EPSON®

LQ-200
ActionPrinter™ 3000

Service Manual

Revision Level

Revision	Date
1st printing	March 1991

FCC Compliance Statement For American Users

This equipment has been tested and found to comply with limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

CAUTION: The connection of a nonshielded equipment interface cable to this equipment will invalidate the FCC Certification of this device and may cause interference levels that exceed the limits established by the FCC for this equipment. It is the responsibility of the user to obtain and use a shielded equipment interface cable with this device. If this equipment has more than one interface connector, do not leave cables connected to unused interfaces.

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This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications.

Le present appareil numérique n'èmet pas de bruits radioélectrique dépassant les limites applicables aux appareils numériques de Classe B prescrites dans le règlement sur le brouillage radioélectriques édicté par le Ministère des Communications du Canada.

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Chapter 1 General Description

Chapter 2 Principles of Operation

Chapter 3 Disassembly and Assembly

Chapter 4 Adjustment

Chapter 5 Troubleshooting

Chapter 6 Maintenance

Appendix

Subsequent product modifications will be brought to your attention via Service Bulletins. Please revise the text as bulletins are received.

This document is subject to change without notice.

Note:

This manual uses minus signs (-) in front of signals to indicate that they are active LOW signals.

Chapter 1

General Description

Figures

Tables

General Description 1

Features

The Epson® LQ-200/ActionPrinter™ 3000 (AP3000) is a small, light-weight, low-cost printer similar to the LQ-500. The printer's main features are:

- Epson ESC/P® code printing, implemented as a standard feature
- These printing speeds: 192 cps (draft, 12 cpi)
  160 cps (draft, 10 cpi)
  64 cps (letter quality, 12 cpi)
  53 cps (letter quality, 10 cpi)
- Clear, easy-to-read printing with standard Epson fonts
- Seven built-in letter quality (LQ) fonts (Roman, Sans Serif, Courier, Prestige, Script, OCR-B, and Orator)
- Direct built-in font selection using control panel buttons
- Automatic loading for single sheet paper
- Two paper slots (rear and bottom)
- Easy handling of single sheet paper with the optional cut sheet feeder (CSF)
- Standard Epson 8-bit parallel interface.

Table l-l lists the optional units available for the printer and Figure l-l shows the printer.

Table 1-1. Optional Units

Model	Description
7341	Cut sheet feeder ***(CSF)***

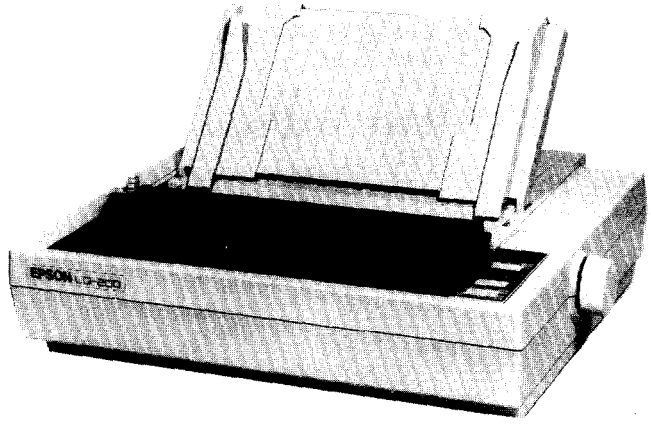


Figure 1-1. LQ-200/AP300

Specifications

This section provides the specifications for the LQ-200/AP3000.

Hardware Specifications

Printing Method	Serial, impact, dot matrix
Pin Configuration	24 wires; 12 x 2 staggered, diameter 0.008 inches (0.2 mm)

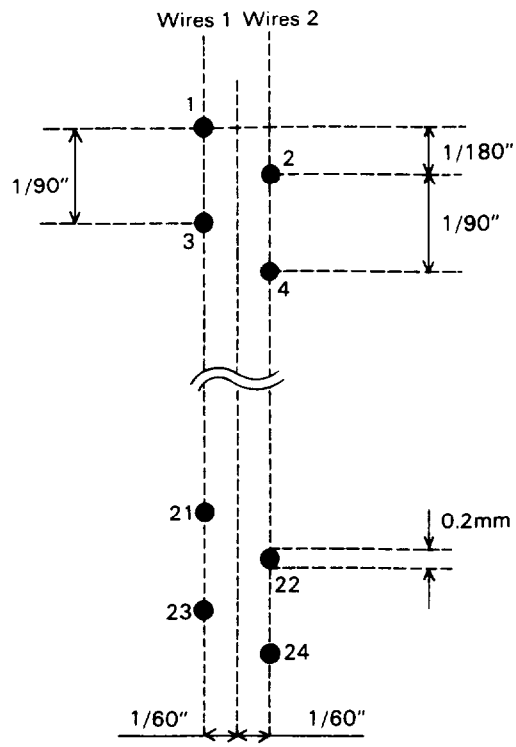


Figure 1-2. Pin Configuration

Feeding Methods	Friction feed, tractor feed
Line Spacing	1/6 inch or programmable in units of 1/180 inch
Paper Insertion	From rear or bottom
Paper Feed Speed	100 ms/line at 1/6-inch line feed 2.2 inches per second, continuous feed

Paper Specifications See Tables 1-2, 1-3, and 1-4.

Table 1-2. Specifications for Single Sheet Paper

Width	7.15 to 10.1 inches (182 to 257 mm)
Length	7.15 to 14.3 inches (182 to 364 mm)
Thickness	0.0025 to 0.004 inches (0.065 to 0.1 mm)
Weight	14 to 22 lb (52 to 82 g/m^2)
Quality	Standard paper
Copies	Not available

Table 1-3. Specifications for Continuous Paper

Width	4.0 to 10.0 inches (101 to 254 mm)
Copies	Three sheets maximum (one original and two copies)
Quality	Standard paper
Total Thickness	0.0025 to 0.01 inches (0.065 to 0.25 mm)
Weight	One sheet: 14 to 22 lb (52 to 82 g/m^2) Two sheets: 11 to 15 lb (40 to 58 g/m^2) × 2 Three sheets: 11 to 15 lb (40 to 58 g/m^2) × 3

Table 1-4. Specifications for Labels

Label Size	2.5 to 0.93 inches minimum (63.5 to 254 mm)
Width of Continuous Backing Paper	4.00 to 10.0 inches (101 to 254 mm)
Thickness	Backing paper: 0.0028 to 0.0035 inches (0.07 to 0.09 mm) Total thickness: 0.0063 to 0.0075 inches (0.16 to 0.19 mm)
Weight	18 lb (68 g/m^2) maximum
Quality	Standard paper

Printable Area

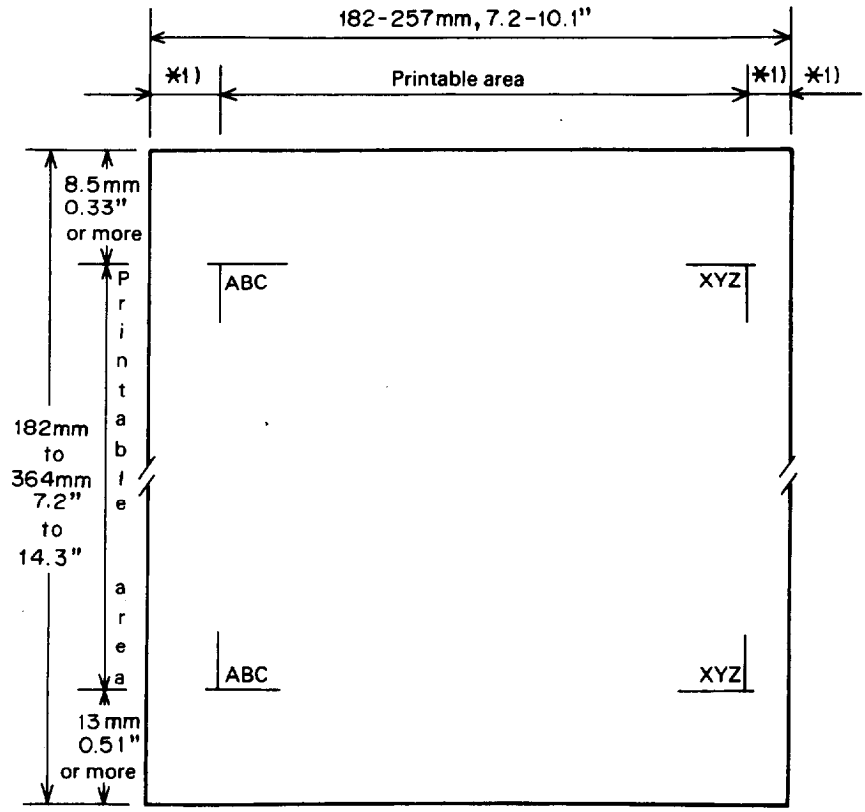


Figure 1-3. Printable Area for Single Sheet Paper

Notes:

1) 0.12 inches (3 mm) or more using 7.2 to 9.0 inch (182 to 229 mm) wide paper. 1.08 inches (27 mm) or more using 10.1 inch (257 mm) wide paper.

- The lowest print position (0.54 inches or 13.5 mm) is only for reference.
- Printing is possible approximately 1.48 inches (37 mm) from the bottom edge of the paper when you press the AUTO LOAD button to load a single sheet.
- Paper feeding accuracy is not assured within 0.88 inches (22 mm) from the top edge of the paper and 1.20 inches (30 mm) from the bottom edge of the paper.

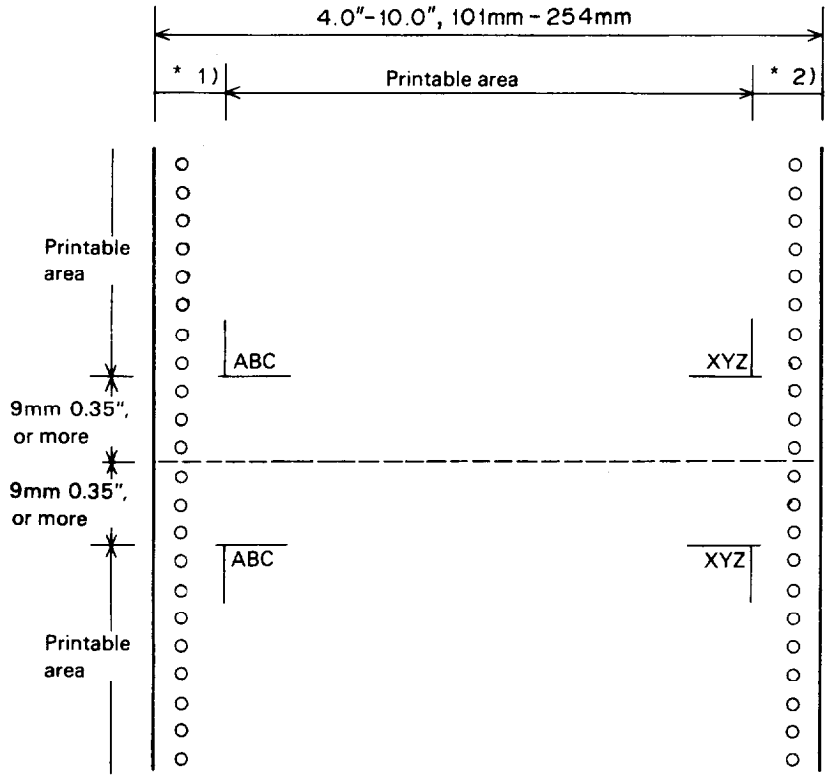


Figure 1-4. Printable Area for Continuous Paper

Notes:

*1) 0.52 inches (13 mm) or more using 4.0 to 9.5 inch (101 to 242 mm) wide paper.
1.04 inches (26 mm) or more using 10.0 inch (254 mm) wide paper.

***2)** 0.52 inches (13 mm) or more using 4.0 to 9.5 inch (101 to 242 mm) wide paper.
1.04 inches (26 mm) or more using 10.0 inch (254 mm) wide paper.

Ink Ribbon

Type	Black ribbon cartridge #7753 Film ribbon cartridge #7768
Color	Black
Life	2 million characters at 48 dots/character (black ribbon) 0.2 million characters using LQ characters (film ribbon)
Dimensions of Ribbon Cartridge	11.72 inches (width) x 1.36 inches (height) x 2.88 inches (depth) (293 mm x 34 mm x 72 mm)

Reliability

Mean Cycles Between Failure **(MCBF)**	3 million lines (excluding printhead)
Mean Time Between Failure (MTBF)	40000 power-on hours POH) at 25% duty

Printhead Life	200 million strokes (black ribbon) 100 million strokes (film ribbon)

Safety Approvals

Safety standards	UL478
Radio Frequency Interference (RFI)	FCC class B

Electrical Specifications

Power Conditions	120 VAC ± 10%
Frequency Range	49.5 to 50.5 Hz (50 Hz model) 59.5 to 60.5 Hz (60 Hz model)
Current Rating	1.8 A
Power Consumption	Approximately 38 W (during self test in draft mode at 10 cpi)
Insulation Resistance	10 megohms minimum between AC line and chassis
Dielectric Strength	1250 VAC (rms), 1 minute between AC line and chassis

Environmental Conditions

Temperature	41° to 95°F (5O to 35°C), operating –22° to 140°F (-30° to 60°C), in shipping container
Humidity	10 to 80 % RH, operating 5 to 85 % RH, storage
Resistance to Shock	1 G, within 1 ms, operating 2 G, within 1 ms, storage
Resistance to Vibration	0.25 G, 55 Hz maximum, operating 0.50 G, 55 Hz maximum, storage

Physical Specifications

Weight	Approximately 14.1 lb (6.4 kg)
Dimensions	15.6 inches (width) x 12.8 inches (depth) x 5.6 inches (height) (390 mm x 320 'mm x 139 mm) excluding knob and paper guide

Firmware Specifications (ESC/P)

Control Codes	ESC/P level ESC/P 84 (Epson Standard Code for Printers)
Printing Direction	Bidirectional (text) Bidirectional (bit image) when DIP switch 2-5 is on Unidirectional (bit image) when DIP switch 2-5 is off
Input Data Buffer	8KB when DIP switch 2-4 is on 1KB when DIP switch 2-4 is off (When DIP switch 2-4 is on, you cannot define user-defined characters.)
Character Code	8 bits
Character Sets	96-character ASCII character set 14 international character sets Legal character set PC (character tables for the Personal Computer) 437, 850, 860,863,865
Built-In Fonts	See Table 1-5.

Table 1-5. Built-h Fonts

Epson Built-In Font	Family Number	10 cpi	12 cpi	15 cpi	Proportional
Draft	—	o	o	o	*1
Roman	0	o	o	*2	o
Sans Serif	1	o	o	o	o
Courier	2	o	o	o	o
Prestige	3	o	o	*2	o
Script	4	o	o	*2	o
OCR-B	5	o	o	*2	o
Orator	7	o	o	*2	o

Notes:

- o = resident, 'I = proportional LQ font specified using ESC k, *2 = 15 cpi Courier
- OCR-B and Orator are basically IO cpi fonts. However, you can select the typestyle and pitch for these fonts.
- You cannot select 15 cpi and condensed printing at the same time.

Printing Modes	You can select and mix any of the following printing modes, except you cannot select 15 cpi and condensed printing at the same time. • Draft or letter quality printing • Character pitch (10 cpi, 12 cpi, 15 cpi, or proportional printing) • Condensed • Double-width • Double-height • Emphasized • Double-strike • Italic • Underlined • Double-underlined • Overscore • Strike-through • Outline • Shadow
Printing Speed	See Table 1-6.
Printing Columns	See Table 1-6.
Character Matrix	See Table 1-7.
Character Size	See Table 1-7.

Table 1-6. Printing Modes

Pitch	Con-densed	Empha-sized	Double-Width		Printable Columns	Character Pitch (cpi)	Printing Speed (cps)	
							Draft	LQ
10 cpi	0	0	0		80	10	160	53.3
	0	0	1		40	5	80	26.65
	0	1	0		80	10	80	53.3
	0	1	1		40	5	40	26.65
	1	x	0		137	17.1	137	91.3
	1	x	1		58	8.5	68.5	45.65
12 cpi	0	0	0		96	12	192	64
	0	0	1		48	6	96	32
	0	1	0		96	12	96	64
	0	1	1		48	6	48	32
	1	x	0		160	20	160	106.7
	1	x	1		80	10	80	53.35
15 cpi	0	0	0		120	15	240	80
	0	0	1		120	15	120	40
	0	1	0		60	7.5	120	80
	0	1	1		60	7.5	60	40
	1	x	x			Cannot be condensed.		
Propor-tional	0	x	0	max	68	8.6	—	46
				min	160	20	—	106.7
	0	x	1	max	34	4.3	—	23
				min	80	10	—	53.35
	1	x	0	max	137	17.1	—	91.3
				min	320	40	—	213.3
	1	x	1	max	68	8.6	—	45.65
				min	160	20	—	106.65
Propor-tional super/ subscript	0	x	0	max	102	12.8	—	68.7
				min	240	30	—	160
	0	x	1	max	51	6.4	—	34.35
				min	120	15	—	80
	1	x	0	max	204	25.7	—	137.3
				min	480	60	—	320
	1	x	1	max	102	12.8	—	68.65
				min	240	30	—	160

Notes:

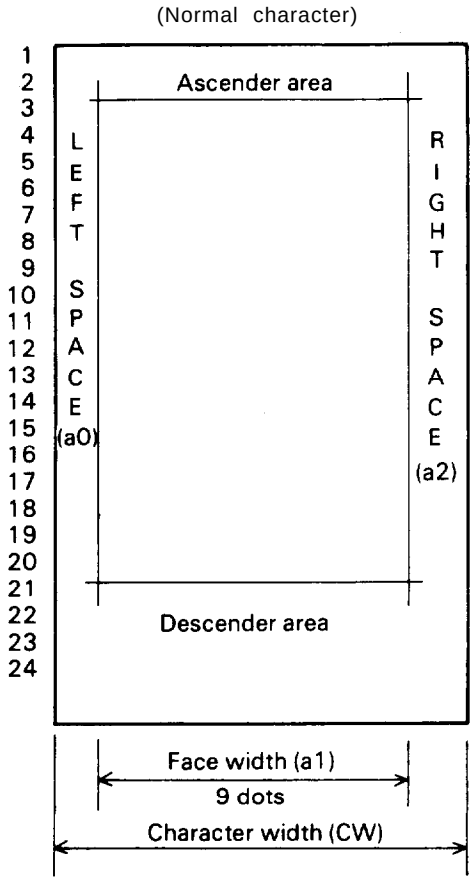
- Max is the value appropriate for the maximum width character.
- Min is the value appropriate for the minimum width character.
- — means that the printer automatically selects LQ mode when you select proportional pitch.

Table 1-7. Character Matrix and Character Size

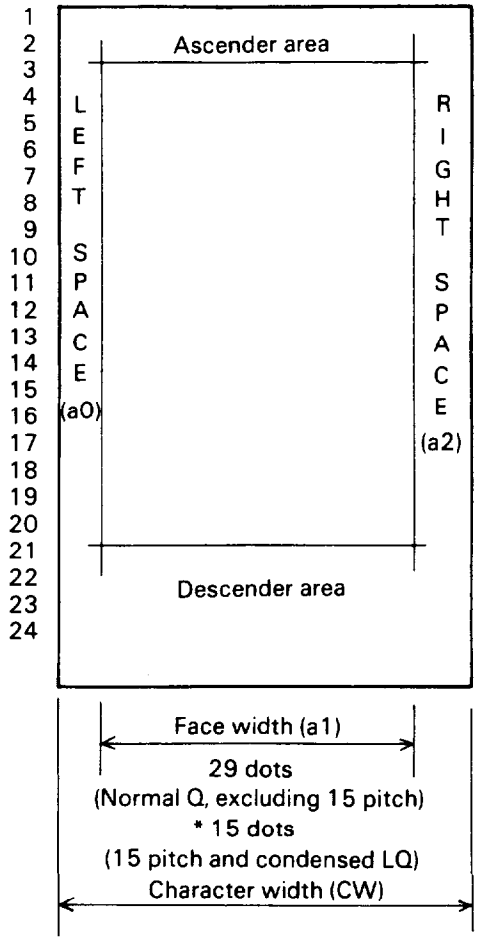
Printing Mode	Face Matrix	HDD	Character Size H × V (mm)	Unit ESC sp
Draft, 10 cpi	9 × 22	120	1.9 × 3.1	120
Draft, 12 cpi	9 × 22	120	1.9 × 3.1	120
Draft, 15 cpi	7 × 16	120	1.0 × 2.3	120
Draft, 10 cpi, condensed	—	240	—	120
Draft, 12 cpi, condensed	—	240	—	120
LQ, 10 cpi	31 × 22	360	2.2 × 3.1	180
LQ, 12 cpi	27 × 22	360	1.9 × 3.1	180
LQ, 15 cpi	22 × 16	360	1.0 × 2.3	180
LQ, 10 cpi, condensed	—	360	—	180
LQ, 12 cpi, condensed	—	360	—	180
LQ, proportional	max 37 × 22 min 18 × 22	360 360	2.6 × 3.1 1.0 × 3.1	180 180
LQ, proportional, condensed	— —	360 360	— —	180 180
LQ, proportional, super/subscript	max 28 × 16 min 12 × 16	360 360	1.8 × 2.3 0.7 × 2.3	180 180
LQ, proportional, super/subscript, condensed	— —	360 360	— —	180 180

Notes:

- HDD is the horizontal dot density in dots per inch.
- The face matrix and character size indicate the size of the maximum character. This value depends on the paper, the ribbon, and other variables.
- Unit ESC SP indicates the minimum length to be added to the right of the character specified using ESC SP. You can also send Unit Esc SP followed by the character string CHR$ (&h20).
- — indicates that printer firmware reshapes the character matrix. Character width is half of the noncondensed character width.

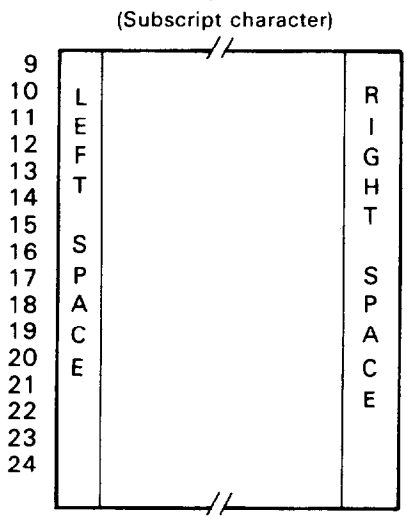


12 dots, 10 cpi, 120 dpi
15 dots, 12 cpi, 180 dpi
16 dots, 15 cpi, 240 dpi
14 dots, condensed, 10 cpi, 240 dpi
12 dots, condensed, 12 cpi, 240 dpi



36 dots, 10 cpi, 360 dpi
30 dots, 12 cpi, 360 dpi
24 dots, 15 cpi, 360 dpi
21 dots, condensed, 10 cpi, 360 dpi
18 dots, condensed, 12 cpi, 360 dpi

* The printer firmware makes 15 dots from 29 dots.



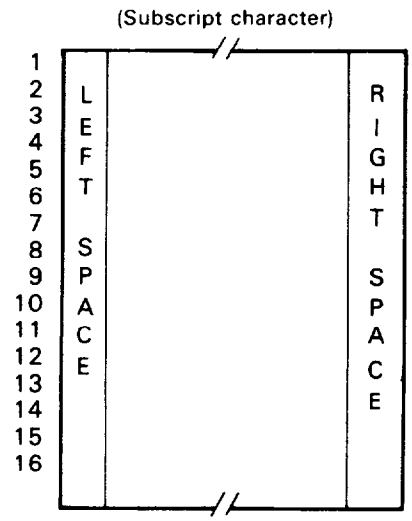


Figure 1-5. Character Matrix

Parallel Interface

This section provides the specifications for the standard parallel interface.

Data Format	8-bit parallel
Synchronization	-STROBE signal
Handshaking	BUSY and -ACKNLG signal
Signal Level	TTL compatible
Adaptable Connector	57-30360 (Amphenol) or equivalent
Data Transmission Timing	See Figure 1-6.

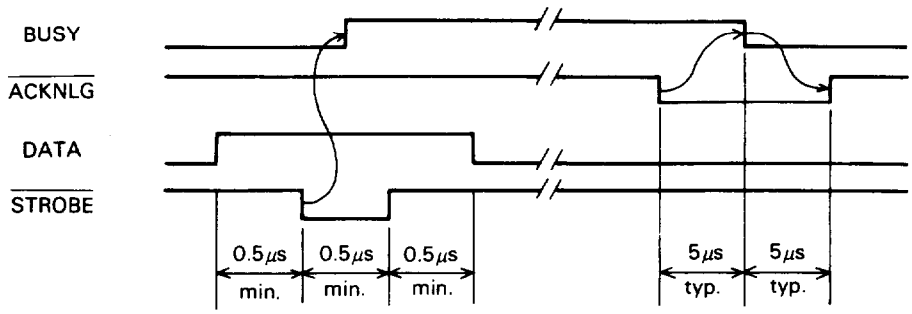


Figure 1-6. Data Transmission Timing

Table 1-8 shows the connector pin assignments and signal functions of the 8-bit parallel interface.

Table 1-8. Connector Pin Assignments and Signal Functions

Pin No.	Signal Name	Return Pin No.	DIR	Description
1	–STROBE	19	In	Strobe pulse to read the input data. Pulse width must be more than 0.5 μs. Input data is latched after the falling edge of this signal.
2 3 4 5 6 7 8 9	DATA 1 DATA 2 DATA 3 DATA 4 DATA 5 DATA 6 DATA 7 DATA 8	20 21 22 23 24 25 26 27	In In In In In In In In	Parallel input data to the printer. HIGH level means 1. LOW level means 0.
10	–ACKNLG	28	Out	This pulse indicates data has been received and the printer is ready to accept more data. Pulse width is approximately 11 μs.
11	BUSY	29	Out	HIGH indicates the printer cannot accept more data.
12	PE	30	Out	HIGH indicates paper-out. This signal is effective only when the –ERROR signal is LOW.
13	SLCT	—	Out	Output is always HIGH. (Pulled up to +5 V through 3.3K-ohm register.)
14	–AUTOFEED XT	—	In	If this signal is LOW when the printer is initialized, the printer automatically performs a line feed when it receives a CR code (auto LF).
15	—	—	—	Not used.
16	GND	—	—	Ground for twisted pair.
17	Chassis GND	—	—	Ground for chassis.
18	—	—	—	Not used.
19 to 30	GND	—	—	Ground for twisted pair.

Table 1-9. Connector Pin Assignments and Signal Functions (cont.)

Pin No.	Signal Name	Return Pin No.	DIR	Description
31	–INIT	16	In	Pulse (width: 50 μs minimum, active LOW) input for printer initialization.
32	–ERROR		Out	LOW indicates that an error has occurred.
33	GND	—	—	Ground for twisted pair.
34	—	—	—	Not used.
35	—	—	Out	Always HIGH. (Pulled up to +5 V through a 3.3K-ohm register.)
36	–SLCT-IN	—	In	If this signal is LOW when the printer is initialized, DC1/DC3 control is disabled.

Notes:

- DIR refers to the direction of signal flow as viewed from the printer.
- Return Pin No. denotes a twisted pair return line.
- The cable must be shielded to prevent noise.
- All interface conditions are based on TTL levels. The rise and fall times of all signals must be less than 0.2 ,us.
- You can set the -AUTO FEED-XT signal to LOW using DIP switch 2-4.
- You can set the -SLCT-IN signal to LOW using jumper 6.
- By setting the DATA 1 through 8 pins to the -STROBE signal, you can perform printing tests, including interface circuit tests, without using external equipment.
- Minus signs are used in front of signal names indicate active LOW signals.

Table 1-9 shows the handshaking (DC1/DC3) protocol.

Table 1-9. Handshaking (DC1/DC3) Protocol

On Line/ Off Line	^SLCT-IN	DC1/DC3	^ERROR	BUSY	^ACKNLG	Data Entry
Off line	HIGH/ LOW	DC1/DC3	LOW	HIGH	No pulse	Disabled
On line	HIGH	DC1	HIGH	LOW/HIGH (during data entry)	Pulse output after entry	Enabled (normal process)
		DC3	HIGH	LOW/HIGH (during data entry)	Pulse output after entry	Enabled (Waits for DC1. See note 2.)
On line	LOW	DC1	HIGH	LOW/HIGH (during data entry)	Pulse output after entry	Enabled (normal process)
		DC3	HIGH	LOW/HIGH (during data entry)	Pulse output after entry	Enabled (normal process)

Notes:

1. Table 1-9 assumes that no *ERROR status exists other than that due to off line mode.

2. When the printer receives a DC3 code, it ignores input data. When the printer receives a DC1 code, data transmission continues.

3. The DC1 and DC3 codes are enabled only when the SLCT-IN signal (pin number 36) is HIGH and the printer is initialized.

4. If the SLCT-IN signal is LOW when the printer is initialized, DC1/DC3 handshaking is invalidated and the printer ignores the DC1/DC3 control codes.

5. If the SLCT-IN signal is HIGH when the printer is initialized, the printer starts from the selected (DC1) state.

6. Minus signs are used in this table to indicate active LOW signals.

DIP Switches and Jumpers

This section describes the functions of the DIP switches and jumpers.

DIP Switches

The LQ-200/AP3000 has two sets of DIP switches underneath the cartridge slot cover. Tables 1-10 through 1-15 describe the functions of these DIP switches. The printer reads the DIP switch settings only at power on or after receiving the -INIT signal.

Table 1-10. Dip Switch Set 1

Number	Description	On	Off
1 2 3	Italics: international set selection Graphics: character table selection	See Table 1-12	
4 5 6	Font selection	See Table 1-13	
7	Table Selection	Graphics	Italics
8	Cut sheet feeder (CSF) mode	On	Off

Table 1-11. Dip Switch Set 2

Number	Description	On	Off
1 2	Page length selection	See Table 1-14	
3 4 5 6	Auto line feed Input data buffer[1] Print direction for graphics[2] One-inch skip-over-perforation	On 8K Bidirectional On	Off 1KB Unidirectional Off
7 8	Character pitch selection	See Table 1-15	

Notes:

- 1. When DIP switch 2-4 is on, you cannot create user defined characters.
- 2. When DIP switch 2-5 is on, you can select bidirectional graphics printing using ESC UO.

Table 1-12. International Character Set and Character Table Selection

1-1	1-2	1-3	Country	Character Table
On	On	On	United States	PC 437 (United States)
On	On	Off	France	PC 850 (multilingual)
On	Off	On	Germany	PC 860 (Portugal)
On	Off	Off	United Kingdom	PC 863 (Canada-French)
Off	On	On	Denmark 1	PC 865 (Norway)
Off	On	Off	Sweden	PC 437 (United States)
Off	Off	On	Italy	PC 437 (United States)
Off	Off	Off	Spain 1	PC 437 (United States)
Default			United States	PC 437

Table 1-13. Font Selection

1-4	1-5	1-6	Font
Off	Off	Off	Courier
On	Off	Off	Roman
Off	On	Off	Sans Serif
On	On	Off	Prestige
Off	Off	On	Script
On	Off	On	OCR-B
Off	On	On	Orator
On	On	On	Draft

Table 1-14. Page Length Selection

2-1	2-2	Page Length	CSF Page Length
Off	Off	11 inches	61 lines (A4)
On	Off	12 inches	65 lines (letter)
Off	On	8.5 inches	61 lines (A4)
On	On	70/6 inches	65 lines (letter)
Default		11 inches	CSF page length 61 lines

Table 1-15. Character Pitch Selection

2-7	2-8	Character Pitch
Off	Off	10 cpi
On	Off	12 cpi
Off	On	17 cpi
On	On	20 cpi

Jumpers

Jumper 6, located underneath the cartridge slot cover, is user selectable. If you connect jumper 6, the -SLCT-IN signal is LOW and the printer ignores the DC1/DC3 control codes.

Operating Instructions

This section explains how to use SelecType, the self test, the demonstration, the hexadecimal dump, and other functions.

SelecType

The SelecType function allows you to easily choose any of the seven built-in LQ fonts when the printer is on line and not printing. To select a font, you press the FORM FEED button until the two SelecType indicator lights match the desired font.

Self Test

To run the self test in draft mode, turn on the printer while pressing the LINE FEED button. To run the self test in letter quality (LQ) mode, turn on the printer while pressing the FORM FEED button.

To stop or start the self test, press the ON LINE button. To end the self test, press the ON LINE button and then turn off the printer.

The first line of the self test shows the firmware revision number. Next the self test prints the current DIP switch settings.

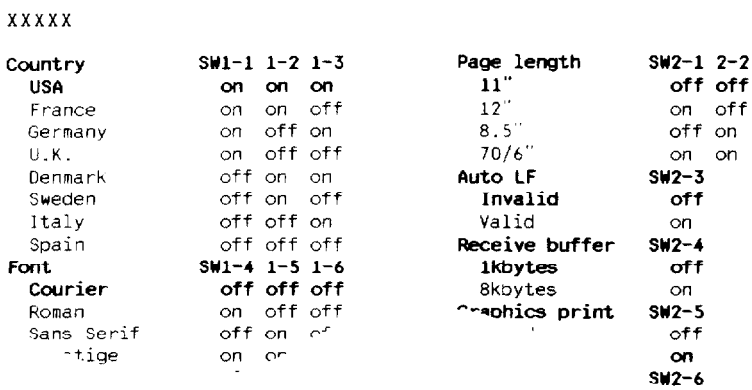
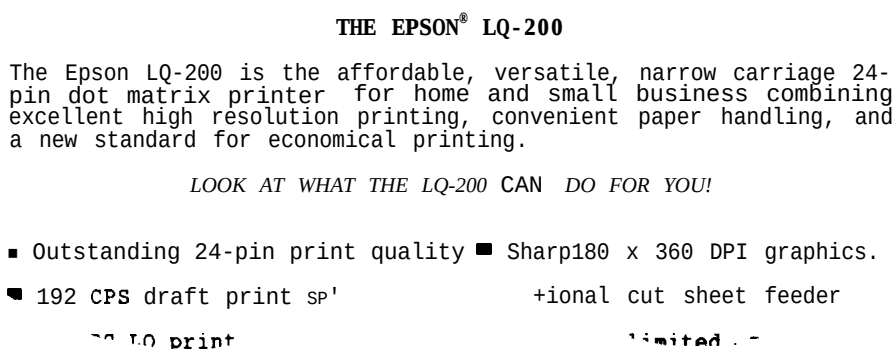


Figure 1-7. Self Test

Demonstration

To start the demonstration, turn on the printer while holding down the LINE FEED and ON LINE buttons.


THE EPSON® LQ-200

The Epson LQ-200 is the affordable, versatile, narrow carriage 24-pin dot matrix printer for home and small business combining excellent high resolution printing, convenient paper handling, and a new standard for economical printing.

LOOK AT WHAT THE LQ-200 CAN *DO FOR YOU!*

- Outstanding 24-pin print quality
- 192 CPS draft print
- Sharp180 x 360 DPI graphics.
- +ional cut sheet feeder

Figure 1-8. Demonstration

Hexadecimal Dump Function

You use the hexadecimal dump function to check the data the printer is receiving from the host. To turn on hexadecimal dump mode, turn on the printer while holding down the LINE FEED and FORM FEED buttons. In hexadecimal dump mode, the printer prints the hexadecimal representation of the input data and the corresponding ASCII characters. If input data is a control code instead of a character code, the printer prints a period (.) in the ASCII column.

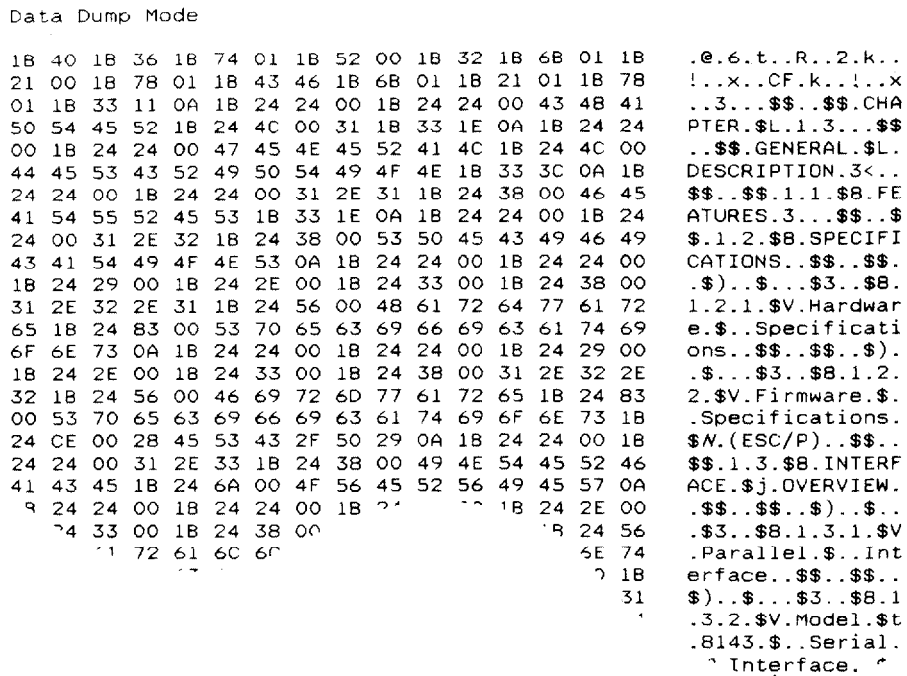


Figure 1-9. Hexadecimal Dump

Bit Image Printing

The LQ-200/AP3000 has four standard print densities. They are listed below in dots per inch (dpi), including half dots.

120 dpi at triple speed
180 dpi at double speed
240 dpi at one and a half speed
360 dpi at normal speed

Tables 1-16 and 1-17 show how the firmware handles the print densities.

Table 1-16. Print Density

Pins	m	Bit Image Printing Mode	Dot Density (dpi)	Adjacent Dot Printing	256 × n2 + n1	Print Speed (ips)
8	0	Single density	60	yes	480	16
8	1	Dual density	120	yes	960	8
8	2	Double speed, dual density	120	no	960	16
8	3	Quadruple density	240	no	1,920	8
8	4	CRT graphics	80	yes	640	8
8	6	CRT graphics II	90	yes	720	10.67
24	32	Single density	60	yes	480	16
24	33	Dual density	120	yes	960	8
24	38	CRT graphics II	90	yes	720	10.67
24	39	Triple density	180	yes	1,440	5.33
24	40	Hex density	360	no	2,880	5.33

Note: ESC * m n1 n2 [DATA]

Table 1-17. Bit Image Printing

Dot Density	Printing Method
80 dpi	Prints at 240 dpi by multiplying the bit image by three: 80 × 3 = 240

Error Conditions

If any of the following error conditions occurs, the printer goes off line.

- The printer cannot detect the home position at printer mechanism initialization.
- The printer detects the home position during printing.
- You press the ON LINE button when the printer is on line, and the printer goes off line.
- The printer detects a paper-out signal and form over-ride is finished.
- A paper-out signal is detected after the printer performs a paper-loading operation with the cut sheet feeder enabled.

The printer outputs the following interface signals to indicate the error and halt data transmission:

The BUSY signal becomes HIGH.
The -ERROR signal becomes LOW.
The printer does not send an -ACKNLG pulse.

Buzzer Operation

The buzzer rings when any of the following occurs:

- The printer receives the BEL code (0.5 second ring).
- The printer detects a paper-out error (three 0.1 second rings with 0.1 second intervals).
- The printer detects abnormal carriage movement (five 0.6 second rings with 0.5 second intervals).
- The printer accepts a control panel setting (0.1 second ring).

Printer Initialization

There are two initialization methods: hardware initialization and software initialization.

Hardware initialization

Hardware initialization takes place when you turn on the printer (and the AC power cord is plugged in) or when the printer receives the -1NIT signal.

During hardware initialization, the printer:

- Initializes the printer mechanism.
- Clears the input data buffer.
- Clears the downloaded character set.
- Clears the print buffer.
- Returns its settings to the default values described on the next page.

Software initialization

Software initialization takes place when the printer receives the software initialization code. During software initialization, the printer:

- Clears the print buffer.
- Returns its settings to the default values described on the next page.

Default Values

When the printer is initialized, the following default values take effect:

Page Position	The current paper position becomes the top-of-form position.
Left and Right Margins	Released
Line Spacing	l/6 inch
Vertical Tabs	Cleared
Horizontal Tabs	Every 8 characters (relative)
VFU Channel	Channel 0
Typestyle	SelecType setting (software initialtiation) DIP switch setting (hardware initialization)
User-Defined Characters	Deselected (software initialization) Cleared (hardware initialization)
Justification	Left justification
Character Spacing	10 cpi
Bit Image Mode Assignment	ESCK=ESC*O, ESCL=ESC*l ESCY=ESC*2, ESCZ=ESC*3
Printing Effects	Clears all effects except for condensed printing.
Condensed Printing	DIP switch setting

Head Adjust Lever

You must move the head adjust lever to the position appropriate for your paper's thickness. See Table 1-18 and Figure 1-10.

Table 1-18. Head Adjust Lever

Lever Positions	Paper Thickness
2nd step	0.002 - 0.0048 inches (0.06 - 0.12 mm)
3rd step	0.0052 - 0.0072 inches (0.13 - 0.18 mm)
4th step	0.0076 - 0.01 inches (0.19 - 0.25 mm)

Note: If the print density is light, move the head adjust lever one step lower.

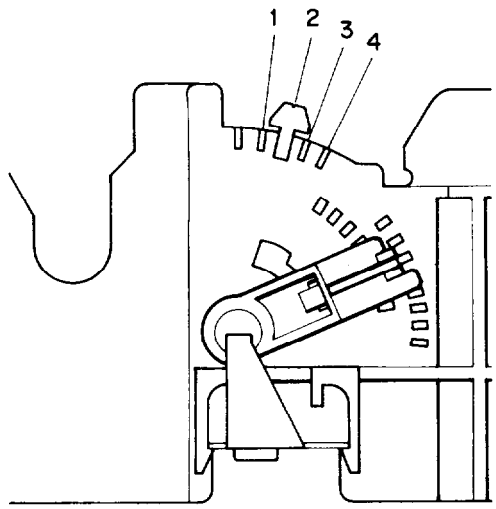


Figure 1-10. Head Adjust Lever

Printhead Protection During Heavy Duty Printing

The printhead is protected from overheating and voltage drops to the printhead driver. If the printhead temperature exceeds the upper limit, printing stops automatically until the printhead temperature drops to the required value.

If heavy duty printing causes the printhead driver voltage to drop below the lower limit, printing stops. When the power supply voltage increases to the required level, the printer prints the rest of the line. This protection occurs when half or more of the wires are activated simultaneously and continuously.

Main Components

The main components are designed so that you can easily remove and replace them when you maintain or repair the printer. The main components are:

- C064 MAIN PCB main control board
- Control Panel PCB control panel board
- PEBFIL-II PCB filter circuit board
- Transformer
- Model 5C10 printer mechanism.

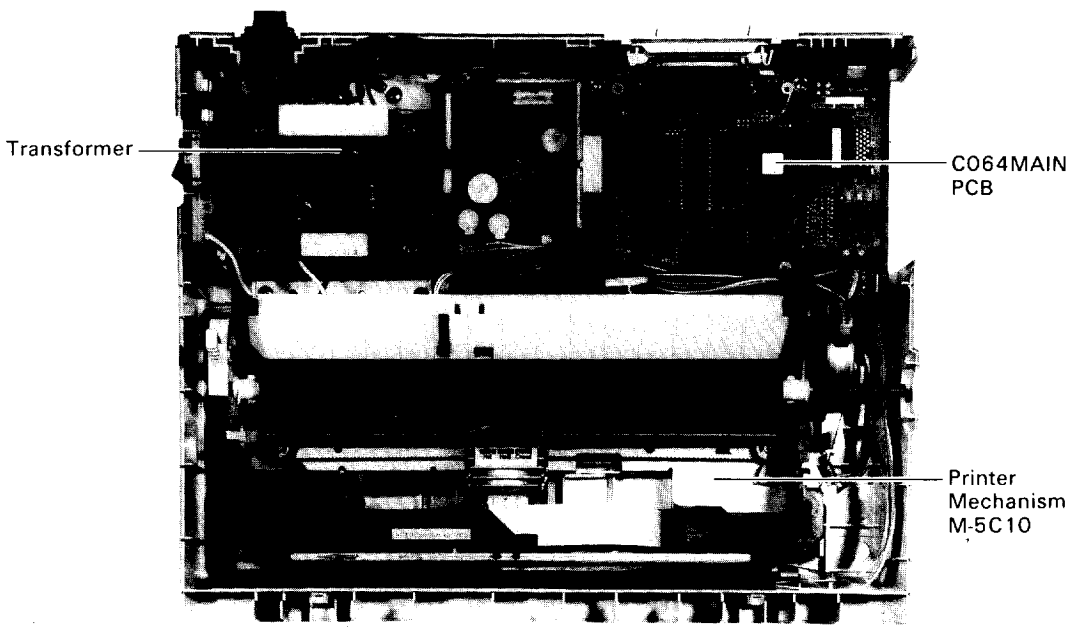


Figure 1-11. LQ-200/AP3000 Component Layout

C064 MAIN PCB

The µPD7810HG CPU on the CO64 MAIN PCB simplifies the circuit design of the main control board and controls all of the printer's main functions.

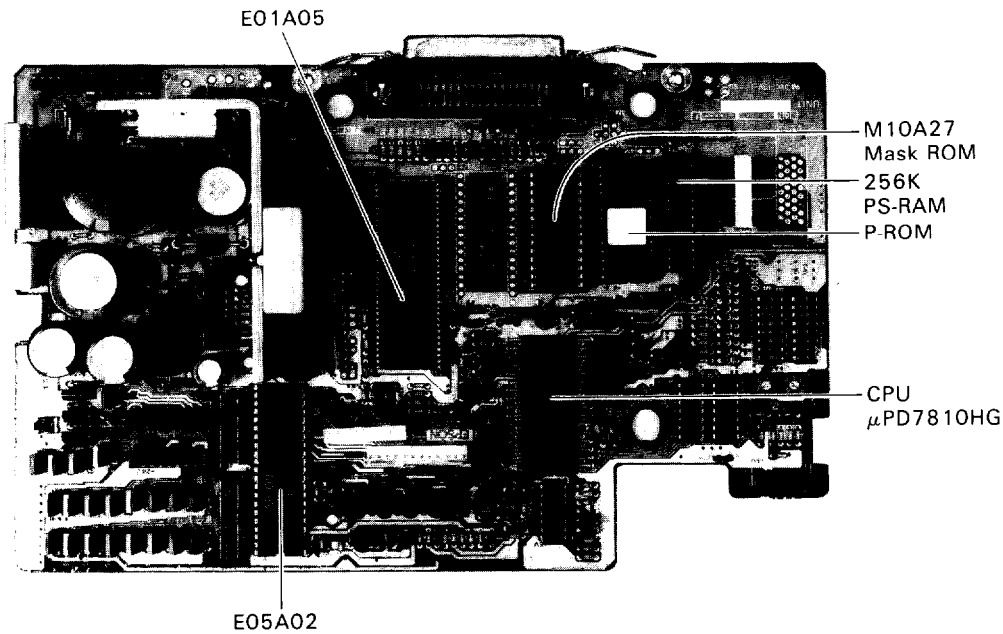


Figure 1-12. C064 Main PCB

Control Panel PCB

The control panel PCB is the control panel. It includes the indicator LEDs, the control panel buttons, and the buzzer.

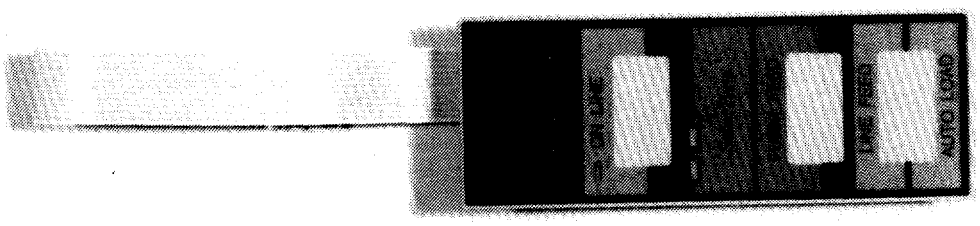


Figure 1-13. Control Panel PCB

PEBFIL-II PCB

The PEBFIL-II PCB filter board eliminates noise from the AC line to the printer and from the printer to the outer line. The fuse on this board prevents overheating.

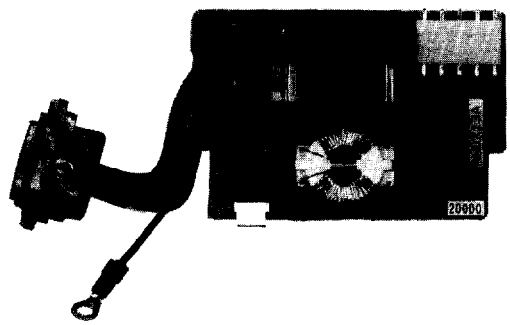


Figure 1-14. PEBFiL-II PCB

Transformer

The transformer converts the input AC from the filter circuit into 28 VAC output to supply the required voltage to the control circuit board.

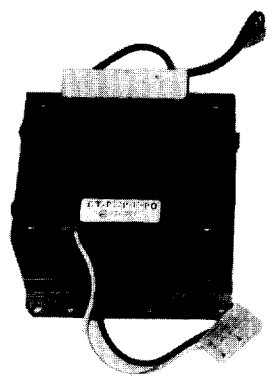


Figure 1-15. Transformer

Model 5Cl0 Printer Mechanism

The model X10 printer mechanism is designed specifically for the LQ-200/AP3000. Its components include the carriage motor, carriage mechanism, paper feed motor, paper feed mechanism, ribbon feed mechanism, printhead, and sensors.

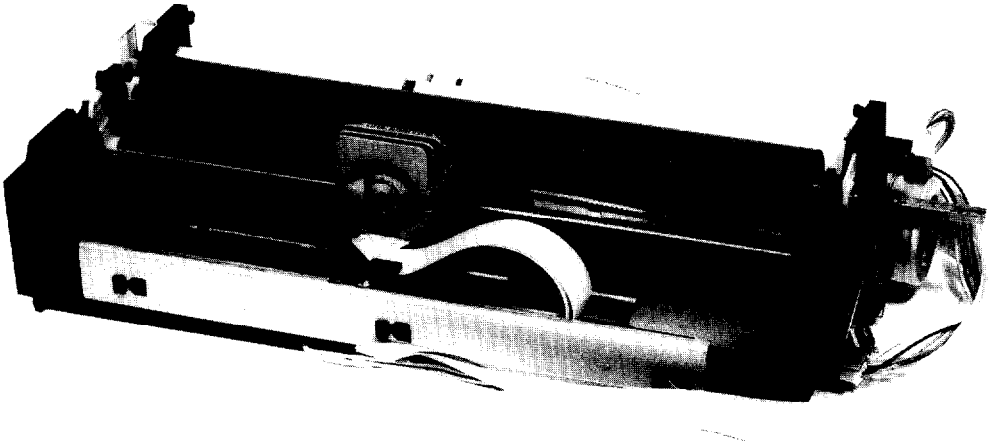


Figure 1-16. Model 5C10 Printer Mechanism

Housing

The housing consists of the upper and lower cases. The upper case houses the control panel. The lower case contains the printer mechanism and the main control board.

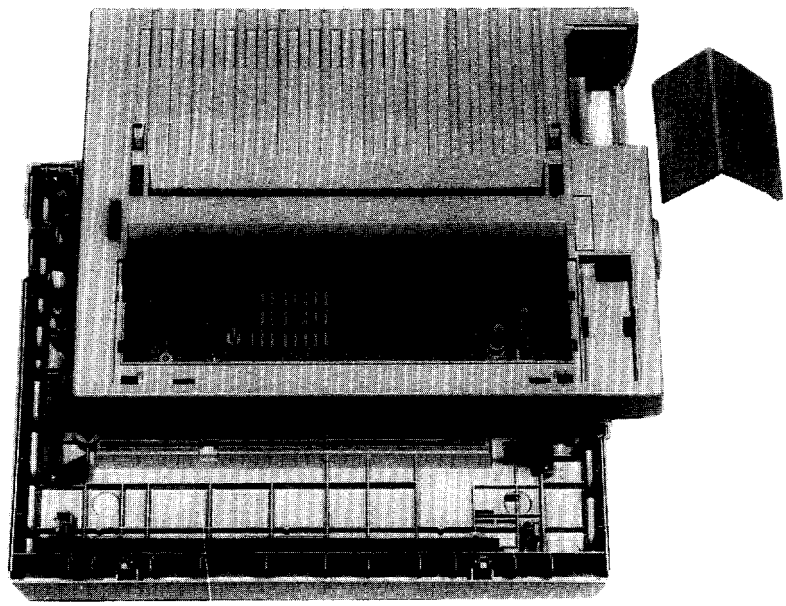


Figure 1-17. Housing

Chapter 2

Principles of Operation

Figures

Tables

Principles of Operation 2

Overview

This chapter describes the signals at the connectors that link the printer's primary components, including the printer mechanism, the power supply circuits, and the control circuits. This chapter also describes how the printer's circuitry and the printer mechanism operate.

Connector Summary

Figure 2-1 shows how the primary components are connected. Table 2-1 lists and describes the connectors.

Table 2-1. Board Connector Summary

Board	Connector	Function	Pins	See Table
C064 MAIN	CN1	Host I/F (parallel)	36	1-8
	CN4	Control panel	11	A-4
	CN5	Head 1	17	A-5
	CN6	Head 2	15	A-6
	CN7	CR and PF motors	12	A-7
	CN8	HP signal	2	A-8
	CN9	PE signal	2	A-9
	CN10	AC power input	4	A-10
PEBFIL-II	CN1	AC power output	2/3	
Control Panel	CN1	Control panel	11	

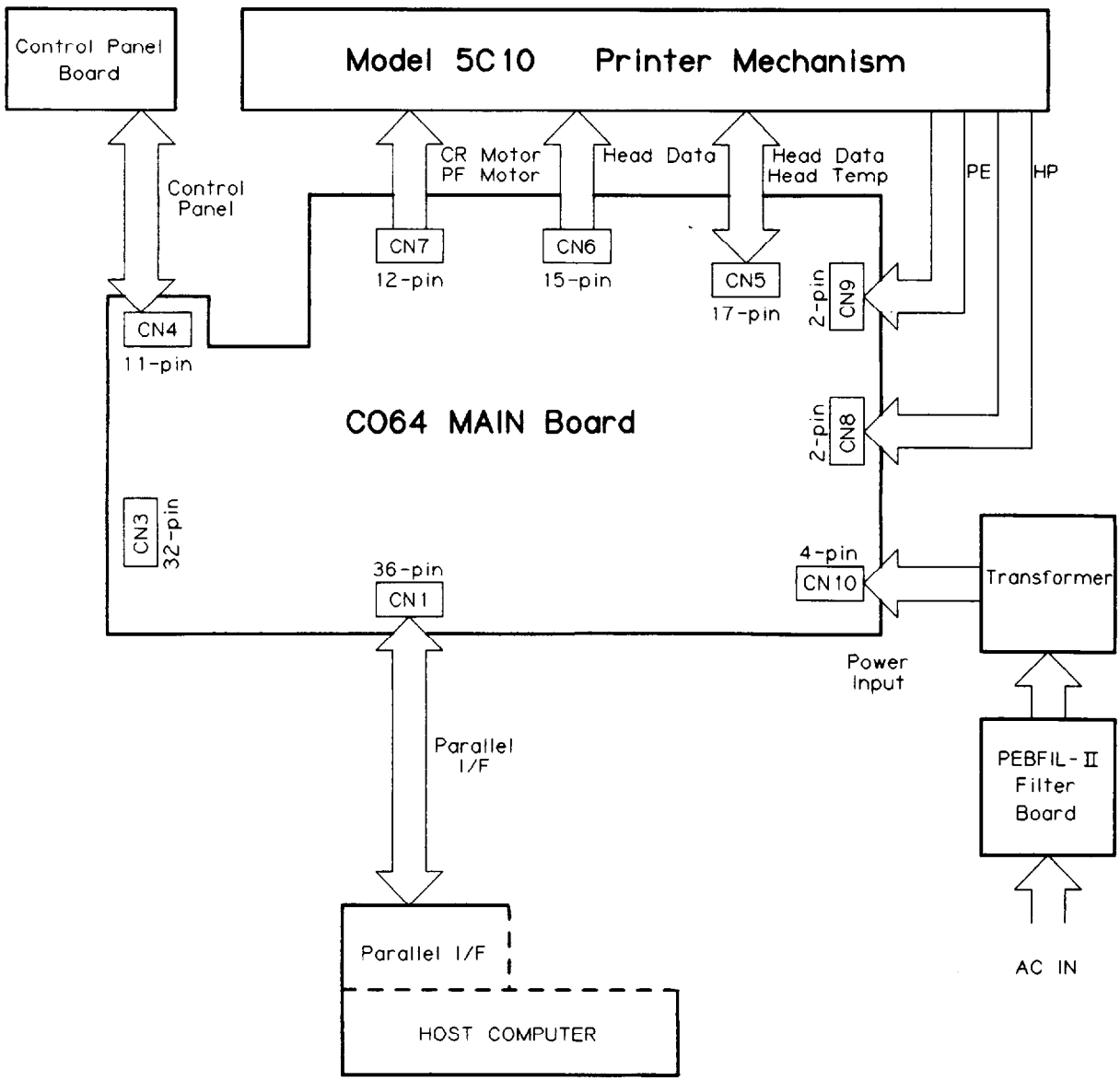


Figure 2-1. Cable Connections

Note:
CR = carriage
PF = paper feed
HP = home position

Overview of Printer Mechanism Operation

The model 5ClO printer mechanism is a serial, impact, dot matrix printer mechanism that prints at 180 dots per inch (dpi) in both the horizontal and vertical directions. Figure 2-2 is a block diagram of the printer mechanism.

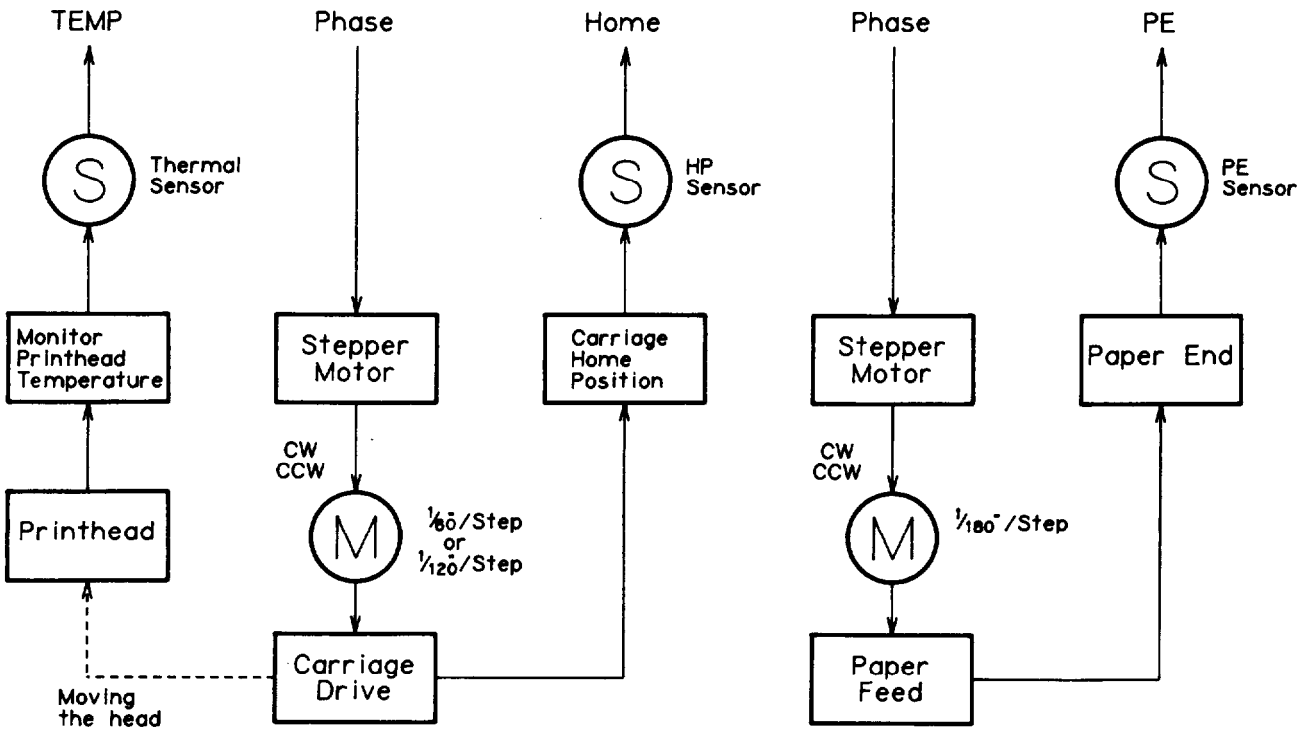


Figure 2-2. Printer Mechanism Block Diagram

Note:

cw = clockwise
CCW = counterclockwise
HP = home position
PE = paper end

Sensors

The printer mechanism contains the following sensors:

- Paper end (PE) sensor
- Home position (HP) sensor
- Thermal sensor

Paper end sensor

The paper end sensor switch goes on when the paper runs out. One switch detects when the paper is out for both the rear and bottom paper slots. Figure 2-3 illustrates the paper end sensor.

Paper out → on → LOW level
Paper present → off → HIGH level

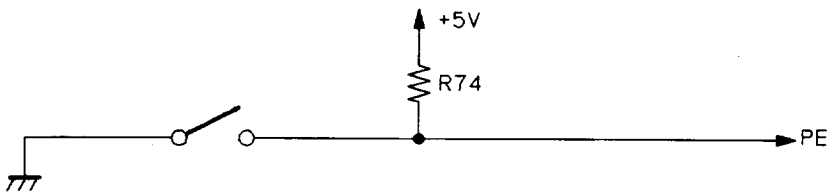


Figure 2-3. Pap End Sensor

Home position sensor

The home position sensor switch is on when the carriage is at the home position. This sensor determines the reference position for the carriage drive. Figure 2-4 illustrates the home position sensor.

Home position → on → LOW level
Other position → off → HIGH level

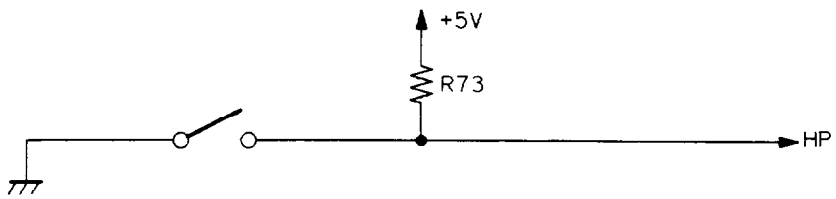


Figure 2-4. Home Position Sensor

Thermal sensor

The thermal sensor in the printhead monitors the printhead's temperature. If the temperature exceeds a predetermined upper limit, the printer stops printing until the temperature drops to a predetermined value. Then printing resumes. Figure 2-5 illustrates the thermal sensor circuit.

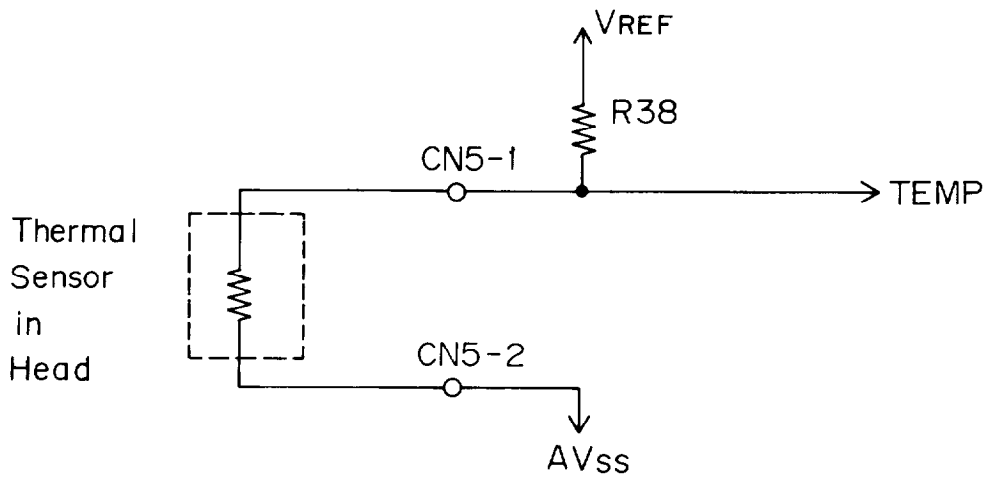


Figure 2-5. Thermal Sensor

Motors

The LQ-200/AP3000 has the following motors:

- Carriage motor (stepper motor)
- Paper feed motor (stepper motor)

Carriage motor

The carriage motor moves the carriage right and left along the platen. It is a four-phase, 48-step motor that uses either 1-2 or 2-2 phase excitation. An open loop system controls the carriage motor.

Paper feed motor

A four-phase, 48-step motor feeds paper. It advances the paper 1/180th of an inch for each step (phase switch), using 2-2 phase excitation. The CPU controls the paper feed motor under an open loop configuration.

Printhead

Figure 2-6 illustrates dot wire operation. The head driving coil energizes and this drives the dot wire outward. The dot wire strikes the ribbon against the paper, printing a dot.

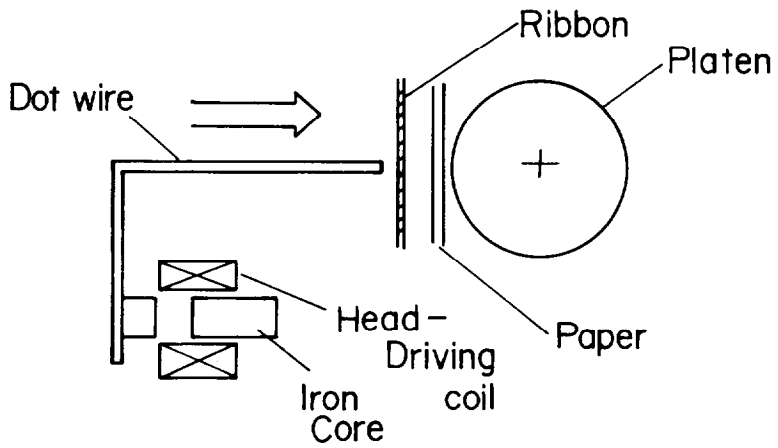


Figure 2-6. Printhead

Circuit Overview

Figure 2-7 is a block diagram of the printer's circuitry.

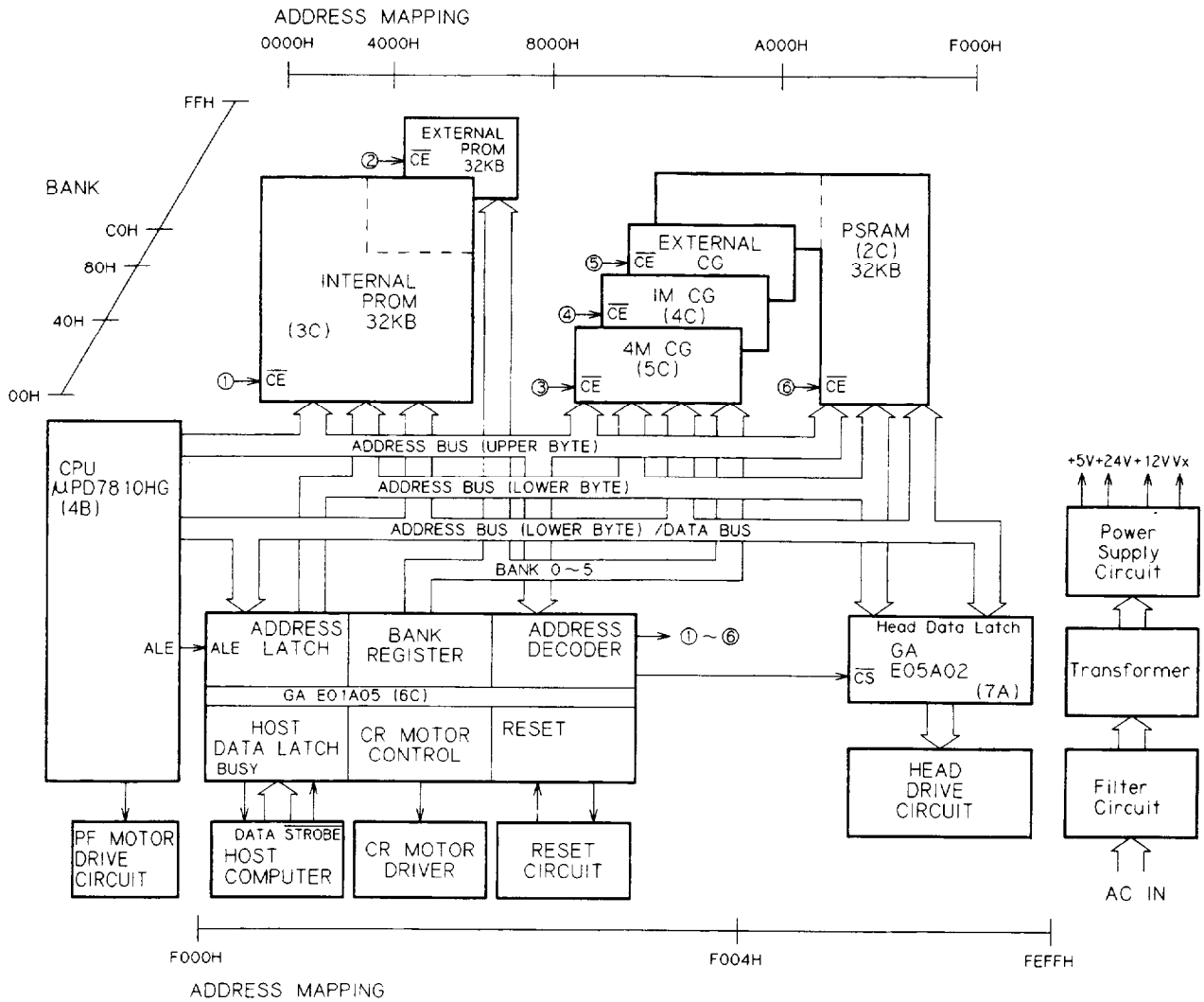


Figure 2-7. Circuit Block Diagram

Note:
CG = character generator
GA = gate array

Firmware Overview

The printer uses a µPD7810HG CPU with 64KB of address space. Figure 2-8 shows a memory map of the address space.

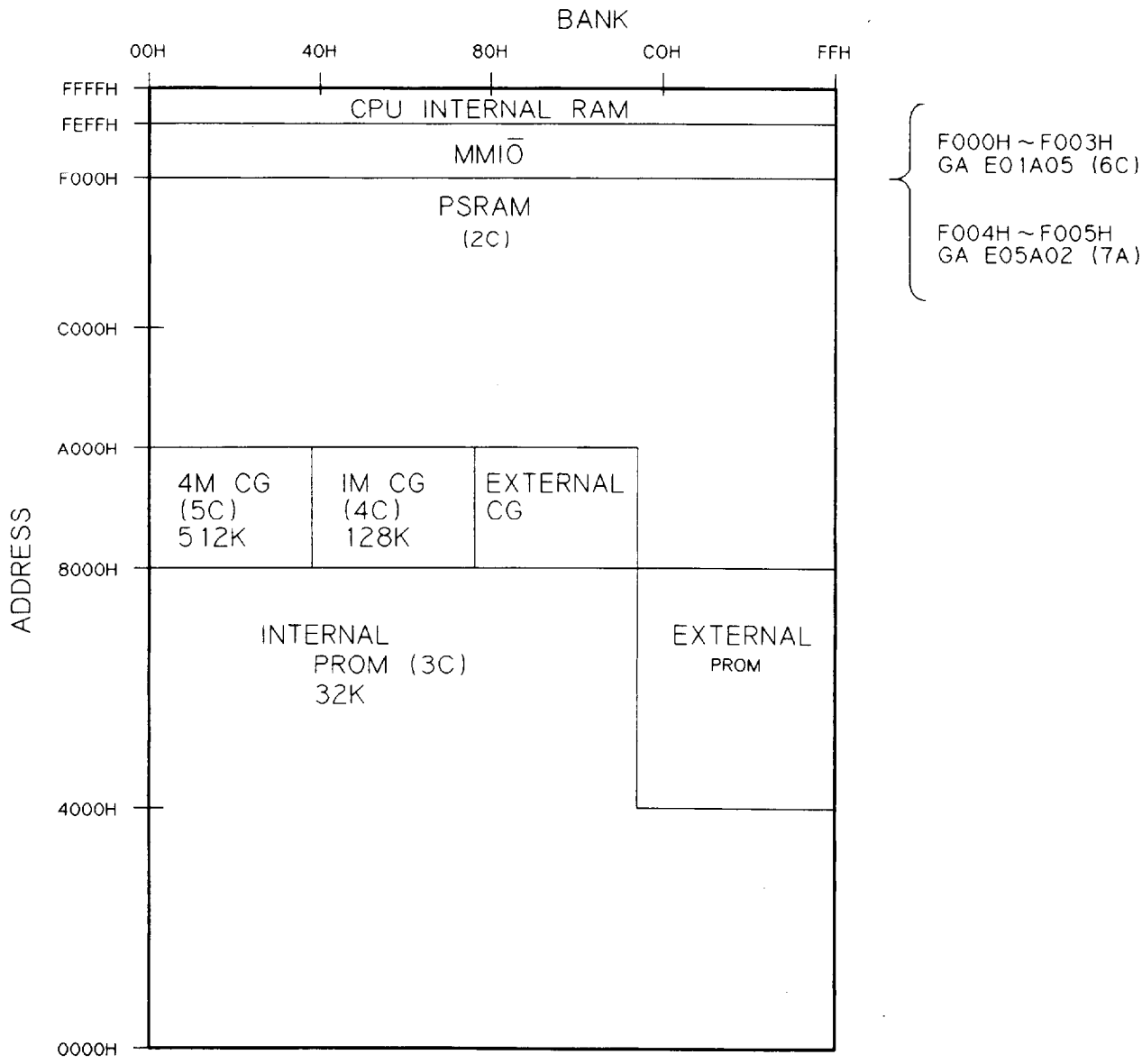


Figure 2-8. Memory Map (64 KB.)

Note:
CG = character generator
GA = gate array

Principles of Operation

This section describes the operation of the printer's components, including the power supply circuit, the reset circuit, the carriage mechanism, the paper feed mechanism, and the printhead.

Power Supply Circuit

This section describes how the power supply circuit operates.

Power supply circuit block diagram

120 VAC is applied through the filter circuit to the step down transformer, which generates 26 VAC. The 26 VAC is input to the power supply circuit on the main board.

The 26 VAC is converted into approximately 36 VDC via the full wave rectifier and smoothing circuit. The 36 VDC is input to the regulator circuits, which supply +24 and +5 VDC to the control circuit. The +24 and +5 VDC are also supplied to the Vx voltage circuit. The Vx voltage circuit is applied to the control circuit.

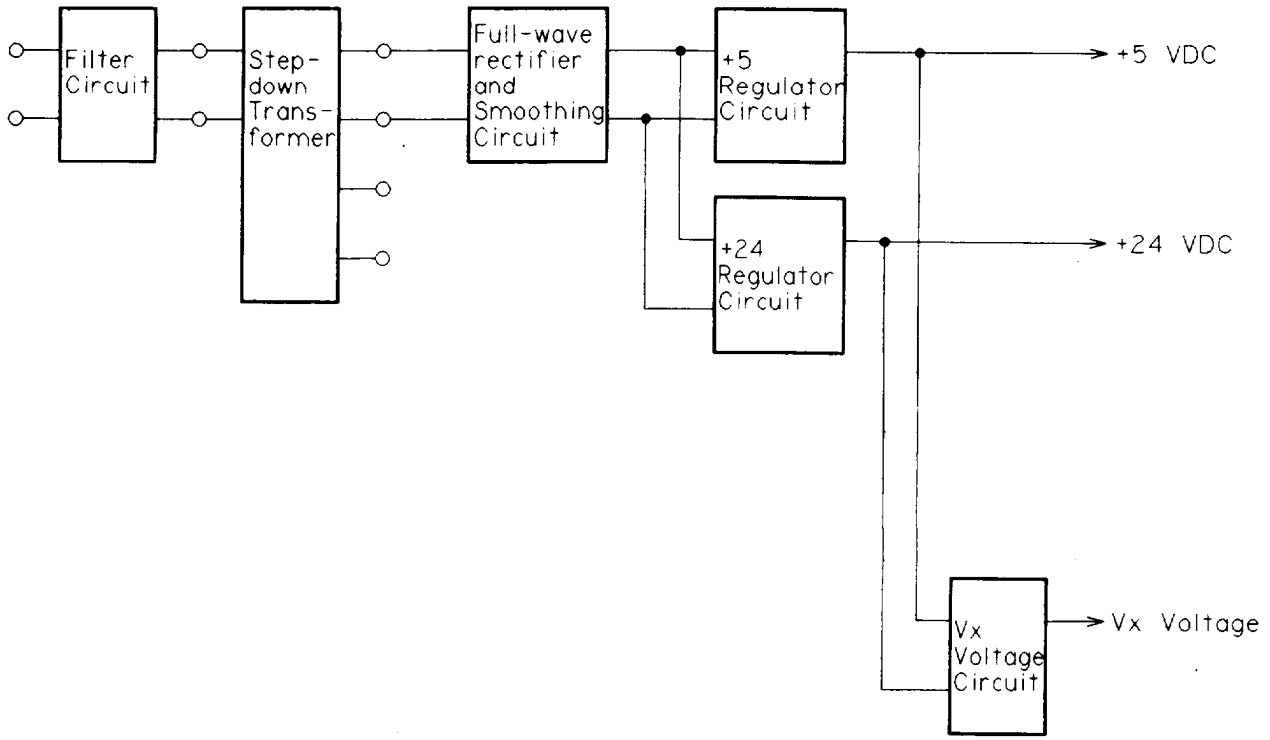


Figure 2-9. Power Supply Circuit Block Diagram

Table 2-2. Power Supply Applications

Voltage	Application
+5 V	Logic circuit, etc.
+24 V	Carriage motor drive voltage Paper feed motor drive voltage Printhead drive voltage
Vx	Reset circuit Printhead data signal pull-up voltage Paper feed motor phase data signal pull-up voltage

Chopper-type switching regulator circuit

The power supply circuit includes a chopper-type switching regulator. The step down circuit operates as follows:

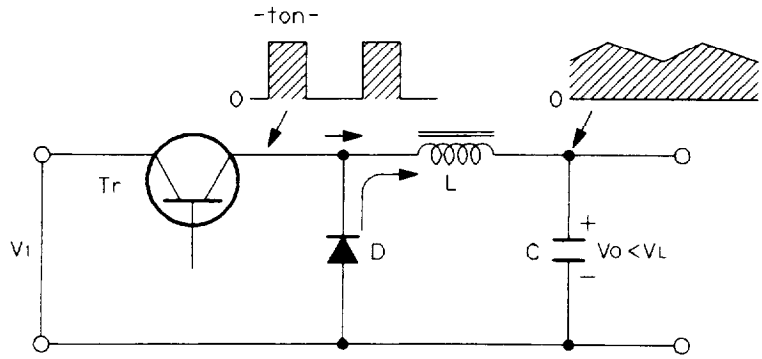


Figure 2-10. Step Down Circuit

Figure 2-10 shows the chopper-type step down switching regulator circuit. When the transistor is on, voltage Vi is applied to coil L and capacitor C. Load current I1 flows and electromagnetic energy Wl accumulates in choke coil L. When the transistor goes off, energy Wl is applied to the load via flywheel diode D. Therefore, output voltage Vo is the average value:

Thus, Vo can be held constant by controlling Ton. Figure 2-11 shows the step down timing.

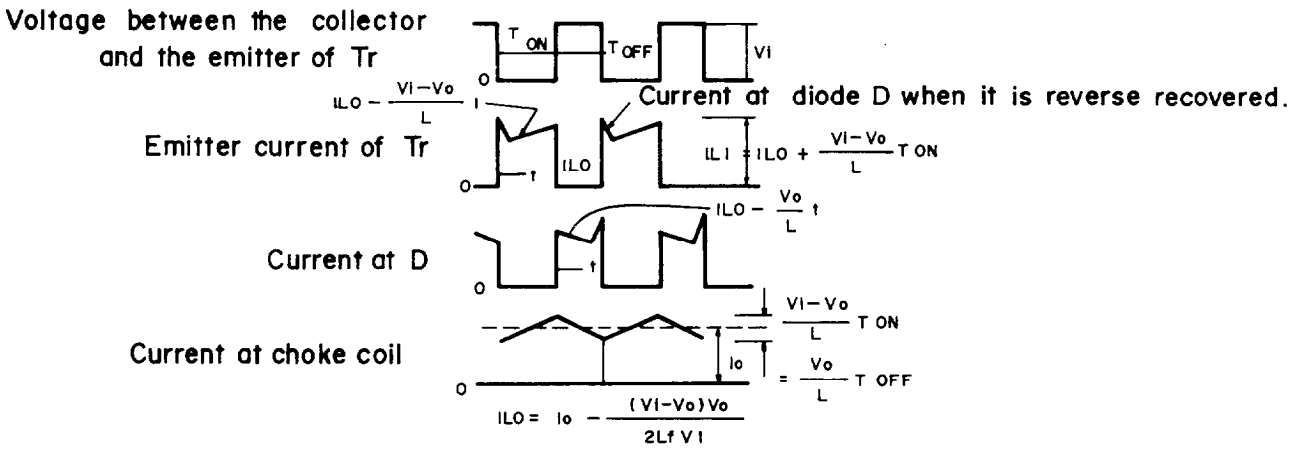


Figure 2-11. Step Down Timing

Filter circuit

The AC line voltage passes through the power switch and is input to the filter circuit. The PEBFIL-II board includes a fuse, Fl. The filter circuit attenuates external noise and inhibits the noise generated in the printer from propagating through the AC line. Cl or C2 drains leakage current between the primary coil and the case. Figure 2-12 shows the filter circuit.

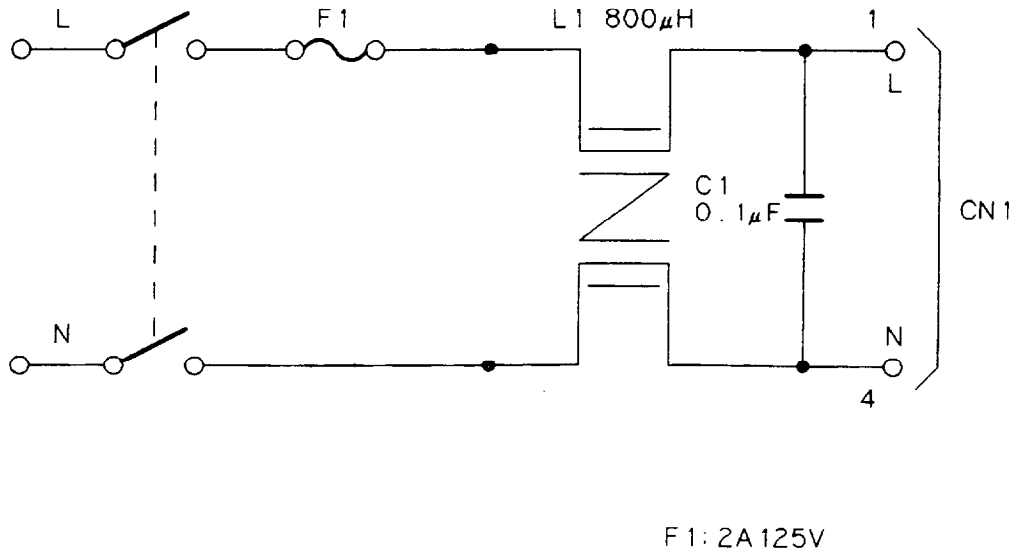


Figure 2-12. PEBFIL-II Filter Circuit Board

Transformer

The 120 **VAC** that passes through the filter circuit is transformed into 26 **VAC** and supplied to the main board. Figure 2-13 is a schematic drawing of the power transformer.

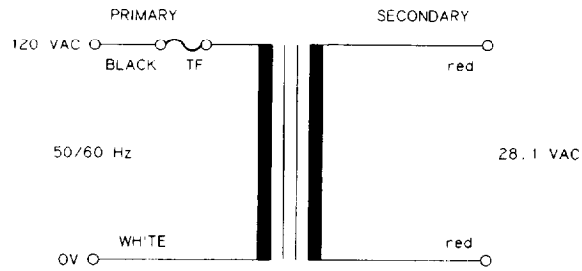


Figure 2-13. Transformer Circuit

Rectifier and smoothing circuit

Diode bridge DB1 full wave rectifies the 26 VAC from the transformer's secondary coil. Then smoothing capacitor C40 converts the 26 VAC into approximately 36 VDC. The +24 and +5 VDC voltages are converted from this DC voltage. The DC voltage is used as the power supply voltage for the switching regulator circuit at the next stage.

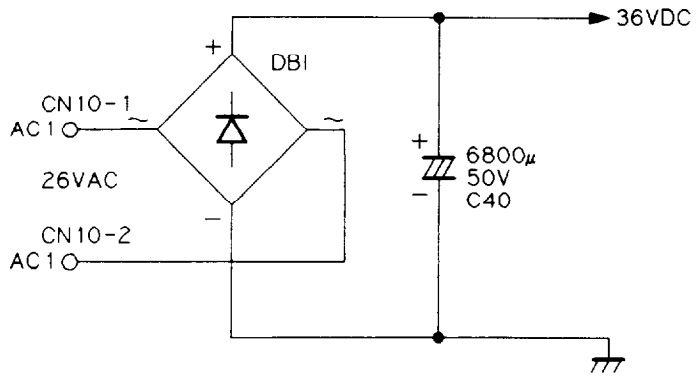


Figure 2-14. Rectifier and Smoothing Circuit

+5 VDC regulator circuit

An NJM2355 switching regulator circuit is used for constant-frequency pulse width modulation. The rectifier and smoothing circuit employs an NJM2355 circuit configured as a chopper-type switching regulator circuit. Figure 2-15 illustrates the +5 VDC regulator circuit.

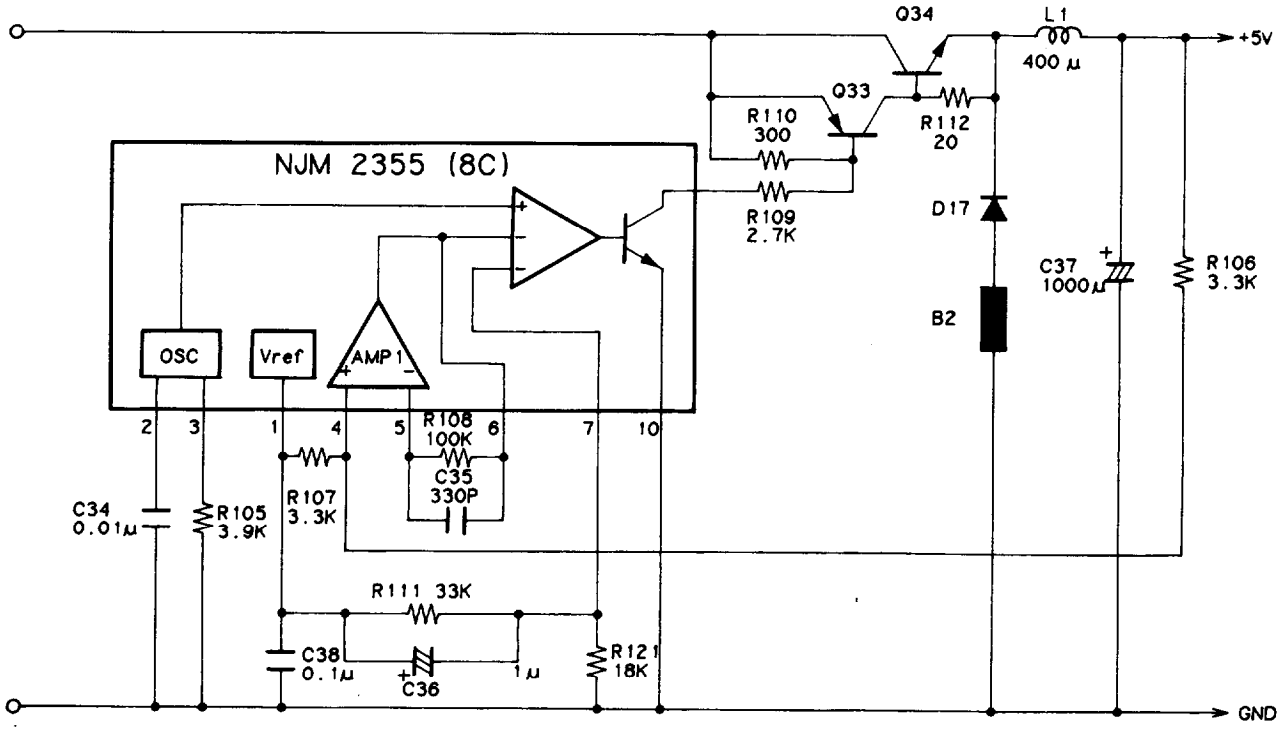


Figure2-15. +5 KDC ***Regulator Circuit***

The +5 VDC regulator circuit has a built-in oscillator. External components connected to pins 2 and 3 determine the oscillation frequency. R105 and C34 cause the circuit to oscillate at about 30 KHz. Figure 2-16 shows the oscillator waveform.

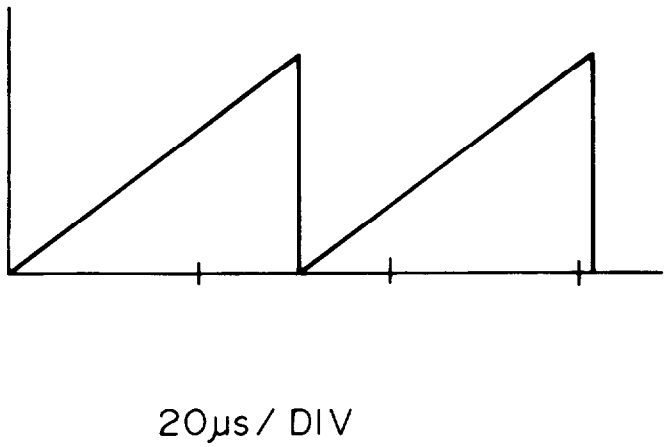


Figure 2-16. Oscillator Waveform

AMP1 in the +5 VDC regulator circuit is an error amplifier that monitors the output voltage. Figure 2-17 shows the constant voltage control circuit. Pin 1 of the +5 VDC regulator circuit provides a 5 V reference output (Vref). Vref is applied to the negative terminal of AMP1. The error amplifier adjusts its output according to the voltages at its positive and negative input terminals. This keeps the positive terminal voltage at 5 V.

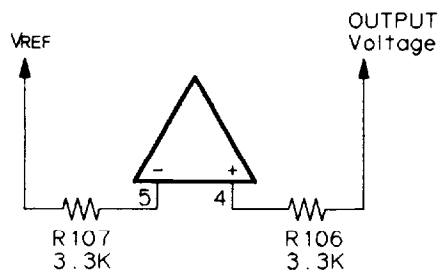


Figure 2-17. Constant Voltage Control Circuit

Figure 2-18 shows the output from AMP1. When the voltage at pin 4 becomes higher than that at pin 5 (over-voltage), pulse width modulation modulates the AMP1 output current and reduces the circuit's output voltage. R108 and C35 compensate for phase lag in the error amplifier, preventing abnormal oscillation. (The next section describes pulse width modulation.)

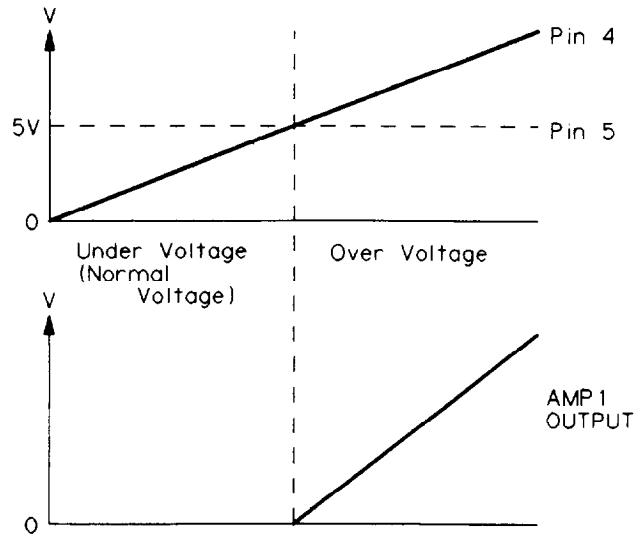


Figure 2-18. AMP1 Output Control (+5 KVC)

Pulse width modulation circuit

This section describes how the pulse width modulation (PWM) comparator operates. Figure 2-19 shows the internal circuitry of the NJM2355 integrated circuit.

In circuit 1, the output from AMP1 flows into the negative terminal of PWM comparator 1. In circuit 2, the outputs from AMP2 and AMP3 flow into the negative terminal of PWM comparator 2 without wired OR. The dead-time control voltage is input to additional negative terminals of both comparators. At the same time, a saw-tooth waveform from the oscillator is input to the positive terminals. The saw-tooth waveform causes the comparators to generate pulses as shown in Figure 2-20.

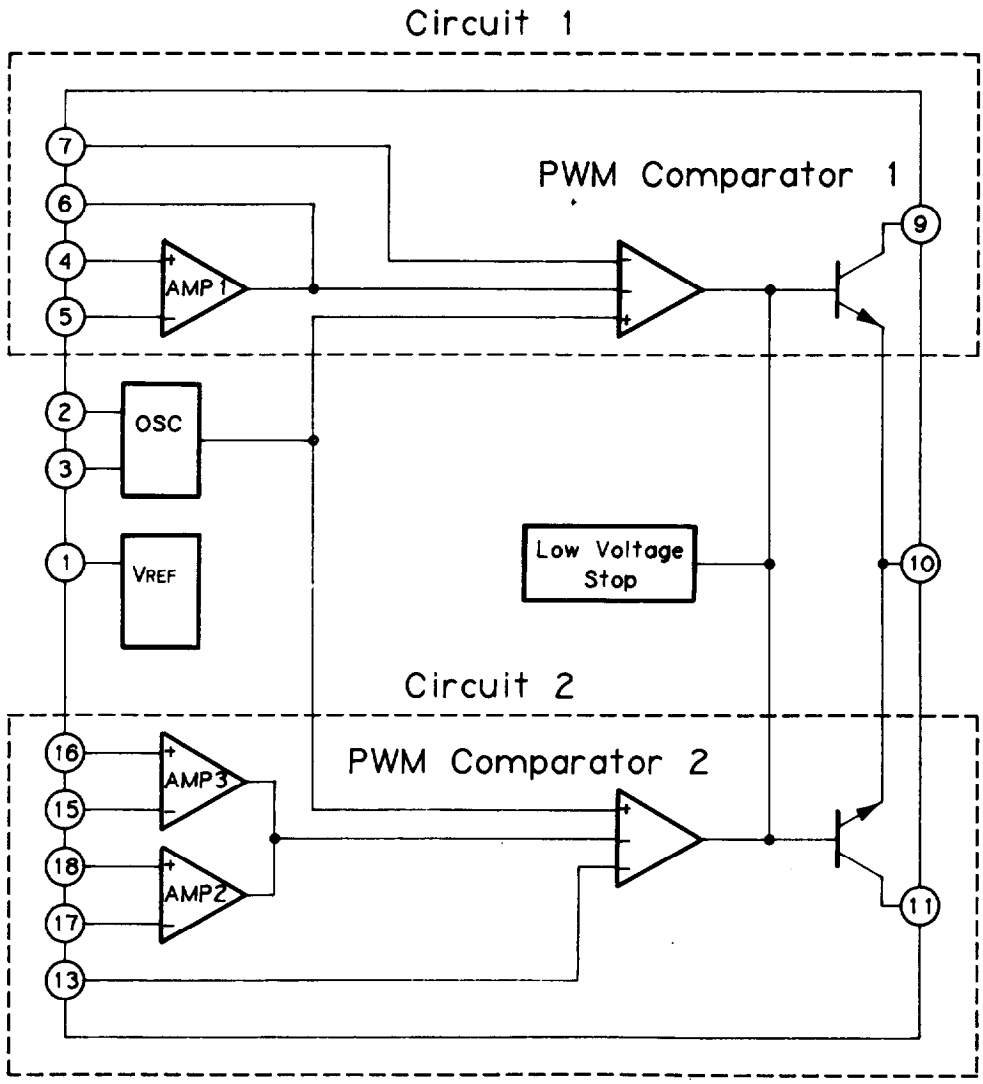


Figure 2-19. NJM2355 Internal Circuit

As shown in Figure 2-20, the dead-time control voltage controls the potential at the NJM2355 circuit when it is lower than the preset voltage or current value. When it exceeds the preset voltage, the error amplifier lowers it below the preset voltage.

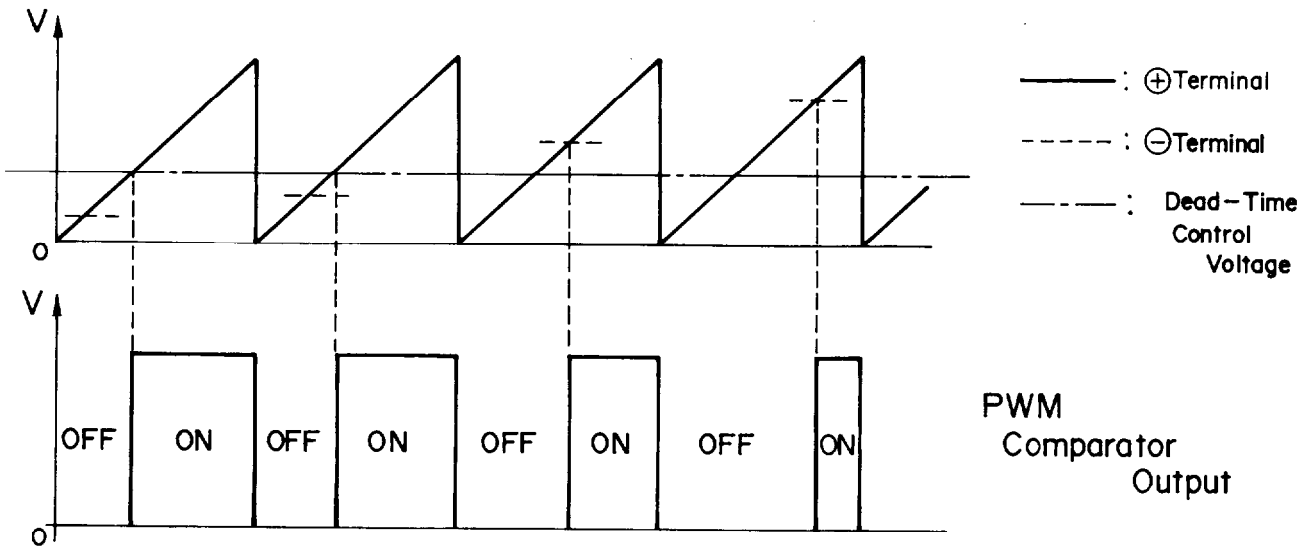


Figure **2-20.** ***Output Transistor Drive Waveform***

+24 VDC regulator circuit

The +24 VDC regulator circuit has approximately the same function and employs the same oscillation circuit as the +5 VDC regulator circuit. In the +24 VDC regulator circuit, error amplifier AMP2 is used for over-current control and AMP3 is used for constant voltage control. Figure 2-21 shows the +24 VDC regulator circuit.

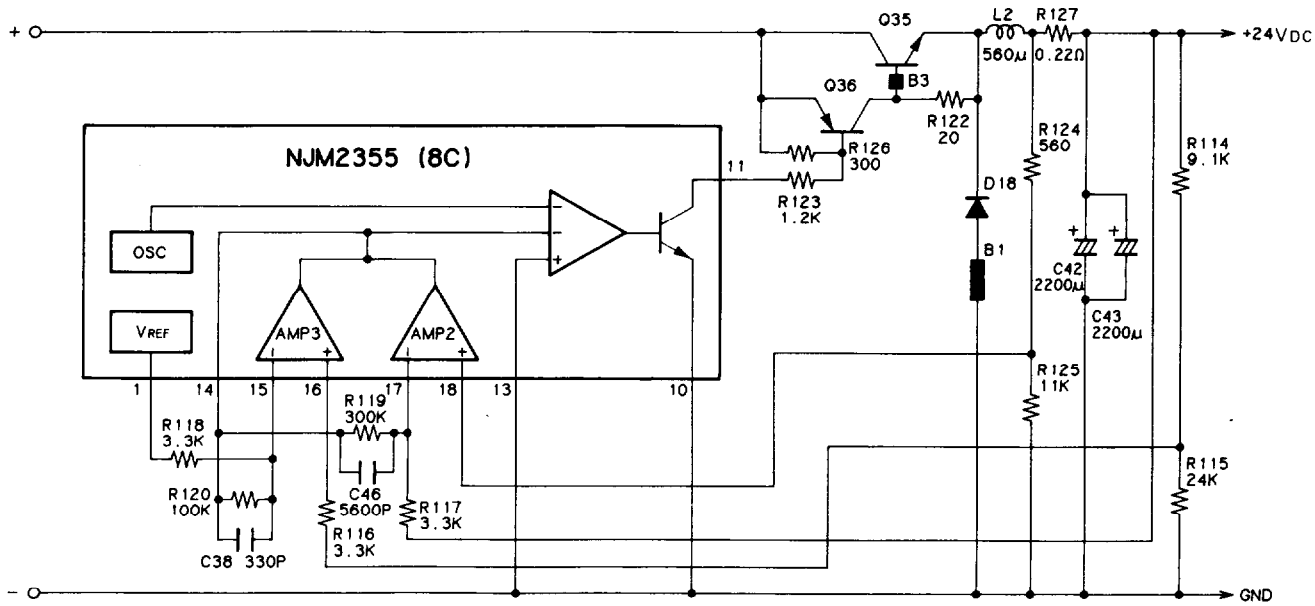


Figure 2-21. +24 VDC Regulator Circuit

Error amplifier AMP3 operates as follows. The negative terminal of AMP 3 receives Vref (5 V) and the voltage applied to the positive terminal is adjusted to 5 V. As shown in Figure 2-22, the output voltage is:

$$\frac{\text{Vref}}{\text{R115}}(\text{R114}+\text{R115}) = \frac{5\text{ V}}{2\text{ 4K ohms}}(9.1\text{ K ohms} + 2.4\text{K ohms}) = 23.96\text{ V}$$

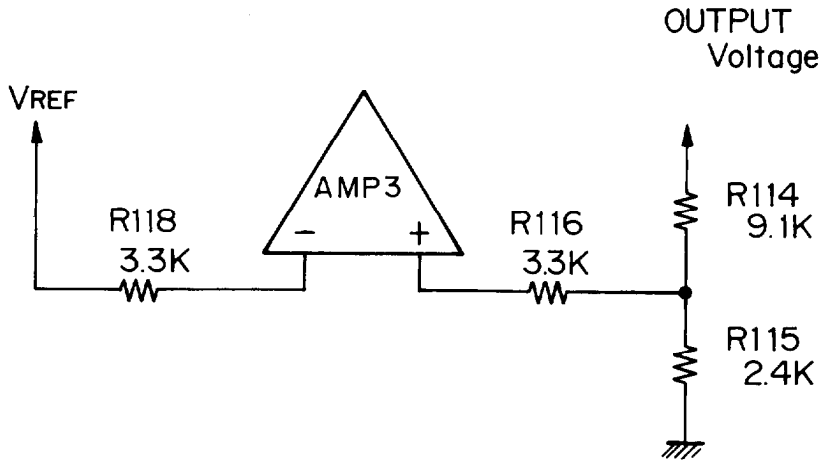


Figure 2-22. Constant Voltage Control (+24 KDC)

AMP 2 controls over current as follows. +24 V is applied to the negative terminal. The positive terminal receives an equal voltage when a negative current of the following value flows:

$$\frac{\text{Output Voltage}}{\text{R125}}\text{ R124/R127} = \frac{+24\text{ V}}{11\text{K ohms}}\ 560\text{ ohms} / 0.22\text{ ohms} = 5.55\text{ A}$$

If the current exceeds this value, over-current protection goes on to reduce the output voltage. Figure 2-23 illustrates over-current protection. Because pin 3 of IC1 is grounded, dead time does not apply in this case.

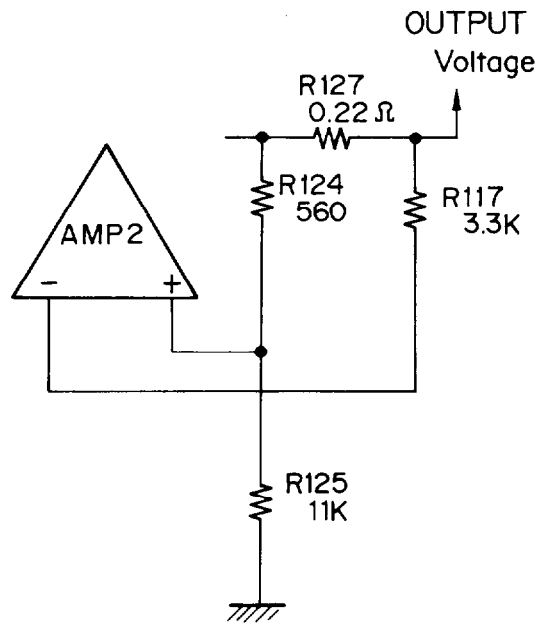


Figure 2-23. Over-Current Protection

Vx voltage supply circuit

When the +24 V power supply line reaches 18.6 V (18 V + 0.6 V), transistors Q25 and Q26 go on and Vx (+5 v) is output. If the +24 V power supply line drops below 18.6 V, Q25 and Q26 go off and the Vx voltage is extinguished.

The Vx voltage prevents abnormal operation when you turn the printer on or off. When you turn the printer on or off:

- The Vx voltage circuitry is reset and does not drive the printer until the power supply stabilizes.
- Full-ups for the printhead signal lines prevent printhead malfunctions.
- Pull-ups for the paper feed motor signal lines prevent paper feed motor malfunctions.

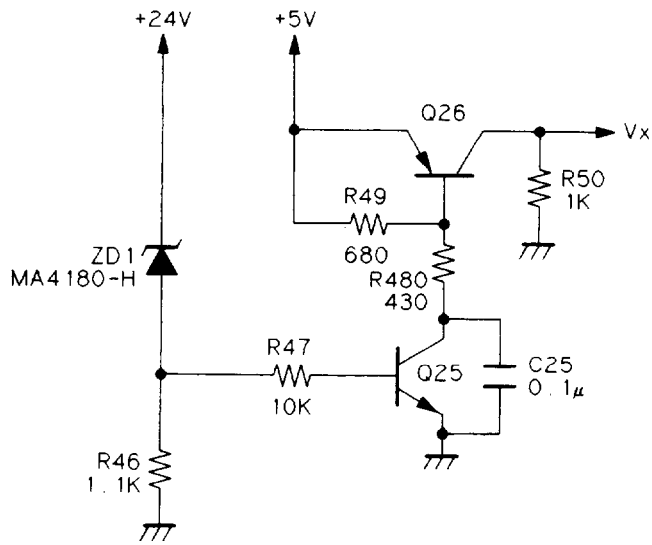


Figure 2-24. Vx Voltage Circuit

Reset Circuit

The reset circuit sends the -RESET signal to the -RESET terminal of CPU µPD7810HG (4B). The -RESET signal acts as a hardware initialization signal. Figure 2-25 shows the reset circuit.

The reset circuit outputs the -RESET signal when any of the following occur:

- You turn the printer on or off.
- The host interface or an optional interface inputs the -INIT signal.

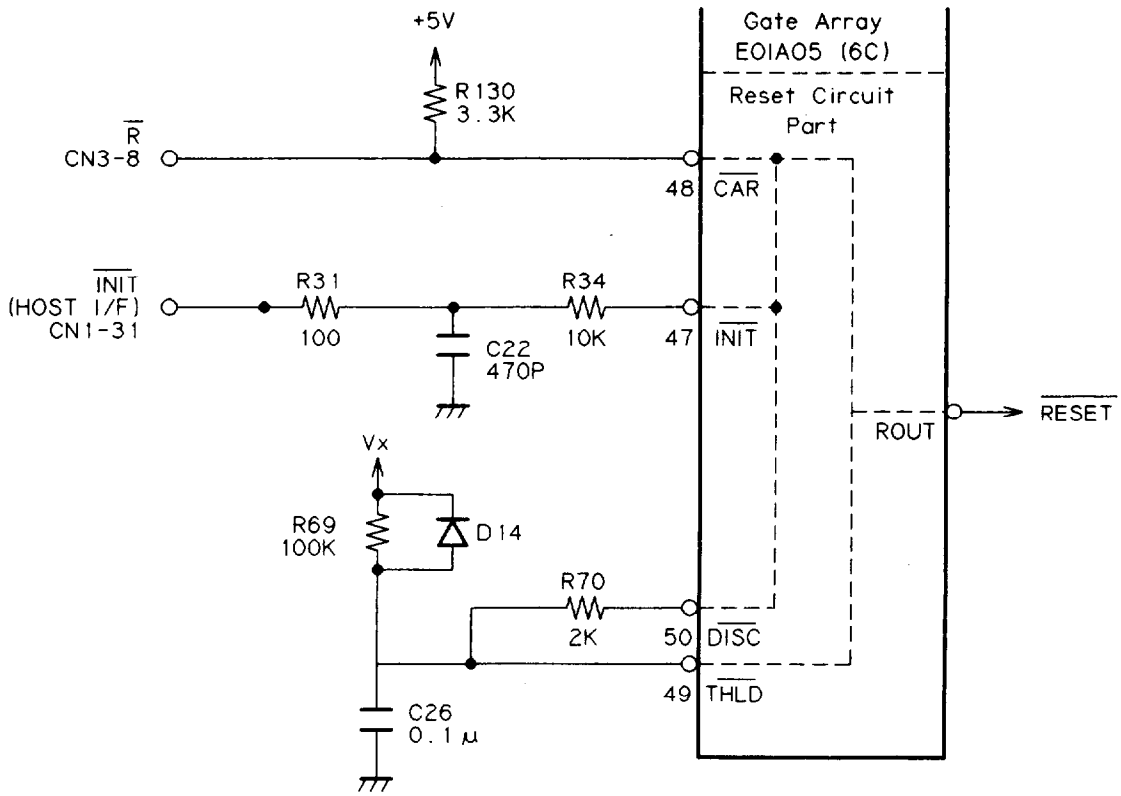


Figure 2-25. Reset Circuit

Power on or off

D14, R69, and C26, shown in Figure 2-25, comprise an on/off reset circuit. This circuit causes the CPU to begin operation from address 0000H when you turn on the, power and it prevents CPU malfunctions when you turn off the power.

The rising edge of the Vx voltage cancels the -RESET signal following a constant-time delay (R69 x C26) produced by the gate array, resistor R69, and capacitor C26. The falling edge of the Vx voltage activates the -RESET signal by discharging capacitor C26 via diode D14.

Gate array pins 49 to 51 are used for waveform shaping.

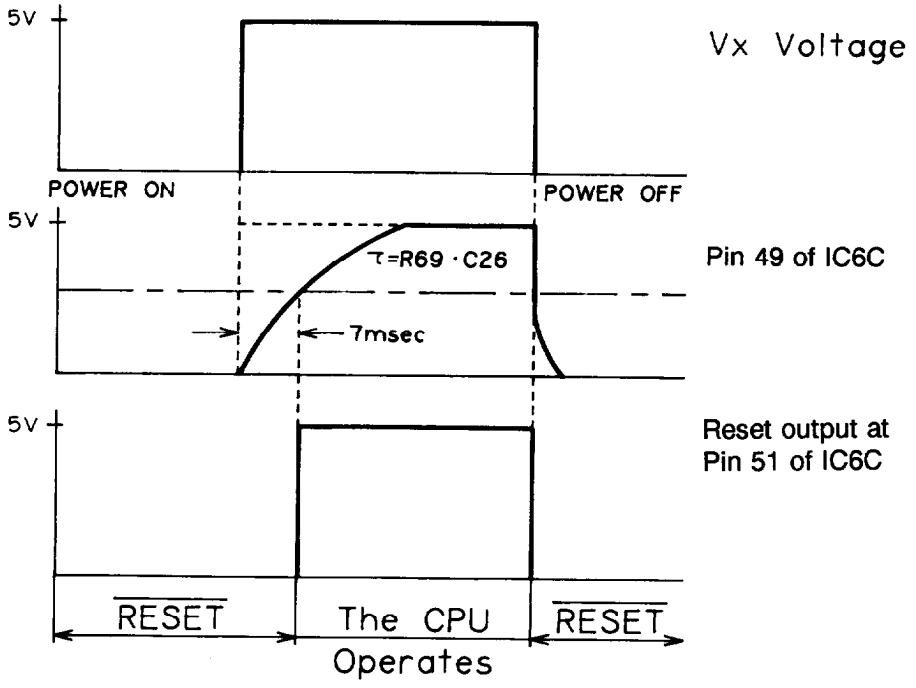


Figure 2-26. -RESET Output

-INIT signal input from CN1

The external -INIT signal (50 psec or more) passes through the low-pass filter by R31 and C22. The signal is wave shaped within the gate array (pin 47, ICGC) so that the -DISC terminal is set to LOW. This causes capacitor C26 to discharge, setting the -THLD terminal to LOW. Then the -Rout terminal outputs the -RESET signal.

ROM cartridge installation and removal

Figure 2-27 shows the -RESET pulse generation process after you install a ROM cartridge. A LOW signal flows into the -CAR terminal of the gate array (6C, the -DISC terminal (1) outputs a LOW signal, and the -Rout terminal (2) outputs a -RESET signal.

As the -DISC terminal goes LOW, capacitor C26 discharges at a time constant of R70 x C26 (3). When the C26 discharge reduces the potential at the -THLD terminal to the threshold voltage Vth, the -RESET signal is canceled (4) and the -DISC terminal goes HIGH (5). After the -DISC terminal goes HIGH, the Vx voltage again discharges C31 at a time constant of R69 x C26 (6).

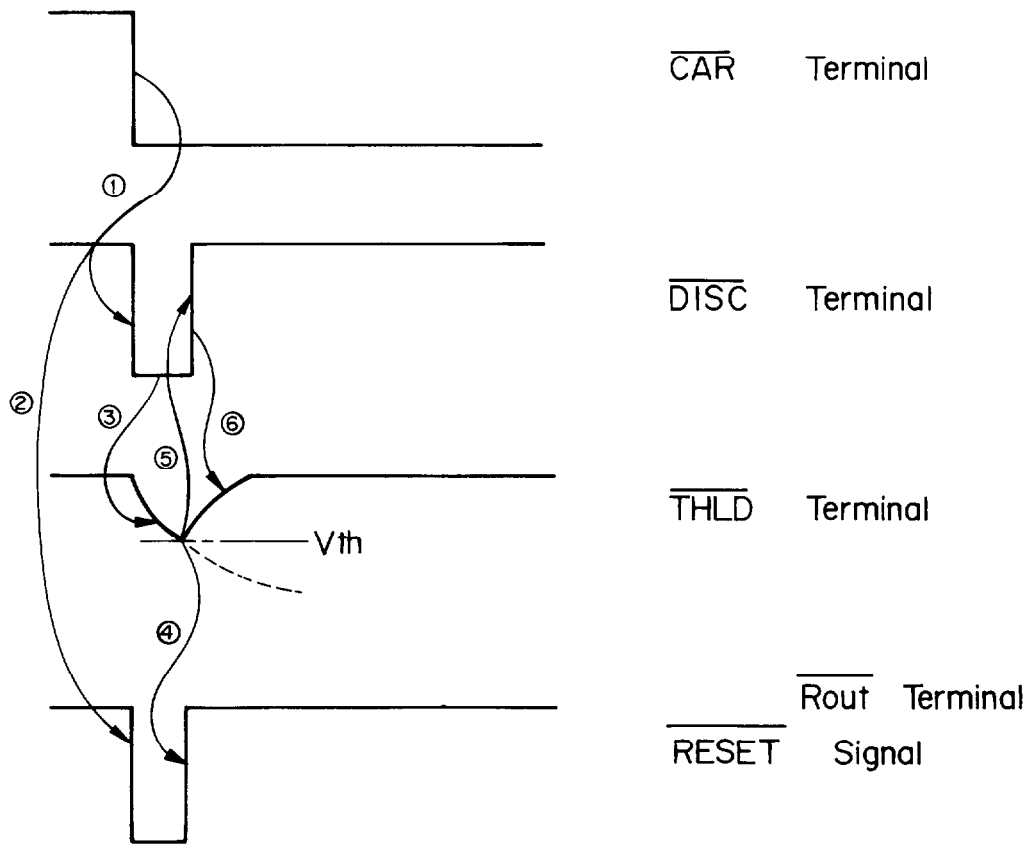


Figure 2-27. -RESET Pulse Oscillation Process After ROM Cartridge Installation

Figure 2-28 shows the -RESET pulse oscillation process after you remove a ROM cartridge. The -CAR terminal of the gate array (6C) receives a HIGH signal, the -DISC terminal outputs a LOW signal (1), and the -Rout terminal outputs a -RESET signal (2). The rest of the process is similar to what occurs after ROM cartridge installation. See the description above.

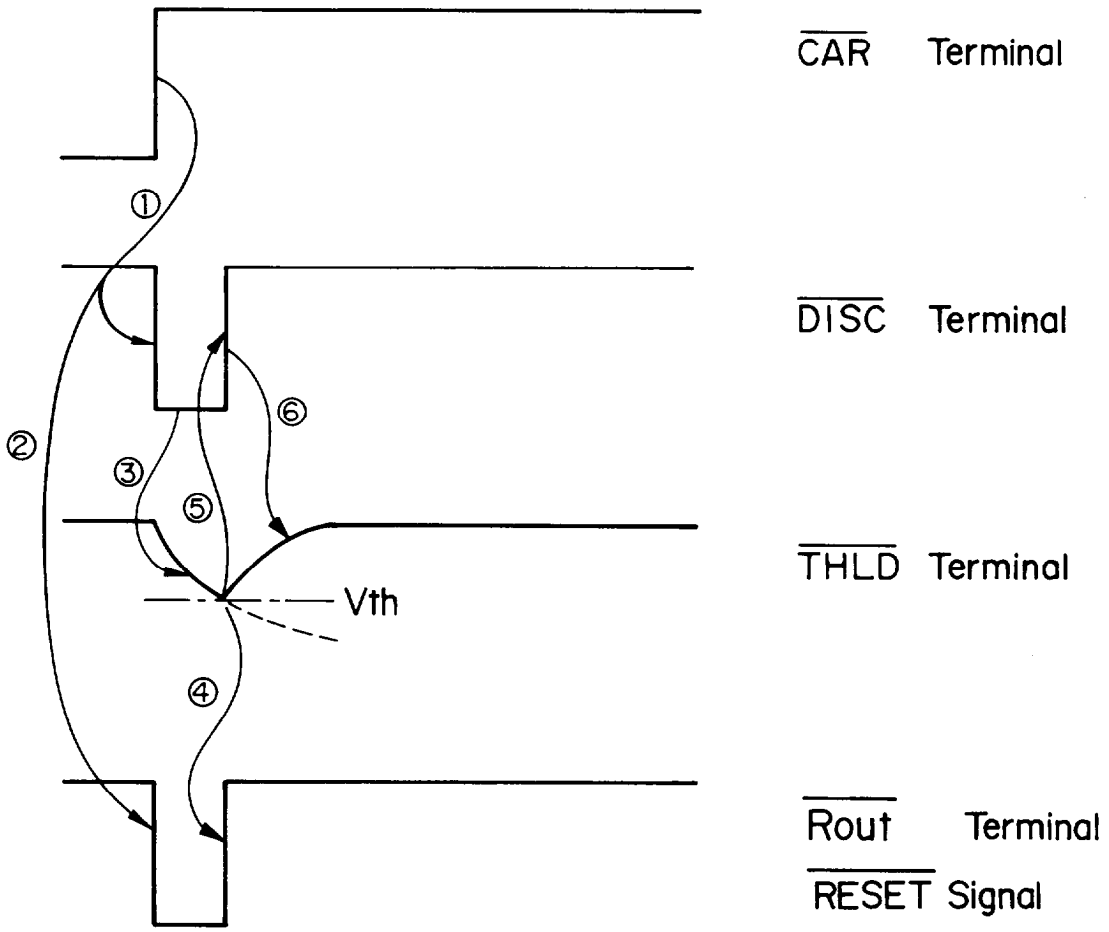


Figure 2-28. -RESET Pulse Oscillation Process After ROM Cartridge Removal

Address Decoder and Bank Register

This section describes the address decoder and bank register.

Address decoder

The address decoder in gate array E01A05 (6C) outputs a chip select signal to the internal PROM (3C), 4MCG (5C), 1MCG (2C), RAM (2C), and HEAD gate array (7A) via address lines AB12 through AB15 and bank lines 7 and 6 in the gate array.

The chip select for -CS is generated with the -RD signal and the chip select for the RAM is generated with the -ALE signal.

Bank register

The printer has a bank register in gate array E0lA05 (6C). The bank lines are set by writing to address F002H and can be checked by reading the same address.

Carriage Operation

This section describes the carriage.

Carriage mechanism

The carriage mechanism includes the printhead, the carriage, the timing belt, the carriage motor, and the platen. Figure 2-29 shows the carriage mechanism.

The timing belt is connected to the bottom of the carriage. It is driven by the carriage motor and moved via the belt-driven pulley. The printhead is mounted on the carriage. The entire unit moves right and left along the guide shaft and guide plate.

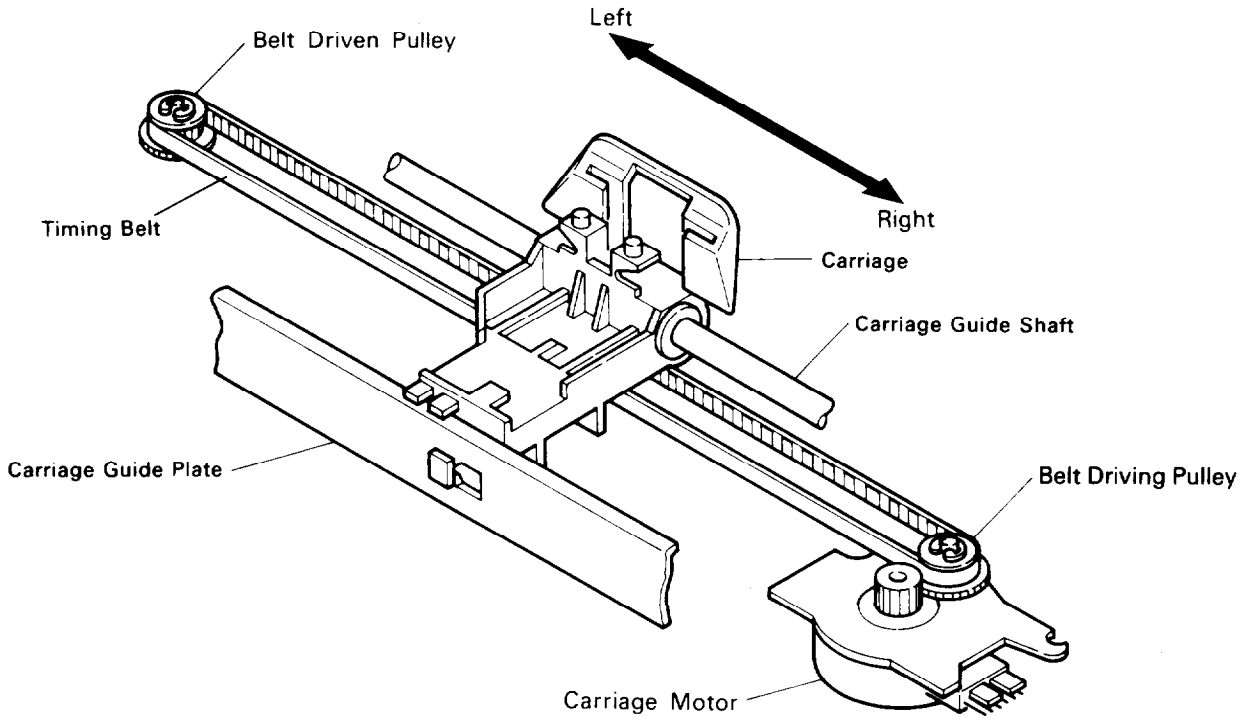


Figure 2-29. Carriage Mechanism

Carriage motor specifications

Type	4-phase, 48pole stepper motor
Drive Voltage	24 V ± 10%
Coil Resistance	21 ohms ± 7% at 77O F (25° C)
Current	0.34 A, maximum (rush current)
	Driving: 0.3 A, typical (triple speed, 24 V)
	0.23 A, typical (double speed, 1.5 speed, normal speed, 24 V)
	Holding: 0.17 A ± 20%

Carriage motor drive circuit block diagram

Figure 2-30 is a block diagram of the carriage motor drive circuit. The CPU does not directly execute phase switching for the carriage motor. Instead, gate array 6C generates the phase switching based on CPU-generated pulses. The STK-6981B circuit stabilizes the drive current.

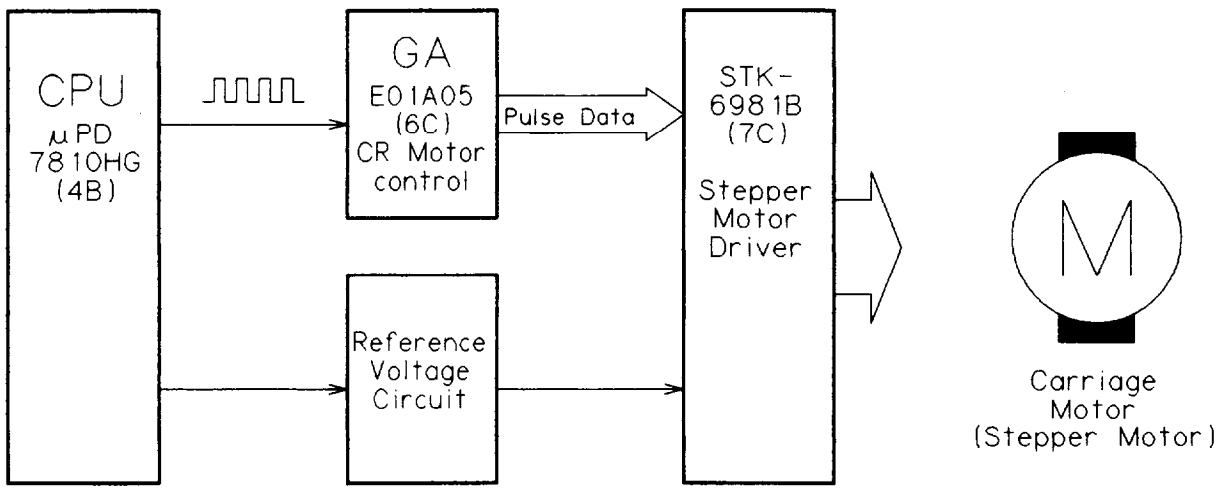


Figure 2-30. Carriage Motor Drive Circuit Block Diagram

Gate array E0lA05 in the carriage motor drive circuit

Gate array E0lA05 (6C) implements phase switching for the carriage motor, which is a stepper motor. The gate array first sets the excitation type (2-2 or 1-2 phase) and rotation direction (clockwise or counterclockwise). When the CPU outputs a pulse to the gate array's TM terminal, the gate array executes auto phase switching, which drives the stepper motor. Figure 2-31 shows this process.

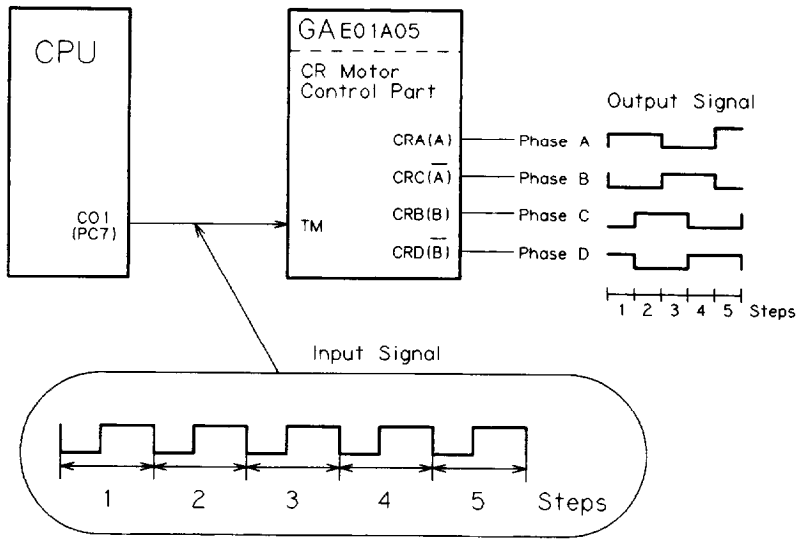


Figure 2-31. Gate Array Operation, 2-2 Phase Excitation

Carriage motor drive circuit

The LQ-200/AP3000 includes an STK-6981B, a hybrid integrated circuit used to drive stepper motors. The STK-6981B (ICSC) circuit drives the stepper motor under a constant current. An external voltage level determines the value of the current. STK-6981B operation is divided into equivalent phases AB and CD. This section describes phase CD. Figure 2-32 shows the carriage motor drive circuit. Figure 2-33 shows the STK-6981B circuit diagram.

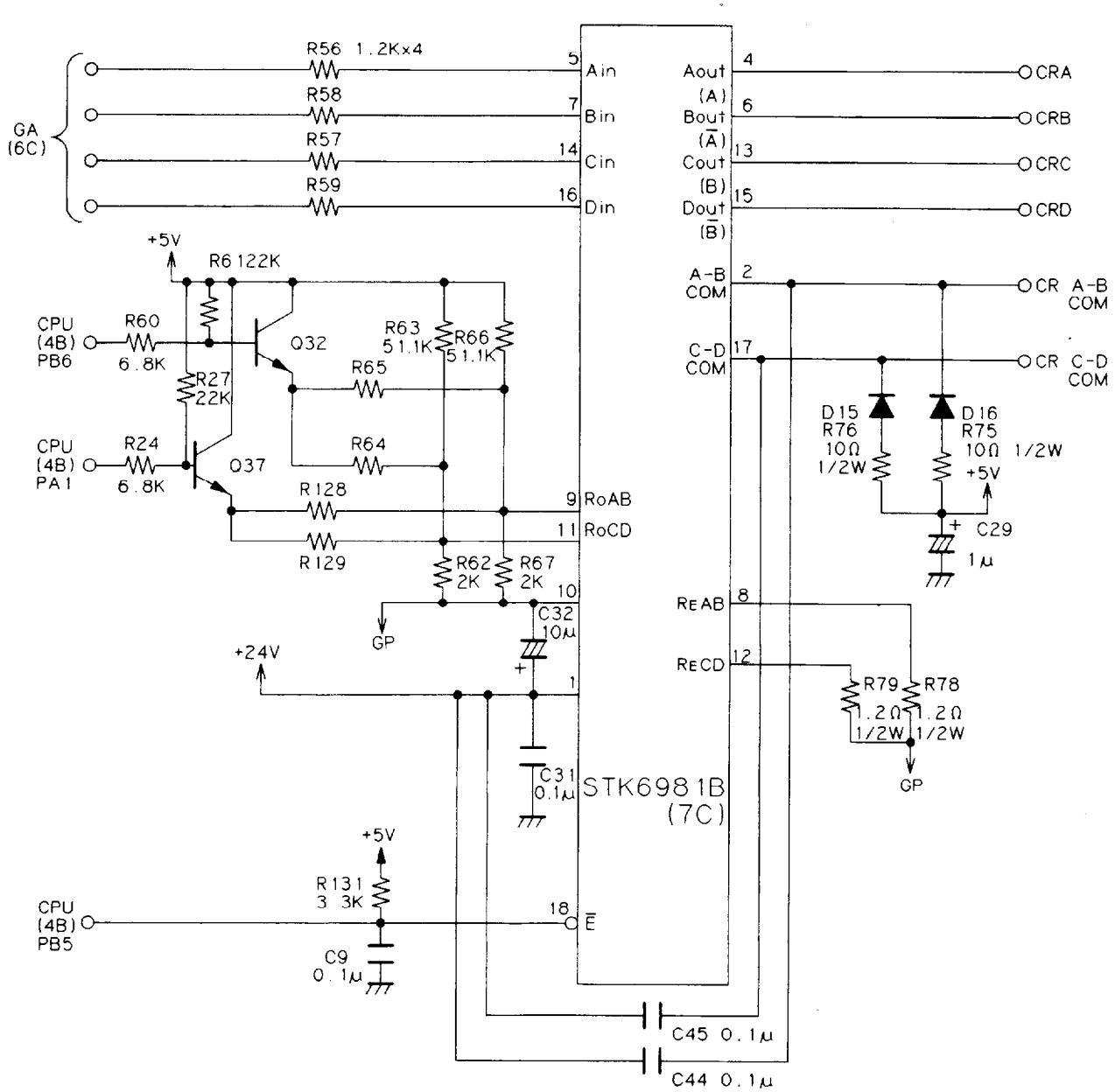


Figure 2-32. ***Carriage Motor Drive Circuit***

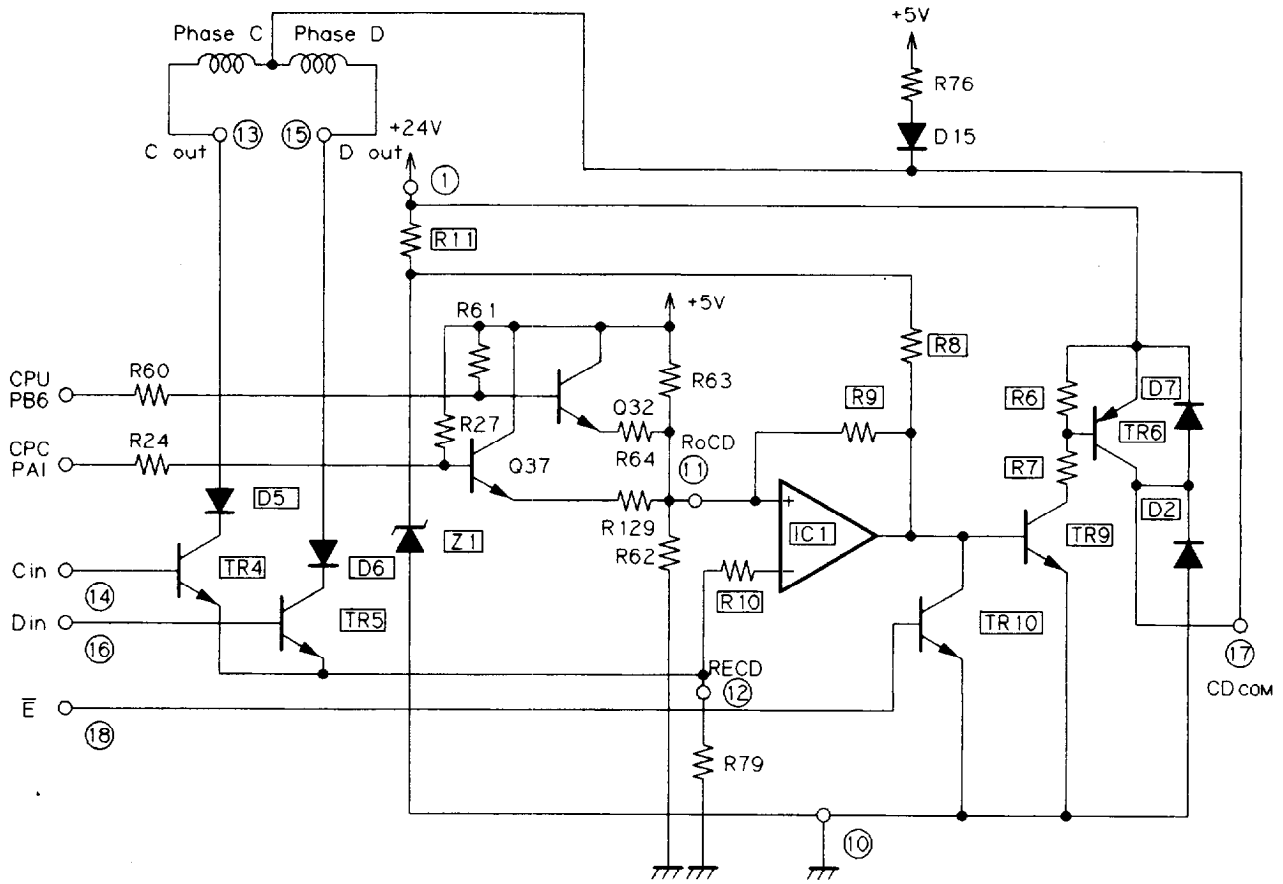


Figure 2-33. STK-6981B Circuit Diagram

Note:

Phase AB is equivalent to phase CD, which is shown in the figure above.

Reference voltage generation circuit

Figure 2-34 shows the reference voltage generation circuit. Table 2-3 shows the reference voltages.

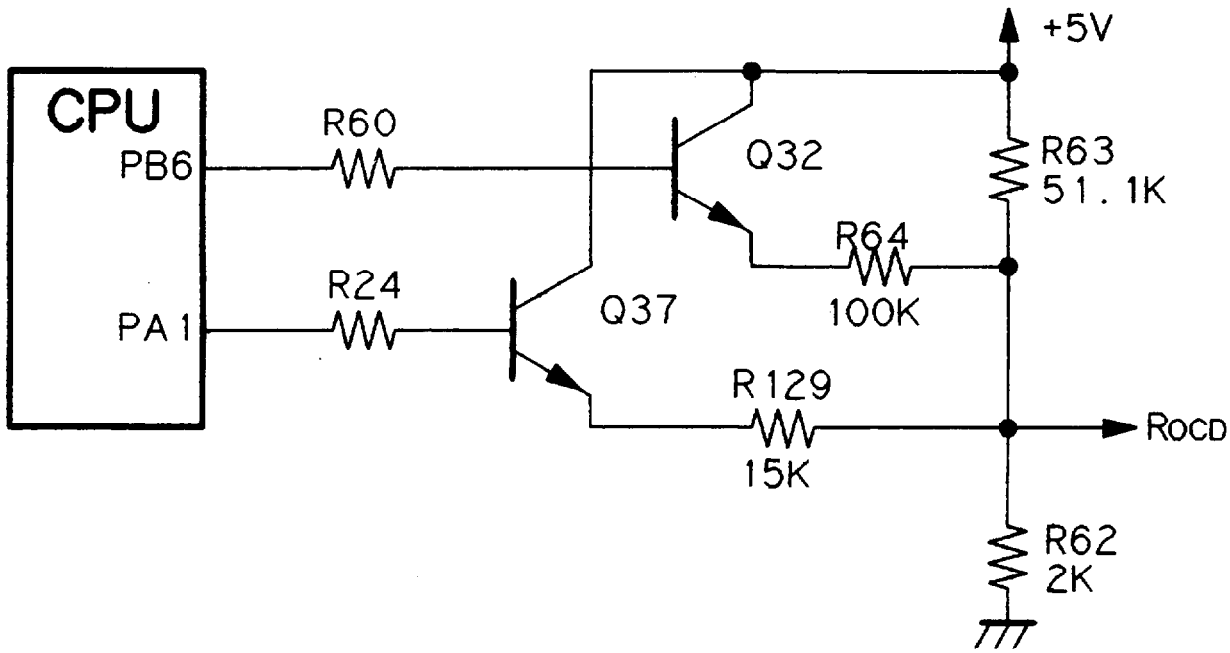


Figure 2-34. Reference Voltage Generation Circuit

Table 2-3. Reference Voltages

PB6 SPDM	PB1 SPDH	Reference Voltage VrCD
H	H	0.807 V
L	H	0.736 V
H	L	0.279 V
L	L	0.188 V

Constant current drive circuit

The carriage motor drive current is given by the following equation:

$$I = VrCD/R79 = VrCD/1.2 \text{ ohms}$$

When the carriage stops, CPU port PB5 is set to HIGH, the input to the chopping circuit becomes 0 V, and current is applied from the +5 V line to the motor via resistance Rl and diode Dl. This current is given by the following equation:

$$I = \frac{(5V - VD15 - VD5)}{R76 - 21 \text{ ohms/phase} + R79}$$

Figure 2-35 shows the constant current control circuit. Table 2-4 lists the current values for the reference voltages.

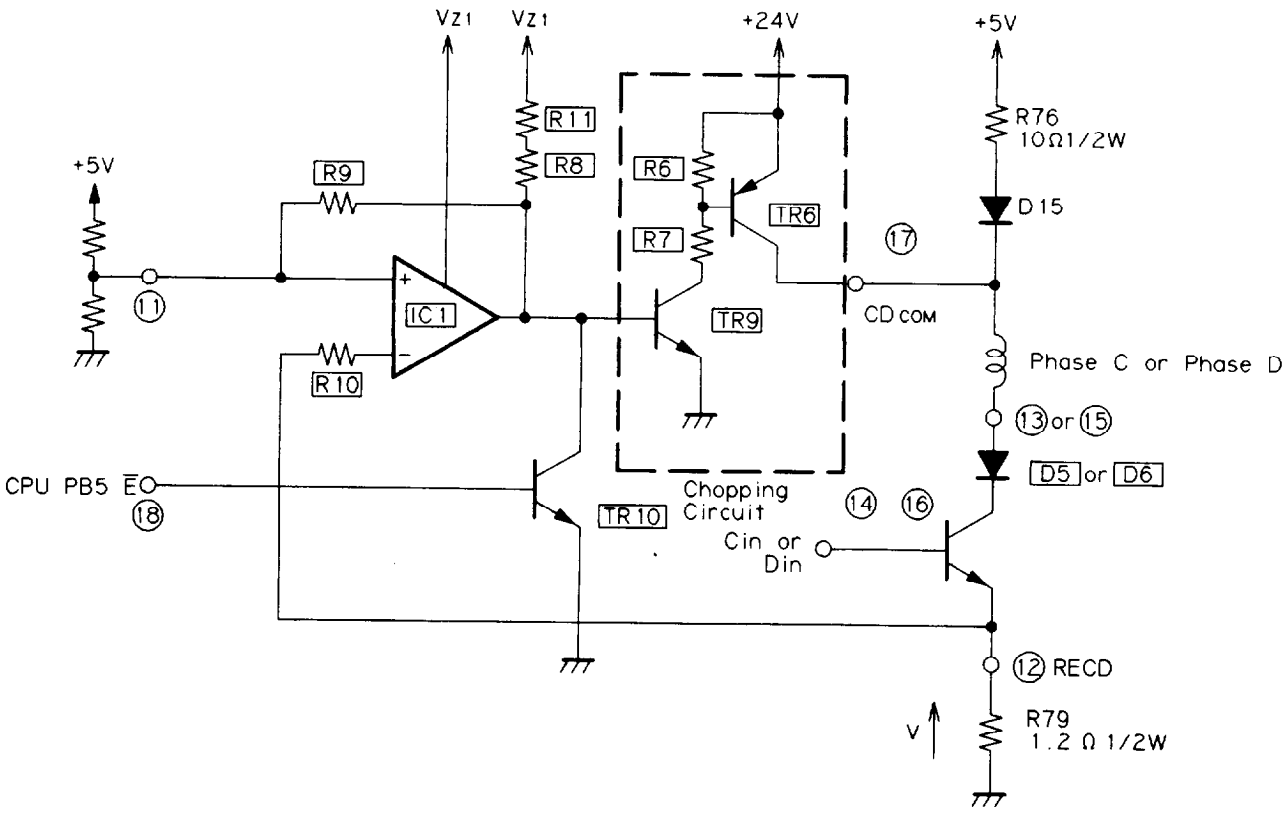


Figure 2-35. Constant Current Control Circuit

Table 2-4. Current Values for Reference Voltages

PB5 E	PB6 SPDM	PB1 SPDH	Current Value
L	H	H	0.67 A
L	L	H	0.61 A
L	H	L	0.23 A
L	L	L	0.16 A
H (Hold)	—	—	0.12 A

Positive feedback through R9 generates a hysteresis in the comparator of ICl. The upper limit of the hysteresis is the reference voltage. The comparator works like a Schmitt trigger, sensing a difference when the inverse terminal feedback is slightly larger or smaller than the hysteresis level. The comparator in ICl compares reference voltage α and the feedback voltage.

When reference voltage α is HIGH, TR6 goes on and applies approximately 25 VDC to the coil. The current rises linearly due to inductance. TR6 goes off when the feedback voltage equals the reference voltage. In this way, an almost constant current is applied to the coil.

Figure 2-36 shows the carriage motor's drive current waveform (pin 12) and the chopping waveform (pin 17) of the drive voltage (+24 v) at 960 pps. Figure 2-37 shows the Schmitt trigger circuit.

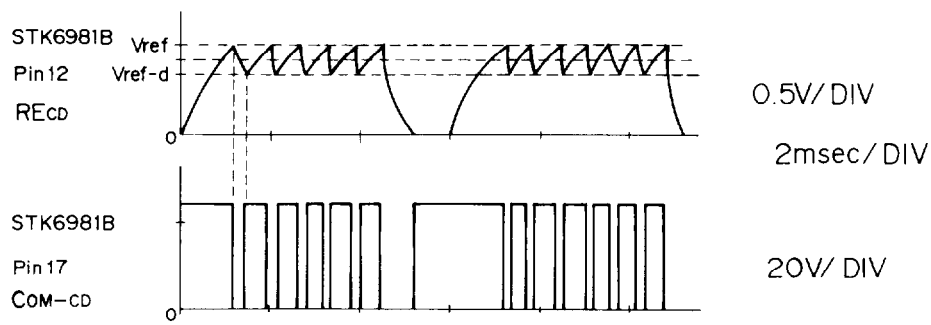


Figure 2-36. Chopping Waveforms

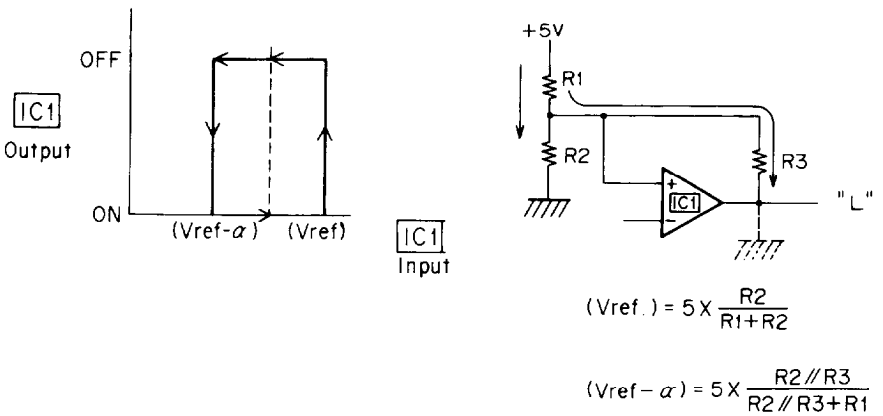


Figure 2-37. Schmitt Trigger Circuit

Carriage motor software control

This section describes the carriage motor software control.

Excitation type

Firmware determines the excitation. As shown in Table 2-5, the excitation is executed according to the carriage speed. Tables 2-6 and 2-7 show the motor drive sequence for each excitation system.

Table 2-5. Phase Excitation

Carriage Speed, pps	Phase Excitation
Triple speed, 960	2-2
Double speed, 640	2-2
One and a half speed, 960	1-2
Normal speed, 640	1-2
Two thirds speed, 427	1-2

Table 2-6. Drive Sequence 2-2 Phase Excitation)

CR Direction	Left → Right				Right → Left			
Step Number	Phase A	Phase B	Phase C	Phase D	Phase A	Phase B	Phase C	Phase D
1	on	off	on	off	on	off	off	on
2	on	off	off	on	on	off	on	off
3	off	on	off	on	off	on	on	off
4	off	on	on	off	off	on	off	on

Table 2-7. Drive Sequence (1-2 Phase Excitation)

CR Direction	Left → Right				Right → Left			
Step Number	Phase A	Phase B	Phase C	Phase D	Phase A	Phase B	Phase C	Phase D
1	on	off	off	on	on	off	on	off
2	on	off	off	off	on	off	off	off
3	on	off	on	off	on	off	off	on
4	off	off	on	off	off	off	off	on
5	off	on	on	off	off	on	off	on
6	off	on	off	off	off	on	off	off
7	off	on	off	on	off	on	on	off
8	off	off	off	on	off	off	on	off

The stepper that controls the carriage can hold the carriage at any position and freely switch its direction. An open loop system controls the carriage motor and switches the phase according to the set speed.

The drive chopping current is switched at the carriage motor drive frequency. Figure 2-38 shows the relationship between drive speeds and switching current values.

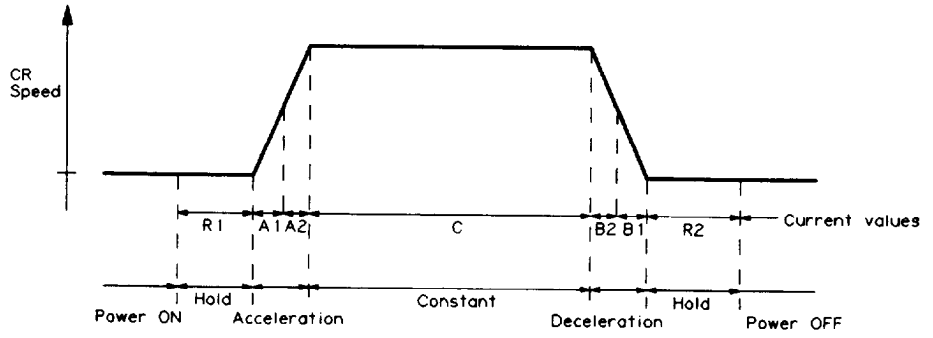


Figure 2-38. Chopping Current and Drive Speed

Home position seek

The home position seek function causes the carriage to move to the home position when the power goes on. Figure 2-39 shows how the home position seek function operates.

When power is first applied, the printer executes 2-2 phase excitation for 20 or 30 ms (regardless of the phase switch setting). Meanwhile, the printer checks the -HOME signal to determine whether the starting position is 1 or 2.

The carriage enters the home position only once during the initialization.

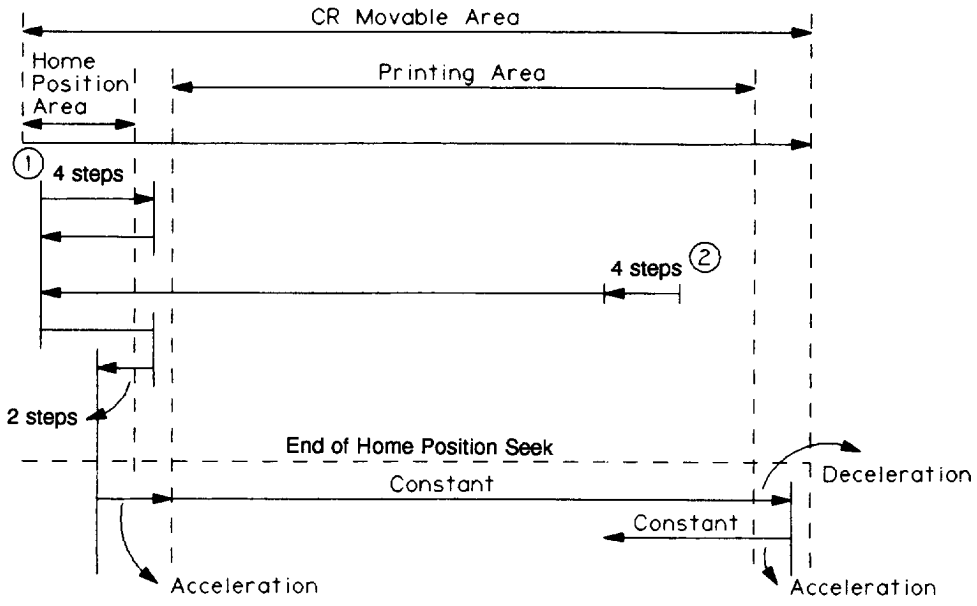


Figure 2-39 Home Position Seek

Printing area

The printing area starts 22 phase switches from the home position.

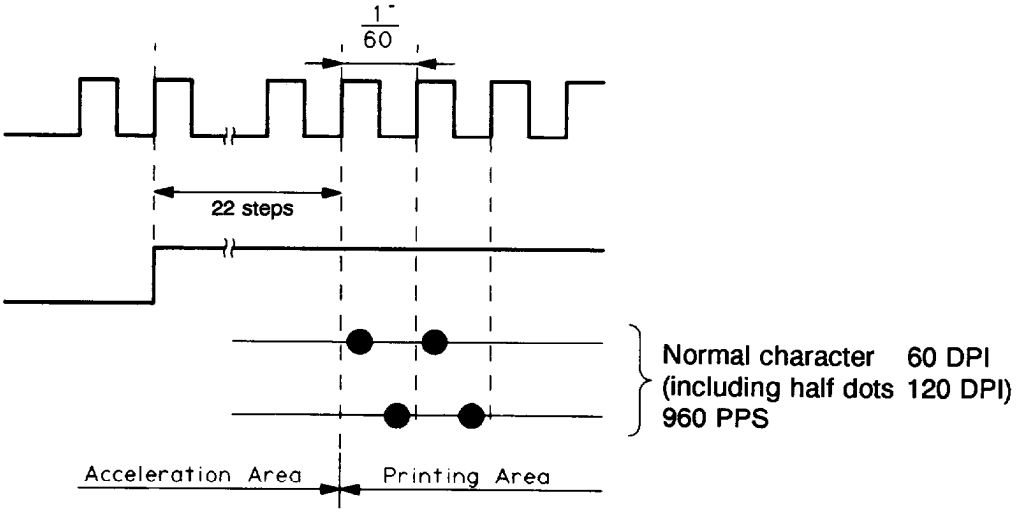


Figure 2-40. Printing Area and Print Timing

Abnormal carriage operation

The LQ-200/AP3000 does not have a print timing signal PTS) sensor and cannot detect abnormal carriage operation. Therefore, an error does not occur if external forces hinder carriage movement. An error occurs only if the printer receives the -HOME signal in the printing area. If this occurs, the carriage stops.

Paper Feeding

This section describes how the printer feeds paper.

Paper feed mechanism

The LQ-200/AP3000 friction feeds single sheet paper and sprocket feeds continuous paper.

The printer *cover* and the spring force of the two paper feed rollers hold the paper against the platen. To release the paper, move the paper release lever forward.

Friction feeding

The paper feed motor rotates the platen gear, via the paper feed reduction gear, in the direction shown in Figure 2-41. Friction from the platen and paper feed rollers feeds the paper in the direction shown in Figure 2-41.

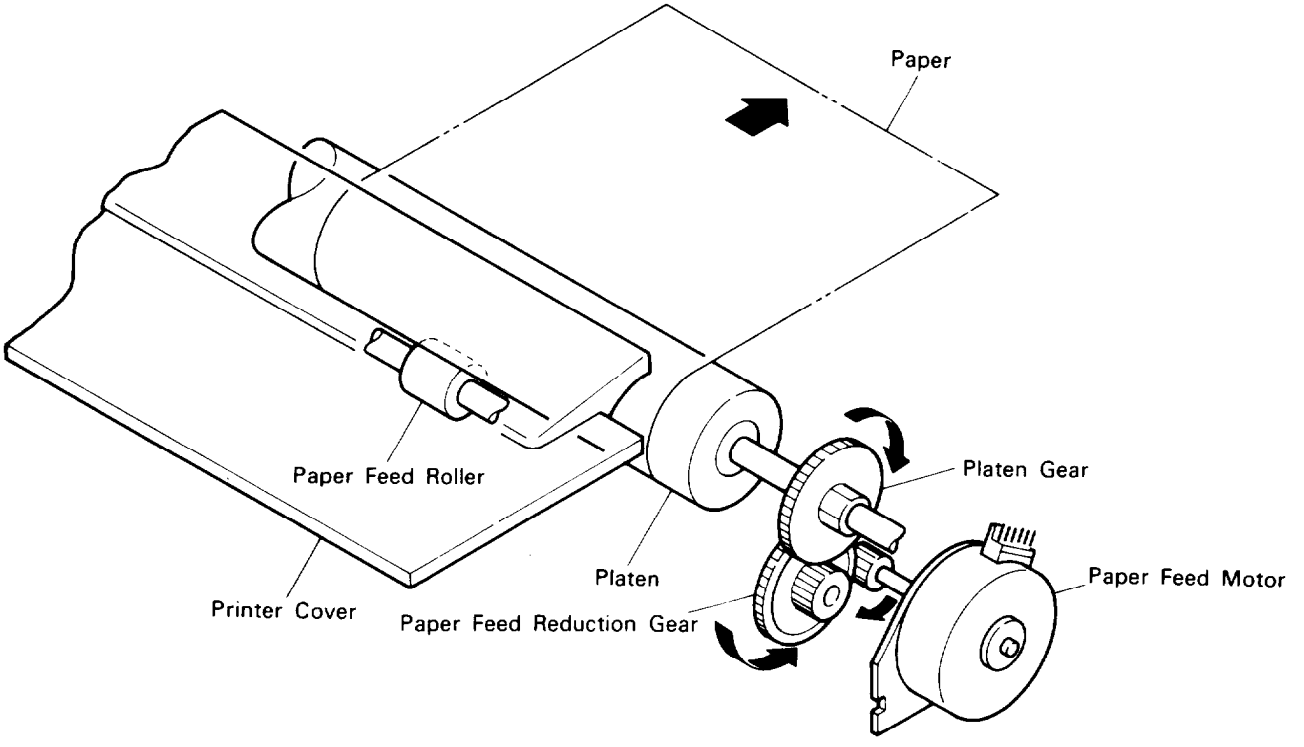


Figure 2-41. Friction Feeding

Sprocket feeding

You place the holes in the paper over the sprocket pins on the sprocket wheel. The paper feed motor rotates the gears, via the pinion on the shaft of the motor, in the direction shown in Figure 2-42. The gear rotation causes the sprocket wheels to rotate and advances the paper in the direction shown in Figure 2-42.

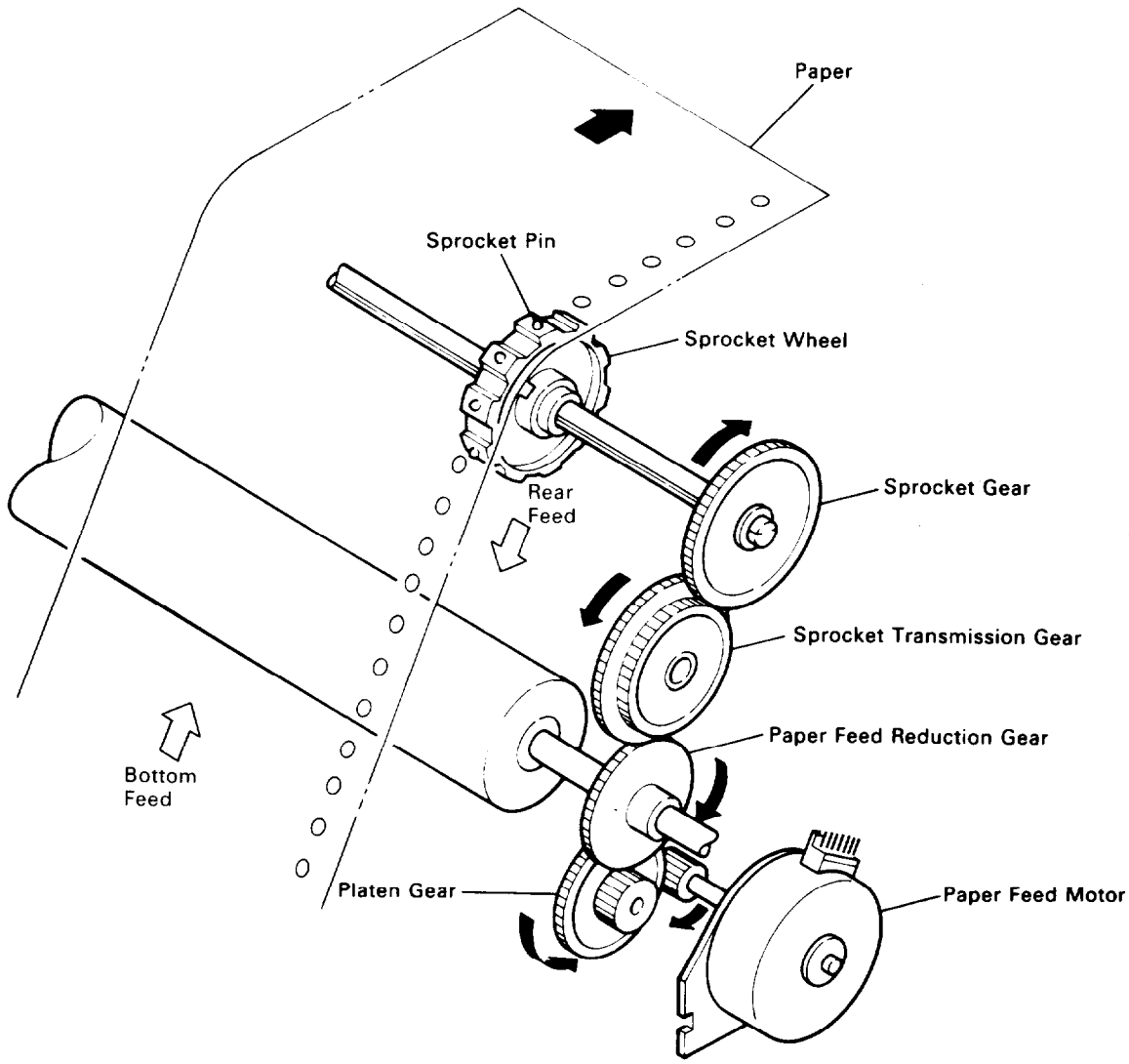


Figure 2-42. Sprocket Feeding

Paper feed motor specifications

Type	4-phase, 48pole stepper motor
Drive Voltage	**24** VDC + 10%
Coil Resistance	58 ohms f 7% at 77O F (25O C)
Phase Excitation	2-2 phase excitation
Current	1.1 A, maximum (rush current)
	Driving: **0.30** A, typical
	Holding: **0.06** A ± 20 **mA**
Driving Frequency	**400** pulses per second

Paper feed motor drive circuit

Figure 2-43 shows the paper feed motor drive circuit. When the paper feed signal **PB2** goes LOW, **Q27** goes on and supplies +24 V to the motor. When the paper feed motor is not being driven (when it is in hold status), +5 V is supplied to the motor via resistor R36 and diode Dll.

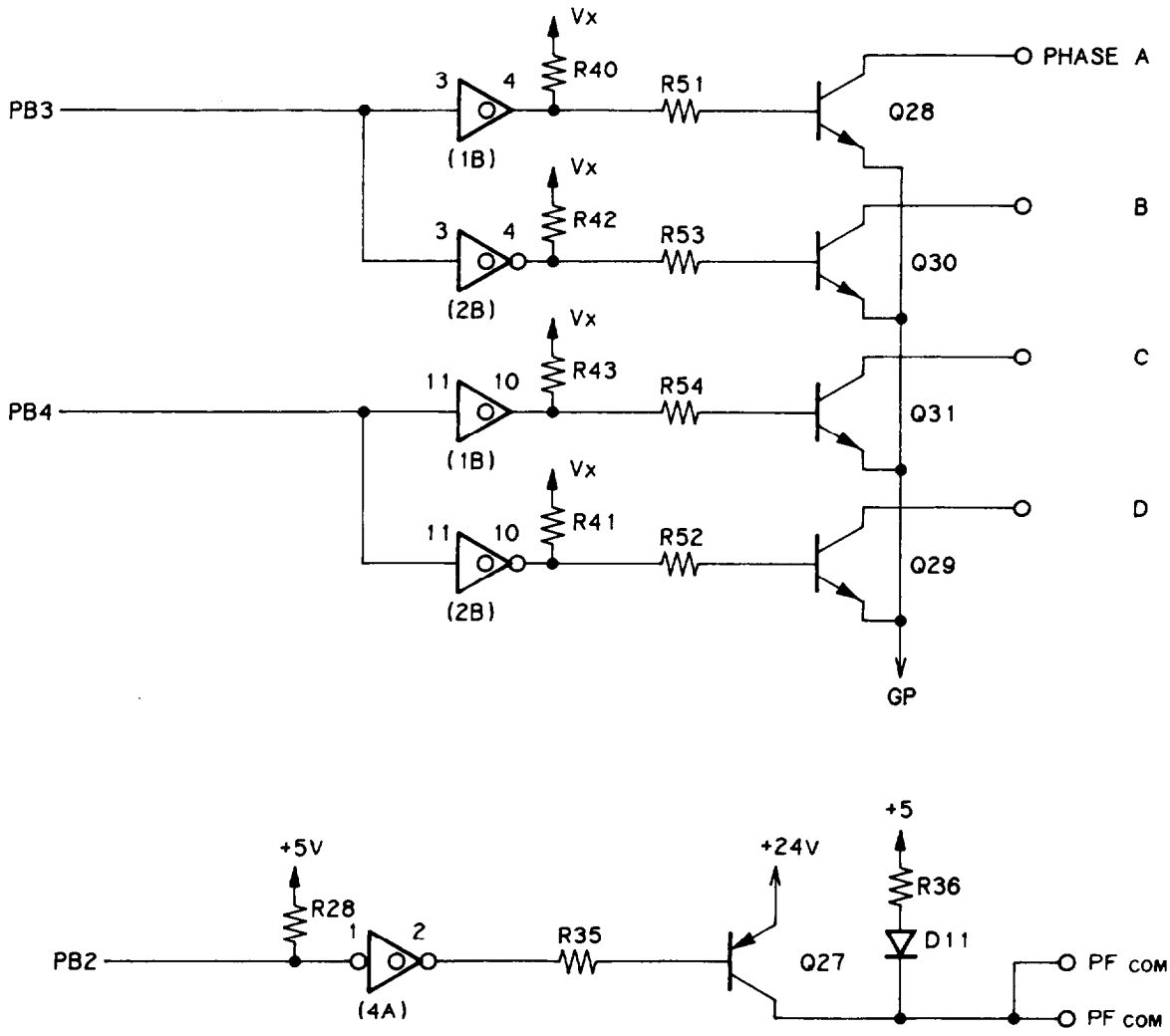


Figure 2-43. Paper Feed Motor Drive Circuit

Paper feed motor software control

The paper feed motor is a 48-pole stepper motor. An open loop system controls the paper feed motor under 2-2 phase excitation. The motor feeds paper 1/180th of an inch for each step. Table 2-8 shows the paper feed motor excitation system when the motor is driven clockwise for forward paper feeding.

Table 2-8. Excitation Sequence (Clockwise for Forward Paper Feeding)

Step No.	PB3	PB4	A Phase	B Phase/ (– A Phase)	C Phase	D Phase/ (– C Phase)
0	H	H	on	off	on	off
1	H	L	on	off	off	on
2	L	L	off	on	off	on
3	L	H	off	on	on	off

Note: If the paper feed motor is driven counterclockwise, it feeds paper backward.

Figure 2-44 shows the timing chart for acceleration and deceleration control.

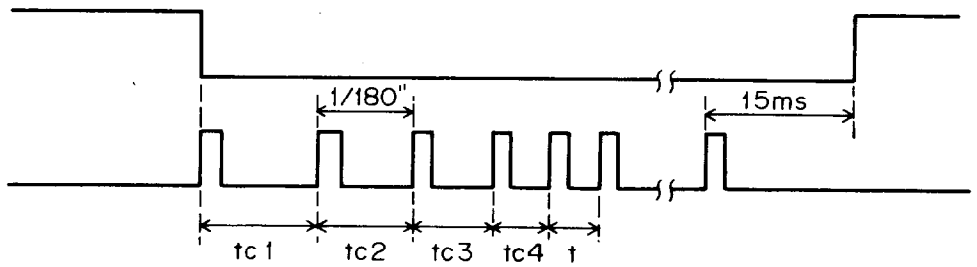


figure 2-44. Paper Feed Motor Drive Timing Chart

Printhead

This section describes how the printhead operates.

Printing

This section describes how a dot wire prints. Figure 2-45 illustrates the printing operation. When the printing process begins, the actuating plate is engaged to the dot wire. When the dot wire's head driving coil is energized, the actuating plate is attracted to the iron core. This drives the dot wire toward the platen. The dot wire strikes the ribbon and the paper against the platen, printing a dot.

When the head driving coil de-energizes, the actuating plate spring returns the plate to its initial position. At, the same time, the impact of printing the dot and the effect, of the wire resetting spring returns the dot wire to its initial position. The dot wire remains engaged to the actuating plate until it is driven again.

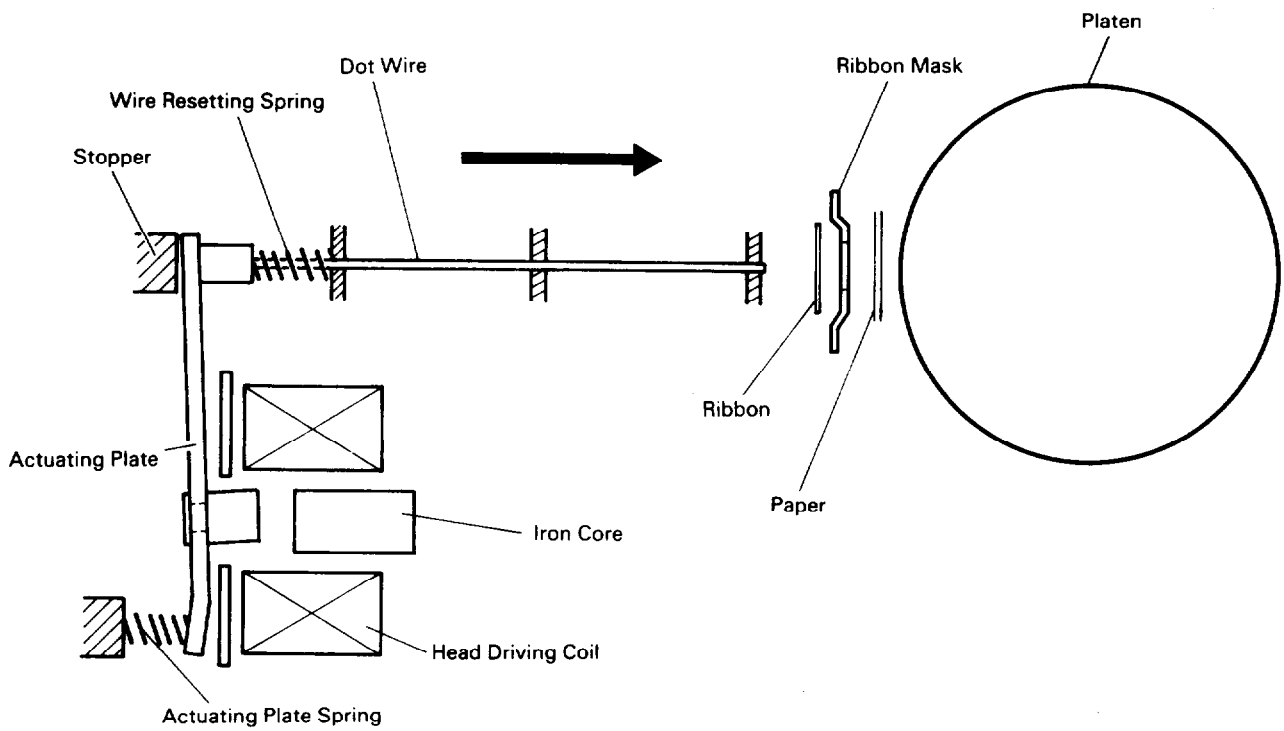


Figure 2-45. Printing

Printhead specifications

Solenoids	24 solenoids
Wire Diameter	0.008 inch (0.20 mm)
Pin Arrangement	12 x 2, staggered
Drive Voltage	24 VDC ± 10%
Coil Resistance	19.1 ± 1.0 ohms at 77° F (25° C)

Printhead drive circuit block diagram

Gate array E05A02 is used as an 8-bit x 3 data latch. By monitoring the printhead drive power (+24 V line), the CPU determines the pulse width for the head wire drive pulses from gate array E05A02. The CPU also monitors the printhead's temperature and suspends printing.if the printhead overheats.

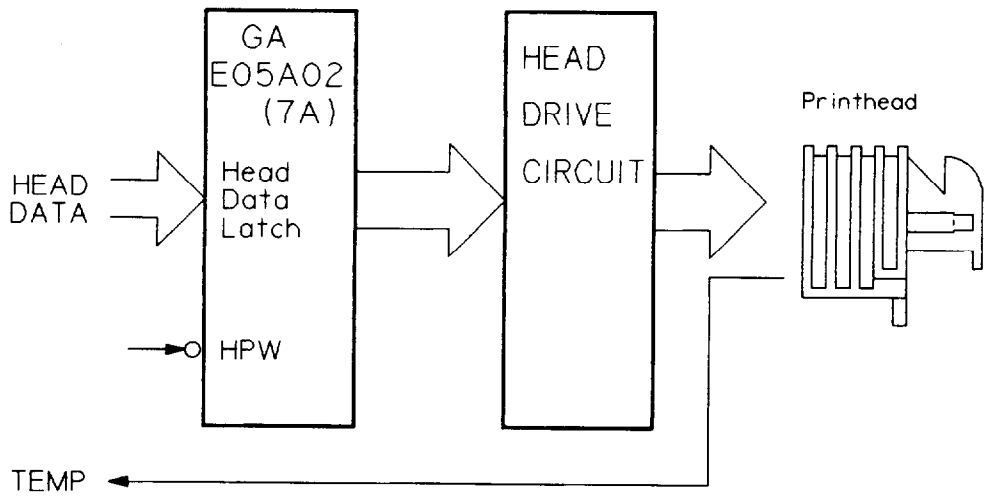


Figure 2-46. Printhead Drive Circuit Block Diagram

Gate array E05A02 in the printhead drive circuit

The E05A02 gate array includes circuitry to interface the CPU and the printhead. This general purpose gate array has special commands that lighten the CPU's load during printhead data output.

Figure 2-47 is a block diagram of gate array E05A02. Gate array operation centers around the three 8-bit data latches. The gate array also supports functions (commands) that can efficiently write data to any of the data latch bits.

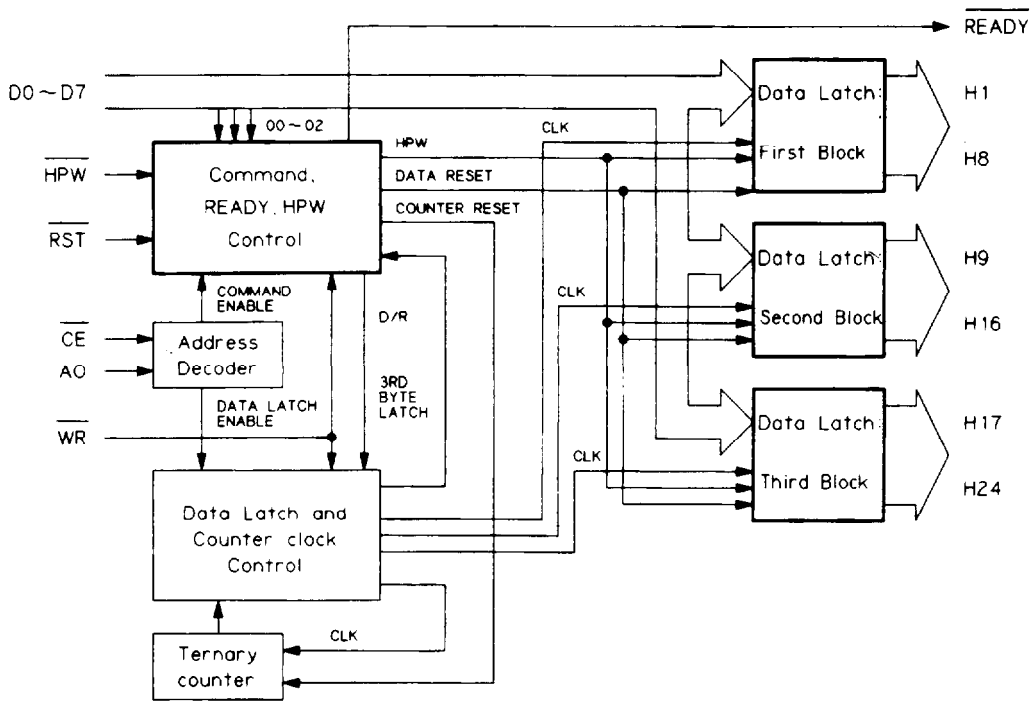


Figure 2-47. Gate Array E05A02 Block Diagram

Printhead drive circuit

CPU port PC6 adjusts the drive pulse width. The Vx voltage pulls up the output signals from the gate array to prevent printhead malfunctions.

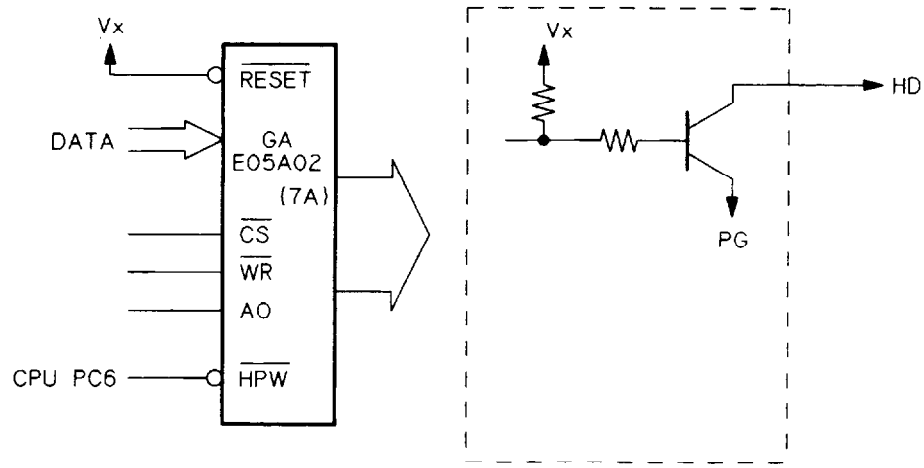


Figure 2-48. Printhead Drive Circuit

Printhead software control

At 960 pps, one print cycle is performed at each phase switch step to meet the printhead's specifications. (The printhead's solenoid drive frequency is 960 Hz). The drive pulse width is adjusted using an A/D converter to detect the drive voltage. The drive pulse width is kept within the range indicated by the oblique lines in Figure 2-50.

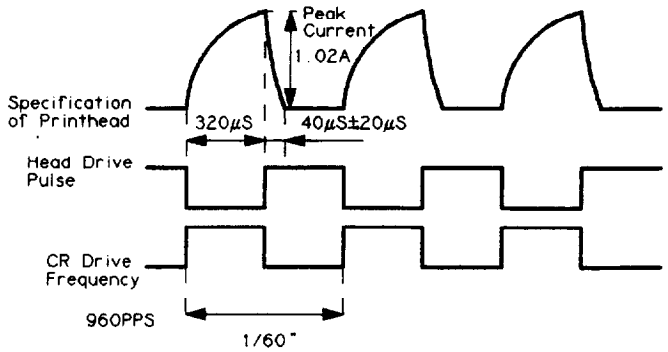


Figure 2-49. Print Timing

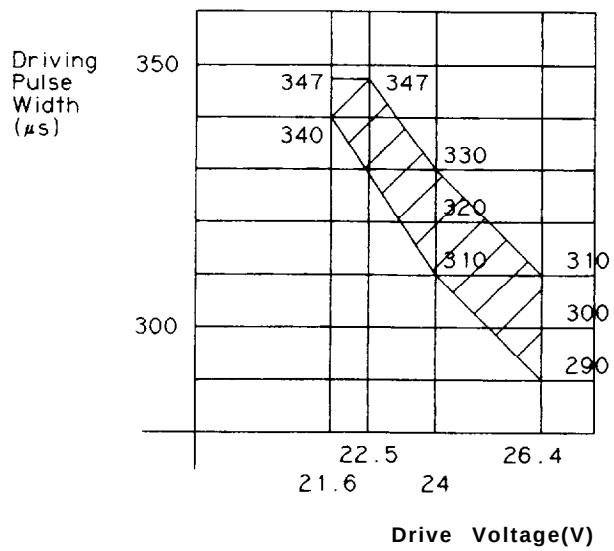


Figure 2-50. Relationship Between the Head Driver Voltage and the Print Driving Pulse Width

A/D Converter Circuit

Figure 2-51 shows the A/D converter circuit. The converter has the following functions:

- Monitors the +24 V line to determine the drive pulse width for the printhead.
- Monitors the temperature (the resistance) of the printhead.
- Reads the initial DIP switch settings.
- Reads the bidirectional adjustment setting.

Shunt regulator TL431CLPB and resistors R37 and R55 regulate reference voltage Vref as follows:

$$Vref = \frac{2.5\ V}{R55}(R55 + R37) = 4.5\ V$$

Note: The shunt regulator's reference voltage is 2.5 V.

Using this value as a reference, AN0 monitors the +24 V line, AN1 monitors the printhead temperature, and AN2 through AN7 read the DIP switch and bidirectional adjustment settings.

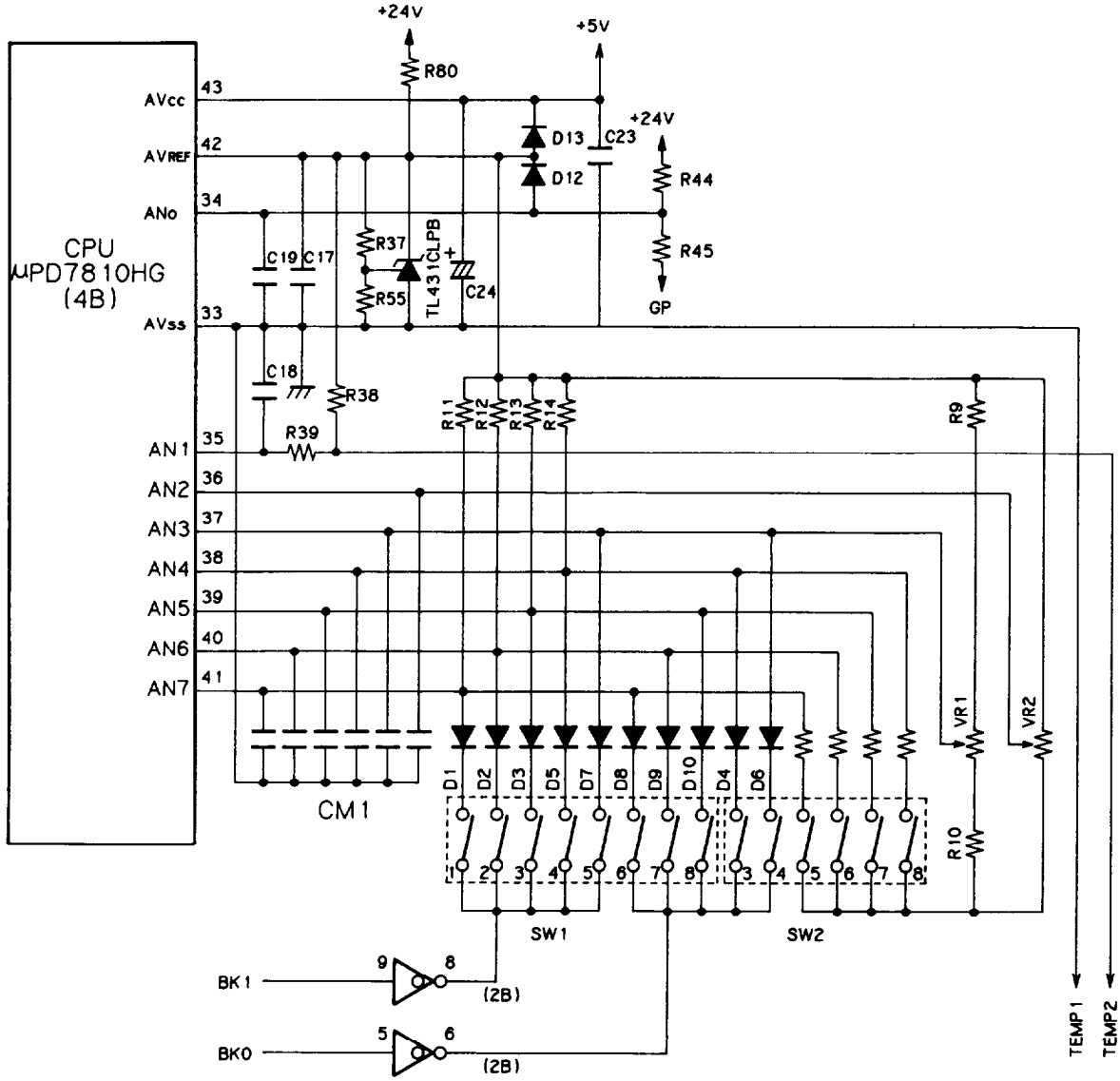


Figure 2-51. A/D Converter Circuit

Table 2-9 shows the relationship between the scan lines and the DIP switches.

Table 2-9. Scan Lines and DIP Switches

DIP Switch	Scan Line	
	BK 0	BK 1
Switch 1-5, set 1	L	H
Switch 6-8, set 1 Switch 3-4, set 2	H	L
Switch 5-8, set 2	H	H

Host Interface

Figure 2-52 shows the host interface circuit. -STROBE pulses from the host computer pass through the low-pass filter formed by R32 and C21 and then flow into the -STRB terminal. These pulses latch the parallel data and set the BUSY signal HIGH, inhibiting subsequent data transfer. The -STROBE signal automatically outputs the gate array's -PINT terminal to request a CPU interrupt. When the CPU receives the interrupt request, it reads the data latched in the gate array.

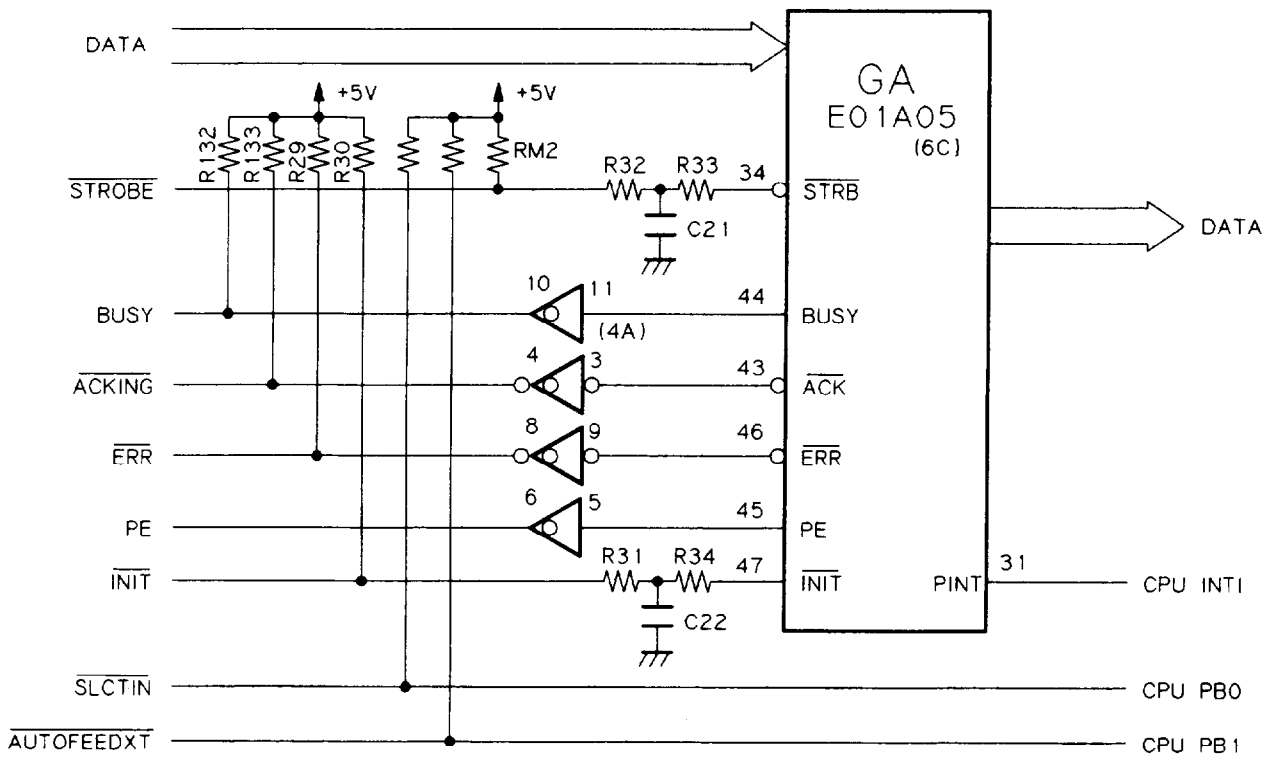


Figure 2-52. Host Interface

Ribbon Feed Mechanism

The ribbon feed mechanism consists of the ribbon cartridge and the ribbon feed section. Table 2-10 describes the ribbon feed gear train. Regardless of the timing belt direction, the gear train setup assures that the ribbon driving gear rotates only counterclockwise.

Table 2-10. Ribbon Feed Gear Train

Direction of Carriage Movement	Gear Train
Left to right (black arrow)	Belt-driven pulley → platen gear (1) → platen gear (2) → ribbon driving gear
Right to left (white arrow)	Belt-driven pulley → platen gear (1) → platen gear (3) → platen gear (4) → ribbon driving gear

Figure 2-53 shows the ribbon feed mechanism. The ink ribbon is an endless loop partly contained in the cartridge case. It is held between the ribbon feed and ribbon pressure rollers mounted on the ribbon driving gear. The gear's movement drives these rollers, which in turn feed the ribbon.

To prevent ribbon slack, a ribbon braking spring is attached at the cartridge case exit. A ribbon mask prevents the ribbon from staining the paper.

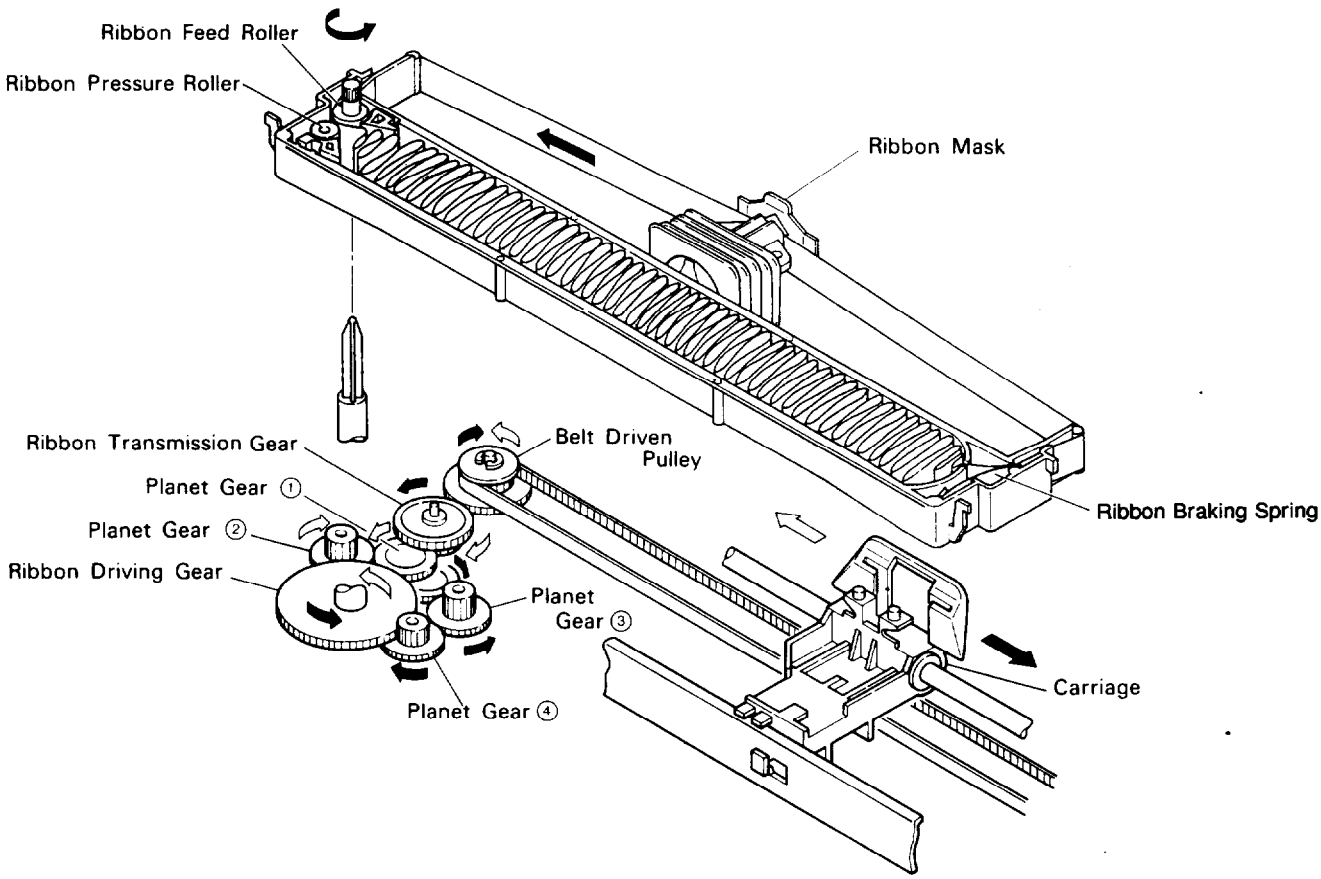


Figure 2-53. Ribbon Feed Mechanism

Chapter 3

Disassembly and Assembly

Figures

Tables

Disassembly and Assembly 3

General Repair Information

This chapter describes how to disassemble and assemble the printer's main components.

WARNING

- Always disconnect the AC power cord before you disassemble or assemble the printer.
- When you disassemble or assemble the printer, wear gloves so that you do not cut your hands on the printer mechanism or the edge of a plate, such as the ground plate.

CAUTION

The LQ-200/AP3000 uses plastic clips instead of screws to hold the printer mechanism, some boards, and other parts in place. Be careful not to damage the plastic clips when you remove these parts.

Tools

Tables 3-1 and 3-2 list tools and measuring instruments you need when you disassemble, assemble, or repair the printer.

Table 3-1. Repair Tools

Description	Type	Part No.
Round-nose pliers	o	B740400100
Diagonal cutters	o	B740500100
Tweezers	o	B641000100
Electric soldering iron	o	B740200100
E-ring holder #2.5*	o	B740800400
E-ring holder #5	o	B740800700
Phillips screwdriver no. 2	o	B743800200
Thickness gauges 0.017 and 0.018 inch (0.42 and 0.45 mm)	o	

Notes:

* You use E-ring holder #2.5 to attach the 0.092 inch (2.3 mm) E-ring.
o = Commercially available
E = Epson-exclusive

Table 3-2. Measuring Instruments

Description	Specification	Class
Oscilloscope	50 MHz	A
Tester		A
Multimeter		B
Logic analyzer		B

Note: A = mandatory, B = recommended

For optimal printer performance, always perform the necessary lubrication, adhesive application, cleaning, and maintenance procedures after you assemble and adjust the printer. (Chapter 4 describes adjustment procedures and Chapter 6 provides maintenance instructions.)

Small Parts

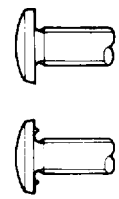
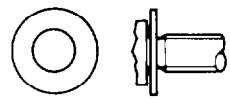
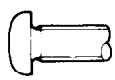
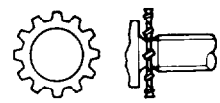
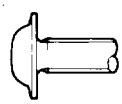
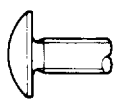
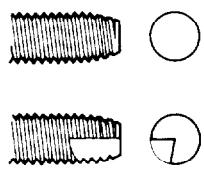
Table 3-3 lists the abbreviations this manual uses for small parts.

Table 3-3. Abbreviations for Small Parts

Abbreviation	Part Name
CBB(P)	Cross-recessed bind head B-tight with plain washer screw
CPS(O)	Cross-recessed pan head S-tight with outside toothed lock washer screw
CB(O)	Cross-recessed bind head with outside toothed lock washer screw
CBB	Cross-recessed bind head B-tight screw

Table 3-4 shows the screw shapes and names.

Table 3-4. Screw Shapes and Names

Head Top	Head Side	Body	Washer (Assembled)
Cross-recessed head 	Bind  (with Notch)	Normal 	Plain washer 
Slotted head 	Pan 	S-tight 	Outside toothed lock washer 
	Cup 	B-tight 	Spring washer 
	Truss 	Tapping 	

Service Checklist

Before you deliver the printer, check the table below to ensure that you repaired it properly. The table is designed to help you maintain service quality standards.

Table 3-5. LQ-200/AP3000 Service Checklist

Item	Component	Points to Check	
Printing	Printhead wires	Are any wires broken?	□ Checked □ N/A
		Are any wires worn out?	□ Checked □ N/A
		Is the platen damaged?	□ Checked □ N/A
		Is the ribbon mask deformed?	□ Checked □ N/A
	Carriage mechanism	Does the carriage move smoothly? □ noise □ contamination □ lubrication	□ Checked □ N/A
		Does the carriage motor overheat?	□ Checked □ N/A
	Paper feed mechanism	Does the printer feed paper smoothly?	□ Checked □ N/A
		Does the paper feed motor overheat?	□ Checked □ N/A
	Paper path	Is the paper release lever set correctly for the type of paper you are using?	□ Checked □ N/A
		Is there any foreign material in the paper path?	□ Checked □ N/A
	Self test	Is it normal?	□ Checked □ N/A
	On line test	Is it normal? (application_____)	□ Checked □ N/A
Adjustment	Printhead	Platen gap adjustment	□ Checked □ N/A
	Printing	Printing position adjustment for bidirectional printing	□ Checked □ N/A
ROM version (main)		The ROM version is _____	□ Checked □ N/A
Delivery		Has the ribbon been removed?	□ Checked □ N/A

Disassembly and Assembly

This chapter describes how to disassemble the printer. To assemble the printer, follow the disassembly steps in reverse. Special assembly notes describe any extra information you need to assemble the printer. Adjustment required notes describe any adjustments that are necessary.

WARNING

Before you disassemble the printer, read the section on general repair information at the beginning of this chapter.

CAUTION

Remove the paper and the ribbon cartridge before you disassemble the printer.

This chapter divides printer disassembly into five main steps:

1. Removing the printhead
2. Removing the case
3. Removing circuit boards
4. Removing the printer mechanism
5. Disassembling the printer mechanism.

For detailed exploded diagrams of the printer and the printer mechanism, see Figures A-6, A-7, and A-8.

Removing the Printhead

1. Make sure that you have removed the paper and the ribbon cartridge. Then remove the printer cover.

2. Unlock (pull down) the two levers that secure the printhead to the carriage. Then lift up and remove the printhead.

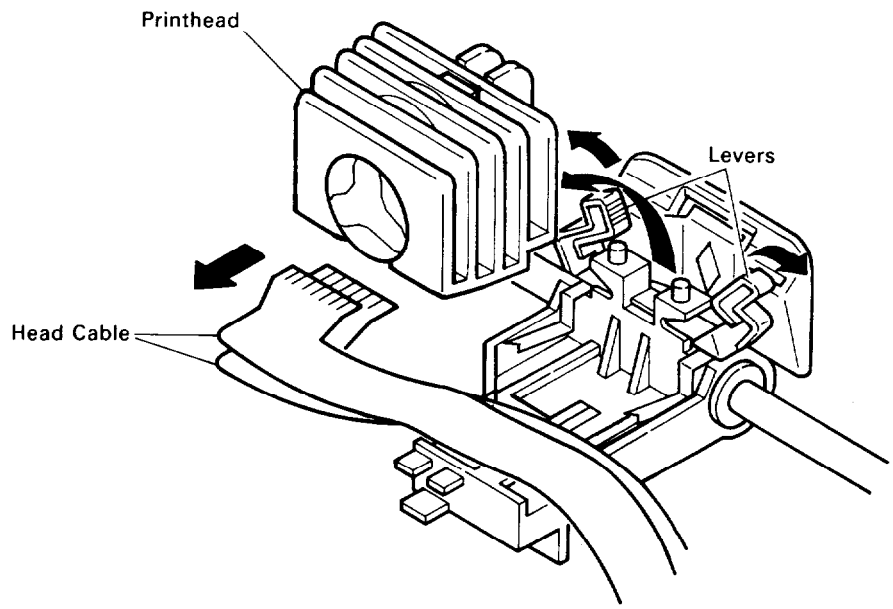


Figure 3-1. Removing the Printhead

3. Disconnect the head cable from the connector on the printhead.

Removing the Case

This section describes how to remove the upper case and the control panel.

Removing the upper case

1. Remove the printer cover and the paper guide.
2. Remove the pull tractor assembly.
3. Insert a standard screwdriver into each of the two holes at the front of the lower case and push to unlock each notch. Then lift up the upper case.

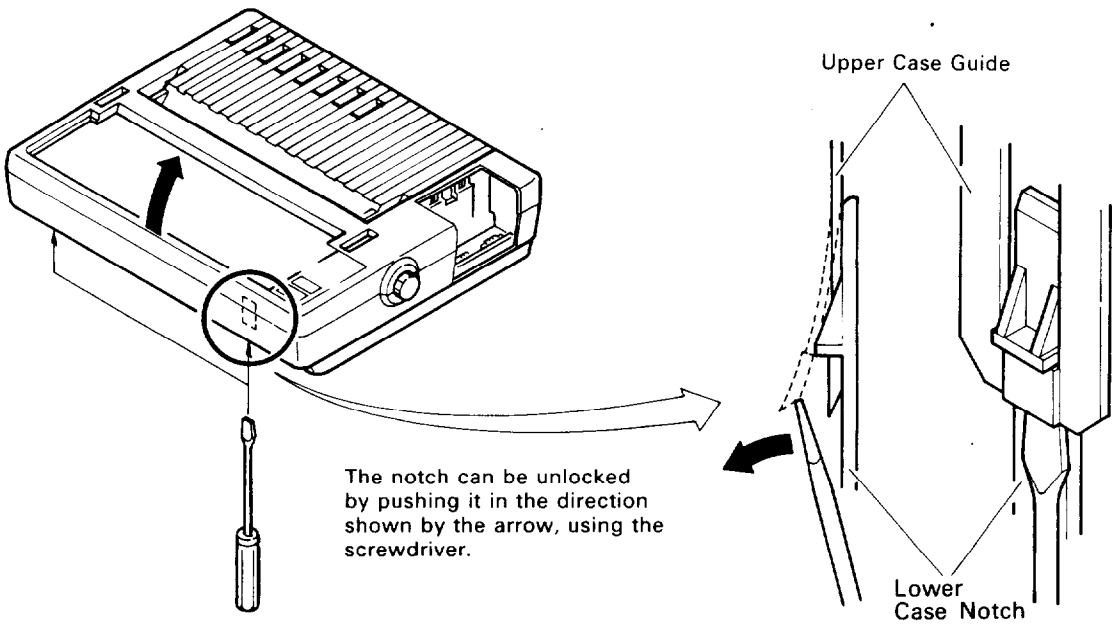


Figure 3-2. Removing the Upper Case - 1

4. While lifting up the upper case, disconnect the control panel's flexible flat cable (FFC) from connector CN4 on the CO64 MAIN board. Then remove the upper case.

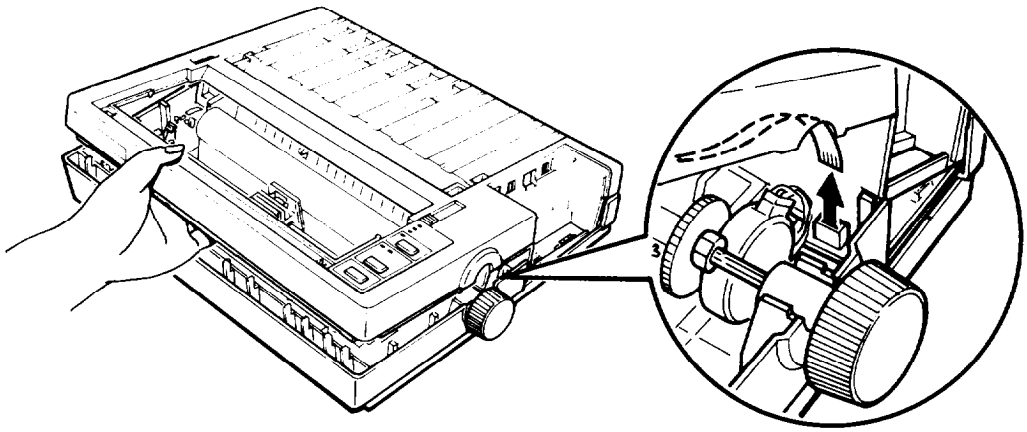


Figure 3-3. Removing the Upper Case - 2

Removing the control panel

1. Remove the upper case as described earlier in this chapter.

2. Turn the upper case upside down and push in the two notches that secure the control panel to the upper case. Then remove the control panel from the upper case.

CAUTION

When you install and remove the control panel, be careful not to damage the FFC on the control panel with the FFC guide on the upper case.

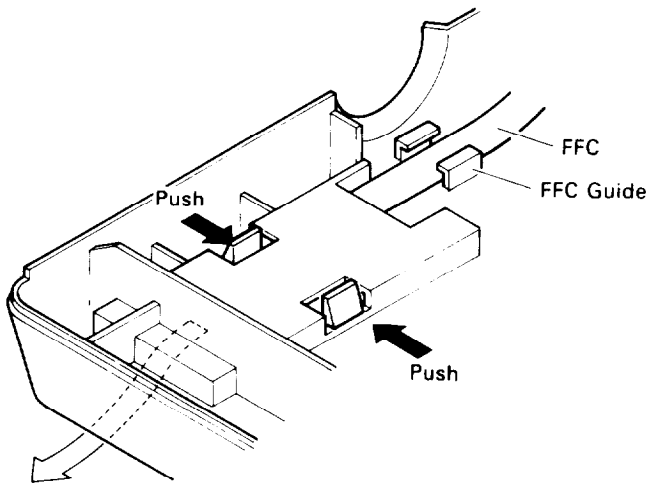


Figure 3-4. Removing the Control Panel

Removing the Circuit Boards

This section describes how to remove the C064 MAIN board, the PEBFIL-II board, and the transformer.

Removing the C064 MAIN board

1. Remove the upper case as described earlier in this chapter.

2. Disconnect connectors CN5, CN6, CN7, CN8, CN9, and CN10 on the C064 MAIN board. (These connectors connect the printer's main components to the ***CO64*** MAIN board.)

CAUTION

To disconnect the connectors, pull them out slowly and gently while holding the board. Forcefully removing the connectors can damage the board.

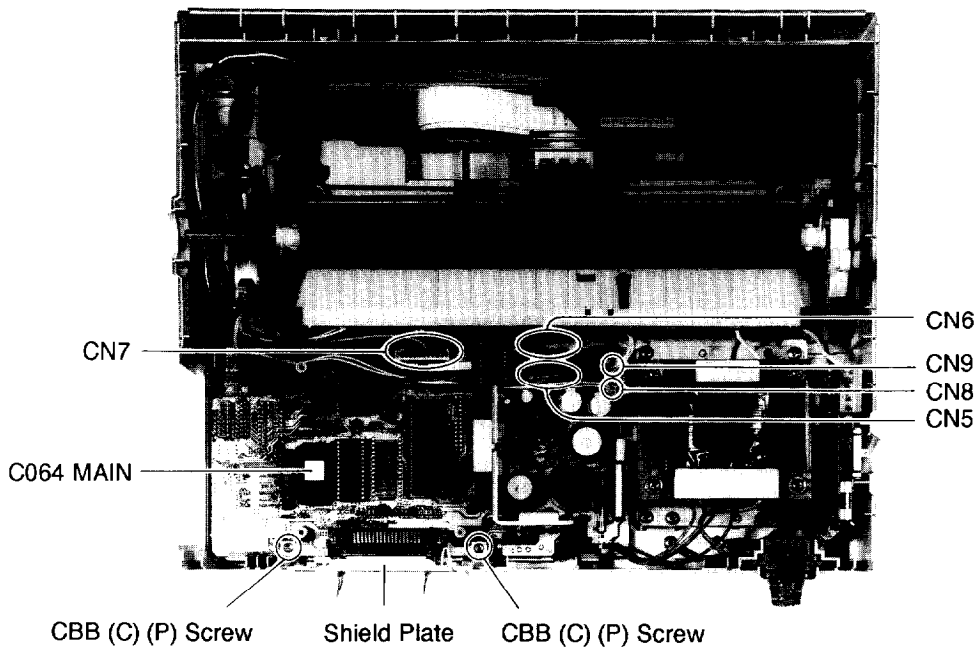


Figure 3-5. Removing the C064 MAINBoard

3. Remove the two CBB(P) screws (M3 x 10) that secure the C064 MAIN board to the base plate.

4. Remove the shield plate.

5. Using a screwdriver, loosen the six bent tabs on the lower case. (These tabs secure the board to the case.) Then remove the CO64 MAIN board.

CAUTION

When you remove the CO64 MAIN board from the lower case, do not bend the tabs too much. When you push the tabs, be careful not to break them or damage any of the board's components.

Removing the PEBFIL-II board

1. Remove the upper case as described earlier in this chapter.
2. Disconnect connector CN1 on the PEBFIL-II board. (CN1 connects the transformer to the PEBFIL-II board.)
3. Remove the CB(0) (M4 x 8) screw that secures the PEBFIL-II board's ground terminal.
4. Remove the CPS(0) (M3 x 6) screw that secures the PEBFIL-II board to the base plate.
5. Remove the PEBFIL-II board and the **power** cord.

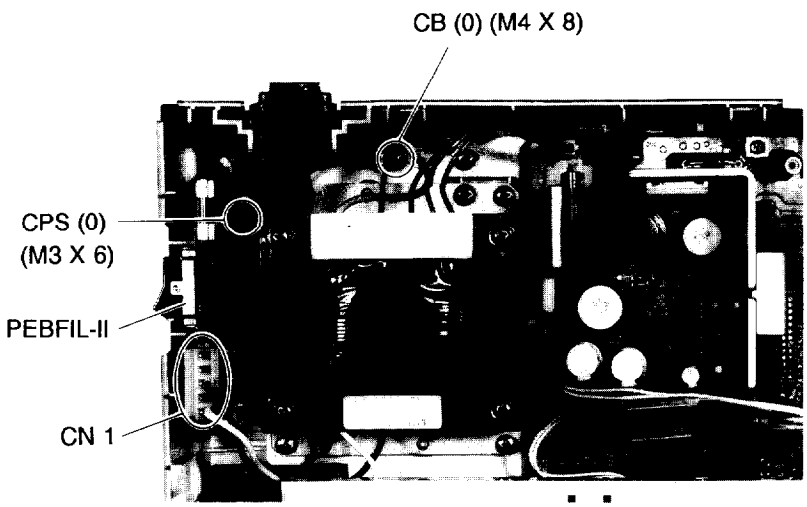


Figure 3-6. Removing the PEBIL-II Board

Removing the transformer

1. Remove the upper case as described earlier in this chapter.

2. Disconnect connector CNl on the PEBFIL-II board. (CNl connects the transformer to the PEBFIL-II board.)

3. Disconnect connector CNlO on the CO64 MAIN board. (CNlO connects the transformer to the CO64 MAIN board.)

4. Remove the CB(0) (M4 x 8) screw that secures the transformer ground terminal.

5. Remove the four CBB (M4 x 12) screws and the CB(0) (M4 x 8) screw that secure the transformer. Then remove the transformer.

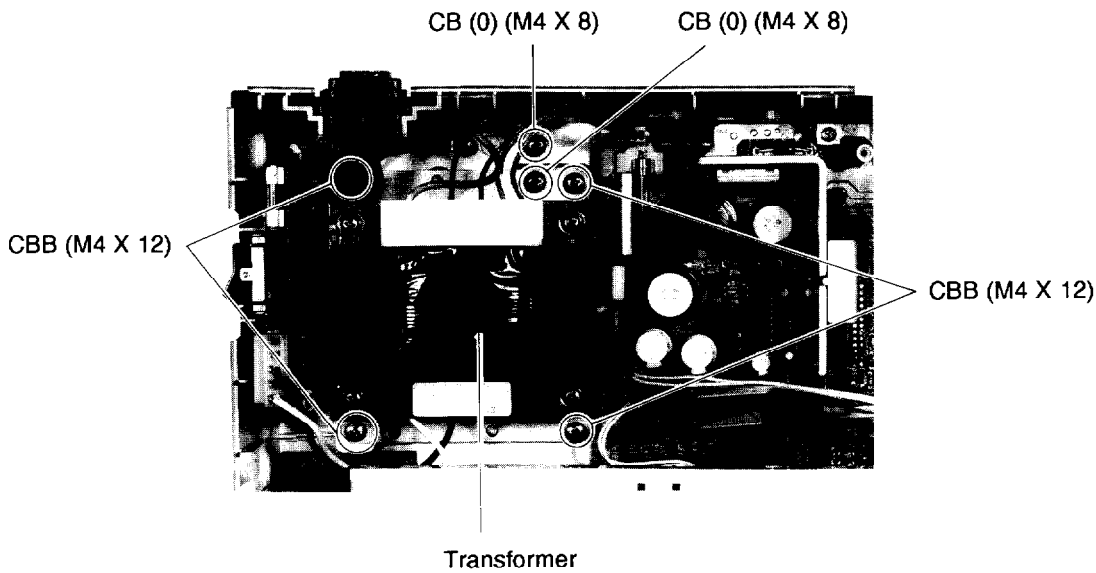


Figure 3-7. Removing the Transformer

Removing the Printer Mechanism

This section describes how to remove the platen unit, the paper guide, and the printer mechanism. You remove the platen unit and the paper guide to facilitate removing the printer mechanism.

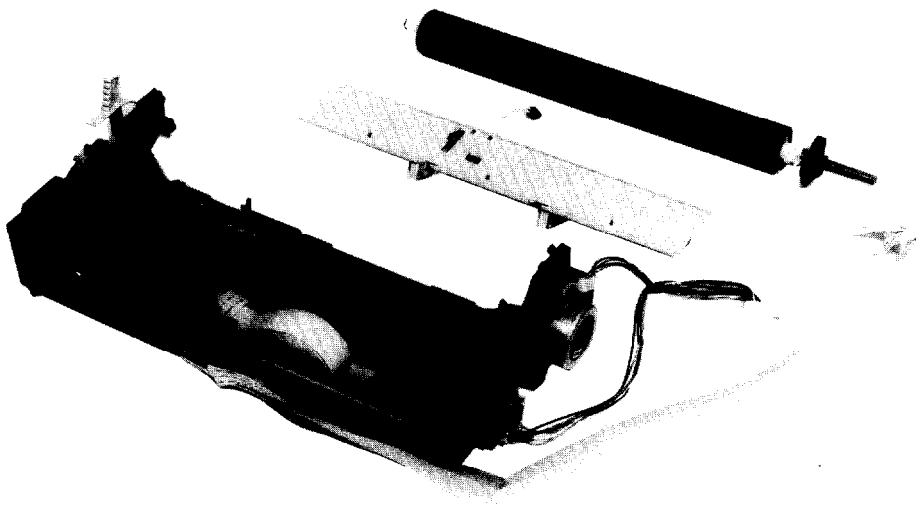


Figure 3-8. Removing the Printer Mechanism

Removing the platen unit and the paper guide

1. Remove the upper case as described earlier in this chapter.

2. Remove the ground spring hook under the paper feed motor at the right side of the platen unit. Then remove the spring from the platen unit.

3. Turn the shaft holders at the left and right sides of the platen unit as shown in Figure 3-9. Then lift the platen unit to remove it.

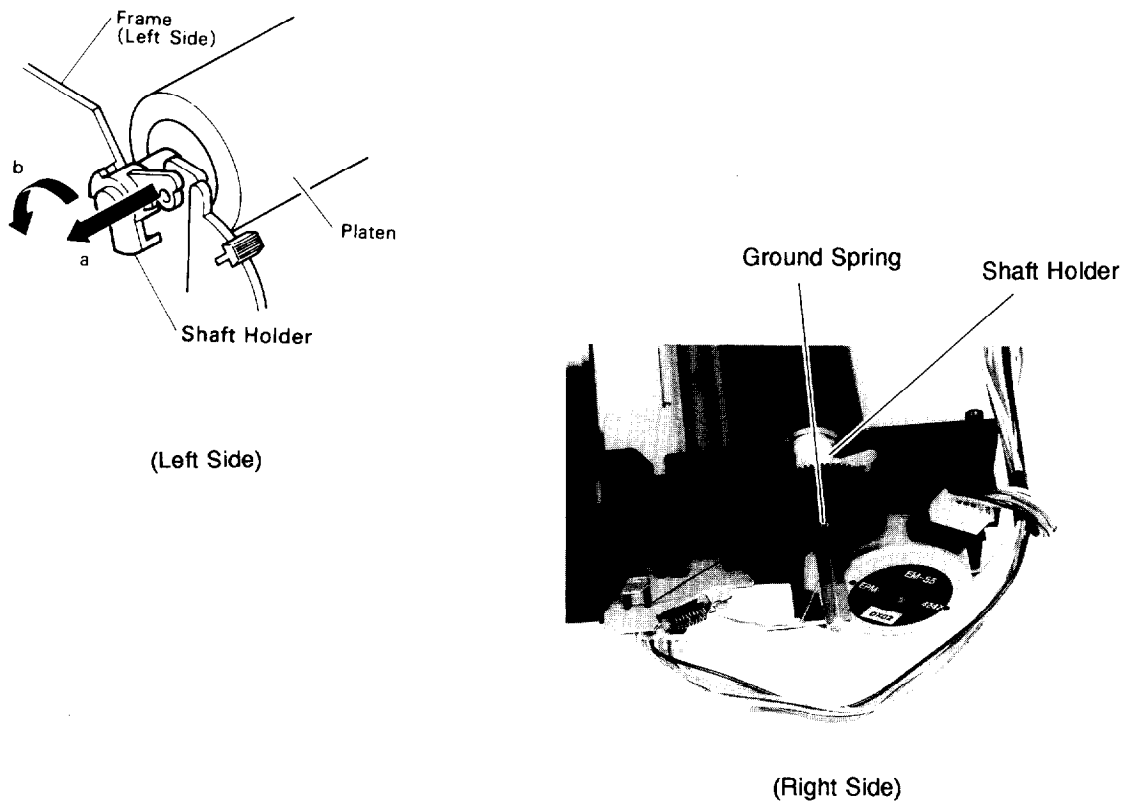


Figure 3-9. Removing the Platen Unit

4. Disconnect the cable from connector CN9 on the C064 MAIN board.

5. Facing the back of the printer mechanism, unlock the two paper guide notches by pushing them toward the front of the printer. Then remove the paper guide.

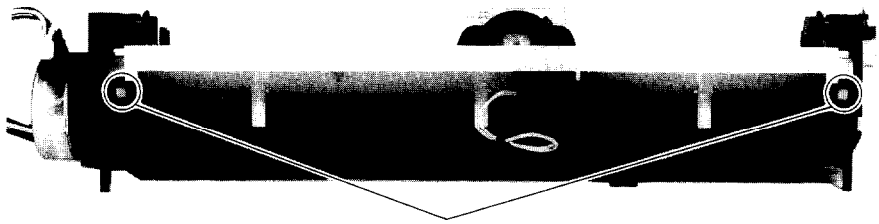


Figure 3-10. Back of the Printer Mechanism

Assembly Notes

- Connect the end of the paper end sensor arm to the bottom paper end lever.
- To install the ground spring, first attach it to the hook at the front and insert it into the platen shaft. Then attach it to the hook near the paper feed motor.

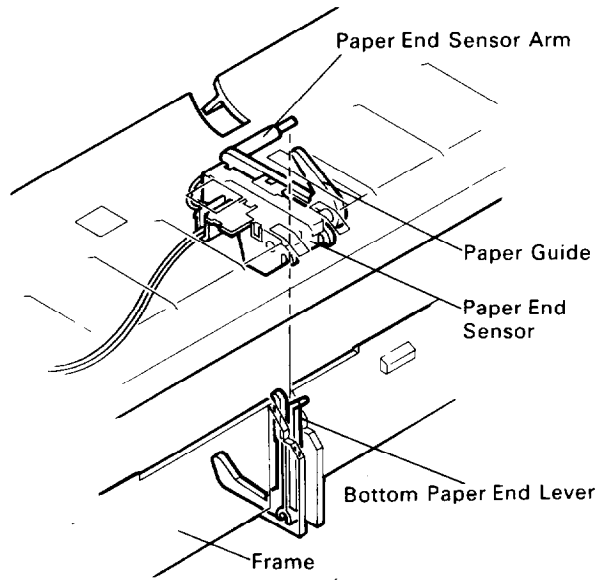


Figure 3-11. Paper-End Sensor Arm

Adjustment Required

If any problems (such as non-uniform print density) occur after you install or replace the platen unit, adjust the platen gap as described in Chapter 4.

Removing the printer mechanism

1. Remove the platen unit and the paper guide as described in the preceding section.

2. Disconnect the cables from connectors CN5, CN6, CN7, and CN8 on the C064 MAIN board. (See Figure 3-5.)

3. Remove the CBB (M3 x 6) screw on the right side of the printer mechanism that secures the bent portion of the ground plate. Then remove the bent portion of the ground plate.

4. To loosen the six tabs on the lower case, push each one with a screwdriver. Loosen the tabs as described in steps a, b, and c below. (The tabs secure the printer mechanism to the lower case.)

CAUTION

When you loosen the tabs, push them gently to avoid damaging the lower case or the printer mechanism.

a. Loosen tabs 1 and 2. Then lift the left side of the frame about a half inch (1 cm) up from the lower case.

b. Loosen tab 3. Then lift the frame's left side up another 2 inches (5 cm).

c. Slide the printer mechanism in the direction indicated by the arrow in Figure 3-12 and remove it from tabs 4 and 5. Use tab 6 as a fulcrum.

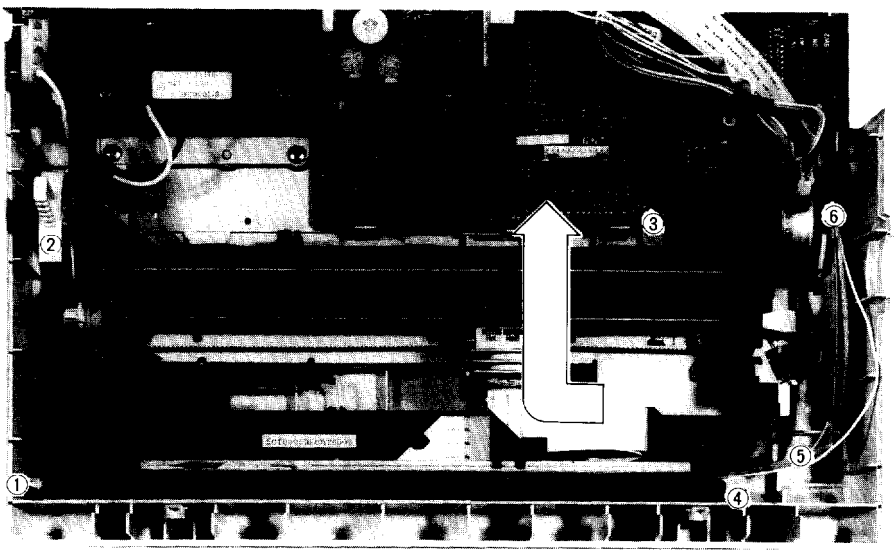


Figure 3-12. Removing the Printer Mechanism

Disassembling the Printer Mechanism

This section describes how to remove the components from the printer mechanism. When you follow the instructions in this section, see Figure A-7, the exploded diagram of the printer mechanism, and Table A-2, the component list.

Removing the paper feed mechanism

1. Remove the printer mechanism as described earlier in this chapter.

2. The paper release lever's notch is inside the frame. Push the notch and remove the paper release lever.

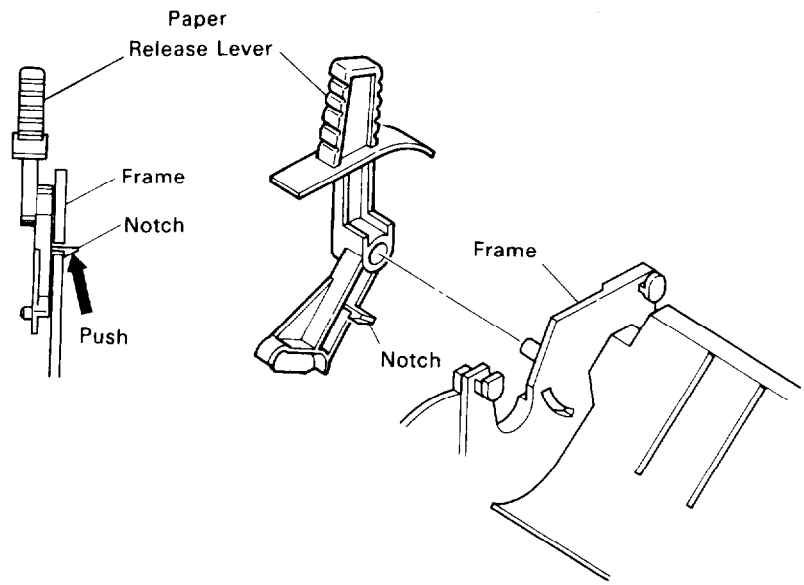


Figure 3-13. Removing the Paper Release Lever

3. Push the paper feed roller shaft downward and slide it approximately an inch (2 cm) to the left. Then lift it up and remove it.

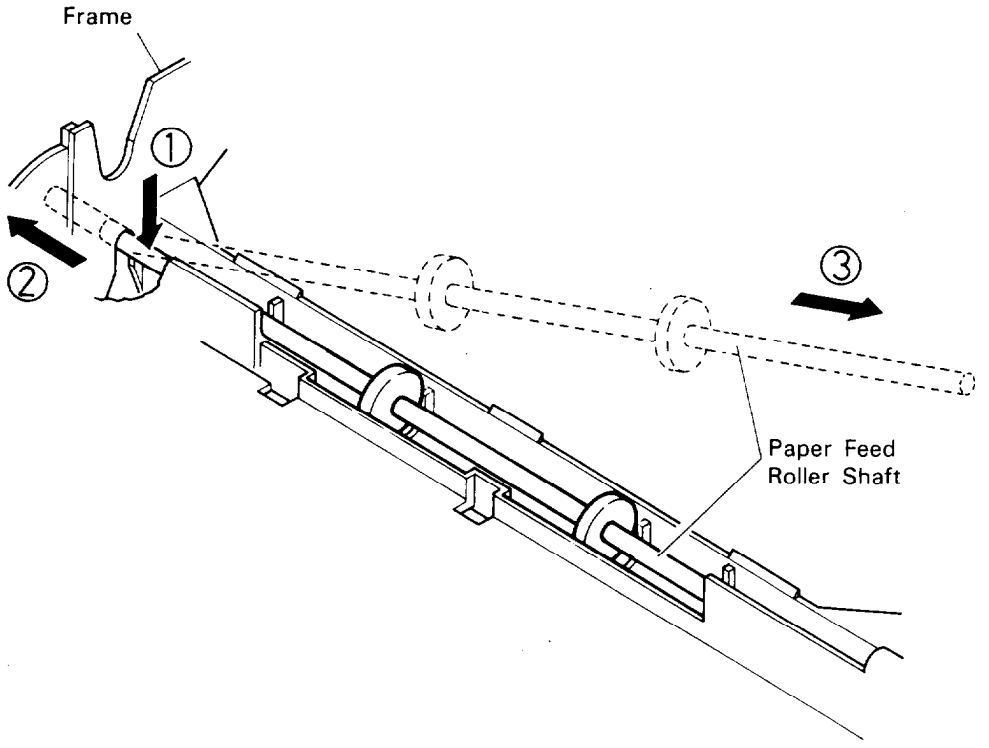


Figure 3-14. Removing the Paper Feed Roller Shaft

4. Use a screwdriver to loosen the two tabs that secure the paper guide plate and the paper guide spacer to the frame. Push the tabs out from the frame.) Then lift up and remove the paper guide plate and spacer.

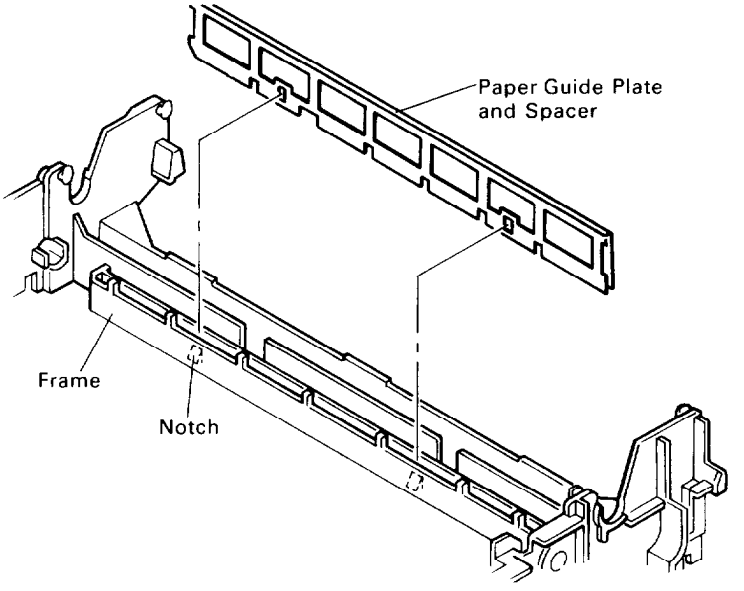


Figure 3-15. Removing the Paper Guide Plate and Spacer

Assembly Note

Figure 3-16 shows the direction in which to install the paper guide plate and spacer.

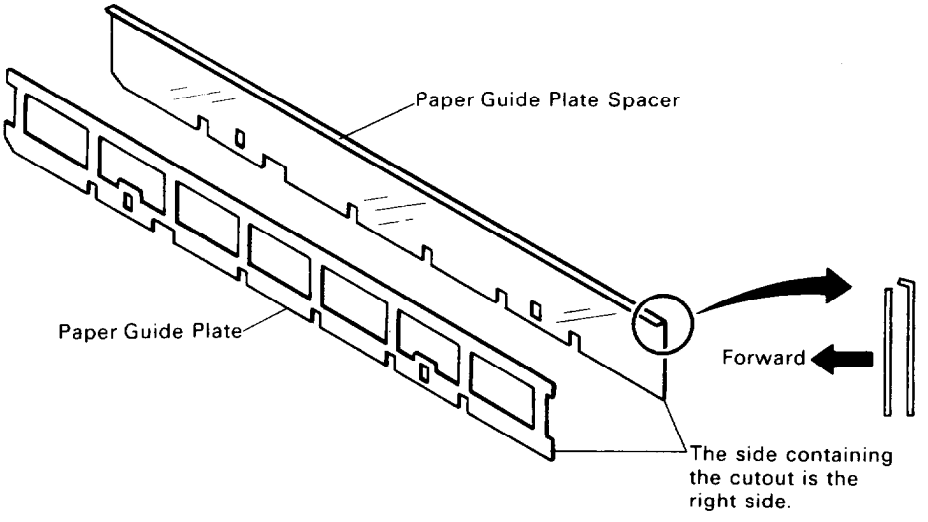


Figure 3-16. Installing the Paper Guide Plate and Spacer

Removing the paper feed motor

1. Remove the printer mechanism as described earlier in this chapter.
2. Disconnect the motor cable from the paper feed motor.
3. Loosen the tab that secures the paper feed motor to the frame by pushing it in with a screwdriver. To remove the paper feed motor, rotate it in the direction shown by the arrow in Figure 3-17. Use point A as the fulcrum.

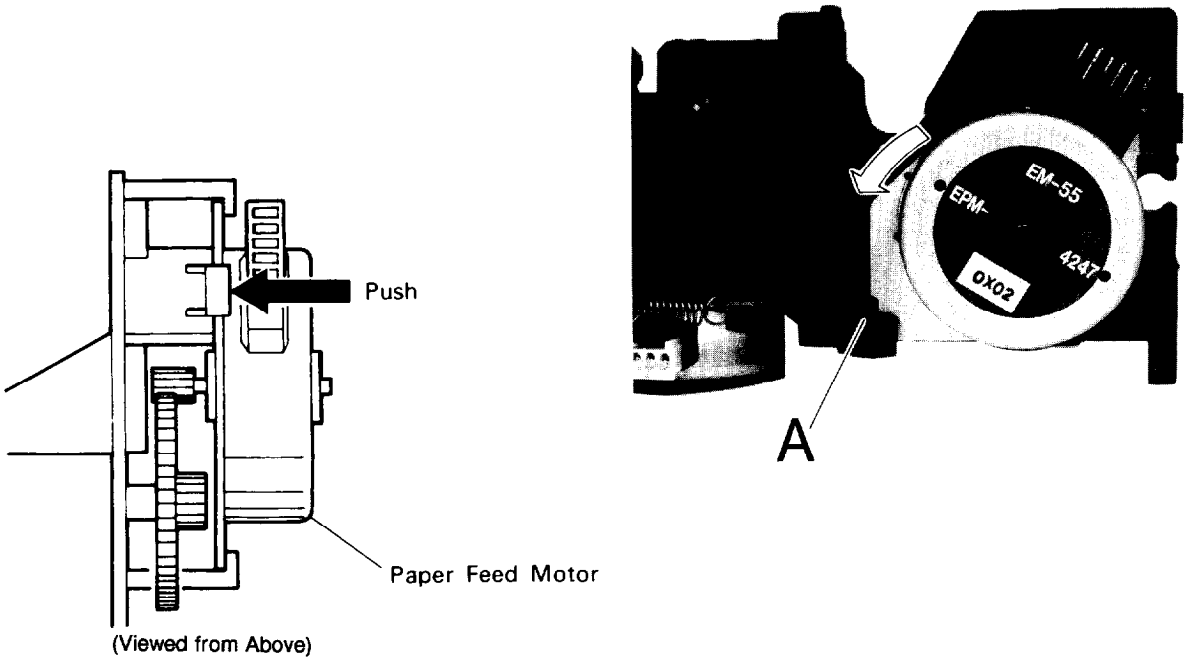


Figure 3-17. Removing the Paper Feed Motor

Removing the paper end sensor

1. Remove the platen unit and the paper guide as described earlier in this chapter.

2. Loosen the tab that secures the paper end sensor to the paper guide. To remove the paper end sensor, rotate it in the direction shown by the arrow in Figure 3-18. Use point A as the fulcrum.

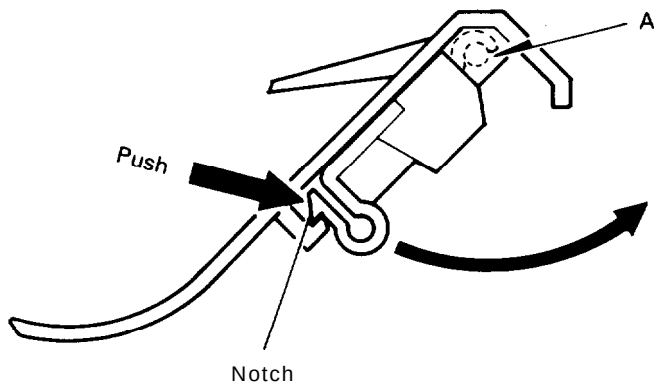


Figure 3-18. Removing the Paper End Sensor

Disassembling the platen unit

1. Remove the platen unit as described earlier in this chapter.

2. Remove the left shaft holder and the paper feed knob from the platen unit.

3. Pull out the ground spring and the platen gear at the right side of the platen unit.

4. Remove the E-ring from the platen unit and pull out the right shaft holder and the flat spring.

Assembly Notes

- When you assemble the platen unit, see Figure 3-19 to ensure that you install the flat spring and the shaft holder properly and that the gap between the platen and the platen gear is the correct size.
- When you attach the ground spring to the platen unit, engage the long hook first and then the short hook.

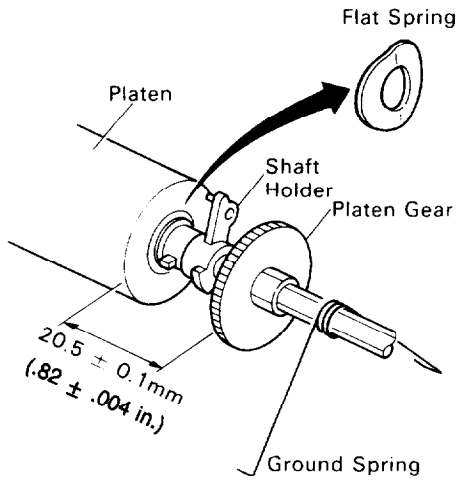


Figure 3-19. Assembling the Platen Unit

Removing the carriage unit

1. Remove the printer mechanism as described earlier in this chapter.
2. Remove the printhead as described earlier in this chapter.
3. Turn the printer mechanism upside down. Then manually move the carriage unit to the cutout in the carriage motor frame. (Move the carriage unit until you see the carriage unit and the timing belt join through the cutout.)

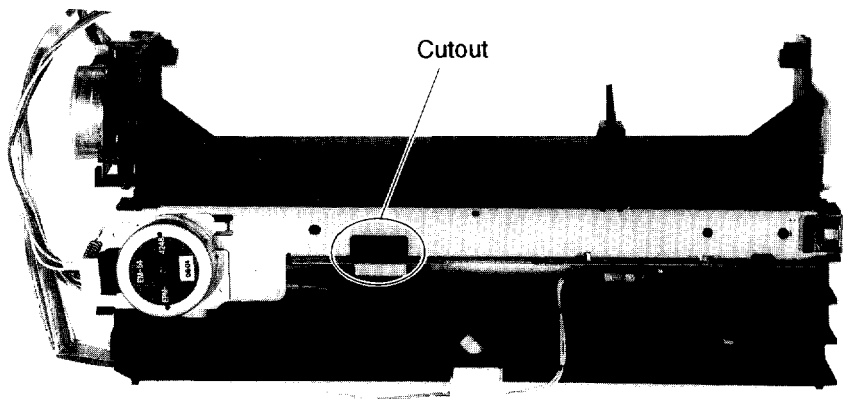


Figure 3-20. Bottom of the Printer Mechanism

4. Using round-nose pliers, detach the timing belt from the carriage unit. Be careful not to damage the belt.

5. Lift portion A (in Figure 3-21) of the carriage guide shaft ground plate and remove it frorn the notch in the carriage motor frame. Slide the plate so that you can remove it from the frame through the plate cutout at B.

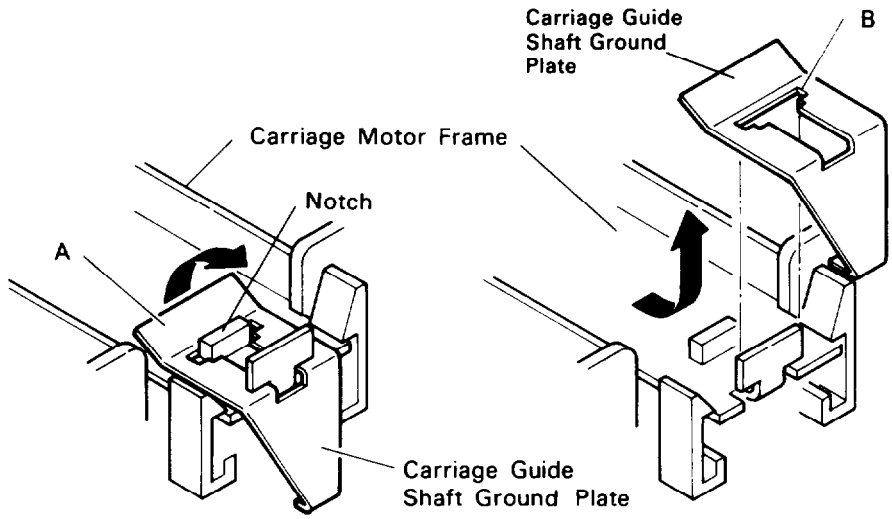
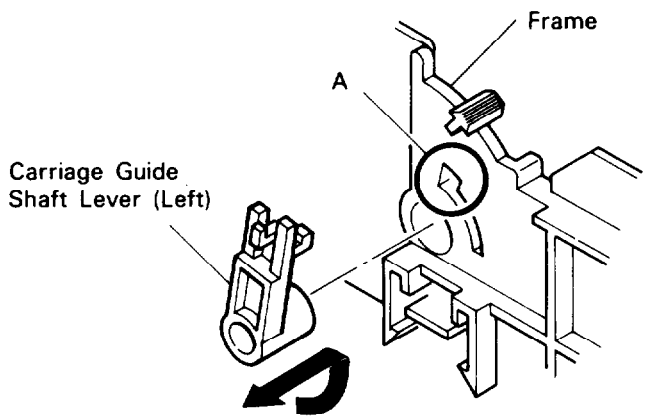


Figure 3-21. Removing the Carriage Guide Shaft Ground Plate

6. Turn the printer mechanism right side up. Rotate the left carriage guide shaft lever fully counterclockwise and pull it out through cutout A. Then turn the right carriage guide shaft lever fully clockwise and pull it out the same way.



(Viewed from the Left Side)

Figure 3-22. Removing the Carriage Guide Shaft

7. Push the notch that secures the carriage guide plate to the frame. Then slide the carriage guide plate to the left and remove it.

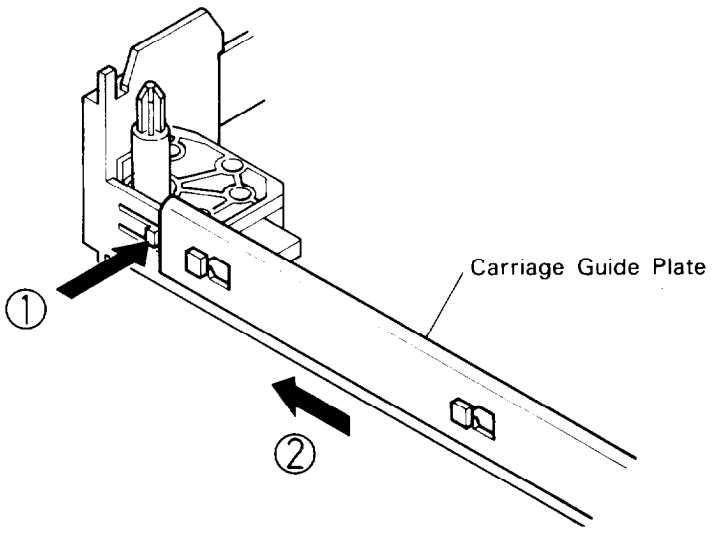


Figure 3-23. Removing the Carriage Guide Plate

8. Lift up and remove the carriage unit, the carriage guide shaft, and the head adjust lever.

Assembly Notes

- Before you install the carriage guide shaft and the head adjust lever, position them as shown in Figure 3-24.

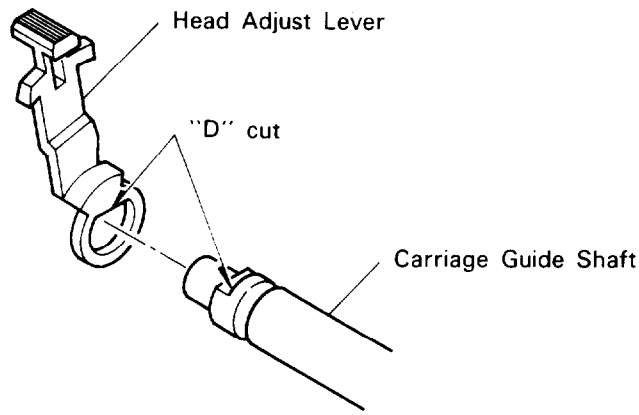


Figure 3-24. Carriage Guide Shaft and Head Adjust Lever

- The left carriage guide shaft lever is gray and the right one is black. For each lever, slide the hole onto the corresponding shaft end.
- When you connect the head cable, be sure to pass it through the FFC guide at the frame correctly.

Adjustment Required

After you assemble the carriage unit, adjust the platen gap as described in Chapter 4.

Removing the carriage motor

1. Follow steps 1 through 5 of the preceding section on removing the carriage unit.

2. Disconnect the motor cable from the carriage motor. Disconnect the home position sensor's lead wire from the molded clip at the bottom of the frame. (See Figure 3-25.)

3. Loosen the four tabs that secure the carriage motor frame to the chassis frame. Remove the carriage motor frame.

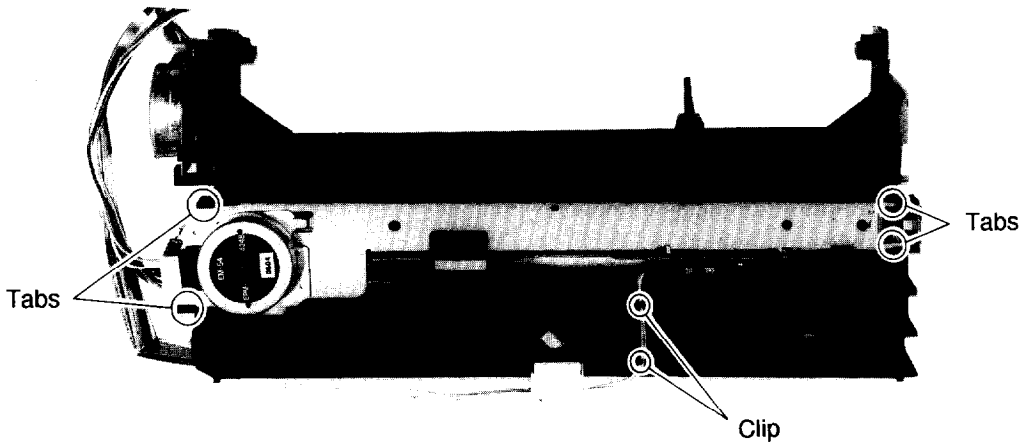


Figure 3-25. Removing the Carriage Motor Frame

4. Remove the belt tension spring from the carriage motor frame. Remove the 0.092 inch (2.3 mm) E-type retaining ring on the carriage motor. Then remove the plain washer, belt pulley flange, belt pulley shaft holder, belt pulley, and timing belt.

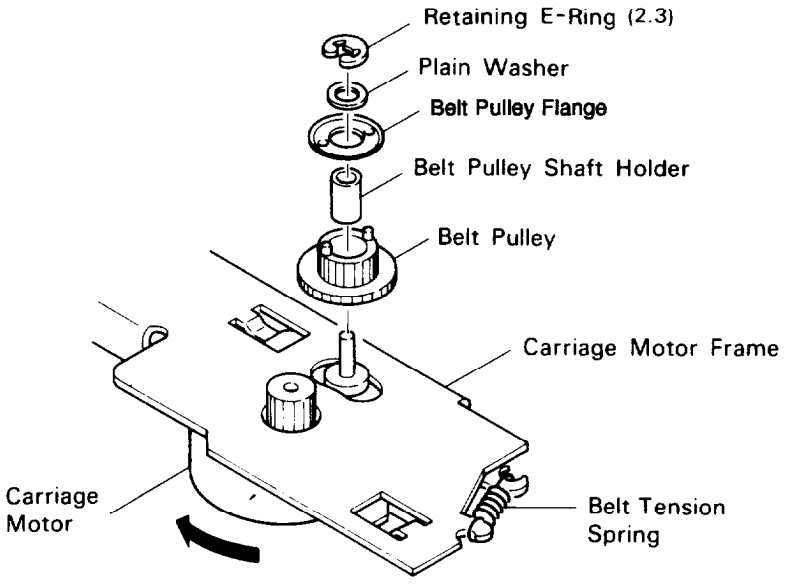


Figure 3-26. Removing the Carriage Motor

5. To remove the carriage motor, move it in the direction indicated by the arrow in Figure 3-26.

Assembly Notes

Attach the E-rings as follows:

- When you attach the ring to the left pulley shaft, install it so that its opening faces left.
- When you attach the ring to the right pulley shaft, install it so that its opening faces right.

After you attach the E-rings, use tweezers to check that they are fixed in place and do not move.

Removing the home position sensor

1. To remove the carriage motor Came, follow steps 1 through 3 of the preceding section on removing the carriage motor.

2. Push in the notch on the home position sensor and remove the sensor from the carriage motor frame.

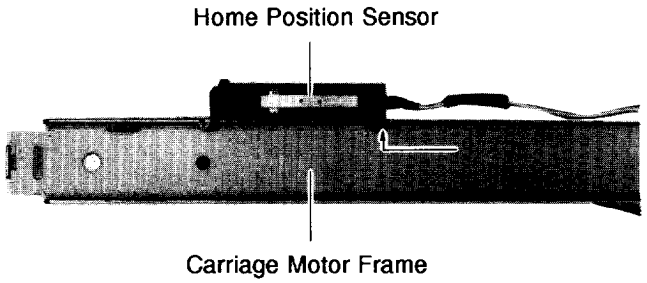


Figure 3-27. Removing the Home Position Sensor

Disassembling the ribbon feed mechanism

1. Remove the printer mechanism as described earlier in this chapter.

2. Turn the printer mechanism upside down. Without removing the ribbon gear cover, use a screwdriver to loosen the four bent tabs of the ribbon gear cover slightly. (Do not remove the ribbon gear cover while the printer mechanism is upside down, because the gears will scatter.>

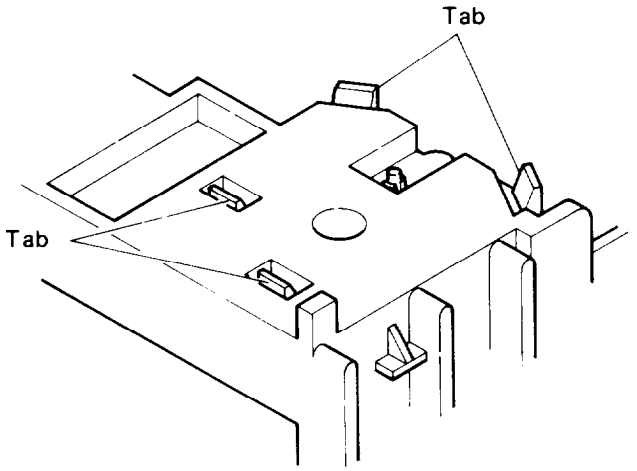


Figure 3-28. Removing the Ribbon Gear Cover

3. Turn the printer mechanism right side up, and remove the ribbon gear cover.

Disassembling the tractor unit

1. Use a screwdriver to loosen the three tabs on the sprocket mounting plate. Remove the side covers. (You can remove the left and right side covers at the same time.)

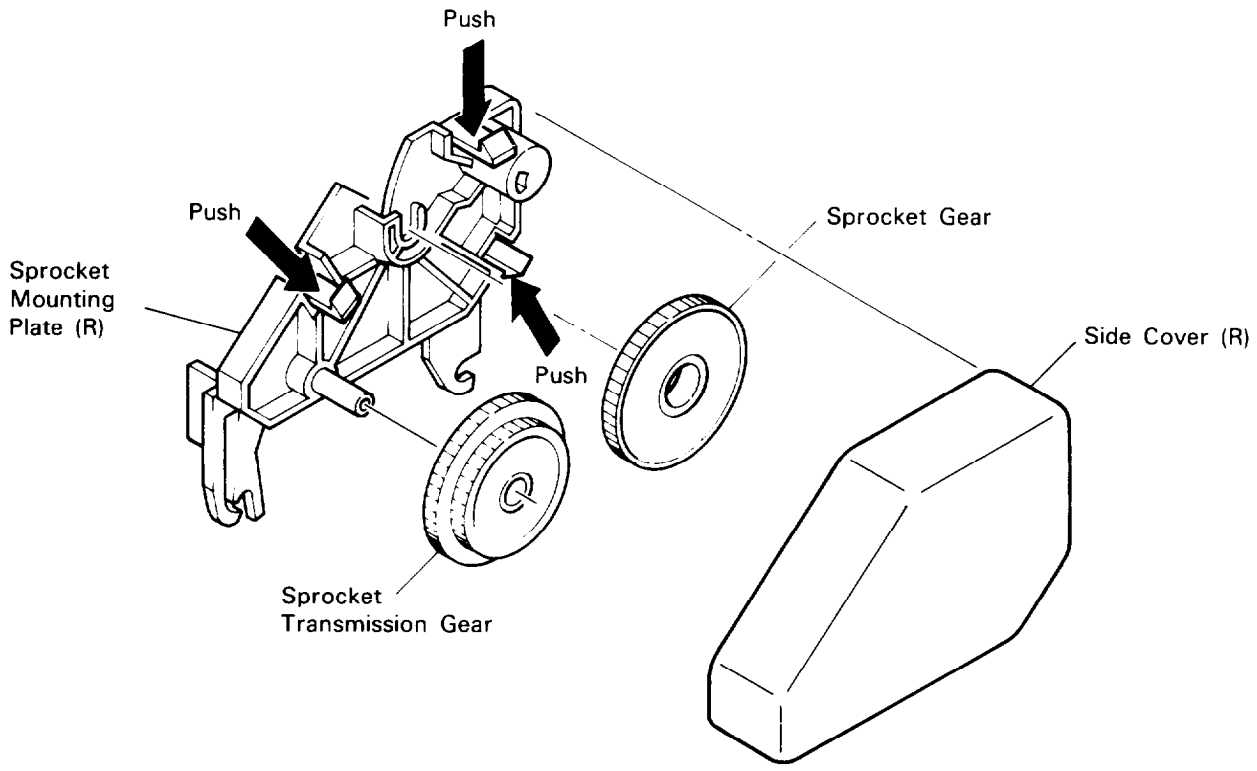


Figure 3-29. Removing a Side Cover

2. Push open the two sprocket gear tabs and remove the sprocket shaft from the sprocket gear.

3. Remove the sprocket transmission gear. Then remove the sprocket mounting plate from the sprocket shaft.

4. Use a screwdriver to loosen the sprocket mounting plate tab. Then pull out the sprocket guide shaft.

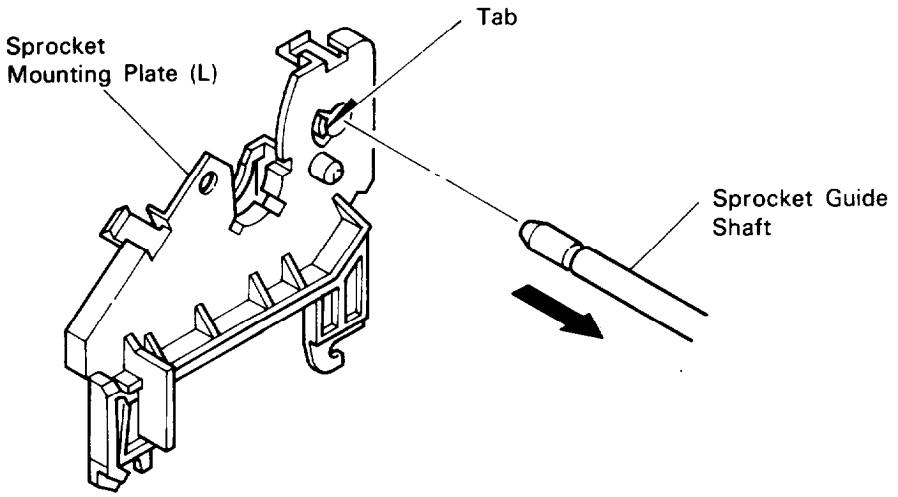


Figure 3-30. Removing the Sprocket Guide Shaft

5. Pull out the sprocket assembly and paper guide roller from the sprocket shaft and the sprocket guide shaft. The T-shaped notch on the paper guide roller indicates the direction in which to move it along the sprocket shaft.

Assembly Note

When you assemble the paper guide roller, insert the sprocket shaft from the side with the T-shaped notch.

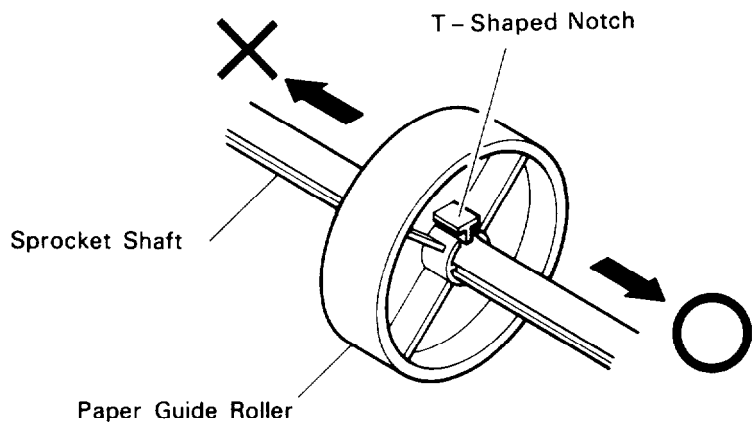


Figure 3-31. Removing the Paper Guide Roller

Assembly Notes

- When you attach the paper guide roller to the sprocket shaft, move the roller in the same direction in which you removed it. (See Figure 3-32.)
- Place the sprocket wheels on the sprocket shaft so that their markings are on the left. Align the markings on the two wheels.

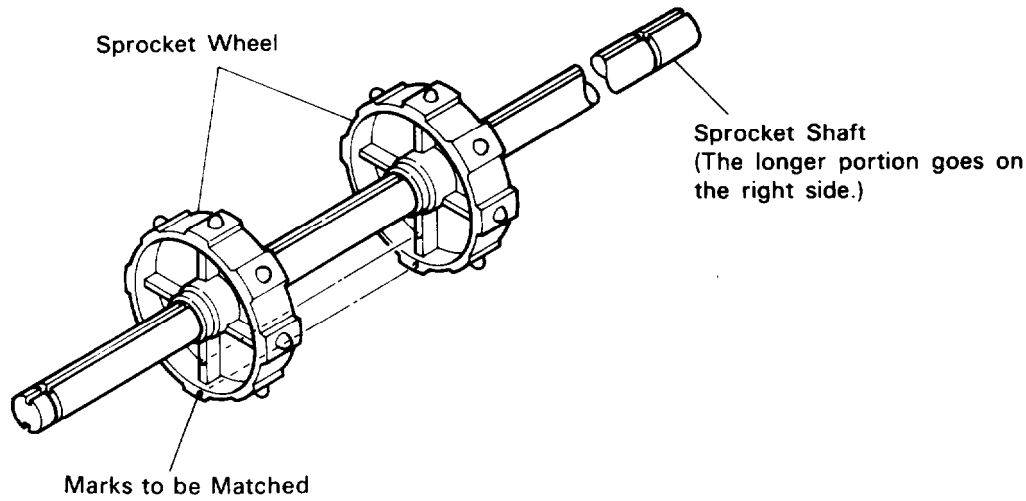


Figure 3-32. Installing the Sprocket Wheels

Chapter 4

Adjustment

Figures

Tables

Adjustment 4

Adjustment Overview

This chapter describes adjustment procedures. To ensure proper operation, you need to adjust the printer after you repair or replace any parts.

Adjusting the Platen Gap

If you rotated or assembled the carriage guide shaft or shaft levers or if printing is abnormal, you need to adjust the gap between the platen and the printhead. Follow these steps:

1. Remove the printer mechanism as described in Chapter 3.

2. Install the paper guide and the platen unit on the printer mechanism.

3. Remove the printhead. To remove the ribbon mask, use tweezers to pull it slightly toward the front of the printer and then lift it up.

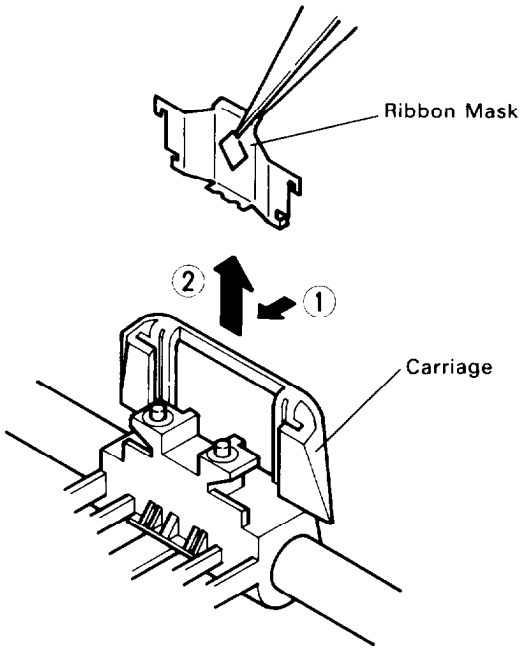


Figure 4-1. Removing the Ribbon Mask

4. Reinstall the printhead.

5. Move the head adjust lever to the second position and move the paper release lever to the tractor position.

6. Manually move the carriage to column 10.

7. Place the gap gauge between the platen and printhead. Using the left and right carriage guide shaft levers, adjust the gap so that the 0.017 inch ***(0.42*** mm) gauge can pass smoothly while the 0.018 inch (0.45 mm) gauge cannot pass at all.

   Rotate the left carriage guide shaft lever clockwise to widen the platen gap or counterclockwise to close it. Rotate the right carriage guide shaft lever counterclockwise to widen the platen gap or clockwise to close it.

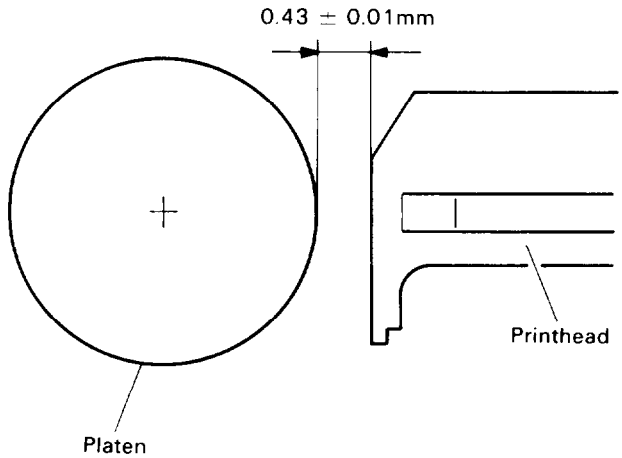


Figure 4-2. Adjusting the Platen Gap

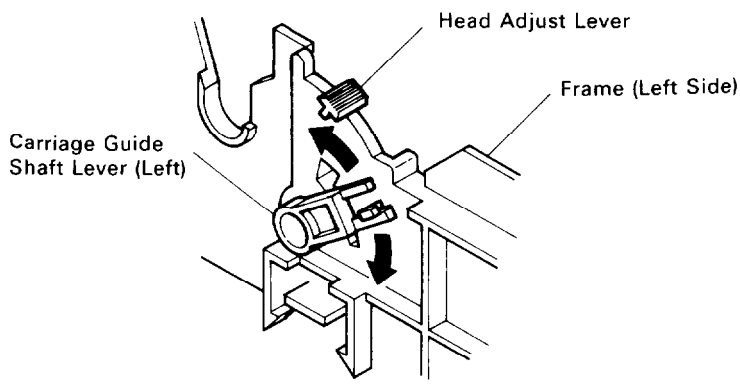


Figure 4-3. Moving the Carriage Guide Shaft Lever

8. Adjust the platen gap at the 10th and 70th column positions and at the middle of the platen. When the gaps at all three positions match, the adjustment is complete.

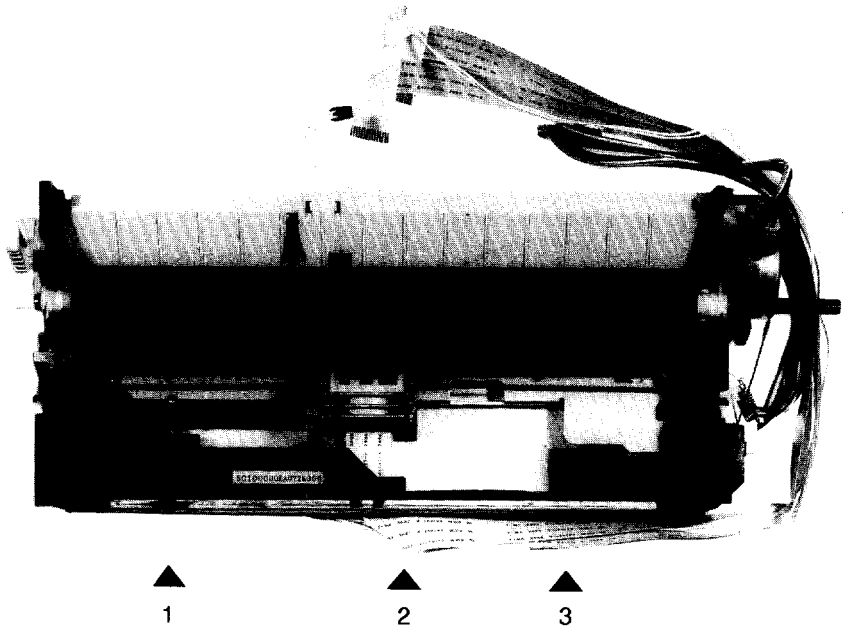


Figure 4. Platen Gap Adjustment Positions

Adjusting the Bidirectional Printing Alignment

If lines or characters are misaligned during bidirectional printing, perform this adjustment. Also perform this adjustment whenever you replace the CO64 MAIN board or the printer mechanism.

VR1 and VR2 Specifications

Use variable resistors VR1 or VR2 on the C064 MAIN board to perform the bidirectional printing alignment adjustment. Use VR1 in draft mode and VR2 in LQ mode. Tables 4-1 and 4-2 show the specifications for VR1 and VR2. Misalignment usually occurs when the carriage moves from right to left.

Table 4-1. VR1 Specifications

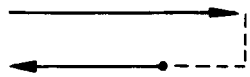
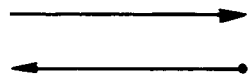
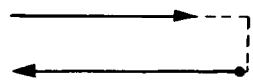
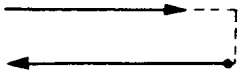
VR1	Shifting Direction and Value	
–7 –6 –5 –4 –3 –2 –1	7/240 inch 6/240 inch 5/240 inch 4/240 inch 3/240 inch 2/240 inch 1/240 inch	 Printing starts n/240 of an inch to the left of the reference position.
0	Normal position (reference position)	 Printing starts here.
1 2 3 4 5 6 7	1/240 inch 2/240 inch 3/240 inch 4/240 inch 5/240 inch 6/240 inch 7/240 inch	 Printing starts n/240 of an inch to the right of the reference position.

Table 4-2. VR2 Specifications

VR2	Shifting Direction and Value	
-11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1	11/720 inch 10/720 inch 9/720 inch 8/720 inch 7/720 inch 6/720 inch 5/720 inch 4/720 inch 3/720 inch 2/720 inch 1/720 inch	 Printing starts n/720 of an inch to the left of the reference position.
0	Normal position (reference position)	 Printing starts here.
1 2 3 4 5 6 7 8 9 10 11	1/720 inch 2/720 inch 3/720 inch 4/720 inch 5/720 inch 6/720 inch 7/720 inch 8/720 inch 9/720 inch 10/720 inch 11/720 inch	 Printing starts n/720 of an inch to the right of the reference position.

Adjustment Procedures

To facilitate adjustment, VR1 and VR2 have standard positions. The standard position is the point at which the variable resistor stops when you turn it counterclockwise. To adjust the alignment, first move VR1 or VR2 to its standard position. Then rotate VR1 or VR2 as described in the following sections.

- Select tractor feeding, load continuous paper, and install the ink ribbon.
- Move the head adjust lever to the second position.

Draft mode

1. Turn on the printer while holding down the ON LINE, FORM FEED, and LINE FEED buttons.

2. Press the ON LINE button.

3. Press the LINE FEED button. The printer prints five test patterns. The pattern corresponding to the current value of VR1 is the middle pattern. For example, in Figure 4-5, VR1 equals -4 (pattern 3).

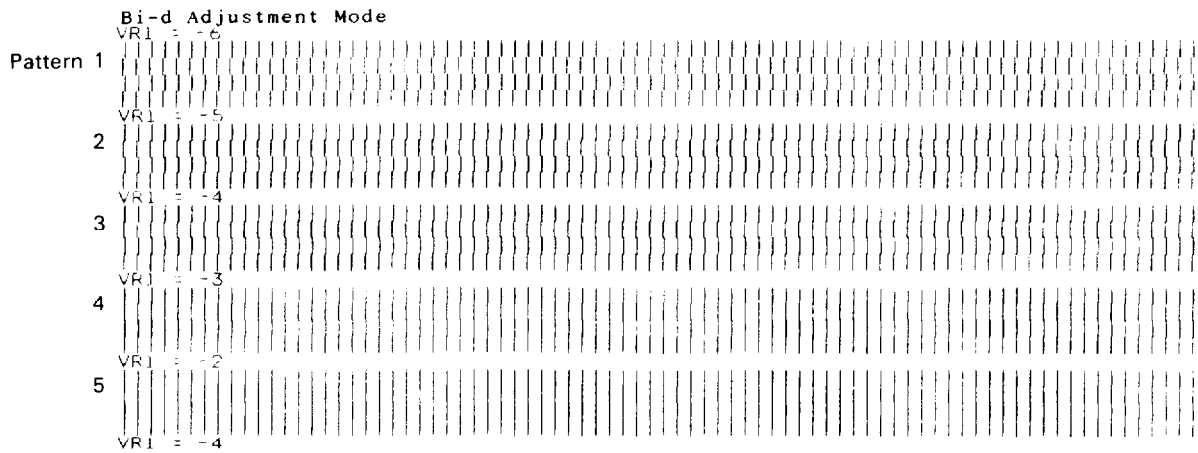


Figure 4-5. Draft Mode Test Patterns

4. Select the best-aligned pattern as described here:

   - If the best-aligned pattern is just above the middle pattern, press the FORM FEED button once. If it is the top pattern, press the FORM FEED button twice. (See Table 4-3.)

   - If the best-aligned pattern is just below the middle pattern, press the LINE FEED button once. If it is the bottom pattern, press the LINE FEED button twice. (See Table 4-3.)

   For example, if the best-aligned pattern is VR1 = -2 (pattern 5), press the LINE FEED button twice.

Table 4-3. Selecting the Best-Aligned Test Pattern

Number of Best-Aligned Pattern	Button to Press	Number of Times to Press the Button
1	FORM FEED	Twice
2	FORM FEED	Once
3 (middle pattern)	—	—
4	LINE FEED	Once
5	LINE FEED	Twice

5. Press the ON LINE button to print the pattern you select.
6. Check the alignment of the printed pattern. If it is not satisfactory, return to step 4.
7. To set VR1 for the best-aligned pattern, turn VRl until the buzzer sounds.
8. Turn off the printer.

LQ mode

The LQ mode adjustment is similar to the draft mode adjustment described above.

1. Turn on the printer while holding down the ON LINE, FORM FEED, and LINE FEED buttons.
2. Press the ON LINE button.

3. Press the FORM FEED button. The printer prints five test patterns. The pattern corresponding to the current value of VR2 is the middle pattern. For example, in Figure 4-6, VR2 equals +4 (pattern 3).

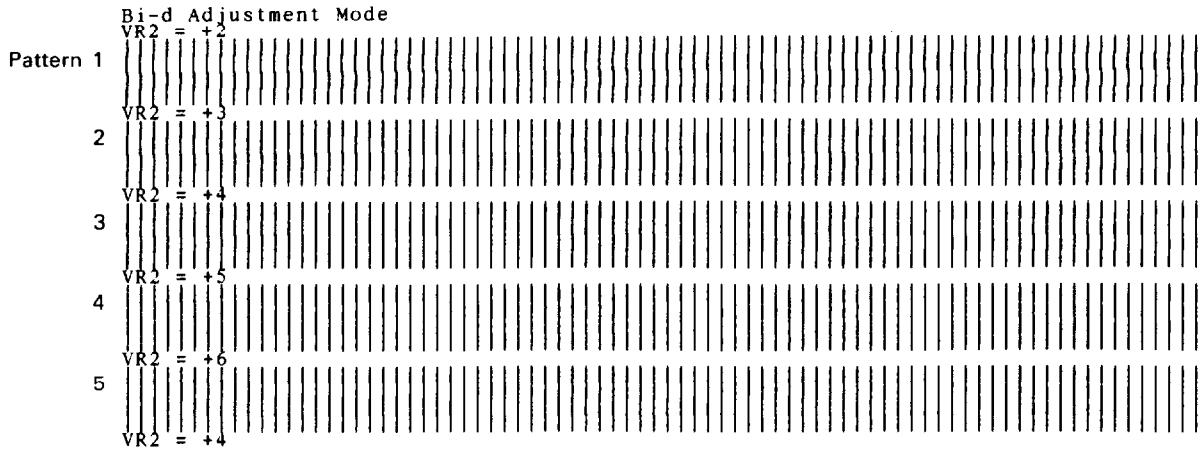


Figure 4-6. LQ Mode Test Patterns

4. Select the best-aligned pattern as described here:

   - If the best-aligned pattern is just above the middle pattern, press the FORM FEED button once. If it is the top pattern, press the FORM FEED button twice. (See Table 4-3.)

   - If the best-aligned pattern is just below the middle pattern, press the LINE FEED button once. If it is the bottom pattern, press the LINE FEED button twice. (See Table 4-3.)

   For example, if the best-aligned pattern is VR2 = +5 (pattern 4), press the LINE FEED button once.

5. Press the ON LINE button to print the pattern you select.

6. Check the alignment of the printed pattern. If it is not satisfactory, return to step 4.

7. To set VR2 for the best-aligned pattern, turn VR2 until the buzzer sounds.

8. Turn off the printer.

Chapter 5

Troubleshooting

Figures

Tables

Troubleshooting 5

Procedure for Troubleshooting the Printer

Printer problems may produce a variety of symptoms that complicate the task of troubleshooting. However, you can simplify this process by following the procedure outlined in the flowchart below.

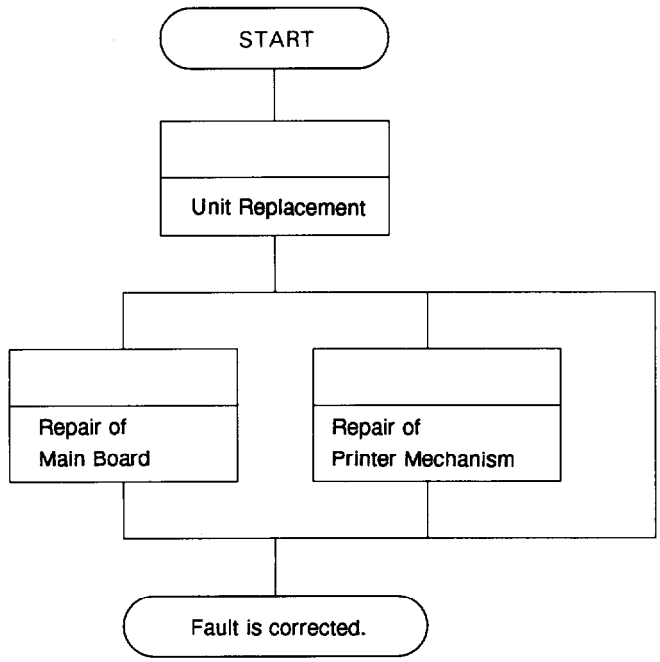


Figure 5-1. Troubleshooting Procedure

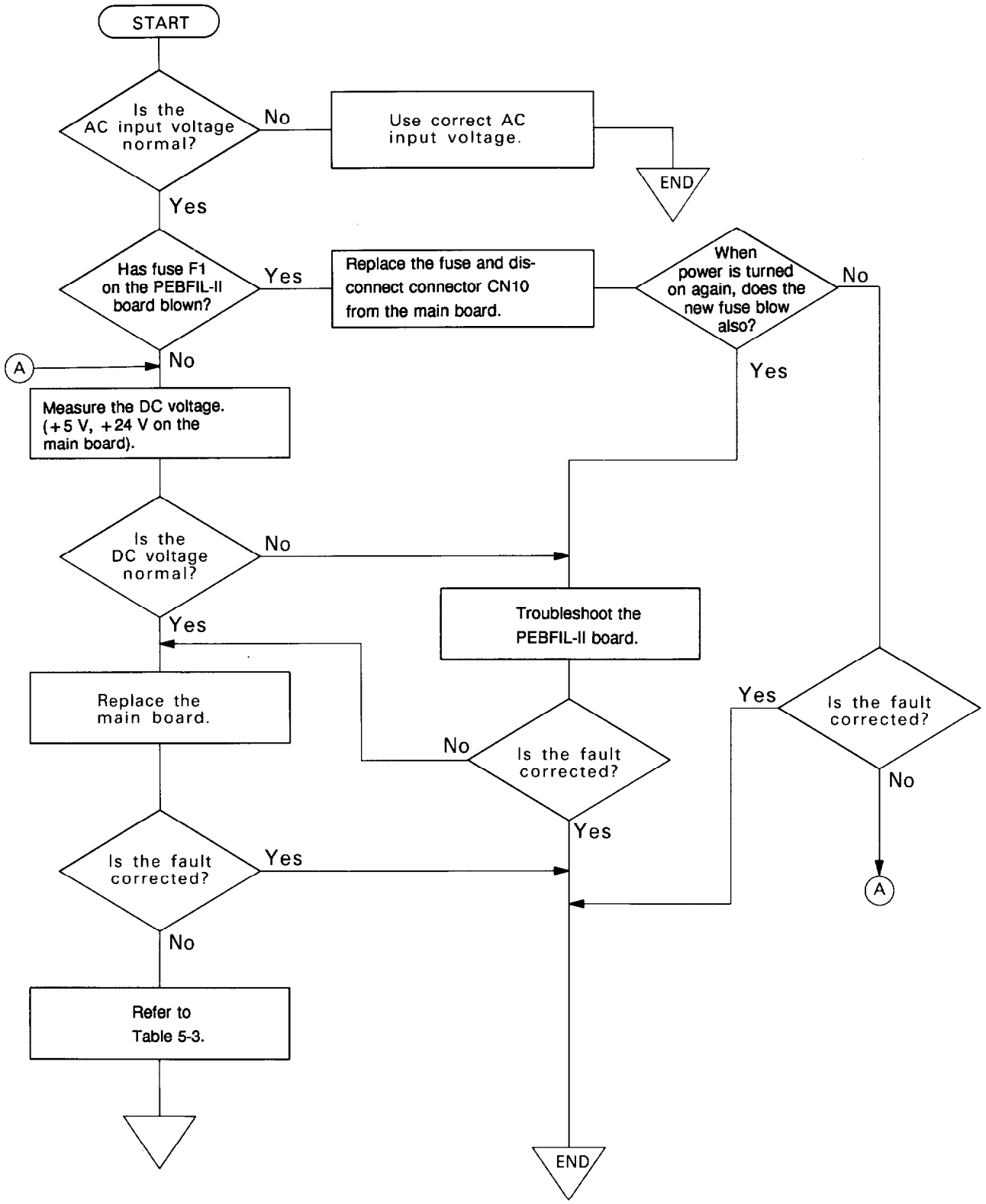
Unit Replacement

For most problems, it is sufficient for you to determine the difficulty to the unit level. Refer to Table 5-1; determine what the problem is; then follow the checks provided in the corresponding flowchart.

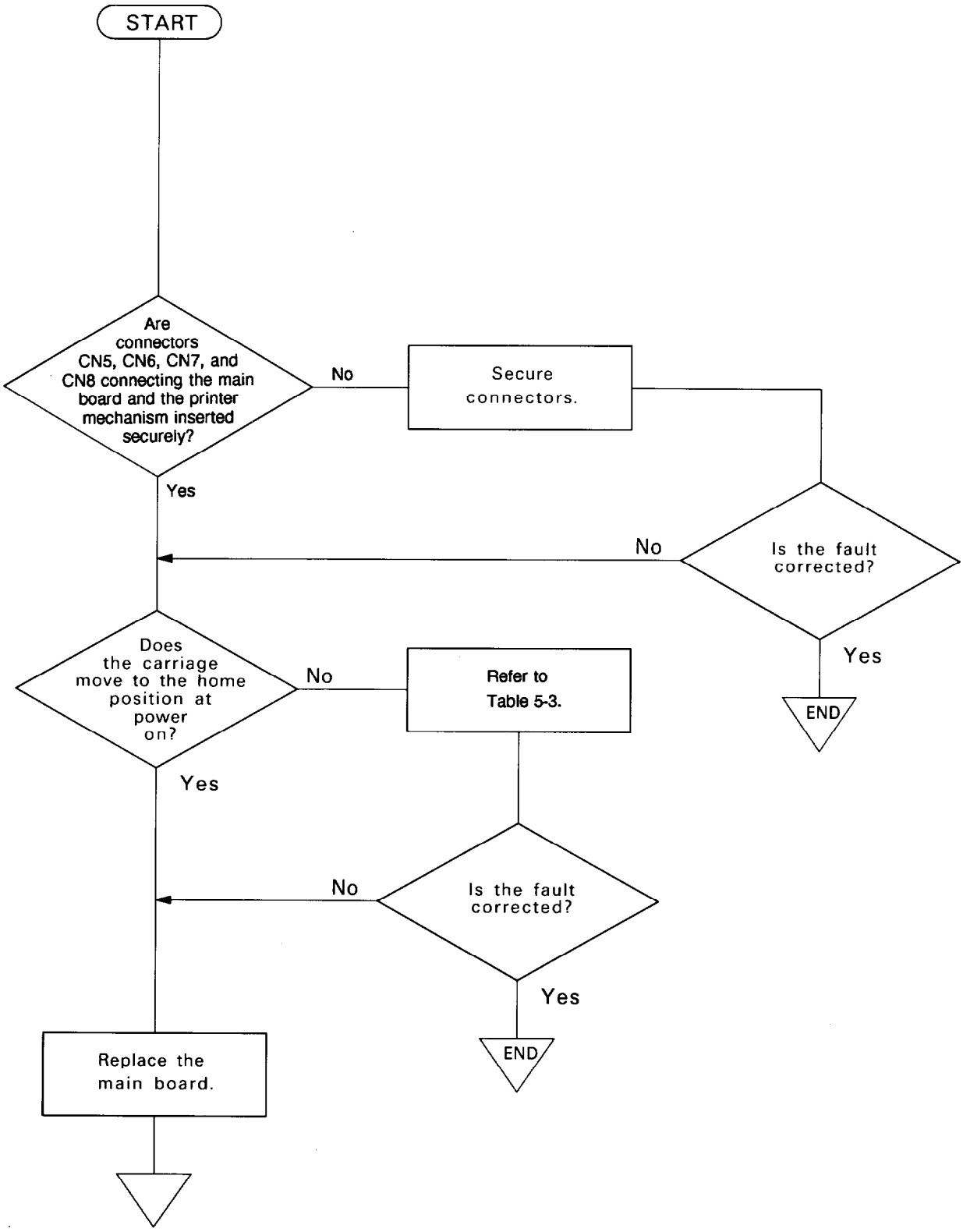
Table 5-1. Symptoms and Reference Pages

Symptom	Problem	See Page
Printer does not operate with power on	• Carriage does not move. • None of the indicators on the control panel light.	5-3
Abnormal carriage operation	• Carriage moves away from home position at power on. • Although the carriage returns to the home position, the printer does not enter READY mode.	5-4
Incorrect printing (in self-test) with normal carriage operation	• No printing is executed. • Some dots do not appear.	5-5
Abnormal paper feed	• No paper is fed. • Space between lines varies as a result of irregular paper feed.	5-7
Abnormal operation of the control panel	• No paper is fed when the LINE FEED or FORM FEED button is pressed and the printer is off line. • The mode of operation cannot be set from the control panel. • On-line or off-line mode cannot be entered.	5-8
Incorrect printing when the printer is on line	• Carriage operates normally at power on, and the result of the self-test is correct. However, the print data from the computer is not printed normally.	5-9

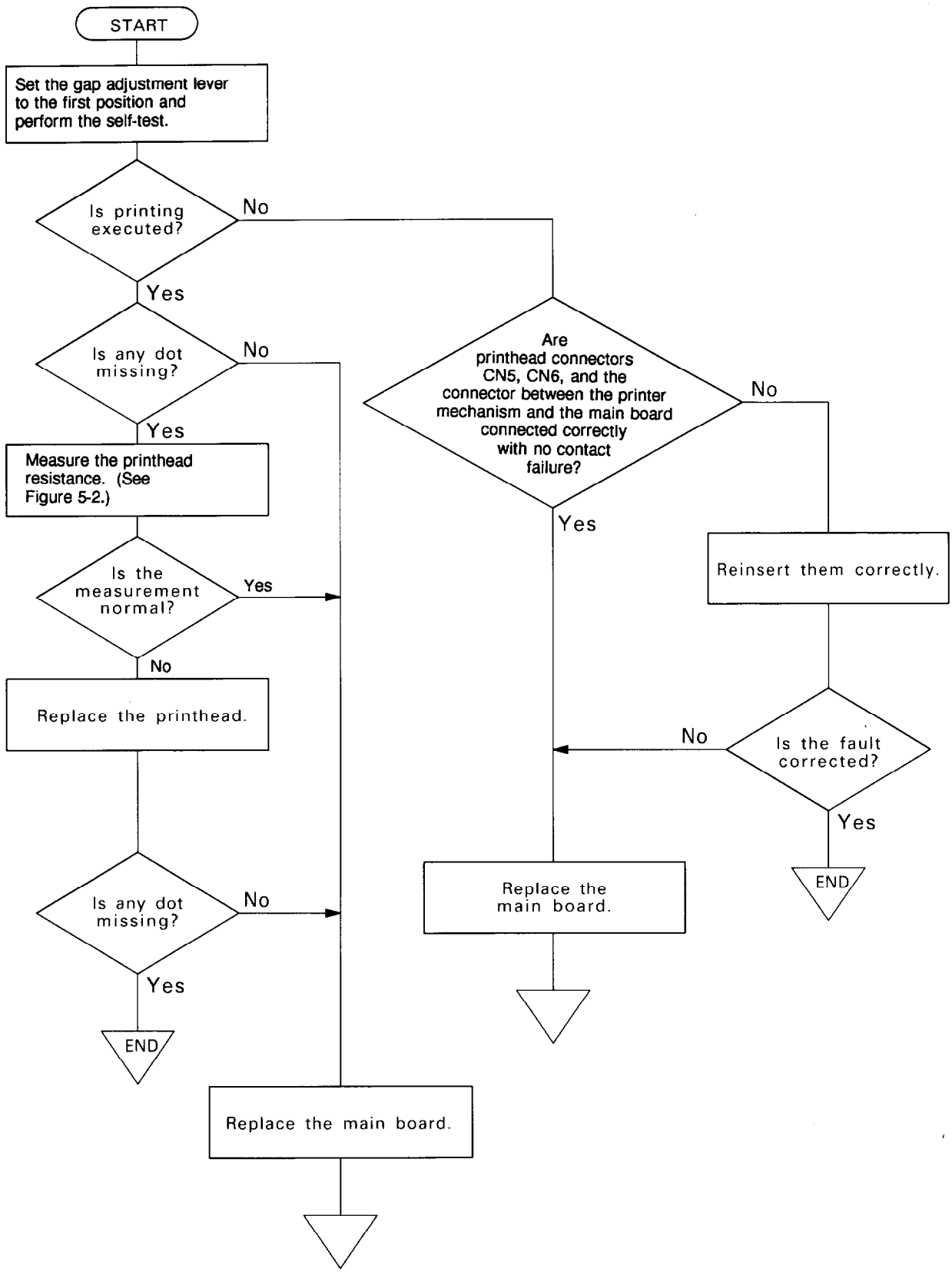
The Printer Does Not Operate when the Power Switch is Turned On.



Abnormal Carriage Operation



Normal Carriage Operation but Incorrect Printing (During Self-Test)



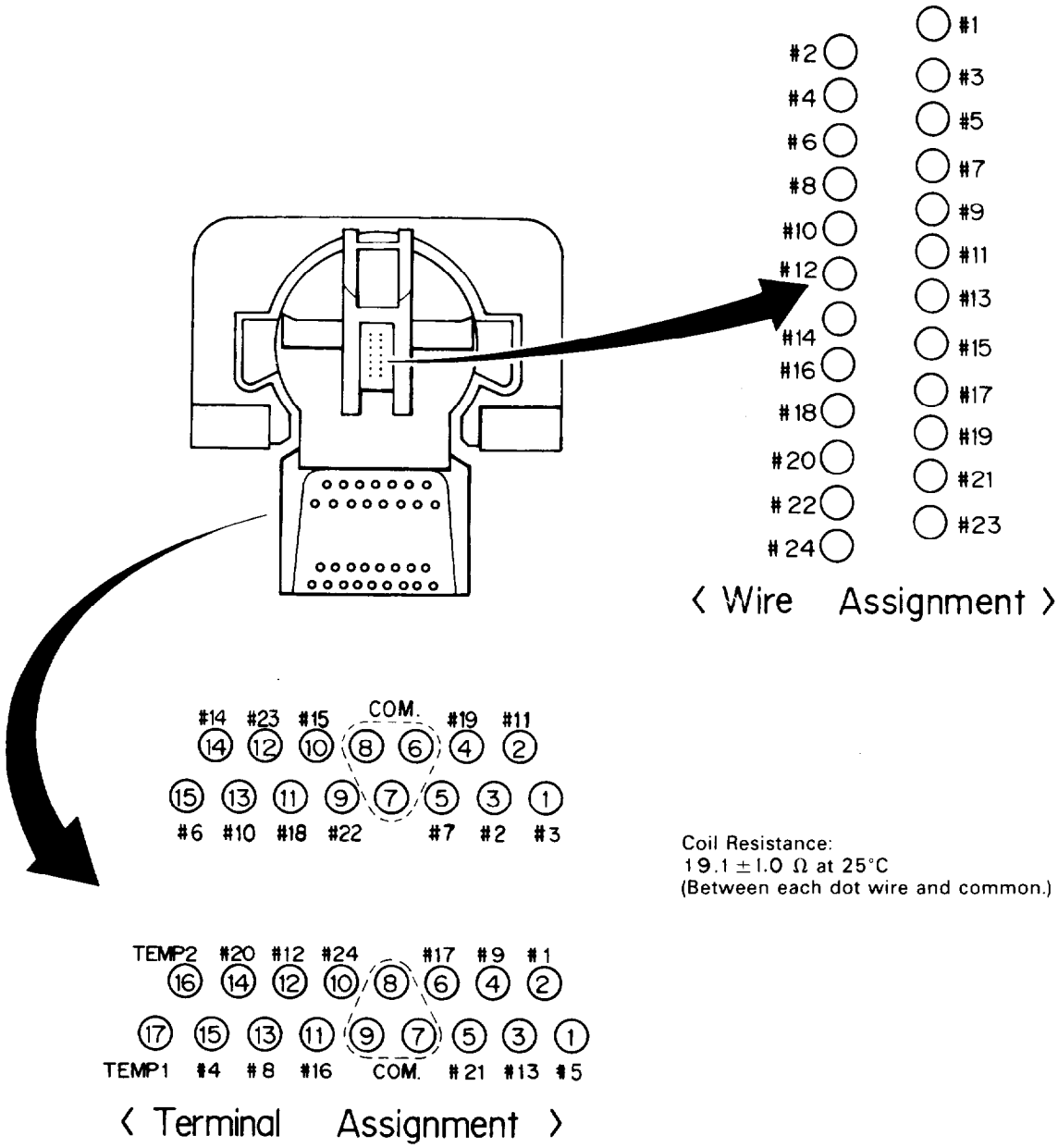
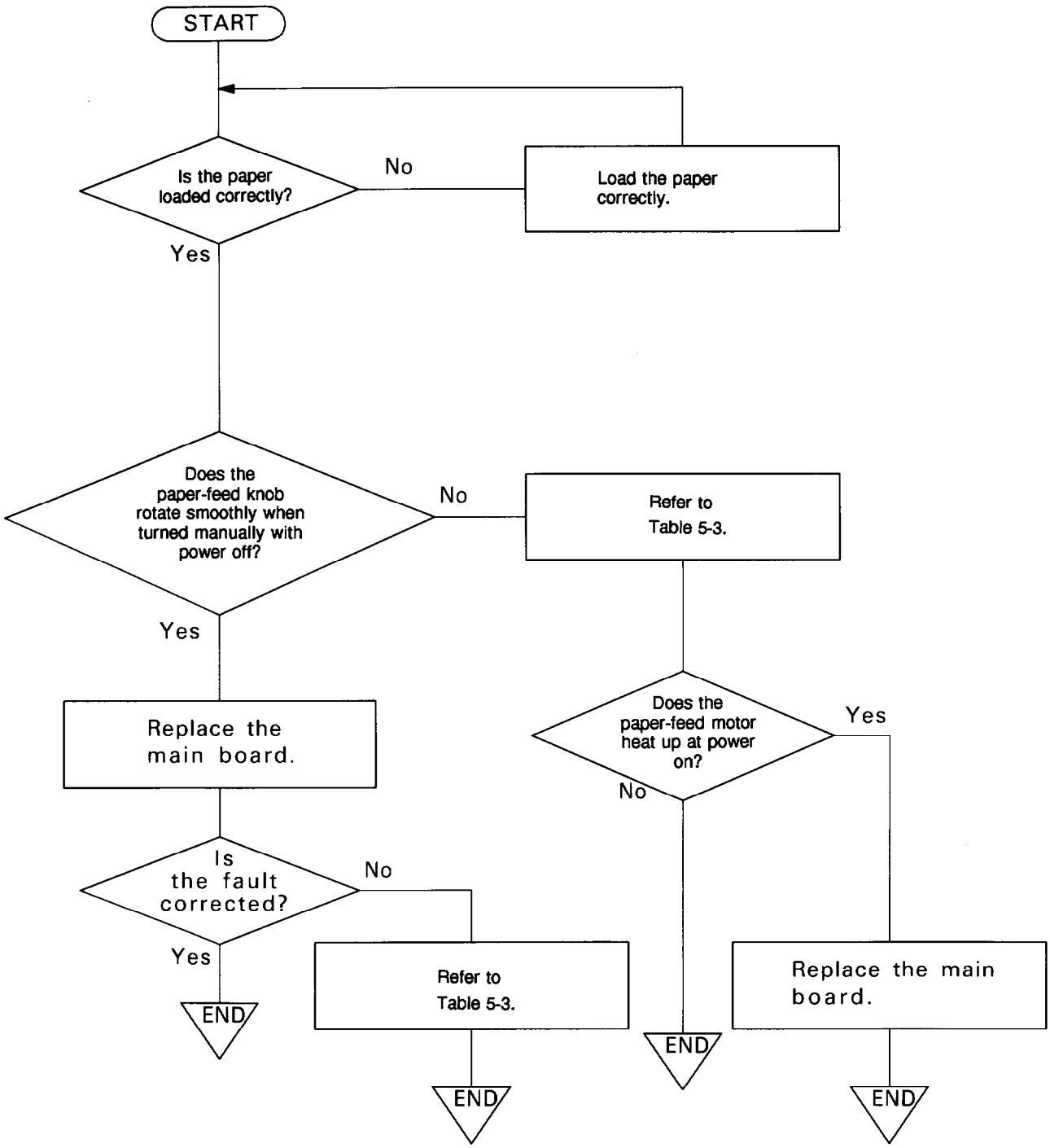
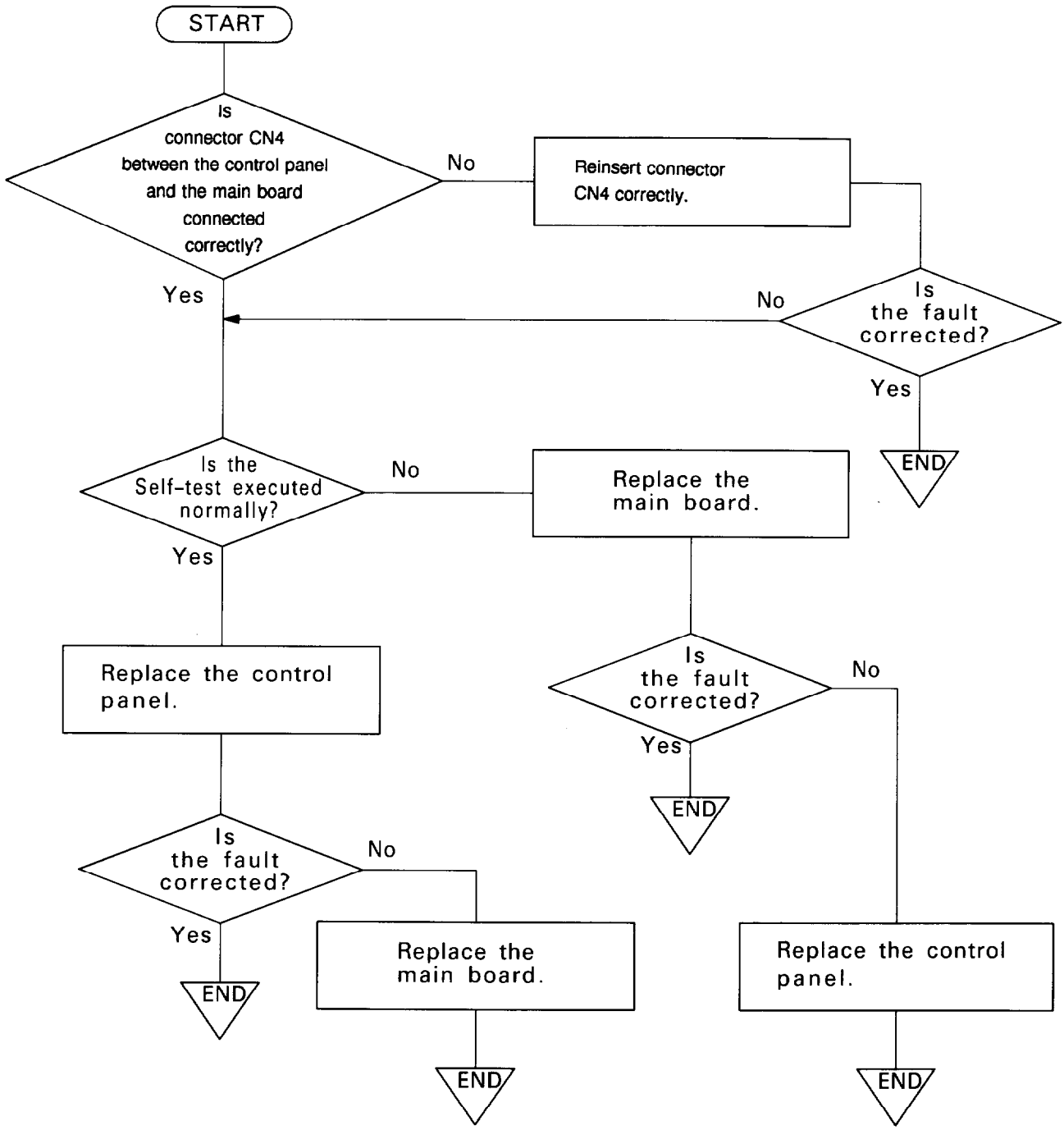


Figure 5-2. Printhead Resistance

Abnormal Paper Feed (but Normal Printing)

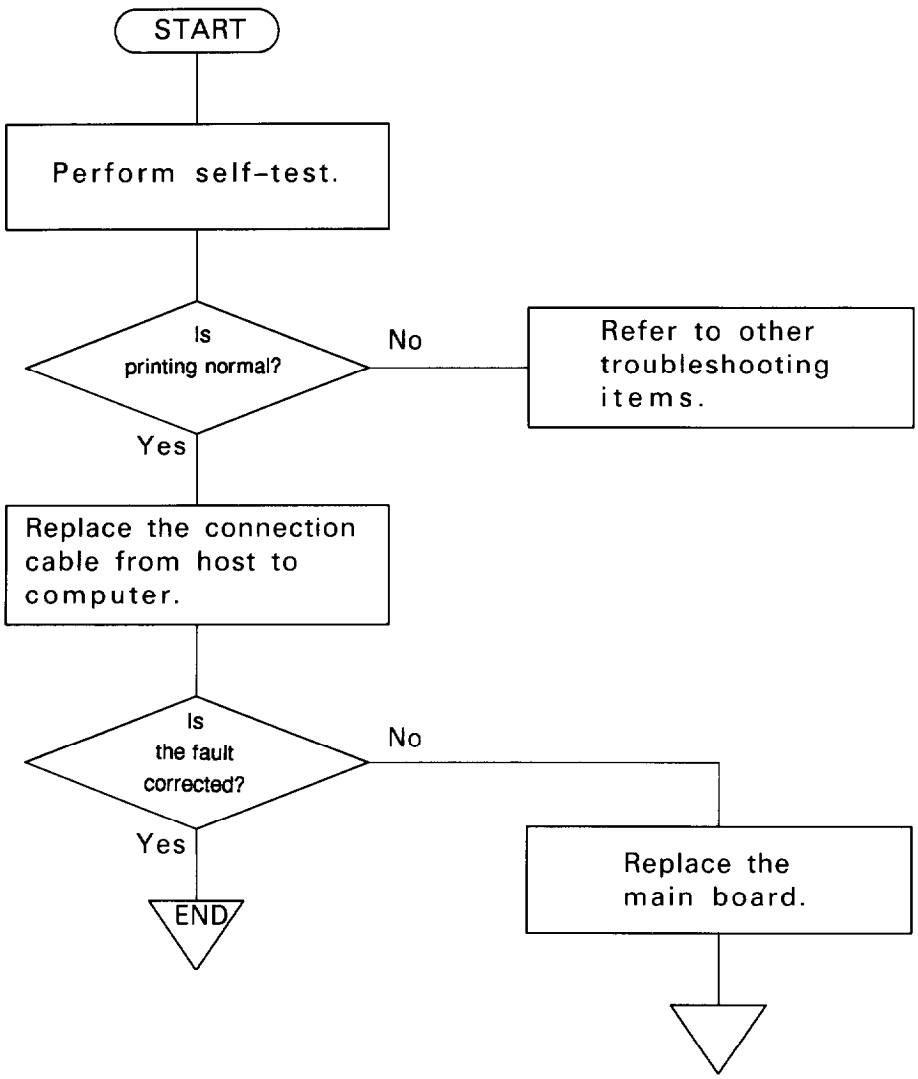


Abnormal Operation of the Control Panel



Incorrect Printing in On-line Mode

Note: It is assumed that the host computer is operating normally.



Repair of the Main Board

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

Table 5-2. Repair of the Main Board

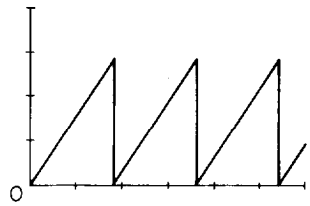
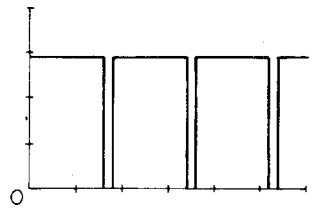
Symptom	Cause	Checkpoint	Solution
The +5 V line is dead.	IC8C is defective.	Observe the oscillation waveform and the switching waveform.  1V/DIV, 20μs/DIV Oscillation waveform (pin 2 of IC8C)  10V/DIV, 20μs/DIV Switching waveform (pin 9 of IC8C)	Replace IC8C.

Table 5-2. Repair of the Main Board (cont.)

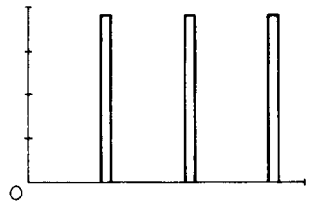
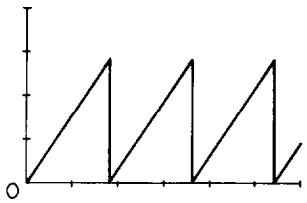
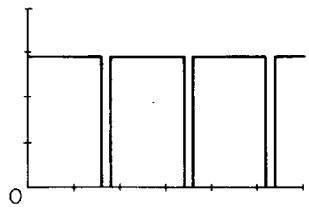
Symptom	Cause	Checkpoint	Solution
The +5 V line is dead.	Transistors Q33 and Q34 are defective.	Observe the chopping waveform  10V/DIV, 20μs/DIV Chopping waveform (emitter of Q34)	
The +24 V line is dead.	IC8C is defective.	Observe the oscillation waveform and the switching waveform.  1V/DIV, 20μs/DIV Oscillation waveform (pin 2 of IC8C)  10V/DIV, 20μs/DIV Switching waveform (pin 11 of IC8C)	

Table 5-2. Repair of the Main Board (cont.)

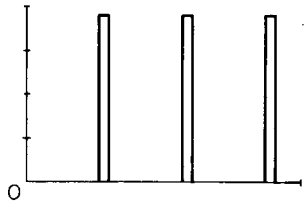
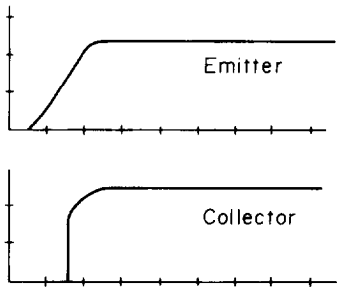
Symptom	Cause	Checkpoint	Solution
The +24 V line is dead.	Transistors Q35 and Q36 are defective.	Observe the chopping waveform.  10V/DIV, 20μs/DIV Chopping waveform (emitter of Q35)	Replace Q35 or Q35.
Vx voltage is not output.	Q25, Q26, and ZD1 are defective.	Observe the Vx voltage when printer power is turned on.  2V/DIV, 5ms/DIV Vx voltage waveform (Q26)	Replace Q25, Q26, or ZD1.

Table 5-2. Repair of the Main Board (cont.)

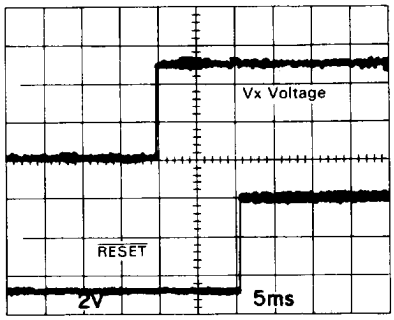
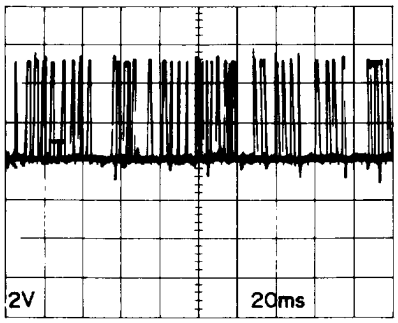
Problem/ Symptom	Cause	Checkpoint	Solution
The printer does not operate at all. / The CPU is not operating.	The Vx voltage is not being output.	Check the voltage waveform at the Vx voltage and for the –RESET signal. 	Replace IC6C.
The printer does not operate at all. / The CPU is not operating.	The Vx voltage is not being output.	Check pin 2 of IC6C for a change in the signal from HIGH to LOW. 	Replace IC6C.
The printer does not operate at all. / The CPU is not operating.	Either ROM or RAM is defective.		Replace either IC3C or IC2C.

Table 5-2. Repair of the Main Board (cont.)

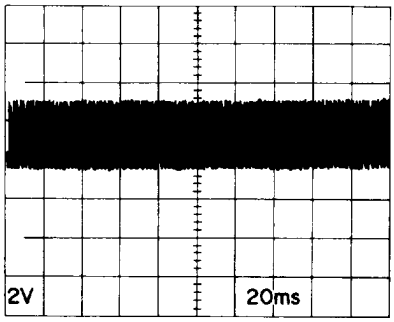
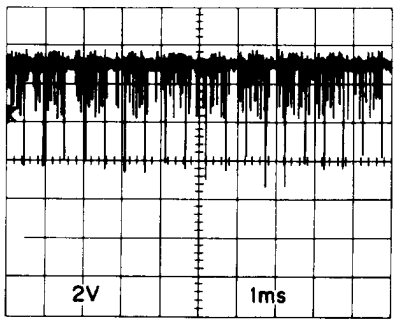
Problem/ Symptom	Cause	Checkpoint	Solution
The printer does not operate at all. / The CPU is not operating.	The CPU is defective.	Check for oscillator signal at either pin 30 or pin 31 of the CPU. 	If a signal is detected, replace IC4B. Otherwise, replace CR1.
Self-test printing is abnormal. / The self-test does not print.	The CPU cannot measure the voltage on the +24 V line.	Measure the voltage at VAref (pin 42) of IC4B. The normal voltage is 4.75 V.	Replace IC4B.
Self-test printing is abnormal. / The self-test does not print.	IC6C is defective.	Check the output of the IC7A chip select signal at pin 58 of IC6C. 	Replace IC6C.

Table 5-2. Repair of the Main Board (cont.)

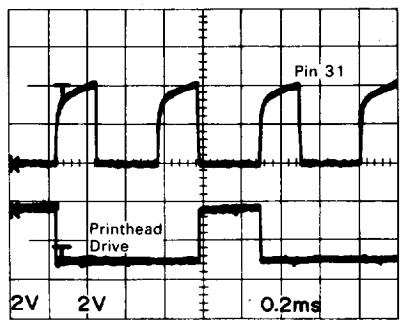
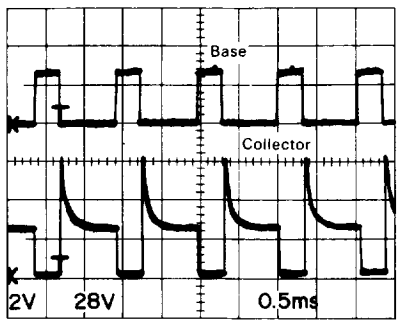
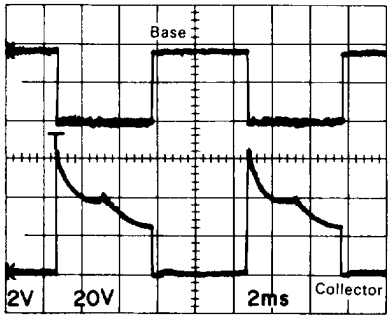
Problem/ Symptom	Cause	Checkpoint	Solution
Self-test printing is abnormal. / The self-test does not print.	IC7A is defective.	At IC7A, check the HPW input signal (pin 31) and printhead drive signal of 7A. 	Replace IC7A.
Self-test printing is abnormal. / A specific dot is not being printed.	A printhead drive transistor is defective.	Check the printhead drive transistor corresponding to the dot. 	Replace the printhead drive transistor.

Table 5-2. Repair of the Main Board (cont.)

Problem/ Symptom	Cause	Checkpoint	Solution
Paper is not fed normally. / Paper feed pitch is abnormal (open-phase).	The paper feed motor drive transistor is defective.	Check the paper feed motor drive signal and paper feed motor drive transistor. 	Replace the paper feed motor drive transistor.
Paper is not fed normally. / Paper does not feed or the feed pitch is abnormal (lack of torque).	Q27 or IC4A is defective.	Check transistor Q27.	Replace Q27 or IC4A.
Printing in on-line mode is abnormal. / Data is corrupted when the parallel interface is used.	IC6C or IC4A is defective.	Check the input/output signals of IC6C or IC4A.	Replace IC6C or IC4A.

Repair of the Printer Mechanism

For detailed procedures for replacing or adjusting parts, refer to Chapter 3, *Disassembly and Reassembly,* and Chapter *4, Adjustment.* If a problem or system recurs after you have attempted to repair the printer, refer to the tables above to find other potential causes.

Table 5-3. Repair of the Printer Mechanism

Problem	Symptom	Cause	Checkpoint	Solution
The carriage motor does not 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 does not operate.	The carriage motor completely fails to activate at power on.	The carriage motor is defective.	Measure the coil resistance of the motor. The resistance should be about 21 ohms.	Replace the carriage motor.
The carriage doesn't operate normally at power on (when the carriage has been centered manually before power is turned on.)	The carriage motor rotates, but the carriage does not move.	The belt pulley is defective. The timing belt is defective.	Check for a broken or worn pulley. Check that the timing belt is correctly inserted into the bottom of the carriage. Check for a broken timing belt.	Replace the belt pulley. Reinsert the timing belt. Replace the timing belt.
The carriage doesn't operate normally at power on (when the carriage has been centered manually before power is turned on.)	The carriage moves left slightly, then stops. The carriage moves to the left end, then stops.	Carriage movement is not smooth. The home position sensor is defective.	Check whether the carriage moves smoothly when you move it manually. Use a tester to check the home position sensor.	Clean and lubricate. Replace the home position sensor.

Table 5-3. Repair of the Printer Mechanism (cont.)

Problem	Symptom	Cause	Checkpoint	Solution
The self-test doesn't print.	The carriage moves, but nothing is printed.	The printhead FFC common wires are disconnected.	Check the connector for the common wires of the printhead FFC.	Replace the FFC.
	Printing stops before the page end is reached.	The paper guide plate is not positioned correctly.	Check whether the paper guide plate is mounted in the right position.	Remount the paper guide plate
Self-test printing is abnormal.	A specific dot fails to print.	The printhead is defective.	Measure the coil resistance of the printhead. The normal value is approximately 19 ohms.	Replace the printhead.
			Check whether the dot wire is broken.	Replace the printhead.
Self-test printing is abnormal.	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 adjustment lever to the second position and check the gap between the tip of the printhead and the platen. The appropriate value is 0.43 mm.	Adjust the gap. Refer to *Platen Gap Adjustment*, in Chapter 4.
Paper feed is defective.	Printing is performed, but the paper is not fed uniformly.	Foreign substances are lodged in the paper path.	Check the paper path visually.	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 substances. Replace the paper feed reduction gear. Replace the platen gear.
		The paper feed motor is defective.	Measure the coil resistance of the paper feed motor. The approximate value is approximately 58 ohms.	Replace the paper feed motor.

Table 5-3. Repair of the Printer Mechanism (cont.)

Problem	Symptom	Cause	Checkpoint	Solution
Ribbon feed is defective.	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 you move the cartridge manually.	Remove any foreign substances.
	Ribbon feeds properly when the carriage moves in only 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 is stained.	Ink stains appear on areas where there is printing.	The ribbon mask is not positioned correctly.	Check whether the ribbon mask is in the correct position.	Reinstall the ribbon mask.
		The platen gap needs to be adjusted.	Set the gap to the second position and check the gap between the tip of the printhead and the platen. The appropriate value is 0.43 mm	Adjust the gap. Refer to *Platen Gap Adjustment* in Chapter 4.
Printing continues past the end of the paper or when no paper is loaded.	The printer continues to print past the bottom edge of the page.	The paper end sensor is defective.	Check the paper end sensor switch.	Replace the paper end sensor.

Chapter 6

Maintenance

Figures

Tables

Maintenance 6

Proper maintenance is essential to assure optimal printer performance for the longest possible period and to minimize malfunction frequency.

Preventive Maintenance

Preventive maintenance includes regular cleaning of the case exterior (using denatured alcohol), as well as occasional vacuuming of the mechanism's interior to remove dust and paper debris.

After cleaning the unit, check that it is adequately lubricated (as described below). Before returning the printer to the customer, inspect the springs, paper feed rollers, and basic operation.

WARNING

Disconnect the printer from the power supply before performing maintenance. Do not use thinner, trichloroethylene, or ketone-based solvents on the plastic components of the printer.

Lubrication and Adhesive Application

Epson recommends that the printer be lubricated at the points illustrated in Figure 6-2. Table 6-2 lists each point along with its recommended lubricant. The three recommended lubricants are Epson O-2, G-20, and G-26, all of which have been tested extensively and found to comply with the needs of this printer. (Table 6-1 provides product details about these lubricants.)

Before applying lubricant, be sure that the surface to be lubricated is clean. Do not apply too much lubricant, as this may damage related parts.

The adhesive application indicated in Table 6-3 is necessary following disassembly or replacement of the timing belt. Epson recommends that Neji lock #2 (G) adhesive be applied to the point illustrated in Figure 6-1. Avoid overflow to contiguous parts.

Table 6-1. Application of Lubricants and Adhesive

Type	Name	Capacity	Availability	Part No.
Oil	O-2	40 cc	E	B710200001
Grease	G-20	40 gm	E	B702000001
Grease	G-26	40 gm	E	B702600001
Adhesive	Neji lock #2 (G)		E	B730200200

E: Epson-exclusive product

Table 6-2. Lubrication Points (Refer to Figure 6-2.)

Reference No.	Lubrication Points	Lubricant
(1)	Carriage guide shaft (on the both left and right sides of carriage)	O-2
(2)	Carriage guide plate (portion in contact with the carriage) 2 inches (50 mm) (L) × .08 inches (2 mm) (W)	G-26
(3)	Platen gear (a quarter of the way around the gear)	G-26
(4)	Shaft that supports the ribbon gears	G-26
(5)	Gear portions of the ribbon gears	G-26
(6)	Felt (inside the carriage)	O-2
(7)	Timing belt pulley (portion in contact with the ribbon gear)	G-26
(8)	Paper release lever	G-26
(9)	Ground spring	G-20

Note: Lubrication must be applied during the reassembly process.

Table 6-3. Adhesive Application Point (Refer to Figure 6-1.)

Adhesive Application Point	No. of Points
Part where timing belt engages the carriage	1

Figure 6-1. Correct Adhesive Application

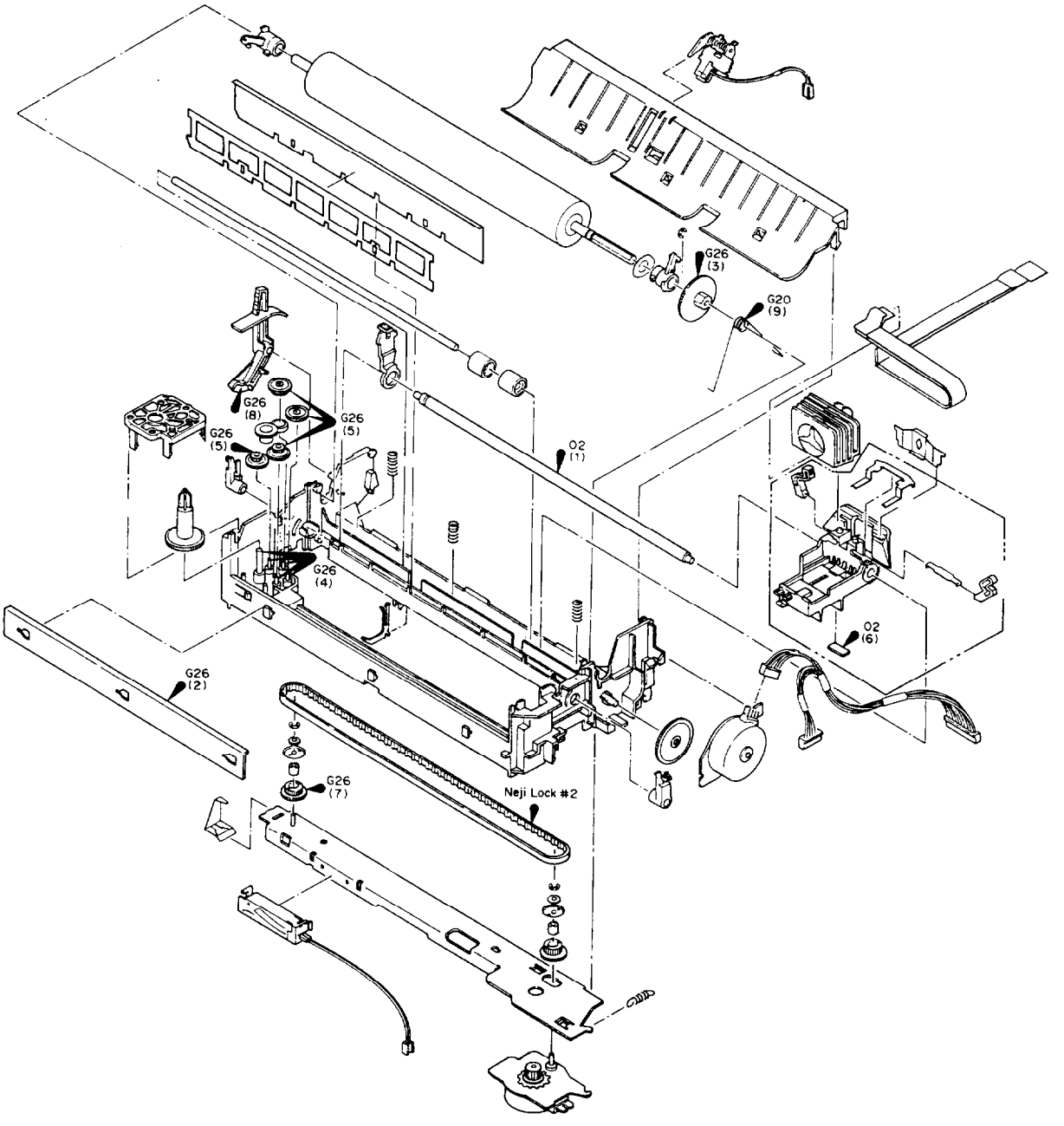


Figure 6-2. LQ-200/AP3000 Lubrication Points

Appendix

Figures

Tables

Appendix

Connector Summary

The figure below illustrates the interconnection of the primary components. Table A-l describes the function and size of the connectors.

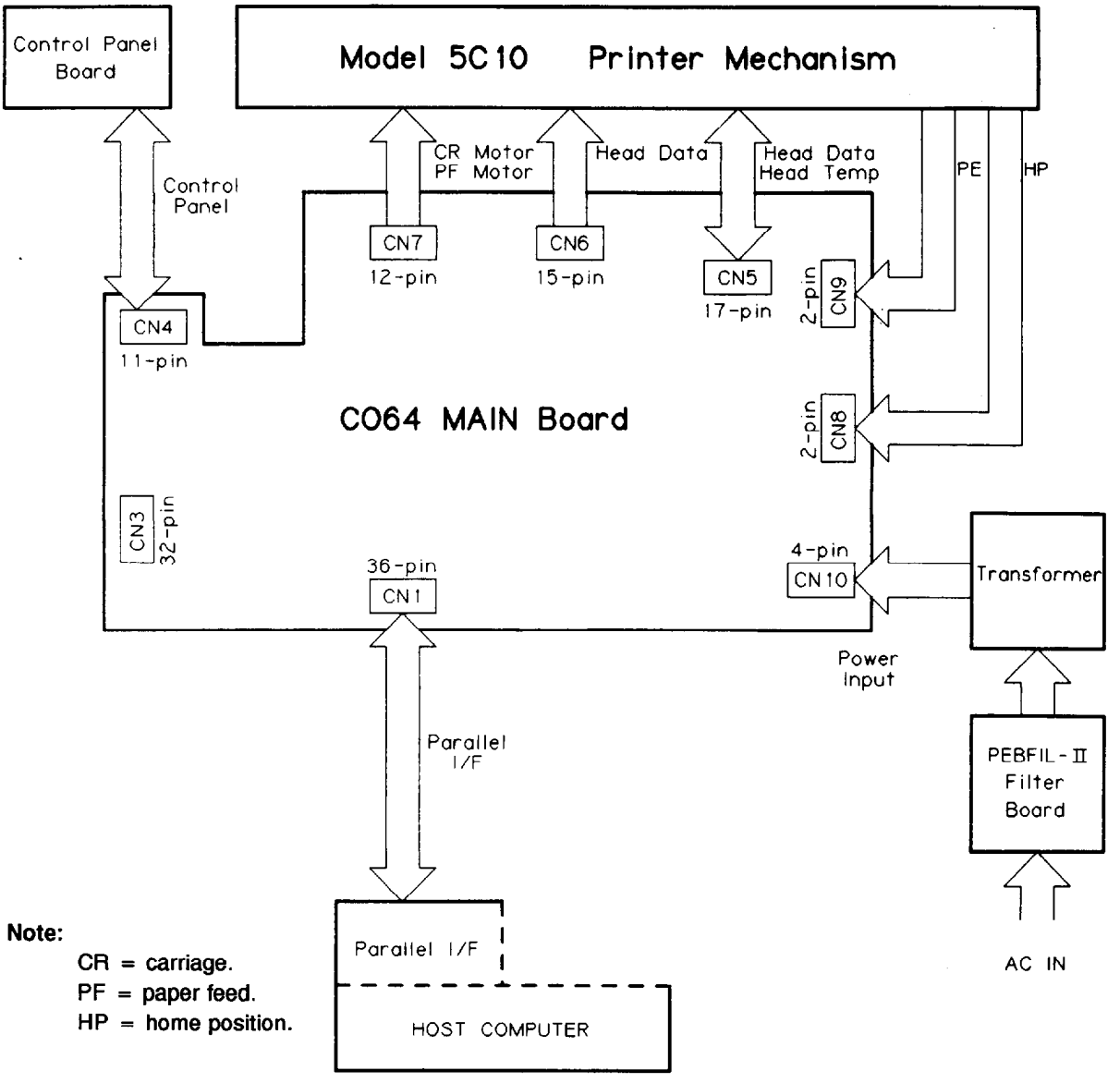


Figure A-l. Cable Connections

Table A-l. Board Connector Summary

Board	Connector	Function	Pins
C064 MAIN board	CN1	Host I/F (parallel)	36
	CN4	Control panel	11
	CN5	Head 1	17
	CN6	Head 2	15
	CN7	CR motor and PF motor	12
	CN8	HP signal	2
	CN9	PE signal	2
	CN10	AC power input	4
PEBFIL-II board	CN1	AC power output	2/3
Control panel board	CN1	Control panel	11

Circuit Diagrams

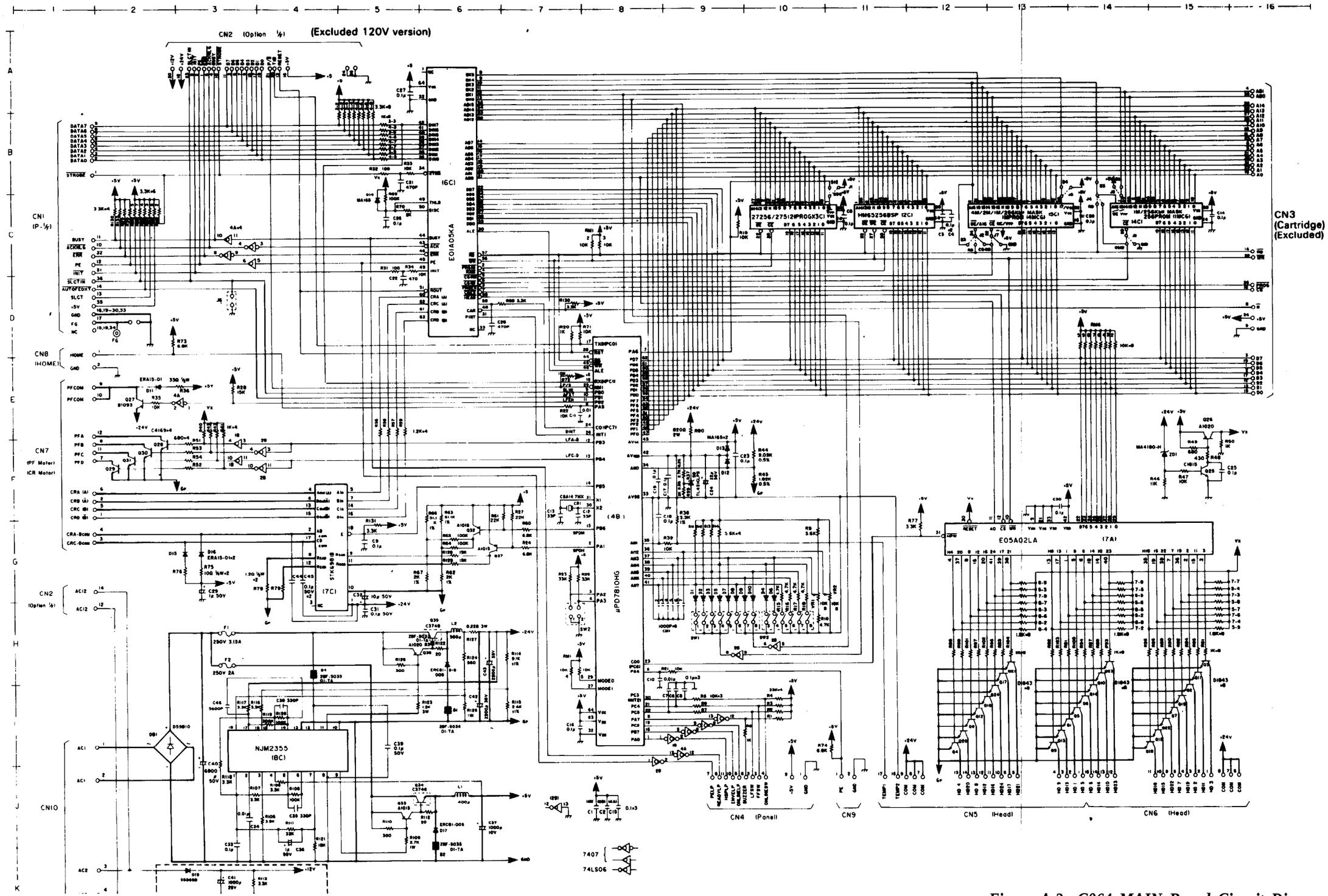
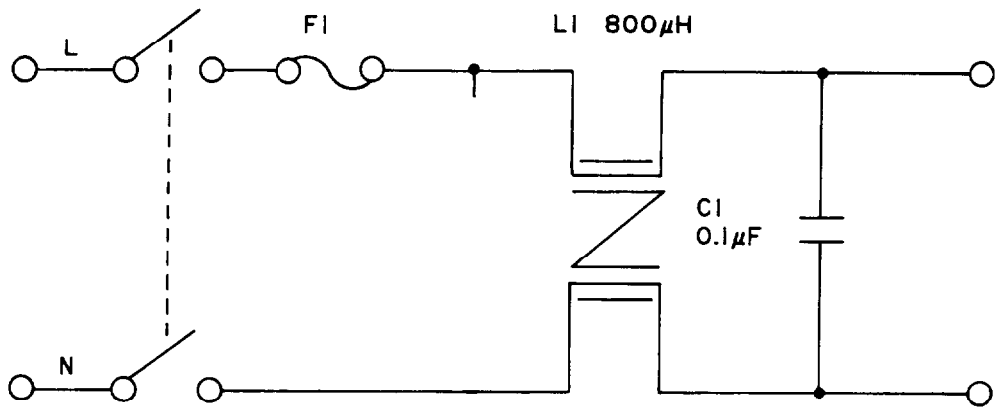


Figure A-2. C064 MAIN Board Circuit Diagram



F1: 2A 125V (100V Version)
2A 125V (120V Version)

Figure A-3. PEBFILL_II Board Circuit Diagram

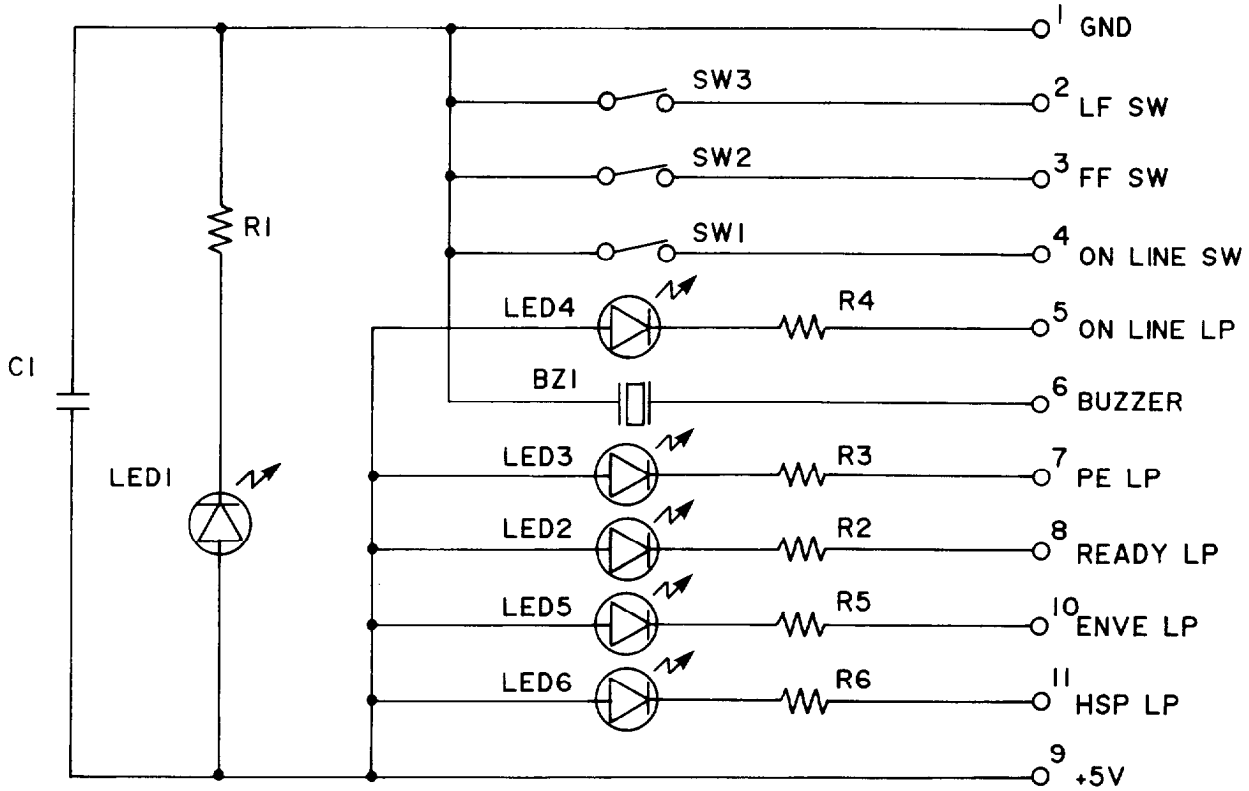


Figure A-4. Control Panel Circuit Diagram

Circuit Board Component Layout

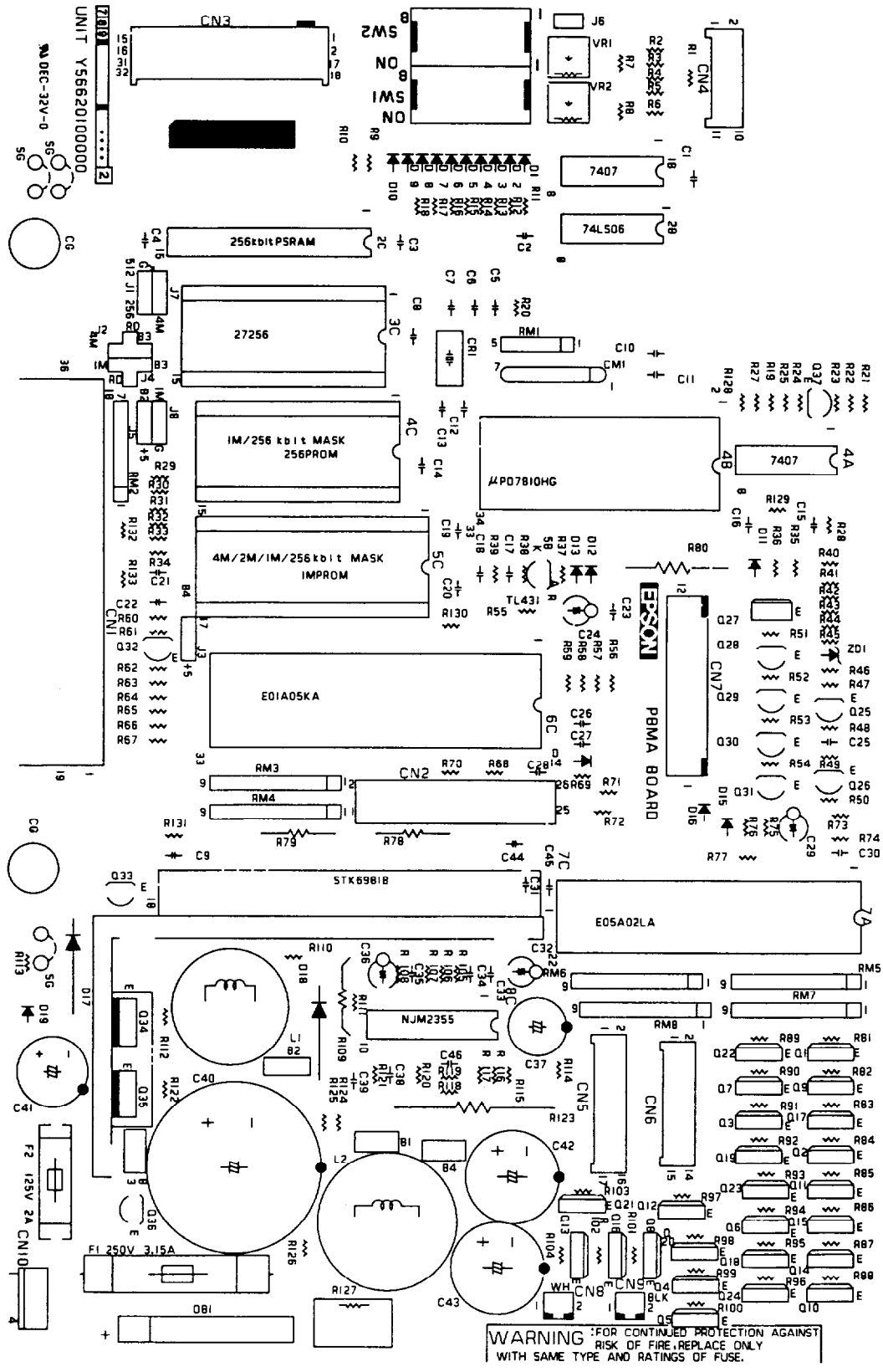


Figure A-5. C064 MAIN Board Component Layout

Exploded Diagrams

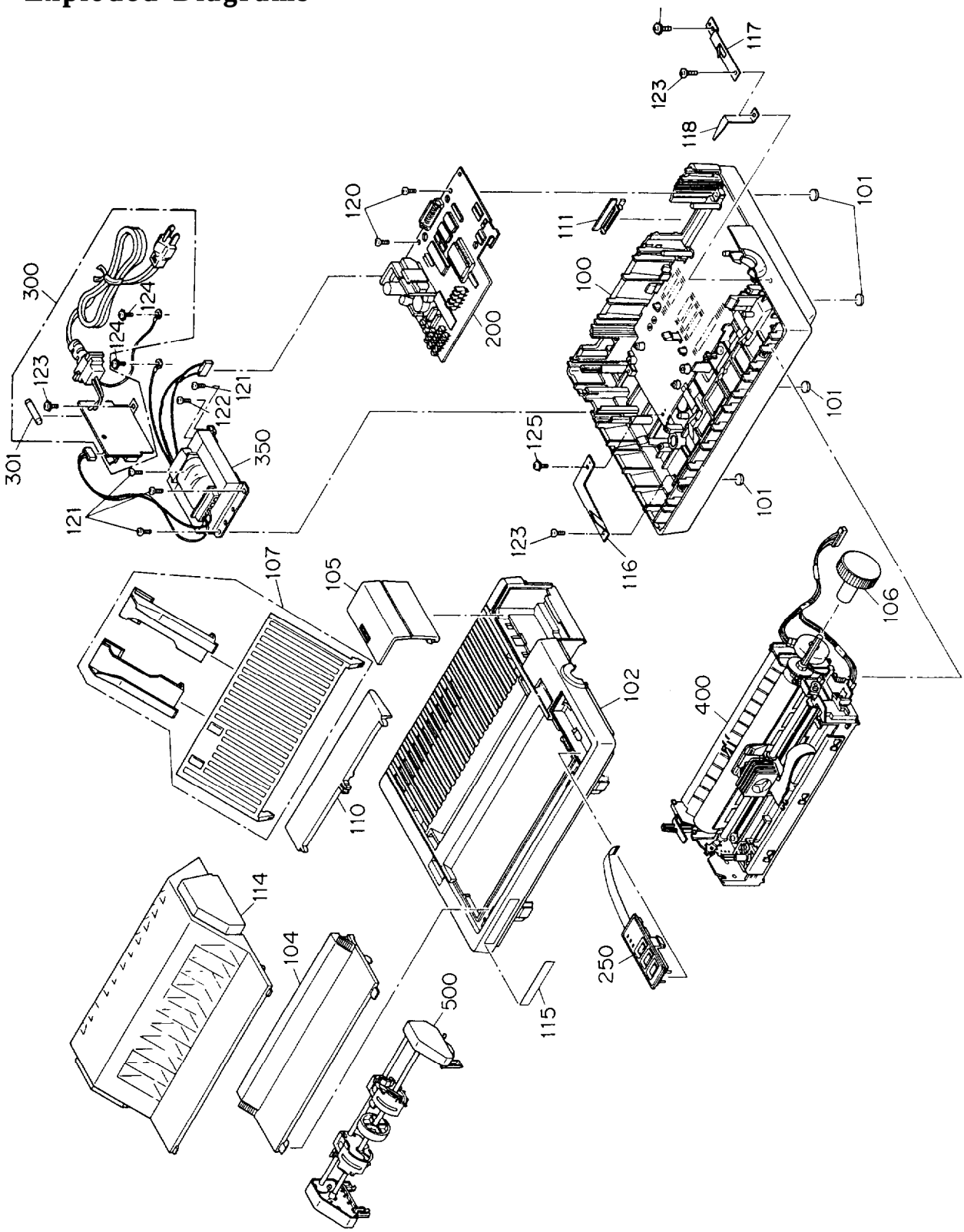


Figure A-6 LQ-200/AP3000 Exploded Diagram

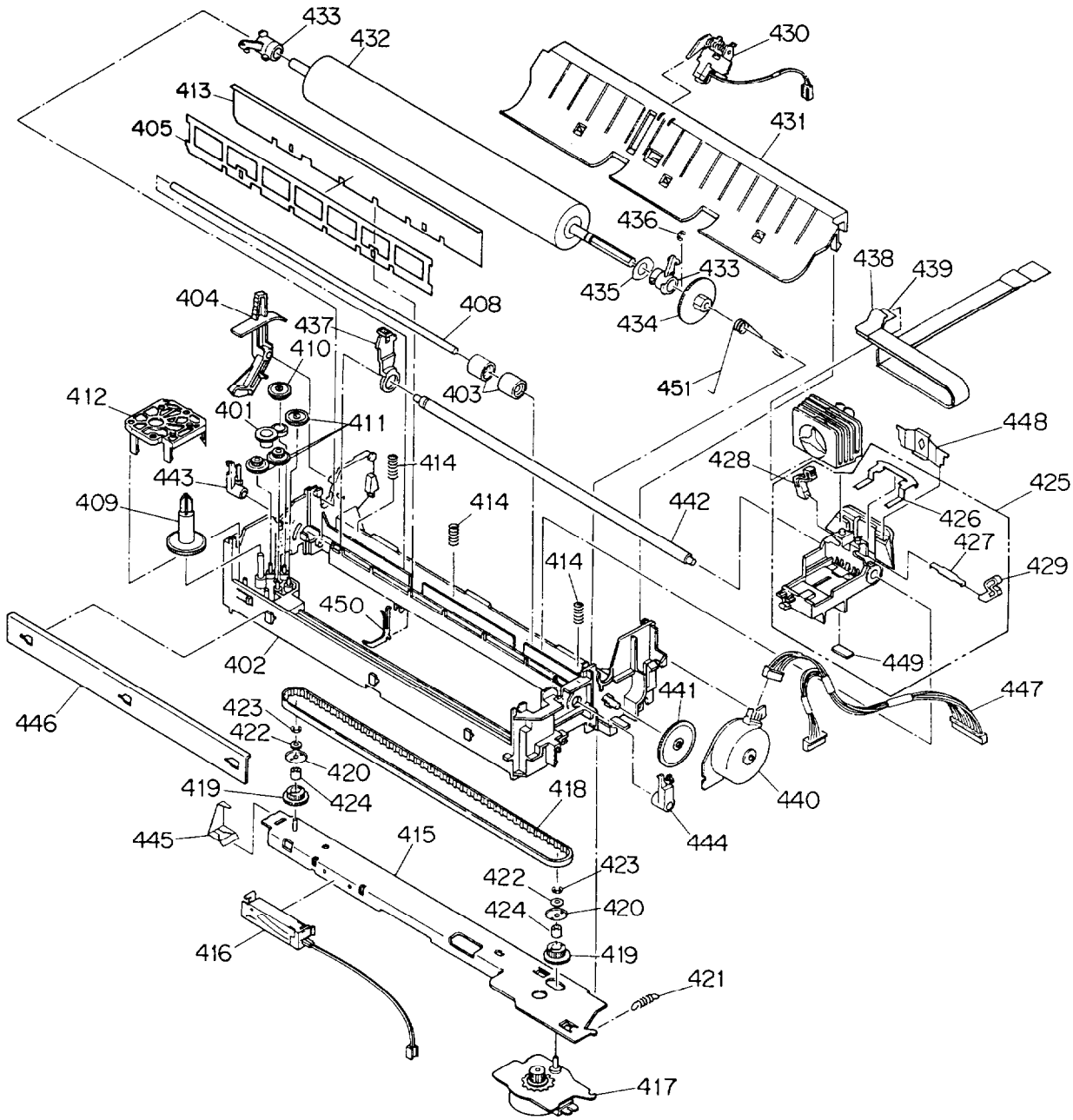


Figure A-7. M-5C1O Printer Mechanism Exploded Diagram

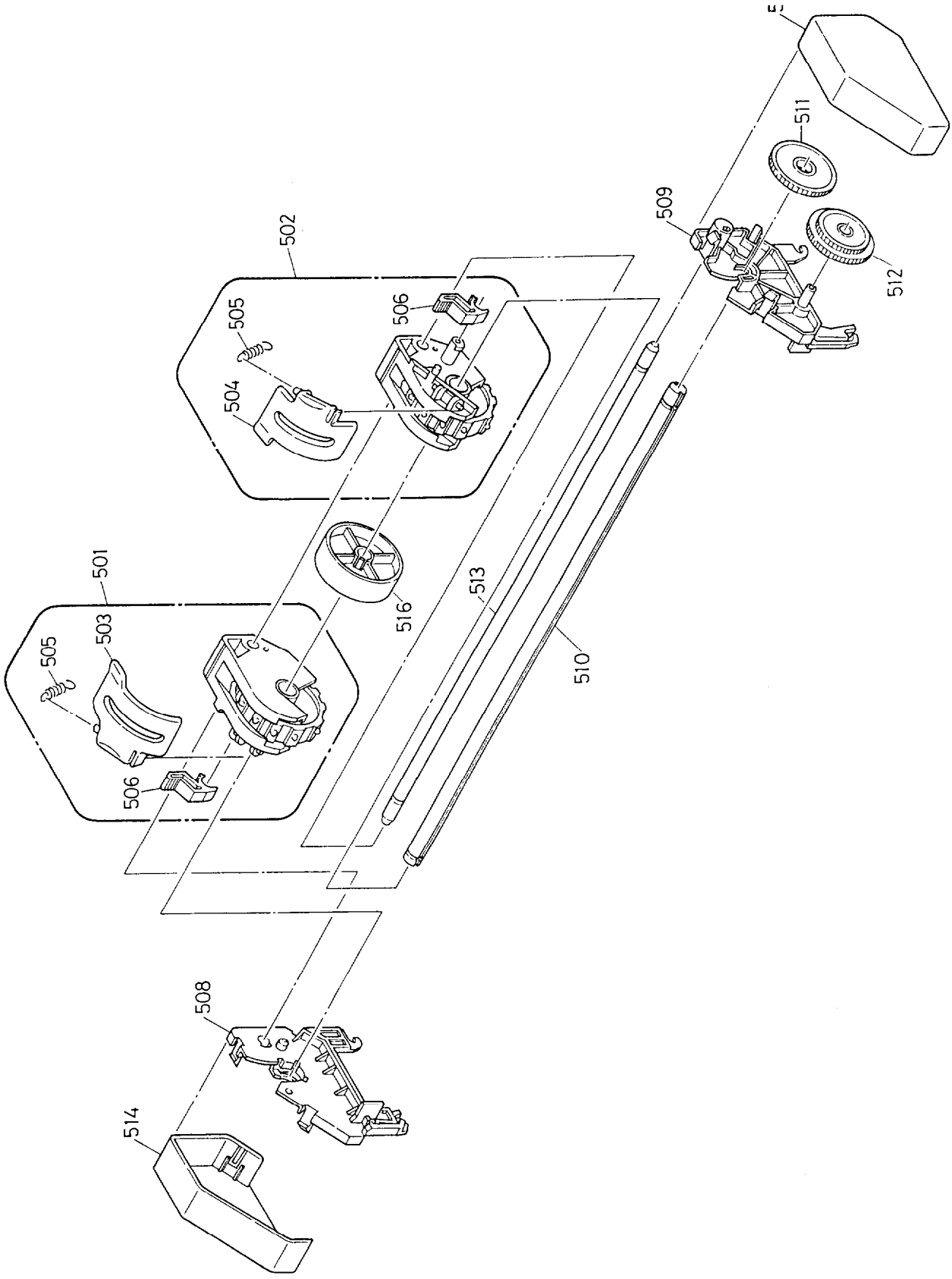


Figure AS. Tractor Exploded Diagram

Table A-2. Part Number Reference Table

Ref. No.	Description	Ref. No.	Description
100	Lower housing assembly	423	Retaining ring (2.3)
101	Foot	424	Ball bearing
102	Upper case assembly	425	CR assembly
104	Printer cover	426	Head ground plate
105	Cartridge cover	427	Head lock lever spring
106	Paper feed knob ESG	428	Head lock lever (left)
107	Sheet guide assembly	429	Head lock lever (right)
110	Paper guide assembly	430	PE sensor assembly
111	Shield plate ESG	431	Platen guide
114	Tractor cover	432	Platen
115	Logo plate	433	Shaft holder
116	Grounding plate	434	Platen gear
117	Grounding plate, PF	435	Leaf spring
118	Grounding plate, CR	436	Retaining rings (6)
120	CPB(P) screw M3 × 10	437	Head adjust lever
121	CBB screw M4 × 12	438	Upper head cable
123	CBB screw M3 × 8	439	Lower head cable
124	CBO screw M4 × 8	440	Paper feed motor
125	CPS(O) screw M3 × 6	441	Paper feed reduction gear
200	Main board assembly	442	Carriage guide shaft
250	Control panel	443	Carriage guide shaft lever (left)
300	PEBFIL-II board unit (120 V)	444	Carriage guide shaft lever (right)
301	Fuse	445	Carriage guide shaft ground plate
350	Power transformer	446	Carriage guide plate B
400	Printer mechanism	447	Motor cable
401	Ribbon planetary lever assembly	448	Ribbon mask
402	Frame	449	Oil pad
403	Paper feed roller	450	Bottom PE lever
404	Paper release lever ESG	451	Torsion spring 813
405	Front paper guide support	500	Sprocket unit
408	Paper feed roller shaft	501	Sprocket assembly (left)
409	Ribbon driving gear	502	Sprocket assembly (right)
410	Ribbon transmission gear	503	Paper holding cover (left)
411	Ribbon gear	504	Paper holding cover (right)
412	Ribbon gear cover	505	Paper holding cover spring
413	Rear paper guide support	506	Sprocket lock lever
414	Paper feed roller spring	508	Sprocket mounting plate (left)
415	Carriage motor frame	509	Sprocket mounting plate (right)
416	Home position sensor	510	Sprocket shaft
417	Carriage motor	511	Sprocket gear
418	Timing belt	512	Sprocket transmission gear
419	Belt pulley	513	Tractor guide shaft
420	Belt pulley flange	514	Side cover (left)
421	Belt tension spring	515	Side cover (right)
422	Plain washer	516	Paper guide roller

Note: ESG = Epson standard gray

Case Outline Drawings

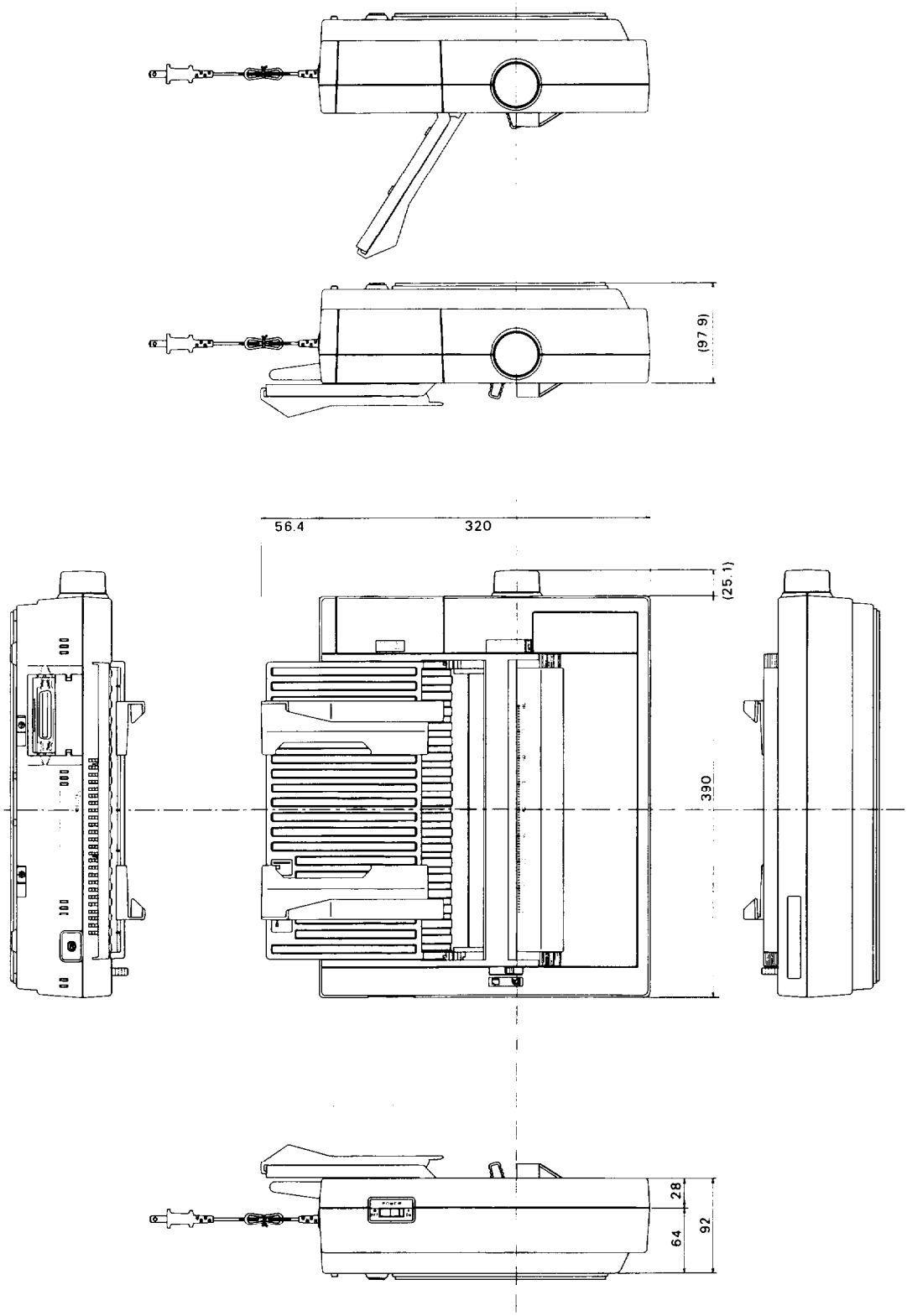


Figure A-9 LQ-200/AP3000 Case *Outline Drawing*

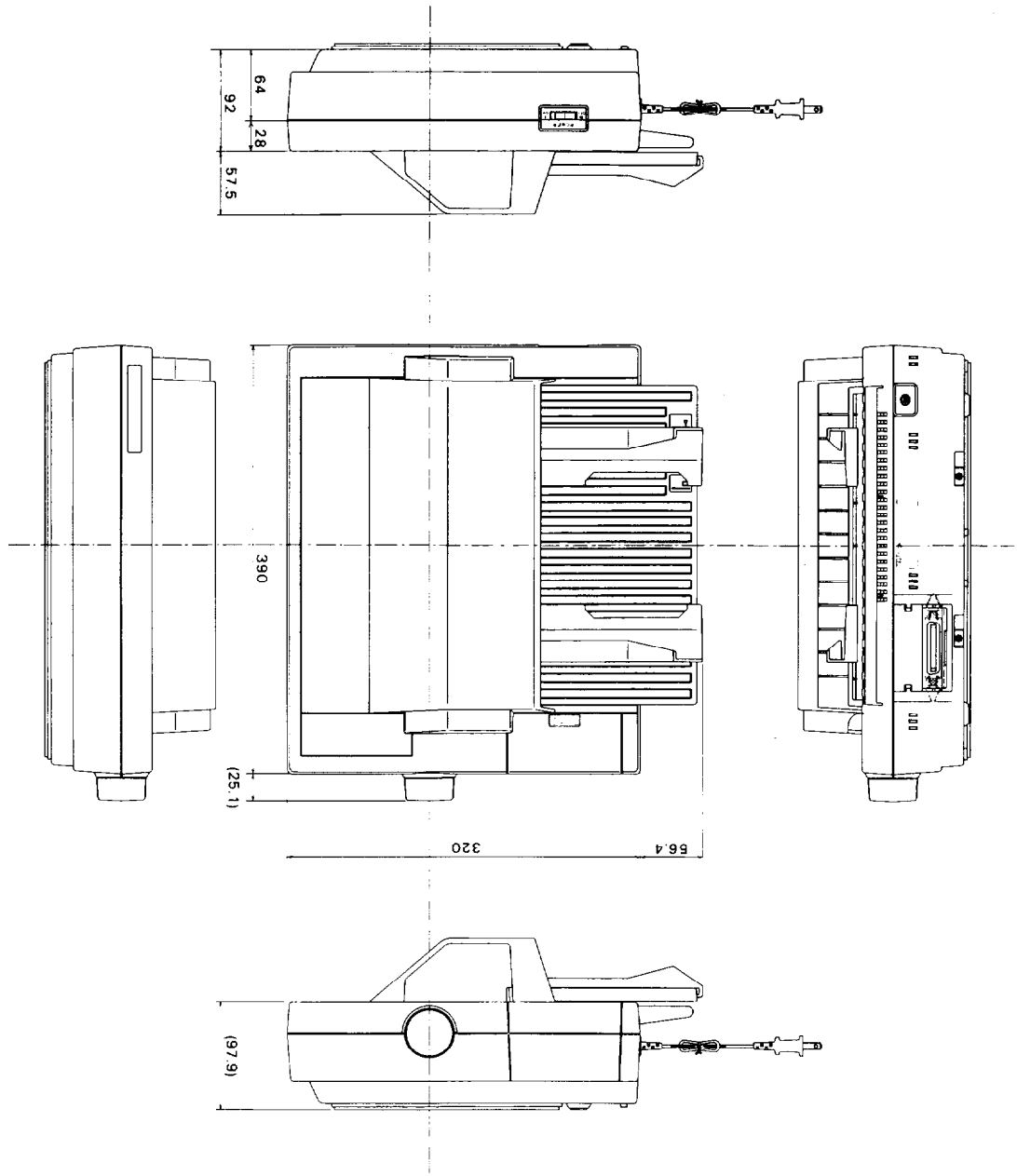


Figure A-10. LQ-200/AP3000 Case Outline Drawing with Tractor Unit

Table A-3. Connector CN3 on the CM4 MAINBoard

Pin Number	Signal Name	Direction	Function
1	D5	In	Data bit 5
2	D4	In	Data bit 4
3	D7	In	Data bit 7
4	AB1	Out	Address bit 14
5	A5	Out	Address bit 5
6	A6	Out	Address bit 6
7	A10	Out	Address bit 10
8	-R	In	Reset input
9	GND	—	Ground
10	A9	Out	Address bit 9
11	A8	Out	Address bit 8
12	D2	In	Data bit 2
13	D1	In	Data bit 1
14	-RD	Out	Read signal
15	D0	In	Data bit 0
16	A0	Out	Address bit 0
17	D3	In	Data bit 3
18	-CG	Out	CG ROM select signal
19	D6	In	Data bit 6
20	A14	Out	Address bit 14
21	A4	Out	Address bit 4
22	-WR	Out	Write signal
23	A7	Out	Address bit 7
24	+5 V	—	+5 V
25	A11	Out	Address bit 11
26	-PROG	Out	Program ROM select signal

Table A-3. Connector CN3 on the C064 MAIN Board (cont.)

Pin Number	Signal Name	Direction	Function
27	A12	Out	Address bit 12
28	A13	Out	Address bit 13
29	A1	Out	Address bit 1
30	AB0	Out	Address bit 13
31	A2	Out	Address bit 2
32	A3	Out	Address bit 3

Note: Minus signs are used in front of signal names to indicate LOW active signals.

Table A-4. Connector CN4 on the C064 MAIN Board

Pin Number	Signal Name	Direction	Function
1	GND	—	Ground
2	LFSW	In	LINE FEED button
3	FFSW	In	FORM FEED button
4	ON-LINE SW	In	ON LINE button
5	ON-LINE LP	Out	ON LINE LED drive
6	BUZZER	Out	Buzzer drive
7	PE LP	Out	Page end LED drive
8	READY LP	Out	Ready LED drive
9	+5 V	—	+5 V
10	ENVELP	—	Not connected
11	HSPLP	—	Not connected

Table AS. Connector CN5 on the C064 MAINBoard

Pin Number	Signal Name	Direction	Function
1	TEMP1	In	TEMP signal
2	TEMP2	In	TEMP signal
3	HD 4	Out	Head data 4
4	HD 20	Out	Head data 20
5	HD 8	Out	Head data 2
6	HD 12	Out	Head data 12
7	HD 16	Out	Head data 16
8	HD 24	Out	Head data 24
9	COM	—	Head common ground
10	COM	—	Head common ground
11	COM	—	Head common ground
12	HD 17	Out	Head data 17
13	HD 21	Out	Head data 21
14	HD 9	Out	Head data 9
15	HD 13	Out	Head data 13
16	HD 1	Out	Head data 1
17	HD 5	Out	Head data 5

Table A-6 Connector CN6 on the C064 MAIN Board

Pin Number	Signal Name	Direction	Function
1	HD 6	Out	Head data 6
2	HD 14	Out	Head data 14
3	HD 10	Out	Head data 10
4	HD 23	Out	Head data 23
5	HD 18	Out	Head data 18
6	HD 15	Out	Head data 15
7	HD 22	Out	Head data 22
8	COM	—	Head common ground
9	COM	—	Head common ground
10	COM	—	Head common ground
11	HD 7	Out	Head data 7
12	HD 19	Out	Head data 19
13	HD 2	Out	Head data 2
14	HD 11	Out	Head data 11
15	HD 3	Out	Head data 3

Table A-7. Connector CN7 on the C064 MAINBoard

Pin Number	Signal Name	Direction	Function
1	CRD	Out	Carriage phase D
2	CRB	Out	Carriage phase B
3	CR CD-COM	—	Carriage DC common ground
4	CR AB-COM	—	Carriage AB common ground
5	CRC	Out	Carriage phase C
6	CPA	Out	Carriage phase A
7	PFD	Out	Paper feed D
8	PAB	Out	Paper feed B

Table A-7. Connector CN7 on the C064 MAIN Board (cont.)

Pin Number	Signal Name	Direction	Function
9	PF COM	—	Paper feed common ground
10	PF COM	—	Paper feed common ground
11	PFC	Out	Paper feed C
12	PFC	Out	Paper feed A

Table A-8. Connector CN8 on the C064 MAINBoard

Pin Number	Signal Name	Direction	Function
1	HOME	In	Home position signal
2	GND	—	Ground

Table A-9 Connector CN9 on the C064 MAIN Board

Pin Number	Signal Name	Direction	Function
1	PE	In	Paper end signal
2	GND	—	Ground

Table A-10. Connector CN10 on the C064 MAIN Board

Pin Number	Signal Name	Direction	Function
1	AC1	In	AC
2	AC1	In	AC
3	AC2	In	AC
4	AC2	In	AC