LBP-UX

SERVICE MANUAL

MAR. 1988

PREFACE

This Service Manual contains basic information required for after-sales service of the LBP-UX laser beam printer. This information is vital to the serviceman in maintaining the high printing quality and performance of the printer.

This manual is made based on the OEM standard manual.

This manual consists of the following chapters:

Chapter 1: General Descripton
Features, specifications, and operation

Chapter 2: Operation and Timing
A description of the principles of operation of the electrical and mechanical systems, their functions, and timing of operations

Chapter 3: The Mechanical System
Explanation of mechanical operation, disassembly, reassembly, and adjustment procedures

Chapter 4: Installation
Requirements for a suitable location and installation procedures, plus storage and handling of EP-S cartridges

Chapter 5: Maintenance and Servicing
Parts replacement schedule, tools, lubricants, and solvents

Chapter 6: Troubleshooting
Reference values and adjustments; troubleshooting procedures

Appendix: General timing chart, general circuit diagram, PCB circuit diagrams, etc.

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CHAPTER 1

GENERAL DESCRIPTION

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I. FEATURES

1. This high-speed, non-impact (low-noise) printer is based on electrophotographic, electronic, and laser technology.
2. The printer produces high-quality prints on plain paper, and can produce a large variety of characters and graphics.
3. The printer is compact and easy to carry. This makes it easy to move the printer to where it is needed.
4. A corona unit, developing cylinder, photosensitive drum, and drum cleaning unit are combined into a single assembly called an "EP-S cartridge". The cartridge can be replaced by the customer when necessary. High printing quality is maintained by a simple cleaning procedure.
5. The printer can be opened and closed with a simple one-hand action, so any paper jams can be cleared easily.
6. Laser beam safety is designed into the printer. The printer is approved by the U.S. Center for Devices and Radiological Health (CDRH).
7. The power supply of the printer will operate on all the following voltages: 100V/115V/220V/240V (50/60Hz).
8. The scanning pitch (300 or 400 DPI) is selected and the printer switched ON/OFF by the external device that is controlling it.

II. SPECIFICATIONS

1. Type — Desk-top page printer
2. Printing method — Electrophotography (single-component dry toner)
3. Printing speed
   Cassette feed — 8.1 prints/min (A4/Letter size)
4. Time for first print

Power supply voltage / Resolution	100V/115V	220V/240V
300 DPI	30s or less	25s or less
400 DPI	32s or less	27s or less

Table 1-1

Note: This table delineates the allowable time from when a signal is received by the printer while in READY state at an ambient temperature of 20°C until an A4 or Letter sized sheet is printed and delivered.

5. Warm-up (WAIT) time — 2 min or less (after power on until the printer warms up at an ambient temperature of 20°C)
6. Optical system
   Laser — Semiconductor laser
   Scanning system — Rotating six-faced prism mirror
   Scanning pitch
   Horizontal — 300 or 400 dots/in
   Vertical — 300 or 400 rasters lines/in
7. Printing system
   Photosensitive drum — OPC
   Charging — Corona
   Exposure method — Laser scanning system
   Development — Toner projection development system
   Paper feed — Cassette (single cassettes; manual feed)
   Image transfer — Corona-assisted
   Separation — Tangential; (small drum radius/paper stiffness)
   Fixing method — Heated roller

100V	About	286W
115V	About	354W
220V	About	962W
240V	About	1100W

   Toner supply — Included in replaceable EP-S cartridge
8. Paper
   Cassette feed — Plain paper of A4, Letter size (60g/m² - 80g/m² paper)
   Manual feed — Plain paper from 100mm × 175mm to 216mm × 356mm (60g/m² - 128g/m² paper)
9. Cassette — A4/Letter selection (Depth: 16mm - about 150 sheets of 80g/m² paper)
10. Print delivery — Face-up

11.	Print tray capacity Plain paper:	About 50 sheets (80g/m²) (Number of sheets depends on operating environment.)
12.	Environment Temperature Humidity Atmospheric	 10°C to 32.5°C (50°F - 91°F) 20% to 80% RH 570mmHg to 760mmHg (0m-2500m)
13.	Noise level	Under 50dB(A) (PRINTING) Under 45dB(A) (STANDBY) (1m away from the printer)
14.	Dimensions (W × D × H)	363mm × 423mm × 180mm
15.	Weight	About 14kg
16.	Power consumption	Max. 540W (100V, printing) Max. 640W (115V, printing) Max. 1240W (220V, printing) Max. 1390W (240V, printing)
17.	Line voltage requirements	110/115V (50/60Hz) or 220/240V (50/60Hz); selectable with a switch (Voltage tolerance: ±10%)

Specifications are subject to change with product improvement.

III. SAFETY INFORMATION

A. CDRH Regulations

The 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 information shown below indicates compliance with the CDRH regulations and must be attached to laser products marketed in the United States.

This product conforms with CDRH Radiation Performance Standard, 21CFR Chapter 1 Subchapter J.

Manufactured: [ ]

Figure 1-1

Note:
The information shown above is subject to change depending on the printer model.

B. Additional Information

When servicing or adjusting the optical system of the printer, be careful not to place screwdrivers or other reflective objects in the path of the laser beam.

Be sure to take off accessories, such as watches and rings, before working on the printer. A 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.

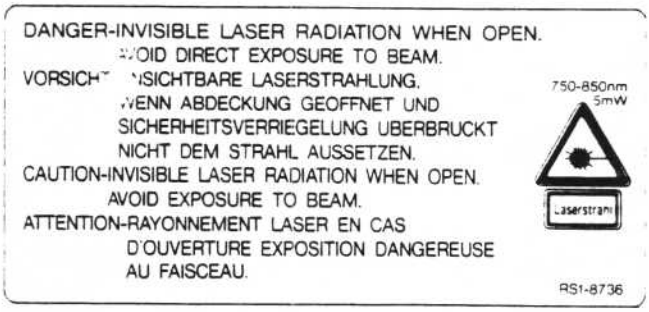
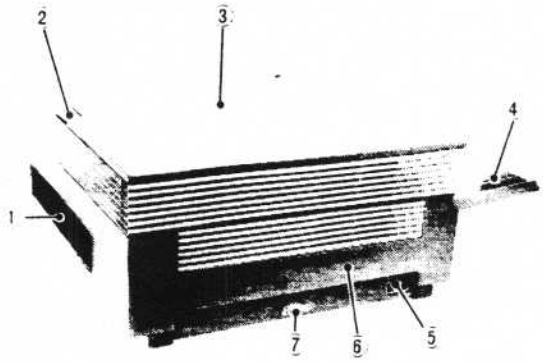


Figure 1-2

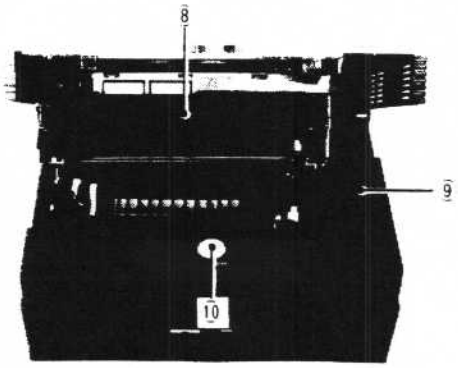
IV. PARTS OF THE PRINTER

A. External View



① Cassette holder
② Upper unit release
③ Upper cover
④ Delivery tray
⑤ Power cord receptacle
⑥ Lower cover
⑦ Interface connector

Figure 1-3



⑧ EP-S cartridge
⑨ Voltage selector
⑩ Print density adjustment dial

Figure 1-4

B. Cross Sectional View

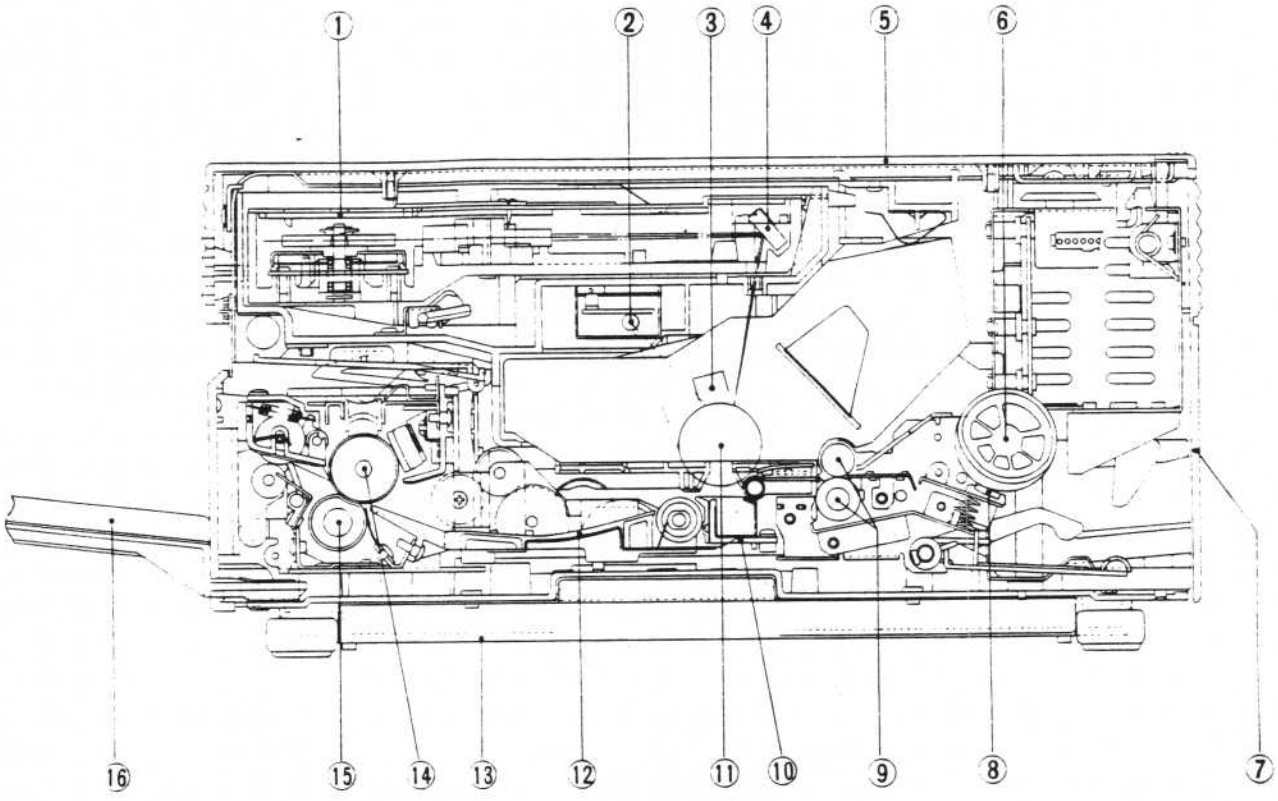


Figure 1-5

① Laser/scanner unit
② Preconditioning exposure lamps
③ Primary corona unit
④ Mirror
⑤ Upper cover
⑥ Pick-up roller
⑦ Lower cover
⑧ Separation pad
⑨ Registration rollers
⑩ Transfer corona unit
⑪ Photosensitive drum
⑫ Feed guide
⑬ Base cover
⑭ Upper fixing roller
⑮ Lower fixing roller
⑯ Delivery tray

V. OPERATION

1. Test Print button

The test print button is located behind a panel on the front side of the base cover. (See Figure 3-1.) Pressing it causes the printer to print the test pattern stored in the memory of the DC controller PCB.

After the printer has been switched ON by a signal from the external device and the $\overline{\text{RDY}}$ signal has been made TRUE by the printer, pressing the button will cause the printer to print a page of the test pattern.

If the button is held down, the printer will print the test pattern continuously.

2. Print density adjustment dial

The print density adjustment dial can be seen when the printer is opened (See Figure 1-4). It is used to adjust the print density.

Turning the dial clockwise lightens the print.

Normally, the dial should be set to the "5" position.

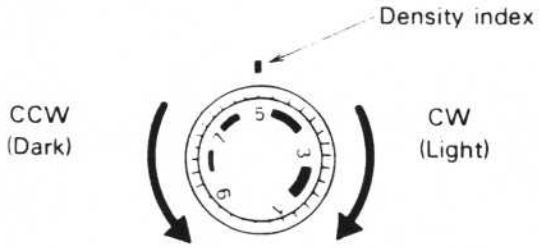


Figure 1-6

CHAPTER 2

OPERATION AND TIMING

1. This chapter describes the printer functions, the relationships between mechanisms and circuits, and timing of operations. Mechanical linkages are indicated by striped conduits (▮▮▮▮), control signals by arrows (——►), and groups of signals by thick arrows (⟹).
2. The signals in digital circuits are identified as "H" for HIGH and "L" for LOW. The voltage for LOW is very close to 0V; the voltage for HIGH depends on the circuit. If a signal name has no bar over it (e.g., PDP), "H" is a "TRUE" signal. If a signal name has a bar over it (e.g., $\overline{PDP}$), "L" is a "TRUE" signal. (A "TRUE" signal will usually cause an action to occur, etc.; a "FALSE" signal will normally prevent the operation).

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I. BASIC OPERATION

A. Functions

Printer functions can be divided into five groups: the interface system, the overall control system, the laser/scanner unit, the image formation system, and the paper pick-up/feed system.

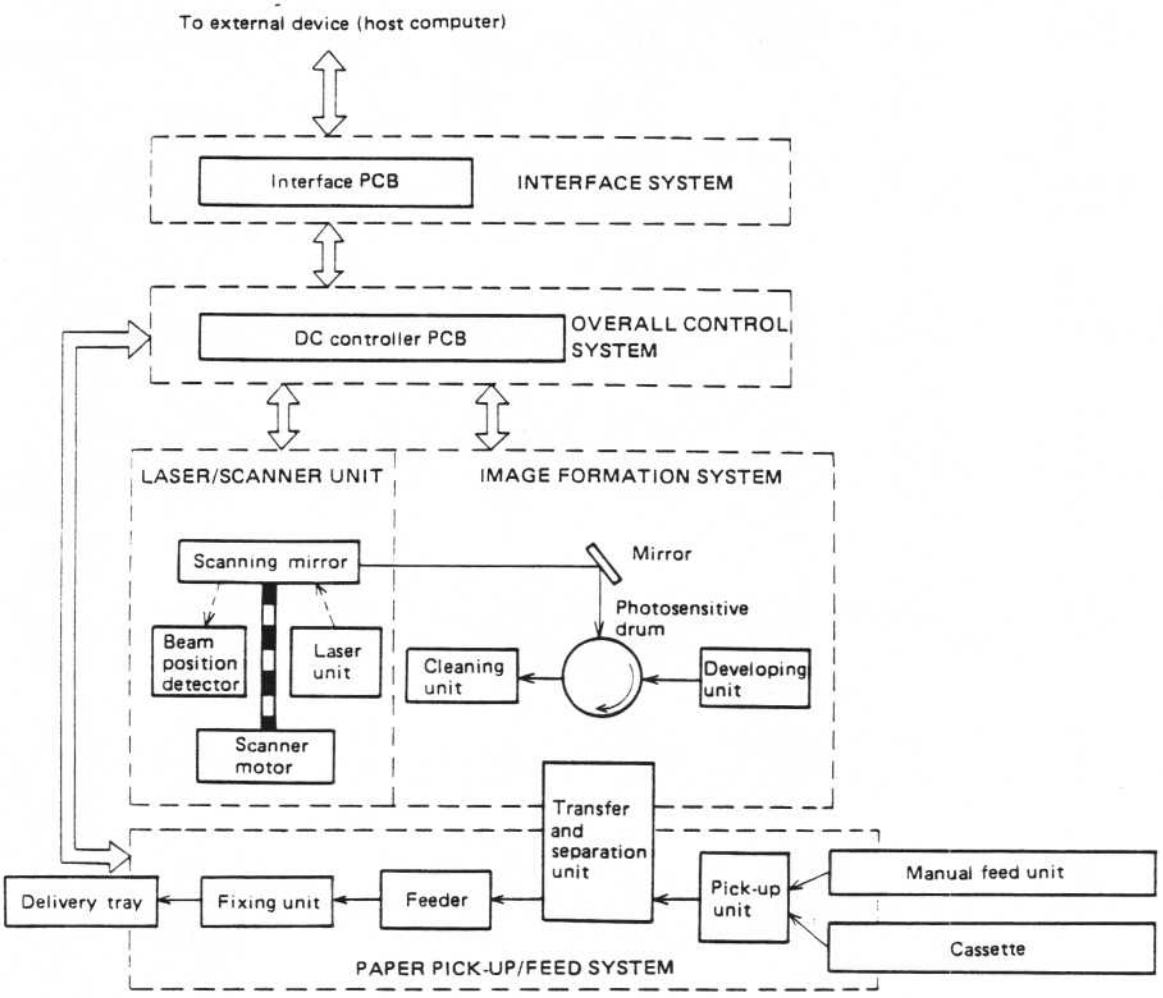


Figure 2-1

B. Outline of the Electrical System

Operations of this printer are controlled by two microprocessors on the DC controller PCB. When the printer power is switched ON by a signal from the external device, the microprocessors output signals to drive the laser diode, scanner motor, main motor, and other components in response to commands and image data received from the external device via the interface PCB.

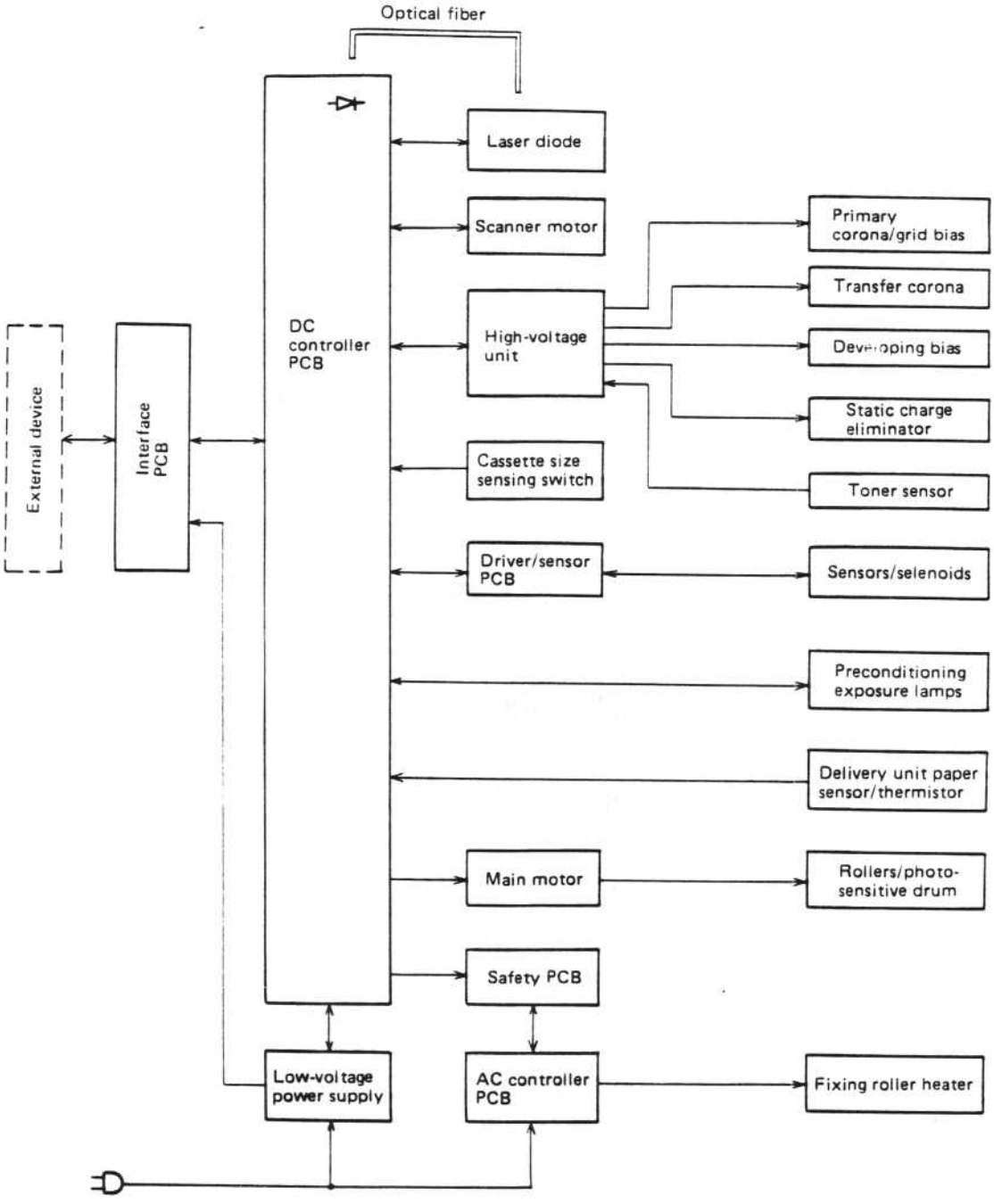


Figure 2-2

C. DC Controller Input Signals

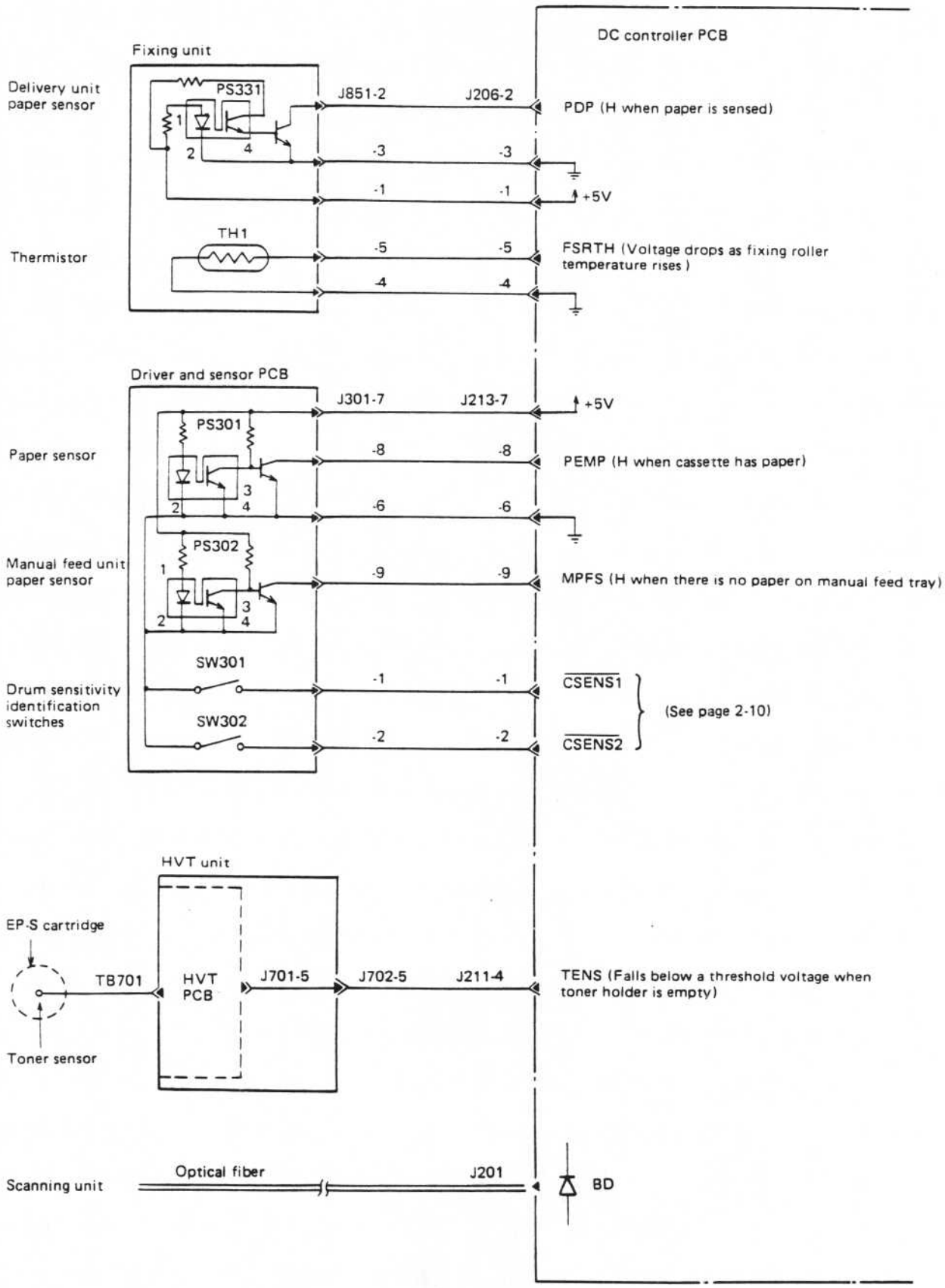


Figure 2-3

D. DC Controller Output Signals

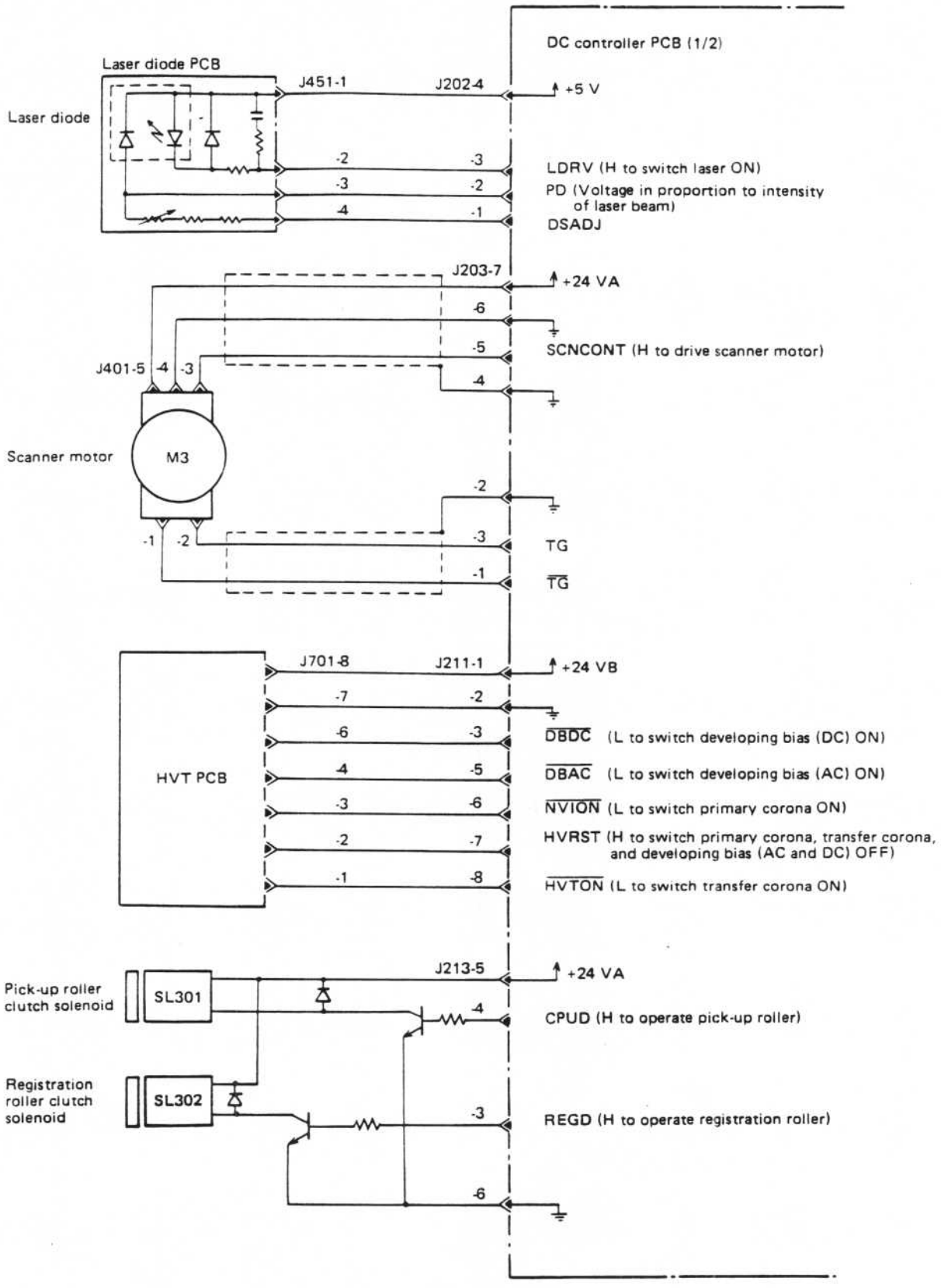


Figure 2-4

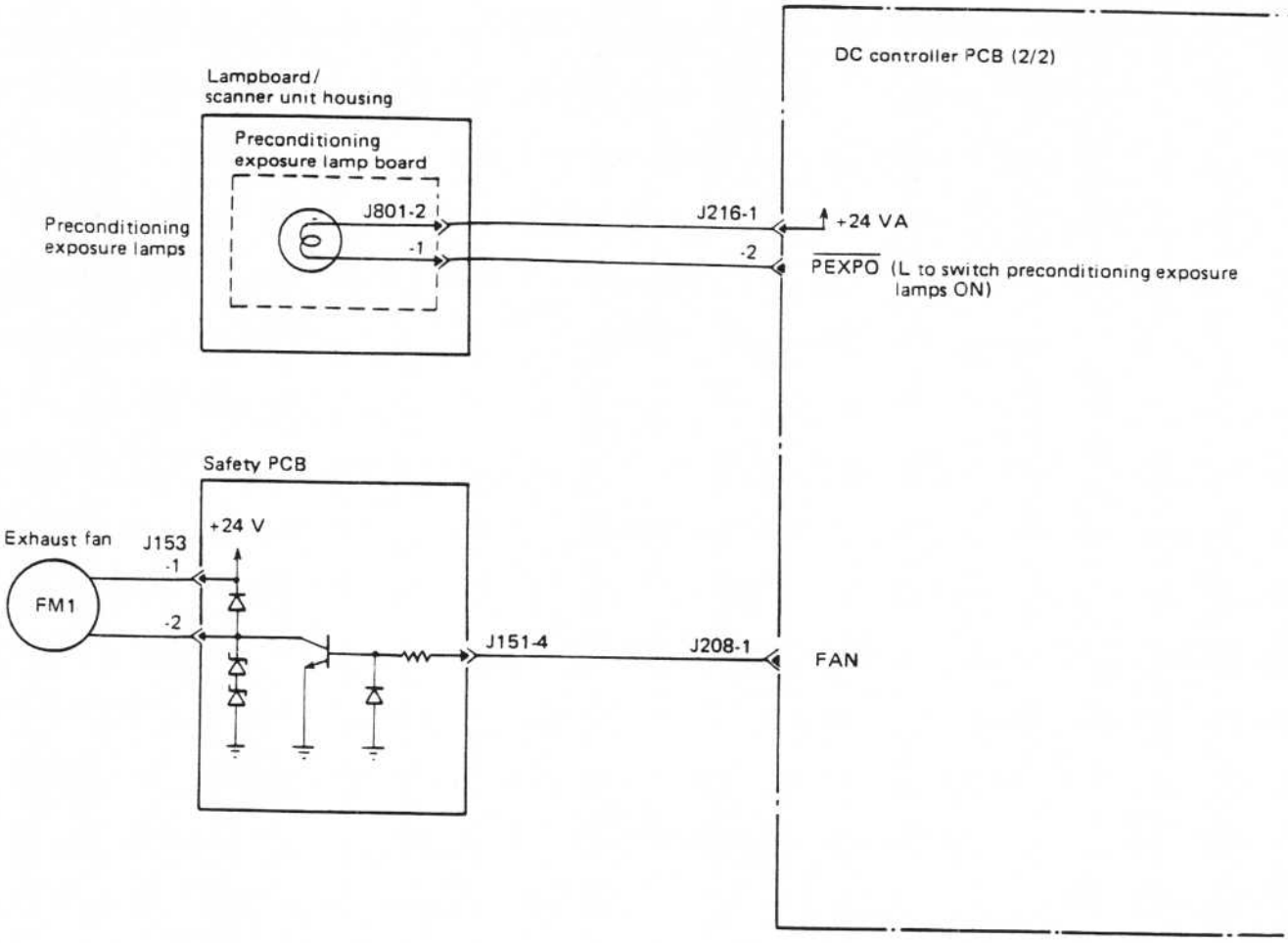

DC controller PCB (2/2)
Lampboard/
scanner unit housing
Preconditioning
exposure lamp board
Preconditioning
exposure lamps
J801-2
-1
J216-1
-2
+24 VA
PEXPO (L to switch preconditioning exposure lamps ON)
Safety PCB
Exhaust fan
J153
-1
-2
FM1
+24 V
J151-4
J208-1
FAN

Figure 2-5

E. Basic Sequence of Operations

Two consecutive prints on A4 paper

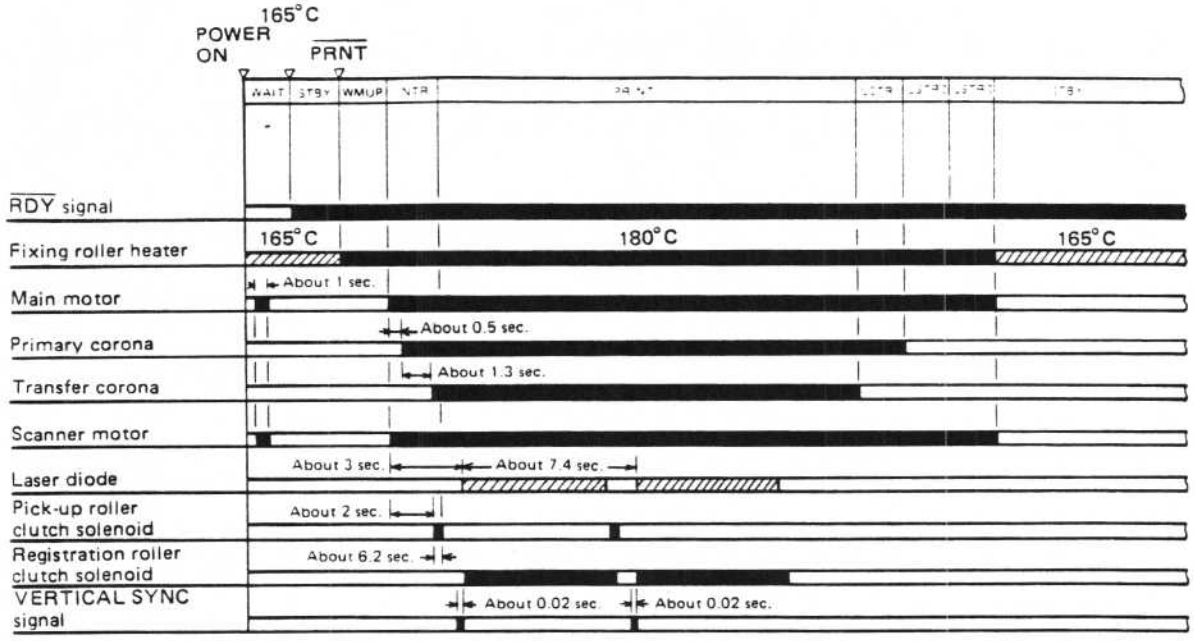


Figure 2-6

Period		Purpose	Remarks
WAIT (WAIT period)	From POWER ON until the fixing roller temperature reaches 165°C. (Two minutes or less in an ambient temperature of 20°C).	Fixing roller warm-up	
STBY (STANDBY)	From the end of the WAIT period until: 1. a $\overline{\text{PRNT}}$ signal is inputted from the external device, or 2. from the end of the LSTR3 period until a $\overline{\text{PRNT}}$ signal is inputted from the external device, or 3. the power is switched OFF.	Fixing roller held at 165°C to keep the printer ready to print.	
WMUP (WARM-UP period)	After the $\overline{\text{PRNT}}$ signal has been inputted from the external device until the fixing roller reaches 175°C. (10 sec. or less.)	Fixing roller warm-up	
INTR (INITIAL ROTATIONS period)	For about 2 sec. after the main motor starts rotating for printing.	Residual charges removed from the drum and its photosensitivity stabilized in preparation for printing.	

Table 2-1

Period		Purpose	Remarks
PRINT (Print)	For about 17.9 sec. from paper pick-up (about 20.4 sec. for Legal size).	The VDO signal from the external device, conveys all image data, the image is formed on the photosensitive drum, and the image is transferred to paper.	
LSTR1 (FINAL ROTATIONS 1 period)	From when the transfer corona goes OFF until the primary corona goes OFF.	Last printed page delivered.	Whenever a $\overline{\text{PRNT}}$ signal is inputted from the external device, the INITIAL ROTATIONS period begins immediately.
LSTR2 (FINAL ROTATIONS 2 period)	From when the primary corona goes OFF until the developing bias (DC) goes OFF.	Last printed page delivered.	If a $\overline{\text{PRNT}}$ signal is inputted from the external device, the developing bias (DC) goes OFF, then the INITIAL ROTATIONS period begins.
LSTR3 (FINAL ROTATIONS 3 period)	From when the developing bias (DC) goes OFF until the main motor stops.	Last printed page delivered.	If a $\overline{\text{PRNT}}$ signal is inputted from the external device, the INITIAL ROTATIONS period begins immediately.

Table 2-2

II. LASER/SCANNER

A. Laser System

1. Introduction

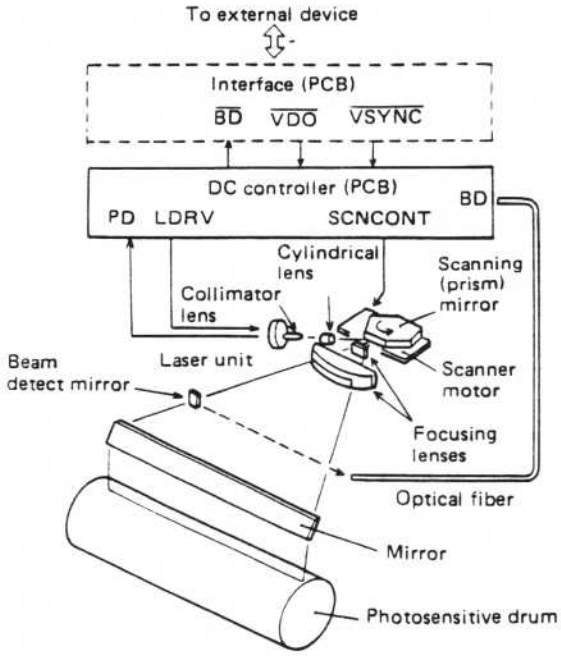


Figure 2-7

In response to the VIDEO signal ($\overline{VDO}$) transmitted from the external device (via an interface PCB) to the DC controller PCB, the laser driver on the DC controller PCB sends a LASER DRIVE command (LDRV) to the laser unit, and the semiconductor laser emits a laser beam.

LDRV can be anyone of three voltages, depending on the sensitivity of the drum. The laser output is regulated using the analog feedback signal PD, which is generated by a photodiode in the laser unit that senses the intensity of the laser beam.

The laser beam is aligned by a collimator lens and cylindrical lens into a parallel beam that strikes the six-faced (prism) scanner mirror that is rotating at constant speed.

The beam is reflected from this mirror, then brought to a point focus on the photosensitive drum via a mirror.

Each face of the scanning mirror in turn scans the beam across the drum.

The drum also rotates at a constant speed. As it rotates, the laser beam successively scans across its surface. Thus the laser beam builds up an image on the drum surface.

2. Scanning Exposure

The simplest example of exposure of the photosensitive drum by the laser beam is to imagine that both the drum and beam are stationary. In this case the laser beam illuminates a single point on the drum.

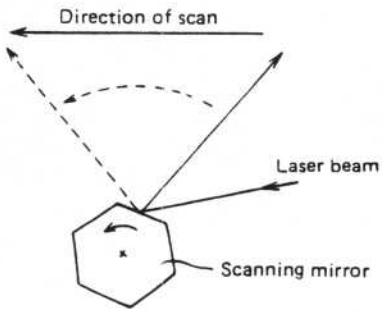


Figure 2-8

The scanning mirror shown in Figure 2-8 is turned by the scanner motor and reflects the laser beam across the photosensitive drum (scanning).

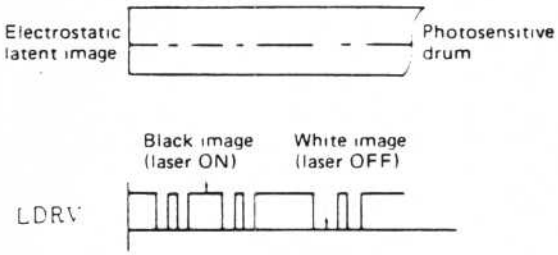


Figure 2-9

Figure 2-9 shows a hypothetical image formed by one scan of the laser beam across a nonrotating drum, the beam being modulated (switched ON/OFF for various lengths of time) by the LDRV signal.

In actuality, the drum is rotating while the laser beam scans across it.

Figure 2-10 shows a more accurate representation of scanning.

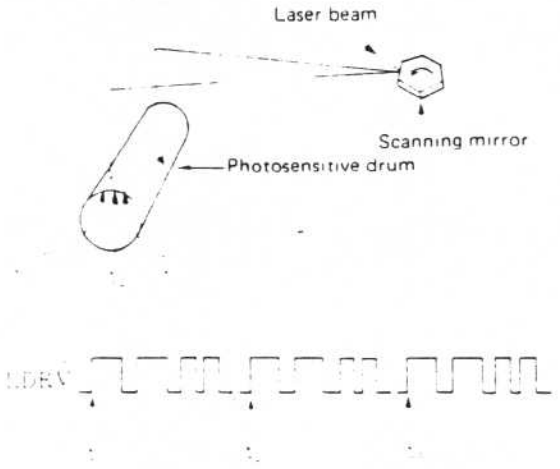


Figure 2-10

The drum rotates at constant speed while the laser beam scans across it. In the time that the beam takes to sweep across the drum and return to its original position, the drum surface has shifted downward by about 85 μm (300 raster lines/inch) or about 64 μm (400 raster lines/inch).

Successive scans are therefore separated by this interval.

Each time the laser beam returns to the start of a scanning line (slightly to the side of the drum), its light is reflected via a small, fixed, beam-detect (BD) mirror to an optical fiber, which carries the light signal to the DC controller PCB to indicate that the beam is about to scan the drum again. The DC controller then generates a HORIZONTAL SYNC signal (BD), the signal to start modulating the laser beam for the next scan across the drum.

3. Laser Driver

1. Outline

This circuit generates the laser drive current (LDRV) and switches it ON and OFF in response to the signal $\overline{VDO}$ from the interface PCB.

The laser driver circuit includes switches SW301 and SW302 that send a combination of signals ($\overline{CSENS1}$ and $\overline{CSENS2}$) to indicate the sensitivity of the photosensitive drum. The driver circuit adjusts the laser drive current to suit the information of these signals, matching the intensity of the laser beam to the sensitivity of the drum.

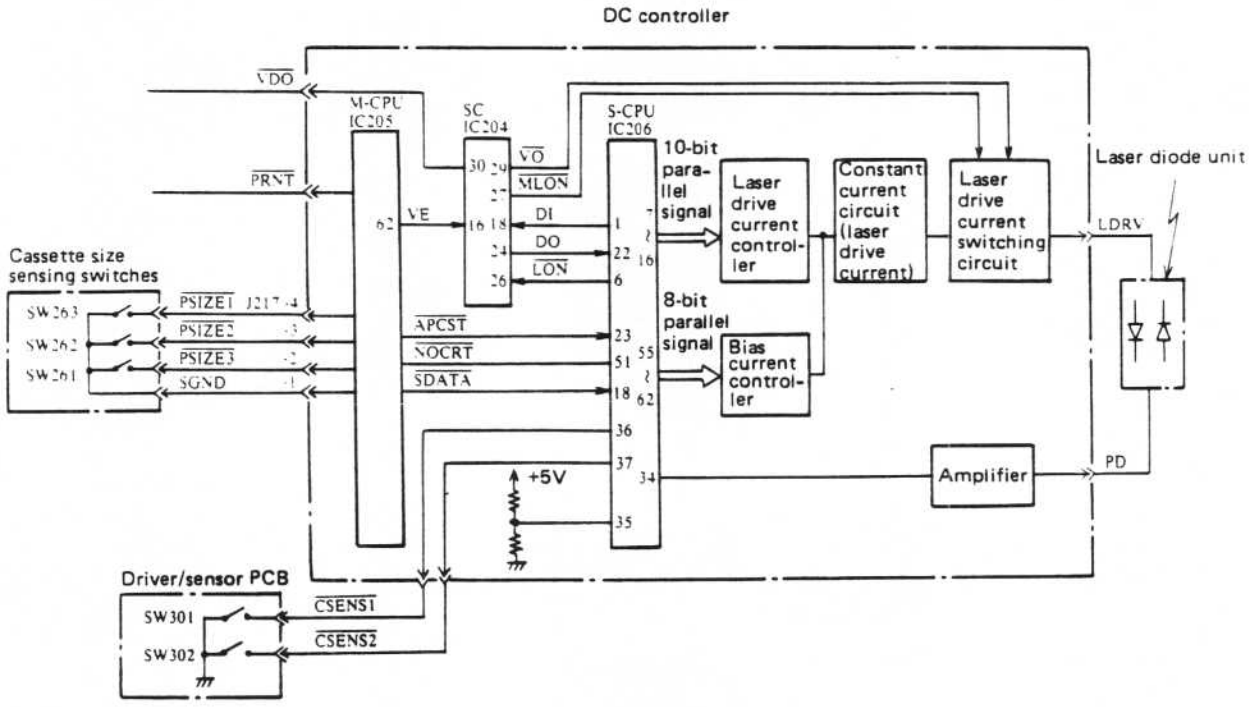


Figure 2-11

2. Principle of Operation

a. Control of laser beam intensity

Just before the laser diode begins emitting the laser beam in response to signal $\overline{VDO}$ for the first line of a new page, the laser beam intensity is always adjusted by the following procedure.

1) A fixed time after the main microprocessor (M-CPU) receives the PRINT command ($\overline{PRNT}$) from the interface PCB, the AUTOMATIC POWER CONTROL START ($\overline{APCST}$) command goes "L".
2) When it receives the $\overline{APCST}$ signal, the sub-microprocessor (S-CPU) cuts off the bias current and drive current to the laser diode, then sets the LASER ON ($\overline{LON}$) command to "L".
3) IC204 receives the $\overline{LON}$ command and outputs a "L" MANDATORY LASER ON ($\overline{MLON}$) command, causing the laser current switching circuit to supply laser drive current to the laser diode.
4) The sub-microprocessor (S-CPU) rapidly steps through an increasing 8-bit parallel output at pins 55-62, causing the bias current through the laser diode to increase steadily (starting from 0).
5) As the bias current increases, the laser diode begins emitting light (lasing). A photodiode (PD) senses the intensity of the laser beam. The voltage (monitor voltage) generated by the photodiode is amplified and sent to the sub-microprocessor (S-CPU) as a feedback signal.
6) When the monitor voltage reaches a preset allowable limit, the sub-microprocessor (S-CPU) stops increasing the bias current.
7) The sub-microprocessor (S-CPU) sets the output at pins 55-62 so that the output from the bias current controller is 80% of the drive voltage to the diode reached when the monitor voltage reached its allowable limit.
   At this bias current the laser diode emits no light.
   (Bias current determination)
8) If the monitor voltage exceeds the preset value, bias current is adjusted again.
9) The sub-microprocessor (S-CPU) then rapidly steps through an increasing 10-bit parallel output at pins 7-16, causing the drive current through the laser diode to increase steadily (starting from 0).
10) As the drive current increases, the laser diode begins emitting light and photodiode returns a feedback signal to the S-CPU.
11) The sub-microprocessor (S-CPU) increases the drive current until the feedback voltage reaches a target value. This value depends on the sensitivity of the drum.

Drum sensitivity	Target value
L	Same as input voltage at pin 35 of S-CPU
M	90% of input voltage at pin 35 of S-CPU
H	80% of input voltage at pin 35 of S-CPU

Table 2-3 Drum Sensitivity and Target Values

DRUM SENSITIVY IDENTIFICATION signals / Drum sensitivity	$\overline{CSENS1}$	$\overline{CSENS2}$
L	L	L
M	L	H
H	H	L
Cartridge (drum) not installed	H	H

Table 2-4 Meaning of Drum Sensitivity Identification Signals

12) The current at which the feedback voltage matches the target value is set as the operating the laser diode drive current.
    (Drive current determination)
13) If the feedback voltage exceeds 105% of the target value, the laser drive current is adjusted again.
14) The LASER ON ($\overline{LON}$) command goes "H", causing the MANDATORY LASER ON ($\overline{MLON}$) command to go "H". This causes the switching circuit to cut off the drive current to the laser diode.
    Figure 2-12 shows how the laser diode bias and drive currents are adjusted by the above procedure.

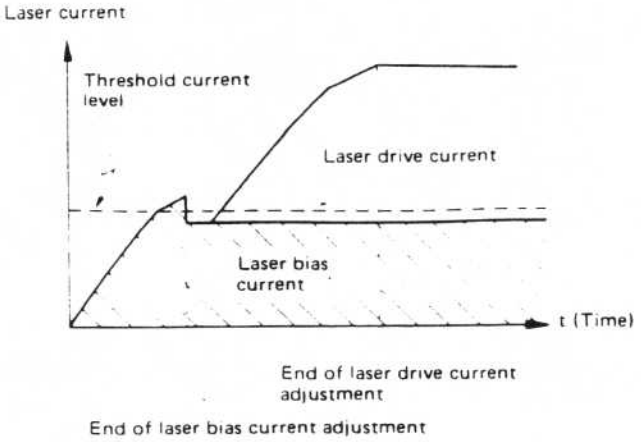


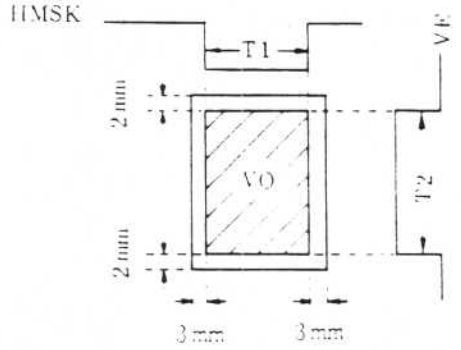
Figure 2-12

b. Laser emission control system
The laser diode emits light in response to the VIDEO ($\overline{VDO}$) signal for a period sufficient to scan the width of the paper being used. Paper size information is inputted from the cassette size sensing switches SW261 to SW263 (signals $\overline{PSIZE1}$ to $\overline{PSIZE2}$).

No.	Cassette size	Cassette holder switch		
		SW261	SW262	SW263
1	A4	OFF	ON	ON
2	Letter	OFF	OFF	ON
3	Cassette not installed	OFF	OFF	OFF

Table 2-5 Coding of Paper Size Information

1) When the main microprocessor (M-CPU) receives a "L" $\overline{PRINT}$ command ($\overline{PRNT}$) from the interface PCB, it outputs the data of the paper information signals to the sub-microprocessor (S-CPU) by an $\overline{SDATA}$ signal.
2) The paper size information is used by the main microprocessor (M-CPU) to output to IC204 a VIDEO ENABLE (VE) command to erase the front and rear edges of the image.
3) The paper size information is used by the sub-microprocessor (S-CPU) to form the DI signal. This goes to IC204, which generates a HORIZONTAL MASK (HMSK) signal, this is used internally in IC204. (HMSK is not outputted.)
4) IC204 modifies the VIDEO signal ($\overline{VDO}$) using the VE and HMSK signals to form signal $\overline{VO}$ which it outputs to the laser drive current switching circuit.
5) When signal $\overline{VO}$ goes "L", the switching circuit passes current to the laser diode, to cause it to emit laser light.
Figure 2-13 shows the relationships among VE, HMSK, and $\overline{VO}$.



Note: Time T1 and T2 vary with the paper size. Time T1 depends on the printing density (300 and 400 DPI).

Figure 2-13

3. Scanner Drive

1. Introduction

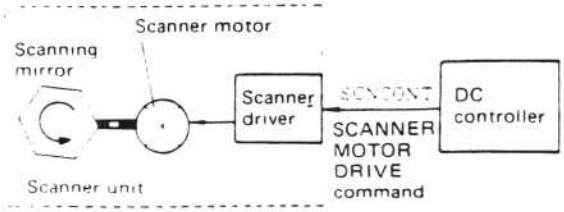


Figure 2-14

The key part of the scanner unit is the scanning mirror, which has the shape of a hexagonal prism with reflective faces. It is mounted on the scanner motor shaft and turned by the motor.

The scanner driver keeps the speed of the scanner motor constant. A special lens system makes the speed of the laser beam across the drum constant.

The scanner driver drives the scanner motor when it is receiving a SCANNER MOTOR DRIVE command (SCNCONT) from the DC controller PCB.

2. Scanner Motor Drive System

Operation

The scanner motor (M3) is a flat-type DC motor.

The M-CPU sets the scanner motor speed to suit the DPI SELECT signal (DPI) from the external device. When signal DPI is H, the scanner motor speed is set for 400 DPI; when the signal is "L", the speed is set for 300 DPI. The speed is changed only when $\overline{PRNT}$ is "H", and is changed only after a complete page has been printed.

The frequency of the signal from a crystal-controlled oscillator (X201) is divided down by IC204 to produce signal DCK, which produces reference frequency signal CPIN for the motor driver.

When $\overline{PRNT}$ (inputted to the DC controller) and $\overline{P}$/S (inputted to the motor driver) are both "L", the motor driver outputs a FREQUENCY CONTROL signal (AFC) and a PHASE CONTROL signal (APC). AFC and APC are summed by an adder amplifier that produces the voltage (SCNCONT) required to drive the scanner motor.

While the scanner motor is rotating, it generates a tacho-generator signal that is fed back to the motor driver (IC207) as FGIN. The signal (frequency and phase) is compared with the reference frequency by the phase locked loop (PLL) IC. If they are different, the speed of M3 is changed until they are equal by changing the effective drive voltage. Motor speed is kept very steady.

Indicator LED201 is ON when the speed is within the correct range.

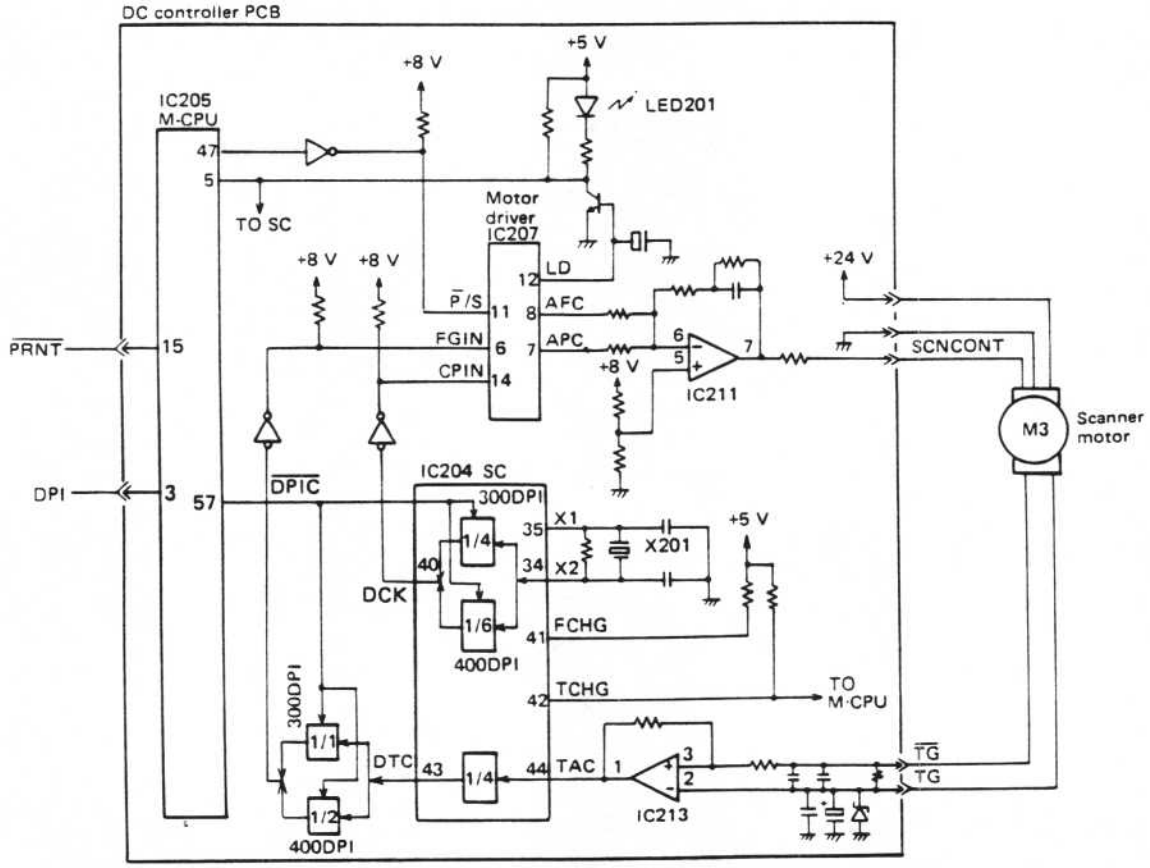


Figure 2-15

Resolution (DPI)	SC (IC204) division ratio	Divider division ratio
300	1/4	1/1
400	1/6	1/2

Table 2-6

The relationship among FGIN, AFC, and APC are given below.

1) AFC output and FGIN frequency

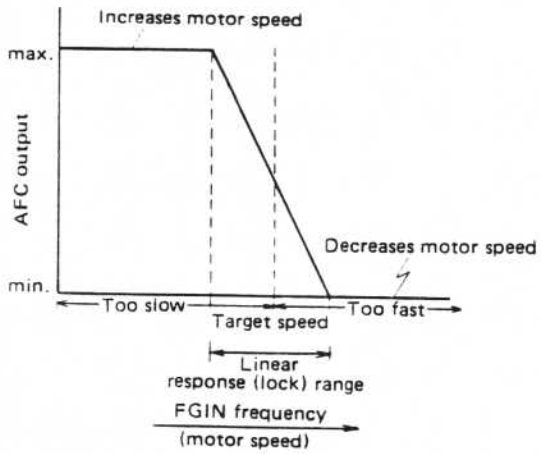


Figure 2-16

2) APC output and phase difference

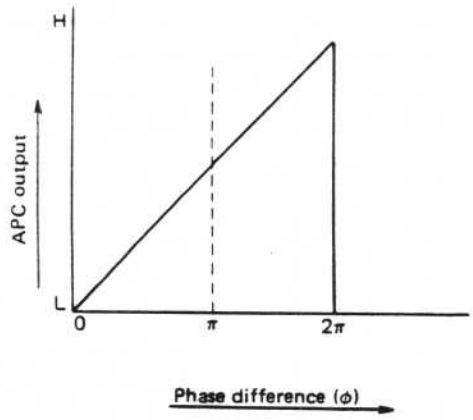


Figure 2-17

The following DPI signals set the resolution of the printer.

	300 DPI	400 DPI
DPI (J205-A9)	L	H
$\overline{\text{DPIC}}$ (IC205-57)	H	L

Table 2-7

III. IMAGE FORMATION SYSTEM

A. Introduction

The image formation system is the main part of the printer, where the image information encoded in a digital signal (VDO) from the interface PCB is transformed into a visible image on the photosensitive drum and subsequently transferred to print paper. In addition to the photosensitive drum, the image formation system includes the developing unit, cleaning unit, and other parts.

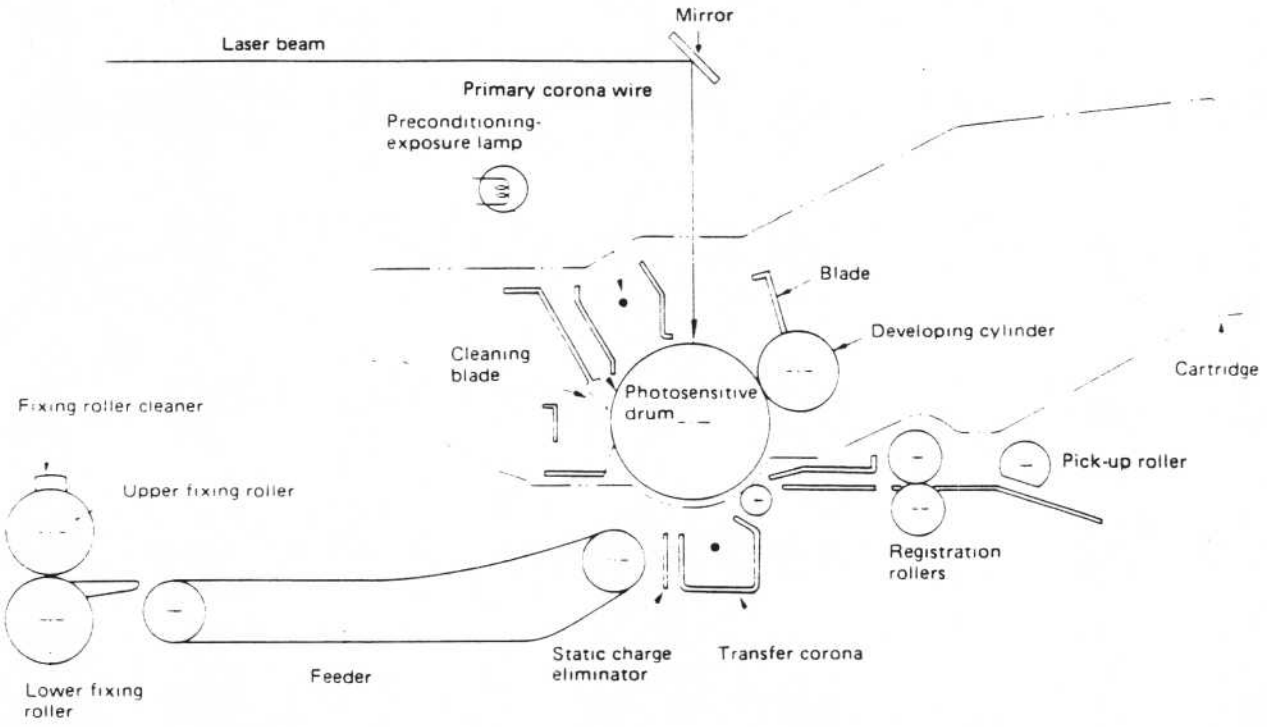


Figure 2-18

B. Printing Process

The cartridge used by the printer has a seamless photosensitive drum with the structure shown in Figure 2-19.

The outer layer consists of an organic photoconductor (OPC); the base is aluminum.

The printing process can be divided into five major stages.

1) Electrostatic latent image formation stage
   - Step 1 Preconditioning exposure
   - Step 2 Primary corona (−)
   - Step 3 Scanning exposure
2) Developing stage
   - Step 4 Development
3) Transfer stage
   - Step 5 Transfer (+)
   - Step 6 Separation
4) Fixing stage
   - Step 7 Fixing
5) Drum cleaning stage
   - Step 8 Drum cleaning

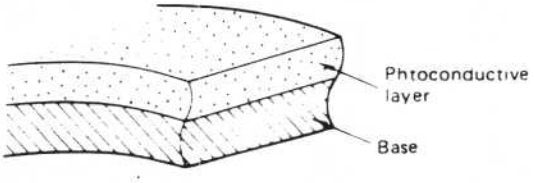


Figure 2-19

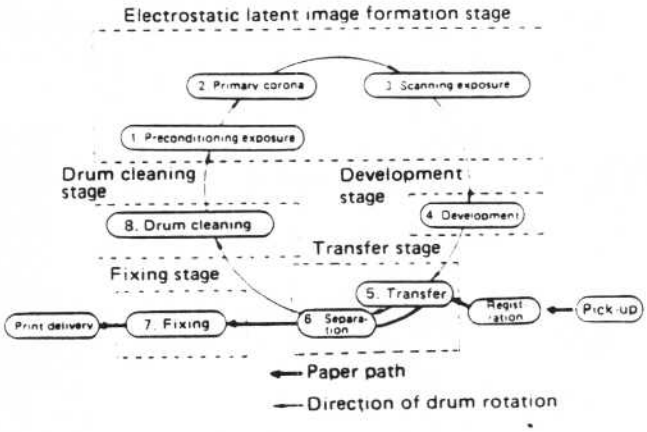


Figure 2-20

1) Electrostatic latent image formation stage

This stage has three steps which together produce a pattern of electrical charges on the photosensitive drum.

At the end of the stage, negative charges remain in the unexposed "dark" areas. Charges are absent from the "light" areas, where the laser beam struck (exposed) the drum surface.

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

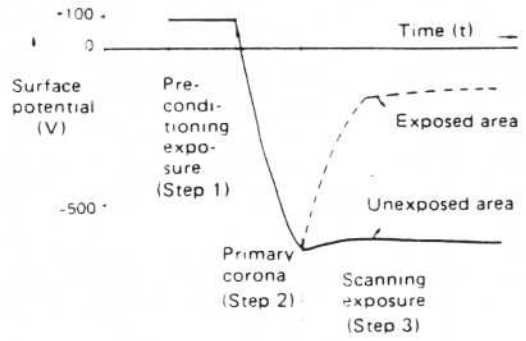


Figure 2-21

Step 1 Preconditioning exposure

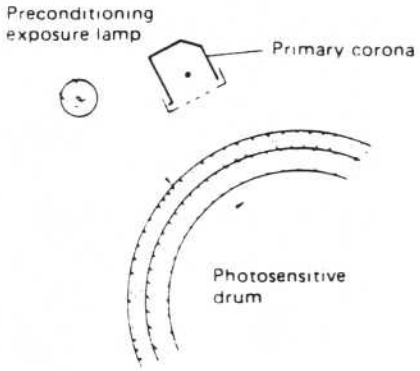


Figure 2-22

Prior to the primary corona step, the drum is preconditioned by exposure to the preconditioning exposure lamps.

This step makes the sensitivity (resistivity) of the drum uniform, and prepares it to receive a uniform charge in the following primary corona step, thus preventing unevenness in the printed image.

Reference:
The drum surface potential before the preconditioning exposure is about +100V because of the residual positive charge from the transfer corona. The preconditioning exposure does not change the drum surface potential, because the photoconductive layer acts as a rectifier and cannot conduct positive charges from the surface to the base.

Step 2 Primary corona

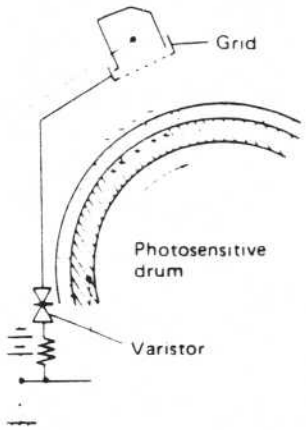


Figure 2-23

The primary corona applies to a uniform layer of negative charges over the drum surface.

The grid ensures that the charge is distributed evenly over the drum.

Step 3 Scanning exposure

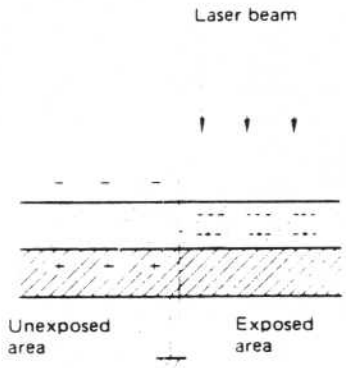


Figure 2-24

When the laser beam scans the drum surface, it causes (by drum processes) the charge to be neutralized in areas struck by the laser beam. Areas on the drum with no charges form the electrostatic latent image.

2) Development stage

Development places particles of toner onto areas of the drum that have been cleared of charges by the laser beam. This makes a visible image, which is subsequently transferred to paper to make the print. This printer uses the toner projection development method with a single-component toner.

Step 4 Development

Note:
The charges on the light area on the photosensitive drum are shown as positive in this figure. In actuality they are negative, but they are more positive than the developing cylinder and explanation is simplified by regarding them as negative.

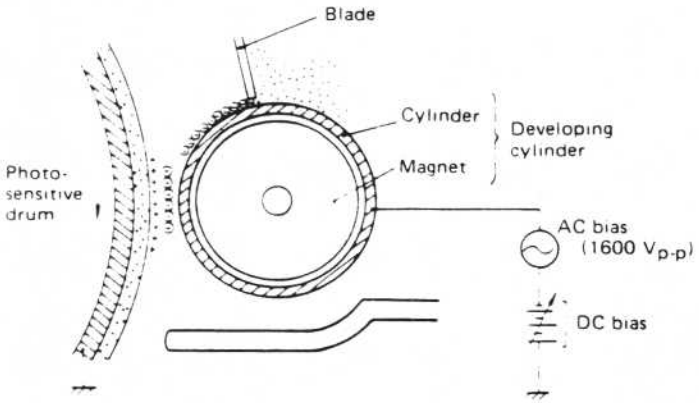


Figure 2-25

As shown in Figure 2-25, the developing unit consists of a developing cylinder and blade. The developing cylinder rotates around a fixed internal magnet.

The single-component toner consists of magnetite and a resin binder and is held to the cylinder by magnetic attraction. The toner is an insulator, and acquires a negative charge by friction due to the rotating cylinder.

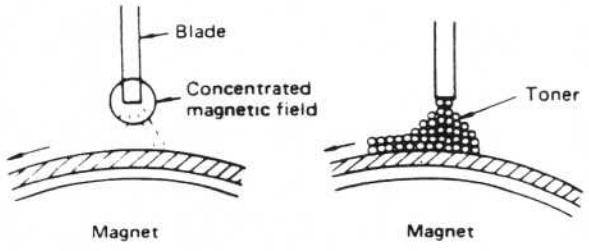


Figure 2-26

A concentrated magnetic field develops between the magnet and the blade and attracts particles to the edge of the blade.

They are held almost immobile, like a curtain. This "curtain" skims the toner particles on the cylinder into a thin, uniform layer.

The areas on the drum that were exposed to the laser beam have a higher potential (are less negative) than the negatively charged toner particles on the developing cylinder. When these areas approach the cylinder, the potential difference projects the toner particles to them. (See Figure 2-25).

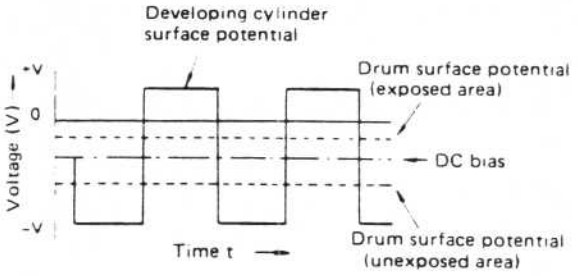


Figure 2-27

An AC bias is applied to the developing cylinder to help project the toner particles to the drum surface and improve the contrast of the printed image.

The AC bias is also applied to the blade to keep the blade and cylinder at the same potential to prevent irregular movement of toner between them.

The center voltage of the AC bias (1600 Vp-p) varies with the DC bias voltage.

Turning the print density adjustment dial changes the DC bias, and thus the potential difference between the cylinder and drum. This changes the density of the print.

Reference: Toner projection development
Actually, both unexposed and exposed areas on the drum surface have a negative potential, but to simplify the explanation, the drum potential is shown as positive when it is higher (less negative) than the developing cylinder potential, and negative when it is lower (more negative) than the developing cylinder potential.

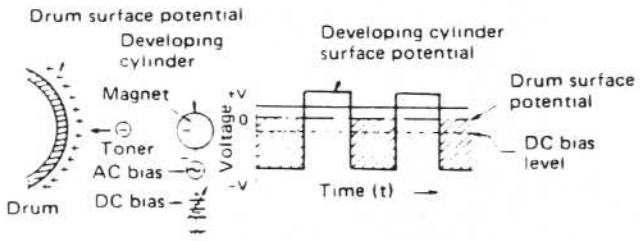
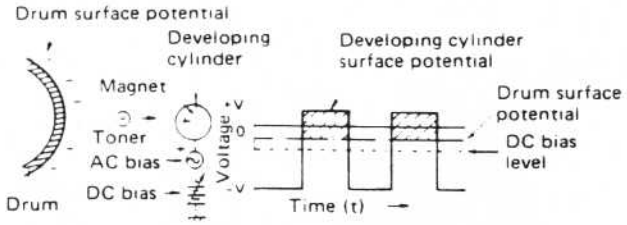
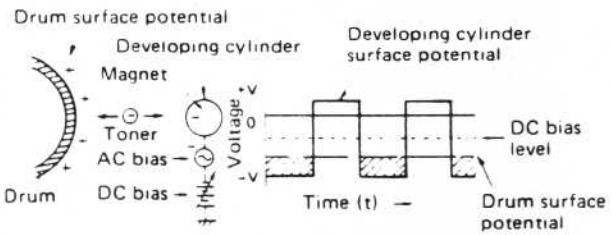
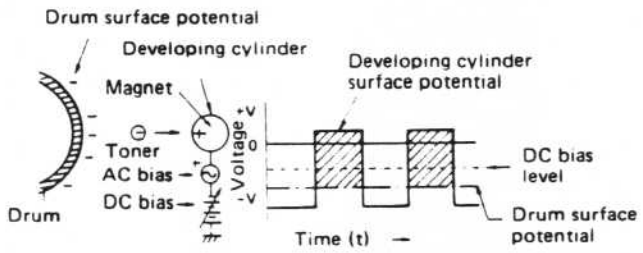
Latent image	Developing bias	Toner movement and electric potentials	Description
Exposed areas	Negative bias		The electrostatic attraction caused by the difference in potential between the drum surface and cylinder is sufficient to overcome the attraction of the magnet, so the toner particles are projected from the cylinder to the drum. The amount of toner projected depends on the DC bias on the cylinder.
	Positive bias		When the bias voltage rises slightly above the drum surface potential, the resulting weak electric field combines with the magnetic field to attract toner from the drum back to the cylinder. This removes any excess toner adhering to the drum, and improves the contrast of the finished print.
Unexposed areas	Negative bias		The drum surface potential is only slightly higher than the cylinder potential, so the magnetic attraction to the cylinder is greater than the attraction toward the drum due to the electric field. Therefore, little toner is projected toward the drum.
	Positive bias		The cylinder bias and the magnetic force now combine to attract the toner strongly to the cylinder, removing excess toner from unexposed areas of the drum and preventing fogging.

Table 2-8

3) Transfer stage

In the transfer stage, the toner image is transferred from the drum surface onto the paper.

Step 5 Transfer

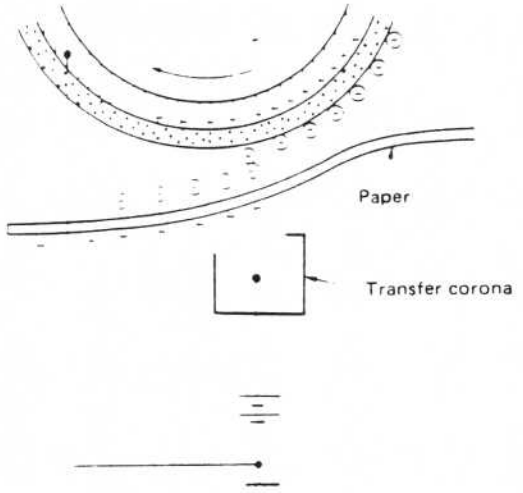


Figure 2-28

A positive corona discharge applied to the back of the paper attracts the negatively charged toner particles to the paper.

Step 6 Separation

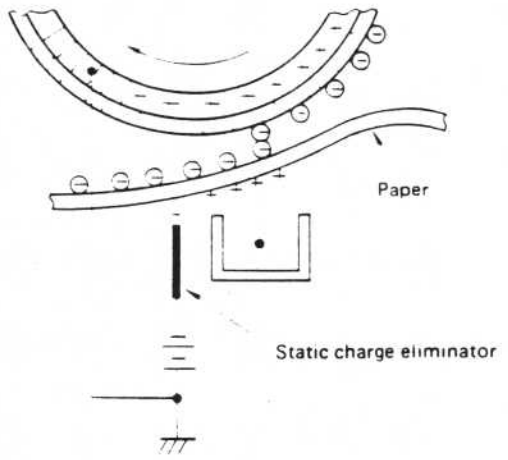


Figure 2-29

The stiffness of the paper causes it to separate from the drum. However, thin paper has low stiffness, and may wrap around the drum. To prevent this, separation is assisted by a negative voltage from a static charge eliminator that weakens the attractive force between the paper and the drum.

4) Fixing stage

The toner image transferred onto the paper in the transfer stage is held only by electrostatic attraction and slight physical adhesion, so even a light touch will smear the image.

In the fixing stage, the toner image is fixed by heating the paper and applying pressure. This fuses the toner particles onto the paper to make a permanent image.

Step 7 Fixing

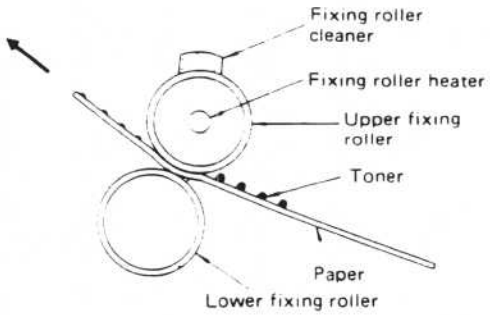


Figure 2-30

The surface of the upper fixing roller is coated with non-sticking PTFE resin, and the fixing roller cleaner applies a further coating of silicone oil. The resin surface and oil keep the paper from sticking to the roller and prevent offsetting.

5) Drum cleaning stage

In the transfer stage, not all the toner is transferred to the paper. Some remains on the photosensitive drum.

This residual toner is cleaned off in the drum cleaning stage so that the next print image will be clear and distinct.

Step 8 Drum cleaning

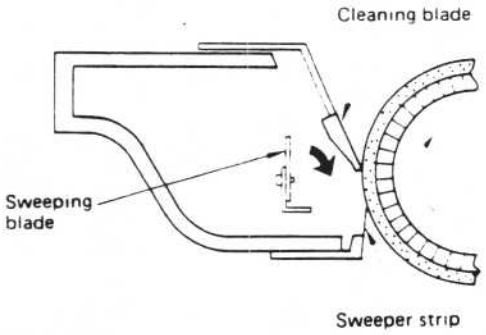


Figure 2-31

Toner remaining on the drum surface is removed by the cleaning blade. The scraped-off toner is collected by the sweeper strip and pushed away from the drum by the sweeping blade.

C. Operation

When the DC controller receives a PRINT command (PRNT) from the external device, the DC controller activates the main motor to rotate the photosensitive drum and developing cylinder, and the processes just described take place.

To compensate for variation of sensitivity of drums (due to normal manufacturing variations), the DC controller needs to adjust the laser beam intensity. A cartridge has one, two or no cams that actuate one, both, or none of two switches (SW301 and SW302) to signal the drum sensitivity.

The cartridge also has a toner sensor. When the output from this sensor falls below a certain level, the printer sets status 15 bit 6 to 1 and informs the external device that the printer is almost out of toner and that the cartridge will soon need to be changed.

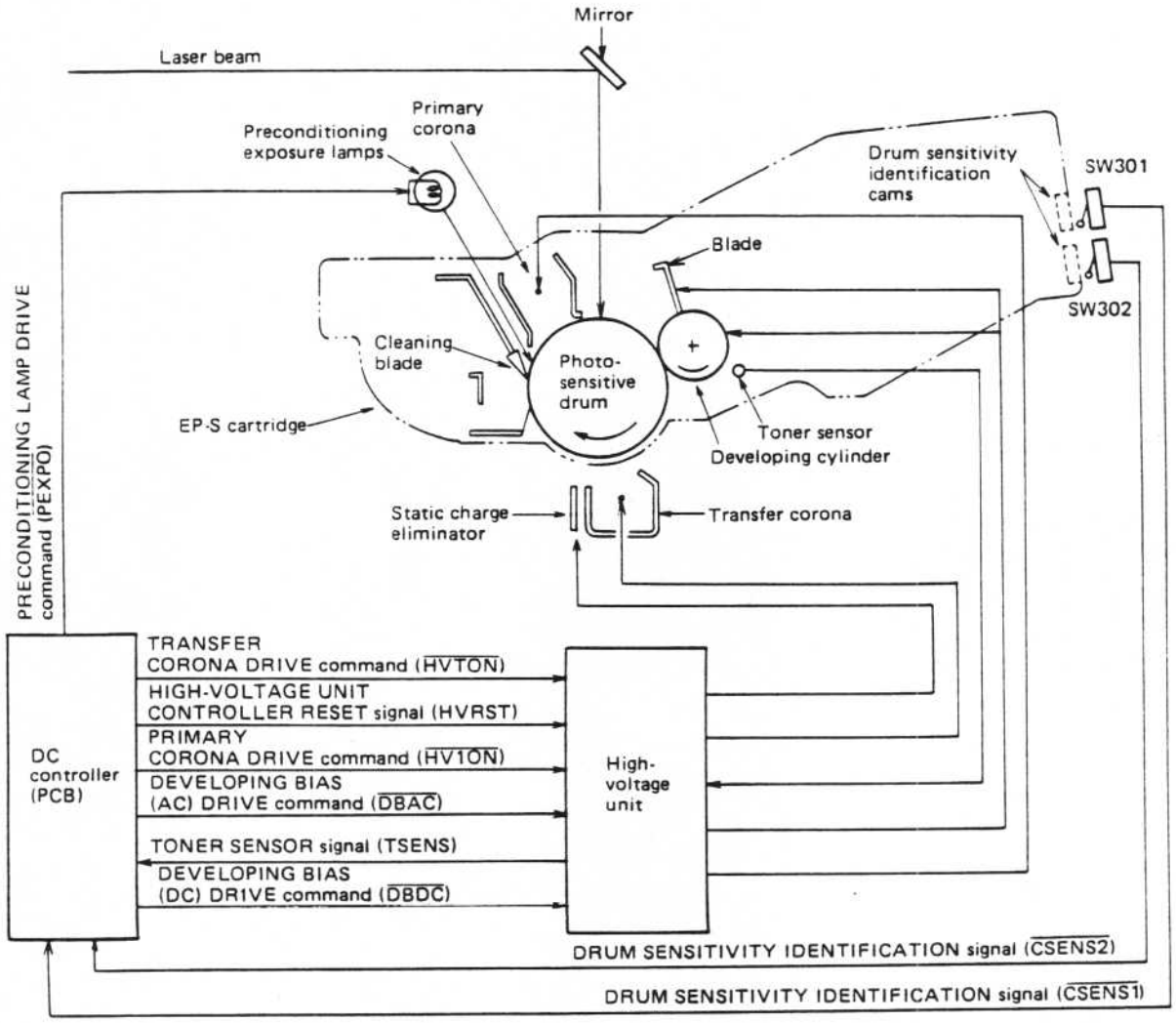


Figure 2-32

■ Sequence of Operations

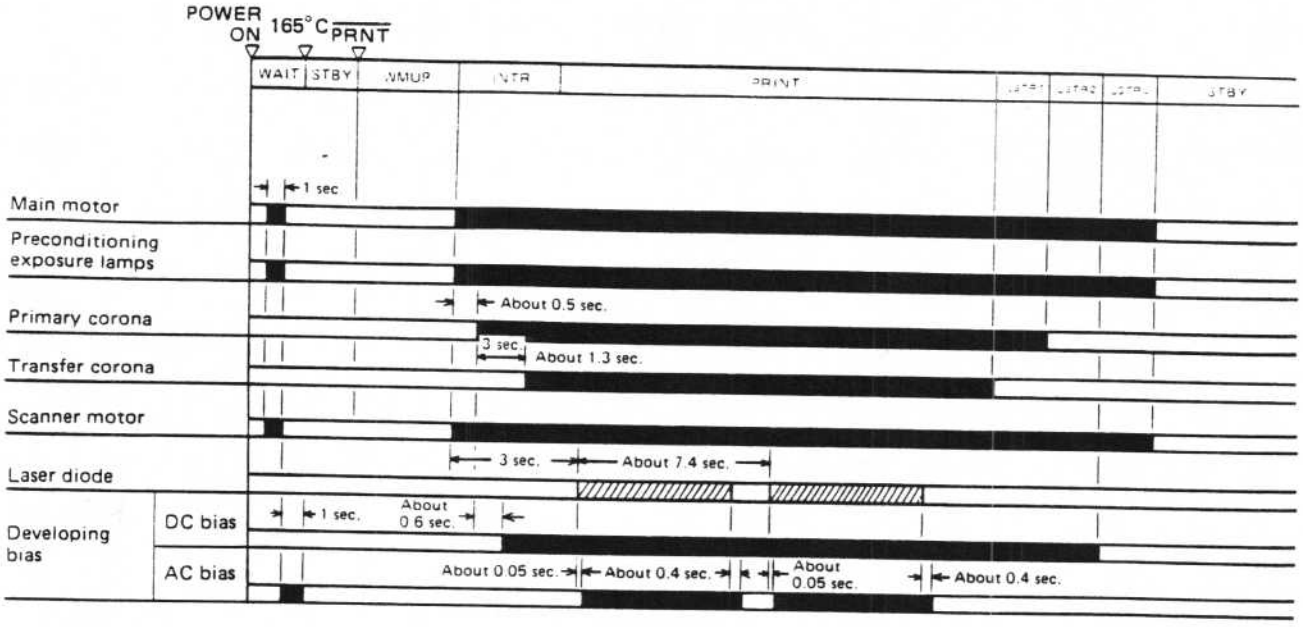


Figure 2-33

Note: Timing chart for two consecutive prints on A4 paper.

D. High-Voltage Power Supply

1. Outline

The high-voltage power supply provides high-voltage DC power to the primary corona and transfer corona when instructed by the main microprocessor (M-CPU) on the DC controller PCB. It also supplies the developing cylinder with DC and AC bias voltages.

In addition, it also houses the amplifier for the TONER SENSOR signal coming from the toner sensor in the cartridge, and feeds it back to the main microprocessor (M-CPU) to notify it when the remaining toner supply is inadequate.

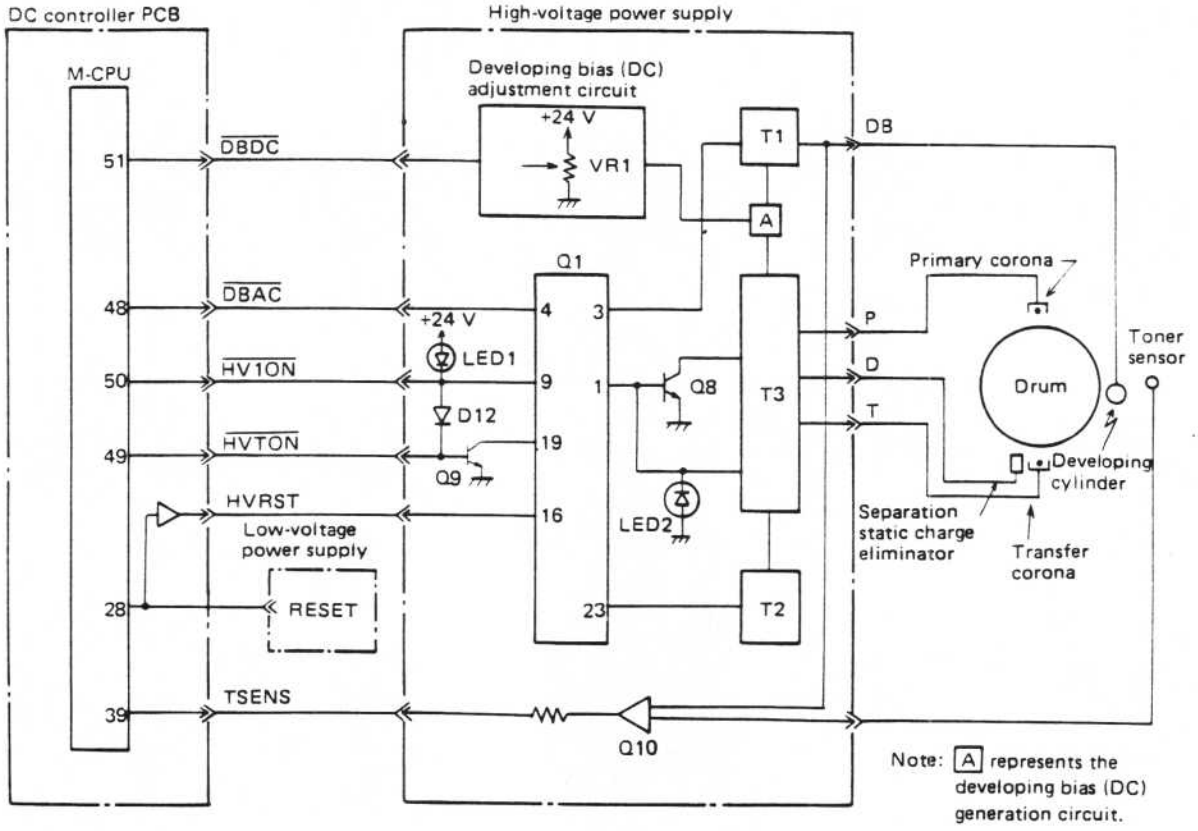


Figure 2-34

2. Principle of Operation

1) Primary corona voltage

When the PRIMARY CORONA ON command ($\overline{\text{HV1ON}}$) from the main microprocessor (M-CPU) of the DC controller to the hybrid IC (Q1) of the high-voltage power supply is "L", a train of pulses is outputted from pin 1 of Q1 to the primary windings of transformer (T3). (LED1 goes ON when $\overline{\text{HV1ON}}$ is "L".) The secondary windings of T3 output voltage P for the primary corona discharge. (LED2 is ON while there is an output from Q1-1.)

2) Transfer corona voltage

When the TRANSFER CORONA ON command ($\overline{\text{HVTON}}$) from the main microprocessor (M-CPU) to Q1-9 is "L" (pin Q1-19 "H"), a train of pulses is outputted from pins 1 and 23 of Q1 to the primary of transformers T3 and T2, respectively.

The output from T2 is added to that of T3 to produce voltage T for the transfer corona discharge.

3) Developing bias voltage

When the PRIMARY CORONA ON command ($\overline{\text{HV1ON}}$) goes "L", AC voltage from T3 is also outputted to the DC developing bias generating circuit.

When the DC DEVELOPING BIAS DRIVE ($\overline{\text{DBDC}}$) command from the main microprocessor (M-CPU) is "L" as required during the printing process, the DC voltage set by variable resistor (VR1) is outputted from the DC developing bias generating circuit and added to the output from the secondary of transformer (T1).

When the AC DEVELOPING BIAS DRIVE ($\overline{\text{DBAC}}$) command from the M-CPU is "L", a square wave is outputted from pin 3 of Q1 to T1.

This AC developing bias is added to the DC developing bias to form the developing bias (DB), which is applied to the developing cylinder.

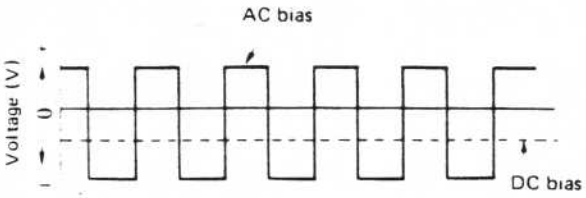


Figure 2-35 Developing Bias

4) Toner Sensor system
The toner sensor is responsive to the electric field of the bias on the developing cylinder. When there is toner between the cylinder and sensor, the field sensed by the sensor is strong; when there is insufficient toner, the sensed field is weak. The voltage (analog) of signal TSENS is proportional to the strength of the field sensed by the toner sensor, and informs the main microprocessor (M-CPU) of the amount of toner.

IV. PICK-UP/FEED SYSTEM

A. Outline

The presence and size of the cassette installed in the cassette holder are sensed by the three switches (SW261, SW262, SW263) mounted on the cassette holder. The presence of paper in the cassette is sensed by photointerrupter PS301, and the presence of paper on the manual feed tray is sensed by photointerrupter PS302. If the cassette contains paper, or a sheet is placed on the manual feed tray, the pick-up roller clutch solenoid (SL301) goes ON, causing the clutch to engage and the pick-up roller to start rotating, thus feeding a sheet of paper into the printer.

The paper is fed by the registration rollers so that the leading edge of the paper is aligned with the leading edge of the toner image on the photosensitive drum, and the toner image is transferred to the paper. The paper is then separated from the drum, carried by the feeder to the fixing unit, and delivered by the delivery unit onto the delivery tray. Delivery of the print is sensed by the delivery unit paper sensor (PS331). If the print does not reach or clear the delivery unit paper sensor within the preset time, the microprocessor on the DC controller assumes a paper jam has occurred. The printer notifies the external device of the jam by sending a status signal to the device.

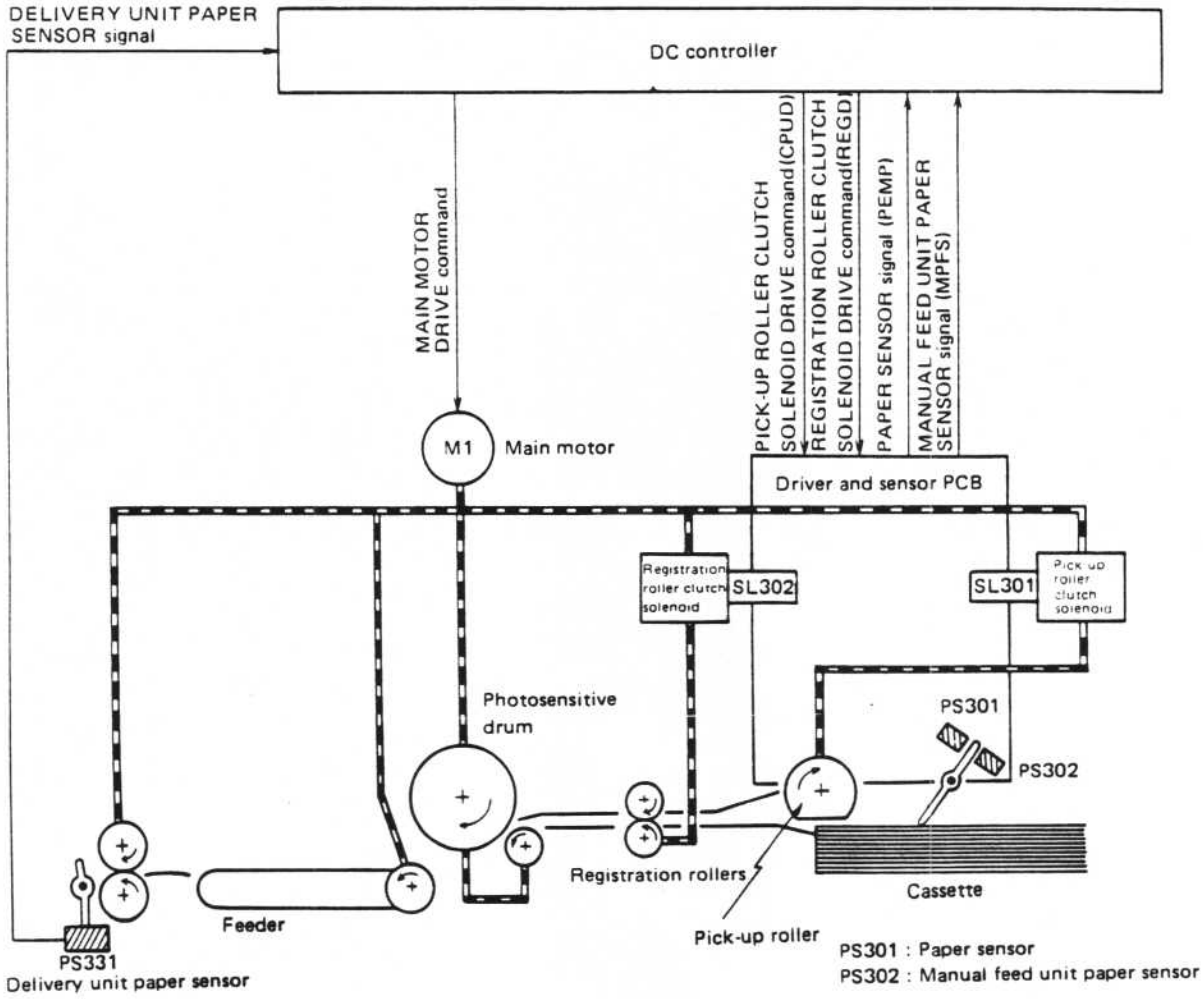


Figure 2-36

B. Cassette/Manual Feed

If there is a cassette with paper in the cassette holder, and the upper fixing roller has reached the required temperature, the printer makes the $\overline{RDY}$ signal TRUE. When a "L" $\overline{PRNT}$ signal is inputted from the external device to the DC controller PCB, the heater is switched ON again until the roller temperature reaches 175°C, then the M-CPU makes signal $\overline{MON}$ "L" to operate the main motor (M1). About 2 seconds later, the M-CPU makes the CPUD signal "H" and actuates the pick-up roller clutch solenoid (SL301).

The main motor (M1) turns the pick-up roller one turn, feeding a sheet of paper to the registration rollers. The registration rollers are not turning when the paper reaches them, so the paper arches up, aligning itself along the rollers. About 2.9 seconds after the $\overline{PRNT}$ signal, the registration roller clutch solenoid (SL302) is actuated, and the registration rollers rotate, feeding the sheet of paper toward the photosensitive drum.

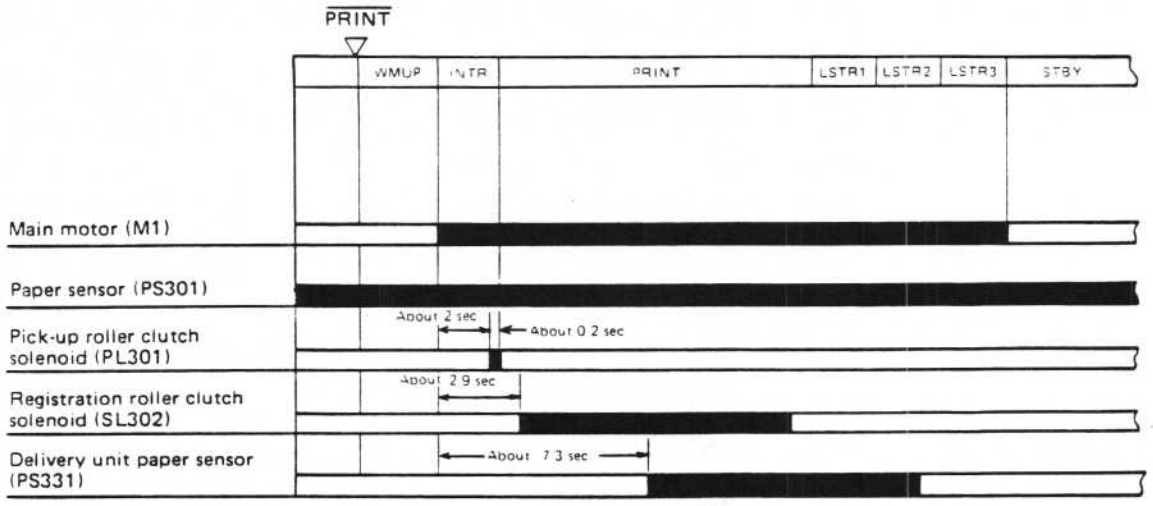


Figure 2-37

Notes: 1. This timing chart is for the pick-up of one sheet.
2. The timing of operations for manual feed is identical to that for cassette feed except for the paper sensor:
   Cassette feed. . . . . Paper sensor (PS301)
   Manual feed . . . . . Manual feed unit paper sensor (PS302)

C. Fixing Roller Heater Controller

1. Outline

The controller operates the fixing roller heater (H1) so as to maintain the fixing roller at a constant (target) temperature. The target temperature depends on the stage in printing operation. In the STANDBY (STBY), the temperature is held at 165°C. During the INITIAL ROTATIONS (INTR), PRINTING ROTATIONS (PRINT) and LAST ROTATIONS (LSTR) periods, the target temperature is 180°C.

2. Principle of Operation

Since the contacts of relay (RL101) of the AC controller are normally closed, when the DC controller outputs the FIXING ROLLER HEATER DRIVE ($\overline{\text{FSRD}}$) command, the solid-state relay (SSR101) operates causing triac (Q101) to conduct and supply AC line voltage to the fixing roller heater (H1).

The resitance of thermistor (TH1) indicates the surface temperature of the upper fixing roller (analog voltage signal) to the DC controller. With this feedback, the DC controller can maintain the roller at the temperature required at the current stage of printing operation.

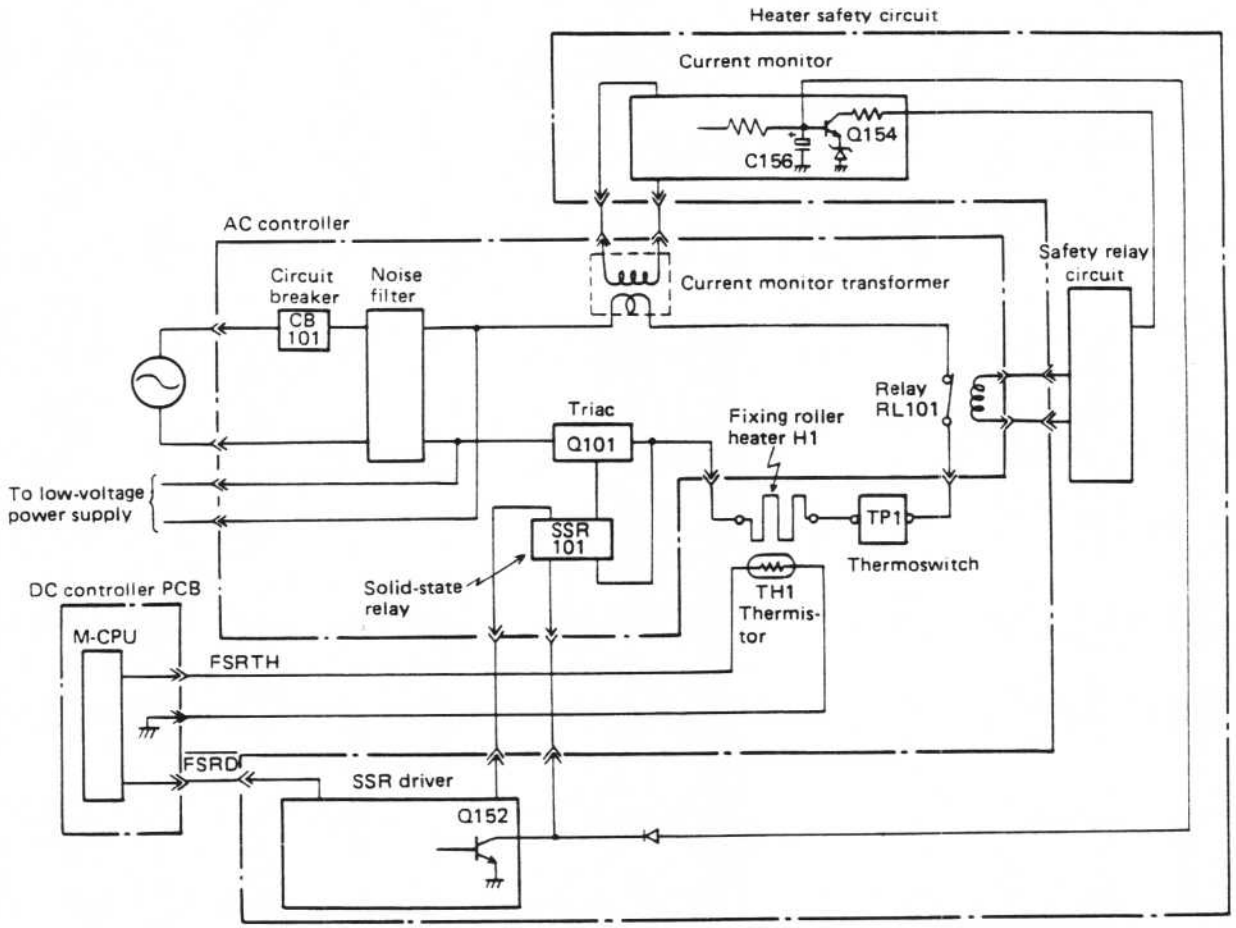


Figure 2-38

3. Protection System

Safety requires that the fixing roller be prevented from overheating.

The following functions protect against this problem.

1) Protection against short-circuited Q101
The current flowing through the fixing roller heater (H1) is constantly monitored via the current monitor transformer. In the event of excessive current flow, capacitor (C156) of the current sensing circuit charges up. When C156 reaches full charge, the voltage on the base of transistor (Q154) is more than about 3.5V. This is high enough to switch Q154 ON and actuate the safety relay circuit, opening the safety relay (RL101) and cutting the current through the fixing roller heater. As long as the heater controller is operating normally, signal $\overline{\text{FSRD}}$ holds transistor Q152 ON, which holds the voltage on capacitor (C156) low, so Q154 stays OFF because the voltage on its base does not rise over about 3.5V.

2) Protection against overheating
Thermoswitch (TP1) switches OFF at a temperature of 210°C ±10°C. If the fixing roller temperature rises above this point, TP1 cuts off the current to the fixing roller heater.

3) Overcurrent protection
This is a circuit breaker (CB101) in the power line supplying the fixing roller heater (H1). If the current becomes excessive, CB101 trips, cutting off power to the fixing roller heater.

4. Monitoring fixing roller heater temperature

If any of the following conditions occurs, the printer identifies the state as error and sets status 2 bit 2 to 1, which stops the printer.

1) If the fixing roller temperature does not rise to 5°C within 18 seconds after the heater goes ON.
2) If the fixing roller temperature does not rise to 165°C within 180 seconds after the heater goes ON.
3) If the fixing roller temperature rises above 230°C
4) If the fixing roller temperature drops below 140°C after the roller has heated up.

Note:
As a safety measure (to prevent overheating of the fixing rollers), the roller heater will not operate, even if the printer is switched OFF, then ON, in quick succession. If it is desired to cause the heater to operate for servicing purposes, switch the printer OFF for at least 10 minutes, then ON.

D. Paper Jam Detection

The delivery unit paper sensor (PS331) detects whether paper is feeding normally. The microprocessor (M-CPU) determines whether paper is jammed by checking whether paper is present or absent at the sensor at times stored in memory.

1) Paper does not reach the delivery unit paper sensor by the required time. (Delivery unit delay jam)
2) Paper does not clear the delivery unit paper sensor by the required time. (Delivery unit stationary jam)
3) There is a sheet of paper at the delivery unit paper sensor when the power is switched ON. (The paper is automatically fed out if the fixing unit temperature is greater than the specified temperature.)
4) There is still a sheet of paper at the delivery unit paper sensor after the paper should have been cleared by automatic paper delivery.
5) The delivery cover has been open for 10 seconds or more.

If it detects a jam, the microprocessor (M-CPU) immediately stops the main motor (M1) and sends a JAM status signal to the external device.

1) Delivery unit delay jam

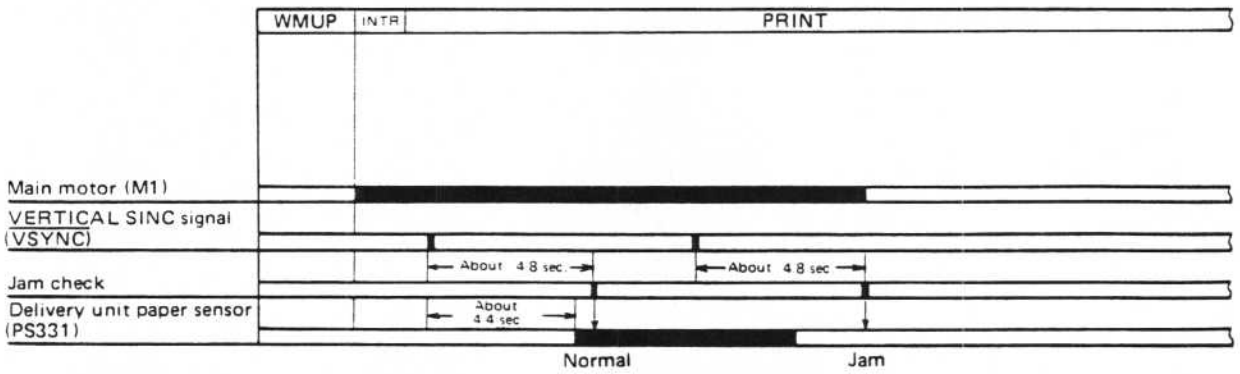


Figure 2-39

2) Delivery unit stationary jam

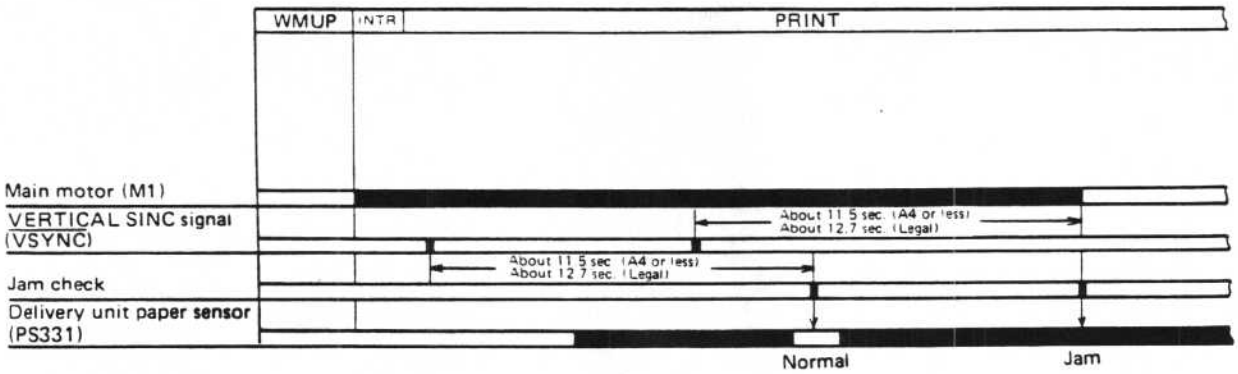


Figure 2-40

V. POWER SUPPLIES

A. Outline

When the low-voltage power supply is activated by a signal from the external device, it produces +5VDC, −5VDC, and +24VDC supplies. The power supply also generates the reset signal (RESET) to reset the printer at the following times:

1) When the power is switched ON.
2) When the power supply is momentarily interrupted.

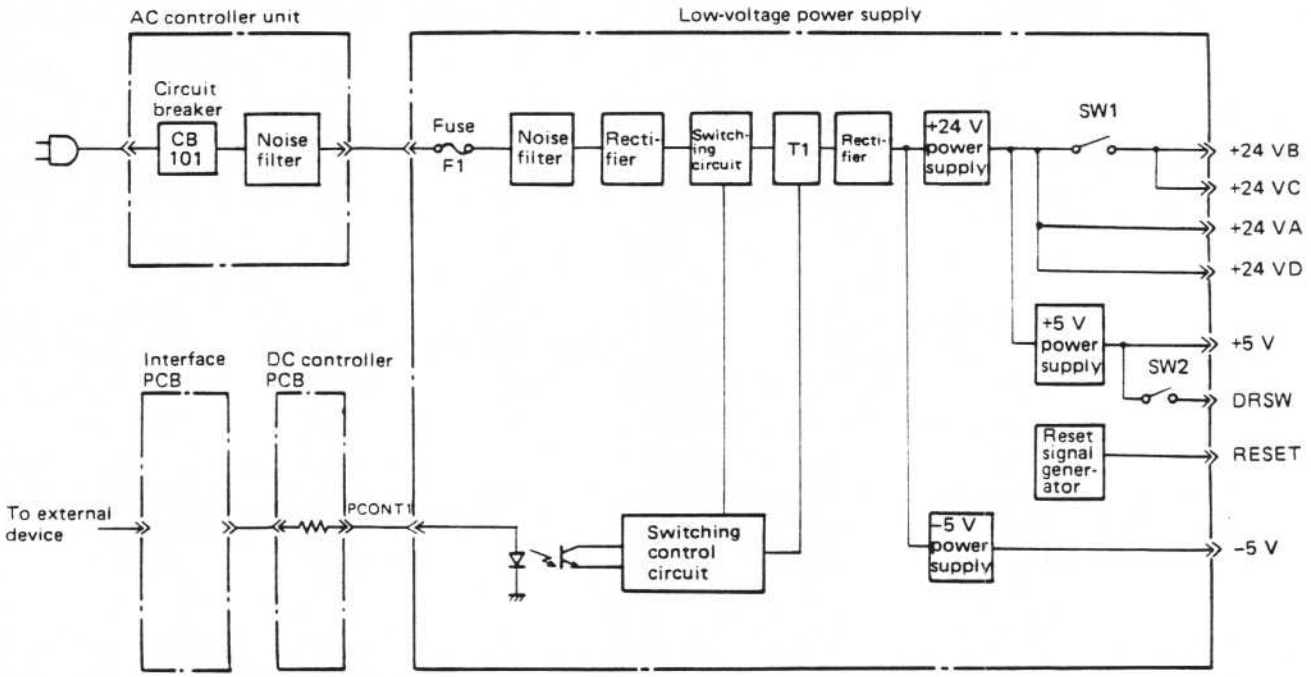


Figure 2-41

B. Protective System

If a short circuit or other fault causes excessive current flow from the +5VDC, −5VDC, or +24VDC power supply, the overcurrent protection system automatically shuts off the output to protect the power supply. To reset the power supply when this system has operated, it is necessary to switch the printer power OFF by a signal from the external device, correct the problem in the faulty component, then switch the power back ON again.

CHAPTER 3

THE MECHANICAL SYSTEM

This chapter explains mechanical operation, and disassembly and reassembly of the printer. Note the following precautions during dissasembly or reassembly.

1. Remove the EP-S cartridge and font cartridge from the printer before disassembling or transporting it. When the cartridge is removed, be sure to close the light-blocking shutter and to keep the cartridge in its original box. If the box is not available, cover the cartridge with a cloth or put it in a dark place to prevent light from affecting the drum inside the cartridge.
2. Disconnect the printer from the wall outlet before servicing it.
3. Note the lengths, diameters, and locations of screws. Use them in their original locations when reassembling the printer.
4. Do not operate the printer with any part removed.
5. To protect the laser device from static electricity, connect the shorting connector to laser connector J202 when J202 is disconnected.
6. Assembly is the reverse of disassembly unless specifically noted.

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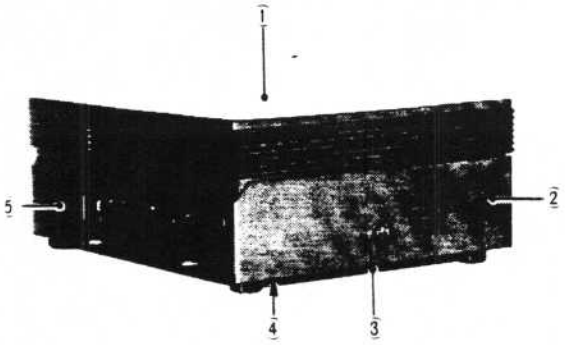
I. EXTERNALS

A. Covers and Panels



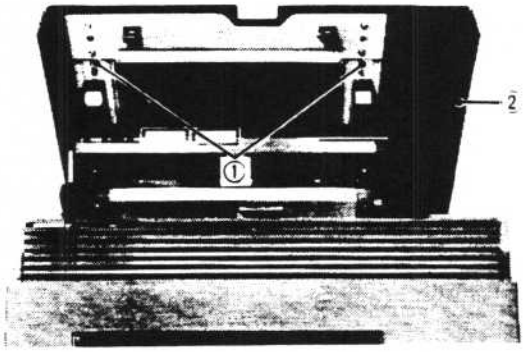
① Upper cover (2)
② Lower cover (8)
③ Front bottom cover (2)
④ Base cover (14)
⑤ Delivery unit cover (1)

Figure 3-1

Note:
Throughout this section, a number enclosed in parentheses represents the number of screws to be removed or loosened in the corresponding step.

When cleaning inside the printer, or inspecting or repairing it, remove appropriate covers and/or panels as described below. The procedure for removing a cover that can be taken off simply by removing screws is omitted.

1. Upper cover
   1) Open the printer.
   2) Remove the two screws from the upper cover.

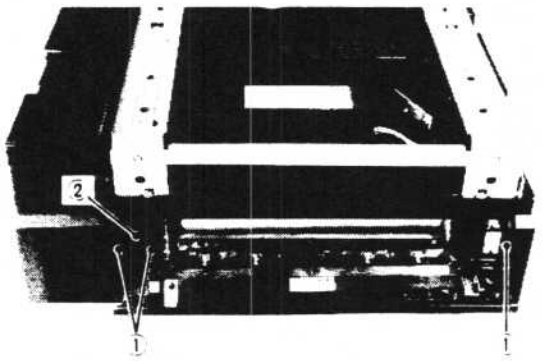


① Screws ② Upper cover

Figure 3-2

3) Push up on the upper cover with both hands to release the four round tabs from the holes, then push the cover backward to release the other two tabs, and remove the cover.

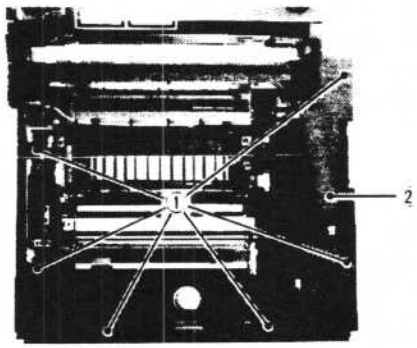
2. Lower cover
   1) Remove the upper cover. (2)
   2) Open the delivery unit, and remove the AC wiring cover. (1)
   3) Remove the two screws that secure the lower cover.



① Screws ② AC wiring cover

Figure 3-3

4) Open the printer.
5) Remove the six screws that secure the lower cover and remove the lower cover.



① Screws ② Lower cover

Figure 3-4

3. Base cover
   1) Lay the printer on the pick-up unit side.

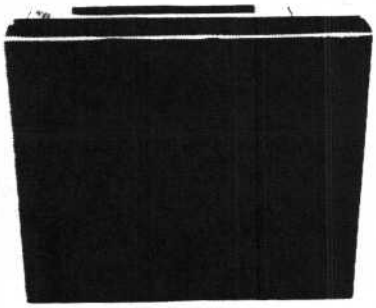
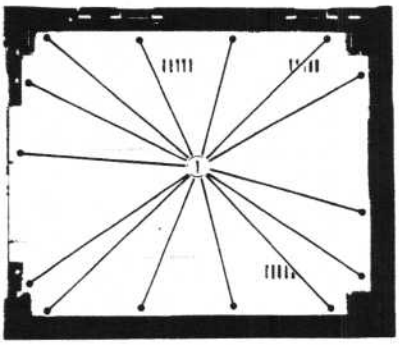


Figure 3-5

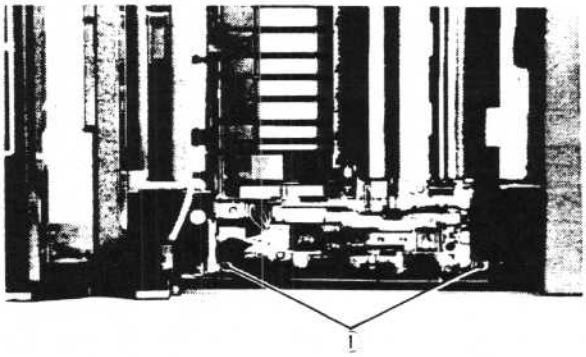
   2) Remove the fourteen screws and remove the base cover.



① Screws

Figure 3-6

4. Front bottom cover (blanking plate for the test connector slot and TEST PRINT button).
   1) Remove the upper cover.
   2) Remove the two screws and remove the front buttom cover.

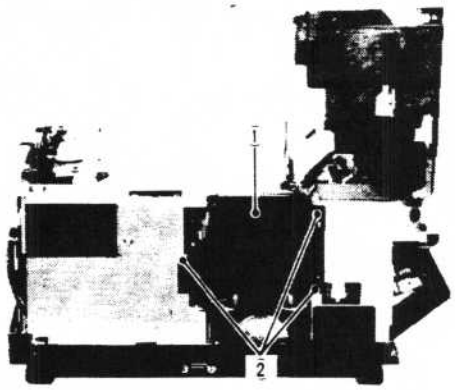


① Screws

Figure 3-7

B. Fan (FM1)

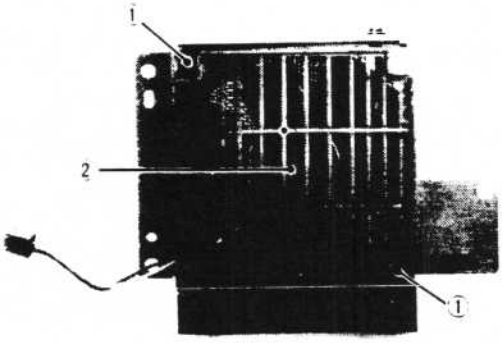
1) Open the printer.
2) Remove the upper cover and lower cover.
3) Remove the ozone filter.
4) Remove the three screws and remove the fan mounting plate.



① Ozone filter ② Screws

Figure 3-8

5) Disconnect the connector (J153).
6) Remove the two screws and remove the fan-motor unit (FM1).



① Screws ② Fan-motor unit (FM1)

Figure 3-9

C. Ozone Filter

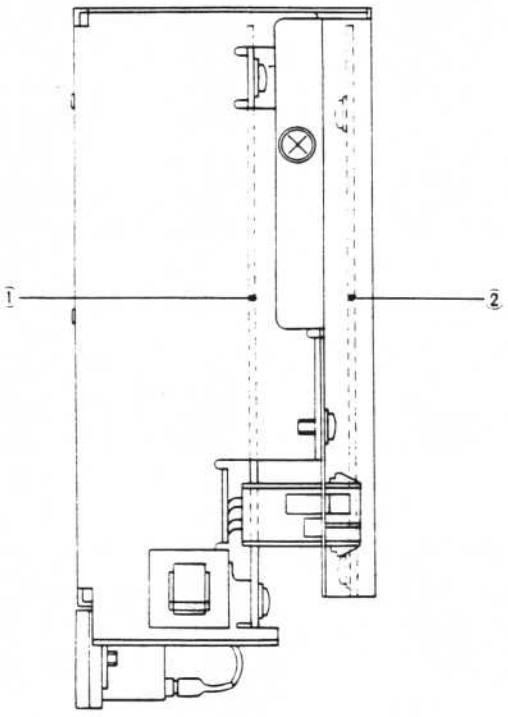
1) Open the printer.
2) Replace the ozone filter.

① Ozone filter

Figure 3-10

D. AC Controller Unit

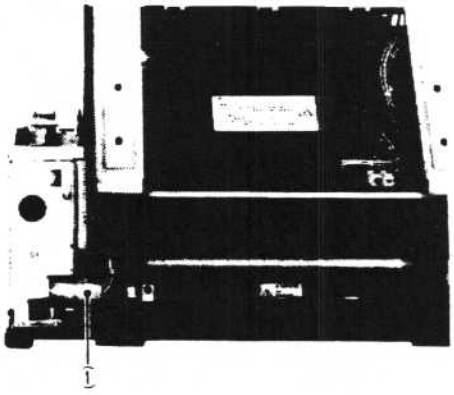
1. Configuration
   The AC controller unit is connected to the AC power lines. It is configured as shown below.



① AC controller PCB ② Safety PCB

Figure 3-11

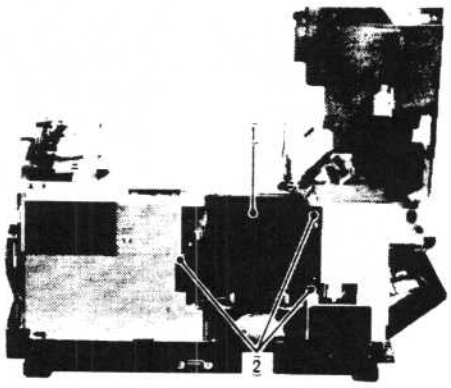
2. Removing the AC controller unit
   1) Open the printer.
   2) Remove the upper cover and lower unit.
   3) Disconnect the connector (J112).



① Connector (J112)

Figure 3-12

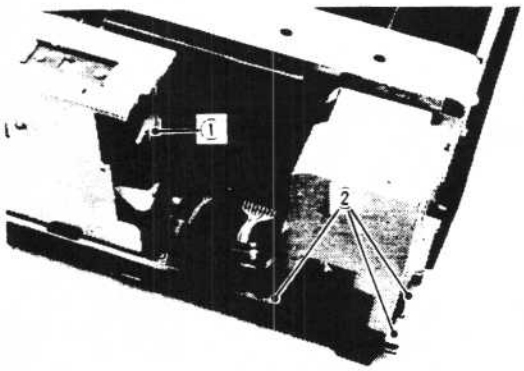
   4) Remove the ozone filter.
   5) Remove the fan mounting plate. (3)



① Ozone filter ② Screws

Figure 3-13

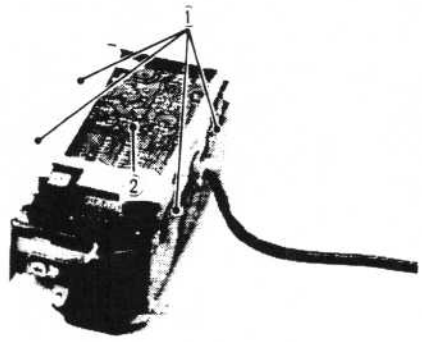
   6) Disconnect the connector (J601).
   7) Remove the three screws and remove the AC controller unit from the base plate.



① Connector (J601) ② Screws

Figure 3-14

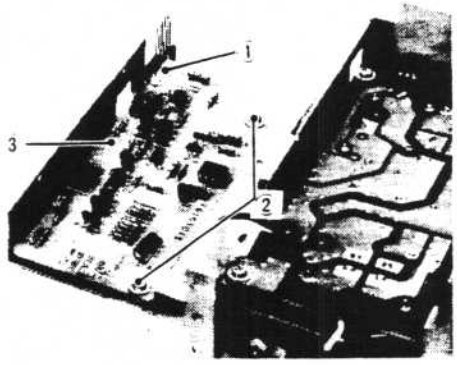
3. Disassembly and reassembly
   1) Remove the four screws.



① Screws ② Safety PCB

Figure 3-15

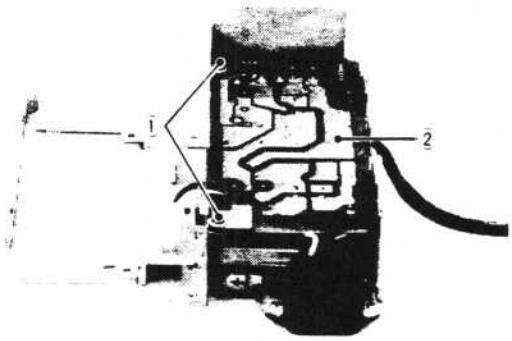
2) Remove the connector (J152) from the AC controller PCB and separate the safety PCB from the AC controller PCB.
3) Remove the two screws and remove the safety PCB.



① Connector (J152) ③ Safety PCB
② Screws

Figure 3-16

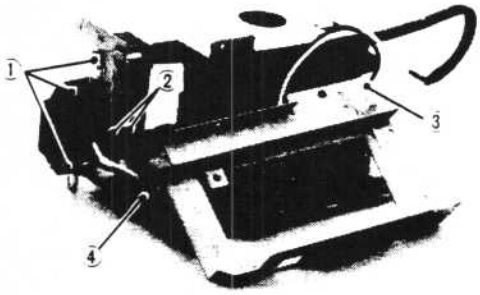
4) Remove the two screws and remove the AC controller PCB from the PCB cover.



① Screws ② AC controller PCB

Figure 3-17

5) Remove the three screws and two spade terminals, disconnect the connector, and separate the AC controller PCB.



① Screws ③ Connector
② Spade terminals ④ AC controller PCB

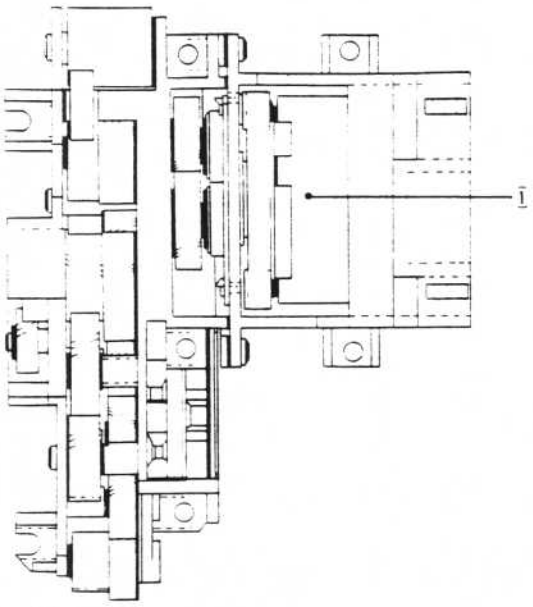
Figure 3-18

II. DRIVE SYSTEM

A. Main Motor Unit

1. Configuration

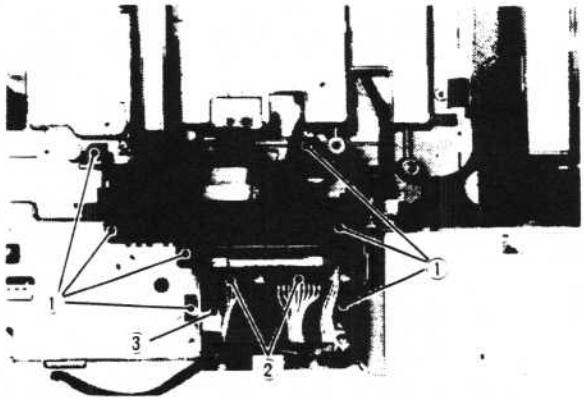
The main motor drives the photosensitive drum, fixing rollers, and delivery rollers. It is configured as shown below.



① Main motor

Figure 3-19

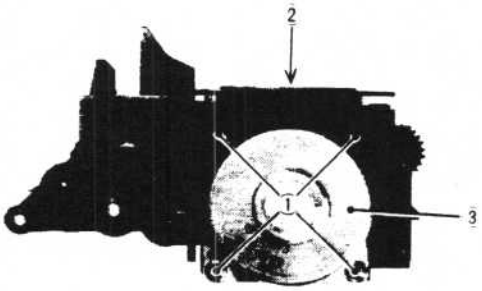
2. Removing the main motor unit
   1) Open the printer.
   2) Remove the upper cover and lower cover.
   3) Remove the sensor/power supply unit.
   4) Remove the pick-up roller unit.
   5) Remove the feed guide unit.
   6) Remove the fixing unit.
   7) Remove the seven screws, disconnect the two connectors, and remove the main motor unit.



① Screws
② Connectors
③ Main motor unit

Figure 3-20

3. Disassembly and reassembly
   1) Remove the four screws and the sheet, then separate the main motor from its mount.



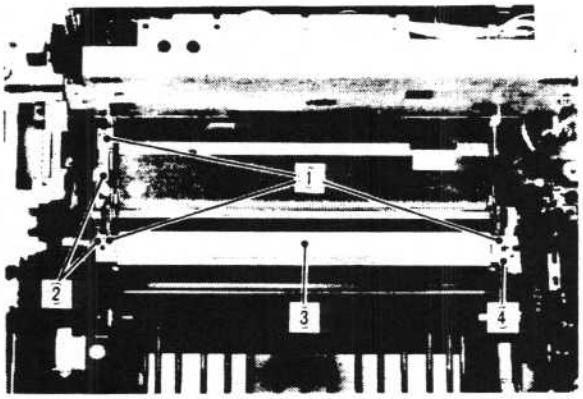
① Screws
② Sheet
③ Main motor

Figure 3-21

III. PAPER TRANSPORT SYSTEM

A. Pick-Up Roller Unit

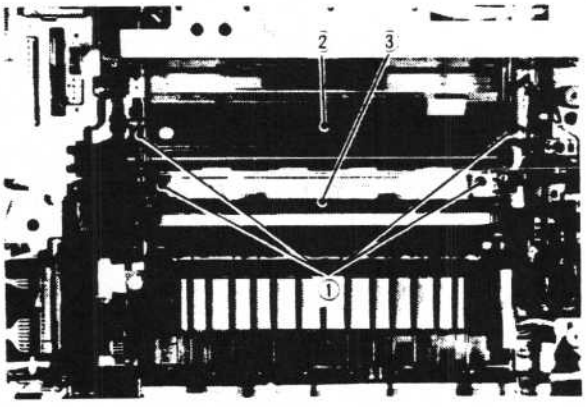
1. Removing the pick-up roller unit
   1) Open the printer.
   2) Remove the upper cover and lower cover.
   3) Remove the sensor/power supply unit.
   4) Remove the three screws and remove the two springs, the upper transfer guide, and the lower transfer guide.



① Screws
② Springs
③ Upper transfer guide
④ Lower transfer guide

Figure 3-22

   5) Remove the four screws and remove the pick-up roller unit.

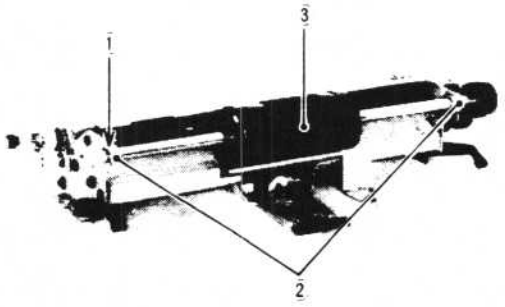


① Screws
② Pick-up roller unit
③ Auxiliary feed roller

Figure 3-23

Note:
When removing the pick-up unit, be especially careful not to press or force the auxiliary feed roller, for its mounts can easily be damaged, and its position must be set accurate using special gauges.

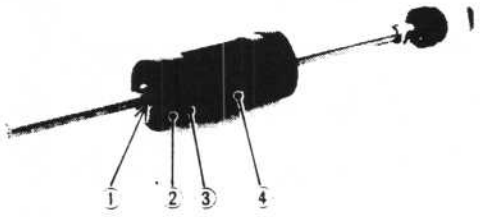
2. Disassembly and reassembly
   a. Pick-up roller
      1) Remove the E-ring and two bushings, and remove the pick-up roller and pick-up roller shaft together.



① E-ring
② Bushings
③ Pick-up roller

Figure 3-24

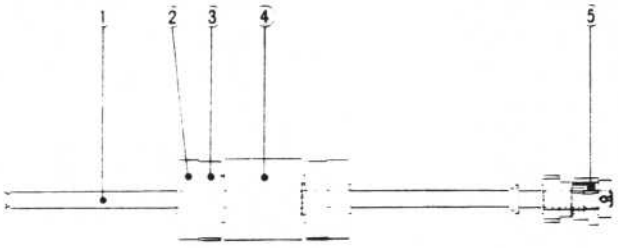
      2) Remove the E-ring, then auxiliary rollers 1 and 2, from the pick-up roller shaft.
      3) Remove the pick-up roller.



① E-ring
② Auxiliary roller 1
③ Auxiliary roller 2
④ Pick-up roller

Figure 3-25

Note:
When installing the pick-up roller, be sure to position the roller and auxiliary roller 2 as shown below.

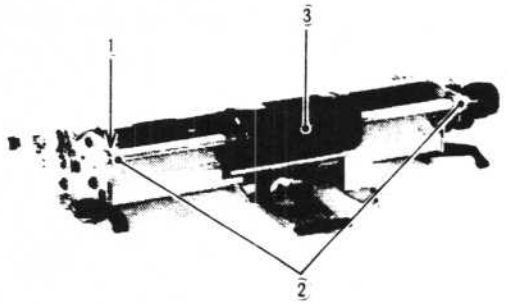


① Pick-up roller shaft
② Auxiliary roller 1
③ Auxiliary roller 2
④ Pick-up roller
⑤ Pick-up roller clutch

Figure 3-26

Note:
The pick-up roller and pick-up roller clutch are mounted on the pick-up roller shaft at particular positions. The pick-up roller can easily be replaced and returned to its original position. However, a special gauge is required to locate the clutch at the correct position.
For this reason, never replace the pick-up roller clutch in the field nor apply any force to the clutch.

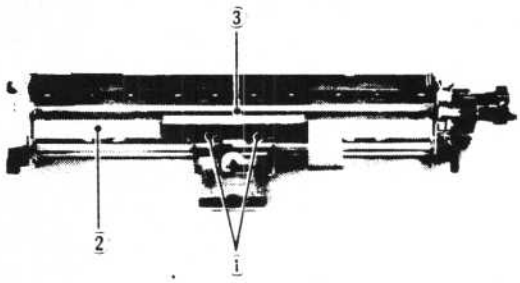
b. Separation pad
1) Remove the E-ring and two bushings and remove the pick-up roller and pick-up roller shaft together.



① E-ring
② Bushings
③ Pick-up roller

Figure 3-27

2) Remove the two screws, then remove the separation pad from the lower pick-up guide.

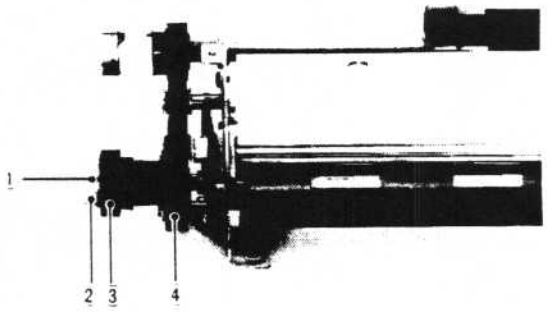


① Screws
② Lower pick-up guide
③ Separation pad

Figure 3-28

c. Registration rollers

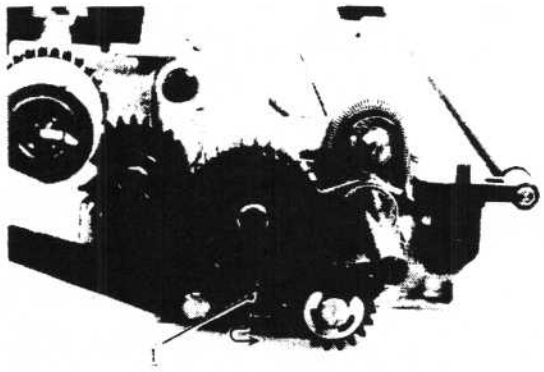
1) Loosen the setscrew that secures the clutch drum to the registration roller shaft.
2) Remove the clutch drum, control ring, and gear together from the registration roller shaft.



① Setscrew
② Clutch drum
③ Control ring
④ Gear

Figure 3-29

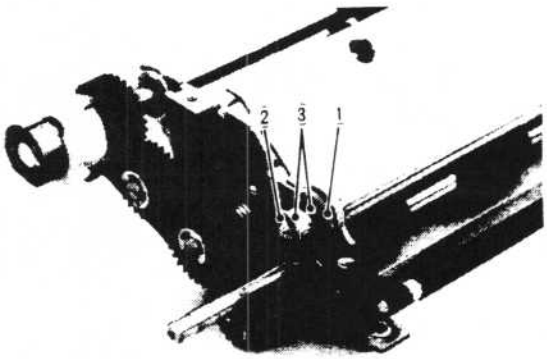
3) Remove the spring.



① Spring

Figure 3-30

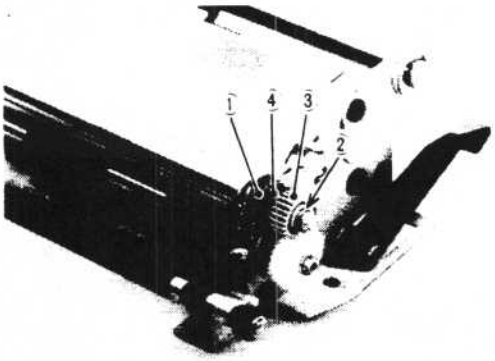
4) Remove the hold down spring and E-ring and then remove the two bushings.



① Spring ② E-ring ③ Bushings

Figure 3-31

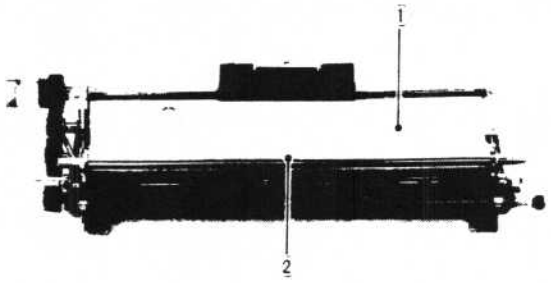
5) Mark the holes in which the hold-down spring is mounted, then remove the spring, E-ring, gear and bushing.



① Spring
② E-ring
③ Gear
④ Bushing

Figure 3-32

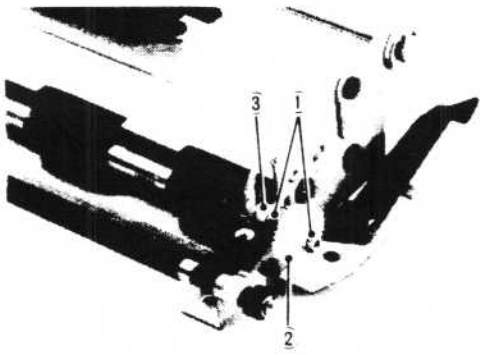
6) Remove the upper pick-up guide and the upper registration roller together.



① Upper pick-up guide
② Upper registration roller

Figure 3-33

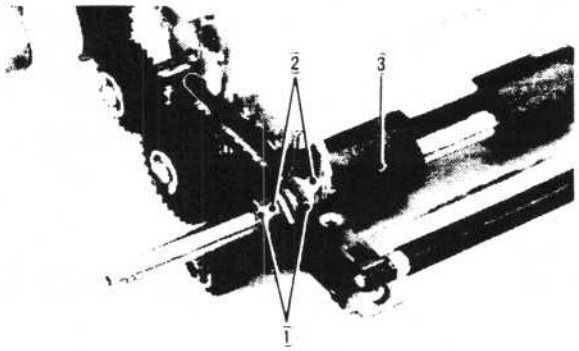
7) Remove the two E-rings and remove the gear and bushing.



① E-rings
② Gear
③ Bushing

Figure 3-34

8) Remove the two E-rings and bushings.
9) Remove the lower registration roller.

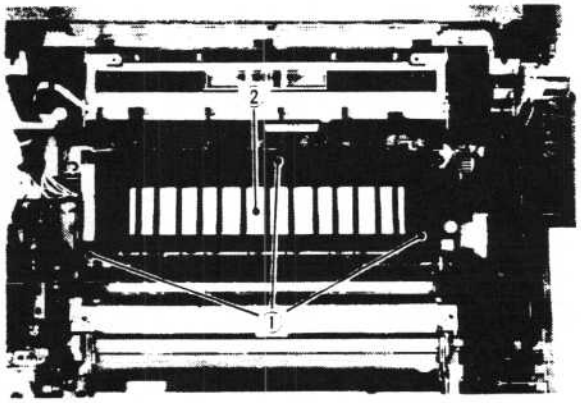


① E-rings
② Bushings
③ Lower registration roller

Figure 3-35

B. Feed Guide Unit

1. Removing the transfer guide unit
   1) Open the printer.
   2) Remove the upper cover and lower cover.
   3) Remove the three screws and remove the transfer guide unit.



① Screws
② Transfer guide

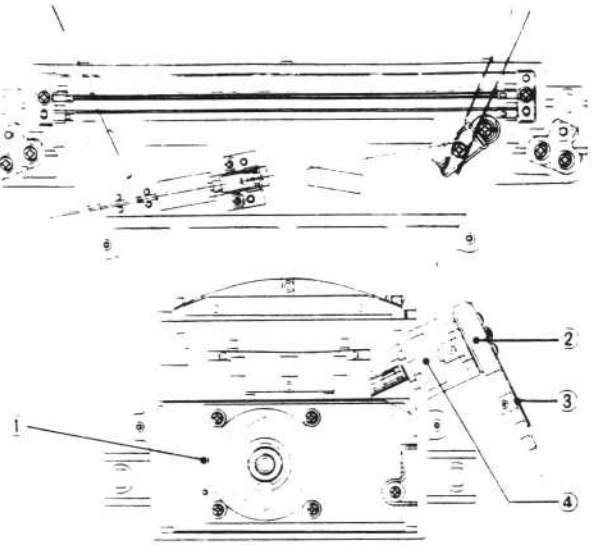
Figure 3-36

IV. EXPOSURE SYSTEM

A. Laser and Scanner Unit

1. Configuration

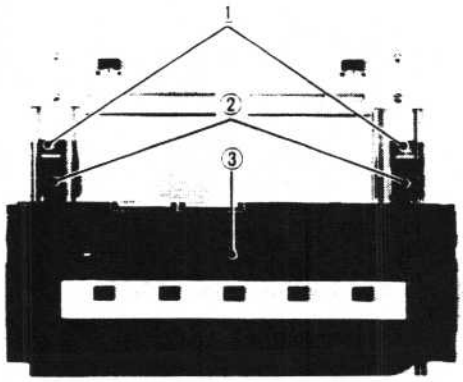
The laser and scanner unit sweeps a laser beam across the photosensitive drum. It is configured as shown below.



① Scanning motor unit
② Laser unit
③ Laser PCB
④ Laser power tester slot

Figure 3-37

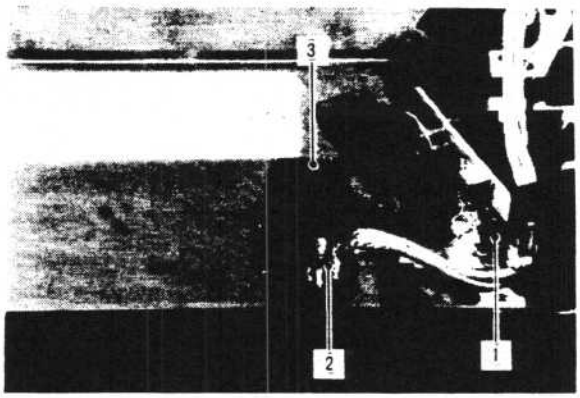
2. Removing the laser and scanner unit
   1) Open the printer.
   2) Remove the upper cover.
   3) Remove the two screws and the blocks holding the lampboard/scanner unit housing, then remove the housing.



① Blocks
② Screws
③ Lampboard/scanner unit housing

Figure 3-38

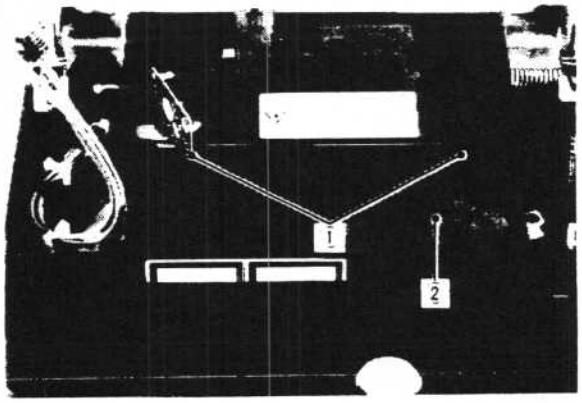
4) Disconnect the connector (J451) from the laser PCB.
5) Open the scanner motor lid and disconnect the connector (J401).



① Connector (J451)
② Connector (J401)
③ Scanner motor lid

Figure 3-39

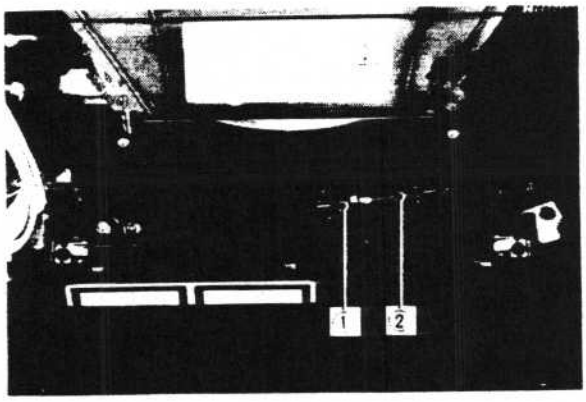
6) Remove the two screws and open the lid.



① Screws ② Lid

Figure 3-40

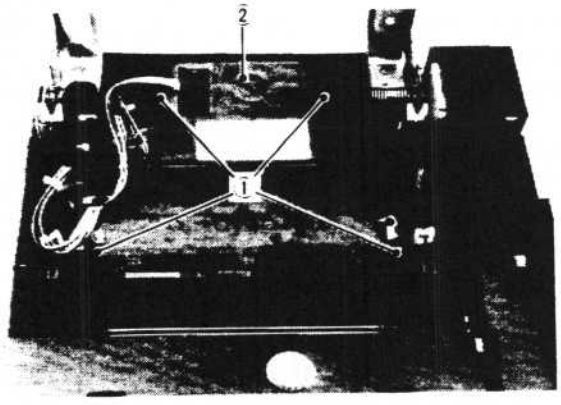
7) Pull the optical fiber unit out of the connector.



① Connector ② Optical fiber

Figure 3-41

8) Remove the four screws and separate the laser and scanner unit.



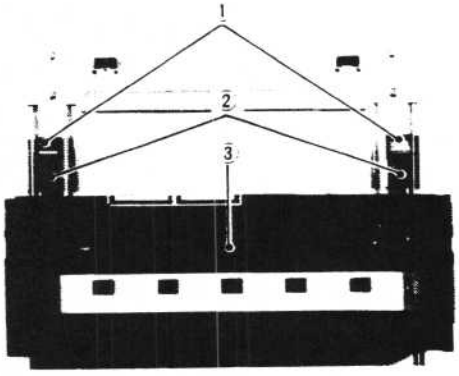
① Screws
② Laser and scanner unit

Figure 3-42

Note:
Do not disassemble the laser and scanner unit. It is not field-adjustable.

B. Preconditioning Exposure Lampboard

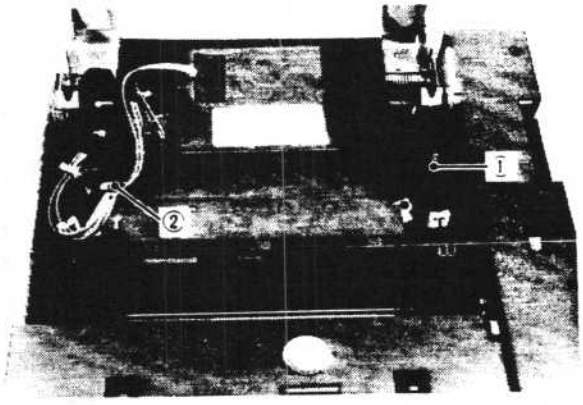
1. Removing the preconditioning exposure lampboard
   1) Open the printer.
   2) Remove the upper cover.
   3) Remove the two screws and the blocks holding the lampboard/scanner unit housing, then remove the housing.



① Blocks
② Screws
③ Lampboard/scanner unit housing

Figure 3-43

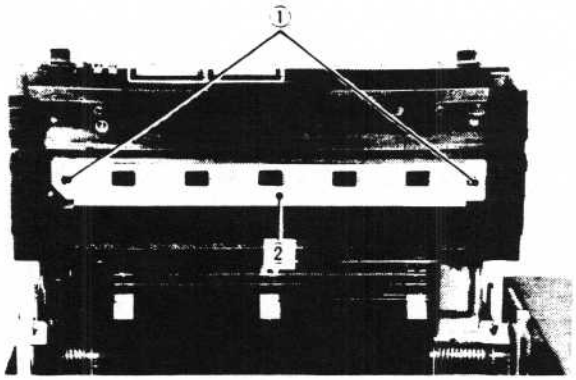
4) Remove the grounding spring and disconnect the connector (J801).



① Grounding spring
② Connector (J801)

Figure 3-44

5) Raise the lampboard/scanner unit housing.
6) Remove the two screws and remove the preconditioning exposure lampboard unit.



① Screws
② Preconditioning exposure lampboard unit

Figure 3-45

7) Remove the preconditioning exposure unit cover plate, then remove the preconditioning exposure lampboard. (1)

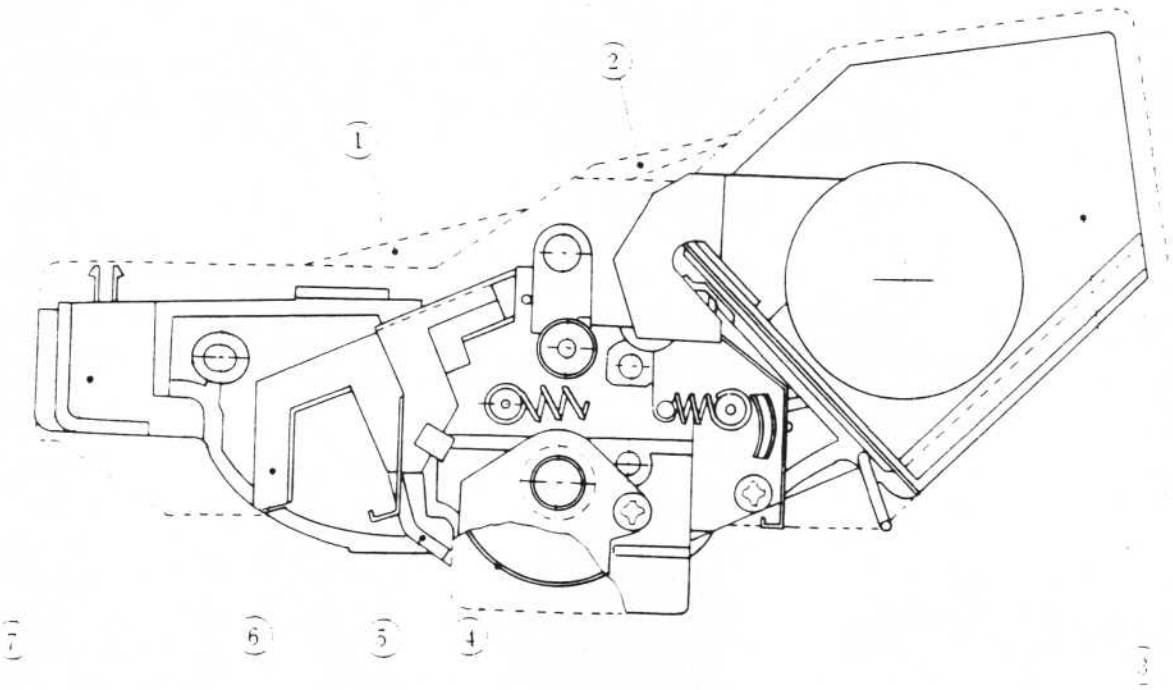
V. ELECTROSTATIC IMAGE DEVELOPING/CLEANING SYSTEM

A. EP-S Cartridge

1. Configuration

The EP-S cartridge combines a photosensitive drum, primary corona unit, developing unit, and drum cleaning unit in one housing, and is replaced as a unit. During printing the drum rotates and an invisible electrostatic latent image is formed on its surface, then developed into a visible image by toner. The latter is transferred to paper to make the print.

The EP-S cartridge cannot be disassembled.



① Light-blocking shutter 1
② Light-blocking shutter 2
③ Developing unit
④ Photosensitive drum
⑤ Protective shield
⑥ Primary corona unit
⑦ Drum cleaning unit

Figure 3-46

a. Protective shield

The photosensitive drum is protected by a protective shield that prevents exposure to strong light. If it were exposed to strong light for a long period, blank areas or black streaks might appear on prints. Do not open the protective shield unless necessary. (The protective shield is automatically opened when the EP-S cartridge is inserted into the printer and the upper unit is lowered.)

b. Light-blocking shutters

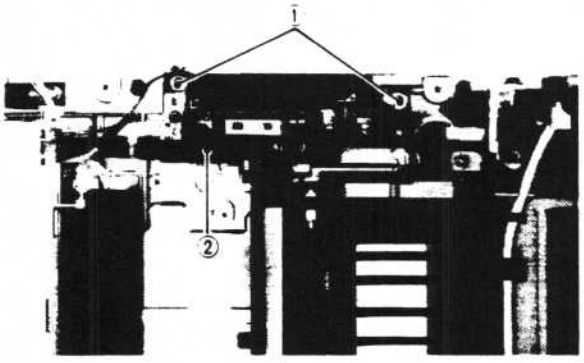
The photosensitive drum is also protected by the light-blocking shutters. These shutters prevent light entering via the laser beam path (above the drum) when the cartridge is removed from the printer.

2. Cleaning the photosensitive drum
   1) Open the printer and remove the EP-S cartridge.
   2) Turn the EP-S cartredge upside down and open the protective shield.
   3) Liberally sprinkle toner on a piece of flannel or other soft cloth and clean the drum surface with it.

Note:
1. Be sure to turn the drum only in the direction that it turns during printing. If the drum is turned backward, the spring-loaded contact that conducts the developing bias to the inside rim of the developing cylinder will be bent.
2. Use flannel or other soft cloth to clean the drum surface. Lint-free paper is too hard and will scratch the surface.
3. Finish cleaning as quickly as possible to avoid long exposure of the drum to light, for this can cause abnormal images.
4. Never use solvents for cleaning the drum.

B. Transfer Corona Unit

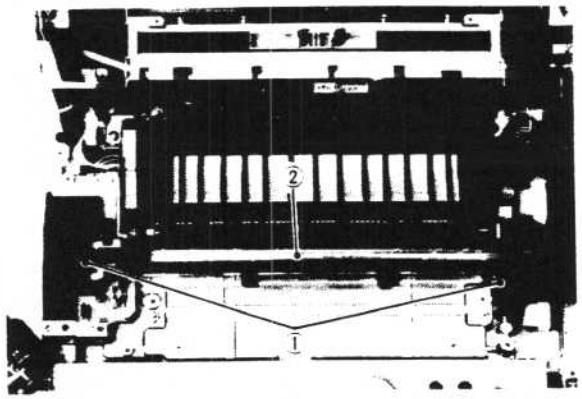
1. Removing the transfer corona unit
   1) Open the printer.
   2) Remove the upper cover and lower cover.
   3) Remove the sensor/power supply unit.
   4) Remove the pick-up roller unit.
   5) Remove the two screws and remove the high-voltage connector unit.



① Screws
② High-voltage connector unit

Figure 3-47

6) Remove the two screws and take out the transfer corona unit.



① Screws ② Transfer corona unit

Figure 3-48

2. Stringing the corona wire
   1) Remove the right and left covers from the corona unit.
   2) Cut off about 300mm of corona wire. Form the corona wire as shown in Figure 3-49.

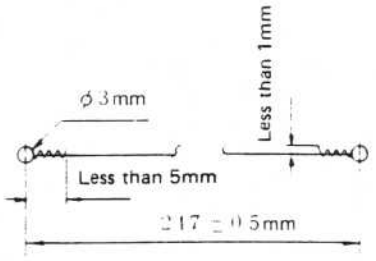


Figure 3-49

(Form a 3-mm loop at each end by wrapping it around a small hex key and then twisting it four or five times. Snip off the loose ends to less than 1mm.)

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

Figure 3-50

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

3. Winding the nylon line on the transfer corona unit
   1) Prepare about 850mm nylon line.
   2) Wind one end of the nylon line around screw A of the transfer corona unit. (See Figure 3-51.)
   3) Wind the nylon line tightly around the corona unit as shown in Figure 3-51, then wind the other end around screw B.

Caution:
Be careful that the nylon line does not touch the discharging needles, for it may be damaged.

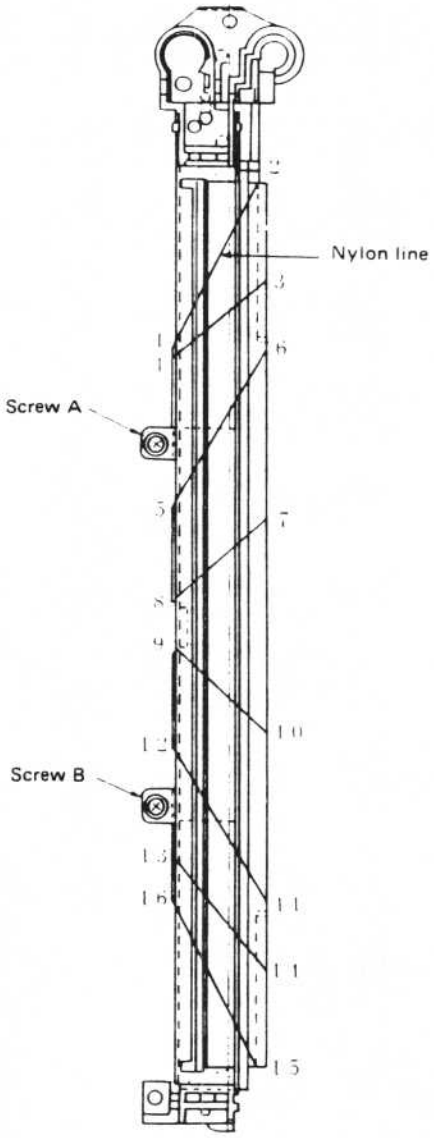


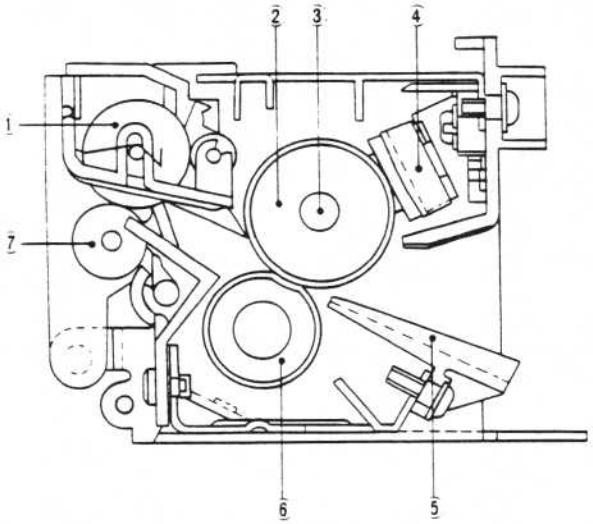
Figure 3-51

VI. FIXING SYSTEM

A. Fixing Unit

1. Configuration

The fixing unit fixes the toner image onto the paper (makes it permanent). It is configured as shown below.

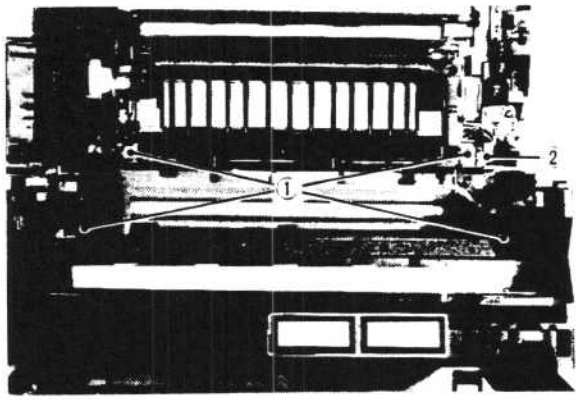


① Upper delivery roller
② Upper fixing roller
③ Fixing roller heater
④ Thermoswitch
⑤ Fixing unit entry guide
⑥ Lower fixing roller
⑦ Lower delivery roller

Figure 3-52

2. Removing the fixing unit

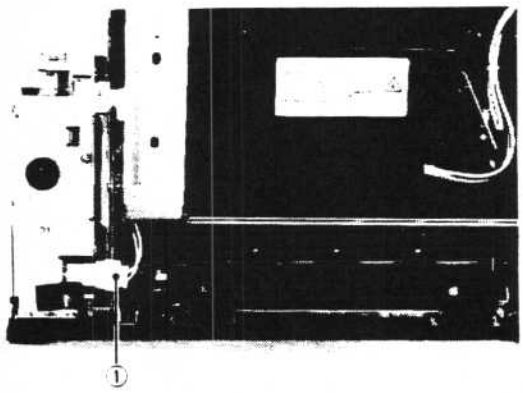
1) Open the printer.
2) Remove the upper cover, lower cover, and delivery unit cover.
3) Remove the fixing roller cleaner.
4) Disconnect the connector (J851) and remove the four screws.



① Screws ② Connector (J851)

Figure 3-53

5) Disconnect the connector (J112).

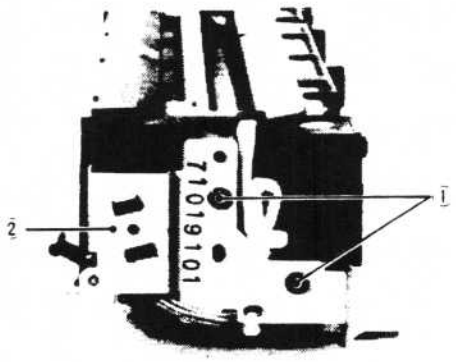


① Connector (J112)

Figure 3-54

6) Take out the fixing unit through the delivery outlet.

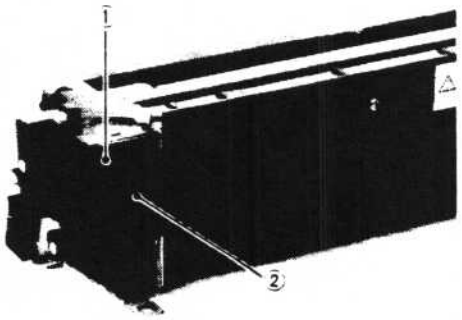
3. Disassembly and reassembly
   a. Fixing roller heater
   1) Remove the two screws and remove the delivery unit paper sensor mounting plate.



① Screws ② Mounting plate

Figure 3-55

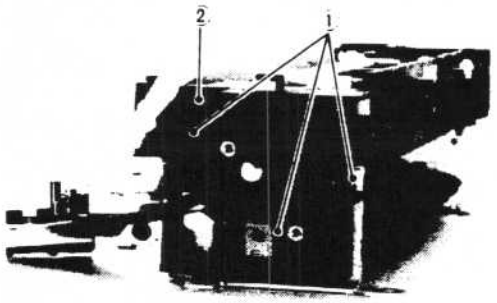
2) Remove the screw and remove the left terminal cover.



① Screw ② Left terminal cover

Figure 3-56

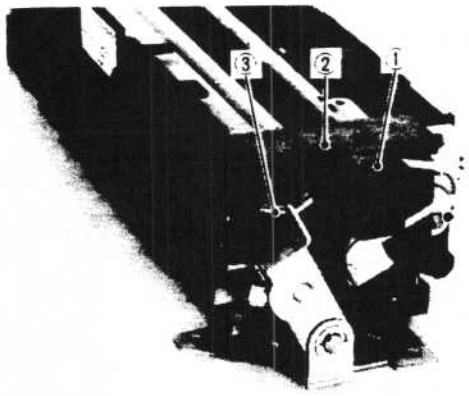
3) Remove the three screws and remove the lead wire and left terminal holder.



① Screws ② Left terminal holder

Figure 3-57

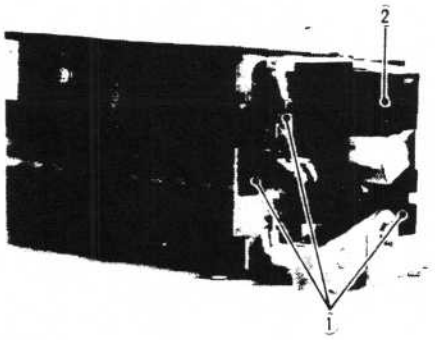
4) Remove the screw and remove the right terminal cover and spring.



① Screw ③ Spring
② Right terminal holder

Figure 3-58

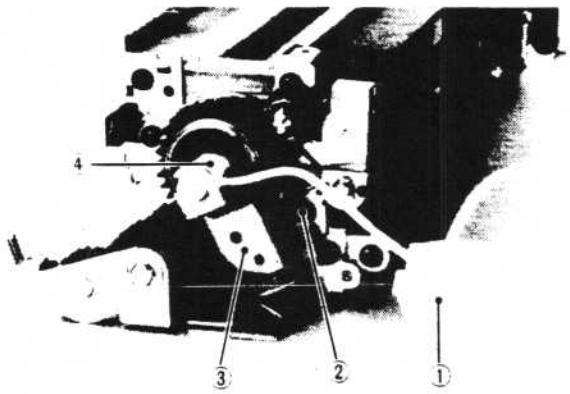
5) Remove the three screws and remove the lead wire and right terminal holder.



① Screws
② Right terminal holder

Figure 3-59

6) Remove the lead terminal connected to the fixing roller heater from the connector (J112).
7) Remove the screw and remove the left terminal cover.

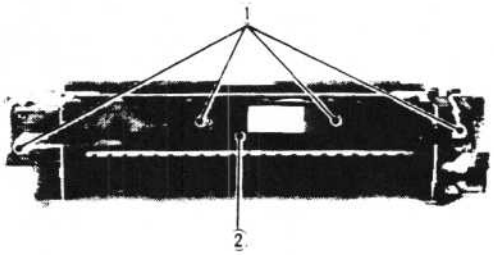


① Connector (J112)
② Screw
③ Left heater cover
④ Fixing roller heater

Figure 3-60

8) Pull the fixing roller heater carefully out of the upper roller.

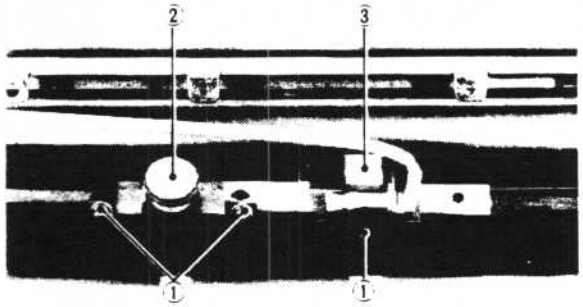
b. Thermoswitch and thermistor
1) Remove the left terminal cover (1) and right terminal cover (1).
2) Remove the four screws and remove the lead wire and the upper entry guide.



① Screws ② Upper entry guide

Figure 3-61

3) Remove the two screws and remove the thermoswitch, or remove the screw and remove the thermistor.



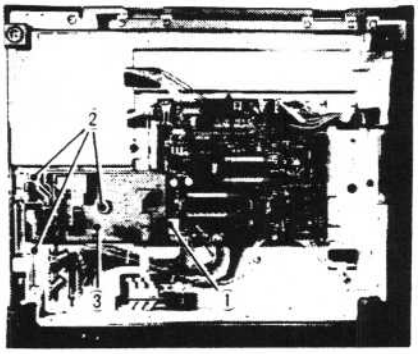
① Screws ③ Thermistor
② Thermoswitch

Figure 3-62

VII. ELECTRICAL COMPONENTS

A. DC Controller PCB

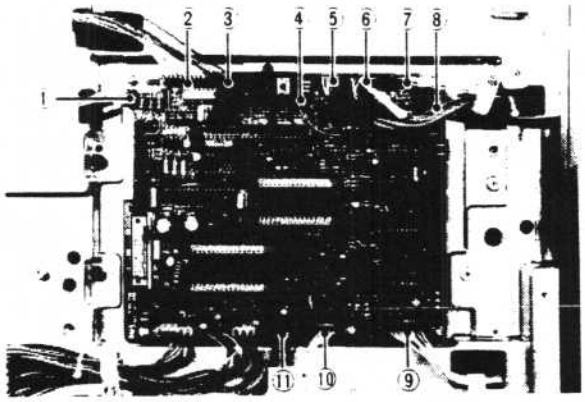
1) Remove the base cover. (14)
2) Disconnect the connector and remove the three screws and the interface PCB.



① Connector
② Screws
③ Interface PCB

Figure 3-63

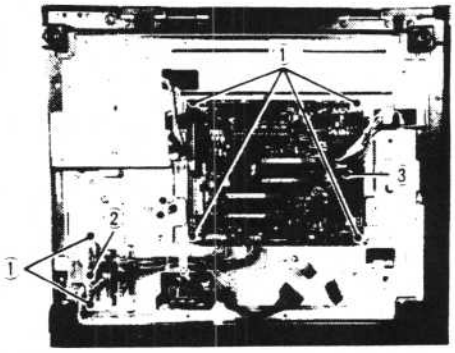
3) Disconnect the following connectors from the DC controller PCB.



① J214
② J215
③ J208
④ J216
⑤ J202
⑥ J203
⑦ J206
⑧ J201
⑨ J211
⑩ J217
⑪ J213

Figure 3-64

4) Remove the two screws holding the connector and the four screws holding the DC controller PCB.
5) Separate the DC controller PCB from the main unit.

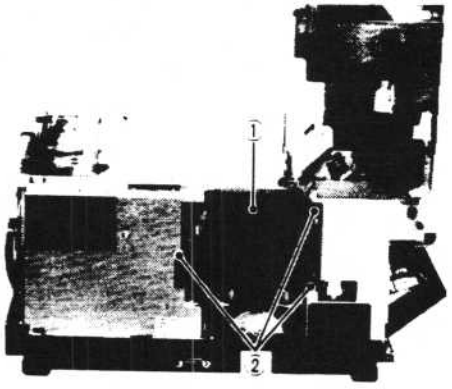


① Screws
② Connector
③ DC controller PCB

Figure 3-65

B. Driver and Sensor PCB and Low-Voltage Power Supply (Sensor/Power Supply Unit)

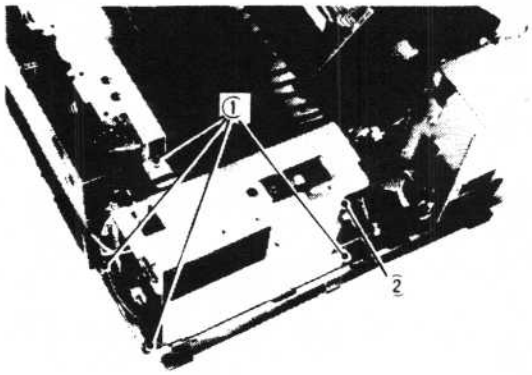
1) Open the printer.
2) Remove the upper cover and lower cover.
3) Remove the ozone filter.
4) Remove the three screws and remove the fan mounting plate.



① Ozone filter
② Screws

Figure 3-66

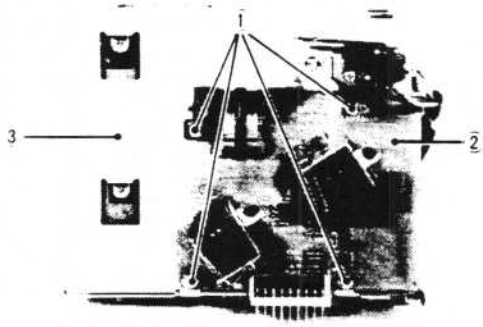
5) Remove the four screws and disconnect the connector



① Screws ② Connector

Figure 3-67

6) Check that there is no cassette in the printer then separate the sensor/power supply unit from the connector by lifting it with both hands.
7) Remove the four screws and separate the driver and sensor PCB from the low-voltage power supply.

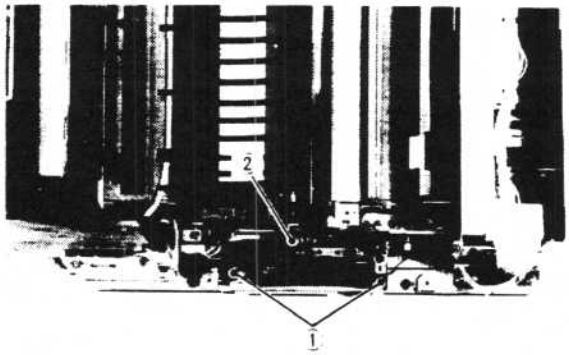


① Screws
② Driver and sensor PCB
③ Low-voltage power supply

Figure 3-68

C. High-Voltage Power Supply

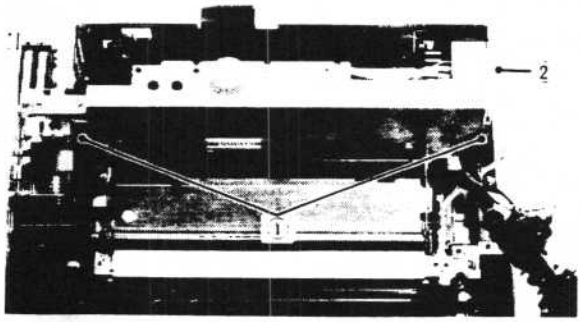
1) Open the printer.
2) Remove the upper cover and lower cover.
3) Remove the two screws and remove the high-voltage connector unit.



① Screws
② High-voltage connector unit

Figure 3-69

4) Remove the two screws, disconnect the connector, and remove the high-voltage power supply.

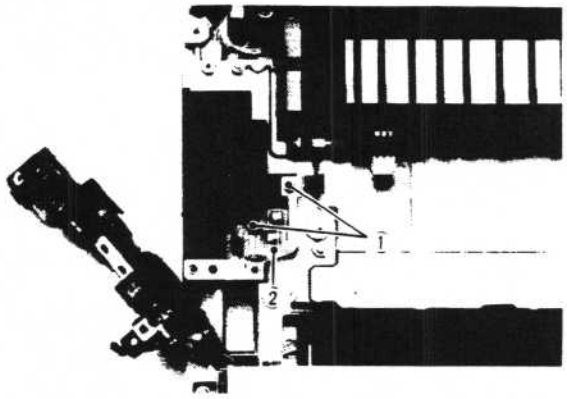


① Screws ② Connector

Figure 3-70

D. Signal Ground PCB (HVT)

1) Open the printer.
2) Remove the upper cover and lower cover.
3) Remove the sensor/power supply.
4) Remove the pick-up roller unit.
5) Remove the high-voltage connector unit.
6) Remove the transfer corona unit.
7) Remove the two screws and remove the signal ground PCB (HVT).

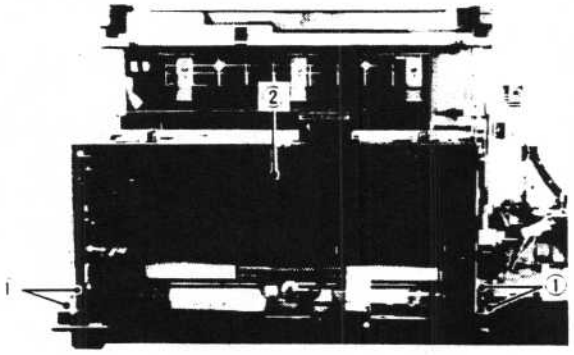


① Screws
② Signal ground PCB (HVT)

Figure 3-71

E. Cassette Size Sensing Switch PCB

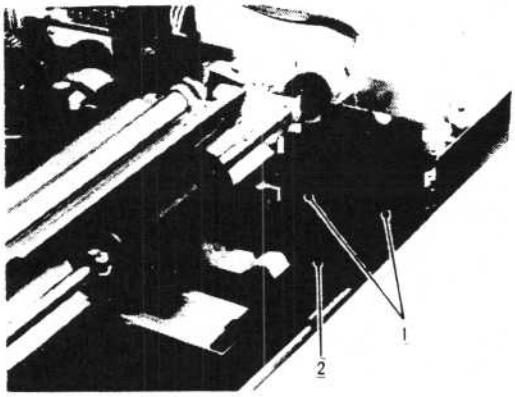
1) Open the printer.
2) Remove the upper cover and lower cover.
3) Remove the sensor/power supply.
4) Remove the four screws and the HVT unit.



① Screws ② HVT unit

Figure 3-72

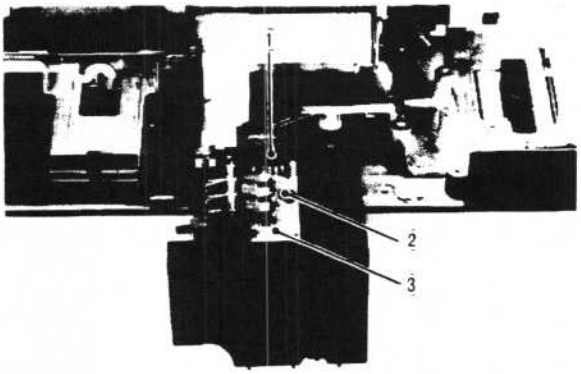
5) Remove the two screws and remove the cassette guide.



① Screws ② Cassette guide

Figure 3-73

6) Disconnect the connector and remove the screw, then remove the cassette size sensing switch PCB.



① Connector
② Screw
③ Cassette size sensing switch PCB

Figure 3-74

CHAPTER 4

INSTALLATION

Each printer is carefully adjusted and stricIty inspected before shipment.
To ensure that it performs as intended, it is very important to install the printer correctly.
The serviceman should have a complete knowledge of the printer, choose a good location, and check the printer out before it is used.

I. CHOOSING A LOCATION 4-1
II. UNPACKING AND INSTALLATION . 4-2
III. STORAGE AND HANDLING OF EP-S CARTRIDGES 4-5
A. Storage of Sealed EP-S Cartridges 4-5
B. Storage of Unsealed EP-S Cartridges 4-5
C. Handling Suggestions 4-5

I. CHOOSING A LOCATION

The serviceman should inspect the planned location before delivery. The following requirements should be met when installing the printer:

- The line voltage should not vary more than ±10% from the voltage marked on the printer rating plate. The circuit should have sufficient current capacity.
- The temperature should be between 10° to 32.5°C (50° to 91°F) and the relative humidity should be between 20% to 80%. There should be no water faucet, humidifier, or air conditioning outlet near the printer.
- The printer should not be exposed to open flames, dust, ammonia fumes, or direct sunlight.
  If it has to be placed in a sunny place, the windows should be curtained to avoid direct sunlight.
- The location should be well ventilated.
- The printer should be placed on a sturdy, level surface.
- There should be an enough space around the printer for easy operation. (See Figure 4-1.)

Note:
If the printer (in the shipping carton) is moved from a cold storage space into a warm room, condesantion would occur inside the printer if it were exposed to room air. This would cause various temporary problems, such as print defects. If a printer has been stored in such conditions, be sure to allow it to come to room temperature before unpacking it. This will take one hour or more.

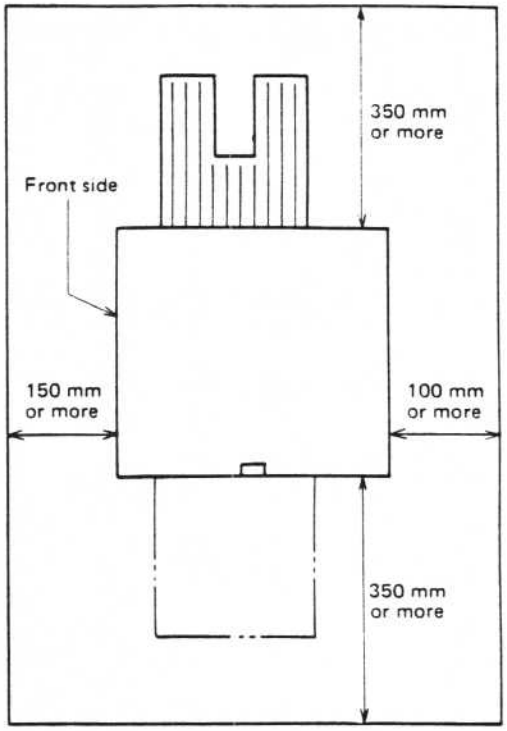


Figure 4-1

II. UNPACKING AND INSTALLATION

No.	Step	Check	Remarks
1	Open the cardboard box.		See Figure 4-2.
2	Lift off the upper foam packing.		See Figure 4-2.
3	Remove the parts and literature.	Check that the following are present: · Cassette · Delivery tray · Power cord · Interface cable	
4	Lift off the middle foam packing and remove the printer.		
5	Remove the plastic bag from around the printer. Remove the tape securing components.	Check for damage to the exterior of covers and panels during shipment.	

Table 4-1

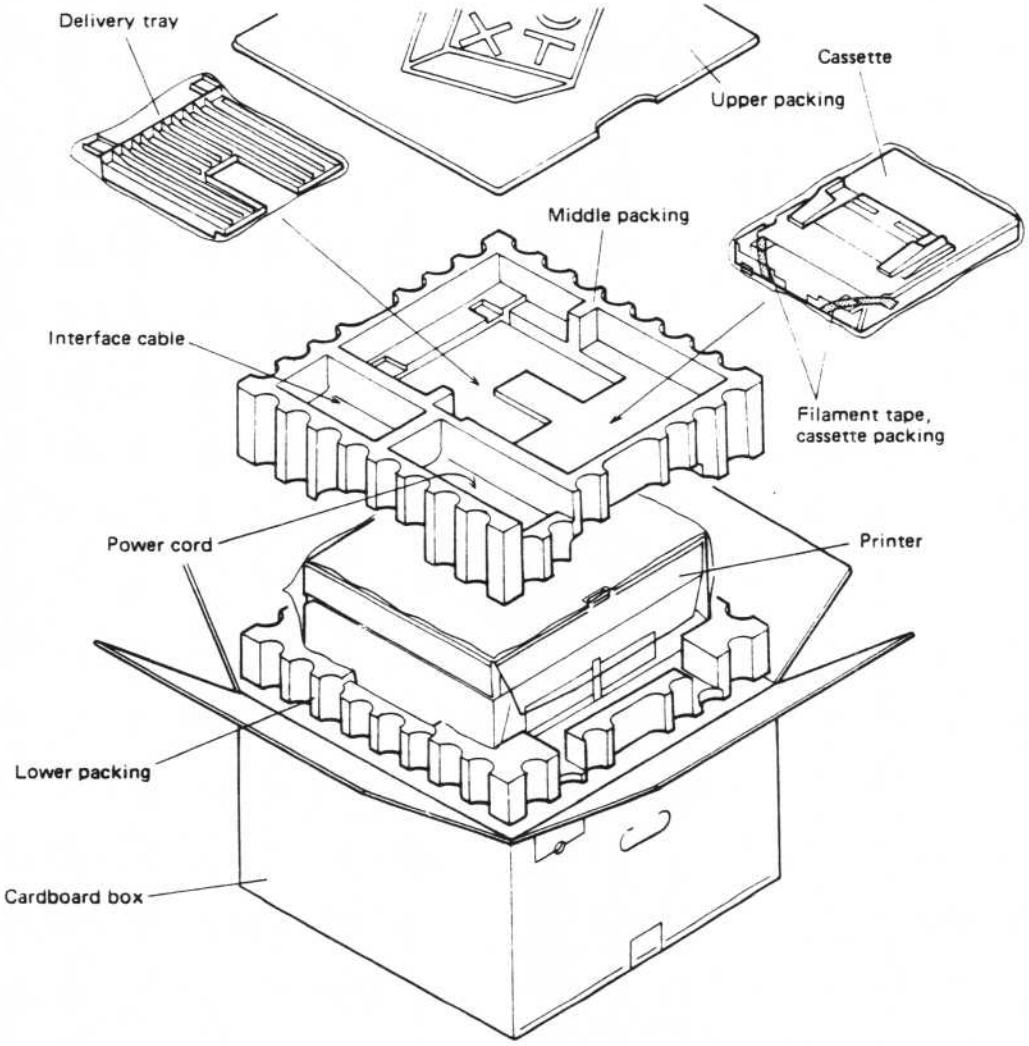


Figure 4-2

No.	Step	Check	Remarks
6	Remove the cardboard packing from the cassette holder and remove the protective sheet.		See Figure 4-3.
7	Open the printer, and remove the internal packing.		See Figure 4-3.
8	Remove the two spacers		See Figure 4-4.
9	Open the small box containing the EP-S cartridge and take out the cartridge. Remove the aluminum bag.	Confirm that the following items are present: · Fixing roller cleaning pad · Cotton swab · Instructions for cartridge · Instructions for using fixing roller cleaning pad · Instructions for using cotton swab	See Figure 4-5.
10	Hold the cartridge horizontal with both hands and slowly rock it about the axis of the drum 45 degrees each way five times to distribute toner evenly.		See Figure 4-6.

Table 4-2

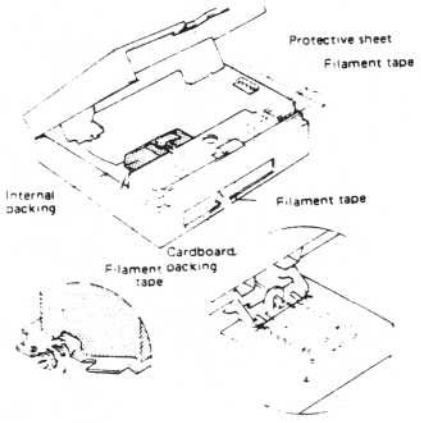
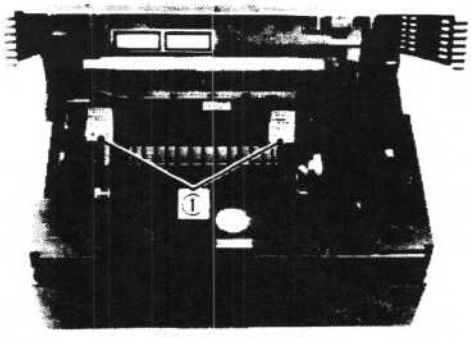


Figure 4-3



① Spacers

Figure 4-4

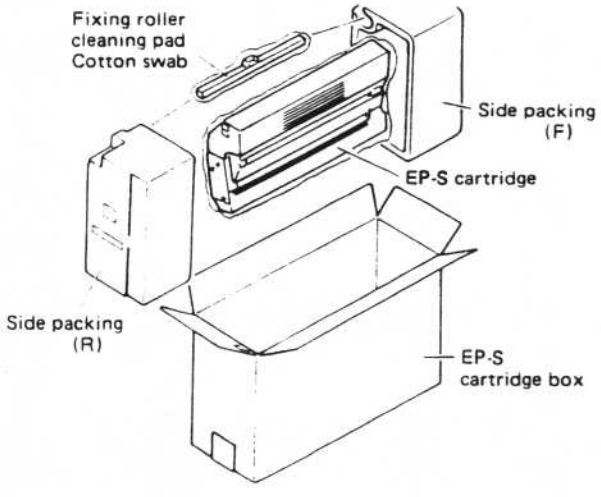


Figure 4-5

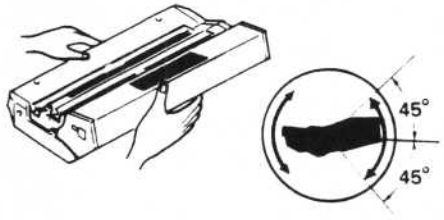


Figure 4-6

No.	Step	Check	Remarks
11	Install the cartridge in the printer. Flex the tab of the seal up and down until it breaks free, then pull out the seal.		
12	Take the fixing roller cleaning unit out of the plastic bag. Remove the felt from the end of the cleaner and install the cleaner in the fixing unit.		
13	Close the printer.		
14	Remove the filament tape and cassette packing from the cassette. Move the guide plate to suit the paper size and set the paper-size identification slider. Put paper in the cassette, put the cover on the cassette, then put the cassette in the printer.	· Check that the paper-size identification slider is to the correct position (A4 or Letter).	See Figure 5-2.
15	Connect the printer to the external device.		
16	Set the voltage selector to suit the line voltage.		
17	Remove the cover on the front side of the base cover. Plug in the power cord. After the printer power has been switched ON by a signal from the external device and the $\overline{RDY}$ signal has been made TRUE by the printer, and press the test print button to make one test print.	· Check that the print density adjustment dial is set to the "5" position. · Check that the test print has the correct density.	
18	Clean up around the printer.		

Table 4-3

III. STORAGE AND HANDLING OF EP-S CARTRIDGES

An EP-S cartridge is affected by the storage conditions, even if it is sealed in its package, so its life depends on the way in which it is used or stored. EP-S cartridges should be handled carefully.

A. Storage of Sealed EP-S Cartridges

In a warehouse or workshop, EP-S cartridges should be stored under the conditions in Table 4-4. Note the following:

1) Avoid direct sunlight.
2) Do not store cartridges on a surface that is subject to vibration.
3) Do not strike or drop packages containing cartridges.

Temperature	Normal (total storage time × 9 10)		0 ~ 35°C
	Severe (total storage time × 1 10)	High	35 ~ 40°C
		Low	−20 ~ 0°C
Temperature change (within 3 minutes or so)			40°C → 15°C −20°C → 25°C
Relative humidity	Normal (total storage time × 9 10)		35 ~ 85%RH
	Severe (total storage time × 1 10)	High	85 ~ 95%RH
		Low	10 ~ 35%RH
Air pressure			460 ~ 760mmHg (0 6 to 1 atm)
Total storage time			2 5 years

Note:
"Total storage time" in the Table is a reference to the cartridge service life information shown on the outside of the EP-S cartridge box.

Table 4-4 Storage conditions

B. Storage of Unsealed EP-S Cartridges

Each EP-S cartridge houses a photosensitive drum that has an organic photoconductor (OPC). This deteriorates when exposed to strong light. The cartridge also contains toner. The customer should be fully informed about correct storage and handling of EP-S cartridges.

1. Storage requirements
   1) Avoid places exposed to direct sunlight or near a window. Do not leave an EP-S cartridge in a car for an extended period in warm weather because the interior temperature may become excessively high.
   2) Avoid places with too-high or too-low temperature and/or humidity. Also avoid places exposed to sudden temperature changes (such as near an air conditioner outlet).
   3) Avoid dusty places or places exposed to ammonia.
   4) Do not store an EP-S cartrige above 40°C.

2. Life of EP-S cartridges
   The design useful service life of an EP-S cartridge is 2.5 years from the date of manufacture (printed on the cartridge). The limit (year and month) of life (date of manufacture plus 2.5 years) is given on both the EP-S cartridge box and cardboard box. An EP-S cartridge older than the expiry date can be expected to produce prints of reduced quality, so a cartrdige should be used within its service life.

C. Handling Suggestions

1) When using a new EP-S cartridge, hold the cartridge horizontal, and slowly rock it about the axis of the drum 45 degrees each way five times to distribute toner evenly, as shown in Figure 4-7, then install it in the printer. Using any method other than this may result in toner leakage from the developing unit or cleaning unit.
   After installing the new cartridge, print three to five pages of test patterns to check for toner leakage. Even if toner leakage did occur, clean prints will be produced after the print test.

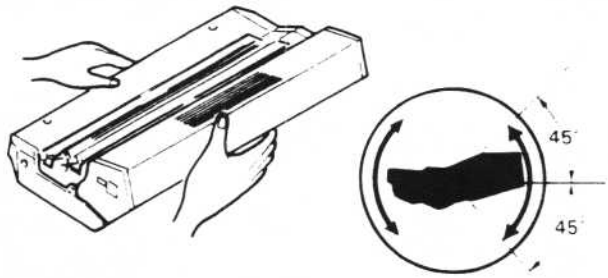


Figure 4-7

   When $\overline{RDY}$ signal is TRUE, a test pattern can be printed by pressing the test print button.
2) If blank spots occur on prints because of lack of toner, rock the EP-S cartridge as explained in 1), above, to distribute toner evenly.
3) Do not invert nor stand an EP-S cartridge on end, as shown in Figure 4-8. Always handle it gently.

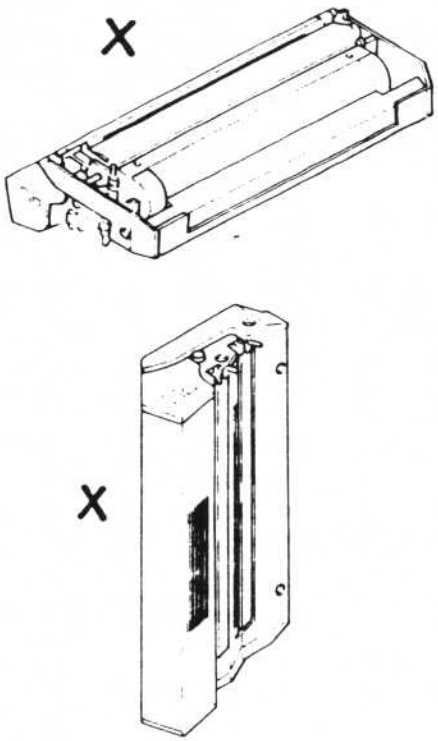


Figure 4-8 Never place a cartridge in these positions

4) Do not touch the surface of the photosensitive drum when the protective shield on the bottom of the EP-S cartridge is opened.
   If the drum surface is dirty, clean it with fannel or other soft cloth sprinkled liberally with toner. Do not use dry cloth, lint-free paper, or solvents.
5) Do not try to disassemble a cartridge.
6) Do not subject a cartridge to vibration or shock.
7) An EP-S cartridge has light-blocking shutters because the photosensitive drum is sensitive to strong light. If the EP-S cartridge is exposed to strong light for a long period, however, blank spots or black streaks may appear on prints despite these. If this happens, stop the printer for a while. This will usually solve the problem.

Note the following:
1. Clear paper jams and change the cartridge as quickly as possible to minimize exposing the drum to light. If possible, reduce the light level before doing these operations.
2. When storing an EP-S cartridge that has been used, put it in its storage box, or cover it with cloth. Do not leave it exposed to light.

Note:
Normal room light is about 1500 lux. Do not expose the photosensitive drum to light of this intensity for more than 5 minutes; if the drum is placed under these conditions accidentally, the cartridge should be stored in a dark place to "recuperate", though an image may be retained on the drum for some time.
Direct sunlight is 10,000 to 30,000 lux. Exposing a drum to light at this intensity will destroy it.

CHAPTER 5

MAINTENANCE AND SERVICING

I. PARTS REPLACEMENT SCHEDULE 5-1
II. CONSUMABLES 5-1
III. LISTS OF TOOLS 5-2
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B. Special Tools 5-3
IV. LIST OF LUBRICANTS, CLEANERS 5-4
V. SERVICE CHECKPOINTS 5-5
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I. PARTS REPLACEMENT SCHEDULE

None

II. CONSUMABLES

None

III. LISTS OF TOOLS

A. Standard Tools

The standard tools required for servicing the printer are listed below.

No.	Tool name	Tool no.	Remarks
1	Tool box	TNK-0001	
2	Jumper wire	TKN-0069	
3	Feeler gauge	CK-0057	
4	Compression spring scale	CK-0058	For checking cassette spring strength (0-600g)
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	Flat-blade screwdriver	CK-0111	
10	Precision flat-blade screwdriver set	CK-0114	
11	Allen wrench set	CK-0151	
12	File, fine	CK-0161	
13	Allen (hex) key	CK-0170	M4
14	Diagonal cutting pliers	CK-0201	
15	Needle-nose pliers	CK-0202	
16	Pliers	CK-0203	
17	Retaining ring pliers	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	CK-0328	100cc
25	Solder	CK-0329	ϕ1.5(mm) × 1(m)
26	Desoldering wick	CK-0330	1.5mm
27	Oiler	CK-0349	30cc
28	Jar, plastic	CK-0351	30cc
29	Digital logic tester	CK-0400	
30	Digital multimeter	CK-0436	For measuring the output of the laser power tester (TKN-0198) etc.
31	Soldering iron	CK-0309	

Table 5-1

B. Special Tools

In addition to the standard tools, the following special tools are required for servicing the printer.

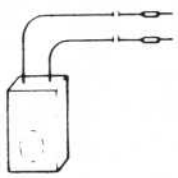
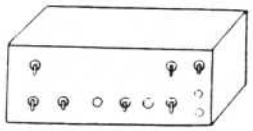
No.	Tool name	Tool no.	Shape	Rank	Application remarks
1	Laser power tester	TNK-0198		B	Used with printer driver and laser driver tester for measuring or adjusting laser power.
2	Printer driver/ laser driver tester	RY9-0024		B	Test printer function and laser power.
3	Laser shorting connector	RY9-0025		B	Protects the laser chip of the printer from damage by static electricity.

Table 5-2

Note: Ranks
- A : Each service technician should carry one with him.
- B : A group of five service technicians should share one.
- C : Each workshop should keep one.

IV. LIST OF LUBRICANTS, SCLEANERS

No.	Material name	Components	Use	Remarks
1	Alcohol: ethyl (pure or denatured) or isopropyl (pure or denatured)-	C_2H_5OH, $(CH_3)_2CHOH$	Cleaning: plastic, rubber, external parts	• Purchase locally • Flammable: Keep away from flame
2	MEK (methyl ethyl ketone)	$CH_3CO\text{-}C_2H_5$	Cleaning: oil and toner stains	• Purchase locally • Highly flammable: keep away from flame
3	Heat-resistant grease	Heat-resistant grease, e.g. 582M Rhone-Poulenc group	Apply to drive mechanism	• Tool no. CK-0427 (500g can) • Equivalent grease may be used (heat resistance more than 200°C)
4	Lubricating oil	ISO VG 68 oil, ESSO Febis K68, MOBIL Vactra oil no. 2, SHELL Tonna oil T68	For bearings	• Tool no. CK-0451 (500g can) • Equivalent oil may be used
5	Lubricating oil	ISO VG 220 oil, ESSO Febis K220, MOBIL Vactra oil no. 4, SHELL Tonna oil T220	Registration roller clutch spring	• Tool no. CK-0524 (100cc) • Equivalent oil may be used.

Table 5-3

VI. MAINTENANCE BY CUSTOMER

The customer should do the following maintenance to maximize printer performance.

Item	Customer maintenance
Fixing unit felt cleaning pad	Replace the cleaning pad whenever the cartridge is replaced.
Fixing unit	Clean the fixing unit when the cartridge is replaced.
Transfer corona unit	Clean the transfer corona unit when the cartridge is replaced.
Primary corona unit	Clean the primary corona unit when necessary.
Transfer guide	Clean the transfer guide when necessary.
EP-S cartridge	Rock the cartridge to redistribute toner. If necessary replace it.

Table 5-4

CHAPTER 6

TROUBLESHOOTING

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B. Basic Procedure 6-1
II. EXPLANATION FOR SPECIAL TOOLS 6-2
A. Printer Driver/Laser Driver Tester 6-2
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B. HVT PCB 6-36
C. Driver and Sensor PCB 6-37

I. INTRODUCTION

A. Initial Check

1. Operating environment

Check that:

- Line voltage does not vary more than 10% from the voltage shown on the rating plate.
- The printer is installed on a solid, level surface.
- Room temperature is kept between 10°C and 32.5°C, and relative humidity between 20% and 80%.
- The printer is not exposed to ammonia gas. The printer is not located in a hot or humid area (such as near a water tap, or humidifier), near open flames, nor in a dusty place.
- The printer is not exposed to direct sunlight. If it has to be placed in a sunny place, the window should be curtained.
- The room is well ventilated.

2. Corona units

Check that:

- The transfer corona unit is clean and the corona wire undamaged. (Replace either if it cannot be cleaned or is damaged.)
- The corona wire spring of the transfer corona unit is not rusted. (If rusted, replace it.)
- The corona wire of the primary corona unit is clean.

3. Print paper

Check that:

- Recommended print paper is being used. (If the paper is too thick or too thin, or tends to curl, paper jams or transfer problems may occur, or prints may be blurred.)
- Print paper is not moist. (Use fresh print paper and check whether print quality improves.)

4. Consumables

Check that:

- The printer sets status 15 bit 6 to 0 when there is an EP-S cartridge in the printer. If the printer sets status 15 bit 6 to 1:
  a. Take out the EP-S cartrdge and slowly rock it to distribute toner evenly. See Figure 4-7 in chapter 4.
  b. If that does not improve the prints, replace the cartridge with a new one.

5. The transfer and feed guide plates are clean. (If they are dirty, clean them with damp cloth.)
6. The fixing roller felt cleaning pad is clean. (If it is very dirty, replace the pad with a new one.)
7. Others

   During winter, if the printer is taken from a cold room (such as a warehouse) into a warm room, condensation will occur inside the printer, causing various problems.

For example:

- Condensation on optical surface (such as the scanning mirror, lenses, and mirror) will cause the print image to be light.
- If the photosensitive drum is cold, the electrical resistivity of the drum will be high, making it impossible to obtain correct contrast in prints.
- Condensation on the corona units will cause corona leakage.
- Condensation on the pick-up guide and feed guide plates will cause paper feed troubles.

If condensation occurs, switch the printer ON and leave it unused for 10 to 20 minutes.

If an EP-S cartridge is unsealed soon after it is taken from a cold room to a warm room, condensation will also occur inside the cartridge; this can cause image defects.

Be sure to instruct the customer to allow the cartridge to come to room temperature before unsealing it. This will take one to two hours.

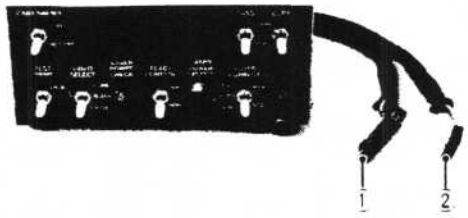
B. Basic Procedure

If an image defect or malfunction occurs, make the initial check, then follow the basic procedure below.

1. If the printer malfunctions, read section V for troubleshooting.
2. If an image defect occurs, determine the type of image defect using the list of image defect samples shown on page 6-10, and correct the defect.

II. EXPLANATION FOR SPECIAL TOOLS

A. Printer Driver/Laser Driver Tester



① J210 ② J202

Figure 6-1

The printer driver/laser driver tester allows the printer to be operated without being connected to an interface, in order to test whether it is operating normally.

The tester has the following three functions:

1) Causes the printer to print vertical and horizontal lines, or a white image (printer driver tester). If the print is not normal, determine whether the trouble is caused by the printer or by the external device.
2) Forces the laser in the printer to operate (laser driver tester). Measure laser power with a laser power tester (explained later) and confirm that the power is within the stipulated range.
3) Simulates the laser driver circuit (laser driver tester). Disconnect the laser from the DC controller PCB and connect the LED of the tester in its place. This simulation allows determining whether the problem is due to the laser diode or the laser driver circuit of the DC controller PCB.

■ Description of the control panel

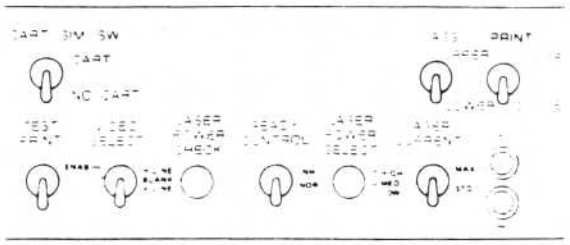


Figure 6-2 Control panel of the printer driver/laser driver tester

TEST PRINT
Causes the printer to print a pattern specified by VIDEO SELECT

VIDEO SELECT
Selects a test pattern to be printed: vertical lines, horizontal lines or a white image.

LASER POWER CHECK
- When connector J202 of the tester is not connected to J202 of the DC controller PCB:
  The laser is forced to operate at the HIGH setting of LASER POWER SELECT.
- When connector J202 of the tester is connected to J202 of the DC controller PCB:
  The LED of the tester is lit with the intensity specified by LASER POWER SELECT.

READY CONTROL
INH forces the printer into the READY condition regardless of whether a cassette is present.

LASER POWER SELECT
Specifies the light output of the LED of the tester to HIGH, MED, or LOW.

LASER CURRENT
The light output of the LED of the tester is monitored by a photodiode. Setting the switch to "STD" feeds the output of the photodiode (LED light output monitor signal) to the LED drive circuit, but at the MAX setting there is no feedback. Therefore, the maximum drive current that can be supplied by the laser driver passes through the LED.

+/−
Terminals for measuring the flow of current in the LED.

CART. SIM. SW

Without the use of actual EP-S cartridge, this switch simulates the presence or absence of the cartridge.

CART — Simulates cartridge in position
NO CART — Simulates no cartridge in position

CASS.

Using this switch does not affect any function of the LBP-UX.

PRINT

Using this switch does not affect any function of the LBP-UX.

■ List of signals

Connector contact no.	Signal name	Function
J202-1	DSADJ	Analog signal indicating sensitivity of the photodiode.
J202-2	PD	Analog signal indicating output from the laser diode.
J202-3	LDRV	For switching laser ON and OFF.
J202-4	+5V	
J202-5	FG	
J210-1	+24VA	
J210-2	NC	
J210-3	NC	
J210-4	$\overline{\text{DBDC}}$	L to apply DC developing bias.
J210-5	−5V	
J210-6	$\overline{\text{DBAC}}$	L to apply AC developing bias.
J210-7	GND	
J210-8	$\overline{\text{HV1ON}}$	L to apply DC high voltage to primary corona.
J210-9	+5V	
J210-10	$\overline{\text{HVTON}}$	L to apply DC high voltage to transfer corona.
J210-11	+3.2V	
J210-12	$\overline{\text{TPA}}$	Specifies type of test pattern to be printed (combination of $\overline{\text{TPB}}$ and $\overline{\text{TSTPTE}}$).
J210-13	$\overline{\text{TSTPT}}$	Goes L when the TEST PRINT button is pressed.
J210-14	$\overline{\text{TPB}}$	See the description of $\overline{\text{TPA}}$.
J210-15	$\overline{\text{RDY INH}}$	L to force printer to print even when it is not ready.
J210-16	$\overline{\text{TSTPTE}}$	See the description of $\overline{\text{TPA}}$.
J210-17	$\overline{\text{LPCHK}}$	Specifies laser power (combination of $\overline{\text{CSENS1}}$ and $\overline{\text{CSENS2}}$).
J210-18	$\overline{\text{CSNT1}}$	Specifies laser power in combination with $\overline{\text{CSNT2}}$.
J210-19	$\overline{\text{SCNON}}$	L to operate the scanner motor.
J210-20	$\overline{\text{CSNT2}}$	See description for $\overline{\text{CSNT1}}$.

Table 6-1

B. Laser Power Tester

Figure 6-3

The laser power tester is used with a digital multimeter to measure laser power. Use the tester as shown below.

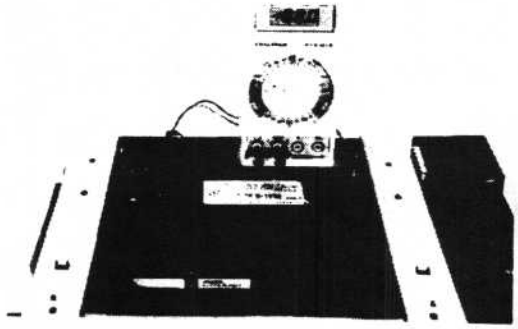


Figure 6-4

III. MEASUREMENT AND ADJUSTMENT

A. Image Adjustment

If an image problem occurs, follow the procedure below to make a test print.

1) Remove the front bottom cover. (2)
2) Switch the power ON by a signal from the external device.
3) Wait for the printer to make the RDY signal TRUE.
4) Press the TEST PRINT button on the DC controller PCB. This makes one test print as shown in the figure below.

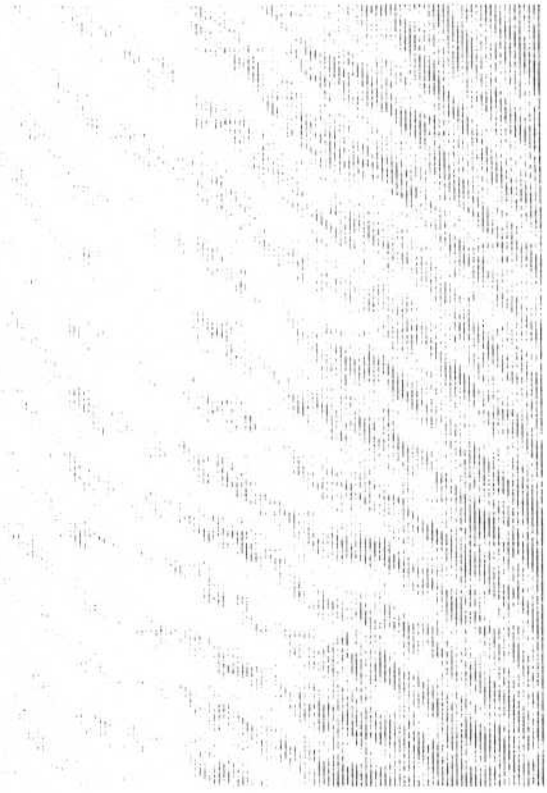


Figure 6-5

5) Determine the type of the image problem from the test print and go to Section IV.

B. Mechanical Adjustments

1. Checking the nip width of the fixing rollers

The fixing unit is not designed to allow adjustment of the pressure (and nip width). If the nip width is not correct, a fixing problem may occur.

Follow the procedure below to check the nip width.

1) Either take along one or two all-black A4/Letter-size copies made with a copier, or make such a black copy using a copier at the customer site.
2) Remove the front bottom cover. (2)
3) Put the black print on the manual feed tray.
4) Press the TEST PRINT button on the DC controller PCB.
5) When the end of the print first emerges at the delivery tray, switch the printer OFF by a signal from the external device, and wait for about 10 seconds, then switch the printer ON again.
6) Measure the width of the glossy band across the print and check that it meets the requirements shown in table 6-2.

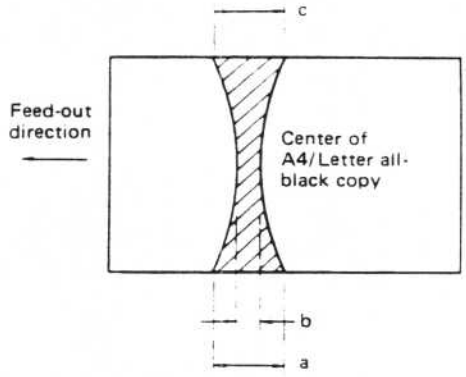


Figure 6-6

	Measurement
b	2 to 3.5 mm
|a − c|	0.5 mm or less
|a − b|	0.5 mm or less
|b − c|	0.5 mm or less

Table 6-2

C. Electrical Adjustments

There are no VRs that require adjustment in the field.

However, since the laser beam used is invisible, a problem with laser output cannot be identified visually. The laser malfunction diagnosis flowchart on the next page should be followed to determine whether the fault lies with the laser/scanner unit or the DC controller PCB.

Special attention should be given to the following items during troubleshooting.

- Plug the (+) lead into the red socket and the (−) lead into the black socket of the multimeter.
- The laser element can be destroyed by excessive current. Be sure to switch the printer OFF before disconnecting a connector.
- The voltage should be measured three times and the average used.

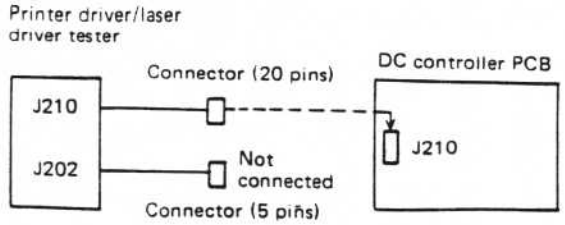


Figure 6-8

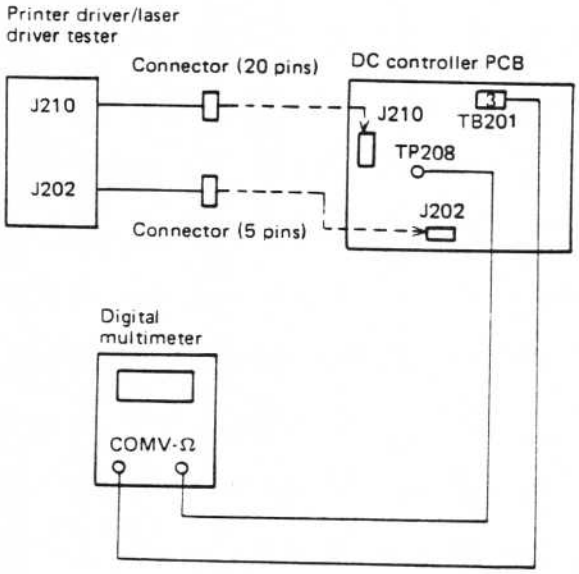


Figure 6-9

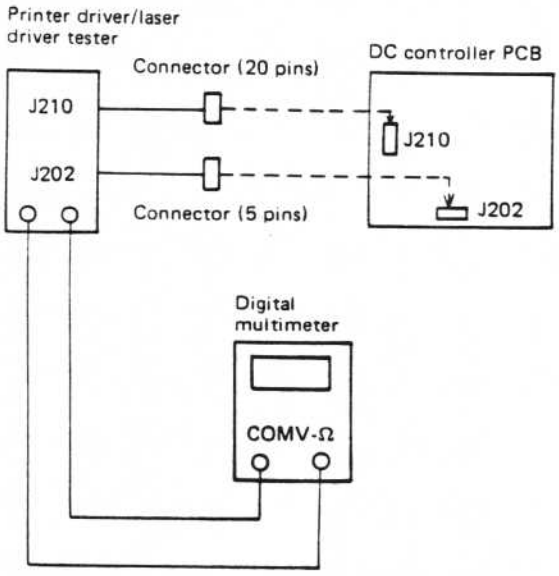


Figure 6-10

IV. IMAGE DEFECTS

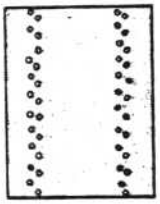
A. Examples of Image Defects

I-1 Light

I-2 Dark

I-3 Completely blank

I-4 All black



I-5 Large dots in line vertically

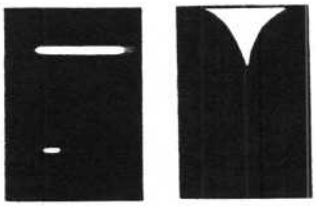
I-6 Dirt on back of paper

I-7 Vertical black streaks

I-8 Thin black horizontal streaks

I-9 Irregular and smudged vertical bands

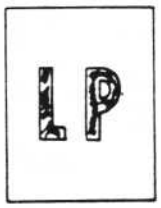
I-10 Irregular and smudged horizontal bands



I-11 Blank spots

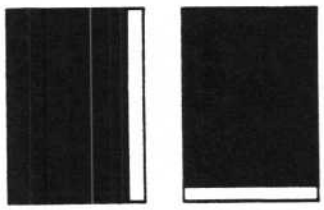
I-12 Solid vertical white line(s)

I-13 Faulty registration

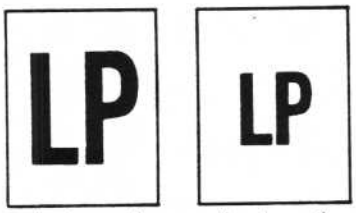


I-14 Poor fixing

I-15 Distortion



I-16 Missing edge or bottom edge



(enlarged) (reduced)

I-17 Incorrect resolution

Figure 6-11

B. How to Use the Troubleshooting Tables

The troubleshooting tables in Section IV to VI give information for troubleshooting if image problems, malfunctions, or paper transport problems occur.

This section describes how to use the troubleshooting tables.

Example: AC power failure

Possible cause	Step	Check	Result	Measure
Power cord	1	Is the printer plugged in?	NO	Plug it in.
Upper unit	2	Is the upper unit closed?	NO	Close it.
Circuit breaker	3	Is the circuit breaker ON?	NO	Reset it.
Line voltage	4	Is normal line voltage being supplied to the printer?	NO	Notify the customer that this is not a printer problem.
Door switch	5	Insert a screwdriver into the door switch hole. Does the printer go ON?	YES	Check the door switch. Replace it if it is faulty.

Table 7-3

The above tables show that the cause of the problem "AC power failure" could be the power cord, upper unit position, circuit breaker, line voltage, or door switch.

To solve a problem, start at step 1 and do the check indicated in the "Check" column. If the check result is indicated in the "Result" column, take the measure indicated in the "Measure" column.

If the check result is not as indicated, go to the next step and do the same as for step 1. The above table can be written in a flowchart format as shown below.

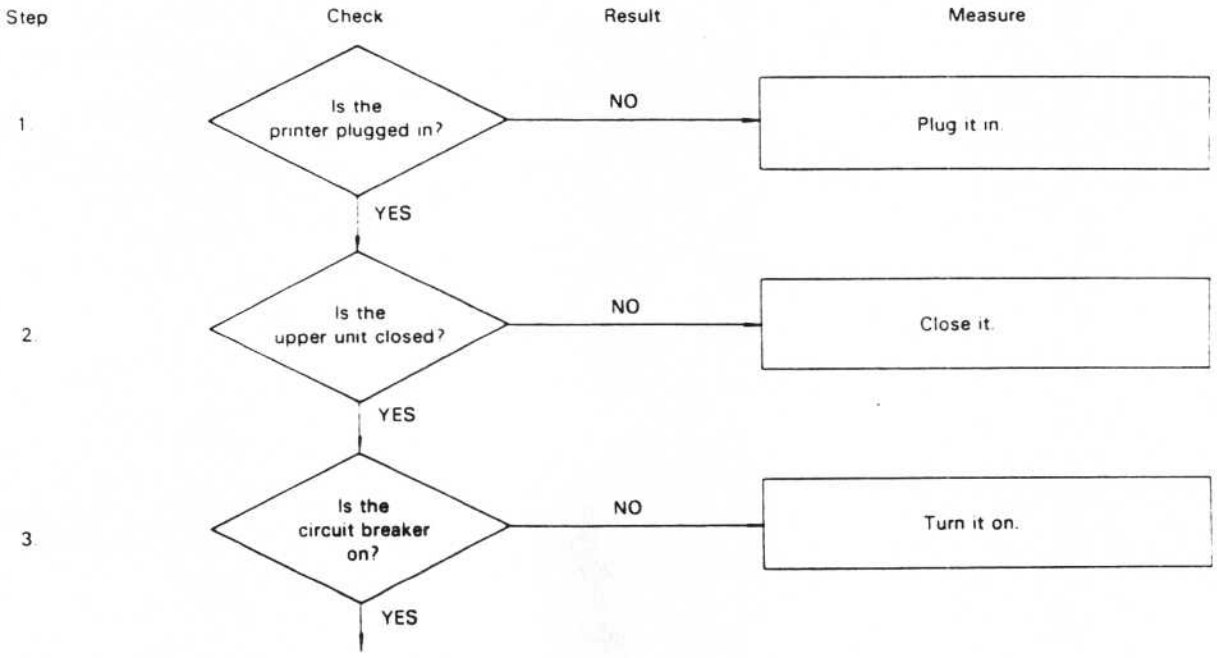
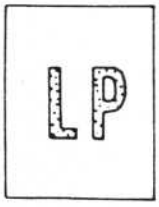


Figure 6-12

C. Troubleshooting Image Defects

I-1 Light



Possible Cause	Step	Check	Result	Measure
	1	Open the printer while a print is being made. Is the toner image on the drum being transferred to the paper? Do not open the drum protective shield for more than 10 seconds.	YES	If the toner image is very faint, go to step 6.
Transfer corona unit	2	Is the corona wire broken?	YES	Replace the corona wire. (See page 3-15)
Print paper	3	Does print quality improve when fresh print paper is used?	YES	Replace the print paper. Advise the customer how to store print paper.
Transfer corona HVT	4	Does the voltage between J702-1 ($\overline{\text{HVTON}}$) and J702-7 (GND) drop from about +20VDC to 0V two seconds after the main motor starts?	YES	Check the wiring from connector J702 to J701, whether connector J701 is making good contact, and the contact between the high-voltage connector and the transfer corona unit. If so good, replace the high-voltage power supply.
DC controller PCB	5	Two seconds after the main motor starts does the voltage between J211-8 ($\overline{\text{HVTON}}$) and J211-2 (GND) drop from about +20VDC to 0V?	NO	Check whether connector J211 is making good contact. (Disconnect the connector, clean the contacts, reconnect it and wiggle it.) If so, replace the DC controller PCB.
Developing bias	6	One second after the main motor starts does the voltage between J702-6 ($\overline{\text{DBDC}}$) and J702-7 (GND) drop from +16VDC to 0V? Three seconds after the main motor starts does the voltage between J702-4 ($\overline{\text{DBAC}}$) and J702-7 (GND) drop from about +16VDC to 0V?	YES	Check the wiring from connector J702 to J701, whether connector J701 is making good contact, and whether the high-voltage connector is making good contact with the developing bias contact. If so, replace the high-voltage power supply.
DC controller PCB	7	One second after the main motor starts does the voltage between J211-3 ($\overline{\text{DBDC}}$) and J211-2 (GND) drop from about +16VDC to 0V? Three seconds after the main motor starts does the voltage between J211-5 ($\overline{\text{DBAC}}$) and J211-2 (GND) drop from about +16VDC to 0V?	NO	Check whether connector J211 is making good contact. (Disconnect the connector, clean the contacts, reconnect it and wiggle it.) If so, replace the DC controller PCB.

Possible Cause	Step	Check	Result	Measure
Drum sensitivity identification switches (SW301, SW302)	8	When drum sensitivity identification switch SW301 is pressed does the voltage between J301-1 ($\overline{CSENS1}$) and J301-6 (GND) drop from about +5VDC to 0V? When drum sensitivity identification switch SW302 is pressed does the voltage between J301-2 ($\overline{CSENS2}$) and J301-6 (GND) drop from about +5VDC to 0V?	NO	Replace the faulty switch (SW301 or SW302).
Laser and scanner unit DC controller PCB	9	Measure the voltage on TP208 using the laser mulfunction diagnosis flowchart in Section III, C of this chapter. Is the voltage normal?	YES	Replace the laser and scanner unit.
			NO	Replace the DC controller PCB.

LP

Possible Cause	Step	Check	Result	Measure
Drum sensitivity identification switches (SW301, SW302)	1	When drum sensitivity identification switch SW301 is pressed does the voltage between J301-1 ($\overline{\text{CSENS1}}$) and J301-6 (GND) drop from about +5VDC to 0V? When drum sensitivity identification switch SW302 is pressed does the voltage between J301-2 ($\overline{\text{CSENS2}}$) and J301-6 (GND) drop from about +5VDC to 0V?	NO	Replace the faulty switch (SW301 or SW302).
High-voltage connector	2	Clean the contact between the high-voltage connector grounding spring and the EP-S cartridge, then make a test print. Does print quality improve?	YES	Make sure that the grounding spring is making good contact with the EP-S cartridge.
Laser and scanner unit DC controller PCB	3	Measure the voltage on TP208 using the laser mulfunction diagnosis flowchart. Is the voltage on TP208 normal?	YES	Replace the laser and scanner unit.
			NO	Replace the DC controller PCB.

I-3 Completely blank

Possible Cause	Step	Check	Result	Measure
EP-S cartridge	1	Has the seal been removed from the cartridge?	NO	Unseal it.
	2	Can the protective shield be opened and closed smoothly?	NO	Repair the cartridge. If impossible, replace it.
	3	Is the laser beam-blocking shutter damaged?	YES	Replace the cartridge.
Transfer corona unit	4	Is there any conductive foreign matter between the corona wire and frame?	YES	Clean the wire.
Developing bias	5	One second after the main motor starts does the voltage between J702-6 ($\overline{DBDC}$) and J702-7 (GND) drop from about +16VDC to 0V? Three seconds after the main motor starts does the voltage between J702-4 ($\overline{DBAC}$) and J702-7 (GND) drop from about +16VDC to 0V?	YES	Check the wiring from connector J702 to J701, whether connector J701 is making good contact, and whether the high-voltage connector is making good contact with the developing bias contact. If so, replace the high-voltage power supply.
DC controller PCB	6	One second after the main motor starts does the voltage between J211-3 ($\overline{DBDC}$) and J211-2 (GND) drop from about +16VDC to 0V? Three seconds after the main motor starts does the voltage between J211-5 ($\overline{DBAC}$) and J211-2 (GND) drop from about +16VDC to 0V?	NO	Check whether connector J211 is making cood contact. (Disconnect the connector, clean the contacts, reconnect it and wiggle it.) If so, replace the DC controller PCB.
Laser and scanner unit DC controller PCB	7	Measure the voltage on TP208 using the laser mulfunction diagnosis flowchart. Is the voltage on TP208 normal?	YES	Replace the laser and scanner unit.
			NO	Replace the DC controller PCB.

I-4 All black

Possible Cause	Step	Check	Result	Measure
Primary corona unit	1	Is the corona wire broken?	YES	Replace the cartridge.
High-voltage power supply	2	One second after the main motor starts does the voltage between J702-3 ($\overline{\text{HV1ON}}$) and J702-7 (GND) drop from about +16VDC to 0V?	YES	Check the wiring from connector J702 to J701, whether connector J701 is making good contact, and whether the high-voltage connector is making good contact with the primary corona unit. If so, replace the high-voltage power supply.
DC controller PCB			NO	Check whether connector J211 is making good contact. If so, replace the DC controller PCB.

I-5 Large dots (in line vertically)

Possible Cause	Step	Check	Result	Measure
Static charge eliminator	1	Clean the contact between the high-voltage connector and the static charge eliminator, then make a test print. Is the print normal?	YES	Make sure that the high-voltage connector has good contact with the static charge eliminator.
High-voltage power supply			NO	Replace the high-voltage power supply.

I-6 Dirt on back of paper

Possible Cause	Step	Check	Result	Measure
Cassette cover	1	Is the cover of the cassette dirty?	YES	Clean it with a damp cloth, then wipe it with a dry cloth.
Transfer guide unit	2	Is the transfer guide dirty?	YES	Clean it with a damp cloth, then wipe it with a dry cloth.
Transfer corona unit	3	Is the transfer corona unit dirty?	YES	Clean it with a damp cloth, then wipe it with a dry cloth.
Feed guide unit	4	Is the feed guide dirty?	YES	Clean it with a damp cloth, then wipe it with a dry cloth.
Fixing roller felt cleaning pad			NO	Replace the felt cleaning pad.

I-7 Vertical black streaks

Possible Cause	Step	Check	Result	Measure
Primary corona unit	1	Clean the primary corona unit and make a test print. Is the print normal?	YES	Clean the primary corona unit.
Photosensitive drum	2	Open the printer while a print is being made. Open the protective shield of the catridge. Can vertical streaks be seen on the drum?	YES	Replace the cartridge.
Fixing roller felt cleaning pad			NO	Replace the felt cleaning pad.

I-8 Thin black horizontal streaks

Possible Cause	Step	Check	Result	Measure
Photosensitive drum	1	Do the streaks occur at regular intervals?	YES	Replace the cartridge.
Laser and scanner unit DC controller PCB			NO	Replace the laser and scanner unit. If there are still problems, replace the DC controller PCB.

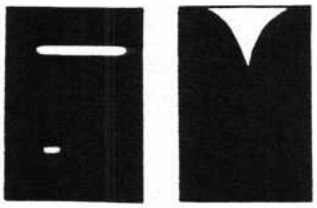
I-9 Irregular and smudged vertical bands

Possible Cause	Step	Check	Result	Measure
Primary corona unit	1	Clean the corona wire with a wire cleaner and make a test print. Is the print normal?	YES	Clean the primary corona unit.
Photosensitive drum			NO	Replace the cartridge.

I-10 Irregular and smudged horizontal bands

Possible Cause	Step	Check	Result	Measure
Photosensitive drum	1	Do the bands appear at regular intervals?	YES	Replace the cartridge.
Fixing roller felt cleaning pad			NO	Replace the felt cleaning pad.

I-11 Blank spots



Possible Cause	Step	Check	Result	Measure
Print paper	1	Has the print paper absorbed moisture?	YES	Replace the paper. Advise the customer to wrap and store print paper to prevent it from absorbing moisture.
Developing bias			NO	Check that the developing bias is normal.

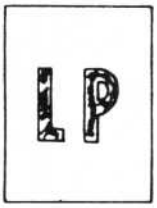
I-12 Solid vertical white line(s)

Possible Cause	Step	Check	Result	Measure
Lack of toner	1	Is there one or more straight vertical white streak of uniform width?	YES	Take out the cartridge, rock it as shown in Section III of Chapter 4 to distribute the toner evenly, then reinstall it.
Mirror	2	Is the mirror dirty?	YES	Clean the mirror using a blower brush. The mirror can be scratch easily, so any other method of cleaning requires great care.
Transfer corona unit			NO	Clean the transfer corona unit.

I-13 Faulty registration

Possible Cause	Step	Check	Result	Measure
Cassette	1	Is the cassette overloaded?	YES	Instruct the customer not to load the cassette with too much paper.
Pick-up roller	2	Is the pick-up roller worn?	YES	Replace it.
Print paper	3	Is paper recommended being used?	NO	Make a test print with recommended paper. If the problem disappears, advise the customer to use recommended paper.
Registration roller clutch	4	Is the clutch spring deformed, rusted, or worn?	YES	Replace the spring.
Driver and sensor PCB DC controller PCB	5	Three seconds after the main motor starts does the voltage between J301-3 (REGD) and J301-6 (GND) change from 0V to between 3 and 5 VDC?	YES	Replace the driver and sensor PCB.
			NO	Replace the DC controller PCB.

I-14 Poor fixing

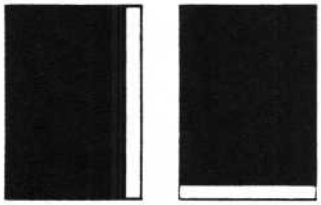


Possible Cause	Step	Check	Result	Measure
Fixing roller heater	1	Make 10 test prints. Is the last image lighter than the first?	YES	Replace the thermistor (TH1).
Fixing rollers	2	Does poor fixing occur in a vertical band?	YES	Check whether the fixing rollers are damaged.
Fixing unit Print paper	3	Is the nip width correct?	YES	Replace the fixing unit.
			NO	Print using Canon-recomended paper. If the problem disappears, advise the customer to use recommended paper.

I-15 Distortion

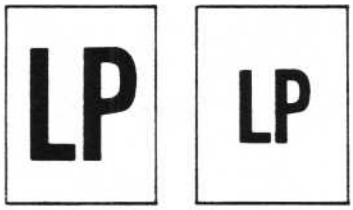
Possible Cause	Step	Check	Result	Measure
Laser and scanner unit	1	Does LED201 on the DC controller PCB go ON after the scanner motor starts?	YES	Replace the laser and scanner unit.
DC controller PCB			NO	Replace the DC controller PCB.

I-16 Missing edge or bottom edge



Possible Cause	Step	Check	Result	Measure
	1	Is the paper-size identification slider to the correct position?	NO	Set it correctly.

I-17 Incorrect resolution



(enlarged) (reduced)

Possible Cause	Step	Check	Result	Measure
DC controller PCB Interface PCB	1	Set printer resolution to 400DPI by a signal from the external device. Make one text print. Is the voltage between connector J205A-9 (DPI) and J205A-1 (GND) about 5VDC while a print is being made?	YES	Replace the DC controller PCB.
			NO	Replace the interface PCB.

V. TROUBLESHOOTING MALFUNCTIONS

When performing any of the corrective actions described below, the following precaution should be taken when measuring voltages at designated connector pins, first check the connector for faulty contacts.

If no otherwise noted, measurements of voltages on pins of connectors are to be made with the connector connected.

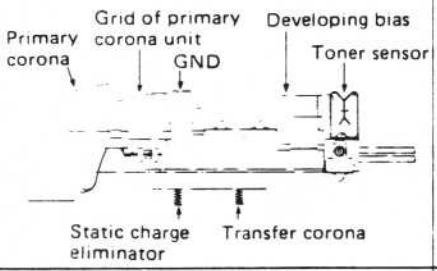
M-1 No AC Power

Possible Cause	Step	Check	Result	Measure
AC lines	1	Is the correct voltage present at the outlet?	NO	Inform the user that there is a problem with the AC power lines.
Power plug	2	Is the power cord firmly plugged into the outlet?	NO	Push the power plug in firmly.
Circuit breaker (CB101)	3	Is the circuit breaker OFF?	YES	Reset the circuit breaker. If it trips again, check for a short circuit.
Low-voltage power supply AC controller unit	4	Unplug connector J601 from the low-voltage power supply. Is the correct voltage present between pins 1 and 3 of J602?	YES	Replace the low-voltage power supply.
			NO	Replace the AC controller unit.

M-2 No DC Power

Possible Cause	Step	Check	Result	Measure
Connector	1	Is connector J601 connected correctly?	NO	Connect it correctly.
AC controller unit	2	Unplug connector J601 from the low-voltage power supply. Is the specified voltage (AC line voltage) present between J601-1 and J602-3?	NO	Replace the AC controller unit.
Misoperation	3	Is the voltage selector set to the correct voltage?	NO	Set it correctly.
Fuse	4	Is the fuse blown in the low-voltage power supply?	YES	Replace the fuse.
External device	5	Switch the power ON. Is the voltage between J205-B9 (PCONT) and J205-A1 (GND) about 5VDC?	YES	Replace the low-voltage power supply.
			NO	This is not a printer problem. Check the external device.

M-3 The printer sets the 6th bit of Status 15 to "1" even when there is Enough Toner in the EP-S Cartridge

Possible Cause	Step	Check	Result	Measure
EP-S cartridge	1	Is there a cartridge in the printer?	NO	Install a cartridge.
	2	Does the cartridge have a drum sensitivity indication cam?	NO	Replace the cartridge.
	3	Remove the cartridge, rock it in the correct manner, then reinstall it. Does the printer set status 15 bit 6 to 0?	NO	The toner supply is getting low, so a new cartridge should be obtained for use when needed.
Actuator	4	When the printer is closed, is one or both drum sensitivity identification switches (SW301 and SW302) actuated?	NO	Replace the actuator.
High-voltage connector	5	Are the connector pins of the high-voltage cable for developing bias and the toner sensor dirty? 	YES	Clean the high-voltage connector.
Driver and sensor PCB DC controller PCB	6	When the drum sensitivity identification switches listed below are pressed, does the voltage at the indicated pins of connector J213 on the DC controller PCB go from about 5VDC to 0V? SW301 — J213-1 SW302 — J213-2	NO	Replace the driver and sensor PCB.
			YES	Replace the DC controller PCB.
High-voltage power supply DC controller PCB	7	Measure the voltage between connector J702-5 (TSENS) and J702-7 (GND). Is the voltage about 24VDC or 0V?	YES	Replace the high-voltage power supply.
			NO	Replace the DC controller PCB.

M-4 The printer sets the 4th bit of Status 1 to "1" even when a Cassette Loaded with Paper is Installed

Possible Cause	Step	Check	Result	Measure
Driver and sensor PCB	1	When there is a cassette with paper in the holder, is the voltage between connector J301-8 (PEMP) and J301-6 (GND) about 5VDC?	NO	Replace the driver and sensor PCB.
Cassette size sensing switch PCB DC controller PCB	2	Press the cassette size sensing switches in turn. Is the voltage between the corresponding connector (J217-2, J217-3, or J217-4) and J217-1 (GND) 0V? SW261 – J217-2 SW262 – J217-3 SW263 – J217-4	NO	Check the wiring from the DC controller PCB to the cassette size sensing switch PCB. If the wiring is correct, replace the cassette size sensing switch PCB.
			YES	Replace the DC controller PCB.

M-5 The printer sets the 4th bit of Status 1 to "1" when a Cassette is out of Paper

Possible Cause	Step	Check	Result	Measure
Driver and sensor PCB DC controller PCB	1	When the cassette is empty, is the voltage between connector J301-8 (PEMP) and J301-6 (GND) PCB 0V?	NO	Replace the driver and sensor PCB.
			YES	Replace the DC controller PCB.

M-6 Faulty Main Motor

Possible Cause	Step	Check	Result	Measure
	1	Have the main motor connectors (J501, J502, J215, and J214) been plugged in?	NO	Plug in the connectors.
Main motor (M1)	2	Is there continuity between J501-1 and J501-2 and between J501-2 and J501-3 of the main motor?	NO	Replace the main motor.
DC controller PCB	3	Connect pin 11 of IC225 on the DC controller PCB to GND. Does the main motor start rotating and does LED202 go ON?	YES	Replace the DC controller PCB.
Main motor (M1) DC controller PCB	4	Connect pin 11 of IC225 on the DC controller PCB to GND. Is the voltage across resistor R250 about 0.7V?	YES	Replace the main motor.
			NO	Replace the DC controller PCB.

M-7 No Paper Pick-Up from Cassette

Possible Cause	Step	Check	Result	Measure
Main motor (M1)	1	Switch the power ON. Does the main motor rotate for one second?	NO	Make a check using the steps of M-6 "Faulty Main Motor".
Pick-up roller clutch solenoid (SL301)	2	Make one test print. Does the voltage across connector pins J301-4 (CPUD) and J301-6 (GND) change from 0V to between 3 and 5VDC?	YES	Replace the driver and sensor PCB.
DC controller PCB			NO	Replace the DC controller PCB.

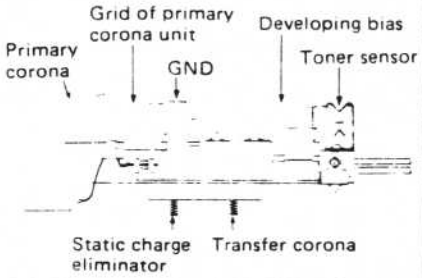
M-8 No Manual Paper Pick-Up

Possible Cause	Step	Check	Result	Measure
Main motor (M1)	1	Switch the power ON. Does the main motor rotate for one second?	NO	Make a check using the steps of M-6 "Faulty Main Motor".
Driver and sensor PCB	2	Measure the voltage across connector pins J301-9 (MPFS) and J301-6 (GND) when there is no paper on the manual feed tray. Does the voltage change from about 5VDC to 0V when a sheet is placed on the tray?	NO	Replace the driver and sensor PCB.
Pick-up roller clutch solenoid (SL301)	3	Make one test print. Does the voltage across connector pins J301-4 (CPUD) and J301-6 (GND) change from 0V to between 3 and 5VDC?	YES	Replace the driver and sensor PCB.
DC controller PCB			NO	Replace the DC controller PCB.

M-9 Preconditioning Exposure Lamps do not go ON

Possible Cause	Step	Check	Result	Measure
Preconditioning exposure lamps	1	Does the voltage between J801-1 ($\overline{\text{PEXPO}}$) and J801-2 (+24VDC) change from 0V to about +24VDC after the main motor starts?	YES	Replace any faulty preconditioning exposure lamp.
DC controller PCB			NO	Replace the DC controller PCB.

M-10 Poor Output of the High-Voltage Power Supply

Possible Cause	Step	Check	Result	Measure
High-voltage connector	1	Is any terminal of the high-voltage connector dirty or burnt? 	YES	Clean the terminals of the high-voltage connector.
High-voltage power supply DC controller PCB	2	Make one test print. Measure the voltage in turn at each of the J702 connector pins indicated below. Does the voltage change in each case from about 5VDC to 0V at some time during the printing cycle?	YES	Replace the high-voltage power supply.
			NO	Replace the DC controller PCB.

Primary corona unit	J702-3
Developing bias (AC)	J702-4
Developing bias (DC)	J702-6
Transfer corona unit	J702-1

M-11 The printer sets the 5th bits of Status 1 to "1" when there is no Paper Jam

Possible Cause	Step	Check	Result	Measure
Delivery cover	1	Is the delivery cover open?	YES	Close it completely.
Delivery unit paper sensor arm	2	Is the delivery unit paper sensor arm unit damaged?	YES	Replace the arm unit.
Delivery unit paper sensor (PS331) DC controller PCB	3	When the delivery unit paper sensor (PS331) arm is moved, does the voltage between connector pins J851-2 (PDP) and J851-3 (GND) go from 0V to about 5VDC?	NO	Replace the sensor.
			YES	Replace the DC controller PCB.

M-12 Fixing Unit Heater does not Operate

Possible Cause	Step	Check	Result	Measure
Thermo-switch (TP1)	1	Is there continuity through the thermo-switch of the fixing unit?	NO	Replace the thermo-switch.
Thermistor (TH1)	2	Disconnect connector J851 of the fixing unit. Measure the resistance across connector pins J851-5 and J851-4. Is the resistance (at room temperature) between 1.0M Ω and 1.6M Ω?	NO	Replace the thermistor.
Fixing roller heater (H1)	3	Is there continuity through the fixing roller heater?	NO	Replace the fixing roller heater.
AC controller unit	4	When the printer power is switched ON, does the voltage between connector pins J208-2 ($\overline{FSRD}$) and J208-3 (GND) of the DC controller PCB go from about 5VDC to 0V?	YES	Replace the AC controller unit.
DC controller PCB Interface PCB	5	Check that there is a cartridge in the printer, that the printer is closed, and that there is paper in the cassette, then switch the printer ON. Does the voltage across connector pins J205-B2 ($\overline{RDY}$) and J205-A1 (GND) on the DC controller PCB go from about 5VDC to 0V within 1 minute?	NO YES	Replace the DC controller PCB. Replace the interface PCB.

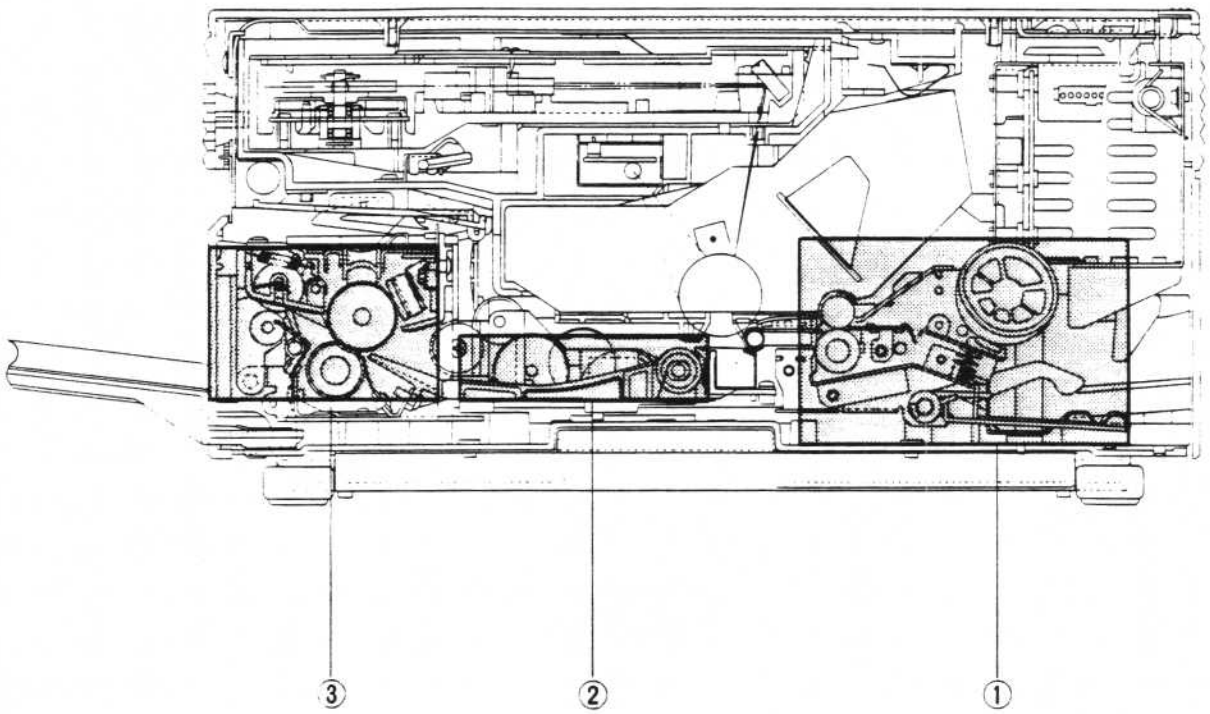
Note:
When the printer self-diagnosis system detects a fixing unit fault, it automatically shuts off current to the fixing roller heater to prevent overheating. If it is required to operate the heater for servicing, the printer should be switched OFF for at least 10 minutes before it is switched ON again.

VI. PAPER TRANSPORT TROUBLESHOOTING

A. Print Paper Jams

Paper in the printer passes through three major sections: ① pick-up section, ② separation and feeder section, ③ fixing and delivery section.

This section explains troubleshooting for jams in each of these sections.



① Pick-up section
② Separation and feeder section
③ Fixing and delivery section

Figure 6-13

T-1 Pick-up Section

Possible Cause	Step	Check	Result	Measure
Print paper	1	Is paper recommended being used?	NO	Advise the customer to use recommended paper.
	2	Is the paper curled or wrinkled?	YES	Replace the paper. Advise the customer how to store paper.
Too much paper in cassette	3	Is the cassette overloaded?	YES	Instruct the customer not to load the cassette with too much paper.
Pick-up roller	4	Is the pick-up roller deformed or worn?	YES	Replace it.
Pick-up roller clutch	5	Is the clutch spring deformed, rusted, or worn?	YES	Replace the pick-up roller (with the clutch).
Driver and sensor PCB	6	Two seconds after the main motor starts does the voltage between J301-4 (CPUD) and J301-6 (GND) rise from 0V to between 3 and 5VDC?	YES	Replace the driver and sensor PCB.
Registration roller clutch	7	Is the clutch spring deformed, rusted, or worn?	YES	Replace the spring.
Driver and sensor PCB DC controller PCB	8	Three seconds after the main motor starts does the voltage between J301-3 (REGD) and J301-6 (GND) rise from 0V to between 3 and 5VDC?	YES	Replace the driver and sensor PCB.
			NO	Replace the DC controller PCB.

T-2 Separation and Feed Section

Possible Cause	Step	Check	Result	Measure
Static charge eliminator bias	1	Clean the contacts between the high-voltage connector and the static charge eliminator, and make several test prints. Does a jam occur?	YES	Make sure that the high-voltage connector is in good contact with the static charge eliminator.
High-voltage power supply			NO	Replace the high-voltage power supply.

T-3 Fixing and Delivery Section

Possible Cause	Step	Check	Result	Measure
Entrance guide	1	Is the entrance guide dirty?	YES	Clean the guide.
Separation claws	2	Are any separation claws worn or damaged?	YES	Replace any faulty separation claws.
Delivery unit paper sensor arm	3	Does the sensor arm move smoothly?	YES	Check the delivery rollers.
			NO	Repair the arm.

B. Incomplete Paper Feed

T-1 Sheets stuck together

Possible Cause	Step	Check	Result	Measure
Print paper	1	Is paper recommended being used?	NO	Advise the customer to use recommended paper.
Separation pad	2	Is the separation pad surface worn?	YES	Replace the separation pad.

T-2 Wrinkles

Possible Cause	Step	Check	Result	Measure
Print paper	1	Is paper recommended being used?	NO	Advise the customer to use recommended paper.
	2	Do wrinkles disappear when fresh paper is used?	YES	Advise the customer how to store paper to prevent it from absorbing moisture.
Pick-up unit	3	Open the printer while the sheet of paper is passing through the feeder unit. Is the paper deformed (creased, folded, etc.)?	YES	Check the pick-up unit and registration rollers.
Entrance guide	4	Is the entrance guide dirty?	YES	Clean the guide.
Fixing unit			NO	Replace the fixing unit.

VII. LOCATION OF ELECTRICAL PARTS/FUNCTION

A. Switches, Photointerrupters, and Solenoids

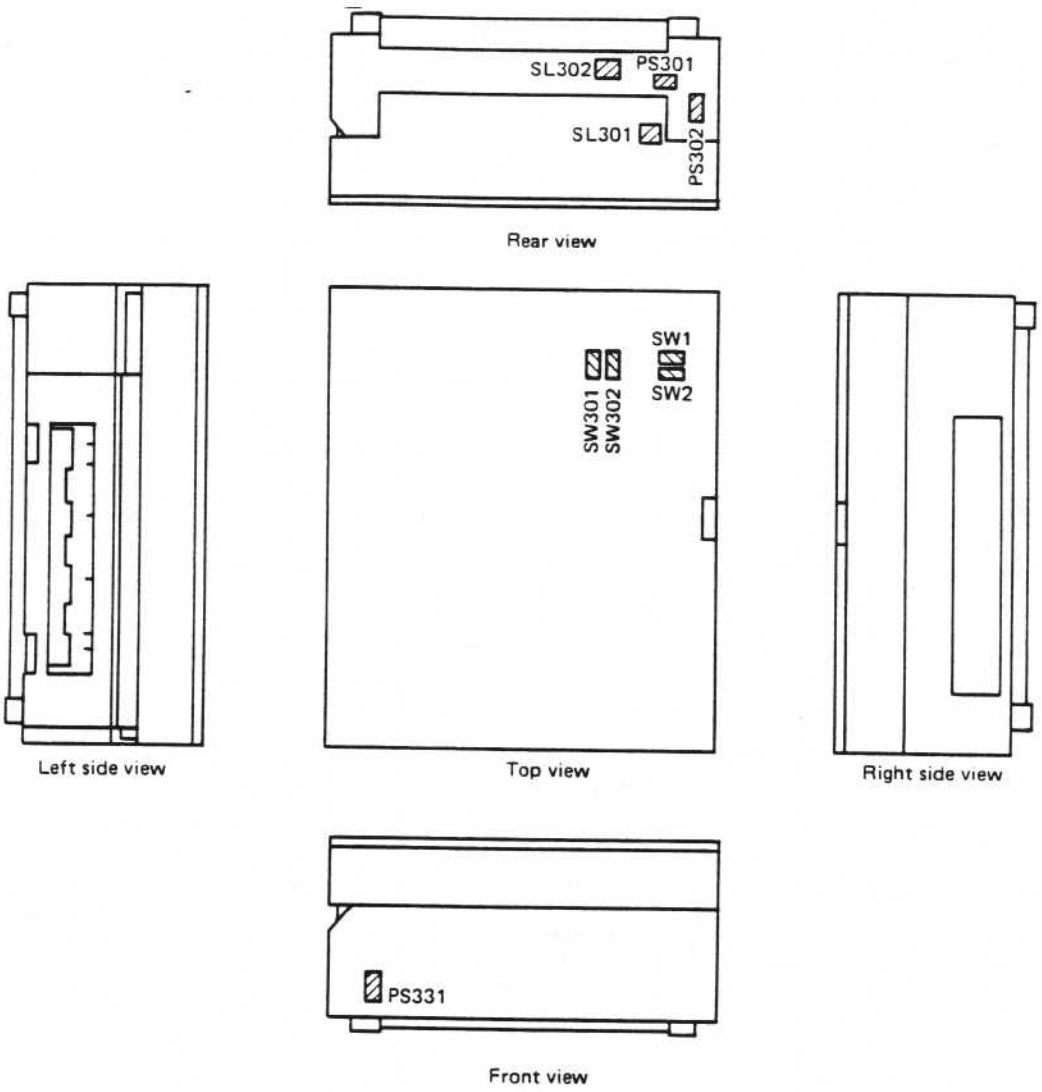


Figure 6-14

Symbol	Name	No.	Function
	Switch	SW301 SW302	Sensing drum sensitivity
		SW 1	Cutting off 24VB and 24VC when printer is open
		SW 2	Sensing if printer is open
	Photointerrupter	PS331	Sensing paper in delivery unit
		PS301	Sensing paper in cassette
		PS302	Sensing paper in manual feed unit
	Solenoid	SL301	Operating pick-up roller
		SL302	Operating registration roller

Table 6-4

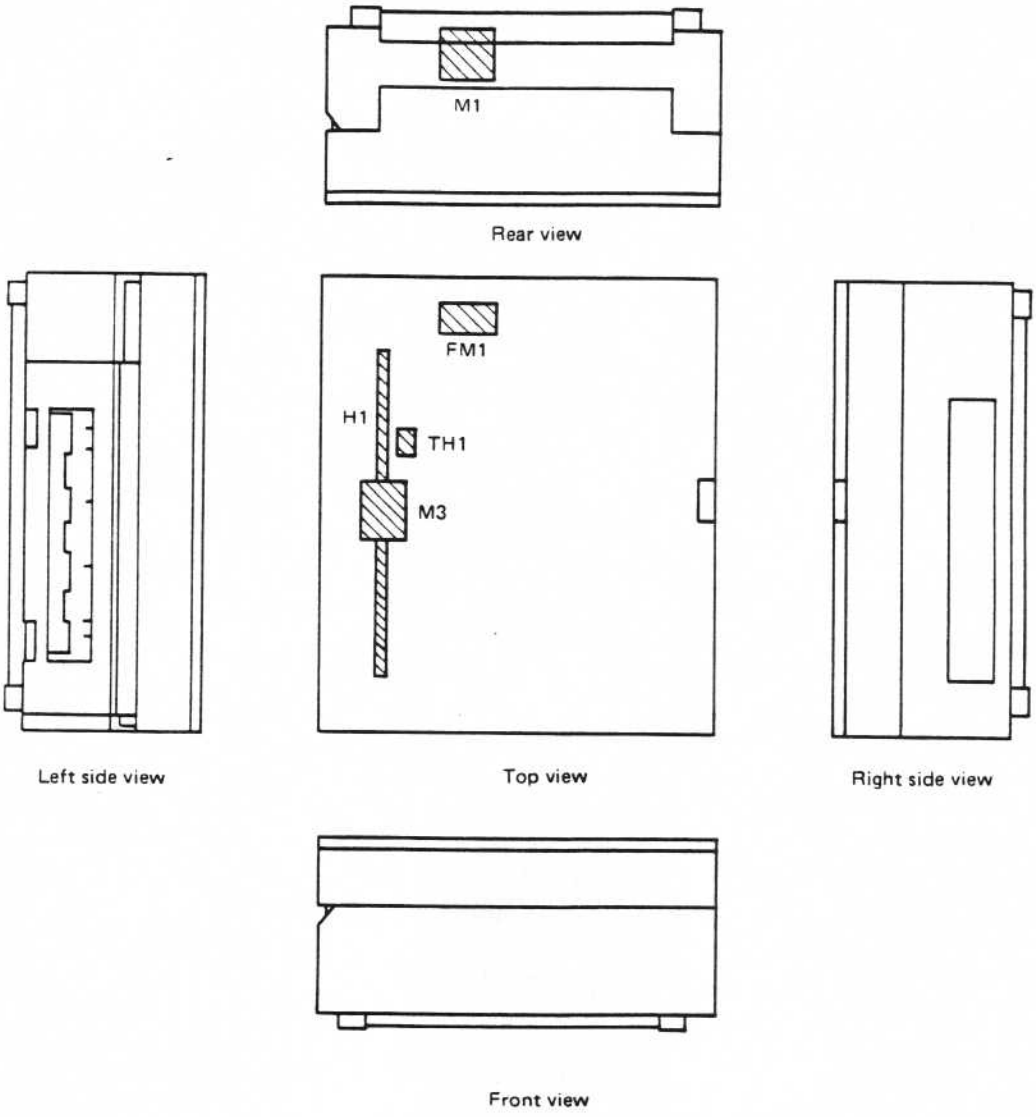


Figure 6-15

Symbol	Name	No.	Function
M	Main Motor	M1	Drive motor for drum, pick-up roller and paper feed roller
	Scanner motor	M3	Drive motor for scanning mirror
	Fan motor	FM1	Exhaust fan for space above the chassis
	Heater	H1	Heating fixing roller
	Thermistor	TH1	Sensing fixing roller surface temperature

Table 6-5

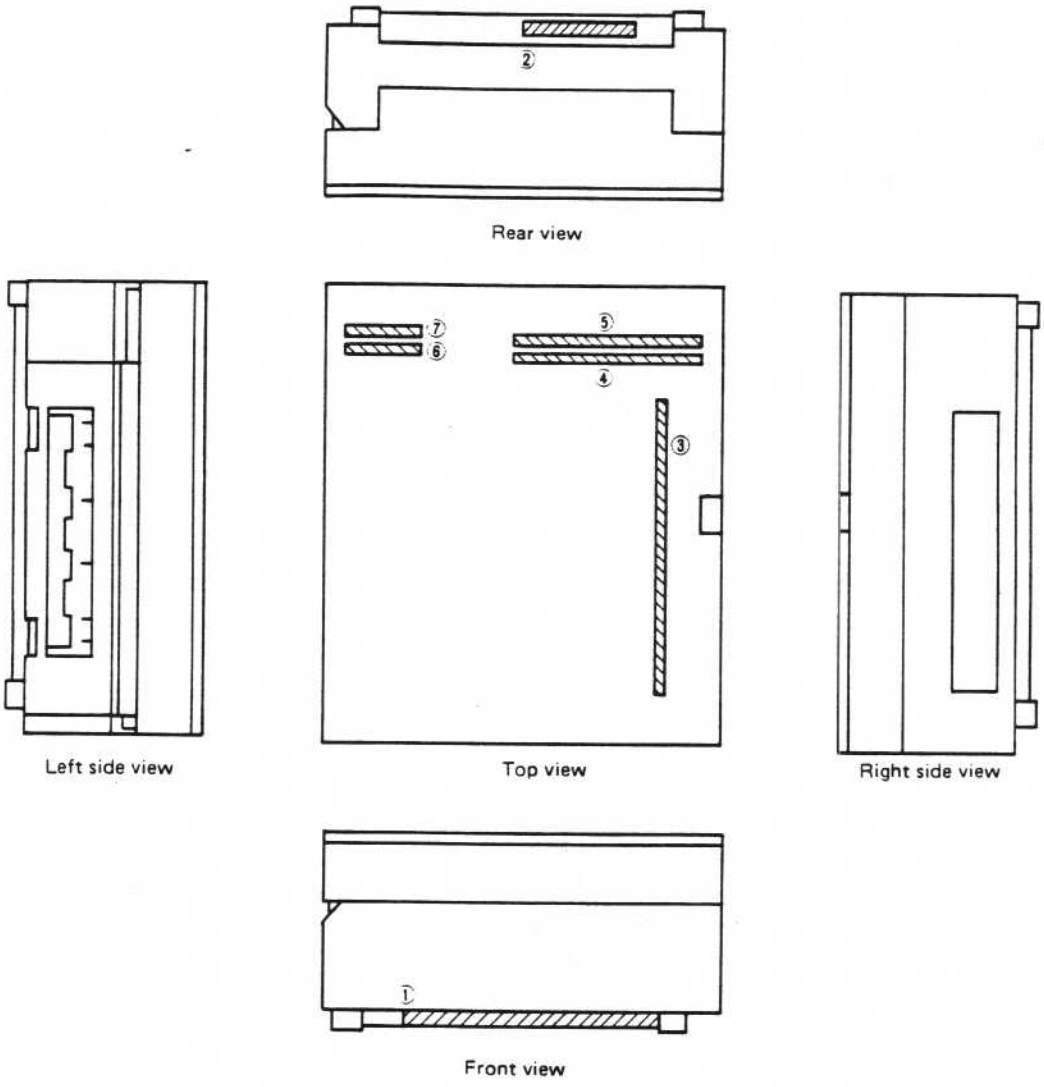


Figure 6-16

Symbol	Name of PCB	Function
1	DC controller PCB	Controlling printing operations, video interface
2	Interface PCB	Connecting PCB for interface signals between printer and external device
3	High-voltage power supply PCB	Applying high voltage to primary corona and transfer corona units Amplification of toner sensor output
4	Driver and sensor PCB	Mount for various sensors, drivers for pick-up roller clutch solenoid and registration roller clutch solenoid
5	Low-voltage power supply	Regulating DC voltage (+5VDC, −5VDC, +24VDC)
6	Fixing roller heater safety PCB	Preventing excessive fixing roller temperature
7	AC controller PCB	Fixing roller heater driver PCB

Table 6-6

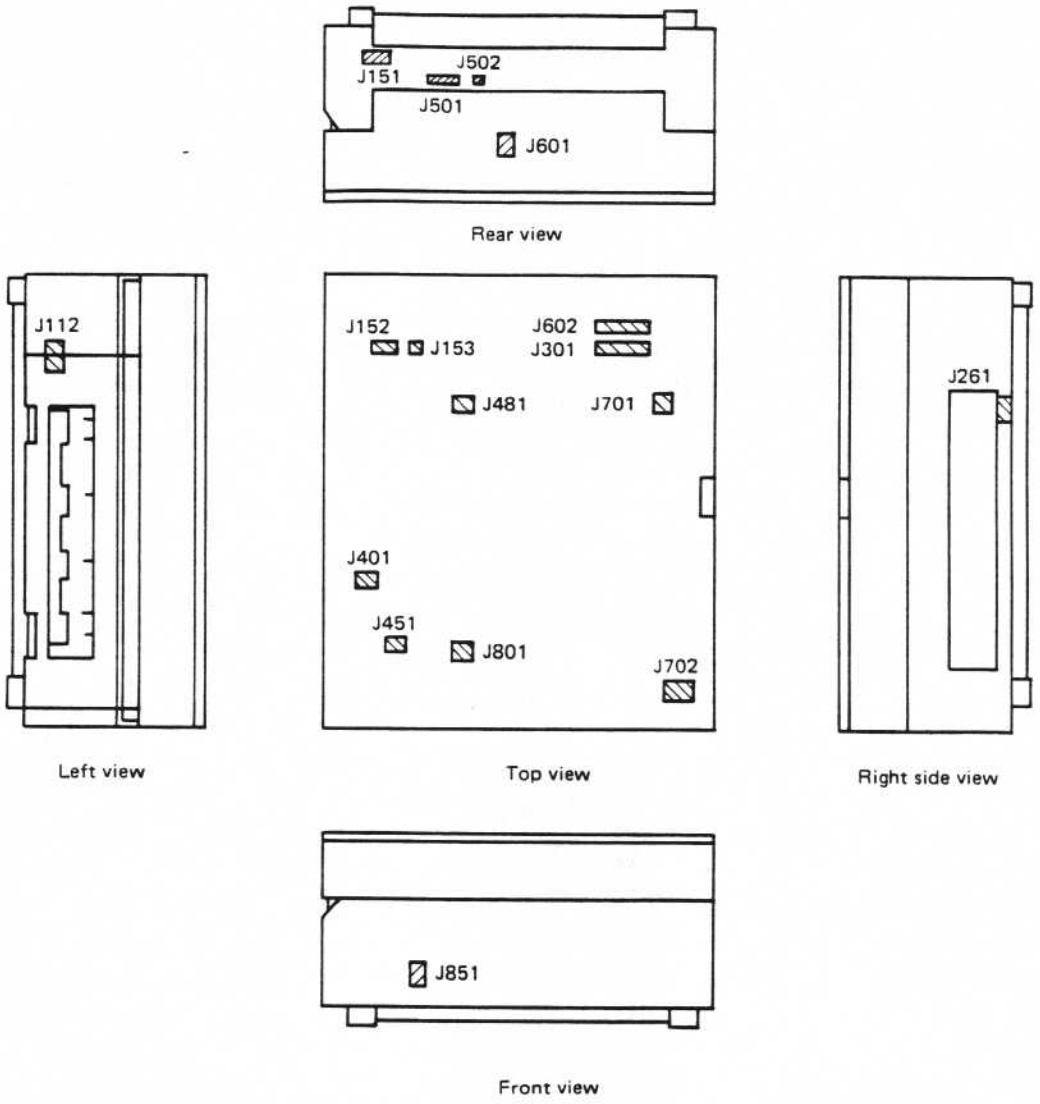


Figure 6-17

No.	Number of pins	Connected to	No.	Number of pins	Connected to
J112	2	Fixing unit	J501	9	Main motor (M1)
J151	4	Safety PCB	J502	3	
J152	6	AC controller PCB	J601	3	AC controller PCB
J153	2	Fan-motor (FM1)	J602	14	Low-voltage power supply
J261	4	Cassette size sensing switch PCB	J701	8	HVT PCB
J301	9	Driver and sensor PCB	J702	8	HVT unit
J401	5	Scanner motor (M3)	J801	2	Preconditioning lampboard
J451	5	Laser diode PCB	J851	5	Fixing unit
J481	1	Scanner unit			

Table 6-7

VIII. VARIABLE RESISTORS, LEDS, TEST PINS, JUMPERS, AND SWITCHES ON PC BOARDS

Variable resistors, LED indicators, test pins, jumpers, and switches required in after-sales service are listed below.

Any variable resistors, test pins, etc., not listed below are for factory use only. They require special tools and measuring instruments, and must be set with high precision. Do not touch them during after-sale service.

Notes:

1. Some of the LED indicators receive leakage current during normal operation, causing a dim glow even when they should be OFF.
2. Potentiometers which may be adjusted in after-sale service are marked ....
   Potentiometers which may not be adjusted in after-sale service are marked .

A. DC controller PCB

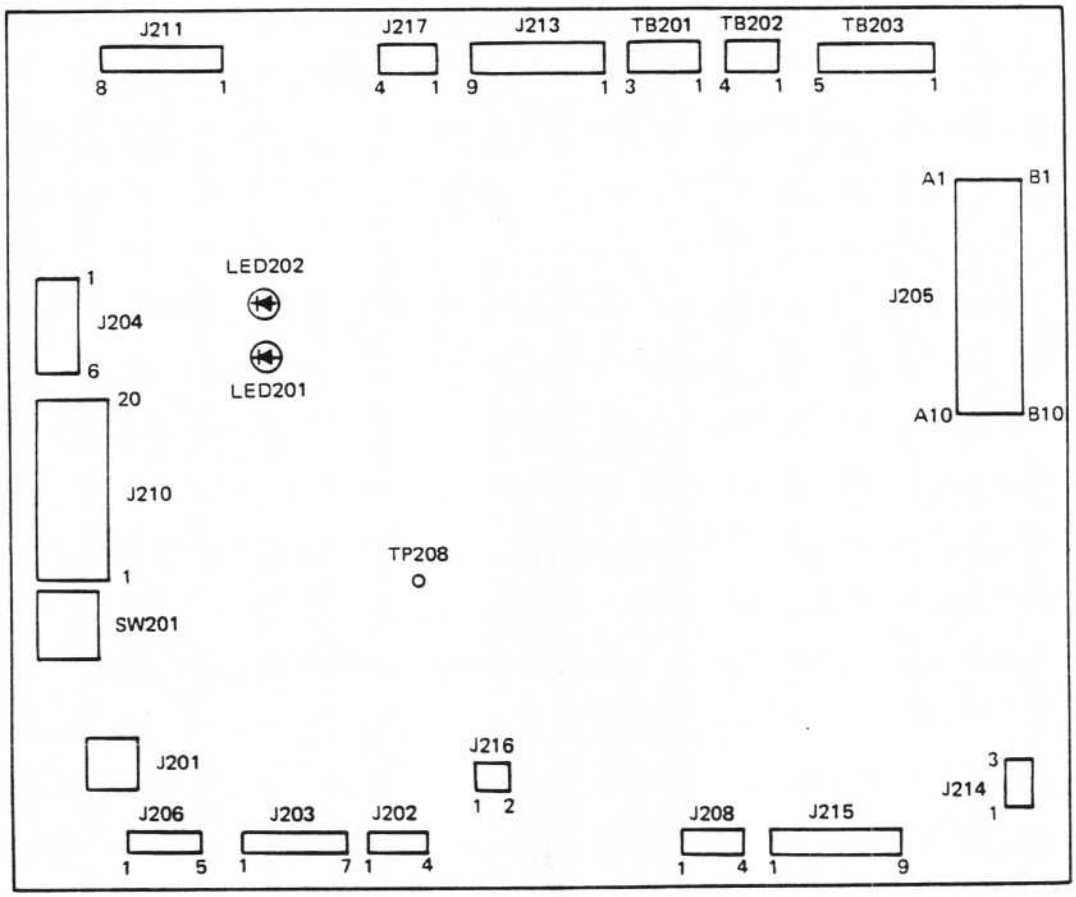


Figure 6-18

SW No.	Function
SW201	Printing test pattern

Table 6-8

LED No.	Function
LED201	ON when scanner motor is running at correct speed
LED202	ON when main motor is running at correct speed

Table 6-9

TP No.	Function
TP208	For checking laser beam intensity

Table 6-10

B. HVT PCB

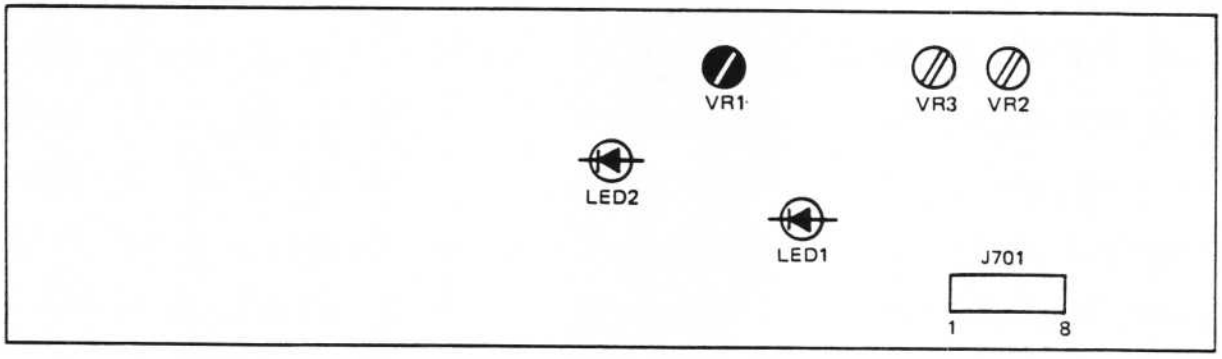


Figure 6-19

VR No.	Purpose
VR1	Adjusting developing bias (DC) (Variable with print density adjustment dial)
VR2	For factory use
VR3	For factory use

Table 6-11

LED No.	Function
LED 1	For indicating state of $\overline{\text{HV1ON}}$ signal (H or L). Bright for "L", dim for "H".
LED 2	For indicating T3 drive command ON when signal being sent (brightness proportional to output being commanded).

Table 6-12

D. Driver and sensor PCB

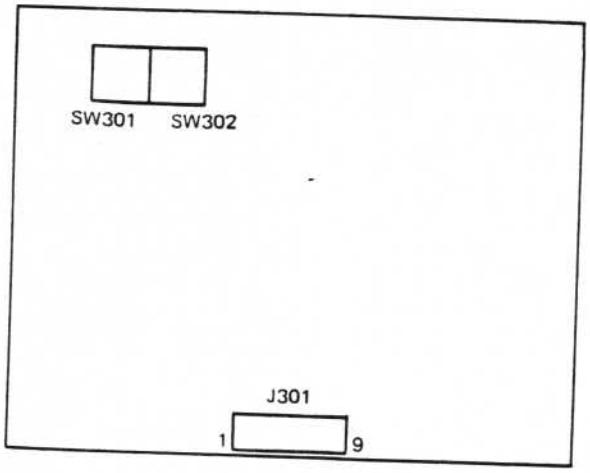


Figure 6-20

SW No.	Function
SW301	For identifying drum sensitivity (See Table 2-3 for details.)
SW302	

Table 6-13

APPENDIX

I. GENERAL TIMING CHART A-1
II. LIST OF SIGNALS/COMMANDS .. A-3
A. DC Controller A-3
III. GENERAL CIRCUIT DIAGRAM A-5
IV. DC CONTROLLER A-6
V. SAFETY CIRCUIT A-11
VI. HIGH-VOLTAGE POWER SUPPLY A-12
VII. INTERFACE CIRCUIT A-13

II. LIST OF SIGNALS/COMMANDS

A. DC Controller

Abbreviation	Name	Function
H-U	MAIN MOTOR DRIVE PULSE TRAIN	Powers the main motor.
H-U		
H-V		
H-V		
H-W		
H-W		
$\overline{BD}$	BEAM DETECTION signal (horizontal sync pulse)	Signal used for identifying left margin of print paper.
$\overline{CBSY}$	COMMAND BUSY signal	Identifies that the video controller is sending a command to the DC controller.
$\overline{CCLK}$	CONTROLLER CLOCK signal	Sync pulse for commands sent from the video controller to the DC controller.
$\overline{CMND}$	COMMAND signal	Printer control command sent from the video controller to the DC controller.
$\overline{CPRDY}$	CONTROLLER POWER READY signal	Indicates that power for the video controller circuit is ON.
CPUD	PICK-UP ROLLER CLUTCH SOLENOID DRIVE command	Causes pick-up roller clutch solenoid to operate.
$\overline{CSENS1}$	DRUM SENSITIVITY IDENTIFICATION signals	Indicate the sensitivity of the photosensitive drum.
$\overline{CSENS2}$		
$\overline{DBAC}$	DEVELOPING BIAS (AC) DRIVE command	Causes bias voltage to be applied to developing cylinder.
$\overline{DBDC}$	DEVELOPING BIAS (DC) DRIVE command	
DPI	DPI SELECT signal	Changes the scanner motor speed.
DSADJ	PHOTODIODE SENSITIVITY ADJUSTMENT signal	Adjusts the sensitivity of the photodiode circuit that measures laser intensity.
DSENS	DOOR OPEN SENSOR signal	Senses if printer is open.
FAN	FAN DRIVE command	Causes the fixing unit ventilation fan to operate.
$\overline{FSRD}$	FIXING ROLLER HEATER DRIVE command	Causes the fixing roller heater to operate.
FSRTH	FIXING ROLLER TEMPERATURE signal (analog)	Indicates the fixing roller temperature.
$\overline{HV1ON}$	PRIMARY CORONA ON command	Causes the primary corona to operate.
HVRST	HIGH-VOLTAGE RESET signal	Prevents all high-voltage outputs.
$\overline{HVTON}$	TRANSFER CORONA ON command	Causes the transfer corona to operate.

Abbreviation	Name	Function
LDRV	LASER DRIVE command	Causes the laser to operate.
MPFS	MANUAL FEED UNIT PAPER SENSOR signal	Indicates that there is paper on the manual feed tray.
$\overline{\text{PCLK}}$	PRINTER CLOCK signal	Sync pulse for status information signals from the DC controller to the video controller.
PCONT	POWER CONTROL signal	Causes the printer to operate.
PD	LASER POWER SENSOR signal	Indicates the laser power.
PDP	DELIVERY UNIT PAPER SENSOR signal	Indicates that paper has emerged from the fixing rollers.
PEMP	PAPER SENSOR signal	Indicates that there is no paper in the lower cassette.
$\overline{\text{PEXPO}}$	PRECONDITIONING EXPOSURE LAMP DRIVE command	Causes the preconditioning exposure lamps to operate.
$\overline{\text{PPRDY}}$	PRINTER POWER READY signal	Indicates that the printer power is ON.
$\overline{\text{RDY}}$	READY signal	Indicates that printing is possible.
REGD	REGISTRATION ROLLER CLUTCH SOLENOID DRIVE command	Causes the registration roller clutch solenoid to operate.
RESET	RESET command	RESETS the microprocessors.
$\overline{\text{SBSY}}$	STATUS BUSY signal	Indicates that the DC controller is sending status information to the video controller.
SCNCONT	SCANNER MOTOR DRIVE command	Causes the scanner motor to operate.
$\overline{\text{STTS}}$	STATUS signal	Status signal sent from the DC controller to the interface circuit.
TSENS	TONER SENSOR signal	Indicates if there is sufficient toner in the EP-S cartridge.
$\overline{\text{VDO}}$	VIDEO signal	Print data sent from the interface circuit to the DC controller.
$\overline{\text{VSREQ}}$	VERTICAL SYNC REQUEST signal	Requests a VERTICAL SYNC (VSYNC) signal.
$\overline{\text{VSYNC}}$	VERTICAL SYNC signal	Determines the top margin on the printed page.