LQ-2550
TECHNICAL MANUAL

EPSON

PRECAUTIONS

Precautionary notations throughout the text are categorized relative to 1) personal injury, and 2) damage to equipment:

DANGER Signals a precaution which, if ignored, could result in serious or fatal personal injury. Great caution should be exercised in performing procedures preceded by a DANGER headings.

WARNING Signals a precaution which, if ignored, could result in damage to equipment.

The precautionary measures itemized below should always be observed when performing repair/maintenance procedures.

DANGER

1. ALWAYS DISCONNECT THE PRODUCT FROM BOTH THE POWER SOURCE AND THE HOST COMPUTER BEFORE PERFORMING ANY MAINTENANCE OR REPAIR PROCEDURE.
2. NO WORK SHOULD BE PERFORMED ON THE UNIT BY PERSONS UNFAMILIAR WITH BASIC SAFETY MEASURES AS DICTATED FOR ALL ELECTRONICS TECHNICIANS IN THEIR LINE OF WORK.
3. WHEN PERFORMiNG TESTING AS DICTATED WITHIN THIS MANUAL, DO NOT CONNECT THE UNIT TO A POWER SOURCE UNTIL INSTRUCTED TO DO SO. WHEN THE POWER SUPPLY CABLE MUST BE CONNECTED, USE EXTREME CAUTION IN WORKING ON POWER SUPPLY AND OTHER ELECTRONIC COMPONENTS.

WARNING

1. REPAIRS ON EPSON PRODUCT SHOULD BE PERFORMED ONLY BY AN EPSON CERTIFIED REPAIR TECHNICIAN.
2. MAKE CERTAIN THAT THE SOURCE VOLTAGE IS THE SAME AS THE RATED VOLTAGE, LISTED ON THE SERIAL NUMBER/RATING PLATE. IF THE EPSON PRODUCT HAS A PRIMARY-AC RATING DIFFERENT FROM THE AVAILABLE POWER SOURCE, DO NOT CONNECT IT TO THE POWER SOURCE.
3. ALWAYS VERIFY THAT THE EPSON PRODUCT HAS BEEN DISCONNECTED FROM THE POWER SOURCE BEFORE REMOVING OR REPLACING PRINTED CIRCUIT BOARDS AND/OR INDIVIDUAL CHIPS.
4. IN ORDER TO PROTECT SENSITIVE μP CHIPS AND CIRCUITRY, USE STATIC DISCHARGE EQUIPMENT, SUCH AS ANTI-STATIC WRIST STRAPS, WHEN ACCESSING INTERNAL COMPONENTS.
5. REPLACE MALFUNCTIONING COMPONENTS ONLY WITH THOSE COMPONENTS RECOMMENDED BY THE MANUFACTURER; INTRODUCTION OF SECOND-SOURCE ICs OR OTHER NONAPPROVED COMPONENTS MAY DAMAGE THE PRODUCT AND VOID ANY APPLICABLE EPSON WARRANTY.

PREFACE

This manual describes functions, theory of electrical and mechanical operations, maintenance, and repair of the LQ-2550.
The instructions and procedures included herein are intended for the experienced repair technician, and attention should be given to the precautions on the preceding page. The chapters are organized as follows:

Chapter 1 - Provides a general product overview, lists specifications, and illustrates the main components of the printer.

Chapter 2 - Describes the theory of printer operation.

Chapter 3 - Discusses the options

Chapter 4 - Includes a step-by-step guide for product disassembly, assembly, and adjustment.

Chapter 5 - Provides Epson-approved techniques for troubleshooting.

Chapter 6 - Describes preventive maintenance techniques and lists lubricants and adhesives required to service the equipment.

* The contents of this manual are subject to change without notice.

REVISION TABLE

REVISION	DATE ISSUED	CHANGE DOCUMENT
A	March 31, 1988	1st issue

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CHAPTER 1
GENERAL DESCRIPTION

LIST OF FIGURES

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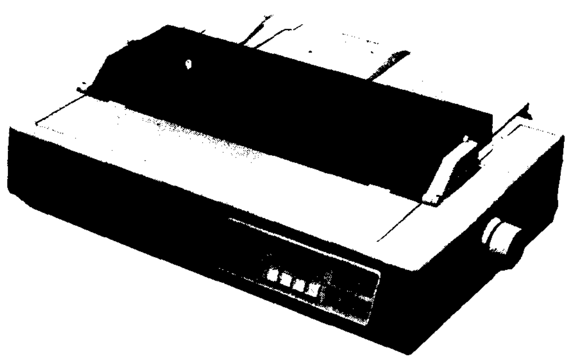
1.1 FEATURES

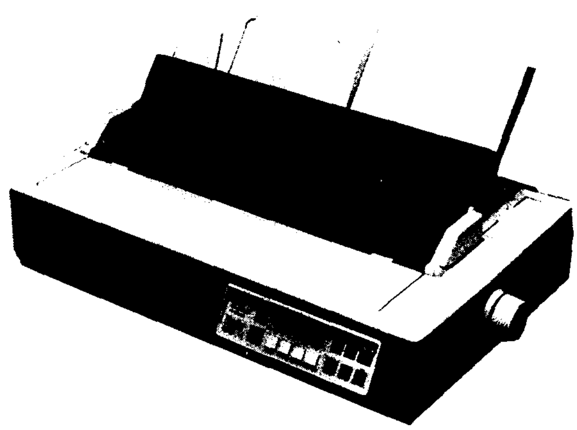
The LQ-2550 printer is a multifunction, 24-pin, impact dot-matrix printer. The main features Of this printer are:

- ESC/P Expanded is implemented as a standard
- Upward compatibility with the LQ-2500/LQ-2500+
- A maximum print speed of 400 CPS in draft mode at 12 CPI and 133 CPS in LQ mode at 12 CPI
- Direct selection of font, pitch, and normal/condensed mode, and SelecType function with LCD (Liquid Crystal Display) which makes panel settings easier
- Multiple standard fonts (Roman, Saris Serif, Courier, Prestige, Script, OCR-A, and OCR-B)
- Advanced paper handling:
  Automatic release function
  Automatic platen gap adjustment function
  Micro adjustment function
  Tear-off function
  Automatic paper-loading/ejecting function
- Color printing capability
- Low-noise acoustics
- Both 8-bit parallel and RS-232C serial interfaces
- Push and (optional) pull tractor feeding ,
- Printing of fanfold paper without removal of the cut sheet feeder (option)
- Optional interface for the EPSON 8100 series
- Optional low-priced, double-bin cut sheet feeder with envelope feeding capability

Figure 1-1 shows exterior views of the printer, Table 1-1 lists optional units that are available, and Table 1-2 lists the optional interface boards (refer to Chapter 3 for more detailed information) for the LQ-2550.



Setting for Continuous Paper



Setting for Cut Sheet Paper

Figure 1-1. Exterior Views of the LQ-2550

Table 1-1. Optional Units

No.	Name
#73 14	Pull tractor unit
#7343	Double bin cut sheet feeder
#7394	Scanner option kit
#7762	Ribbon cartridge (black)
#7763	Ribbon cartridge (color)
#7764	Ribbon cartridge (film-black)

Table 1-2. Optional Interface Boards

No.	Name
#8143	New serial interface
#8145	RS-232C current loop interface type II
#8 148	Intelligent serial interface
#8 149	Intelligent serial interface type II
#8 149M	Intelligent serial interface type III
#8 161	IEEE-488 interface
#81 65	Intelligent IEEE-488 interface
#8 172	32 K-byte buffer parallel interface
#8 172M	128K-byte buffer parallel interface

1.2 SPECIFICATIONS

The LQ-2550 communicates with a wide variety of host computers, with the aid of the optional Identity Modules. However, this section describes the specifications for the printer without the Identity Module. Specifications not affected by firmware (hardware specifications) are the same whether or not the Identity Module is installed.

1.2.1 Hardware Specifications

Printing *Method*	**Serial, impact dot matrix**
Pin Configuration	**See Figure 1-2 (1 2x2 staggered, diameter: 0.2 mm).**

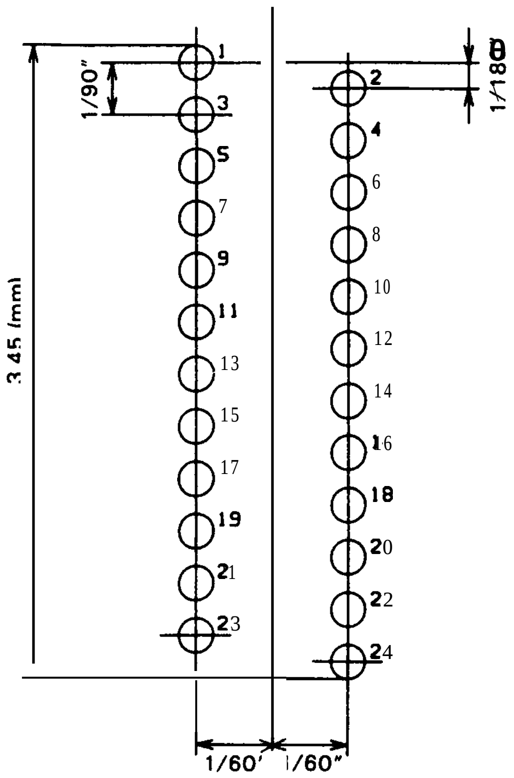


Figure 1-2. Printhead Pin Configuration

Feeding Method — **Friction feed**
Tractor feed (push: standard, push-pull: optional)

NOTES: 1. When using friction feed:

- **Select friction feed on the control panel.**
- **Do not use continuous (fanfold) paper.**
- **Do not use a single sheet paper shorter than 92mm or longer than 364mm**
- **Do not perform any reverse paper feed operations within the top 8.5 mm and bottom 22 mm of the paper.**
- **Do not perform reverse feed beyond 1/6” after the paper end has been detected.**
- **Do not use multi-part, single-sheet forms.**

2. When using push-pull tractor feed:

- **Select tractor feed on the control panel.**
- **Mount the pull tractor unit (optional).**
- **Do not loosen the paper between the platen and the pull sprocket.**
- **Precisely align the horizontal position of the pull sprocket and push tractor.**
- **Do not perform reverse feeding for more than 1/6”.**
- **Do not perform reverse feeding after the paper end has been detected.**
- **Multiple copy paper must be pasted together using line or dots.**
- **Copy paper must be carbonless multi-part paper.**

Paper Loading Directions

Fanfold paper — **Inserted from the rear**
Cut sheet paper — **Inserted from the top**

Line Spacing — **1/6”, 1/8”, or programmable in units of 1/1 80” or 1/360”**

Line Feed Speed — **See Table 1-3.**

Table 1-3. Line Feed Speeds

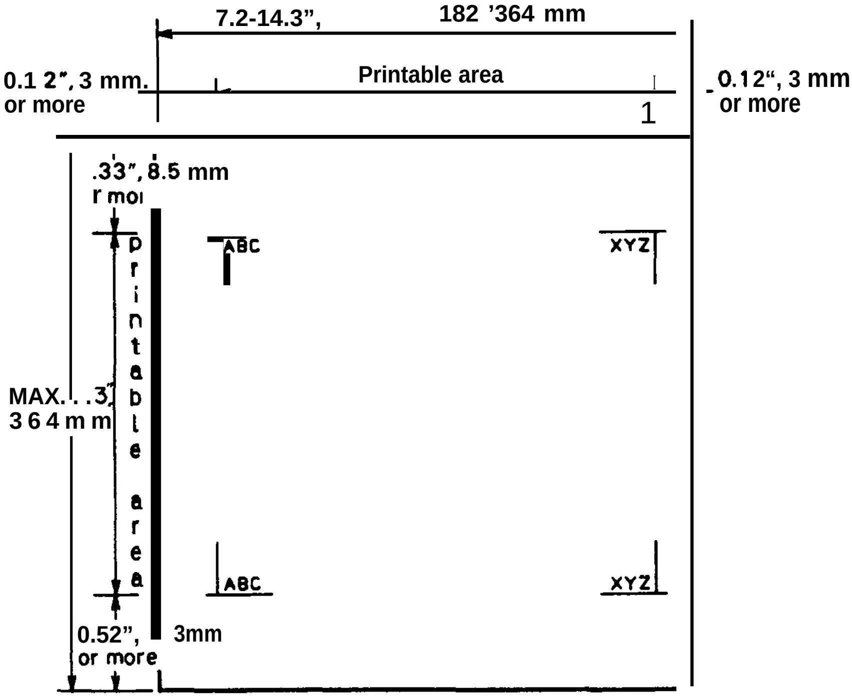
Feeding Method	*1/6”* **line spacing [ins/line]**	**Continuous [inch/s]**
Friction without CSF	84	4.0
Friction with CSF		
Tractor		

\ **Paper Specifications**

Cut sheet paper Refer to Table 1-4 and Figure 1-3.

Table 1-4. Cut Sheet Paper Specified Conditions

Width [mm]	182 -364 (7.2 - 14.3”)
Length [mm]	364 (14.3”) max.
Thickness [mm]	0.065-0.10 (0.0025 - 0.004”)
Weight [lb]	14 ~ 22 (52 -82 g/m²)
Quality	Plain paper
Copies	Not available



NOTES: 1. Printing is possible approx. 8.5mm (0.33”) from the top of the paper. But the paper feed accuracy can not be assured in the area approx. 22mm (0.87”) from the top of the paper.

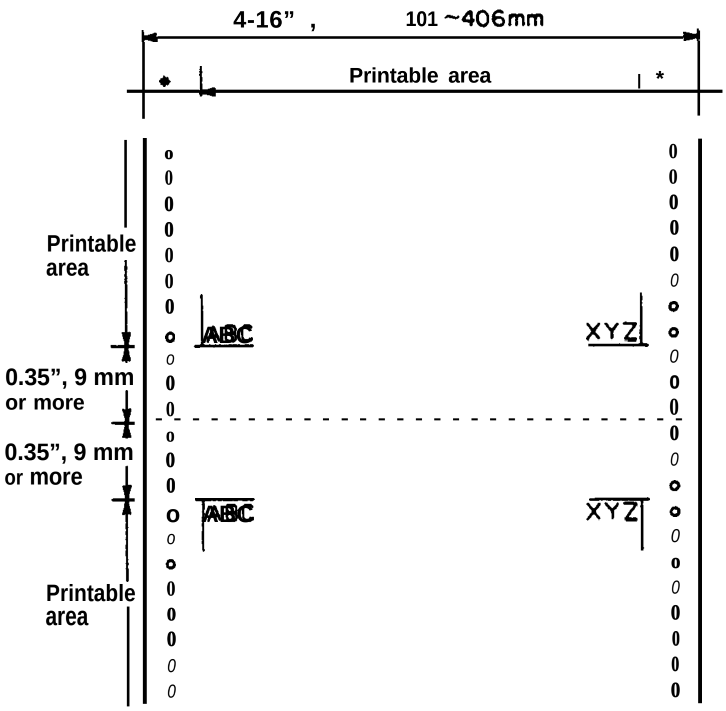
2. Printing is possible approximately 45.9mm past the point where end-of-page has been detected. Thus, the value 13.3mm (0.52”) (lowest print position) is given for reference only. Paper feed accuracy cannot be assured in the area approximately 22mm(0.87”) from the bottom of the page.

Figure *1-3. Cut* Sheet Paper Printable Area

Fanfold paper **Refer to Table 1-5 and Figure 1-4.**

Table 1-5. Fanfold Paper Specified Conditions

Width [mm]	101 -406 (4.0 - 16.0")
Copies [sheets]	6 (1 original + 5) over the entire temperature range
Quality	Plain paper
Total Thickness [mm]	0.06-0.46 (0.0023 -0.0 18")
Weight [lbs]	1 sheet..........12-22 (40 -82 g/m²) 6 sheets ....12 -15 (40 - 58.2 g/m²) each sheet



*: 101 - 381 mm (4 - 15") wide paper .... 13mm or more,
406 mm (16") wide paper .... 26mm or more

Figure 1-4. Fanfold Paper Printable Area

Envelopes

Size	No. 6 165 x 92 mm (6.5 x 3.63")
	No. 10241 x 105mm (9.5 x 4. 13")
Quality	Bond paper, xerographic copier paper, airmail paper
Thickness	0.16-0.52 mm (0.0063 -0.01 97")

NOTE: Differences in thickness within printing area must be less than 0.25 mm (0.0098").

Weight	1 2 - 24 lb (45 -91 g/m^2)

NOTES: 1. Envelope printing is only available at normal temperature.
2. Keep the longer side of the envelope horizontal.

Labels

Size	2· 1/2 x 15/1 6", 4 x 15/1 6", 4 x 1"7/16"
Thickness	O.19 mm (0.0075") max.

NOTE: Thickness excluding the base paper must be less than or equal to 0.12 mm (0.0047").

NOTES:
1. Printing of labels is only possible at normal temperature.
2. Labels must be fanfold.
3. Labels with pressure-sensitive paper must be joined by dot or line pasting, and the total thickness must be less than or equal to 0.3 mm (0.01 1 8") and should be printed under conditions between 5 to 35 'C and 20 to 80% RH.
4. Examples of labels: AVERY CONTINUOUS FORM LABELS
   AVERY MINI-LINE LABELS

Printable area	See Figure 1-5.

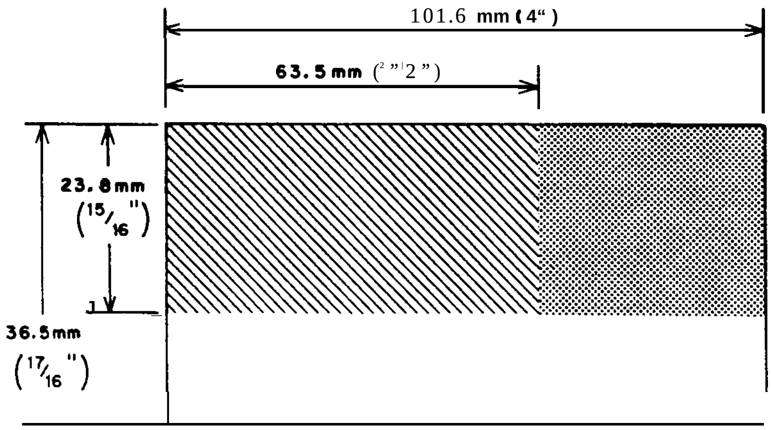


Figure 1-5. Label Printable Area

Ribbon Cartridge See Table 1-6.

Table 1-6. Ribbon Cartridge Specification

Ribbon Model No.	#7762	#7764	#7763
Type	Normal	Film	Multi-color
Color	Black		Black, Cyan, Magenta, and yellow
Life [million/characters]*1	3	0.2	Black: 1 Cyan: 0.7 Magenta: 0.7 Yellow: 0.5

*1: LQ-selftest

Dimensions See Table 1-7 (Details are shown in Figure A-59.)
Weight See Table 1-7.

Table 1-7. Dimensions and Weight

Width [mm]	Height [mm]	Depth [mm]	Weight [Kg]
676	198	535	20 (approx.)

NOTE: Including the paper feed knob and paper guide.

Electrical Specifications See Table 1-8.

Table 1-8. Electrical Specifications

	100-120 V Version	220-240 V Version
Voltage [V AC]	108- 132	198-264
Frequency Range [Hz]	49.5 - 60.5	
Rating Current *1 [A]	1.6	1.0
Insulation Resistance [M ohm] min. (between AC line and chassis)	10	
Dielectric Strength [V AC, rms] (1 minute, between AC line and chassis)	1250	3750

*1: At draft-selftest printing.

Environmental Conditions Refer to Table 1-9.

Table 1-9. Environmental Conditions

	Storage	Operating
Temperature [“C]	–30 - 65*	5 - 35
Humidity [% RH]	5 - 85	10 - 80
Resistance to shock [G] 1 (within 1 ms)	2	1
Resistance to Vibration [G] (55 Hz, max.)	0.50	0.25

*: With shipment container

Reliability

MCBF — 5 million lines (excluding printhead)
(MCBF... Mean Cycles Between Failure)

MTBF — 6000 POH (duty 25%)
(POH... Power On Hour)

Printhead life — 200 million strokes/wire

Safety Approvals

Safety standards — UL478 (U.S.A. version)
CSA22.2#154
VDE0806 (TUV) (European version)

Radio frequency Interface (RFI) — FCC class B (U.S.A. version)
VDE0871 (self-certification)
(European version)

1.2.2 Firmware Specifications

Control Code	ESC/P-83 Expanded
Printing Direction	Bidirectional logic seeking
Input Data Buffer	8K-bytes
Character Code	8 bits
Character Set	96 ASCII and 13 international character sets
Family	Roman: No. O
	SansSerif: No. 1
	Courier: No. 2
	Prestige: No. 3
	Script: No. 4
	OCR-B: No. 5
	OCR-A: No. 6
Font and Character Spacing	Roman: 10, 12, 15, Proportional
	SansSerif: 10, 12, 15, Proportional
	Courier: 10, 12, 15, Proportional
	Prestige: 10, 12, 15, Proportional
	Script: 10, 12, 15, Proportional
	OCR-B: 10, 12, Proportional
	OCR-A: 10, 12 Proportional
	Draft: 10, 12, 15
Printing Mode	Printing quality (Draft/LQ)
	Character pitch (10, 12, 15 CPI or Proportional)
	Condensed
	Double-width
	Double-height
	Emphasized
	Double-strike
	Italic
	Underlined
	Outline
	Shadow

NOTE: A condensed mode for 15 CPI characters is not available.

Print Speed	Refer to Table 1-10.

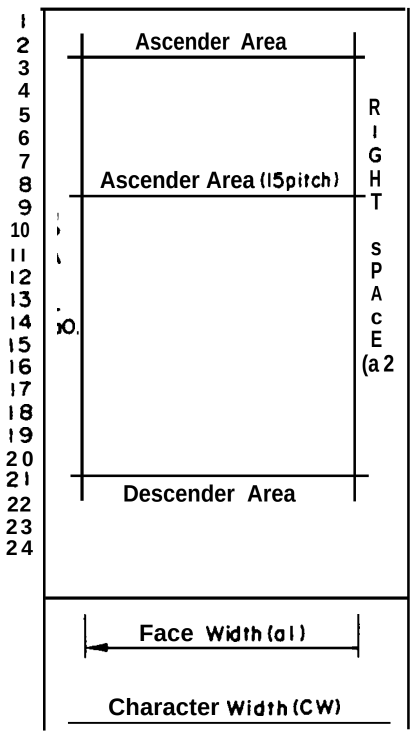
Table 1-10. Printing Mode

Print Pitch	Condensed	Emphasized	Double Width	Character Pitch [CPI]	Printing Speed [CPS] Draft	Printing Speed [CPS] LQ	Printable Columns
10	0	0	0	10	333	111	136
			1	5	167	55	68
		1	0	10	167	111	136
			1	5	83	55	68
	1	x	o	17.1	285	189	233
			1	8.5	142	94	116
12	0	0	0	12	400	133	163
			1	6	200	67	81
		1	0	12	200	133	163
			1	6	100	67	81
	1	x	o	20	333	221	272
			1	10	167	111	136
15	0	0	0	15	500	167	204
			1	15	250	83	204
		1	0	7.5	250	167	102
			1	7.5	124	83	102
	1	x	x	Ignored			
'proportional	o	x	o	8.6	—	94	Max. 116
				20		221	Min. 272
			1	4.3		50	Max. 58
				10		111	Min. 136
	1	x	o	17.1		189	Max. 233
				40		444	Min. 544
			1	8.6	—	94	Max. 116
				20		221	Min. 272
'proportional Super/ Subscript	o	x	o	12.8	—	142	Max. 174
				30		333	Min. 408
			1	6.4	—	71	Max. 87
				15		167	Min. 204
	1	x	o	25.7	—	285	Max. 174
				60		667	Min. 816
			1	12.8		142	Max. 87
				30		333	Min. 204

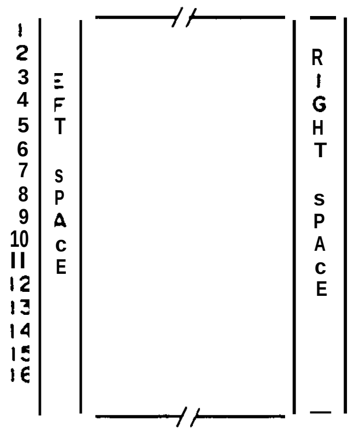
NOTES: 1. Max. means the value when the maximum width characters are printed.
2. Min. means the value when the minimum width characters are printed.
3. "—" means that LQ character set is automatically selected when proportional pitch is specified.

character Matrix **See Figure 1-6.**

(Normal Character)



(Superscript Character)
Pin Nos. 17 to 24 are not used for superscript printing.



(Subscript Character)
Pin Nos. 1 to 8 are not used for subscript printing.

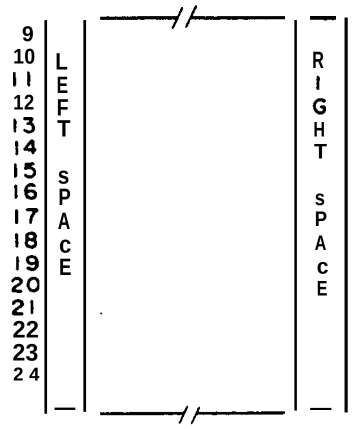


Figure 1-6. Character Matrix

Character Size See Table 1-11.

Table 1-11. Character Matrix and Character Size

Printing Mode	Face Matrix	HDD	Character Size H. x V. [mm]	Unit ESC sp
DRAFT, 10 pitch	9 x 23	120	1.9 x 3.2	120
DRAFT, 12 pitch	9 x 23	120	1.9 x 3.2	120
DRAFT, 15 pitch	9 x 16	120	1.0 x 2.3	120
DRAFT, 10 pitch, condensed	...	240	. . .	240
DRAFT, 12 pitch, condensed	...	240	...	240
LQ, 10 pitch	29 x 23	360	2.0 x 3.2	180
LQ, 12 pitch	29 x 23	360	2.0 x 3.2	180
LQ, 15 pitch	15 x 16	360	1.0 x 2.3	180
LQ, 10 pitch, condensed	...	360	. . .	360
LQ, 12 pitch, condensed	...	360	...	360
LQ, proportional	Max. 39 x 23	360	2.6 x 3.2	180
	Min. 18 x 23	360	1.0 x 3.2	
LQ, proportional, condensed	...	360	...	360
	...	360	...	
LQ, proportional, super/subscript	Max. 28 x 16	360	1.8 x 2.3	180
	Min. 12 x 16	360	0.7 x 2.3	
LQ proportional, super/subscript, condensed	...	360	...	360
	...	360	..	

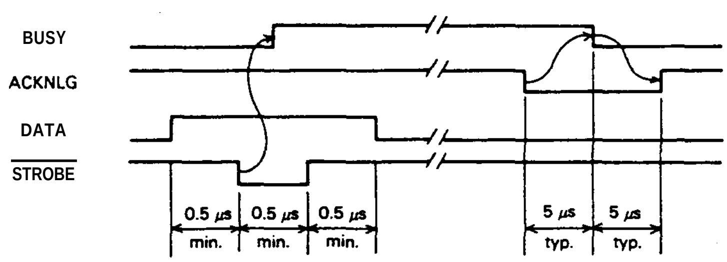
NOTES: 1. "HDD" means the Horizontal dot density, and the units are dots per inch.
2. "Face matrix" and "character size" indicate the maximum size of characters and this vailue will change with condition of paper.
3. "Unit ESC sp" indicates the minimum length which is added to the right of the character that can be specified with ESC sp control code.
4. "..." indicates that the character matrix is reformed by printer firmware. Character width becomes half of a non-condensed character.

1.3 INTERFACE OVERVIEW

The LQ-2550 has both an 8-bit parallel interface and an RS-232C serial interface as standard. The interface can be selected from the control panel (For details of the control panel settings, refer to Section 1.8.6.2.).

1.3.1 8-bit Parallel Interface Specifications

Data Transmission Mode	**8-bit parallel**
Synchronization	**By $\overline{\text{STROBE}}$ pulse**
Handshaking	**By BUSY and $\overline{\text{ACKNLG}}$ (either or both)**
Logic Level	**TTL (LS) compatible**
Data Transmission Timing	**See Figure 1-7.**
Connector	**57-30360 (AMPHENOL) or equivalent (See Figure 1-8.)**
Connector Pin Assignment	**Refer to Table 1-12.**
Select/Deselect (DC1/DC3) Control	**Refer to Table 1-13.**



NOTE: Transmission time (rising and falling time) of every input signal must be less than 0.2 μs.

Figure 1-7. Data Transmission Timing for the 8-bit Parallel Interface

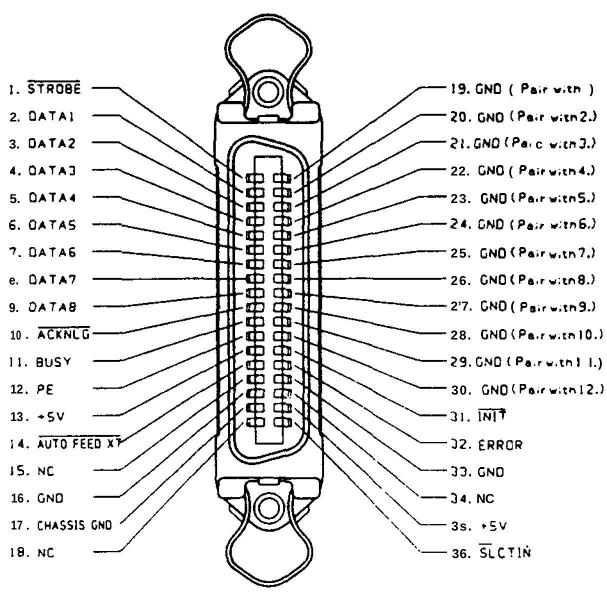


Figure 1-8. 36-Pin 57-30360 Connector

Table 1-12. 8-bit Parallel I/F Connector Pin Assignments

Pin No.	Signal	Return	I/O	Description
1	$\overline{\text{STROBE}}$	19	I	Strobe pulse to read the input data. Pulse width must be more than 0.5 μs. Input data is latched after falling edge of this signal.
2 3 4 5 6 7 8 9	DATA1 DATA2 DATA3 DATA4 DATA5 DATA6 DATA7 DATA8	20 21 22 23 24 25 26 27	I I I I I I I I	Parallel input data to the printer. "HIGH" level means data "I". "LOW'" level means data "O".
10	$\overline{\text{ACKNLG}}$	28	0	This pulse indicates data are received and the printer is ready to accept next data. Pulse width is approx. 11 μs.
11	BUSY	29	0	"HIGH" indicates printer can not accept data.
12	PE	30	0	"HIGH" indicates paper-out. This signal is effective only when $\overline{\text{ERROR}}$ signal is "LOW".
13	SLCT	—	0	Always "HIGH". (Pulled up to +5V through 3.3 K ohms resistor.)
14	$\overline{\text{AUTOFEED-XT}}$	—	I	If this signal is "LOW" when the printer is initialized, a line feed is automatically performed by input of "CR" code (Auto LF).
15	NC	—	—	Not used.
16	GND	—	—	Ground for twisted-pair.
17	Chassis GND	—	—	Printer chassis ground.
18	NC	—	—	Not used.
19 to 30	GND	—	—	Ground for twisted-pair.
31	INIT	16	I	Pulse (width: 50 μs min., active "LOW") input for printer initialization.
32	$\overline{\text{ERROR}}$	—	0	"LOW" indicates that some error has occurred in the printer.
33	GND	—	—	Ground for twisted-pair.
34	NC	—	—	Not used.
35	+ 5V	—	o	Always "HIGH". (Pulled up to +5V through 3.3 K ohms resistor.)
36	$\overline{\text{SLECT-IN}}$	—	I	If the signal is "LOW" when printer is initialized, the DC1/DC3 control is disabled.

NOTES: 1. "Direction" of signal flow is as viewed from the printer.
2. "Return" denotes "TWISTED PAIR RETURN" and is to be connected at signal ground level. As to the wiring for the interface, be sure to use a twisted-pair cable for each signal and never fail to connect the return side. To prevent noise, cables should be shielded and connected to the chassis of the host computer and the printer.

Table 1-13. Select/Deselect Control

ON-LINE Sw	$\overline{\text{SLCT-IN}}$	DC1/DC3	$\overline{\text{ERROR}}$	BUSY	$\overline{\text{ACKNLG}}$	DATA ENTRY
OFF-LINE	HIGH/LOW	DC 1/DC3	LOW	HIGH	No pulse	Disable
ON-LINE	HIGH	DC 1	HIGH	LOW/HIGH (During data entry)	Pulse output after entry)	Enable (Normal Process)
		DC3	HIGH	LOW/HIGH (Durring data entry)	Pulse output after entry	Enable (Waits DC 1. See Note 2)
	LOW	DC1	HIGH	LOW/HIGH (During data entry)	Pulse output after entry	Enable (Normal Process)
		DC3	HIGH	LOW/HIGH (Durring data entry)	Pulse output after entry	

NOTES:
1. In Table 1-13, it is assumed that no $\overline{\text{ERROR}}$ status exists other than that attributable to the OFF-LINE mode.
2. Once the printer is deselected by the DC3 code, the printer will not revert to the selected state until the DC 1 code is input (In the deselected state, input data is ignored until DC 1 is received.).
3. The DC 1 and DC3 codes are enabled only when the $\overline{\text{SLCT-IN}}$ signal (Input Connector Pin No. 36 when the parallel interface unit is used) is HIGH and the printer is initialized.
4. The $\overline{\text{SLCT4N}}$ signal is LOW when the printer is initialized. At this time the DC 1/DC3 printer select/deselect control is invalidated, and these control codes are ignored.
5. The $\overline{\text{SLCT-IN}}$ signal is HIGH, and it is not set to LOW by SelecType function when the printer is initialized. The printer will start from the selected (DC 1) state.

1.3.2 RS-232C Serial Interface Specifications

Data Transmission Mode	RS-232C serial
Synchronization	Asynchronous
Handshaking	By DTR (REV) signal or X-ON/OFF protocol Refer to Table 1-14 and Figure 1-9.

Table 1-14. Serial Interface Handshaking

DTR Signal	X-ON/OFF protocol	Description
MARK	X-OFF (DC3/13H)	When the number of bytes remaining in the input buffer reaches 256 or less, the signal level goes to MARK, or an X-OFF code is sent to the host computer. This indicates that the printer is not ready to receive data.
SPACE	X-ON (DC 1/11H)	When the number of bytes remaining in the input buffer reaches 528 or more, the signal level goes to SPACE, or an X-ON code is sent to the host computer. This indicates that the printer is ready to receive data.

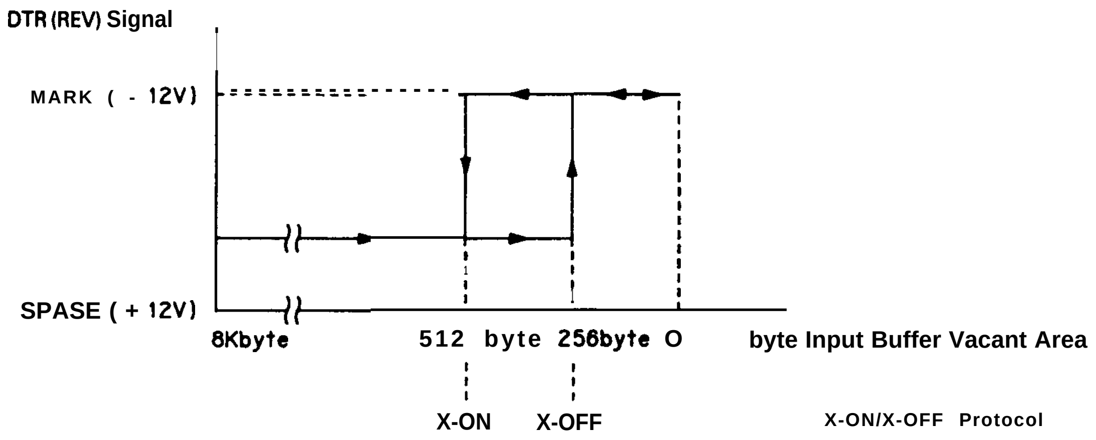
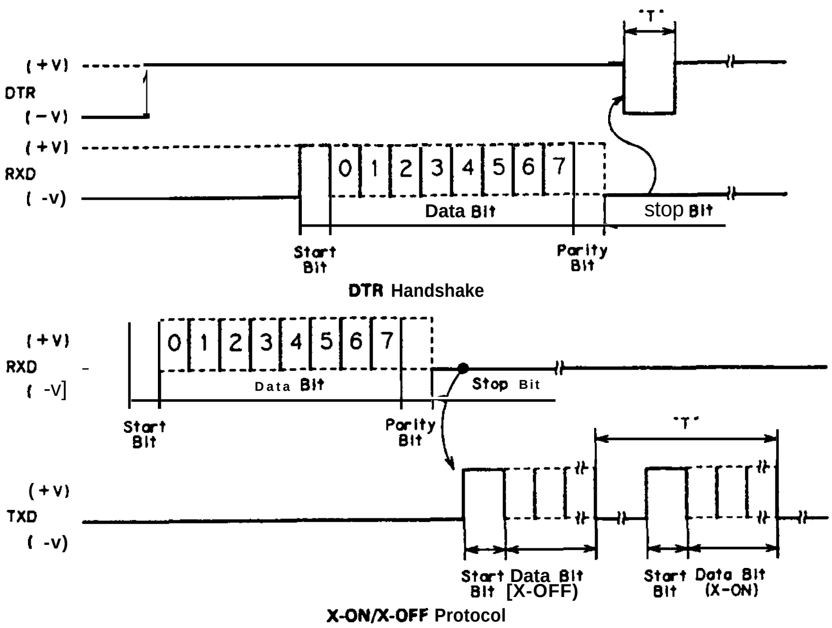


Figure 1-9. Handshaking for RS-232C Interface

Word Length	
Start bit	1
Data bits	8
Parity	Odd, Even, or none
Stop bits	1 bit or more
Bit Rate	300, 600, 1200, 2400, 4800, 9600, or 19200 BPS
Logic Level	EIA level, MARK: logical 1 (–3 - –27 V) SPACE: logical O (+3 - +27 V)

Data Transmission Timing See Figure 1-10.



NOTES: 1. The value of "T" varies according to the input data.

2. The word structure of serial data is 1 start bit + 8 data bits + parity (Odd, Even, or none) + 1 or more stop bits.

Figure 1-10. Serial Data Transmission Timing

Error Detection	Parity error: "*" is printed.
	Overrun error: Ignored
	Framing error: Ignored
Connector	D-SUB 25-pin connector (See Figure 1-1 1.)
Connector Pin Assignments	Refer to Table 1-15.

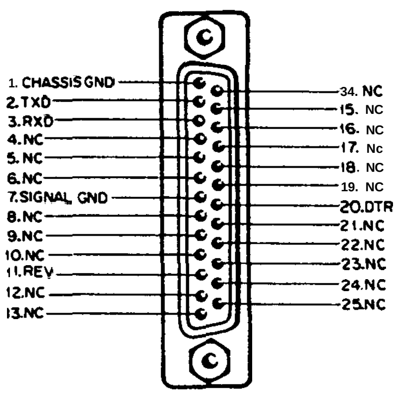


Figure 1-11. Serial Interface Connector

Table 1-15. RS-232C Serial Interface Connector Pin Assignments

Pin No.	Signal	I/O	Description
2	TXD	o	Transmit data.
20	DTR	o	Indicates when printer is ready to receive data. "MARK" level indicates printer is not ready to receive data.
11	REV(=2nd RTS)	o	Same as DTR.
3	RXD	I	Receive data.
7	SIGNAL GND	—	Signal (Logic) ground level.
1	CHASSIS GND	—	Printer chassis ground.

NOTE: "Direction" of signal flow is as viewed from the printer.

1.4 SELF-TEST OPERATION

The LQ-2550 printer has the following self-test functions. The current and default settings at the control panel are printed when the self-test is executed. When the CSF mode is enabled, the current sheet length is printed out at the end of the first page.

Table 1-16 lists the self-test operating instructions and Figure 1-12 shows the self-test printing.

Table 1-16. Self-Test Operation

Type-face	Start	stop
Draft	Turn the power ON while pressing the LINE FEED switch.	Push the ON LINE switch, and turn the power OFF.
LQ	Turn the power ON while pressing the FORM FEED switch.	

```
           Current setting
FONT                   Roman
PITCH                  10CPI
CONDENSED                off
FORM LNG
Tractor               66LINE
CSF bin1             132LINE
CSF bin2             132LINE
1" SKIP                  off
AUTO TEAR OFF            off
LEFT MARGIN                0
RIGHT MARGIN             136
CG TABLE              Italic
COUNTRY                  USA
PRINT DIR.              Bi-d
COLOR                  Black

           Default setting
INTE                Parallel
                     9600BPS
AULT MACRO

Roman
 ! " #$%& ' ()*+,-./0 1 234 56789: ; < = >?@ABCDEFGHIJK
! " #$%&' ( )*+ , -. /01234 56789 : ; < = > ?@ ABCDEFGHIJKL
" #$%& ' ( )*+ ,-. /0123456789 : ; < = > ?@ ABCDEFGHIJKLM
#$%& ' ( )*+ ,-. /0 123456789 : ; < = > ?@ ABCDEFGHIJKLMN
$%& ' ( )*+ ,-. /0 123456789 : ; < = > ?@ABCDEFGHIJKLMNO
%& ' ( )*+ , -. /0 123456789 : ; < = > ?@! ABCDEFGHIJKLMNOP
& ' ( )*+ , - . /0 1234 56789: ; < = > ?@ABCDEFGHIJKLMNOPQ
```

Figure 1-12. Self-Test Printing (LQ)

1.5 HEXADECIMAL DUMP FUNCTION

In hexadecimal dump mode, the printer prints out the data it receives in hexadecimal format. The printer prints a column of 16 hexadecimal values, followed by a column containing the 16 corresponding ASCII characters. If there is no corresponding printable character for a value (e.g., a control code, such as a carriage return or line feed), a period (.) is printed in the ASCII column in the position of the code.

Each line of the dump contains 16 values, printed in the order they were received, and any remaining data (less than 16 values on the final line) can be printed by operating the ON LINE switch. Table 1-17 explains the hexadecimal dump operation and Figure 1-13 shows a sample printout of the operation.

Table 1-17. Hexadecimal Dump Operation

Function	Operation	stop
Hexadecimal dump mode	Turn the power ON while pressing both the LINE FEED and FORM FEED switches.	Turn the power OFF.

```
Data Dump Mode

31 2E 31 20 46 45 41 54 55 52 45 53 OD OA OD OA    1.1 FEATURES. . . .
54 68 65 20 4C 51 2D 38 35 30 2F 31 30 35 30 20    The LQ-850/1050
70 72 69 6E 74 65 72 73 20 61 72 65 20 6D 75 6C    printers are mul
74 69 66 75 6E 63 74 69 6F 6E 61 6C 2C 20 32 34    tifunctional, 24
2D 70 69 6E 20 70 72 69 6E 74 68 65 61 64 2C 20    -pin print head,
69 6D 70 61 63 74 20 64 6F 74 2D OD OA 6D 61 74    impact dot- . . mat
72 69 78 20 70 72 69 6E 74 65 72 73 2E 20 54 68    rix printers. Th
65 20 6D 61 69 6E 20 66 65 61 74 75 ‘72 65 73 20   e main f eatu res
6F 66 20 74 68 65 20 74 68 65 73 65 20 70 72 69    of the these pri
6 E 74 65 72 73 20 61 72 65 3A 20 OD OA OD OA 2E   nters are: . . . . .
 20 55 70 77 61 72 64 20 63 6 F 6D 70 61 74 69 62  Upward compatib
69 6C 69 74 79 20 77 69 74 68 20 74 68 65 20 4C    ility with the L
51 2D 38 30 30 2F 31 30 30 30 OD OA 2 E 20 41 20   Q-800 /1000... A
6D 61 78 69 6D 75 6D 20 70 72 69 6E 74 20 73 70    maximum print sp
65 65 64 20 6F 66 20 32 36 34 20 43 50 53 20 69    eed of 264 CPS i
6E 20 64 72 61 66 74 20 6D 6F 64 65 20 61 74 20    n draft mode at
```

Fig 1-13. Hexadecimal Dump List

1.6 PRINTER INITIALIZATION

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

1.6.1 Hardware Initialization

This type of initialization occurs when printer power is turned on or when the printer receives the I NIT signal from the host via the 8-bit parallel interface. When the printer is initialized in this way, it performs the following actions:

- Initializes the printer mechanism
- Clears the downloaded character set
- Clears the input data buffer
- Clears the image buffer
- Sets printer selections to their default values (Refer to Section 1.6.3.)

1.6.2 Software Initialization

This type of initialization occurs when the printer receives a command (ESC @) via software. When the printer is initialized in this way, it performs the following actions:

- Clears the image buffer
- Sets printer selections to their default values

(Several settings are changed by the last SelecType operation before ESC@ is input (Refer to Section 1.6.3.).

1.6.3 Default Values

The default values set by the default setting mode of the SelecType function are only reset by a hardware initialization. The printer's default values are as follows:

Page Position	Preset paper position becomes top-of-form position
Left and Right Margin	SelecType setting
Line Spacing	1/6"
Vertical Tab Positions	Cleared
Horizontal Tab Positions	Every 8 characters (relative)
VFU Channel	Channel O
Family Number of Type Style	SelecType setting
Downloaded Characters	Deselected
Justification	Left justification
Character Spacing	No additional spacing
Bit Image Mode Assignment	ESC K = ESC *0, ESC L = ESC *1, ESC Y = ESC *2, ESC Z = ESC *3

1.7 ERROR CONDITIONS AND BUZZER OPERATION

This section describes the error conditions and buzzer operation of the printer.

1.7.1 Error Conditions

If any of the following errors occur, the printer automatically enters the OFF LINE mode and outputs the appropriate interface signal.

- Carriage and platen gap home positons are not detected at printer mechanism initialization.
- The ON LINE switch is pressed, causing the printer to enter OFF-LINE mode.
- Paper-out is detected.
- A paper-out signal is detected after the printer has performed a paper loading operation with the cut sheet feeder enabled.

For information concerning the status of the interface signals, refer to Table I-l 2.

1.7.2 Buzzer Operation

The buzzer rings as follows:

- When a BEL code is sent to the printer, the buzzer sounds for 0.1 seconds.
- When an error has occurred,

Carriage Trouble:	Sounds 5 times (rings for 0.5 seconds with 0.5 second intervals.)
Paper End:	Sounds 3 times (rings for 0.1 seconds with 0.1 second intervals.)

- When a panel setting is accepted, the buzzer sounds for 0.1 seconds.

1.8 MAIN COMPONENTS

The LQ-2550 printer includes the following major subassemblies:

- Model-5560 printer mechanism
- ROMA board (main board)
- ROPS/ROPSE board (power supply board, 100- 120V and 220- 240V versions)
- Fan Unit
- Housing
- ROPNL-W board (control panel)

Figure 1-14 shows the LQ-2550 component locations.

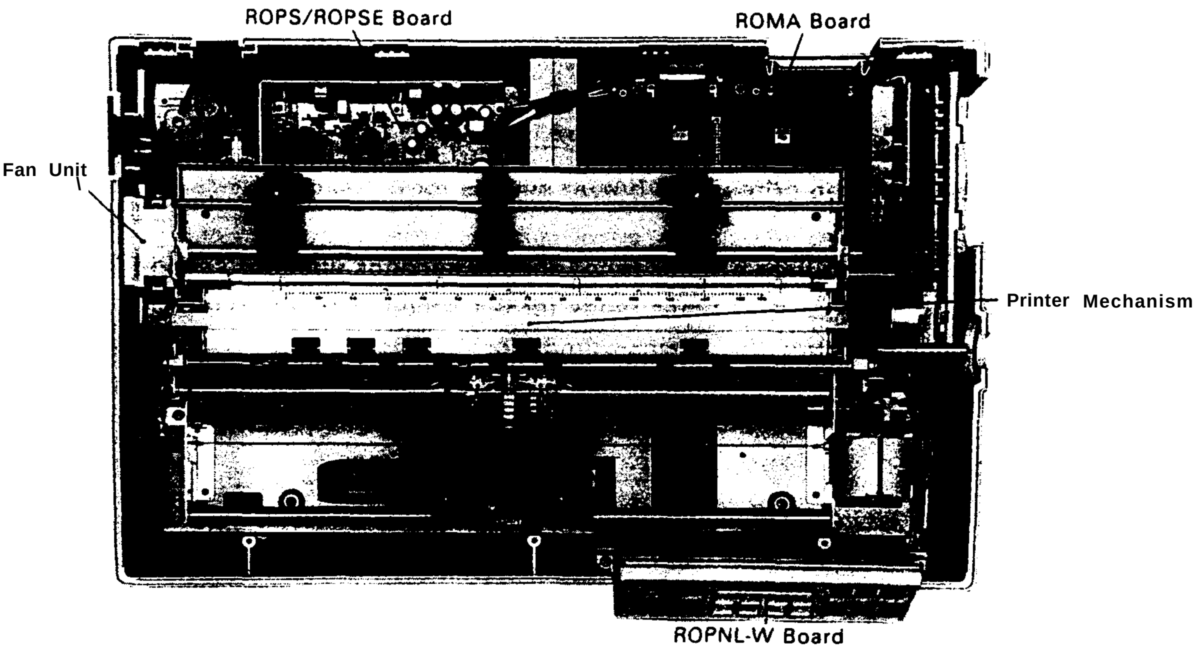


Figure 1-14. LQ-2550 Component Locations

1.8.1 Printer Mechanism

This section describes over view of the printer mechanism, and paper handling and operations.

1.8.1.1 Overview

To improve paper handling, the following functions are newly incorporated in this 24-pin printer in addition to the conventional ones.

- **Automatic release mechanism**
- **Automatic paper thickness detection nechanism**
- **Automatic platen gap adjustment mechanism**
- **Automatic paper width detection mechanism**
- **Automatic loading lever open/close mechanism**

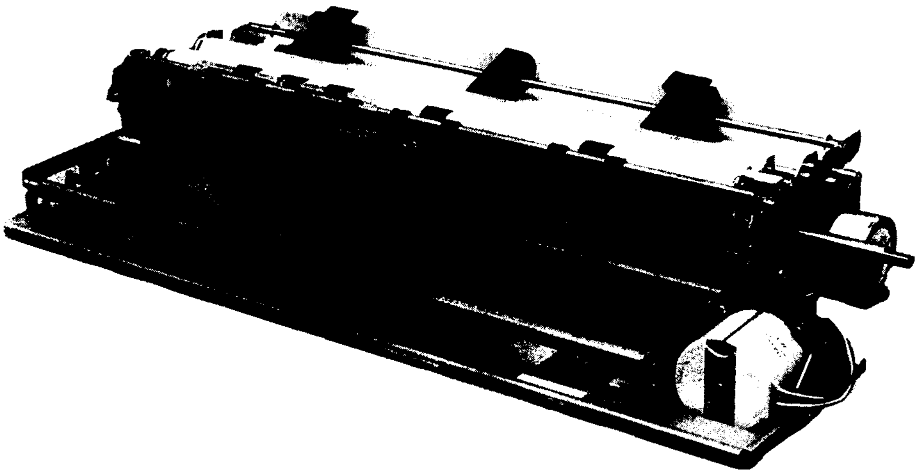


Figure 1-15. Model-5560 Printer Mechanism

1.8.1.2 Paper Handling and Operations

Paper Loading and Ejection

Since the paper release lever is controlled automatically, the pApER SELECT and LOAD/EJECT switches on the control panel provide highly improved paper handling. That is, change over between fanfold (continuous) and single sheet paper and loading/ejecting paper are performed automatically.

a) Single Sheet Loading and Ejection

To load a sheet of paper, press the PAPER SELECT switch and select FRICTION feed. If fanfold paper is loaded, the paper is ejected backward (automatic back out). Place the page along the paper guide, and press the LOAD/EJECT switch. This loads the paper at the top-of-form position. If the LOAD/EJECT switch is pressed after paper has been loaded, it causes the paper to be ejected forward.

b) Fanfold Paper Loading and Ejection (Back Out)

Set the fanfold paper into the push-tractor unit. To load fanfold paper, press the PAPER SELECT switch and select TRACTOR feed. If single sheet paper is loaded, the paper is ejected forward and the fanfold paper is loaded. When the TRACTOR feed has already been selected, pressing the LOAD/EJECT switch loads the paper automatically to the top-of-form position. If LOAD\ EJECT switch is pressed after the fanfold paper has been loaded, the printer ejects the paper backward to the push tractor. To back out several pages, press the LOAD\ EJECT switch several times, since reverse feed is performed on a page-by-page basis.

Micro Adjustment Function

In either case a) or b) above, the top-of-form position is adjustable using the MICRO FEED switch (the message “TOF ADJUST” is displayed on the LCD, and the MICRO FEED, V, and A LEDs are lit.). Pressing the FORM FEED switch advances the paper forward in increments of 1/1 80” continuously as long as the switch is held down, and pressing the LINE FEED switch moves the paper in reverse in increments of 1/180”. Moving the paper with these switches is called micro adjustment. The adjusted position is stored in the memory and remains effective at the next loading even if the power is cycled. But the tractor feed is selected, the adjusted position is remained even if the power is turned off.

Auto-Tear-Off Function

To enable the auto-tear-off function, select AUTO TEAR OFF using the SelecType function. When this function is activated and the PAPER SELECT is FRICTION, paper is fed in the following way: after the input data buffer becomes empty, while the printer is ON-LINE, the printer feeds the paper so that the perforation at the form’s end is moved automatically to the tear-off edge of the printer cover. After the printer has positioned the paper, the message “TEAR OFF ADJUST” is displayed on the LCD, and the V, A, and MICRO FEED LEDs are lit. The FORM FEED and LINE FEED switches are then available for micro adjustment of the tear-off position. The adjusted position is stored in the memory and remains effective at the next tear-off even if the power is turned off and on. If subsequent data is input to the printer, the paper will be reversed to its original position automatically and printing will start. If the ON-LINE switch is pressed (taking the printer OFF-LINE) while the paper is advanced to the tear-off position, then the printer will reverse the paper to its original position. The manual tear-off function selected by the TEAR OFF switch is also called a tear-off function.

1.8.2 ROMA Board (Main Board)

Figure 1-16 shows the ROMA board, which contains an HD64 180R1 P6 (main) CPU andaPPD7810HG (sub) CPU to control the operation of the printer. Driver circuits for the motors, solenoids, printhead, and sensors are also included on this board. The main ICs on the ROMA board are:

CPU
- HD64180R1 P6 (1 3A) .... 8-bit one-chip CPU (main control)
- pPD7810HG (7B) .... 8-bit one-chip CPU (sub control)

Gate Array IC
- E05A1OAA (1 4A) .... Memory management unit (MMU) IC
- E05A02LA (2A) .... Printhead data control IC
- E05A09BA (4B) .... Carriage (CR) and paper feed (PF) motors phase pulse control unit (MCU) IC
- E05A09BA (3B) .... Platen gap (PG) and color select (CS) motors phase pulse control unit (MCU) IC

Memory IC
- EP-ROM (1 1A) .... Main CPU program, 256 K-bit
- EP-ROM (7A) .... Sub CPU program, 256 K-bit
- MASK-ROM (1 2A) .... Character generator, 2M-bit
- PS-RAM (9A) .... Buffers, working area, 256 K-bit
- ST-RAM* (10A) .... Holds status data, panel data, 256 K-bit

*: This memory is backed-up by a lithium battery.

Universal IC
- M546 10P (1 1B) .... 8-bit parallel interface IC
- SI7304 (7C) .... CR motor driver IC
- STK6981 H (7D) .... PF motor driver IC
- H8D2148 (2C) .... Head fan (HF) motor controller and driver IC
- STK66082E (1A) .... Printhead driver IC

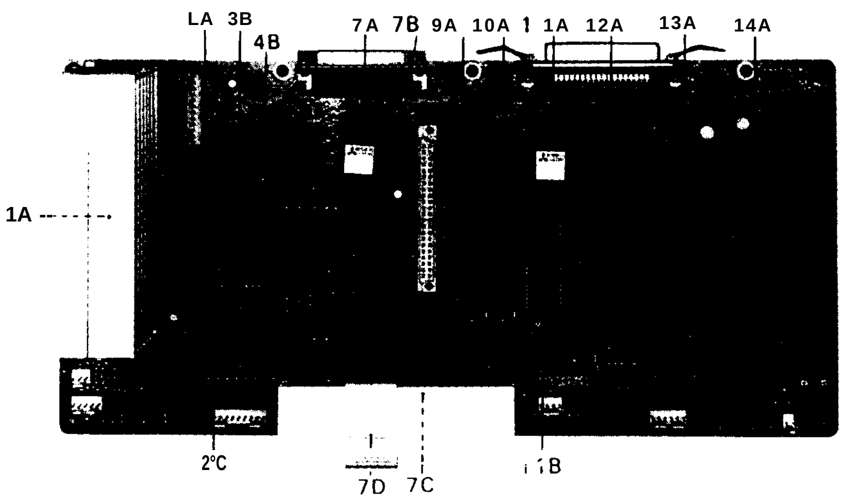
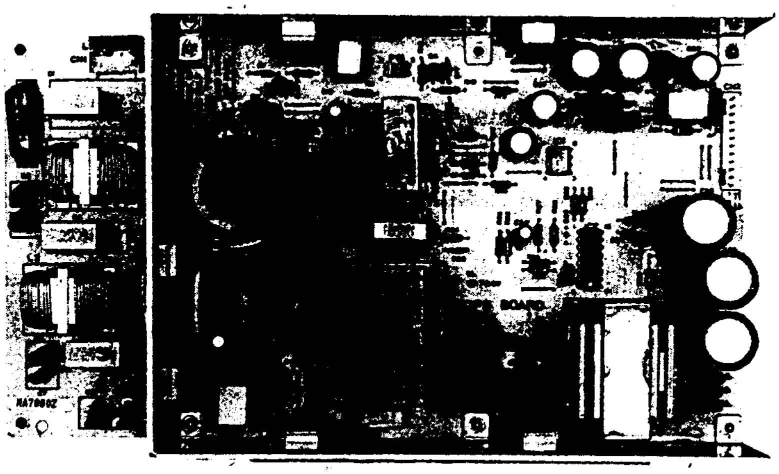


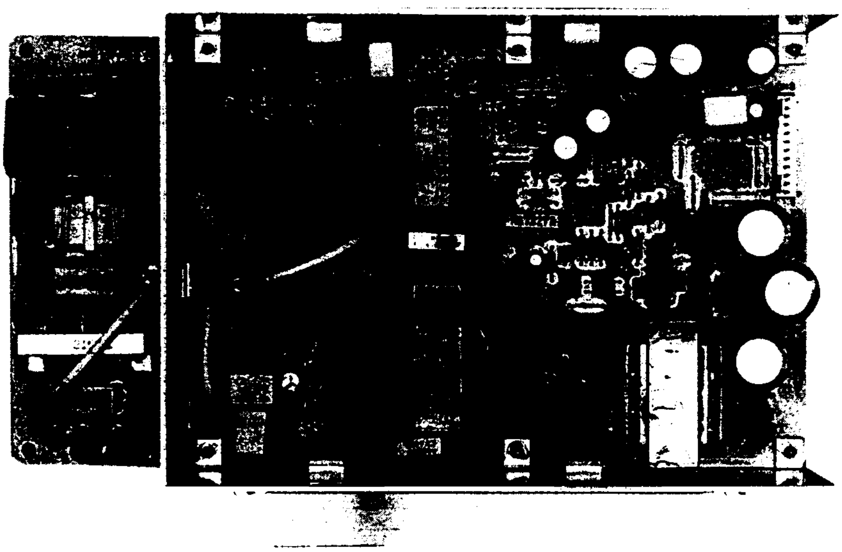
Figure 1-16. ROMA Board

1.8.3 ROPS/ROPSE Board *(Power Supply Circuit Board)*

The power supply circuit board is one of two boards, the ROPS for 100- 120 V AC operation or the "-" ROPSE for 220- 240 V operation. The basic construction of the two boards are the same: each board contains a fuse, line filter, and switching regulator circuit. Compact circuitry is made possible by the use of a DC-to-DC converter.



ROPS Board



ROPSE Board

Figure 1-17. ROPS/ROPSE Board

1.8.4 Fan Unit

A fan unit is used to lower the internal temperature of the printer. It removes heat within the printer housing that is generated by the electric circuits.

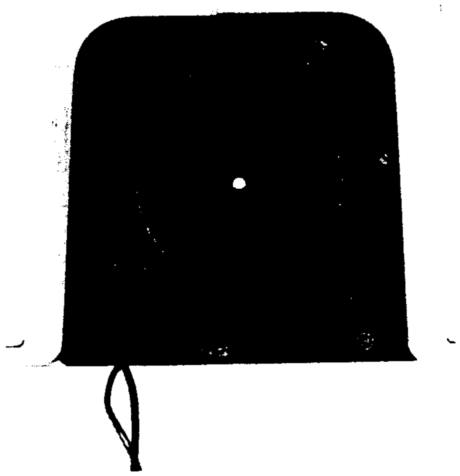


Figure 1-18. Fan Unit

1.8.5 Housing

The housing consists of the upper and lower cases and accommodates the control panel, printer mechanism, control circuit board, power circuit, and fan unit. The optional cartridges (e.g., font and identity modules) can be mounted easily without removing the upper case. Figure 1-19 shows the LQ-2250 housings.

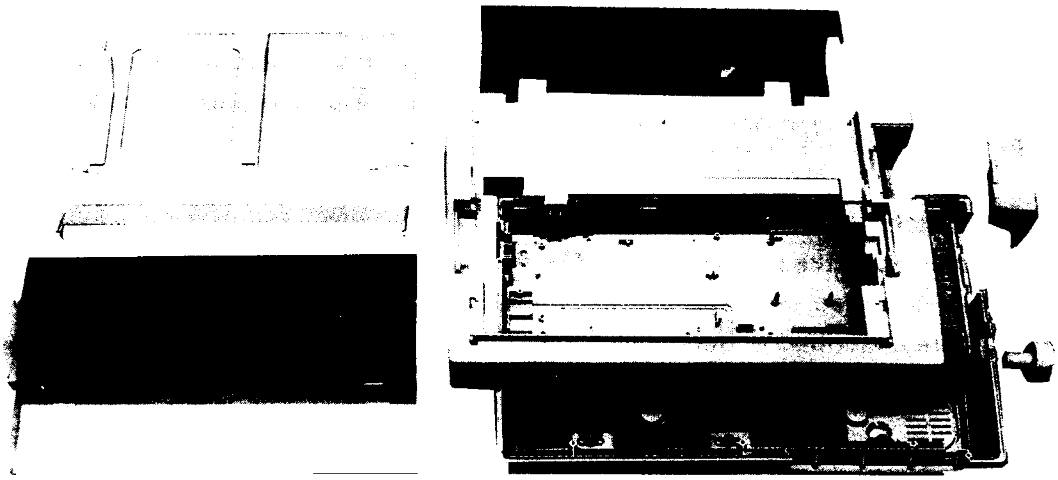


Figure. 1-19. Housing

1.8.6 Control Panel

This section describes the control panel functions.

1.8.6.1 Hardware Specification

On the control panel, there are twelve non-locking switches, sixteen LEDs, and a 20-column LCD (Liquid Crystal Display) as shown in Figure 1-20. The functions of the switches and indicators are given immediately below the illustration.

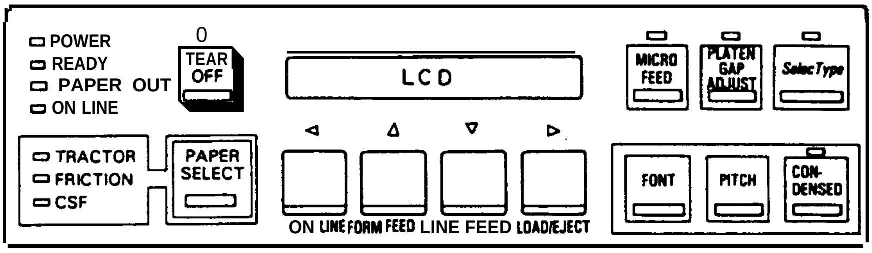


Figure 1-20. Control Panel

ON LINE Switch

This switch toggles the printer between ON-LINE and OFF-LINE. If the printer is set OFF-LINE, printing is stopped and the printer becomes BUSY. This switch is also used in the SelecType function.
ON LINE LED (Green) Lights in the ON-LINE mode. Blinks when the printhead temperature is too high.

FORM FEED Switch

Pressing this switch once while the printer is OFF-LINE, advances the paper vertically to the next top-of-form position. This switch is also used for the micro adjustment function, the platen gap adjustment function, and the SelecType function.

LINE FEED Switch

When the printer is OFF-LINE, the paper advances continuously one line at a time if this switch is pressed for more than 0.5 seconds. The space between lines of text is set using the line spacing command. This switch is also used for the micro adjustment function, the platen gap adjustment function, and the SelecType function.

LOAD/EJECT *Switch*

Pressing this switch when the printer is OFF-LINE, loads or ejects the paper (If a page is inserted in the cut sheet feeder, it is loaded; if a page is already loaded, it is ejected). Details of the paper loading and ejection process are described in Section 1.8.1.2. This switch is also used in the SelecType function.

FONT Switch

Pressing this switch selects a font, and holding the switch for more than 1.0 second cycles through the fonts sequentially. The LCD displays the currently selected font.

PITCH Switch

Pressing this switch selects the character pitch, and holding the switch for more than 1.0 second cycles through the character pitches sequentially. The LCD displays the currently selected character pitch.

CONDENSED Switch

Pressing this switch selects normal or condensed printing.

CONDENSED LED (Green) Lights when condensed mode is selected.

PAPER SELECT Switch

Selects the paper. Each time this switch is pressed, the paper handling method changes in the following order: TRACTOR, FRICTION, CSF BIN 1, CSF BIN 2. Each LED and the LCD displays the currently selected paper handling.

TRACTOR LED (Green) Lights when tractor feed is selected.

FRICTION LED (Green) Lights when friction feed is selected.

CSF LED (Green) Lights when CSF mode is selected.

TEAR OFF Switch

Advance the paper to the tear-off position. This switch is only effective for the tractor feed (Refer to Section 1.8.1.2.).

TEAR OFF LED (Orange) Lights when the tear-off function is enabled.

MICRO FEED Switch

Selects or cancels the micro adjustment function. When this function is enabled, the LED on this switch and the V and A LEDs are lit. In the micro feed mode, the LINE FEED switch is used to feed the paper backward and the FORM FEED switch is used to feed the paper forward. Paper feed performed in this micro feed mode does not affect the page position control. This function is also used to adjust the paper loading position and to adjust the paper to meet the tear-off edge (Refer to Section 1.8.1.2.).

MICRO FEED LED (Orange) Lights when micro feed is enabled.

PLATEN GAP ADJUST Switch

Selects or cancels the platen gap adjustment function. When this function is selected, three LEDs (A, V, and the LED on this switch) are lit and the LINE FEED and FORM FEED switches are used to increase and decrease the platen gap respectively. The relative platen gap value message is displayed on the LCD. "+" level means to be widened. "-" level means to be narrowed. The limits of adjustment are +0.14mm to –0.14mm.

PLATEN GAP ADJUST LED (Orange) Lights when the platen gap adjustment function is enabled.

SelecType Switch

Selects or cancels the SelecType function. When the SelecType function is selected, the LED on this switch is lit and the functions of the ON LINE, FORM FEED, LINE FEED, and LOAD/EJECT switches are changed for the SelecType function.

SelecType LED (Orange) Lights when SelecType mode is selected.

Other LEDs

POWER LED (Green) Lights when power is ON.

READY LED (Green) Lights when the printer can receive data.

PAPER OUT LED (Red) Lights when the paper is at the end.

D ◁ A V LED (Yellow) Lights the setting for the SelecType, tear-off, micro adjustment, and platen gap adjustment functions.

1.8.6.2 SelecType Function

This function is invoked when the SelecType switch is pressed (except during ‘printing). When” this function is invoked, the printer beeps and the message "SelecType MODE" is displayed.. In the SelecType function, major functions can be set by operating the ON LINE (◁). FORM FEED (A), LINE FEED (V), and LOAD/EJECT (D) switches. By pressing the SelecType switch the second time the printer exits this mode and returns to the ON-LINE mode. Exiting without performing “SAVE MACRO” or “SAVE DEFAULTS” means that MACRO settings or DEFAULT settings will not be stored in the backup memory.

- Refer to Figure 1-21 for the entire SelecType operational sequence.

The SelecType mode has five menus. While the message "SelecType MODE” is displayed, every time the LINE FEED (V) switch is pressed, the main menu of this mode is displayed in the order:

LOAD MACRO

Function in which the settings stored in one of the four macro channels can be read out and set as the current SelecType settings.

CHANGE MACRO

Function in which the current settings can be changed and stored into one of the four macro channels. The twelve settings and their options are shown in Table 1-18.

CHANGE DEFAULTS

Functions in which the default settings shown can be changed. the default settings and options are shown in Table 1-19.

PRINT OUT SETTINGS

Function in which all settings in macro channels and the defaults can be printed out.

CLEAR ALL MACROS

Function which all settings in macro channels are cleared.

CHAPTER 2
OPERATING PRINCIPLES

LIST OF FIGURES

LIST OF TABLES

2.1 GENERAL

This chapter will describe features and operations of the Model-5560 printer mechanism, ROPS/ROPSE power circuit board, ROMA control circuit board and control panel.

In this chapter, the following abbreviations are used:

CR: Carriage
CS: Color select
PE: Paper end
PF: Paper feed
PG: Platen gap
PT: Paper thickness
LD: Loading
RL: Release
HP: Home position
HF: Head fan
PW:Paper width

2.1.1 Connector Descriptions

Figure 2-1 shows the connection between the ROMA board and other units. Table 2-1 gives general descriptions of the connectors.

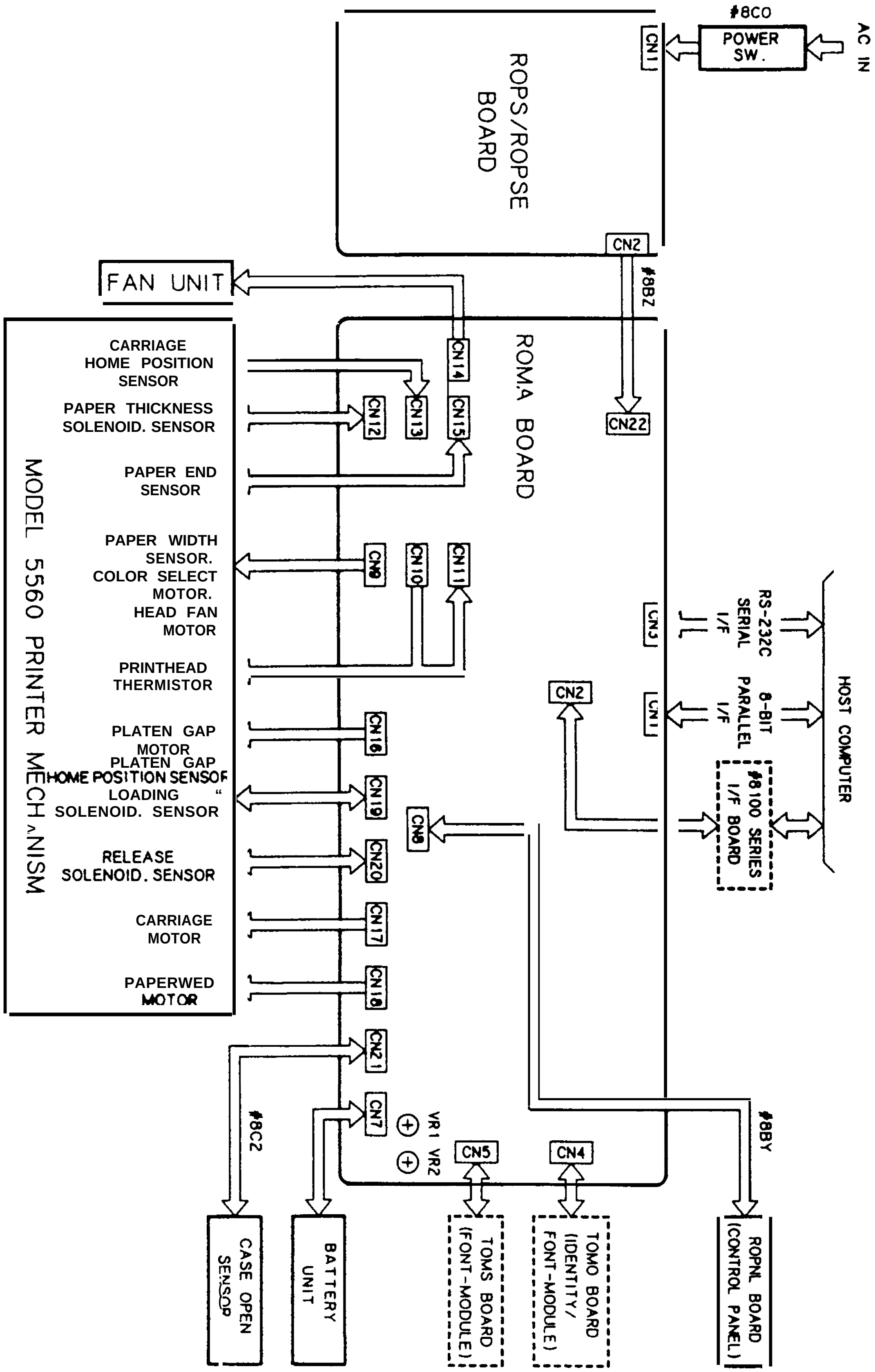


Figure 2-1. Cable Connections

Table 2-1. Connector Descriptions

Boards	Connectors	Connection	Descriptions	Pin number
ROMA	CN1	Host computer	I/F (8-bit parallel)	36
	CN2	#8 IXX I/F board	I/F (option)	26
	CN3	Host computer	I/F (RS-232C serial)	—
	CN4	Identity/font module	SLOT A	32
	CN5	Font module	SLOT B	32
	CN6	Not used	——	—
	CN7	Battery unit	Memory backup +3V DC	2
	CN8	Control panel		18
	CN9	Printer mechanism	CS motor, HF motor, and PW sensor	18
	CN10		Printhead (R)	18
	CN11		Printhead (F)	18
	CN 12		PT solenoid and PT sensor	5
	CN 13		CR HP sensor	3
	CN14		Fan unit	2
	CN 15		PE sensor	2
	CN16		PG motor and PG HP sensor	9
	CN17		CR motor	6
	CN18		PF motor	6
	CN19		LD solenoid and LD sensor	4
	CN20		RL solenoid and RL sensor	4
	CN21	Uppercase	Case open sensor	3
	CN22	ROPS board	+ 5 VDC ±12 VDC +35 DC	12
ROPS/ ROPSE	CN1	External AC power switch	Power supply board	2
	CN2	ROMA board		6

NOTES: Refer to Table A-18 in Appendix for details.

2.1.2 Printer Mechanism Operations

The Model-5560 is a serial printer mechanism equipped with a 24-pin impact dot printhead. This mechanism has various new features to reduce manual paper handling. A block diagram is shown in Figure 2-2.

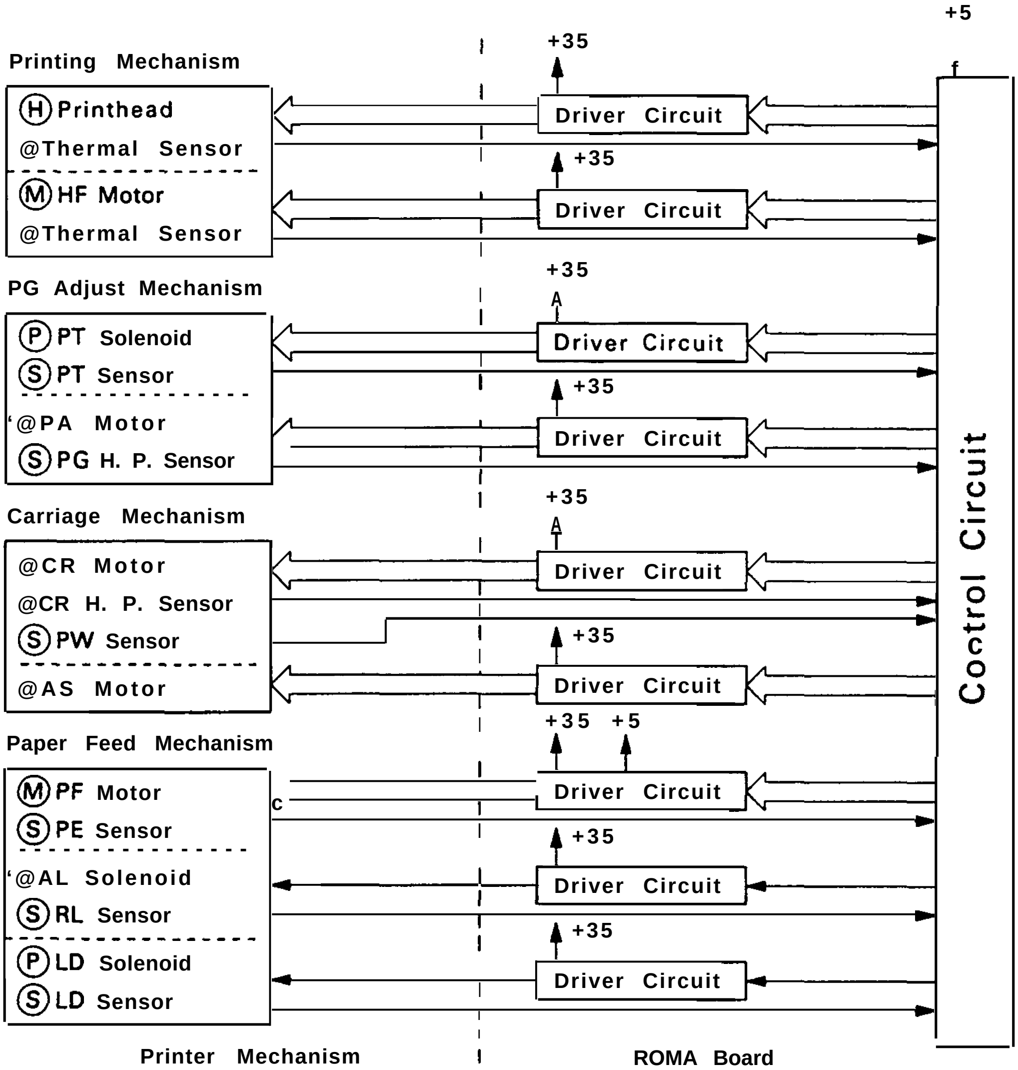


Figure 2-2. Printer Mechanism Block Diagram

2.1.2.1 Printing Mechanism

The printing mechanism consists of two parts: The printing mechanism composed of the printhead, ink ribbon and platen, and the printhead cooling mechanism composed of the printhead fan.

Printing Mechanism

Figure 2-3 shows the printing mechanism.

The printhead has 24 wires arranged in two staggered lines (12 wires for each line). These wires are connected to their own wire drive coils. The printhead specifications are listed in Table 2-2.

The basic printing operations are as follows:

1. The drive signal is sent from the control circuit to the printhead drive circuit and converted to the printhead drive voltage (+35 V DC), which causes current to flow through the assigned head driving coil in the printhead. This magnetizes the coil and the iron core.
2. This magnetism pulls the actuating plate to the iron core, and the dot wire attached to the plate is pushed toward the platen.
3. The dot wire strikes the inked ribbon and paper against the platen to print a dot on the paper.
4. When the coil is de-energized, the iron core loses it magnetic force so that the actuating plate returns to its initial position under the action of the actuating plate spring. After having struck the platen, the dot wire also returns to its initial position under the action of impact energy and the wire resetting spring, and is held in contact with the actuating plate until it is driven again.

This is the sequence used to print a dot on the paper.

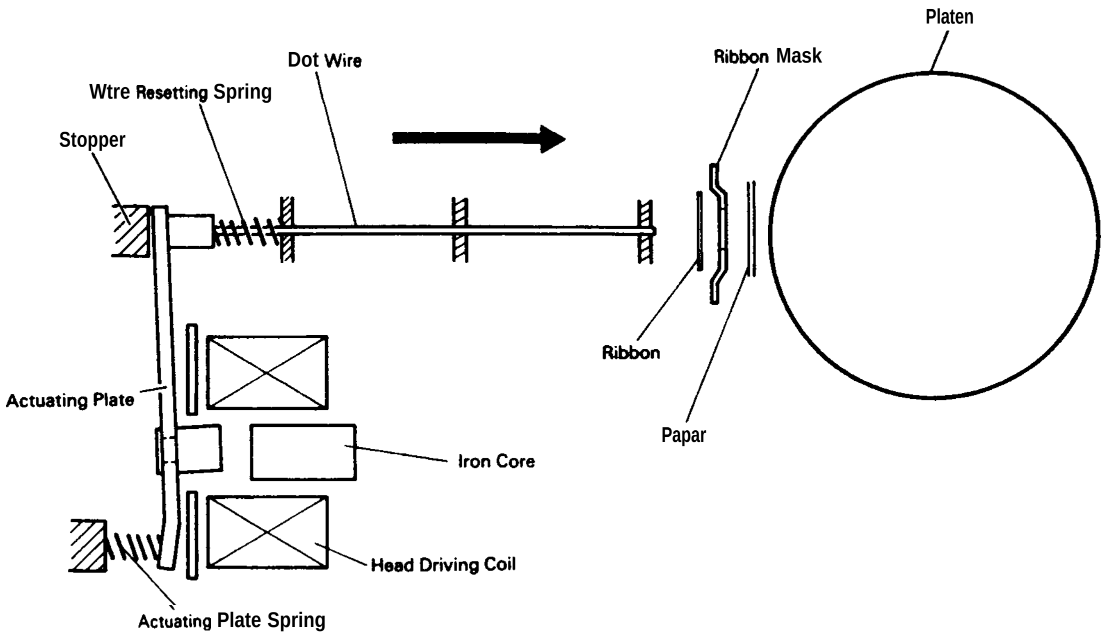


Figure 2-3. Printing Mechanism

Table 2-2. Printhead Specifications

Item	Description	Remarks
Type	Impact dot	Refer to Figure 1-2.
Pin Diameter	0.2 mm	
Pin Configuration	12 line X 2 col.	
Dot Pitch	1/1 80”	
Drive Voltage	35 VDC	± 10%
Coil Resistance	8.6 ohms ± 10%	25°C, for one coil
Drive Frequency	2.00 KHz (Max.)	
Drive Mode	Normal copy 1 copy 2	The selection is depend on the paper thickness. Refer to section 2.3.5.3 for details.
Thermal Sensor	Thermistor	Built-in

Printhead Cooling Mechanism

Figure 2-4 shows the printhead cooling mechanism.

The printhead has a built-in thermistor to protect the dot wire drive coils from the high printhead temperatures (which can occur after many hours of continuous printing) which may burn or degrade them. The printhead temperature detected by the thermistor is converted into a voltage signal and fed back to the control circuit. This is used for printhead protection and, if the printhead temperature rises to about 40°C, the HF motor (Refer to Table 2-3 for its specif ications.) is turned on to cool down the printhead.

Another thermistor is used to protect the HF motor drive circuit from abnormal heating of the HF motor.

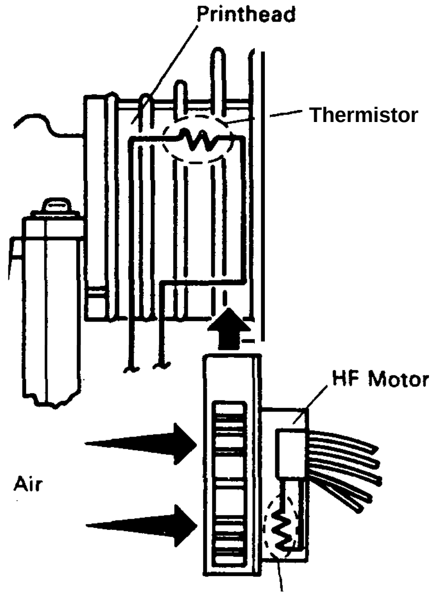


Figure 2-4. Printhead Cooling Mechanism

Table 2-3. HF Motor Specifications

Item	Description	Remarks
Type	Two-phase 6-pole PM type stepper motor	
Drive Voltage	35 VDC	±10%
Coil Resistance	61 ohms ± 7%	25°C, for one coil
Drive Frequency	1600PPS ± 120PPS	One-phase excitation
Driving Method	Constant voltage drive	
Thermal sensor	Thermistor	Built-in

2.1.2.2 Platen Gap Adjustment Mechanism

This mechanism sets the platen-printhead gap according to the paper thickness. Figure 2-5 shows the platen gap adjustment sequence.

NOTE: Also, the gap can be ajusted by control panel operation (Refer to section 1.8.6. 1.).

Start → Paper Thickness Detection → Platen Gap Adjustment → Printhead Drive Mode Selection → Setup Completed

Figure 2-5. Platen Gap Adjustment Sequence

Paper Thickness Detection Mechanism

Figure 2-6 shows the paper thickness detection mechanism. The PT sensor lever is driven by the PT solenoid when it is energized. The distance that the PT sensor lever moves is monitored by the TCR on the PT sensor, and the detected value is converted into a voltage and transferred to the control circuit. Table 2-4 lists the specifications of the PT solenoid and Table 2-5 lists the specifications of the PT sensor.

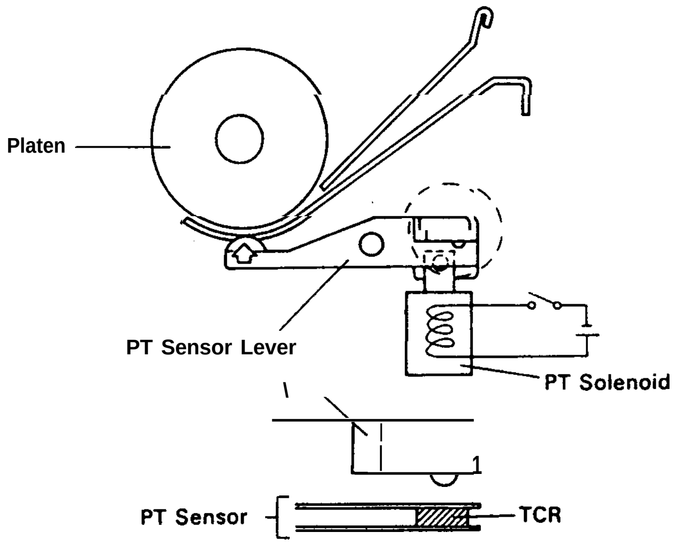


Figure 2-6. Paper Thickness Detection Mechanism

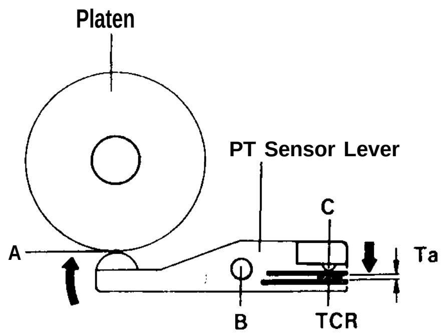
Table 2-4. PT Solenoid Specifications

Item	Description	Remarks
Resistance	65 ohms	± 10%
Drive Voltage	35 VDC	± 10%

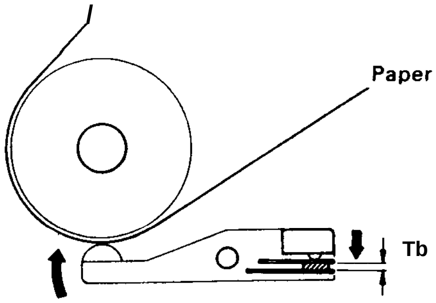
Table 2-5. PT Sensor Specifications

Item	Description	Remarks
Type	Conductive rubber	TCR (Touch Control Sensor)
Drive Voltage	12 VDC	+ 1.5 V, –2.5 V

Figure 2-7 shows the operation of the paper thichness detection mechanism.
When paper is not loaded, point A of the PT sensor lever pushes the platen using shaft B as a fulcrum. At this time, point C of the PT sensor lever places pressure on the TCR (Touch Control Sensor) in the PT sensor to indicate the thickness. Ta is used for this TCR reading. After paper is loaded, point A of the paper sensor lever holds the paper against the platen. Tb is used for this TCR reading.



(a) When no paper is loaded:



(b) When paper is loaded:

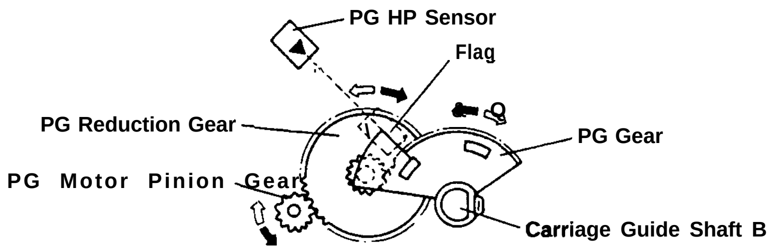
Figure 2-7. Paper Thickness Detection Operation

The control circuit uses Tb - Ta as the paper thickness, and controls the platen gap mechanism so as to provide the proper platen gap for the paper.
The control circuit adjusts printhead trigger pulses applied to the printhead coils according to the paper width which is divided into three grades (Refer to Section 2.3.5.).

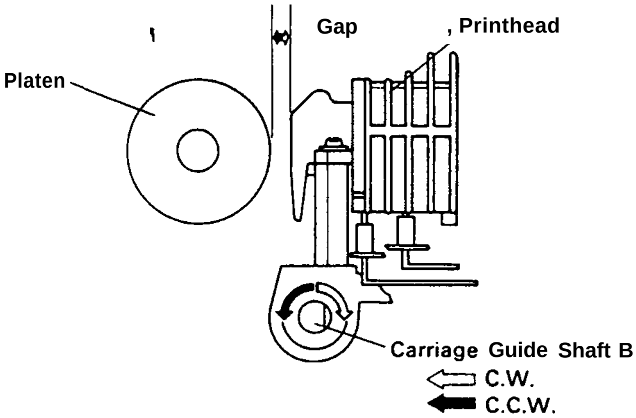
Platen Gap Adjustment Mechanism

Figure 2-8 shows the platen gap adjustment mechanism and Table 2-6 lists its specifications. The rotation of the PG motor is transmitted to the PG gear via the PG reduction gear. The position of the PG gear is detected by the PG HP sensor (Refer to Figure 2-8(a).).

When the PG gear rotates, it drives carriage guide shaft B. Because carriage guide shaft B is attached off-center, its rotation varies the printhead-platen gap (Refer to Figure 2-8(b).).



(a) PG Motor Gear Train



(b) Platen Gap Adjustment

Figure 2-8. Platen Gap Adjustment Mechanism

Table 2-6. Platen Gap Adjustment Mechanism Specifications

Motor	Driving method	Sensor
PG motor; Refer to Table 2-7.	Gear transmission	PG HP sensor Refer to Table 2-8.

Table 2-7. PG Motor Specifications

Item	Description	Remarks
Type	Four-phase 48-pole PM type stepper motor	
Drive Voltage	35 VDC	±10%
Hold Voltage	5 VDC	± 5%
Coil Resistance	125 ohms ± 7%	25°C, for one coil
Driving Frequency	400 PPS	2-2 phase excitation
Driving Method	Constant voltage drive	

Table 2-8. PG HP Sensor Specifications

Item	Description	Remarks
Type	Photo-interrupter	
Drive Voltage	5 VDC	± 5%

2.1.2.3 Carriage Mechanism

This mechanism consists of the carriage movement mechanism, ribbon feed mechanism and color select mechanism.

Carriage Movement Mechanism

Figure 2-9 shows the carriage movement mechanism and Table 2-9 lists its specifications. The printhead is mounted on the carriage, and the entire unit is supported by the two carriage guide shafts. The carriage is fixed to the timing belt on one side and is moved when the CR motor drives the timing belt. Printing is accomplished by the combination of printing mechanism and carriage movement mechanism operations.

The print start position is determined by the CR HP sensor when the mechanism is initialized. The PW sensor monitors paper width so as to prevent printing outside the printable area (See Figure 2-1 O.).

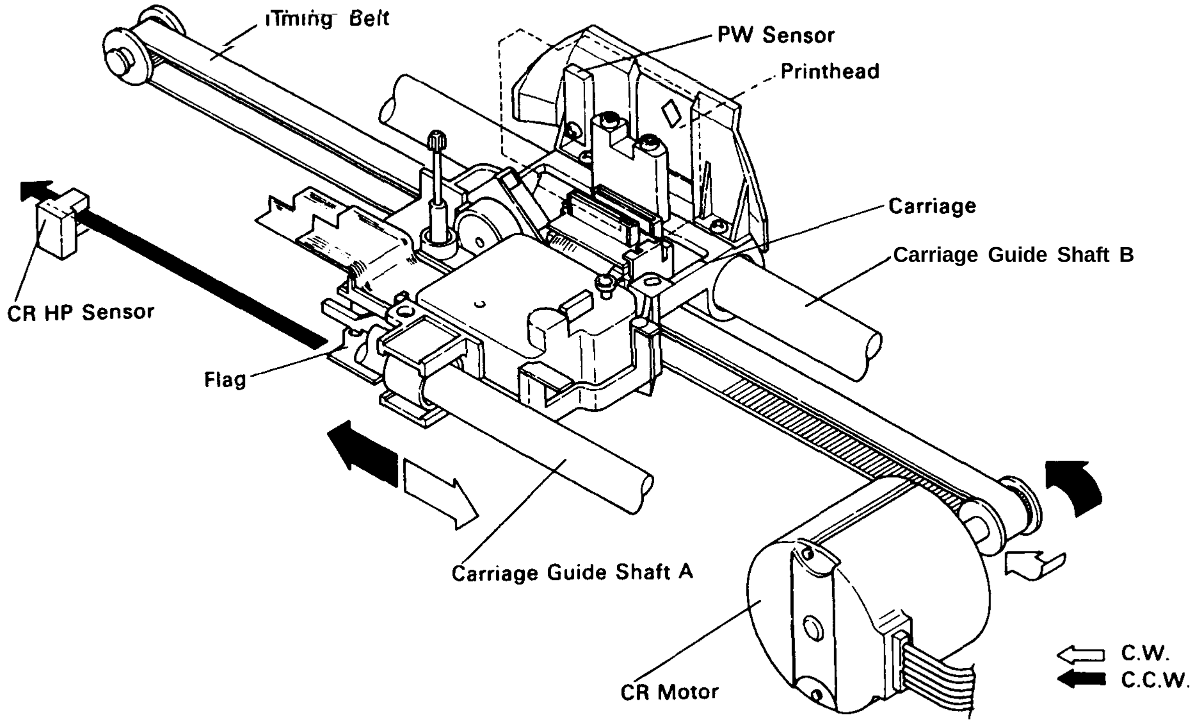


Figure 2-9. Carriage Movement Mechanism

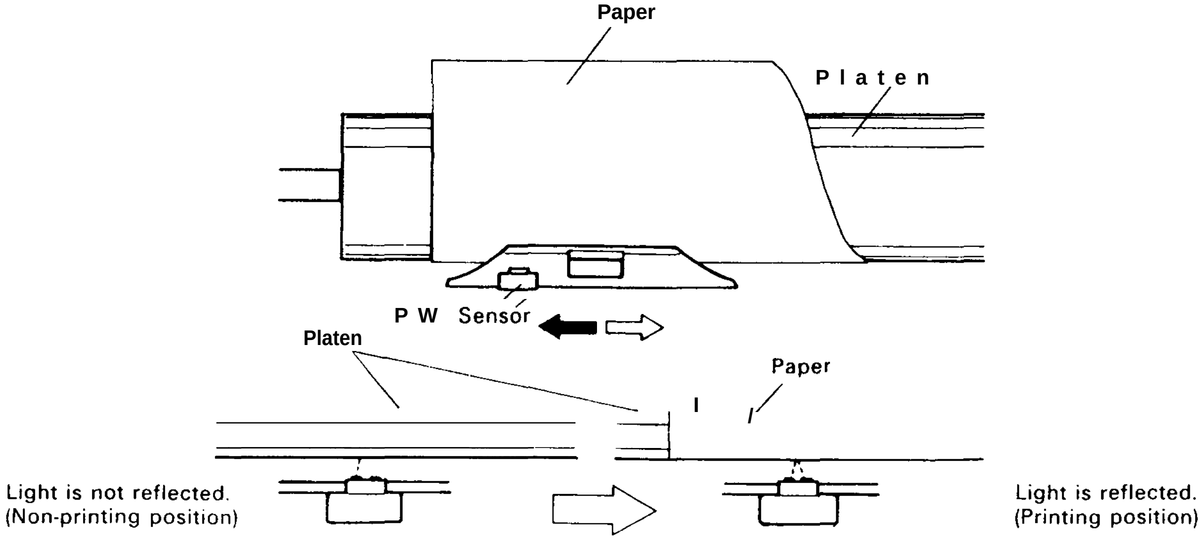


Figure 2-10. PW Sensor Operations

Table 2-9. Carriage Movement Mechanism Specifications

Motor	Driving Method	Carriage Per Step Movement	Sensor	
CR motor; Refer to Table 2-10.	Timing belt	1/120"/step (MIN.)	CR HP sensor	PW sensor
			Refer to Table 2-11.	Refer to Table 2-12.

Table 2-10. CR Motor Specifications

Item	Description	Remarks
Type	Four-phase 200-pole PM type stepper motor	
Drive Voltage	35 VDC	±10’YO
Coil Resistance	2.15 ohms ± 10%	25°C, for one coil
Driving Frequency	4000 PPS 2667 PPS	2-2 phase excitation
	2000 PPS 1333 PPS 667 PPS	1-2 phase excitation
Driving Method	Constant current chopper drive	

Table 2-11. CR HP Sensor Specifications

Item	Description	Remarks
Type	Photo-interrupter	
Drive Voltage	5 VDC	± 5%

Table 2-12. PW Sensor Specifications

Item	Description	Remarks
Type	Photo-reflector	
Drive Voltage	5 VDC	± 5%

Ribbon Feed Mechanism

The ribbon feed mechanism consists of the ribbon feed mechanism and ribbon cartridge. Figure 2-11 shows the ribbon feed mechanism.

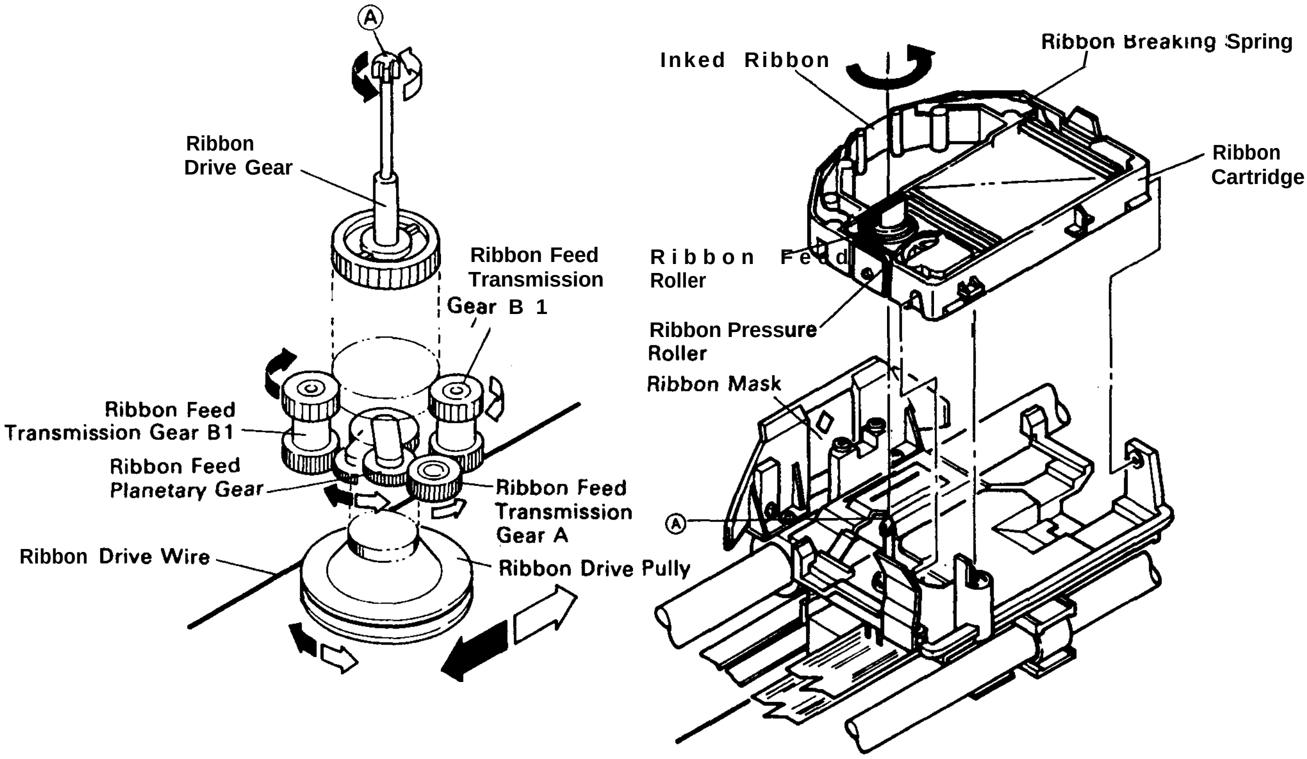


Figure 2-11. Ribbon Feed Mechanism

The ribbon feed mechanism is mounted on the carriage. The ribbon drive wire is fixed between the side frames of the mechanism. The wire is wrapped around the ribbon drive pulley so that the ribbon drive gear always turns counterclockwise, via the gear trains containing the planetary gear (Refer to Table 2-1 3).

Table 2-13. Ribbon Feed Gear Train

Direction of Carriage Movement	Gear Train
Left to right (arrow ⇨)	Ribbon drive pulley → Ribbon feed planetary gear → Ribbon feed transmission gear A → Ribbon feed transmission gear B 1 → Ribbon drive gear
Right to left (arrow ⬅)	Ribbon drive pulley → Ribbon feed planetary gear → Ribbon feed transmission gear B2 → Ribbon drive gear

The inked ribbon is a loop contained in the cartridge case, and is held between the ribbon feed and ribbon pressure rollers. When the ribbon feed roller mounted on the ribbon drive gear is driven by the movement of the gear, the inked ribbon is fed. A spring is attached at the exit of the carriage case to prevent the ribbon from slackening.

The area along the printhead wire is shielded by the ribbon mask to prevent the paper from getting dirty during ribbon feeding.

Color Select Mechanism Specifications

If the color ribbon cartridge is mounted on the carriage, the color select mechanism operates to allow seven-color printing.

Table 2-14 shows the specifications of the color select mechanism.

Table 2-14. Color Select Mechanism Specifications

Motor	Driving Method	Ribbon Shift Direction	Color Select*'
CS motor; Refer to Table 2-15.	Crank gear	Black - Syan Syan - Magenta Magenta - Yellow	Refer to Table 2-16.

*1: Three of the seven colors are printed by mixing the three ribbon colors.

Table 2-15. CS Motor Specifications

item	Description	Remarks
Type	Four-phase 48-pole PM type stepper motor	
Drive Voltage	35 VDC	± 10%
Hold Voltage	5 VDC	± 5%
Coil Resistance	165 ohms ± 10 ohms	25°C, for one coil
Driving Frequency	450 PPS	2-2 phase excitation
Driving Method	Constant voltage drive	

Table 2-16. Color Select

Print color	Print Ribbon	
	1st time	2nd time
Black	Black	—
Magenta	Magenta	
Cyan	Cyan	
Violet	Magenta	Cyan
Yellow	Yellow	
Orange	Yellow	Magenta
Green	Yellow	Cyan

NOTE: The printer prints in sequence from bright colors to dark colors so as to minimize ribbon smearing due to mixed color printing.

1. Outline

The color-inked ribbon is divided into four strips as shown in Figure 2-12. One strip can be selected by vertically moving the color ribbon cartridge using point A of the carriage as a fulcrum.

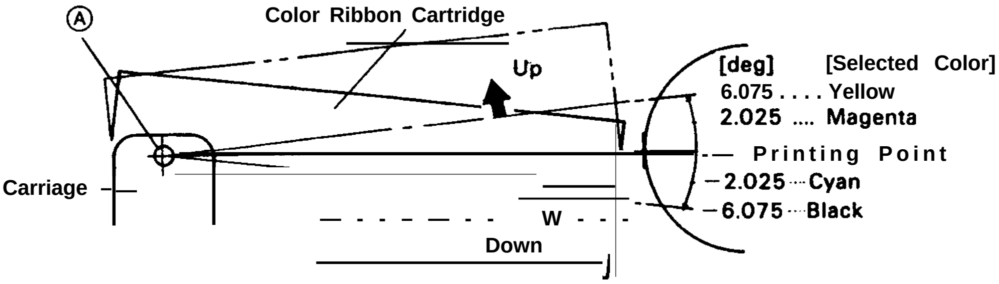


Figure 2-12. Color Ribbon Strip Selection

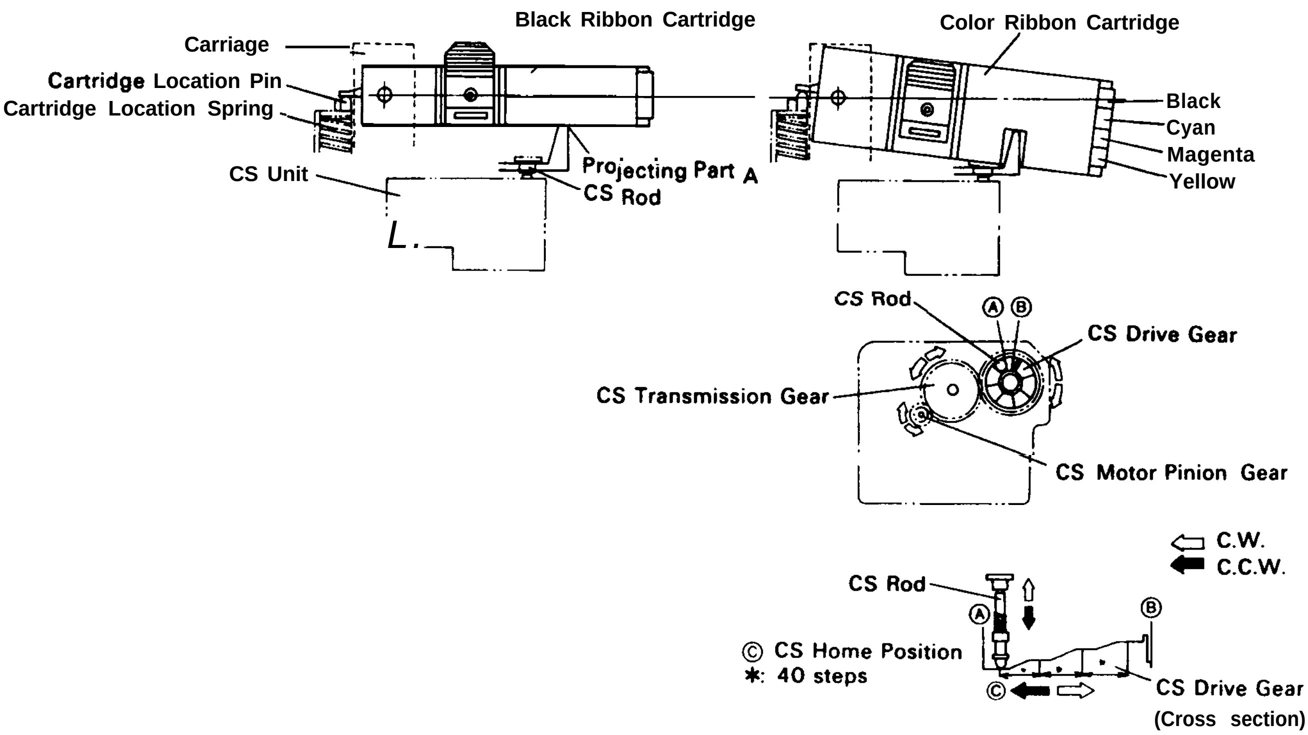
2. Operations

The rotation of the CS motor is converted into vertical motion of the CS rod via the CS transmission gear and CS drive gear, and moves the color ribbon cartridge up or down. The cartridge location spring at the rear of the cartridge pushes the ribbon cartridge against the CS rod via the cartridge location pin to firmly hold the ribbon cartridge.

The next color strip on the ribbon cartridge is selected by the CS motor rotating 40 steps from Color select home position (point C). (Refer to Figure 2-13 (b).) When the black ribbon cartridge is mounted, the bottom of the ribbon cartridge touches projecting part A of the carriage.

This keeps the bottom of the black ribbon cartridge away from the CS rod during its up and down movement, and defeats the color select mechanism operation.

The cartridge location spring at the rear of the ribbon cartridge pushes the ribbon cartridge toward the projecting part A of the carriage via the cartridge location pin to firmly hold the ribbon cartridge. (Refer to Figure 2-1 3(a).)



(a) When a black ribbon is used

(b) when a color ribbon is used

Figure 2-13. Color Select Mechanism

2.1.2.4 Paper Feed Mechanism

This mechanism consists of the PF motor, paper feed mechanism, paper release mechanism and paper loading lever open/close mechanism.

Paper feed mechanism

The PF motor drives the platen or tractor via the PF transmission gear, and feeds the paper. If the paper runs out, the PE sensor detects it (Refer to Figures 2-14 and 2-1 5.).

Table 2-17 lists the specifications of the paper feed mechanism.

Table 2-17. Paper Feed Mechanism Specifications

Motor	Driving method	Paper feeding per step	Sensor
PF motor; Refer to Table 2-18.	Gear transmission	l/360 "/step	PE sensor; Refer to Table 2-19.

Table 2-18. PF Motor Specifications

Item	Description	Remarks
Type	Four-phase 48-pole PM type stepper motor	
Drive Voltage	35 VDC	± 10%
Hold Voltage	5 VDC	± 5%
Coil Resistance	4.2 ohms ± 10%	25°C, for one coil
Driving Frequency	144 PPS	2-2 phase excitation
Driving Method	Constant voltage drive	

Table 2-19. PE Sensor Specifications

Item	Description	Remarks
Type	Mechanical switch	
Rated Voltage	5 VDC	± 5%

Push tractor feeding and friction feeding are described below.

The paper feeding methods consist of push tractor feeding (for continuous paper) and friction feeding (for cut sheet paper). (Refer to Table 2-20.)

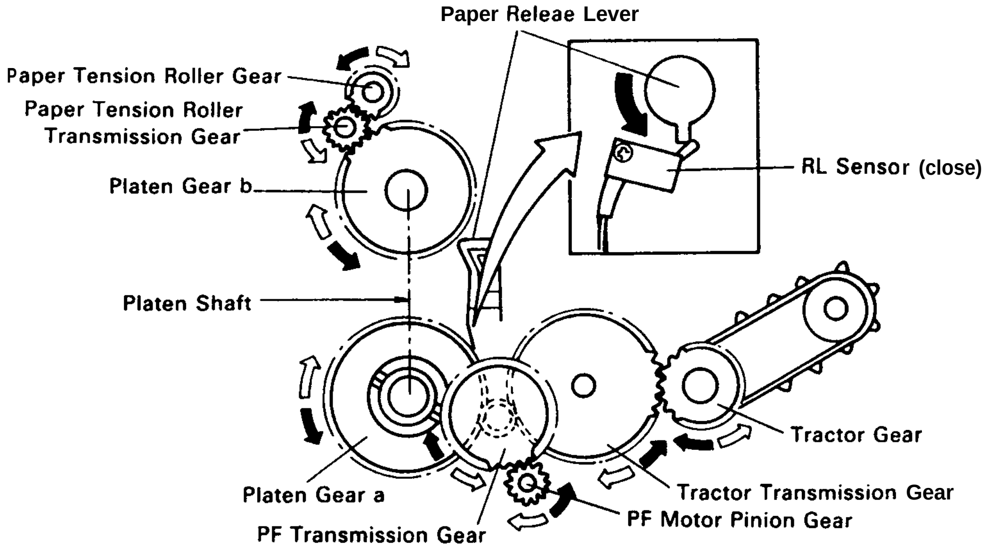
Table 2-20. Paper Feeding Method and Paper

Paper Release Mechanism State	Friction Feeding		Tractor Feeding
Paper	Cut sheet		Continuous
Push tractor	Invalid		Valid
Paper feeding method	Standard	Cut sheet feeder"	Push & pull*

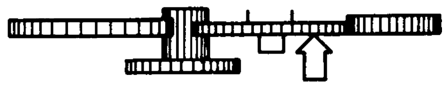
*: Optional Equipment

1. Push Tractor Feeding

Paper is fed by driving the PF motor with the paper release lever set forward to load fan-fold paper into the push tractor unit.

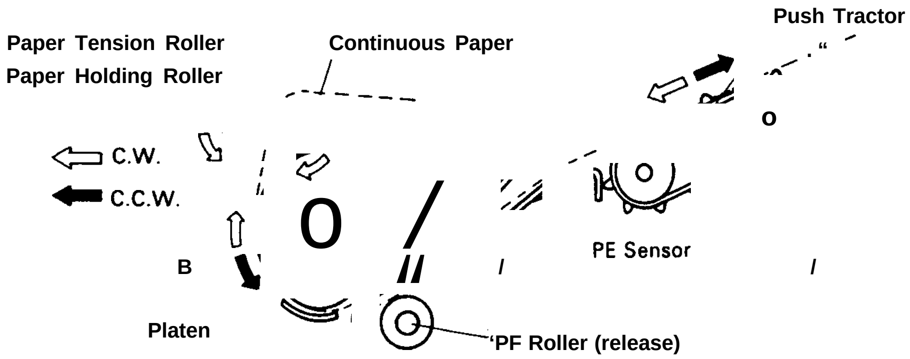


(i) Side View



(ii) Top View

(a) Gear Arrangement



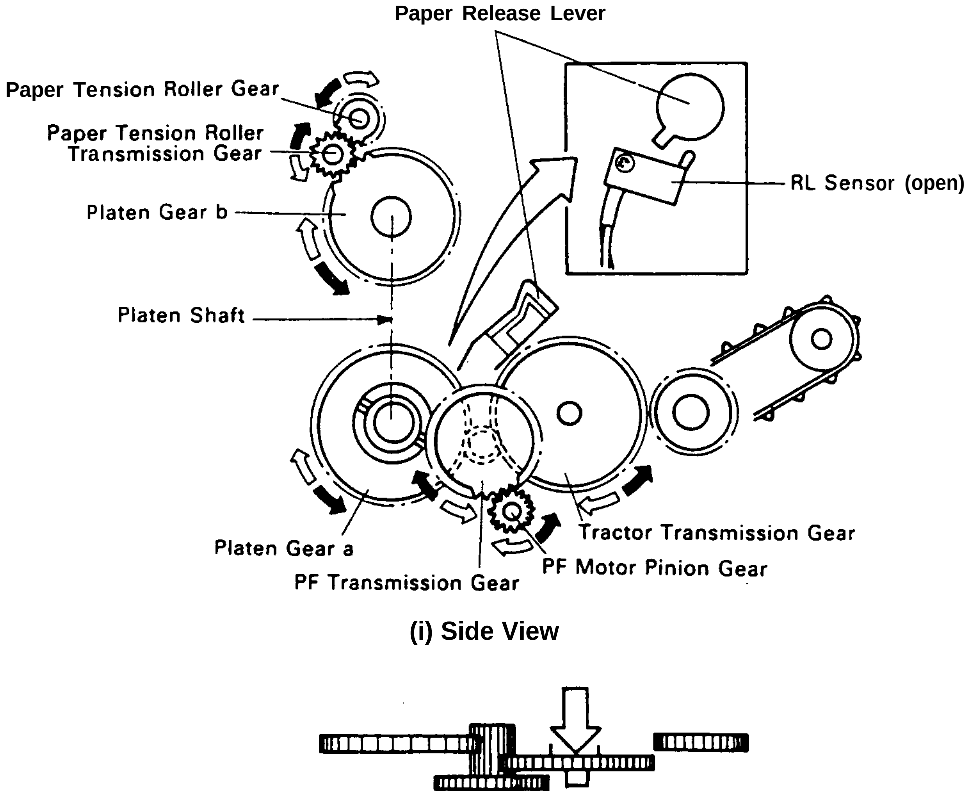
(b) Paper Path

Figure 2-14. Push Tractor Feeding

2. Friction Feeding

The paper is loaded from the upper paper entrance with the paper release lever set backward. The paper is held against the platen by the paper feed roller and is fed due to friction by the platen and paper feed roller.

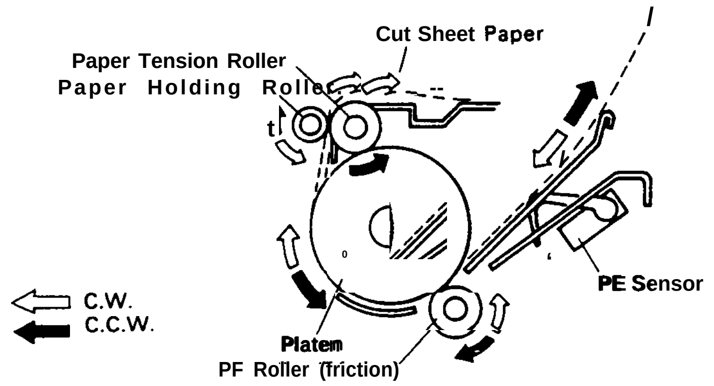
During friction feeding, the paper release lever retracts the tractor gear from the tractor transmission gear so that the push tractor is not driven.



(i) Side View

(ii) Top View

(a) Gear Arrangement



(b) Paper Path

Figure 2-15. Friction Feeding

Paper Release Mechanism

The paper release mechanism operates so that the paper feeding method is automatically switched between friction feeding and push tractor feeding.

Table 2-21 lists the specifications of the paper release mechanism.

Table 2-21. Paper Release Mechanism Specifications

Motor	Driving Method	Trigger	Sensor
PF motor; Refer to Table 2-18.	Gear via trigger clutch	RL solenoid; Refer to Table 2-22.	RL sensor; Refer to Table 2-23.

Table 2-22. RL Solenoid Specifications

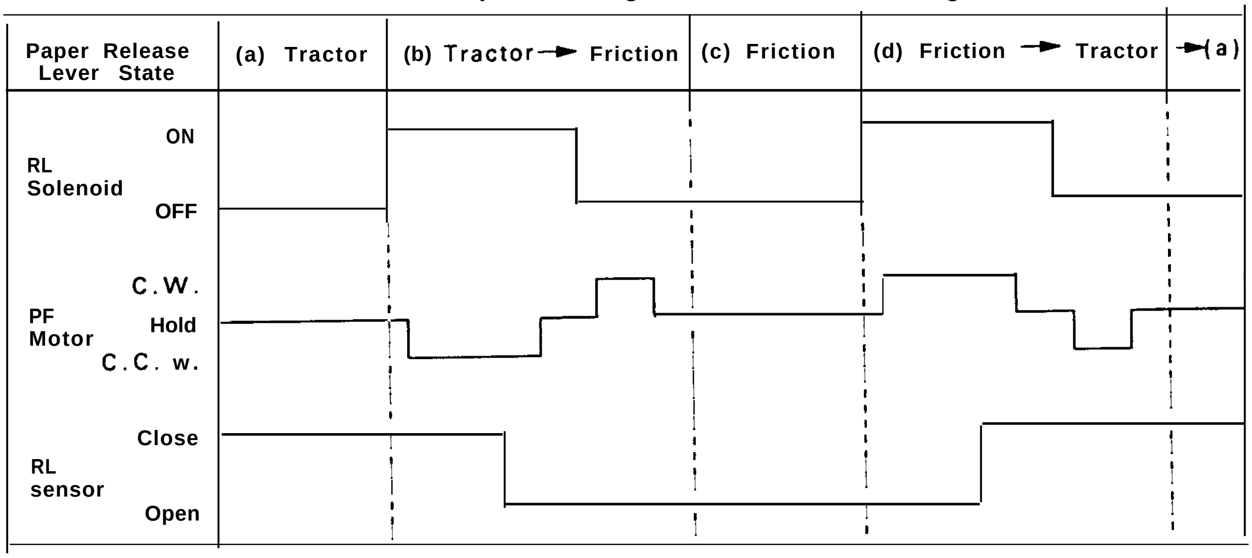
Item	Description	Remarks
Coil Resistance	130 ohms	± 10%
Drive Voltage	35 VDC	± 10%

Table 2-23. RL Sensor Specifications

Item	Description	Remarks
Type	Micro switch	
Rated Voltage	5 VDC	± 5%

Figure 2-16 shows the basic operations of the paper release mechanism, and Table 2-24 lists the switch timina for the paper feeding method. Switching is described below.

Table 2-24. Paper Feeding Method Switch Timing



1. Switching from Tractor Feeding to Friction Feeding
When the RL solenoid is energized, the RL trigger is pulled, and the clockwise rotation of the PF motor is transmitted as follows:

PF motor → PF transmission gear → Tractor transmission gear+ Sun gear → RL planetary gear A → Paper release lever

The RL sensor confirms the switching operation. Subsequently, the PF motor is driven counterclockwise so as to allign the RL planetary lever and RL trigger.

2 Switching from Friction Feeding to Tractor Feeding
When the RL solenoid is energized, the RL trigger is pulled, and the counterclockwise rotation of the PF motor is transmitted as follows:

PF motor → PF transmission gear → Tractor transmission gear → Sun gear
→ RL planetary gear B → Paper release lever

The RL sensor confirms the switching operation. Subsequently, the paper feed motor is driven clockwise so as to align the RL planetary lever and RL trigger.

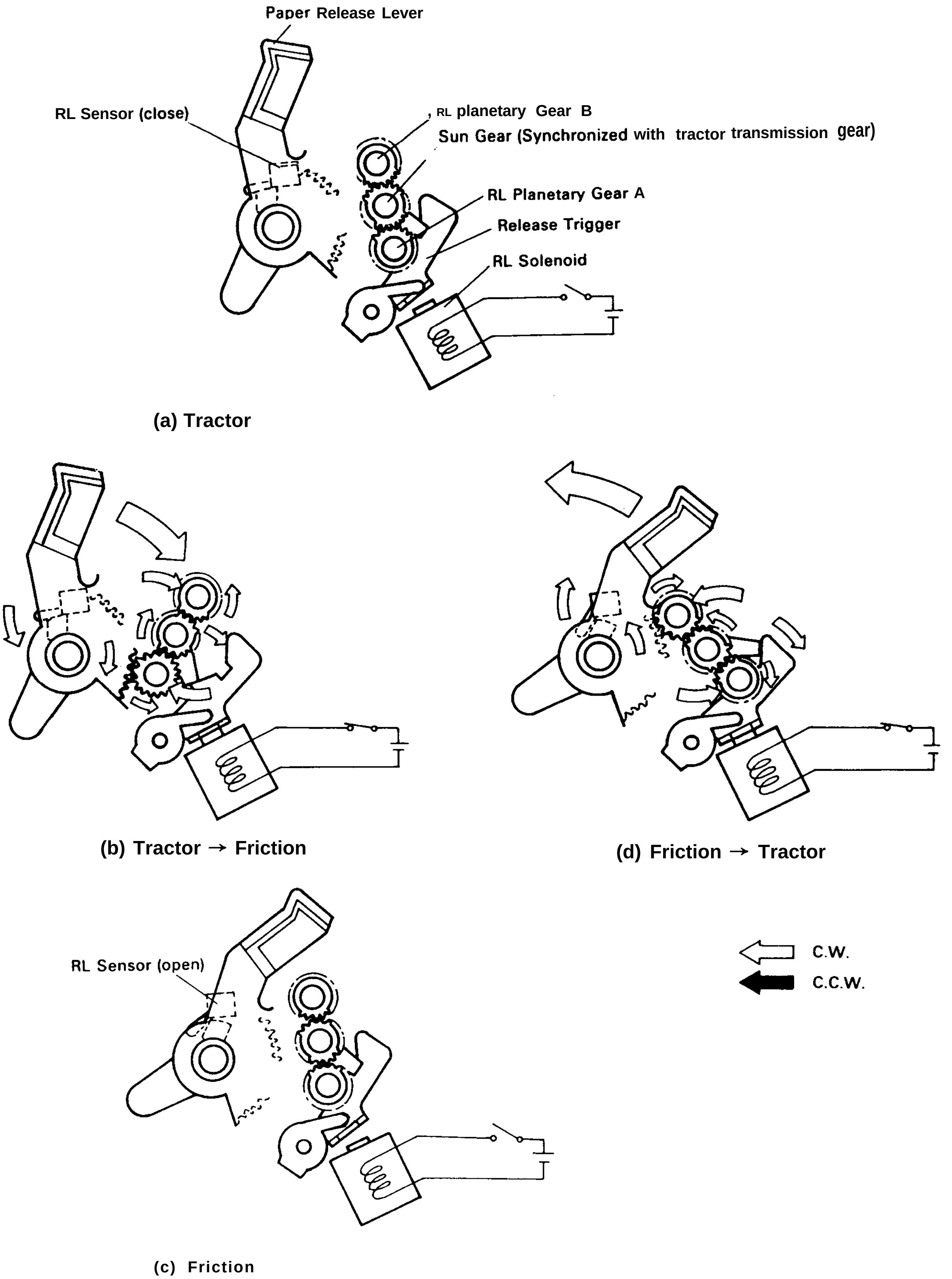


Figure 2-16. Paper Release Mechanism Operations

Paper Loading Lever Open/Close Mechanism

This mechanism advances the paper through the paper holding roller during loading or unloading. Table 2-25 lists the specifications of the paper loading lever open/close mechanism.

Table 2-25. Paper Loading Lever Open/Close Mechanism Specifications

Motor	Driving Method	Trigger	Sensor
PF motor; Refer to Table 2-18.	Gear via trigger clutch	LD solenoid; Refer to Table 2-26.	LD sensor; Refer to Table 2-27.

Table 2-26. LD Solenoid Specifications

Item	Description	Remarks
Coil Resistance	130 ohms	± 10%
Drive Voltage	35 VDC	± 10%

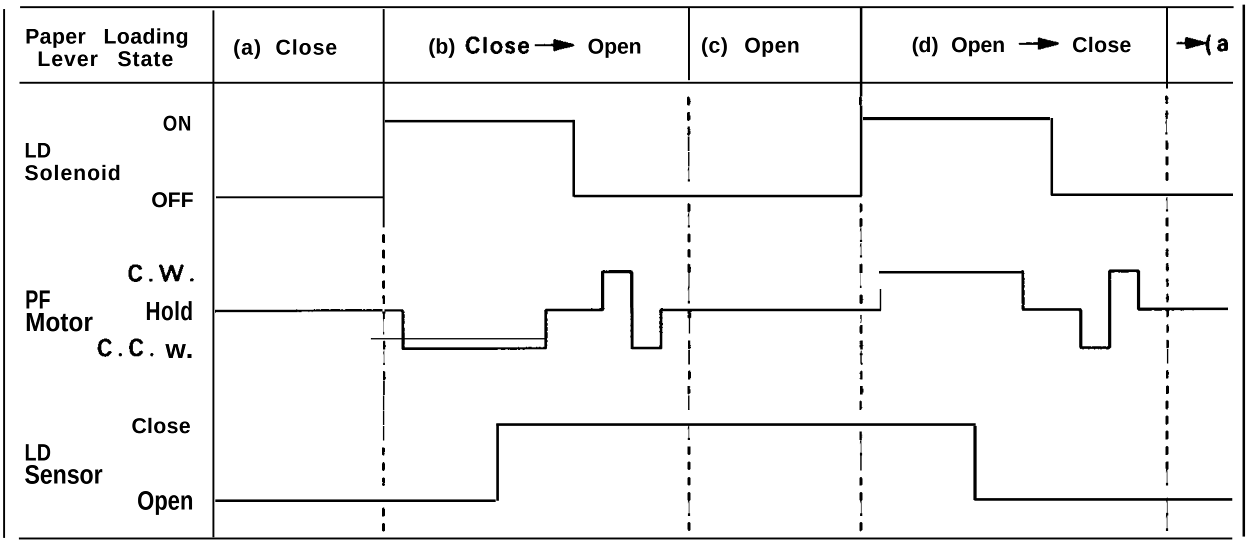
Table 2-27. LD Sensor Specifications

Item	Description	Remarks
Type	Micro switch	
Rated Voltage	5 VDC	+5%

Figure 2-17 shows the basic operation of the paper loading lever open/close mechanism, and Table 2-28 lists open/close timing for the paper loading lever.

Switching operations are described below.

Table 2-28. Paper Loading Lever Open/Close Timing



1. Switching from Close to Open
When the LD solenoid is energized, the LD trigger is pulled and the clockwise rotation of the paper feed motor is transmitted as follows:

PF motor → PF transmission gear → Platen gear → LD planetary gear → LD gear A → Paper loading lever → Paper holding lever (= Paper holding roller)

The LD sensor confirms the switching operation.

Subsequently, the PF motor is driven clockwise/counterclockwise so as to take up slack in the paper.

2. Switching from Open to Close
When the LD solenoid is energized, the LD trigger is pulled, and the clockwise rotation of the PF motor is transmitted as follows:

PF motor → PF transmission gear+ Platen gear+ LD planetary gear+ LD gear A → LD gear+ Paper loading lever → Paper holding lever (= paper holding roller)

The LD sensor confirms the switch operation. Subsequently, the PF motor is driven clockwise/counter-clockwise so as to take up slack in the paper.

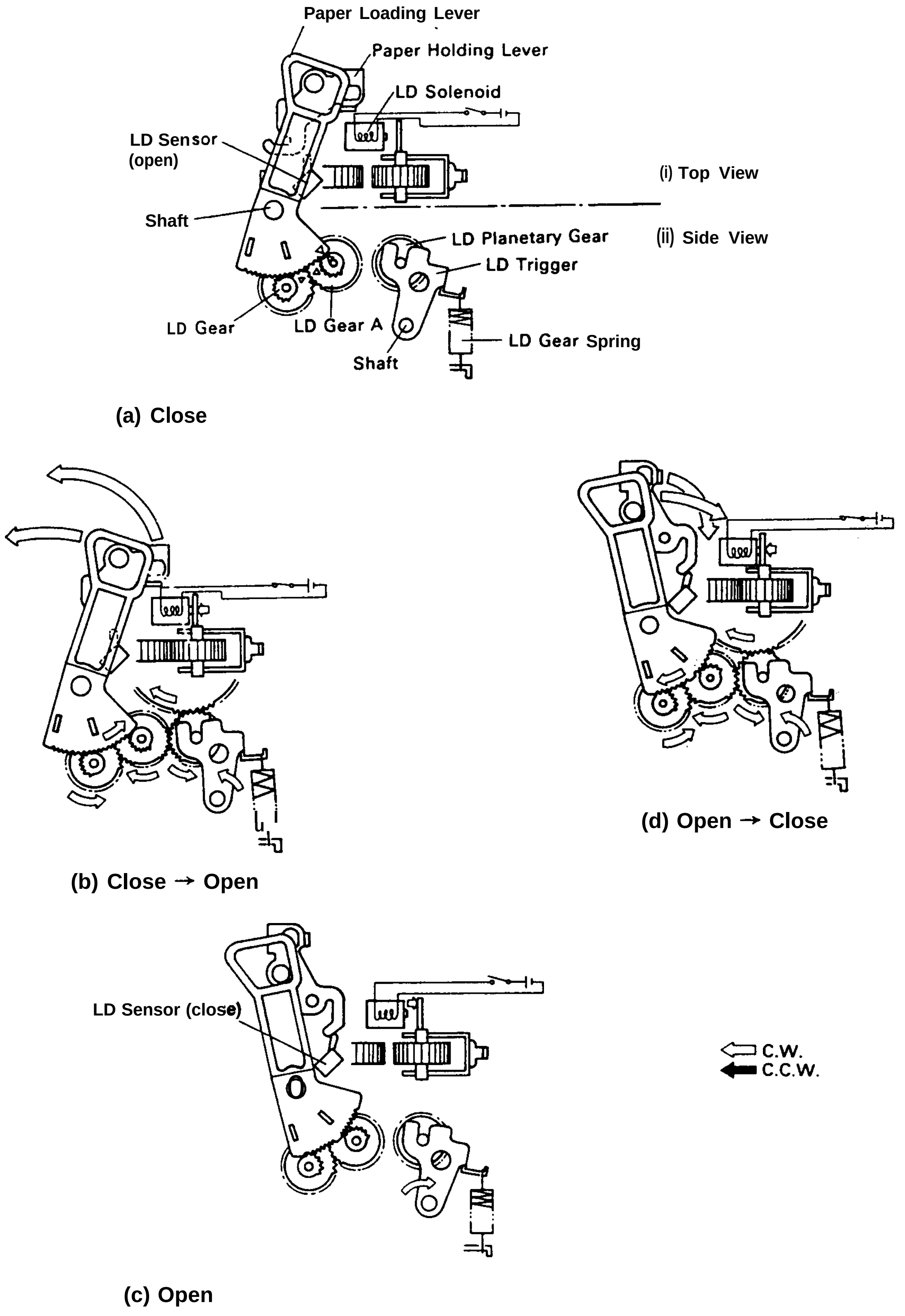


Figure 2-17. Paper Loading Lever Open/Close Mechanism Operation

2.2 POWER SUPPLY CIRCUIT OPERATION (ROPS/ROPSE Board)

The DC power supplies required by the control circuits and mechanisms in this printer are included on the power supply board. Table 2-29 shows the input ratings for this board.

Table 2-29. ROPS/ROPSE Board Ratings

Name	Input Voltage [VAC]	Fuse F1 Rating
ROPS	100- 120	125V, 6.3A
ROPSE	220- 240	250V, 4.0A

2.2.1 ROPS/ROPSE Board Outline

The ROPS/ROPSE board supplies various DC voltages, as shown in Table 2-30, to operate the mechanisms and control circuits.
Since the ROPS board has almost the same structure as the ROPSE board, this section will be describe the ROPS board.

- Refer to Appendix, Figures A-49 and A-50, for the entire circuit of the ROPS/ROPSE board.

Table 2-30. Voltages and Applications

Power Supply Voltage (DC)	Applications
+35 V– GH	. Printhead solenoids driving ● PT solenoid driving . LD solenoid driving ● RL solenoid driving ● HF motor driving . PG motor driving ● CR motor driving ● CS motor driving ● PF motor driving ● Fan motor driving
+ 5V - GL	● Logic circuit ● Sensor circuits (excluding the PT sensor circuit) ● Control panel ● PG motor holding ● CS motor holding ● PF motor holding ● Optional interface board ● Optional Identity/Font module
VX (+5 V) - GL	● Reset circuit ● +35 V drive system/control system output pull ups ● Buzzer
±12V – GL	● Optional interface board
+ 12 V – AGN	● PT sensor circuit (+ 12 V only)

NOTE: GH . . Ground of drive circuit, GL .,.. Ground of logic circuit, AGN . . . . Ground of analog circuit

Figure 2-18 shows a block diagram of the power supply circuit.
External noise on the AC input line is first attenuated by the input filter circuit. Then the input AC is rectified by the full-wave rectifier circuit and smoothed by the smoothing circuit.
Surge current that flows when the printer power is first turned on is suppressed by the surge-suppression circuit.
The voltage output from the smoothing circuit is converted to various voltages for the control circuits (+5 V and ± 12 V) and drive circuits (+35 V).
When main switching circuit 1 is activated, voltage is induced in the secondary side of transformer T1 by electromagnetic coupling with the primary side. The voltage is rectified and smoothed separately into + 5 V and ± 12 V.
After being rectified and smoothed, the + 5 V output is fed back to main switching circuit 1 by the current limiting and voltage regulator circuits via the photo coupler, and stabilized.
When the power supply for the control circuits starts operating normally, voltage is induced in the secondary side of transformer T2. Upon receiving this voltage, main switching circuit 2 turns on, and voltage is induced in the secondary side of transformer T3. After being rectified and smoothed, the +35 V output is fed back to main switching circuit 2 by the current limiting, voltage regulator, and over voltage protection circuits, and is stabilized.

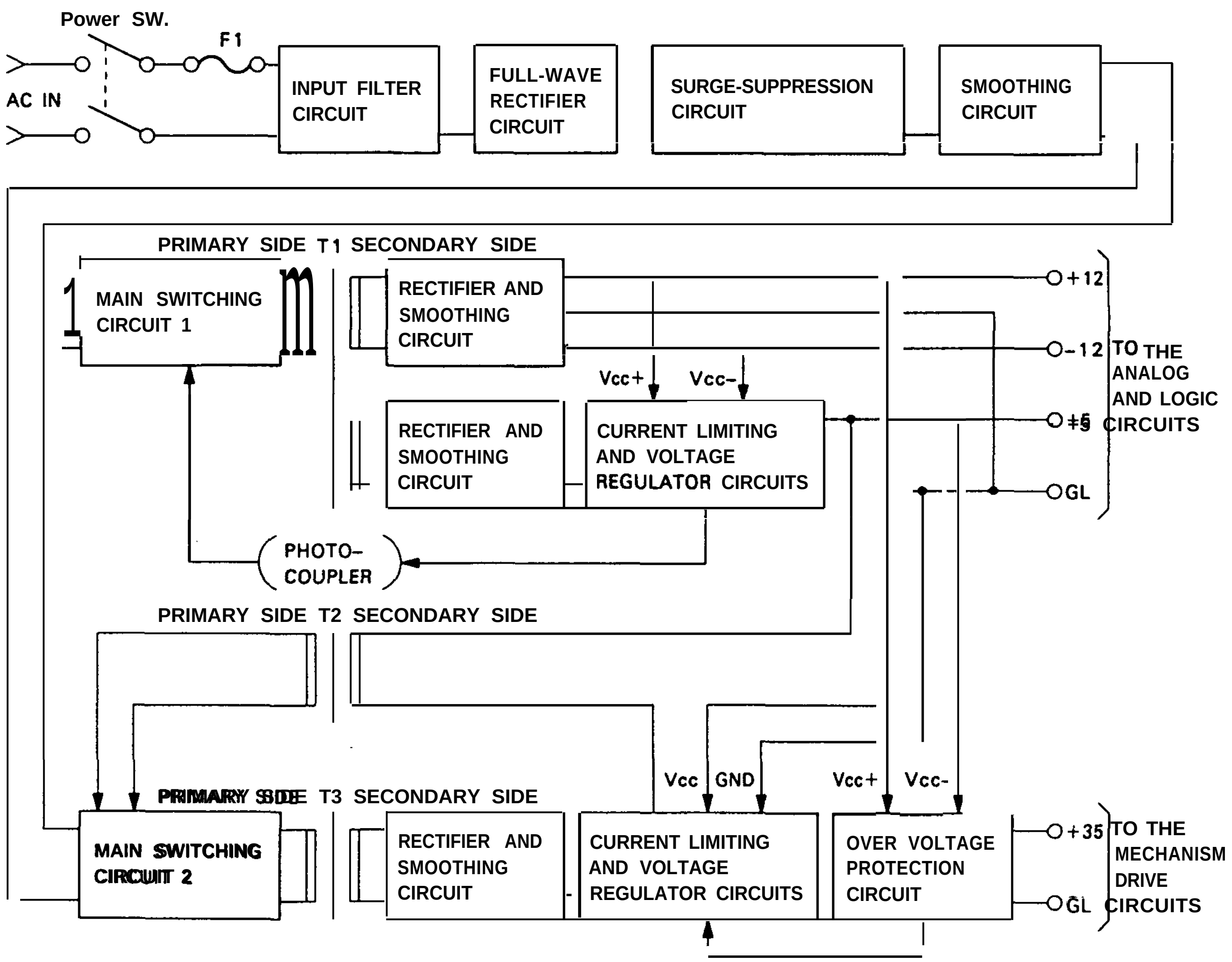


Figure 2-18. ROPS/ROPSE Board Block Diagram

2.2.2 Input Filter Circuit

Figure 2-19 shows the input filter circuit. The input filter circuit attenuates external harmonics (noise) on the AC input line, and inhibits noise generated by the circuits in the printer from going out over the AC line. The coils and capacitors employed in this filter have been chosen to be able to handle fluctuations of the AC input line. The frame grounds (F. G.) connected between C2 and C3, and C5 and C7 are for leakage current from the AC line to the frame.

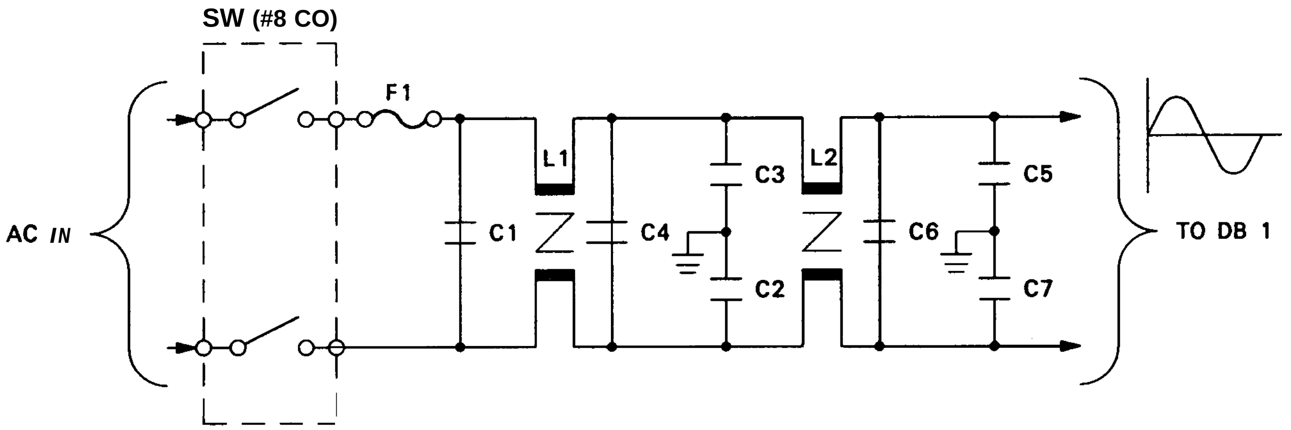


Figure 2-19. Input Filter Circuit

2.2.3 Rectifier, Smoothing, and Surge-suppression Circuits

Figure 2-20 shows the rectifier, smoothing, and surge-suppression circuits. The filtered AC input voltage from the input filter is input to diode bridge DB 1, full-wave rectified, and smoothed by capacitor Cl 2. . Normally, the voltage across C 12 is O V before the printer power is turned on. This means the line is shorted at C 12 via DB 1 when viewed from the input side. Therefore, when the power is first turned on, a large charging current flows to C 12. This current is known as a surge current. If the power switch is turned on again when the input voltage is near its peak, the maximum surge current will flow (See point Ⓐ in Figure 2-2 1.).

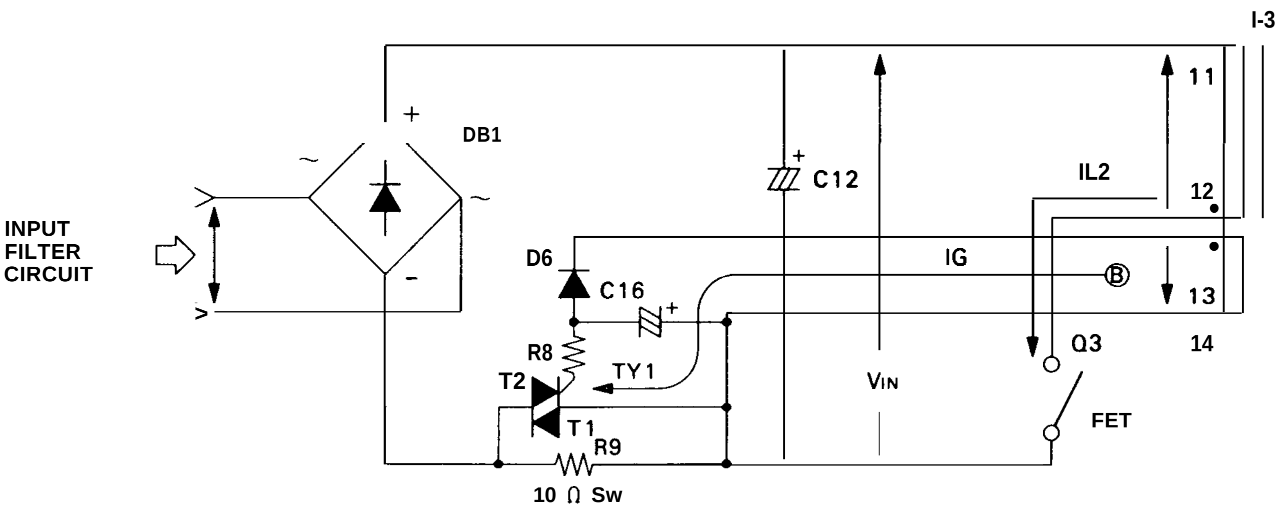


Figure 2-20. Rectifier, Smoothing, and Surge-suppression Circuits

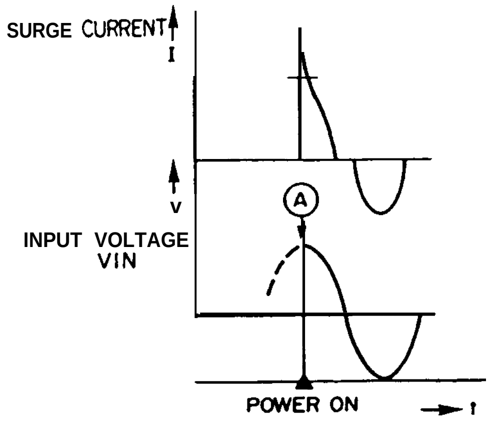


Figure 2-21. Surge Current

After the power is turned on, as the voltage across C 12 rises, the current is stabilized. Therefore, after the power switch is turned on, resistor R9 is inserted in series between smoothing capacitor C 12 and the input line to limit the surge current until the voltage across C 12 is stabilized. When 120 VAC is applied, the voltage across C 12 reaches about 170 V. In this circuit, the surge current is limited to approx. 17 [A] or less (170/R9 = 17 [A]).

When C 12 is fully charged, R9 is shorted to prevent it from wasting energy as heat. It is shorted by TRIAC TY 1. When FET Q3 is turned on, voltage is induced by coil $T3_{14\text{-}13}$ at the primary side in coil $T3_{14\text{-}13}$ at the secondary side of transformer T3, and the line between T1 and T2 is shorted upon receiving IG.

2.2.4 Main Switching Circuit 1

Figure 2-22 shows main switching circuit 1.

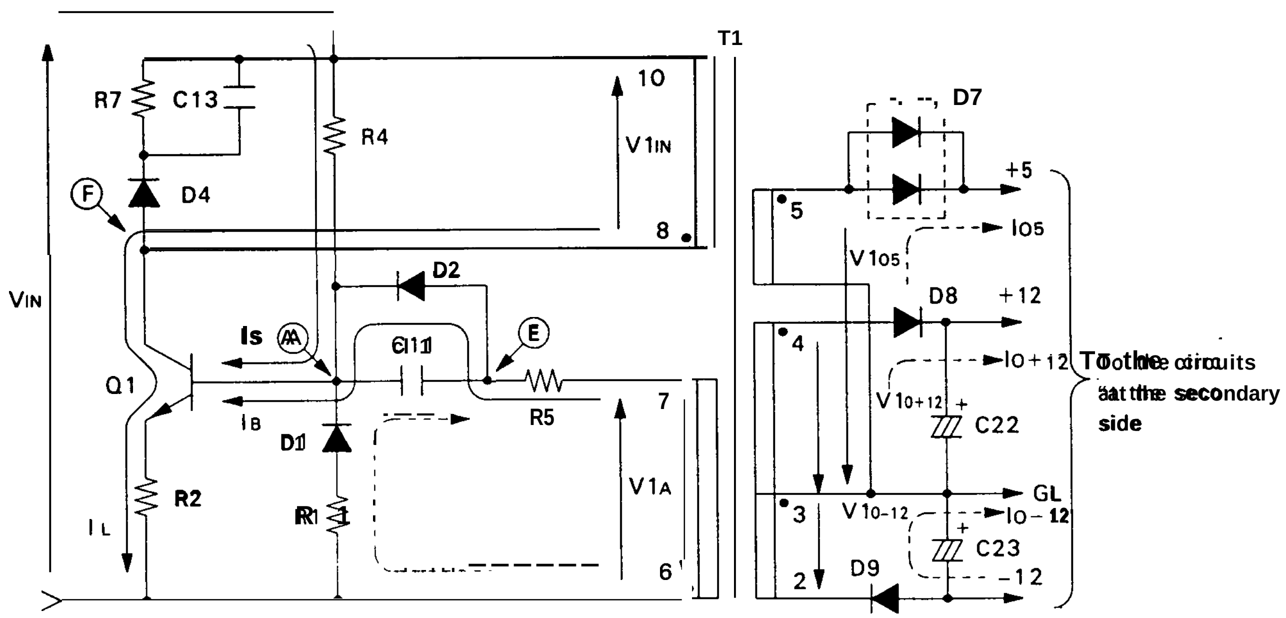


Figure 2-22. Main Switching Circuit 1

The starting sequence is described below.

1. When the printer power is turned on, DC input voltage V_{IN} is input to this circuit.
2. Drive current Is flows to the base of switching transistor Q1 via starting resistor R4, and Q1 turns on.
3. At the same time as step 2, $V1_{IN}$ is applied to coil $T1_{10\text{-}8}$ at the primary side of pulse transformer Tl, voltage VIA is induced in coil $T1_{7\text{-}6}$ of T1 at the primary side, and positive bias current I_B flows. Therefore, Q1 turns on quickly.
4. Since the value of current I_B is constant as shown in the expression below, current I_L applied to coil $T1_{10\text{-}8}$ increases continuously in proportion to time.

$$I_B = \frac{(T_{7\text{-}6}/T_{10\text{-}8})\ V_{IN} - (V_{D2} + V_{Q1BE})}{R5 + R2\ (1 + h_{FE})}$$

where, V_{D2}: Voltage drop across D2
V_{Q1BE}: Voltage drop between the base and emitter of Q 1

At this time, voltages $V1_{05}$, V1O+12, and V1O-12 are induced in coils $T1_{3\text{-}5}$, T13-4, and $T1_{2\text{-}3}$ at the secondary side. Since the current flows in the reverse direction to diodes D7, D8, and D9, no voltage is output to the circuits at the secondary side.

5. I_L increases as time passes. When $h_{FE} \times I_B = I_L$, however, Q1 saturates, so that the value of I_L is limited. Therefore, voltage $V1_{IN}$ across coil T110.E drops. At the same time, a reverse voltage is applied to coil T17-6, the value of I_B lowers, and current flows in the reverse direction via R 1 and D 1. Since the potential at point Ⓐ becomes higher than that at point@, speed-up capacitor C 11 absorbs current which flows from point Ⓐ to Ⓔ. Therefore, Q 1 turns off quickly.
6. When Q 1 turns off, the energy induced in coils $T1_{3.5}$, $T1_{3\text{-}4}$, and $T1_{2\text{-}3}$ at the secondary side in step 4 is released in the reverse direction and the forward current flows to diodes D7, D8, and D9 at the secondary side. In this way, voltage is applied to the secondary side of the circuit.
7. The energy being released decreases linearly with time. When the energy release is completed, the voltage at each coil of T1 reaches zero momentarily, but switching current I_B flows in the forward direction again due to R5, and Q1 switches on again. The potential at point@ becomes higher than that at point Ⓐ, and the energy accumulated in C 11 is released to keep I_B flowing to Q1.
8. The operating sequence then returns to step 3. The circuit continues switching by repeating this sequence.

The above described sequence is generally known as a self-excited ringing choke converter (R. C. C.) system.

When Q1 turns off in step 5, reverse voltage is induced at point Ⓕ momentarily, but D4, R7, and C 13 (snubber circuit) act as a limiter.

The waveforms at various points are shown below.

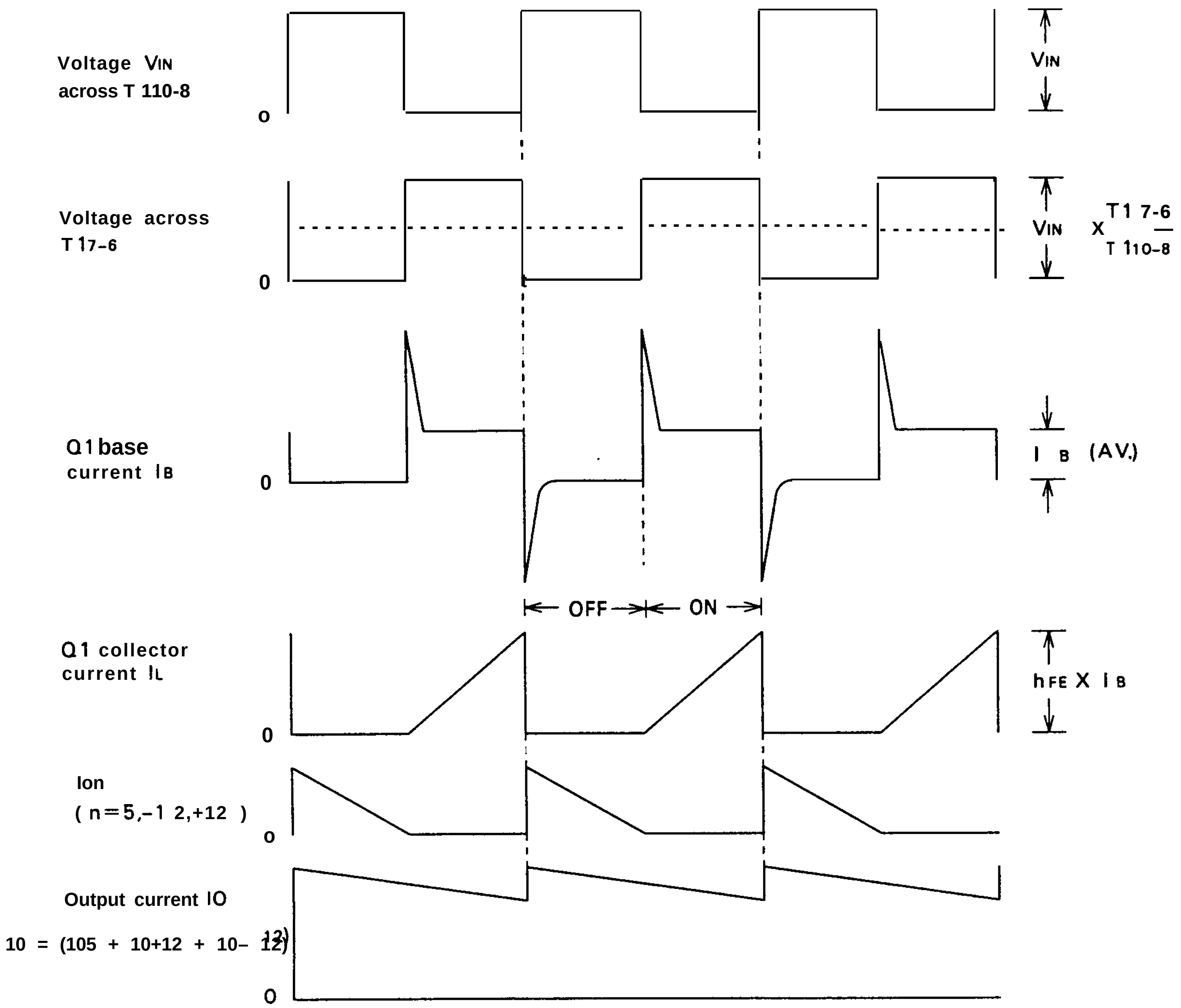


Figure 2-23. Main Switching Circuit 1 Waveforms

As shown in the figure above, the output voltage to the circuits at the secondary side is controlled by the ON/OFF time of Q 1.

2.2.5 +5 V and +12 V Supply Circuit

Figure 2-24 shows the +5 V and + 12 V supply circuit.

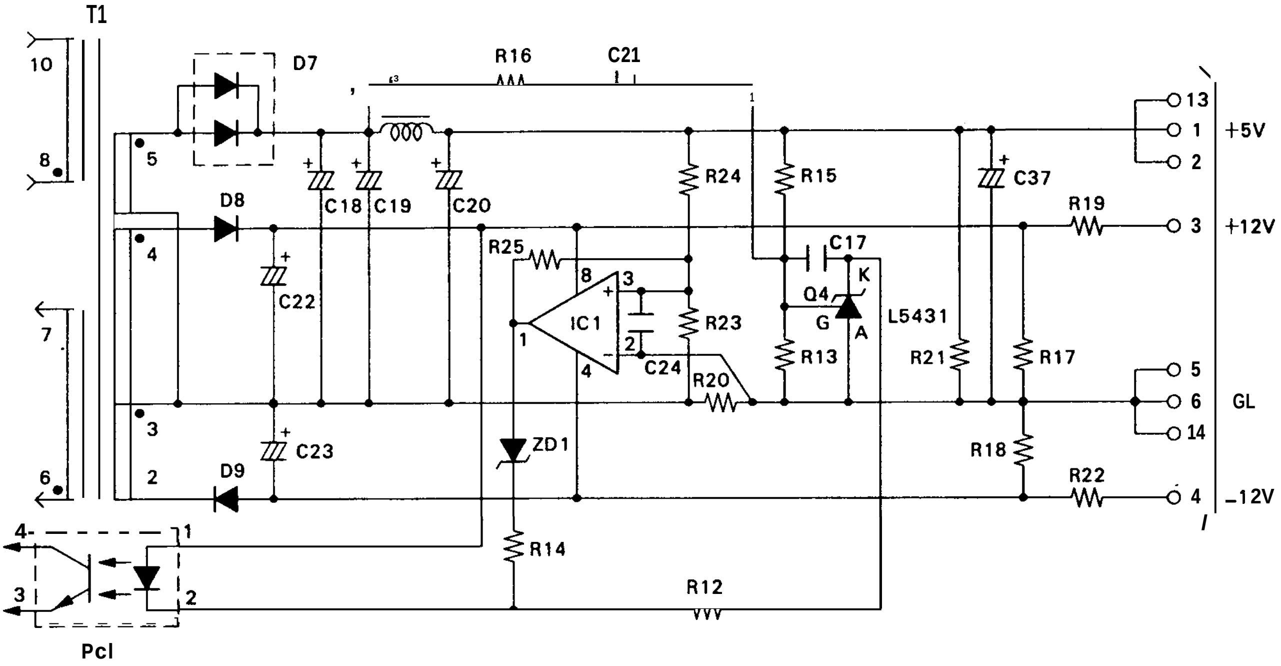


Figure 2-24. +5 V and +12 V Supply Circuit

This circuit outputs + 5 V, + 12 V, and –12 V. As described in the former section, this circuit also rectifies and smoothes the energy released from the secondary side of pulse transformer T 1. The ± 12 V is output after being rectified by D8 and D9, and smoothed by C22 and C23. Fuse resistors R 19 and R22 protect this circuit against a shorted output. R 17 and R 18 are dummy resistors, and are used to limit the rise of the output voltage when it is open-circuited.

The + 5 V is output after being rectified by D7, smoothed by C 18, and after passing through the filter circuit consisting of C 19, L3, and C20, so that ripples and spikes will be eliminated.

2.2.5.1 +5 V Current Limiting and Voltage Regulator Circuits

The + 5 V current limiting and voltage regulation is performed by controlling the ON/OFF time of switching transistor Q 1.

Current Limiting

Figure 2-25 shows the + 5 V current limiting circuit.
The +5 V current limiting is controlled by a comparator (IC 1).

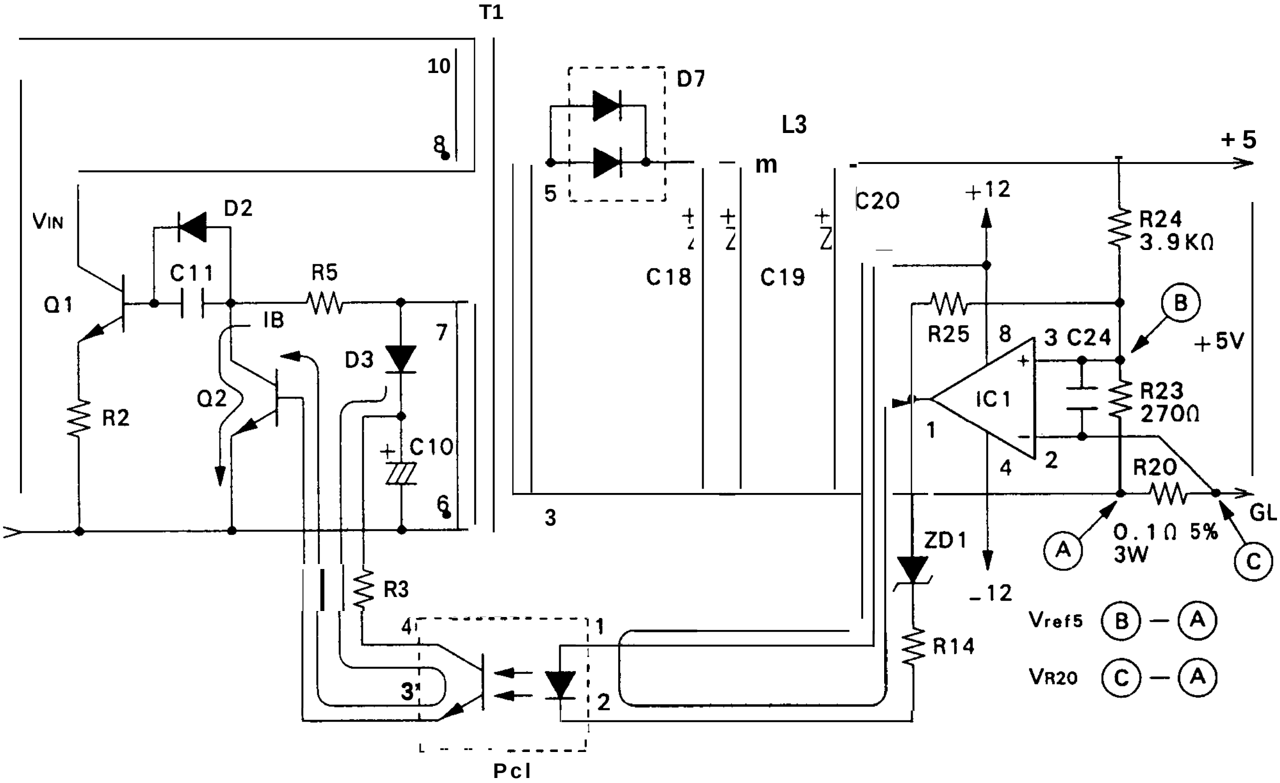


Figure 2-25. +5 V Current Limiting Circuit

Reference voltage V_{ref5} which is obtained by dividing the + 5 V output by R24 and R23 is supplied to the plus side (pin 3) of IC 1. Voltage V_{R20}, which is proportional to the current flowing through current detection resistor R20, is supplied to the minus side (pin 2) of IC 1.
As the load at R20 increases, V_{R20} rises. When $V_{ref5} < V_{R20}$, the output (pin 1) of IC 1 is changed from + 12 V (HIGH) to O V (LOW) by Zener diode ZD 1 and R 14. ZD 1 keeps the voltage at the cathode side of the photo transistor in photo coupler PC 1 constant. At this time, the photo diode and photo transistor of PC 1 turns on, transistor Q2 turns on, and Q 1 turns off.
The collector current for the transistor of PC 1 is supplied by D3, C 10, and the primary side of coil $T1_{7-6}$.

Voltage Regulation

Figure 2-26 shows the + 5 V voltage regulator circuit. The voltage is regulated by shunt regulatorL5431 (Q4).

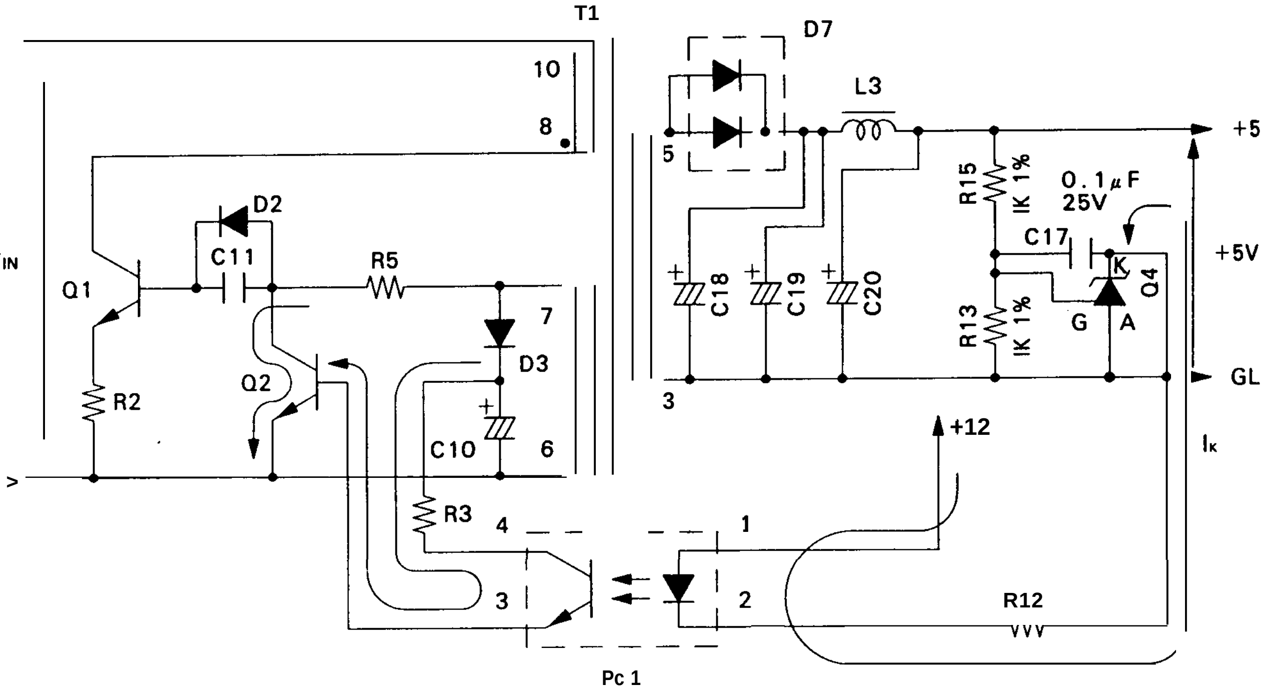


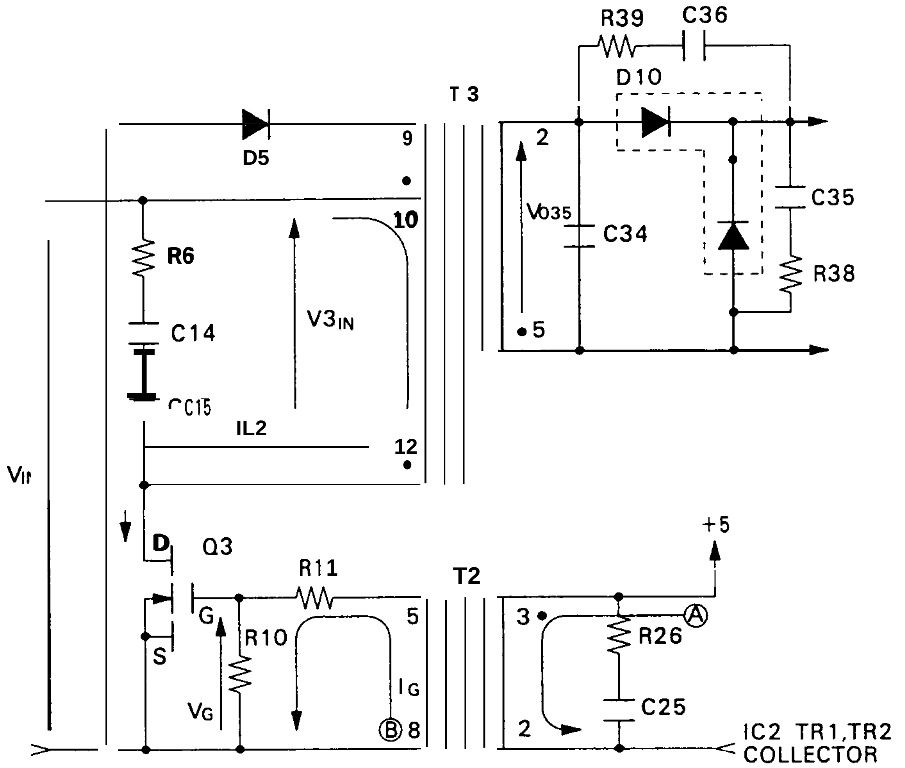
Figure **2-26. +5 V Voltage Regulator Circuit**

Q4 keeps the cathode at + 5 V using the 2.5 V reference voltage from the gate terminal, which is set by voltage dividing resistors R 13 and R 15. If the output exceeds + 5 V, current IK flows to the cathode of Q4, the photo diode and photo transistor of PC 1 turns on, Q2 turns on, and Q 1 turns off.

2.2.6 Main Switching Circuit 2 (+35 V Supply Circuit)

Figure 2-27 shows main switching circuit 2.

Main switching circuit 2 turns on after the + 5 V line is turned on. The +35 V supPly circuit is controlled mainly by regulator IC TL594 (IC2) at the secondary side. The circuit configuration of main switching circuit 2 is a general forward converter system, which is a separately-excited system. This circuit is turned on after the + 5 V line turns on, + 12 V is applied to pin 12 of IC2, and IC2 starts oscillation.



(Refer to Figure 2-30.)

Figure 2-27. Main Switching Circuit 2

One end of coil $T2_{3-2}$ is connected to the + 5 V line and the other end is connected to the collectors (pin 8 and pin 1 1) of the output transistors TR1 and TR2 of IC2 (Refer to Figure 2-30.). Since IC2 already started switching when it received the + 12 V, transistors TR 1 and TR2 are on. Therefore, current flows through coil $T2_{3-2}$ of T2 in the direction shown by Ⓐ. Gate current IG, then flows through coil $T2_{5-8}$ in the direction shown by Ⓑ, potential VG is generated across R 10, and Q3 turns on. Input voltage $V3_{IN}$ is applied to coil T3 $_{10-12}$ on the primary side of T3 and voltage V_{035} is induced in coil $T3_{2-5}$ on the secondary side.

Figure 2-28 shows the +35 V supply circuit.
Current flowing in the direction shown by Ⓓ is applied to choke coil L4 and smoothing capacitors C31, C32, and C33, via D 10-1, and then output.
If the output voltage from the secondary side reaches the limit of the current limiting or voltage regulator circuits in the latter stage of this circuit, transistors TR 1 and TR2 of IC2*1 turn off so that no current flows to coil $T2_{3-2}$. IG therefore stops flowing to coil $T2_{5-8}$ (Refer to Figure 2-27.), VG becomes O V, and Q3 turns off. No current I_{L2} flows to coil $T3_{10-12}$, and the energy Ⓓ' accumulated in choke coil L4 is output rectified by D 10-2, smoothed by C31, C32, and C33, and output.
When the current drops below the limit of the current limiting or voltage regulator circuits (after Q3 has turned off), TR1 and TR2 turn on again, and this sequence is repeated. Figure 2-29 shows the waveforms at various points in main switching circuit 2.
In this way, the voltage output from this circuit is kept constant by controlling the ON/OFF time of Q3, which is the different method employed in main switching circuit 1.
*1: See Figure 2-30,

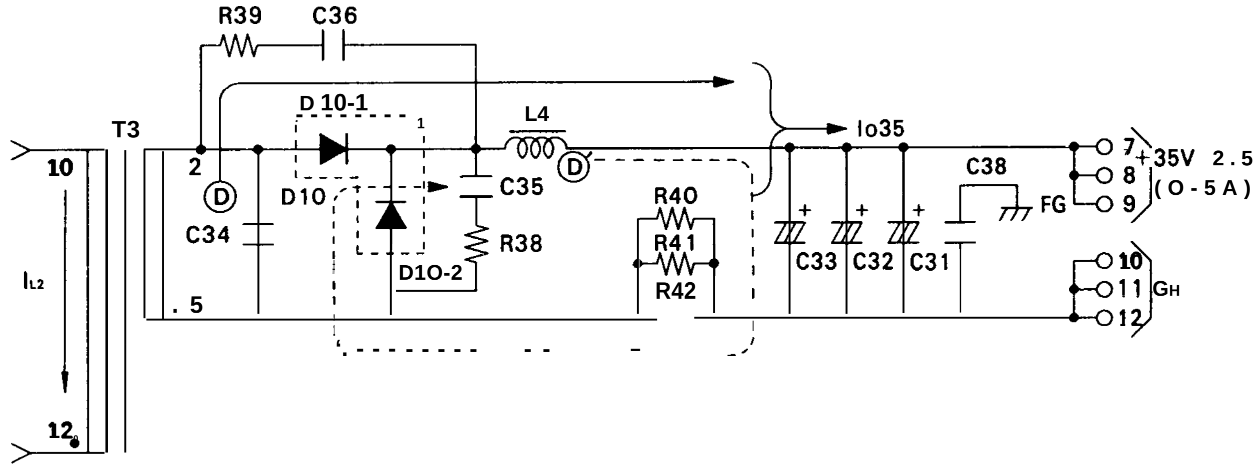


Figure 2-28. +35 V Supply Circuit

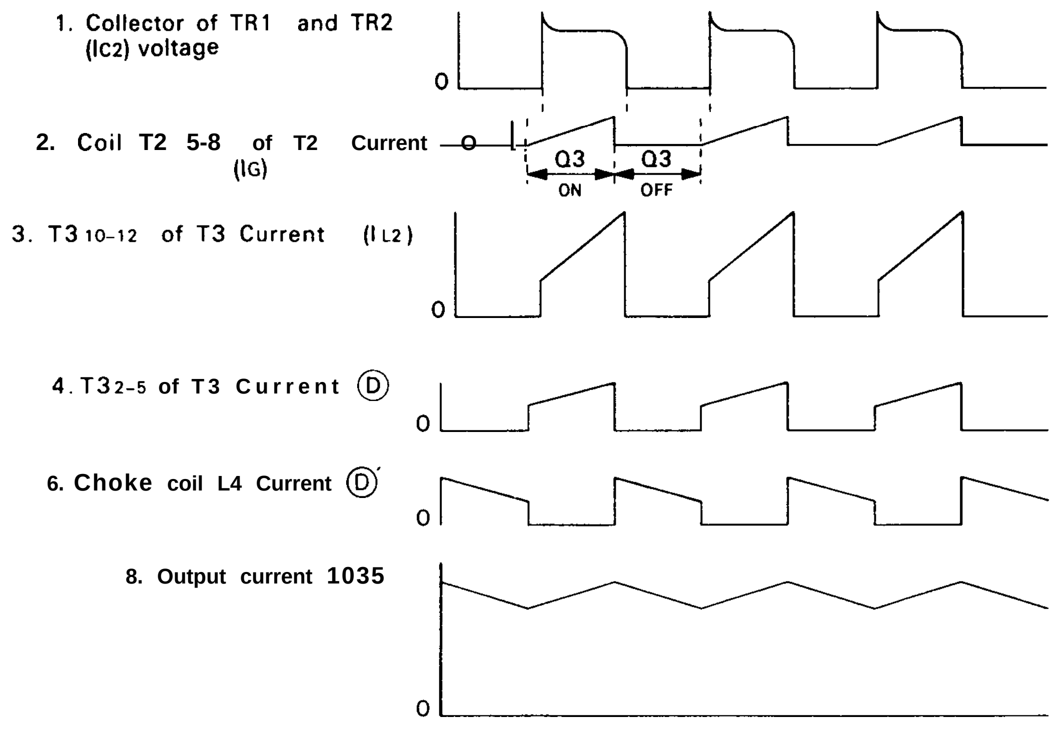


Figure 2-29. Main Switching Circuit 2 Waveforms

2.2.7 +35 V Current Limiting and Voltage Regulator Circuits

Figure 2-30 shows the +35 V current limiting and voltage regulator circuits. This circuits is controlled by switching regulator IC TL594*1(IC2).

IC2 has two error amplifiers, EA 1 and EA2. IC2 compares the output from either amplifier to a sawtooth waveform from the oscillator section, using a PWM comparator, and turns on TR 1 and TR2 only when the sawtooth waveform is larger than the outputs from both amlifiers.

*1: Refer to Section A.1.2.1 in Appendix for details.

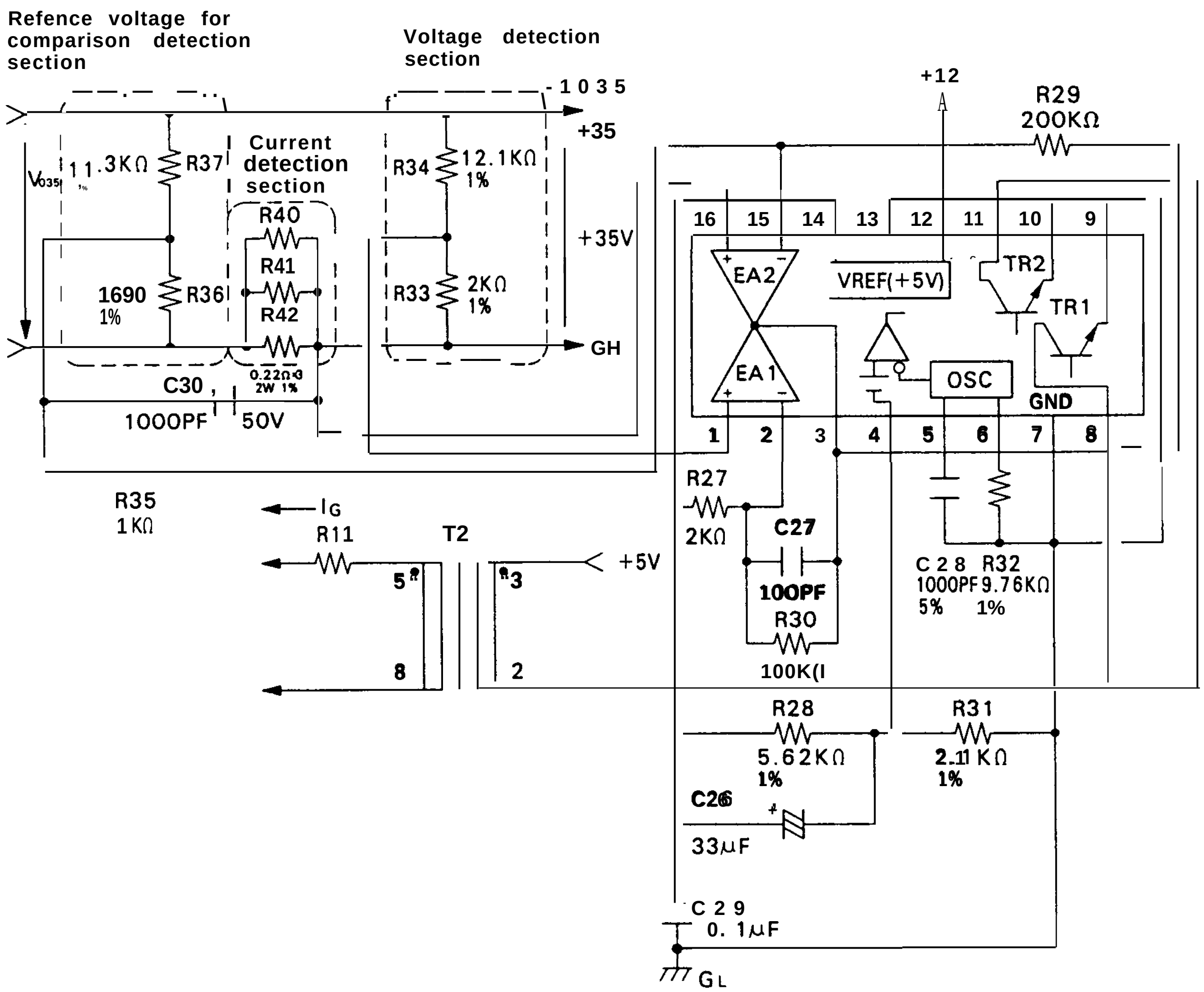


Figure. 2-30. +35 V Current Limiting and Voltage Regulator Circuits

The relationships between the error amplifier outputs, sawtooth waveform output from the oscillator, and the dead-time control voltage are shown in Figure 2-31.

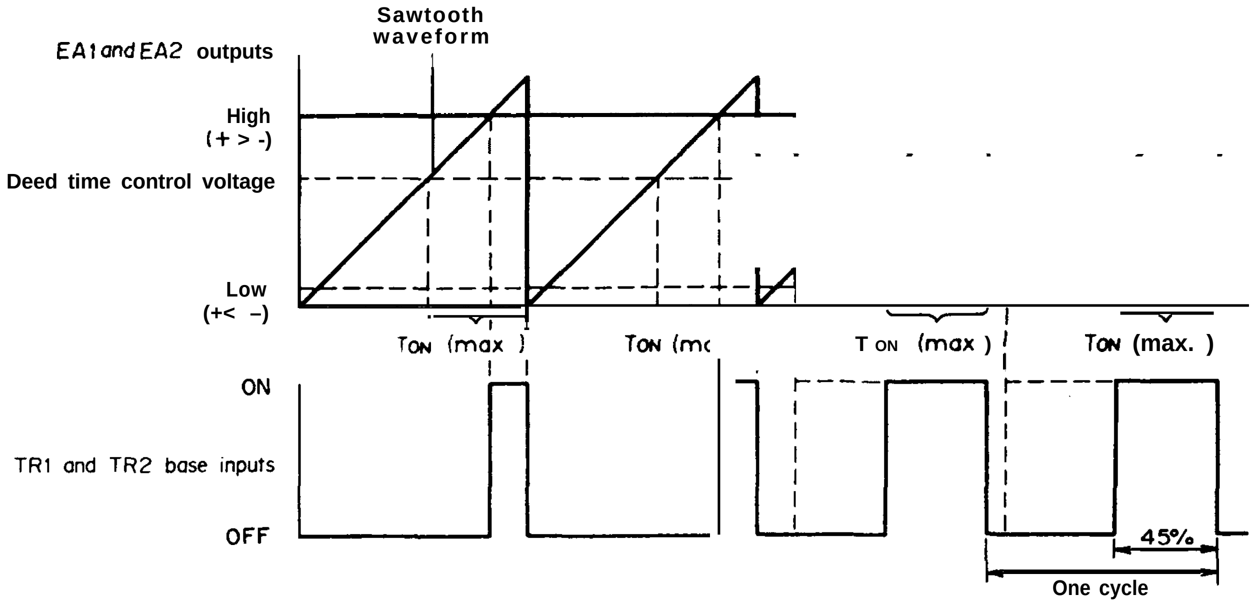


Figure 2-31. PWM Comparison Sequence

The on-time of TR 1 and TR2 becomes short when the outputs of EA1 and EA2 are not inverted, and becomes long when the outputs are inverted. The maximum on-time, however, is limited to 45% of one cycle by the dead-time control.

Current Limiting

Figure 2-30 shows the +35 V current limiting circuit. Current limiting is performed mainly by error amplifier EA2.

Reference voltage V_{ref35I} which is obtained by dividing the +35 V by R36 and R37 is supplied to the minus side of EA2 via resistor R35.

Voltage V_{RO} which is proportional to current 1035 flowing to current detection resistor RO (= R40//R41//R42) is supplied to the plus side of EA2.

$$V_{ref35I} \leqq V_{RO} \quad \text{(at this time, 1035} \geqq 7 \text{ [A])}$$

As the load at 1035 increases. When the condition shown above is met, the output of EA2 changes from LOW to HIGH. When the output of EA2 is HIGH, TR 1 and TR2 turn off, and Q3 in main switching circuit 2 turns off.

In this way, the voltage induced in the secondary side of T3 is dropped.

Voltage Regulation

Figure 2-30 shows the +35 V voltage regulator circuit. Voltage regulation is performed mainly by error amplifier EA 1.

Reference voltage VREF (+5 V) output from IC2 (pin 14) via resistor R27 is supplied to the minus side of EA 1.

Voltage which is obtained by dividing the +35 V by R33 and R34 (see the expression below) is supplied to the plus side of EA 1.

$$V_{35E} = \frac{R33}{R33 + R34} \times V035$$

When the output voltage of the +35 V line rises and the relationship between V_{REF} and V_{35E} becomes as shown below, the output of EA1 is changed from LOW to HIGH.

$V_{REF} \leqq V_{35E}$ (at this time, V035 $\geqq$ 35.3 [V])

When the output of EA 1 is HIGH, TR 1 and TR2 turn off, and Q3 in main switching circuit 2 turns off. In this way, the voltage induced in the secondary side of T3 drops. When $V_{REF} \geqq V_{35E}$, TR 1 and TR2 starts switching operation again, and turns Q3 on and off.

2.2.8 Over Voltage Protection Circuit

As described in Section 2.2.7, the voltage from the +35 V line is monitored by the voltage regulator circuit, and fed back to main switching circuit 2 to keep the voltage constant. This circuit is employed to protect main switching circuit 2 from being damaged if the voltage regulator circuit operates abnormally.

Figure 2-32 shows the over voltage protection circuit.

Reference voltage V_{REF} (5 V) is supplied to the plus side of IC 1. Voltage V_{OVER} (= 0.12 X V_{O35}), which is obtained by dividing the +35 V by R45 and R46, is supplied to the minus side (pin 6) of IC 1.

When the output voltage of the +35 V line meets the condition shown in the expression below, the output (pin 7) of IC1 changes from HIGH (1 2 V) to LOW (O V), transistor Q5 turns on, and R28 is shorted. Therefore, 5 V is applied to the dead-time control terminal (pin 4) of IC2, the dead-time becomes 100%, and TR 1 and TR2 turn off.

$$V_{REF} \leqq V_{OVER} \ (V_{O35} \geqq 40.8 \ [V])$$

Then, Q3 in main switching circuit 2 is cut off, the voltage applied to coil Tlo.12 of T3 turns off, and the voltage induced in coil $T3_{2\text{-}5}$ at the secondary side drops,

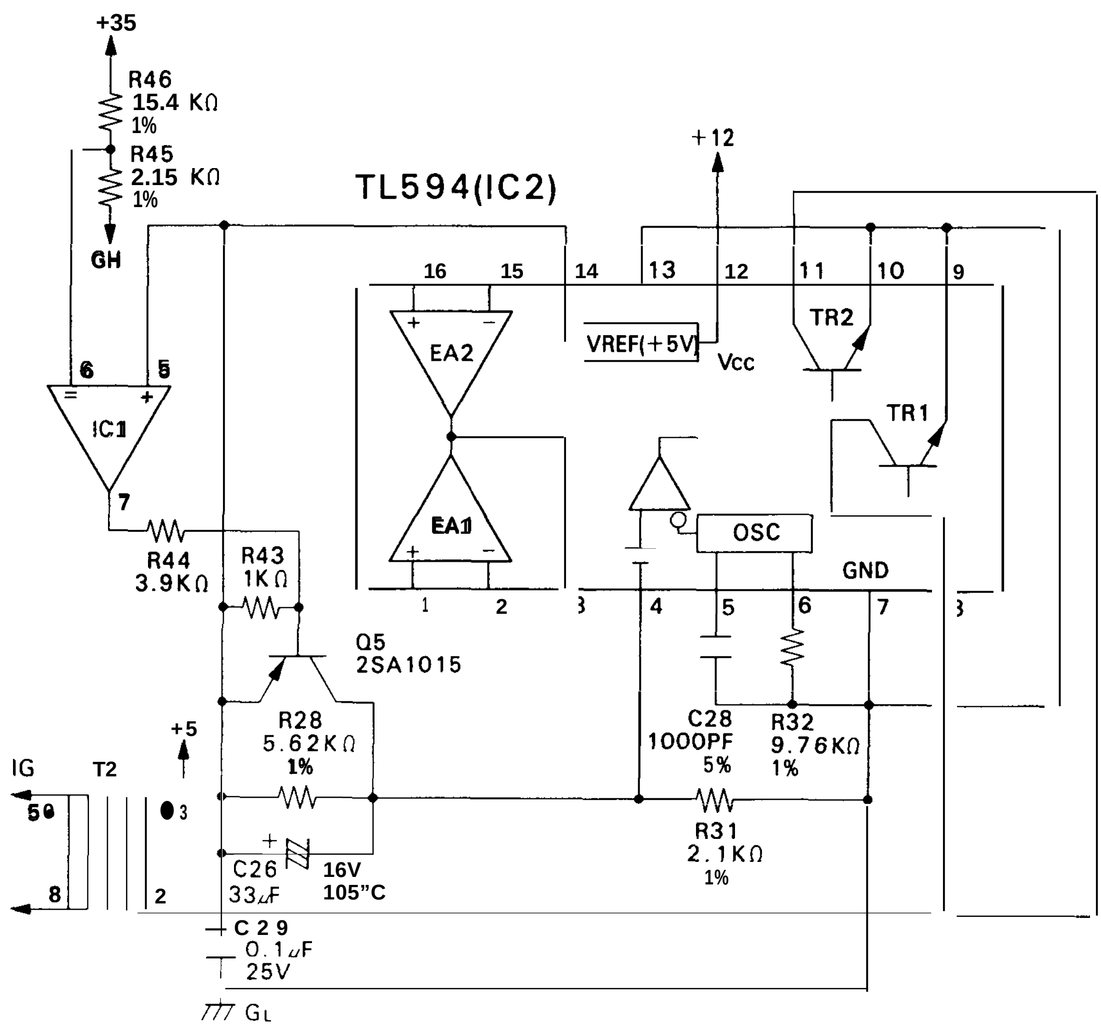
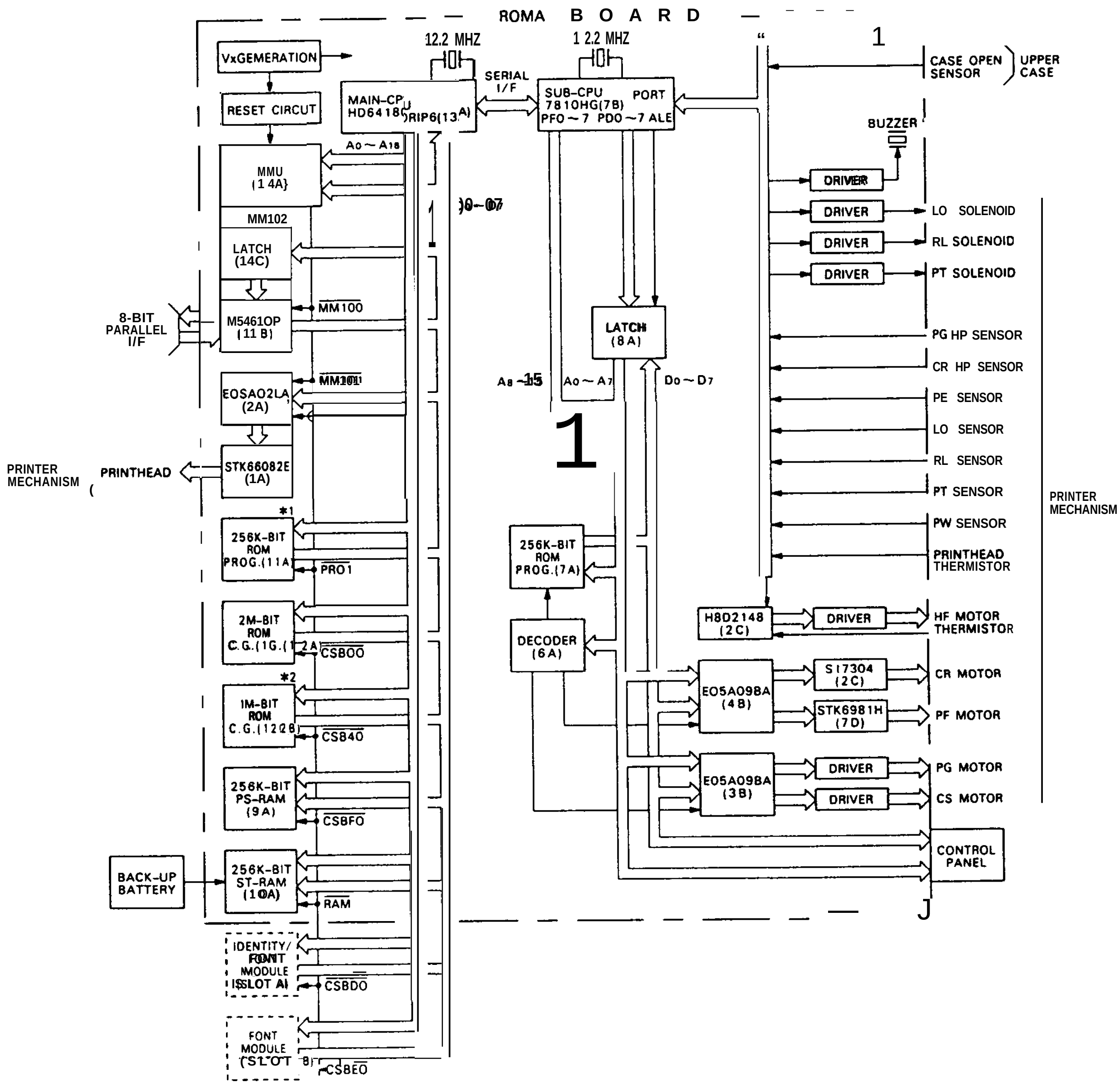


Figure 2-32. Over Voltage Protection Circuit

2.3 CONTROL CIRCUIT BOARD (ROMA Board)

Figure 2-33 shows a block diagram of the ROMA board.
The ROMA board mainly consists of two 8-bit CPUs; one is the HD64 180R 1 P6 (1 3A) for the main control and the other is the μPD78 10HG (7B) for the sub control. Both are operated at a clock frequency of 12.2 MHz (to match the serial data transfer clocks). The main and sub CPUs communicate with each other using serial ports. Various gate array ICs and hybrid ICs are employed to lighten the load on the main and sub CPUs and to simplify the circuits.



*1: VP-3000 (Japanese version): 5 12K-bit ROM
*2: Used only in the VP-3000

Figure 2-33. ROMA Board Block Diagram

The main functions of the main CPU and its peripheral components are as follows:

- Interfacing with the host computer
- Processing and expanding the commands and data input from the computer via the interface
- Printhead control

The main CPU controls the memory using a gate array (MMU:14A).
Figure 2-34 shows the IC address map for the main CPU.

The main functions of the sub CPU and its peripheral components are as follows:

- Printer mechanism control
- Control panel control
- Printer cover state monitoring
- Buzzer driving

The sub CPU has a multiplexed low order address/data bus. The low order address bus and data bus are selected according to the ALE signal from the sub CPU via a latch (14C).
Figure 2-35 shows the IC address map for the sub CPU.

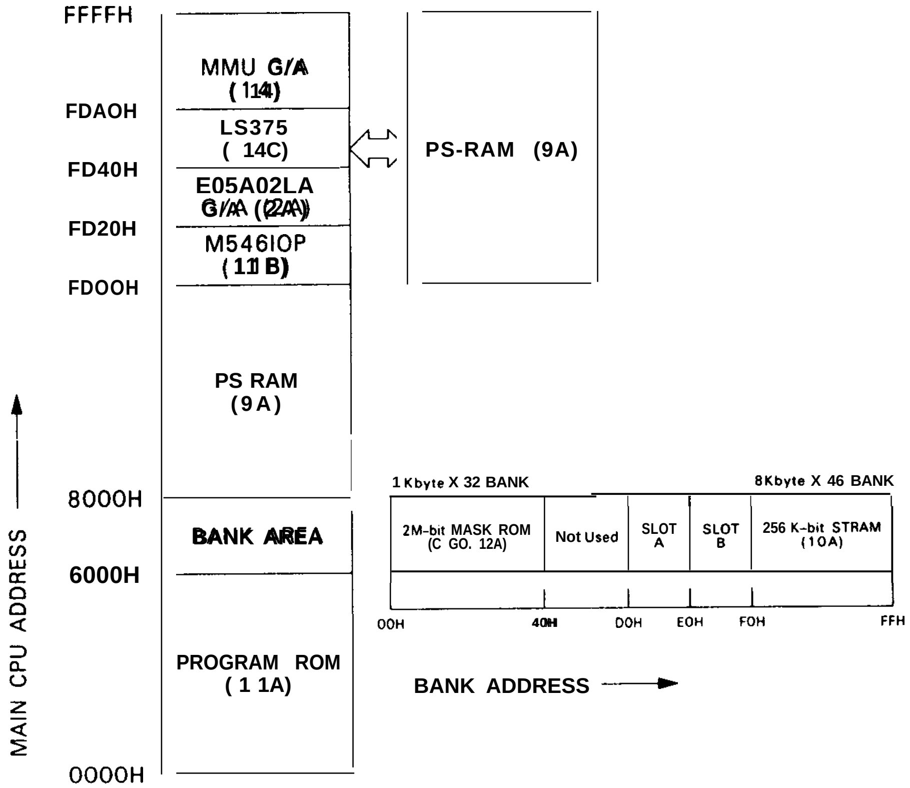


Figure 2-34. Main CPU Address Map

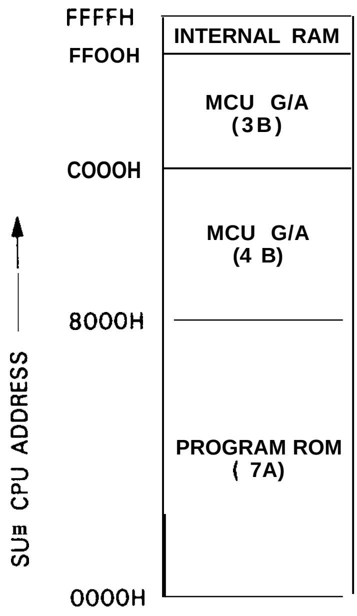


Figure 2-35. Sub CPU Address Map

2.3.1 Reset Circuit

Figure 2-36 shows the reset circuit.
After being input to the E05A 10AA gate array (MMU: 14A), the reset signal resets the gate array, then is sent out to the other devices. Reset operation (hardware reset) is performed when:

1. **The printer power is turned on or off.**
2. **A low $\overline{\text{INIT}}$ signal is input from the host computer.**
3. **A identity/font module is installed or removed with the power on.**

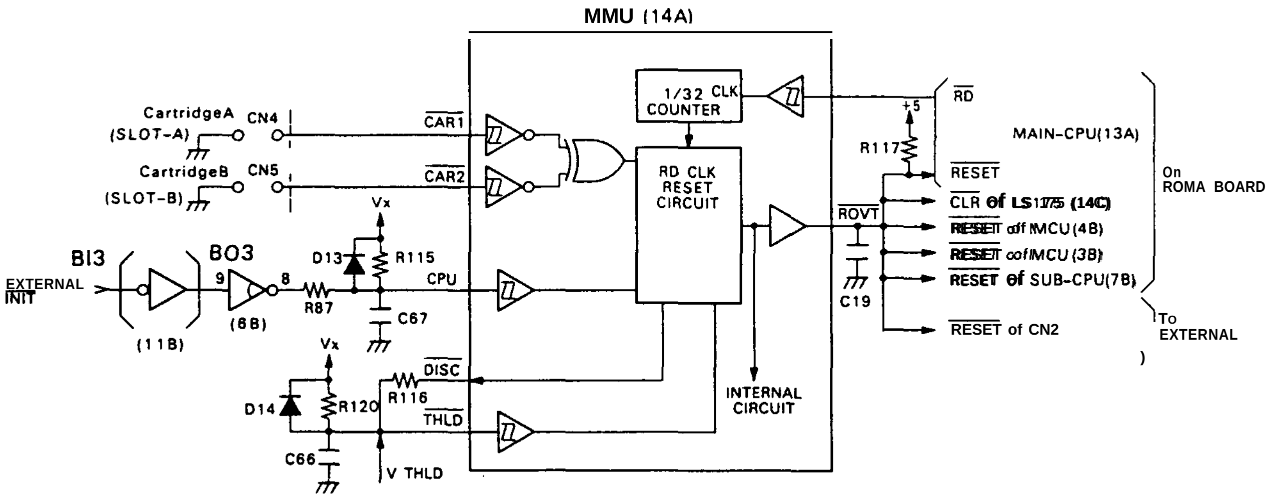


Figure 2-36. Reset Circuit

2.3.1.1 Vx (Drive System Pull-up) Voltage Supply Circuit

Figure 2-37 shows the Vx voltage supply circuit.

The Vx voltage is used to pull up the bus for the control signals transmitted to the power on reset on reset circuit, and drive circuits. It is also used to pull up the output of the buzzer drive IC (66).

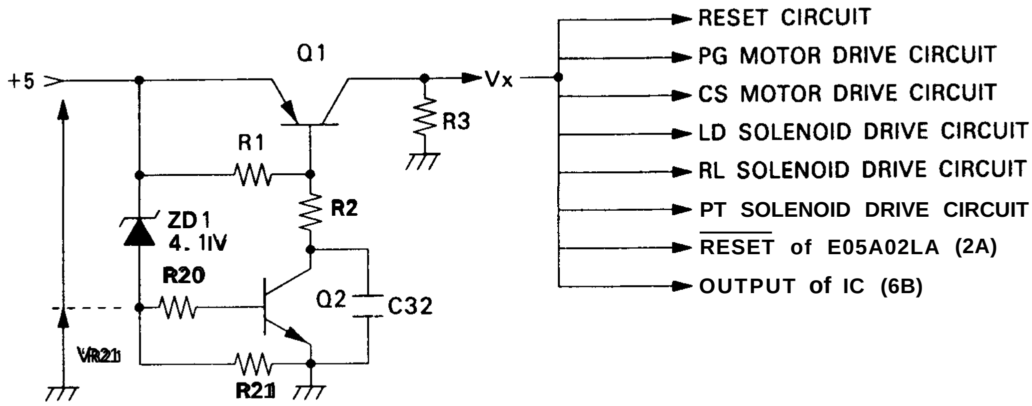


Figure 2-37. Vx Voltage Supply Circuit

After the printer power is turned on, the + 5V line reaches about 4.7V, and a potential of about 0.6V (V_{R21}) is induced across resistor R21. The difference and +5V is applied to the Vx line.

When the + 5V line drops to about 4.7V or less, Q2 and Q 1 turn off so that the Vx line drops to OV. Therefore, each IC is reset, and the control circuits stop operating.

2.3.1.2 Power ON/OFF

Figure 2-36 shows the reset circuit and Figure 2-38 shows the waveform of this operation.

When the power is switched on and Vx rises, voltage is applied to the integration circuit (composed of R 120, C66, D 14). The voltage at C66 increases according to $V_{THLD}=Vx\ (1-e^{-n})$ and the reset circuit in the MMU sets the $\overline{ROUT}$ signal high (Figure 2-38, T_{R1}). The reset ($\overline{ROUT}$) signal is sent to the IC's on the ROMA board and to the outside via CN2.

When the power is switched off, the voltage at C66 decreases according to $V_{THLD} = Vx\ (e^{-n-1})$ and, when V_{THLD} reaches V_N the output switches from high to low, and the reset circuit in the MMU sets the $\overline{ROUT}$ signal low. (D1 4 is a diode used to discharge C66).

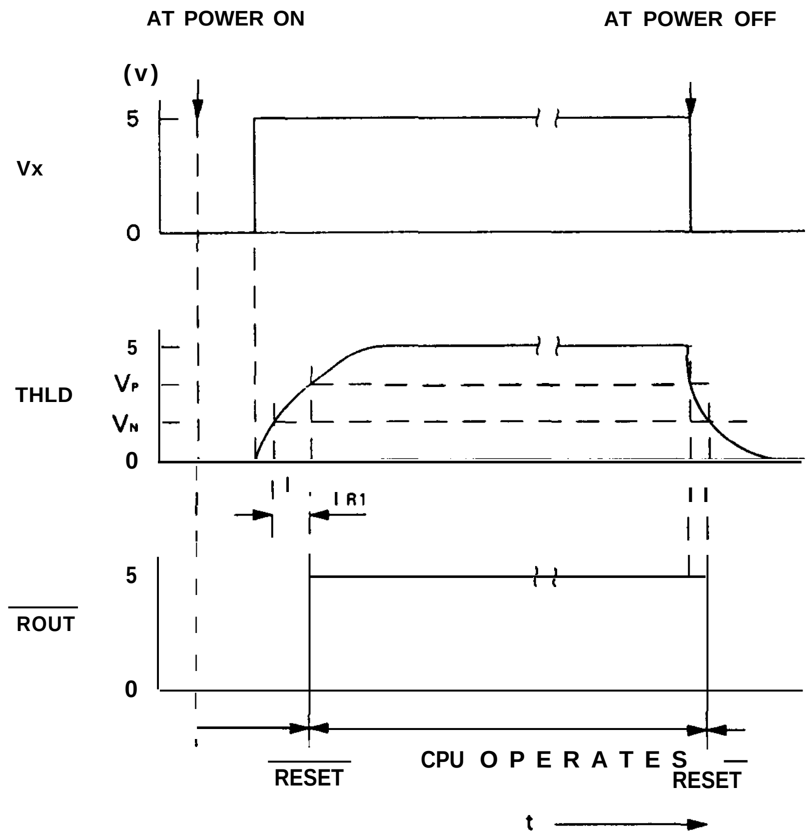


Figure 2-38. Power ON Reset Timing

2.3.1.3 INIT Signal Input from CN1 or CN2

Figures 2-36 shows the reset circuit and Figure 2-39 show the timing of the signals during this operation. When the INIT signal is input from outside (it should be low for 50 μs or more), it reduces the voltage at the CPU terminal via the integration circuit (R 115, C67, and D 13), the M546 10P (1 1 B), and IC (6 B). When the voltage at the CPU terminal reaches V_N, the reset circuit (in the MMU) is activated to set the $\overline{DISC}$ signal low. When the $\overline{DISC}$ signal goes low, the $\overline{ROUT}$ signal subsequently goes low, the voltage at the $\overline{THLD}$ terminal drops to V_N (the pulse width shold be: $T_{R2} > INIT$ = low), and then the $\overline{DISC}$ signal goes high after the reset circuit is initialized. When the $\overline{THLD}$ terminal voltage increases to VP, the $\overline{ROUT}$ signal goes high again.

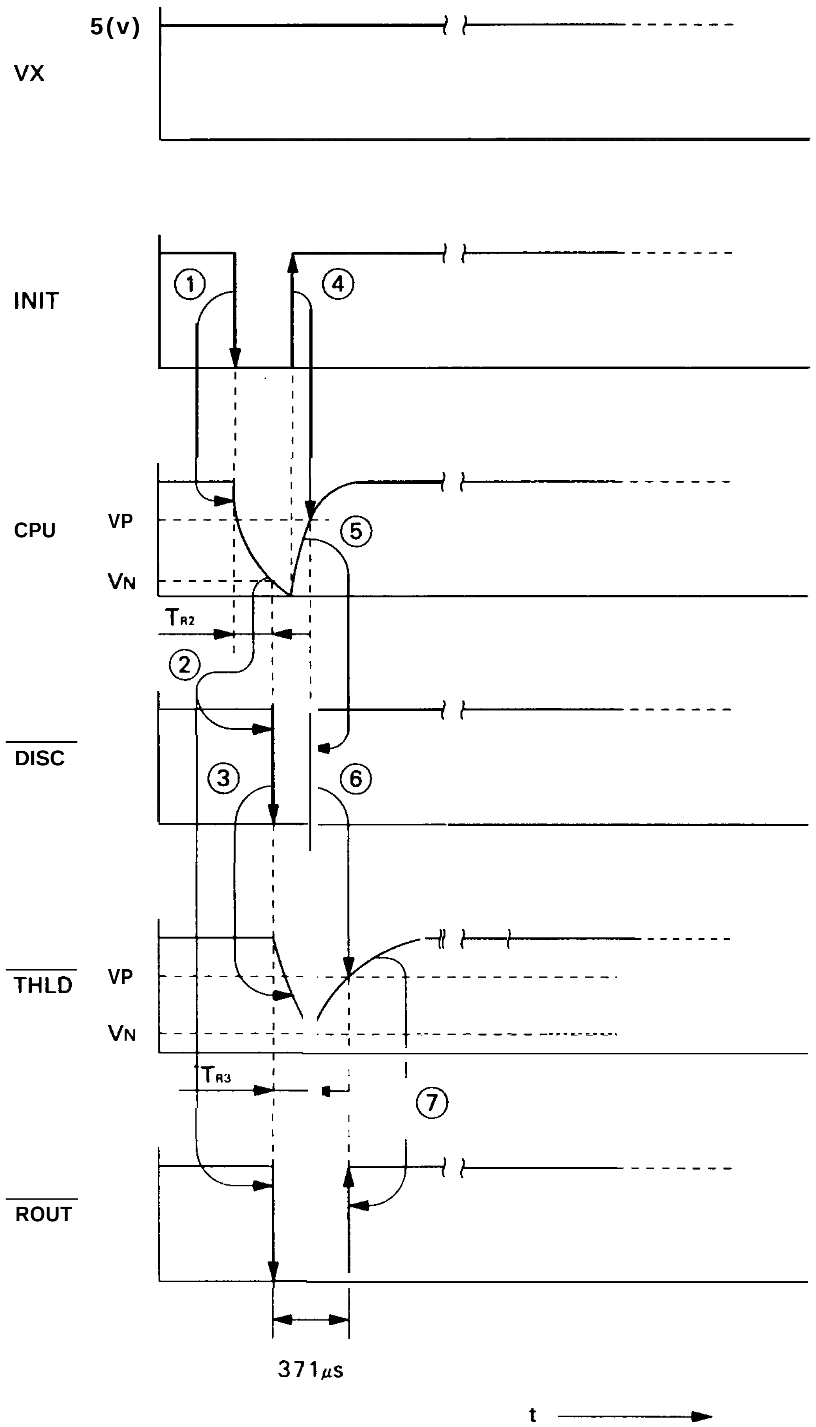


Figure 2-39. INIT Reset Timing

2.3.1.4 Font/Indentity Module Installation and Removal

Figure 2-36 shows the reset circuit and Figure 2-40 shows the module installed/removed reset timing. The font and indentity modules should not be installed or removed while the power is on. If this is done, the $\overline{\text{ROUT}}$ signal must be set low to prevent a ROMA board circuit malfunction.

After reset, the main CPU starts execution for address 00001-1 and sends a $\overline{\text{RD}}$ signal to the memory devices. The reset circuit in the MMU counts 32x$\overline{\text{RD}}$ pulses and then generates a RDCLK pulse. When a module is installed or removed, the exculsive OR value of CAR1 and CAR2 changes from the reset default value, and the DISC signal is set low by the rising edge of the second pulse of the synchronized RDCLK signal. Consequently, the $\overline{\text{THLD}}$ voltage begins decreasing. When the THLD voltage drops to V_N the DISC signal goes high an then begins increasing. When it rises to VP, the ROUT signal goes high and the main and sub CPUS restart from address OOOOH.

Also, Table 2-31 shows the relationship between the input at $\overline{\text{CAR1}}$ and $\overline{\text{CAR2}}$ of MMU (1 4A) and the state of the mudule.

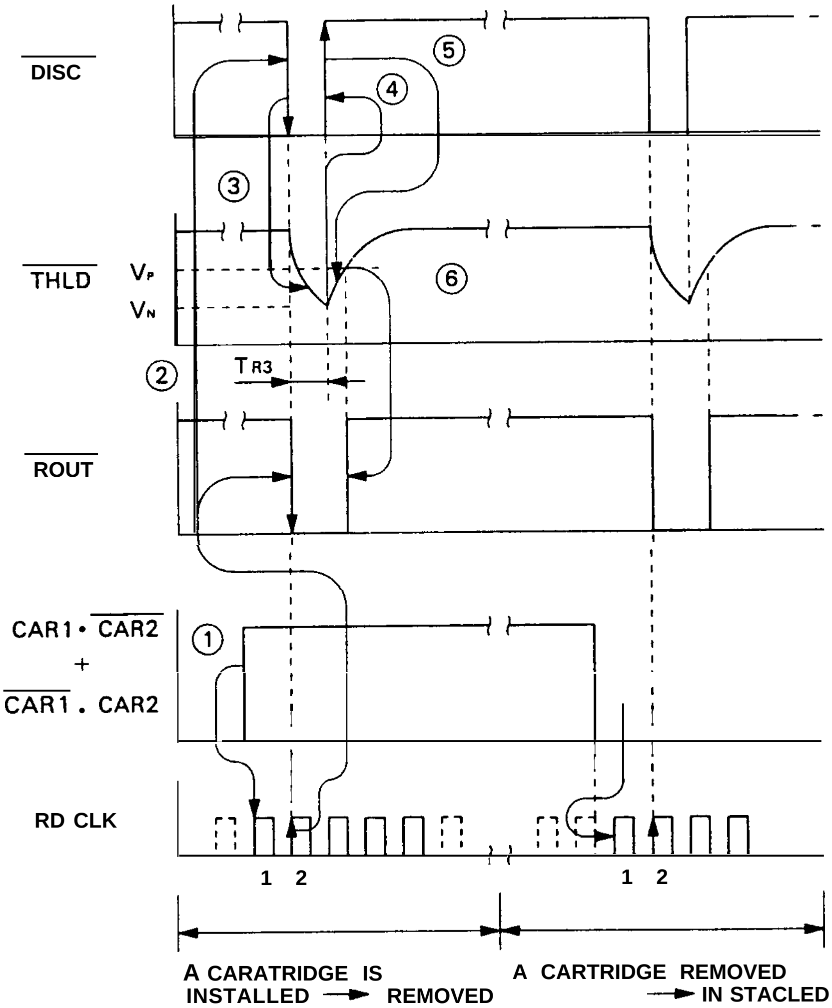


Figure 2-40. Module Installed/Removed Reset Timing

Table 2-31. State of Module

CN4 Side	CN5 Side	$\overline{\text{CAR1}}$	$\overline{\text{CAR2}}$	$\overline{\text{ROUT}}$
Installed	Mouting	L	H →L	
	Removing		L → H	
Not installed	Mounting	H	H → L	
	Removing		L → H	
Mouting	Not installed	H → L	L	
Removing		L → H		
Mounting	Not installed	H → L	H	
Removing		L → H		

2.3.1.5 ST-RAM (1 OA) Battery Backup Circuit

The ST-RAM (1 OA) employes a lithium battery (3.00 to 3.35 VDC) for backup, and is used to maintain the initial data for the printer mechanism and settings for the control panel when the printer power is turned off.

Figure 2-41 shows the ST-RAM (1 OA) battery backup circuit, and Table 2-32 shows the ST-RAM conditions when the power is turned on or off.

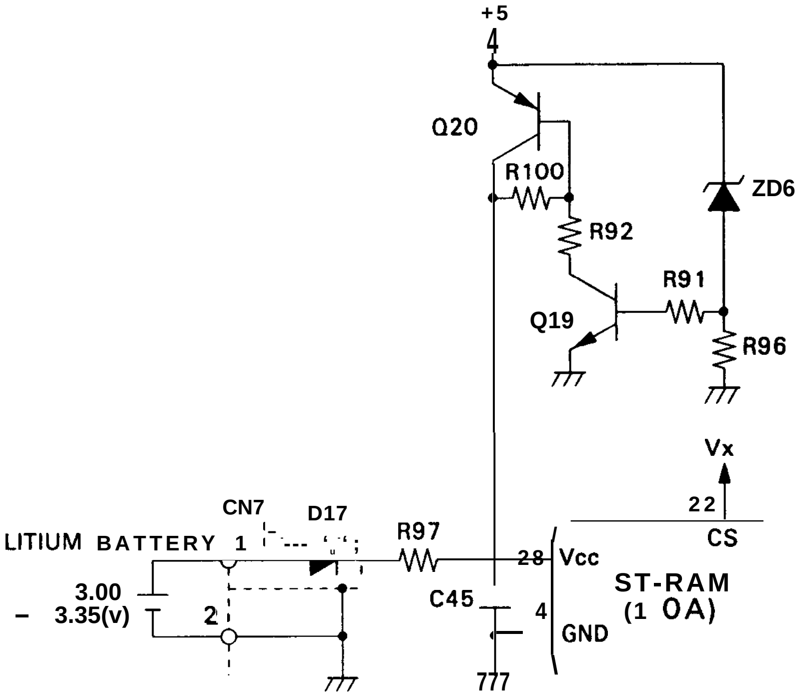


Figure 2-41. Battery Backup Circuit

When the power is turned on under normal conditions, + 5V is applied to Vcc of the ST-RAM, and the CPU starts read/write operations. When the power is turned off, and the voltage on the + 5V line drops to about 3.3V or less, transistors Q 19 and Q20 turn off, and the voltage from the external lithium battery is applied to the Vcc terminal of the ST-RAM. In this way, the data in the ST-RAM is maintained.
When the voltage from the lithium battery drops, the message “RAM CLEAR” is displayed on the LCD when the printer power is turned on.

Table 2-32. ST-RAM Conditions with Power ON/OFF

Printer Power	+5 V Line	CS (Pin 22)	Vcc [V]	ST-RAM Mode
OFF	L	L*1	2.4- 2.7*2	Standby*3
ON	H	H	+5	Normal

*1: Must be 0.2 V or less
*2: Must be 2.0 V or more
*3: Data hold
NOTE: L = O V, H = 5V
Reference: Power consumption at standby: 0.002 [mA] TYP.

2.3.2 Interface

This printer has both an 8-bit parallel interface and an RS-232C serial interface.

2.3.2.1 8-Bit Parallel Interface

Operating Principles

Figure 2-42 shows the 8-bit parallel interface data transmission timing. Data is transferred between a host computer and the printer using the following sequence:

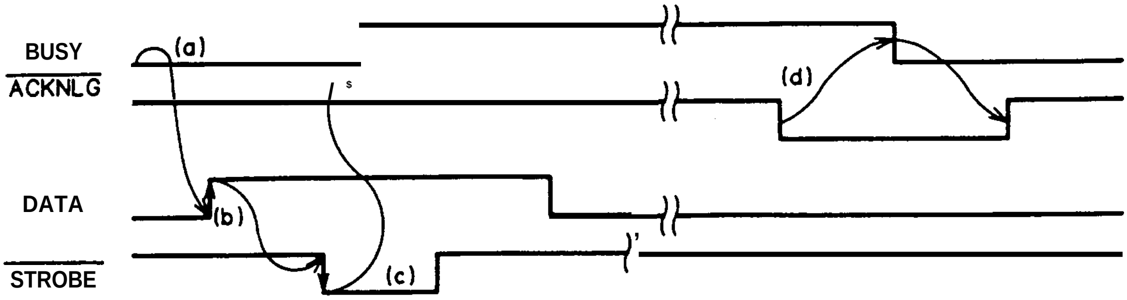


Figure 2-42. 8-Bit Parallel Data Transmission Timing

a) First, the host computer confirms that the BUSY signal from the printer is low or that the $\overline{\text{ACKNLG}}$ signal from the printer is high. When the BUSY signal is low, the printer is ready to receive data. When it is high, the printer can not receive data from the host computer since the printer is proseccing data. Therefore, the host computer does not transfer data until the BUSY signal changes from high to low. (Some host computers check both the BUSY and $\overline{\text{ACKNLG}}$ signals, and others just check either the BUSY or $\overline{\text{ACKNLG}}$ signal.)

b) After the host computer has confirmed that the BUSY signal is low, it places data (8 bits per word) in parallel on the data bus (DO - D7), and the printer reads the data at the falling edge of the $\overline{\text{STROBE}}$ pulse.

c) After receiving a data word from the host computer, the printer sets the BUSY signal high to inform the host computer that the printer is proseccing data and is not ready to receive any more data.

d) After proseccing the data, the printer sets the $\overline{\text{ACKNLG}}$ signal low, allowing the host computer to transfer data again. The printer sets the BUSY signal low approximately 5 μs after setting the $\overline{\text{ACKNLG}}$ signal low, then sets the $\overline{\text{ACKNLG}}$ signal high after approximately 5 μs, informing that the host computer that the printer is ready to receive data.

8-bit Parallel Inteface Circuit

Figure 2-43 shows the 8-bit parallel interface circuit.
This circuit is controlled by the main CPU.
Address mapping for the M546 10P (11 B) is performed by the main CPU via the MMU (14A). General purpose 8-bit parallel interface ICM546 10P (11 B) is employed to simplify the control required from the main CPU.
The latch circuit (14C) converts the control data in the main CPU into an 8-bit parallel interface signal (PE, ERROR, and BUSY) according to the select signal (MMIO2) from the MMU.
The SLCTIN and AUTO FEED XT signals are fixed signals from the host computer, read into the sub CPU as default values, and transferred to the main CPU.

- Refer to Appendix A.1.1 .10 for the details of the M546 10P.

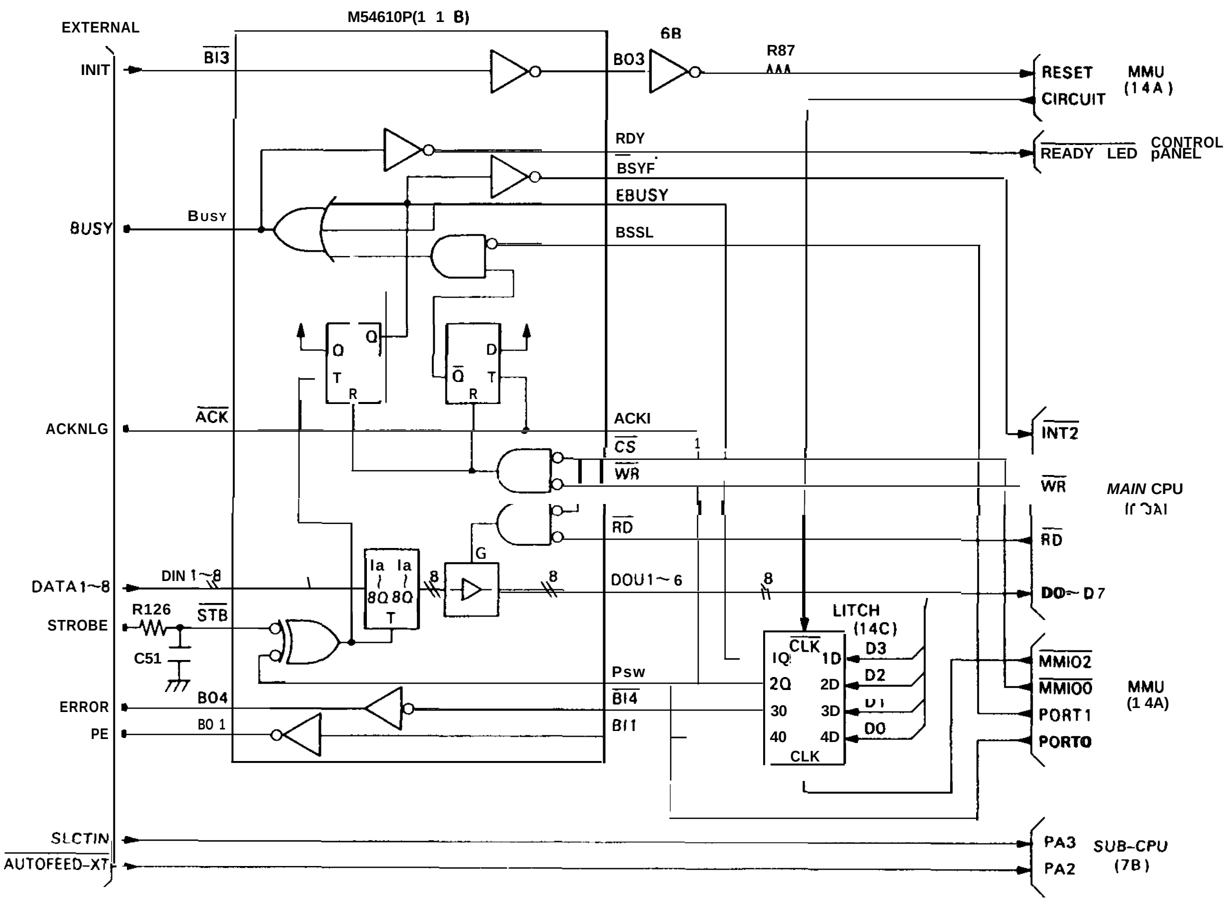


Figure 2-43. 8-Bit Parellel Interface Circuit

Figures 2-44 and 2-45 show the processing sequence for these signals and the interface signal timing.
Table 2-33 shows the control signals used between the printer and host computer.

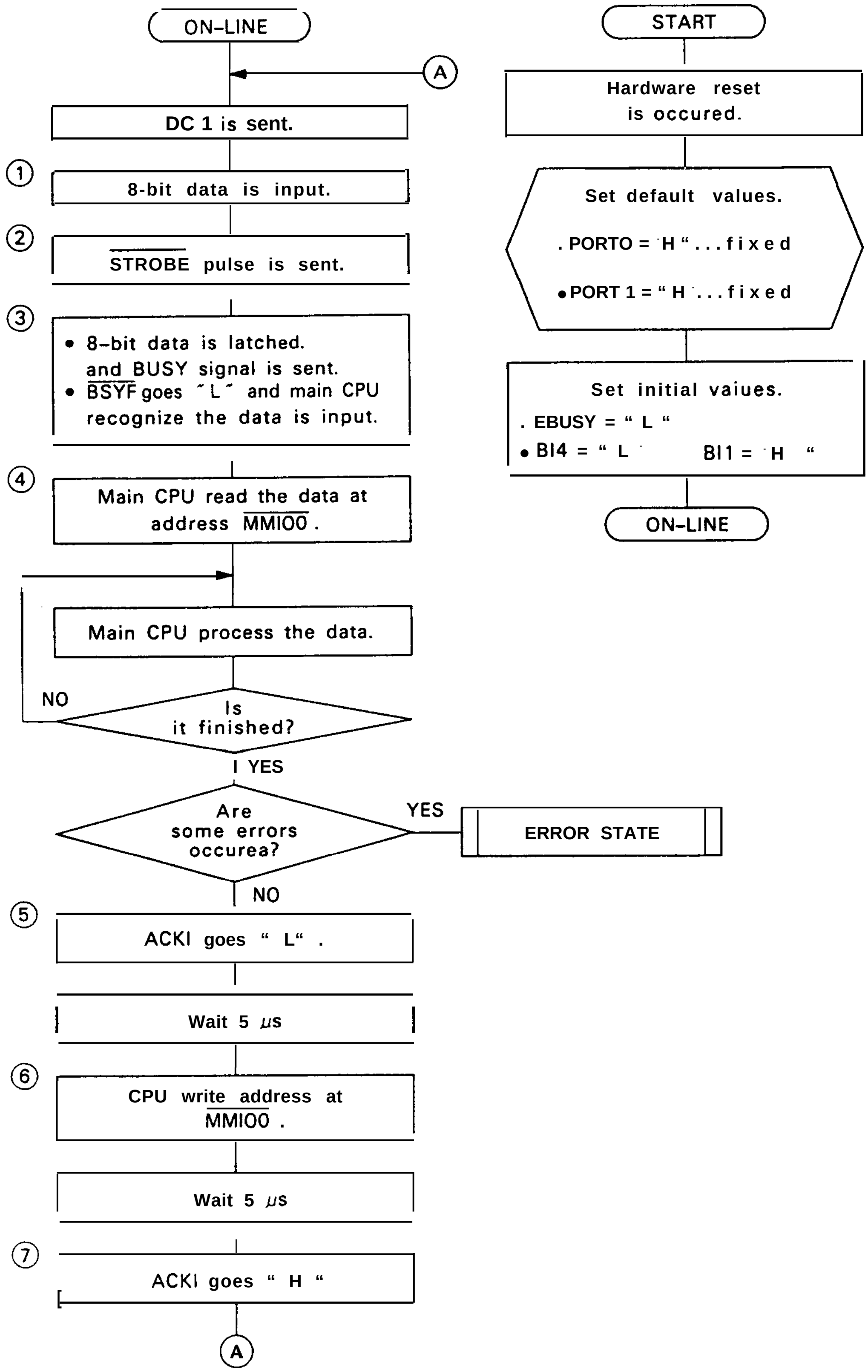


Figure 2-44. 8-Bit Parallel Interface Circuit Operation

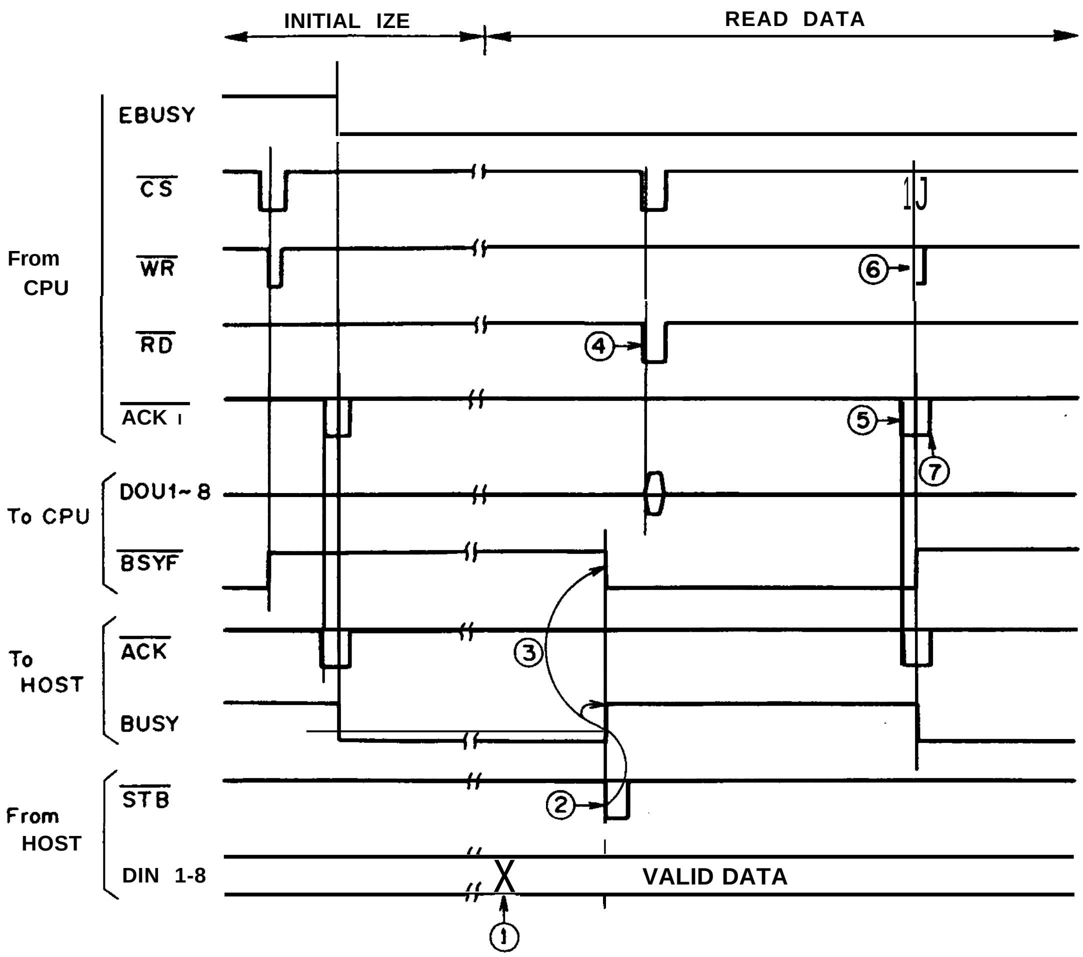


Figure 2-45. 8-Bit Parallel Interface Timing

Table 2-33. 8-Bit Parallel I/F Signals

READY/$\overline{\text{ERROR}}$	PE	BUSY	PRINTER	HOST Acknowledge:
H	Disable	Goes high, when $\overline{\text{STROBE}}$ pulse is sent from host.	ON-LINE	READY
L	L	H	OFF-LINE An error has occurred. (for error conditions, refer to Section 1.7.1.)	NOT READY
	H		OFF-LINE Paper end has occurred.	PAPER END

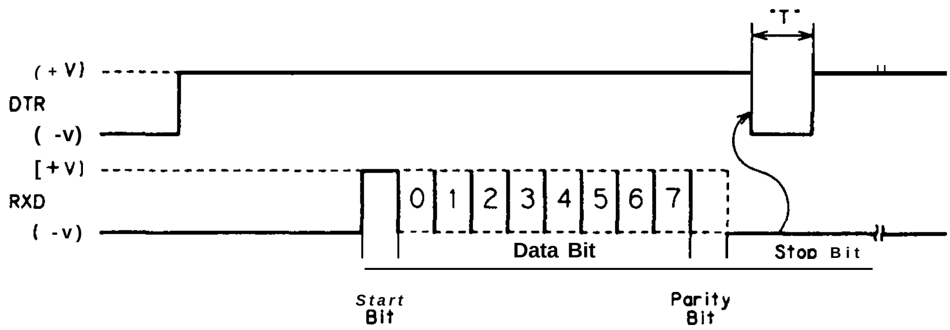
2.3.2.2 RS-232C Serial Interface

Operating Principles

The two handshaking methods are as follows:

1. Status flag . . . DTR (REV) signal

The DTR signal is set to SPACE (+V) when the printer can accept data and is set to MARK (–V) when the printr is in an error state or when the empty area in the input buffer reaches 256 bytes or less. In this way, handshaking with the host is accomplished by setting the DTR signal to either SPACE or MARK. (Refer to Figure 2-46.)

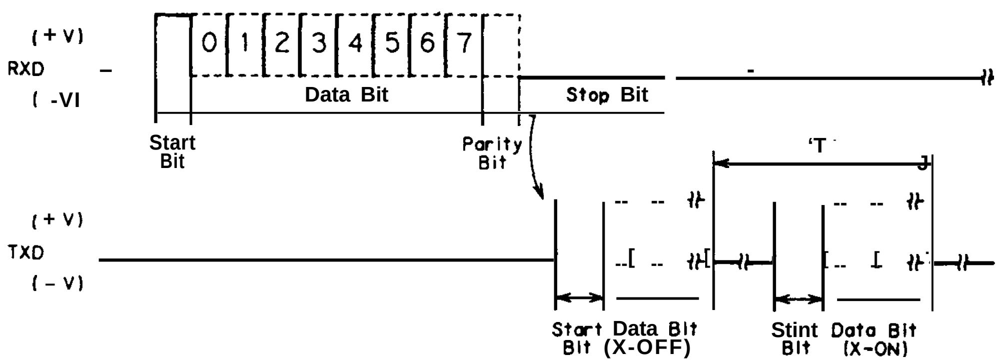


NOTES: 1. The value of "T" veries according to the input data.
2. The word structure of the serial data is:
1 start bit + 8 data bits + parity (Odd, Even, or none) + 1 or more stop bits.

Figure 2-46. DTR Handshaking

2. X-ON/X-OFF protocol . . . Sent over the TXD line

Handshaking is accomplished by sending either X-ON (1 1H)orX-OFF(13H) over the TXD line to the host. When the printer can accept data, the printer sends an X-ON code. When the printer becomes busy, it sends, an X-OFF code to the host computer. The X-OFF code is sent to the host when the empty area in the printer input buffer reaches 256 bytes or less, or when the printer is in an error state (Refer to Figure 2-47.).



NOTES: 1. The value of "T" veries according to the input data.
2. The word structure of the serial data is: 1 start bit + 8 data bits + parity (Odd, Even, or none) 1 or more stop bits.

Figure 2.47. X-ON/X-OFF Handshaking

Circuit Description

Figure 2-48 shows the RS-232C serial interface circuit. Data transmitted from the host computer is converted from EIA (+3 to +27 V, –3 to –27 V) to TTL O V, + 5 V voltage levels by the RS-232C line driver 75189 (3A). The converted data is sent to the main CPU via buffers in the M54610P (1 1 B). On the contrary, data transmitted from the main CPU is sent to the 75188 (4A), converted from TTL to EIA voltage levels, and transmitted to the host computer.

The sequence for the serial interface operation is shown in Figure 2-49, and that for handshaking in Figure 2-50.

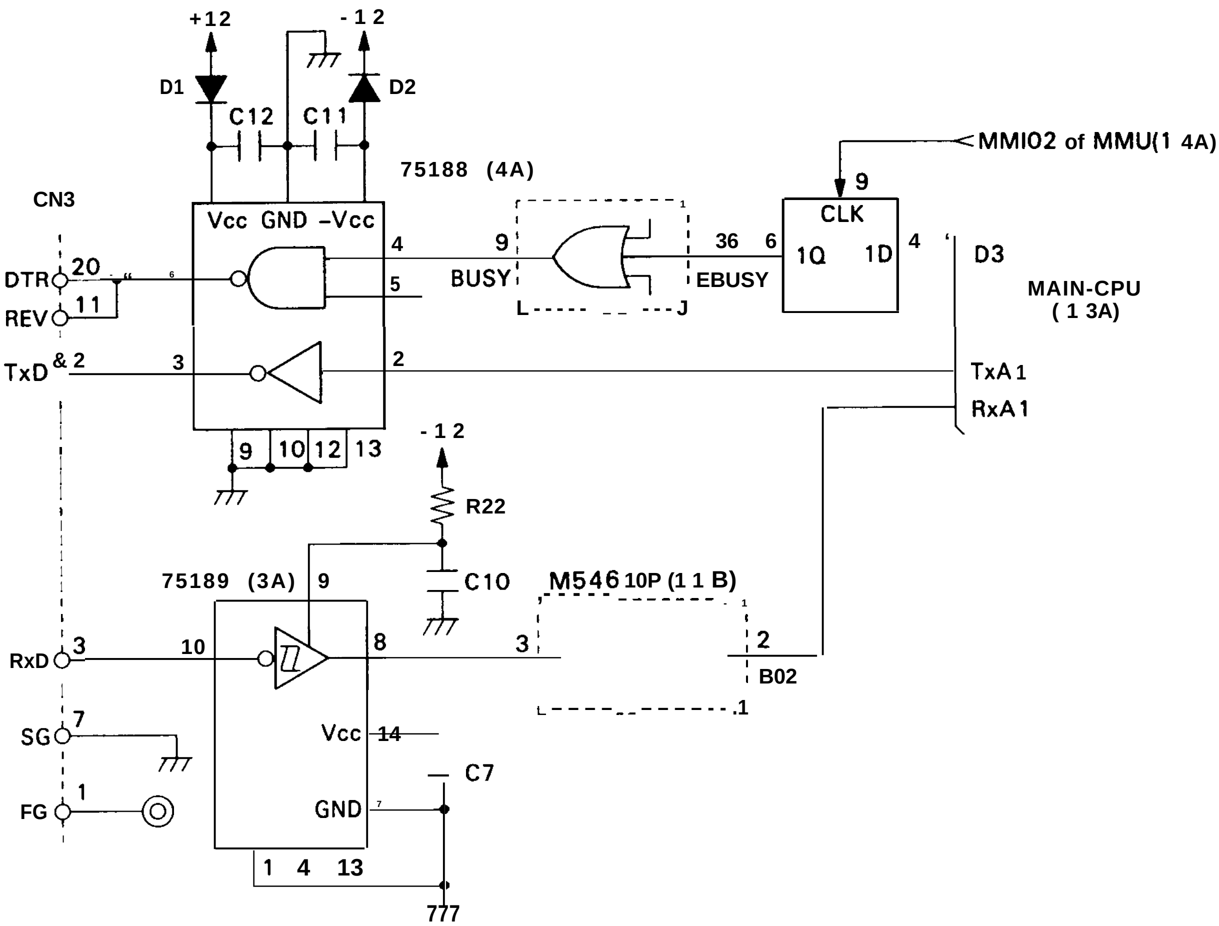


Figure 2-48. RS-232C Serial Interface Circuit

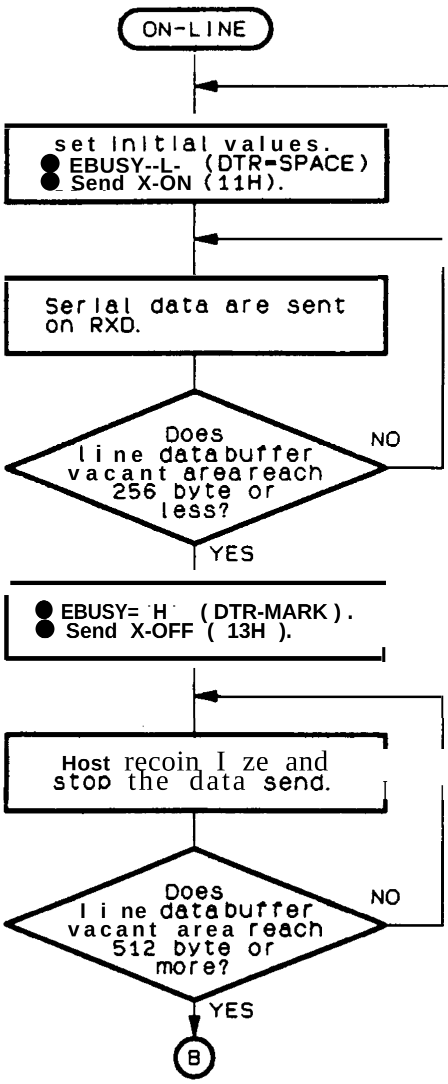


Figure 2-49. RS-232C Serial Interface Circuit Operation

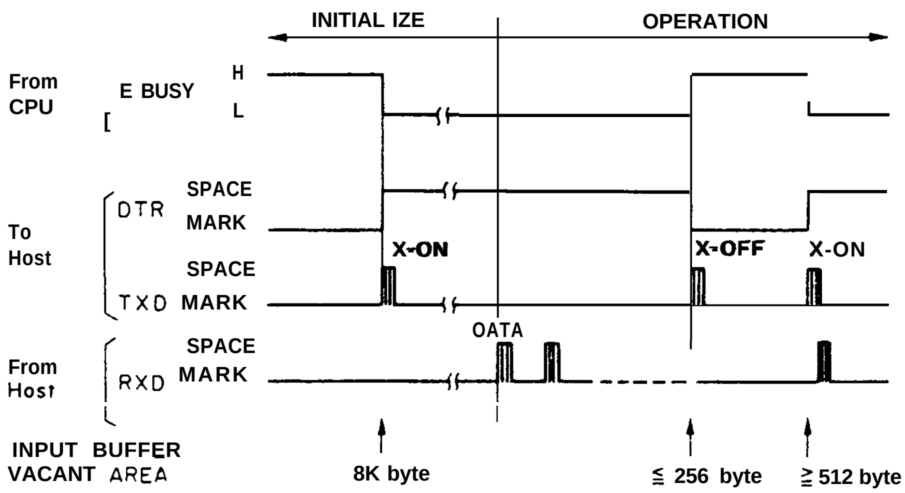


Figure 2-50. RS-232C Data Transmission Timing

2.3.3 Control Panel Interface Circuit

Figure 2-51 shows the control panel interface circuit.
This circuit is mainly divided into the following three blocks:

- LED drive section
- Switch status read section
- LCD control/drive section

Descriptions of the above sections will now be given.

- Refer to Figure A-55 for the detailed circuits on the ROPNL board.

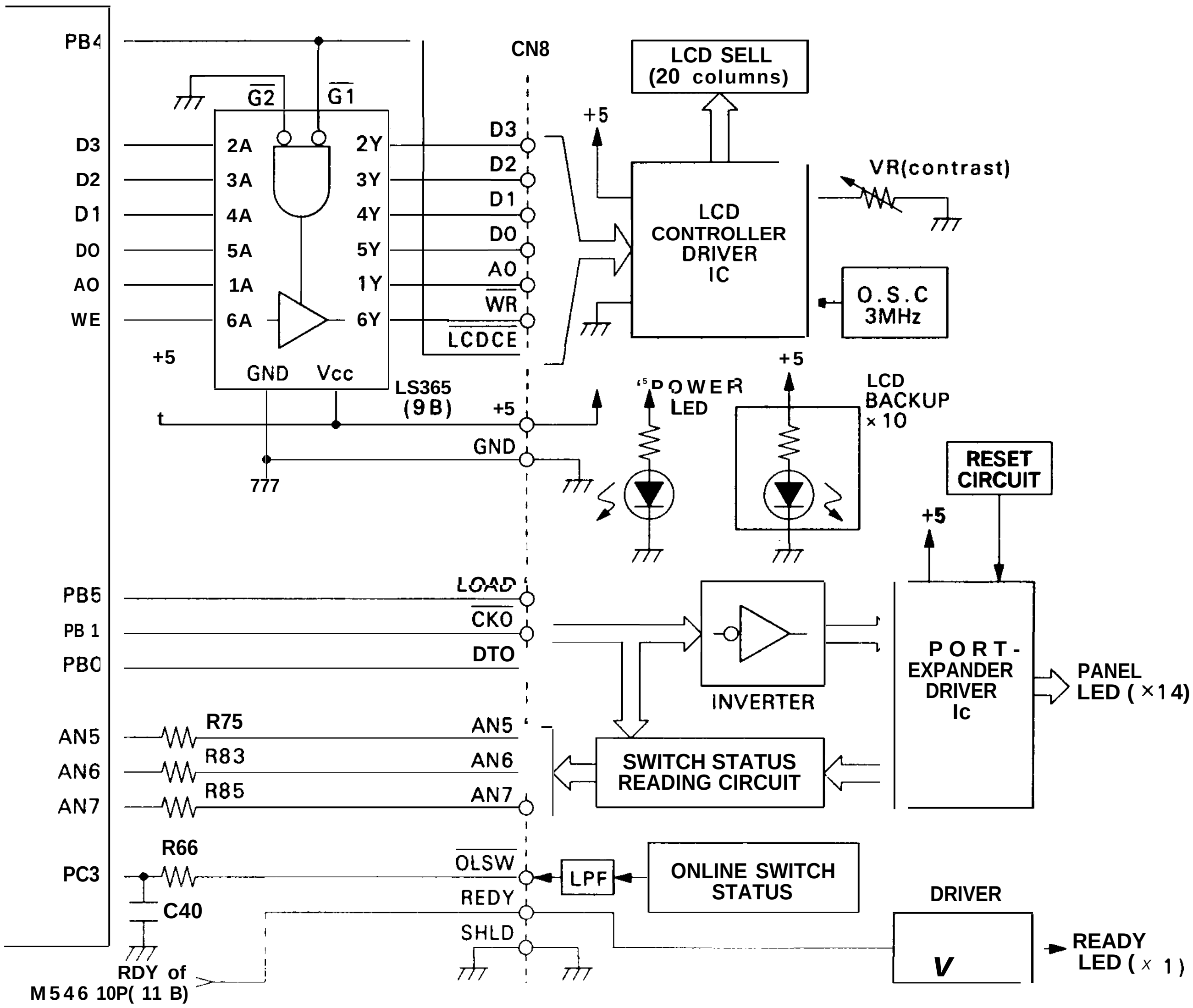


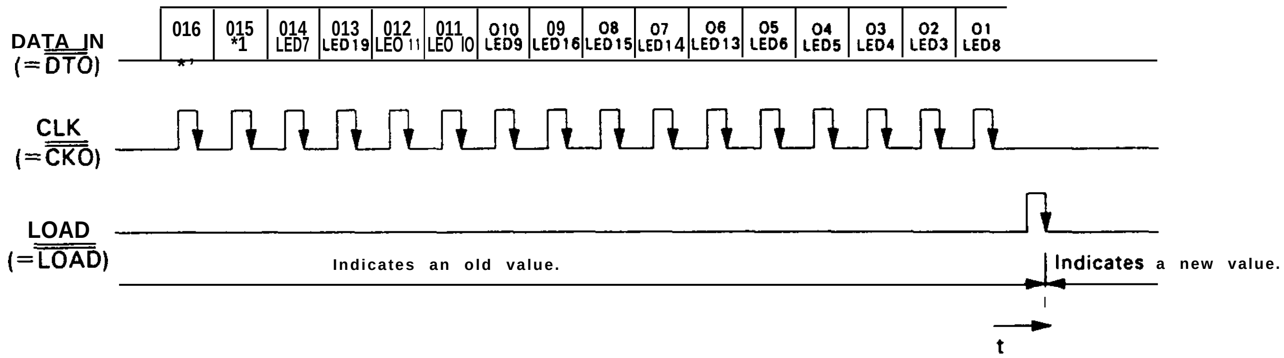
Figure 2-51. Control Panel Interface Circuit

2.3.3.1 LED Drive Section

Each LED is controlled and driven by port expander driver IC MSM59371, which includes a 16-bit shift register and LED drivers.

Figure 2-52 shows the data transfer timing for the MSM59371, and Figure 2-53 shows a block diagram of the MSM5937 1.

The MSM59371 converts 16-bit serial data (DATA IN) from the sub CPU into parallel data using a synchronous clock (CLK) and trigger signal (LOAD), then outputs the data to the output ports (O 1 to O 16). Output ports 01 to 014 are used to drive the LEDs, and 015 and 016 are for the signals that control the reading of the switch states.



*: Switch read control flag

NOTES: 1. An LED turns on when the data bit is "1".

2. Refer to Table A-41 for the layout of the LEDs.

Figure 2-52. MSM59371 Data Transfer Timing

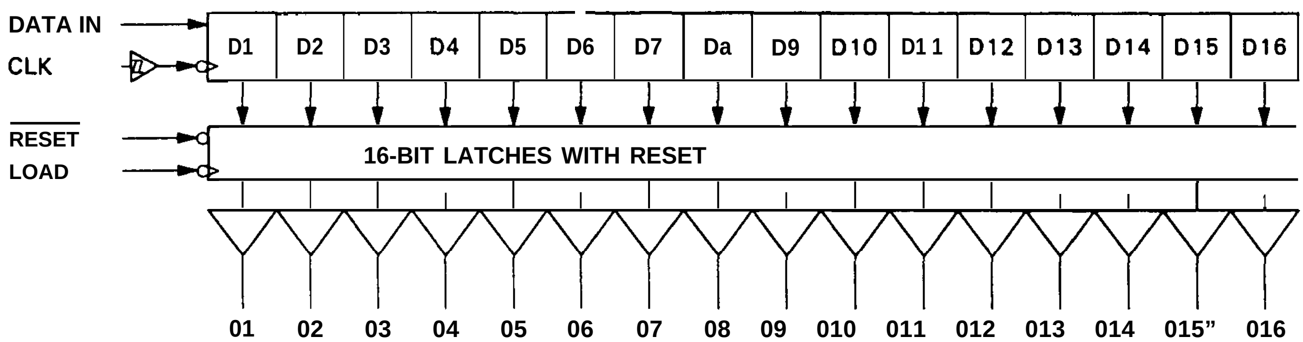


Figure 2-53. MSM59371 *Block Diagram*

2.3.3.2 Switch Status Read Section

The state of each switch is read periodically by the sub CPU through analog ports AN5 to AN7. When the state of a switch is found to be different from the previous value, the new value is transferred to the LED drive and LCD control/drive sections as data to rewrite the switch status.

Since the states of 11 switches must be read using only the three input ports (AN5 to AN7), a matrix circuit is constructed using four control signals (O 15 and 016 of the MSM59371, CKO, and DTO) (See Table 2-34).

The state of the ON LINE switch is monitored using port PC3 of the sub CPU via LPF (consisting of R66 and C40).

Table 2-34. Switch Status Reading

MSM59371		SUB CPU				
		(OUT)		(IN)		
Control Signal Status				Switches Read		
016	015	CKO	DTO	AN7	AN6	AN5
1	0	0	0	SW2	SW7	SW6
o	1	0	0	SW3	SW11	SW10
o	0	1	0	—	SW9	SW1o
0	0	0	1	SW4	SW12	SW8

NOTE: Refer to Table A-40 for the layout of the switches.

Figure 2-55 shows the command/data write timing for the SED 1200.
The sub CPU selects which type of information will be written, command or data, using address line AO (command: AO = O, data: AO = 1), then outputs 4-bit data on the data bus (DO to D3). The sub CPU enables the outputs of tri-state LS375 (96) by changing port PB4 from high to low, and writes the command/data into the SED 1200.
Table 2-36 lists the commands of the SED 1200, and Figure 2-56 shows the character code map for SED 1200. Writing command/data to the SED 1200 is performed by inputting 4-bit data twice, the upper nibble and lower nibble (4 bits X 2 = 8 bits).

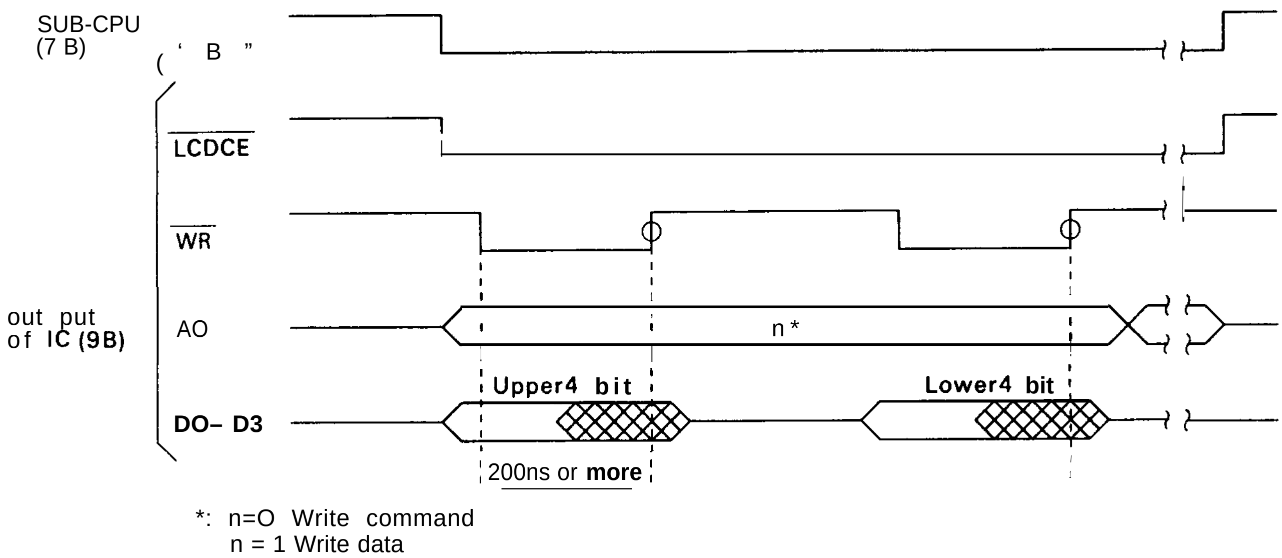


Figure 2-55. SED1 200 Command/Data Write Timing

Table 2-36. SED1200 Command List

Command		CS	WR	AO	First Input DB3 (D7)	DB2 (D6)	DB1 (D5)	DB0 (D4)	Second Input DB3 (D3)	DB2 (D2)	DB1 (D1)	DB0 (D0)	Function
SET CURSOR DIRECTION		0	0	0	0	0	0	0	0	1	0	D/I	DO= 1:DEC. DO= 0:INC.
CURSOR ADDRESS −1 +1		0	0	0	0	0	0	0	0	1	1	−1/+1	DO= 1:−1 DO= 0:+1
CURSOR FONT SELECT		0	0	0	0	0	0	0	1	0	0	A/U	DO= 1 :Blinking DO= O: Under Line
CURSOR BLINK ON/OFF		0	0	0	0	0	0	0	1	0	0	ON/OFF	DO= 1 :ON DO= O: OFF
DISPLAY ON/OFF		0	0	0	0	0	0	0	1	1	0	ON/OFF	DO= 1 :ON DO= O: OFF
CURSOR ON/OFF		0	0	0	0	0	0	0	1	1	1	ON/OFF	DO= 1 :ON DO= O: OFF
SYSTEM RESET		0	0	0	0	0	0	1	0	0	0	0	
LINE SELECT		0	0	0	0	0	0	1	0	0	0	2/1	DO= 1 :Display for 1 line DO= O: Display for 2 lines
SET CURSOR ADDRESS	1st LINE	0	0	0	1	0			(N Colums-1)B				
	2nd LINE	0	0	0	1	1			(N Colums-1)B				
SET CHARACTER CODE		0	0	1	(CHARACTER CODE)*1								
SET CGRAM ADDRESS		0	0	0	0	0	1	0	(Lower Address)				
SET CGRAM DATA		0	0	0	0	1	0	0	(CGRAM Data)				

*1: Refer to Figure 56.

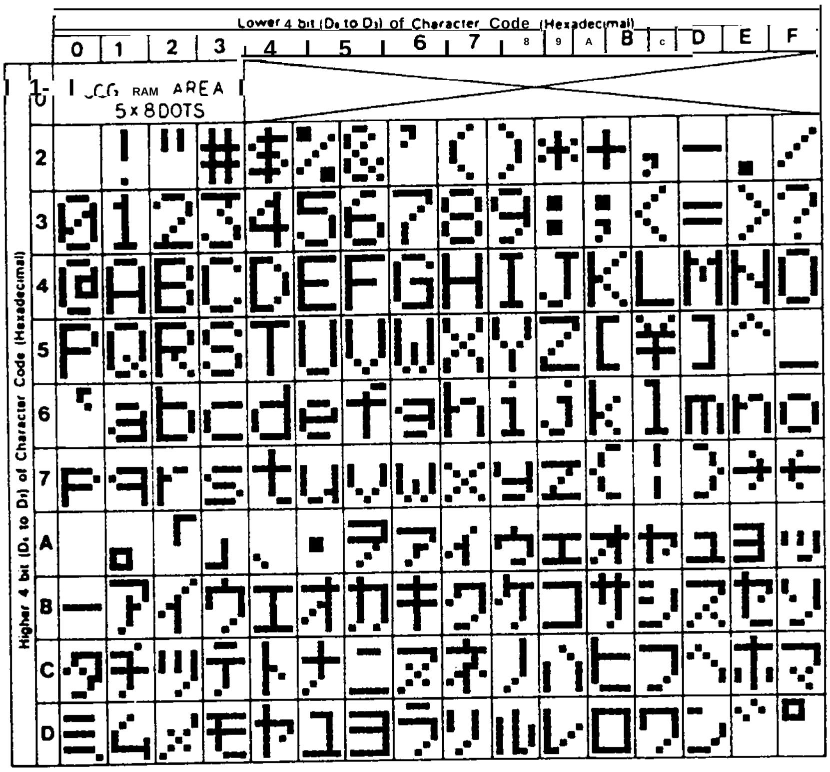


Figure 2-56. SED1 200 Character Code Map

, 2.3.4 State Detection and Sensor Signal Input Circuits

This section describes the state detection circuits on the ROMA board and sensor signal input circuit. Table 2-37 lists the state detection circuits onthe ROMA board. Table 2-38 lists the sensors connected to the ROMA board.

Table 2-37. State Detection Circuits

Name	Description	Sub CPU Signal Reading Port	Reference Section
35 V Line Voltage Detection Circuit	Monitors the 35 V line voltage	AN0	2.3.4.2
VR1 Reading Circuit	Reads the correction value for bidirectional printing in the LQ mode	AN6	2.3.4.3
VR2 Reading Circuit	Reads the correction value for bidirectional printing in the draft mode	AN5	

Table 2-38. Sensors List

Name	Position	Type	Description	Sub CPU Signal Reading Port	Reference Section
Printhead thermal sensor	Printhead	Thermistor	Detects the printhead temperature	AN 1	2.3.4.4
PW sensor	Printer mechanism	Photo reflector	Detects the paper width	AN3	2.3.4.5
PT sensor	Printer mechanism	TCS	Detects the paper thickness	AN4	2.3.4.6
PG HP sensor	Printer mechanism	Photo interrupter	Detects the platen gap home position	PA 1	2.3.4.7
CR HP sensor	Printer mechanism	Photo interrupter	Detects the carriage home position	PAO	2.3.4.8
PE sensor	Printer mechanism	Mechanical switch	Detects whether paper exists or not	PB7	2.3.4.9
RL sensor	Printer mechanism	Micro switch	Detects paper feeding meted	AN6	2.3.4.10
LD sensor	Printer mechanism	Micro switch	Detects the loading lever position	AN7	
Case open senser	Upper case	Hall effect IC	Detects whether the printer cover is open or closed	AN 1	2.3.4.11

2.3.4.1 Reference Voltage Supply Circuit

Figure 2-57 shows the circuit that supplies reference voltage V_{AREF} (4.746 VDC) to the A/D converter in the sub CPU. In this circuit, programmable shunt regulatorTL431 (9C) is used to output the reference voltage.

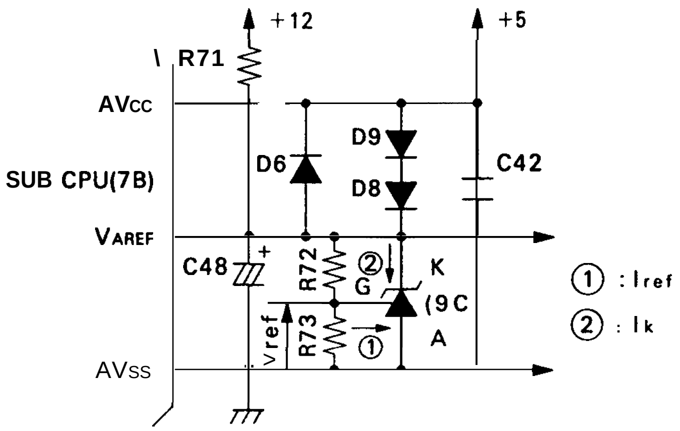


Figure 2-57. Reference Voltage Supply Circuit

Reference voltage V_{AREF} for the A/D converter is determined by the combination of resistors R72 and R73 connected in parallel with the TL431.

$$V_{AREF} = V_{ref}\left(1 + \frac{R72}{R73}\right) + I_{ref} \times R72 = 4.746 \ [V]$$

where, $I_{ref} = 2\ [\mu A]$

$V_{ref} = 2.495\ [V]$

As shown by the above expression, V_{AREF} is regulated to approximately 4.746 [V].

2.3.4.2 35 V Line Voltage Detection Circuit

As shown in Figure 2-58, this circuit detects the voltage on the 35 V line. The detected voltage is divided by R79 and R80, and the voltage at point Ⓐ is input to the ANO terminal of the sub CPU.

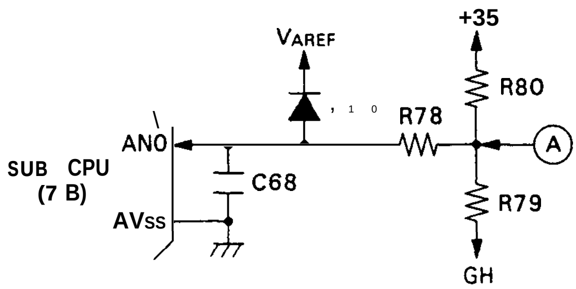


Figure 2-58. 35 V Line Voltage Detection Circuit

As shown in Figure 2-59, if the detected voltage drops to 30.53 V or less due to a circuit problem or high duty cycle printing, the printer stops printing. and the message "ERROR 2" is displayed on the control panel on the LCD. The printer cannot be recovered from this state. The power must be turned off and then on again.

NOTE: If "ERROR 2" is displayed again after the printer power is turned off and on, refer to Chapter 5 (Troubleshooting).

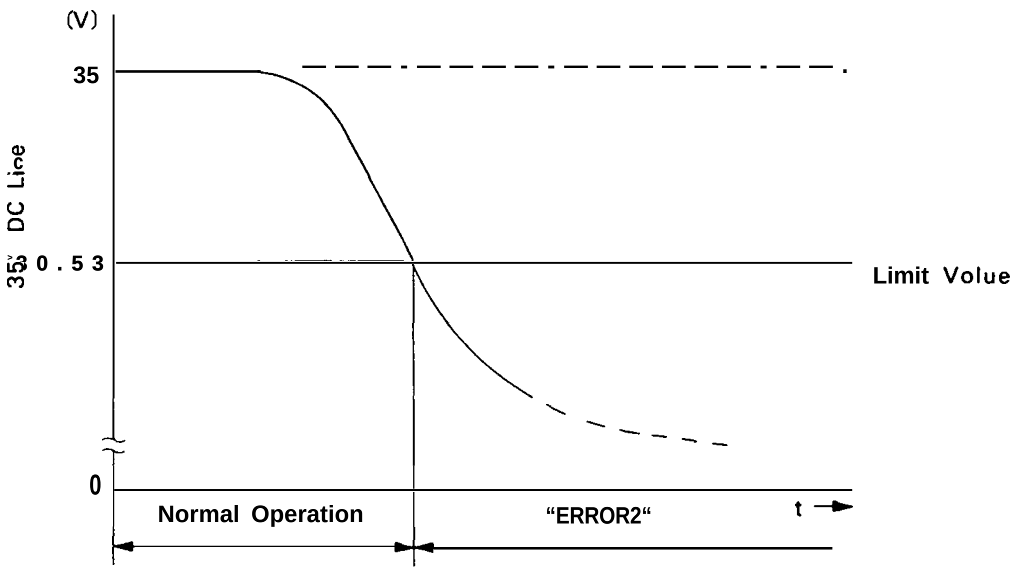


Figure 2-59. 35 V Line Protection

Table 2-39 shows the relationship between the 35 V line voltage and the input voltage at ANO.

Table 2-39. 35 V Line Voltage and ANO Voltage

35 V Line Voltage [V]	ANO Terminal Voltage [V]
35	3.89
30.53 ●1	3.39

*1: Lower limit

2.3.4.3 VR1/VR2 Reading Circuit

Figure 2-60 shows the VR1/VR2 reading circuit. The values (voltages) set by VR1 and VR2 are used to control the corrections for bidirectional printing in the LQ and draft modes. VR 1 is used for bidirectional printing in the LQ mode, and VR2 is used for bidirectional printing in the draft mode.
NOTE: Refer to Section 4.3.6 for adjustment of VR1 and VR2.

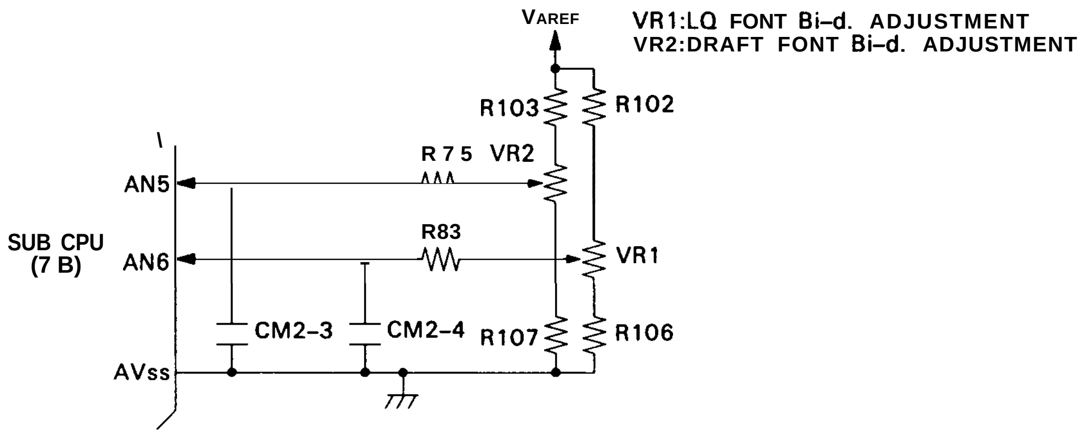


Figure 2-60. VR1/VR2 Reading Circuit

Table 2-40 shows the relationship between the VR 1/VR2 value and the terminal voltages at AN5/AN6.

Table 2-40. VR1/VR2 Values and AN5/AN6 Voltages

VR1/VR2 value	MAX. - MIN. [V]
AN5/AN6 terminal voltage	3.68 - 1.4

2.3.4.4 Printhead Temperature Detection Circuit

Figure 2-61 shows the printhead temperature detection circuit. This circuit detects the temperature using a thermistor in the printhead.

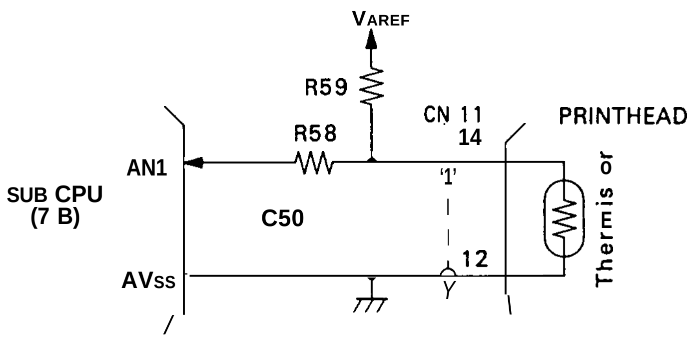


Figure 2-61. Printhead Temperature Detection Circuit

The temperature of the printhead rises as the solenoids in the printhead continue to be driven. To prevent the solenoids from burning, printer operates as shown in Figure 2-62.

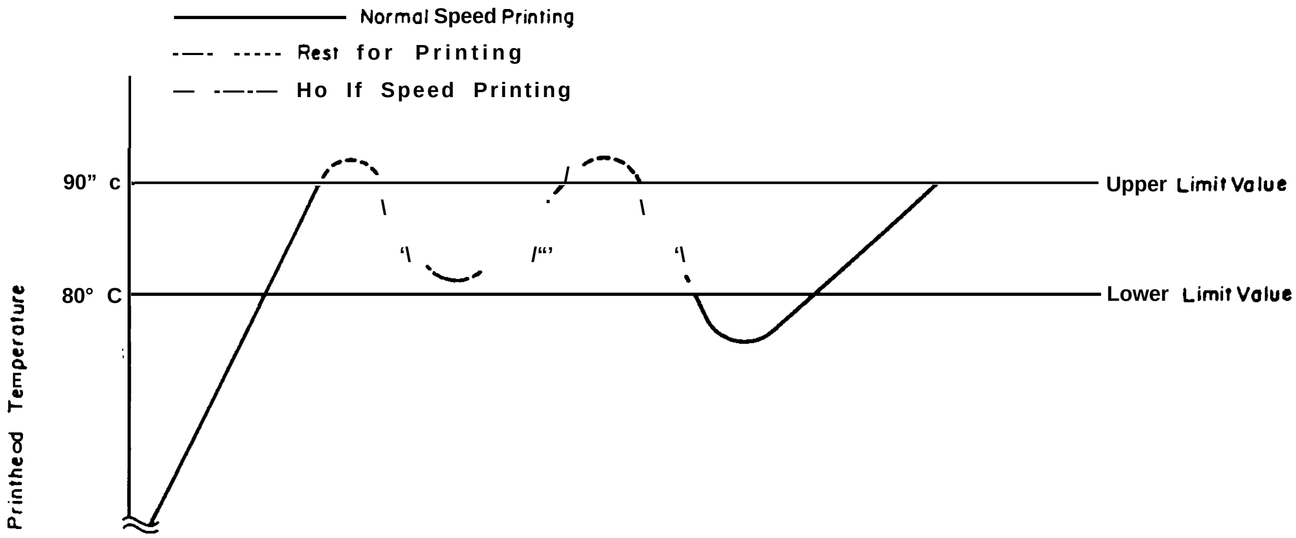


Figure 2-62. Printhead Temperature and Printing Operation

If the printhead temperature exceeds the upper limit (90°C), printing is "automatically stopped. In this state, the ON LINE LED blinks. When the printhead temperature drops to the upper limit or less, printing is resumed at half speed. When the printhead temperature drops to the lower limit (80" C) or less, the normal printing speed is automatically resumed.

NOTE: "Half speed" actually means to drop down to the next lower print speed.

Table 2-41 shows the relationship between the upper/lower limit values for printhead temperature, and the voltage at the AN 1 terminal of the sub CPU.

Table 2-41. Printhead Temperature Upper/lower Limits and AN1 Voltage

	Temperature [“C]	**AN1** *Terminal Voltage [V]*
Upper limit	90	2.71
Lower limit	**80**	**2.80**

2.3.4.5 PW Sensor Circuit

Figure 2-63 shows the PW sensor circuit. This sensor becomes active when the paper thickness exceeds 0.18 [mm] (a postcard or envelop). The paper width is detected by this sensor, and carriage movement is controlled so that printing is executed to within 1/2 inch from either end of the paper.

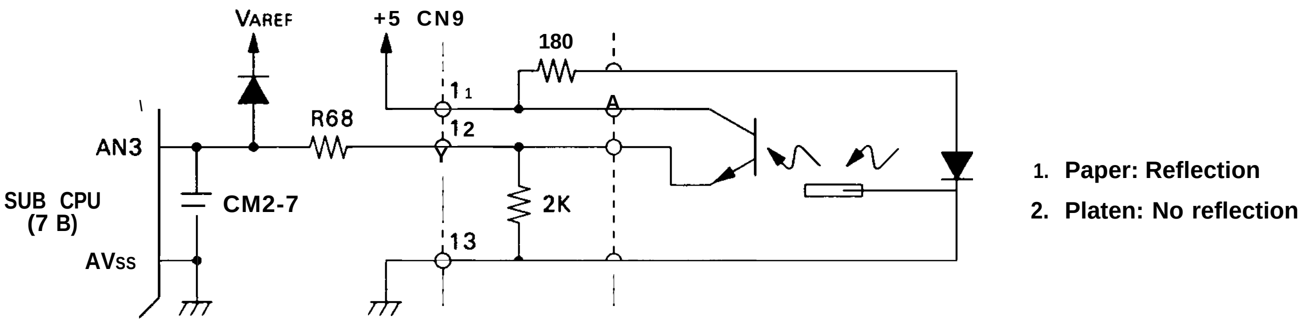


Figure 2-63. PW Sensor Circuit

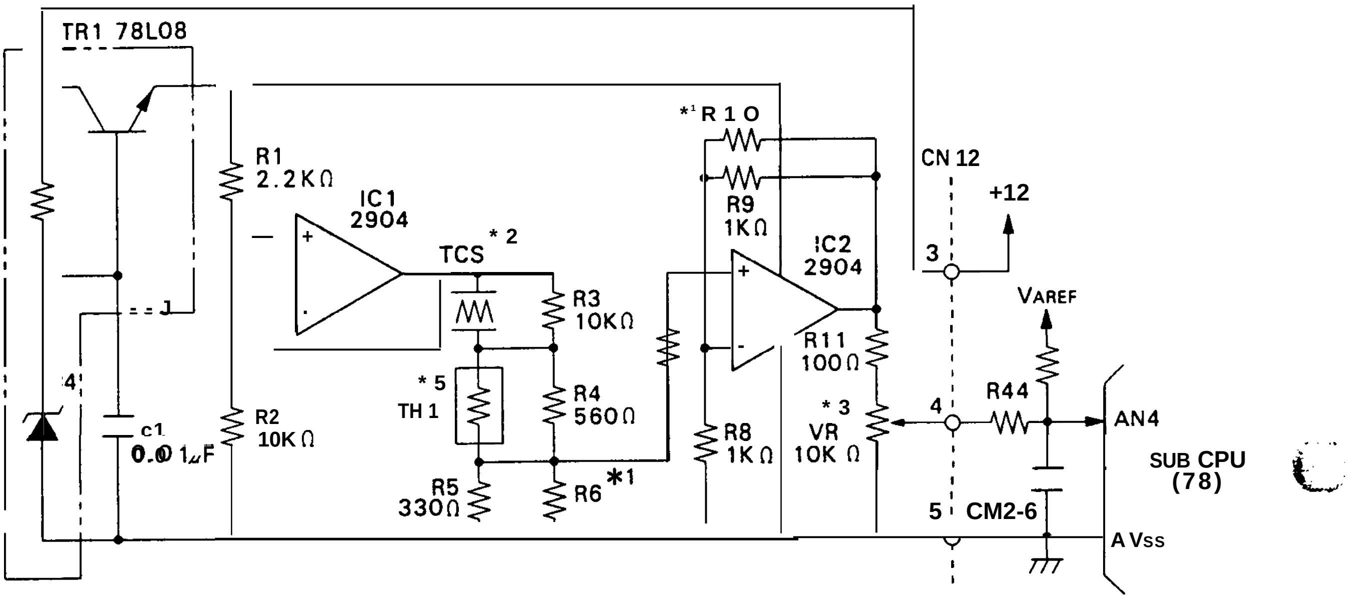
Table 2-42 shows the relationship between the PW sensor detection position and the voltage at the AN3 terminal of the sub CPU.

Table 2-42. Paper State and AN3 Voltage Level

Detection Position	**AN3** *Terminal Voltage Level*
Paper	**H**
Platen	**L**

2.3.4.6. PT Sensor Circuit

Figure 2-64 shows the PT sensor circuit. The TCS (Touch Control Sensor) in this circuit detects the paper thickness according to the change in pressure applied by the PT solenoid, and the pressure is changed the voltage value.This circuit can detect paper thickness between O and 0.8 [mm].



*1: Resistor for sensor gain adjustment

*2: Touch control sensor

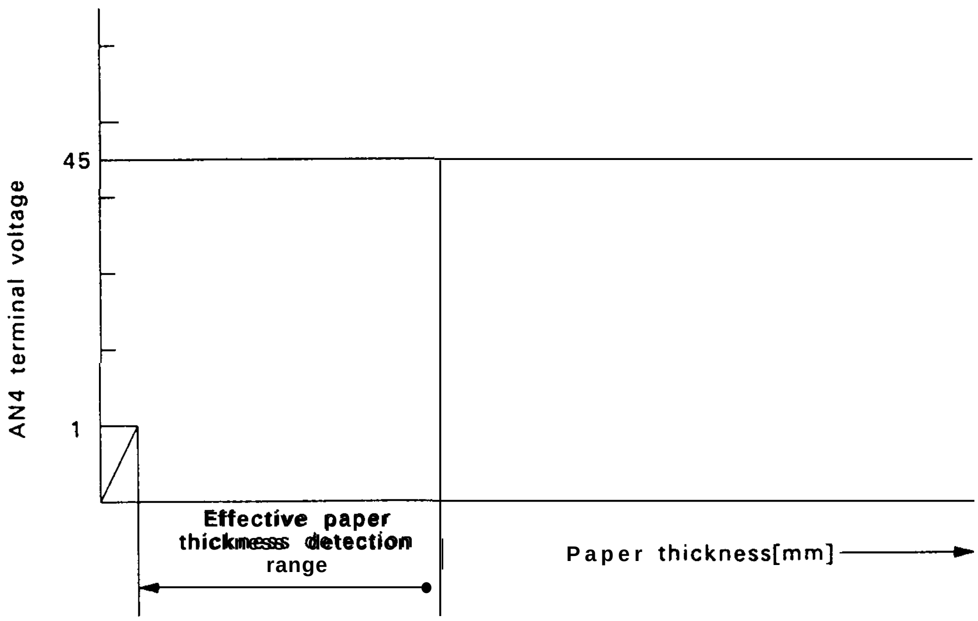
*3: Potentiometer (VR) for gain adjustment

*4: 8 V for constant voltage supply

*5: Thermistor for compensating for changes in paper thickness due to changes in temperature

Figure 2-64. PT Sensor Circuit

Figure 2-65 shows the relationship between the PW sensor detection value and the voltage at the AN4 terminal of the sub CPU.



Paper thickness (T) = 1.66x AN4 terminal voltage (E)
where, $1 \leqq E \leqq 4.5$

Figure 2-65. Paper Thickness and AN4 Voltage

2.3.4.7 PG HP Sensor Circuit

Figure 2-66 shows the PG HP sensor circuit. This circuit determines the platen gap home position of the PG motor.

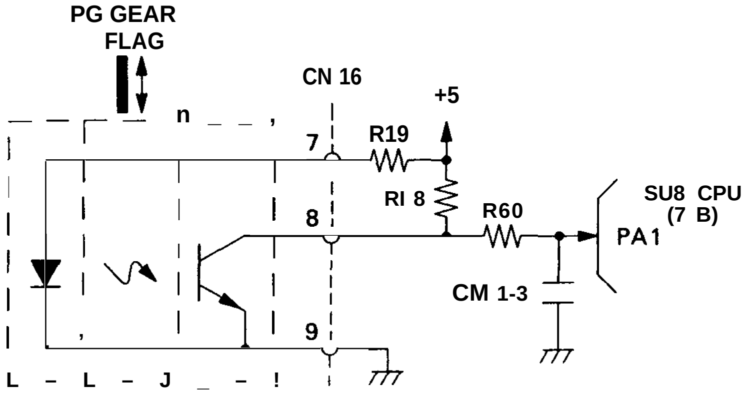


Figure 2-66. PG HP Sensor Circuit

Table 2-43 shows the relationship between the PG gear flag and the voltage at the PA1 terminal of the sub CPU.

Table 243. PG Gear Flag and PA1 Voltage

PG Gear Flag Position	PA1 Terminal Voltage [V]
At the home position	5
Outside the home position	o

2.3.4.8 CR HP **Sensor Circuit**

Figure 2-67 shows the CR HP sensor circuit. This circuit determines the home position of the carriage.

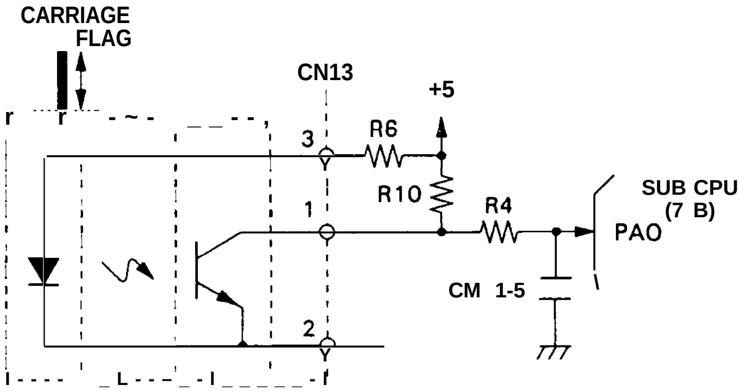


Figure 2-67. CR HP Sensor Circuit

Table 2-44 shows the relationship between the carriage flag and the voltage at the PAO terminal of the sub CPU.

Table 2-44. CR HP Sensor Flag and PAO Voltage

Carriage Flag Position	PAO Terminal Voltage [V]
At the home position	5
Outside the home position	0

2.3.4.9 PE Sensor Circuit

Figure 2-68 shows the PE sensor circuit. This circuit determines whether paper exists in the printer or not.

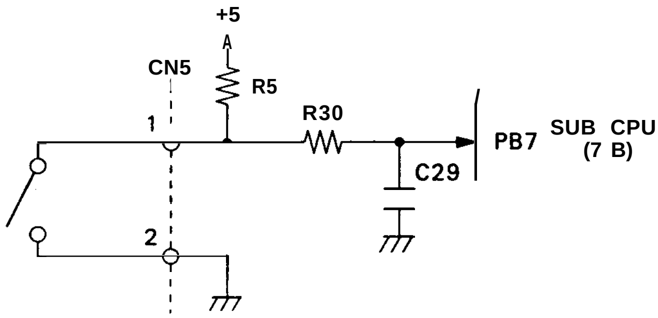


Figure 2-68. PE Sensor Circuit

Table 2-45 shows the relationship between the paper state and the voltage at the PB7 terminal of the sub CPU.

Table 2-45. Paper State and PB7 Voltage

Paper State	PB7 Terminal Voltage [V]
Loading (Paper exists)	5
Ejecting (Paper out)	0

2.3.4.10 RL/LD Sensor Circuit

Figure 2-69 shows the RL/LD sensor circuit. This circuit uses the AN6 and AN7 terminals of the sub -- CPU as signal inputs.

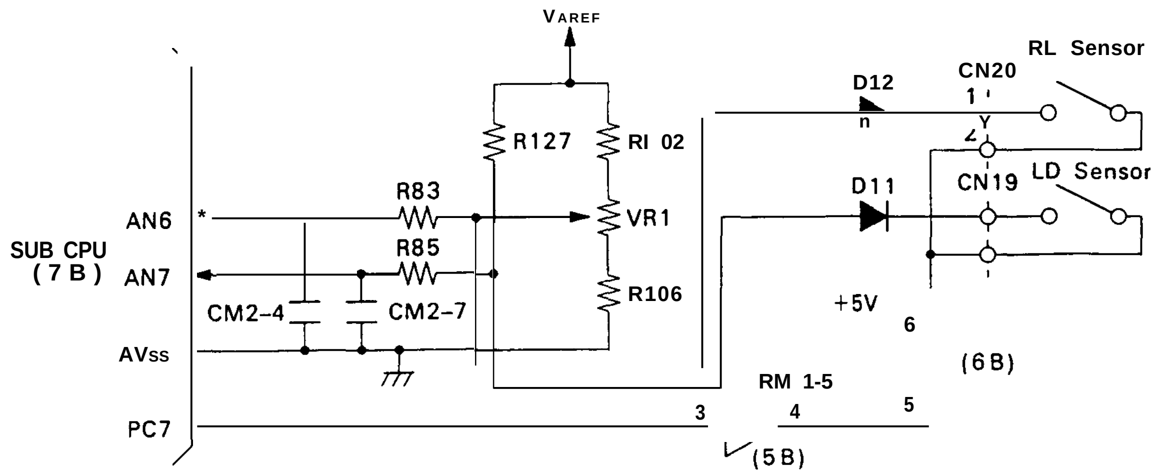


Figure 2-69. RL/LD Sensor Circuit

Table 2-46 shows the relationship between the printer mechanism status and signals at the sub CPU ports AN6 and AN7.

Table 2-46. RL/LD Sensor Circuit Signal Status

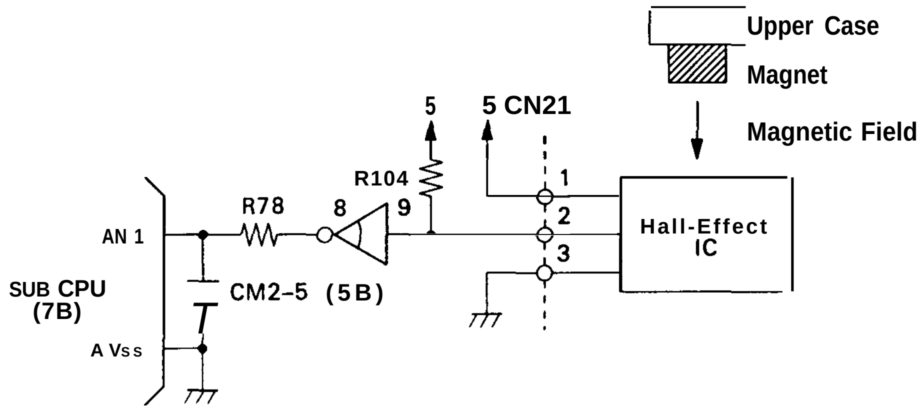
PC7 Terminal Voltage of the Sub CPU	Release Lever Position	Loading Lever Position	AN6 Sub CPU Terminal Voltage Level *1	AN7 Sub CPU Terminal Voltage Level
H	X	X	H	H
L	Friction	—	H	—
	Tractor	—	L	—
	—	Open	—	L
	—	Closed	—	H

*1: When the terminal voltage at PC7 is "H," the actual voltage level is between 3.68 and 1.4 [V] depending on the value of VR1(AN6).

NOTE: The "X" mark means unstable.

2.3.4.11 Case Open Sensor Circuit

Figure 2-70 shows the case open sensor circuit. This circuit employs an IC including a hall-effect element that can detect a magnetic field.



NOTE: The output of the hall-effect IC goes LOW/HIGH when the IC moves close to/away from the magnet.

Figure 2-70. Case Open Sensor Circuit

Table 2-47 shows the relationship between the printer cover state and the voltage at the AN 1 terminal of the Sub CPU.

Table 2-47. Printer Cover State and AN1 Voltage

Printer Cover State	AN1 Terminal Voltage [V]
Closed	5
Open	0

2.3.5 Printhead Control/Drive Circuit

Figure 2-71 shows the printhead control/drive circuit block diagram. The main CPU (1 3A) transmits print data for one line in three steps (8-bit data x 3 = 24 dots) and stores the data in control gate array E05A02LA (2A). The sub CPU (7B) outputs the printhead trigger pulse ($\overline{HPW}$) to the E05A02 LA. When the $\overline{HPW}$ signal is LOW, chopper type drive signal $\overline{PNPON}$ goes active, the drive transistors in printhead drive IC STK-66082E (1A) which drive the printhead coils are activated, and printing is executed. The sub CPU monitors the printhead internal temperature to prevent the printhead coil from burning, and also monitors the paper thickness and +35 V line voltage in order to apply the correct print energy to the printhead coils in accordance with the paper thickness.

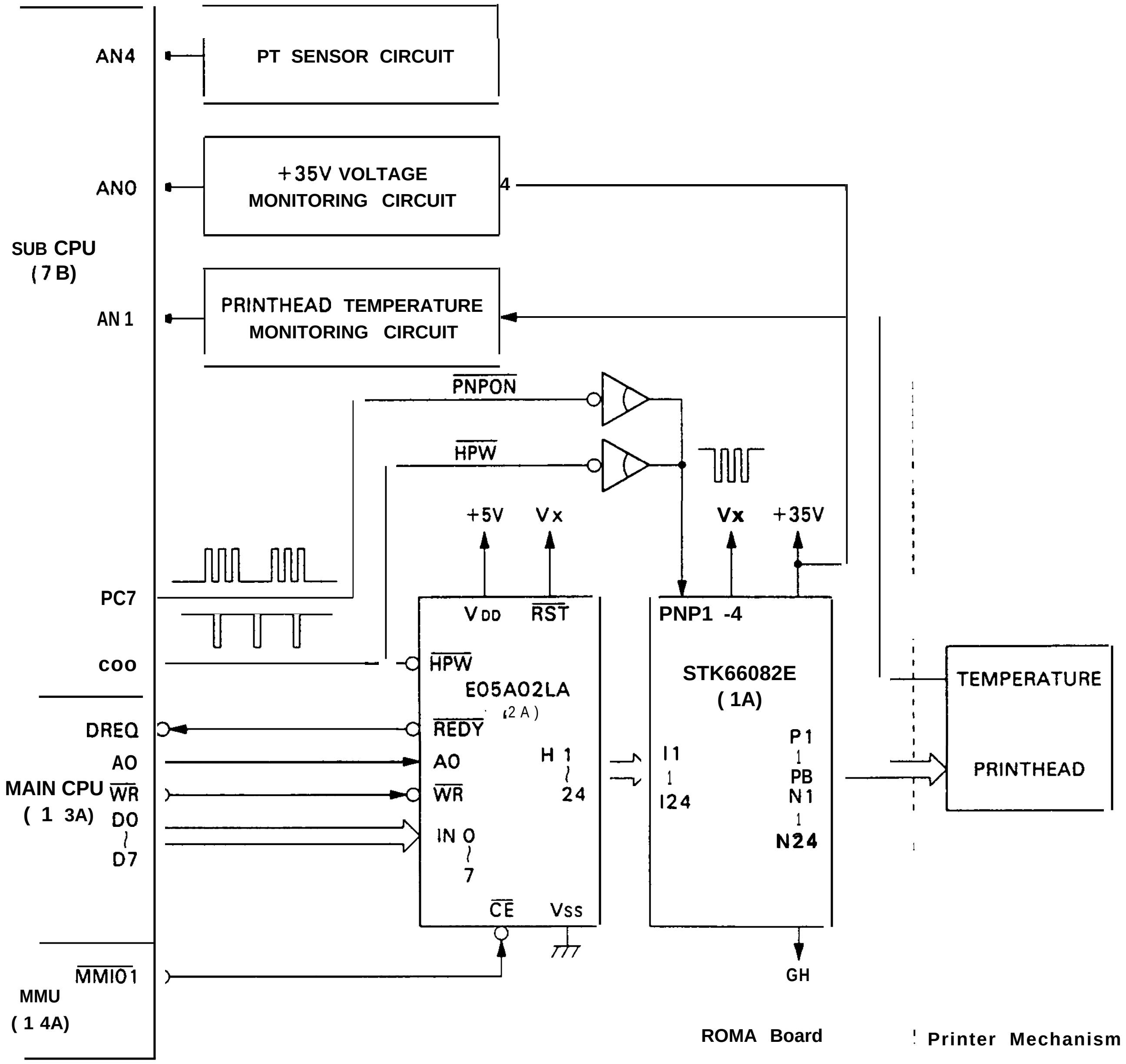


Figure 2-71. Printhead Control/Drive Circuit Block Diagram

2.3.5.1 E05A02LA Gate Array (2A)

● Refer to Appendix A.1 .1.18 for the details of the E05A02 LA.

The E05A02LA gate array is a 24-pin printhead data control IC, and includes the interface circuits used between the CPU and printhead driver. Because the gate array is mapped so that it corresponds to CPU memory addresses, the functions of the gate array can be accessed as memory-mapped 1/0. This IC constructs the data for one character row (24 dots) by inputting 8-bit data three times, and outputs the print signal to printhead driver IC STK66082E (1A) using printhead trigger pulse $\overline{\text{HPW}}$. The IC also has functions to write and output the 24-bit data effectively. Table 2-48 shows the E05A02LA gate array functions.

Table 2-48. E05A02LA Gate Array Functions

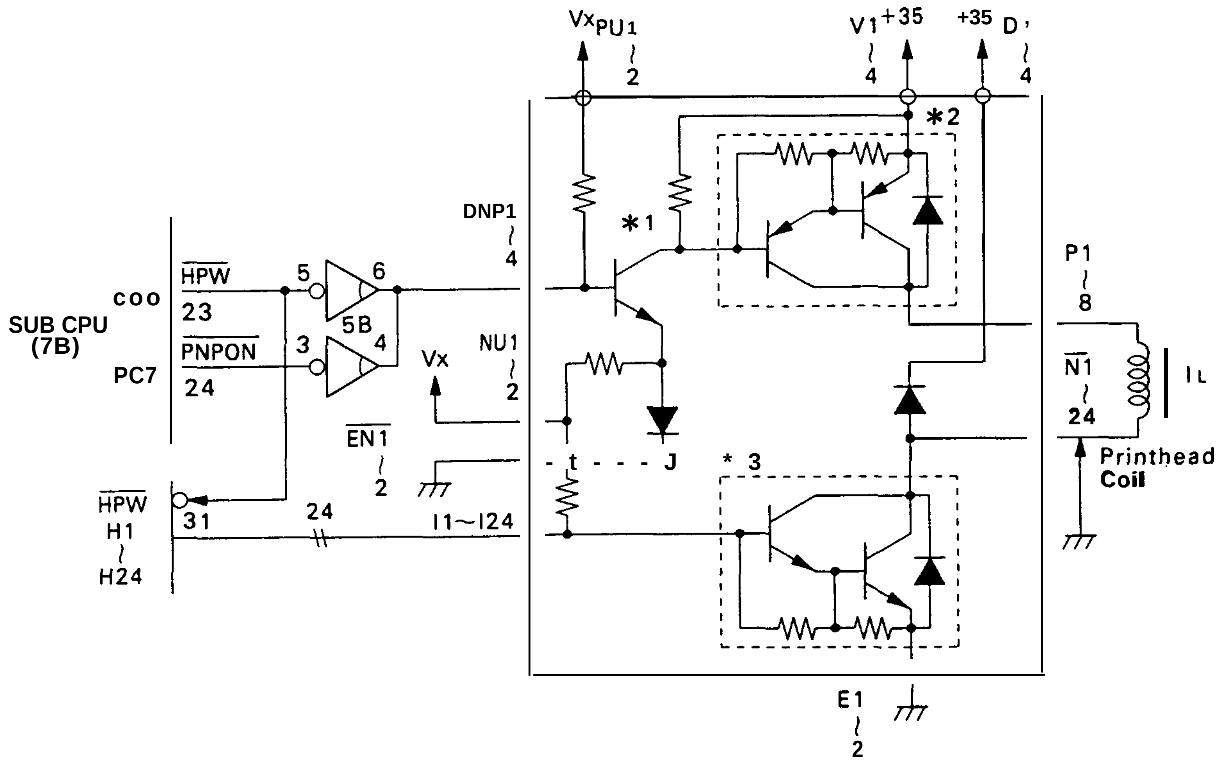
Address Bus AO	Function
o	● Inputs a command. Data bit 7: Sets the data latch write sequence. HIGH: Ascending order LOW: Descending order Data bit 6: Enables/disables the $\overline{\text{HPW}}$. Data bit 5: Resets the counter. Data bits 4 to O: Not used.
1	● Latches data, and increments the counter. When latching data, half-protection is performed by NANDing the contents of the new data and the previous data (so that the output goes LOW continuously). . Data latching is completed by latching l-byte data three times. ● The $\overline{\text{REDY}}$ signal is changed to HIGH by the WR signal that latches the third byte, so that data transfer is automatically inhibited. ● When $\overline{\text{HPW}}$ is set valid, the latched data is inverted and output while $\overline{\text{HPW}}$ is LOW. ● The $\overline{\text{REDY}}$ signal goes LOW at the leading edge of $\overline{\text{HPW}}$, to indicate that the gate array is ready to receive data.

NOTE: When $\overline{\text{HPW}}$ is set invalid, the output is open-drain active regardless of the $\overline{\text{HPW}}$ input.

2.3.5.2 Printhead Drive Circuit

The printhead drive circuit converts the print signals output from the E05A02LA into printhead coil drive voltages. The major drive circuits are incorporated in hybrid IC STK66082E (1 A). Figure 2-72 shows the equivalent circuit.

● Refer to Appendix A.1.1.14 for the details of the STK66082E.



*1: +35 V Switching Transistor
*2: +35 V Power Transistor
*3: Printhead Coil Switching Transistor

Figure 2-72. Printhead Drive Equivalent Circuit

The functions of each section are as follows.

+35 V Switching Transistor

This transistor turns on when both printhead drive pulse $\overline{HPW}$ from the sub CPU and chopper type drive signal $\overline{PNPON}$ are LOW.

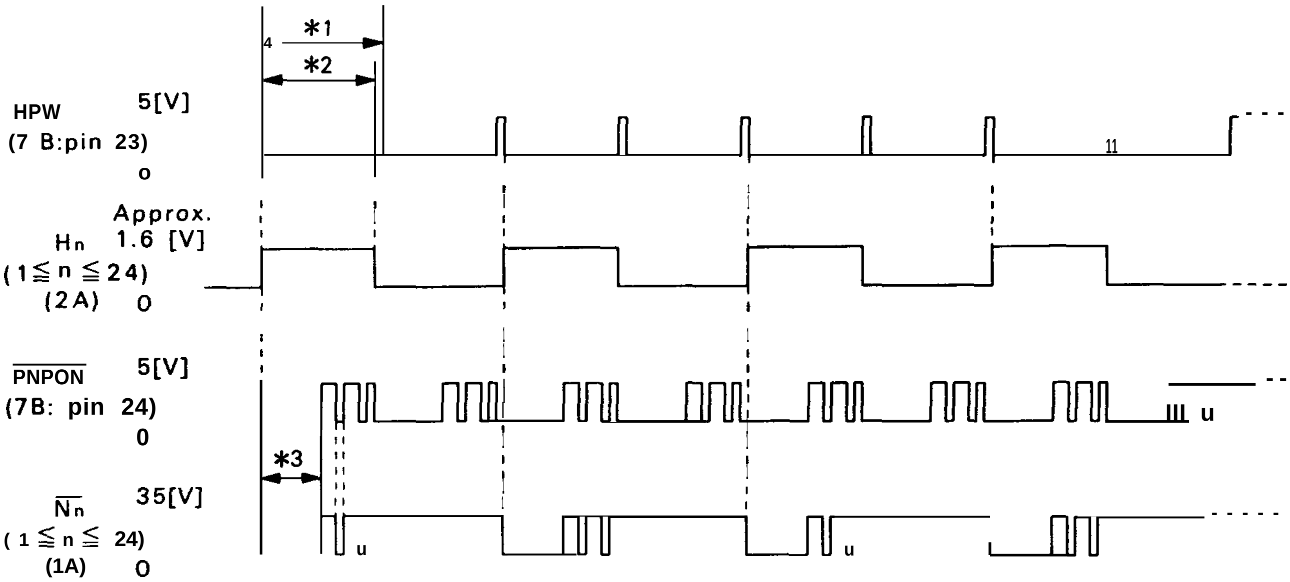
+35 V Power Transistor

This transistor outputs +35 V to common lines P1 through P8 when the 35 V switching transistor is on.

Printhead Coil Switching Transistor

This transistor corresponds to outputs H1 through H24 of the E05A02LA. The E05A02LA transmits the print signal to this transistor when HPW is LOW. When the print signal is active, this transistor turns on. When the transistor turns on, $\overline{N1}$ through N24 are shorted by GH, current flows to the printhead coil from the +35 V line, and printing is executed.

Figure 2-73 shows the printhead drive circuit signal timing.



*1 : Approx. 250 [μ s] at 35 V, 25 'C, in the Draft self test mode, when the paper thickness is normal

*2 : Approx. 220 [μ s] at 35 V, 25 'C, in the Draft self test mode, when the paper thickness is normal

*3 : First pulse width. this varies depending on the paper thickness (paper mode) and the +35 V line voltage. Refer to sections 2.3.5.3 and 2.3.5.4.

Figure 2-73. Printhead Drive Circuit Signal Timing

2.3.5.3 Relationship Between Paper Thickness and Print Mode

The sub CPU detects paper thickness t [mm] using the PT sensor. Based on t, the sub CPU selects one of three printhead drive pulses so that the correct print energy will be applied to the printhead coils. Table 2-49 shows the relationship between the printhead drive pulse and paper thickness.

Table 2-49. Printhead Drive Pulse and Paper Thickness

Printhead Solenoid Drive Pulse	Paper Thickness [mm]
Normal mode	$0.06 \leqq t \leqq 0.18$
Copy mode 1	$0.18 \leqq t \leqq 0.36$
Copy mode 2	$0.36 \leqq t \leqq 0.46$

As shown in Figure 2-73, the printhead coil is driven by the chopper type control which divides a cycle into three pulses. The width of the first pulse is varied depending on the paper thickness so that the correct print energy can by applied to the printhead coil. Table 2-50 shows the relationship between the printhead coil drive cycle, printhead first drive pulse width, and print mode.

Table 2-50. Printhead Coil Drive Cycle, Printhead First Drive Pulse Width, and Print Mode

CR Motor Speed [PPS]	Printhead Coil Drive Cycle *1 [KHz]	Printhead Coil First Drive Pulse Width *2			Printing Mode	
		Nomal Mode [μs]	copy Mode 1 [μs]	copy Mode 2 [μs]	Text	Bit image
4000	2.00	110	120	140	Draft	8-dot normal-density, high speed double density 24-dot normal density
2667	2.00	110	120	140	—	8-dot CRT graphics II 24-dot CRT graphics II
2000	2.00	110	120	140	Half speed Draft	8-dot double-density, quadruple-density 24-dot double-density
1333	2.00	110	120	140	LQ	24-dot triple-density
667	1.00	110	120	140	Half speed LQ	24-dot quadruple-density

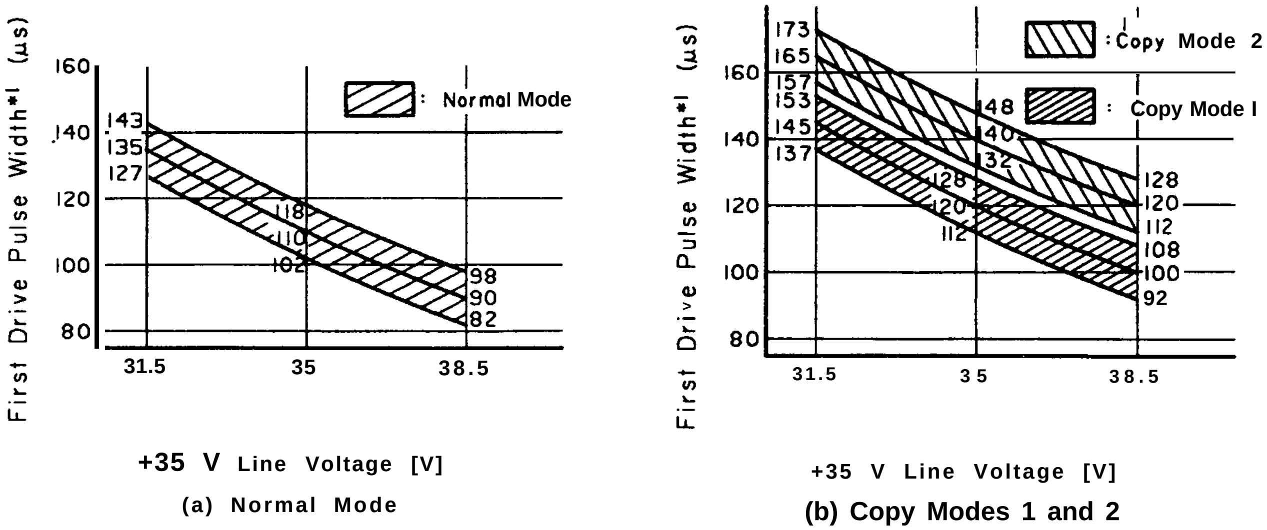
*1: The +35 V line voltage is 35 V.

*2: Refer to Figure 2-73 for the $\overline{\text{PNPON}}$ signal.

2.3.5.4 Relationship Between the First Printhead Drive Pulse Width and +35 V Line Voltage

As described in Section 2.3.5.3, this printer has three kinds of pulse widths for the first drive pulse depending on the paper thickness. Figure 2-74 shows the relationship between the first printhead drive pulse width and +35 V line voltage.

To keep the energy (W.s [J]) applied to the printhead coil constant, the first drive pulse width of the $\overline{\text{PNPON}}$ signal (see Figure 2-73) is controlled by the sub CPU internal clock (output from the COO terminal) depending on the +35 Vline voltage.



***1: Refer to Figure 2-73.**

Figure 2-74. First Printhead Drive Pulse Width and +35 V Line Voltage

2.3.6 HF Motor Control/Drive Circuit

Figure 2-75 shows the HF motor control/drive circuit, and Figure 2-76 shows the HF motor control/drive circuit signal timing.

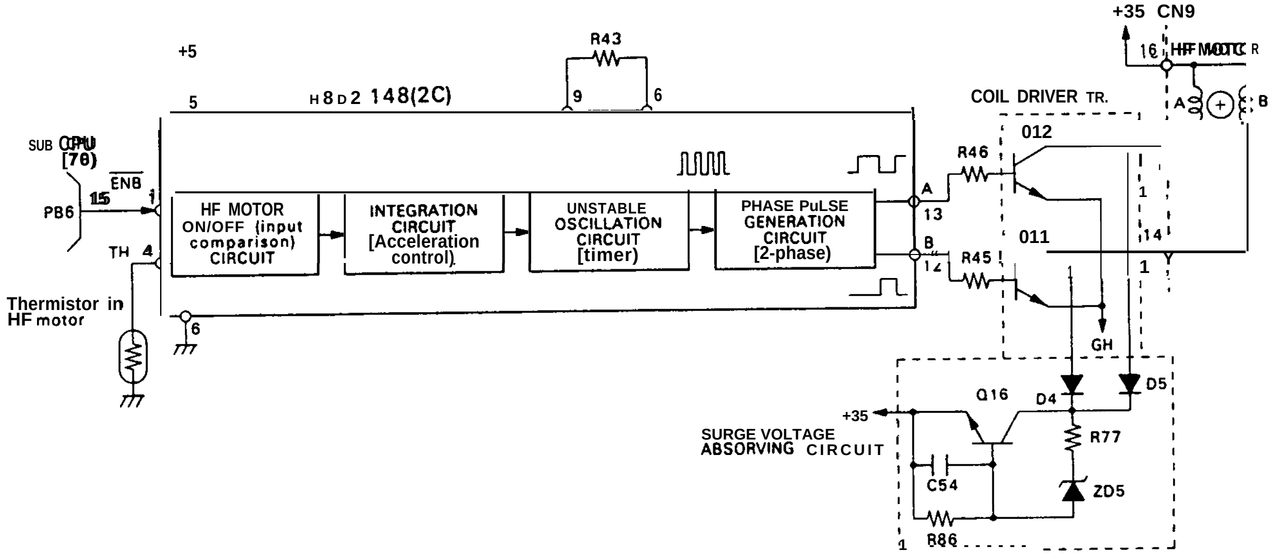


Figure 2-75. HF Motor Control/Drive Circuit

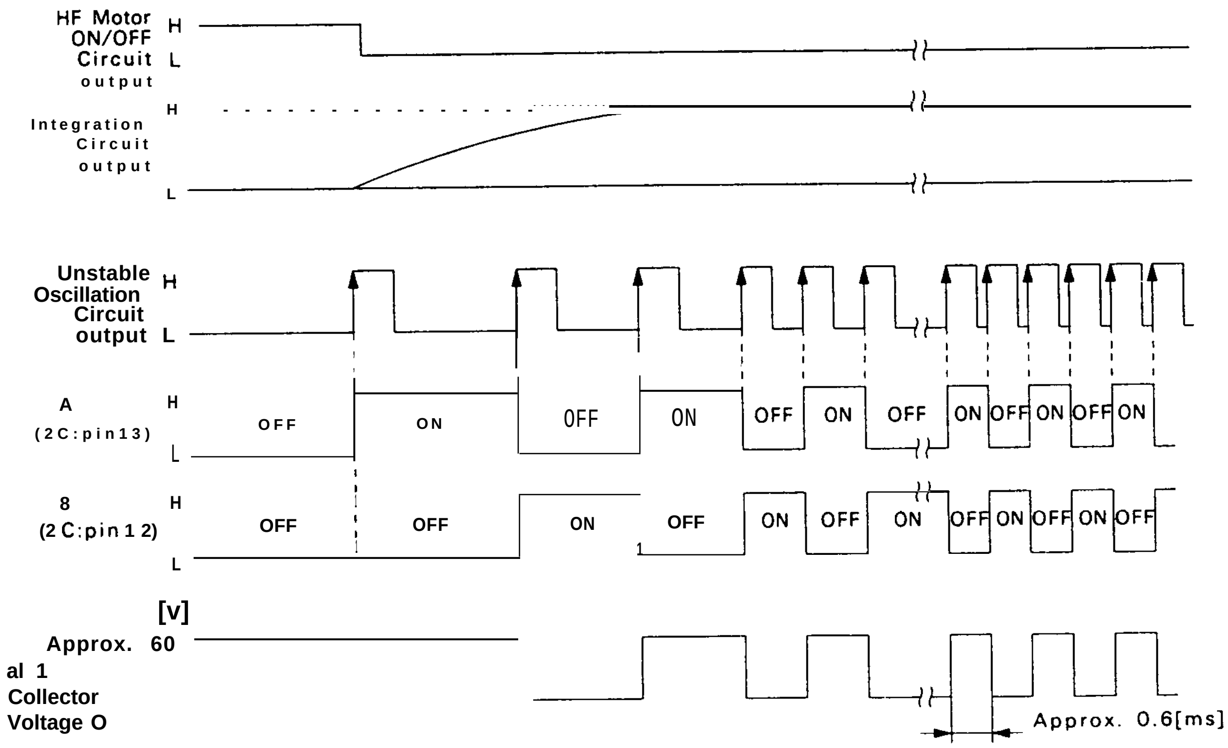


Figure 2-76. Motor Control/Drive Circuit Signal Timing

Control Circuit

The control circuit consists of hybrid IC H8D2 148 (2 C). This IC is divided into four blocks.

1. HF Motor ON/OFF Circuit

This circuit controls the ON/OFF switching of the HF motor using two inputs (ENB signal and HF motor thermistor resistance). The sub CPU sets the ENB signal LOW when the thermistor in the printhead detects a temperature of 40”C or higher. While the HF motor is on, the sub CPU monitors the temperature of the HF motor using a thermistor in the HF motor to prevent the motor coils from burning if the motor stops due to external noise (Refer to Table 2-5 1.).

Table 2-51. H8D2148 Input Signal and HF Motor Status

ENB	TH Terminal Voltage [V]	HF Motor Status	Note
H	—	OFF	
L	< 4.22	ON	Normal
	≧ 4.22	ON → OFF	HF motor abnormal heat generation occurs.
	≦ 4.15	OFF → ON	HF motor abnormal heat generation ends.

NOTE: Even when the HF motor is on, the motor will stop five seconds after the last print signal is received.

2. Integration Circuit

When the output from the HF motor ON/OFF circuit changes from HIGH to LOW, it is integrated by this circuit, and output to the block in the second stage. Acceleration control is performed using this integrated waveform.

3. Unstable Oscillation Circuit

This circuit generates the reference clock to execute phase switching for the HF motor. R43 is an oscillation frequency selection resistor. The frequency starts rising gradually at the leading edge of the integrated signal from the previous stage and stablizes at the set value (approx. 1600 Hz).

4. Phase Pulse Generation Circuit

This circuit generates the phase switching pulse for the 2-phase stepper motor. The phase switching pulse is synchronized with the clock pulse output from the previous stage.

Drive Circuit

The drive circuit consists of an HF motor coil drive transistor and surge voltage absorption circuit that absorbs the surge voltage output from the motor coil when the HF motor coil drive transistor changes from on to off. D4 and D5 are flywheel diodes, and ZD5 is a surge voltage consumption Zener diode.

2.3.7 CR and PF Motors Control/Drive Circuit

Figure 2-77 shows the CR and PF motors control/drive circuit block diagram. The CR and PF motors are controlled by the sub CPU (7 B). The stepper motor control gate array IC (M CU:4B) is memory-mapped into the address space of the sub CPU, allowing the stepper motor to be controlled by address selection ($\overline{MMIO1}$). The reference clock required to generate the phase switching pulses that drive the stepper motor is generated by a timer in the sub CPU. The TM 1 clock is output to the MMU via the TM 1 clock generation circuit, and the TM2 clock is directly output to the MMU (TM 1 and TM2 are for the CR motorand PF motor phase switching pulse generation, respectively). Based on these clocks, the MCU generates CR and PF motor phase switching pulses, drives stepper motor drivers IC S17304 (7C: CR motor) and STK698 1 H (7D: PF motor), and rotates the CR and PF motors. These motor driver ICs input a reference voltage that corresponds to the motor speed for the constant current control drive IC. The CR and PF motor constant current control is based on the reference voltage.

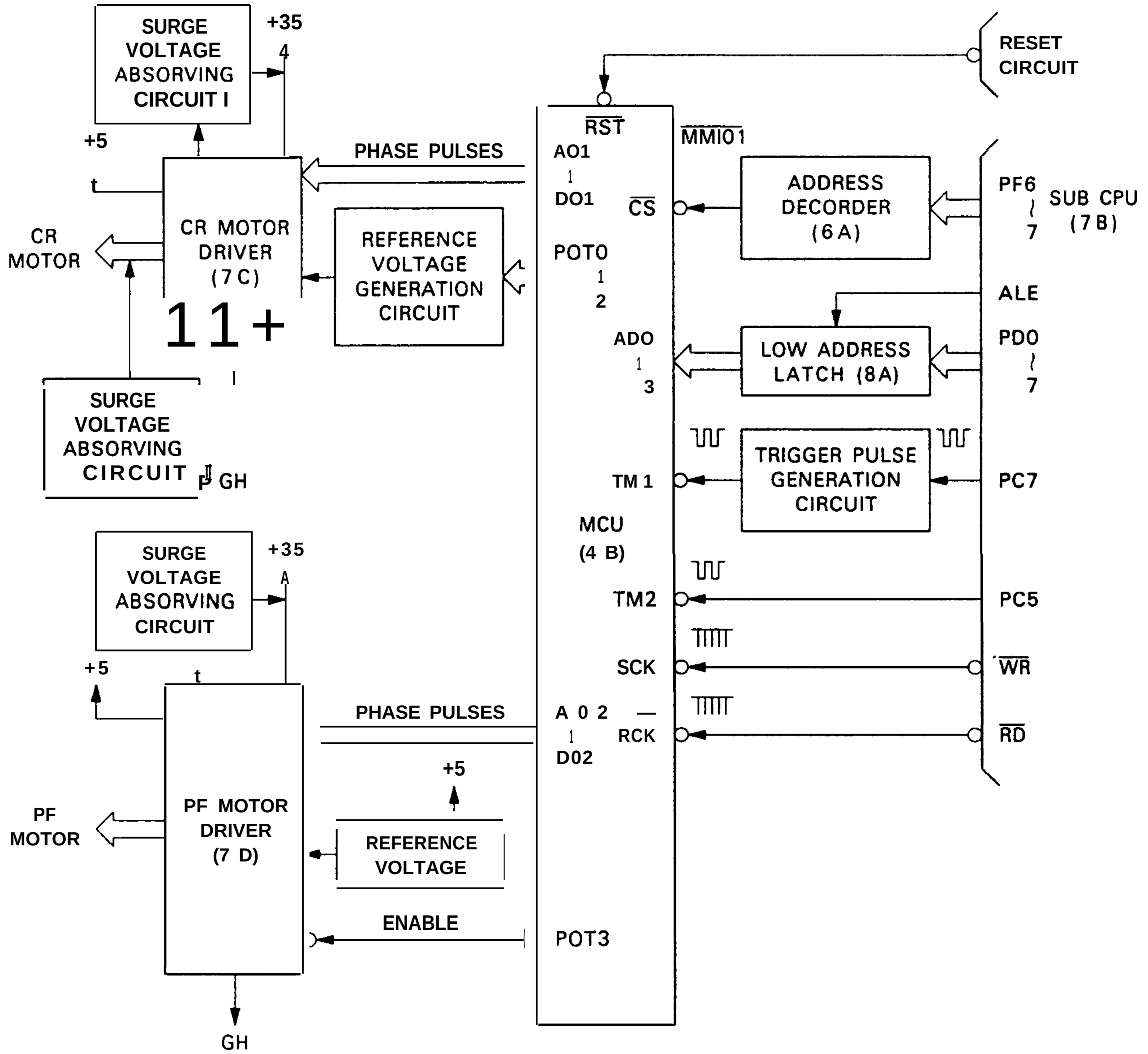


Figure 2-77. CR and PF Motors Control Circuit Block Diagram

2.3.7.1 E05A09BA Gate Array (MCU: 4B)

The MCU has two 4-phase stepper motor phase switching pulse generation circuits that can be controlled separately. Phase switching timing, motor forward rotation, reverse rotation, and holding, and the phase switching system are all controlled by the sub CPU. In addition to the above, the MCU can control three ports.

● Refer to Appendix A. 1.1.9 for details of the MCU.

The MCU (4B) goes active when address MMIO 1 is output by the sub CPU. However, the operating mode is selected by a combination of the low order (4-bit) address and the RD (RCK) or WR (SCK) signal. Table 2-52 shows these combinations.

Table 2-52. MCU (4B) Address Allocations

RST	CS	AD3	AD2	AD1	ADO	SCK	RCK	Function		Remark	
H	H	X	x	X	x	x	x	Changes nothing.			
	L	L	L	L	L	L	H	CR motor rotational direction	C.W.	Carriage	Left to righ
						H	L		C.C.W.		Right to lef
					H	L	H	CR motor phase switching	2-2		
						H	L		1-2		
				H	L	L	H	PF motor rotational direction	C.W.	Paper	Forward feeding
						H	L		C.C.W.		Reverse feeding
					H	L	H	PF motor phase switching	2-2		
						H	L		1-2	Not used	
			H	L	L	L	H	POTO selection	OUT = H		
						H	L		OUT = L	Selects R56.	
					H	L	H	POT1 selection	OUT = H		
						H	L		OUT = L	Selects R57.	
				H	L	L	H	POT2 selection	OUT = H		
						H	L		OUT = L	Selects R55.	
					H	L	H	POT3 selection	OUT = H		
						H	L		OUT = L	Enables IC (7 D).	
		H	L	L	L	L	H	A01 ~ D01 output logic	Positive logic	NPN	
						H	L		Negative logic	PNP (Not used)	
					H	L	H	Same as the RST signal input			
						H	L	Not used			
L	—		—	—	—	—	—	Resets the internal circuit and closes the output gate.			

NOTES: 1.X . . . Don't care.

2. When the printer power is on or when the LOW INIT signal is input the RST signal goes LOW.

2.3.7.2 CR Motor Control/Drive Circuit

The circuits included in the CR motor control/drive circuit are as follows.

TM1 Clock Generation Circuit

Figure 2-78 shows the TM 1 clock generation circuit and Figure 2-79 shows the timing for the sub CPU output signal and TM 1 signal. This circuit employs retriggerable IC LS 123 (5A). This IC generates the TM 1 signal that includes a constant LOW pulse width even when the frequency of the reference clock output from the TO terminal of the sub CPU changes (when acceleration, deceleration, or constant speed control is performed.) The LOW pulse width is set to approximately 25 [μs] by R25 and C 13.

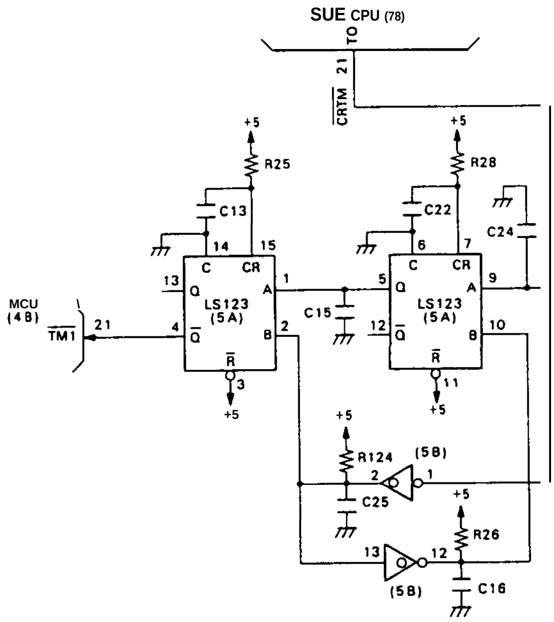
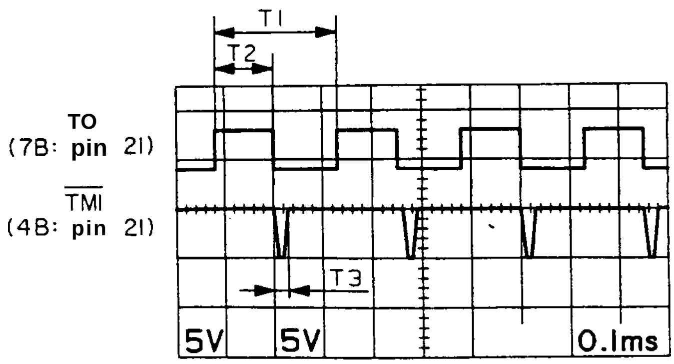


Figure 2-78. TM1 Clock Generation Circuit



NOTE: In the draft self test mode: T1 = 254 [μS], T2 = 123 [μS], T3= 2.5 [/4S]

Figure 2-79. Sub CPU Output Signal and TM1 Signal Timing

Reference Voltage Generation Circuit

Figure 2-80 shows the reference voltage generation circuit and Table 2-53 shows the relationship between each POT terminal state of the MCU and carriage speed. This circuit changes the voltage applied to the RS terminal of the CR motor driver IC S17304 (7C) using the combination of R55, R56, R57, and R 123 so that the current limiting value for the current flowing to a coil of the CR motor varies. The current limit is raised as the carriage speed increases by changing the voltage applied to the RX terminal.

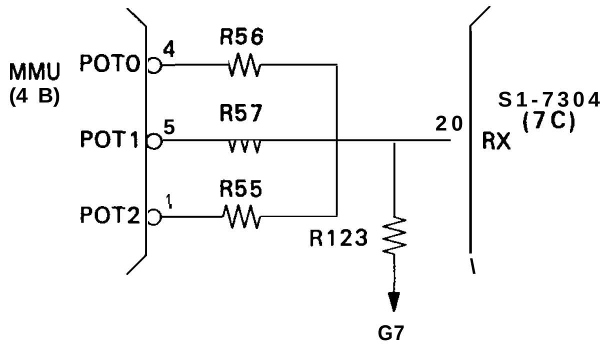


Figure 2-80. Reference Voltage Generation Circuit

Table 2-53. MCU POT Terminal States and Carriage Speed

RX Terminal Voltage	POT2	POT1	POT0	Mode	CR Motor Coil Current [A/Coil]	Carriage Speed Voltage
High	H	H	H	Driving	1.4 ± 0.1	Speed O or 1
↕	L	H	H		1.0 ± 0.1	Speed 2 or 3
	H	L	H		0.6 ± 0.1	Speed 4
Low	H	H	L	Holding	0.25	—

CR Motor Drive Circuit

Figure 2-81 shows the CR motor drive circuit. Figure 2-82 shows the CR motor drive circuit signal timing. This circuit employs unipolar stepper motor driver IC SI7304 (7 C), and drives the CR motor using constant current chopper type control. The chopper type control is performed by a separately-excited system. The +35 V power supply voltage is applied intermittently to the CR motor coil from ACcom and BCcom so that a mean voltage is applied to the CR motor coil, which keeps the CR motor current constant.

● Refer to Appendix A.1.I.12 for details of the SI7304.

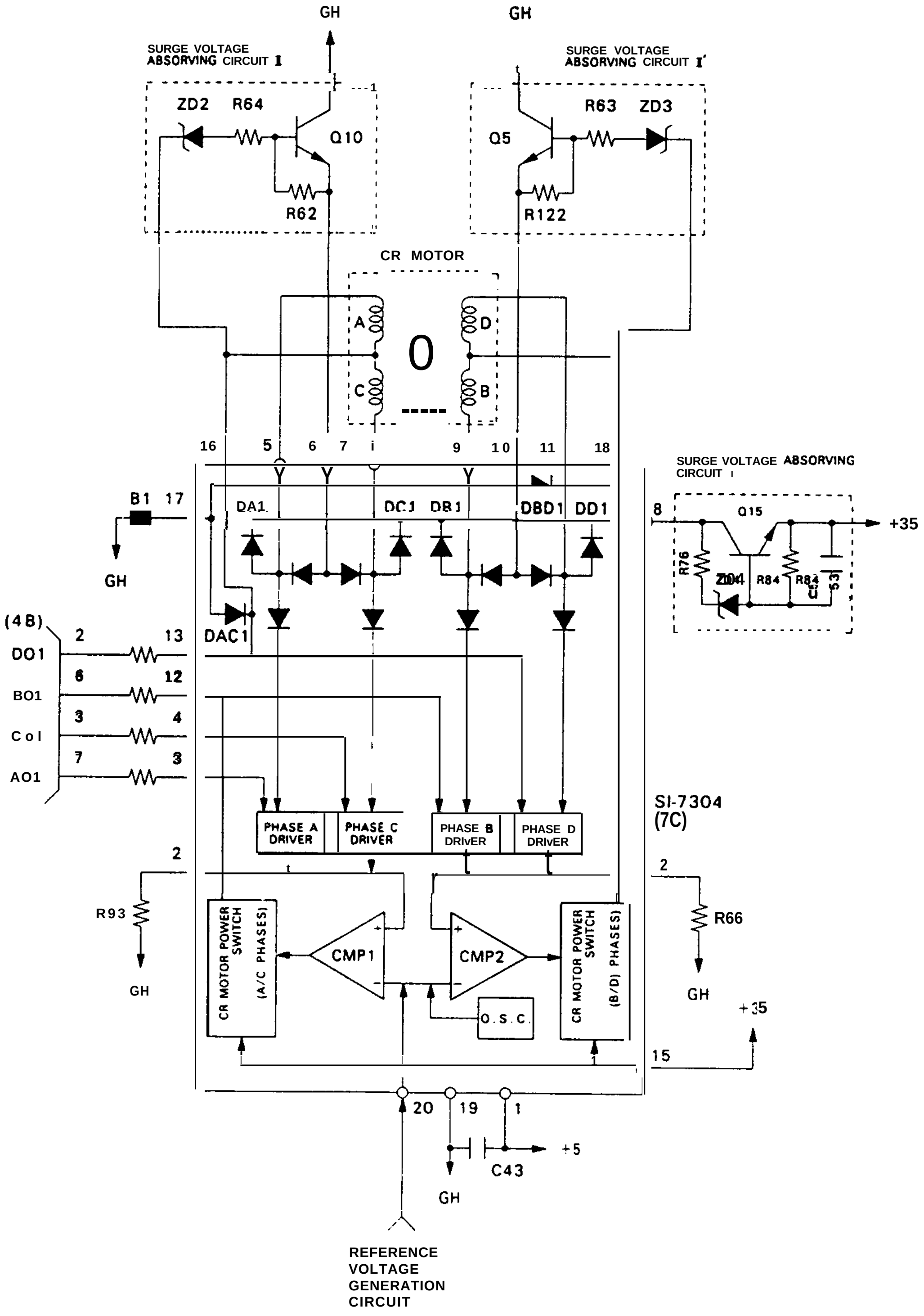
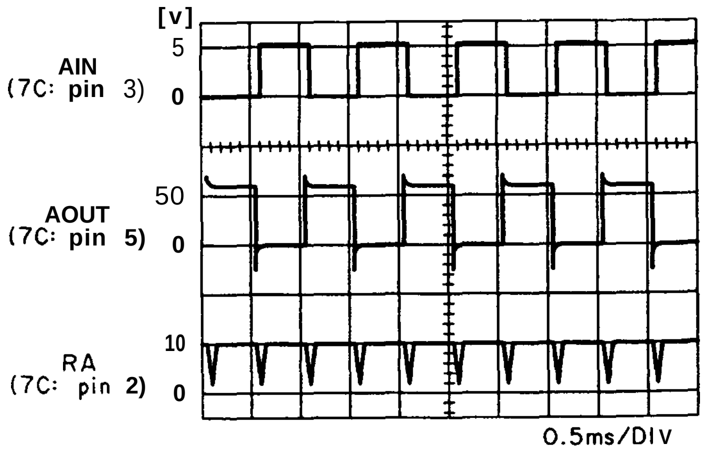


Figure 2-81. CR Motor Drive Circuit



NOTE: In the Draft self test mode:

Figure 2-82. CR Motor Drive Circuit Signal Timing

The blocks are as follows.

1. Phase Drivers (A to D)

These drivers are turned on and off upon receiving the drive pulses AO 1 to DO 1 from the MCU (4 B). When the input signal is HIGH, the corresponding phase driver turns on.

2. CMP1 and CMP2

CMP1 or CMP2 compares the reference voltage at the minus terminal with the voltage applied to the plus terminal, which is from the current detection resistor (R93 or R88). When the reference voltage is lower than the voltage across the current detection resistor, the output goes HIGH, and the voltage applied to AC_{COM} or BD_{COM} is shut off.

3. CR Motor Power Switches (A/C phase and B/D phase)

This switch is turned on and off upon receiving the output from CMP 1 (CMP2). When the output from CMP1(CMP2) is LOW, +35 V is applied to AC_{COM}(BD_{COM}).

4. O.S.C.

The O.S.C. generates a square wave which is used as the reference for chopper type driving (Pulse Width Modulation control).

5. Current Detection Resistors (R93 and R88)

Voltage is induced across the current detection resistor in proportion to the current that flows to the CR motor coil. This voltage is input to the plus terminal of CMP1(CMP2).

6. Reference Voltage Generation Circuit

The current applied to the CR motor coil is determined by the reference voltage applied to the minus terminal of CMP1(CMP2). (Refer to the section on Reference Voltage Generation Circuit.)

7. Surge Voltage Absorbing Circuit I

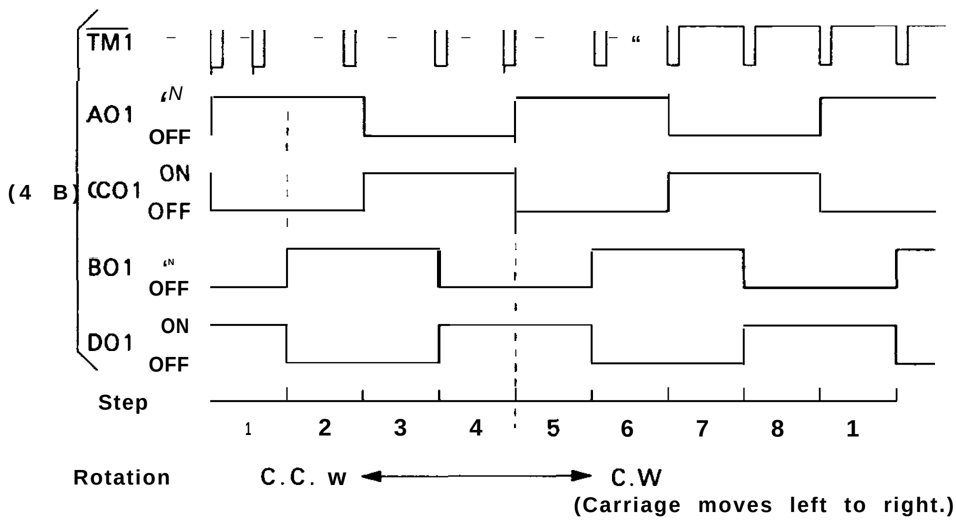
When the phase A driver or phase C driver (phase B driver or phase D driver) turns off, positive surge voltage is induced at the CR motor coil. This voltage is absorbed by ZD4 via fly wheel diode DA 1 or DC1(DB1 or DD1).

8. Surge Voltage Absorbing Circuit II (II')

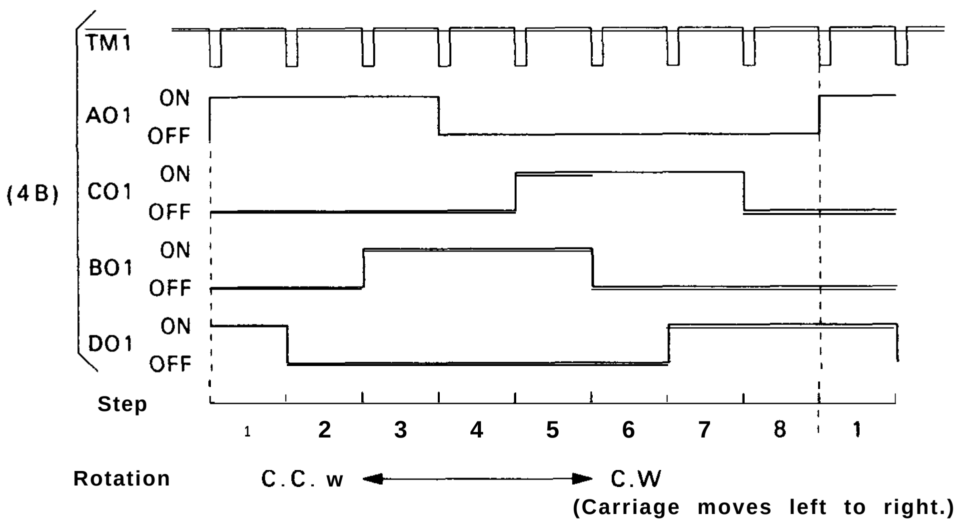
When the phase A driver or phase C driver (phase B driver or phase D driver) turns on, negative surge voltage is induced at the CR motor coil. This voltage is absorbed by ZD2(ZD3) via flywheel diode DAC 1 (DBD 1).

CR Motor Phase Switching System

The CR motor is a 4-phase stepper motor, and each phase is controlled by the corresponding terminal (AO1 to DO1) of the MCU (4 B). Two phase switching systems are used; 2-2 phase switching and 1-2 phase switching. One step of the 2-2 phase switching system corresponds to two steps of the 1-2 system. Figure 2-83 shows the CR motor phase switching timing. Table 2-54 shows the relationship between the CR motor speed and the phase switching system.



(a) 2 Phase Excitation



(b) 1-2 Phase Excitation

Figure 2-83. CR Motor Phase Switching Timing

Table 2-54. CR Motor Speed and Phase Switching System

Mode	Driving					Holding
Speed	o	1	2	3	4	
Phase Switching System	2-2		1-2			2-2
Carriage Speed [PPS]	4000	2667	2000	1333	667	—
Cycle [μs/step]	250	375	500	750	1450	
DPI [dot./inch]	60	90	120 (60)	180	360 (1 20,1 80)	
Print Mode (Major mode)	Draft	—	Condensed draft, Half speed draft	LQ	Half speed LQ	

NOTE: The carriage speed and cycle in the 1-2 phase switching system are converted to those in the 2-2 phase switching system.

Carriage Motion Area and *Speed Control*

The carriage motion area is shown in Figure 2-84. This is mainly divided into three areas: 1) acceleration area, 2) printable area, and 3) deceleration area. The printer has five carriage speeds modes.

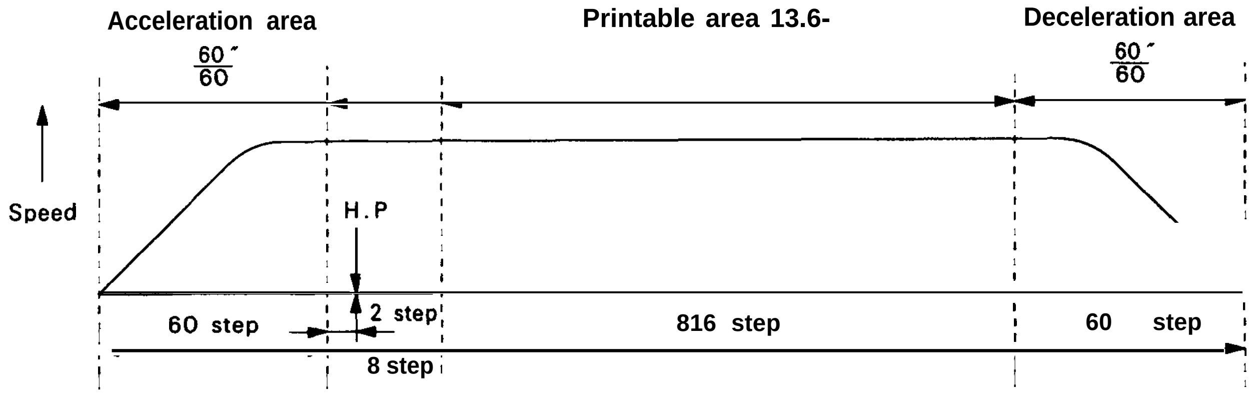


Figure 2-84. Carriage Motion Area

1. Acceleration Control

When the carriage speed is either O or 1, the carriage is accelerated for 60 steps using 2-2 phase switching. When the speed is 2, 3, or 4, the carriage is accelerated for 120 steps using 1-2 phase switching.

2. *Constant Speed Control*

Within the printable area, the carriage moves at a constant speed except when the logic seeking function is active. When the logic seeking function isactive, printing is performed after phase switching for 8 steps (speed O or 1) or 16 steps (speed 2, 3, or 4).

3. Deceleration Control

When the speed is O or 1, the carriage is decelerated for 60 steps using 2-2 phase switching. When the speed is 2, 3, or 4, the carriage is decelerated for 120 steps using 1-2 phase switching.

4. High Speed Skip

When spaces (20H) continue for 10 characters or more during text printing, high speed skipping (speed O = 4000 PPS) will be performed. This function is shown in Figure 2-85 and is used to shorten the printing time.

a) Acceleration control:	When shifting to the high speed skip mode from the 1-2 phase switching at speed 2, 3, or 4, the current setting value is changed to that of speed O and the switching system is changed to 1-2 phase switching.
b) Constant speed control:	The carriage is moved at 4000 PPS.
c) Deceleration control:	When returning to the 1-2 phase switching at speed 2, 3, or 4 from the high speed skip mode, the switching system is changed from 2-2 to 1-2 after deceleration control is performed in the 2-2 phase switching mode. At this time, a margin for one character is used.

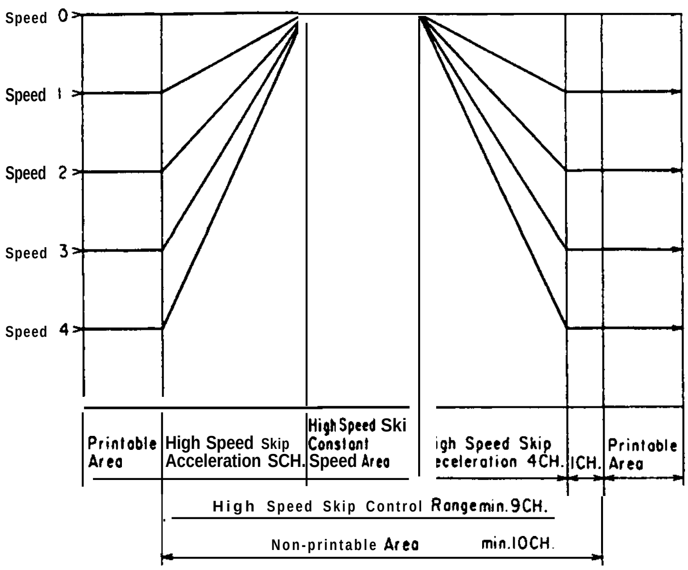


Figure 2-85. High Speed Skip

2.3.7.3 *PF Motor Control/Drive Circuit*

The PF motor is driven only by the 2-2 phase switching system, and the minimum paper feeding amount s 1/360 inch. Table 2-55 shows the various PF motor control relationships.

Table 2-55. Various PF Motor Control Relationships

Mode	**PF** *Motor Coil Current [A/Coil]*	*Paper Feeding Amount [Inches]*	*Acceleration/ Deceleration Control*	*Remark*
Holding	0.07 ± 0.01	—	—	—
Driving	**0.8 ± 0.1**	**≦ 46/360**	**Not performed.**	**Constant speed control:290 [PPS]**
		≧ 46/360	**Performed.**	**At constant speed: 1440 [PPS]**

PF Motor Drive Circuit

Figure 2-86 shows the PF motor drive circuit and Figure 2-87 shows the PF motor drive circuit signal timing. This circuit employs unipolar stepper motor driver IC STK6981 H (7D) and drives the PF motor using constant current chopper type control. The chopper type control is performed by a self-excitation system using the reactance in the PF motor coil. The +35 V power supply voltage is applied intermittently to the PF motor coil from ACCOM and BCCOM so that a mean voltage is applied to the PF motor coil to keep the PF motor coil current constant.

- **Refer to Appendix A.1.1.11 for details of the STK6981 H.**

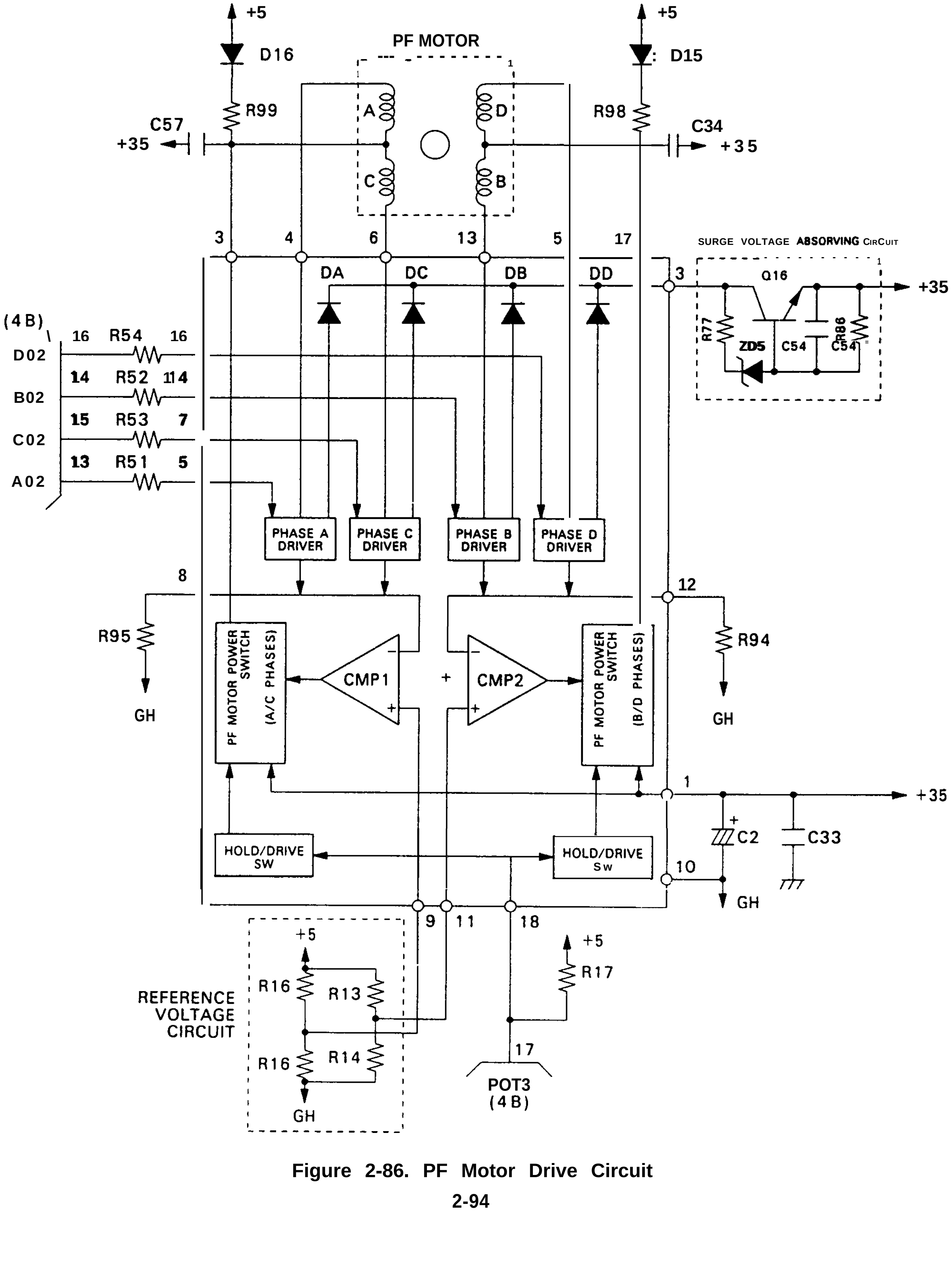
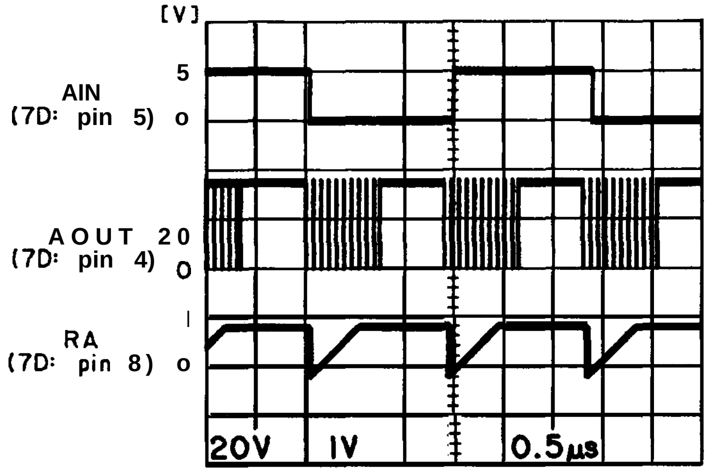


Figure 2-86. PF Motor Drive Circuit



NOTE: During form feeding.

Figure 2-87. PF Motor Drive Circuit Signal Timing

Each block in the PF motor drive circuit is described below.

1. *Phase Drivers (A to D)*

These drivers are turned on and off upon receiving the drive pulses A02 to D02 from the MCU (4 B). When the input signal is HIGH, the corresponding phase driver turns on.

2. PF *Motor Power Switches (A/C phase and B/D phase)*

This switch is turned on and off upon receiving the output from CMP 1 (CMP2). When the output from the CMP1(CMP2) is HIGH, +35 V is applied to AC_{COM} (BD_{COM}).

3. Current Detection Resistors (R95 end R94)

Voltage is induced across the current detection resistors in proportion to the current that flows to the PF motor coil. The voltage is input to the minus terminal of CMP1(CMP2).

4. *Reference Voltage Circuit*

The current applied to the PF motor coil is determined by the reference voltage applied to the plus terminal of CMP1 or CMP2.

5. **CMP1** *and* **CMP2**

CMP 1 or CMP2 compares the reference voltage at the plus terminal to the voltage applied to the minus terminal, which is from the current detection resistor (R95 or R94). When the reference voltage is lower than the voltage across the current detection resistor, the output goes LOW.

6. *Surge Voltage Absorbing Circuit*

When a phase driver changes from on to off, a surge voltage is induced due to reactance in the motor coil. This voltage is absorbed by ZD5 via flywheel diode DA or DC (DB or DD).

7. Driving/holding Control

Driving and holding of the PF motor is controlled by the POT3 terminal of the MCU (4 B). When the output at the terminal is HIGH, the motor is held, and when it is LOW, the motor is driven. When the motor is held, the PF motor power switch turns off, and + 5 V is applied to AC_{COM}(BD_{COM}) via D 16 and R99 (D15 and R98).

PF Motor Phase Switching Timing

The PF motor is a 4-phase stepper motor, and each phase is controlled by the corresponding terminal (A02 to D02) of the MCU (4 B). The 2-2 phase switching system is employed. Figure 2-88 shows the PF motor phase switching timing.

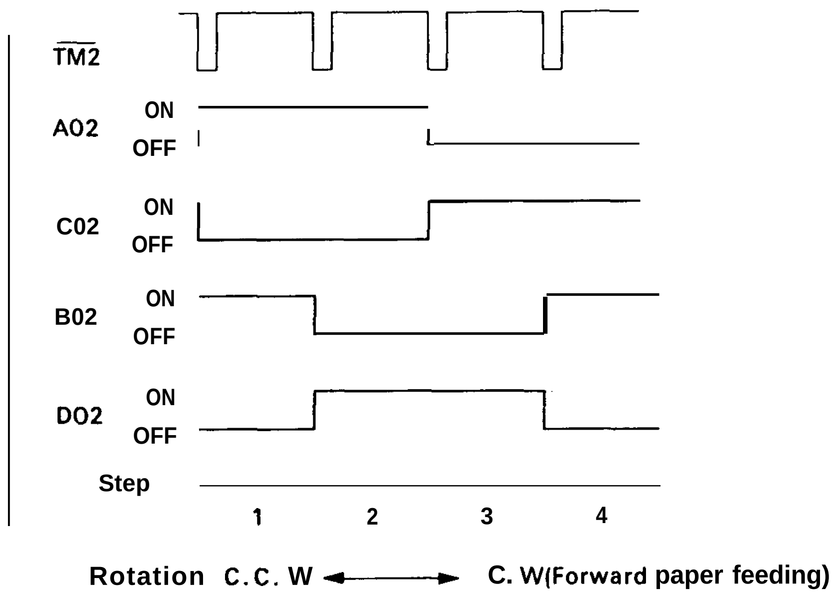


Figure 2-88. PF Motor Phase Switching Timing

2.3.8 PG and CS Motors Control/Drive Circuits

Figure 2-89 shows a block diagram of the PG motor and CS motor drive circuits.The MCU (3B) is mapped into the sub CPU address space, and the PG and CS motors are controlled from the sub CPU by sending commands to the MCU (3 B).The reference clock required to generate phase switching pulses for the stepper motor drive is generated by the timer within the sub CPU, which generates the phase switching pulses for the PG and CS motor drive circuits by sending commands to the MCU.
The PG and CS motors are driven using constant voltage.

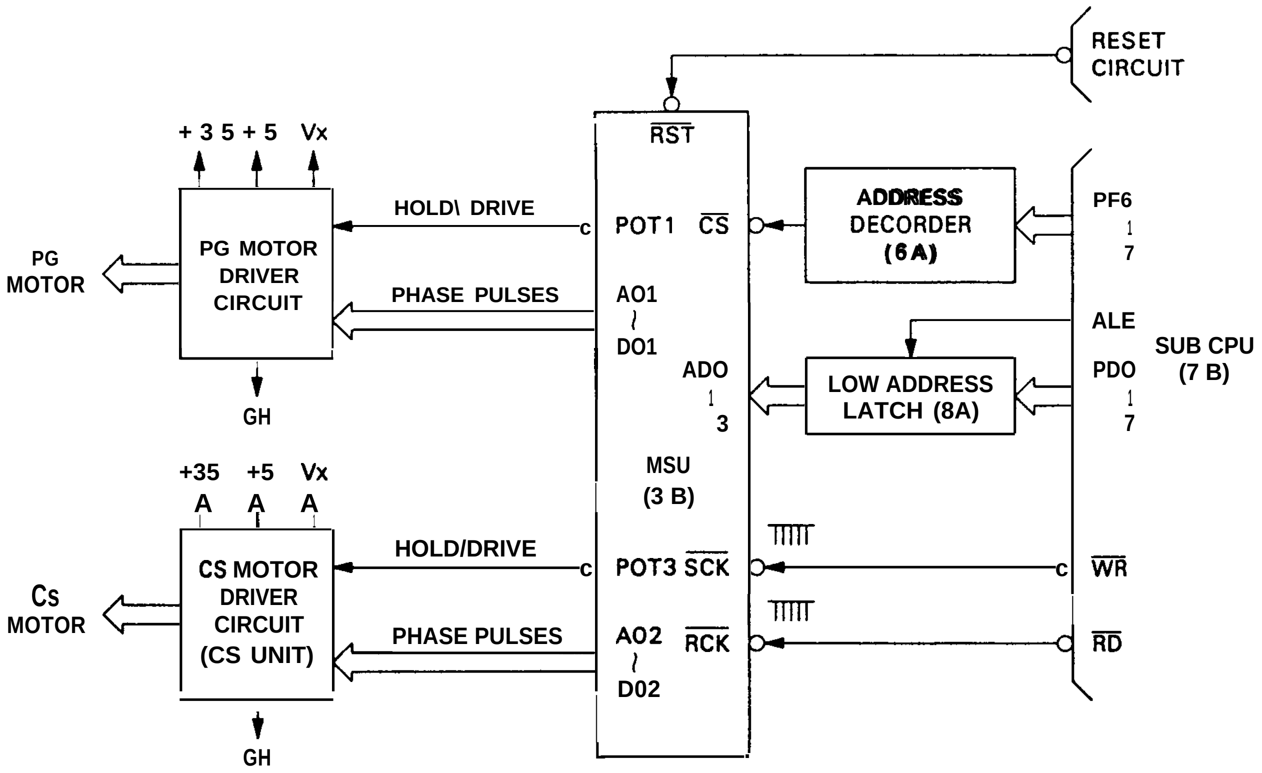


Figure 2-89. PG and CS Motors Drive Circuits Block Diagram

2.3.8.1 **E05A09BA** *Gate Array* **(MCU: 3B)**

The E05A09BA gate array has the same functions as the MCU (4B) described in Section 2.3.7.1. This MCU (3B) is accessed when address $\overline{MMIO2}$ is selected by the sub CPU. Table 2-56 lists the address assignments for the MCU (3 B).

- **See A. 1.1.9 in Appendix for details of the MCU.**

Table 2-56. MCU (3B) Address Assignments

$\overline{RST}$	$\overline{CS}$	AD3	AD2	AD1	ADO	$\overline{SCK}$	$\overline{RCK}$	Function		Remark
H	H	x	x	x	x	X	X	No change		
	L	L	L	L	L	L	H	PG motor rotation direction	C.W	Platen gap: Narrow to wide
						H	L		C.C.W.	Platen gap: Wide to narrow
					H	L	H	PG motor phase switching	2-2	
						H	L		1-2	Not used
				H	L	L	H	CS motor rotation direction	C.W.	Ribbon Color: Y → M → C → B
						H	L		C.C.W.	Ribbon Color: B → C → M → Y
					H	L	H	CS motor phase switching	2-2	
						H	L		1-2	Not used
			H	L	L	L	H	POTO selection	OUT = H	Pull-up (Not used)
						H	L		OUT = L	
					H	L	H	POT1 selection	OUT = H	PG motor hold
						H	L		OUT = L	PG motor drive
				H	L	L	H	POT2 selection	OUT = H	Pull-up (Not used)
						H	L		OUT = L	
					H	L	H	POT3 selection	OUT = H	CS motor hold
						H	L		OUT = L	CS motor drive
		H	L	L	L	L	H	AO1 to DO1 output logic	Positive logic	NPN
						H	L		Negative logic	PNP (Not used)
					H	L	H	Same as the RST signal input		
						H	L	Not used		
L	—	—	—	—	—	—	—	Resets the internal circuit reset and disables the output		

NOTES: 1. X: Not defined.

2. When the power is first applied or when $\overline{INIT}$ goes LOW, $\overline{RST}$ goes LOW.

2.3.8.2 PG Motor Drive Circuit

Figure 2-90 shows the PG motor drive circuit and Figure 2-90 shows the signal timing.

The PG motor is driven using only 2-2 phase switching and regulated +35 VDC. Table 2-57 lists the relationships between various CS motor control factors.

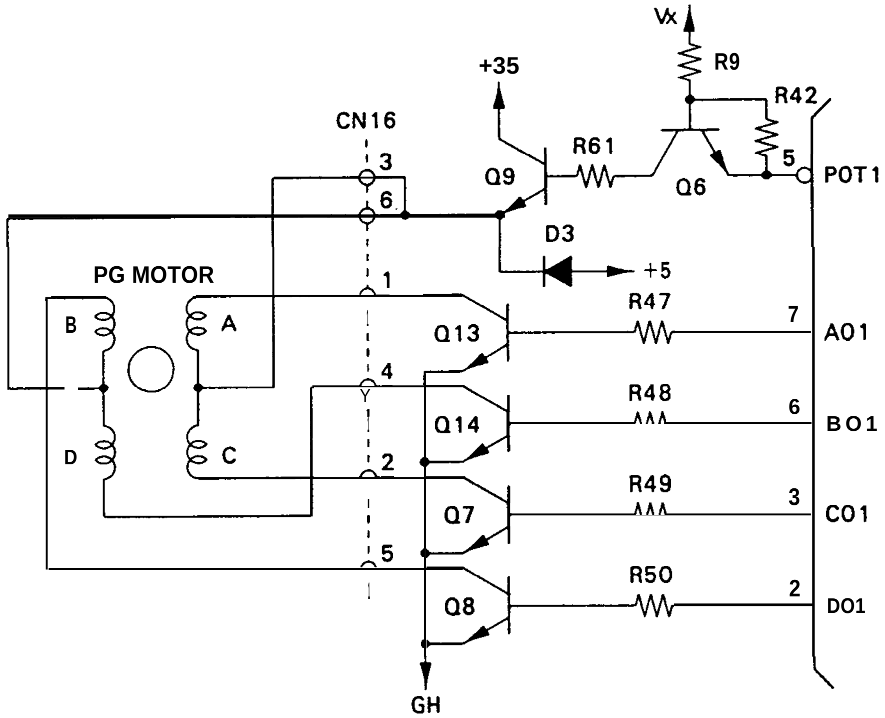


Figure 2-90. PG Motor Drive Circuit

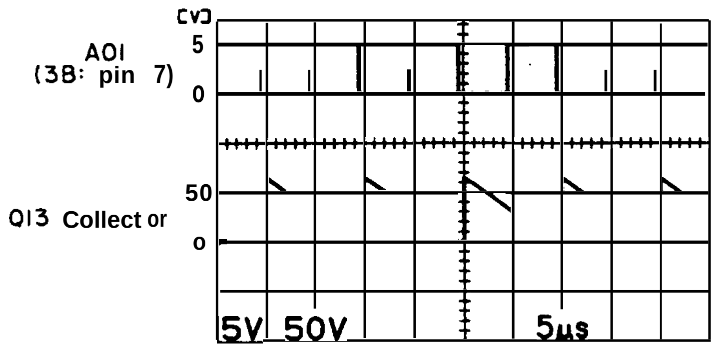


Figure 2-91. PG Motor Drive Circuit Signal Timing

Table 2-57. Motor Control Factors

MCU (3B)	PG motor		Remarks
POT1	Applied Voltage [V]	State	
High	5	Hold	
Low	35	Drive	Constant speed 400 [PPS]

PG Motor Phase Switching Timing

The PG motor is a 4-phase stepper motor, and the phases are controlled by MCU(3B) terminals AO1 to DO 1. 2-2 phase switching is used for this motor. Figure 2-92 shows the PG motor phase switching timing.

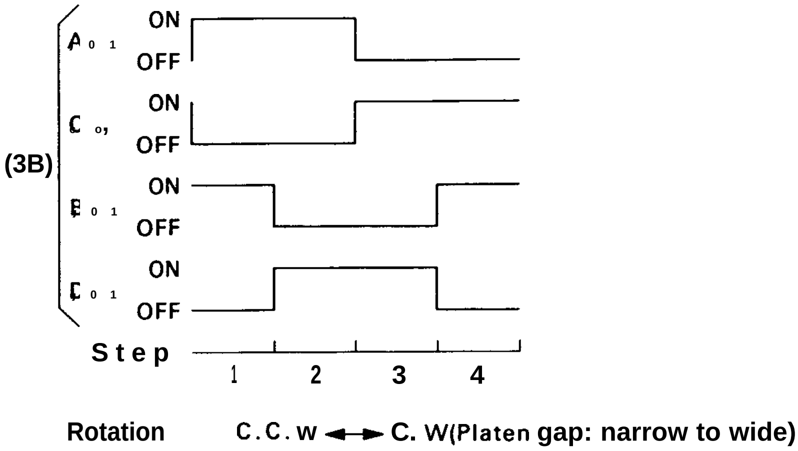


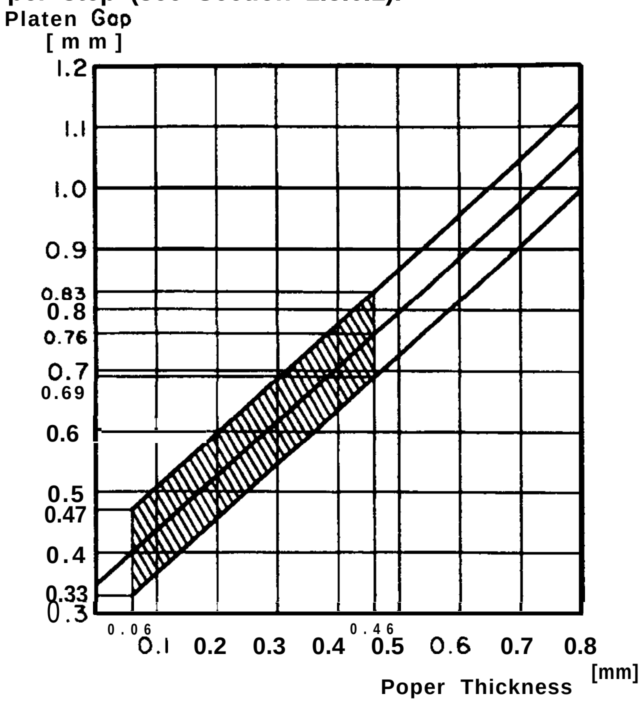
Figure 2-92. PG Motor Phase Switching Timing

Relationship Between Platen Gap and Papar Thickness

The paper thickness value detected by the PT sensor is processed by the sub CPU(7B), which rotates the PG motor to obtain the proper platen gap (see Section 2.1 .2.2).

During initialization after power is applied, the PG motor is driven to set the platen gap, starting from the platen gap home position determined by the PG HP sensor (1.2 mm from the platen). The PG motor increments or decrements the platen gap in steps of 0.0014 mm. Figure 2-93 shows the relationship between paper thickness and platen gap.

If the control panel is set, a total of 10 steps of fine adjustment can be manually performed on the platen gap value with 0.014 mm per step (see Section 1.8.6.1).



NOTE: **The above figures include no manual adjustments.**

Figure 2-93. Paper Thickness and Platen Gap

2.3.8.3 CS Motor Drive Circuit

CS Motor *Drive Circuit*

Figure 2-94 shows the CS motor drive circuit and Table 2-58 lists the related factors for CS motor control. The CS motor is driven using only 2-2 phase switching and regulated +35 VDC.

In this printer, the color ribbon can be switched at every 40 steps (Refer to Figure 2-1 3.) from the color home position, and the CS motor has an adjustable speed control.

The CS motor drive circuit supplies regulated voltage to control the motor.

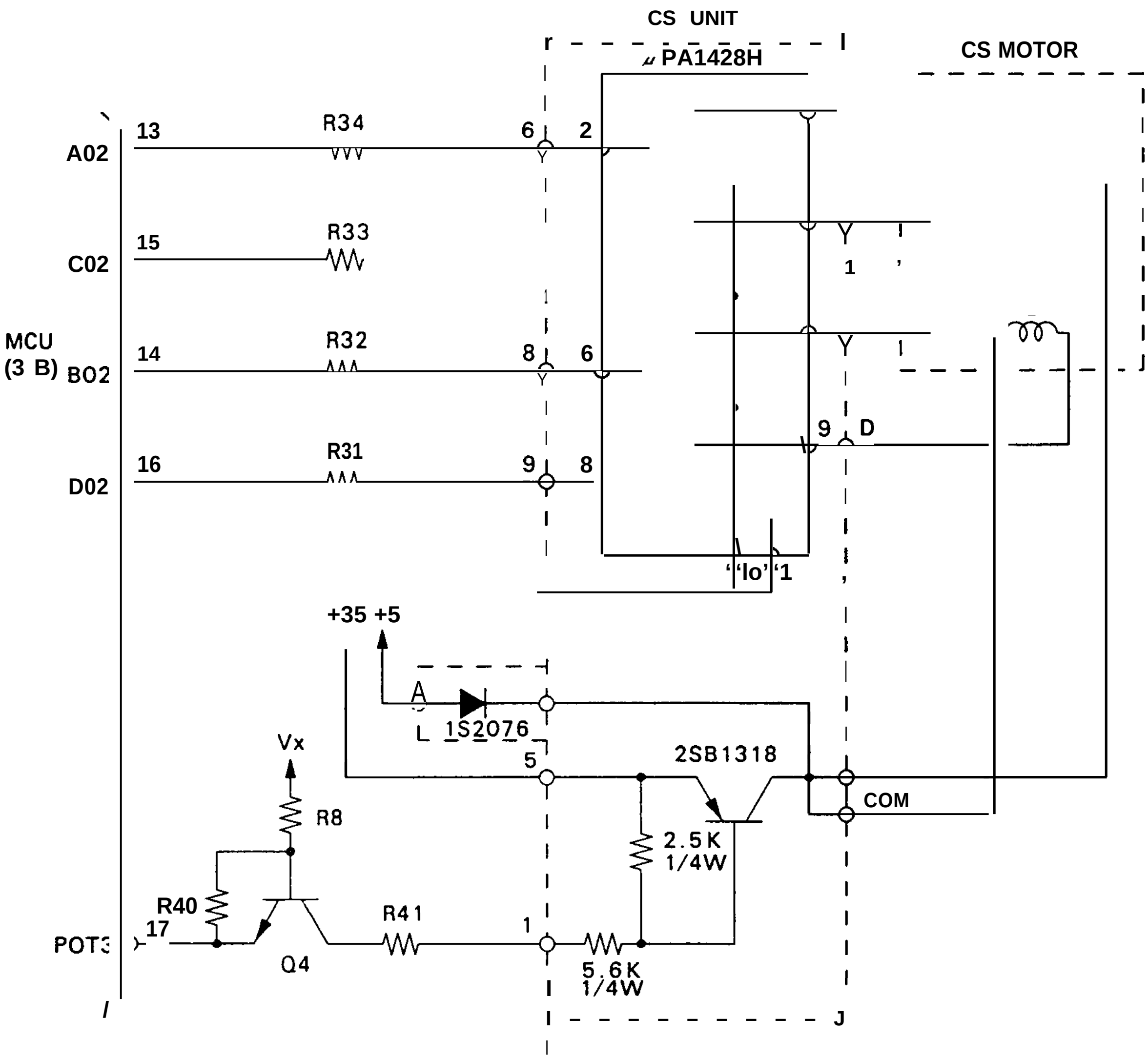


Figure 2-94. CS Motor Drive Circuit

Table 2-58. Related Factors for CS Motor Control

MCU (3B)	PG motor		Remarks
POT3	Applied voltage [V]	State	
High	5	Hold	
Low	35	Drive	Adjustable speed control is possible. For constant speed, 450 [PPS]

CS Motor Phase Switching Timing

The CS motor is a 4-phase stepper motor, and the phases are controlled by MCU(3B) terminals A02 to D02. 2-2 phase switching is used for controlling this motor. Figure 2-95 shows the CS motor phase switching timing.

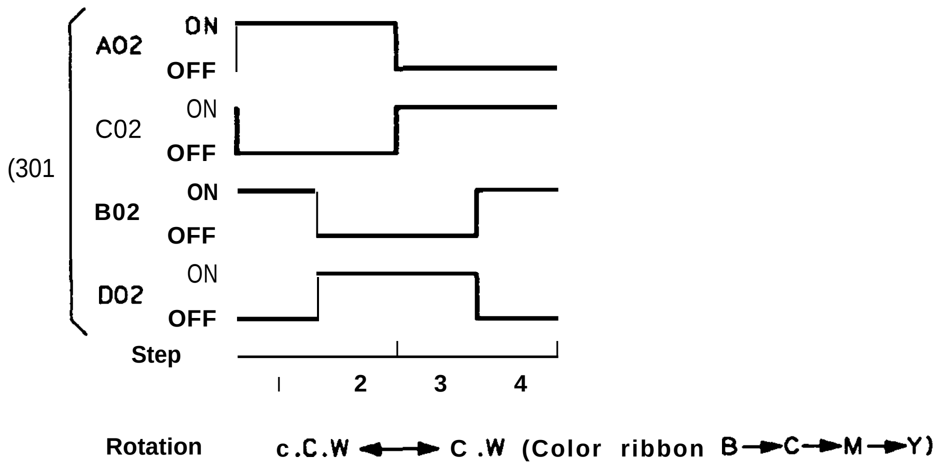


Figure 2-95. CS Motor Phase Switching Timing

Color Ribbon Switching Control

When power is applied, a color home position seek is performed. This operation mechanically determines the color home position by rotating the CS motor counterclockwise for 150 steps(120 steps are used for actual movement.). (120 - 150 + n steps cannot be adjusted. See Figure 2-1 3.)

The ribbon color is switched in the sequence black → cyan → magenta → yellow for every 40 steps starting from the color home position.

2.3.9 PT/RL/LD Solenoid Drive Circuit

Figure 2-96 shows the PT/RL/LD solenoid drive circuit, Table 2-59 lists the related factors for PT/RL/LD solenoid control, and Figure 2-96 shows the PTsolenoid drive circuit pulse timing.
Each solenoid drive circuit is turned on and off directly by the sub CPU (7 B).

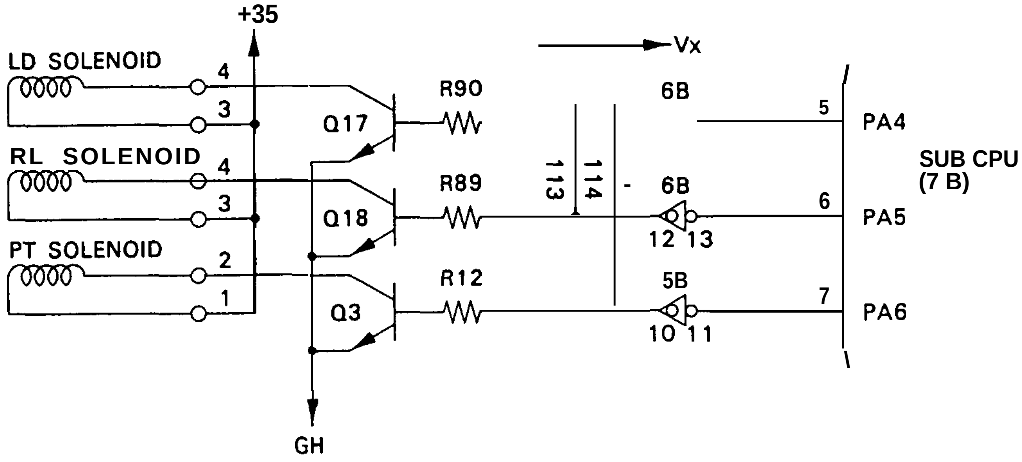


Figure 2-96. **PT/RL/LD** *Solenoid Drive Circuit*

Table 2-59. Related Factors for **PT/RL/LD Solenoid Control**

Solenoid	*Sub CPU control port*		*Solenoid state*
PT	**PA6**	**HIGH**	**Not driven**
		LOW	**Driven (35 [V])**
RL	**PA5**	HIGH	**Not driven**
		LOW	**Driven (35 [V])**
LD	**PA4**	**HIGH**	**Not driven**
		LOW	**Driven (35 [V])**

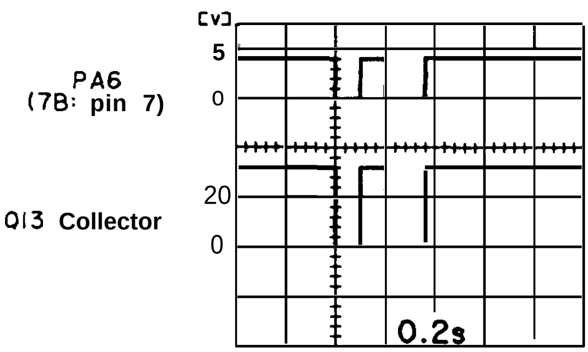


Figure 2-97. PT Solenoid Drive Circuit Pulse Timing

2.3.10 Buzzer Drive Circuit

This printer uses a piezo-buzzer to confirm control panel switch input and indicate errors. Figure 2-98 shows the buzzer drive circuit and Figure 2-99 shows the its pulse timing.

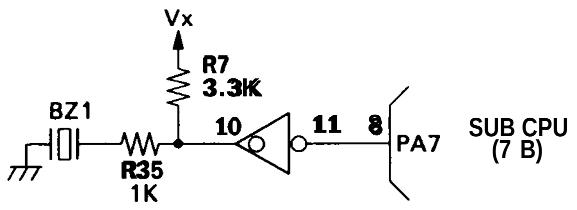
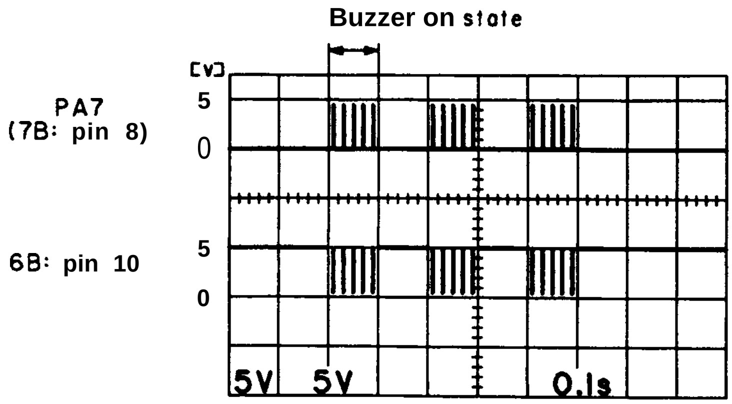


Figure 2-98. Buzzer Drive Circuit



Buzzer sounds when there is no paper.

Figure 2-99. Buzzer Drive Circuit Pulse Timing

2.3.11 Initialization Sequence

Figure 2-100 shows the initial sequence from power-on to printing operation.

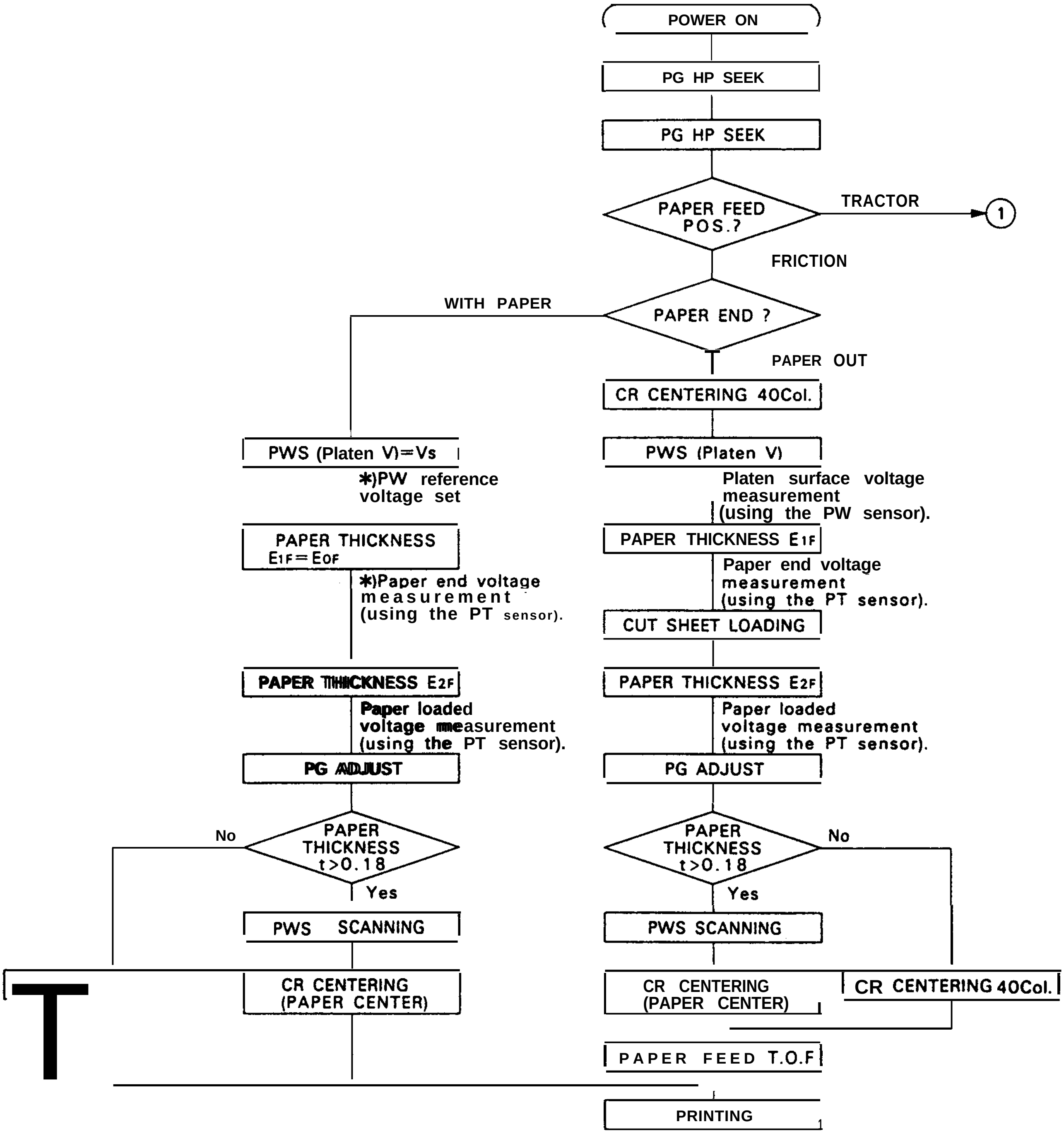
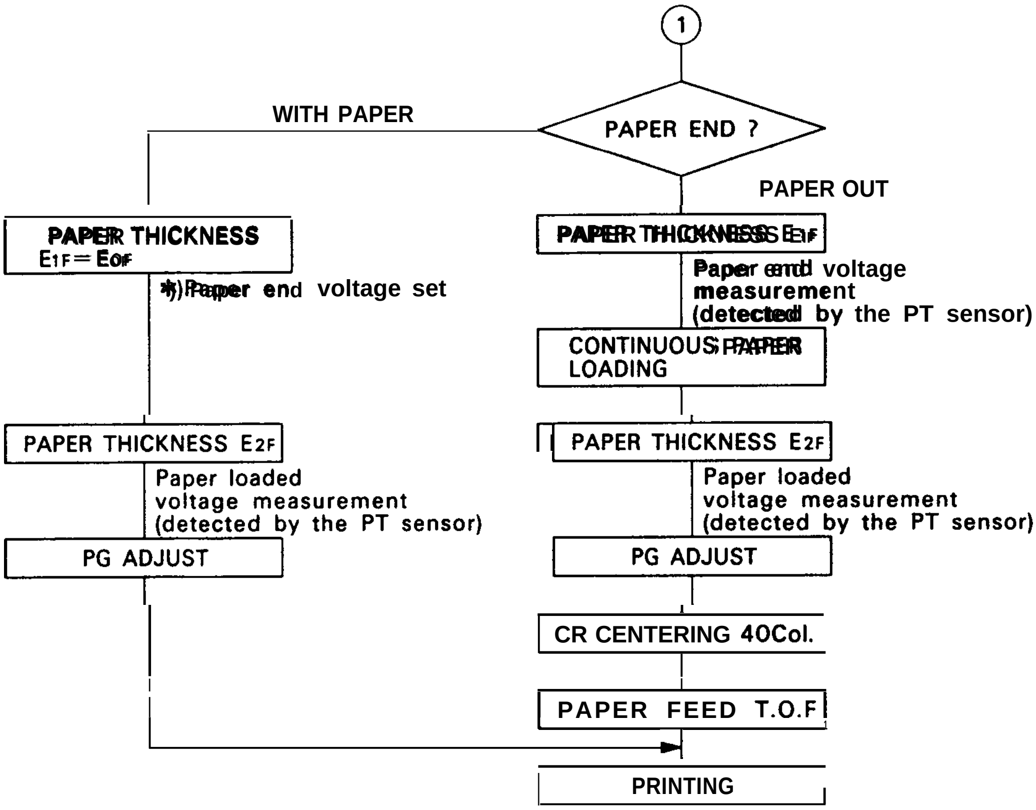


Figure *2-100. Printer Mechanism Initialization Sequence 1*

*NOTES: *1:* **For the setup operations marked with a *), use the value stored in the back-up memory.**

***2: The platen gap detected by the PW sensor is converted into voltage Vs.**

The sub CPU detects the paper end by comparing Vs with 2 X Vs.



NOTE: **For the setup operations marked with a *), use the value stored in the back-up memory.**

Figure 2-101. Printer Mechanism Initialization Sequences 2

CHAPTER 3
OPTIONAL EQUIPMENTS

LIST OF TABLES

3.1 GENERAL

This chapter describes the options available for the LQ-2550.

3.2 OPTIONAL INTERFACES

The LQ-2550 uses the 8100 series optional interfaces. The main optional interfaces are listed in Table 3-1.

Table 3-1. Optional Interfaces

	Cat. No.	Description			
Standard Parallel Interfaces		Buffer Size	Function		
	#8 172	32K	32 K-byte buffer parallel interface		
	#8 172M	128K	128 K-byte buffer parallel interface		
		Buffer Size	Flag Control	X-ON/OFF Control	Max. Bit Rates (BPS)
RS-232C	#8 143=	None	o	0	19200
	#8 145	2K	o	x	9600
	#8 148	2K/8K	o	0	19200
Current Loop	#8 149	32K	o	0	19200
	#8 149M	128K	o	0	19200
		Buffer Size	Function	Listen Only Operation	Address Operation
IEEE-488	#816 1	None	L	x / 0	o
(GP-IB)	#8165	2K/8K	AH,L,DC	o	0

O... Available X ... Not available *... Refer to section 3.2.1.

NOTES: 1. Refer to the "Optional Interfaces Technical Manual" for details,
2. When optional interface is used, DIP switches 2-3 and 2-4 should be set at OFF. This means that the printer interface is set to the parallel interface.

3.2.1 8143 Interface Board

When the RS-232C and 20 mA neutral current loop are in use, the printer will also support the 8143 new serial interface.

Specifications

Synchronization	Asynchronous
Bit rate	75 to 19,200 BPS
Word length	
Start bit	1 bit
Data bit	7 or 8 bit*
Parity bit	Odd, Even or Non-parity'
Stop bit	1 bit or more
Signal level (EIA level)	
RS-232C	MARK = logical "1"' (–3 to –27 V)
	SPACE = logical "O" (+3 to +27 V)
Current loop	MARK = logical "1" (current ON)
	SPACE = logical "O" (current OFF)
Handshaking	By REV (DTR) signal or X-ON/X-OFF code
	(Signal polarity can be inverted by jumper setting.)

* Can be selected by DIP switch setting on the 8143 board.

NOTE: The parallel interface cable, if connected, should be disconnected before using the 8143 board because parallel interface input is used to read jumper settings and DIP switch status.

Jumper Settings

Table 3-2 shows the 8143 interface jumper settings.

Table 3-2. 8143 Jumper Settings

	Function				
J1	ON: "TTY TXD" is pulled up to + 12V through 470 ohm resistor.				
J2	ON: "TTY TXD RET" is connected to signal ground.				
J3	ON: "TTY RXD" is pulled up to + 12V through 470 ohm resistor.				
J4	ON: "TTY RXD RET" is connected to signal ground.				
J5	ON: "DTR and DCD" are pulled up to + 12V through 4.7K ohm resistor.				
JRS	Selects input signal level	ON	RS-232C level	OFF	Current loop level
JC		OFF		ON	
JNOR	Selects polarity to disable data entry	ON	MARK (RS-232C) SPACE (Current loop)	OFF	SPACE (RS-232C) MARK (Current loop)
JREV		OFF		ON	
JF	Selects TTY TXD function	ON	Outputs DTR flag	OFF	outputs X-ON/X-OFF signal
JX		OFF		ON	

DIP Switch Settings

Table 3-3 shows the 8143 DIP switch **settings, and Table 3-4 lists the bit rates selected by the DIP switch settings. When a standard 8-bit parallel interface is used instead of the 8143 I/F board , DIP switch 1-8 should be turned off.**

Table 3-3. DIP Switch Settings

DIP SW No.	Function	ON	OFF
1-1 (JB3)	Bit rate selection	See Table 3-4.	
1-2 (J8/7)	Data length selection	7 bits	8 bits
1-3 (JB 1)	Bit rate selection	See Table 3-4.	
1-4 (JB2)	Bit rate selection	See Table 3-4.	
1-5 (JO/E)	Parity selection	Even	Odd
1-6 (JPDS)	Parity selection	Enabled	Disabled
1-7 (JB4)	Bit rate selection	See Table 3-4.	
1-8 (P/S)	# 8143 I/F selection	Enabled	Disabled

Table 3-4. Bit Rate Selection

Bit Rate (BPS)	SW1-7 (JB4)	SW1-1 (JB3)	SW1-4 (JB2)	SW1-3 (JB1)	Bit Rate (BPS)	SW1-7 (JB4)	SW1-1 (JB3)	SW1-4 (JB2)	SW1-3 (JB1)
75	ON	ON	ON	ON	1,800	OFF	ON	ON	ON
110	ON	ON	ON	OFF	2,400	OFF	ON	ON	OFF
134.5	ON	ON	OFF	ON	4,800	OFF	ON	OFF	ON
150	ON	ON	OFF	OFF	9,600	OFF	ON	OFF	OFF
200	ON	OFF	ON	ON	19,200	OFF	OFF	ON	ON
300	ON	OFF	ON	OFF	19,200	OFF	OFF	ON	OFF
600	ON	OFF	OFF	ON	19,200	OFF	OFF	OFF	ON
1,200	ON	OFF	OFF	OFF	19,200	OFF	OFF	OFF	OFF

NOTE: **In the current loop operation, normal data transfer cannot be guaranteed at a bit rate greater than 1200 BPS.**

Handshaking Timing

The handshake controls are shown in Table *3-5.*

Table 3-5. 8143 Handshaking Control

Transmission	Flag	X-ON/OFF Control
Possible	Resets when the vacant area of the input buffer is over 512 bytes.	Sends X-ON when the vacant area of the input buffer reaches 512 bytes.
Impossible	Sets when the vacant area of the input buffer is 256 bytes or less.	Sends X-OFF when the vacant area of the input buffer reaches 256 bytes.

Error Handling

Errors are processed as follows:

Parity error:	**an asterisk "*" is printed,**
Overrun error:	**ignored.**
Framing error:	**ignored.**

CHAPTER 4
DISASSEMBLY, ASSEMBLY, AND ADJUSTMENT

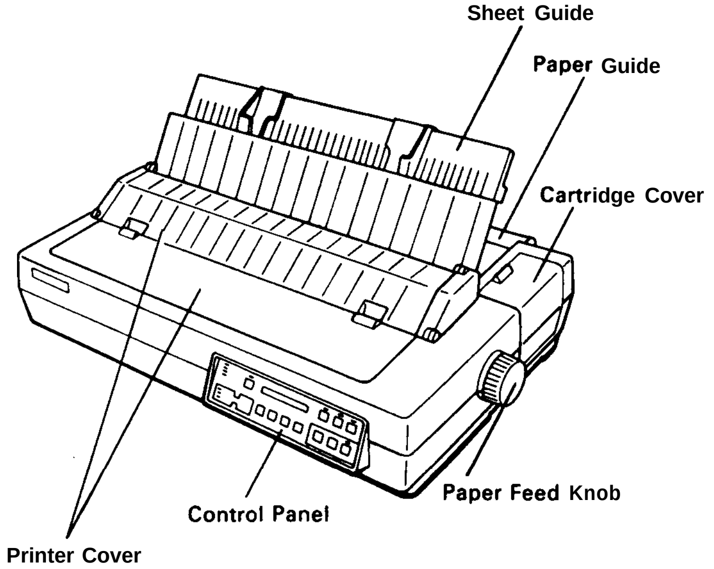
CHAPTER 4

TABLE OF FIGURES

LIST OF TABLES

4.1 GENERAL REPAIR INFORMATION

This chapter describes the disassembly, assembly, and adjustment procedures for replacing any of the main components of the LQ-2550. Figure 4-1 shows the external view of the LQ-2550.



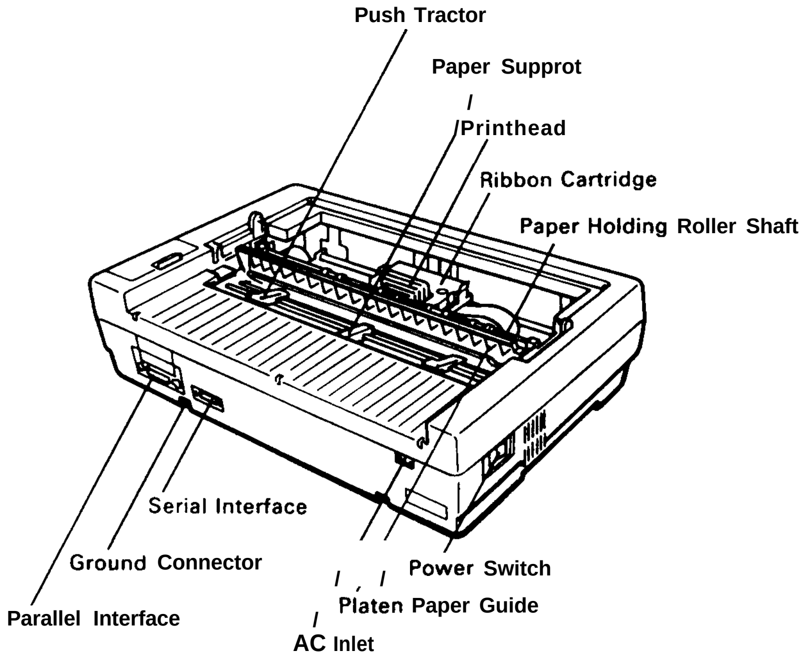


Figure 4-1. External View of LQ-2550

DANGER

- Prior to beginning the disassembly, assembly, and adjustment procedures, be sure to disconnect the AC power cord and the interface cable.
- Wear gloves to protect your hands from being cut.

WARNING

- When disassembling and checking the printer, remove the protective materials inside of the printer. Removal of the protective materials can be performed by reversing the order of installation. (Refer to Figures 4-2 and 4-3.)
- For transportation, the protective parts should be installed in the printer as follows:
  1. Secure the two transport screws.
  2. Slide the printhead all the way to the left, then insert the printhead protector between the platen and the paper holding roller shaft.
  3. Install the three pieces of white foam packing material.

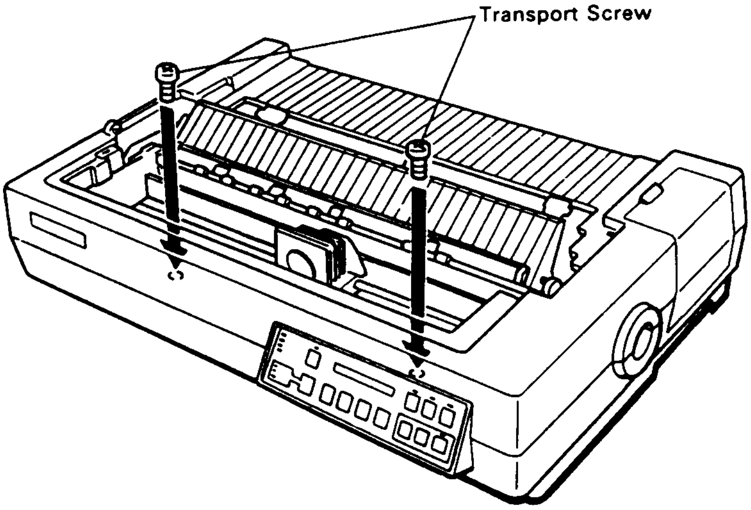


Figure 4-2. Transport Screws

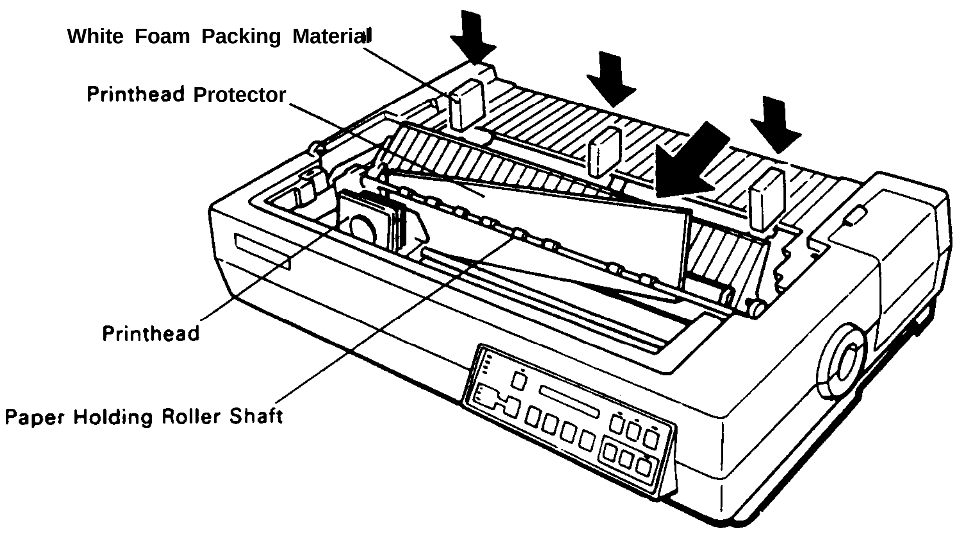


Figure 4-3. Printhead Protector and White Foam Packing Material Installation

The tools, measuring instruments, and lubricants listed in Tables 4-1 through 4-3 are recommended for use when disassembling and repairing the printer.

Table 4-1. Repair Tools

Designation	Part No.	Availability	Class
Phillips screwdriver #2	B743800200	o	A
Phillips screwdriver #1	B743800 100	0	A
Box driver (7 mm across)	B74 1700200	0	A
Round nose pliers	B740400 100	0	A
Diagonal cutting nipper	B740500 100	0	A
Tweezers	B64 1000100	0	A
E-ring holder #2	B740800300	o	A
E-ring holder #3	B740800500	o	A
E-ring holder #5	B740800700	o	A
E-ring holder #6	B740800800	o	A
E-ring holder #8	B74080 1000	0	A
Brush #1	B74 1400200	0	B
Brush #2	B74 1400100	0	B
Cleaning brush	B74 1600100	0	B
Hexagonal wrench (3 mm across)	———	O	A
Tension gauge (7000 g) #E668	B777200301	Ⓔ	A
Thickness gauge (1.2 mm) #E667	B77670150 1	Ⓔ	A
Adjustment Cartridge #E658	Y499035020	Ⓔ	A
Dial gauge #E 672	B7651 11401	Ⓔ	A
Dial gauge base #E 671	B7651 11801	Ⓔ	A
Extension cable #E 649	B765 109801	Ⓔ	A

Availability
O: Commercially available tool
Ⓔ: EPSON exclusive tool

Class
A: Mandatory
B: Recommended

Table 4-2. Measuring Instruments

Designation	Specification	Class
Oscilloscope	20 MHz or more	B
Multi meter		A

A: Mandatory
B: Recommended

Table 4-3. Lubricants and Adhesive

Classification	Designation	Capacity	Availability	Part No.
Oil	o-2	40 cc	Ⓔ	B7 10200001
Grease	G-2	40 g	Ⓔ	B70020001 1
Grease	G-27	40 g	Ⓔ	B702700001
Adhesive	Neji lock #2 (G)	1000 g	Ⓔ	B730200200

Ⓔ: EPSON exclusive product

After disassembly, assembly, and adjustment, be sure to perform lubrication, adhesive application, cleaning, and inspection, as indicated in Chapter 6, to maintain optimal printer performance.

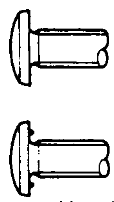
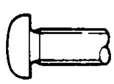
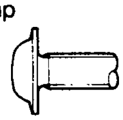
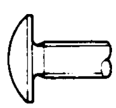
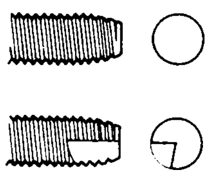
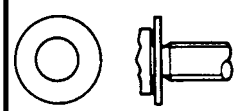
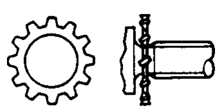
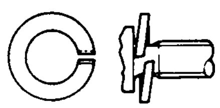
Small parts are described using the following abbreviations.

Table 4-4. Abbreviations for Small Parts

Abbreviation	Part Name
Cs	Cup Screw
CB	Cross-Bind-head screw
CBO	Cross-Bind-head with Outside-toothed washer
CBB	Cross-Bind-head B-tight
CBS	Cross-Bind-head S-tight
CBS (0)	Cross-Bind-head S-tight with Outside-toothed washer
CPS	Cross-Pan-head with Spring washer
CPS (o)	Cross-Pan-head S-tight with Outside-toothed washer
CPS (P)	Cross-Pan-head S-tight with Plain washer
CP (o)	Cross-Pan-head with Outside-toothed washer
CP (P)	Cross-Pan-head with Plain washer
HNO	Hexagon Nut with Outside toothed lock washer
PW	Plain Washer
LS	Leaf Spring
RE	Retaining ring type-E

Table 4-5 describes the relationship between the form of screw and its abbreviated part name.

Table 4-5. Screw Types and Abbreviated Part Names

Head		Body	Washer (assembled)
Top	Side		
cross–recessed head  Slotted head e	1. Bind  (with Notch) 2. Pan  3. Cup  4. Truss 	1. Normal  2. !&tight  3. B-tight  4. Tapping 	1. Plain washer  2. Outside toothed lock washer  3. Spring washer 

4.2 DISASSEMBLY AND ASSEMBLY

This section describes the procedures for disassembling the main components of the LQ-2550 printer, with illustrations. The disassembled components are reassembled by simply performing the disassembly operation in reverse sequence. Assembly procedures, therefore, have been omitted. However, special notes for assembly are labeled "ASSEMBLY POINT." For assembly and disassembly procedures which require adjustments, the necessary adjustments are indicated by "ADJUSTMENT REQUIRED." Refer to Figures A-55, A-56 and A-57, which are exploded diagrams of the LQ-2550 and the printer mechanism.

WARNING

- **Read Section 4.1, General Repair Information, before disassembling the printer.**
- **Remove the paper and the ribbon cartridge when disassembling the printer.**

The disassembly sequence in this section is grouped into five parts: (1) removal of the printhead, (2) removal of the upper case, (3) removal of the tractor unit, (4) removal of the circuit boards, and (5) disassembly of the printer mechanism.
This sequence is shown in Figure 4-4.

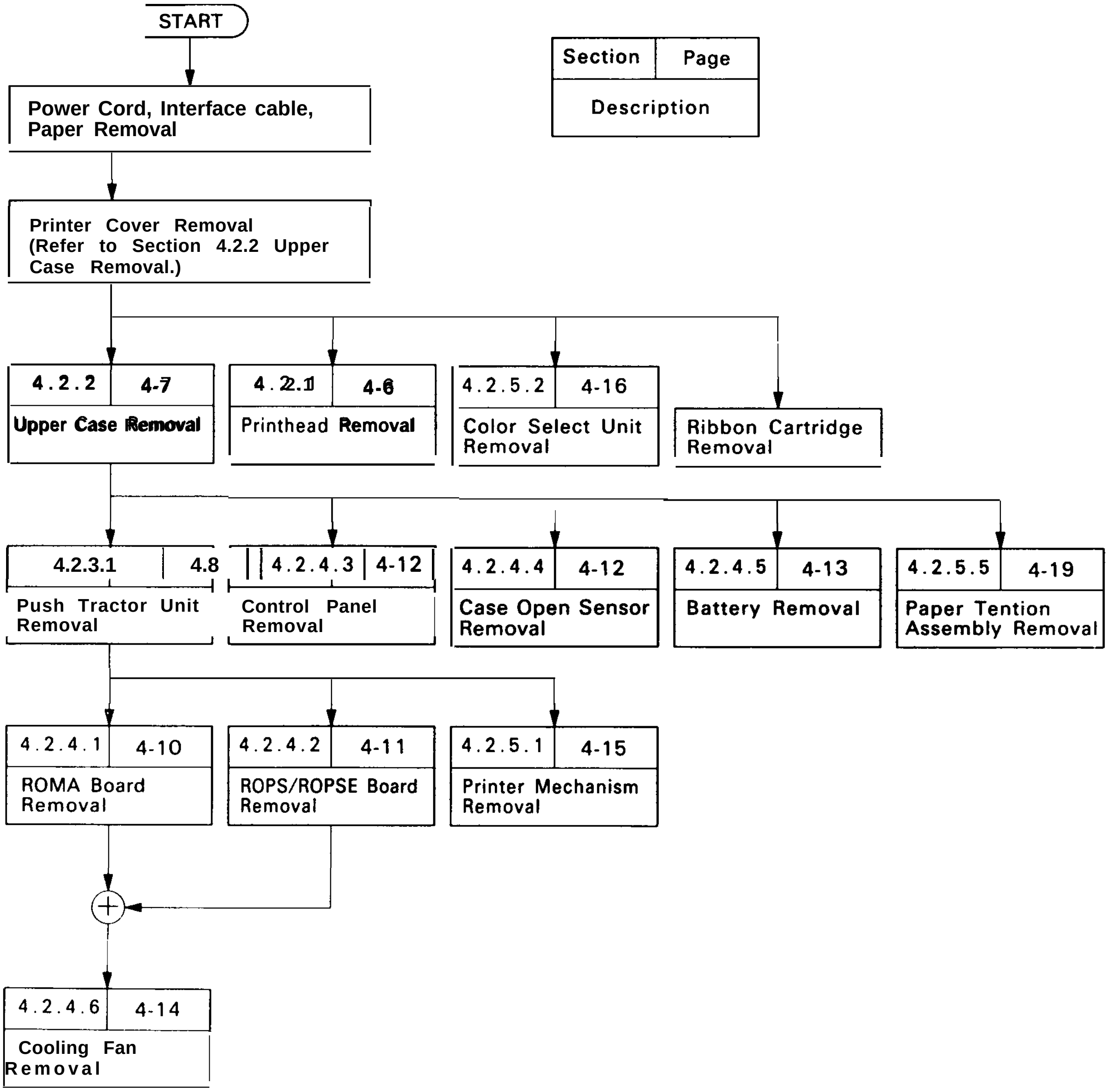


Figure 4-4. Printer Disassembly Procedures

4.2.1 Printhead Removal

Step 1: Remove the two printer covers.

Step 2: Remove the two screws CS(M3 × 6) securing the printhead.

Step 3: Disconnect the printhead connector by lifting the printhead, and remove the printhead.

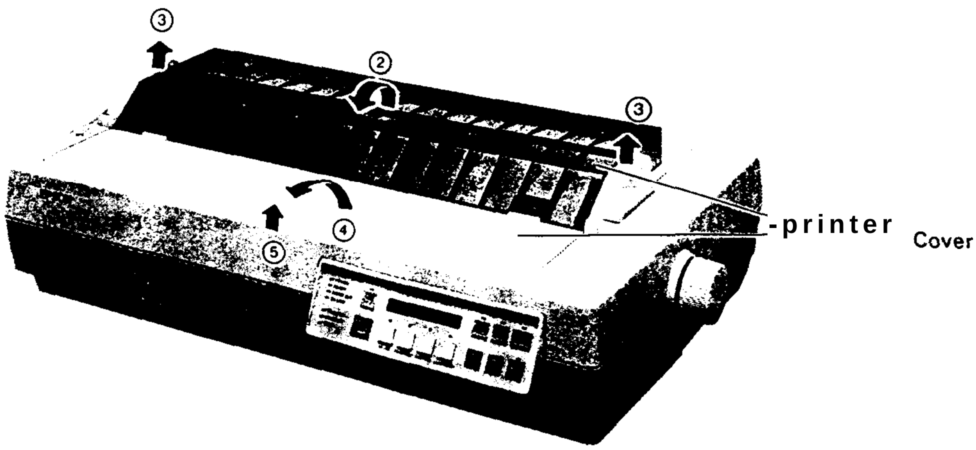


Figure 4-5. Printer Covers Removal

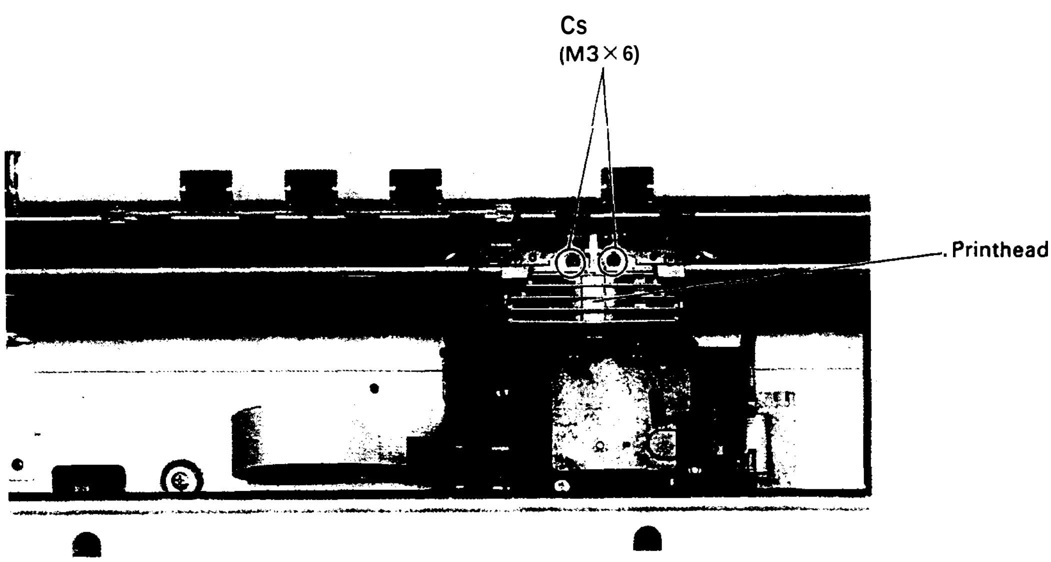


Figure 4-6. Printhead Removal

4.2.2 Upper Case Removal

Step 1: Pull out the paper feed knob.
Step 2: Remove the two printer covers. (Refer to arrows ② through ⑤.)
Step 3: Remove the cartridge cover.
Step 4: Remove the platen paper guide by turning it toward you.
Step 5: Remove the three screws CBB(M4 X 12) securing the upper and lower cases.
Step 6: Lift the front edge of the upper case and move it backward.
Step 7: Disconnect connector CN21 on the ROMA board, and remove the upper case.

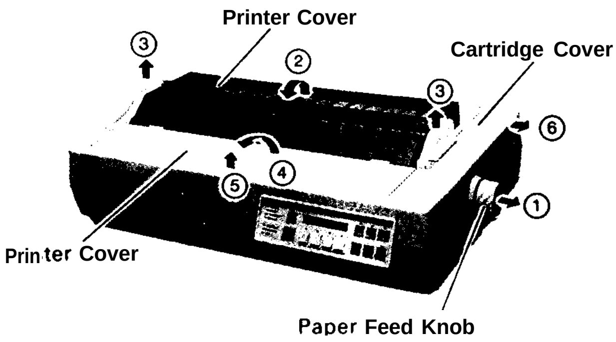


Figure 4-7. Upper Case Removal (1)

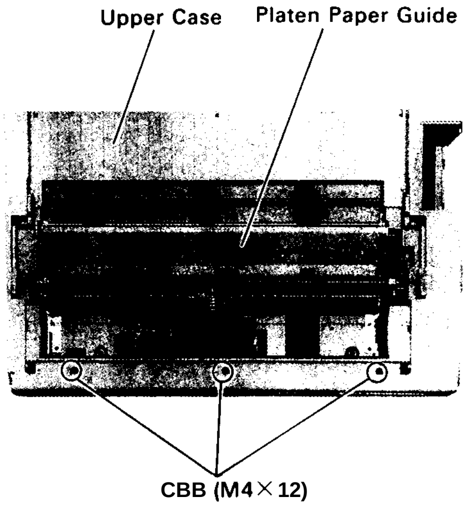


Figure 4-8. Upper Case Removal (2)

Figure 4-9 shows the arrangement of the main components of this printer as seen after removing the upper case.

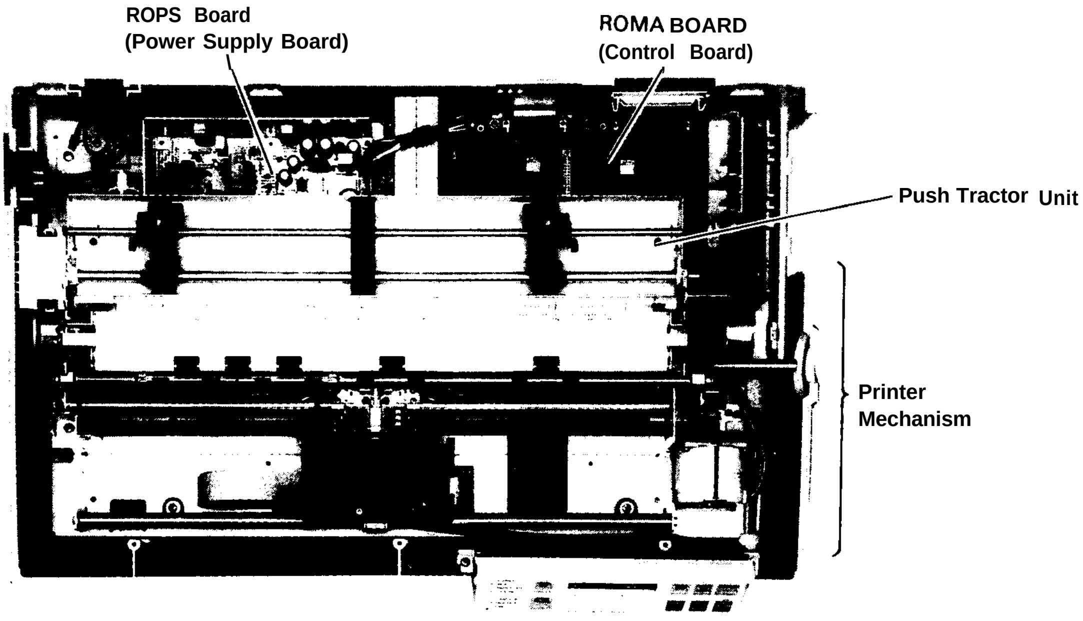


Figure 4-9. Main Components Arrangement

4.2.3 Push Tractor Unit Removal

The push tractor unit should be removed before removing the circuit boards and the printer mechanism from the lower case.

4.2.3.1 Push Tractor Unit Removal

Step 1: Remove the upper case. (Refer to Section 4.2.2.)

Step 2: Remove the two screws CBS(M3 X 6) securing the push tractor unit to the printer mechanism.

Step 3: Remove the push tractor unit.

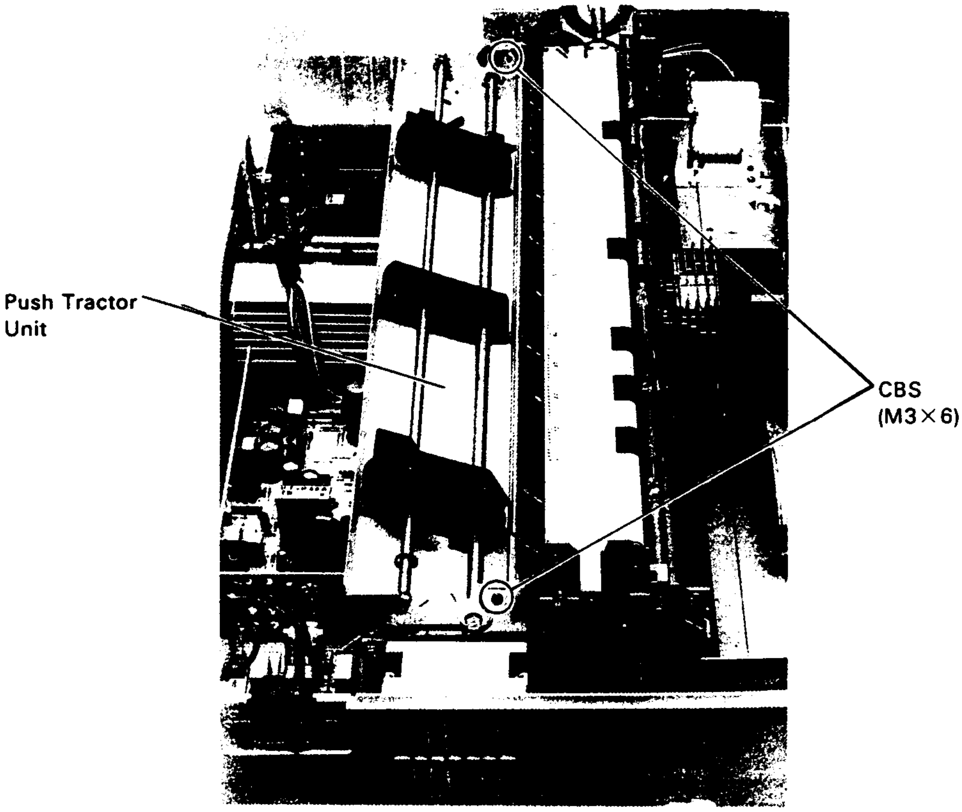


Figure 4-10. Push Tractor Unit Removal

ASSEMBLY POINT:

- Mount the push tractor unit as shown in Figure 4-11.

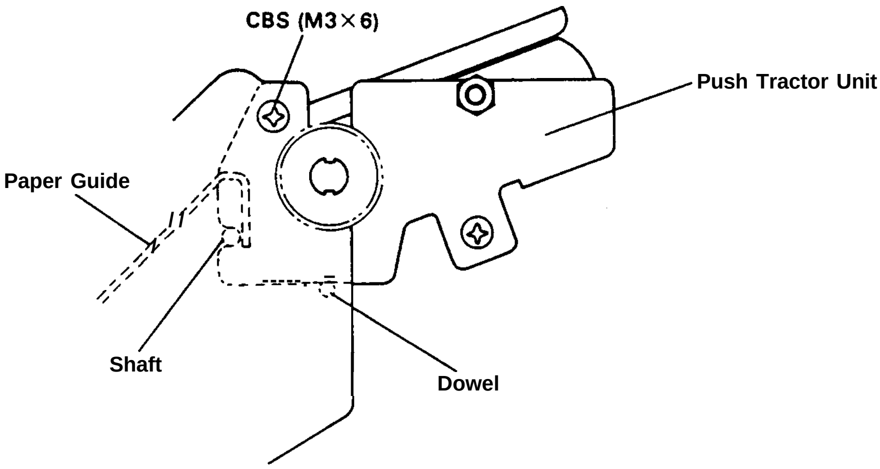


Figure 4-11. Push Tractor Unit Mounting

4.2.3.2 Push Tractor Unit Disassembly

This section describes the removal of the left tractor assembly.

Step 1: Remove the left shaft holder inward from the left tractor frame.

Step 2: Remove the nut HNO(M4) and the screw CPS(M3× 6) from the left side of tractor frame, then remove the frame.

Step 3: Remove the E-ring RE(5) from the shaft.

Step 4: Push the tractor lock lever backwards, and remove the left tractor assembly from the shafts.

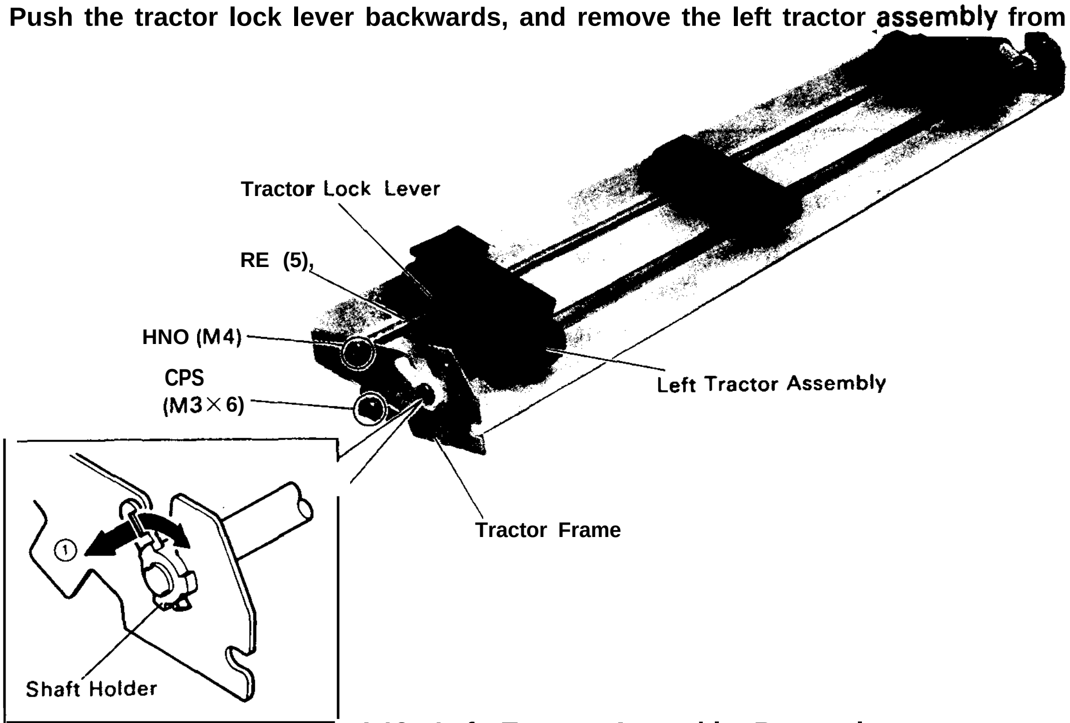


Figure 4-12. Left Tractor Assembly Removal

ASSEMBLY POINT:

- When mounting the tractor assemblies on the shafts, set them so that the marks on the right and left tractor frames are at the same positions. Make sure that the pins on the right and left tractor belts are alighned (parallel).

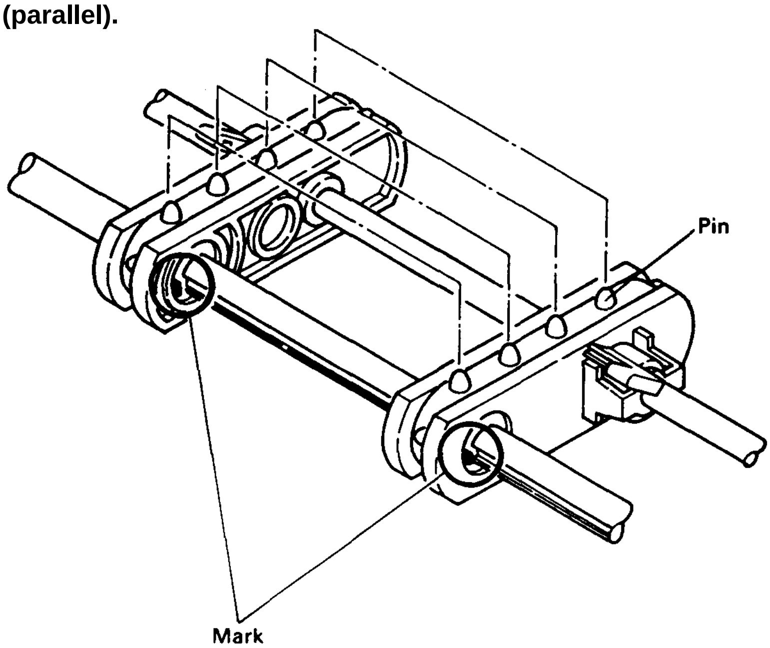


Figure 4-13. Tractor Assembly Phases

4.2.4 Circuit Board Removal

The circuit boards control the printer mechanism, and consist of the ROMA control board and the ROPS/ROPSE power supply board.
Removal of the control panel, the case open sensor, the battery, and the cooling fan are also described in this section.

DANGER

Prior to disassembly of any of the main circuit components, be sure to first disconnect the power cord and the interface cable.

4.2.4.1 ROMA Control Board Removal

Step 1: Remove the upper case. (Refer to Section 4.2.2.)
Step 2: Remove the push tractor unit. (Refer to Section 4.2.3. 1.)
Step 3: Disconnect connector CN22 from the ROMA board, which connects the ROMA board to the ROPS/ROPSE board.
Step 4: Disconnect fourteen connectors CN15, CN 14, CN 13, CN 12, CN 11, CN 10, CN9, CN 16, CN8, CN 19, CN20, CN 17, CN 18, and CN7 from the ROMA board, which connect the printer mechanism to the ROMA board.
Step 5: Remove the shield plate and the DIP switch cover.
Step 6: Remove the three CBB(M3X 12) screws and two CPS(O)(M3× 8) screws securing the ROMA board to the lower case, then remove the ROMA board.

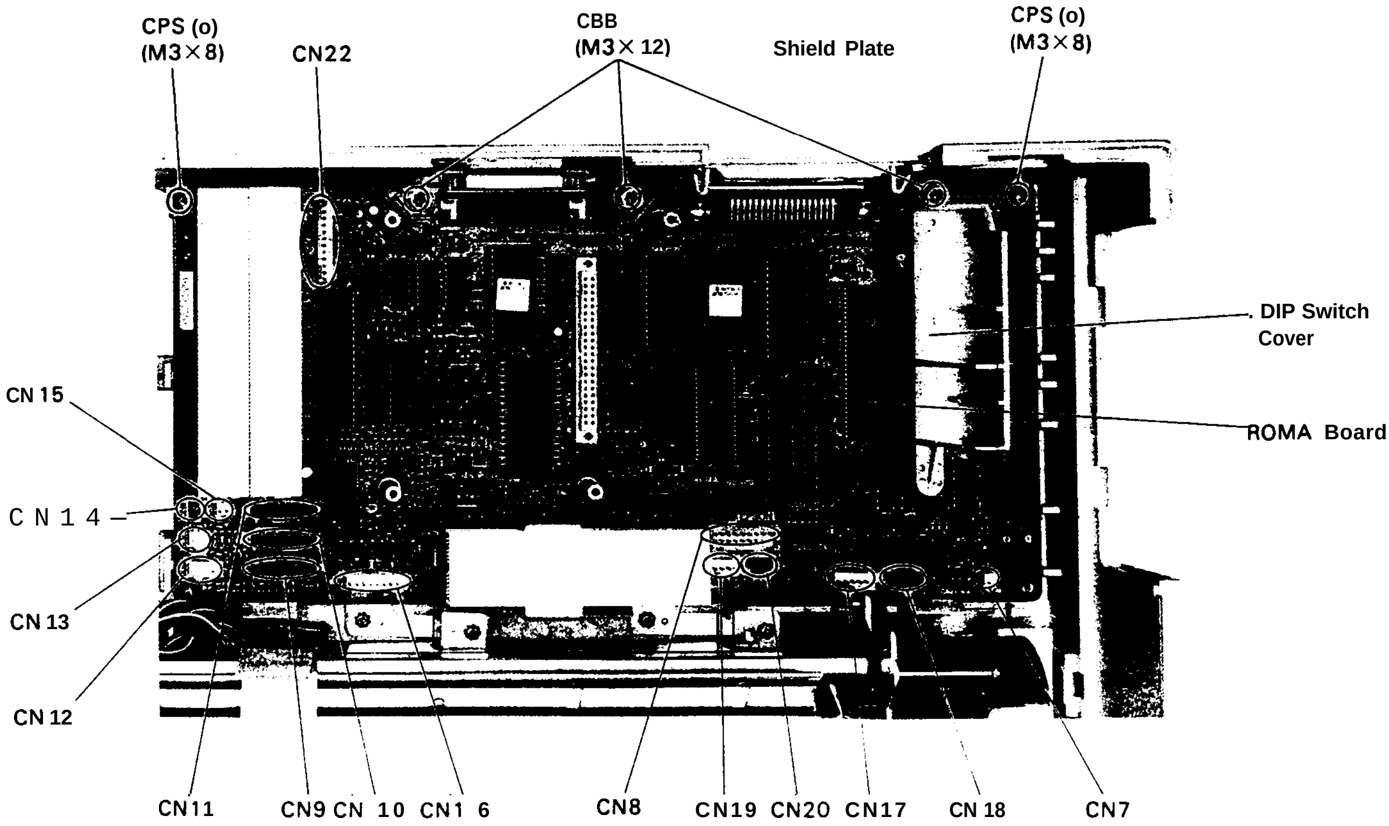


Figure 4-14. ROMA Board Removal

ADJUSTMENT REQUIRED

- When the ROMA board is replaced, perform the following adjustment:
  Section 4.3.6 Bi-directional Printing Alignment (Page 4-47)
- When the connector CN7 for the battery is disconnected, perform the following adjustment:
  Section 4.3.5 Platen Gap Initial Value Write Operation (Page 4-46).

4.2.4.2 ROPS/ROPSE Power Supply Board Removal

Step 1: Remove the upper case. (Refer to Section 4.2.2.)

Step 2: Remove the push tractor unit. (Refer to Section 4.2.3.1.)

Step 3: Disconnect connector CN2 from the ROPS/ROPSE board, which connects the ROPS/ROPSE board to the ROMA board.

Step 4: Disconnect connector CN 1 from the ROPS/ROPSE board, which connects the power switch to the ROPS/ROPSE board.

Step 5: Remove the two CBB(M3× 12) screws and four CP(O)(M3×8) screws securing the ROPS/ROPSE board to the lower case, and remove the ROPS/ROPSE board.

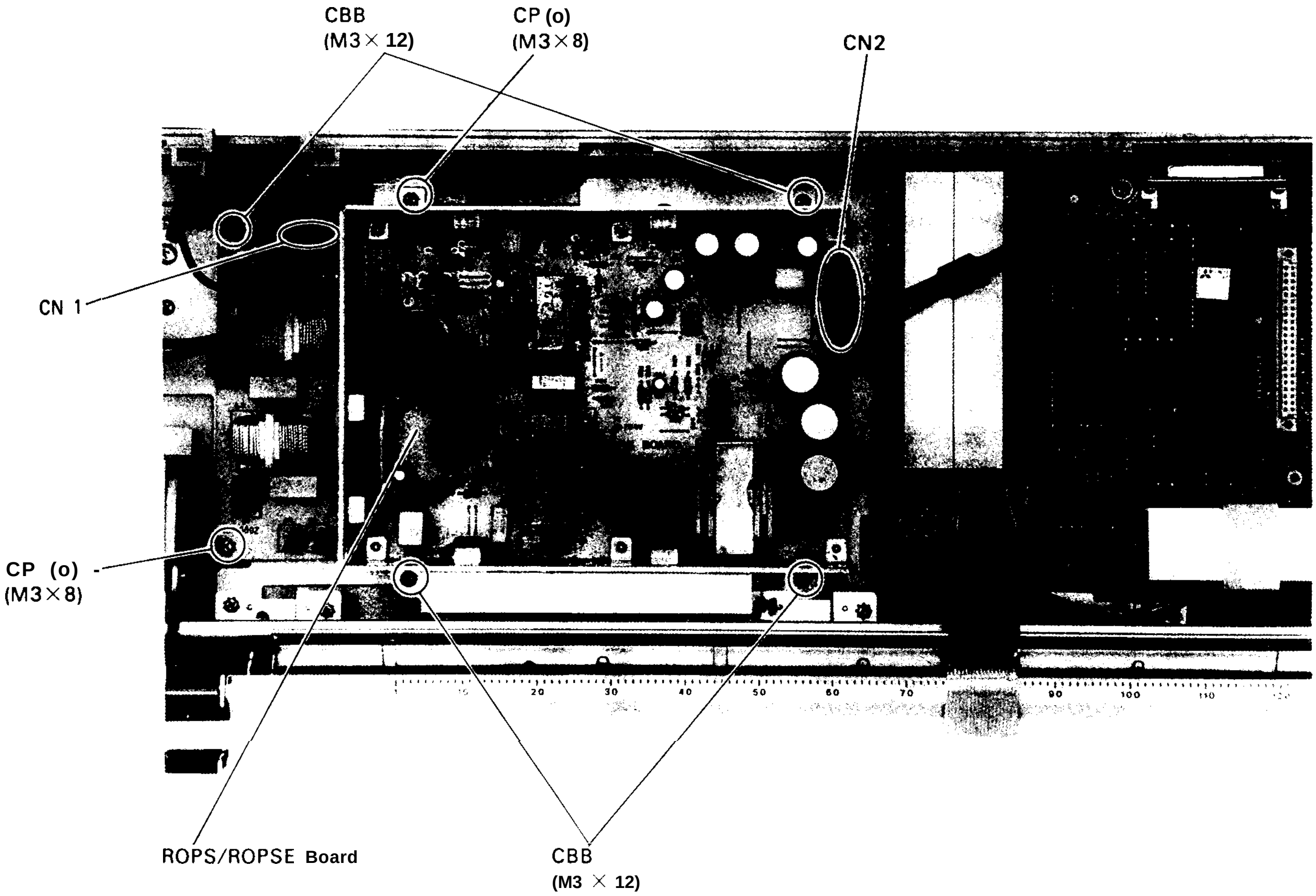


Figure 4-15. ROPS/ROPSE Board Removal

4.2.4.3 Control Panel Removal

Step 1: Remove the upper case. (Refer to Section 4.2.2.)

Step 2: Remove the two screws CBB(M4 × 12) securing the control panel.

Step 3: Disconnect the cable from the connector at the back of the control panel, which connects the control panel to the ROMA board.

Step 4: Remove the control panel.

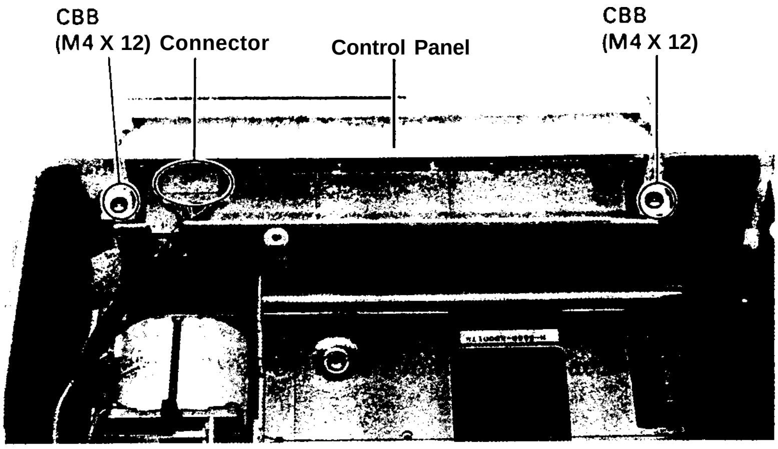


Figure 4-16. Control Panel Removal

4.2.4.4 Case Open Sensor Removal

Step 1: Remove the upper case. (Refer to Section 4.2.2.)

Step 2: Remove the screw CBB(M3 × 10) securing the case open sensor, then remove the case open sensor.

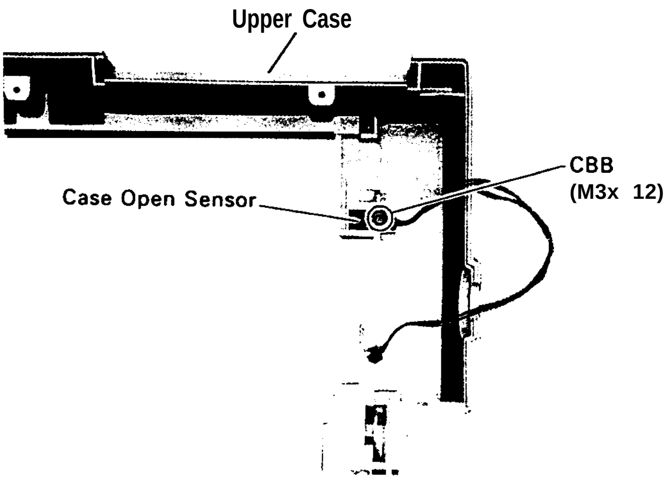


Figure 4-17. Case Open Sensor Removal (Back of Base Frame)

4.2.4.5 Battery Removal

Step 1: Remove the upper case. (Refer to Section 4.2.2.)

Step 2: Disconnect connector CN7 on the ROMA board.

Step 3: Insert a slotted screwdriver into the groove of the lower case, then unlock the tab of the battery case.

Step 4: Remove the battery together with the battery case.

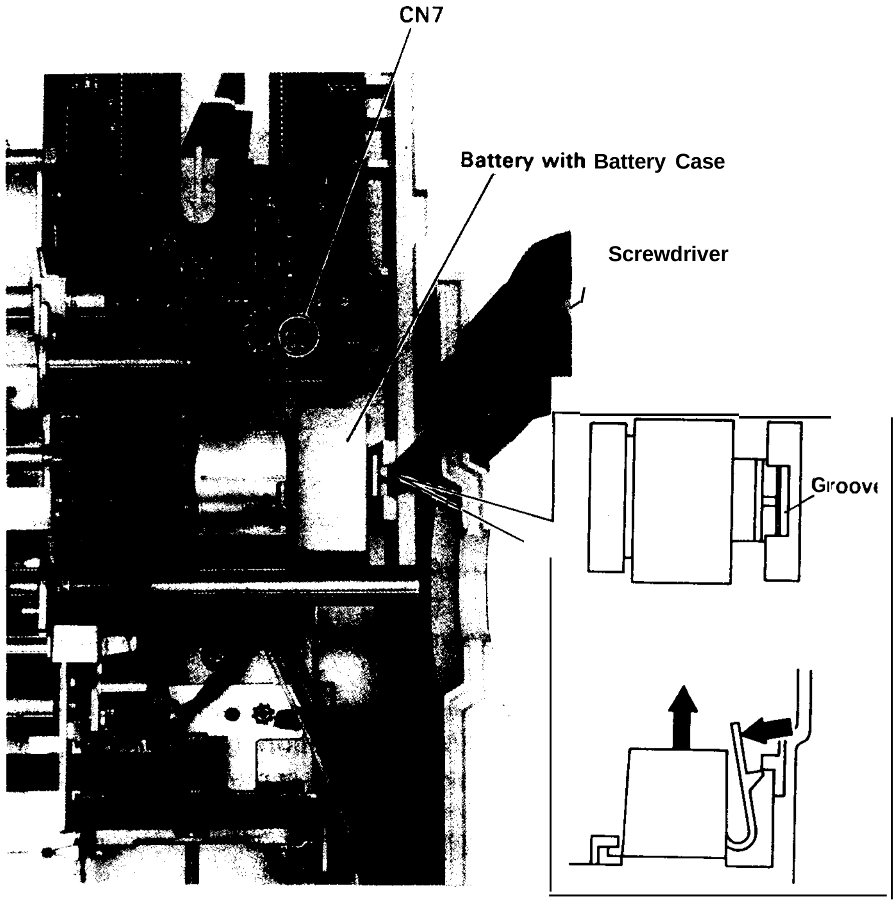


Figure 4-18. Battery Removal

ADJUSTMENT REQUIRED

When connector CN7 for the battery is disconnected, perform the following adjustment:
Section 4.3.5 Platen Gap Initial Value Write Operation (Page 4-46)

ASSEMBLY POINT:

- When mounting the battery, push down the tab of the battery case with a slotted screwdriver so that it can be smoothly inserted into the lower case.

4.2.4.6 Cooling Fan Removal

Step 1: Remove the upper case. (Refer to Section 4.2.2.)
Step 2: Remove the push tractor unit. (Refer to Section 4.2.3. 1.)
Step 3: Remove the ROMA board. (Refer to Section 4.2.4.1.)
Step 4: Remove the ROPS/ROPSE board. (Refer to Section 4.2.4.2.)
Step 5: Remove the eight screws CPS(O)(M3 X 6) securing the ground plates, then remove the four ground plates.
Step 6: Remove the screw CBO(M4 X 8) securing the ground terminal of the power cord.
Step 7: Remove the three screws CBB(M3 X 12) securing the base plate to the lower case.

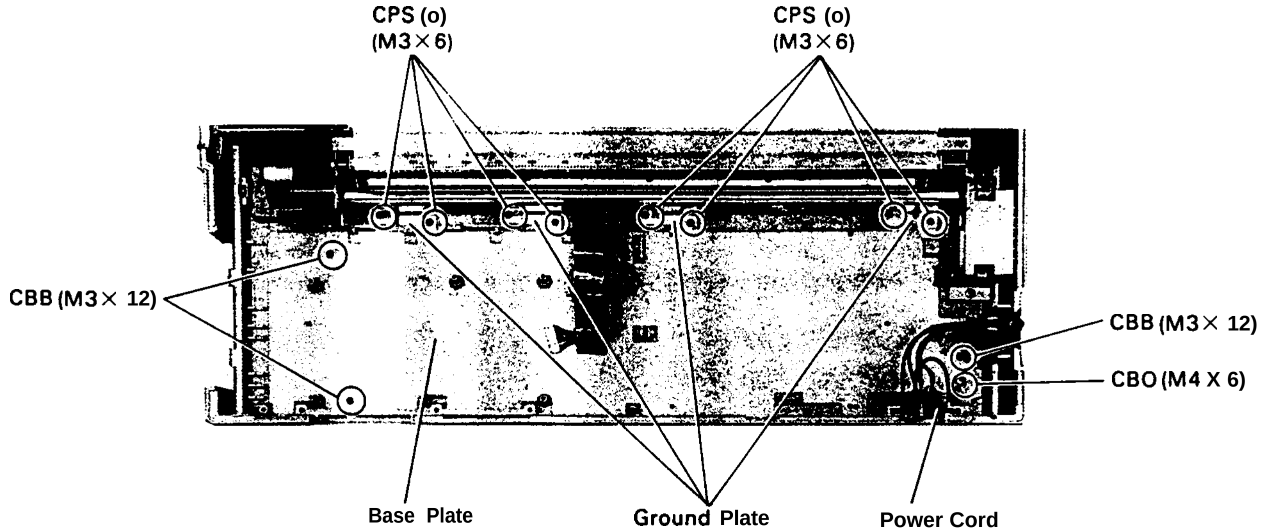


Figure 4-19. Base Plate Removal

Step 8: Remove the two ground screws CPS(O)(M3 X 6) at the rear of the printer, then remove the base plate.
Step 9: Tear off the three pieces of tape fixing the cooling fan wires to the lower case.
Step 10: Remove the two screws CBB(M4 X 12) securing the fan adapter to the lower case.
Step 1 1: Lift the cooling fan together with the fan screen and fan adapter, and remove them.

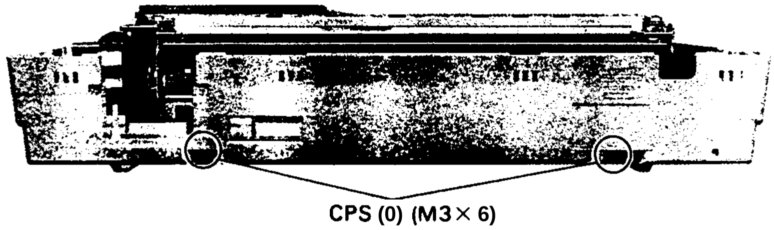


Figure 4-20. Ground Screws Removal

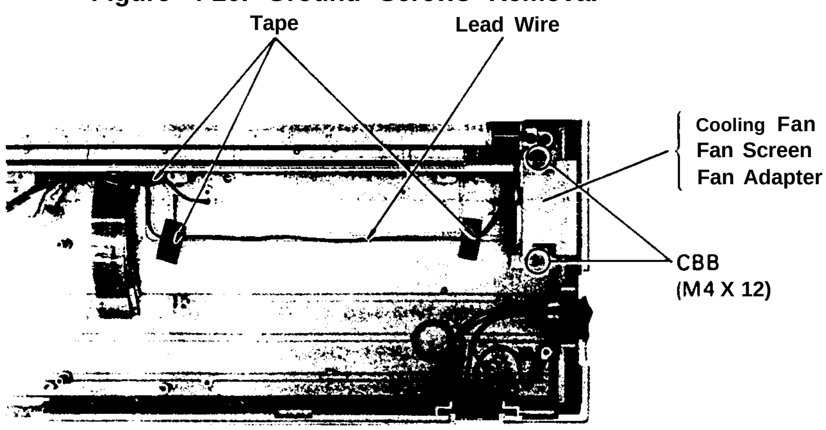


Figure 4-21. Cooling Fan Removal

4.2.5 Printer Mechanism Disassembly

This section describes the procedures for disassembling the main components of the printer mechanism. Refer to Figures A-56 and A-57 in the appendix during assembly.

4.2.5.1 Printer Mechanism Removal

Step 1: Remove the upper case. (Refer to Section 4.2.2.)

Step 2: Remove the push tractor unit. (Refer to Section 4.2.3. 1.)

Step 3: Disconnect twelve connectors CN 15, CN 13, CN 12, CN11, CN 10, CN9, CN 16, CN8, CN 19, CN20, CN 17 and CN 18 from the ROMA board, which connect the printer mechanism to the ROMA board.

Step 4: Remove the eight screws CPS(O)(M3×6) securing the ground plates, then remove the four ground plates. (See Figure 4-1 9.)

Step 5: Remove the five screws CB(M4 X 6) securing the printer mechanism to the lower case.

Step 6: Remove the printer mechanism.

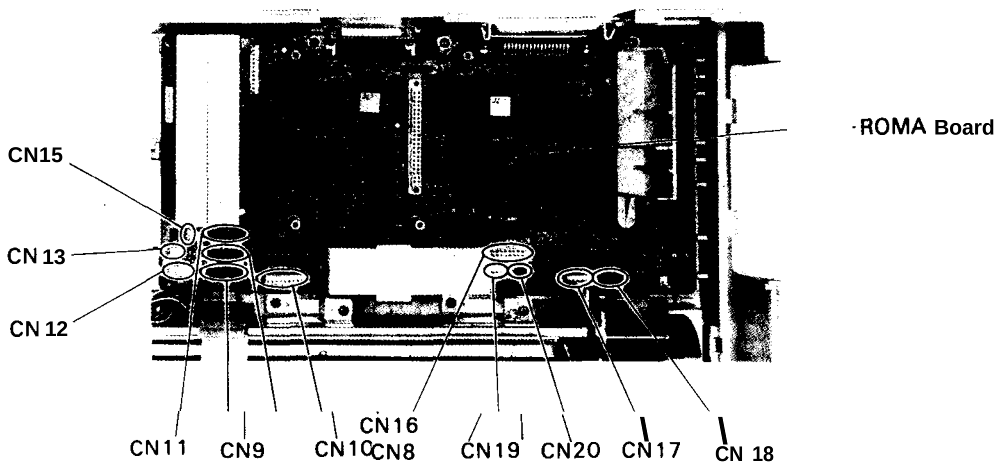


Figure 4-22. Connector Locations

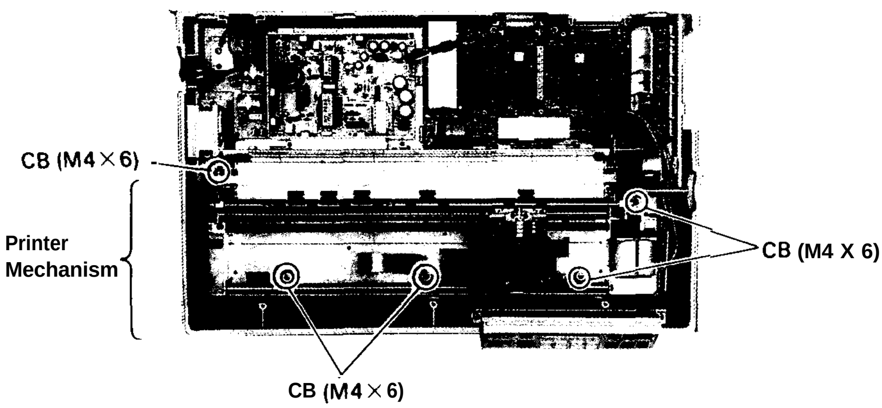


Figure 4-23. Printer Mechanism Removal

ADJUSTMENT REQUIRED

- When the printer mechanism, is removed or replaced, perform the following adjustment:
  Section 4.3.5 Platen Gap Initial Value Write Operation (Page 4-46)
- When the printer mechanism is replaced, perform the following adjustment:
  Section 4.3.6 Bi-directional Printing Alignment (Page 4-47).

4.2.5.2 Color Select Unit Removal

Step 1: Remove the front side of the printer cover.

Step 2: Turn the lever on the color select unit counterclockwise 90 degrees to unlock the color select unit.

Step 3: Remove the color select unit by lifting it straight up.

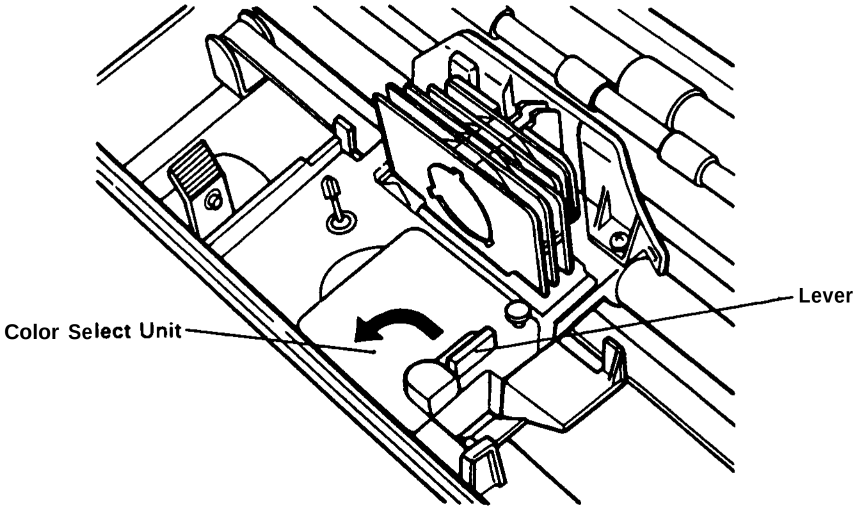


Figure 4-24. Color Select Unit Removal (1)

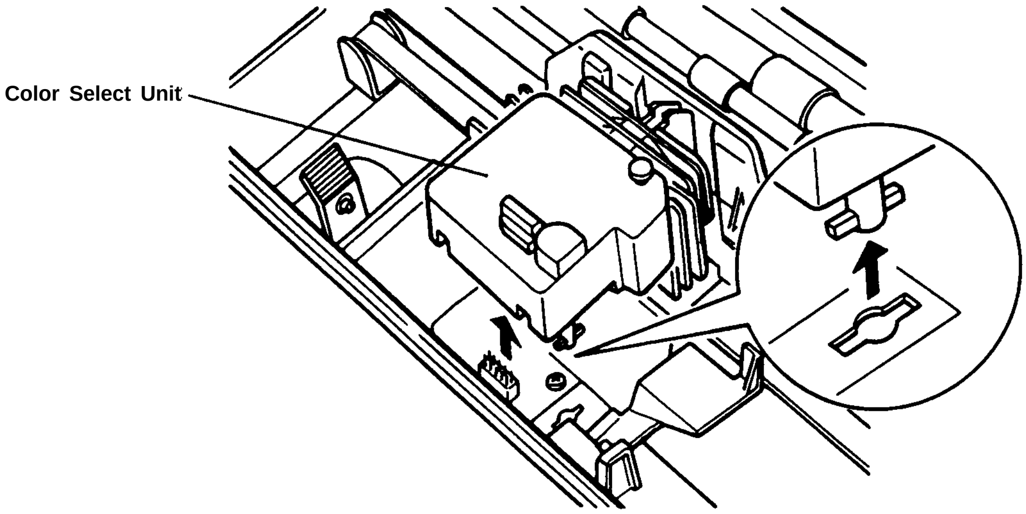


Figure 4-25. Color Select Unit Removal (2)

4.2.5.3 Cartridge Base Removal

Removal of the cartridge base is useful when removing the head cables, the head fan motor, and the paper width sensor.

WARNING

When removing the cartridge base, be careful not to snap the tabs.

Step 1: Remove the printer mechanism. (Refer to Section 4.2.5.1.)

Step 2: Remove the printhead. (Refer to Section 4.2.1.)

Step 3: Remove the screw CB(M4×8) securing the cartridge base to the carriage.

Step 4: Release the three tabs at the back of the cartridge base, then remove the cartridge base by lifting it straight up.

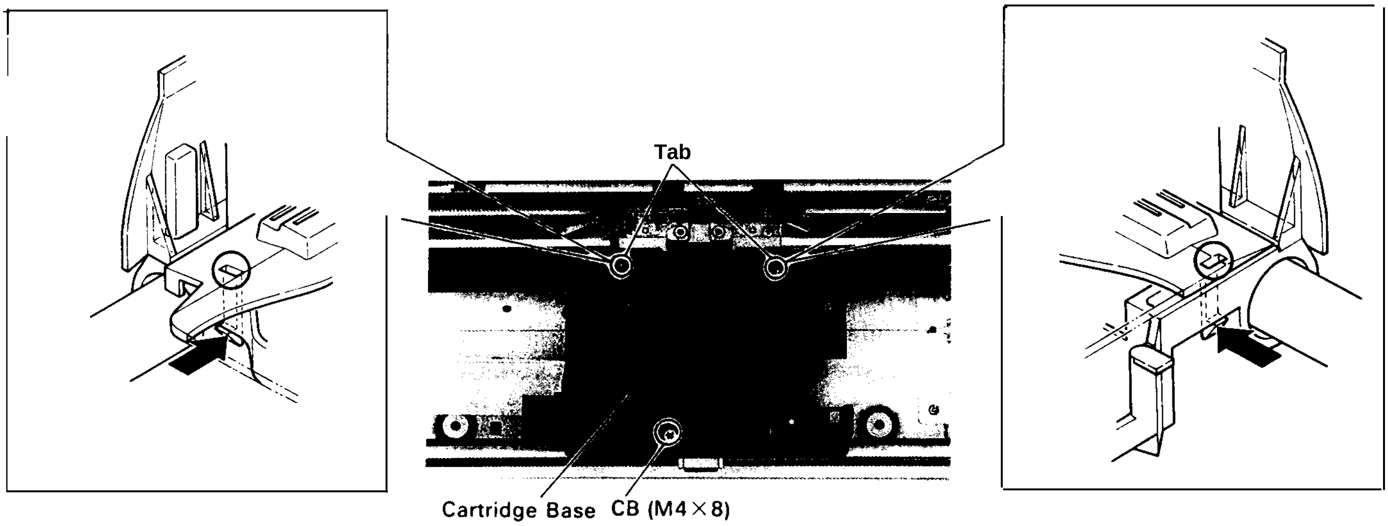


Figure 4-26. Cartridge Base Removal (1)

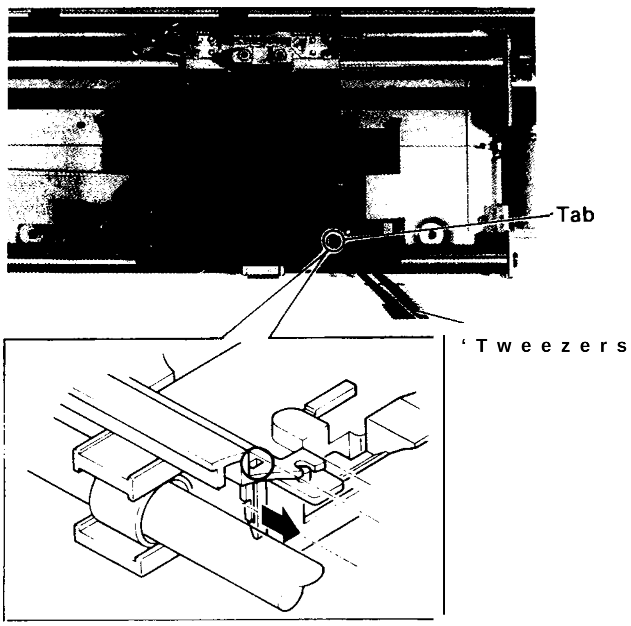


Figure 4-27. Cartridge Base Removal (2)

4.2.5.4 Cable Removal (Front Head Cable, Rear Head Cable, Color Select Cable)

WARNING

- When removing the cables from the two tabs of the carriage, be careful not to disconnect the cables.The three cables should be put together as shown in Figure 4-28 for assembly.
. If they are put together incorrectly. the printer mechanism will not operate.
  - Ⓐ ...... Fold front and rear head cables and put them together. Then mount them to the carriage with rear head cable on top.
  - Ⓑ...... Bind the three cables together and fold them.

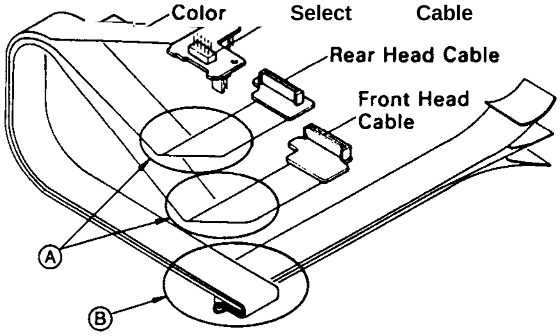


Figure 4-28. Cable Binding

Step 1: Remove the printer mechanism. (Refer to Section 4.2.5.1.)
Step 2: Remove the printhead. (Refer to Section 4.2. 1.)
Step 3: Remove the cartridge base. (Refer to Section 4.2.5.3.)
Step 4: Remove cable holders A and B, then draw out the three cables, the front head cable, rear head cable, and color select cable, from the cutout in the base frame.
Step 5: Place the carriage over the cutout in the base frame, then disconnect the two connectors from the back of the base frame.
Step 6: Remove the color select unit. (Refer to Section 4.2.5.2.)
Step 7: Loosen the three cables from the two tabs of the carriage.
Step 8: Remove the screw CPS(M3 × 6) securing the color select cable, and remove the cable.
Step 9: Remove the front and rear head cables.

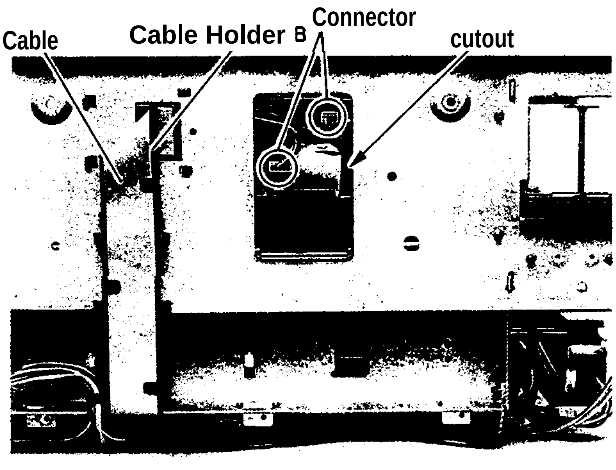


Figure 4-29. Cable Holder B and Connector Removal (Back of Base Frame)

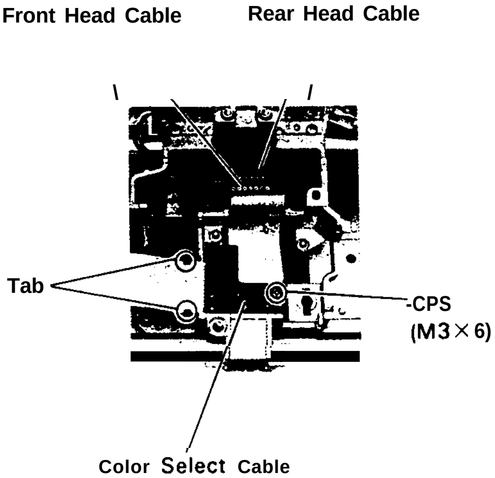


Figure 4-30. Front Head Cable, Rear Head Cable, and Color Select Cable Removal

ASSEMBLY POINT:

- Verify that the cables do not touch the left frame or the back of the carriage when moving the carriage to the left end.

4.2.5.5 Paper Tension Assembly Removal

WARNING

- Confirm that the paper release lever is in the friction position (backward setting).
- When removing the two screws securing the paper tension assembly to the right and left frames, take care not to drop the plain washers PW(3-0.5-4.8) inserted between the paper tension assembly and both frames.

Step 1: Remove the upper case. (Refer to Section 4.2.2.)

Step 2: Remove the two screws CPS(M3×8) securing the paper tension assembly to the right and left frames, and remove the paper tension assembly.

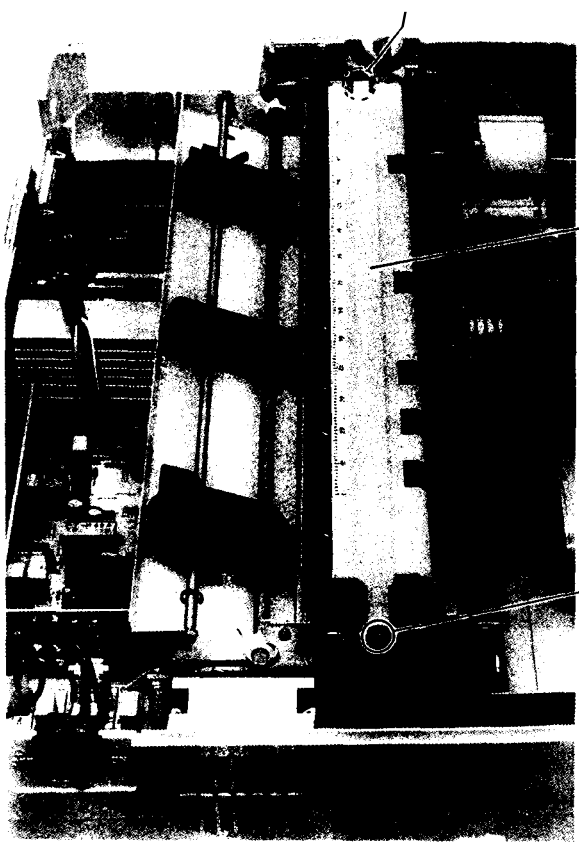


Figure 4-31. Paper Tension Assembly Removal

4.2.5.6 Carriage Motor Removal

Step 1: Remove the printer mechanism. (Refer to Section 4.2.5.1.)

Step 2: Remove the screw CBS(0)(4X12) securing the belt driven pulley mounting plate, then release the timing belt from the belt drive pulley at the rear of the carriage motor.

Step 3: Remove the two screws CPS(M3×8) securing the carriage motor to the base frame.

Step 4: Remove the CPS(O)(M3× 8) screw for the motor ground wire from the base frame.

Step 5: Remove the carriage motor.

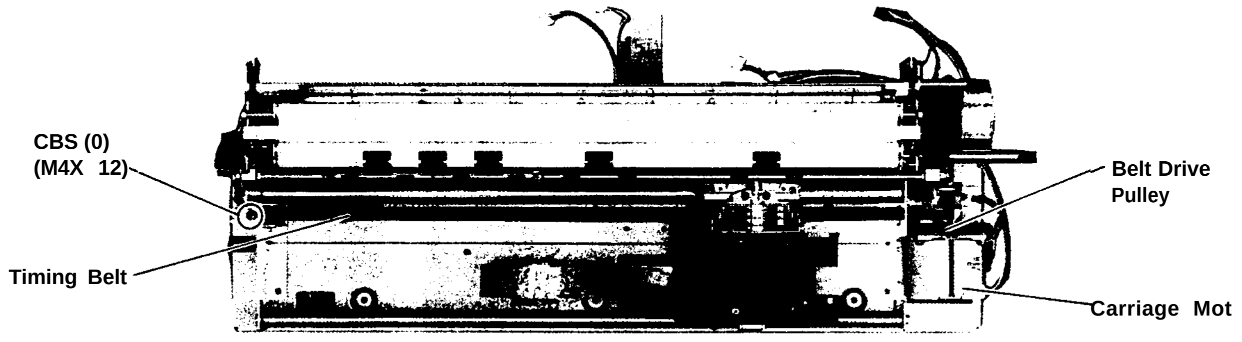


Figure 4-32. Belt Driven Pulley Screw Removal

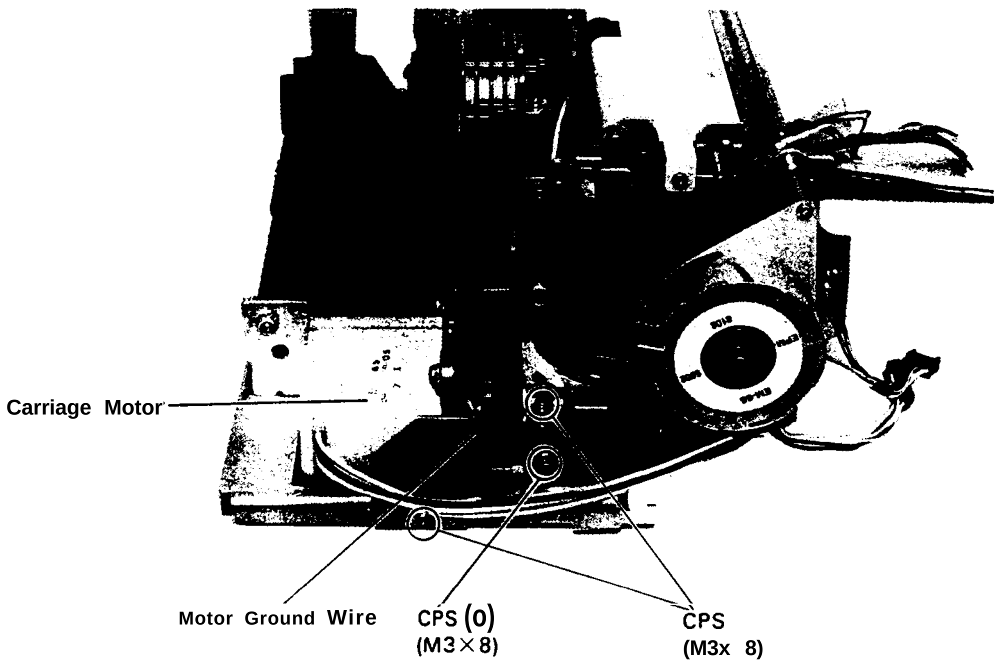


Figure 4-33. Carriage Motor Removal

ADJUSTMENT REQUIRED

When the carriage motor is removed, perform the following adjustments:

- Section 4.3.1 Timing Belt Tension Adjustment (Page 4-40)
- Section 4.3.6 Bi-directional Printing Alignment (Page 4-47)

4.2.5.7 Paper Feed Motor Removal

WARNING

When removing the paper feed motor, the tractor transmission gear spring may fly out. Be careful not to lose it.

Step 1: Remove the printer mechanism. (Refer to Section 4.2.5.1.)

Step 2: Remove the two screws CPS(M3×8) securing the paper feed motor, and remove the motor.

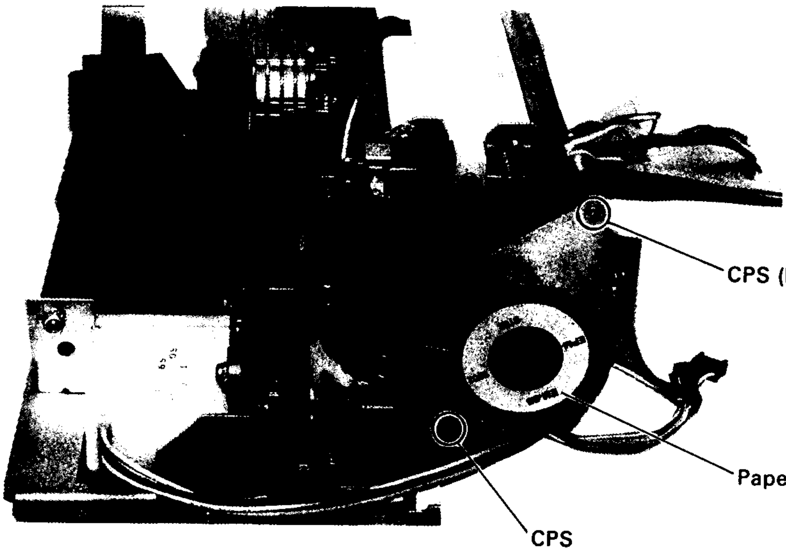


Figure 4-34. Paper Feed Motor Removal

ADJUSTMENT REQUIRED

When the paper feed motor is replaced, perform the following adjustment:
Section 4.3.2 Paper Feed Motor Backlash Adjustment (Page 4-4 1)

4.2.5.8 Platen Gap Motor Removal

Step 1: Remove the printer mechanism. (Refer to Section 4.2.5. 1.)

Step 2: Remove the two screws CPS(M3 X 8) securing the platen gap motor.
If the platen gap home position flag prevents the motor securing screw from being removed, manually rotate the platen gap reduction gear so that the screw can be removed.
NOTE: Do not hold the platen gap home position flag to rotate the gear.

Step 3: Remove the wire clamp fixing the lead wires of the platen gap motor from the base frame.

Step 4: Take out the platen gap motor through the cutout at the back of the base frame, then separate the lead wires from the motor by disconnecting the connector. (The lead wire is supplied independently of the platen gap motor. The motor lead wire is included in the platen gap home position sensor assembly.)

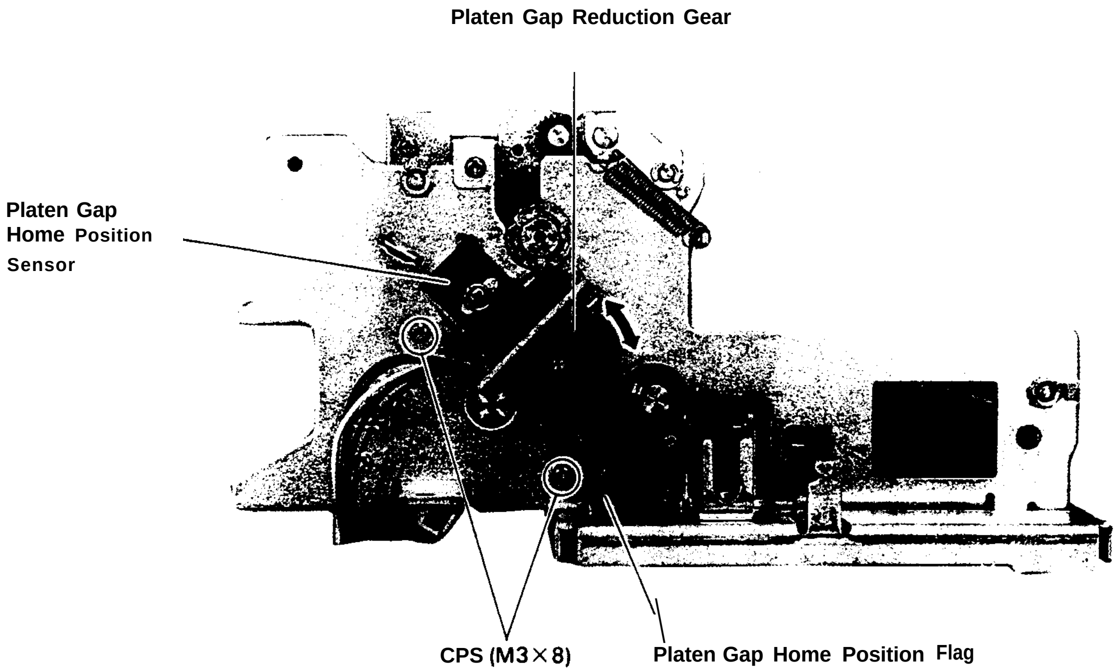


Figure 4-35. Platen Gap Motor Screw Removal

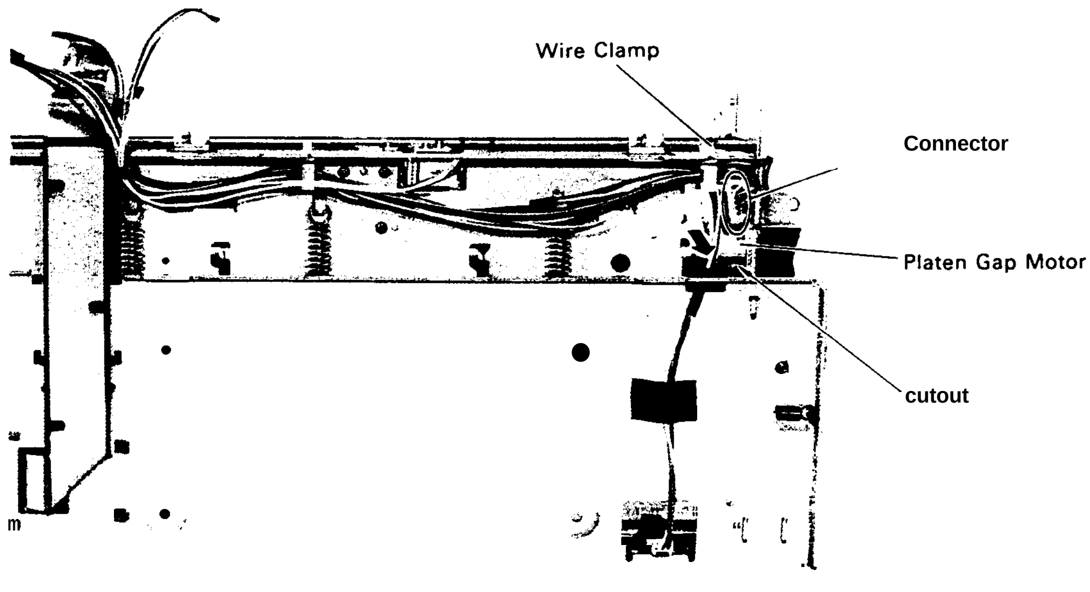


Figure 4-36. Platen Gap Motor Removal (Back of Base Frame)

4.2.5.9 Head Fan Motor Removal

WARNING

When shifting the ribbon drive assembly, be careful not to cause unnecessary stress at the point where the lead wires come out from the head fan motor.

Step 1: Remove the printer mechanism. (Refer to Section 4.2.5. 1.)
Step 2: Remove the printhead. (Refer to Section 4.2. 1.)
Step 3: Remove the cartridge base. (Refer to Section 4.2.5.3.)
Step 4: Place the carriage over the cutout in the base frame, and disconnect the two connectors of the head fan motor and the paper width sensor at the back of the base frame.
Step 5: Loosen the lead wires of the head fan motor and the paper width sensor from the hooks of the ribbon drive assembly and the carriage.
Step 6: Remove the screw CPS(M3X 6) securing the ribbon drive assembly, then shift the assembly in the direction of the arrow.
Step 7: Remove the screw CPS(M3 X 6) securing the head fan motor and remove the motor.

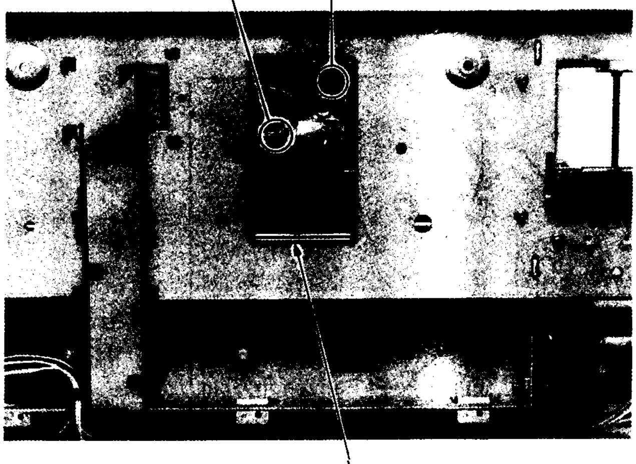


Figure 4-37. Head Fan Motor Connector Removal (Back of Base Frame)

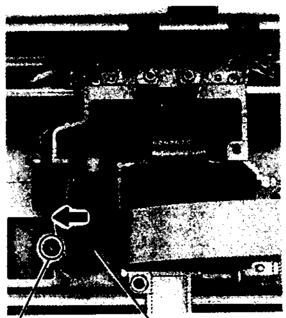


Figure 4-38. Ribbon Drive Assembly Removal

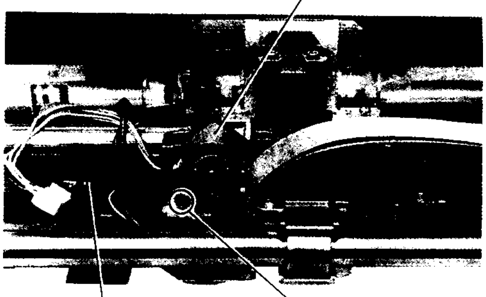


Figure 4-39. Head Fan Motor Removal

4.2.5.10 Platen Removal

Step 1: Remove the printer mechanism. (Refer to Section 4.2.5.1.)

WARNING

Confirm that the paper release lever is in the friction position (backward setting).

Step 2: Remove the paper tension assembly. (Refer to Section 4.2.5.5.)

Step 3: Remove the paper feed motor. (Refer to Section 4.2.5.7.)

Step 4: Remove the paper feed reduction gear.

Step 5: Rotate the platen and pass a screwdriver through the cutout in the platen gear, then remove the screw CPS(M3 × 8) securing the shaft holder at the right frame side.

Step 6: Remove the E-ring RE(8) from the platen shaft at the left frame side.

Step 7: Shift the whole platen shaft to the right, then remove the right side of the shaft holder outward.

Step 8: Remove the platen with the gears and other related parts attached.
NOTE: It is unnecessary to remove the left side of the shaft holder.

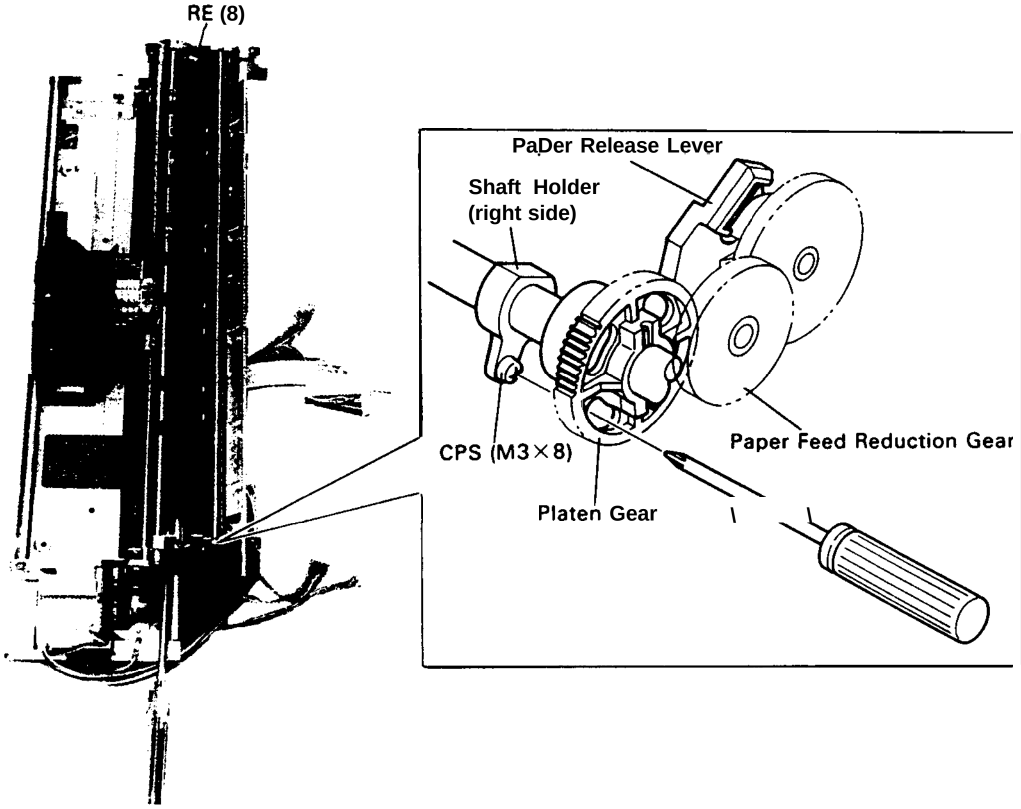


Figure 4-40. Platen Removal

ADJUSTMENT REQUIRED

● When the platen is removed, perform the following adjustment:
Section 4.3.2 Paper Feed Motor Backlash Adjustment (Page 4-4 1)

. When the platen is replaced, perform the following adjustments:
Section 4.3.4 Platen Gap Home Position Sensor Mounting Position Adjustment (Page 4-44)
Section 4.3.5 Platen Gap Initial Value Write Operation (Page 4-46)

4.2.5.11 Carriage Home Position Sensor Removal

Step 1: Remove the printer mechanism. (Refer to Section 4.2.5.1.)

Step 2: Separate the cable from the carriage home position sensor by disconnecting the connector.
NOTE: The carriage home position sensor and the home position sensor cable are supplied as separate after service parts.

Step 3: Press the two tabs securing the carriage home position sensor, and remove the sensor.

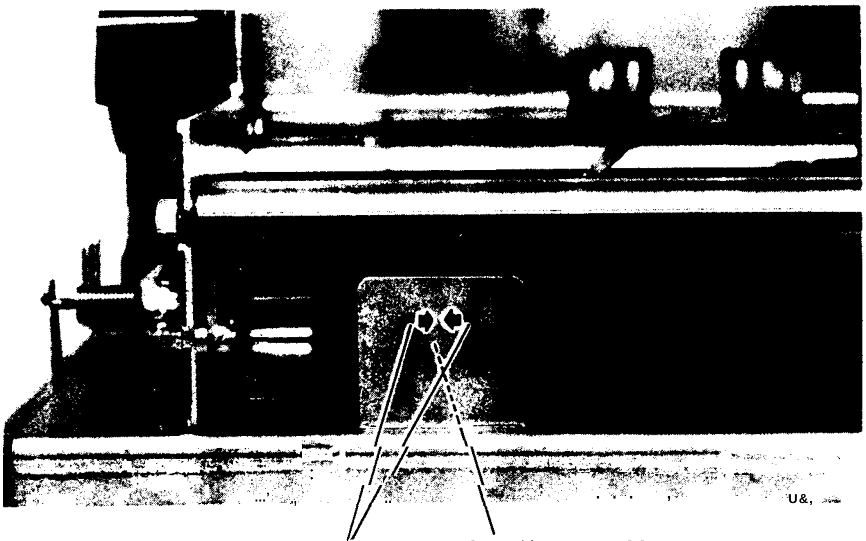


Figure 4-41. Carriage Home Position Sensor Removal

4.2.5.12 Paper End Sensor Removal

Step 1: Remove the printer mechanism. (Refer to Section 4.2.5.1.)

Step 2: Loosen the two bends securing the paper end sensor to the paper guide at the rear of the printer.

Step 3: Remove the paper end sensor.

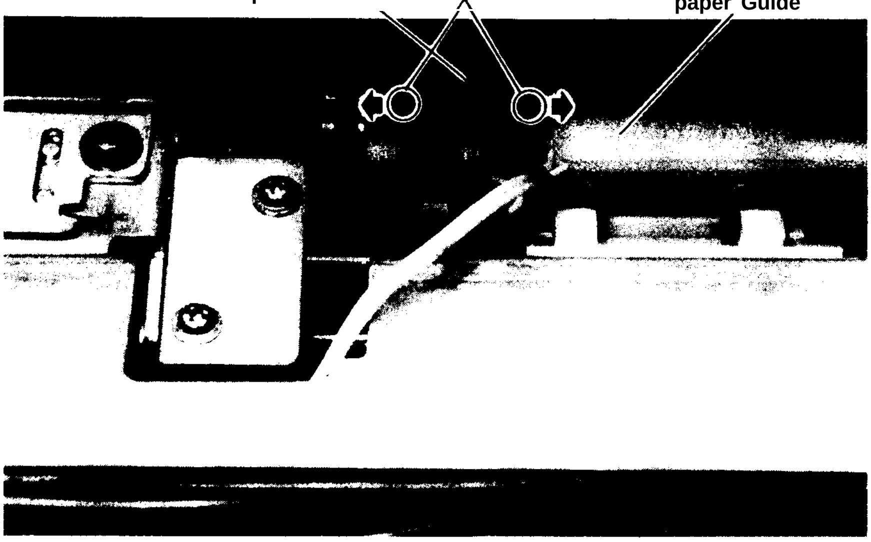


Figure 4-42. Paper End Sensor Removal (Rear of Printer Mechanism)

ASSEMBLY POINTS:

- Confirm that the paper end sensor is securely fixed to the paper guide by the two tabs.
- Verify that the sensor lever operates smoothly without touching the paper guide.
- Pass the lead wires of the paper end sensor through the cutout in the base frame, and fix them to the wire clamp.

4.2.5.13 Platen Gap Home Position Sensor Assembly Removal

The platen gap home position sensor assembly includes the lead wires from the platen gap motor.

Step 1: Remove the printer mechanism. (Refer to Section 4.2.5. 1.)

Step 2: Disconnect the connector for the platen gap motor at the back of the base frame.

Step 3: Remove the screw CPS(P)(M3×8) securing the platen gap home position sensor, then remove the platen gap home position sensor assembly.

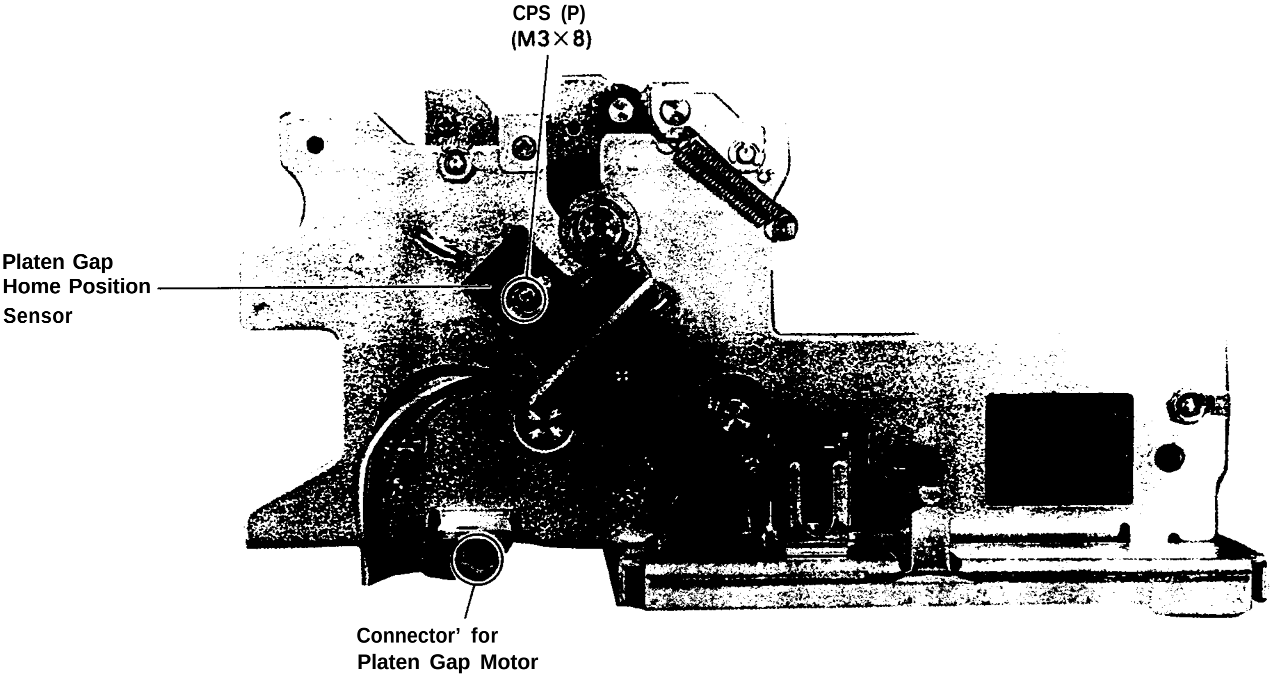


Figure 443. Platen Gap Home Position Sensor Assembly Removal

ADJUSTMENT REQUIRED

When the platen gap home position sensor mounting position is shifted, perform the following adjustment:

Section 4.3.4 Platen Gap Home Position Sensor Mounting Position Adjustment (Page 4-44)

4.2.5.14 Paper Width Sensor Removal

Step 1: Remove the printer mechanism. (Refer to Section 4.2.5. 1.)

Step 2: Remove the printhead. (Refer to Section 4.2.1.)

Step 3: Remove the cartridge base. (Refer to Section 4.2.5.3.)

Step 4: Place the carriage over the cutout in the base frame, then disconnect the connector for the paper width sensor from the back of the base frame.

Step 5: Remove the screw CB(M2.5X5) securing the paper width sensor and remove the sensor.

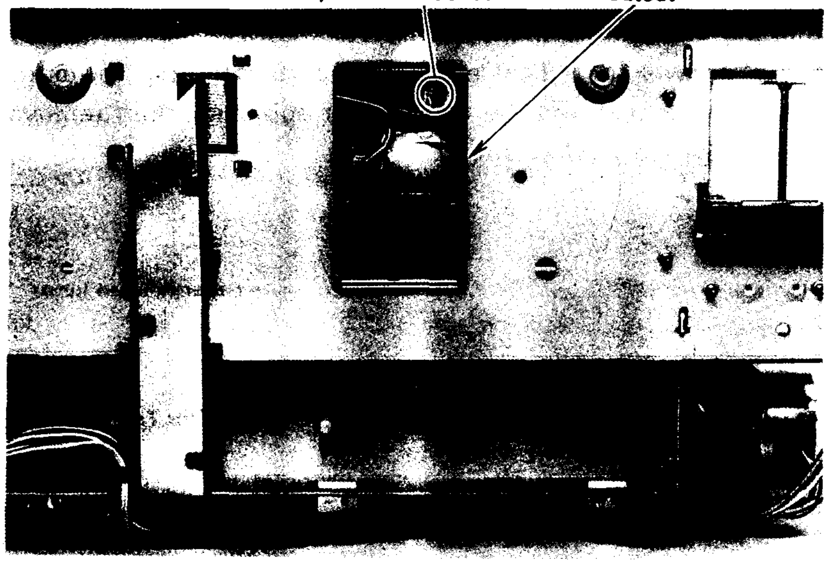


Figure 444. Paper Width Sensor Connector Removal (Back of Carriage)

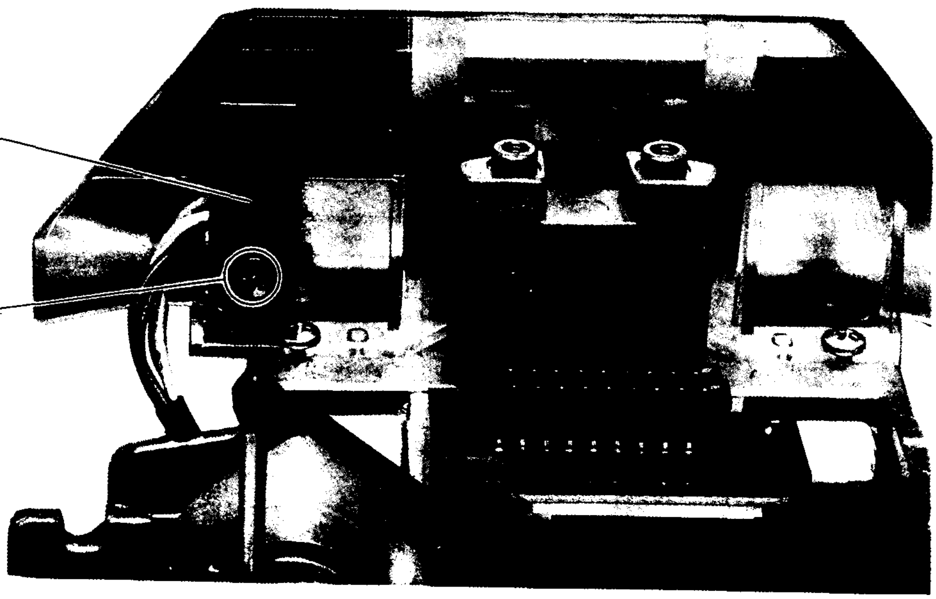


Figure 4-45. Paper Width Sensor Removal

4.2.5.15 Paper Release Solenoid Assembly Removal

WARNING

When mounting the sensor, the stud should be fixed in the frame hole. Otherwise paper release mechanism will not function correctly.

Step 1: Remove the printer mechanism. (Refer to Section 4,2,5,1,)

Step 2: Remove the paper tension assembly. (Refer to Section 4.2.5.5.)

Step 3: Remove the paper feed motor, being careful not to lose the spring at the rear of the motor. (Refer to Section 4.2.5.7.)

Step 4: Remove the paper feed reduction gear and the platen. (Refer to Section 4.2.5 .10.)

Step 5: Remove the tractor transmission gear and the paper release lever by pushing the loading trigger plate in the direction of the arrow.

Step 6: Remove the two screws CB(M2X8) and CPS(M3×8) securing the paper release solenoid assembly (one is for sensor and the other is for solenoid), then remove the paper release solenoid assembly (sensor and solenoid).

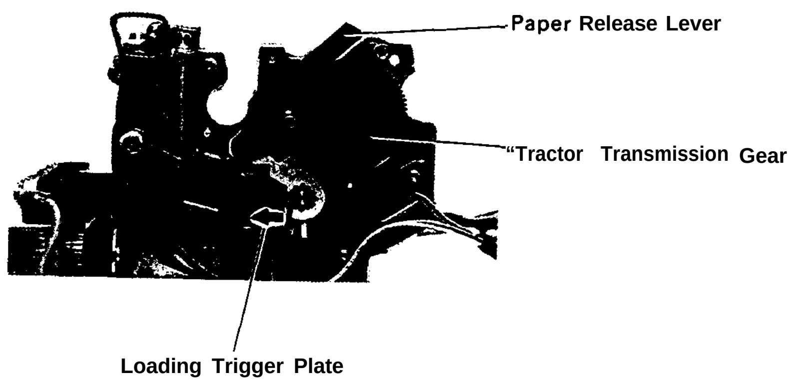


Figure 446. Paper Release Lever Removal

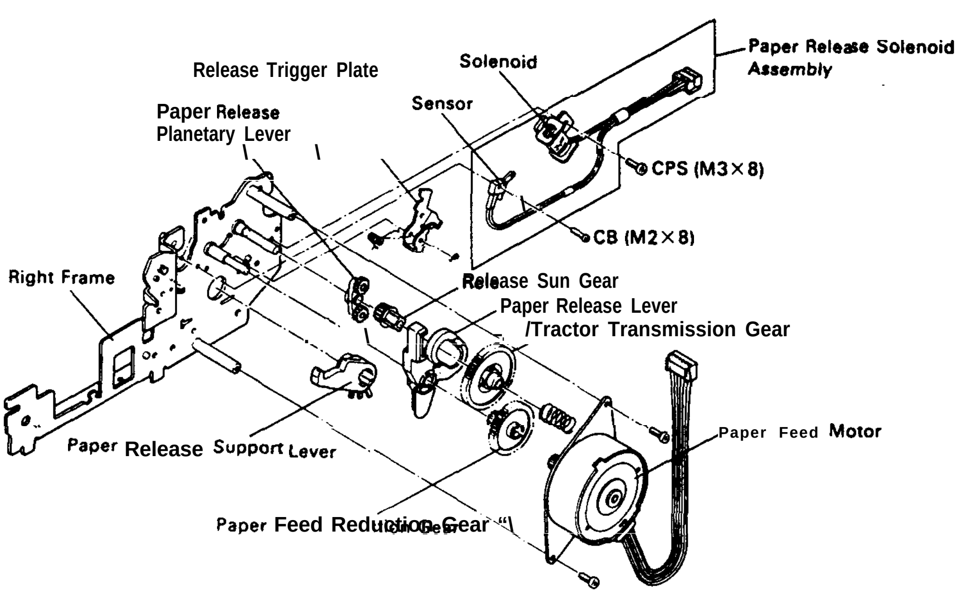


Figure 4-47. Paper Release Solenoid Assembly Removal

ADJUSTMENT REQUIRED

When the paper release solenoid assembly is removed, perform the following adjustment:
Section 4.3.2 Paper Feed Motor Backlash Adjustment (Page 4-4 1)

ASSEMBLY POINTS:

- **The lead wires from the sensor should be drawn along the frame to the rear of the printer and hooked by the tabs on the loading frame.**

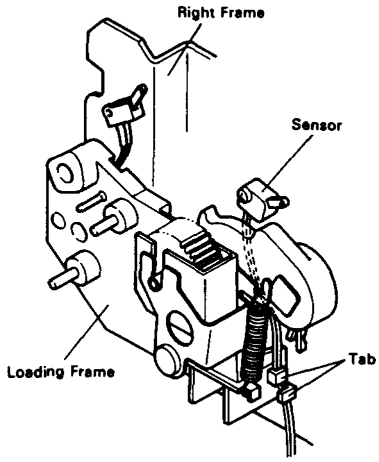


Figure 4-48. Path of Sensor Lead Wires

- **Before mounting the paper release lever, confirm that the paper release planetary lever and the release trigger plate are in their correct positions as shown in Figure 4-49.**
- **The positional relationship between paper release lever and paper release support lever is shown in Figure 4-50.**

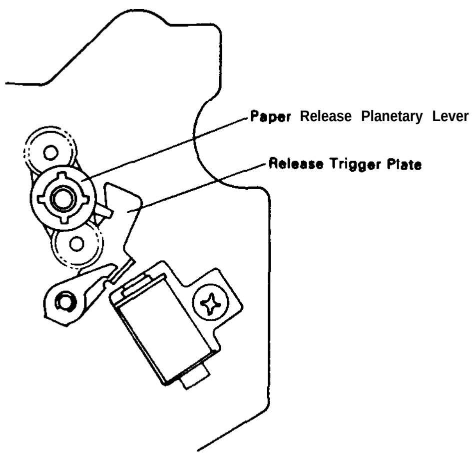


Figure 4-49. Positional Relationship Between Release Planetary Lever and Release Trigger Plate

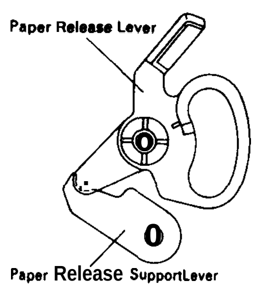


Figure 4-50. Positional Relationship Between Paper Release Lever and Paper Release Support Lever

4.2.5.16 Paper Loading Trigger Assembly Removal

The loading planetary gear is not included in the paper loading trigger assembly.

WARNING

> **When mounting the sensor, the stud of the sensor should be fixed in the frame hole. Otherwise, the paper loading mechanism will not function correctly.**

Step 1: Remove the printer mechanism. (Refer to Section 4.2.5. 1.)
Step 2: Remove the paper feed motor. (Refer to Section 4.2.5.7.)
NOTE: Take care not to lose the spring at the rear of the paper feed motor.
Step 3: Remove the loading lever shaft, the paper loading lever, the loading gear spring, the loading gear A, and the loading gear assembly.
Step 4: Remove the two screws CB(M2 × 8) and CPS(P)(M3 X 8) securing the paper loading trigger assembly (one is for sensor and the other is for loading frame), then remove the paper loading trigger assembly.
Step 5: Remove the loading planetary gear from the paper loading trigger assembly.

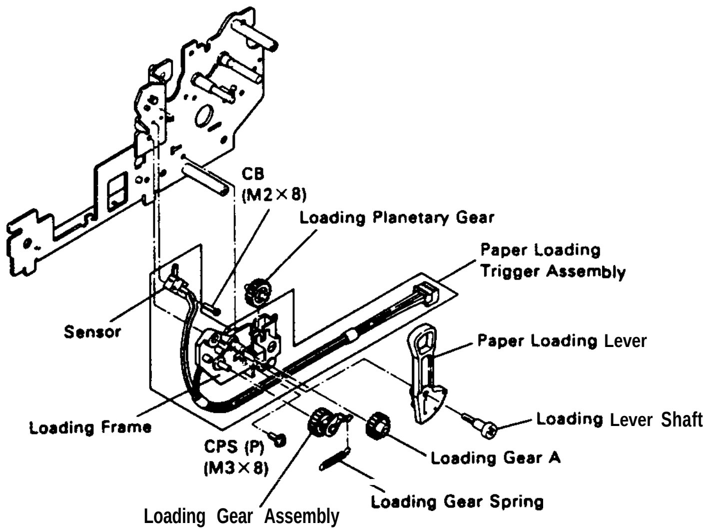


Figure 4-51. Paper Loading Trigger Assembly Removal

ASSEMBLY POINTS:

- **Pass the lead wires for the sensor of the paper loading trigger assembly between the cutout in the loading frame and the right frame.**

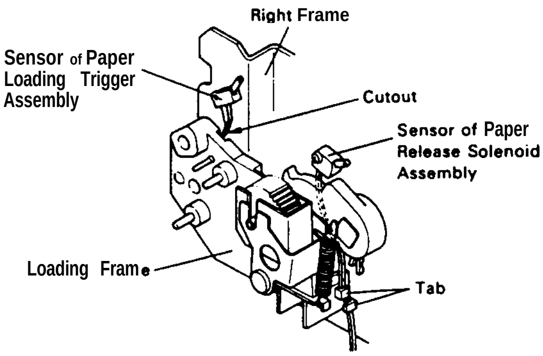


Figure 4-52. Path of Sensor Lead Wires

- **Hook the lead wires forthe sensor of the paper release solenoid assembly under the tab on the loading frame. (Refer to Figure 4-52.)**

- When setting the paper loading lever, observe the following sequence.
  1. Align the two marks on the loading gear A and the loading gear assembly.
  2. Set the paper loading lever so that the marks on the lever is in alignment with the mark on the loading gear A.

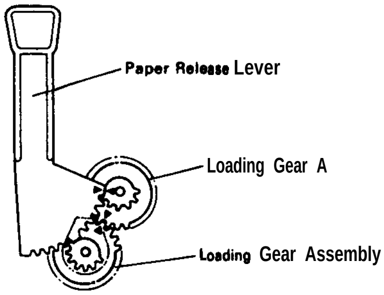


Figure 4-53. Paper Loading Lever, Loading Gear A, Loading Gear Assembly Setup

3. Install the loading lever shaft, and tighten the screw temporary.
4. Check the following operations of the loading planetary gear.
   (1) The platen gear should engage the loading planetary gear and the planetary gear should follow the platen gear when it rotates.
   (2) When pressing the loading trigger plate in the direction of the arrow, the loading planetary gear should engage loading gear A so that the rotation of the platen gear is transmitted to the loading gear. If the loading planetary gear does not work well, adjust it using the screw CPS (P) (M3 × 8) securing the loading frame.

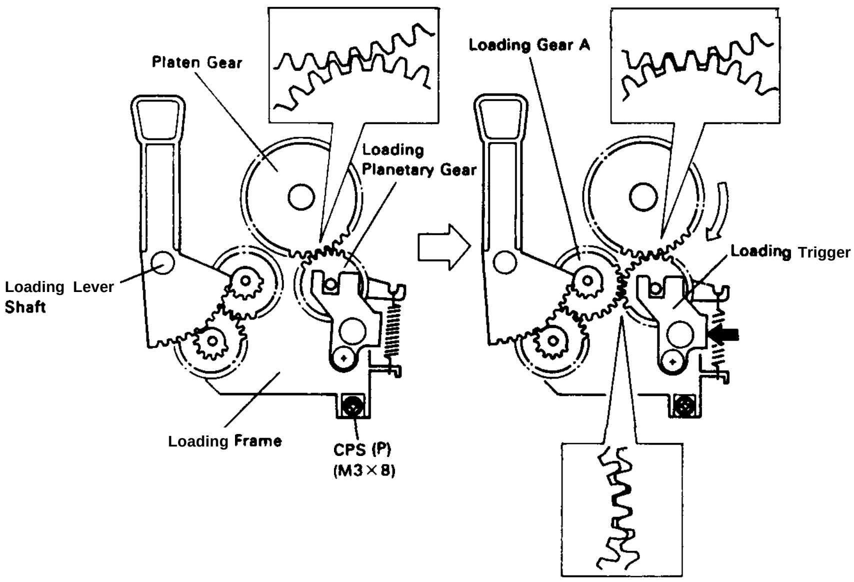


Figure 4-54. Loading Planetary Gear Operation

5. Tighten the loading lever shaft and the screw securing the loading frame.
6. Install the loading gear spring.

ADJUSTMENT REQUIRED

When the paper loading trigger assembly is removed, perform the following adjustment:
Section 4.3.2 Paper Feed Motor Backlash Adjustment (Page 4-4 1)

4.2.5.17 Paper Thickness Sensor Assembly Removal

Step 1: Remove the printer mechanism. (Refer to Section 4.2.5. 1.)

Step 2: Release the lead wires (except the carriage home position sensor wire) from the wire clamp at the back of the base frame.

Step 3: Remove the three screws CPS(M3× 8) securing the paper thickness sensor unit to the base frame at the back of the base frame.

Step 4: Remove the left frame. (Refer to Section 4.2.5 .20.)

Step 5: Remove the paper guide assembly.

Step 6: Remove the paper thickness sensor assembly.

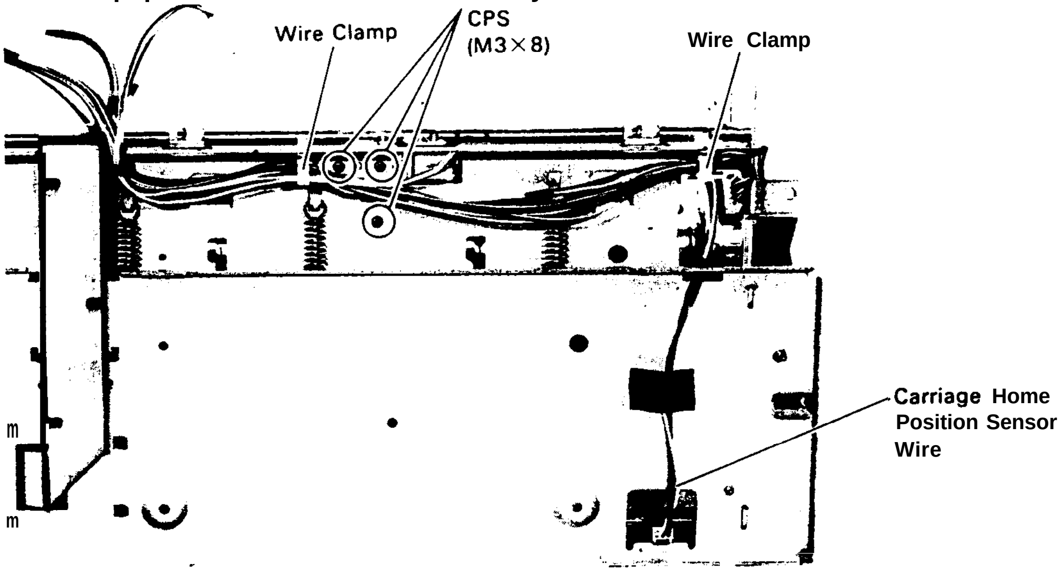


Figure 4-55. Paper Thickness Sensor Assembly Removal (1)
(Back of Base Frame)

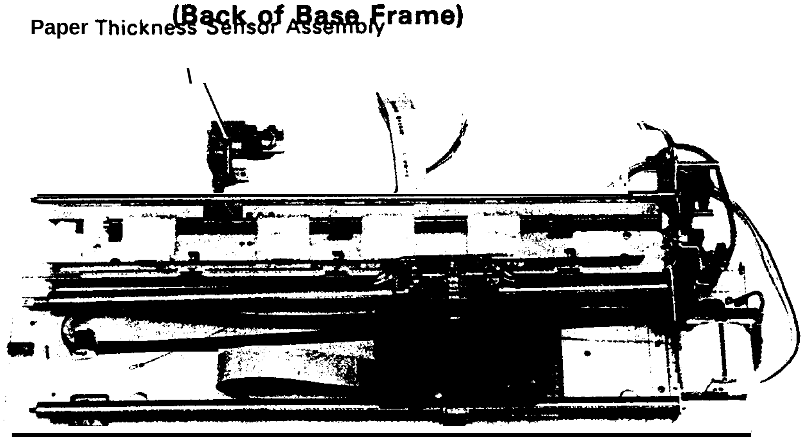


Figure 4-56. Paper Thickness Sensor Assembly Removal (2)

ADJUSTMENT REQUIRED

- When the paper thickness sensor assembly is removed, perform the following adjustments:
  Section 4.3.1 Timing Belt Tension Adjustment (Page 4-40)
  Section 4.3.2 Paper Feed Motor Backlash Adjustment (Page 4-4 1)
  Section 4.3.3 Parallelism Adjustment Between Carriage Guide Shaft B and Platen (Page 4-42)
  Section 4.3.6 Bi-directional Printing Alignment (Page 4-47)
- When the paper thickness sensor is replaced, perform the following adjustment:
  Section 4.3.5 Platen Gap Initial Value Write Operation (Page 4-46).

4.2.5.18 Paper Guide Plate Removal

DANGER

Because the paper guide plate is a thin metallic part, handle it carefully.

Step 1: Remove the printer mechanism. (Refer to Section 4.2.5.1.)

Step 2: Place the printhead at the left (or right) end.

Step 3: Remove the three paper guide plate springs from the back of the base frame.

Step 4: Draw the paper guide plate horizontally toward you, then tilt and remove it so as not to damage the ribbon mask. (The paper guide plate cannot be removed upward.)

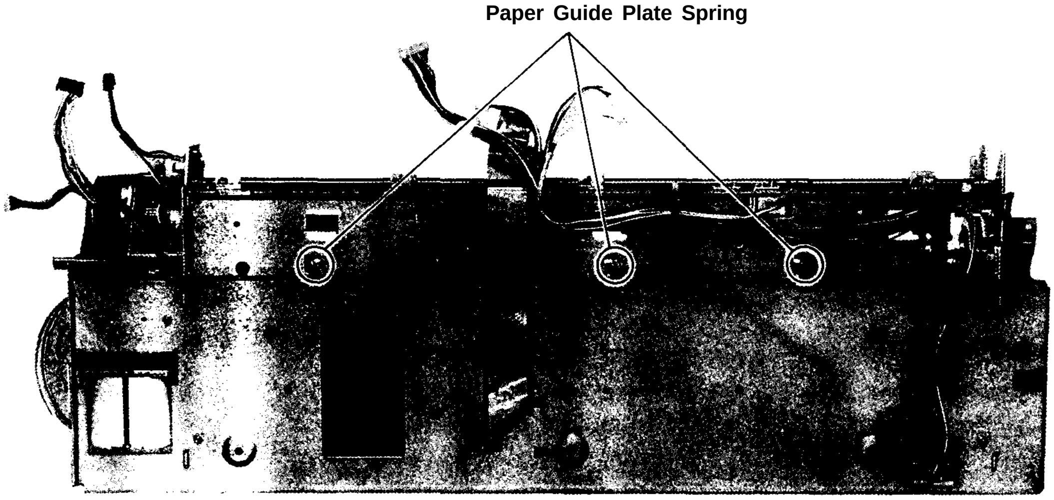


Figure 4-57. Paper Guide Plate Spring Removal (Back of Base Frame)

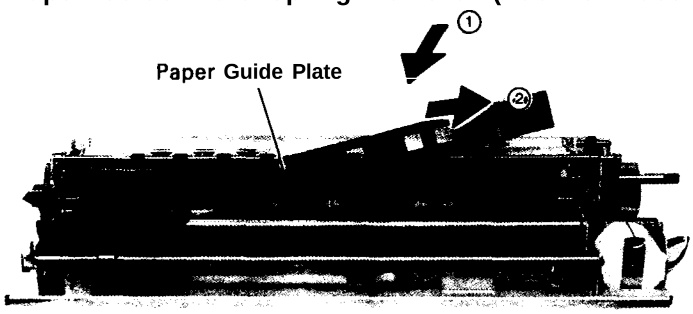


Figure 4-58. Paper Guide Plate Removal

ASSEMBLY POINTS:

- When mounting the paper guide plate, verify the orientation of its top as shown in Figure 4-59.

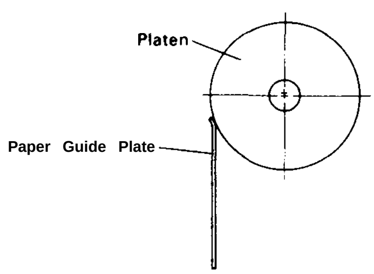


Figure 4-59. Paper Guide Plate Orientation

- You can easily mount the paper guide plate spring by using a round nose pliers. (Refer to Figure 4-57.)

4.2.5.19 Paper Holding Roller Assembly Removal

Step 1: Remove the two paper holding lever springs from the right and left frames.

Step 2: Remove the two E-rings RE(3) fixing the right and left paper holding levers to both frames.

Step 3: Remove the left paper holding lever from the shaft.

Step 4: Shift the whole paper holding roller shaft, then remove the paper holding roller assembly by rotating it in the direction of the arrow.

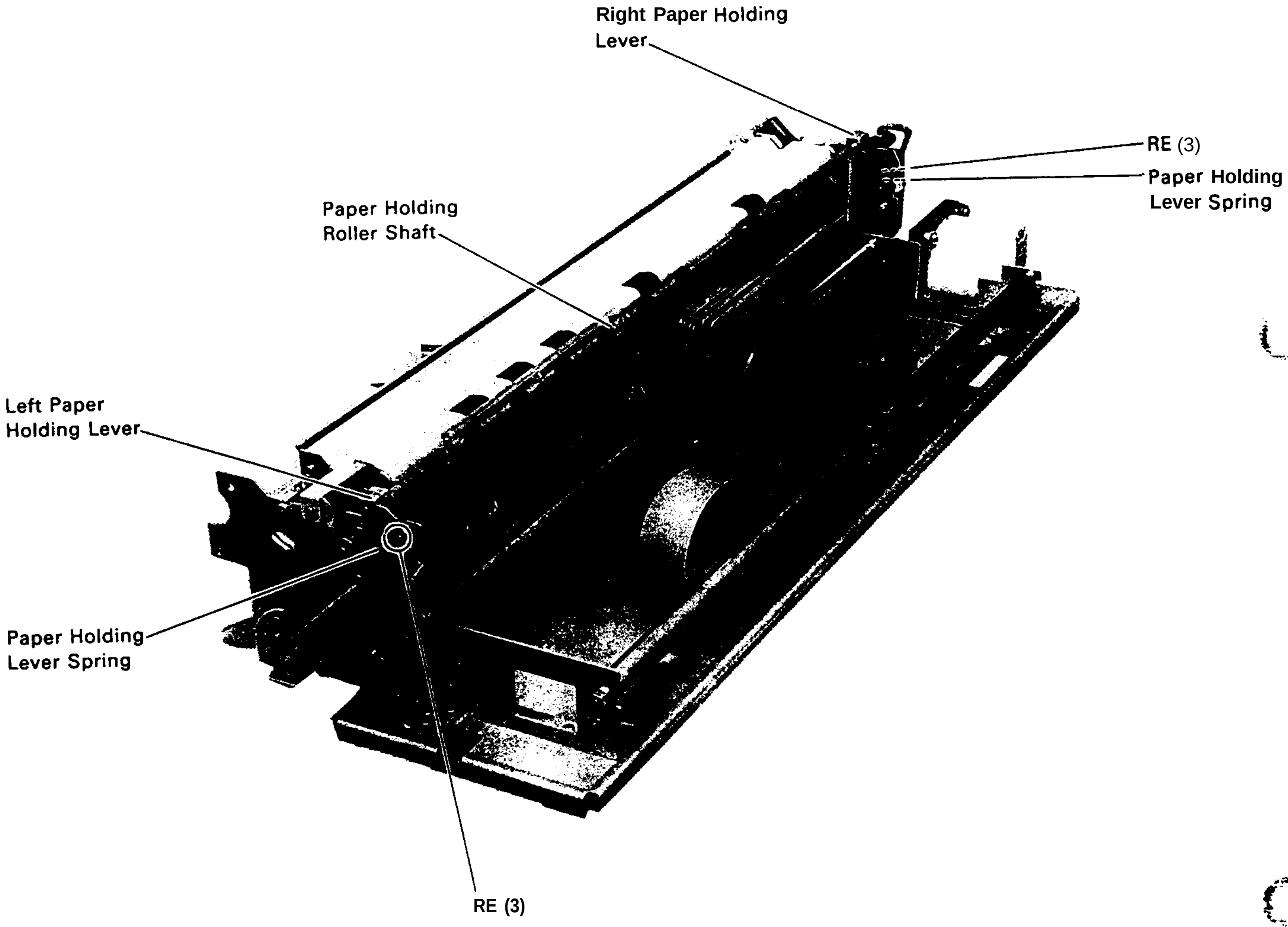


Figure 4-60. Paper Holding Roller Assembly Removal

4.2.5.20 Left Frame Removal

This section describes the removal of the left frame from the printer mechanism. This is useful when removing the paper feed roller shaft and the paper thickness sensor assembly.

Step 1: Remove the paper holding roller assembly. (Refer to Section 4.2.5.1 9.)
Step 2: Remove the paper tension assembly. (Refer to Section 4.2.5.5.)
Step 3: Remove the paper feed motor. (Refer to Section 4.2.5.7.)
Step 4: Remove the platen. (Refer to Section 4.2.5.10)
NOTE: The tractor transmission gear, paper feed reduction gear and paper feed motor should be mounted again after the above steps, in order to easily remove the left frame. This will help prevent the parts on the right frame from being dropped.
Step 5: Release the lead wires of the platen gap home position sensor and the platen gap motor from the wire clamp at the back of the base frame.
Step 6: Remove the ribbon drive wire spring and the ribbon drive wire.
Step 7: Remove the screw CBS(O)(M4 X 12) securing the belt driven pulley mounting plate.
Step 8: Remove the screw CP(P)(M3 X 6) securing the platen gap gear assembly on carriage guide shaft B, then remove the platen gap gear assembly and the leaf spring LS(8.2-0.25-1 5).
Step 9: Remove the nut HNO(M4) securing carriage guide shaft A to the left frame.
Step 10: Remove the nut HNO(M4) securing the side frame support to the left frame.
Step 1 1: Remove the three screws CPS(M3×8) securing the left frame to the base frame.
Step 12: Remove the left frame from the base frame with the sensor and motor attached.

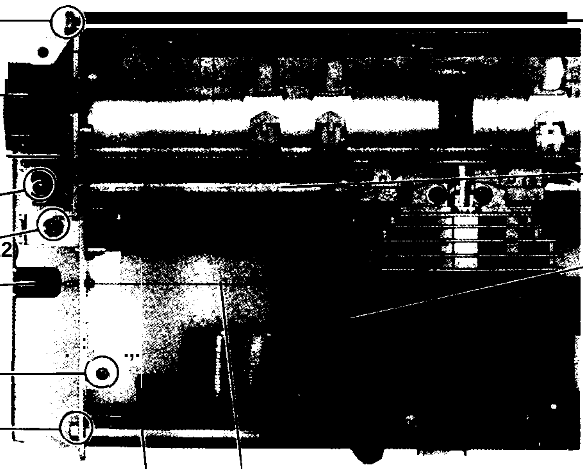


Figure 4-61. Left Frame Removal (1)

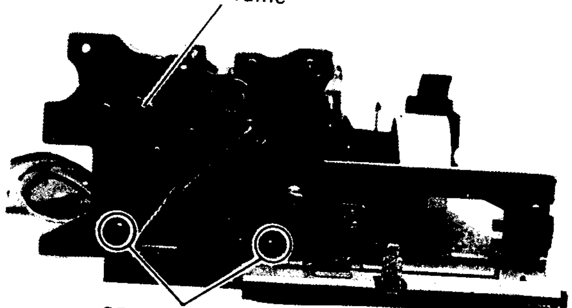


Figure 4-62. Left Frame Removal (2)

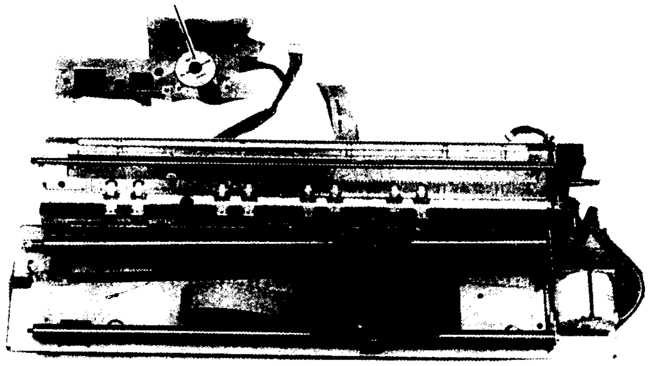


Figure 4-63. Printer Mechanism with Left Frame Removed

ADJUSTMENT REQUIRED

When the left frame is removed, perform the following adjustments:

- Section 4.3.1 Timing Belt Tension Adjustment (Page 4-40)
- Section 4.3.2 Paper Feed Motor Backlash Adjustment (Page 4-41)
- Section 4.3.3 Parallelism Adjustment Between Carriage Guide Shaft B and Platen (Page 4-42)
- Section 4.3.6 Bi-directional Printing Alignment (Page 4-47)

ASSEMBLY POINTS:

- Prior to installing the platen gap gear assembly, verify that the leaf spring is mounted as shown below.

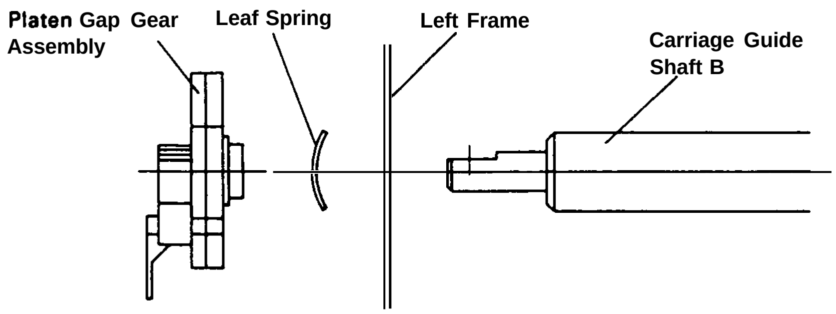


Figure 4-64. Leaf Spring Mounting Orientation

- When installing the platen gap gear assembly, shift one cog at the end of the gear so as to true up the edge of the two gears at the other end. This ensures that the platen gap gear assembly will rotate without backlash.

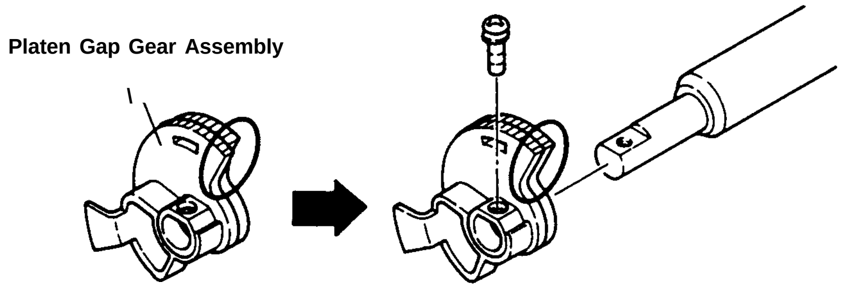


Figure 4-65. Platen Gap Gear Assembly Installation

- Install the ribbon drive wire as following procedures.
  1. Mount the ribbon drive wire to the ribbon drive wire spring.
  2. Wind it around the ribbon drive pulley at the back of the carriage counterclockwise.
  3. Attach it to the right frame.
  4. Move the carriage horizontally, and confirm that the ribbon drive shaft rotates counterclockwise.
- If the nut at the right frame securing the side frame support is loose, tighten it using a 7 mm wrench.

4.2.5.21 Paper Feed Roller Assembly Removal

Step 1: Remove the printer mechanism. (Refer to Section 4.2.5.1.)

Step 2: Remove the four paper feed springs at the back of the base frame.

Step 3: Remove the three screws CPS(M3×8) securing the paper thickness sensor assembly at the back of the printer.

Step 4: Remove the left frame. (Refer to Section 4.2.5 .20.)

Step 5: Remove the paper guide assembly.

Step 6: Remove the paper thickness sensor assembly, and place it at the opposite side of the base frame.

Step 7: Remove the paper feed roller shaft, then remove the paper feed roller assembly from the shaft.

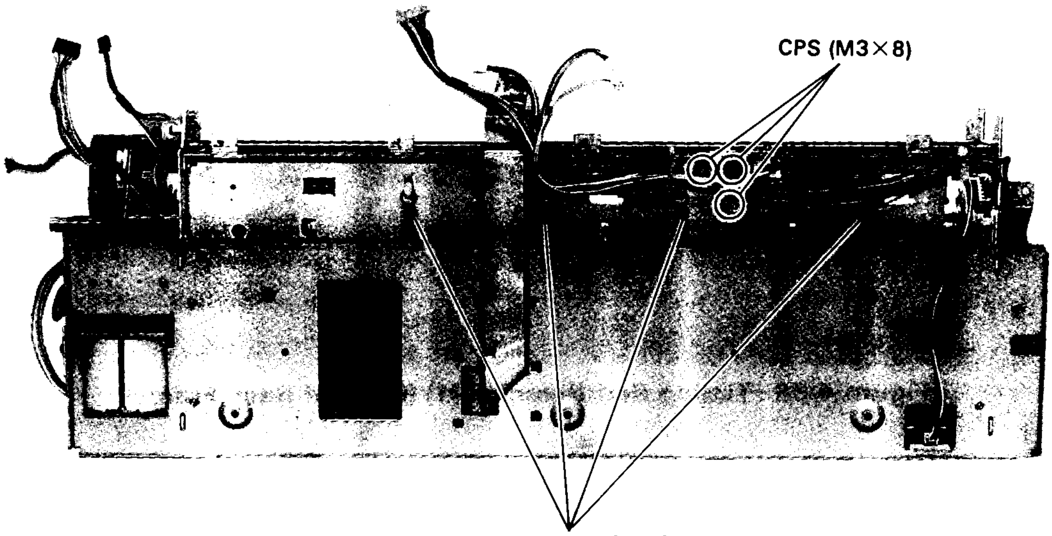


Figure 4-66. Paper Feed Spring Removal (Back of Base Frame)

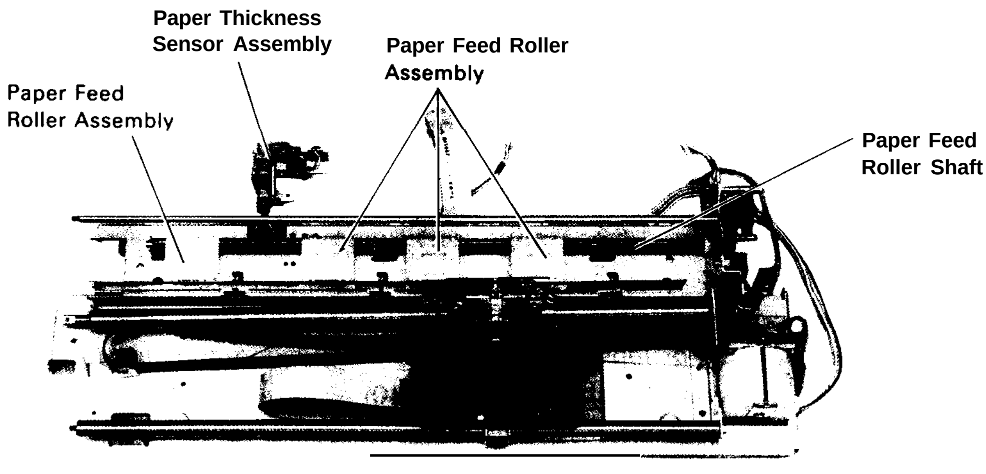


Figure 4-67. Paper Feed Roller Assembly Removal

ADJUSTMENT REQUIRED

When the paper feed roller assembly is removed, perform the following adjustments:

. Section 4.3.1 Timing Belt Tension Adjustment (Page 4-40)

● Section 4.3.2 Paper Feed Motor Backlash Adjustment (Page 4-41)

● Section 4.3.3 Parallelism Adjustment Between Carriage Guide Shaft B and Platen (Page 4-42)

. Section 4.3.6 Bi-directional Printing Alignment (Page 4-47)

4.2.5.22 Timinq_ Belt Removal

Step 1: Remove the printer mechanism. (Refer to Section 4.2.5. 1.)

Step 2: Place the carriage over the cutout in the base frame.

Step 3: Remove the screw CPS(M3 X 8) securing the timing belt fixing plate at the back of the base frame, then remove the belt fixing plate.

Step 4: Remove the screw CBS(O)(M4 X 12) securing the belt driven pulley mounting plate, then remove the timing belt from the pulley.

Step 5: Release the timing belt from the belt drive pulley at the rear of the carriage motor.

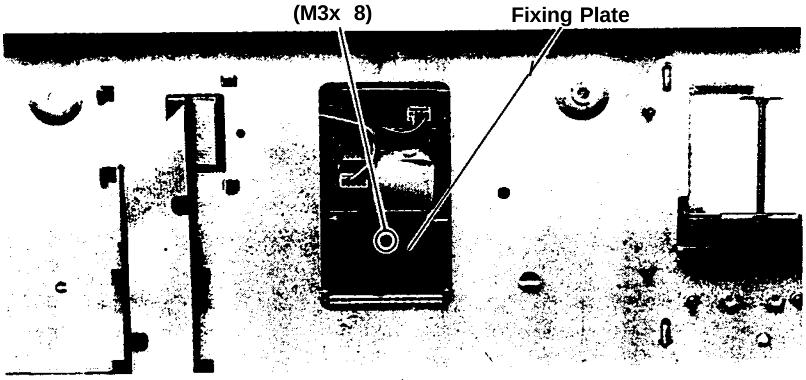


Figure 4-68. Timing Belt Removal (1) (Back of Base Frame)

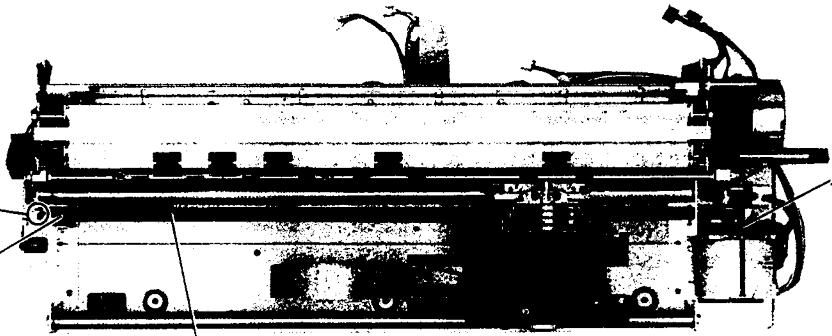


Figure 4-69. Timing Belt Removal (2)

ADJUSTMENT REQUIRED

When the timing belt is replaced or loosened, perform the following adjustment:
Section 4.3.1 Timing Belt Tension Adjustment (Page 4-40)

ASSEMBLY POINT:

● **When attaching the timing belt to the carriage, secure the screw so that the timing belt and timing belt fixing plate are positioned as shown below.**

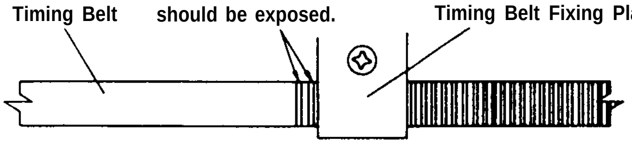


Figure 4-70. Timing Belt Fixation (Back of Base Frame)

4.3. ADJUSTMENT

This section describes the adjustment procedures required when reassembling the LQ-2550 printer. When disassembly or replacement is performed during maintenance or repairs of the parts described in this section, the following adjustments should be performed to ensure proper operation.
The adjustment sequence is shown in Figure 4-71.

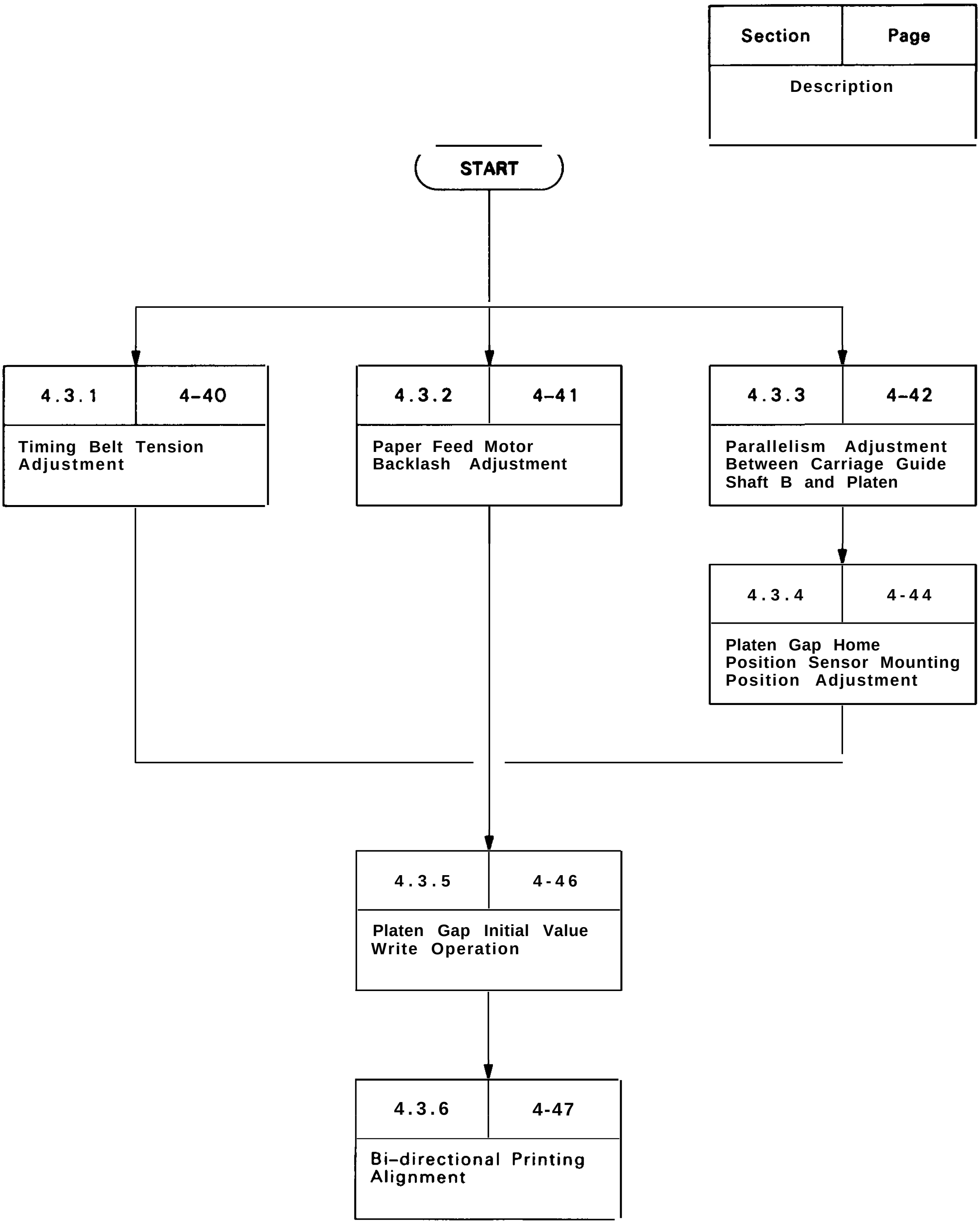


Figure 4-71. Printer Adjustment Procedures

4.3.1 Timing Belt Tension Adjustment

This adjustment is required when the timing belt is removed or loosened.

Step 1: Remove the printer mechanism. (Refer to Section 4.2.5.1.)

Step 2: Verify that the timing belt is correctly inserted into the bottom of the carriage.

Step 3: Loosen the screw CBS(O)(M4 × 12) on the belt driven pulley mounting plate.

Step 4: Adjust the belt tension using a tension gauge.

Tension value: 5000g ± 500g

Step 5: Tighten the screw CBS(O)(M4 × 12) on the belt driven pulley mounting plate.

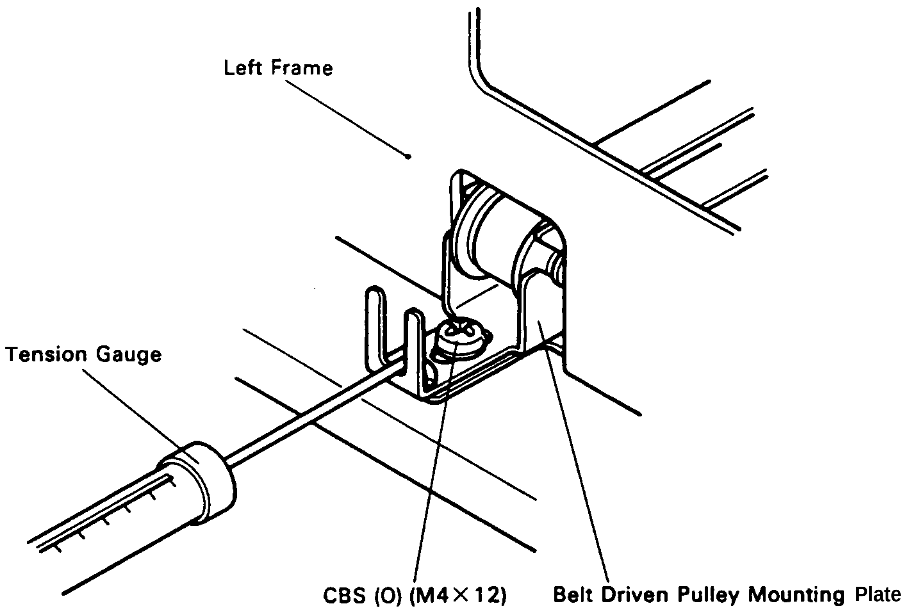


Figure 4-72. Timing Belt Tension Adjustment

4.3.2. Paper Feed Motor Backlash Adjustment

This adjustment is required when either the paper feed motor is replaced or when its mounting position is shifted.

Step 1: Remove the printer mechanism. (Refer to Section 4.2.5.1.)

Step 2: Loosen the two screws CPS(M3 X 8) securing the paper feed motor.

Step 3: Manually rotate the paper feed motor, and adjust the backlash between the pinion and the paper feed reduction gear.
Allowable backlash: 0.05mm to 0.1 mm

Step 4: Tighten the screws CPS(M3×8) on the paper feed motor.

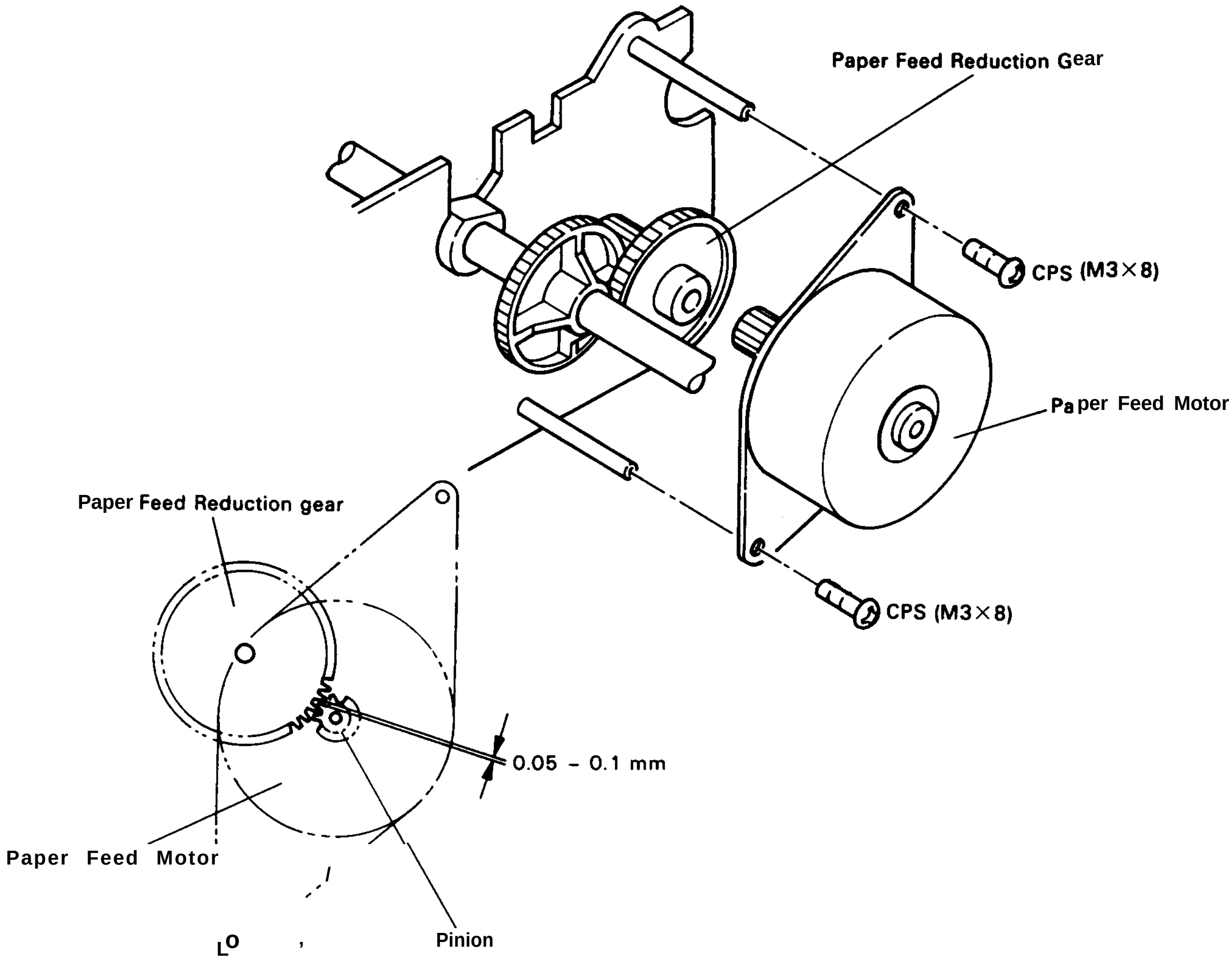


Figure 4-73, Paper Feed Motor and Paper Feed Reduction Gear Backlash Adjustment

4.3.3 Parallelism Adjustment Between Carriage Guide Shaft B and Platen

This adjustment is required when:

- **Left frame is removed.**

Step 1: Remove the printer mechanism. (Refer to Section 4.2.5.1.)
Step 2: Remove the printhead. (Refer to Section 4.2. 1.)
Step 3: Remove the CB screw (M2.5 X 5), then remove the paper width sensor from the ribbon mask. (See Figure 4-74.)
Step 4: Remove the two CB screws (M2.5 X 5), then remove the ribbon mask. (See Figure 4-74.)
Step 5: Rotate the platen gap motor pinion manually so that the carriage moves to the farthest position from the platen. (See Figure 4-75.)
Step 6: Move the carriage to the left.
Step 7: Fix the dial gauge base to the carriage using the two CS screws (M3 X 6) for securing the printhead. (See Figure 4-76.)
Step 8: Attach the dial gauge to the dial gauge base, confirm that the feeler of the gauge touches the platen and that the long needle registers 15 to 20 units higher on the scale than when the feeler does not contact the platen, and fix the dial gauge with the hexagonal screw.
Step 9: Set the limiters (left and right) at 1.5 and 1.5 on the scale.
Step 10: Rotate the outer frame of the dial gauge and so that the long needle points to O.
Step 1 1: While pushing the lift lever, move the carriage to the right end of the platen.
Step 12: Loosen the CPS(P) screw (M3 X 8), slide the head adjustment lever, and fix it at a point where the long needle of the dial gauge registers between the limits. (See Figure 4-77.)
Step 13: While pushing the lift lever, move the carriage to the left end of the platen, and confirm that the long needle registers between the limits.
If it does not, repeat the adjustment from Step 10.
Step 14: Remove the dial gauge and dial gauge base, and attach the ribbon mask, paper width sensor, and printhead.

NOTE: Perform the adjustment with the printer mechanism on a flat table.

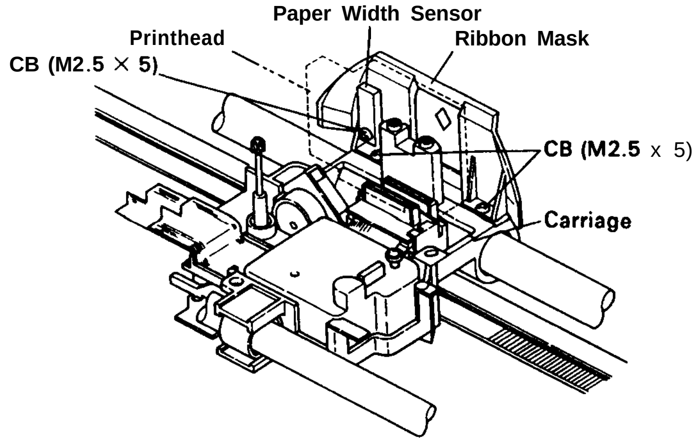


Figure 4-74. Paper Width Sensor and Ribbon Mask Holder Removal

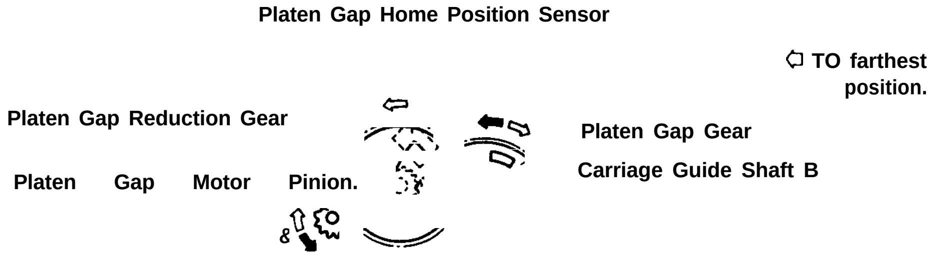


Figure 4-75. Platen Gap Motor Gears Series

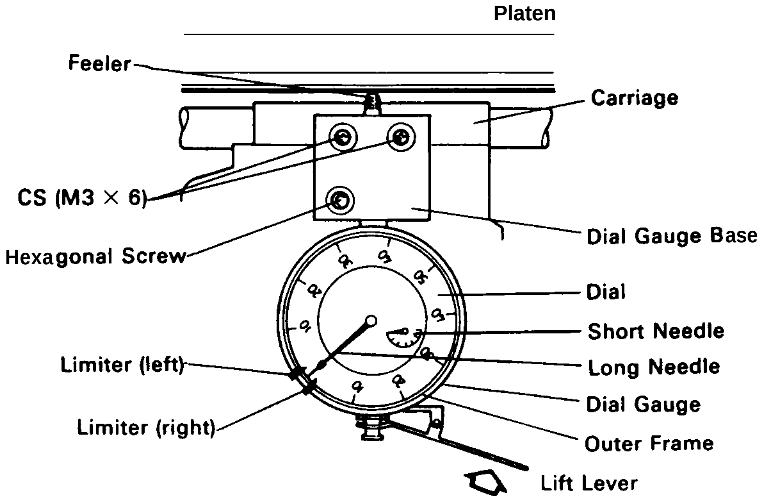


Figure 4-76. Dial Gauge Base and Dial Gauge Positions and Names of Parts

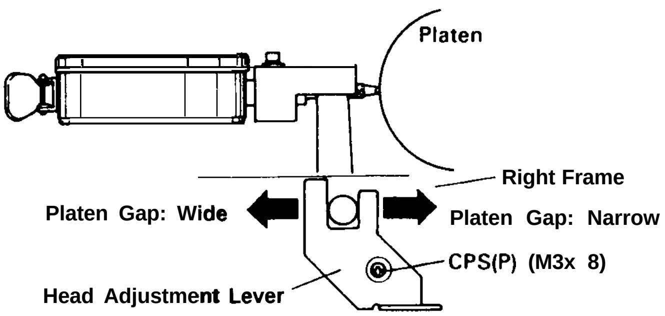


Figure 4-77. Head Adjustment Lever Mounting Position Adjustment

4.3.4 Platen Gap Home Position Sensor Mounting Position Adjustment

This adjustment is required when:

- The platen gap home position sensor mounting position is shifted.
- The platen gap gear is replaced.
- The platen is replaced.

Step 1: Remove the printer mechanism. (Refer to Section 4.2.5. 1.)

Step 2: Remove the printhead. (Refer to Section 4.2. 1.)

Step 3: Remove the CB screw (M2.5 X 5), then remove the paper width sensor from the ribbon mask. (See Figure 4-74.)

Step 4: Remove the two CB screws (M2.5 X 5), then remove the ribbon mask. (See Figure 4-74.)

Step 5: Attach the printhead by the two CS screws (M3 X 6).

Step 6: Move the carriage to the center of the platen.

Step 7: Rotate the platen gap motor pinion little by little manually so that the gap between the platen and printhead can be adjusted to 1.2 [mm] using a thickness gauge. (See Figure 4-78.)

Step 8: Loosen the CPS(P) screw (M3 X 8) securing the platen gap home position sensor (See Figure 4-80).

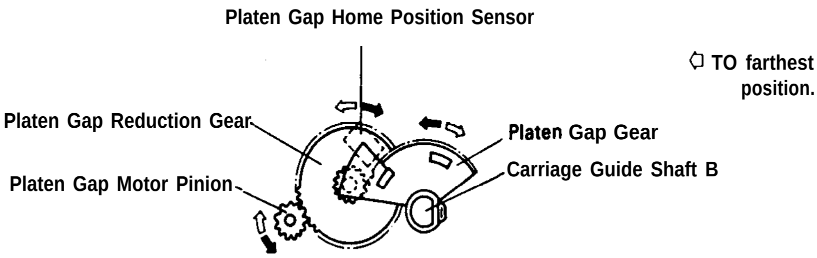
Step 9: Connect extension cable E649 (modified cable; see Figure 4-79.) between the ROMA board (CN 16) and the 9 pin connector of the printer mechanism.

Step 10: Attach the probe of either the oscilloscope or multi-meter (digital type) to CN 16 of the ROMA board. (Connect the plus and minus probes to pins 8 and 9, respectively. When using the oscilloscope, its ranges should be 2 V/DIV. and 1 ms/DIV.)

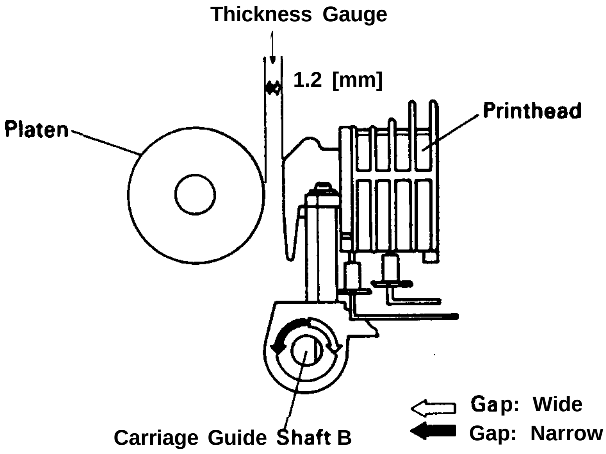
Step 1 1: Turn the printer power on.

Step 12: Move the platen gap home position sensor along the groove on left frame, and fix it at the position where the voltage changes from O to 0.1 [V] (low level) to 5 [V], using the CPS(P) screw. (See Figure 4-80.)

NOTE: If the voltage does not reach 5.0 [V] even after the platen gap home position sensor was moved to the back of the mechanism, loosen the screw CTB(P) (M3 × 8) and move the platen gap home position flag to clockwise until the voltage reaches 5.0 [V]. (See Figure 4-80.) At this time, make sure that the platen gap gear does not move.

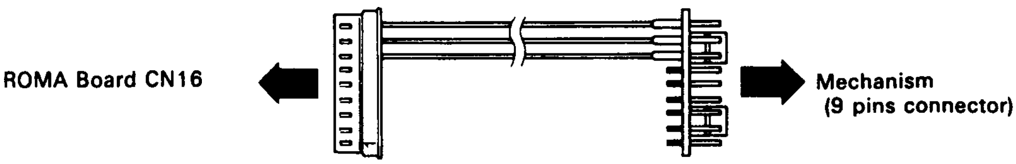


(a) Platen Gap Motor Gears Series



(b) Platen Gap Adjustment

Figure 4-78. Platen Gap Adjustment



NOTE: Remove cables for pins 1 to 5.

Figure 4-79. Extension Cable E649 Modification

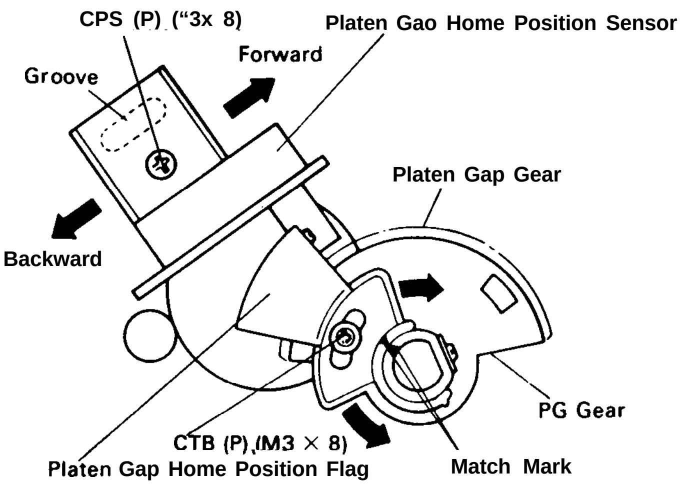


Figure 4-80. Platen Gap Gear Mounting Position Adjustment

4.3.5 Platen Gap Initial Value Write Operation

The platen gap initial value write operation is required when:

- **Connector CN7 for the battery unit is disconnected. (The LCD displays "RAM CLEAR" with the power on.)**
- **The printer mechanism is removed or replaced.**
- **The platen is replaced.**
- **The paper thickness sensor assembly is replaced.**

The procedure is as follows (see Figure 4-8 1):

Step 1: Remove the cartridge cover, and insert the adjustment cartridge in slot A (see Figure 4-82).

Step 2: Confirm that no paper is loaded, and turn the printer power on. The LCD displays "Bi-D Adjustment", and the A and V LEDs blink.

Step 3: Press either the FORM FEED (❑) or LINE FEED (❑) switch once. The LCD displays "✱Write PG Voltage", and the A and V LEDs blink.

Step 4: Press the LOAD/EJECT (⊡) switch. The printer measures the platen gap four times in each (once per 1/4 rotation of the platen) of the friction and push tractor modes and stores the mean value of the four measured values for each mode in the memory as the initial platen gap. When the write operation is completed, the LCD displays "✱Write PG Voltage" again, and the A and V LEDs blink.

Step 5: Turn the printer power off, and remove the adjustment cartridge from slot A.

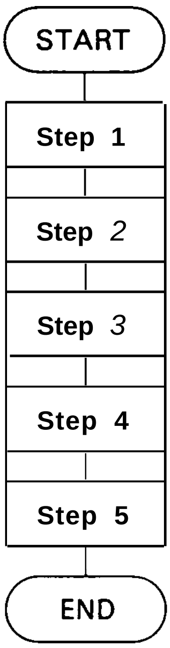


Figure 4-81. Platen Gap Initial Value Write Sequence

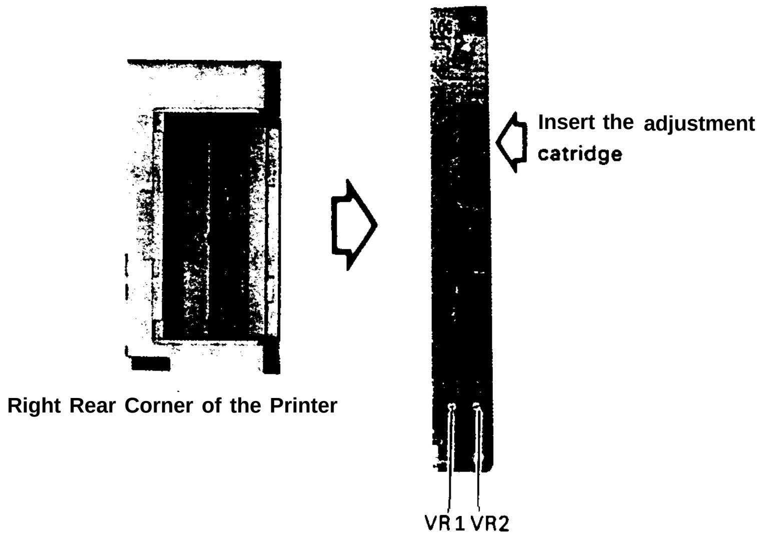


Figure 4-82. Bidirectional Printing Alignment Value Adjustment Section

4.3.6 Bi-directional Printing Alignment

This alignment is required when:

- The even-numbered lines and the odd-numbered lines are misaligned in the bi-directional printing mode.
- The printer mechanism is replaced.
- The ROMA board is replaced.
- The timing belt is loosened.

The alignment procedure is as follows (see Figure 4-83.):

Step 1: Remove the cartridge cover, and insert the adjustment cartridge in slot A (see Figure 4-82).

Step 2: Load continuous paper (width: 15 to 16 inches) into the pull tractor.
Turn the printer power on. The LCD displays "✱ Bi-D Adjustment," and the A and V LEDs blink.

Step 3: Press the LOAD/EJECT (⍈) switch. The LCD displays "PAPER OUT", and the D LED blinks.

Step 4: Press ⍈ so that the paper is loaded. The LCD displays "OFF LINE," and the ◁ LED blinks.

Step 5: Press the ON LINE switch (El). The printer enters the menu selection mode, the LCD displays "◁EX AALL VLQ Dr▷," and the A, V, and ▷LEDs blink.

Step 6: If ❑ is pressed, "1 l" characters are printed for four lines in the Draft test mode, and the LCD displays "Draft mode printing."
If the characters on the odd-numbered lines are shifted to the left when compared with those on the even-numbered lines, press ❑ to shift the characters to the right. Each time ❑ is pressed, the alignment value increments (the alignment value is displayed on the LCD as "T [± xx]"). If the characters on the odd-numbered lines are shifted to the right, press ❑ to shift the characters to the left. If ❑ is pressed after the alignment value is set, the alignment value displayed on the LCD is added and "1 l" characters are printed again for four lines.

Step 7: When the correct alignment value is set, press ❑ . The LCD displays "Tar. <+xx>, VR2 <+xx>."

Step 8: Adjust VR2 using either a Philips or standard screw driver, with a thin tip, so that VR2 is set to the target (Tar.) value. When VR2 is turned clockwise, the alignment value increments, and when it is turned counterclockwise, the value decrements.
When VR2 is adjusted to the target value, the buzzer wind ring continuously like "Pi-pi-pi, pi-pi-pi·····" and the ◁LED will blink.

Step 9: Press El. The printer returns to the menu selection mode (Step 5).

Step 10: If ❑ is pressed, "1 l" characters are printed for four lines in the LQ test mode, and the LCD displays "LQ mode printing."
If the characters on the odd-numbered lines are shifted to the left when compared to the even-numbered lines, press ❑ to shift the characters to the right. Each time ⍗ is pressed, the alignment value increments (the alignment value is displayed on the LCD as "T [+ xx]"). If the characters on the odd-numbered lines are shifted to the right, press ⍐ to shift the characters to the left. If ❑ is pressed after the alignment value is set, the alignment value displayed on the LCD is added and "1 l" characters are printed again for four lines.

Step 1 1: When the correct alignment value is set, press El. The LCD displays "Tar. <+xx>, VR 1 <+xx> .".

Step 12: Adjust VR 1 using either a philips or standard screw driver, with a thin tip, so that VR 1 is s to the target (Tar.) value. When VR 1 is turned clockwise, the alignment value increments, and when it is turned counterclockwise, the value decrements.
When VR1 is adjusted to the target value, the buzzer will ring continuously like “Pi-pi-pi, pi-pi-pi”.-” and the ◁LED will blink.

Step 13: Press ❑ . The printer returns to the menu selection mode (Step 5).

Step 14: If ❑ is pressed, the printer executes test printing at each of five printing speeds, and the LCD displays “’All mode print test”. After all the test printing is completed, the printer returns to Step 5.

Step 15: Press ❑ . The LCD displays the initial message “✱Bi-D Adjustment.”

Step 16: Turn the printer power off, and remove the adjustment cartridge.

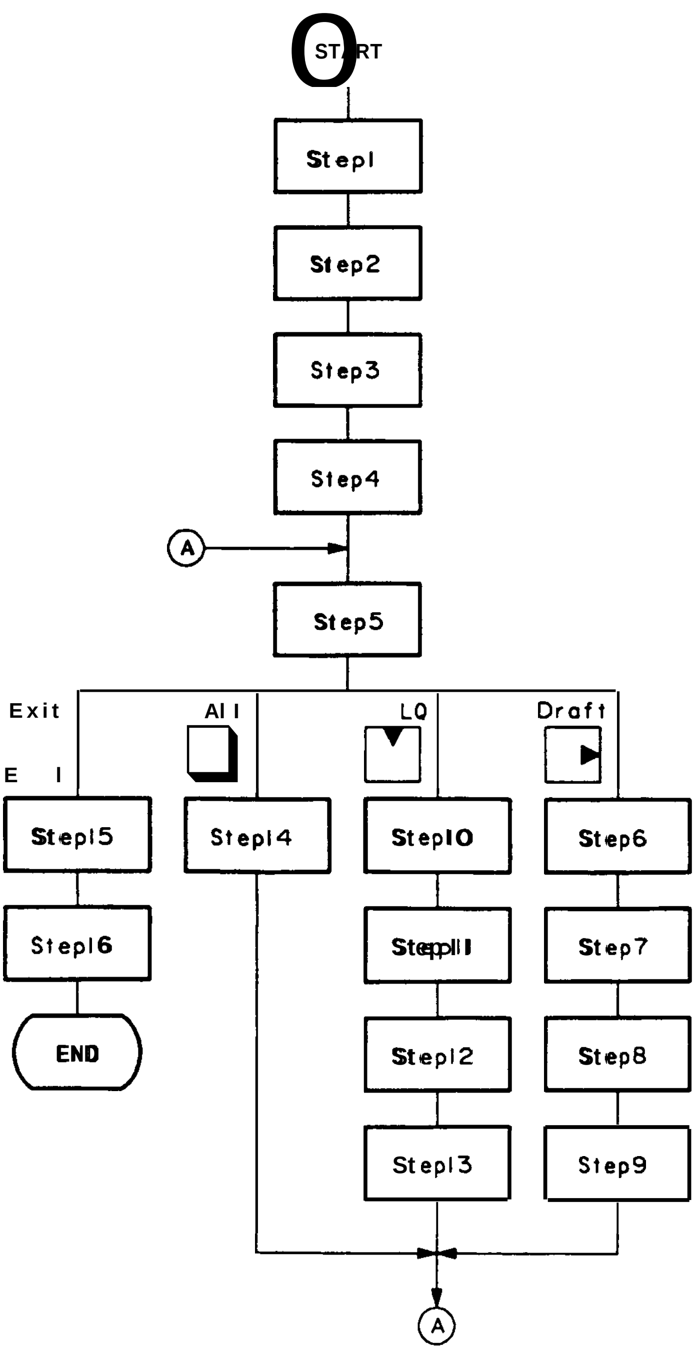


Figure 4-83. Bidirectional Printing Alignment Sequence

CHAPTER 5
TROUBLESHOOTING

LIST OF FIGURES

CHAPTER 5

LIST OF TABLES

5.1 GENERAL

Because various types of problems can occur, troubleshooting is not easy to perform. Here is a simple procedure provided to perform troubleshooting.

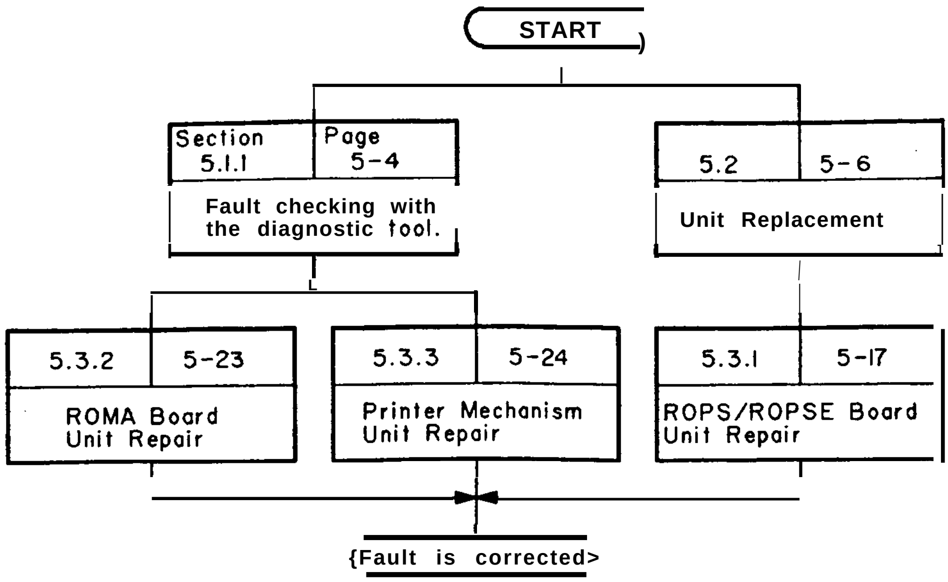


Figure 5-1. Troubleshooting Procedure

Table 5-1 lists the troubleshooting tools contained in the printer.

Table 5-1. Troubleshooting Tools

Tool No.	Item	Description	Part No.
E653	Diagnostic Tool	● Use with EPSON PC, APEX, EQUITY series	B7651 10101
E654		● Use with EPSON QX-16	B7651 10201
E658	Adjustment Cartridge	. Write mechanism initial value, and perform print alignment adjustment	Y499035020
E594	Cable (2 pin)	● Between ROMA board (CN 15) and PE sensor	B765 105401
E625	Cable (3 pin)	● Between ROMA board (CN 13) and CR home position sensor . Between ROMA board (CN21) and case open sensor	B765 108001
916	Cable (4 pin)	● Between ROMA board (CN 19) and LD solenoid, and LD sensor . Between ROMA board (CN20) and RL solenoid, and RL sensor	Y427307000
E600	Cable (5 pin)	● Between ROMA board (CN 12) and PT sole-noid, and PT sensor	B765 105501
E512	Cable (6 pin)	● Between ROMA board (CN 17) and CR motor ● Between ROMA board (CN 18) and PF motor	B765 102701
E649	Cable (9 pin)	● Between ROMA board (CN 16) and PG motor, and PG home position sensor	B765 109801
E659	Cable (18 pin)	● Between ROMA board (CN9) and HF motor, CS motor, and PW sensor ● Between ROMA board (CN 10) and printhead ● Between ROMA board (CN 1 1) and printhead	B7651 10801
E660	Connector (18 pin)		B7651 10901

NOTES: 1. These cables and connectors are longer than the distance between the ROMA board and the printer mechanism to make troubleshooting easier (Refer to Figure 5-2.).
2. In this chapter, the following abbreviations are used:
CR: Carriage
CS: Color select
PE: Paper end
PF: Paper feed
PG: Platen gap
LC: Loading
RL: Release
PT: Paper thickness
PW: Paper width

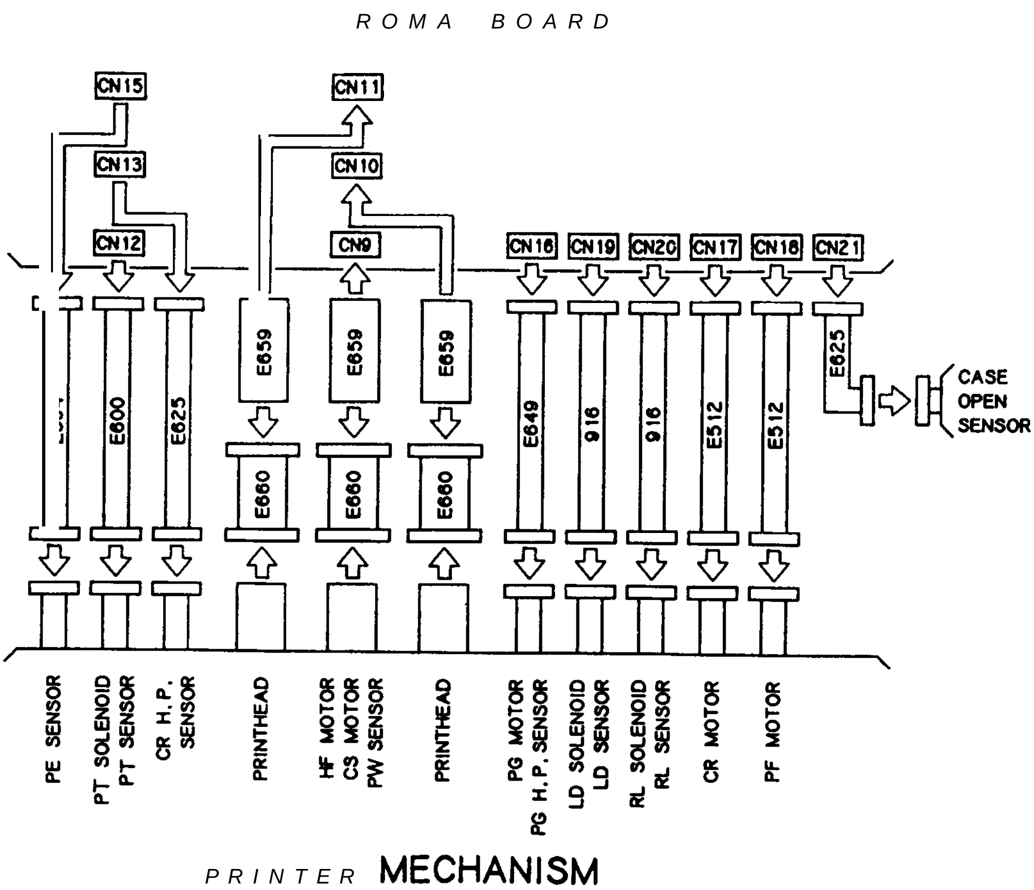


Figure 5-2. Extension Cable Connections

5.1.1 Diagnostic Tools

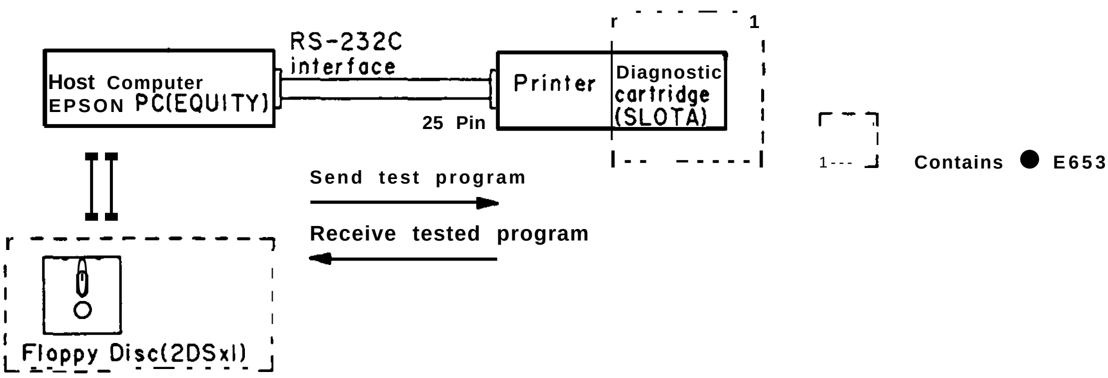
The diagnostic tools enable anyone to troubleshoot the electric components, regardless of experience.

5.1.1.1 System Outline

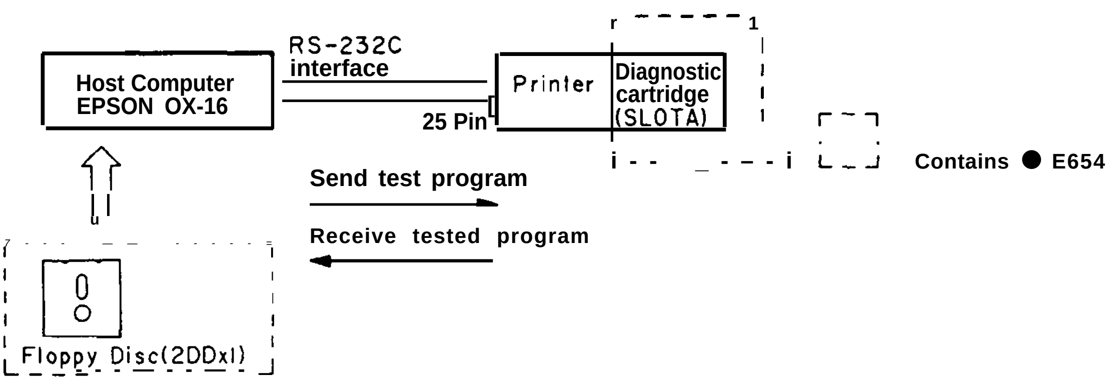
This system has the following features:

- **Provides anyone with a way to troubleshoot, regardless of technical or electronic expertise.**
- **A choice of programs offers various methods for repair, analysis, and testing of the printer.**
- **Defective units can be identified easily.**

Connect this system to an MS-DOS-based computer (EPSON QXI 6, PC (EQUITY), etc.) using an RS-232C cable.
First, install the diagnostic cartridge in the printer and run the diagnostic program with the computer. The host-computer sends the test programs to the printer, which then executes them. The host computer receives the test program results back from the printer and determines the status of the printer. Figure 5-3 and Table 5-2 show this diagnostic system.



(a) #E653 with EPSON PC (EQUITY)



(b) #E654 with EPSON QX-16

Figure 5-3. Printer Diagnostic System

Table 5-2. Printer Diagnostic System

Computer	EPSON PC (EQUITY)	EPSON QX-16
Diagnostic Tool	#E653	#E654
	● Floppy disk (2DS × 1)	. Floppy disk (2DD × 1)
	● Diagnostic cartridge ● Operational manual	
Cable	● D-SUB 25 pin I/F cable*1	
	● AMPHENOL 36 pin I/F cable*2	

*1: The RS-232C I/F cable circuit is shown in Figure 5-4.

*2: It is useful when performing the test printing to use the 8-bit parallel interface.

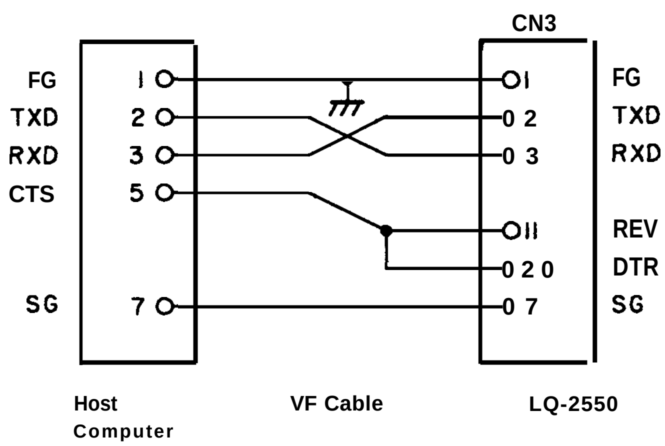


Figure 54. RS-232C I/F Cable Circuit

5.2 UNIT REPLACEMENT

The unit replacement is based on system analysis. According to the particular symptom found by the multimeter, the units listed in Table 5-3 need to be replaced, and Table 5-4 shows sympton and reference pages.

Table 5-3. Replacement Unit Numbers

Unit	Description	Unit No.
Fuse (FI)	125V 6.3A (for ROPS board) 250V 4.0A (for ROPSE board)	X50206 1070 X502063060
ROPS Board ROPSE Board	100- 120V AC 220- 240V AC	Y456202000 Y456203000
Battery Unit	Lithium battery	Y454504000
ROMA Board	Control board	Y456201 200
Fan Unit	Fan motor	Y456503000
Panel Unit	ROPNL-W board	Y45650 1000
#8C2	Case open sensor	Y456305000
Model-5560	Printer mechanism (exclude printhead)	Y456590000
Printhead	24-pin dot head	F4 18000000
CS Unit	Color select unit	F344902000

WARNINGS

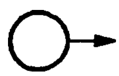
1. Before starting any unit replacement, confirm that all connectors are connected firmly, and that no cables are cut.
2. When repairing the printer by unit replacement, be sure to reattach the upper case and reconnect connector CN21 to the ROMA board. (If CN2 1 is disconnected, the LCD on the printer continues to display "CASE OPEN.")

Table 5-4. Symptoms and Reference Pages

Symptom	Problem Indicators	Reference Page
Printer does not operate at all with power switch on.	● POWER LED on the control panel is not lit. . HF motor does not rotate. ● if the printer cover is not shut correctly, the LCD displays "CASE OPEN."	5-8
Platen gap adjustment mechanism and carriage mechanism are not initialized.	● LCD displays "ERROR n"." *1: n = O, 2 or 10	5-9
Abnormal paper release mechanism operation	● The paper feed system is not switched correctly by the PAPER SELECT switch.	5-10
Incorrect printing with normal carriage operation a) When using a black ribbon: (In the self test or normal printing mode)	. Vertical lines (ruled lines) are misaligned. . A specific dot is missing.	5-11
b) When using a color ribbon: (In the self test mode)	● Printing positions are misaligned during color printing (mixed color; violet, orange, and green). . Printing colors are not switched correctly.	5-12
Abnormal paper feed	● The paper feeding method and the paper being used do not match. . Line feeding is not uniform during printing. . LD solenoid (paper holding roller shaft) does not open and close.	5-13
Abnormal control panel operation	● Printer does not respond to switches. ● LEDs light abnormally. . No message is displayed on the LCD.	5-14
Incorrect printing in ON LINE mode	● Printer operates abnormally when it is connected to a host computer.	5-15

The flow charts on the subsequent pages use the following symbols.

Start



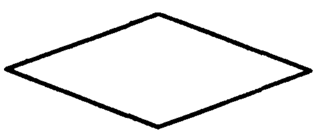
Branching

Processing

End

Forwarding to another item

Returning to the Start of the item



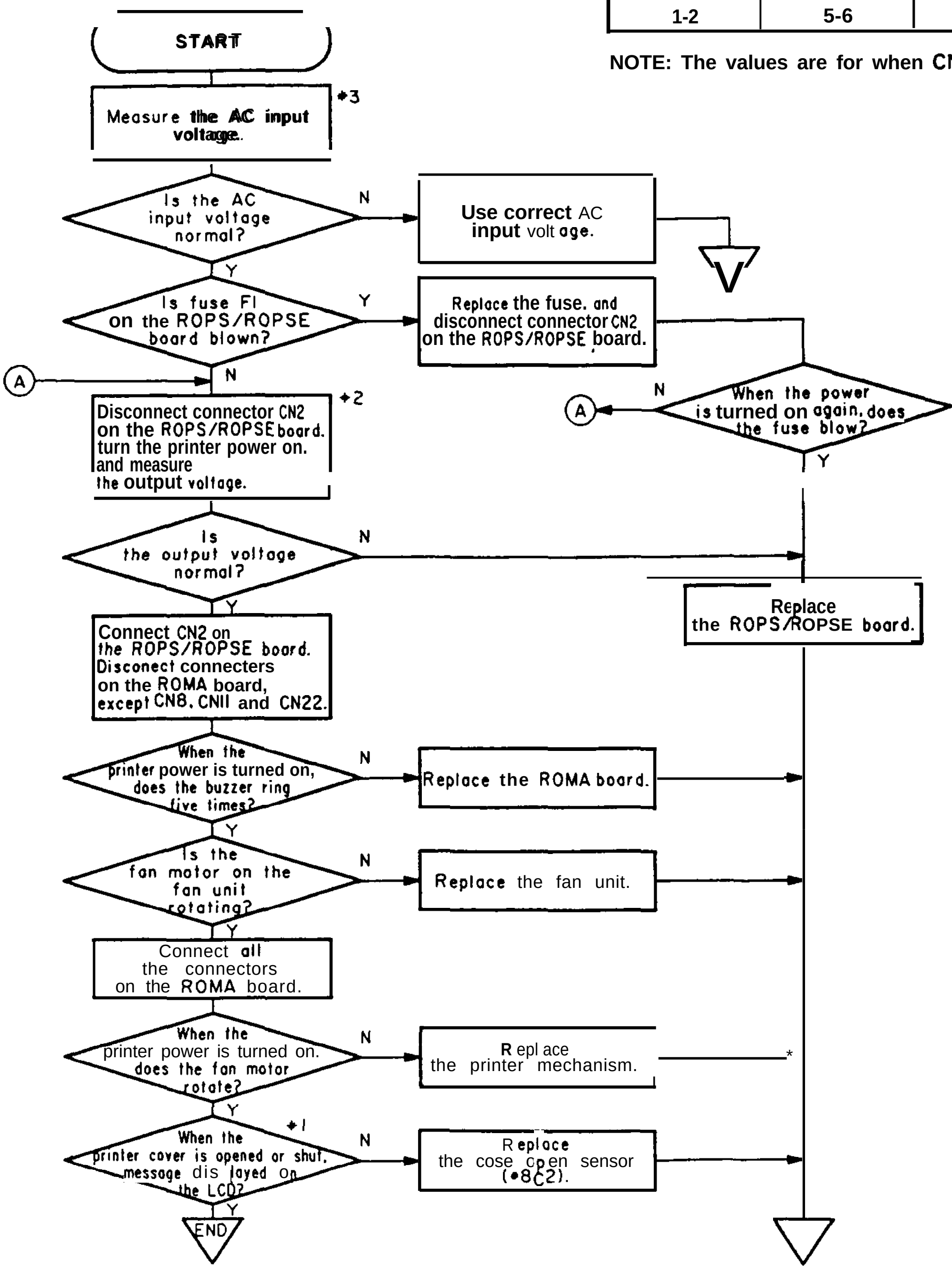
Decision

1. Printer does not operate at all with power switch on.

Table 5-5. ROPS/ROPSE Board Output Voltages

Power Output Terminal (Connector CN2)		Output Voltage [V]
+ Side	– Side	
7-8-9	10-11-12	35V ± 10%
3	5-6	Approx. – 1 IV
4	5-6	Approx. – 1 I V
1-2	5-6	+ 5 ± 5%

NOTE: The values are for when CN2 is disconnected.

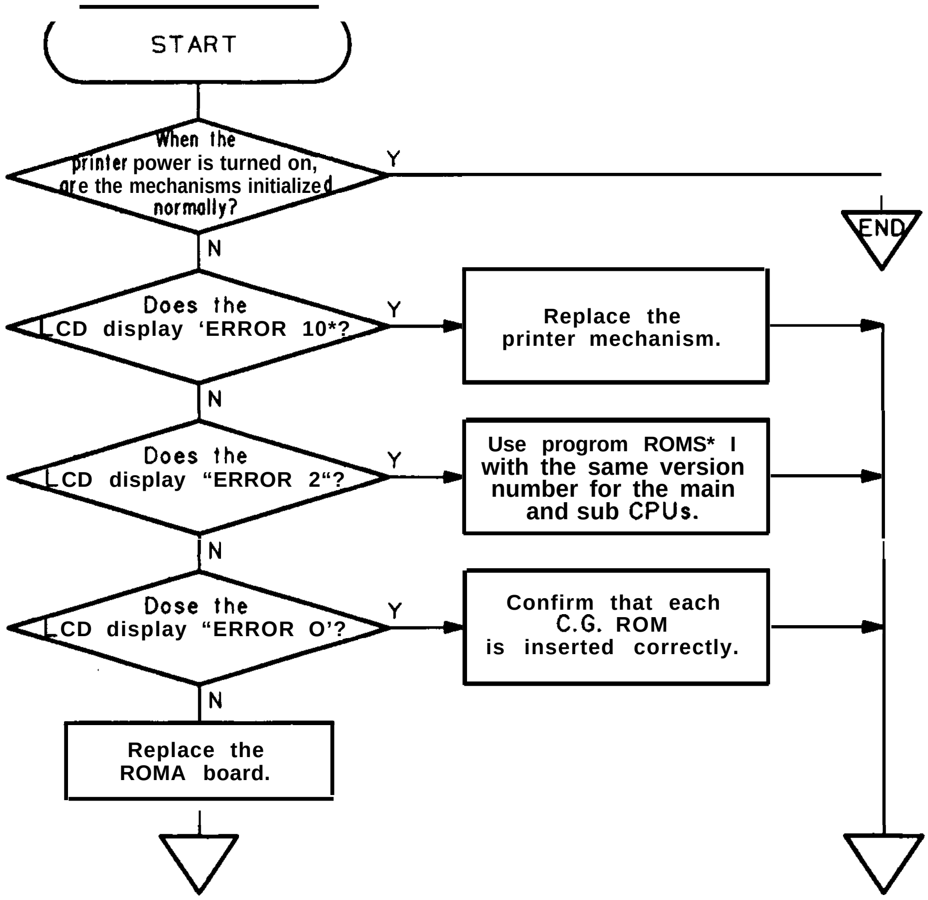


*1: When the printer cover is open: "CASE OPEN"
When the printer cover is shut: "OFF LINE" or "ON LINE"

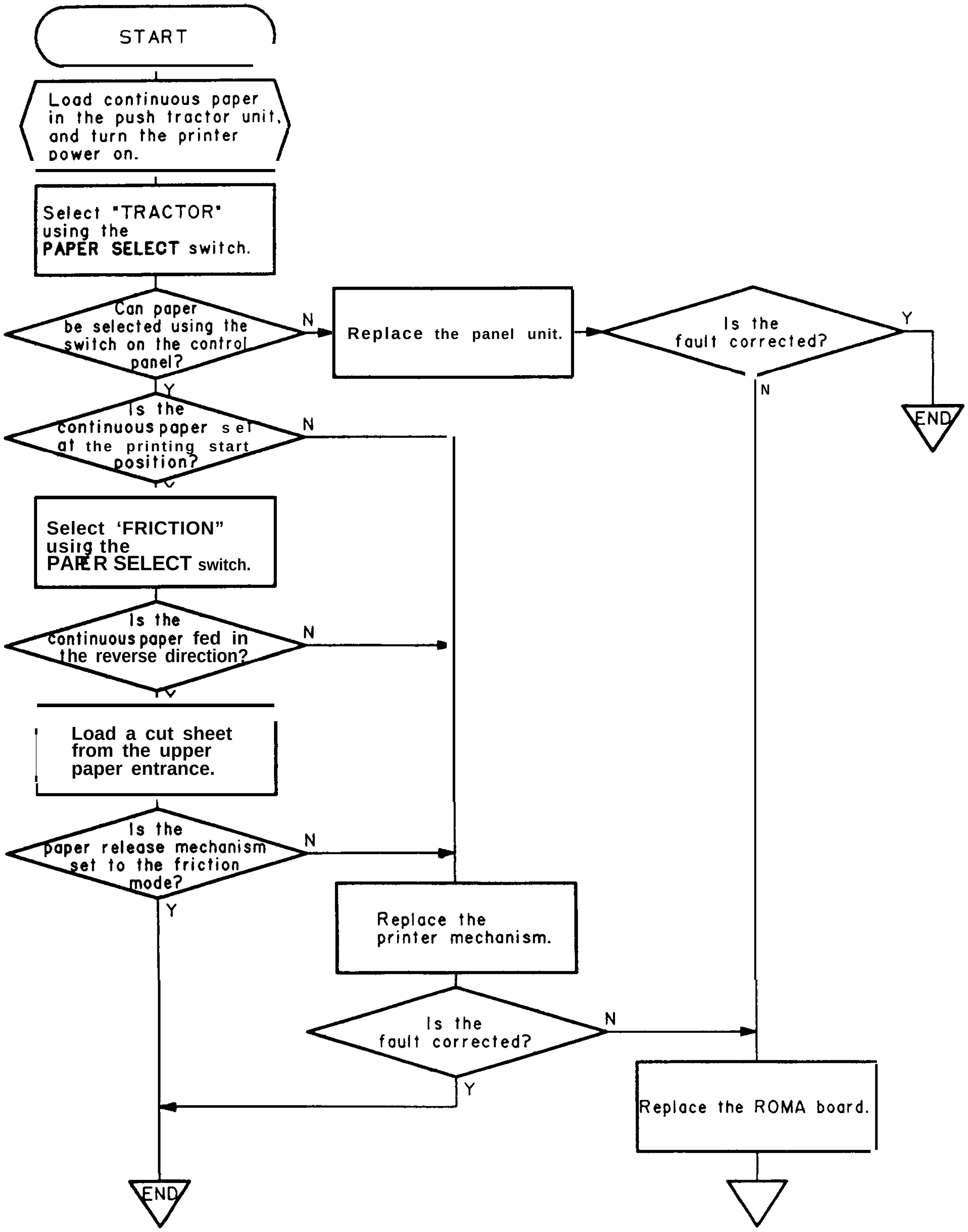
*2: Refer to Table 5-5.

*3: ROPS board: 108 - 132V AC
ROPSE board: 198 - 264V AC

2. Platen gap adjustment mechanism and carriage mechanism are not initialized.

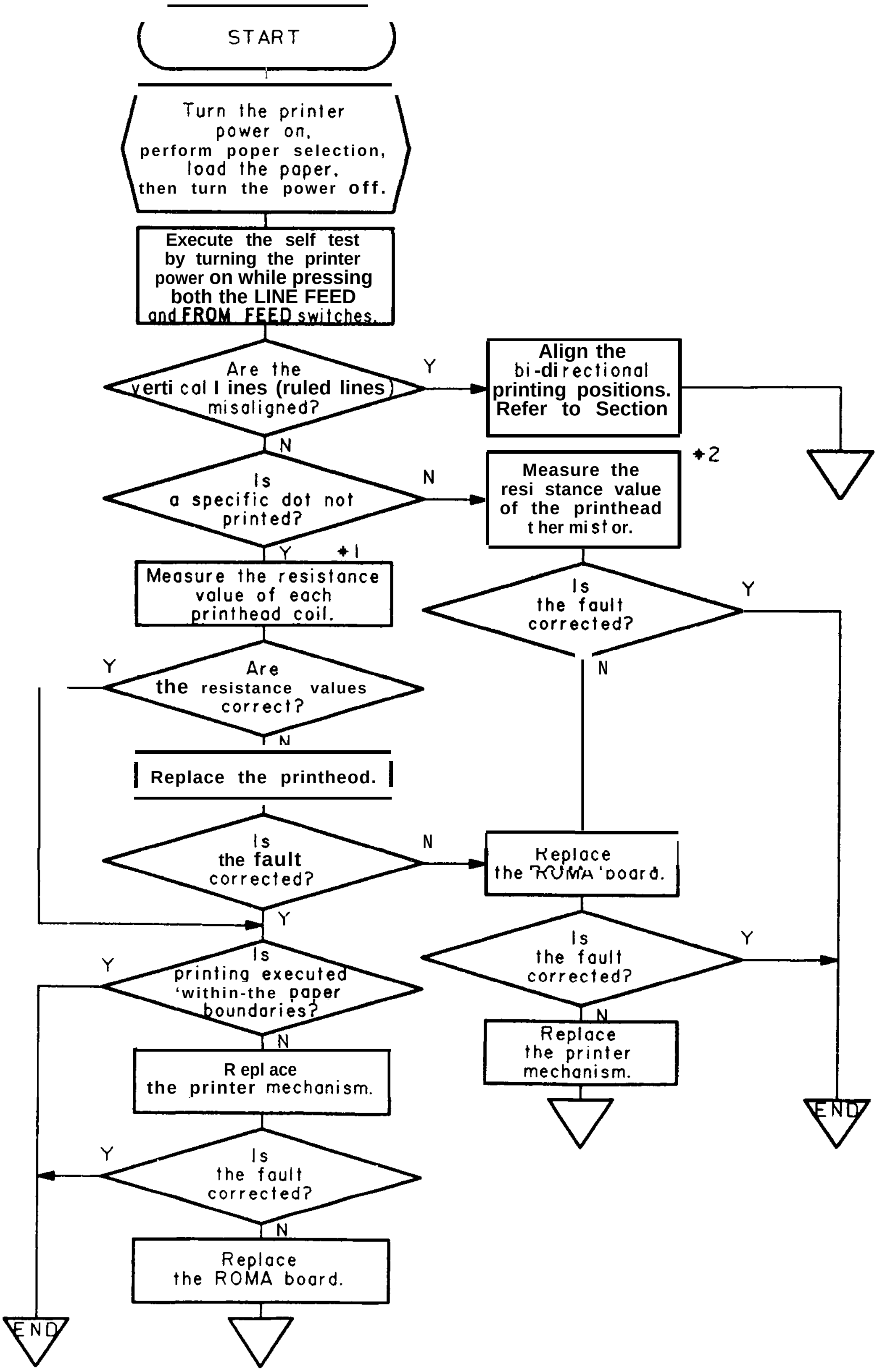


3. Abnormal paper release mechanism operation



4. Incorrect printing with normal carriage operation

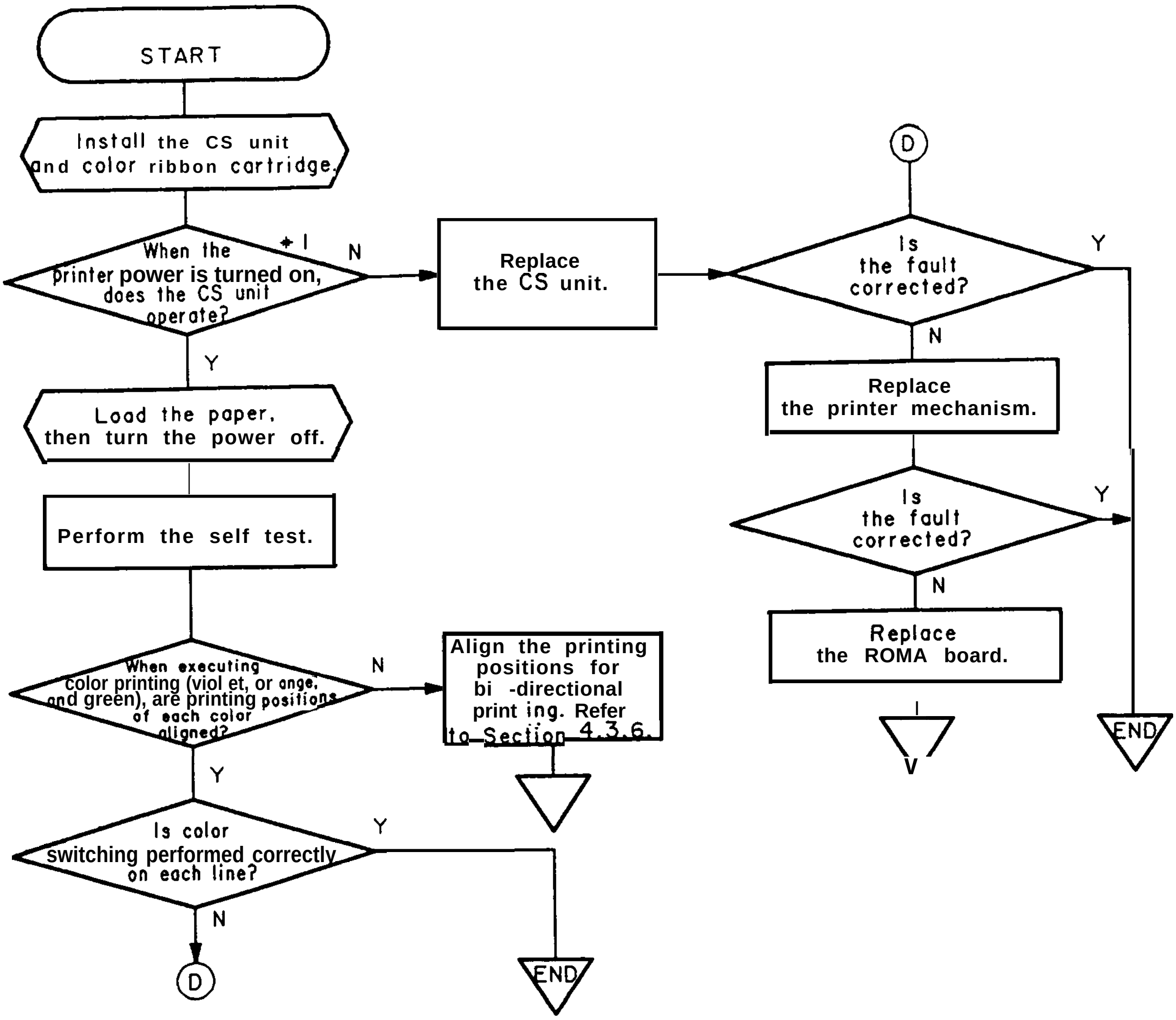
a) In the self test or normal printing mode: Using a black ribbon.



*1: Refer to Figure 5-5 and Table 5-6.

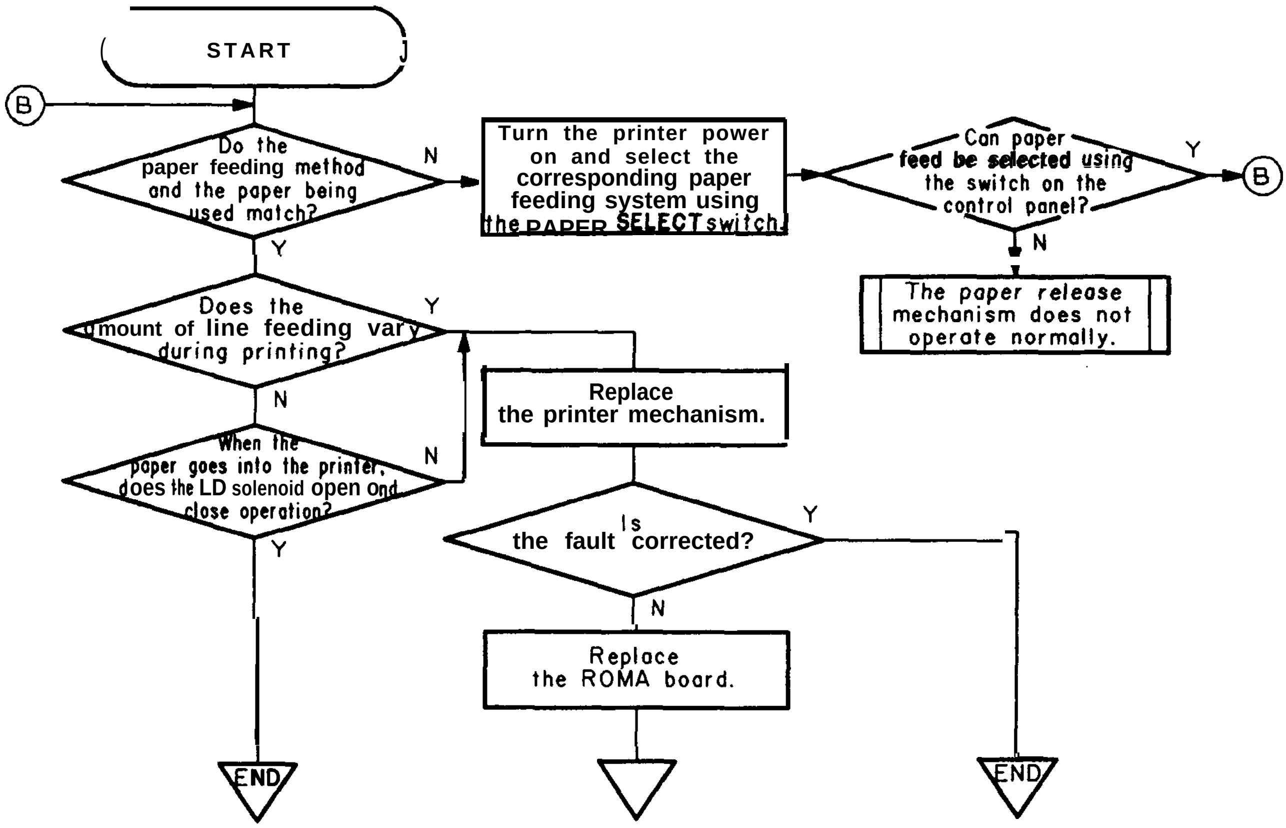
*2: Refer to Figure 5-6.

b) In the self test: Using a color ribbon

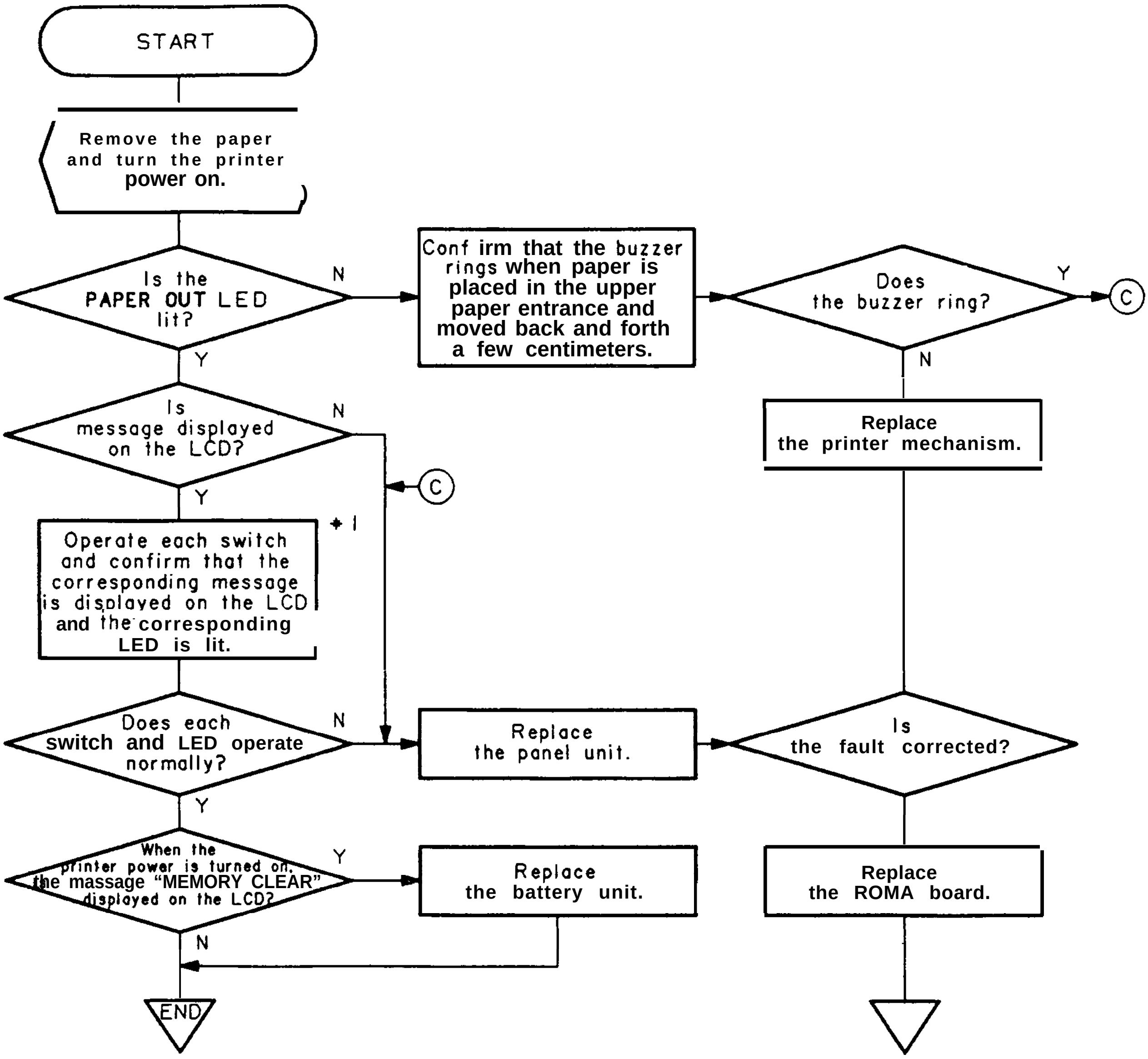


*1: Confirm whether the CS unit operates correctly by observing the up and down movement of the color ribbon cartridge and rotational noise of the CS motor.

5. Abnormal paper feed

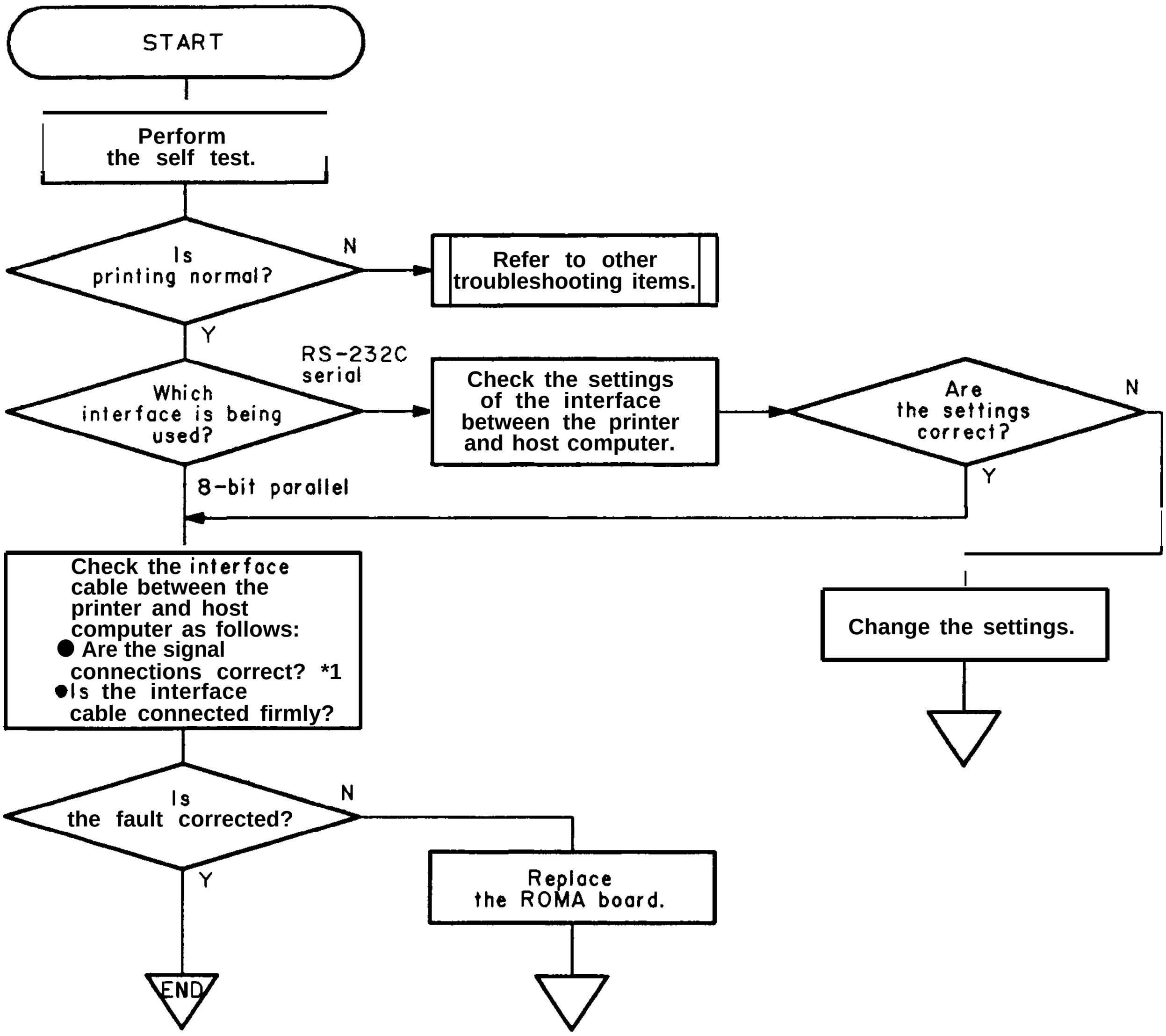


6. Abnormal control panel operation

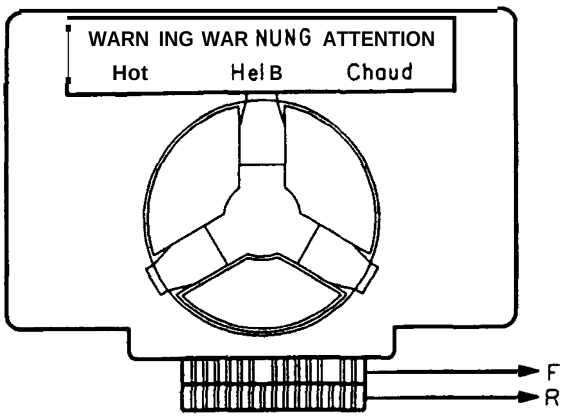


*1: The MICRO FEED switch is only valid when paper is loaded in the printer mechanism. The TEAR OFF switch is only valid when continuous paper is loaded in the printer mechanism.

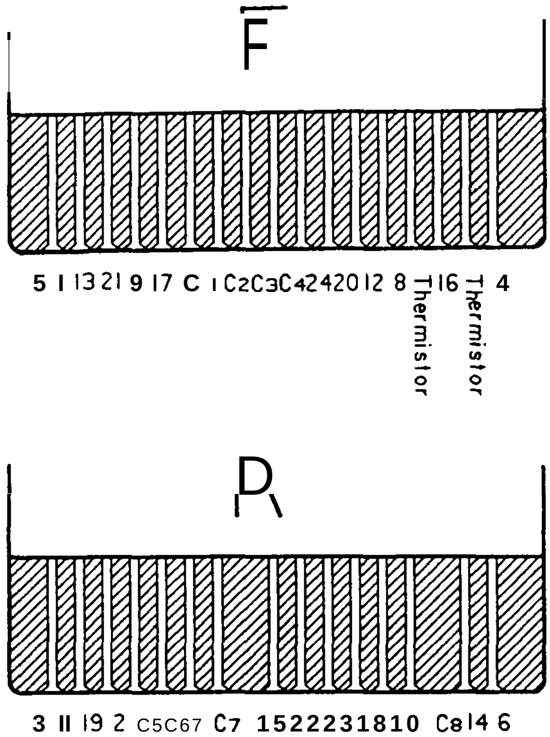
7. Incorrect printing in ON LINE mode



*1: 8-Bit parallel . . Refer to Section 1.3.1.
RS-232C Serial . .. Refer to Section 1.3.2.



(a) Back of the printhead



(b) Printhead connectors closeup

Figure 5-5. Printhead Connectors F and R Wiring

Table 5-6. Relationship between Common Wires and Each Coil

F		R	
Common Line	Corresponding Coil Numbers	Common Line	Corresponding Coil Numbers
C1	1, 9, 17	C5	2, 7, 15
C2	5, 13, 21	C6	3, 11, 19
C3	12, 20, 24	C7	14, 22, 23
C4	4, 8, 16	C8	6, 10, 18

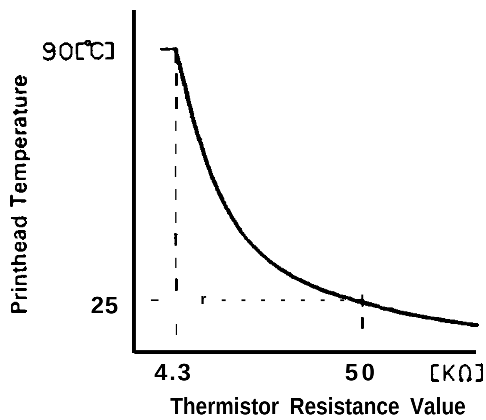


Figure 5.6, Relationship Between Printhead Temperature and Thermistor Resistance

If a specific dot is not printed, one possible cause is a defective printhead coil (refer to Figure 1-2 for the relationships between the coil numbers and wire pins).

Whether the coil is defective or not is determined by measuring the resistance across the terminals of the common line and corresponding coils (refer to Figure 5-5 and Table 5-6). The normal resistance for a printhead coil is 8.6 Ω + 10% (at 25°C).

If a thermistor, a temperature sensor in the printhead, is shorted, the message "HEAD HOT" is displayed on the LCD even when printing is not being executed. The relationship between the printhead temperature and thermistor resistance value in the normal state is shown in Figure 5-6.

5.3 UNIT REPAIR

Unit repair is divided into three parts: (1) The ROPS/ROPSE board; (2) The ROMA board; (3) The Printer mechanism.
This section will describe (l), the ROPS/ROPSE board unit repair. If (2) ROMA board or (3) Printer mechanism should need repair, use the diagnostic tool introduced in Section 5.1.1.

5.3.1 ROPS/ROPSE *Board*

The power supply circuit ROPS/ROPSE board is divided into three blocks:(1) Input filter circuit, (2) Main switching circuits, and (3) Secondary side (Refer to Figure 5-7.).

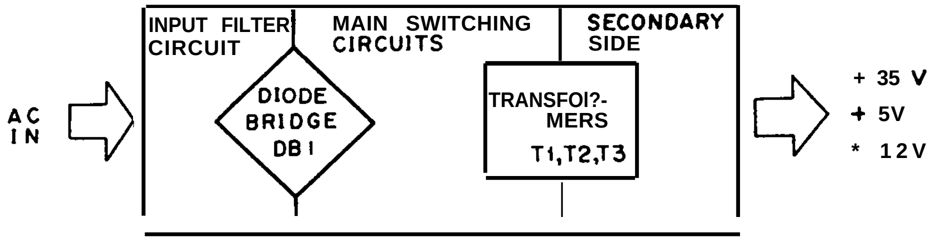


Figure 5-7. ROPS/ROPSE Board Block Diagram

If trouble occurs, first determine the faulty block and then find the bad component, referring to Tables 5-7 and 5-8, and Figures 5-9 to 5-13. in addition, Tables 5-9 and 5-10 list the parts used in the ROPS/ROPSE board.

DANGER

1. **Before checking anything using the measuring instruments, check (that there are no metal chips inside and that there are no burned components.).**
2. **Since this power supply is an isolated switching regulator, do not use a grounded measuring instrument such as a multimeter or oscilloscope. If a grounded instrument is used, fuse F 1 may burn out. Be sure that the measuring instrument is not connected to ground before using it on this power supply circuit. In most cases, the line plug shown in Figure 5-8 will avoid this problem.**
3. **If your measuring instrument has multiple channels, measure the resistance value of each block in the same way as described above and as shown in Figure 5-7. (Do not connect multiple channels, such as channel 1 to the main switching circuit and channel 2 to the secondary side.)**
4. **Measure the resistance value on the circuit board after turn the power off.**

Figure 5-8. AC Connector for Measuring Instruments

Table 5-7. ROPS/ROPSE Board Unit Repair

Symptom	Cause	Checkpoint	Solution
No DC voltage is present at the + 5 V, ± 12 V, or +35 V output.	Transistor Q1 does not turn on.	● Observe the voltage wave-form between the base of Q 1 and pin 6 of T1. See Figure 5-9.	Observe the output voltage waveform of Q2.
		● Observe the voltage waveform between the base and emitter of Q2 (Q3). See Figure 5-9.	Replace Q2 or PC1
		. Observe the voltage waveform between the collector of Q 1 and pin 6 of T1. See Figure 5-10.	Replace Q1.
	Triac TY 1 is defective.	. Check the continuity between T1 and T2 of TY 1. See Figure 5-11.	Replace TY1.
	OP. AMP. IC1 is defective.	● Check the voltage between pins 8 and 2 of IC1. (Approx. 10.6 V) . Check the voltage between pins 4 and 2 of IC1. (Approx. 10.7 V)	Replace IC1
		. Check the voltage between pins 1 and 2 of ICl. (Approx. 7.4 V)	Measure the voltage between A and K of ZD1, or replace IC 1.
The + 12 V line is dead.	Fuse resistor RI 9 (R21) is open.	. Measure the resistance across R19(R2 1). (Approx. 3.1 ohms)	Replace R19(R21).
The − 12 V line is dead.	Fuse resistor R22(R25) is open.	. Measure the resistance across R22(R25). (Approx. 3.1 ohms)	Replace R22(R25).
An abnormal voltage is output to the +5V line. (5 v +5%)	Shunt regulator Q4(Q5) is defective.	. Measure the voltage between the cathode and anode of Q4(Q5). (Approx. 9.0 V) . Measure the voltage between the gate and anode of Q4(Q5). (Approx. 2.5 V)	Replace Q4 (Q5).
	Photo coupler PC 1 is defective.	● Measure the voltage between pins 1 and 2 of the photo diode in PC1. (Approx. 1.1 V)	Replace PC 1.
	Zener diode ZD 1 is defective.	● Confirm the voltage between the anode and cathode of ZD 1. (Approx. 1.9 V)	Replace ZD1.

NOTE: The parenthesized component numbers indicate those for the ROPSE board.

Table 5-7. ROPS/ROPSE Board Unit Repair

Symptom	Cause	Checkpoint	Solution
The +35 V line is dead.	The FET (Q3 (Q4)) does not turn on.	. Observe the voltage between pins 12 and 7 of IC2. (Approx. 10.6 V)	Replace IC2.
		. Measure the resistance across R11 (RI 4). (Approx. 20.0 ohms)	Replace RI 1 (RI 4).
		. Measure the resistance across R1O (R13). Approx. 20.0 ohms)	Replace Q1O (R13).
		. Observe the voltage wave-form between the gate and source of Q3 (Q4). See Figure 5-12. . Observe the voltage waveform between the drain and souce of Q3 (Q4). See Figure 5-12.	Replace Q3 (Q4).
An abnormal voltage is output on the +35 V line. (35 v + lo%)	IC2 does not operate.	. Measure the voltage between pins 4 and 7 of IC2. (Approx. 1.6 V) . Measure the voltage between pins 12 and 7 of IC2. (Approx. 10.6 V) . Observe the voltage waveform between pins 5 and 7 of IC2. See Figure 5-13. ● Observe the voltage waveform between pins 11 and 10 (pins 8 and 9) of IC2. See Figure 5-13. . Measure the voltage between pins 14 and 13 of IC2. (Approx. 5.0 V)	Replace IC2.

NOTE: The parenthesized component numbers indicate those for the ROPSE board.

Table 5-8. ROPS/ROPSE Board Voltage Waveforms

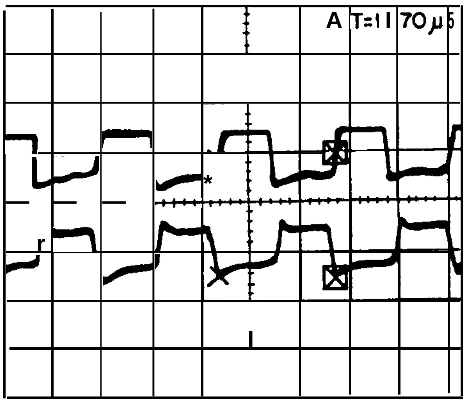
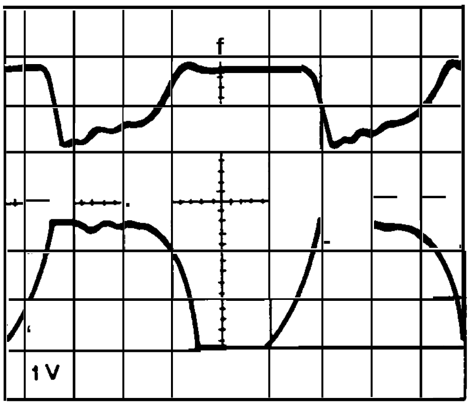
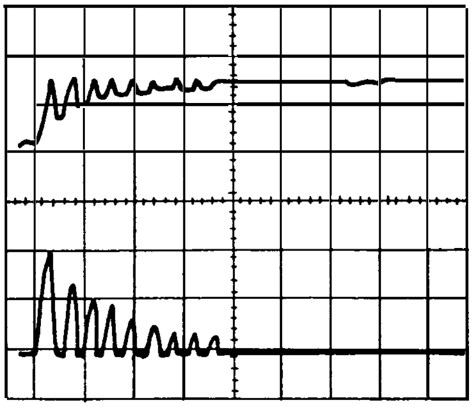
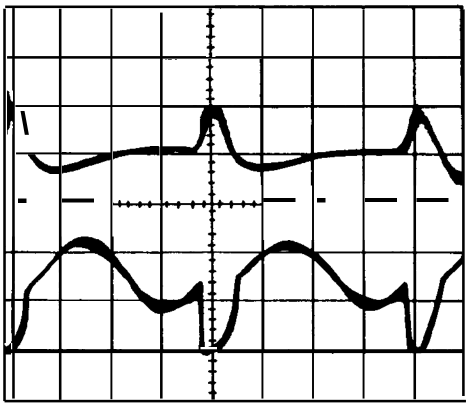
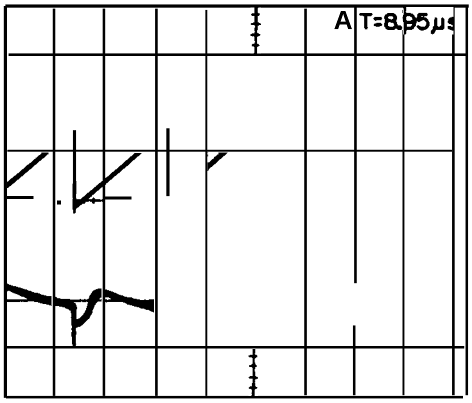
Mesuring osition	+ Side	– Side	V/D IV.	S/DIV.	Condition	Voltage Waveform
2(Q3)	Base	Emitter	2	5p	Storage	 Figure 5-9. Q2 Output/Q1 Input Voltage Waveforms
1-T1	Base of a l	6pin of T1	2			
1	Base	Emitter	1	1μ	Storage (CN2 is discon- nected)	 Figure 5-10. Q1 Input/Output Voltage Waveforms
1-T1	Emittor of Q 1	6pin of T1	100			
)B1	+	–	100	20m	Storage	 Figure 5-11. DB1 Output/TY1 Off → On Voltage Waveforms
Y1	T1	T2	50			

Table 5-8. ROPS/ROPSE Board Voltage Waveforms

Mesuring position	+ Side	– Side	V/D IV.	S/DIV.	Condition	Voltage Waveform
Q3 (Q4)	Gate	Source	5	2μ	Storage	 Figure 5-12. Q3 Input/Output Voltage Waveforms
Q3 (Q4)	Drain	Source	100			
IC2	5pin ”	7pin	2	5μ	Storage	 Figure 5-13. IC2 Oscillation/Output Voltage Waveforms
IC2	11 pin	10pin	5			

NOTE: ( ) means location of the ROPSE board.

Table 5-9. ROPS Board Main Parts List

Location	Classification	Name	Description
ZD 1	Zenor Diode	HZ2CLL-TD	2.2 - 2.6V 50mA 250mW
Q1 Q2 Q5	Transistor	2SC3446 2SC2655-TPE6 2SA 10 15-TPE2	500V 3A 40W 50V 2A 900mW 50V 150mA 400mW
Q3	FET	2SK556	450V 12A
Q4 IC1 IC2	IC	L5431 -AA NJM2903D TL594CN	Refer to Table A-1.
R9 R10 R11 R 19,R22	Resistor	MEG05N 10OKU 135 ERQ-1CUJ201 ERQ-1CUJ200 ERQ-12HUJ2R0	10 ohms 5W 135°C 200 ohms 1W ± 5% 20 ohms 1W ± 5% 2 ohms 1/2W ± 5%
Pc 1	Photo Coupler	TLP621	55V 50mA 150mW
TY1	Triac	BCR 10CM-8L	400V 10A

Table 5-10. ROPSE Board Main Parts List

Location	Classification	Name	Description
ZD 1	Zenor Diode	HZ2CLL-TD	2.2 - 2.6V 50mA 250mW
Q1 Q2,Q3 Q6	Transistor	2SC3456 2SC2655-TPE6 2SA 10 15-TPE2	800V 1.5A 50V 2A 900mW 50V 150mA 400mW
Q4	FET	2SK872	900V 6A
Q5 IC1 IC2	IC	L543 1 -AA NJM2903D TL594CN	Refer to Table A-1.
R11 R13 R14 R21,R25	Resistor	MEG05N 10OKU 135 ERQ-2CUJ101 ERQ-1CUJ200 ERQ-12HUJ2R0	10 ohms 5W 135°C 100 ohms 2W ±5% 20 ohms 1W±5% 2 ohms 1/2W ±5%
Pc 1	Photo Coupler	TLP732LF2	55V 50mA 150mW
TY 1	Triac	BCR 10CM-8L	400V 10A

5.3.2 ROMA Board

The ROMA board can be repaired using the diagnostic tool. Table 5-11 lists the main parts of the ROMA board.

Table 5-11. ROMA Board Main Parts List

Location	Classification	Name	Description
6A 5B,6B 5A 14C 9B 4A 3A	TTL	74LSO0 74LS05 74LS 123 74LS 175 74 LS365A SN75 188N SN75 189N	Refer to Table A-1.
8A	C-MOS	TC74HC373P	
9C	Ic	TL431 CLPB	
11B	LSI	M546 10P	
1A 2C 7C 7D	Hybrid IC	STK66082E H8D2 148 SI-7304 STK6981 H	
9A 10A	PS-RAM ST-RAM	HM65256BSP-15 μPD43257C-15L	
14A 2A 3B,4B	Gate Array	E05A1OAA E05A02LA E05A09BA	
13A 7B	CPU	HD64 180R1 P6 PPD7810HG	
ZD1 ZD2,ZD3 ZD4 ZD5 ZD6	Zenor Diode	MA4043-L-TA MA4300-H-TA RD39JSB3 HZS39EB3-TD MA4033-L-TA	4.03 - 4.26V 250mA 370mW 30.2 - 31.8V 250mA 370mW 38.99 - 40.99V 5A 400mW 36.0 - 37.85V 150mA 400mW 3.12 - 3.28V 250mA 370mW
Q1 Q2,Q4,Q6,Q19 Q3,Q17,Q18 Q5,Q10 Q7,Q8,Q11-Q14 Q9 Q15,Q16 Q20	Transistor	2SA 1020-TPE6 2SC 18 15Y-TPE2 2SD 1843-T 2SD 1521 2SD 1978-TZ 2SB 1093-T 2SC4007 2SA 10 15-TPE2	50V 2A 900mW 50V 150mA 400mW 60V 1A 10W 50V 1.5A 10W 120V 1.5A 1.2W 80V 1.5A 1W 80V 4A 40W 50V 150mA 400mW
CR1,CR2	Ceramic O.S.C.	CSA 12.2MT-TF	12.2MHZ

5.3.3 Model-5560 Printer Mechanism

Use the diagnostic tool to detect malfunctions among the motors, solenoids, and sensors.
Table 5-12 lists the reference Tables for these component. For other components, use the printing test, and also inspect visually.

Table 5-12. Electric Device List

Classification	Name	Reference Table
Motor	HF Motor	2-2
	PG Motor	2-7
	CR Motor	2-10
	CS Motor	2-15
	PF Motor	2-18
Solenoid	PT Solenoid	2-4
	RL Solenoid	2-22
	LD Solenoid	2-26
Sensor	PT Sensor	2-5
	PG Home Position Sensor	2-8
	CR home Position Sensor	2-11
	PW Sensor	2-12
	PE Sensor	2-19
	RL Sensor	2-23
	LD Sensor	2-27

CHAPTER 6
MAINTENANCE

LIST OF FIGURES

LIST OF TABLES

6.1 PREVENTIVE MAINTENANCE

Proper maintenance is essential to maintain optimal printer performance for the longest possibly period and to minimize malfunction frequency. Preventive maintenance includes regular cleaning of the case exterior, using neutral detergent, and occasional vacuuming of the mechanism interior to remove dust and paper particles.

Following cleaning, refer to Section 6.2 to verify that the unit is adequately lubricated. Before returning the serviced printer to the consumer, inspect the springs, paper feed rollers, and the basic operationof the unit.

WARNING

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

6.2 LUBRICATION AND ADHESIVE APPLICATION

EPSON recommends that the points illustrated in Figures 6-2, 6-3, and 6-4 be lubricated, according to the schedule listed in Table 6-2, with EPSON O-2, G-2 and G-27, which have been extensively tested and found to comply with needs of this priter. (Refer to Table 6-1 for details of O-2, G-2 and G-27.) Be sure that the parts to be lubricated are clean before applying lubricant, and avoid excessive application, which may damage related parts.

Adhesive application is necessary at the point indicated in Table 6-3 when the part is disassembled or replaced. EPSON recommends Neji Lock #2 (G) adhesive be applied to the point diagramed in Figure 6-3. Avoid overflow of excess to related parts.

Table 6-1. Lubricants and Adhesive

Classification	Designation	Capacity	Availability	Part No.
Oil	o-2	40 cc	Ⓔ	B7 10200001
Grease	G-2	40 g	Ⓔ	B70020001 1
Grease	G-27	40 g	Ⓔ	B702700001
Adhesive	Neji lock #2 (G)	1000 g	Ⓔ	B730200200

Ⓔ: EpSON exclusive product

Table 6-2. Lubrication Points
(Refer to Figures 6-2, 6-3, and 6-4.)

Ref. No.	Lubrication Points	Lubricant
(1)	Oil pad inside of carriage	o-2
(2)	Gear portion of platen gear	G-27
(3)※	Contact portion of dowel on release trigger plate and right frame	G-2
(4)	Gear portion of release planetary gear	G-27
(5)X	Four convex portion of release sun gear	G-27
(6)	Gear portion of tractor transmission gear	G-27
(7)	Outer gear portion of paper feed reduction gear	G-27
(8)※	Contact portion of paper release support lever and paper release lever	G-27
(9)	Outer and inner gear portions of loading gear A	G-27
(1 o)	Outer and inner gear portions of loading gear assembly	G-27

※ Lubrication is necessary in the process of assembly

Table 6-2. Lubrication Points (Cent'd)
(Refer to Figures 6-2, 6-3, and 6-4.)

Ref. No.	Lubrication Points	Lubricant
(11)	Contact portion of frame and paper holding lever (right and left)	G-27
(12)※	Contact portion of carriage guide shaft B and frame (right and left)	G-27
(13)※	Shaft that sets platen gap reduction gear	G-27
(14)	Gear portion of platen gap gear assembly	G-27
(15)	Outer and inner gear portions of platen gap reduction gear	G-27
(16)	Gear portion of paper ejecting gear	G-27
(17)X	Contact portion of paper feed roller and paper feed roller holder	G-27

※ Lubrication is necessary in the process of assembly.

Table 6-3. Adhesive Application Points
(Refer to Figures 6-1 and 6-2.)

Ref. No.	Adhesive Application Points	No. of Points
(21)	Screw for sensor of paper release solenoid assembly (inside of right frame)	1
(22)	Screw for sensor of paper loading trigger assembly (inside of right frame)	1
(23)	Contact portion of platen gap home position sensor and left frame	1

[To Screw for Sensor]

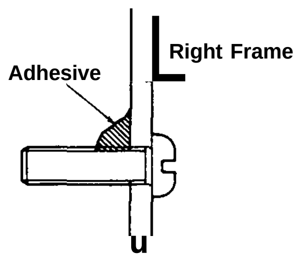


Figure 6-1. Correct Adhesive Application

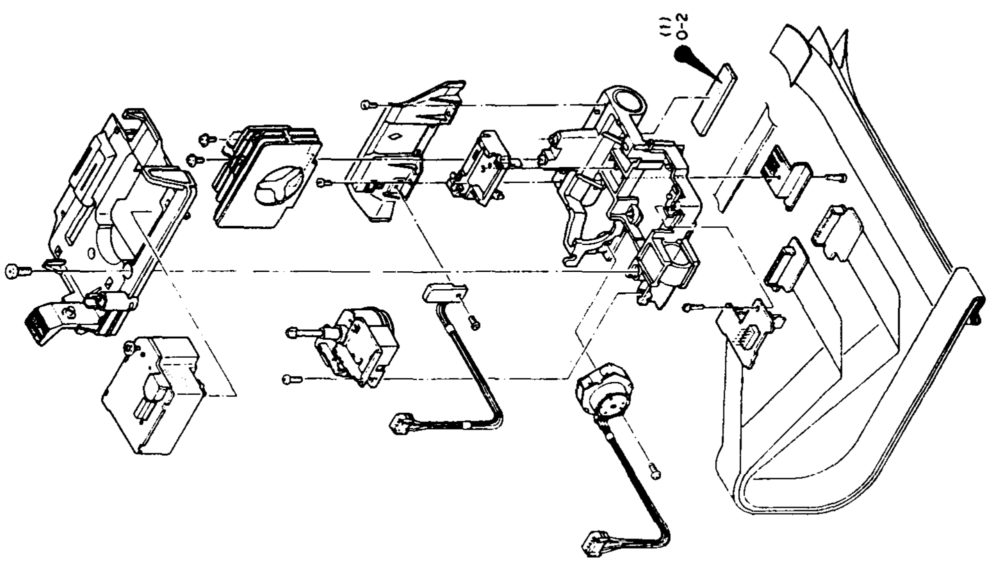


Figure 6-2. LQ-2550 Lubrication and Adhesive Application Points Diagram 1

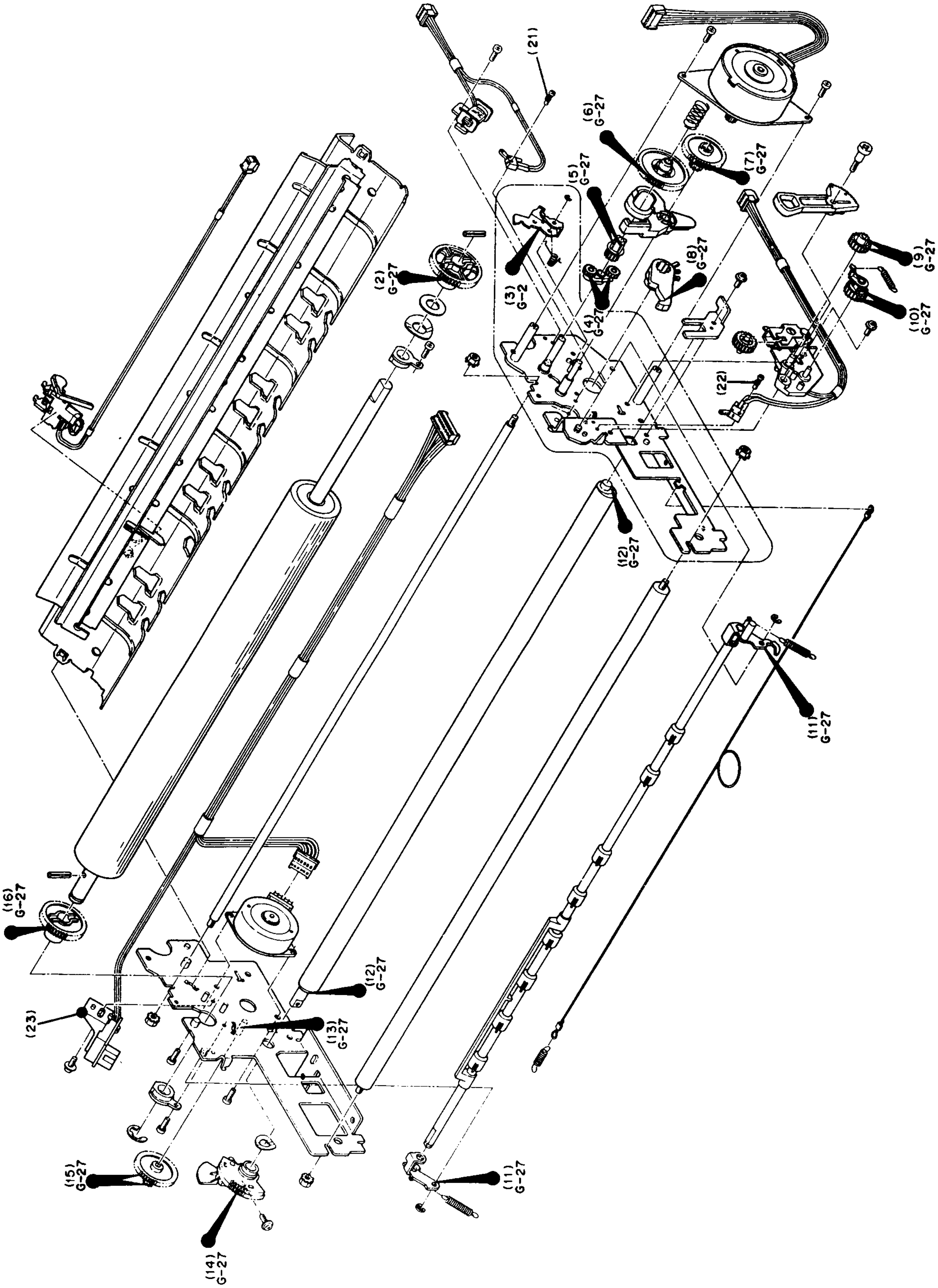


Figure 6-3. LQ-2550 Lubrication and Adhesive Application Points Diagram 2

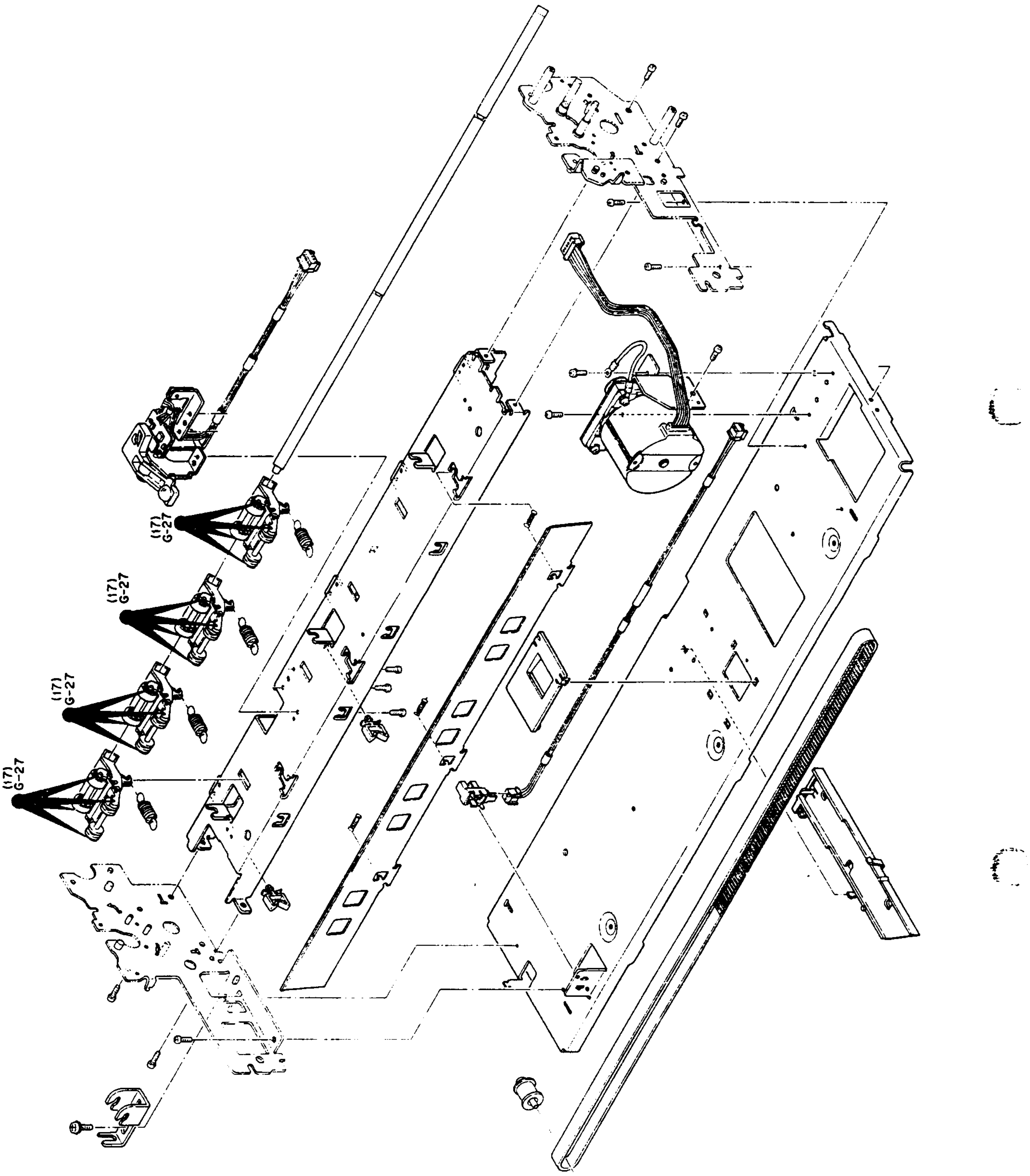


Figure 6-4. LQ-2550 Lubrication and Adhesive Application Points Diagram 3

APPENDIX

APPENDIX

LIST OF FIGURES

LIST OF TABLES

A.1 PRINCIPLE IC SPECIFICATIONS

This chapter describes the principal ICs used in this printer.

A.1.1 ROMA Board

Table A-1 shows the primary ICs used on the ROMA board.

Table A-1. Primary ICs on the ROMA Board

Location	Name of IC	Type	Description	Reference Section
13A	HD64180R1P6	CPU	CMOS 8-Bit	A. 1.1.1
7B	μPD7810HG	CPU	NMOS 8-Bit	A. 1.1.2
1A	D27512-J2 *1	EP-ROM	Program ROM for HD64180R1P6	A. 1.1.3
1A	M5L27256K*2	EP-ROM	Program ROM for HD64180R1P6	A. 1.1.4
7A	M5L27256K	EP-ROM	Program ROM for μPD7810HG	A. 1.1.4
12A	M40A13KA*1	Mask-ROM	4M-Bit Kanji C.G.	—
12A	M20A02EA*2	Mask-ROM	2M-Bit Alpha, numeric, and graphics C.G.	—
12B	M10A13KA*1	Mask-ROM	1 M-Bit Alpha, numeric, kana, and graphics C.G.	—
9A	HM65256BSP-15	PS-RAM	32K X 8-Bit 150nS	A. 1.1.5
10A	μPD43257C-15	ST-RAM	32K X 8-Bit 150nS	A. 1.1.6
14A	E05A10AA	Gate array	Memory Management Unit	A. 1.1.7
2A	E05A02LA	Gate array	Printhead Data Control	A. 1.1.8
3B, 4B	E05A09BA	Gate array	Motor Control Unit	A. 1.1.9
11B	M54610P	LSI	8-Bit Parallel I/F	A. 1.1.10
7D	STK6981H	Hybrid IC	PF Motor Driver	A. 1.1.11
7C	SI-7304	Hybrid IC	CR Motor Driver	A. 1.1.12
2C	H8D2148	Hybrid IC	HF Motor Control and Driver	A. 1.1.13
1A	STK66082E	Hybrid IC	Printhead Driver	A. 1.1.14
6A	74LS00	TTL	Quad 2 Input NAND	A. 1.1.15
5B, 6B	74LS05	TTL	Hex O.C. Inverters	A. 1.1.16
5A	74LS123	TTL	Dual Retriggerable Single Shot	A. 1.1.17
14A	74LS175	TTL	Quad D-FFs	A. 1.1.18
9B	74LS365A	TTL	Hex 3-State Bus Buffers	A. 1.1.19
8A	74LS373	TTL	Octal 3-State D-Latches	A. 1.1.20
4A	SN75188N*2	IC	Quad Line Drivers	A. 1.1.21
3A	SN75189N*2	IC	Quad Line Receivers	A. 1.1.22
9C	TL431CLPB	IC	Adjustable Precision Shunt Regulator	A. 1.1.23

*1: IC used only in the VP-3000 (Japan only).
*2: IC used in the LQ-2550.

A.1.I.I HD64180

The HD64 180 is an 8-bit one-chip CPU, and is software compatible with model 2-80 and higher models. The chip includes a DMA controller (DMAC), asynchronous serial communication interface (ASCI) (2 channels), serialI/Oport, and timers (one with internal and one with external output), in addition to the CPU.

The main features are as follows:

- MMU: 5 12K-byte physical address space
- DMAC (2 channels): High speed data transfer between memories (including memory mapped 1/0)
- ASCI (2 channels): Start-stop asynchronous system (full duplex) SCI modem control signals
- CS I/O port (1 channel): Serial to parallel conversion shift register
- 16-bit timer (2 channels): Pulse output function
- Interrupts: Internal (4), external (8)
- Bus I/F: 80 CPU-line bus I/F
- Dynamic RAM refresh controller: Programmable refresh interval
- Low speed memory input/output I/F: Programmable number of weight states
- Built-in clock oscillator circuit
- CMOS

Figures A-1 and A-2 show the pin diagram and internal block diagram. Table A-2 shows the terminal functions.

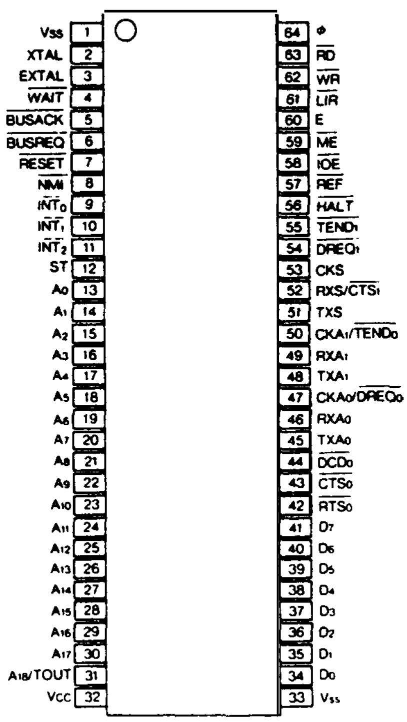


Figure A-1. HD64180 Pin Diagram

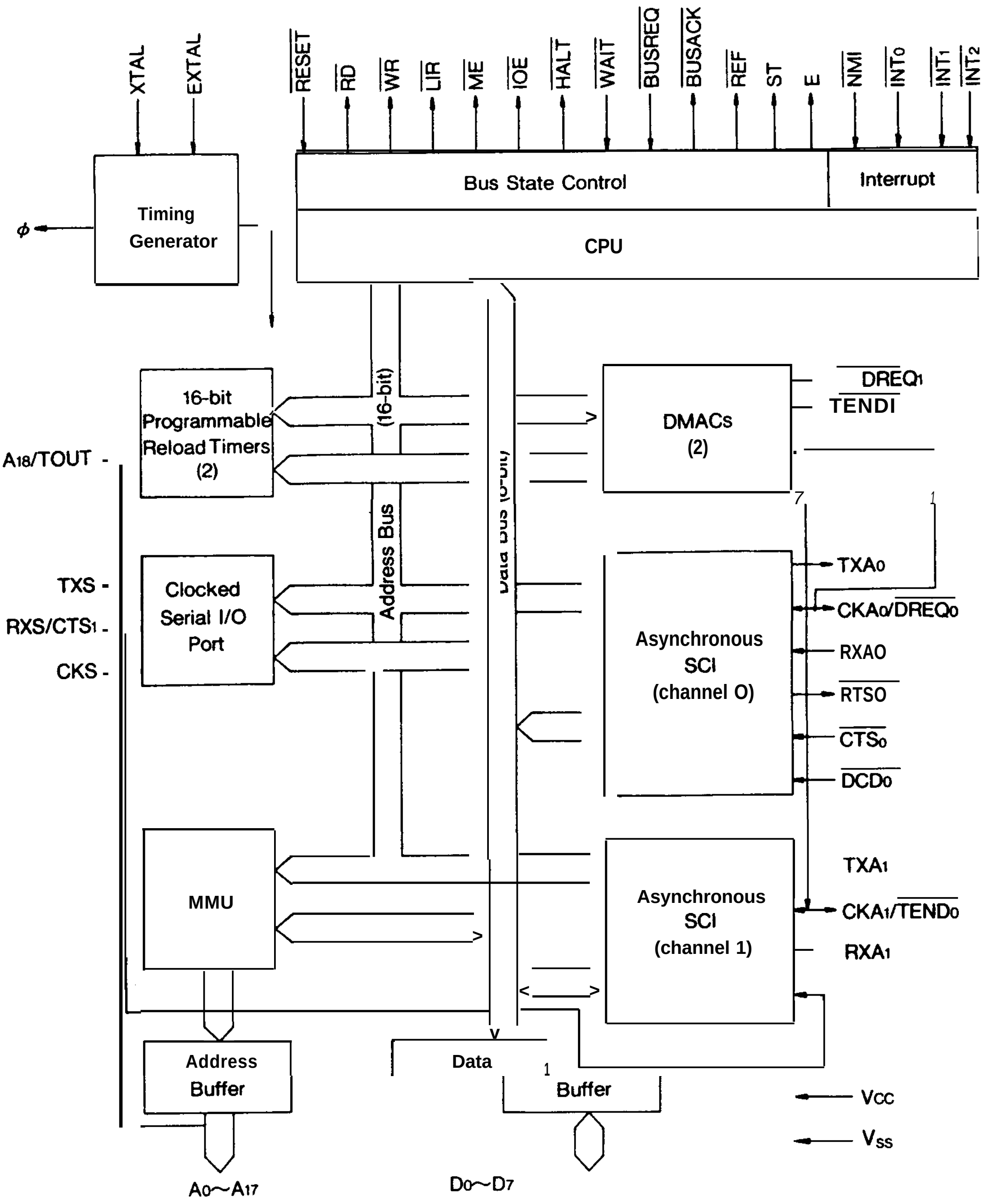


Figure A-2. HD64180 Block Diagram

Table A-2. HD64180 Terminal Functions

Pin No.	Terminal	I/O	Description	Notes
32 1, 33	Vcc Vss	I —	+5 VDC GND	
2 3	XTAL EXTAL	I I	External oscillator (1 2.2 MHz)	
64	ϕ	o	Pulled up	
7	$\overline{\text{RESET}}$	I	Reset signal	IC (1 4A: $\overline{\text{ROUT}}$, pin 21)
13-31	AO-A 18	0	Address bus (1 9-bit, 5 12K-byte)	
34-41	DO~D7	I/O	Data bus (8-bit)	
63 62 59	$\overline{\text{RD}}$ WR ME	o o o	Read pulse Write pulse Memory enable	 IC (1 4A: ME, pin 45)
58 4	$\overline{\text{IOE}}$ $\overline{\text{WAIT}}$	o I	Pulled up Pulled up	
60	E	o	Enable (synchronous clock)	IC (1 4A: E, pin 53)
6 5 58 61 12	$\overline{\text{BUSREQ}}$ $\overline{\text{BUSACK}}$ $\overline{\text{HALT}}$ LIR ST	I o o o o	Pulled up Pulled up Pulled up Pulled up Pulled up	
57	REF	o	Refresh signal	IC (1 4A: REF, pin 1 1)
8 9 10	NMI INTO INT1	I I I	Pulled down Pulled up Pulled up	
11	INT2	I	Interrupt 2	IC (1 1B: $\overline{\text{BSYF}}$, pin 37)
47 54 55 45 46	$\overline{\text{DREQO}}$ $\overline{\text{DREQ 1}}$ $\overline{\text{TEND 1}}$ TXAO RXAO	I I 0 o I	Data request signal Pulled up Pulled up Pulled up Pulled up	IC (2A: RDY, pin 32)
42 43	$\overline{\text{RTSO}}$ $\overline{\text{CTSO}}$	o I	SCI channel O RTS SCI channel O CTS	IC (7B: PB2, pin 1 1) IC (7B: PB3, pin 12)
44	$\overline{\text{DCDO}}$	I	Pulled down	
48 49	TXA 1 RXA 1	0 I	SCI channel 1 SCI channel 1	External serial I/F TXD External serial I/F RXD
50	CKA 1	I/O	Pulled up	
51 52 53	TXS RXS CKS	o I I/O	CSO I/O TXD CSO I/O RXD CS I/O clock	IC (7B: RXD, pin 18) IC (7B: TXD, pin 17) IC (7B: SCK, pin 19)

CPU Timing

- **Two oscillator cycles define one state.**
- **One machine cycle, such as OP (operational) code fetch or memory read/write, requires three states.**

a) OP code fetch timing

During the first half of state T1, the contents of the program counter (PC) are output on address bus lines AO to AI 8. During the latter half of state T1, the ME and $\overline{RD}$ signals go active, and the memory is accessed.

The OP codes on the data busses are fetched at the trailing clock of state T2.

The $\overline{LIR}$ signal goes active from the first half of state T1 to that of state T3, and indicates that this cycle is an OP code fetch cycle.

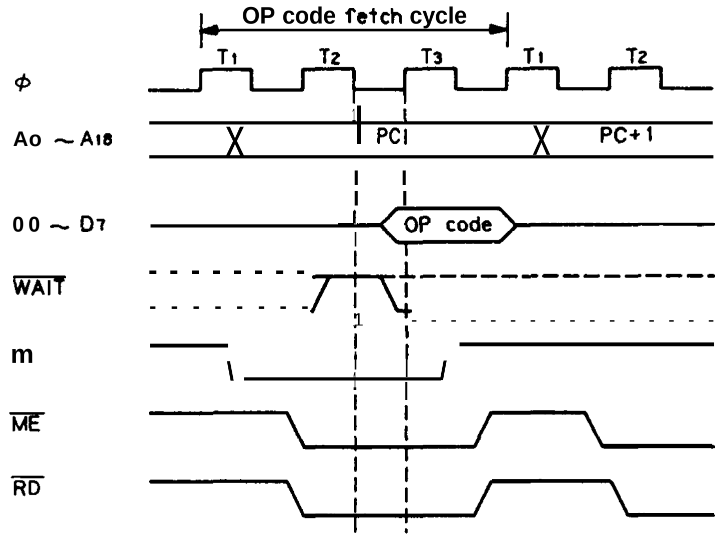


Figure A-3. OP Code Fetch Timing

b) Memory Data Read/Write Timing

The memory data access timing is different from the OP code fetch timing in the following points:

. The LIR signal does not go active.

. Read data is valid a half clock later, as comparing with the OP code fetch timing. (The data is fetched at the trailing clock of state T3.)

For memory data write timing, the ME signal and WR signal are activated at the latter half of state T1 and the first half of state T2, respectively, and the write data is output on DO to D7 from the latter half of state T 1. The ME and WR signals go inactive in the latter half of state T3, and the write data remains valid on the data bus unitl just before state T 1 starts.

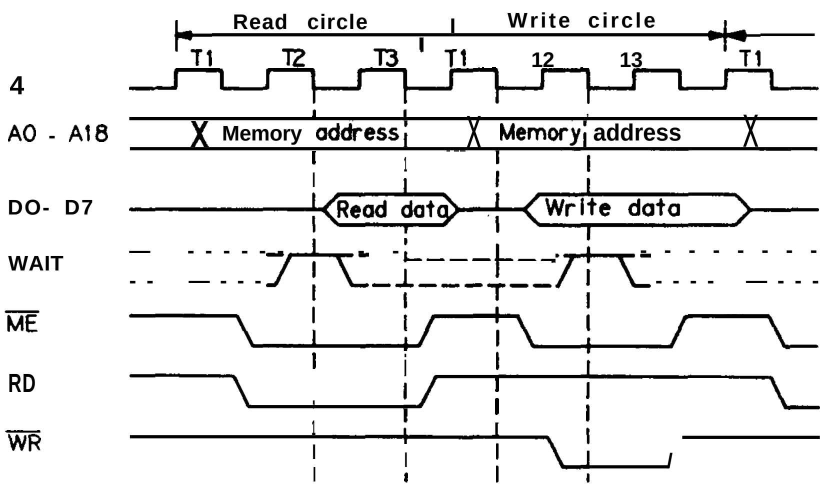


Figure A-4. Memory Data Read/Write Timing

A.1.1.2 PPD781OHG

The μPD78 10HG is a one-chip 8-bit CPU and includes two 8-bit timers, an 8-bit A/D converter, 256-byte RAM, and a serial interface.
The main features of this chip are as follows:

- 256-byte RAM
- Direct addressing of up to 64K bytes
- 8-bit A/D converter
- 158 instructions
- 1 μs instruction cycle (12 MHz)
- 16-bit timer/event counter
- Two 8-bit timers
- Interrupts (3 internal, 8 external)
- General purpose serial interface
- I/O lines (1/0 ports: 28 bits; edge detection inputs: Four)
- Zero crossing detection
- Standby function
- Built-in clock oscillator circuit
- NMOS

Figures A-5 and A-6 show the pin diagram and the internal block diagram. Table A-3 shows the functions of each terminal.

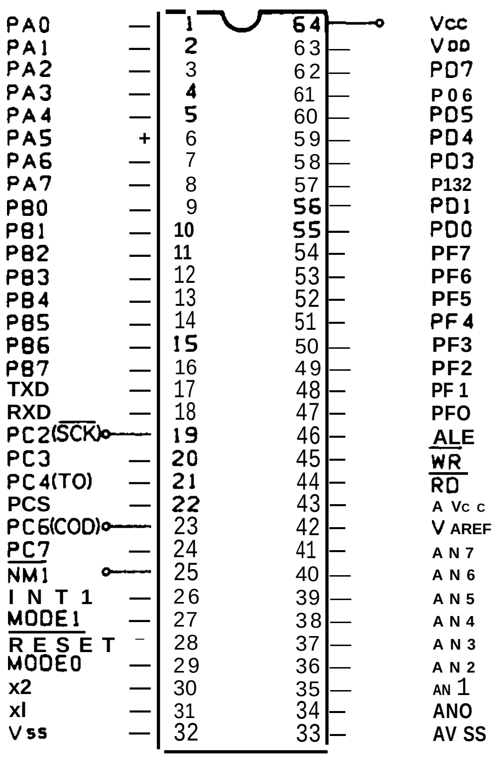


Figure A-5. μPD781 OHG Pin Diagram

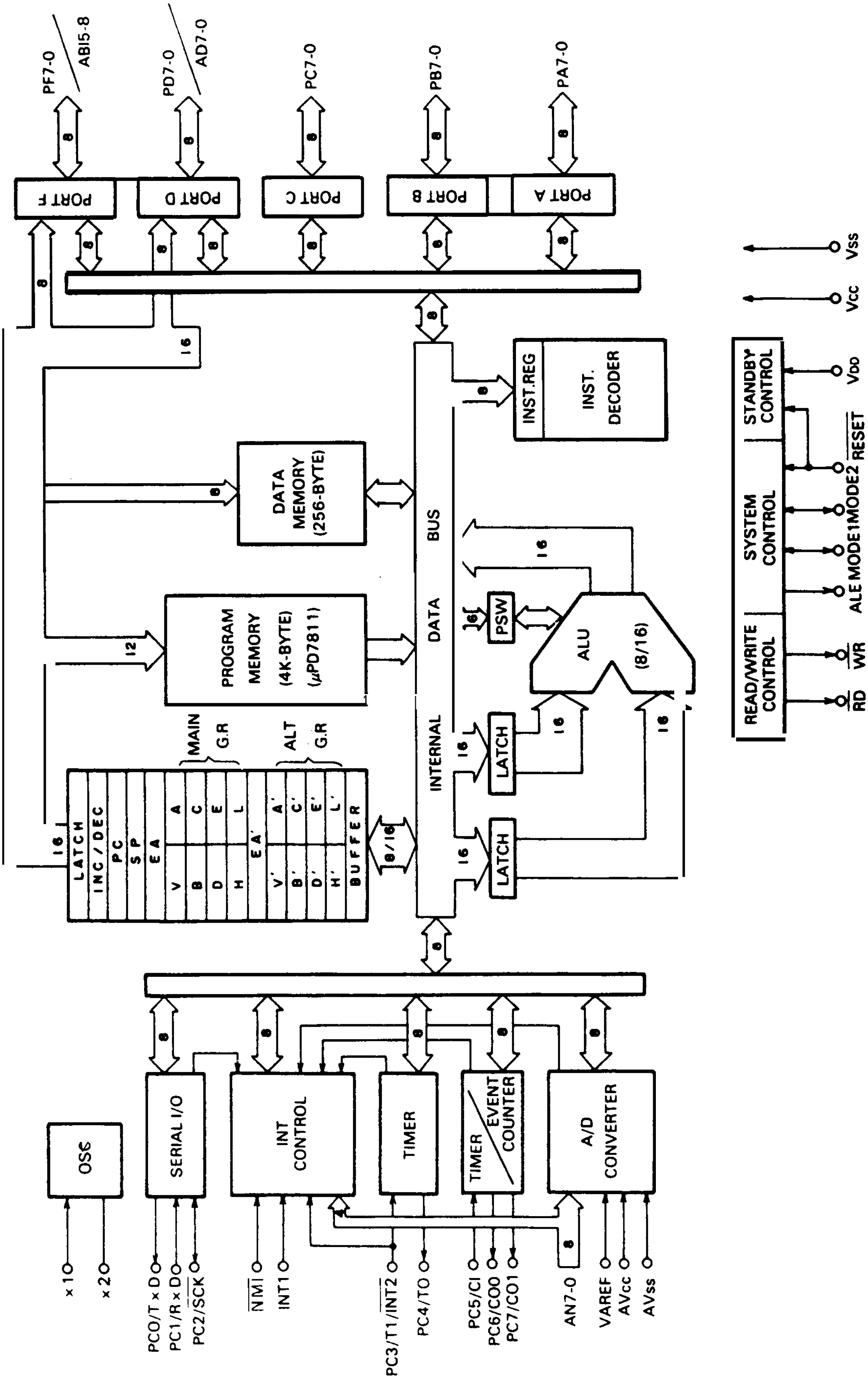


Figure A-6. PPD781OHG Block Diagram

Table A-3. μPD781 OHG Terminal Functions

Pin No.	Terminal	I/O	Signal Name	Description	Notes
3	PA2	I	$\overline{\text{AFXT}}$	Parallel I/F $\overline{\text{AUTO FEED XT}}$ signal	External 8-bit parallel I/F
4	PA3	I	SLIN	Parallel I/F SLIN signal	External 8-bit parallel I/F
1	PA0	I	CRHM	CR home position sensor signal HOME/OUT	Printer mechanism
2	PA1	I	PGHM	PG home position sensor signal HOME/OUT	Printer mechanism
5	PA4	O	$\overline{\text{LDPL}}$	LD solenoid OFF/ON	Printer mechanism
6	PA5	O	RLPL	RL solenoid OFF/ON	Printer mechanism
7	PA6	O	PTPL	PT solenoid OFF/ON	Printer mechanism
16	PB7	I	$\overline{\text{PESN}}$	PE sensor PAPER STAY/END	Printer mechanism
8	PA7	O	BUZ	Buzzer	Control panel
9	PB0	O	DTO	Serial data signal	Control panel
10	PB1	O	CKO	Serial data synchronous clock	Control panel
14	PB5	O	$\overline{\text{LOAD}}$	Serial data trigger pulse	Control panel
13	PB4	O	$\overline{\text{LCDCE}}$	LCD controller chip enable signal	Control panel
20	INT2	I	$\overline{\text{OLSW}}$	ON LINE switch signal	Control panel
11	PB2	I	SINH	CS I/O handshaking	IC (13A: RTSO, pin 42)
12	PB3	O	MINH	CS I/O handshaking	IC (13A: CTSO, pin 43)
15	PB6	O	$\overline{\text{FNEN}}$	HF motor enable signal	IC (2C: pin 2)
17	TXD	O	TXD	CSI/O TXD	IC (13A: RXS, pin 52)
18	RXD	I	RXD	CSI/O RXD	IC (13A: TXS, pin 51)
19	PC2	I/O	SCK	CS I/O clock	IC (13A: CKS, pin 53)
21	TO	O	$\overline{\text{CRTM}}$	CR motor drive pulse	IC (5A: pin 9), IC (5B: pin 1)
22	PC5	O	$\overline{\text{PFTM}}$	PF motor drive pulse	IC (4B: TM2, pin 20)
23	C00	O	HPW	Printhead coil trigger pulse	IC (2A: pin 31)
24	PC7	O	$\overline{\text{PNPON}}$	Printhead driver drive voltage ON/OFF	IC (5B: pin 3), IC (6B: pin 3)
25	NMI	I	P/$\overline{\text{S}}$	Parallel/$\overline{\text{Serial}}$	Optional 81XX I/F board
26	INT1	I		Pulled up	

Table A-3. PPD781OHG Terminal Functions

Pin No.	Terminal	1/0	Signal Name	Description	Notes
34	ANO	I		+35 V line voltage detection	
35	AN 1	I		Printhead temperature and printer cover OPEN/CLOSE detection	Printhead, upper case
36	AN2	I		Image scanner signal	Optional image scanner
37	AN3	I		PW sensor signal	Printer mechanism
38	AN4	I		PT sensor signal	Printer mechanism
39	AN5	I		CONDENSED, PAPER SE-LECT, MICRO FEED, and FONT switches signal	Control panel
40	AN6	I		SelecType, TEAR OFF, PLATEN GAP ADJUST, and PITCH switches signal	Control panel
41	AN7	I I		LOAD/EJECT, LINE FEED, FORM FEED switches signal	Control panel
43	AVcc	I		Analog port power supply (+5 VDC)	
42	V AREF	O		Analog port reference voltage	
33	AVss	—		Analog port ground	
47 ∫ 54	PFO ∫ PF7	o		Upper address (A8 to Al 5) bus	
55 ∫ 62	PDO ∫ PD7	I/O		Lower address (A0 to A7)/ data (A0 to A7) bus	Selected by the ALE signal
46	ALE	O		Address latch enable	
44	RD	o		Read strobe	
45	WR	O		Write strobe	
29	MODEO	I		Mode 3 select (fixed)	
27	MODE 1	I		Address OOOOH to EFFFH (External) FFOOH to FFFFH (Internal RAM)	
28	$\overline{\text{RESET}}$	i		Reset signal	
31	xl	I		External oscillator (1 2.2 MHz)	
30	x2	I			
64	Vcc	I		+ 5 VDC	
63	VDD	I		+5 VDC	
32	GND	—		Ground	

Timing

- Three oscillator cycles define one state.
- One read/write machine cycle requires three states, and one OP code fetch machine cycle requires 4 states.
- Wait states cannot be inserted.

a) OP Code Fetch Timing

The OP code fetch timing consists of four states, T1 to T4. During T1 to T3, program memory is read, and instructions are processed (decoded) during T4.

AB 15 to 8 (PF7 to O) are output from T1 to T4. Since AD7 to O (PD7 to O) are used in the multiplex mode, the address is latched at the ALE signal during state T1, and the drivers for AD7 to O are disabled. Then the $\overline{RD}$ signal is output from T1 to T3 to enable the memory to be addressed, fetching at T3, and internal processing at T4.

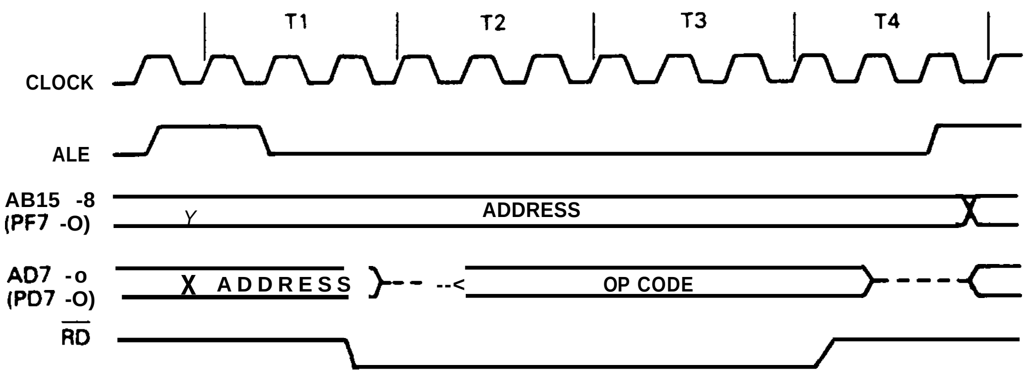


Figure A-7. OP Code Fetch Timing

b) Memory Read Timing

The memory read timing consists of three states, T1 to T3.

Timings for address output, the ALE signal, and the $\overline{RD}$ signal are the same as those for the OP code fetch (excluding T4).

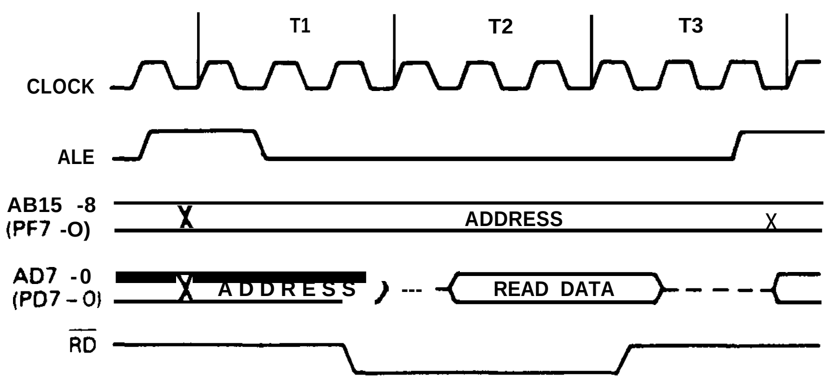


Figure A-8. Memory Read Timing

c) **Memory Write Timing**

The memory write timing consists of three states, T1 to T3.

Timings for address output and the ALE signal are the same as those for the memory read machine cycle, however, AD7 to O (PD7 to O) are not disabled after the memory address is output, and write data is output on AD7 to O from the beginning of T2 to the end of T3. The WR signal is output from the middle of T1 to the beginning of T3.

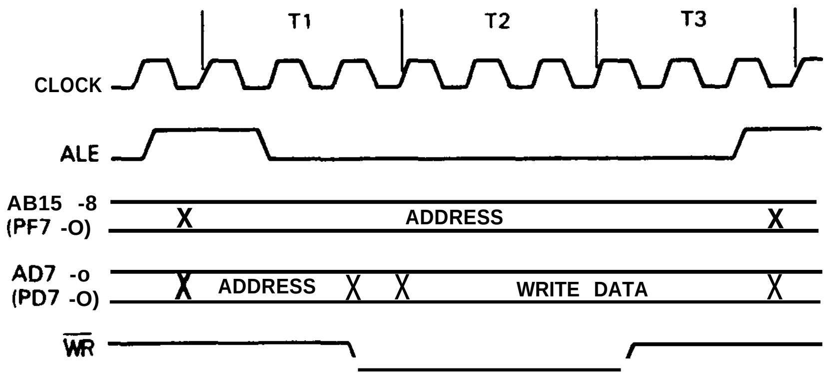


Figure A-9. Memory Write Timing

NOTE: When PD7 to O and PF7 to O are output to the mautiplexed address/data bus (AD7 to O) and address bus (AB 15 to 7), both the $\overline{RD}$ and WR signals during the machine cycle are HIGH when external memory is not being accessed.

A.1.1.3 27512

The 27512 is an EPROM, which is an ultra-violet erasable and electrically programmable ROM.

Features:

- 65536 words X 8 bits
- TTL compatible input/output
- +5V single power
- Acccess time: 200 ns (max.)
- 28 pins (DIP)

Terminal Functions:

- AO to Al 5: Address input
- $\overline{CE}$: Chip enable input
- $\overline{OE}/V_{PP}$: Output enable input/programming power supply
- 00 to 07: Data output
- V_{CC}: Power supply (+5 V)
- GND: Ground

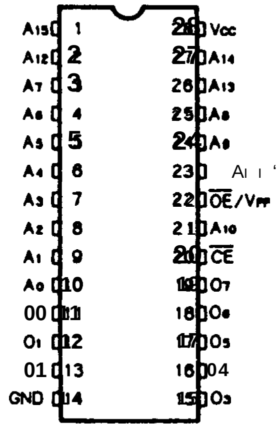


Figure A-10. 27512 Pin Diagram

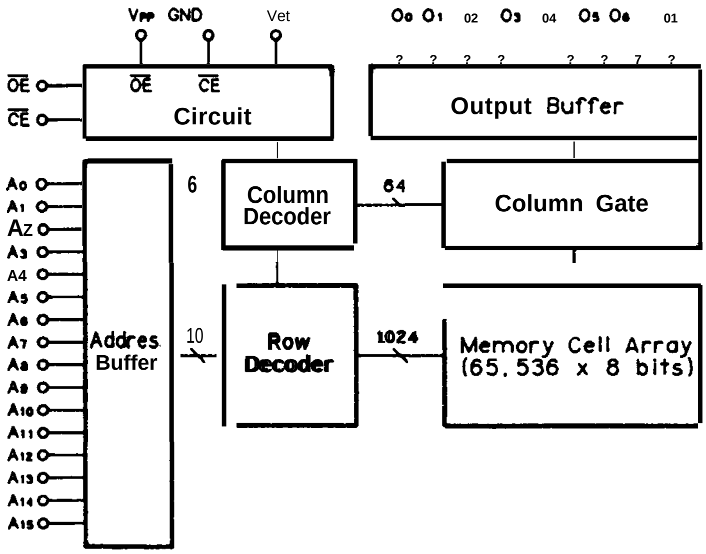


Figure A-1 1. 27512 Block Diagram

Table A-4. 27512 Signal Status

Pin Name / Mode	Vcc (28)	OE/VPP (22)	CE (20)	00- 07 (11 - 13, 15 - 19)	Power
Read	5V	L	L	Data output	Active
Output disable		H	*	High impedance	
Standby		*	H	High impedance	Standby
Program	6V	VPP	L	Data input	Active
Program inhibit		VPP	H	High impedance	
Program verify		L	L	Data output	

*: VIH or VIL

A.1.1.4 27256

The 27256 is an EPROM, which is a ultra-violet erasable and electrically programmable ROM.

Features:

- 32768 words X 8 bits
- TTL compatible input/output
- +5 V single power supply
- Access time: 250 nS (max.)
- 28 pins (DIP)

Terminal Functions:

- AO to AI 4: Address input
- $\overline{CE}$: Chip enable input
- $\overline{OE}$: Output enable input
- DO to D7: Data output
- V_{PP}: Program power supply
- V_{CC}: Power supply (+5 V)
- GND: Ground

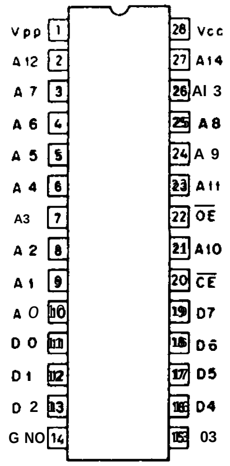


Figure A-12. 27256 Pin Diagram

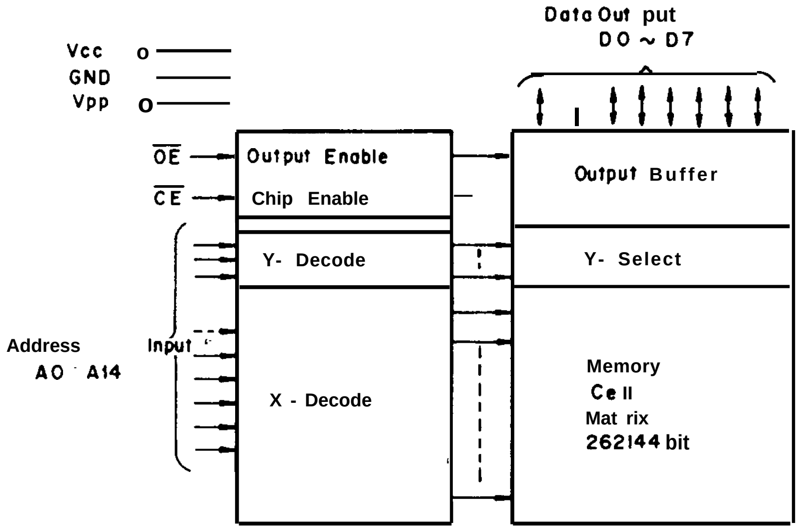


Figure A-1 3. 27256 Block Diagram

Table A-5. 27256 Signal Status

Mode	CE	OE	A9	VPP	Vcc	outputs
Read	L	L	x	Vcc	Vcc	D out
Output Disable	L	H	x	Vcc	Vcc	High Z
Standby	H	x	x	Vcc	Vcc	High Z
High Performance Program	L	H	x	VPP	Vcc	D in
Program Verify	H	L	x	VPP	VPP	D out
Optional Verify	L	L	x	VPP	VPP	D out
Program Inhibit	H	H	x	VPP	Vcc	High Z
Identifier	L	L	VH	Vcc	Vcc	Code

NOTES: 1. X... Don't care

2. VH = 12.0V ± 0.5V

3. Vcc = −0.6 - + 7V

4. VPP = −0.6 - + 14V

A.1.1.5 HM65256Bsp-15

The HM65256BSp-15 is a CMOS pseudo static RAM, and features low power consumption and TTL compatible input/output.

Features:

- 32768 words × 8 bits
- TTL compatible input/output
- +5 V single power supply
- $\overline{CE}$ access time: 150 nS (max.)
- 28 pins (DIP)

Terminal Functions:

- AO to Al 4: Address input
- WE: Write enable
- $\overline{CE}$: Chip enable input
- $\overline{OE}$: Output enable input
- 1/00 to 1/07: Data input/output
- Vcc: Power supply (+5 V)
- GND: Ground

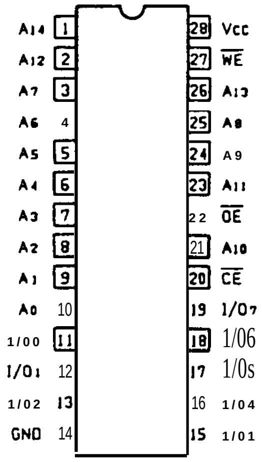


Figure A-14. HM65256BSP-15 Pin Diagram

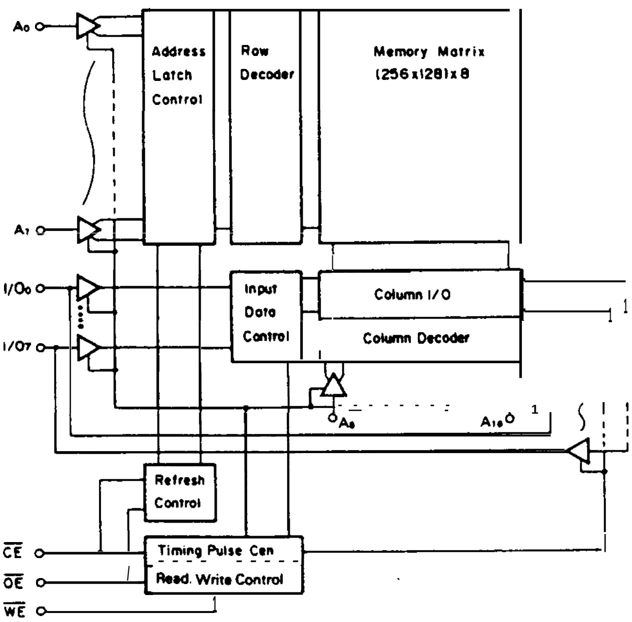


Figure A-1 5. HM65256BSP-15 Block Diagram

Table A-6. HM65256BSP-15 Signal Status

CE	OE	$\overline{WE}$	I/O Terminal	Function
L	L	H	Low Z	Read
L	x	L	High Z	Write
L	H	H	High Z	—
H	L	x	High Z	Refresh
H	H	X	High Z	Standby

NOTE: X Don’t care

A.1.1.6 μPD43257C-15L

The wPD43257C-15L is a CMOS static RAM, features low power consumption, and has a standby mode so that the memory can be backed up with a battery.

Features:

- 32768 words X 8 bits
- TTL compatible input/output
- +5 V single power supply
- . CE access time: 150 nS (max.)
- 28 pins (DIP)
- Battery back-up is possible
  Standby power consumption: 2 μA (typ.)

Terminal Functions:

- . AO to Al 4: Address input
- WE: Write enable
- CE1: Chip enable 1 input
- . CE2: Chip enable 2 input
- I/O1 to 1/08: Data output
- Vcc: Power supply (+5 V)
- GND: Ground

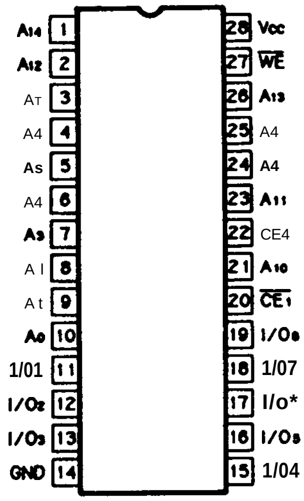


Figure A-1 6. IAPD43257C-15L Pin Diagram

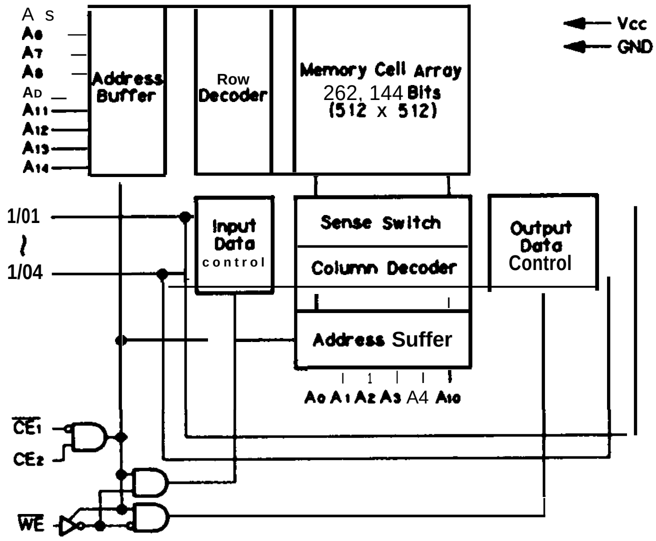


Figure A-1 7. pPD43257C-15L Block Diagram

Table A-7. pPD43257C-15L Signal Status

CE1	CE2	WE	Mode	Output Status
H	x	x	Deselect (Power down)	High impedance
x	L	x		
L	H	H	Read	DOUT
L	H	L	Write	DIN

NOTE: X... Don’t care

A.1.1.7 EO5A1OAA

The E05A 10AA is a gate array, and includes a memory management unit, reset circuit, and memory refresh circuit.

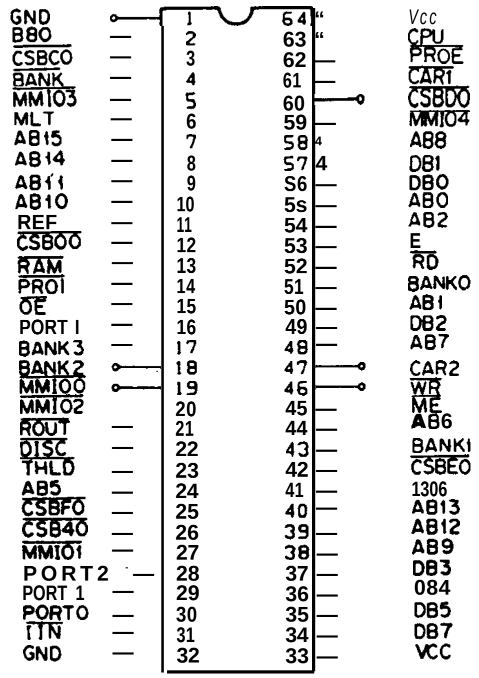


Figure A-1 8. E05A10AA Pin Diagram

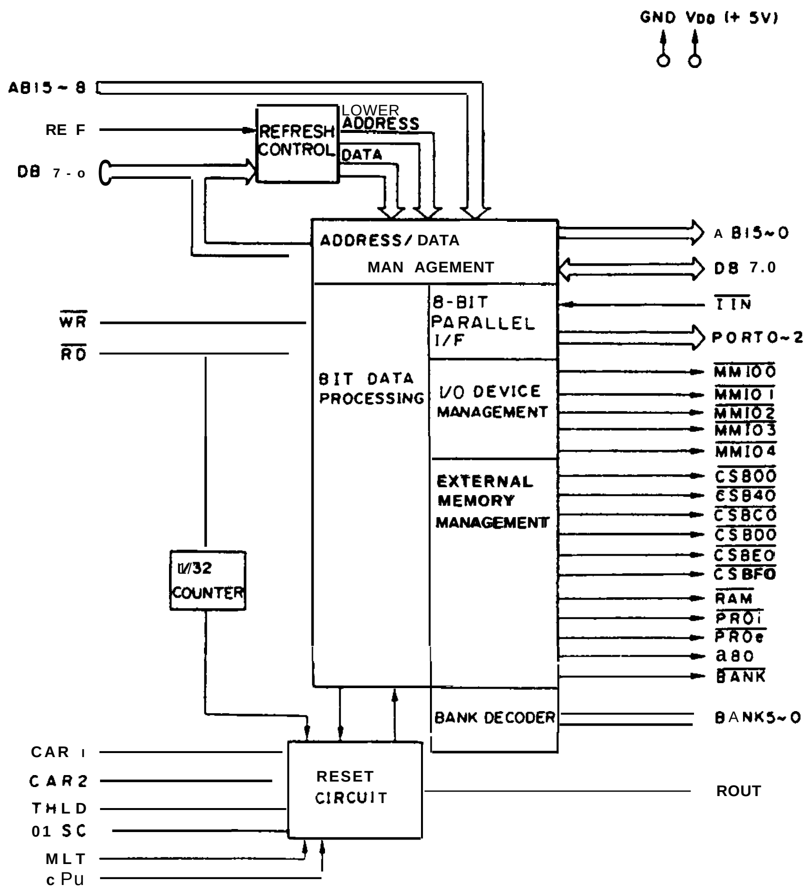


Figure A-1 9.E05A10AA Block Diagram

Table A-8. EO5A1OAA Terminal Functions

Pin No.	Name	I/O	Description	Notes
51	BANKO	o	Bank select O	IC (1 2A: AI 7, pin 30), IC (12B: AI 7, pin 30)
43	BANK 1	0	Bank select 1	IC (1 2A: AI 8, pin 31)
18	BANK2	o	Bank select 2	Not used
17	BANK3	o	Bank select 3	Not used
15	OE	o	Output enable	IC (9A: $\overline{OE}$, pin 22)
55	ABO	I	Address bus O	
50	AB 1	I	Address bus 1	
54	AB2	I	Address bus 2	
53	AB3	I	Enable signal	IC (1 3A: E, pin 60)
45	AB4	I	Memory enable signal	IC (1 3A: ME, pin 59)
24	AB5	I	Address bus 5	
44	AB6	I	Address bus 6	
48	AB7	I	Address bus 7	
58	AB8	I	Address bus 8	
38	AB9	I	Address bus 9	
10	AB 10	I	Address bus 10	
9	AB 11	I	Address bus 11	
39	AB 12	I	Address bus 12	
40	AB 13	I	Address bus 13	
8	AB 14	I	Address bus 14	
7	AB 15	I	Address bus 15	
59	AB 16	I	Address bus 16	
28	AB 17	I	Address bus 17	
29	AB 18	I	Address bus 18	
56	DO	I/O	Data bus O	
57	D1	I/O	Data bus 1	
49	D2	I/O	Data bus 2	
37	D3	I/O	Data bus 3	
36	D4	I/O	Data bus 4	
35	D5	I/O	Data bus 5	
41	D6	I/O	Data bus 6	
34	D7	I/O	Data bus 7	
30	POTO	0	Port 1	IC (11B: $\overline{PSW}$", pin 20)
16	POT 1	0	Port 2	IC (11B: BSL, pin 34)
19	$\overline{MMIOO}$	0	Memory mapped 1/0 O	IC (11B: $\overline{CS}$, pin 32)
27	$\overline{MMIO1}$	o	Memory mapped I/O 1	IC (2A: $\overline{CS}$, pin 12)
20	$\overline{MMIO2}$	o	Memory mapped I/O 2	IC (14C: $\overline{CLK}$, pin 9)
5	$\overline{MMIO3}$	o	Memory mapped I/O 3	CN6 ($\overline{MMIO}$, pin 20)
12	$\overline{CSBOO}$	0	Chip select bank OOH	IC (12A: $\overline{CE}$, pin 22) C.G.
26	$\overline{CSB40}$	0	Chip select bank 40H	IC (12B: $\overline{CE}$ pin 22) C.G.
3	$\overline{CSBCO}$	0	Chip select bank COH	CN6 (CG3, pin 41)
60	$\overline{CSBDO}$	o	Chip select bank DOH	CN4 (SLOT-A: CG, pin 18)
42	$\overline{CSBEO}$	o	Chip select bank EOH	CN5 (SLOT-B: CG, pin 18)
25	$\overline{CSBFO}$	0	Chip select bank FOH	IC (1 OA: CS, pin 20)

Table A-8. EO5A1OAA Terminal Functions

Pin No.	Name	I/O	Description	Notes
11	REF	I	Refresh cycle	IC (1 3A: REF, pin 57)
52	$\overline{RD}$	I	Read strobe	
46	WR	I	Write strobe	
13	RAM	o	RAM select	IC (9A: $\overline{CE}$, pin 20)
14	PRO I	o	ROM (PROG.) select	IC (1 1A: $\overline{CE}$, pin 20) or CN6 ($\overline{PROG}$ pin 42)
62	$\overline{PROE}$	o	External ROM select	CN4 (SLOT-A: $\overline{PROG}$, pin 26)
2	B80	o	Bank select	CN6 (KANJI, pin 39)
4	$\overline{BANK}$	o	Bank select	CN6 ($\overline{BANK}$, pin 19)
31	$\overline{IIN}$	I	8-bit parallel I/F data input flag	IC (1 1 B: $\overline{BSYF}$, (pin 37))
33, 64	Vcc	I	+5 VDC	
1, 32	Vss	—	Ground	
23	$\overline{THLD}$	I	Power-on reset	
21	$\overline{ROUT}$	o	$\overline{RESET}$ signal	
22	$\overline{DISC}$	o	Discharge	
6	MLT	I	Pulled down	
63	CPU	I	Power-on reset/INIT reset	
61	$\overline{CAR1}$	I	Cartridge MOUNT/DISMOUNT signal	CN4 (SLOT-A: $\overline{R}$, pin 8)
47	$\overline{CAR2}$	I	Cartridge MOUNT/DISMOUNT signal	CN5 (SLOT-B: $\overline{R}$, pin 8)

A.1.1.8 E05A02LA

The E05A02LA is a gate array IC used to lighten the load on the CPU when processing print data.

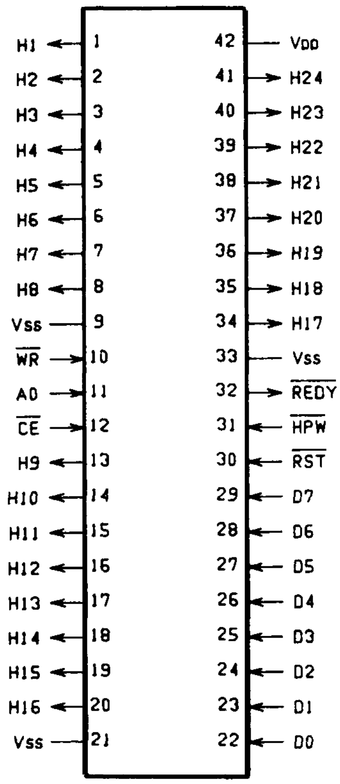


Figure A-20. E05A02LA Pin Diagram

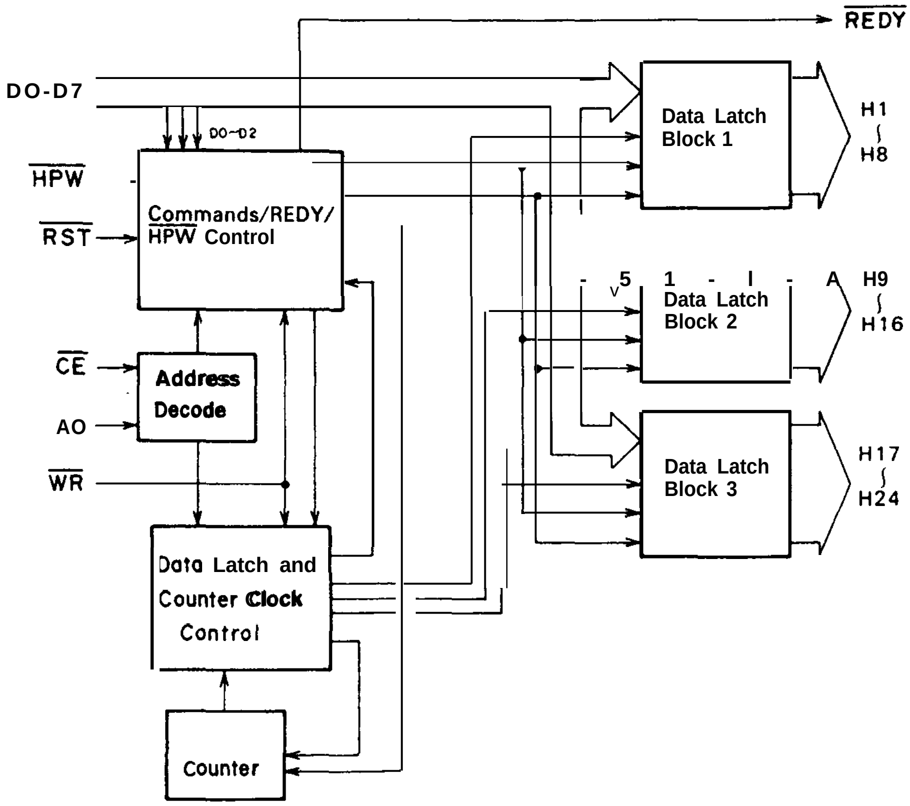


Figure A-21. E05A02LA Block Diagram

Table A-9 E05A02LA Terminal Functions

Pin No.	Ter-minal	1/0	Description
1 ∫ 8	HI ∫ H8	0	Printhead solenoids (1 to 8) ON/OFF
13 ∫ 20	H9 ∫ H16	o	Printhead solenoids (9 to 16) ON/OFF
34 ∫ 41	H17 ∫ H24	o	Printhead solenoids (17 to 24) ON/OFF
22 ∫ 29	DO ∫ D7	I	Print data/command
11 12 10 30 31 32	AO CE WR RST HPW REDY	I I I I I o	Address bit O Chip enable Write strobe Reset signal Printhead solenoid trigger pulse Ready signal
42 9,12, 33	VDD Vss	I —	+ 5 VDC Ground

A.1.1.9 E05A09BA

The E05A09BA is a gate array used to separately control two 4-phase stepper motors.

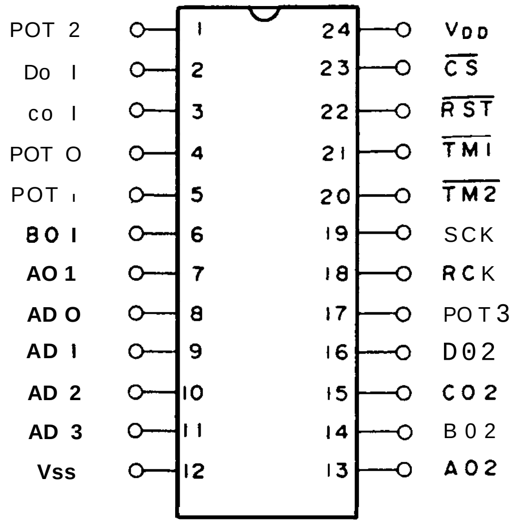


Figure A-22. E05A09BA Pin Diagram

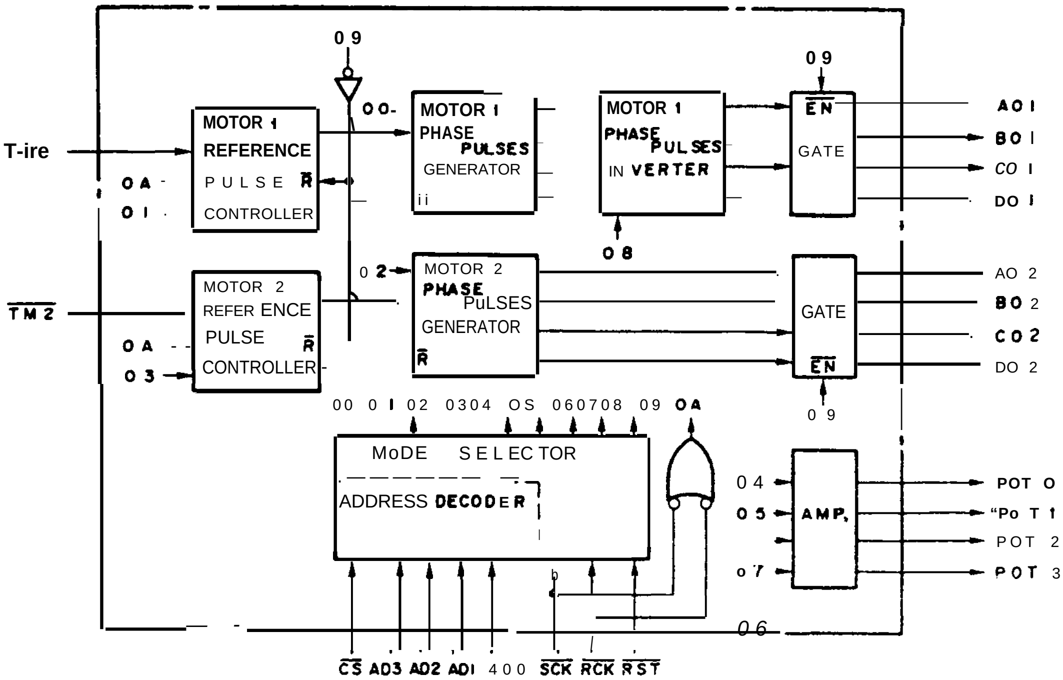


Figure A-23. E05A09BA Block Diagram

Table A-10. E05A09BA Terminal Functions

Pin No.	Terminal	I/O	Description (4B)	Description (3B)
8 9 10 11	ADO AD 1 AD2 AD3	I I I I	Address bus O Address bus 1 Address bus 2 Address bus 3	
21 20	TM 1 TM2	I I	CR motor synchronous pulse PF motor synchronous pulse	Pulled up Pulled up
18 19	RCK SCK	I I	Read pulse Write pulse	
4	$\overline{\text{POTO}}$	o	CR motor reference voltage #O OFF/~ (Hold)	Pulled up
5	$\overline{\text{POT1}}$	o	CR motor reference voltage # 1 OFF/ON (Speed 4)	PG motor HOLD/$\overline{\text{DRIVE}}$
1	$\overline{\text{POT2}}$	o	CR motor reference voltage #2 OFF/~ (Speed 2, 3)	Pulled up
17	$\overline{\text{POT3}}$	o	IC (7D: E, pin 18)	CS motor HOLD/$\overline{\text{DRIVE}}$
7 6 3 2	AO 1 601 Col DO 1	0 0 o 0	CR motor coil A CR motor coil B CR motor coil C CR motor coil D	PG motor coil A PG motor coil B PG motor coil C PG motor coil D
13 14 15 16	A02 602 C02 D02	o 0 o o	PF motor coil A PF motor coil B PF motor coil C PF motor coil D	CS motor coil A CS motor coil B CS motor coil C CS motor coil D
22 23	RST Cs	I I	Reset signal Chip select	
24 12	V_{DD} Vss	I —	+ 5 VDC Ground	

A.1.1.10 M54610P

The M546 10P is an IC used to simplify data processing between the host computer and CPU.

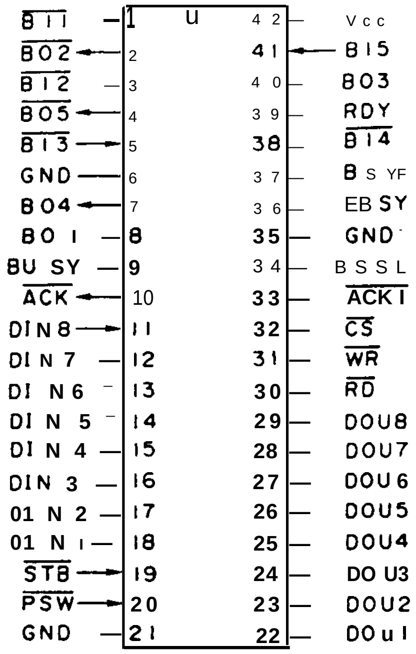


Figure A-24. M5461 OP Pin Diagram

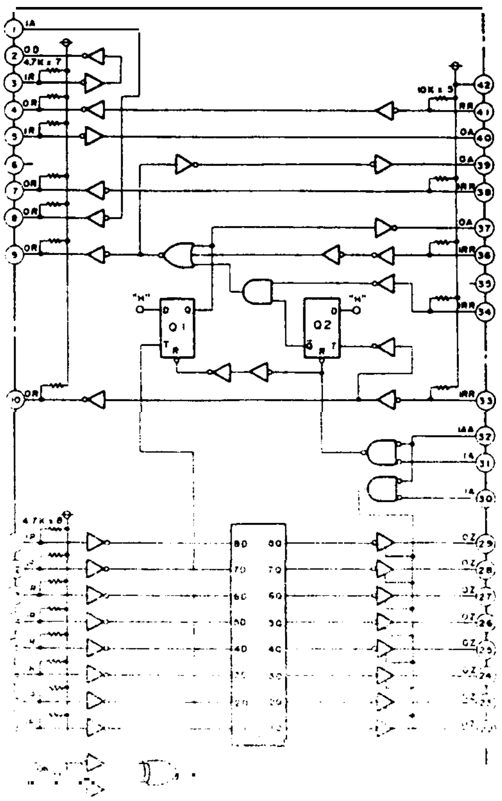


Figure A-25. M54610P Internal Circuit

Table A-1 1. M5461OP Terminal Functions

Pin No.	Name	Signal Direction	Description
11 ∫ 18	DIN8 ∫ DIN 1	← HOST	8-bit parallel I/F data (8 to 1)
22 ∫ 29	DOU1 ∫ DOU8	→ CPU *1	8-bit parallel I/F data (1 to 8)
19	STB	← HOST	STROBE pulse
9	BUSY	← HOST	BUSY signal
20	PSW	← MMU *2	BUSY signal output timing IC (14A: PO, pin 30) O: Leading edge of the STROBE signal 1: Trailing edge
34	BSSL	← MMU	BUSY signal selection O: When ACKl changes from LOW to HIGH, BUSY changes HIGH to LOW. 1: When CS·WR changes from HIGH to LOW, BUSY changes HIGH to LOW.
30 31	RD WR	← CPU ← CPU	Read strobe Write strobe
32	Cs	← MMU	Chip select signal (MMIOO, pin 19)
33	ACKl	← CPU	Data bit 2
36	EBUSY	← CPU	Data bit 3
37	BSYF	→ CPU	BUSY flag
38	RDY	→ PANEL LED	Ready signal
1	BI1	← CPU	Data bit O
8	BO1	→ HOST	PE signal
3	BI2	← HOST	RXD signal
2	BO2	→ CPU	RXD signal
5	BI3	← HOST	INIT signal
40	BO3	→ MMU	INIT signal
38	BI4	← CPU	Data bit 1
7	BO4	→ HOST	ERROR signal
41	BI5	!	Pulled up
4	BO5	O	Open
42	Vcc		+5 VDC
6, 21, 35	GND	–	Ground

*1: CPU ... IC (13A)
*2: MMU ... IC (14A)

NOTE: **Bold** indicates the setting for the standard model

A.1.1.11 STK6981 H

The STK6981 H is a unipolar constant current chopper type driver IC, and includes a control/drive circuit for a 4-phase stepper motor.

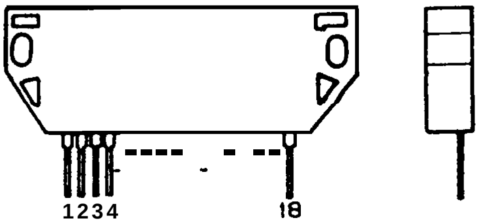


Figure A-26. STK6981 H Pin Diagram

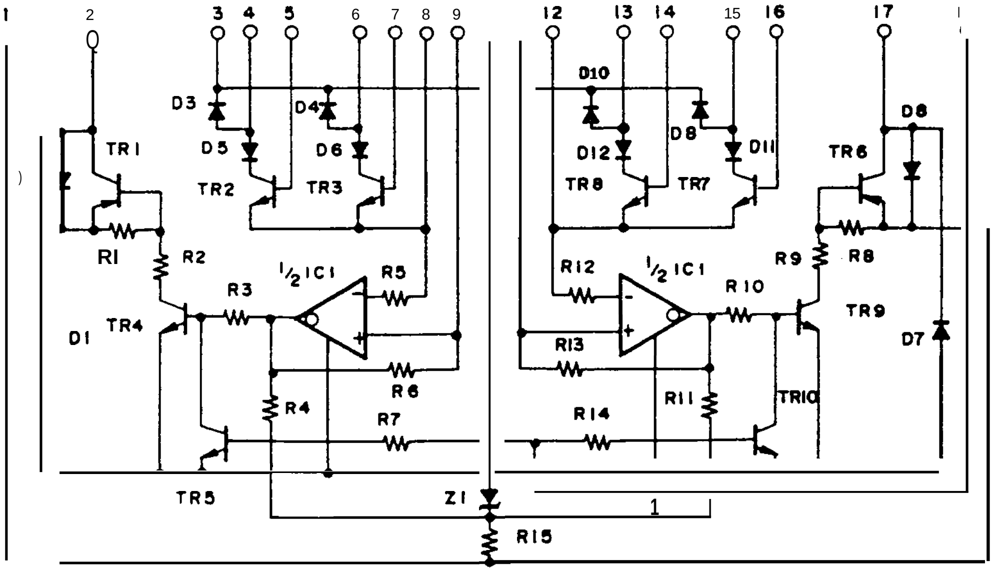


Figure A-27. STK6981 H Internal Circuit

Table A-1 2. STK6722H Terminal Functions

Pin No.	Terminal	I/O	Description
1 10	VPP GND	I —	+35 VDC GH
2 17	ACcom BDcom	o o	PF motor coil A/C drive voltage PF motor coil B/D drive voltage
5 14 7 16	AIN BIN CIN DIN	I I I I	PF motor coil A drive pulse PF motor coil B drive pulse PF motor coil C drive pulse PF motor coil D drive pulse
4 13 6 15	AOUT BOUT COUT DOUT	o o o o	PF motor coil A drive terminal PF motor coil B drive terminal PF motor coil C drive terminal PF motor coil D drive terminal
3	ZD	o	PF motor surge voltage output terminal
18	E	o	HOLD/DRIVE switch
8 12	RAC RBD	I I	Coil A/C current detection resistor mounting terminal Coil B/D current detection resistor mounting terminal
9 11	VRAC VRBD	I I	Constant current control reference voltage (Coil A/C) Constant current control reference voltage (Coil B/D)

A.1.1.12 SI-7304

The SI-7304 is a unipolar constant current chopper type driver IC, and includes a control/drive circuit . for a 4-phase stepper motor.

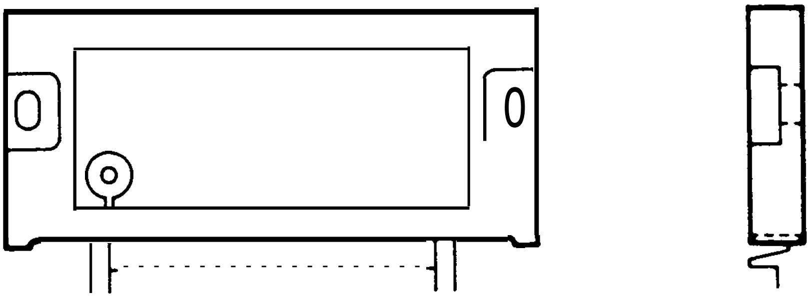


Figure A-28. SI-7304 Pin Diagram

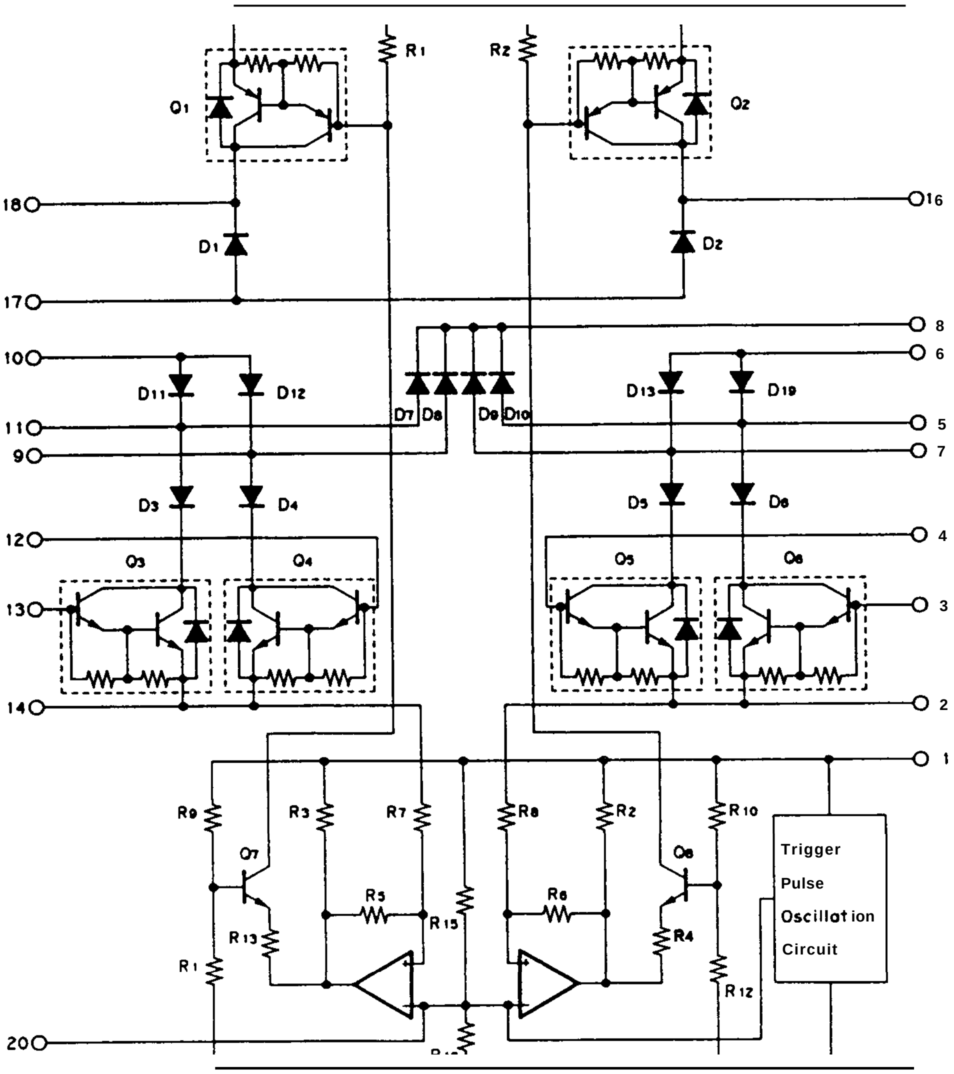


Figure A-29. SI-7304 Internal Circuit

Table A-1 3. S1-7304 Terminal Functions

Pin No.	Terminal	I/O	Description
15	VPP	I	+35 VDC
19	GND	—	GH
16	ACCOM	O	CR motor coil A/C drive voltage
18	BDCOM	O	CR motor coil B/D drive voltage
3	AIN	I	CR motor coil A drive pulse
12	BIN	I	CR motor coil B drive pulse
4	CIN	I	CR motor coil C drive pulse
13	DIN	I	CR motor coil D drive pulse
5	AOUT	O	CR motor coil A drive terminal
9	BOUT	O	CR motor coil B drive terminal
7	COUT	O	CR motor coil C drive terminal
11	DOUT	O	CR motor coil D drive terminal
8	ZD"	O	CR motor surge voltage output terminal
17	E	O	HOLD/$\overline{\text{DRIVE}}$ switch
2	RAC	I	Coil A/C current detection resistor mounting terminal
14	RBD	I	Coil B/D current detection resistor mounting terminal
20	RX	I	Constant current control reference voltage
6	DA	I	Coil A/C surge voltage
10	DB	I	Coil B/D surge voltage
1	Vcc	I	+5 VDC

A.1.1.13 H8D2148

The H8D2 148 is an IC with temperature detection and feedback circuits, and is used to control the 2-phase stepper motor.

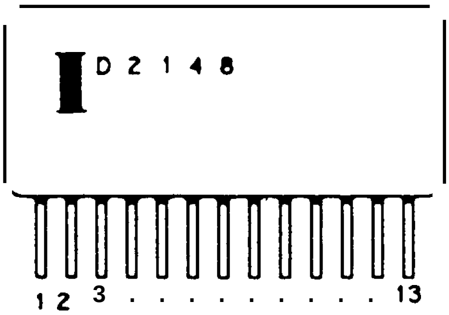


Figure A-30. H8D2148 Pin Diagram

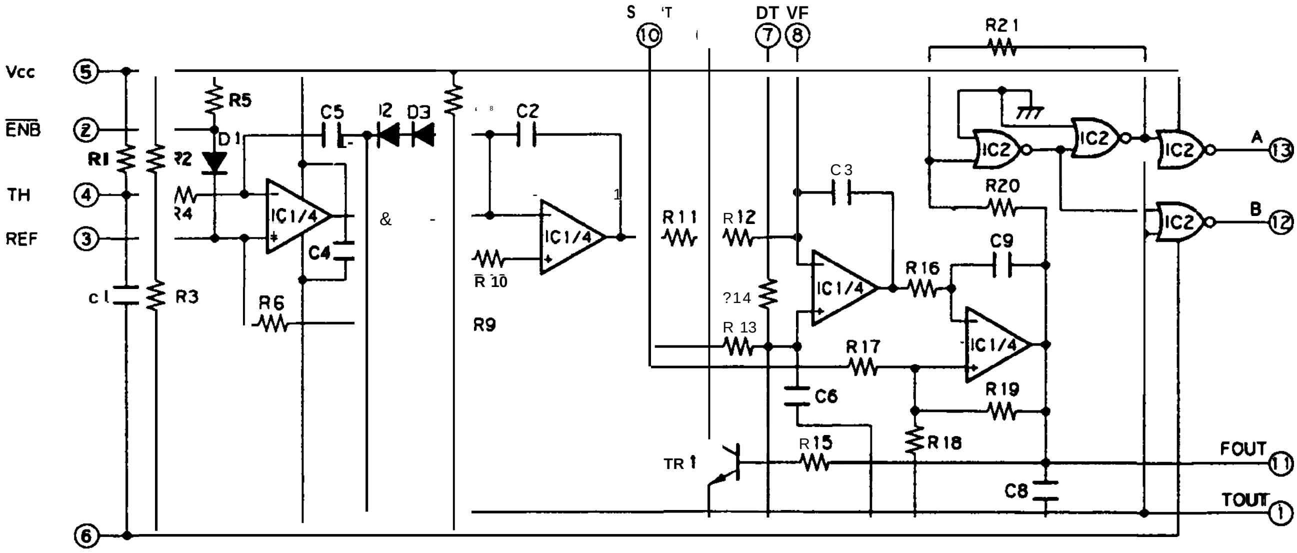


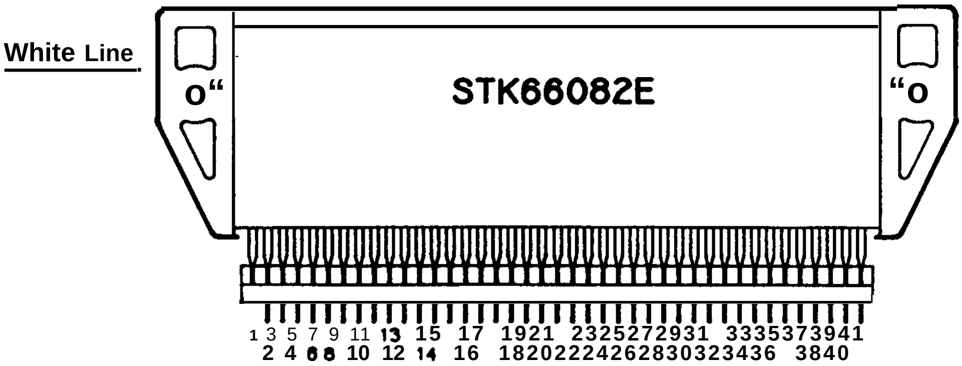
Figure A-31. H8D2148 internal Circuit

Table A-1 4. H8D2148 Terminal Functions

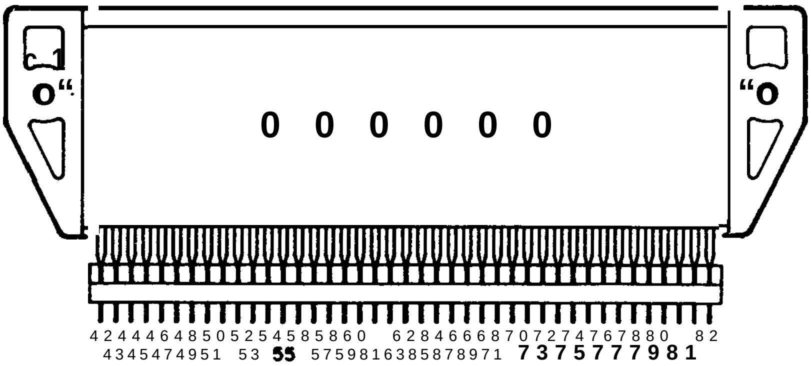
Pin No.	Terminal	I/O	Description Primary Destinations “
12	A	o	HF motor coil A drive terminal
13	B	o	HF motor coil B drive terminal
2	ENB	I	Enable IC (7B: PB6, pin 15)
4	TH	o	HF motor temperature detection (thermistor)
8	VF	I	External resistor terminal for constant selection
9	FB	I	
5	Vcc	I	+5 VDC
6	GND	—	Ground
1	TOUT	—	Not used
3	REF	—	
7	DT	—	
10	SOUT	—	
11	FOUT	—	

A.1.1.14 STK66082E

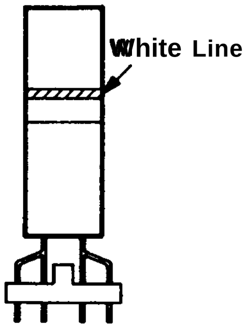
The STK66082E is a unipolar constant current chopper type driver IC, and includes a drive circuit for the solenoids of the printhead.



(a) Front View



(b) Reor View



(c) Left Side View

Figure A-32. STK66082E Pin Diagram

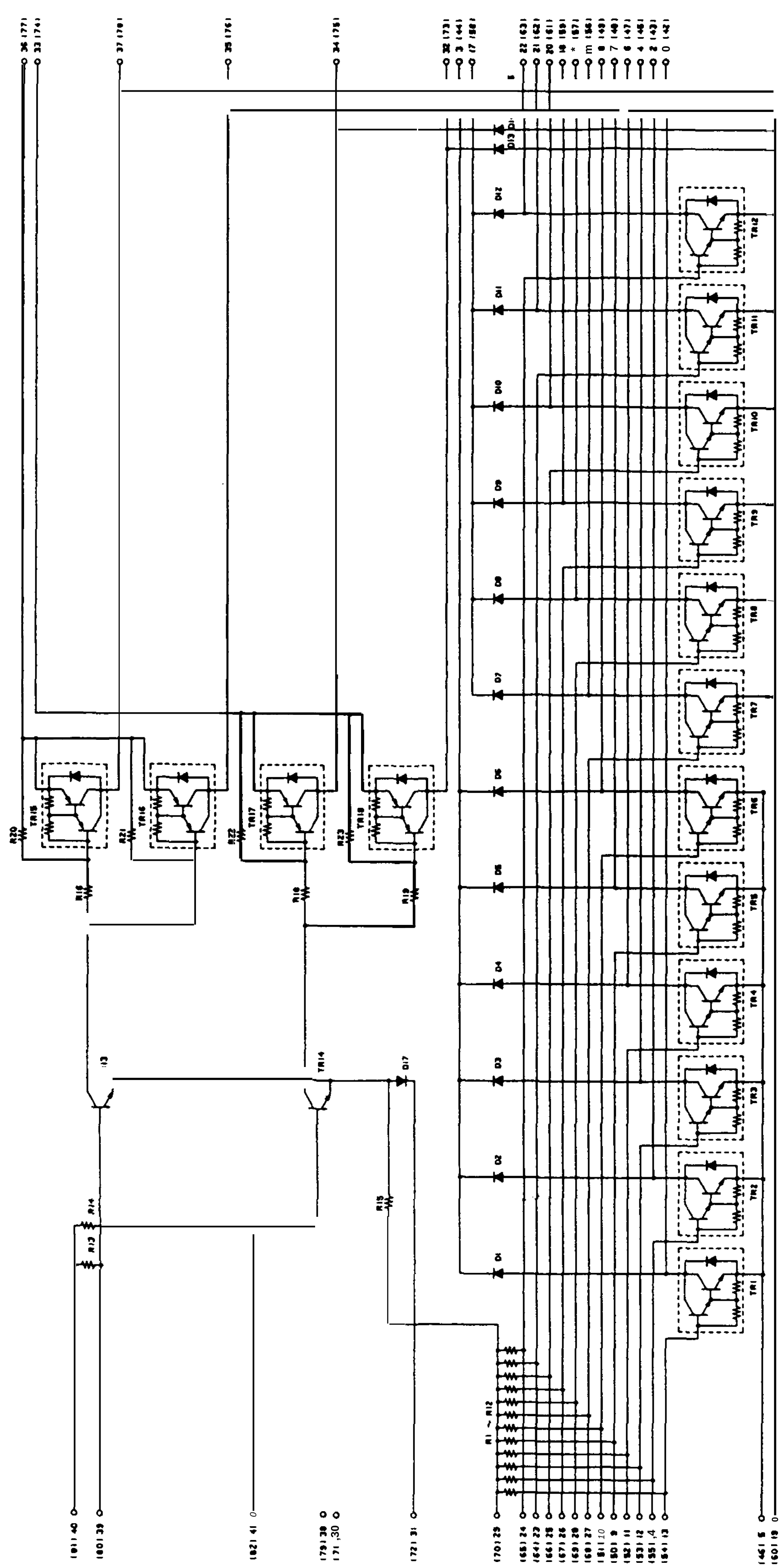


Figure A-33. STK66082E Internal Circuit

Table A-1 5. STK66082E Terminal Functions

Input Side		Output Side		Description
Pin No.	Terminal	Pin No.	Terminal	
26	I1	18	i i i	Printhead solenoid #1 drive
53	I2	45	$\overline{H2}$	9
50	I3	48	$\overline{H3}$	17
		35	P1	Common line for printhead solenoids #1, #9, and #17
68	I4	56	$\overline{H4}$	Printhead solenoid #5 drive
55	I5	43	$\overline{H5}$	13
28	I6	16	$\overline{H6}$	21
		37	P2	Common line for printhead solenoids #5, #13, and #21
52	I7	47	$\overline{H7}$	Printhead solenoid #12 drive
23	I8	21	$\overline{H8}$	20
54	I9	42	$\overline{H9}$	24
		32	P3	Common line for printhead solenoids # 12, #20, and #24
25	I10	20	H10	Printhead solenoid #4 drive
24	I11	22	H11	8
51	I12	49	H12	16
		34	P4	Common line for printhead solenoids #4, #8, and #16
67	I13	59	H13	Printhead solenoid #2 drive
66	I14	61	H14	7
69	I15	57	H15	15
		76	P5	Common line for printhead solenoids #2, #7, and #15
12	I16	4	H16	Printhead solenoid #3 drive
11	I17	6	H17	11
14	I18	2	H18	19
		78	P6	Common line for printhead solenoids #3, # 11, and #19
13	I19	1	H19	Printhead solenoid #14 drive
64	I20	62	H20	22
27	I21	15	H21	23
		75	P7	Common line for printhead solenoids # 14, #22, and #23
9	I22	7	H22	Printhead solenoid #6 drive
10	I23	8	H23	10
65	I24	63	H24	18
		73	P8	Common line for printhead solenoids #6, #1 O, and #18
33	V1			+35 VDC
36	V2			
74	V3			
77	V4			
5	E1			GH
19	E2			
46	E3			
60	E4			
31	EN1			+35 VDC input OFF/ON (Fixed LOW)
72	EN2			

Table A-1 5. STK66082E Terminal Functions

Input Side		Output Side		Description
Pin No.	Terminal	Pin No.	Terminal	
39 41 80 82	PNP1 PNP2 PNP3 PNP4			+35 VDC input ON/OFF
29 70	NU1 NU2			Printhead drive Tr. (X 24) base pulled up (by Vx)
40 81	Pu 1 PU2			+35 VDC switching Tr. (x 4) base pulled up (by Vx)
30 38 71 79	TS1 TS2 TS3 TS4			Not used (open)
		3 17 44 58	D1 D2 D3 D4	Surge voltage feedback terminal (→ +35 V line)

A.1.1.15 7400

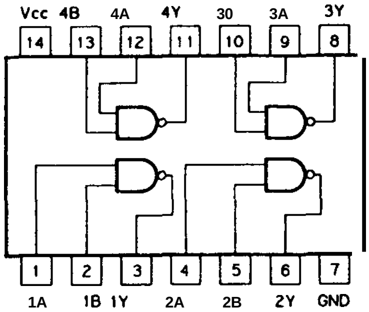


Figure A-34. 7400 Pin Diagram

A.1.1.16 7405

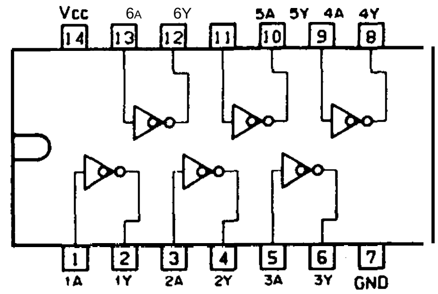


Figure A-35. 7405 Pin Diagram

A.1.1.17 74123

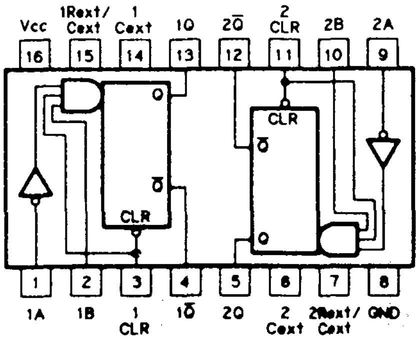


Figure A-36. 74123 Pin Diagram

A.1.1.18 74175

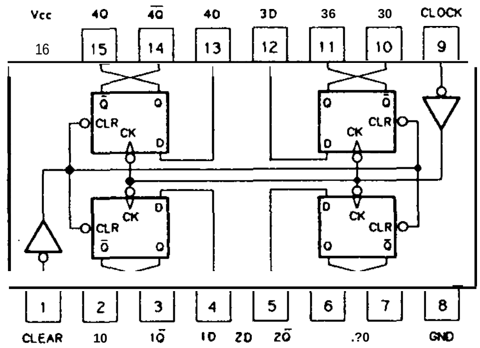


Figure A-37. 74175 Pin Diagram

A.1.1.19 74365

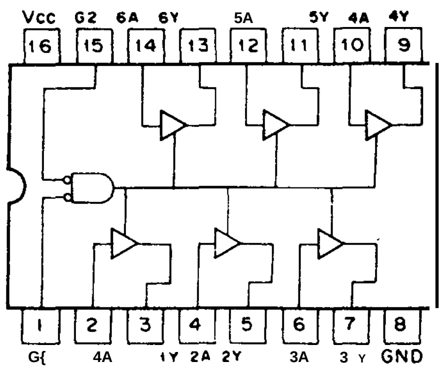


Figure A-38. 74365 Pin Diagram

A.1.1.20 74373

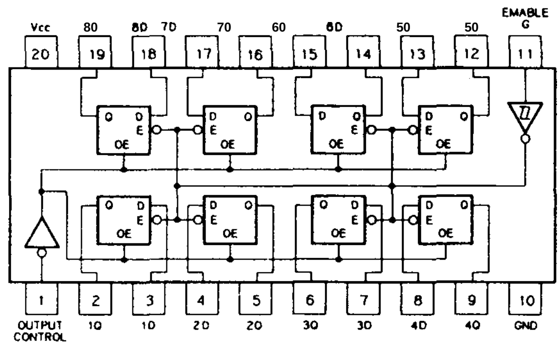


Figure A-39. 74373 Pin Diagram

A.1.1.21 75188

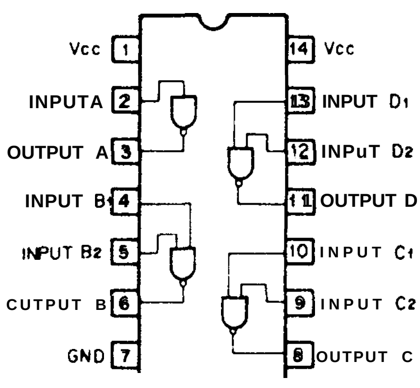


Figure A-40. 75188 Pin Diagram

A.1.1.22 75189

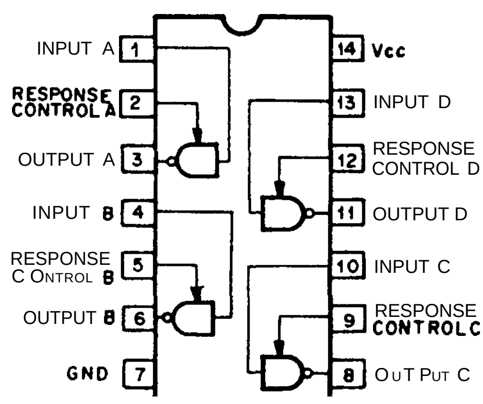


Figure A-41. 75189 Pin Diagram

A.1.1.23 TL431

The TL431 is a high-accuracy temperature compensated shunt regulator. The output voltage can be changed between 2.5 and 35 V using two external resistors. The TL431 has high stability and outputs a large current so that it can replace various Zener diodes.

Features:

- Temperature compensated feedback voltage: 50 PPM/°C TYP
- Low Zener current: 400 μA TYP.
- High response speed
- Low dynamic output impedance
- Low noise

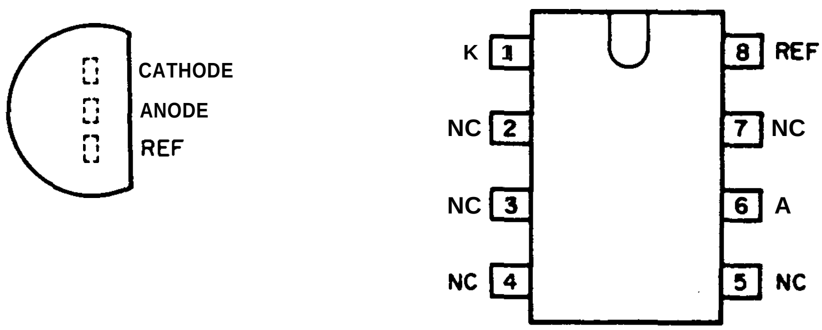


Figure A-42. TL431 Pin Diagram

A.1.2 ROPS/ROPSE Board

Table A-1 6 shows the primary ICs on the ROPS/ROPSE board.

Table A-1 6. Primary ICs on the ROPS/ROPSE Board

Location	Name of IC	Type	Description	Reference Section
Q4	L5431 -AA	IC	Low power type TL431	A. 1.1.23
IC2	TL594CN	IC	Switching Regulator	A. 1.2.1
IC1	NJ M2903D	IC	Dual Comparators	A. 1.2.2

REV.-A

A.1.2.1 TL594

The TL594 is a switching regulator IC, and consists of two error amplifiers, a comparator, reference voltage generator, sawtooth waveform generator, dead-time control circuit, and power transistors.

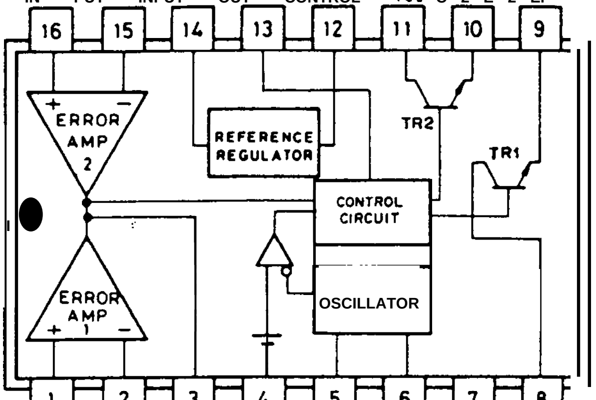


Figure A-43. TL594 Pin Diagram

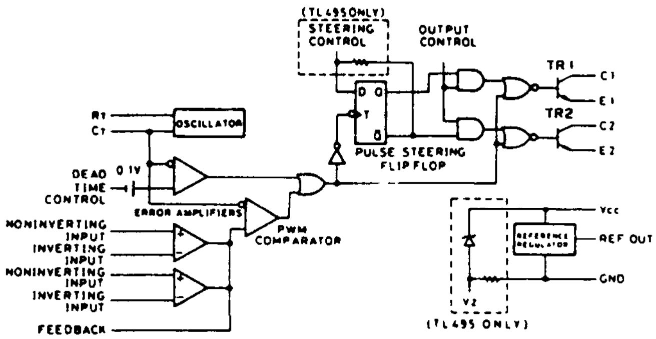


Figure A-44. TL594 Block Diagram

Table A-1 7. TL594 Terminal Functions

in No.	Terminal	I/O	Description
1	NON INV	I	+side of ERROR AMP1
2	INV	I	–side of ERROR AMP 1
16	NON INV	I	+side of ERROR AMP 2
15	INV	I	–side of ERROR AMP 2
3	FEED BACK	I	Feed back
4	DEADTIME	I	Dead time control
13	OUTPUT CONTROL	I	Output control
5	CT	I	External condenser terminal for the sawtooth waveform oscillator
6	RT	I	External resistor terminal
12	Vcc	I	+ 12 V DC
7	GND	I	Ground
8	c1	I	Collector of TR 1
9	EI	O	Emitter of TR 1
11	C2	I	Collector of TR2
10	E2	O	Emitter of TR 2
14	REF OUT	o	Reference Voltage output (+ 5V DC)

A.1.2.2 NJM2903

The NJ M2903 includes two comparators. The main features are as follows:

- Single power supply
- Open collector output
- Voltage range: +2 to +36 V

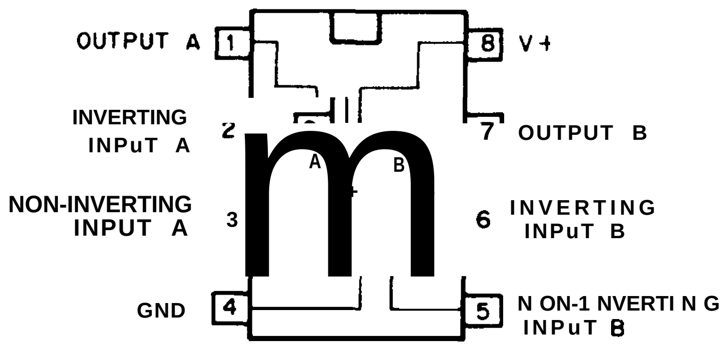


Figure A-45. NJ M2903 Pin Diagram

A.2 CONNECTOR PIN ASSIGNMENTS

Figure A-46 shows interconnections of the primary connectors and cables. Table A-18 gives a summary of each connector.

NOTE: The signal directions for the connectors are as viewed from the ROMA board.

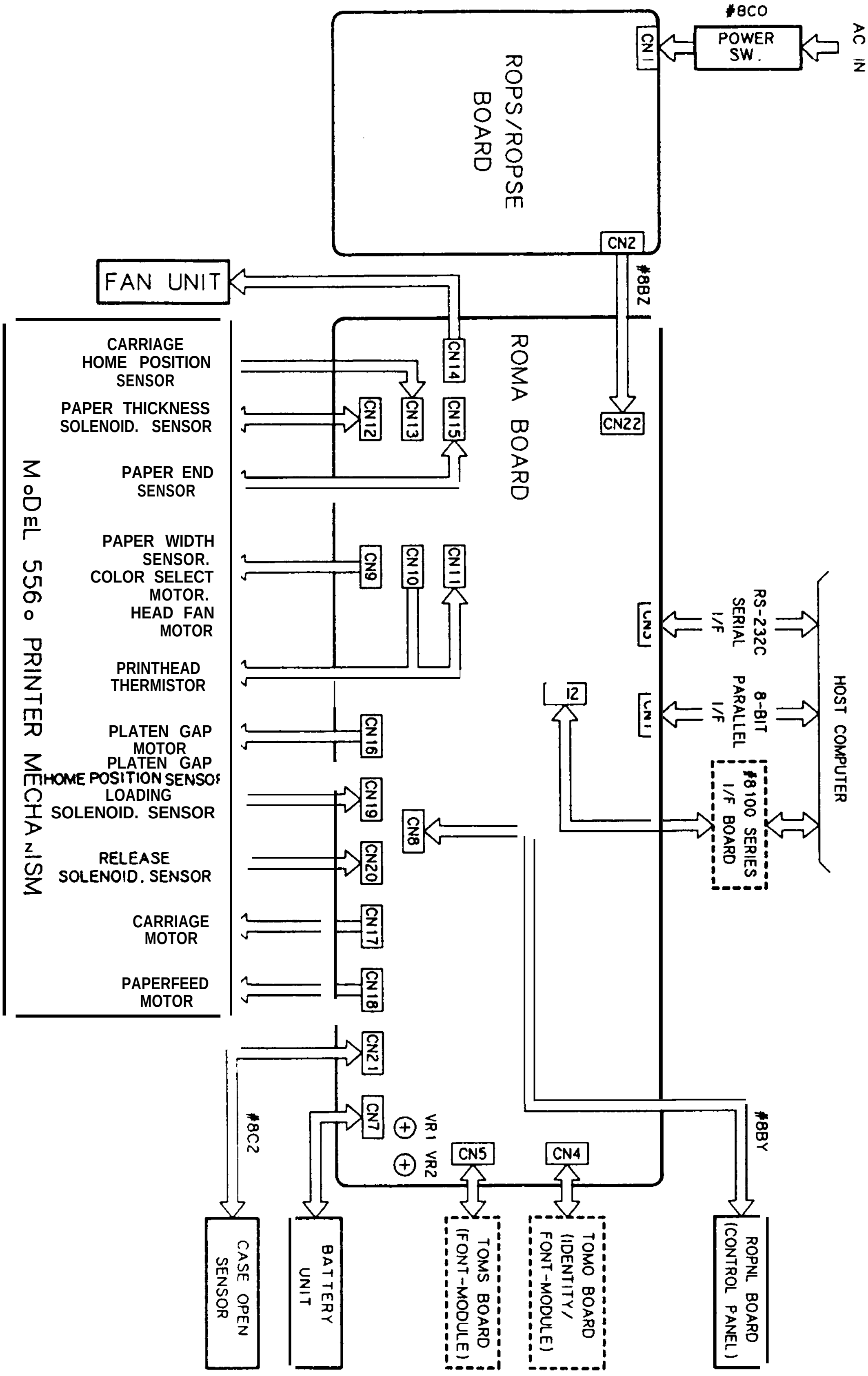


Figure A-46. Cable Connections

Table A-1 8. Connector Summary

Board	connector	Number of pins	Destination	Description	Cable	Reference Table
ROMA Board	CN1	36	Host computer	I/F (8-bit parallel)	Prepared on the user side	1-12
	CN2	26	#8 IXX I/F Board	I/F (option)	x	A-19
	CN3	25	Host computer	I/F (RS-232C serial)	Prepared on the user side	1-15
	CN4	32	Identity/font module	SLOT A	x	A-20
	CN5	32	Font module	SLOT B	x	A-21
	CN6	44	Not used		x	A-22
	CN7	2	Battery unit	+3 VDC	—	A-23
	CN8	18	Control panel		#8BY	A-24
	CN9	18	Printer mechanism	HF motor, CS motor, PW sensor	—	A-25
	CN10	18		Printhead (R)	—	A-26
	CN11	18		Printhead (F)	—	A-27
	CN12	5		PT solenoid and PT sensor	—	A-28
	CN13	3		CR home position sensor	—	A-29
	CN14	2		Fan unit	—	A-30
	CN15	2		PE sensor	—	A-31
	CN16	9		PG motor and PG home position sensor	—	A-32
	CN17	6		CR motor	—	A-33
	CN18	6		PF motor	—	A-34
	CN19	4		LD solenoid and LD sensor	—	A-35
	CN20	4		RL solenoid and RL sensor	—	A-36
	CN21	3		Case open sensor	#8C2	A-37
	CN22	12	ROPS/ROPSPE	5V, + 12V-GND, 35 V,-GH	#8BZ	A-38
ROPES/ ROPSE Board	CN1	4	External AC plug socket	AC power supply (via the POWER switch)	#8CO	A-39
	CN2	12	ROMA Board	Regulated power supply	#8BZ	A-38

NOTES: 1. x . . . Not necessary

2. – . . . Included in the unit

3. In this section, the following abbreviations are used:

CR: Carriage

CS: Color select

PE: Paper end

PF: Paper feed

PG: Platen gap

LD: Loading

RL: Release

PT: Paper thickness

HF: Head fan

PW: Paper width

Table A-1 9. CN2 *Pin Assignments*

Pin No.	*Signal*	I/O	*Description*
1	$\overline{\text{ERROR}}$	o	Error
2	PE	o	Paper end
3	D6 (B4)	I	Data bit 6
4	BUSY	o	BUSY ($\overline{\text{READY}}$)
5	D5 (B3)	I	Data bit 5
6	$\overline{\text{ACKNLG}}$	o	Acknowledge
7	D4 (Par-dis)	I	Data bit 4 (Parity disable)
8	INIT	I	Initialize
9	D3 (0/E)	I	Data bit 3 (Odd/Even parity select)
10	$\overline{\text{STROBE}}$	I	Strobe pulse
11	D7 (RXD)	I	Data bit 7 (Serial signal input)
12	GND	—	Signal GND
13	$\overline{\text{RESET}}$	o	Reset
14	– 12	o	– 12V DC
15	D2 (B2)	I	Data bit 2 (Bit rate select)
16	+ 5	o	+5V DC
17	D1 (B1)	I	Data bit 1 (Bit rate select)
18	NC	—	Not connected
19	DO/(8/7)	I	Data bit O (8-bit/7-bit select)
20	+ 12	o	+ 12V DC
21	P/$\overline{\text{S}}$	I	Parallel/Serial select
22	—	—	—
23	$\overline{\text{SLCT IN}}$	I	Select in
24	GND	—	Signal GND
25	TXD	o	Transit data
26	GND	—	Signal GND

NOTE: The parenthesized descriptions in the "signal'" column are for the 8143 interface board.

Table A-20. CN4 Pin Assignments

Pin NO.	Signal	I/O	Description
1	D5	I/O	Data bus 5
2	D4	I/O	Data bus 4
3	D7	I/O	Data bus 7
4	AB 1	0	Bank 1
5	A5	o	Address bus 5
6	A6	o	Address bus 6
7	A IO	o	Address bus 10
8	$\overline{\text{R}}$	I	Reset signal
9	GND	—	GND
10	A9	o	Address bus 9
11	A8	o	Address bus 8
12	D2	I/O	Data bus 2
13	D1	I/O	Data bus 1
14	RD	o	Read strobe
15	DO	I/O	Data bus O
16	AO	o	Address bus O
17	D3	I/O	Data bus 3
18	CG	o	CG select
19	D6	I/O	Data bus 6
20	A14	o	Address bus 14
21	A4	o	Address bus 4
22	WR	o	Write strobe
23	A7	o	Address bus 7
24	+ 5	o	+ 5V DC
25	AI 1	0	Address bus 11
26	$\overline{\text{PROG}}$	I	Program select
27	AI 2	0	Address bus 12
28	A13	o	Address bus 13
29	AI	o	Address bus 1
30	ABO	o	Bank O
31	A2	o	Address bus 2
32	A3	o	Address bus 3

Table A-21. CN5 Pin Assignments

Pin No.	Signal	I/O	Description
1	D5	I/O	Data bus 5
2	D4	I/O	Data bus 4
3	D7	I/O	Data bus 7
4	AB1	0	Bank 1
5	A5	o	Address bus 5
6	A6	o	Address bus 6
7	A10	0	Address bus 10
8	R̄	I	Reset signal
9	GND	—	GND
10	A9	o	Address bus 9
11	A8	O	Address bus 8
12	D2	I/O	Data bus 2
13	D1	I/O	Data bus 1
14	RD	o	Read strobe
15	DO	I/O	Data bus O
16	AO	O	Address bus O
17	D3	I/O	Data bus 3
18	CG	o	CG select
19	D6	I/O	Data bus 6
20	A14	o	Address bus 14
21	A4	O	Address bus 4
22	WR	o	Write strobe
23	A7	o	Address bus 7
24	[illegible]	O	+5V DC
25	AI 1	0	Address bus 11
26	$\overline{\text{PROG}}$	I	Pulled up (+5V)
27	AI 2	0	Address bus 12
28	AI 3	0	Address bus 13
29	AI	O	Address bus 1
30	ABO	o	Bank O
31	A2	o	Address bus 2
32	A3	o	Address bus 3

Table A-22. CN6 Pin Assignments

n No.	Signal	1/0	Description
1	A12	o	Address bus 12
2	A7	o	Address bus 7
3	A6	o	Address but 6
4	A5	o	Address bus 5
5	A4	o	Address bus 4
6	A IO	o	Address bus 10
7	A I	o	Address bus 1
8	AO	o	Address bus O
9	DO	I/O	Data bus O
10	D1	I/O	Data bus 1
11	D2	I/O	Data bus 2
12	+5	o	+ 5V DC
13	GND	–	GND
14	BO	o	Not used
15	AI 7	—	Not Connected
16	A14	o	Bank O
17	A16	o	Bank 2
18	$\overline{\text{TYEN}}$	O	Pulled up (+5V DC)
19	$\overline{\text{BANK}}$	o	Kanji C.G ROM CE Signal
20	$\overline{\text{MMIO}}$	o	$\overline{\text{DIP}}$ select
21	$\overline{\text{RD}}$	O	Read pulse
22	NC	-	Not connected
23	$\overline{\text{WE}}$	O	Not connected
24	A8	o	Address bus 8
25	A9	o	Address bus 9
26	All	O	Address bus 11
27	A3	o	Address bus 3
28	A2	o	Address bus 2
29	D7	I/O	Data bus 7
30	D6	I/O	Data bus 6
31	D5	I/O	Data bus 5
32	D4	I/O	Data bus 4
33	D3	I/O	Data bus 3
34	+5	O	+5V DC
35	GND	—	GND
36	B1	o	Not used

Table A-22. CN6 Pin Assignments

Pin No.	Signal	I/O	Description
37	Ala	—	Not connected
38	Al 5	0	Bank 1
39	KANJI	o	Kanji C.G ROM OE Signal
40	ALE	—	Not connected
41	CG3	o	CG3 select
42	$\overline{\text{PROG}}$	o	Not used
43	WR	o	Write pulse
44	RST	o	Not used

Table A-23. CN7 Pin Assignments

Pin No.	Signal	I/O	Description
1	BAT	I	Battery + side (3.0 to 3.3 VDC)
2	GND	—	Ground

Table A-24. CN8 Pin Assignments

Pin No.	Signal	I/O	Description
1	SHLD	—	Pulled down
3	REDY	o	LED2 ON/OFF *2
13	$\overline{\text{OLSW}}$	I	SW1 OFF/$\overline{\text{ON}}$
4	AN5	I	Read status of SW5, SW6, SW8, and SW1O *1.
6	AN6	I	Read status of SW7, SW9, SW1 1, and SW12.
15	AN7	I	Read status of SW2, SW3, and SW4.
12	AO	o	LCD control driver IC address bit O
8	DO	o	LCD control driver IC data bit O
7	D1	o	LCD control driver IC data bit 1
10	D2	o	LCD control driver IC data bit 2
9	D3	o	LCD control driver IC data bit 3
5	$\overline{\text{WR}}$	o	LCD control driver IC write strobe
11	$\overline{\text{LCDCE}}$	o	LCD control driver IC chip select
14	$\overline{\text{LOAD}}$	o	Port expander IC parallel data output trigger
16	CKO	o	Port expander IC Serial data transfer clock
17	DTO	o	Port expander IC Serial data
18	+5	o	+5 VDC
2	GND	—	Ground

*1: See Table A-40.

*2: See Table A-4 1.

Table A-25. CN9 Pin Assignments

Pin No.	Signal	I/O	Description
3	IMSN	I	Scan data
4	AGN	—	Analog ground
11	+ 5	O	+ 5 VDC
12	PWSN	I	Paper width signal
13	GND	—	Ground
1	$\overline{\text{CSEN}}$	O	CS unit enable
2	GH	—	Ground (for drive circuits)
5	+35	O	+35 VDC
6	CSA	O	CS motor coil A
7	CSC	O	CS motor coil B
8	CSB	O	CS motor coil C
9	CSD	O	CS motor coil D
10	CSHL	O	+ 5VDC
14	FNB	O	HF motor coil B
15	FNA	O	HF motor coil A
16	FNAB	O	Common line for coils A and B (+35 VDC)
17	FTH	I	HF motor thermistor
18	GND	—	Ground

Table A-26. CN10 Pin Assignments

Pin No.	Signal	I/O	Description
1	H2	O	Printhead solenoid #2
4	H7	O	Printhead solenoid #7
7	H15	O	Printhead solenoid #15
2	C5	O	Common line (+35 VDC)
18	$\overline{\text{H3}}$	O	Printhead solenoid #3
17	H11	O	Printhead solenoid #11
16	H19	O	Printhead solenoid #19
3	C6	O	Common line (+35 VDC)
14	H14	O	Printhead solenoid #14
8	H22	O	Printhead solenoid #22
9	H23	O	Printhead solenoid #23
5,6	C7	O	Common line (+35 VDC)
15	H6	O	Printhead solenoid #6
11	H10	O	Printhead solenoid #10
10	H18	O	Printhead solenoid #18
12,13	C8	O	Common line (+35 VDC)

Table A-27. CN11 Pin Assignments

Pin No.	Signal	I/O	Description
17	H1	O	Printhead solenoid # 1
2	$\overline{\text{H9}}$	O	Printhead solenoid #9
3	H17	O	Printhead solenoid #17
4	C1	O	Common line (+35 VDC)
16	$\overline{\text{H5}}$	O	Printhead solenoid #5
18	H13	O	Printhead solenoid #13
1	H21	O	Printhead solenoid #21
5	C2	O	Common line (+35 VDC)
10	H12	O	Printhead solenoid #12
9	H20	O	Printhead solenoid #20
8	H24	O	Printhead solenoid #24
6	C3	O	Common line (+35 VDC)
15	$\overline{\text{H4}}$	O	Printhead solenoid #4
11	H8	O	Printhead solenoid #8
13	H16	O	Printhead solenoid #16
7	C4	O	Common line (+35 VDC)
14	TMSN	I	Printhead thermistor
12	AGN	—	Analog ground

Table A-28. CN12 Pin Assignments

Pin No.	*Signal*	I/O	*Description*
1	PGPL	O	PT solenoid ON/OFF
2	+35	O	+35 VDC
3	+12	O	+12 VDC
4	PGSN	I	Paper thickness signal
5	AGN	—	Analog ground

Table A-29. CN13 Pin Assignments

Pin No.	*Signal*	I/O	*Description*
1	CRHM	I	CR home position signal
2	GND	—	Ground
3	CRLP	O	+ 5 VDC

Table A-30. **CN14 Pin Assignments**

Pin No.	*Signal*	I/O	*Description*
1	+35	O	+35 VDC
2	GH	—	Ground (for drive circuits)

Table A-31. CN15 Pin Assignments

Pin No.	Signal	I/O	Description
1	PESN	I	Paper end signal
2	GND	-	Ground

Table A-32. CN16 Pin Assignments

Pin No.	Signal	I/O	Description
3	PGAC	o	Common line for PG motor coils A and C (+35 VDC)
6	PGBD	o	Common line for PG motor coils B and C (+35 VDC)
1	PFA	o	PG motor coil A
2	PFC	o	PG motor coil C
4	PFB	o	PG motor coil B
5	PFD	o	PG motor coil D

Table A-33. CN17 Pin Assignments

Pin No.	Signal	I/O	Description
5	CRAC	o	Common line for CR motor coils A and C (+35 VDC)
6	CRBD	o	Common line for CR motor coils B and C (+35 VDC)
1	CRA	o	CR motor coil A
2	CRC	o	CR motor coil C
3	CRB	o	CR motor coil B
4	CRD	o	CR motor coil D

Table A-34. CN18 Pin Assignments

Pin No.	Signal	I/O	Description
5	PFAC	o	Common line for PF motor coils A and C (+35 VDC)
6	PFBD	O	Common line for PF motor coils B and C (+35 VDC)
1	PFA	o	PF motor coil A
2	PFC	o	PF motor coil C
3	PFB	o	PF motor coil B
4	PFD	o	PF motor coil D

Table A-35. CN19 Pin Assignments

Pin No.	Signal	I/O	Description
1	LDSW	I	LD sensor signal
2	BK2	o	LD sensor enable signal
3	+ 35	0	+35 VDC
4	LDPL	o	LD solenoid ON/OFF

Table A-36. CN20 Pin Assignments

Pin No.	Signal	I/O	Description
1	RLSW	I	RL sensor signal
2	$\overline{\text{BK2}}$	O	RL sensor enable signal
3	+35	O	+35 VDC
4	$\overline{\text{RLPL}}$	O	RL solenoid ON/OFF

Table A-37. CN21 Pin Assignments

Pin No.	Signal	I/O	Description
1	+ 5	O	+ 5 VDC
2	OPEN	I	Printer cover OPEN/CLOSE signal
3	GND	—	Ground

Table A-38. CN22 Pin Assignments

Pin No.	Signal	I/O	Description
1,2	+ 5	I	+ 5 VDC
3	+ 1 2	I	12 VDC
4	– 1 2	I	– 12 VDC
5,6	GND	—	Ground (for control circuits)
7 - 9	+ 3 5	I	+35 VDC
1 0 - 1 2	GH	—	Ground (for drive circuits)

Table A-39. CN1 Pin Assignments

Pin No.	Signal	I/O	Description
1	N	I	External AC plug connector
2	L	I	

A.3 Drawings

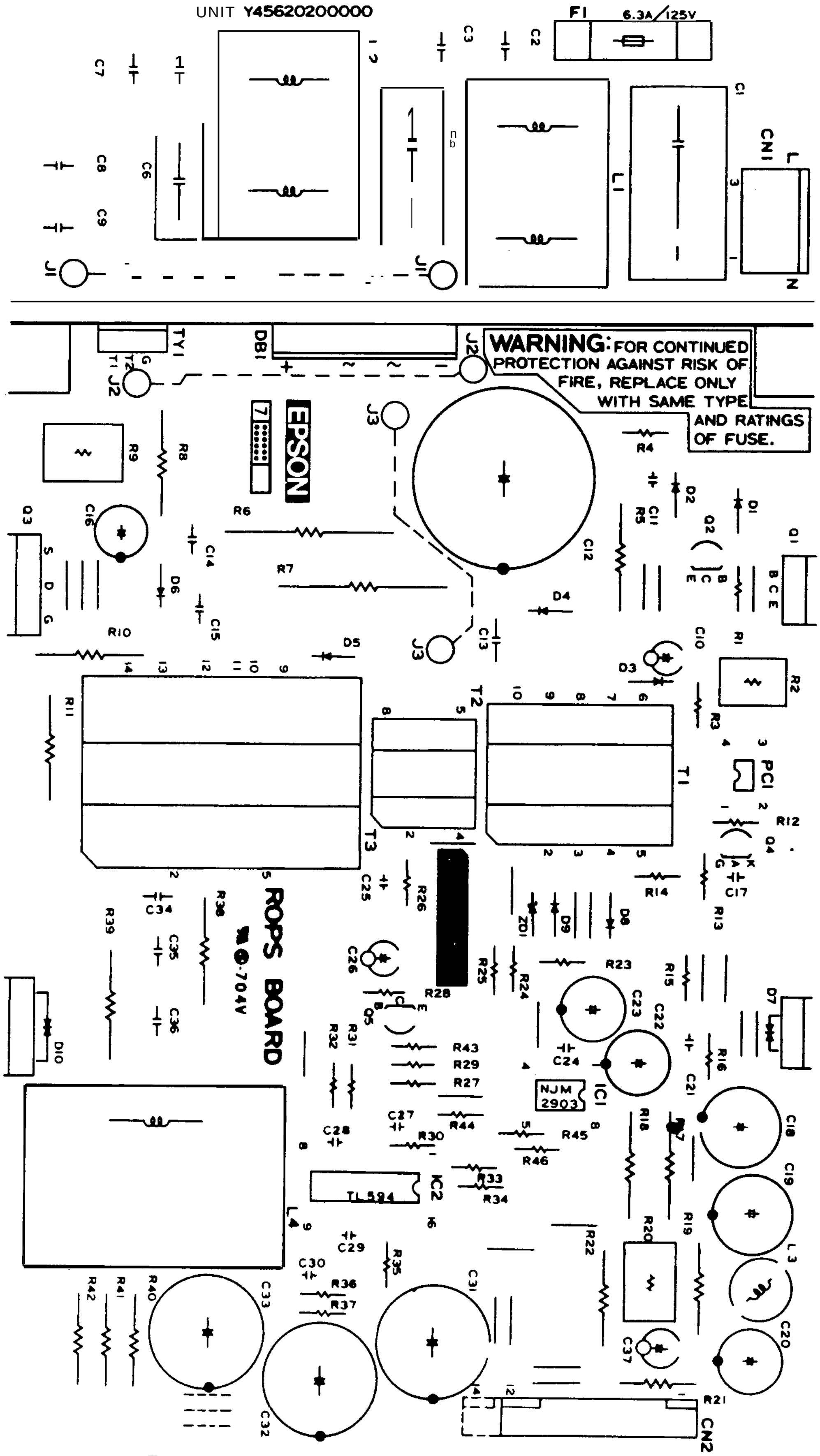


Figure A-47. ROPS Board Component Layout

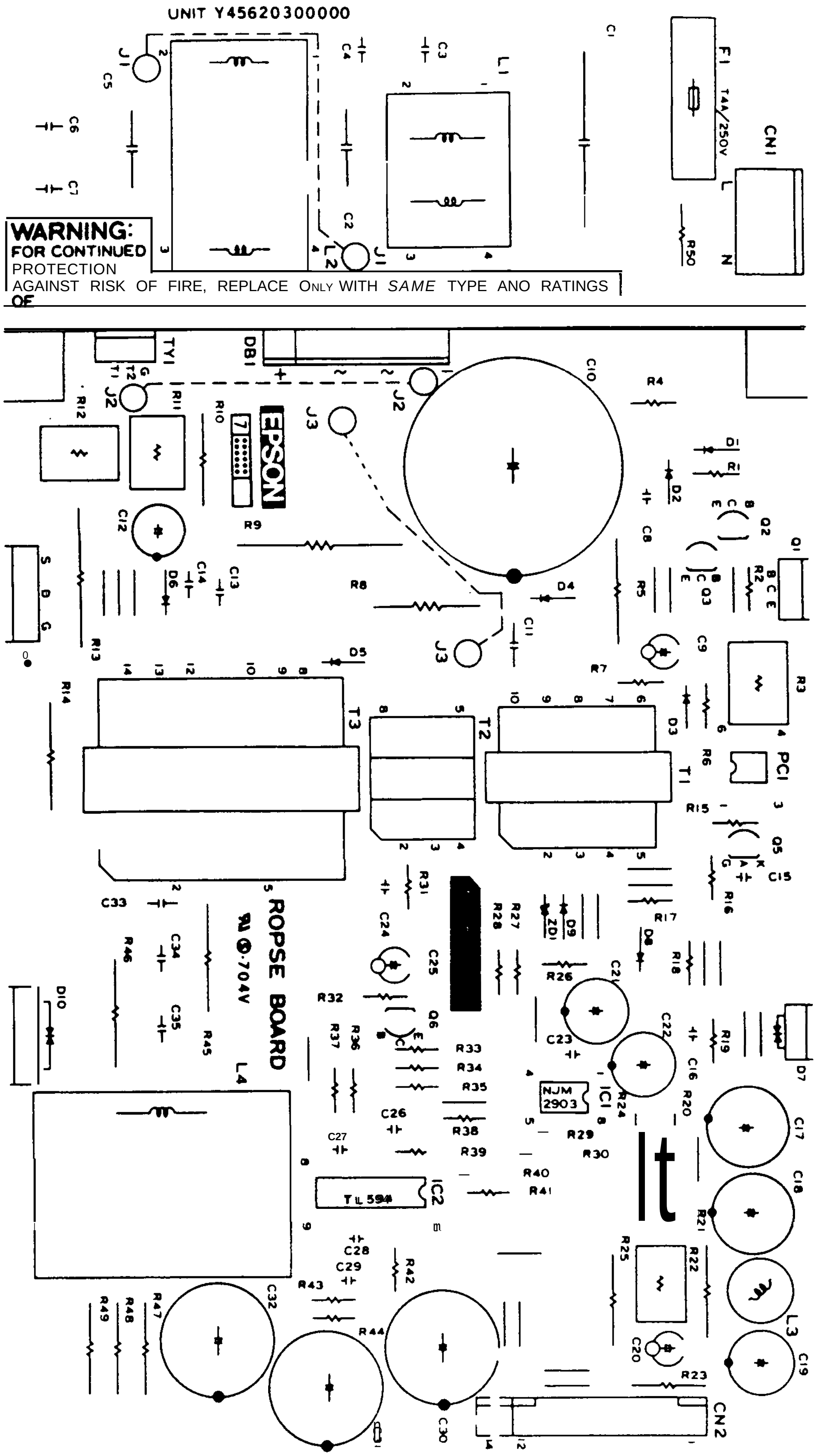


Figure A-48. ROPSE Board Component Layout

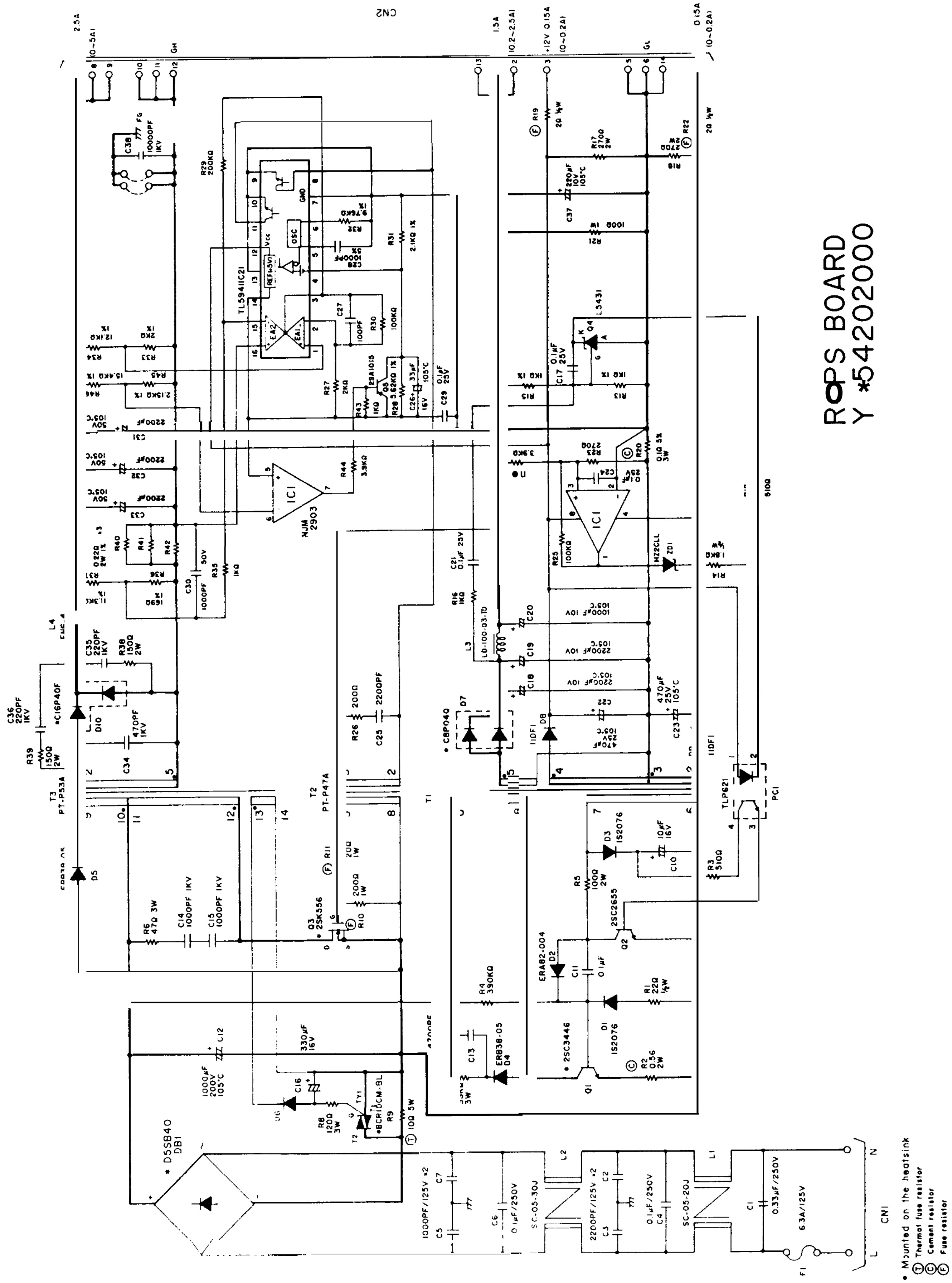


Figure A-49. ROPS Board Circuit Diagram

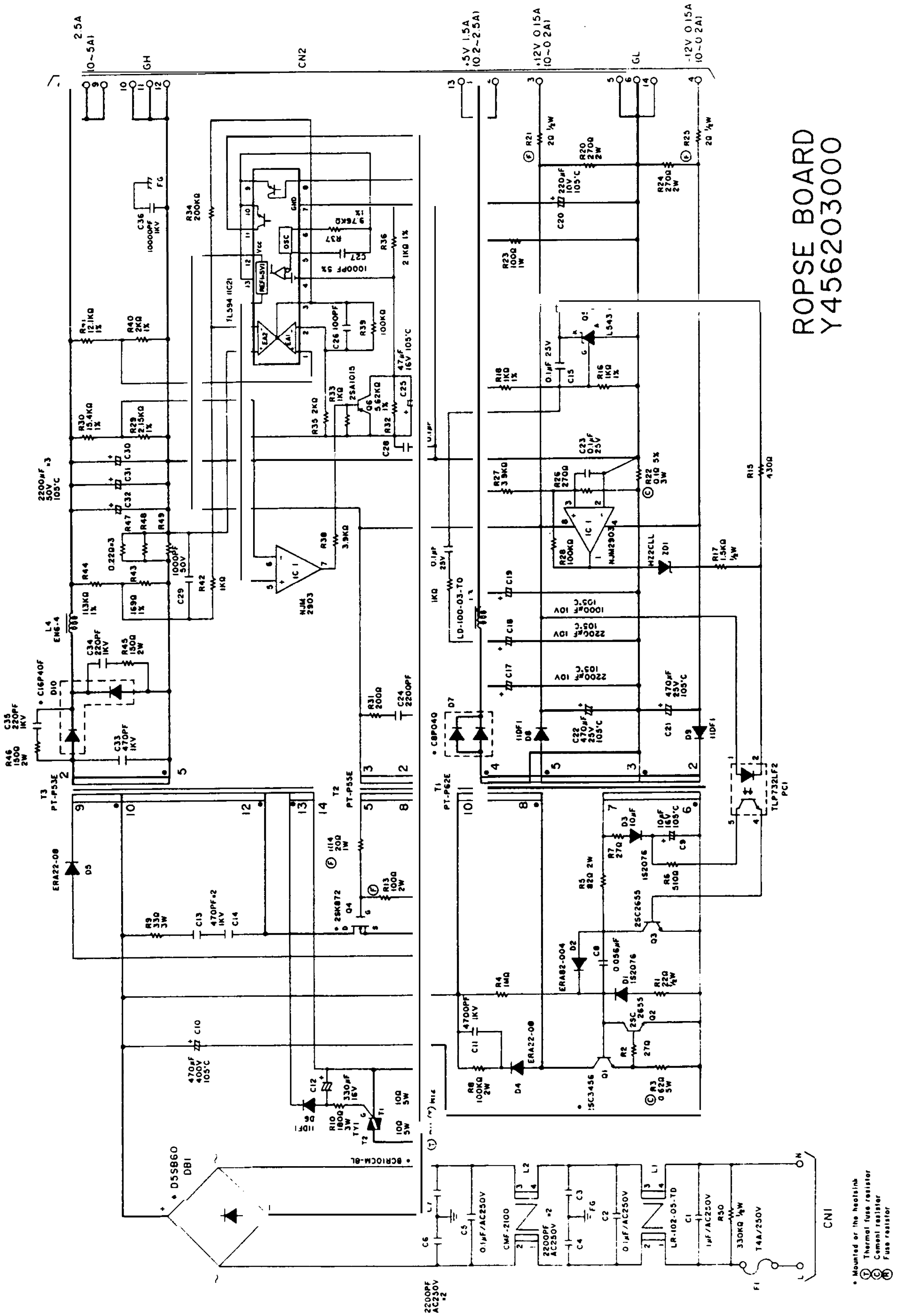


Figure A-50. ROPSE Board Circuit Diagram

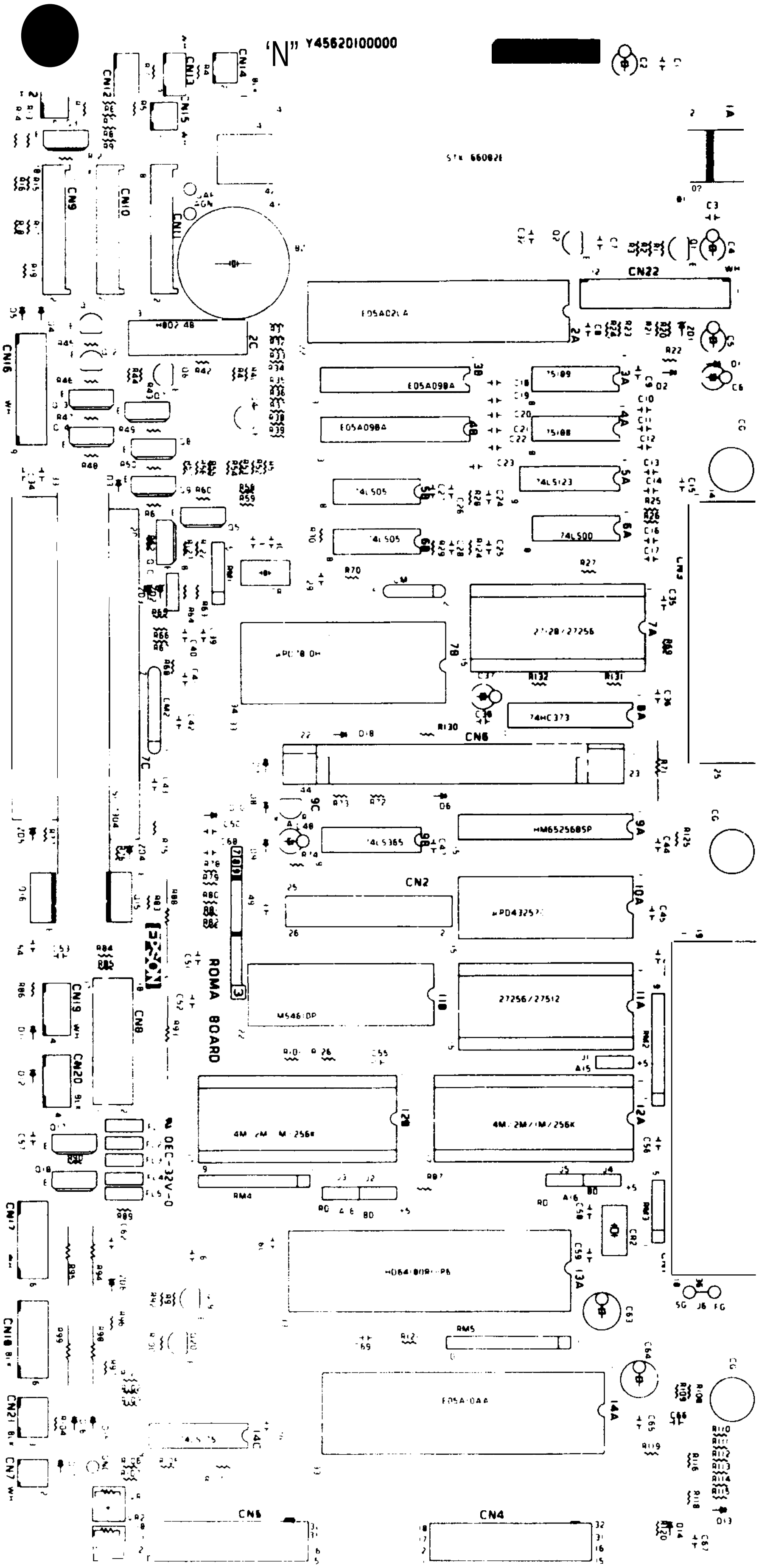


Figure A-51. ROMA Board Component Layout

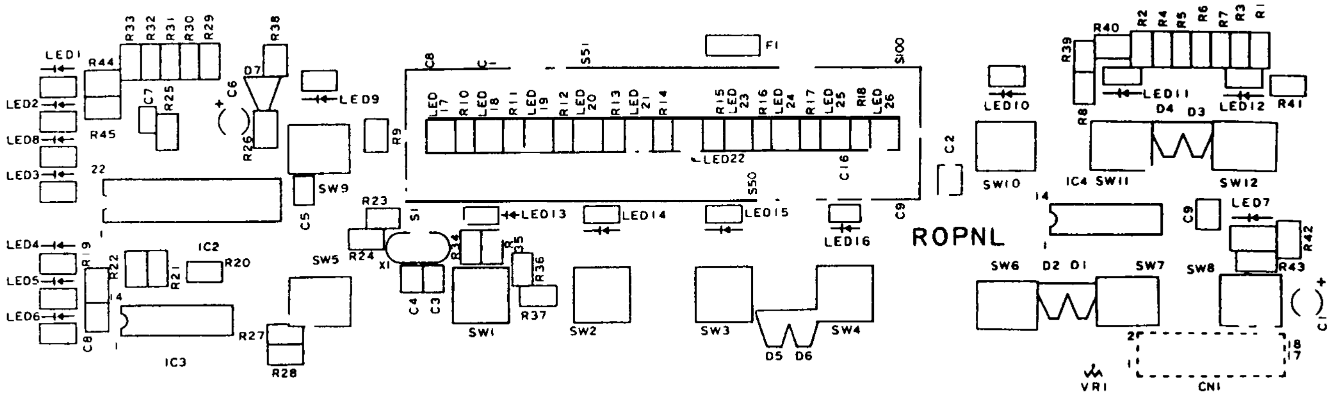


Figure A-53. ROPNL Board Component Layout

Table A-40. ROPNL Board Switch Layout

Switch	Name
SW1	ON LINE
SW2	FORM FEED
SW3	LINE FEED
SW4	LOAD/EJECT
SW5	PAPER SELECT
SW6	FONT
SW7	PITCH
SW8	CONDENSED
SW9	TEAR OFF
SW1o	MICRO FEED
SW11	PLATEN GAP ADJUST
SW12	SelecType

Table A-41. ROPNL Board LED Layout

Switch	Name
LED 1	POWER
LED2	READY
LED3	ON LINE
LED4	TRACTOR
LED5	FRICTION
LED6	CSF
LED7	CONDENSED
LED8	PAPER OUT
LED9	TEAR OFF
LED 10	MICRO FEED
LED11	PLATEN GAP ADJUST
LED 12	SelecType
LED 13	a
LED 14	A
LED 15	v
LED 16	D
LED 17 ∫ LED26	LCD backup light

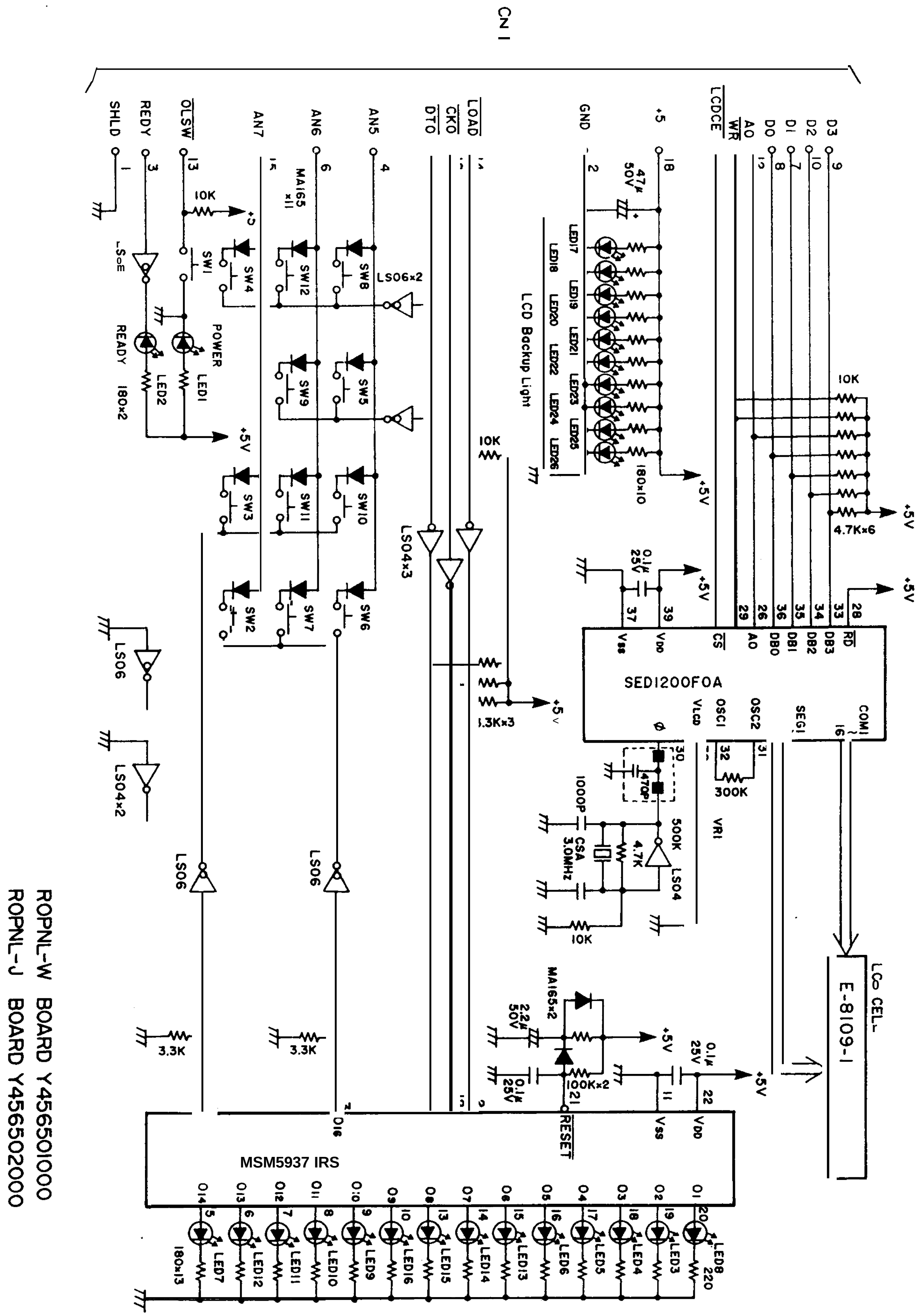


Figure A-54. ROPNL Board Circuit Diagram

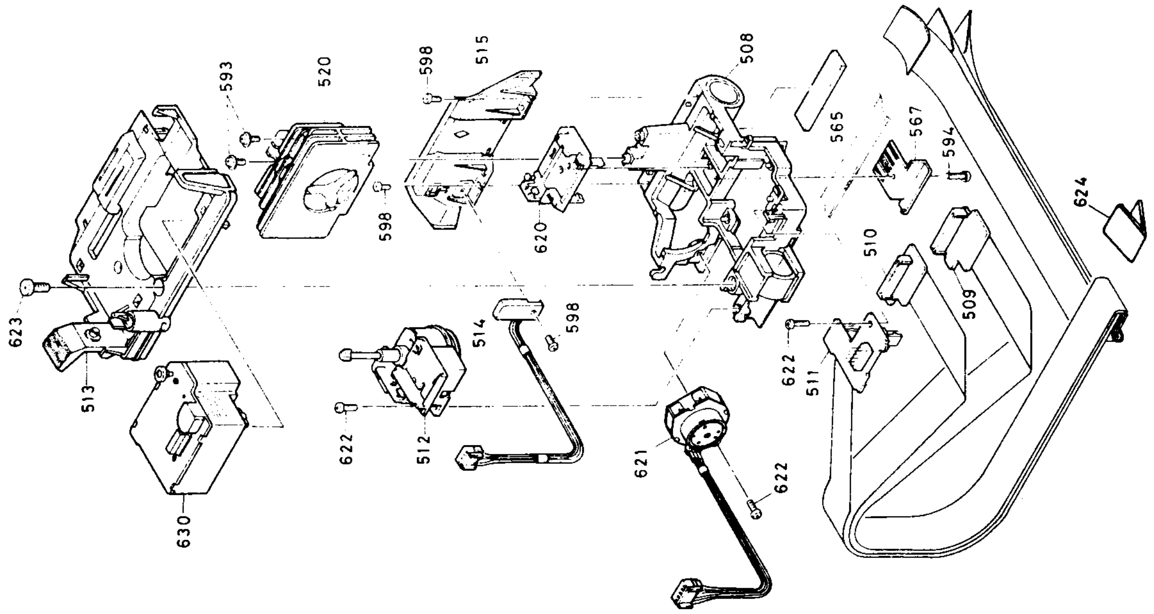


Figure A-57. Model-5560 Exploded Diagram 2

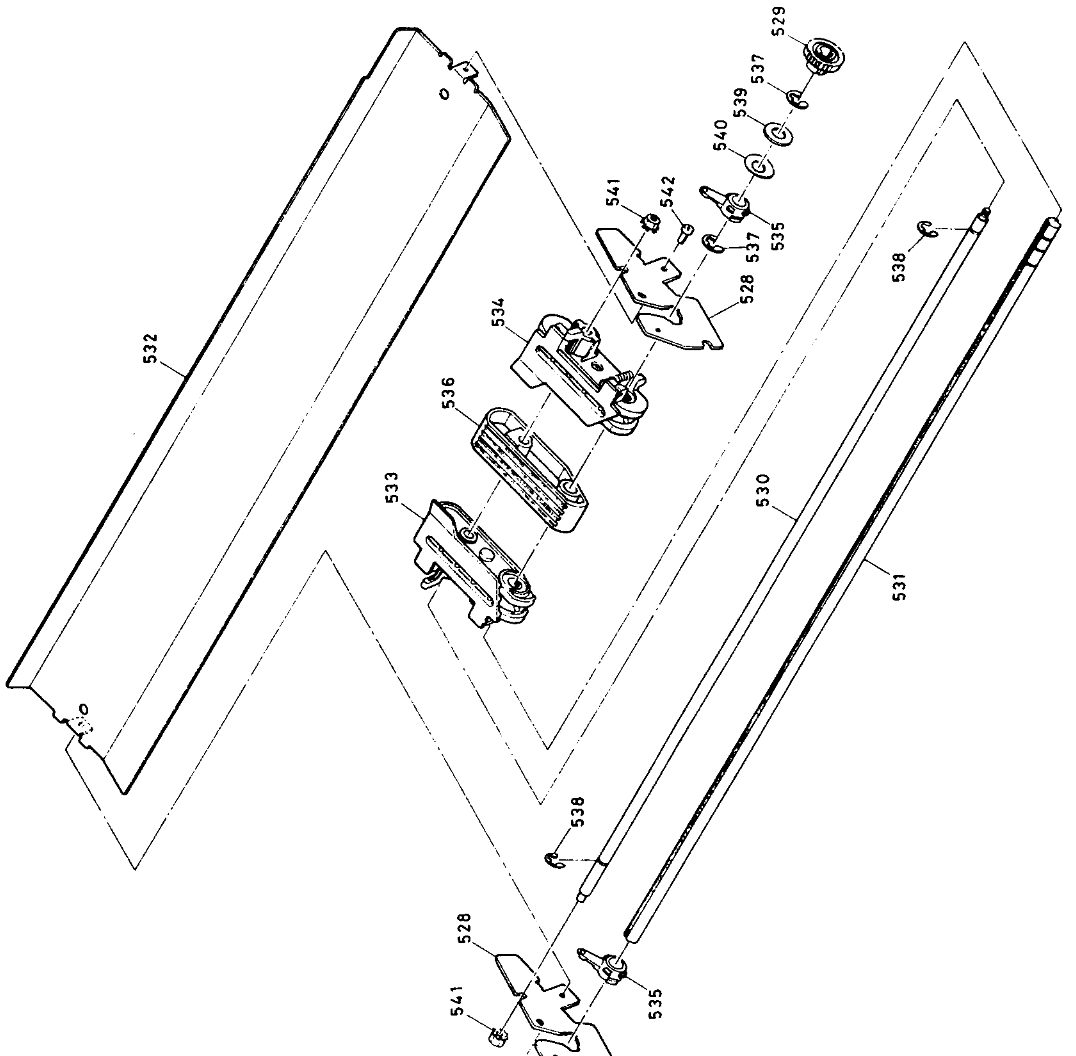


Figure A-58. Model-5560 Push Tractor Unit Exploded Diagram