LQ-570+
SERVICE MANUAL

IMPORTANT

Please refer this manual in conjunction with the **LQ-570/1070** Service Manual

EPSON

CHAPTER 1
GENERAL DESCRIPTION

LIST OF FIGURES

LIST OF TABLES

1.1 FEATURES

The LQ-570+ is a small, light-weight, low-cost, printer with advanced paper handling that is upper compatible with the LQ-510/550 and compatible with the LQ-570/1070. The printer's main features areas follows:

1. Use of ESC/P 2 control codes
   Ability to print multi-point fonts
   Ability to receive and print raster graphic images
   Compatibility with the LQ/SQ series available on the market
2. Printing speeds: 225 characters per second (cps) (draft, 10 characters per inch (cpi))
   High speed draft has not equiped
   269 cps (draft, 12 cpi)
   225 cps (draft, 10 cpi)
   90 cps (LQ, 12 cpi)
   75 cps (LQ, 10 cpi)
3. Optional interface card
4. Clear, easy-to-read printing with standard EPSON fonts
5. Multiple fonts resident in the printer
   9 LQ fonts (Roman, Saris Serif, Courier, Prestige, Script, OCR-B, Script C, Orator, Orator-S)
   1 draft font
6. Control panel switch selection of fonts, mndensed, and cut-sheet feeder (CSF) bin
7. Optional tractor unit that can make up push-pull tractor
8. Easy handling of cut sheets with the optional cut-sheet feeder
9. Continuous Paper
   Three ways to 'insert continuous paper (front/bottom/rear path)
   Auto backout & auto loading (rear insertion)
   Continuous paper can be used without removing CSF
   Standard tractor unit can be attached in two position (push/pull)
   Cut Sheet
   Two ways to insert cut sheets (front/top)
   Auto loading

The LQ-570+ is equipped with the standard EPSON 8-bit parallel interface(Printing is not possible for the following baud rates: 1800, 200, 134.5, 110, 75 bps). Various interface options ensure compatibility with a wide variety of computers. Table 1-1 lists the interface options, Table 1-2 lists the optional units available for the LQ-570+, and Figure 1-1 shows an exterior view of the LQ-570+.

Table 1-1. Interface Options

Model	Description
C82305	Serial I/F card(inch screw)
C82306	Serial I/F card(mm screw)
C82307	32KB intelligent serial I/F card(inch screw)
C82308	32KB intelligent serial I/F card(mm screw)
C8231O	32KB intelligent pararell I/F card(inch screw)
C82311	32KB intelligent pararell I/F card(mm screw)
C82313	32KB IEEE-488 I/F card

NOTES : Refer to the "Optional Interface Technical Manual" for details.

Table 1-2. Optional Units

Model	Description
C806371(EAI ver.)	Single-bin cut sheet feeder(80-column)
C806372(others)	Single-bin cut sheet feeder(80-column)
C806381(EAI ver.)	High-capacity cut sheet feeder(80-column)
C806382(others)	High-capacity cut sheet feeder(80-column)
C800191(EAI ver.)	Tractor unit(80-column)
C800192(others)	Tractor unit(80-column)
7753	Fabric ribbon cartridge(80-column)
7768	Fabric ribbon cartridge(80-column)

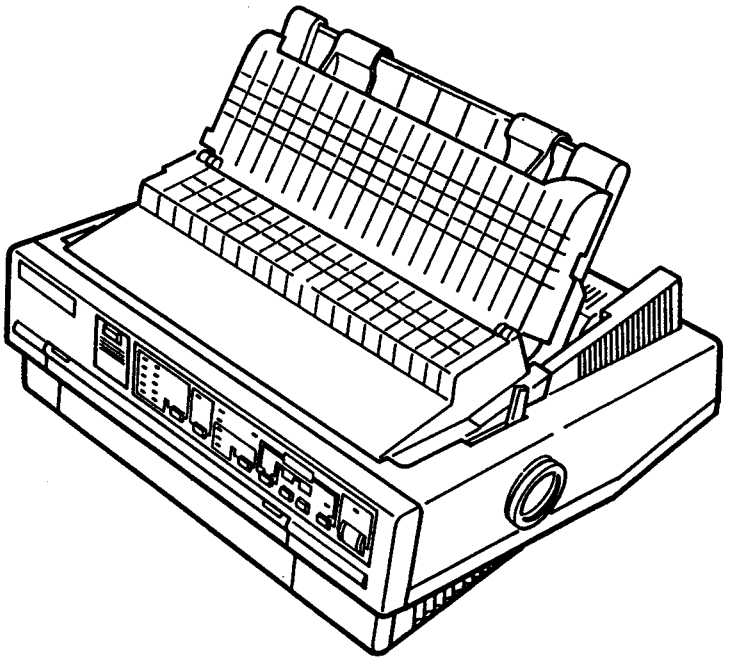


Figure 1-1. Exterior View of the LQ-570+

1.2 SPECIFICATIONS

This section provides specifications for the LQ-570+ printer.

1.2.1 Hardware Specifications

Printing method	Serial, impact, dot matrix
Pin configuration	24 wires (12x 2 staggered, diameter 0.2 mm)

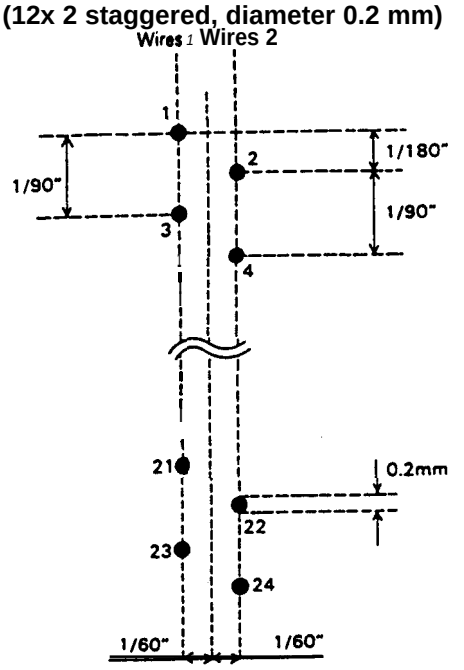


Figure 1-2. Pin Configuration

Feeding methods	Friction feed (front/top) Push tractor feed (rear) Pull tractor feed (front/bottom) Push-pull tractor feed (with optional tractor) (rear)
Line spacing	1/6 inch, 1/8, or programmable in units of 1/360 inch
Paper insertion	Friction feed -- Front or rear side Tractor feed -- Front, bottom, or rear side
Paper-feed speed	Friction without CSF -2.0 msec/0.141mm(continuous) 60.0ms/4.23mm(continuous 2.8IPS) 65.2ms/4.23mm(interval 2.8IPS) Friition with CSF -- 2.20ms/0.141mm(continuous) 66.7rns/4.23mm(mntinuous 2.5IPS) 73.1 ms/4.23mm(interval 2.5IPS) Tractor -- 2. 0ms/0.141mm(continuous normal mode) 60.0ms/4.23mm(continuous normal mode 2.8IPS) 65.2ms/4.23mm(interval normal mode 2.8IPS) 2.5ms/0.141mm(copy mode) 75.0ms/4.23mm(copy mode 2.2IPS) 80.6ms/4.23mm(copy mode 2.2IPS)

NOTE: The points below provide precautions for paper handling.

1. Friction feed(release lever in FRICTION POSITION).
   . Paper must be loaded from the front or top entrance.
   - Do not use continuous paper.
   - Do not perform any reverse paper feeds within the top 8.5 mm(.34in.),bottom 22 mm(.87in.) (top entrance), or bottom 40.2mm(1.6in.)<front entrance) area.
   - Do not perform any reverse feeds greater than 1/6 inch after a paper end has been detected.

Table 1-3. Specifications for Cut Sheets

Width	148 mm to 257 mm (5.8 in. to 10.1 in.) (top insertion) 182 mm to 257 mm (7.2 in. to 10.1 in.) (front insertion)
Length	364 mm (14.3 in.), maximum
Thickness	0.065 mm to 0.14 mm (0.0025 in. to 0.0055 in.)
Weight	14 lb to 24 lb (52.3 g/m**2 to 90 g/m**2)
Quality	plain paper or recycled paper(under normal temperature)

Table 1-4. Specifications for Cut Sheets (Carbonless Duplicating Paper)

Width	182 mm to 216 mm (7.2 in. to 8.5 in.)
Length	257 mm to 297 mm (10.7 in. to 11.7 in.)
Thickness	0.12 mm to 0.32 mm (0.0047 in. to 0.012 in.)
Weight	12 lb to 15 lb (40 g/m**2 to 58 g/m**2)
Quality	Carbonless duplicating paper
Copies	4 sheets (1 original and 3 copies)

Table 1-5. Specifications for Continuous Sheets

Width	101 mm to 254 mm (4.0 in. to 10.0 in.)
Copies	4 sheets (1 original and 3 copies)
Quality	plain or carbonless multi-part paper recycled paper(under normal temperature)
Thickness	0.065 mm to 0.10 mm (0.0025 in. to 0.0039 in.) - single sheet 0.065 mm to 0.32 mm (0.0025 in. to 0.012 in.) - total
Weight	14 lb to 22 lb (52.3 g/m**2 to 82 g/m**2) - single sheet 12 lb to 15 lb (40 g/m**2 to 58 g/m**2) - each

Table 1-6. Envelopes

Size	No. 6 166 mm x 92 mm No. 10 240 mm x 104 mm
Copies	Not available
Thickness	0.16 mm to 0.52 mm (0.0063 in. to 0.0197 in.) Differences in thickness within the printing area must be less than 0.25 mm (0.0098 in.)
Weight	12 lb to 24 lb (45 g/m**2 to 91 g/m**2)
Quality	Bond paper, plain paper, airmail

NOTES: a. Printing on envelopes is available only at normal temperatures and only using top insertion.
b. Keep the longer side of the envelope-horizontal during insertion.
c. Place the left edge of a No. 6 envelope at the sheet guide setting mark.

Table 1-7. Labels Specifications

Label size	2 1/2 in. x 15/16 in. 4 in. x 15/16 in. 4 in. x 17/16 in.
Copies	Not available
Thickness	0.07 mm to 0.09 mm (0.0028 in. to 0.0031 in.) - base paper 0.16 mm to 0.19 mm (0.0063 in. to 0.0075 in.) - total

NOTES: a. Printing on labels is available only at normal temperatures.
b. Labels must be of the fanfold type.
c. Labels with pressure sensitive paper must be pasted along the perforation and tractor holes and the total thickness must be less than or equal to 0.3 mm (0.0118 in.). Labels can be printed out only if the temperature is between 5 and 36 degrees C (41 and 95 degrees F) and humidity is between 10 O/. and 80 % RH.
d. Recommendation AVERY CONTINUOUS FORM LABELS
AVERY MINI-LINE LABELS
f. Labels must be used with the pull tractor unit (front or button)
g. Do not perform reverse feeds.

220240 V version	Rated voltage	220 to 240 VAC
	Input voltage range	198 to 264 VAC
	Rated frequency	50 to 60 Hz
	Input frequency	49.5 to 60.5 Hz
	Rated current	1.0 A
	Power consumption	Approx. 33W(during a self-test in draft mode,10 cpi)
	Insulation resistance	10 megohms, minimum(at 500 VDC between AC lines and chassis).
	Dielectric strength	1250 VAC rms 1 minute or 1500 VAC rrns 1 second(between AC line and chassis)
Environmental	Temperature range	5 to 35 degrees C (41 to 95 degrees F) -- operting
		-30 to 60 degrees C (-22 to 140 degrees F) -- in shipment container
	Humidity	10 to 80% RH - operating
		5 to 85% RH -- storage
	Resistance to shock	IG, within 1ms -operating
		2G, within 1ms - storge
	Resistance to Vibration	0.25 G, 55 Hz,max. - operating
		0.50 G, 55 Hz,max. -- storge
Physical specifications	Weight	6.8 kg,approx(15 lb.,approx.)
	Dimensions	434mm(width) x 368mm(depth) x 160mm(height)
		17.4 in.(width) x 14.7 in.(depth) x 6.3 in.(height)

1.2.2 Firmware Specifications

Control code	EPSON ESC/P 2(ESC/P™ level 2: EPSON new control code for printers) IBM emulation mode (European version only)*1
	NOTE: ● 1 :The European version is equipped with the IBM emulation mode, Please refer to the emulation mode specification for details.
Printing direction	Bidirectional with logic seeking
Input data buffer	8KB (when SW 1-7 is OFF) OKB (when SW 1-7 is ON)
Character code	ESC(^nL nH data... Print data as characters
Character tables	Italic character table, PC 437, PC 850, PC 880, PC 883, PC 885, PC437*, PC851* PC853*, PC852*, PC857*, PC869*, PC861*, BRACII**, Abicomp** *:Available on the European version only ● *available on the other versions only
Fonts and pitches	
Bit-map fonts.	EPSON Roman 10, 12, 15, proportional EPSON Saris-serif 10, 12, 15, proportional EPSON Courier 10, 12, 15 EPSON Prestige 10, 12 EPSON Script 10, 12 EPSON Script C proportional OCR-B 10 EPSON Orator 10 EPSON Orator-S 10 EPSON Draft 10, 12, 15
Scalable fonts	EPSON Roman 8 pt to 32 pt EPSON Saris-serif 8 pt to 32 pt
Printing modes	Selection and mixture of the following modes are allowed, excluding 15 cpi condensed mode: o Print quality (draft/letter quality) o Character pitch (10, 12, 15, or proportional) o Condensed 0 Double-width o Double-height o Emphasized o Double-strike o Italic o Underlined o Double-underlined o OverScore o Strike-through o Outline o Shadow

Printing speed	See tables 1-8 and 1-9.
printing columns	See Table 1-8.
Character matrix	See Table 1-10.
Character size	See Table 1-10.

Table 1-8. Printing Text Mode)

Print Pitch	T		Character Pitch (cpi)	Printing Speed (cps)	
				Draft	LQ
10	off	80	10	225	75
	on	137	17.1	192	128
12	of	96	12	269	90
	on	160	20	225	154
15	off	120	15	337	112
	on	Invalid			

cpi: characters per inch
Cps: characters per second
LQ: letter quality

Table 1-9. Printing (Bit Image Mode)

Pins	Bit Image Printing Mode	Density (dpi)	Printable Dots	Printing Speed (ips)
8	Single-density	60	480	22.5
8	Dual-density	120	960	11.2
8	Double-speed, dual-density	120	960	22.5
8	Quadrupledensity	240	1920	11.2
8	CRT graphics	80	640	11.2
8	CRT graphics II	90	720	15.0
24	Single-density	60	480	22.5
24	Dual-density	120	960	11.2
24	CRT graphics II	90	720	15.0
24	Triple-density	180	1440	7.5
24	Hexdensity	360	2880	7.5

dpi: dots per inch
ips: inches per second

Table 1-10. Character Matrix and Character Size

Printing Mode	Face Matrix	HDD	Character Size	Unit ESC sp
Draft, 10 pitch	9 x 22	120	1.9 x 3.1	120
Draft, 12 pitch	9 x 2 2	120	1.9 x 3.1	120
Draft, 15 pitch	7 X 16	120	1.0 X 2.3	120
Draft, 10 pitch, condensed	------	240	-------	120
Draft, 12 pitch, condensed	------	240	.....	120
LQ, 10 pitch	31 x 22	360	2.2 x 3.1	180
LQ, 12 pitch	27X 22	360	1.9 x 3.1	180
LQ, 15 pitch	22 X 16	360	1.6 X 2.3	180
LQ, 10 pitch, condensed	- - - -	360	--------	180
LQ, 12 pitch, condensed	—- -	360	--------	180
LQ, proportional	Max. 37X 22 Min. 18x 22	360 360	2.6 X 3.1 1.0 x 3.1	180
LQ, proportional, condensed	....- ------	360 360	-------- --------	180
LQ, proportional, super/subscript	Max. 28X 16 Min. 12x 16	360 360	1.8 x2.3 0.7 X 2.3	180
LQ, proportional, super/subscript, condensed	----- ------	360 360	..... --------	180

NOTES:
* HDD is horizontal dot density in dots per inch.
* Face matrix and character size indicate the size of the maximum character. This value is dependent on paper, ribbon, etc.
* Unit ESC sp (which also can be sent as unit, followed by the character string CHR$(&h20)), indicates the minimum length to be added to the right of the character specified with the ESC sp control code.
* "----' indicates that the character matrix is reshaped by printer firmware. Character width becomes half of the noncondensed character width.

1.5 DIP SWITCHES AND JUMPER SETTING

This section describes the DIP switch selections and jumper setting for the LQ-570+ printer.

1.5.1 DIP Switch Setting for ESC/P 2 mode

This printer is equipped with two banks of DIP-SWITCHES and they are located on the control panel. The table1-12 through 1-15 shows the available function settings of two DIP switches. (Note that the status of the DIP switches is only read at power on or upon receipt of the /INIT signal.)

Table 1-12. Settinas for DIP Switch 1 (SW1)

No.	Description	ON	OFF	Factory Setting
1	International character set and PC table selection	See the table 1-14		ON
2				ON
3				OFF
4	Character table selection	Graphic	Italic	OFF
5	Graphic print direction	Unidir.	Bidir.	OFF
6	Comand language*1	IBM	ESC/P2	OFF
7	Input buffer	0KB	8KB	OFF
8	I-inch skip perforations	ON	OFF	OFF

NOTE: : *1 is European version only. The switch of 1-6 is invalid for another versions.

Table 1-13. Settings for DIP Switch 2 (SW2)

No.	Description	ON	OFF	Factory Setting
1 2	Page length of continuous paper	See Table 1-15 below.		OFF OFF
3	Auto tear-off	ON	OFF	OFF
4	Auto LF	ON	OFF	OFF

Table 1-14. International Character Set Selection

1-1	1-2	1-3	Country	Table: Europe	Table: Others
ON	ON	ON	Us.	437	←
ON	ON	OFF	France	850	←
ON	OFF	ON	Germany	860	←
ON	OFF	OFF	U.K.	863	←
OFF	ON	ON	Denmark 1	665	←
OFF	ON	OFF	Sweden	437Greek	BRASCII
OFF	OFF	ON	Italy	653	Abicomp
OFF	OFF	OFF	Spain 1	852	437

— When SW 1-4 is ON.

---..... --..—.- When SW 1-4 is Off.

NOTE: • is not available on the European version(PC437 is selected).

Table 1-15. Page Length

2-1	2-2	Page Length
OFF	OFF	11 inches
ON	OFF	12 inches
OFF	ON	8.5 inches
ON	ON	11.7 inches

1.5.2 Jumper Setting

Jumper 12 : Connect it to the "SLIN" to use the "SELECT IN" signal from host computer.

1.5.2 DIP Switch Setting for IBM emulation mode

In the IBM emulation mode, with the DIP awitch 1-6 to ON, some other awitches are recognized by the printer in different meanings from the ESC/P 2 mode.
Please refer to the emulation mode specification for details.

Table 1-16. Setting for DIP Switch 1

No.	Description	ON	OFF	Factory Setting
1	Code page selection	See the table 1-14		ON
2				ON
3				OFF
4	Character set selection	set 2	set 1	OFF
5	Graphic print direction	Unidir.	Bidir.	OFF
6	Comand language	IBM	ESC/P2	OFF
7	Input data buffer size	oKB	8KB	OFF
8	AGM(Alternate Grafic Mode)	ON	OFF	OFF

Table 1-17. Settinas for DIP Switch 2 (SW2)

No.	Description	ON	0FF	Factory Setting
1	Page length of continuous from	12 inch	11 inch	OFF
2	Auto-CR	valid	invalid	OFF
3	Auto tear-off	ON	0FF	OFF
4	Auto LF	ON	0FF	OFF

Table 1-18. Code page Selection

1-1	1-2	1-3	Code page
ON	ON	ON	437
ON	ON	OFF	850
ON	OFF	ON	660
ON	OFF	OFF	663
OFF	ON	ON	665
OFF	ON	OFF	437Greek
OFF	OFF	ON	653
OFF	OFF	OFF	652

1.6.11 Printer Protection for Heavy-Duty Printing

This printer has a printhead protection function to prevent it from overheating and to handle the printer when the head driver voltage drops. If head temperature exceeds its maximum value, printing stops automatically until the head temperature drops to a certain value before printing resumes. Printing resumes at a lower print speed at first. However, as the head temperature decreases, print speed increases to normal speed automatically. If the head temperature continues to increase at the lower speed, printing is stopped or resumed as temperature increases or decreases.

If the voltage supplied to the head drive circuit drops below its minimum limit as a result of heavy-duty printing, printing is interrupted immediately. When the power supply voltage recovers to a certain level, the remaining print line is printed at half speed. This protective action occurs when half or more of the wires are activated continuously.

1.7 MAIN COMPONENTS

The main components of the LQ-570+ printer are designed for easy removal and replacement at maintenance and repair of the printer. The main composed of this printer are:

1) C107 MAIN board: the main control board; the CPU on this board controls all main functions.
2) C062 PNL board: the control panel board.
3) C062 PSB/PSE board: the power supply board.
4) M-5J1O: the printer mechanism.

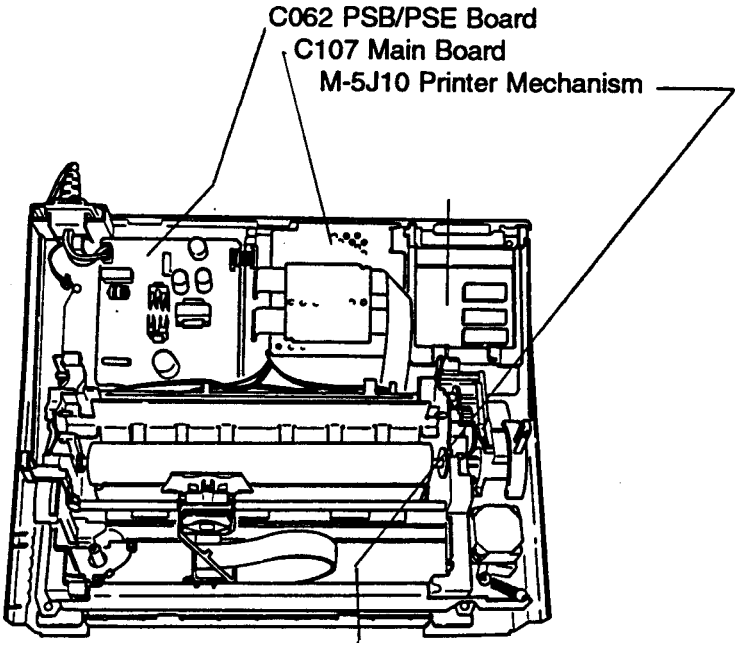


Figure 1-11. LQ-570+ Component Layout

1.7.1 C107 MAIN Board (Main Control Circuit Board)

This consists of a TMP90C041N 6-bit CPU, an E05A50 gate array, a PROM (512K), a mask ROM (character generator, 2M), Head Gate Array, an EEPROM, a CR Driver, a PF Driver and Head Drivers.

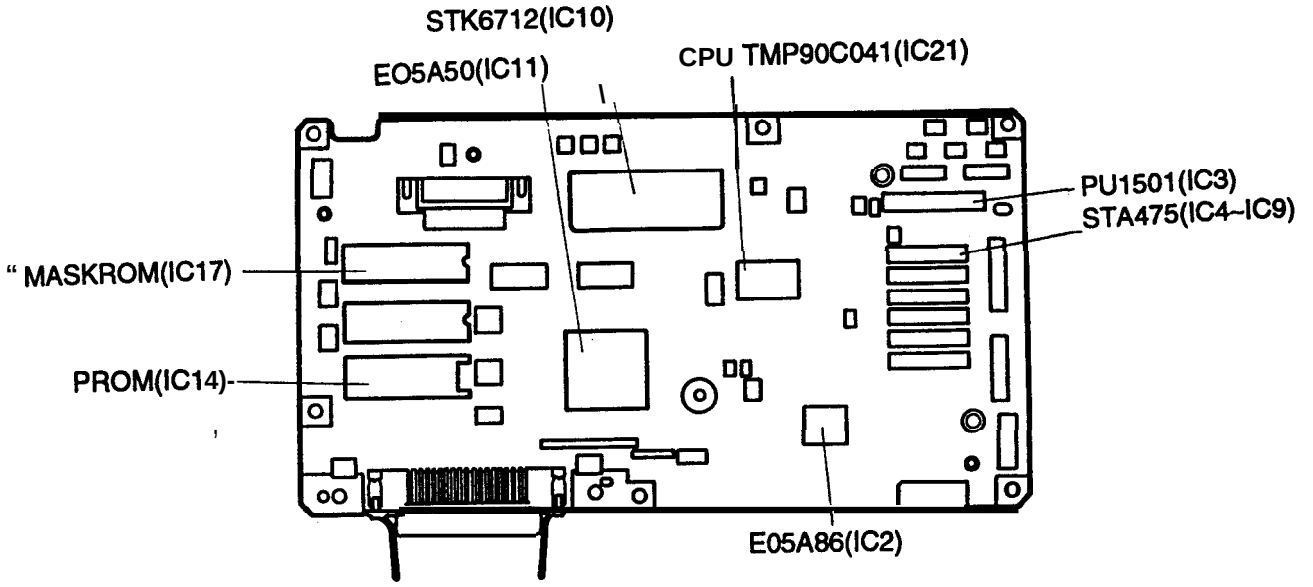


Figure 1-12. C107 MAIN Board

1.7.2 C062 PNL Board (Control Panel Circuit Board)

The C062 PNL board is the LQ-570+ control panel, which includes the indicator LEDs, switches, and DIP switches.

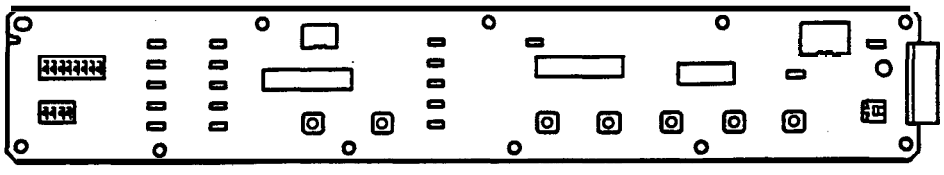


Figure 1-13. C062 PNL Board

1.7.3 C062 PSB/PSE Board (Power Supply Circuit Board)

The power supply unit consists of a switching regulator circuit, which converts the AC line voltage to the DC voltages (for example, +35V and +5V) used by the printer. The C062 PSB board is 120V input type, and the C062 PSE board is 220/240V input type.

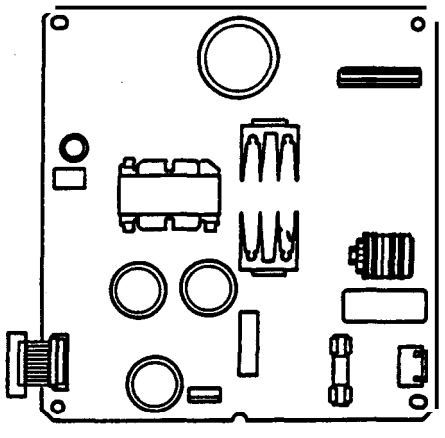


Figure 1-14. C062 PSB/PSE Board

1.7.4 Printer Mechanism (M-5J10)

The M-5J10 printer mechanism was developed specifically for use with LQ-570+ printer. The components include a carriage motor, carriage mechanism, paper-feed motor, paper-feed mechanism, ribbon-feed mechanism, printhead, and sensors. This printer mechanism allows three ways of paper insertion.

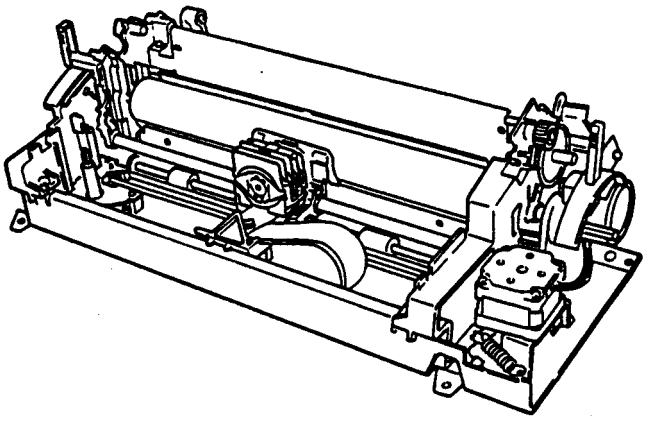


Figure 1-15. Model-5J10 Printer Mechanism

1.7.5 Housing

The LQ-570+ housing consists of the upper, lower, and front cases. The front case houses the control panel board. The lower case holds the printer mechanism, the main control circuit board, and power supply circuit board.

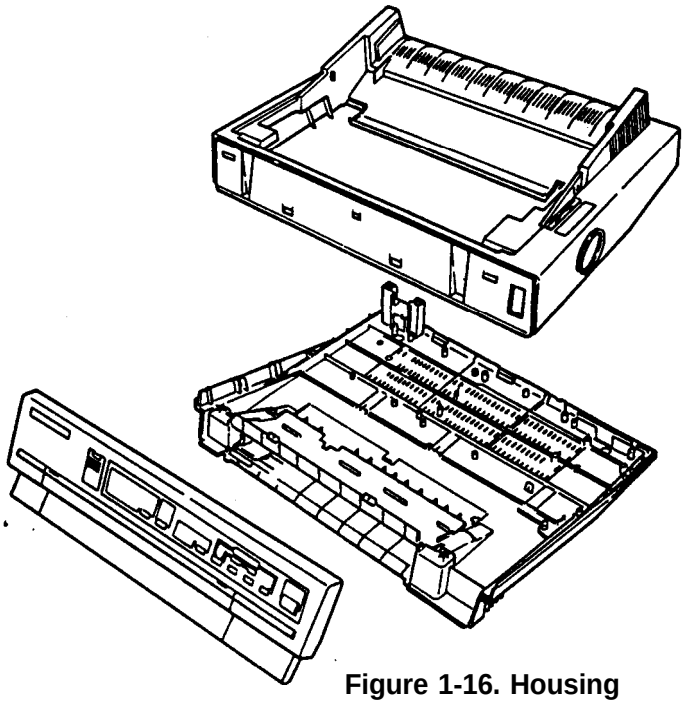


Figure 1-16. Housing

CHAPTER 2
OPERATION PRINCIPLES

LIST OF FIGURES

LIST OF TABLES

2.1 OVERVIEW OF PRINTER MECHANISM OPERATION

This section describes the printer mechanism of the Model-5J10 printer unit and explains how the printer works. Model-5J10 has a printer mechanism that features a 24-pin impact dot printhead for serial printing. There are four main parts to the printer mechanism: 1) the printhead mechanism, 2) the carriage movement mechanism, 3) the paper advance mechanism, and 4) the ribbon advance mechanism. Each of these is described below.

2.1.1 Printhead Mechanism

The printhead mechanism consists of the printhead itself, the ink ribbon, and the platen. The printhead contains 24 wires in a zigzag arrangement in two rows of 12. A drive coil is provided for each of these wires to make the wires move in and out of the printhead and print dots independently of each other. The basic way that the wires are driven is described in the four steps below.

1. The control circuit outputs the drive signal to the printhead drive circuit. This changes the printhead drive voltage, and current flows through the corresponding printhead coil. The coil acts as a solenoid and generates a magnetic force.
2. This induced force causes the plate to approach the coil rod and the associated dot wire is rapidly ejected to impact on the platen.
3. The dot wire presses the ink ribbon up against the paper as it hits the platen, and in this way prints a dot on the paper.
4. As soon as the current through the coil is switched off, the force induced in the coil rod stops. The plate then returns to its original position (its position before the coil was energized) through the action "of the plate spring. After the dot wire hits the platen, the rebounding force of hitting the platen works together with the wire return spring to pull the wire back to its original position in relation to the plate.

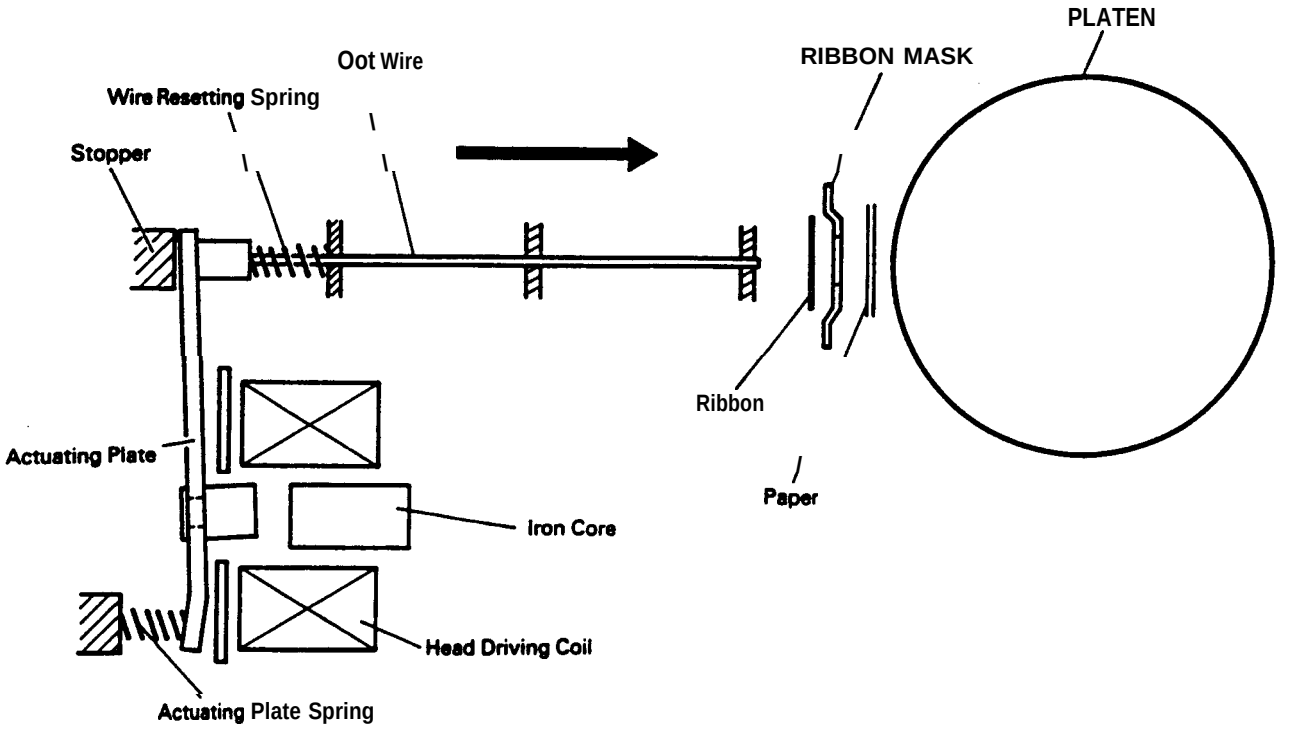


Figure 2-1. How the Printhead Works

Figure 2-1 shows the action of the printer mechanism when a single dot is printed.

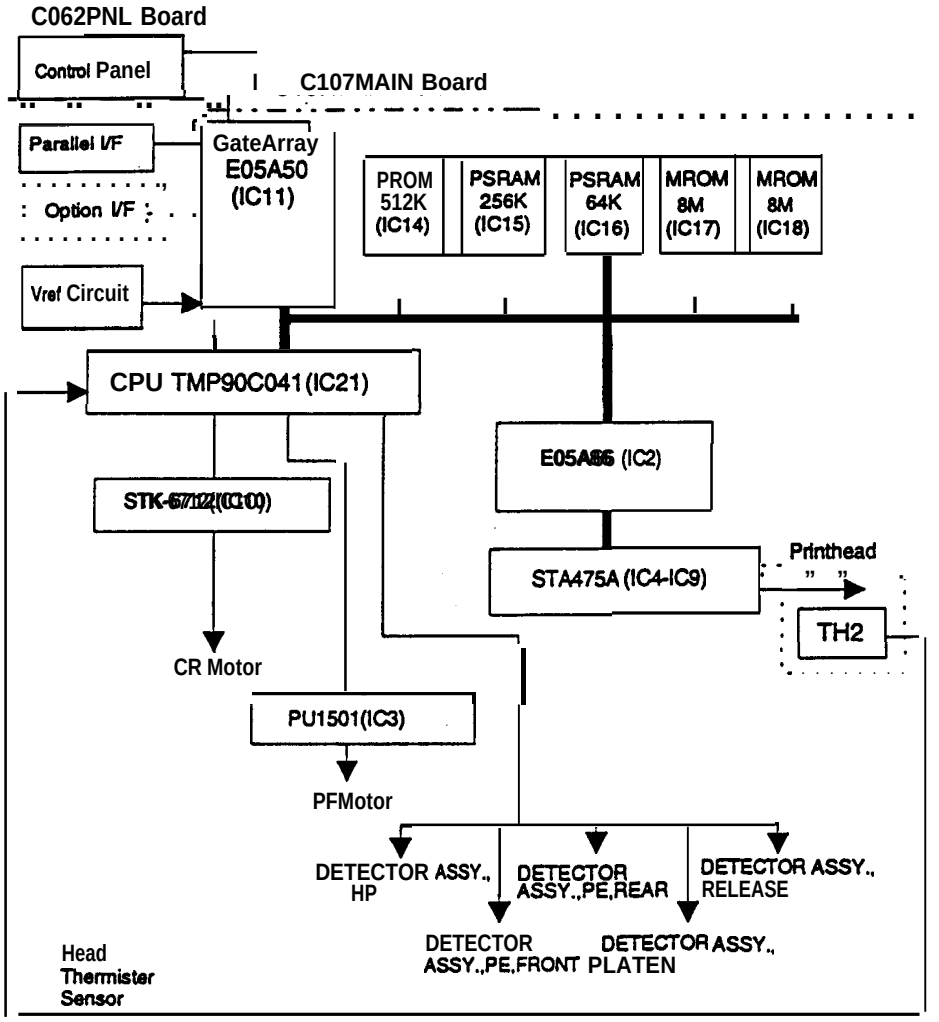
The printhead tends to heat up after a period of continuous printing. To minimize the possibility of the dot wire drive coils overheating within the printhead and any loss of performance, the head is equipped with a thermistor that detects the head temperature. When this thermistor detects changes intheprinthead temperature, the voltage signal changes. This signal change is read by the control circuit for feedback control.

2.3 CONTROL CIRCUIT OPERATION

The control circuit consists of two boards: the C107 MAIN board, which acts as the main board, and the C062 PNL board, which acts as the control panel board. This section describes how these boards work.

2.3.1 Control Circuit Operation Overview

The printer CPU is an 8-bit CPU TMP90C041 running at 10 MHz. It oversees control of all the components of the printer. The E05A50 gate array contains various memory management functions that control the assignment of the memory and I/O areas, and it controls a head gate array IC2 (E05A86), a PU1501 or STK-67129 for the PF and CR motor driver, STA475A(IC4 - IC9) is transistor array for the head pins drive, several sensor circuits and so on.
Figure 2-17 shows the block diagram of the C107 Main Board.



CR Motor	: Carriage Motor
PF Motor	: Paper Feed Motor
DETECTOR ASSY.,PE,FRONT	: Paper End Sensor(Front)
DETECTOR ASSY.,PE,REAR	: Paper End Sensor(Rear)
DETECTOR ASSY.,HP	: Home Position Sensor
DETECTOR ASSY.,PLATEN	: Platen Gap Sensor
DETECTOR ASSY.,RELEASE	: Release Lever Position Sensor
TH2	: Therrnister Sensor

Figure 2-17. Control Circuit Block Diagram

Table 2-5 lists the functions of the main components and circuits of the printer. The CPU converts the print data sent from the host computer to image data (the print image). The image data is then loaded to RAM. Each line of data is processed sequentially. The CPU transfera the print data to the printhead drive circuit. The CPU sends the printhead drive pulse to the printhead drive circuit. The length of this pulse corresponds to the printhead drive voltage. The head drive circuit then outputs the head drive signal.

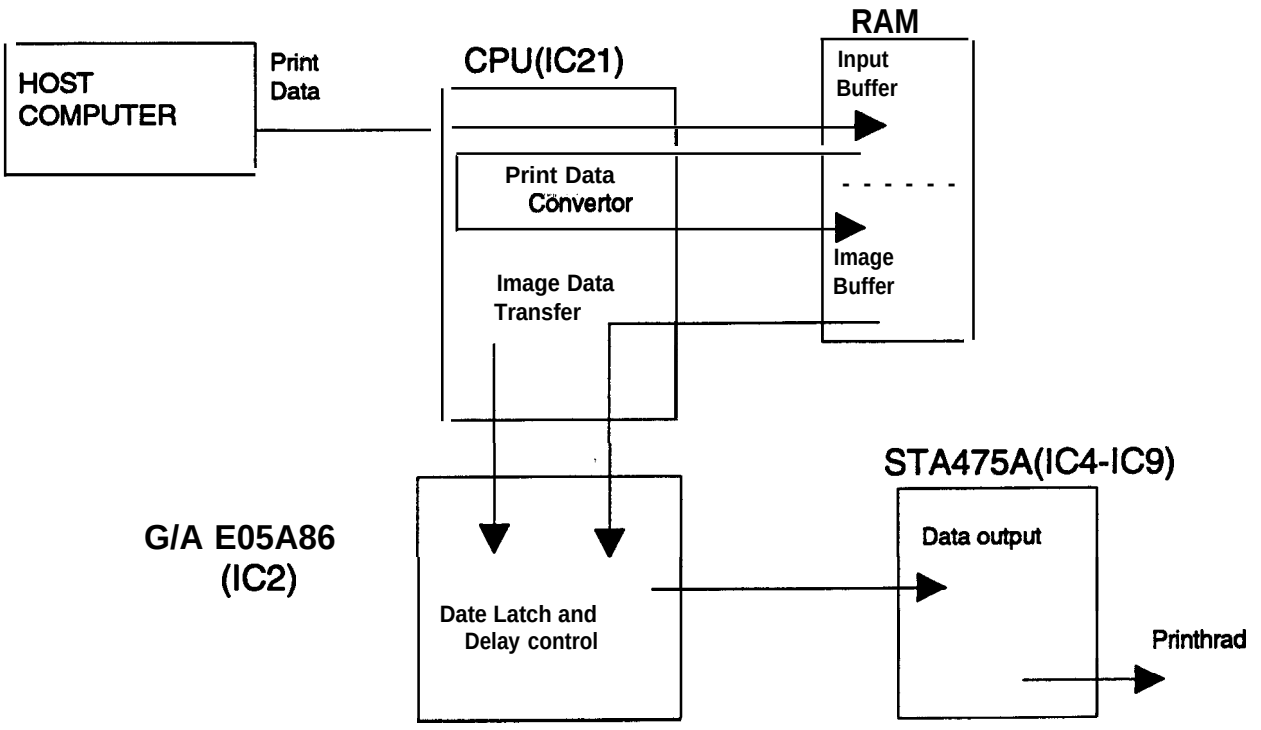


Figure 2-18. Data Flow

Table 2-5. Functions of the Main IC and Circuits

IC or Circuit	Location	Functions
TMP90C041	IC21	Receives data from the host computer and loads the data to the input buffer in RAM (under interrupt processing control). Expands the input data held in the buffer to create image data. Loads this image data to the image buffer in RAM. Transfers the image data to the printhead drive circuit. It also controls various parts of the printer mechanism, such as the motors.
E05A50	IC11	This is a gate array consisting of three components configured on a single chip: Memory Management Unit Handles CPU memory in ROM, RAM, and mask ROM, and assigns addresses for other devices. Parallel Interface (Parallel I/F) Holds the parallel interface functions. Reset Circuit Contains the circuit that generates the /RESET signal.

Table 2-5. Functions of the Main IC and Circuits (Cont.)

IC or Circuit	Location	Functions
PROM	IC14	PROM contains the program that runs the CPU.
RAM	IC15 IC16	Holds the CPU working area and the various buffers. (1E is not used for an 80-column device and is not installed.)
MROM (Mask ROM)	IC17 IC18	Holds the character design (also called the character generator).
EEPROM	IC12	EEPROM is an electronically writable and erasable ROM used to hold such information as the TOF position.
HEAD GATE ARRAY	IC2	This is a gate array consisting of three components configured on a single chip: • Change order of the Head pulse outputs Mode 1: HD1→HD2→HD3→.....→HD22→HD23→HD24 Mode 2: HD24→HD23→HD22→..... →HD3→HD2→HD1 • Delay control(for low noise) • Image data latching
Vref Circuit	···	This is a circuit for generating the reference voltage used in the A/D convertor within the CPU.

2.3.2 Reset Circuit

Figure 2-19 shows the reset circuit block diagram. The reset circuit issues the /RESET signal. Each part of the control circuits is initialized when this /RESET signal is received. The renditions when the /RESET signal is output are described below.

When Turning on the Power Supply

Immediately after the power has been turned on, PST 529 (IC19) outputs the /PON pulse. E05A50 (IC11) receives this pulse and then outputs the /DISC pulse. The electrical charge in the capacitor(C29) is then discharged. After this, The /THLD port within E05A50 detects the low level and then outputs the /RESET signal from the /OUT port of IC19. After a certain time has elapsed, the charge in the condenser builds up again. The /THLD signal is canceled and then the /RESET signal is canceled.

Resets performed by the CPU itself (CPU self-reset)

The CPU outputs the /RESET signal if there is a /RESET request for E05A50 and E05A50 output the /DISC pulse. "

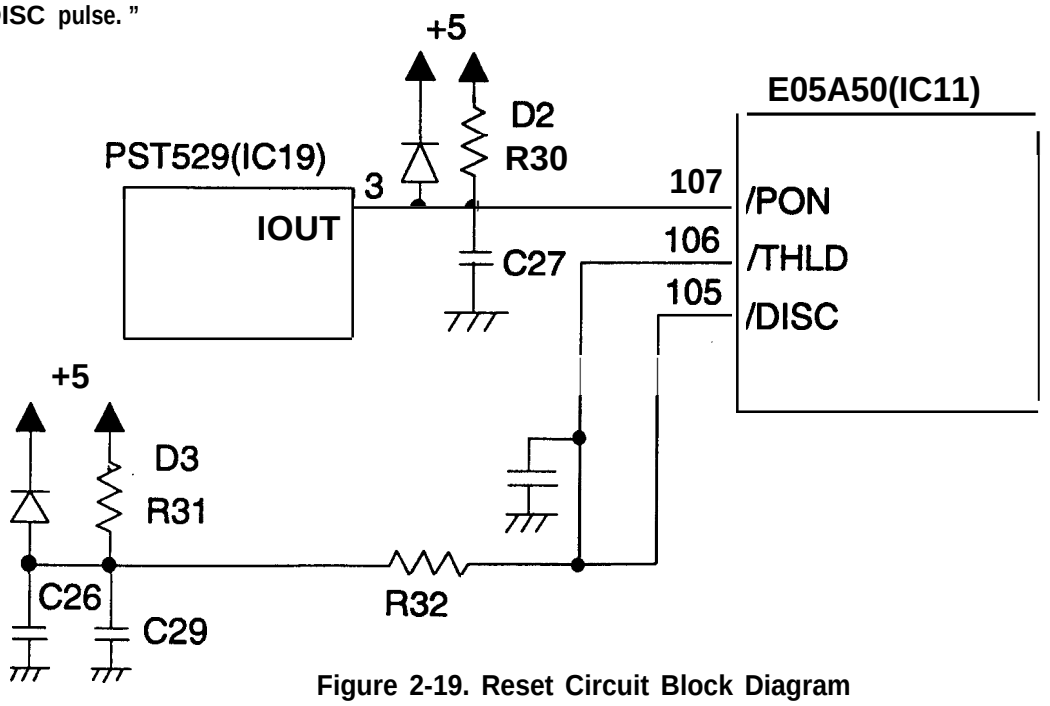


Figure 2-19. Reset Circuit Block Diagram

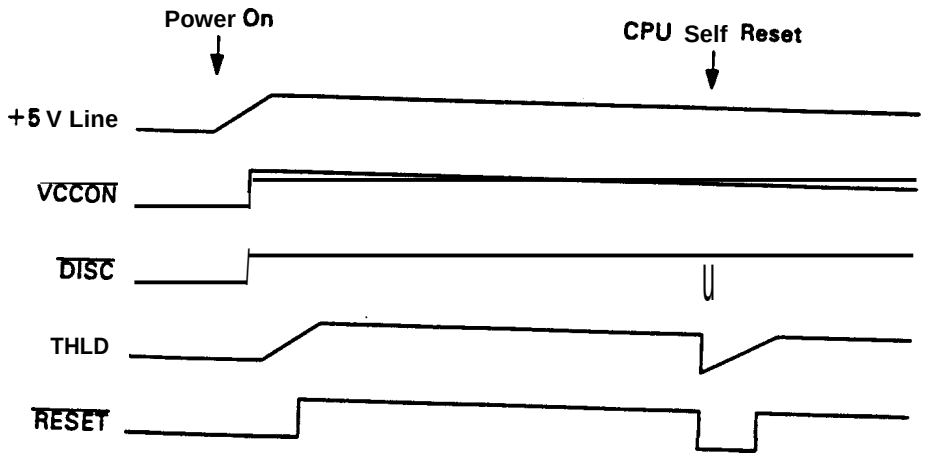


Figure 2-20. /RESET Signal Timing

2.3.3 Sensor Circuits

Figure 2-21 shows the sensor circuits block diagram. Detection of any excessive printheadtemperature causes the TEMP2 signal to be sent directly to the CPU. Other signals, such as the CRHOME signal, pass through the each low path filters before reaching the CPU. Terminals P50 to P55 on the CPU are used for the A/D mnvertor. The Vref circuit generates the A/D convertor reference voltage Vref.

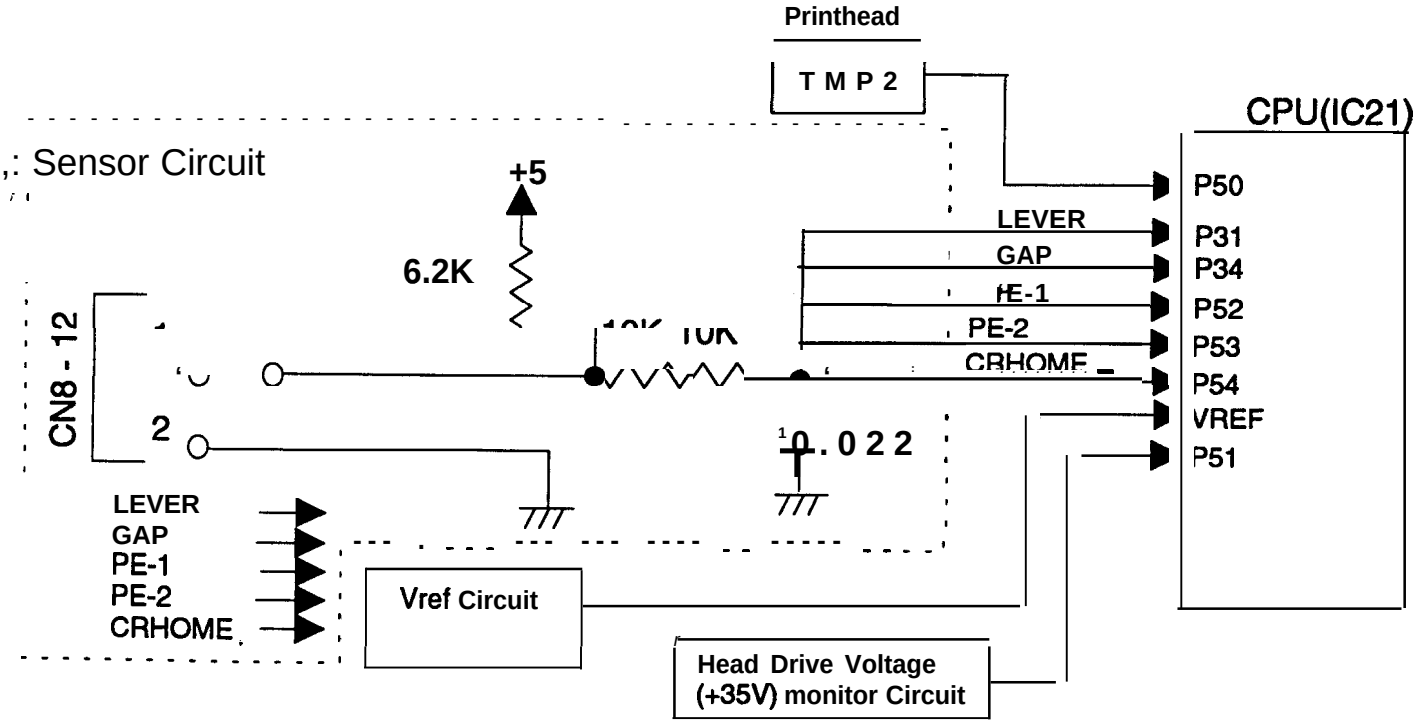


Figure 2-21. Sensor Circuit Block Diagram

2.3.4 MOTOR, CR Drive Circuit

Figure 2-22 shows the MOTOR, CR drive circuit. An open-loop, constant-current drive control is used to drive the MOTOR, CR. The motor is driven by 2-2 phase excitation and 1-2 phase excitation. 2-2 phase excitation corresponds to two 1-2 phase excitation steps. Thus, for each single step phase change of a 2-2 phase excitation motor, the carriage moves 1/120 inch. For each single step phase change of a 1-2 phase excitation motor, the carriage moves 1/240 inch.

The MOTOR, CR drive circuit of the STK-67128 detects the amount of current flow in the MOTOR, CR coil and regulates it. The current flowing through the coil varies depending on the speed of the MOTOR, CR.
The amount of current is set by the CPU via the E05A50 I/O port. Signals are sent to Vref1 or Vref2 on the STK-67128. The STK-67128 sets the coil current to correspond to the MOTOR, CR speed.

Ports P60 to P63 on the CPU are used exclusively as phase control ports for the stepping motor.

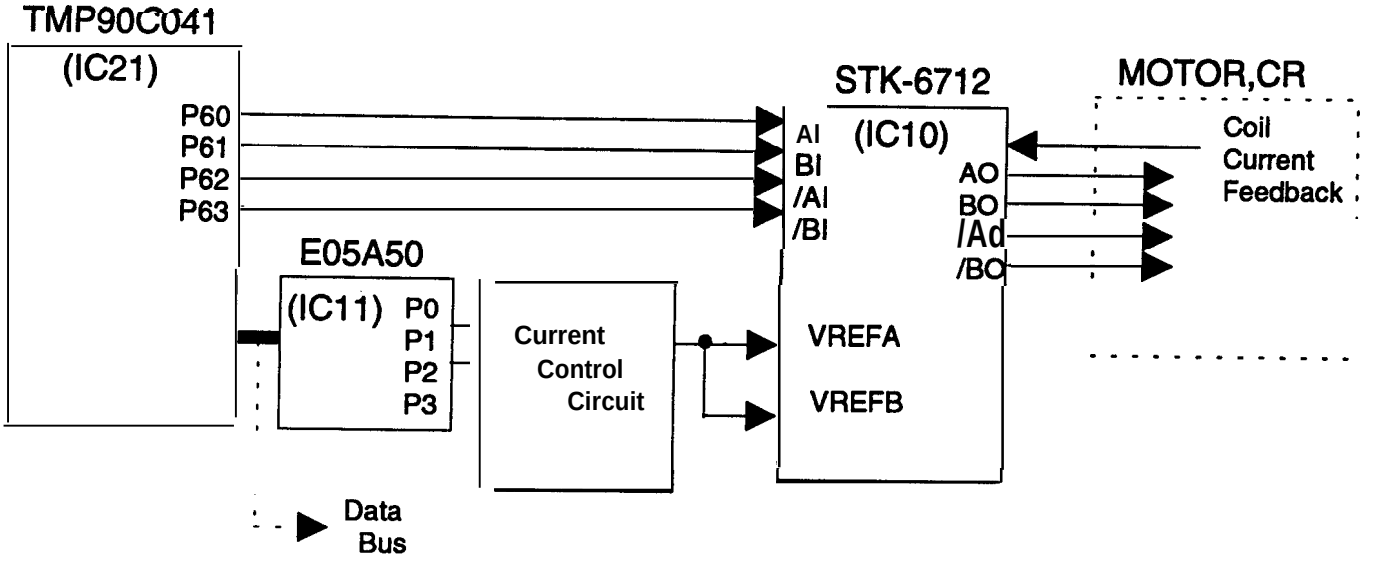


Figure 2-22. MOTOR, CR Drive Circuit

Table 2-6. MOTOR, CR Drive Modes

Drive Mode	Extension Type	Type Drive Frequency	Standard Print Character
3 x speed	2-2 phase	2695 pps	Draft
2 x speed	2-2 phase	1773 pps	High Speed LQ
1.5 x speed	2-2 phase	1347 pps	Draft(Emphasis, Condensed)
4/3 x speed	1-2 phase	1191 pps	
1 x speed	1-2 phase	1796 pps	LQ
3/4 x speed	1-2 phase	1347 pps	
2/3 x speed	1-2 phase	1190 pps	
1/2 x speed	1-2 phase	898 pps	

2.3.5 MOTOR, PF Drive Circuit

The printer uses a stepping motor to advance the paper. The paper can be advanced for minimum of 1/380 inch. The motor is a 2-2 phase or 1-2 phase, constant-voltage drive type. P70 to P73 on the CPU are the phase control ports forthe stepping motor. MOTOR, PF phase data output through these ports. Cl to C4 are turned on and off within the PU1501(IC3) according to the phase data sent from the CPU.

When the paper advanoe motor is running, the supply voltage to the coil of the MOTOR,PF is +35 V. When the paper advance motor is not running and is in hold state, the supply voltage to the coil is +5 V. Switching between these two supply voltages occurs at the CP terminal of the PU1501(IC3) when the switch is turned on or off.

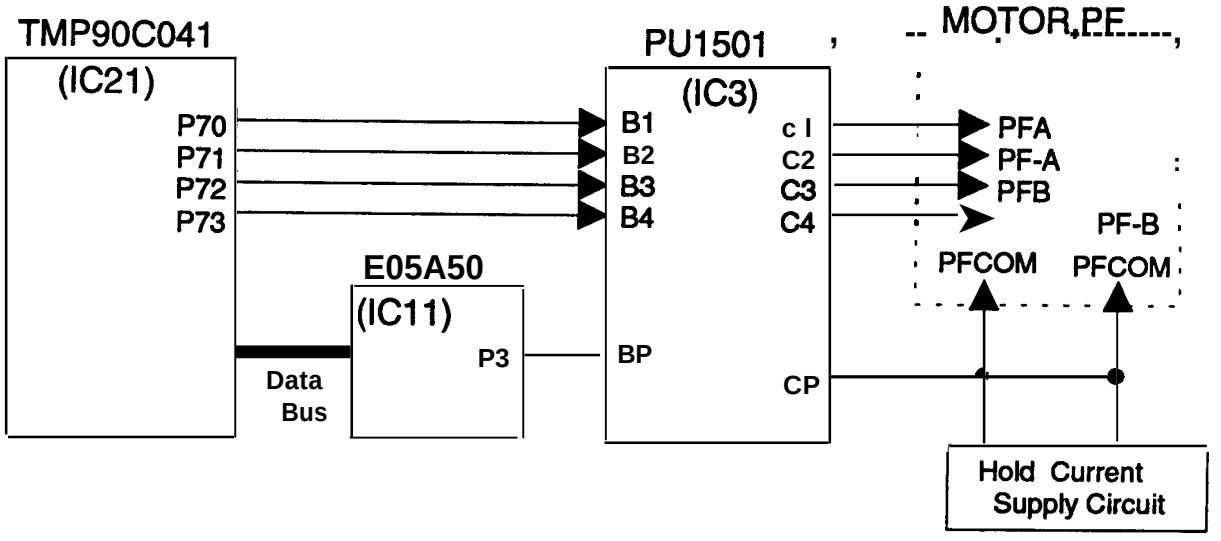


Figure 2-23. MOTOR, PF Drive Circuit

2.3.6 Printhead Drive Circuit

Figure 2-24 shows the printhead drive circuit block diagram. The print data already is expanded to create the image data. The CPU splits up this data three times and transfers this information to the latch circuit within the Head Gate Array(IC2). The CPU samples the voltage of the +35 V line via the A/D convertor (see Section 2.3.3). The CPU outputs a pulse via the CPU time output port P63. The length of this pulse corresponds to the voltage of the +35 V line. This pulse becomes the head drive signal. In this way, Head Gate Array(IC2) outputs head drive signals (signals HD1 to HD24) that relate to voltage level through the width of the pulses. These signals are output to the head for each of the section of print data that were created by subdividing the data three times before sending.

By sampling the +35 V line voltage and determining the length of the head drive signal, it is possible to maintain the energy supplied to the head at a constant level. If the voltage of the +35 V line is . HIGH, the CPU shortens the output pulse. If the voltage of the +35 V line is LOW, the CPU lengthen the output pulse.

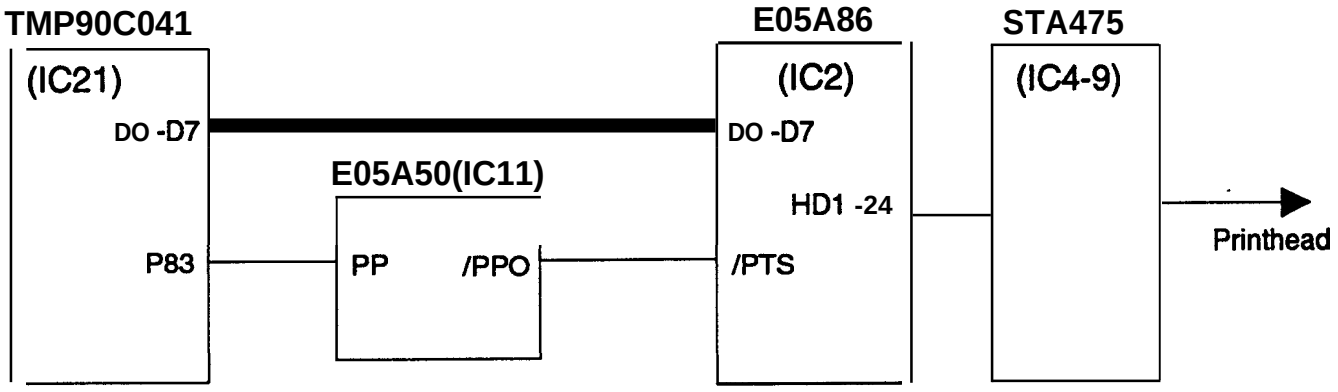


Figure 2-24. Printhead Drive Circuit

CHAPTER 3
DISASSEMBLY AND ASSEMBLY

LIST OF FIGURES

3.2.1 Removing the Circuit Boards

1. Remove the FRAME ASSY.,SHEET GUIDE.
2. Remove the COVER ASSY.,EJECT.

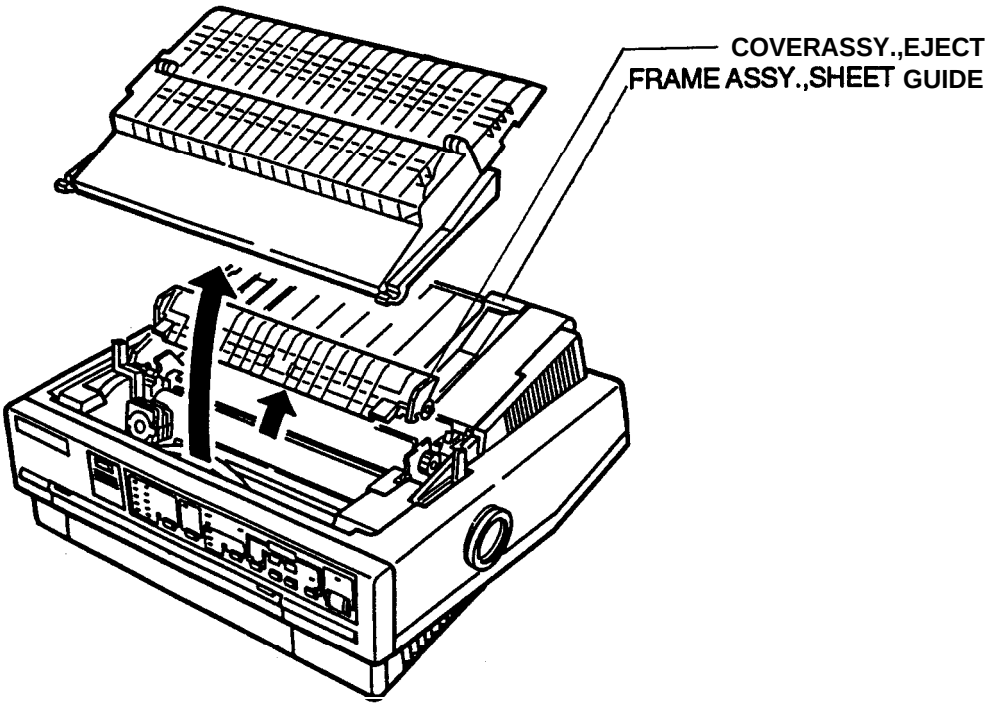


Figure 3-2. Removing the FRAME ASSY., SHEET GUIDE and the COVER ASSY., EJECT

3. Release the two levers that hold the printhead to the carriage, and remove the printhead.
4. Remove the two FFCS (CABLE, HEAD, FRONT(,REAR)) from the printhead.

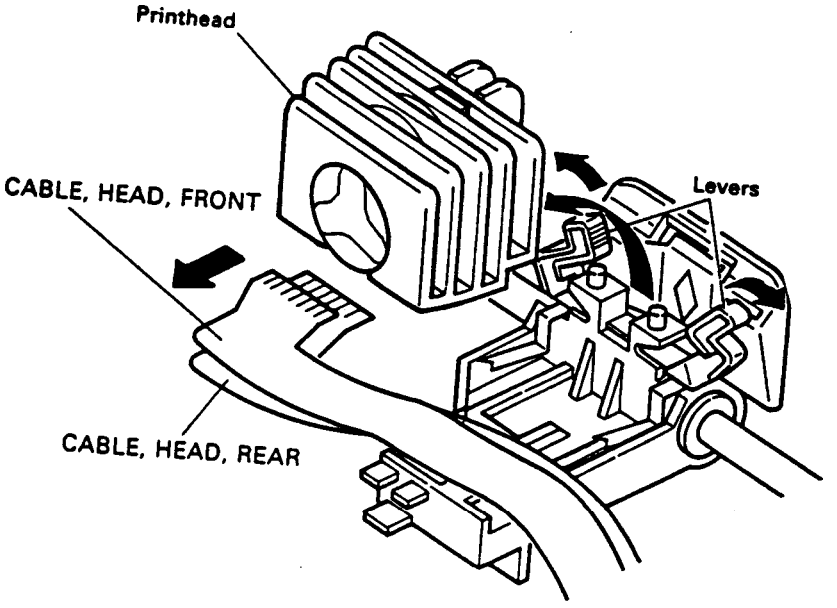


Figure 3-3. Remove the Printhead

3.2.3 Removing the Circuit Boards

This section describes how to remove the BOARD ASSY.,MAIN (C107 MAIN board), the BOARD ASSY.,POWER SUPPLY (C062 PSB/PSE board) and the BOARD ASSY.,PANEL (C062 PNL board).

3.2.3.1 Removing the BOARD ASSY.,MAIN (C107 MAIN Board)

1. Remove the HOUSING ASSY.,UPPER (see Section 3.2.2.2).
2. Remove the CB (M3 X 6) screw that hold the HOLDING PLATE,FFC to the SHIELD PLATE,MAIN BOARD, and remove it.
3. Disoonneot the FFC(CABLE,HEAD, FRONT(REAR)) removing the cables for the CN6 and CN7 connectors on the BOARD ASSY.,MAIN.
4. Remove three CBB (C) (M3 X 10) sorews that hold the SHIELD PLATE,MAIN BOARD to the BOARD ASSY.,MAIN, and remove it.

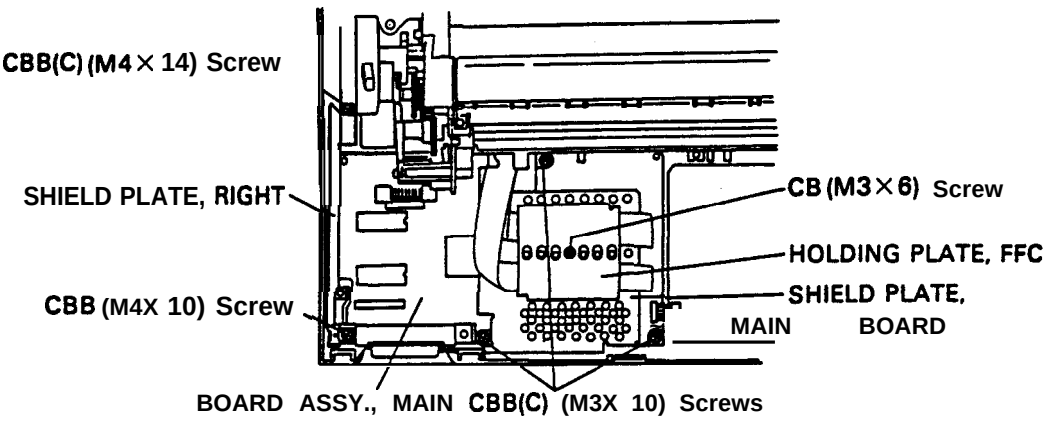


Figure 3-6. Removing the Shield Plate, MAIN BOARD

5. Remove the CBB (M4 X 10) sorew that hold the SHIELD PLATE, RIGHT to the BOARD ASSY.,MAIN. Remove the CBB(C)(M4 X 14) screws that hold it to the HOUSING ASSY.,LOWER. Remove the SHIELD PLATE, RIGHT.

6. Remove the cables from the following connectors on the main board: CN3 (brown 12-pin), CN4 (white 5-pin), CN5 (white 6-pin), CN8 (yellow 2-pin), CN9 (black 2-pin), CN1O (blue 2-pin),CN11 (white 2-pin) and CN12 (red 2-pin).
7. Remove three CBB(C) (M3 X 10) screws and CB A-LAMITITE (M3 X 8) sorew that hold the main board to the lower case. Remove the main board.

CAUTION

Be careful with a color of the harness cable when you connect them to the connector CN11 and CN12 of the Main board. The connect connection should be as below.

Harness(BLACK)→CN11(WHITE)
Harness(GRAY)→CN12(WHITE)

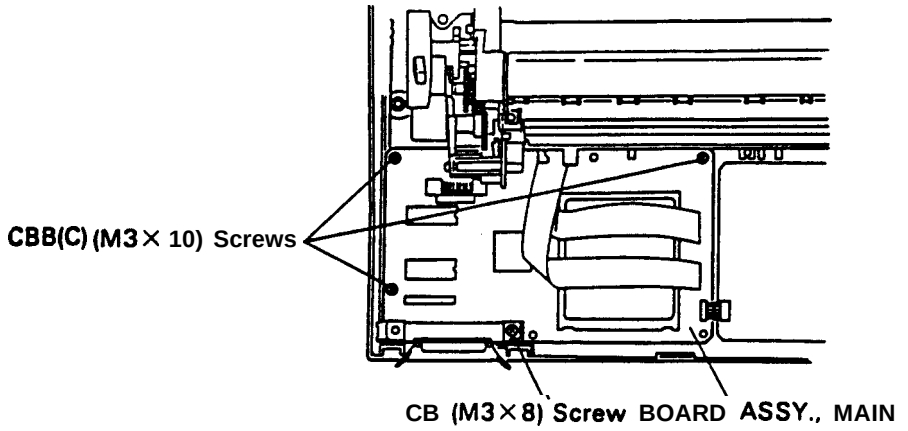


Figure 3-7. BOARD ASSY.,MAIN

Adjustment Required

When replacing the BOARD ASSY.,MAIN, you must adjust the bidirectional print position again to ensure bidirectional printing is correctly aligned
<Bidirectional Print position adjustment(See section 4.2)>

3.2.3,2 Removing the BOARD ASSY.,POWER SUPPLY (C062 PSB/PSE Board)

1. Remove the HOUSING ASSY.,UPPER (see Section 3.2.2.2).
2. Remove the cable from the connector CN13 of the BOARD ASSY.,MAIN.
3. Remove the cable for connector CN1 of the BOARD ASSY.,POWER SUPPLY.
4. Remove five CBB(C) (M3 X 10) screws and the CB (M3 X 8) screw that hold the BOARD ASSY.,POWER SUPPLY to the HOUSING ASSY.,LOWER. Remove the BOARD ASSY., POWER SUPPLY.

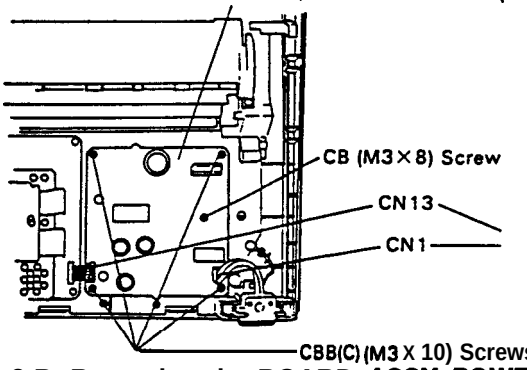


Figure 3-B. Removing the BOARD ASSY.,POWER SUPPLY

3.2.3.3 Removing the BOARD ASSY.,PANEL(C082 PNL Board)

1. Remove the HOUSING, FRONT (see Section 3.2.2.1).
2. Remove five CBB(C) (M3 X 10) screws that hold the BOARD ASSY.,PANEL to the HOUSING, FRONT. Remove the BOARD ASSY.,PANEL.

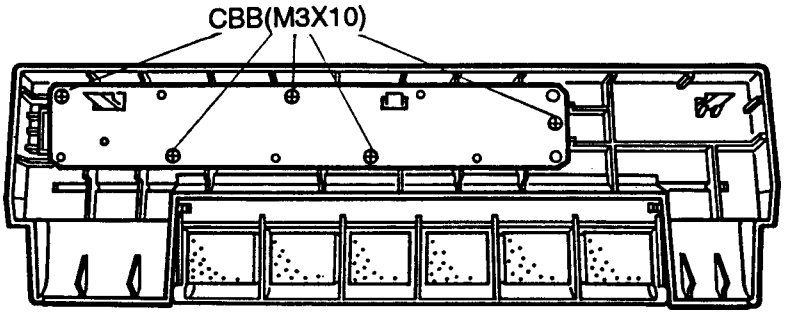


Figure 3-9. Removing the BOARD ASSY.,PANEL

CHAPTER 4
ADJUSTMENTS

4.3 CIRCUIT ADJUSTMENT

The C107 MAIN board contains variable resistor VR1, which is used for balancing the circuitry. When any of the following parts are replaced, the circuitry must be balanced by adjusting the VR1.

R6, R7, TL431(IC1), and VR1

If the circuitry is not properly adjusted, the CPU A/D converter functions abnormally and causes irregular operation of the printer.

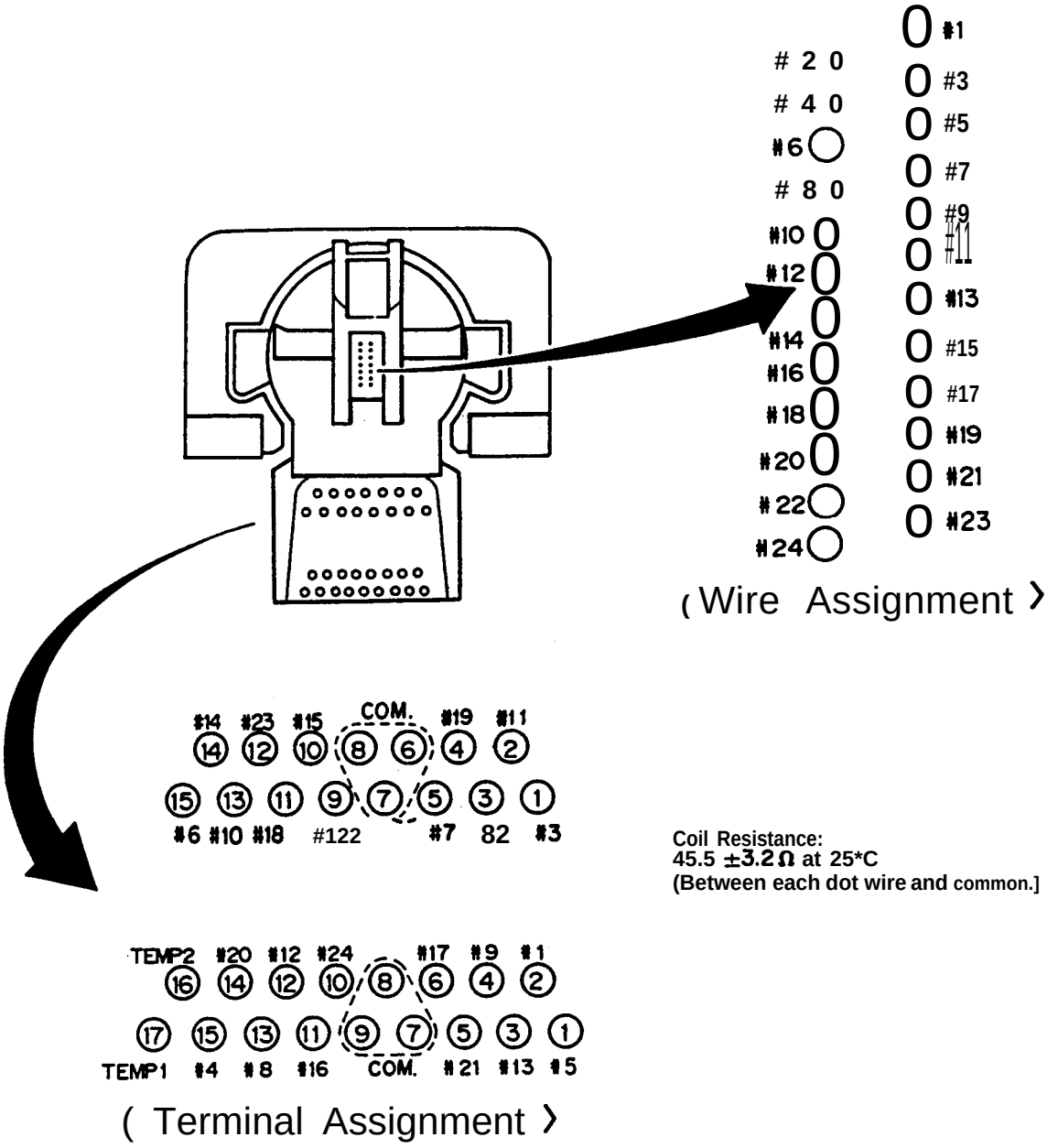
4.3.1 Adjustment Process

Attach a digital multimeter to the check terminal TP1 (Vref voltage) on the C107 MAIN board. Turn the printer On and adjust the variable resistor VR1 until a reading of 4.741 V is obtained.

CHAPTER 5
TROUBLESHOOTING

LIST OF FIGURES

LIST OF TABLES



Coil Resistance:
45.5 ±3.2Ω at 25*C
(Between each dot wire and common.]

Figure 5-2. Printhead Resistance

5.3 REPAIR OF THE MAIN BOARD

This section provides instructions for repairing the main board when it is defective and describes various symptoms, likely causes, and checkpoints. Checkpoints refer to proper waveforms, resistance values, and other values to be checked to evaluate the operation of any component that might be bad. Check these values and take the appropriate action.

Table 5-4. **Repair** of the Main Circuit Board

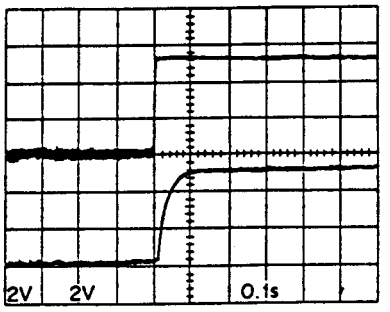
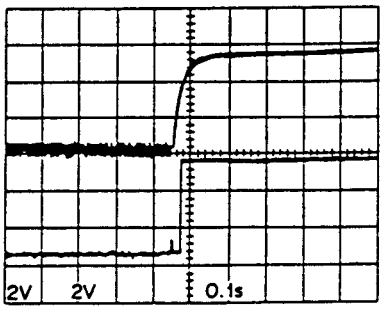
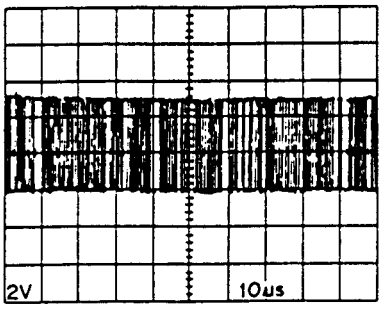
Problem	Symptom	Cause	Checkpoint	Solution
The printer does not operate at all.	The CPU does not operate.	The reset circuit is not operational.	Check the voltage waveforms of the +5V line (IC19 pin 1) and for the THLD signal (IC11 pin 106) when power is on. 	Replace IC19 or IC11.
			Check the voltage waveforms of the THLD signal (IC11 pin 106) and the /RESET signal (IC11 pin 4) when power is on. 	Replace IC11.
			Check pin 15 of IC21 for a High-Voltage (/NMI Signal)	Replace IC20.
		Selection of control ROM is abnormal.	Check pin 36 of IC11 for a change in the signal level(HIGH/LOW). 	Replace IC11.

Table 5-4. Repair of the Main Circuit Board (Continued)

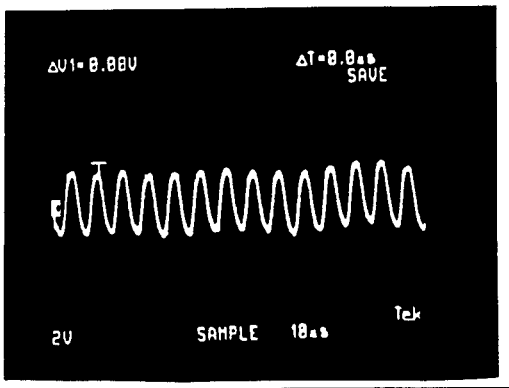
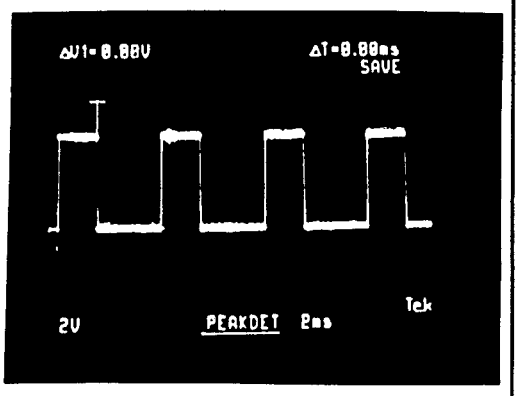
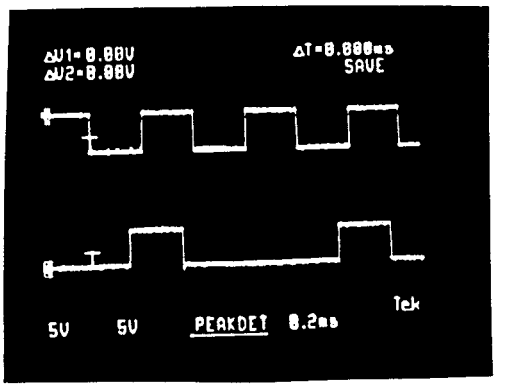
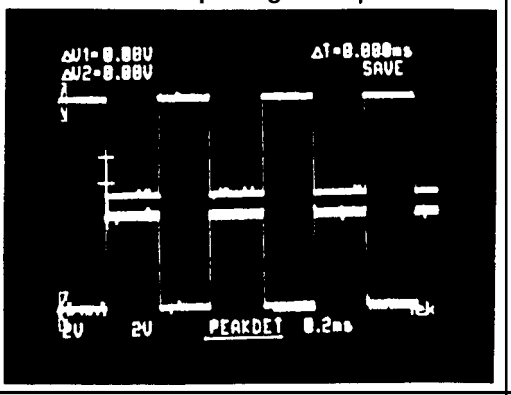
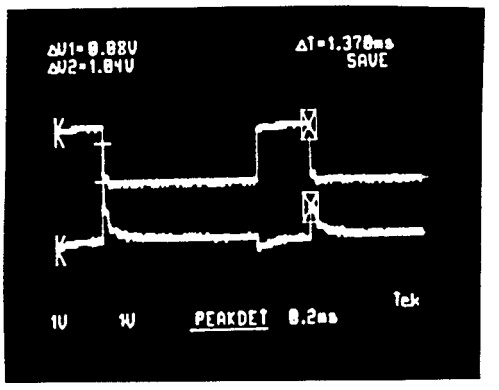
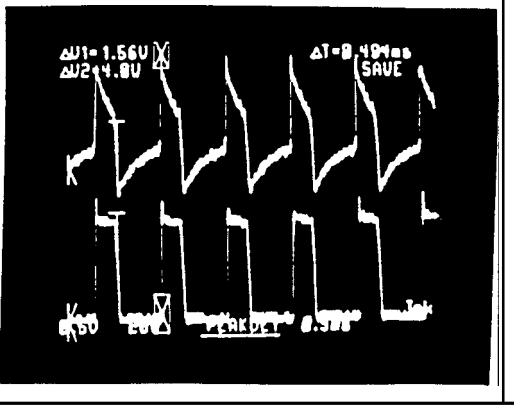
Problem	Symptom	Cause	Checkpoint	Solution
The printer does not operate at all.	The CPU does not operate.	Either ROM or RAM is defective.		Replace IC14 or IC15.
		The CPU is defective.	Check the oscillator signal at either pin 27 or pin 28 of the CPU. 	If a signal is detected, replace IC21. Otherwise, replace CR1.
The carriage operates abnormally.	The carriage does not operate at all.	IC21 is defective.	Check the CR motor phase signal at pins 3, 4, 5, and 6 of IC21. 	Replace IC21.
		IC10 is defective.	Check the input signal to pin 13 and the output waveform of pin 2.	Replace IC10.
		IC 2 is defective.	Check the input signal for pin 42 and output signal for pin 7(ex.) 	Replace IC2.

Table 5-4. Repair of the Main Circuit Board (Continued)

Problem	Symptom	Cause	Checkpoint	Solution
The carnage operates abnormally	Carnage operation is unstable(lack of torque)	IC10 Is defective		Replace IC10
Self-test printing is abnormal	Self-test is not executed	The CPU can not measure the voltage on the +35V line	Measure the voltage at pin 59(Vref) of IC21 The normal voltage is 4741 V	Adjust VR1 (Refer to 43)
		IC11 Is defective	At IC11, check the input signal at pin 101 and the output signal at pin 46 	Replace IC4D
	A particular dot is not being printed	IC4 - IC9 Is defective	For example, check the output signal at pin2 and the out put signal at pin3 with IC4 	Replace IC4 - IC9
Paper is not fed normally	The paper does not feed, or the feed pitch is abnormal	IC3 Is defective	Check the input signal at pin1 and the output signal at pin2 	Replace IC3

5.5 REPAIR OF THE PRINTER MECHANISM

For detailed procedures for replacing or adjusting parts, refer to Chapter 3, *Disassembly and Assembly*, and Chapter 4, *Adjustment*. If a problem or symptom recurs following an attempted repair, refer to Table 5-5 to try to find other potential causes.

Table 5-5. Repair of the Printer Mechanism

Problem	Symptom	Cause	Checkpoint	Solution
The carriage motor fails to operate.	The carriage motor completely fails to activate at power on.	Foreign substances are lodged in the gears or elsewhere in the mechanism.	Manually move the timing belt to see if this causes the motor to rotate.	Remove any foreign substances.
		The carriage motor is defective.	Measure the coil resistance of the motor. The resistance should be about 19.5 ohms.	Replace the carriage motor.
The carriage does not operate at power on (after the carriage has been manually centered prior to power on.)	The carriage motor rotates, but the carriage does not mwe.	The belt pulley is defective.	Check for broken or worn pulley.	Replace the belt pulley.
		The timing belt is defective.	Check that the timing belt is correctly inserted into the bottom of the carriage.	Reinsert the timing belt.
			Check for a broken timing belt.	Replace the timing belt.
	The carriage moves left slightly, then stops.	Carriage movement is not smooth.	Check whether the carriage moves smoothly when moved manually.	Clean and lubricate.
	The carriage moves to the left or right end, then stops.	The home position sensor is defective.	Use a multimeter to check the home position sensor.	Replace the home position sensor.
Self-test printing does not execute.	The carriage moves, but no printing is performed.	The printhead FFC common wires are disconnected.	Check the common wires for the printhead FFC.	Replace the FFC.

Table 5-5 Repair of the Printer Mechanism (Continued)

Problem	Symptom	Cause	Checkpoint	Solution
Self-test printing is abnormal.	A particular dot fails to print.	The printhead is defective.	Measure the coil resistance of the printhead. The normal value is approximately 45.5 ohms.	Replace the printhead.
			Check whether the dot wire is worn.	Replace the printhead.
	The printing is too light, or the print density is not uniform.	The printhead is defective.	Check whether the tip of the dot wire is worn.	Replace the printhead.
		The platen gap is not properly adjusted.	Set the gap adjust lever to the second position, and check the gap between the tip of the printhead and the platen. The appropriate value is 0.48 mm.	Adjust the gap. Refer to Section 4.1.2, *Platen Gap Adjustment*.
Paper feeding is abnormal.	Printing is performed, but the paper is not fed, *or* is not fed uniformly.	Foreign substances are lodged in the paper path.	Perform a visual check of the paper path.	Remove any foreign substances.
		The paper-feed motor is not driving the gear correctly.	Check that no foreign substance is lodged between the gears, and that the gears are not broken or worn.	• Remove any foreign substance. • Replace the paper-feed reduction gear. • Replace the platen gear.
		The paper-feed motor is defective.	Measure the coil resistance for the paper feed motor. The approximate value should be 79 ohms.	Replace the paper-feed motor.

Table 5-5. Repair of *Printer Mechanism (Continued)*

Problem	Symptom	Cause	Checkpoint	Solution
The ribbon feed is abnormal.	The ribbon is not fed.	The ribbon cartridge is defective.	Dismount the ribbon cartridge, rotate its knob manually, and check whether the ribbon feeds normally.	Replace the ribbon cartridge.
		Foreign substances are caught in the gears.	Check whether the ribbon driving gear rotates when the carriage is moved manually.	• Remove any foreign substance. • Replace the ribbon-feed mechanism.
	The ribbon feeds properly only when the carriage moves in one direction (i.e., it fails to feed when the carriage moves in the other direction).	The planetary lever is defective.	Move the carriage manually, and check whether the planetary lever turns in reverse and engages the gear.	Replace the ribbon-feed mechanism.
Paper becomes stained.	Ink stains appear on areas where there is printing.	The ribbon mask is not correctly positioned.	Check whether the ribbon mask is in the correct position.	Reinstall the ribbon mask.
		The platen gap is not adjusted.	Set the gap adjust lever to the second position, and check the gap between the tip of the printhead and the platen. The appropriate value is 0.46 mm.	Adjust the gap. Refer to Section 4.1.2 *Platen Gap Adjustment*.
Printing continues after the paper ends or when no paper is loaded.	Printing continues past the paper end.	The paper-end sensor is defective.	Check the paper-end sensor switch.	Replace the paper-end sensor.

APPENDIX

LIST OF FIGURES

LIST OF TABLES

A.1 CONNECTOR SUMMARY

Figure A-1 illustrates the interconnection of the primary components. Table A-1 summarizes the functions and sizes of the connectors.

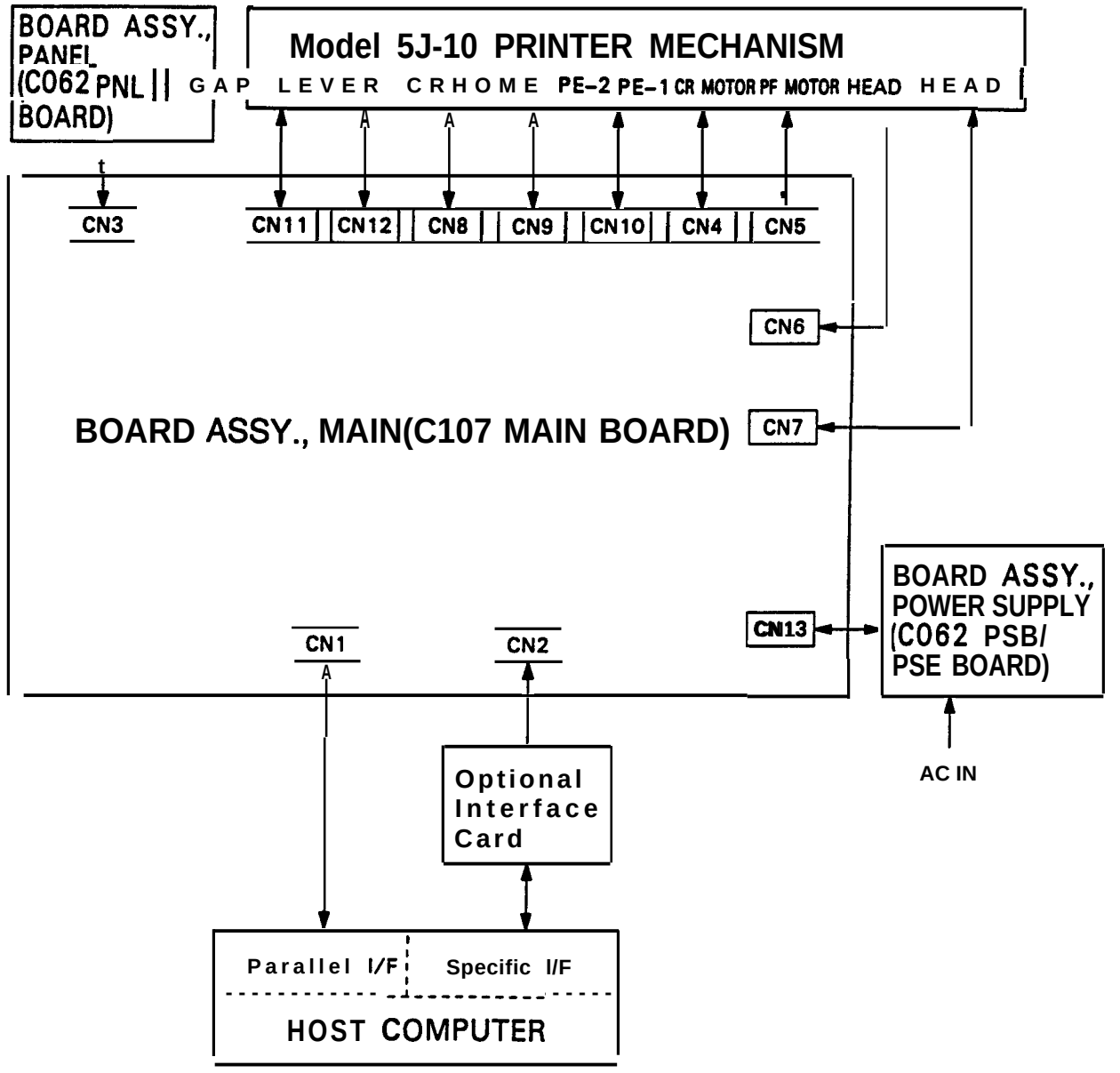


Figure A-1. Cable Connections

Table A-1. Board Connector Summary

Board	Connector	Function	Pins
BOARD ASSY.,PANEL	CN1	BOARD ASSY.,MAIN	12
BOARD ASSY.,POWER SUPPLY	CN1	AC power input	2
	CN2	DC power output	11
BOARD ASSY.,MAIN (C107 MAIN BOARD)	CN1	Parallel interface	36
	CN2	Optional interface card	36
	CN3	Control panel	12
	CN4	MOTOR,CR	5
	CN5	MOTOR,PF	5
	CN6	Printhead	17
	CN7	Printhead	15
	CN8	DETECTOR ASSY.,HP	2
	CN9	DETECTOR ASSY.,PE,REAR	2
	CN10	DETECTOR ASSY.,PE,FRONT	2
	CN11	DETECTOR ASSY.,PLATEN	2
	CN12	DETECTOR ASSY.,RELEASE	2
	CN13	DC power input	11

Table A-2 CN2 BOARD ASSY., MAIN (C107 MAINI

No.	I/O	Signal Name	Function
1		+5	+5 VDC
2		+5	+5 VDC
3		+5	+5 VDC
4		+5	+5 VDC
5		+5	+5 VDC
6		+5	+5 VDC
7	o	TXD	Transmit data
8	0	/READY	Ready to receive data
9	I	RXD	Receive data
10		NC	No connection
11	O	/RST	Reset
12	o	INH	Inhibit
13	I	/CMREQ	Command request
14	I	/WRRDY	Write ready
15	I	/RDREQ	Read request
16	o	/WR	Write
17	0	/RD	Read
18	0	/CS	Chip select
19		GND	Signal ground
20		GND	Signal ground
21		GND	Signal ground
22		GND	Signal ground
23		GND	Signal ground
24		GND	Signal ground
25	0	A3	Address bus bit 3
26	0	A2	Address bus bit 2
27	0	A I	Address bus bit 1
28	0	AO	Address bus bit O
29	I/O	D7	Data bus bit 7
30	I/O	D6	Data bus bit 6
31	I/O	D5	Data bus bit 5
32	I/O	D4	Data bus bit 4
33	I/O	D3	Data bus bit 3
34	I/O	D2	Data bus bit 2
35	I/O	D1	Data bus bit 1
36	I/O	DO	Data bus bit O

Table A-3. CN3 BOARD ASSY., MAIN (C107 MAIN

No.	I/O	Signal Name	Function
1	I	/PAUSE	Pause switch
2		/READY	Fixed GND
3	o	TXS	Transmit signal (LED)
4	0	/LDLED	LED data latch
5	0	/CKS	Shift clock
6	0	/LDSW	Load switch data
7	I	RXS	Receive data (switch)
8		+5	+5 VDC
9		GND	Signal ground
10		SHLD	Shield ground
11	I	POWER1	Power switch
12		POWER2	Fixed GND

Table A4. CN4 BOARD ASSY., MAIN (C107 MAIN)

No.	1/0	Signal Name	Function
1	0	CRA	MOTOR, CR phase A
2	0	CRB	MOTOR, CR phase B
3	0	CRC	MOTOR, CR phase C
4	0	CRD	MOTOR, CR phase D
5	0	CRCOM	MOTOR, CR common

Table A-5. CN5 BOARD ASSY., MAIN (C107 MAIN)

No.	I/O	Signal Name	Function
1	0	PFA	MOTOR, PF phase A
2	0	PFB	MOTOR, PF phase B
3	0	PFC	MOTOR, PF phase C
4	0	PFD	MOTOR, PF phase D
5	0	PFCOM	MOTOR, PF common
6	0	PFCOM	MOTOR, PF common

Table A-6. CN6 BOARD ASSY., MAIN (C107 MAIN)

No.	I/O	Signal Name	Function
1	o	HD5	Head data 5
2	0	HD1	Head data 1
3	0	HD13	Head data 13
4	0	HD9	Head data 9
5	0	HD21	Head data 21
6	0	HD17	Head data 17
7		COM	Common
8		COM	Common
9		COM	Common
10	0	HD24	Head data 24
11	0	HD16	Head data 16
12	0	HD12	Head data 12
13	0	HD8	Head data 8
14	0	HD20	Head data 20
15	0	HD4	Head data 4
16	I	TEMP2	Head temperature
17		TEMP1	+VU

Table A-7. CN7 BOARD ASSY., MAIN (C107 MAIN)

No.	I/O	Signal Name	Function
1	0	HD3	Head data 3
2	0	HD11	Head data 11
3	0	HD2	Head data 2
4	0	HD19	Head data 19
5	0	HD7	Head data 7
6	-	COM	Common
7	-	COM	Common
8	-	COM	Common
9	0	HD22	Head data 22
10	0	HD15	Haad data 15
11	0	HD18	Head data 18
12	0	HD23	Head data 23
13	0	HD10	Head data 10
14	0	HD14	Head data 14
15	0	HD6	Head data 6

Table A-8. CN8 BOARD ASSY., MAIN (C107 MAIN)

No.	1/0]	Signal Name	Function
1	I	CRHOME	DETECTOR ASSY.,HP
2	-	GND	Signal ground

Table A-9. CN9 BOARD ASSY., MAIN (C107 MAIN)

No.	1/0	Signal Name	Function
1	I	PE2	DETCTOR ASSY.,PE, REAR
2	-	GND	Signal ground

Table A-10. CN10 BOARD ASSY., MAIN (C107 MAIN)

No.	I/O	Signal Name	Function
1	I	PE1	DETECTOR ASSY.,PE,FRONT
2	-	GND	Signal ground

Table A-n. CN11 BOARD ASSY.,MAIN(C107 MAIN)

No.	I/O	Signal Name	Function
1	I	GAP	DETECTOR ASSY., PLATEN
2	-	GND	Signal ground

Table A-12. CN12 BOARD ASSY., MAIN (C107 MAIN)

No.	I/O	Signal Name	Function
1	I	LEVER	DETECTOR ASSY., RELEASE
2	-	GND	Signal ground

Table A-13. CN13 BOARD ASSY., MAIN (C107 MAIN)

No.	I/O	Signal Name	Function
1	0	Psc	Power switch signal
2	-	+5	+5 VDC
3	-	+5	+5 VDC
4	-	GND	Signal ground
5	-	GND	Signal ground
6	-	GND	Signal ground
7	-	GND	Signal ground
8	-	GND	Signal ground
9	-	+35	+35 VDC
10	-	+35	+35 VDC
11	-	+35	+35 VDC

, A.5 CASE OUTLINE DRAWING

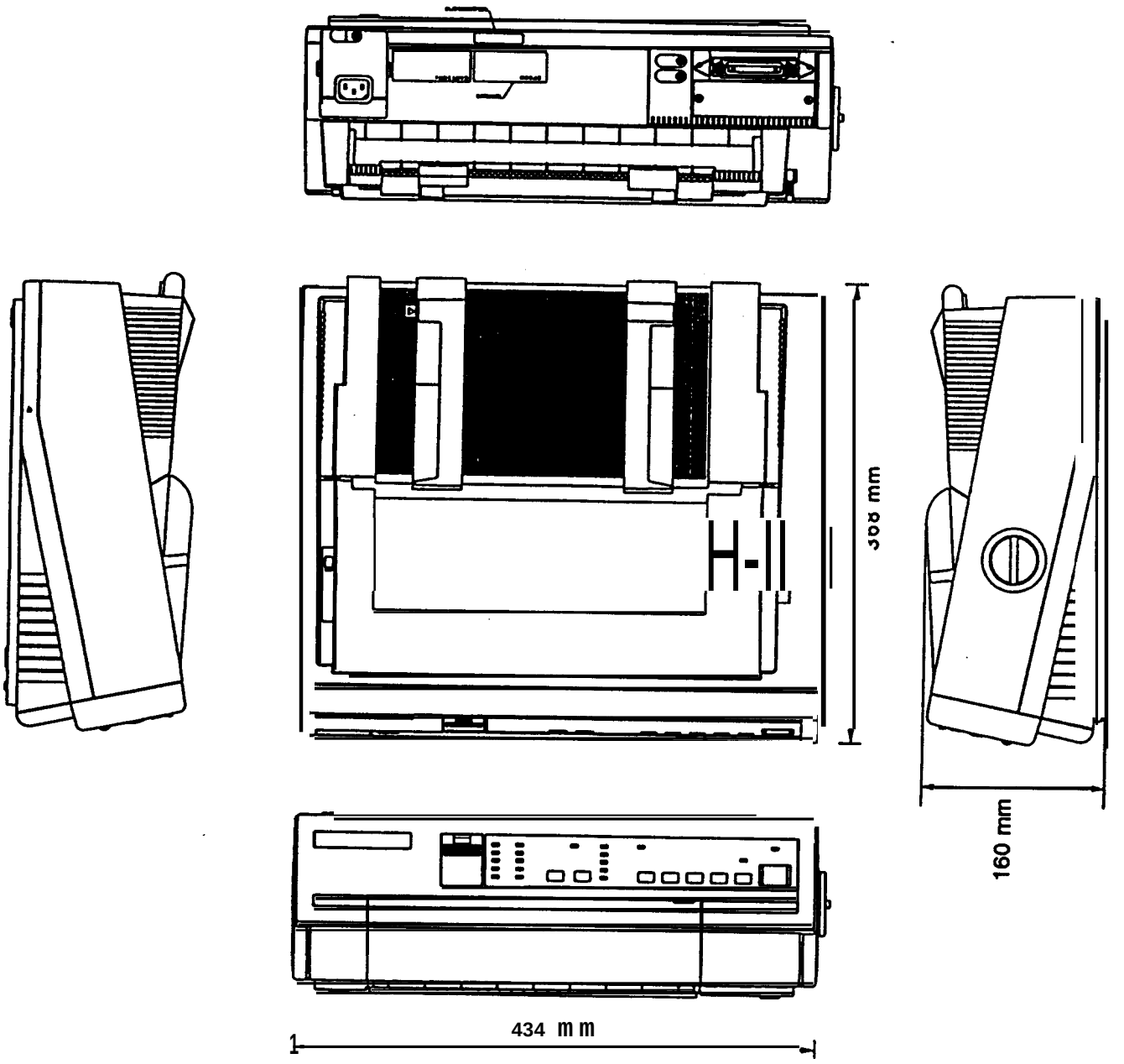


Figure A-17. LQ-570+ Case Outline Drawing

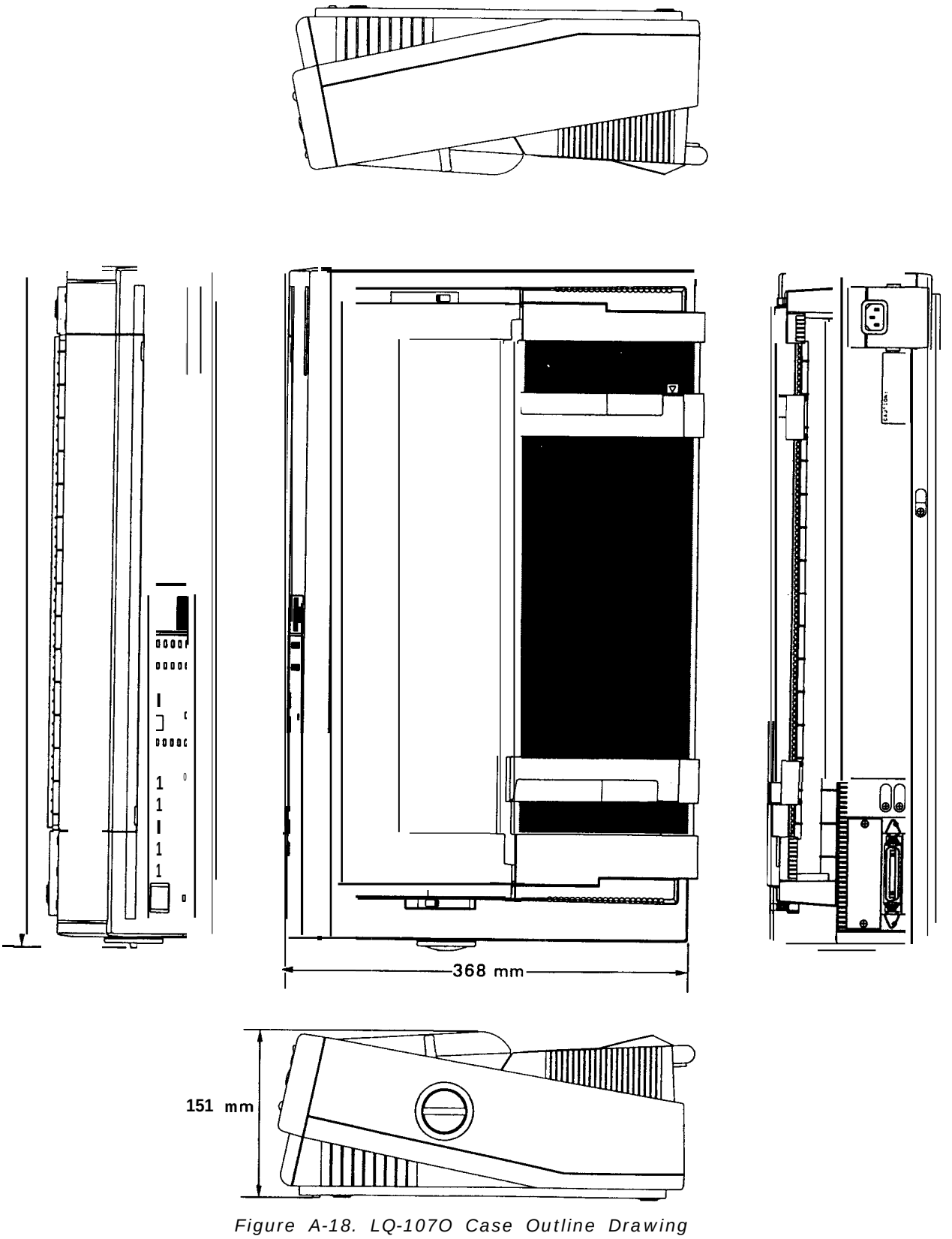


Figure A-18. LQ-107O Case Outline Drawing

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