LBP-8II

SERVICE MANUAL

REVISION 1

Canon

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PREFACE

This Service Manual contains basic information required for after-sale service of the LBP-8II laser beam printer. This information is vital to the serviceman in maintaining the high printing quality and performance of the printer.

Chapter 1: General Description
Features, specifications, operation, and parts of the printer

Chapter 2: Operation and Timing
A description of the difficult systems in the printer and their roles in producing a print

Chapter 3: The Electrical System
A brief description of the electrical circuits and their operation

Chapter 4: The Mechanical System
Explanation of mechanical operation, disassembly, reassembly, and adjustment

Chapter 5: Installation
Requirements for a suitable location and installation procedures; storage and handling of EP-S cartridges

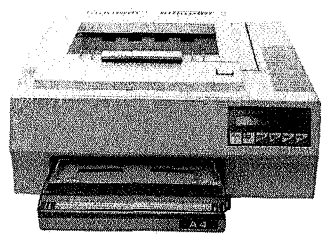
Chapter 6: Maintenance and Servicing
Parts replacement schedule, tools, lubricants, cleaners

Chapter 7: Troubleshooting
What to do if the printer malfunctions: reference values and adjustments; troubleshooting procedures

Appendix: General circuit diagram, interconnection diagrams, PCB circuit diagrams, etc.

Information in this manual is subject to change as the product is improved or redesigned. All relevant information in such cases will be supplied in Service Information Bulletins.

A thorough understanding of this printer, based on information in this Manual and Service Information Bulletins, is required for maintaining its performance and for locating and repairing the causes of malfunctions.



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CHAPTER 1 GENERAL DESCRIPTION

CHAPTER 2 OPERATION AND TIMING

CHAPTER 3 THE ELECTRICAL SYSTEM

CHAPTER 4 THE MECHANICAL SYSTEM

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CHAPTER 5 INSTALLATION

CHAPTER 6 MAINTENANCE AND SERVICING

CHAPTER 7 TROUBLESHOOTING

APPENDIX

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I. FEATURES

1. This high-speed, non-impact (low-noise) printer is based on electrophotography, electronics, and laser technology.
2. The printer produces high-quality prints on plain paper. Modulation of the laser beam provides a wide variety of characters and graphics.
3. The printer is compact and easy to carry. This makes it easy to move the printer to when it is needed.
4. A corona assembly, developing cylinder, photosensitive drum, and cleaner of the printer are combined into a single assembly called an "EP-S cartridge". The cartridge can be replaced by the customer when necessary without the need of a service call. 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 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 printer functions conform to and extended the functions of the Diablo 630 API-ECS daisywheel printer.
8. Character fonts can be changed simply by replacing font cartridges (available as options).
9. The printer can print in both portrait and landscape orientations (see blow).

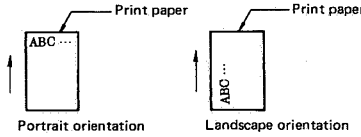

Figure 1-1

10. The printer can be used as an on-line or off-line output unit for office computers, word processors, and CAD workstations.
11. The printer operates on both 50Hz and 60Hz power.
12. Two font cartridges can be mounted simultaneously, so three or more than three fonts can be used without changing font cartridge.
13. Both serial (RS-232C) and parallel (Centronics) interfaces are provided as standard equipment.

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II. SPECIFICATIONS

1. Type — Desk-top page printer
2. Printing method — Electrophotography (single-component dry toner)
3. Printing speed
   - Cassette feed — 8 prints/min (Other than legal size)
     7 prints/min (Legal size)
4. Time for first print

Pick-up/Delivery / Resolution	Cassette		Manual Feed	
	Face Down	Face Up	Face Down	Face Up
240DPI/300DPI	21 s	18 s	25 s	22 s
400DPI	23 s	20 s	25 s	22 s

5. Warm-up (WAIT) time — 1 min or less (after power ON, at 20°C ambient)
6. Optical system
   - Laser — Semiconductor laser
   - Scanning system — Rotating six-faced prism mirror
7. Scanning pitch
   - Horizontal — 240, 300, or 400 dots/in
   - Vertical — 240, 300, or 400 luster lines/in
8. Printing system
   - Photosensitive drum — OPC
   - Charging — Corona
   - Exposure method — Laser scanning system
   - Development — Toner projection development system
   - Paper feed — Cassette (one cassette) or manual feed
   - Image transfer — Corona
   - Separation — Natural, due to small radius of drum
   - Fixing method — Heated roller (500W)
   - Toner supply — Included in replaceable EP-S cartridge
9. Paper
   - Cassette feed — Plain paper of letter, legal, A4, or B5 size (CANON-approved, 60g/m² – 80g/m² paper) and envelopes (designated size)
   - Manual feed — Plain paper from 90mm × 155mm to 216mm × 356mm (CANON-approved, 60g/m² – 80g/m²), overhead projector (OHP) film, colored paper, postcards, label stock, and envelopes (designated type)
     However, for plain paper exceeding 80g/m², OHP film, post cards, labels, and envelopes, print delivery is to be made face-up.
10. Double-sided printing — Possible with plain papers (60g/m² to 135g/m²) and post cards using manual feed. However, print delivery of plain papers exceeding 80g/m² and post cards is to be made face-up.
11. Cassettes — Letter, Legal, Executive, A4, and B5 (Depth: 20mm – about 200 sheets of 80g/m² paper)
    X1 (Depth: 13mm – about 15 envelopes)

    Note: As to paper size detection, X1 cassette is detected as the cassette for Legal size.

12. Print delivery — Face-down or face-up (manually selectable)
13. Print tray capacity
    - Face-down — About 100 sheets (80g/m²)
    - Face-up — About 20 sheets (80g/m²)

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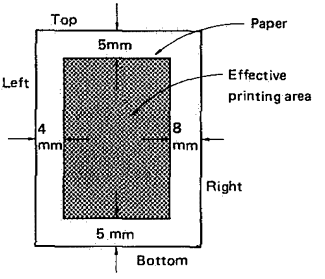
14. Effective printing area

Top, bottom, 5mm from the edge of the paper.
Left, 4mm from the edge of the paper.
Right, 8mm from the edge of the paper.



15. Standard interfaces

Serial

RS-232C, asynchronous, 300, 600, 1200, 2400, 4800, 9600, or 19,200 baud
Data length: 7 or 8 bits
Parity: If desired
Stop bits: 1 or 2
Handshaking: XON-XOFF, ETX-ACK, or DTR

Parallel

8-bit parallel (Centronics standard) interface

16. Expansion interface

One expansion interface slot at back of printer

17. Internal fonts

Type style	Font dots (width × height)	Type pitch (CPI)	Type size (points)	Type thickness	Style	Remarks
Courier	30 × 50	10	12	Regular	Upright	Separate internal fonts are provided for portrait and landscape orientations
	30 × 50	10	12	Bold	Upright	
	30 × 50	10	12	Regular	Italic	
	18 × 34	15	8, 16	Regular	Upright	

Table 1-1

18. Environment

Temperatuer: 10°C to 32.5°C
Humidity: 20% to 80% RH

19. Noise level

Under 50 dB(A) (printing)
Under 40 dB(A) (standby)

20. Dimensions (W × D × H): 454mm (17.9") × 492mm (19.4") × 232mm (9.1")
21. Weight (main unit alone): About 21kg (46.7 lb)
22. Power consumption: Max. 900W
23. Line voltage requirements

Voltage (V) ± 10%	Frequency (Hz)
100/115	50/60
220/240	50

Specifications are subject to change with product improvement.

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III. SAFETY INFORMATION

A. Laser Safety

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

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

B. CDRH Regulations

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

MANUFACTURED : [ ]
CANON INC.
3-30-2 SHIMOMARUKO, OHTA-KU, TOKYO, JAPAN
THIS PRODUCT CONFORMS WITH CDRH RADIATION PERFORMANCE STANDARD, 21CFR CHAPTER 1 SUBCHAPTER J.
RS1-8446

Figure 1-2

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

C. 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:

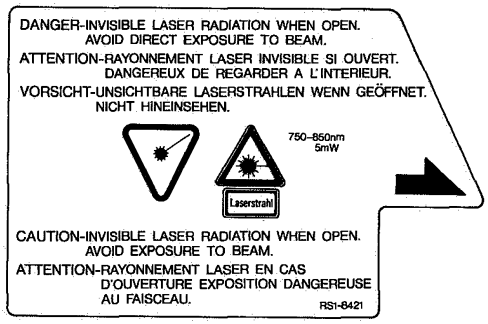

Figure 1-3

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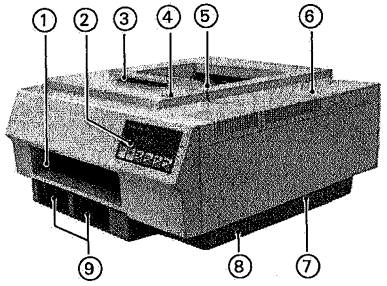
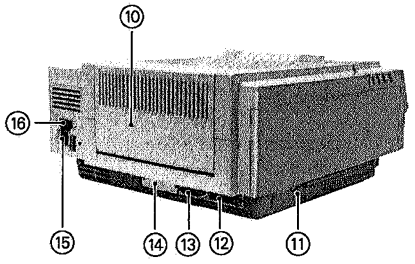
IV. PARTS OF THE PRINTER

A. External View



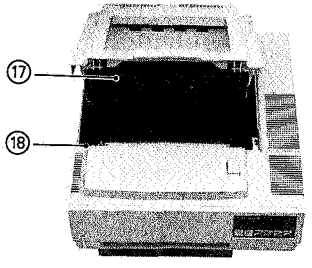
① Cassette slot
② Control panel
③ Upper unit
④ Upper unit release
⑤ Face-down tray
⑥ Top cover
⑦ Check connector slot
⑧ Base cover
⑨ Font cartridge slots

Figure 1-4



⑩ Face-up tray
⑪ Expansion memory slot
⑫ Parallel interface connector
⑬ Serial interface connector
⑭ Expansion interface slot
⑮ Power cord socket
⑯ Power switch

Figure 1-5



⑰ EP-S cartridge
⑱ Print density adjustment dial

Figure 1-6

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B. Cross Sectional View

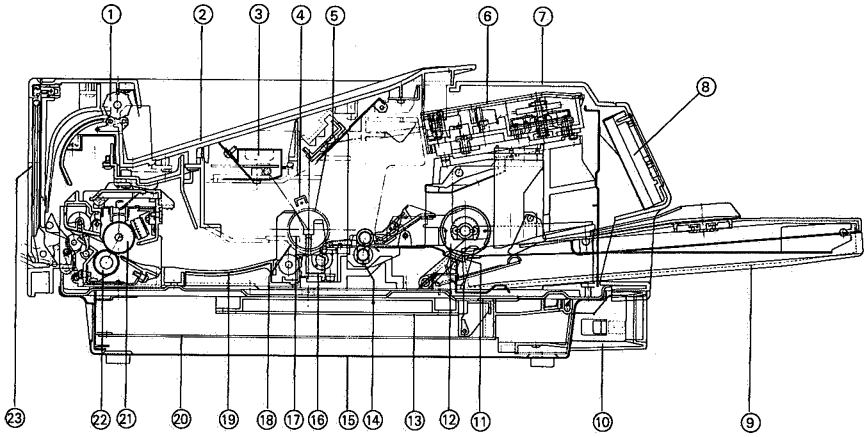

Figure 1-7

① Delivery roller
② Face down tray
③ Preconditioning exposure lamp
④ Primary corona assembly
⑤ Reflection mirror
⑥ Laser/Scanner assembly
⑦ Top cover
⑧ Control panel
⑨ Cassette
⑩ Font cartridge guide
⑪ Separation pad
⑫ Pick-up roller
⑬ DC controller circuit PCB
⑭ Resist roller
⑮ Base cover
⑯ Transfer corona assembly
⑰ Photosensitive drum
⑱ Protective shield
⑲ Feeder
⑳ Video controller circuit PCB
㉑ Upper fixing roller
㉒ Lower fixing roller
㉓ Face up tray

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V. OPERATION

A. Control Panel, Test Switch, Print Density Adjustment Dial

1. Control panel

The printer operates in either normal or setup mode. In normal mode, the printer prints. In setup mode, the printing environment can be changed, stored, or recalled.

On power-up, the printer enters normal mode. Pressing the MENU switch in offline mode causes the printer to enter setup mode.

Specifying the group of printing environment in setup mode allows settings to be changed, stored or recalled as shown in Figure 1-12. Incidentally, Table 1-2 itemizes group menu, mode menu and mode values to be displayed by STATUS indicator in the setup mode.

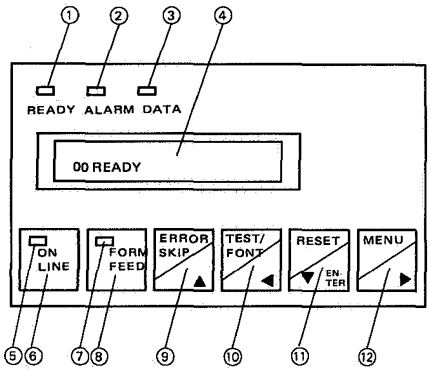

Figure 1-8

① READY indicator (green)

Flashing Indicates the printer is in a wait state.
On Indicates the rinter is ready.
Off Indicates the printer is not ready.

② ALARM indicator (orange)

On Indicates the printer is not ready because of a failure. The STATUS indicator provides information on the failure by flashing a two numeric or alphabetic character code and with a message.
Off Indicates the printer is ready.

③ DATA indicator (orange)

Flashing Indicates the printer is receiving data from the external device.
On Indicates the buffer memory contains data to be printed.
Off Indicates the buffer memory contains no data to be printed and the printer is not receiving data from the external device.

Note:
There are two types of buffer memory: page buffer memory and receive buffer memory. The page buffer memory contains data in pages and the receive buffer memory temporarily holds data.

④ STATUS Indicator (16 segment by 1 line LCD)

Flashing Indicates a failure (such as an operator call for paper feed check or paper supply, an electrical circuit failure, or a received data error) occurs in the printer. Information on the failure is provided with a two numerical or alphabetic characters code and a message.
On Indicates printer status with a two numeric character code and a message. See Chapter 2 Section 5 for a complete description of status information.

⑤ ON LINE indicator (orange)

Flashing Indicates the printer is changing from online to offline.
On Indicates the printer is online.
Off Indicates the printer is offline.

The printer receives data from the external device when the READY Indicator is ON in an online state. In an offline state, the printer does not receive data from the external device.

⑥ ON-LINE switch

Pressing the ON LINE switch is used to alternate between online and offline. If an attempt is made to set the printer offline during data reception, the printer will stop the data reception. If an attempt is made to set the printer offline during printing, the printer will complete and deliver the print, and then enter an offline state. The ON LINE indicator will flash while the printer is changing to offline.

⑦ FORM FEED indicator (orange)

Flashing Indicates the FORM FEED switch was pressed to stop form feed and the printer is waiting for the paper to be delivered.
On Indicates form feed is in progress.
Off Indicates form feed is not in progress.

⑧ FORM FEED switch

The FORM FEED switch is valid when the printer is offline in normal mode. Pressing the FORM FEED switch with the DATA and READY indicators ON causes the printer to print all remaining data. If the switch is pressed during form feed, the printer will stop the form feed.

⑨ ERROR SKIP/▲ (rear scroll) switch

Pressing the ERROR SKIP/▲ switch when the printer is offline in normal mode after a failure occurred will cause the printer to exit from the error state. If the cause of the failure is not corrected, the printer will enter the error state again.

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In setup mode, mode menu is scrolled back to group menu, or group menu is scrolled back to READY state. (Refer to Figure 1-12)

⑩ TEST/FONT, ◀ (left scroll/decrement) switch

It functions as the left scroll switch when a group or mode menu is displayed. It functions as the decrement switch when a mode value is displayed. In normal mode, this switch is used to print a test pattern or font list.

⑪ RESET/▼ (front scroll) ENTER switch

Pressing the RESET/▼ ENTER switch when the printer is offline in normal mode clears data remaining in the printer and resets print modes. In setup mode, the switch is used to change the printer to a higher mode level, such as from a group menu to a mode menu or from a mode menu to a mode value. And pressing the RESET/▼ ENTER switch, after changing the mode and while the STATUS indicator displays the mode, puts the printer environment into the current mode to which it has been changed.

⑫ MENU/▶ (right scroll/increment) switch

Pressing the MENU/▶ switch when the printer is offline in normal mode will place the printer in setup mode. In setup mode, the switch functions as the right scroll switch when a group or mode menu is displayed or as the increment switch when a mode value is displayed.

Notes:

1) On power-on, the printer is online with cassette feed selected.
2) If a failure occurs in an online state, the printer will become offline and the STATUS indicator will provide information on the failure.
3) If the STATUS indicates requests paper supply, paper feed check, cassette replacement, or manual paper feed, take the appropriate action. The STATUS indicator will go off and the printer will become ready.
4) Replace the font cartridge when the printer is offline. If the font cartridge is replace when the printer is online, the STATUS indicator will display FE (font cartridge removed error) and the message "FONT REMOVAL." The printer can recover from this error only by turning the printer off and then on.
5) When the printer is online, only the ON LINE switch is effective.
6) Any switch other than the ON LINE switch does not function while the printer is printing. Pressing a switch during printing will sound the beeper to indicate that the switch is invalid.
7) If the POWER switch is set to ON, pressing the RESET/▼ ENTER switch or the RESET/▼ ENTER switch is held down for at least 10 seconds and release, the printer will enter hex dump mode, and print commands or parameters as they are entered from the external device.

2. TEST switch

The TEST switch is located on the right side of the base cover. (See Figure 1-4.) It is used to print the test pattern stored on the DC controller PC board. Pressing the switch when the photosensitive drum stops and the READY indicator is ON will cause the printer to print a page of the test pattern. If the switch is held down, the printer will print the test pattern continuously.

3. Print density adjustment dial

The print density adjustment dial is located on the high voltage power supply unit. (See Figure 1-6.) It is used to adjust print density. Turning the dial clockwise lightens the print. Normally, this dial should be set to the 5 position.

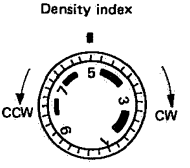

Figure 1-9

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B. Operating Procedure

1. Flowchart for basic operation

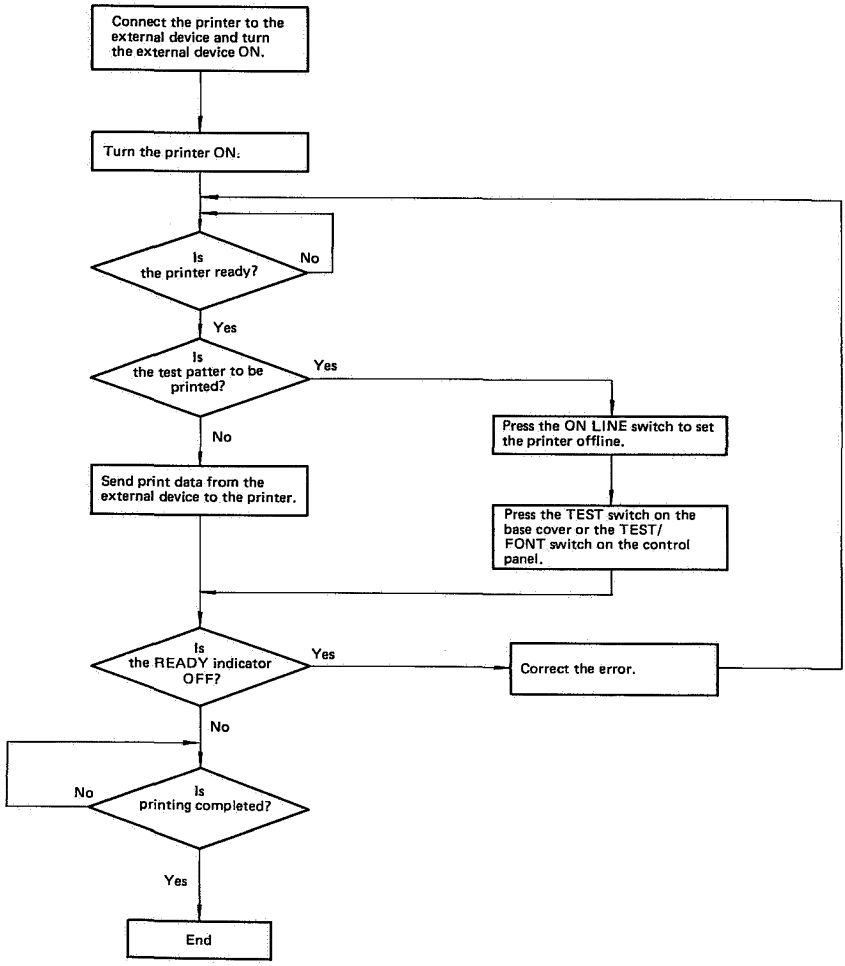

Figure 1-10

Notes:

1. Turn the external device and then the printer ON. Turn the printer and then the external device OFF. If the external device is turned ON or OFF with the printer ON, an error may result because of noise from the external device.
2. Before connecting or disconnecting the interface connector, be sure to turn the external device and printer OFF. Otherwise, a failure may occur.

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2. Control panel operation

① Stopping and resuming printing

Printing can be stopped or resumed, using the ONLINE switch.

- To stop printing, press the ON LINE switch. If the ON LINE switch is pressed during printing, the printer will complete and deliver the paper, and stop printing. Also, the ON LINE indicator starts flashing and it continues until the print is delivered. If the ON LINE switch is pressed when the printer does not print, the ON LINE indicator will go OFF immediately.
- To resume printing, press the ON LINE switch. If the ON LINE switch is pressed in an offline state, the printer will enter an online state and resume printing. Also, the ON LINE Indicator will go ON. If printing stops because of a failure, the printer will not resume printing even if the ON LINE switch is pressed. To resume printing, the cause of the failure must be eliminated.

② Reset

Reset is done to abort printing. When the printer is reset, the environment is shored in RAM.

1) Press the ON LINE switch to set the printer offline. (The ON LINE indicator goes OFF.)
2) Hold down the RESET switch for at least one second. The printer will be reset and the STATUS indicator displays "03 RESET." Then, the STATUS indicator will display "00 READY" to indicate that the printer is initialized.

Note:
The printer can also be initialized by an initialize command from the external device.

③ Print test

Two test patterns (A and B) and two font lists (A and B) are available. These test patterns and font lists can be printed, using the TEST/-FONT switch. During test print B, self-diagnosis (such as ROM check, RAM check, and LED check) are performed.

Test print A: Prints a page of test pattern A.
Test print B: Prints test pattern B continuously.
Font list A: When the font cartridge is not installed, all characters incorporated in the machine will get printed with the font samples. When the font cartridge is installed, only the characters from the cartridge installed will get printed with the font samples.
Font list B: When the font cartridge is not installed, all characters incorporated in the machine will get printed with the graphic set. When the font cartridge is installed, only the characters from the cartridge installed will get printed with the graphic set.

■ State transition when the TEST/FONT switch is pressed

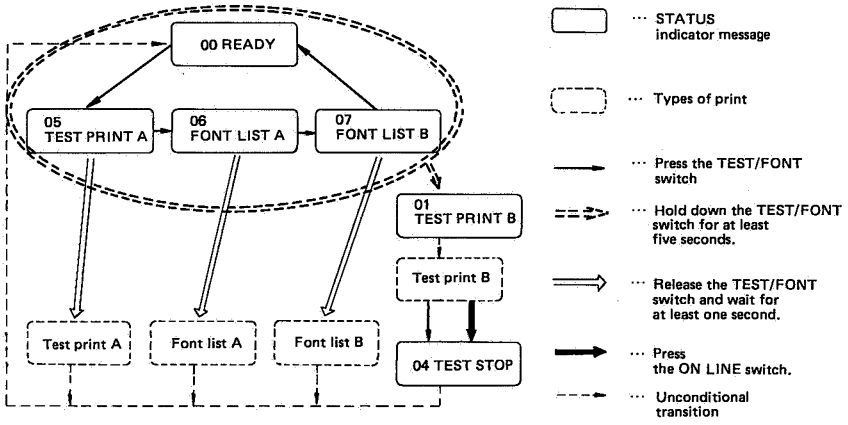

Figure 1-11

Setup mode allows the printing environment to be changed, stored, or recalled, using the MENU/▶, RESET/▼ ENTER, and TEST/FONT/◀ and ERROR SKIP/▲ switches. Environmental mode settings are displayed on the STATUS indicator when a group menu (such as font selection or layout change) and a mode menu are specified, followed by another operation of pressing RESET/▼, ENTER switches.

Figure 1-12 shows the switches used to change the printing environment in setup mode. Table 1-2 shows the group menu, mode menu, and gives listing of mode settings for the printing environment.

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■ Control panel display transition

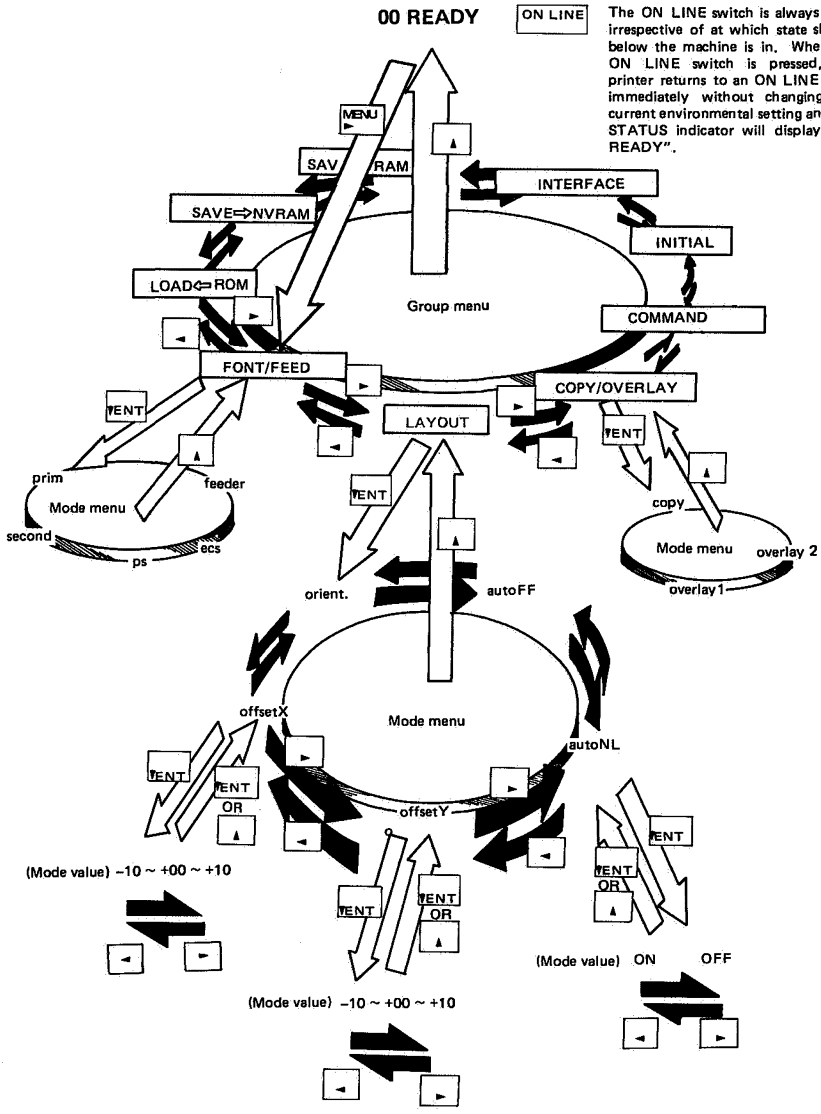

Figure 1-12

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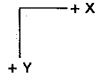
■ Listing of menu in the setup mode

Note:
1) The names of displays given in the listing are in the order group menu or mode menu get displayed by the STATUS indicator.
2) Mode settings with asterisk means they are factory settings.

Group menu (listed in the order displayed)	Name	Type of memory used		Description
		NVRAM	RAM	
Font group	FONT/FEED	O	O	Can be changed even if the DATA LED is ON. Character set selection, etc.
Page layout group	LAYOUT	O	O	Automatic CR/LF, orientation, paper feed mode, fine adjustment of print position, etc.
Copy group	COPY/OVERLAY	x	O	No. of copies and overlay on/off
Special group	COMMAND	O	x	Does not change even if the printer is reset. Command mode.
Initialization control group	INITIAL	O	x	Valid only when the printer is reset. Start-up macro, paint memory, etc.
Interface group	INTERFACE	O	x	Does not change even if the printer is reset. Interface setting
–	SAVE → RAM	x	O	Font, page layout, and copy group information get stored in the RAM.
–	SAVE → NVRAM	O	O	Special, initializing control, and interface groups information get stored in RAM. Font and page layout groups get stored in RAM and NVRAM. Copy group gets stored in RAM.
–	LOAD ← ROM	–	–	The machine gets set to the printing environment stored in the ROM.

Mode menu	Display mode name	Mode setting	Remarks
Primary character set selection	prim	Character set ID number (The value set in ROM is NONE.)	
Secondary character set selection	second	Character set ID number (The value set in ROM is NONE.)	
Proportional operation	ps	Enable*/Disable	
Diablo ECS	ecs	7*/8	
Paper feed mode	feeder	Cass*/Manu	

Mode menu	Display mode name	Mode setting	Remarks
Page orientation	Orient.	Port*/Land	
Offset (fine adjustment of print position)	offsetX offsetY	± xx Main scan direction ± yy Sub-scan direction xx: −10 ~ +00* ~ +10 (x 32 dot) yy: −10 ~ +00* ~ +10 (x 32 dot)	
Automatic CR/LF (Auto Line Wrap)	autoNL	ON*/OFF	
Automatic FF	autoFF	ON*/OFF	

Mode menu	Display mode name	Mode setting	Remarks
No. of copies	copy	1* ~ 99	
Overlay	overlay1 overlay2	ON/OFF* ON/OFF*	Up to two pages

Mode menu	Display mode name	Mode setting	Remarks
Command mode	command	ISO/DIABLO*/VDM	
LCD angle adjustment	lcd	0 ~ 7 (5*)	

Mode menu	Display mode name	Mode setting	Remarks
Start-up macro selection	macro	0 ~ 99 (30*)	
Lineprinter mode	lp	ON/OFF*	
Automatic CR	autoCR	ON/OFF*	
Automatic LF	autoLF	ON/OFF*	
Print memory mode	paint	Partial*/Full	
Paper size	paper	Letter/A4*	
Default graphic set selection	gr. −set	The value set in the ROM is D96-USA.	Used as both the primary and secondary default graphic sets. When IBMR1 or IBMR2 is selected, the primary default graphic set is IBML.
No. of lines	lines	6LPI*, 8LPI, 10 ~ 99	10 to 99 indicate the number of lines.
No. of columns	columns	AUTO*, 10CPI, 12CPI 15CPI, 10 ~ 200	Auto is set according to the current font.

Mode menu	Display mode name	Mode setting	Remarks
Interface	i/f	RS232C/CENTRO*	
Baud rate	baud	19200/9600*/4800/ 2400/1200/600/300	Valid for RS-232C
Serial communication parameter	rsmode	7OS/7ES/7OSS/7ESS/ 8OS/8ES/8S*/8SS	Same as above
DTR signal operation	dtr	Ready−H: High when ready Ready−L: Low when ready Fix−H*: High fixed Fix−L : Low fixed	Same as above
RS-232 handshaking	xon/xoff etx/ack	ON*/OFF ON/OFF*	Same as above
DSR mode	dsr	ON/OFF*	Same as above
Centronix interface BUSY-ACK Mode	bsyack	B−A A−B−A* See the figure below. A−B	Valid when an centronix interface is used

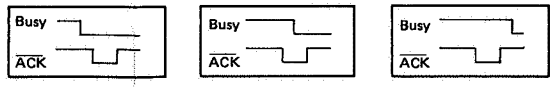


Table 1-2

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I. BASIC OPERATION

A. Functions

The printer functions can be divided into five blocks: the paper pick-up/feed system; the image formation system; the laser/scanner system; the control system; and the system interface.

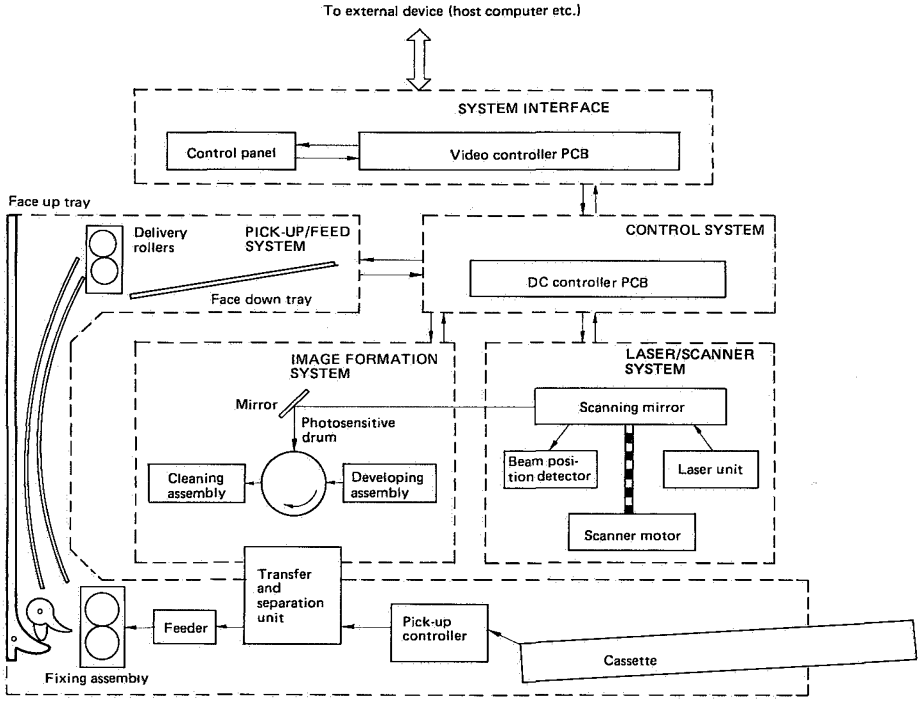

Figure 2-1

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B. Main Drive

The main motor (M1), and scanner motor (M3) provide the mechanical power necessary for printing. The main motor is controlled via a driver by commands outputted from the DC controller. The scanner motor is controlled by commands (SCNCONT) outputted from the DC controller.

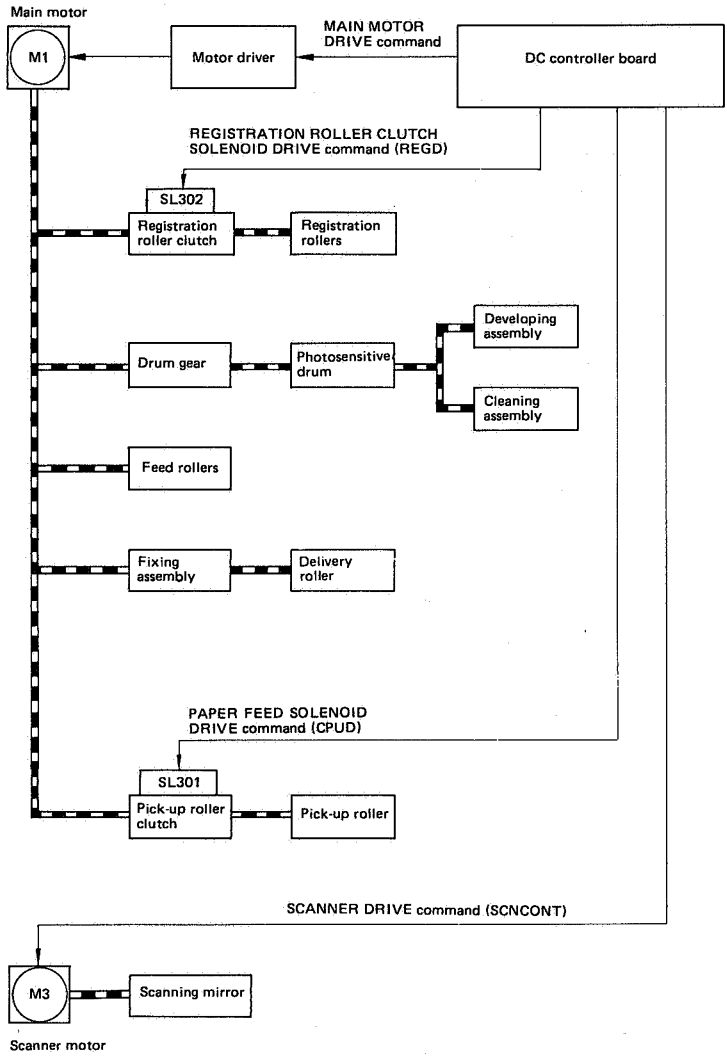

Figure 2-2

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C. Basic Sequence

- Timing for two consecutive prints on A4 paper

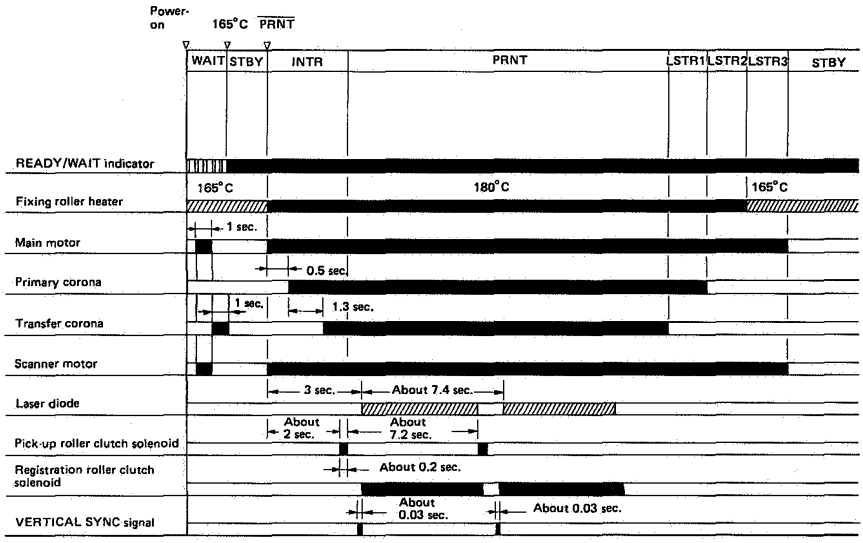

Figure 2-3

	Period	Purpose	Remarks
WAIT	From power-on until the fixing roller temperature reaches 165 °C. (One minute or less in an ambient temperature of 20°C.)	Fixing roller warm-up	READY/WAIT Indicator flashes
STBY (STANDBY)	From the end of the WAIT period until the $\overline{\text{PRNT}}$ signal is inputted from the video controller pcb, or from the end of LAST ROTATION (3) period until the $\overline{\text{PRNT}}$ signal is inputted from the video controller pcb or the power is switched OFF.	Fixing roller held at 165 °C to keep printer ready to print.	The READY/WAIT Indicator glows steadily if the printer is ready to print (cassette in place with paper present, upper unit closed). If the printer is not ready to print, the READY/WAIT indicator goes OFF.
INTR (INITIAL ROTATION)	For about 2 sec after receiving $\overline{\text{PRNT}}$ signal	Residual charges removed from the drum and photosensitivity stabilized in preparation for printing.	

Table 2-1

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Period		Purpose	Remarks
PRNT (Print)	For about 17.7 sec from paper pick-up (about 20.2 sec for Legal size)	VDO signal inputted from video controller pcb, image formed on photosensitive drum, and image transferred to paper.	
LSTR1 (FINAL ROTATION 1)	From when the transfer corona goes OFF until the primary corona goes OFF.	Last printed page delivered.	If a $\overline{\text{PRNT}}$ signal is inputted from the video controller PCB, the INITIAL ROTATION period begins immediately.
LSTR2 (FINAL ROTATION 2)	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 video controller PCB, the developing bias (DC) goes OFF, then the INITIAL ROTATION period begins.
LSTR3 (FINAL ROTATION 3)	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 video controller pcb, the INITIAL ROTATION period begins immediately.

Table 2-1 (Con't.)

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II. LASER/SCANNER SYSTEM

A. Introduction

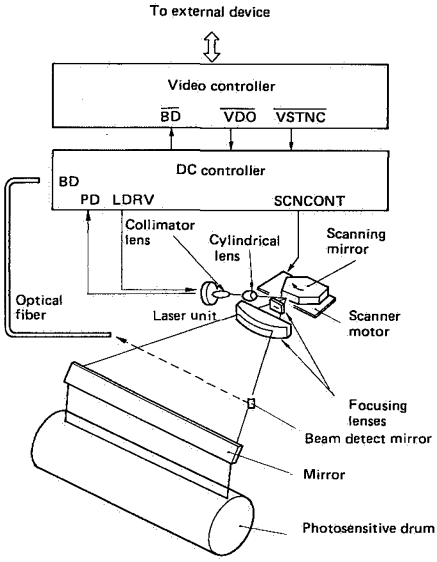

Figure 2-4

In response to the video signal (VDO) transmitted from the video controller via an interface on the DC controller PCB, the laser driver on the DC controller PCB sends a LASER DRIVE command (LDRV) to the laser unit. The laser driver sets laser diode drive voltage (LDRV) to one of three levels to match the laser power output to the sensitivity of the photosensitive drum in the EP-S cartridge. The exact LDRV voltage is determined using the analog feedback signal PD from a photodiode in the laser unit that senses the intensity of the beam.

The LDRV signal is switched ON and OFF modulated, thus switching. The laser beam ON and OFF as required to form the desired image on the drum.

The modulated laser beam is aligned by a collimating lens and cylindrical lens into a parallel beam that strikes a six-faced (prism) scanning mirror that rotates at constant speed. After being reflected from this mirror, the beam is brought to a point focus by focussing lenses 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 scan across its surface, thus building up an image on the drum surface in the form of tiny dots in exactly the way an image is formed on a television screen. (As detailed later, where the beam strikes the drum, a black dot will be formed by subsequent drum processes.)

B. 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.

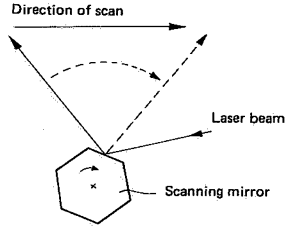

Figure 2-5

The scanning mirror is turned by the scanner motor.

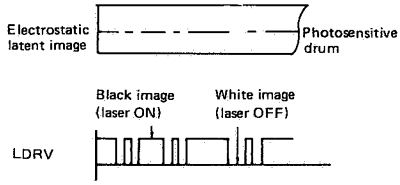

Figure 2-6

Figure 2-6 shows a hypothetical image formed by one scan of the laser beam across a nonrotating drum, the beam being modulated (switched ON/OFF) by the LDRV signal.

A more accurate representation of scanning is as shown in Figure 2-7.

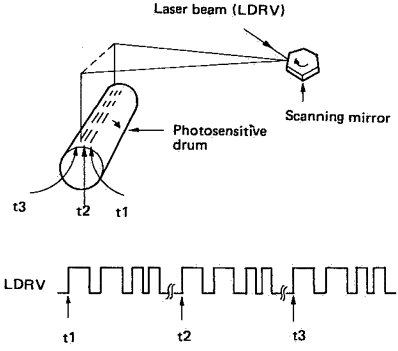

Figure 2-7

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 106μm (240 raster lines/inch) or 85μm (300 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 mirror to an optical fiber, which carries the light signal to the DC controller indicating that the beam is about to scan the drum again. The DC controller then generates the horizontal sync signal (BD), the signal to start modulating the laser beam for the next scan across the drum.

C. Scanner Drive

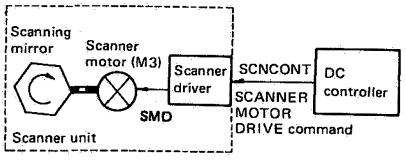

Figure 2-8

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

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III. IMAGE FORMATION SYSTEM

A. Introduction

The image formation system is the main part of the printer, where the image encoded in a digital signal VDO from an external device is formed on the photosensitive drum (and subsequently transferred to paper). In addition to the photosensitive drum, the image formation system includes the developing assembly, cleaning assembly, and other parts.

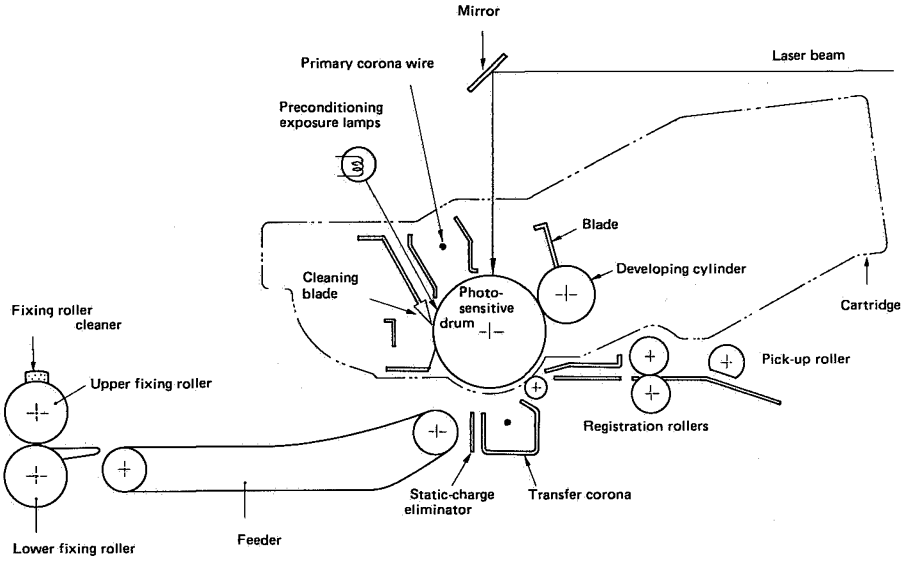

Figure 2-9

B. Printing Process

The cartridge used by the printer has a seamless photosensitive drum with the structure shown in Figure 2-10. The outer layer consists of an organic photoconductor (OPC); the core is aluminum.

The printing process can be divided into five stages.

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

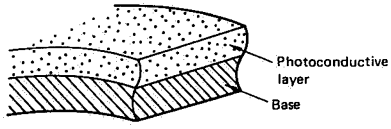

Figure 2-10

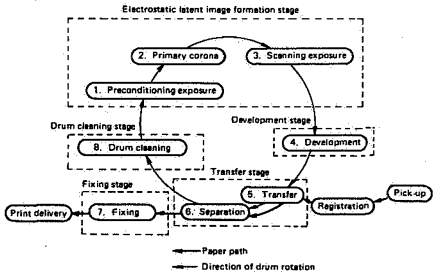

Figure 2-11

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1) Electrostatic latent image formation stage

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

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

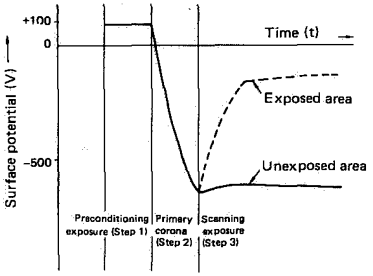

Figure 2-12

Step 1 Preconditioning exposure

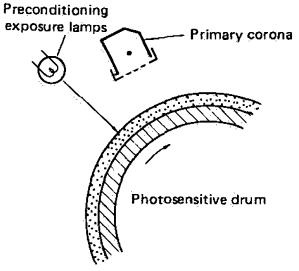

Figure 2-13

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

This prepares the drum to receive a uniform charge in the following primary corona step, and prevents unevenness in the printed image.

Reference:

The drum surface potential before the preconditioning exposure is 100V (because of the positive charge from the transfer corona). The preconditioning exposure does not change the drum surface potential, because the photoconductive layer acts as a rectifier. When illuminated by the preconditioning lamps, the conductive layer of the drum conducts negative charges but blocks positive charges. As a result, positive charges on the drum surface cannot combine in the photoconductive layer with negative charges from the aluminum drum base. Instead, they remain on the drum surface, which therefore retains an unchanged potential.

Step 2 Primary corona

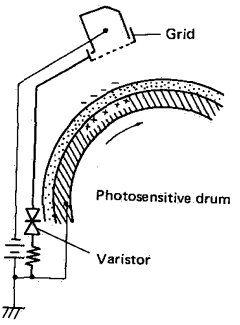

Figure 2-14

The primary corona applies 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

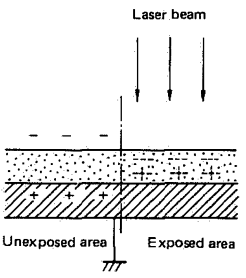

Figure 2-15

The laser beam scans the drum surface, causing (by drum processes) the charge to be neutralized in areas struck by the laser beam. The charges left on the drum form an invisible pattern, the electrostatic latent image.

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2) Development stage

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

Step 4 Development

Note:
The charges making up the latent image are negative, but they are shown as positive in Figure 2-16 because they are less negative than the charges on the toner.

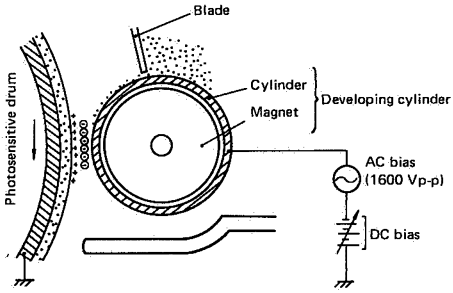

Figure 2-16

As shown in Figure 2-16, the developing assembly 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.

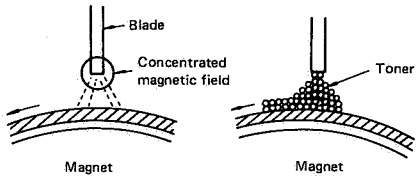

Figure 2-17

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

The 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 causes the toner particles to jump to the drum surface. This process is called toner projection development. It converts the electrostatic latent image into a visible toner image.

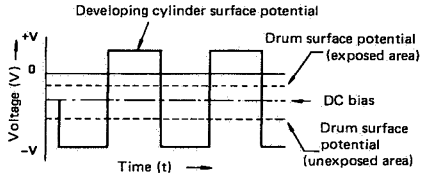

Figure 2-18

An AC bias is applied to the developing cylinder to assist the toner particles in jumping 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.

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

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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.

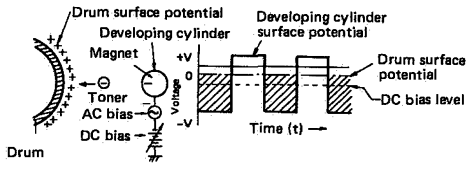
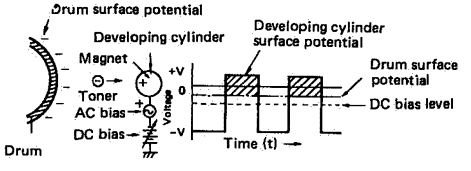
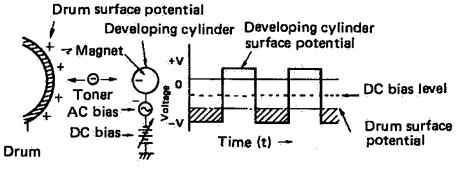
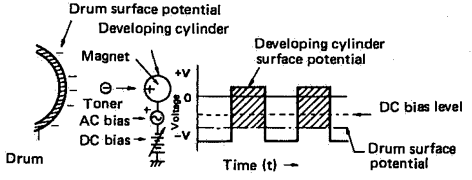
Latent image	Developing bias	Toner movement and electric potentials	Description
Exposed areas	Negative bias		The electrostatic attraction caused by the potential difference between the drum surface and cylinder is sufficient to overcome the attraction of the magnet, so the toner particles are projected from the cylinder to the drum. The amount of toner projected depends on the DC bias of 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 excess toner adhering to the drum and improves the contrast of the finished print.
Unexposed areas	Negative bias		Here the drum surface potential is only slightly higher than the cylinder potential, so the magnetic attraction is greater than the electric field force. 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 2-2

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3) Transfer stage

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

Step 5 Transfer

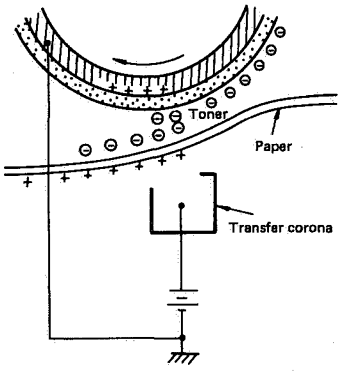

Figure 2-19

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

Step 6 Separation

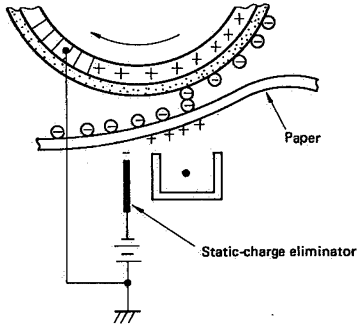

Figure 2-20

The stiffness of the paper causes it to separate from the drum. Separation is assisted by a negative voltage from a static-charge eliminator that weakens the attractive force between the paper and the drum. Without such assistance thin paper might wrap around 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

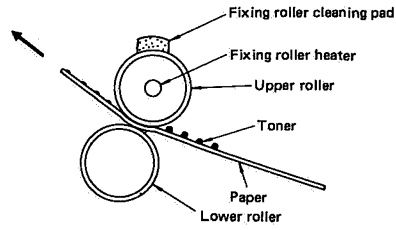

Figure 2-21

The surface of the upper roller is coated with non-sticking PTFE resin, and the cleaning pad applies a further coating of silicone oil. The resin surface and oil keep the paper from sticking to the roller and prevent offsetting (adhesion of toner from one print to the roller and subsequent transfer of that toner to another print).

5) Drum-cleaning stage

In the transfer 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

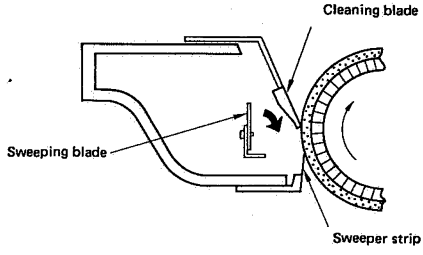

Figure 2-22

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

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C. Operation

When the DC controller receives a Print command (PRNT) from the external device via the video controller, the DC controller activates the main motor to rotate the photosensitive drum and developing cylinder. After the drum surface has been given a negative charge by the primary corona, the laser beam (modulated by the VDO signal) scans the drum to form a latent image. The latent image is developed by toner from the developing cylinder, then transferred to the paper with the aid of the transfer corona.

The cleaning blade removes any remaining toner from the drum, then the preconditioning exposure lamps illuminate the drum to give it uniform sensitivity in preparation for forming a new latent image. Drum sensitivity identification cams in the cartridge provide feedback to the DC controller via two switches (SW301 and SW302). The DC controller adjusts the laser beam intensity to match the drum sensitivity.

The cartridge also has a toner sensor. When the output from this sensor falls below a certain level, it indicates that the printer is almost out of toner and that the cartridge needs to be changed.

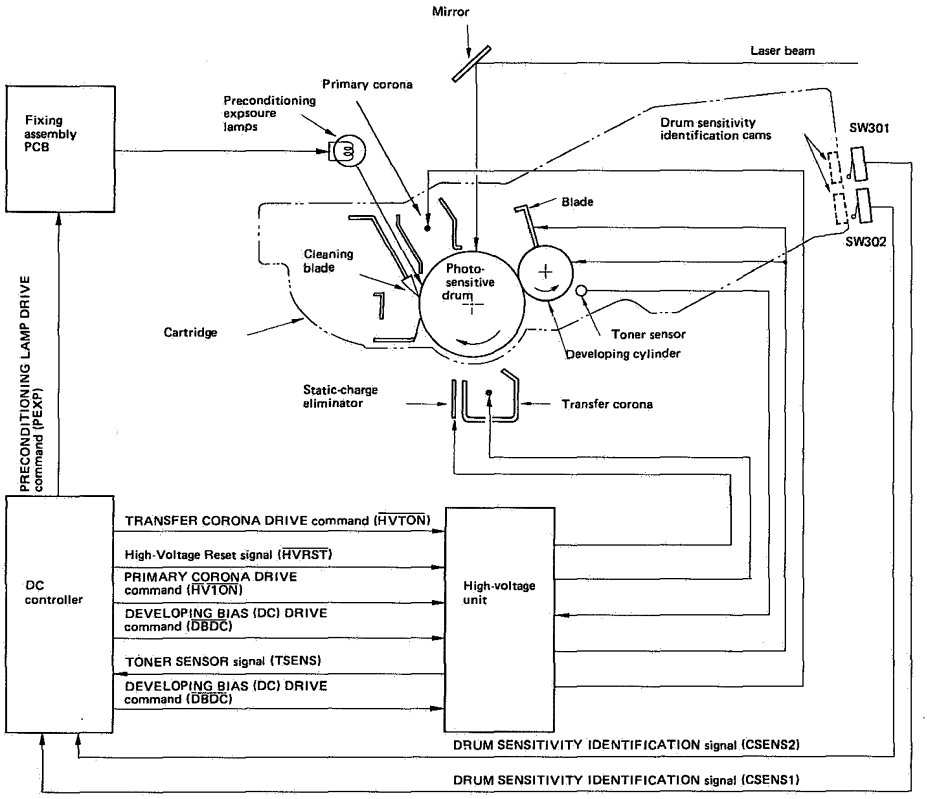

Figure 2-23

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■ Operating Sequence

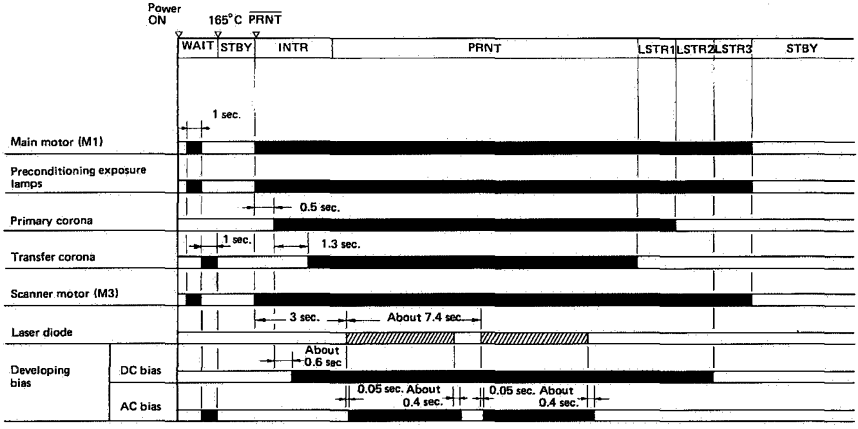

Figure 2-24

Note: Timing for two consecutive prints on A4 paper.

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IV. PICK-UP/FEED SYSTEM

A. Outline

While the main motor is running, if a PICK-UP ROLLER CLUTCH SOLENOID DRIVE command is inputted to the driver/sensor PCB, solenoid SL301 is actuated, causing the clutch to engage and turn the paper pick-up roller.

The roller then feeds a sheet of paper to the registration rollers.

The registration rollers turn at the time that will feed the sheet with the leading edge of the paper aligned with the leading edge of the image on the photosensitive drum. After transfer, separation, and fixing, the printed paper is delivered to the print tray.

The paper delivery sensor (PS331) senses delivery of the paper. If the paper fails to reach and clear the delivery sensor within the necessary times, a paper jam is determined to have occurred. The printer notifies a paper jam to the external device by a status signal.

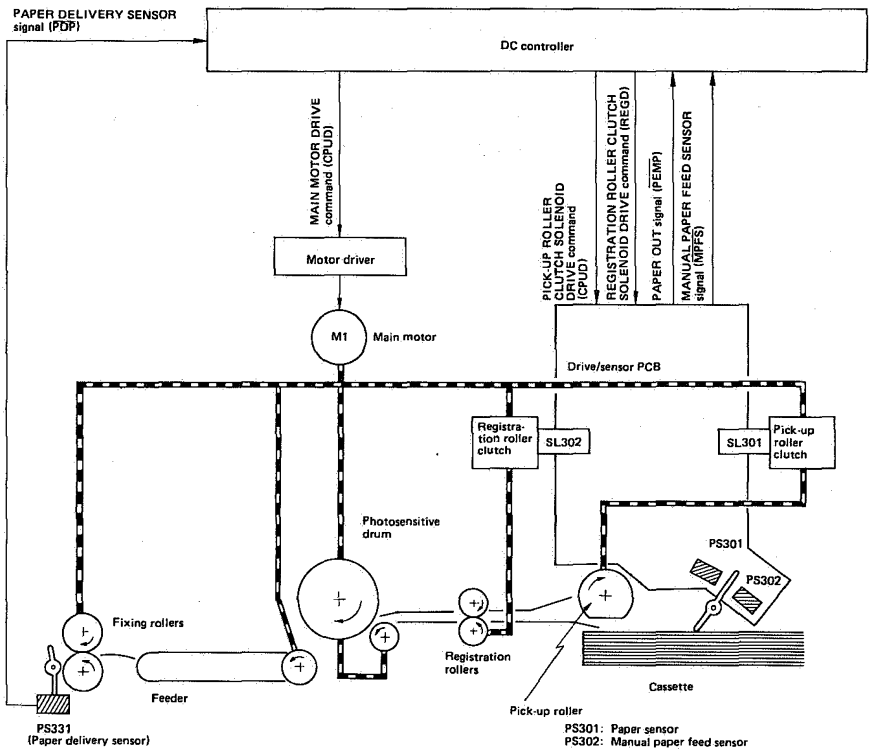

Figure 2-25

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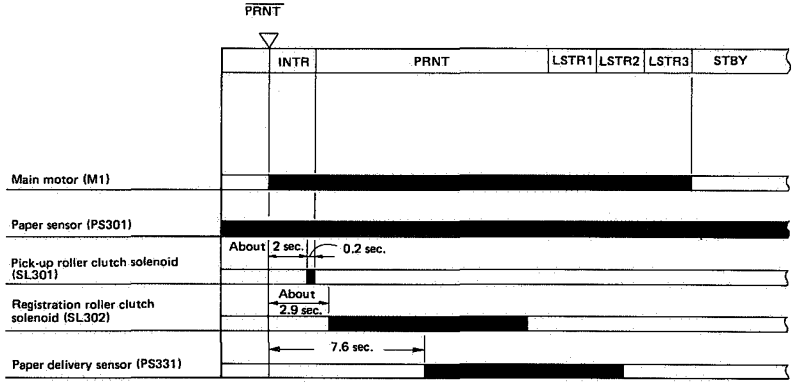
B. Cassette Feed

If there is a cassette with paper in the printer, and the fixing assembly reaches operating temperature, the READY/WAIT indicator stops flashing and glows steadily. When a $\overline{\text{PRNT}}$ signal is received from the external device, the main motor (M1) starts. About two seconds later pick-up roller clutch solenoid (SL301) are driven and the pick-up roller makes one rotation. This feeds 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 $\overline{\text{PRNT}}$ signal, the registration roller clutch solenoid (SL302) is actuated, the registration rollers rotate, and the paper is fed toward the photosensitive drum.



Notes:
1. This timing chart is for the pick-up of one sheet.
2. For the timing of pick-up from the X1 cassette, see the manual feed timing chart.

Figure 2-26

C. Manual Feed

The timing of manual paper feed is identical to the timing for cassette paper feed except for the following points:

1. A different paper sensor is used.
   Cassette feed sensor: PS301
   Manual feed sensor: PS302
2. The INITIAL ROTATION time is different.
   Cassette feed: About 2.2 seconds
   Manual feed: About 6.2 seconds

   The reason is to allow time for the fixing roller to reach 180°C. This permits heavier paper to be used with manual feed than with cassette feed.

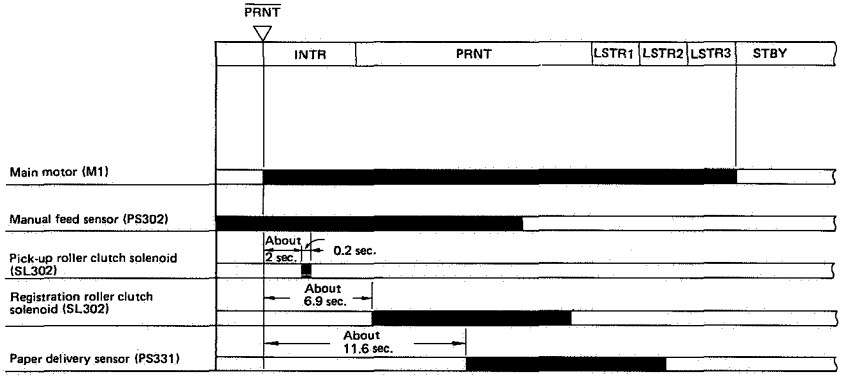


Figure 2-27

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D. Paper Jam Detection

The paper delivery sensor (PS331) in the delivery system detects whether paper is feeding normally. The printer microprocessor determines whether paper is jammed by ascertaining whether paper is present or absent at check times stored in memory. If it detects a jam, the microprocessor immediately turns the main motor OFF and notifies the external device of the jam.

A paper jam is detected in any of the following conditions:

1. Paper does not reach the delivery sensor within the required time. (Delivery-delay jam)
2. Paper does not clear the delivery sensor within the required time. (Delivery jam)
3. Paper is present at the delivery sensor when power is switched ON. (The paper is delivered automatically to the print tray if the fixing temperature is 150°C or more.)

1) Delivery-delay jam

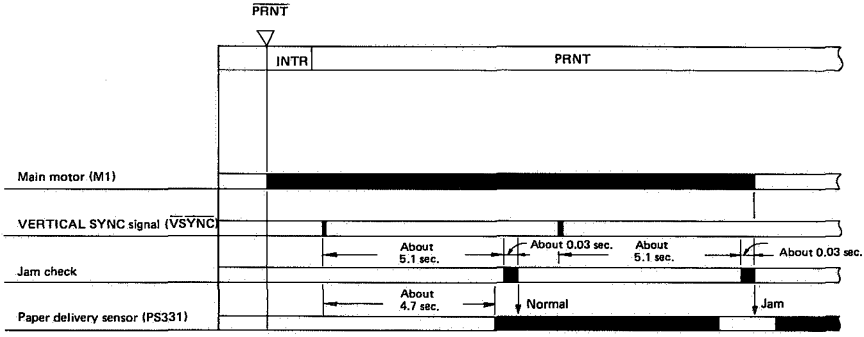

Figure 2-28

2) Delivery jam

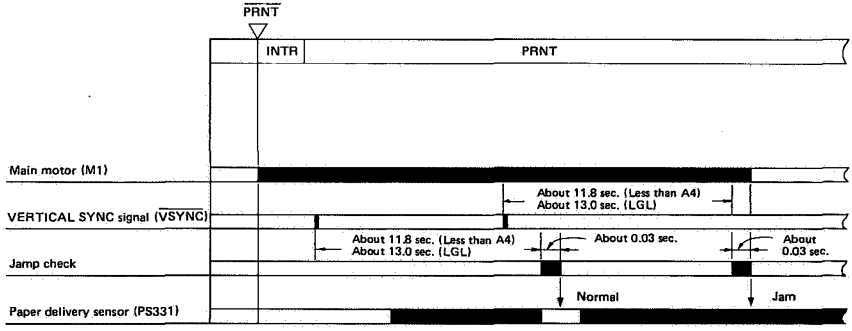

Figure 2-29

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V. CONTROL SYSTEM

A. Reading of Control Switches

Figure 2-30 indicates the periods during which the switches on the control panel have effect when pushed.

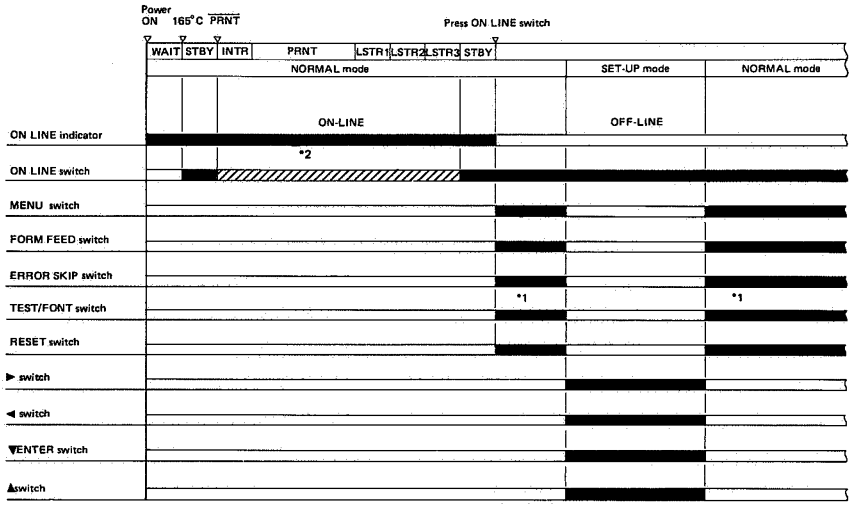

Figure 2-30

*1 The TEST/FONT switch has no effect unless the DATA Indicator is OFF.
*2 If ON-LINE switch is pressed during this period, ON-LINE display starts flashing and immediately after LSTR3, the printer becomes OFF-LINE.

As shown in Figure 2-30, the control panel switches become effective as classified into three groups shown below.

1. When the printer is ON-LINE
   Only the ON LINE switch is effective.
2. When the printer is off-line in NORMAL mode
   The ON LINE, MENU, FORM FEED, ERROR SKIP, RESET, AND TEST/FONT switches are effective.
3. When the printer is off-line in the SET-UP mode
   The ON LINE, (▶) (increment), (◀) (decrement), (▲), and ▼ ENTER switches are effective.

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B. Status List

Category	Status message	Meaning	Action
Status	00 (lit) READY	The printer is ready to print.	–
	01 (lit) TEST PRINT B	Continuous test printing: The video controller prints test pattern B, a repetitive pattern of alphanumeric characters.	
	02 (lit) WARMING UP	The printer is warning up. Wait for the warm-up period to end.	
	03 (lit) RESET	The printer has received a RESET command.	
	04 TEST STOP	Continuous test printing has stopped.	
	05 (lit) TEST PRINT A	Single test print: The video controller is printing test pattern A.	
	06 (lit) FONT LIST A	The video controller is printing font sample list A.	
	07 (lit) FONT LIST B	The video controller is printing font sample list B.	
Operator call	11 (flashing) PAPER OUT	Request for paper: The paper cassette is empty or no cassette is installed (cassette feed).	Install a paper cassette that contains paper.
	12 (flashing)	The printing unit is not receiving power because the upper unit is not completely closed.	Close the upper part of the printer.
	13 PAPER JAM	Paper feed check: A paper jam has occurred.	Rise the upper part of the printer, remove the jammed paper, then close the upper unit.
	14 (flashing) NO EP-CART	There is no EP-S cartridge, or it is not pushed in completely.	Install an EP-S cartridge. Push it in fully.
	15 (flashing) ENGINE TEST	Test print by DC controller: The DC controller is printing a test pattern (parallel vertical lines).	Release the TEST key and wait for the test printing to end.
	16 TONER LOW	The toner almost used up.	Obtain a new toner cartridge for use when required (near future).

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Category	Status message	Meaning	Action
Operator call	PC (flashing) LOAD A4	Request for loading an A4 paper cassette.	• Mount a cassette containing A4-size paper, then press the ON LINE key. • Alternatively, press the ERROR SKIP then the ON LINE key. The printer will then print on paper from cassette then in place, but correct printing is not guaranteed: some parts of the page may be missing.
	PC (flashing) LOAD B5	Request for loading a B5 paper cassette.	
	PC (flashing) LOAD LETTER	Request for loading a Letter-size paper cassette.	
	PC (flashing) LOAD LEGAL	Request for loading a Legal-size paper cassette.	
	PC (flashing) LOAD PAPER nn	Request for a universal paper cassette. **Note:** The value of nn (80–90) is a paper-size code designated by the external device (host computer) in a paper size command to the printer.	
		The above messages all indicate that the size of paper in the cassette in place is different from the size designated by the external device (host computer) in a paper size command.	
	PF (flashing) FEED A4	Request for manual feed of A4 paper.	Align a sheet of paper of the requested size with the paper guide and feed it into the printer.
	PF (flashing) FEED B5	Request for manual feed of B5 paper.	
	PF (flashing) FEED LETTER	Request for manual feed of Letter-size paper.	
	PF (flashing) FEED LEGAL	Request for manual feed of Legal-size paper.	
	PF (flashing) FEED PAPER nn	Request for manual paper feed. **Note:** The value of nn (80–99) is a paper size code designated by the external device in a paper size command to the printer.	
	FC (flashing) LEFT FONT	Request the for a new font cartridge in the left slot.	Install a new font cartridge or reinstall a font cartridge removed earlier, then press the ON LINE key.
	FC (flashing) RIGHT FONT	Request for a new font cartridge in the right slot.	
	FC (flashing) BOTH FONTS	Request for new font cartridges in both slots.	
		The above messages indicate that a font cartridge was removed or changed in OFF-LINE status while the printer has data to be printed in its buffer.	
	FE (flashing) FONT REMOVAL	Font cartridge removal error: A font cartridge was removed while the printer was performing a form feed commanded by the FORM FEED key, while the video controller was printing a test pattern, or while the printer was ON-LINE (as indicated by the ON LINE LED).	Switch power, OFF, then ON again.

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Category	Status message	Meaning	Action
Operator call	FF (flashing) FONT FULL	Font pattern data overflow: The maximum number of character sets that can be loaded into the printer has been reached. No further fonts can be loaded. **Note:** A maximum of 32 fonts can be loaded.	Take one of the following actions: ● Stop printing. (See Chapter 1 Section V for the stop procedure.) ● If an installed font cartridge is not needed, remove it, then input the data again from the beginning. ● Press the ERROR SKIP key, then press the ON LINE key. Loading of the font that cause the error is canceled.
	OC (flashing) XX ~ XX (16 characters)	Operating comment (user-defined operator call): A message or two-digit number (decimal) requesting the operator to take a particular action. The message or number is inputted to the printer from the external device.	Take the action designated by the message or number, press the ERROR SKIP key, then press the ON LINE key to continue printing.
Data error	20 (flashing) PAGE FULL	Page buffer overflow: The external device has sent the printer more data than the page buffer memory of the printer can hold. **Note:** To avoid this error, enlarge the page buffer memory space (by deleting unneeded character sets for example). In an expansion RAM board is installed, use the FULL PAINT mode described at the end of this table. The FULL PAINT mode can be designated by a command.	When the page buffer overflows, the printer considers the page to have ended, prints the page, then displays the 20 PAGE FULL message. If the ERROR SKIP key is pressed to clear the error, then the ON LINE key is pressed, the overflowing data are printed on the next page.
	21 (flashing) COMPLEX DATA	Print overrun: The printer could not print fast enough to keep up with the characters and graphics being inputted to its pattern memory. **Note:** This error sometimes occurs when characters and graphics are overlapped. If a expansion RAM board is installed, this error can be avoided by sending the printer a command disignating the FULL PAINT mode described at the end of this table.	Press the ERROR SKIP key, then the ON LINE key to continue printing on the next page. The page on which the error occurred is printed, but the printing may be incomplete.
	22 (flashing) LINE ERROR	Receive buffer memory overflow: The external device sent data while the printer was in BUSY status (not ready to receive data), causing the receive buffer memory of the printer to overflow.	Press the ERROR SKIP key, then the ON LINE key to continue printing. The data that caused the overflow are not printed. If this error occurs frequently, check the interface cable between the printer and external device, and check the interface settings. If there is a difference in interface settings, change the settings using the menu on the operator panel.

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Category	Status message	Meaning	Action
Data error	23 (flashing) MEMORY FULL	Download overflow: The memory that stores pattern data for use-defined characters (downloaded from the external device) has overflowed.	Take one of the following actions: ● Press the ERROR SKIP key, then press the ON LINE key to continue receiving data from the external device. The pattern data that caused the error are ignored. ● Stop printing (by the stop procedure given in Chapter 1 Section V), then return to ON-LINE status and input the data again. If the error recurs, ask the customer to check the input data.
	24 (flashing) FULLPAINT REJ	Paint memory overflow: Under current memory allocations there is not enough pattern memory space to use the FULL PAINT mode. See the notes at the end of this table for the FULL PAINT mode.	Check whether an expansion RAM board is installed. If no expansion RAM board is installed, inform the customer that one is needed. If an expansion RAM board has been installed, take the following action: ● Press the ERROR SKIP key then the ON LINE key to continue receiving data from external device. The printer will process the data in the PARTIAL PAINT mode, so data (print data or commands) that can be used only in the FULL PAINT mode will be pressed at text data (print data or command data). See the notes at the end of this table for details of the PARTIAL PAINT mode.
	25 (flashing)	Cannot change to VECTOR GRAPHIC The printer is not in the FULL PAINT mode, so it cannot change to the VECTOR GRAPHIC mode. **Note:** In the VECTOR GRAPHIC mode, the printer draws circles, ellipses, and other shapes and fills in closed areas in response to commands from the external device. This mode is not available in the standard model; an expansion RAM board is required. See the end of this table for details of the full paint mode.	Take one of the following actions: ● Stop printing (by the stop procedure given in Chapter 1 Section V), input a Full Paint MODE command, then send the data again from the beginning. ● Press the ERROR SKIP key, then press the ON LINE key. The VECTOR GRAPHIC MODE command is ignored. Subsequent VECTOR GRAPHIC commands are treated as text data (print data or command data).
	26 (flashing) MEMORY FULL	Work memory overflow: The internal memory of the video controller has overflowed. The designated function cannot be executed.	Check whether an expansion RAM board is installed. If there is not expansion RAM BOARD, INFORM THE CUSTOMER THAT ONE IS NEEDED. If an expansion RAM board has been installed, take the following action: ● Press the ERROR SKIP key then the ON LINE key to continue receiving data from the external device. The functions that caused this error are all ignored.

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Category	Status message	Meaning	Action
Printing error	40 (flashing) LINE ERROR	This message is displayed in serial (RS-232C) interface models when the printer cannot receive data correctly from the external device. **Note:** When this error occurs, the printer prints pages up to and including the page before the error, then flashes the 40 LINE ERROR message. If this error occurs 256 times on the same page, the printer ends the page at that point and prints it, with an error mark substituted for the data that caused this error.	Follow the procedure below until the error is corrected. • Press the ERROR SKIP key then the ON LINE key to continue receiving data. • Check the interface cable between the external device and the video controller, and check whether the interface settings (baud rate, data length, etc.) match, If they do not match, change the setting using the menu on the operator panel.
	41 (flashing) PRINT CHECK	Request for print check: A temporary error occurred, causing an unnecessary horizontal line or other defect in the printed output.	Take the defectively printed sheet from the print tray, then press the ERROR SKIP key to continue printing. The printer reprints the page on which the error occurred.
Service-man call	50 (flashing) SERVICE	Fixing assembly error: The fixing assembly has failed to reach the necessary temperature.	Switch power OFF, wait about five minutes, then switch power ON again. If the error recurs, perform the procedure in Chapter 7 Section V.
	51 (flashing) SERVICE	Beam detect error: The laser beam is too dim or there is a problem in the optical system. The DC controller failed to send the HORIZONTAL SYNC signal (difference between BD and BD) to the video controller.	Press the ERROR SKIP key, then the ON LINE key to continue printing. If the error recurs, perform the procedure in Chapter 7 Section V.
	52 (flashing) SERVICE	Scanner error: The scanner motor has failed to run at the correct speed.	Press the ERROR SKIP Key, then the ON LINE key to continue printing. If the error recurs, perform the procedure in Chapter 7 Section V.
	55 (flashing) SERVICE XXXXX (error number)	The DC controller has failed to receive any control signals from the video controller, such as PRNT (PRINT command) or the STATUS REQUEST sent on the SC (status/command) signal line.	Press the ERROR SKIP Key, then the ON LINE key to continue printing. If the error recurs, perform the procedure in Chapter 7 Section V.
	61 (flashing) SERVICE XXXXX (ROM address)	Program ROM error: An error has occurred in the video controller ROM (Read-Only Memory), which stores control programs for the microprocessor.	Switch power oFF, then ON again.
	62 (flashing) SERVICE	Internal font ROM error: An error has occurred in the ROM of the video controller PCB that contains the pattern data for printing internal fonts.	Switch power OFF, then ON again.

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Category	Status message	Meaning	Action
Service-man call	63 (flashing) SERVIDE [XXXXX] (ROM address)	DRAM error A read or write error has occurred in the dynamic RAM of the video controller PCB.	Switch power OFF, then ON again.
	64 (flashing) SERVICE [XXXXX] (ROM address)	Scan buffer error: A read or write error has occurred in the scan buffer memory of the video controller PCB.	Switch power OFF, then ON again.
	65 (flashing) SERVICE [XXXXX] (ROM address)	DRAM controller error: The DRAM controller on the video controller PCB has malfunctioned.	Switch power OFF, then ON again.
	67 (flashing) SERVICE [XXXXX] (ROM address)	Other error	Switch power OFF, then ON again.
	68 (flashing) SERVICE [XXXXX] (ROM address)	NVRAM error: A read or write error has occurred in the nonvolatil RAM on the video controller PCB.	switch power OFF, then ON again.

Notes:

1. From the character and graphic data it receives, the printer generates character and graphic patterns which it writes in a memory area called "pattern memory", then prints on the page. The patterns can be generated in two modes: FULL PAINT mode and PARTIAL PAINT mode. In the FULL PAINT mode the printer uses a pattern memory area equivalent to a full page; in the PARTIAL PAINT mode it does not. The mode should be selected to suit the contents of the page. If double or triple over-printing occurs frequently on the same line, the output process may get ahead of the pattern generation process, when the PARTIAL PAINT mode is being used, causing a print overrun error (indicated by status message 21 COMPLEX DATA). The FULL PAINT mode should be used in such cases. The FULL PAINT mode requires an expansion RAM board.
2. In the VECTOR GRAPHICS mode the printer can generate circles and ellipses and fill in closed areas. The VECTOR GRAPHICS mode requires an expansion RAM board.

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VI. SYSTEM INTERFACE

A. Outline

The printer has connectors for an 8-bit parallel (Centronics) interface, RS-232C serial interface, as standard equipment. Data can be inputted to the video controller via any of these connectors. Data is inputted a page at a time and edited in the layout set on the control panel. If the external device sends code data, the video controller converts the data (before passing the data to the DC controller) to dot data that the printer can print.

B. Operation

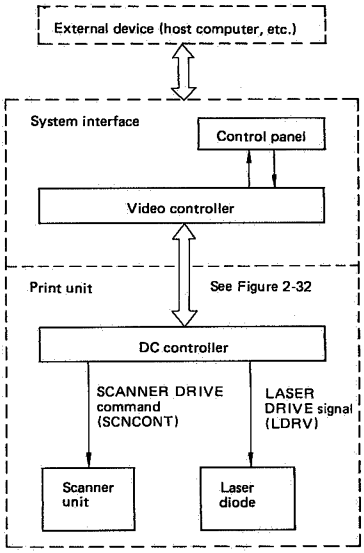

Figure 2-31

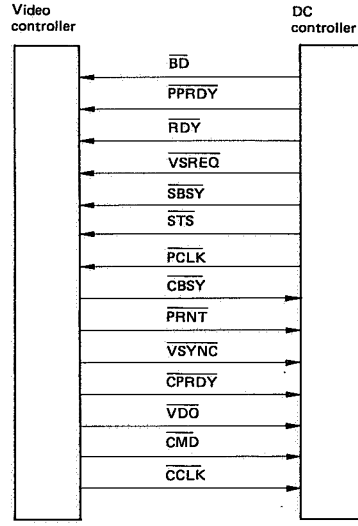

Figure 2-32

When its power is switched on, the printer goes into a WAIT state, during which the READY/WAIT indicator flashes. After the WAIT phase ends, the READY/WAIT Indicator stays ON and a READY ($\overline{RDY}$) signal is sent via the DC controller interface to notify the video controller that the printer is now ready for printing.

When the video controller receives the $\overline{RDY}$ signal, it begins receiving print data from the external device.

The video controller then receives print data from the external device. When a complete page of data has been received, the PRINT command ($\overline{PRNT}$) is sent to the video interface circuit of the DC controller.

When the DC controller receives the $\overline{PRNT}$ command, it starts INITIAL ROTATION (INTR) operations. At the end of this period, the DC controller sends a VERTICAL SYNC REQUEST ($\overline{VSREQ}$) command to the video controller via the interface. On receiving the $\overline{VSREQ}$ command, the video controller sends a VERTICAL SYNC ($\overline{VSYNC}$) signal to the interface of the DC controller. On receiving the $\overline{VSYNC}$ signal, the DC controller begins printing operation:

The video controller also receives HORIZONTAL SYNC ($\overline{BD}$) and VIDEO ($\overline{VDO}$) signals synchronized with the VERTICAL SYNC ($\overline{VSYNC}$) signal. From these signals it generates a LASER DRIVE (LDRV) command which switches the laser diode ON and OFF. The laser beam is scanned the repeatedly across photosensitive drum to form a latent electrostatic image of the original image (represented by the digital data). This invisible image is developed by very fine toner particles, which are

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transferred to plain paper and fixed to make the final permanent print. The print is delivered to the print tray.

While a page is being printed, the DC controller checks for $\overline{\text{PRNT}}$ commands coming from the video controller. If no further $\overline{\text{PRNT}}$ commands arrive, at the end of the page the DC controller ends printing operation and begins LAST ROTATION (phases LSTR1, LSTR2, and LSTR3) operations. At the end of this time period the printer enters the STANDBY (STBY) state. If further $\overline{\text{PRNT}}$ commands arrive during printing, however, printing operation continues until the last $\overline{\text{PRNT}}$ command has been executed. Then the LAST ROTATION operations are performed and the printer enters STANDBY.

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I. 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, and after the READY/WAIT Indicator on the control panel has stopped flashing, signals are outputted from the DC controller to drive the laser diode, scanning motor, main motor, and other components in response according to print commands and image data received from the external device.

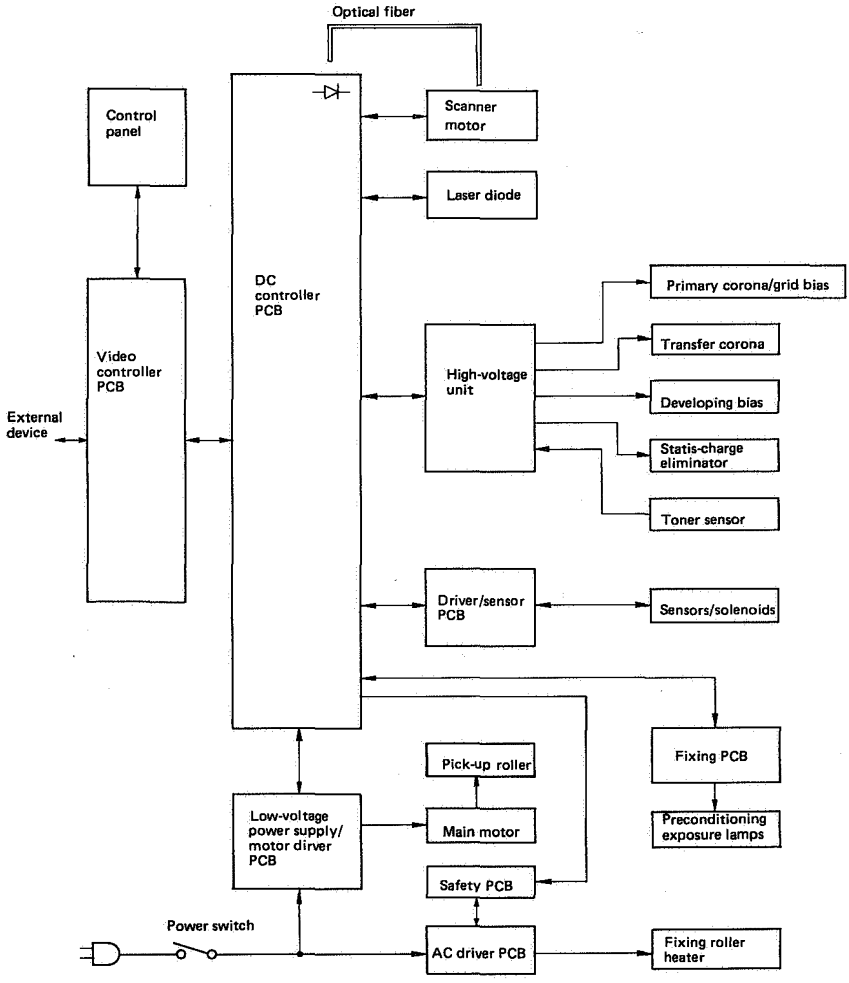

Figure 3-1

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II. DC CONTROLLER INPUTS AND OUTPUTS

A. Input Signals

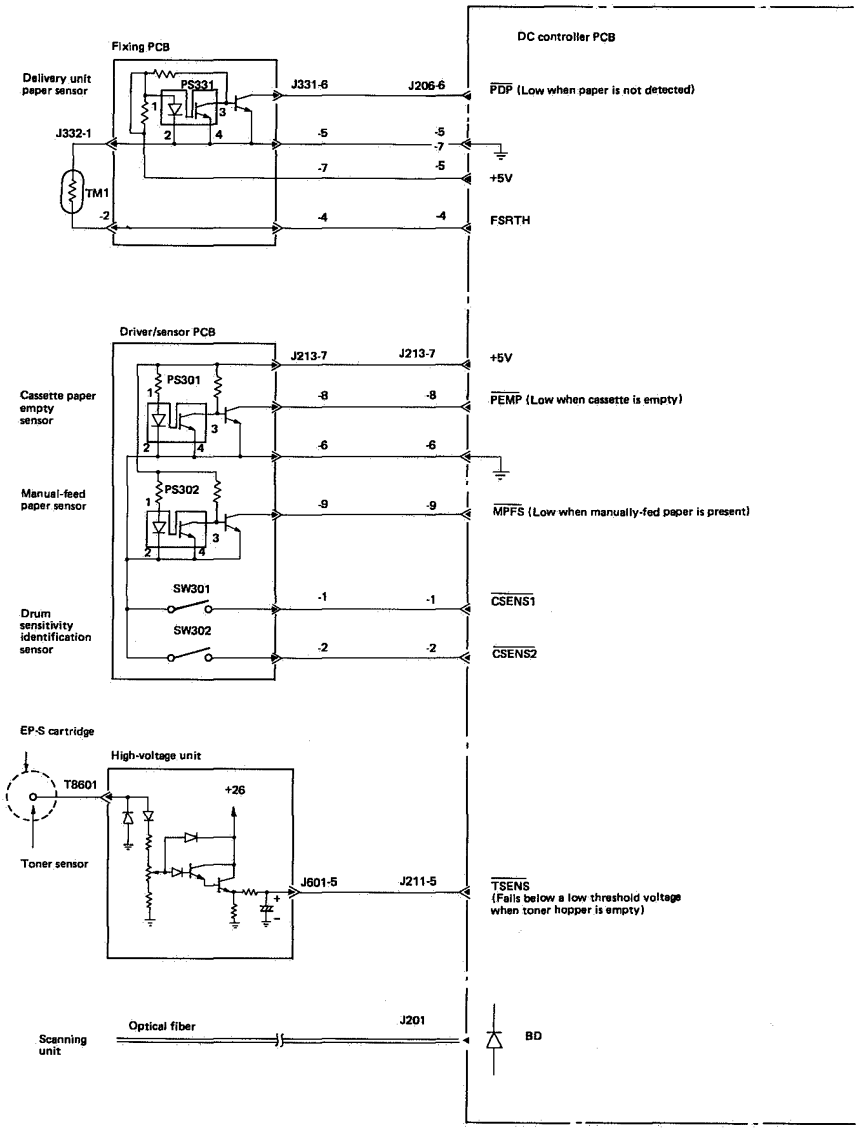

Figure 3-2

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B. Output Signals

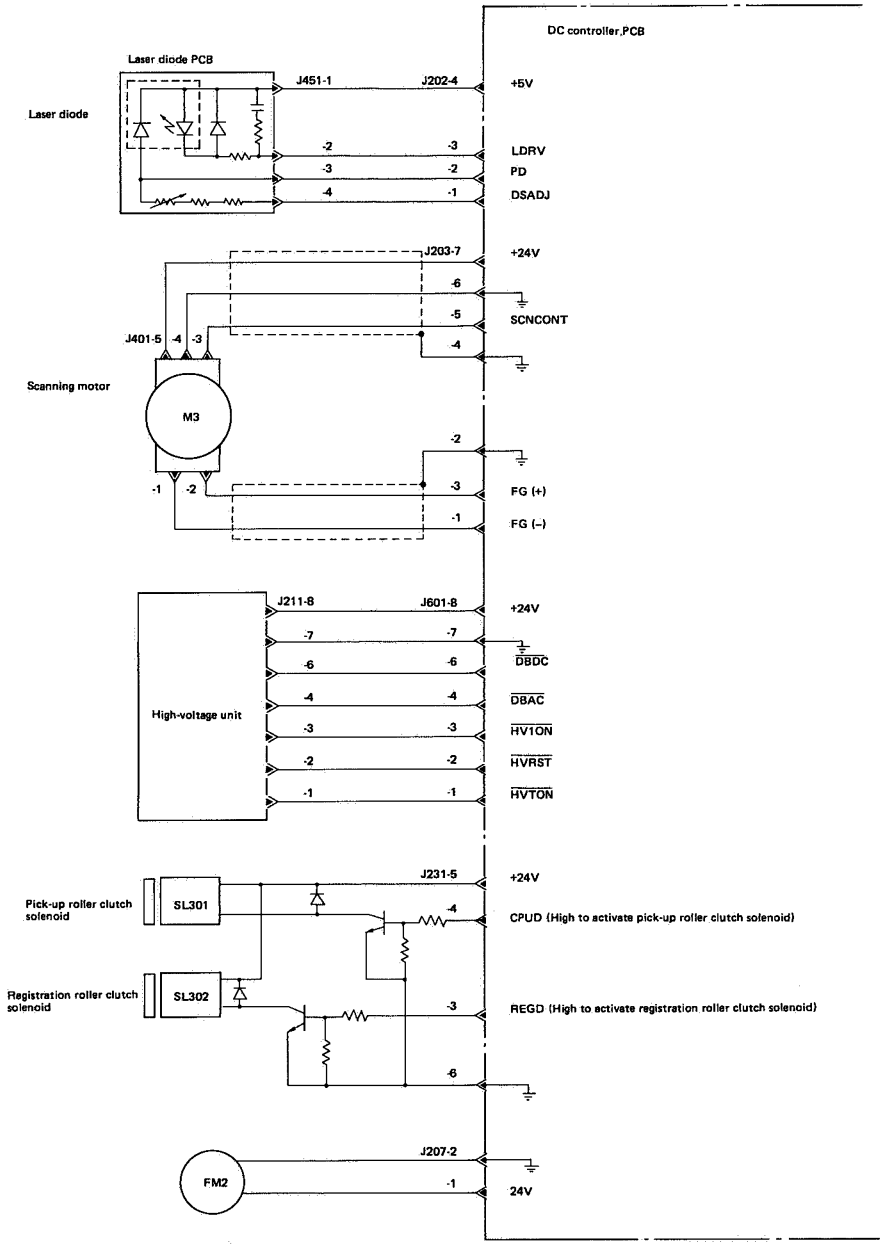

Figure 3-3

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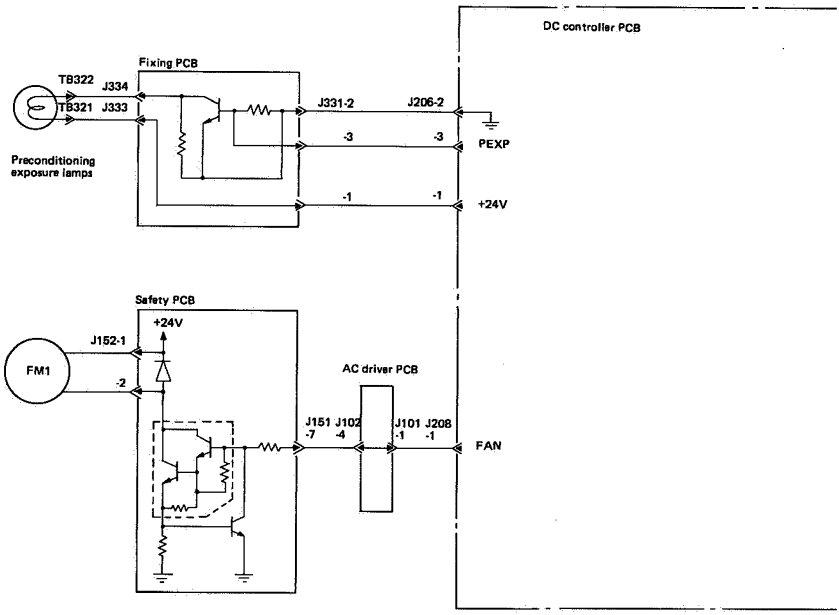

Figure 3-4

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III. CIRCUIT DESCRIPTIONS BY FUNCTION

A. Main Motor Driver

1. Outline

The main motor (M1) is a 4-phase stepping motor with a step angle of 1.8°. When the DC controller receives a PRINT command ($\overline{\text{PRNT}}$), the main microprocessor (M-CPU) generates a DRUM DRIVE ($\overline{\text{DRMD}}$) command that commands the sub-microprocessor (S-CPU) to generate 4-phase motor drive pulses (A, $\overline{\text{A}}$, B, $\overline{\text{B}}$). These 4-phase pulses are amplified to drive pulses ϕ_1, $\overline{\phi_1}$, ϕ_2, and $\overline{\phi_2}$ by the motor driver, to drive the main motor.

The sub-microprocessor generates the 4-phase pulses by dividing the frequency of a crystal oscillator, so the period of these pulses is extremely stable, enabling precise control of the speed of the main motor.

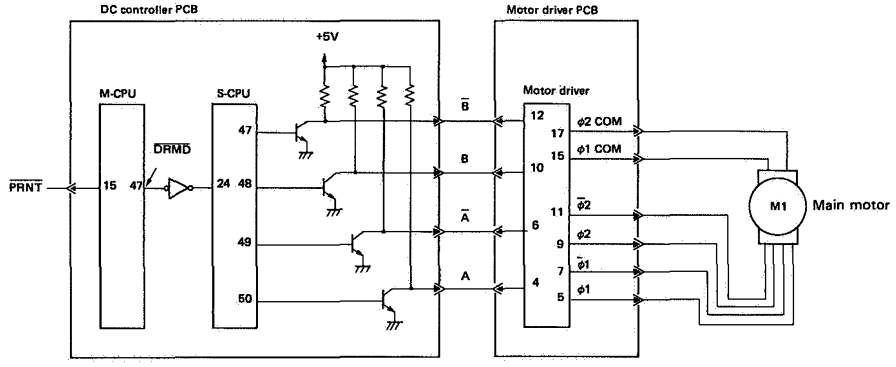

Figure 3-5

2. Principle of operation

Figure 3-6 shows the 4-phase pulse waveforms fed to the main motor. Each pulse has a duty cycle of 50%, and the pulses have a phase difference of 90°. The stator windings are excited in the sequence of ϕ_1, $\overline{\phi_1}$, ϕ_2, $\overline{\phi_2}$, each pulses turning the roller 8°.

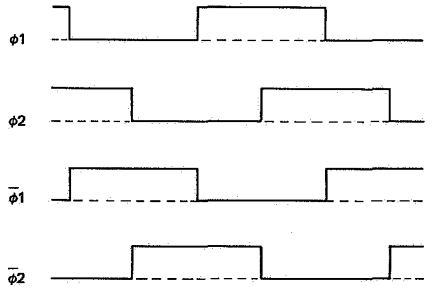

Figure 3-6

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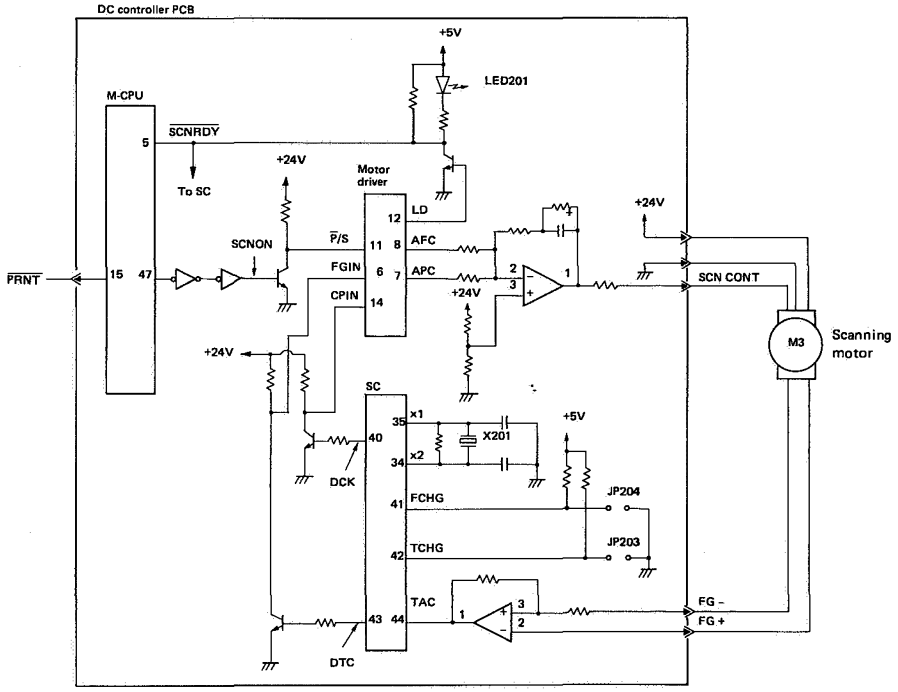
B. Scanning Motor Driver

1. Outline

The scanner drive motor is a flat-type DC motor. A standard cell (SC) the frequency of the signal from a crystal controlled oscillator (X201) is divided to generate signal DCK. This provides reference frequency signal CPIN to the motor driver. When the $\overline{PRNT}$ input to the DC controller and the P/S input to the motor driver are both L, the motor driver outputs a SPEED CONTROL signal (AFC) and PHASE CONTROL signal (APC) to the scanning motor. AFC and APC are summed by an adder to produce the SCNCONT signal sent to the scanner motor.

While the scanning motor is rotating it generates a tachometer signal that is fed back to the motor driver as FGIN. Its frequency and phase are compared continuously with reference signal. If they are not the same, the motor speed is adjusted. As a result, the motor speed is maintained extrernely steady. Indicator LED201 is ON when the speed is within the correct range.



Note: The frequency of X201 depends on the resolution.

Figure 3-7

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2. Principles of operation

Figures 3-8 and 3-9 show the relationships among the CPIN and FGIN signals inputted by the motor driver and the AFC and APC signal outputted by the motor driver.

a. Variation of AFC output in response to FGIN frequency

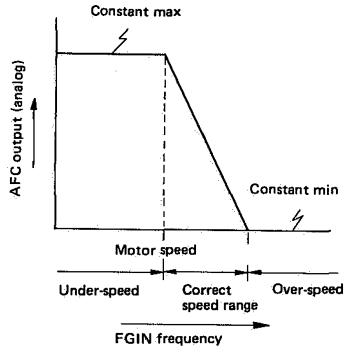

Figure 3-8

b. Variation of APC output in response to phase difference

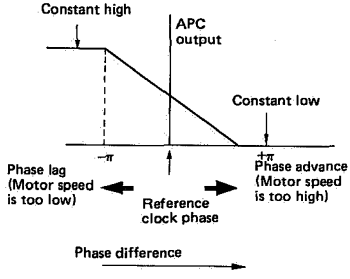

Figure 3-9

Jumpers JP203 and JP204 are set as follows according to the resolution of the printer. These jumper settings are made for reasons concerning the motor driver specifications (frequency characteristics).

	240DPI	300DPI	400DPI
JP203	Open	Open	Connected
JP204	Open	Open	Open

Table 3-1

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C. Pick-Up Roller Driver

1. Outline

The pick-up roller driver circuit actuates the pick-up roller-clutch solenoid (SL301) to engage the pick-up roller-clutch. Therefore the pick-up motor turns by the main motor (M1). The pick-up roller turns once to feed a sheet of paper up to the registration rollers.

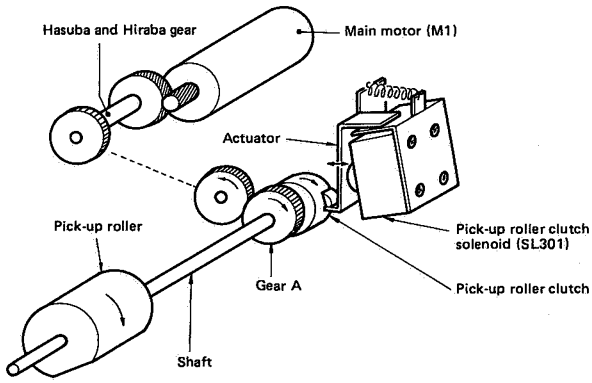

Figure 3-10

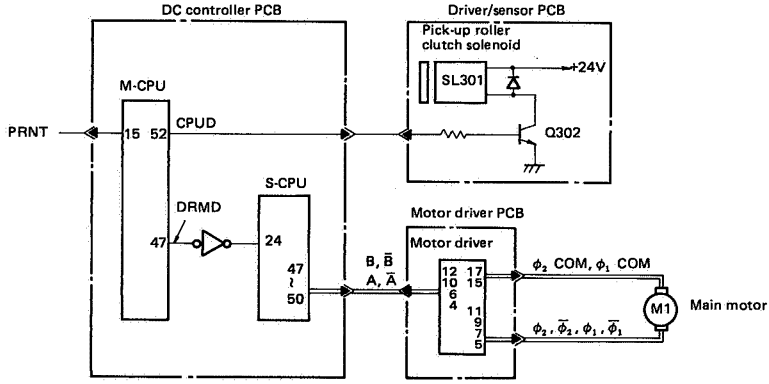

Figure 3-11

2. Principles of Operation

Signal $\overline{\text{PRNT}}$ from the video controller to the DC controller goes "L", then signal $\overline{\text{DRMD}}$ from the M-CPU on the DC controller also goes "L", causing the main motor, M1 to rotate.

Approxmately 2 sec. after $\overline{\text{PRNT}}$ goes "L", CPUD from the M-CPU on the DC controller goes "H", actuating the pick-up roller clutch solenoid, SL301 for approx. 0.2 sec.

The pick-up roller clutch then engages, and the pick-up roller turns once to pick-up and feed one sheet of paper up to the registration roller.

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D. Laser Driver

1. Outline

This circuit generates the laser diode drive signal (LDRV) in response to the signal $\overline{VDO}$ inputted from the video controller.

The laser driver circuit includes switches SW301 and SW302 that detect the sensitivity of the photosensitive drum. The driver circuit adjusts the laser drive current according to the input signals from these switches (CSENS1 and CSENS2), matching the intensity of the laser beam to the sensitivity of the drum.

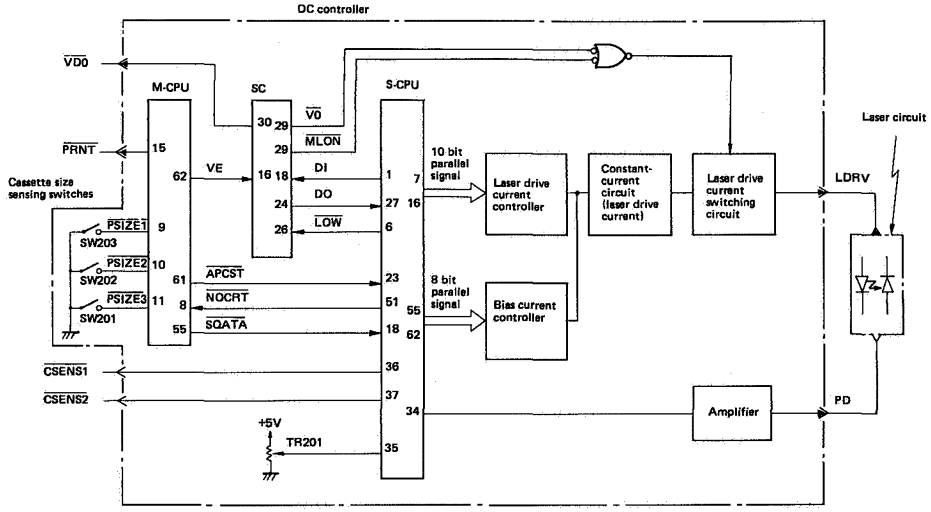

Figure 3-12

2. Principle of operation

a. Control of laser beam intensity

Just before the laser diode emits laser beam on the drum in response to the signal $\overline{VDO}$, the laser beam intensity is always adjusted by the following procedure.

(1) A fixed time after the main microprocessor inputs the PRINT command (PRNT) from the video controller PCB, the AUTOMATIC POWER CONTROL START (APCST) command goes low.

(2) When it receives the APCST signal, the sub-microprocessor resets the bias current and drive current fed to the laser diode, and sends the LASER ON (LON) command.

(3) The standard cell (SC) inputs the LON command and outputs an L Mandatory Laser On (MLON) command, causing the laser current switching circuit to supply laser drive current to the laser diode.

(4) The sub-microprocessor 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 (analog) generated by the photodiode is amplified and sent to the sub-microprocessor as a feedback signal (analog voltage).

(6) When the feedback voltage reaches a preset limit, the sub-microprocessor stops increasing the bias current.

(7) The sub-microprocessor sets the output at pins 55-62 to 80% of the output through these pins when the feedback voltage reached the limit. At this bias current the laser diode emits no light.

(8) If the feedback voltage exceeds the preset value, bias current is adjusted again.

(9) The sub-microprocessor 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. The photodiode (PD) senses the intensity of the laser beam and returns a feedback signal to the sub-microprocessor.

(11) The sub-microprocessor increases the drive current until the feedback voltage reaches a target value, this value depends on the sensitivity of the drum.

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Drum Sensitivity and Target Values

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 3-2

Meaning of Drum Sensitivity Identification Signals

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

Table 3-3

(12) The value at which the feedback voltage matches the target value is set as the value of the drive current to be fed to the laser diode.
(13) If the feedback voltage exceeds 105% of the target value, the laser drive current control 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 3-13 shows the changes in adjustment bias current and drive current in the above control procedure.

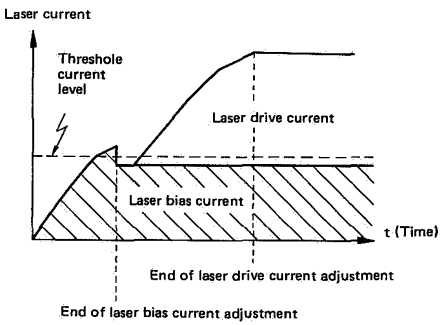

Figure 3-13

b. Control of laser emission

The laser diode emits light in response to the VIDEO ($\overline{VDO}$) signal inputted from the video controller, subject to paper size. Paper size information is input from the cassette size detector switches (SW201 to SW203).

Coding of Paper Size Information

Paper size / Switch	SW201	SW202	SW203
No paper (no cassette)	OFF	OFF	OFF
X1	ON	ON	OFF
B5R	ON	OFF	ON
Legal	ON	OFF	OFF
A4R	OFF	ON	ON
Letter R	OFF	OFF	ON
Executive R	ON	ON	ON

Table 3-4

(1) When the main microprocessor receives an L PRINT command ($\overline{PRNT}$) from the video controller, it outputs the data of the PAPER SIZE INFORMATION signals ($\overline{PSIZE1}$ to $\overline{PSIZE3}$) to the sub-microprocessor by an SDATA signal.
(2) Using the paper size information from the cassette size sensing switches, the main microprocessor outputs to the standard cell (SC) a VERTICAL ENABLE (VE) command to erase the front and rear edges of the image.
(3) The paper size information received by the sub-microprocessor is used to form the DI signal outputted to the standard cell. From this signal the standard cell generates a HORIZONTAL MASK (HMSK) signal, which it uses internally. (HMSK is not outputted.)
(4) The standard cell inputs the VIDEO signal ($\overline{VDO}$) from the video controller, processes it using the VE and HMSK signals, then outputs the result as $\overline{VO}$ to the laser drive current switching circuit.
(5) When $\overline{VO}$ is low, the switching circuit passes drive current to the laser diode, which emits the required laser light.
The figure below shows the relationships among VE, HMSK and $\overline{VO}$.

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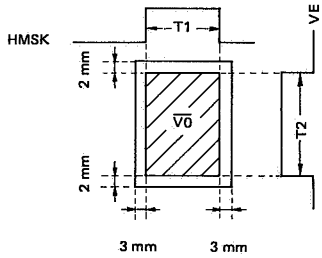

Note:
Times T1 and T2 vary with the paper size.

Figure 3-14

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E. Fixing Roller Heater Controller

1. Outline

This 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) and LAST ROTATION 3 (LSTR3) periods, the temperature is held at 165°C. During the INITIAL ROTATION (INTR), PRINTING ROTATION (PRNT) and LAST ROTATION 1 and 2 (LSTR1 and LSTR2) periods the target temperature is 180°C.

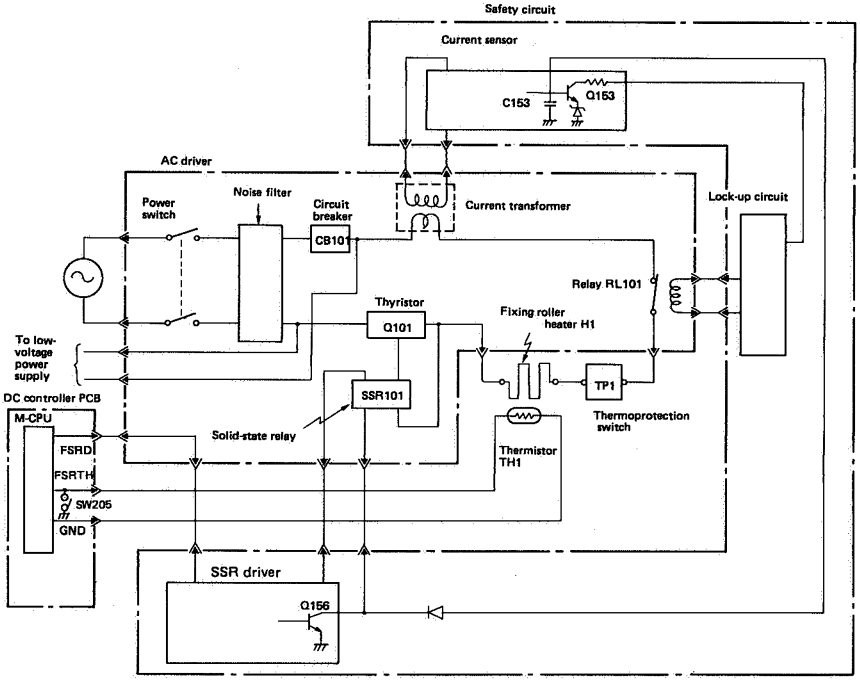

Figure 3-15

2. Principle of operation

When power is switched on, AC line voltage is supplied to the low-voltage power supply, which generates +5V, −5V, and +24V power for the DC controller. Since the contacts of relay RL101 of the AC driver are normally Closed, when the DC controller inputs the Fixing Roller Heater Drive (FSRD) command, the SSR driver causes the solid-state relay (SSR101) to operate, supplying AC line voltage to the fixing roller heater (H1). Thermistor TH1 acts as a fixing roller temperature sensor and provides an analog voltage signal to the DC controller. By means of this feedback loop, the DC controller can maintain the temperature of the roller at the value required at the current stage of printing operation.

3. Protection system

Safety requires that the temperature of the fixing roller is accurately controlled. The following protection functions are therefore provided.

a. Protection against Q101 short

The current following through the fixing roller heater (H1) is constantly monitored by a current transformer. In the event of excessive current flow, capacitor C153 of the current sensing circuit charges up. When C153 reaches full charge the voltage on the base of transistor Q153 is over 3.5V. This is high enough to switch Q153 ON and actuate the cut-off circuit, opening relay RL101 and breaking the flow of current to the fixing roller heater.

As long as the fixing roller heater is operating normally, signal FSRD constantly holds transistor Q156 ON, continuously holding the charge on capacitor C153 low and the transistor Q153 does not go ON because its base voltage does not rise over around 3.5V.

b. Protection against overheating

Thermoprotection switch TP1 switches OFF at a temperature of 210°C. If the fixing roller temperature rises above this point, TP1 cuts

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off the current through the fixing roller heater.

c. Overcurrent protection

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

4. Detecting fixing roller heater temperature level

When the fixing roller heater encounters the following conditions, printer identifies the state as error and turns OFF the READY display on the control panel.

1) If the fixing roller heater temperature does not rise to 30°C within 18 seconds of switching the printer ON.
2) If the fixing roller heater temperature does not rise to 165°C within 90 seconds of switching the printer ON.
3) If the fixing roller heater rose above 230°C.
4) If the temperature of the fixing roller heater dropped below 140°C after the READY display was turned ON.

Note:
If there is a malfunction of fixing roller heater, do not turn ON the printer power for about 10 minutes. Even if the power is turned ON during this period, power to the heater will be cut off to prevent overheating of the fixing assembly.

5. Others

When there is a malfunction, put the printer in upright position by bringing its right side to the bottom. Test pins, connectors, and electrical signals can be checked upon removing the base cover.

To protect outer panel from the fixing assembly heat even under such a sitnation, there is a switch (SW205) on the DC control PCB.

1) When the base cover is fitted to the printer, SW205 is open and the temperature level of the fixing roller heater is monitored by means of thermistor TH1 changing its resistance.
2) When the base cover is detached from the printer standing upright on its right side at the bottom, SW205 shorts. That puts the printer into the condition no different from the condition when the resistance of the thermistor TH1 is 0 Ω, and for that reason FSRD signal is not generated from the master CPU. Consequently SSR101 and Q101 do not come ON and the fixing assembly roller heater is not switched ON.

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F. High-Voltage Power Supply

1. Outline

This power supply provides high-voltage DC power to the primary corona and transfer coronas when instructed by the main microprocessor of the DC controller PCB. It also supplies the developing cylinder with AC and DC bias voltages. In addition, it amplifies the Toner Sensor signal and feeds the amplified signal back to the main microprocessor to notify the main microprocessor when the remaining toner supply is inadequate.

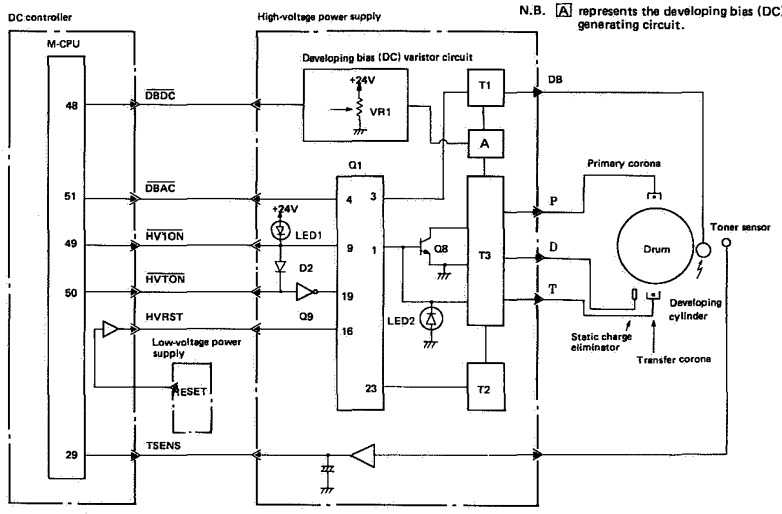

Figure 3-16

2. Principle of operation

a. Primary corona voltage

When the PRIMARY CORONA (HV1ON) command from the main microprocessor of the DC controller to the hybrid IC (Q1) of the high-voltage power supply goes L, LED1 lights (normally it is not lit), and a one pulse is outputted from pin 1 of Q1 to the primary windings of transformer T3. The secondary windings of T3 then outputs voltage P that provides the primary corona discharge. LED2 is lit during output of P. LED1 indicates that signal HV1ON is being sent, and LED2 indicates that a drive command is being sent to T3.

b. Transfer corona voltage

When the Transfer Corona (HVTON) command from the main microprocessor goes L, pin 9 of Q1 goes low and pin 19 of Q1 goes high. This causes a pulse train from pins 1 and 23 of Q1 to the primary side of transformers T3 and T2, respectively. The output from T2 is added to that of T3 to produce the voltage T that provides the transfer corona discharge.

c. Developing bias voltage

When the PRIMARY CORONA (HV1ON) goes L, AC voltage is outputted from T3 to the developing bias (DC) generating circuit.

If the developing bias (DC) drive (DBDC) command from the main microprocessor goes L according to the print sequence, DC voltage set by variable resistor (VR1) is outputted to transformer T1 from the developing bias (DC) generating circuit. And when the developing bias (AC) drive (DBAC) command goes L, a square wave gets outputted from the Q1-3 and is applied to T1.

As the result the AC voltage outputted from T1 is added to the DC voltage generated from the developing bias (DC) generating circuit. The combined voltage as the developing bias is applied to the developing cylinder.

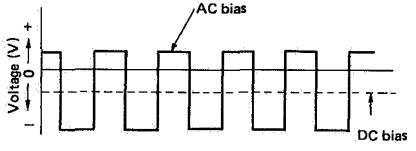

Figure 3-17 Developing Bias

d. Toner Sensor signal

When the amount of toner in the hopper falls below the required level, the voltage (analog) of the TSENS signal from the toner sensor mounted in the cartridge drops below a certain value, thus notifying the main microprocessor.

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G. Video Controller

1. Outline

Correct communication between the video controller and the external device is established by switch settings on the control panel. Code data from the external device is then processed according to the control panel settings and converted to dot data. The dot data is sent to the DC controller for operating the laser diode.

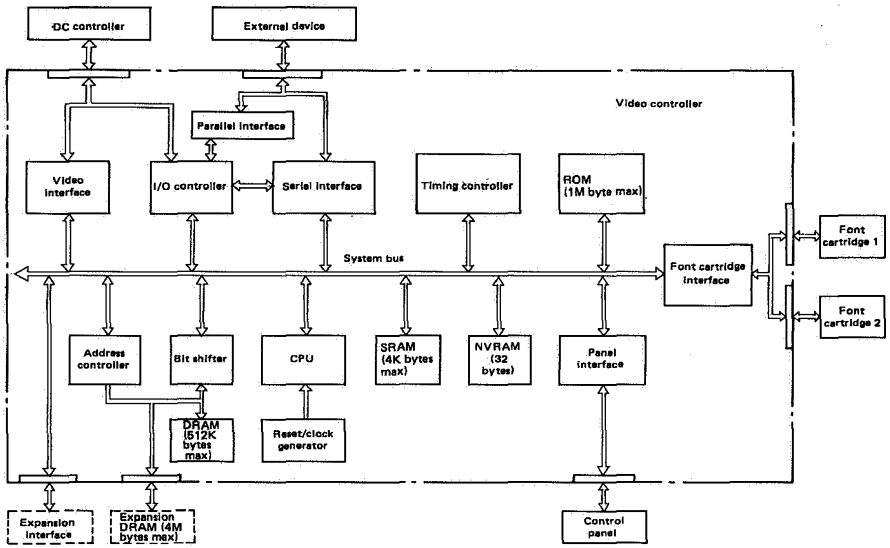

Figure 3-18

2. Descriptions of blocks

a. CPU

The CPU block contains a 16-bit microprocessor that executes programs stored in ROM to control the operation of the video controller circuit.

b. ROM

Besides storing microprocessor control programs, the ROM stores the dot patterns of internal character sets. Maximum ROM capacity is 1M byte.

c. NVRAM

The NVRAM is a nonvolatile random-access memory with a capacity of 32 bytes. Since its contents are not lost when power is switched OFF, it is used to store printing set-up information entered via the control panel.

d. SRAM

The 4K-byte SRAM is used as a stack area in the 16M-byte address space accessed by the microprocessor.

e. Address controller

The address controller is a single gate array circuit (GA1). Jumpers attached to the gate array enable the ROM address region to be changed. The ROM has a maximum capacity of 1M byte, and is used in four separate sections. The address controller also outputs address information enabling access to data in the video internal DRAM (maximum capacity 512K bytes) controller and expansion DRAM (maximum capacity 4M bytes).

f. DRAM

The DRAM is a dynamic random-access memory with a maximum capacity of 512K bytes. It stores printing information, font information, and other information input from the external device. The microprocessor subdivides the DRAM memory space as required.

g. Bit shifter

The bit shifter is used to offset or overlay printed characters, and to shift data by 1 to 15 bits.

h. Timing controller

The timing controller generates timing signals needed when data is written to or read from DRAM. It also generates DRAM refresh signals.

i. I/O controller

The I/O controller controls the timing of inputting data from the external device to the microprocessor via the parallel interface connector. It also controls the timing of communication with the DC controller.

j. Video interface

The video interface has two 4K-byte scan buffer memories (SRAMs) through which printing information converted to dot data is outputted continuously to the DC controller.

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H. Display Circuit

(1) Outline

The control panel has five LEDs, one liquid-crystal display (LCD), six switches, and one beeper.

The control panel is connected to the video controller circuit, and has the following functions:

1) Status code and error message are displayed on the LCD.
2) Operating condition is displayed on the LED.
3) Printing environment is changed by the switch.
4) Beeper makes sound when ineffective switch is depressed.

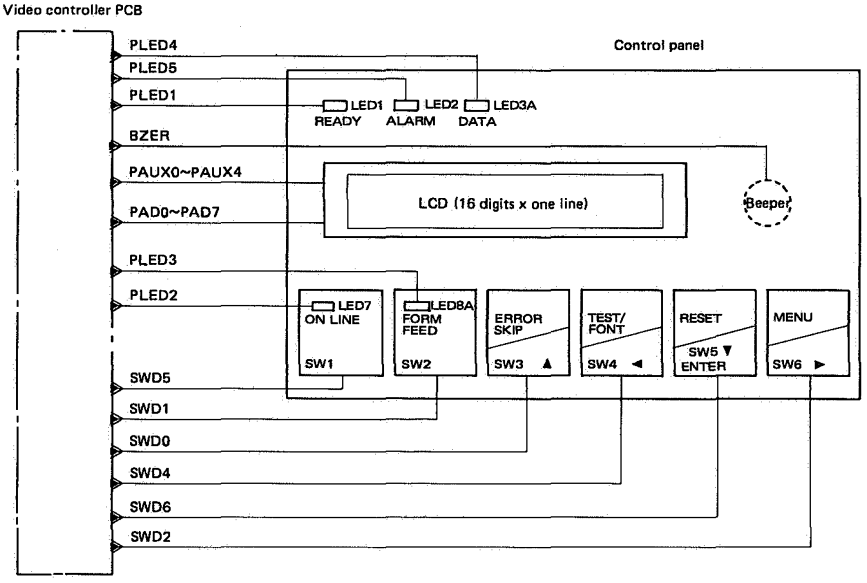

Figure 3-19

(2) Principles of operation

The LEDs, LCD, and beeper on the control panel are controlled by output signals from the video controller circuit.

Signals generated by the switches on the contorl panel are inputted to the video controller circuit.

The functions of these input and output signals are explained below.

PLED1 to PLED5
LED DRIVE signals

BZER
BEEPER DRIVE signal

PAD0 to PAD7
LCD DRIVE signals

PAUX0
Determines whether the parallel signal PAD0 to PAD7 form a command or data.

PAUX1
PAD0 to PAD7 sync pulse signal

PAUX2 to PAUX4
LCD BRIGHTNESS CONTROL signals (eight brightness levels)

SWD0 to SWD2 and SWD4 to SWD6
Input signals from SW1 to SW6

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IV. POWER SUPPLIES

A. Outline

When the power switch (SW181) is switched ON, AC power is fed to the low-voltage power supply via the AC driver. The low-voltage power supply generates +5VDC, −5VDC, and +24VDC power. Another function of this power supply is to generate the Reset signal to reset the printer at the following times:

1. When power is switched on.
2. When +5VDC power falls below the required level.
3. When the power supply voltage is momentarily interrupted.

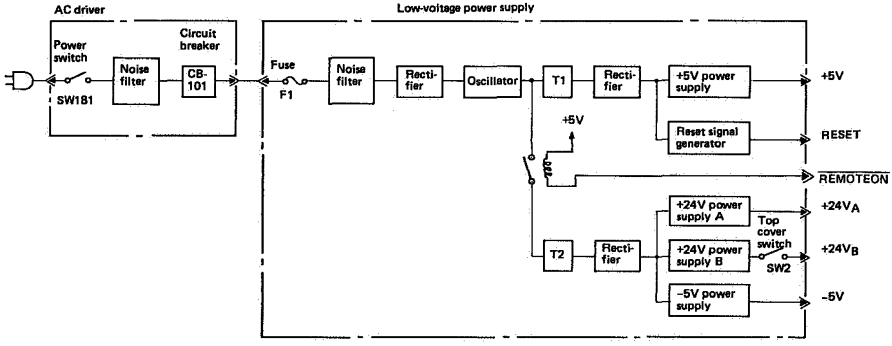

Figure 3-20

B. Protection Functions

If a short circuit or other fault in a load should causes excessive current flow from the +5VDC, −5VDC, or +24VDC power supply, the overcurrent protection system automatically shuts off the output voltage to protect the power supply. To reset the power supply after such a protective shutdown, it is necessary to set the power switch to OFF, correct the problem in the load, then switch power back ON again.

C. REMOTEON Signal

The purpose of this signal is to prevent soleniod and motor driven by +24V power supply to start operation before the initialization of CPU. Early start may lead to malfunction. REMOTEON signal delays and cause +24V/−5V power supply rise to come after the rise of +5V power supply.

Incidentially, REMOTEON signal is outputted to the low-voltage power supply PCB from the DC controller PCB Immediately after the printer is turned ON.

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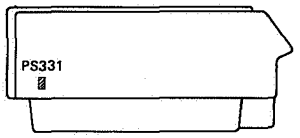
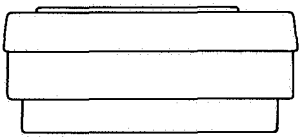
V. LOCATION OF ELECTRICAL PARTS/FUNCTION

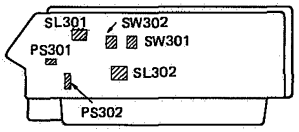
A. Switches/Sensors/Solenoids



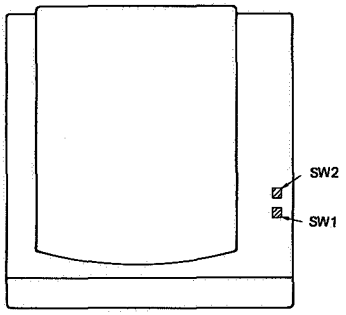
Left side view



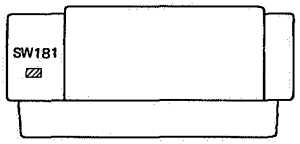
Front view



Right side view



Top view



Rear view

Symbol	Name	Switch No.	Function
	Switch	SW181	Printer power supply switch
		SW301	Sensing drum surface potential
		SW302	Sensing drum surface potential
		SW1	Prohibiting output of main motor drive pulse when the upper unit is opened
		SW2	Prohibiting output of +24VB when the upper unit is opened
	Photosensor	PS331	Sensing delivery of paper
		PS301	Sensing presence of paper in the cassette
		PS302	Sensing manual feed of paper
	Soleniod	SL301	Operating pick-up rollers
		SL302	Operating registration rollers

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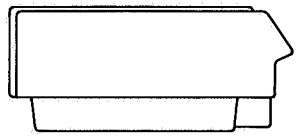
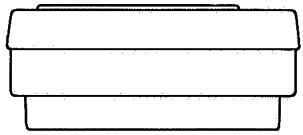
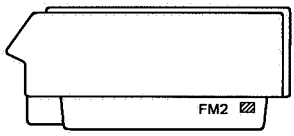
B. Motors/Heater



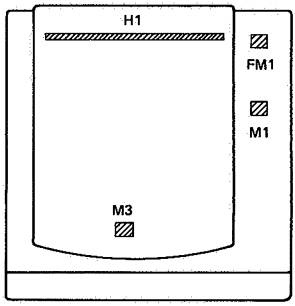
Left side view



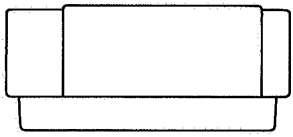
Front view



Right side view



Top view



Rear view

Symbol	Name	Switch No.	Function
	Main motor	M1	Drive motor for the drum, pick-up rollers and paper feed
	Scanner motor	M3	Drive motor for turning the polygon mirror to scan the drum with laser.
	Fan	FM1	Exhaust fan for space in the machine, above the chassis
		FM2	Exhaust fan for space in the machine inside the base cover.
	Fixing Heater	H1	Raising the temperature of fixing roller

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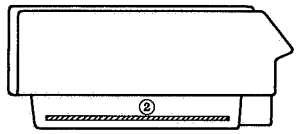
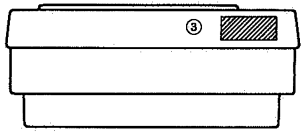
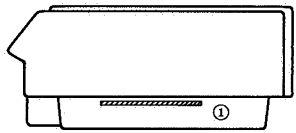
C. PC Boards



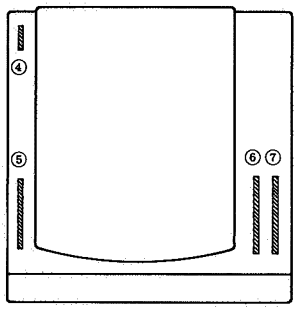
Left side view



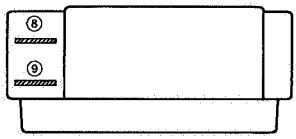
Front view



Right side view



Top view



Rear view

No.	Name of PCB	Function
①	DC controller PCB	Print sequence control, video interface control
②	Video controller PCB	Processing input/output with external device, processing of various data
③	Control panel PCB	Input/output of signal with the video controller PCB
④	Fixing assembly PCB	Delivery of paper, and for switching ON of pre-exposure conditioning lamp
⑤	High-voltage power supply PCB	Applying high voltage to primary corona, and the pre-transfer corona. Amplification of toner sensor output.
⑥	Electrical unit PCB	Various sensors, paper feed solenoid, registration roller solenoid, registration roller solenoid PCB
⑦	Low voltage power supply/motor driver PCB	Regulating DC voltage (+5VDC, −5VDC, +24VDC), and controlling main motor
⑧	Fixing assembly heater safety PCB	Controlling fixing assembly temperature rise
⑨	AC driver PCB	Fixing assembly heater driver PCB

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VI. TRIMMERS, LED INDICATORS, TEST PINS, JUMPERS, AND SWITCHES ON PC BOARDS

Of the various trimmers, LED Indicators, test pins, jumpers, and switches, those required in after-sale service are listed below. Trimmers, 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 should be OFF.
2. Trimmers which may be adjusted in after-sale service are marked .....
   Trimmers which may not be adjusted in after-sale service are marked .....

A. DC Controller PCB

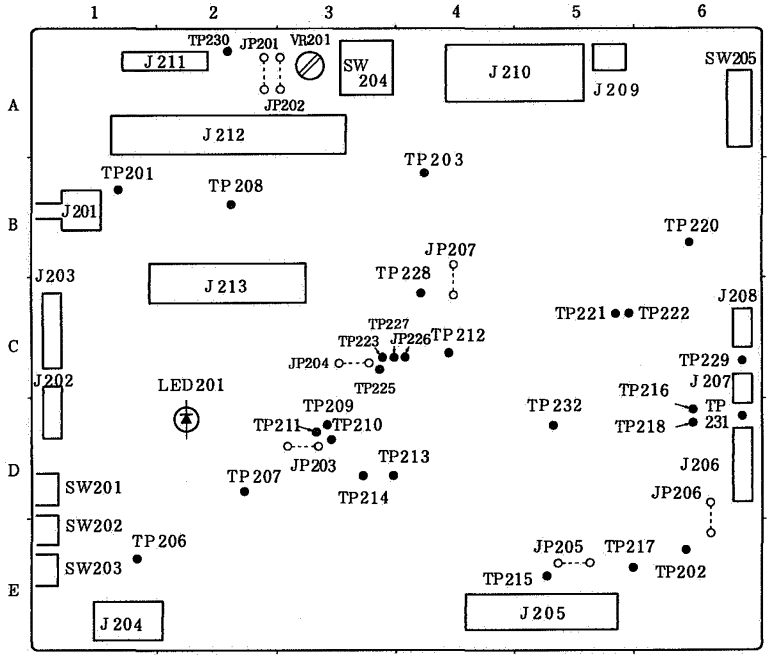

Figure 3-21

Position	Switch No.	Function
D-1	SW201	Detecting paper size in the cassette. (Refer to table 3-4)
E-1	SW202	
E-1	SW203	
A-3	SW204	Printing test pattern.
A-6	SW205	Power cut-off of fixing assembly heater

Table 3-5

Position	LED No.	Function
D-2	LED201	Lighted on while the scanner motor rotates constantly.

Table 3-6

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Position	Check pin No.	Purpose of check pin
B-1	TP201	To confirm +5VDC
E-6	TP202	To confirm GND
B-4	TP203	To confirm reset signal
E-1	TP206	For factory use
D-2	TP207	For factory use
B-2	TP208	For factory use
D-3	TP209	For factory use
D-3	TP210	for factory use
D-3	TP211	For factory use
C-4	TP212	To confirm reset signal
D-3	TP213	For factory use
D-3	TP214	For factory use
E-5	TP215	For factory use
D-6	TP216	For factory use
E-5	TP217	For factory use
D-6	TP218	For factory use
B-6	TP220	For factory use
C-5	TP221	For factory use
C-5	TP222	To confirm reset signal
C-3	TP223	For factory use
C-3	TP225	For factory use
C-4	TP226	For factory use
C-3	TP227	For factory use
C-4	TP228	To confirm +3.2VDC
C-6	TP229	To confirm +24VA DC
A-2	TP230	To confirm +24VB DC
D-6	TP231	To confirm −5VDC
D-5	TP232	For laser power motor

Table 3-7

Position	JP No.	Function
A-2	JP201	See page 23 of Appendix
A-3	JP202	
D-3	JP203	
C-3	JP204	
E-5	JP205	
D-6	JP206	
B-4	JP207	

Table 3-8

Position	VR No.	Function
A-3	VR201	For factory use

Table 3-9

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B. HVT PCB

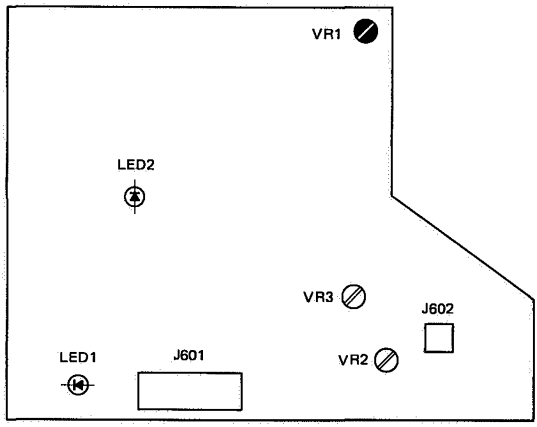

Figure 3-22

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

Table 3-10

LED No.	Function
LED1	For H and L of HV1ON signal. Lights brightly for L and lights dimly for H.
LED2	For high voltage output. Lights when there is high voltage output. Higher the output, LED lights more brightly.

Table 3-11

C. Driver and Sensor PCB

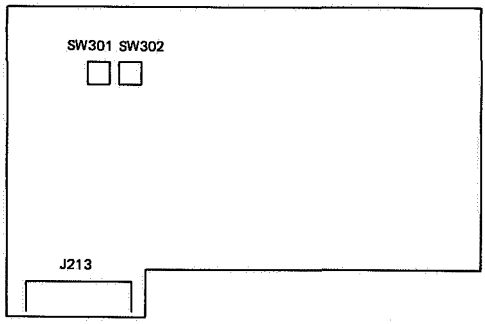

Figure 3-23

SW No.	Function
SW301	For sensing drum surface potential
SW302	

Table 3-12

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D. Video controller PCB

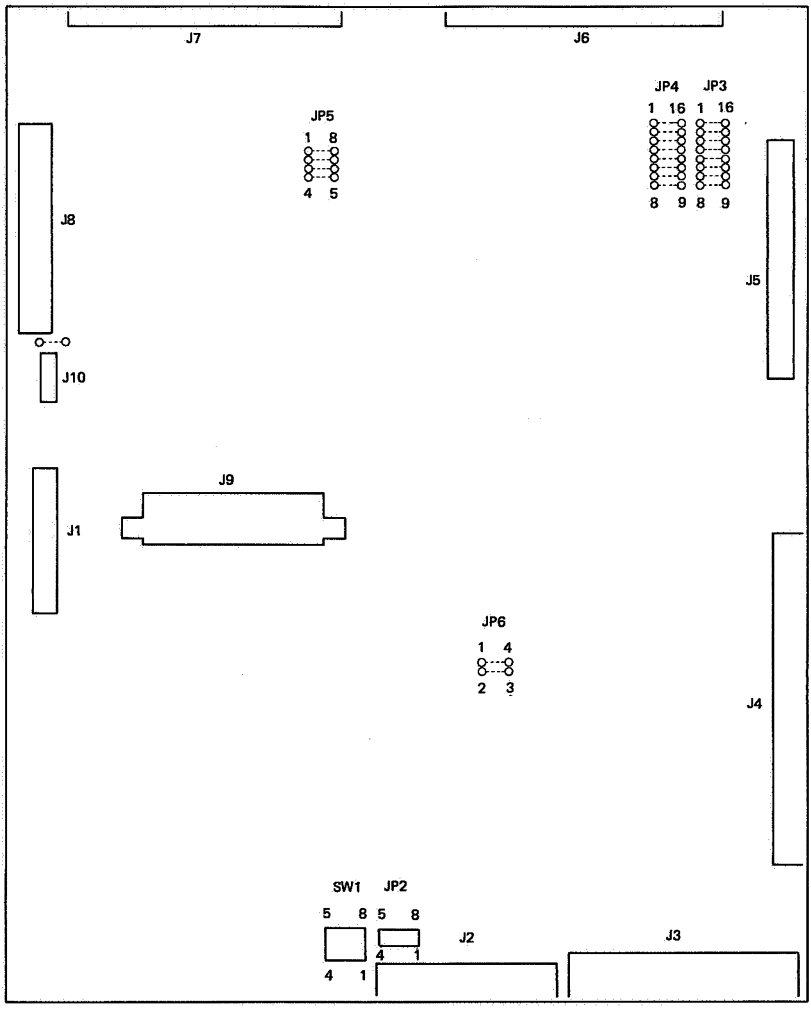

Figure 3-24

JP No.	Function
JP2	See page 23-25 of Appendix
JP3	
JP4	
JP5	
JP6	
JP8	

Table 3-13

SW No.	Function
SW1	See page 25 of Appendix

Table 3-14

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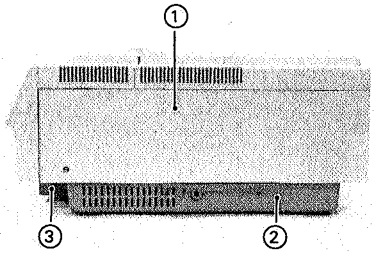
I. EXTERNALS

1. Covers, and Panels



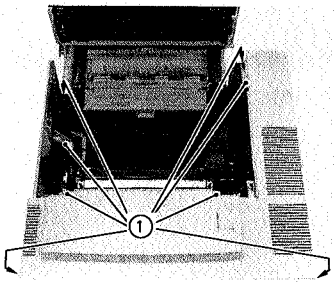
① Top cover
② Base cover
③ Font cartridge cover

Figure 4-1

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

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

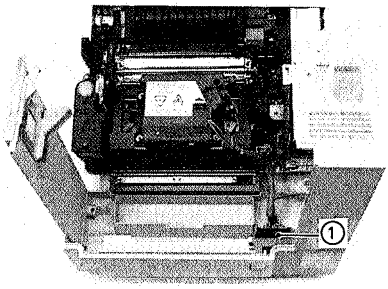
(1) Top cover
1) Open the upper unit.
2) Remove the eight (8) screws from the top cover.



① Screws

Figure 4-2

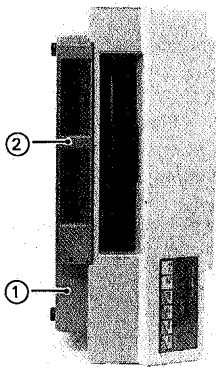
3) Lift the top cover with both bands to separate the top cover from the lower unit.
4) Disconnect the connector (J1) from the control panel on the top cover.



① Connector (J1)

Figure 4-3

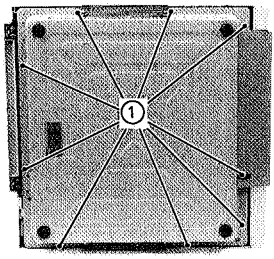
(2) Base cover and font cartridge cover
1) Place the printer on its right side down.



① Base cover ② Font cartridge cover

Figure 4-4

2) Remove the nine (9) screws to remove the base cover with the font cartridge cover from the lower unit.



① Screws

Figure 4-5

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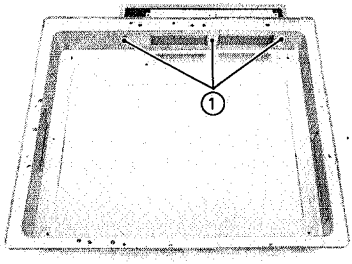
Note:
When removing the base cover be careful not to bend the spring that locks the parallel interface connector.

3) Remove the three (3) screws to separate the font cartridge cover from the base cover.



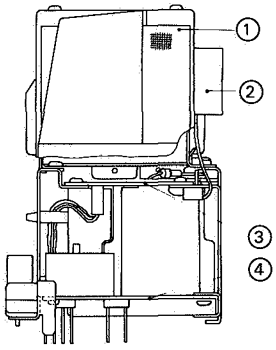
① Screws

Figure 4-6

2. AC Power Supply

(1) Configuration

The AC power supply receives AC source power from the AC outlet. It is configured as shown below.

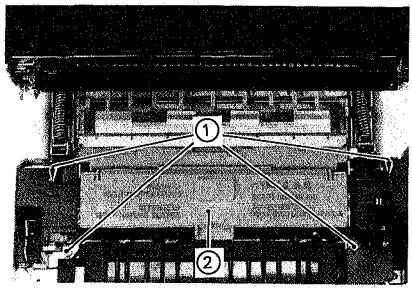


① Ozone filter
② Fan
③ Safety PCB
④ AC driver PCB

Figure 4-7

(2) Removing the AC power supply from the lower unit

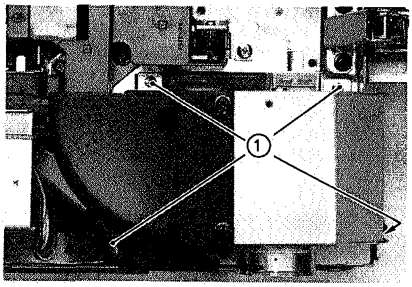
1) Open the upper unit.
2) Remove the top cover.
3) Remove the four screws to remove the fixing assembly from the base.



① Screws ② Fixing assembly

Figure 4-8

4) Remove the four screws to remove the AC power supply from the base.



① Screws

Figure 4-9

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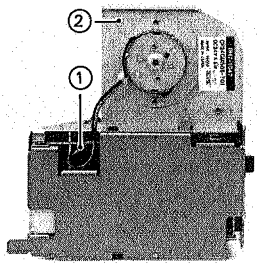
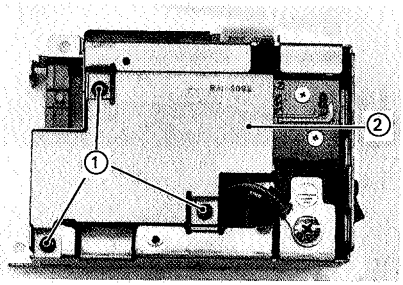
(3) Disassembly and reassembly
1) Remove the ozone filter case with the ozone filter. (2)
2) Disconnect the connector (J152).
3) Remove the fan motor unit (FM1). (3)



① Connector ② Fan motor unit

Figure 4-10

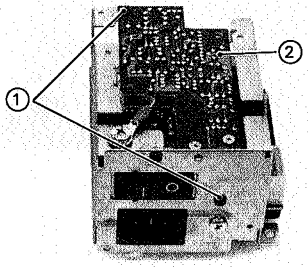
4) Remove the spacer. (3)



① Screws ② Spacer

Figure 4-11

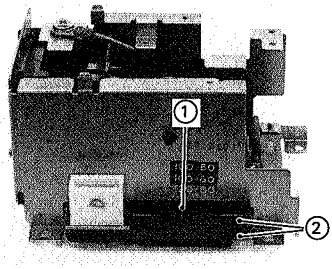
5) Remove the safety PCB. (2)



① Screws ② Safety PCB

Figure 4-12

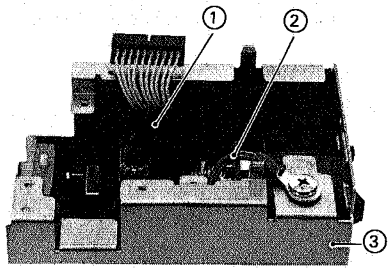
6) Remove the connector (J151) and separate the safety PCB.
7) Remove the upper and lower PCB covers. (1)



① Screw ② PCB covers

Figure 4-13

8) Release the cables from the cable holder and disconnect the grounding wire from the cabinet. (1)



① Cable holder ③ Cabinet
② Grounding wire

Figure 4-14

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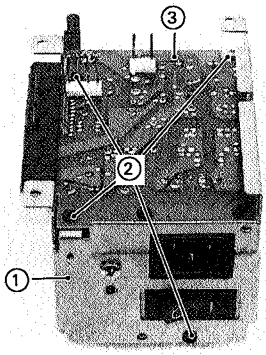
9) Remove the AC driver PCB from the cabinet. (4)



① Cabinet
② Screws
③ AC driver PCB

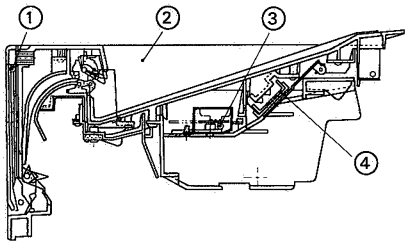
Figure 4-15

10) Disconnect the connector (J102) and remove the cable from the AC driver PCB.

3. Upper Unit

(1) Configuration

The upper unit includes two trays and a set of preconditioning exposure lamp unit, as shown below.

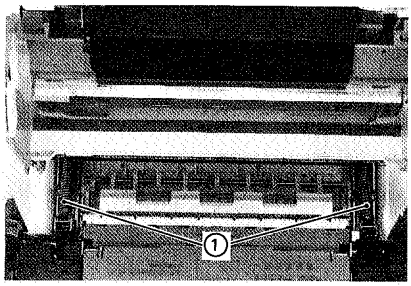


① Face-up tray
② Face-down tray
③ Preconditioning exposure lamps
④ Reflection mirror

Figure 4-16

(2) Separating the upper unit from the lower unit

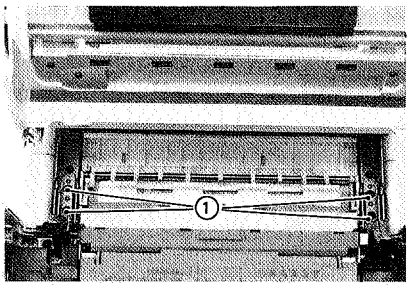
1) Raise the upper unit.
2) Remove the EP-S cartridge from the upper unit.
3) Remove the two hinge springs from the upper unit.



① Hinge springs

Figure 4-17

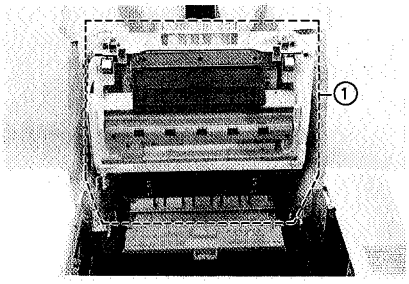
4) Remove the four (4) screws from the hinge.



① Screws

Figure 4-18

5) Lift the upper unit with both hand and move it slightly to unhinge the upper unit.



① Upper unit

Figure 4-19

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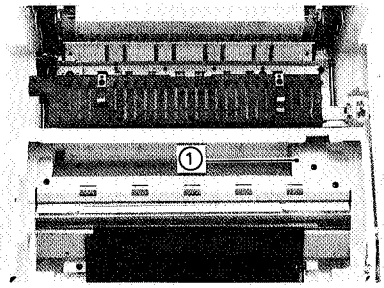
(3) Disassembly and reassembly

① Preconditioning exposure lampboard

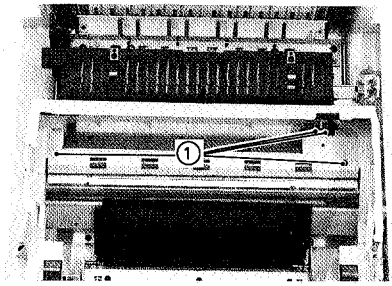
1) Remove the preconditioning exposure unit contact cover. (1)



① Preconditioning exposure unit contact cover

Figure 4-20

2) Remove the preconditioning exposure lamp unit. (4)



① Screws

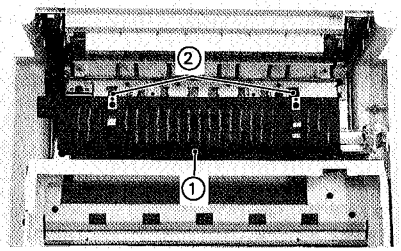
Figure 4-21

3) Remove the preconditioning exposure plate. (2)

4) Remove the preconditioning exposure lampboard. (1)

② Reflection mirror

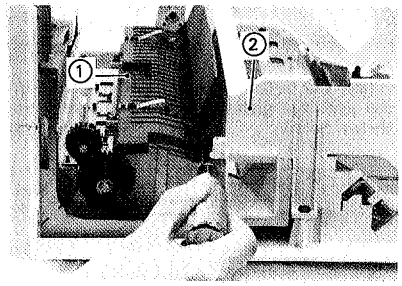
1) Remove the two (2) screws from the heat cover.



① Heat cover ② Screws

Figure 4-22

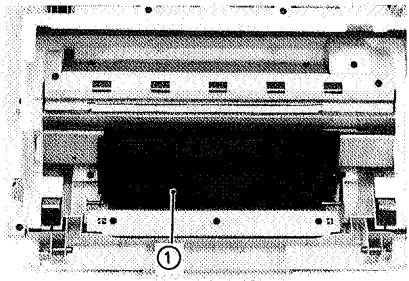
2) Using a screwdriver, release the two claws that lock the heat cover to the cartridge guide, and separate the heat cover from the cartridge guide.



① Heat cover ② Cartridge guide

Figure 4-23

3) Remove the shutter unit. (3)



① Shutter unit

Figure 4-24

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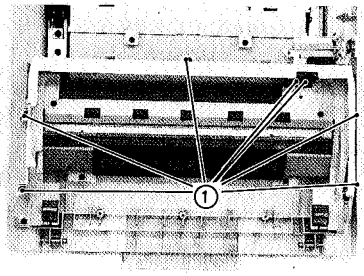
4) Remove the preconditioning exposure contact cover. (1)
5) Remove the cartridge guide together with the preconditioning exposure unit. (7)



① Screws

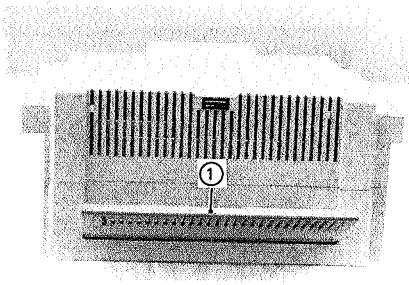
Figure 4-25

6) Remove the reflection mirror.

Note:
When the setting the reflection mirror in the cartridge guide, be sure to orient it as shown below.

Figure 4-26

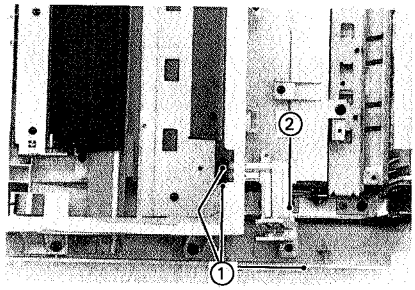
③ Delivery roller
1) Remove the face-up tray.



① Face-up tray

Figure 4-27

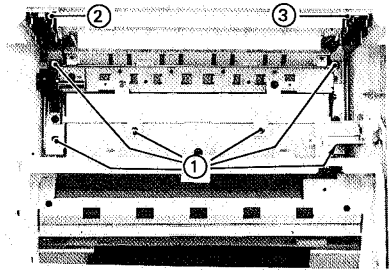
2) Remove the heat cover. (2)
3) Remove the preconditioning exposure contact cover. (1)
4) Remove the three screws from the arm so that it can be removed.



① Screws ② Arm

Figure 4-28

5) Remove the six (6) screws to separate the parts on stays A and B from the top cover. Also, remove the arm.



① Screws ③ Stay B
② Stay A

Figure 4-29

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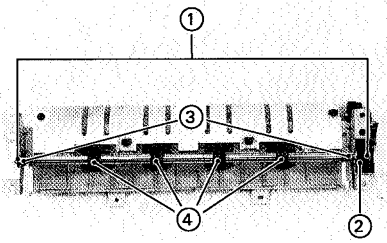
6) Remove the delivery unit from stays A and B. (2)
7) Remove the C-ring from each end of the delivery roller shaft.

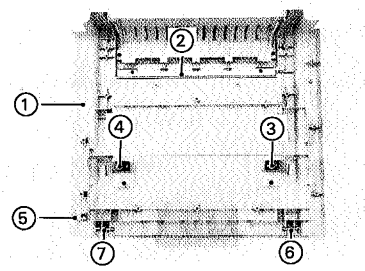


① C-rings
② Gears
③ Bearings
④ Delivery roller

Figure 4-30

8) Remove the one gear and two bearings from the delivery roller shaft, and remove the delivery roller from the delivery unit.

④ Top cover (face-down tray)
1) Remove the face-up tray.
2) Remove the heat cover. (2)
3) Remove the preconditioning exposure cover. (1)
4) Remove the shutter unit. (3)
5) Remove the cartridge guide with the pre-conditioning exposure unit. (7)
6) Remove the reflection mirror.
7) Remove the arms.
8) Remove the parts on stays A and B from the top cover. (6)
9) Remove the parts (2) to (7) shown in the figure below from the top cover.



① Top cover
② Static charge eliminating needles array
③ Left mirror spring
④ Right mirror spring
⑤ Switch lever
⑥ Left lock shaft
⑦ Right lock shaft

Figure 4-31

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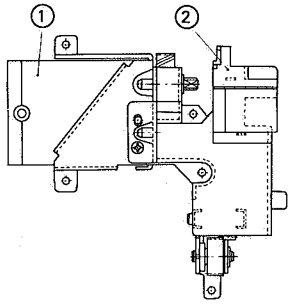
II. DRIVE SYSTEM

1. Main Motor Assembly

(1) Configuration

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

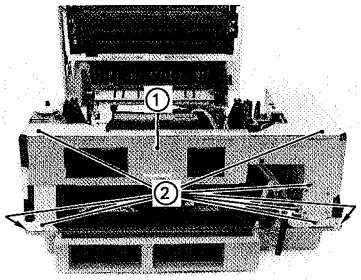


① Main motor ② Gear cover

Figure 4-32

(2) Removing the main motor assembly from the lower unit

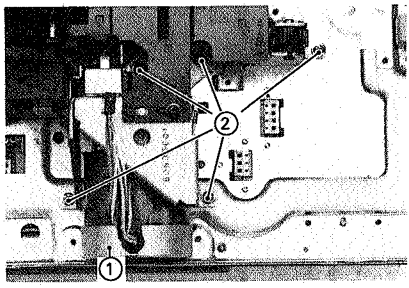
1) Raise the upper unit.
2) Remove the top cover.
3) Remove the fixing assembly.
4) Remove the AC power supply.
5) Remove the front reinforcement. (8)



① Front reinforcement ② Screws

Figure 4-33

6) Remove the sensor/power supply assembly. (See page 4-21).
7) Remove the main motor. (5)



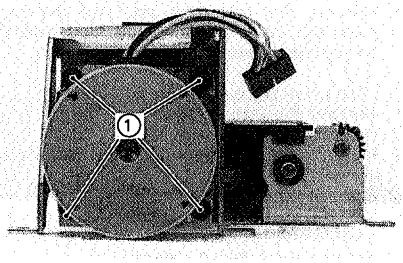
① Main motor ② Screws

Figure 4-34

(3) Disassembly and reassembly

① Main motor

1) Remove the four (4) screws. Then separate the main motor from its mount.



① Screw

Figure 4-35

Note:
Be carefull not to damage the Hasuba gear when removing the main motor.

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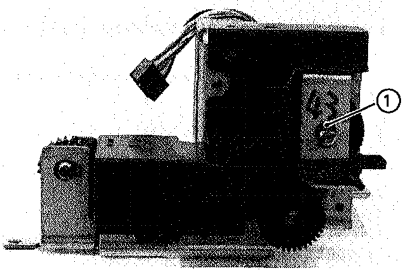
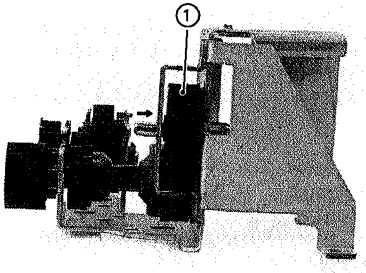
② Hasuba idler gear
1) Remove the C-ring.



① C-ring

Figure 4-36

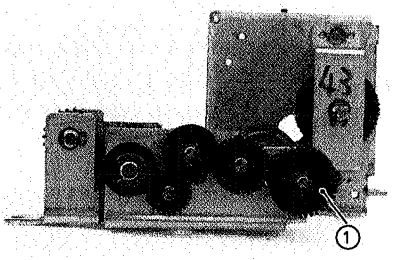
2) Remove the gear cover. (1)
3) Remove the main motor. (4)
4) Push the shaft (in the direction of the arrow shown below) out of the motor mount and remove the Hasuba idler gear.



① Hasuba idler gear

Figure 4-37

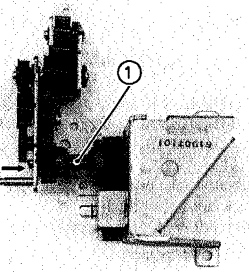
③ Hasuba and Hiraba gear
1) Remove the gear cover. (1)
2) Remove the main motor. (4)
3) Remove the C-ring and gear.



① Gear

Figure 4-38

4) Remove the C-ring.
5) Push the shaft (in the arrow direction shown below) out of the motor base and remove the Hasuba and Hiraba gear.



① Hasuba and Hiraba gear

Figure 4-39

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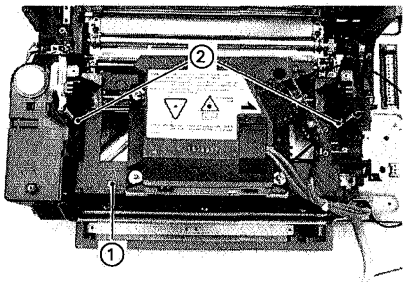
III. PAPER DELIVERY SYSTEM

1. Pick-Up Roller Assembly

(1) Removing the pick-up roller assembly from the lower unit
1) Raise the upper unit.
2) Remove the top cover.
3) Remove the front reinforcement.
4) Remove the sensor/power supply assembly. (See page 4-21).
5) Remove the two screws that secure the bearing of the pick-up roller shaft in the main block.

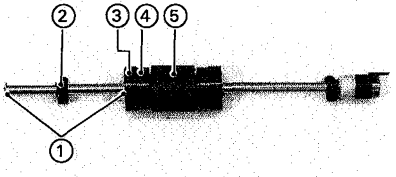


① Main block ② Screws

Figure 4-40

6) Separate the pick-up roller assembly from the main block. Be careful not to damage any part in the main block.

(2) Disassembly and reassembly
① Pick-up roller
1) Remove the two washers from the pick-up roller shaft.



① Washers
② Bearing
③ Auxiliary roller
④ Auxiliary cam
⑤ Pick-up roller

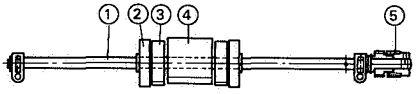
Figure 4-41

2) Remove the bearing, auxiliary roller, and auxiliary cam from the pick-up roller shaft.

> **Note:**
> Be careful not to lose the balance pin the auxiliary roller.

3) Remove the pick-up roller

> **Note:**
> When setting the pick-up roller, be careful to position the roller and auxiliary cam as shown below.

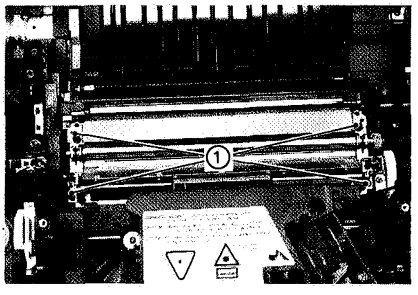


① Shaft
② Auxiliary roller
③ Auxiliary cam
④ Pick-up roller
⑤ Pick-up roller clutch

Figure 4-42

2. Transfer Guide Assembly

(1) Removing the transfer guide assembly from the lower unit
1) Raise the upper unit.
2) Remove the top cover.
3) Remove the front reinforcement.
4) Remove the driver/sensor assembly.
5) Remove the transfer guide assembly. (4)



① Screws

Figure 4-43

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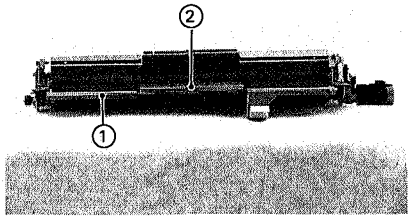
(2) Disassembly and reassembly

① Separation pad

1) Remove the two screws to separate the separation pad from the lower pick-up guide.

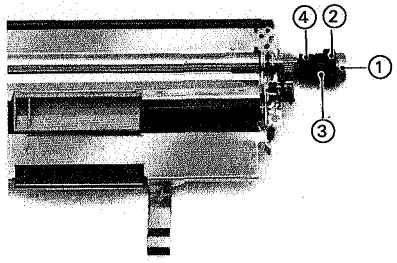


① Lower pick-up guide ② Separation pad

Figure 4-44

② Registration roller

1) Loosen the setscrew that secures the clutch drum to the registration roller.

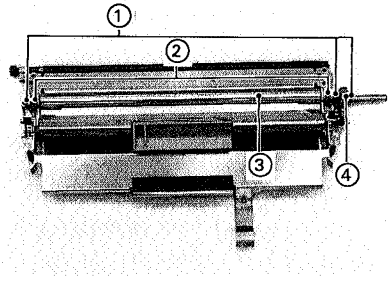


① Setscrew
② Clutch drum
③ Control ring
④ Gear

Figure 4-45

2) Remove the clutch drum, control ring, and gear together from the registration roller shaft.

3) Remove the three washers from the registration roller shaft.



① Washer
② Bearing
③ Registration roller
④ Registration roller gear

Figure 4-46

4) Remove the gear from the registration roller shaft.

Note:
Be careful not to lose the balance pin when removing the gear.

5) Remove the two bearings and registration roller.

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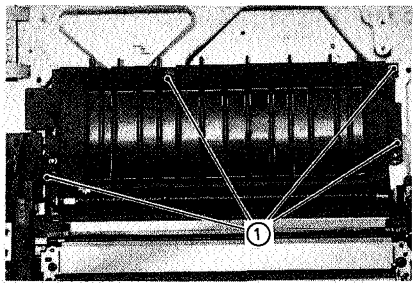
3. Feed Guide Assembly

(1) Removing the feed guide assembly from the lower unit
1) Raise the upper unit.
2) Remove the top cover.
3) Remove the fixing assembly.
4) Remove the AC power supply.
5) Remove the front reinforcement.
6) Remove the driver/sensor assembly.
7) Remove the main motor assembly.
8) Remove the four screws from the feed guide assembly.



① Screws

Figure 4-47

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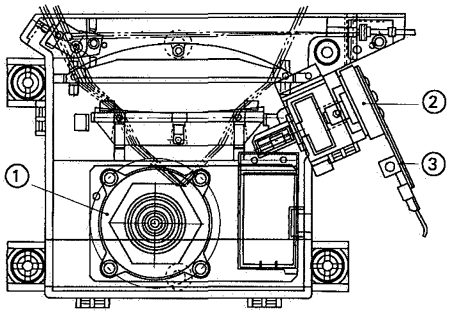
IV. EXPOSURE SYSTEM

1. Laser and Scanner Assembly

(1) Configuration

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

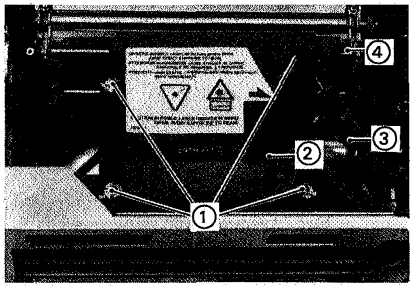


① Scanning motor assembly
② Semiconductor laser assembly
③ Laser PCB

Figure 4-48

(2) Removing the laser and scanner assembly from the lower unit

1) Raise the lower unit.
2) Remove the top cover.
3) Disconnect the connector (J202) from the laser PCB.



① Screw
② Scanning motor cap
③ Connector (J202)
④ Optical fiber

Figure 4-49

4) Open the scanning motor cap and disconnect the connector (J203).
5) Remove the four screws to separate the laser and scanner assembly from the main block.
6) Pull the optical fiber carefully from the laser and scanner assembly.

Note:
Do not disassemble the laser and scanner assembly, for it is not field adjustable.

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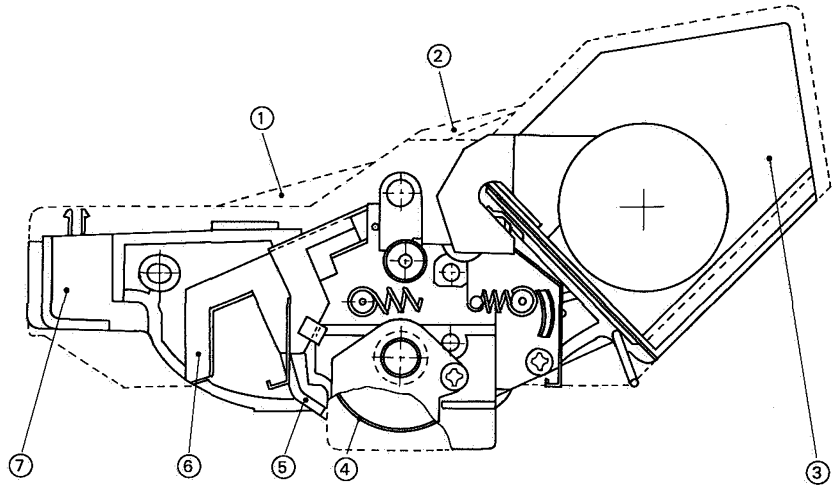
V. ELECTROSTATIC IMAGE/DEVELOPING/CLEANING SYSTEM

1. EP-S Cartridge

(1) Configuration

The EP-S cartridge includes a photosensitive drum, primary corona assembly, developing unit, and drum cleaning unit. During printing the drum rotates and an electrostatic invisible 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 design of the EP-S cartridge is such that it 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
⑦ Cleaner unit

Figure 4-50

① 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 units is lowered.)

② Light-blocking shutters

The photosensitive drum is also protected by the light-blocking shutters. These shutters prevents light coming from the exposure path located above the drum when the EP-S cartridge is removed from the printer.

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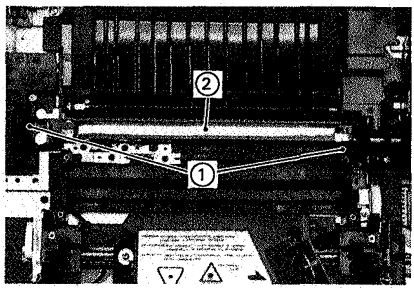
(2) Cleaning the photosensitive drum
1) Raise the upper unit and remove the EP-S cartridge.
2) Turn the cartridge upside down and open the protective shield. Do this work in dimy light, if possible.
3) Liberally sprinkle toner on a piece of flannel or other soft cloth and clean the drum surface with it.

Notes:
1. Be sure to turn the drum in the same direction as it turns in 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.

2. Transfer Corona Assembly

(1) Removing the transfer corona assembly from the lower unit
1) Raise the upper unit.
2) Remove the top cover.
3) Remove the front reinforcement.
4) Remove the driver and sensor assembly.
5) Remove the transfer guide assembly.
6) Remove the high-voltage block.
7) Remove the two screws from the transfer corona assembly.



① Screws ② Transfer corona assembly

Figure 4-51

(2) Stringing the corona wire
1) Remove the right and left covers from the corona assembly.
2) Cut off about 30cm of corona wire. Form the corona wire as shown in Figure 4-59.

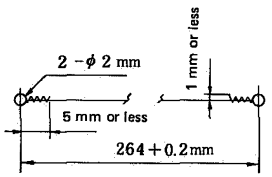


Figure 4-52

Form a 2-mm loop at each end by wrapping it around a small Allen wrench and then twisting it four or five times.
3) Hook one of the loops over the right stud and put the wire through the V-groove in the stud.
4) Hook one end of the spring on the other loop and then the other end of the spring on the spring hanger.

Figure 4-53

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 guide wire
1) Prepare about 85cm grid wire.
2) Wind one end of the guide wire around screw A in the transfer corona assembly. (See Figure 4-54.)
3) Wind the wire tightly around the corona assembly as shown in Figure 4-54. wind the other end of the wire around screw B.

Caution:
Be careful that the grid wire does not touch the discharging needle. The wire may be damaged.

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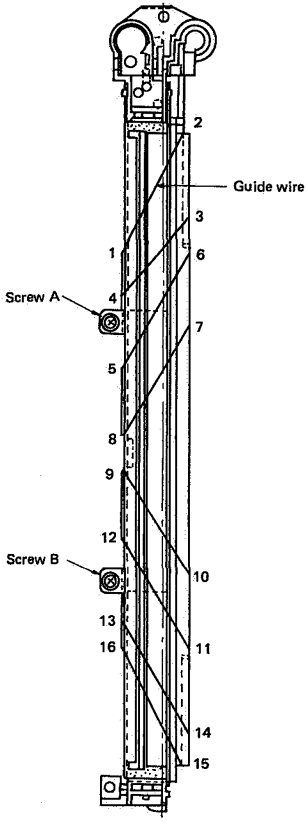

Figure 4-54

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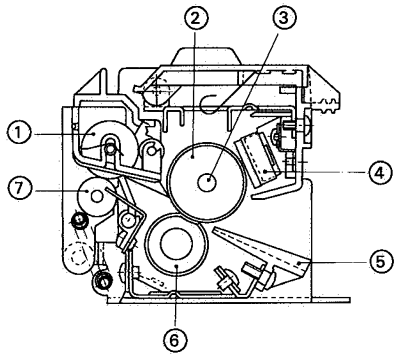
VI. FIXING SYSTEM

1. Fixing Assembly

(1) Configuration

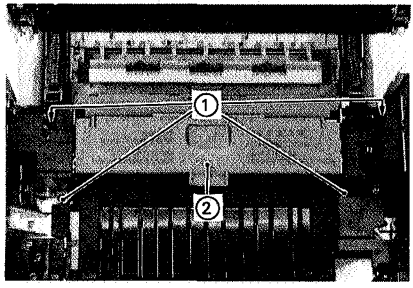
The fixing assembly fixes the toner image onto the paper. It is configured as shown below.



① Auxiliary roller
② Upper fixing roller
③ Fixing roller heater
④ Thermo-switch
⑤ Delivery guide
⑥ Lower fixing roller
⑦ Delivery roller

Figure 4-55

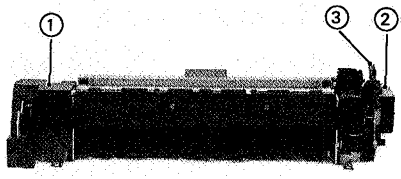
(2) Removing the fixing assembly from the lower unit
1) Raise the upper unit.
2) Remove the four screws to release the fixing assembly from the bottom plate.



① Screws
② Fixing assembly

Figure 4-56

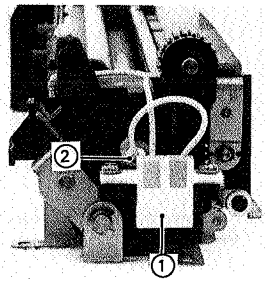
(3) Disassembly and reassembly
① Fixing roller heater
1) Remove the cover and cleaner.
2) Remove the washer, spring and lever.



① Left contact cap
② Right contact cap
③ Lever

Figure 4-57

3) Remove the right contact cap.
4) Disconnect the terminal of the lead (connected to the fixing roller heater) from connector J103.



① Connector J103
② Fixing roller heater

Figure 4-58

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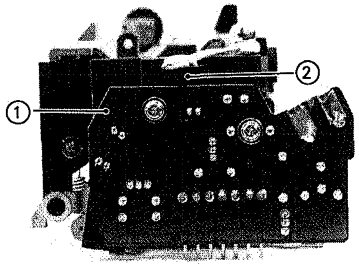
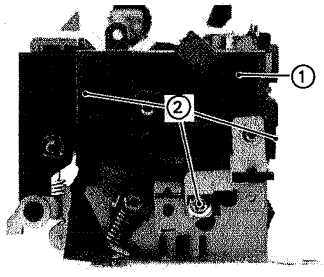
5) Remove the left contact cap.
6) Disconnect connector J332 from the fixing PCB.



① Fixing PCB ② Connector J332

Figure 4-59

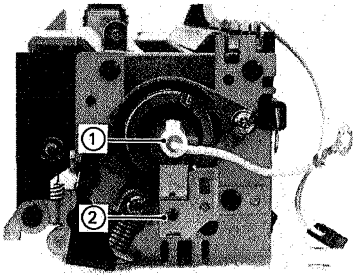
7) Remove the two screws and the fixing PCB.
8) Remove the left terminal mount. (3)



① Left terminal mount ② Screws

Figure 4-60

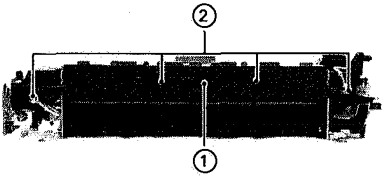
9) Remove the screw and separate the left heater support, and pull the fixing roller heater carefully from the upper roller.



① Fixing roller heater ② Left heater support

Figure 4-61

② Thermo-switch and thermistor
1) Remove the fixing assembly cover and cleaner.
2) Remove the left contact cap.
3) Remove the cam.
4) Remove the right contact cap.
5) Remove the four screws and the delivery guide.



① Delivery guide ② Screws

Figure 4-62

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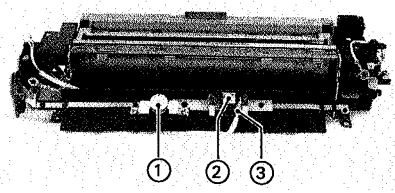
6) Remove the two screws from the thermo-switch, or remove the screw and disconnect connector J332 from the thermistor.



① Thermo-switch
② Thermistor
③ Connector J332

Figure 4-63

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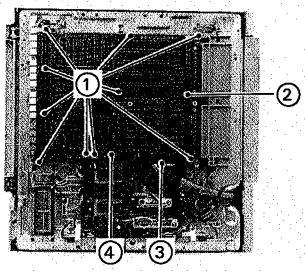
VII. ELECTRICAL COMPONENTS

1. Video Controller PCB

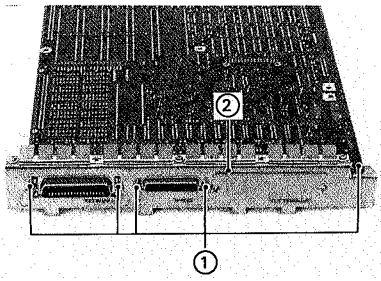
1) Remove the base cover.
2) Remove the ten screws from the video controller PCB



① Screws
② Video controller PCB
③ Connector J8
④ Connector J205

Figure 4-64

3) Pull the video controller PCB with both hands to remove it from connector J205.
4) Disconnect connector J8 from the video controller PCB.
5) Remove the five screws to separate the bracket from the video controller PCB.



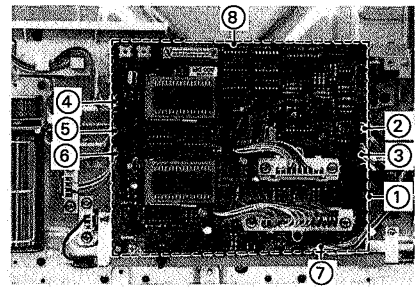
① Screws
② Bracket

Figure 4-65

Notes:
1. When attaching the bracket to the video controller PCB, be sure to attach the supplied accessory to the serial interface connector.
2. When mounting the video controller PCB in the lower unit, be sure to use washers with the screws that attach the 5V and grounding wire.

2. DC Controller PCB

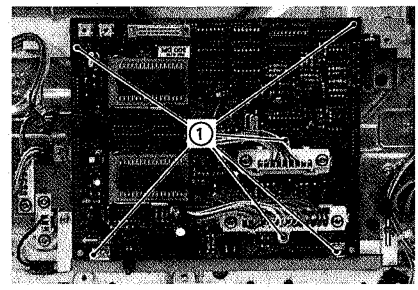
1) Remove the base cover.
2) Remove the video controller PCB.
3) Disconnect the connectors shown in the figure below from the DC controller PCB.



① J201
② J202
③ J203
④ J206
⑤ J207
⑥ J208
⑦ J211
⑧ DC controller PCB

Figure 4-66

4) Remove the six screws from the DC controller PCB.



① Screws

Figure 4-67

5) Pull the DC controller PCB with both hands to remove it from the connectors, J212 and J213.

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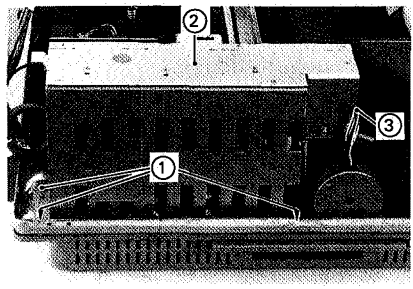
3. Driver and Sensor PCB and Low-Voltage Power Supply (Sensor/Power Supply Assembly)

1) Raise the upper unit.
2) Remove the top cover.
3) Remove the front reinforcement.
4) Remove the connector J501 and three screws.



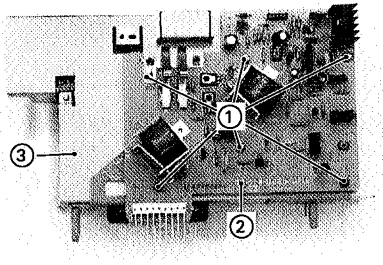
① Screws
② Sensor/power supply assembly
③ Connector J501

Figure 4-68

5) Lift the sensor/power supply assembly with both hands to remove it from the connector.

> **Note:**
> Before lifting the sensor/power supply assembly, check that there is no cassette in the holder.

6) Remove the assembly cover. (1)
7) Remove the six screws to separate the driver and sensor PCB from the low-voltage power supply.

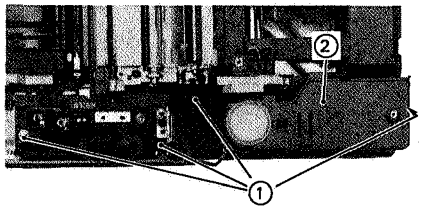


① Screws
② Driver and sensor PCB
③ Low-voltage power supply

Figure 4-69

4. High-Voltage Power Supply

1) Raise the upper unit.
2) Remove the top cover.
3) Remove the front reinforcement.
4) Remove the four screws from the high-voltage power supply.



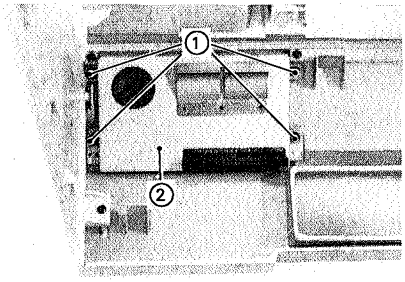
① Screws
② High-voltage power supply

Figure 4-70

5) Lift the high-voltage power supply with both hands to remove it from the connector.

5. Control Panel PCB

1) Raise the upper unit.
2) Remove the top cover.
3) Remove the four screws from the control panel assembly.



① Screws
② Back plate

Figure 4-71

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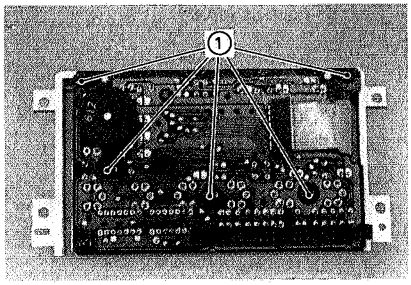
4) Release the two clicks on the control panel to separate it from the back plate.
5) Remove the five screws from the control panel PCB.



① Screws

Figure 4-72

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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 nameplate.
- The temperature between 10° to 32.5°C and the relative humidity should be between 20% to 80%. There should be no water faucet, humidifier, refrigerator, or air conditioner outlet near the printer.
- The printer should not be exposed to open flames, dust, ammonia fumes, or direct sunlight. 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 to operate the printer. See Figure 5-1.

Note:
If the printer (in its shipping carton) is moved from a cold storage space into a warm room, it may not print normally because of condensation. In such a case, leave it in its carton for an hour or more to warm up.

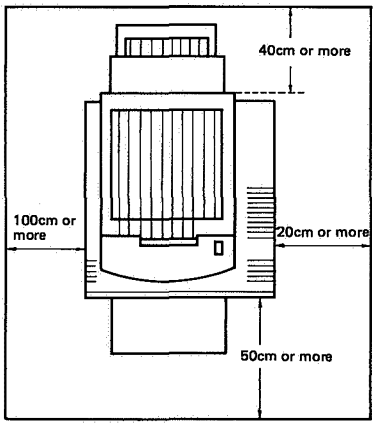

Figure 5-1

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II. UNPACKING AND INSTALLATION

No.	Step	Check	Remarks
1	Open the cardboard box.		See Figure 5-2.
2	Remove the parts and literature from the depressions in the foam packing.	Check that the following are present: • EP-S cassette • Power cord • Manuals	
3	Lift off the foam packing and remove the printer in its sealed bag.		
4	Remove the plastic bag from around the printer. Remove the tape securing components.	Check for damage to the exterior during transportation.	
5	Draw out packing B from the cassette slot.		See Figure 5-3.

Table 5-1

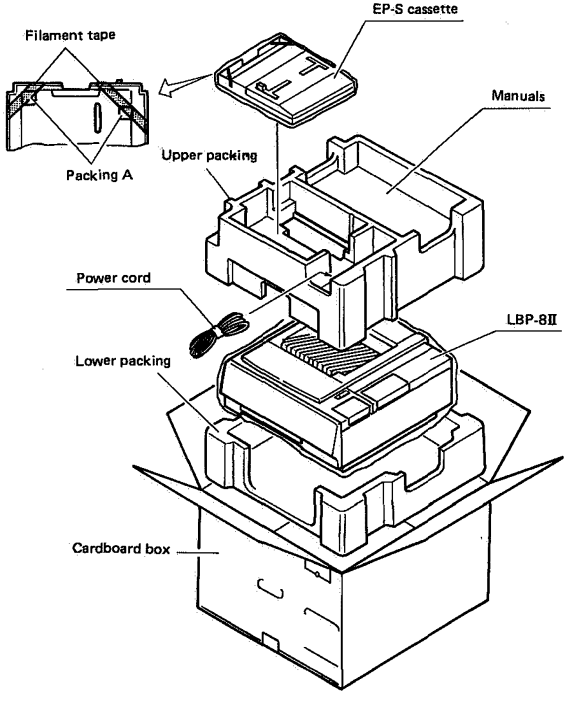

Figure 5-2

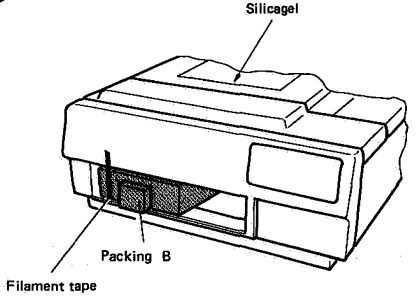

Figure 5-3

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No.	Step	Check	Remarks
6	Raise the upper unit and remove packing C.		See Figure 5-4.
7	Remove the spacer from the upper main body, and remove the label from the top cover.		See Figure 5-5.
8	Remove the tape and protective sheet from the fixing assembly.		See Figure 5-4.
9	Remove the two spacers from the fixing assembly.		See Figure 5-6.
10	Open the small box containing the cartridge and take out the cartridge. Remove the aluminum bag.		See Figure 5-7.

Table 5-1 (continued)

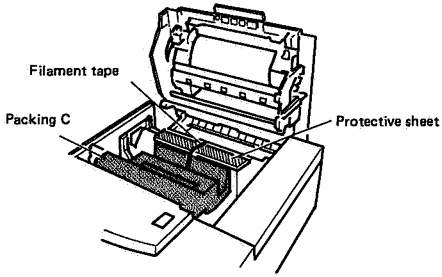
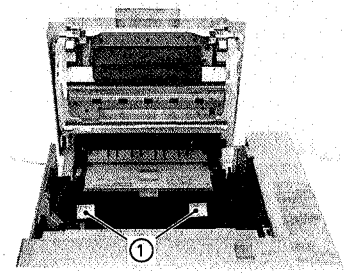


Figure 5-4



① Spacers

Figure 5-6

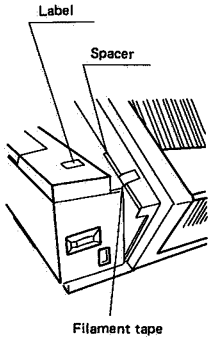


Figure 5-5

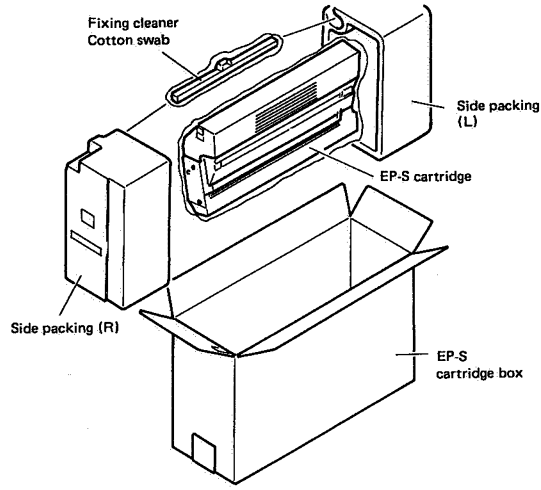


Figure 5-7

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No.	Step	Check	Remarks
11	Hold the cartridge horizontal with both hands and slowly rock it 45 degrees each way five times to distribute toner evenly.		See Figure 5-8.
12	Put the cartridge in the upper unit, then unseal the cartridge.		
13	Take the fixing roller cleaning unit out of the plastic bag. Clean the upper fixing roller with the felt at one end of the cleaner, remove the felt, and put the cleaner in the fixing assembly.		
14	Lower the upper unit.		
15	Remove packing A from the cassette, put paper in the cassette, put the cover on the cassette then put the cassette in the printer.		
16	Plug the power cord into the AC outlet and switch the printer ON. When the READY/WAIT lamp glows steadily, press the ON LINE switch to enter the OFF LINE state. Press the TEST/FONT switch to make a printing test.	• Check that the print density adjustment dial is set at the "5" position. • Check that the test print has the correct density.	
17	Keep the area around the printer clear for safe operation.		

Table 5-1 (continued)

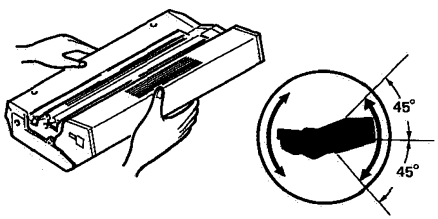

Figure 5-8

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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

When storing EP-S cartridges in a warehouse or workshop, the conditions shown in Table 5-2 should be met.

1) Avoid direct sunlight.
2) Do not store cartridges on a surface that is subject to vibration.
3) Do not hit 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 validity date information shown on the EP-S cartridge packing, the cartridge validity from the date of manufacture.

Table 5-2 Storage conditions

B. Storage of Unsealed EP-S Cartridges

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

(1) Storage requirements

1) Avoid a place exposed to direct sunlight or near a window. Do not leave an EP-S cartridge in a car in warm or hot weather even if it is in the storage box.
2) Avoid places with too-high or too-low temperature and/or humidity. Also avoid places exposed to sudden temperature or humidity changes (such as near an air conditioner outlet).
3) Avoid dusty places or places exposed to ammonia fumes or other harmful fumes.
4) Do not store an EP-S cartridge above 40°C.

(2) Life of the EP-S cartridges

The design useful service life of an EP-S cartridge is 2.5 years from the data 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 cartridge 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 five times in each direction to distribute toner evenly, as shown in Figure 5-8, 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 test patterns to check for toner leakage. Even if toner leakage did occur, clean prints will be produced after the print test.

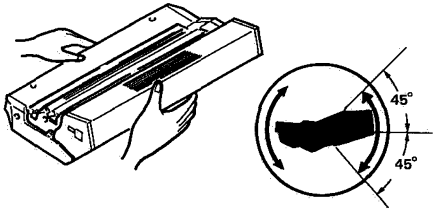

Figure 5-9

A test pattern is printed by pressing the TEST/FONT key when the READY/WAIT lamp is glowing steadily and the ON LINE lamp is OFF. Pressing the TEST/FONT key continuously for 5 seconds or more will cause continuous test printing. Continuous test printing is stopped by pressing the TEST/FONT or ON LINE Key. The print test should not be made when the ON LINE lamp is ON. If the ON LINE lamp is ON, press the ON LINE key and then do the test printing.

2) If blank spots occur on prints because of lack of toner, rock the EP-S cartridge as explained above to distribute toner evenly.
3) Do not invert nor stand an EP-S cartridge, on end. Always handle it gently.

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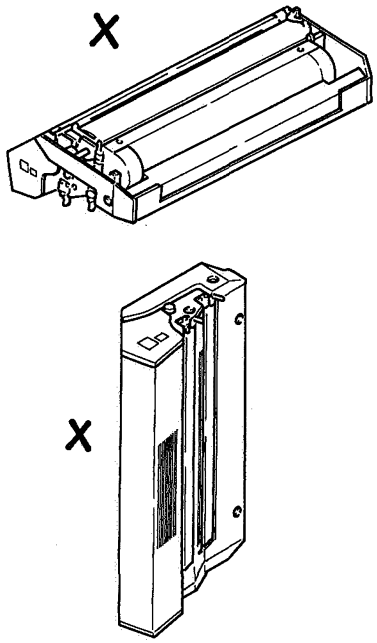

Figure 5-10

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 flannel 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. It is not designed for disassembly.
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 is strong light. Despite this, however, if the EP-S cartridge is exposed to strong light for a long period, blank spots or black streaks may appear on prints. 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 minimuize exposing the drum to light.
2. When storing the 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, measured a few meters from a window on an average day, is about 1,500 lux. Do not expose the photosensitive drum to light of this intensity for more than 5 minutes; if the drum is placed under these conditions accidentally, the EP-S cartridge should be stored in a dark place to "recuperate", although an image may be retained on the drum for some time. Direct sunlight is 10,000 to 30,000 lux. A drum exposed to direct sunlight may be ruined.

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I. PARTS REPLACEMENT SCHEDULE

The parts listed below must be replaced at regular intervals, even though they may be functioning properly and show no signs of wear. (Failure of these parts would seriously affect system performance.)
These parts should be replaced during the regular service visit closest to the end of the service life of the part.

As of June 1987

No.	Description		Part no.	Q'ty	Service life (number of prints)	Remarks
1	Fixing assembly		RG1-0939-000	1	100,000	110V/115V line voltage
	Fixing assembly		RG1-0940-000	1	100,000	220V/240V line voltage
2	Pick-up rollers	Pick-up roller unit	RA1-3851-000	1	100,000	
3	Separation pad	Transfer guide unit	RF1-1145-000	1	100,000	
4	Transfer corona assembly		RG1-0933-000	1	100,000	
5	Ozone filter		RA1-4081-000	1	100,000	

Table 6-1

II. CONSUMABLE SUPPLIES

None

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III. LISTS OF TOOLS

A. Standard Tool

The standard tool required for servicing the printer is listed below.

No.	Description	Tool no.	Remarks
1	Tool box	TKN-0001	
2	Lead cable	TKN-0069	
3	Feeler gauge	CK-0057	
4	Compression spring scale (0 – 600g)	CK-0058	For checking cassette spring strength
5	Phillips scerwdriver	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) screwdriver	CK-0170	M4
14	Diagonal cutting pliers	CK-0201	
15	Needle-nose pliers	CK-0202	
16	Pliers	CK-0203	
17	Retaining ring pliers, ext., 19 – 30mm	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		
24	Bottle, plastic	CK-0328	
25	Solder	CK-0329	
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 checker (TKN-0198) etc.
31	Soldering iron	CK-0309	

Table 6-2

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B. Special Tools

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

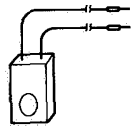
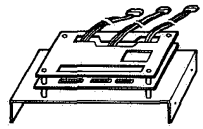
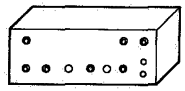
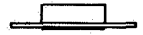
No.	Tool name	Tool No.	Shape	Code	Application/remarks
1	Laser power checker	TKN-0198		B	Used with printer driver and laser driver checker (RY9-0024) for checking or adjusting laser power.
2	8II/SX adapter	RY9-0019		B	An additional tool for the LBP-CX printer driver and laser driver checker to make that checker usable for the LBP-8II/SX as well.
3	Printer driver and laser driver checker	RY9-0024		B	Checks printer function and laser power. For checking laser power, use this tool with the laser power checker (TKN-0198).
4	Laser shorting connector	RY9-0025		B	Protects the laser chip of the printer from damage by static electricity.

Table 6-3

Note:

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.

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IV. LIST OF LUBRICANTS, CLEANERS

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
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	For bearings	ISO VG 68 oil, ESSO Febis K68, MOBIL Vactra oil no. 2, SHELL Tonna oil T68	• 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	Cassette pick-up roller clutch spring	• Tool no. CK-0524 (100cc) • Equivalent oil may be used.

Table 6-4

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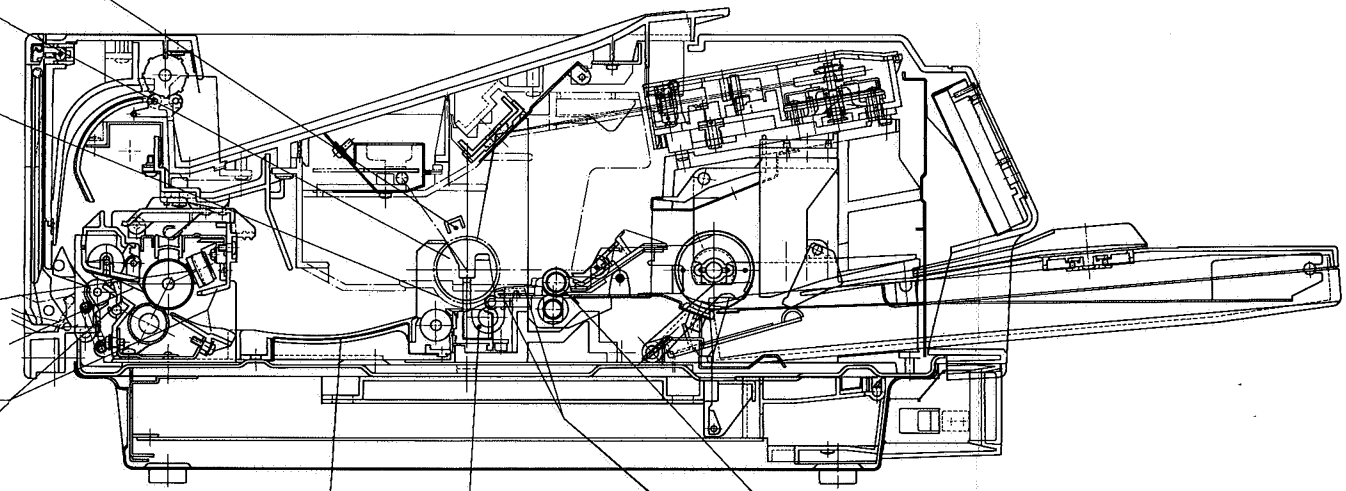
Cartridge

Point	Tool/solvent	Remarks
Primary corona wire	–	Clean with wire cleaner supplied with printer
Photo-sensitive drum	Toner	Unless absolutely required, drum should not be touched or cleaned. Never clean with anything but toner. Do not expose to light.
Protective shield for drum	Damp clutch	Image may be directied by falling toner so always clean this part.

Fixing assembly

Point	Tool/solvent	Remarks
Fixing roller cleaner felt	–	If dirty, prints will be dirty and there will be jams
Separation claws	MEK	Be careful. The tip of the claw is easily damaged
Paper guides	MEK	
Lower delivery guide	MEK	



Transfer area

Point	Tool/solvent	Remarks
Registration rollers	Damp cloth	
Transfer guides	Damp cloth	

Feeder unit

Point	Tool/solvent	Remarks
Feeder guide	Damp cloth	

Transfer corona ass'y

Point	Tool/solvent	Remarks
Transfer corona wire	Alcohol	Wipe with dry cloth, then clean with lint-free paper dampened with alcohol.

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VI. CUSTOMER MAINTENANCE

Customers should make the following maintenance to maximize printer performance:

Item	Customer maintenance
Fixing assembly cleaning felt	Replace the cleaning felt together with EP-S cartridge.
Fixing assembly	Clean the fixing assembly when the EP-S cartridge is replaced.
Transfer corona assembly	Clean the corona wire and transfer corona assembly when necessary.
Primary corona assembly	Clean the corona wire when necessary.
Transfer guide	Clean the transfer guide when necessary.
EP-S cartridge	Rock the EP-S cartridge or replace it when necessary.

Table 6-5

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I. INTRODUCTION

A. Initial Check

(1) Operating environment
Check if:
- 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. Relative humidity is kept between 20% to 80%.
- The printer is not exposed to ammonia gas or other harmful gases.
- The printer is not located in a hot or humid area (such as near a water tap or humidifier), in a cold place (such as the outlet of an air conditioner), 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 assemblies
Check if:
- The transfer corona assembly is clean. The corona wire is undamaged. (Replace them if they cannot be cleaned or are damaged.)
- The corona wire of the primary corona assembly is clean.
- The corona wire spring of the transfer corona assembly is not rusted. (If rusted, replace it.)

(3) Print paper
Check if:
- 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 if:
- The message "16 TONER LOW" appears on the status indicator when there is an EP-S cartridge in the printer. If the message appears, replace the cartridge with a new one. (If dropouts occur on prints, take out the EP-S cartridge and slowly rock it to distribute toner evenly. See Figure 5-8 in chapter 5.)

(5) Others
Check if:
- The transfer guide and feed guide are clean. (If they are dirty, clean them with damp cloth.)
- The fixing roller cleaner is clean. (If it is very dirty, replace the cleaner with a new one.)

Condensation:
During the winter, if the printer is taken from a cold room 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, the reflection mirror will cause the print image to be light.
- If the photosensitive drum is cold, the electrical resistance of the photosensitive layer will be high, making it impossible to obtain correct contrast in prints.
- Condensation on the corona assemblies will cause corona leakage.
- Condensation on the pick-up guide and feed guide plates will cause paper feed troubles.

If condensation occurs, wipe these assemblies or parts with dry cloth, or leave the printer power on 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, which may 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

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

(1) Check whether the status indicator on the control panel is on and off. If the indicator goes on and off, read the message displayed and go to Section V for troubleshooting.
(2) If an image defect occurs, determine the type of image defect and go to Section IV for troubleshooting.

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II. EXPLANATION FOR SPECIAL TOOLS

A. Printer Driver/Laser Driver Checker

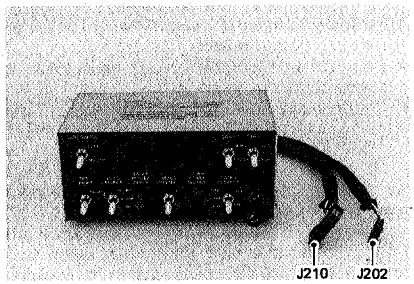

Figure 7-1

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

The checker has the following functions:

1) Lets the printer print horizontal or vertical lines, or a white image (printer driver checker). If the print is not normal, determine whether the trouble is caused by the printer or system interface.
2) Forces the semiconductor laser in the printer to operate (laser driver checker). 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 checker). Disconnect the semiconductor laser from the DC controller PCB and connect the LED of the checker instead. This simulation allows determining whether the problem is due to the semiconductor laser or the DC controller PCB.

■ Control panel of the checker

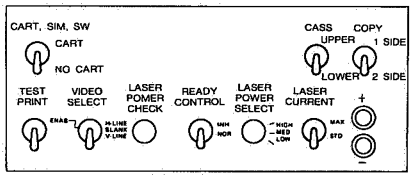

Figure 7-2 Control panel of the checker

TEST PRINT
Lets the printer 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
Forces the laser to operate at the HIGH setting of LASER POWER SELECT.

READY CONTROL
INH forces the printer ready regardless of whether a paper cassette is present. NOR does not.

LASER POWER SELECT
Specifies the light level of LEDs in the checker to HIGH, MED, or LOW.

LASER CURRENT
Monitors the light level of LEDs in the checker with photo diodes. STD setting of the switch feeds back the LED Light level monitor signal to LED drive circuit but at MAX setting this signal will not be fed back.

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

CART. SIM. SW
Without the use of actual EP-S cartridge, simulates the presence or no presence of the cartridge.
CART; setting cartridge "in use" switch position
NO CART; setting cartridge "not in use" switch position.

CASS.
Designate the cassette used in printing.
UPPER .... Upper cassette.
LOWER ... Lower cassette.
(Using this switch does not affect any function for the LBP-8II)

COPY
Designate either single-side copy or double-side copy
1 SIDE .... Single-side copy
2 SIDE .... Double-side copy
(Using this switch does not affect any function for the LBP-8II)

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B. 8II/SX Adapter

The above adapter is an additional tool to the printer driver and laser driver checker (RY9-0002) for the LBP-CX already in use. The new tool enables the use of LBP-LX checker on the LBP-8II/SX as well by modifying the checker.

The external view of the adapter is shown below.

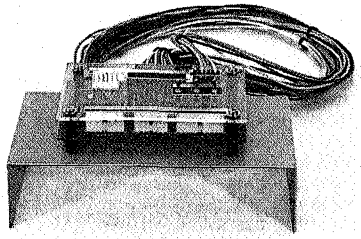

Figure 7-3

- Procedure for modifying the LBP CX printer driver/laser driver checker.
  1) Remove the top cover from the checker.
  2) Secure the 8II/SX adapter to the position where there was a top cover.
  3) Connect three cables with connectors (J204, J205, and J209) to the connectors with the same numbers on the 8II/SX adapter.

The aforementioned modification makes possible substitution of check for the LBP-CX as a checker for the LBP-8II/SX.

C. Laser Power Checker

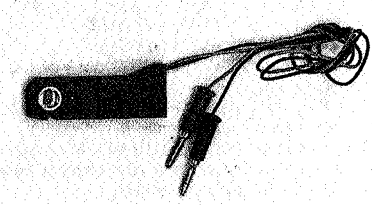

Figure 7-4

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

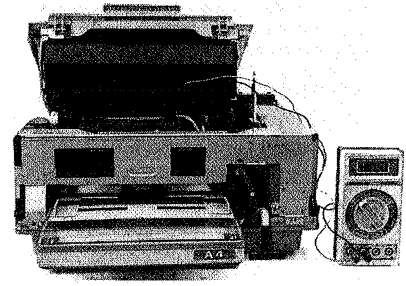

Figure 7-5

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III. MEASUREMENT AND ADJUSTMENT

A. Image Adjustment

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

1) Enter normal and offline modes.
2) Turn the DATA lamp on the control panel off.
3) Continue to press the TEST/FONT switch for one second and release it.
   The message "05 TEST PRINT A" appears on the status indicator of the control panel and the DATA lamp goes ON.
   A test print is produced.

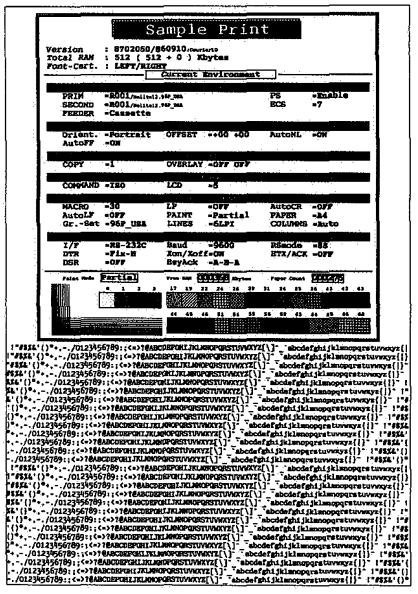

Figure 7-6

4) Determine the type of the image trouble and go to Section IV.

B. Mechanical Adjustment

(1) Checking the nip width of the fixing rollers

The fixing assembly is not designed to allow adjustment of the nip width. If the nip width is not correct, a fixing problem may occur. Follow the procedure below to check the nip width.

1) Take to customer site, black print made with a copier or make an A4/Letter-size, black print using a copier at the customer site.
2) Sets the black print on the manual feed tray.
3) Open the face-up tray.
4) Press the test print switch at the right side of the base cover.
5) When one end of the print comes out to the face-up tray, turn the printer off and wait for 10 seconds.
6) Turn the printer on again and feed the paper out.
7) Measure the width of the glossy band across the print and check that it meets the requirements shown in Table 7-1.

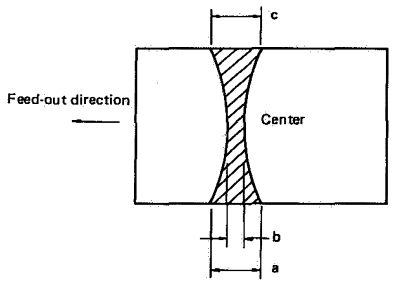

Figure 7-7

	Measurement
b	2 to 3.5 (mm)
| a – c |	0.5mm or less
| a – b |	0.5mm or less
| b – c |	0.5mm or less

Table 7-1

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C. Electrical Adjustment

On this machine, there are no VRs which require adjustment in the field. However, laser power is used and it is invisible. When laser power could be the cause for malfunctions, "Laser power malfunction diagnosis flowchart" on the next page should be referred to find out whether there was a failure in laser/scanner area or in the DC controller PCB.

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

1) Notes when laser power is adjusted.

- To avoid accidents, be sure to plug the black lead into the black socket and the red lead into the red socket, and set the meter as instructed.
- Be sure to switch the printer OFF before disconnecting a connector.
- The voltage should be measured three times and the average should be used.

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■ Flowchart for adjusting laser power

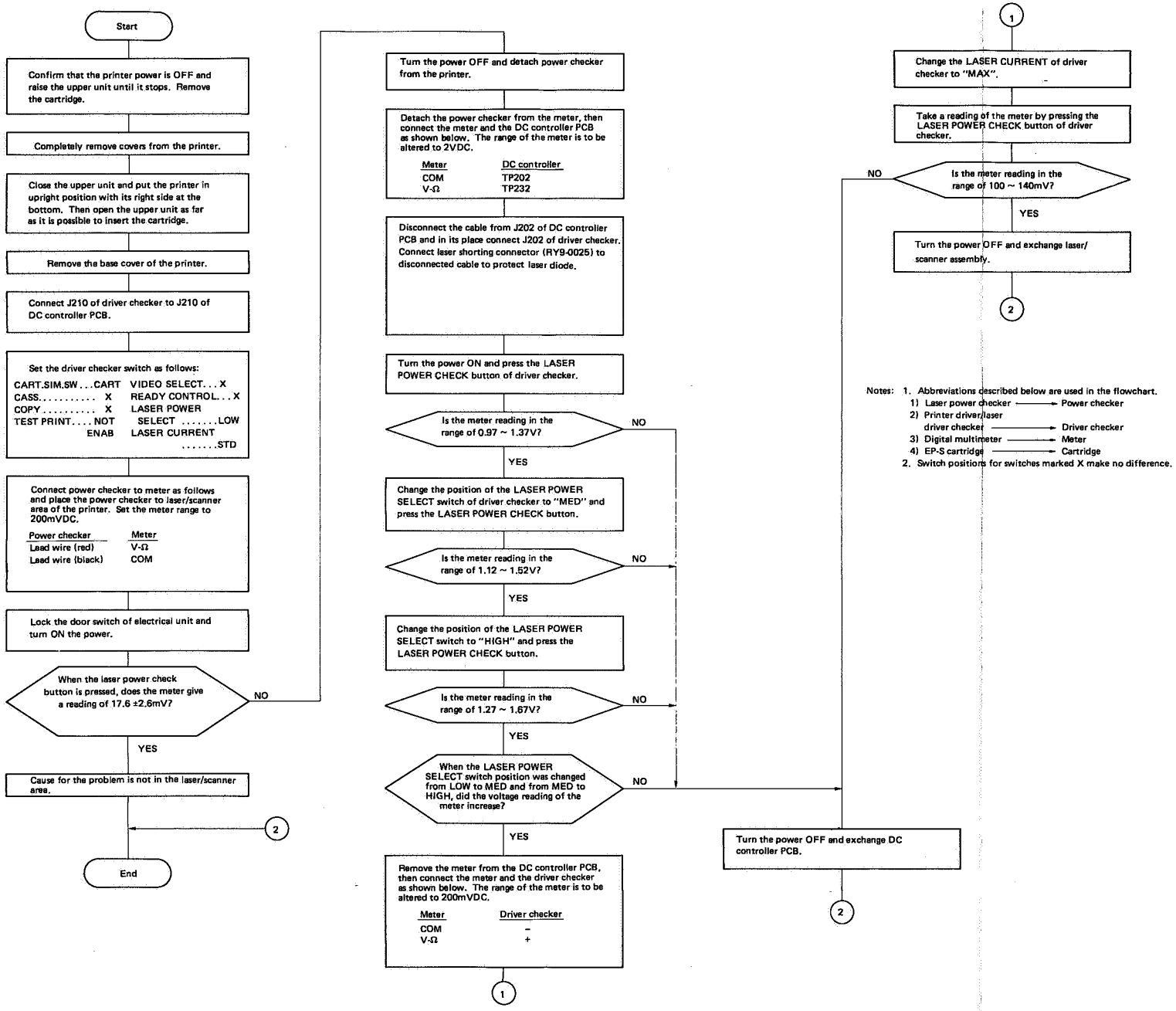

Figure 7-8

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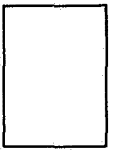
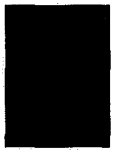
IV. IMAGE DEFECTS

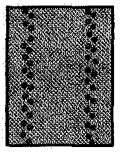
A. Example of Image Defects

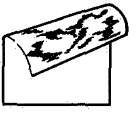
I-1 Light

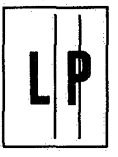
I-2 Dark


I-3 Completely blank


I-4 All black


I-5 Polka dots


I-6 Dirt on back of paper



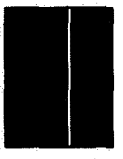
I-7 Black vertical streaks

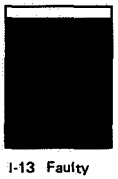
I-8 Black and thin horizontal streaks

I-9 Black and blurred vertical stripes

I-10 Black and blurred horizontal stripes


I-11 Droupouts


I-12 White vertical streaks


I-13 Faulty registration

I-14 Poor fixing

I-15 Distortion

Figure 7-9

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B. How to Use the Troubleshooting Tables

The troubleshooting tables in Sections IV to VI give information about troubleshooting when image problems, malfunctions, and paper delivery problems occur.

The example of troubleshooting when no power is supplied to the printer is used as to explain use of these troubleshooting tables.

Example: No power in the printer

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.
Power switch, circuit breaker	3	Are the power switch and circuit breaker on?	NO	Turn them on.
Line voltage	4	Is normal line voltage being supplied to the printer?	NO	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 7-2

The above table shows that the cause of the problem "No power in the printer" could be the power cord, upper unit, power switch, 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 as 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.

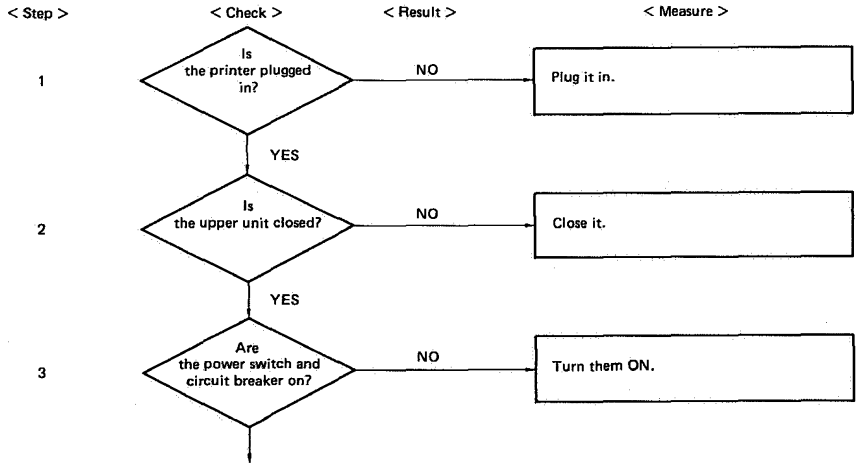

Figure 7-10

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C. Troubleshooting Image Defects

I-1. Light

Possible cause	Step	Check	Result	Measure
	1	Raise the upper unit during printing operation. Is the toner image on the drum being transferred to the paper? (To protect the drum from light, perform this step as quickly as possible.)	YES	If the toner image is very faint, go to step 6.
Transfer corona assembly	2	Is the corona wire broken?	YES	Replace the corona wire. (See Page 4-15.)
Print paper	3	Does print quality improve when fresh print paper is used?	YES	Replace the print paper. Instruct the customer how to store print paper.
High-voltage power supply	4	Does the voltage between J601 pin 1 ($\overline{\text{HVTON}}$) and J601 pin 7 (GND) drop from +20VDC to 0V one second after the main motor starts?	YES	Check the contact between the high-voltage power supply and the transfer corona assembly. If it is good, replace the high-voltage power supply.
DC controller PCB	5	Does the voltage between J211 pin 1 ($\overline{\text{HVTON}}$) and J211 pin 7 (GND) drop from +20VDC to 0V one second after the main motor starts?	NO	Check whether connector J211 is making good contact. If so, replace the DC controller PCB.
Developing bias	6	Does the voltage between J601 pin 6 ($\overline{\text{DBDC}}$) and J601 pin 7 (GND) drop from +16VDC to 0V one second after the main motor starts? Does the voltage between J601 pin 4 ($\overline{\text{DBAC}}$) and J601 pin 7 (GND) drop from +16VDC to 0V three seconds after the main motor starts?	NO	Check whether connector J601 is making good contact with developing bias. If so, replace the high-voltage power supply.
DC controller PCB	7	Does the voltage between J211 pin 6 ($\overline{\text{DBDC}}$) and J211 pin 7 (GND) drop from +16VDC to 0V one second after the main motor starts? Does the voltage between J211 pin 4 ($\overline{\text{DBAC}}$) and J211 pin 7 (GND) drop from +16VDC to 0V three seconds after the main motor starts?	NO	Check whether connector J211 is making good contact. If so, replace the DC controller PCB.

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Possible cause	Step	Check	Result	Measure
Drum sensitivity identification switches	8	Does the voltage between J213 pin 1 ($\overline{\text{CSENS1}}$) and J213 pin 6 (GND) drop from +5VDC to 0V after drum sensitivity identification switch SW301 has been pressed? Does the voltage between J213 pin 2 ($\overline{\text{CSENS2}}$) and J213 pin 6 (GND) drop from +5VDC to 0V after drum sensitivity identification switch SW302 has been pressed?	NO	Replace the faulty switch (SW301 or SW302).
Laser and scanner assembly DC controller PCB	9	Is TP232 output voltage normal? (Use the flowchart for laser power adjustment to measure TP232 voltage.)	YES	Replace the laser and scanner assembly.
			NO	Replace the DC controller PCB.

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I-2. Dark

Possible cause	Step	Check	Result	Measure
Drum sensitivity identification switches	1	Does the voltage between J213 pin 1 ($\overline{\text{CSENS1}}$) and J213 pin 6 (GND) drop from +5VDC to 0V after drum sensitivity identification switch SW301 has been pressed? Does the voltage between J213 pin 2 ($\overline{\text{CSENS2}}$) and J213 pin 6 (GND) drop from +5VDC to 0V after drum sensitivity identification switch SW302 has been pressed?	NO	Replace the faulty switch (SW301 or SW302).
Grounding spring	2	Clean the contact between the grounding spring and the EP-S cartridge, then make a test print. Does print quality improve?	YES	Make sure that the ground spring has good contact with the EP-S cartridge.
Laser and scanner assembly DC controller PCB	3	Is TP232 output voltage normal? (Use the flowchart for laser power adjustment to measure TP232 voltage.)	YES	Replace the laser and scanner assembly.
			NO	Replace the DC controller PCB.

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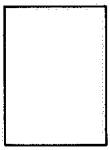
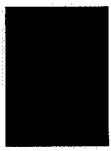
I-3. Completely blank



Possible cause	Step	Check	Result	Measure
EP-S cartridge	1	Is the EP-S cartridge unsealed?	NO	Unseal it.
	2	Can the protective shield be opened or closed smoothly?	NO	Repair the cartridge. If impossible, replace it.
	3	Is a laser beam-blocking shutter damaged?	YES	Replace the EP-S cartridge.
Developing bias	4	Does the voltage between J601 pin 6 ($\overline{\text{DBDC}}$) and J601 pin 7 (GND) drop from +16VDC to 0V one second after the main motor starts? Does the voltage between J601 pin 4 ($\overline{\text{DBAC}}$) and J601 pin 7 (GND) drop from +16VDC to 0V three seconds after the main motor starts?	NO	Check whether connector J601 has good contact with developing bias. If so, replace the high-voltage power supply.
DC controller PCB	5	Does the voltage between J211 pin 6 ($\overline{\text{DBDC}}$) and J211 pin 7 (GND) drop from +16VDC to 0V one second after the main motor starts? Does the voltage between J211 pin 4 ($\overline{\text{DBAC}}$) and J211 pin 7 (GND) drop from +16VDC to 0V three seconds after the main motor starts?	NO	Check whether connector J211 is making good contact. If so, replace the DC controller PCB.
Laser and scanner assembly	6	Is TP232 output voltage normal? (Use the flowchart for laser power adjustment to measure TP232 voltage.)	YES	Replace the laser and scanner assembly.
DC controller PCB			NO	Replace the DC controller PCB.

I-4. All black



Possible cause	Step	Check	Result	Measure
Primary corona assembly	1	Is the corona wire broken?	YES	Replace the EP-S cartridge.
High-voltage power supply	2	Does the voltage between J601 pin 3 (HV1ON) and J601 pin 7 (GND) drop from +16VDC to 0V one second after the main motor starts?	YES	Check whether connector J601 is making good contact with the primary corona assembly. 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.

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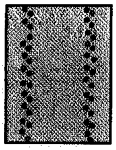
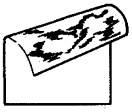
I-5. Polka dots



Possible cause	Step	Check	Result	Measure
Static-charge eliminator bias High-voltage power supply	1	Clean the contact between terminal TB605 and the static-charge eliminator, then make a test print. Is the print normal?	YES	Make sure that the static-charge eliminator has good contact with terminal TB605.
			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	2	Is the transfer guide dirty?	YES	Clean it with a damp cloth, then wipe it with a dry cloth.
Transfer corona assembly	3	Is the transfer corona assembly dirty?	YES	Clean it with a damp cloth, then wipe it with a dry cloth.
Feed guide Fixing roller cleaning pad	4	Is the feed guide dirty?	YES	Clean it with a damp cloth, then wipe it with dry cloth.
			NO	Replace the cleaning pad.

I-7. Vertical black streaks

Possible cause	Step	Check	Result	Measure
Primary corona assembly	1	Clean the primary corona assembly and make a test print. Is the print normal?	YES	Clean the primary corona assembly.
Photosensitive drum Fixing roller cleaning pad	2	Raise the upper unit during printing operation, then the protective shield on the EP-S cartridge. Are vertical streaks seen on the drum?	YES	Replace the EP-S cartridge.
			NO	Replace the fixing roller cleaner felt.

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I-8. Black and thin horizontal streaks

Possible cause	Step	Check	Result	Measure
Abnormal horizontal sync signal (BD)	1	Does the status indicator display "41" "51", or "52"?	YES	Replace the laser and scanner assembly.
DC controller PCB			NO	Replace the DC controller PCB.

I-9. Blurred black vertical stripes

Possible cause	Step	Check	Result	Measure
Primary corona assembly	1	Clean the corona wire and make a test print. Is the print normal?	YES	Clean the primary corona assembly.
Photosensitive drum			NO	Replace the EP-S cartridge.

I-10. Blurred black horizontal stripes

Possible cause	Step	Check	Result	Measure
Photosensitive drum	1	Do black stripes appear at regular intervals?	YES	Replace the EP-S cartridge.
Fixing roller cleaning pad			NO	Replace the fixing roller cleaning pad.

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I-11. Blank spots

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

I-12. Vertical white streaks

Possible cause	Step	Check	Result	Measure
Lack of toner	1	Do vertical white streaks go through on paper?	YES	Take out the EP-S cartridge and rock it as shown in Section III of Chapter 5 to distribute toner evenly.
Reflection mirror	2	Is the reflection mirror dirty?	YES	Clean the reflection mirror.
Transfer corona assembly			NO	Clean the transfer corona assembly.

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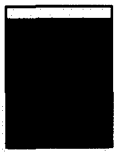
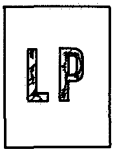
I-13. Faulty registration



Possible cause	Step	Check	Result	Measure
Cassette	1	Is the cassette overloaded?	YES	Instruct the user not to load the cassette with too much paper.
Pick-up rollers	2	Are the pick-up rollers worn?	YES	Replace them.
Print paper	3	Is paper recommended by Canon being used?	NO	Make a test print. If the problem disappears, advise the customer to use Canon recommended paper.
Registration roller clutch	4	Is the clutch spring worn or deformed?	YES	Replace the spring.
Driver and sensor PCB DC controller PCB	5	Does the voltage between J213 pin 3 (REGD) and J213 pin 6 (GND) rise from 0V to +5VDC three seconds after the main motor starts?	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. Do the first and last prints have the same fixing level?	YES	Replace the thermistor (TH1).
Fixing rollers	2	Does poor fixing occur vertically?	YES	Check whether the rollers are worn. If so, replace them.
Fixing assembly Print paper	3	Is the nip width correct?	YES	Replace the fixing assembly.
			NO	Print using Canon-recommended paper. If the problem disappears, advise the customer to use Canon-recommended paper.

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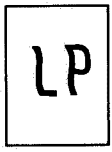
I-15. Distortion



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

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V. TROUBLESHOOTING MALFUNCTIONS

When performing any of the corrective actions described below, the following precautions should be taken:

1) Remove the expansion RAM PCB and font cartridge from the printer.
2) If replacing the video controller PCB, remove the nonvolatile RAM from the old controller PCB and reinstall it on the new PCB.
3) When measuring voltages at designated connector pins, first check the connector for faulty contacts.

M-1. Failure of AC Power

Suspected cause	Step	Check	Result	Corrective action
Line voltage	1	Is the correct voltage present at the outlet?	NO	Inform the user that the correct line voltage is not available at the outlet.
Power plug	2	Is the power cord firmly plugged into the outlet?	NO	Push the power plug in firmly.
Power switch (SW181)	3	Is the power switch ON?	YES	Check continuity of the power switch.
			NO	Set the power switch ON.
Circuit breaker (CB101)	4	Is the circuit breaker OFF?	YES	Set the circuit breaker ON. If the circuit breaker trips again as soon as power is switched ON, check for a short circuit.
Low-voltage power supply AC power supply	5	Unplug connector J502 from the low-voltage power supply, then switch the power supply ON. Is the correct voltage output across pins J502-1 and J502-3?	YES	Replace the low-voltage power supply.
			NO	Replace the AC power supply.

M-2. Failure of DC Power

Suspected cause	Step	Check	Result	Corrective action
Fuse	1	Is the fuse blown in a low-voltage power supply?	YES	Replace the fuse.
DC controller PCB Low-voltage power supply	2	When power is switched ON, does the voltage between J212-7 ($\overline{\text{REMOTEON}}$) and J212-1 (ground) go from approximately +4.5VDC to 0V?	NO	Check the DC controller PCB.
			YES	Check the low-voltage power supply. If normal, check the DC controller PCB.

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M-3. Malfunction of Status Indicators on Control Panel

Suspected cause	Step	Check	Result	Corrective action
	1	Press and release the TEST/FONT button. About 1s after the button is released, do all LED indicators go ON and does the LCD display an all-black pattern?	NO	Note the appearance of the LCD, then follow the troubleshooting procedure below.
Control panel PCB	2	Does at least one of the 16 character positions on the LCD indicate an all-black pattern? Alternatively, does one particular LCD segment fail to go ON?	YES	Replace the control panel PCB.
Video controller PCB			NO	Replace the video controller PCB.

M-4. Failure of LED Indicators on Control Panel

Suspected cause	Step	Check	Result	Corrective action
	1	Press and release the TEST/FONT button. About 1s after the switch is released, do all LED indicators go ON and does the LCD display an all-black pattern?	NO	Troubleshoot the unlit LED indicators by the procedure below.
Control panel PCB Video controller PCB	2	Press the TEST/FONT button and measure the voltage at the pin of connector J1 connected to the LED indicator that fails to light. Does it go from approximately 5VDC to 0V? (See table below.)	YES	Replace the control panel PCB.
			NO	Replace the video controller PCB.

READY/WAIT LED indicator	J1B-13
ALARM LED indicator	J1B-14
DATA LED indicator	J1B-15
ON LINE LED Indicator	J1B-12
FORM FEED LED indicator	J1B-9

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M-5. Failure of Switches of Operation Buttons on Control Panel

Suspected cause	Step	Check	Result	Corrective action
Operator mistake	1	Were the buttons pressed according to the instructions in Chapter 1 Section V?	NO	Operate the buttons according to the instructions in Chapter 1 Section V.
Control panel PCB Video controller PCB	2	When a button is pressed, does the voltage at the pin of connector J1 connected to the related switch go from approximately 5VDC to 0V? (See table below.) ON LINE button — J1B-4 FORM FEED button — J1A-4 ERROR SKIP button — J1A-3 TEST/FONT button — J1A-2 RESET button — J1A-5 MENU button — J1A-6	YES	Replace the video controller PCB.
			NO	Replace the control panel PCB.

M-6. Continuous Control Panel Beeper

Suspected cause	Step	Check	Result	Corrective action
Control panel Video controller PCB	1	Does the beep tone stop when a button other than the ON LINE button is pressed and released?	YES	Replace the control panel PCB.
			NO	Check the video controller PCB.

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M-7. Flashing "11" Code with Paper in Cassette

Suspected cause	Step	Check	Result	Corrective action
Sensor/driver PCB	1	When there is a cassette containing paper in the holder, is the voltage across connector pins J213-8 ($\overline{PEMP}$) and J213-6 (GND) of the DC controller PCB approximately 5VDC?	NO	Replace the sensor/driver PCB.
DC controller PCB	2	When the cassette size sensing switches are pressed, does the voltage at the following pins of the microprocessor on the DC controller PCB go from approximately 5VDC to 0V? SW201 – IC218-11 SW202 – IC218-10 SW203 – IC218-9	NO	Replace the DC controller PCB.
Video controller PCB	3	Check that there is an EP-S cartridge in place, that the upper unit is closed, and that there is paper in the cassette, then switch the power ON. When the READY/WAIT indicator stops flashing and glows steadily, does the voltage across connector pins J205-B2 ($\overline{RDY}$) and J205-B10 (GND) of the video controller PCB go from approximately 5VDC to 0V?	NO	Replace the DC controller PCB.
			YES	Replace the video controller PCB.

M-8. No "11" Code with No Paper in Cassette

Suspected cause	Step	Check	Result	Corrective action
Sensor/driver PCB	1	When there is an empty paper cassette in the printer, is the voltage across connector pins J213-8 ($\overline{PEMP}$) and J213-6 (GND) of the DC controller PCB 0V?	NO	Replace the sensor/driver PCB.
DC controller PCB Video controller PCB			YES	Try replacing the DC controller PCB. If that does not correct the trouble, replace the video controller PCB.

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M-9. Erroneous Display of "14" NO EP-S CART

Suspected cause	Step	Check	Result	Corrective action
EP-S cartridge	1	Is there an EP-S cartridge in the printer?	NO	Install an EP-S cartridge.
	2	Does the EP-S cartridge have a drum sensitivity indication cam?	NO	Replace the EP-S cartridge.
Actuator	3	When the upper unit is closed, are the drum sensitivity sensing switches (SW301, SW302) actuated?	NO	Replace the actuator.
Sensor/driver PCB DC controller PCB	4	When the drum sensitivity sensing switches listed below are pressed, does the voltage at the indicated pins of connector J213 on the DC controller PCB go from 5VDC to 0V? SW301 — J213-1 SW302 — J213-2	NO	Replace the sensor/driver PCB.
			YES	Replace the DC controller PCB.

M-10. "12" Code Display with Upper Unit Closed

Suspected cause	Step	Check	Result	Corrective action
Actuator Low-voltage power supply/motor driver unit	1	Is the actuator (the lever that actuates switches SW1 and SW2 of the low-voltage power supply and motor driver circuit) of the upper unit damaged?	YES	Replace the actuator.
			NO	Replace the low-voltage power supply/motor driver unit.

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M-11. Main Motor Failure

<table>
<tr><th>Suspected cause</th><th>Step</th><th>Check</th><th>Result</th><th>Corrective action</th></tr>
<tr><td>Main motor (M1)</td><td>1</td><td>Connect the leads of a voltmeter to the connector pins indicated below. Does the voltage reach approximately 1.4VDC 1 sec. after power is switched ON?
<table><tr><th>Plus (+) lead</th><th>Minus (–) lead</th></tr><tr><td>J501-5 (ϕ1COM)</td><td>J501-1 (ϕ1)</td></tr><tr><td>J501-5 (ϕ1COM)</td><td>J501-2 ($\overline{\phi 1}$)</td></tr><tr><td>J501-6 (ϕ2COM)</td><td>J501-3 (ϕ2)</td></tr><tr><td>J501-6 (ϕ2COM)</td><td>J501-4 ($\overline{\phi 2}$)</td></tr></table></td><td>YES</td><td>Replace the main motor.</td></tr>
<tr><td rowspan="2">Low-voltage power supply/motor driver unit
DC controller PCB</td><td rowspan="2">2</td><td rowspan="2">Connect the leads of a voltmeter to the connector pins indicated below. Does the voltage reach approximately 1VDC 1 sec. after power is switched ON?
<table><tr><th>Plus (+) lead</th><th>Minus (–) lead</th></tr><tr><td>J212-8 (A)</td><td>J212-1 (GND)</td></tr><tr><td>J212-9 ($\overline{A}$)</td><td>J212-1 (GND)</td></tr><tr><td>J212-10 (B)</td><td>J212-1 (GND)</td></tr><tr><td>J212-11 ($\overline{B}$)</td><td>J212-1 (GND)</td></tr></table></td><td>YES</td><td>Replace the low-voltage power supply/motor driver unit.</td></tr>
<tr><td>NO</td><td>Replace the DC controller PCB.</td></tr>
</table>

M-12. No Paper Pick-Up from Cassette

Suspected cause	Step	Check	Result	Corrective action
Operator mistake	1	Is the printer set for Manual pick-up	YES	Change to pick-up from cassette.
Main motor (M1)	2	Raise the upper unit, lock switches SW1 and SW2 with an actuating tool, and switch the power ON. Does the main motor rotate for 1s?	NO	Make repairs to satisfy the tests of M-11.
Pick-up roller clutch solenoid (SL301) DC controller PCB	3	Make a one-page test print. Does the voltage across connector pins J213-4 (CPUD) and J213-6 (GND) on the DC controller PCB change from 0V to approximately 5VDC?	YES	Replace the sensor/driver PCB.
			NO	Replace the DC controller PCB.

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M-13. No Manual Paper Pick-Up

Suspected cause	Step	Check	Result	Corrective action
Operator mistake	1	Is the printer set for cassette pick-up?	YES	Change to manual pick-up.
Main motor (M1)	2	Raise the upper unit, lock switches SW1 and SW2 with an actuating tool, and switch the power ON. Does the main motor rotate for 1s?	NO	Make repairs to satisfy the tests of M-11.
Sensor/driver PCB	3	Measure the voltage across connector pins J213-9 ($\overline{\text{MPFS}}$) and J213-6 (GND) of the DC controller PCB before and after placing a sheet of paper on the manual feed tray. Does the voltage change from approximately 5VDC to 0V?	NO	Replace the sensor/driver PCB.
Pick-up roller clutch solenoid (SL301) DC controller PCB	4	Make a one-page test print. Does the voltage across connector pins J213-4 (CPUD) and J213-6 (GND) of the DC controller PCB change from 0V to approximately 5VDC?	YES	Replace the sensor/driver PCB.
			NO	Replace the DC controller PCB.

M-14. Pre-Exposure Lamp does not Light Up

Suspected cause	Step	Check	Result	Corrective action
Pre-exposure lamp	1	After the power switch is turned on, does the voltage between J333 (+24VDC) and J334 go approximately 24VDC?	YES	Replace the pre-exposure lamp.
Fuse PCB DC controller PCB	2	After the power switch is turned on, does the voltage between J331-5 (GND) and J331-3 (PEXP) change from 0V to approximately 5VDC?	YES	Replace the fuser PCB.
			NO	Replace the DC controller PCB.

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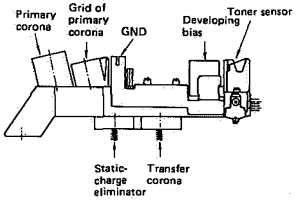
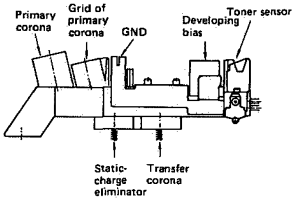
M-15. Poor Output of the High-voltage Power Supply

Suspected cause	Step	Check	Result	Corrective action
High-voltage connector	1	Is the terminal of high-voltage connector dirty? 	YES	Brush up the terminal of high-voltage connector.
High-voltage power supply DC controller PCB	2	Make a one-page test print. Does the voltage of connector pins described below on the DC controller PCB change from approximately 5VDC to 0V? Primary corona — J211-3 Developing bias (AC) — J211-4 Developing bias (DC) — J211-6 Transfer corona — J211-1	YES	Replace the high-voltage power supply.
			NO	Replace DC controller PCB

M-16. Incorrect "16" TONER LOW Display

Suspected cause	Step	Check	Result	Corrective action
EP-S cartridge	1	Remove the EP-S cartridge from the printer, agitate it in the correct manner, then reinstall it in the printer. Does the LCD now indicate 00 READY?	YES	The toner had collected at one end of the EP-S cartridge. This is also an indication that the toner supply is getting low, so a new EP-S cartridge should be obtained for use when needed.
High-voltage connector	2	Is the connector pin of the high-voltage connector for developing bias or the toner sensor dirty? 	YES	Clean the high-voltage connector
High-voltage power supply DC controller PCB	3	Set the printer level and measure the voltage between pins J211-5 (TSENS) and J211-7 (GND) of the DC controller PCB. Is the voltage approximately 24VDC or 0V?	YES	Replace the high-voltage power supply PCB.
			NO	Replace the DC controller PCB.

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M-17. Fixing assembly heater does not operate

Suspected cause	Step	Check	Result	Corrective action
Thermo-switch (TP1)	1	Is there continuity through the thermo-switch of the fixing assembly?	NO	Replace the thermo-switch.
Thermistor (TH1)	2	Remove the fixing assembly from the printer. Measure the resistance across connector pins J331-4 and J331-5 of the fuser PCB. Is the resistance (at room temperature) between 1.0MΩ and 1.6MΩ?	NO	Replace the thermistor.
Fixing heater (H1)	3	Is there continuity through the fixing roller heater?	NO	Replace the fixing roller heater.
AC power supply	4	After 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 approximately 5VDC to 0V?	YES	Replace the AC power supply.
DC controller PCB Video controller PCB	5	Check that there is an EP-S cartridge in the printer, that the upper unit is closed, and that there is paper in the cassette, then switch the power ON. Does the voltage across connector pins J205-B2 ($\overline{RDY}$) and J205-B10 (GND) on the video controller PCB go from approximately 5VDC to 0V within 1 minute?	NO YES	Replace the DC controller PCB. Replace the video controller PCB.

Note:
When the printer self-diagnosis system detects a fixing assembly fault, it should be switched OFF for about 10 minutes. If it is switched ON during this time, the printer will automatically shut off current to the fixing roller heater to prevent overheating.

M-18. Flashing "51" SERVICE Display

Suspected cause	Step	Check	Result	Corrective action
EP-S cartridge	1	Is the actuator of the EP-S cartridge that operates the laser-beam-blocking shutter damaged?	YES	Repair the actuator or replace the EP-S cartridge.
DC controller PCB Laser/scanner unit	2	Measure the TP232 voltage on the DC controller PCB by the method given in Chapter 7 Section III-C. Is the voltage within the designated limits?	NO YES	Replace the DC controller PCB. Replace the laser/scanner unit

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M-19. Flashing "52" SERVICE Display

Suspected cause	Step	Check	Result	Corrective action
DC controller PCB Laser/scanner unit	1	Measure the TP232 voltage on the DC controller PCB by the method given in Chapter 7 Section III-C. Is the voltage within the designated limits?	NO	Replace the DC controller PCB.
			YES	Replace the laser/scanner unit

M-20. Code "13" Does Not Flash When Paper Jam Occurs

Suspected cause	Step	Check	Result	Corrective action
Delivery unit paper sensor lever	1	Is the delivery unit paper sensor lever damaged?	YES	Replace the lever.
Fuser PCB DC controller PCB, Video controller PCB	2	When the delivery unit paper sensor is blocked, does the voltage between connector pins J331-6 (PDP) and J331-5 (GND) go from approximately 5VDC to 0V?	NO	Replace the fuser PCB.
			YES	Try replacing the DC controller PCB. If that does not correct the trouble, replace the video controller PCB.

M-21. Flashing "20" PAGE FULL or "21" COMPLEX DATA Display

Suspected cause	Step	Check	Result	Corrective action
Data error	1	Were any of the data (commands or print data) sent from the external device to the printer newly created?	NO	Proceed to step 3.
	2	Ask the customer to send data to the printer that were printed correctly in the past. Are they printed correctly now? If no such data are available, proceed to step 3.	YES	Inform the customer that the problem occurred because there was too much data for one page.
Video controller PCB	3	———	___	Replace the video controller PCB.

M-22. Flashing "22" LINE ERROR or "40" LINE ERROR Display

Suspected cause	Step	Check	Result	Corrective action
Operator mistake	1	Was the printer switched ON before the external device was switched ON, or was the external device switched off before the printer was switched on?	YES	Advise the customer that this order of switching power ON/OFF sometimes causes messages 22 or 40 to appear. Ask the customer not to switch power ON in this order.
			NO	Check whether the interface mode setting is compatible with the external device.
Video controller PCB	2	———	___	Replace the video controller PCB.

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M-23. Flashing "23" MEMORY FULL or "24" FULLPAINT REJ Display

Suspected cause	Step	Check	Result	Corrective action
Data error	1	Were any of the data (commands or print data) sent from the external device to the printer newly created?	NO	Proceed to step 3.
	2	Ask the customer to send the printer data containing downloaded characters that were printed correctly in the past. Are they printed correctly now? If no such data are available, proceed to step 3. **Note:** Downloaded characters are customer-designed characters for which the dot patterns have been sent from the external device and stored in the printer.	YES	Inform the customer that the problem occurred because the quantity of downloaded data was too large, there were too many fonts (character patterns) created by downloaded data, or the quantity of data was too large for one page.
Video controller PCB	3	———	———	Replace the video controller PCB.

M-24. Flashing "41" PRINT CHECK Display

Suspected cause	Step	Check	Result	Corrective action
	1	Does this problem occur frequently?	NO	The problem is temporary. Remove the paper in use when the trouble occurred and continue printing.
Laser/scanner unit, DC controller PCB			YES	Try replacing the laser/scanner unit. If that does not correct the trouble, replace the DC controller PCB.

M-25. Flashing "55" SERVICE Display

Suspected cause	Step	Check	Result	Corrective action
Video controller PCB	1	Does replacing the video controller PCB correct the trouble?	YES	Replace the video controller PCB.
DC controller PCB			NO	Replace the DC controller PCB.

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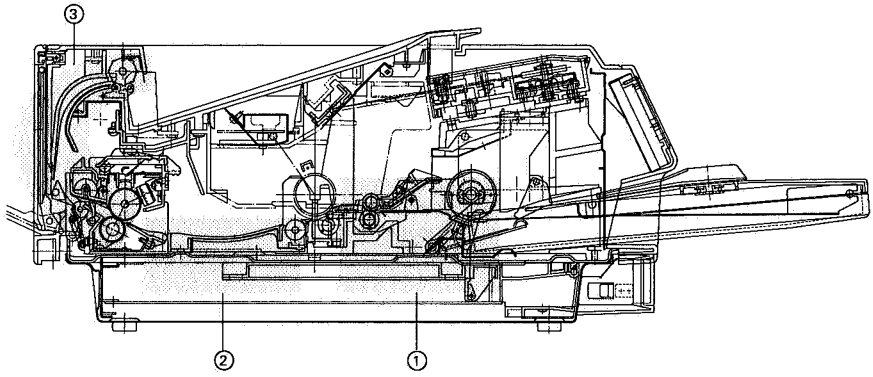
VI. PAPER TRANSPORT TROUBLESHOOTING

A. Print Paper Jams

Paper in the printer passes through three major blocks: (1) pick-up block, (2) separation and feeder block, and (3) fixing and feed-out block. This section explains how to do troubleshooting when jams occur for each of these major blocks.



① Pick-up block
② Separation and feed block
③ Fixing and delivery block

Figure 7-11

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T-1. Pick-up block

Possible cause	Step	Check	Result	Measure
Print paper	1	Is paper recommended by Canon being used?	NO	Instruct the customer to use Canon-recommended paper.
	2	Is the paper wrinkled or curled?	YES	Replace the paper. Advise the customer how to store paper.
Cassette	3	Is the cassette over loaded?	YES	Instruct the user not to load the cassette with too much paper.
Pick-up rollers	4	Are the pick-up rollers worn?	YES	Replace them.
Registration roller clutch	5	Is the clutch spring worn or deformed?	YES	Replace the spring.
Driver and sensor PCB DC controller PCB	6	Does the voltage between J213 pin 4 (CPUD) and J213 pin 6 (GND) rise from 0V to +5VDC two seconds after the main motor starts?	YES	Replace the driver and sensor PCB.
			NO	Replace the DC controller PCB.
Registration roller clutch	7	Is the clutch spring worn or deformed?	YES	Replace the spring.
Driver and sensor PCB DC controller PCB	8	Does the voltage between J213 pin 3 (REGD) and J213 pin 6 (GND) rise from 0V to +5VDC two seconds after the main motor starts?	YES	Replace the driver and sensor PCB.
			NO	Replace the DC controller PCB.

T-2. Separation and feed block

Possible cause	Step	Check	Result	Measure
Static-charge eliminator bias	1	Clean the contact between TB605 and the static-charge eliminator, and make several test prints. Does a jam occur?	YES	Make sure that the static-charge eliminator has good contact with TB605.
High-voltage power supply			NO	Replace the high-voltage power supply.

T-3. Fixing and delivery block

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 defective claws.
Delivery unit sensor arm	3	Does the sensor arm move smoothly?	YES	Repair the arm.
Deflector (when the face-up tray is used)			NO	Check the deflector.
Feed-out rollers (when the face-down tray is used)			NO	Check the feed-out rollers.

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B. Incomplete Paper Feed

T-1. Sheets stuck together

Possible cause	Step	Check	Result	Measure
Print paper	1	Is paper recommended by Canon being used?	NO	Advise the customer to use Canon-recommended paper.
Cassette springs	2	Are the cassette springs damaged?	YES	Replace the springs.
Separation pad			NO	Replace the separation pad.

T-2. Wrinkles

Possible cause	Step	Check	Result	Measure
Print paper	1	Is paper recommended by Canon being used?	NO	Advise the customer to use Canon-recommended paper.
	2	Do wrinkles disappear when fresh paper is used?	YES	Advise the customer how to store paper.
Pick-up assembly	3	Raise the upper unit while paper is passing through the feed guide (just after pick-up). Is the paper wrinkled? Is the paper being fed correctly?	YES	Check the pick-up assembly and registration rollers.
Entrance guide	4	Is the entrance guide dirty?	YES	Clean the guide.
Fixing assembly			NO	Replace the fixing assembly.

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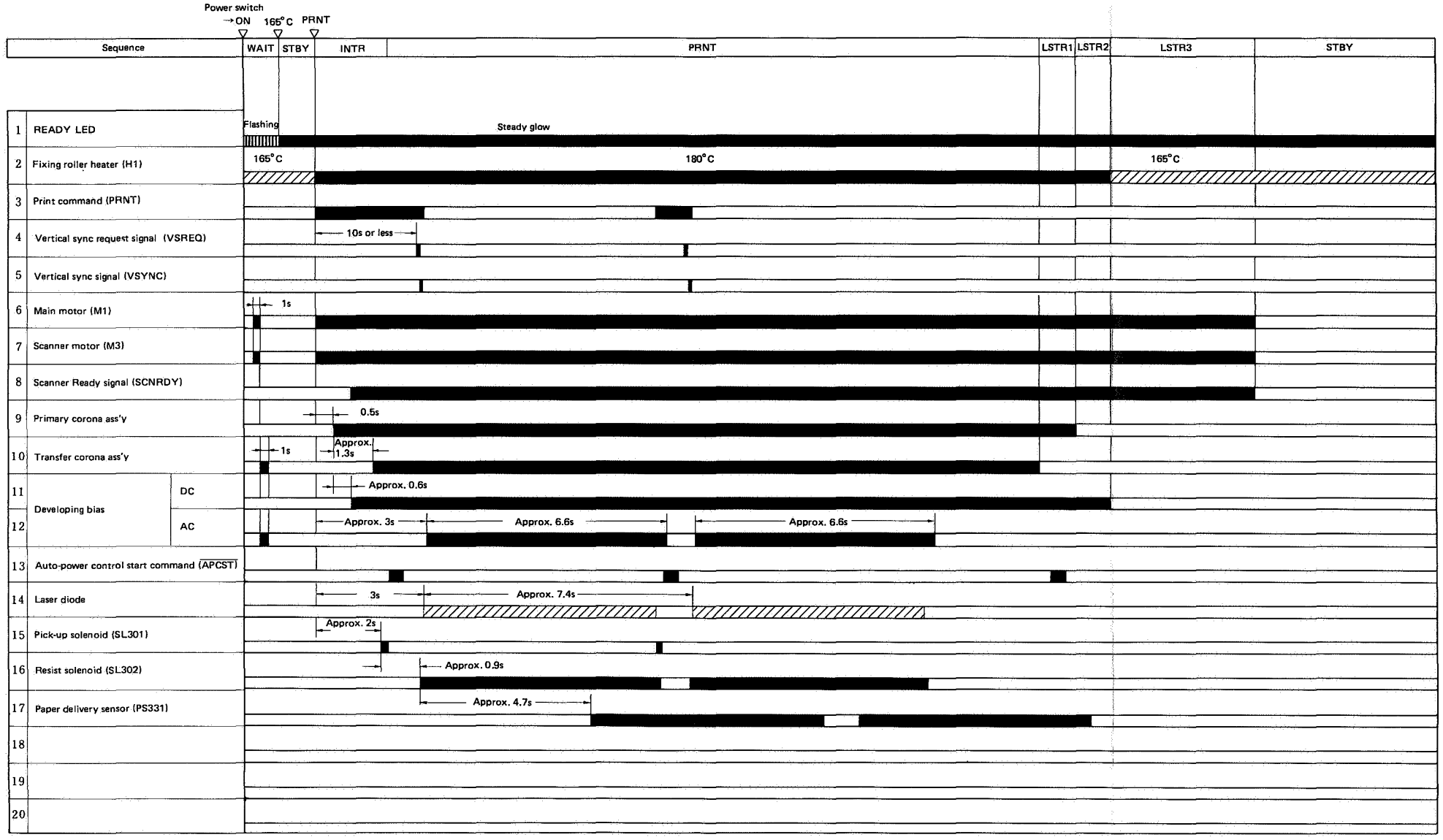
- Timing for two consecutive prints on A4 paper.



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II. LIST OF SIGNALS/COMMANDS

A. DC Controller

Abbreviation	Name	Function
A $\overline{A}$ B $\overline{B}$	MAIN MOTOR DRIVE command	Causes the main motor to rotate
$\overline{BD}$	BEAM DETECT signal (horizontal sync pulse)	Identification signal for the left margin on the printed paper
$\overline{CBSY}$	COMMAND BUSY signal	Indicates 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 signals	Printer control commands sent from the video controller to the DC controller
$\overline{CPRDY}$	CONTROLLER POWER READY signal	Indicates that the video controller circuit power is ON
CPUD	CASSETTE PICK-UP ROLLER CLUTCH SOLENOID DRIVE command	Operates the cassette pick-up roller clutch solenoid
CSENS1 CSENS2	DRUM SENSITIVITY IDENTIFICATION signal	Indicates the sensitivity of the photosensitive drum
$\overline{DBAC}$	DEVELOPING BIAS (AC) DRIVE command	Supplies to developing cylinder as bias voltage.
$\overline{DBDC}$	DEVELOPING BIAS (DC) DRIVE command	
DSADJ	PHOTODIODE SENSITIVITY ADJUSTMENT signal	Adjusts the sensitivity of the photodiode that measures laser intensity
FAN	FIXING UNIT FAN DRIVE command	Operates the fixing assembly ventilation fan
$\overline{FARD}$	FIXING ROLLER HEATER DRIVE command	Operates the fixing roller heater
FSRTH	FIXING ROLLER TEMPERATURE signal (analog)	Indicates the fixing roller heater temperature
$\overline{HV1ON}$	PRIMARY CORONA DRIVE command	Operates the primary corona
HVRST	HIGH-VOLTAGE RESET signal	Switches off a high-voltage outputs
$\overline{HVTON}$	TRANSFER CORONA DRIVE command	Operates the transfer corona
LD	LASER DRIVE command	Operates the laser
$\overline{MPFS}$	MANUAL PAPER FEED signal	Indicates that there is paper on the manual feed tray
$\overline{PCLK}$	PRINTER CLOCK signal	Sync pulse for status information signals from the DC controller to the video controller
PD	LASER POWER SENSOR signal	Indicates the laser power
$\overline{PDP}$	FIXING ASSEMBLY PAPER SENSOR signal	Indicates that printed paper has passed the fixing rollers
$\overline{PEMP}$	PAPER OUT signal	Indicates that there is no paper in the cassette.
PEXP	PRECONDITIONING EXPOSURE LAMP DRIVE command	Operates the preconditioning exposure lamps
$\overline{PPRDY}$	PRINTER POWER READY signal	Indicates that the printer power is ON
$\overline{RDY}$	READY signal	Indicates that printing is possible
$\overline{REMOTE}$	Changed command	Delays the output of 24VDC slightly after 5VDC is switched ON

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Abbreviation	Name	Function
REGD	REGISTRATION SHUTTER SOLENOID DRIVE command	Operates the registration shutter solenoid
RESET	RESET command	RESETS the electrical circuits
$\overline{\text{SBSY}}$	STATUS BUSY signal	Indicates that the DC controller is sending status information to the video controller.
SCNCONT	SCANNER MOTOR DRIVE command	Operates the scanner motor ON/OFF
$\overline{\text{STATUS}}$	STATUS signal	Status signal sent from the DC controller to the video controller
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 video controller to the DC controller
$\overline{\text{VSREQ}}$	VERTICAL SYNC REQUEST command	Requests a VERTICAL SYNC signal ($\overline{\text{VSYNC}}$)
$\overline{\text{VSYNC}}$	VERTICAL SYNC signal	Determines the top margin on the printed page

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B. Video Controller

Abbreviation	Name	Function
A1 ~ A13	ADDRESS signals	ADDRESS signal lines to the expansion interface PCB
A1B ~ A20B	ADDRESS BUS signals	ADDRESS signal lines to the font cartridge
$\overline{\text{A19L}}$ ~ $\overline{\text{A22L}}$	ADDRESS BUS signals	ADDRESS signal lines to the expansion RAM board (prelatched)
$\overline{\text{ACKNLG}}$	ACKNOWLEDGE signal	Requests the external device to transmit new data. Also used to report (to the external device) receipt of a data transmission. (Parallel interface)
$\overline{\text{ADSD}}$	ADDRESS STROBE signal	Strobes ADDRESS signals sent to the expansion interface PCB
$\overline{\text{ASB}}$	ADDRESS STROBE signal	Strobes ADDRESS signals sent to the font cartridge
$\overline{\text{AUX IN1}}$ $\overline{\text{AUX IN2}}$	AUXILIARY INPUT signal	Used in the 8-bit parallel interface
$\overline{\text{AUX OUT1}}$ $\overline{\text{AUX OUT2}}$	AUXILIARY OUTPUT signals	Used in the 8-bit parallel interface
BUSY	BUSY signal	Informs the external device that the printer cannot accept data input (Parallel interface)
BZER	BEEPER DRIVE command	Causes a beep tone
$\overline{\text{CAS}}$	COLUMN ADDRESS STOROBE signal	Output to the expansion RAM board to latch address signals
$\overline{\text{COLEN}}$	COLUMN ADDRESS ENABLE signal	Output to the expansion RAM board
$\overline{\text{CTBD0}}$ $\overline{\text{CTBD1}}$	SENSOR signals	Input from the font cartridge; "0" when the font cartridge is installed
$\overline{\text{CTRG0B}}$ $\overline{\text{CTRG1B}}$	SELECT signals	Output to the font cartridge
CTS	CLEAR TO SEND signal	Sent from the external device to the printer granting or denying permission to transmit data (Serial interface)
D0B ~ D15B	DATA BUS signals	DATA signal lines to the font cartridge
DATA1 ~ DATA8	DATA signals	Transmission lines used to transfer data (commands and print data) from the external device to the printer. (Parallel interface) Signal codes are represented by the 8-bit of the parallel signal
$\overline{\text{DATASTROBE}}$	DATA STROBE signal	Timing signal used to strobe data on the DATA1 to DATA8 lines into the printer (Parallel interface)
DCD	DATA CARRIER DETECT signal	Data carrier detection signal for the external device (not used by the printer) (Serial interface)

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Abbreviation	Name	Function
$\overline{\text{DEND}}$		
D10 ~ D115	INPUT DATA BUS signals	Signals inputed from the expansion RAM board
DO0 ~ DO15	OUTPUT DATA BUS signals	Output to the expansion RAM board
$\overline{\text{DSR}}$	DATA SET READY signal	Sent by the external device to report its operational status to the printer (Serial interface)
DTR	DATA TERMINAL READY signal	Informs the external device whether the printer is ready to receive data (commands or print data) (Serial interface)
$\overline{\text{EXIF2}}$	EXPANSION INTERFACE 2 signal	SELECT signal outputed to the expansion interface PCB
$\overline{\text{EXIRQ}}$	EXTENDED INTERRUPT REQUEST signal	INTERRUPT REQUEST signal inputted from the expansion interface PCB
$\overline{\text{EXVDO}}$	EXTENDED VIDEO signal	VIDEO signal inputted from the expansion interface PCB
$\overline{\text{FAULT}}$	FAULT signal	Reports that the printer has gone OFF-LINE (the ON LINE indicator goes OFF), or reports to the external device that a malfunction has occured in the printer (Parallel interface)
$\overline{\text{INPUT PRIME}}$	INPUT PRIME command	Initializes the printer (Parallel interface)
$\overline{\text{LDSB}}$	LOWER DATA STROBE signal	Strobes low-order data to the font cartridge
LED1	READY INDICATOR DRIVE command	Operates the READY indicator
LED2	ON LINE INDICATOR DRIVE command	Operates the ON LINE indicator
LED3	FORM FEED INDICATOR DRIVE command	Operates the FORM FEED indicator
LED4	DATA INDICATOR DRIVE signal	Operates the DATA indicator
LED5	ALARM INDICATOR DRIVE signal	Operates the ALARM indicator
$\overline{\text{LWE}}$	DRAM lower Write Enable command	Output to the expansion RAM board to enable writing of the low-order data byte
MA0 ~ MA8	MEMORY ADDRESS BUS signals	ADDRESS BUS signals outputted to the expansion RAM board
OPCALL	OPERATOR call signal	
PAD0 ~ PAD7	PANEL PCB ADDRESS BUS signals	Lines for transmitting data to the LCD on the control panel PCB
PAUX0 ~ PAUX4	CONTROL PANEL PCB AUXILIARY BUS signals	Lines for transmitting control data to the LCD on the control panel PCB
RAS	ROW ADDRESS STROBE signal	Output to the expansion RAM board to latch address data
RD/RDA RDB	RECEIVE DATA signal	Data received from the external device (Serial interface)

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Abbreviation	Name	Function
$\overline{\text{REFRESHD}}$	DRAM REFRESH signal	To refresh memory storage in expansion RAM board
RTS	REQUEST TO SEND signal	Informs the external device that the printer has data (status information) to send (Serial interface)
R/WB	READ/WRITE signal	Indicates whether font cartridge data is read data or write data
$\overline{\text{RMDB0}}$ $\overline{\text{RMBD1}}$	EXPANSION RAM BOARD DETECT signals	Input from the expansion RAM board; logic "0" when an expansion RAM board is installed
SCLKB	SERIAL CLOCK signal	CLOCK signal sent to the font cartridge
SELECT	SELECT signal	Reports back to the external device that the printer and external device are connected (ON-LINE status) (Parallel interface)
SWD0	ERROR SKIP command	Ignores the preceding error (ERROR SKIP or + key)
SWD1	FORM FEED command	Ends and delivers the current page 9form feed key)
SWD2	MENU command	Displays a menu of settings that can be changed (menu, ▶ switch)
SWD4	TEST command	Makes a test print (TEST/FONT, ◀ switch)
SWD5	ON LINE command	Sets the printer ON-LINE (ON LINE key)
SWD6	RESET command	Resets the printer, or changes printer settings (RESET, ▼ ENTER key)
TD TDA TDB	Transmit Data	Transmission line used to send status information from the printer to the external device (Serial interface)
$\overline{\text{UDSB}}$	UPPER DATA STROBE signal	Strobes high-order data to the font cartridge
$\overline{\text{UWE}}$	DRAM UPPER WRITE ENABLE signal	Output to the expansion RAM board to enable writing of a high-order data byte

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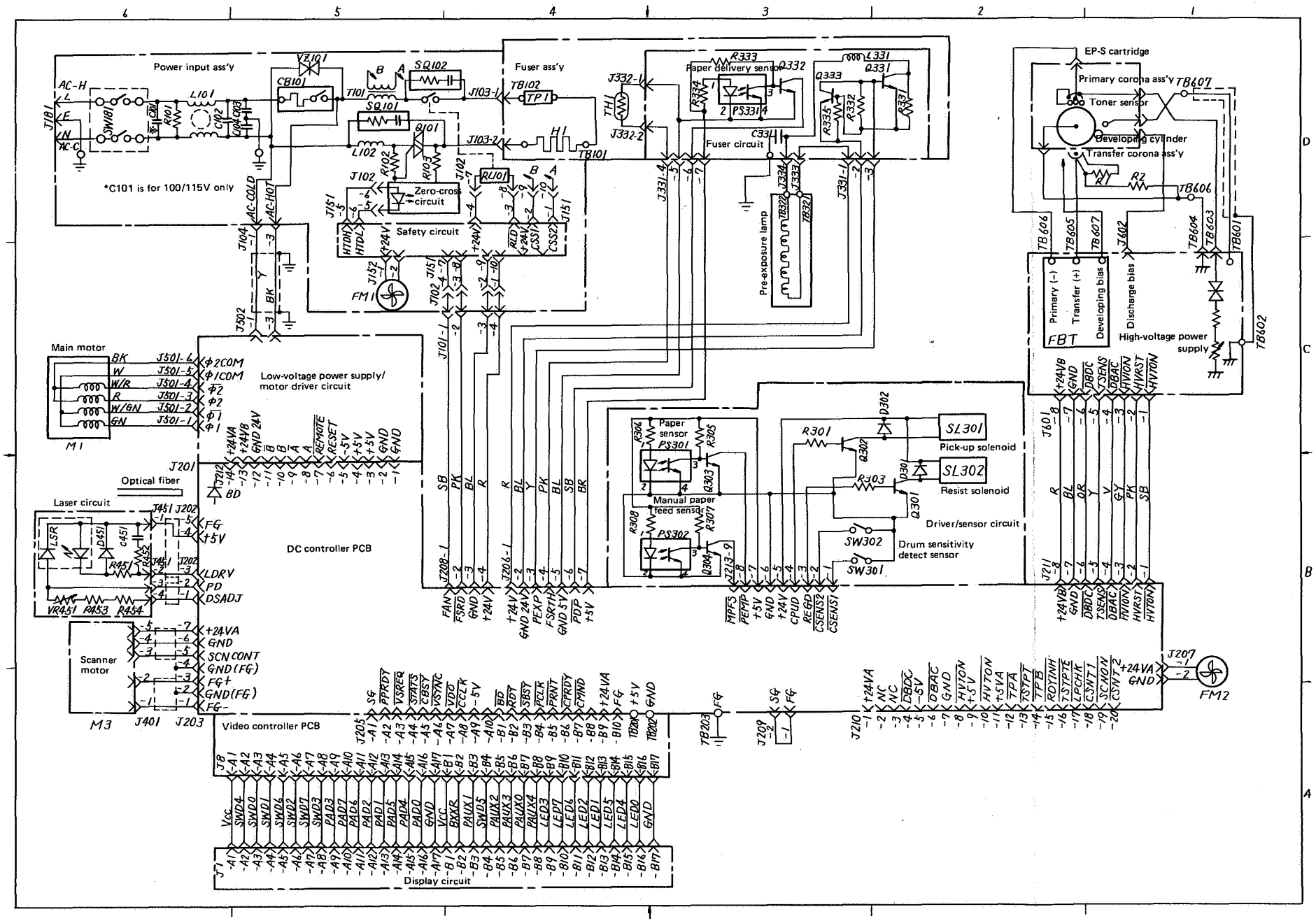

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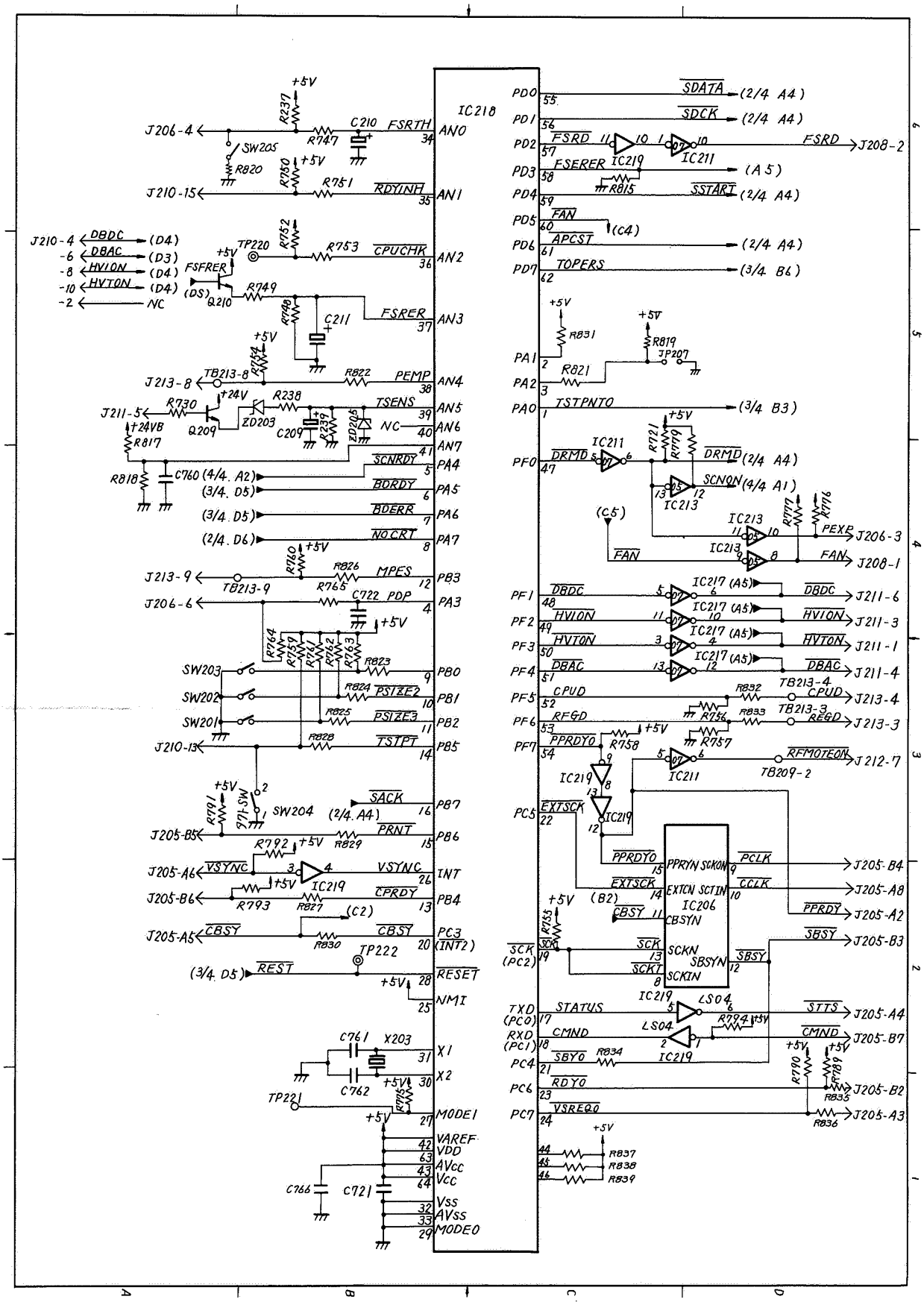

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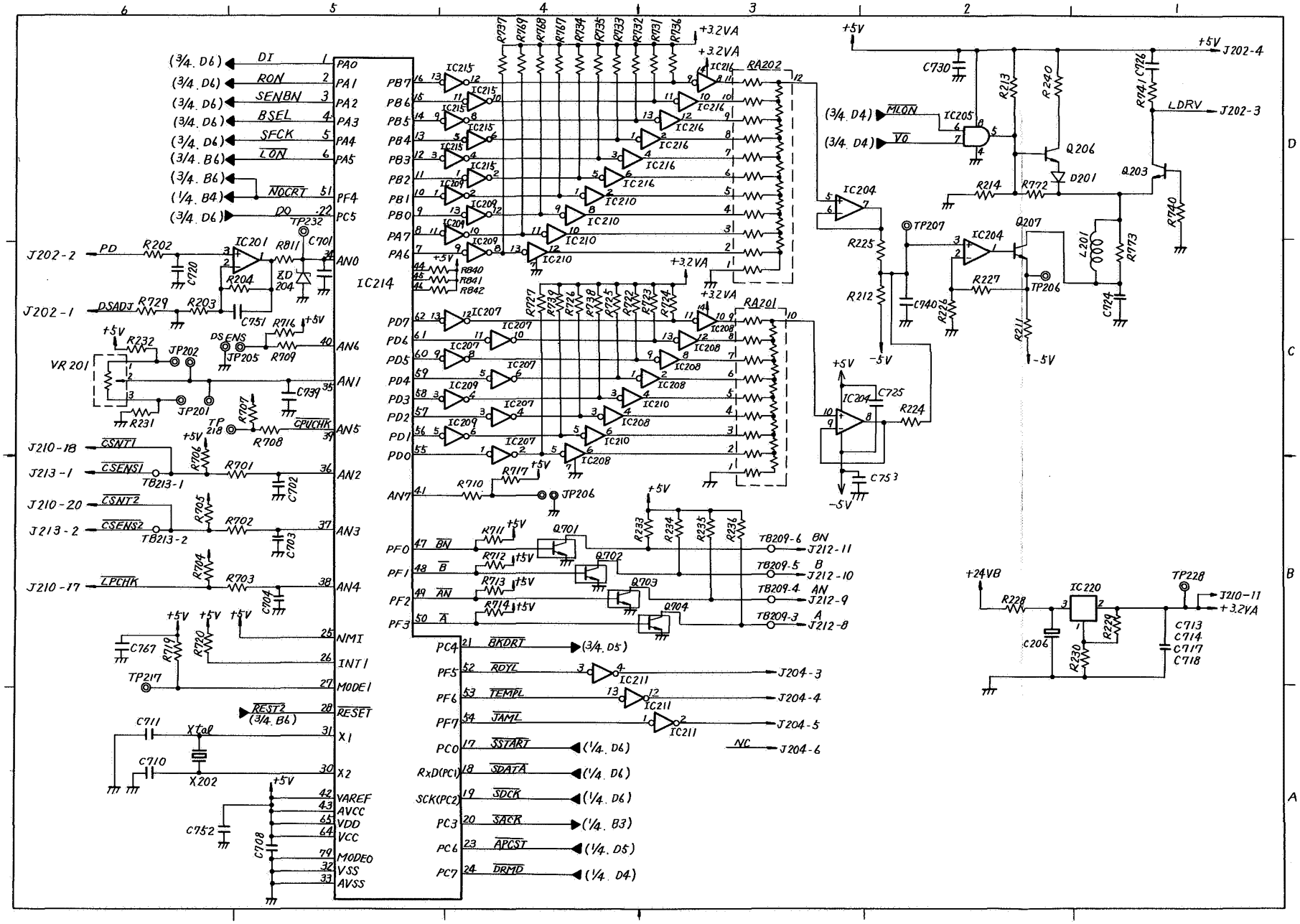

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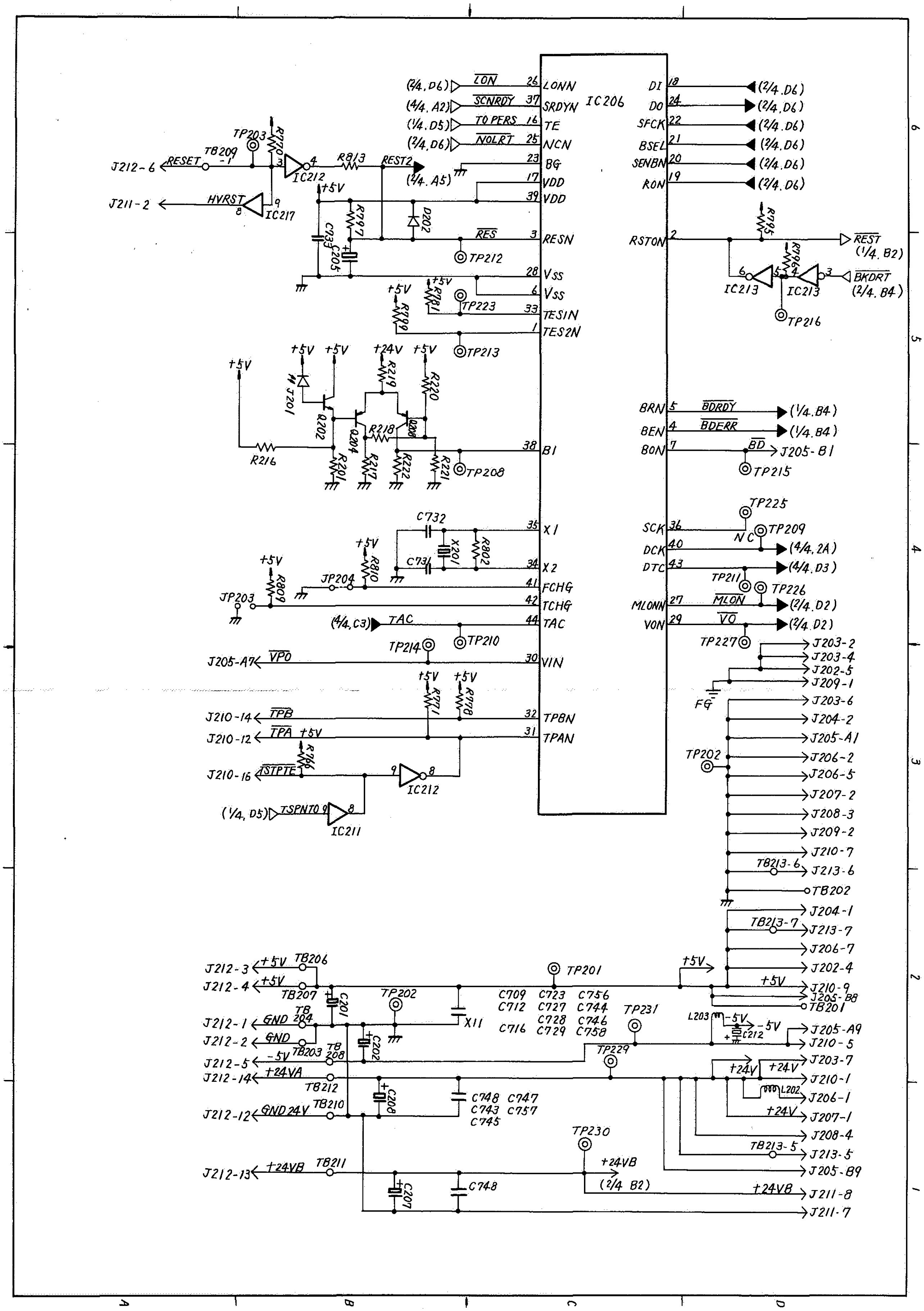

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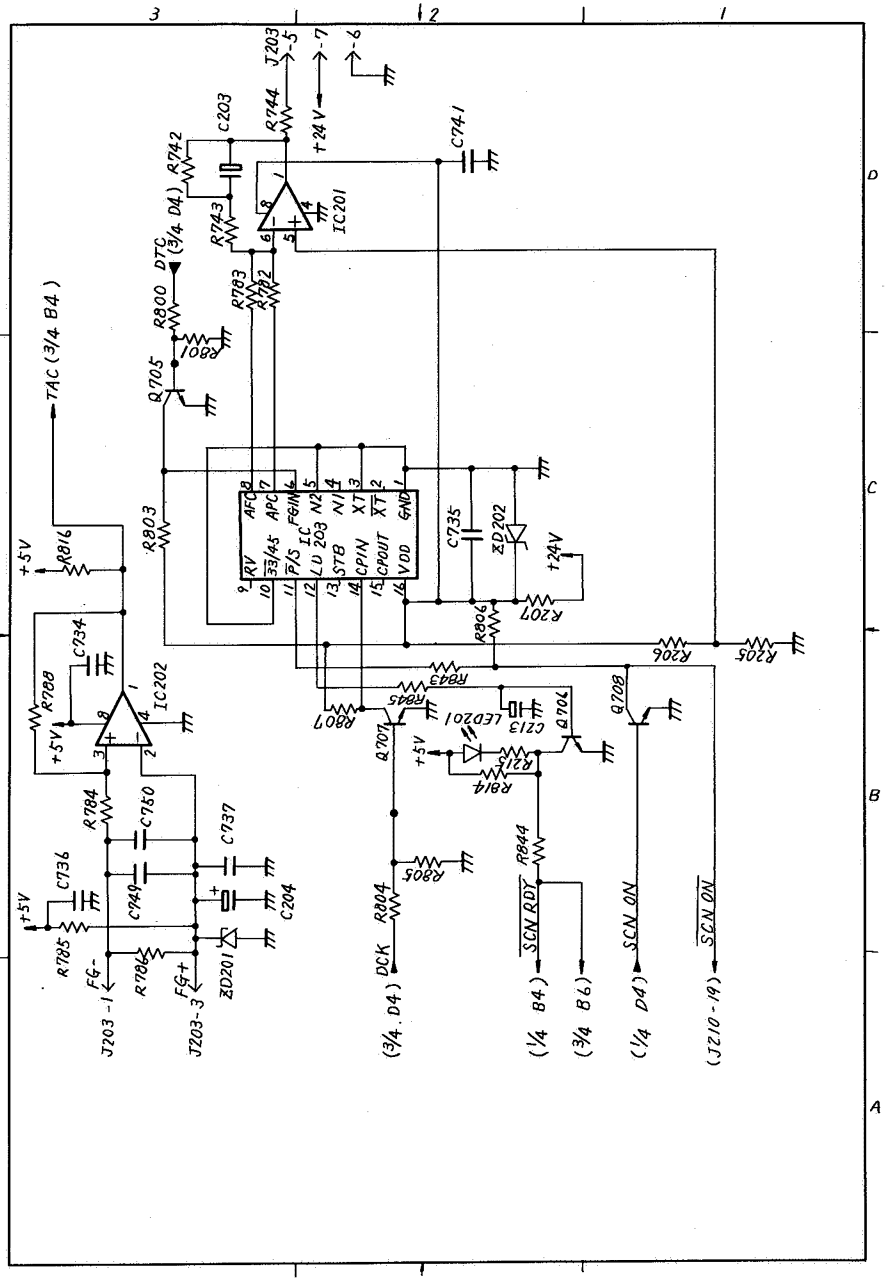

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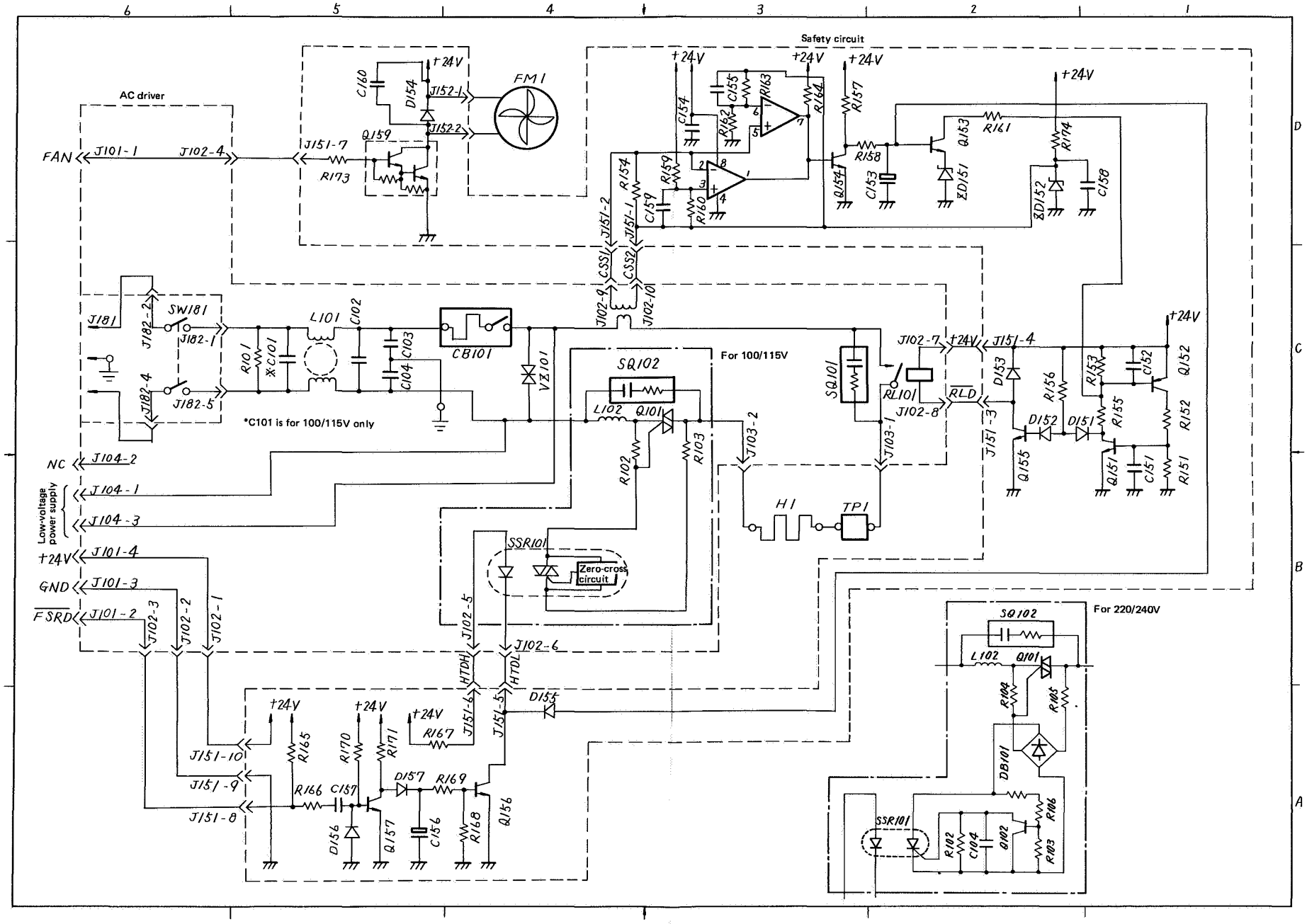

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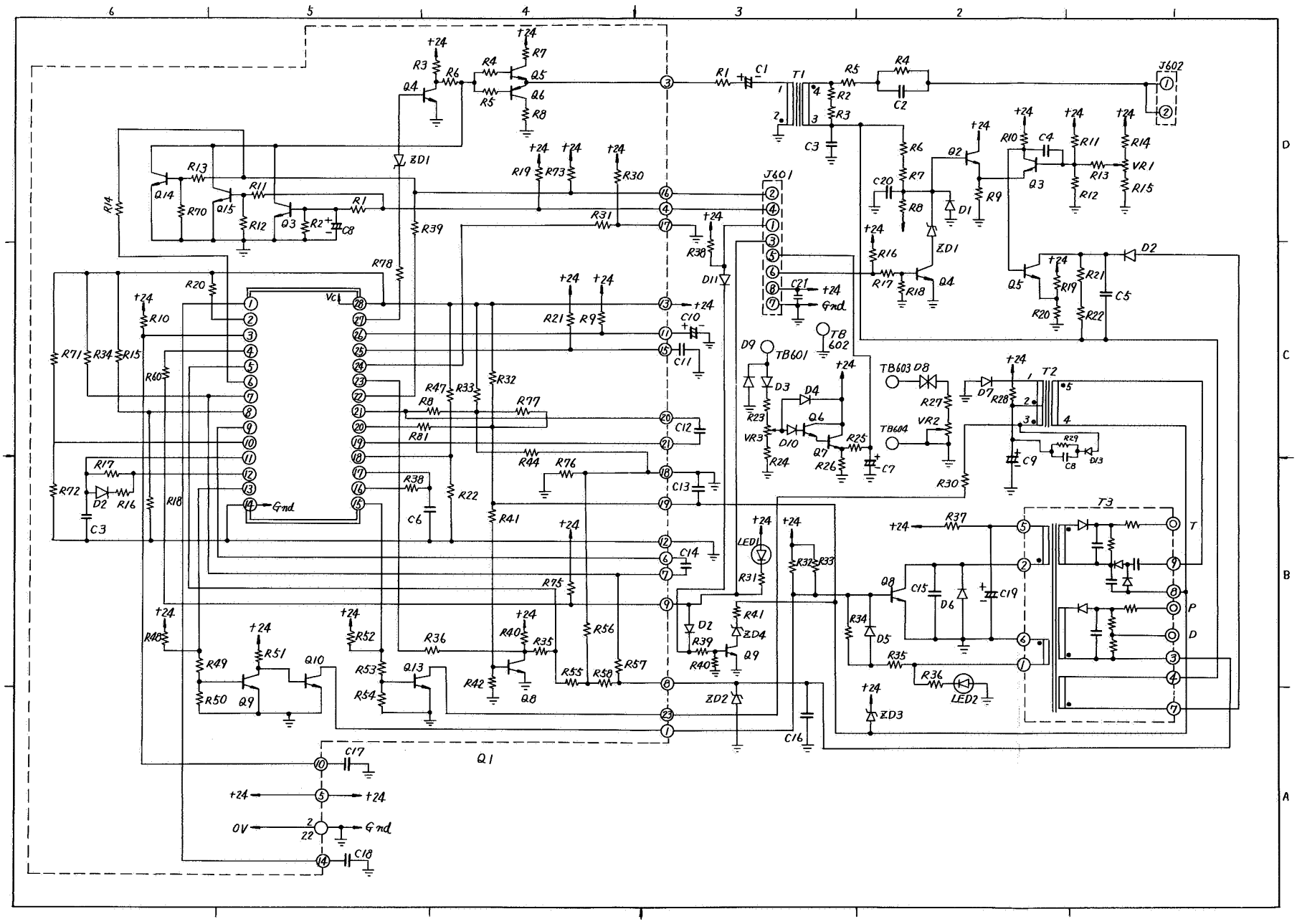

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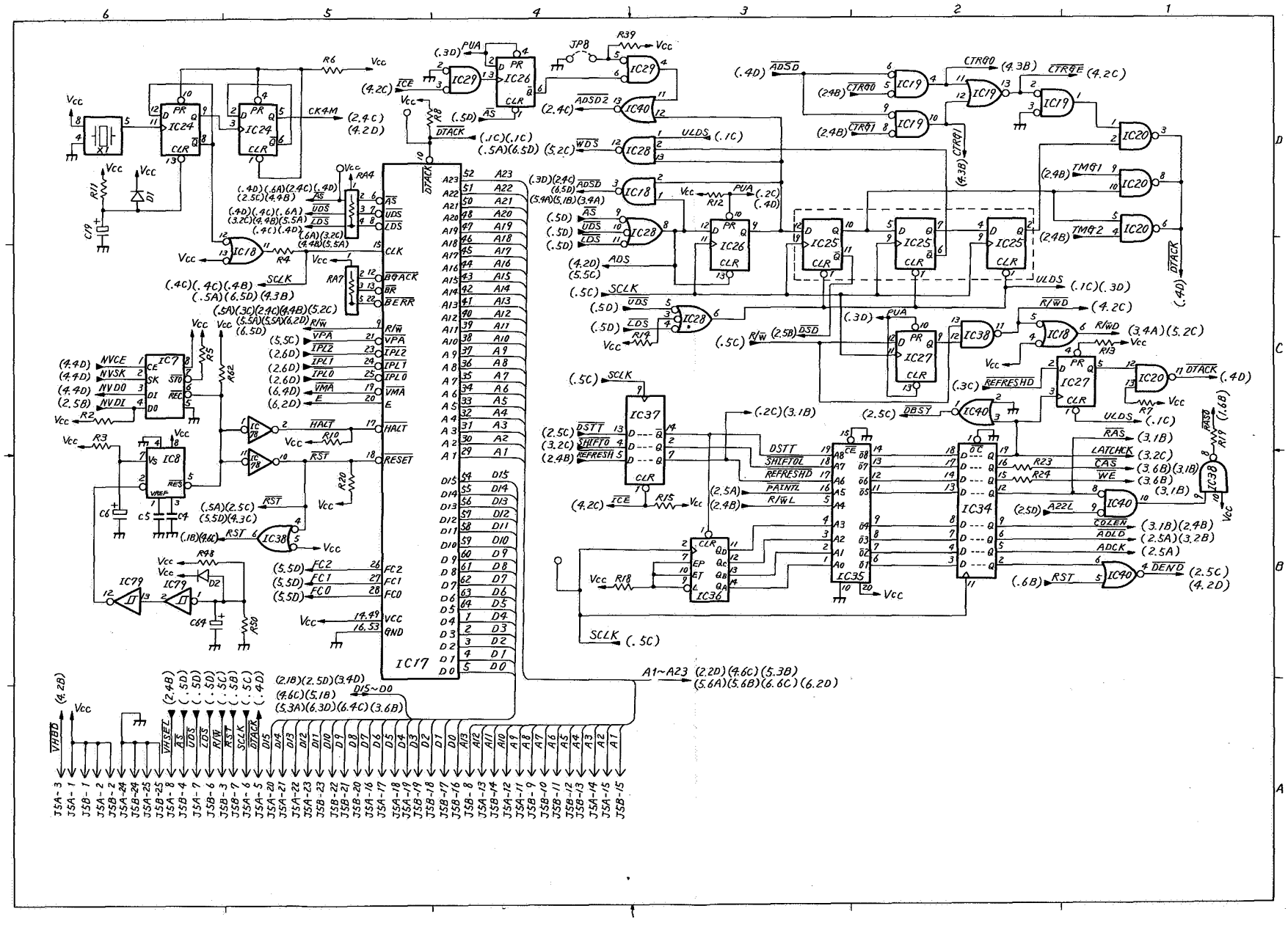

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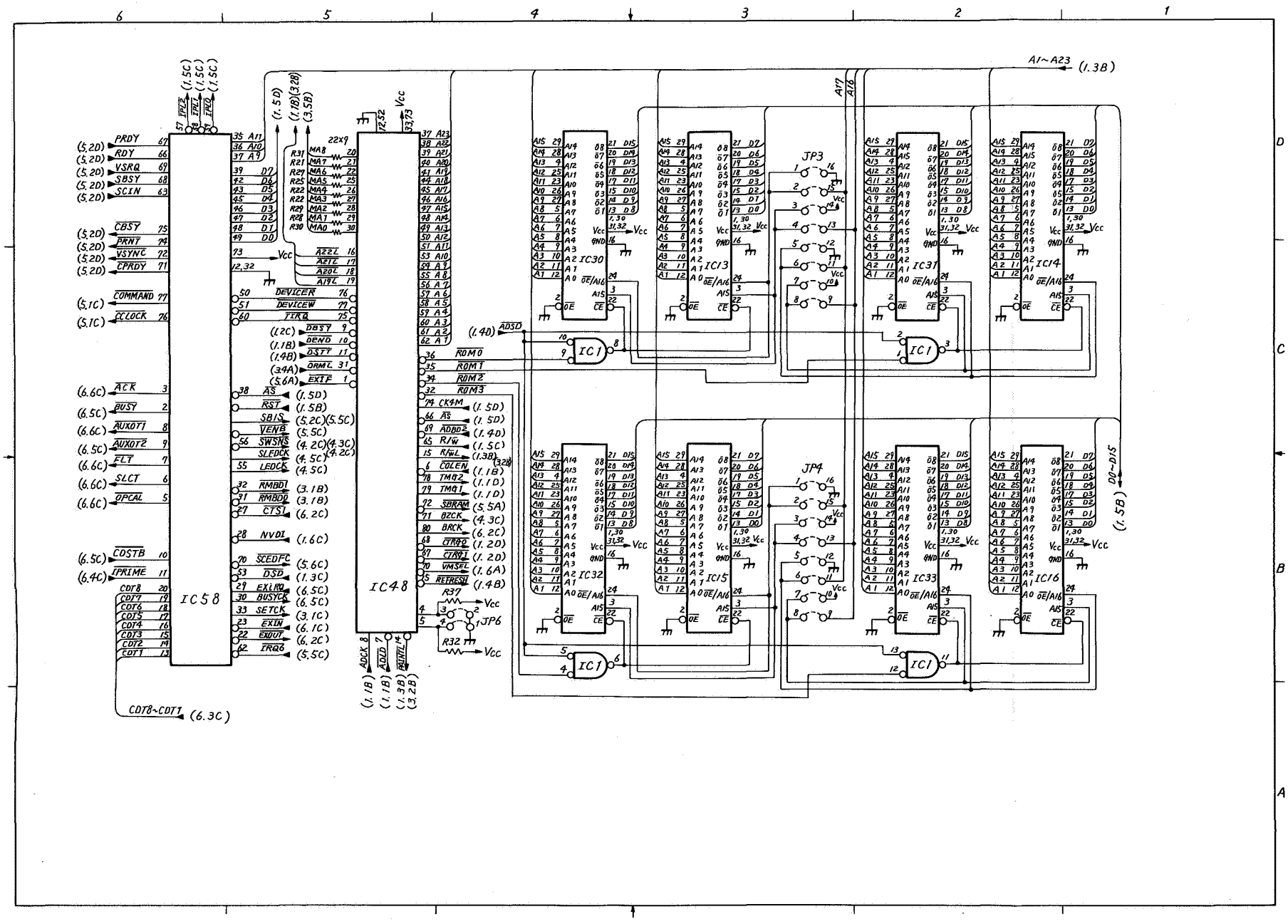

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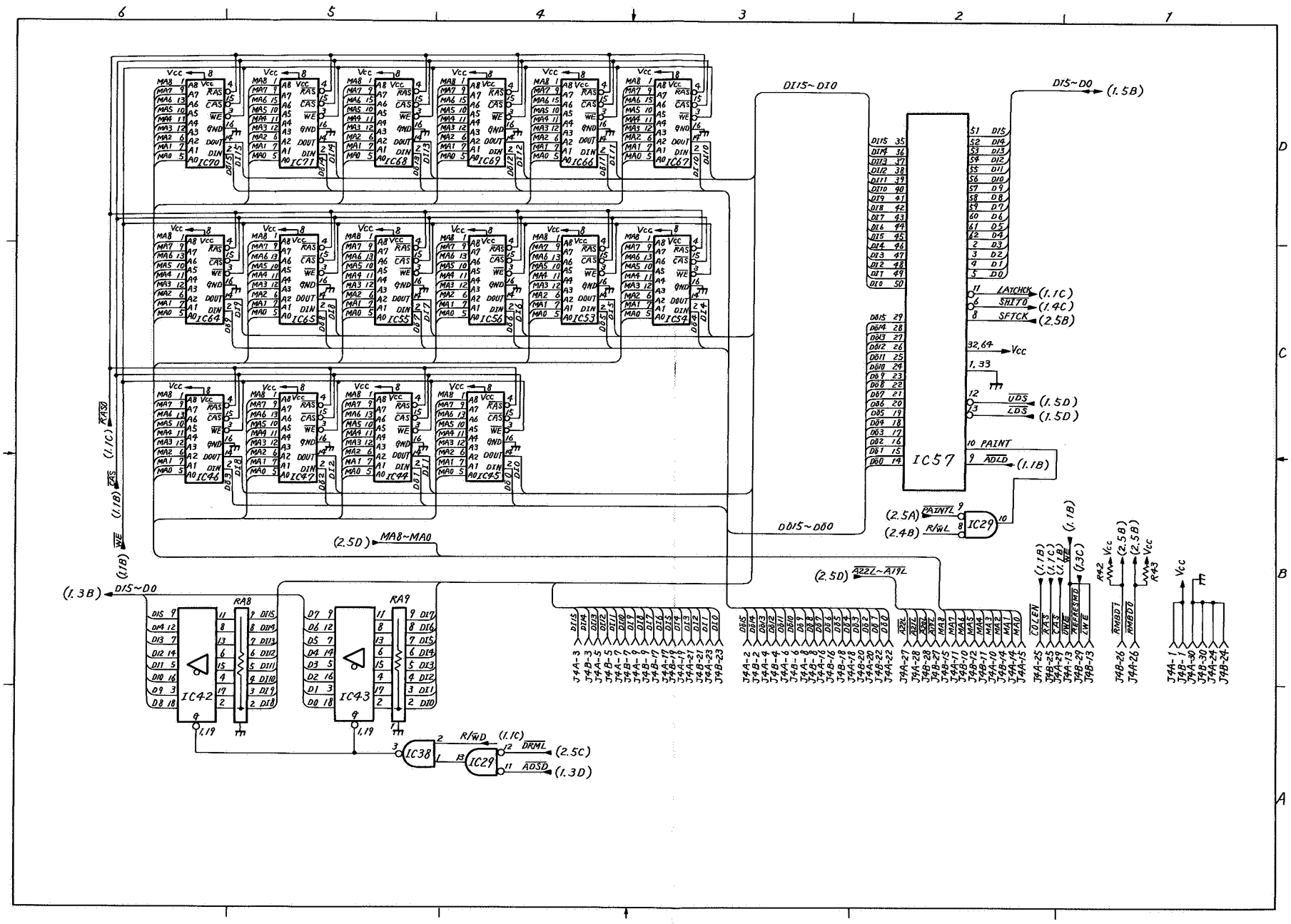

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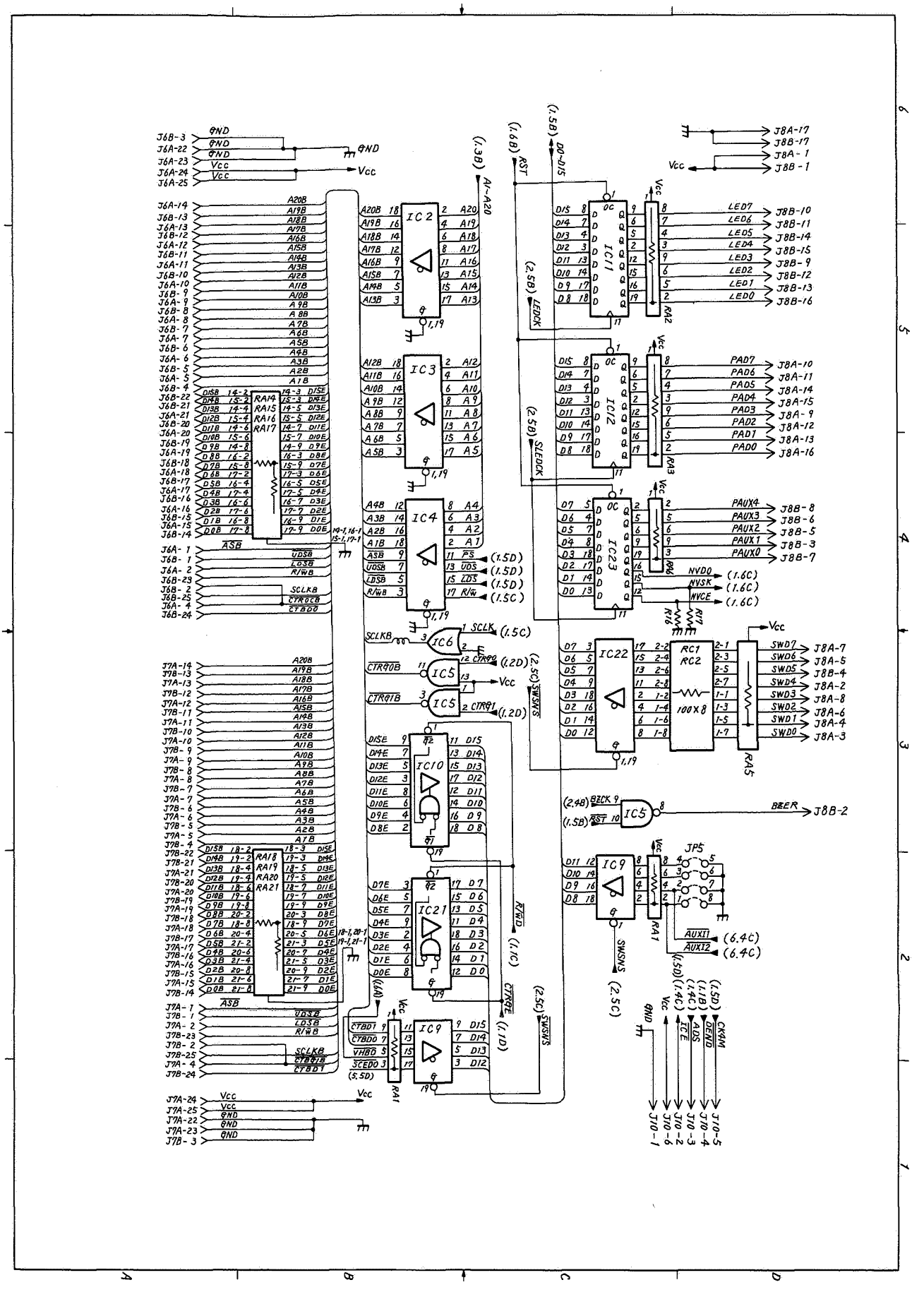

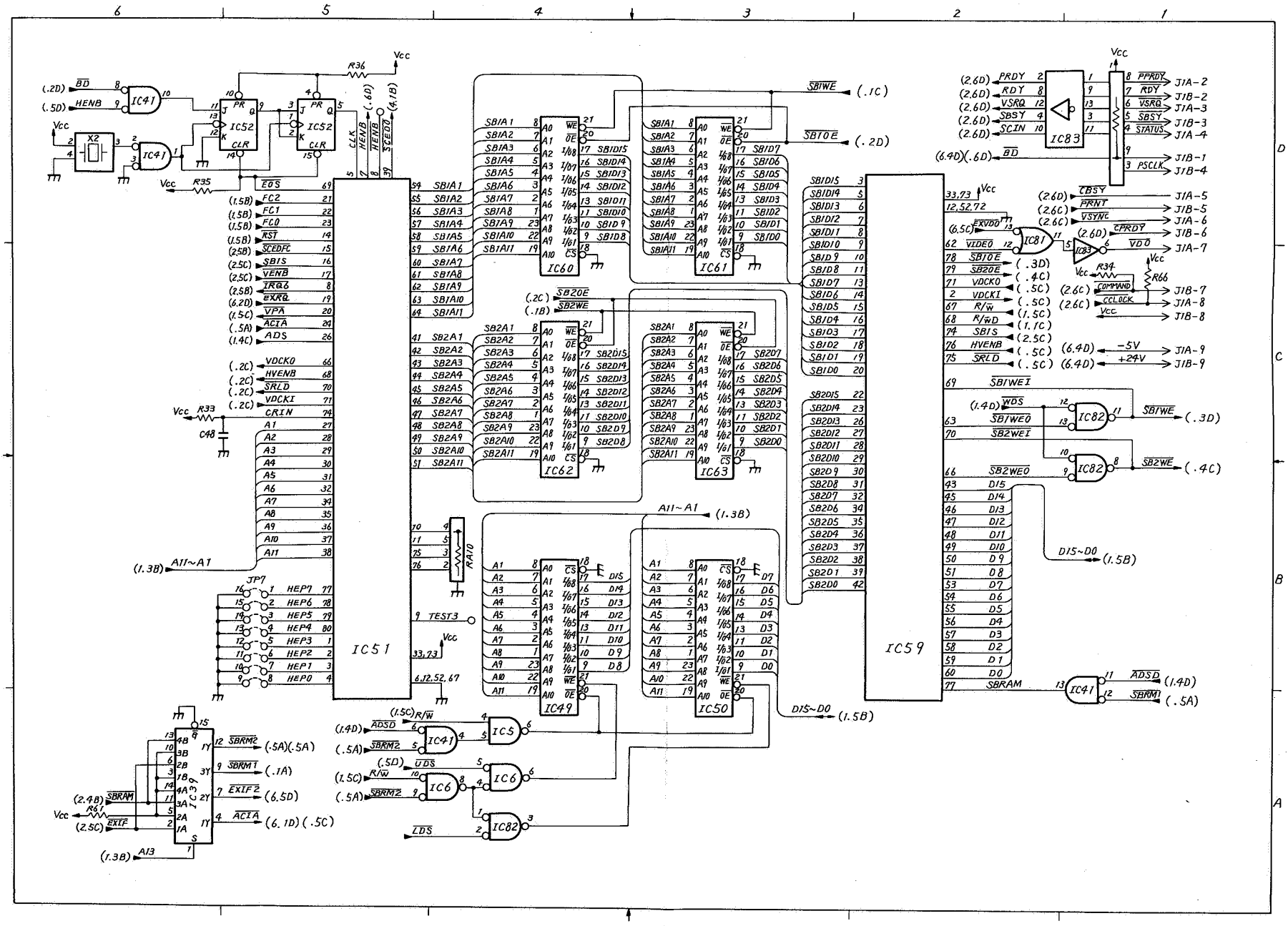

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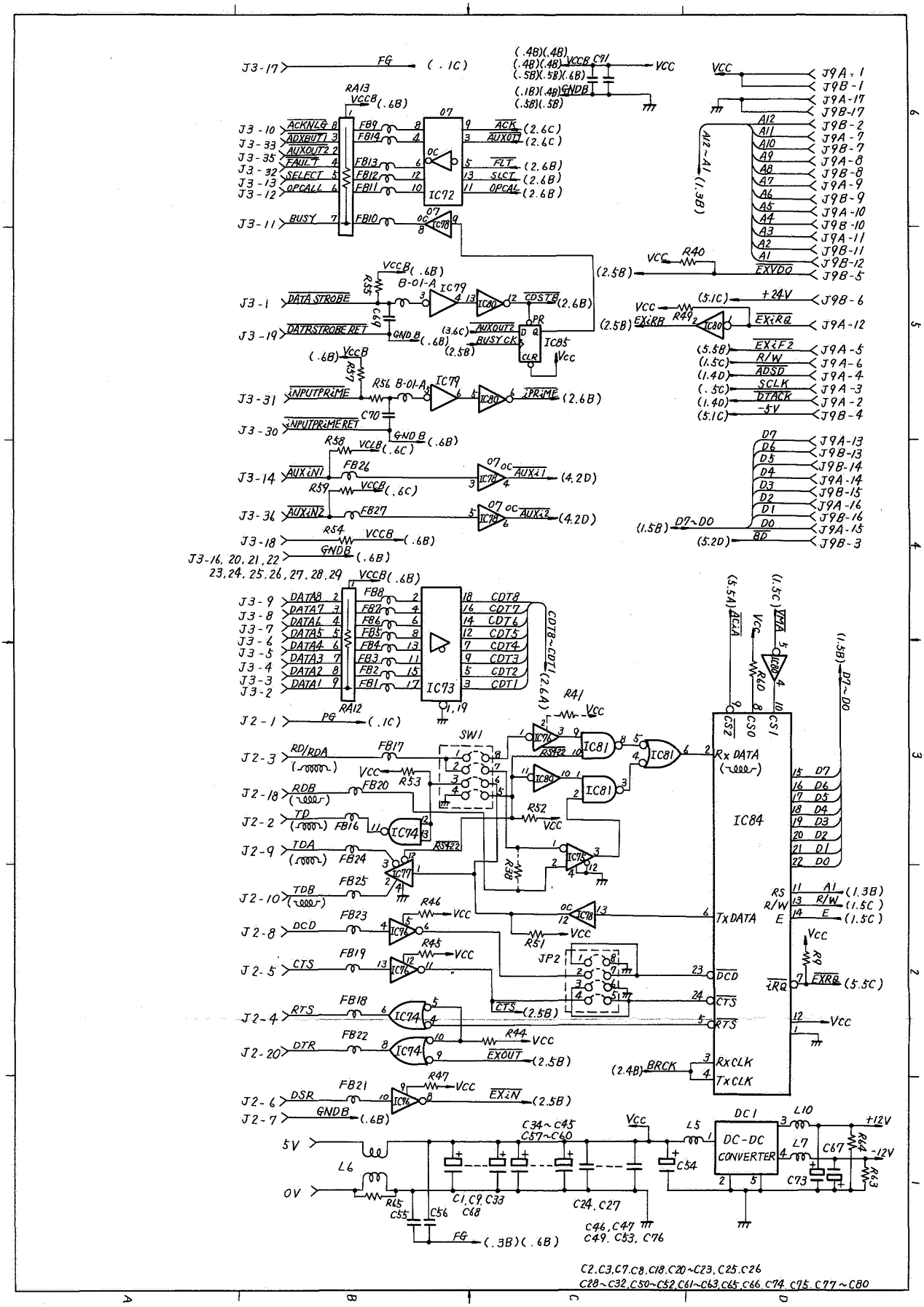

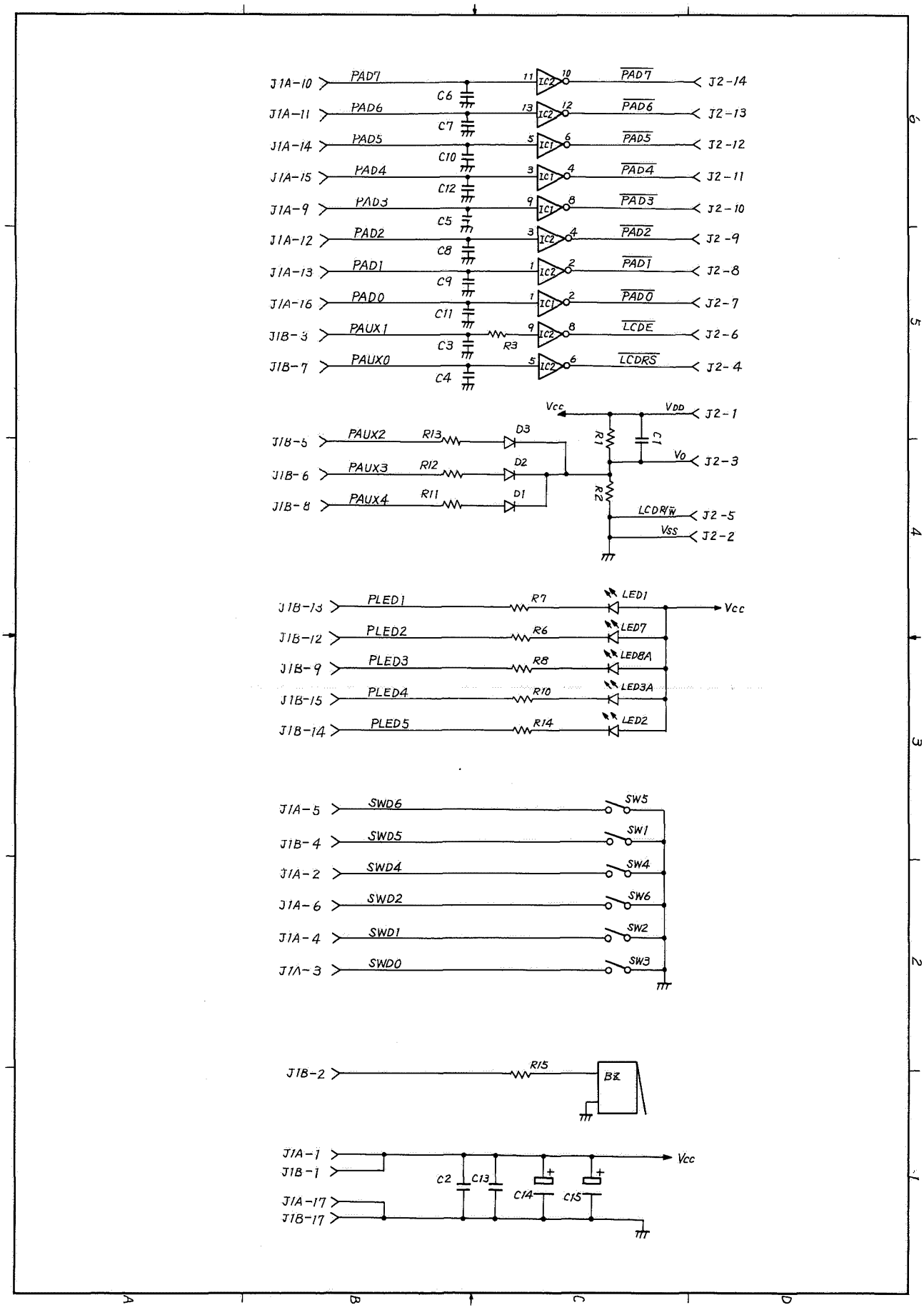

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IX. JUMPER AND SWITCH SETTINGS

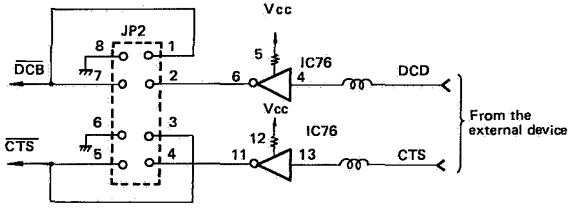
A. DC Controller

Jumper No.	Purpose	Remarks
JP201 JP202	Connect JP201 and JP202 when setting the reference power of the semiconductor laser only with a resistor.	The jumpers are usually factory-set. They should not be field-set.
JP203 JP204 JP205	Set printer resolution. Not connected: 240 DPI/300 DPI Connected: 400 DPI	
JP206	Set the right and left margins of paper. Not connected: 3mm Connected: 0.5mm	
JP207	Determines whether the main motor is to rotate once every 30 minutes when the printer stands by for over 30 minutes. Not connected: To rotate Connected: Not to rotate	

B. Video Controller

Jumper No.	Purpose	Remarks
JP2	Determines whether Data Carrier Detect ($\overline{DCD}$) and Clear To Send ($\overline{CTS}$) signals from the RS-232C serial interface are to be supplies to the ACIA (IC for serial-parallel data conversion).	

Signal	Jumper setting	Description
$\overline{DCD}$	Connect 1 and 8.	Always true (low)
	Connect 2 and 7.	Supplies $\overline{DCD}$ signals from the RS-232C buffer IC (IC76).
$\overline{CTS}$	Connect 3 and 6.	Always true (low)
	Connect 4 and 5.	Supplies $\overline{CTS}$ signals from the RS-232C buffer IC (IC76).



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Jumper No.	Purpose	Remarks
JP3 JP4	Set the capacity of ROM IC chips. Note: 0 – Connected 1 – Not connected	
JP5	For factory use	

ROM NO.	ROM capacity	JP3 connection							
		8-9	7-10	6-11	5-12	4-13	3-14	2-15	1-16
ROM0 (IC30-U / IC13-L)	256k bit					1	0	1	0
	512k bit					0	1	1	0
	1M bit MASK ROM					0	1	0	1
	1M bit EPROM					0	1	0	1
ROM1 (IC31-U / IC14-L)	256k bit	1	0	1	0				
	512k bit	0	1	1	0				
	1M bit MASK ROM	0	1	0	1				
	1M bit EPROM	0	1	0	1				

ROM NO.	ROM capacity	JP4 connection							
		8-9	7-10	6-11	5-12	4-13	3-14	2-15	1-16
ROM2 (IC33-U / IC15-L)	256k bit					1	0	1	0
	512k bit					0	1	1	0
	1M bit MASK ROM					0	1	0	1
	1M bit EPROM					0	1	0	1
ROM3 (IC33-U / IC16-L)	256k bit	1	0	1	0				
	512k bit	0	1	1	0				
	1M bit MASK ROM	0	1	0	1				
	1M bit EPROM	0	1	0	1				

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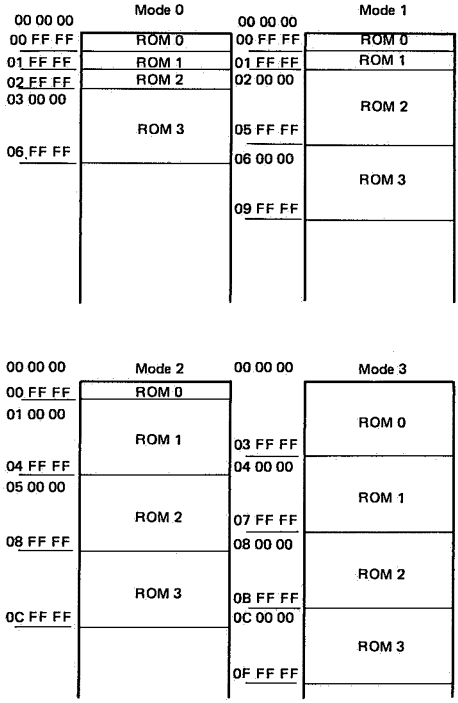
Jumper No.	Purpose	Remarks
JP6	Sets address space modes for ROM0 to ROM3 (see the note below) according to their capacity.	

JP6 / Mode No.	2-3	1-4
Mode 0	0	0
Mode 1	0	1
Mode 2	1	0
Mode 3	1	1



Note: ROM0 ... IC30 (UPPER), IC13 (LOWER)
ROM1 ... IC31 (UPPER), IC14 (LOWER)
ROM2 ... IC32 (UPPER), IC15 (LOWER)
ROM3 ... IC33 (UPPER), IC16 (LOWER)

JP8	For factory use	
SW1	Determines an interface used, RS-232C or RS-422, for connection to the external device. RS-232C: Set bits 2 and 7, and 4 and 5 to ON. The others are OFF. RS-422 : Set bits 1 and 8, and 3 and 6 to ON. The others are OFF.	

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