

# **LBP-CX SERIES**

# **SERVICE MANUAL**

**REVISION 2**

**Canon**

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Prepared by

REPROGRAPHIC PRODUCTS QUALITY ASSURANCE DIVISION

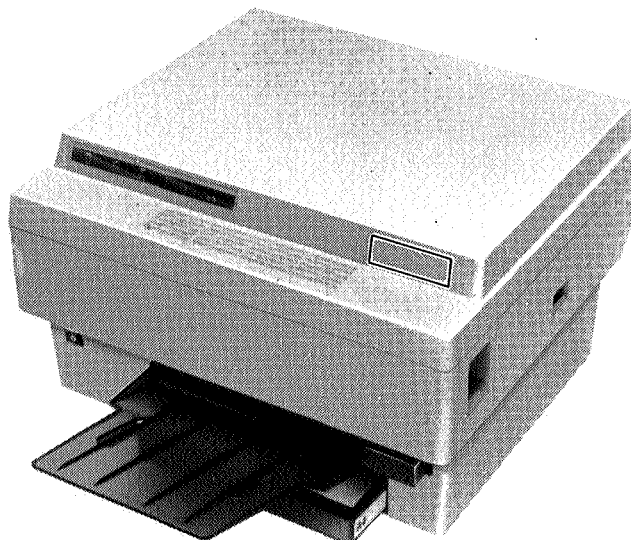
CANON INC.

7-1 Nishi-Shinjuku 2-chome, Shinjuku-ku, Tokyo 160, Japan

## INTRODUCTION

This service manual contains basic information required for after-sale service of laser beam printers (240 raster lines/inch and 300 raster lines/inch models). This information is vital to the serviceman in maintaining high printing quality and performance of the printer. The content of this manual may be revised as a result of product modification. There revisions are detailed in Service Information Bulletins.

- Chapter 1: General Description  
Features, specifications, operation, and parts of the printer
- Chapter 2: Operation and Timing  
A brief description of the different systems in the printer and their roles in producing a print
- Chapter 3: The Electrical System  
Printer timing and signals, explanation of selected circuit
- Chapter 4: The Mechanical System  
Explanation of mechanical operation, disassembly, reassembly, and adjustment
- Chapter 5: Installation  
Requirements for a suitable location and installation procedures
- Chapter 6: Maintenance and Servicing  
Parts replacement schedule, expected service lives of printer parts, and details of periodic servicing
- Chapter 7: Troubleshooting  
What to do if the printer malfunctions
- Chapter 8: Appendix





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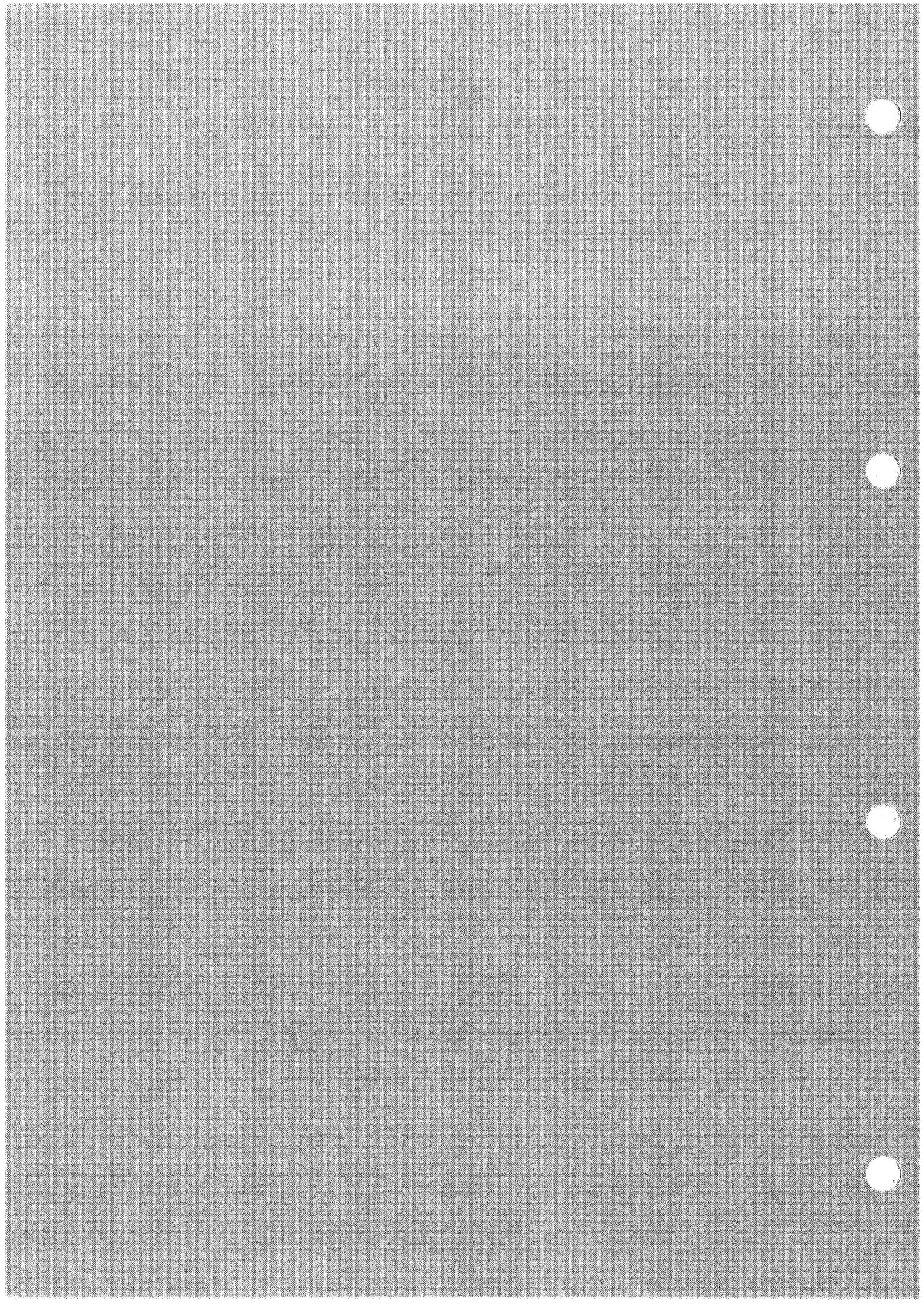




# CHAPTER 1

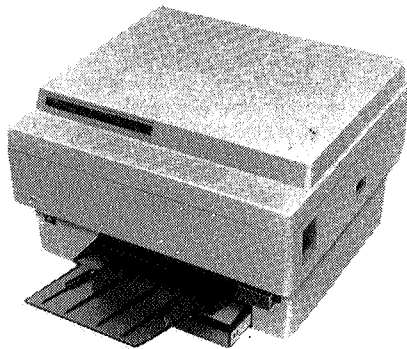
## GENERAL DESCRIPTION

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## I. FEATURES

- A. This is a non-impact (low-noise) printer based on electrophotography, electronics, and laser technology.
- B. This printer produces high-quality prints with plain paper.
- C. This printer is compact and easy to carry. This allows the printer to be placed near the customer.
- D. This printer combines a photosensitive drum, toner hopper, developing cylinder and drum cleaner in a single assembly called an "EP cartridge." This allows maintenance servicing and periodic replacement of parts and consumables simply by replacing the EP cartridge. The customer can do this, saving time and the cost of the serviceman.
- E. This printer body can be opened/closed with a simple one-handed action, which allows easy clearing of paper jams.
- F. This printer has been designed with full provision made for laser safety. It has been certified by the U.S. Bureau of Radiological Health (BRH) as conforming with their standards for laser safety.
- G. This printer employs a semiconductor laser which is much more compact than an ordinary gas laser, and which is driven directly by control signals.
- H. This printer can be used as an on-line or off-line output unit for office computers, word processors, graphic displays, facsimiles, and other systems.



## II. SPECIFICATIONS

1. Type: Desk-top page printer
2. Printing method: Electrophotography (single component-dry process), laser-beam scanning
3. Print speed:
  - Cassette feed
    - 6.9 (Legal-size) sheets/minute
    - 8.1 (A4, Letter, and other sizes) sheets/minute
  - Manual feed
    - 5.1 (all sizes) sheets/minute
4. Time for first print: 18 sec. or less (cassette feed)  
22 sec. or less (manual feed)  
[Definition: the interval between receiving a print command from the external device (when the printer is READY) and delivery of one A4/Letter print]
5. Warm-up (wait) time:
  - Less than 2 min. from power ON (20°C ambient; specified line voltage)
6. Optical system:
  - 6-1 Laser: Semiconductor laser
  - 6-2 Scanning system: Rotating six-faced mirror
  - 6-3 Scanning pitch:
    - Horizontal: Selectable (0-300 dots/inch)
    - Vertical: 240 raster lines/inch or 300 raster lines/inch (2 types of printer)
7. Printing system
  - 7-1 Process speed: 47.1 mm/sec. (1.85 in./sec.)
  - 7-2 Photosensitive drum:
    - Two-layer structure; conductive base, photoconductive upper layer (OPC)
  - 7-3 Charging: Corona
  - 7-4 Exposure method: Laser scanning system
  - 7-5 Development:
    - Single-component, dry toner
    - Toner Projection Development System
  - 7-6 Paper supply: Manual or cassette feed
  - 7-7 Image transfer: Corona transfer
  - 7-8 Separation: Fixed belt and roller
  - 7-9 Fixing method:
    - Heated roller
    - (115V, 220V: 500W, 240V: 600W)
  - 7-10 Toner supply: Replaceable EP cartridge
8. Paper: Plain paper (manufacturer-approved)
  - Cassette feed;
    - 60 g/m<sup>2</sup> - 80 g/m<sup>2</sup> [16 lb - 21 lb]
  - Manual feed;
    - Single-side print
      - 40 g/m<sup>2</sup> - 128 g/m<sup>2</sup> [11 lb - 33 lb]
    - Double-sided print
      - 60 g/m<sup>2</sup> - 128 g/m<sup>2</sup> [16 lb - 33 lb]

9. Cassette feed
  - 9-1 Maximum paper load:
    - Cassette loading depth is 10 mm (0.4 in.), max.
    - e.g. 100 sheets of 80 g/m<sup>2</sup> paper
  - 9-2 Cassette:

Paper size	mm	inches	Cassette
A4	210 x 297	8.3 x 11.7	A4
B5	182 x 257	7.2 x 10.1	B5
Legal	216 x 356	8.5 x 14.0	Legal
Letter	216 x 279	8.5 x 11.0	Letter

10. Manual feed
  - 10-1 Paper size:
    - From 100 mm (H) x 140 mm (V)
    - to 216 mm (H) x 356 mm (V)
  - 10-2 Printing on double sides:
    - Possible, using manual feed
11. Tray capacity: About 20 sheets (80 g/m<sup>2</sup>)
12. Power consumption
  - Operating: Max. 690W (115V, 220V),  
790W (240V)
  - Standby: Typical avg. 120W
13. Environment
  - 13-1 Temperature: 10°C - 32.5°C  
(50°F - 90.5°F)
  - 13-2 Humidity: 20% - 80%RH
14. Noise level: Under 55 dB (A) (during printing)  
Under 45 dB (A) (during standby)
15. Dimensions:
  - 475 mm (W) x 290 mm (H) x 415 mm (D)
  - 18.7 in. (W) x 11.4 in. (H) x 16.3 in. (D)
16. Weight: 25 kg (55 lb) (unloaded)
17. Line voltage requirements

	Voltage (V) ±10%	Freq. (Hz)
240 raster lines/inch model		
	115	60
	220	50
	240	50
300 raster lines/inch model		
	115	60
	220	50
	240	50

Specifications are subject to change due to product improvements.

### III. SAFETY INFORMATION

#### A. Laser Safety

This printer is certified as a Class 1 laser product under the U.S. Department of Health and Human Services (DHHS) Radiation Performance Standard according to the Radiation Control for Health and Safety Act of 1968. This means that the printer does not produce hazardous laser radiation.

Since radiation emitted inside the printer is completely confined within protective housings and external covers, the laser beam cannot escape from the machine during any phase of user operation.

#### B. CDRH Regulations

Center for Devices and Radiological Health (CDRH) of the U.S. Food and Drug Administration implemented regulations for laser products on August 2, 1976. These regulations apply to laser products manufactured from August 1, 1976. Compliance is mandatory for products marketed in the United States. The label shown below indicates compliance with the CDRH regulations and must be attached to laser products marketed in the United States.

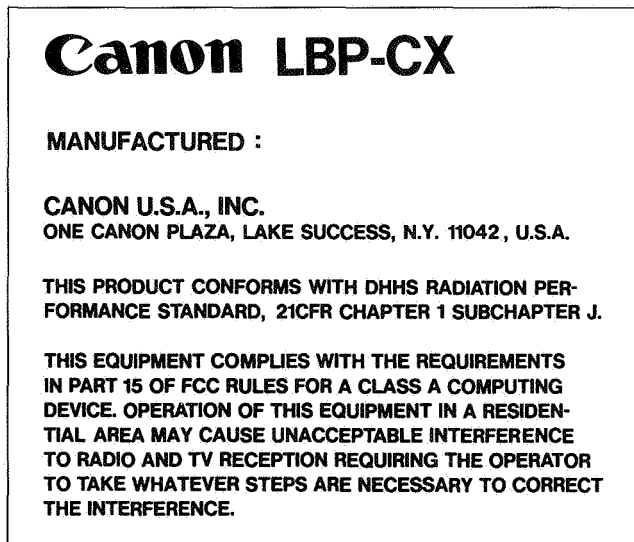


Figure 1-1

**Note:** The information above is subject to change depending on printer models.

#### C. Additional Information

When servicing or adjusting the optical system of the printer, be careful not to place screwdrivers or other shiny objects in the path of the laser beam. Also, accessories such as watches and rings should be removed before working on the printer. The reflected beam, though invisible, can permanently damage your eyes.

Since the beam is invisible, the following label is attached to the insides of covers where there is danger of exposure to laser radiation:

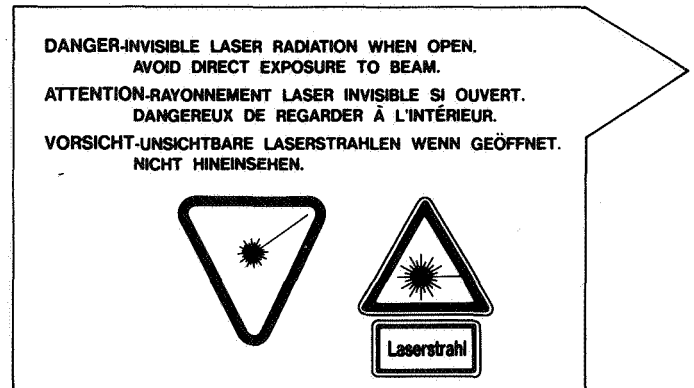


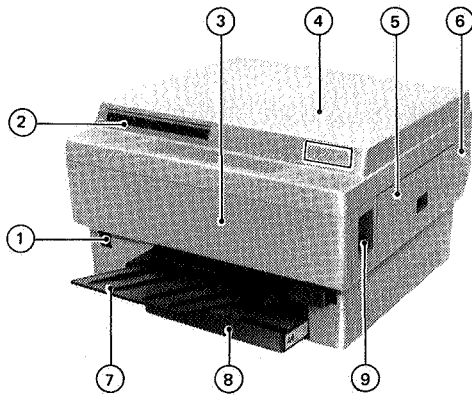
Figure 1-2

Some warning labels are stuck in the printer wherever special service attention is needed. Obey the instructions on the labels. For details, see Appendix XX, where the warning labels in the printer are shown.

According to West German standard VDE0836 (VDE-Bestimmung für die elektrische Sicherheit von Lasergeräten und Anlagen), printer servicing requires at least two servicement.

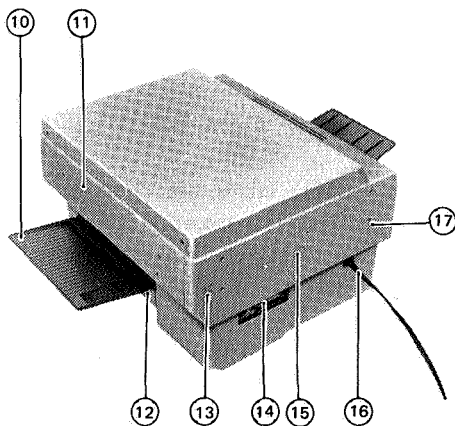
## IV. PARTS OF THE PRINTER

### A. External View



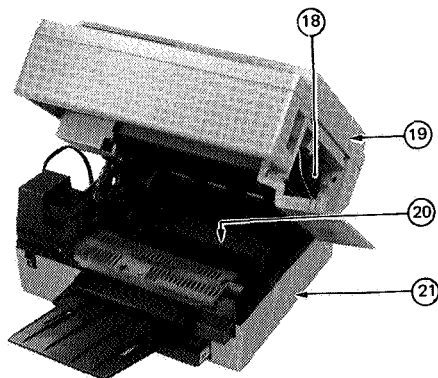
1. Power switch
2. Control panel
3. Front panel
4. Top cover
5. Right door
6. Right panel
7. Print tray
8. Cassette
9. Upper unit release

Figure 1-3



10. Manual feed tray
11. Rear panel
12. Paper pickup guide
13. Test switch
14. I/O connector
15. Print density adjustment dial
16. Power cord
17. Left panel

Figure 1-4



18. EP cartridge
19. Upper main body
20. Lower main body
21. Pedestal

Figure 1-5

## B. Cross Sectional View

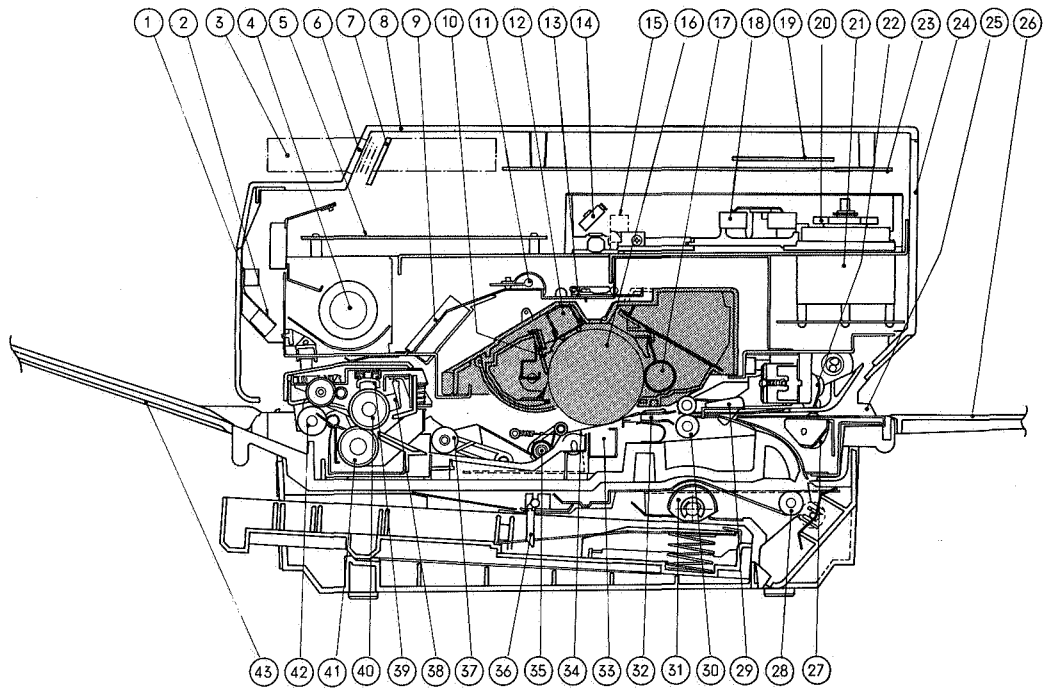


Figure 1-6



Indicates EP cartridge

- |                                       |   |
|---------------------------------------|---|
| 1. Front cover                        | 22. Upper manual pickup roller            |
| 2. Duct                               | 23. Video controller PCB                  |
| 3. Font cartridge                     | 24. Rear panel                            |
| 4. Fan                                | 25. Manual paper feed guide               |
| 5. DC controller PCB                  | 26. Manual feed tray                      |
| 6. Control panel                      | 27. Lower manual pickup roller            |
| 7. Control panel PCB                  | 28. Cassette feed roller                  |
| 8. Top cover                          | 29. Registration shutter                  |
| 9. Ozone filter                       | 30. Feed roller                           |
| 10. Cleaning blade                    | 31. Cassette pickup roller                |
| 11. Preconditioning exposure lamps    | 32. Transfer guide assembly               |
| 12. Primary corona assembly           | 33. Transfer corona assembly              |
| 13. Laser beam-blocking shutter       | 34. Separation belt                       |
| 14. Beam-to-drum mirror               | 35. Separation feeder unit                |
| 15. Stationary mirror                 | 36. Paper detection arm                   |
| 16. Photosensitive drum               | 37. Pinch roller (separation feeder unit) |
| 17. Developing cylinder               | 38. Thermistor                            |
| 18. Focusing lenses                   | 39. Fixing roller cleaner felt            |
| 19. Expansion RAM PCB (A2 model only) | 40. Upper fixing roller                   |
| 20. Scanning mirror                   | 41. Lower fixing roller                   |
| 21. Scanner motor                     | 42. Delivery roller                       |
|                                       | 43. Print tray                            |

## V. OPERATION

### A. Display Unit and Print Density Adjustment Dial

#### 1. Display unit

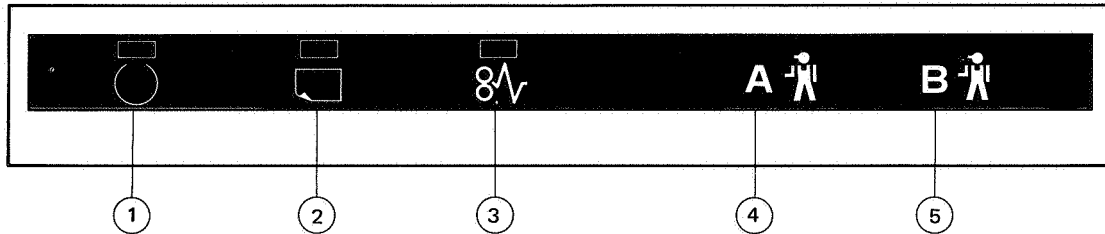


Figure 1-7

- ① **READY/WAIT indicator (green)**  
This green LED flashes when the printer is in the WAIT state or during TEST printing, and lights steadily when the printer is ready to operate.
- ② **PAPER OUT indicator (yellow)**  
With paper feed from a cassette, this yellow LED lights steadily if the cassette is empty or not in place. With manual feed, this yellow LED lights steadily if there is no paper on the manual feed tray.
- ③ **JAM indicator (yellow)**  
This yellow LED lights steadily if paper has jammed inside the printer. Printing is not possible until the jammed paper is removed (and the upper half closed).
- ④ **Indicator A (yellow)**  
This yellow LED lights steadily if one of the following malfunctions occurs:
  - The scanner motor is not rotating at the correct speed.
  - The laser beam is not scanning at the specified speed or the laser intensity drops under the specified value. (BD timing is not correct.)
- ⑤ **Indicator B (yellow)**  
This yellow LED lights steadily if the temperature of the laser chip or the upper fixing roller is not correct.

#### Note:

- These LEDs are all off if the EP cartridge is not inserted properly.
- If the external device sends data to the printer, but the laser beam does not scan at the specified speed, or if the laser is not at the specified intensity, the printer is not ready, and the READY/WAIT indicator goes out. The printer informs the external device of this, telling it the number of pages to retransmit. The external device sends a DATA RETRANSMISSION REQUEST RELEASE command, telling the printer to ready itself for data retransmission and printing. If the laser beam then does not scan at

#### 2. Test switch

The test switch is located on the left panel (see Figure 1-4). This switch is used to test components and functions of the printer. When this switch is pressed with the photosensitive drum stopped and the READY/WAIT indicator lit, one test print composed of vertical lines is output.

The test switch is a momentary contact switch. Test prints continue to be output as long as the switch is pressed. The READY/WAIT indicator flashes while test prints are being made.

#### 3. Print density adjustment dial

The print density adjustment dial is located on the left panel (see Figure 1-4). The dial is used to adjust the intensity of the finished print. Turning the dial counterclockwise increases print density (and vice versa).

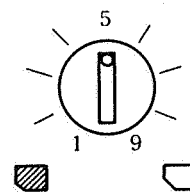


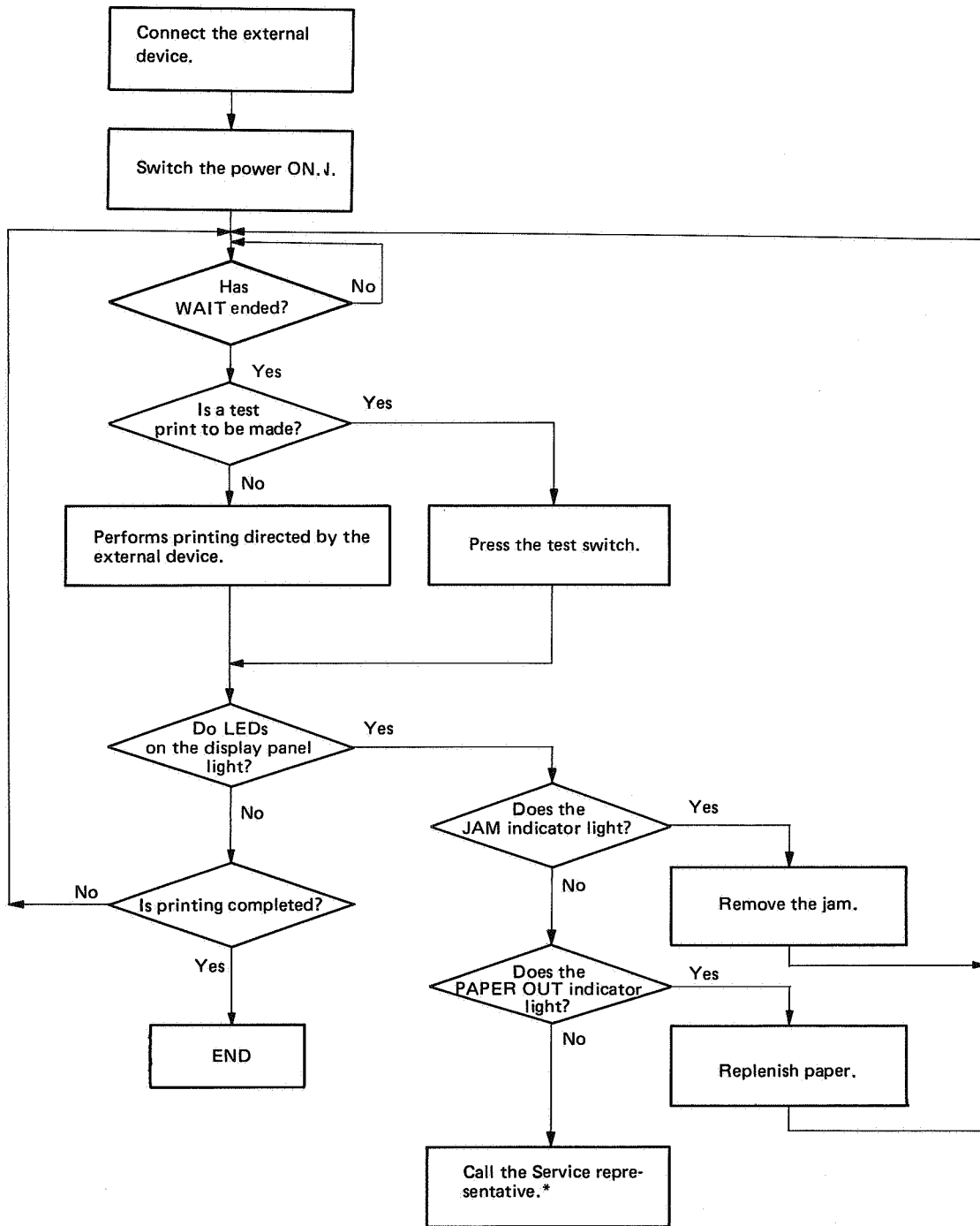
Figure 1-8

- the specified speed, or if the laser is not at the specified intensity for more than one second, indicator A lights.
- If there is no error in the printer, and the printer enters the PAUSE state from a PAUSE command input from the external device, all LEDs go out.
- If the main motor malfunctions all LEDs go out.



## B. Operating Procedure

### 1. Flowchart (basic operation)



\* In this case indicator A or B lights.

Figure 1-9

## 2. Manual feed

Manual feed is useful for making prints on paper sizes other than the cassette size. Manual feed is also used for overlay and double-sided printing. (excluding B4 paper)

- 1) Set the printer to manual feed through the external device.
- 2) Confirm that the READY/WAIT indicator goes off and the PAPER OUT indicator lights. Insert the paper lengthwise along the manual feed guide with the side to be printed face up (see Figure 1-9 below).

**Note:** Do not pull the paper from the manual feed guide when the printer begins paper feeding. Pulling the paper out makes JAM.

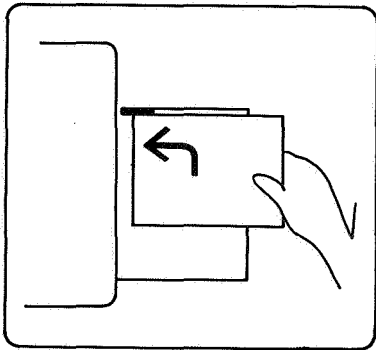


Figure 1-10

- 3) When making prints continuously using manual feed, the next sheet of paper should be inserted after a delay of about 1.5 seconds or more after the previous sheet has been completely drawn into the printer.

### Reference:

Printer throughput is 5.1 sheets/minute (for all paper sizes), given the following conditions.

- Paper should be fed into the printer between 1.5 seconds and time t (below) after the previous sheet has been drawn into the printer.

Paper size	Paper length (mm)	Time t (sec.)
Legal	356	2.0
Letter	279	3.5
A4	297	3.0
B5	257	4.0

Table 1-1 Manual paper feeding (standard sizes)

- When the external device specifies manual feed, the printer outputs TRUE PAPER OUT and NOT READY status signals (RDY goes FALSE) to the external device through the interface. Because of this, the external device should output a TRUE PRINT command (PRNT comes TRUE) within 10 ms after the NOT READY signal becomes FALSE, which means that paper is on the manual feed guide.

## 3. Double-sided printing

Double-sided printing is possible using manual feed. Insert the paper lengthwise along the guide with the side to be printed face up.

**Note:** If the paper curls on the first pass, uncurl it before inserting it into the printer again.

# CHAPTER 2

## OPERATION AND TIMING

This chapter shows the relationships between mechanisms and circuits by means of selected signals. Control signals are indicated by arrows (→), groups of signals by thick arrows (→), and mechanical linkages (chains, gears, shafts, etc.) by striped conduits (→).

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# I. BASIC OPERATION

## A. Functions

Functionally, this printer can be divided into three parts: a system interface, a laser scanner, and a print unit.

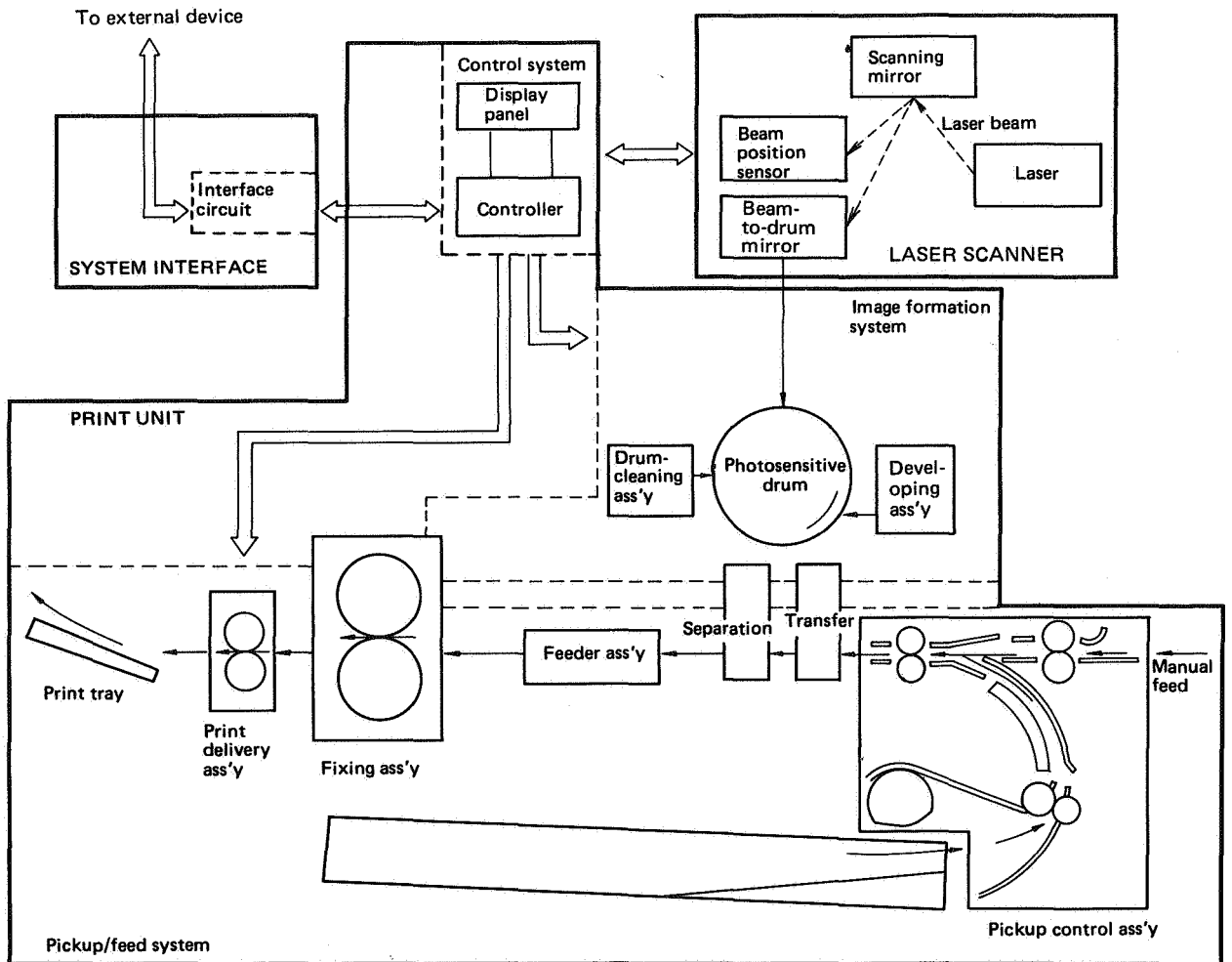


Figure 2-1

## B. Main Drive

The main motor provides all the drive necessary for printing. The main motor is controlled by the DRUM DRIVE command (DRMD) from the DC controller.

The scanner motor rotates the scanning mirror for laser beam scanning on the photosensitive drum. The scanner motor is controlled by the SCANNER DRIVE command (SCNON) from the DC controller.

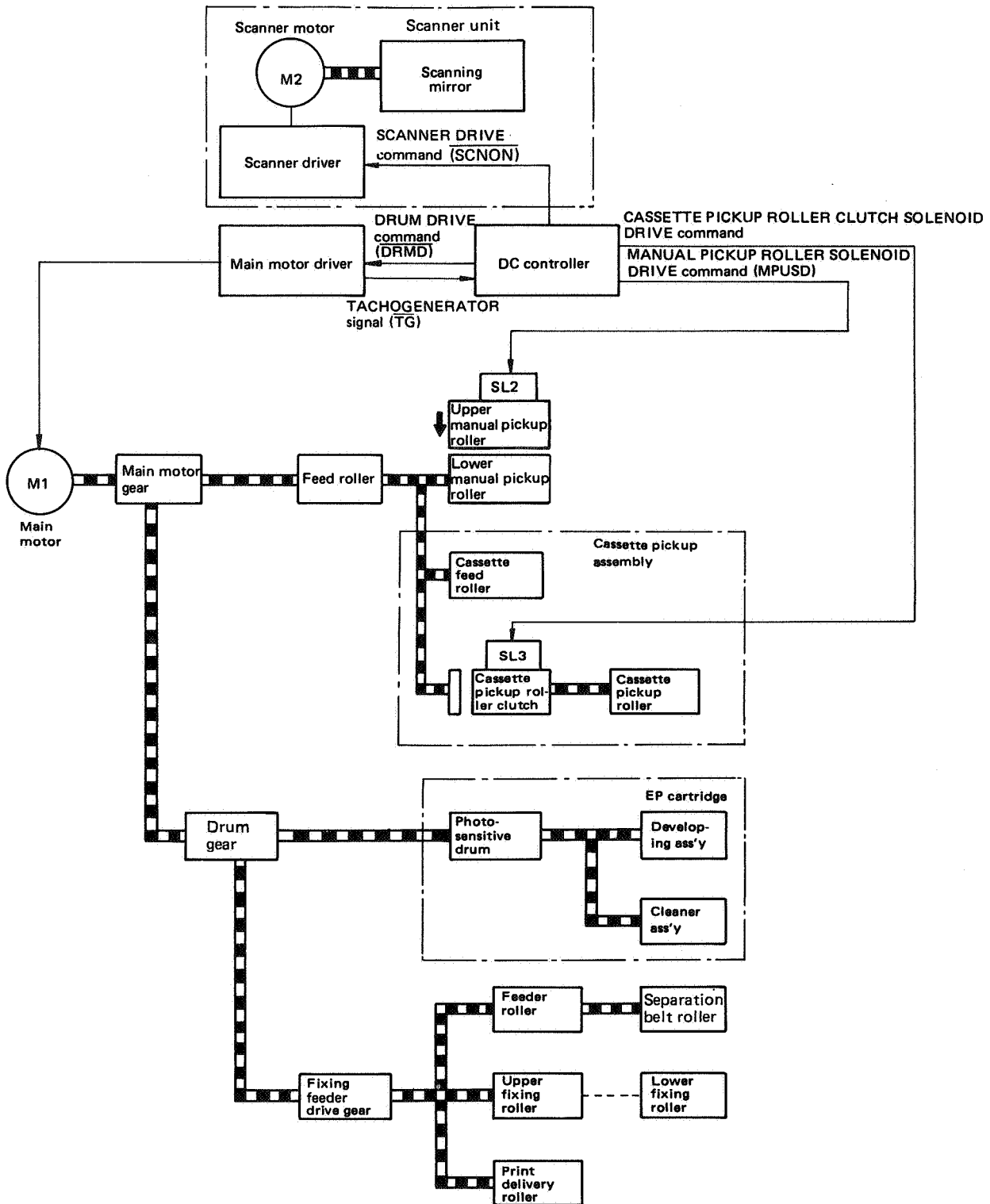
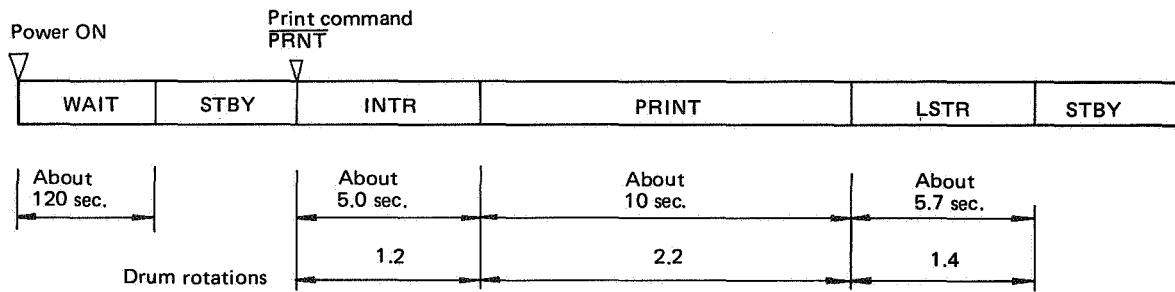


Figure 2-2

### C. Basic Sequence



Note: The sequence is based on the example of printing one sheet of A4 paper.

Figure 2-3

The microcomputer in the DC controller functions as a sequence controller, counting the signals generated by the main motor drive circuit (TACHO-GENERATOR signal ( $\overline{TG}$ )), proportional to main motor rotations. The microcomputer directs printer sequencing and switches electrical components ON and OFF based on the  $\overline{TG}$  signals counted.

#### 1. WAIT (WAIT)

The time required for the fixing roller and laser chip to reach operating temperature is called the WAIT period. The WAIT time is normally about 120 seconds from a cold start (20°C).

When the power is switched ON, the fixing roller heater (upper roller) and the laser chip heater (which controls the laser chip temperature) operates, and the READY/WAIT indicator flashes.

#### 2. STANDBY (STBY)

When the WAIT period is completed, the READY/WAIT indicator changes from flashing to a steady glow. This phase is called STANDBY. The printer is ready to print.

#### 3. INITIAL ROTATION (INTR)

This sequence ensures good drum photosensitivity by putting a uniform layer of charges on the drum, in the preconditioning exposure and primary corona steps.

When the DC controller receives a TRUE PRINT command ( $\overline{PRNT}$ ) from the external device, the DC controller actuates the main and scanner motors, and lights the preconditioning exposure lamps. Along with the main motor, the drum begins rotating. The corona assemblies also begin functioning in sync with drum rotation.

#### 4. PRINT (PRINT)

In this sequence the laser beam is modulated by video signals transmitted from the external device to the DC controller. The modulated laser beam scans

the photosensitive drum. The electrostatic latent image produced on the drum by laser beam scanning is changed to a visible image electrophotographically and printed onto paper. While the previous image is being printed, the DC controller requests the external device to transmit a TRUE  $\overline{PRNT}$  command (for the next page). If a TRUE  $\overline{PRNT}$  command is not received within a specified time, the printer goes on to the LAST ROTATION (LSTR) period.

#### 5. LAST ROTATION (LSTR)

During this period the drum rotates once after printing, preparing the drum for the next printing. If a TRUE  $\overline{PRNT}$  command is not received during LSTR, the drum continues rotating, delivers the paper, are remove and any residual charges on the drum. After LSTR, the drum stops rotating and the printer is in STBY. If the printer receives a TRUE  $\overline{PRNT}$  command, the sequence starts again from INTR.

#### Note:

INTR and PRINT timing are different for different paper sizes and paper feed method (cassette or manual feed).

Sequence Paper feed mode	INTR (sec.)	PRINT (sec.)	
Cassette feed	5.0	LEGAL	9.9
		LETTER	8.6
		B5	8.6
		A4	8.6
Manual feed	9.0	9.9 (all paper sizes)	

Table 2-1 Time periods

## II. LASER/SCANNER

### A. Introduction

The laser driver (part of the DC controller PCB) produces a LASER DRIVE signal (LD) based on the video signal (VDO,  $\overline{VDO}$ ) transmitted from the video controller (through the video interface), which causes the semiconductor laser to generate the laser beam that exposes the rotating photosensitive drum.

The laser driver stabilizes laser beam intensity according to the signals generated by the photodiode in the laser unit, and adjusts beam intensity according to the sensitivity of the drum based on signals from the drum sensitivity identification micro-switches.

As the drum rotates the stationary laser scans the drum by reflecting a beam off a rotating scanning mirror. The result is a raster scan, very much like that which forms the pictures in a television set. The arrangement is shown below.

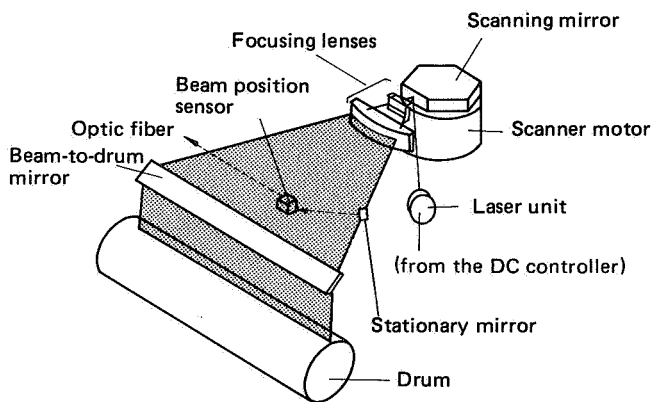


Figure 2-4

The collimating lens aligns the laser light into a thin, parallel beam which strikes the six-faced scanning mirror. Reflecting from the mirror, the laser beam is focused to a tiny spot on the drum surface. If the laser is ON, it exposes the drum at this point. How this exposed point is developed into a visible dot on paper is explained in Section III.

The focusing lenses focus the laser beam onto the drum.

### B. Exposure, Image Formation

The simplest example of image formation is an unmoving laser beam striking an unmoving drum in a single spot. If the image were developed the result would be a white print with a single, tiny, black dot.

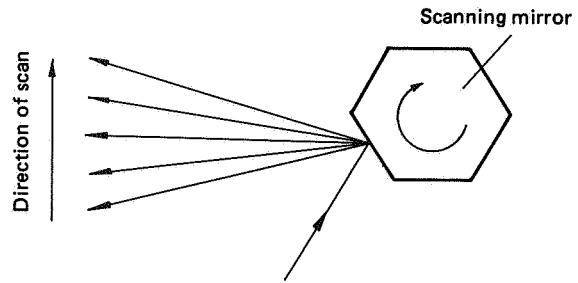


Figure 2-5 Scanning mirror

This printer uses the rotating, six-faced scanning mirror shown in Figure 2-5 to move the laser beam across the drum.

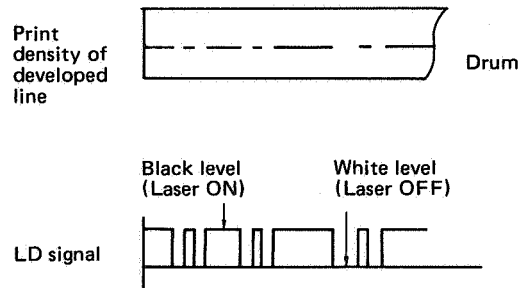


Figure 2-6 A single scan

Figure 2-6 shows a non-rotating drum which is scanned once by the laser beam. The result of a laser pulse train is shown above. A laser exposure results in a black trace when developed.

Actual scanning is accomplished with a rotating drum, so that the resulting scan resembles the raster technique used in television.

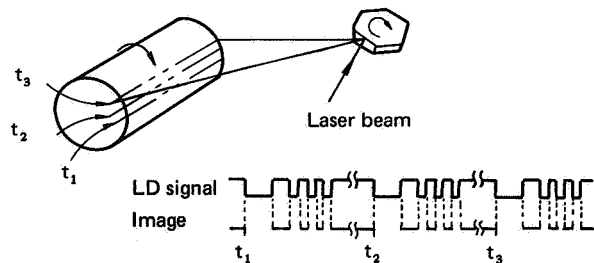


Figure 2-7 Scanning a rotating drum



The drum is rotating at a constant speed. In the time that the beam takes to cross the drum and return to its original position, the drum's surface has shifted downward 1/240 of an inch (240 raster lines/inch model; about 106  $\mu$ ), 1/300 of an inch (300 raster lines/inch model; about 85  $\mu$ ), 1/400 of an inch (400 raster lines/inch model; about 64  $\mu$ ).

To the front left of the drum is a small, stationary mirror which reflects the beam to the beam position sensor, which then sends the reflected beam through an optic fiber to the photodiode of the horizontal sync generator (a part of the DC controller PCB). The horizontal sync generator produces a beam detect pulse (IBD) just before each line is scanned. The IBD pulse informs the microcomputer in the printer that the laser beam is at home position.

### C. Scanner Drive

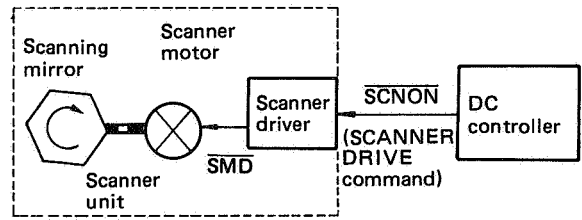


Figure 2-8 Driving the scanner

The heart of the scanner unit is a mirror with six rectangular faces of equal size spaced equally around an axis. (It is a regular hexagon when viewed from the end.) It is manufactured with extreme precision. This mirror rotates at a carefully controlled speed and deflects the stationary laser beam across the rotating drum. The scanner mechanism that provides such precise rotation is a self-contained unit. When required for making a printing sequence, the DC controller outputs a TRUE SCNON command and the scanner driver generates a TRUE SMD signal to cause the scanner motor to rotate, turning the scanning mirror.

### III. PRINT UNIT

The print unit performs the electrophotographic process. The print unit consists of an image formation system, a paper pickup/feed system, and a control system. The timing in the timing chart on the next page begins when a TRUE PRINT command (PRNT) is received by the printer (and the drum starts rotating). The timing chart is correct only if the VERTICAL SYNC signal ( $\bar{V}SYNC$ ) and the VIDEO signal ( $\bar{V}DO$ ,  $\bar{V}DO$ ) are transmitted as shown in Fig. 2-31 (p.2-17).

#### A. Image Formation System

##### 1. Printing system

The printing system performs the following functions: producing an electrostatic latent image, developing the latent image (making the image visible), and transferring the image onto paper. The functions are sequentially controlled by control signals from the DC controller. All of the components required for printing are included in the EP cartridge. The microswitches (MS3, MS4) in the printer judge the sensitivity of the drum based on the notches located on the side of the EP cartridge, and adjust laser beam intensity to one of three levels according to the drum. The construction of the printing system is shown in Figure 2-9.

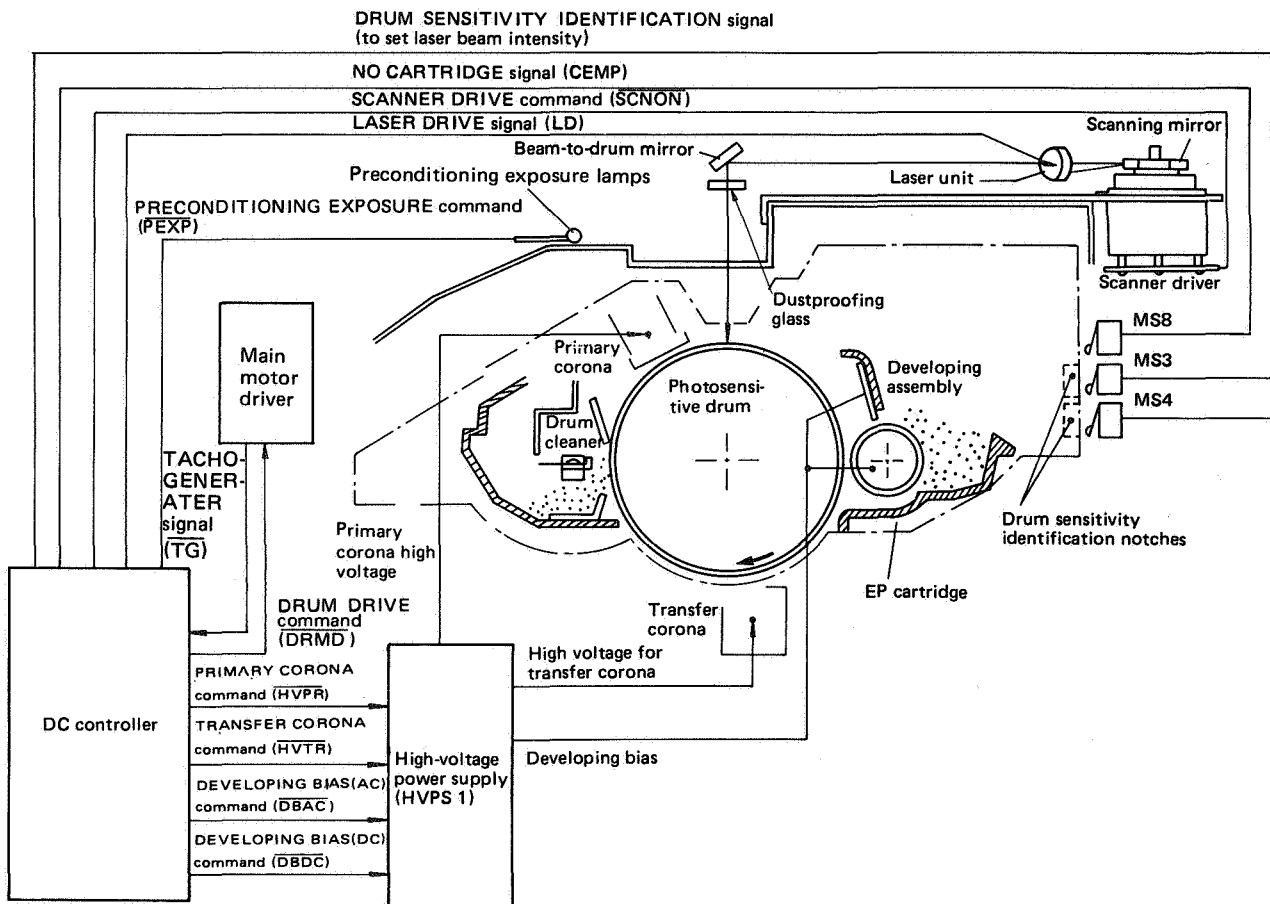


Figure 2-9 Printing signals

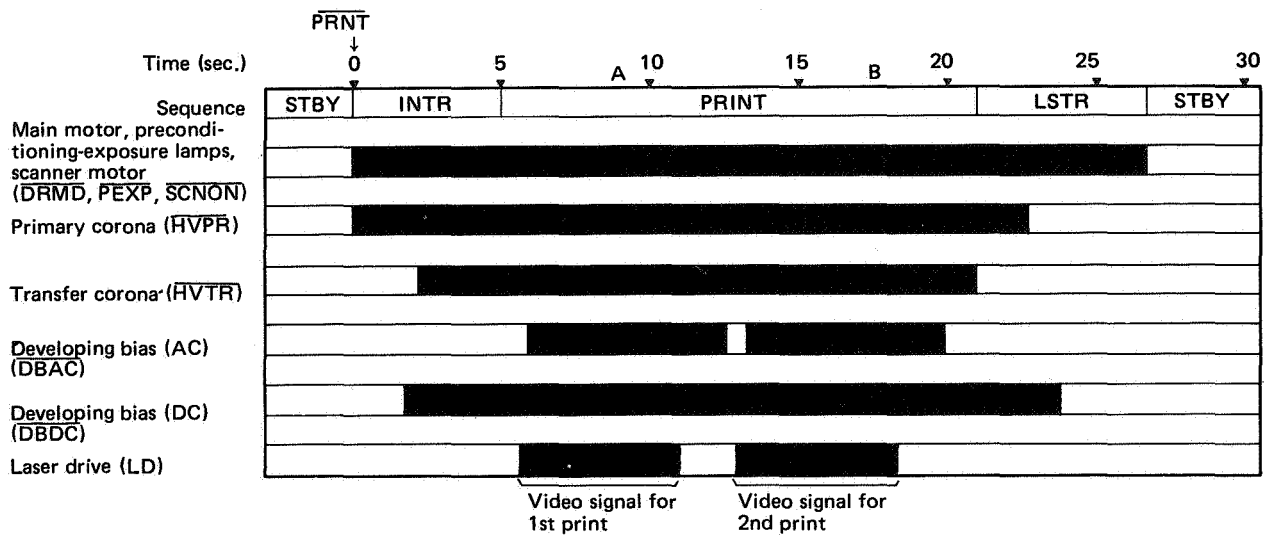


Figure 2-10 Using cassette feed for two consecutive A4 prints

The signals to drive the electrical components are generated by the microcomputer chip on the DC controller PCB. The microcomputer functions as a sequence controller, counting  $\overline{TG}$  signals in sync with main motor rotations when a TRUE  $\overline{PRNT}$  command is received. The microcomputer actuated individual electrical parts based on the count according to specified timing in its ROM program.

#### a. INTR

After receiving a TRUE  $\overline{PRNT}$  command from the external device, the DC controller outputs a TRUE DRUM DRIVE command ( $\overline{DRMD}$ ), PRECONDITIONING EXPOSURE command ( $\overline{PEXP}$ ), and SCANNER DRIVE command ( $\overline{SCNON}$ ).  $\overline{DRMD}$ ,  $\overline{PEXP}$  and  $\overline{SCNON}$  activate the main and scanner motors, and turn the preconditioning exposure lamps on. Along with the main motor, the photosensitive drum begins rotating. In sync with drum rotation, the DC controller microcomputer outputs a TRUE PRIMARY CORONA DRIVE command ( $\overline{HVPR}$ ), DEVELOPING BIAS (DC) command ( $\overline{DBDC}$ ), and TRANSFER CORONA command ( $\overline{HVTR}$ ).

The DC controller switches on the primary corona, the developing bias (DC) and the transfer corona in that order.

#### b. PRINT

The DC controller switches the laser ON and OFF through LASER DRIVE signals (LD). The laser scans the drum via the scanning mirror, producing an electrostatic latent image on the drum. When

the latent image on the drum reaches the developing assembly, the DC controller outputs the DEVELOPING BIAS (AC) command ( $\overline{DBAC}$ ). The developing assembly changes the electrostatic latent image into a visible image by attaching toner onto the latent image.  $\overline{DBAC}$  is set FALSE after forming the toner image for one page. When the toner image reaches the transfer corona, the image is transferred onto paper.

#### c. LSTR

In the example shown in Figure 2-10, the DC controller switches off the transfer corona, primary corona, and developing bias (DC) after image transfer for the second print. After the second print has been delivered, the DC controller turns off the main motor, scanner motor, and preconditioning exposure lamps. The leftover charges on the drum are removed. (This lengthens drum life and prevents uneven images.)

While each print is being made, the DC controller checks whether the video controller has transmitted a TRUE  $\overline{PRNT}$  command (at A and B in Figure 2-10), indicating that another print is to be made. If a TRUE  $\overline{PRNT}$  command is not received, the DC controller waits for a TRUE  $\overline{PRNT}$  for a certain period (about 5 seconds). If a TRUE  $\overline{PRNT}$  command is not received within that period, LSTR begins.

## 2. Printing process

### a. Basic process

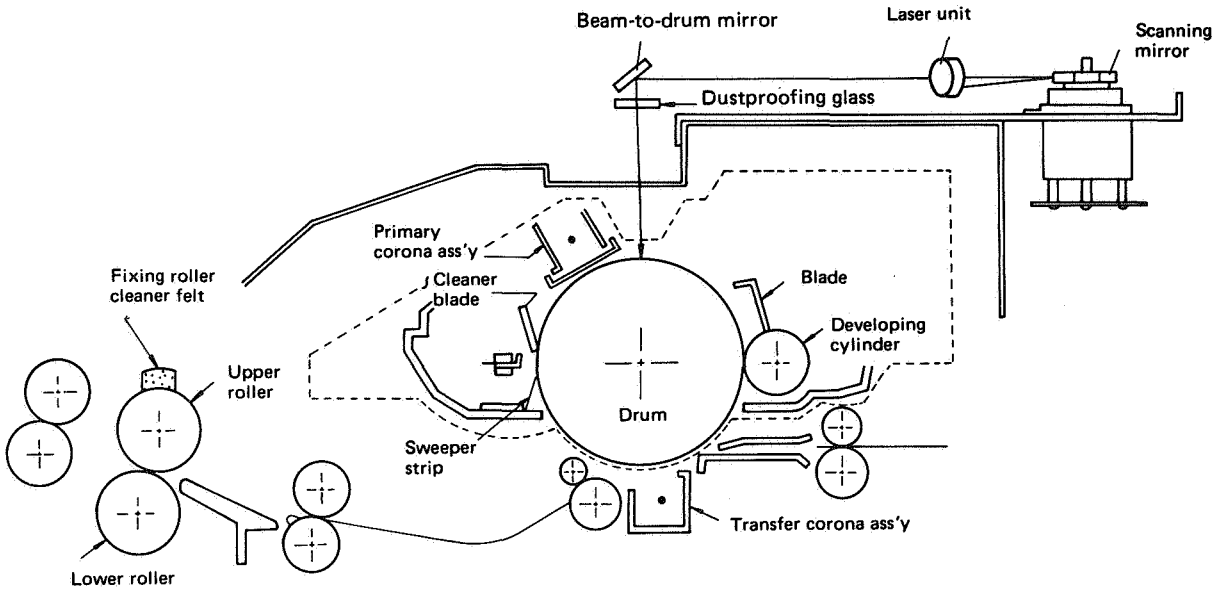


Figure 2-11 The print unit

This printer has a seamless photosensitive drum with the structure shown in Fig. 2-12. The drum consists of an outer layer of an organic photoconductor (OPC) on a conductive aluminum base.

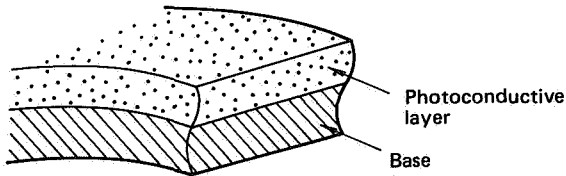


Figure 2-12

The image-forming process can be divided into seven steps. The first three steps constitute one stage, while each other stage is a single step.

- |   |                                   |
|---|-----------------------------------|
| 1) Electrostatic latent image formation stage | — Step 1 Preconditioning exposure |
|   | — Step 2 Primary corona           |
|   | — Step 3 Scanning exposure        |
| 2) Development stage                          | — Step 4 Development              |
| 3) Transfer stage                             | — Step 5 Transfer                 |
| 4) Fixing stage                               | — Step 6 Fixing                   |
| 5) Drum cleaning stage                        | — Step 7 Drum cleaning            |

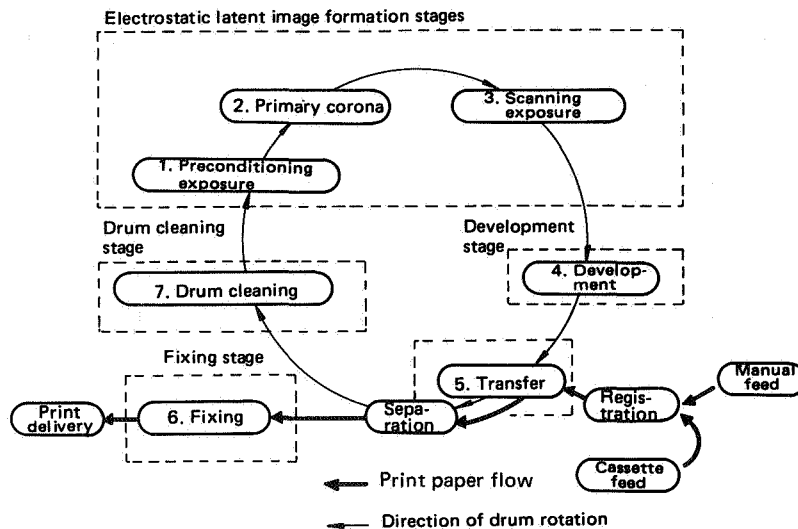


Figure 2-13 Printing stages

### 1) Electrostatic latent image formation stage introduction

This stage has three steps which together produce a pattern of electrical charges on the drum. At the end of the stage, negative charges remain in unexposed areas corresponding to dark areas, and are absent from areas corresponding to light areas where the laser beam exposed the drum.

Since this image of negative charges on the drum is invisible to human eyes, it is called an "electrostatic latent image".

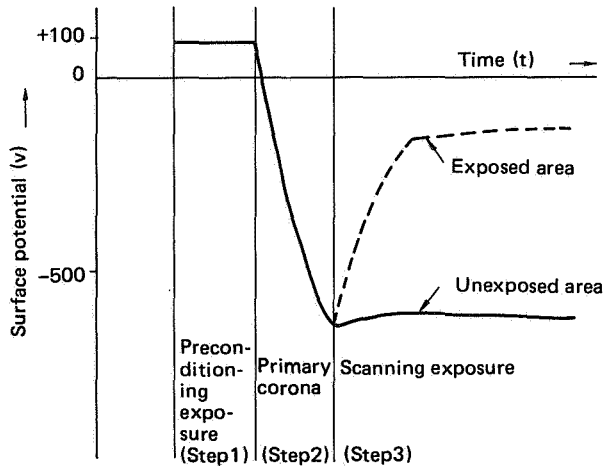


Figure 2-14 Surface potentials

#### Step 1 Preconditioning exposure

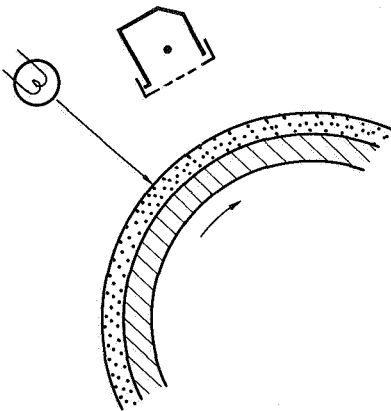


Figure 2-15 Preconditioning exposure

Prior to the primary corona step, the drum is preconditioned by exposure to the preconditioning exposure lamp. This neutralizes any leftover charges on the drum, preparing the drum for uniform primary corona exposure.

#### Reference:

The drum surface potential before the preconditioning exposure lamps turn on is 100V (because

of the positive corona charge from the transfer corona assembly). Drum surface potential does not change even after the preconditioning exposure lamps turn on because the photoconductive layer functions as a rectifier. When receiving light from the preconditioning exposure lamps, the conductive layer of the drum becomes conductive for negative charges on the drum and intercepts positive charges on the drum. That is, positive charges on the drum neither join with the negative charges from the aluminum base of the drum nor disappear, but remain as is.

#### Step 2 Primary corona

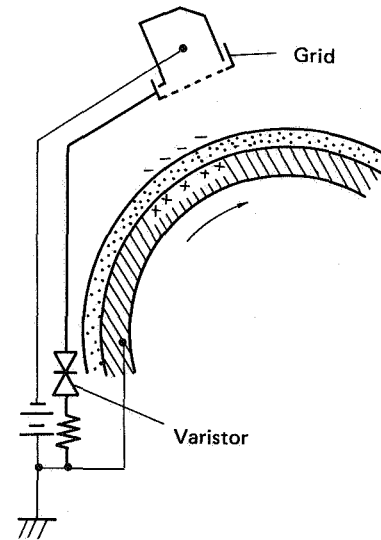


Figure 2-16 Primary corona exposure

The primary corona applies a uniform layer of negative charges over the drum surface. The grid ensures that the charge is distributed uniformly over the drum.

#### Step 3 Scanning exposure

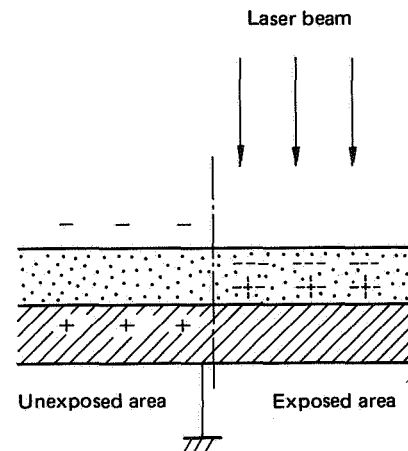


Figure 2-17 Laser beam exposure

The laser beam scans the drum surface. This causes charges in areas where the laser strikes to be neutralized.

## 2) Development stage

Development converts the electrostatic latent image on the drum surface into a visible image composed of toner particles. This printer uses the Toner Projection Development method with a single-component developer.

### Step 4 Development

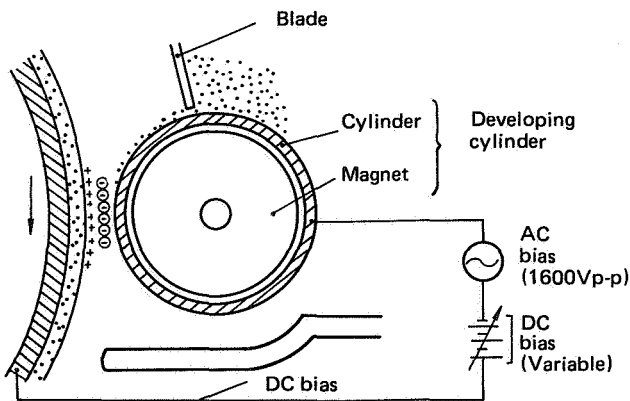


Figure 2-18 Development

**Note:** The potential of the exposed areas of the drum surface is illustrated as positive, though it is actually slightly negative (as shown in Fig. 2-14). This means that the drum surface potential is higher compared with the cylinder potential applied by the DC bias.

As shown in Figure 2-18, the developing assembly consists of a developing cylinder comprising a fixed magnet and cylinder rotating around it, plus a blade of magnetic material. The single-component developer, "toner", is made of pigment, magnetite and a resin binder. The toner is an insulating material, and is charged to a negative potential by friction with the rotating cylinder.

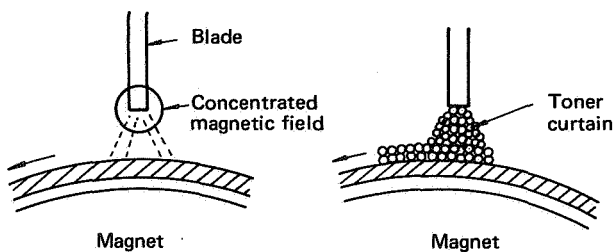


Figure 2-19 Uniform toner application

A concentrated magnetic field develops between the blade and the magnet and attracts toner particles to the edge of the blade where they are held almost immobile, like a curtain. This "curtain" skims the toner particles on the cylinder into a thin, uniform layer.

The laser beam exposed areas on the drum approach the toner layer on the developing cylinder with, compared to the developing cylinder, a higher potential. Toner particles jump and adhere to the drum surface because of the potential difference between the cylinder and the drum surface (which is higher). This process is called "toner projection development". It converts the electrostatic latent image into a visible toner image.

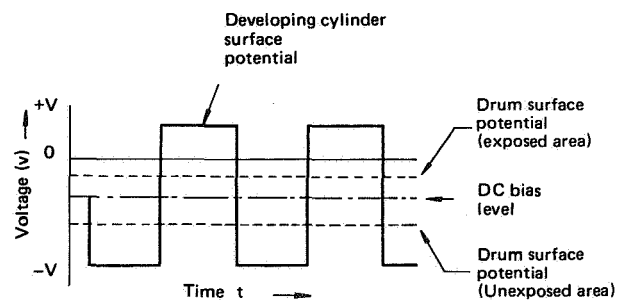


Figure 2-20 AC bias

The AC bias is applied to the developing cylinder to ensure that toner is projected smoothly, thus ensuring sharp contrast in the printed image. The AC bias is also applied to the blade to prevent irregular movement of toner between the blade and cylinder.

The central voltage of the AC bias (1600V<sub>p-p</sub>) varies with the DC bias voltage. A print density adjustment dial is provided on the left panel of the printer for changing the DC bias (and, as a result, the potential difference between the developing cylinder surface and the drum surface).

**Reference: Toner projection development**

Actually, both unexposed and exposed areas on the drum surface have negative potential. To simplify explanation, the potential is represented as positive when it is higher than developing cylinder potential and negative when it is lower than developing cylinder potential.

Latent image	Developing bias	Toner movement electric potentials	Description
	Negative bias		<p>When the attraction of the drum surface charges, combined with repulsion due to the negative potential (bias voltage) applied to the developing cylinder, is sufficient to overcome the attraction of the internal magnet (in the cylinder) on the toner particles, toner is projected toward the drum from the developing cylinder.</p>
Exposed areas	Positive bias		<p>When the bias voltage rises and becomes strongly positive, there is no electrical force to repel toner particles from the cylinder in opposition to the attraction of the internal magnet. Therefore, it is difficult for toner particles to be projected from the cylinder. Instead, toner is attracted back from areas of the drum where an excess of toner was applied to the drum during a negative cycle of the cylinder bias. This improves contrast of the finished print.</p>
Unexposed areas	Negative bias		<p>Little toner is projected toward the drum because the surface potential of the drum is very low, and because the magnet in the cylinder continues to attract toner.</p>
	Positive bias		<p>In this case both the cylinder bias and the magnet are attracting and holding toner to the cylinder. Excess toner in unexposed areas is attracted back to the cylinder. This prevents fogging.</p>

Table 2-2 Toner projection

### 3) Transfer stage

During this stage the toner image is transferred from the drum surface onto print paper.

#### Step 5 Transfer

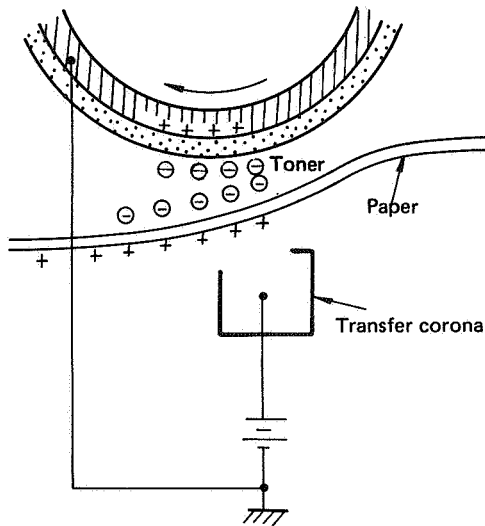


Figure 2-21 Transfer

A positive corona is applied to the back of the paper to attract the negatively charged toner particles to the paper.

### 4) Fixing stage

The toner image transferred onto paper in the transfer stage is held only by electrostatic attraction and slight physical adhesion, so even a light touch will smear the image. This step fixes the toner image by heating the print paper and applying pressure. This fuses the toner particles and presses them onto the paper to make a permanent image.

#### Step 6 Fixing

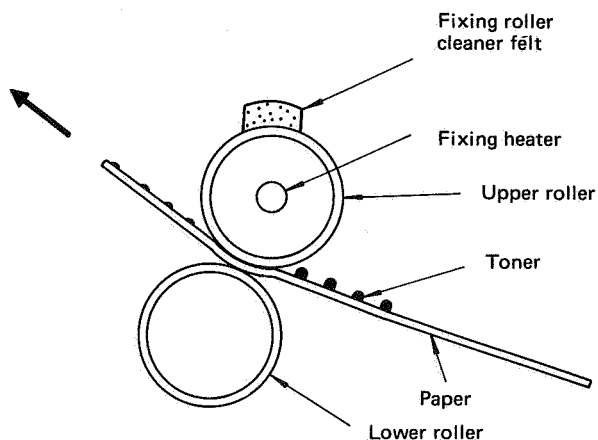


Figure 2-22 Fixing

The surface of the upper roller is coated with PTFE plastic, and the cleaner felt applies silicone oil to it. The non-stick surface of the roller and the oil prevent the paper from sticking to it and prevent offsetting (adhesion of toner from one print to the roller and subsequent transfer of that toner to another print).

### 5) Drum-cleaning stage

In the transfer step, not all the toner is transferred to the paper. In the drum-cleaning stage, any residual toner is cleaned off the drum surface so that the next print image will be clear and distinct.

#### Step 7 Cleaning

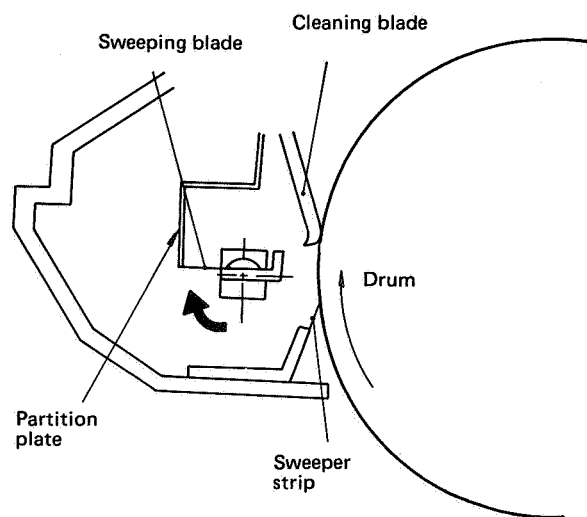


Figure 2-23 Drum cleaning

Toner remaining on the drum is removed by the cleaning blade, and the scraped-off toner is collected by the rotating sweeping blade and pushed to the rear of the cleaner assembly. The sweeper strip prevents the scraped-off toner from scattering out of the cleaner.



## b. Auxiliary processes

### 1) Static-charge eliminators

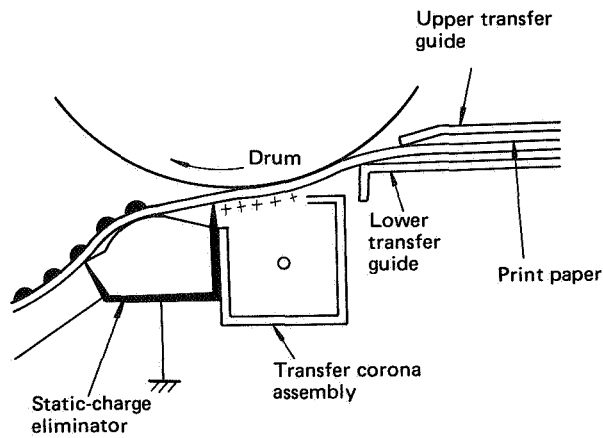


Figure 2-24 Static charge elimination

High-resistance print material, such as OHP film, develops a high electric charge on its rear surface during transfer. When the print separates from the drum at a high speed, this charge can be rearranged, causing toner particles on the other side to move around, producing what appears to be "water spots" on the print.

To prevent the problem, a static-charge eliminator (a row of needle-like conductors that project close to the print) is positioned after the transfer corona assembly to remove charges from high-resistance print material.

### 2) Ozone filter

To prevent ozone (generated by coronas) from leaking out of the machine, a catalytic filter for breaking down ozone is provided next to the exhaust fan (FM1).

## B. Pickup/Feed System

### 1. Outline

Paper can be fed by auxiliary feed (manual feed, external cassette), or from an internal cassette. Control of pickup timing and flow of print paper differ somewhat according to the mode of paper feed.

All rollers, except the upper manual pickup roller and the cassette pickup rollers, are always rotating while the main motor is operating.

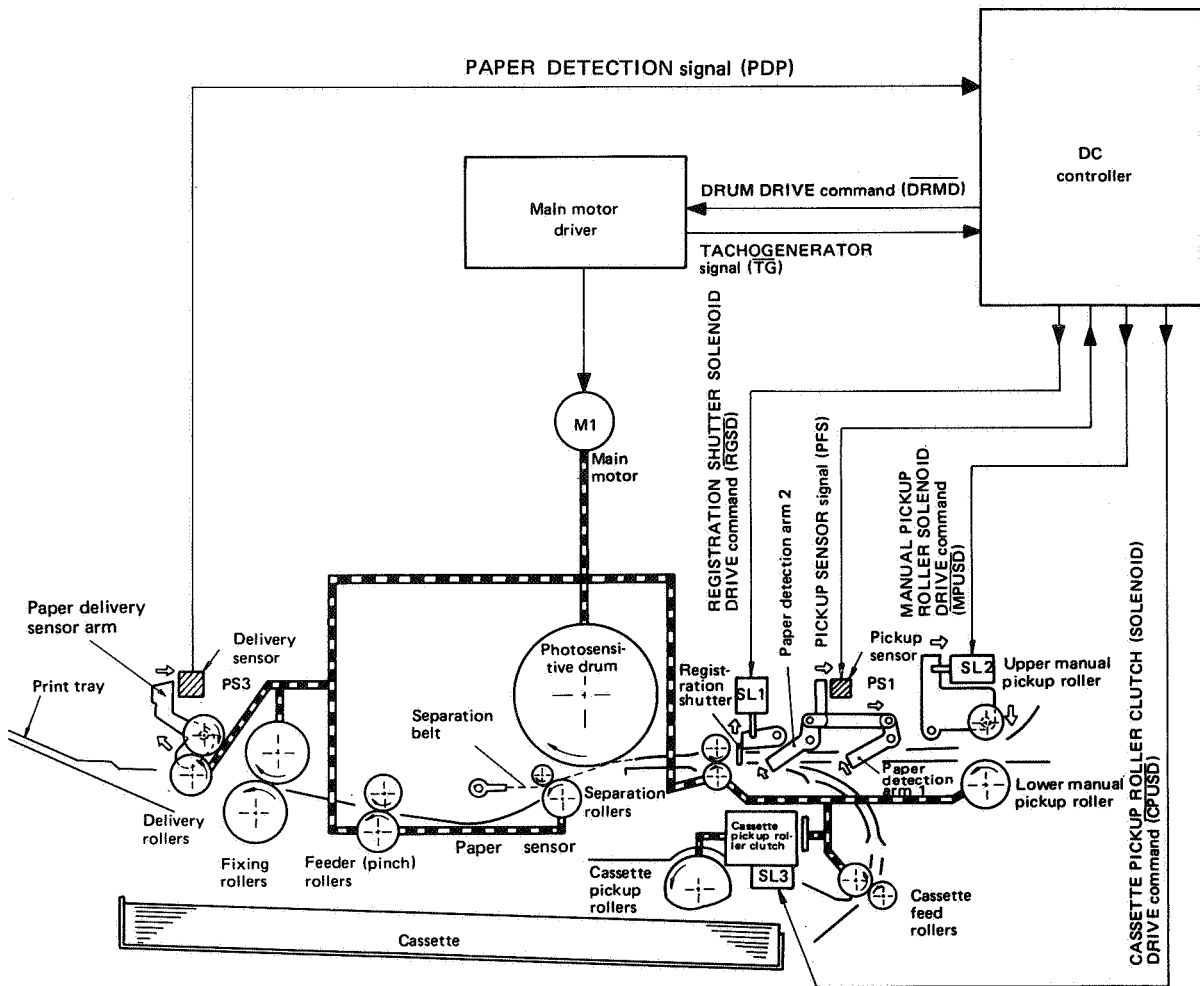


Figure 2-25 Pickup/feed system

## 2. Cassette feed

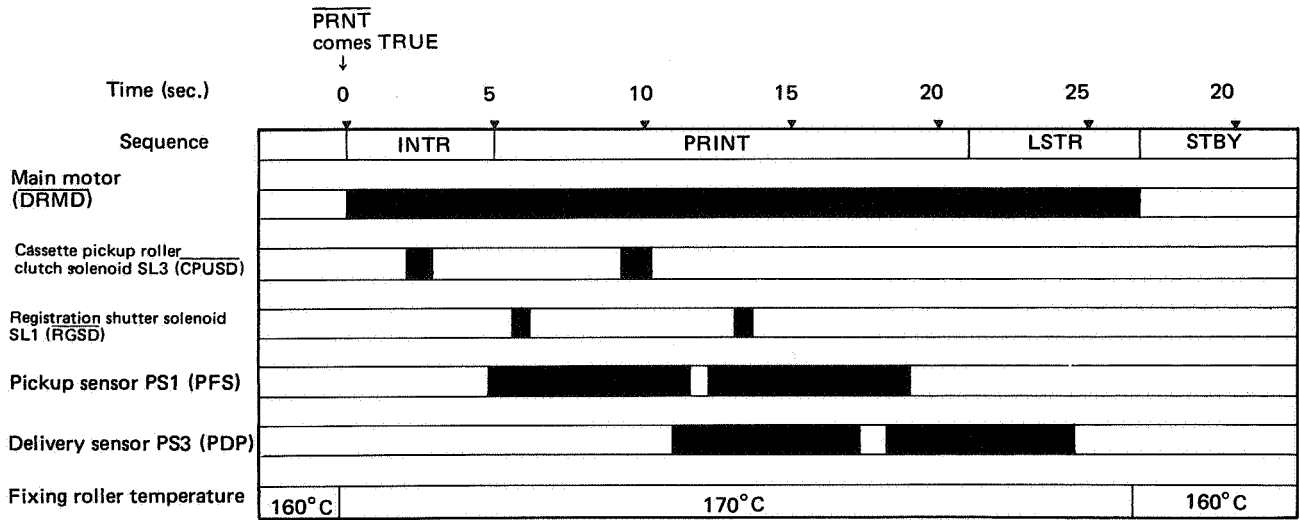


Figure 2-26 Two consecutive A4/Letter size prints

The signals which drive the cassette pickup roller clutch solenoid (SL3) and the registration shutter solenoid (SL1) are generated by the microcomputer on the DC controller. The microcomputer begins counting  $\overline{TG}$  signals (which are synchronous with main motor rotation) as soon as a TRUE  $\overline{PRNT}$  command is transmitted. Based on the count, the microcomputer sends drive signals to control SL3 and SL1.

When the DC controller receives a TRUE  $\overline{PRNT}$  command from the external device, the DC controller outputs a TRUE DRUM DRIVE command ( $\overline{DRMD}$ ) and actuates the main motor. The DC controller energizes the pickup roller clutch solenoid for about 0.9 seconds by outputting a TRUE CASSETTE PICKUP ROLLER CLUTCH SOLENOID command

( $\overline{CPUSD}$ ). At this time, the cassette pickup rollers make one rotation, pickup a sheet of paper from the cassette, and transport it via the cassette feed rollers toward the registration shutter. Since the registration shutter is closed at this time, the paper strikes it and stops.

When the paper is aligned with the leading edge of the image on the drum, the DC controller outputs a TRUE REGISTRATION SHUTTER SOLENOID DRIVE command ( $\overline{RGSD}$ ) and energizes the registration shutter solenoid for 0.5 seconds. Then the registration shutter is raised and the paper is moved into contact with the drum. After transfer, the paper is separated from the drum by the separation belt, carried by the feeder rollers into the fixing assembly, and delivered to the print tray by the delivery rollers.

### 3. Auxiliary feed (manual feed)

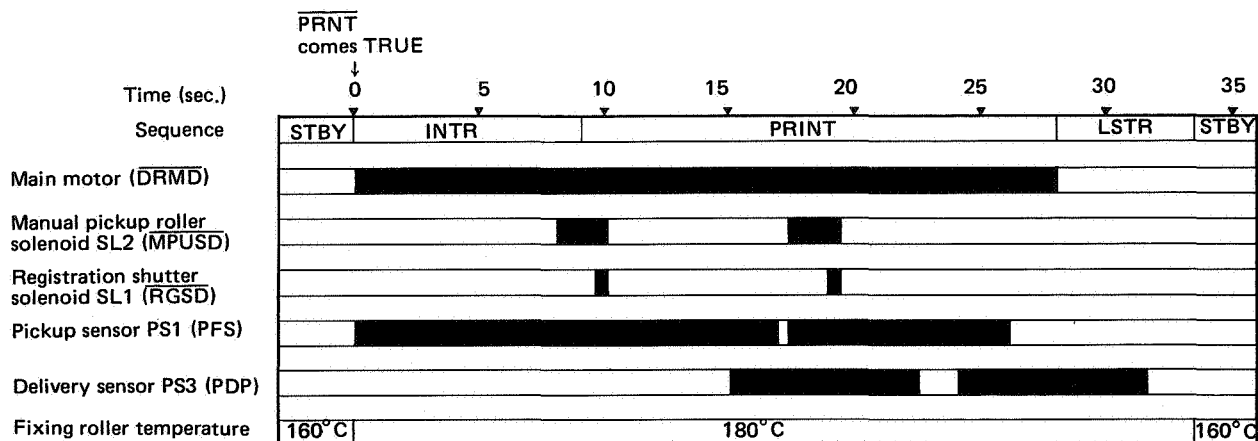


Figure 2-27 Two consecutive legal-size prints

The control signals for the manual pickup roller solenoid (SL2) and the registration shutter solenoid (SL1) are generated by the microcomputer on the DC controller. When a TRUE  $\overline{\text{PRNT}}$  command is received by the DC controller and there is paper set in the manual feed tray, the microcomputer actuates the main motor and begins counting the  $\overline{\text{TG}}$  signals produced in sync with main motor rotation. Based on the counted  $\overline{\text{TG}}$  signals, the microcomputer generates the signals which control the manual pickup roller solenoid and the registration shutter solenoid.

Upon receiving a true  $\overline{\text{PRINT}}$  command from the external device, the DC controller checks the pickup sensor signal (PFS) to detect whether there is paper on the manual feed tray. If paper is ready, the DC controller outputs a TRUE DRUM DRIVE command ( $\overline{\text{DRMD}}$ ) and actuates the main motor. Then the DC controller outputs a TRUE MANUAL PICKUP ROLLER SOLENOID DRIVE command ( $\overline{\text{MPUSD}}$ ) (timing as shown in Fig. 2-27), thus energizing the manual pickup roller clutch solenoid for about 2

seconds. One sheet of paper is transported toward the registration shutter. Since the registration shutter is closed at this time, the paper strikes it and stops.

When the paper is aligned with the leading edge of the image on the drum, the DC controller outputs a TRUE REGISTRATION SHUTTER SOLENOID DRIVE command ( $\overline{\text{RGSD}}$ ) and energizes the registration shutter solenoid for 0.5 seconds. The registration shutter is raised and the paper is moved into contact with the drum. After transfer, the paper is separated from the drum by the separation belt, carried by the feeder rollers into the fixing assembly, and delivered to the print tray by the delivery rollers.

**Note:**

In auxiliary feed (manual) mode, the process time of PRINT does not vary with paper size. The process time is that for legal-size paper.

The process time for INTR is 4 seconds longer than for cassette feed, increasing the fixing temperature by 10°C more than for cassette feed, thus ensuring proper image fixing on thick paper.

## IV. SYSTEM INTERFACE

### A. Handshaking Signals

The standard video interface circuit is part of the DC controller PCB and is normally provided with this printer. The standard interface processes ordinary video signals generated by an external device (usually a computer) and is responsible for handshaking signals when initiating data transmission. A knowledge of these signals is necessary to interface the printer.

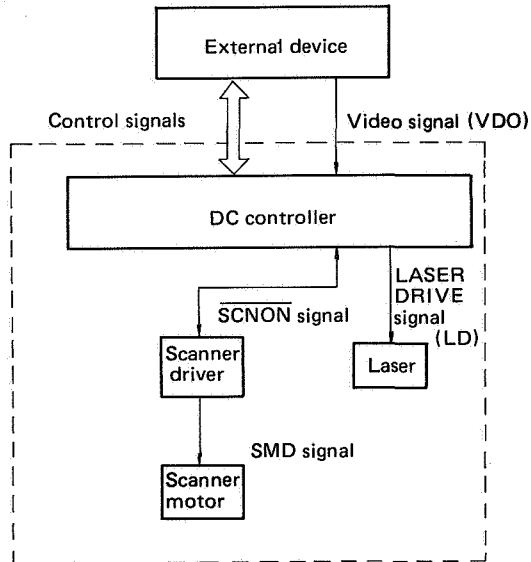


Figure 2-28 Interface signals

The printer enters the WAIT state when the power is switched ON. After the WAIT phase, the printer generates a TRUE  $\overline{\text{RDY}}$  signal to notify the external device that the printer is now READY for printing. The external device then sends a TRUE PRINT command ( $\overline{\text{PRNT}}$ ) to the DC controller. The photosensitive drum starts rotating and the DC controller sends a TRUE VERTICAL SYNC REQUEST command ( $\overline{\text{VSREQ}}$ ) to the external device. The external device sends a TRUE VERTICAL SYNC signal ( $\overline{\text{VSYNC}}$ ).

The external device also receives a HORIZONTAL SYNC signal in regular pulses ( $\overline{\text{BD}}$ ,  $\overline{\text{BD}}$ ), synchronizes the VIDEO signal ( $\overline{\text{VDO}}$ ,  $\overline{\text{VDO}}$ ) vertically (with  $\overline{\text{VSYNC}}$ ) and horizontally (with  $\overline{\text{BD}}$ ,  $\overline{\text{BD}}$ ), and sends a synchronized VIDEO signal to the DC controller. The DC controller interface processes this signal for the laser driver (part of the DC controller PCB), which turns the laser ON and OFF accordingly. The laser scans the drum to produce the electrostatic latent image on the drum. (See Chapter 3 for details.)

The printer is plugged into the external device through the I/O connector shown below.

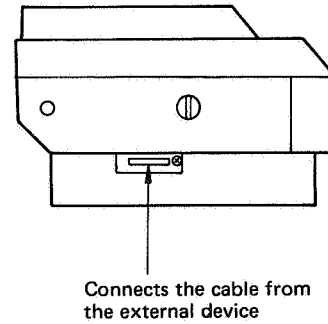


Figure 2-29 Printer connection

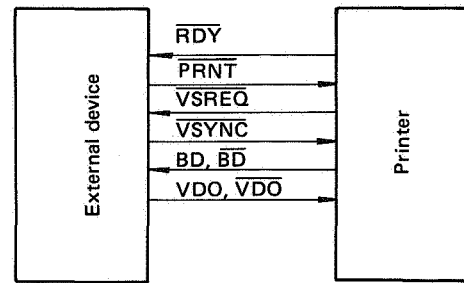


Figure 2-30 Interface signal lines

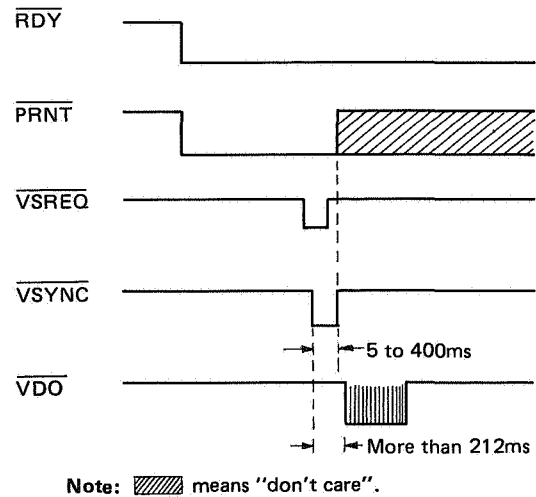
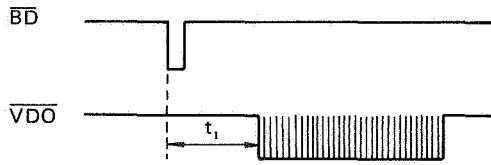


Figure 2-31 Timing of  $\overline{\text{PRNT}}$ ,  $\overline{\text{VSYNC}}$ , and  $\overline{\text{VDO}}$  for one print



$t_1$ :  $t_1$  is the time for making a finished print with a left margin.

Figure 2-32  $\overline{VDO}$  (horizontal scan) timing chart

Paper size (horizontal x vertical axis)	$t_1$
Letter (215.9 mm x 279.4 mm)	135.5 $\mu s^*$ (108.4 $\mu s$ )
A4 (210.0 mm x 297.0 mm)	182.2 $\mu s^*$ (145.8 $\mu s$ )
B5 (182.0 mm x 257.0 mm)	404.0 $\mu s^*$ (323.2 $\mu s$ )

\* 240 lines per inch. Values in parentheses indicate 300 lines per inch.

$t_1$ :  $t_1$  is the time for making a finished print with a left margin of 8mm.

If the left margin is to be widened by 1mm, add about 7.9 $\mu s$  (240 lines per inch) and about 6.3 $\mu s$  (300 lines per inch) to  $t_1$  in this Table. If the left margin is to be narrowed by 1mm, reduce  $t_1$  by the same amount.

Table 2-3  $\overline{BD}$  timing

## B. VIDEO Signal

Besides handshaking with the external device, the video interface receives a VIDEO signal ( $\overline{VDO}$ , VDO) from the external device, processes it into an internal VIDEO signal, then transmits it to the laser driver (part of the DC controller PCB). Figure 2-33 below illustrates the relationship between the  $\overline{VDO}$  signal and drum exposure.

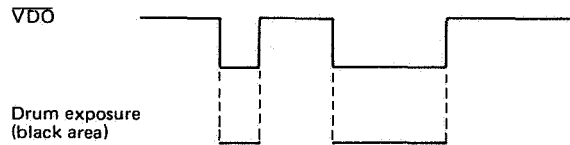


Figure 2-33 Effect of the  $\overline{VDO}$  signal on drum exposure

# CHAPTER 3

## THE ELECTRICAL SYSTEM

Signal levels in digital circuits are LOW or HIGH. If a signal name has no bar over it (e.g., FSRD), a HIGH SIGNAL IS A TRUE signal, and a LOW signal is a FALSE signal. If a signal name has a bar over it (e.g.,  $\overline{\text{FSRD}}$ ), a LOW signal is TRUE and a HIGH signal is a FALSE signal.

The actual voltage for a LOW signal is ground (zero volts) or very close to it. The voltage for a HIGH signal depends on the circuit.

For simplicity, most circuits are represented by block diagrams, and detailed description of internal operation is omitted.

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II. REFERENCE LISTS .....	3- 2	VI. POWER SUPPLIES .....	3-51
III. PRINT PROCESS .....	3-14	VII. TIMING CHART FOR DC CONTROLLER INPUTS/OUTPUTS .....	3-54
IV. LASER/SCANNER .....	3-21		





## I. OUTLINE OF THE ELECTRICAL SYSTEM

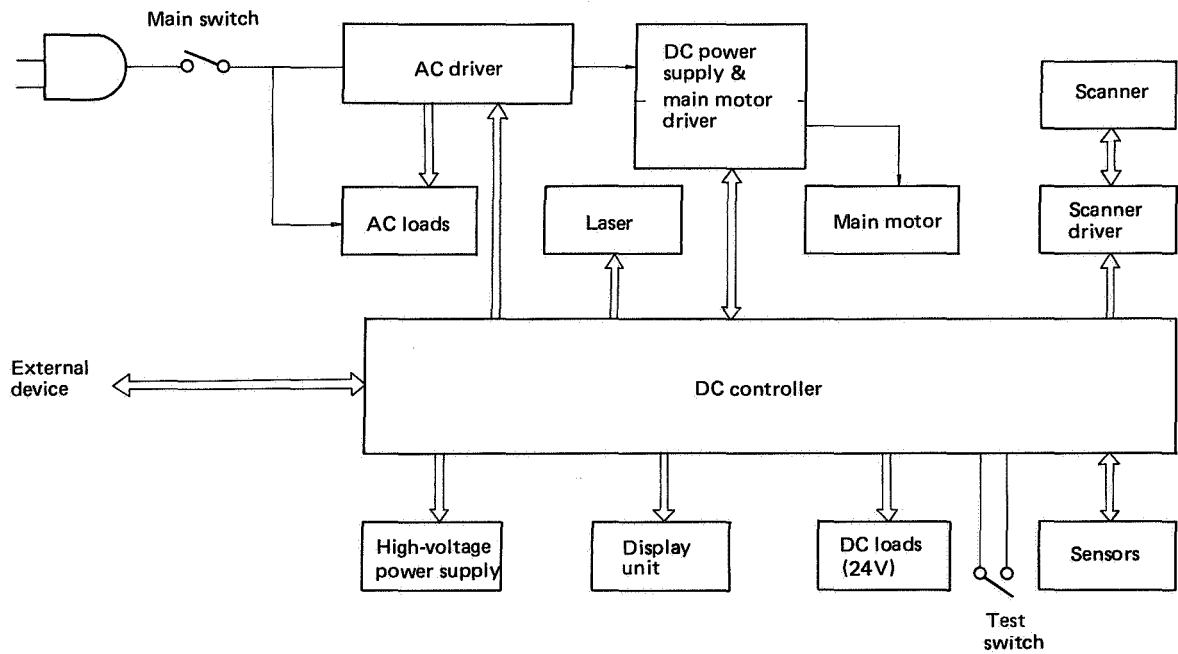
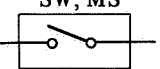
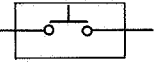
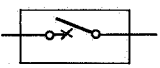
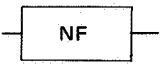
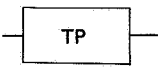
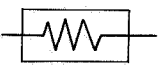
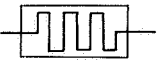
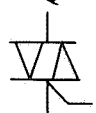
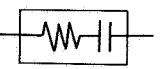
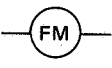


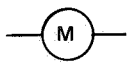
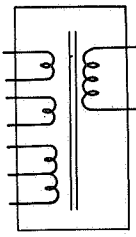
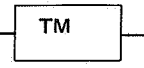

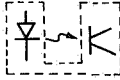
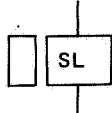


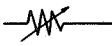
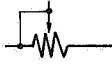
Figure 3-1 Electrical system

Control of most electrical components in this printer is by a microcomputer on the DC controller PCB. This microcomputer receives information from sensors, the Test switch, and the external device. Using a built-in program, this microcomputer directs the operation of AC loads (via the AC driver), the laser, the scanner (via the scanner driver), the main motor (via the main motor driver), the high-voltage power supply, DC loads, and the display unit.

## II. REFERENCE LISTS – COMPONENTS, LEDs, SIGNALS, PCBs; PCB LAYOUT

### A. Component Symbols, Functions

Symbol	Type	Code	Function
 	Switches	SW1 SW2 MS1 MS2 MS3 MS4 MS5 MS6 MS7 MS8	Power switch Test switch Door switches Drum sensitivity detection Cassette size switches NO CARTRIDGE detection
	Circuit breaker	CB1	Protects all loads
	Noise filter	NF1 NF2	Power line noise filter AC line noise filter
	Thermoprotector	TP1	Protects the fixing heater assembly from excessive temperature (245°C)
	Thermistor	TH1	Senses upper fixing roller surface temperature
	Heater	H1	Fixing roller heater (500W)
	Triac	Q1	Controls fixing roller heater
	Noise suppressor	SQ1	Eliminates electrical noise (voltage spikes) from lines to protect Q1
	Fan	FM1	Cooling fan

Symbol	Type	Code	Function	
<p>M</p> 	Motor	M1	Main motor	
<p>PT</p> 	Low-voltage transformer	PT1 PT2	For DC power supply & main motor driver PCB For DC power supply for the video controller PCB	
<p>TM</p> 	Timer	TM1	Used for the total counter	
<p>LA</p> 	Lamps	LA1 LA2 LA3 LA4 LA5	} Preconditioning exposure lamps	
<p>PS</p> 	Photointerrupters	PS1 PS2 PS3		Pickup detection PAPER OUT detection Delivery detection
<p>SL</p> 	Solenoids	SL1 SL2 SL3		Control of registration shutter Control of manual pickup roller Control of clutch of cassette pickup roller
<p>LED</p> 	LEDs	LED1 LED2 LED3 LED4 LED5		READY/WAIT indicator DATA indicator ON LINE indicator AUX FEEDER indicator FORM FEED indicator
<p>VZ</p> 	Varistor	VZ1		Regulates grid bias voltage of the primary corona ass'y
	Variable resistors	VR1	Control of voltage of grid bias on primary corona	
		VR2	Control of print density	

**B. Layout of Electrical Components**  
 1. Electrical components (1 of 2)

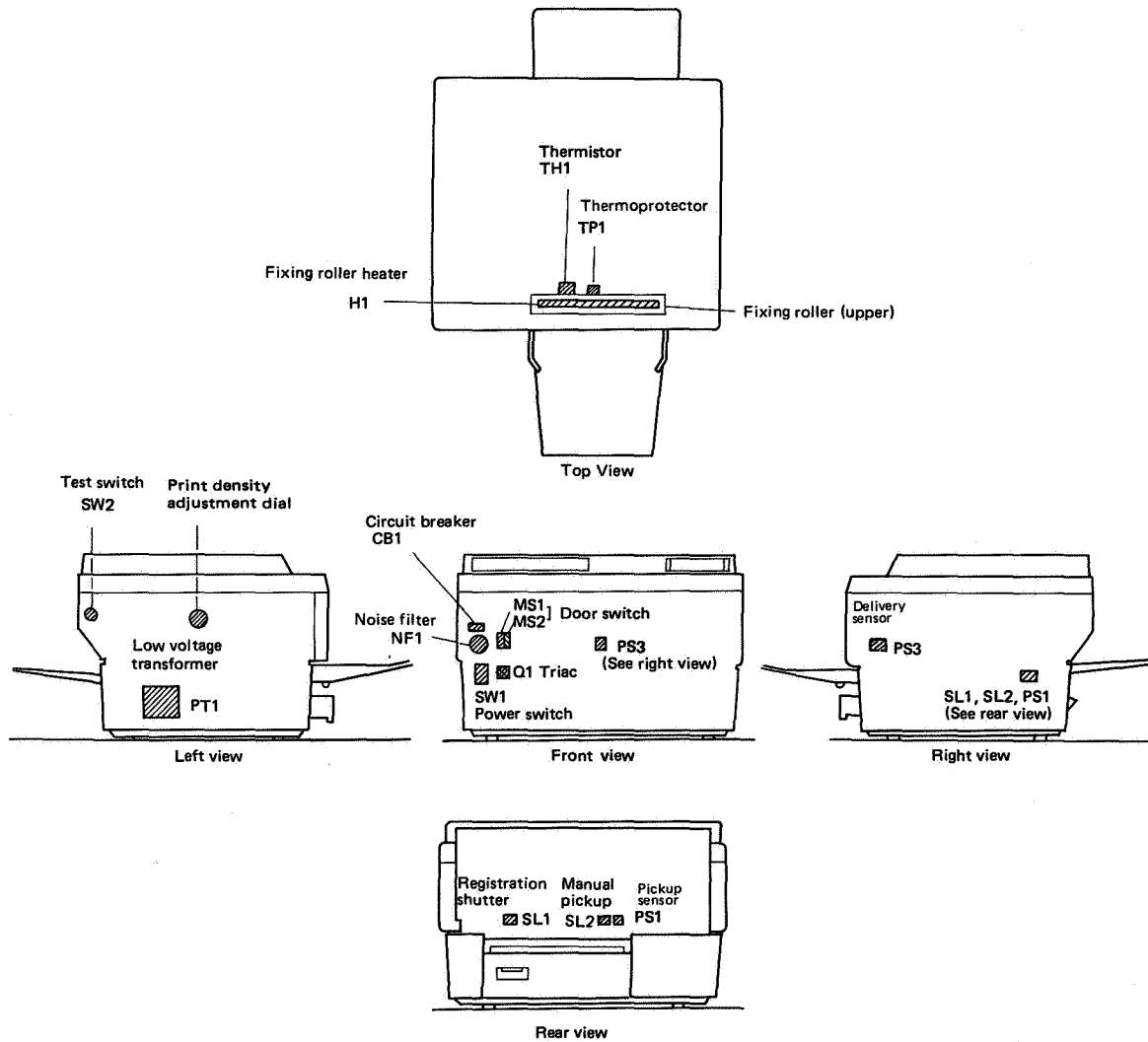


Figure 3-2

Electrical components (2 of 2)

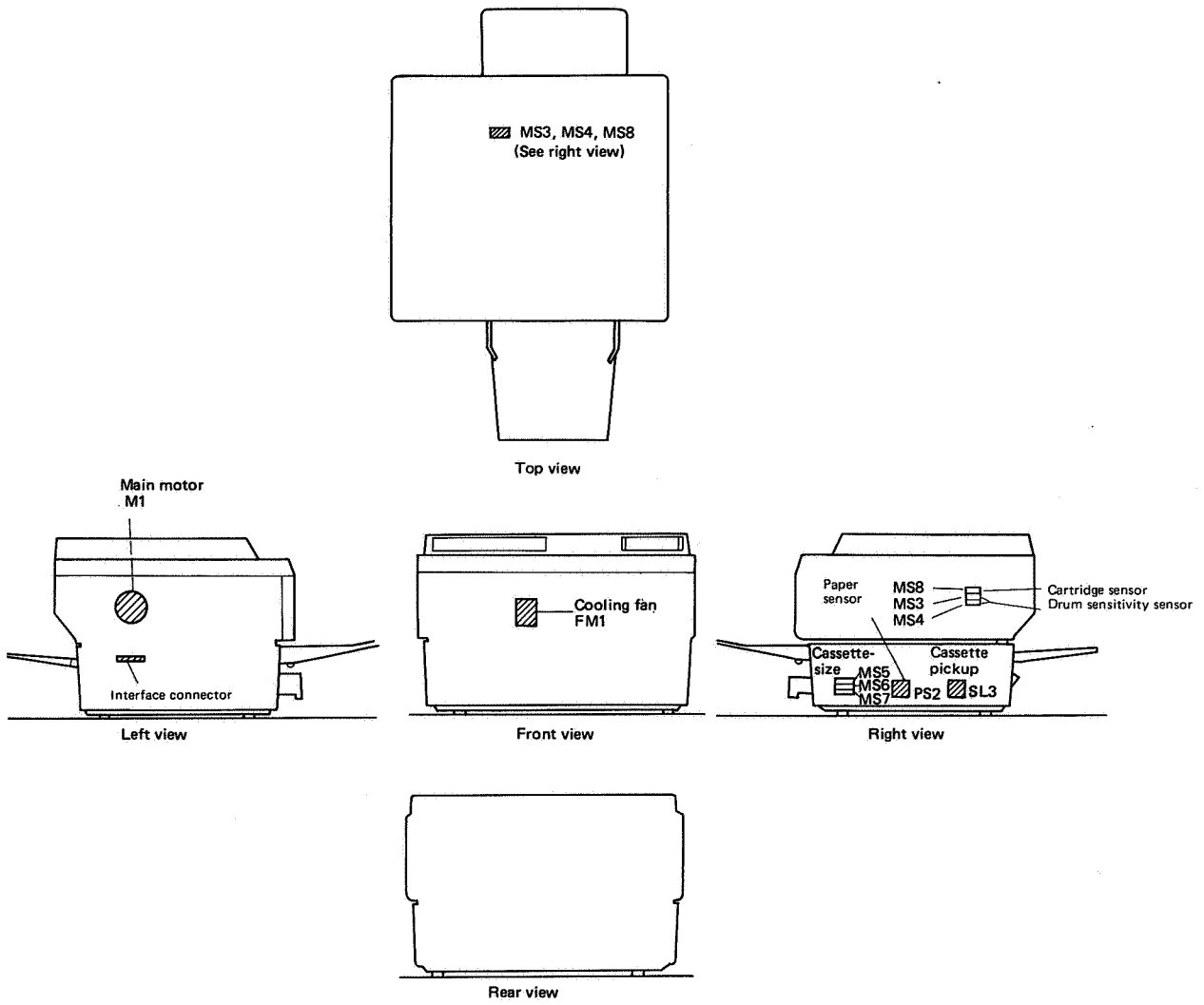


Figure 3-3

2. Printed circuit boards

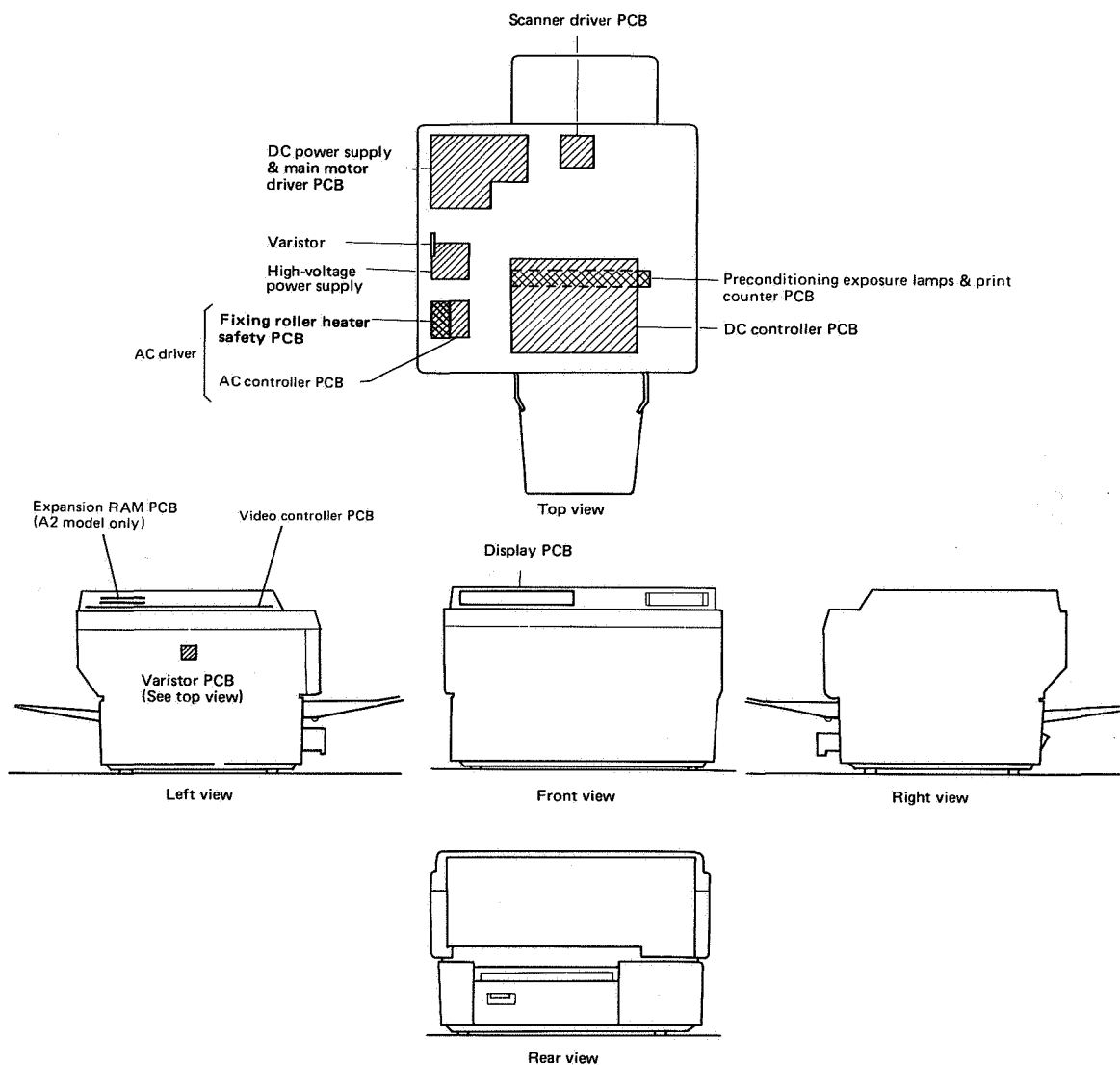


Figure 3-4

C. Signal list

1. DC controller I/O signals

Abbreviation	Name	Function
ACP	AC PULSE signal	Control power to the fixing roller heater using a zero-cross circuit
BD, $\overline{BD}$	BEAM DETECT (HORIZONTAL SYNC) PULSE) signal	Indicates the beginning of a new line
$\overline{CBSY}$	COMMAND BUSY signal	Indicates that command information (cassette feed specification, auxiliary feed (manual feed) specification, etc.) is being sent from the video controller to the DC controller.
CEMP	NO CARTRIDGE signal	Indicates no cartridge
CPRDY	CONTROLLER POWER READY signal	Indicates that power for the video controller is ON
$\overline{CPUSD}$	CASSETTE PICKUP ROLLER CLUTCH SOLENOID DRIVE command	Actuates SL3
$\overline{CSENS1}$	DRUM SENSITIVITY IDENTIFICATION signal	Indicates drum sensitivity
$\overline{CSENS2}$	DRUM SENSITIVITY IDENTIFICATION signal	Indicates drum sensitivity
$\overline{DBAC}$	DEVELOPING BIAS (AC) DRIVE command	Switches on developing bias (AC)
$\overline{DBDC}$	DEVELOPING BIAS (DC) DRIVE command	Switches on developing bias (DC)
$\overline{DRMD}$	DRUM DRIVE command	Actuates M1
DSADJ	PHOTODIODE SENSITIVITY ADJUSTMENT signal	Adjusts sensitivity of photodiode that measures laser intensity
$\overline{FSRD}$	FIXING ROLLER HEATER DRIVE command	Actuates H1
FSRTH	FIXING ROLLER TEMPERATURE signal	Indicates fixing heater temperature
HMSK	HORIZONTAL MASK command	Inhibits the laser beam from "writing" on non-image areas (cross feed direction)
$\overline{HVPR}$	PRIMARY CORONA DRIVE command	Enables the primary corona
HVRST	HIGH-VOLTAGE RESET signal	Switches off transfer and primary corona and developing bias
$\overline{HVTR}$	TRANSFER CORONA command	Enables the transfer corona
LD	LASER DRIVE command	Drives laser output
$\overline{LSRHD}$	LASER HEATER DRIVE command	Actuates the heater in the laser unit
LSRTH	LASER TEMPERATURE signal	Indicates laser chip temperature
$\overline{MPUSD}$	MANUAL PICKUP ROLLER SOLENOID DRIVE command	Actuates SL2
PD	LASER POWER SENSOR signal	Indicates the laser power
PDP	DELIVERY SENSOR signal	Indicates that a finished print has been delivered
PEMP	PAPER SENSOR signal	Indicates no paper in cassette
PEXP	PRECONDITIONING EXPOSURE	Causes the drum to be uniformly exposed
PFS	DRIVE command	Indicates that pickup sensor PS1 senses paper
PPRDY	PICKUP SENSOR signal	Indicates that power for the print unit is ON
PRNT	PRINTER POWER READY signal	Starts printing
PSIZE1	PRINT command	Indicate whether the cassette is installed and cassette size
PSIZE2	PRINT command	
PSIZE3	PRINT command	
RDY	PAPER SIZE signals READY signal	Indicates that printing is possible
RDYINH	READY INHIBIT command	Enables printing though the print unit is NOT READY
$\overline{RGSD}$	REGISTRATION SHUTTER SOLENOID DRIVE command	Actuates SL1
SBSY	STATUS BUSY signal	Indicates that the status information of paper out, jam, etc., is being sent from the DC controller to the video controller

Abbreviation	Name	Function
$\overline{SC}$	Status/Command message signal	Status information (paper out, jam, etc.) which the DC controller sends to the video controller, or command information (cassette feed specification, manual feed (manual feed) specification, etc.) which the video controller sends to the DC controller. (bidirectional)
$\overline{SCLK}$	Status/Command message clock	Clock signal for $\overline{SC}$ line
$\overline{SCNON}$	Scanner drive command	Drives scanning mirror rotation
$\overline{SCNRDY}$	Scanner ready signal	Indicates that the scanning mirror is motor at the correct speed
$\overline{TG}$	Tachogenerator signal	Generates a pulse signal proportional to main motor speed (about 1.3 ms cycle)
TM (+)	Print counter drive command	Advances the electronic counter that registers total number of prints made
TM (-)		
TPAN	Test pattern select signal	Selects a combination of the test patterns
TPBN		
$\overline{TSTPT}$	Test print command	Causes a test print to be made
$\overline{TSTPTE}$	Test pattern enable command	Enables selection of test patterns by TPAN and TPBN
VDO, $\overline{VDO}$	Video signal	Provides image data for printing
VMSK	Vertical mask command	Inhibits the laser beam from "writing" on non-image areas (paper feed direction)
$\overline{VSREQ}$	Vertical sync request command	Requests the video controller to send a TRUE $\overline{VSYNC}$ to the printer
$\overline{VSYNC}$	Vertical sync pulse	Indicates the beginning of a new page

**D. PCB List**

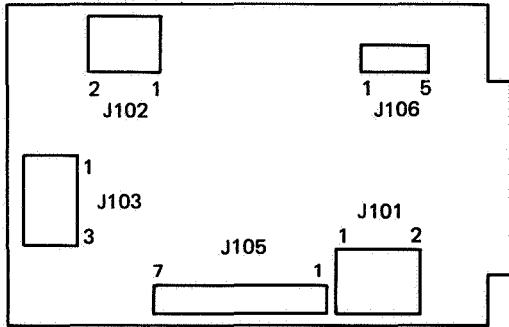
1. AC controller
2. Fixing roller heater safety
3. DC controller
4. Preconditioning exposure lamps & print counter
5. Scanner driver
6. Varistor
7. Control panel

8. DC power supply & main motor driver
9. High-voltage power supply

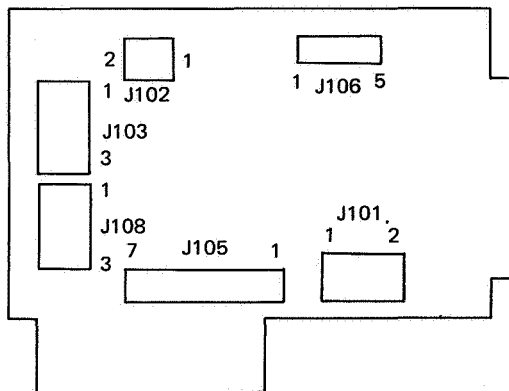
2. Fixing roller heater safety PCB

**E. Layouts of Electrical Components on PCBs (1 of 4)**

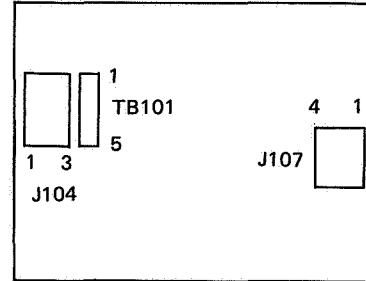
1. AC controller PCB



(115V/60Hz only)



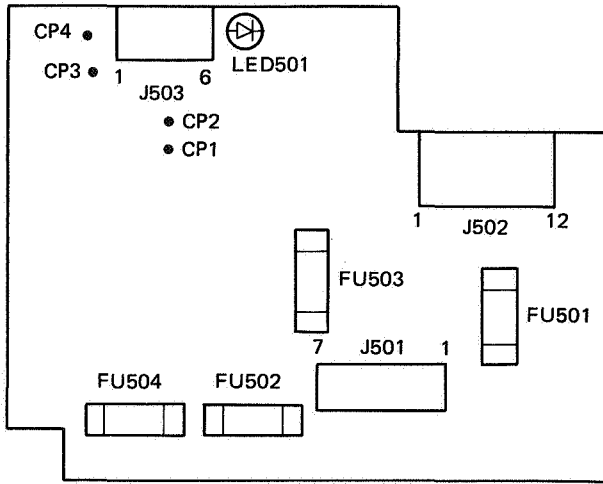
(220V/240V 50Hz only)



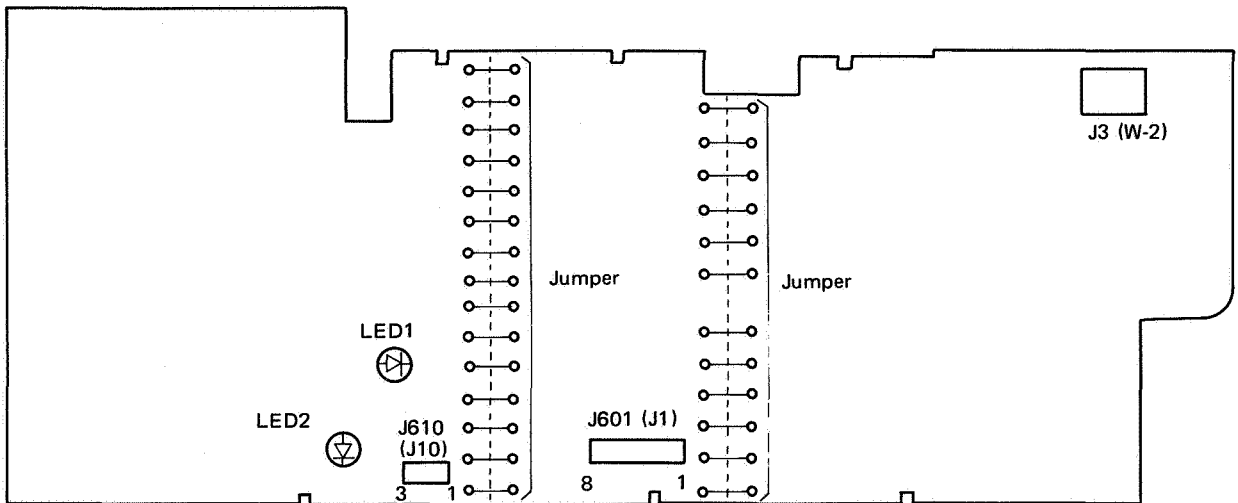


Layouts of Electrical Components on PCBs (3 of 4)

8. DC power supply & main motor driver PCB



9. High-voltage power supply PCB



### III. PRINT PROCESS

#### A. Print Sequences

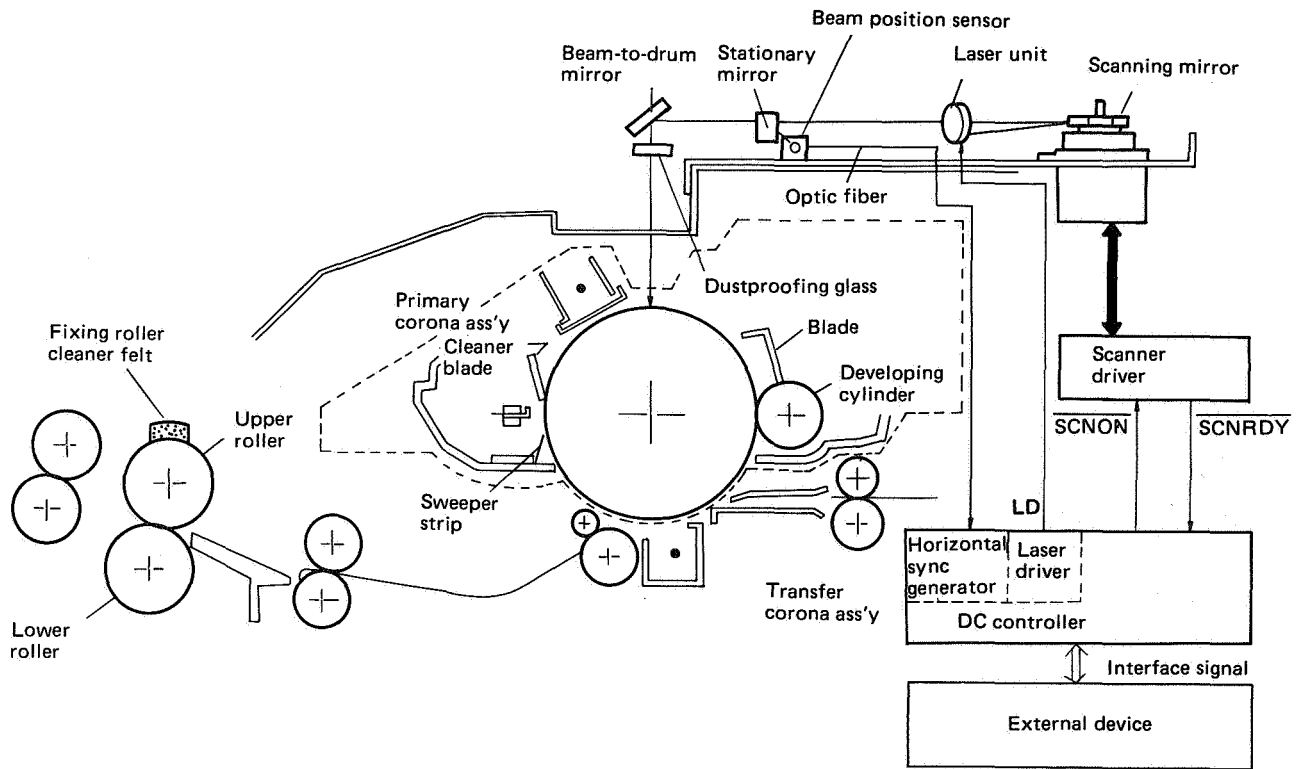


Figure 3-5

There are seven basic phases in which the printer operates, variously combined into four operational sequences. The seven phases are power-up reset (PURS), wait (WAIT), initial rotation (INTR), print (PRNT), last rotation (LSTR), standby (STBY), and pause (PAUSE). Each refer to a particular mode of operation.

The DC controller operates in one of four sequences according to the presence and timing of PRNT, the PAUSE command, and the DRUM ROTATION START command from the external device.

- **PRNT command**  
The external device sends a TRUE PRNT command to the DC controller to indicate that the data are ready for printing.
- **PAUSE command**  
The external device sends this command to the DC controller to set the printer in a pause stage, which reduces power consumption.
- **DRUM ROTATION START command**  
This command from the external device is used to improve DC controller throughput by keeping the drum and the scanner rotating

after completion of printing.

Explanation of the four sequences comes next. All times given are approximate.

#### 1. Sequence 1

The DC controller follows sequence 1 if no TRUE PRNT command is received.

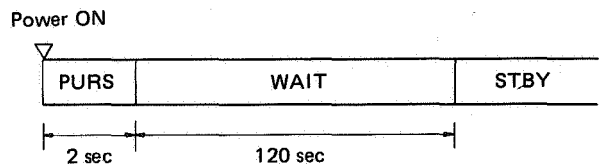


Figure 3-6 Sequence 1

The DC controller enters the power-up reset (PURS) phase when the power is switched on. During PURS, the pin on the side of the drum drive gear in EP cartridge fits into one of the depressions in the side of the drum flange and turns the drum when the drive gear turns.

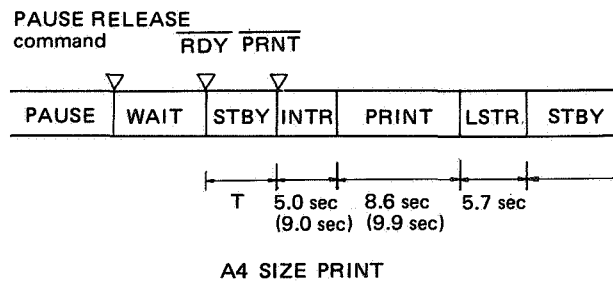
### 3. Sequence 3

The printer enters the PAUSE state after LSTR if the DC controller receives a TRUE PAUSE command from the external device during INTR, PRINT, or LSTR. During WAIT or STBY, the printer enters PAUSE the instant the DC controller receives the command.

The PAUSE command is a serial signal which the external device transmits to the DC controller through the  $\overline{SC}$  interface line. When the DC controller receives the PAUSE command, only the laser chip heater is actuated. All other electrical components are switched OFF.

The external device must transmit a PAUSE RELEASE command to the DC controller to release the printer from the PAUSE state. The PAUSE RELEASE command is a serial signal which the external device transmits to the DC controller through the  $\overline{SC}$  interface line.

Figure 3-9 shows the sequences for making an A4 print after release of PAUSE by the PAUSE RELEASE command.



Note: The timing for auxiliary (manual) feed is given in parentheses.

Figure 3-9 Sequence 3

When the PAUSE RELEASE command is transmitted to the DC controller, the printer goes into a WAIT state. The fixing roller heater is actuated.

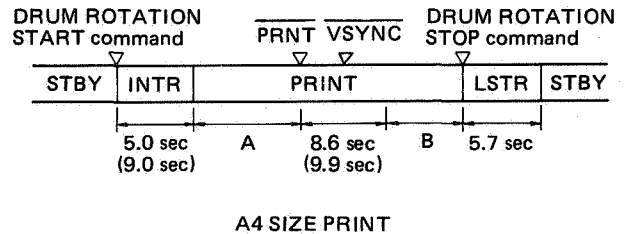
The fixing roller heater warms the upper fixing roller to the specified temperature and WAIT finishes. The sequence after completion of WAIT is the same as sequence 2. (See the previous item on sequence 2.)

### 4. Sequence 4

When the DC controller receives the DRUM ROTATION START command from the external device via the interface signal ( $\overline{SC}$ ) line while in READY status after the power is switched ON, the DC controller starts the sequences from INTR to PRINT and waits for a TRUE PRNT command. When a TRUE PRNT is received, the DC controller begins paper feeding and printing. The DC controller continues the PRINT sequence even if PRNT is set FALSE unless a DRUM ROTATION STOP command is transmitted from the external device via the interface signal ( $\overline{SC}$ ) line. If the DRUM ROTATION

STOP command is transmitted, the DC controller begins the LSTR sequence. After completion of LSTR, the printer enters STBY and the drum stops rotation.

The sequence timing when the DRUM ROTATION START command is input during STBY and one sheet of A4/letter paper is printed is shown below.

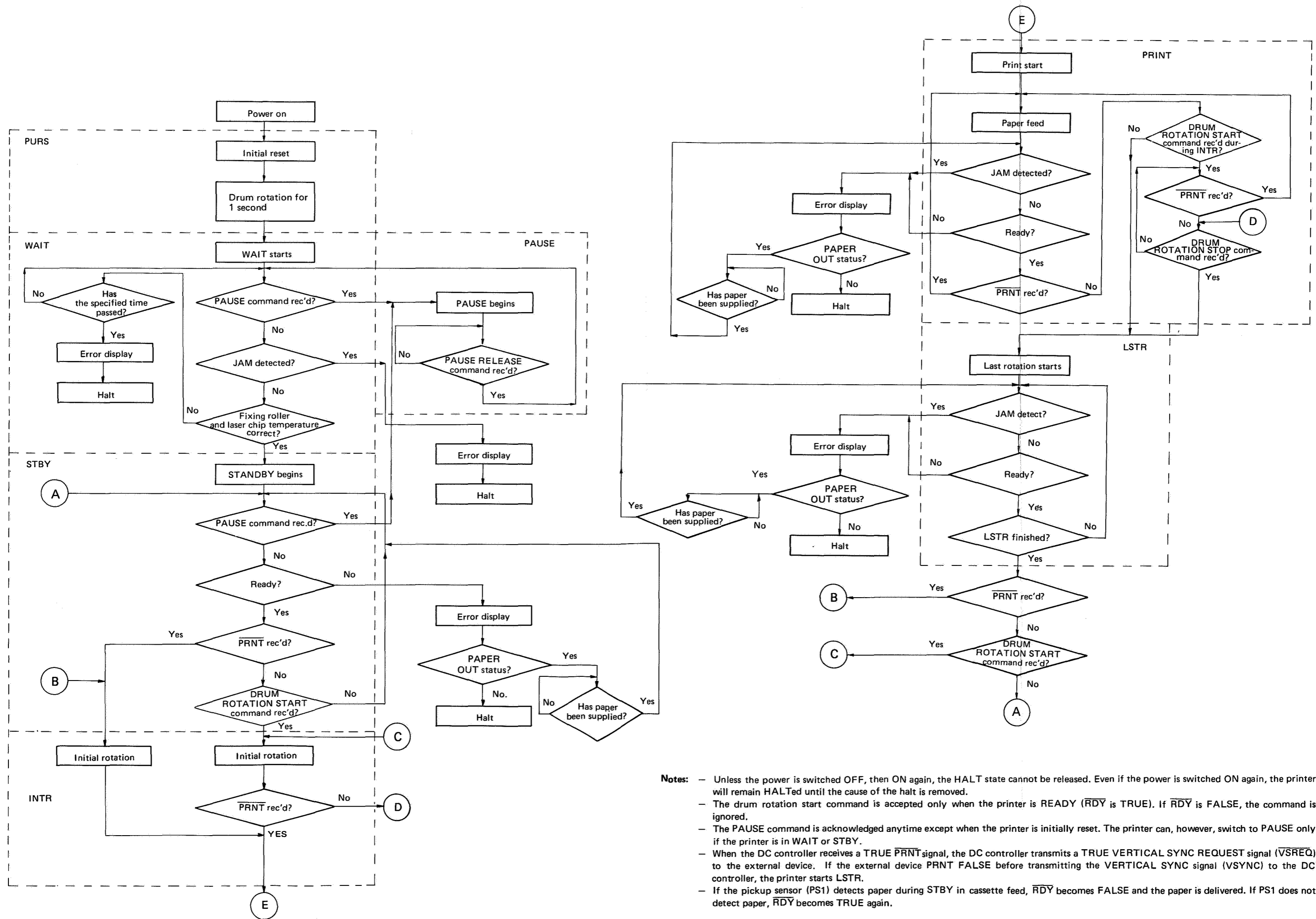


#### Notes:

- The time from A to B indicates the period when the PRINT sequence is being performed.
- The timing for auxiliary (manual) feed is given in parentheses.
- The sequence times of 8.6 sec (9.9 sec) for an A4 size print are for printing one page of A4 size the vertical synchronization signal  $\overline{VSYNC}$  is sent from the external device to the DC controller plus the time to return to the pause status during the PRINT sequence.

Figure 3-10

The DRUM ROTATION START command is useful when the external device can prepare the data to be printed only intermittently. That is, when this command is transmitted, the DC controller is maintained in the PRINT sequence and starts printing, with the INTR sequence skipped, as soon as a TRUE PRNT command is transmitted.



- Notes:**
- Unless the power is switched OFF, then ON again, the HALT state cannot be released. Even if the power is switched ON again, the printer will remain HALT until the cause of the halt is removed.
  - The drum rotation start command is accepted only when the printer is READY ( $\overline{RDY}$  is TRUE). If  $\overline{RDY}$  is FALSE, the command is ignored.
  - The PAUSE command is acknowledged anytime except when the printer is initially reset. The printer can, however, switch to PAUSE only if the printer is in WAIT or STBY.
  - When the DC controller receives a TRUE  $\overline{PRNT}$  signal, the DC controller transmits a TRUE VERTICAL SYNC REQUEST signal ( $\overline{VSREQ}$ ) to the external device. If the external device  $\overline{PRNT}$  FALSE before transmitting the VERTICAL SYNC signal (VSYNC) to the DC controller, the printer starts LSTR.
  - If the pickup sensor (PS1) detects paper during STBY in cassette feed,  $\overline{RDY}$  becomes FALSE and the paper is delivered. If PS1 does not detect paper,  $\overline{RDY}$  becomes TRUE again.

## 6. TIMING CHART FOR LOADS AND FUNCTION

Component \ Phase	PURS Power up reset	WAIT Wait	STBY Standby	INTR Initial rotation	PRINT Print	LSTR Last rotation	STBY Standby	PAUSE Pause	JAM Jam	MLFUNK Malfunc- tion
Drum	○			○	○	○				
Preconditioning exposure lamps	○			○	○	○				
Scanner motor	○			○	○	○				
Fixing roller heater		○	○	○	○	○	○			
High-voltage primary				○	○	○				
High-voltage transfer				○	○	○				
Developing bias (DC)				○	○	○				
Developing bias (AC)				○	○	○				
Cassette pickup roller clutch solenoid				○	○	○				
Manual pickup roller solenoid				○	○	○				
Registration shutter solenoid				○	○	○				
Laser heater		○	○	○	○	○	○	○		
Auto power control start signal (APCST) (See V. A. 4. C in this chapter)				○	○	○				
	1 sec	2 min		5.0 sec (9.0 sec)	8.6 sec (9.9 sec)	5.7 sec				

Table 3-3 Timing chart

- Notes:** — “○” indicates that the component or function is ON.  
 — Auxiliary (manual) feed timing is given in parentheses.  
 — During PAUSE, only the laser heater is ON.  
 — If a jam or malfunction occurs, all components are turned off.  
 — The laser driver in the DC controller stabilizes laser beam intensity only when the scanner motor is rotating at the correct speed.  
 — The temperature of the upper fixing roller is kept at 160°C during STBY. During INTR, PRINT and LSTR, upper fixing roller temperature is kept at 170°C for cassette feed and 180°C for auxiliary (manual) feed.

### B. Interface Signals

The video interface signals used to coordinate print data from the external device to the DC controller are shown below.

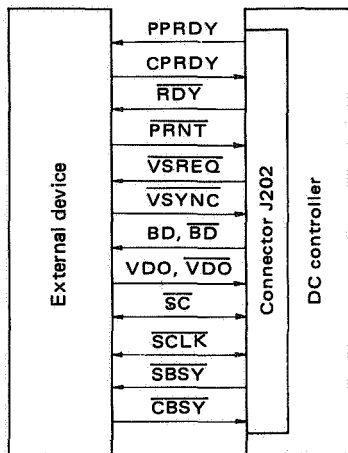


Figure 3-11 Handshaking signals

When the power is switched ON the DC controller transmits the PRINTER POWER READY signal (PPRDY) and informs the external device that the printer is ON. The external device sends a TRUE CONTROLLER POWER READY signal (CPRDY) to the DC controller when the external device is switched ON. The DC controller receives an interface signal from the external device only when signal CPRDY is TRUE. When the printer carries out the sequence from WAIT to STBY, and is ready for printing, a TRUE READY signal (RDY) is transmitted to the external device.

If the external device has prepared data to print and receives a TRUE RDY signal from the DC controller, the external device sends a TRUE PRINT

command ( $\overline{\text{PRNT}}$ ) to the DC controller.

Upon receiving a  $\overline{\text{TRUE PRNT}}$  command from the external device, the DC controller begins INTR, activating the scanner motor, main motor, corona assemblies, preconditioning exposure lamps and developing bias (DC). Drum sensitivity is regulated to the appropriate level and the drum is cleaned.

After that, the scanner motor rotates at the specified speed. When the beam detect signal ( $\overline{\text{BD}}$ ,  $\overline{\text{BD}}$ ; a differential signal) reaches the correct frequency, the DC controller sends a  $\overline{\text{TRUE VSYNC REQUEST}}$  command ( $\overline{\text{VSREQ}}$ ) to the external device. The external device transmits a  $\overline{\text{TRUE VERTICAL SYNC}}$  signal ( $\overline{\text{VSYNC}}$ ) in sync with  $\overline{\text{VSREQ}}$ .

The external device sends the DC controller the  $\overline{\text{VIDEO}}$  signal ( $\overline{\text{VDO}}$ ,  $\overline{\text{VDO}}$ ; a differential signal) after  $t_1$  from the leading edge of each beam detect signal, and after specified time period  $t_2$  from the  $\overline{\text{TRUE VSYNC}}$  signal. Time period  $t_2$  is about 212 ms for a 5 mm top margin. Time period  $t_1$  differs by paper size, and produces a left margin.

(See Table 2-3 in Chapter II (see page 2-18) for the relation between  $t_1$ , which is the time period for producing about an 8 mm left margin, and paper sizes.)

After receiving a  $\overline{\text{TRUE VSYNC}}$  signal, the DC controller starts the  $\overline{\text{PRINT}}$  sequence, feeds paper and modulates the laser beam by  $\overline{\text{VDO}}$  and  $\overline{\text{VDO}}$  from the external device. The modulated laser beam scans the drum via the six-faced scanning mirror, producing an electrostatic latent image.

The electrostatic latent image is developed into a visible toner image, which is transferred onto paper. The transferred image is fixed onto the paper, and the printed paper is delivered to the print tray.

While each print is being made, the DC controller checks whether a  $\overline{\text{TRUE PRNT}}$  command has been sent by the external device. If not, the DC controller sends an eight-bit serial  $\overline{\text{PRINT REQUEST}}$  status ( $\overline{\text{PTRQ}}$ ) to the external device through the  $\overline{\text{STATUS/COMMAND}}$  signal ( $\overline{\text{SC}}$ ) line, indicating that the DC controller requests a  $\overline{\text{TRUE PRNT}}$  command.

At the same time as the  $\overline{\text{PTRQ}}$  status signal is sent, the  $\overline{\text{STATUS BUSY}}$  signal ( $\overline{\text{SBSY}}$ ) goes TRUE, indicating to the external device that a  $\overline{\text{PTRQ}}$  status signal has been sent.

To continue printing the external device sets  $\overline{\text{PRNT}}$  TRUE. Upon receiving a  $\overline{\text{TRUE PRNT}}$  command, the DC controller commences the  $\overline{\text{PRINT}}$  sequence. If the DC controller sends a  $\overline{\text{PTRQ}}$  status and the external device does not transmit a  $\overline{\text{TRUE PRNT}}$  command within the specified time (about 5 sec.), the DC controller begins LSTR.

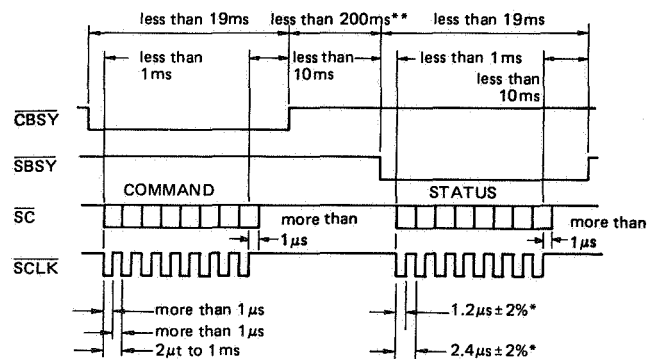
Upon completion of LSTR, the DC controller turns off the fixing roller heater and all electrical components except the laser chip heater. The DC controller enters STBY and waits for a  $\overline{\text{TRUE PRNT}}$  command from the video controller.

#### Reference:

$\overline{\text{SC}}$  is a bidirectional serial signal used for transmitting statuses from the DC controller to the external device, or commands from the external device to the DC controller. As long as the DC controller is sending a  $\overline{\text{TRUE PPRDY}}$  signal to the external device and  $\overline{\text{SBSY}}$  is FALSE, the external device can send commands to the DC controller.

The external device can detect various status such as paper out, a jam, a malfunction in the fixing assembly, etc., by making and  $\overline{\text{COMMAND BUSY}}$  signal ( $\overline{\text{CBSY}}$ ) TRUE, and then transmitting a  $\overline{\text{STATUS REQUEST}}$  command to the DC controller via the  $\overline{\text{SC}}$  signal line.  $\overline{\text{SBSY}}$  and  $\overline{\text{CBSY}}$  signals indicate whether the  $\overline{\text{SC}}$  signal line is being used by the DC controller or the external device.

$\overline{\text{SCLK}}$  signal is a clock signal used to read serial signals transmitted on the  $\overline{\text{SC}}$  signal line.



\* The value when  $\overline{\text{SCLK}}$  is output from the DC controller

\*\* The DC controller performs self-diagnosis and sends the external device a status message using the  $\overline{\text{SC}}$  line.

Figure 3-11A Timing of  $\overline{\text{CBSY}}$ ,  $\overline{\text{SBSY}}$ ,  $\overline{\text{SC}}$ , and  $\overline{\text{SCLK}}$

## IV. LASER/SCANNER

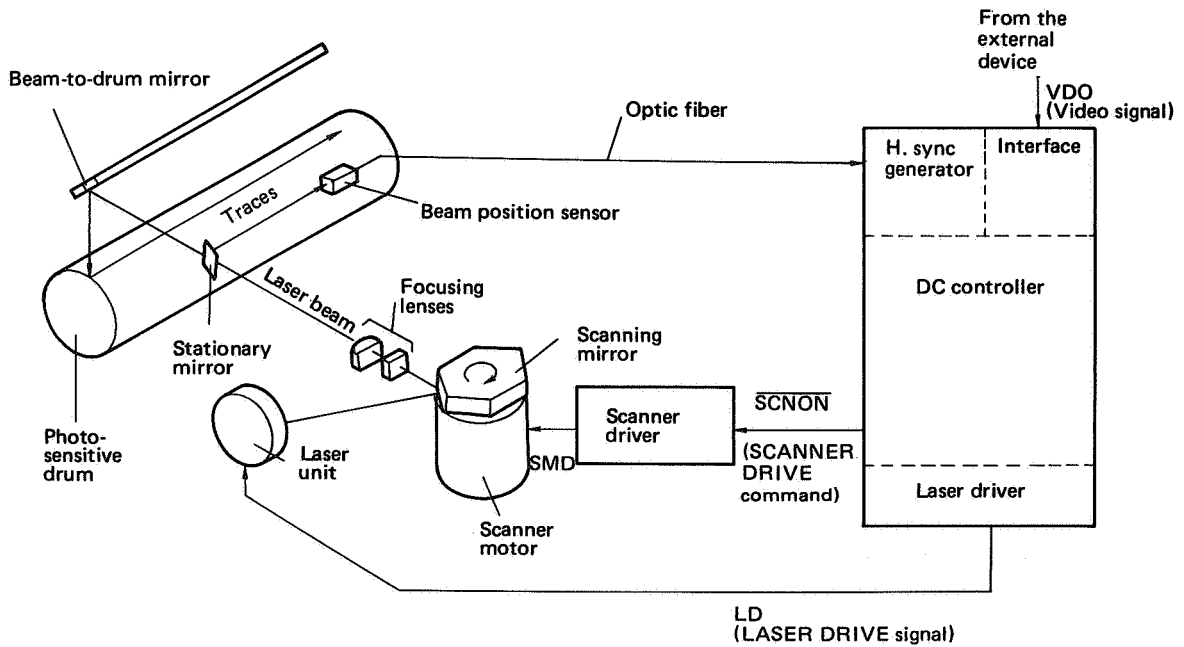


Figure 3-12 Laser scanning system

### A. Semiconductor Laser

#### 1. Principles of operation

The printer uses a semiconductor chip laser to expose the photosensitive drum. This laser provides a very thin, intense beam of light with an elliptical cross section. After the light leaves the laser it is made parallel by a collimating lens. It then reflects off the rotating scanning mirror. Finally the light is focused to a small point on the drum surface by focusing lenses and the beam-to-drum mirror.

The following explanation describes how the semiconductor laser chip generates light.

When voltage is applied to a metal, electrons (negative charges) move through the metal. The electrons constitute an electric current.

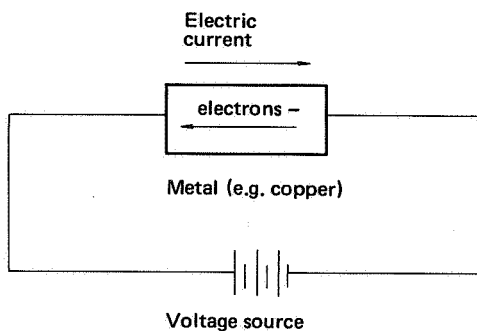


Figure 3-13 Conductor

In a semiconductor, electrons and holes (Figure 3-14) move inside the semiconductor, in opposite directions. The two together constitute current flow. Note: A hole is the absence of an electron (hence the name "hole"). A hole has a positive charge.

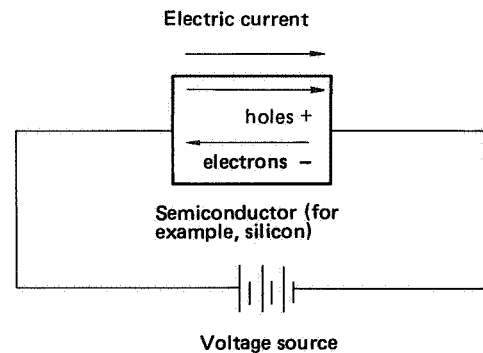


Figure 3-14 Semiconductor

A semiconductor whose mode of conduction is mostly by electrons is called an n-type semiconductor. A semiconductor whose mode of conduction is mostly by holes is called a p-type semiconductor.

A semiconductor laser is a kind of diode combining an n-type semiconductor and a p-type semiconductor. When voltage is applied to the diode as shown in Fig. 3-15, holes move to the right and electrons to the left. At the contact face (junction), the electrons and holes combine, producing light.

In the semiconductor laser, the junction plane is as shown in Fig. 3-16. (The junction plane is

hereafter called the junction.) When voltage is applied to the semiconductor laser as shown in Fig. 3-16 (forward bias), the electrons and holes combine, emitting light energy in discrete packets. The light is enclosed in the junction, passing back and forth between the two reflective faces.

As more electrons and holes combine, more light packets continue to be generated. Because of the design and physics of the laser, the light tends to move in phase, somewhat like current in a resonating circuit. And passes through the reflecting faces. When the light energy exceeds a critical level, light passes through one of the reflecting faces. Every packet of light that escapes from the laser has exactly the same frequency, and the light is coherent. The emission from the laser in the printer is in the invisible infrared part of the spectrum.

Being coherent, a laser beam can be focused onto a very small point (with the help of a focusing lens). Its high intensity and high resolution are the main requirements for a laser printer.

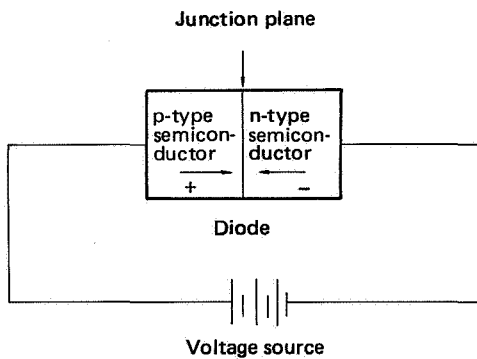


Figure 3-15 Junction plane

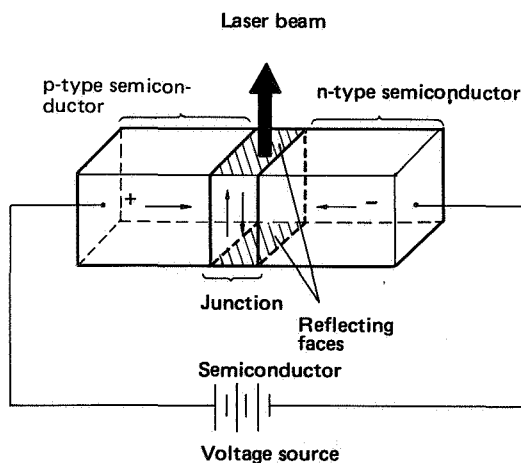


Figure 3-16 Laser generation

## 2. Control signals for scanning

The DC controller receives the  $\overline{VDO}$  and VDO interface signals, representing print data, from the video controller. Circuitry processes  $\overline{VDO}$  and VDO

and outputs it to the laser driver circuit (part of the DC controller).

The laser driver circuit contains a current switch, and a laser power stabilization circuit which provides necessary power for LD, the driver signal for the laser chip. It is important that the voltage of LD never rises above a certain level, otherwise the laser chip may be ruined.

After the laser chip temperature becomes correct, LD is output to drive the laser. If LD is not output the laser is switched off.

## 3. Collimating lens

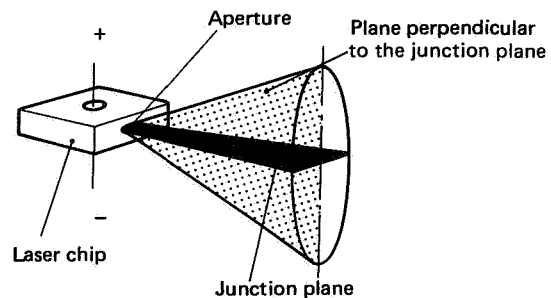


Figure 3-17 Dispersion of the laser beam (no collimating lens)

Figure 3-17 shows how light produced by the laser chip leaves the chip as a diffused, wide beam. For reasons of optics, a small convex lens is mounted immediately outside the beam aperture to make the laser light parallel, drawing it into a thin, tight beam. This lens is called a collimating lens. The beam next strikes the rotating scanning mirror.

## B. Scanning Mirror and Focusing Lenses

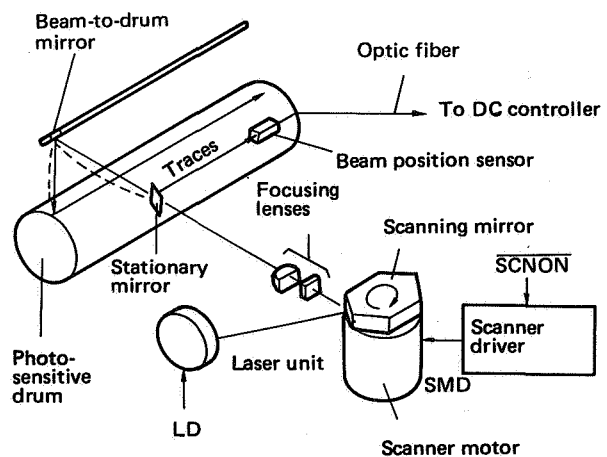


Figure 3-18 Scanning

Figure 3-18 shows how the rotating, six-faced scanning mirror sprays the laser beam across the photosensitive drum. This mirror has six highly



polished faces and is manufactured to exacting tolerances. The mirror rotates when the DC controller generates SCNON, the scanner driver outputs SMD, and the scanner motor turns. Because the laser beam must be directed very precisely, the scanner motor must rotate at a precise speed.

Immediately after the laser beam reflects off the scanning mirror, it passes through a convex collimating lens (focusing lens), and is focused to a tiny point on the drum surface via the beam-to-drum mirror.

## V. CIRCUIT DIAGRAMS BY FUNCTION

### A. DC Controller Circuit

The DC controller process signals from the sensors and from the video controller, and outputs signals to control the AC driver (which drives the fixing roller heater), high-voltage power supply, laser, scanner driver, and main motor driver (a part of DC power supply & main motor driver). It provides the external device with the printer status. The DC controller also drives some DC loads directly.

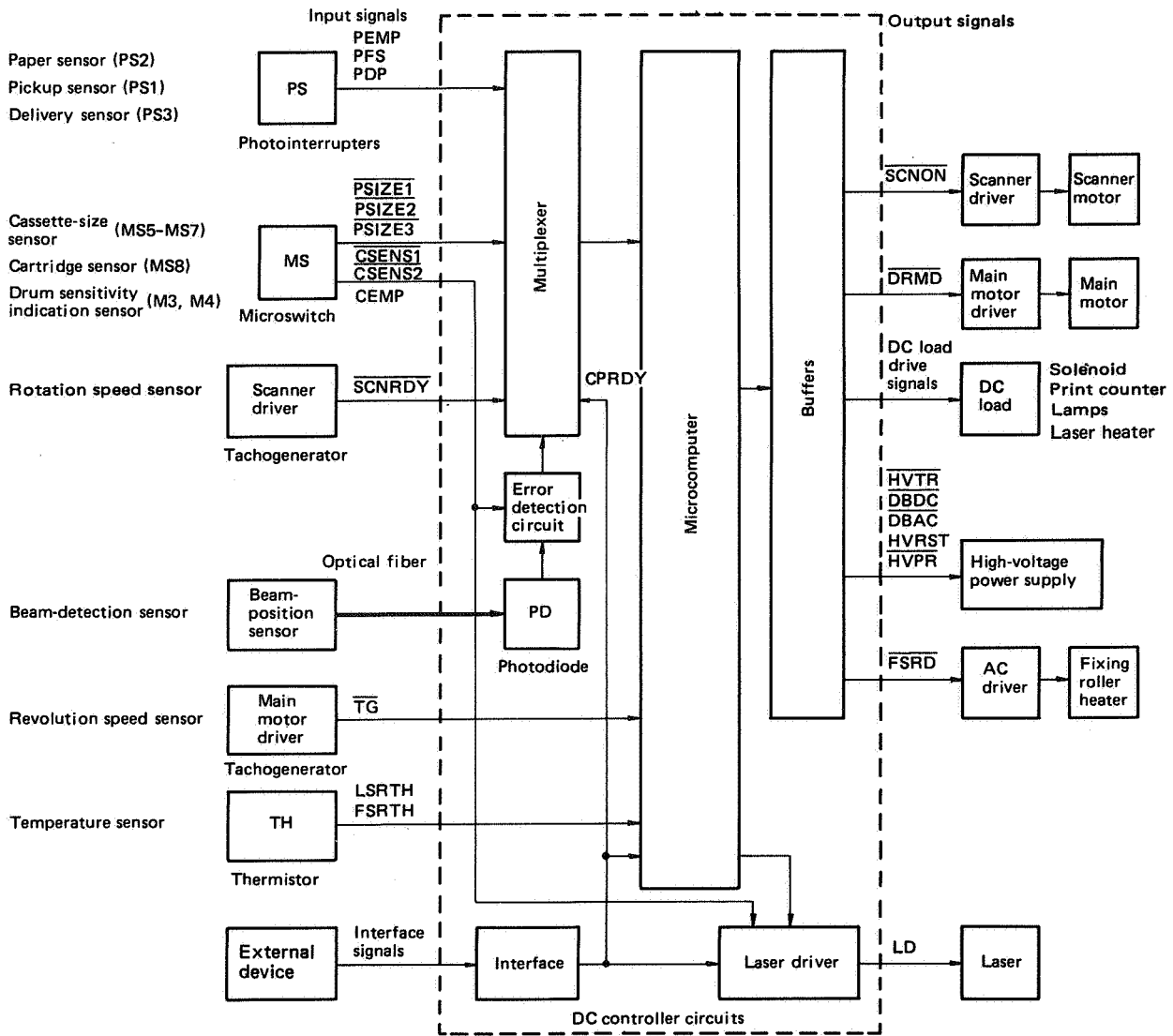


Figure 3-19 DC controller circuit

## 1. Input/output circuits

### a. Input circuits

Photocoupler output signal inputs

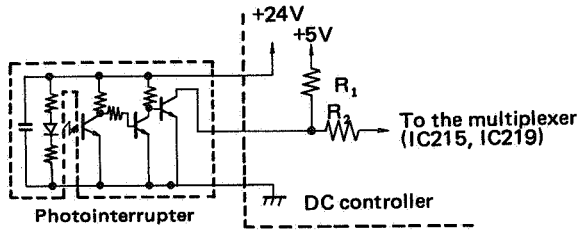


Figure 3-20 Photointerrupter

The output of a photointerrupter is 5V when an obstacle passes through the light path between the light-emitting diode and the phototransistor. The output is 0V when the light path is clear.

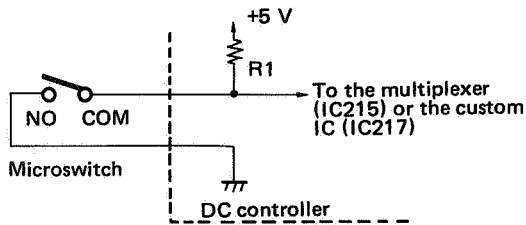


Figure 3-21 Microswitch

The output of the microswitch is 0V when the switch is ON and 5V when OFF.

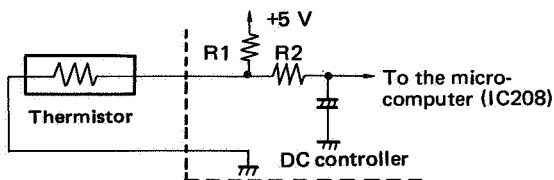


Figure 3-22 Thermistor

The output of a thermistor is input to the microcomputer after any external noise is eliminated by an integration circuit.

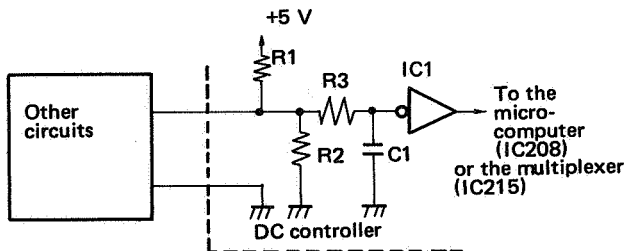


Figure 3-23 Impedance matching

If a long transmission cable is used to transmit a fast digital signal, inexact impedance matching can cause reflections which seriously deteriorate the signal. When data must be transmitted over a long distance, R1 and R2 are used to match impedances and to prevent reflections.

R3 and C1 comprise an integrating circuit for suppressing electrical noise. IC1 reshapes the integrated pulse into a sharp, noise-free pulse again.

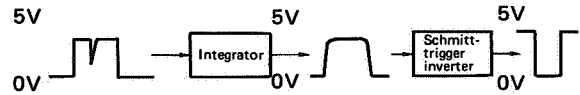


Figure 3-24 Inversion and noise suppression

### Differential inputs

A differential amplifier amplifies only the voltage difference between two signals. If a data signal is inverted and both signals are transmitted to a differential amplifier, the input voltages of the original data signal are effectively doubled ( $V_s - (-V_s) = 2 \times V_s$ ), but noise picked up on the transmission line cancels out since it is not inverted ( $V_N - (V_N) = 0$ ).

In the simple case, data is transmitted along a signal line (A in Figure 3-25 below) with a ground return (GND). Normally this is good enough, but over a long distance or in an electrically noisy environment both the A and GND lines may pick up glitches, largely due to the different impedances. The error rate increases with transmission speed and distance.

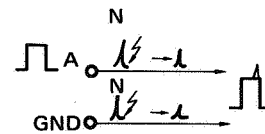


Figure 3-25 Noise

Transmitting original data (A) and its inverted signal ( $\bar{A}$ ) allows the use of a differential amplifier to cancel the noise component.

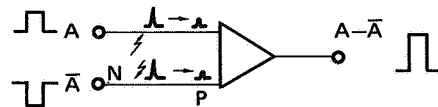


Figure 3-26 Noise suppression

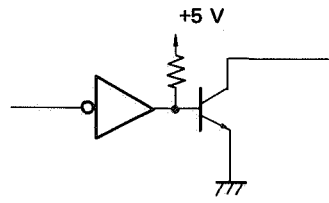
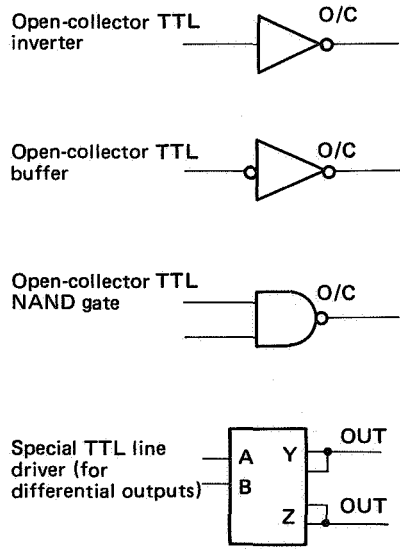
The differential amplifier subtracts the voltages at the lower input ( $\bar{A} + V_N$ ) from that at the upper input ( $A + V_N$ ). The result is  $(A - \bar{A}) + (V_N - V_N)$ ; the amplitudes of the data signals add, but the noise components cancel.

The printer uses differential amplifier for the VDO and BD signals because the signal pulse rates are so fast.

**b. Output circuits**

TTL drivers are used to drive almost all loads.

Transistor inverter-drivers are used to drive solenoids, lamps, heaters, and the print counter.



Inverter driver

Figure 3-27 TTL drivers

## 2. Jam detection

Sensors PS1 and PS3 in the pickup and delivery assemblies check for normal feeding of print paper. A jam is detected if print paper is not fed normally. If print paper jams, the JAM indicator on the Display unit lit, and all other electrical components switch off.

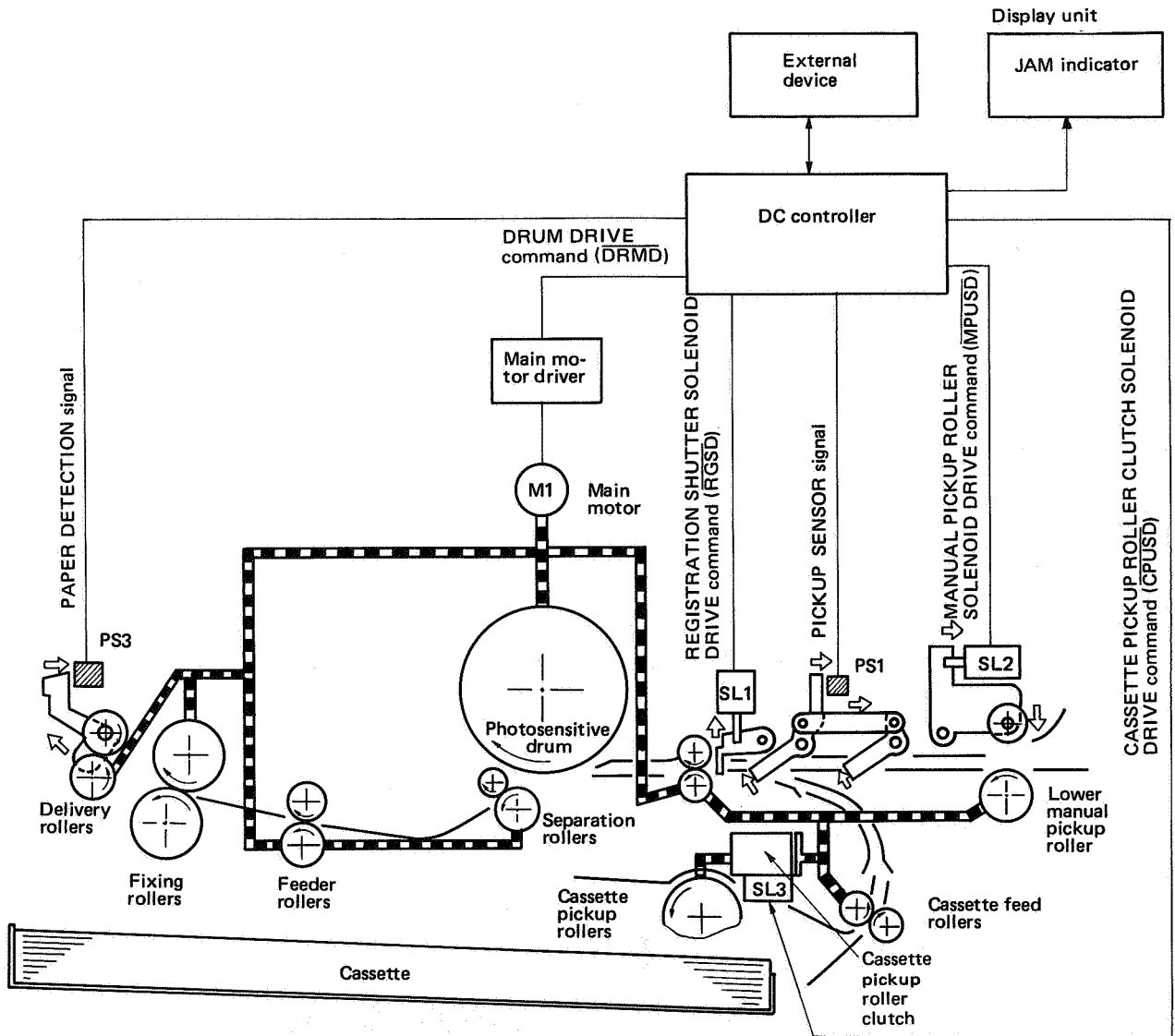


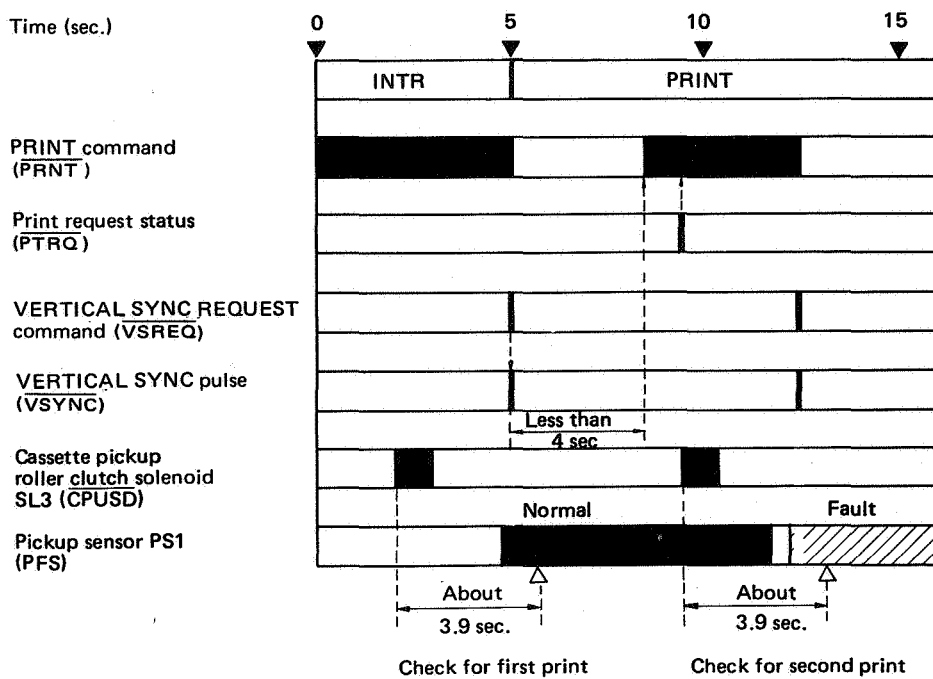
Figure 3-28 Jam detection

For detecting jams, a photointerrupter senses whether print paper has reached or passed through a given point within a specified time. The sensor signal informs the microcomputer on the DC controller of the presence or absence of print paper or a jam. As can be seen in Figure 3-28, there are two paper detection photointerrupters to detect the following three types of jam:

Jam type	Condition
Faulty pickup (delay)	The print paper does not reach the pickup sensor (PS1) within the specified time after the DC controller outputs a TRUE CASSETTE PICKUP ROLLER CLUTCH SOLENOID DRIVE command ( $\overline{CPUSD}$ ). (See Fig. 3-29.)
Outlet delay jam	The print paper does not reach the delivery sensor (PS3) within the specified time after the DC controller receives a TRUE VSYNC signal. (See Fig. 3-30 and 3-31.)
Outlet stationary jam	The print paper does not pass through the delivery sensor (PS1) within the specified time after the DC controller receives a TRUE VSYNC signal. (See Fig. 3-32 and 3-33.)

Table 3-4

a. Faulty pickup jam (delay)

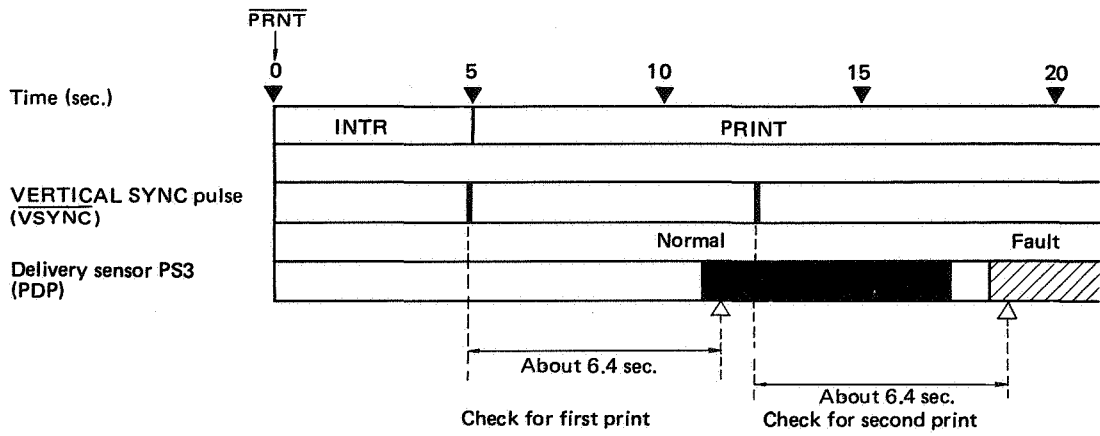


Notes:

- If the external device transmits a TRUE  $\overline{PRNT}$  command to the DC controller within 4 seconds after the leading edge of a TRUE  $\overline{VSYNC}$  signal, the DC controller does not output  $\overline{PTRQ}$ .
- This timing chart is for an A4 print. Jam detection timing (about 3.9 seconds after  $\overline{CPUSD}$ ) is the same for other sizes.

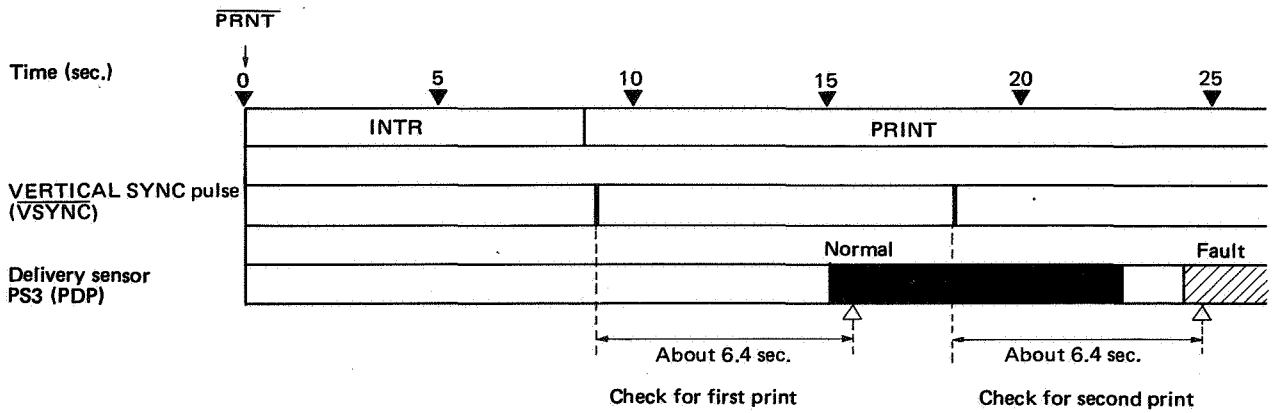
Figure 3-29 Faulty pickup jam for cassette feed

**b. Outlet delay jam**



**Note:** The timing chart is for an A4 print. Jam detection timing is the same (about 12.9 seconds after a TRUE VSYNC signal) for other sizes.

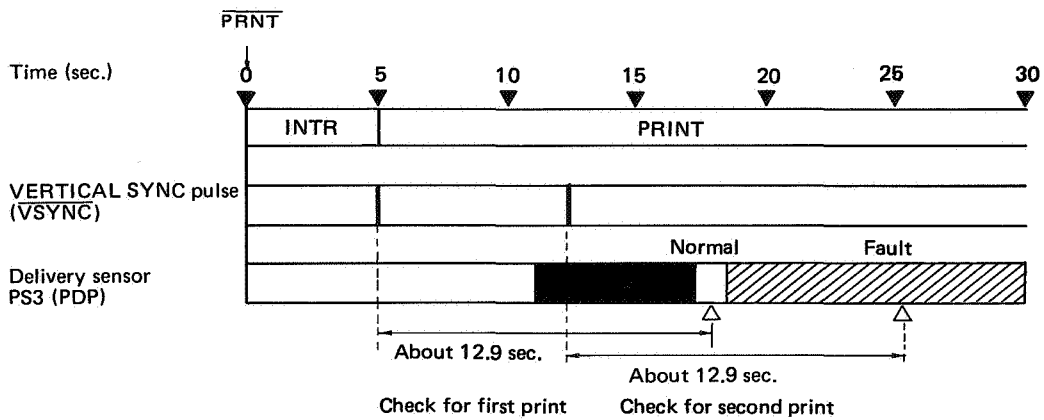
Figure 3-30 Outlet delay jam for cassette feed



**Note:** This timing chart is for legal size paper printed at 5.1 pages/minute throughput. Jam detection timing is the same (about 14.1 seconds after a TRUE VSYNC signal) for other sizes.

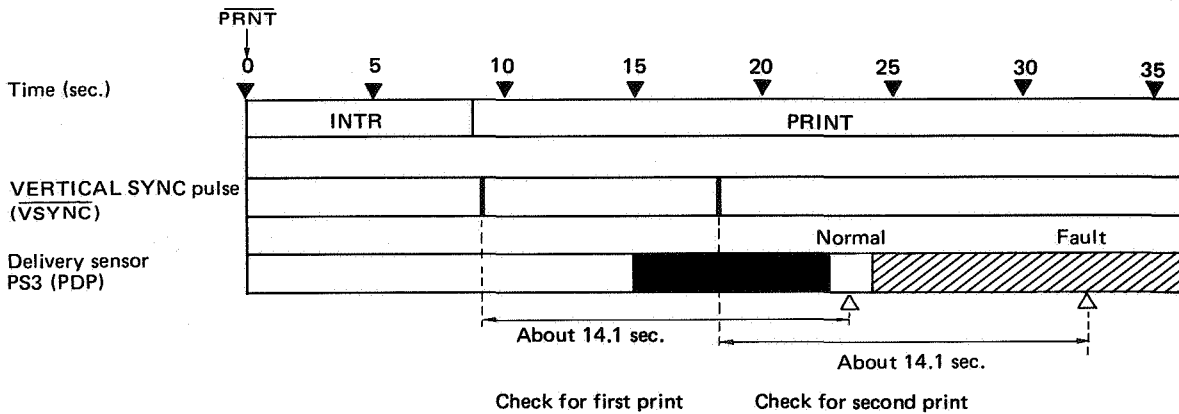
Figure 3-31 Outlet delay jam for auxiliary (manual) feed

c. Outlet stationary jam



Note: The timing chart is for an A4 print. Jam detection timing for a legal and B4 size paper is 14.1 seconds after a TRUE  $\overline{\text{VSYNC}}$  signal. For other sizes jam detection timing is about 12.9 seconds after a TRUE  $\overline{\text{VSYNC}}$  signal.

Figure 3-32 Outlet stationary jam for the cassette feed



Note: The timing chart is for legal size paper printed at 5.1 pages/minute throughput. Jam detection timing is the same (about 14.1 seconds after a TRUE  $\overline{\text{VSYNC}}$  signal) for other sizes.

Figure 3-33 Outlet stationary jam for the auxiliary (manual) feed



### 3. The multiplexer and error-detection circuitry

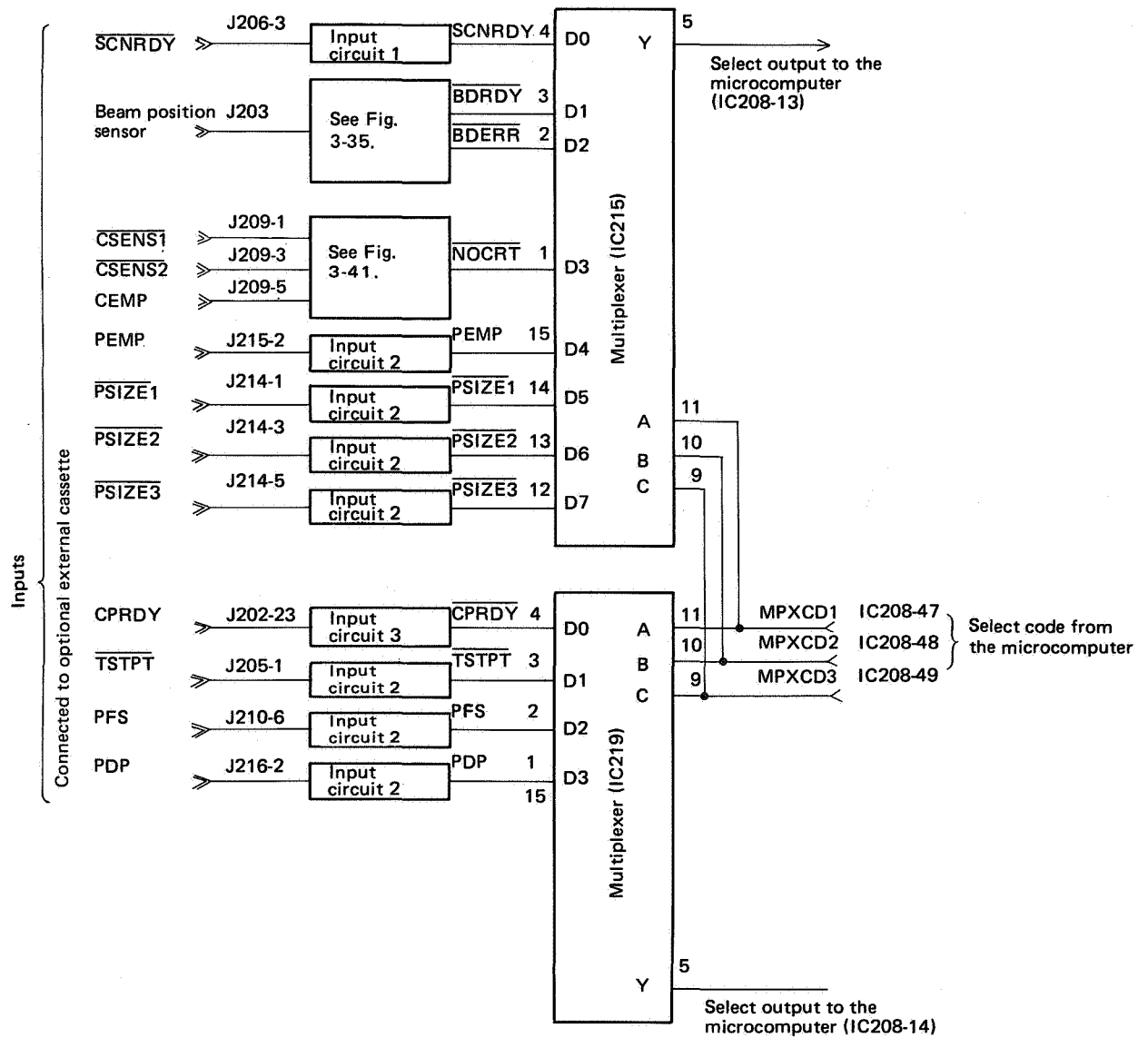


Figure 3-34 Circuits leading to the multiplexer

### a. Introduction

The multiplexer and error detection circuitry are explained in this section.

When the operating program in ROM tells the microprocessor to read a certain signal (both the ROM program and the microprocessor are in the microcomputer chip), a select code (MPXCD 1-3) is input to the multiplexer (IC215, IC219), which acts as an electronic switch by connecting one of its 8 inputs to pin 13 and 14 of the microcomputer chip. It is not necessary for the microcomputer to check these input signals continually, so each one is switched through the multiplexer only when necessary.

The microprocessor checks the input signals received from the multiplexers (IC215, IC219) for the prescribed voltage level, and also to make sure that the prescribed voltage level is reached within a set time limit.

If this check detects a malfunction, the microprocessor sets the READY signal ( $\overline{RDY}$ ) FALSE to inform the external device that malfunction has occurred. In response to this, the external device transmits a status request command (via the STATUS/COMMAND signal ( $\overline{SC}$ ) line) to the DC controller. Upon receipt of this command, the DC controller encodes the nature of the malfunction (as status information) in the  $\overline{SC}$  signal, and turns off READY/WAIT display on the display panel sends it to the external device.

### b. Checking the BD pulse

Each time the reflected laser beam reaches home position (the stationary mirror), it lights a beam position sensor (optic fiber). The optic fiber transmits the laser beam to the photodiode at the H. sync generator, which generates an INTERNAL BEAM DETECT pulse (IBD). Accordingly, if the scanning mirror is rotating constantly at the correct speed, IBD pulses are generated at the correct frequency.

All the frequency detection circuits for IBD pulses are contained in one custom IC. The custom IC is a collection of integrated logic circuits users may need.

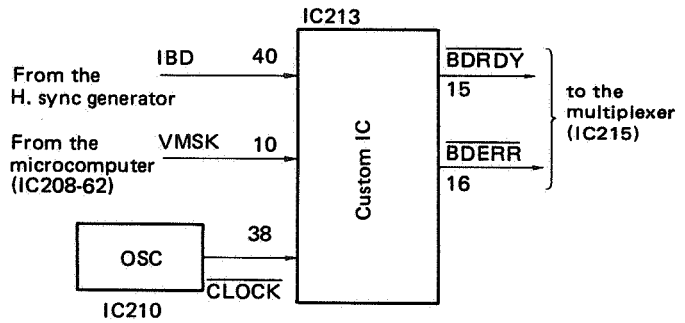


Figure 3-35 Frequency detection circuit for IBD pulses

A block diagram of the frequency detection circuit is shown in Figure 3-35. The circuit in Figure 3-35 checks whether the IBD frequency is correct. If correct, the circuit generates a TRUE BEAM DETECT READY signal ( $\overline{BDRDY}$ ); if not, a FALSE  $\overline{BDRDY}$ .

If VMSK and  $\overline{BDRDY}$  go FALSE during printing, custom IC213 outputs a TRUE BEAM DETECT ERROR signal (TRUE  $\overline{BDERR}$ ). Microprocessor IC208 receives the TRUE  $\overline{BDERR}$  signal through multiplexer IC215, and sets the READY signal ( $\overline{RDY}$ ) FALSE. At the same time, the microprocessor uses the STATUS/COMMAND signal ( $\overline{SC}$ ) to send a PRINT CHECK REQUEST to the external device.

When  $\overline{RDY}$  is FALSE, the external device will receive status information from the DC controller via the SC signal. The external device then knows that the DC controller is in a PRINT CHECK REQUEST state.

Additionally, if  $\overline{BDRDY}$  stays FALSE for at least one second, the external device interprets (via the SC signal) this to mean that a malfunction has occurred in the BD generator on the DC controller. The READY/WAIT indicator goes out.

When the READY/WAIT indicator goes out, the printer stops printing, goes through a LAST ROTATION cycle, then halts. Further printing operations are inhibited.

$\overline{BDERR}$  from custom IC213 becomes FALSE after one page has been printed. The BD error status (where  $\overline{BDERR}$  is TRUE) is maintained by microcomputer IC208, and is not released unless the printer is switched OFF, then ON again, or until the external device sends a DATA RETRANSMISSION REQUEST RELEASE command to the DC controller via the STATUS/COMMAND ( $\overline{SC}$ ) signal line.

The timing chart in Figure 3-36 shows normal BD generation.

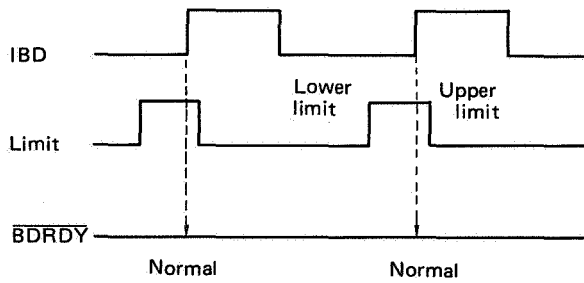


Figure 3-36 BD pulse generated normally

The custom IC213 generates a limit signal in sync with the output signals (CLOCK) from IC210.

If a TRUE IBD signal is transmitted from the H. sync generator when the limit signal is TRUE, the custom IC213 outputs a TRUE BDRDY signal.

If the frequency of the IBD pulse is too high or too low, BDRDY goes FALSE. Both possibilities are shown below.

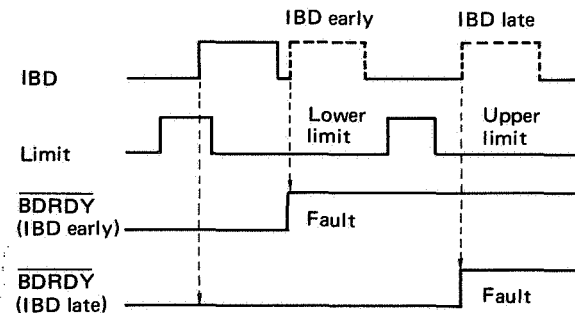


Figure 3-37 IBD pulse early or late

The custom IC generates a DEFAULT pulse in sync with CLOCK.

If the H. sync generator circuit does not transmit IBD within a certain period after the upper limit has been reached, the custom IC sets BDRDY FALSE using a DEFAULT pulse.

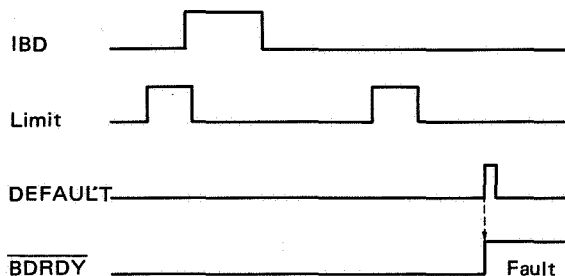


Figure 3-38 An IBD pulse is not generated

### c. Detecting paper in the cassette

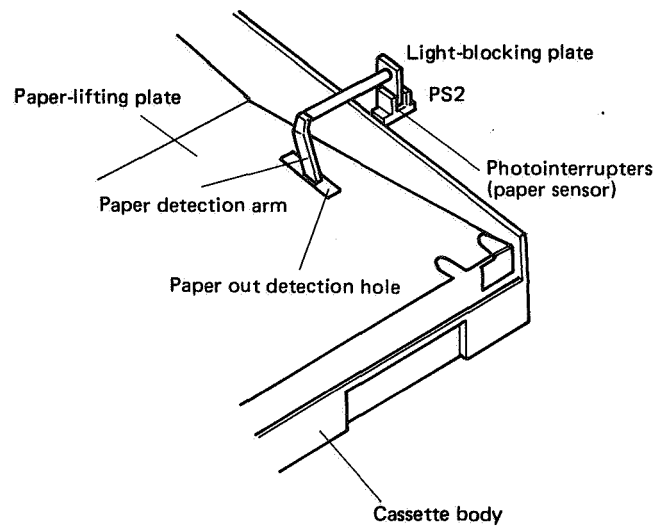


Figure 3-39 Paper detection

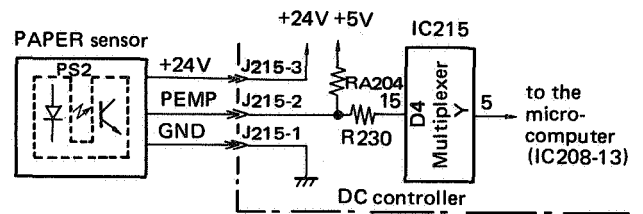


Figure 3-40 Paper detection

When paper in a cassette runs out, the paper detection arm drops into the paper out detection hole. In conjunction with the arm movement, the light-blocking plate interrupts the optical path of the paper sensor (PS2). The paper sensor (PS2) sends a TRUE PAPER EMPTY signal (PEMP) to the DC controller. The microcomputer in the DC controller receives a TRUE PEMP signal via pin 5 of the multiplexer (IC215) and sets the READY signal (RDY) FALSE.

The external device thus knows that some type of malfunction has occurred. If RDY is FALSE, the external device sends a STATUS REQUEST command to the DC controller via the COMMAND/STATUS signal (SC). Upon receiving this command, the DC controller uses the SC signal to pass a PAPER OUT status back to the external device.

If PAPER OUT is detected during printing operations the printer stops printing, goes through a LAST ROTATION cycle, then halts. Further printing operations are inhibited.

Replenishing the paper supply in the cassette enables printing. Printing commences after a TRUE

PRINT command ( $\overline{\text{PRNT}}$ ) is transmitted by the external device.

**d. Detecting the EP cartridge in the printer**

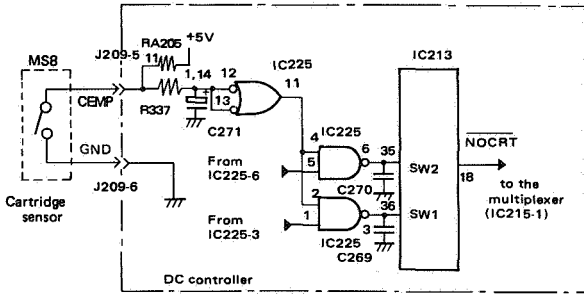


Figure 3-41 EP cartridge detection

When the EP cartridge is removed from the printer, the cartridge no longer presses sensor MS8, and CEMP becomes TRUE. The custom IC sends a TRUE NO CARTRIDGE signal ( $\overline{\text{NOCRT}}$ ) to multiplexer IC215-1. Upon detecting this signal at the multiplexer, the microcomputer (on the DC controller) sets the READY signal ( $\overline{\text{RDY}}$ ) FALSE to inform the external device that a malfunction has occurred. At the same time, the external device receives the NO CARTRIDGE status over the COMMAND/STATUS signal ( $\overline{\text{SC}}$ ) by transmitting a STATUS REQUEST to the DC controller via the COMMAND/STATUS signal (SC).

#### 4. Control circuits

##### a. Zero-cross sync generator

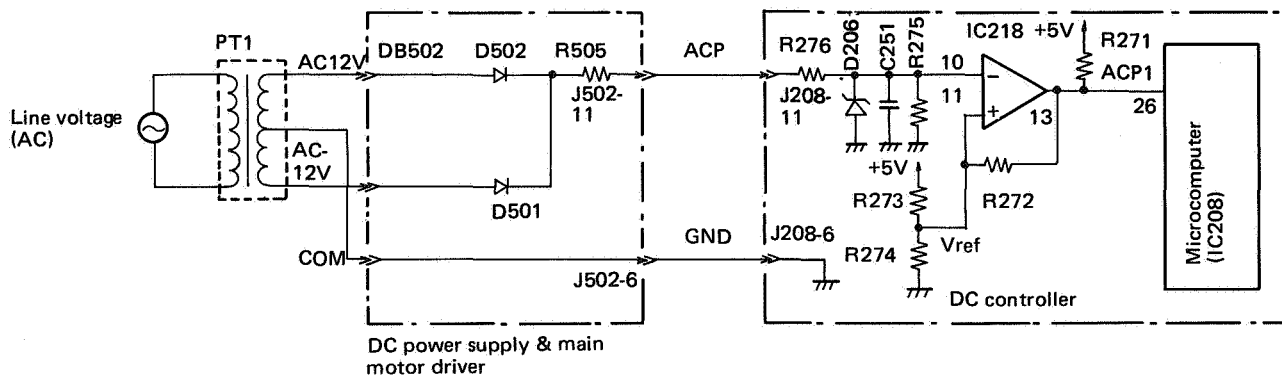


Figure 3-42 Zero-cross sync generator

##### 1) Introduction

The zero-cross sync generator full-wave rectifies the AC voltage, transforms it into a pulse, and inputs the AC pulse to IC208 of the microcomputer. The microcomputer uses the AC pulse as a timing signal to turn on the fixing heater H1 at zero-cross.

##### 2) Operation

The AC line voltage is transformed to low-voltage AC output by transformer PT1 and applied to rectification elements D501 and D502. D501 and D502 full-wave rectify the AC output and apply the signal (ACP) to comparator IC218 on the DC controller. IC218 compares the reference voltage ( $V_{ref}$ ) generated by R273 and R274 with the voltage of the full-wave rectified output (ACP). If ACP is lower than  $V_{ref}$ , IC218 sends a positive pulse (ACP1) to IC208 pin 26.

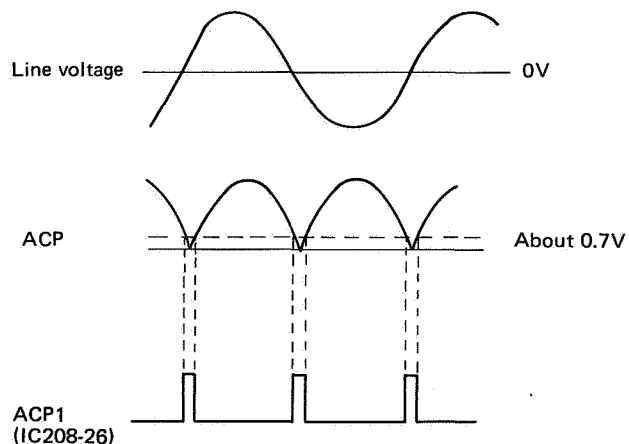
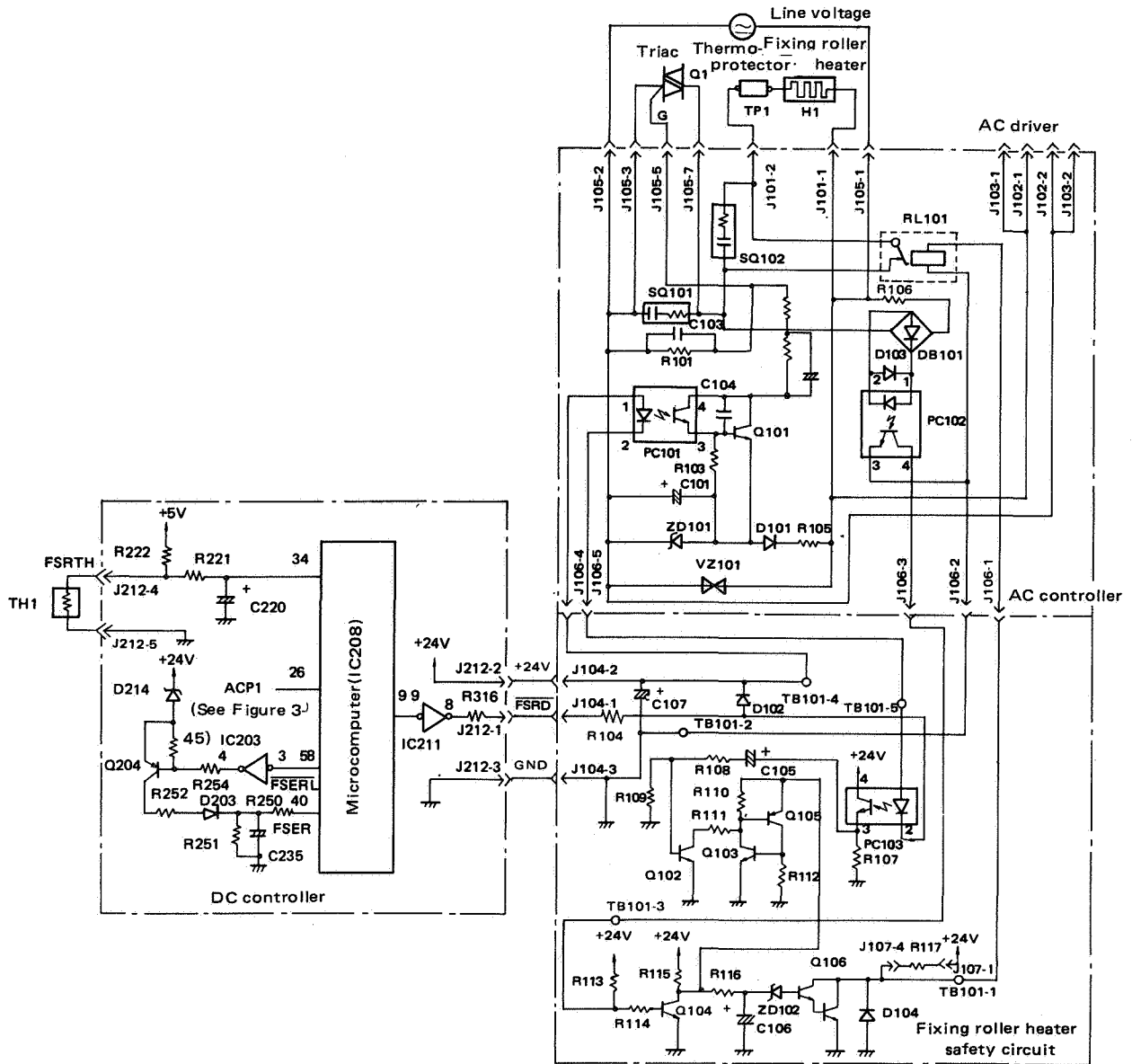


Figure 3-43 ACP1

b. Fixing roller temperature control circuit



- Notes: — The AC driver consists of the AC controller and fixing roller heater safety circuit.  
 — The illustration is the AC driver for the 115V/60Hz model. Since the circuit diagram for the 220/240V model is similar, no separate illustration is given.

Figure 3-44 Fixing roller temperature control circuit

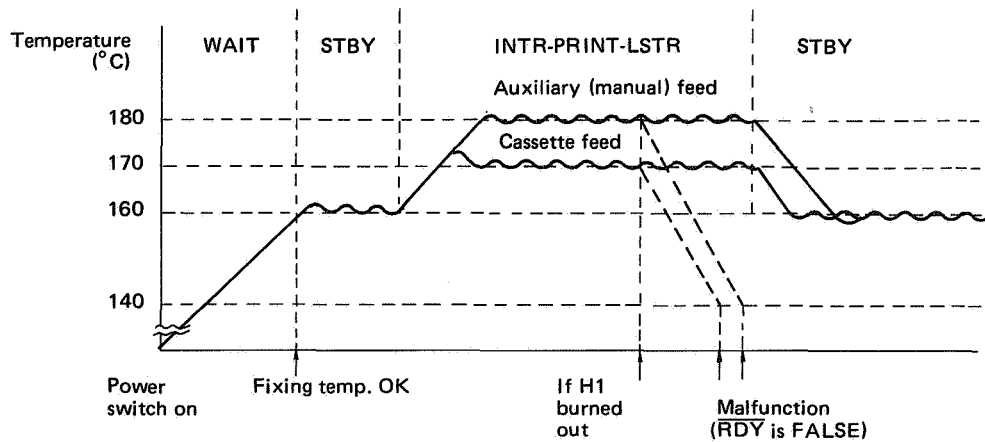


Figure 3-45 Fixing roller temperature

(1) Introduction

The fixing roller heater temperature control circuit keeps the temperature of the fixing roller even, and changes the temperature according to the printer printing sequence. During STBY, the temperature is maintained at 160°C. During INTR, PRINT and LSTR, the temperature is maintained at 170°C for cassette feed and 180°C for auxiliary (manual) feed.

(2) Operation

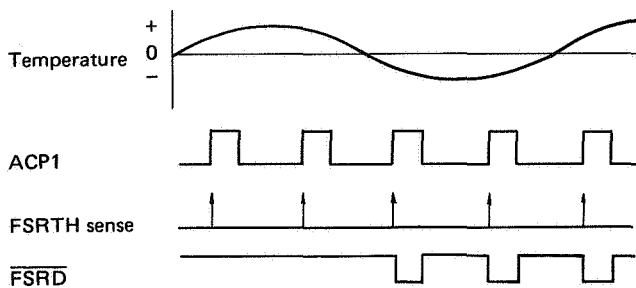


Figure 3-46 Fixing roller heater control

Microcomputer IC208 reads the FIXING ROLLER TEMPERATURE signal (FSRTH) from thermistor TH1, which contacts the upper surface of the fixing roller when ACP1 from the zero-cross generator (See Fig. 3-42) is TRUE. IC208 detects the surface temperature of the fixing roller and checks whether the temperature has reached the specified level. If it is lower, IC208 sends a TRUE FIXING ROLLER HEATER DRIVE command (FSRD) to photocoupler PC101 on the AC driver. PC101 turns on transistor Q101. When Q101 turns ON, a gate voltage is applied to gate G of triac Q1 and Q1 turns ON. Power is supplied to fixing roller heater H1.

(3) Thermistor malfunction

Microcomputer IC208 self-diagnoses any thermistor malfunction detected. To prevent damage to the printer, power to fixing roller heater H1 is cut, and the READY signal ( $\overline{RDY}$ ) sets FALSE. This informs the external device that a malfunction has occurred. The external device responds by sending a STATUS REQUEST to the DC controller over the COMMAND /STATUS signal ( $\overline{SC}$ ). When the DC controller receives this command, it sends a FIXING ASSY MALFUNCTION status report back to the external device via the SC signal. Printing is disabled at the time the READY signal goes FALSE.

Thermistor malfunction	Detection
Open circuit	At power ON or PAUSE command input, the temperature does not reach a specified value (160°C) after about 70 seconds. During printing, the temperature drops below the lower limit (140°C).
Short circuit	The temperature exceeds the upper limit (230°C).

Table 3-5 Thermistor malfunction

Notes:

- IC208 begins detecting the lower limit temperature after the upper fixing roller temperature once reaches the specified value.
- If the thermistor is short-circuited and the power is switched ON, IC208 assumes the fixing roller heater is at the upper limit temperature. The printer is disabled from printing.
- If a breakdown of the thermistor is detected by microprocessor IC208, the microprocessor sends a fixing assembly breakdown signal (FSERL) to the buffer IC (IC203), via I/O port IC227.

IC208 sends a TRUE  $\overline{\text{FSERL}}$  to the buffer IC (IC203) to turn on transistor Q204 and charge capacitor C235. When C235 is charged, a TRUE FUSER ERROR signal (FSER) is applied to IC208. Microcomputer IC208 never generates a TRUE  $\overline{\text{FSRD}}$  command as long as FSER is TRUE. FSER does not go FALSE unless a certain period has passed (which is determined by a timing circuit comprised of C235 and R252) after the printer is switched OFF.

If FSER is input to microcomputer IC208, IC208 does not actuate fixing roller heater H1 even if the power is switched OFF and immediately thereafter switched ON. Fixing roller heater H1 cools down until FSER becomes FALSE.

If fixing roller heater H1 warms up before microcomputer IC208 detects an open circuit in the thermistor, which takes about 70 seconds after the power is turned ON, the printer will not be damaged.

#### (4) Triac malfunction

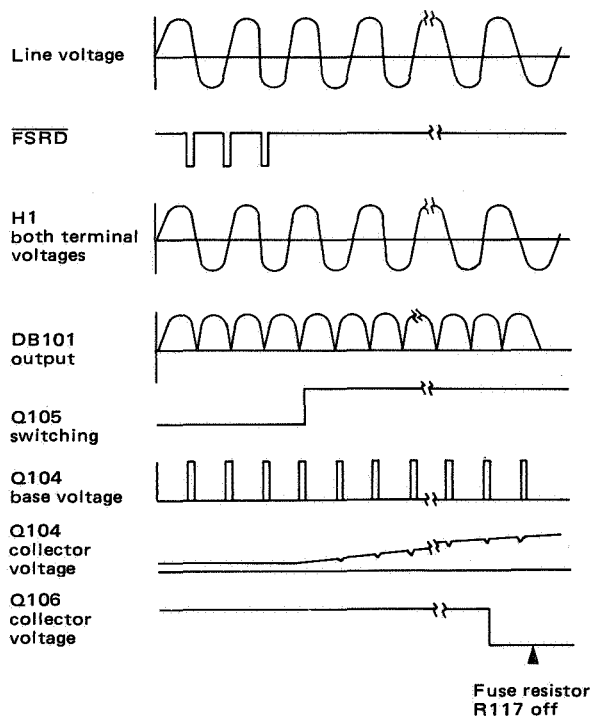


Figure 3-47

If line voltage is applied to fixing roller heater H1 even if a FALSE  $\overline{\text{FIXING ROLLER HEATER DRIVE}}$  command ( $\overline{\text{FSRD}}$ ) is transmitted from microcomputer IC208, the line voltage is turned OFF by the fixing roller heater safety circuit to prevent damage to the printer.

When microcomputer IC208 applies a TRUE  $\overline{\text{FSRD}}$  command to photocoupler PC103, PC103 turns transistor Q102 ON through the differentiation circuit comprising capacitor C105 and resistors R108 and R109. Trigger signals are applied by Q102 to the latch circuit comprising Q103 and Q105. Q103 and Q105 are switched ON. Q105 then discharges C106 via R116, Q105 and R112. Transistor Q106 is turned OFF and DC voltage is applied to the coil of relay RL101 through fuse resistor R117. RL101 is turned ON and line voltage is applied to fixing roller heater H1.

If line voltage is applied to fixing roller heater H1 when  $\overline{\text{FSRD}}$  output from microcomputer IC208 is FALSE, the line voltage is full-wave rectified into a lower AC voltage, which is then applied to PC102 by rectifier DB101. PC102 transmits a positive pulse to the base of the transistor Q104 when the AC voltage from DB101 approaches 0V. Q104 is turned ON when a positive pulse is applied to its base.

When  $\overline{\text{FSRD}}$  becomes FALSE, PC103 is turned OFF, and Q102 turns OFF the trigger signals to the latch circuit comprising Q103 and Q105. Q103 and Q105, therefore, turn OFF when Q104 turns ON.

The output of Q104 is applied to capacitor C106 via resistor R116. Since Q104 stays OFF longer than the period when it is ON, the voltage in C106 increases gradually. When the voltage of C106 exceeds that of zener diode ZD102, transistor Q106 turns ON. The current in fuse resistor R117 increases until R117 fuses, which turns RL101 OFF and the current flow to fixing roller heater H1 is cut off.



c. Laser driver circuit

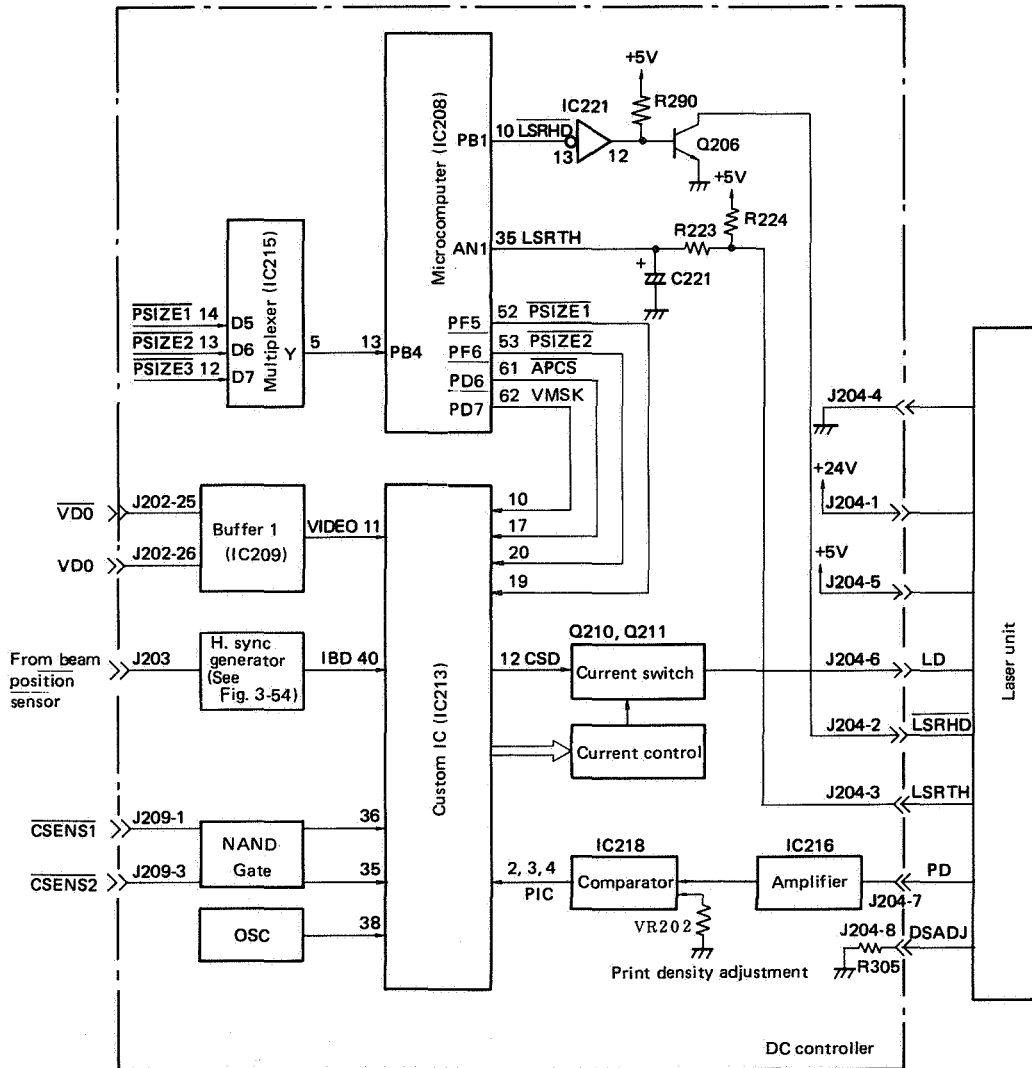


Figure 3-48 Laser driver circuit

(1) Introduction

The laser driver circuit generates a laser drive signal (LD) which controls laser beam power (ON/OFF), stabilizes laser beam intensity, and controls laser chip temperature. The laser beam driver circuit judges drum sensitivity by the drum sensitivity identification cam and drum sensitivity identification microswitches MS3 and MS4, all of which are located near the right side of the EP cartridge, and maintains correct laser beam intensity.

(2) Operation

Generation of laser drive signal

Laser drive signal (LD) is generated when the printer is READY ( $\overline{RDY}$  is TRUE) by custom IC213 and a current switch circuit comprising Q210 and Q211. IC213 ORs the video signal (VIDEO) transmitted from the external device via buffer IC209 (a line receiver) with the UNBLANKING signal (UNBL), which IC213 generates by itself based on IBD transmitted from the H. sync generator. IC213 then generates the CURRENT SWITCH DRIVER signal (CSD), which is transmitted to a current switch circuit comprising Q210 and Q211. Q210 and Q211 generate a TRUE LASER DRIVER signal (LD), which is the voltage/current conversion of CSD. (When CSD is TRUE, the current flows). LD is transmitted to the laser unit.

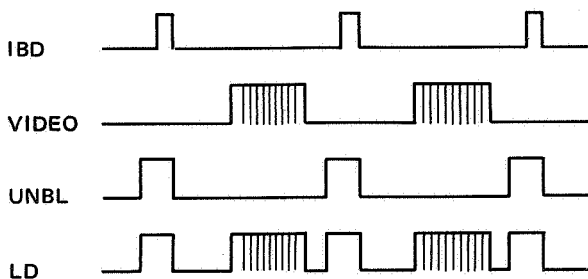


Figure 3-49 LD signal generation timing chart

Reference:

In TV scanning, the electron beam usually scans from left to right. When the beam scans from right to the left, the beam is OFF.

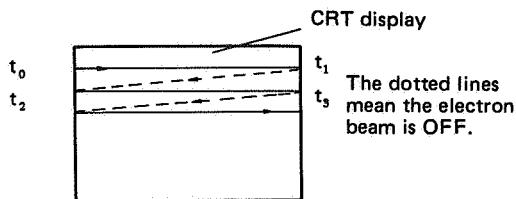


Figure 3-50 Electron beam (TV) scanning

Laser beam scanning differs slightly from TV scanning. In laser scanning, the laser beam is ON in non-image areas (to strike the stationary mirror). This is called "unblanking".

The laser beam striking the stationary mirror is sent to the beam position sensor (See Fig. 3-51). Then the H. sync generator of the DC controller outputs IBD.

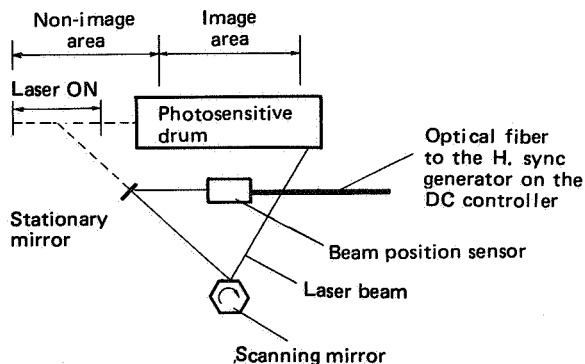
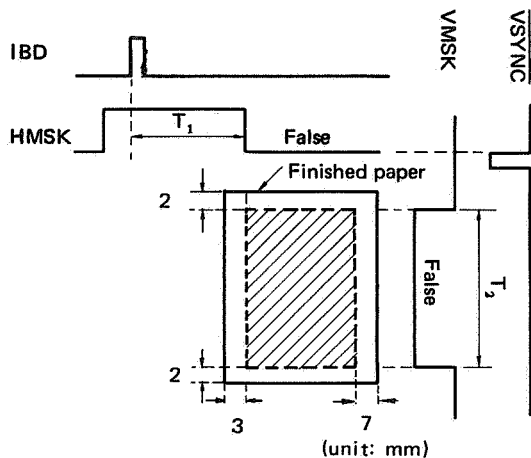


Figure 3-51 Unblanking

Before ORing VIDEO with UNBL, custom IC213 ANDs VIDEO, the horizontal mask signal (HMSK) and vertical mask signal (VMSK), to inhibit the laser beam from "writing" on non-image areas. Custom IC213 sets VIDEO FALSE when HMSK and VMSK are TRUE.



- \* indicates the area where the laser beam writes on the drum.
- \*  $T_1$  and  $T_2$  differ for different paper sizes.
- \* A 7 mm and 25 mm right margin is made by blocking the laser beam.

Figure 3-52 Blank areas

HMSK is generated by custom IC213, based on PAPER SIZE 1 signal (PSIZE1) and PAPER SIZE 2 signal (PSIZE2), both of which come from microcomputer IC208. VMSK is generated by microcomputer IC208 through I/O port IC227 based on three PAPER SIZE signals (PSIZE1, PSIZE2, PSIZE3) which are received via multiplexer IC215 and transmitted to custom IC213.

#### Reference:

See Table 3-2 for contents of PSIZE1, PSIZE2 and PSIZE3 for different paper sizes. The contents of PSIZE1 and PSIZE2 generated from microcomputer IC208 for different paper sizes are the same as those for PSIZE1 and PSIZE2 input to multiplexer IC215.

#### Laser beam intensity control

Laser beam intensity is controlled only when a TRUE AUTO POWER CONTROL START signal (APCST) is output from microcomputer IC208 while the printer is in INTR, PRINT or LSTR. APCST is usually output after one page has been written on the drum by the laser, and before the next page begins to be written by the laser beam.

Upon receiving APCST, custom IC213 turns the laser ON. The laser beam power sensor in the laser unit sends the LASER POWER DETECT signal (PD) in voltage proportional to laser intensity to amplifier IC216 of the DC controller. IC216 amplifies PD to a specified level and sends it to comparator IC218. IC218 compares the reference voltage from print density adjustment resistor VR202 ( $V_{ref}$ ) (which equals the output from IC216 at the specified laser intensity) with the output from IC216. If the output

from IC216 is smaller than  $V_{ref}$ , IC218 sends a TRUE POWER INCREASE command (PIC) to custom IC213.

Custom IC213 commands the current control circuit to gradually increase laser intensity when APCST from microcomputer IC208 comes TRUE. At the same time, IC213 checks whether PIC goes FALSE. Upon receiving a TRUE PIC command for increasing the current in the semi-conductor element, the current control circuit controls the current switch circuit comprising Q210 and Q211 and gradually increases the current of the LASER DRIVE signal (LD) from zero.

Along with the increase in semi conductor element current, laser intensity also increases. When the intensity exceeds the level specified by variable resistor VR202, PIC applied to custom IC213 goes FALSE. Custom IC213 commands the current control circuit to maintain laser intensity to the level obtained when PIC goes FALSE and turns the laser OFF. After that, when semi conductor element current becomes TRUE, the laser is always turned on with the specified intensity.

Custom IC213 restarts laser intensity control when another TRUE APCST signal is transmitted from microcomputer IC208. Besides laser intensity control, custom IC213 detects drum sensitivity and accordingly switches laser intensity to a proper value based on drum sensitivity identification signals (CSENS1, CSENS2) output by drum sensitivity identification microswitches MS3 and MS4.

The laser drive circuit contains three individual comparator circuits in IC218, each of which is applied with a different reference voltage from VR202. Each output of the three comparators is connected to custom IC213.

Custom IC213 selects one of the three comparator outputs (PIC) according to detected drum sensitivity, and switches laser beam intensity.

#### Laser chip temperature control

The temperature of the laser chip is controlled by microcomputer IC208 on the DC controller PCB when there is no jam or malfunction in the printer. Upon receiving the LASER TEMPERATURE signal (LSRTH) from the thermistor in the laser unit, microcomputer IC208 checks whether the laser chip temperature has reached the specified value. If the temperature is lower, IC208 sends a TRUE LASER HEATER DRIVE command (LSRH) to the laser heater in the laser unit, and the laser heater warms the laser chip.

When the laser heater reaches the correct temperature, IC208 sets LSRH FALSE and turns the laser heater OFF.

To prevent the laser chip from being damaged by a defective thermistor in the laser unit, IC208 detects a malfunction in the thermistor by self-diagnosis.

If microcomputer IC208 detects an abnormal

condition in the the thermistor, it cuts power to the laser heater, and sets the READY signal ( $\overline{\text{RDY}}$ ) FALSE. The video controller thus knows that a malfunction has occurred, and responds by sending a STATUS REQUEST command to the DC controller via the COMMAND/STATUS signal ( $\overline{\text{SC}}$ ). Upon receipt of this command, the DC controller sends a status report to the external device (via  $\overline{\text{SC}}$ ) noting that a malfunction has occurred in the laser temperature control circuit.

Thermistor malfunction	Detection
Open circuit	At power ON, the temperature does not reach the specified value within about 10 minutes. During printing, the temperature drops under the lower limit ( $34^{\circ}\text{C}$ ).
Short circuit	The temperature exceeds the upper limit ( $50^{\circ}\text{C}$ ).

Table 3-6 Laser chip thermistor malfunction

**Notes:**

- IC208 begins detecting lower limit temperature ( $34^{\circ}\text{C}$ ) once the laser chip temperature reaches the specified value. This prevents the printer from being disabled for printing ( $\overline{\text{RDY}}$  is FALSE) when the power is switched ON.
- If the thermistor is short-circuited, IC208 starts detecting the upper limit temperature and printing is disabled.

Printing is disabled when the READY signal goes false. Once this signal goes FALSE, and the printer is switched OFF, temperature adjustments will not be made on the laser chip for about 10 minutes. This allows plenty of time for the laser to cool and prevents overheating.

After power is switched back ON, microcomputer IC208 will not check for a thermistor malfunction for about 10 minutes, but even though heated by by the laser heater, this is not enough time to damage the laser chip.

**d. Stationary mirror and horizontal sync generator (a part of the the DC controller)**

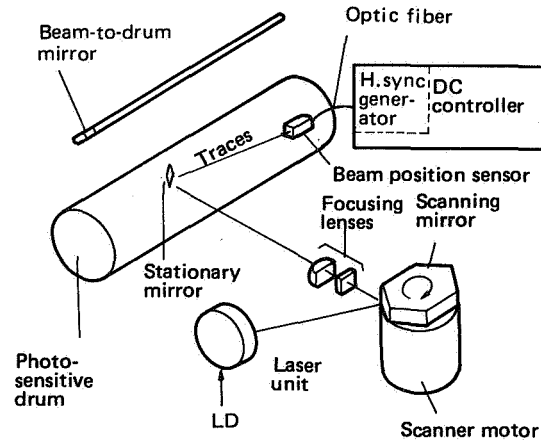


Figure 3-53 Horizontal sync generator mechanism

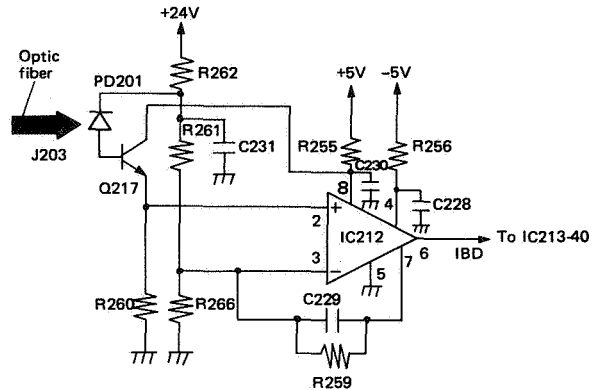


Figure 3-54 Beam detect pulse (IBD)

The horizontal sync generator mechanism is shown in Figure 3-53. The circuit for the horizontal sync generator is shown in Figure 3-54.

The laser beam strikes the stationary mirror after reflecting off the scanning mirror and passing through the focusing lens. Reflecting off the stationary mirror once every scan, the laser beam, which is transmitted by an optic fiber, illuminates photodiode PD201, which causes IC212 to produce a pulse (IBD).

IC212 is a comparator: when PD201 is illuminated, IC212-2 is more positive than IC212-3, which sets IC212-6 HIGH; when PD201 is not illuminated, IC212-2 is more negative than IC212-3, which sets IC212-6 LOW.

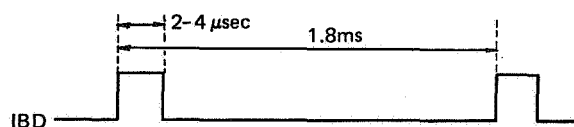


Figure 3-55 Beam detect pulse (IBD)

e. CPU reset circuit

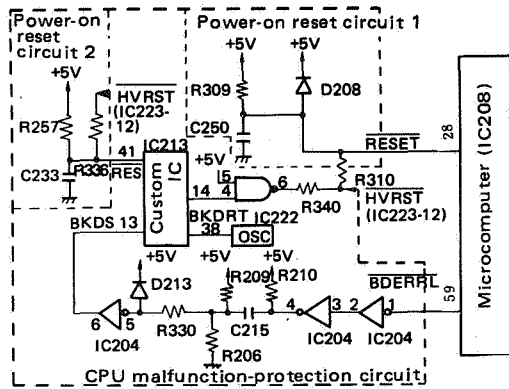


Figure 3-56 CPU reset circuit

The dual circuit shown in the diagram above forms the RESET signal ( $\overline{\text{RESET}}$ ) used to reset microcomputer IC208.

- High-voltage reset signal (HVRST)  
The RESET signal ( $\overline{\text{RESET}}$ ) is taken from the HIGH-VOLTAGE RESET signal ( $\overline{\text{HVRST}}$ ), that is effective (in resetting the microcomputer) during the interval between power ON and the +5V power supply reaching prescribed voltage level, or if the power supply drops suddenly.

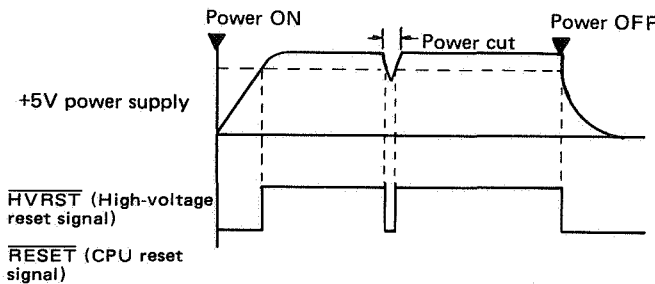


Figure 3-56A  $\overline{\text{HVRST}}$ ,  $\overline{\text{RESET}}$  timing

The HIGH-VOLTAGE RESET signal is produced by the DC power supply/main motor driver circuit, and is sent to the DC controller as  $\overline{\text{HVRST}}$ .

- CPU malfunction protection circuit  
Failure of microcomputer IC208 to produce a BD MALFUNCTION DETECTION signal ( $\overline{\text{BDERRL}}$ ) is interpreted as a malfunction with the device, and the microcomputer will be reset. When power to the machine is switched ON, prior to the first  $\overline{\text{BDERRL}}$  output by IC208, it is possible for the custom IC (IC213) to interpret a microcomputer malfunction when one has not actually occurred. To prevent this from happening, the power ON reset circuits (1 and 2) are set to clear the reset condition of the CPU (IC208) before the custom IC (IC213).

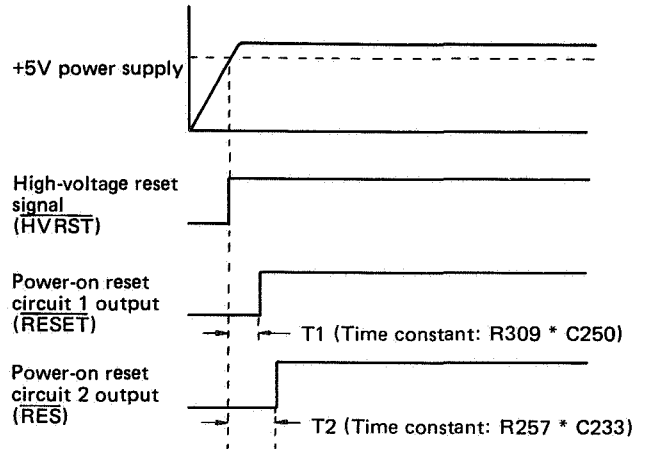
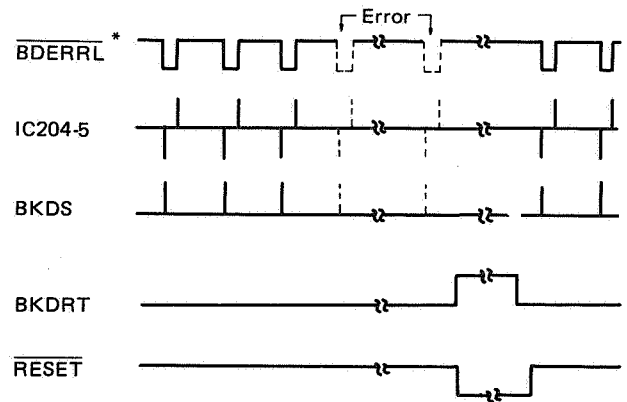


Figure 3-56B Timing between  $\overline{\text{RESET}}$  and  $\overline{\text{RES}}$

The function of the CPU malfunction-protection circuit is described below.



\*  $\overline{\text{BDERRL}}$  indicates the timing if no BD error happens

Figure 3-57 CPU malfunction protection timing

If operating normally, IC208 outputs through I/O port IC227 a BD MALFUNCTION DETECTION signal ( $\overline{\text{BDERRL}}$ ) from output port (IC227-22) at specified intervals (several tens of ms).  $\overline{\text{BDERRL}}$  is differentiated by the differentiation circuit (consisting of capacitor C215, and resistors R206 and R209), then passed through inverter IC204 and sent to the custom IC (IC213) as the BREAK DOWN DETECTION signal (BKDS).

When the custom IC receives BKDS, an internal timer is activated, and the custom IC waits for input of the next BKDS signal. If the next BKDS does not arrive within the time period set by the timer (several hundred ms), custom IC (IC213) generates a BREAK DOWN RESET signal (BKDRT) having a pulse width of several hundred milliseconds (set by an internal timer in IC213), and sends this signal to power ON reset circuit 1. After power ON reset circuit 1 receives

this signal, it sends the CPU RESET signal ( $\overline{\text{RESET}}$ ) to microcomputer IC208. Once reset, the microcomputer again outputs the BD MALFUNCTION DETECTION signal ( $\overline{\text{BDERRL}}$ ) for the specified period.

**Reference:**  $\overline{\text{BDERRL}}$  is also used to light the display panel indicator on other (different specification) models (for example, OEM models).

For this reason, timing of the output of  $\overline{\text{BDERRL}}$  (by IC208) will depend on whether this indicator is ON or OFF.

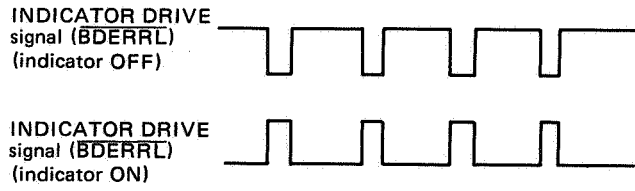


Figure 3-58

## B. High-Voltage Power Supply

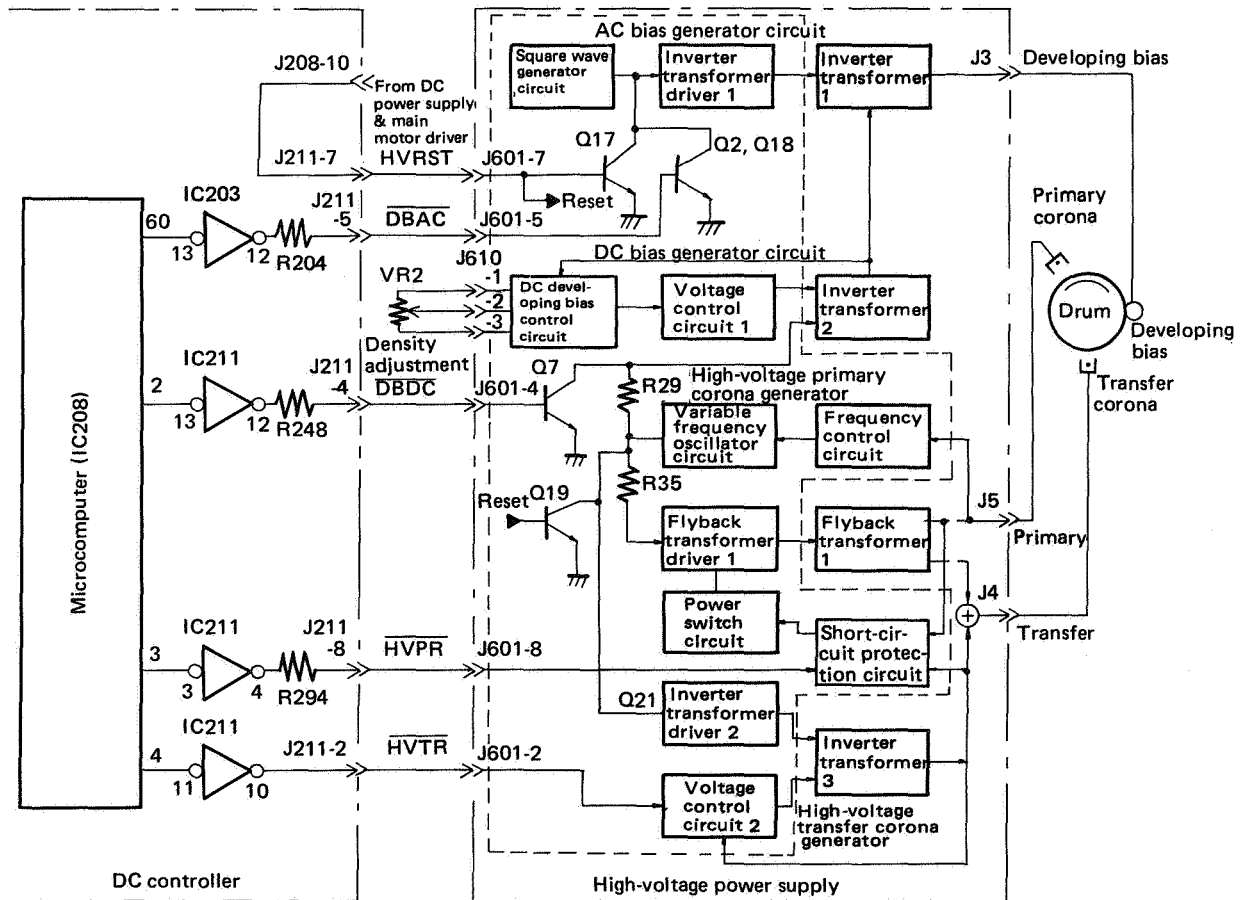


Figure 3-59 High-voltage control circuit

### 1. Outline

The high-voltage power supply generates high voltage for the primary corona, transfer corona, and developing bias according to commands from microcomputer IC208. The high-voltage power supply prevents the circuit from being damaged by a short circuit in the high-voltage output, and stabilizes corona discharge current in different environments.

### 2. Operation

#### Generation of primary corona high voltage

The high-voltage primary corona generator circuit transmits a pulse from the variable frequency oscillator circuit to flyback transformer driver 1, and generates primary corona high voltage, which is then applied to the primary corona. The high-voltage primary corona generator circuit applies a feedback signal proportional to the corona discharge current which flows in the primary corona assembly to the frequency control circuit in order to stabilize corona discharge current.

The frequency control circuit compares the feedback signal with the reference voltage (which

equals the voltage of the feedback signal when the correct corona discharge current flows in the primary corona assembly). If there is a difference in voltage, the frequency control circuit changes the pulse frequency of the variable frequency oscillator circuit to eliminate the difference.

The high-voltage primary corona generator circuit contains a short-circuit protection circuit to prevent the circuit from being damaged by a short circuit in primary corona high-voltage output. When detecting high-voltage short circuits the short-circuit protection circuit switches off the power to flyback transformer driver 1 using the power switch circuit.

#### Generation of transfer corona high voltage

The high-voltage transfer corona generator circuit applies pulses from the variable frequency oscillator circuit in the high-voltage primary corona generator circuit to inverter transformer 3 via inverter transformer driver 2, and generates transfer corona high voltage. The transfer corona high voltage is added to the bias high voltage which is generated by flyback transformer 1, and lower than the starting voltage of transfer corona discharge. The addition method

requires less voltage for the transfer corona, and thus lowers voltage parts. As a result, the high-voltage transfer corona generator circuit can be compact.

The high-voltage transfer corona generator circuit applies a feedback signal proportional to the corona discharge current (produced by the added transfer corona high voltage) to voltage control circuit 2 to stabilize corona discharge current. Voltage control circuit 2 compares the feedback signal with the reference voltage (which equals the feedback signal voltage when the specified corona discharge current flows to the transfer corona). If the two voltages differ, the voltage control circuit 2 changes the drive voltage of inverter transformer 3 to eliminate the difference.

The high-voltage transfer corona generator circuit uses a short-circuit protection circuit in the high-voltage primary corona generator circuit to protect the circuit from being damaged by a short circuit in transfer corona high-voltage output.

#### Developing bias generation

The developing bias circuit is comprised of DC and AC bias generator circuits. It generates the developing bias by adding the AC and DC bias.

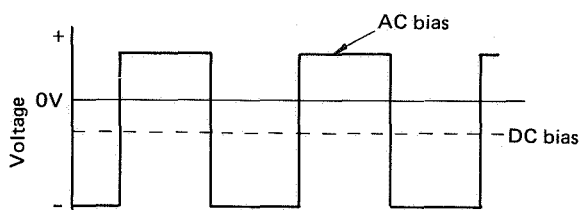


Figure 3-60 Developing bias

The DC bias in the developing bias controls print density. It is adjusted by density adjustment VR2, which varies the potential difference between the drum surface and the developing bias.

The DC bias generator circuit generates DC bias by applying pulses from the variable frequency oscillator in the high-voltage primary corona generator circuit to inverter transformer 2. The DC developing bias control circuit compares a reference voltage generated by density adjustment VR2 with the feedback voltage. If there is a difference in voltage, this circuit actuates voltage control circuit 1 to control the drive voltage of inverter transformer 2, and the difference is eliminated.

A TRUE DEVELOPING BIAS (DC) command (DBDC) is sent from microcomputer IC208 to transistor Q7. Transistor Q7 is turned OFF. When Q7 is OFF, pulses from the variable frequency oscillator circuit flow into inverter transformer 2, thus generating a DC bias.

The AC bias generator circuit sends a square wave signal from the square wave generator circuit to inverter transformer driver 1. Upon receiving the

square wave signal, inverter transformer driver 1 amplifies this signal and transmits it to inverter transformer 1. Inverter transformer 1 generates an AC bias based on the output from inverter transformer driver 1, and adds the AC bias to the DC bias sent by inverter transformer 2, thus generating a developing bias.

#### Reset circuitry

The high-voltage power supply and microcomputer IC208 in the DC controller are driven off +24V and +5V, respectively. The +24V power supply is connected to many DC loads. A large capacity capacitor is used to drive the loads.

When the printer is switched OFF, if the +5V power supply goes off before the +24V power supply, the high-voltage power supply may not work correctly. To prevent this, reset circuit (transistors) Q17 and Q19 stop the high-voltage power supply from being driven when +24V is applied.

The DC power supply and main motor driver circuit send a TRUE HIGH-VOLTAGE RESET signal (HVRST) to reset circuit Q17 and Q19 via the DC controller when the +5V power supply is switched OFF.

Reset circuit Q19 turns the variable frequency oscillator circuit off so that the generator circuits for the primary corona high voltage, transfer corona high voltage, and DC bias do not function. Reset circuit Q17 turns the square wave generator circuit off so that the AC bias generator circuit does not function.



### C. Main Motor Driver Circuit

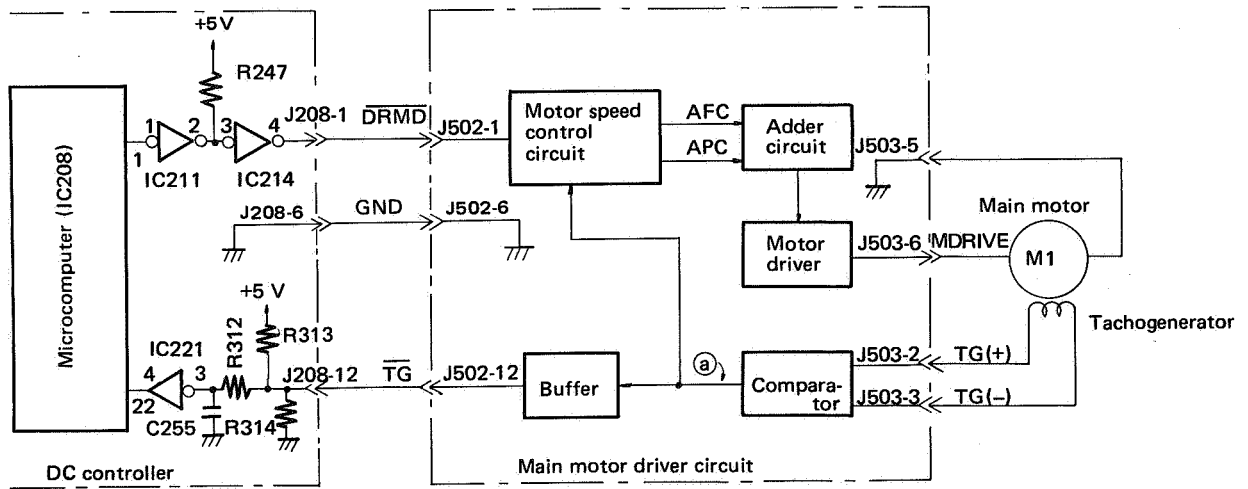


Figure 3-61 Main motor control circuit

#### 1. Outline

The main motor driver circuit, which is contained in the DC power supply & main motor driver, turns main motor M1 ON or OFF according to a command from microcomputer IC208.

When the main motor is ON, the circuit detects a signal generated by a tachogenerator in the main motor unit. The tachogenerator measures motor speed. Thus the main motor drive circuit keeps the motor rotating at the correct speed. The tachogenerator signals are changed into pulses and sent to microcomputer IC208 in the DC controller. Microcomputer IC208 use the pulses as timing signals when executing a print sequence.

#### 2. Operation

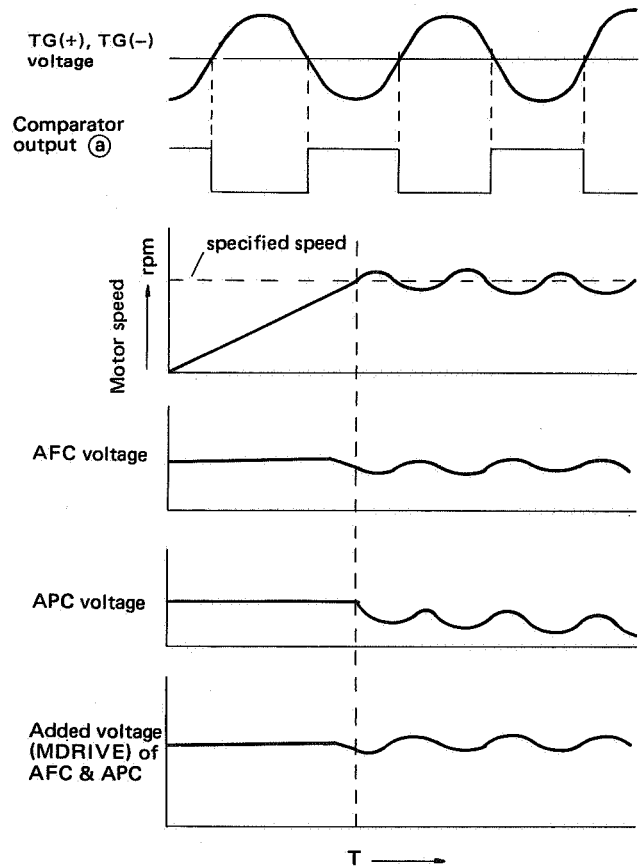
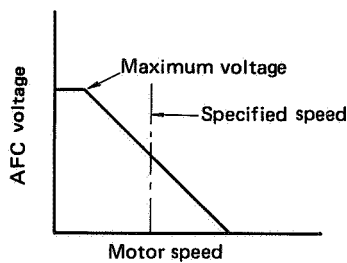


Figure 3-62 Main motor driver timing chart

When microcomputer IC208 in the DC controller outputs a TRUE DRUM DRIVE command (DRMD), the main motor driver circuit actuates main motor M1. Main motor M1 sends tachogenerator signals (TG(+), TG(-)) corresponding to motor speed to the main motor driver circuit.

The main motor drive circuit changes TG(+) and TG(-) to pulses using a comparator, and distributes them to the motor speed control circuit and DC controller. The motor speed control circuit compares the frequency of the pulses from the comparator and a reference frequency produced by an internal oscillator. The reference frequency equals the pulse frequency generated by the comparator when the main motor is rotating at the correct speed.

Based on the comparison, AFC and APC are generated and sent to the adder circuit. AFC is a voltage signal which varies in response to the difference between the frequency of comparator pulses and the reference frequency. AFC reaches a maximum when the motor is not running, and gradually decreases as the motor gains speed.



**Note:**

Motor speed is proportional to the frequency of pulses from the comparator.

Figure 3-63 AFC voltage

APC is a voltage signal which varies in response to the phase difference between the comparator pulse and the reference frequency. APC reaches a minimum when the pulse phase shifts in a plus direction 180° and reaches a maximum when the pulse phase shifts in a minus direction 180°

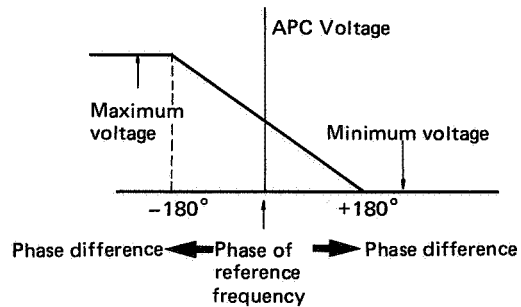


Figure 3-64 APC voltage

The adder circuit generates a MOTOR DRIVE signal (MDRIVE) by adding AFC and APC, and sends this signal to the motor driver. The motor driver amplifies the power of MDRIVE and sends it to main motor M1. The speed of main motor M1 is regulated by MDRIVE.

Pressing a control panel circuit switch generates a signal (PSW0 – PSW5) sent to microcomputer IC3 (video controller) via input port IC40. Upon receiving this signal, the microcomputer IC3 directs the performance of the task assigned to that switch. For example, if the SHIFT and FORM FEED switches are pressed simultaneously while the printer is off-line, the self-test function produces a print-out. For this, microcomputer IC3 directs the video signal generator (within the video controller) to form the video signal (VDO, VDO: differential signals) for a repeated pattern of alphanumerics to be printed out.

### 1. Test switch

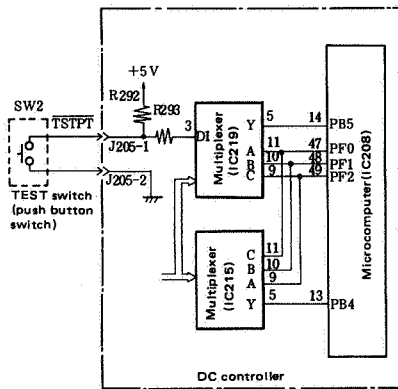
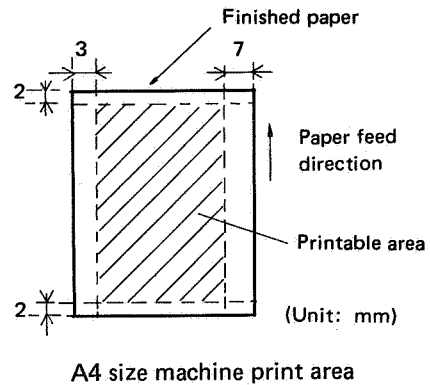


Figure 3-65

The test switch is located on the left side of the left panel. (See Fig. 1-4 in Chapter 1.) After the photosensitive drum has stopped (and the READY/WAIT indicator is lit), pressing this switch once results in a one page print-out of the vertical line test print.

Pressing the test switch sends a TEST PRINT command (TSTPT) to multiplexer IC219. This command is further passed to microcomputer IC208 on the DC controller, which directs printing a test print.

The printing areas for test prints using A4, B5, legal, and letter size paper are shown in the diagram below.



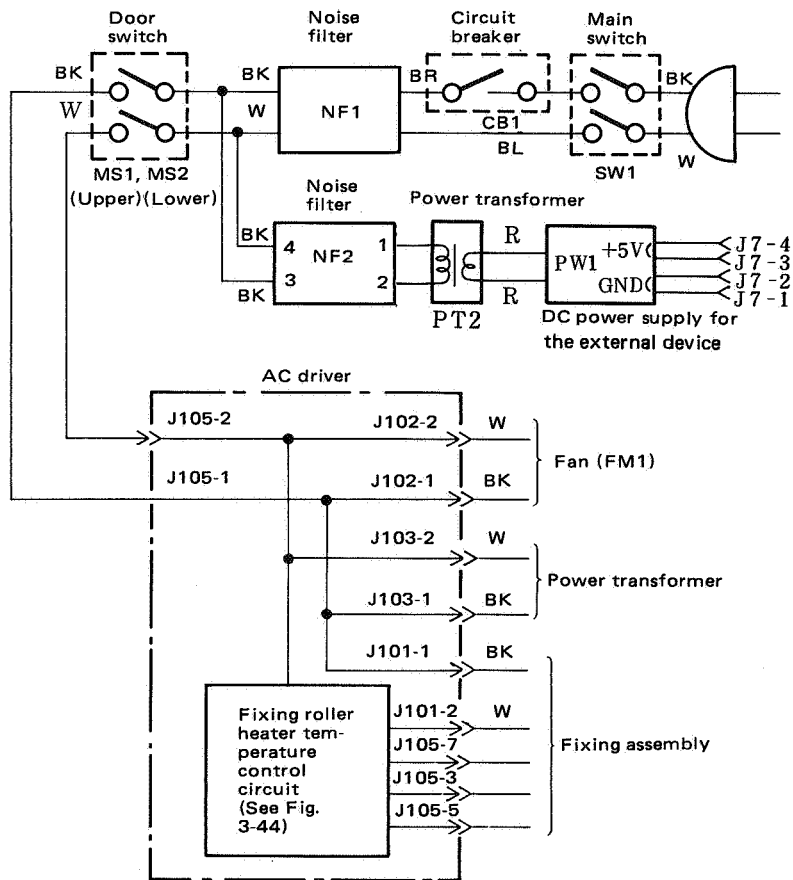
A4 size machine print area

Figure 3-66

## VI. POWER SUPPLIES

### A. Power Interlock Assembly

The power interlock assembly controls all AC loads. It switches the AC supply to the AC loads for printing.



**Note:** The illustration is the power supply for the 115V/60Hz model. Since the block diagram for the 220/240V model is similar, no separate illustration is given.

The DC power supply for the video-controller in the main illustration shows the new type, and the illustration on the left, the old type.

Figure 3-67

AC line voltage is applied to AC loads when main switch SW1 and door switches MS1 and MS2 are ON. (MS1 and MS2 switch ON when the upper half of the main body is closed, and switch OFF when the upper half is opened). If an abnormal current flows in the AC loads, circuit breaker CB1 functions even if SW1, MS1 and MS2 are turned ON, and the AC line voltage is switched OFF.

Noise filter NF1 and NF2 prevent noise in the AC line caused by the printer and protect the printer from noise in the AC line.

## B. DC Power Supply

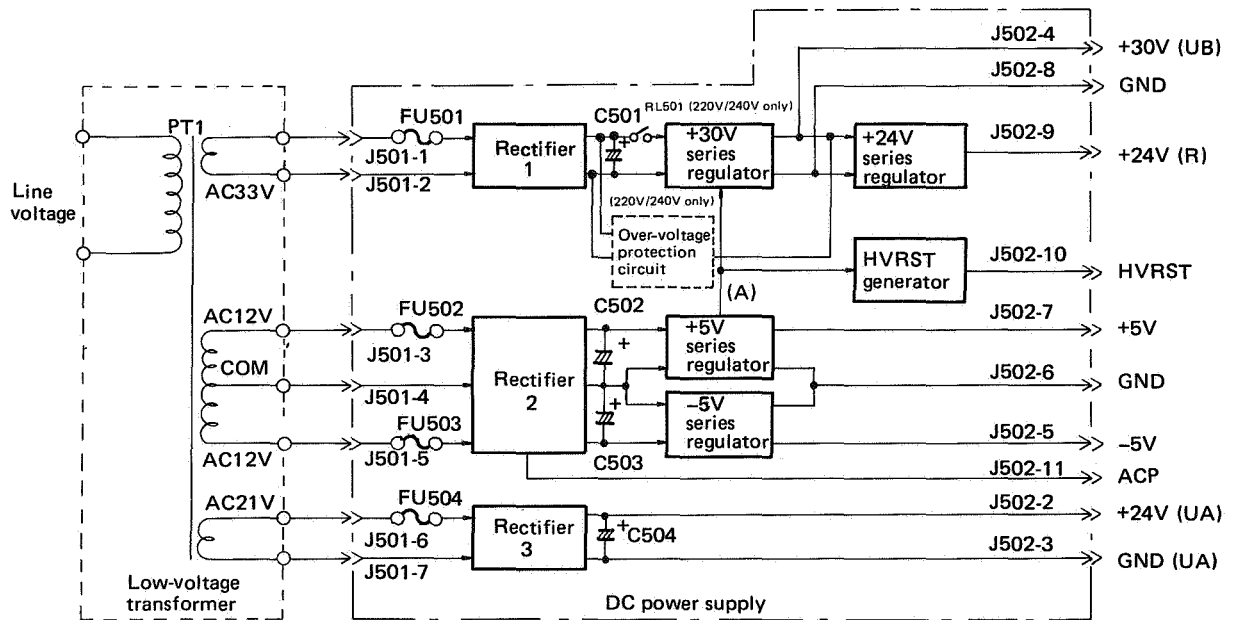


Figure 3-68 Block diagram of DC power supply

The DC power supply, which is contained in the DC power supply & main motor driver, generates and outputs five DC voltages and two sequence control signals.

When the main switch is turned ON, line voltage is sent to low-voltage transformer PT1. Low-voltage transformer PT1 changes the line voltage to lower AC voltage, and sends the AC voltage to the DC power supply.

The DC power supply full-wave rectifies the low AC voltage with rectifiers 1, 2 and 3, and outputs full-wave rectified pulses (ACP) from rectifier 2 as a sequence control signal.

The outputs from the three rectifiers are sent to capacitors C501, C502, C503 and C504 for smoothing, and output +24V(UA) by C504. The unregulated DC voltage smoothed by C501, C502 and C503 is sent to the series regulator. Since the +24V(UA) is not regulated, it varies in response to line voltage.

The series regulator changes the unregulated DC voltage to regulated DC voltage, and outputs its as +5V, -5V, +24V(R) and +30V(UB). +30V(UB) is an unregulated DC voltage which fluctuates with AC voltage fluctuations.

The +5V series regulator outputs sequence control signal (A), which causes +25V(R) and +30V (UB) to switch ON and OFF after +5V does. Using sequence control signal (A), the HVRST generator outputs a TRUE HVRST signal, which actuates the high-voltage power supply and microcomputer IC208 on the DC controller only when +5V is provided (and HVRST is FALSE).

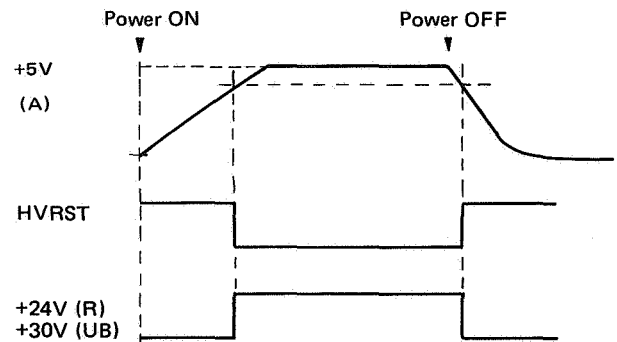


Figure 3-69 Power-up sequence

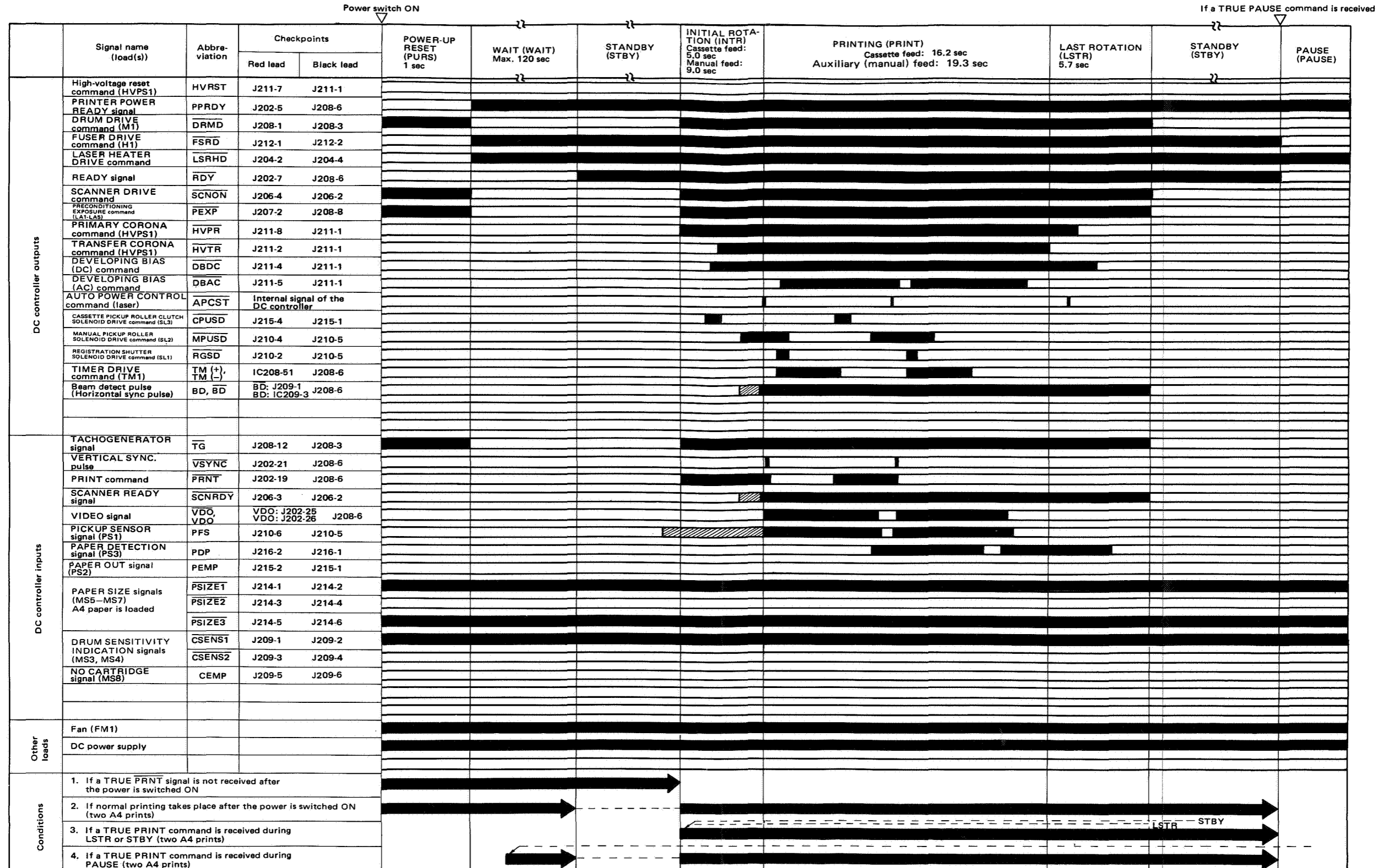
In 220V/240V models, the over-voltage protection circuit detects the +30V (UB) voltage. If the voltage exceeds the specified voltage, this circuit actuates the relay RL501, and cuts off +30V (UB) and +24V(R).



## VII. TIMING CHART FOR DC CONTROLLER INPUTS/OUTPUTS

- Notes:** — A black bar (■) on the timing chart indicates when each signal is TRUE.  
 — One drum rotation equals about four seconds.  
 — The time SCNRDY becomes TRUE varies within the area marked ▨ .  
 — BD and BD (differential signals) become TRUE when SCNRDY becomes TRUE. The timing of the three signals is the same.

- In auxiliary (manual) feed the printer does not start INTR unless paper is placed on the manual feed tray and PFS is TRUE. The timing of PFS, therefore, differs from that in cassette feed. ▨ indicates PFS timing in manual feed; ■ indicates timing common to auxiliary (manual) and cassette feed.  
 — FSRD, LSRHD vary according to temperature detection signals (FSRTH, LSRTH) from individual thermistors.



# CHAPTER 4

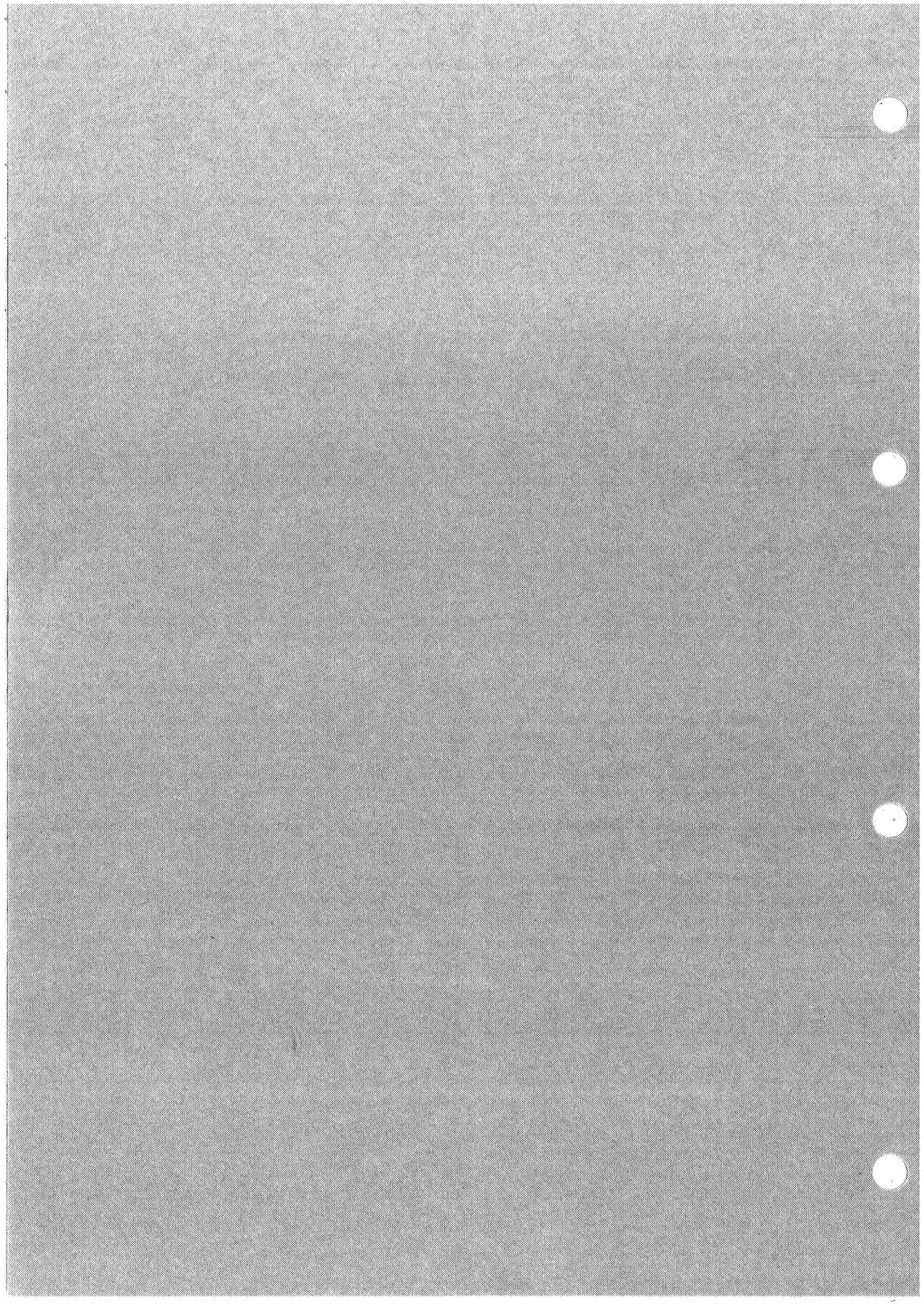
## THE MECHANICAL SYSTEM

This chapter explains mechanical operation, disassembly and reassembly of printer mechanisms, and adjustment procedures.

1. If the EP cartridge is removed while dismantling the printer, be sure to close the light-blocking shutters and to keep the cartridge in its original box. Cover it with a cloth, or put it in a dark place to prevent light from affecting the cartridge.
2. Remove the manual feed tray and print tray before disassembling, reassembling, or transporting the printer.
3. Disconnect the printer from the wall outlet before removing or replacing parts.
4. Unless specifically noted, reassembly is the reverse of disassembly, and will not be described unless necessary.
5. Do not mix screws (length, diameter), parts or locations when reassembling the printer.
6. As a rule, the printer should not be operated if any components have been removed.
7. Connect the laser shorting connector (RY9-0003) to the laser unit to prevent damage to the laser from static electricity.

I. EXTERNALS .....	4- 1	V. ELECTROSTATIC IMAGE/ DEVELOPING/CLEANING SYSTEM .....	4-17
II. DRIVE SYSTEM .....	4- 6	VI. FIXING SYSTEM .....	4-20
III. PAPER TRANSPORT SYSTEM .....	4- 7	VII. ELECTRICAL COMPONENTS ...	4-25
IV. EXPOSURE SYSTEM .....	4-15		





## I. EXTERNALS

### A. Covers and Panels

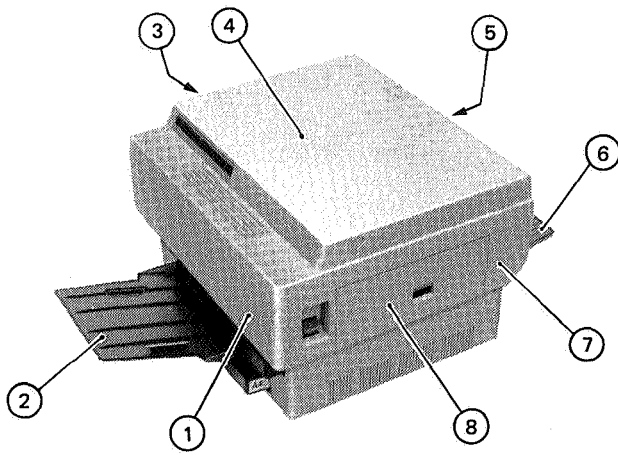


Figure 4-1

- |                |                     |
|----------------|---------------------|
| 1. Front panel | 5. Rear panel       |
| 2. Print tray  | 6. Manual feed tray |
| 3. Left panel  | 7. Right panel      |
| 4. Top cover   | 8. Right door       |

#### Note:

If not at the beginning of a line, numbers inside parentheses () refer to the number of screws that must be removed to detach a part. When cleaning inside the printer, inspecting or repairing, remove the necessary panels as explained. Because the panels are removed and attached just by loosening or removing screws, the procedure is not detailed.

#### 1. Rear panel

- (1) Open the printer (raise the upper half) and the right door.
- (2) Take out the EP cartridge.
- (3) Remove the four fastening screws to remove the rear panel.

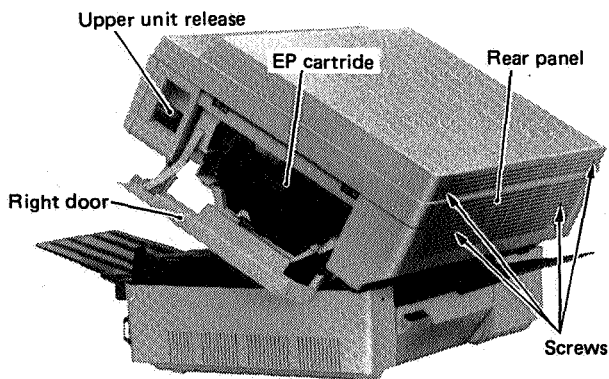


Figure 4-2

#### 2. Top cover

- (1) Open the printer (raise the upper half) and the right door.
- (2) Take out the EP cartridge.
- (3) Take off the rear panel.
- (4) Remove the four fastening screws for the top cover.
- (5) Lift the right side of the top cover and remove the connectors from the DC supply for the video controller, DC controller, and the interface connector. Remove the top cover.

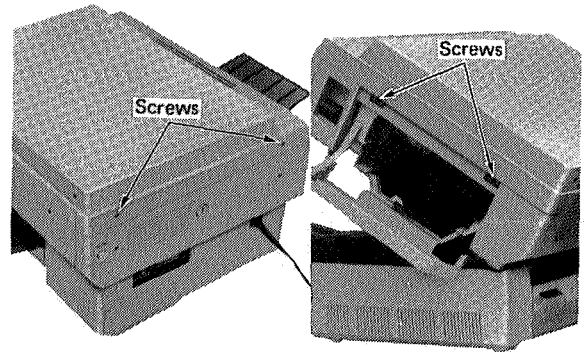


Figure 4-3

#### 3. Right and left panels

- (1) Open the printer (raise the upper half) and open the right door.
- (2) Take out the EP cartridge.
- (3) Take off the rear panel and top cover.
- (4) Take off the left and right panels (2 + 4 = 6).

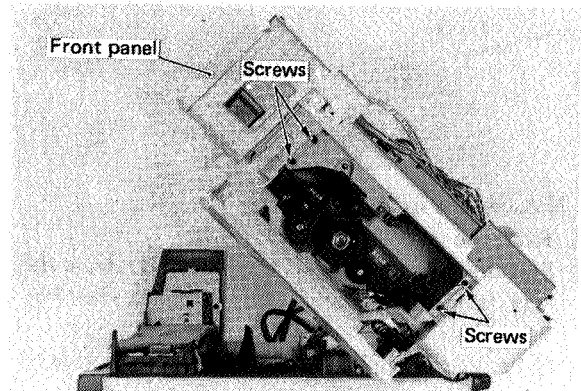


Figure 4-4

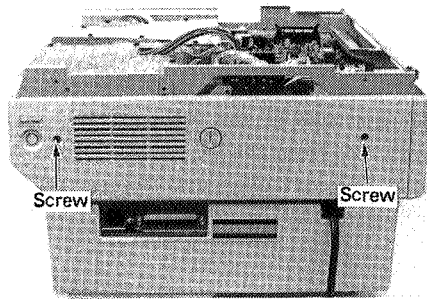


Figure 4-5

#### 4. Front panel

- (1) Open the printer (raise the upper half). Open the right door and take off the EP cartridge.
- (2) Take off the rear panel, the top cover, the right panel, and the left panel.
- (3) Remove the fastening screws (4), and take off the front panel.

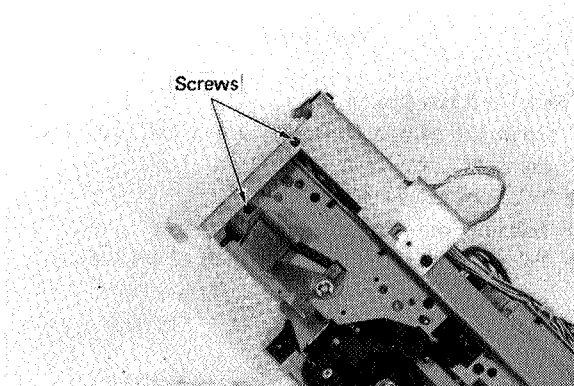


Figure 4-6

#### 5. Manual feed tray

- (1) Raise the manual feed tray. ①
- (2) Pull the left top edge of the tray and release the tray from the projection on the panel. (See Fig. 4-7, ②)
- (3) Take off the tray by pulling it in the direction of arrow ③ in Fig. 4-7.

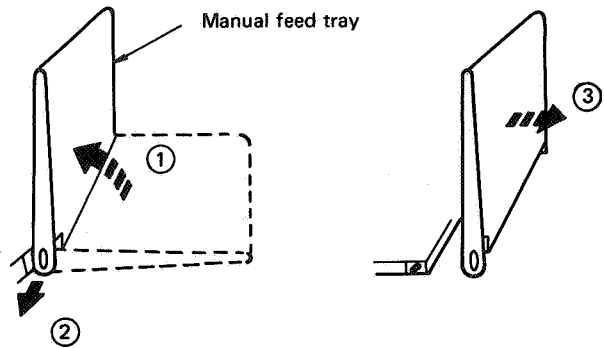


Figure 4-7

#### 6. Print tray

- (1) Raise the print tray.
- (2) Press the projection on one end of the print tray to release that end, then press the other end to release the tray. (See Fig. 4-8.)

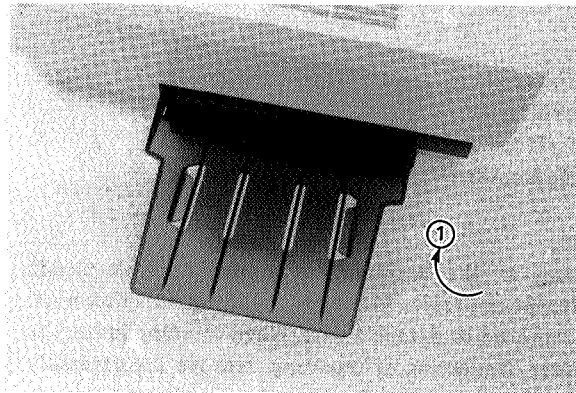


Figure 4-8

#### B. Power Interlock Assembly

##### 1. Power switch unit

- (1) Open the printer (Raise the upper half).
- (2) Remove the fastening screw on the power switch cover and take the cover off.

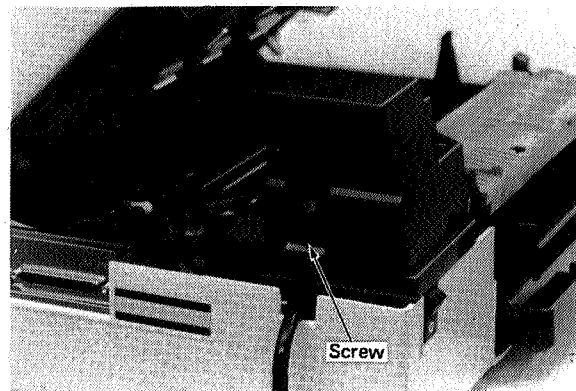


Figure 4-10

- (3) Remove the fastening screw to the wire harness cover. (See Fig. 4-11.)

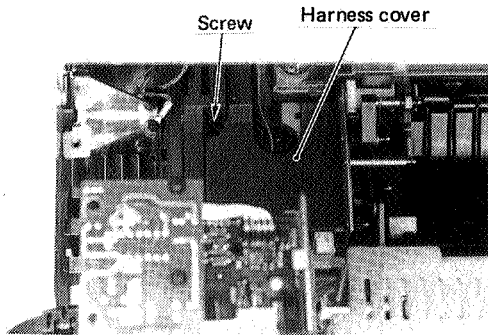


Figure 4-11

- (4) Open the cover side in contact with the power switch unit using a flat-bladed screwdriver. (See Fig. 4-12.) Take out the wire harness cover.

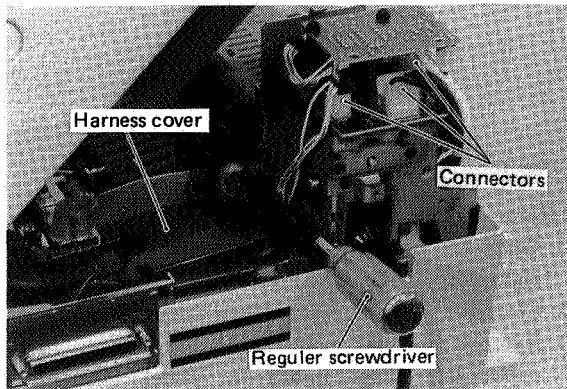


Figure 4-12

- (5) Unplug all PCB connectors on the AC driver PCB (fixing roller heater safety PCB and AC controller PCB). Pull the two Faston connectors out of the power switch unit. Remove the ring terminals (2) and five fastening screws. Then take out the power switch unit.

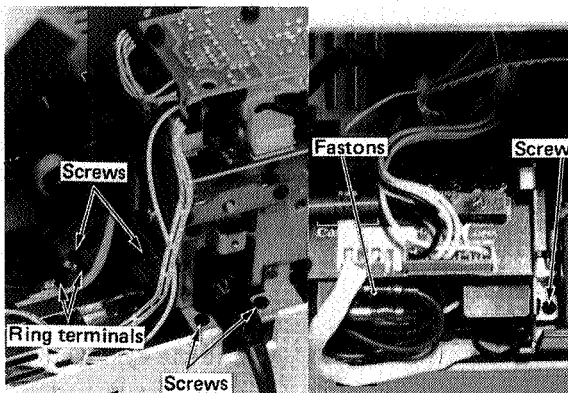


Figure 4-13

## 2. Door switch

- (1) Open the printer. (Raise the upper half.)
- (2) Remove the fastening screw on the power switch cover and take the cover off. (See Fig. 4-10.)
- (3) Remove fastening screw A (2) and take out the door switch together with the switch plate. Pull the four Faston connectors out, remove fastening screw B (2) and take out the door switch.

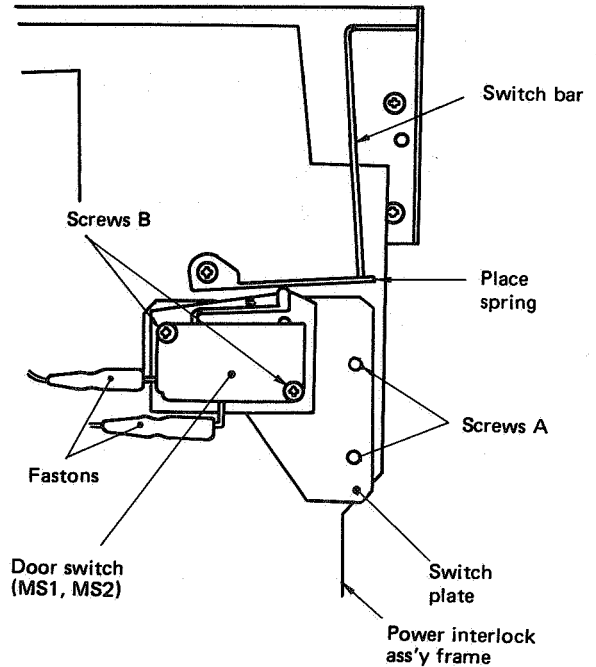


Figure 4-14

## 3. Test switch

- (1) Open the printer (raise the upper half) and the right door. Take the EP cartridge out of the printer.
- (2) Take off the rear panel (4).
- (3) Remove the four fastening screws and slide the top cover a little to the right (looking from the front).
- (4) Take off the left panel (2).
- (5) Remove the two Faston connectors, the fastening screw and the test switch.

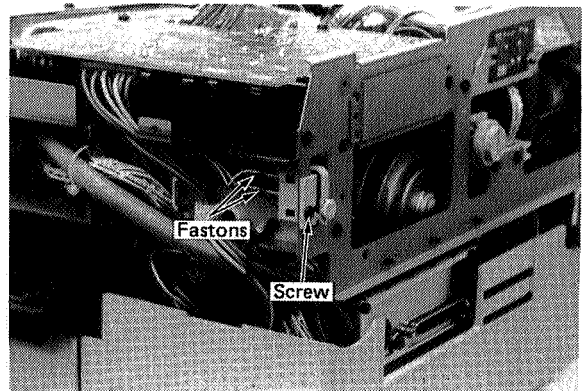


Figure 4-15

### C. Interface (I/O) Connector

#### Removal

- (1) Open the printer (raise the upper half).
- (2) Remove the fastening screws (1) for the ground.
- (3) Take out the interface (I/O) connector together with the mounting plate (2).

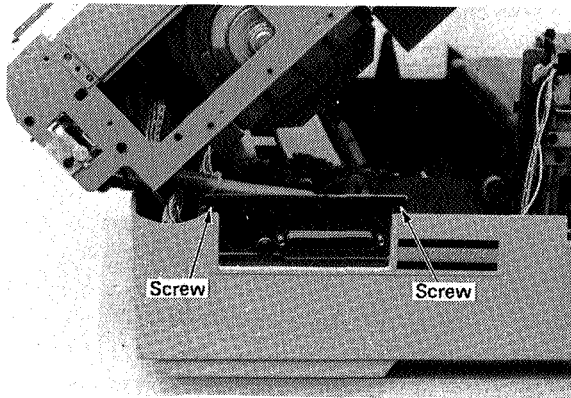


Figure 4-16

### D. Print Density Adjustment Dial

#### Removal

- (1) Open the printer (raise the upper half) and the right door. Take the EP cartridge out of the printer.
- (2) Remove the rear panel, the top cover, the left panel, and the left frame. (See Figs. 4-2 to 4-5, and 4-22.)
- (3) Pull the knob off the dial.
- (4) Remove the connector and the fastening nut. Take the dial out.

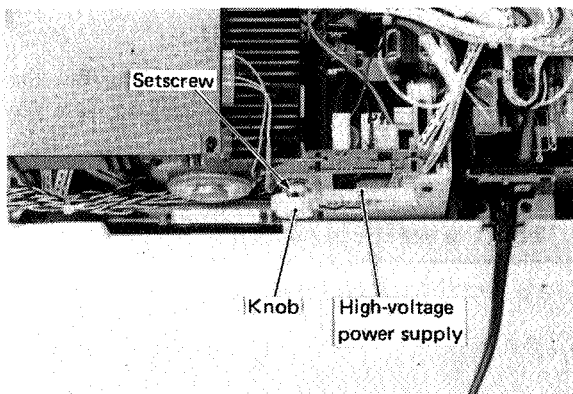


Figure 4-17

### E. Fan

#### 1. Outline

The printer has one exhaust fan, used to keep the temperature down.

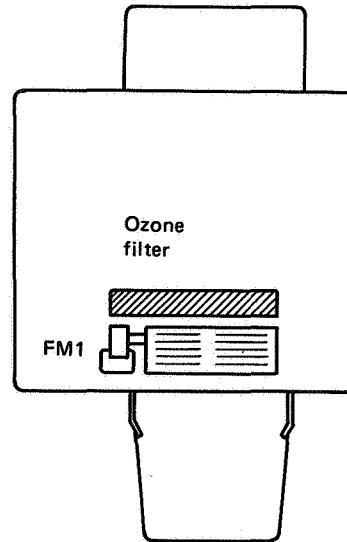


Figure 4-18

#### 2. Removal

##### a. Removing the fan

- (1) Open the printer (raise the upper half) and the right door. Take the EP cartridge out.
- (2) Close the right door first, then the upper half.
- (3) Remove the rear panel and the top cover, right panel, left panel, and front panel. (See Figs. 4-2 to 4-6.)
- (4) Take out the fan duct (6).

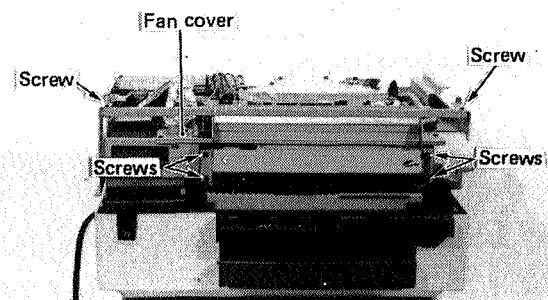
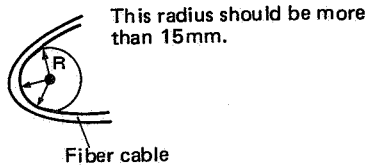


Figure 4-19

- (5) Unplug all PCB connectors on the DC controller PCB. Connect the laser shorting connector to J204 (cables attached), remove the nylon fastener, and take out the DC controller PCB. (See Fig. 4-98.)

#### Note:

Do not bend the fiber cable excessively.



- (6) Take out the fan cover (3).
- (7) Unplug the connector located at the left side of the printer. Remove the two fastening screws and take out the fan.

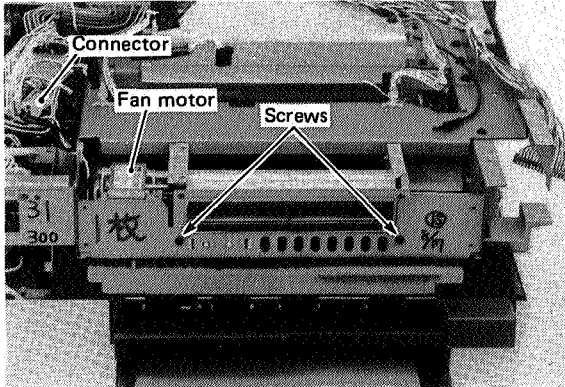


Figure 4-20

**b. Removing the ozone filter**

- (1) Open the printer (raise the upper half). Open the right door. Take the EP cartridge out.
- (2) Remove the fastening screw, hold the ozone filter slightly up and pull out the ozone filter.

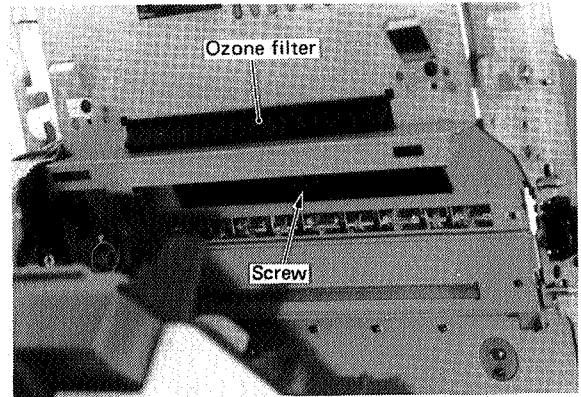


Figure 4-21

## II. DRIVE SYSTEM

### A. Main Motor

All necessary mechanical drive for printing (drum, developing assembly, fixing assembly, pickup/delivery unit) is provided by the main motor.

#### Removal

- (1) Open the printer (raise the upper half). Open the right door and take the EP cartridge out.
- (2) Remove the rear panel, the top cover and the left panel. (See Figs. 4-2 to 4-5.)
- (3) Unplug the three connectors on the varistor PCB.
- (4) Take the left frame out (8).

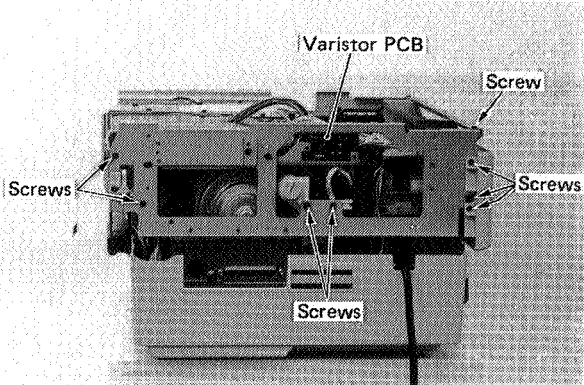


Figure 4-22

- (5) Remove the fastening screw on the high-voltage power supply cover and disconnect the connector. Remove the high-voltage power supply (1). (See Fig. 4-96.)
- (6) Unplug the connector. Take out the main motor (5).

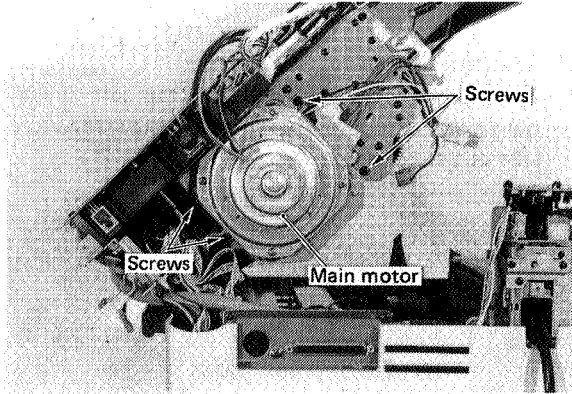


Figure 4-23

### III. PAPER TRANSPORT SYSTEM

#### A. Manual Pickup Roller

##### 1. Outline

The paper feed system will align print paper correctly even if paper is inserted crooked. When a sheet of print paper is inserted into the manual feed unit, it moves paper detection arm 1, causing the paper pickup sensor to energize the solenoid, lowering the upper roller. This roller presses the paper against the lower roller, which is rotating. Both rollers (which are narrow) are skewed in the direction the paper should move; this is represented by direction F in Fig. 4-25. When the corner of the leading edge of the print paper is pushed against the pickup guide, component f1 of force F pushes the paper along the guide, while component f2 pushes the paper to the side, against the guide. Force f2 aligns the paper so it enters the printer correctly aligned.

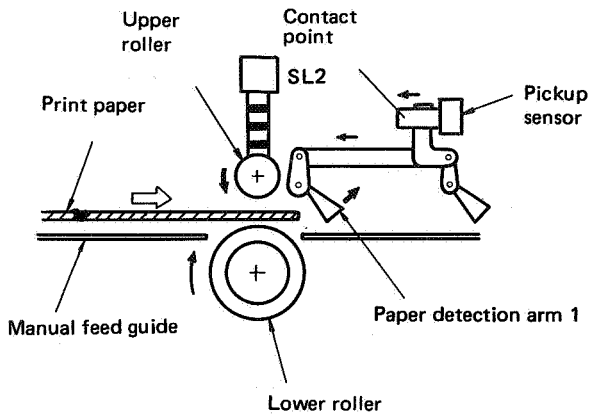


Figure 4-24 Paper feed system (rear view (simplified))

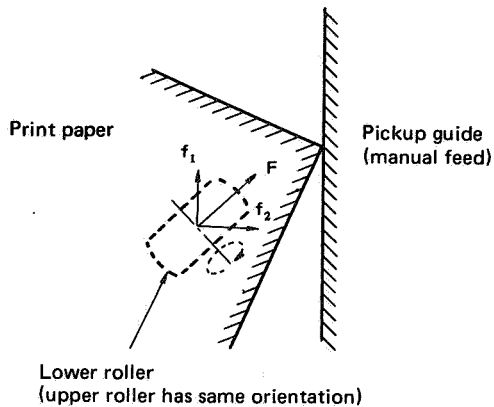


Figure 4-25 Paper feeding (top view)

##### 2. Removal

###### a. Removing the lower roller

- (1) Open the printer (raise the upper half).
- (2) Take the EP cartridge out and close the upper half of the printer. Remove the rear panel, the top cover, left panel, right panel, front panel and left frame. (See Figs: 4-2 to 4-6 and 4-22.)
- (3) If there is some wiring disturbing separation of the upper and lower halves, move the wire out of the way (or temporarily disconnect it).

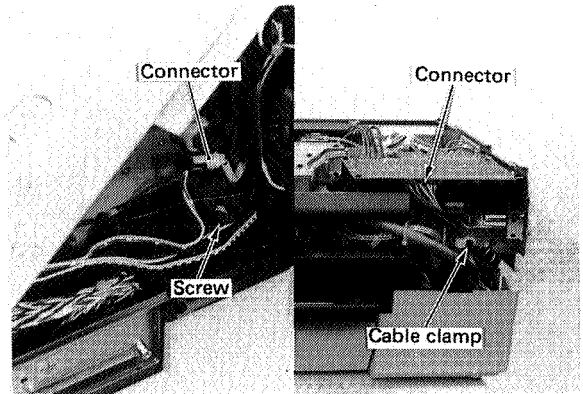


Figure 4-26

- (4) Remove the four right and left screws. Move the upper unit free from the lower half of the printer.

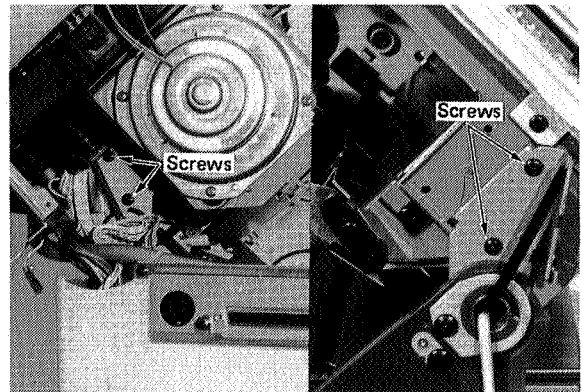


Figure 4-27



- (5) Remove the two fastening screws at the rear bottom of the lower half.

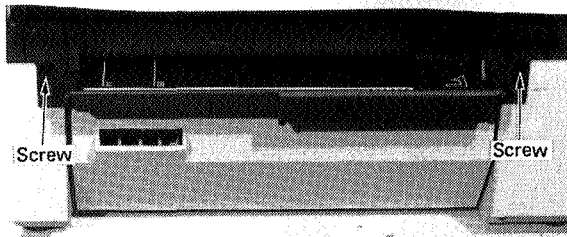


Figure 4-28

- (6) Remove the roller pressure spring (1). Take out the manual feed guide (4).

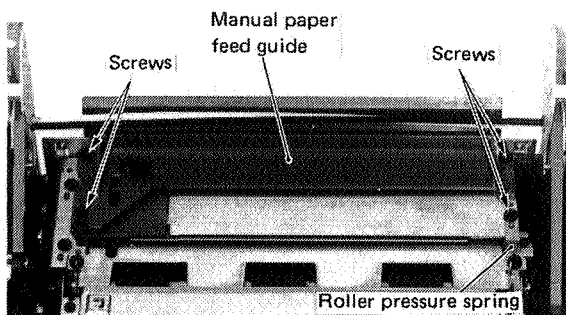


Figure 4-29

- (7) Remove the lower roller assembly (2).

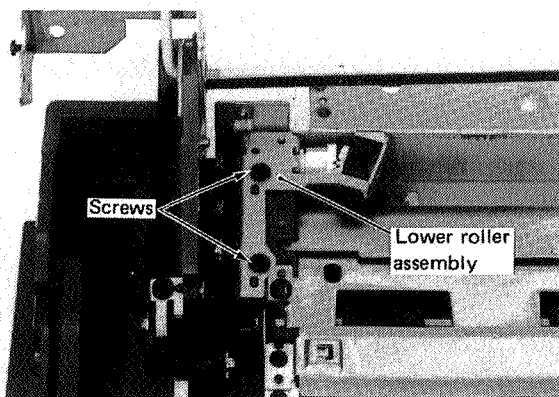


Figure 4-30

- (8) Remove the E-ring. Pull out the shaft and remove the lower roller.

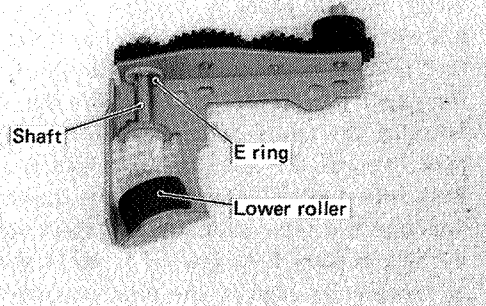


Figure 4-31

## B. Registration Shutter

### 1. Outline

This printer has a paper alignment system. A registration shutter is used to control registration.

If print paper of large width is skew-fed into a printer with a registration roller system, the left edge of the paper may be pinched or hit by the registration rollers. This results in high friction between the paper and the roller so that the end of the print paper may not be aligned. For this reason, a registration shutter is used in the printer to overcome this problem by reducing friction.

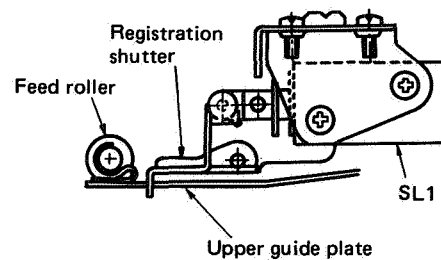


Figure 4-32

## 2. Removal

- (1) Open the printer (raise the upper half).
- (2) Take the EP cartridge out. Close the upper half. Remove the rear panel, top cover, and left panel. (See Figs. 4-2 to 4-5.)
- (3) Unplug the connector, and the scanner and laser unit. (See Fig. 4-60.)
- (4) Remove the DC power supply and main motor driver PCB together with the heat sink. (See Fig. 4-99.)
- (5) Remove the connector and four Faston connectors.

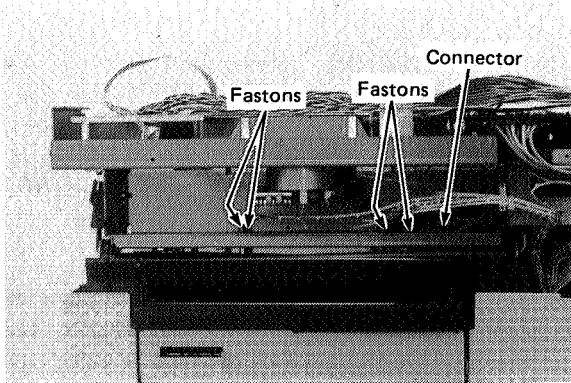


Figure 4-33

- (6) Remove the two screws.

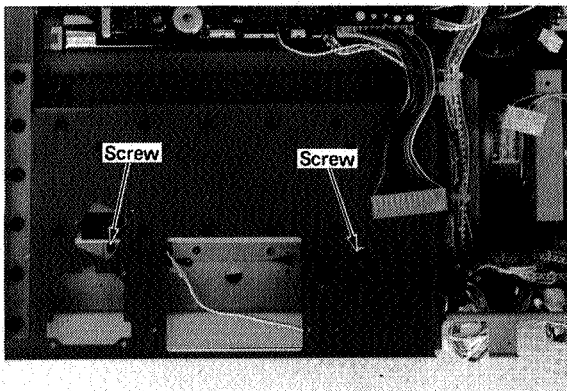


Figure 4-34

- (7) Open the printer and remove the registration shutter.

Be careful of the following when assembling.

- ① Place each grip ring on the shaft so that there is a clearance of  $0.2 \pm 0.1$  mm between the ring and the lever or arm when each is pressed firmly against its mount.
- ② Attaching the guide spring

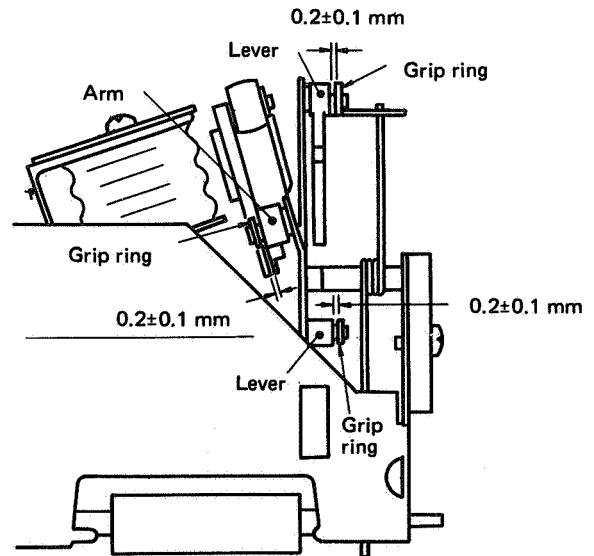


Figure 4-35

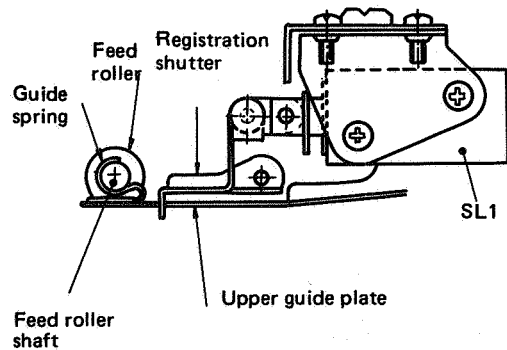


Figure 4-36

## C. Transfer Guide

### 1. Outline

The transfer guides consist of plates and rollers which guide the paper (manual or cassette feed) to the transfer unit of the photosensitive drum.

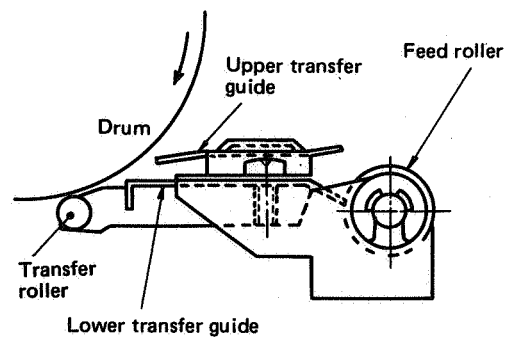


Figure 4-37

## 2. Removal

- (1) Open the printer (raise the upper half).
- (2) Take the EP cartridge out. Close the upper half. Remove the rear panel, top cover, right panel, left panel, and front panel. (See Figs. 4-2 to 4-6.)
- (3) Unplug the connector and take out the left frame, high-voltage power supply, and main motor. (See Figs. 4-22, 4-23 and 4-96.)
- (4) Remove the separation belt.

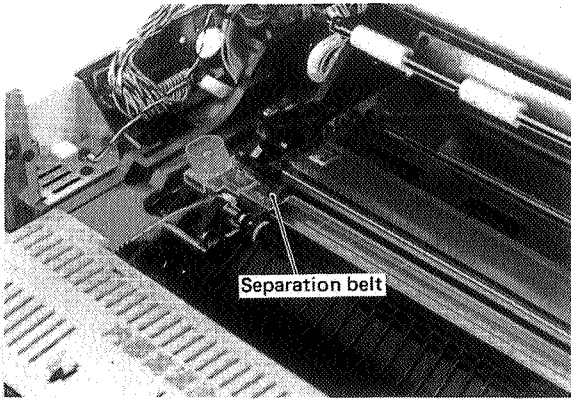


Figure 4-38

- (5) Remove screw and the lower guide plate.

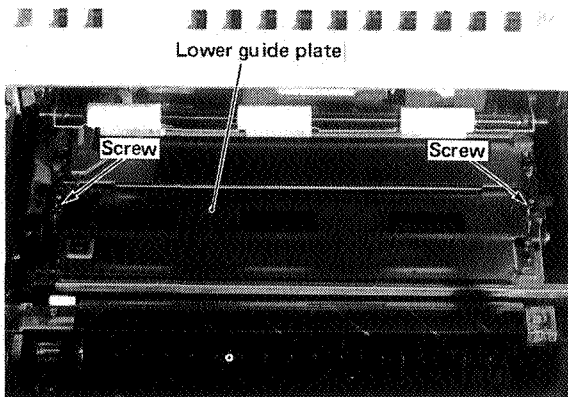


Figure 4-39

- (6) Remove the bearing holder (1) and the transfer guide.

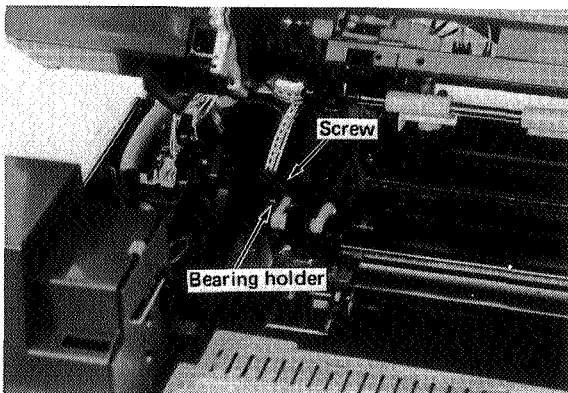


Figure 4-40

## 3. Attaching the transfer guides

Assembly is the reverse of disassembly. During assembly, however, be careful of the following points.

- (1) The transfer guide should be grounded via 15MΩ resistance.

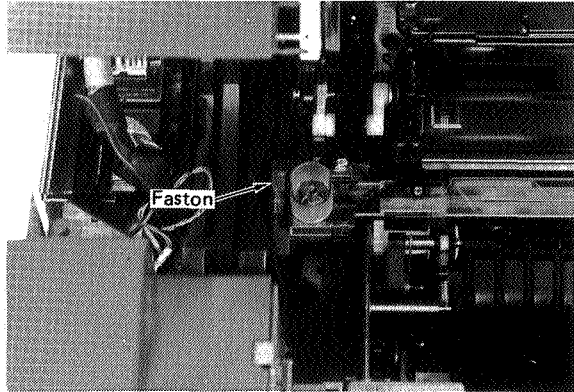


Figure 4-41

- (2) The lower guide plate and the U-guide plate are kept in contact by the roller pressure spring, and therefore are grounded via the transfer guide.

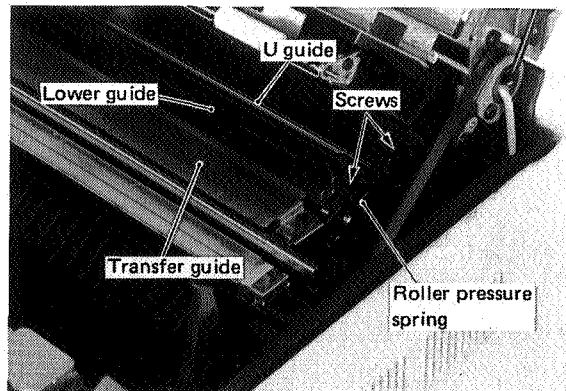


Figure 4-42

## D. Separation/Feeder Unit

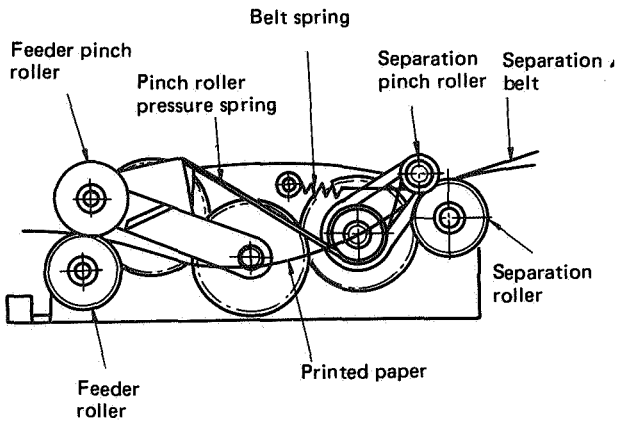


Figure 4-43

### Removing the separation/feeder unit

- (1) Open the printer and remove the EP cartridge and the separation belt.
- (2) Remove the harness cover. (See Fig. 4-11.)
- (3) Remove the fixing assembly. (See Figs. 4-75 to 4-77.)
- (4) Remove the feed guide. (See Fig. 4-46.)
- (5) Remove the two separation/feeder unit screws, then remove the separation/feeder unit.

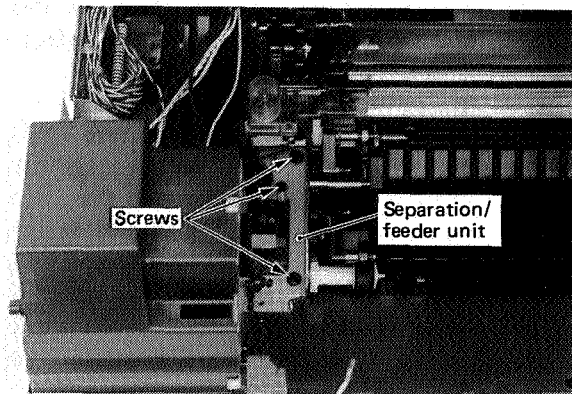


Figure 4-44

Assembly is the reverse of disassembly. During assembly, be careful not to bend or damage the separation belt. See V.B.2. in Ch. 6. for instructions about separation belt installation.

Transfer guide side

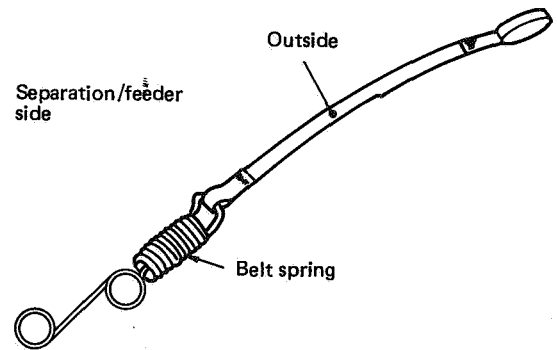


Figure 4-45 Assembled separation belt

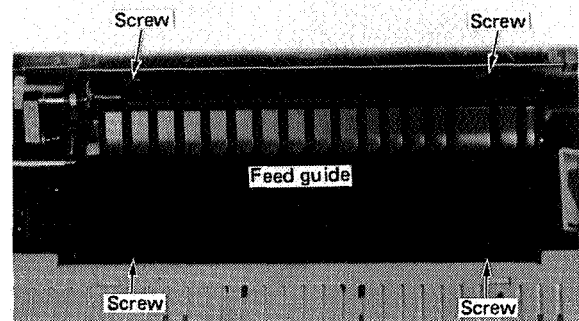
## E. Feed Guide

### 1. Outline

The separation/feeder unit guides the paper to the fixing assembly.

### 2. Removal

- (1) Open the printer and remove the EP cartridge.
- (2) Remove the feed guide (4).



### Note:

Be careful not to break the transfer corona guide wire.

Figure 4-46

## F. Cassette Pickup Assembly

### 1. Construction of the paper pickup assembly

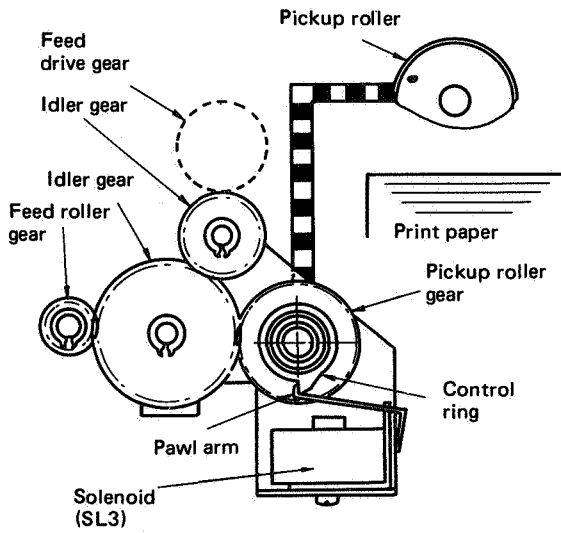


Figure 4-47

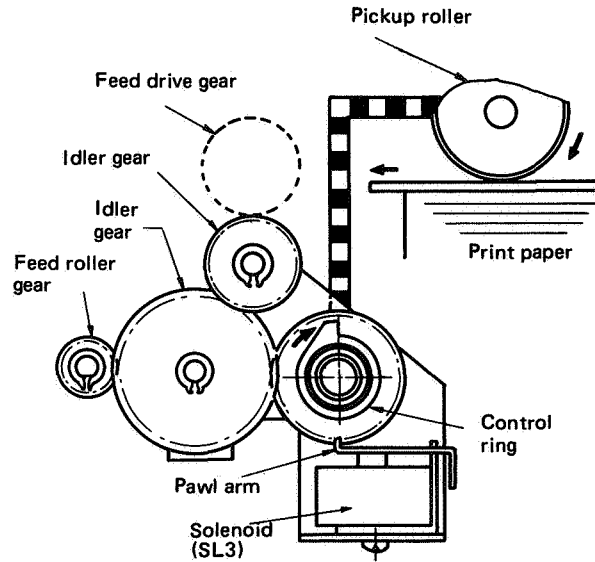


Figure 4-49

### 2. Construction of the paper pickup control clutch

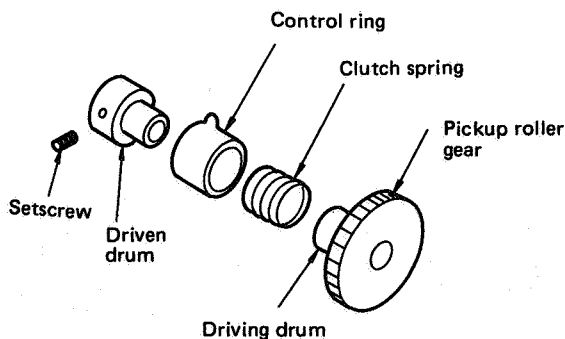


Figure 4-48

### 3. Pickup roller and clutch operation

The pickup roller is driven by the main motor through a train of gears and a spring clutch. The pickup roller gear is the input gear; projecting from the side of the gear is the driving drum. A second drum, the driven drum, is in line with the end of the driving drum, and is attached solidly to the shaft of the pickup roller. A clutch spring is wound around the two drums, fastened securely to the driven drum at one end and to the control ring at the other end (the end nearer the input gear). The control ring fits loosely over the spring.

#### Disengaged

When solenoid SL3 is not energized, the pawl holds the control ring stationary; this holds the end of the spring back so the spring is loose and the driving drum rotates freely inside the spring

with only slight friction. No drive is transferred to the driven drum.

#### Engaged

When SL3 is energized, the pawl is pulled away from the control ring, allowing the spring to pull the control ring around with it. The diameter of the spring decreases and the spring tightens first onto the driving drum, then onto the driven drum. This turns the pickup roller so it draws a piece of print paper out of the cassette.

The control ring makes only a single turn because the solenoid is de-energized very quickly after being energized; the pawl returns to the normal position and stops the control ring when the single projecting tab on the control ring completes its turn. When the control ring stops, the end of the spring unwinds from the driving drum so the drum can again slip within the spring (disengaged state).

#### 4. Removing the pickup roller

- (1) Open the printer. Remove the rear panel and the top cover.
- (2) Remove the fastening screw for the power switch unit cover. Unplug the connector (J103), the two Faston connectors and the ring terminal for the power switch unit. (See Figs. 4-10, 4-12 and 4-13.)
- (3) Take out the interface (I/O) connector together with the mounting plate (2). (See Fig. 4-16.)
- (4) Unplug the connector located at the rear of the printer.

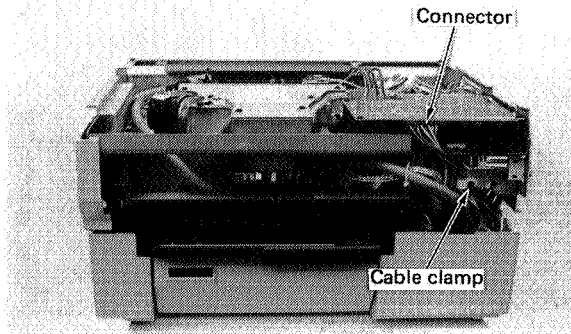


Figure 4-50

- (5) Remove the pedestal mounting screws and separate the pedestal from the printer.

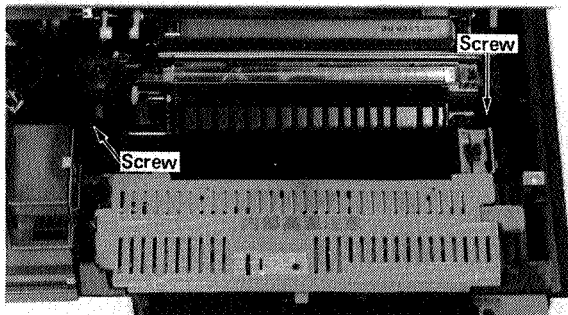


Figure 4-51

- (6) Remove the four screws. Turn the upper pickup guide over.

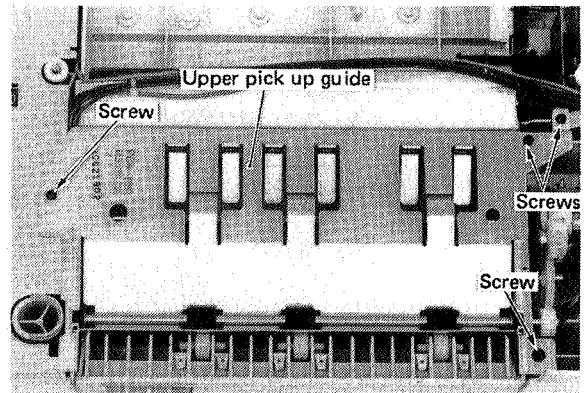


Figure 4-52

- (7) Remove the grip-ring, the bearing, then the pickup roller unit.

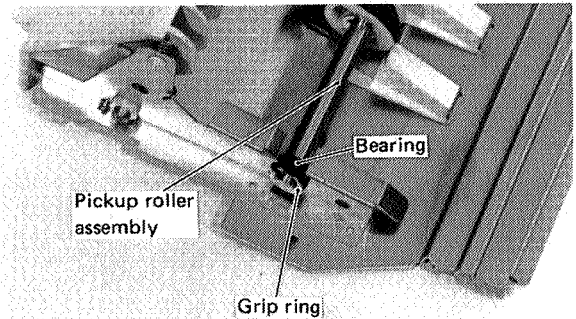


Figure 4-53

- (8) Remove the E-ring and the pickup roller.

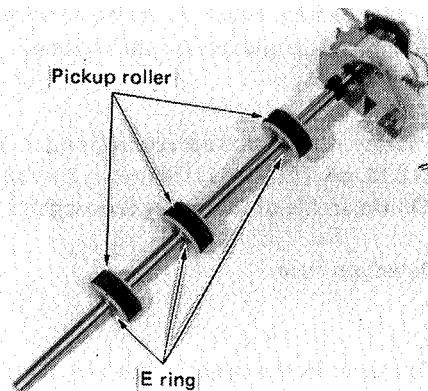


Figure 4-54

Assembly is the reverse of disassembly. Be careful that the direction of rotation of the pickup rollers is correct.

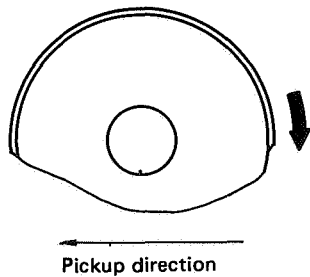


Figure 4-55

### 5. Removing the pickup control clutch

Remove the pickup roller unit, E-ring, and set-screw, then pull the clutch from the pickup roller shaft.

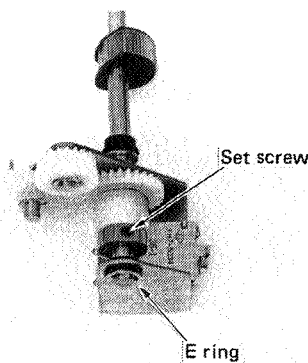


Figure 4-56

Reassembly is the reverse of disassembly.

With the clutch spring correctly engaging the control ring and the driven drum, position the control ring so that the pawl of solenoid SL3 firmly engages the projection. Position the pickup roller shaft so that the center of the semicircular part of the pickup roller is facing upward (as shown in Fig. 4-56), and tighten the setscrew.

### 6. Oiling

Oil the spring of the pickup control clutch with ISO VG 220 oil (CK-0441). Remove the clutch spring. Oil the inside of the spring thoroughly.

### G. Paper Detection Arm

#### 1. Outline

When the paper in the cassette runs out, the paper detection arm descends and blocks the light from the photosensor. This sets a no paper status, and the STATUS indicator on the control panel will read "1"

#### 2. Removing the paper detection arm

- (1) Open the printer. Remove the rear panel and the top cover.
- (2) Remove the fastening screw for the power switch unit cover. Unplug the connector (J103), the

two Faston connectors and the ring terminal for the power switch unit. (See Figs. 4-10, 4-12 and 4-13.)

- (3) Take out the interface (I/O) connector together with the mounting plate (2). (See Fig. 4-16.)
- (4) Unplug the connector located at the rear of the printer.
- (5) Separate the pedestal (2) from the printer. (See Fig. 4-51.)
- (6) Take out the paper detection arm (2) together with the mounting plate.

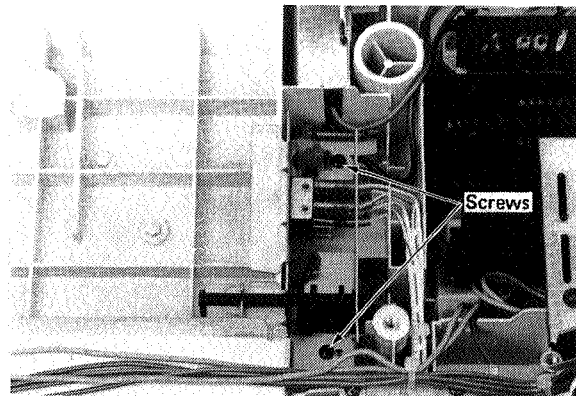


Figure 4-57

- (7) Move the detection arm toward the helical groove in the shaft and lift out the detection arm.

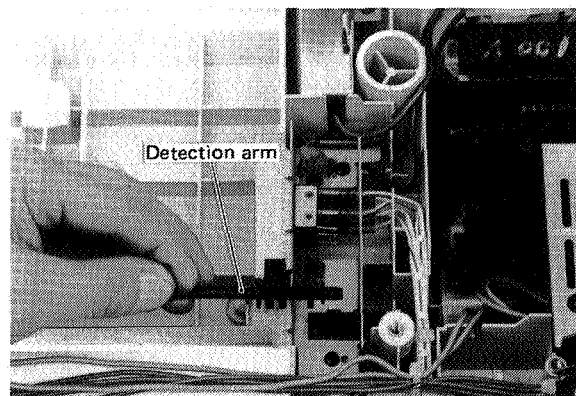


Figure 4-58

### H. Cassette (spring lifting force)

Often poor pickup can be associated with a particular cassette. In such a case, the first thing to check is the lifting force of the cassette springs.

Hold a millimeter ruler vertical (as shown in Fig. 4-59). Position a compression spring scale (CK-0058) on the lifting plate between the cassette springs. Press down on the lifting plate with the specified force and read the scale. If the correct distances are not measured, replace the cassette springs.

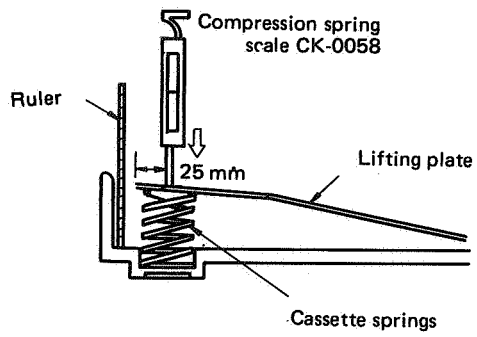


Figure 4-59

Cassette size	3 mm depressed	13 mm depressed
Legal	320 ± 30g	410 ± 40g
A4	340 ± 30g	440 ± 40g
B5	320 ± 30g	420 ± 40g
Letter	320 ± 30g	410 ± 40g

Table 4-1 Cassette spring force



## IV. EXPOSURE SYSTEM

### A. Laser and Scanner Unit

#### 1. Outline

The laser and scanner unit comprises the laser unit and the scanner unit.

The scanner unit comprises the scanner motor, scanner driver PCB, scanner mirror and focusing lenses.

#### 2. Removing the laser unit and scanner unit

- (1) Open the printer (raise the upper half). Open the right door and take out the EP cartridge.
- (2) Close the right door, then the upper half of the printer.
- (3) Remove the rear panel and top cover.
- (4) Unplug connectors J203, J204 and J206. Connect the laser shorting connector to J204 (cables attached).
- (5) Remove the screws (4), and carefully lift the laser/scanner unit from the positioning pins.

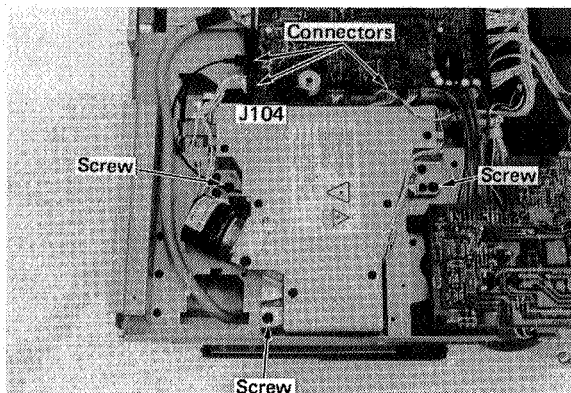


Figure 4-60

- (6) Take off the rubber cap of the laser and scanner unit. Remove the two Allen screws and take out the laser unit.

#### Reference:

If the scanner motor or the scanner driver PCB is broken, but the laser unit works, remove the old laser unit and install it along with a new scanner unit.

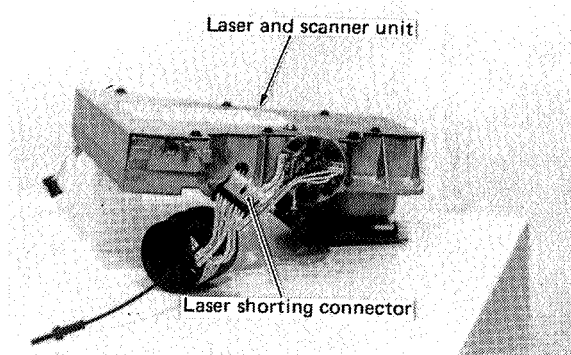


Figure 4-61

#### 3. Installation

- (1) Align the laser unit to the locating pinhole. Put the two Allen screws in loosely, then tighten them alternately so that the laser and scanner unit fits firmly.
- (2) Align the laser and scanner unit with the locating pinhole.
- (3) Installation is the reverse of removal.

#### Note:

- When installing and removing the laser and scanner unit, be careful not to scratch the scanner driver PCB.
- Be careful not to leave fingerprints or dust on the window, mirrors, lenses, or laser unit mounting plate.
- Clean the mounting face of the laser and scanner unit before installing the unit.
- Do not bend the optic fiber cable a radius of 15 mm or less to prevent damaging to the cable.

To prevent damage to the laser from static electricity, connect the laser shorting connector (RY9-0003) to the laser unit. Do not unplug the laser shorting connector until the laser connector is plugged into the DC connector.

#### 4. Laser beam-blocking shutter

##### Removal

- (1) Take out the laser and scanner unit. (See Fig. 4-60.)
- (2) Remove the ozone seal plate, the two tension springs, the fastening screw and the two guide bushings. Take out the shutter.

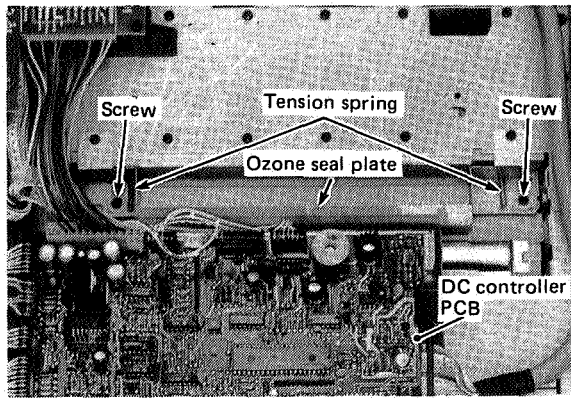


Figure 4-62

### B. Preconditioning Exposure Lamps and Print Counter Assembly

#### 1. Removal

- (1) Open the printer and the right door. Take the EP cartridge out of the printer.
- (2) Close the right door, then the upper half of the printer.
- (3) Remove the rear panel and the top cover.
- (4) Unplug all PCB connectors on the DC controller PCB. Connect the laser shorting connector to J204 (cables attached). Release the nylon fastener to the PCB and take out the PCB. (See Fig. 4-95.)
- (5) Take out the preconditioning exposure lamps and print counter assembly (2).

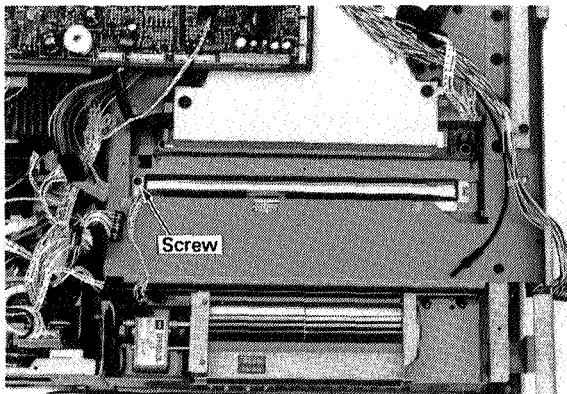


Figure 4-63

- (6) Take out the preconditioning exposure lamps and print counter PCB (1).

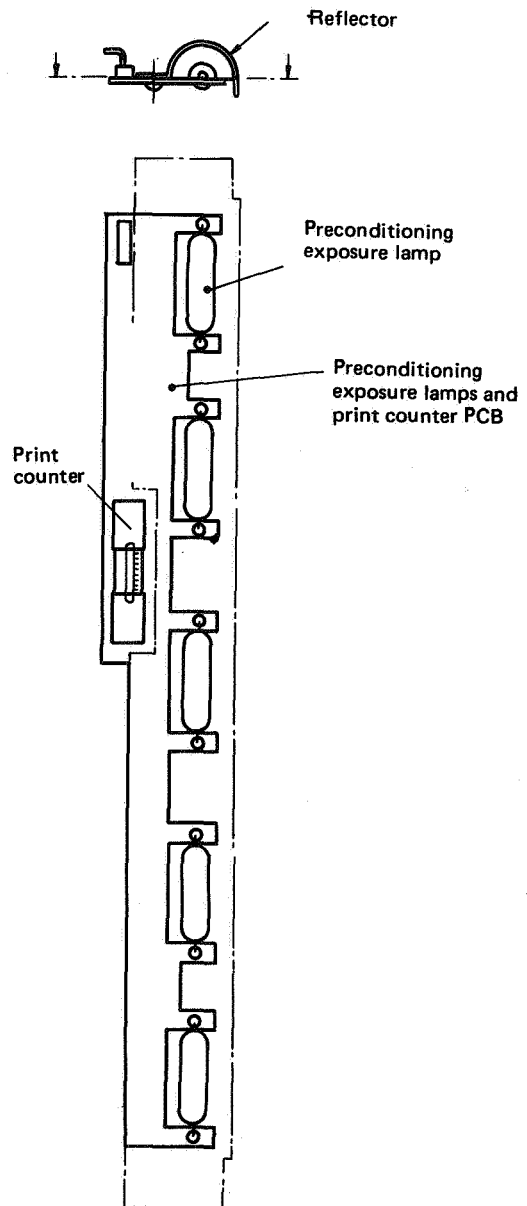


Figure 4-64

- When the preconditioning exposure lamp is changed, always replace the print counter with a new unit.

## V. ELECTROSTATIC IMAGE/DEVELOPING/CLEANING SYSTEM

### A. EP Cartridge

#### 1. Outline

In this printer the photosensitive drum, primary corona, developing unit, toner hopper, and drum cleaner are in one unit, called the EP cartridge. This unit cannot be disassembled.

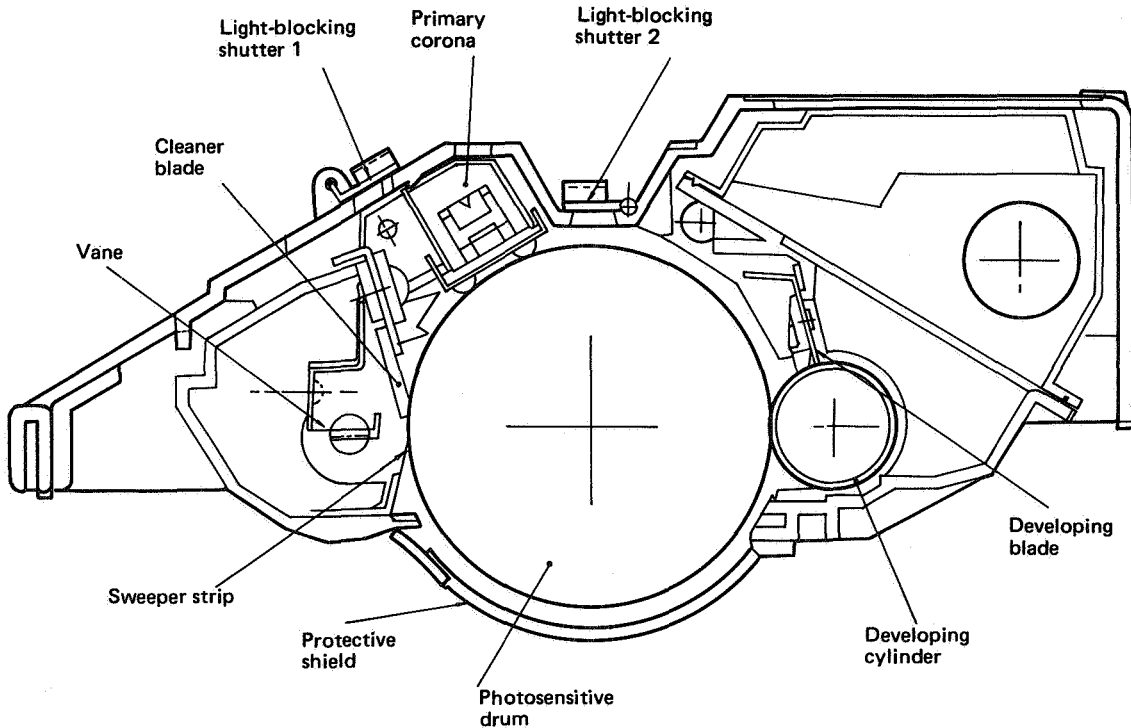


Figure 4-65

#### a. Protective shield

The photosensitive drum has a protective shield to protect it from long periods of exposure to strong light (which cause blank areas and faint black stripes). Do not open the protective shield unless necessary. (The shield is opened automatically when the EP cartridge is inserted in the printer and the upper half of the printer is closed. See Chapter 5 for details.)

#### b. Light-blocking shutters

When the EP cartridge is removed from the printer, light can enter the EP cartridge via the slot through which the optical image reaches the photosensitive drum. For this reason, light-blocking shutters are provided to protect the photosensitive drum from outside light. The customer should be instructed to check that the shutters are closed any time the cartridge is removed from the printer and to close them manually if they have not closed automatically. Also be sure that the customer understands that the shutters of any cartridge must be opened when placed in the printer.

## 2. Drum cleaning

- (1) Open the printer. Remove the EP cartridge.
- (2) Turn the cartridge upside down, then open the protective shield.
- (3) Wipe a piece of flannel or other soft cloth over a toner-coated area so that the cloth is liberally coated with toner, then clean fingerprints, etc., from the drum with this toner-covered cloth.

### Note:

- Always turn the drum only in the direction that it turns while making prints. If it is turned backward, the spring-loaded contact that applies the developing bias to the inside rim of the developing cylinder may be bent backward so that it no longer contacts the cylinder, thus preventing proper development.
- Use a piece of flannel cloth (or other soft cloth) to clean the drum surface. Never use lint-free paper (it could scratch the surface).
- Cleaning should be done quickly to prevent blank areas and/or white lines due to photosensitive “memory”.

## B. Transfer Corona Assembly

### 1. Removal

- (1) Open the printer (raise the upper half).
- (2) Remove the separation belt. (See Fig. 4-38.)
- (3) Remove the transfer guide.
- (4) Remove the screw(1) and the transfer corona assembly.

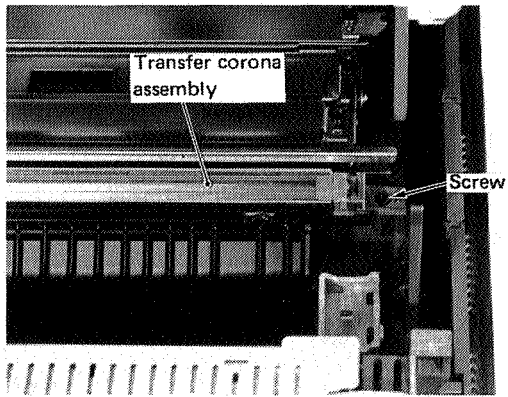


Figure 4-67

## 2. Stringing the corona wires

- (1) Remove the right and left panels. Remove the old corona wire.
- (2) Cut off about 30 cm of corona wire. Form a 2-mm loop at one end by wrapping the wire around a small Allen wrench and twisting the loop closed. Make a loop of the same size at the other end so that the total length of the wire is as shown in Fig. 4-68.

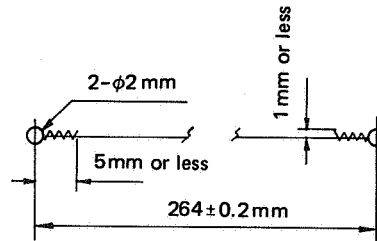


Figure 4-68

- (3) Hook one of the loops over the stud on the right block and pass the wire through the V-groove in the block.
- (4) Put one end of the spring through the other loop of the wire, then put the other end of the spring over the spring hanger on the left block.



Figure 4-69

**Note:** The corona wires should not be bent, twisted or kinked. They also should be clean and smooth. Clean the corona wires with a cotton swab (provided with the EP cartridge) dampened with alcohol.

### 3. Corona wire height

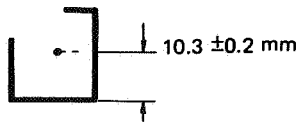


Figure 4-70

#### Note:

The height (position) of the corona wire can be adjusted by turning the screw at the rear of the corona assembly. One turn of the screw changes the wire position about 0.5 mm.

### 4. Stringing the guide wire

- (1) Remove the polyester sheet from area A in the figure at the right, then unreel the guide wire from the reel (0.148 mm $\phi$ ) and cut off about 84 cm.
- (2) Wrap one end of the guide wire around screw 1 two to three times as shown in Fig. 4-71, and tighten the screw.
- (3) Wrap the wire around the corona assembly as shown in Fig. 4-71.
- (4) Wrap the end of the grid wire around screw 14 two to three times as shown in Fig. 4-71. Tighten the screw and clip off the extra wire.
- (5) Attach the polyester sheet to area A as shown in the figure at the right.

- (5) The guide wire should be wound tightly.  
(tension: 150 $\pm$ 30 g)

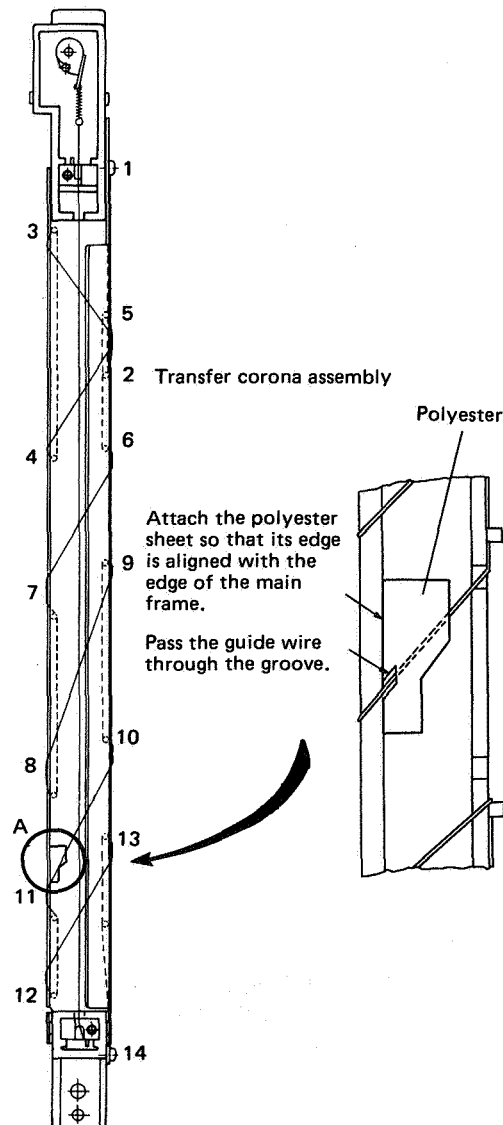


Figure 4-71

## VI. FIXING SYSTEM

### A. Fixing Assembly

#### 1. Construction

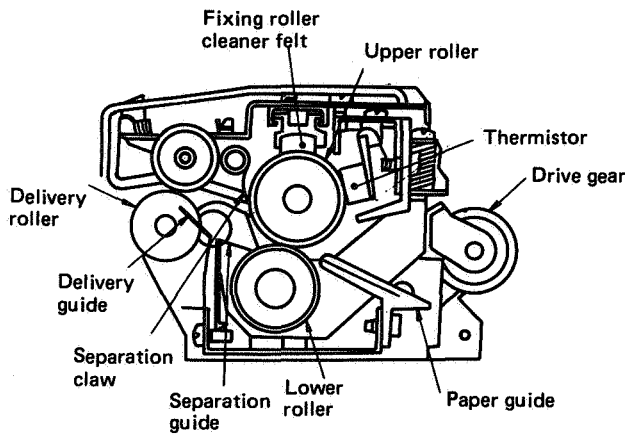


Figure 4-72

#### Fixing roller cleaner felt

To prevent toner on the print from being transferred (offset) to the upper roller when the print paper passes between the upper and lower rollers, and to prevent the print from wrapping around the upper roller, silicone oil is applied by a felt to the roller while the roller is being cleaned.

#### 2. Operation

Drive from the main motor is transmitted to the upper roller via the drive gear. The lower roller is driven by the upper roller.

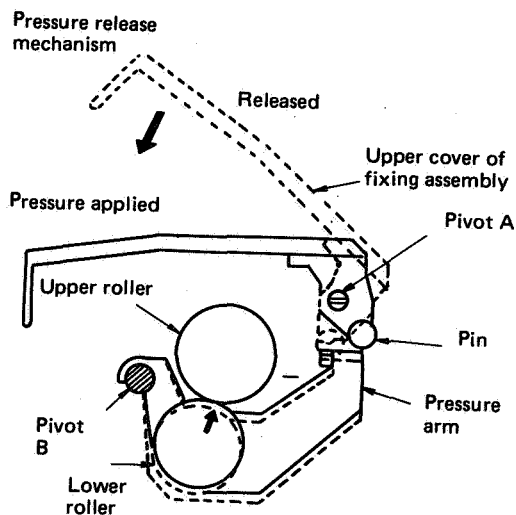


Figure 4-73

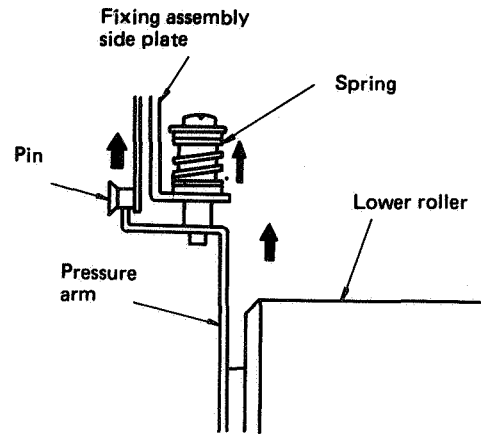


Figure 4-74

The spring in Fig. 4-74 provides constant upward push against the pressure arm. When the upper panel of the fixing assembly is closed, the pin shown in Figs. 4-73, -74 will move upward, lifting the pressure arm and pressing the lower roller against the upper roller.

#### Note:

Pressure between the fixing rollers cannot be adjusted.

#### 3. Removal

- (1) Open the printer (raise the upper half). Raise the top part of the fixing assembly.
- (2) Remove the cover/latch unit (2).

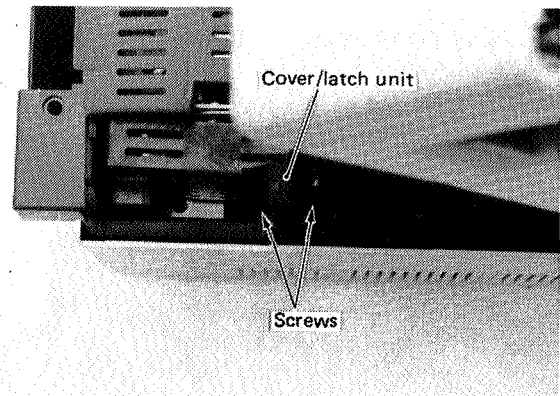


Figure 4-75

- (3) Remove the harness cover and pull out the connector (J2).

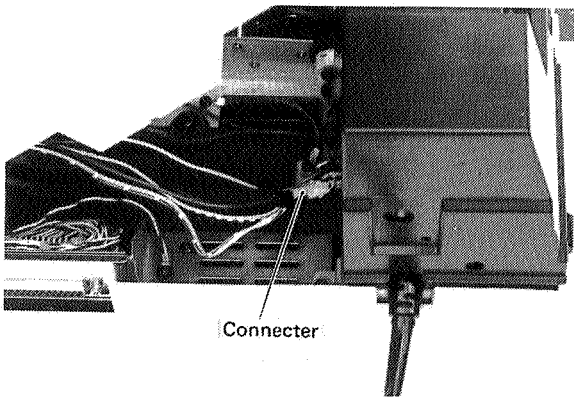


Figure 4-76

(4) Remove the four screws from the fixing assembly.

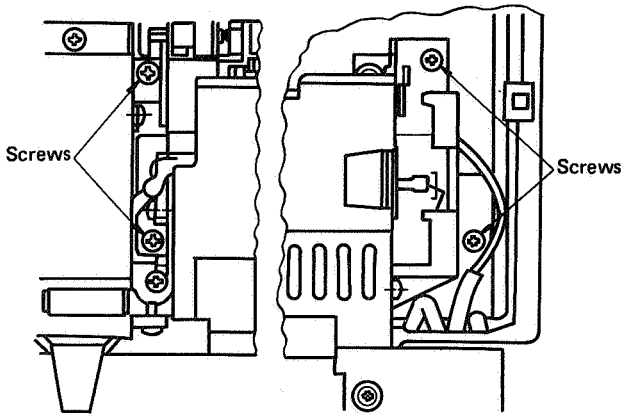


Figure 4-77A Left Figure 4-77B Right

(5) Lift each end of the fixing assembly enough to remove the spade connectors (one on each end), then remove the assembly.

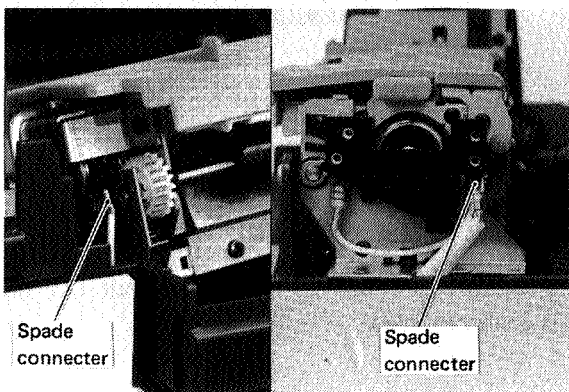


Figure 4-78A Left Figure 4-78B Right

Assembly is the reverse of disassembly. Be sure the wire harness leading to the fixing roller heater is fitted firmly in the groove in the bottom of the printer.

#### 4. Removing the upper roller/fixing roller heater

(1) Remove the right electrode holder (2), then the fixing roller heater.

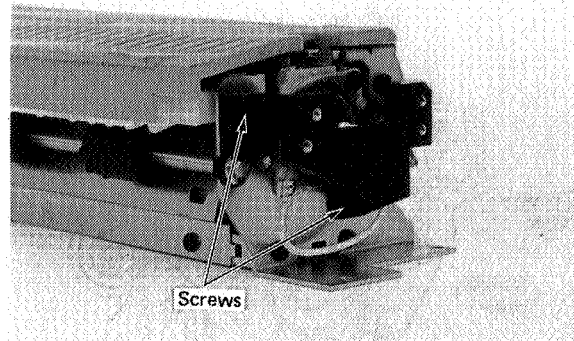


Figure 4-79

(2) Remove the front and rear screws and remove the complete fixing assembly upper unit.

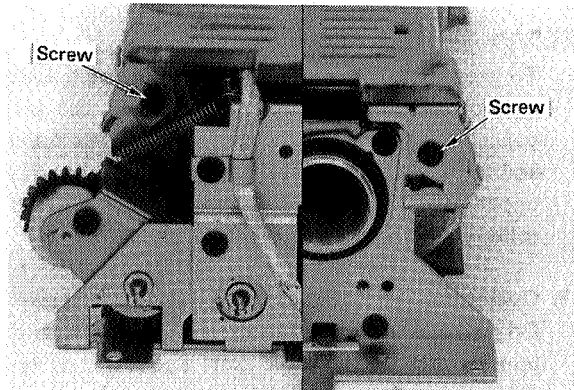


Figure 4-80A Left Figure 4-80B Right

(3) Remove the two screws and the front and rear pressure springs.

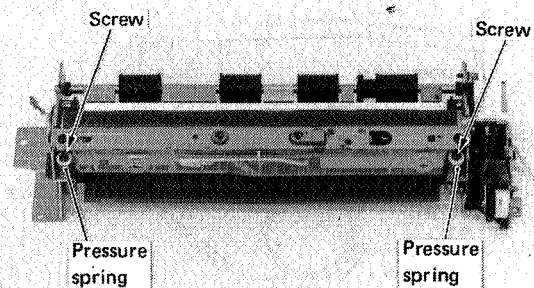


Figure 4-81

- (4) Remove the two fastening screws, then loosen the cord holder screws. Remove the spring, then the lamp terminal mounting plate.

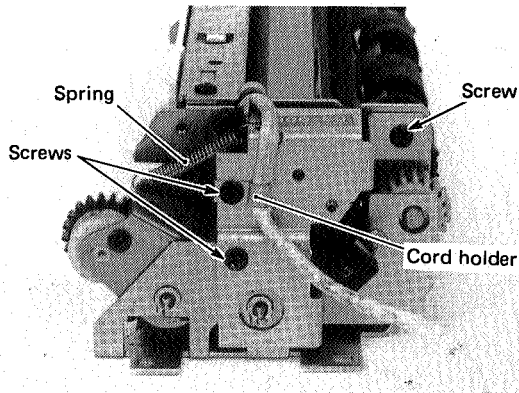


Figure 4-82

- (5) Remove the retaining ring from the shaft, then take off the gear.

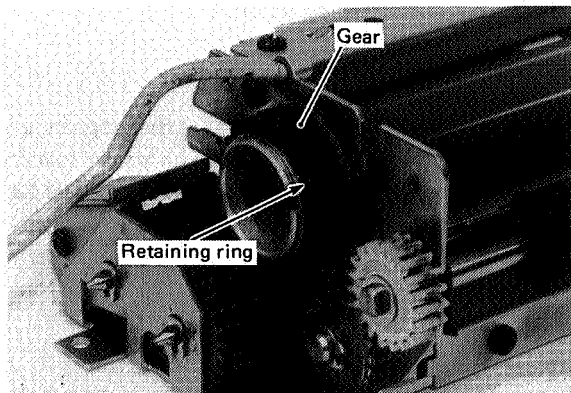


Figure 4-83

- (6) Pull out the upper roller together with the front fixing roller bearing (2) from the front.

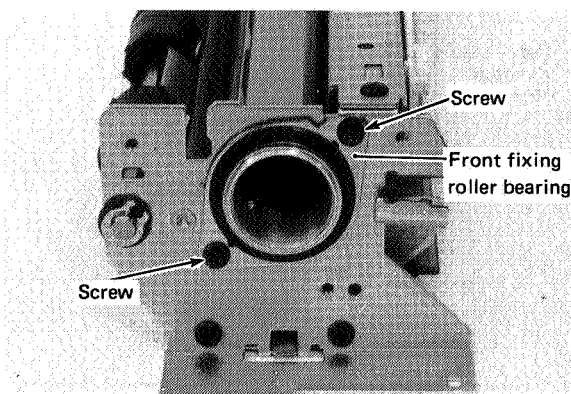


Figure 4-84

**Note:**

The surface of the upper roller can be easily scratched. Exercise caution.

**5. Installing the upper roller/fixing roller heater**

Assembly is the reverse of disassembly. Check that the surface of the thermistor contacts the upper roller evenly.

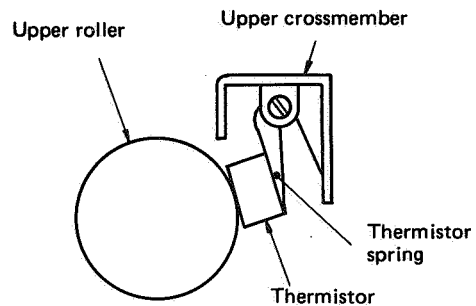


Figure 4-85

**Note:**

- It is not necessary to adjust the position of the thermistor. If contact is not even, check whether the thermistor spring is deformed.
- Clean the thermistor with alcohol or MEK.

● **Attaching the fixing roller heater**

Position the terminal with the manufacturer's mark to the front.

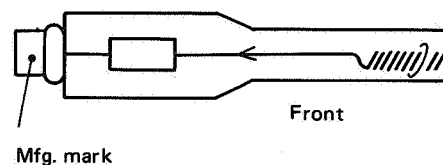


Figure 4-86 Fixing roller heater

**Note:**

If the fixing roller heater is installed backwards, the toner on the separation belt side of the printer will not be fixed properly.

**6. Installing the thermoprotector**

- (1) Confirm that the detecting surface of the thermoprotector is even with the upper roller surface.
- (2) There is no need to adjust the position of the thermoprotector.
- (3) If the surface of the thermoprotector is dirty, clean it with alcohol.



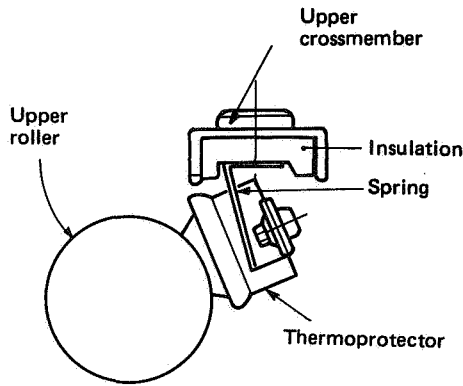


Figure 4-87

**7. Removing the lower roller**

- (1) Remove the upper roller.
- (2) Remove the upper crossmember (2).

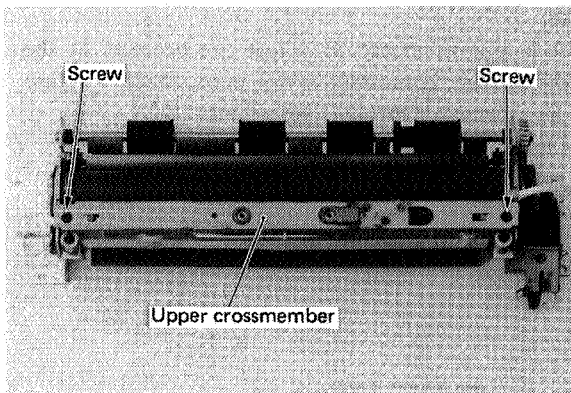


Figure 4-88

- (3) Remove the lower delivery guide (2).

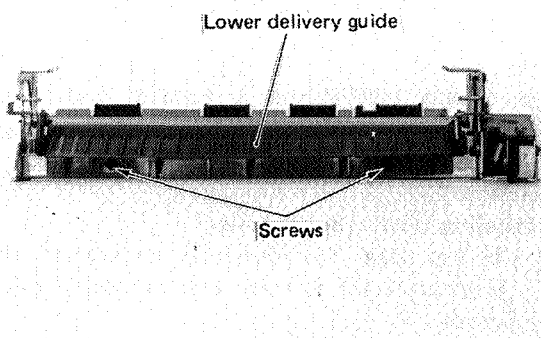


Figure 4-89

- (4) Remove the lower roller together with the separation guide and the pressure arm.

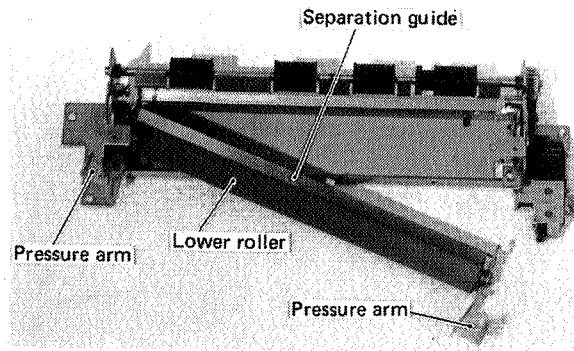


Figure 4-90

**8. Installing the lower roller**

Installing the lower roller is reverse of removal. It is not necessary to adjust nip width, but to confirm it, use the following procedure. If the nip width is not correct, fixing will be faulty.

**Procedure for measuring nip width**

- (1) Make an A4/Letter size print.
- (2) When the leading edge of the print appears at the outlet port, switch off the main power switch.
- (3) Pull the paper lightly a few centimeters, wait 10 seconds, then pull the paper out of the fixing assembly completely.
- (4) Measure the width of the glossy part of the toner.

**Note:**

Measure the nip width only when the rollers are hot; wait 15 minutes after switching on the power before making the measurement.

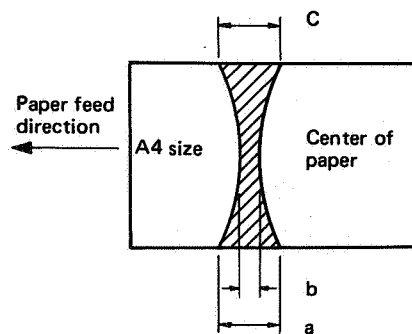


Figure 4-91 Nip width

Width	Measure when upper and lower rollers are hot.
b	2 - 3 mm
a - b	Under 0.5 mm
a - b	Under 0.5 mm
b - c	Under 0.5 mm

Table 4-2 Nip width measurement

**9. Removing the separation claws**

- (1) Remove the upper cover of the fixing assembly. (See Fig. 4-80.)
- (2) Remove the fixing roller cleaner felt to protect it from dirt.
- (3) Remove the screws, release the catches, then remove the upper cover of the fixing assembly.

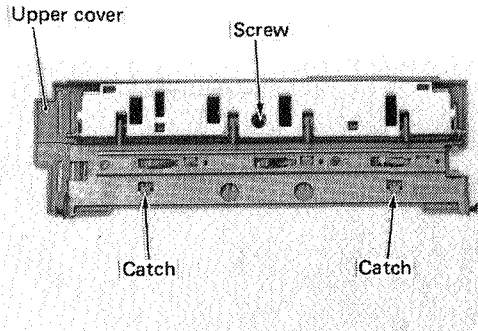


Figure 4-92

- (4) Remove the screws, release the catches, then remove the upper delivery guide.

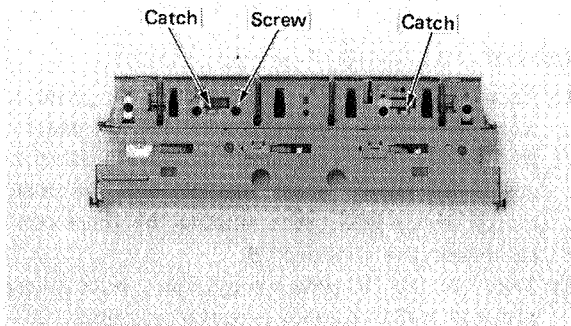


Figure 4-93

- (5) Remove the four springs.

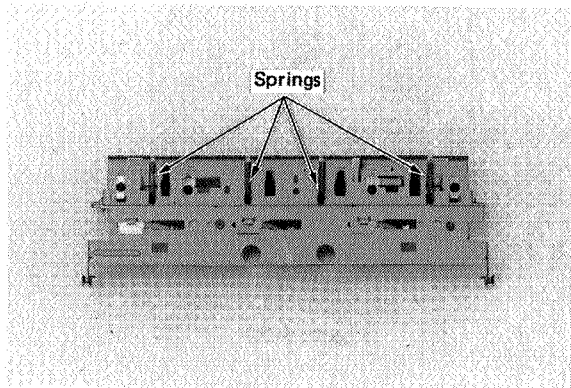


Figure 4-94

- (6) Remove the front or rear E-ring holding the shaft, then remove the separation claws.

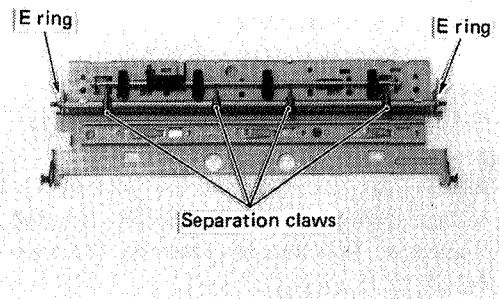


Figure 4-95

**Cleaning**

Wipe with lint-free paper or a soft dry cloth.

## VII. ELECTRICAL COMPONENTS

### Note:

See Figs. 4-2 to 4-6 for removing the covers and panels.

### A. High-Voltage Power Supply

#### Removal

- (1) Take out the EP cartridge. Remove the rear panel, the top cover and the left panel.
- (2) Remove the left frame and the cover of the high-voltage power supply assembly. Unplug the connector. Take out the assembly (1). (See Fig. 4-22.)

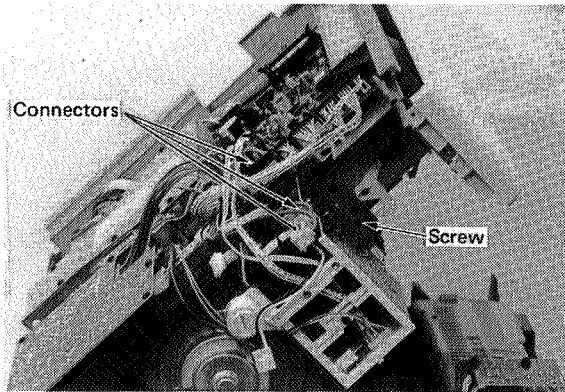


Figure 4-96

### B. AC Driver PCB (Fixing Roller Heater Safety PCB and AC Controller PCB)

#### Removal

- (1) Open the printer and remove the power switch cover. (See Fig. 4-10).
- (2) Unplug connector J106 and J104. Remove the two fastening screws and take out the fixing roller heater safety PCB.
- (3) Unplug all the connectors on the AC controller PCB. Remove the two fastening screws and take out the AC controller PCB.

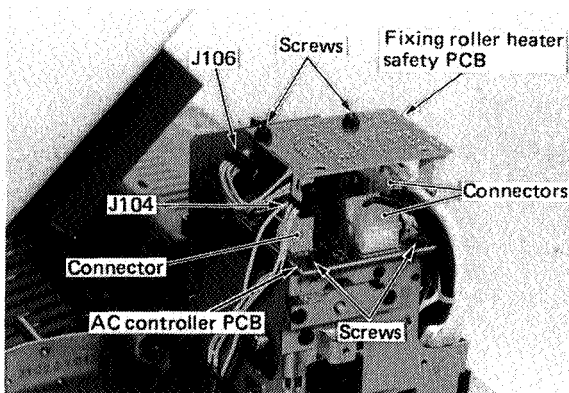


Figure 4-97

### C. DC Controller PCB

#### Removal

- (1) Open the printer and take out the EP cartridge. Close the printer. Remove the rear panel, top cover, and duct plate.
- (2) Unplug all the connectors on the DC controller PCB. Connect the laser shorting connector to J204. Remove the five nylon fasteners and the DC controller PCB.

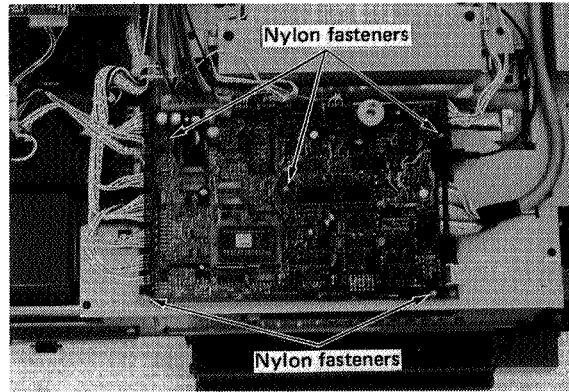


Figure 4-98

### D. DC Power Supply and Main Motor Driver PCB

#### Removal

- (1) Take out the EP cartridge. Close the printer. Remove the rear panel, top cover and left panel.
- (2) Unplug the three connectors and two protective covers for the DC power supply and the main motor driver PCB. Also unplug the three connectors on the varistor PCB.
- (3) Take out the DC power supply and main motor driver PCB (5), together with the heat sink.

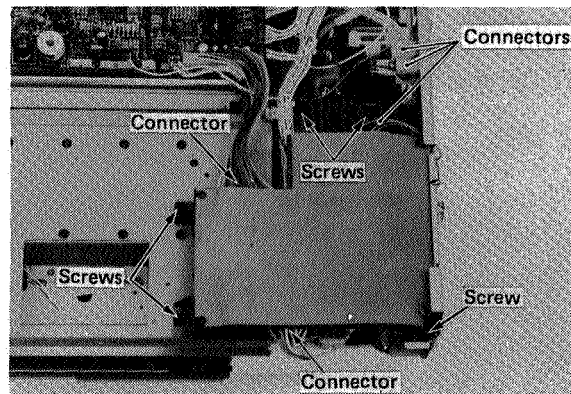


Figure 4-99

- (4) Remove the insulating sheet (4).

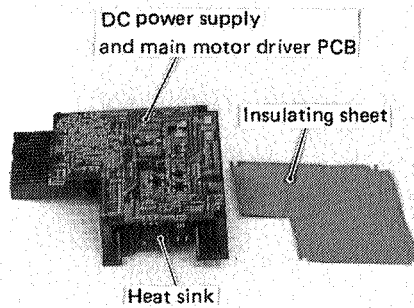


Figure 4-100

**Note:**

When installing the DC power supply and main motor driver PCB, be sure to attach the insulating sheet.

**E. Scanner Driver PCB**

**Removal**

- (1) Remove the laser and scanner unit by following the procedure described in IV. EXPOSURE SYSTEM on page 4-15.

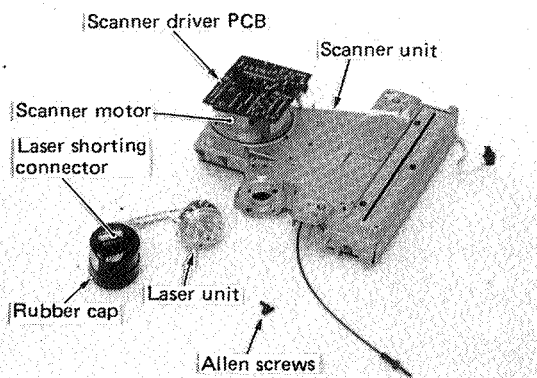


Figure 4-101

**Note:** The scanner driver PCB, scanner motor, scanner mirror, and focusing lenses cannot be separated. Replace the scanner unit as a whole.

**F. Transformer**

**Removal**

- (1) Since the transformer is attached to the pedestal, the procedure to separate the pedestal from the printer is the same as that given in III. PAPER TRANSPORT SYSTEM, G. Paper Detection Arm, on page 4-13.
- (2) Remove the screws (4), and take off the transformer cover.

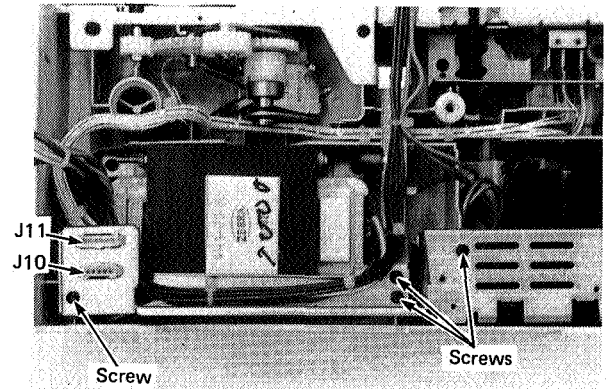


Figure 4-102

- (3) Remove the screws(4), and take out the transformer.

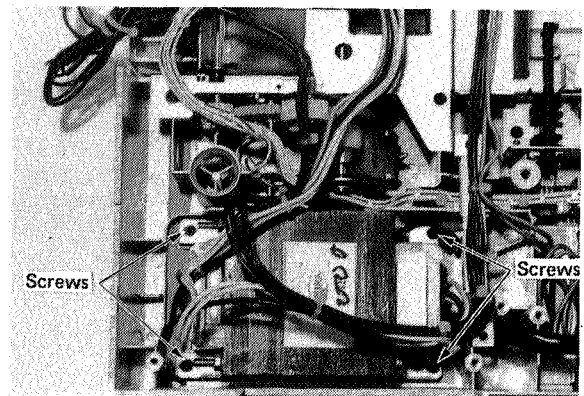


Figure 4-103

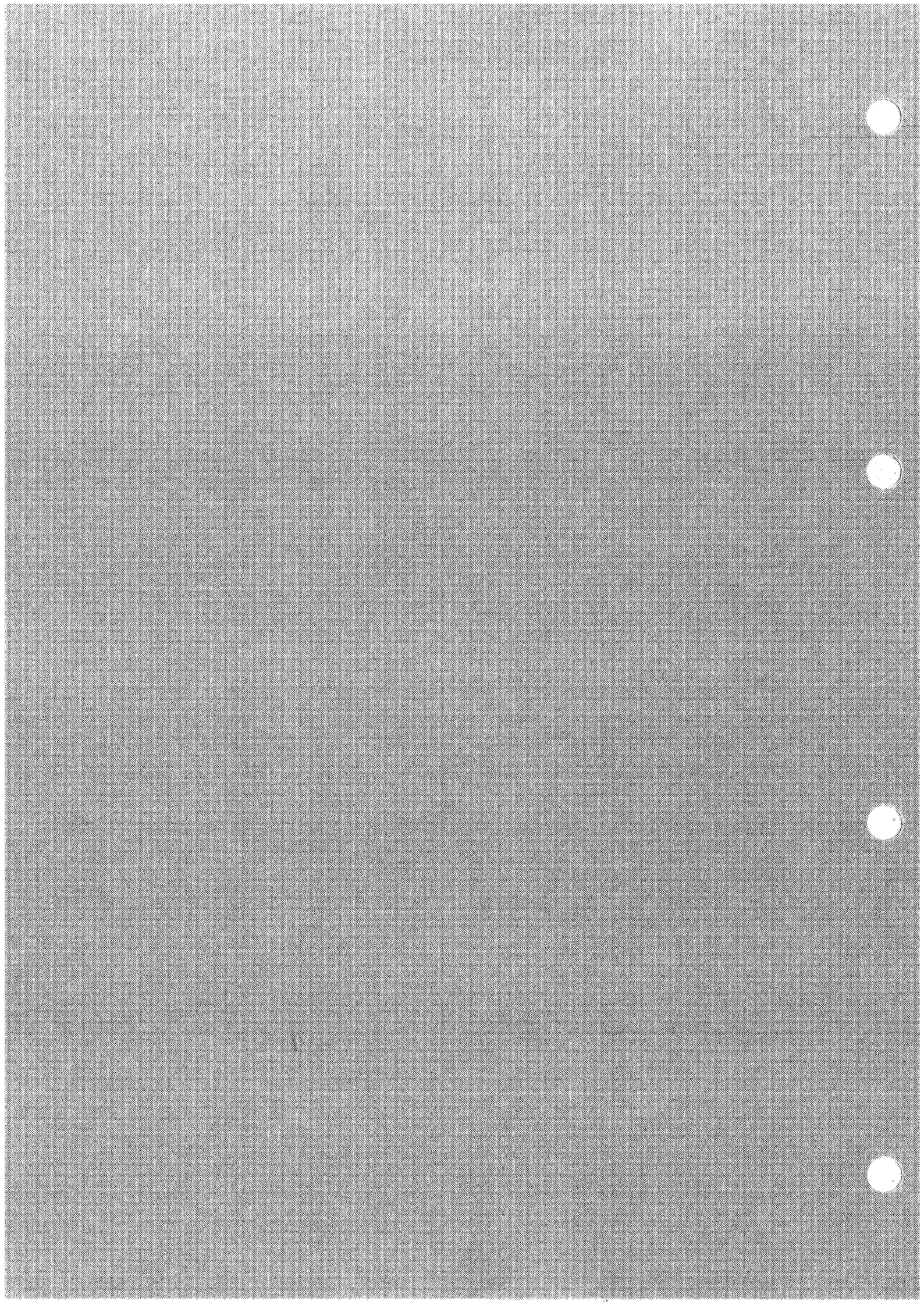


# CHAPTER 5

## INSTALLATION

Each printer is carefully adjusted and strictly inspected before it is shipped. Correct installation of the printer is extremely important to maintain its performance at the level set at the factory. The service technician should fully understand the functions of the printer, install properly in a suitable location, and carry out the necessary checks before it is used.

I. INSTALLATION SUGGESTIONS .....	5- 1	III. STORING AND HANDLING EP CARTRIDGES .....	5- 7
II. UNPACKING AND INSTALLATION .....	5- 2		



## I. INSTALLATION SUGGESTIONS

It is recommended that the serviceman personally inspect the customer's premises before installing any printer. The location should meet the following requirements:

- The line voltage should not vary more than  $\pm 10\%$  from the voltage marked on the printer nameplate, and a ground connection should be available.
- The temperature should be between  $10^{\circ}$  to  $32.5^{\circ}\text{C}$  ( $50^{\circ}$ – $90.5^{\circ}\text{F}$ ), and the relative humidity 20 to 80%.
- The printer should not be installed near water faucets, boilers, humidifiers, refrigerators, etc., and should not be put in a location where the temperature changes abruptly, such as near air conditioners.
- The printer should not be exposed to open flames, dust, ammonia fumes, or direct sunlight. (A heavy curtain can be installed to protect the printer if it must be placed in a sunny location).
- The room should be well-ventilated.
- The printer should be installed on a sturdy, level surface.
- The printer should be located at least 17.5 cm (7") from the rear wall. There should be sufficient space to permit unimpeded operation. (See Figure 5-1.)

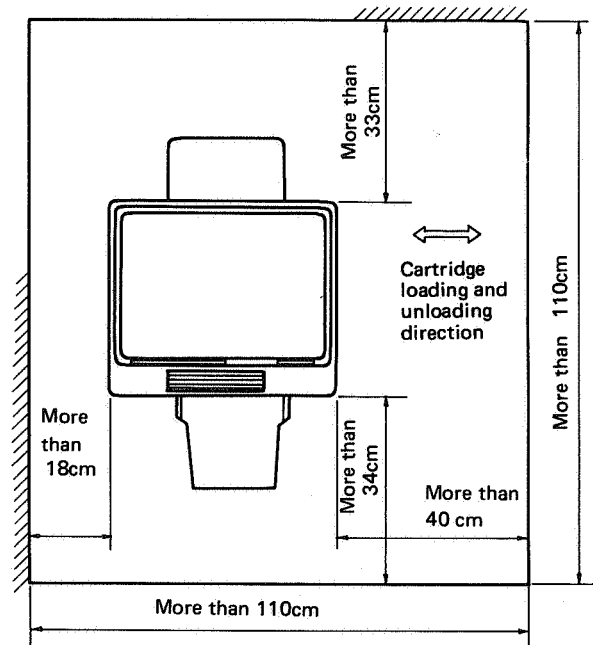


Figure 5-1 Installation space requirements



## II. UNPACKING AND INSTALLATION

The EP cartridge is not packed with the printer; be sure to take an EP cartridge with you when you plan to install a printer.

No	Procedure	Checkpoint	Remarks
1	Open the cardboard box.		See Fig. 5-2.
2	Remove the parts and literature from the depressions in the foam packing sheet.	Check that the following are present: • print tray • manual feed tray • cassette	
3	Lift off the foam packing and remove the printer in its sealed bag.		
4	Remove the aluminum bag from around the printer. Remove the tape securing components.	Check for damage to the exterior during transportation.	
5	Lift the release grip, and raise the upper half of the printer.	Check that the inside is not dirty. If dirty clean it with damp cloth.	
6	Open the top cover of the fixing assembly and remove the two spacers.		See Fig. 5-3.
7	Take the fixing roller cleaner felt out of the package. Insert it securely into the groove in the top part of the fixing assembly. Then lower the top of the fixing assembly back into place.		
8	Peel off the tape securing the wire cleaner.		See Fig. 5-4.
9	If the printer is being installed where line voltage is 115V.		
10	Remove the power switch cover.		See Fig. 5-5.
11	Check to make sure that the setting of the voltage selector (the selector is on the side with the screw) matches the power supply voltage (220/240V). If so, replace the cover and skip to step 13.		See Fig. 5-5.
12	If the voltage setting is not correct, remove the screw securing the selector, and rotate the selector 90° to match the setting with the power supply voltage. If the printer is to be set for 240V, replace the 220V rating plate with the 240V rating plate that is inside the power switch cover. Resecure the selector, and replace the cover.		See Fig. 5-5.

No	Procedure	Checkpoint	Remarks
13	Attach the rear panel. Lift the release grip, and raise the upper half of the printer, and open the right door.		
14	Remove the cartridge (in the sealed aluminum bag) from the package. Remove the aluminum bag. Hold the cartridge horizontal and rock it 45° slowly back and forth about five times to distribute the toner evenly, then install the cartridge into the printer.		See Fig. 5-7.
15	Peel the seal off the EP cartridge. Close the front door, and lower the upper half of the printer.		
16	Install the print tray, manual feed tray and cassette.		Install the manual tray on the printer mounted vertically.
17	Clean the outside of the printer and surrounding area.		

Table 5-1

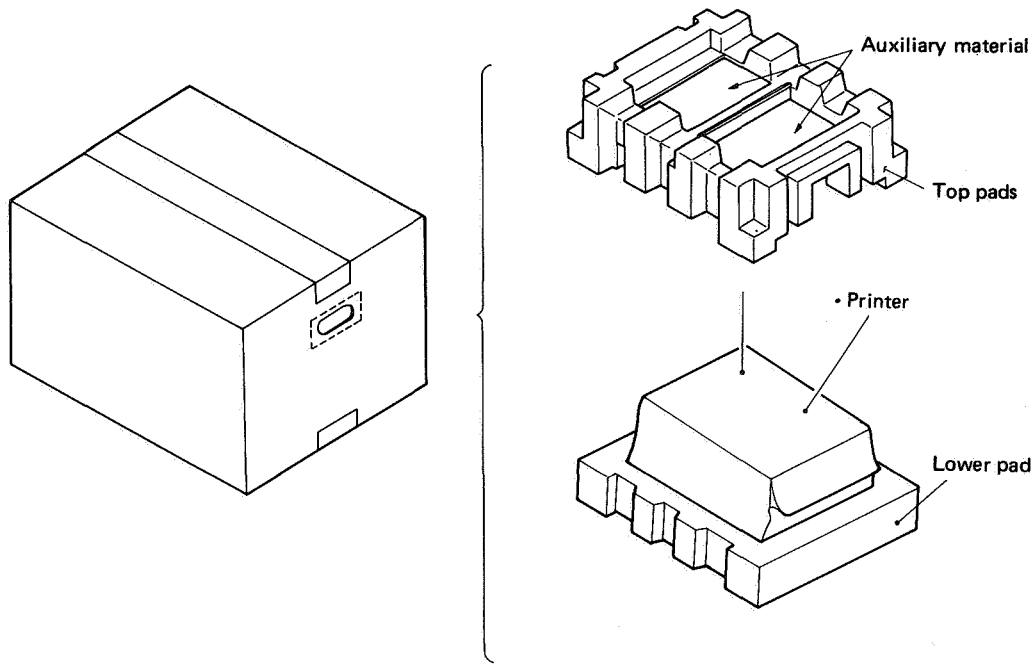


Figure 5-2 Packing

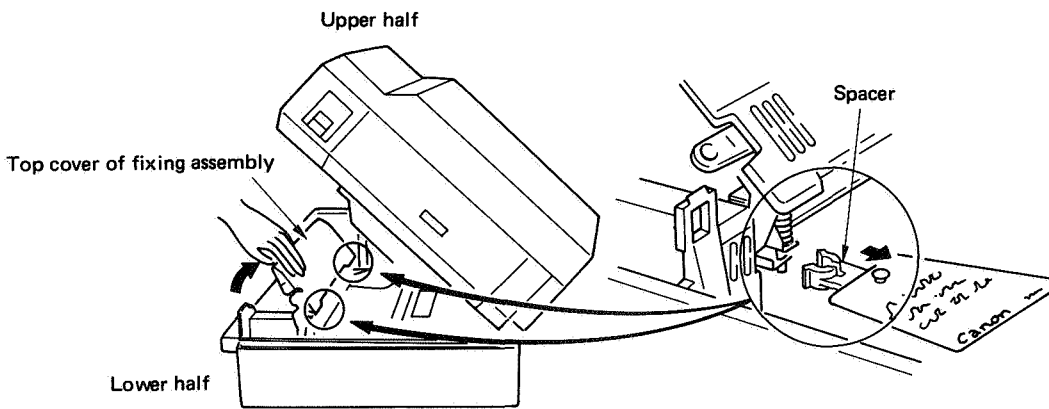


Figure 5-3 Fixing assembly spacers

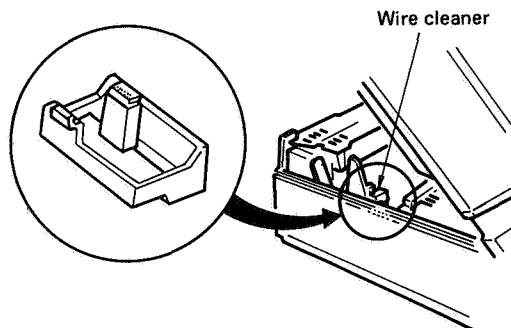


Figure 5-4 Wire cleaner

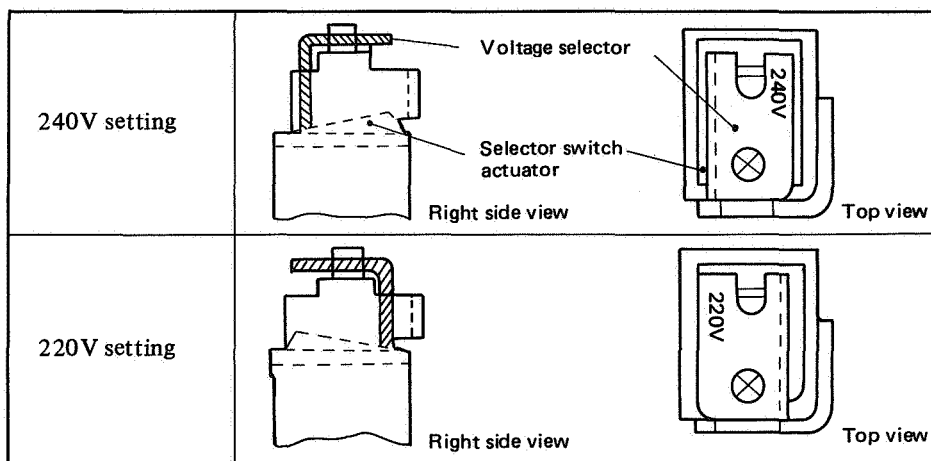
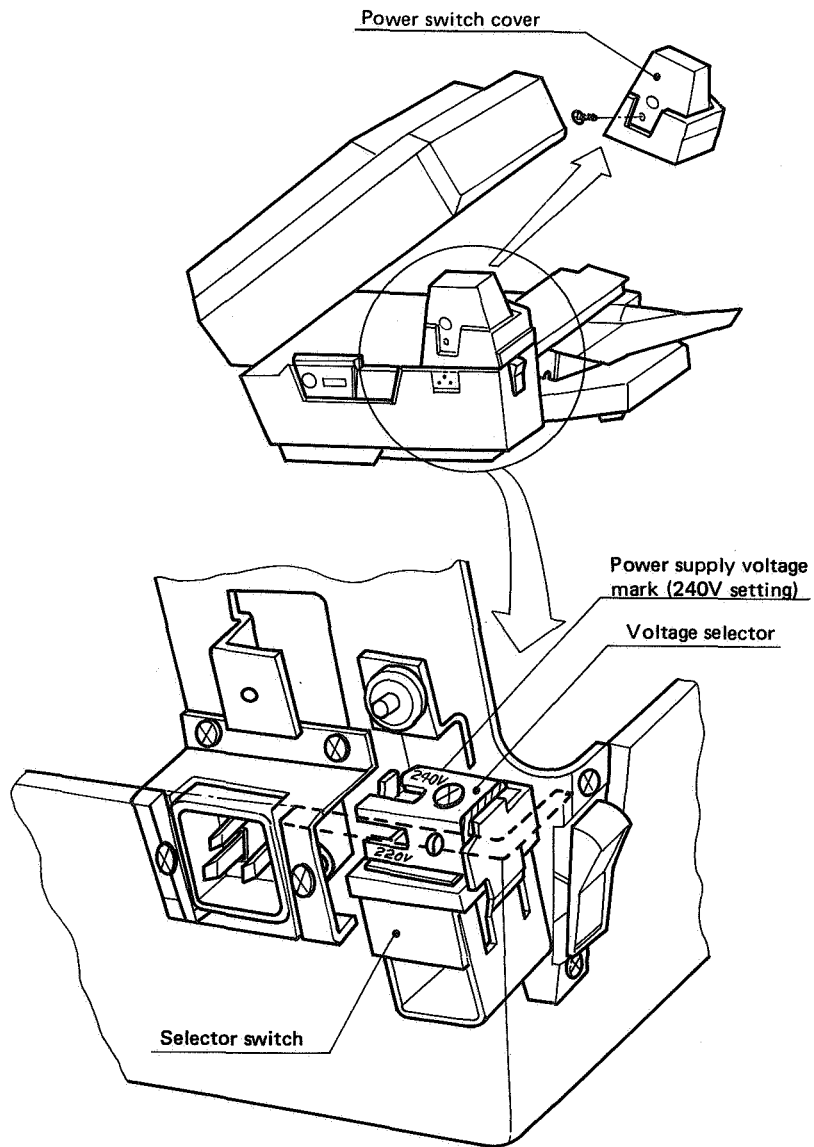


Figure 5-5

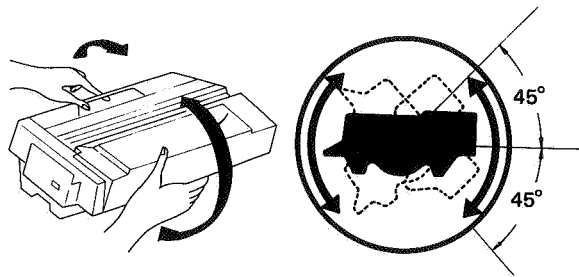


Figure 5-7

### III. STORING AND HANDLING EP CARTRIDGES

The EP cartridge can be affected by the environment whether the seal is intact or has been removed. When the cartridge is installed in the printer, it can be similarly affected regardless of whether it is being used or not.

There is a very large difference in the effects of time, depending on how the cartridge is stored. Pay careful attention to the following points for storing and handling cartridges.

#### A. Conditions for Storage with Intact Packing Seal

When storing the EP cartridge in a warehouse or workshop, be sure that the storage place meets the conditions in Table 5-2.

Temperature	Normal conditions (total storage period x 98/100)		0° to 35° C
	Severe conditions (total storage period x 2/100)	high temp.	35° to 40° C
		low temp.	-20° to 0° C
Temperature variation (within about 3 min.)			40°→15° C -20°→25° C
Relative humidity	Normal conditions (total storage period x 98/100)		35 to 85% RH
	Severe conditions (total storage period x 2/100)	high humidity	85 to 95% RH
		low humidity	10 to 35% RH
Air pressure			460 to 760 mm Hg (0.6 to 1 atm)
Total storage time			2½ years

**Note:** Total storage + Use time = 2½ years

Table 5-2 Storage conditions

Pay attention to the following points.

- 1) Keep the printer out of direct sunlight.
- 2) Keep the printer on a secure, level surface where it is not likely to be bumped.

#### B. Storing and Handling the Cartridge After the Packing Seal Has Been Removed

The photosensitive drum in the EP cartridge uses an organic photosensitive coating which deteriorates when exposed to strong light. The toner in the EP cartridge can also be affected by the environment. For these reasons the customer must be fully informed about the correct method for storing and handling the cartridge.

##### 1. Storage conditions

- 1) Do not place cartridges in direct sunlight or near a window. Also, do not leave them inside an automobile for a long period in warm weather because the interior can become very hot. (Even if it is still in its storage box, do not place a cartridge in direct sunlight nor leave it in an automobile for long periods.)
- 2) In addition to avoiding areas with high or low temperatures or high or low relative humidity (as listed in the table), avoid any place that has abrupt changes in either temperature or humidity, such as close to an air conditioner, etc.
- 3) Do not place cartridges in dusty locations and avoid places where they might be exposed to ammonia gas or organic solvent vapors.
- 4) Store the EP cartridge below 40° C (104° F).

##### Note:

The expiration date of the cartridge is specified on the cartridge box and on the cardboard box of the printer. The usable lifetime of an EP cartridge is 2½ years from the date of manufacture. An EP cartridge that is more than 2½ years old may give poor print quality.

##### 2. Handling suggestions

- 1) When replacing the EP cartridge in the printer, hold the cartridge as illustrated in Fig. 5-8, and slowly rock it back and forth, tipping both ends down at an angle of about 45-degrees. Do this about five times to make sure that the toner is evenly distributed, then install the cartridge into the printer. Do not vary from this procedure; using other methods may result in toner leaking out of the EP cartridge. After the cartridge has been installed in the printer, always run three to five test pattern prints to confirm that there is no toner leakage and that the finished prints are clean. Continuous test pattern print-out is activated by holding the SHIFT switch down, and pressing the FORM FEED switch at least three seconds (with READY/WAIT lit and ON-LINE out). Hold SHIFT down and tap FORM FEED to stop test pattern print. If the ON-LINE indicator is lit, press the ON-LINE switch to switch it OFF. The above procedure can then be used for printing a test pattern.

- 2) If white areas are produced on prints due to lack of toner, hold the cartridge horizontal and rock it 45° slowly back and forth about five times to distribute toner evenly. (See Fig. 5-8.)

**Note:**

Be sure to distribute toner inside the EP cartridge as instructed. Hold the EP cartridge by the handle and the rear to distribute toner. Do not hold it by the main cartridge body (on the handle side). If the cartridge is not turned in this way, toner may leak from the EP cartridge.

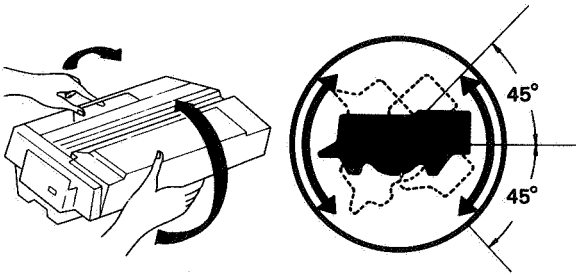
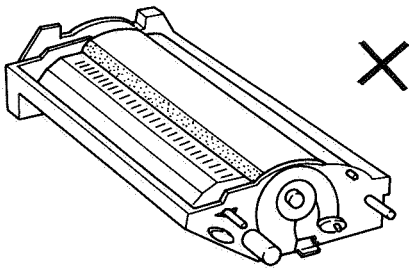
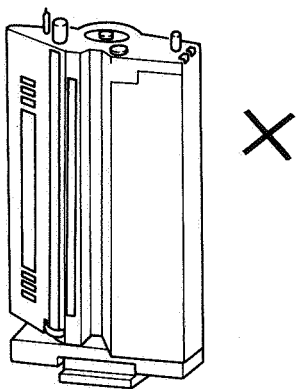


Figure 5-8

- 3) As shown in Figure 5-9, do not stand the cartridge upright, invert it, nor handle it roughly.



Do not invert.



Do not stand on end.

Figure 5-9 Storing a cartridge

- 4) Do not touch the surface of the drum when opening the protective shield for the drum on the bottom of the EP cartridge. If the surface of the drum becomes dirty, wipe it clean with a piece of flannel that has been liberally sprinkled with toner. Do not wipe with a dry cloth and do not use solvent.
- 5) Do not try to disassemble the EP cartridge.
- 6) Do not expose a cartridge to unnecessary vibration or shocks.
- 7) An EP cartridge has light-blocking shutters because the photosensitive drum is sensitive to strong light. Despite these, however, if the cartridge is left in strong light for a long time, white blanks or white stripes will appear on prints. If this happens, stop the printer at once and wait a few minutes. This should eliminate the defective images.

Pay attention to the following points:

- \* Clear a paper jam quickly and replace the EP cartridge in as short a time as possible.
- \* When removing the EP cartridge, always place the cartridge in its storage box and close the lid. Do not leave it lying in the open after removing it from the printer.

**Note:**

Normal room light, measured a few meters from a window on an average day, is about 1,500 lux. Do not expose the photosensitive drum to light of this intensity for more than 5 min.; if the drum is placed under these conditions accidentally, the EP cartridge can be stored in a dark place to "recuperate", although an image may be retained on the drum for some time. Direct sunlight is 10,000 – 30,000 lux. A drum exposed to direct sunlight may be ruined.

# CHAPTER 6

## MAINTENANCE AND SERVICING

I. EXPECTED SERVICE LIFE OF CONSUMABLES .....	6- 1	IV. SERVICE CHECKPOINTS .....	6- 5
II. LIST OF TOOLS .....	6- 2	V. CUSTOMER MAINTENANCE ...	6- 7
III. LIST OF LUBRICANTS, CLEANERS .....	6- 4		





## I. EXPECTED SERVICE LIFE OF CONSUMABLES

The expected service lives of these parts are as follows:

(as of May 1985)

No.	Description	Part No.	Q'ty	Service life* (No. of prints)	Remarks
1	EP cartridge	R34-0002	1	3000	Replace only as required
2	Fixing roller cleaner felt	FG1-2377-000	1	3000	
3	Separation belt	RF1-0224-000	1	50000	

**Note:** The expected service life estimates are based on A4 or letter size prints with an average of 5% toner image in the effective image area (shown below).

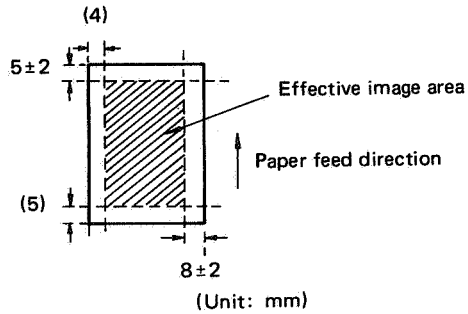


Table 6-1

## II. LIST OF TOOLS

Tools required for servicing the printer are listed below.

NO.	NAME	NO.	REMARKS
1	Tool case	TKN-0001	
2	Lead wire	TKN-0069	
3	Thickness gauge	CK-0057	
4	Spring gauge	CK-0058	Measures the strengths of cassette springs 0-600 g
5	Phillips screwdriver	CK-0101	M4, M5
6	Phillips screwdriver	CK-0104	M3, M4
7	Phillips screwdriver	CK-0105	M4, M5
8	Phillips screwdriver	CK-0106	M4, M5
9	(Regular) screwdriver	CK-0111	
10	Precision (regular) screwdriver set	CK-0114	
11	Allen wrench set	CK-0151	
12	File, fine	CK-0161	
13	Allen (hex) screwdriver	CK-0170	M4
14	Diagonal cutting pliers	CK-0201	
15	Needle nose pliers	CK-0202	
16	Slip-joint pliers	CK-0203	
17	Retaining ring pliers, ext., 19-30 mm	CK-0205	
18	Crimper	CK-0218	
19	Tweezers	CK-0302	
20	Ruler	CK-0303	
21	Mallet, plastic head	CK-0314	
22	Brush	CK-0315	
23	Penlight	CK-0327	
24	Bottle, plastic, 100cc	CK-0328	
25	Solder, $\phi 1.5$ (mm) $\times$ 1 (m)	CK-0329	
26	Desoldering wick, 1.5 (m)	CK-0330	
27	Oiler, 30cc	CK-0349	
28	Jar, plastic, 30cc	CK-0351	
29	Logic tone	CK-0400	
30	Multimeter, digital	CK-0436	Measuring the output of the laser power checker (TKN-0198), etc.

Table 6-2

## SPECIAL TOOLS

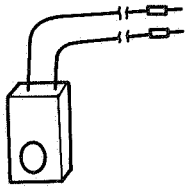
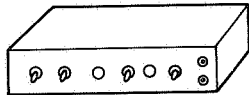
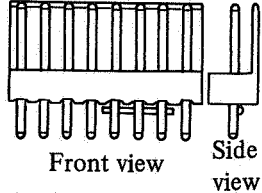
NO.	NAME	NO.	SHAPE	APPLICATION
1	Laser power checker	TKN-0198		Used with printer driver and laser driver checker (RY9-0002), for checking or adjusting laser power.
2	Printer driver and laser driver checker	RY9-0002		Checks printer function and laser power. For checking laser power, use this tool with the laser power checker (TKN-0198).
3	Laser shorting connector	RY9-0003		Protects the laser chip from damage by static electricity

Table 6-3

### III. LIST OF LUBRICANTS, CLEANERS

No.	Material name	Use	Contents	Purchase	Remarks
1	Alcohol: ethyl (pure or denatured) or isopropyl (pure or denatured)	Cleaning: glass, rubber plastic, external covers	$C_2H_5OH$ $(CH_3)_2CHOH$	Locally	All are flammable. Use in a well-ventilated area. Avoid breathing concentrated vapor.
2	MEK (Methyl ethyl ketone)	Cleaning: metal, oil and toner stains	$CH_3CO-C_2H_5$	Locally	Very flammable. Do not use for cleaning the drum, molded plastic parts or corona wires. Use in well-ventilated area. Avoid breathing concentrated vapor. Avoid contact with eyes, or excess contact with skin.
3	Heat-resistant grease	Apply to drive mechanism	Heat-resistant grease e.g. 582M Rhone-Poulenc group	Printer manufacturer or locally	Tool No. CK-0427 (500 g can) Equivalent grease may be used (heat resistance more than $200^{\circ}C$ ).
4	Lubricating oil	For bearings	ISO VG 68 oil ESSO Febis K 68 MOBIL Vactra oil No.2 SHELL Tonna oil T68	Printer manufacturer or locally	Tool No. CK-0451 (100 cc) Equivalent oil may be used.
5	Lubricating oil	Cassette pickup roller clutch spring	ISO VG 220 oil ESSO Febis K220 MOBIL Vactra oil No.4 SHELL Tonna oil T220	Printer manufacturer or locally	Tool No. CK-0524 (100 cc) Equivalent oil may be used.
6	Trichloroethylene	Cleaning oil from parts	$CH-C1-CC1_2$	Locally	Use in well-ventilated area. Avoid breathing concentrated vapor. Avoid contact with eyes, or excess contact with skin.
7	Cotton flannel cloth	Cleaning the drum		Locally	It should be soft enough for cleaning the drum and should not produce lint.
8	Lint-free paper	Cleaning	Kimberly-Clark Kimwipes 6020-23 x 40 cm, or 6021-13 x 21 cm	Locally	Equivalent product may be used. It should be soft enough for cleaning the dustproofing glass of the laser and scanner unit and not produce lint.

**Note:** Avoid breathing the solvents listed above in high concentration.  
Avoid contact with the skin for a long period of time.  
(Wash your hands after servicing the printer.)

Table 6-4

#### IV. SERVICE CHECKPOINTS

##### Fixing assembly

Check	Solvent	Remarks
Fixing roller cleaner felt	-	If dirty, prints will be dirty and there will be jams.
Separation claws	MEK	The leading edge is easily damaged.
Lower delivery guide	MEK	
Separation guide	MEK	
Entrance guide	MEK	

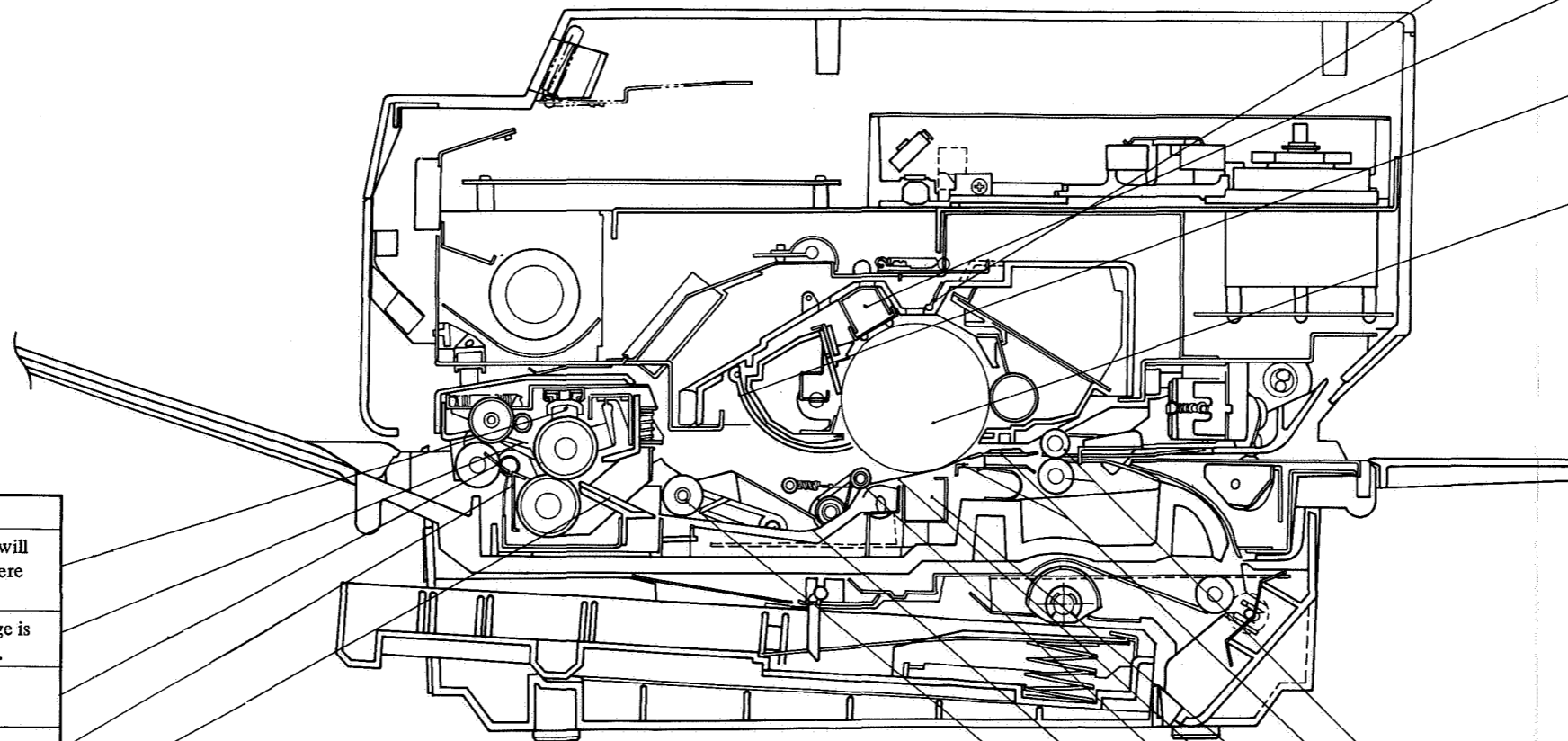


Figure 6-1

##### EP Cartridge

Check	Cleaner	Remarks
Light-blocking shutter	-	Always close when removing EP cartridge from printer.
Primary corona wire	-	Clean with mechanical cleaner supplied with printer.
Protective shield for drum	Damp cloth	Image may be dirtied by falling toner so always clean. Check that foam on the shutter edge is not peeling.
Photosensitive drum	Toner	Do not clean the drum unless absolutely necessary. Do not expose the drum to sunlight.

##### Feed, separation and transfer guides

Check	Cleaner
Feed rollers	Tightly wrung damp cloth
Transfer guides	Tightly wrung damp cloth
Transfer corona ass'y	Lint-free paper
Separation belt	Tightly wrung damp cloth
Separation roller	Tightly wrung damp cloth
Feeder guide	Tightly wrung damp cloth
Feeder roller	Tightly wrung damp cloth



## V. CUSTOMER MAINTENANCE

### A. Regular Servicing Checkpoints

Follow the measure prescribed if one of the following problems occur.

- 1) If the PAPER OUT or JAM indicator on the display panel lights

If using the cassette, replenish the paper in the cassette when the PAPER OUT indicator lights. If using manual feed, put print paper on the manual feed tray when the PAPER OUT indicator lights. If the JAM indicator lights, open the upper main body and remove the jammed paper, then close the upper main body.

- 2) If white or light lines or stripes appear on the print

If the color indicator on the EP cartridge is red, replace the EP cartridge (see item B. 1. below). If the indicator is not yet completely red, see III.B.2 in Ch. 5. for instructions on how to evenly distribute the toner in the cartridge.

- 3) If toner stains appear on the print

Clean the primary and transfer corona wires, and transfer guide. (Cleaning procedures are covered in item C of this section.) If the finished print has a black line along its right edge (on the separation belt side), check for a dirty separation belt. If dirty, clean with a cotton swab (provided with the EP cartridge), or tissue paper.

- 4) If the separation belt breaks

Replace the separation belt (see item B.2. on the next page for instructions).

### B. Replacing Consumables

#### 1. EP cartridge

The EP cartridge can be replaced by the customer. To determine whether the EP cartridge needs to be replaced, look at the color of the indicator, visible through the window on the right. As the drum rotates, the color of the indicator changes to indicate the usable service life of the cartridge.

Each cartridge contains enough toner to make about 3,000 A4- or letter-size prints (5% toner image in the effective image area). If many originals with high toner image ratios are printed, toner is used up more quickly, and white stripes may appear on prints before the printing capacity indicator turns red.

Printing capacity indicator	Number of prints (approx.)	Meaning
	1,700	—
	2,000	A new EP cartridge should be obtained.
	2,800	—
	3,000	Replace the EP cartridge.

G : Green  
R : Red  
Y : Yellow

Figure 6-2 Printing capacity indicator

The number of prints is based on the assumption of 4.5 drum revolutions per print. The fixing roller cleaner (provided with the EP cartridge) felt in the fixing assembly should be replaced and the transfer corona wires should be cleaned with a cotton swab (provided with the EP cartridge) when the EP cartridge is replaced.

#### Replacing the EP cartridge

- 1) Lift the release and raise the upper half of the printer.

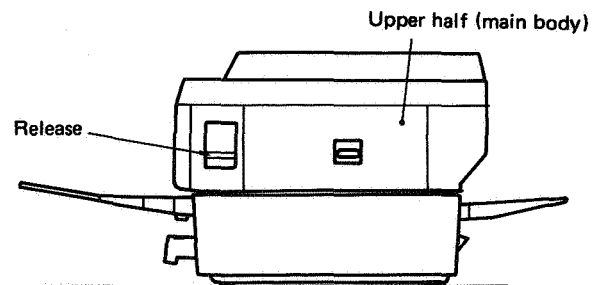


Figure 6-3

- 2) Open the right door and pull out the used EP cartridge.

#### Note:

The right door can be opened only after the upper main body has been raised.



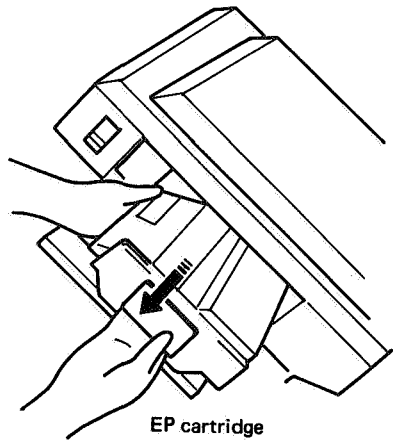


Figure 6-4

- 3) Hold the new EP cartridge horizontal and rock it 45° slowly back and forth about five times (with the drum as the center of rotation). Do this if white stripes appear on the finished paper.

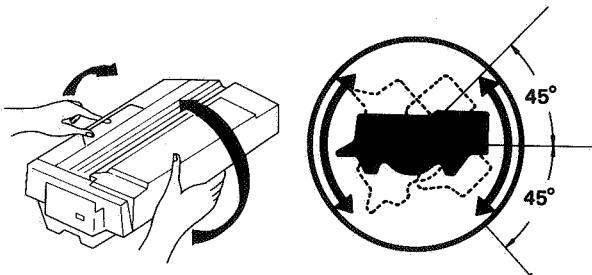


Figure 6-5

**Note:**

Hold the EP cartridge by the handle and the rear to distribute toner. Do not hold it by the main cartridge body (on the handle side).

- 4) Fully insert the new EP cartridge into the printer.
- 5) Flex the black tab on the EP cartridge until it breaks loose. (Hold the cartridge steadily). Pull the tab out completely to remove the attached sealing tapes.

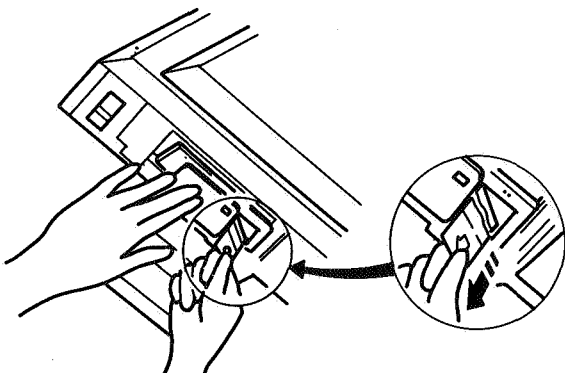


Figure 6-6

- 6) Raise the top of the fixing assembly and replace the fixing roller cleaner felt with a new one. Lower the top of the fixing assembly.
- 7) Close the upper half of the printer.
- 8) Make three to five test pattern prints by holding the SHIFT switch down and pressing the FORM FEED switch for at least three seconds. (The READY/WAIT indicator must be lit, and the ON-LINE indicator out. The ON-LINE indicator can be switched OFF by pressing the ON-LINE switch.)  
To stop test pattern print, hold SHIFT down and tap FORM FEED.

**2. Separation belt**

If the separation belt breaks, replace it with the replacement belt provided with the machine. (See Fig. 6-11)

**Replacement procedure**

- 1) Push the release lever up and open the upper half main body.

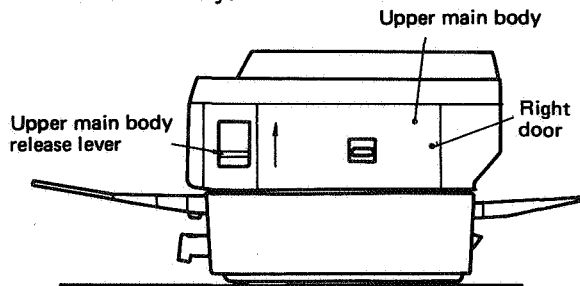


Figure 6-7

- 2) Open loop A on the separation belt with a screwdriver.

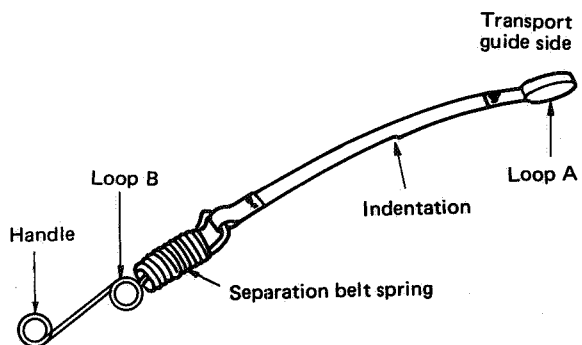


Figure 6-8 Separation belt

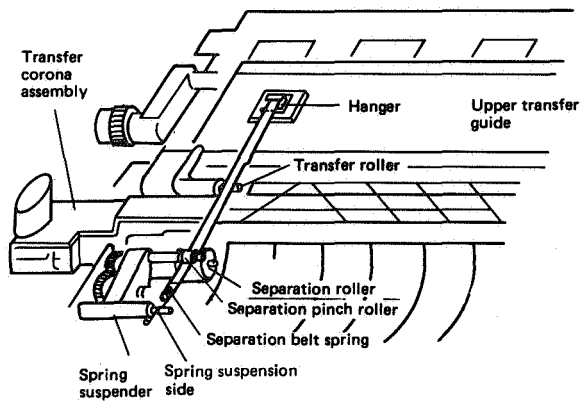


Figure 6-9

- 3) Hang loop A on the separation belt from the right side of the upper transfer guide. - The indentation on the separation belt belongs on the right side.
- 4) Pass the separation belt over the transfer roller, and under the separation pinch roller.
- 5) Grasping the handle of the separation belt (marked handle), stretch the belt out and hook the loop B over the retainer, making sure that the loop is in the groove.
- 6) Check the following items after installing the separation belt.
  - Is the belt twisted or cut?
  - Is the indentation on the right side?
  - Is loop A securely hung from the upper transfer guide?
  - Does the belt pass over the transfer roller?
  - Does the belt pass between the separation roller and the separation pinch roller?
  - Is the separation belt spring hooked securely to the spring suspension side of the spring suspender?
- 7) Close the upper main body.

## C. Cleaning

If dirty prints are produced, the printer should be cleaned as follows. (These instructions should be given to the customer.)

### 1. Primary corona wire

Open the printer and pull out the EP cartridge. Insert the wire cleaner into the long slot of the EP cartridge (beside the shutter) and move it back and forth in the slot. (The cleaner displaces the thin protective plastic sheet.) After cleaning, replace the cartridge in the printer, and close the printer.

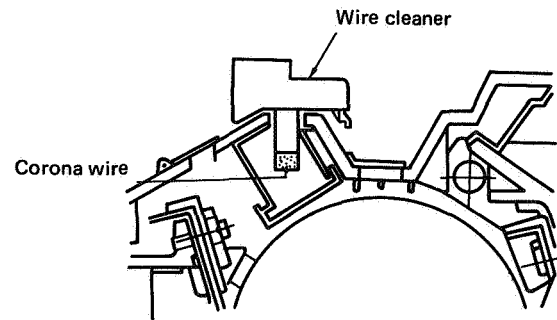


Figure 6-10

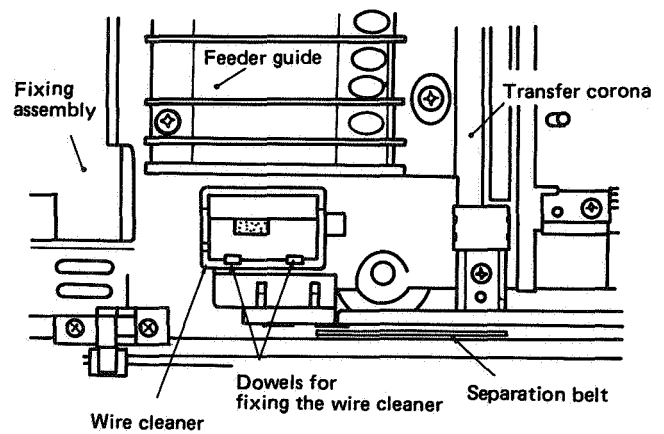


Figure 6-11 Wire cleaner and separation belt location

## 2. Transfer corona wire

Open the printer. Pull out the EP cartridge. Gently draw the cotton swab (provided with the cartridge) up and down the corona wire. Replace the cartridge in the printer, and close the printer.

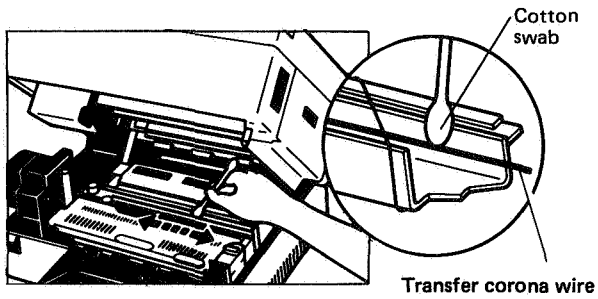


Figure 6-12

## 3. Transfer guide

Clean the transfer guide with a damp cloth. (Don't soak it – it should be moist, not wet.)

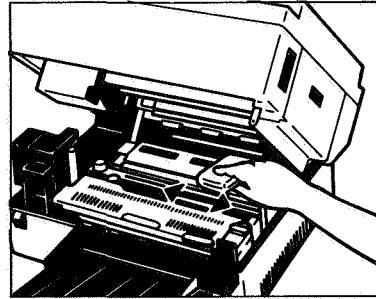


Figure 6-13.

# **CHAPTER 7**

## **TROUBLESHOOTING**

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# I. INTRODUCTION

## A. Initial Check

### 1. Check the operating environment.

- a. Line voltage should not vary more than 10% from the rated value.
- b. The printer must be installed on a solid, level surface.
- c. Room temperature must be kept between 10° and 32.5°C (50° – 90°F). Relative humidity should be between 20% and 80%.
- d. The printer should not be located in hot or humid areas (near water taps, boilers, or humidifiers), nor in a cold place, near open flames, or in a dusty location.
- e. Make sure that the printer is never exposed to ammonia gas, which is produced by diazo copiers or by office cleaning. Stress the importance of this to the customer.
- f. The printer should not be exposed to direct sunlight. If it has to be located in a sunny place, the customer must install protective curtains over the window.
- g. Install the printer in a well-ventilated area.

### 2. Check the corona assemblies

- a. The primary corona assembly in the EP cartridge and the transfer corona assembly must be clean and undamaged. (Replace them if they can not be cleaned or are damaged.)
- b. Check the height of the transfer corona wire.
- c. Make sure the transfer corona assembly is securely seated in its socket.
- d. Check that the transfer corona spring is not rusted. (If rusted, replace the spring.)

### 3. Check the print paper.

- a. Is manufacturer-approved paper used? If extremely thick paper or thin paper, or paper that tends to curl, is used, paper may jam, transfer may be poor, or the image may be blurred.
- b. Has the print paper absorbed moisture? (Take paper from a newly opened package, make prints with it, and observe whether print quality improves.)

### 4. Check consumables

Check the color of the indicator on the EP cartridge. If it is red, replace the cartridge (about 3,000 prints standard).

If blank areas occur in the image, toner may have accumulated at one side of the cartridge. Remove the cartridge and rock it side to side to distribute the toner within, then make a sample print and check print quality.

### 5. Several more items should be checked before troubleshooting.

- a. Make sure that the transfer guide and the feeder guide are clean. If they are dirty, clean them with a damp cloth.
- b. Check whether the fixing roller cleaner felt is too dirty to clean the roller anymore.

### 6. Other items

During the winter, if the printer is taken from a cold room into a warm room, condensation will form inside the printer and cause various problems.

#### Examples

- Condensation on the optical surfaces (lens, glass, mirrors, etc.) will cause the image to lighten.
- If the drum is cold, the electrical resistance of the photosensitive layer is high, and correct contrast in prints will not be obtained.
- Condensation on the corona assembly will result in corona leakage.
- Moist paper or condensation on the manual feed guide or manual pickup rollers may cause poor paper feed. If condensation is noticed on components, wipe them gently with a clean dry cloth or plug in the printer and leave it for 10 – 20 minutes.
- If the aluminum bag protecting the cartridge is opened in a warm room just after being stored in the cold, moisture will condense inside the cartridge and could cause image trouble. Be sure to instruct the customer to allow the package to come to room temperature before he opens it, if it has been stored in the cold. This takes one to two hours.

### B. Basic Procedure

When a malfunction or image defect is reported, follow the basic procedure below after performing the initial check.

1. Use the printer driver and laser driver checker (RY9-0002) to determine whether the problem lies with the printer or the external device.
2. If the printed image is at fault, locate the problem on the chart of image defects on page 7-13, then go to the appropriate table.

## II. CHECK/ADJUSTMENT

### A. Printer Driver and Laser Driver Checker Operation

Use the printer driver and laser driver checker (RY9-0002) for both checking electrical and mechanical functions of the printer and to make the printer produce an image besides vertical lines (e.g. horizontal lines, or a blank print). The printer driver and laser driver checker sends various control signals to connectors J205 and J209 in the DC controller.

The control signals generated by the printer driver and laser driver checker are listed in the table below.

Pin No.	Signal	Function
J205-1	TSTPT	The printer executes test printing when <u>TSTPT</u> is TRUE.
J205-2	GND	
J205-3	<u>RDYINH</u>	When <u>RDYINH</u> is TRUE, the printer functions even if the printer is NOT READY (no cartridge, no paper, etc.).
J205-4	GND	
J205-5	(Reserved)	For factory adjustment
J205-6	GND	
J205-7	TPAN	Selects a test pattern in combination with TPBN
J205-8	GND	
J205-9	TPBN	Selects a test pattern in combination with TPAN
J205-10	<u>TSTPTE</u>	Enables selection of test patterns by TPAN and TPBN
J209-1	<u>CSENS1</u>	Adjusts laser intensity in combination with <u>CSENS2</u> and <u>CEMP</u>
J209-2	GND	
J209-3	<u>CSENS2</u>	Adjusts laser intensity in combination with <u>CSENS1</u> and <u>CEMP</u>
J209-4	GND	
J209-5	<u>CEMP</u>	The laser driver on the DC controller PCB adjusts laser power according to the drum sensitivity identification signals ( <u>CSENS1</u> , <u>CSENS2</u> ) only when <u>CEMP</u> is FALSE.
J209-6	GND	
J209-7	<u>LPCK</u>	The laser is forced to turn ON continuously while this signal is TRUE.

**Note:** Do not make LPCK low except when adjusting laser beam intensity, because it may damage the laser chip.

Table 7-1

### Operation

- 1) Confirm that printer power is OFF. Remove the top cover (See I.A. in Ch. 4).
- 2) Connect the printer driver and laser driver checker to J205 and J209 on the DC controller and switch the printer ON.

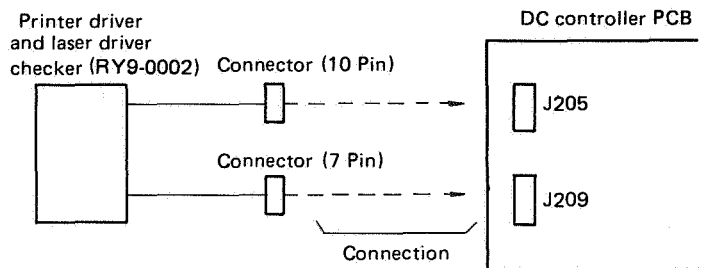


Figure 7-1

- 3) Select the output image (horizontal lines, vertical lines, or blank print) using the video select switch.
- 4) When the READY/WAIT indicator lights, set the Test Print switch to ENABLE. The printer keeps outputting the image selected in the previous step as long as the test print switch is set to ENABLE.

**Reference:**

This tool makes it possible to check printer functions without paper. To do this, set the Ready Control switch to INHIBIT, remove the cassette, and perform steps 1) to 4).

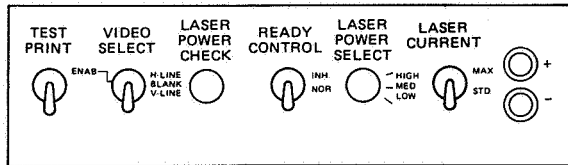


Figure 7-2 Printer driver and laser driver checker control panel

**B. Image Adjustment**

**1. Basic image adjustment**

**a. Making sample prints**

If an image problem occurs, make sample prints to help identify the problem.

**b. Adjustment**

Follow the procedures in the troubleshooting charts in dealing with image problems. For the most basic problems of faint images and dark (fogged) images use the following procedure.

- Clean the corona wires. (See V.C. in Ch. 6.)
- Adjust print density adjustment dial VR2 on the left panel. If the image is faint, turn the dial counterclockwise. If the image is too dark, turn the dial clockwise.
- Check the drum sensitivity indication micro-switches MS3, MS4. If they do not function normally, replace them.

**2. Adjusting the height of the transfer corona wire**

The height of the transfer corona wire is not normally adjusted in the field. The standard height of the wire is as shown below.

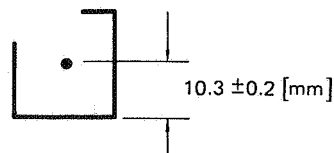


Figure 7-3

The front or rear height can be adjusted by turning the screw at the rear of the corona assembly. One turn results in a 0.5 mm change in height.

**C. Mechanical Adjustment**

**1. Adjusting the cassette spring lifting force**

Stand a scale in the gap at the front of the lifting plate. Place a spring scale (CK-0058) 25 mm from the edge and between the cassette springs. Press the spring scale down the specified distance and read the force. If the force is not as specified, replace the springs.

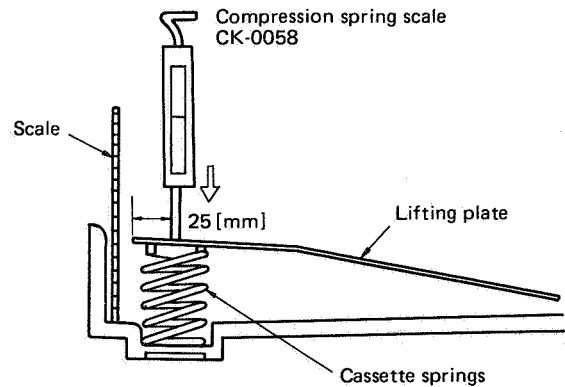


Figure 7-4

Depression Cassette	3 mm	13 mm
	A4	340 ± 30 g
B5	320 ± 30 g	420 ± 40 g
Legal	320 ± 30 g	410 ± 40 g
Letter	320 ± 30 g	410 ± 40 g

A4 size model

Table 7-2 Cassette spring force

**2. Adjusting the fixing rollers (nip width)**

It is unnecessary to adjust the nip width. To check it, follow the following procedure.

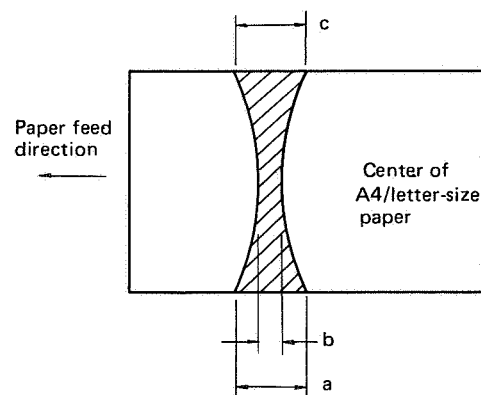


Figure 7-5



Measurement	Measure for sufficient pressure between upper and lower rollers
b	2 to 3 [mm]
a - c	less than 0.5 [mm]
a - b	less than 0.5 [mm]
b - c	less than 0.5 [mm]

Table 7-3 Fixing roller nip width

- (1) Make an A4/letter print.
- (2) Switch the power OFF when the leading edge of the print appears at the delivery port.
- (3) Pull the leading edge slightly and wait 10 seconds, then pull the print completely from the fixing assembly.
- (4) Measure the width of the glossy toner.

**Note:** - Take measurements when the rollers are cold; wait 15 minutes after switching on the power.

- This adjustment should be made by outputting a test pattern.

## D. Electrical Adjustment

### 1. LEDs and VR settings

#### a. LEDs

LEDs on the main PCBs allow visual checking of electrical signals. The following table indicates these LEDs and their reasons for lighting.

PCB	LED	Reason for lighting
DC controller	LED201	Lights continuously when the laser beam is turned ON at more than the specified intensity
Scanner driver	LED401	Lights continuously when the scanner motor is rotating at the specified speed (SCNRDY is TRUE.)
DC power supply & main motor driver	LED501	Lights continuously when the main motor is rotating at the specified speed

Table 7-4 LEDs

#### b. Setting VRs

VR202 is the only VR in the DC controller that can be adjusted in the field. Adjust VR202 (only if necessary) for proper laser power when a DC controller PCB or a laser unit is replaced.

#### Note:

Removing the connectors with the power ON will overload the laser and damage it, so be certain to SWITCH THE POWER OFF BEFORE REMOVING CONNECTORS. Improper adjustment will also damage the laser. Read the section on laser power adjustment (see II. D. 3 in this Chapter) very carefully before beginning.

### 2. Checking the DC controller and AC driver (AC controller and the fixing roller heater safety circuits)

#### a. Connector locations on the DC controller, AC controller and fixing roller heater safety circuits

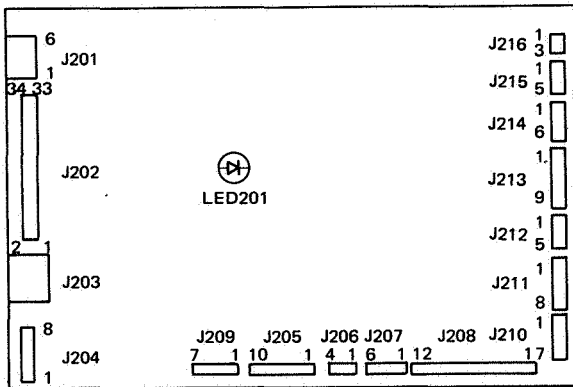


Figure 7-6 Connector locations on the DC controller PCB

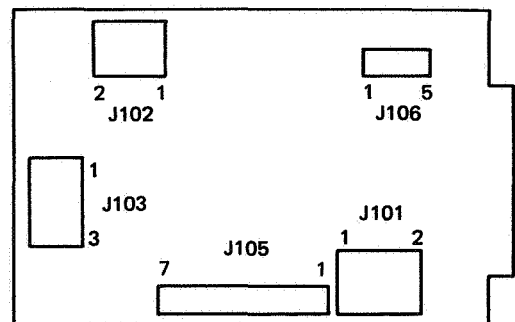


Figure 7-7A Connector locations on the AC controller PCB

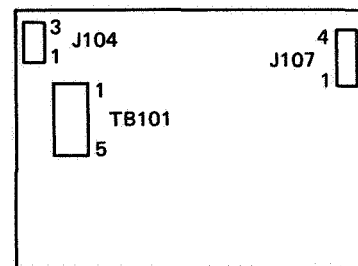


Figure 7-7B Connector locations on the fixing roller heater safety PCB

**b. Checking the input/output signals**

(1) DC controller signals

Connect the red and black leads of each signal in the table to the red and black leads on the multimeter, respectively. Measure the voltage to check whether the signal is normal or not. For signal time (TRUE, FALSE), see the timing chart for DC controller inputs/outputs in Chapter 3.

	Signal/command	Checkpoint		Approx. DC voltage (V)		Remarks
		Red lead	Black lead	True	False	
Inputs	AC pulse signal (ACP)	J208-11	J208-6	Pulse (6 - 7)	0	Full-wave rectified waveform  +0.8VDC - +2.0VDC (at the specified temperature) +0.8 VDC - +2.0VDC (at the specified temperature)  Check with a Logic Tone.
	Drum sensitivity indication signal (CSENS1)	J209-1	J209-2	0	5	
	Drum sensitivity indication signal (CSENS2)	J209-3	J209-4	0	5	
	Fixing roller temperature signal (FSRTH)	J212-5	J212-3	-	-	
	Laser temperature signal (LSRTH)	J204-3	J204-4	-	-	
	No cartridge signal (CEMP)	J209-5	J209-6	5	0	
	Paper out signal (PEMP)	J215-2	J215-1	5	0	
	Pickup sensor signal (PFS)	J210-6	J210-5	5	0	
	Paper detection signal (PDP)	J216-2	J216-1	5	0	
	Paper size signal (PSIZE1)	J214-1	J214-2	0	5	
	Paper size signal (PSIZE2)	J214-3	J214-4	0	5	
	Paper size signal (PSIZE3)	J214-5	J214-6	0	5	
	Scanner ready signal (SCNRDY)	J206-3	J206-2	0	2.5 - 3.5	
Tachogenerator signal (TG)	J208-12	J208-3	Pulse (0 - 3 peak)	0		
Outputs	Beam detect pulse (BD, $\overline{BD}$ )	$\overline{BD}$ : J202-3 BD: J202-4	J208-6	Pulse (0 - 3.5 peak)	$\overline{BD}$ : 3.5 BD: 0	Check with a Logic Tone.  Various ms period pulse
	Cassette pickup roller clutch solenoid drive command (CPUSD)	J215-4	J215-1	0	24	
	Drum drive command (DRMD)	J208-1	J208-3	0	7 - 8	
	Developing bias (DC) command ( $\overline{DBDC}$ )	J211-4	J211-1	0	19-21	
	Developing bias (AC) command (DBAC)	J211-5	J211-1	0	15-18	
	Fixing roller heater drive command (FSRD)	J212-1	J212-2	Pulse (10-20)	24	
	High-voltage reset command (HVRST)	J211-7	J211-1	16	0	
	Primary corona command ( $\overline{HVPR}$ )	J211-8	J211-1	1	17-19	
	Transfer corona command ( $\overline{HVTR}$ )	J211-2	J211-1	0	19-21	
	Indicator A drive command ( $\overline{BDERRL}$ )	J201-5	J208-6	0	3-5	
	Indicator B drive command (FSERL)	J201-6	J208-6	0	3-5	
	JAM indicator drive command (JAML)	J201-4	J208-6	0	3-5	

	Signal/command	Checkpoint		Approx. DC voltage (V)		Remarks
		Red lead	Black lead	True	False	
Outputs	Laser heater drive command (LSRHD)	J204-2	J204-4	0	15-30	
	Manual pickup roller solenoid drive command (MPUSD)	J210-4	J210-5	0	24	
	PAPER OUT indicator drive command (PEMPL)	J201-3	J208-6	0	3-5	
	Printer power ready signal (PPRDY)	J202-5	J208-6	5	0	
	Preconditioning-exposure command (PEXP)	J207-1	J207-2	24-35	0	
	Ready signal (RDY)	J202-7	J208-6	0	5	
	READY/WAIT indicator drive command (RDYL)	J201-2	J208-6	0	3-5	
	Registration shutter solenoid drive command (RGSD)	J210-2	J210-5	0	24	
	Scanner drive command (SCNON)	J206-4	J206-2	0	5-15	
	Print counter drive command (TM)	J207-3	J207-4	0.1-0.15	0.04-0.06	
	Vertical sync request command (VSREQ)	J202-9	J208-6	0	5	

Table 7-5

(2) AC driver (AC controller and fixing roller heater safety circuits) signals

	Signal/command	Checkpoint		Approx. DC voltage (V)		Remarks
		Red lead	Black lead	True	False	
Input	Fixing roller heater drive command (FSRD)	J104-2	J104-1	Pulse (10-20)	24	
Outputs	AC power supply for fan (FM1)	J102-1	J102-2	Line voltage	0	TRUE while the main switch is ON
	Triac Q1 (voltage for both ends)	J105-7	J105-3	0	Line voltage	Fixing roller heater control
	AC power supply for fixing roller heater (H1)	J101-1	J101-2	Line voltage	0	Controlled by Triac Q1
	AC power supply for transformer (PT1)	J103-1	J103-2	Line voltage	0	TRUE while the main switch is ON

Table 7-6

**3. Adjusting laser power**

Laser power adjustment should be made after replacing the DC controller, the laser unit, or if the following image defects arise: light image (I-1), dark image (I-2).

- (1) Switch the power OFF.
- (2) Remove the top cover (6).  
(See I.A. in Ch. 4.)
- (3) Open the plate over the access hole for the laser driver checker on the laser and scanner unit.
- (4) Connect a digital multimeter to the laser power checker (TKN-0198)  
Set the range to 200 mV.

**Note:**

1. If the multimeter does not make good contact, or if the meter range is wrong, the power of the laser cannot be measured accurately. Be sure to plug the black lead into the black socket and the red lead into the red socket.
2. Adjust laser power as seldom as possible. Frequent adjustment increases the chances of damaging the laser chip.



**Warning:**

Never unplug any connector unless the power is OFF. This can destroy the laser chip.

**Note:**

1. Confirm that the laser power checker operates normally before making adjustments.
2. If the laser output is adjusted incorrectly, the laser will be damaged. In any case, the output should be adjusted as seldom as possible.
3. Output power of the laser should be within the range indicated on the laser unit label.
4. Check the laser output power after replacing the DC controller PCB, the laser unit, if the print is faint or lines on the print are thin, if lines are too wide, if the laser intensity decreases, or if the laser beam stops.
5. Turn VR202 slowly on the DC controller PCB.
6. Measurement should be made three times and averaged.
7. If the laser unit or DC controller PCB is replaced, turn VR202 fully counterclockwise and adjust laser beam intensity.

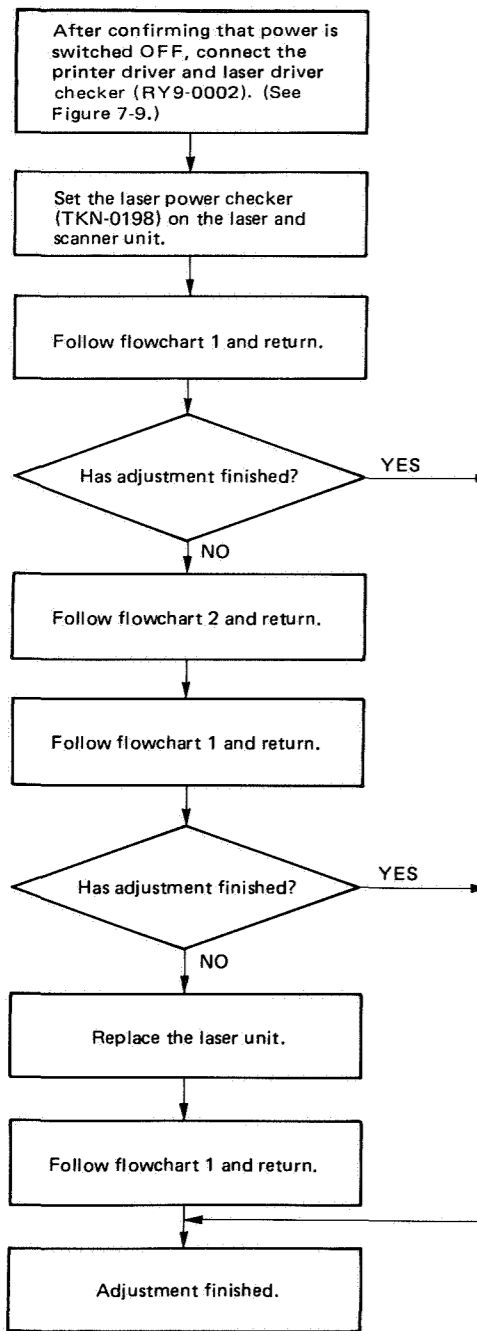


Figure 7-12 Basic flowchart

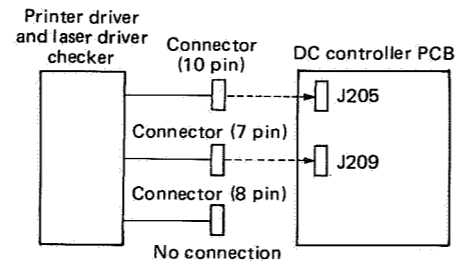


Figure 7-9

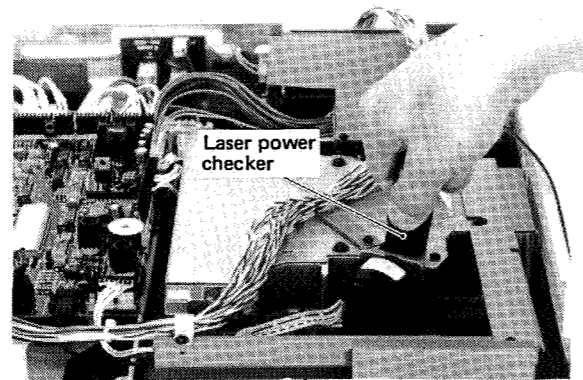


Figure 7-10

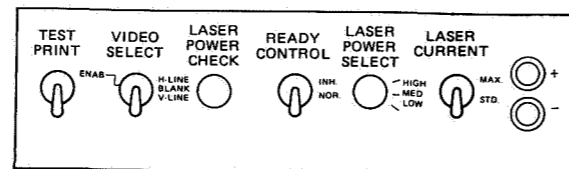


Figure 7-11 Printer driver and laser driver checker control panel

**a. Flowchart 1**

Note: Laser power does not change if VR202 is turned while the laser power check button is being pressed. Be sure to turn VR202 before pressing the laser power check button. If VR202 is turned too far clockwise and the laser power button is pressed, the laser chip may be damaged. VR202 rotation should be within 5°.

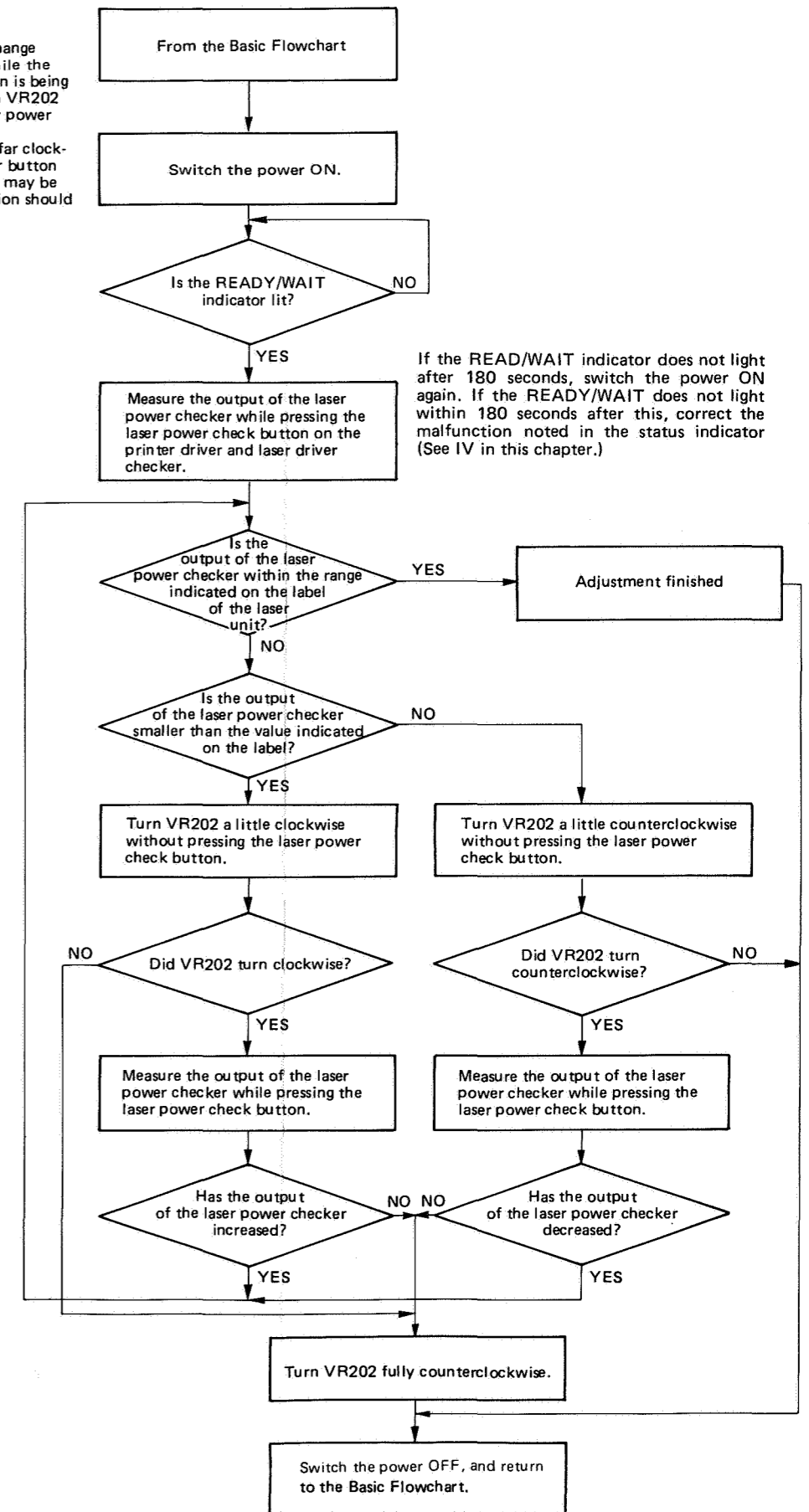


Figure 7-13



b. Flowchart 2

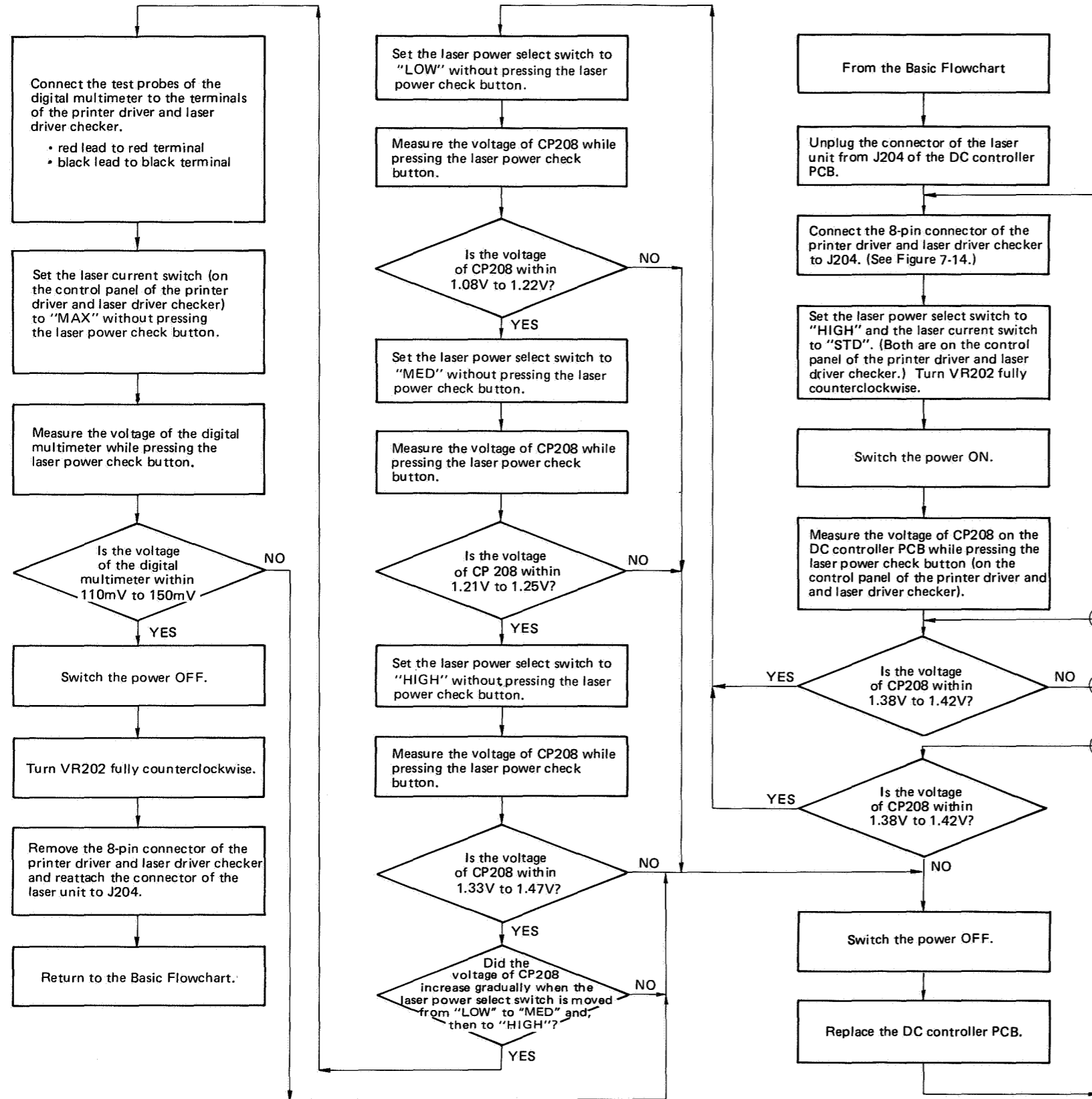


Figure 7-15

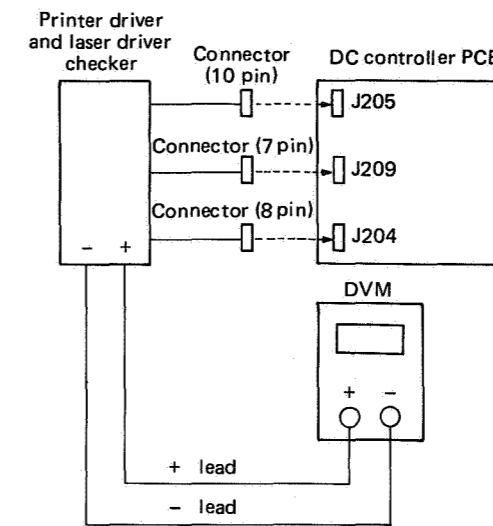
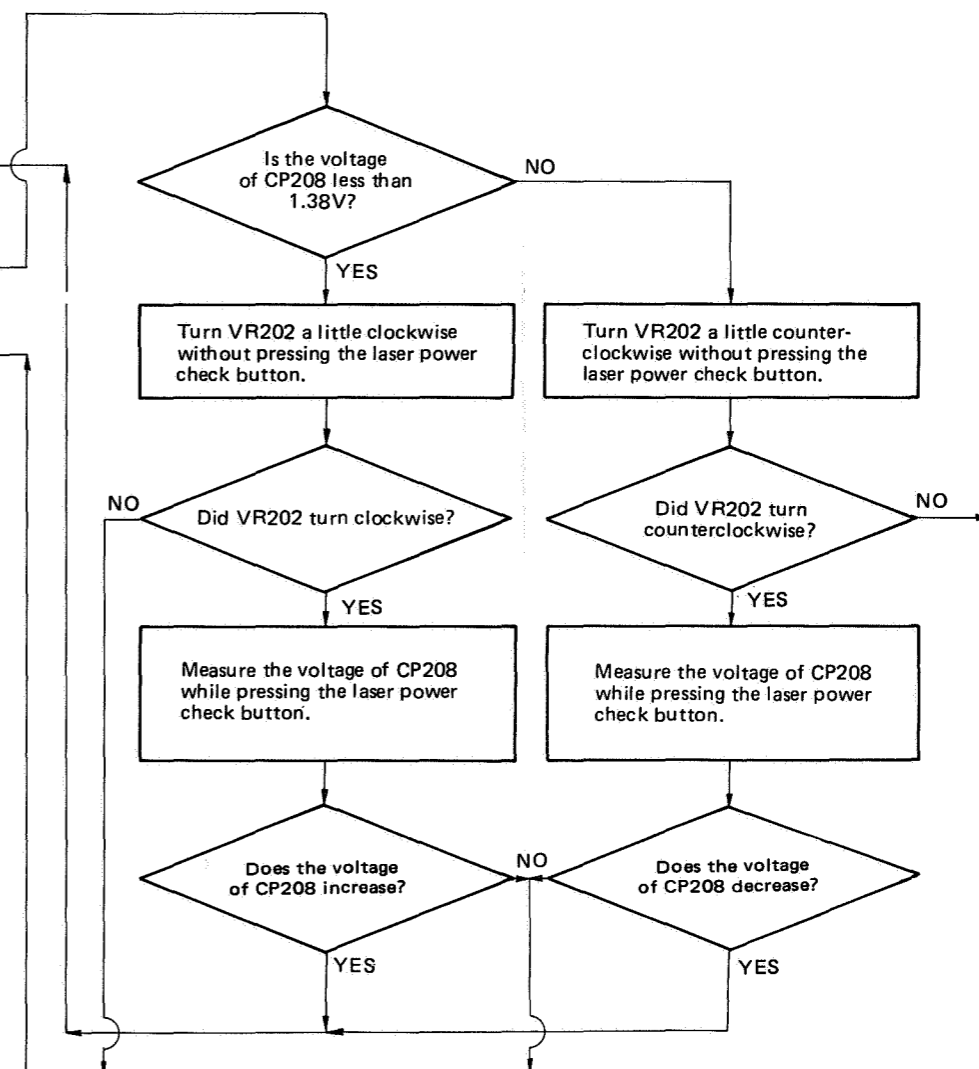


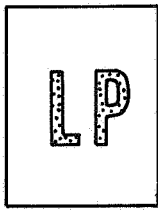
Figure 7-14



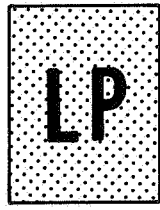




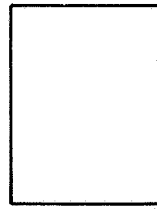
A. Examples of Image Defects



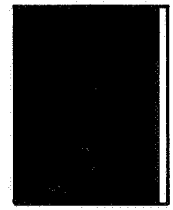
I-1 Light image



I-2 Dark image



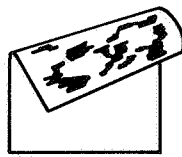
I-3 Blank print



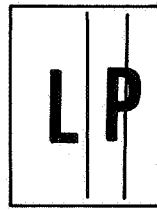
I-4 Black image



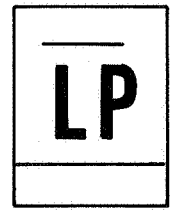
I-5 Stained separation strip



I-6 Stains on back of paper



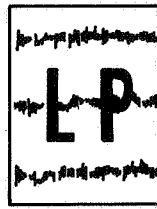
I-7 Dark vertical lines



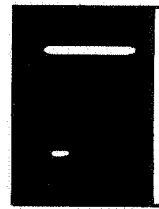
I-8 Sharp horizontal black lines



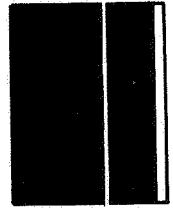
I-9 Vertical fogged stripes



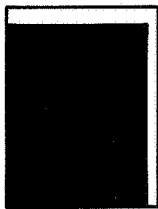
I-10 Horizontal fogged stripes



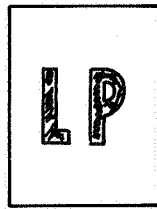
I-11 White horizontal lines/  
other shapes on a black  
print



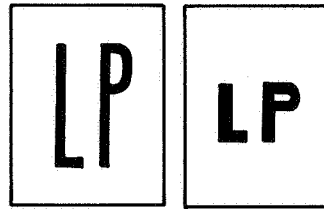
I-12 Thin vertical white  
lines/strips



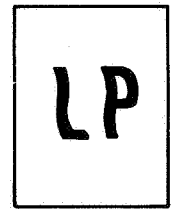
I-13 Faulty registration



I-14 Poor fixing



I-15 Distortion



I-16 Waviness

Figure 7-15

## B. How to Read the Troubleshooting Tables

The troubleshooting tables from III. to V. in this chapter are explanations of the general servicing procedure. The example below shows how to read the tables.

(Example) There is no power.

Case	Step	Check	Result	Measure
Power cord	1	Is the printer plugged in?	NO	Plug it in.
Upper main body	2	Is the upper main body closed?	NO	Close securely.
Power switch, circuit breaker	3	Are the power switch and circuit breaker ON?	NO	Switch ON.
Line voltage	4	Is normal voltage supplied at the outlet?	NO	This is not a problem with the printer. Inform the customer.
Power network	5	Insert a screwdriver into the door switch hole. Does the printer switch ON?	YES	Check the door switch actuator and readjust it if necessary.

Table 7-7

If only the cause of what is considered to be the problem (name of a faulty part) is desired, look under "cause". With the problem "no power" in the chart above, the power cord, upper main body, power switch, circuit breaker, line voltage or door switch could be faulty.

To solve a problem, begin at step one and perform the check explained there. If the result is not as indicated in the "Result" column, go to the next step. But if the result is as printed, perform the measure in the right-hand column and observe the result. If the problem is not eliminated, continue to the next step.

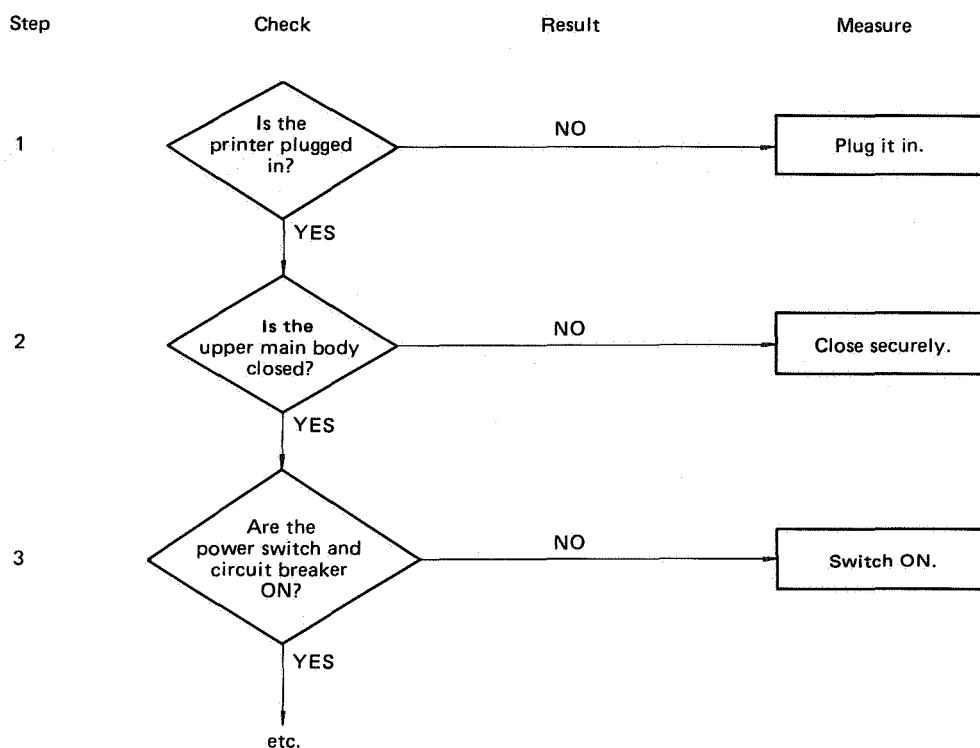
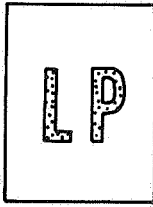


Figure 7-17

### C. Troubleshooting Image Defects

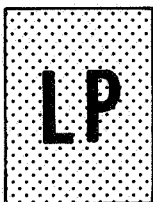
#### I-1 Light image (whole print)



Cause	Step	Check	Result	Measure	
	1	Switch off the power switch during printing. Raise the upper half of the printer. Is the toner image on drum transferred to print paper? (To protect the drum from light, perform this step as quickly as possible.)	YES	If the toner image on drum is very faint, go to step 5.	
Faulty transfer	Transfer corona ass'y	2	Is the transfer corona wire broken?	YES	Replace the transfer corona wire. (See V.B. in Ch4.)
	Moist print paper	3	Do prints improve when new print paper is used?	YES	Replace the print paper with manufacturer-approved paper. Show the customer the correct method for storing paper.
	High-voltage power supply, DC controller PCB	4	Does the voltage between J601-8 (HVPR) and J601-1 (GND) of the high-voltage power supply drop from about +18VDC to about +1VDC as soon as the main motor begins rotating? Does the voltage between J601-2 (HVTR) and J601-1 (GND) of the high-voltage power supply drop from about +20VDC to about 0VDC a few seconds after the main motor starts rotating?	YES NO	Check J601, J4 and J5 for good contact. If all are good, replace the high-voltage power supply. Check the wiring between J211 on the DC controller PCB and J601. If it is good, replace the DC controller PCB.
Grid bias	5	Does the voltage between J21-1 and J21-2 (GND) come to about -690V as soon as the main motor begins rotating?	NO	Check J21 and J22 on the varistor PCB for good contact. If both are good, replace the varistor PCB.	
Drum sensitivity identification microswitch	6	Does the voltage between J209-1 (CSENS1) and J209-2 (GND) on the DC controller vary from +5VDC to 0VDC when microswitch MS3 (the middle one) is pressed? Does the voltage between J209-3 (CSENS2) and J209-4 (GND) on the DC controller vary from +5VDC to 0VDC when microswitch MS4 (the lower one) is pressed?	NO	Replace the faulty microswitch. If either MS3 and/or MS4 is faulty, the image will not become very faint.	
Developing bias	7	Is the print density adjustment dial set with its dot at the top?	NO	Set the dial correctly.	

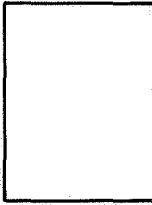
Cause	Step	Check	Result	Measure
Developing bias	8	Does the voltage between J601-4 (DBDC) and J601-1 (GND) on the high-voltage power supply vary from about +20 VDC to about 0VDC a few seconds after the main motor starts rotating?	YES	Check J601 and J3 on the high-voltage power supply for good contact. If both are good, replace the high-voltage power supply. Is the problem solved? If not, proceed to step 9.
		Does the voltage between J601-5 (DBAC) and J601-1 (GND) of the high-voltage power supply sometimes vary from about +17VDC to about 0VDC during continuous printing?	NO	Check the wiring between J211 on the DC controller and J601. If it is good, replace the DC controller PCB. Is the problem solved? If not, proceed to step 9.
Laser power	9	Is laser output normal? Check laser output by following the adjustment procedure described in II. D. 3 in this chapter.	NO	Adjust laser power.

## I-2 Dark image



Cause	Step	Check	Result	Measure
Drum sensitivity identification microswitch	1	Does the voltage between J209-1 (CSENS1) and J209-2 (GND) on the DC controller vary from +5 VDC to 0VDC when microswitch MS3 (the middle one) is pressed? Does the voltage between J209-3 (CSENS2) and J209-4 (GND) on the DC controller vary from +5 VDC to 0VDC when microswitch MS4 (the lower one) is pressed?	NO	Replace the faulty microswitch.
Grounding spring	2	With a EP cartridge in place, is there continuity between the aluminum base of the drum and the metal frame of the upper main body?	NO	Check whether the grounding spring is in place in the middle of the drum drive gear.
Developing bias	3	Is the print density adjustment dial set with its dot at the top?	NO	Set the dial correctly.
Grid bias	4	Does the voltage between J21-1 and J21-2 (GND) come to about -690V as soon as the main motor begins rotating?	NO	Check J21 and J22 on the varistor PCB for good contact. If both are good, replace the varistor PCB.
Laser power	5	Is laser output normally? Check laser output by following the adjustment procedure described in II. D. 3 in this chapter.	NO	Adjust laser power.

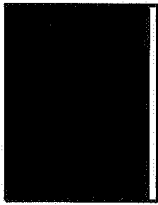
### I-3 Blank print



Cause	Step	Check	Result	Measure
EP cartridge	1	Has the EP cartridge been inserted correctly in the printer?	NO	Insert the EP cartridge correctly.
	2	Is the cartridge status indicator red?	YES	Replace the EP cartridge.
	3	Has the sealing tape been removed?	NO	Remove it.
	4	Do the EP cartridge protective and the light-blocking shutters open when an EP cartridge is inserted? (See Fig. 4-65 in Chapter 4.)	NO	Locate the cause of trouble and repair. If the cause is in the EP cartridge, replace the cartridge.
High-voltage power supply, DC controller PCB	5	Does the voltage between J601-8 (HVPR) and J601-1 (GND) of the high-voltage power supply vary from about +18VDC to about +1VDC as soon as the main motor begins rotating?	YES	Check for good contact J601, J4 and J5 for good contact. If all are good, replace the high-voltage power supply. Is the problem solved? If not, proceed to step 6.
		Does the voltage between J601-2 (HVTR) and J601-1 (GND) of the high-voltage power supply vary from about +20VDC to about 0VDC a few seconds after the main motor begins rotating?	NO	Check the wiring between J211 on the DC controller PCB and J601. If it is good, replace the DC controller PCB. Is the problem solved? If not, proceed to step 6.
Developing bias	6	Does the voltage between J601-4 (DBDC) and J601-1 (GND) of the high-voltage power supply vary from about +20VDC to about 0VDC a few seconds after the main motor begins rotating?	YES	Check J601 and J3 on the high-voltage power supply for good contact. If both are good, replace the high-voltage power supply. Is the problem solved? If not, proceed to step 7.
		Does the voltage between J601-5 (DBAC) and J601-1 (GND) of the high-voltage power supply sometimes vary from about +17VDC to about 0VDC during continuous printing?	NO	Check the wiring between J211 on the DC controller and J601. If it is good, replace the DC controller PCB. Is the problem solved? If not, proceed to step 7.
Laser power	7	Is laser output normal? Check laser output by following the adjustment procedure described in II. D. 3 in this chapter.	NO	Adjust laser power.

**Note:** Upon receiving a print command ( $\overline{PRNT}$ ), the printer transmits a vertical sync request command ( $\overline{VSREQ}$ ) to the external device. If the external device sets  $\overline{PRNT}$  FALSE before transmitting a TRUE vertical sync signal ( $\overline{VSYNC}$ ) to the printer in response to the  $\overline{VSREQ}$ , there is a possibility that a blank page may be output.

**I-4 Black image**



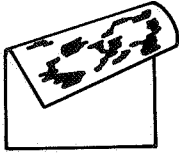
Cause	Step	Check	Result	Measure
EP cartridge	1	Is the primary corona wire broken?	YES	Replace the EP cartridge.
High-voltage power supply, DC controller PCB	2	Does the voltage between J601-8 (HVPR) and J601-1 (GND) of the high-voltage power supply vary from about +18VDC to about +1VDC as soon as the main motor begins rotating?	YES	Check J601 and J5 for good contact. If both are good, replace the high-voltage power supply.
			NO	Check the wiring between J211 on the DC controller and J601. If it is good, replace the DC controller PCB.

**I-5 Stained separation strip**



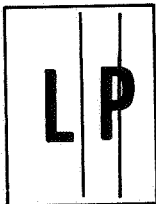
Cause	Step	Check	Result	Measure
Separation belt, separation roller, pinch roller, EP cartridge	1	Are the separation belt, separation roller, or pinch roller dirty?	YES	Clean them.
			NO	Replace the EP cartridge.

### I-6 Stains on back of paper



Cause	Step	Check	Result	Measure
Manual paper feed guide	1	Is the manual paper feed guide dirty or correctly grounded?	YES	Clean it with a damp cloth, then with a dry cloth if it is dirty. Ground it if it is not correctly grounded.
Leading-edge blank area	2	Is the leading-edge blank area about 2 mm?	NO	Replace the DC controller PCB.
Transfer guides	3	Is there toner on the transfer guides, or are the guides dirty?	YES	Clean with a damp cloth, then with a dry cloth.
	4	Are the transfer guides correctly grounded via 15MΩ resistance?	NO	Ground them correctly.
Transfer corona ass'y, feeder guides	5	Is there any toner on the assembly or guides?	YES	Clean with a damp cloth, then with a dry cloth.
Separation belt, roller and pinch roller	6	Is there any toner on the belt or rollers?	YES	Clean with a damp cloth, then with a dry cloth.
Fixing assembly	7	Is the assembly correctly grounded?	NO	Ground it correctly.
EP cartridge	8	Is there any toner on the underside of the EP cartridge?	YES	Clean with a damp cloth, then with a dry cloth.
Fixing roller cleaner felt	9	Is the fixing roller cleaner felt dirty?	YES	Replace the fixing roller cleaner felt.

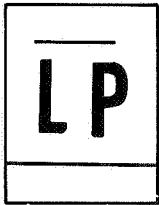
### I-7 Dark vertical lines (paper feed direction)



Cause	Step	Check	Result	Measure
Fixing roller cleaner felt	1	Is the fixing roller cleaner felt dirty?	YES	Replace the fixing roller cleaner felt.
EP cartridge	2	Turn the printer off in the middle of printing and open the upper half of the printer. Open the protective shield on the EP cartridge. Can you see a vertical line on the drum? (Make this check as quickly as possible to prevent light from damaging the drum.)	YES	Replace the EP cartridge.



**1-8 Sharp horizontal black lines (cross feed direction)**



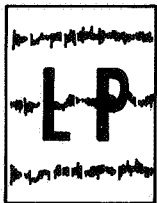
Cause	Step	Check	Result	Measure
BD signal frequency outside specification	1	Is BD error status being transmitted?	YES	Proceed to M-12 in this chapter.

**1-9 Vertical fogged stripes (paper feed direction)**



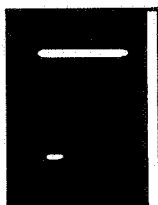
Cause	Step	Check	Result	Measure
EP cartridge	1	Does the print image improve after cleaning the primary corona wire?	NO	Replace the EP cartridge.

**1-10 Horizontal fogged stripes (cross feed direction)**



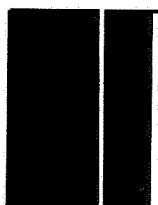
Cause	Step	Check	Result	Measure
EP cartridge	1	Check the distance of stripes from the edge. Are they about 188 mm or 66 mm from the edge of prints? (The circumference of the drum is 188.5 mm, that of the developing cylinder, 66 mm.)	YES	Replace the EP cartridge.

I-11 White horizontal lines or other shapes on a black print



Cause	Step	Check	Result	Measure
Damp print paper	1	Is manufacturer-approved paper being used?	NO	Check whether paper is manufacturer-approved. Advise the customer to use manufacturer-approved paper. Explain that poor paper causes poor quality prints.
	2	Is paper damp?	YES	Replace the paper. Show the customer the correct method of storing paper.

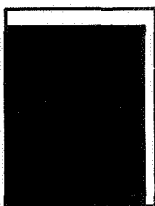
I-12 Thin vertical white lines or stripes (paper feed direction)



Cause	Step	Check	Result	Measure
EP cartridge	1	Are white stripes reproduced?	YES	If the EP cartridge status indicator is not red, rock the cartridge to spread the toner evenly (See Fig. 5-6 in Ch5.) If the indicator is already red, tell the customer that all the toner has been used.
Fixing roller cleaner felt	2	Is the fixing roller cleaner felt dirty?	YES	Replace the fixing roller cleaner felt.
Transfer corona ass'y, EP cartridge	3	Do prints improve after the transfer corona wire is cleaned?	YES	Finished
			NO	Replace the EP cartridge.
Laser beam-blocking shutter	4	To check whether the beam porthole is dirty, using the following procedure. (1) Open the printer (raise the upper half). (2) Open the front door. Take the EP cartridge out of the printer. (3) Press the levers (marked "A" in the figure of the right) toward the laser beam shutter. The shutter opens and the beam porthole can be seen.		

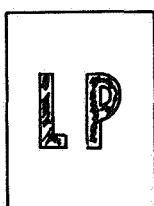
Cause	Step	Check	Result	Measure
		(4) Check whether there are any obstacles in the area where the beam passes through. Are there any?	YES	Remove the obstacle(s), or clean with a brush (CK-0315).
Dustproofing glass	5	Is the dustproofing glass dirty? (Refer to Figure 2-9 in CHAPTER 2)	YES	Remove the laser/scanner unit. Clean it with lint-free paper. Paper dust should not be left. (See IV, A in Chapter 4 about unit disassembly.)

### I-13 Faulty registration



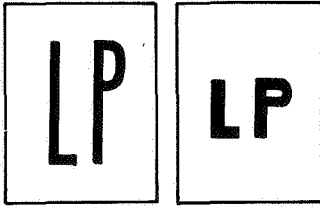
Cause	Step	Check	Result	Measure
Feed rollers (registration shutter ass'y)	1	Has either guide spring (at ends of feed roller shaft) come off?	YES	Reinstall
Print paper	2	Is the leading edge of paper curled excessively?	YES	Straighten the edge before using, or change paper.
	3	Is manufacturer-approved paper being used?	NO	Check whether the paper is manufacturer-approved. Advise the customer to use manufacturer-approved paper.
DC controller PCB	4	Is the problem solved if the DC controller PCB is replaced?	YES	Finished

### I-14 Poor fixing



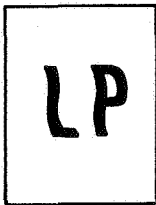
Cause	Step	Check	Result	Measure
Print paper	1	Is manufacturer-approved paper used?	NO	Advise the customer to use manufacturer-approved paper.
Fixing ass'y	2	Are the upper and the lower rollers worn?	YES	Replace the rollers.
	3	Is the nip width correct? (Correct values are 2 – 3 mm at center, and a difference within 0.5 mm at both edges. See II. C. 2 in this chapter.)	NO	Replace the lower roller. If the image does not improve after replacing the roller, replace the pressure springs.

I-15 Distortion



Cause	Step	Check	Result	Measure
Drive mechanism, DC power supply and main motor driver PCB, main motor	1	Does LED501 on the DC power supply and main motor driver PCB flash or go out?	YES	Perform the following measures until the problem is solved. (1) Check all parts of the drive mechanism. (2) Replace the DC power supply and main motor driver PCB. (3) Put the original DC power supply and main motor driver PCB back in the printer and replace the main motor.

I-16 Waviness



Cause	Step	Check	Result	Measure
Scanner driver PCB, scanner motor, DC controller PCB	1	Does LED 401 on the scanner driver PCB (part of the scanner unit) light continuously?	NO	Replace the scanner unit. (See IV. A. in Ch. 4.) Is the problem solved? If not, put the original unit back in the printer and replace the DC controller PCB.

#### IV. TROUBLESHOOTING MALFUNCTIONS

##### M-1. There is no power.

If air is blowing through the louver when the power is switched ON, start from step 8.

Cause	Step	Check	Result	Measure												
Power cord	1	Is the printer plugged in?	NO	Plug it in.												
Upper main body	2	Is the printer firmly closed?	NO	Close it.												
Line voltage	3	Is the required line voltage supplied to the outlet?	NO	Tell the operator that nothing is wrong with the printer. If power is supplied at a lower voltage, suggest that the customer install a line-voltage regulator.												
Circuit breaker	4	Is circuit breaker CB1 open?	YES	Reset the circuit breaker. (If the circuit breaker breaks its connection as soon as it is reset, excessive current may be flowing. Check the circuit.)												
	5	Confirm that the power is switched OFF. Unplug the printer. Open the upper half of the printer and disconnect J105 on the AC driver PCB. Confirm that circuit breaker CB1 is reset. Is CB1 conducting?	NO	Replace circuit breaker CB1.												
Noise filter, main switch, power cord	6	Plug the printer in and turn it ON. Is line voltage supplied between TB101-1 and TB102-1? Prior to checking, be sure to set the multimeter to the correct AC voltage measuring range.	NO	Check noise filter NF1, main switch SW1, and the power cord (and plug). Replace as required.												
Door switch, MS1, MS2	7	Switch the power OFF. Unplug the printer. Connect J105 to the AC driver PCB. Plug the printer in and turn the main switch ON. Is AC voltage supplied between J105-1 and J105-2 of the AC driver when the door switch is actuated with a screwdriver?	NO	Replace MS1 and/or MS2.												
AC driver PCB (AC controller PCB and fixing roller heater safety PCB)	8	Is AC voltage supplied between J103-1 and J103-2 of the AC controller when the door switch is actuated with a screwdriver?	NO	Replace the AC controller PCB. Is the problem solved? If not, replace the fixing roller heater safety PCB.												
DC power supply	9	Shut the upper half of the printer and remove the top cover. Are the specified DC voltages supplied between the J502 pins on the DC power supply & main motor driver PCB listed in the table below?	YES	Proceed to step 22.												
		<table border="1"> <thead> <tr> <th>Check pin</th> <th>Voltage</th> </tr> </thead> <tbody> <tr> <td>J502-4 and J502-8 (GND)</td> <td>24-35</td> </tr> <tr> <td>J502-9 and J502-8 (GND)</td> <td>24</td> </tr> <tr> <td>J502-7 and J502-6 (GND)</td> <td>5</td> </tr> <tr> <td>J502-5 and J502-6 (GND)</td> <td>-5</td> </tr> <tr> <td>J502-2 and J502-3 (GND)</td> <td>20-30</td> </tr> </tbody> </table>	Check pin	Voltage	J502-4 and J502-8 (GND)	24-35	J502-9 and J502-8 (GND)	24	J502-7 and J502-6 (GND)	5	J502-5 and J502-6 (GND)	-5	J502-2 and J502-3 (GND)	20-30		
Check pin	Voltage															
J502-4 and J502-8 (GND)	24-35															
J502-9 and J502-8 (GND)	24															
J502-7 and J502-6 (GND)	5															
J502-5 and J502-6 (GND)	-5															
J502-2 and J502-3 (GND)	20-30															

Cause	Step	Check	Result	Measure						
Low voltage transformer	10	Switch the main switch OFF and disconnect J501 on the DC power supply and main motor driver PCB. Switch the printer ON. Are the specified AC voltages supplied between the connector pins (cables attached) as in the table below?	NO	Replace low-voltage transformer PT1.						
		<table border="1"> <thead> <tr> <th>Check pin</th> <th>Voltage</th> </tr> </thead> <tbody> <tr> <td>J501-1 and J501-2</td> <td>29-37</td> </tr> <tr> <td>J501-3 and J501-4</td> <td>10-14</td> </tr> <tr> <td>J501-4 and J501-5</td> <td>10-14</td> </tr> <tr> <td>J501-6 and J501-7</td> <td>18-24</td> </tr> </tbody> </table>			Check pin	Voltage	J501-1 and J501-2	29-37	J501-3 and J501-4	10-14
Check pin	Voltage									
J501-1 and J501-2	29-37									
J501-3 and J501-4	10-14									
J501-4 and J501-5	10-14									
J501-6 and J501-7	18-24									
DC power supply & main motor driver PCB	11	Switch the printer OFF. Disconnect J502 on the DC power supply & main motor driver PCB and connect J501. Switch the printer ON. Is the DC voltage shown in the table in step 9 supplied at J502 on the DC power supply & main motor driver PCB?	NO	Replace the DC power supply and main motor driver PCB.						
DC controller PCB	12	Disconnect all connectors besides J208 on the DC controller PCB after turning the main switch OFF. Are any of the following the J502 pins (cables attached) short circuited? J502-4 and J502-8 J502-9 and J502-8 J502-7 and J502-6 J502-5 and J502-6 J502-2 and J502-3	YES	Check the wiring between J502 and J208 for a short circuit. If there is no short circuit, replace the DC controller PCB.						
Connections	13	Connect all the connectors on the DC controller PCB. Are any of the following J502 pins (cables attached) short circuited? J502-4 and J502-8 J502-9 and J502-8 J502-7 and J502-6 J502-2 and J502-3	NO	Proceed to step 22.						
Preconditioning exposure lamps & print counter PCB	14	Were J502-4 and J502-8 shorted?	NO	Proceed to step 15.						
			YES	Check the wiring between J207 and TB5 for a short circuit. If there is no short circuit, replace the preconditioning exposure lamps & print counter PCB.						
	15	Were J502-9 and J502-8 shorted?	NO	Proceed to step 18.						

Cause	Step	Check	Result	Measure												
DC controller loads	16	Disconnect connectors J215, J212, J210, J216, J213, J211, J208, J206 on the DC controller PCB. Are any of the circuits between the following connectors (cables attached) shorted? J215-3 and J215-1, J215-5 and J215-1, J212-2 and J212-3, J210-1 and J210-5, J210-3 and J210-5, J210-7 and J210-5, J216-3 and J216-1, J213-8 and J213-1, J211-6 and J211-1, J206-1 and J206-2	YES	Check the wires between the shorted connectors and the loads for continuity. If none are shorted, replace the loads (sensors, other components). If a short is found, remove the cause of the short.												
AC driver PCB (fixing roller heater safety PCB and AC controller PCB)	17	Is J212-2 and J212-3 of the connector (cable attached) shorted?	YES	Check the wiring between J104 and J212 for a short. If it is OK, replace the AC controller PCB or fixing roller heater safety PCB.												
	18	Were J502-7 and J502-6 shorted?	NO	Proceed to step 20.												
Laser unit, display PCB	19	Disconnect J201 and J204 on the DC controller PCB. Are J201-1 and J208-8, or J204-4 and J204-5, shorted?	YES	<ul style="list-style-type: none"> <li>• If the circuit between J201-1 and J208-8 are shorted, check the wiring between J201 and J18 and the display PCB for a short.</li> <li>• If the circuit between J204-4 and J204-5 are shorted, check the wiring between J204 and TB3, and between J204 and TB4 for a short. If there are no shorts, replace the laser unit.</li> </ul>												
	20	Were J502-2 and J502-3 shorted?	NO	Proceed to step 22.												
Laser unit	21	Disconnect J204 on the DC controller PCB. Are J204-1 and J204-4 of the connector (cable attached) shorted?	YES	Check the wiring between J204 and TB3 and TB4 for a short. If there are no shorts, replace the laser unit.												
Connections	22	Plug in all the connectors on the DC power supply & main motor driver PCB and DC controller PCB. Confirm that the circuit breaker has been reset and the upper half of the printer has been closed. Switch the printer ON. Are the specified DC voltages shown in the table below supplied between the J208 pins on the DC controller PCB?	NO	Check wiring between J502 on the DC power supply and main motor driver PCB and J208 on the DC controller PCB for good contact or scratches on the wire insulation.												
			YES	Replace the DC controller PCB.												
		<table border="1"> <thead> <tr> <th>Check pin</th> <th>Voltage</th> </tr> </thead> <tbody> <tr> <td>J208-4 and J208-8 (GND)</td> <td>24-35</td> </tr> <tr> <td>J208-9 and J208-8 (GND)</td> <td>24</td> </tr> <tr> <td>J208-7 and J208-6 (GND)</td> <td>5</td> </tr> <tr> <td>J208-5 and J208-6 (GND)</td> <td>-5</td> </tr> <tr> <td>J208-2 and J208-8 (GND)</td> <td>20-30</td> </tr> </tbody> </table>	Check pin	Voltage	J208-4 and J208-8 (GND)	24-35	J208-9 and J208-8 (GND)	24	J208-7 and J208-6 (GND)	5	J208-5 and J208-6 (GND)	-5	J208-2 and J208-8 (GND)	20-30		
Check pin	Voltage															
J208-4 and J208-8 (GND)	24-35															
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J208-7 and J208-6 (GND)	5															
J208-5 and J208-6 (GND)	-5															
J208-2 and J208-8 (GND)	20-30															

**M-2. The main motor does not rotate.**

Cause	Step	Check	Result	Measure
Drive component	1	Remove the rear panel of the printer. Does the main motor begin rotating as soon as the test printing is executed while the READY/WAIT indicator lights continuously?	YES	Check that all gears mesh correctly.
Main motor	2	Does the voltage between J503-6 and J503-5 (GND) on the DC power supply and main motor driver PCB vary from 0V to about +13VDC when the same operation as in step 1 is performed?	YES	Replace main motor M1.
			NO	Check all connections and wires to main motor M1. Is the problem solved? If not, proceed to step 3.
DC controller PCB	3	Does the voltage between J208-1 (DRMD) and J208-3 (GND) on the DC controller PCB vary from about +8VDC to about 0V when the same operation as in step 1 is conducted?	YES	Check J208 on the DC controller PCB and J502 on the DC power supply & main motor driver PCB for good contact. Repair any poor contacts. Is the problem solved? If not, proceed to step 5.
			NO	Replace the DC controller PCB.
DC power supply & main motor driver PCB	4	Does the voltage between J502-1 (DRMD) and J502-3 (GND) on the DC power supply and main motor driver PCB vary from about +8VDC to about 0VDC when the same operation as in step 1 is performed?	YES	Replace the DC power supply & main motor driver PCB.

**M-3 The high-voltage power supply does not provide power.**

Cause	Step	Check	Result	Measure
Drive component	1	Remove the rear panel of the printer. Execute the test printing while the READY/WAIT indicator lights continuously. Does the main motor begin rotating immediately?	NO	Go to M-2.
DC power supply & main motor driver PCB	2	Is the voltage between J601-7 (HVRST) and J601-1 (GND) on the high-voltage power supply about 0VDC when the power is switched ON?	NO	Check the wires between the following connectors for good contact. Repair any problem with poor contact. <ul style="list-style-type: none"> <li>● J211 on the DC controller PCB and J601 on the high-voltage power supply</li> <li>● J208 on the DC controller PCB and J502 on the DC power supply &amp; main motor driver PCB</li> </ul> Is the problem solved? If not, replace the DC power supply & main motor driver PCB.



Cause	Step	Check	Result	Measure
High-voltage power supply	3	<p>Do the voltages of the J601 pins on the high-voltage power supply vary as follows when the same operation as in step 1 is executed?</p> <ul style="list-style-type: none"> <li>● from about +18VDC to about +1VDC between J601-8 (HVPR) and J601-1 (GND) immediately after the test switch is pressed</li> <li>● from about +20VDC to about 0VDC between J601-2 (HVTR) and J601-1 (GND) and between J601-4 (DBDC) and J601-1 (GND) a few seconds after the test switch is pressed</li> <li>● from about +17VDC to about 0VDC between J601-5 (DBAC) and J601-1 (GND) about 6 seconds after the test switch is pressed</li> </ul>	YES	Check J601 and J3, 4, 5 for good contact. Repair any poor contact. Is the problem solved? If not, replace the high-voltage power supply.
DC controller PCB	4	<p>Do the voltages between the J211 pins on the DC controller PCB vary as follows when the same operation as in step 1 is performed?</p> <ul style="list-style-type: none"> <li>● from about +18VDC to about +1VDC between J211-8 (HVPR) and J211-1 (GND) immediately after the test switch is pressed</li> <li>● from about +20VDC to about 0VDC between J211-2 (HVTR) and J211-1 (GND) and between J211-4 (DBDC) and J211-1 (GND) a few seconds after the test switch is pressed</li> <li>● from about +17VDC to about 0VDC between J211-5 (DBAC) and J211-1 (GND) about 6 seconds after the test switch is pressed</li> </ul>	NO	Replace the DC controller PCB.

**M-4. The fixing roller heater does not operate.**

Cause	Step	Check	Result	Measure
Fixing roller heater, thermoprotector	1	<p>Switch the printer OFF. Unplug connector J101 on the AC driver PCB. Measure the resistance between J101-1 and J101-2 of the connector (cable attached). Are they <math>1\Omega - 5\Omega</math>?</p> <p>After measurement, plug in J101 on the AC driver PCB.</p>	NO	Check whether the circuit is ON at both ends of thermoprotector TP1. If not, replace the thermoprotector. If ON, replace fixing roller heater H1, then proceed to step 2 without switching the power ON.

Cause	Step	Check	Result	Measure
Thermistor	2	Unplug J212 on the DC controller PCB. Measure the thermistor resistance between J212-4 and J212-5 (connector cable attached). Is it 100k $\Omega$ -400k $\Omega$ (at normal temperature)? After measurement, plug in J212 on the DC controller PCB.	NO	Check the wiring between thermistor TH1 in the fixing assembly and the DC controller PCB. If it is normal, replace the thermistor. If the thermistor resistance reaches the specified value, proceed to step 3.
DC controller PCB	3	Does the voltage between J104-1 (FSRD) and J104-3 (+24V) on the fixing roller heater safety PCB go from about +24V DC to about +22VDC about one second after the power is switched ON?	NO	Check the wiring between J212 on the DC controller PCB and J104 on the fixing roller heater safety PCB for good contact. Repair any poor contact. Is the problem solved? If not, replace the DC controller PCB.
AC driver PCB (fixing roller heater safety PCB and AC controller PCB), triac Q1	4	Do the line voltages between the specified connectors on the AC controller PCB vary as follows about one second after the power is switched ON? <ul style="list-style-type: none"> <li>● from line voltage to 0VAC between J105-7 and J105-3</li> <li>● from 0VAC to line voltage between J101-1 and J101-2</li> </ul>	NO	Replace the AC controller PCB. Is the problem solved? If not, replace the fixing roller heater safety PCB. Is the problem solved? If not, reinstall the AC controller PCB and fixing roller heater safety PCB, and replace triac Q1.

Note: If any fixing malfunction switch the printer OFF for about 10 minutes. If the printer is turned ON within this period, the fixing roller heater will be turned OFF.

#### M-5. Cannot feed paper manually

Cause	Step	Check	Result	Measure
Operation error	1	Has the external device input a manual paper feed command to the printer?	NO	Input a manual paper feed command from the external device to the printer.
DC power supply & main motor driver PCB, main motor	2	Is a pulse applied between J208-12 (TG) and J208-3 (GND) on the DC controller PCB? Check it with a Logic Tone (CK-0400).	NO	Check the wiring between J502 on the DC power supply & main motor driver PCB and J208. If all are correctly connected, replace the DC power supply & main motor driver PCB or main motor M1.
Pickup sensor	3	Does the voltage between J210-6 (PFS) and J210-5 (GND) on the DC controller PCB go from about 0VDC to +5VDC when paper is set on the manual feed tray?	NO	Check J4 of the pickup sensor and J210 on the DC controller PCB for poor contact. If it cannot be fixed, replace pickup sensor PS1.
Faulty upper and lower manual pickup rollers	4	Does the upper manual pickup roller descend and feed the paper about 8 seconds after the main motor begins rotating?	YES	Check the lower roller for wear and rotation. Check that the upper roller presses the paper firmly.
DC controller PCB	5	Does the voltage between J210-4 (MPUSD) on the DC controller PCB and J210-5 (GND) go from about +24VDC to about 0VDC about 8 seconds after the main motor begins rotating, and remain at 0V for about 1.5 seconds?	NO	Replace the DC controller PCB.

Cause	Step	Check	Result	Measure
Poor contact, manual pickup roller clutch solenoid	6	Unplug J210 on the DC controller PCB. Check the circuit between J210-4 and J210-3 (connector with cable attached) using a multimeter. Is there continuity?	NO	Check whether the Faston connector for the manual pickup roller clutch solenoid SL2 is firmly attached. Also, check the wire to the DC controller PCB. Is the problem solved? If not, replace manual pickup roller clutch solenoid SL2.

**M-6. Paper is not fed from the cassette.**

Cause	Step	Check	Result	Measure
Operation error	1	Has the external device input a manual paper feed command to the printer?	YES	Input a cassette feed command.
Cassette feed roller	2	Does the cassette feed roller begin rotating when the test switch is pressed while the READY/WAIT indicator lights continuously?	YES	Check whether the paper pickup guide is firmly closed or whether the cassette feed roller rotates smoothly. If the cassette feed roller is worn out, replace it.
			NO	Go to M-2. Is the problem solved? If not, proceed to step 3.
DC controller PCB, cassette pickup roller clutch solenoid	3	Does the voltage between J215-4 (CPUSD) and J215-1 (GND) on the DC controller PCB drop from +24VDC to 0V about 2 seconds after the same operation as in step 2 is executed, and remain at 0V for about one second?	YES	Separate the main printer body from the pedestal. Activate cassette pickup roller clutch solenoid SL3 and rotate the idler gear (both) manually. Does the paper pickup roller clutch function normally and cause the pickup roller to rotate one time? If the pickup roller clutch operates correctly, check the connector of cassette pickup roller clutch solenoid SL3 for good contact. If it has good contact, replace cassette pickup roller solenoid SL3. If the cassette pickup roller is worn out, replace it.
Cassette size microswitch	4	Unplug J214 on the DC controller PCB. Do the resistances between the following pins (connector and cable attached) vary from $\infty$ to $0\Omega$ when microswitches MS5, MS6, and MS7 are pressed? J214-1 and J214-2 J214-3 and J214-4 J214-5 and J214-6 After measurement, plug in J214 on the DC controller PCB.	NO	Check the wires between the microswitches and the DC controller PCB for continuity, and all connectors for good contact. If everything checks out OK, replace the microswitch which has resistance not equal to $0\Omega$ .
			YRS	Replace the DC controller PCB.

**M-7. Jam are detected when there are no jams.**

Cause	Step	Check	Result	Measure
DC controller PCB	1	Does the JAM indicator on the display unit light when the printer is switched ON?	YES	Check the wiring between J201 on the DC controller PCB and TB18 on the display unit. If it is OK, replace the DC controller PCB.
Print paper still in the delivery unit	2	Is a paper fragment, etc., caught in the delivery unit?	YES	Remove the obstacle(s).
Pickup sensor	3	Does the voltage between J210-6 (PFS) and J210-5 (GND) on the DC controller PCB vary from about 0V to about +5VDC when paper is set on the manual feed tray?	NO	Check J4 on pickup sensor PS1 and J210 on the DC controller PCB for good contact. Also check that paper detection arm 1 (see III. B. in Chapter 2) functions smoothly. If everything checks out OK, replace pickup sensor PS1.
Delivery sensor	4	Open the upper half of the printer. Activate the door switch with a screwdriver. Shield the light from delivery sensor PS3 with paper. Does the voltage between J216-2 (PDP) and J216-1 (GND) on the DC controller PCB vary from about 0V to about +5VDC?	NO	Check J5 on delivery sensor PS3 and J216 on the DC controller PCB for poor contact. Check also that the paper delivery sensor arm moves smoothly. (See III. B. in Chapter 2.) If there is no apparent problem, replace delivery sensor PS3.

**M-8. Jams are not detected.**

Cause	Step	Check	Result	Measure
Display PCB	1	Does the JAM indicator on the display unit light when the circuit between J201-4 (JAML) and J208-6 (GND) on the DC controller PCB is shorted?	NO	Check J201 on the DC controller PCB and TB18 on the display unit for good contact. If contact is good, check whether +5VDC is supplied between J201-1 and J208-6 (GND) on the DC controller PCB. If +5VDC is supplied, replace the display PCB. If +5VDC is not supplied, go to M-1.
Pickup sensor	2	Does the voltage between J210-6 (PFS) and J210-5 (GND) on the DC controller PCB vary from about 0V to +5VDC when paper is set on the manual feed tray?	NO	Check J4 on pickup sensor PS1 and J210 on DC controller PCB for good contact. Also check that paper detection arm 1 moves smoothly (see III. B. in Chapter 2.) If there is no apparent problem, replace delivery sensor PS3.
Delivery sensor	3	Open the upper half of the printer. Activate the door switch with a screwdriver. Shield the light from delivery sensor PS3 with paper. Does the voltage between J216-2 (PDP) and J216-1 (GND) on the DC controller PCB vary from about 0V to about +5VDC?	NO	Check J5 on delivery sensor PS3 and J216 on the DC controller PCB for poor contact. Check also that the paper delivery sensor arm moves smoothly. (See III. B. in Chapter 2.) If there is no apparent problem, replace delivery sensor PS3.

Cause	Step	Check	Result	Measure
DC power supply & main motor driver PCB, main motor	4	Execute the test printing while the READY/WAIT indicator on the display unit lights continuously. Check using a Logic Tone (CK-0400) that a pulse occurs between J208-12 ( $\overline{TG}$ ) and J208-3 (GND) on the DC controller PCB.	NO	Check J502 on the DC power supply & main motor driver PCB and J208 for poor contact. If contact is good, replace the DC power supply & main motor driver PCB or main motor M1.

**M-9. The PAPER OUT indicator lights when there is still paper.**

Cause	Step	Check	Result	Measure
Operation error	1	Has the external device input a manual paper feed command to the printer?	YES	For printing with manual feed, put the paper along the manual feed guide. For printing with cassette feed, input a cassette feed command.
Paper sensor	2	Does the voltage between J215-2 (PEMP) and J215-1 (GND) on the DC controller PCB vary from about +5VDC to about 0V when the paper detection arm lifts?	NO	Check J5 on the paper sensor, J215 on the DC controller PCB, and the connection in-between for good contact. Also check that the paper detection arm moves smoothly. If everything checks out OK, replace paper sensor PS2.
Cassette size microswitch	3	Unplug J214 on the DC controller PCB. Do the resistances between the following pins (connector and cable attached) vary from $\infty$ to $0\Omega$ when microswitches MS5, MS6 and MS7 are pressed? J214-1 and J214-2 J214-3 and J214-4 J214-5 and J214-6 After measurement, plug in J214 on the DC controller PCB.	NO	Check the wires between the microswitches and DC controller PCB for continuity and all connectors for good contact. If they are all OK, replace the microswitch which does not have resistance equal to $0\Omega$ .
DC controller PCB	4	Does the PAPER OUT indicator go out when a cassette with paper is installed?	NO	Replace the DC controller PCB.

**M-10. The PAPER OUT indicator does not light when there is no paper.**

Cause	Step	Check	Result	Measure
Operation error	1	Has the external device input a manual paper feed command to the printer?	YES	Input a cassette feed command.

Cause	Step	Check	Result	Measure
Display PCB	2	Does the PAPER OUT indicator light when the circuit between J201-3 (PEMPL) and J208-6 (GND) on the DC controller PCB is shorted?	NO	Check J201 on the DC controller PCB and TB 18 on the display unit for good contact. If contact is good, check if +5VDC is supplied between J201-1 and J208-6 (GND) on the DC controller PCB. If +5VDC is supplied there, replace the display PCB. If not, go to M-1.
Paper sensor	3	Does the voltage between J215-2 (PEMP) and J215-1 (GND) on the DC controller PCB vary from about 0V to about +5VDC when the paper detection arm descends?	NO	Check J5 on the paper sensor, J215 on the DC controller PCB, and the connection in-between for good contact. Also check that the paper detection arm moves smoothly. If everything checks out OK, replace paper sensor PS2.
Cassette size microswitch	4	Unplug J214 on the DC controller PCB. Do the resistances between the following pins (connector and cable attached) vary from $\infty$ to $0\Omega$ when microswitches MS5, MS6, and MS7 are pressed? J214-1 and J214-2 J214-3 and J214-4 J214-5 and J214-6 After measurement, plug in J214 on the DC controller PCB.	NO	Check the wires between the microswitches and the DC controller PCB for continuity, and all connectors for good contact. If everything checks out OK, replace the microswitch which does not have resistance equal to $0\Omega$ .
DC controller PCB	5	Does the PAPER OUT indicator light when a cassette with paper is taken out?	NO	Replace the DC controller PCB.

**M-11. The preconditioning exposure lamps do not light.**

Cause	Step	Check	Result	Measure
Preconditioning exposure lamps and print counter PCB	1	Is at least one lamp lit? Open the upper half of the printer and take out the EP-F cartridge. Switch the printer ON. Activate the door switch using a screwdriver. Do all lamps flash momentarily?	YES	Replace the preconditioning exposure lamps and print counter PCB if lamp intensity is low.
DC controller PCB, DC power supply and main motor driver PCB	2	Execute the test printing while tl. READY/WAIT indicator lights continuously. Does the voltage between J207-1 (+24VDC – +30VDC) and J207-2 (PEXP) on the DC controller PCB vary from 0V to between +24VDC and +35VDC?	YES	Check J207 on the DC controller PCB for good contact.
	3	Is the voltage between J207-1 and J208-6 (GND) on the DC controller PCB within the range from +24VDC to +35VDC, and between J208-7 and J208-8 (GND) on the DC controller PCB at +5VDC?	YES	Replace the DC controller PCB.
			NO	Check J502 on the DC power supply & main motor driver PCB and J208 on the DC controller PCB for good contact. If OK, replace the DC power supply & main motor driver PCB. Is the problem solved? If not, replace the DC controller PCB.

**M-12. Laser, scanner malfunction.**

Cause	Step	Check	Result	Measure
Laser power	1	Is the laser power at the proper level? (See II. D.3. in this Chapter.)	NO	Adjust laser power to the proper level. (See II.D.3. in this Chapter).
Scanner driver PCB	2	Execute the test printing while the READY/WAIT indicator on the display unit lights continuously. Does the scanner motor start and LED401 on the scanner driver PCB of the scanner unit light continuously?	YES	Proceed to step 6.
	3	Is contact good between J401 on the scanner driver PCB of the scanner unit and J206 on the DC controller PCB?	NO	Repair any poor contact between J401 and J206.

Cause	Step	Check	Result	Measure
DC power supply & main motor driver PCB	4	Is +24VDC supplied between J401-1 and J401-2 (GND) on the scanner driver & scanner motor unit?	NO	Check whether +24VDC is supplied between J208-9 and J208-8 (GND) on the DC controller PCB. If +24VDC is not supplied there, check J502 on the DC power supply & main motor driver PCB and J208 for poor contact. If contact is good, replace the DC power supply & main motor driver PCB.
DC controller PCB Scanner driver PCB	5	Does the voltage between J206-4 (SCNON) and J206-2 (GND) on the DC controller PCB vary from about +7VDC to about 0V when the same procedure as in step 2 is performed?	NO	Replace the DC controller PCB.  Replace the scanner unit. (See IV. A. in Chapter4.) If this does not correct the problem, go to step 6.
Scanner driver PCB, DC controller PCB,	6	Does the voltage between J401-3 (SCNRDY) and J401-2 (GND) in the scanner driver PCB of the scanner unit vary from about +3VDC to about 0V a few minutes after the same procedure as in step 2 is performed?	YES	Replace the DC controller PCB. Is the problem solved? If not, put the old PCB back in the printer and replace the scanner unit. (See IV. A. in Ch. 4.)
			NO	Replace the scanner unit. (See IV. A. in Ch. 4.)

**M-13. Heater malfunction.**

Cause	Step	Check	Result	Measure
Fixing temperature control	1	Switch the power ON and wait one minute. Open the upper half of the printer. Take off the upper cover of the fixing assembly. Has the temperature of the upper roller increased?	NO	Go to M-4.
DC power supply & main motor driver PCB	2	Is the voltage between J204-1 and J204-4 (GND) from +20VDC to +30VDC, and +5VDC between J204-5 and J204-4 (GND) in the laser unit?	NO	Check whether the voltage between J208-2 and J208-3 (GND) is from +20VDC to +30VDC, and +5VDC between J208-7 and J208-6 (GND). If not, check the wiring between J502 on the power supply & main motor driver PCB and J208 for poor contact. If contact is good, replace the DC power supply & main motor driver PCB.



Cause	Step	Check	Result	Measure
Laser unit	3	Unplug J204 on the DC controller PCB after switching the printer OFF. Measure the resistance between J204-1 and J204-2 of the connector (cable attached). Is it $40\Omega - 55\Omega$ ?	NO	Replace the laser unit.
DC controller PCB, laser unit	4	Measure the resistance between J204-3 and J204-4 on the connector (cable attached). Is it $5k\Omega - 15k\Omega$ at normal temperature? After measurement, plug in J204 on the DC controller PCB.	YES	Replace the DC controller PCB.
			NO	Replace the laser unit.

**M-14. All LEDs on the display panel do not light.**

Cause	Step	Check	Result	Measure
EP cartridge	1	Is an EP cartridge installed in the printer?	NO	Install the EP cartridge.
Power momentarily cut, BD signal malfunction	2	Is the problem solved when the power is switched ON again?	YES	Finished, because the power momentarily cut the detection function, which worked normally. If this problem occurs frequently, the cause may be attributed to BD malfunction. In this case, go to M-12.
Self-diagnosis	3	Does the main motor begin rotating and actuate paper feeding as soon as all LEDs on the display panel go out?	YES	Wait until a sheet of paper is delivered to the print tray. If paper comes out, it means that the pickup sensor has detected the paper in the paper transport area, which causes the self-diagnosis function to deliver the printed paper.
TG signal malfunction	4	Press the test switch on the left panel while the READY/WAIT indicator lights steadily. Is a pulse applied between J208-12 (TG) and J208-3 (GND) on the DC controller PCB? Check it with a Logic Tone (CK-0400).	NO	Go to M-2. Is the problem solved? If not, replace the DC power supply and main motor driver PCB.
DC power supply	5	Is +5 VDC supplied between J201-1 and J208-6 (GND) on the DC controller PCB?	NO	Go to M-1.

**M-15. The READY/WAIT indicator does not stop flashing.**

Cause	Step	Check	Result	Measure
DC controller PCB	1			Replace the DC controller PCB.

**M-16. The READY/WAIT indicator does not light.**

Cause	Step	Check	Result	Measure
Operator call, service call	1	Do the other LEDs light steadily?	YES	<ul style="list-style-type: none"> <li>● If the PAPER OUT indicator lights steadily, put paper in the cassette.</li> <li>● If the JAM indicator lights steadily, take the jammed paper out of the printer.</li> </ul>
	2	Have all the LEDs on the display panel gone out?	YES	Go to M-14. Is the problem solved? If not, proceed to step 3.
DC controller PCB, display unit	3	Does the READY/WAIT indicator light steadily when the circuit between J201-2 (RDYL) and J208-6 (GND) on the DC controller PCB is shorted?	YES	Replace the DC controller PCB.
			NO	Check J201 on the DC controller PCB and TB18 on the display PCB for good contact. If contact is good, check whether +5VDC is supplied between TB18-1 and J208-6 (GND) on the DC controller PCB. If so, replace the display unit. If not, go to M-1.

**M-17. Printing does not start when a TRUE print command (PRNT) is input.**

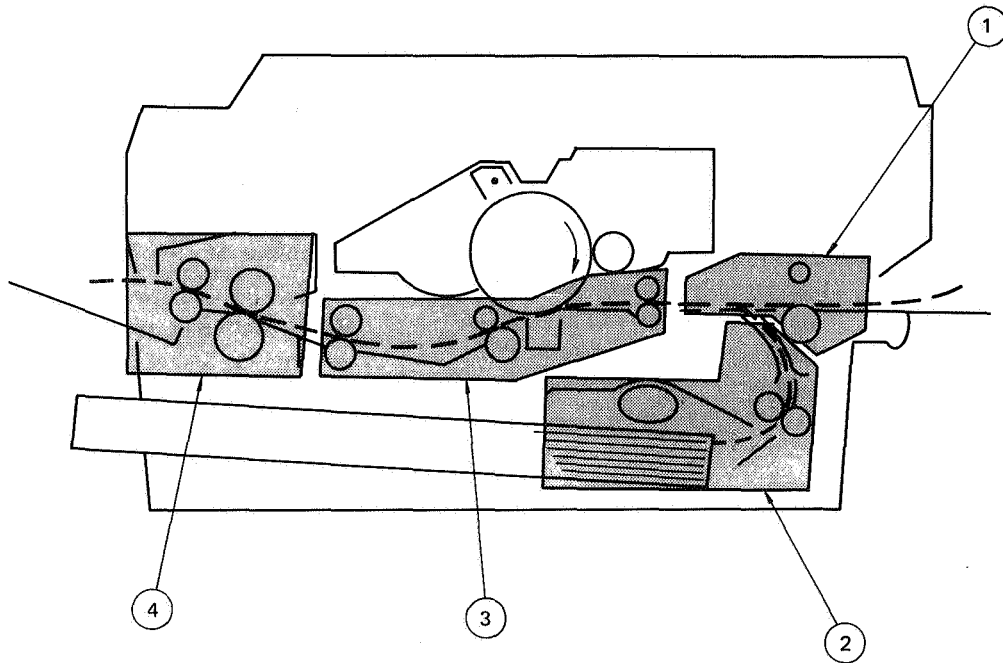
Cause	Step	Check	Result	Measure
Cable	1	Is J202 on the DC controller connected with the cable from I/O connector J12?	NO	Connect the cable.
Operator call, service call	2	Does the READY/WAIT indicator light steadily?	NO	Go to M-16.
DC controller PCB	3	Is test printing executed, and a print composed of vertical lines delivered?	NO	Replace the DC controller PCB. Is the problem solved? If not, check the external device (user designed interface PCB).
			YES	Check J202 on the DC controller PCB and I/O connector J2 for good contact. If contact is good, replace the DC controller PCB.

## V. PAPER TRANSPORT PROBLEMS

(A jam occurs every time paper is fed.)

### A. Paper Jams

Paper in the printer passes through four main areas: (1) manual feed area, (2) cassette feed area, (3) separation/feeder area, and (4) fixing/delivery area. Frequent jams in any area indicate that the area should be checked and repaired or cleaned.



- |   |                    |   |                        |
|---|--------------------|---|------------------------|
| 1 | Manual feed area   | 3 | Separation/feeder area |
| 2 | Cassette feed area | 4 | Fixing/delivery area   |

Figure 7-18

**T-1. Manual feed unit**

Cause	Step	Check	Result	Measure
Print paper	1	Is manufacturer-approved paper being used?	YES	Advise the customer to use manufacturer-approved paper.
	2	Is paper wrinkled or curled?	YES	Replace the paper. Inform the customer of the correct method of storing paper.
Paper detection arm 1	3	Does the arm move smoothly?	NO	Adjust the arm motion.
Lower roller	4	Is there deformation due to wear? Is the roller dirty?	YES	Replace the roller if worn. Clean with alcohol.
Guides	5	Are guides deformed?	YES	Replace deformed guides.

**T-2. Cassette pickup assembly**

Cause	Step	Check	Result	Measure
Cassette loading capacity, print paper	1	Is the internal cassette loaded with more than 10mm of paper?	YES	Advise the customer to remove the excess paper.
	2	Is manufacturer-approved paper being used?	NO	Advise the customer to use manufacturer-approved paper.
	3	Is paper wrinkled or curled? Is damp paper being used?	YES	Replace the paper. Show the customer how to store paper.
Cassette position	4	Is the cassette spring lifting force as specified? Refer to table 7-2 in this chapter.	NO	Show the customer how to insert the cassette.
Cassette springs	5	Is the cassette spring lifting force as specified?	NO	Check the movement of the cassette plate. If OK, replace the 2 springs.
Cassette hold-down tabs	6	Is the left or right cassette hold-down tab deformed?	YES	Replace the hold-down tabs.
Pickup rollers	7	Are any pickup rollers deformed or worn?	YES	Replace the pickup rollers as required.
Pickup control unit	8	Is the clutch spring deformed, rusty or worn?	YES	Replace the clutch spring.

**T-3. Separation/feeder unit**

Cause	Step	Check	Result	Measure
Separation belt	1	Is the separation belt damaged or twisted?	YES	Replace the belt.
	2	Is the belt inside out?	YES	Reinstall correctly.
Separation/feeder unit	3	Is any roller dirty or worn?	YES	Clean dirty rollers. Replace the separation/feeder unit if rollers are badly worn.
	4	Do pinch rollers press firmly against separation and feeder rollers?	NO	Replace the pinch roller spring.
Feeder rollers	5	Are the feeder rollers dirty or worn?	YES	Clean with alcohol if dirty and replace if worn.
Transfer guides	6	Are the transfer guides deformed in any way?	YES	Replace the guides.

**T-4. Fixing/delivery area**

Cause	Step	Check	Result	Measure
Fixing roller cleaner felt	1	Is the fixing roller cleaner felt dirty?	YES	Replace the fixing roller cleaner felt.
Entrance guides	2	Are the entrance guides dirty?	YES	Clean the guides.
Separation claws	3	Are the separation claws worn or the leading edges damaged?	YES	Replace claws.
Lower delivery guides	4	Are the lower delivery guides dirty?	YES	Clean the guides.
Upper delivery guides	5	Are the upper delivery guides dirty?	YES	Clean the guides.
Paper delivery sensor arm	6	Does the arm move freely?	NO	Repair to restore free motion.

**B. Incomplete Feed**

**T-1. Sheets stuck together**

Cause	Step	Check	Result	Measure
Print paper	1	Is manufacturer-approved paper being used? Refer to Table 7-2 in this chapter.	NO	Advise the customer to use manufacturer-approved paper.
Cassette springs	2	Is the cassette spring lifting force as specified?	NO	Check the action of the lifting plate. If OK, replace the 2 springs.
Cassette side plates	3	Are the side plates worn?	YES	Replace the plates.

**T-2. Wrinkles**

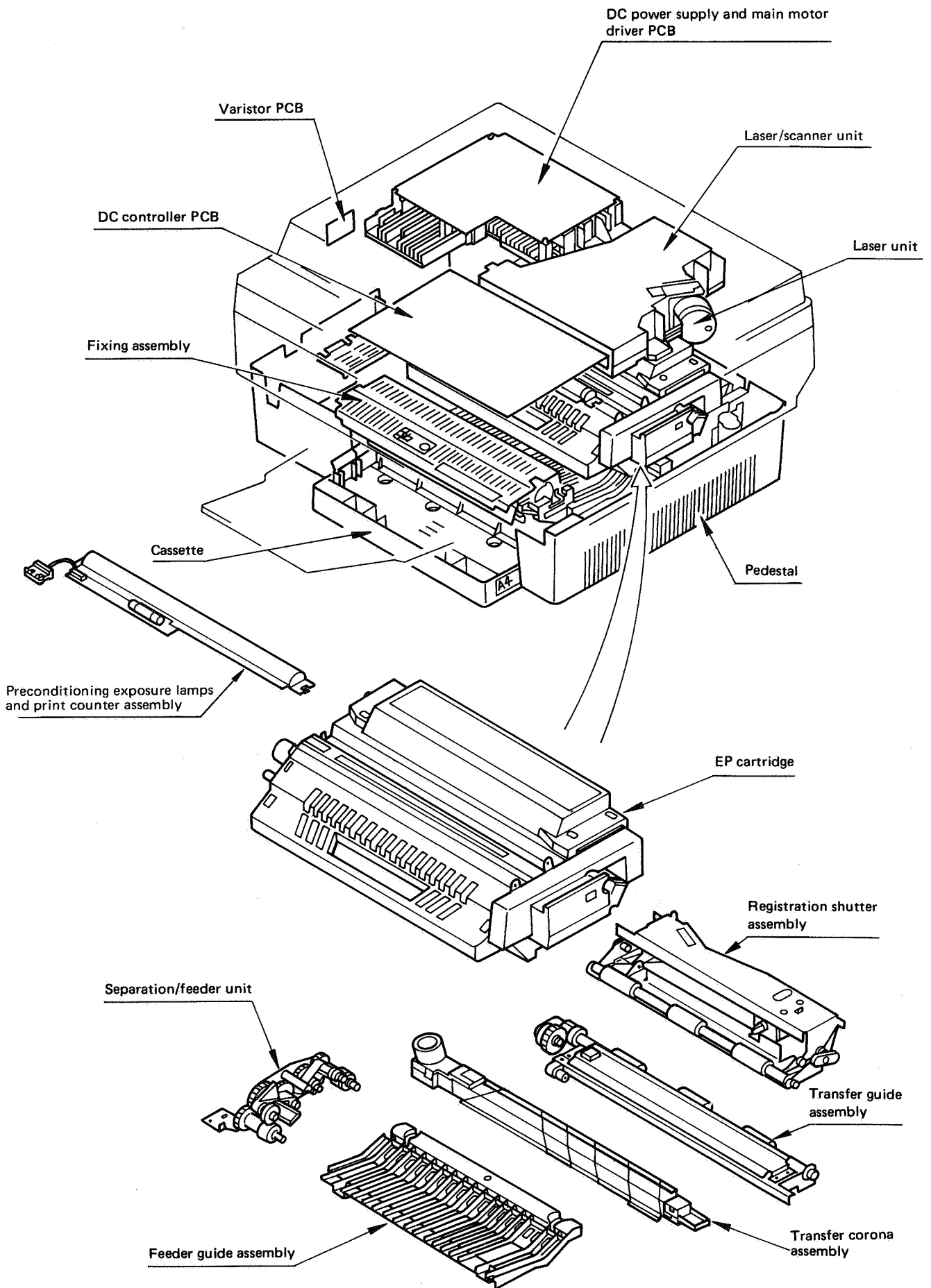
Cause	Step	Check	Result	Measure	
Print paper	1	Is manufacturer-approved paper being used?	NO	Advise the customer to use manufacturer-approved paper.	
	2	Do wrinkles disappear when new paper is used?	YES	Show the customer how to store paper.	
Cassette, pickup mechanism	3	Is print paper fed correctly?	NO	Check the cassette or make prints using a new cassette. Check the pickup roller or make prints using a new roller.	
Separation belt and roller	4	Are the belt and roller abnormal?	YES	Clean or replace the belt. Check the roller and clean or replace.	
Separation/feeder unit	5	Do rollers operate smoothly?	NO	If changing the pinch roller spring does not improve the action, replace the unit.	
Transfer guides	6	Is there toner on the transfer guides?	YES	Clean with alcohol.	
Fixing ass'y	Entrance guides	7	Are the entrance guides dirty? Are they deformed?	YES	Clean the entrance guides. Replace the entrance guides.
	Upper roller temperature sensor	8	Is the thermistor firmly in contact with the surface of the upper roller?	NO	Clean and adjust.
	Nip width	9	Is the nip width as specified?	NO	Replace the lower roller.

# APPENDIX

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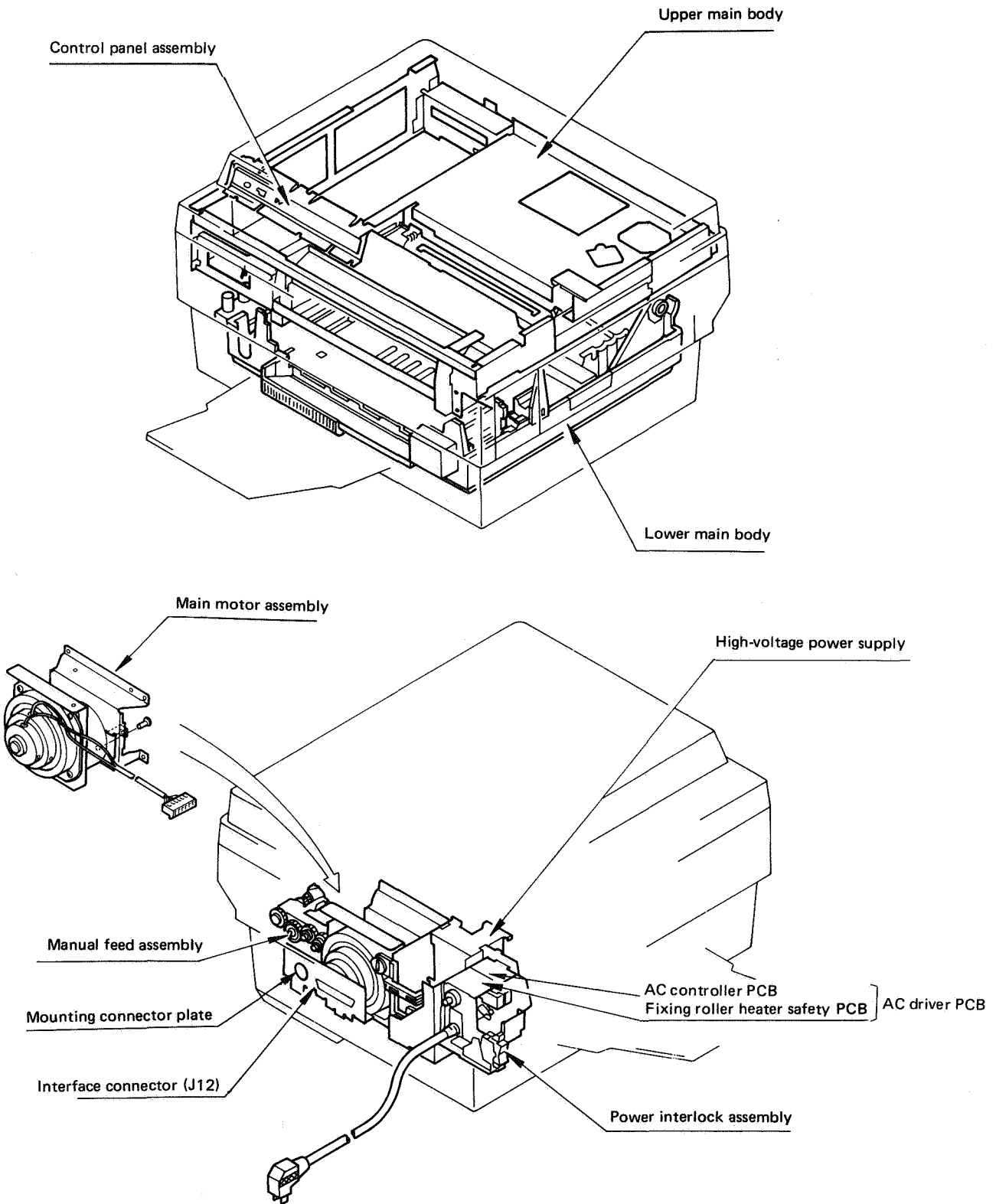


# I. LOCATION OF ASSEMBLIES, UNITS (1 of 2)

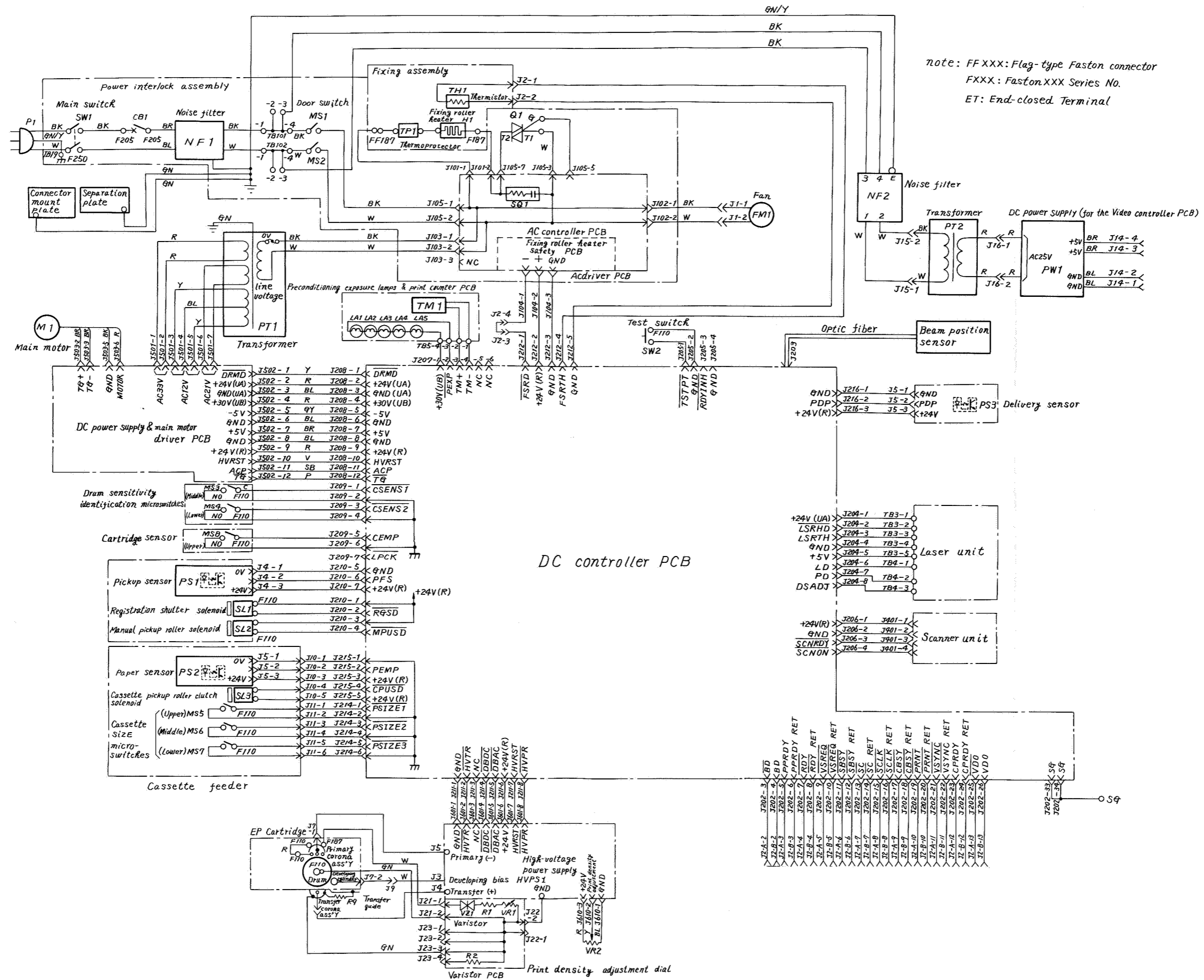




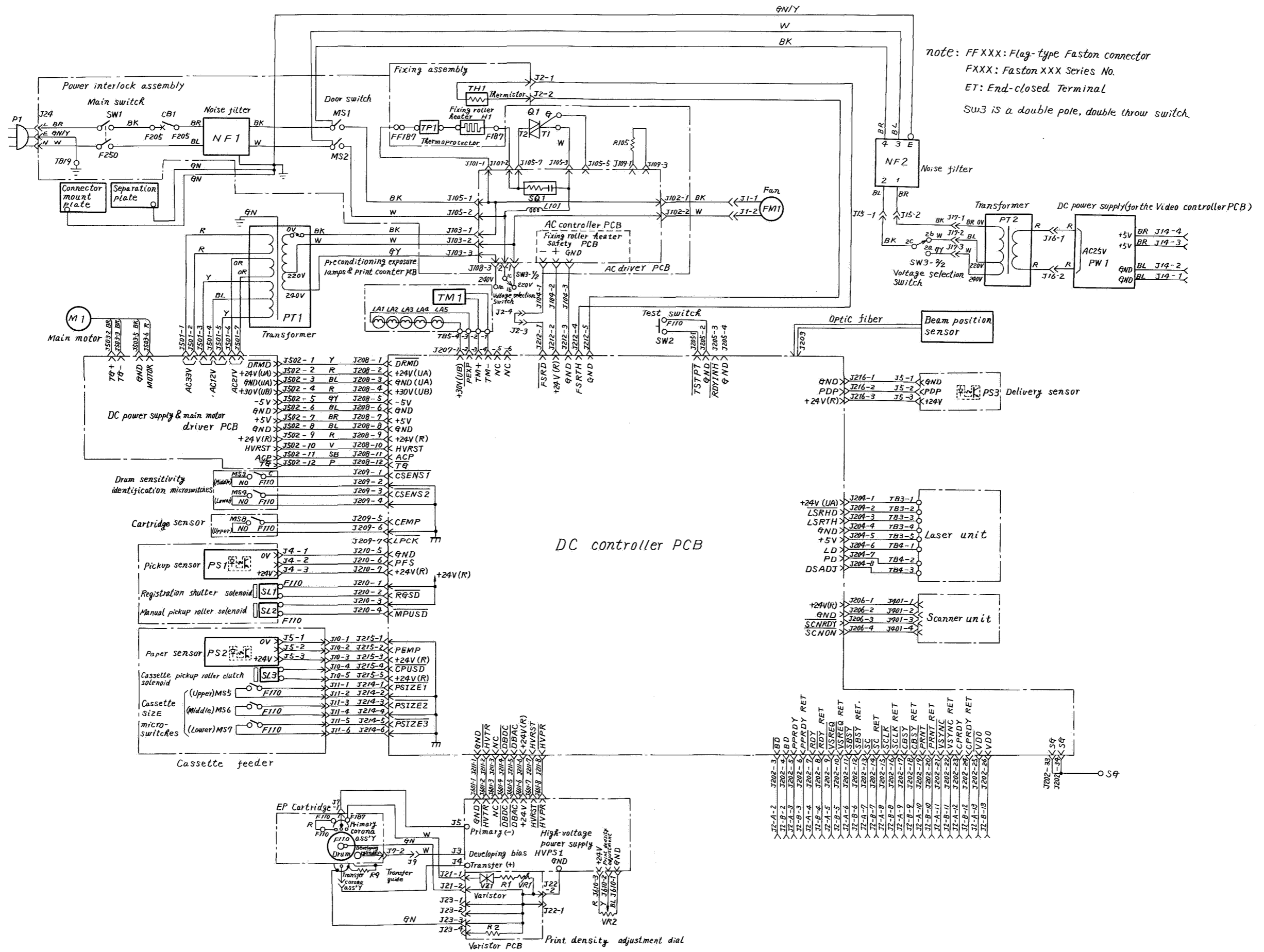
# LOCATION OF ASSEMBLIES, UNITS (2 of 2)



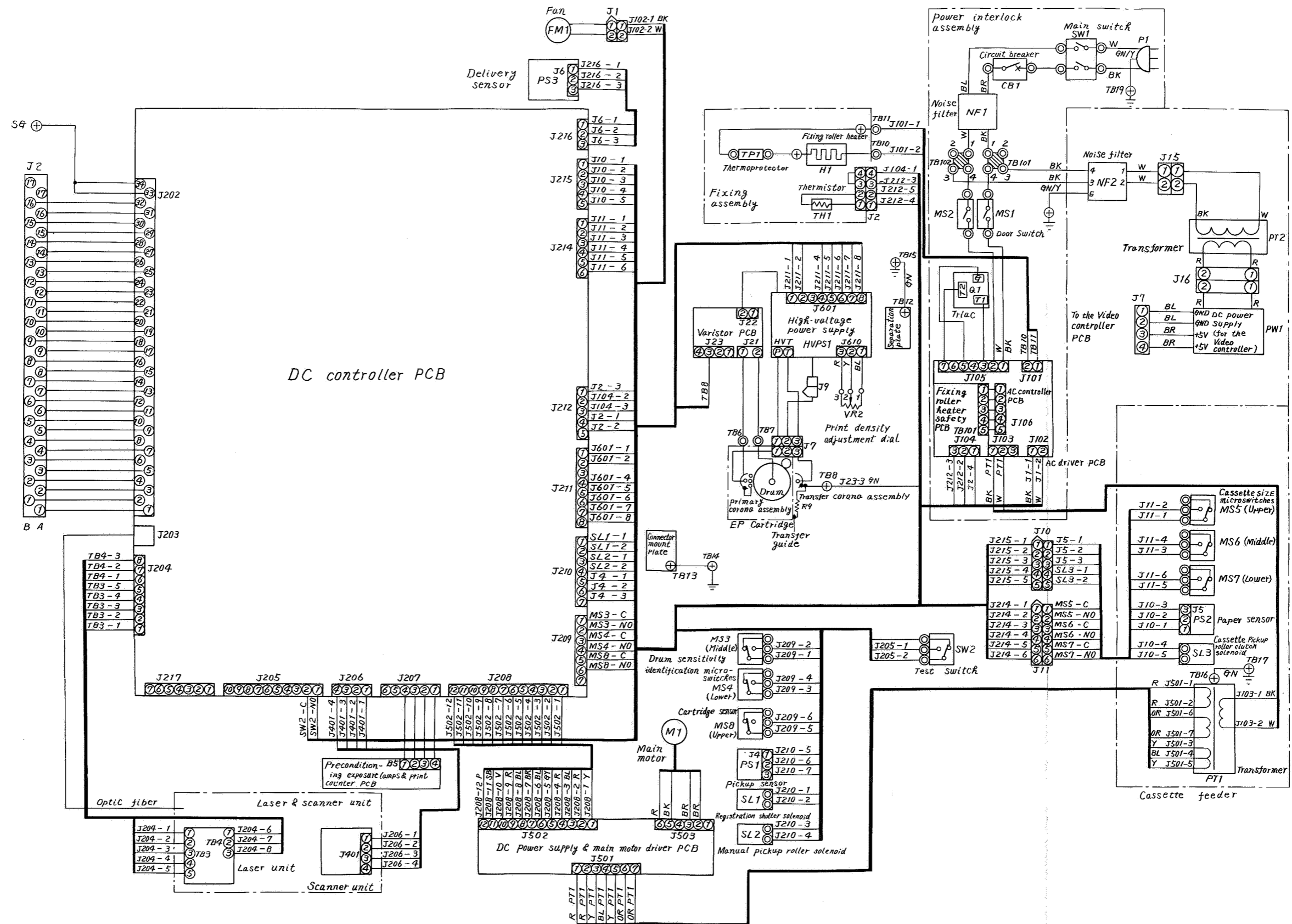
II. GENERAL CIRCUIT DIAGRAM (115V, 60Hz only) (1 of 2)



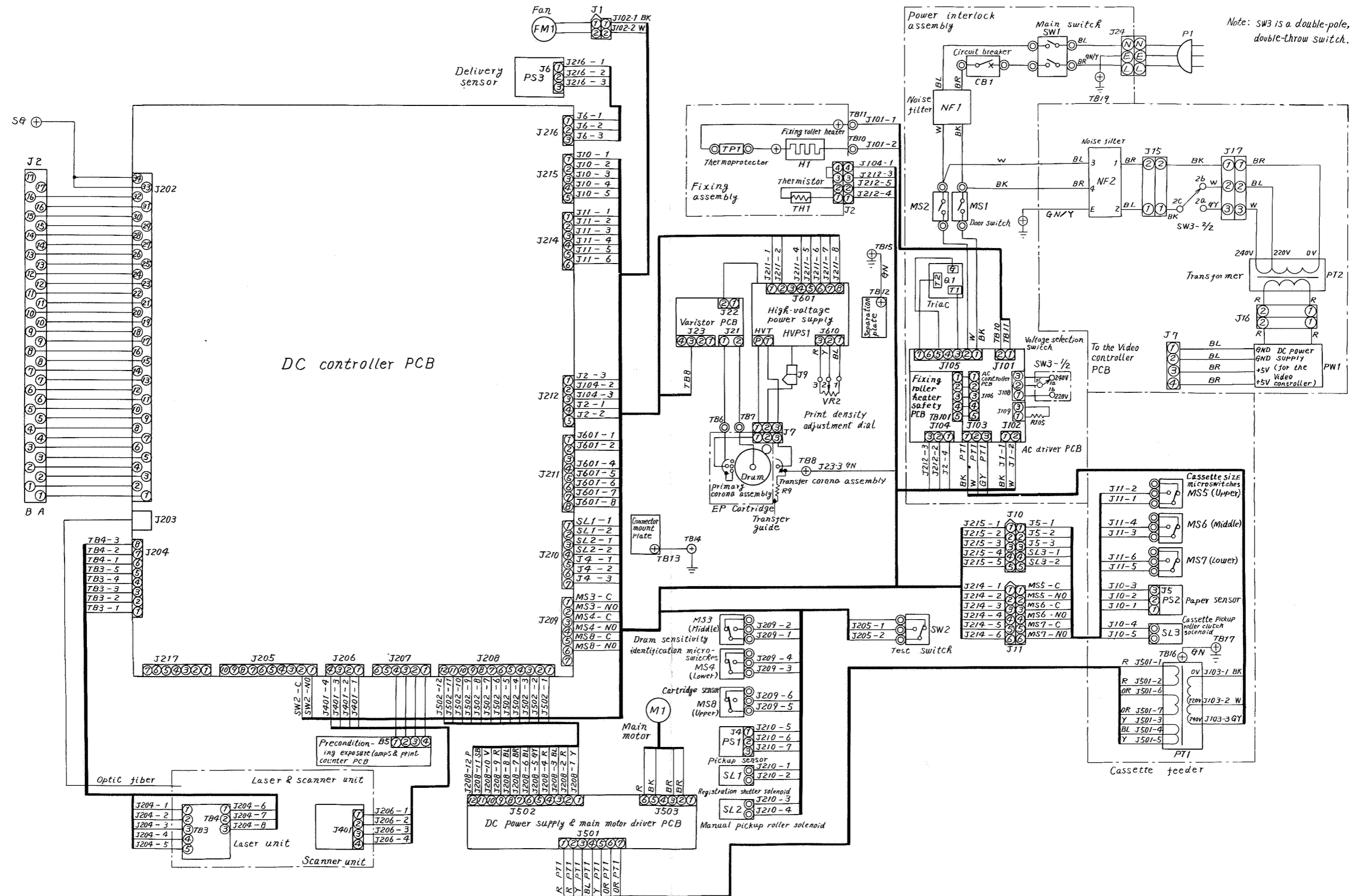
GENERAL CIRCUIT DIAGRAM (220V/240V, 50Hz only) (2 of 2)

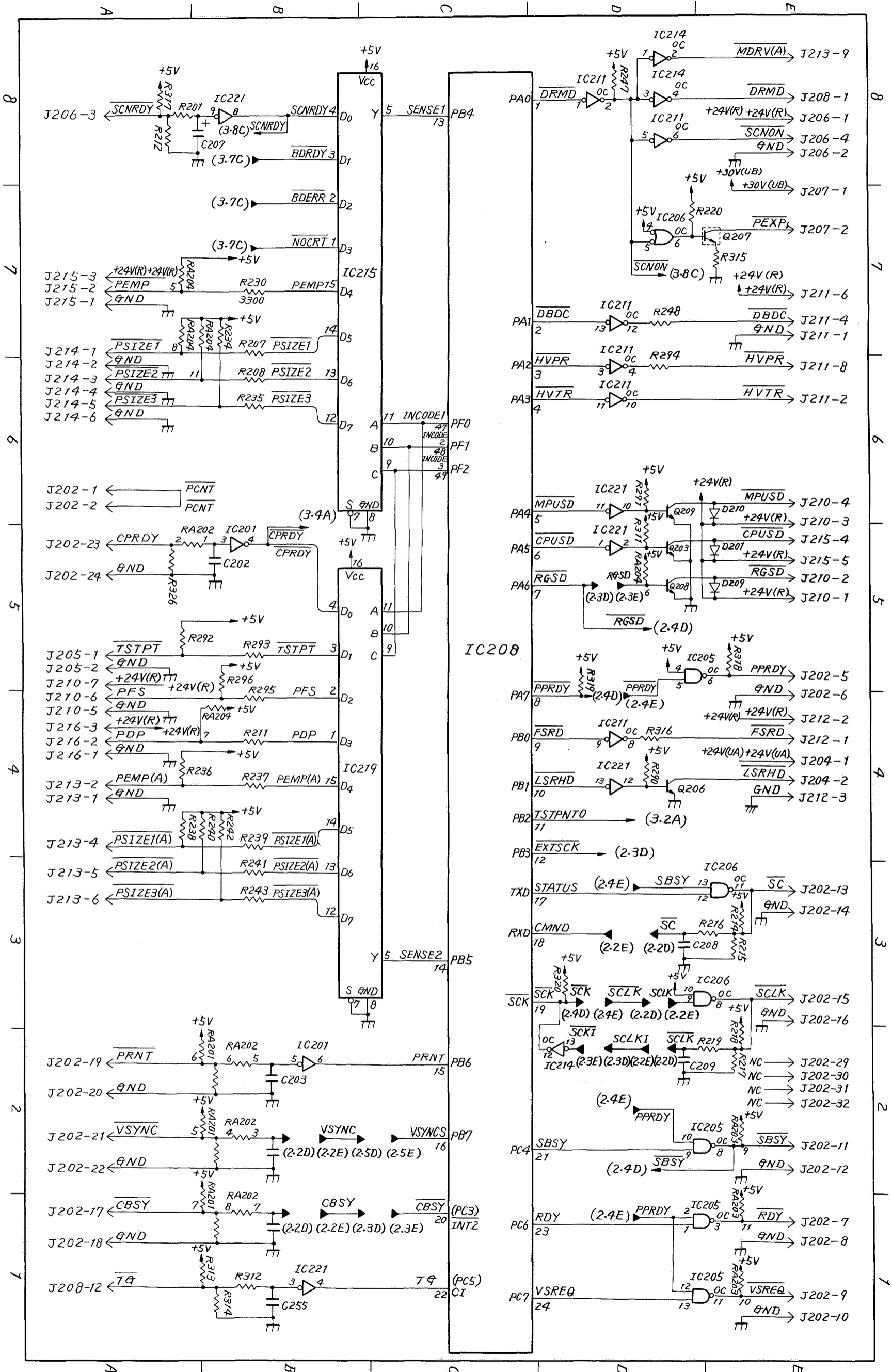


III. WIRING DIAGRAM (115V, 60Hz only) (1 of 2)

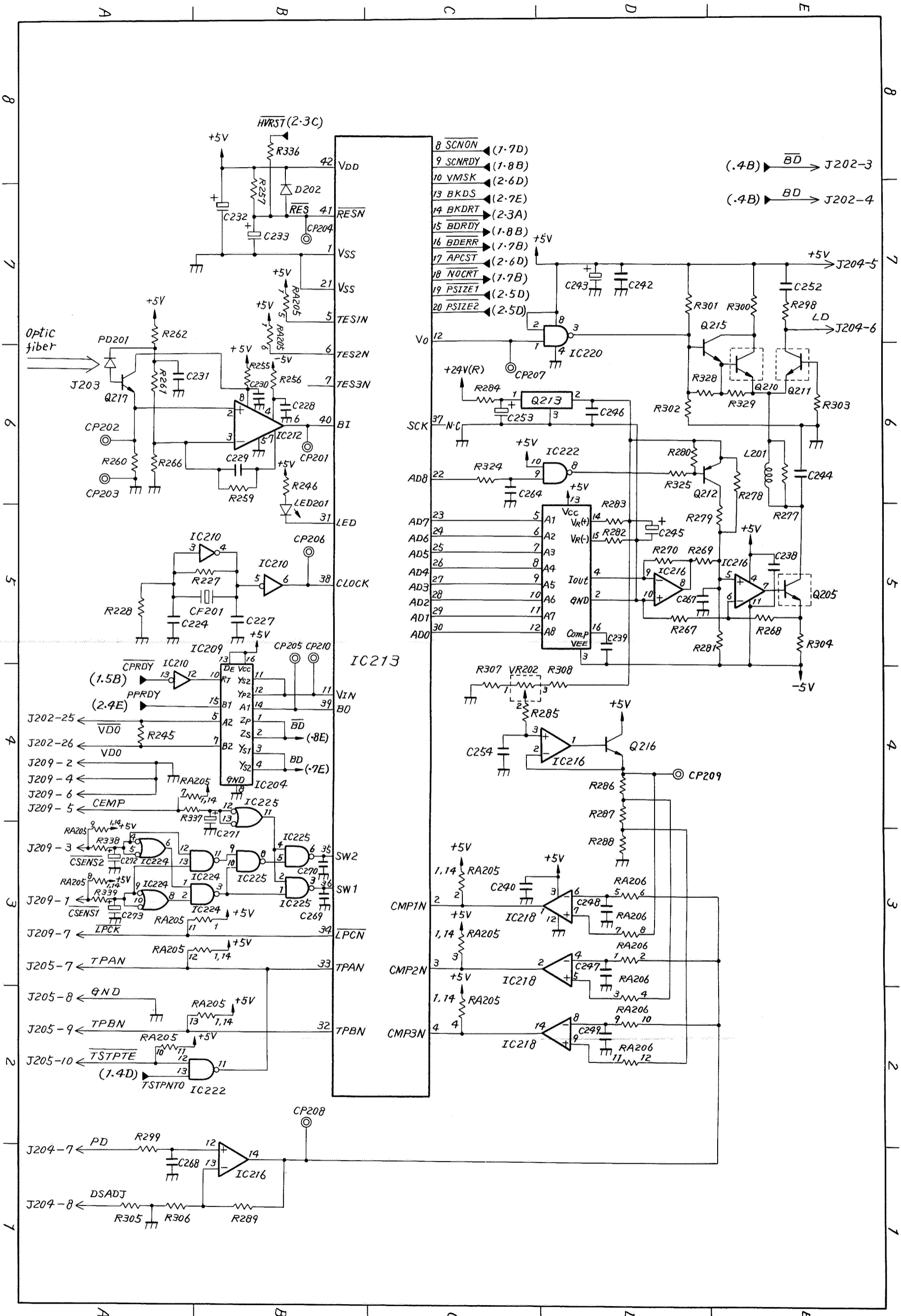


WIRING DIAGRAM (220V/240V, 50Hz only) (2 of 2)





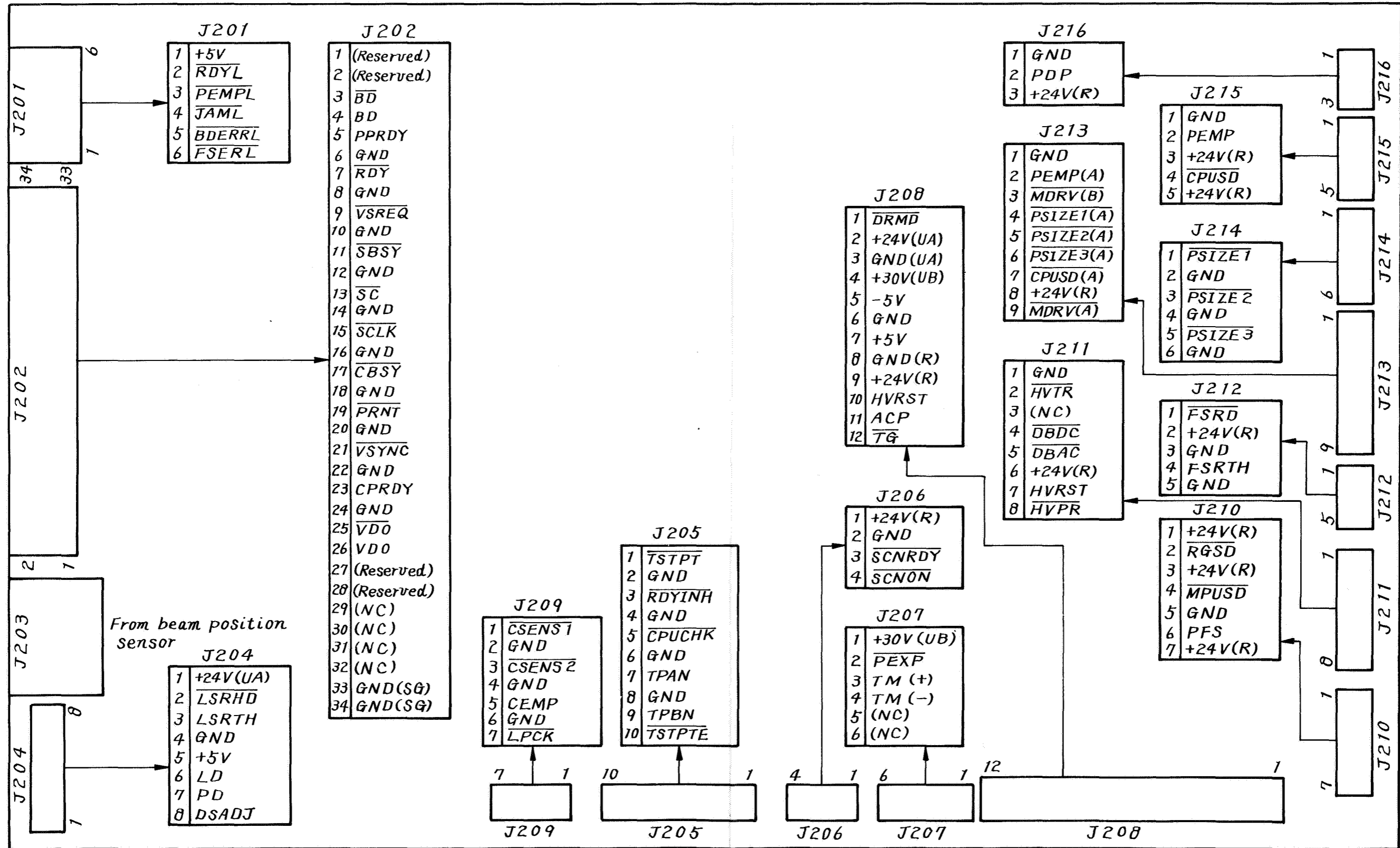




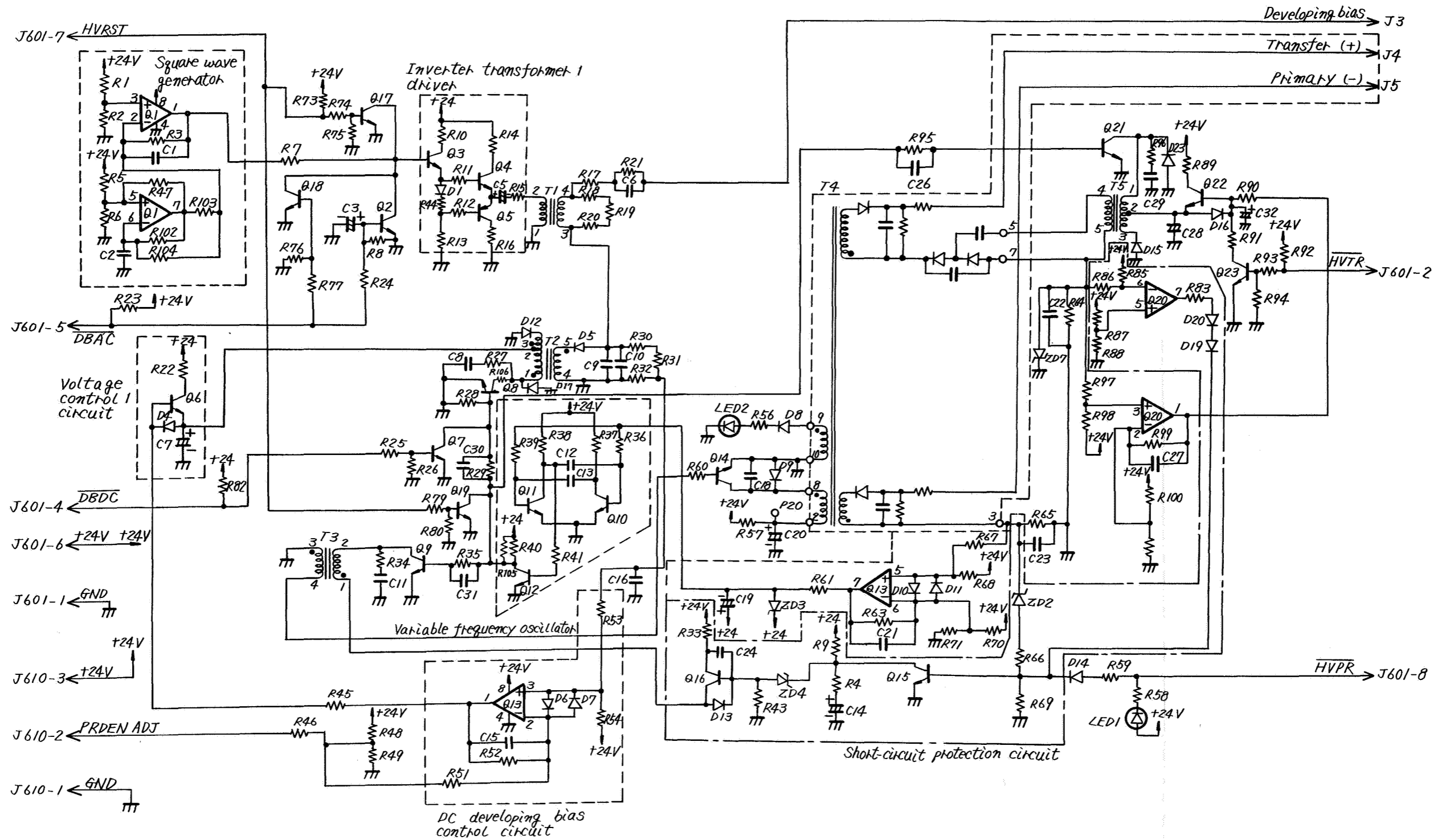
DC Controller Circuit Diagram (3 of 3)



B. DC Controller PCB: Connector Locations and Signals



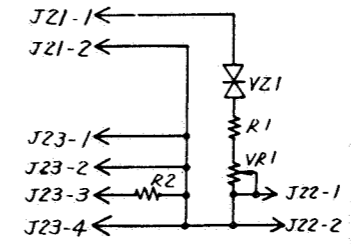
V. HIGH-VOLTAGE POWER SUPPLY CIRCUIT DIAGRAM



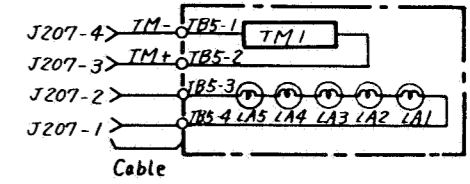


VIII. VARISTOR AND PRECONDITIONING EXPOSURE LAMPS AND PRINT COUNTER CIRCUIT DIAGRAMS

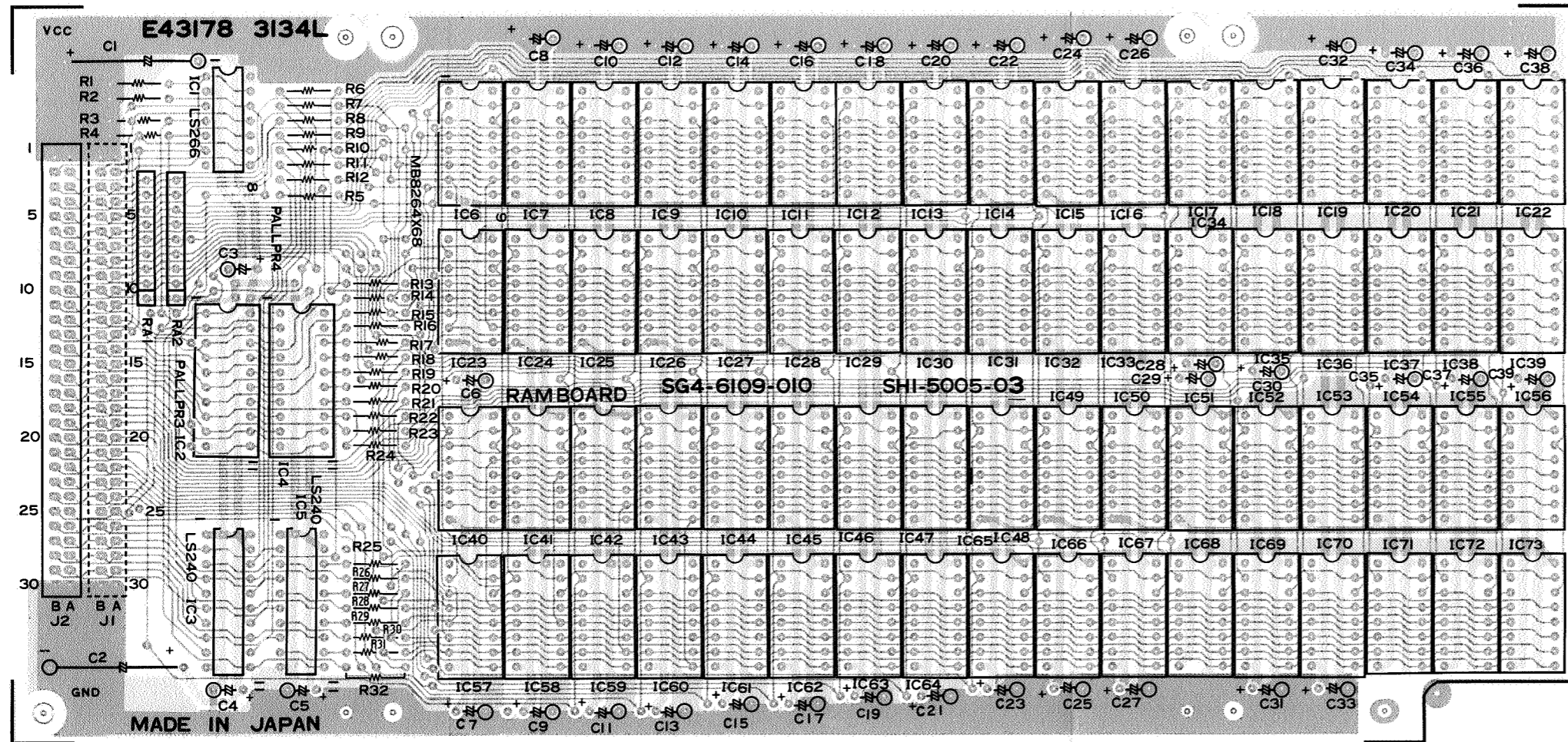
A. Varistor Circuit Diagram



B. Preconditioning Exposure Lamps and Print Counter Circuit Diagram

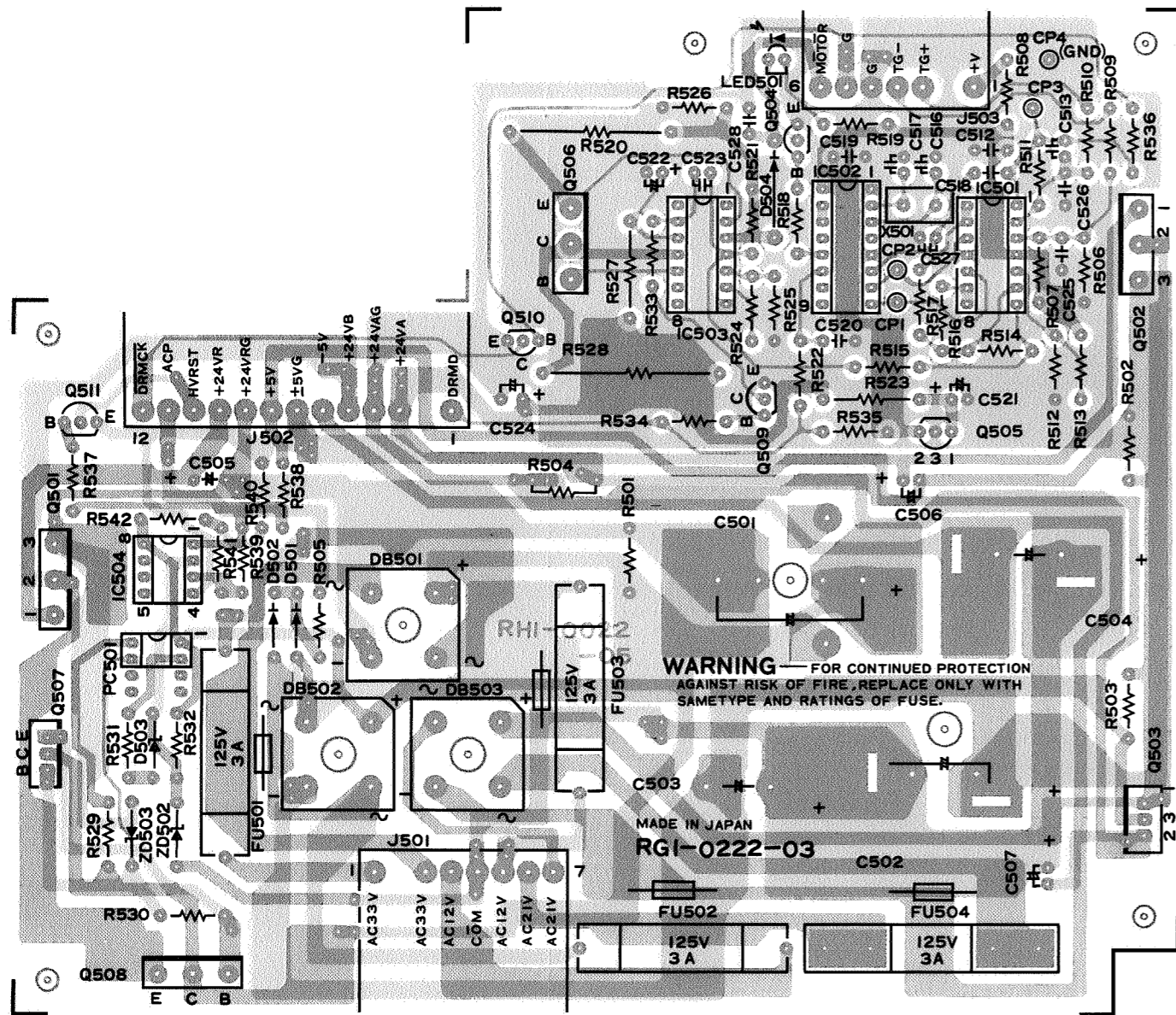


IX. EXPANSION RAM PCB LAYOUT (A2 model only)

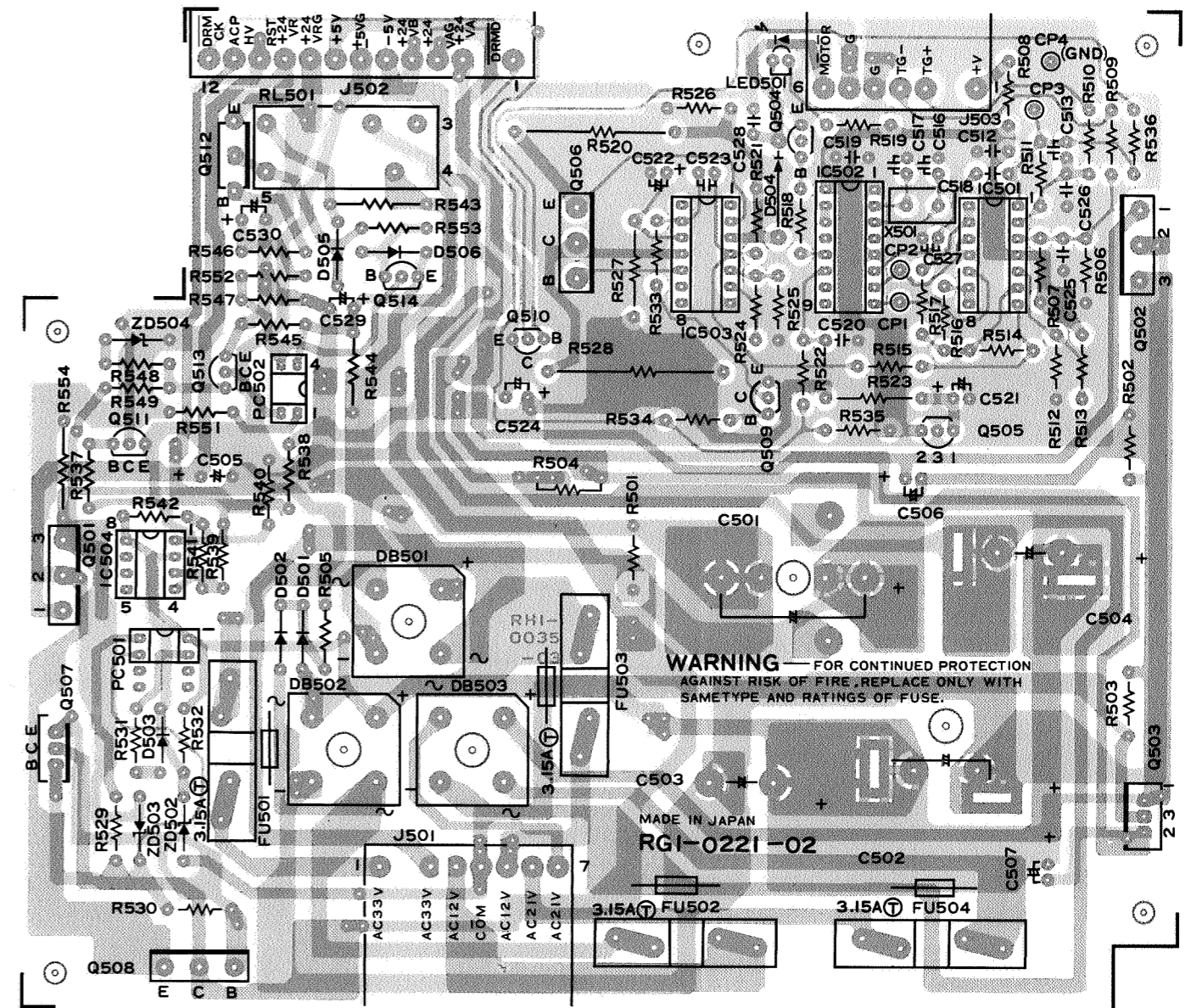




XI. DC POWER SUPPLY & MAIN MOTOR DRIVER PCB LAYOUT



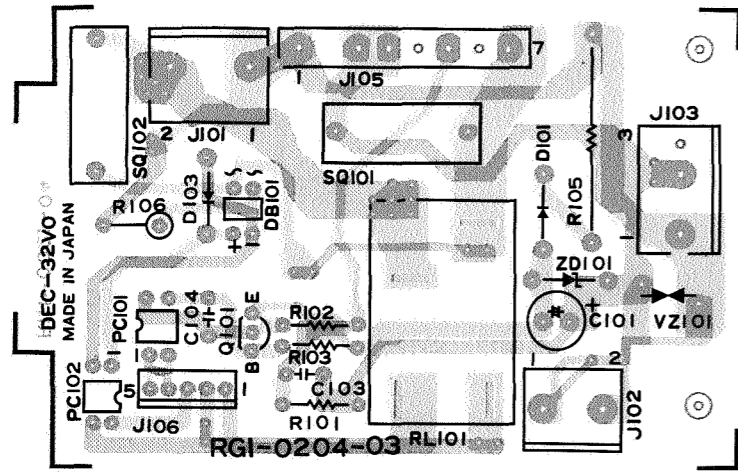
115V, 60 Hz only



220/240V, 50 Hz only

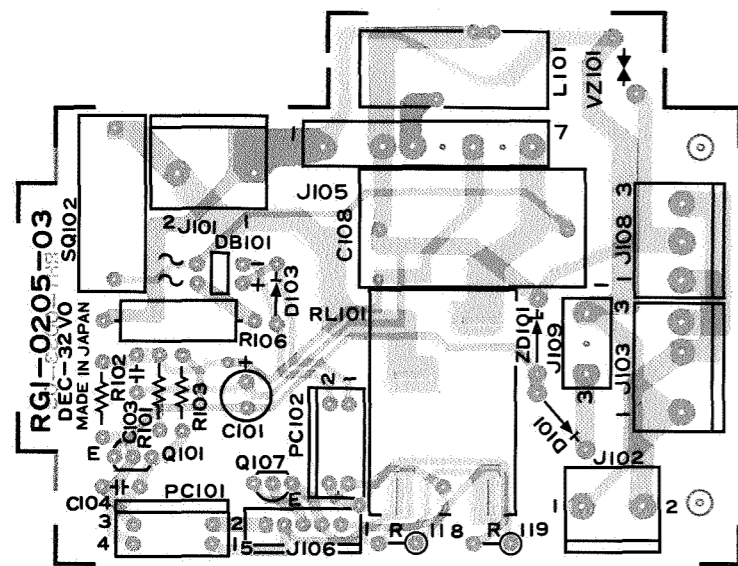
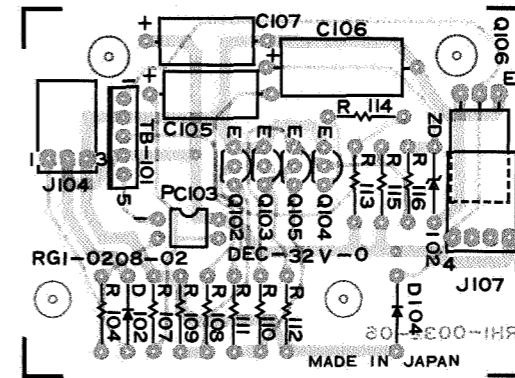
XII. AC DRIVER PCB LAYOUT (AC CONTROLLER PCB, FIXING ROLLER HEATER SAFETY PCB)

A. AC Controller PCB Layout



115V, 60 Hz only

B. Fixing Roller Heater Safety PCB Layout

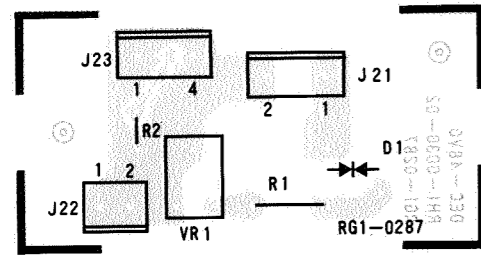


220V/240V, 50 Hz only

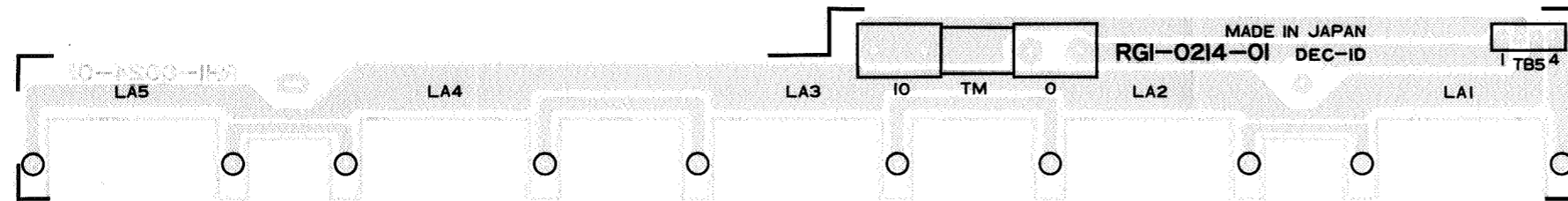


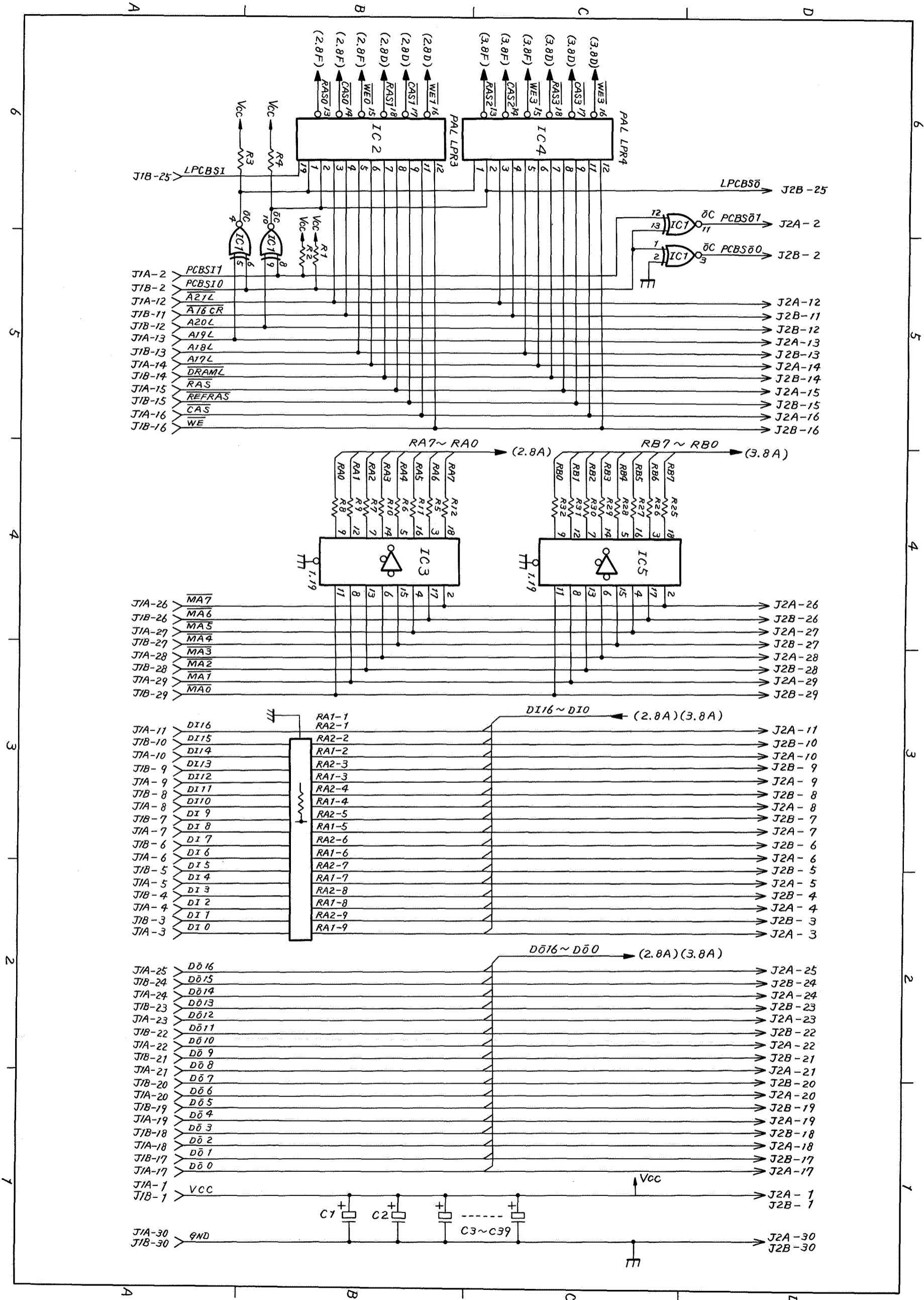
### XIII. VARISTOR PCB LAYOUTS

Varistor PCB Layout



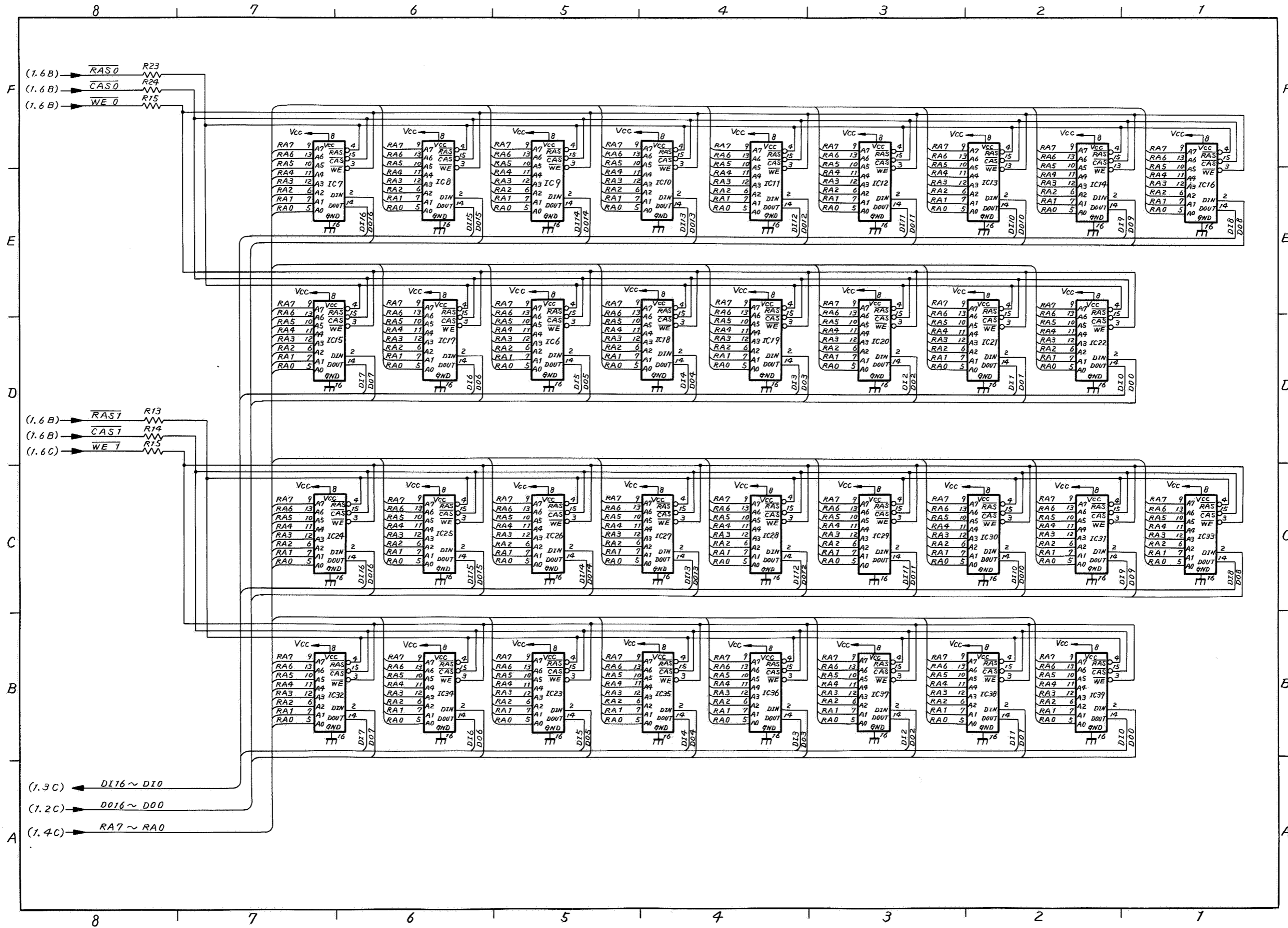
### XIV. PRECONDITIONING EXPOSURE LAMPS AND PRINT COUNTER PCB LAYOUT



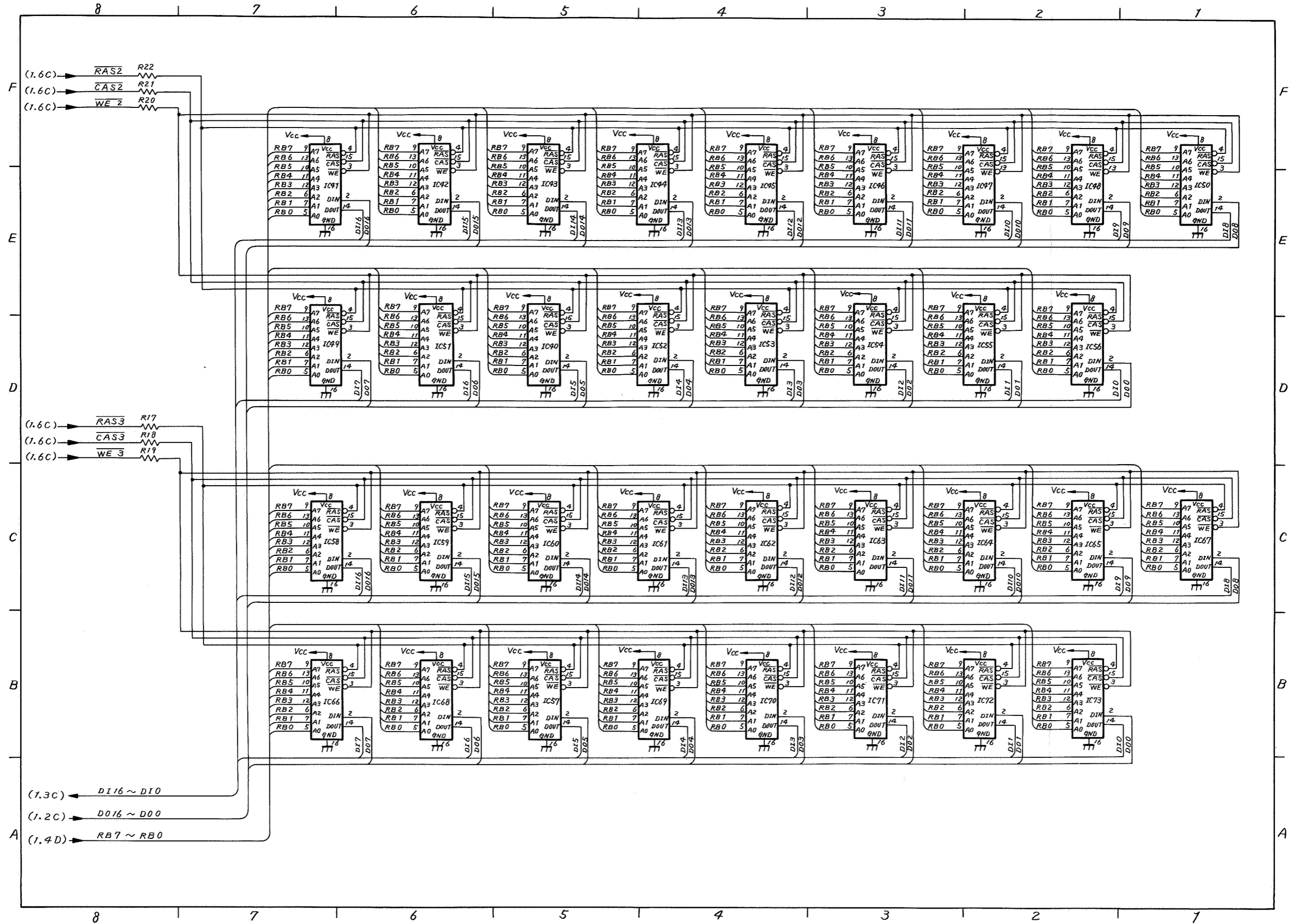


XV. EXPANSION RAM CIRCUIT DIAGRAM (1 of 3)

EXPANSION RAM CIRCUIT DIAGRAM (2 of 3)



EXPANSION RAM CIRCUIT DIAGRAM (3 of 3)

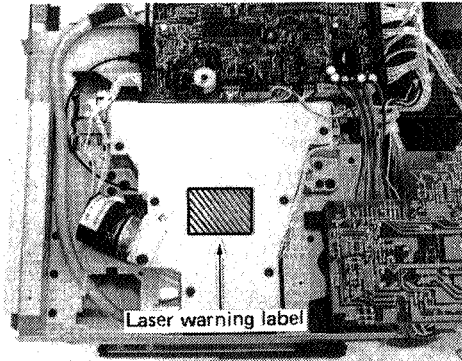




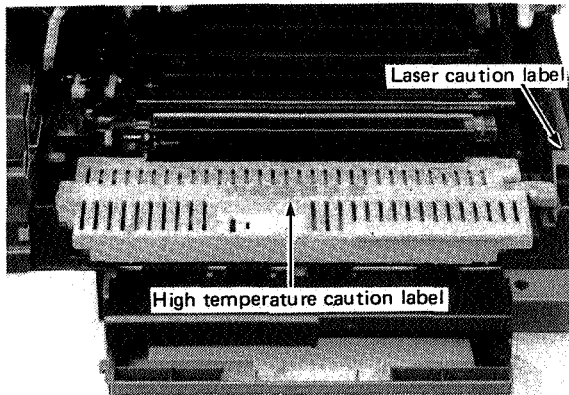
## XVI. LABELS

### A. Location of Warning Labels

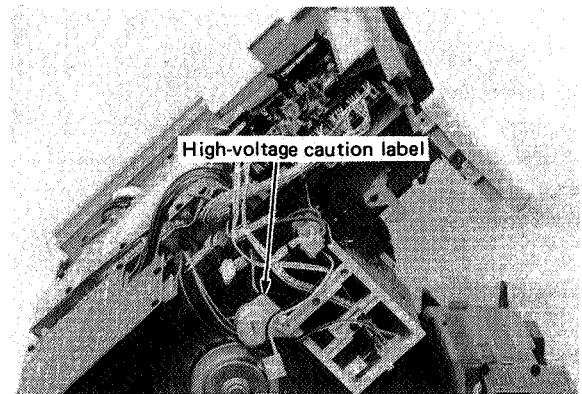
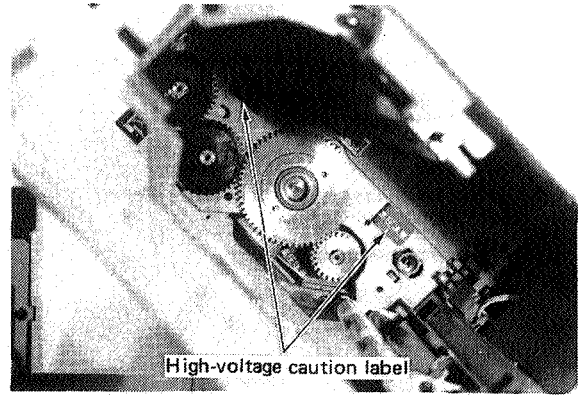
#### 1. Laser warning label



#### 2. High temperature and laser caution label

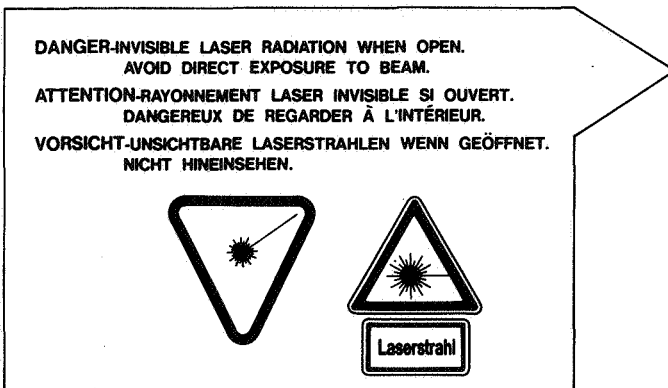


#### 3. High-voltage caution label

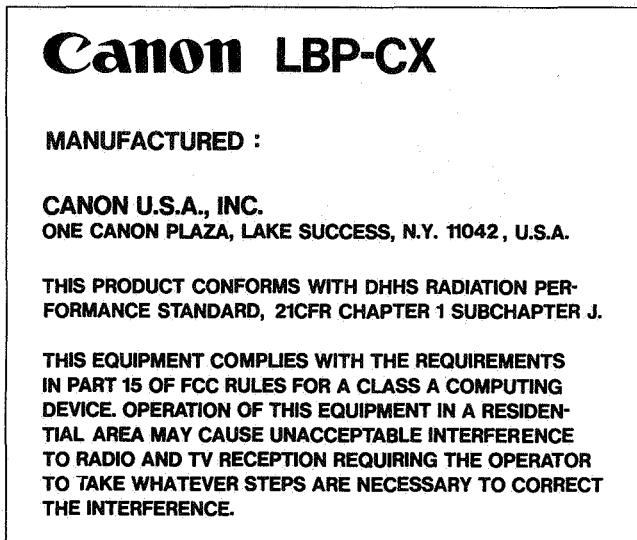


## B. Warning Labels

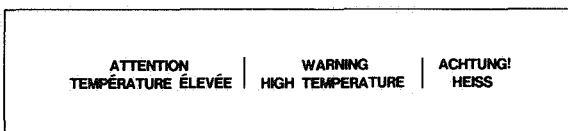
### 1. Laser warning label



### 2. Laser caution label



### 3. High temperature caution label



### 4. High-voltage caution label



115 V, 60 Hz only



220 V/240 V, 50 Hz only

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