brother

LASER PRINTER
SERVICE MANUAL

MODEL:HL-720/730/730Plus

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PREFACE

This service manual contains basic information required for after-sales service of the laser printer (here- in-after referred to as "this machine" or "the printer"). This information is vital to the service technical in maintaining the high printing quality and performance of the printer.

This service manual covers both HL-720 and HL-730/730Plus.

This manual consists of the following chapters:

Chapter I : **Features and Specifications**
Features, specifications, etc.

Chapter II : **Theory of Operation**
Basic operation of the mechanical system, the electrical system and the electrical circuit, and their timing.

Chapter III : **Disassembly and Reassembly**
Procedures of disassembling and reassembling the mechanical system.

Chapter IV : **Troubleshooting**
Reference values and adjustment, troubleshooting for image defects, troubleshooting for malfunctions, etc.

APPENDICES : Connection diagrams, PCB circuit diagrams

Note: There are each captions for HL-720 and HL-730/730Plus to divide this manual according to the contents. You can find the captions under the headings.Please pay attention to them.On the other hand, the headings have no captions that means the contents are common to HL-720 and HL-730/730Plus.

Information in this manual is subject to change due to improvement or re-design of the product. All relevant information in such cases will be supplied in service information bulletins (Technical Information).
A thorough understanding of this printer, based on information in this service manual and service information bulletins, is required for maintaining its quality performance and for fostering the practical ability to find the cause of troubles.

CONTENTS

CHAPTER I FEATURES AND SPECIFICATIONS

1. SYSTEM REQUIREMENTS

<<HL-720 ONLY>>

The following are the minimum system requirements to setup and operate the printer:

- IBM PC or compatible with 80486 SX or higher microprocessor
- Parallel interface (or printer port)
- 4 Mbytes or more of memory
- 10 Mbytes of space available on your hard disk for the printer driver and all fonts
- Microsoft Windows 3.1/3.11 or Windows 95

Caution: *This printer has been designed specially for Windows 3.1/3.11 and Windows 95. It cannot work in a DOS environment such as MS-DOS.*

2. FEATURES

<<HL-720>>

This printer has the following features:

600 dpi Resolution and 6 ppm Printing Speed

600 dots per inch (dpi) with microfine toner and six pages per minute (ppm) printing speed (A4 or Letter size paper).

User-Friendly Operation for Windows

The dedicated printer driver and TrueType™-compatible fonts for Microsoft® Windows 3.1 and Windows 95 are available on the floppy disks supplied with your printer. You can easily install them into your Windows system using our installer program. The driver supports our unique compression mode to enhance printing speed in Windows applications and allows you to set various printer settings including toner saving mode, custom paper size, sleep mode settings, gray scale adjustment, resolution, and so forth. You can easily set these print options through the Printer Setup Menu within the Windows Control Panel.

Printer Status Monitor with Bi-directional Parallel Interface

The printer driver can monitor your printer's status using bi-directional parallel communications.
The printer status monitor program can show the current status of your printer. When printing, the animated dialog box appears on your computer screen to show the current printing process. If an error occurs, a dialog box will appear to let you know what to correct. For example: when your printer is out of paper, the dialog box will display "Paper Empty" and instructions for the proper corrective action.

Versatile Paper Handling

The printer has a multi-purpose sheet feeder and a straight paper path mechanism. Using this mechanism, you can load A4, letter, legal, B5, A5, and executive sizes of paper, and various types of paper including envelopes, postcards, organizer paper, or a custom paper size. The multi-purpose sheet feeder also allows manual paper loading, so you can use labels and transparencies.

Auto Resolution Reduction

When printing in 600 dpi, mode with the standard memory, the printer may not be able to print due to insufficient memory. To prevent this memory error, the printer driver automatically reduces the resolution to 300 dpi or less and for successful printing

Environment-Friendly

Economy Printing Mode
This feature will save your printing cost by saving toner. It is useful to obtain draft copies for proof-reading. You can select from two economy modes, 25% toner saving and 50% toner saving, through the Windows printer driver supplied with your printer.

Sleep Mode
Sleep mode automatically reduces power consumption when the printer is not in use. The printer consumes less than 7W when in sleep mode. The time-out for auto sleep mode can be set through the Windows printer driver.

Low Running Cost
Since the toner cartridge is separate from the Drum Unit, you need to replace only the toner cartridge after around 2,200 pages printed, which is cost effective and ecologically friendly.

Enhanced Memory Management

The printer provides its own data compression technology on its printer hardware and the supplied printer driver software, which can automatically compress graphic data and font data efficiently into the printer's memory. You can avoid memory errors and print most full page 600 dpi graphic and text data, including large fonts, with the printer's standard memory.

<<HL-730/730Plus>>

This printer has the following features:

600 dpi Resolution and 6 ppm Printing Speed

600 dots per inch (dpi) with microfine toner and six pages per minute (ppm) printing speed (A4 or Letter size paper).

User-Friendly Operation for Windows

The dedicated printer driver and TrueType™-compatible fonts for Microsoft® Windows 3.1 and Windows 95 are available on the floppy disk supplied with your printer. You can easily install them into your Windows system using our installer program. The driver supports our unique compression mode to enhance printing speed in Windows applications and allows you to set various printer settings including toner saving mode, custom paper size, sleep mode settings, gray scale adjustment, resolution, and so forth. You can easily set these print options through the Printer Setup Menu within the Windows Control Panel.

Printer Status Monitor with Bi-directional Parallel Interface

The printer driver can monitor your printer’s status using bi-directional parallel communications.
The printer status monitor program can show the current status of your printer. When printing, the animated dialog box appears on your computer screen to show the current printing process. If an error occurs, a dialog box will appear to let you know what to correct. For example: when your printer is out of paper, the dialog box will display “Paper Empty” and instructions for the proper corrective action.

Versatile Paper Handling

The printer has a multi-purpose sheet feeder and a straight paper path mechanism. Using this mechanism, you can load A4, letter, legal, B5, A5, and executive sizes of paper, and various types of paper including envelopes, postcards, organizer paper, or a custom paper size. The multi-purpose sheet feeder also allows manual paper loading, so you can use labels and transparencies.

Environment-Friendly

Economy Printing Mode
This feature will save your printing costs by saving toner. It is useful for obtain draft copies for proof-reading. You can select from two economy modes, 25% toner saving and 50% toner saving, through the Windows printer driver supplied with your printer.

Sleep Mode
Sleep mode automatically reduces power consumption when the printer is not in use. The printer consumes less than 7W when in sleep mode. The time-out for auto sleep mode can be set through the Windows printer driver.

Low Running Cost
Since the toner cartridge is separate from the Drum Unit, you need to replace only the toner cartridge after around 2,200 pages printed, which is cost effective and ecologically friendly.

Remote Printer Console Program for DOS

The utility program, Remote Printer Console (RPC), is available on the floppy disk supplied with your printer. When you operate your computer in the DOS (Disk Operating System) environment, this program allows you to easily change the default settings of the printer such as fonts, page setup, emulations and so on.
This program also provides a status monitor program, which is a Terminate-and-Stay Resident (TSR) program. It can monitor the printer status while running in the background and report the current status or errors on your computer screen.

Popular Printer Emulation Support

This printer supports three printer emulation modes, HP LaserJet IIP, Epson FX-850, and IBM Proprinter XL. When you use DOS application software or Windows™ version 3.0 or earlier, you can use any of these emulations to operate the printer in the 300 dpi resolution mode. The printer also supports Auto-emulation switching between HP and Epson or HP and IBM. If you want to set the printer emulation, you can do it using the Remote Printer Console Program.

Optional Apple Macintosh / Serial Interface

The optional Apple Macintosh serial interface kit is available, which allows your printer to be connected to Apple Macintosh computers. With this option, you can use your printer with both an IBM PC, or compatible and an Apple Macintosh at the same time. This optional interface board can be used as an RS-422A interface for Macintosh or an RS-232C serial interface for IBM PC or compatible.

Enhanced Memory Management

The printer provides its own data compression technology in the printer hardware and the supplied printer driver software, which can automatically compress graphic data and font data efficiently into the printer's memory. You can avoid memory errors and print most full

3. SPECIFICATIONS

3.1 Printing

<HL-720>

Print method	Electrophotography by semiconductor laser beam scanning
Resolution	600 dots/inch (under Brother Printing Solution for Windows)
Print speed	6 page/minute (when loading A4 or letter-size paper from the multi-purpose sheet feeder)
Warm-up	Max. 20 seconds at 23°C (73.4°F)
First print	20 seconds (when loading A4 or letter-size paper from the multi-purpose sheet feeder)
Print media	Toner in a cartridge Life Expectancy: 2,200 pages/cartridge (when printing A4 or letter-size paper at 5% print coverage)
Developer	Drum unit, separated from toner cartridge

<HL-730/730Plus>

Print method	Electrophotography by semiconductor laser beam scanning
Resolution	600 dots/inch (under Brother Printing Solution for Windows) 300 dots/inch (under DOS, Apple Macintosh and other operating system)
Print speed	6 page/minute (when loading A4 or letter-size paper from the multi-purpose sheet feeder)
Warm-up	Max. 20 seconds at 23°C (73.4°F)
First print	20 seconds (when loading A4 or letter-size paper from the multi-purpose sheet feeder)
Print media	Toner in a cartridge Life Expectancy: 2,200 pages/cartridge (when printing A4 or letter - size paper at 5% print coverage)
Developer	Drum unit, separated from toner cartridge

3.2 Functions

<HL-720>

CPU	Z80 12.5 MHZ
Emulation	Windows 3.1 GDI
Printer driver	Windows™ 3.1/3.11 and Windows 95 driver, supporting Brother Native Compression mode and bi-directional capability
Interface	Bi-directional Centronics parallel interface.
Memory	0.5Mbytes Expandable up to 2.0 Mbytes with an optional memory board. MB-215W - 1.5 MB
Control panel	1 switch and 4 lamps
Diagnostics	Self-diagnostic program

<HL-730/730Plus>

CPU	MC68EC000 16 MHz
Emulation	Automatic emulation selection among HP LaserJet IIP, EPSON FX-850, and IBM Proprinter XL
Printer driver	Windows™ 3.1/3.11 and Windows 95 driver, supporting Brother Native Compression mode and bi-directional capability. Optional Macintosh® QuickDraw driver (Standard in some countries.)
Interface	Bi-directional Centronics parallel interface. RS-422A/RS-232C serial interface is optionally available.(The serial interface is a standard in some countries.)
Memory	0.5 Mbytes (HL-730) or 1.0 Mbytes (HL-730Plus) only with Data Compression Technology. Expandable up to 2.0 Mbytes with an optional memory board. MB110 - 1.0 MB (for HL-730/730Plus) MB115 - 1.5 MB (for HL-730 only)
Control panel	1 switch and 4 lamps
Diagnostics	Self-diagnostic program

3.3 Electrical and Mechanical

<HL-720>

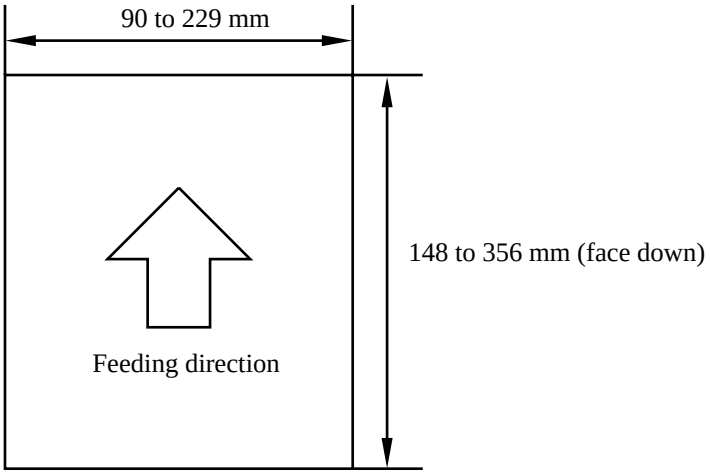
Power source	U.S.A. and Canada:	AC 110 to 120V, 50/60Hz
	Europe and Australia:	AC 220 to 240V, 50Hz
Power consumption	Printing:	150 W or less
	Standing by:	35 W or less
	Sleep:	7 W or less
Noise	Printing:	48 dB A or less
	Standing by:	35 dB A or less
Temperature	Operating:	10 to 32.5°C (59 to 90.5°F)
	Storage:	0 to 40°C (38 to 104°F)
Humidity	Operating:	20 to 80% (without condensation)
	Storage:	20 to 80% (without condensation)
Dimensions (W x D x H)	366 (W) x 353 (D) x 250 (H) (when the output tray is closed and the Multi-purpose sheet feeder is removed.)	
Weight	Approx. 6.5 kg (14.3 lb.) including the drum unit	

<HL-730/730Plus>

Power source	U.S.A. and Canada:	AC 110 to 120 V, 50/60Hz
	Europe and Australia:	AC 220 to 240 V, 50Hz
Power consumption	Printing:	150 W or less
	Standing by:	35 W or less
	Sleep:	7 W or less
Noise	Printing:	48 dB A or less
	Standing by:	35 dB A or less
Temperature	Operating:	10 to 32.5°C (59 to 90.5°F)
	Storage:	0 to 40° C (38 to 104°F)
Humidity	Operating:	20 to 80% (without condensation)
	Storage:	20 to 80% (without condensation)
Dimensions (W x D x H)	366 (W) x 353 (D) x 250 (H) (when the output tray is closed and the Multi-purpose sheet feeder is removed.)	
Weight	Approx. 6.5 kg (14.3 lb.) including the drum unit	

3.4 Paper Specification

(1) Multi-purpose tray loading
Paper size: A4, Letter, Legal, B5, A5, and Executive, and other sizes of paper that can be handled by the feed mechanism, can be loaded.



Feedable paper type:	60 (16 lb.) to 157 (42 lb.) g/m^2 (long-grained paper)
Maximum load height:	22 mm (200 sheets of 75 g/m^2 paper) letter size
Envelopes:	10 envelopes
Setting method:	Pull the paper tray cover towards you, insert the stack of paper into the tray, aligning the top edge of the sheets, then push the tray cover back to its original position.

(2) Manual paper loading
Manual paper loading takes priority over the multi-purpose tray during paper feeding and a single sheet of paper can be fed into the printer. The applicable sizes and types of paper are the same as the multi-purpose tray loading above in specification.

3.5 Print Delivery

(1) With the print output delivery tray open
Tray capacity : Maximum 100 sheets (75g/m^2), face-down only

(2) With the print delivery tray closed
Tray capacity : 1 sheet (75 g/m^2), face-down only

Note) Face down: Deliver the printed side of the paper downward.
Environment : 23°C

3.6 Paper

(1) Types of paper
(a) Normal paper (60 to 157 g/m^2, specified types of high-quality paper)

- A4 size
- Letter size
- Legal size
- B5 size
- A5 size
- Executive size
- 9" envelope size (printing area is Letter size)

*The specified types of plain paper are as follows:

Letter	:	Xerox 4200 (75 g/m^2)
A4	:	Xerox 80 Premier Paper

(b) Special paper (specified types)

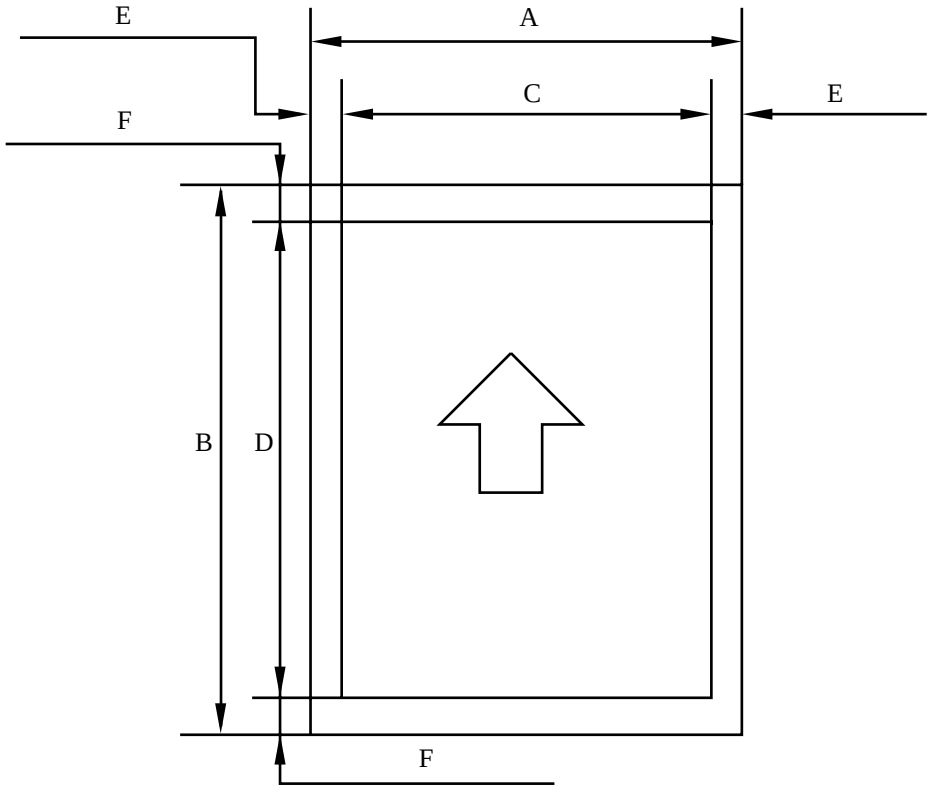
- Labels
- Envelopes (DL,C5, COM10)
- Postcards
- Organizers (K, L, and J sizes of DAY-TIMERS)

(2) Paper feed conditions

Types	Name	Tray feed	Manual feed
Normal paper (cut sheet)	60 to 157 g/m^2 paper	○	○
Special paper (cut sheet)	Labels	○	○
	Envelopes	○	○
	Postcards	○	○
	Organizers	○	○

3.7 Effective Printing Area

Printable area



The effective printing area means the area within which the printing of all the data received without any omissions can be guaranteed.

The table below shows the effective printing areas.

Size	A	B	C	D	E	F
A 4	210.0mm 8.27” (2,480 dots)	297.0mm 11.69” (3,507 dots)	203.2mm 8.0” (2,400 dots)	288.5mm 11.36” (3,407 dots)	3.4mm 0.13” (40 dots)	4.23mm 0.17” (50 dots)
Letter	215.9mm 8.5” (2,550 dots)	279.4mm 11.0” (3,300 dots)	203.2mm 8.0” (2,400 dots)	271.0mm 10.67” (3,200 dots)	6.35mm 0.25” (75 dots)	↑
Legal	215.9mm 8.5” (2,550 dots)	355.6mm 14.0” (4,200 dots)	203.2mm 8.0” (2,400 dots)	347.1mm 13.67” (4,100 dots)	↑	↑
B 5 (JIS)	182.0mm 7.16” (2,149 dots)	257.0mm 10.12” (3,035 dots)	170.0mm 6.69” (2,007 dots)	248.5mm 9.78” (2,935 dots)	6.01mm 0.24” (71 dots)	↑
B 5 (ISO)	176.0mm 6.93” (2,078 dots)	250.0mm 9.84” (2,952 dots)	164.0mm 6.46” (1,936 dots)	241.5mm 9.5” (2,852 dots)	↑	↑
Executive	184.15mm 7.25” (2,175 dots)	266.7mm 10.5” (3,150 dots)	175.7mm 6.92” (2,075 dots)	258.3mm 10.17” (3,050 dots)	6.35mm 0.25” (75 dots)	↑
A 5	148.5mm 5.85” (1,754 dots)	210.0mm 8.27” (2,480 dots)	135.8mm 5.35” (1,604 dots)	201.5mm 7.93” (2,380 dots)	6.01mm 0.24” (71 dots)	↑
Organizer (J size)	69.85mm 2.75” (825 dots)	127.0mm 5.0” (1,500 dots)	56.2mm 2.21” (663 dots)	118.5mm 4.66” (1,400 dots)	6.35mm 0.25” (75 dots)	↑
Organizer (K size)	95.25mm 3.75” (1,125 dots)	171.45mm 6.75” (2,025 dots)	86.78mm 3.42” (1,024 dots)	163.0mm 6.42” (1,925 dots)	↑	↑
Organizer (L size)	139.7mm 5.5” (1,650 dots)	215.9mm 8.5” (2,550 dots)	131.23mm 5.17” (1,550 dots)	207.43mm 8.17” (2,450 dots)	↑	↑
COM-10	104.78mm 4.125” (1,237 dots)	241.3mm 9.5” (2,850 dots)	92.11mm 3.63” (1,087 dots)	232.8mm 9.16” (2,750 dots)	↑	↑
MONARCH	98.43mm 3.875” (1,162 dots)	190.5mm 7.5” (2,250 dots)	85.7mm 3.37” (1,012 dots)	182.0mm 7.16” (2,150 dots)	↑	↑
C 5	162mm 6.38” (1,913 dots)	229mm 9.01” (2,704 dots)	150.0mm 5.9” (1,771 dots)	220.5mm 8.68” (2,604 dots)	6.01mm 0.24” (71 dots)	↑
DL	110mm 4.33” (1,299 dots)	220mm 8.66” (2,598 dots)	98.0mm 3.86” (1,157 dots)	211.5mm 8.33” (2,498 dots)	↑	↑

(Note that the paper sizes indicated here should conform to the nominal dimensions specified by JIS.)
A4 paper must accommodate 80 characters printed in pica pitch (203.2 mm).
The dot size is based on 300 dpi resolution.

4. SAFETY INFORMATION

4.1 Laser Safety (110 - 120V Model only)

This printer is certified as a Class 1 laser product under the US 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 dose not produce hazardous laser radiation.
Since radiation emitted inside the printer is completely confined within the protective housings and external covers, the laser beam cannot escape from the machine during any phase of user operation.

4.2 CDRH Regulations (110 -120V Model only)

The Center for Device and Radiological Health (CDRH) of the US 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.

The label for Japanese products

> MANUFACTURED : K
> BROTHER INDUSTRIES, LTD.
>
> 15-1, Naeshiro-cho, Mizuho-ku, Nagoya 467, Japan.
> This product complies with FDA radiation performance standards, 21 CFR Subchapter J.

The label for Chinese products

> MANUFACTURED : C
> Brother Corporation (Asia) Ltd.. Shenzhen Buji Nan Ling Factory Gold Garden Ind., Nan Ling Village, Buji, Rong Gang, Shenzhen, CHINA.
> This product complies with FDA radiation performance standards, 21 CFR Subchapter J.

4.3 Caution for Laser Product

(1) CAUTION: When the machine during servicing is operated with the cover open, the regulations of VBG 93 and the performance instructions for VBG 93 are valid.

(2) CAUTION: In case of any trouble with the laser unit, please replace the complete laser unit. To prevent direct exposure to the laser beam, do not try to open the enclosure of the laser unit.

(3) Location of the Laser Beam Exit Opening.

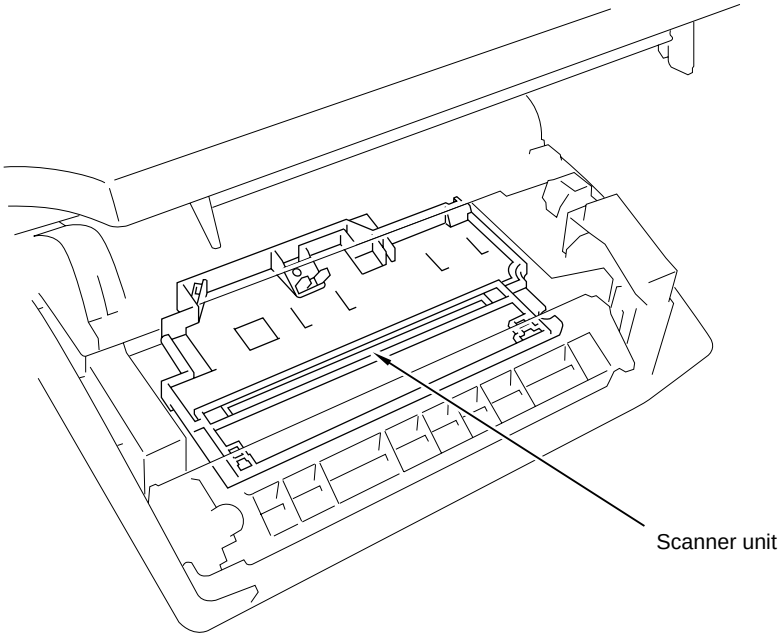


Fig. 1.2

(4) Location of the Caution Label for Laser Products.

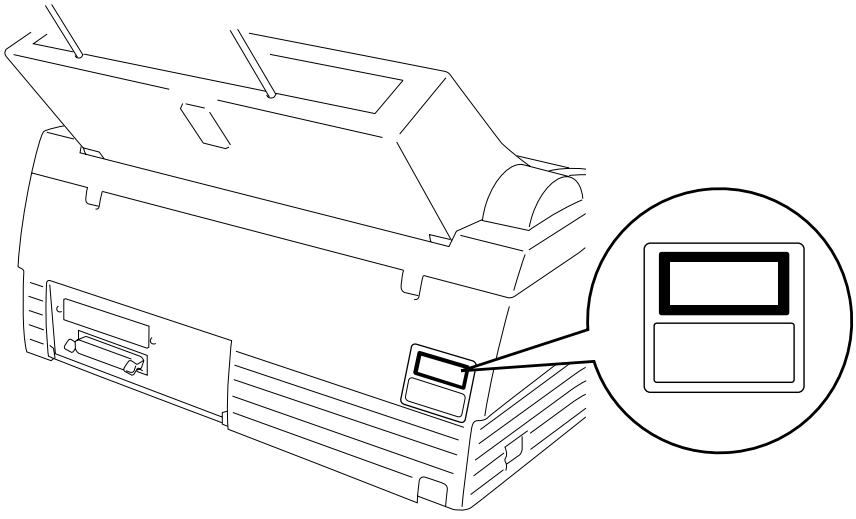


Fig. 1.3

CHAPTER II THEORY OF OPERATION

1. ELECTRONICS

1.1 General Block Diagram

<HL-720>

Fig. 2.1 shows a general block diagram of this printer.

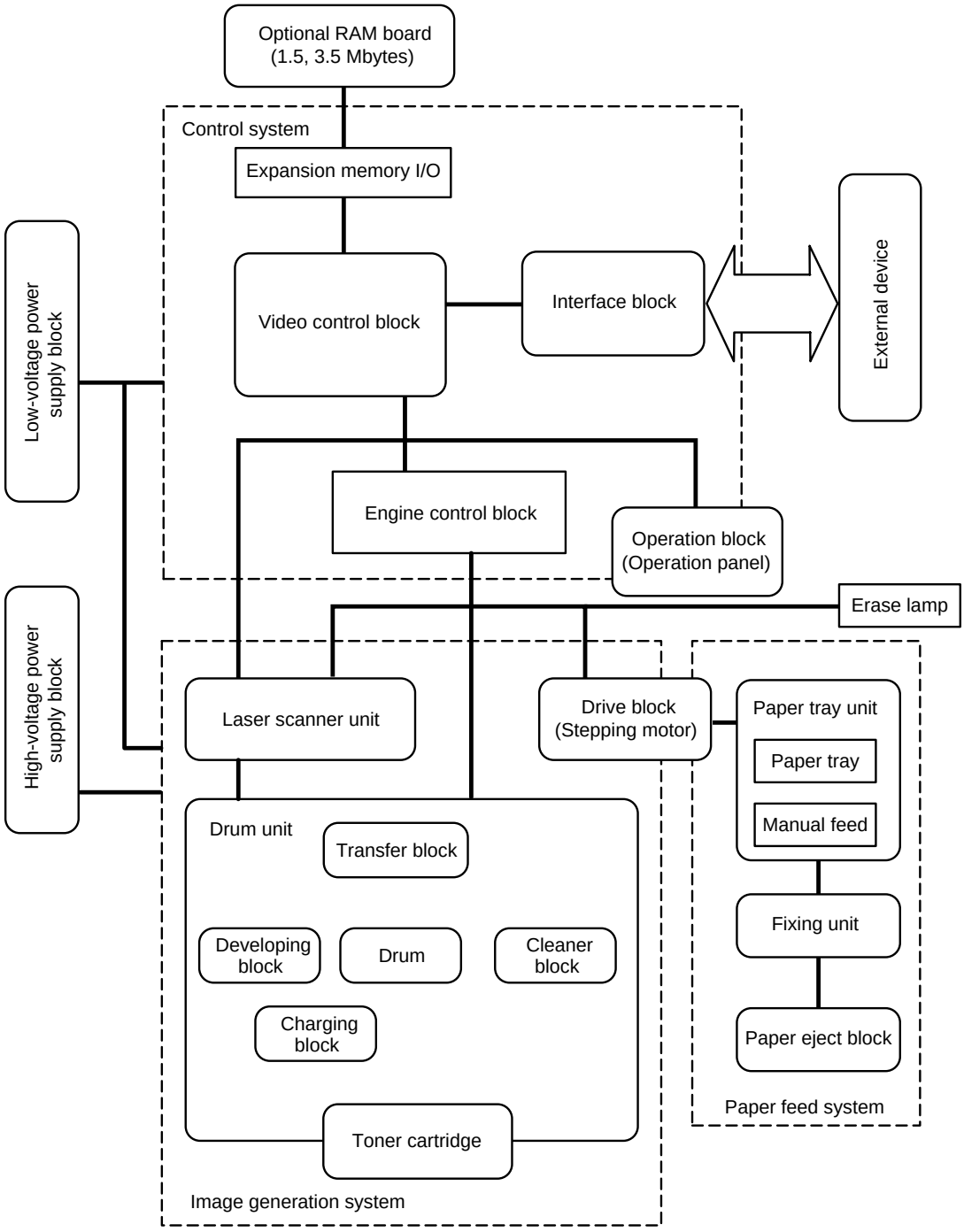


Fig. 2.1

<HL-730/730Plus>

Fig. 2.2 shows a general block diagram of this printer.

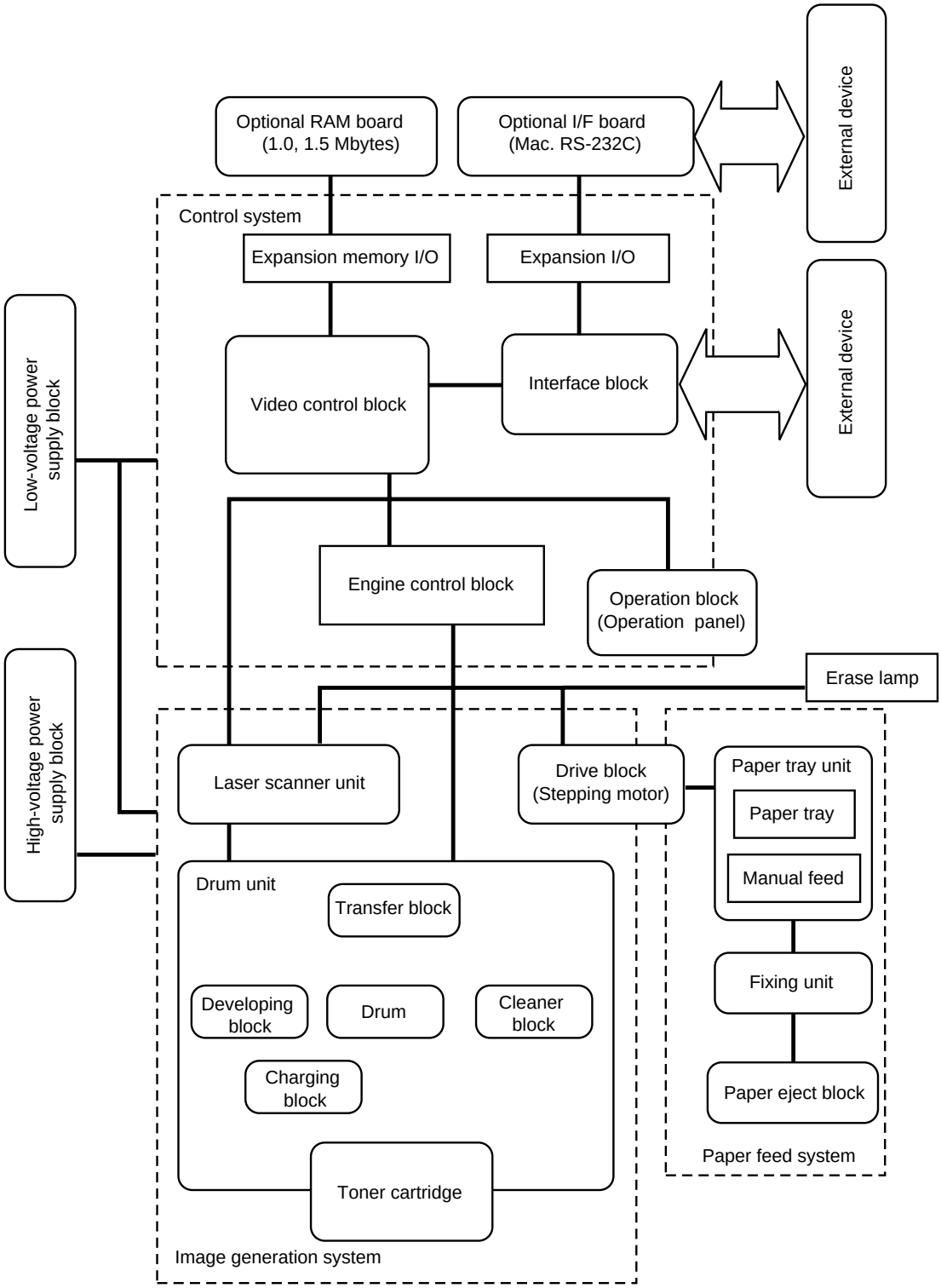


Fig. 2.2

1.2 Main PCB Block Diagram

<HL-720>

Fig. 2.3 shows a block diagram of the main PCB.

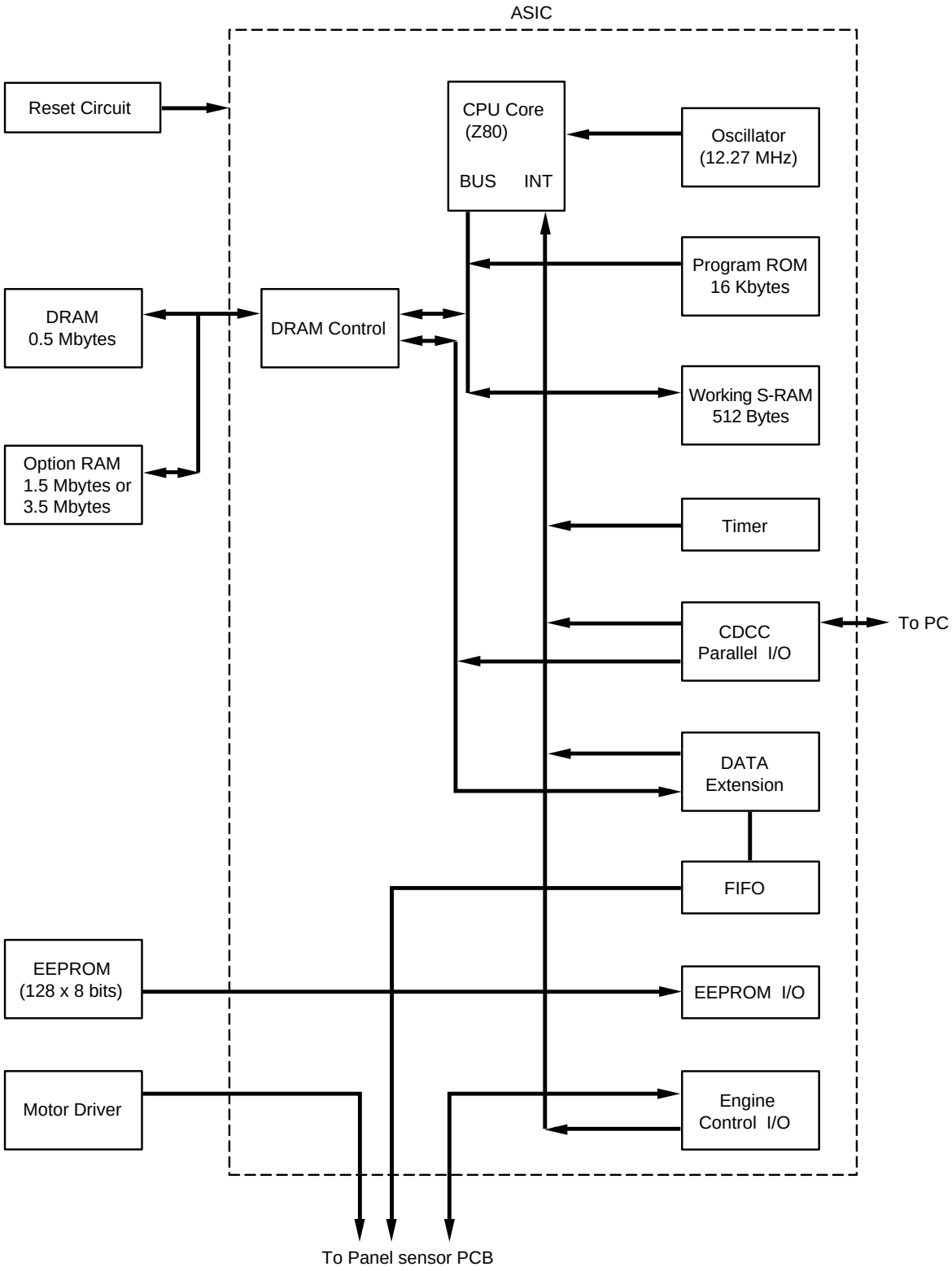


Fig. 2.3

<HL-730/730Plus>

Fig. 2.4 shows a block diagram of the main PCB.

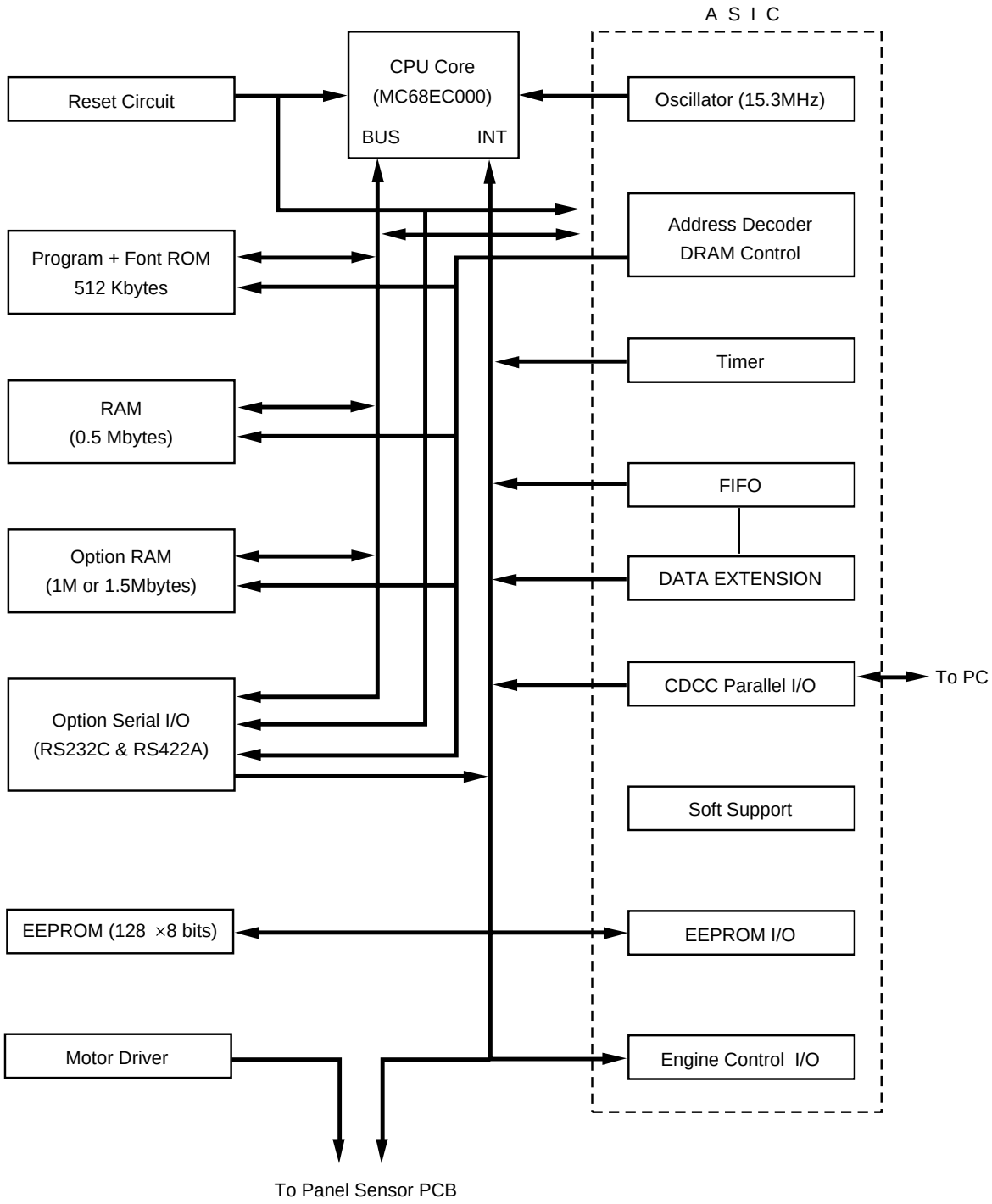


Fig. 2.4

1.3 Main PCB

1.3.1 CPU Core

<HL-720>

Fig. 2.5 shows the ASIC circuit block on the main PCB.

The CPU core is a Z80 which is driven with a clock frequency of 12.27 MHz. This frequency is made by dividing the source clock of 24.54 MHz into two in the oscillator circuit. The address bus is 16 bits and the data bus is 8 bits. The total memory space is 64 Kbytes. The CPU core directly accesses only the program ROM and the working S-RAM, the DRAM is accessed through the DRAM control unit.

NOTE: The ASIC has the functions above.

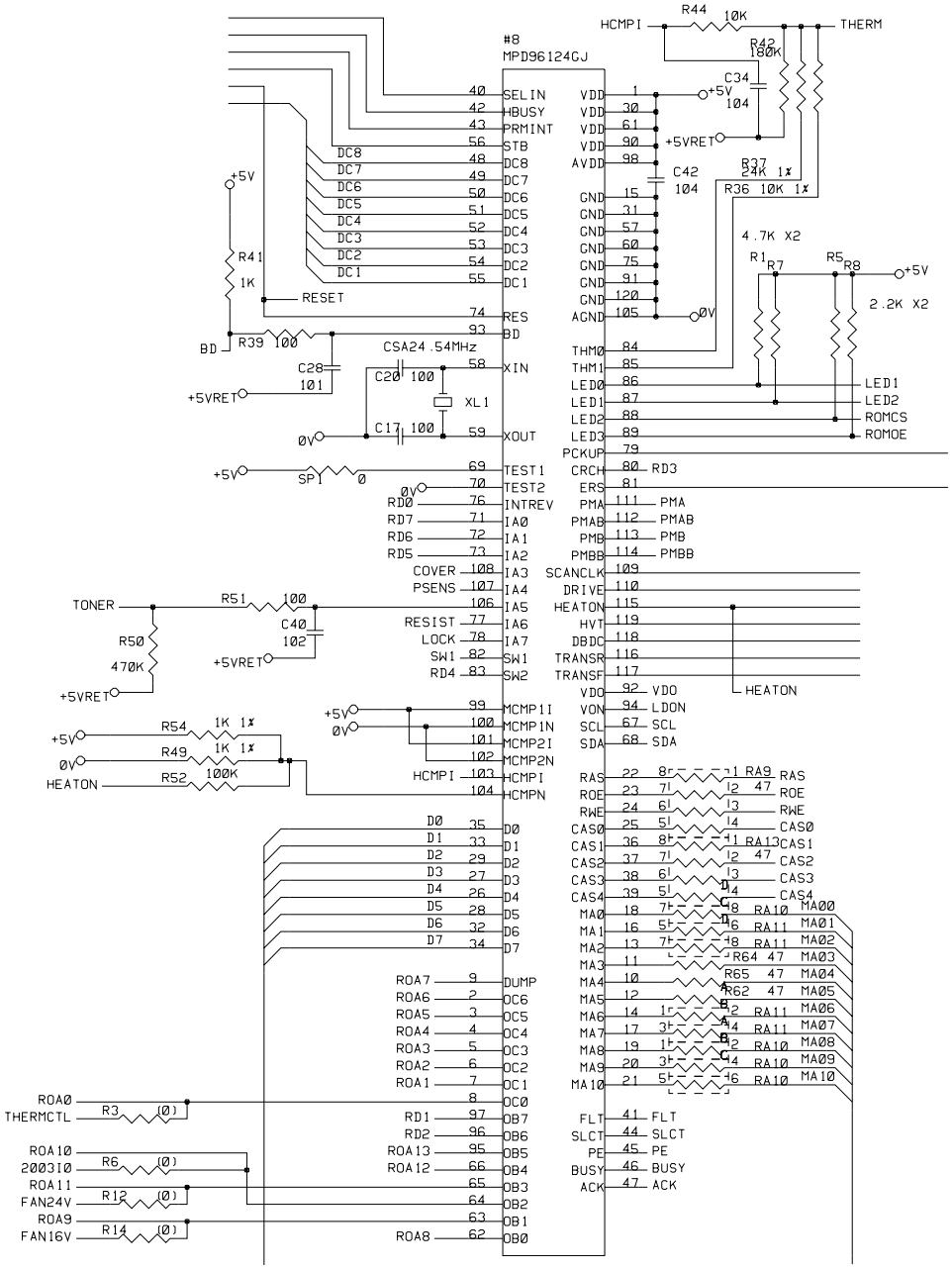


Fig. 2.5

<HL-730/730Plus>

Fig. 2.6. shows the CPU circuit block on the main PCB.

The CPU is a Motorola MC68EC000FN16 which is driven with a clock frequency of 15.3 MHz. This clock frequency is made by dividing the source clock of 30.67 MHz into two. The address bus is 23 bits of A1 to A23, and the data bus is 16 bits. The total memory space is 16 Mbytes.

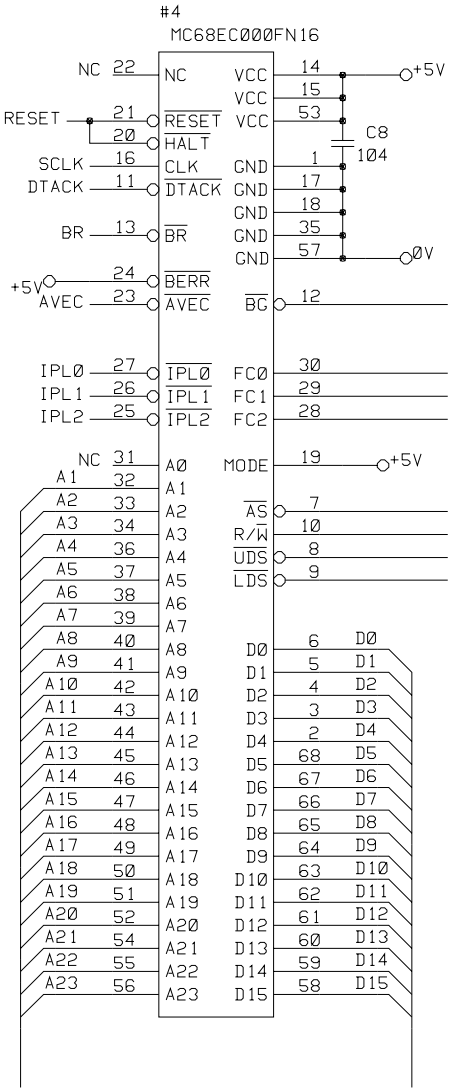


Fig. 2.6

1.3.2 ASIC

<HL-720>

The ASIC is composed of a Cell Based IC and has the following function blocks.

(1) Oscillator circuit

Oscillator circuit drives the outside ceramic resonator, and generates the main clock for the CPU core by dividing the source clock frequency into two. It is also equipped with several clocks for the timer unit, engine control I/O unit, CDCC parallel I/O unit, data extension unit and FIFO.

(2) Program ROM

The program ROM of 16 Kbytes is contained in the ASIC.

(3) Working S-RAM

S-RAM of 512 Bytes is also contained in the ASIC as working RAM for the CPU core.

(4) DRAM control circuit

This circuit generates the $\overline{RAS}$, $\overline{CAS}$, $\overline{WE}$, $\overline{OE}$ and MA signals for the DRAM and controls the refresh for the DRAM (CAS before RAS self-refreshing method). The CPU core, the CDCC parallel I/O unit and the data extension unit access the DRAM through the DRAM bus controlled by the DRAM control unit.

(5) Interrupt control

This circuit controls all the interrupts to the CPU core. The CPU core has no priority to each interrupt element. Once the first interrupt is accepted, then the second waits until the first has been completed. The interrupt elements can be masked respectively.

(6) Timers

The following timers are incorporated:

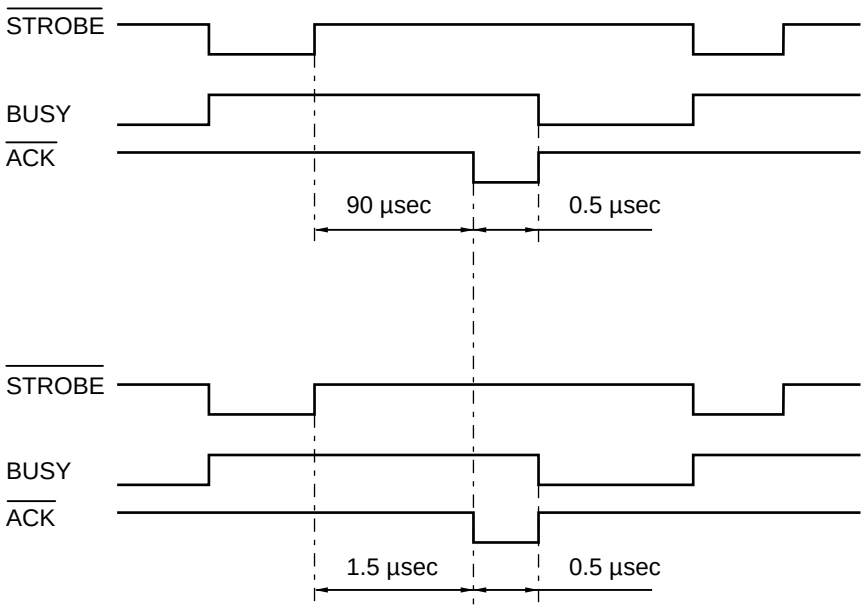
Timer 1	16-bit timer
Timer 2	10-bit timer
Timer 3	Watch-dog timer

(7) CDCC parallel I/O

<Data receiving>

There are two modes in this unit. One is the CPU receiving mode and the other is the DMA receiving mode. In the CPU receiving mode the CPU receives the command data from the PC, and, after the CPU is switched to the DMA mode, it receives the image data and writes to the DRAM directly.

CPU Receiving Mode



BUSY goes HIGH at the falling edge of STROBE. The data (8 bits) from the PC is latched in the data buffer at the rising edge of STROBE. The pulse width of ACK differs according to the speed MODE as shown above. BUSY goes LOW at the rising edge of ACK.

<IEEE1284 support>

This supports IEEE1284 data transfer in the following mode.

Nibble mode
Byte mode

(8) Data extension

This circuit expands the compressed image data which is received from the PC, and writes the bit map data to the FIFO.

(9) FIFO

A 5,120-bit FIFO is incorporated. Data for one raster is transferred from the DRAM to the FIFO through the data extension unit and exported as serial video data. The data clock cycle is 6.13 MHz.

(10)EEPROM I/O

One output port and one I/O port are assigned.

(11) Engine control I/O

This I/O is used for the connections to the panel sensor PCB. It controls the main motor, solenoid, sensors, scanner, etc.

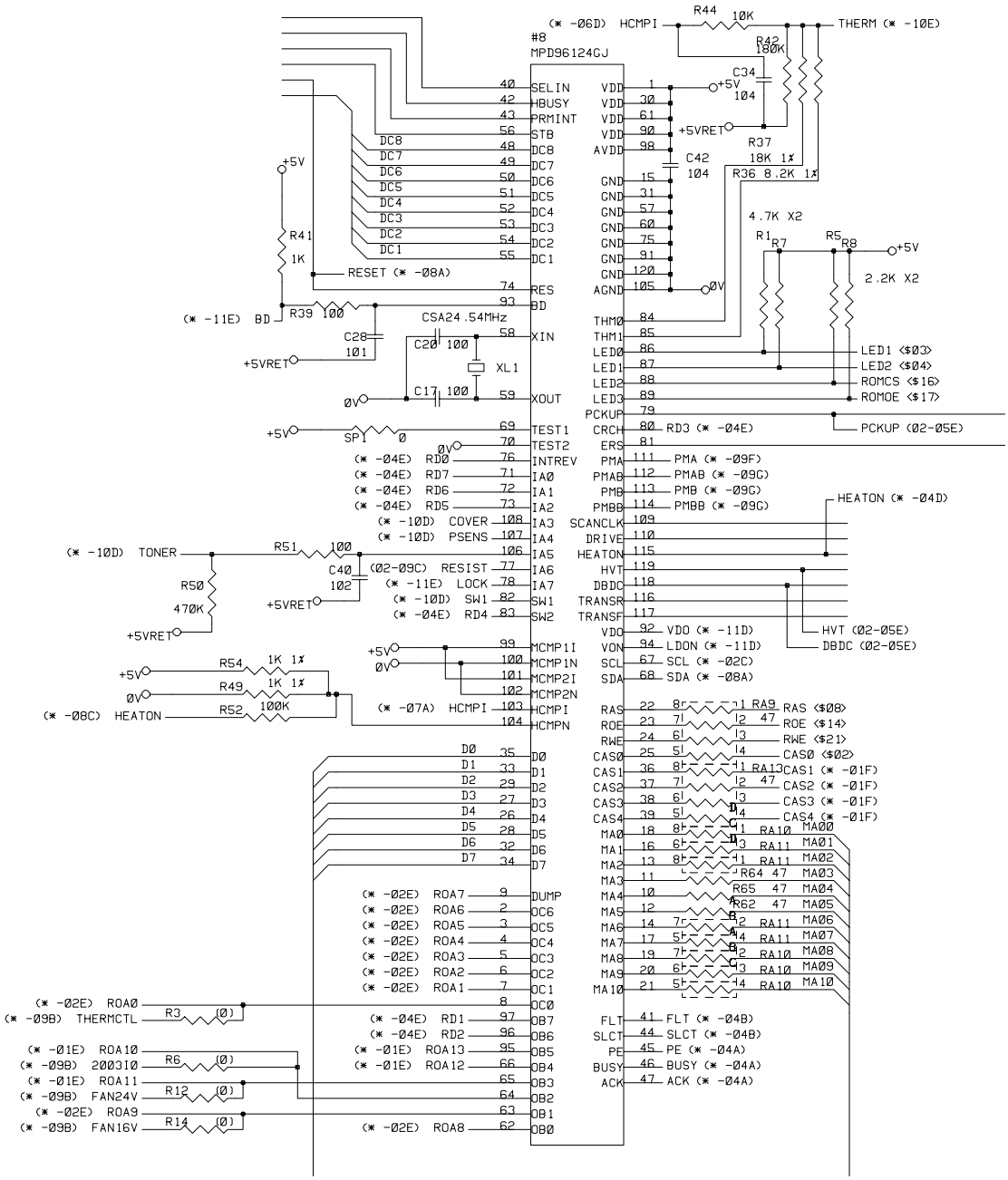


Fig. 2.7

<HL-730/730Plus>

The ASIC is composed of a Cell Based IC and has the following function blocks.

(1) Oscillator circuit

Generates the main clock for the CPU by dividing the source clock frequency into two.

(2) Address decoder

Generates the CS for each device.

(3) DRAM control

Generates the $\overline{RAS}$, $\overline{CAS}$, $\overline{WE}$, $\overline{OE}$ and MA signals for the DRAM and controls the refresh process (CAS before RAS self-refreshing method).

(4) Interrupt control

Interrupt levels:

Priority	High	7	NMI
		6	FIFO
		5	EXINT(Option Serial I/O)
		4	BD / Timer 1
		3	SCANINT
		2	CDCC / BOISE / DATA EXTENTION
	Low	1	Timer 2

(5) Timers

The following timers are incorporated:

Timer 1	16-bit timer
Timer 2	10-bit timer
Timer 3	Watch-dog timer

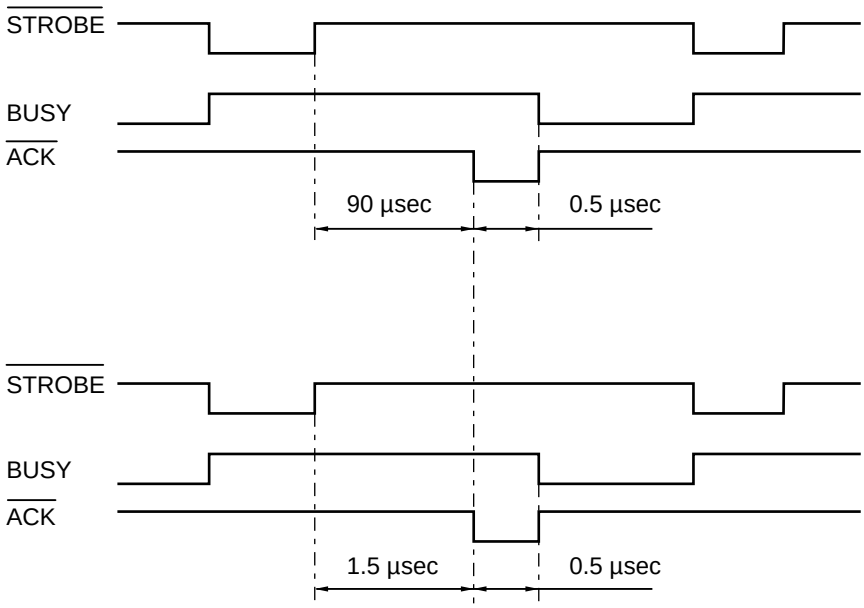
(6) FIFO

A 5,120-bit FIFO is incorporated. Data for one raster is transferred from the RAM to the FIFO by DMA transmission and is output as serial video data. The data clock cycle is 6.13 MHz.

(7) CDCC parallel I/O

<Data receiving>
There are two modes in this unit. One is the CPU receiving mode and the other is the DMA receiving mode. In the CPU receiving mode the CPU receives the command data from the PC, and, after the CPU is switched to the DMA mode, it receives the image data and writes to the DRAM directly.

CPU Receiving Mode



BUSY goes HIGH at the falling edge of STROBE. The data (8 bits) from the PC is latched in the data buffer at the rising edge of STROBE. The pulse width of ACK differs according to the speed MODE as shown above. BUSY goes LOW at the rising edge of ACK.

<IEEE1284 support>
This supports IEEE1284 data transfer in the following modes.
Nibble mode
Byte mode

(8) Data extension

This circuit expands the compressed image data which is received from the PC, and writes the bit map data to the FIFO.

(9) Software support
Supports 16 x 16 rotation, bit expansion, and bit search.

(10)EEPROM I/O
One output port and one I/O port are assigned.

(11)Engine control I/O

This I/O is used for the connections to the panel sensor PCB. It controls the main motor, solenoid, sensors, etc.

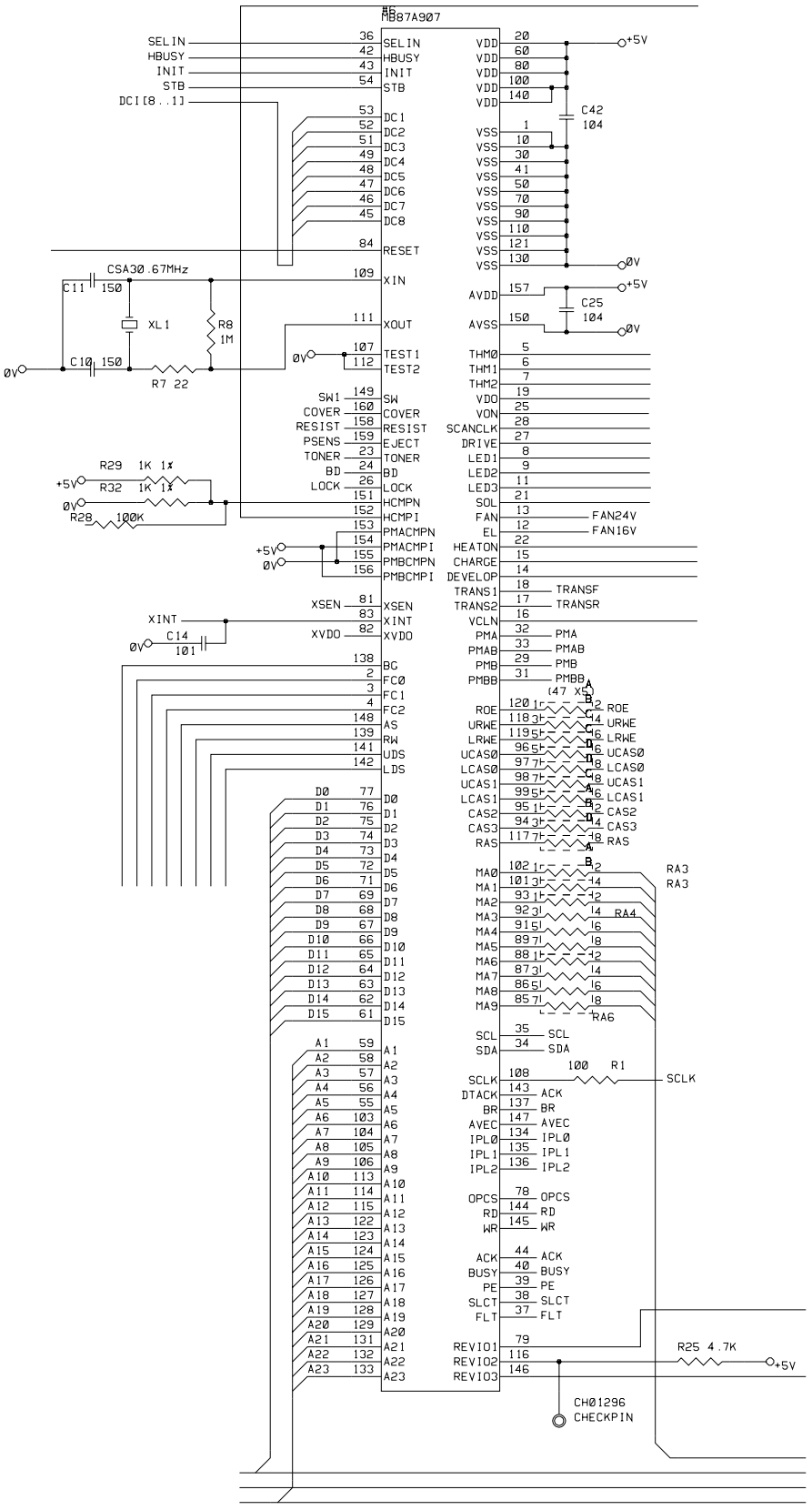


Fig. 2.8

1.3.3 ROM

<HL-730/730Plus ONLY>

A program of 512 Kbytes and the font data are stored in the ROM. A 42-pin IC socket is provided: an 8 Mbit ROM (42-pin) is mounted in this socket normally, but a 4 Mbit ROM (40-pin) can be used and must be mounted to leave the 1st and 42nd pins of the socket open circuit.

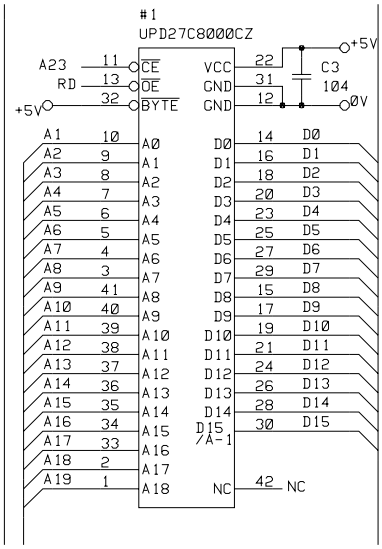


Fig. 2.9

1.3.4 DRAM

<HL-720>

A 4M-bit DRAM (x8 bits) is used as the RAM.

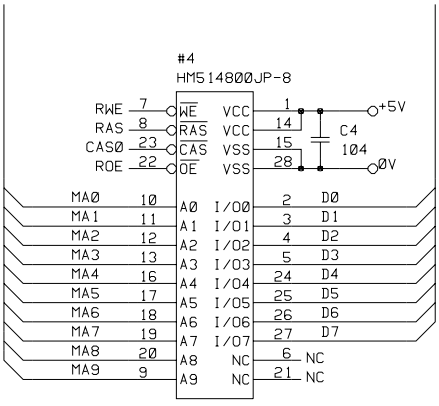


Fig. 2.10

<HL-730/730Plus>

A 4M-bit DRAM (x 16bits) is used as the RAM. Only one DRAM is installed in the 0.5 Mbyte model.

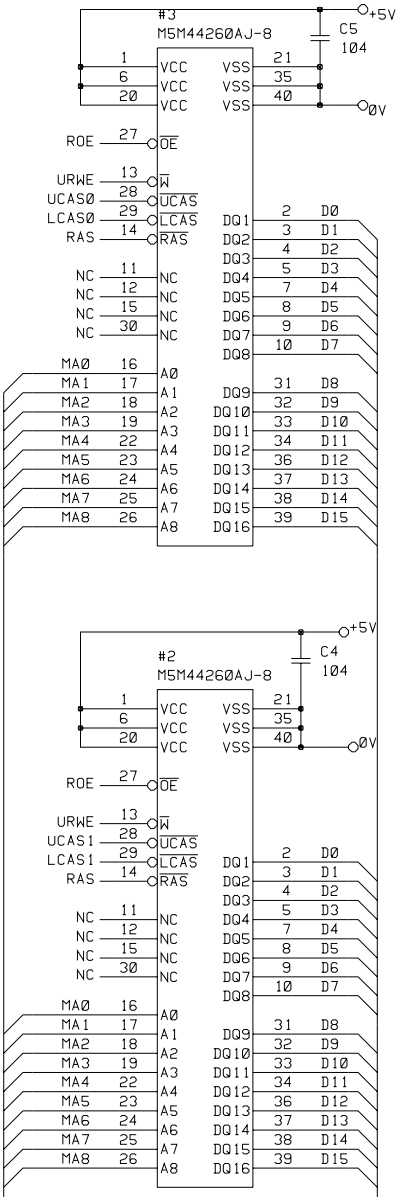


Fig. 2.11

1.3.5 Optional RAM

<HL-720>

Three 4M-bit DRAM (x 8 bits) and one 16M-bit DRAM (x 8 bits) are used as the optional RAM. The total memory area is expanded up to 4 Mbytes.

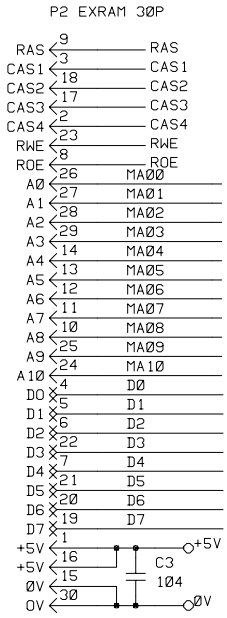


Fig. 2.12

<HL-730/730Plus>

There are two types of optional RAMs: the 1 Mbyte model and the 1.5 Mbytes model for HL-730, and one type of optional RAM: the 1Mbyte model for HL-730Plus. The memory capacity can be expanded up to 2 Mbytes for both HL-730 and HL-730Plus.

HL-730 (0.5 M model):

+ 1 M optional RAM = 1.5 Mbytes
+ 1.5 M optional RAM = 2 Mbytes

HL-730Plus (1 M model)

+ 1 M optional RAM = 2 Mbytes

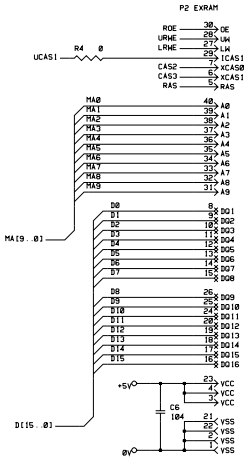


Fig. 2.13

1.3.6 Optional Serial I/O

<HL-730/730Plus ONLY>

The interrupt of the serial I/O is input to the EXINT terminal of the ASIC, and is recognized by the CPU. A 32-byte register is provided for this I/O, which is read from and written to by the CPU.

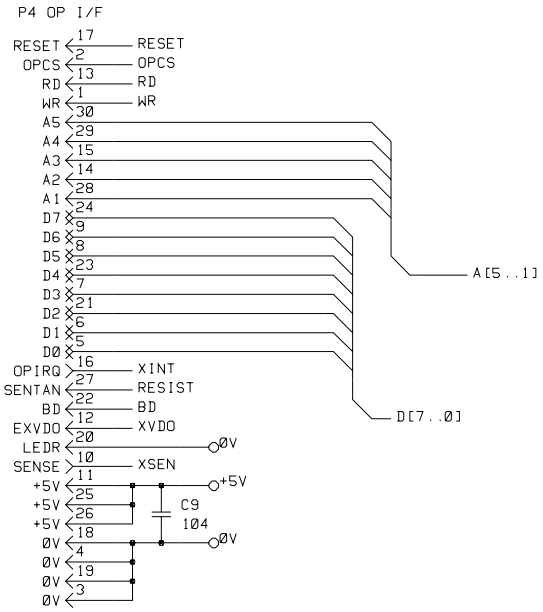


Fig. 2.14

1.3.7 EEPROM

<HL-720>

The EEPROM is XL24C01AF type of a two-wire method with a 128 x 8 bits configuration.

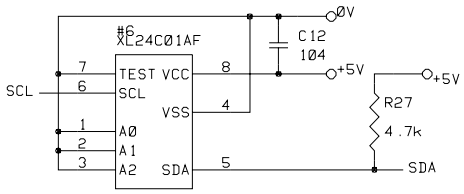


Fig. 2.15

<HL-730/730Plus>

The EEPROM is XL24C01AF type of a two-wire method with a 128 x 8 bits configuration.

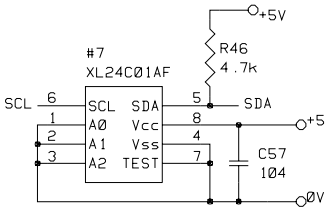


Fig. 2.16

1.3.8 Reset Circuit

<HL-720>

The reset IC is a PST591DMT. The reset voltage is 4.2V (typ.) and the LOW period of reset is 50 ms (typ.).

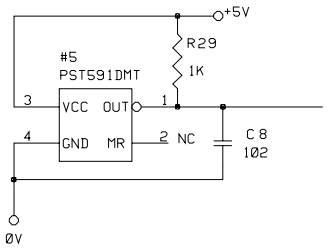


Fig. 2.17

<HL-730/730Plus>

The reset IC is a PST593DMT. The reset voltage is 4.2V (typ.) and the LOW period of reset is 200 ms (typ).

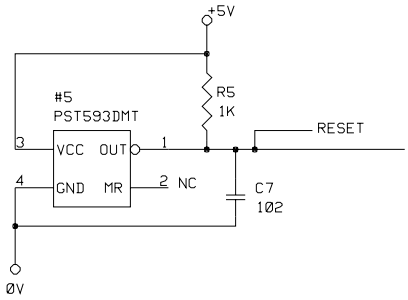


Fig. 2.18

1.3.9 CDCC I/O

<HL-720>

Fig. 2.19 shows the CDCC interface circuit.

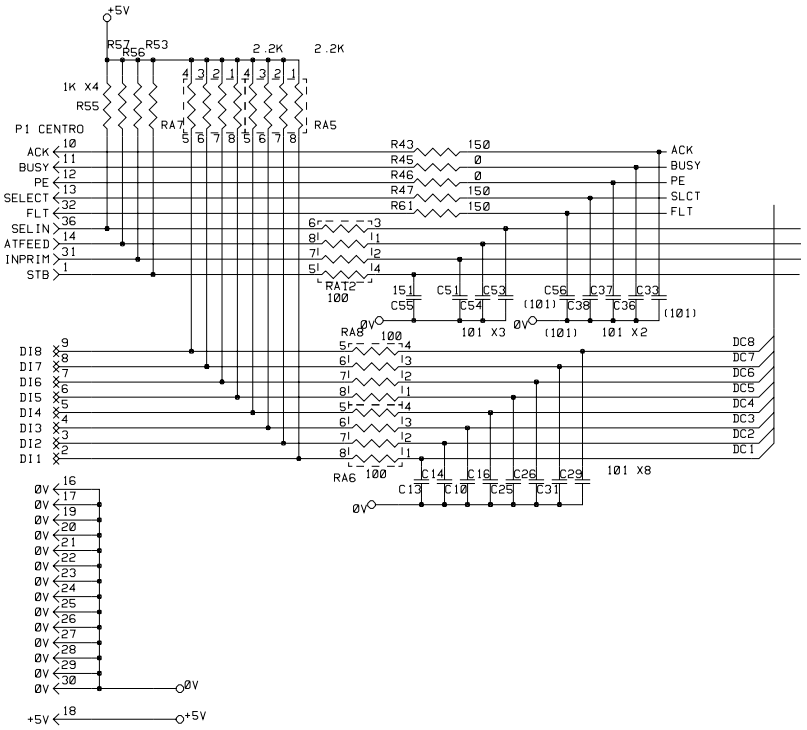


Fig. 2.19

<HL-730/730Plus>

Fig. 2.20 shows the CDCC interface circuit.

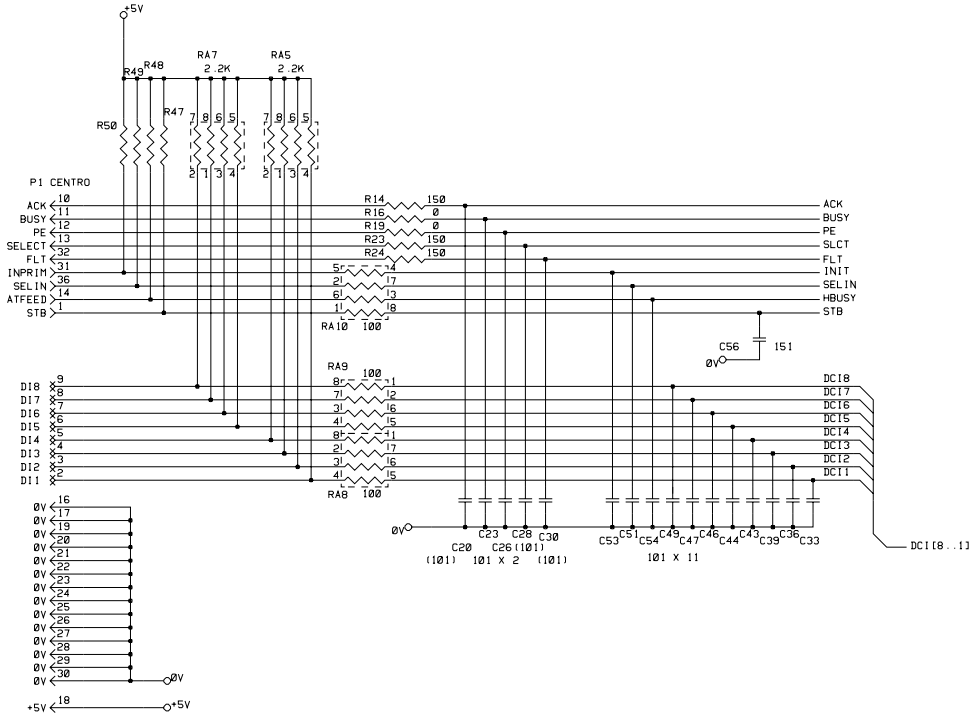


Fig. 2.20

1.3.10 Engine I/O

<HL-720>

Fig. 2.21 shows the engine interface circuit.

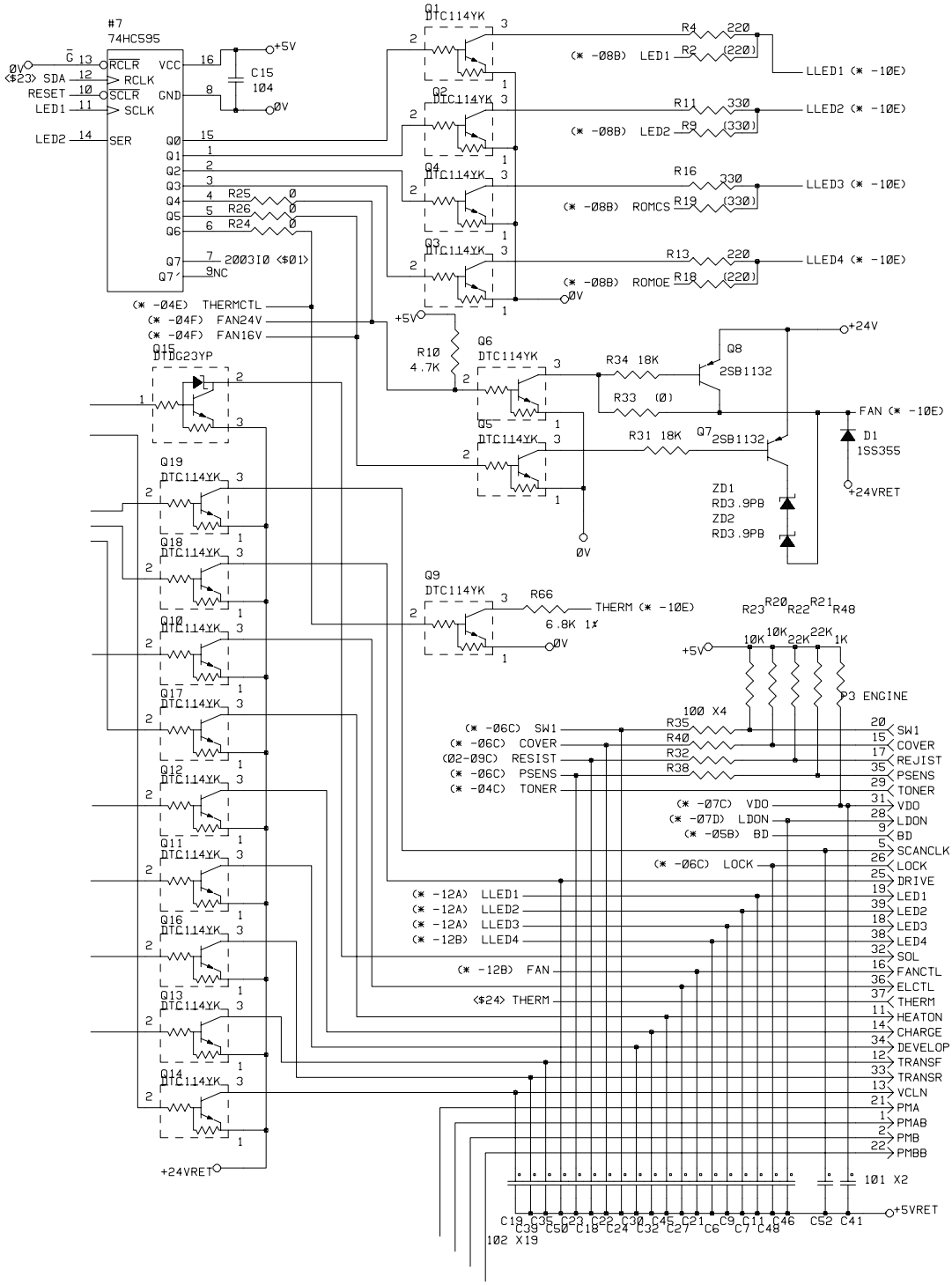


Fig. 2.21

<HL-730/730Plus>

Fig. 2.22 shows the engine interface circuit.

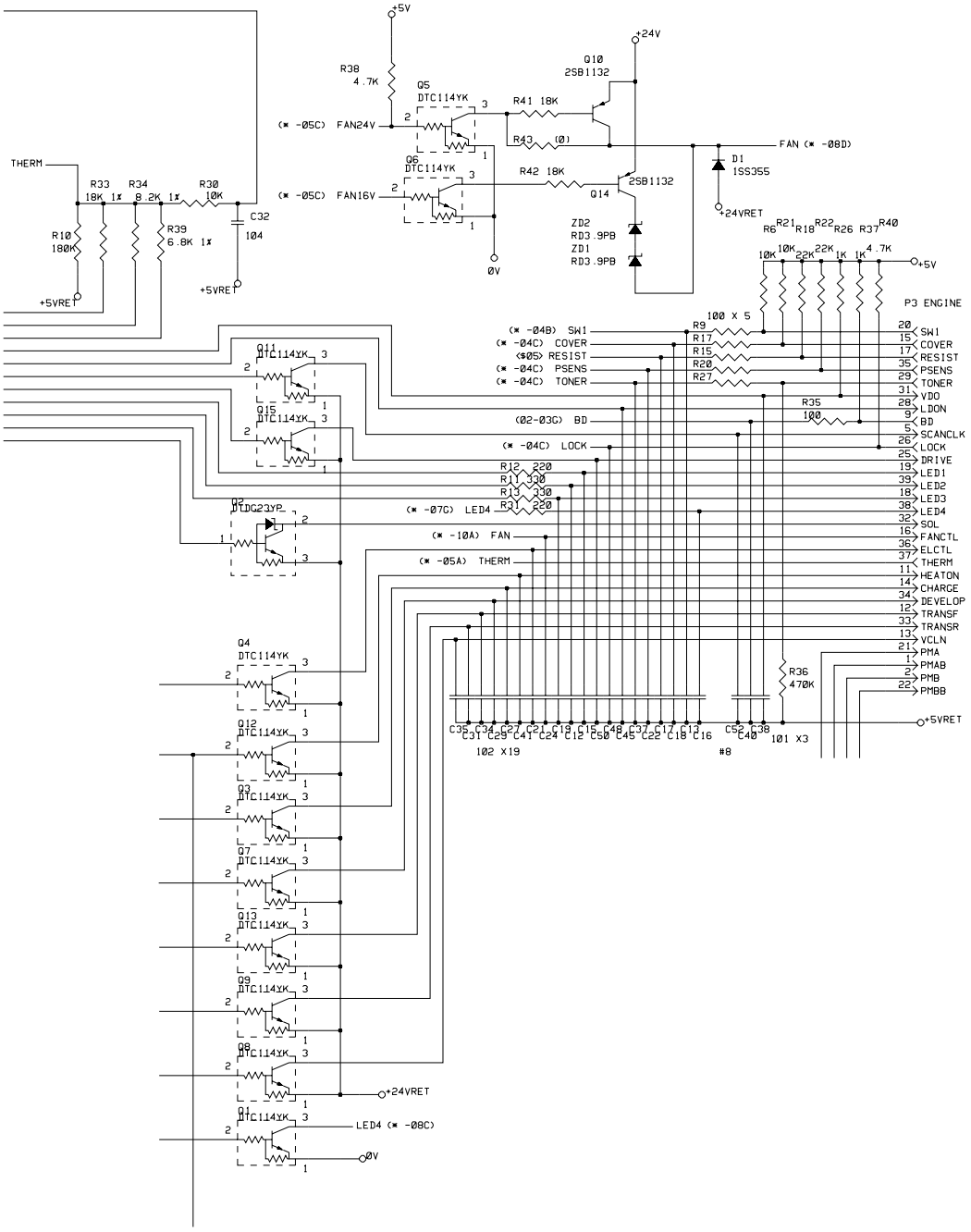


Fig. 2.22

1.3.11 Paper Feed Motor Drive Circuit

<HL-720>

The motor driver consists of a TR array. The excitation method is 2-2 phase excitation with a bipolar drive.

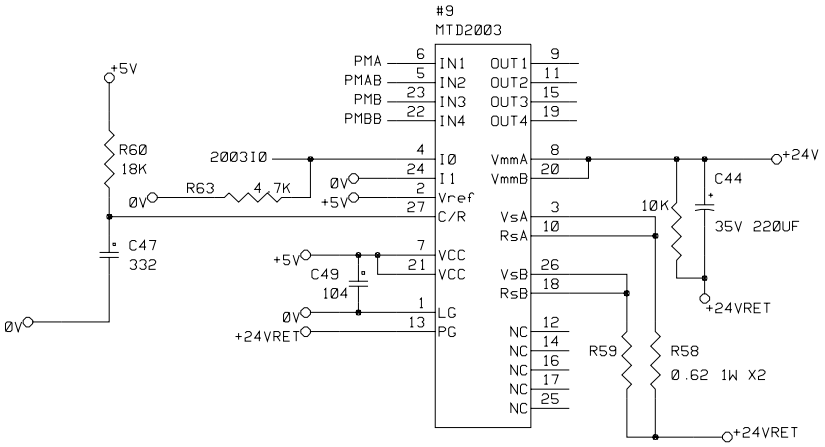


Fig. 2.23

<HL-730/730Plus>

The motor driver is a TR array, The excitation method is 2-2 phase excitation with a bipolar drive.

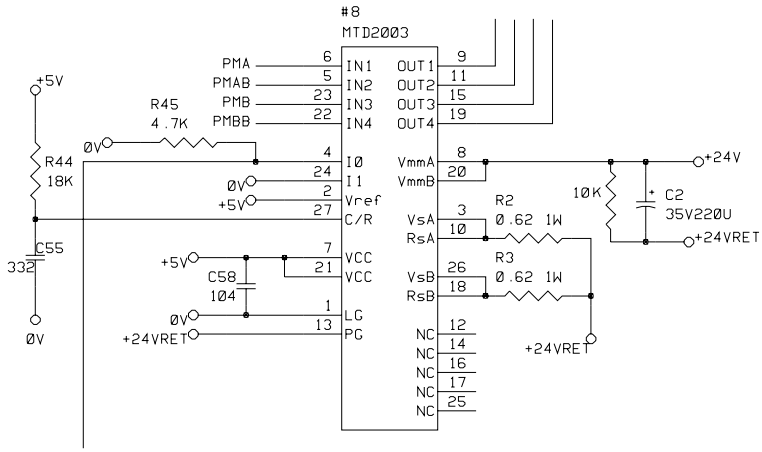


Fig. 2.24

1.4 Panel Sensor PCB

The following parts are on the panel sensor PCB.

- Operation Panel 1Key, 4LEDs
- Connectors.....Low-voltage, high-voltage, solenoid, main motor, toner sensor, laser, polygon motor, connector for main PCB
- Registration sensor

1.5 Power Supply

The power supply uses the switching regulation system to generate the regulated DC power (+5V and +24V), which are converted from the AC line.

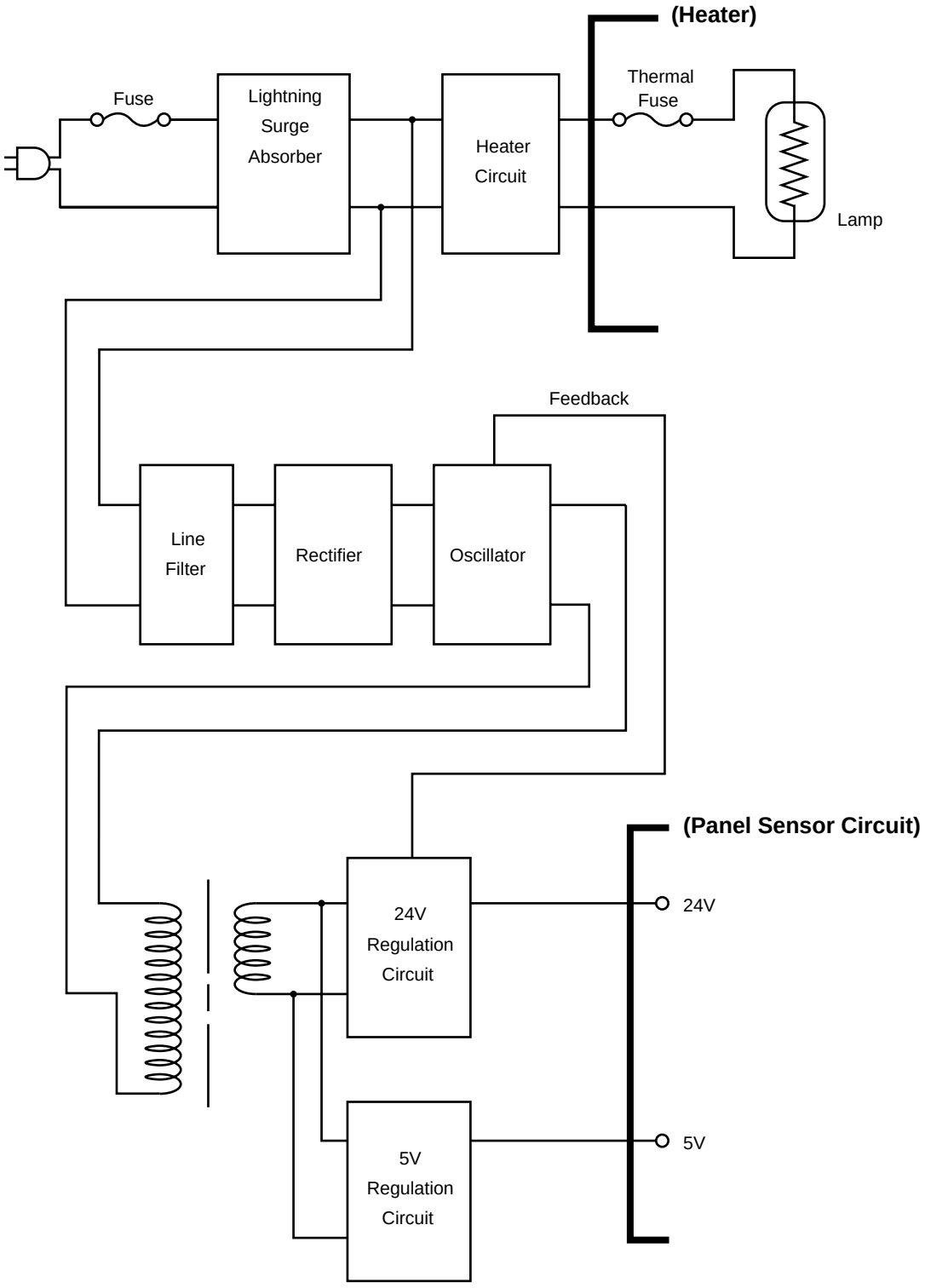


Fig. 2.25

2. MECHANICS

2.1 Overview of the printing mechanism

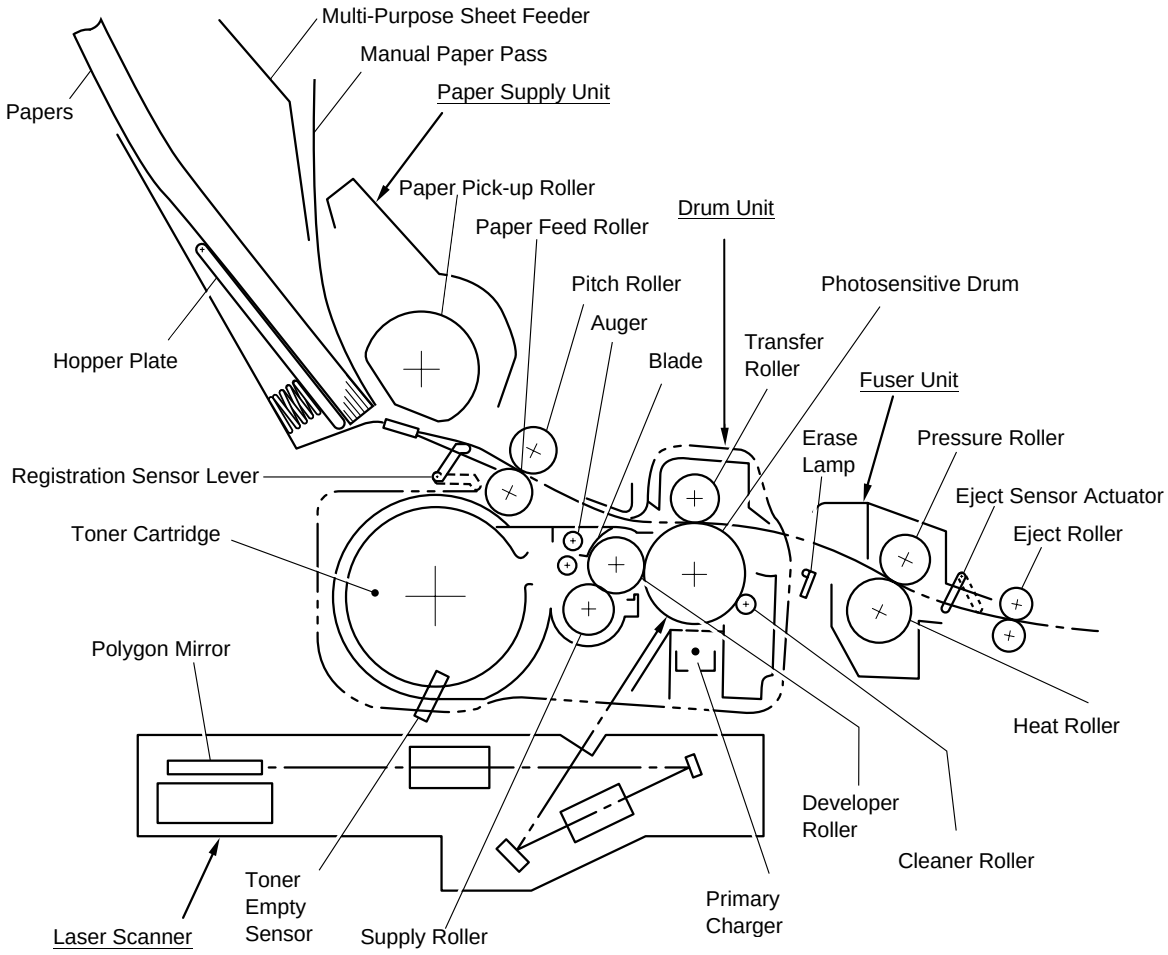
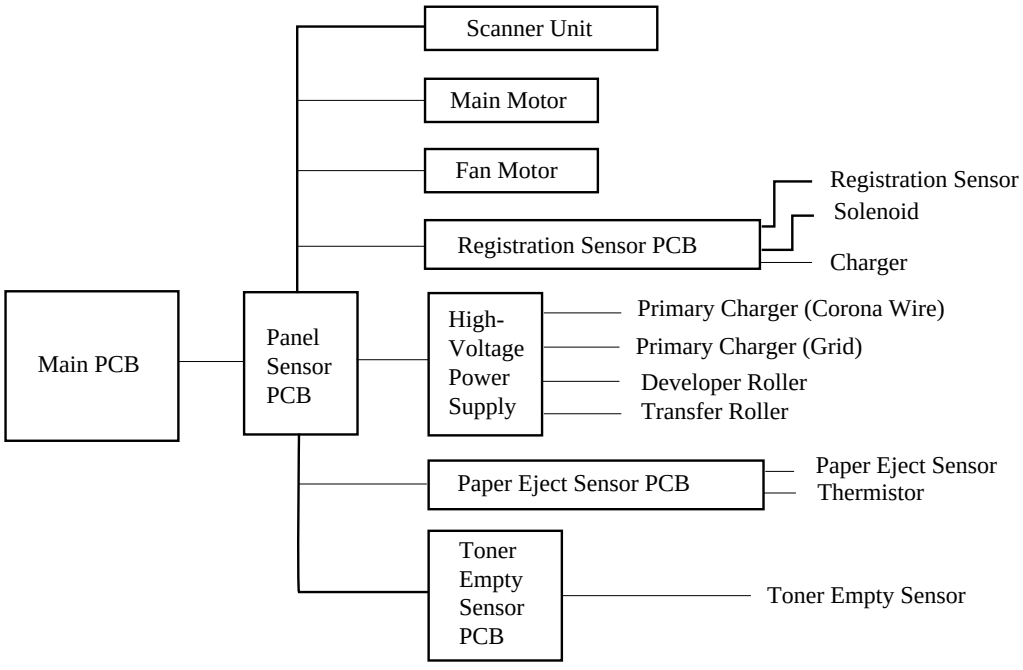


Fig. 2.26



2.2 Paper Transfer

2.2.1 Paper Supply

The pick-up roller picks up one sheet of paper from the paper tray at each single revolution and feeds it to the paper feed roller.

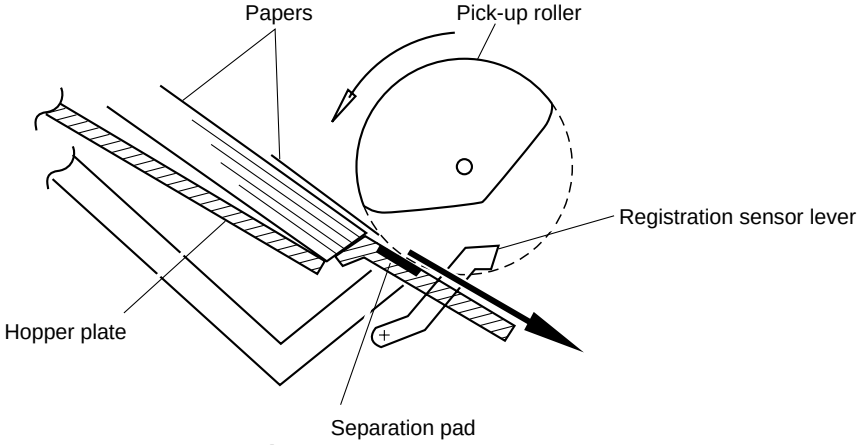


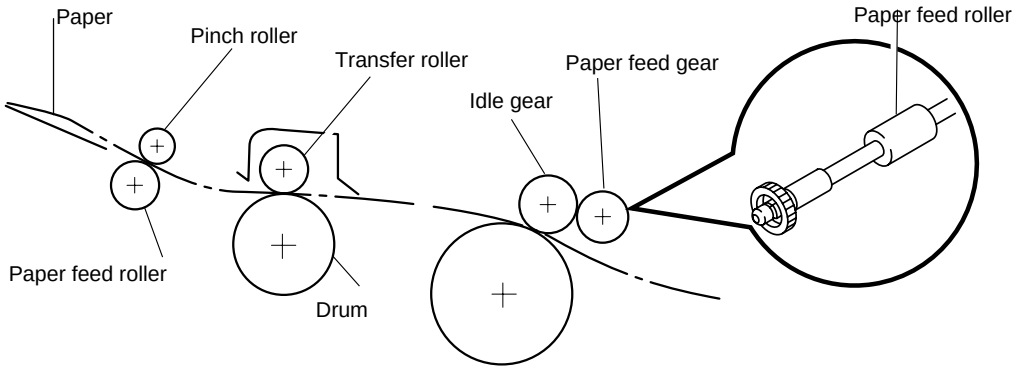
Fig. 2.27

The paper is gripped between the pick-up roller and the separation pad and separated into individual sheets.

The pick-up roller is directly connected to the sector gear, whose rotation is forcibly stopped by the gear stopper. When the pick-up solenoid is activated, the clutch mechanism is engaged by the solenoid ON/OFF operation and the sector gear is driven; when it has completed one full turn its rotation is stopped again by the gear stopper. The paper drawn out by the pick-up roller presses against the top of form sensor lever and the paper top position (or absence of paper) is detected by sensing the motion of the lever.

2.2.2 Paper Registration

When paper picked up from the multi-purpose paper tray (MPT) presses against the top of form sensor actuator, the registration sensor lever is caused to turn, and the photo sensor detects this motion. When this signal is received from the sensor, the paper feed roller rotation is stopped temporarily by the clutch. The paper is fed to the nip point between the paper feed roller and the pinch roller in the multi purpose paper tray, and the skew of the paper is corrected by forcing the leading edge of the paper against the nip point. When the paper feed roller starts to rotate again by the operation of the clutch, the sheet of paper, the leading edge of which has been aligned, is fed by the paper feed roller to the transfer roller.



Clutch mechanism (engaged/released by the solenoid assembly)
Released when the solenoid is ON and engaged when the solenoid is OFF.

Fig. 2.28

2.2.3 Paper Eject

The completion of paper eject is detected in the following manner:

(a) When the leading edge of the paper pushes down the eject sensor actuator located in the fixing unit, the photo sensor (photo interrupter) is opened and detects the start of paper eject motion.

(b) After that, when the bottom of the edge of paper has passed through the paper eject sensor actuator, the photo sensor is closed and the completion of paper eject motion is recognized.

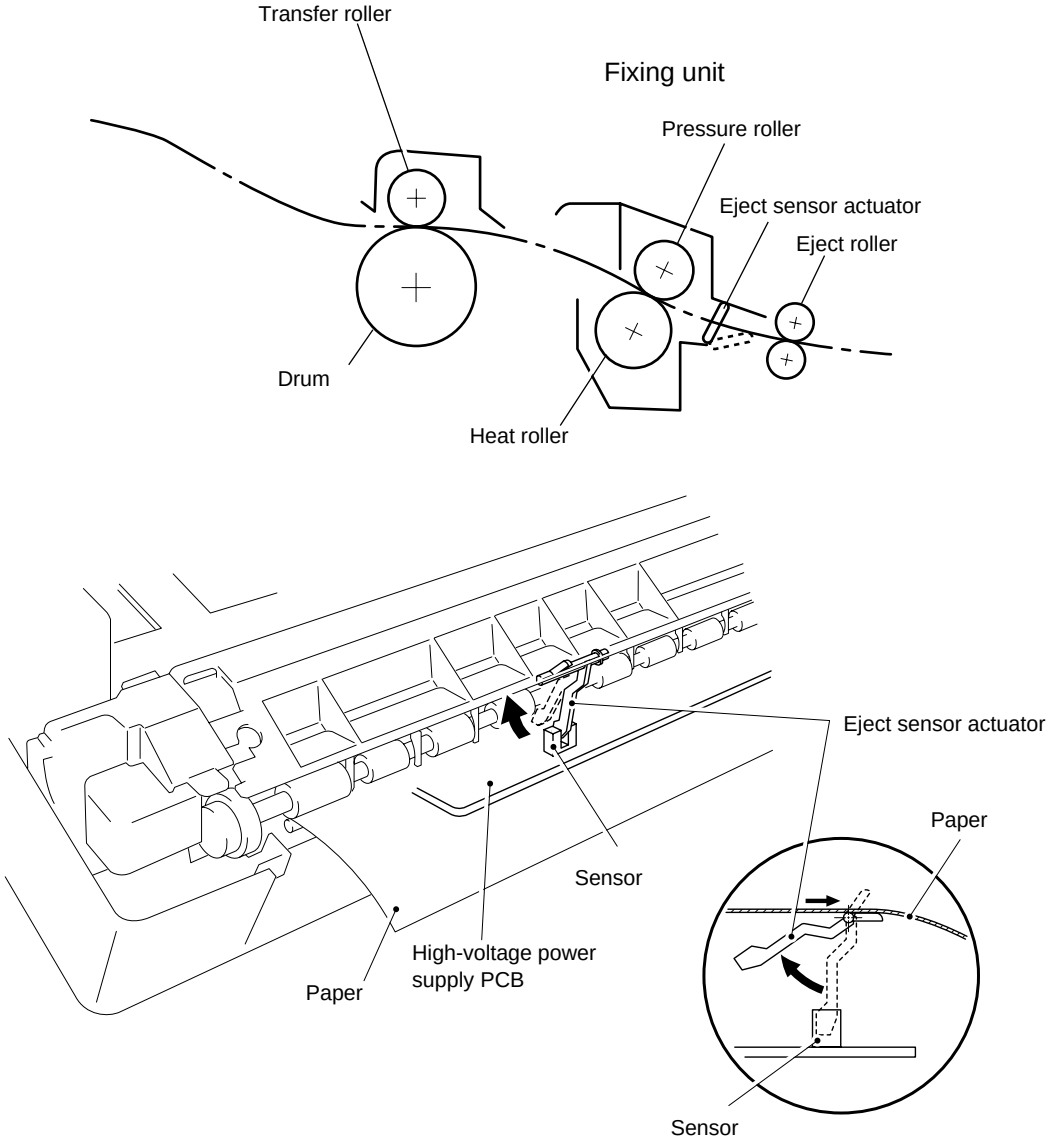


Fig. 2.29

2.3 Sensors

2.3.1 Cover Sensor

Detects the top cover open and closed.

2.3.2 Toner Empty Sensor

Detects if there is toner in the toner cartridge. It also detects whether or not the drum unit is installed. (The toner cartridge is installed in the drum unit).

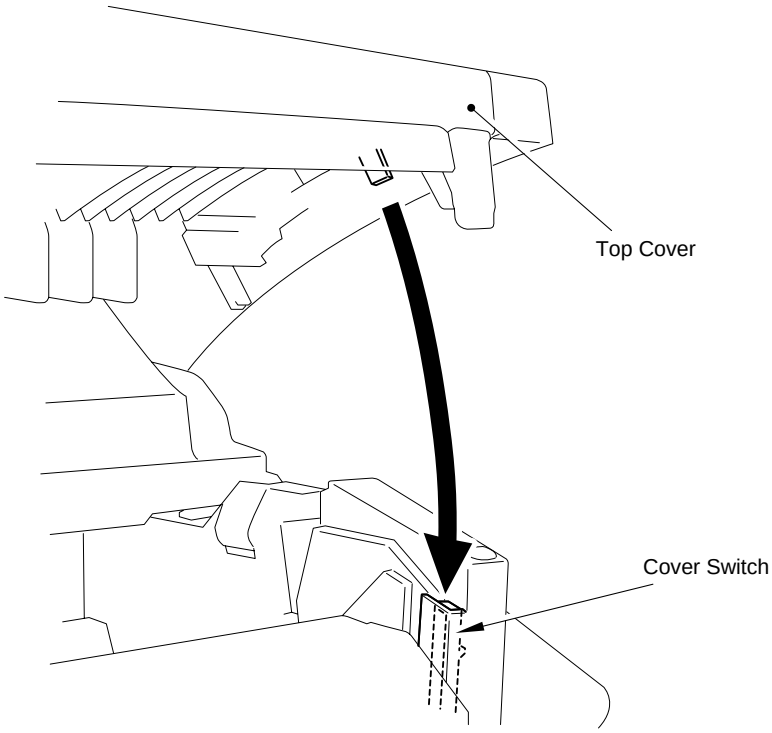


Fig. 2.30

2.4 Drum Unit

2.4.1 Photosensitive Drum

Generates the latent electrostatic image and develops the image on the drum surface.

2.4.2 Primary Charger

Forms a uniform charge on the drum surface.

(1) Corona wire
Generates an ion charge on the drum.

(2) Grid
Spreads the ion charge evenly over the drum.

2.4.3 Developer Roller

Develops the latent electrostatic image on the drum surface by adding the toner.

2.4.4 Transfer Roller

Transfers the toner image to the paper from the drum surface.

2.4.5 Cleaner Roller

Removes and exhausts the toner remaining on the drum surface.

2.4.6 Erase lamp

Discharges the electrostatic latent image on the drum.

2.5 Print Process

2.5.1 Charging

The drum is charged to approx. +1000V by an ion charge which is generated by the primary charger. The Ion charge is generated by the corona wire, which applied to it a DC bias from High-voltage Power Supply. The flow of ion is controlled by the grid to be distributed evenly on the drum surface. The other end of the grid is regulated to approx. 280V by the voltage regulator.

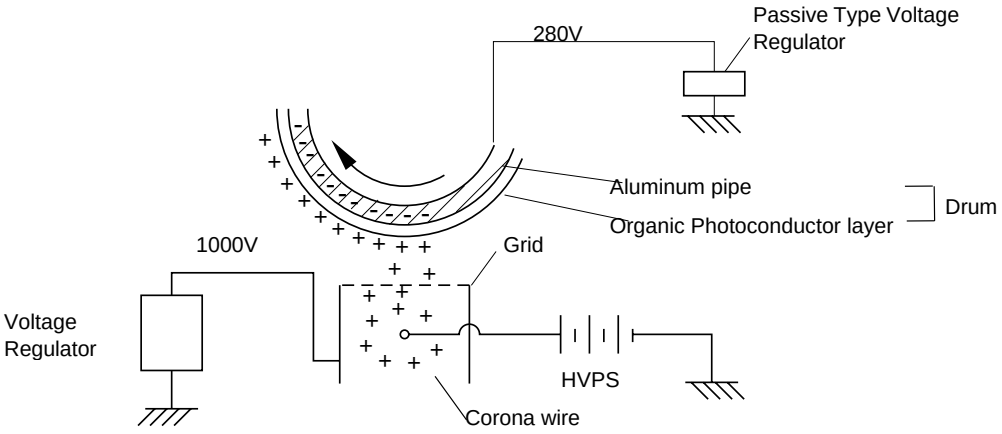


Fig. 2.31

The primary charge uses a corona wire, but since the charging terminal of the drum is a positive terminal , less than 1/10 of the usual quantity of ozone is generated. The level of ozone expelled from the printer is therefore not harmful to the human body. Applicable safety standards have been complied with.

2.5.2 Exposure stage

After the drum is positively charged, it is exposed to the light emitted from the laser unit.

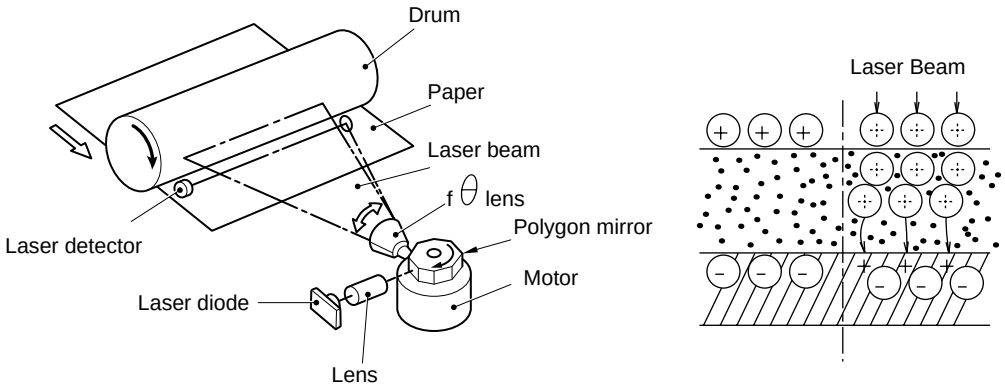
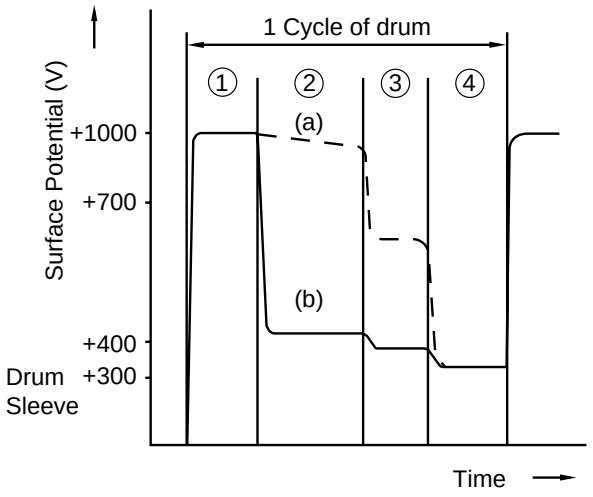


Fig. 2.32

The exposed area is the part to be printed. The surface potential of the exposed area is reduced, forming an electrostatic image to be printed.



① Primary charging

② Laser beam exposure and developing
(a) Unexposed area
(Non image area)
(b) Exposed area
(Image area)

③ Transfer the image to paper

④ Erase the residual potential

Fig. 2.33

2.5.3 Developing

Developing causes toner to be attracted to the electrostatic image on the drum so as to transform it into a visible image.

The Developer Consists of non-magnetic toner. The developer roller, made of conductive rubber and the supply roller, made of conductive sponge, rotate on each other. The toner is charged and carried from the supply roller to the developer roller. Thus, the toner is carried on the developer roller and conveyed to the drum with its thickness controlled by the blade. The toner is nipped between the developer roller and the drum and developed on the drum latent image. The Electrostatic field between the drum and the developer roller, which is DC-biased from the High-voltage power supply, makes an electrostatic potential which attracts toner particles from the developer roller to the drum.

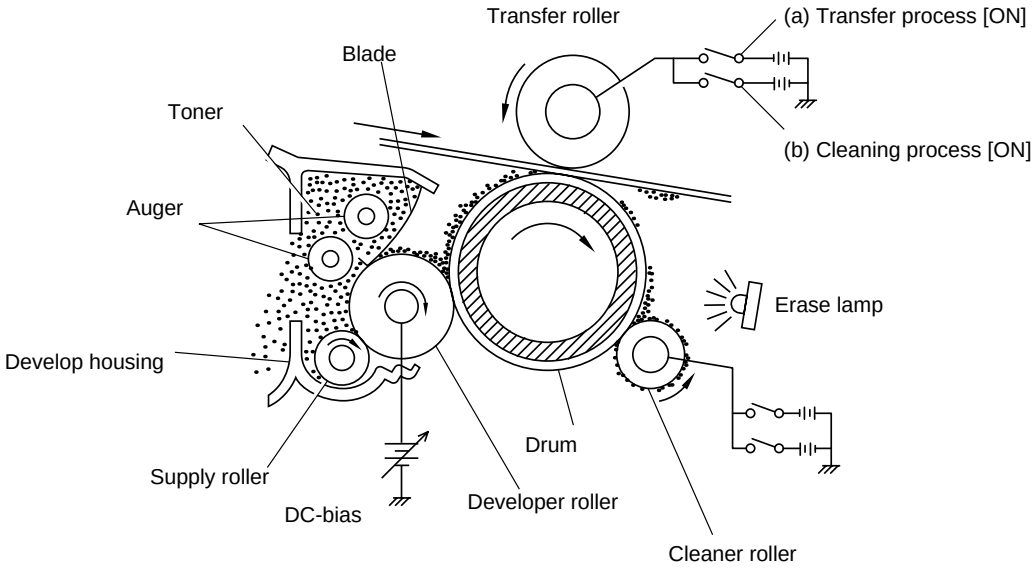


Fig. 2.34

2.5.4 Transfer

(a) Transfer process
After the drum has been charged and exposed, and has received a developed image, the toner formed image is transferred onto the paper by applying a negative charge from the back of the paper. The negative charge to the paper causes the positively charged toner to leave the drum, and adhere to the paper. As a result, the image is visible on the paper.

(b) Cleaning process of transfer roller
If the toner is not transferred onto the paper perfectly, it is possible that toner will adhere to the charge transfer roller. The transfer voltage changes to a positive voltage during non transferring process time. Therefore, the transfer roller is cleaned by returning the positively charged toner on the transfer roller back onto the photo-conductive drum.

2.5.5 Drum Cleaning Stage

In the image transfer stage, not all the toner on the photosensitive drum is transferred onto the paper but some remains on the drum. In the drum cleaning stage, the drum surface is cleaned by the cleaning roller, so that residual toner on the drum surface is removed and collected on the cleaning roller itself. The residual toner on the cleaning roller will be discharged back to the drum when the printer is first starting or or during non-printing. The toner is collected by the developing roller and reused (for further developing).

2.5.6 Erasing Stage

Before the cleaning stage, the drum surface is exposed to the light emitted from the erase lamp. (LED lamp) This stage prepares the drum by decreasing its surface voltage uniformlyready to receive a uniform charge in the primary charging stage.

CHAPTER III DISASSEMBLY AND REASSEMBLY

1. SAFETY PRECAUTIONS

To prevent the creation of secondary problems by mishandling, be careful to followthe precautions below during maintenance work.

(1) Always turn off the power switch and unplug the power cord from the power outlet before accessing any parts inside the printer.

(2) Be careful not to lose screws, washers, or other parts removed during servicing.

(3) Be sure to apply grease to the gears and applicable positions as specified in this chapter.

(4) When using soldering irons or other heat-generating tools, take care not to damage the wiring, PCBs, and covers.

(5) Before handling the PCBs, touch a metal portion of the equipment to discharge any static electricity charge in your body, or else electronic parts or components may be damaged.

(6) When transporting PCBs, be sure to wrap them in conductive sheet to prevent static damage.

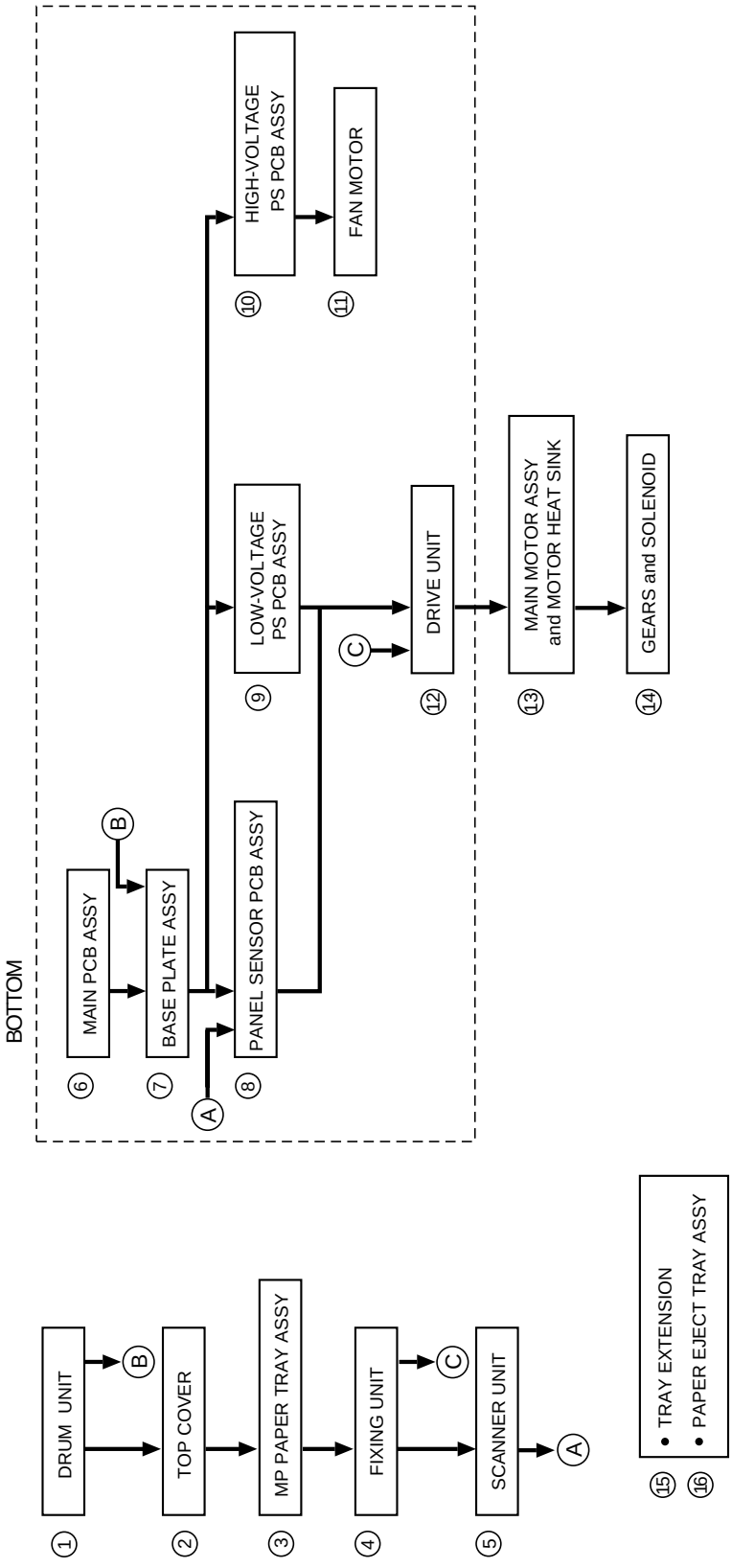
(7) Be sure to replace self-tapping screws correctly, if removed during servicing. Unless otherwise specified, tighten screws to the following torque values.

TAPTITE, BIND or CUP B
M3 : 6kgf • cm
M4 : 9kgf • cm
TAPTITE, BIND S
M3 : 9kgf • cm
SCREW
M3 : 7kgf • cm
M4 : 10kgf • cm

(8) When connecting or disconnecting cable connectors, hold the connector bodies, not the cables. If the connector has a lock, release the connector lock first then disconnect the cable.

(9) After a repair, do not only check the repaired portion but also check the connectors and that other related portions are functioning properly before doing operation checks.

2. DISASSEMBLING FLOW



3. DISASSEMBLING PROCEDURE

3.1 Drum Unit

(1) Open the top cover.

(2) Lift out the drum unit.

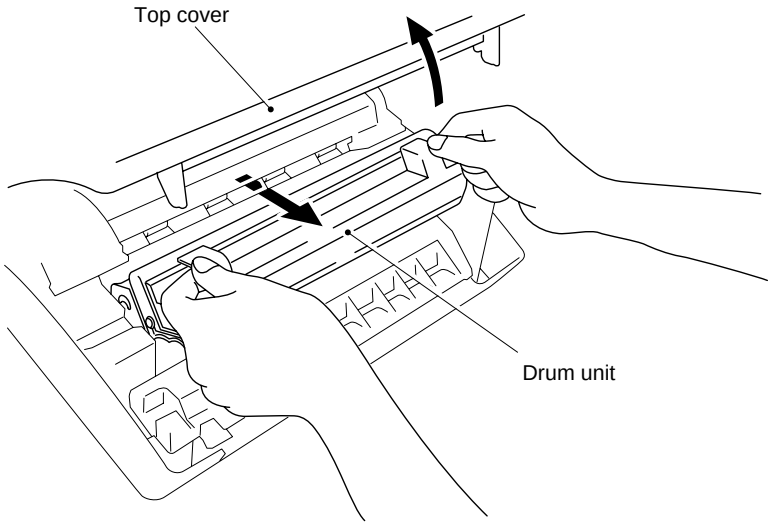


Fig. 3.1

3.2 Top Cover

(1) Open the top cover to the first lock position.

(2) Prise up the top cover link and free it from the dowel on the top cover to release it inward.

(3) Press the link downward.

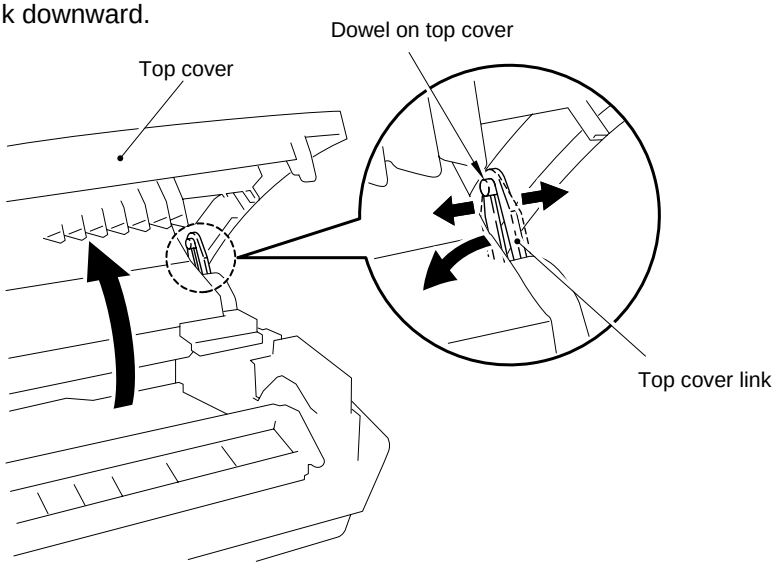


Fig. 3.2

(4) Open the top cover further and release the catches on the both sides of the printer by sliding the top cover backwards.

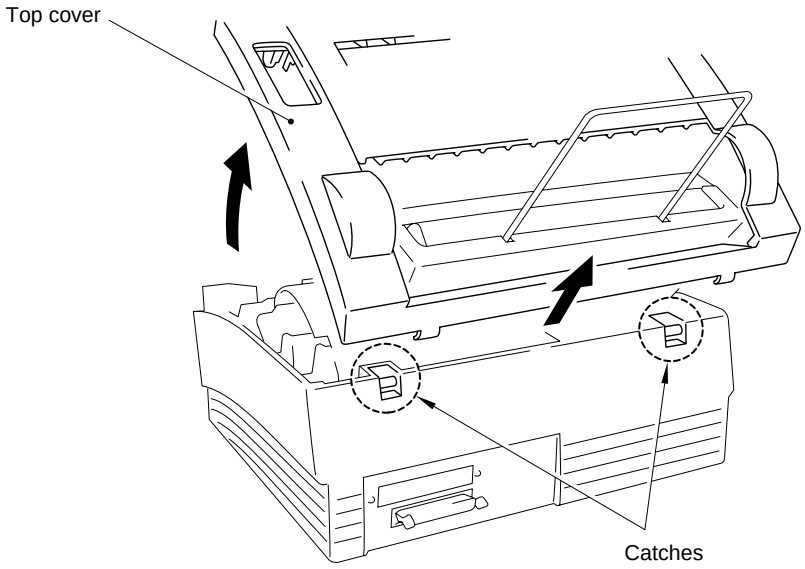


Fig. 3.3

3.3 Multi-purpose Paper Tray Assembly

(1) Pull the left rib outwards from the MP tray and pull out the MP tray. It is not necessary to release the right rib.

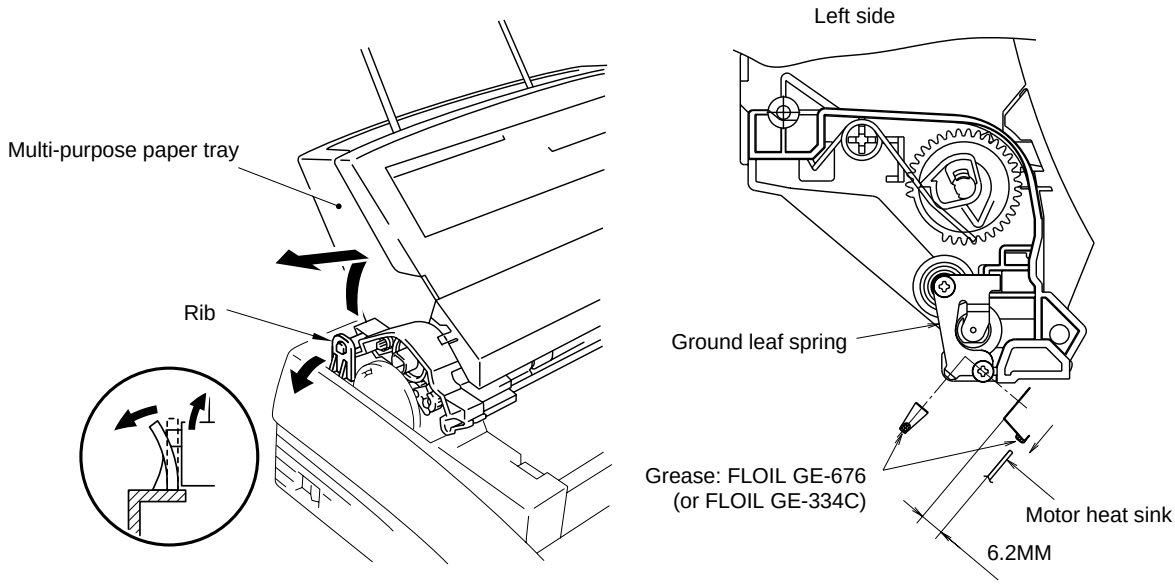


Fig. 3.4

NOTE: When reassembling, remove the old grease from the Motor heat sink and apply a suitable amount of new grease (2 rice-grain size) between the heat sink of the motor and the ground leaf spring.

3.4 Fixing Unit

(1) Remove the screw securing the fixing unit.

(2) Lifting up the fixing unit, disconnect the two heater harnesses and disconnect the thermistor cable from the connector on the EL PCB.

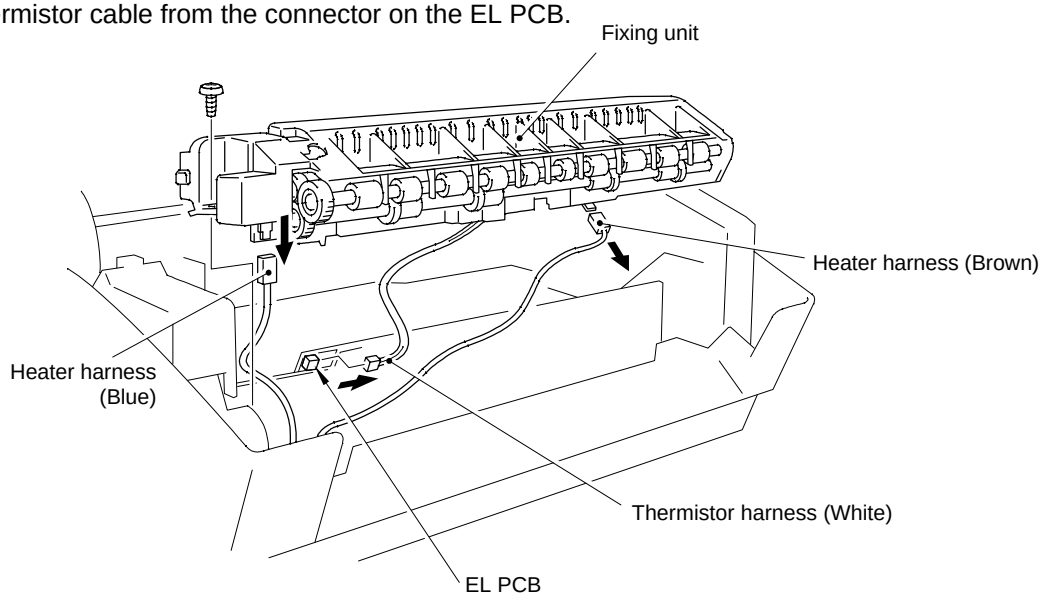


Fig. 3.5

3.5 Scanner Unit

(1) Remove the three screws.

(2) Lift the scanner unit to obtain access to the panel sensor PCB.

(3) Disconnect the three scanner unit connectors from the panel sensor PCB.

(4) Remove the screw and disassemble the Toner sensor PCB from the Scanner unit.

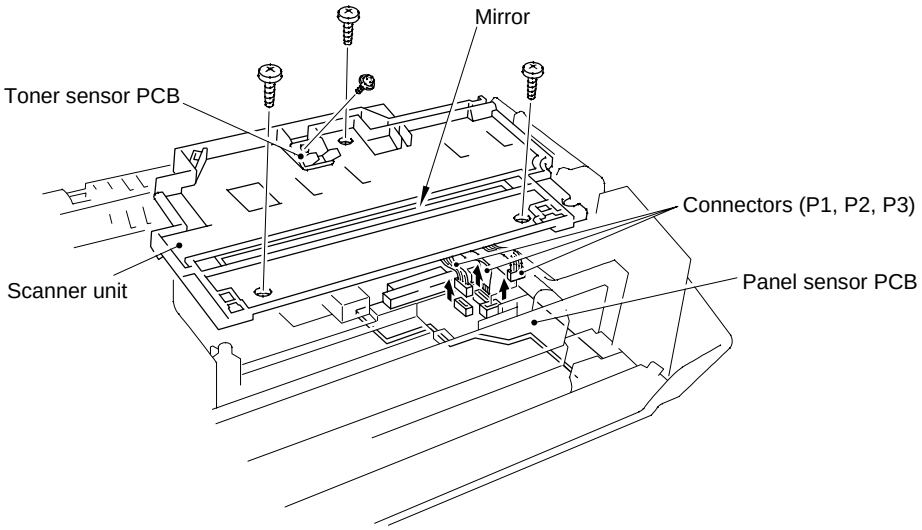


Fig. 3.6

NOTE: Never touch the inside of the scanner unit or the mirror when disassembling or reassembling. If there is any dirt or dust on the mirror, blow it off.

3.6 Main PCB Assy

(1) Remove three screws securing the main PCB holder to the back of the printer.

(2) Grasp the hooks at the left and right ends of the PCB holder and draw out the main PCB assy.

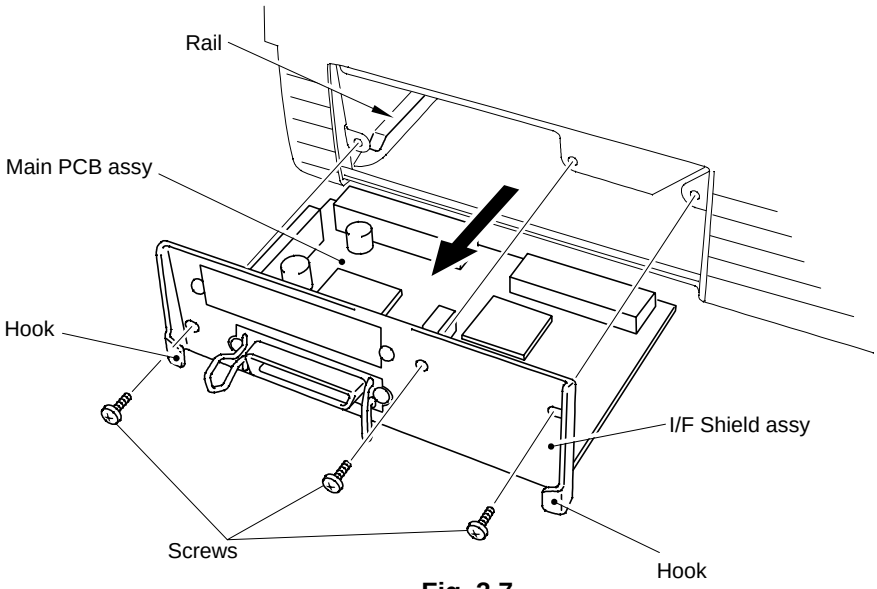


Fig. 3.7

3.7 Base Plate Assy

NOTE Prior to turning the printer upside-down, the drum unit should be removed from the printer.

(1) Turn the printer upside down.

(2) Remove the four M4 and four M3 tapping screws.

(3) Lift out the base plate assy and remove the grounding screw.

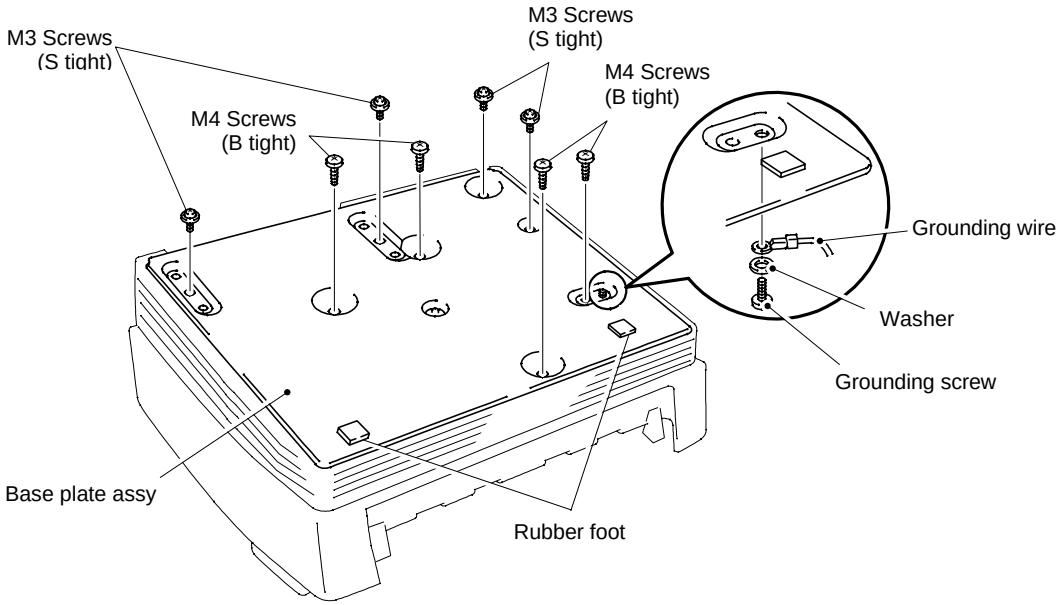


Fig. 3.8

3.8 Panel sensor PCB Assy

(1) Remove the screw securing the panel sensor PCB assy. Slide the part A from under the main shield and lift the PCB assembly upwards.

(2) Disconnect the seven connectors from the PCB (The three connectors P!, P2 and P3 have already been disconnected when disassembling the scanner unit. See page, III-5).

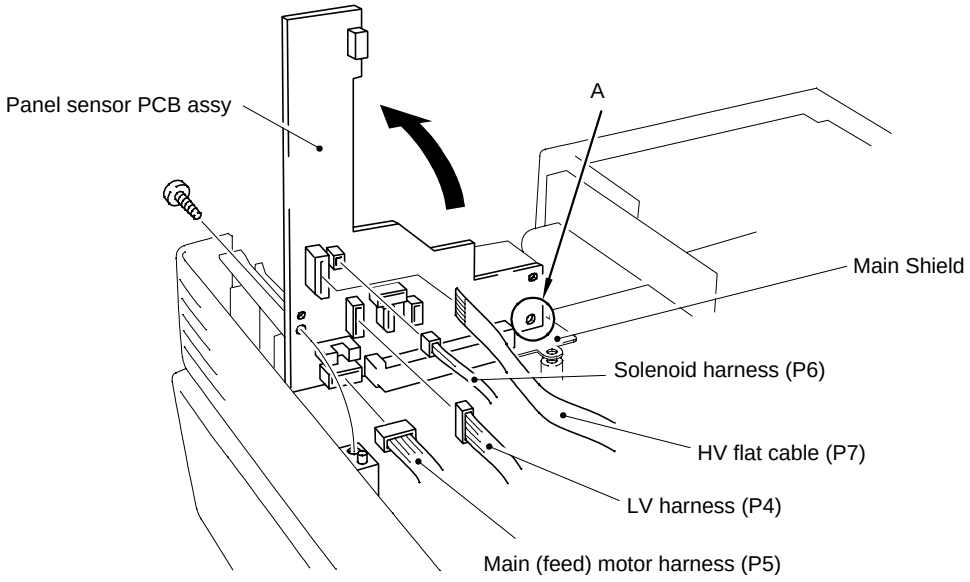


Fig. 3.9

NOTE1: When reassembling, the connectors must be inserted fully into the PCB and the PCB must not be lifted up by the harnesses.

NOTE2: The connectors should be inserted by matching the housing color and the number of pins.

3.9 Low-Voltage Power Supply PCB Assy

(1) Remove the screw securing the low-voltage power supply PCB assy and lift the PCB.

(2) Disconnect the two connectors from the component side of the PCB.

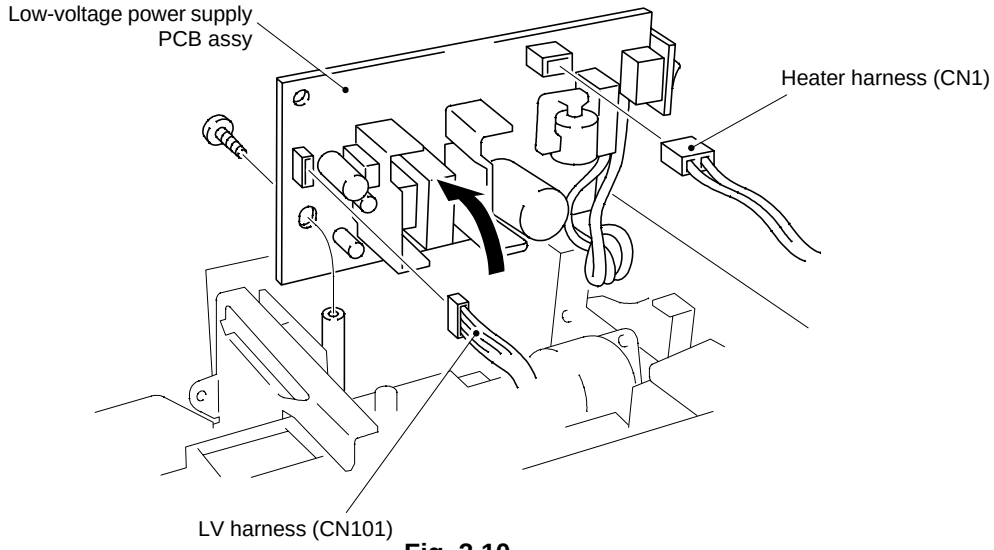


Fig. 3.10

3.10 High-voltage Power Supply PCB Assy

(1) Remove the screw securing the high-voltage power supply PCB assy and lift the PCB.

(2) Disconnect the four connectors from the PCB.

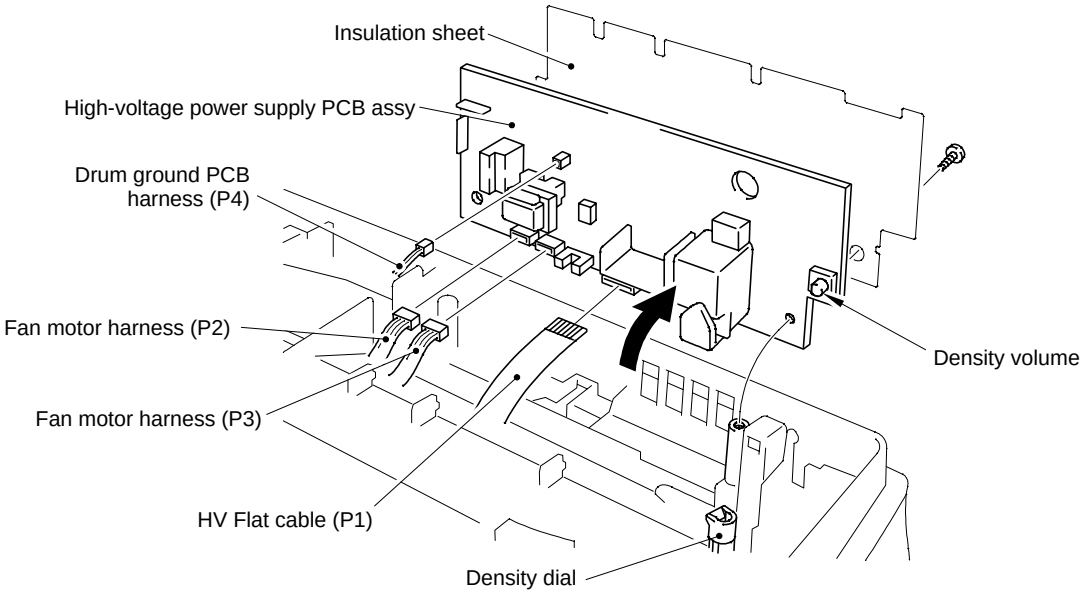


Fig. 3.11

NOTE: When reassembling, the density volume adjuster knob must be fitted into the cutout side of the density dial.

3.11 Fan Motor

(1) Disconnect the connector from the high-voltage power supply PCB. (It should have been disconnected already, see above)

(2) Lift out the fan motor assy.

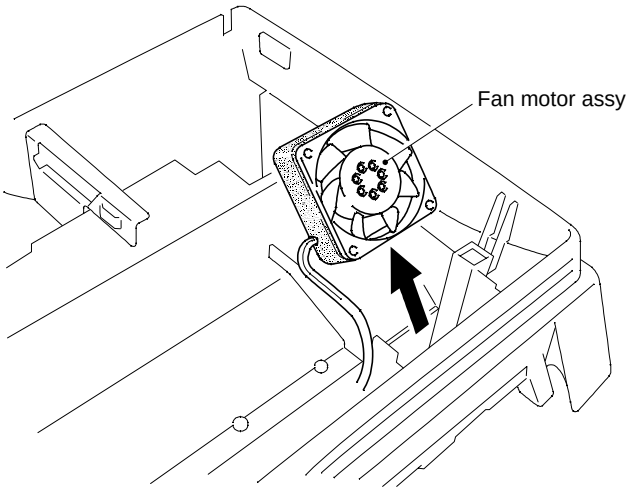


Fig. 3.12

3.12 Drive Unit

(1) Remove the four screws securing the drive unit.

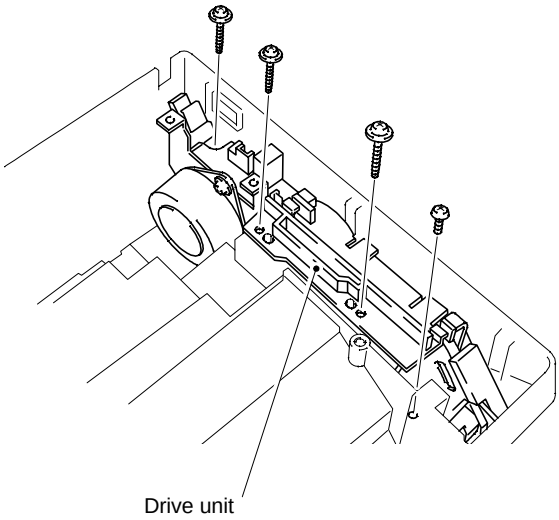


Fig. 3.13

3.13 Main Motor Assy and Motor Heat Sink

(1) Remove the two screws securing the main motor assy.

(2) Remove the two screws securing the motor heat sink.

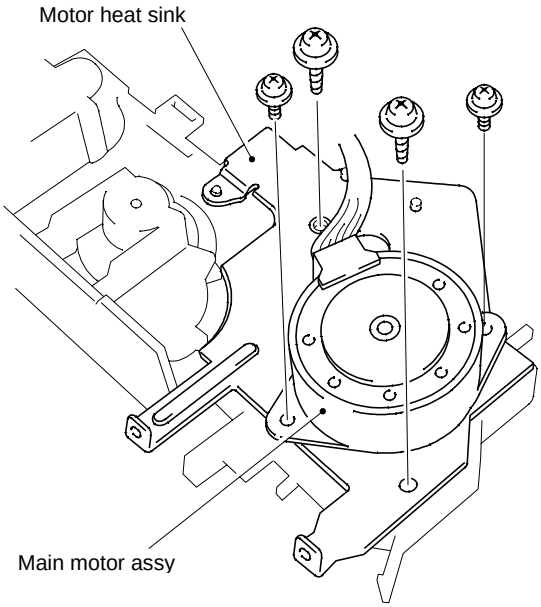
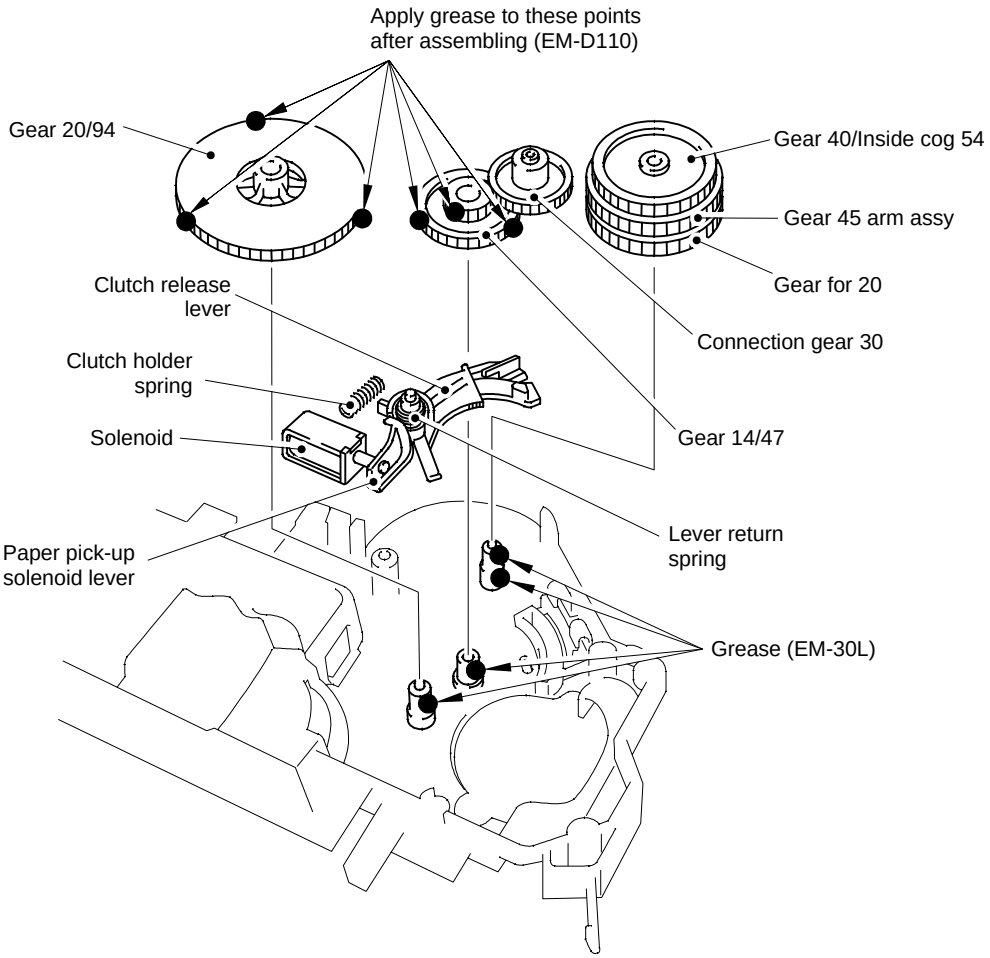


Fig. 3.14

3.14 Gears and Solenoid

(1) Apply grease the points shown below.

Grease: MOLYKOTE EM-30L TKC-0
MOLYKOTE EM-D110



NOTE: Apply EM-30L to the small gears (2 pcs.) inside the "Gear 45 arm assy".

Fig. 3.15

3.15 Tray Extension

(1) Put the tray extension assembly down towards the front of the printer, and pull the bottom of both side legs outwards to release it.

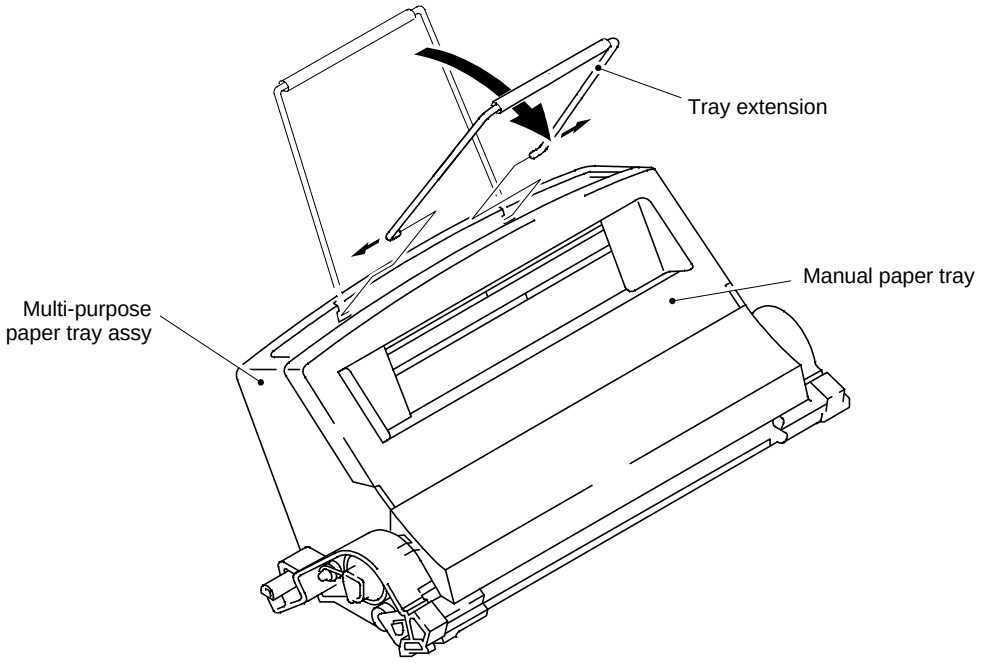


Fig. 3.16

3.16 Paper Eject Tray Assy

(1) Open the paper eject tray.

(2) Press both sides of the hinges of the paper eject tray inwards to release it from the holes in the top cover.

(3) Press the tray extension inwards as shown by the arrows and remove it.

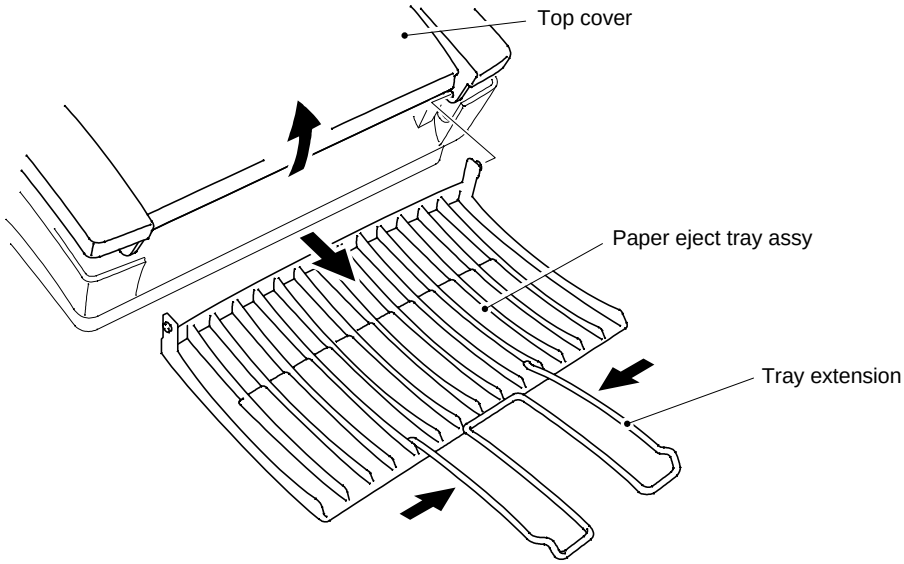


Fig. 3.17

4. PACKING

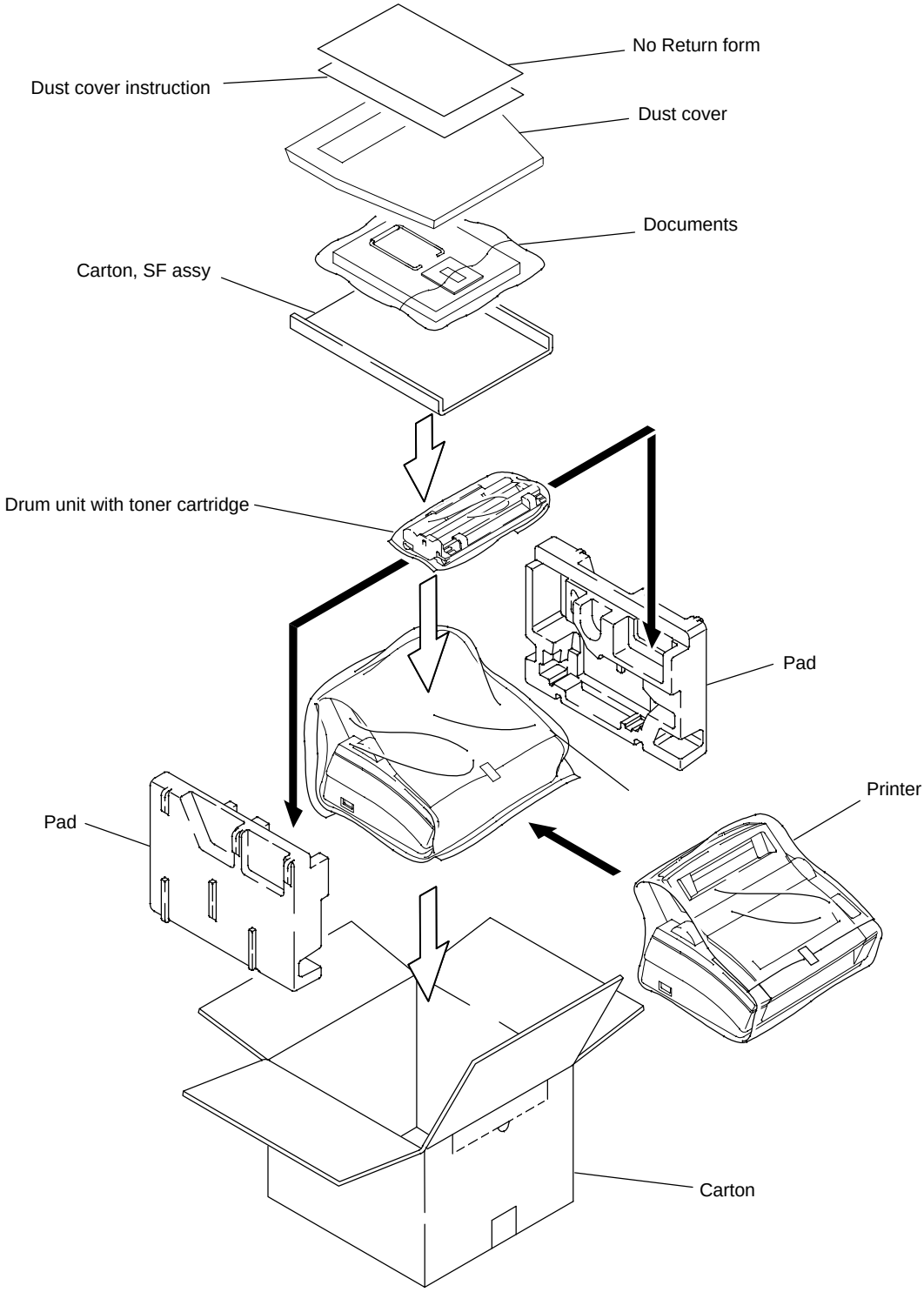


Fig. 3.18

CHAPTER IV TROUBLESHOOTING

1. INTRODUCTION

1.1 Initial Check

(1) Operating environment

Check if :
1) The source voltage stays within ±10% from the rating voltage shown on the rating plate.
2) The printer is installed on a solid, level surface.
3) The room temperature is maintained between 10°C and 32.5°C. The relative humidity is maintained between 20% and 80%.
4) The printer is not exposed to ammonia fumes or other harmful gases.
5) The printer is not located in a hot or humid area (such as near water or a humidifier)
6) The printer is not exposed to direct sunlight.
7) The room is well-ventilated

(2) Printer paper

Check if :
1) A recommended type of print paper is being used (if the paper is too thick or too thin, or tends to curl, paper jams or paper feed problems may occur, or prints may be blurred).
2) The print paper is damp. [If so, use fresh paper, and check whether the print quality improves or not.]

(3) Consumables

Check if :
1) The toner LED is not lit on the display when a toner cartridge is installed in the printer. [If the above LED is lit, replace the toner cartridge with a new one. If blank areas occur on printouts, take out the complete toner and drum cartridge assembly and slowly rock it to distribute the toner evenly.]

(4) Others

Condensation:
When the printer is moved from a cold room into a warm room in cold weather, condensation may occur inside the printer, causing various problems as below:
1) Condensation on optical surfaces such as the scanning mirror, lenses, the reflection mirror and the protection glass may cause the print image to be light.
2) If the photosensitive drum is cold, the electrical resistance of the photosensitive layer is higher, making it impossible to obtain the correct contrast during printing.
3) Condensation on the corona unit may cause corona charge leakage.
4) Condensation on the hopper gate and separation pad may cause paper feed problems.

If condensation has occurred, leave the printer in the warm room for at least two hours to allow the condensation to clear. If necessary, wipe the effected units or parts with a dry cloth.

If the process cartridge is unsealed soon after being moved from a cold room to a warm room, condensation may occur inside the cartridge, which may cause an incorrect image. Instruct the user to allow the cartridge to come to room temperature before unsealing it. This will take one to two hours.

1.2 Basic Procedure

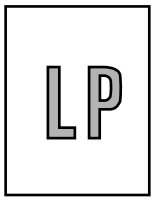
If a malfunction occurs or an incorrect printout is produced, make an initial check, then follow the basic procedure below:

(1) Check the error lamps according to the procedure of the inspection mode described later in this section. If no error lamp is lit, see Section 4 for troubleshooting.

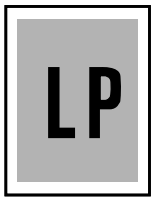
(2) If any incorrect image output is found, follow the image defect description in this section to correctly identify the fault.

2. IMAGE DEFECTS

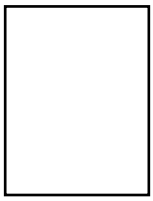
2.1 Image Defect Examples



I-1 Light



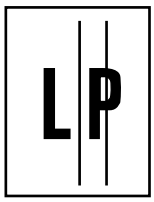
I-2 Dark



I-3 Completely blank

I-4 All black

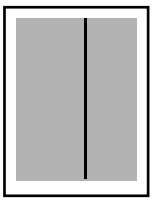
I-5 Dirt on back of paper



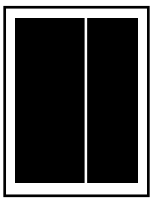
I-6 Black vertical streaks

I-6 Black vertical streaks

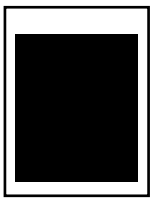
I-7 Black horizontal stripes



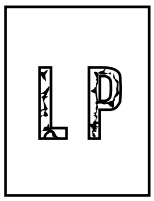
I-8 Black vertical streaks



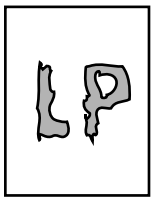
I-9 White vertical streaks



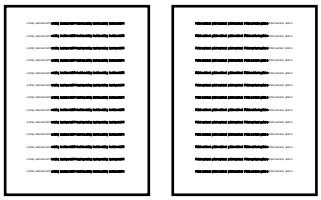
I-10 Faulty registration



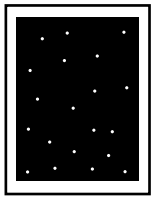
I-11 Poor fixing



I-12 Image distortion

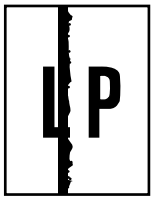


I-13 Faint print



I-14 White spots

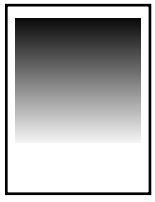
I-15 Black spots



I-16 Black band

I-17 Gray background

I-18 Hollow print



I-19 Downward fogging of solid black

Fig. 4.1

2.2 Troubleshooting Image Defects

The following procedures are to be followed in the event of specific image defects.

See subsection 2.3 for information about the location of the high-voltage contacts and grounding contacts.

I-1	Light

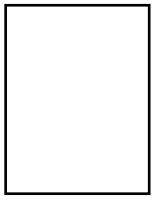
Possible cause	Step	Check	Result	Remedy	HV.GND contacts (Fig.4-5)
Density dial	1	Is the density dial in the centre (click) position?	No	Set it to the centre detect position.	
Toner sensing failure (printer failure)	2	Can printing be started with the drum unit removed?	Yes	Toner sensor failure. Check if the toner sensor needs cleaning and check the toner sensor connection.	
Toner sensing failure (toner cartridge failurs)	3	Is the problem solved when 4 or 5 pages are printed after the toner cartridge is replaced with a full one?	Yes	The wiper of the toner cartridge is defective. Replace the toner cartridge.	
Drum connection failure	4	Do all the contacts (HV, GND) connect with the electrodes when the drum unit is installed?	No	Clean contact electrodes both in the printer body and on the drum unit.	①
Transfer electrode contact failure	5	Is there continuity between the transfer roller shaft and the transfer electrode on the external drum unit?	Yes	Remove the transfer roller and clean the contact electrode. Clean the external electrode.	③
Transfer failure	6	Is the problem solved when the transfer roller is replaced?	Yes	Replace the drum unit.	
High-voltage power supply PCB failure	7	Check the harness connection between the high-voltage power supply PCB and the panel sensor PCB.	No	If the connection is normal, replace the high-voltage power supply PCB.	
Driver PCB or main PCB failure	8	Perform the same check as step 7 above and also between the panel sensor PCB and the main PCB.	No	Replace the panel sensor PCB or the main PCB.	
Scanner unit failure	9	Is the problem solved by replacing the scanner unit?	Yes	Replace the scanner unit.	

I-2	Dark

LP

Possible cause	Step	Check	Result	Remedy	HV.GND contacts (Fig.4-5)
Density dial	1	Is the density dial at the centre (click) position?	No	Set it to the centre click position or a reasonably close position.	
Corona failure (dirty wire)	2	Is the corona wire dirty?	Yes	Clean the corona wire by using the wire cleaner.	⑧
Corona failure (contact failure)	3	Are the corona electrode connections between the printer body and drum unit dirty?	Yes	Clean the electrodes.	⑥
Drum unit failure	4	Is the problem solved when the drum unit is replaced?	Yes	Replace the drum unit with a new one.	
H.V. power supply PCB	5	Are there any disconnected connectors?	No	Replace the H.V. power supply.	
Main PCB	6	Are there any disconnected connectors?	No	Replace the main PCB.	
Panel sensor PCB	7	Are there any disconnected connectors?	No	Replace the panel sensor PCB.	

I-3	Completely blank

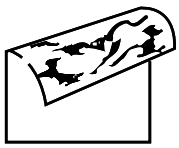


Possible cause	Step	Check	Result	Remedy	HV.GND contacts (Fig.4-5)
Developing bias contact failure	1	Are the developing bias contacts between the printer body and drum unit dirty?	Yes	Clean the both sides of the electrodes.	⑦
Drum unit	2	Are the drum shaft and drum electrode in the printer body connected correctly?	Yes	Clean the shaft and the electrode.	①
			No	Check the connection between the shaft and the electrode.	①
Drum unit failure	3	Is the problem solved after the drum unit is replaced?	Yes	Replace the drum unit.	
Scanner harness connection failure	4	Is the scanner harness connected securely? Is there any play in the connection?	No	Reconnect the connector properly.	
Main/Panel sensor PCB connection failure	5	Are printing signals being input to the scanner? Is the problem solved after the main PCB or the panel sensor PCB are replaced?	Yes	Replace the main PCB or the panel sensor PCB.	
Scanner unit failure	6	Scanner interlock lever damaged. Scanner mirror is broken or loose.	Yes	Replace the scanner unit.	
			No	Replace the H.V. power supply.	

I-4	All black

Possible cause	Step	Check	Result	Remedy	HV.GND contacts (Fig.4-5)
Corona failure	1	Is the corona wire in the drum unit broken?	Yes	Replace the drum unit.	
	2	Are the electric terminal springs in the printer body and the electrode on the bottom face of the drum unit dirty?	Yes	Clean the terminals in the printer and the electrode on the drum.	⑥
Harness connection	3	Is the scanner unit connected to the panel sensor PCB correctly?	No	Check the harness connection between the scanner unit and the panel sensor PCB.	
H.V. power supply PCB	4	Is the problem solved after the H.V. power supply PCB replaced?	Yes	Replace the H.V. power supply PCB.	
Panel sensor PCB	5	Is the problem solved after the panel sensor PCB is replaced?	Yes	Replace the panel sensor PCB.	
Main PCB	6	Is the problem solved after the main PCB is replaced?	Yes	Replace the main PCB.	

I-5	Dirt on back f

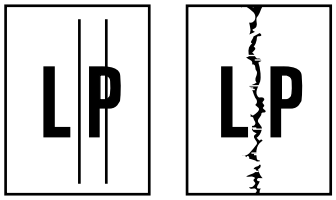


Possible cause	Step	Check	Result	Remedy
Fixing unit	1	Is the pressure roller dirty? Is any other area in the printer dirty?	Yes	Clean the pressure roller. (See the following note.)
Dirt in the drum unit	2	Is the paper feed system in the drum unit soiled with toner?.	Yes	Clean the paper feed system in the drum unit.
Ditto	3	Is the transfer roller dirty? Is the problem solved after the drum unit replaced?	Yes	Replace the drum unit
			No	Replace the H.V. power supply PCB.

Note: Cleaning the pressure roller

(1) Set three or more sheets of paper in the MP sheet feeder.
(2) Open the top cover.
(3) Turn on the power switch while holding down the switch on the control panel.
(4) Release the panel switch when the Drum lamp comes on.
(5) Close the top cover.
(6) Hold down the panel switch until the Ready lamp is on, and then release the switch.
(7) Print three patterns; grid, zip and solid black.
(8) Turn off the power switch with the top cover closed.
(9) Set printed solid black paper in the manual feed slot with the solid black side upwards.
(10) Turn on the power switch while holding down the switch on the control panel.
(11) Release the panel switch when the Drum lamp is on.
(12) Press the panel switch again and release it immediately.
(13) Print a page of test pattern while cleaning the pressure roller.

I-6	Black vertical streaks	Black and blurred vertical stripes



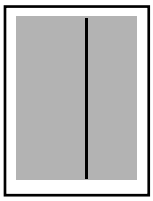
Possible cause	Step	Check	Result	Remedy	HV.GND contacts (Fig.4-5)
Corona failure	1	Is the corona wire dirty?	Yes	Clean the corona wire with the wire cleaner.	⑧
Corona failure	2	Is the vertical block streak about 10mm wide? Is the corona wire cleaner out of its home position?	Yes	Return the wire cleaner to its home position.	
Dirt in the paper feed system	3	Is the paper tray or feed system on the drum unit soiled with toner?	Yes	Clean the toner off.	
Scratch on the drum	4	Is the drum surface scratched?	Yes	Replace the drum unit.	
Cleaning failure	5	Is the drum surface dirty with toner in streaks?	Yes	Replace the drum unit.	
Scratch on the heater roller	6	Is the surface of the heater roller scratched?	Yes	Replace the fixing unit.	

Note: If you print the same pattern continuously, the drum will be worn ecxcesssively in the area of the image and black vertical streaks will appear on the paper.

I-7	Black and blurred horizontal stripes

Possible cause	Step	Check	Result	Remedy
Scratch on the drum	1	Are the horizontal stripes at 94mm (OPC drum) intervals?	Yes	Replace the drum unit.
Toner stuck on the developer roller	2	Are the horizontal stripes at 25mm (developer roller) intervals?	Yes	Print several sheet and see what happens. The problem may disappear after a while. If not, replace the drum unit.
Scratch on the fixing roller	3	Are the horizontal streaks at 50mm (heat roller) intervals?	Yes	Replace the fixing unit.

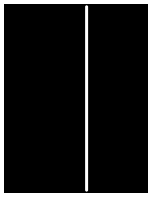
I-8	Black vertical streaks (in a gray background)



Possible cause	Step	Check	Result	Remedy
Translucent stain on the scanner window	1	Are there any stains?	Yes	Clean the scanner window. If this is not effective, replace the scanner unit.

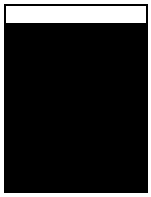
Note: When the same problem occurs after cleaning as above, follow the procedure in I-6.

I-9	White vertical streaks



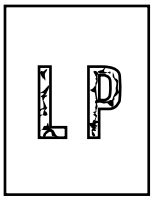
Possible cause	Step	Check	Result	Remedy
Scanner window dirty	1	Is the scanner window dirty?	Yes	Clean the scanner window with a dry tissue.
Transfer failure	2	Is the transfer roller scratched?	Yes	Replace the drum unit.

I-10	Faulty registration



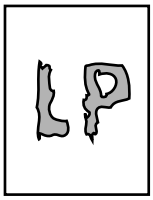
Possible cause	Step	Check	Result	Remedy
Excessive paper loaded	1	Is the paper loaded in the paper feeder more than 22mm deep?	Yes	Instruct the user to keep paper loads below 22mm in depth.
Print paper	2	Is the specified weight of the recommended paper being used?	No	Instruct the user to use the recommended types of paper.
Ditto	3	Is the first printing position within ±1mm of the tolerance specified?	Yes	Adjust the Y offset by using the utility software supplied.
Paper resist sensor position incorrect	4	Is the position of the paper resist sensor normal?	No	Reposition the sensor to the correct position.

I-11	Poor fixing



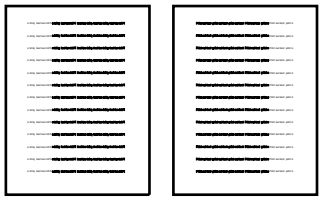
Possible cause	Step	Check	Result	Remedy
Printing paper	1	Is thick paper of more than 36lb weight in use?	Yes	Instruct the user to use paper of the recommended weight and thickness.
Media type setting	2	Is the media type setting in the printer driver correct?	No	Select the correct media type in the printer driver.
Toner sensing failure	3	Is the problem solved by replacing the drum unit or the toner cartridge? (When printing is faint.)	Yes	Toner is empty. The toner sensing is defective, clean the toner sensor. If the wiper in the toner cartridge is broken, replace the toner cartridge with a new one.
Thermistor failure	4	Is the thermistor fitted correctly?	No	Fit the thermistor correctly.
Low-voltage power supply PCB failure	5	Is the problem solved by replacing the low-voltage power supply PCB?	Yes	Replace the low-voltage power supply PCB.

I-12	Image distortion



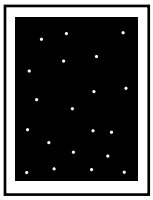
Possible cause	Step	Check	Result	Remedy
Scanner	1	Is the scanner unit secured to the frame incorrectly? Is there any play?	Yes	Secure the unit correctly and tighten the screws.
Scanner LD emission failure Scanner motor rotation failure	2	Is the laser diode or the laser scanner motor defective?	Yes	Replace the scanner unit.
Scanner connection failure	3	Is the scanner harness connected incorrectly? Is it coming loose?	Yes	Connect the harness correctly.

I-13	Faint print



Possible cause	Step	Check	Result	Remedy
Printer not level	1	Is the printer placed horizontally?	No	Place the printer on a flat surface.
Drum unit	2	Does the problem happened immediately after replacing the drum unit with a new one?	Yes	Remove and shake the drum unit horizontally carefully.
Scanner window dirty	3	Is the window of the laser scanner dirty?	Yes	Clean the scanner window with a dry tissue.
Scanner unit failure	4	Is the problem solved by replacing the scanner unit?	Yes	Replace the scanner unit.

I-14	White spots



Possible cause	Step	Check	Result	Remedy
Toner cartridge	1	Is the toner in the toner cartridge almost empty?	Yes	Shake the drum unit horizontally. Replace the toner cartridge with a new one.
			No	Replace the drum unit.
Print paper	2	Is the problem solved after change to fresh paper of the correct specification?	Yes	Recommend the user to change the paper. (Damp (wet) paper mayhave been used.)
Environment	3	Check if the problem still appears after the printer has warmed up.	Yes	Replace the drum unit. Advise the user of the specified print environment.

I-15	Black spots

Possible cause	Step	Check	Result	Remedy
Drum unit	1	Are the spots at 94mm intervals? The problem is not solved after printing a few pages.	Yes	If toner remains stuck to the drum surface, wipe it off gently with a cotton swab. Replace the drum unit if the OPC drum is scratched or deteriorated (exposed). (Refer to the following note.)
Fixing unit	2	Are the spots at 50mm intervals? The problem is not solved after printing a few pages.	Yes	Check and clean the heat roller with a cloth dampened with alcohol. Replace the fixing unit.

Note: Clean the drum unit as follows:

(1) Place the printing samples in front of the process unit, and find the exact portion of the image defect.

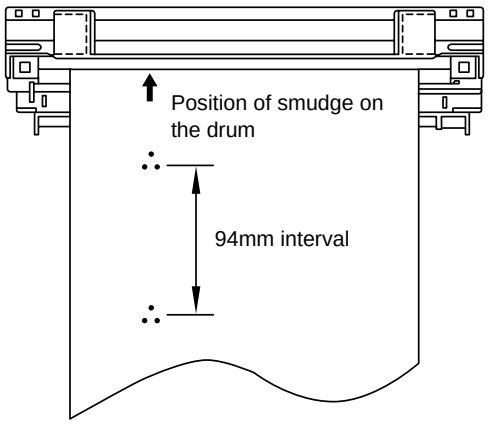


Fig. 4.2

(2) Turn the drum gear by hand while looking at the surface of the OPC drum.

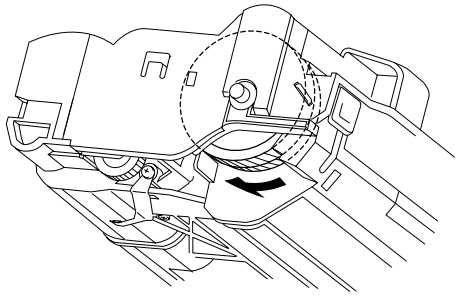


Fig. 4.3

(3) Wipe the surface of the photosensitive drum with a cotton swab until the dust or paper powder on the drum surface comes off.

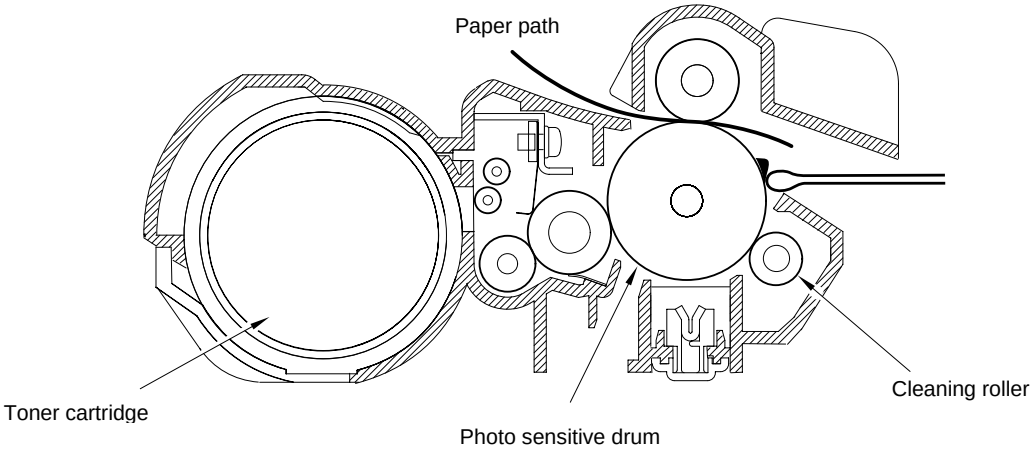
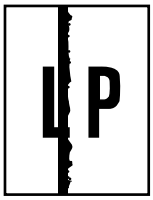


Fig. 4.4

Caution: *Do not wipe the surface of the photosensitive drum with something sharp. (ball-point pen etc.)*

Use cleaning liquid which is a mixture of 50% ethyl alcohol and 50% pure (demineralised)water.

I-16	Black bank



Possible cause	Step	Check	Result	Remedy
Drum unit	1	Is the wire cleaner positioned at its home position?	No	Return the wire cleaner to its home position.
			Yes	Replace the drum unit.

I-17	Gray background

Possible cause	Step	Check	Result	Remedy
Density dial	1	Is the problem corrected by adjusting the density dial?	Yes	Adjust the dial to the most suitable position.
Print paper	2	Does the paper being used meet the paper specification (weight, etc.).	No	Recommend to change the paper to a specified type of the paper.
			Yes	Recommend the user to change to a fresh pack of paper.
Drum unit	3	Is the problem solved after replacing the drum unit?	No	Replace the H.V. power supply.
			Yes	Replace the drum unit.

Note: The following cases raise the possibility of this problem.

1. The drum unit is at the end of its life.
2. There is excessive dust or paper powder.
3. A large number of sheets of paper narrower than A4 have been printed.

I-18	Hollow print

Possible cause	Step	Check	Result	Remedy
Print paper	1	Is thick paper of more than 42lb being used or paper with an extremely rough surface?	Yes	Recommend to use the specified type of paper.
			No	Refer to and compare with I-14.

I-19	Downward fogging of solid black

Possible cause	Step	Check	Result	Remedy
Drum unit	1	Is the problem solved after replacing the drum unit?	Yes	Replace the drum unit.

2.3 Location of High-voltage Contacts and Grounding Contacts

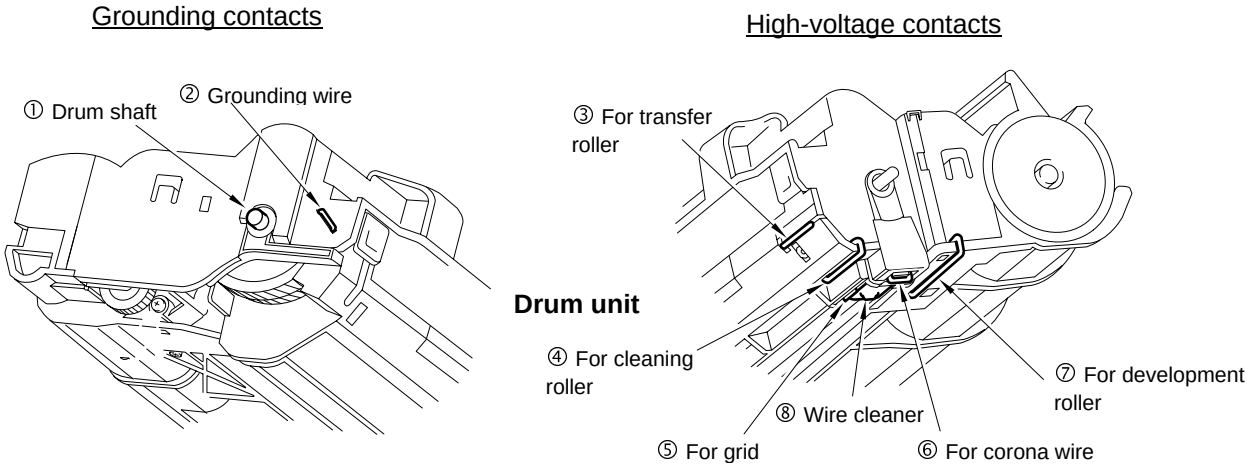


Fig. 4.5

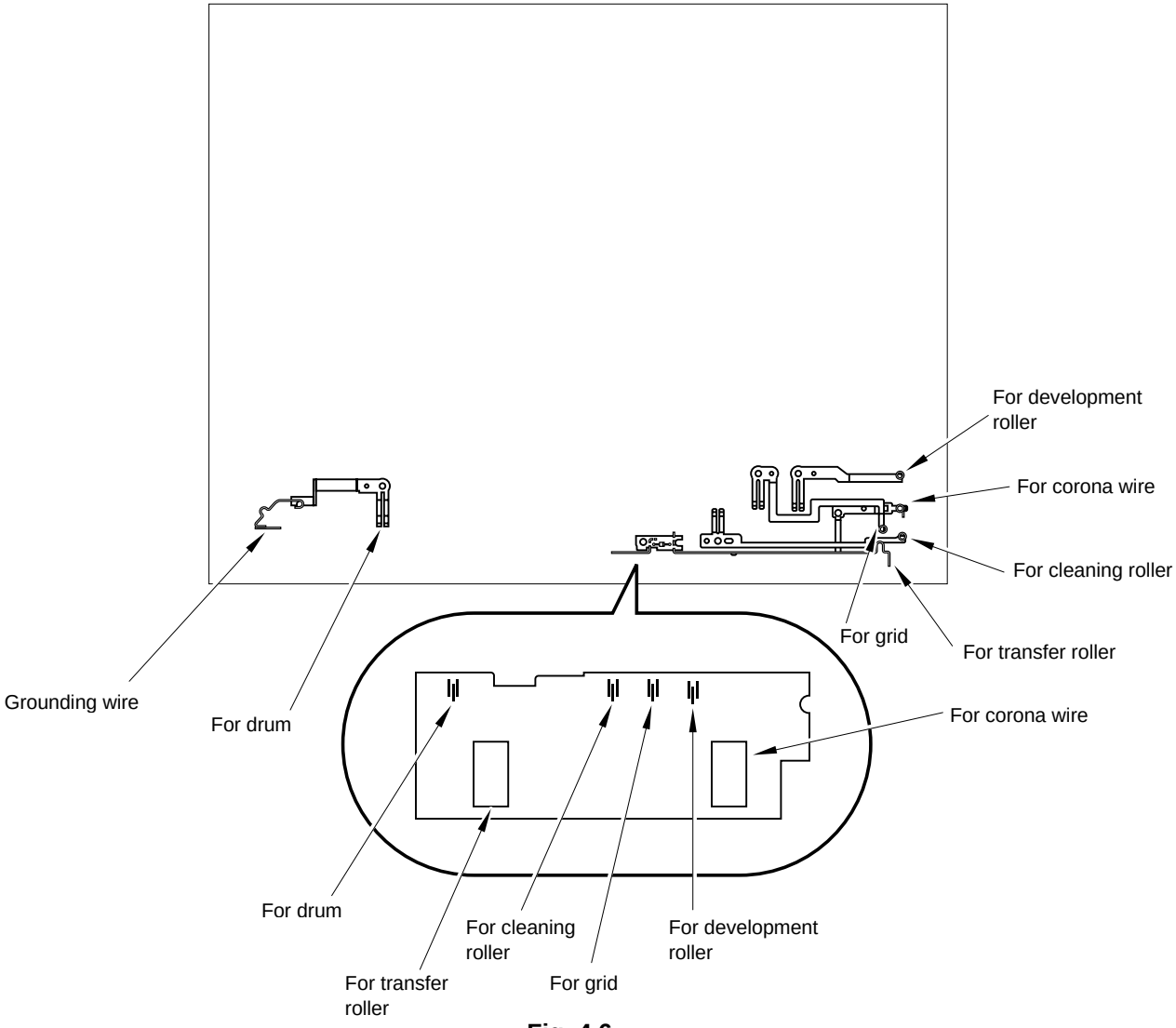


Fig. 4.6

2.4 Location of Feed Roller Shaft and Grounding Contacts

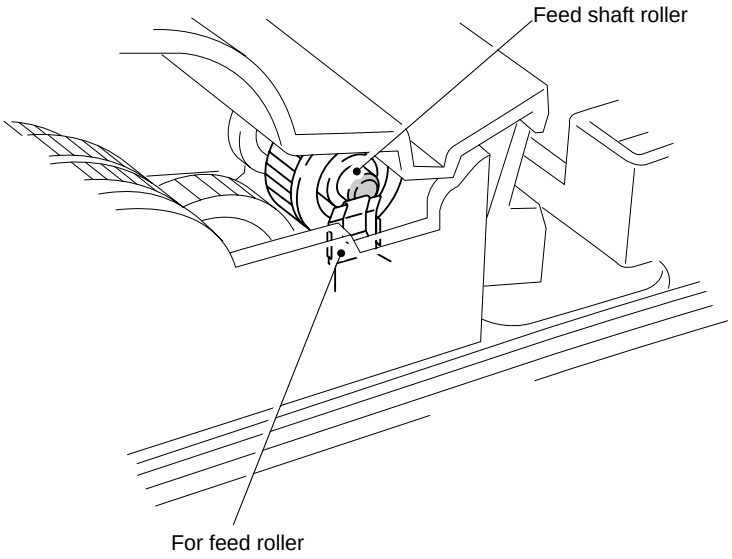


Fig. 4.7

3. TROUBLESHOOTING MALFUNCTIONS

Always turn off the power switch and unplug the power cord from the power outlet before accessing any parts inside the printer.
If you are analyzing malfunctions with the plug inserted into the outlet, such as checking the supply voltage, special caution should be exercised even if the power switch is OFF because it is a single pole switch. Touching the power supply PCB may cause an electric shock.

When carrying out the countermeasures for malfunctions described in this section, make sure to check connectors for contact failure before measuring the voltage on the specified connector pins.

M-1	No AC power supplied

Possible cause	Step	Check	Result	Remedy
Supply voltage	1	Is the correct voltage present at the power outlet?	No	Inform the user that the correct voltage is not supplied at the poweroutlet.
Power plug	2	Is the power cord securely plugged into the outlet?	No	Plug the power cord securely into the outlet.
Fuse (F1)	3	Is the fuse blown?	Yes	If the fuse blows again immediately after replacing it, replace the low-voltage power supply PCB. Check if there is a short circuit somewhere in the AC power supply line.
Wiring	4	Unplug the power supply plug. Is there a broken wire between the AC input connector of the low-voltage power supply and the power plug?	Yes	Replace the AC power cord.

M-2	No DC power supplied

<table>
<tr><th>Possible cause</th><th>Step</th><th>Check</th><th>Result</th><th>Remedy</th></tr>
<tr><td>AC power supply</td><td>1</td><td>Is AC power supplied between connectors CN1-L and CN1-N when the power plug is plugged into the outlet?</td><td>No</td><td>Follow the same check procedure of M-1 “No AC power supplied”.</td></tr>
<tr><td>Wiring, DC load</td><td>2</td><td>Turn the power switch OFF and disconnect the P4 connector (panel sensor PCB).
Measure the voltages between the terminals.
Do the measured voltage satisfy the prescribed value in the table below?
<table><tr><th>PCB</th><th>+ lead pin</th><th>- lead pin</th><th>Voltage</th></tr><tr><td rowspan="2">Panel sensor</td><td>P4-1</td><td>P4-4</td><td>Approx. 24 V</td></tr><tr><td>P4-2</td><td>P4-3</td><td>Approx. 5 V</td></tr></table></td><td>Yes</td><td>Turn the power switch OFF, connect the connector disconnected, and turn the power switch ON again.
If the protector circuit is activated, check the connector, the wiring from the connector, and the DC load.</td></tr>
<tr><td>Power supply input unit</td><td>3</td><td></td><td>No</td><td>Replace the power supply input unit after unplugging the power cord from the power outlet.</td></tr>
</table>

M-3	Main motor does not

<table>
<tr><th>Possible cause</th><th>Step</th><th>Check</th><th>Result</th><th>Remedy</th></tr>
<tr><td>Connector failure</td><td>1</td><td>Is the connection of connector P5 to the panel sensor PCB correct?</td><td>No</td><td>Reconnect the connector.</td></tr>
<tr><td>Main motor (M1)</td><td rowspan="2">2</td><td rowspan="2">Disconnect connector P5 from the panel sensor PCB.
Measure the resistance between the connector pins of the main motor by using a circuit tester.
Do the measured resistance satisfy the prescribed value in the table below?
<table><tr><td>P5-1 and P5-3</td><td>Approx. 9 Ω</td></tr><tr><td>P5-4 and P5-6</td><td>Approx. 9 Ω</td></tr></table></td><td>No</td><td>Replace the Main motor.</td></tr>
<tr><td>Panel sensor circuit</td><td>Yes</td><td>Replace the panel sensor PCB.
Replace the Main PCB.</td></tr>
</table>

M-4	No paper pickup feed

Possible cause	Step	Check	Result	Remedy
Connector failure	1	Is the contact of connector P6 to the panel sensor PCB good?	No	Reconnect the connector.
Panel sensor circuit	2	Set paper in the manual paper tray and press the test print button on the operation panel.	No	Replace the panel sensor PCB.
Paper pick-up clutch solenoid (SL501)		Does the voltage between pins 1 (SOLENOID) and 2 (GND) of the P6 connector on the panel sensor PCB change from approx. 24 VDC to 0V within the specified time?	Yes	Replace the paper pick-up solenoid.

M-5	Insufficient output from high-voltage power supply unit

Possible cause	Step	Check	Result	Remedy
High-voltage contact	1	Do any of the terminals on the high-voltage contacts have dirt marks or contact burns?	Yes	Clean the high-voltage contact.
High-voltage power supply failure	2	Check the connection of the harness between the high-voltage power supply and the driver PCB is OK?	Yes	Replace the high-voltage power supply PCB.
			No	Reconnect the harness between the high-voltage power supply and the driver PCB.

M-6	Fixing heater temperature incorrect

Possible cause	Step	Check	Result	Remedy
Poor thermistor harness contact	1	Are the connectors on the erase lamp PCB and the high-voltage power supply PCB secured correctly?	No	Connect the connectors securely.
Blown thermal fuse	2	Remove the fixing unit and measure the resistance between the input connectors. Is it open circuit?	Yes	Replace the fixing unit **after unplugging the power cord from the power outlet**.
Halogen heater lamp failure	3	Remove the fixing unit and measure the resistance of the fixing unit lamp. Is it open circuit?	Yes	Replace the halogen heater lamp.
Thermistor failure	4	Is the thermistor installed properly?	Yes	Replace the fixing unit **after unplugging the power cord from the power outlet**.
			No	Reinstall the thermistor correctly.

M-7	BD failure

Possible cause	Step	Check	Result	Remedy
Harness connection failure	1	Is connector P2 on the panel sensor PCB connected correct?	No	Connect it securely.

M-8	Scanner failure

Possible cause	Step	Check	Result	Remedy
Harness connection failure	1	Is the scanner motor connector and connector P3 on the panel sensor PCB connected correct?	No	Connect the connectors securely.
Power supply input	2	Does the voltage between pins 1 (+24 VDC) and 2 (GND) of connector P3 on the panel sensor PCB measure 24 VDC?	No	Check if +24 VDC is supplied between pins 1 (+24 VDC) and 3 (GND) of connector P4 on the panel sensor PCB. If not, check the power supply input.
			Yes	Replace the scanner unit.

F-1	Double feeding

Possible cause	Step	Check	Result	Remedy
Paper	1	Is paper of a recommended type used?	No	Instruct the user to use the recommended types of paper.
Separation pad	2	Is the surface of the separation pad worn?	Yes	Replace the MP paper tray.

F-2	Wrinkles

Possible cause	Step	Check	Result	Remedy
Paper	1	Is paper of a recommended type used?	No	Instruct the user to use the recommended types of paper.
	2	Is the wrinkle problem solved if new paper is used?	Yes	Instruct the user how to store paper so that it does not absorb moisture.
Fixing unit entrance guide	3	Is the entrance guide dirty?	Yes	Clean the entrance guide.
Fixing unit	4	Is the pressure roller dirty?	Yes	Clean the pressure roller.
				Replace the fixing unit.

4. INSPECTION MODE

4.1 Incorporated Inspection Modes

The printer incorporates the inspection modes such as the factory inspection mode and the test print mode. The inspection mode varies with the model of the printer.

HL-720:	Factory inspection mode and Continuous test print mode
HL-730/730Plus:	Factory inspection mode, Continuous grid pattern print mode, 3 patterns print mode and NV-RAM value dump mode.

The operation of the inspection mode is as follows.

(1) Turn off the power of the printer.

(2) With the top cover open, turn on the power while holding down the button of the operation panel.

When entering this setting, DRUM LED is ON. While holding down the button, LEDs go ON in the order of DRUM -> ALARM -> READY -> DATA -> DRUM. If you release the button, a mode is selected. The mode selected is indicated by the LED which is ON when you release the button. The inspection modes are assigned to the respective LEDs as shown below.

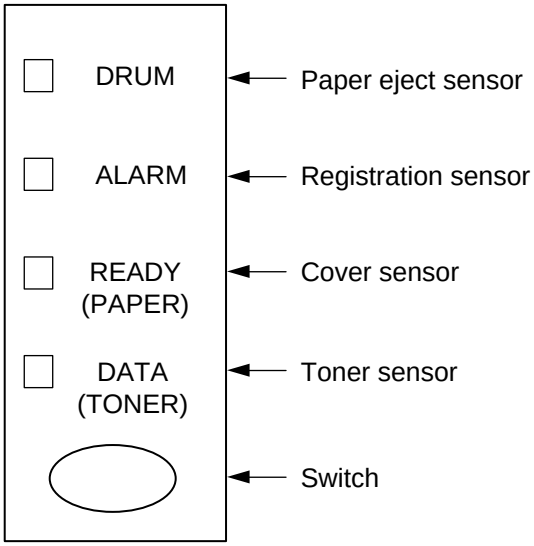
HL-720:

LED	Type of inspection
DRUM	Factory inspection mode
ALARM	Continuous test print mode
READY	Not defined
DATA	Not defined

HL-730/730Plus:

LED	Type of inspection
DRUM	Factory inspection mode
ALARM	Continuous grid pattern print mode
READY	3 patterns print mode (black, grid and horizontal lines)
DATA	NV-RAM value dump mode

Details of the factory inspection mode are as follows.
This mode is used to check if the sensors in the printer function correctly. On the process of this inspection, LEDs and buttons are also checked. On entering this mode, the LEDs show the status of respective sensors as follows.



Paper eject sensor	ON (Paper is detected.)	DRUM LED ON
	OFF (No paper is detected.)	DRUM LED OFF
Registration sensor	ON (Paper is detected.)	ALARM LED ON
	OFF (No paper is detected.)	ALARM LED OFF
Cover sensor	ON (The top cover is closed.)	READY LED OFF
	OFF (The top cover is open.)	READY LED ON
Toner sensor	ON (The toner cartridge is installed.)	DATA LED OFF
	OFF (No toner cartridge is installed.)	DATA LED ON

The procedure for the factory inspection mode is as follows.

(1) Open the top cover and remove the drum unit.

(2) Turn on the power of the printer while holding down the button. The DRUM LED comes ON.

(3) Release the button and immediately lightly press the button again.

(4) Check if DRUM (paper eject sensor) and ALARM (registration sensor) LEDs go OFF after all the LEDs go ON.

If the paper eject sensor is ON at this point and the DRUM LED goes ON (error).
If the registration sensor is ON at this point and the ALARM LED goes ON (error).

(5) Install the drum unit.
Check that the DATA LED goes OFF.

(6) Lightly touch the registration sensor actuator.
Check that the ALARM LED comes ON.

(7) Close the top cover.
Check that the READY LED goes OFF.

(8) Press the button.

(9) If all the sensors are correct, the printer goes back to the READY status. If any error is detected, the corresponding LED stays ON.

4.2 Error codes

In the event of a printer failure, error codes will be indicated as shown below. All the LEDs and the specific LEDs are turned ON alternately. The specific combination of ON LEDs indicates the type of error.

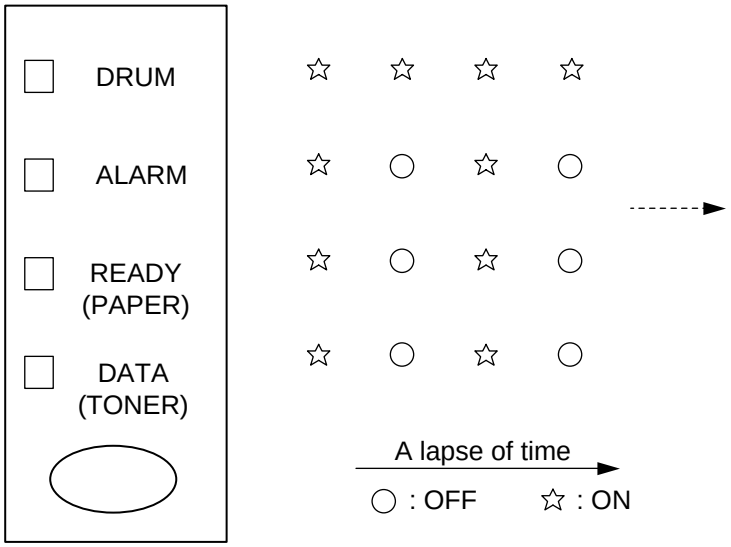
Type of error	DATA	READY	ALARM	DRUM
Fuser malfunction				O
Laser BD malfunction			O	
Scanner Malfunction			Ov	O
ROM Error		O		
D-RAM Error		O		O
Service A *		O	O	
Service B *		O	O	O
Service C *	O			
Service D *	O			O
Service E0 *	O		O	
Service E1 *	O		O	O
Service P *	O	O		
NV-RAM Error	O	O		O

* Note these errors appear in HL-730 only.
Refer to the further description of these errors as follows;

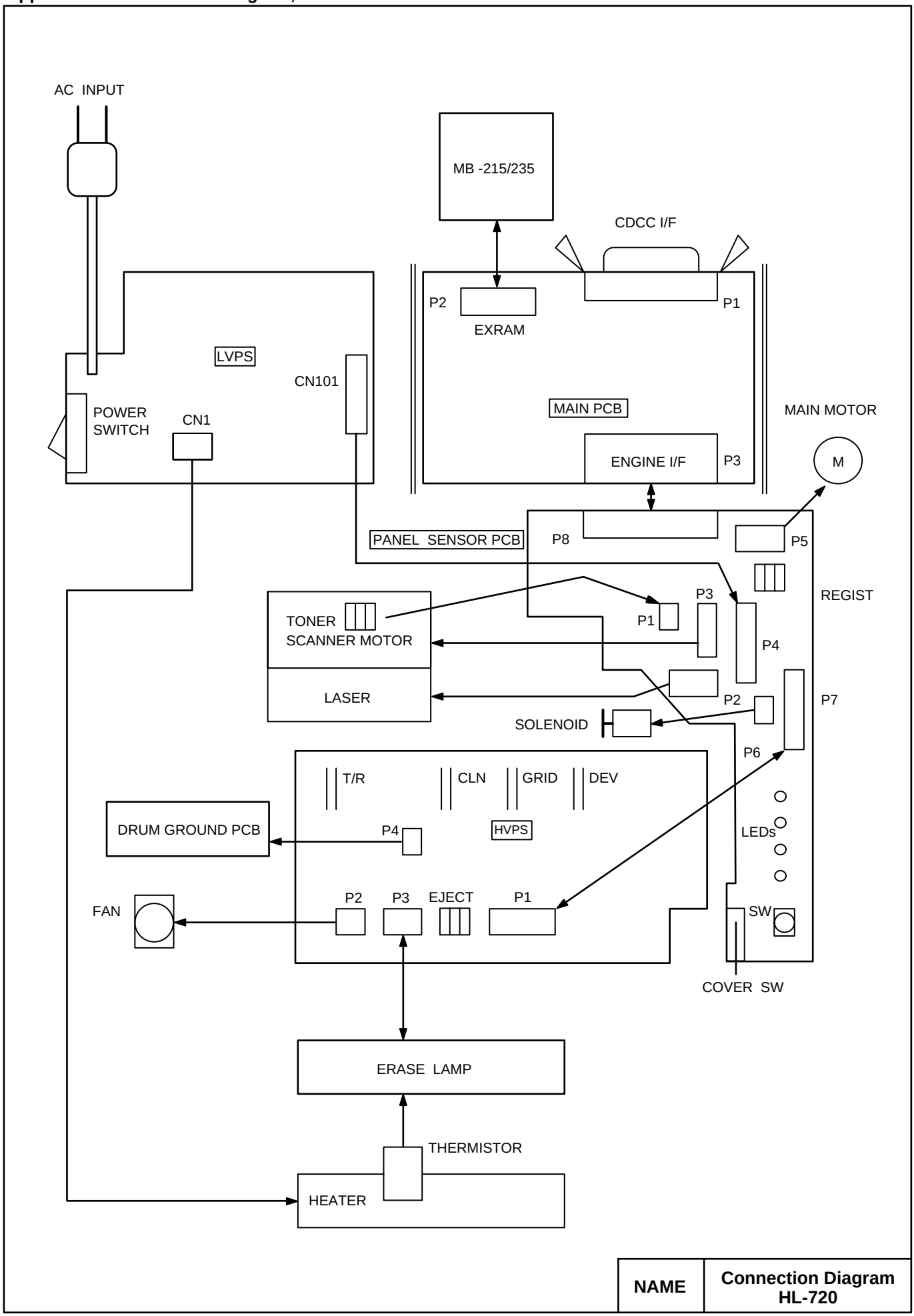
- Service A: Address Error
- Service B: Bus Error
- Service C: Illegal Instruction
- Service D: Zero Divide
- Service E0: Unimplemented Instruction
- Service E1: Unimplemented Instruction
- Service P: Privilege Violation

LED error indications

Fuser Malfunction

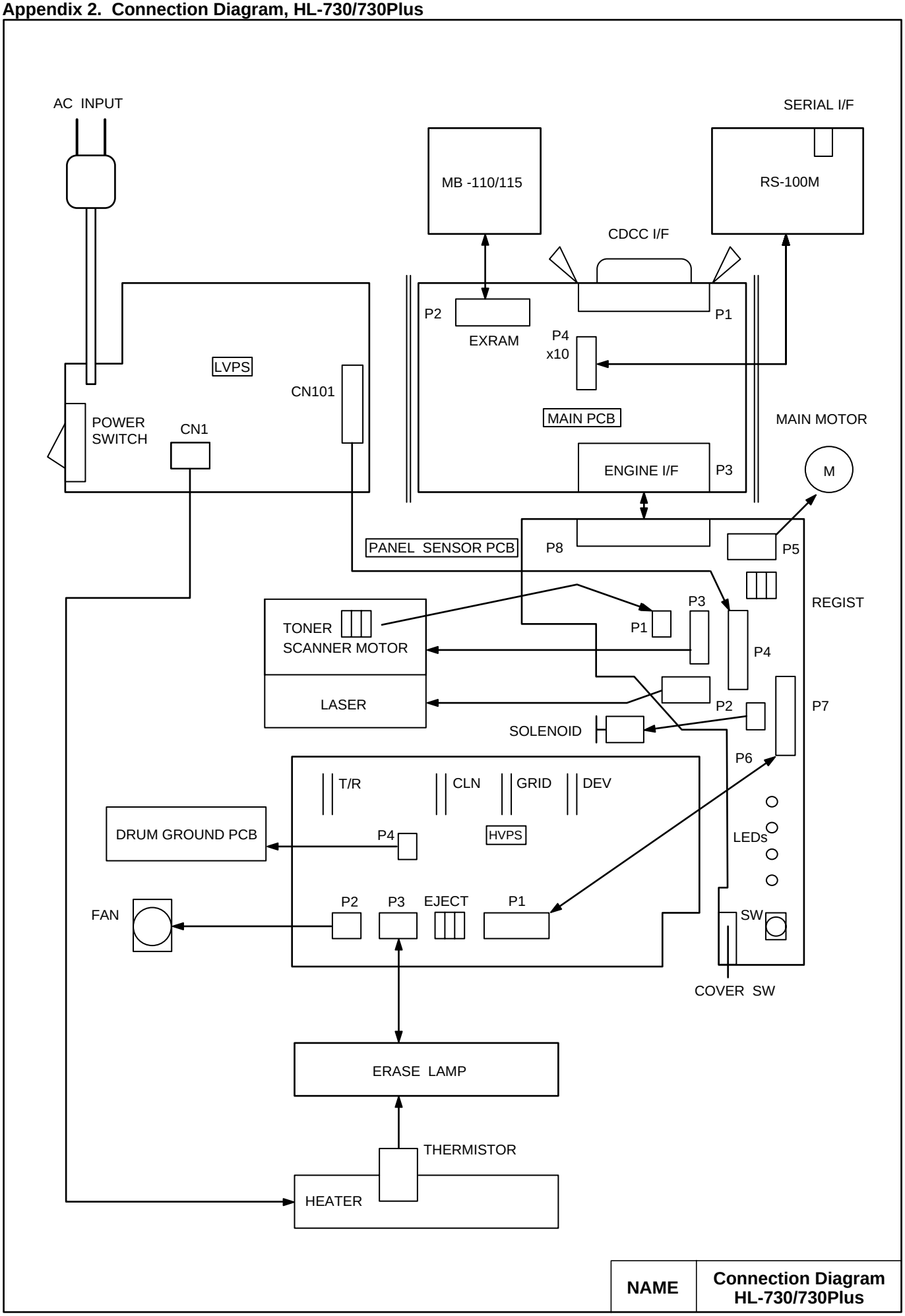


Appendix 1. Connection Diagram, HL-720



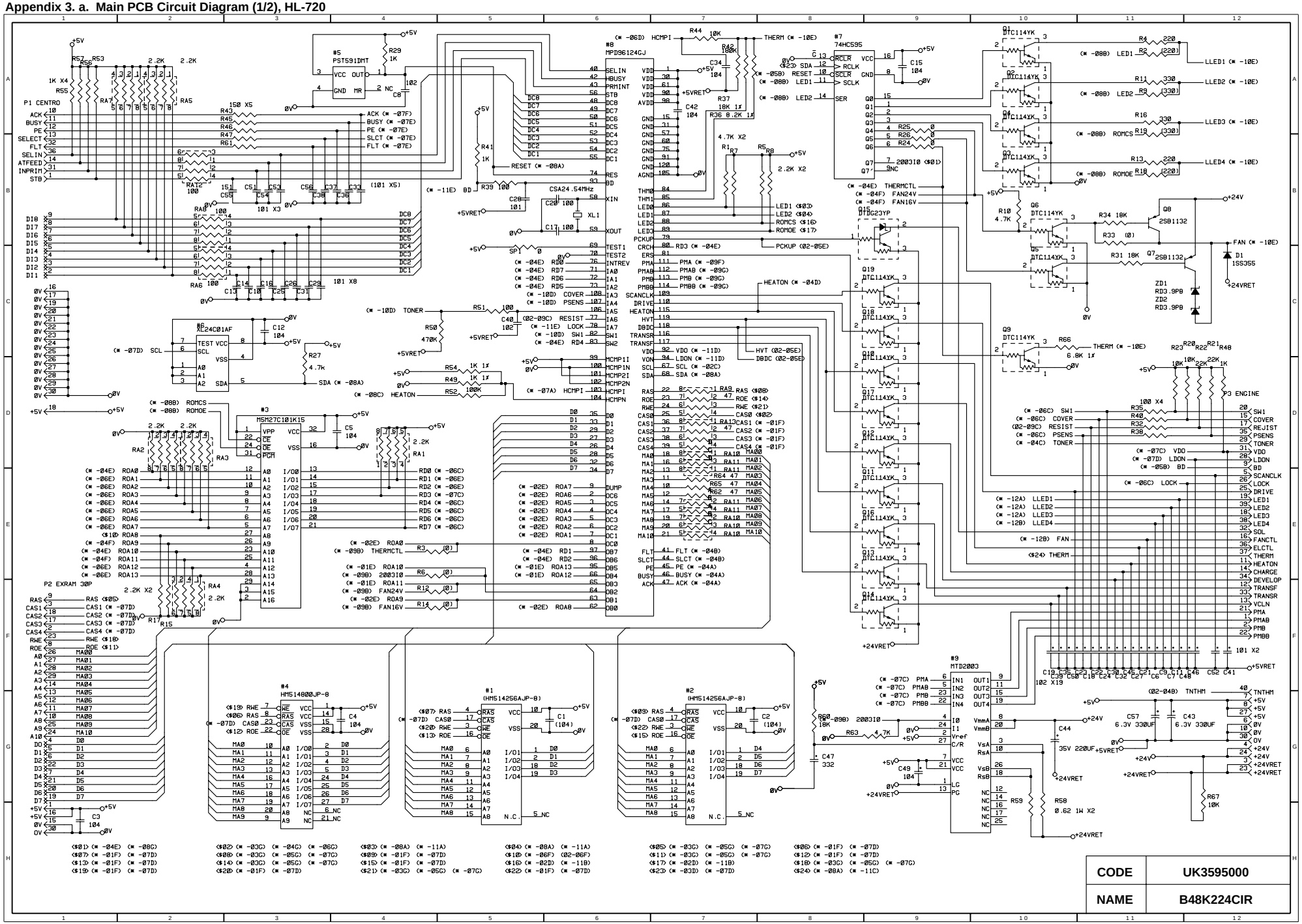
NAME	Connection Diagram HL-720

Appendix 2. Connection Diagram, HL-730/730Plus

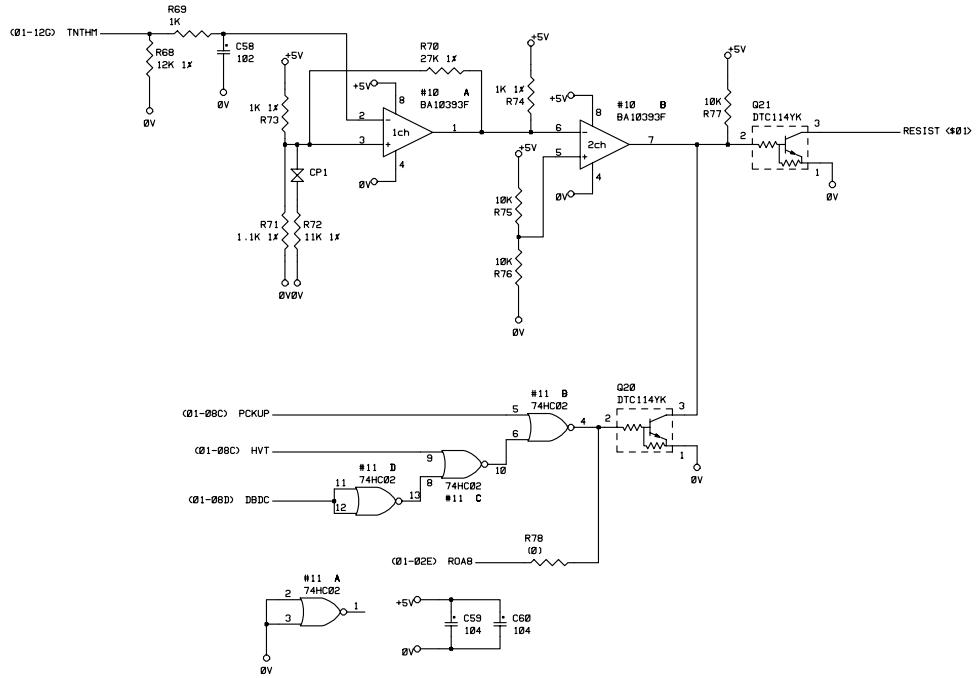


NAME	Connection Diagram HL-730/730Plus

Appendix 3. a. Main PCB Circuit Diagram (1/2), HL-720

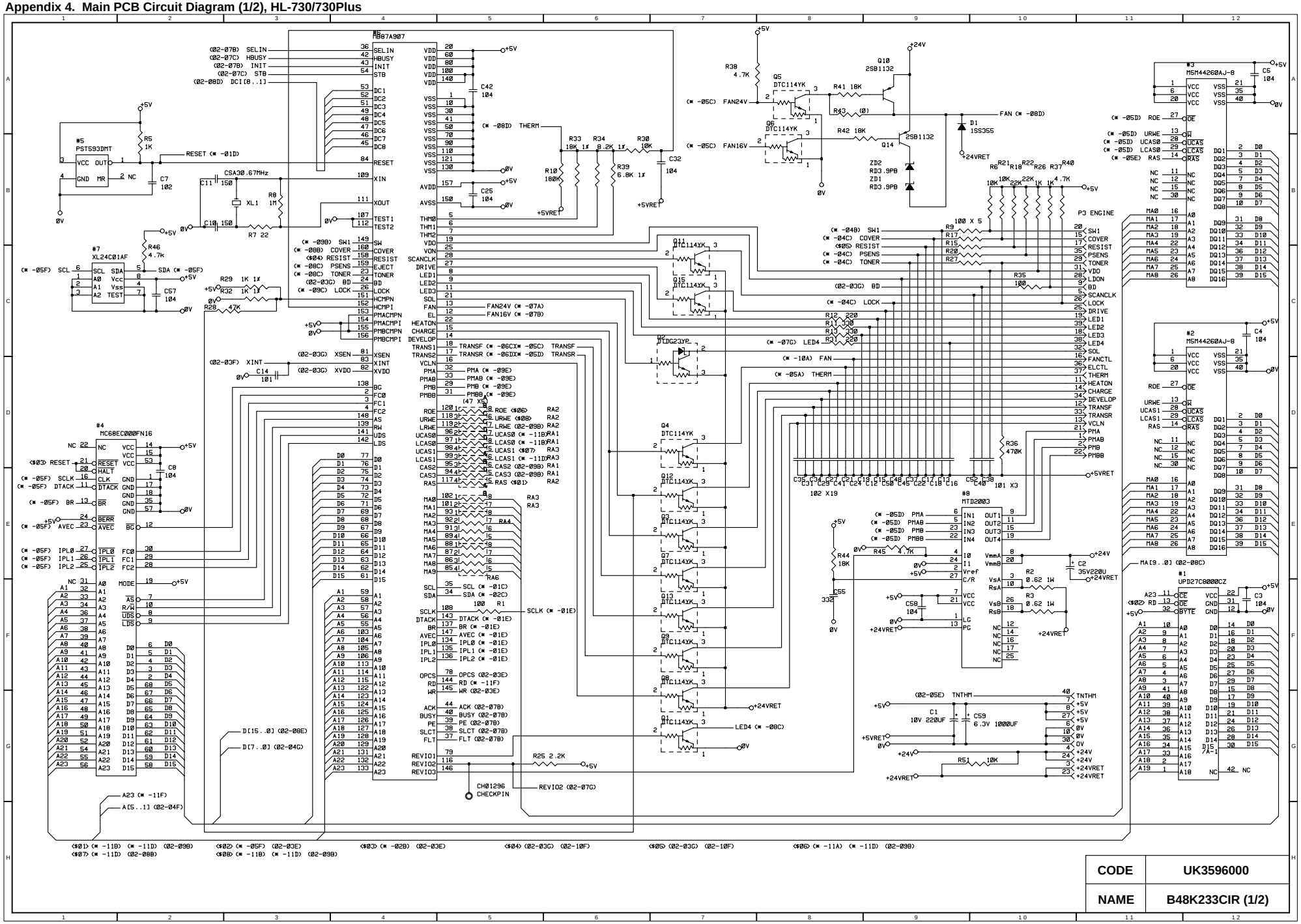


CODE	UK3595000
NAME	B48K224CIR



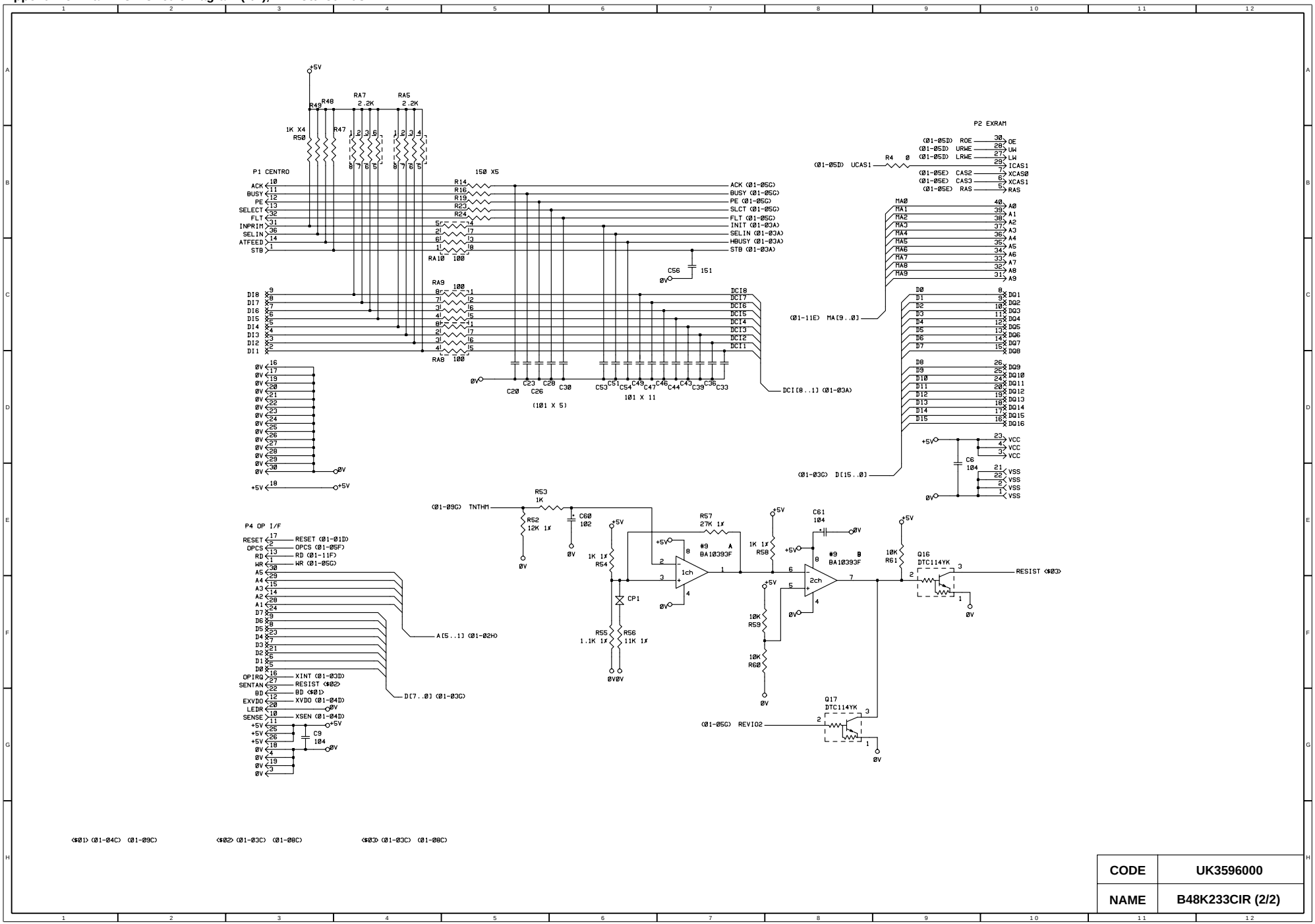
CODE	UK3595000
NAME	B48K224CIR

Appendix 4. Main PCB Circuit Diagram (1/2), HL-730/730Plus

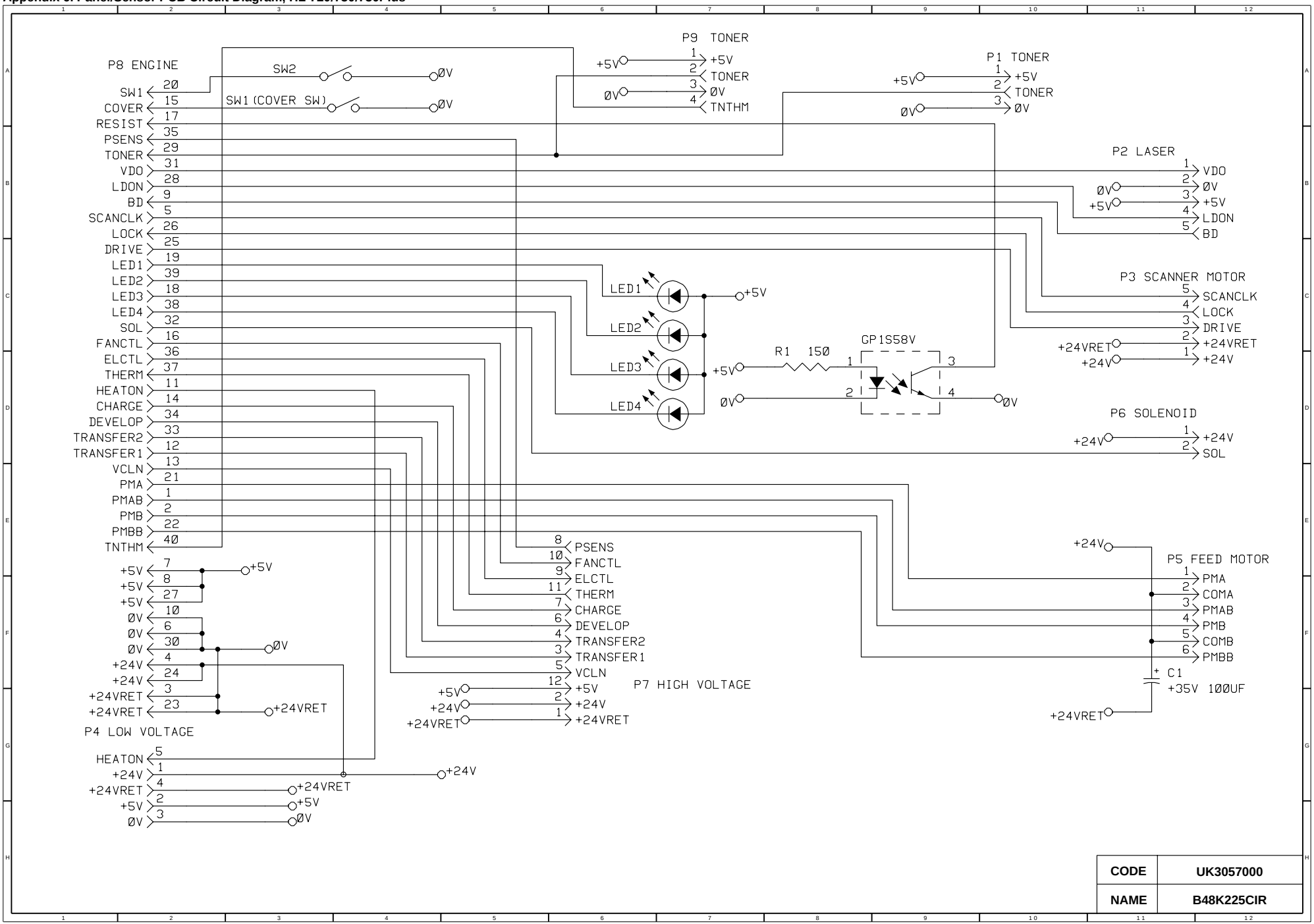


CODE	UK3596000
NAME	B48K233CIR (1/2)

Appendix 5. Main PCB Circuit Diagram (2/2), HL-730/730Plus

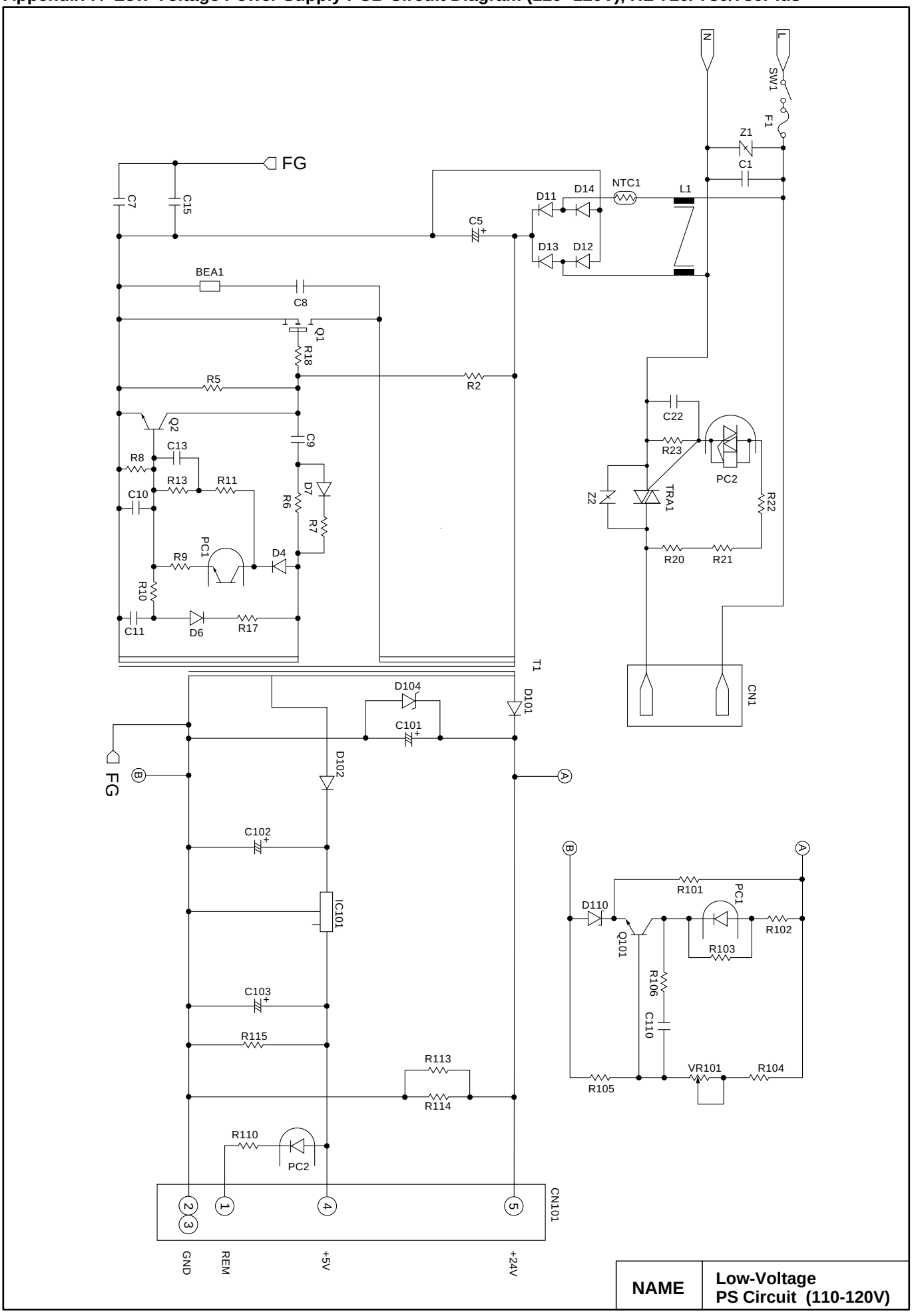


CODE	UK3596000
NAME	B48K233CIR (2/2)



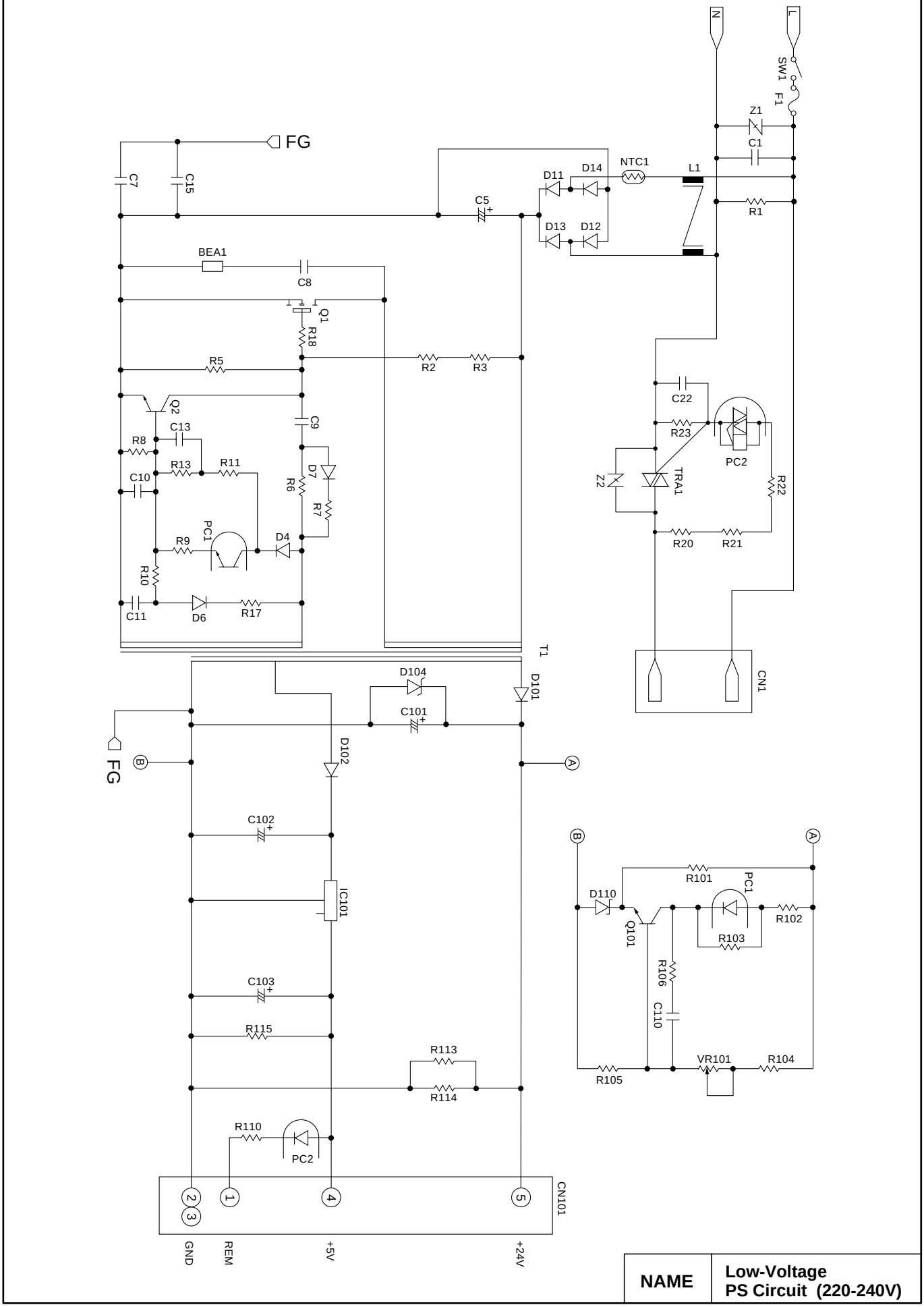
CODE	UK3057000
NAME	B48K225CIR

Appendix 7. Low-Voltage Power Supply PCB Circuit Diagram (110 -120V), HL-720/ 730/730Plus



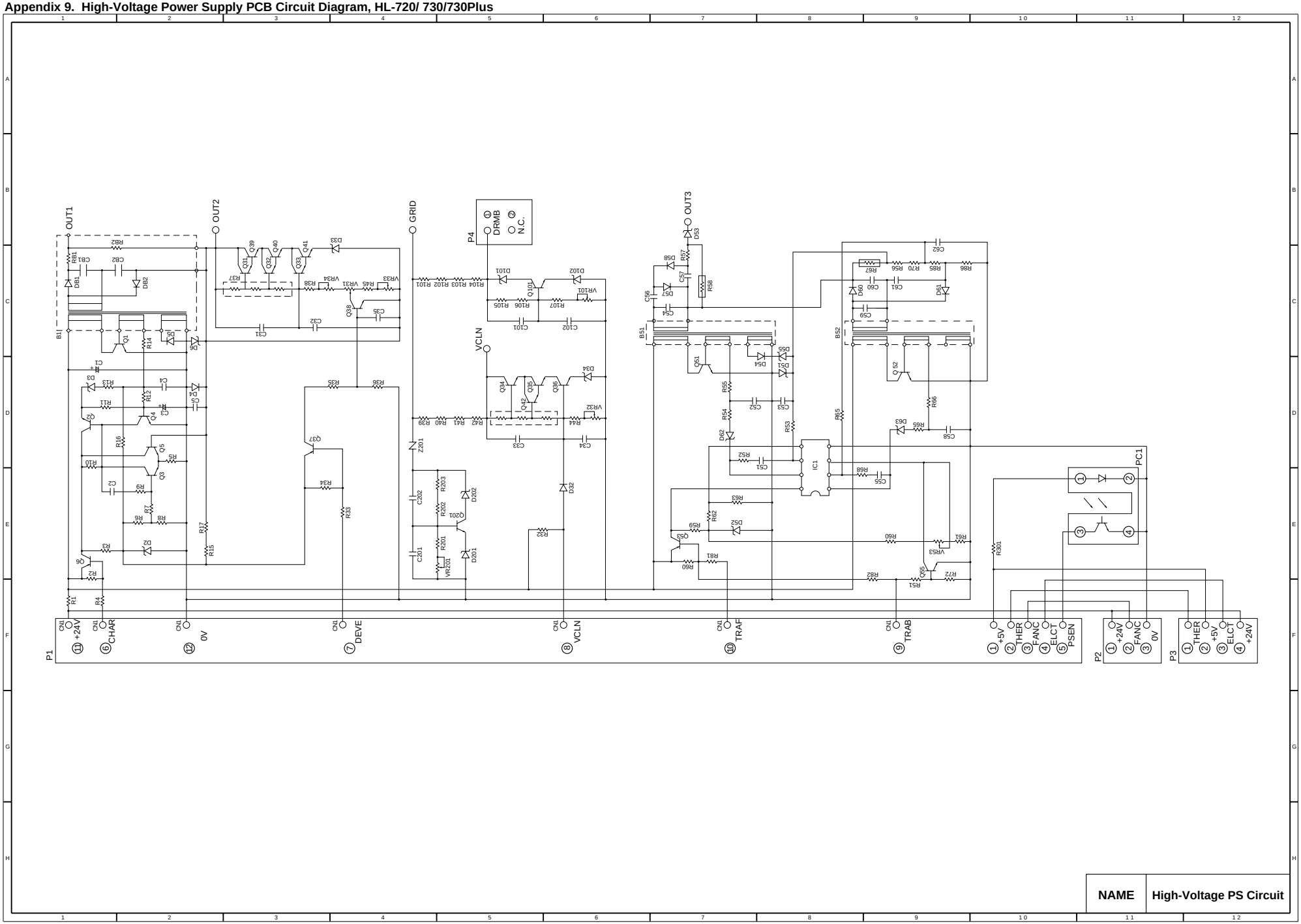
NAME	Low-Voltage PS Circuit (110-120V)

Appendix 8. Low-Voltage Power Supply PCB Circuit Diagram (220 -240V), HL-720/ 730/730Plus



NAME	Low-Voltage PS Circuit (220-240V)

Appendix 9. High-Voltage Power Supply PCB Circuit Diagram, HL-720/ 730/730Plus



brother

LASER PRINTER
SERVICE MANUAL

MODEL:HL-760

PREFACE

This service manual contains basic information required for after-sales service of the laser printer (here-after referred to as "this machine" or "the printer"). This information is vital to the service technical in maintaining the high print quality and performance of the printer.
This service manual covers the HL-760 printer.
This manual consists of the following chapters:

CHAPTER I: **FEATURES AND SPECIFICATIONS**
Features, specifications, etc.

CHAPTER II: **THEORY OF OPERATION**
Basic operation of the mechanical system, the electrical system and the electrical circuit, and their timing.

CHAPTER III: **DISASSEMBLY AND REASSEMBLY**
Procedures of disassembling and reassembling the mechanical system.

CHAPTER IV: **TROUBLESHOOTING**
Reference values and adjustments, troubleshooting for image defects, troubleshooting for malfunctions, etc.

APPENDICES: Connection diagrams, PCB circuit diagrams.

Note: This service manual ffor the HL-760 describes only the changesin each part of the HL-720/730 (84U002BE0) service manual which was published previously. Parts in common with those in the HL-720/730 service manual are omitted, this is indicated in the Table of Contents.. When you require to refer to the parts omitted in this manual, please refer to the service manual of that model.

Information in this manual is subject to change due to improvement or re-design of the product. All relevant information in such cases will be supplied in service information bulletins (Technical Information).
A thorough understanding of this printer, based on information in this service manual and service information bulletins, is required for maintaining its quality performance and for fostering the practical ability to find the cause of problems.

CONTENTS

CHAPTER I FEATURES AND SPECIFICATIONS

1. FEATURES

This printer has the following features:

600 dpi Resolution and 6 ppm Printing Speed

600 dots per inch (dpi) resolution with microfine toner and six pages per minute (ppm) printing speed (A4 or Letter paper). This printer also supports 1200 (H) x 600 (V) dots per inch (dpi) for Windows DIB (Device Independent Bitmap) graphics. (It is recommended to add memory when printing in 1200 x 600 dpi mode.)

User-Friendly Operation for Windows

The dedicated printer driver and TrueType™-compatible fonts for Microsoft® Windows 3.1 and Windows 95 are available on the floppy disks supplied with your printer. You can easily install them into your Windows system using our installer program. The driver supports our unique data compression mode to enhance printing speed in Windows applications and allows you to set various printer settings including toner saving mode, custom paper size, sleep mode, gray scale adjustment, resolution, and so forth. You can easily setup these print options in the graphic dialog boxes through Printer Setup within the Windows Control Panel.

Printer Status Monitor with Bi-directional Parallel Interface

The printer driver can monitor your printer's status using bi-directional parallel communications.

The printer status monitor program can show the current status of your printer. When printing, an animated dialog box appears on your computer screen to show the current printing process. If an error occurs, a dialog box will appear to let you know what to correct. For example: when your printer is out of paper, the dialog box will display "Paper Empty" and will give the instructions for the corrective action to take.

Versatile Paper Handling

The printer has a multi-purpose sheet feeder and a straight paper path mechanism. Using this mechanism, you can load A4, letter, legal, B5, A5, and executive sizes of paper, and various types of paper including envelopes, postcards, organizer paper, or a custom paper size. The multi-purpose sheet feeder also allows manual paper loading, so you can also use labels and transparencies.

Environment-Friendly

Economy Printing Mode

This feature will cut your printing costs by saving toner. It is useful to obtain draft copies for proof-reading. You can select from two economy modes, 25% toner saving and 50% toner saving, through the Windows printer driver supplied with your printer.

Sleep Mode (Power Save Mode)
Sleep mode automatically reduces power consumption when the printer is not in use. The printer consumes less than 9W when in sleep mode.

Low Running Cost
The toner cartridge is separate from the drum unit. You need to replace only the toner cartridge after around 2,000 pages, which is cost effective and ecologically friendly. (In some countries the printer is supplied with a starter toner cartridge which must be replaced after 1,000 pages.)

Remote Printer Console Program for DOS

The utility program, Remote Printer Console (RPC), is available on the floppy disk supplied with your printer. When you operate your computer in the DOS (Disk Operating System) environment, this program allows you to easily change default settings of the printer such as fonts, page setup, emulations and so on. This program also provides a status monitor program, which is a Terminate-and-Stay Resident (TSR) program. It can monitor the printer status while running in the background and report the current status or errors on your computer screen.

Popular Printer Emulation Support

This printer supports three printer emulation modes, HP LaserJet 5P, Epson FX-850, and IBM Proprinter XL. The printer also supports Auto-emulation switching between HP and Epson or HP and IBM. If you want to set the printer emulation, you can do it by using the Remote Printer Console Program.

Optional Apple Macintosh Interface

An optional Apple Macintosh serial interface kit is available which allows your printer to be connected to Apple Macintosh computers. With this option, you can use your printer with both an IBM PC, or compatible, and an Apple Macintosh at the same time. This optional interface board can be used as an RS-422A interface for Macintosh or an RS-232C serial interface for IBM PC or compatible.

Enhanced Memory Management

The printer provides its own data compression technology in the printer hardware and the supplied printer driver software, which can automatically compress graphic data and font data efficiently into the printer's memory. You can avoid memory errors and print most full page 600 dpi graphic and text data, including large fonts, with the printer's standard memory.

2. SPECIFICATIONS

2.1 Printing

Print method	Electrophotography by semiconductor laser beam scanning
Resolution	1200 (H) x 600 (V) dots/inch (for Windows DIB graphics) 600 x 600 dots/inch (for Windows and DOS) 300 x 300 dots/inch (using Apple Macintosh with the optional RS-100M)
Print speed	Up to 6 pages/minute (when loading A4 or letter-size paper from the multi-purpose sheet feeder)
Warm-up	Max. 20 seconds at 23°C (73.4°F)
First print	20 seconds (when loading A4 or letter-size paper from the multi-purpose sheet feeder)
Print media	Toner in a cartridge Life Expectancy: 2,200 pages/cartridge (when printing A4 or letter -size paper at 5% print coverage)
Developer	Drum unit, separate from the toner cartridge

2.2 Functions

CPU	IDT79R3041-20J 20Mhz
Emulation	Automatic emulation selection among HP LaserJet 5P (PCL Level 5e), EPSON FX-850, and IBM Proprinter XL
Printer driver	Windows 95/Windows 3.1 driver, supporting Brother Native Compression mode and bi-directional capability. Optional Macintosh® QuickDraw driver (Standard in some countries.)
Interface	Bi-directional Centronics parallel interface. (IEEE 1284 compliant) An RS-422A/RS-232C serial interface (RS-100M) is optionally available.
Memory	1.0 Mbytes with Data Compression Technology. Expandable up to 33 Mbytes by installing an industry standard SIMM.
Control panel	1 switch and 4 lamps
Diagnostics	Self-diagnostic program

2.3 Electrical and Mechanical

Power source	U.S.A. and Canada:	AC 110 to 120 V, 50/60Hz
	Europe and Australia:	AC 220 to 240 V, 50Hz
Power consumption	Printing:	150 W or less
	Standing by:	35 W or less
	Sleep:	9 W or less
Noise	Printing:	48 dB A or less
	Standing by:	35 dB A or less
Temperature	Operating:	10 to 32.5°C (59 to 90.5°F)
	Storage:	0 to 40° C (38 to 104°F)
Humidity	Operating:	20 to 80% (without condensation)
	Storage:	20 to 80% (without condensation)
Dimensions (W x D x H)	366 (W) x 383 (D) x 250 (H) (when the output tray is closed and the Multi-purpose sheet feeder is removed.)	
Weight	Approx. 7.0 kg (15.45 lb.) including the drum unit.	

CHAPTER II THEORY OF OPERATION

1. ELECTRONICS

1.1 General Block Diagram

Fig. 2.1 shows a general block diagram of this printer.

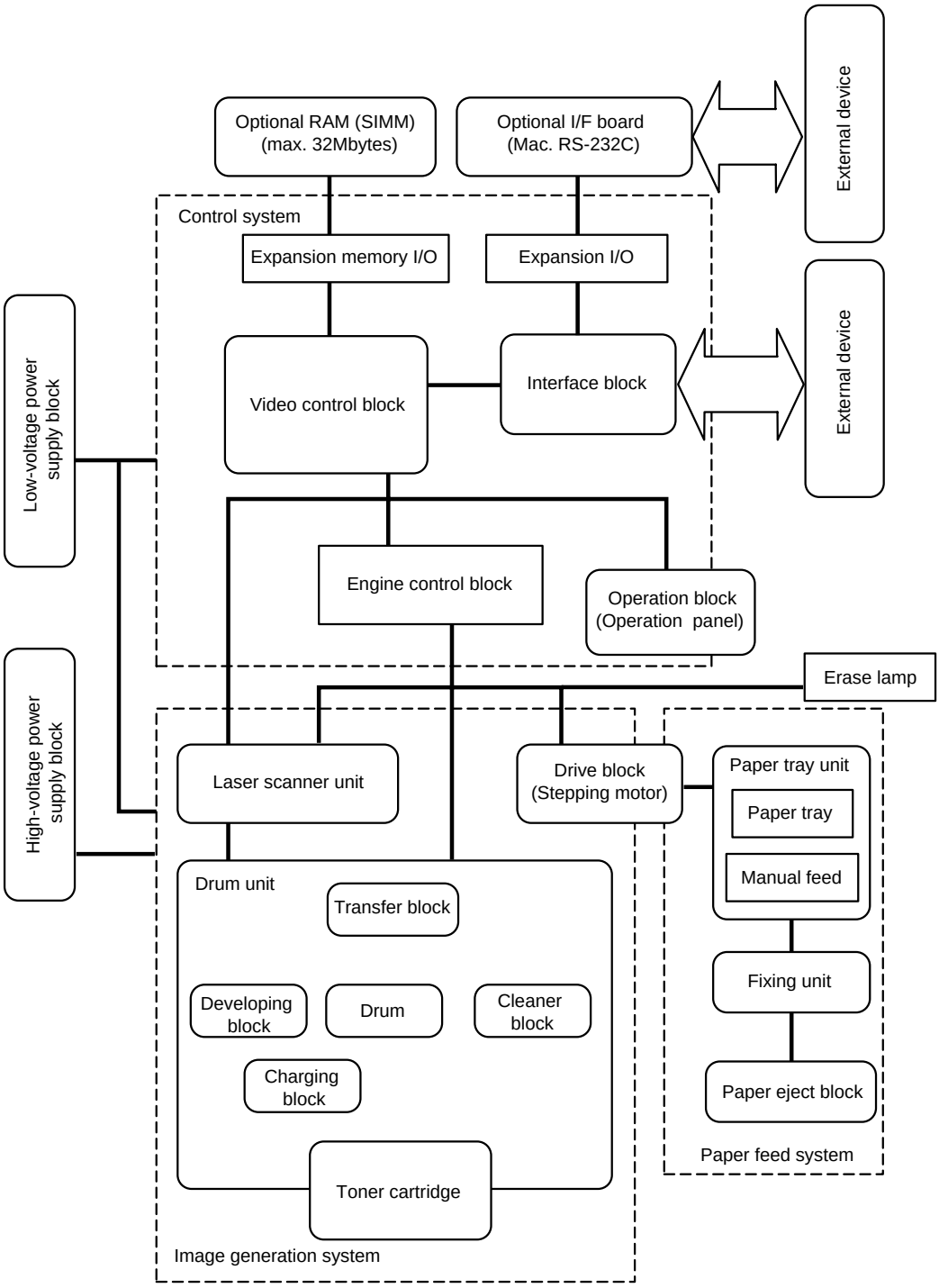


Fig. 2.1

1.2 Main PCB Block Diagram

Fig. 2.2 shows a block diagram of the main PCB.

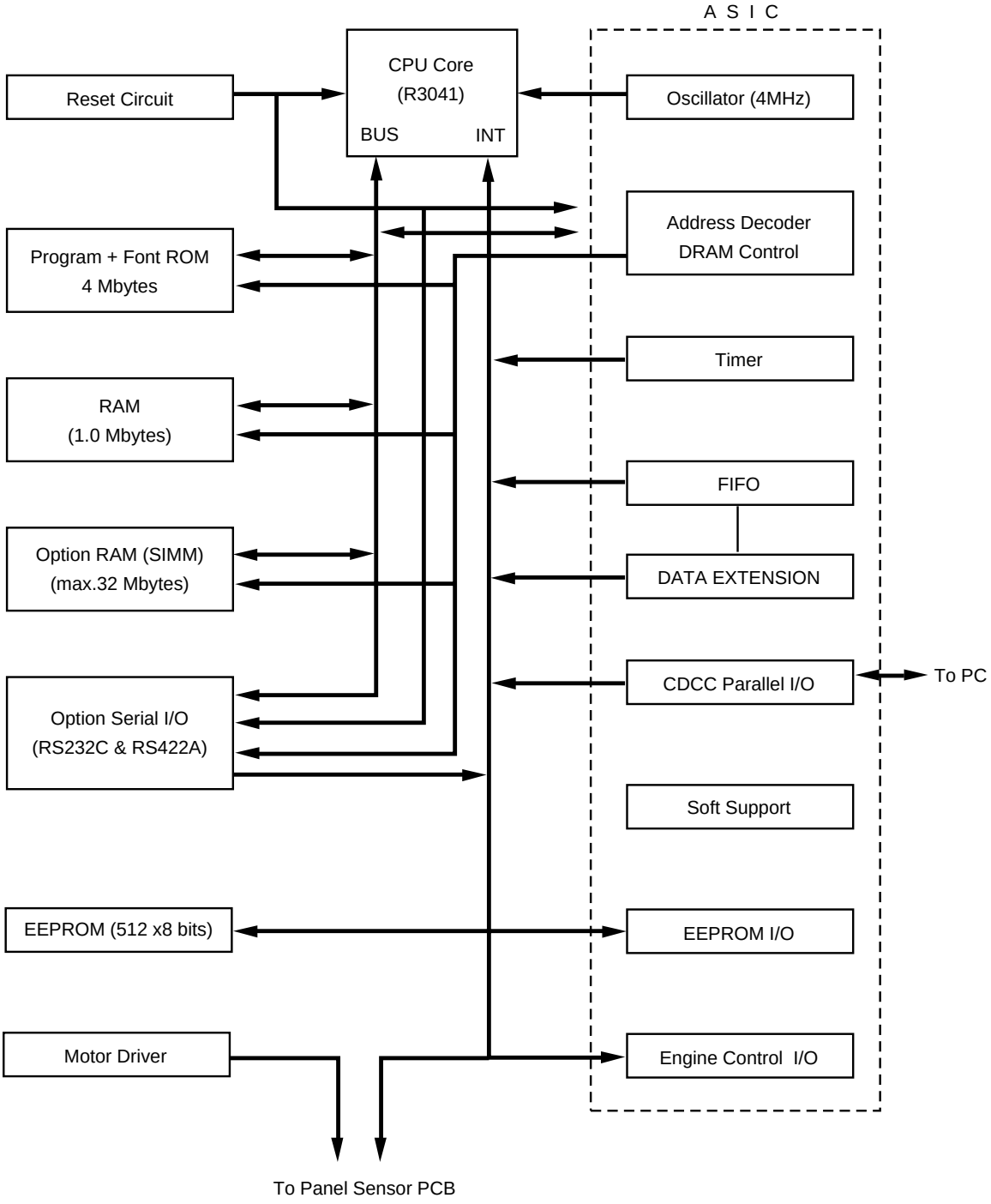


Fig. 2.2

1.3 Main PCB

1.3.1 CPU Core

Fig. 2.3. shows the CPU circuit block on the main PCB.
The CPU is an IDT 79R3041-20J which is driven at a clock frequency of 20 MHz. This clock frequency is made by dividing the source clock of 40.0 MHz into two. The address and data bus are both 32 bit of AD0 to AD31 and D0 to D31. The total addressable memory space is 4 Gbytes.

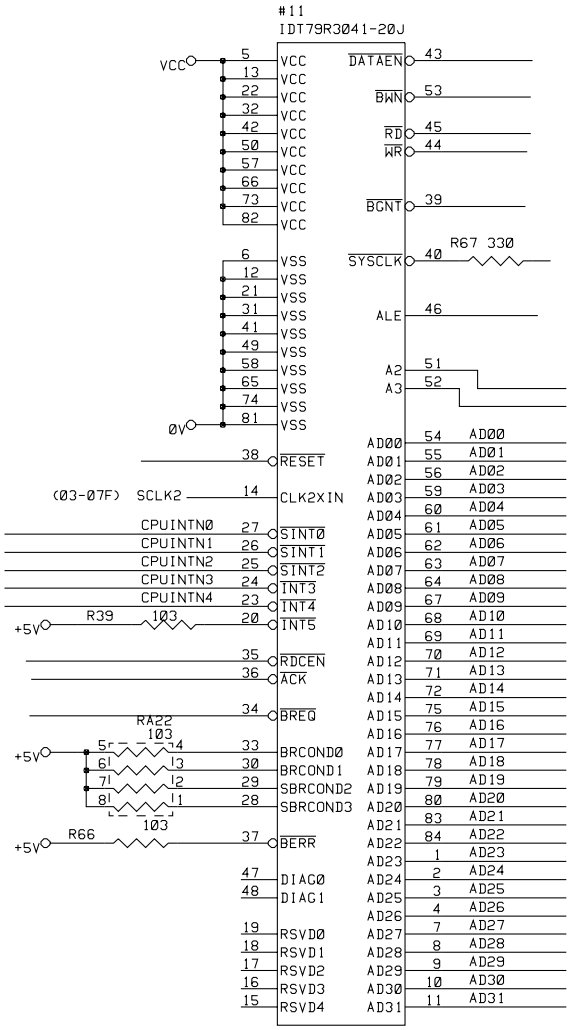


Fig. 2.3

1.3.2 ASIC

The ASIC is composed of a Cell Based IC and has the following function blocks.

(1) Oscillator circuit
Generates the main clock for the CPU by dividing the source clock frequency by two.

(2) Address Generator
This controls the address buss by latching the AD buss signals with the ALE signal.

(3) Address decoder
Generates the CS for each device.

(4) DRAM control
Generates the $\overline{RAS}$, $\overline{CAS}$, $\overline{WE}$, $\overline{OE}$ and MA signals for the DRAM and controls the memory refresh processing (CAS before RAS self-refreshing method).

(5) Interrupt control
Interrupt levels:

Priority	High	9	TIMER 3 (Watch Dog)
		8	MONITOR
		7	FIFO
		6	EXINT
		5	TIMER1
		4	BD
		3	Spare
		2	CDCC / BOISE / DATA EXTENTION
	Low	1	TIMER 2

All the interrupts can be masked.

(6) Timers
The following timers are included:

Timer 1	16-bit timer
Timer 2	10-bit timer
Timer 3	Watch-dog timer

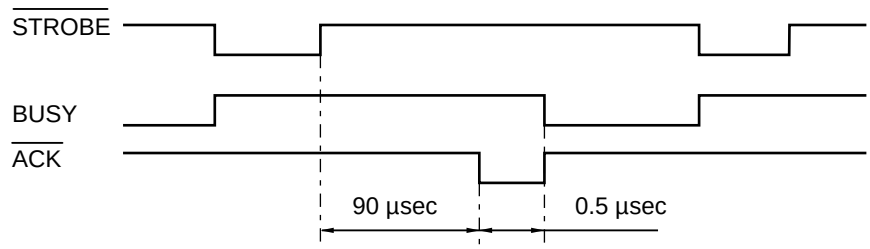
(7) FIFO
A 10Kbit FIFO is includedrporated. Data for one raster is transferred from the RAM to the FIFO by DMA transmission and is output as serial video data. The data cycle is 6.13 Mhz.

(8) CDCC parallel I/O

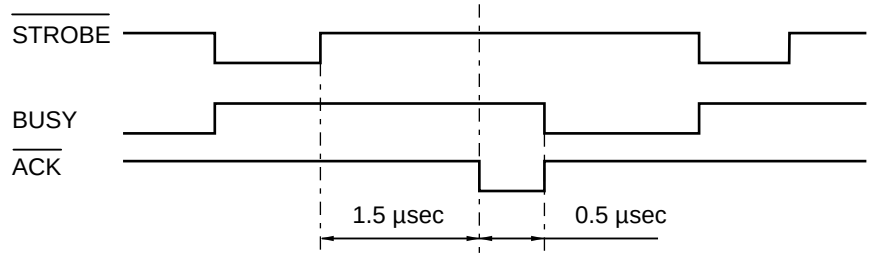
<Data receiving>

There are two modes in this unit. One is the CPU receiving mode and the other is the DMA receiving mode. In the CPU receiving mode the CPU receives the command data from the PC, and after the CPU is switched to the DMA mode, it receives the image data and writes to the DRAM directly.

CPU Receiving Mode



DMA Receiving Mode



BUSY goes HIGH at the falling edge of STROBE. The data (8 bits) from the PC is latched in the data buffer at the rising edge of STROBE. The pulse width of ACK differs according to the speed MODE as shown above. BUSY goes LOW at the rising edge of ACK.

<IEEE1284 support>

This supports the IEEE1284 data transfer with the following mode.

Nibble mode
Byte mode
ECP mode

(9) Data extension

This circuit extents the compressed image data which are received from the PC, and writes the bit map data to the FIFO.

(10) Software support

Supports 16 x 16 rotation, bit expansion, bit search, and decimal point change.

(11) EEPROM I/O

One output port and one I/O port are assigned.

(12) Engine control I/O

This I/O is used for the connection to the panel sensor PCB. It controls the main motor, solenoid, sensors, etc.

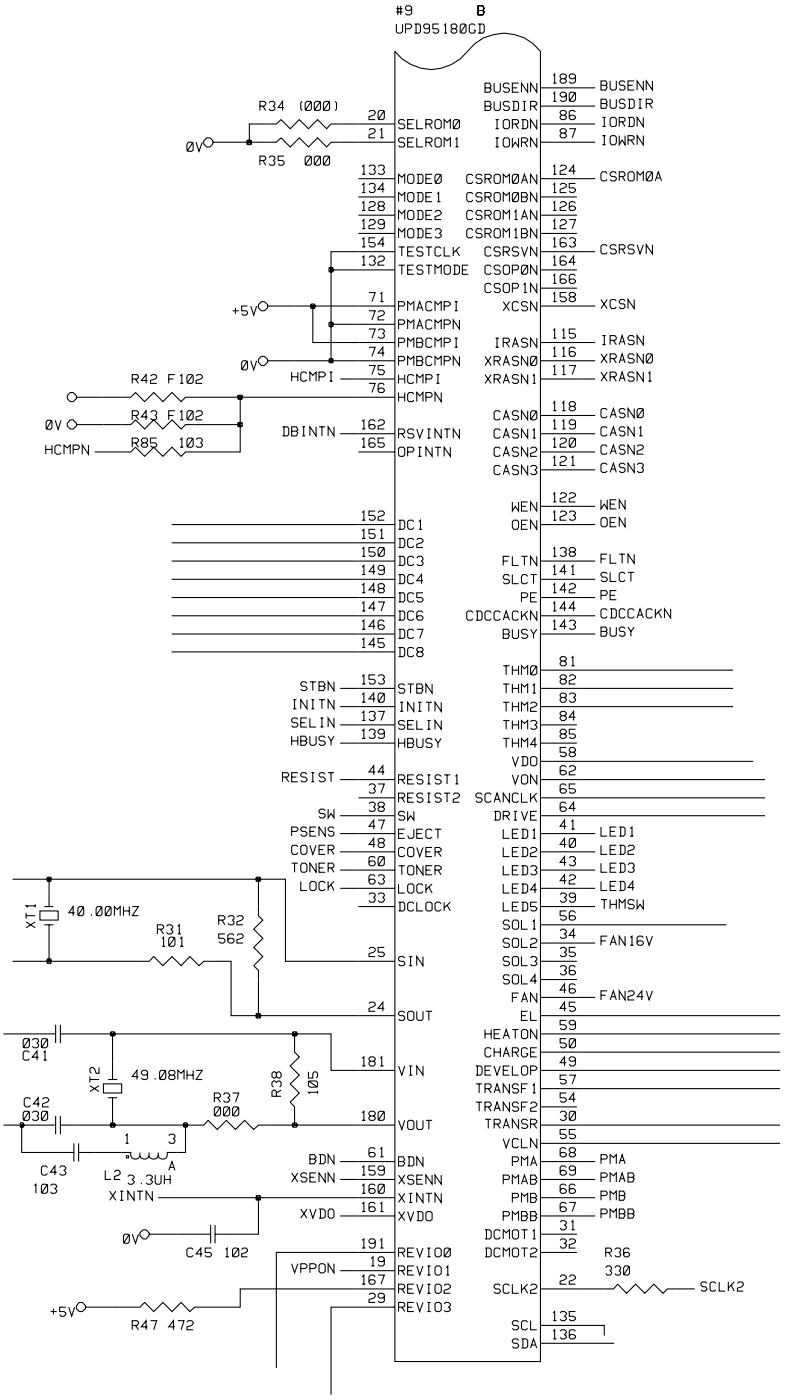


Fig. 2.4

1.3.3 ROM

A program and font data are stored in the 4MBytes ROM. ROM is composed by the two 16 Mbits masks and is mounted to the 42 pin IC socket. And 16 Mbits Flash ROM Module can be mounted to it, too.

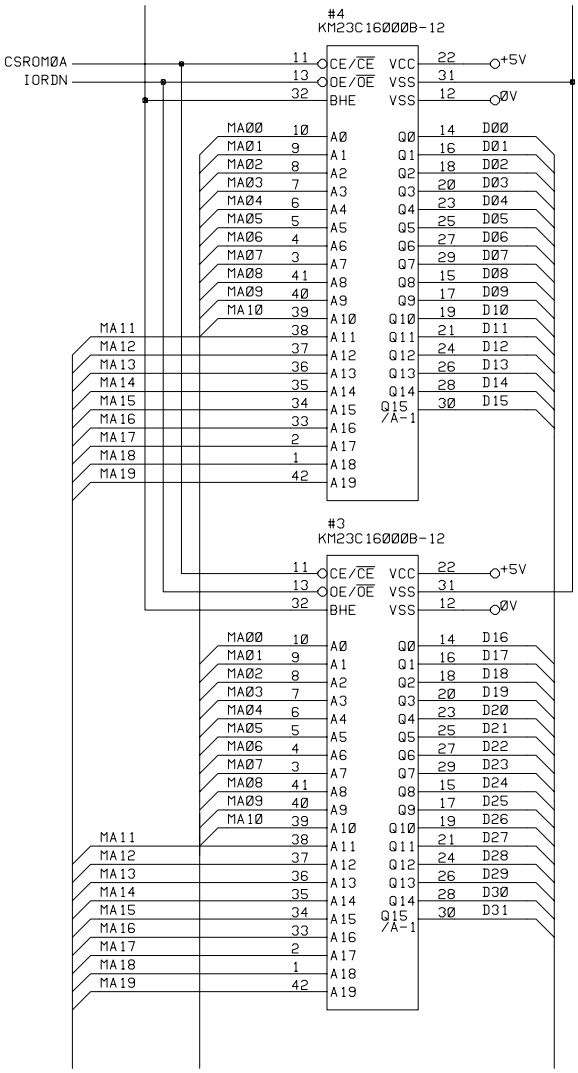


Fig. 2.5

1.3.4 DRAM

Two 4M-bit DRAMs (x 16bits) are used as the RAM.

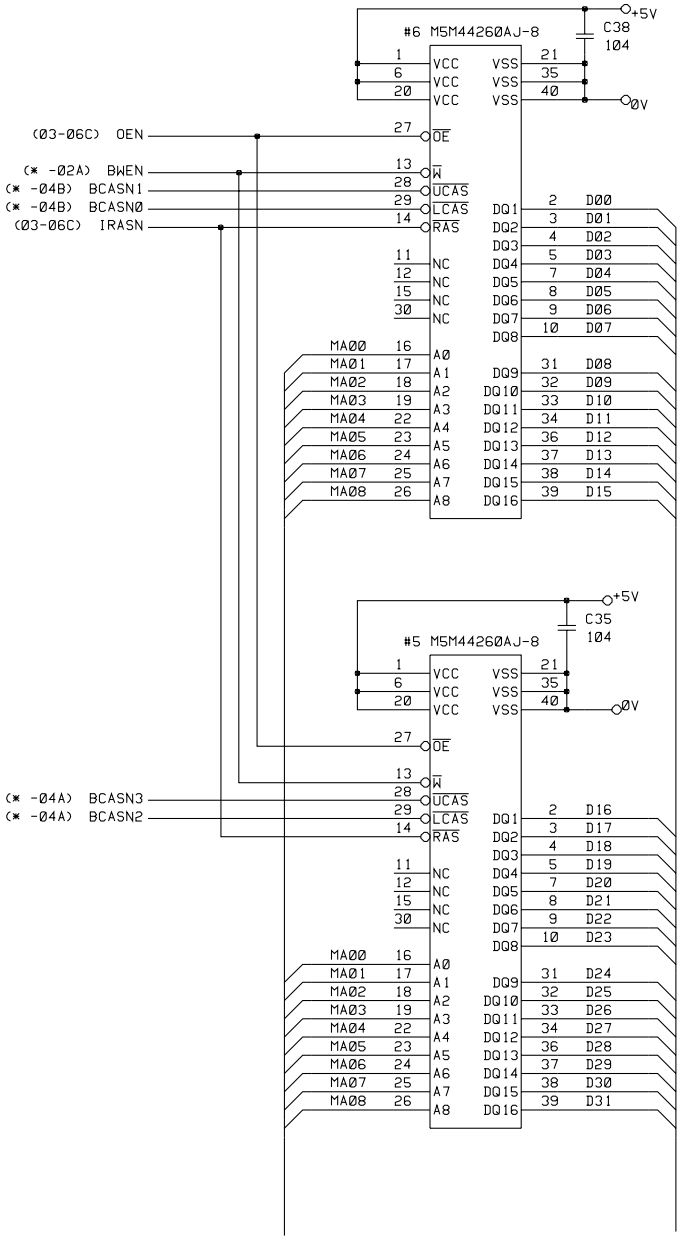


Fig. 2.6

1.3.5 Optional RAM

As the option RAM, 32 bit SIMM of 72 pin can be mounted. SIMM has one slot and can deal with 1 MBytes to 32 MBytes.

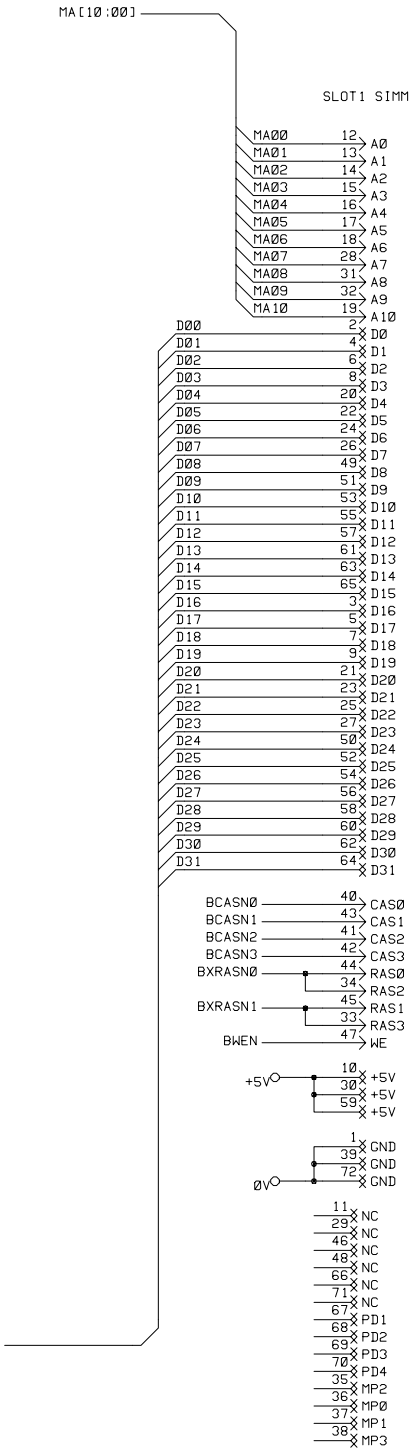


Fig. 2.7

1.3.6 Optional Serial I/O

The interrupt of serial I/O are input to the EXINT terminal of the ASIC, and are recognized by the CPU. A 32-byte space for register is provided for this I/O, which are read and written to by the CPU.

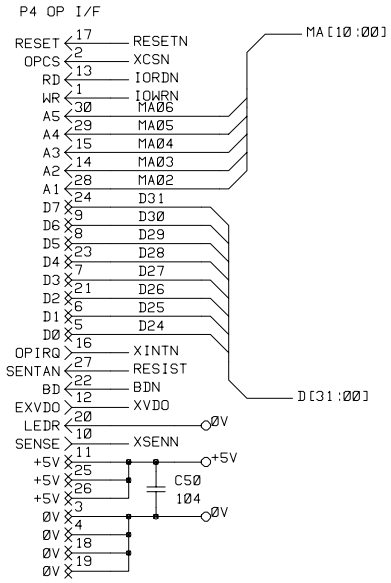


Fig. 2.8

1.3.7 EEPROM

The EEPROM is X24C04F type of a two-wire method with a 512 x 8 bits configuration.

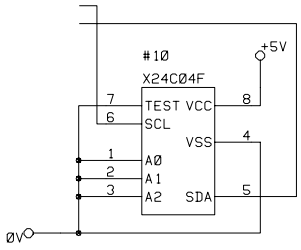


Fig. 2.9

1.3.8 Reset Circuit

The reset IC is PST591DMT. The reset voltage is 4.2V (typ.) and the LOW period of reset is 50 ms (typ).

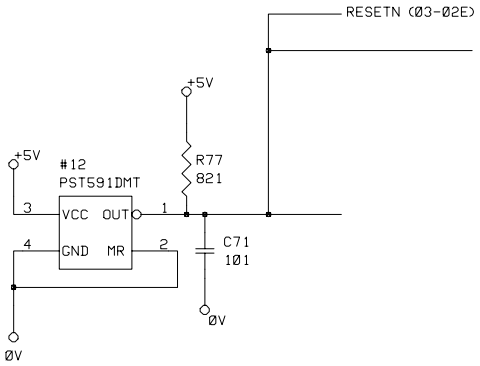


Fig. 2.10

1.3.9 CDCC I/O

Fig. 2.11 shows the CDCC interface circuit.

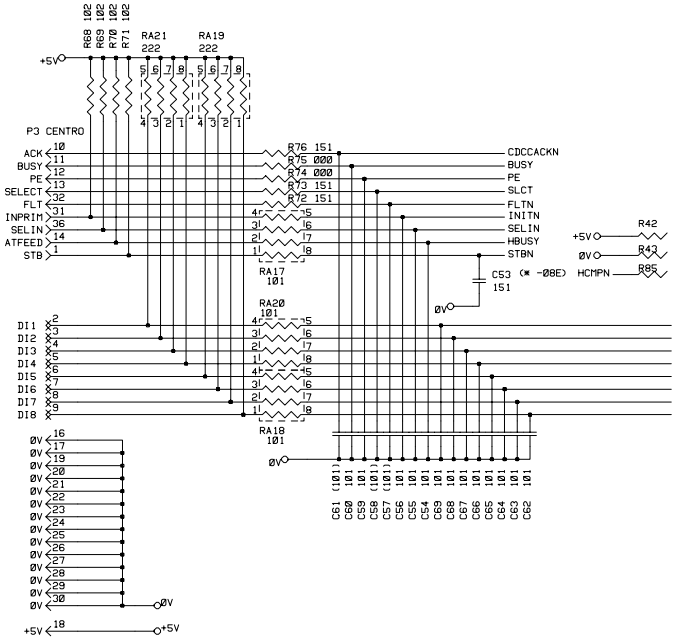


Fig. 2.11

1.3.10 Engine I/O

Fig. 2.12 shows the engine interface circuit.

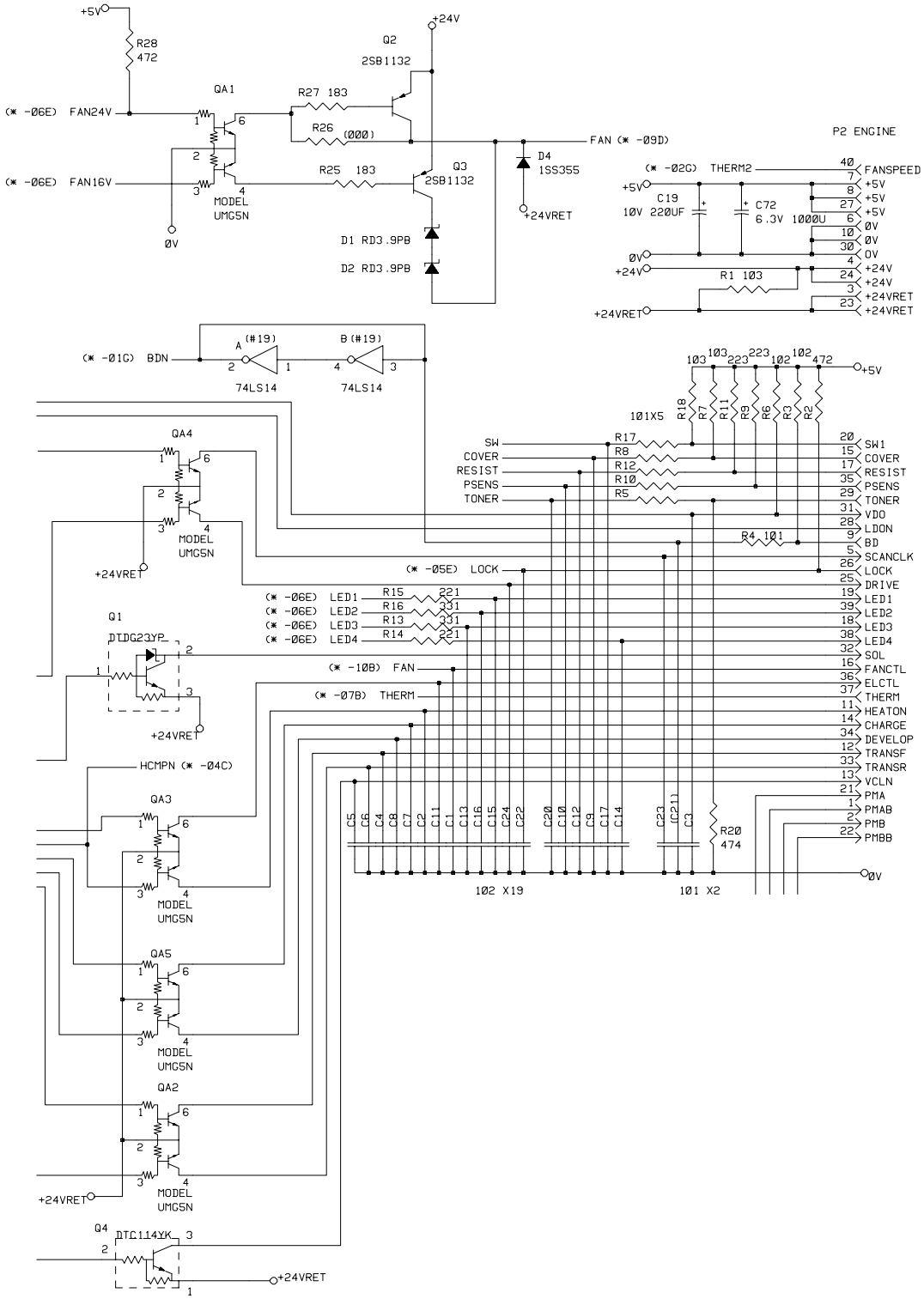


Fig. 2.12

1.3.11 Paper Feed Motor Drive Circuit

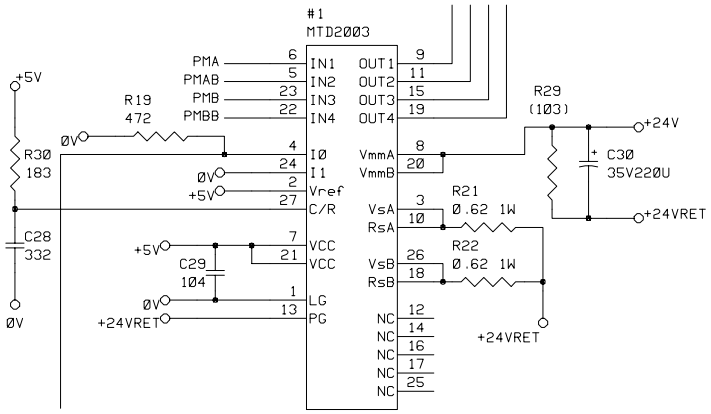


Fig. 2.13

CHAPTER III DISASSEMBLY AND REASSEMBLY

1. SAFETY PRECAUTIONS

To avoid creating secondary problems by mishandling, be careful to follow the precautions below during maintenance work.

(1) Always turn off the power switch and unplug the power cord from the power outlet before accessing any parts inside the printer.

(2) Be careful not to lose screws, washers, or other parts removed during servicing.

(3) Be sure to apply grease to the gears and other positions as specified in this chapter.

(4) When using soldering irons or other heat-generating tools, take care not to damage wiring, PCBs and covers.

(5) Before handing the PCBs, touch a metal part of the equipment to discharge any static electricity chargein your body, or elseelectronic parts or components may be damaged.

(6) When transporting PCBs, be sure to wrap them in conductive sheet to prevent static damage.

(7) Be sure to replace self-tapping screws correctly, if removed during servicing. Unless otherwise specified, tighten screws to the following torque values.

TAPTITE, BIND or CUP B
M3 : 6kgf • cm
M4 : 9kgf • cm

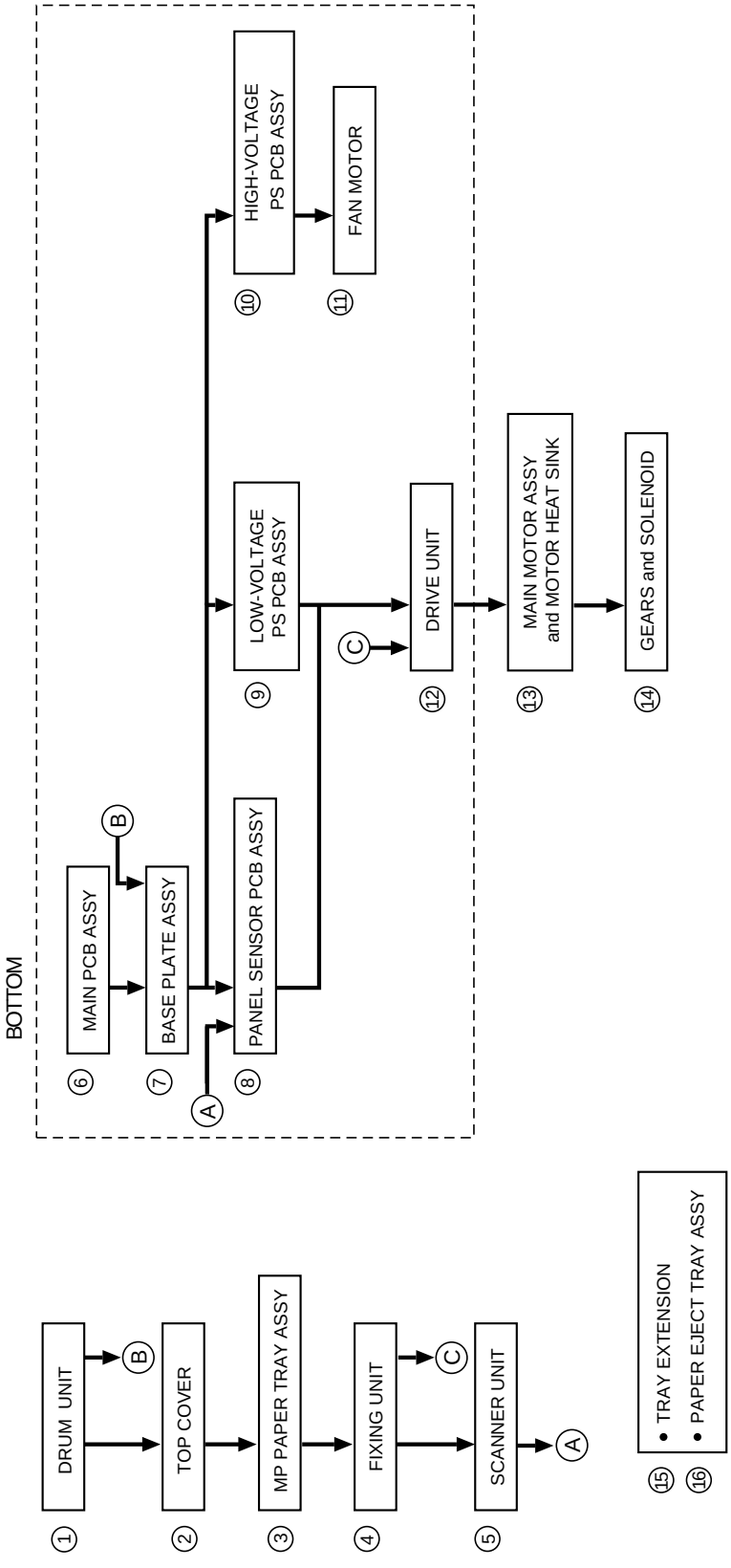
TAPTITE, BIND S
M3 : 9kgf • cm

SCREW
M3 : 7kgf • cm
M4 : 10kgf • cm

(8) When connecting or disconnecting cable connectors, hold the connector body, not the cables. If the connector has a lock, release the connector lock first then disconnect the cable.

(9) After a repair, do not only check the repaired portion but also check the connectors and that other related portions are functioning properly before doing operation checks.

2. DISASSEMBLING FLOW



3. DISASSEMBLING PROCEDURE

3.1 Drum Unit

(1) Open the top cover.

(2) Lift out the drum unit.

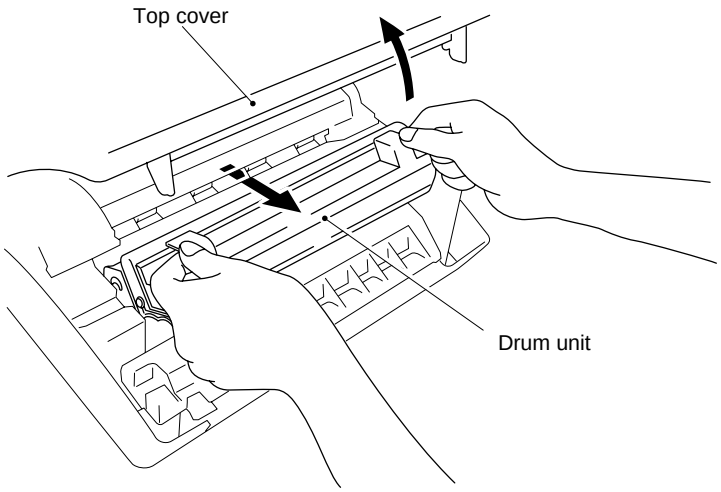


Fig. 3.1

3.2 Top Cover

(1) Open the top cover to the first lock position.

(2) Prise up the top cover link and free it from the dowel on the top cover to release it inwards.

(3) Press the link downward.

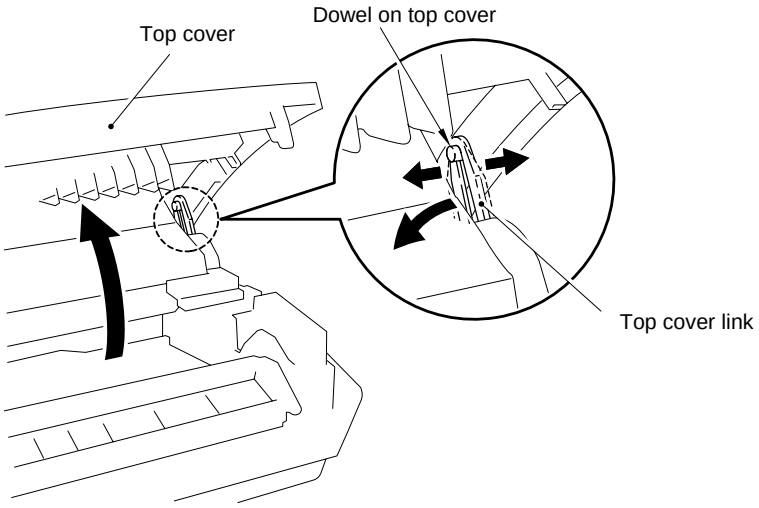


Fig. 3.2

(4) Open the top cover further, release the catches on both sides by sliding the top cover backward.

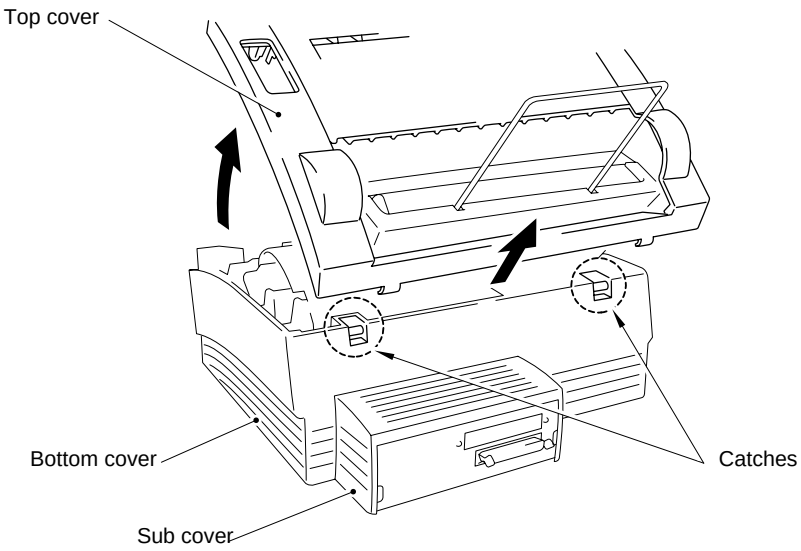


Fig. 3.3

3.3 Multi-purpose Paper Tray Assembly

(1) Pull the left rib outwards from the Mp tray and pull out the MP tray. It is not necessary to release the right rib.

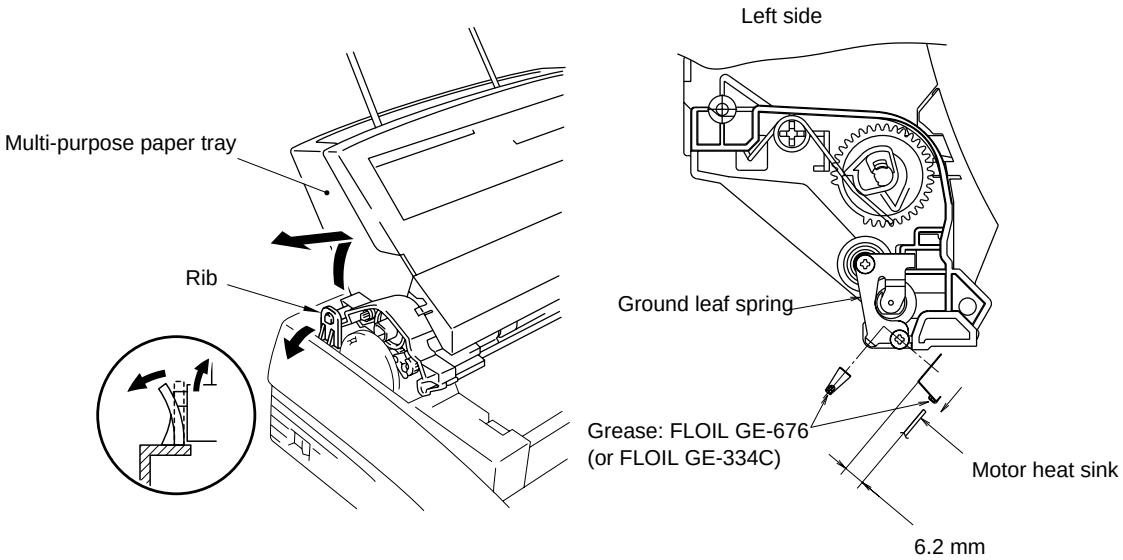


Fig. 3.4

NOTE: When reassembling, remove the old grease from the Motor heat sink and apply a suitable amount of new grease (2 rice-grain size) between the heat sink of the motor and the ground leaf spring.

3.4 Fixing Unit

(1) Remove the screw securing the fixing unit.

(2) Lifting up the fixing unit, disconnect the two heater harnesses and disconnect the thermistor cable from the connector on the EL PCB.

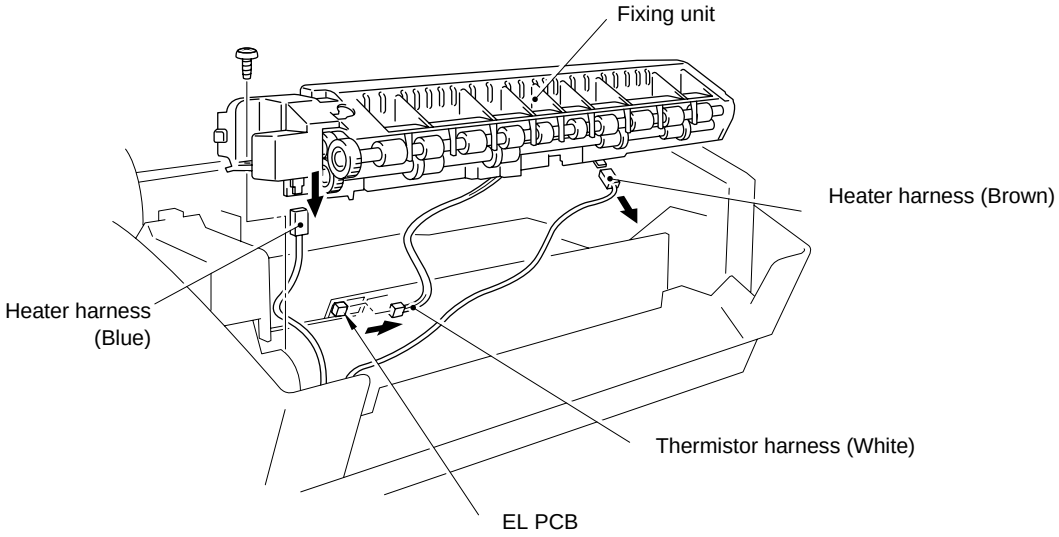


Fig. 3.5

3.5 Scanner Unit

(1) Remove the three screws.

(2) Lift the scanner unit to obtain access to the panel sensor PCB.

(3) Disconnect the three scanner unit connectors from the panel sensor PCB.

(4) Remove the screw and disassemble the Toner sensor PCB from the Scanner unit.

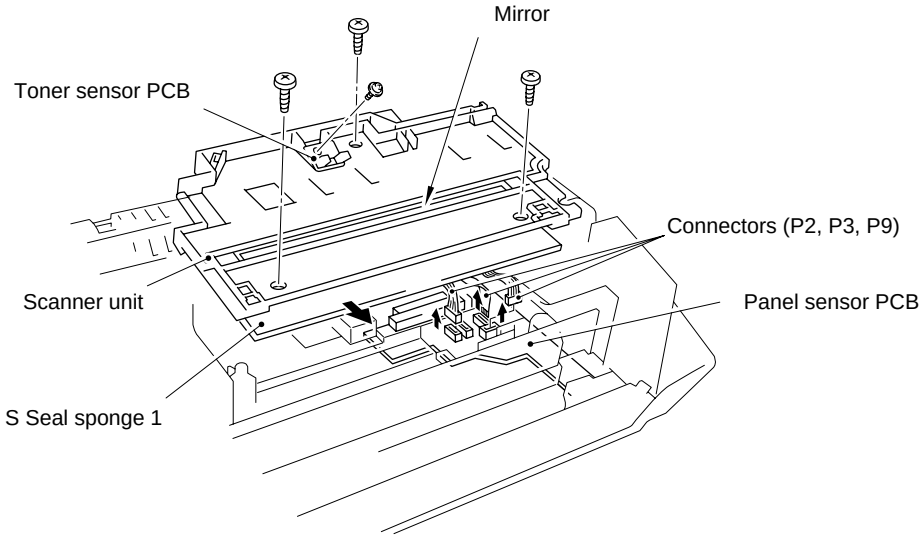


Fig. 3.6

NOTE: Never touch the inside of the scanner unit or the mirror when disassembling or reassembling. If there is any dirt or dust on the mirror, blow it off.

3.6 Main PCB Assy

(1) Remove the four screws securing the main PCB holder to the back of the printer.

(2) Grasp the hooks at the left and right ends of the PCB holder and draw out the main PCB assy.

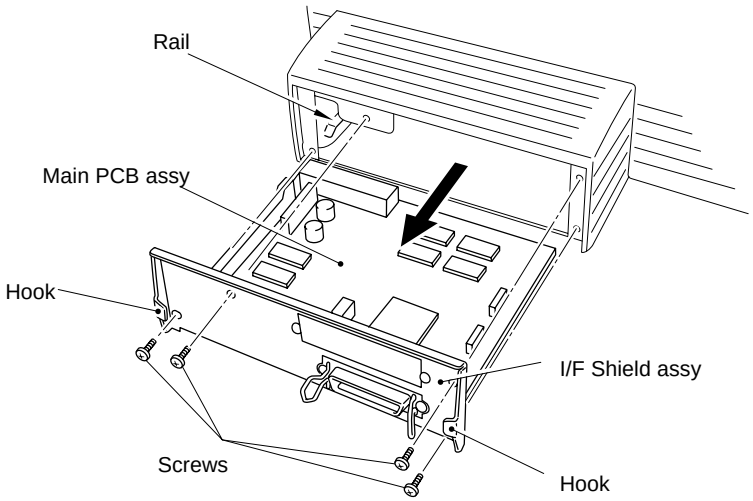


Fig. 3.7

3.7 Base Plate Assy

NOTE: Prior to turning the printer upside-down, the drum unit should be removed from the printer.

(1) Turn the printer upside down.

(2) Remove the six M4 and eight M3 tapping screws.

(3) Lift out the base plate assy and remove the grounding screw.

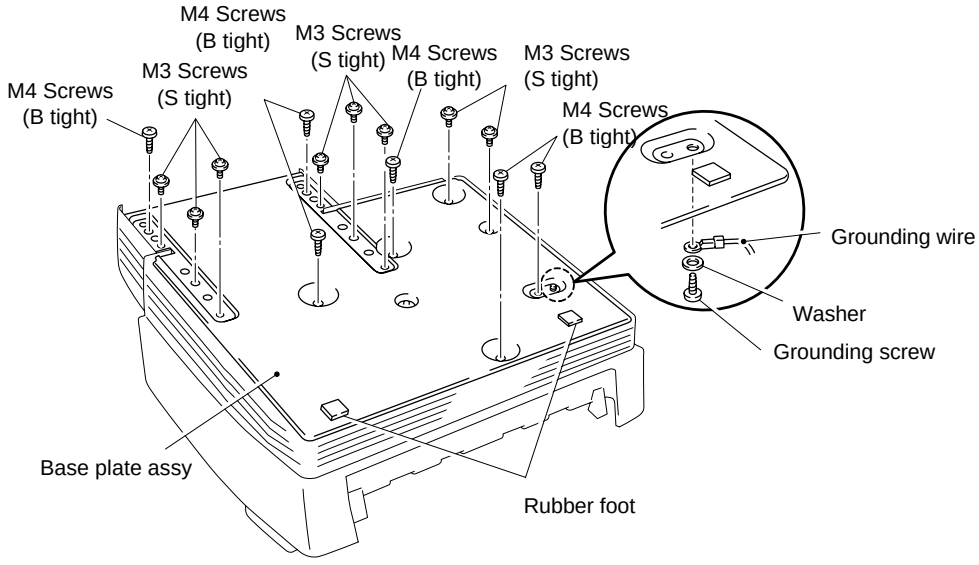


Fig. 3.8

3.8 Panel sensor PCB Assy

(1) Remove the screw securing the panel sensor PCB assy. Slide the part A from under the main shield and lift the PCB assembly upwards.

(2) Disconnect the seven connectors from the PCB (The three connectors P2, P3 and P9 have already disconnected when disassembling the scanner unit. See page, III-5).

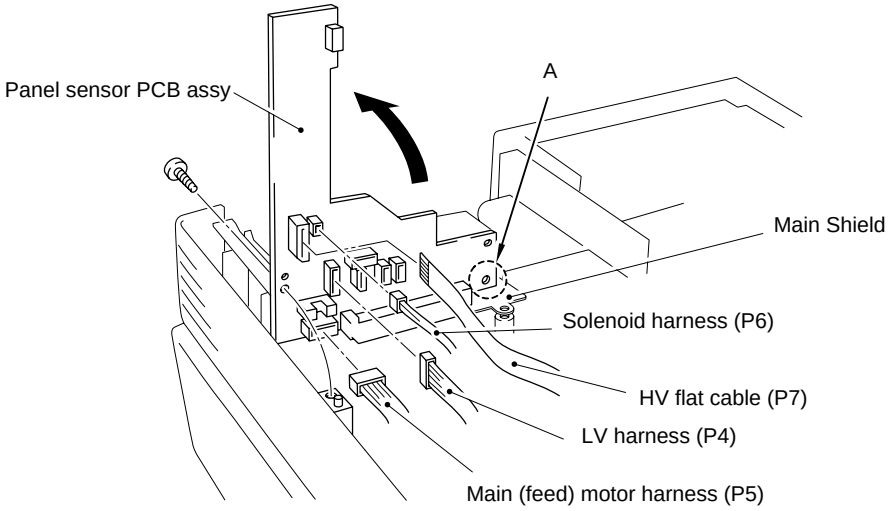


Fig. 3.9

NOTE1: When reassembling, the connectors must be inserted fully into the PCB and the PCB must not be lifted up by the harnesses.

NOTE2: The connectors should be inserted by matching the housing colour and the number of pins.

3.9 Low-Voltage Power Supply PCB Assy

(1) Remove the screw securing the low-voltage power supply PCB assy and lift the PCB.

(2) Disconnect the two connectors from the component side of the PCB.

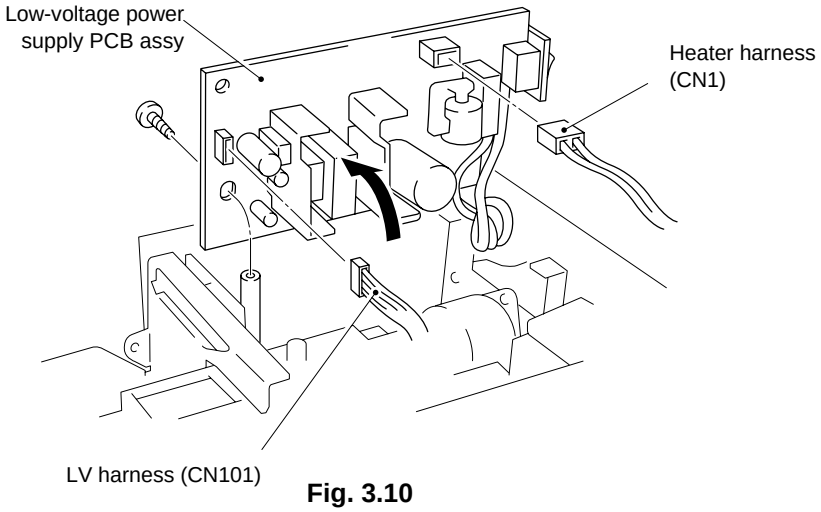


Fig. 3.10

3.10 High-voltage Power Supply PCB Assy

(1) Remove the screw securing the high-voltage power supply PCB assy and lift the PCB.

(2) Disconnect the four connectors from the PCB.

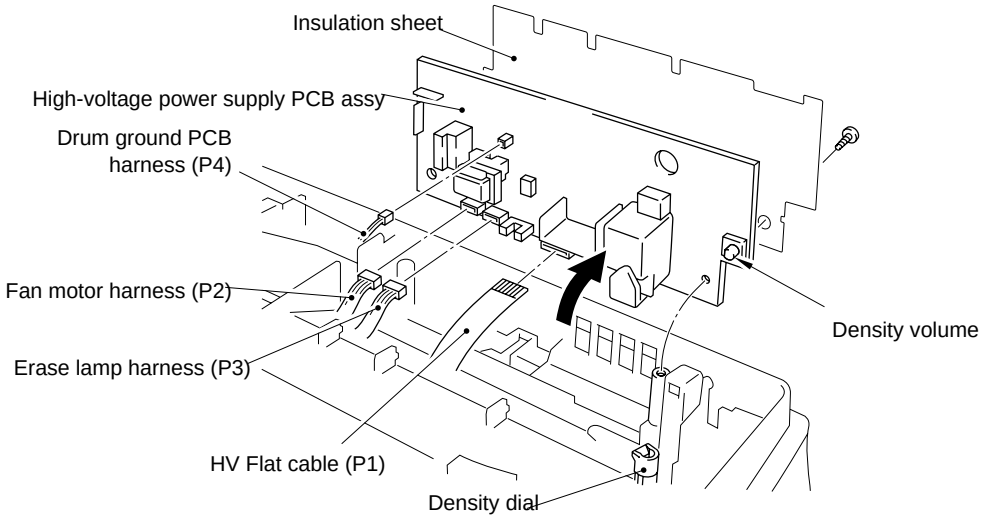


Fig. 3.11

NOTE: When reassembling, the density volume adjuster knob must be fitted into the cutout side of the density dial.

3.11 Fan Motor

(1) Disconnect the connector from the high-voltage power supply PCB. (It should have been disconnected already, see above)

(2) Lift out the fan motor assy.

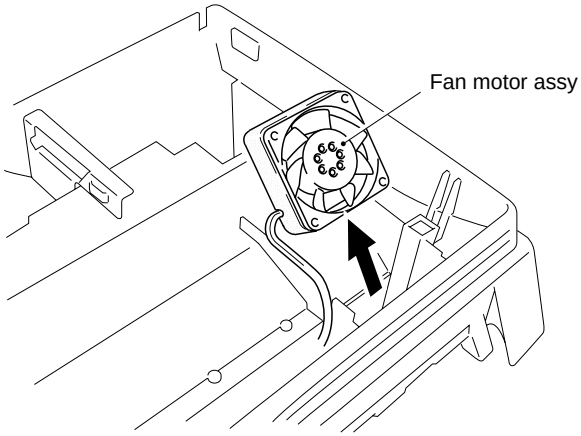


Fig. 3.12

3.12 Drive Unit

(1) Remove the four screws securing the drive unit.

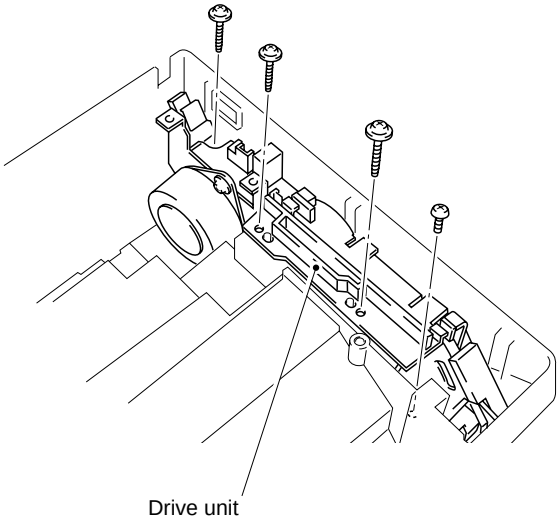


Fig. 3.13

3.13 Main Motor Assy and Motor Heat Sink

(1) Remove the two screws securing the main motor assy.

(2) Remove the two screws securing the motor heat sink.

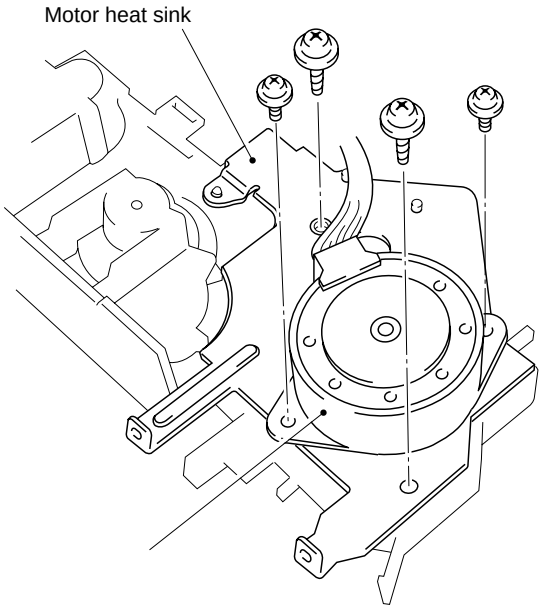
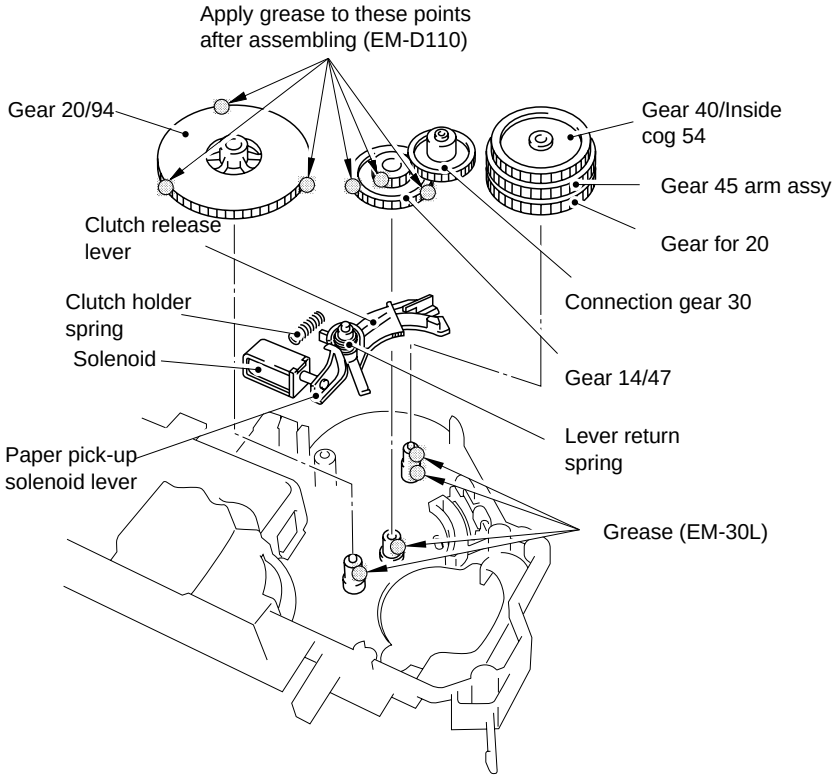


Fig. 3.14

3.14 Gears and Solenoid

(1) Apply grease the points shown below.

Grease: MOLYKOTE EM-30L TKC-0
MOLYKOTE EM-D110



NOTE: Apply EM-30L to the small gears (2 pcs.) inside the "Gear 45 arm assy".

Fig. 3.15

3.15 Tray Extension

(1) Put the tray extension assembly down towards the front of the printer, and pull the bottom of both side legs outwards to release it.

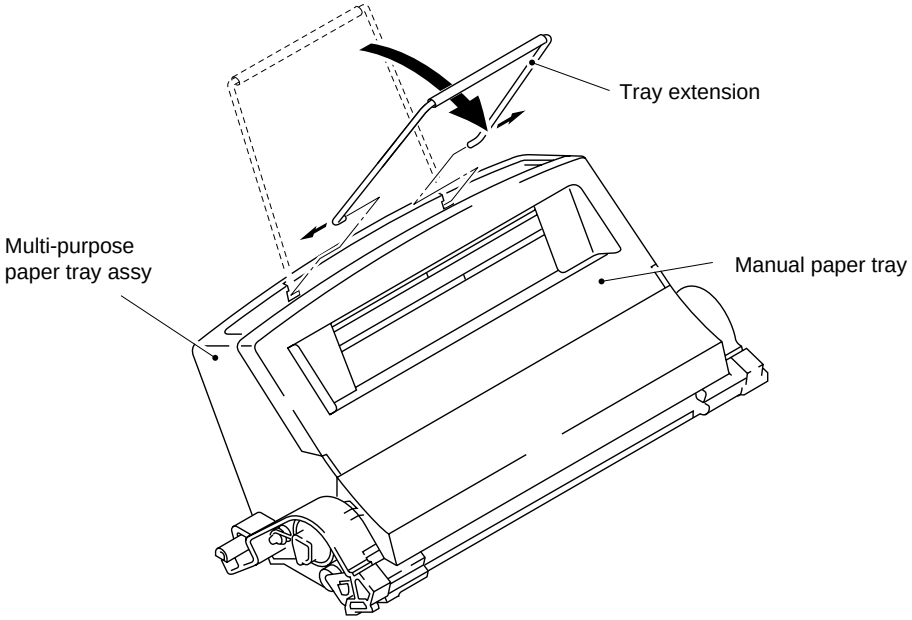


Fig. 3.16

3.16 Paper Eject Tray Assy

(1) Open the paper eject tray.

(2) Press both sides of the hinges of the paper eject tray inwards to release it from the holes in the top cover.

(3) Press the tray extension inwards as shown by the arrows and remove it.

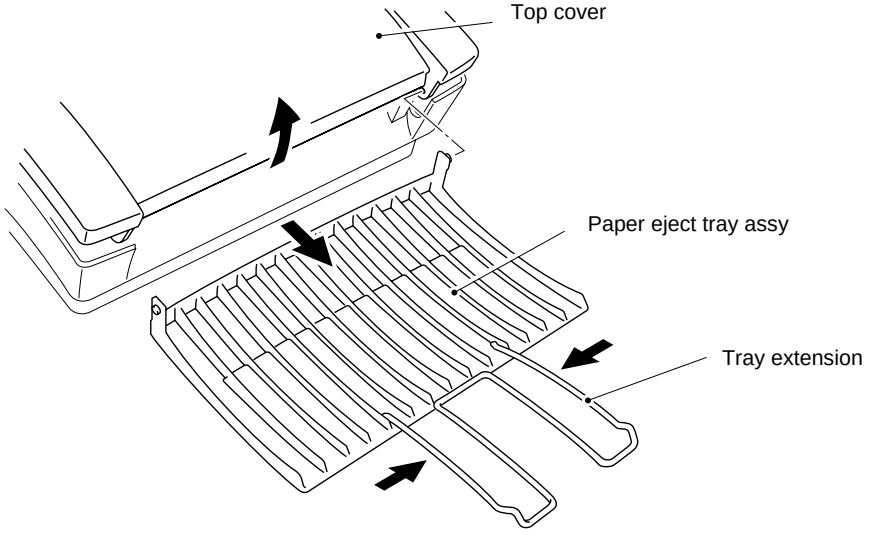


Fig. 3.17

3.17 Core

(1) Remove the flat cable from the ferrite core secured to the LD harness on the back of the scanner unit, and then carefully cut the tywrap to remove the ferrite core secured to the LD harness.

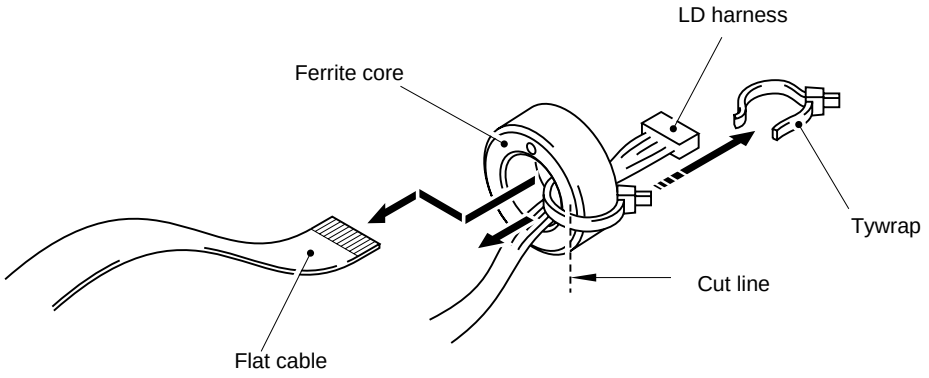


Fig. 3.18

(2) Carefully cut the tywrap to remove the core secured to the body bottom. And then remove the motor harness, the solenoid harness and the drum ground PCB assy harness which all pass through the core.

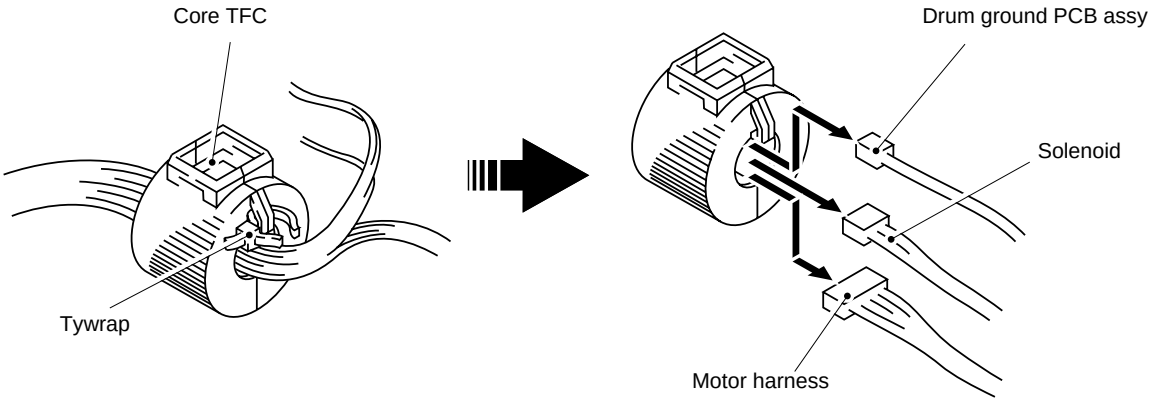


Fig. 3.19

4. PACKING

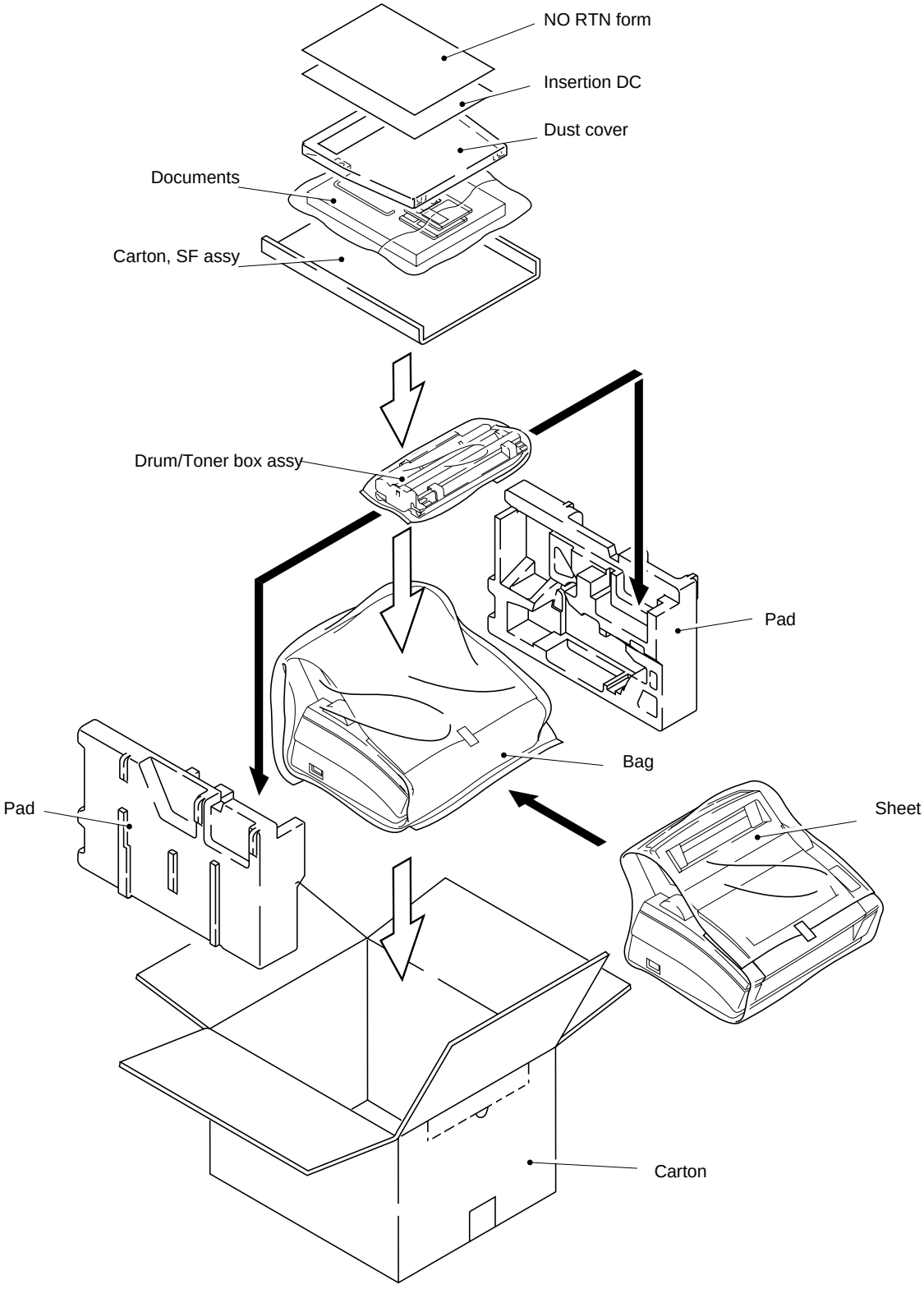


Fig. 3.20

CHAPTER IV TROUBLESHOOTING

1. INSPECTION MODE

1.1 Inbuilt Inspection Modes

The printer incorporates the following inspection modes such as the factory inspection mode and the test print mode.

Factory inspection mode, Continuous grid pattern print mode, 3 patterns print mode, NV-RAM value dump mode, ROM code update (FLASH rom only), RAM check and 4% density test print..

The operation of the inspection mode is as follows.

(1) Turn off the power to the printer.

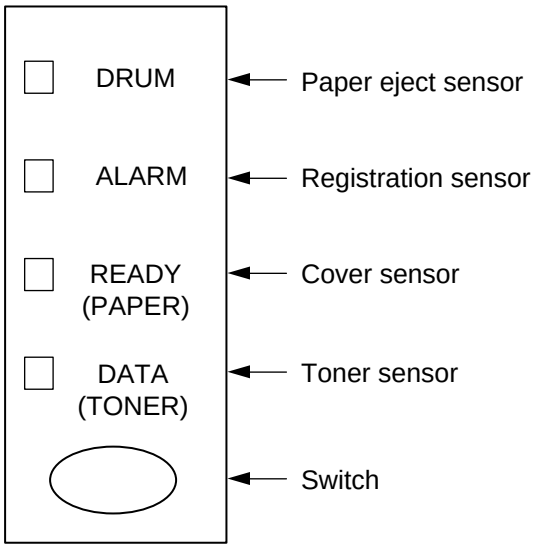
(2) With the top cover open, turn on the power while holding down the button on the operation panel.

When entering this mode, the DRUM LED is ON. Holding down the button causes the LEDs to turn ON in the order DRUM -> ALARM -> READY -> DATA -> DRUM. When you release the button, a mode is selected. The mode selected is indicated by the LED which is ON when you release the button. The inspection modes are assigned to the respective LEDs as shown below.

LED	Type of inspection
DRUM	Factory inspection mode
ALARM	Continuous grid pattern print mode
READY	3 patterns print mode (grid horizontal lines and black)
DATA	NV-RAM value dump mode
DRUM + ALARM	The ROM code update (only when flash memory is mounted)
ALARM + READY	RAM check
READY + DATA	4% density printing

Details of the factory inspection mode are as follows.

This mode is used to check if the sensors in the printer function correctly. In the process of this inspection, the LEDs and buttons are also checked. On entering this mode, the LEDs show the status of the respective sensors as follows.



Paper eject sensor	ON (Paper is detected.)	DRUM LED ON
	OFF (No paper is detected.)	DRUM LED OFF
Registration sensor	ON (Paper is detected.)	ALARM LED ON
	OFF (No paper is detected.)	ALARM LED OFF
Cover sensor	ON (The top cover is closed.)	READY LED OFF
	OFF (The top cover is open.)	READY LED ON
Toner sensor	ON (The toner cartridge is installed.)	DATA LED OFF
	OFF (No toner cartridge is installed.)	DATA LED ON

The procedure for the factory inspection mode is as follows.

(1) Open the top cover and remove the drum unit.
(2) Turn on the power to the printer while holding down the button. The DRUM LED comes ON.
(3) Release the button and immediately lightly press the button again.
(4) Check if the DRUM (paper eject sensor) and ALARM (registration sensor) LEDs go OFF after all the LEDs go ON.
    If the paper eject sensor is ON at this point and the DRUM LED goes ON (error).
    If the registration sensor is ON at this point and the ALARM LED goes ON (error).
(5) Install the drum unit. Check that the DATA LED goes OFF.
(6) Lightly touch the registration sensor actuator. Check that the ALARM LED comes ON.
(7) Close the top cover. Check that the READY LED goes OFF.
(8) Press the button.
(9) If all the sensors are correct, the printer goes back to the READY status. If any error is detected, the corresponding LED stays ON.

1.2 Error codes

In the event of a printer failure, error codes will be indicated as shown below. All the LEDs and the specific LEDs are turned ON alternately. The specific combination of ON LEDs indicates the type of error.

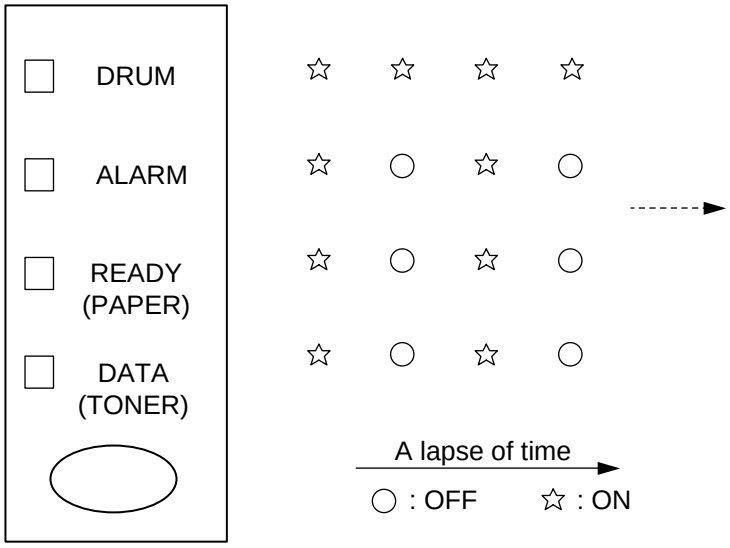
Type of error	DATA	READY	ALARM	DRUM
Fuser Malfunction				○
Laser BD Malfunction			○	
Scanner Malfunction			○	○
ROM Error		○		
D-RAM Error		○		○
Service A *		○	○	
Service B *		○	○	○
NV-RAM Error *	○	○		○
CPU Runtime Error	○	○	○	○

* Refer to the further description of those errors as follows;

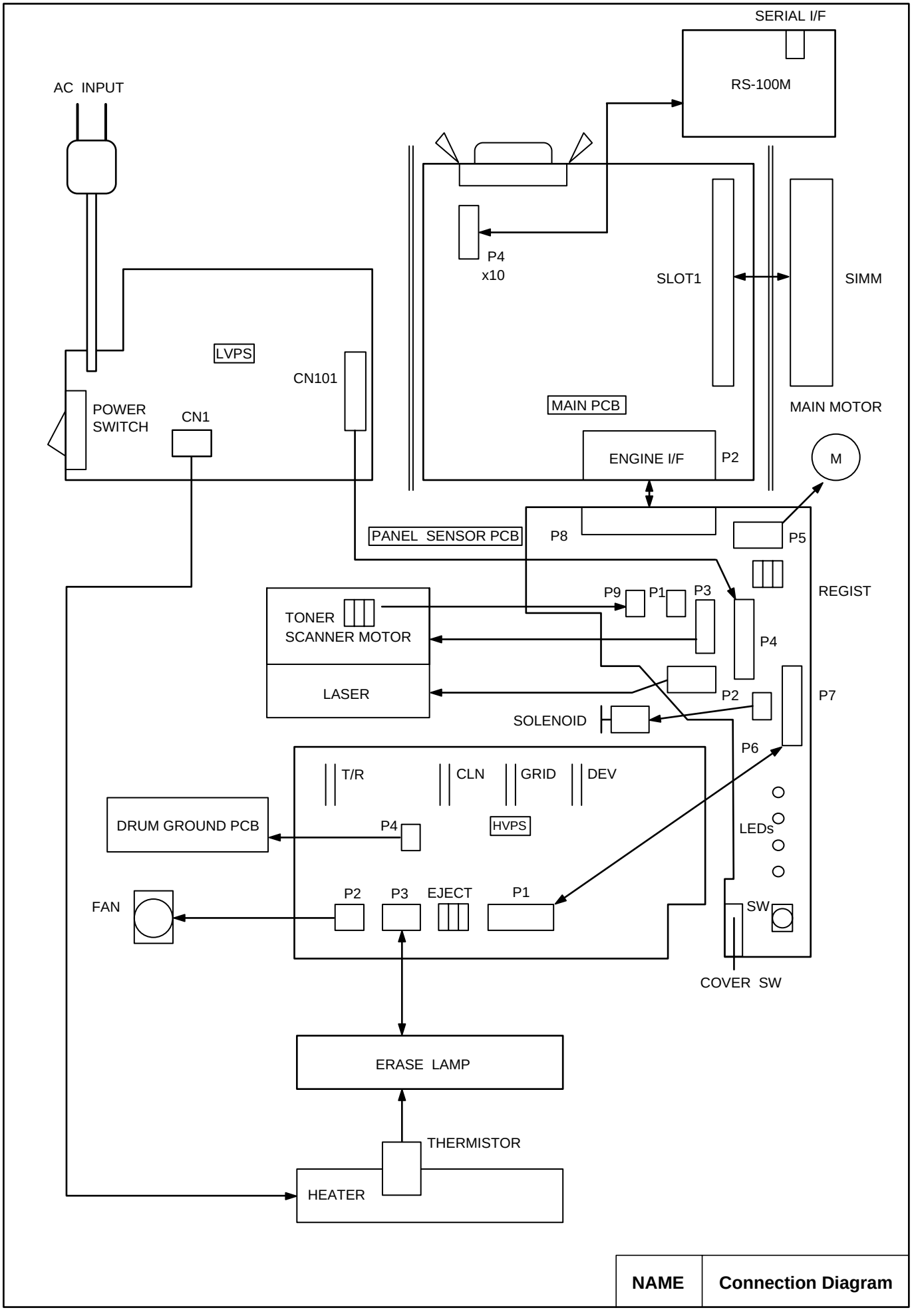
- Service A: Address Error
- Service B: Bus Error
- CPU Runtime Error: Other CPU errors such as Illegal Instruction or Operation Overflow

LED error indications

FUSER MALFUNCTION

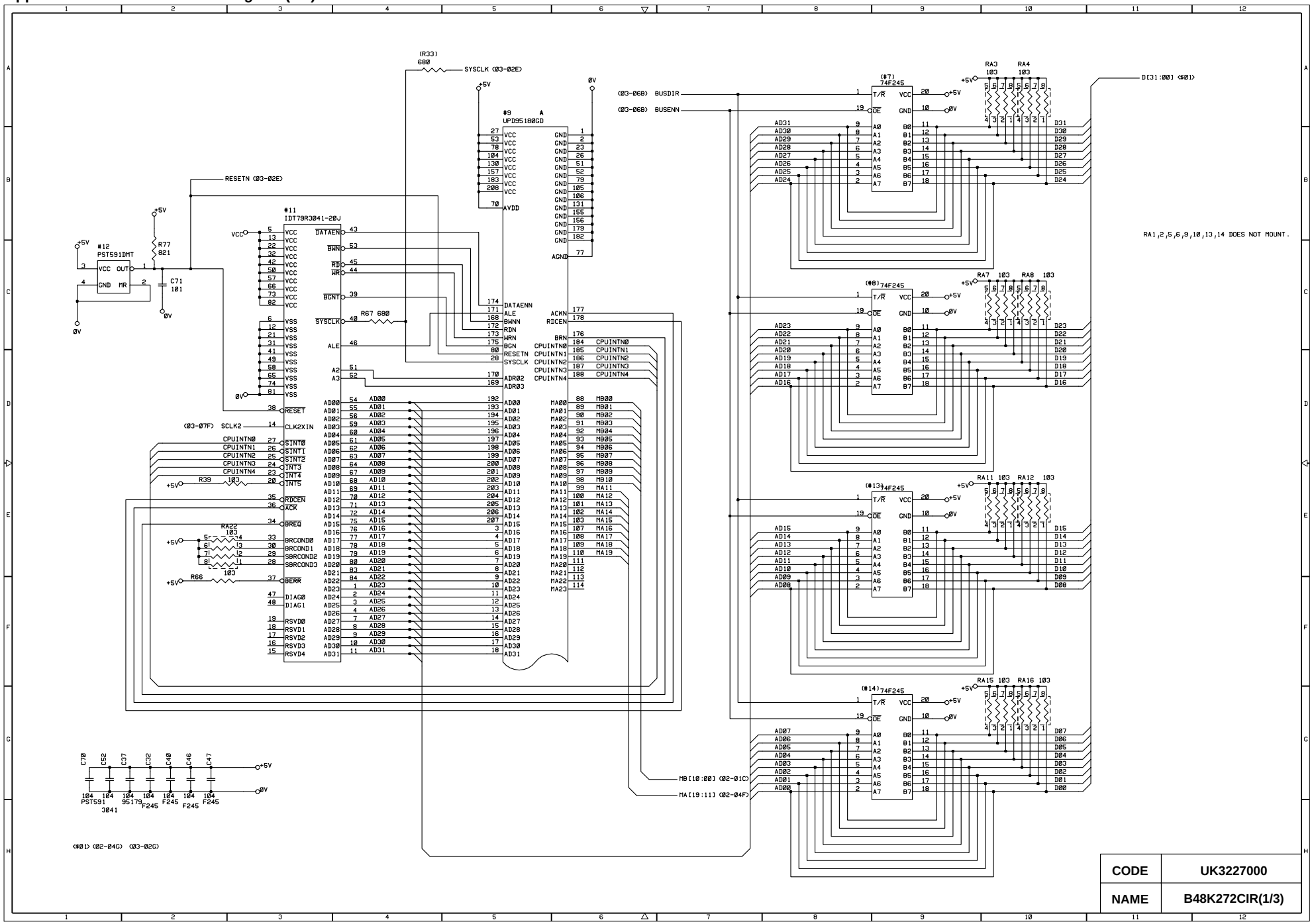


Appendix 1. Connection Diagram

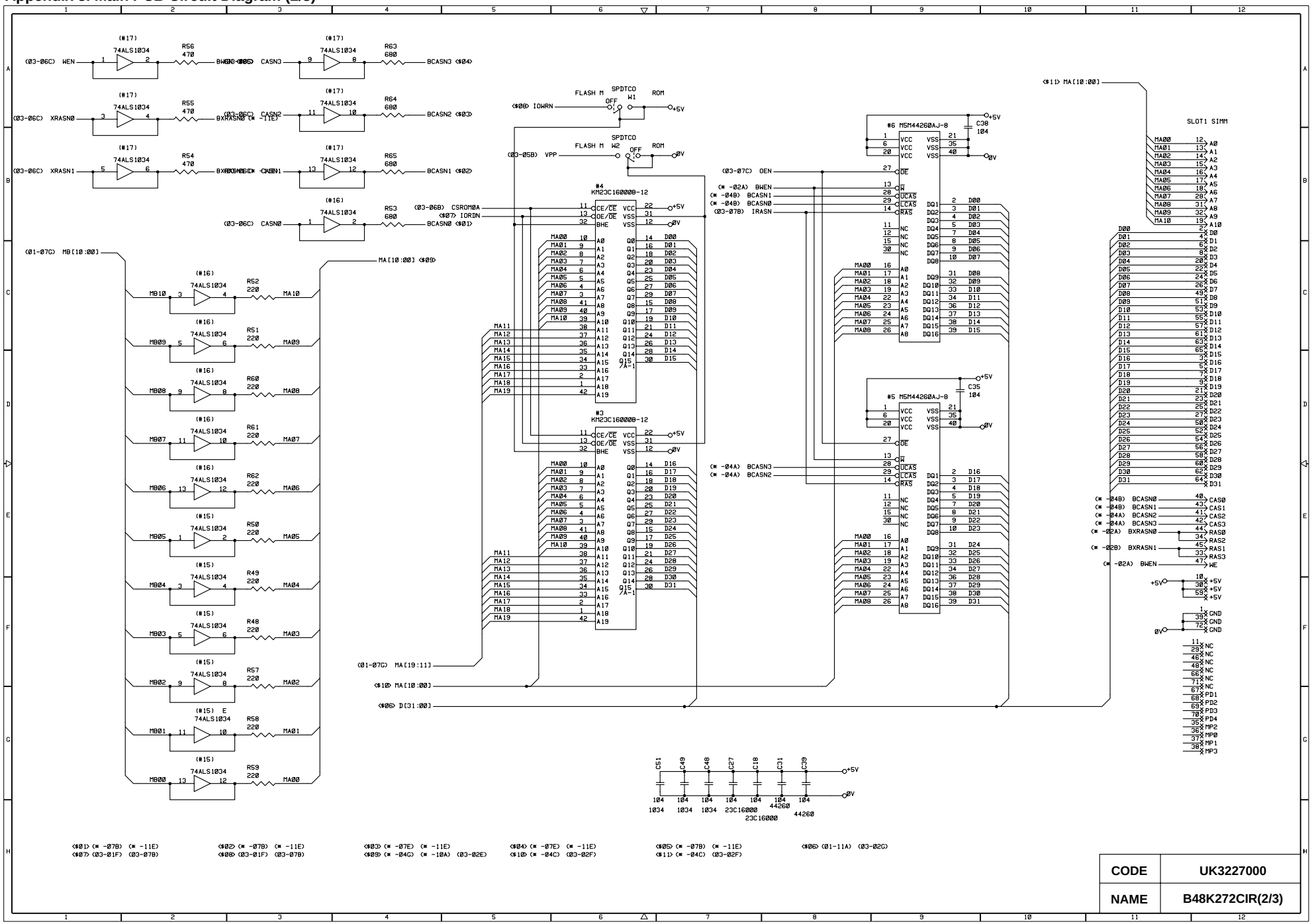


NAME	Connection Diagram

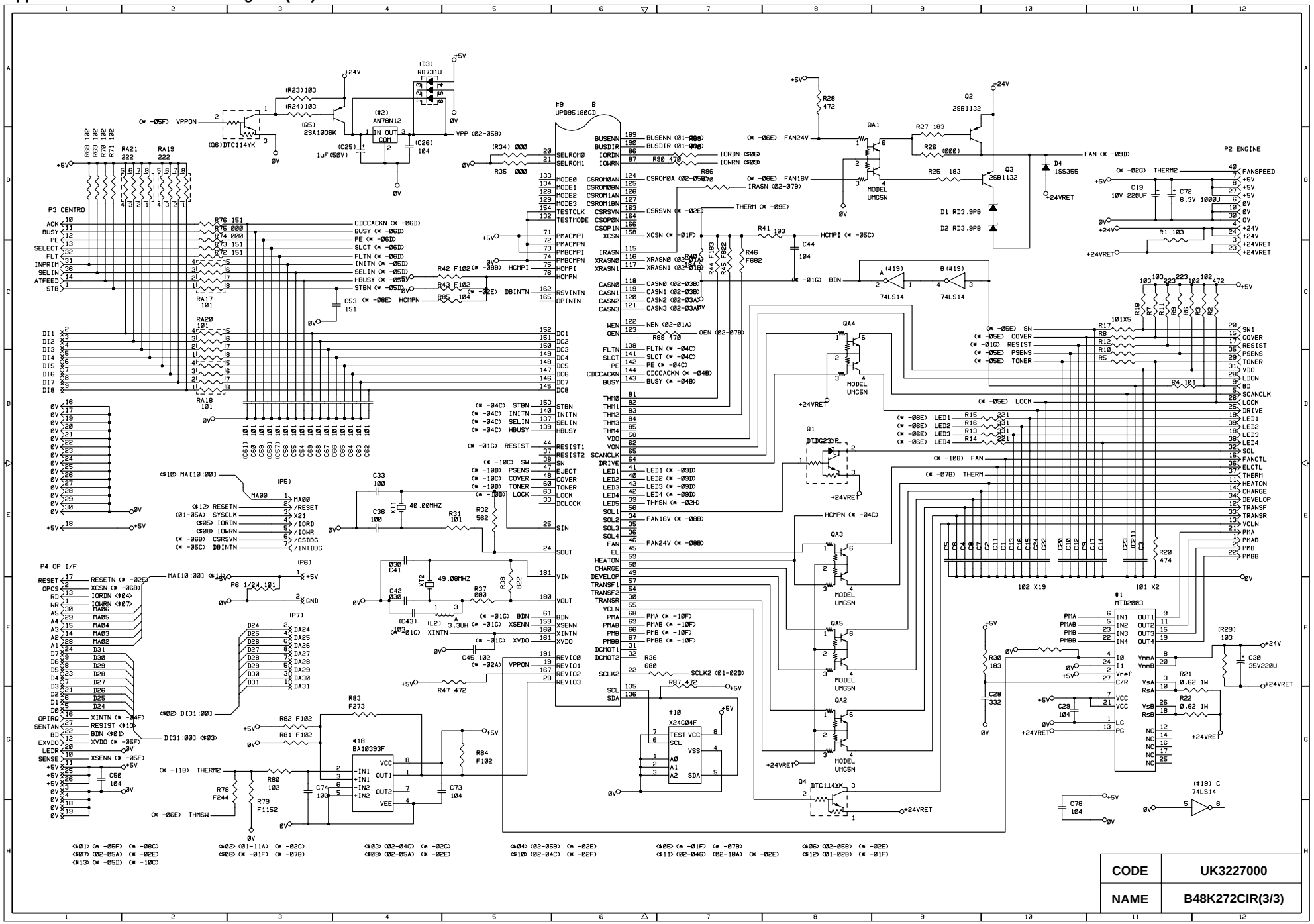
Appendix 2. Main PCB Circuit Diagram (1/3)



Appendix 3. Main PCB Circuit Diagram (2/3)

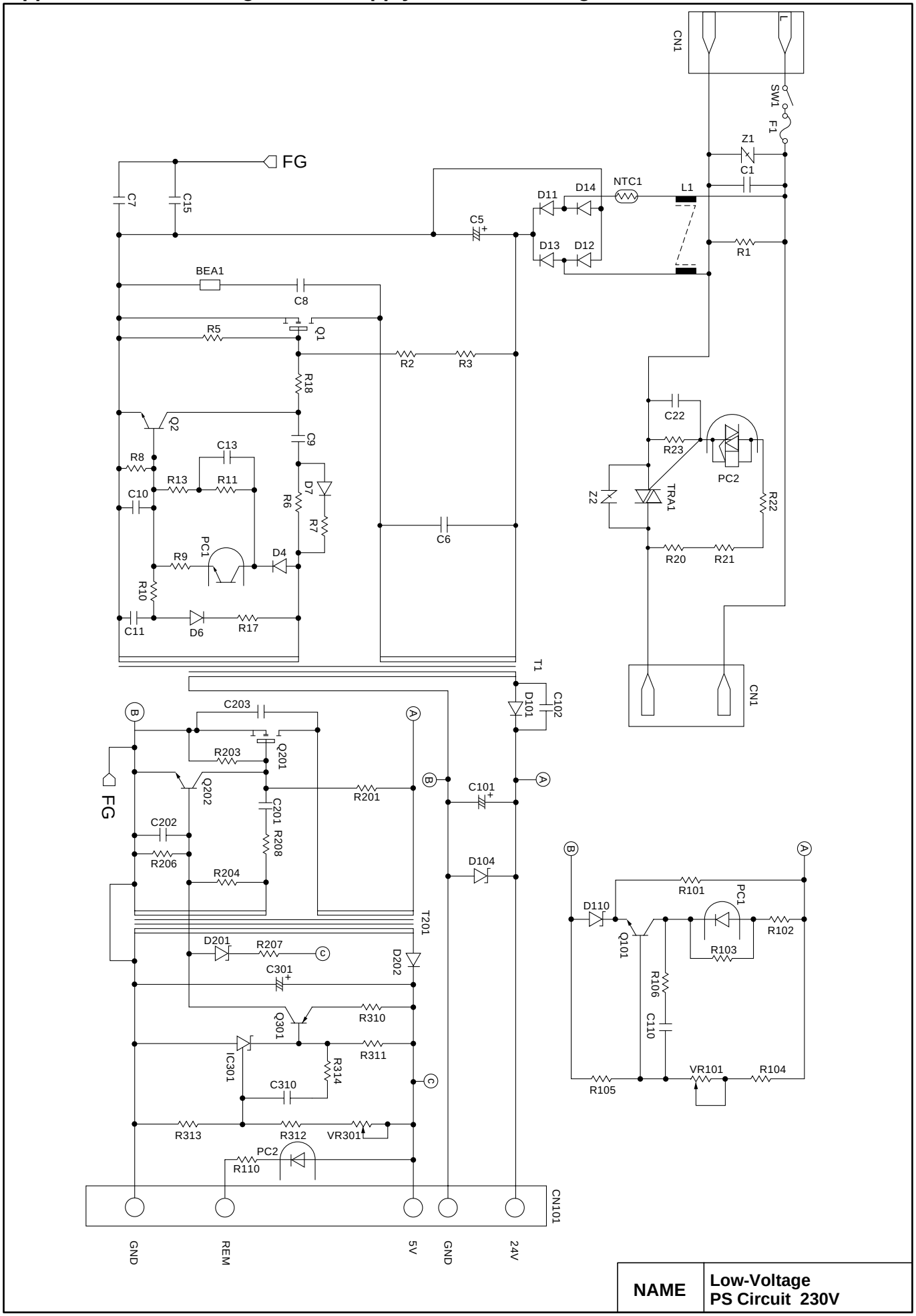


Appendix 4. Main PCB Circuit Diagram (3/3)

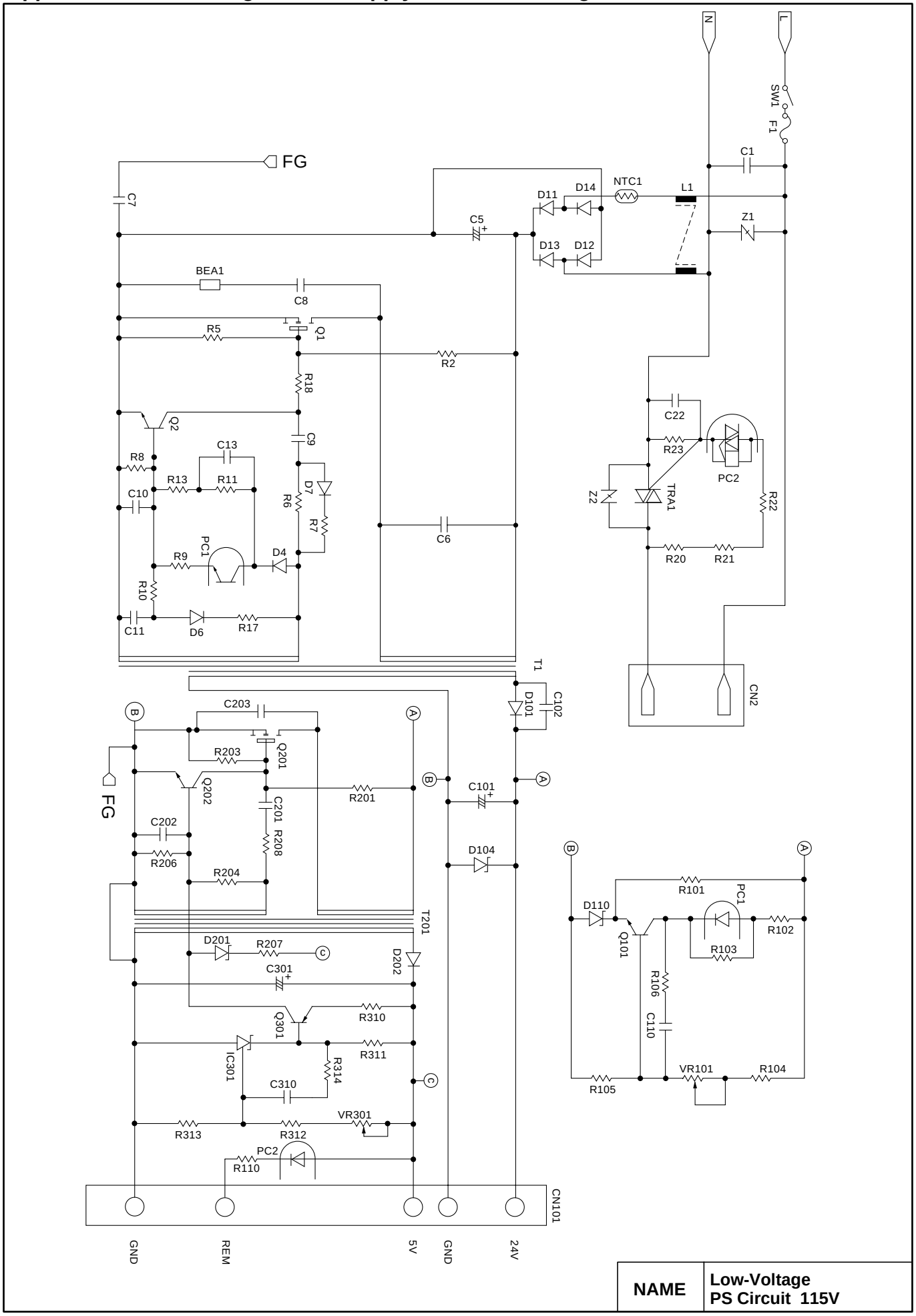


CODE	UK3227000
NAME	B48K272CIR(3/3)

Appendix 6. Low-Voltage Power Supply PCB Circuit Diagram 230V



Appendix 7. Low-Voltage Power Supply PCB Circuit Diagram 115V



brother

LASER PRINTER
SERVICE MANUAL

MODEL:HL-760

PREFACE

This service manual contains basic information required for after-sales service of the laser printer (here-after referred to as "this machine" or "the printer"). This information is vital to the service technical in maintaining the high print quality and performance of the printer.
This service manual covers the HL-760 printer.
This manual consists of the following chapters:

CHAPTER I: **FEATURES AND SPECIFICATIONS**
Features, specifications, etc.

CHAPTER II: **THEORY OF OPERATION**
Basic operation of the mechanical system, the electrical system and the electrical circuit, and their timing.

CHAPTER III: **DISASSEMBLY AND REASSEMBLY**
Procedures of disassembling and reassembling the mechanical system.

CHAPTER IV: **TROUBLESHOOTING**
Reference values and adjustments, troubleshooting for image defects, troubleshooting for malfunctions, etc.

APPENDICES: Connection diagrams, PCB circuit diagrams.

Note: This service manual ffor the HL-760 describes only the changesin each part of the HL-720/730 (84U002BE0) service manual which was published previously. Parts in common with those in the HL-720/730 service manual are omitted, this is indicated in the Table of Contents.. When you require to refer to the parts omitted in this manual, please refer to the service manual of that model.

Information in this manual is subject to change due to improvement or re-design of the product. All relevant information in such cases will be supplied in service information bulletins (Technical Information).
A thorough understanding of this printer, based on information in this service manual and service information bulletins, is required for maintaining its quality performance and for fostering the practical ability to find the cause of problems.

CONTENTS

CHAPTER I FEATURES AND SPECIFICATIONS

1. FEATURES

This printer has the following features:

600 dpi Resolution and 6 ppm Printing Speed

600 dots per inch (dpi) resolution with microfine toner and six pages per minute (ppm) printing speed (A4 or Letter paper). This printer also supports 1200 (H) x 600 (V) dots per inch (dpi) for Windows DIB (Device Independent Bitmap) graphics. (It is recommended to add memory when printing in 1200 x 600 dpi mode.)

User-Friendly Operation for Windows

The dedicated printer driver and TrueType™-compatible fonts for Microsoft® Windows 3.1 and Windows 95 are available on the floppy disks supplied with your printer. You can easily install them into your Windows system using our installer program. The driver supports our unique data compression mode to enhance printing speed in Windows applications and allows you to set various printer settings including toner saving mode, custom paper size, sleep mode, gray scale adjustment, resolution, and so forth. You can easily setup these print options in the graphic dialog boxes through Printer Setup within the Windows Control Panel.

Printer Status Monitor with Bi-directional Parallel Interface

The printer driver can monitor your printer's status using bi-directional parallel communications.

The printer status monitor program can show the current status of your printer. When printing, an animated dialog box appears on your computer screen to show the current printing process. If an error occurs, a dialog box will appear to let you know what to correct. For example: when your printer is out of paper, the dialog box will display "Paper Empty" and will give the instructions for the corrective action to take.

Versatile Paper Handling

The printer has a multi-purpose sheet feeder and a straight paper path mechanism. Using this mechanism, you can load A4, letter, legal, B5, A5, and executive sizes of paper, and various types of paper including envelopes, postcards, organizer paper, or a custom paper size. The multi-purpose sheet feeder also allows manual paper loading, so you can also use labels and transparencies.

Environment-Friendly

Economy Printing Mode

This feature will cut your printing costs by saving toner. It is useful to obtain draft copies for proof-reading. You can select from two economy modes, 25% toner saving and 50% toner saving, through the Windows printer driver supplied with your printer.

Sleep Mode (Power Save Mode)
Sleep mode automatically reduces power consumption when the printer is not in use. The printer consumes less than 9W when in sleep mode.

Low Running Cost
The toner cartridge is separate from the drum unit. You need to replace only the toner cartridge after around 2,000 pages, which is cost effective and ecologically friendly. (In some countries the printer is supplied with a starter toner cartridge which must be replaced after 1,000 pages.)

Remote Printer Console Program for DOS

The utility program, Remote Printer Console (RPC), is available on the floppy disk supplied with your printer. When you operate your computer in the DOS (Disk Operating System) environment, this program allows you to easily change default settings of the printer such as fonts, page setup, emulations and so on. This program also provides a status monitor program, which is a Terminate-and-Stay Resident (TSR) program. It can monitor the printer status while running in the background and report the current status or errors on your computer screen.

Popular Printer Emulation Support

This printer supports three printer emulation modes, HP LaserJet 5P, Epson FX-850, and IBM Proprinter XL. The printer also supports Auto-emulation switching between HP and Epson or HP and IBM. If you want to set the printer emulation, you can do it by using the Remote Printer Console Program.

Optional Apple Macintosh Interface

An optional Apple Macintosh serial interface kit is available which allows your printer to be connected to Apple Macintosh computers. With this option, you can use your printer with both an IBM PC, or compatible, and an Apple Macintosh at the same time. This optional interface board can be used as an RS-422A interface for Macintosh or an RS-232C serial interface for IBM PC or compatible.

Enhanced Memory Management

The printer provides its own data compression technology in the printer hardware and the supplied printer driver software, which can automatically compress graphic data and font data efficiently into the printer's memory. You can avoid memory errors and print most full page 600 dpi graphic and text data, including large fonts, with the printer's standard memory.

2. SPECIFICATIONS

2.1 Printing

Print method	Electrophotography by semiconductor laser beam scanning
Resolution	1200 (H) x 600 (V) dots/inch (for Windows DIB graphics) 600 x 600 dots/inch (for Windows and DOS) 300 x 300 dots/inch (using Apple Macintosh with the optional RS-100M)
Print speed	Up to 6 pages/minute (when loading A4 or letter-size paper from the multi-purpose sheet feeder)
Warm-up	Max. 20 seconds at 23°C (73.4°F)
First print	20 seconds (when loading A4 or letter-size paper from the multi-purpose sheet feeder)
Print media	Toner in a cartridge Life Expectancy: 2,200 pages/cartridge (when printing A4 or letter -size paper at 5% print coverage)
Developer	Drum unit, separate from the toner cartridge

2.2 Functions

CPU	IDT79R3041-20J 20Mhz
Emulation	Automatic emulation selection among HP LaserJet 5P (PCL Level 5e), EPSON FX-850, and IBM Proprinter XL
Printer driver	Windows 95/Windows 3.1 driver, supporting Brother Native Compression mode and bi-directional capability. Optional Macintosh® QuickDraw driver (Standard in some countries.)
Interface	Bi-directional Centronics parallel interface. (IEEE 1284 compliant) An RS-422A/RS-232C serial interface (RS-100M) is optionally available.
Memory	1.0 Mbytes with Data Compression Technology. Expandable up to 33 Mbytes by installing an industry standard SIMM.
Control panel	1 switch and 4 lamps
Diagnostics	Self-diagnostic program

2.3 Electrical and Mechanical

Power source	U.S.A. and Canada:	AC 110 to 120 V, 50/60Hz
	Europe and Australia:	AC 220 to 240 V, 50Hz
Power consumption	Printing:	150 W or less
	Standing by:	35 W or less
	Sleep:	9 W or less
Noise	Printing:	48 dB A or less
	Standing by:	35 dB A or less
Temperature	Operating:	10 to 32.5°C (59 to 90.5°F)
	Storage:	0 to 40° C (38 to 104°F)
Humidity	Operating:	20 to 80% (without condensation)
	Storage:	20 to 80% (without condensation)
Dimensions (W x D x H)	366 (W) x 383 (D) x 250 (H) (when the output tray is closed and the Multi-purpose sheet feeder is removed.)	
Weight	Approx. 7.0 kg (15.45 lb.) including the drum unit.	

CHAPTER II THEORY OF OPERATION

1. ELECTRONICS

1.1 General Block Diagram

Fig. 2.1 shows a general block diagram of this printer.

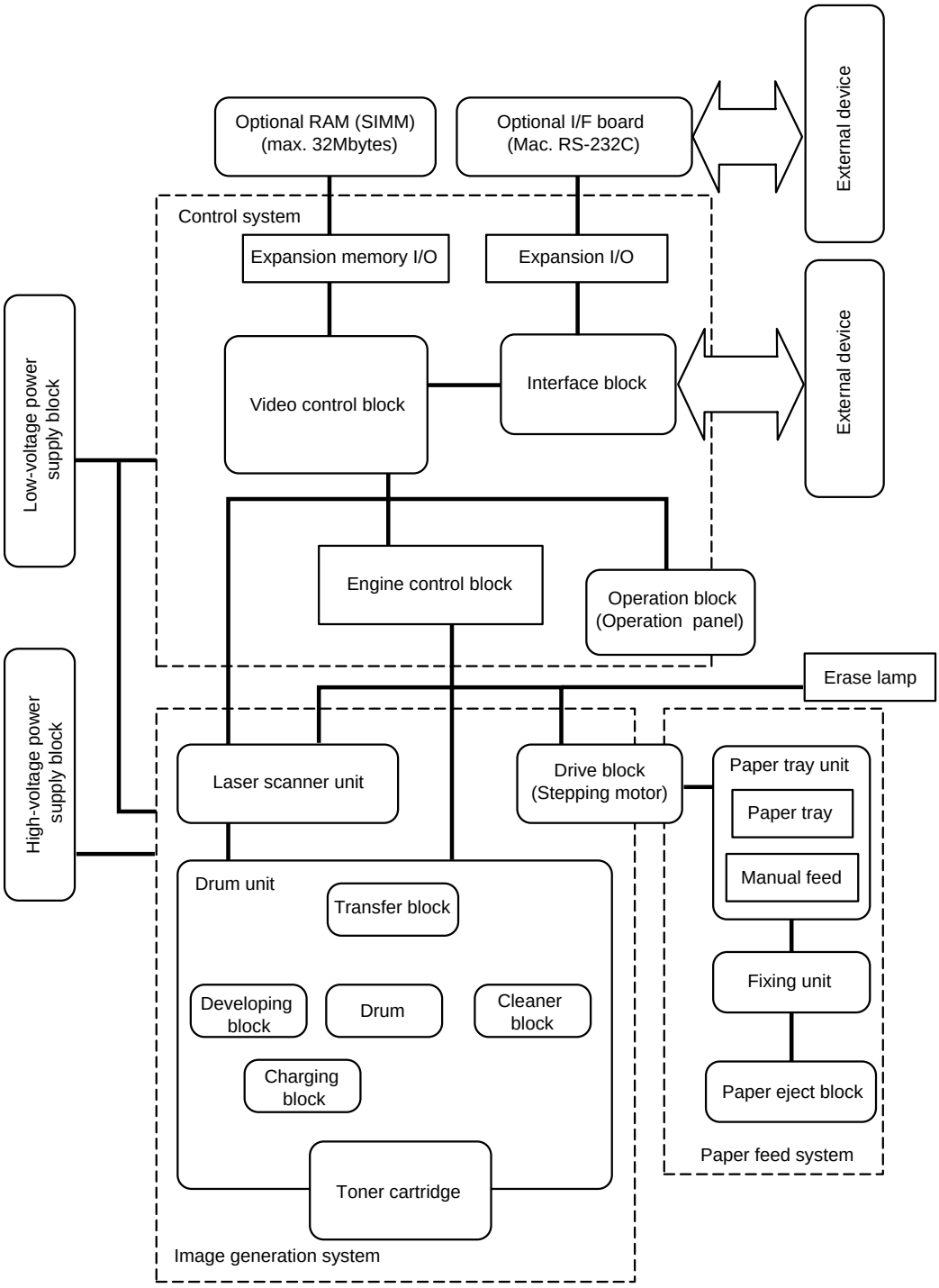


Fig. 2.1

1.2 Main PCB Block Diagram

Fig. 2.2 shows a block diagram of the main PCB.

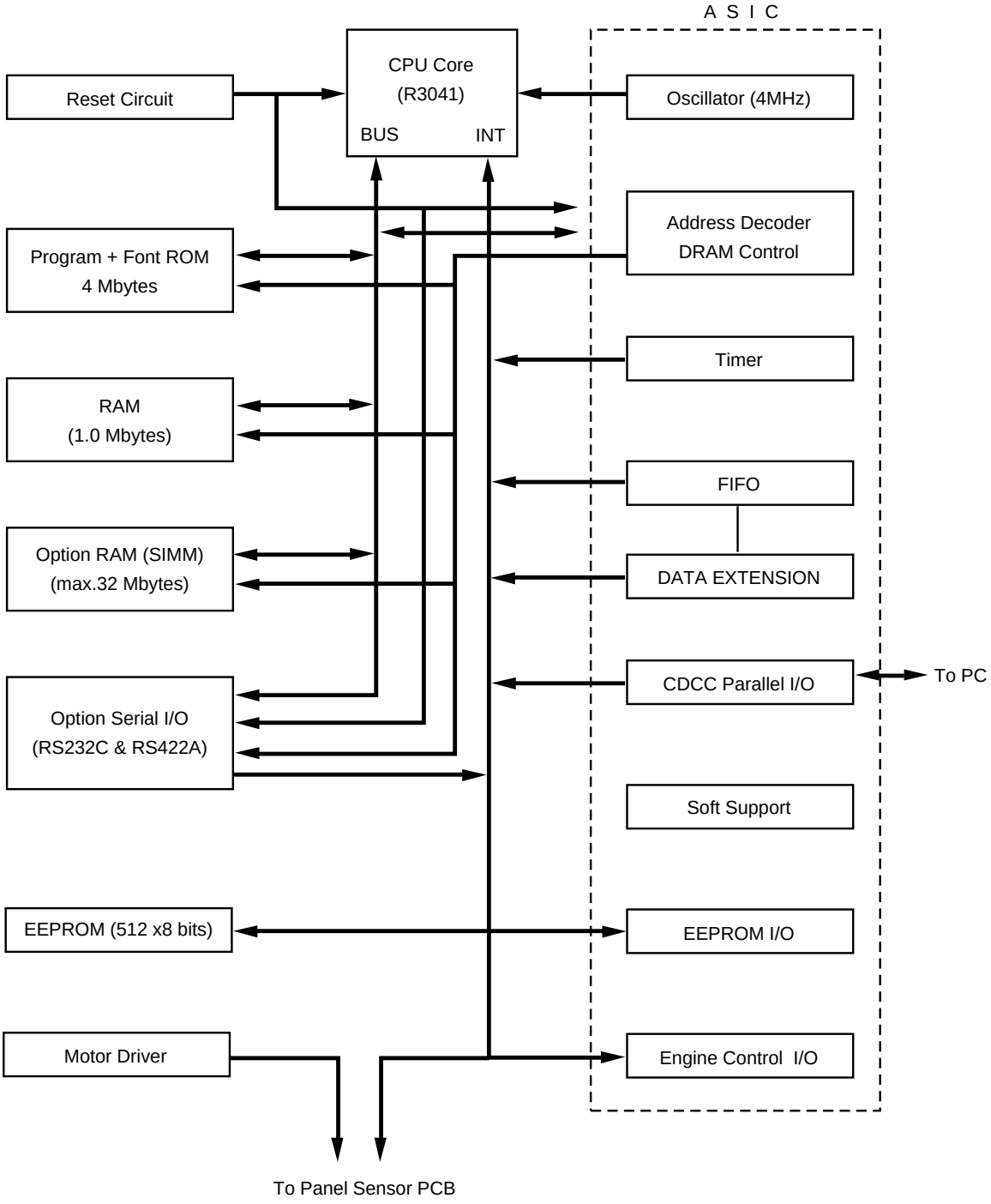


Fig. 2.2

1.3 Main PCB

1.3.1 CPU Core

Fig. 2.3. shows the CPU circuit block on the main PCB.
The CPU is an IDT 79R3041-20J which is driven at a clock frequency of 20 MHz. This clock frequency is made by dividing the source clock of 40.0 MHz into two. The address and data bus are both 32 bit of AD0 to AD31 and D0 to D31. The total addressable memory space is 4 Gbytes.

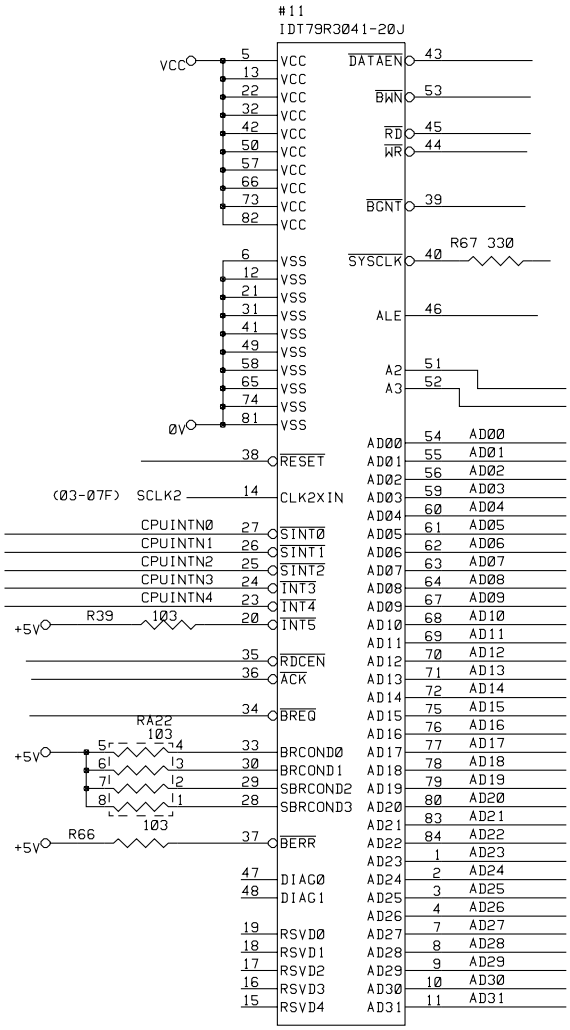


Fig. 2.3

1.3.2 ASIC

The ASIC is composed of a Cell Based IC and has the following function blocks.

(1) Oscillator circuit
Generates the main clock for the CPU by dividing the source clock frequency by two.

(2) Address Generator
This controls the address buss by latching the AD buss signals with the ALE signal.

(3) Address decoder
Generates the CS for each device.

(4) DRAM control
Generates the $\overline{RAS}$, $\overline{CAS}$, $\overline{WE}$, $\overline{OE}$ and MA signals for the DRAM and controls the memory refresh processing (CAS before RAS self-refreshing method).

(5) Interrupt control
Interrupt levels:

Priority	High	9	TIMER 3 (Watch Dog)
		8	MONITOR
		7	FIFO
		6	EXINT
		5	TIMER1
		4	BD
		3	Spare
		2	CDCC / BOISE / DATA EXTENTION
	Low	1	TIMER 2

All the interrupts can be masked.

(6) Timers
The following timers are included:

Timer 1	16-bit timer
Timer 2	10-bit timer
Timer 3	Watch-dog timer

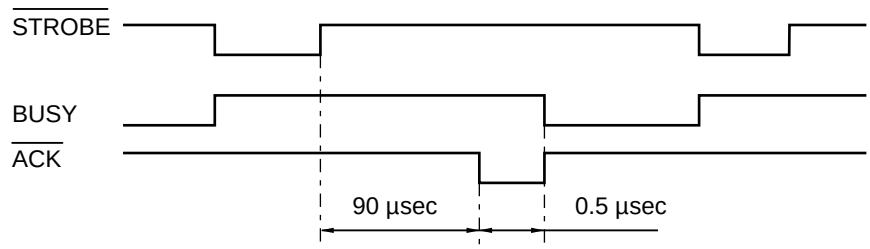
(7) FIFO
A 10Kbit FIFO is includedrporated. Data for one raster is transferred from the RAM to the FIFO by DMA transmission and is output as serial video data. The data cycle is 6.13 Mhz.

(8) CDCC parallel I/O

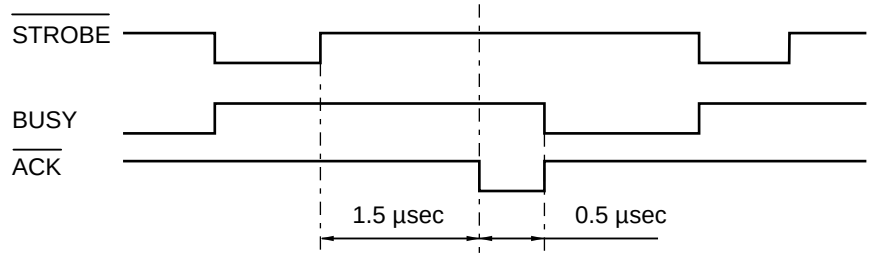
<Data receiving>

There are two modes in this unit. One is the CPU receiving mode and the other is the DMA receiving mode. In the CPU receiving mode the CPU receives the command data from the PC, and after the CPU is switched to the DMA mode, it receives the image data and writes to the DRAM directly.

CPU Receiving Mode



DMA Receiving Mode



BUSY goes HIGH at the falling edge of STROBE. The data (8 bits) from the PC is latched in the data buffer at the rising edge of STROBE. The pulse width of ACK differs according to the speed MODE as shown above. BUSY goes LOW at the rising edge of ACK.

<IEEE1284 support>

This supports the IEEE1284 data transfer with the following mode.

Nibble mode
Byte mode
ECP mode

(9) Data extension

This circuit extents the compressed image data which are received from the PC, and writes the bit map data to the FIFO.

(10) Software support

Supports 16 x 16 rotation, bit expansion, bit search, and decimal point change.

(11) EEPROM I/O

One output port and one I/O port are assigned.

(12) Engine control I/O

This I/O is used for the connection to the panel sensor PCB. It controls the main motor, solenoid, sensors, etc.

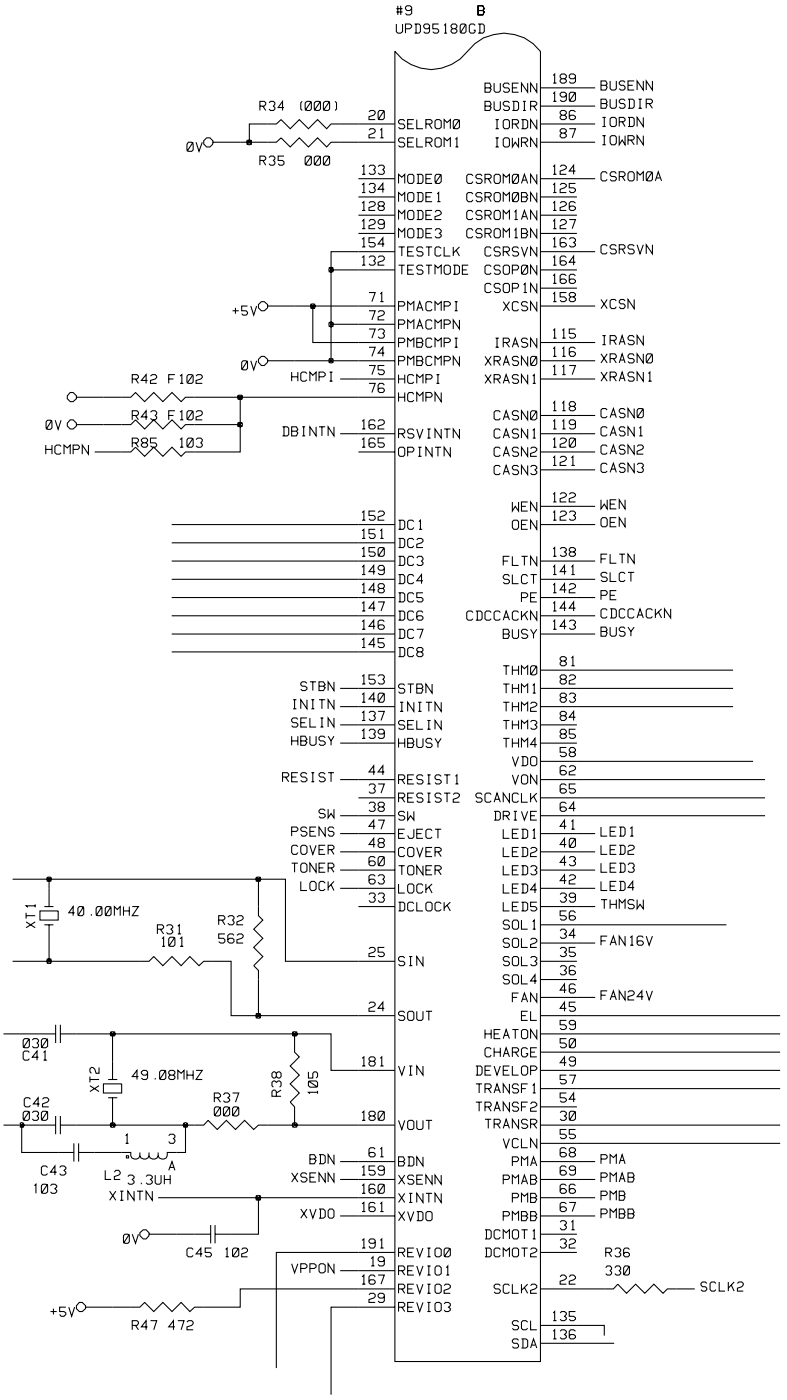


Fig. 2.4

1.3.3 ROM

A program and font data are stored in the 4MBytes ROM. ROM is composed by the two 16 Mbits masks and is mounted to the 42 pin IC socket. And 16 Mbits Flash ROM Module can be mounted to it, too.

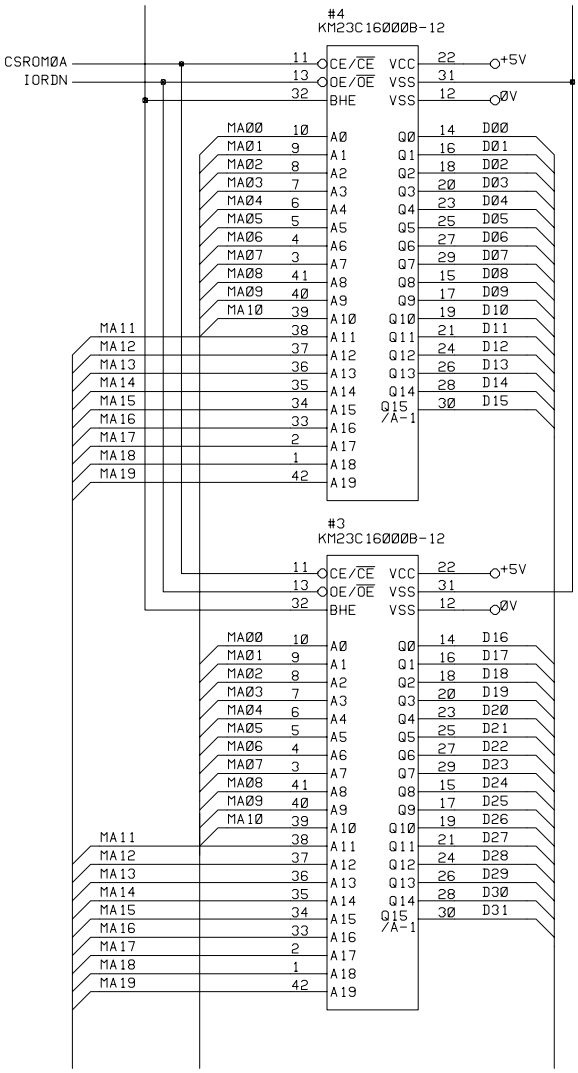


Fig. 2.5

1.3.4 DRAM

Two 4M-bit DRAMs (x 16bits) are used as the RAM.

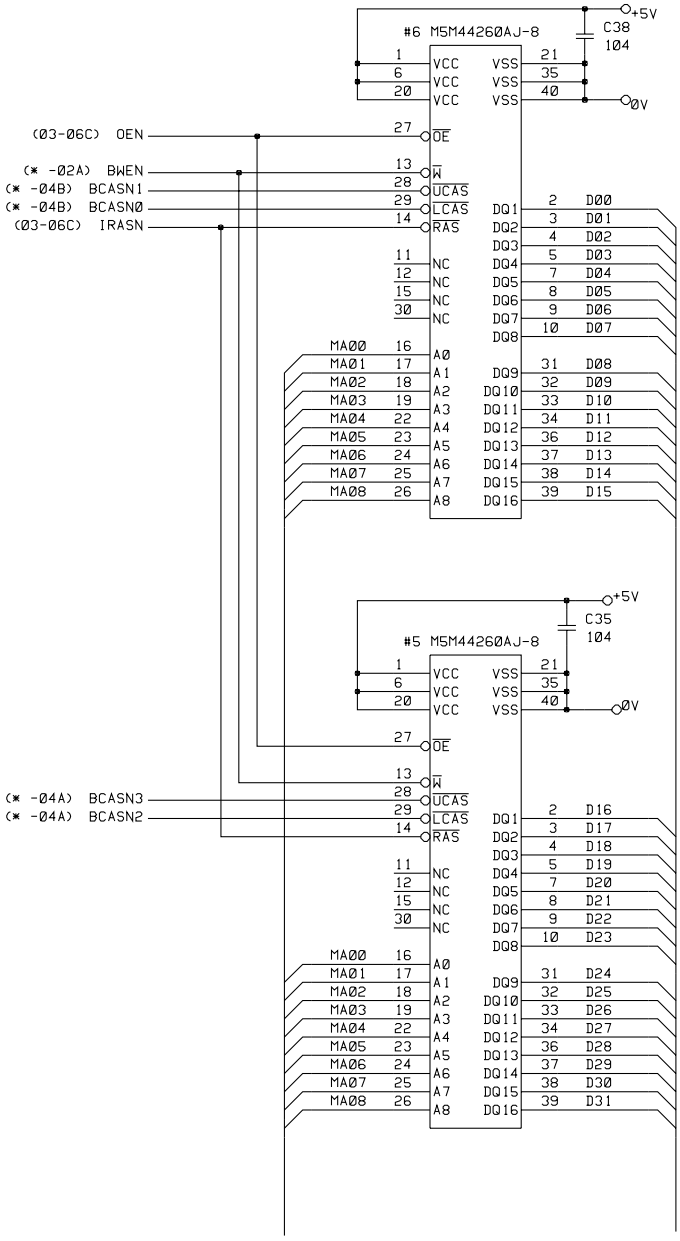


Fig. 2.6

1.3.5 Optional RAM

As the option RAM, 32 bit SIMM of 72 pin can be mounted. SIMM has one slot and can deal with 1 MBytes to 32 MBytes.

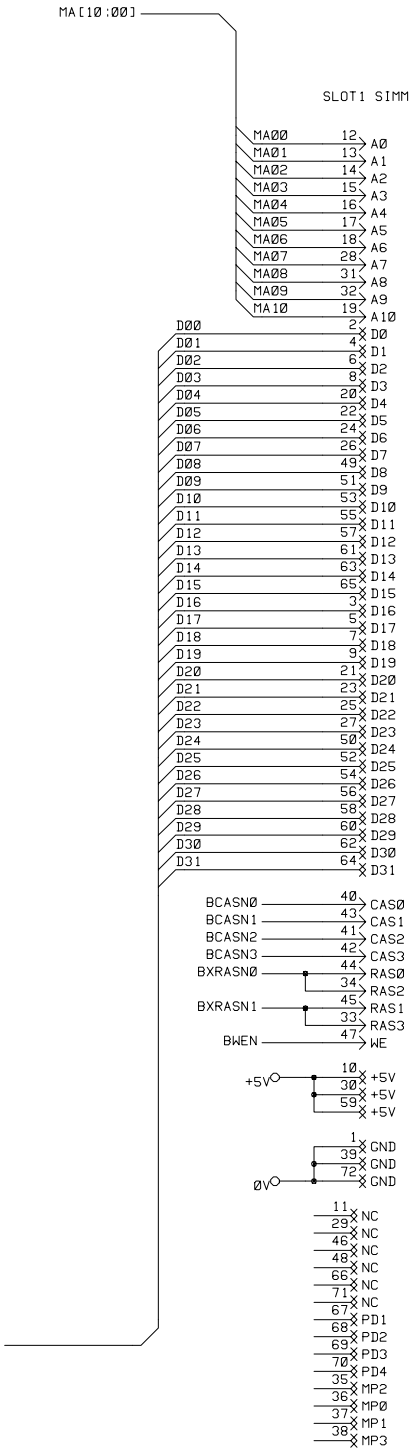


Fig. 2.7

1.3.6 Optional Serial I/O

The interrupt of serial I/O are input to the EXINT terminal of the ASIC, and are recognized by the CPU. A 32-byte space for register is provided for this I/O, which are read and written to by the CPU.

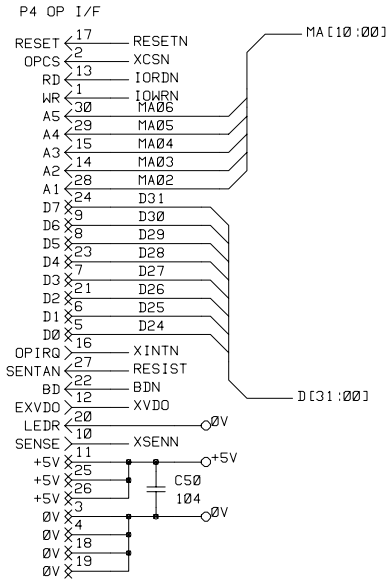


Fig. 2.8

1.3.7 EEPROM

The EEPROM is X24C04F type of a two-wire method with a 512 x 8 bits configuration.

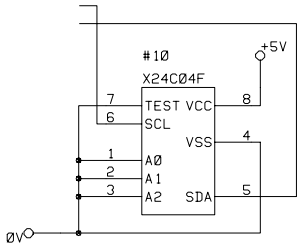


Fig. 2.9

1.3.8 Reset Circuit

The reset IC is PST591DMT. The reset voltage is 4.2V (typ.) and the LOW period of reset is 50 ms (typ).

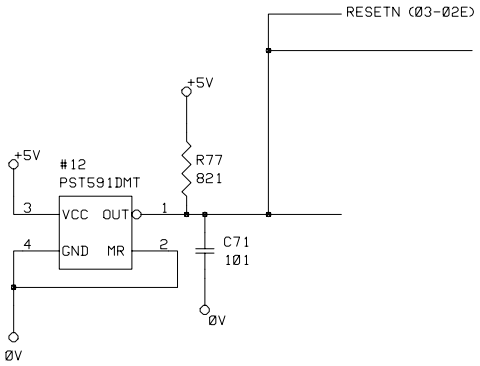


Fig. 2.10

1.3.9 CDCC I/O

Fig. 2.11 shows the CDCC interface circuit.

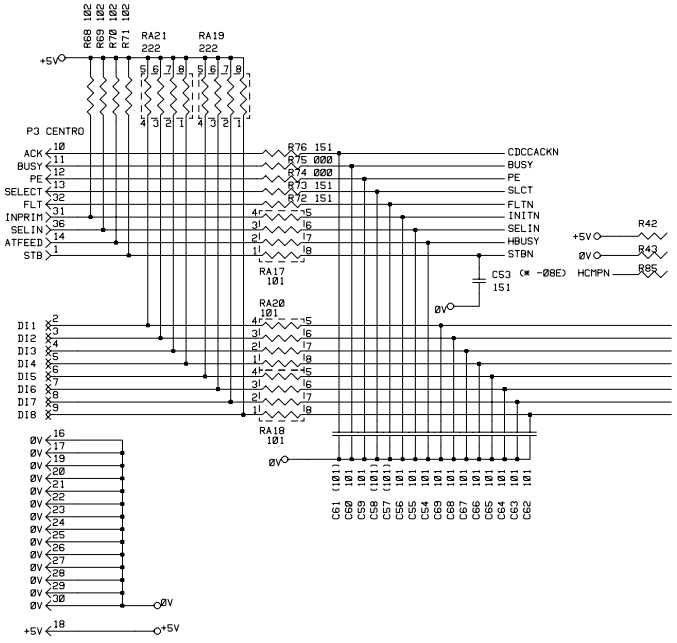


Fig. 2.11

1.3.10 Engine I/O

Fig. 2.12 shows the engine interface circuit.

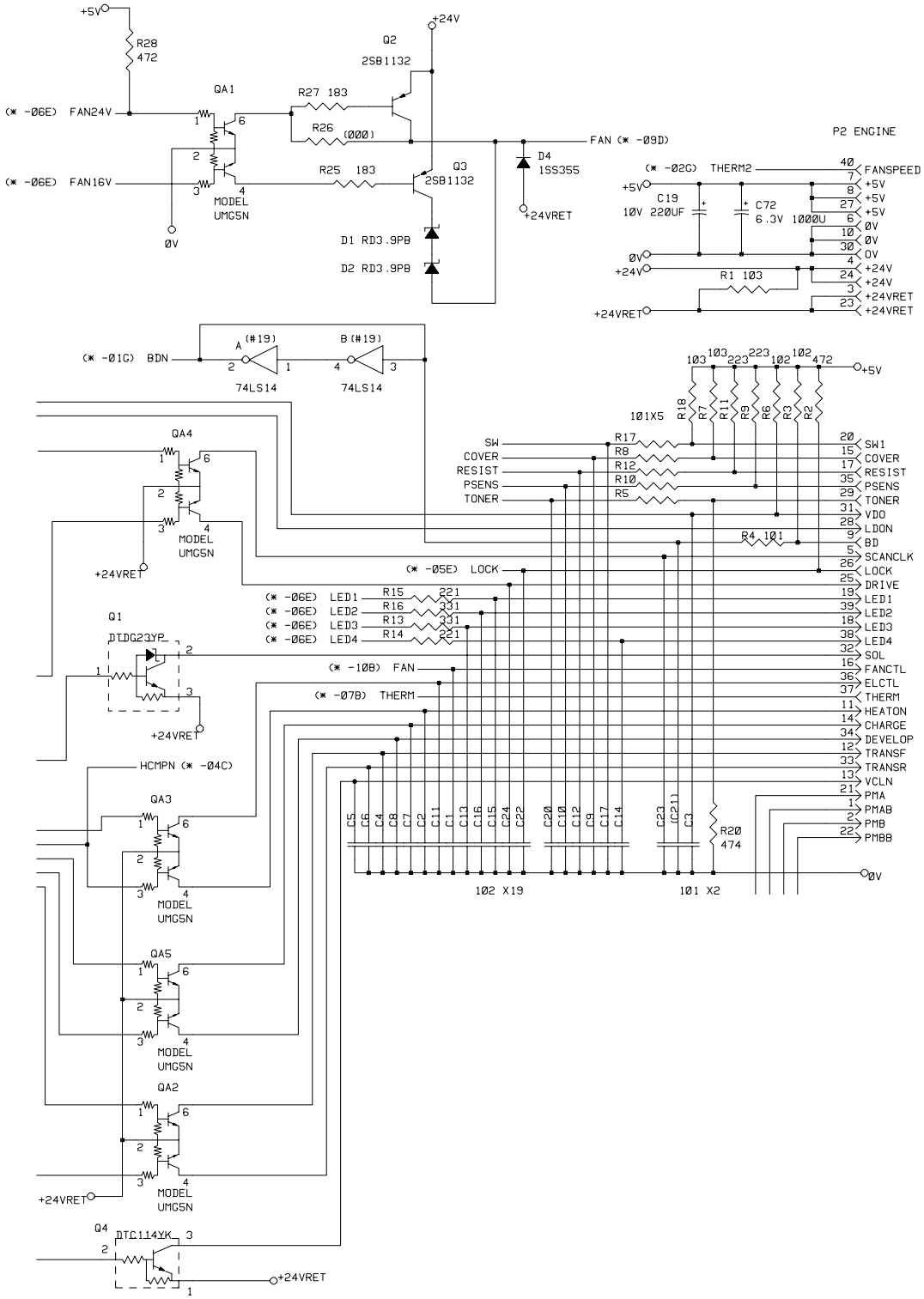


Fig. 2.12

1.3.11 Paper Feed Motor Drive Circuit

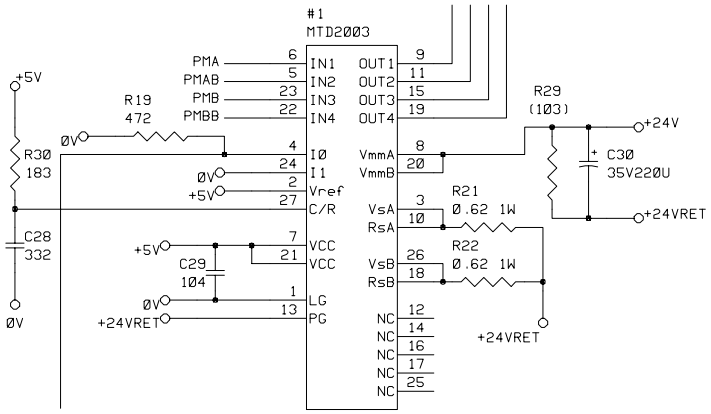


Fig. 2.13

CHAPTER III DISASSEMBLY AND REASSEMBLY

1. SAFETY PRECAUTIONS

To avoid creating secondary problems by mishandling, be careful to follow the precautions below during maintenance work.

(1) Always turn off the power switch and unplug the power cord from the power outlet before accessing any parts inside the printer.

(2) Be careful not to lose screws, washers, or other parts removed during servicing.

(3) Be sure to apply grease to the gears and other positions as specified in this chapter.

(4) When using soldering irons or other heat-generating tools, take care not to damage wiring, PCBs and covers.

(5) Before handing the PCBs, touch a metal part of the equipment to discharge any static electricity chargein your body, or elseelectronic parts or components may be damaged.

(6) When transporting PCBs, be sure to wrap them in conductive sheet to prevent static damage.

(7) Be sure to replace self-tapping screws correctly, if removed during servicing. Unless otherwise specified, tighten screws to the following torque values.

TAPTITE, BIND or CUP B
M3 : 6kgf • cm
M4 : 9kgf • cm

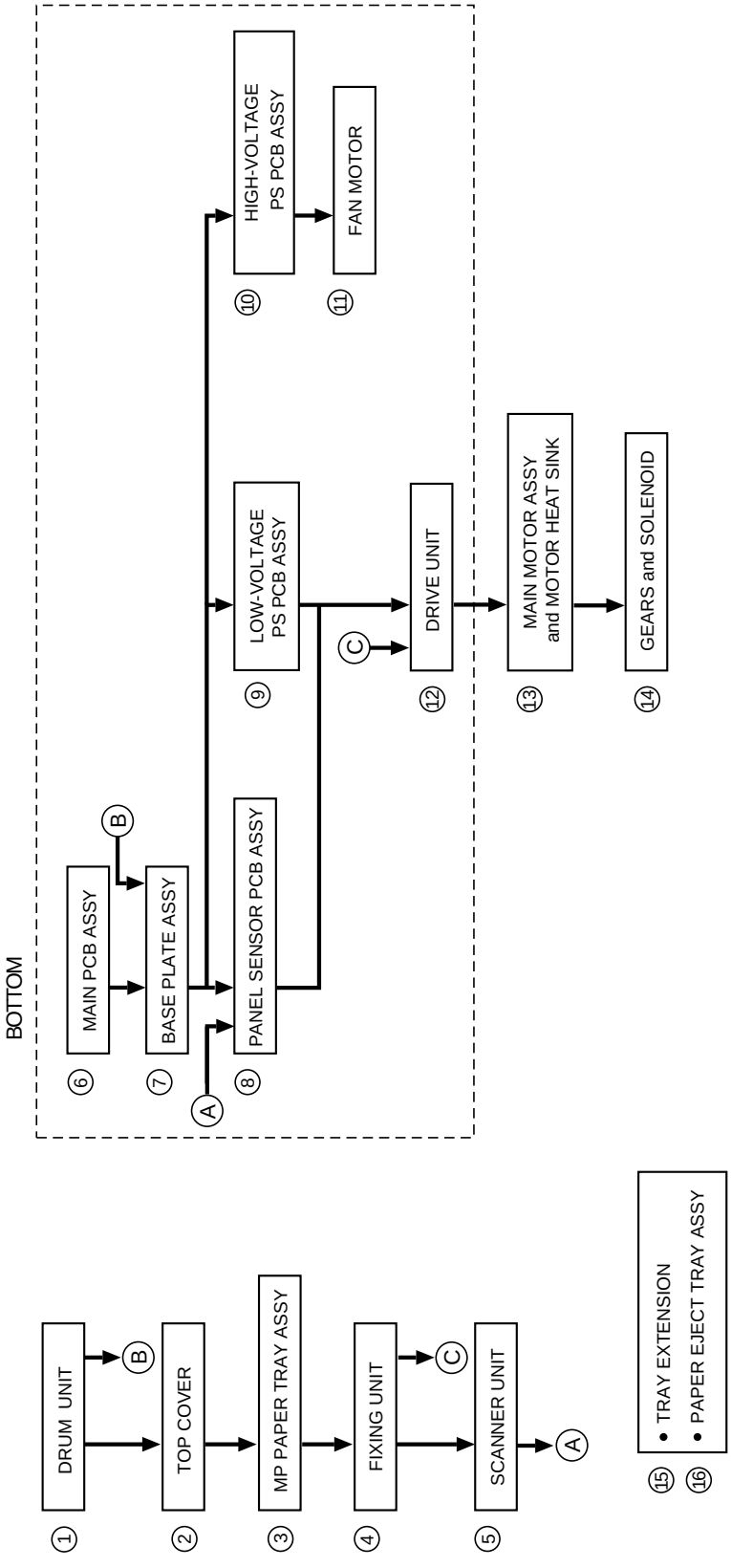
TAPTITE, BIND S
M3 : 9kgf • cm

SCREW
M3 : 7kgf • cm
M4 : 10kgf • cm

(8) When connecting or disconnecting cable connectors, hold the connector body, not the cables. If the connector has a lock, release the connector lock first then disconnect the cable.

(9) After a repair, do not only check the repaired portion but also check the connectors and that other related portions are functioning properly before doing operation checks.

2. DISASSEMBLING FLOW



3. DISASSEMBLING PROCEDURE

3.1 Drum Unit

(1) Open the top cover.

(2) Lift out the drum unit.

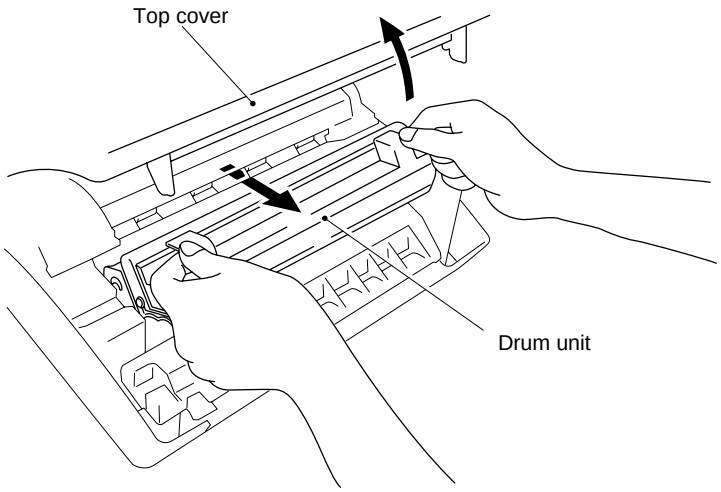


Fig. 3.1

3.2 Top Cover

(1) Open the top cover to the first lock position.

(2) Prise up the top cover link and free it from the dowel on the top cover to release it inwards.

(3) Press the link downward.

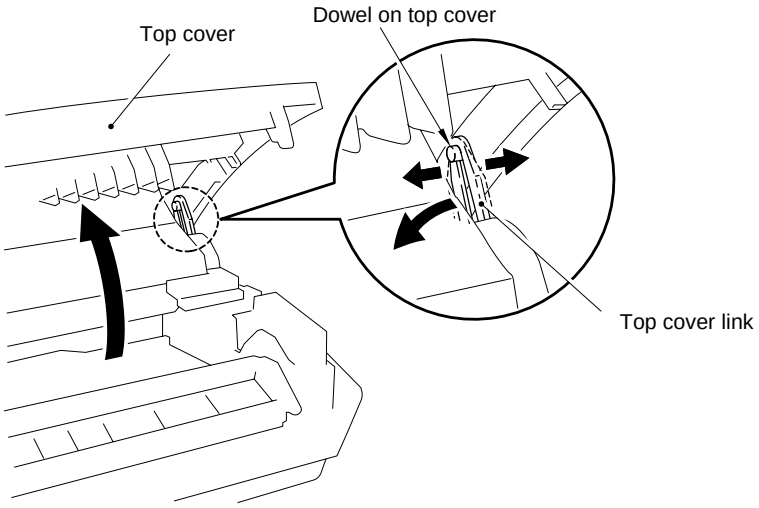


Fig. 3.2

(4) Open the top cover further, release the catches on both sides by sliding the top cover backward.

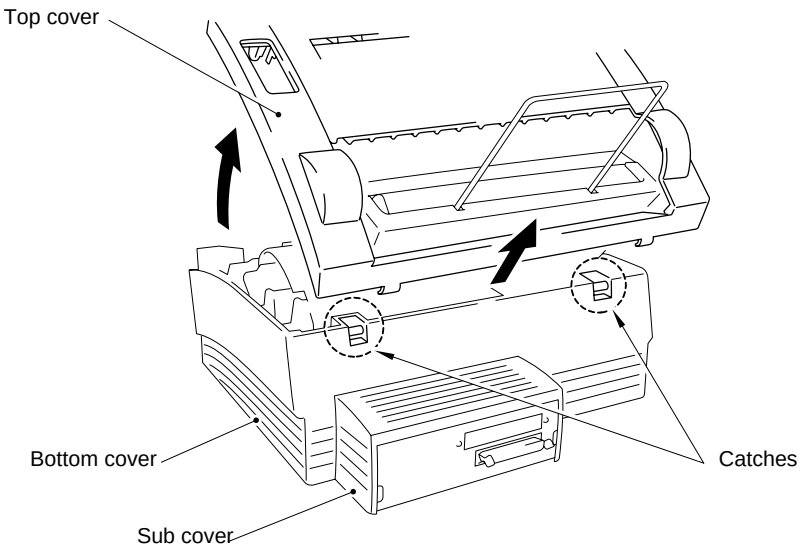


Fig. 3.3

3.3 Multi-purpose Paper Tray Assembly

(1) Pull the left rib outwards from the Mp tray and pull out the MP tray. It is not necessary to release the right rib.

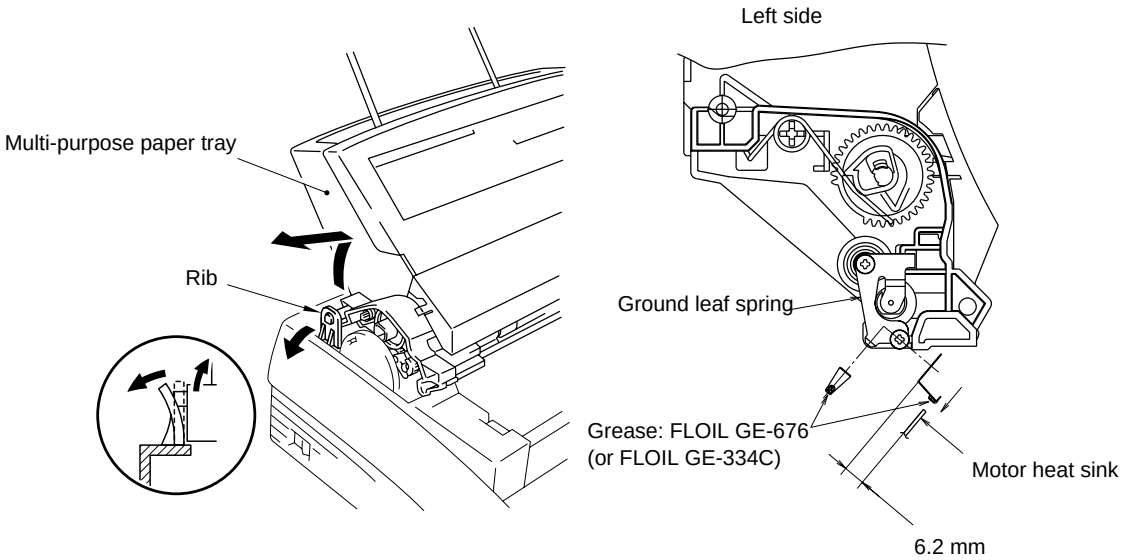


Fig. 3.4

NOTE: When reassembling, remove the old grease from the Motor heat sink and apply a suitable amount of new grease (2 rice-grain size) between the heat sink of the motor and the ground leaf spring.

3.4 Fixing Unit

(1) Remove the screw securing the fixing unit.

(2) Lifting up the fixing unit, disconnect the two heater harnesses and disconnect the thermistor cable from the connector on the EL PCB.

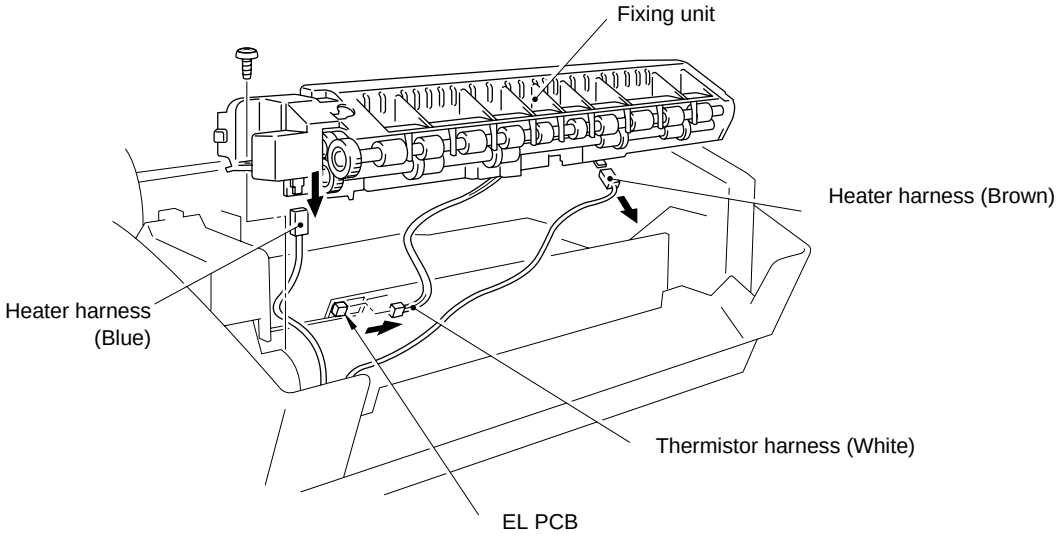


Fig. 3.5

3.5 Scanner Unit

(1) Remove the three screws.

(2) Lift the scanner unit to obtain access to the panel sensor PCB.

(3) Disconnect the three scanner unit connectors from the panel sensor PCB.

(4) Remove the screw and disassemble the Toner sensor PCB from the Scanner unit.

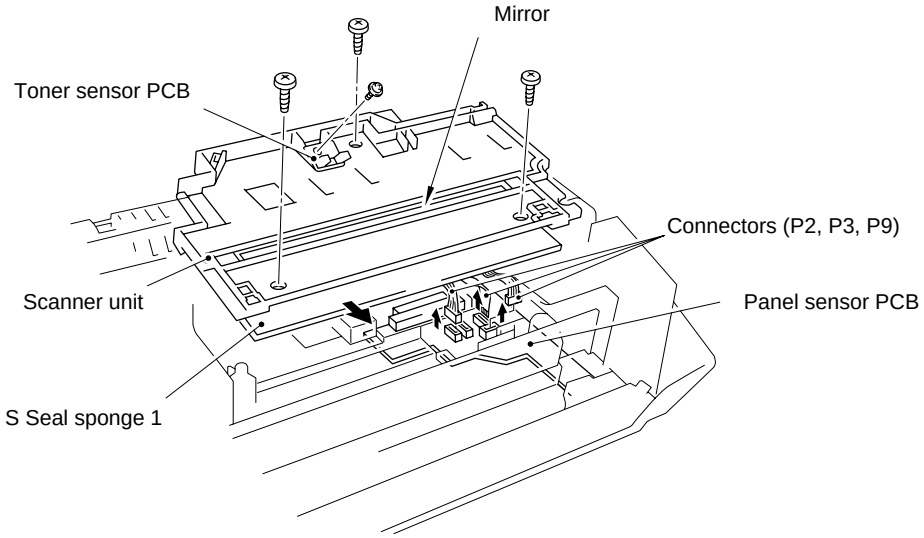


Fig. 3.6

NOTE: Never touch the inside of the scanner unit or the mirror when disassembling or reassembling. If there is any dirt or dust on the mirror, blow it off.

3.6 Main PCB Assy

(1) Remove the four screws securing the main PCB holder to the back of the printer.

(2) Grasp the hooks at the left and right ends of the PCB holder and draw out the main PCB assy.

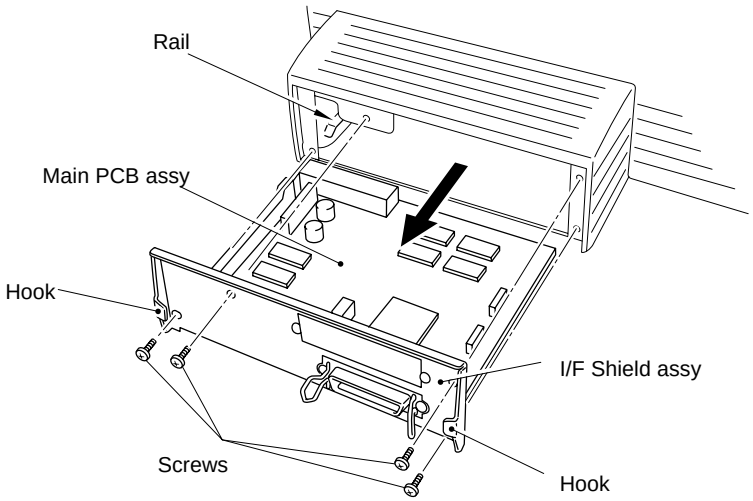


Fig. 3.7

3.7 Base Plate Assy

NOTE: Prior to turning the printer upside-down, the drum unit should be removed from the printer.

(1) Turn the printer upside down.

(2) Remove the six M4 and eight M3 tapping screws.

(3) Lift out the base plate assy and remove the grounding screw.

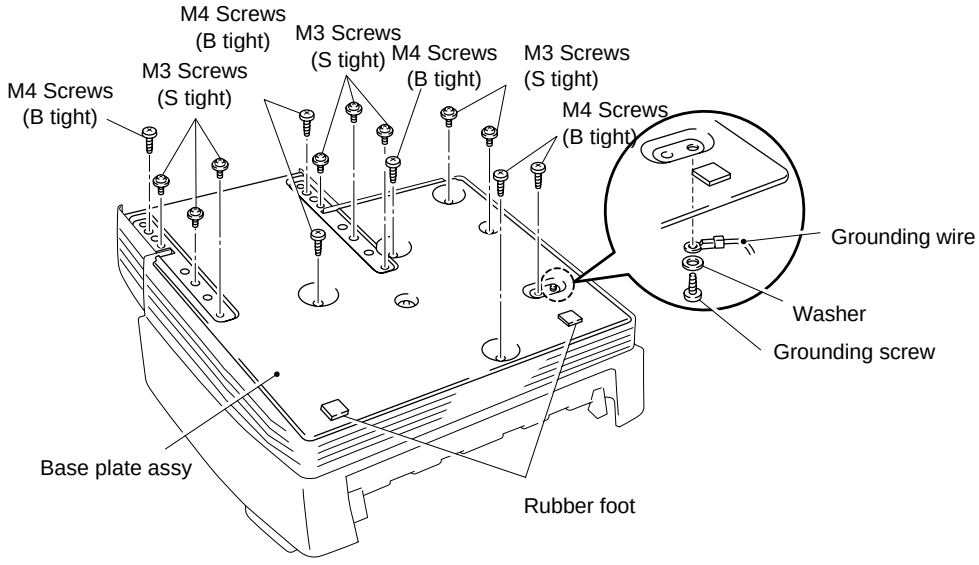


Fig. 3.8

3.8 Panel sensor PCB Assy

(1) Remove the screw securing the panel sensor PCB assy. Slide the part A from under the main shield and lift the PCB assembly upwards.

(2) Disconnect the seven connectors from the PCB (The three connectors P2, P3 and P9 have already disconnected when disassembling the scanner unit. See page, III-5).

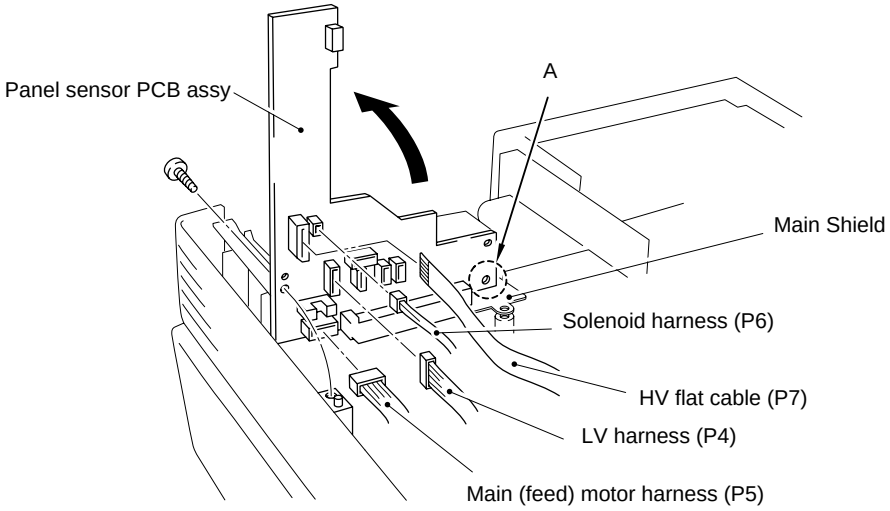


Fig. 3.9

NOTE1: When reassembling, the connectors must be inserted fully into the PCB and the PCB must not be lifted up by the harnesses.

NOTE2: The connectors should be inserted by matching the housing colour and the number of pins.

3.9 Low-Voltage Power Supply PCB Assy

(1) Remove the screw securing the low-voltage power supply PCB assy and lift the PCB.

(2) Disconnect the two connectors from the component side of the PCB.

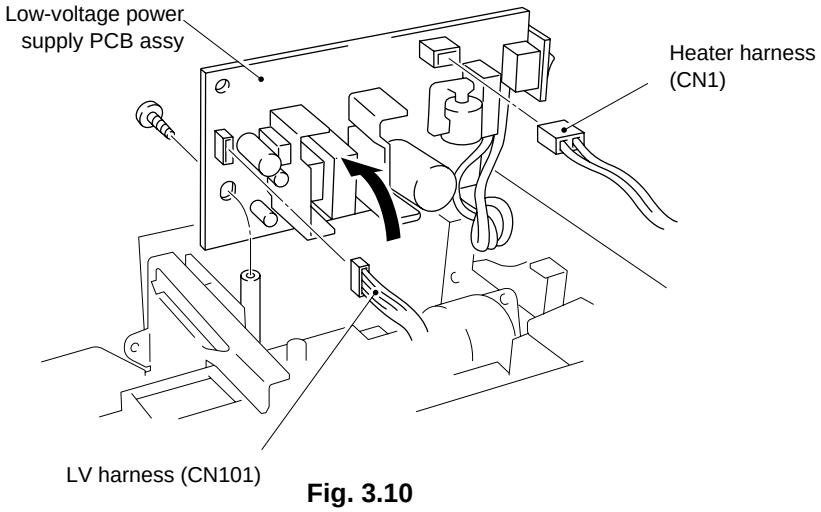


Fig. 3.10

3.10 High-voltage Power Supply PCB Assy

(1) Remove the screw securing the high-voltage power supply PCB assy and lift the PCB.

(2) Disconnect the four connectors from the PCB.

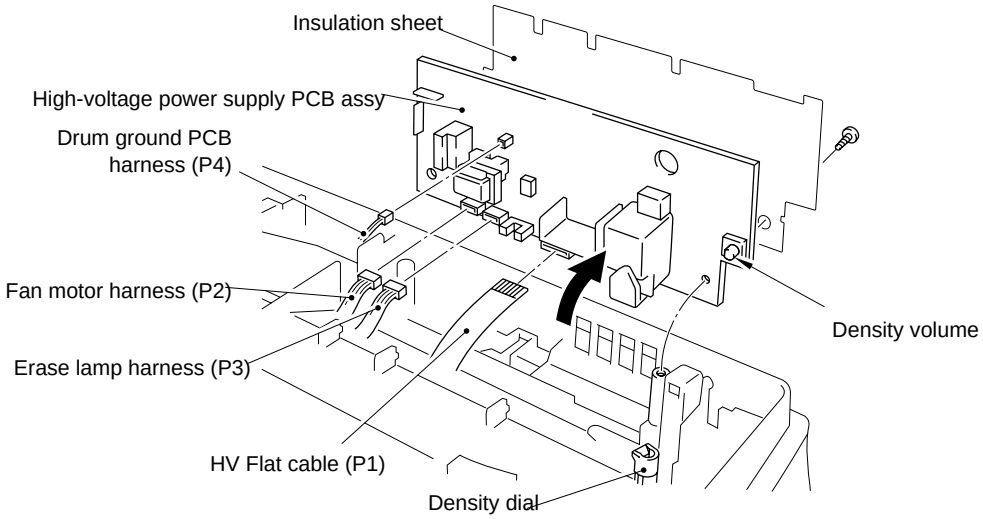


Fig. 3.11

NOTE: When reassembling, the density volume adjuster knob must be fitted into the cutout side of the density dial.

3.11 Fan Motor

(1) Disconnect the connector from the high-voltage power supply PCB. (It should have been disconnected already, see above)

(2) Lift out the fan motor assy.

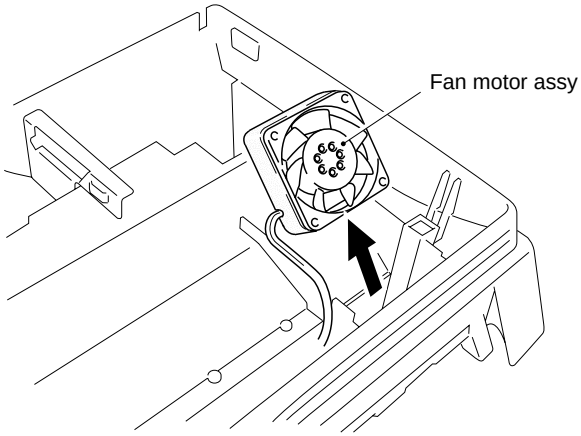


Fig. 3.12

3.12 Drive Unit

(1) Remove the four screws securing the drive unit.

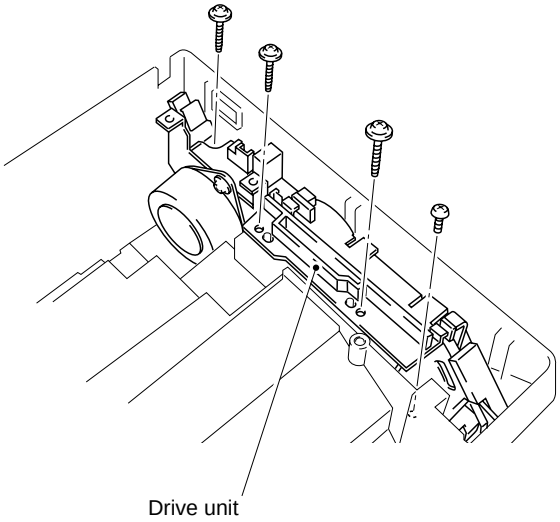


Fig. 3.13

3.13 Main Motor Assy and Motor Heat Sink

(1) Remove the two screws securing the main motor assy.

(2) Remove the two screws securing the motor heat sink.

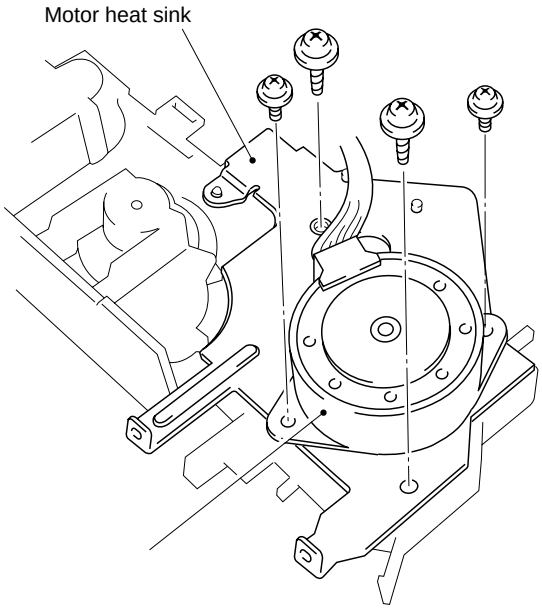
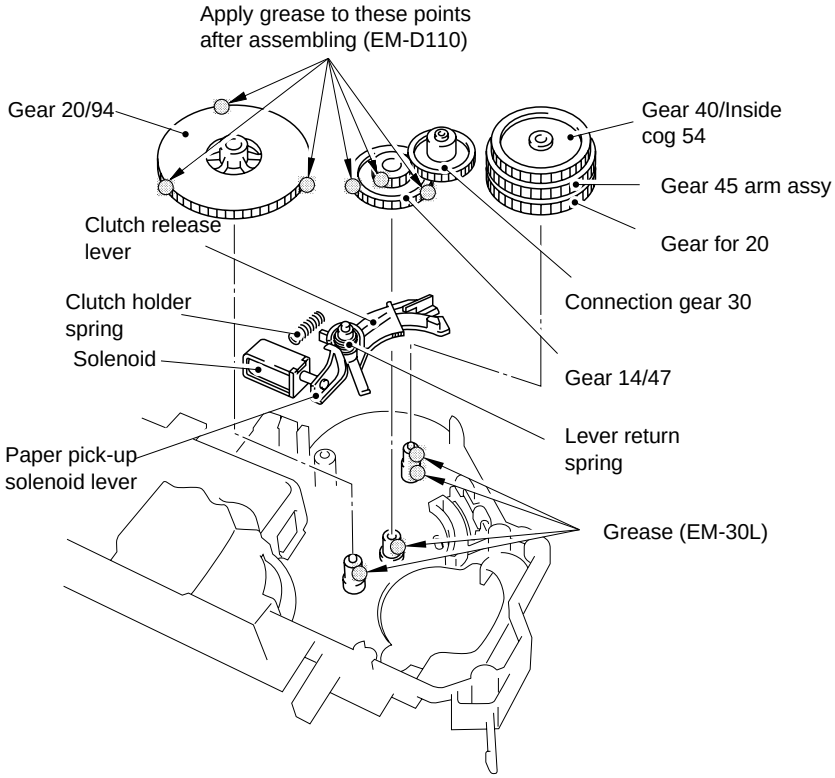


Fig. 3.14

3.14 Gears and Solenoid

(1) Apply grease the points shown below.

Grease: MOLYKOTE EM-30L TKC-0
MOLYKOTE EM-D110



NOTE: Apply EM-30L to the small gears (2 pcs.) inside the "Gear 45 arm assy".

Fig. 3.15

3.15 Tray Extension

(1) Put the tray extension assembly down towards the front of the printer, and pull the bottom of both side legs outwards to release it.

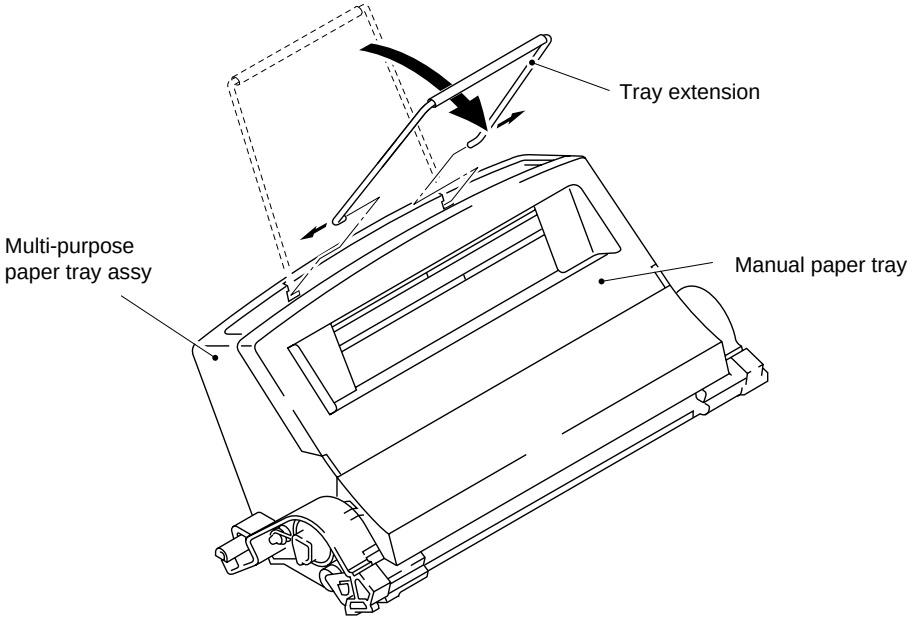


Fig. 3.16

3.16 Paper Eject Tray Assy

(1) Open the paper eject tray.

(2) Press both sides of the hinges of the paper eject tray inwards to release it from the holes in the top cover.

(3) Press the tray extension inwards as shown by the arrows and remove it.

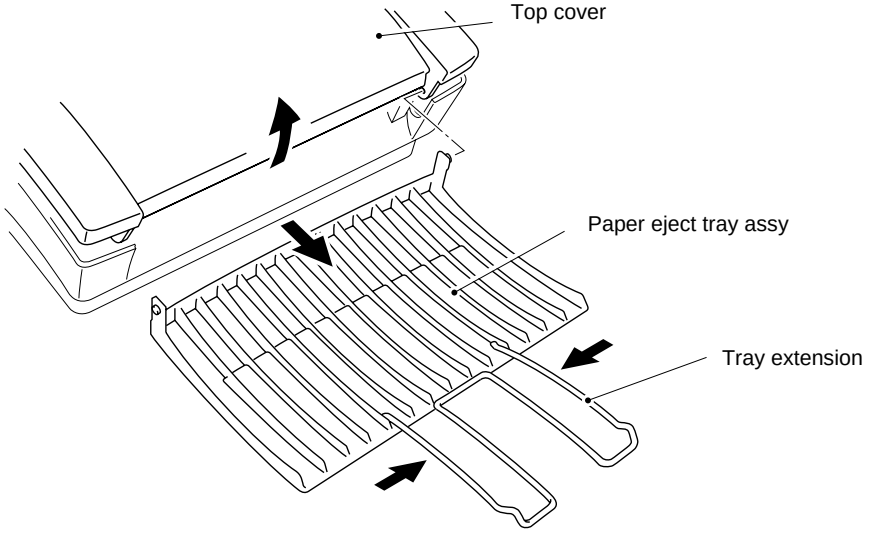


Fig. 3.17

3.17 Core

(1) Remove the flat cable from the ferrite core secured to the LD harness on the back of the scanner unit, and then carefully cut the tywrap to remove the ferrite core secured to the LD harness.

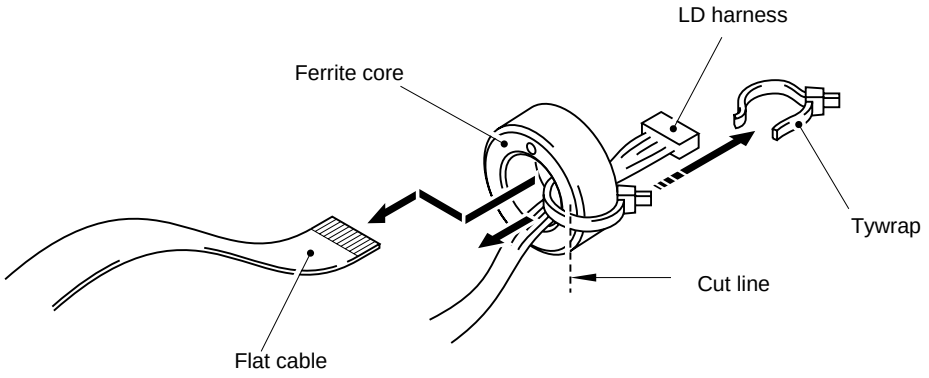


Fig. 3.18

(2) Carefully cut the tywrap to remove the core secured to the body bottom. And then remove the motor harness, the solenoid harness and the drum ground PCB assy harness which all pass through the core.

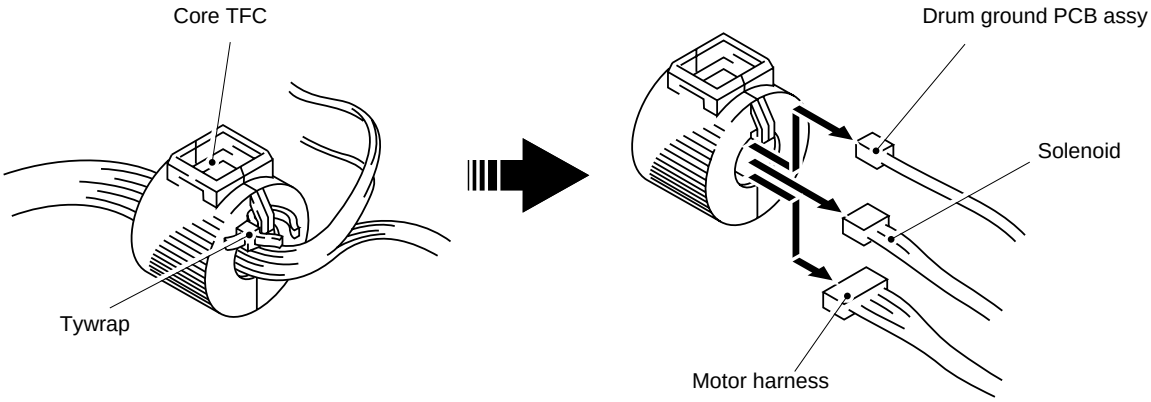


Fig. 3.19

4. PACKING

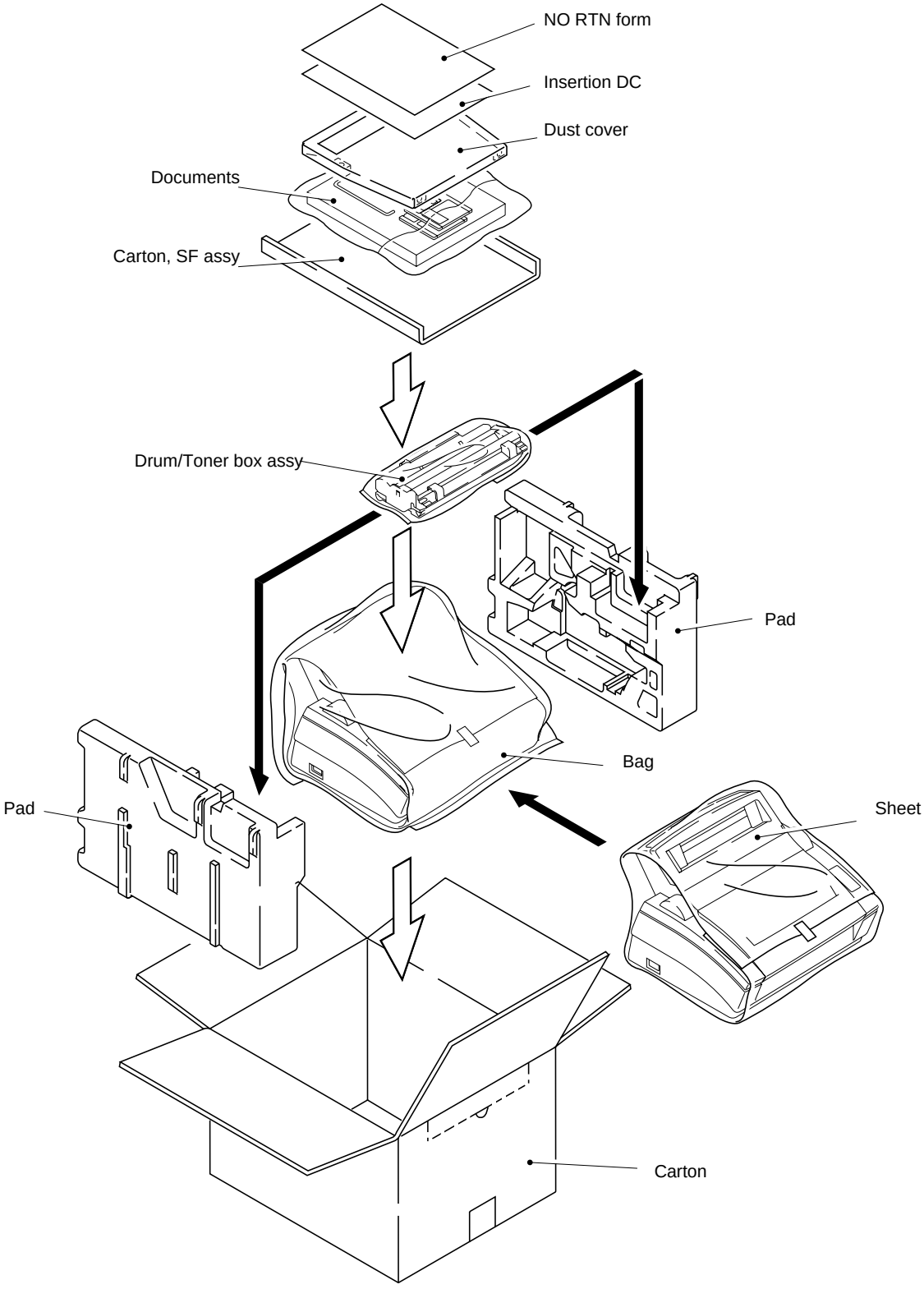


Fig. 3.20

CHAPTER IV TROUBLESHOOTING

1. INSPECTION MODE

1.1 Inbuilt Inspection Modes

The printer incorporates the following inspection modes such as the factory inspection mode and the test print mode.

Factory inspection mode, Continuous grid pattern print mode, 3 patterns print mode, NV-RAM value dump mode, ROM code update (FLASH rom only), RAM check and 4% density test print..

The operation of the inspection mode is as follows.

(1) Turn off the power to the printer.

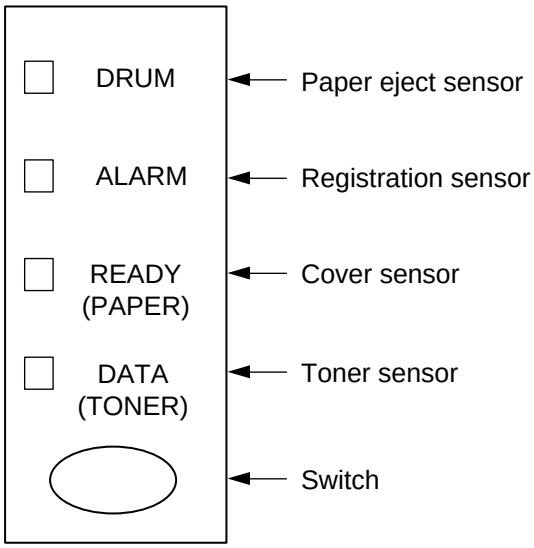
(2) With the top cover open, turn on the power while holding down the button on the operation panel.

When entering this mode, the DRUM LED is ON. Holding down the button causes the LEDs to turn ON in the order DRUM -> ALARM -> READY -> DATA -> DRUM. When you release the button, a mode is selected. The mode selected is indicated by the LED which is ON when you release the button. The inspection modes are assigned to the respective LEDs as shown below.

LED	Type of inspection
DRUM	Factory inspection mode
ALARM	Continuous grid pattern print mode
READY	3 patterns print mode (grid horizontal lines and black)
DATA	NV-RAM value dump mode
DRUM + ALARM	The ROM code update (only when flash memory is mounted)
ALARM + READY	RAM check
READY + DATA	4% density printing

Details of the factory inspection mode are as follows.

This mode is used to check if the sensors in the printer function correctly. In the process of this inspection, the LEDs and buttons are also checked. On entering this mode, the LEDs show the status of the respective sensors as follows.



Paper eject sensor	ON (Paper is detected.)	DRUM LED ON
	OFF (No paper is detected.)	DRUM LED OFF
Registration sensor	ON (Paper is detected.)	ALARM LED ON
	OFF (No paper is detected.)	ALARM LED OFF
Cover sensor	ON (The top cover is closed.)	READY LED OFF
	OFF (The top cover is open.)	READY LED ON
Toner sensor	ON (The toner cartridge is installed.)	DATA LED OFF
	OFF (No toner cartridge is installed.)	DATA LED ON

The procedure for the factory inspection mode is as follows.

(1) Open the top cover and remove the drum unit.
(2) Turn on the power to the printer while holding down the button. The DRUM LED comes ON.
(3) Release the button and immediately lightly press the button again.
(4) Check if the DRUM (paper eject sensor) and ALARM (registration sensor) LEDs go OFF after all the LEDs go ON.
    If the paper eject sensor is ON at this point and the DRUM LED goes ON (error).
    If the registration sensor is ON at this point and the ALARM LED goes ON (error).
(5) Install the drum unit. Check that the DATA LED goes OFF.
(6) Lightly touch the registration sensor actuator. Check that the ALARM LED comes ON.
(7) Close the top cover. Check that the READY LED goes OFF.
(8) Press the button.
(9) If all the sensors are correct, the printer goes back to the READY status. If any error is detected, the corresponding LED stays ON.

1.2 Error codes

In the event of a printer failure, error codes will be indicated as shown below. All the LEDs and the specific LEDs are turned ON alternately. The specific combination of ON LEDs indicates the type of error.

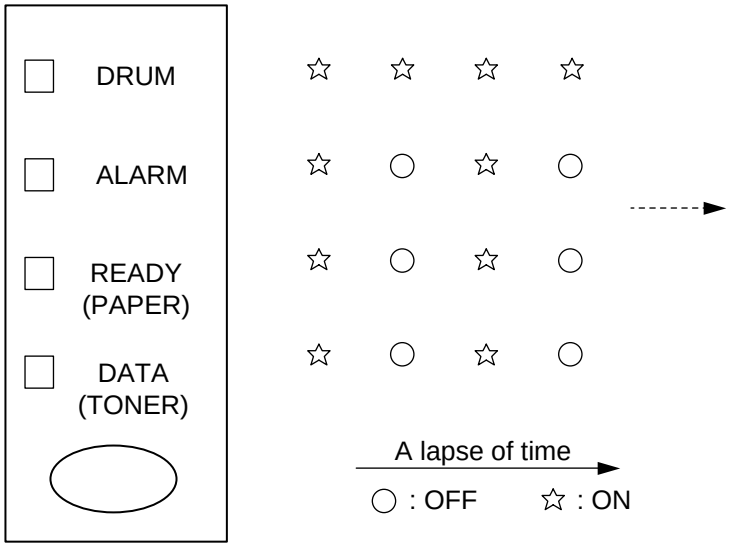
Type of error	DATA	READY	ALARM	DRUM
Fuser Malfunction				○
Laser BD Malfunction			○	
Scanner Malfunction			○	○
ROM Error		○		
D-RAM Error		○		○
Service A *		○	○	
Service B *		○	○	○
NV-RAM Error *	○	○		○
CPU Runtime Error	○	○	○	○

* Refer to the further description of those errors as follows;

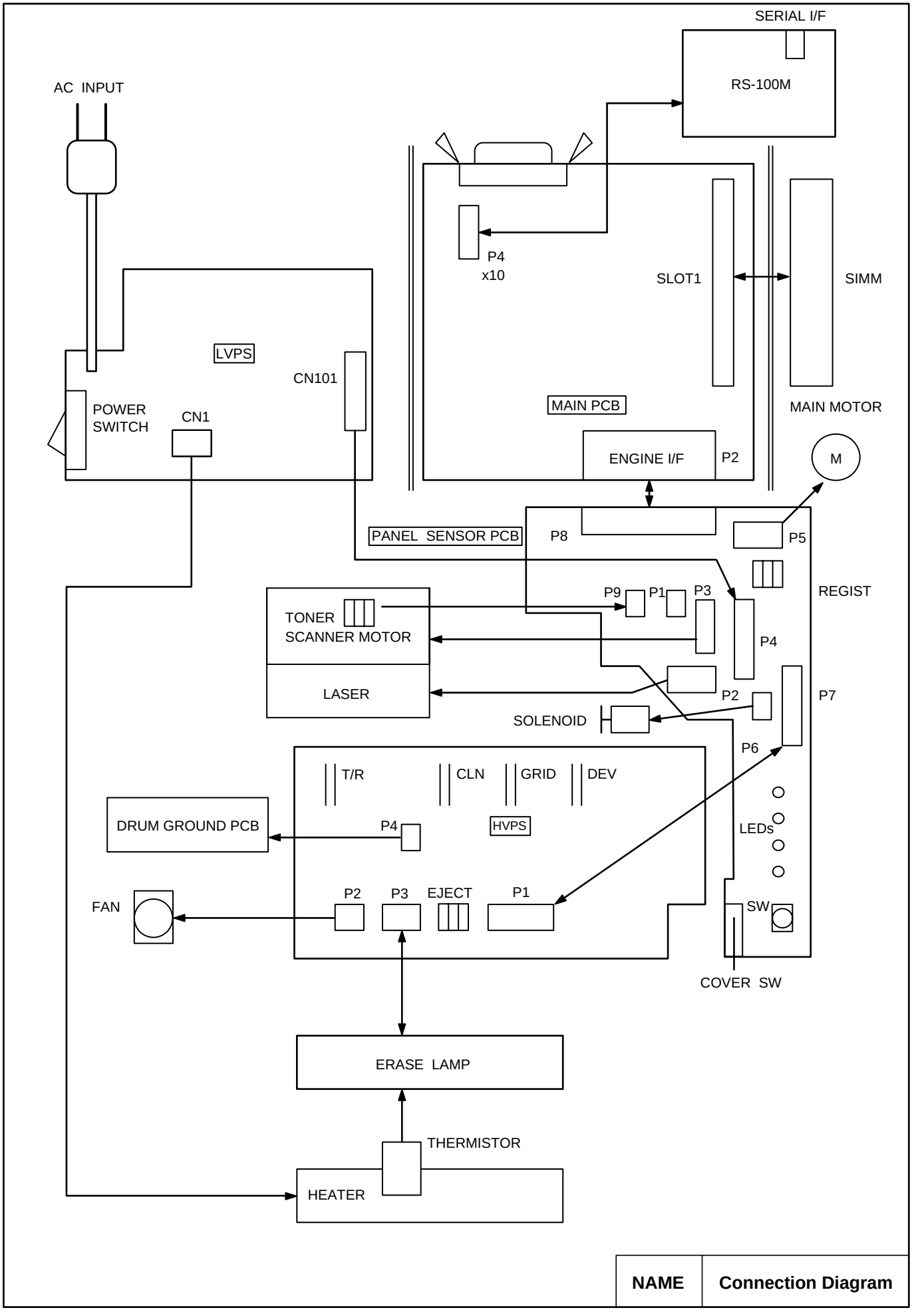
- Service A: Address Error
- Service B: Bus Error
- CPU Runtime Error: Other CPU errors such as Illegal Instruction or Operation Overflow

LED error indications

FUSER MALFUNCTION

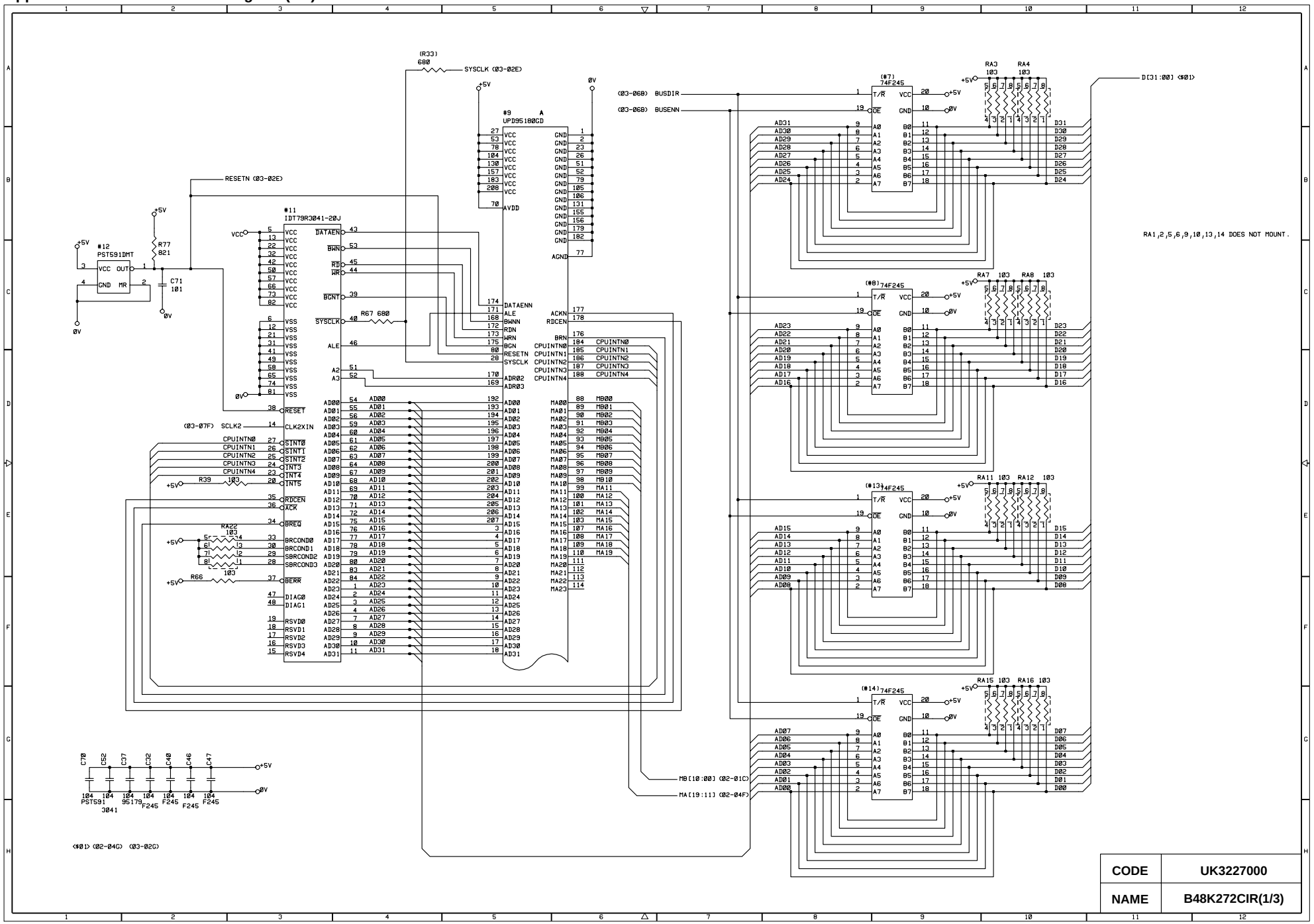


Appendix 1. Connection Diagram

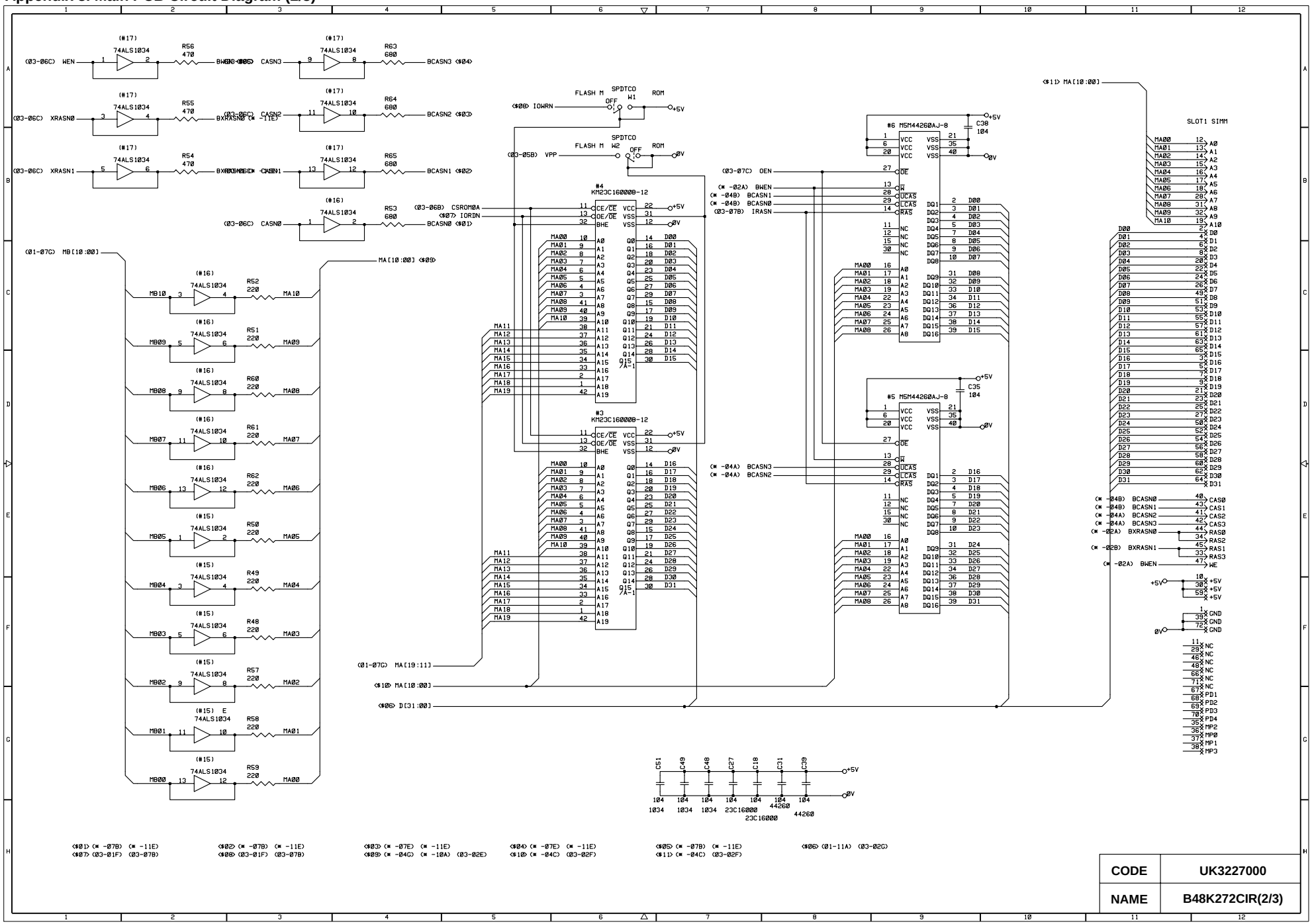


NAME	Connection Diagram

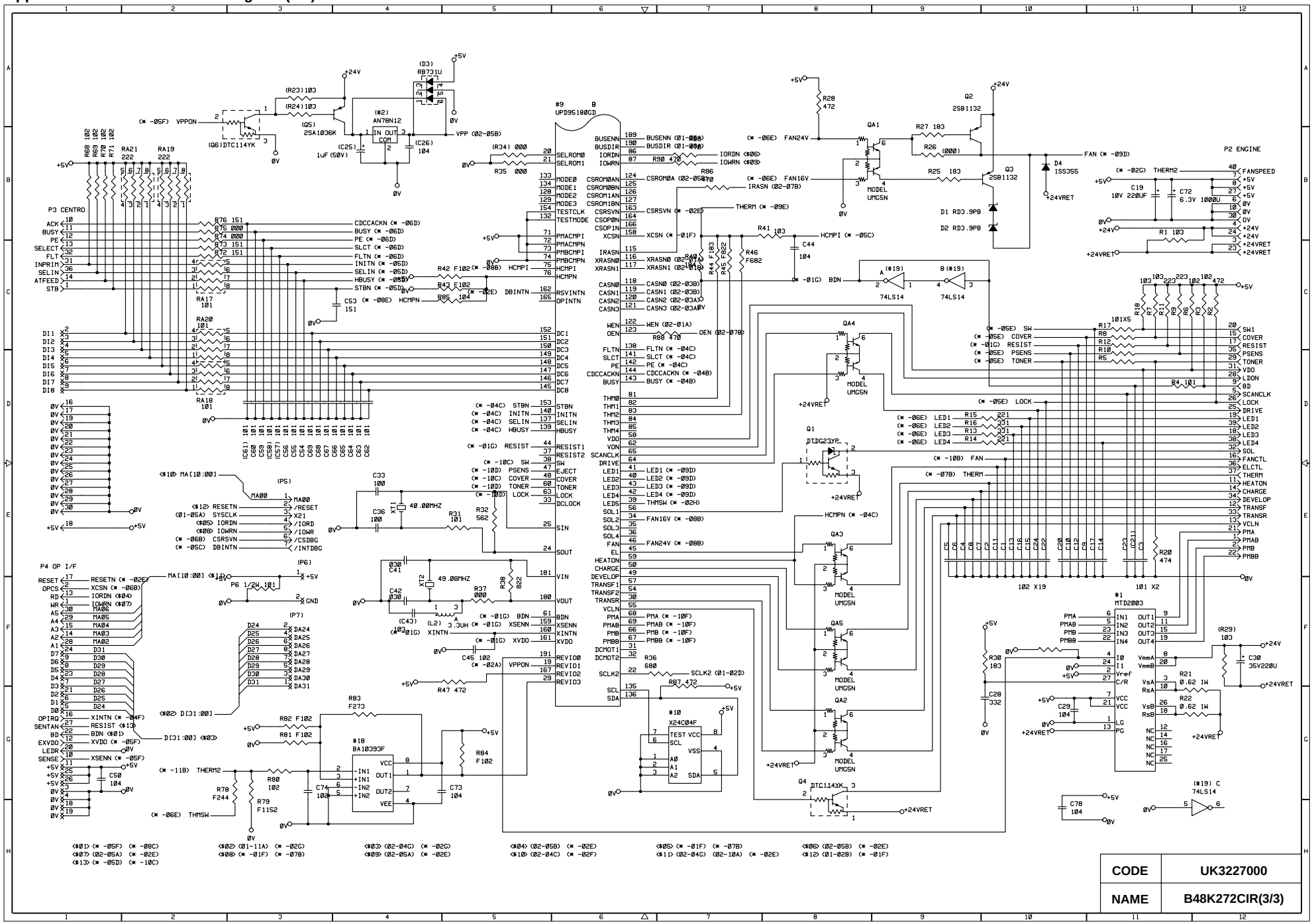
Appendix 2. Main PCB Circuit Diagram (1/3)



Appendix 3. Main PCB Circuit Diagram (2/3)

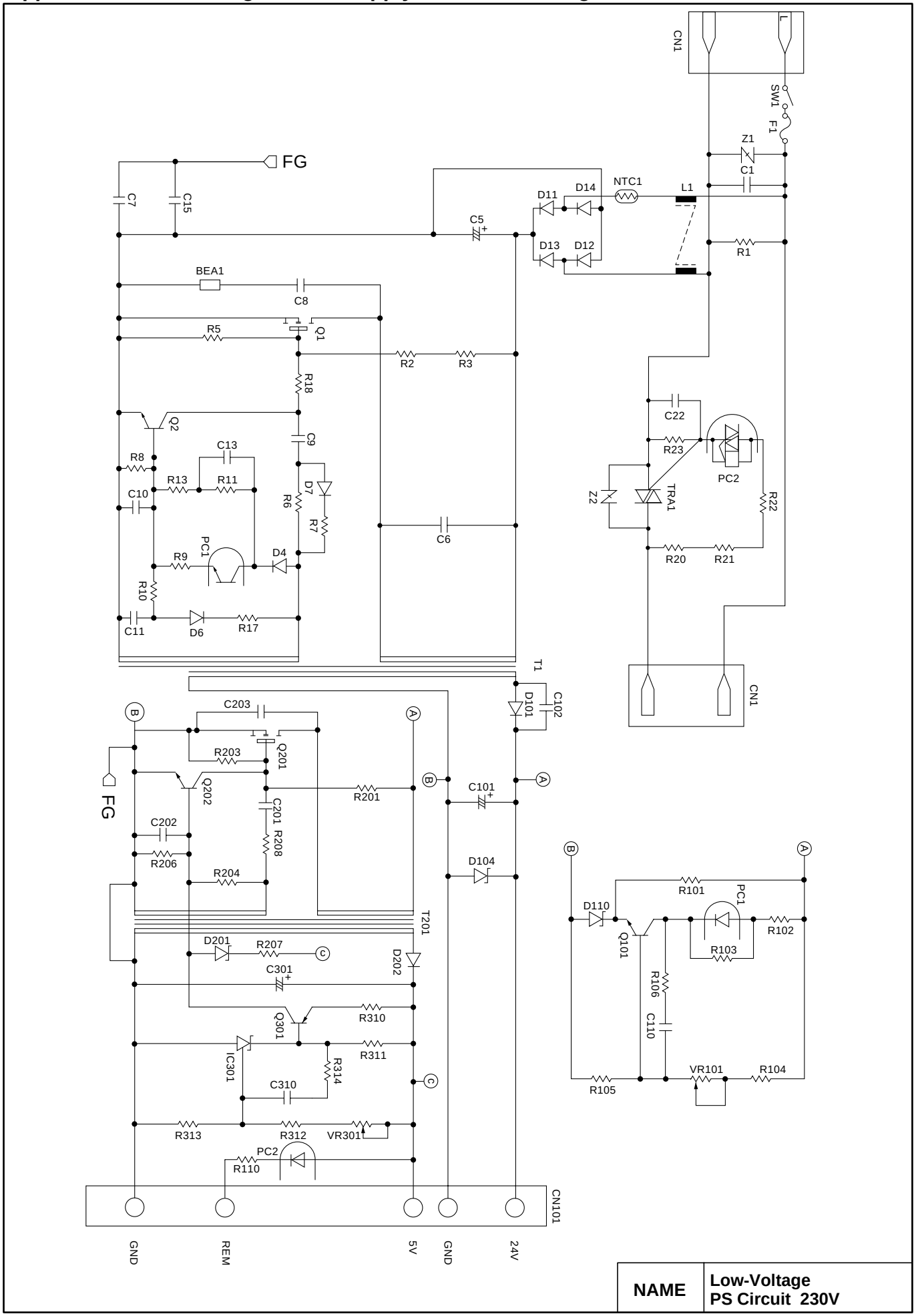


Appendix 4. Main PCB Circuit Diagram (3/3)



CODE	UK3227000
NAME	B48K272CIR(3/3)

Appendix 6. Low-Voltage Power Supply PCB Circuit Diagram 230V



Appendix 7. Low-Voltage Power Supply PCB Circuit Diagram 115V