it may be moving.
18. Avoid wearing loose clothing that may be caught in machinery. Shirt sleeves must be left buttoned or rolled above the elbow.
19. Ties must be tucked in shirt or have a tie clasp (preferably nonconductive) approximately 3 inches from end. Tie chains are not recommended.
20. Before starting equipment, make certain fellow CEs and customer personnel are not in a hazardous position.
21. Maintain good housekeeping in area of machine while performing and after completing maintenance.

**Knowing safety rules is not enough.  
An unsafe act will inevitably lead to an accident.  
Use good judgment — eliminate unsafe acts.**

## ARTIFICIAL RESPIRATION

### General Considerations

1. **Start Immediately — Seconds Count**  
Do not move victim unless absolutely necessary to remove from danger. Do not wait or look for help or stop to loosen clothing, warm the victim, or apply stimulants.
2. **Check Mouth for Obstructions**  
Remove foreign objects. Pull tongue forward.
3. **Loosen Clothing — Keep Victim Warm**  
Take care of these items after victim is breathing by himself or when help is available.
4. **Remain in Position**  
After victim revives, be ready to resume respiration if necessary.
5. **Call a Doctor**  
Have someone summon medical aid.
6. **Don't Give Up**  
Continue without interruption until victim is breathing without help or is certainly dead.

### Rescue Breathing for Adults

1. Place victim on his back immediately.
2. Clear throat of water, food, or foreign matter.
3. Tilt head back to open air passage.
4. Lift jaw up to keep tongue out of air passage.
5. Pinch nostrils to prevent air leakage when you blow.
6. Blow until you see chest rise.
7. Remove your lips and allow lungs to empty.
8. Listen for snoring and gurglings — signs of throat obstruction.
9. Repeat mouth to mouth breathing 10-20 times a minute. Continue rescue breathing until victim breathes for himself.



Thumb and  
finger positions



Final mouth-to-  
mouth position



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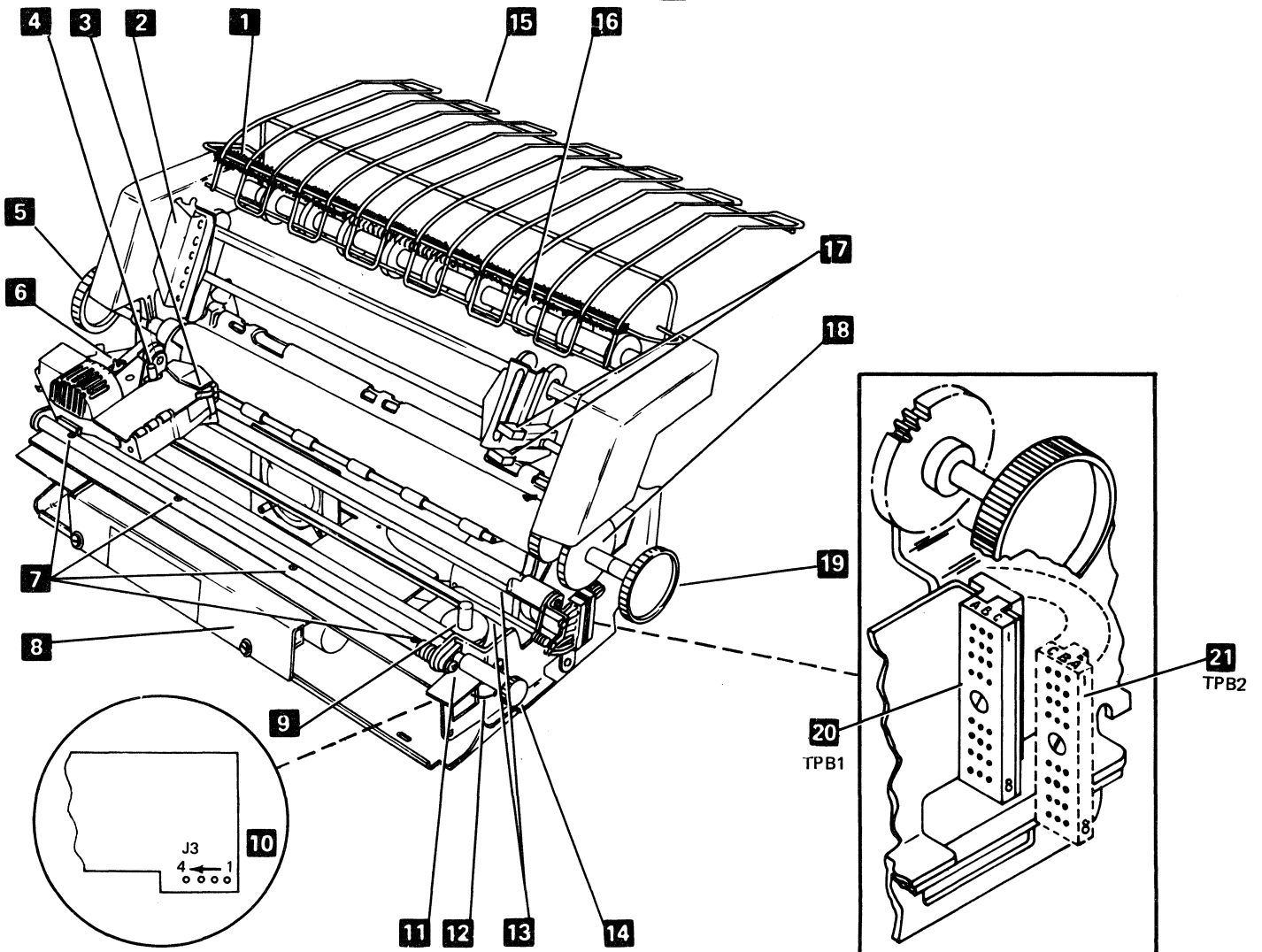
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## Locations

### 300 FRONT AND RIGHT SIDE LOCATIONS

- |                                              |                                          |
|----------------------------------------------|------------------------------------------|
| <b>1</b> Static Eliminator                   | <b>11</b> Fine Adjustment Mounting Screw |
| <b>2</b> Left Tractor                        | <b>12</b> Ground Wire                    |
| <b>3</b> Ribbon Feed Roll Release Knob       | <b>13</b> Ribbon Drive Lines             |
| <b>4</b> Ribbon Advance Knob                 | <b>14</b> Fine Adjustment Knob           |
| <b>5</b> Paper Advance Knob                  | <b>15</b> Forms Tractor Unit Rack        |
| <b>6</b> Retract Lever                       | <b>16</b> Tractor Rollers                |
| <b>7</b> Print Emitter Support Shaft Screws  | <b>17</b> Right Tractor Release Knobs    |
| <b>8</b> Safety Cover                        | <b>18</b> Forms Tractor Drive Gear       |
| <b>9</b> Print Head Stepper Motor and Pulley | <b>19</b> Paper Advance Knob             |
| <b>10</b> Oscillator                         | <b>20</b> TPB1                           |
|                                              | <b>21</b> TPB2                           |





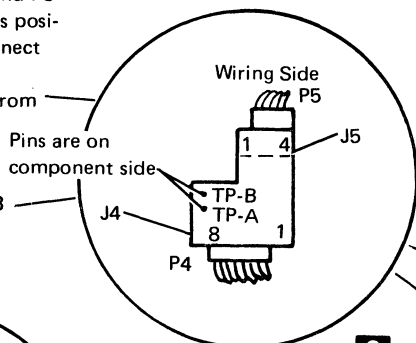
## 301 FRONT AND LEFT SIDE LOCATIONS

- |           |                                                                                |           |                                        |
|-----------|--------------------------------------------------------------------------------|-----------|----------------------------------------|
| <b>1</b>  | Forms Feed Emitter Amplifier Card (on machines without EC 579623 or EC 579920) | <b>14</b> | Paper Release Lever                    |
| <b>2</b>  | Print Head Forms Guide                                                         | <b>15</b> | Platen Gears                           |
| <b>3</b>  | Platen                                                                         | <b>16</b> | Idler Gear                             |
| <b>4</b>  | A-frame                                                                        | <b>17</b> | Ribbon Advance Knob                    |
| <b>5</b>  | Platen Release Level                                                           | <b>18</b> | Ribbon Box                             |
| <b>6</b>  | End of Forms Switch                                                            | <b>19</b> | Print Head Cover                       |
| <b>7</b>  | Switch S1 (metal cover machines only)                                          | <b>20</b> | Copy Control Dial                      |
| <b>8</b>  | Platen Pressure Rolls                                                          | <b>21</b> | EC3                                    |
| <b>9</b>  | Ribbon Drive Lines                                                             | <b>22</b> | Print Emitter Support Shaft            |
| <b>10</b> | Ground Wire (on machines without EC 579623)                                    | <b>23</b> | Oil Reservoir                          |
| <b>11</b> | Hold Down Bracket                                                              | <b>24</b> | Print Head Carrier                     |
| <b>12</b> | Retract Ramp                                                                   | <b>25</b> | Belt                                   |
| <b>13</b> | Carrier Main Shaft                                                             | <b>26</b> | Carrier Support Shaft                  |
|           |                                                                                | <b>27</b> | Print Emitter Assembly                 |
|           |                                                                                | <b>28</b> | Print Emitter Pickup (slider assembly) |

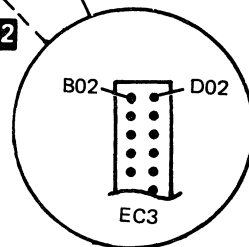
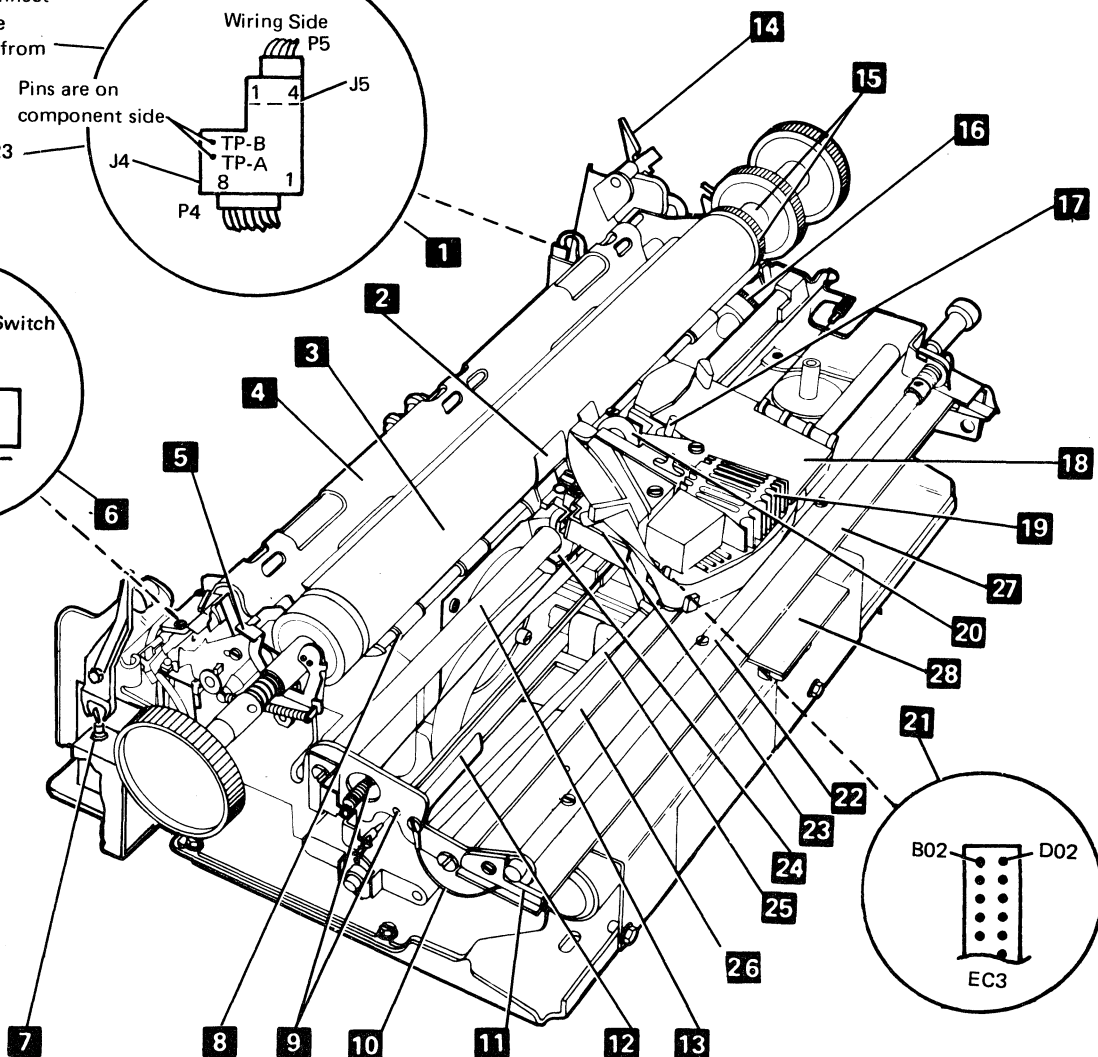
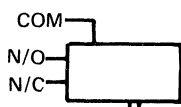
A mark on the P4 and P5 connectors indicates position 1. Always connect P4 and P5 with the marked side away from the board.

On machines without EC 579623 or EC 579920.

Pins are on component side



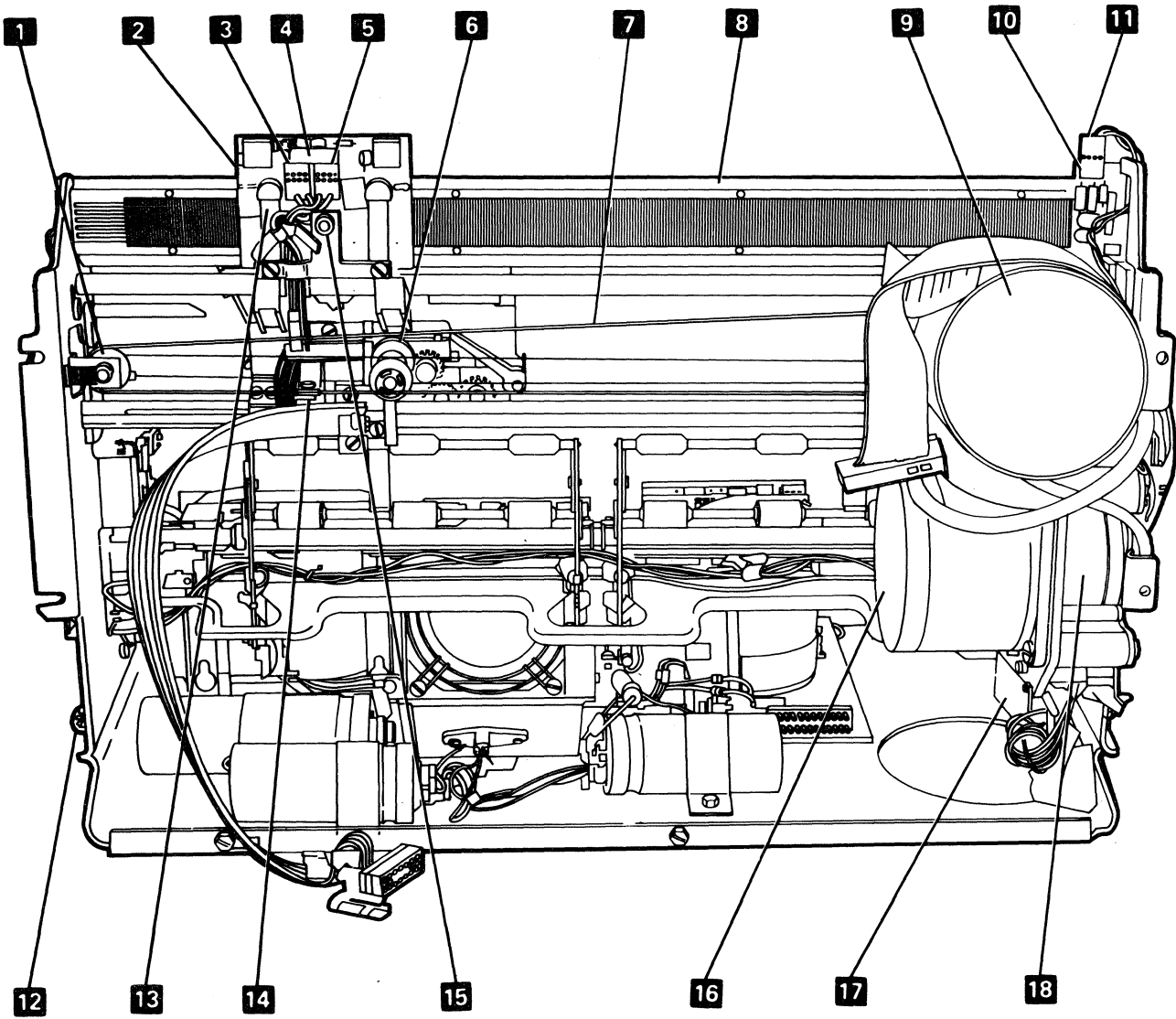
End of Forms Switch





**302 BOTTOM LOCATIONS**

- |          |                                 |           |                                                                                |
|----------|---------------------------------|-----------|--------------------------------------------------------------------------------|
| <b>1</b> | Drive Belt Idler                | <b>10</b> | J3                                                                             |
| <b>2</b> | Print Emitter Pickup            | <b>11</b> | P3                                                                             |
| <b>3</b> | P2A                             | <b>12</b> | Screw (clamping printer in service position)                                   |
| <b>4</b> | J2                              | <b>13</b> | Print Emitter Flat Springs                                                     |
| <b>5</b> | P2B                             | <b>14</b> | Belt Clamp                                                                     |
| <b>6</b> | Ribbon Drive Clutches and Gears | <b>15</b> | Compression Spring                                                             |
| <b>7</b> | Print Head Drive Belt           | <b>16</b> | Forms Feed Stepper Motor                                                       |
| <b>8</b> | Print Emitter Board             | <b>17</b> | Forms Feed Emitter Amplifier Card (on machines without EC 579623 or EC 579920) |
| <b>9</b> | Print Head Stepper Motor        | <b>18</b> | Forms Feed Emitter                                                             |



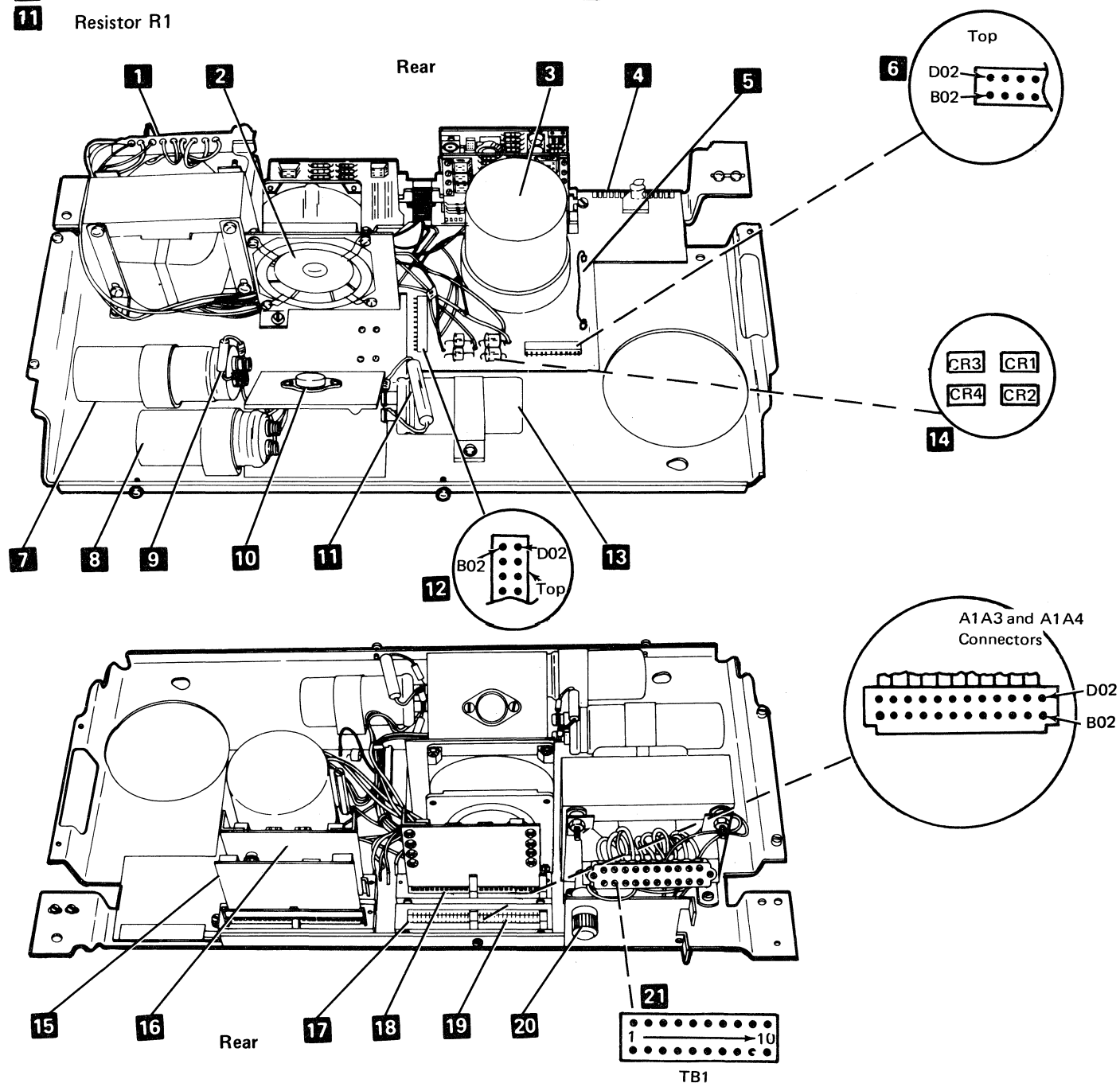
Service Position



## 303 BASE LOCATIONS

- 1** Transformer and TB1
- 2** Fan
- 3** Capacitor C3
- 4** Power Supply Board A1 (see following page)
- 5** Jumper Z3
- 6** EC2
- 7** Capacitor C1
- 8** Capacitor C4 (80 cps only)
- 9** Resistor R2
- 10** Transistor Q1
- 11** Resistor R1

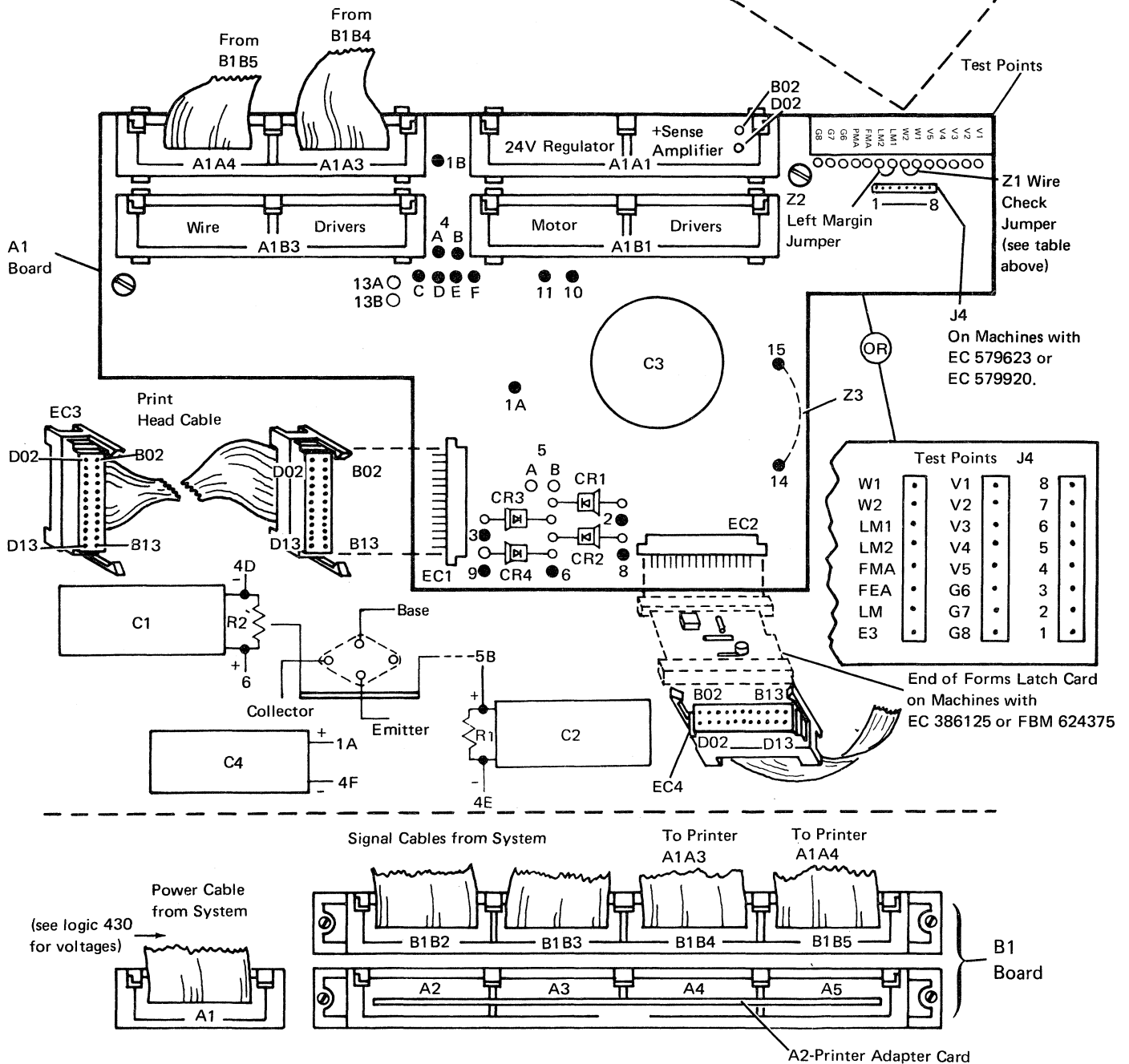
- 12** EC1
- 13** Capacitor C2
- 14** CR1-CR4
- 15** A1A1
- 16** A1B1
- 17** A1A3
- 18** A1B3
- 19** A1A4
- 20** Fuse F1
- 21** TB1





# 304 POWER SUPPLY BOARD A1 AND PRINTER ADAPTER BOARD B1

Test Points		Tolerance	
V1	+24 Vdc	21.6 Vdc	26.4 Vdc
V2	+30 Vdc	27.0 Vdc	40.0 Vdc
V3	+10.8 Vdc	8.1 Vdc	15.0 Vdc
V4	+5 Vdc	4.6 Vdc	5.5 Vdc
V5	+5 Vdc	4.6 Vdc	5.5 Vdc
W1	Wire On		
W2	Sets Wire Check (to adapter)		
LM1	Left Margin		
LM2	Left Margin (to adapter)		
FMA	A Forms Drive		
PMA	A Print Head Driver		
G6;7	Ground from A1A3, A4		
G8	Ground from A1A4		





## Covers

### 310 PRINTER COVER

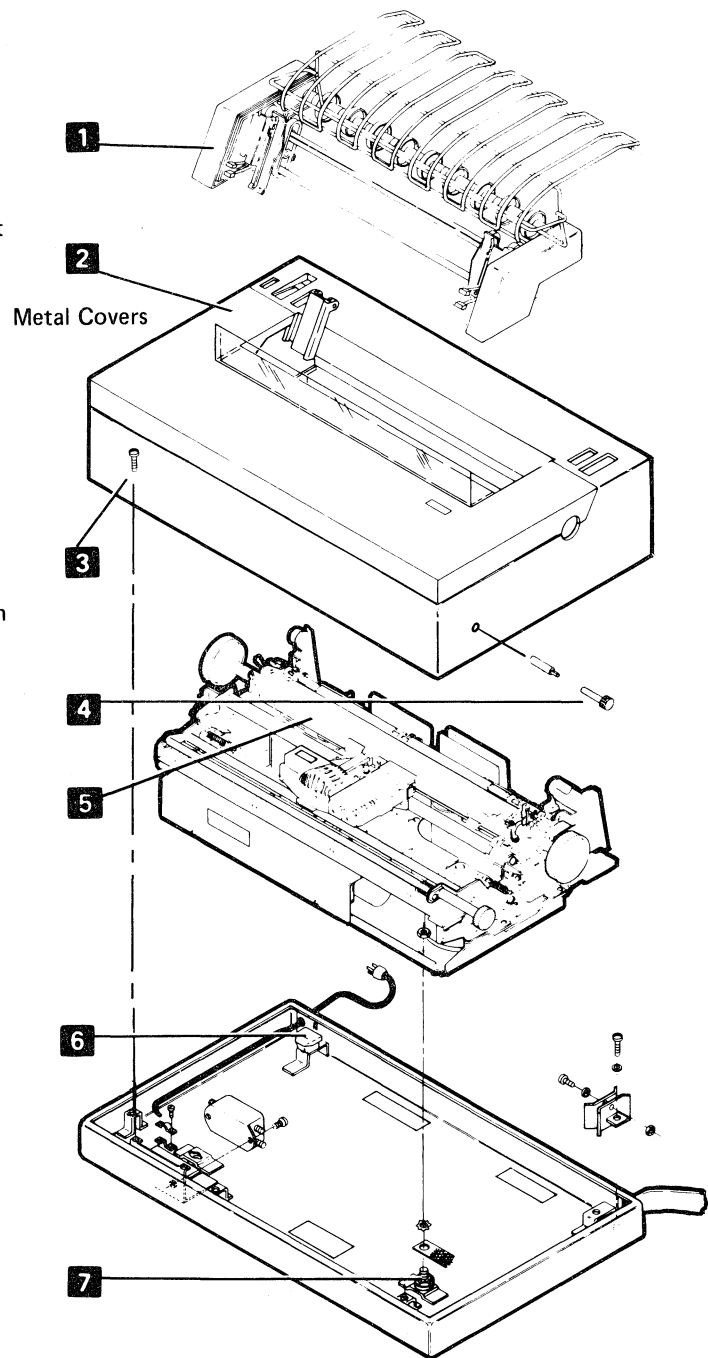
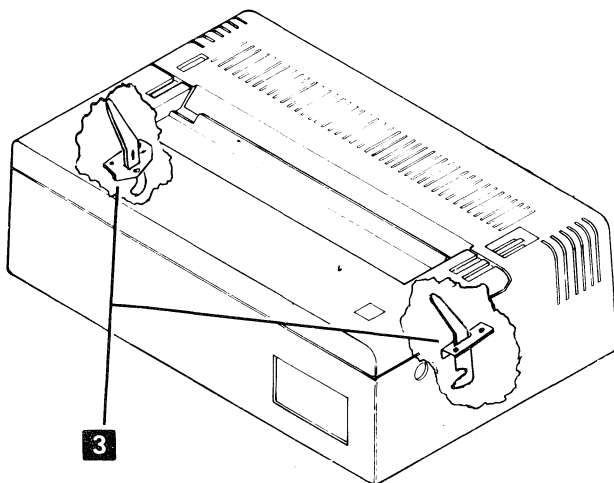
#### Adjustment

1. Center the platen knobs vertically and maintain a gap of 1/8 inch to 5/32 inch (3.18 mm to 3.96 mm) between the top cover **2** and the forms tractor **1** by adjusting the pads **6** in back and the double nuts in front.
2. Position the printer horizontally on the double nut studs **7** to center the paper release lever.

#### Removal

1. Power down.
2. Remove the forms tractor unit (324). **1**
3. Remove the platen (320). **5**
4. Pull off the horizontal fine adjustment knob **4** on metal covers; on plastic covers, loosen the set screw first.
5. Remove the sliding covers if the machine has plastic covers.
6. Loosen the fasteners **3** and remove the covers. Some covers have screws for fasteners.
7. To replace, reverse this procedure.

#### Plastic Covers

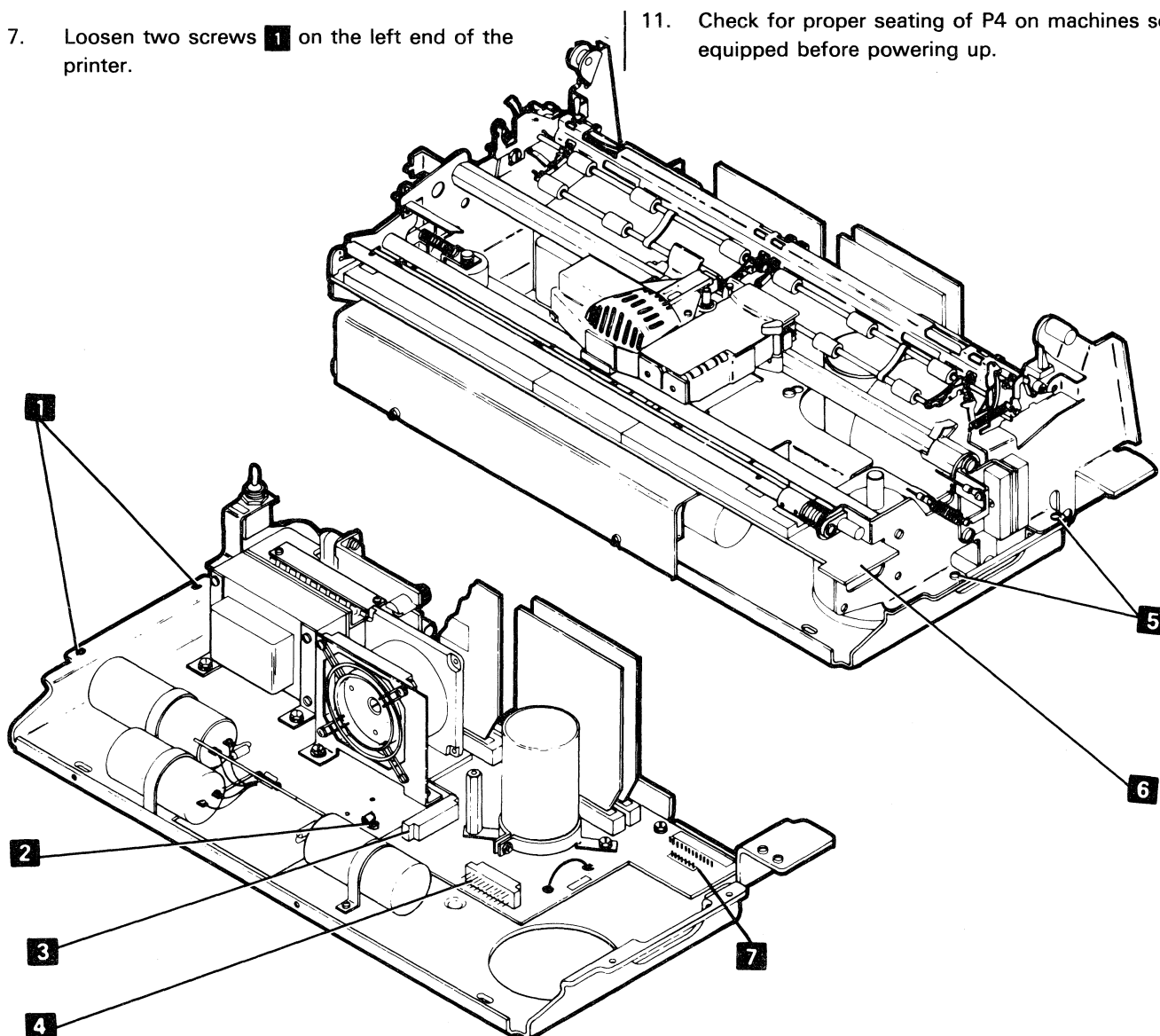




### 311 SEPARATING THE PRINTER FROM THE POWER SUPPLY

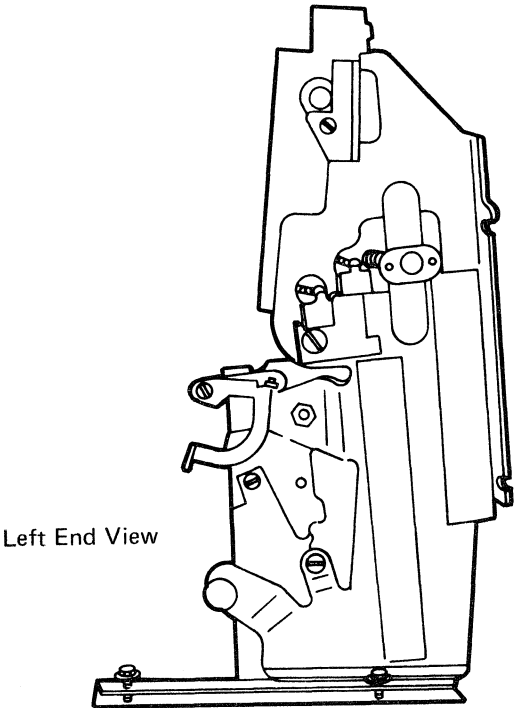
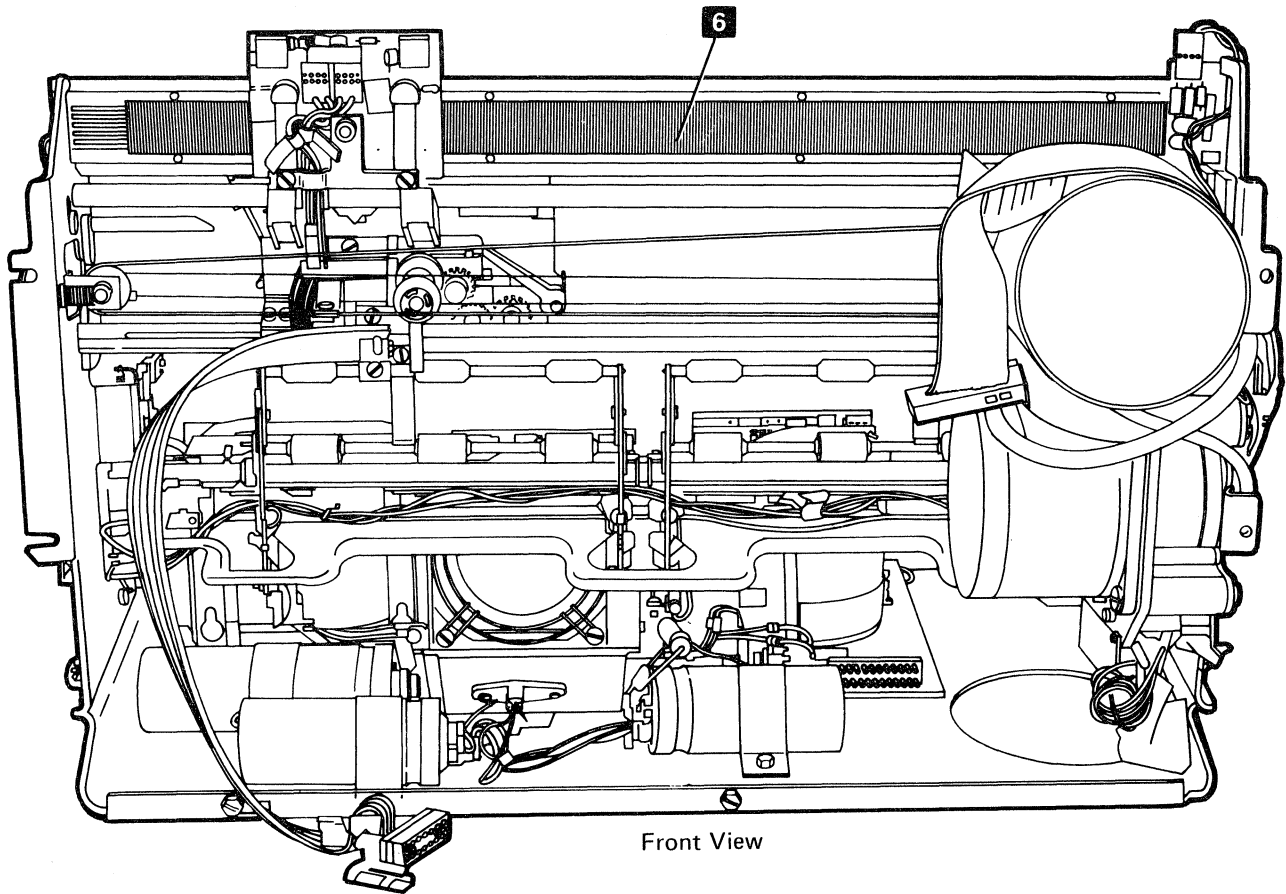
1. Power down.
2. Remove the printer cover (310).
3. Remove the cable clamp **2** near EC1.
4. Disconnect EC1 **3** and EC2 **4**. For installation, be sure the print head cable is against the flat spring.
5. Disconnect J4 **7** on machines so equipped. Note the position of the white dot on the connector to the arrow on the power board.
6. Remove two screws on the right end of the printer **5** (when CE is facing the printer).
7. Loosen two screws **1** on the left end of the printer.
8. Lift the right end of the printer slightly and slide the printer to the right to clear the screws **1**. (Be careful not to damage the forms emitter amplifier on machines without EC 579623 or EC 579920.)
9. Lift the printer from the power supply. If the underside of the printer is to be serviced, remove the paper deflector and set the printer into the service position on the base (so that the print emitter **6** points upward). Secure the printer in this position with a base screw **1** on the left side and a base screw **5** on the right side.
10. To reassemble the printer on the power supply, reverse this procedure.
11. Check for proper seating of P4 on machines so equipped before powering up.

**Note:** Open the ribbon feed rolls and make sure the ribbon box cover remains closed.



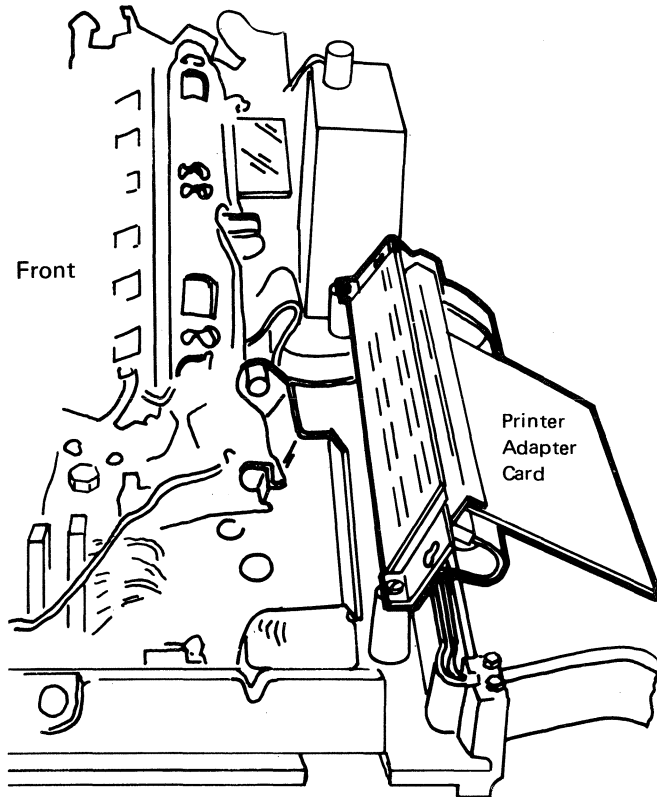


Printer

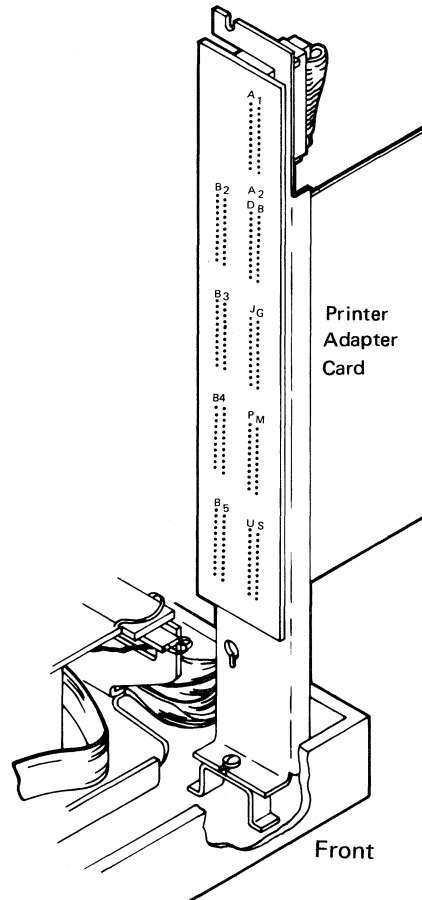




B1 Board



Plastic Covers



Metal Covers



## Forms

### 320 PLATEN AND PAPER DEFLECTOR

#### Removal

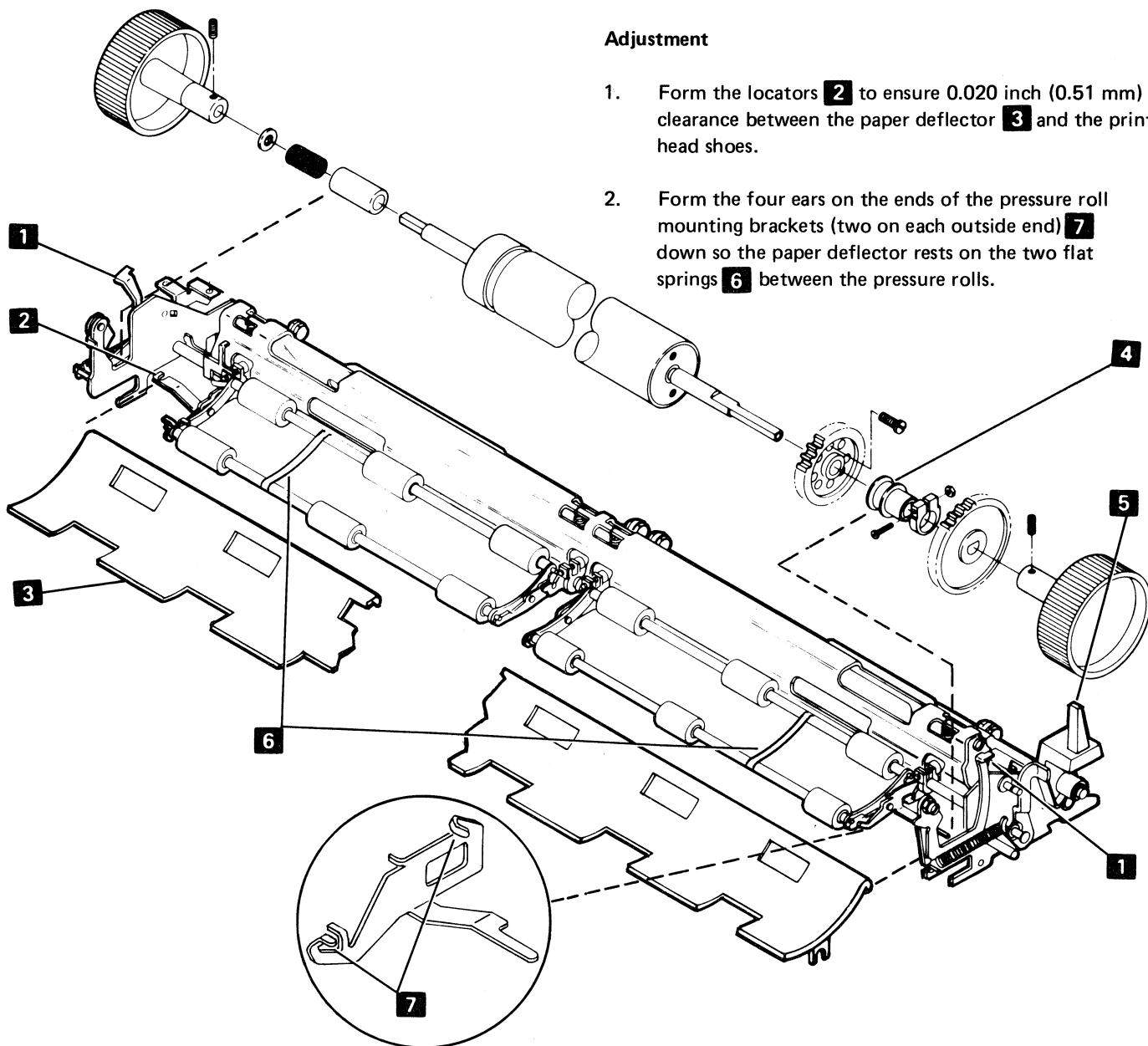
1. Power down.
2. Center the print head on the platen.
3. Remove the forms tractor unit (324).
4. To remove the platen, open the cover platen saddles and lift up on the platen knobs while pressing down on the platen release levers **1**.

5. To install the platen:
  - a. If the paper release lever **5** is back, pull it forward.
  - b. Ensure that the paper deflector **3** is seated correctly with slotted tabs engaging locators **2**.
  - c. Center the print head on the platen.
  - d. Align the groove in the gear end of the platen shaft **4** with the sideplate. Then, press down on both ends of the platen. Ensure that the gears mesh properly.
  - e. Ensure that the platen release levers are completely seated.

*Note:* Locators **2** may require forming to ensure 0.020 inch (0.51 mm) clearance between paper deflector **3** and the print head shoes (364).

#### Adjustment

1. Form the locators **2** to ensure 0.020 inch (0.51 mm) clearance between the paper deflector **3** and the print head shoes.
2. Form the four ears on the ends of the pressure roll mounting brackets (two on each outside end) **7** down so the paper deflector rests on the two flat springs **6** between the pressure rolls.





## 321 PLATEN RELEASE ECCENTRICS

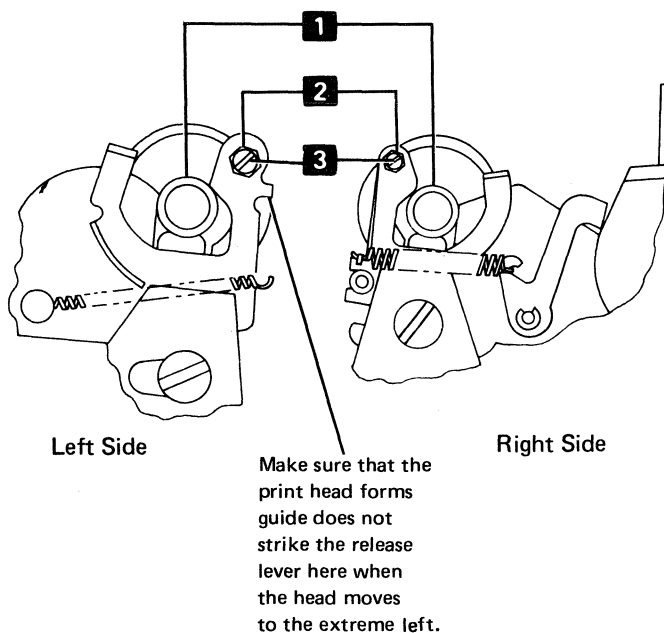
### Adjustment

This procedure adjusts both the left and right eccentrics. However, when adjusting the left eccentric, ensure that the platen release lever does not touch the print head forms guide when the carrier moves to the extreme left.

1. Power down.
2. Remove the printer cover (310).
3. Loosen the screw **3** that locks the eccentric nut **2** until the screw is finger tight.

*Note:* When adjusting the right side, remove the platen knob and forms tractor drive gear. When replacing, adjust clearance to bushing **8**.

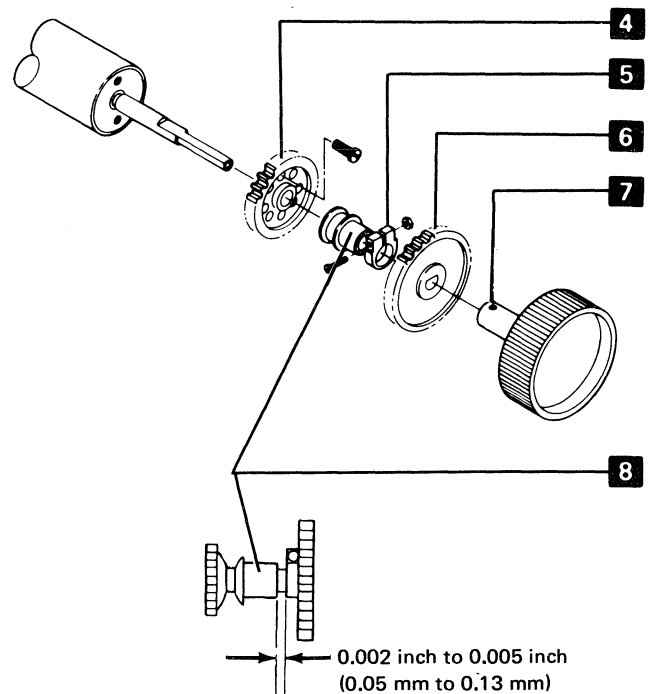
4. Press the platen bushing **1** down and turn the eccentric nut so that when released, the lever holds the bushing firmly against the frame.
5. Hold the eccentric nut in this position and tighten the locking screw.
6. Check the platen gear backlash adjustment (327, 330).
7. Reinstall the printer cover (310).



## 322 PLATEN GEARS

### Removal

1. Power down.
2. Remove the forms tractor unit.
3. Open the cover platen saddles and remove the platen.
4. Remove the knob from the gear end of the platen (two setscrews **7**).
5. Loosen the clamping hub **5** on the forms tractor drive gear.
6. For installation, the bushing **8** must rotate freely with 0.002 inch to 0.005 inch (0.05 mm to 0.13 mm) clearance to the gear hub **5**.
7. Remove the gear **6** and bushing **8**.
8. Remove the screws that hold the platen gear **4**.
9. Remove the gear.
10. To reinstall the gears, reverse this procedure.





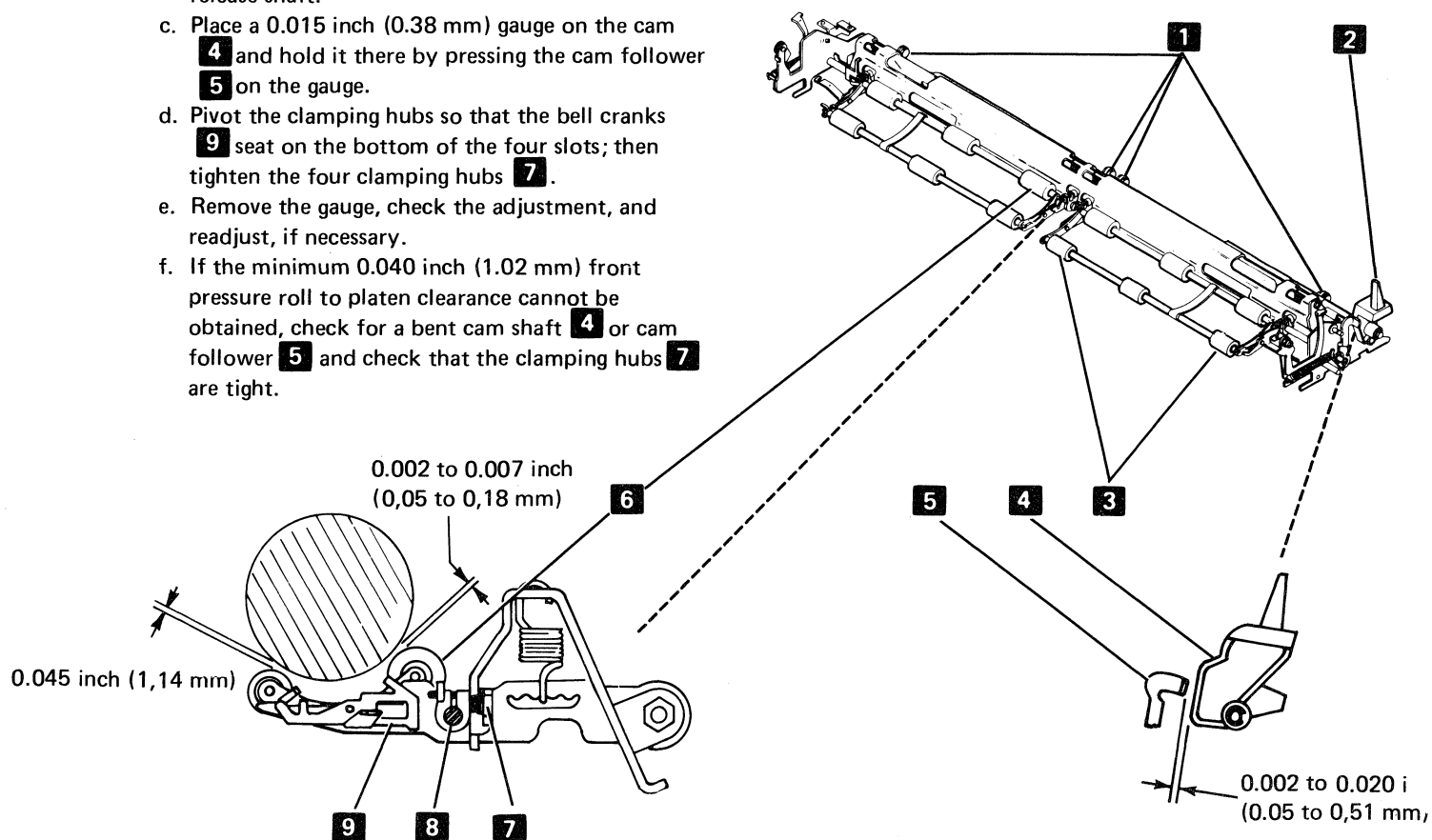
## 323 PLATEN PRESSURE ROLLS

### Adjustment

Adjust the paper release shaft **8** so that the paper release **2** provides a minimum of 0.040 inch (1.02 mm) between the pressure rolls **6** and the platen with the paper release lever **2** forward.

Adjust the pressure roll arms **1**, front to rear, so that a 0.002 to 0.007 inch (0.05 mm to 0.18 mm) clearance exists between the rear pressure rolls **6** and the platen. Insert 0.045 inch (1.14 mm) gauges (or 6 tab cards) between the front pressure rolls and the platen, with the paper release lever **2** back. With the gauges removed and the paper release lever back, there should be no clearance.

1. Power down.
2. Remove the printer cover (310), platen, and paper deflector.
3. Reinstall the platen.
4. Adjust the paper release shaft **8**:
  - a. Push the paper release lever **2** back.
  - b. Loosen the four clamping hubs **7** along the paper release shaft.
  - c. Place a 0.015 inch (0.38 mm) gauge on the cam **4** and hold it there by pressing the cam follower **5** on the gauge.
  - d. Pivot the clamping hubs so that the bell cranks **9** seat on the bottom of the four slots; then tighten the four clamping hubs **7**.
  - e. Remove the gauge, check the adjustment, and readjust, if necessary.
  - f. If the minimum 0.040 inch (1.02 mm) front pressure roll to platen clearance cannot be obtained, check for a bent cam shaft **4** or cam follower **5** and check that the clamping hubs **7** are tight.
5. Adjust the pressure roll arms:
  - a. Slide the print head to the extreme left.
  - b. Push the paper release lever **2** back.
  - c. Adjust the right half of the platen pressure roll assembly first by forcing 0.045 inch (1.14 mm) gauges between the two outside front pressure rolls and the platen **3**. (The 0.045 inch gauges can also be obtained using 6 tab cards.)
  - d. Loosen the two nuts **1** holding this set of pressure roll arms.
  - e. Move the arms as required to obtain a 0.002 to 0.007 (0.05 mm to 0.18 mm) inch gap between all three rear pressure rolls and the platen, then tighten the two nuts **1**.
  - f. Check adjustment; repeat if necessary.
  - g. Check adjustment on pressure rolls for the left half of the platen; adjust, if necessary, using the previous steps.
6. Check the adjustments for platen gear backlash (327) and end of forms switch (334); correct them if necessary.
7. Reinstall the printer cover (310).





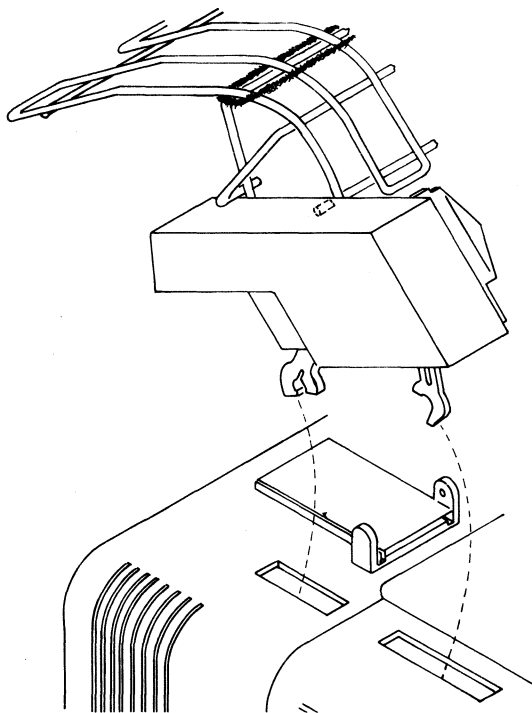
## 324 FORMS TRACTOR UNIT

### Removal

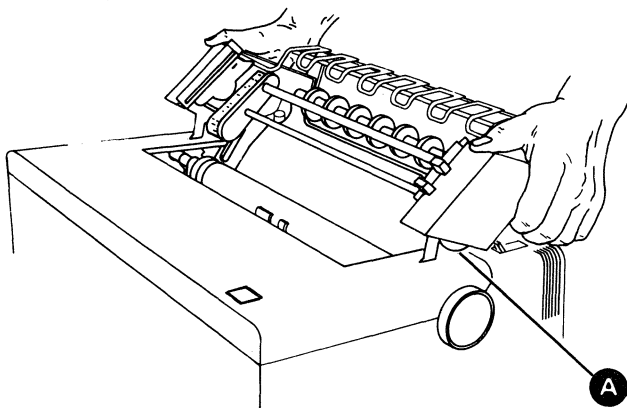
#### CAUTION

When removing the forms tractor unit, take care to avoid twisting it.

1. Remove the unit by pulling up on the rear extensions and allowing the unit to pivot on the platen shaft.
2. Install the unit by setting it on top of the printer and pressing on the rear extensions to snap the rear legs onto their retaining pins. Then, snap the front legs over the platen shaft.



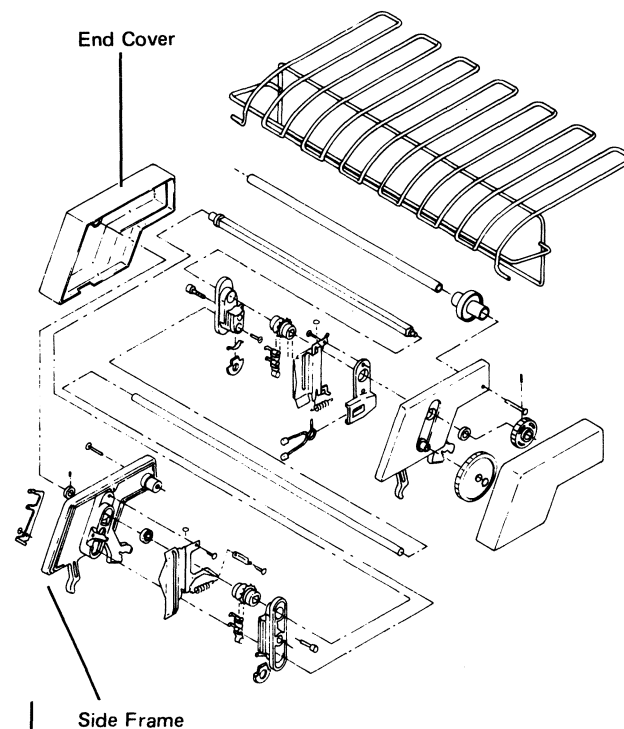
**Note:** When reinstalling, make sure that the gears **A** mesh properly, the platen knobs turn, and the forms tractors rotate.



### Disassembly

Disassemble according to the illustration as needed. The end covers are removed by just pulling them off. When the chain gears are replaced, slide the gears together and ensure the teeth on each gear line up with each other.

**Note:** The forms tractor unit must maintain a parallel position with the platen and be fully seated at all four mounting points. Improper seating is usually caused by a twisted forms tractor unit. This condition can be corrected by removing the right side cover and loosening the two shaft screws 1/8 to 1/4 turn.

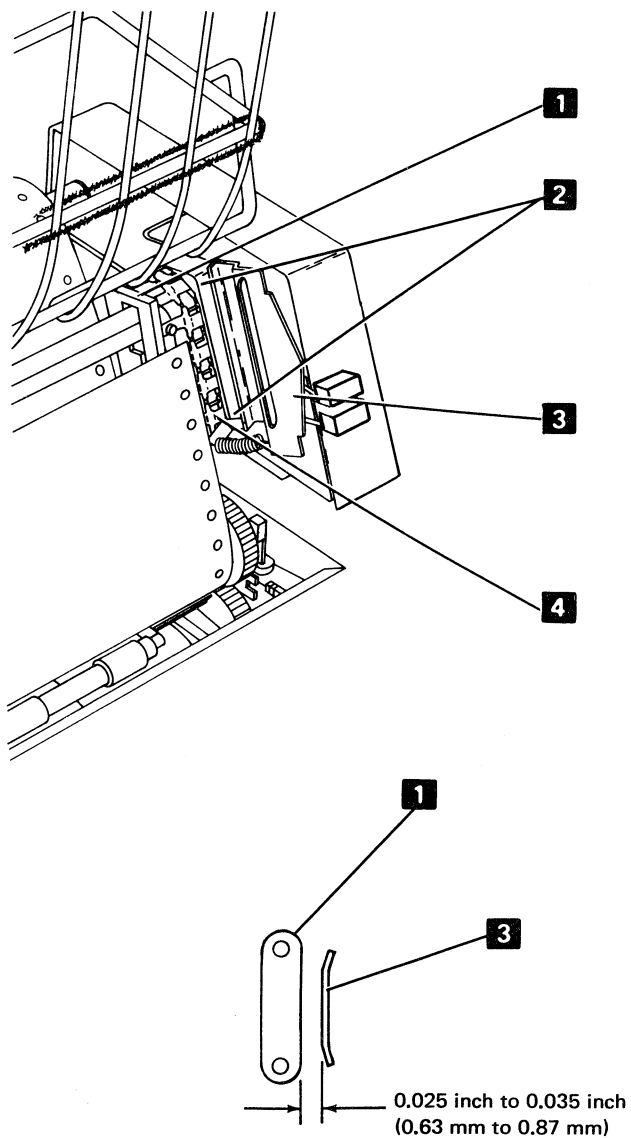




## 325 FORMS TRACTOR UNIT CHAIN COVER

### Adjustment

Form the cover stops **2** so that the gap between the chain guide **1** and cover **3** is 0.025 inch to 0.045 inch (0.63 mm to 1.13 mm). It might be necessary to reposition the hinge brackets **4** to obtain this clearance.



## 326 FORMS TRACTOR UNIT CHAIN

### Removal

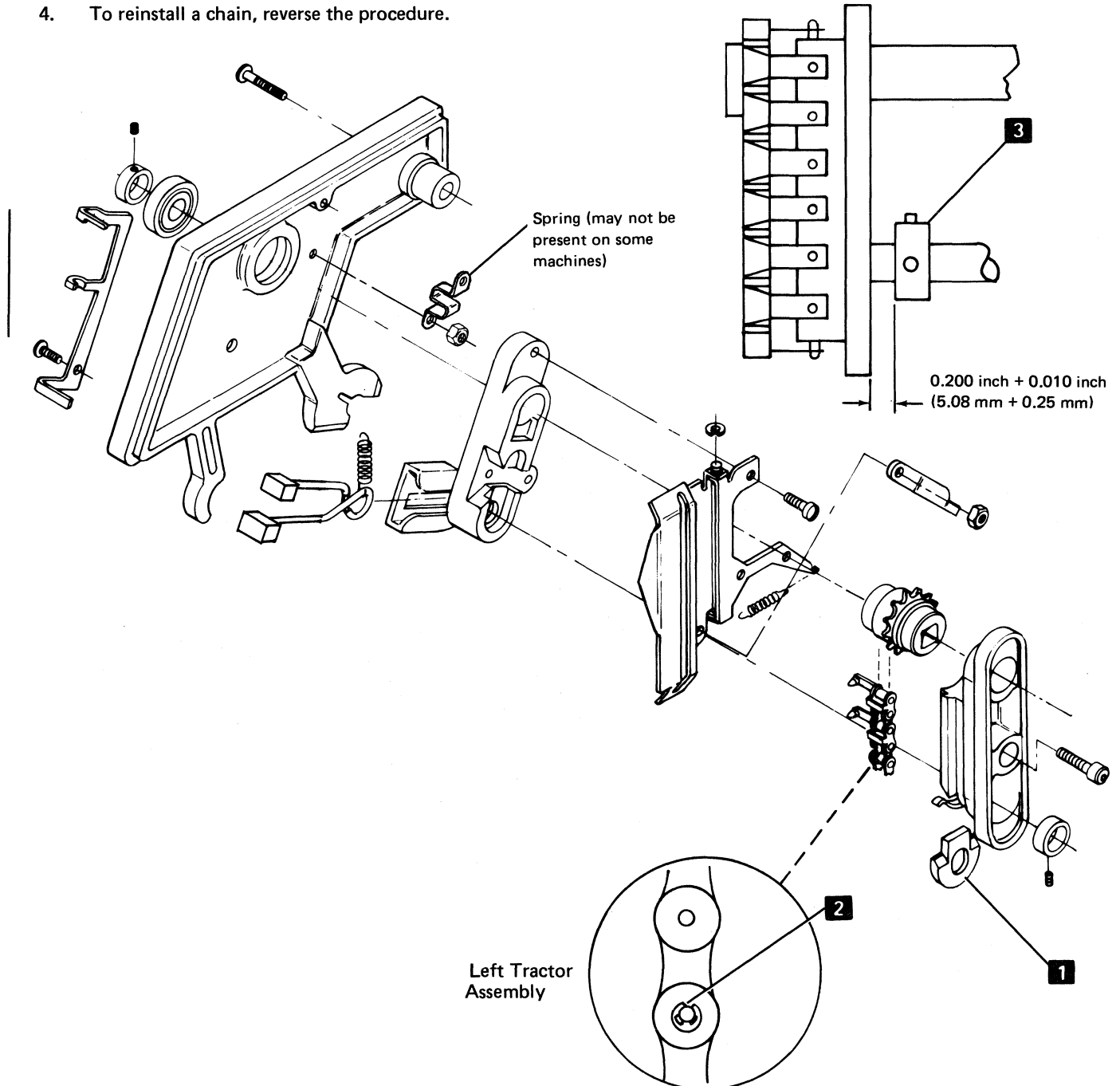
1. Remove the forms tractor unit (324).
2. Locate the pin **2** that holds the chain together. Move the pin to the back side and remove the C-clip.
3. Slide the removable pin from the chain. The chain tensioner **1** and spring might fall out.
4. To reinstall a chain, reverse the procedure.

### LEFT TRACTOR

#### Adjustment

Machines equipped with an adjustable left tractor should follow this procedure.

With the left tractor in the leftmost position, adjust the collar **3** to allow  $0.200 \text{ inch} \pm 0.010 \text{ inch}$  ( $5.08 \text{ mm} \pm 0.25 \text{ mm}$ ) movement of the tractor.



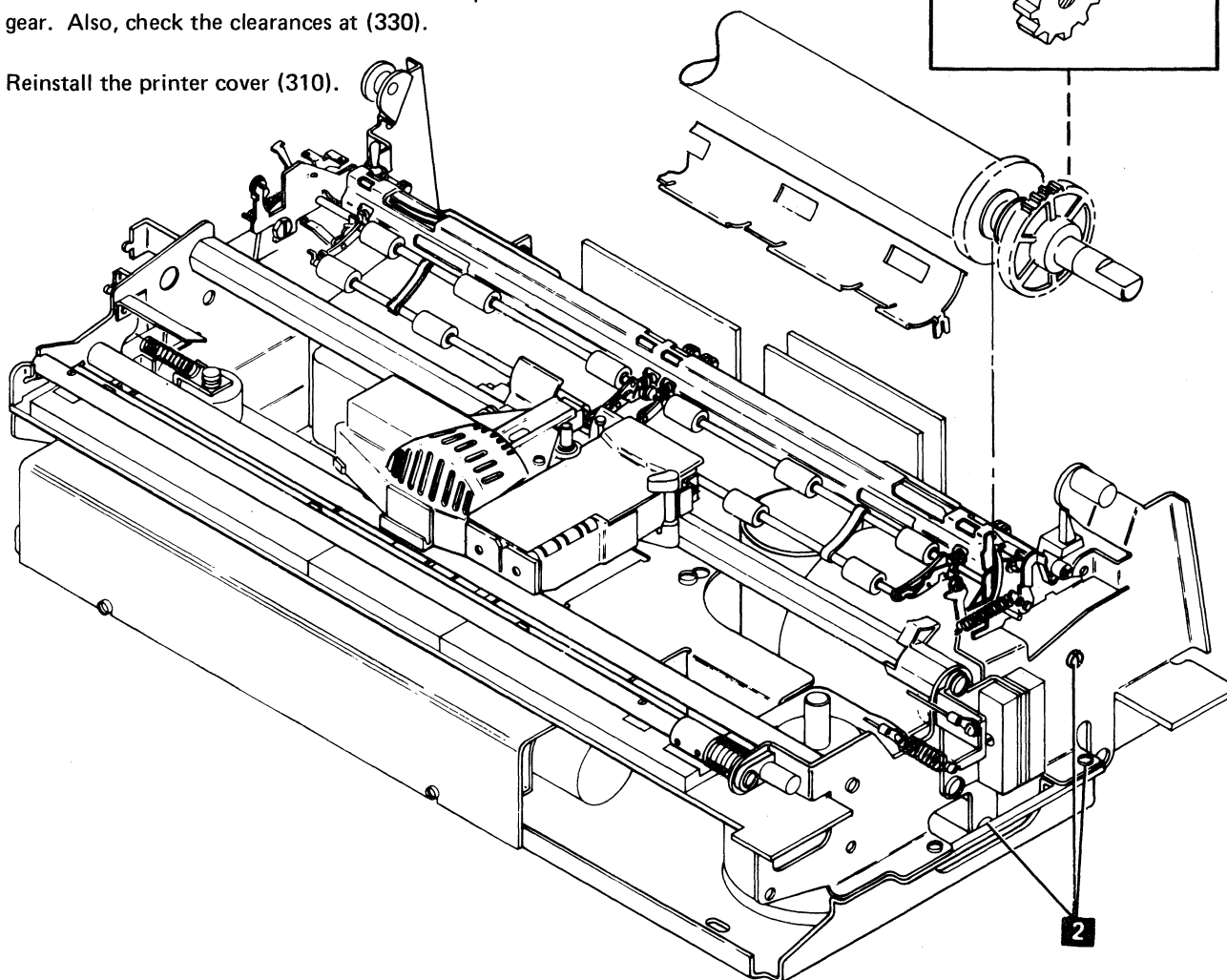
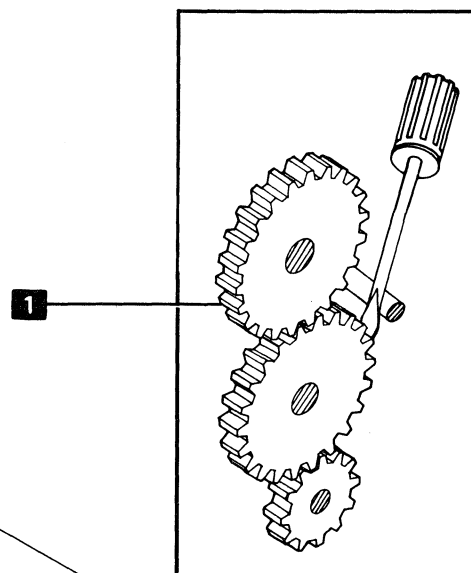


## 327 PLATEN GEAR BACKLASH

### Adjustment

Idler and platen gears should have a slight backlash throughout their rotation.

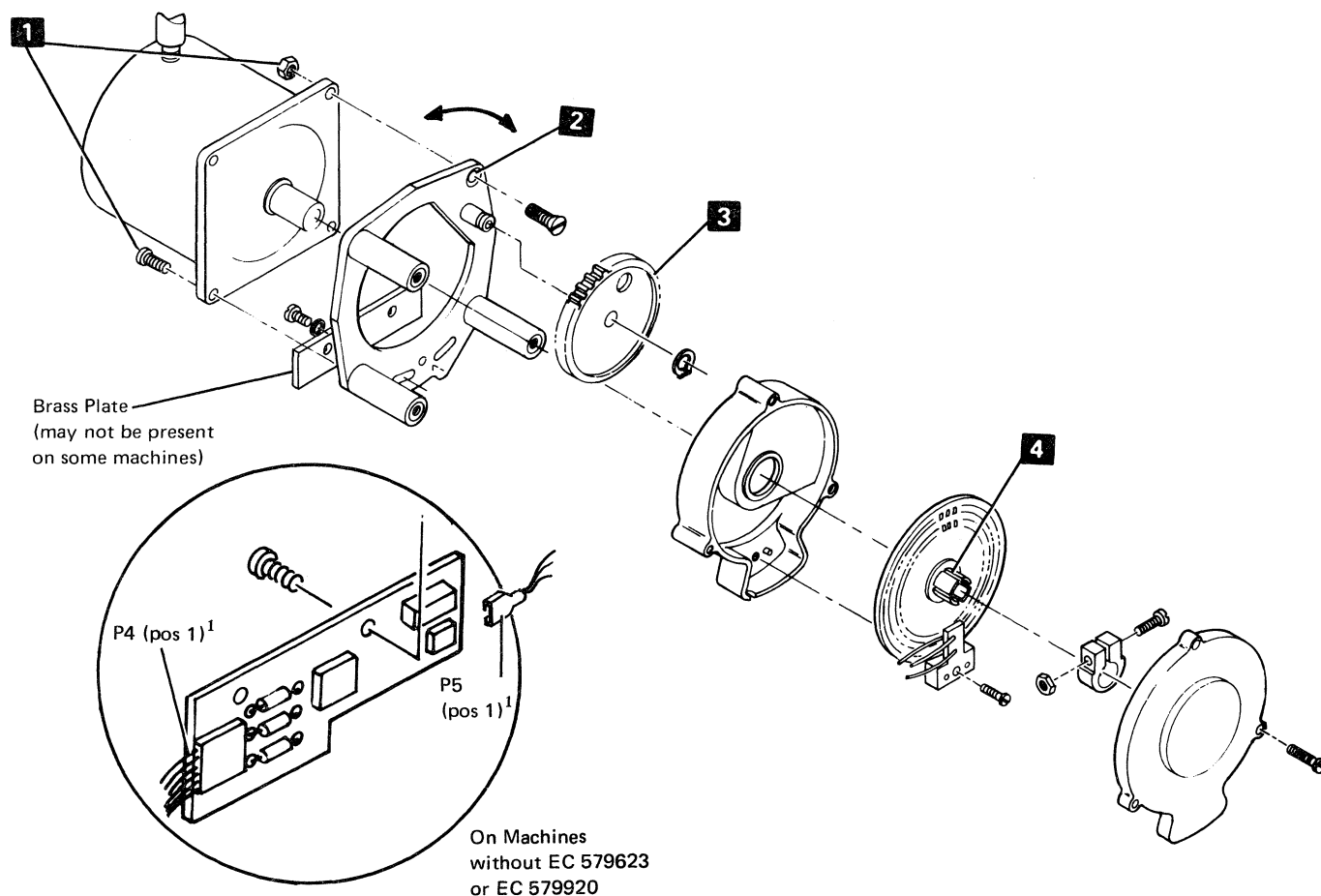
1. Power down.
2. Remove the printer cover (310).
3. Loosen the forms feed stepper motor/emitter mounting screws **2**.
4. Position the stepper motor up and back to provide slight backlash from platen gear to idler gear, 0.000 inch to 0.006 inch (0.00 mm to 0.15 mm) estimated at several locations on the platen gear **1**. Use a screwdriver as shown to prevent the motor idler gear from moving when checking for backlash.
5. Tighten the mounting screws and check for binds and minimum backlash at several locations on the platen gear. Also, check the clearances at (330).
6. Reinstall the printer cover (310).



## 328 FORMS FEED STEPPER MOTOR GEAR BACKLASH

### Adjustment

1. Power down.
2. Separate the printer from the power supply and place the printer in the service position (311).
3. Remove the forms feed stepper motor/emitter assembly (329).
4. Loosen the screws and the nut **1** (bolt head access through hole in the idler gear) that holds the emitter base on the stepper motor.
5. Rotate the base **2** on the motor to obtain slight backlash, 0.000 inch to 0.006 inch (0.00 mm to 0.15 mm) estimated, between idler gear **3** and the motor gear **4**.
6. Check backlash in several positions of the idler gear.
7. Tighten screws and nut.
8. Check backlash and readjust if necessary.
9. Reinstall the forms feed stepper motor/emitter assembly.
10. Adjust platen gear backlash (327).
11. Reassemble the printer and power supply (311).



<sup>1</sup> A mark on the P4 and P5 connectors indicates position 1. Always connect P4 and P5 so that the marked side faces away from the board.

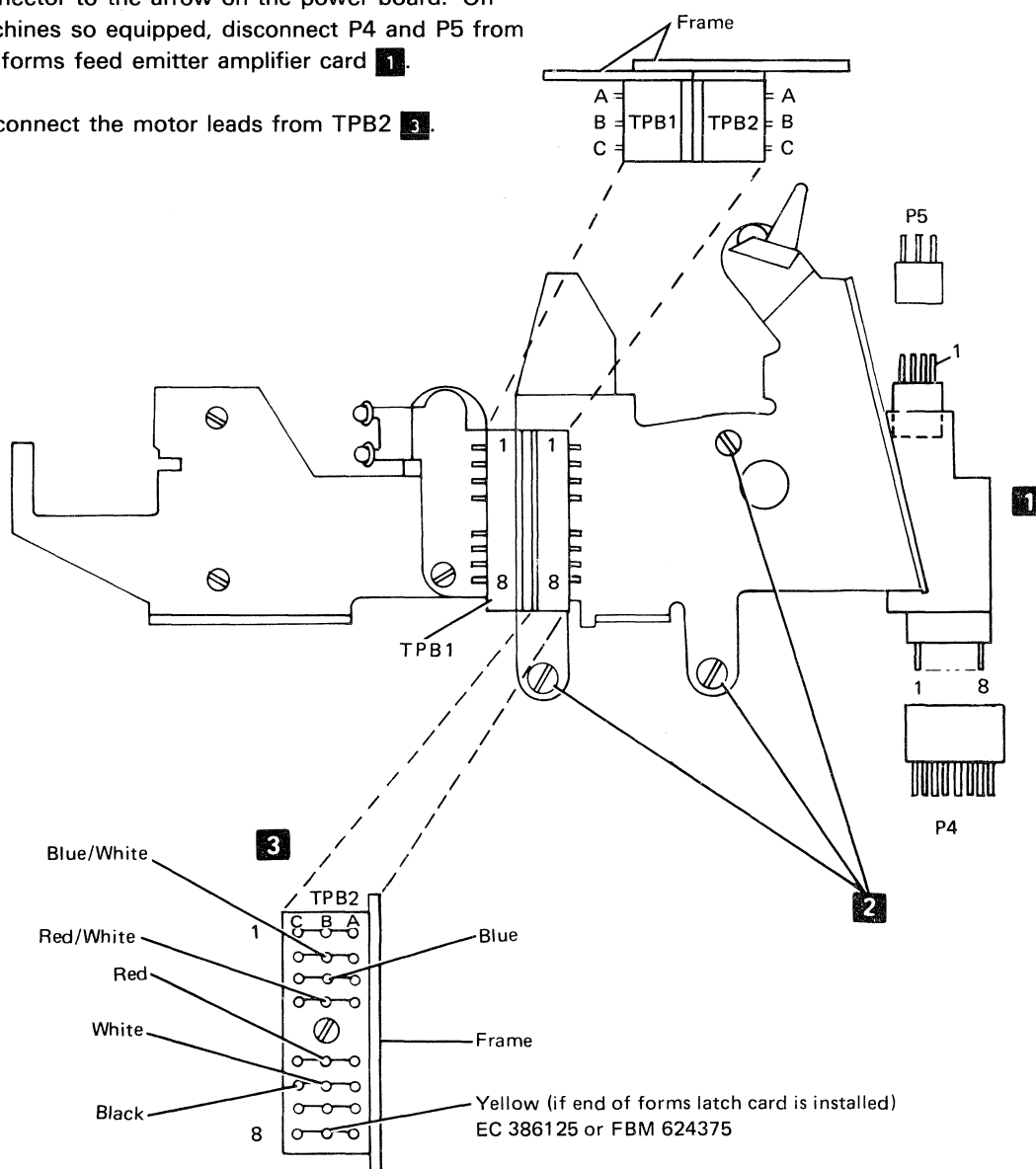


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## 329 FORMS FEED STEPPER MOTOR/EMITTER

### Removal

1. Power down.
2. For installation, if the motor/emitter was disassembled, perform the forms feed stepper motor/emitter timing (332).
3. For installation, adjust the platen gear backlash (327, 330).
4. Disconnect J4 on the power supply board (304). Note the position of the white dot on the connector to the arrow on the power board. On machines so equipped, disconnect P4 and P5 from the forms feed emitter amplifier card **1**.
5. Disconnect the motor leads from TPB2 **3**.
6. Separate the printer from the power supply and place the printer in the service position (312).
7. While supporting the forms feed stepper motor/emitter assembly, remove three mounting screws **2** from the right side frame.
8. Remove the motor/emitter assembly. To remove any parts from the motor/emitter assembly, disassemble it, as required (330).
9. To reinstall the motor/emitter assembly, reverse the procedure.



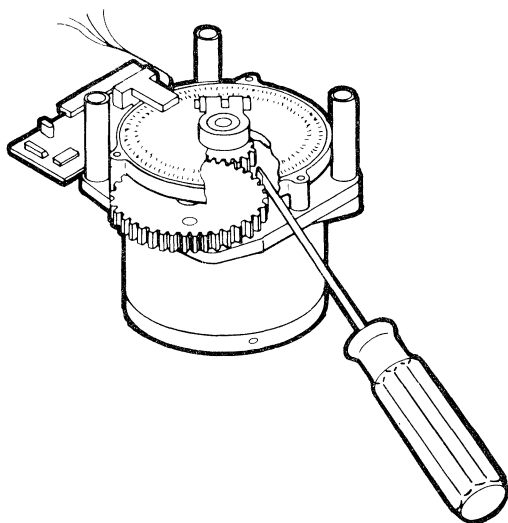


## 330 FORMS FEED STEPPER MOTOR/EMITTER

### Disassembly

1. Power down.
2. Remove the forms feed stepper motor/emitter from the side frame (329).
3. Remove the emitter outer cover **13**.
4. Loosen the disk/gear clamping hub **12**.
5. Remove the two adjusting screws **1** from the back of the base.
6. Remove the screw that holds the photocell assembly **11**.
7. **CAUTION**  
Do not pry on the slotted disk; doing so will bend or scratch it.

Remove the inner cover **8** and the disk/gear assembly from the motor shaft by prying up on the motor gear as illustrated.

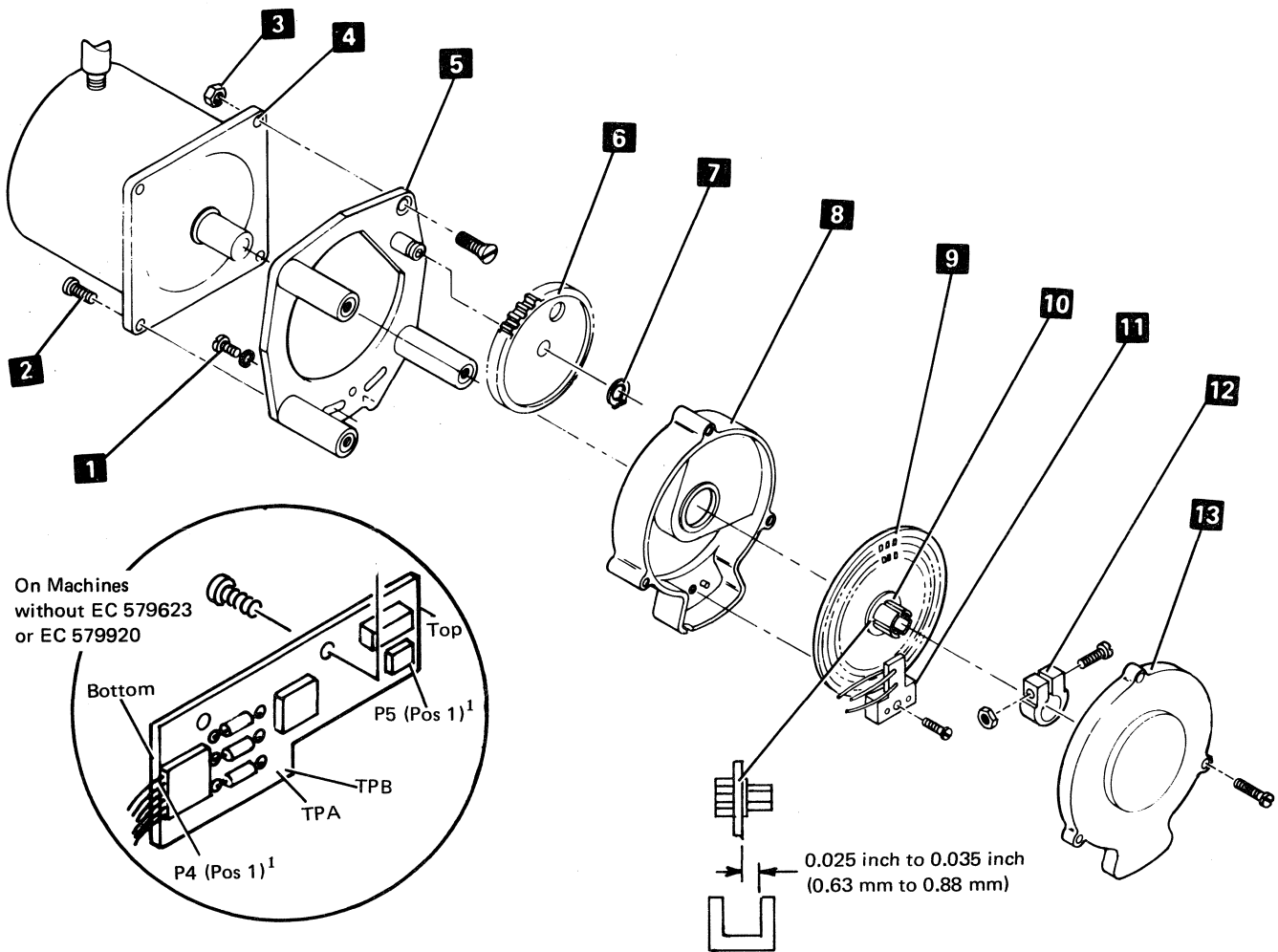


8. Remove the clip **7** that holds the idler gear **6** and lift off the gear.
9. Remove the three screws **2** plus one bolt and nut **3** that fasten the base **5** to the stepper motor **4**.
10. To reassemble the motor/emitter, use the reassembly procedure.

### Reassembly

1. Install the three screws **2** plus one bolt and nut **3** that fasten the base **5** to the stepper motor **4**. Do not tighten the screws and bolt now.
2. Install the idler gear **6** with the longest hub toward the motor. On machines without EC 579623 or EC 579920, install the idler gear **6** and the retaining clip **7** so that the idler has 0.002 inch to 0.010 inch (0.05 mm to 0.25 mm) end play.
3. Install the inner cover **8** with the two adjusting screws **1** finger tight.
4. Place the photocell assembly **11** on the disk/gear assembly **9** and slide them onto the motor shaft.
5. Secure the photocell assembly with its mounting screw.
6. Center the forms feed emitter disk in the slot. Avoid scratching the black paint from around the disk slots. A 0.030 inch (0.76 mm) feeler gauge should slide freely on the upper side of the disk. Check clearance at several points on the disk.
7. Tighten the clamping hub **12** and recheck the clearance.
8. Rotate the base **5** on the motor to obtain a slight backlash between the idler gear **6** and motor gear **10** flush to 0.006 inch (0.15 mm) estimated.
9. Tighten the screws and nut, and check backlash in several positions of the idler gear.
10. Install the outer cover **13**.
11. Install the motor/emitter assembly in the printer (329).

Forms Feed Stepper Motor  
(rotated 90° clockwise)



<sup>1</sup> A mark on the P4 and P5 connectors indicates position 1. Always connect P4 and P5 with the marked side away from the board.

## 331 FORMS FEED EMITTER DISK

### Adjustment

The disk should be centered in the photocell assembly slot for all positions of the disk.

1. Remove the forms feed stepper motor/emitter assembly (329).
2. Remove the outer cover **13**.
3. Loosen the clamping hub **12** and center the disk in the slot. A 0.030 inch (0.76 mm) feeler gauge should slide freely on the upper side of the disk. Avoid scratching the black paint from around the disk slots. Check the clearance at several points on the disk. The emitter disk must be clean and free of any smudges or scratches.
4. Tighten the clamping hub and recheck the clearance.
5. Reinstall the outer cover.
6. Reinstall the motor/emitter assembly (329).



## 332 FORMS FEED STEPPER MOTOR/EMITTER TIMING

### Adjustment

Three techniques are available for the adjustment of the emitter timing: the general logic probe method, the use of an adjustment program within the MDI 0800 programs, and a similar program that must be entered manually. The logic probe method provides sufficient accuracy for normal printer applications. Print/plot applications that require reverse forms motion may need to use one of the programming techniques. The MDI program is not supplied for the IBM 5100.

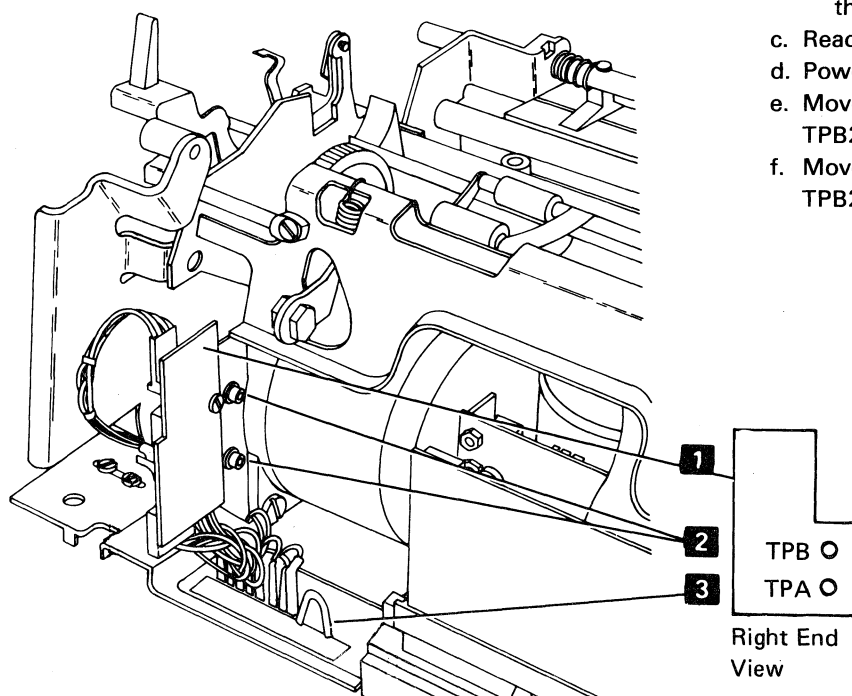
#### General Logic Probe (GLP) Adjustment Method

1. Power down.
2. Remove the printer cover (310).
3. Connect a jumper wire between test points FMA and G7 **3** (forms motor driver A to ground).
  - a. Move the black wire from TPB2-6C to TPB2-3C (300).
  - b. Move the red wire from TPB2-5B to TPB2-6C.
4. Loosen the photocell assembly (two screws **2** behind the motor) so that the assembly will slide but not move by itself.

5. Connect the probe power lead (red) to test point V5 and the black lead to G6.
6. Place the Printer Adapter card in the service position (312) on machines with EC 579623 or EC 579920.
7. Probe A2-U07 on the B1 board with the probe ground lead on P08. On machines without EC 579623 or EC 579920, probe TPA on the forms feed emitter amplifier card **1** with the probe ground lead on test point G8.
8. Power up.
9. Slide the photocell down as far as possible.
10. Slowly slide the assembly up until the probe UP light comes on.

Note: If the UP light is on with the photocell down as far as possible, slide the assembly up until the UP light goes out and then comes back on.

- a. Hold the photocell assembly firmly in place and tighten the two screws.
- b. Verify the adjustment as follows:
  - Apply a small amount of forward force on the platen knob. The probe should stay at the up level when you remove your hand from the knob.
  - Apply a small amount of backward force on the platen knob. The probe should stay at a down level when you remove your hand from the knob.
- c. Readjust if necessary.
- d. Power down.
- e. Move the red wire from TPB2-6C back to TPB2-5B (300).
- f. Move the black wire from TPB2-3C back to TPB2-6C.



11. Remove the probe and jumper wire. Reinstall the printer adapter card on machines that required removal.
12. Reinstall the printer cover and forms tractor unit.
13. Check the adjustment by running MDI 800; readjust if necessary.

*Note:* If adjusted incorrectly, the forms motor might run backwards.

#### *MDI 800 Emitter Adjustment Method (5110 only)*

For the MDI 800 test, refer to the *Diagnostic Aids* section of the *IBM 5110 Computer Maintenance Information Manual*, SY31-0550.

The procedure explained in the *Manual Entry Programming Method* section that follows accomplishes the same test as MDI 800, but without the need to run the complete diagnostic program.

#### *Manual Entry Programming Method*

This technique is similar to the 5110 MDI 0800 emitter adjustment routine and may be used on both the 5100 and the 5110 computer systems. Initial set-up for the adjustment should include the installation of the tractor assembly and the insertion and engagement of paper under the platen with platen rolls engaged.

Initial entries on the 5100 computer system are:

1. Load DCP1 normal mode. (See *Diagnostic Aids* section, *5100 Maintenance Information Manual*, SY31-0405.)
2. Alter read/write storage locations 3F70 through 3FFF by entering the data given in the data table that follows.
3. Press the spacebar after all characters have been entered.
4. Enter: BR 3F70.
5. Press the EXECUTE key.

Refer to *Test Description* in this section.

Initial entries on the 5110 computer system are:

1. Load DCP normal mode. (See *Diagnostic Aids* section, *5110 Maintenance Information Manual*, SY31-0550.)
2. Alter read/write storage locations 3F70 through 3FFF by entering the data given in the data table that follows.
3. Hold down the CMD key and press the ATTN key after all characters have been entered.
4. Enter: BR 3F78.
5. Press the EXECUTE key.

Refer to *Test Description* in this section.

### DATA TABLE

[illegible]

**Test Description:** When the program has begun to execute, the 5103 platen should be rotating back and forth. The accuracy of the emitter adjustment is displayed with a series of arrows. If there are no binds in the carriage and the emitter is in adjustment, approximately 1 and 1/3 lines of arrows should be pointing up, and 1 and 1/3 lines of arrows should be pointing down.

If the lines of arrows are not within  $\pm$  three arrows of being the same length, the forms emitter needs to be adjusted. If the print/plot feature is on the system using the printer, the emitter should be adjusted to give within  $\pm$  one arrow of the same length lines.

Loosen the forms emitter and move it slightly in the direction of the greater number of arrows. The length of the lines of arrows is an indication of the relative freedom from binds in the platen.

The pattern of arrows shown below would require a slight downward adjustment of the emitter to obtain a  $\pm$  one arrow adjustment accuracy.



***Saving the Manually Entered Diagnostic Program:*** The diagnostic program may be saved on a tape cartridge that can be reserved for this purpose. Do not store the program on the diagnostic tape or in a used file. Insert a *scratch* tape cartridge with a file marked for at least 1K bytes.

To store locations 3F70 through 3FFF, perform the following steps if you are using an IBM 5100.

1. Load DCP1 diagnostic mode.
2. Enter: C
3. Hold down the CMD key and press 9.
4. Enter: 3F70 3FFF 0001 004B 0000
5. Press the EXECUTE key.

This program will write the data stored from 3F70 through 3FFF into file 0001 of the tape cartridge. A different file may be used, but the 0001 must be changed to a different file number and entered in hexadecimal to identify the different file.

If you are using a 5110, perform the following steps to store the program.

1. Load DCP diagnostic mode.
2. Enter: C
3. Enter: 5
4. Enter: E80 WT A 3F70 S 3FFF F 1
5. Press the EXECUTE key.

This program will write the data stored from 3F70 through 3FFF into file 1 of the internal tape cartridge. A different file may be used, but F 1 must be changed to identify the correct file number.

***Loading the Forms Emitter Test Program from Tape:*** If you are using an IBM 5100, perform the following steps to load the test program from the tape cartridge.

1. Load DCP1 diagnostic mode.
2. Enter: C

3. Hold down the CMD key and press 8 on the numeric key pad.
4. Enter: 3F70 0001 0000
5. Press the EXECUTE key. (The program will be loaded from file 0001 (hex) of the tape cartridge.)
6. Enter: BR 3F70
7. Press the EXECUTE key. (The program will begin to execute.)

*Note:* The file number must be in hex.

If a file other than file 1 was specified when the program was stored on the tape cartridge, then you must specify that file by using a hex number during the entry of the commands given above. Step 4 specifies file 1 with the hex byte 0001. This should be changed to properly identify the file used on the tape cartridge.

If you are using an IBM 5110, perform the following steps to load the test program from the tape cartridge.

1. Load DCP diagnostic mode.
2. Enter: C
3. Enter: 5
4. Enter: E80
5. Enter: RD A 3F70 F 1
6. Press the EXECUTE key. (The program will be loaded from the tape cartridge.)
7. Hold down the CMD key and press the ATTN key.
8. Enter: BR 3F78
9. Press the EXECUTE key. (The program will begin to execute.)

If a file other than file 1 was specified when the program was stored on the tape cartridge, then you must specify that file number during the entry of the commands given above. Step 5 specifies file 1 with the label F 1. This should be changed to properly identify the file used on the tape cartridge.

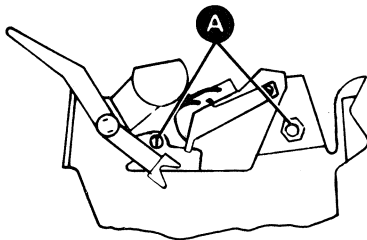
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## 333 A-FRAME

### Alignment

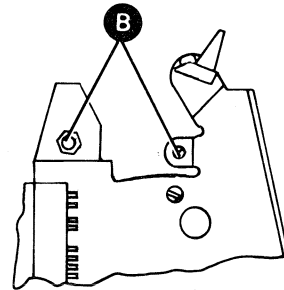
A-frame alignment to the platen is set at the factory and mounting screws are secured with Loctite<sup>1</sup>. Further alignment should not be required in normal printer use. However, if alignment is required, use the following procedure:

1. Power down.
2. Remove the printer cover (310).
3. Set the copy control dial to 0.
4. Measure the clearance between the platen and the print head at both ends of the platen. Clearance should be 0.012 inch to 0.014 inch (0.30 mm to 0.36 mm). If the left end dimension is not correct, go to the next step; if the right end dimension is not correct, go to step 9.
5. If the left end dimension is not correct, slightly loosen the A-frame mounting screws in the left side frame **A**.



6. With a brass drift punch and a hammer, tap on the A-frame left side plate to obtain the specified clearance.
7. Securely tighten the A-frame mounting screws (Loctite is unnecessary), check the clearance, and readjust if necessary.

8. Check the clearance at the right end of the platen. If the clearance is not correct, continue on to the next step. If the clearance is correct, install the printer cover (310), power up, and set the copy control dial for proper printing.
9. If the right end dimension is not correct, slightly loosen the A-frame mounting screws in the right side frame **B**.



10. With a brass drift punch and a hammer, tap on the A-frame right side plate to obtain the specified clearance.
11. Securely tighten the A-frame mounting screws (Loctite is unnecessary), check the clearance, and readjust if necessary.
12. Check the clearance at the left end of the platen. If the clearance is not correct, return to step 5. If the clearance is correct, install the printer cover (310), power up, and set the copy control dial for proper printing.
13. Check platen gear backlash (327, 330) and adjust, if necessary.
14. Check end of forms switch adjustment and correct if necessary (334).

<sup>1</sup>Trademark of the Loctite Corp.



## 334 END OF FORMS SWITCH (New Style)

**Note:** The new style end of forms switch actuator lever is *under* the platen; the old style actuator lever is behind the platen.

### Adjustment

1. Power down.
2. Remove the printer covers (310).
3. Remove the paper deflector and reinstall the platen.
4. Pull the paper release lever toward the platen and leave it there.
5. Check that the switch actuator lever is centered in the platen groove **3**. If it is not centered, loosen the switch assembly mounting screw **4** and reposition the switch assembly. Tighten the screw securely.
6. Set your CE meter to the Rx1 scale. Remove the wire at the common (C) terminal of the switch. **1**
7. Connect the meter leads to the normally closed (N/C) and the common (C) terminals of the switch **1**.
8. Loosen the switch mount holding screws **8** then move the switch mount **9** toward the front of the printer.
9. Insert a 0.030 inch (0.76 mm) feeler gauge between the top of the actuator lever and the bottom of the platen groove.

**Note:** Hold the feeler gauge in a horizontal position and do not insert it more than necessary.

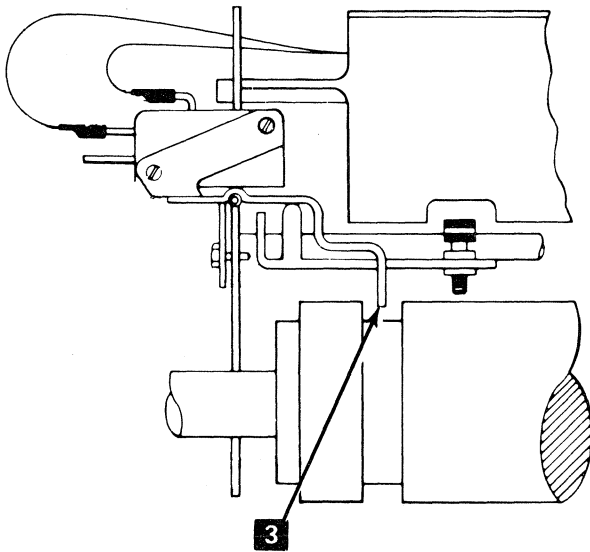
Slowly push the switch mount toward the rear until the meter indicates that the switch has operated.

10. Tighten the screws **8** and check the adjustment.
11. Remove the platen.

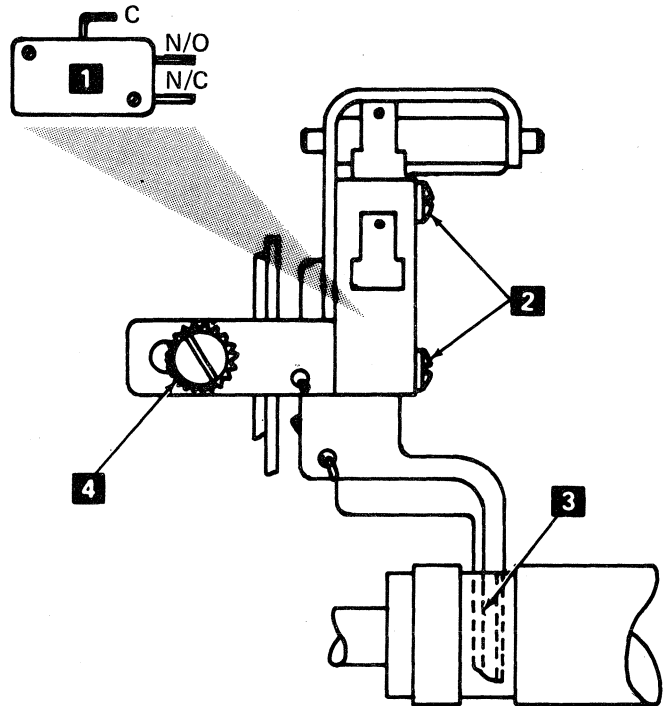
12. Reinstall the paper deflector and the platen.
13. Check that the override arm operates the end of forms switch by operating the paper release lever several times. If the switch operates, skip steps a through d. Otherwise:
  - a. Pull the paper release lever forward.
  - b. Loosen setscrew **7** and move the override arm **5** so that the end of the arm touches, but does not move the end of forms switch actuator lever **6**.
  - c. Tighten the setscrew.
  - d. Recheck the adjustment.
14. Disconnect your meter and reconnect the wire that you removed in step 6.
15. Reinstall the printer covers.

### Removal

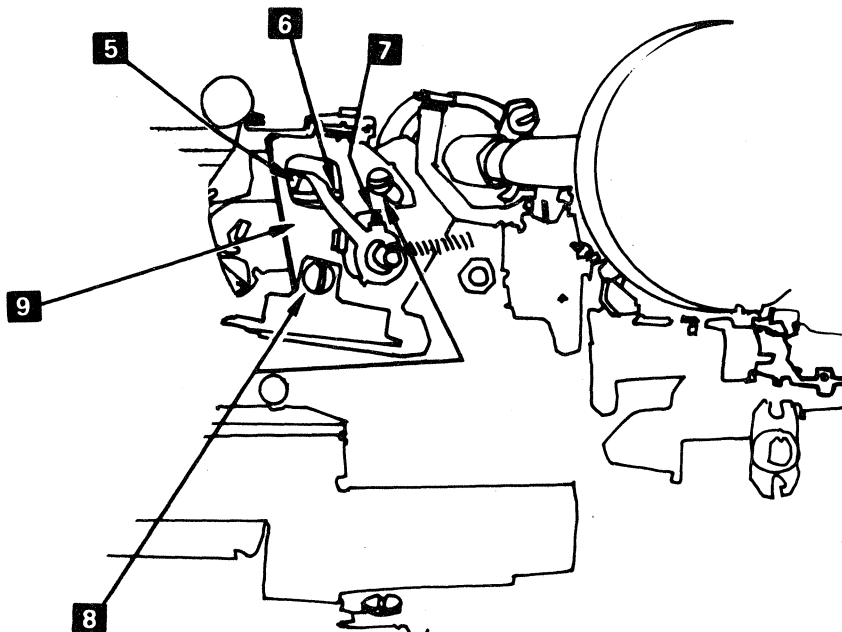
1. Power down.
2. Remove the printer cover (310).
3. Remove the end of forms switch assembly by removing the screw and the lockwasher **4**.
4. Remove the switch from the assembly by removing the two screws **2**.
5. Transfer the switch leads from the old switch to the new switch (N/C and C) **1**.
6. Install the new switch on the assembly and the assembly on the printer.
7. Adjust the switch.



The actuator lever for EOF Switch is located behind the platen without EC 579581.



The actuator lever for EOF Switch is located under platen with EC 579581.



## 334 END OF FORMS SWITCH (Old Style)

**Note:** The new style end of forms switch actuator lever is *under* the platen; the old style actuator lever is *behind* the platen.

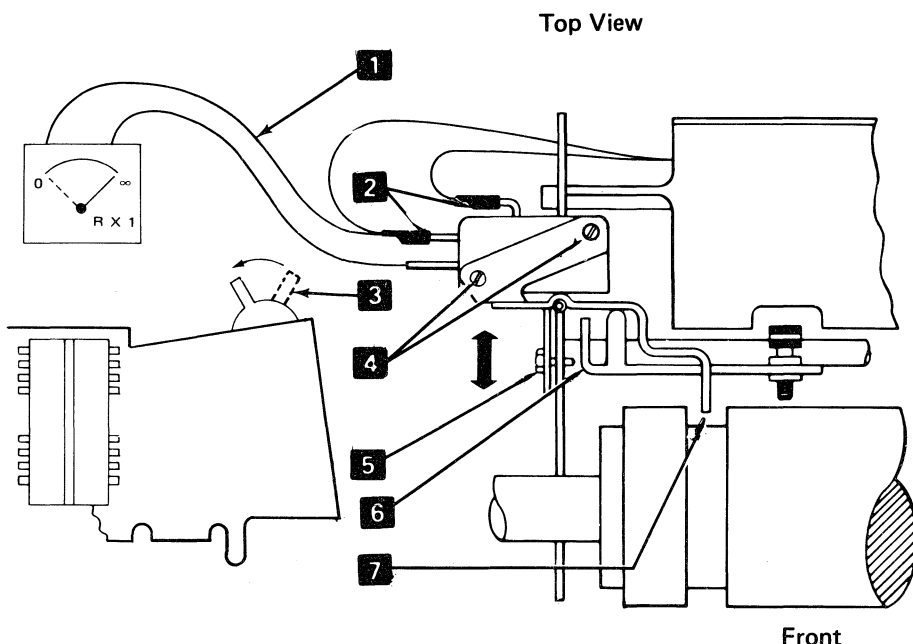
### Adjustment

The switch points should close when the actuator tip is 1/2 to 3/4 of the way into the platen slot **7** and the paper release lever **3** is forward. If they do not, perform the following adjustment. Check with the power off.

1. Power down.
2. Remove the printer cover (310).
3. Set up an ohmmeter to the RX1 scale.
4. Connect the meter leads to the switch **1**.
5. Slightly loosen the switch bracket mounting screw **5**.
6. Slide the switch away from the platen as far as possible.
7. In this step, operate the switch by moving the paper release lever **3**. Position the switch so that its points close when the actuator tip is 1/2 to 3/4 of the way into the platen slot **7** and the paper release lever is being pulled toward the platen.
8. Tighten the switch assembly mounting screw **4**.
9. Pull the paper release lever toward the platen and leave it there.
10. Form the switch override bracket **6** by twisting it so that it lifts the switch actuator 0.000 inch to 0.010 inch (0.00 mm to 0.25 mm) from the platen slot bottom **7**.
11. Check the adjustment by operating the paper release lever several times. The switch contacts should open when the actuator tip is 1/2 to 3/4 of the way out of the platen slot and the paper release lever is being pushed backward. Readjust if necessary.
12. Install the printer cover and the forms tractor unit.

### Removal

1. Power down.
2. Remove the forms tractor unit (324).
3. Remove the printer cover (310).
4. Remove the switch and actuator by removing two screws **4**.
5. Transfer the switch leads **2** from the old switch to the new switch.
6. Reinstall the switch and actuator with screws **4**.
7. Adjust the switch.





## 335 FORMS GUIDE RACK

### Removal and Replacement

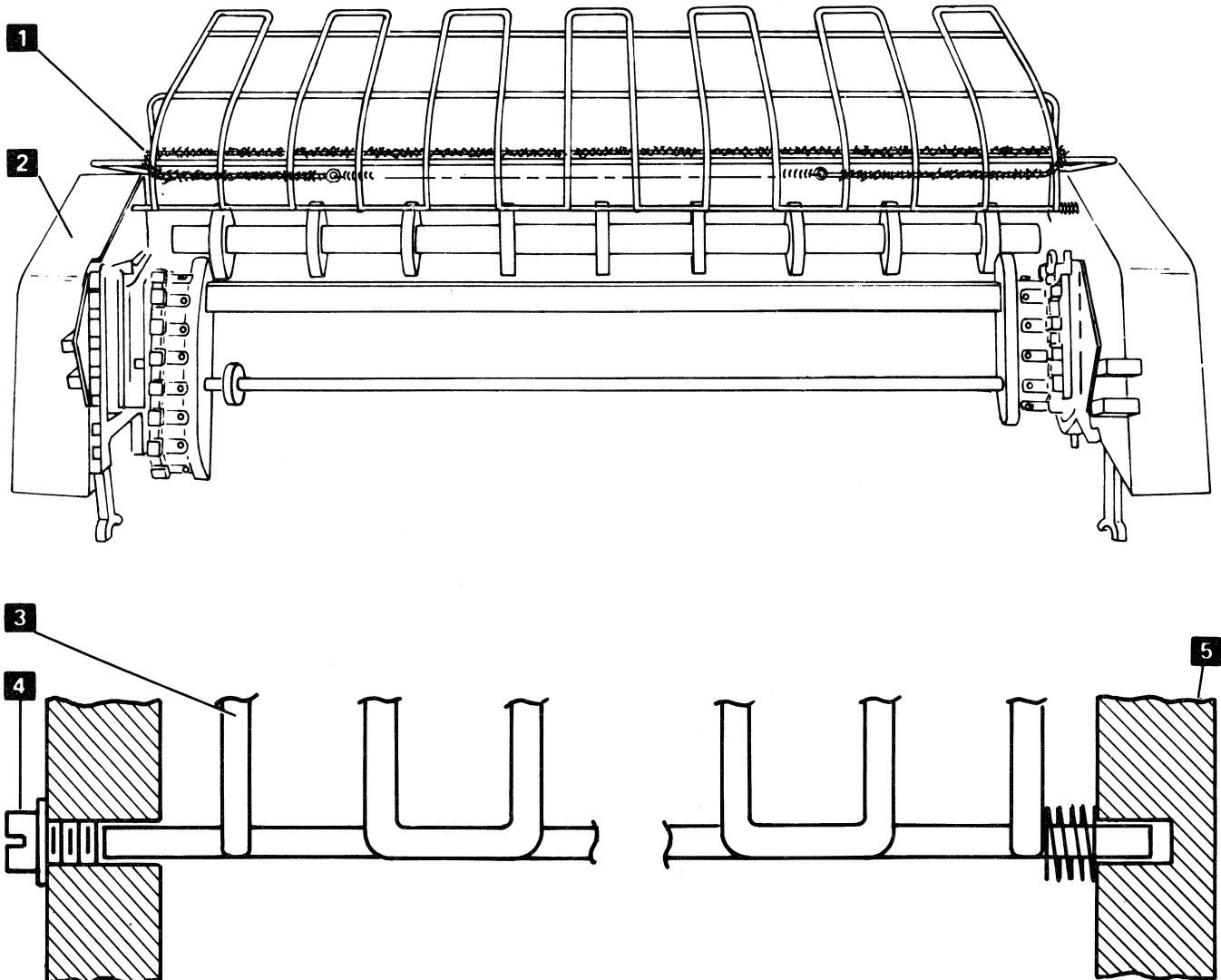
This procedure is not used on forms tractors that have the snap-in type forms guide rack.

1. Snap off the left tractor cover **2**.
2. Remove the self-tapping screw **4** from the tractor left side frame.
3. Slide the forms guide rack **3** to the left until the right end clears the tractor right side frame **5**.
4. Remove the forms guide rack.
5. To replace, reverse this procedure.

## FORMS GUIDE RACK STATIC ELIMINATOR

### Replacement

Install the static eliminator observing detail as shown. **1**



## Print Emitter

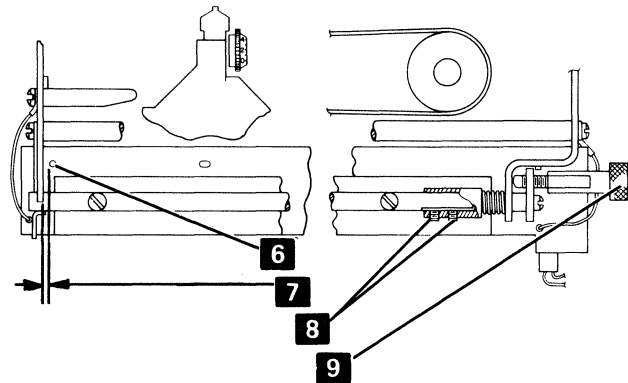
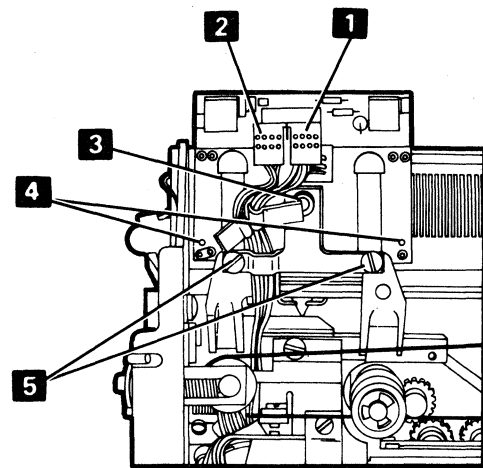
### 340 PRINT EMITTER PICKUP

#### Adjustment

1. Separate the printer from the power supply (311).
2. Turn the fine adjustment knob **9** full counterclockwise (emitter in the full left position).
3. Loosen the adjustment setscrews **8**.
4. Slide the emitter board as far to the right as possible.
5. Move the print head carrier to the right.
6. Insert code plate aligning tool, P/N 460028, into the left hole **6** in the emitter.
7. Slide the emitter board to the left until the gap between the left side frame and the aligning tool is 0.128 inch  $\pm$  0.005 inch (3.25 mm  $\pm$  0.13 mm) **7**.
8. Tighten the adjustment setscrews.
9. Remove the aligning tool.
10. Loosen the pickup mounting screws **5**.
11. Move the print head to the left against the side frame.
12. Insert code plate aligning tools **4**. Do not touch the fine adjustment knob.
13. **CAUTION**  
Do not pinch the wires to the emitter pickup.  
  
Tighten the pickup mounting screws with the carrier against the left side frame.
14. Remove the aligning tools and replace the covers.
15. Adjust the left margin (343).

**Removal**

1. Power down.
2. Remove the printer cover (310).
3. Separate the printer from the power supply (311) and place the printer in the service position.
4. For installation, adjust the left margin (343).
5. Verify that P2A **2** and P2B **1** are connected as shown on the safety cover decal; if they are not, record the connection.
6. Disconnect P2A and P2B.
7. For installation, adjust the print emitter pickup.
8. **CAUTION**  
The coil spring **3** may fly out when the pickup mounting screws are removed.  
  
Remove two screws **5** that hold the pickup to the carrier.
9. Reinstall the pickup by reversing this procedure.





## 341 PRINT EMITTER

### Removal

#### CAUTION

Do not loosen the four screws in the top of the print emitter support shaft; doing so could destroy the flatness of the board.

1. Power down.
2. Remove the printer cover (310).
3. Remove the emitter ground leads **10** (on machines without EC 579623) from each side frame.
4. Disconnect the connector **6** from the circuit card.
5. Remove the hold down bracket **11** from the left side frame.
6. Remove the print emitter support shaft retaining screw **5** from the right end of the shaft. (The fine adjustment shaft **4** will come off also.)
7. Remove the emitter **7** by pulling the left end out.
8. Reinstall the emitter by reversing this procedure.
9. Lubricate the emitter as shown in Appendix C.
10. Adjust the print emitter pickup (340), left margin (343), and the print emitter hold down bracket (342).

## 342 PRINT EMITTER HOLD DOWN BRACKET

### Adjustment

Position the hold down bracket **11** for two conditions:

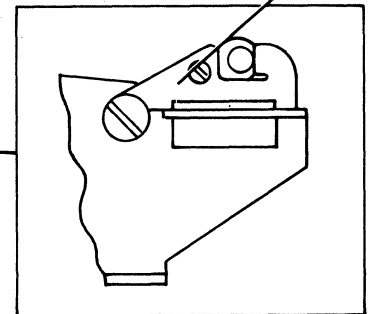
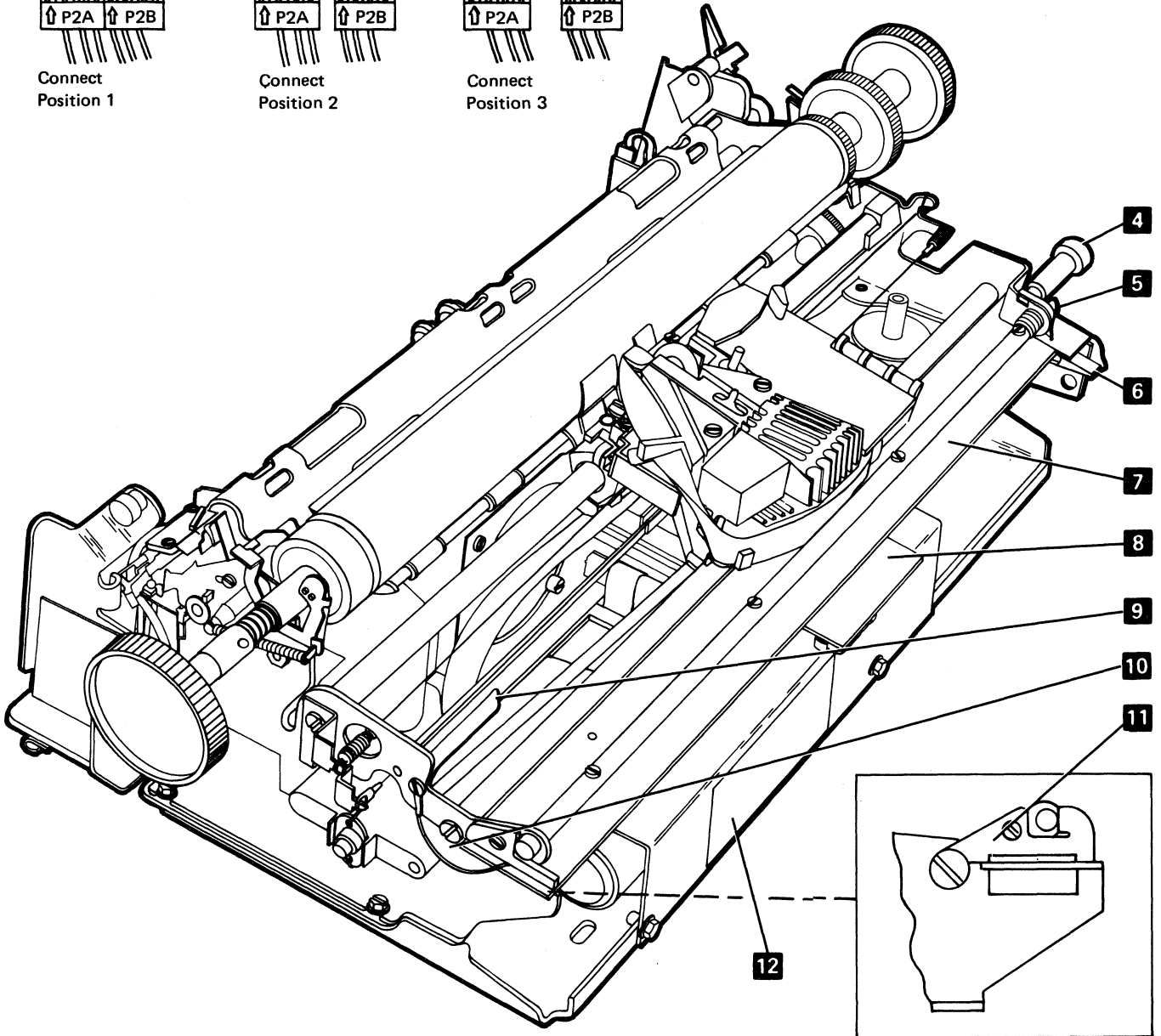
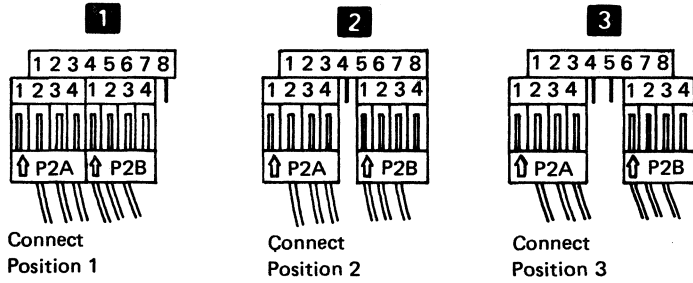
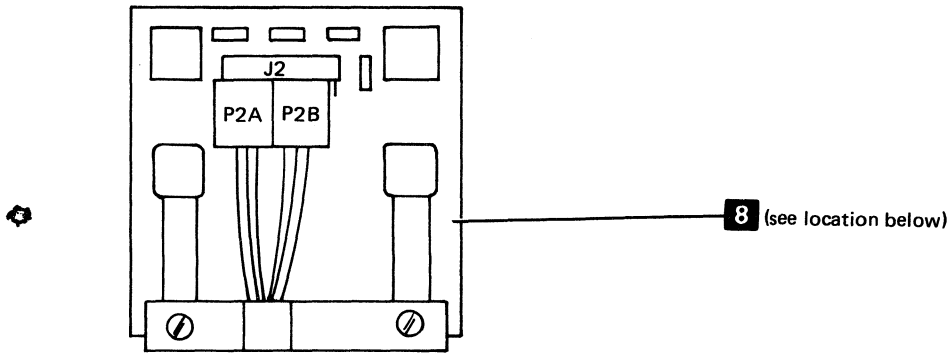
1. There must be no vertical movement of the print emitter board **7**.
2. The board must slide freely when the horizontal fine adjustment knob **4** is rotated in either direction.

## 343 LEFT MARGIN

### Adjustment

This adjustment is to ensure that the fall of the 'left margin' signal is centered between two 'print emitter 3' signals.

1. Power down.
2. Remove the printer cover (310).
3. Rotate the horizontal fine adjustment knob **4** to the center of its travel.
4. Push the print head carrier against the left side frame.
5. Using the CE probe, monitor the left margin signal by connecting the probe to B1A2-S10 ('-left margin').
6. Power up.
7. Slowly move the carrier to the right (by rotating the motor pulley) until the UP light comes on. (Use the fine adjustment knob to get as near to the shift point as possible.)
8. Mark a point on the knob **4**.
9. Monitor the '-print emitter 3' signal by connecting the probe to B1A2-M08.
10. Check that the DOWN light is not on initially but comes on when the fine adjustment knob is rotated 1/4 turn or more in each direction from the mark.
11. If the DOWN light comes on, go to the next step. If the DOWN light is on initially, or does not shift as indicated, move plug P2B **8** to another position **1**, **2**, or **3** (see the decal on the safety cover) and return to step 3.
12. Mark the final position of P2B on the decal **12**.
13. Run MDI 800 to perform a dynamic check/adjustment of the left margin timing.



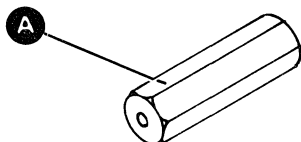
## Carrier

### 350 CARRIER MAIN AND SUPPORT SHAFTS

#### Adjustment

Two adjustments are required for the carrier. The main shaft is adjusted for full contact of the carrier bearing on the shaft. The carrier bracket support bearing is adjusted for 0.001 inch to 0.003 inch (0.025 mm to 0.076 mm) clearance to the support shaft.

1. Remove the printer cover (310).
2. Adjust the carrier support shaft bearing as follows:
  - a. Separate the printer from the power supply (311).
  - b. Slightly loosen the socket head screw **3** at the end of the bearing eccentric stud **2**. Remove the ribbon drive clutches to gain access.
  - c. Rotate the eccentric stud to obtain 0.001 inch to 0.003 inch (0.025 mm to 0.076 mm) between the bearing and shaft **1** while pushing on the bottom of the carrier as shown by the directional arrow.
  - d. Tighten the socket screw **3** on the end of the bearing eccentric stud.
  - e. Recheck clearance and adjust, if necessary.
  - f. Reassemble the printer and power supply.
3. Adjust the carrier main shaft (hexagonal) as follows:
  - a. Loosen the retaining screws at the shaft ends.
  - b. Rotate the shaft until the full width of the bearing **4** rolls on the shaft flat **5**. The mark **A** on the left end of the main shaft must be up.

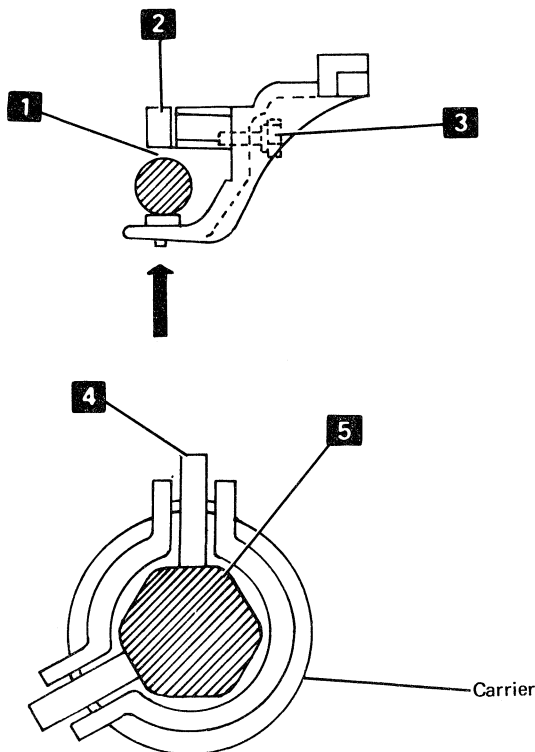


- c. Hold the shaft in this position with an adjustable wrench (take care not to damage the flats) and tighten the screws in the shaft ends.
4. Check adjustment as follows:
    - a. Insert a strip of carbon paper about 3/16 inch (4.70 mm) wide and 5 inches (127.0 mm) long between the bearing and shaft **5**.
    - b. Push the carrier over the carbon paper.
    - c. Check for a smooth, even mark; readjust if necessary.
  5. Reinstall the printer cover.

### 351 CARRIER SUPPORT SHAFT

#### Removal

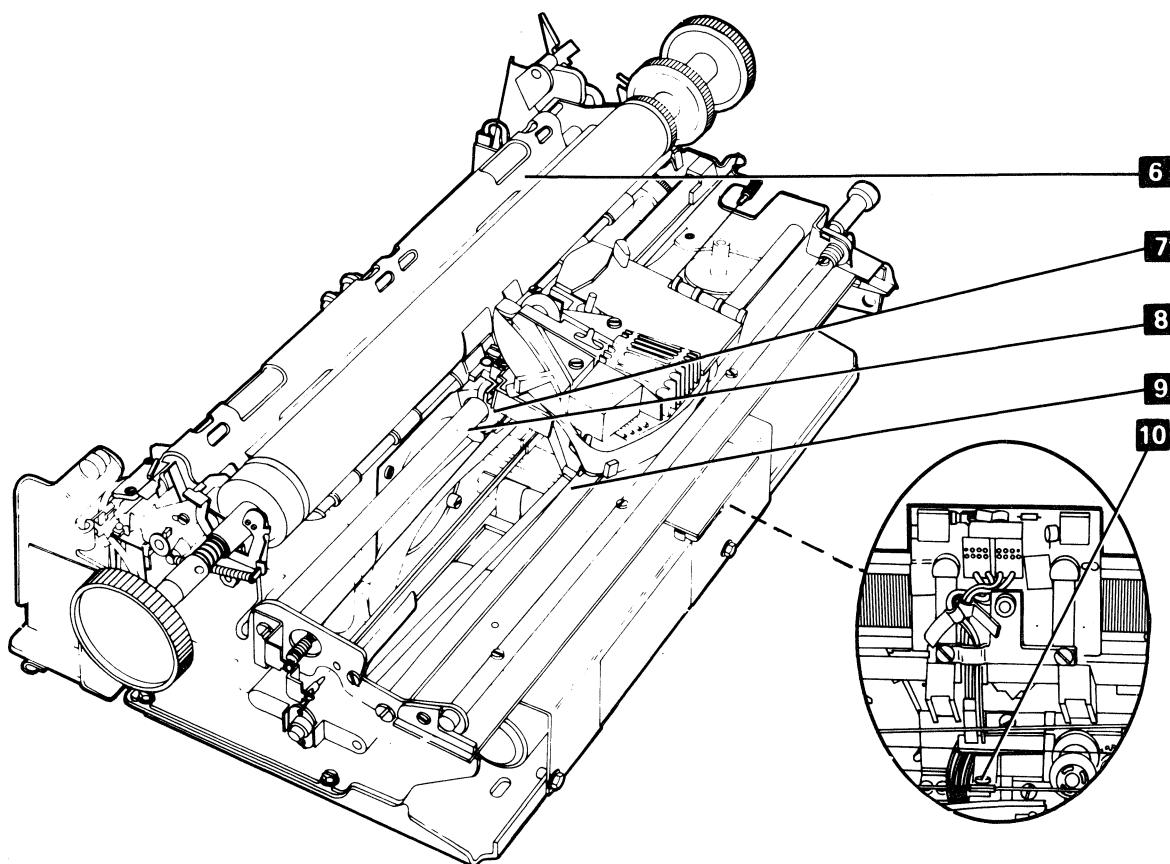
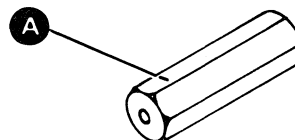
1. Power down.
2. Separate the printer from the power supply (311).
3. Remove the print emitter (341).
4. Remove the print carrier drive belt from the motor.
5. Loosen the screws on the end of the carrier main shaft **8**.
6. Remove the screws from the ends of the carrier support shaft **9**.
7. Spread the side frames enough to free the support shaft.
8. To reinstall the shaft, reverse this procedure.
9. Perform adjustments for the print emitter pickup (340), the left margin (343) and the carrier main shaft (350).



## 352 CARRIER AND MAIN SHAFT

### Removal

1. Power down.
2. Remove the covers (310).
3. Remove the print emitter (341).
4. Remove the print head (360).
5. Separate the printer from the power supply (311).
6. Loosen the belt clamp **10** and remove the belt from the motor. For installation, be sure the belt alignment is correct.
7. Remove the print emitter pickup (340).
8. Remove the ribbon drive lines (373).
9. Remove the screws from each end of the carrier main shaft **8**.
10. Pivot the carrier and main shaft around the carrier support shaft **9** to clear the A-frame **6**.
11. Lift the carrier out **7**. For installation, be sure the mark **A** on the left end of the main shaft is up.
12. Remove the ribbon drive assembly (370).
13. To reinstall the carrier, reverse this procedure. Be sure to perform the following checks and/or adjustments:
  - a. Carrier main shaft and carrier support shaft (350)
  - b. Print head (360)
  - c. Print emitter pickup (340)
  - d. Left margin (343)

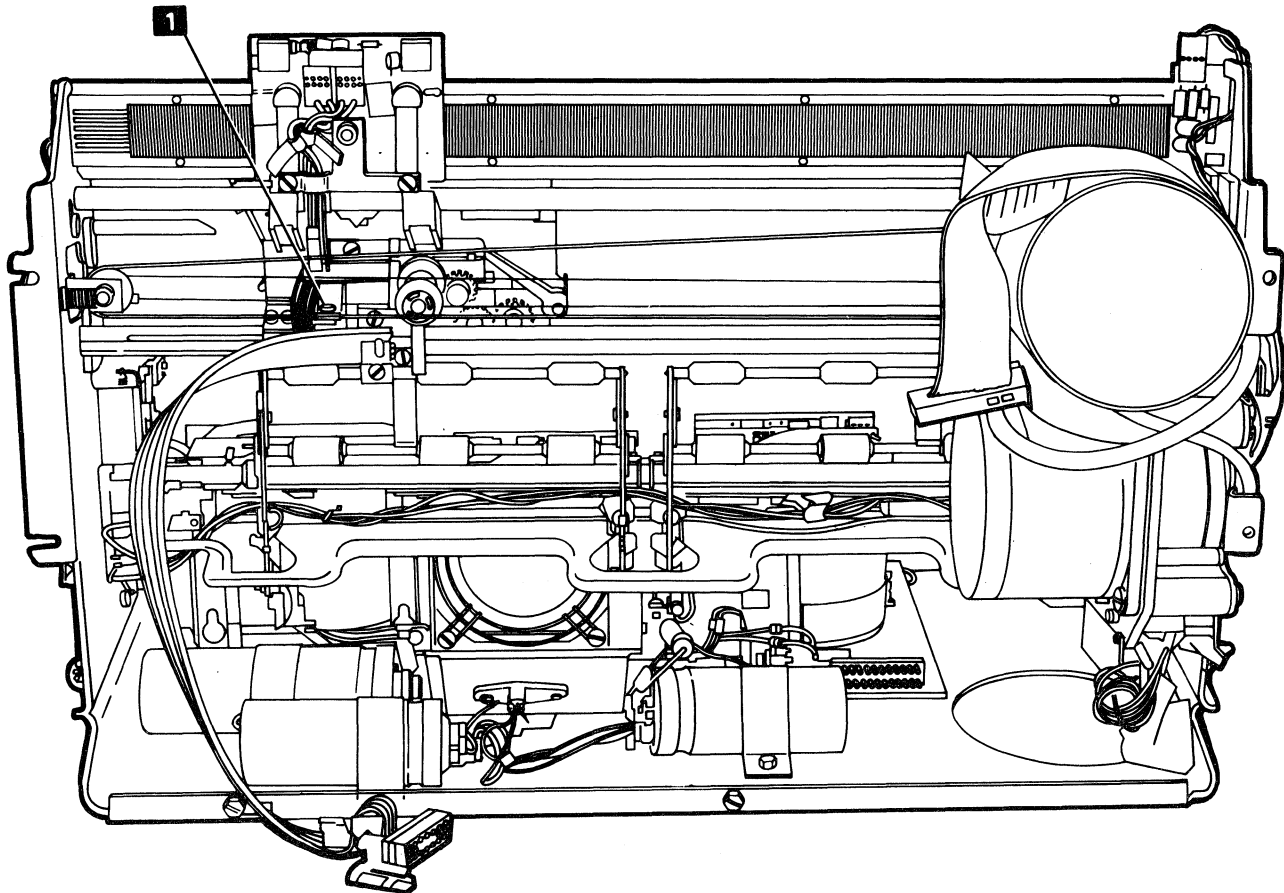
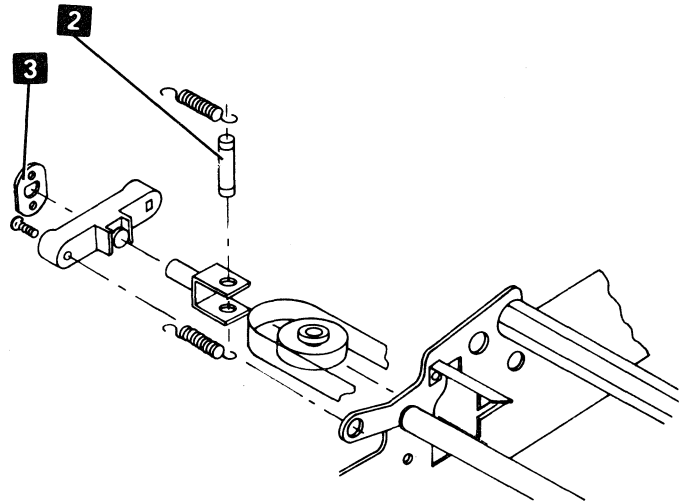




## 353 CARRIER DRIVE BELT

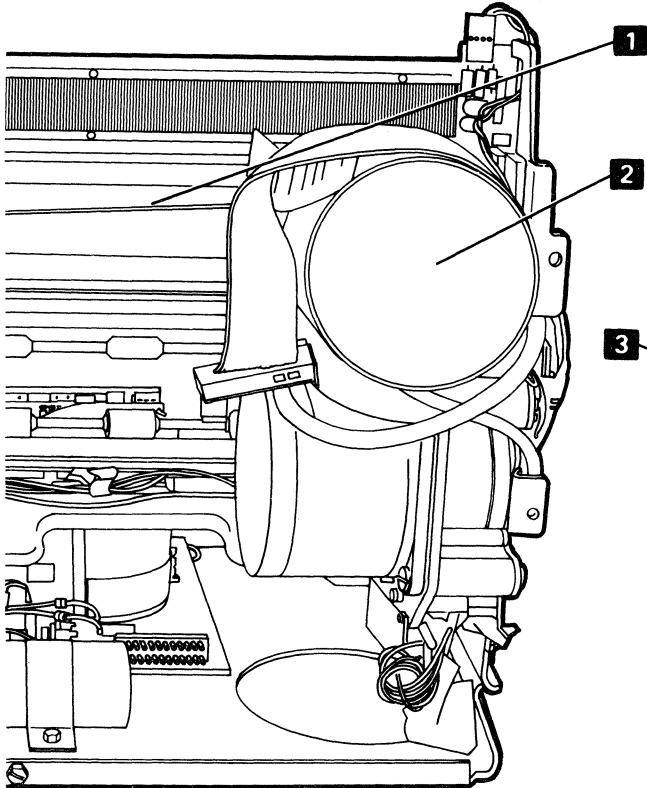
### Removal

1. Power down.
2. Remove the printer cover (310).
3. Loosen the carrier belt clamp **1** and slip the belt out of the clamp. For installation, be sure belt aligns with the pulleys before tightening the clamp.
4. Remove the belt from the motor pulley.
5. Remove the two springs from the belt tension bracket **3** outside the left side frame.
6. Remove the pulley and belt together.
7. Remove the pulley from the yoke by removing the shaft **2**.
8. To reinstall the belt, reverse this procedure. Apply a light film of IBM No. 23 grease to the shaft **2** before reassembling the yoke and belt.

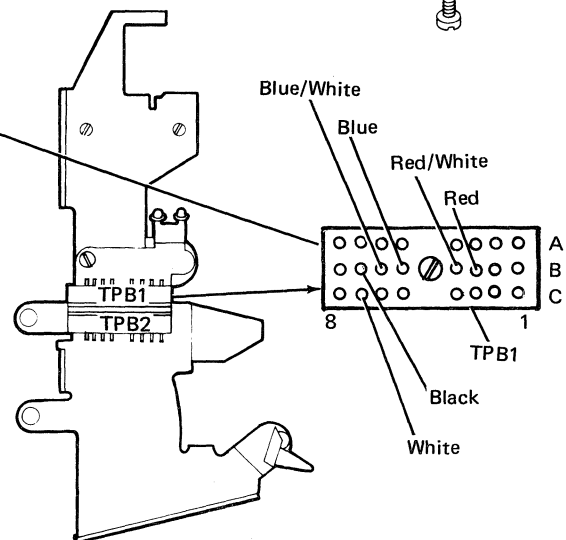
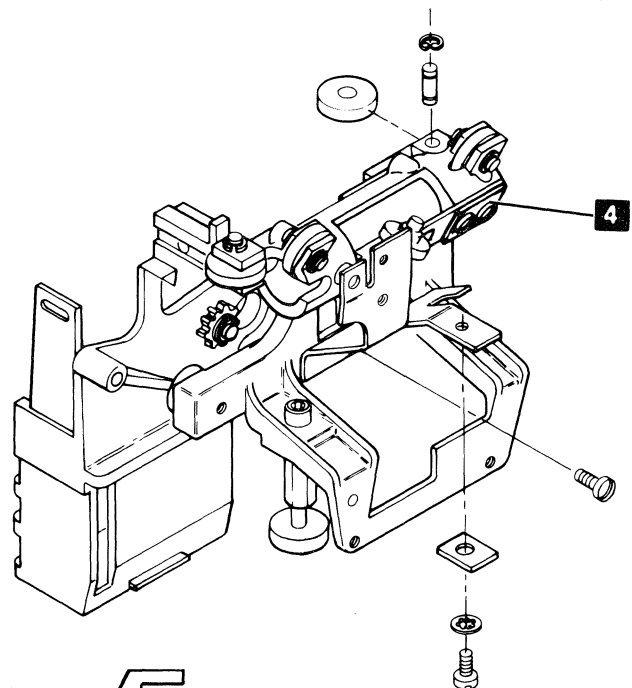


**354 PRINT HEAD STEPPER MOTOR****Removal**

1. Power down.
2. Separate the printer from the power supply (311) and place the printer in the service position.
3. Disconnect the motor leads from TPB1 **3**.
4. Slip the belt off the motor pulley **1**.
5. Remove the two screws holding the stepper motor **2** to the motor mount.
6. To reinstall the motor, reverse this procedure.

**355 CARRIER LEAF SPRING AND BEARING****Removal**

1. Power down and remove the printer cover.
2. Separate the printer from the power supply and place the printer in the service position (311).
3. Remove the two screws from the leaf spring and bearing **4** and remove the assembly.
4. Reinstall the assembly by reversing this procedure. Be sure that bearing sides are parallel to the shaft flats. (Sight through holes in the left side frame to verify parallelism.)



Service Position (right end view)

## Print Head

### 360 PRINT HEAD

#### Adjustment

1. Remove the printer cover (310).
2. Move the print head to the center of the printer.
3. Open the ribbon feed rolls **4**.
4. Remove the print head cover (two screws) **1** and lay the cover and ribbon to the right.
5. Remove the print head forms guide (361).
6. Remove the print head ribbon shield if installed (366).
7. Install the platen and rotate it so that the midpoint between the two setscrews that hold the right-hand platen knob points straight up.
8. Position the print head so that the ends of the wires are 0.012 inch to 0.014 inch (0.30 mm to 0.35 mm) from the platen as follows:
  - a. Loosen the hold down stud **10** and screw **7** on the right of the print head.
  - b. Set the copy control dial **8** on zero.
  - c. Place a 0.014 inch (0.35 mm) feeler gauge between the platen and print head wires **6**.
  - d. Position the print head in the center of the printer and push the head lightly toward the platen.
  - e. Tighten the hold down screw and stud.
9. Check the adjustment and readjust if necessary.
10. Reinstall and adjust the print head ribbon shield if removed (366).
11. Reinstall and adjust the print head forms guide (361).
12. To complete the adjustment, reverse the first four steps.

#### Removal

##### **DANGER**

The print head may be very hot after continued use. Always allow the head to cool before removing it.

1. Power down.
2. Remove the printer cover (310).
3. Unthread the ribbon from the print head and its cover, and lay the ribbon to the right.
4. Open the ribbon feed rolls **4**. Remove the print head cover (two screws) **1**.

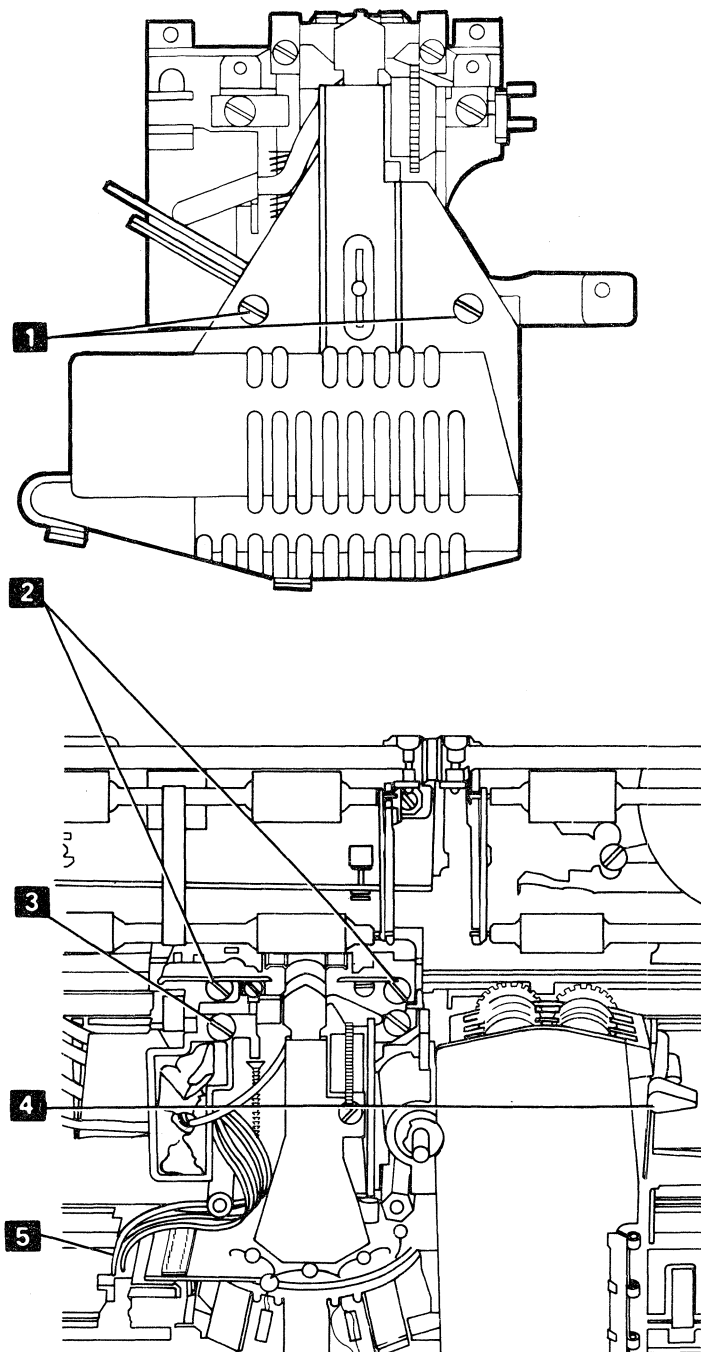
5. Disconnect the print head cable from EC3 **5**.
  6. To the right of the print head, remove the screw **7** and hold down stud **10** that hold the bronze tabs.
  7. To the left of the print head, remove the screw that holds the bronze block **3**.
  8. Check the part number of the print head installed in the machine (see the label on the top of the head).
    - a. If the print head is part 1638706, unclip the plastic clip **15** and oil wick from the head. Be careful to not lose the small felt pad **14** next to the print wires.
    - b. If the print head is part 843130, pull the wick **13** out of the hole **12** in the print head.
  9. Lift off the print head.
  10. For new print installation, use IBM No. 6 oil to saturate the two felt washers on the right bar, the bronze block, and the rear slide points on the left bar.
  11. To install the print head in place, tilt the tip of the head down and slide it under the print head forms guide.
  12. Loosely install screw **7** and hold down stud **10**. Install and tighten screw **3**.
  13. Adjust the print head as described in steps 8 through 11 in the adjustment section.
  14. Install the oil wick assembly as follows:
    - a. For print head part 1638706, place the small felt pad **14** against the print wires **11** and snap the clear plastic clip **15** to the print head.
    - b. For the print head part 843130, insert the oil wick **13** into the print head through the hole **12**. Ensure that the wick contacts all 8 of the print wires **11**.
- Note: If there is no oil in the reservoir or felt, add IBM No. 6 oil to the reservoir. Check that the wick **13** used on part 843130 or that the pad **14** used on part 1638706 touches all 8 print wires **11**.
15. Reinstall the print head cable EC3 **5**.
  16. Reinstall the print head cover **1** (two screws).
  17. Thread the print ribbon as shown on the label on the ribbon box cover and close the ribbon feed rolls **4**.

## 361 PRINT HEAD FORMS GUIDE

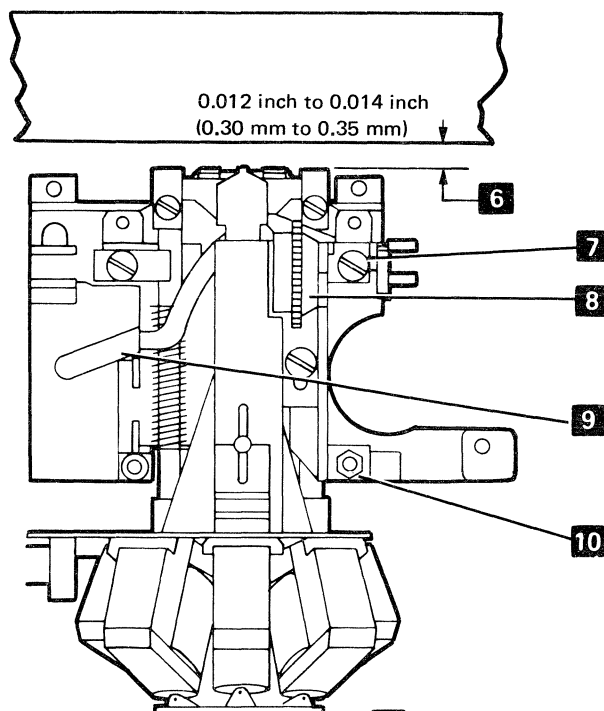
### Removal

The print head forms guide should be as far as possible from the platen and centered within the limits of the mounting slots.

1. Power down.
2. Remove the forms tractor unit and printer covers (310).
3. Slide the print head to the center.



4. Remove the guide mounting screws **2**, retract the print head by hand, and remove the guide.
5. Install the new guide with the screws loose.
6. Center the guide in the mounting slots, press both ends of the guide toward the print head, and tighten the screws.
7. Complete the operation by reversing the first two steps.



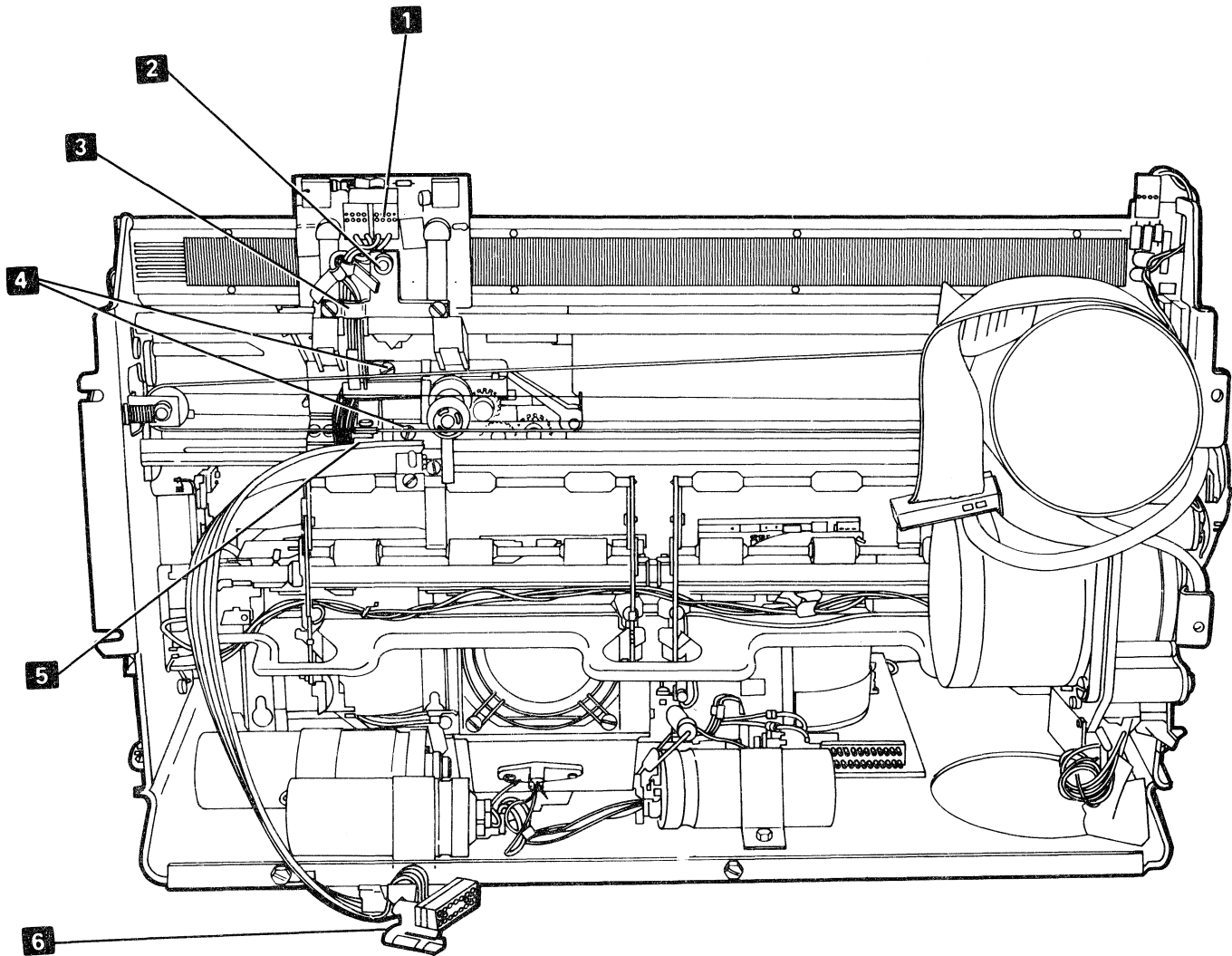
Oil Wick Installation For Print Head P/N 1638706



## 362 PRINT HEAD CABLE

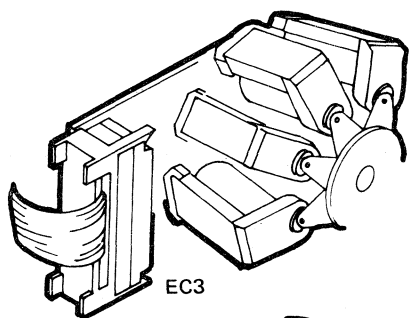
### Removal

1. Power down and remove the printer covers.
2. Remove the print head (360). Adjust the print head on installation.
3. Separate the printer from the power supply (311). Observe the cable routing to aid in replacing the cable.
4. Remove P2A and P2B **1**. Note how P2B is connected. See (343) for P2B plugging positions.
5. **CAUTION**  
When loosening the print emitter pickup mounting screws, the coil spring **2** might fly out.  
Loosen the print emitter pickup cable clamp **3**. Remove the clamp screw on the left side and remove the wires from under the clamp.
6. Loosen the belt clamp **5**. Remove the cable clamp bracket **4** (two screws).
7. Work the cable out of the slots in the casting **8** and push the connector through the hole.
8. Remove two screws from the cable clamp assembly **9** (long flat spring with plastic on ends) and remove the old cable.

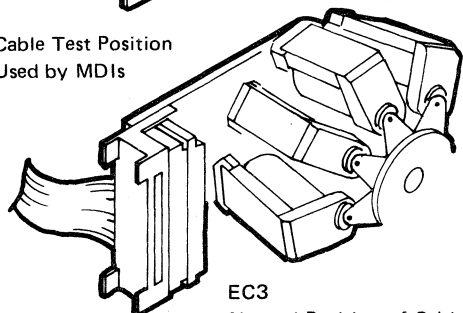


## Replacement

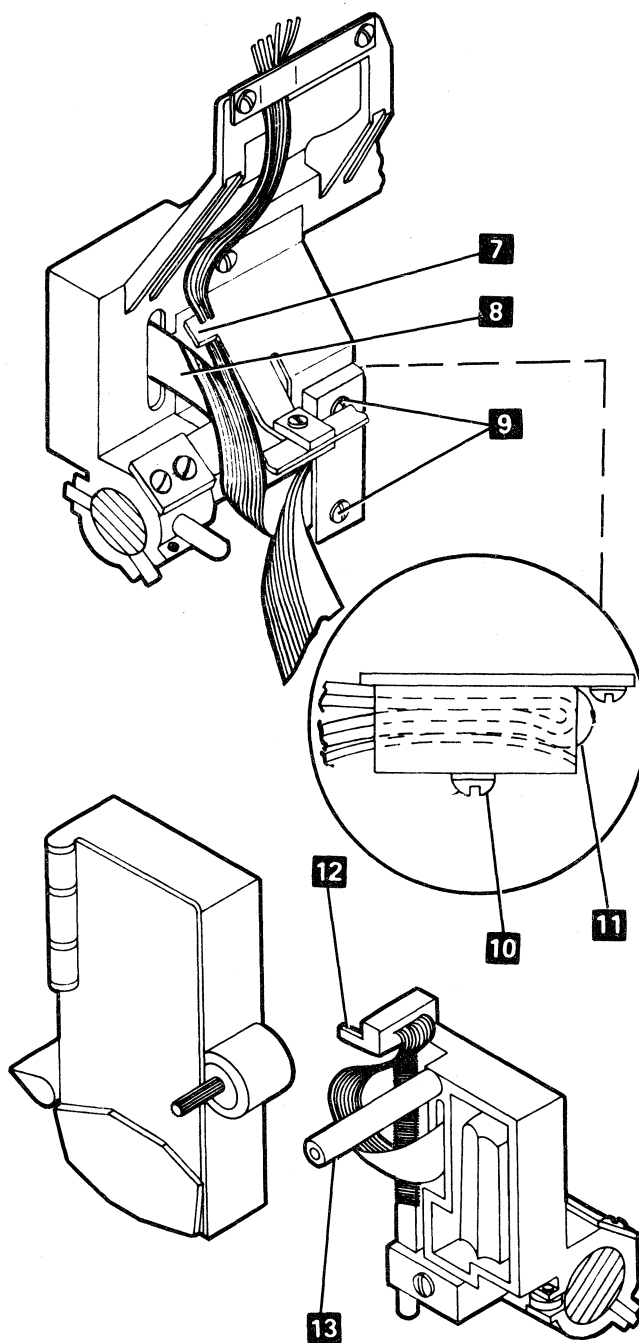
1. Fold the new cable on the mark **11**.
2. Attach the cable clamp assembly and cable to the bracket **10**.
3. Make a 90° counterclockwise twist in the cable and fold the cable at right angles to the long part of the cable.
4. Place the two small parts of the cable in the bracket notch **7** and fold them back.
5. Push the large connector through the hole in the casting and fasten the cable clamp bracket in place (two screws) **4**.
6. Work the cable into the slots so that the locking arms **12** are at the left.
7. Place the two small cables under the clamp for the print emitter pickup and install the screws loosely.
8. Form the cable to the flat spring.
9. Form a loop in the cable **6** at the end of the flat spring.
10. Form the print head cable around the head mounting stud **13** before connecting it into EC3. The loop must be large enough here so the cable will not restrict print head movement.
11. Install the print head (360).
12. Replace the printer on the power supply (311).
13. Connect P2A and P2B **1**.
14. Adjust the emitter pickup (340).
15. Adjust the left margin (343).



Cable Test Position  
Used by MDIs

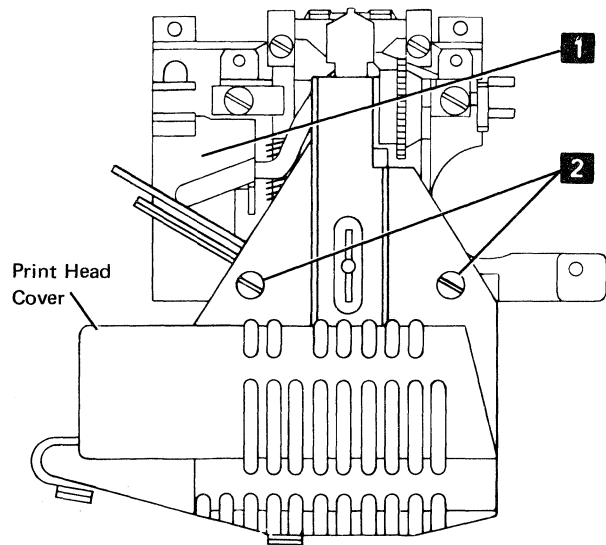


EC3  
Normal Position of Cable



### 363 FELT AND WICK SERVICE

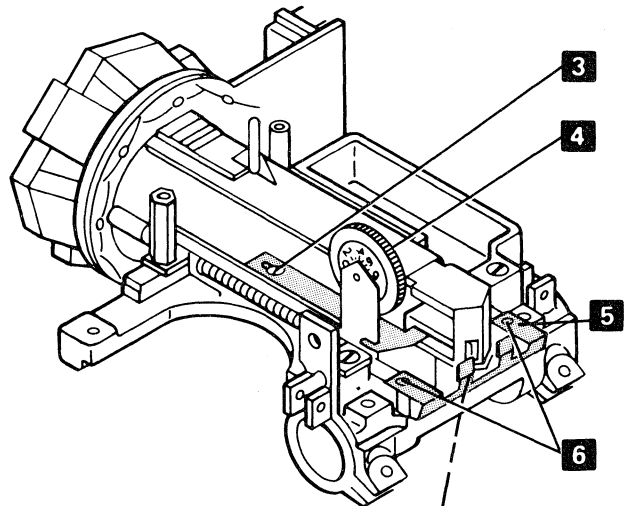
1. Power down.
2. Remove the forms tractor unit.
3. Remove the printer top cover (310).
4. Unthread the ribbon from its guides and lay it on top of the ribbon in the ribbon box.
5. Remove the print head cover (two screws) **2**.
6. Remove the plastic cover on the felt reservoir **1**.
7. Saturate the felt with IBM No. 6 oil.
8. Complete by reversing the first six steps.



### 364 PRINT HEAD SHOE

#### Removal

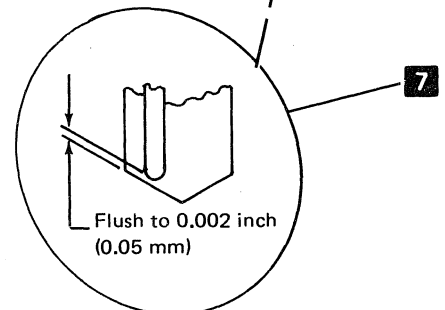
1. Power down and remove the printer cover (310).
2. Remove the print head (360). Adjust the print head during installation.
3. Remove the two screws **6**.
4. Remove the print head shoe **5**.
5. Complete the operation by reversing the first four steps.



### 365 PRINT HEAD RIBBON LIFTER

#### Removal

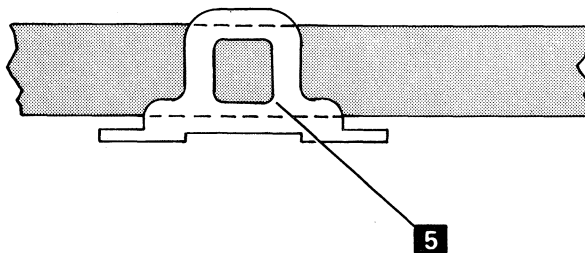
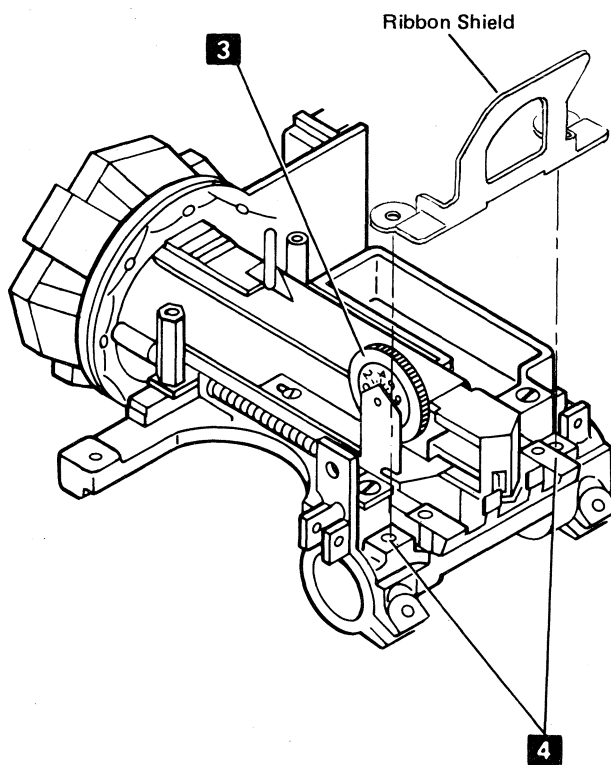
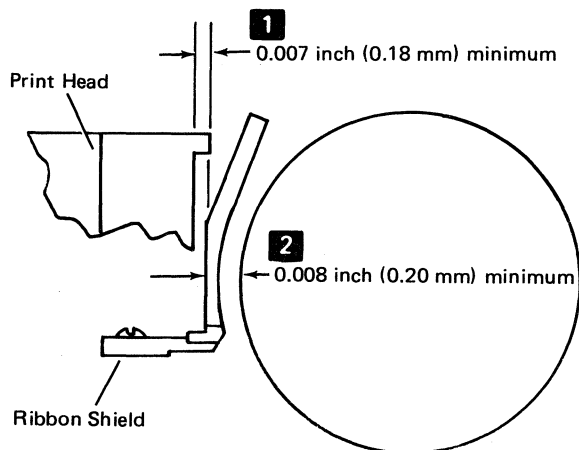
1. Power down and remove the printer covers.
2. Remove the print head (360). Adjust the print head during installation.
3. Remove the screw **3** and remove the ribbon lifter.
4. When installing, adjust flush to 0.002 inch (0.05 mm) **7** when the copy control dial **4** is set at the highest mark.
5. Complete the procedure by reversing the first four steps.



## 366 PRINT HEAD RIBBON SHIELD

### Replacement and Adjustment

1. Power down.
2. Remove the printer cover (310).
3. Remove the paper deflector.
4. Remove the print head forms guide (361).
5. Open the ribbon feed rolls (360 lever **4**).
6. Remove the ribbon from in front of the print head. On installation, check for 0.007 inch (0.18 mm) minimum clearance **1** between the ribbon shield and the print head to allow rethreading of the ribbon. For proper feeding, the ribbon bottom must track below the opening in the ribbon shield **5**.
7. Remove the two screws **4** and replace the ribbon shield. For adjustment only, loosen but do not remove the screws.
8. Install the platen without the paper deflector.
9. Set the copy control dial **3** to zero.
10. Place 0.012 inch to 0.020 inch (0.30 to 0.51 mm) of paper or card stock between the ribbon shield and the platen.
11. Push the print head firmly against the paper or card stock and tighten the two screws **4**. This is to ensure proper parallel alignment between ribbon shield and platen.
12. Remove the paper or card stock. The result should be a minimum of 0.008 inch (0.20 mm) clearance between the ribbon shield and the platen as shown at **2**.
13. Remove the platen.
14. Reassemble the machine by reversing the first six steps.





## Ribbon Drive

### 370 RIBBON DRIVE

#### Removal

1. Power down and remove the printer covers.
2. Remove the print head (360). Adjust the print head for installation.
3. Separate the printer from the power supply (311) and place the printer in the service position.
4. Remove the ribbon drive lines **7** (373).
5. Remove the retaining screw from the inside of the ribbon box **4**.
6. Remove the retaining screw from the left side of the ribbon box beside the feed rolls **1**.
7. Lift out the ribbon drive.
8. To reinstall the assembly, reverse this procedure.

### 371 RIBBON DRIVE CLUTCHES

#### Removal

1. Power down and remove the printer covers.
2. Separate the printer from the power supply and place the printer in the service position (311).
3. Remove the ribbon drive lines **7** (373).
4. Remove the C-clip from the bottom of the ribbon clutch shaft **6**.
5. For installation, you should be able to turn both clutches clockwise (when viewed from the clutch end of the shaft) **8** when the shaft is held.
6. Remove the clutches and washers **5**.
7. To reinstall the clutches, reverse this procedure. Apply a light film of IBM No. 23 grease to the clutch end of the shaft before installing the clutches.

### 372 RIBBON DRIVE SHAFT

#### Removal

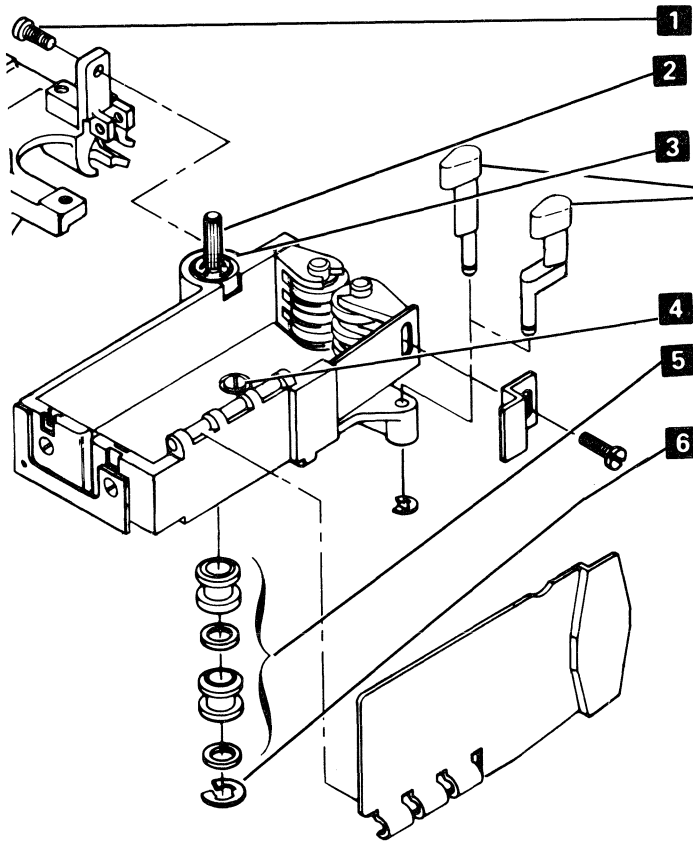
1. Power down and remove the printer covers.
2. Remove the ribbon (376).
3. Remove the C-clip at the ribbon advance knob **3**.
4. Separate the printer from the power supply and place the printer in the service position (311).
5. Remove the ribbon drive lines (373) and slip the carrier drive belt off the motor pulley.
6. Remove the clutches **5** and shaft **2**.
7. Remove the remaining C-clip **6** and slide the clutches off the shaft.
8. For installation, you should be able to turn both clutches clockwise (when looking at the clutch end of the shaft) when the shaft is held.
9. To reinstall the shaft, reverse this procedure.

### 373 RIBBON DRIVE LINES

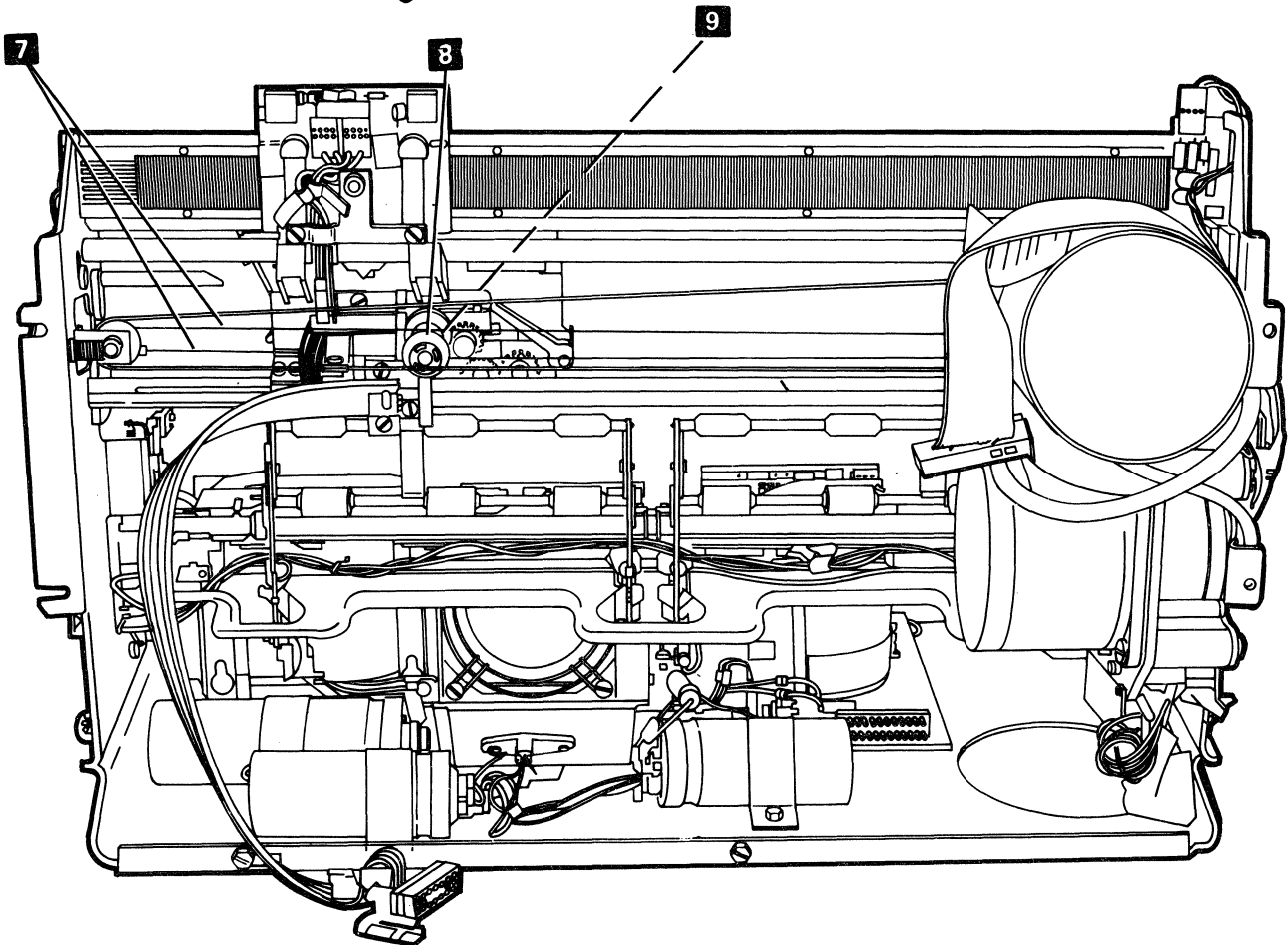
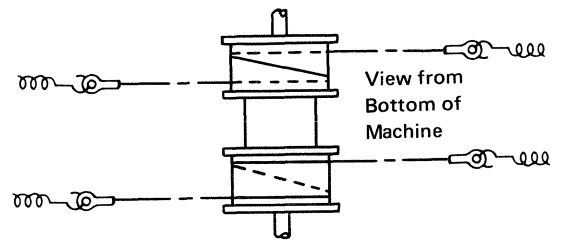
#### Removal

1. Separate the printer from the power supply and place the printer in the service position (311).
2. Unthread the lines from the clutches but leave the springs attached to the tabs on the right and left bracket.
3. To reinstall, thread the lines so that they are parallel to each other and to the carrier main shaft. The line crossovers must be as shown **9**.
4. Reassemble the printer and power supply (311).

*Note:* It helps, when stringing the upper line, to use a small piece of pressure sensitive tape to secure the loop around the clutch while attaching the ends to the side frame.



Note: Ribbon release knob may have an offset shaft.



## 374 RIBBON FEED ROLLS AND SLOT

### Adjustment

1. Power down.
2. Remove the forms tractor unit (324).
3. Remove the printer cover (310).
4. Adjust the feed rolls as follows:
  - a. Loosen the screw **3** that holds the right hand feed roll.
  - b. Open the feed rolls by pushing the flat spring to the right **6**.
  - c. Position the right hand feed roll so that the right feed roll aligns with the left roll **1**.
  - d. Tighten the screw.

*Note:* Some machines have a new clip-on style ribbon box guide **8** that does not require adjusting.

5. Adjust the ribbon box slot as follows:
  - a. Remove the ribbon from the slot.
  - b. Loosen the two plates in the ribbon box end **7**.
  - c. Position the left plate about halfway into the opening and tighten the screw.
  - d. Position the plates 0.016 inch to 0.018 inch (0.41 mm to 0.46 mm) apart and tighten the screws.
  - e. Check and readjust if necessary. Replace the ribbon in the slot.

### Removal

1. Power down.
2. Remove the forms tractor unit (324).
3. Remove the printer covers (310).
4. Remove the ribbon (376).
5. Remove the right feed roll as follows:
  - a. Remove the screw **3**.
  - b. Hold the flat spring **6** to the right and rotate the feed roll **5** toward the platen area to free it from the spring.
6. Remove the left feed roll as follows:
  - a. For installation, install the platen and adjust the print head.
  - b. Remove the print head (360).
  - c. Remove the screw **2** from the left side of the ribbon box.
  - d. If the right feed roll is in place, hold the flat spring **6** to the right and rotate the left feed roll toward the platen.

7. To reinstall the feed rolls, reverse this procedure. Be sure to align the right feed roll vertically to the left roll **1**.

## 375 RIBBON BOX AND COVER

### Removal

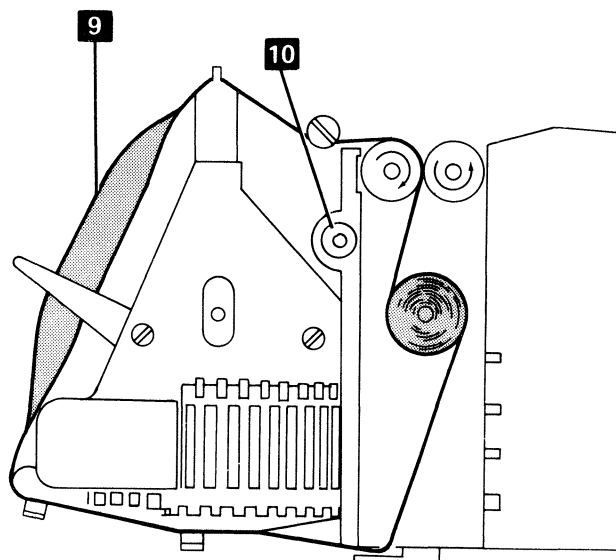
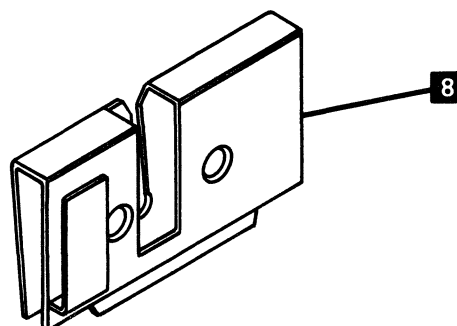
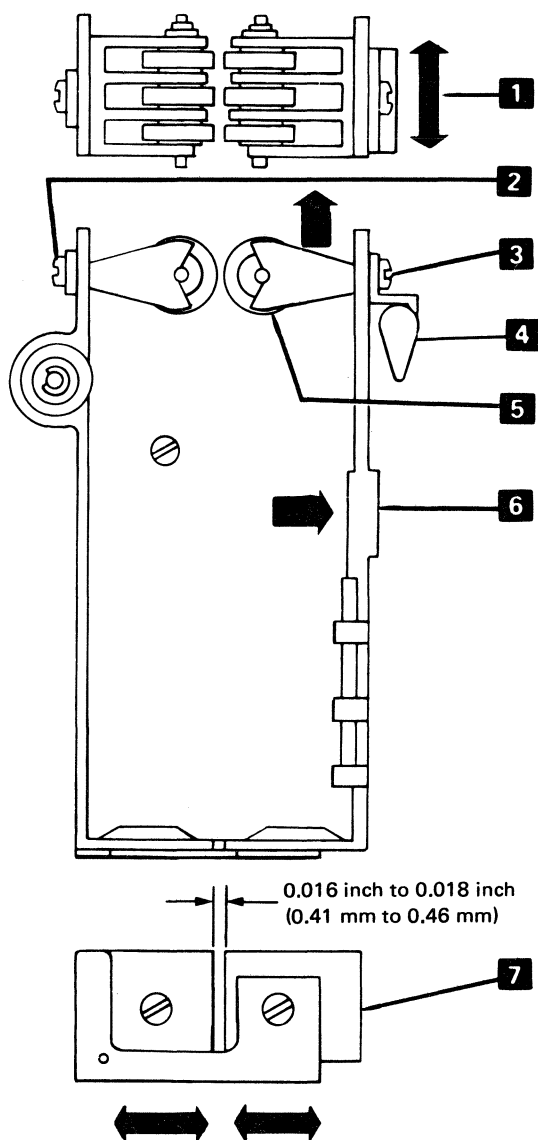
The ribbon box cover can be separated from the box at the hinge.

1. Power down.
2. Remove the printer cover. Separate the printer from the power supply and place the printer in the service position (311).
3. Remove the ribbon drive assembly (370).
4. Remove the following parts:
  - a. Ribbon feed rolls (374)
  - b. Ribbon drive shaft (372)
  - c. Ribbon feed roll release knob **4** (C-clip on bottom)
4. Reassemble the ribbon box and cover by reversing this procedure.

## 376 RIBBON CHANGING

1. Power down.
2. Tilt the forms tractor unit back.
3. Open the top cover.
4. Open the ribbon feed rolls **5**.
5. Remove and discard the old ribbon (see decal on ribbon box cover).
6. Eject a new ribbon into the box by pressing on the disk in the holder. Discard the holder and disk.
7. Pull about 10 inches (254 mm) of ribbon from the coil and form a loop **9**.
8. Thread the side of the loop nearest the platen as shown on the ribbon box decal. Thread this end just past the print head. Close the feed rolls.

9. Thread the other end of the ribbon as shown. The half twist should now be beside the horizontal guides.
10. Take up ribbon slack by rotating the knurled knob **10**. Guide the ribbon between the horizontal guides so that 1/4 turn counterclockwise is on each side of the guide.
11. Close the cover, restore the forms tractor to operating position, and power up.





## Power

### 380 POWER TRANSFORMER

#### Removal

1. Remove power to the printer.
2. Separate the printer from the power supply (311).
3. Remove the following leads from TB1:
  - a. Neutral TB1-10 and phase A TB1 connection as shown in the chart on 384 **2**. (Remove the leads from the bottom side of TB1.)
  - b. Fan leads TB1-7 and TB1-10 **2**.
4. Remove the four transformer mounting screws **4**.
5. Remove the two screws from the fan mounting bracket **5**.
6. Disconnect the secondary leads from the power supply board **6**, **7**, and **8**.
7. Lift out the transformer and fan.

#### Replacement

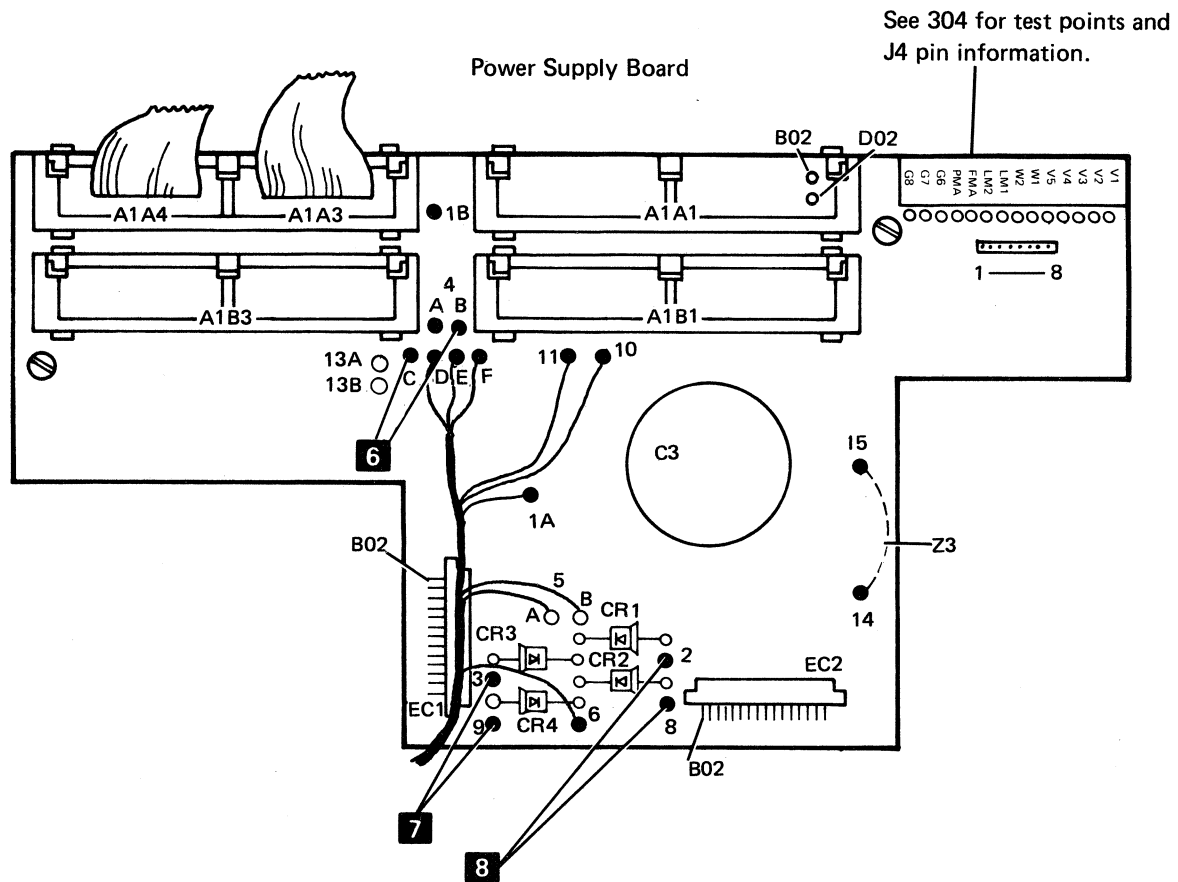
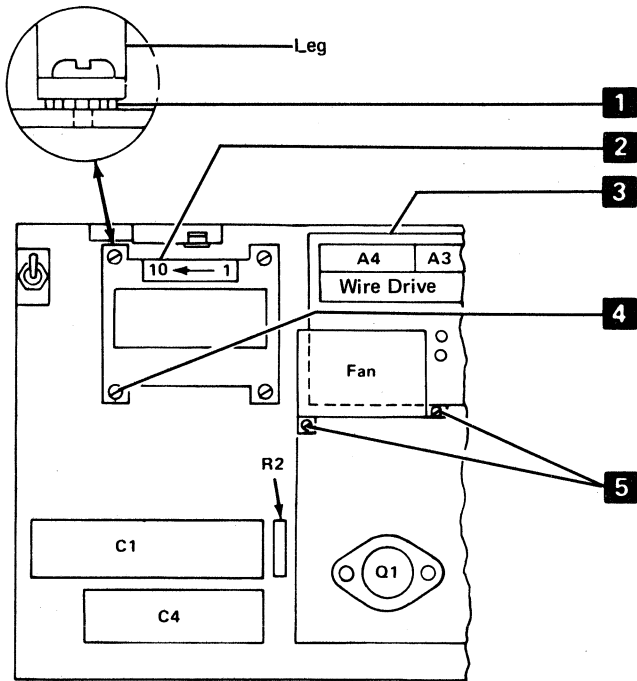
1. Connect the fan leads to the new transformer.
2. Set the transformer in place, being sure that the star washer **1** is under the left rear leg of the transformer (viewed from the front of the printer).
3. Install the four mounting screws **4** in the transformer legs.
4. Connect the secondary leads into the power supply board as follows:
  - a. Black into 4B (lead 12) and 4C (lead 15) **6**
  - b. Blue into 3 (lead 14) and 9 (lead 16) **7**
  - c. Red into 2 (lead 11) and 8 (lead 13) **8**
5. Install the fan (two screws) **5**.
6. Connect the neutral lead to TB1-10 and the phase A TB1 lead as shown on (384).
7. Complete the procedure by reassembling the printer on the power supply (311).

*Note:* Transformers with an internal shield have a ground lead that must be connected under a transformer leg when installing the transformer.

### 381 FAN

#### Removal

1. Power down.
2. Remove the printer covers and separate the printer from the power supply (311).
3. Remove the two fan leads from the transformer side of TB1-7 and TB1-10 **2**.
4. Remove the two fan bracket mounting screws **5**.
5. Lift the fan assembly out. (Make sure that the bracket clears the power supply board.)
6. Remove the fan from the bracket. When reinstalling the bracket, be sure that the air flow direction arrow on the fan points toward the bracket.
7. Reinstall the fan by reversing this procedure.



## 382 POWER SUPPLY BOARD

### Removal

1. Power down.
2. Separate the printer from the power supply (311).
3. Disconnect the transformer leads from the board:
  - a. Black from points 4B (lead 12) and 4C (lead 15) **2**
  - b. Blue from points 3 (lead 14) and 9 (lead 16) **7**
  - c. Red from points 2 (lead 11) and 8 (lead 13) **8**
4. Disconnect and label the capacitor cable leads **6** as shown.
5. Remove the screw and stud from capacitor C3 **9**.
6. Remove two fan mounting screws **5** and move the fan aside.
7. Remove two board mounting screws **1** and **4** lift the board out.

8. For installation, locate capacitor C3 as far to the rear of the board as possible and locate the board as far to the rear of the machine as possible.

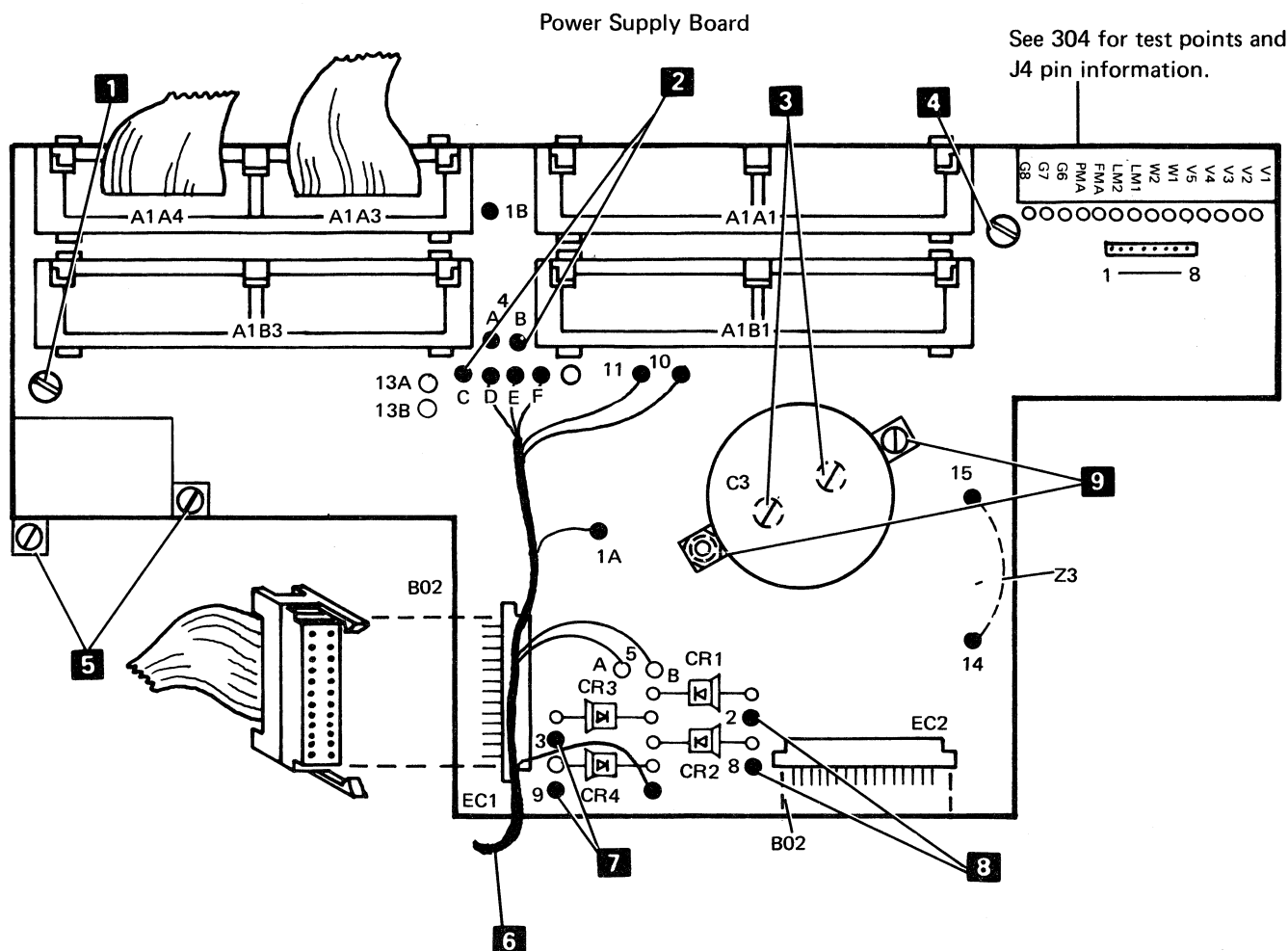
9. To reinstall board, reverse this procedure.

10. Be careful to install the cable **6** correctly.

## 383 CAPACITOR C3

### Removal

1. Remove the power supply board (382).
2. Note the polarity connections and remove the two capacitor connecting screws **3** on the underside of the power supply board.
3. To replace the capacitor, reverse this procedure. Position the capacitor as far to the rear as possible.



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**CABLES . . . . . 2-8**

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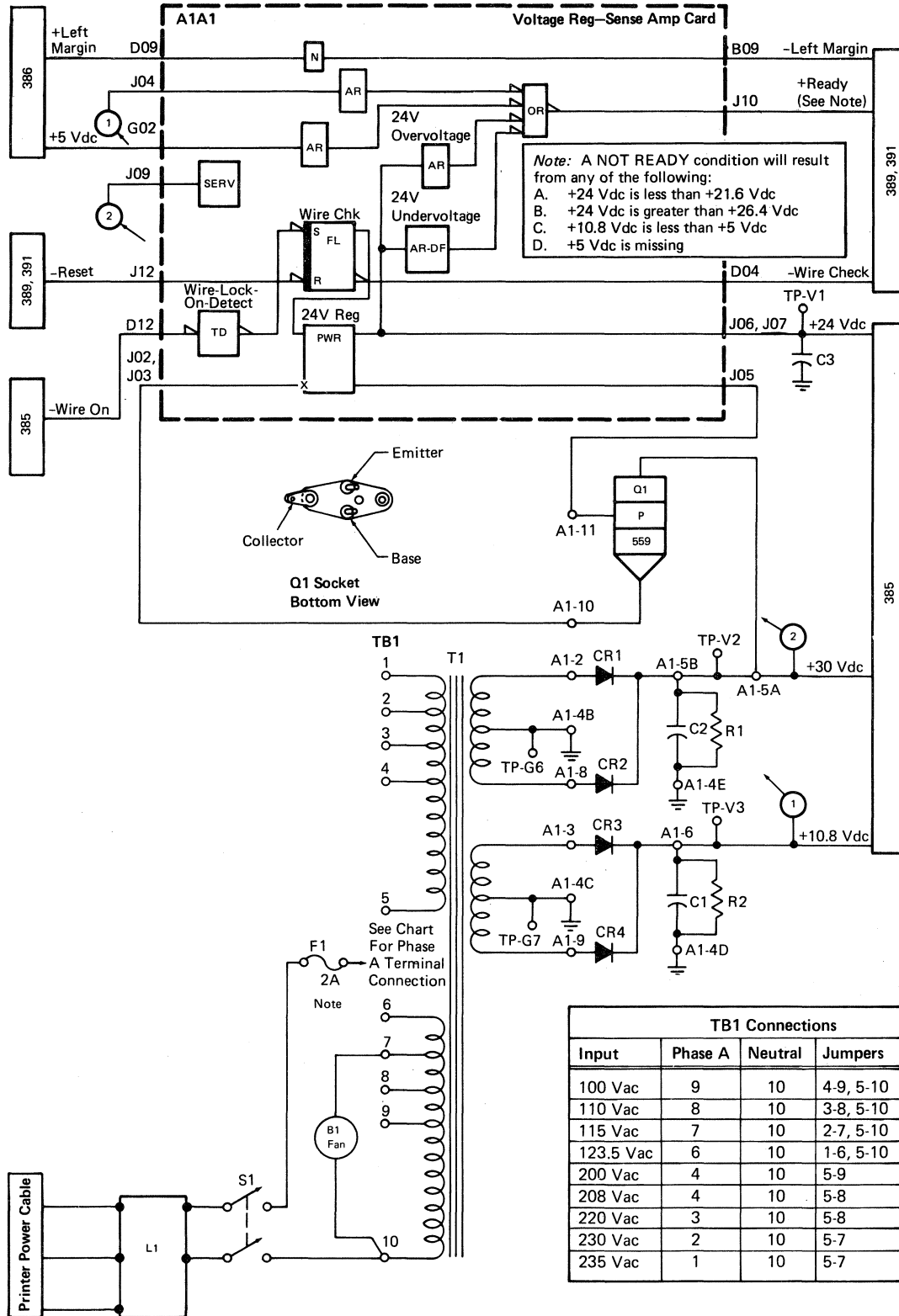
Printer Signal Cables (A1 Board to B1 Board Cables) . 2-10

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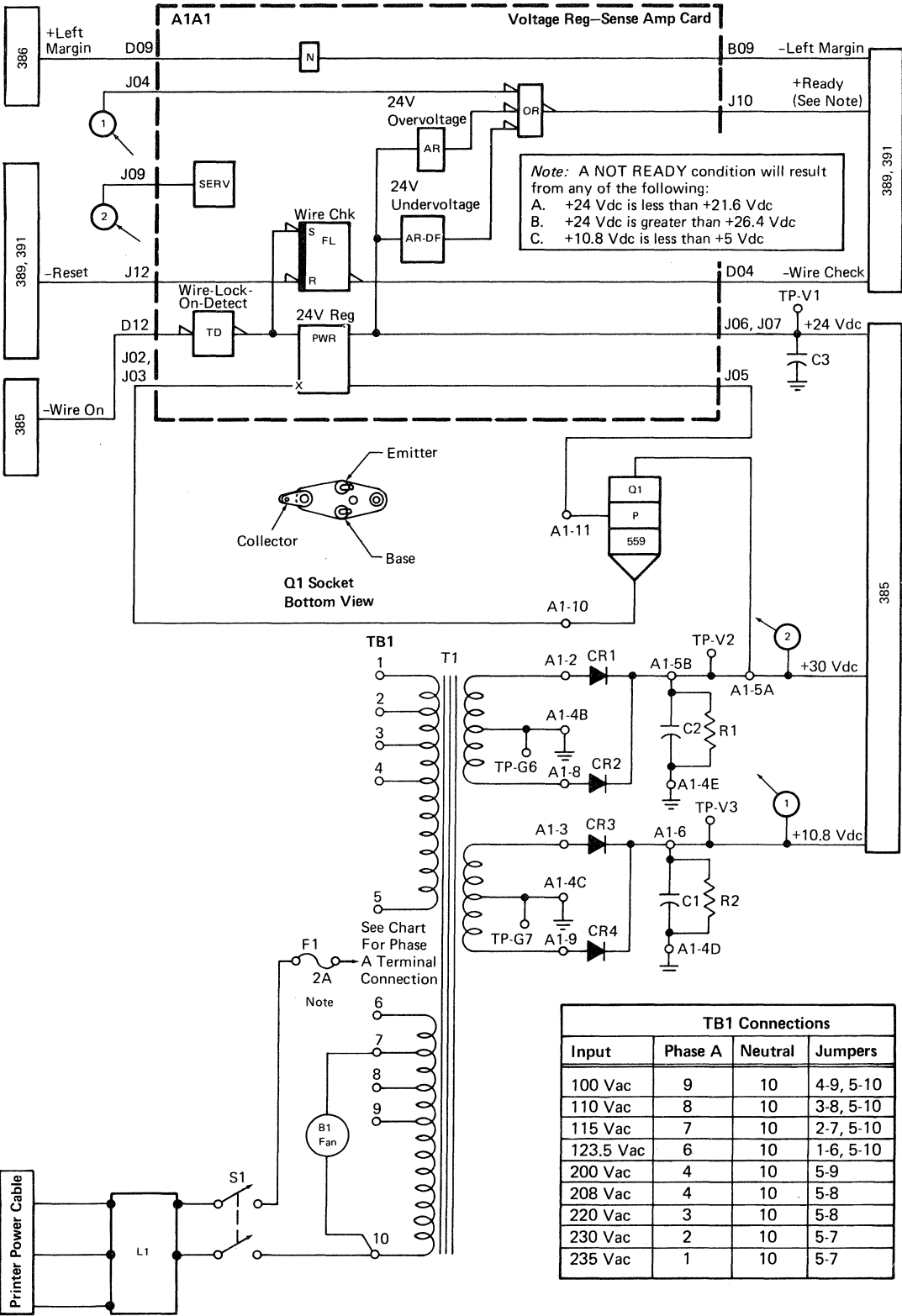




Note: 1A on 220 Vac and 235 Vac machines.

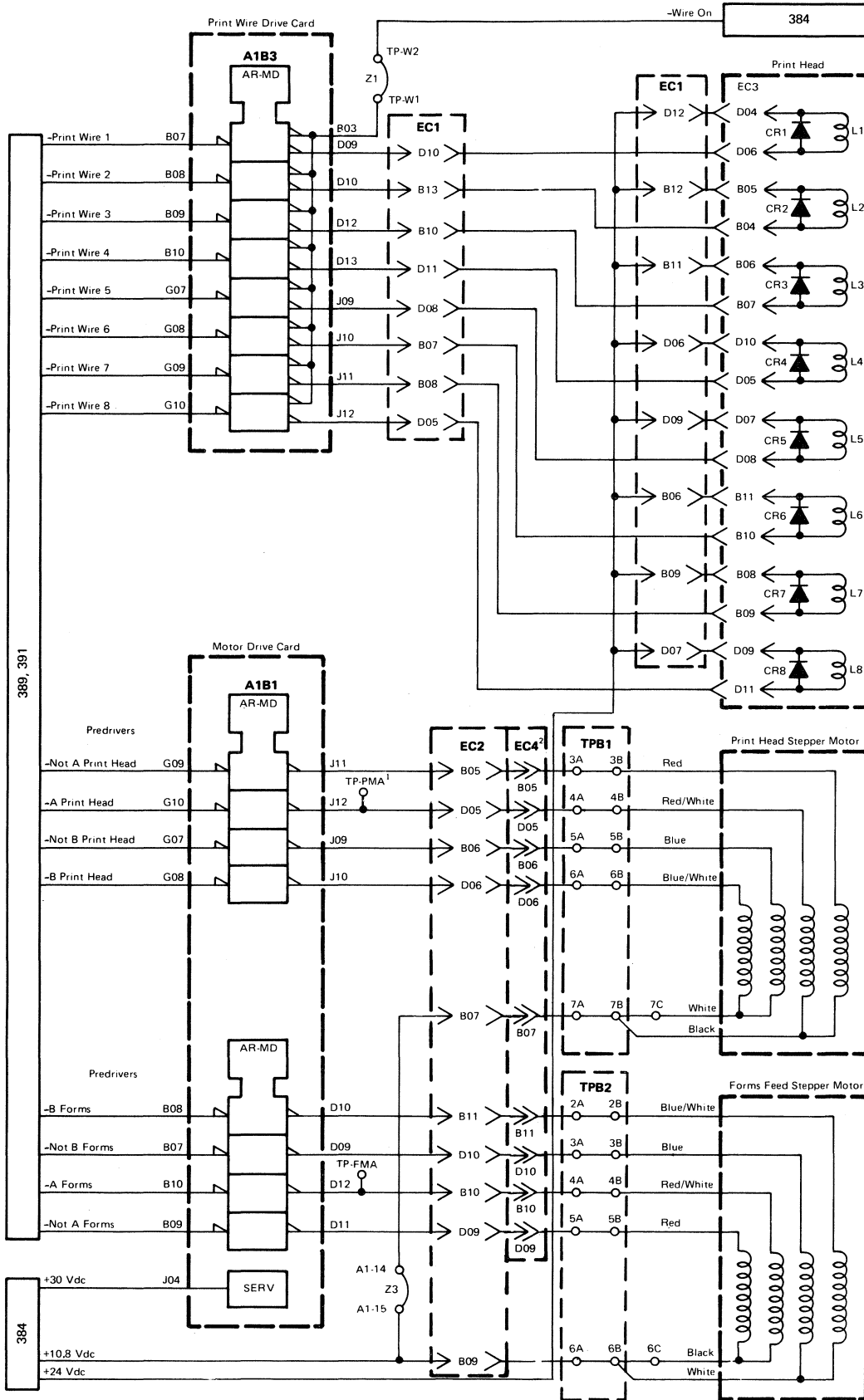
384

PRINTER WIRING DIAGRAM (Machines without EC 579623 or EC 579920)  
 (Page 2 of 2)



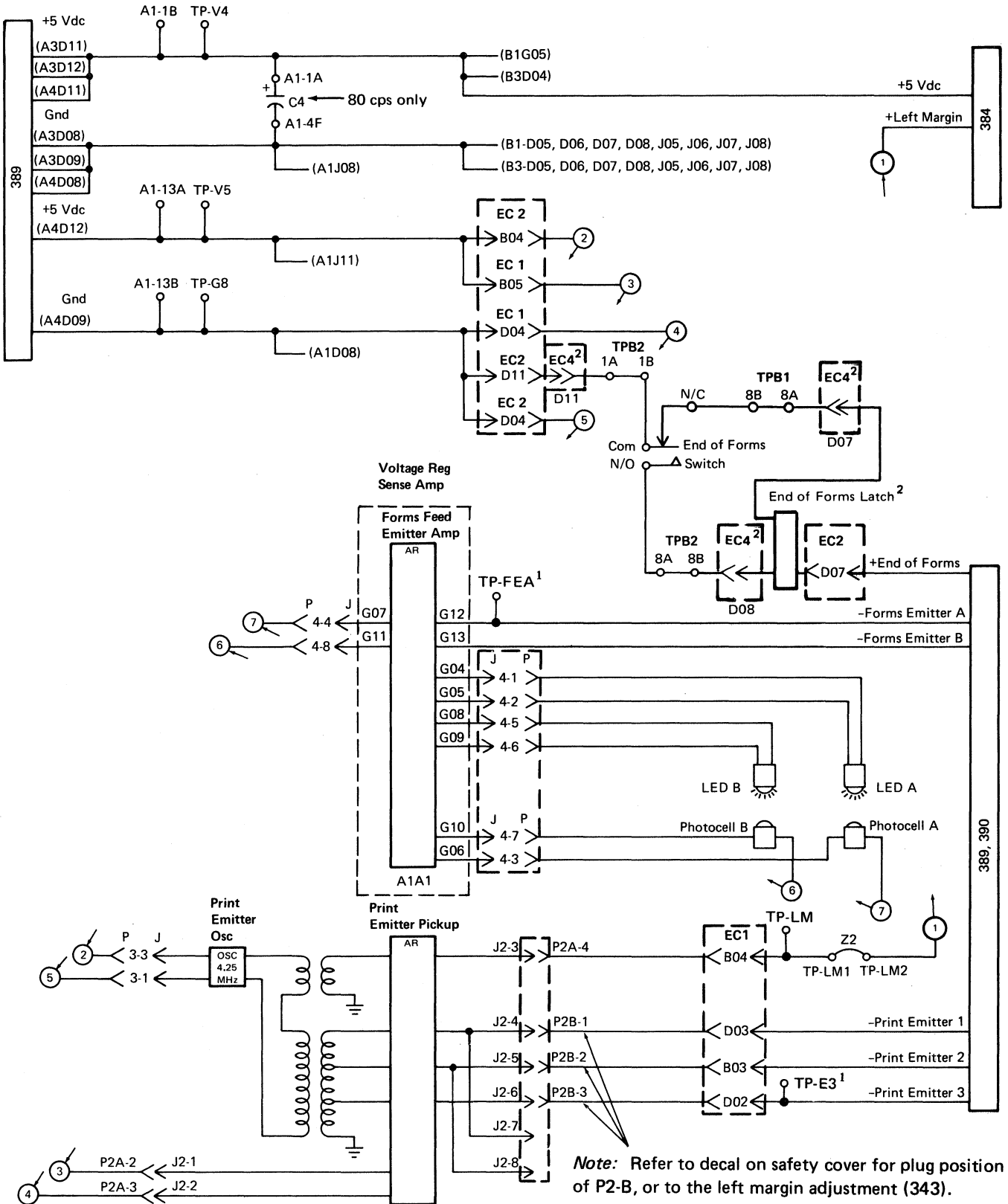
Note: 1A on 220 Vac and 235 Vac machines.

## 385 PRINTER WIRING DIAGRAM

<sup>1</sup>Not on all machines.<sup>2</sup>EC4 is present only when the End-of-Forms latch card is installed (EC 386125 or FBM 624376).

# **386** PRINTER WIRING DIAGRAM (Machines with EC 579623 or EC 579920) (Page 1 of 2)

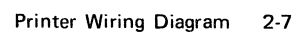
**Note:** Numbers in parentheses are card socket-pin locations on the A1 board.



<sup>1</sup>Not on all machines.

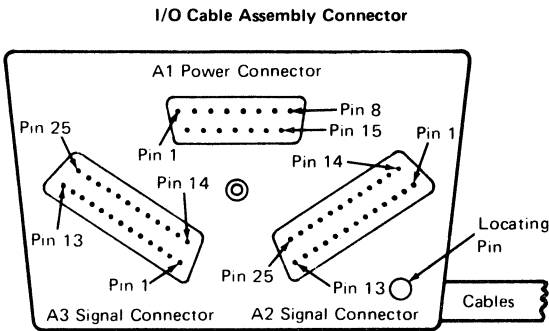
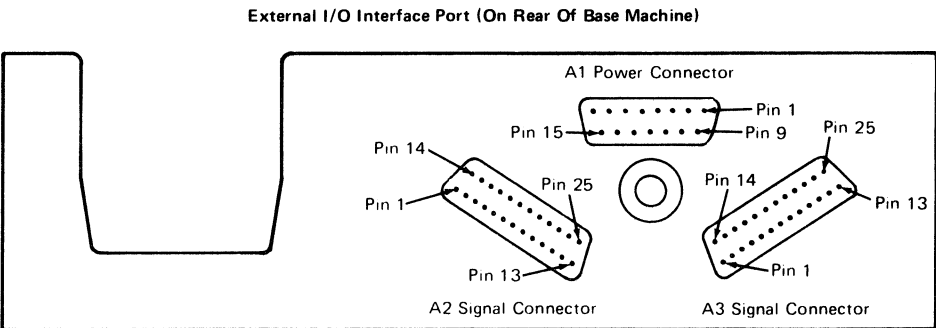
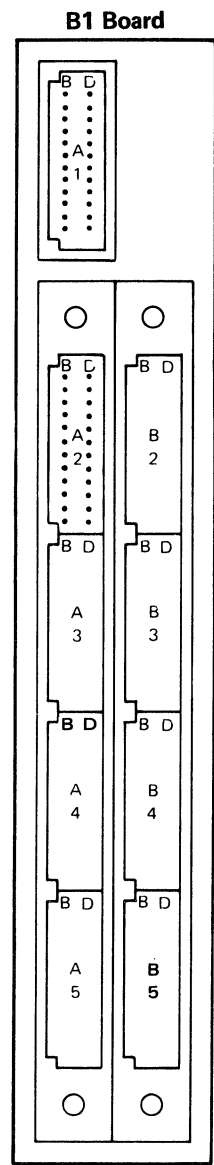
<sup>2</sup>EC4 is present only if the End-of-Forms latch card is installed (EC 386125 or FBM 624376).

**Note:** Numbers in parentheses are card socket-pin locations on the A1 board.





387 PRINTER I/O CABLE ASSEMBLY



Printer B1 Board Socket List

Socket Location	Cable Or Card
A1	A1 Power Cable Entry Point
A2-A5 <sup>1</sup>	Printer Adapter Card
B2 <sup>1</sup>	A2 Signal Cable Entry Point
B3 <sup>1</sup>	A3 Signal Cable Entry Point
B4 <sup>1</sup>	Signal Cable To Location A1A3
B5 <sup>1</sup>	Signal Cable To Location A1A4

<sup>1</sup>Power down the system and the 5103 before removing the card or the cables.

A1 Power Connector And B1 Board Pin Locations

	External I/O Interface Connector Pin	Line Name	Power Cable Entry Pin	Printer Adapter Card Pin(s)	B4 And B5 Printer Cable Pins	Voltage Pins Commoned Together On B1 Board
To System I/O Interface Port—A1 Connector	01	+5V	A1D03	A2D03	B4D11	A1B02,A1B03,A1D02,
	02	+5V	A1B03	A2J03	B4D12	A1D03,A1D04,A2D03,
	03	+5V	A1D04	A2P03	B5D11	A2J03,A2P03,A2U03,
	04	+5V	A1D02	A2U03	B5D12	B4D11,B4D12,B5D11,
	05	+5V	A1B02			B5D12
	06			A2D08	B4D08	A1B07,A1B08,A1B09,
	07			A2J08	B4D09	A1D07,A1D08,A1D09,
	08			A2P08	B5D08	A2D08,A2J08,A2P08,
	09			A2S06	B5D09	A2S06,A2U08,B2D08,
	10			A2U08		B3D08,B4D08,B4D09,
	11					B5D08,B5D09
	12	+8.5V	A1B11	A2M11		A1B11,A2M11
	13	+12V	A1B12			
	14	-12V	A1D12			
	15	-5V	A1D11			

Note: Ground to the Printer Adapter card (B1A2) and to the B4 and B5 cables is supplied through the A2 and A3 signal connectors via the ground bus on the back of the B1 board.

A2 Signal Connector And B1 Board Pin Locations

	External I/O Interface Connector Pin	Line Name	A2 Cable Entry Pin	Printer Adapter Card Pin
To System I/O Interface Port—A2 Connector	01	-Ground	B2D08	A2D08
	02	-Put Strobe	B2B13	A2B13
	03	-Control Strobe	B2B12	A2B12
	04	-Get Strobe	B2B11	A2B11
	05	+Device Adr Y3	B2B10	A2B10
	06	+Device Adr Y2	B2B09	A2B09
	07	+Device Adr Y1	B2B08	A2B08
	08	+Device Adr Y0	B2B07	A2B07
	09	+Device Adr X3	B2B06	A2B06
	10	+Device Adr X2	B2B05	A2B05
	11	+Device Adr X1	B2B04	A2B04
	12	+Device Adr X0	B2B03	A2B03
	13	-Ground	B2D08	A2D08
	14	-Ground	B2D08	A2D08
	15	+Op Code E	B2D13	A2D13
	16	+Bus In P	B2D12	A2D12
	17	+Bus In 7	B2D11	A2D11
	18	+Bus In 6	B2D10	A2D10
	19	+Bus In 5	B2D09	A2D09
	20	+Bus In 4	B2D07	A2D07
	21	+Bus In 3	B2D06	A2D06
	22	+Bus In 2	B2D05	A2D05
	23	+Bus In 1	B2D04	A2D04
	24	Unused		
	25	+Bus In 0	B2D02	A2D02

A3 Signal Connector And B1 Board Pin Locations

	External I/O Interface Connector Pin	Line Name	A3 Cable Entry Pin	Printer Adapter Card Pin
To System I/O Interface Port—A3 Connector	01	-Ground	B3D08	A2D08
	02	+Oscillator <sup>1</sup>	B3B13	A2G13
	03	-Interrupt Req 2	B3B12	A2G12
	04	+Bus Out Bit P	B3B11	A2G11
	05	-Bus Out Bit 0	B3B10	A2G10
	06	-Bus Out Bit 1	B3B09	A2G09
	07	-Bus Out Bit 2	B3B08	A2G08
	08	-Bus Out Bit 3	B3B07	A2G07
	09	-Bus Out Bit 4	B3B06	A2G06
	10	-Bus Out Bit 5	B3B05	A2G05
	11	-Bus Out Bit 6	B3B04	A2G04
	12	-Bus Out Bit 7	B3B03	A2G03
	13	-Ground	B3D08	A2D08
	14	-Ground	B3D08	A2D08
	15	+C5 <sup>1</sup>	B3D13	A2J13
	16	+C4 <sup>1</sup>	B3D12	A2J12
	17	+C3 <sup>1</sup>	B3D11	A2J11
	18	+C2 <sup>1</sup>	B3D10	A2J10
	19	+C1 <sup>1</sup>	B3D09	A2J09
	20	+Start Execute Bit	B3D07	A2J07
	21	-Machine Check	B3D06	A2J06
	22	+Ext Horiz Drive	B3D05	A2J05
	23	+Char Cntr 4 <sup>1</sup>	B3D04	A2J04
	24	Unused		
	25	-Power On Reset	B3D02	A2J02

<sup>1</sup> 5100 only, see 5110 MIM for changes.

## 389 PRINTER SIGNAL CABLES (A1 Board to B1 Board Cables)

A1A3 To B1B4 Cable		
A1 Board Signal Pin	Line Name	B1 Board Signal Pin
A3B02	Unused	B4B02
A3B03	-Print Wire 1	B4B03
A3B04	-Print Wire 3	B4B04
A3B05	-Print Wire 5	B4B05
A3B06	Unused	B4B06
A3B07	-Print Wire 7	B4B07
A3B08	-Print Emitter 3	B4B08
A3B09	-Print Emitter 2	B4B09
A3B10	-Print Emitter 1	B4B10
A3B11	Unused	B4B11
A3B12	-Reset	B4B12
A3B13	Unused	B4B13
A3D02	+Ready	B4D02
A3D03	Unused	B4D03
A3D04	-Print Wire 2	B4D04
A3D05	-Print Wire 4	B4D05
A3D06	-Print Wire 6	B4D06
A3D07	-Print Wire 8	B4D07
A3D08	Ground	B4D08
A3D09	Ground	B4D09
A3D10	Unused	B4D10
A3D11	+5V	B4D11
A3D12	+5V	B4D12
A3D13	+ End Of Forms	B4D13

*Note:* The unused wires in each cable are connected to a signal line on the B1 board.

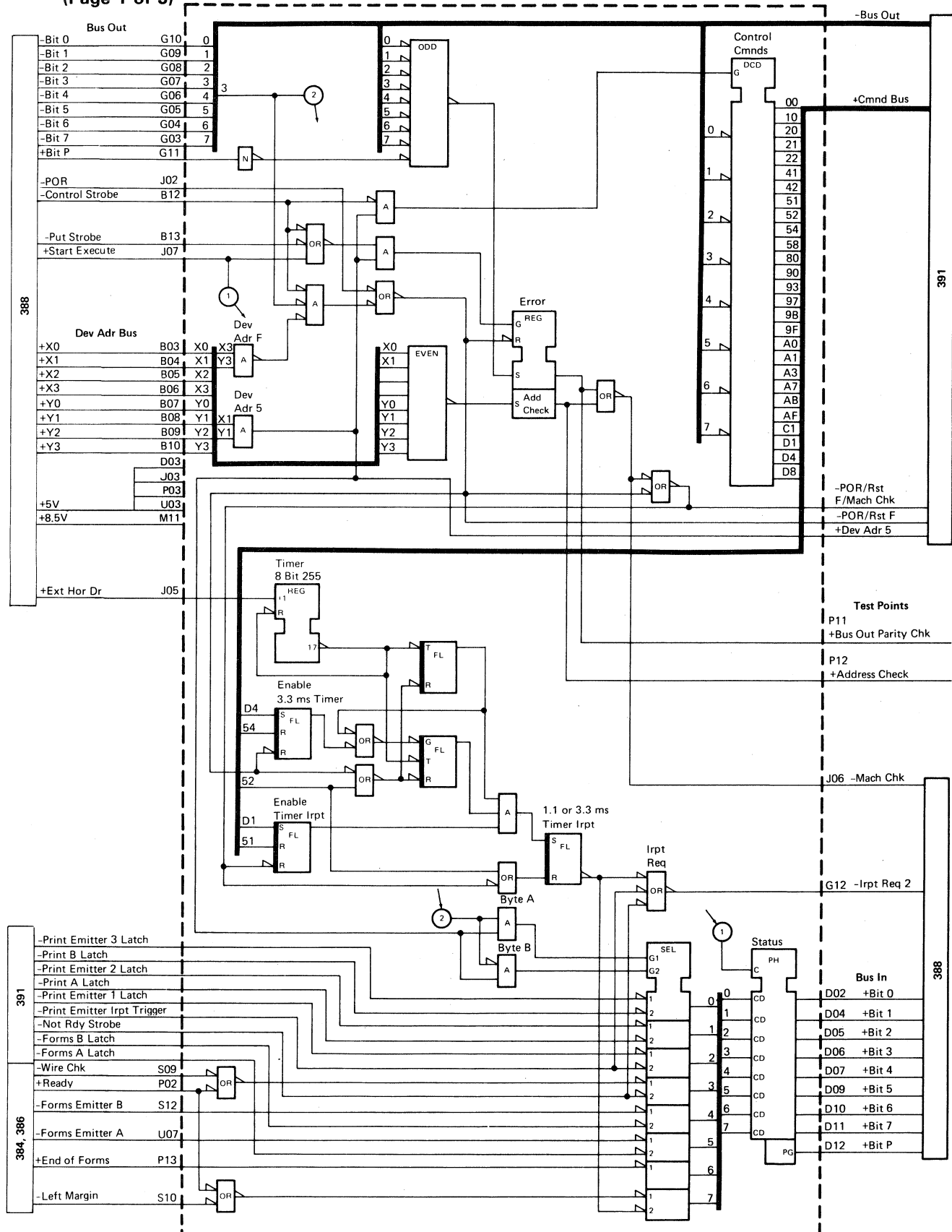
A1A4 To B1B5 Cable		
A1 Board Signal Pin	Line Name	B1 Board Signal Pin
A4B02	Unused	B5B02
A4B03	-Not B Forms Predriver	B5B03
A4B04	-Not A Forms Predriver	B5B04
A4B05	-Not B Print Head Predriver	B5B05
A4B06	Unused	B5B06
A4B07	-Not A Print Head Predriver	B5B07
A4B08	-A Print Head Predriver	B5B08
A4B09	-Wire Check	B5B09
A4B10	-Left Margin Signal	B5B10
A4B11	Unused	B5B11
A4B12	-Forms Emitter B	B5B12
A4B13	Unused	B5B13
A4D02	Unused	B5D02
A4D03	Unused	B5D03
A4D04	-B Forms Predriver	B5D04
A4D05	-A Forms Predriver	B5D05
A4D06	-B Print Head Predriver	B5D06
A4D07	-Forms Emitter A	B5D07
A4D08	Ground	B5D08
A4D09	Ground	B5D09
A4D10	Unused	B5D10
A4D11	+5V	B5D11
A4D12	+5V	B5D12
A4D13	Unused	B5D13

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# Logics

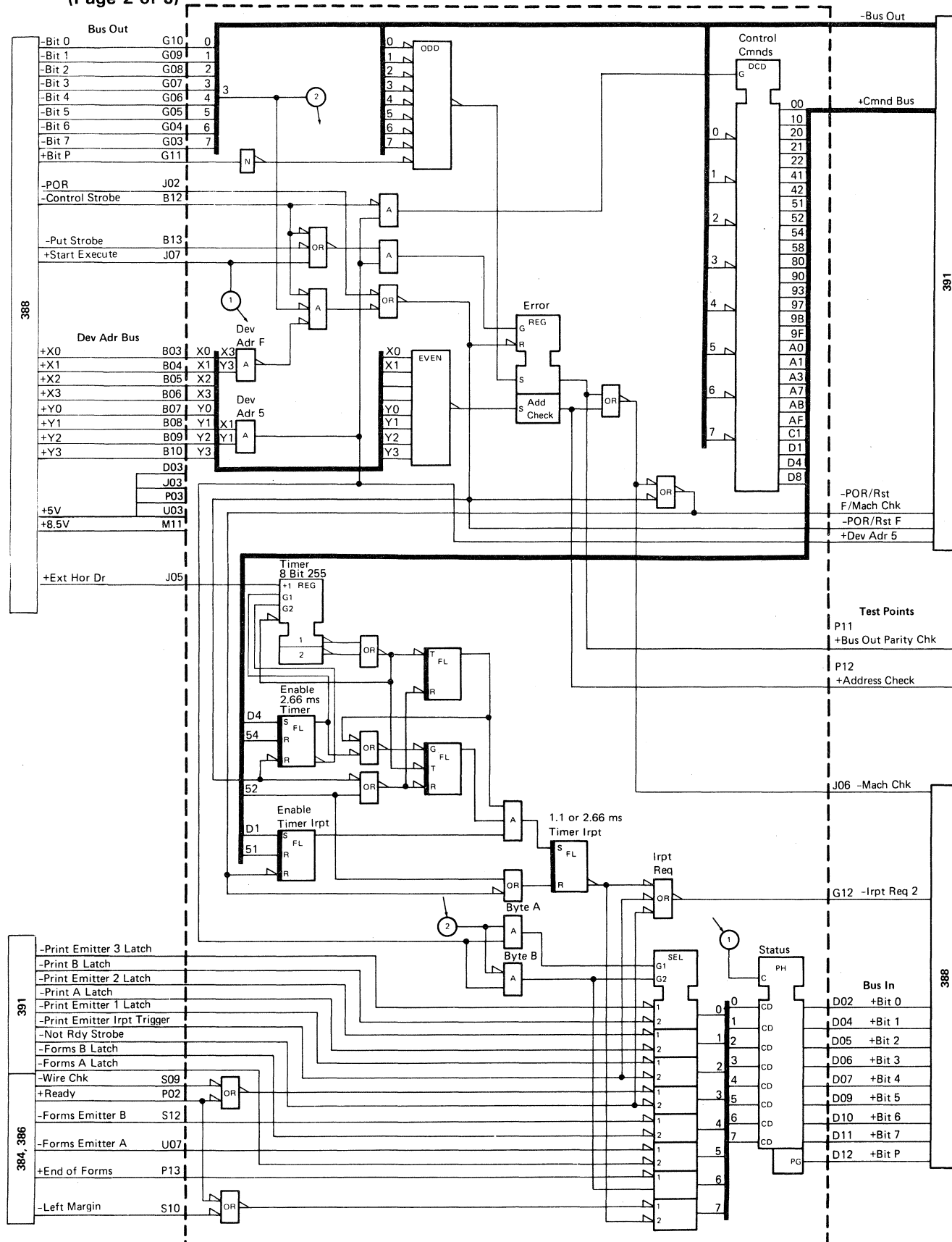
## 390 PRINTER ADAPTER CARD (80 cps)-5100 ATTACHMENT (See 392 for 5110)<sup>1</sup>

(Page 1 of 3)



<sup>1</sup>Mod 11 logics in the IBM 5110 System Logic Manual, SY31-0552.

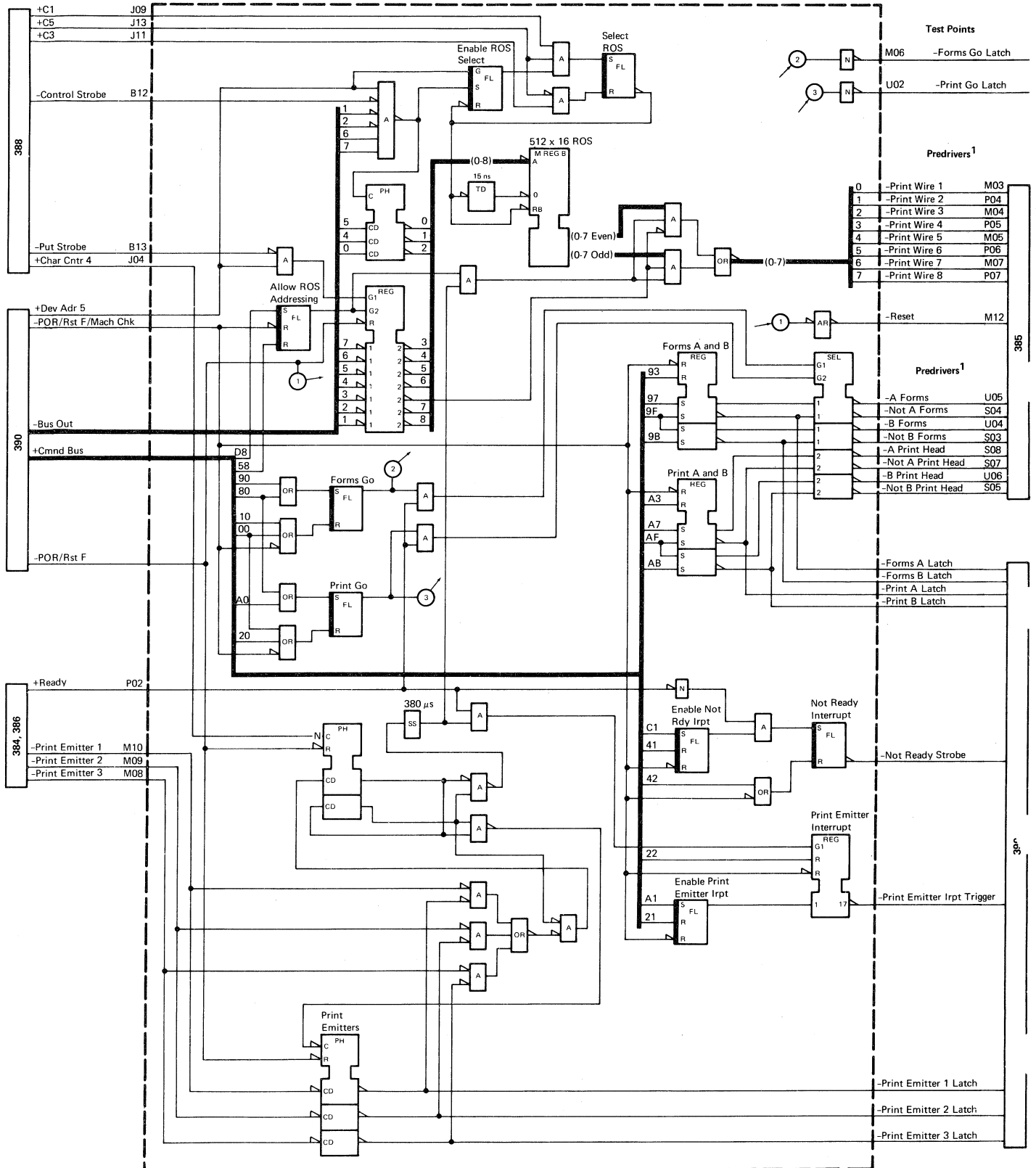




<sup>1</sup>Mod 11 logics in the IBM 5110 System Logic Manual, SY31-0552.

# 391 PRINTER ADAPTER CARD-5100 ATTACHMENT (See 392 for 5110)<sup>2</sup>

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<sup>1</sup>The general logic probe will not detect an up level on these lines on machines with EC 579623 or EC 579920 (both lights will be off).

<sup>2</sup>Mod 11 logics in the *IBM 5110 System Logic Manual*, SY31-0552.

See the *IBM 5110 System Logic Manual*, SY31-0552.

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## Introduction

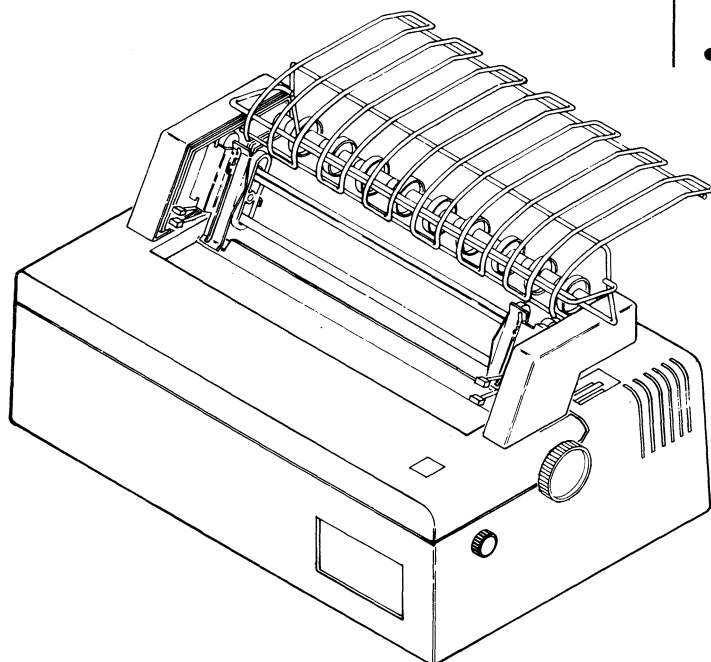
The IBM 5103 Printer is a bidirectional (prints left and right) printer that prints at 80 cps or 120 cps (characters per second).

This printer produces printed characters by a series of dots within a matrix. Characters are formed by printing a pattern of dots that corresponds to a stored image in the adapter.

Printer control, logic voltages, and data signals are provided by the system controller.

The printer provides the following capabilities:

- 128 different characters
- 132-character print line
- 10 characters per inch horizontal spacing
- Six lines per inch vertical spacing
- 15-inch pressure platen for cut forms
- Forms tractor unit for continuous forms
- Microcode controllable vertical spacing
- Bidirectional forms motion



IBM 5103 Printer

## Printer Operation Overview

The IBM 5103 Printer is powered by two stepper motors: the print head stepper motor and the forms feed stepper motor. Each motor is controlled by four predriver lines: A,  $\bar{A}$  (not A), B,  $\bar{B}$  (not B). The different combinations of these predriver lines in a prescribed sequence determine the direction the motor rotates. The direction that the motor rotates determines the direction of print head travel (left or right) and the direction in which the forms are fed (forward or reverse).

The print head stepper motor is coupled to the print head carrier. The print head carrier supports the ribbon box, the ribbon drive mechanism, the print head, and the print emitter pickup.

The ribbon box holds a continuous ribbon. The ribbon drive mechanism is driven by two monofilament lines through a series of idler gears.

The print head contains eight vertically mounted print wires. Signals from the microprogram in the controller move the print head along the print line and selectively energize the print wires.

The character dot matrix is 7-high by 7-wide, except for some special character patterns that are 8-high by 7-wide. Underscoring the characters is a separate operation and requires a second pass over the print line. Print wire 7 is used for the underscore after the printer spaces up 1/4 of a line (four steps of the forms stepper motor).

The print emitter pickup consists of four land patterns and four associated amplifier detector trigger circuits. Three of the land patterns are vertical; the fourth is horizontal (all references to land pattern direction in this overview are with the printer in the service position). The print emitter pickup slides along the length of the print emitter.

The print emitter is a stationary board with one continuous land pattern and a 4.25 MHz oscillator.

A print emitter pulse is produced when the land pattern of the print emitter and one of the vertical land patterns of the print emitter pickup are at maximum misalignment (null position). The maximum misalignment of a vertical print emitter pickup land pattern and the vertical part of the print emitter land pattern occurs every 0.030 inch (0.76 mm). Because each vertical print emitter pickup land pattern is displaced every 0.010 inch (0.25 mm), a print emitter pulse occurs every 0.010 inch (0.25 mm).

When the horizontal land pattern of the print emitter pickup is aligned with the horizontal part of the print emitter land pattern, a left margin pulse occurs.

The print emitter pulses and the left margin pulse energize four lines:

Print emitter 1  
Print emitter 2  
Print emitter 3  
Left margin

When these lines are active, they signal the adapter:

- When the print head is in the left margin
- How far the print head is in the left margin
- Which direction the print head is moving
- When to fire the print magnets

The adapter for the IBM 5103 Printer is contained on one card located within the printer (390 and 391). The printer character set is stored on this card in the 512 by 16 ROS (read only storage).

Data that points to ROS bytes is loaded by the microprogram into read/write storage of the system anywhere above location 0800. The ROS bytes bit configuration determines which print wire magnets to fire. The data is accessed to address the corresponding ROS bytes stored in the printer adapter. Because the bytes of a character are read from ROS one at a time, 10 accesses are needed to print one character (seven for the character and three for the space between characters). The ROS may be jumpered to produce different language graphics in the 5103 Models 11 and 12.

In preparation for printing a line, the printer microprogram scans the control unit read/write storage area that contains printer data to locate the first byte that is not blank. The location of the first nonblank byte is the start position for the line to be printed.

Next, the printer microprogram scans the read/write storage area in the opposite direction to locate the position of the last significant character of the line to be printed. This value is the last position of the line.

The microprogram then determines the position of the print head. If the print head position counter (located in the microprogram) contains a value:

- Less than the value of the start position, the printer is told to start to print and print left to right.
- Greater than the value of the last position, the printer is told to start to print and print right to left.
- Equal to or greater than the start position (but less than or equal to the last position), the microprogram computes which position (first or last) is nearer to the print head position counter value.

If the print head is in the area to be printed and the adapter is told to print right, the print head must be moved left past the start position, stopped, allowed to settle, started in a left-to-right direction, and be at printing speed by the time the first character is to be printed. The reverse sequence occurs when the adapter is told to print left.

The distance the print head must be moved if it is inside the print area and moved left is the difference between the print head position counter value and the start position plus one. This is the positioning value. The head is moved left until the positioning value is zero. At that time, the head is stopped and allowed to settle for 50 ms. After the settle time, the print head stepper motor is started to the right and continues to move until the print head position counter value equals the last position value. The head is stopped, and another 50 ms settle time occurs before the end of the print operation.

When the print head is at the right edge of the left margin, the print head position counter contains a value of hex 00. The counter value is increased as the head moves to the right.

The forms feed stepper motor drives the platen. Line spacing is variable and is controlled by the microcode that sends control signals to the printer adapter card (391). The printer adapter card controls the forms feed stepper motor drive lines for both spacing and direction.

The forms feed stepper motor drives the platen and the forms feed emitter. The forms tractor drive is on the right end of the platen gear. The platen gear drives a forms tractor unit, which is required for printing on continuous forms. The 5103 Printer contains an end of forms switch that is inactive when printing on single forms or ledger cards.

## PRINT TIMINGS

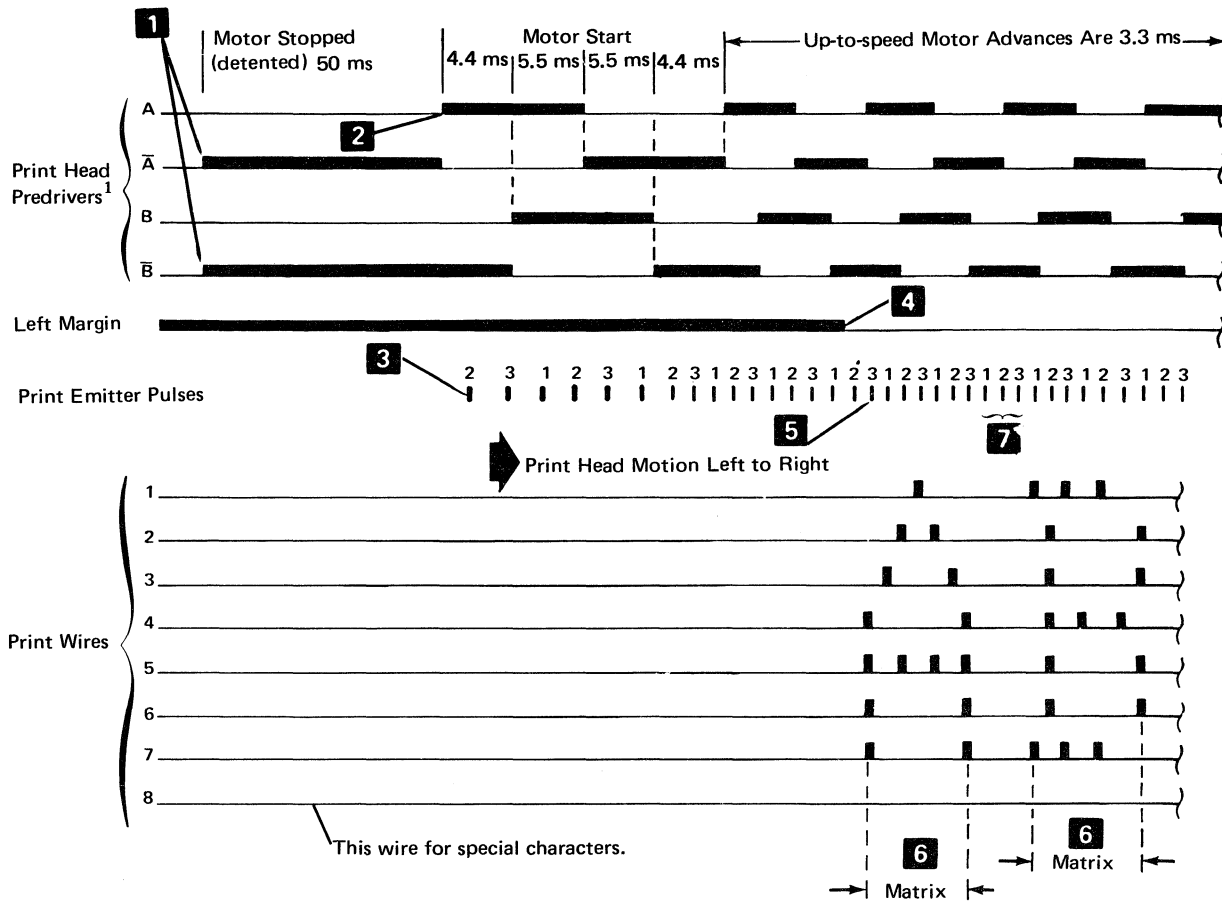
The illustration below represents timing (80 cps) as controlled by the printer adapter. The timing relationship of the print head predriver signals vary from those of the left margin, print emitter, and print wires. The timing relationship between left margin, print emitter pulses and print wire pulses does not vary.

Example: To start print head motion from the left margin, print an A in character position 1, and print a B in character position 2.

- 1** Print head stepper motor drive lines  $\bar{A}$  and  $\bar{B}$  are active for 50 ms settle time; A and B are inactive.
- 2** Print head left-to-right start sequence begins ( $\bar{A}$  becomes inactive, A becomes active).
- 3** Print emitter pulses are generated when the print head stepper motor moves the print emitter pickup. Moving left to right, a count up sequence is generated (1,2,3).

This example shows 'print emitter 2' as the first active pulse; it could be any of the three pulses, depending on where the print emitter pickup is aligned with the print emitter. Print emitter pulses are sent to the adapter to indicate 0.010 inch (0.25 mm) of print head travel along the print line.

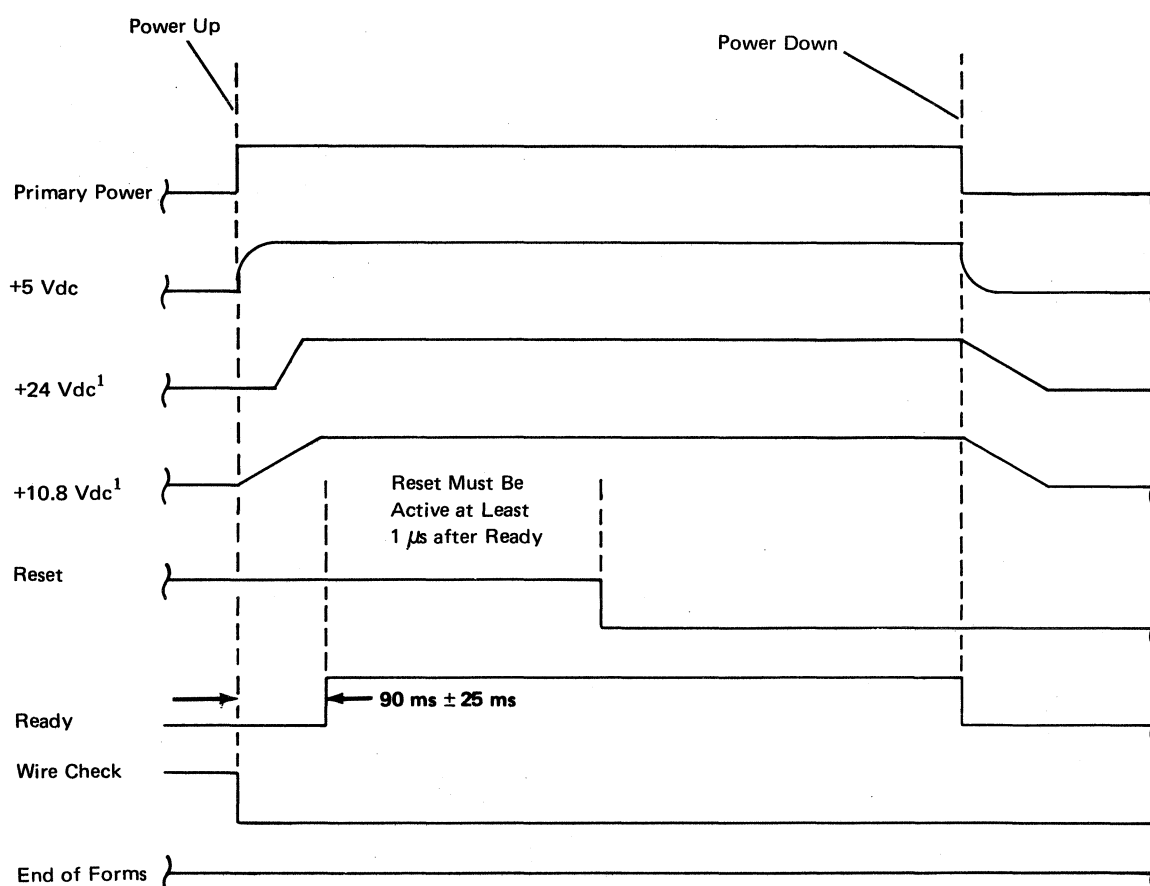
- 4** 'Left margin' goes inactive between the pulses of 'print emitter 3'.
- 5** Printing starts (in character position 1) on the next 'print emitter 3' pulse after 'left margin' goes inactive. The adapter uses the print emitter pulses to synchronize the firing of the print wire magnets.
- 6** The adapter pulses the print wire lines between 375 and 400  $\mu$ s in synchronization with the print emitter pulses to form a character within an 8-high by 7-wide matrix.
- 7** Three print emitter pulses separate a character position.



<sup>1</sup>These lines are shown for reference only. Timing relationship between their active and inactive states to all other signals in this chart will vary. What is important, however, is (1) this chart shows that print head motion is continuous throughout printing, and (2) timing relationship between left margin, print emitter pulses, and print wire magnet pulses does not vary.

## POWER UP AND POWER DOWN SEQUENCE

The timing chart below shows the power up and power down timings. 'Ready' becomes active, if no error condition exists,  $90\text{ ms} \pm 25\text{ ms}$  after 'primary power' and '+5 Vdc' are supplied to the printer. 'Reset' from the adapter must be active at least  $1\text{ }\mu\text{s}$  after 'ready' becomes active for a positive reset of the 'wire check' signal.



<sup>1</sup> These voltages are developed within the printer power supply.

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## Power and Signal Distribution

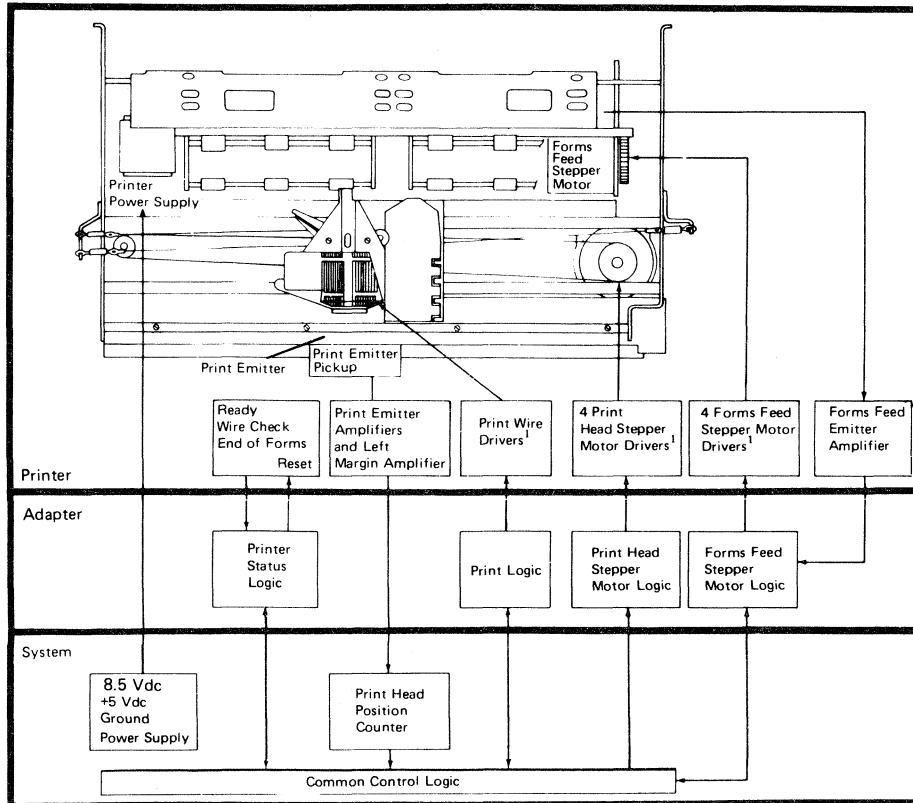
The printer contains one print magnet card and one motor driver card, one voltage regulator and sense amplifier card, print emitter and forms emitter circuits, a power supply that produces 24, 30, and 10.8 Vdc and an end-of-forms switch.

The system supplies the printer with the following:

- 8.5 Vdc, +5 Vdc, and ground
- A signal to reset the 'wire check' latch in the printer
- Signals to fire the print wire magnets
- Signals to move the forms forward and backward or to eject the form

The printer supplies the system with the following:

- A signal that the printer is ready
- A signal that a print magnet driver is on too long ('wire check')
- 'Left margin' and 'print emitters 1, 2, and 3' signals so the system can determine the position of the print head and the direction it is moving
- A signal that determines how far the forms have moved
- A signal that forms are not present



<sup>1</sup> The driver card connects into a printed circuit board at the back of the printer.

## Functional Components

### STEPPER MOTORS

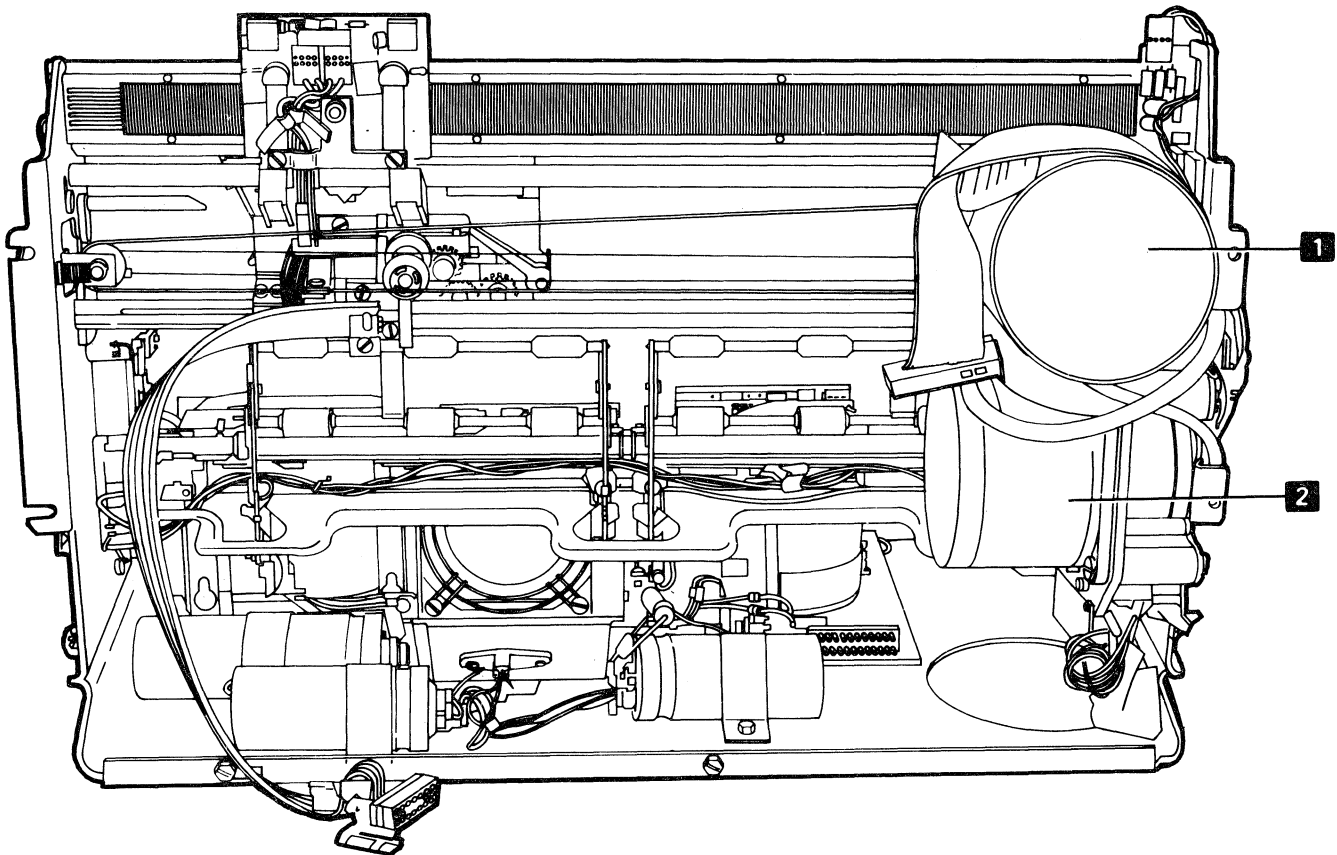
The forms feed motor **2** and the print head motor **1** are sealed, dc stepper motors consisting of a permanent magnet rotor and two pairs of bifilar stator windings.

#### CAUTION

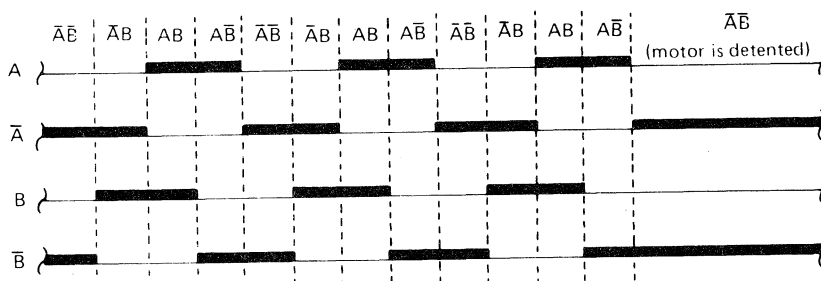
Stepper motors require no maintenance; they should not be opened or disassembled because the magnetic flux of the rotor will be reduced, which reduces the torque.

Each stepper motor is controlled by four direct-current control lines. The direction the motor turns is determined by the sequence of the control pulses; each time the phases are shifted, the motor shaft rotates 2 degrees.

The timing chart shows the sequence of pulses to step the motor counterclockwise and move the forms forward. The combination of the not A line and not B line at the end of the sequence holds the motor detented during settle time in the example below. Note that the motor can be detented in any one of its motor steps.



Pulse  
Sequence for 2°  
Counterclockwise  
Increments



## PRINT HEAD

Illustrated at the right is a side view of the print head and an end view of the wire guide. The print head has eight print wires arranged vertically 1 through 8, from top to bottom. The character image dots are made by the print wires as they strike the ribbon.

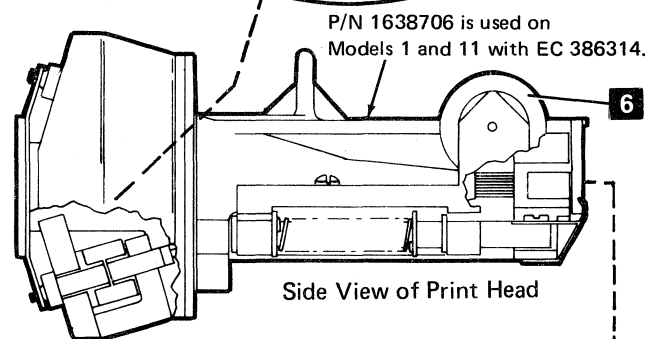
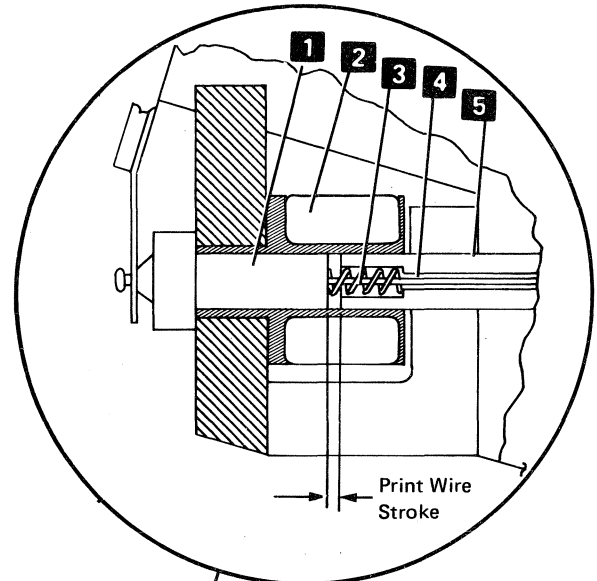
The circled area is a cross-section of a print wire magnet. The print wire **4** is attached to the armature **1**. When the coil **2** is energized by the print wire driver, the armature is driven forward against the print wire guide **5**, driving the print wire against the ribbon. The microprogram pulses the print wire driver to fire the print magnet. When the pulse ends and the coil is de-energized, the return spring **3** restores the armature and print wire. The print wire stroke is the distance the print wire travels to accomplish printing.

The copy control dial **6** on the printer adjusts the distance from the print head to the platen to allow for the thickness of the form. The dial is set to zero for single part forms and adjusted for legibility and reducing ribbon smudging when using multiple-part forms.

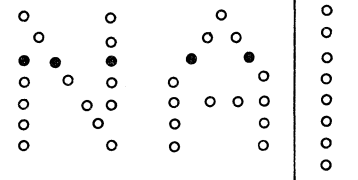
As required by the character pattern, each wire can strike the ribbon up to four times per character (for example, print wire 5 when printing the character A). Note that the character pattern is determined by the bits that are on in the eight ROS bytes (seven bytes determine the character to be printed, and the eighth byte de-energizes all print wire magnets).

Print wire magnets are not fired at successive emitter pulses because time is required to restore the magnet armatures; at least one emitter pulse must intervene between firings of the same wire. No more than 25 dots are used per character.

Three emitter pulses are used for the space between the characters.



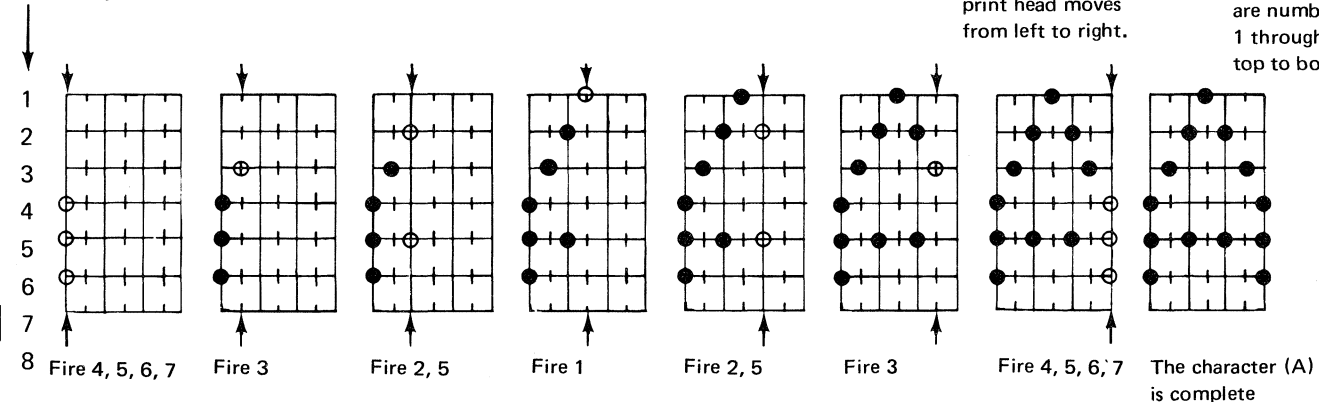
End View of Wire Guide



Solid dots indicate portions of characters printed by print wire 3 as the print head moves from left to right.

Print wires are numbered 1 through 8, top to bottom.

Print Wires



## Print Head Movement

The print head stepper motor is driven by four lines from the adapter: 'print head A', 'not print head A', 'print head B', and 'not print head B'. Refer to 391.

When the head is starting, printing, stopping, or settling, only two of the four drive lines are active at any one time. When the head is stopped for a length of time that is greater than the settling time, none of the four drive lines is active.

Each time the status (phase) of the four lines is changed, 2 degrees of motor rotation results. The length of time that the lines stay in each phase is controlled by the microprogram with a 1.1 ms or 3.3 ms (80 cps) or 1.1 ms or 2.66 ms (120 cps) timer.

At the end of print head movement, two drive lines must remain on during the settle time (50 ms). This ensures that the print head has stopped moving and that correct print head movement occurs when the next printer operation begins. A settle time is also necessary at the beginning of print head movement.

If there is no printer operation pending, the print drive lines are deactivated after the ending settle time of the current printer operation.

### *Start, Move Left to Right, and Stop*

When power is first applied, the print head predrivers  $\overline{A}$  and  $\overline{B}$  are activated by the adapter for 50 ms. This detents the motor for a settle time to ensure that the print head is stopped and will move correctly when the print head stepper motor is advanced.

Other than a power up sequence, the start sequence can begin on any of the four *active* print head predriver conditions ( $AB$ ,  $A\overline{B}$ ,  $\overline{A}B$ ,  $\overline{A}\overline{B}$ ), but the active start condition must be the same as the previous settle time.

To advance the stepper motor clockwise and move the print head left to right, the print head predrivers are sequenced on and off (see the following illustration). Up-to-speed motor advance pulses are sequenced 3.3 ms apart for the 80 cps printer and 2.15 ms apart for the 120 cps printer. At this motor speed, print emitter pulses are spaced about 1.25 ms apart when printing at 80 cps or 0.83 ms apart at 120 cps.

To stop the print head movement, the print head stepper motor must go through a stop sequence, which includes slowing the motor down and detenting it for a settle time.

### *Move Print Head Right to Left*

To advance the print head stepper motor counterclockwise and move the print head right to left, the print head predrivers are sequenced on and off (see the following illustration). The start and stop timings are the same as when moving the print head left to right.

### *Start and Stop Sequence*

The motor is started slowly and slowed down to stop. At the beginning (start sequence) and ending (stop sequence) of print head motion, the print head stepper motor must be detented for a settle time. This ensures that the print head is not moving and will move correctly when it is restarted. The settle time is normally 50 ms.

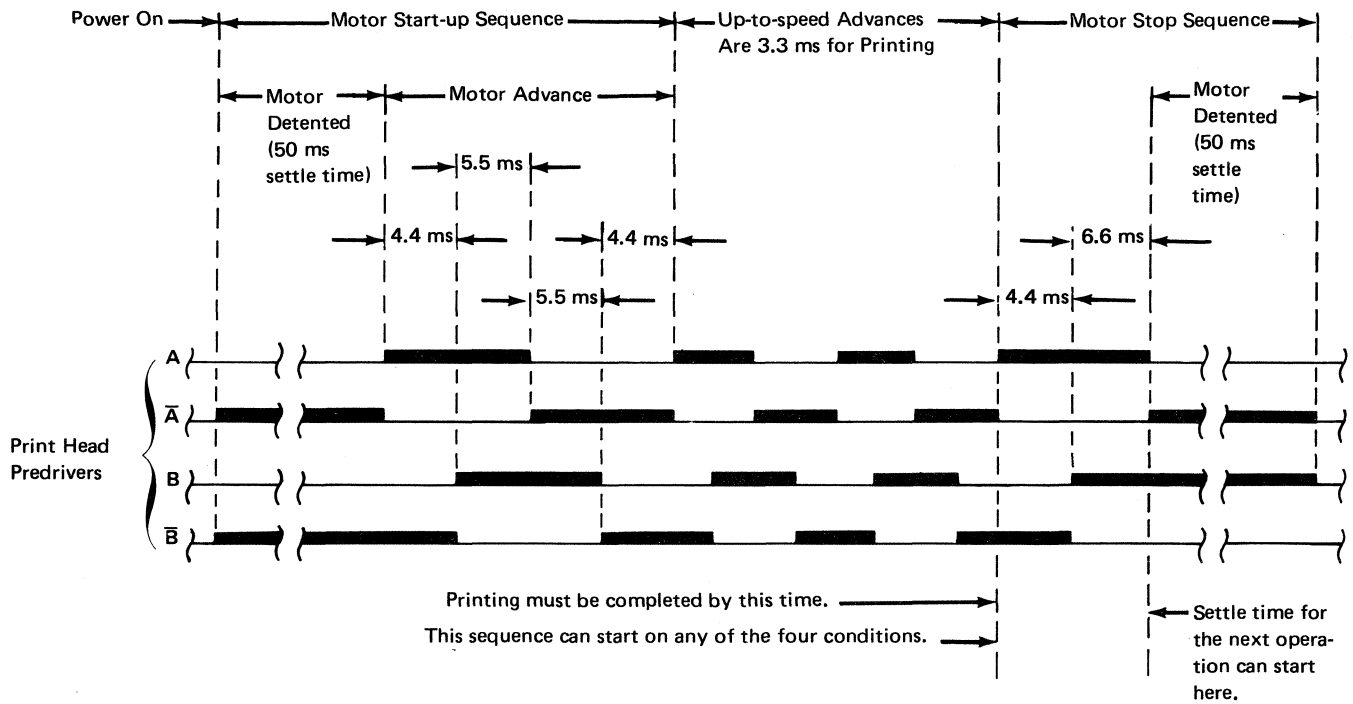
### *Right Margin Stop*

When moving the print head left to right, the adapter must initiate a stop sequence (see the following illustration) immediately after character position 132 to ensure the print head does not contact the mechanical stop in the right margin.

# 80 CPS Print Head Control



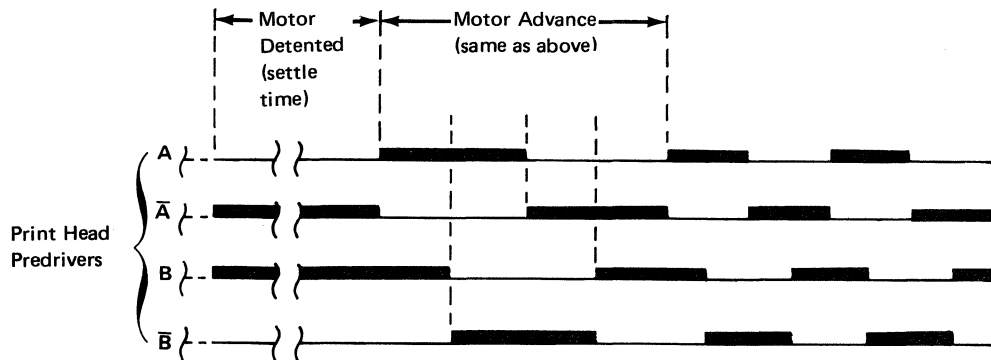
Print Head Moving Left to Right



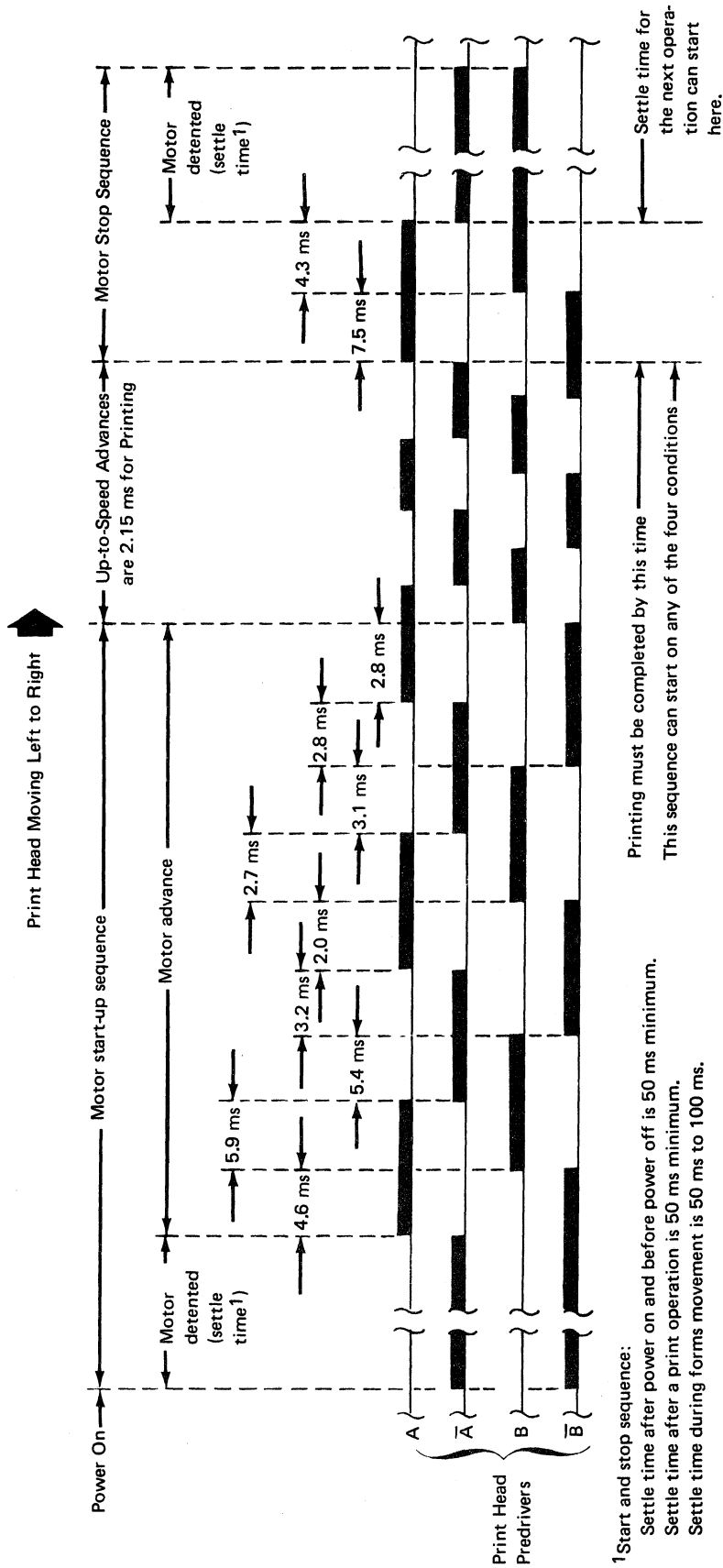
Theory



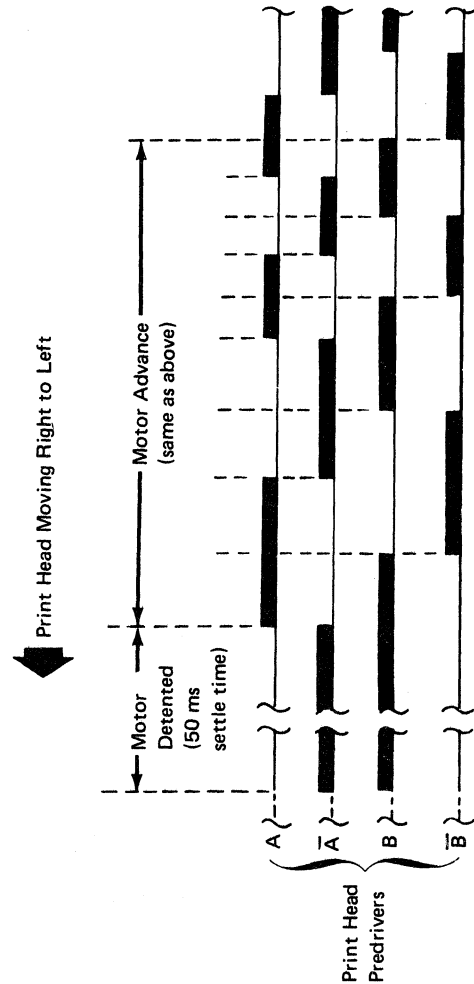
Print Head Moving Right to Left



# 120 CPS Print Head Control



Note: Start and stop timings are the same when moving the print head in either direction.





## Ramping

A ramp operation causes the head to move left into the left margin and stop where the head retract ramp moves the head away from the paper. Ramping the head prevents ribbon ink from bleeding on the paper and makes it easier to insert the paper.

When the head is ramped, it is said to be unloaded, retracted, or in the forms loading/unloading position.

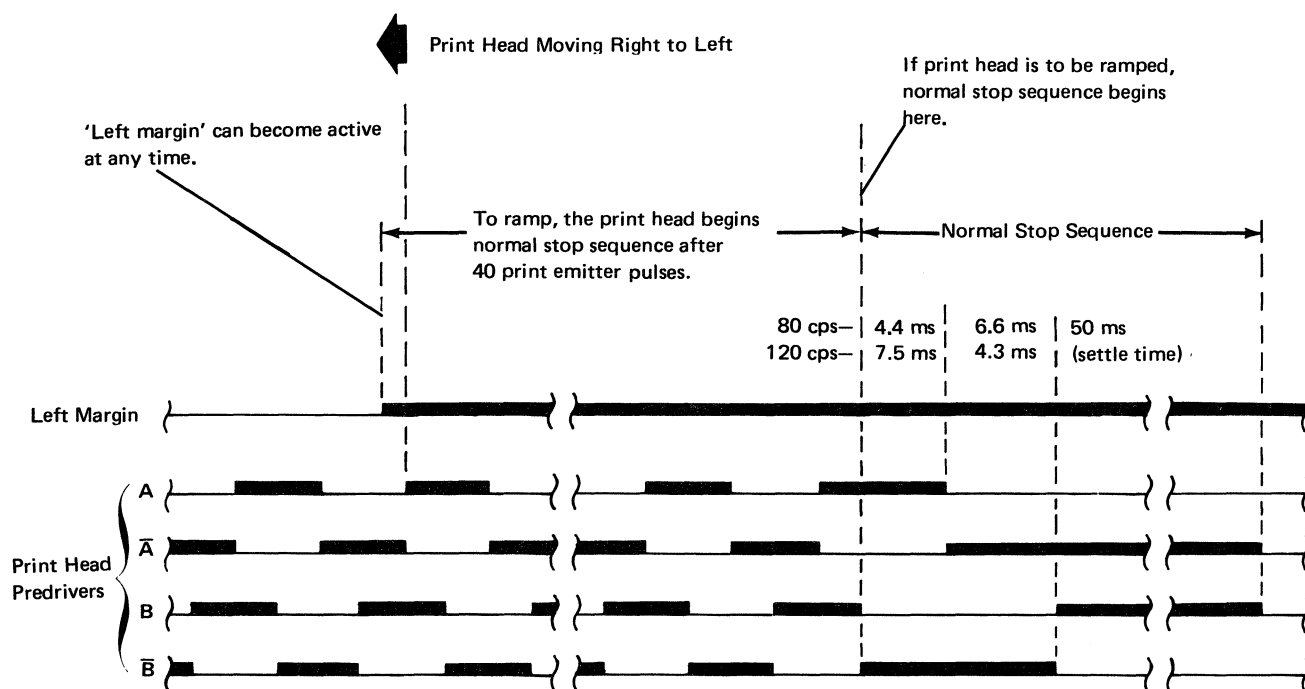
As the head moves left through the right edge of the left margin, the head position counter is forced to hex 00 for recalibration.

If the head is not in the left margin when the ramp operation begins, it is started going left. The head stops 40 print emitters pulses after 'left margin' is detected and is allowed to settle for 50 ms.

If the head is in the left margin when the ramp operation begins, it is started going right until the 'left margin' line becomes inactive. It is then stopped, allowed to settle for 50 ms, and started going left.

Head ramp operations are started by a sense command when the print head is not in the left margin.

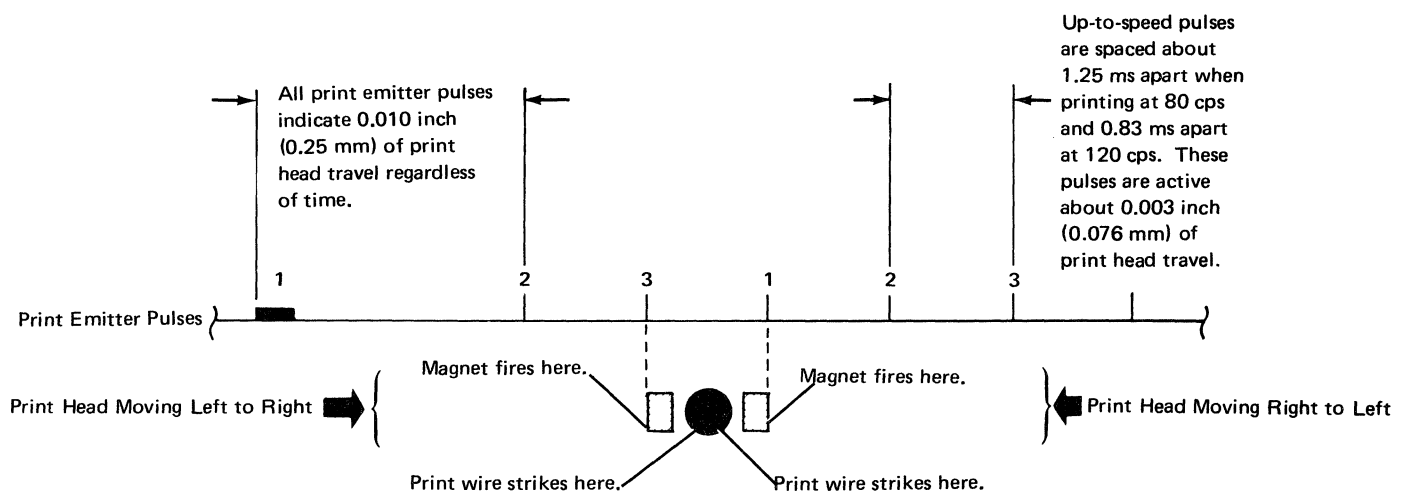
### Ramp Timing



## Print Wire Timing

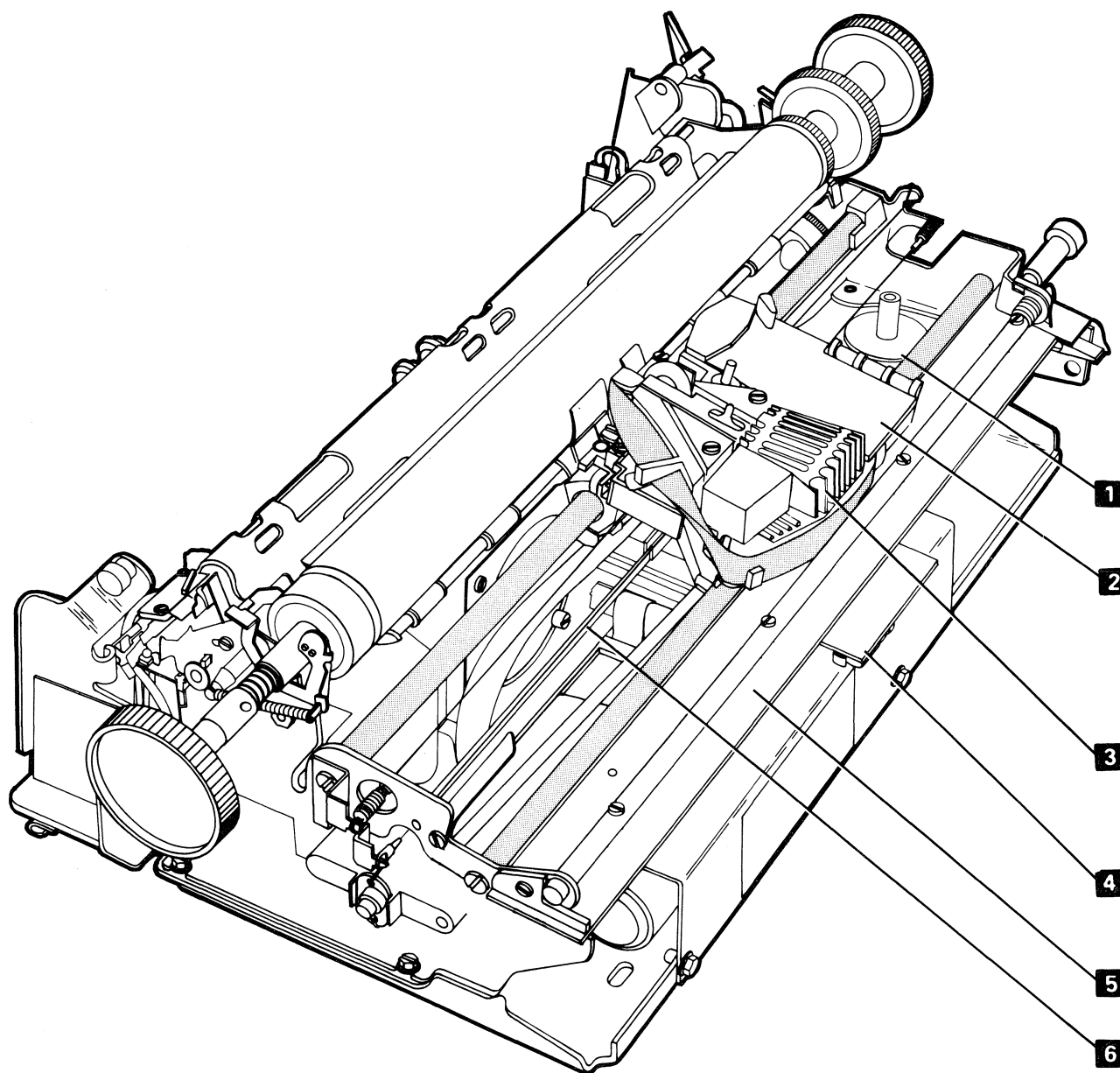
The illustration below shows dots being printed from right to left and from left to right. If the print head is moving to the right, the dots are printed to the right of the position where the print emitter pulse occurs. To print to the left on the next line and align the dots vertically, or to over-print to the left on the same line, it is necessary to use the print emitter pulse that occurs to the right of the position where the original pulse occurred.

### Printing at 80 or 120 Characters per Second



## PRINT HEAD CARRIER

The print head carrier supports and transports the print head **3**, print emitter pickup **4**, and ribbon box **2** horizontally along the print line. The print head carrier is moved by the drive belt **6** coupled to the print head motor **1**. Print head movement slides the print emitter pickup along the print emitter **5** to produce print emitter pulses.



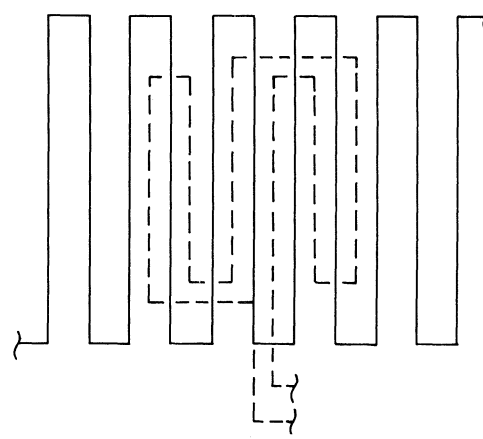
## PRINT EMITTER/PRINT EMITTER PICKUP

The print emitter **3** is a stationary board with a land pattern and a 4.25 MHz oscillator **4**. The land pattern simulates the primary winding of an air core transformer. Refer to 386 for wiring details.

The print emitter pickup **2** is mounted on the bottom of the print carrier **1** and slides along the length of the print emitter. The pickup consists of four separate land patterns and associated amplifier detector trigger circuits. The land patterns of the print emitter pickup simulate the secondary windings of an air core transformer.

Land patterns denoted by **8** and **9** are at right angles to the patterns denoted by **5**, **6**, and **7**. When the print emitter pickup enters the left margin area, land pattern **8** of the print emitter pickup moves directly underneath land pattern **9** of the print emitter. As a result of this alignment, energy is coupled from the primary winding of the print emitter into the secondary winding of the print emitter pickup and causes a level change at the output of the amplifier detector trigger circuit. This level change signals the microprogram that the print head is in the left margin area.

The amplifier detector trigger circuit of patterns **5**, **6**, and **7** is set to trigger at the null position (where minimum energy is coupled from the print emitter winding). The null position occurs at the maximum misalignment of the land patterns of the print emitter and land patterns of the print emitter pickup. When the print emitter pickup is moved left or right, land patterns **5**, **6**, and **7** each produce an output pulse every 0.030 inch (0.76 mm) of print head travel. When the pulses from the three circuits are ORed, a pulse is produced every 0.010 inch (0.25 mm) of print head travel.

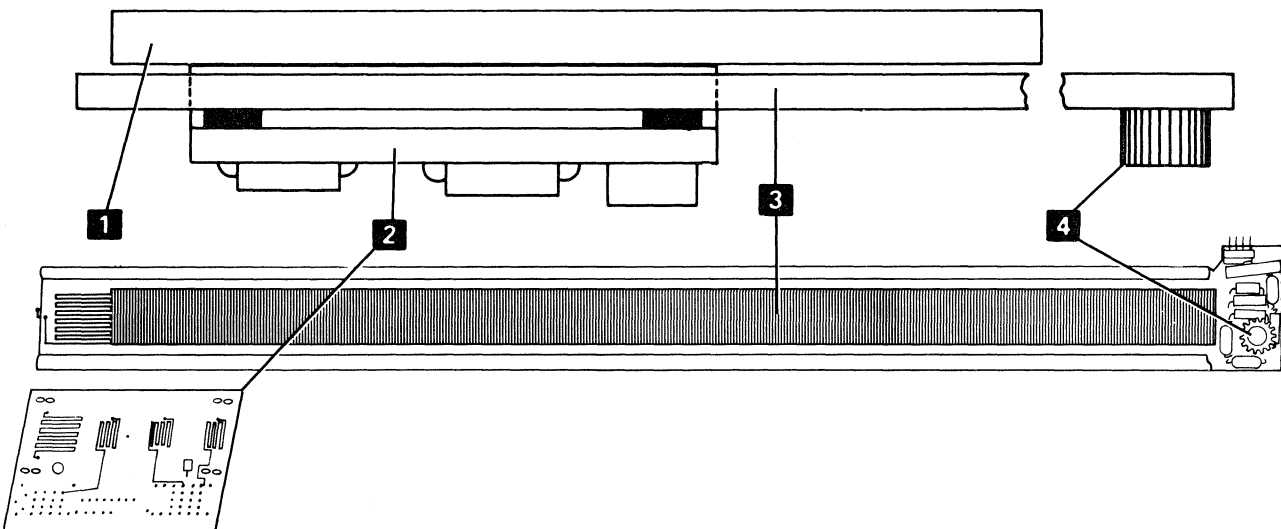


This illustrates the null position of the print emitter land pattern. The land pattern of the print emitter pickup is shown in phantom.

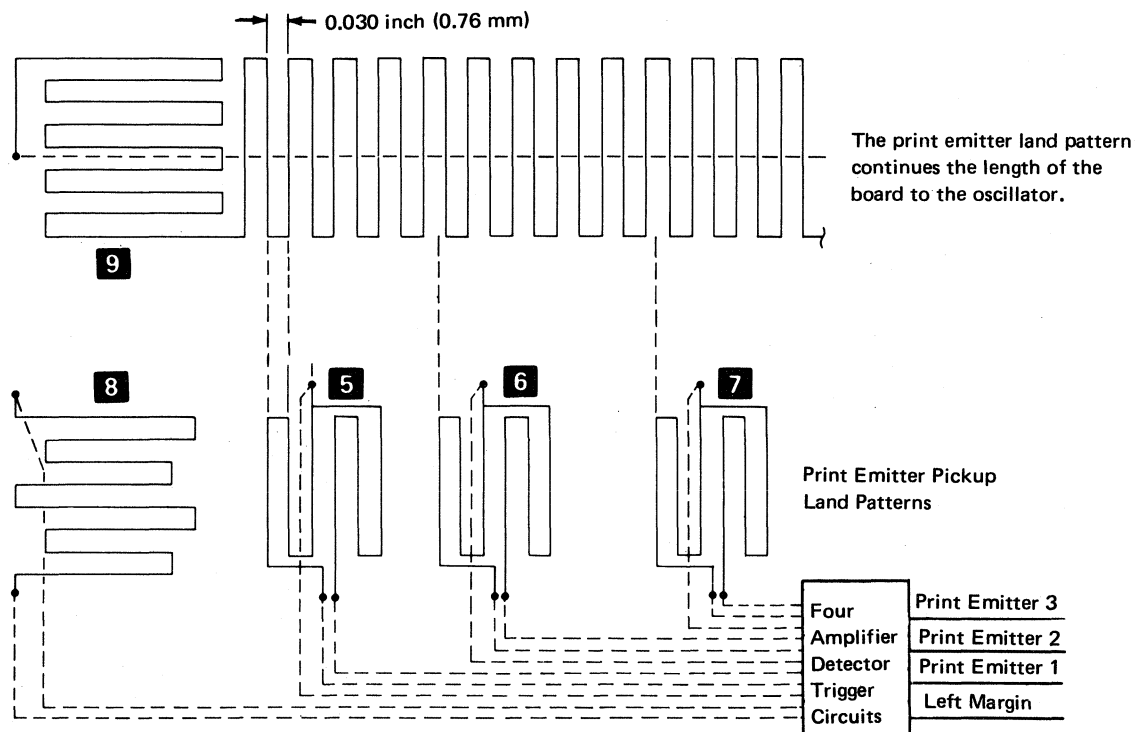
Because character spacing is 10 characters per inch (25.4 mm), there is 0.100 inch (2.54 mm) for each character. With the seven dot positions for each character and three positions between characters, there is 0.010 inch (0.25 mm) between dot positions and an emitter pulse for each position.

Outputs of the amplifier detector trigger circuits are left margin, print emitter 1, print emitter 2, and print emitter 3. The print emitter pickup moving from left to right produces a sequence of emitter pulses—**5**, **6**, and **7**; from right to left produces a sequence of emitter pulses—**7**, **6**, and **5**. The left margin signal and the emitter pulses provide the microprogram with enough information to determine:

- The firing time for the wires
- Where the print head is on the print line
- Which direction the print head is moving



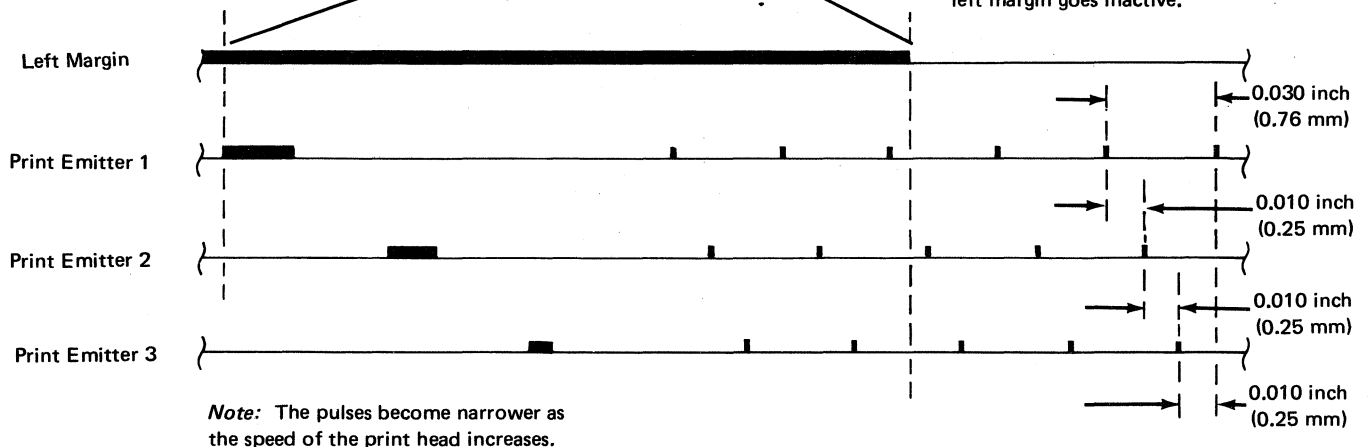
## Print Emitter Pickup in Left Margin



Print Head Moving Left to Right

The number of print emitter 1, 2, and 3 pulses depends on how far the print head is into left margin.

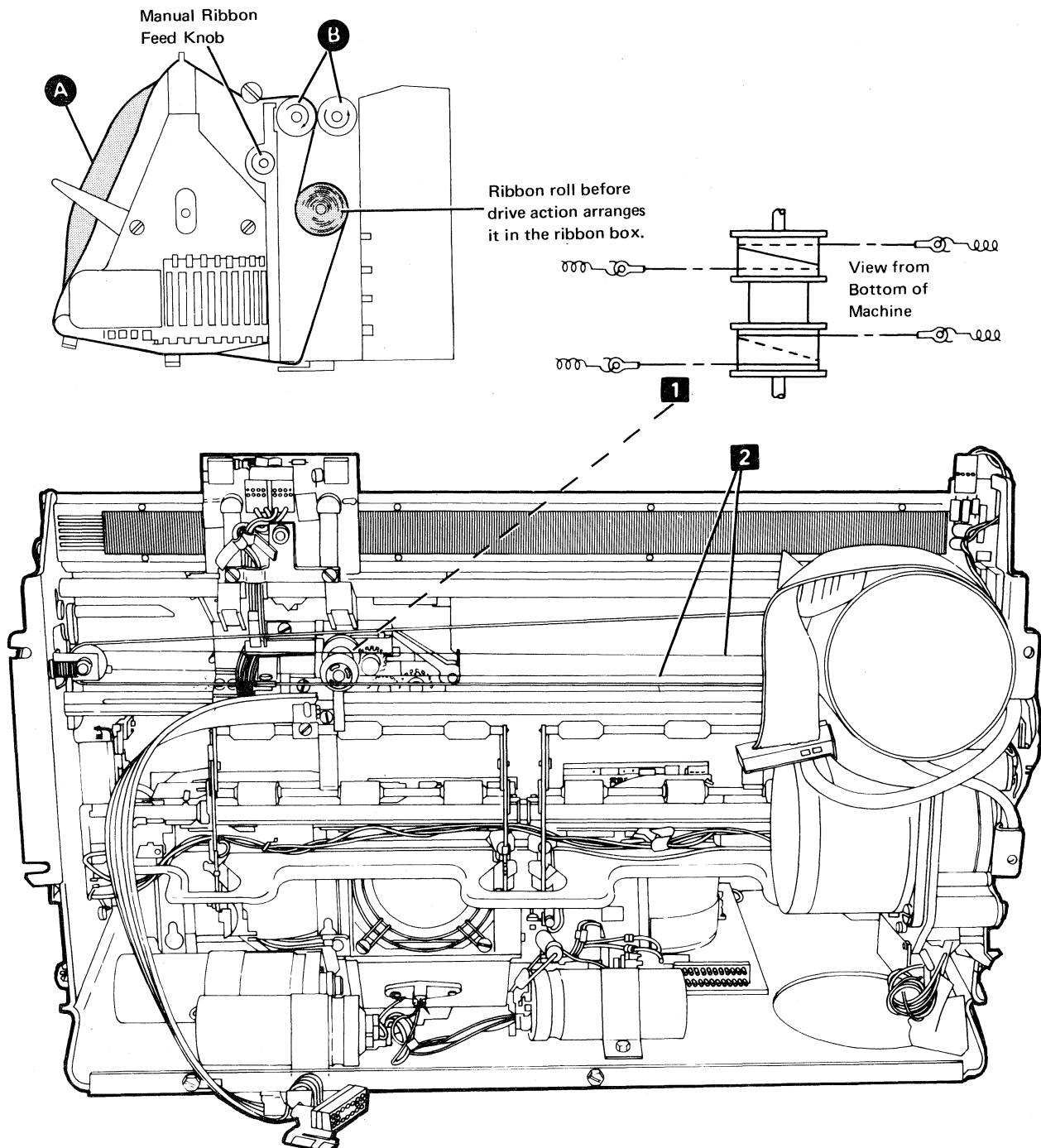
Printing starts (in character position 1) on the next print emitter 3 pulse after left margin goes inactive.



## RIBBON DRIVE

The printer uses a continuous ribbon that can be replaced by the operator. Two ribbon feed rolls **B** pull the ribbon through a slot from one end of the ribbon box, around the print head, past the print wires, and feed it into the other end of the box. A half twist **A** is placed in the ribbon during manufacturing so that, as the ribbon passes the print wires, the top half of the ribbon prints on one pass and the bottom half prints on the next pass.

The print head, ribbon box, and ribbon drive mechanism are mounted on the print head carrier and move left or right under control of the print head stepper motor. The ribbon feed rolls are driven by two monofilament lines **2** through a series of idler gears. The lines are looped around a double clutch **1**, located underneath the print carrier, that drives the ribbon feed rolls. The clutches drive in one direction and free wheel in the other. The lines are looped so they both drive the ribbon in the same direction, providing a clockwise ribbon path whether the print head carrier is moving left or right.

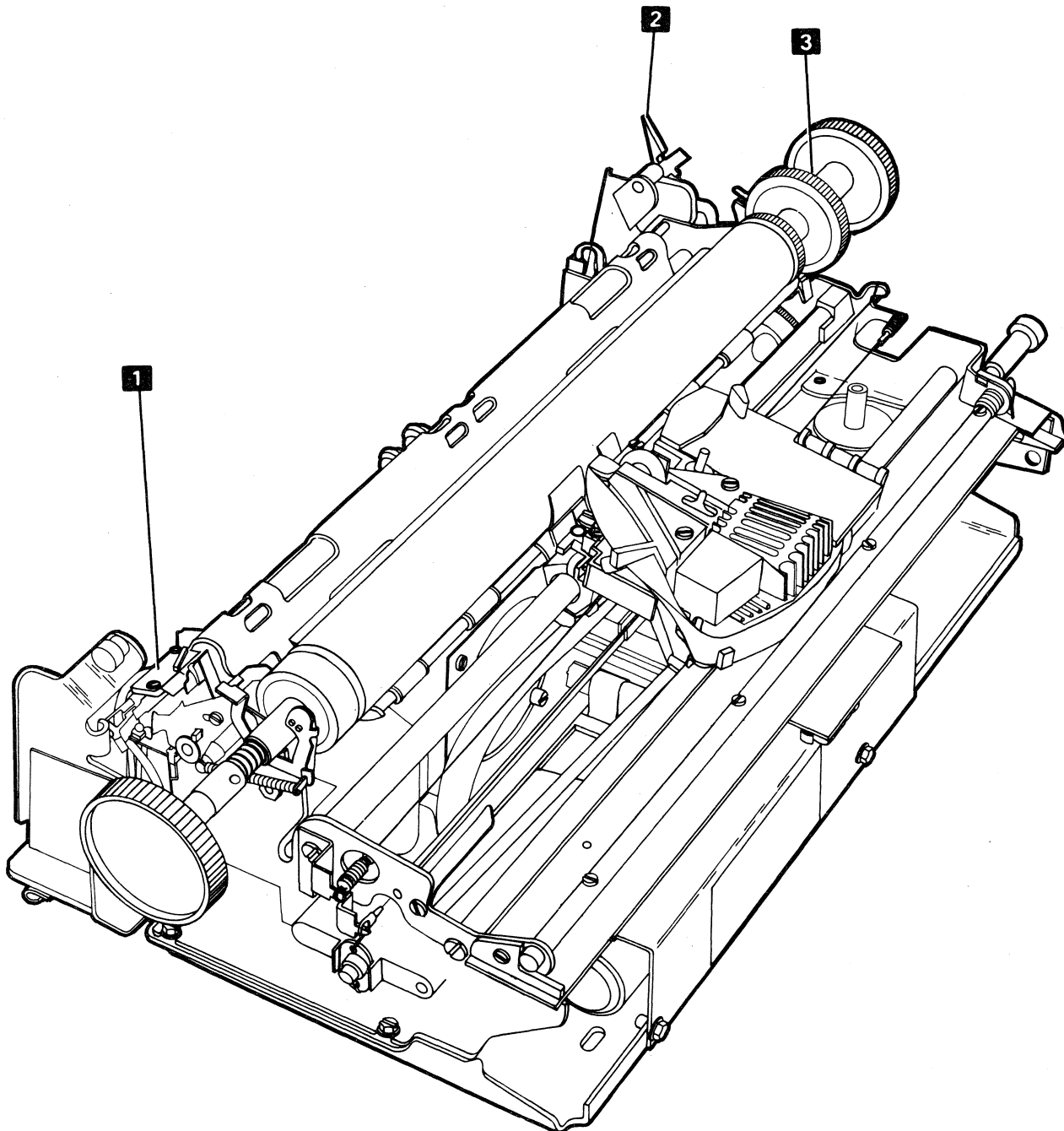




## FORMS FEED

The platen is driven by the forms feed stepper motor. For feeding continuous forms, a forms tractor unit is driven by the forms tractor drive gear **3** located on the right end of the platen.

When the end of the form is 2 inches  $\pm$  1 inch (50.8 mm  $\pm$  25.4 mm) from the line being printed, the end of forms switch **1** activates and signals the adapter. The switch operates only when the paper release lever **2** is in the forward position, and is used when the forms tractor unit is installed.



## Forms Movement

Forms movement is controlled by the microprogram. Forms are moved by the forms stepper motor that is geared to the platen. When the forms are moved, the forms emitter sends pulses to the adapter to update the forms A and B registers to advance the stepper motor. Refer to 391.

At the beginning of forms movement, the microprogram issues a status command to the printer adapter to get the forms emitter status. Based upon this status, the microprogram issues the proper controls to turn on or turn off the correct forms registers in the adapter to start forms movement.

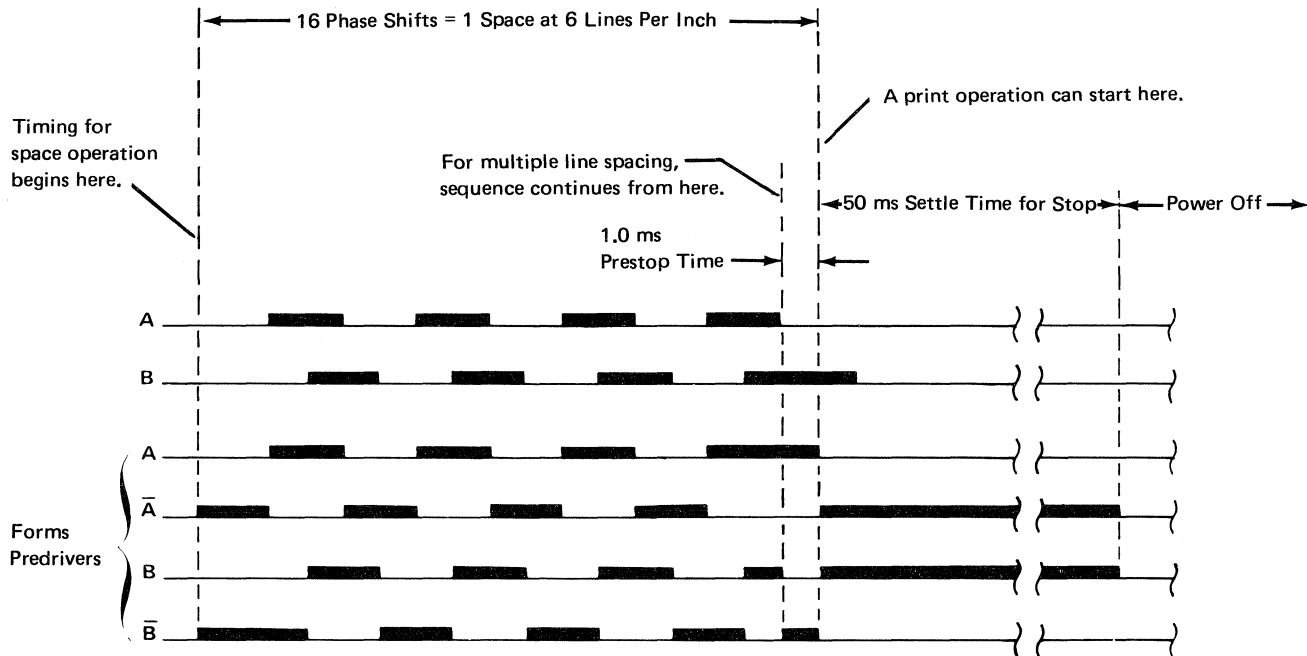
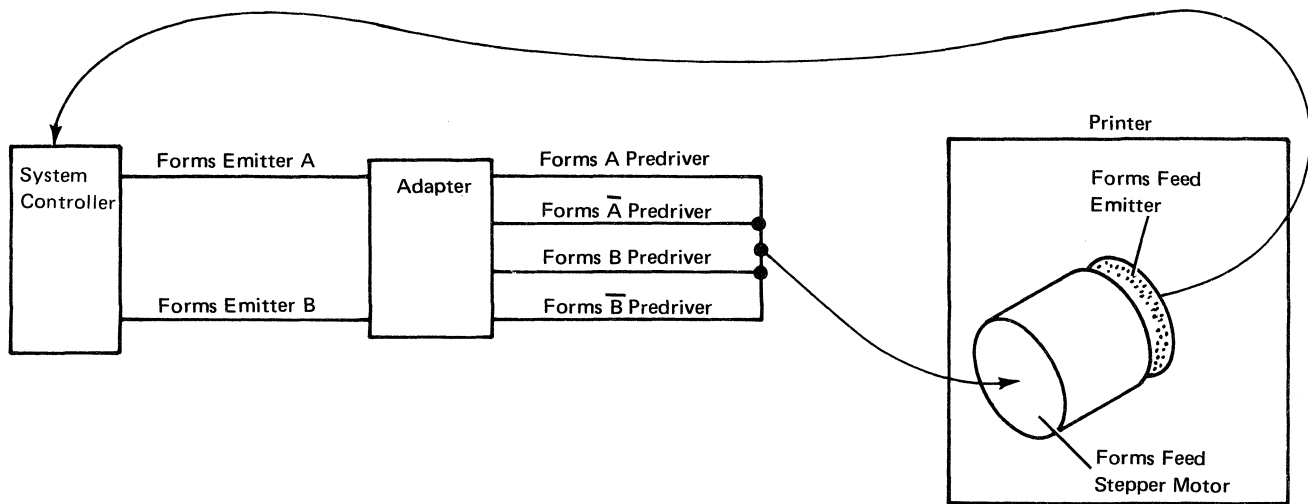
There is one forms latch and two forms registers in the printer adapter card: 'forms A' latch, forms A register, and forms B register. The forms A register develops the 'forms A' and 'not forms A' predriver lines; the forms B register develops the 'forms B' and 'not forms B' predriver lines.

Two predriver lines are always active at the same time except, after the settling time when all four lines are inactive. For example, assume that the forms feed stepper motor is detented with 'not A' and 'not B' predriver lines active. The proper stepping sequence for forward motion is as follows:

- Step 1 — A and not B
- Step 2 — A and B
- Step 3 — not A and B
- Step 4 — not A and not B

This sequence repeats four times per line; a total of 16 steps per line. The microprogram uses the forms emitter status after each step to develop the next step. However, for any of the predriver lines to become active, the 'forms go' latch must be turned on. This is done with a device address of 5 (X1 and Y1 lines), a control strobe, and a control command decode of hex 80 or hex 90 from the microprogram in the system.

To stop forms movement, the motor stepping sequence is reversed for 1 ms under microprogram control. During this time, the display is turned off to enable accurate timing. Following this, 50 ms of settling time is allowed before starting a print operation. The following timing chart shows the timing for one space at six lines per inch and the ending settle time.



Forms Feed Stepper Motor Timing for Forward Motion

## FORMS FEED EMITTER

Below is a conceptual illustration of the forms feed emitter used in the serial printer. An emitter disk **2** is driven by the forms feed stepper motor **4**. The emitter disk has 90 slots, 45 on an outer track, and 45 on an inner track. The slots of the outer track are positioned 2 degrees in advance of the inner track. Each slot is 4 degrees of one emitter disk revolution.

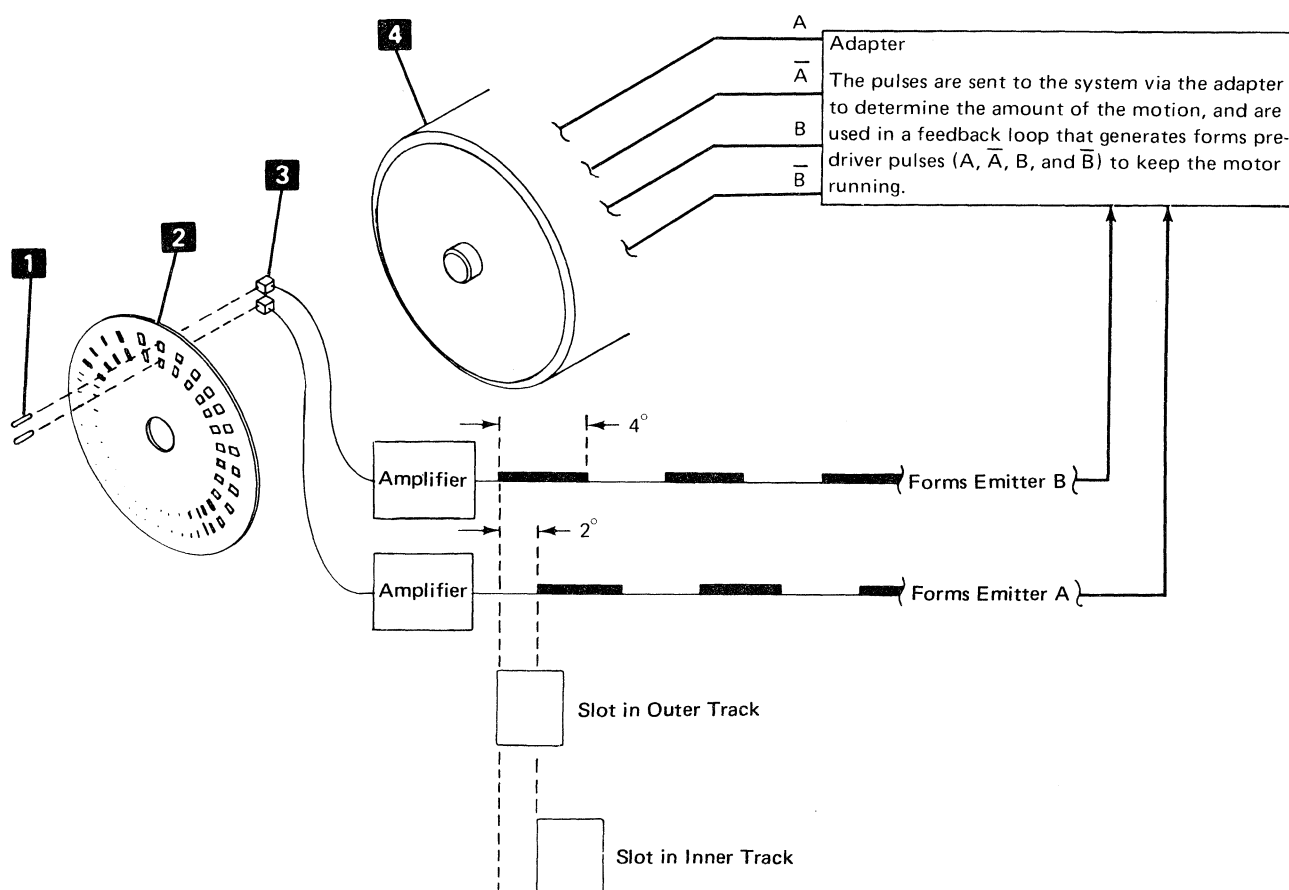
Two LEDs **1** (light emitting diodes) are positioned opposite the two tracks. Two photocells **3** face the diodes on the opposite side of the disk. The disk turns freely between the LEDs and the photocells so that light from the LEDs can be sensed by the photocells. When the disk is rotating and a slot appears in front of the LED, light passes through the slot, the photocell senses it, and current is conducted. The photocells drive two amplifiers. The amplifiers convert the low level current signal from the photocells to a TTL logic level. The signals from the printer to the adapter are forms emitter A and forms emitter B (390).

As the forms feed stepper motor rotates, the forms feed emitter produces one pulse for each 2 degrees of rotation. For every 16 pulses the paper advances 1/6 inch (or one line). These pulses signal the adapter that a line feed is occurring. (The system via the adapter uses these pulses to control forms movement.)

This is a closed loop system:

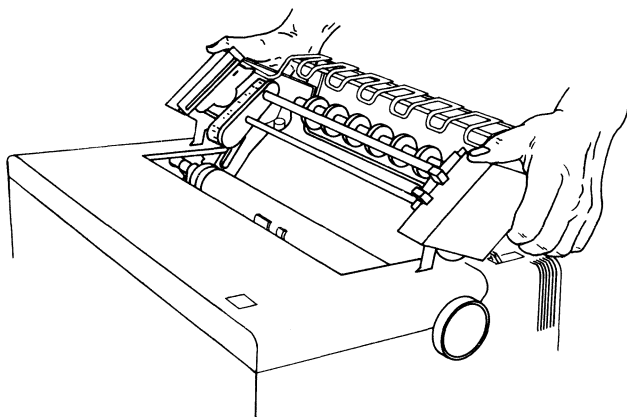
*Forms emitter A* is used by the adapter to control forms predriver A and forms predriver  $\bar{A}$ .

*Forms emitter B* is used by the adapter to control forms predriver B and forms predriver  $\bar{B}$ .

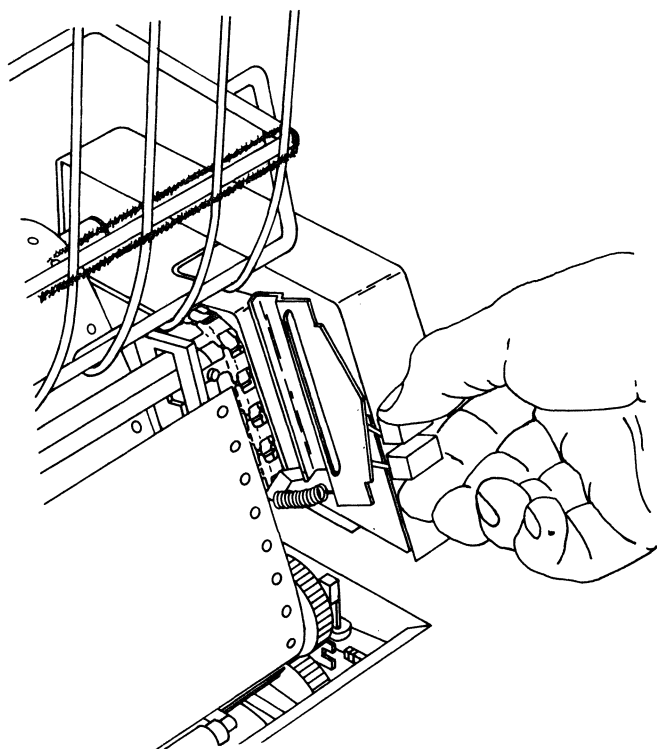


## FORMS TRACTOR UNIT

The forms tractor unit is required for printing on continuous forms. The unit snaps into place on top of the printer frame and can be removed to use cut forms. The right tractor is adjustable to handle forms from 3 inches to 15 inches (76.20 mm to 381.00 mm) wide; the left tractor is adjustable to position the forms.

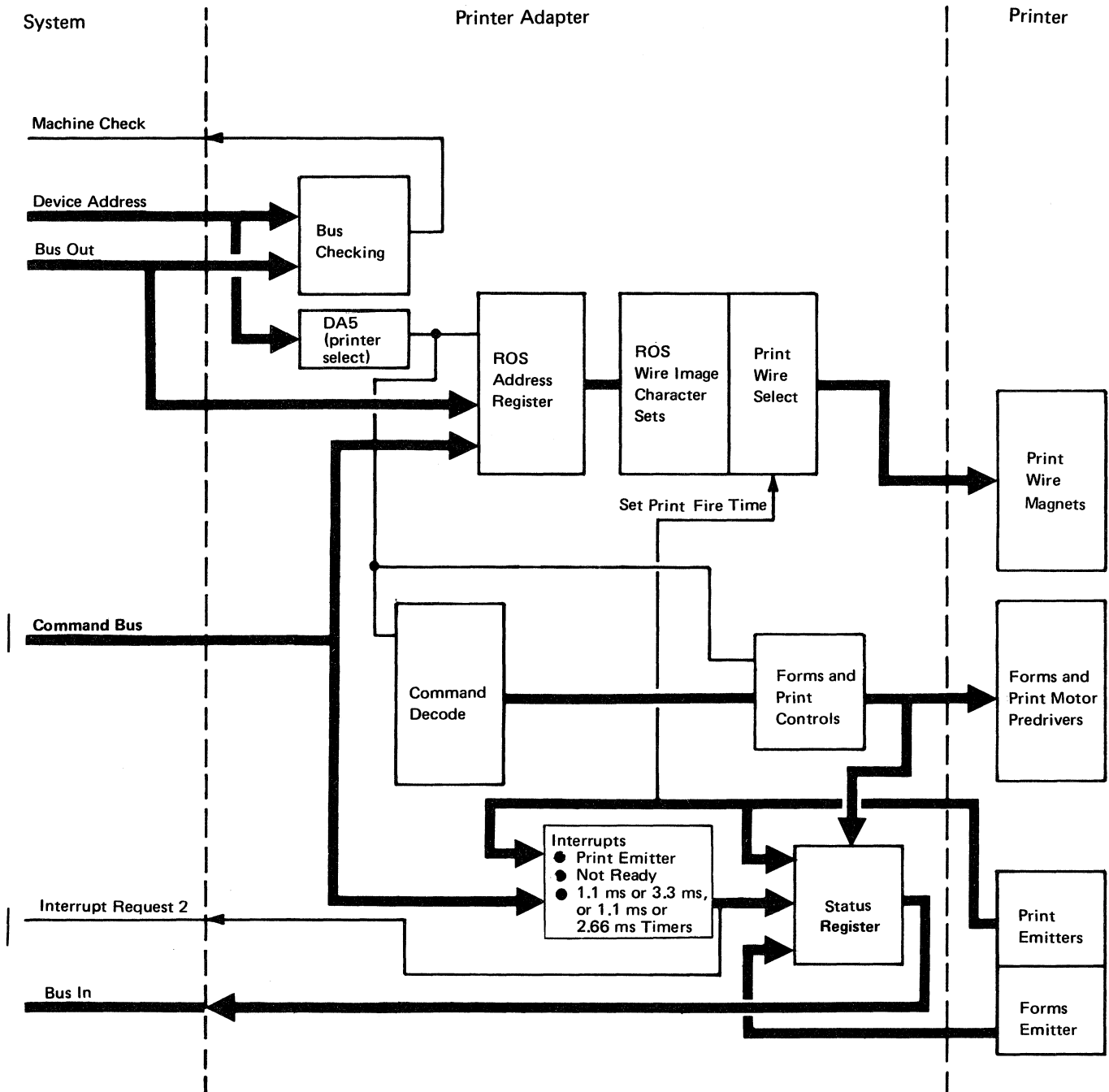


Installing the Forms Tractor Unit



Adjusting the Right Tractor

## Printer Adapter Data Flow





Refer to the *Printer Adapter Data Flow* and *Printer Adapter Card* logic diagrams (390 and 391) in the *Circuits* section when reading the following descriptions.

## BUS CHECKING

The output of the bus checking block is 'machine check'. When active, this line causes a process check. The 'machine check' line is active when the printer is addressed by the microprogram and when either of the following conditions exist:

- An odd number of device address lines are active.
- An even number of bus out lines are active.

## COMMAND DECODE

This block decodes the data on the bus out lines into commands that control printer functions on the adapter card. The command decode output (command bus) reflects its input (bus out bits 0–7) when 'device address 5' (printer select) and 'control strobe' are active. The values shown at the command decode output are actual hex values of the bus out lines during control instruction. For example, to set the 'forms go' latch requires a control 90 command.

Bus out bits 0 and 3, and no other bits active, result in a command decode output of hex 90. Control command functions along with their set and reset hex values are shown in the following chart:

Reset	Set (hex)	Function
10	90	Forms go latch
	93	Not forms motor latch A and B
	97	Forms motor latch A
	9B	Forms motor latch B
	9F	Forms motor latch A and B
11	91	Enable forms interrupt (5110)
12		Reset forms interrupt (5110)
20	A0	Print go latch
21	A1	Enable print emitter interrupts
22		Reset print emitter interrupt
	A3	Not print motor latches A and B
	A7	Print motor latch A
	AB	Print motor latch B
	AF	Print motor latches A and B
	80	Both motors on (both go latches on)
00		Both motors off (both go latches off)
51	D1	Enable timer interrupts
52		Reset timer interrupt
	D4	Enable 3.3 ms or 2.66 ms interrupt
54	D4	Enable print fire (5110)
	54	Enable 1.1 ms interrupt
41	C1	Enable not ready interrupt
42		Reset not ready interrupt
58	D8	Allow ROS addressing
	D8	Preset timer counter (5110)
	EC	ROS address byte 0
	6C	ROS address byte 1
	E4	ROS address byte 2
	64	ROS address byte 3
	E8	ROS address byte 4
	68	ROS address byte 5
	E0	ROS address byte 6
	60	ROS address byte 7

## FORMS AND PRINT CONTROLS

Forms controls consist of the 'forms go' latch (gates the forms motor pulses to the forms stepper motor) and the forms A and B registers (generates the forms stepper motor pulses from control instructions). Four forms predriver lines 'forms A', 'not forms A', 'forms B', and 'not forms B' control forms movement.

Print controls consist of the 'print go' latch and the print A and B registers. Four predriver lines 'print head A', 'not print head A', 'print head B', and 'not print head B' control print head movement.

## PRINT EMITTERS

The print emitters determine print fire time and cause print emitter interrupts.

## ROS ADDRESS REGISTER

This register stores the characters to be printed with one put instruction from the system per character. This character generates an address for each emitter pulse that follows. The address selects the correct wire image from ROS for each part of the character matrix. To print a character requires seven emitter pulses with three additional pulses for spaces between characters or a total of ten emitter pulses.

## ADAPTER ROS

Printer adapter ROS contains the wire images of all characters in the character set.

## PRINT WIRE SELECT

Print wire select gates the lines coming from ROS to the print magnet drivers at each print emitter time (set print fire time). The duration of the pulse to the selected magnets is 375–400 ms.

## STATUS

The printer adapter uses two status bytes (status byte A and status byte B). These status bytes contain the status of the forms and print controls, emitters, and timers. The microprogram selects one status byte at a time and receives the status information on the bus in lines:

Status Byte A (bus out bit 3 equals zero)

0	1	2	3	4	5	6	7	
1								Print emitter latch 3
	1							Print emitter latch 2
		1						Print emitter latch 1
			1					Wire check or not ready
				1				Forms emitter B
					1			Forms emitter A
						1		Not end of forms
							1	Left margin signal or not ready

Status Byte B (bus out bit 3 equals one)

0	1	2	3	4	5	6	7	
1								Print motor latch B (0 = not B)
	1							Print motor latch A (0 = not A)
		1						Print emitter interrupt
			1					Not ready interrupt
				1				Forms motor latch B (0 = not B)
					1			120 cps (0=80 cps)—Forms interrupt—5110)
						1		1.1 ms or 3.3 ms, or 1.1 ms or 2.66 ms timer interrupts—(Timer interrupt—5110)

**Note:** The register selected for loading the status determines which status byte you receive. Even registers give you status byte A and odd registers give you status byte B.

Six signals are produced in the printer and sent to the adapter to indicate printer status:

- Ready
- Wire check
- End of forms
- Print emitter pulses
- Forms emitter pulses
- Left margin

### Ready Signal

This signal becomes active, if no error conditions exist, 90 ms  $\pm$  25 ms after primary power and +5 Vdc are sent from the adapter to the printer. Any of the following error conditions deactivate 'ready':

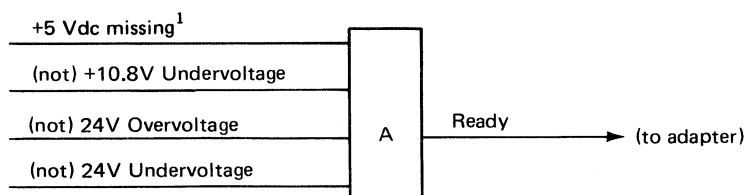
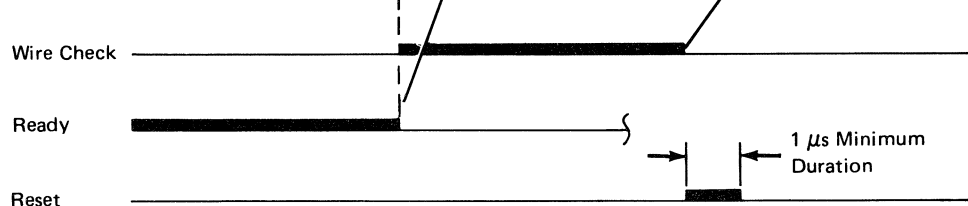
- +5 Vdc missing<sup>1</sup>
- +10.8 Vdc undervoltage
- +24 Vdc overvoltage
- +24 Vdc undervoltage.

The 'ready' signal is inactive when the input ac voltage drops below specifications and before a printer malfunction occurs due to the change of input ac voltage.

'Wire check' becomes active as a result of a print wire magnet on too long.

'Ready' becomes inactive because 'wire check' drops +24 Vdc, causing +24 volt undervoltage. ('Wire on' drops +24 Vdc on machines without EC 579623 or EC 579920.)

'Wire check' resets if all wire drivers are off.



<sup>1</sup> This line is not used on machines without EC 579623 or EC 579920.

### Wire Check Signal

This signal indicates that a print wire magnet was energized for more than 0.61 ms  $\pm$  25% (1.6 ms when printing or 3.0 ms when not printing on machines prior to serial number 20658).

The 'wire on' signal is developed for the duration of a print wire pulse. If the 'wire on' signal is on too long, it sets the 'wire check' latch and turns off the +24 volt regulator. For machines with EC 579623 or EC 579920, if the 'wire on' signal is on too long, it sets the 'wire check' latch. The wire check latch turns off the +24 volt regulator. Loss of the 24 volt regulator causes a +24 volt undervoltage, which deactivates the 'ready' signal.

The 'reset' signal from the system is required to deactivate the 'wire check' signal. The 'reset' signal is active during power up and for a minimum of 1  $\mu$ s after 'ready' becomes active. 'Wire check' can be on and still have 'ready' (only on machines without EC 579623 or EC 579920).

## End of Forms Signal

This signal indicates the presence of forms in the printer. The signal is activated by a normally open switch.<sup>2</sup> The signal is active when forms are present and inactive when the end of forms is about 2 inches  $\pm$  1 inch (50.8 mm  $\pm$  25.4 mm) from the print line.

## Print Emitter Pulses

The adapter must check for three other error conditions:

- Count up, count down errors
- Fast print emitter checks
- Motor hung condition

### Count Up, Count Down Errors

The adapter must stop printer operations if it senses an incorrect sequence of print emitter pulses; such as print emitter pulses in a count up sequence during print head right to left motion, or print emitter pulses in a count down sequence during print head left to right motion.

### Fast Print Emitter Checks

The average time between print emitter pulses is 1.25 ms for 80 cps, during printing. The adapter should stop the printing operation if print emitter pulses are received from the printer at a sequence less than 0.7 ms.

The average time between print emitter pulses for 120 cps is 0.83 ms. Printing should stop if pulses are received at a sequence less than 0.5 ms.

## Motor Hung Condition

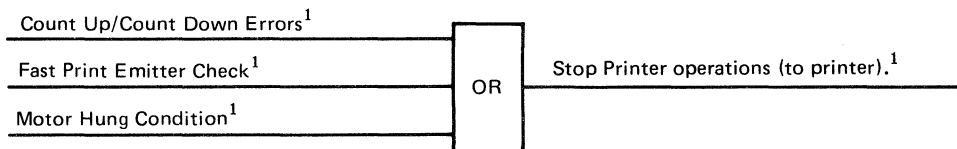
The adapter should stop sending print head stepper motor pulses after not reading print emitter pulses for 125.0 ms. This condition could indicate that the drive belt is broken, a loss of +5 Vdc, oscillator malfunction, a motor bind, or a print emitter pickup malfunction.

## Forms Emitter Pulses

To move the forms, the using system starts the forms feed stepper motor in motion. As the motor turns, the forms feed emitter disk rotates, and forms feed emitter pulses (A and B) are sent to the using system. The pulses are counted by the using system and are used to determine the distance the forms have moved. The pulses are used in a closed loop feedback system to generate the drive signals needed for the forms feed stepper motor to move the forms.

## Left Margin Signal

The left margin signal is used by the using system to determine the position of the print head on the print line. The left margin signal becomes active when the print head is positioned to the left and in the left margin area. The left margin signal must be adjusted to become inactive at a point midway between the two print emitter 3-pulses.



<sup>1</sup> These are not signal lines, but are terms used here to indicate printer error conditions that the adapter can detect by monitoring the print emitter pulses.

<sup>2</sup> On machines without EC 579623 or 579920, the signal is activated by a normally closed switch.

## INTERRUPTS

The printer adapter generates three types of interrupts: print emitter, timer, and not ready.

### Print Emitter

Each print emitter generates an 'interrupt request 2' when print emitter interrupts are activated by the microprogram. This tells the system that the printer is requesting service.

### Forms Emitter (5110 Attachment)

Each forms emitter generates an 'interrupt request 2' when the forms emitter interrupts are activated by the microprogram.

### Timer (5100 Attachment)

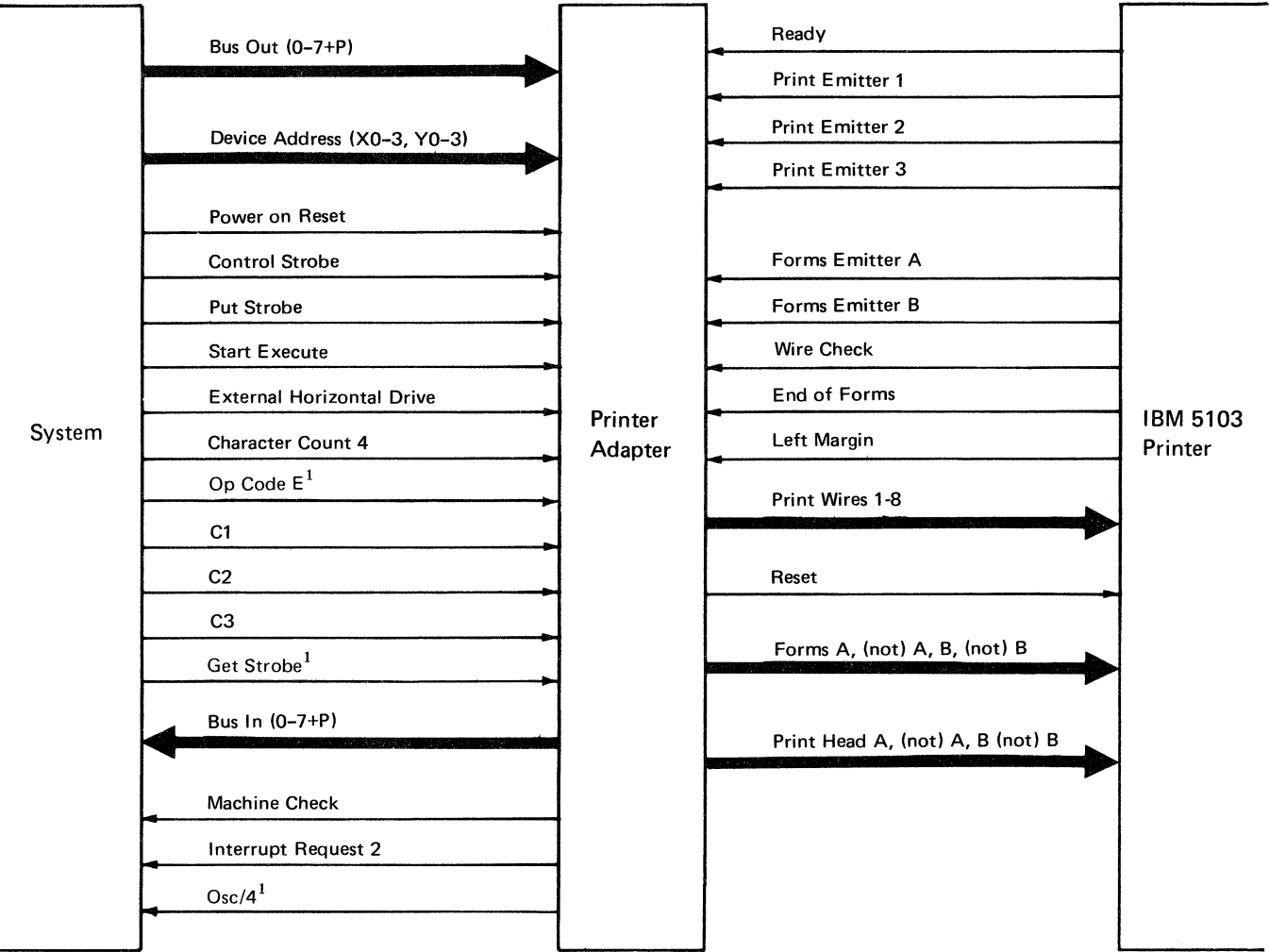
The 1.1 ms or 3.3 ms (80 cps), or 1.1 ms or 2.66 ms (120 cps) timer interrupts control the speed of the print head stepper motor. The timer also times miscellaneous delays in the adapter circuitry. Each timer interrupt generates an 'interrupt request 2'.

### Not Ready

The not ready interrupt is caused by the printer adapter sensing a not ready condition from the printer. A not ready condition results when any of the following occur:

- +24 Vdc is less than +21.6 Vdc
- +24 Vdc is greater than +26.4 Vdc
- 10.8 Vdc is less than +5 Vdc
- +5 Vdc is missing
- Wire on check

ADAPTER I/O LINES



<sup>1</sup>5110 attachment only.

## INPUT LINES

### From the System

**Bus out:** Carries the printer commands and character data (9 bits, 0 through 7 + P).

**Device address bus:** Contains all device addresses (8 bits). The device address of the printer (5) is developed in the adapter by device address lines X1 and Y1 being active.

**Power on reset:** Resets all printer circuits. Turning power on or pressing RESTART activates this signal.

**Control strobe:** Signals the adapter that the data on bus out is a control instruction.

**Put strobe:** Signals the adapter that the data on bus out is a put instruction.

**Start execute:** Signals the adapter to sample bus out and device address bus.

**External horizontal drive:** Generates the timer interrupts (a clock pulse).

**Character count 4:** Selects the print wires and generates the print emitter interrupt (a clock pulse).

**C1, C2, C3:** Gate characters out of ROS (continuously running clock pulses).

**Op code E<sup>1</sup>:** Signals the adapter to gate data or status onto bus in.

**Get strobe<sup>1</sup>:** Signals the adapter that information from its registers on bus in was sampled by the controller.

**Osc/4<sup>1</sup>:** Generates clocking signals for use in setting latches on the adapter card.

### From the IBM 5103 Printer

**Ready:** Signals the adapter that the printer primary voltages are present and within specifications.

**Print emitters 1, 2, and 3:** Monitor printer error conditions and time print wire firing.

**Forms emitters A and B:** Determine when to stop forms movement.

**Wire check:** Signals the adapter that a print wire magnet was energized for more than 1.6 ms when printing or 3.0 ms when not printing.

**End of forms:** Indicates the presence or absence of forms. The signal is active with forms present and inactive when forms are within 2 inches (50.8 mm) of the print line. Note, the inactive level of the line indicates the end of forms condition.

**Left margin:** Used as a reference for positioning the print head.

## OUTPUT LINES

### To the System

**Bus in:** Carries printer status to the microprogram (9 bits, 0 through 7 + P).

**Machine check:** Signals the microprogram that parity checks occurred on bus out, bus in, or the device address bus. The active level of the line turns on the PROCESS CHECK light on the system and stops the print operation.

**Interrupt request 2:** Signal the microprogram that the printer needs service.

### To the IBM 5103 Printer

**Print wires 1–8:** Control the print wires in the print head.

**Reset:** Deactivates the printer error checks. This signal is active during power up and for a minimum of 1 ms after 'ready' becomes active.

**Forms A,  $\bar{A}$ , B, and  $\bar{B}$ :** Provide controls for the forms feed stepper motor.

**Print head A,  $\bar{A}$ , B, and  $\bar{B}$ :** Provide controls for the print head stepper motor.

<sup>1</sup> 5110 attachment only.



## Commands

The system uses four microprogram commands to control all printer operations and communicate printer status to the microprogram. These commands are:

Sense<sup>1</sup>  
Ramp  
Write  
Diagnostic write<sup>1</sup>

### SENSE

When the microprogram issues the sense command, it is requesting printer status. The system sends data on bus out, which the adapter decodes into control commands (refer to *Command Decode*). These control commands poll or monitor specific printer functions and return the status of the following:

- Device check: Checks for presence and readiness of the printer.
- Maximum line length: Checks for 132 characters.
- Left margin: Checks that the print head is located in the left margin, and if it is not in the left margin, the print head is ramped.

### RAMP

The ramp command moves the print head to the left margin, up the ramp, and away from the paper. If the print head is already in the left margin, the head moves six characters to the right, then left to the ramp position.

### WRITE

The write command controls all print and forms movement operations. This command analyzes and edits the blanks within the print line.

### DIAGNOSTIC WRITE

The diagnostic write command moves the print head to print blanks and does not edit left or right blanks; this moves the head without printing.

### PRINT PLOT

The IBM 5103 Printer may be used for plotting when it is controlled by the print/plot program. The necessary microcode for print/plot operations is loaded (from a tape or diskette) into the controlling system, either an IBM 5100 or an IBM 5110. When the IBM 5103 Printer is controlled by the print/plot microcode, the paper motion may alternate between the forward and reverse directions. The paper may also be moved in increments as small as 26 mm (0.010 in.). This increment is equal to one forms stepper motor step. Use of the print/plot program also allows either a single print dot pattern or a full character pattern to be printed.

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<sup>1</sup>5100 attachment only.

## Error Codes

Error Code	Meaning
13	No printer on system, or device address not recognized
47 <sup>1</sup>	Print position error
48 <sup>1</sup>	Sense error
49 <sup>1</sup>	Two or more underscore instructions
50	End of forms
51	Printer is not ready
52	Forms step time-out error
53	Program error-line length too large
54	Wire check
55	Undefined interrupt occurred
56	Incorrect print emitter sequence
57	Lack of print emitter pulses while stepping print head motor
58	Timer interrupt time-out
59	Overspeed (minimum time between emitters was exceeded)

For additional descriptions of the error codes, see *Error Codes* in the *Diagnostic Aids* section of the *IBM 5100 Maintenance Information Manual*, SY31-0405, or *IBM 5110 Maintenance Information Manual*, SY31-0550.

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<sup>1</sup> 5110 attachment only.

## PRINTER SERVICE TIPS

### Reset Signal Line Checkout

A reset signal line that is not functioning properly will not always cause printer failures. Consequently, there is no particular symptom associated with this problem. If you suspect that the 'reset' signal line is not functioning properly, use the following procedure to check out the 'reset' signal in the printer:

1. Power down the 5110.
2. Do not power down the printer.
3. Probe B1-B4, B12 (-Reset).
4. Power up the 5110.
5. Check that the probe DOWN light is on.
6. Press the HOLD key. Press the CMD key and the ← key to copy the display.
7. Check that the probe UP light is on.
8. Power down the printer.
9. Check that the probe DOWN light is on.

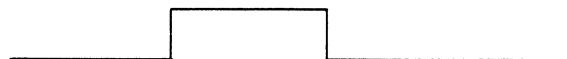
### Print Emitter Timing Using MDI 805

If you are doing left margin adjustments, run MDI 805. This MDI checks the timing of the left margin. You can also loop on step to check for intermittent errors. If you do the print emitter pickup adjustment 340, do the left margin adjustment 343 and run MDI 800 to verify the adjustments.

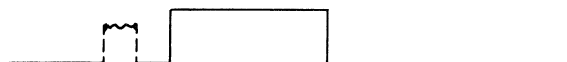
### Forms Emitter Timing Scope Procedure (5103 Models 1 or 2)

1. Remove the forms tractor unit and the paper.
2. Move the copy control dial to eliminate printing on the platen.
3. Load printer diagnostics MDI 800, Step 103.
4. Place the scope lead on U07 on the printer adapter card (forms Emitter A). Display one pulse on the screen.

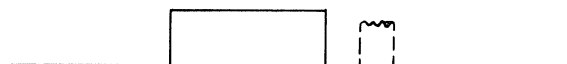
Good: adjust until display looks like this:



Bad:



Bad:



### Forms Emitter Timing (5103 Models 11 or 12)

Use the MDI 800 diagnostic to check the forms emitter timing. The MDI 800 checks the forward and reverse emitter pulses and displays up and down arrows. The MDI 800 directs you to adjust the emitter until the number of up arrows and down arrows are equal.

## Forms Jams

The following items can cause forms jams and incorrect forms movement:

- There is incorrect pressure plate clearance on the forms tractor.
- The paper deflector is too close to the platen.
- The cut form guide on the left rear top cover is not flipped back or it is used with continuous forms.
- The correct paper path can prevent many form jams. See the *BASIC* or *APL Reference Manuals* for correct forms feed paths.
- Forms are being used that are thicker than specified. The maximum forms thickness allowed is 0.018 inch (4.572 mm). See the *Form Design Reference Guide*, GA24-3488.
- The ribbon shield might be too close to the platen.
- The forms tractor unit is not parallel with the platen and is not fully seated at all four mounting points.
- All the pressure rolls do not contact the platen evenly.
- Pins on the forms tractors may be bent or out of alignment.
- The top cover may be too close to the platen (on printers with the on/off switch on the front of the machine only). Remove the window cover and measure the width of the clear plastic window. If the window width exceeds 7.62 cm (3 in.), order 5103 ECA 11.

## Ribbon Jams

Check the following items if you are experiencing frequent ribbon jams:

- The ribbon shield is not adjusted properly.
- There is important tracking of the ribbon through the ribbon feed rolls. The ribbon should not be above the rollers more than 0.010 to 0.015 inch (0.254 to 0.381 mm). If the ribbon is above the rollers, one of the following could be the cause:
  - The rollers are not adjusted properly. Check that the rollers are the same height and are not cocked.
  - The print head cover is hitting the print cable near the oil reservoir. This can cause the left side of the head cover to rise and lift the ribbon off the print head. If this condition is present, cut a small portion from the head cover where it hits the head cable.
  - The ribbon box may be positioned too low. Loosen the two screws holding the ribbon box to the carrier (one on the left side and one in the bottom of the box), raise or lower the box for proper ribbon tracking through the ribbon rollers. Retighten the screws.
- The ribbon drive rolls are sticking. Remove and clean the rollers.
- There are metal spacers in the ribbon roller assembly between the rubber rolls and the plastic housing. Replace the rollers if either spacer is missing (one at the top of the rollers and one at the bottom).
- The print wires are protruding beyond the face of the print head by more than 0.002 inch (0.0508 mm).
- The copy control dial is improperly set. The dial should be set for good print quality on the last copy and no smudging on the first copy. The numbers on the copy control dial do not correspond to the number of parts in the form.

## PRINTER SYMPTOM INDEX

Symptom	Isolation Aid	Fix
Process checks with the 5103 Printer or 5106 Auxiliary Tape Unit attached to the 5110.	Check the solder connections on the I/O interface connectors.	Resolder the connections or replace the cable.
Wavy print or 057 errors (vertical print alignment).	The print head might be touching the foam on the inside of the cover.	Check that the emitter board and pickup are adjusted properly. Remove a small portion of the foam if necessary. If the print head is moved manually, the characters will not line up with the characters printed before the interruption.
051, 054, and 058 errors.	Check the forms guide rack for proper grounding.	Ground the forms guide rack. Be sure the screw fastening the ground strap to the forms guide is making good contact.
056 and 057 errors when running MDI 800.	None.	Replace the print emitter pickup card.
Forms gear binds on the top cover.	Check the bottom of the printer for two orange shipping bolts.	Remove the orange shipping bolts using the 5103 unpacking instructions.
050 to 059.	Check the screws on capacitors C1 and C2 to make sure they are tight.	Tighten all screws on these capacitors.
051 errors when attempting to print.	Capacitors C1, C2, and C4 measure OK with no power applied.	Replace the C1 capacitor. C1 breaks down under power.
056 and 057 errors.	Carrier drive belt dirty. Check for missing +24 Vdc and +10.5 Vdc. Check for print wires protruding through the print head. When running MDI 800. Check print head and carrier assembly. Make sure the carrier is mounted solidly to the guide bars. Also check the eccentric to be sure it is positioned properly.	Clean or replace the belt. Replace transistor Q1 in the 5103 Printer power supply. Replace the ribbon. Replace the print emitter pickup card. Tighten the eccentric and/or print head.
051 errors.	Scope the +24 Vdc (TP-V1). The ripple should be between 20 millivolts and 500 millivolts.	If the ripple is greater than 500 millivolts, replace capacitor C3.

Symptom	Isolation Aid	Fix
Intermittent 051 through 059 errors and other intermittent problems.	Check all grounds on the 5103 Printer and on the 5110.	<p>Check the AC power source for proper grounding.</p> <p>Check that the forms tractor unit is mounted securely on the printer.</p> <p>Check the frame ground to forms guide.</p> <p>Check the ground strap connections.</p> <p>Check the I/O interface cable grounds.</p> <p>Check for noise being generated by other equipment on the AC power line.</p>
Wavy printing or left margin varies by one position.	None.	Place printer on a solid surface.
Fails to print in the first few positions in each line.	None.	Reposition the paper deflector on the left side.
All print wires fire at the left margin or the motor hangs up at the left margin.	Check the print emitter pickup for excessive solder that might be shorting out the print emitter board.	Replace the print emitter pickup.
End of forms and forms motion problems.	Check the screws in the 5110 power supply. Loose mounting screws can cause noise to be generated throughout the system.	Tighten the power supply mounting screws.
Forms feed fails to index.	Check for binds and other mechanical problems.	<p>Repair binds in the platen gears, idler gears, forms motor/emitter assembly, or the forms tractor unit.</p> <p>Replace the broken idler gear stud on the forms motor/emitter assembly.</p> <p>Adjust or replace the forms emitter assembly.</p> <p>Replace the forms feed emitter amplifier.</p> <p>Adjust or replace the end of forms switch.</p> <p>Replace the motor driver card (A1B1).</p>
Forms run backward.	None.	Adjust the forms emitter.

Symptom	Isolation Aid	Fix
Fails to print.	Do a copy display.	Replace the printer adapter card.
Fails to print or head fails to move.	None.	Adjust or replace the end of forms switch. Adjust or replace the print emitter pickup. Adjust the copy control dial. Adjust the print head to platen clearance. Check for shorts between the print emitter and print emitter pickup.
Print plot fails to print.	Printer diagnostics should run OK.	Replace the J2 card in the 5110.
Extra line spaces.	Check for excessive play in gear train. This causes incorrect partial lines.	Adjust or repair excessive gear play. Adjust or replace the forms emitter.
Variable line spacing (forms creep).	Excessive play in the gears. The forms emitter is not adjusted properly.	Adjust the gear wink. Adjust the forms emitter. The forms tractor unit is not mounted securely.
Print line skewed or crooked.	The forms tractor unit must be parallel with the platen and seated at all four mounted points.	Remove the right side cover and loosen the two shaft screws 1/8 to 1/4 turn to allow the forms tractor to seat properly. Check for cover interference.
Uneven left margin.	None.	Adjust the left margin. Check the adjustments of the print emitter and the print emitter pickup.
Missing part of the character in print position 1.	None.	Adjust the left margin. Check the adjustments of the print emitter and the print emitter pickup.



Symptom	Isolation Aid	Fix
Overprinting.	Overprinting occurs if a print emitter error is detected while a line is being printed. If the data is correct, check for a defective or a misadjusted print emitter or print emitter pickup.	Adjust or replace the print emitter or the print emitter pickup.
Backward printing (mirror image).	Check the parallelism between the print emitter and the print emitter pickup. Use the two small land patterns on the top right side of the printer to aid you in making this check. The distance between the land patterns and the print emitter pickup should not vary more than 0.025 inches (0.64 mm).	<p>Reform the right side frame near the support shaft. Adjust the gap between the print emitter and the print emitter pickup. Also check that the print emitter moves freely as the horizontal fine adjustment knob is turned to both extremes.</p> <p>Check the ground locations.</p> <p>Adjust or replace the end of the forms switch.</p> <p>Replace the print head cable.</p> <p>Adjust or replace the print emitter or the print emitter pickup.</p>
Light printing.	<p>One end of a printed line is darker.</p> <p>The ribbon is not advancing.</p> <p>Not enough tension on the two print head springs.</p>	<p>Adjust the copy control dial.</p> <p>Replace the ribbon.</p> <p>Adjust the clearance between the print head and the platen.</p> <p>Check the A-frame alignment.</p> <p>Check for broken ribbon drive lines, defective drive clutches, and incorrect alignment of the ribbon drive gears. Also check that the ribbon feed roll release knob is in the proper position.</p> <p>Check for 700 to 900 grams of tension at the tip of the print head near the print wires. This measurement should be taken while the platen is removed and with the print head located near the center of the machine.</p>

Symptom	Isolation Aid	Fix
Light printing. (continued)	Check for mechanical binds, sticking, or other interference that would prevent the print head from making complete contact with the platen. Especially check the print head cable.	
Every other line has light printing.	None.	Check for broken ribbon drive lines.  Check for a defective ribbon drive clutch.
Broken print wires.	To prevent breaking print wires:  Set the copy control dial to the proper forms thickness.  Instruct operators to never print over perforations, feed holes, or the edge of the forms.  Insure that all fixes for ribbon jams are installed.	
Printer blows fuses.	Disconnect EC3 at the print head to keep from blowing fuses; then measure the wire driver inputs at cable A1A3 with your meter. All inputs should be at an up level of +4.5 to +5.5 Vdc or +1.4 to +20 Vdc. A down level indicates an active level.	Check for more than one active wire drive signal from the system.  Check for a defective signal cable.
+24 Vdc supply voltage is too high.	None.	Replace A1A1 card and the Q1 transistor (see logic 430).
Printing stops.	Capacitor C4 is the filter capacitor for the +5 Vdc to the printer.	The problem can be caused by any of the following (see logic 430). <ul style="list-style-type: none"> <li>• Open capacitor C4.</li> <li>• Loose, broken, or poorly crimped wire between C4 and point 1A.</li> <li>• Open between point 1A and test point V4.</li> <li>• Loose, broken, or poorly crimped wire between point 4F and capacitor C4.</li> <li>• Open land pattern between point 4F and test point G6.</li> <li>• Replace the A1A1 card.</li> </ul>

Symptom	Isolation Aid	Fix
Printing stops intermittently or printer prints backward when running diagnostics or programs.	Disable the end of the forms switch by jumpering A1-A3D13 to A1-A3C08. If the symptom disappears, the problem is in the end of forms switch, mechanism, or wiring.	Adjust, repair, or replace the end of the forms switch, the wiring, or the mechanism.
Printing stops.	<p>Check the print emitter or print emitter pickup boards for warpage or contaminants.</p> <p>Component failures are not always detected by the static checks. They can, however, cause the printer to fail under dynamic (operating) conditions. An oscilloscope normally is required to detect these problems.</p>	<p>Adjust, repair, or replace as required.</p> <p>Replace the forms feed photocell assembly or forms feed emitter amplifier.</p>
Print head carrier stops near right side.	Check that the belt clamp does not touch the print head stepper motor when the print head carrier is moved to the extreme right.	Adjust the belt clamp as required.
All print wires tend to fire and printer errors may occur.	Check for +8.5 volts to the adapter card A2M11.	Repair as required.

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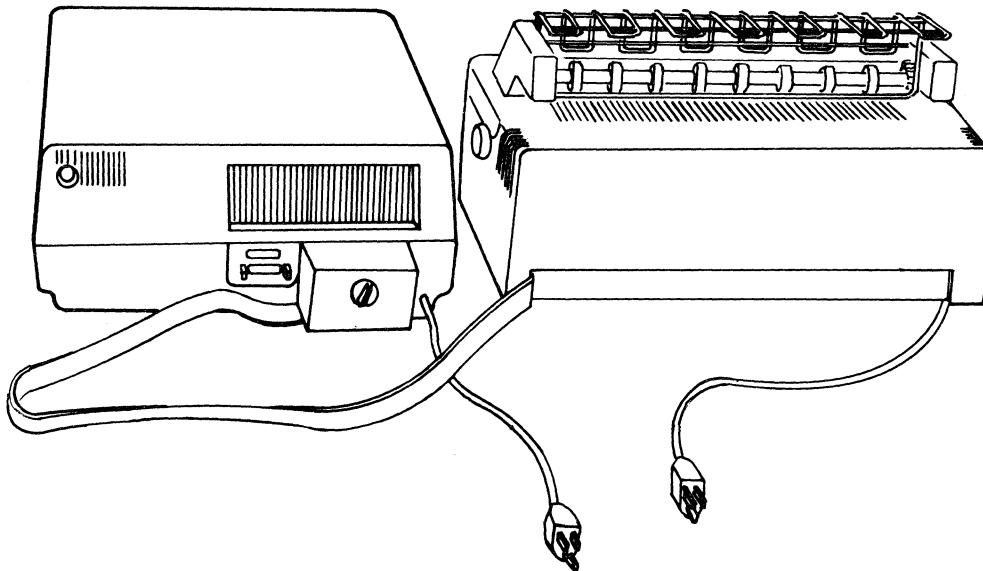
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## IBM 5103 Printer Installation

### 5103 PRINTER TO THE IBM 5100 PORTABLE COMPUTER OR IBM 5110 COMPUTER

IBM 5100 Portable Computer  
or IBM 5110 Computer

IBM 5103 Printer



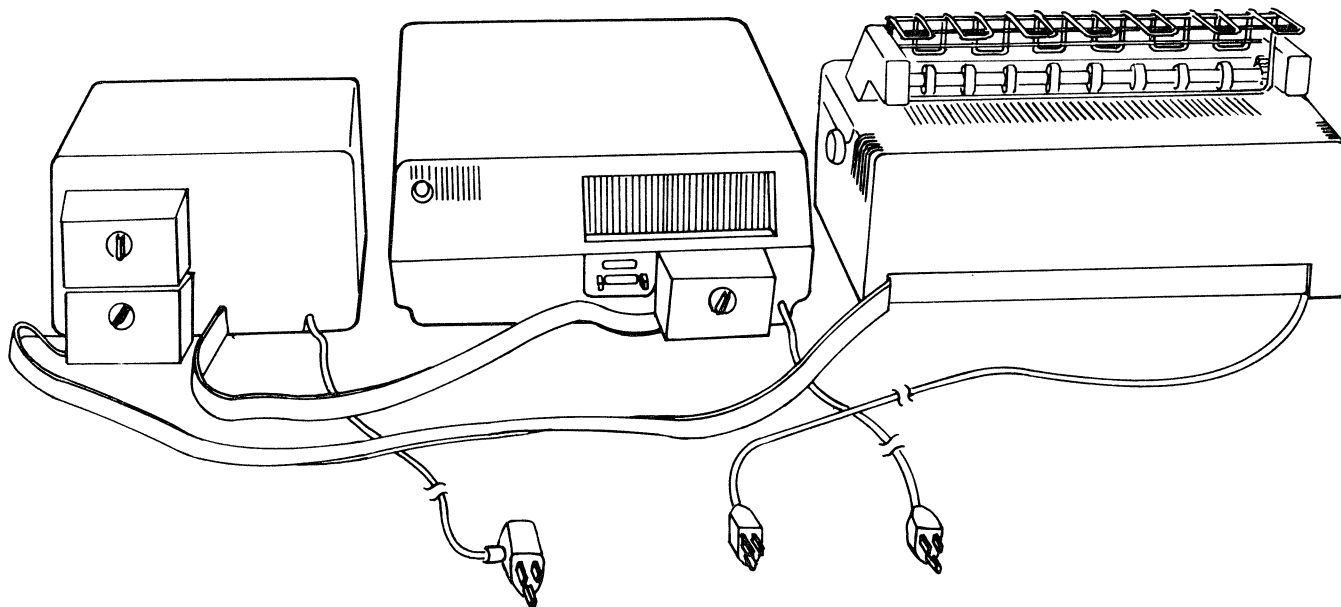


**IBM 5103 PRINTER TO THE IBM 5100 PORTABLE COMPUTER OR IBM 5110 COMPUTER VIA THE IBM 5106  
VIA THE IBM 5106 AUXILIARY TAPE UNIT**

IBM 5106 Auxiliary Tape Unit

IBM 5100 Portable Computer  
or IBM 5110 Computer

IBM 5103 Printer

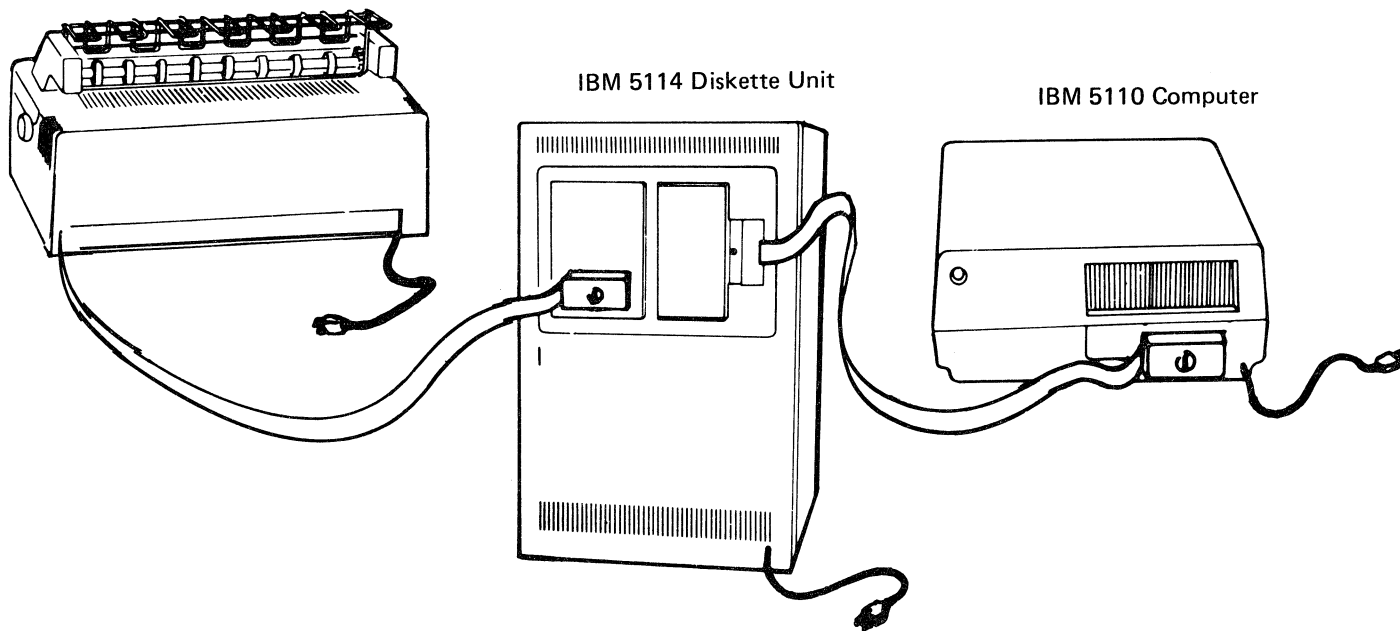


**IBM 5103 PRINTER TO THE IBM 5110 COMPUTER VIA THE IBM 5114 DISKETTE UNIT**

IBM 5103 Printer

IBM 5114 Diskette Unit

IBM 5110 Computer



### Prepower Check

Check with the customer to verify that the ac outlet is properly grounded.

### Safety

Remove all electrical power from the machine by disconnecting the system and 5103 mainline cords.

### Cable Installation

1. Turn the system POWER ON/OFF switch off.
2. Attach the cable from the printer to the auxiliary tape unit (if there is one) or to the system.
3. If there is an auxiliary tape unit, move the line terminator to its storage position.

### Power On Check

1. Make sure that the printer POWER ON/OFF switch is off.
2. Connect the printer mainline cord to the ac power outlet.
3. Turn the printer POWER ON/OFF switch on.
4. Observe the machine for signs of overheating or smoke. Turn off the POWER ON/OFF switch immediately if any abnormal conditions are noted.
5. Check that the fan is turning.
6. Install the forms tractor.
7. Turn the system POWER switch on.
8. Use the Printer MAP 0810 to check the printer operation and performance.

### Completion of Installation

The machine serial number is on a tag located on the frame on the left side of the IBM 5103 Printer.

1. Place the *IBM 5103 Printer Maintenance Information Manual* and the *IBM 5103 Printer Parts Catalog* in the Maintenance Library binder.

2. Fill out the IR and report the installation according to local procedures.
3. Place the diagnostic tape cartridge into its pocket in the Maintenance Library binder.

### Cover Cleaning

Use only a mild soap or isopropyl alcohol PN2200200.

### IBM 5103 Printer Specifications

#### Dimensions:

Metal Covers:	Front	Side	Height
Inches	21.25	13.25	7.1
Millimeters	539.8	336.5	180
Plastic Covers:	Front	Side	Height
Inches	24.0	14.5	7.0
Millimeters	609.6	368.3	177.8

**Weight:** Metal covers—59 pounds (27 kg)  
Plastic covers—50 pounds (22.9 kg)

**Heat Output/hr:** 350 Btu

#### Power Requirements:

AC Voltages (single phase)	Hertz	KVA
100 Vac	50	.2
100 Vac	60	.2
115 Vac	60	.2
220 Vac	50	.2
235 Vac	50	.2

#### Operating Environment:

Temperature	60° F to 90° F (15.6° C to 32.2° C)
Relative humidity	8% to 80%
Maximum wet bulb	73° F (22.8° C)

#### Power Cord Specifications:

220 and 235 Vac 50 Hertz

Cable OD	0.4 ± 0.015 inches (10.16 ± 0.38 mm)
Shields	None
Conductors	3
Conductor Size	16 Awg (1.3 mm <sup>2</sup> )

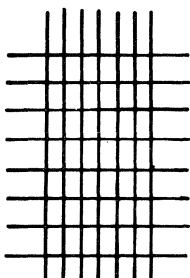
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## Print Character Information

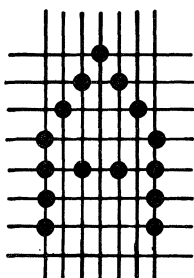
### PRINTER CHARACTER SET

The characters enclosed in parentheses ( ) are the hex value of the character for the 5100. The characters enclosed in brackets [ ] are the hex value of the character for the 5110.

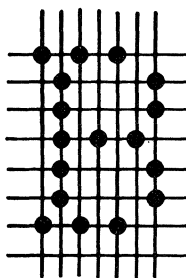
**Blank** (00) [40]



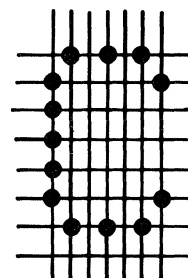
**A** (01) [C1]



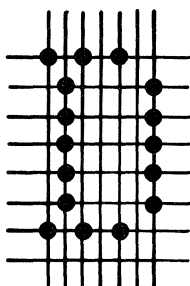
**B** (02) [C2]



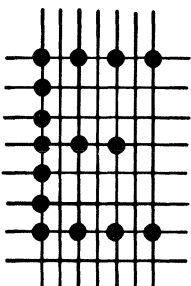
**C** (03) [C3]



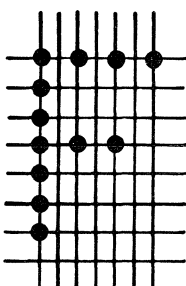
**D** (04) [C4]



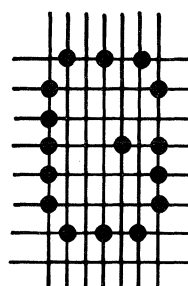
**E** (05) [C5]



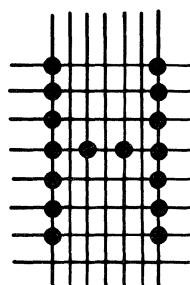
**F** (06) [C6]



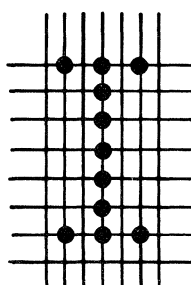
**G** (07) [C7]



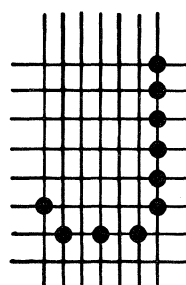
**H** (08) [C8]



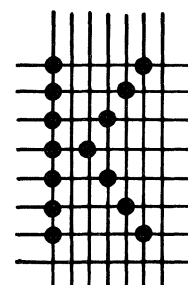
**I** (09) [C9]



**J** (0A) [D1]

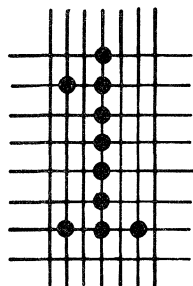


**K** (0B) [D2]

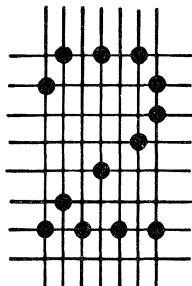




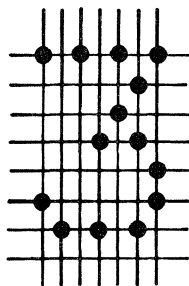
1 (1C) [F1]



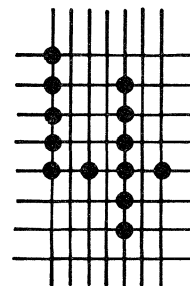
2 (1D) [F2]



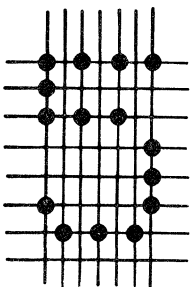
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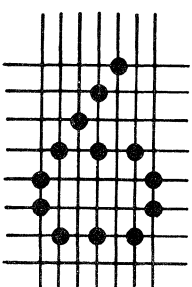
4 (1F) [F4]



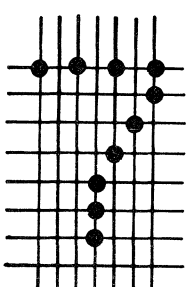
5 (20) [F5]



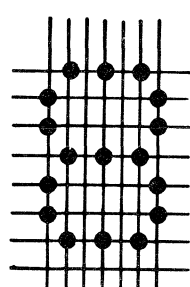
6 (21) [F6]



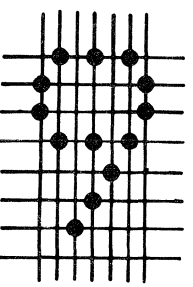
7 (22) [F7]



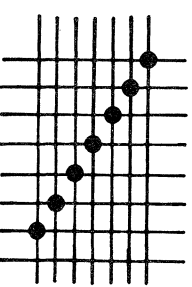
8 (23) [F8]



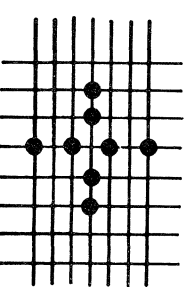
9 (24) [F9]



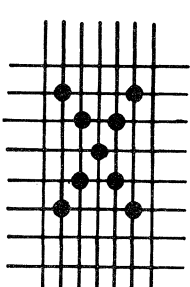
/ (25) [61]



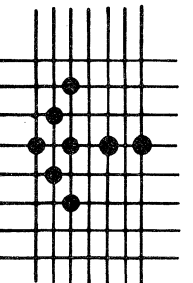
+ (26) [4E]



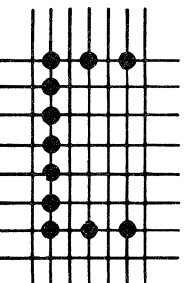
x (27) [A7]



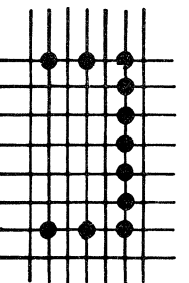
← (28) [9F]



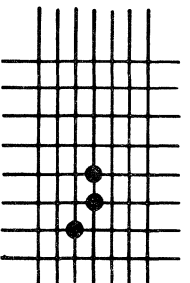
[ (29) [AD]



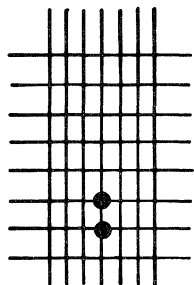
] (2A) [BD]



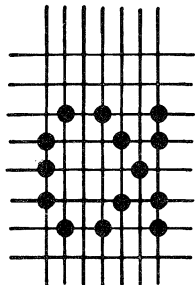
, (2B) [6B]



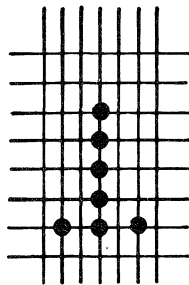
• (2C) [4B]



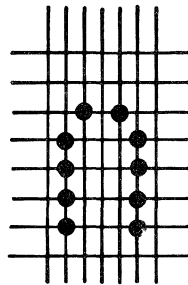
∞ (2D) [B0]



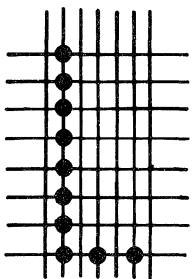
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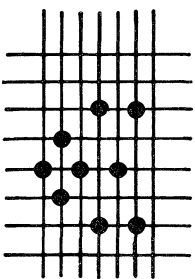
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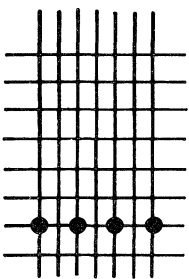
⊥ (30) [8E]



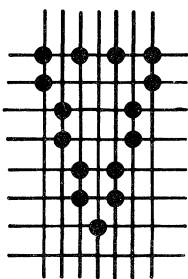
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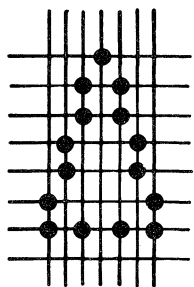
— (32) [6D]



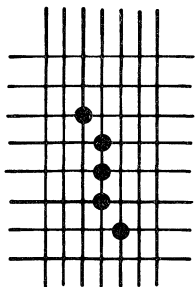
∇ (33) [BA]



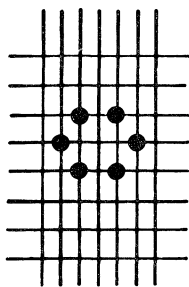
△ (34) [BB]



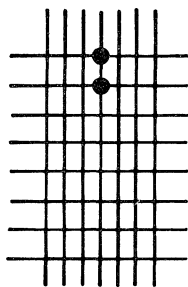
⌈ (35) [B2]



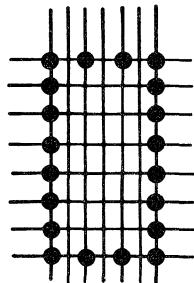
◦ (36) [AF]



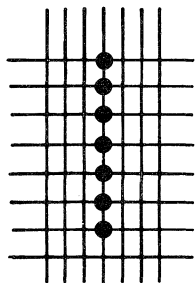
‡ (37) [7D]



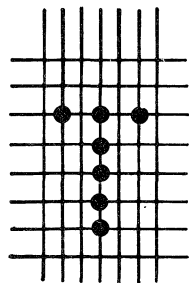
□ (38) [90]



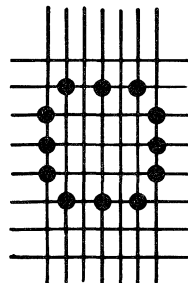
⌋ (39) [FA]



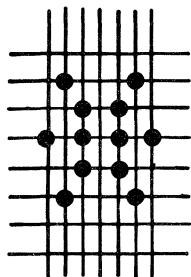
⋮ (3A) [BC]



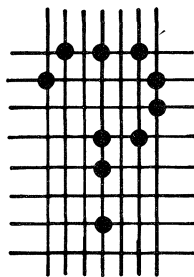
○ (3B) [9D]



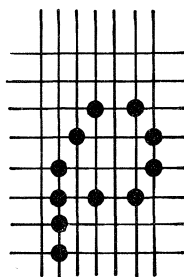
\* (3C) [5C]



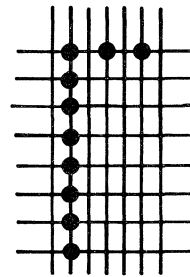
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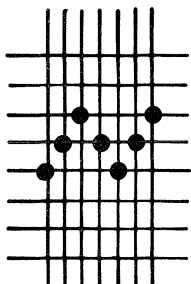
ρ (3E) [B3]



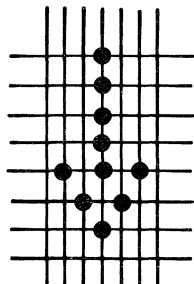
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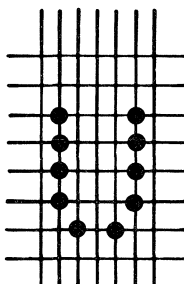
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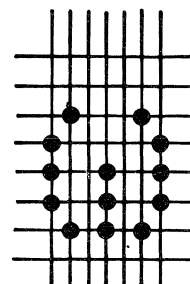
↓ (41) [8B]



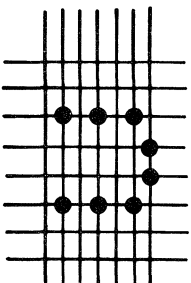
∪ (42) [AB]



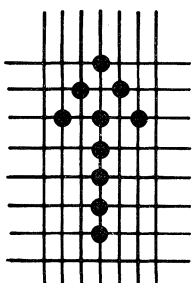
ω (43) [B4]



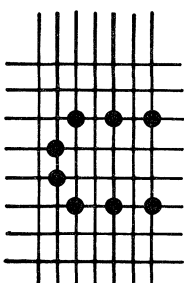
⊃ (44) [9A]



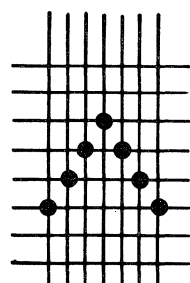
↑ (45) [8A]



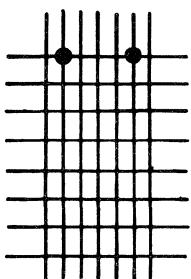
⊂ (46) [9B]



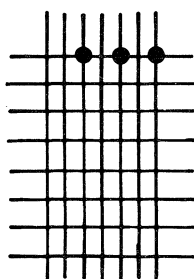
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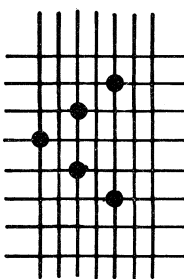
.. (48) [72]



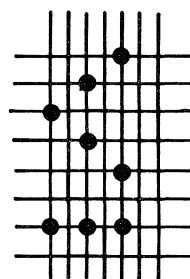
− (49) [A0]



< (4A) [4C]



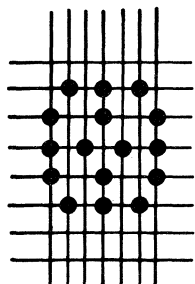
≤ (4B) [8C]



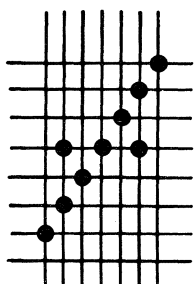




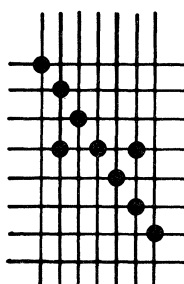
⊗ (5C) [FD]



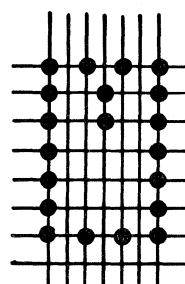
↗ (5D) [EA]



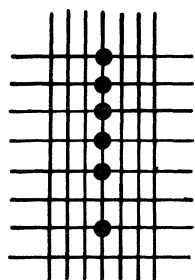
↘ (5E) [EB]



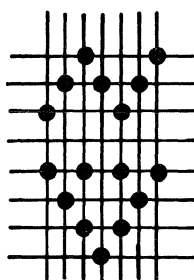
⌈ (5F) [DE]



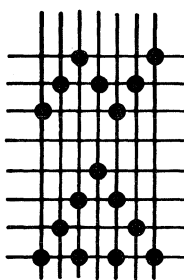
! (60) [5A]



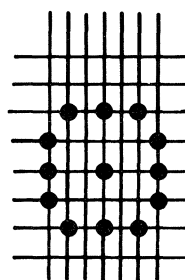
⋈ (61) [FB]



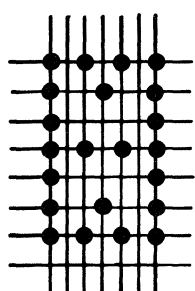
⋈ (62)



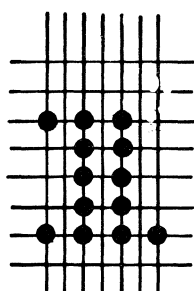
⊙ (63)



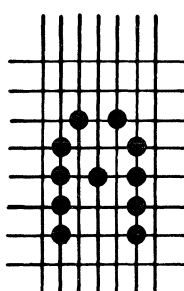
⊞ (64) [EE]



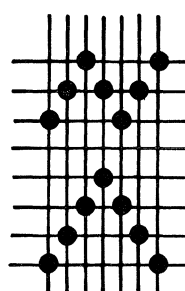
⊞ (65) [DA]



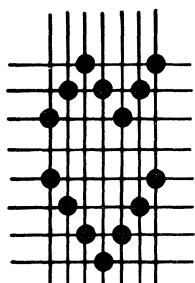
⊞ (66) [DF]



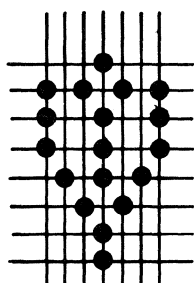
⋈ (67) [CA]



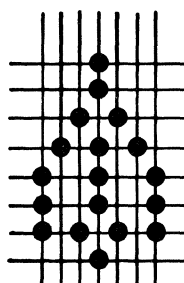
⋈ (68) [CB]



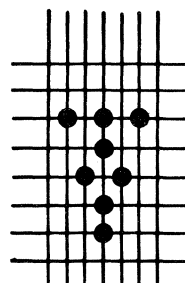
⋈ (69) [DC]



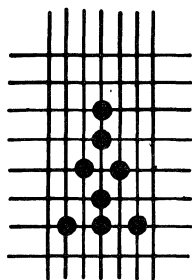
⋈ (6A) [DD]



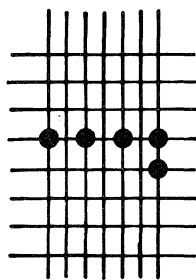
⋈ (6B) [EF]



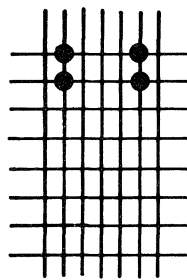
ϕ (6C) [FE]



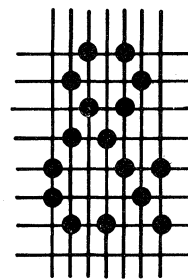
⌋ (6D) [5F]



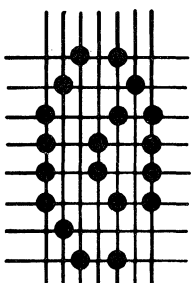
“ (6E) [7F]



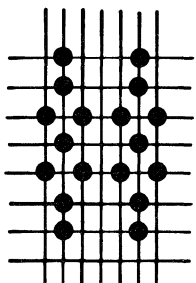
& (6F) [50]



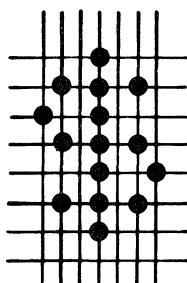
@ (70) [7C]



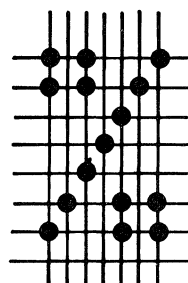
# (71) [7B]



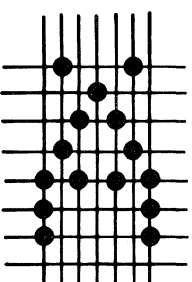
\$ (72) [5B]



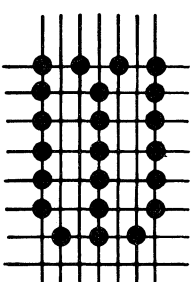
% (73) [6C]



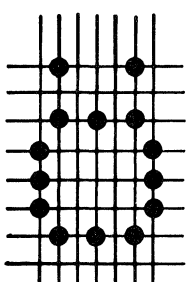
Ä (74)



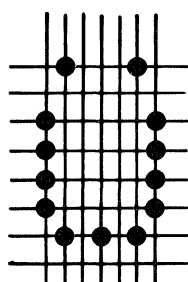
⊙ (75) [75]



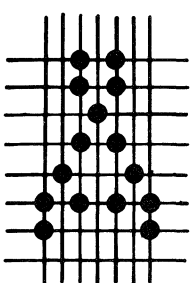
ö (76)



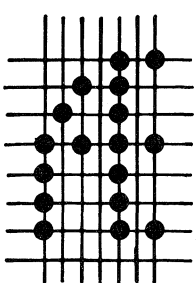
ÿ (77)



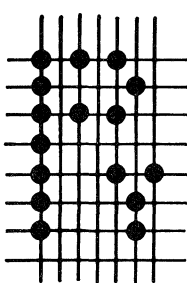
Ř (78)



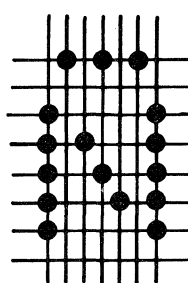
Æ (79)



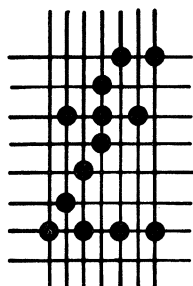
ℙ (7A)



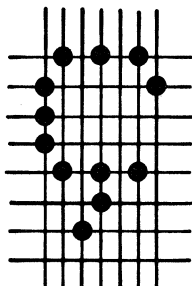
Ñ (7B)



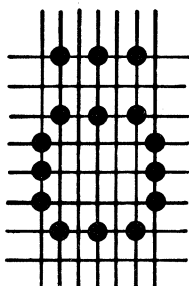
£ (7C)



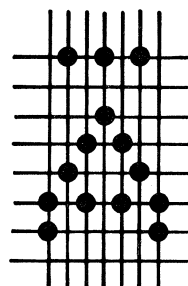
ξ (7D)



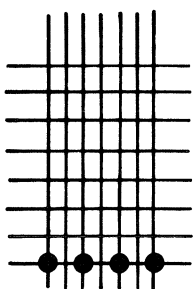
ō (7E)



Ã (7F)



— (80) [6D]<sup>1</sup>



<sup>1</sup>The underscore character (80) [6D] appears to be printed with wire 8. This is done by using wire 7 and moving the platen and forms forward one incremental step.

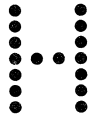
## Special Characters

Char	Country	Hex	4A	5A	5B	5F	6A	79	7B	7C	A1	C0	D0	E0
1	Austria/Germany		Ä	Ü	ß	^	ö	·	#	\$	ß	ä	ü	ö
2	Belgium		l	l	\$	^	ü	·	#	ä	·	é	é	é
3	Brazil		E	\$	ç	^	ç	ã	õ	ã	~	õ	é	/
4	Denmark/Norway		#	ø	Å	^	ø	·	#	ø	ü	æ	ä	/
5	Finland/Sweden		\$	ö	Å	^	ö	ö	Å	ö	ü	ä	ä	E
6	France		°	\$	\$	^	ü	·	£	ä	·	é	é	é
7	Italy		°	é	\$	^	ö	ü	£	\$	í	ä	é	é
8	Japan		£	l	¥	-	l	·	#	@	-	{	}	\$
9	Portugal		l	l	\$	^	ö	·	ã	ö	ç	ã	·	ç
0	International		l	l	\$	^	l	·	#	@	~	{	}	/
/	Spain		l	l	£	-	ñ	·	N	@	·	{	}	/
*	Spanish Speaking		l	l	\$	-	ñ	·	N	@	·	{	}	/
-	United Kingdom		\$	l	£	-	l	·	#	@	-	{	}	/
+	French Canadian		ä	·	\$	^	ü	·	#	@	·	é	é	·
·	Domestic		ç	l	\$	-	l	·	#	@	~	{	}	/

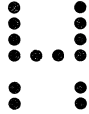
## PRINT QUALITY PROBLEMS

These print quality problems are used with the MAPs:

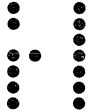
Character printed correctly.



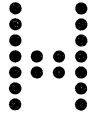
Missing horizontal row of dots.



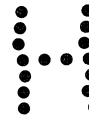
Random missing dots.



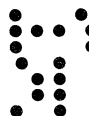
Extra dots.



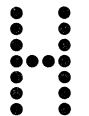
Dots within a character are not aligned vertically.



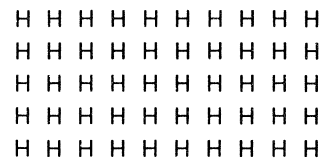
Unintelligible printing.



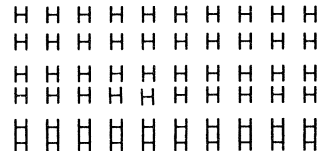
Wrong character width.



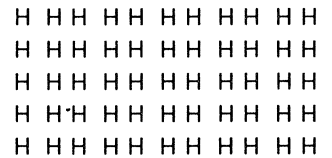
Correct printing.



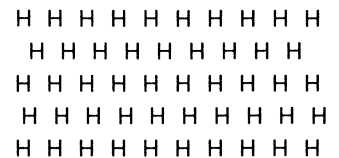
Incorrect line spacing.



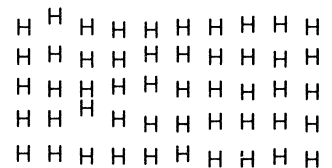
Incorrect character spacing.



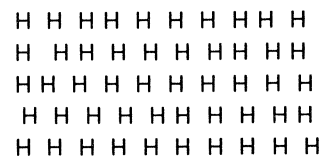
Printing misaligned vertically.



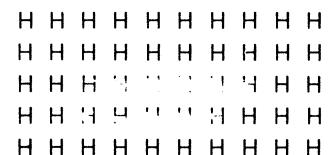
Printing misregistered vertically.



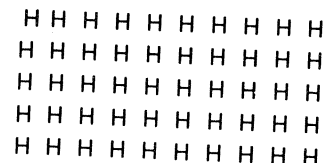
Printing misregistered horizontally.



Defective ribbon.  
Oil spot on ribbon.  
Defective platen.



Printing not aligned with the forms  
(crooked printing).

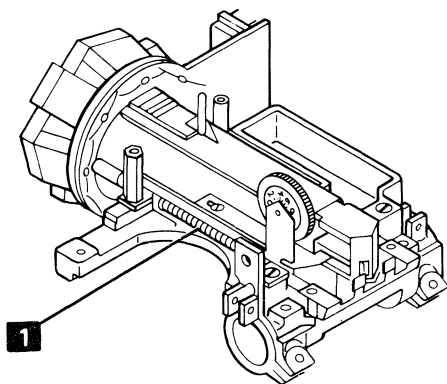


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## Preventive Maintenance

Perform preventive maintenance for the printer on any 01 call if a check of the incident reports shows that more than a year passed since the last PM.

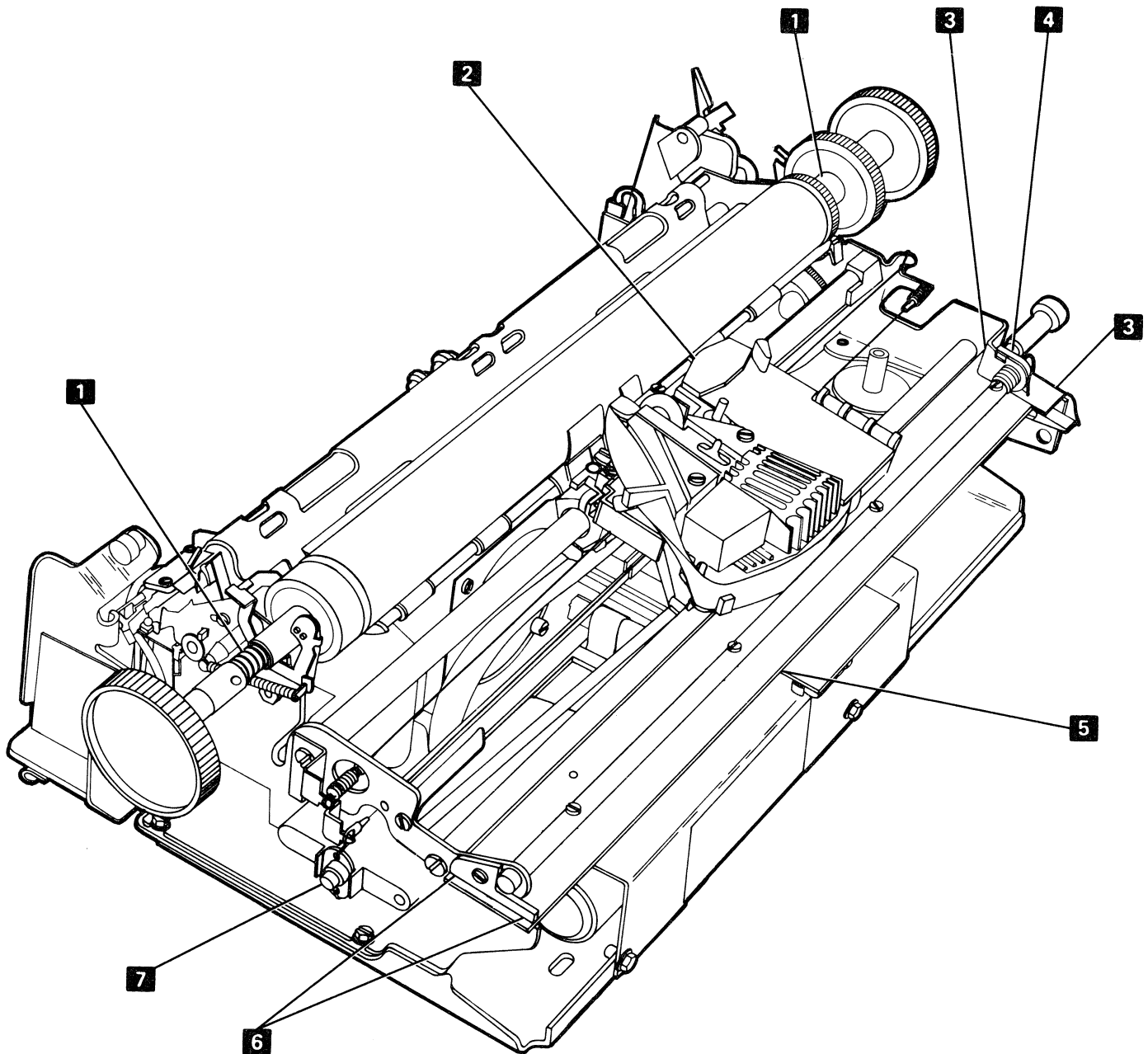
Unit	Operation	Lubricant	Notes
Ribbon drive	Check lines for cuts or abrasions and replace as needed. Lubricate feed roll shafts. Clean ink from ribbon guides.	IBM No. 23	Refer to 373. Light film.
Print head	<b>CAUTION</b> Excess oil will bleed to the ribbon and cause light and dark printing.  Clean wire guide tip and side grooves. Check printing for variations in density.  Oil felt. Lubricate support bars.	IBM No. 6 IBM No. 6	Variations may indicate print wire wear. Refer to 363. Drop.
Forms tractor unit	Lubricate shafts.	IBM No. 23	Light film.
Print emitter	Lubricate: Pickup pads. Contact points between emitter board and side frame (7). Horizontal fine adjustment threads and shaft sides.	IBM No. 23 IBM No. 23 IBM No. 23	Light film. Light film. Light film.
Carrier drive	Lubricate belt tensioner guide shaft.	IBM No. 23	Light film.
Forms feed drive	Lubricate idler gear stud.	IBM No. 6	Drop.
Platen	Lubricate bushings.	IBM No. 23	Light film.
Power supply	Check fan operation.	IBM No. 6	Light film.
Support bars (2) <b>1</b>		IBM No. 6	Light film.





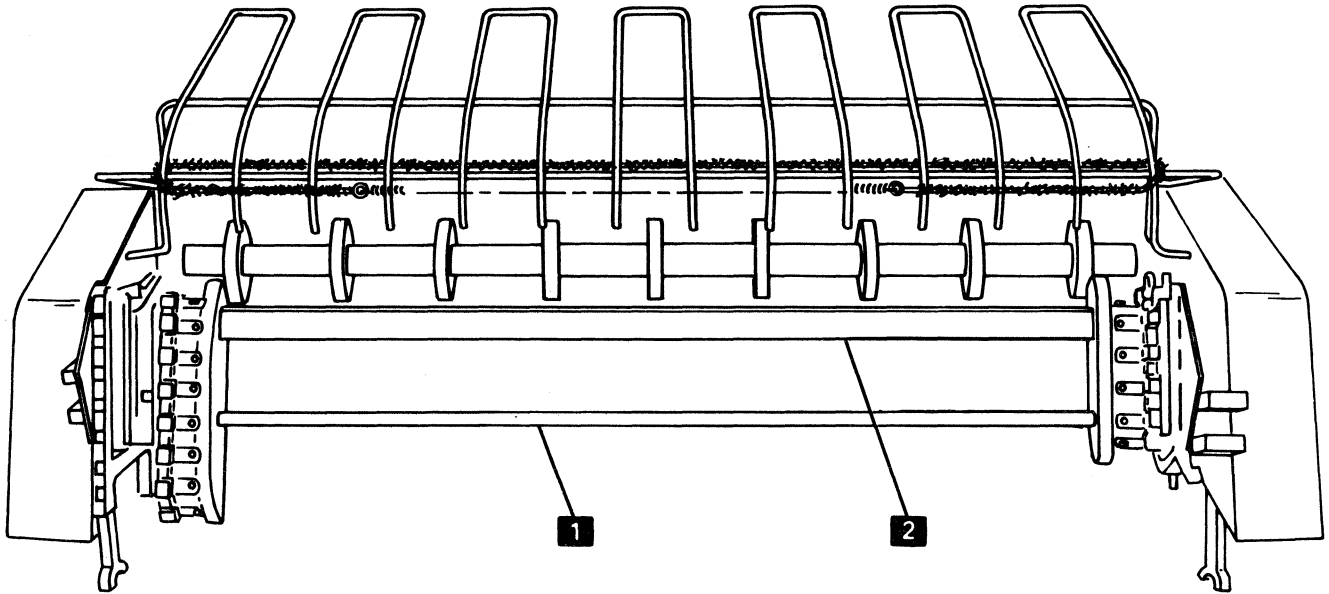
Use IBM No. 23 grease for:

- 1** Platen Bushings (2)
- 2** Feed Roller Shafts
- 3** Contact Points (three) between Emitter Board and Right Side of Frame
- 4** Horizontal Fine Adjustment Threads
- 5** Pickup Pads (4)
- 6** Contact Points (four) between Emitter Board and Left Side of Frame
- 7** Belt Tensioner Guide Shaft



Use IBM No. 23 grease for:

- 1** Bottom Forms Tractor Shaft (light film)
- 2** Top Forms Tractor Shaft (light film)



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## Glossary

**μs:** Microsecond.

**$\bar{A}$ :** Not A.

**adapter:** A hardware device that connects two channels on the same computing system or on different systems.

**$\bar{B}$ :** Not B.

**com:** Common.

**controller:** The microinstruction processor in the system.

**cps:** Characters per second.

**detent:** To lock, hold, or restrain. A detented stepper motor has one or more of its drive lines energized to ensure proper rotation when it is restarted.

**EC:** Edge connector.

| **FBM:** Field bill of material.

**hex:** Hexadecimal.

**LED:** Light emitting diode.

**MAP:** Maintenance analysis procedures.

**MDI:** MAP diagnostic integration.

**MHz:** Megahertz.

**ms:** Millisecond.

**n/c:** Normally closed.

**n/o:** Normally open.

**null position:** Maximum misalignment of the print emitter and one of the land patterns on the print emitter pickup.

**ramp:** A mechanical device that causes the print head to move away from the forms. When the print head is ramped, it is unloaded, retracted, or in the forms loading/unloading position.

**read only storage:** A storage whose contents are not changed by computer instructions.

**ROS:** Read only storage.

**strobe:** Signal or pulse.

**TB:** Terminal block.

**TP:** Test point.

**TPB:** Taper pin block.

**TTL:** Transistor-transistor logic.

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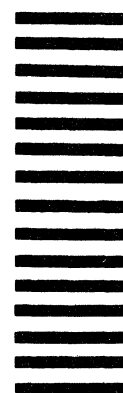
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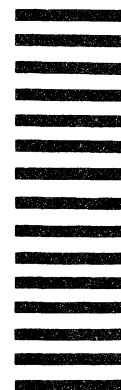
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