EPSON

EPSON TERMINAL PRINTER

LQ-850/1050
TECHNICAL MANUAL

Y45499901 0-A

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-850 and LQ-1 050.
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	Aug. 31, 1987	1st issue

TABLE OF CONTENTS

CHAPTER 1
GENERAL DESCRIPTION

LIST OF FIGURES

LIST OF TABLES

1.1 FEATURES

The LQ-850/1050 printers are multifunctional, 24-pin printhead, impact dot matrix printers The main features of the these printers are:

- Upward compatibility with the LQ-800/1000
- A maximum print speed of 264 CPS in draft mode at 12 CPI and of 88 CPS in I-Q mode at 12 CPI
- Direct selection of font, pitch, and normal/condensed mode from the control panel
- Automatic paper-loading/ejecting function
- Low-noise acoustics
- Both 8-bit parallel and RS-232C serial interfaces
- Push and (optional) pull tractor feeding
- Advanced paper handling:
  - Auto backing of fanfold paper and autoloading of cut sheet paper
  - Auto ejecting of cut sheet paper and autoloading of fanfold paper
  - Printing of fanfold paper without removal of the cut sheet feeder (option)
- Optional interface for the EPSON 8100 series
- Optional low-priced, single-bin cut sheet feeder which contains envelope feeding capability

Figure 1-1 shows exterior views of the printers, Table 1-1 lists optional units available, and Table 1-2 lists the optional interface boards (refer to Chapter 3 for more detailed information) for the LQ-850/1050.

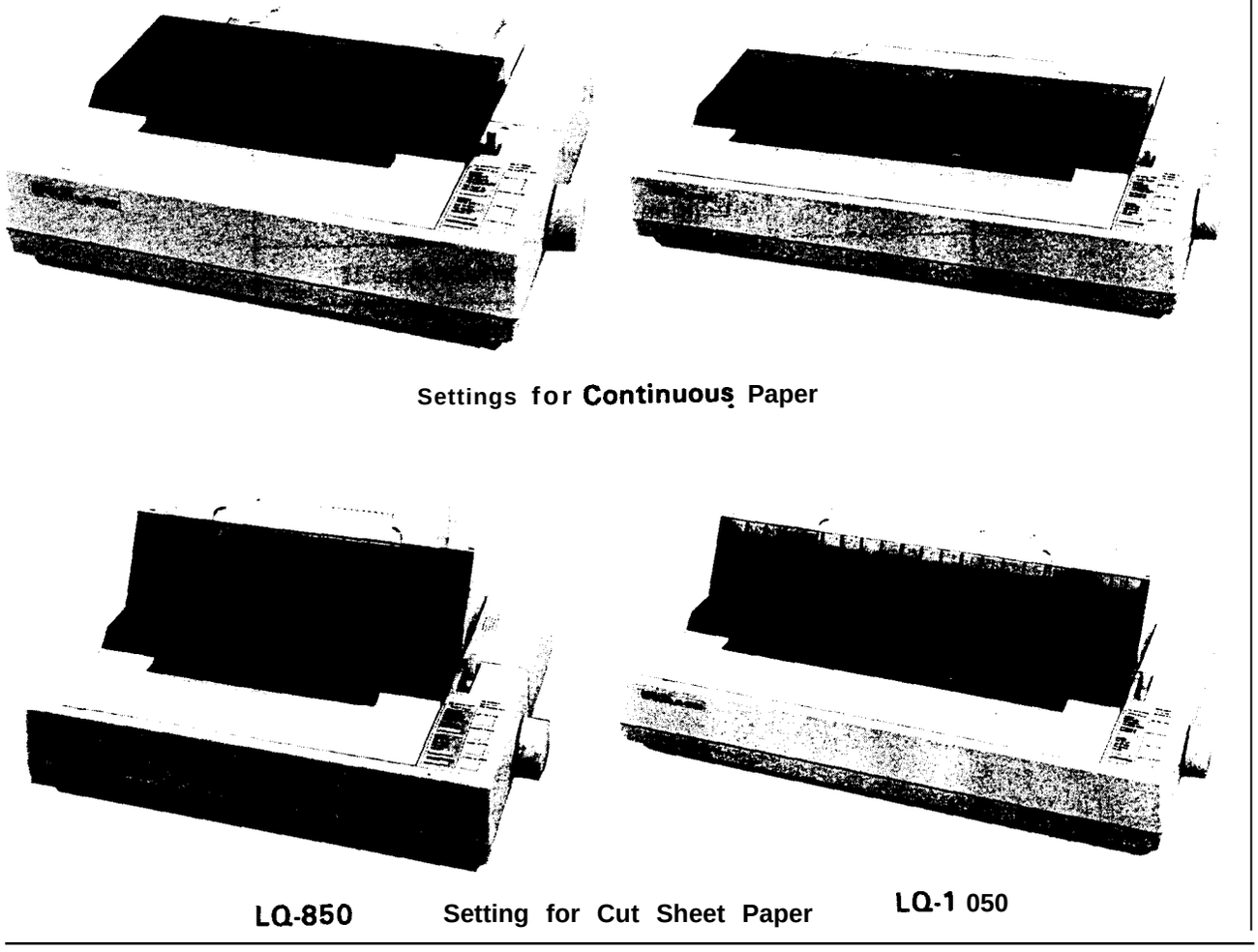


Fig. 1-1. Exterior Views of the LQ-850/1050

Table 1-1. Optional Units

No.	Name	LQ-850	LQ-1 050
#73 11	Tractor unit	o	
#731 2	Tractor unit		o
#7339	Cut sheet feeder (single-bin)	o	
#7340	Cut sheet feeder (single-bin)		o
#7753	Ribbon cartridge	o	
#7754	Ribbon cartridge		o
#7400	Courier font-module	o	
#7401	Prestige font-module	o	
#7402	Script font-module	o	
#7403	OCR-B font-module	o	

Table 1-2. Optional Interface Boards

No.	Name
#8143	New serial interface
#8 145	RS-232C current loop interface type II
#8148	Intelligent serial interface
#8 149	Intelligent serial interface type II
#8 149M	Intelligent serial interface type III
#816 1	IEEE-488 interface
#8 165	Intelligent IEEE-488 interface
#8 172	32 K-byte buffer parallel interface
#81 72M	128K-byte buffer parallel interface

1.2 SPECIFICATIONS

The LQ-850/ 1050 communicates with a wide variety of host computers, with aid of the optional Identity Module.

However, this section describes the specifications for the printer without the Identity Module option. 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 (12X 2 staggered, diameter: 0.2 mm).

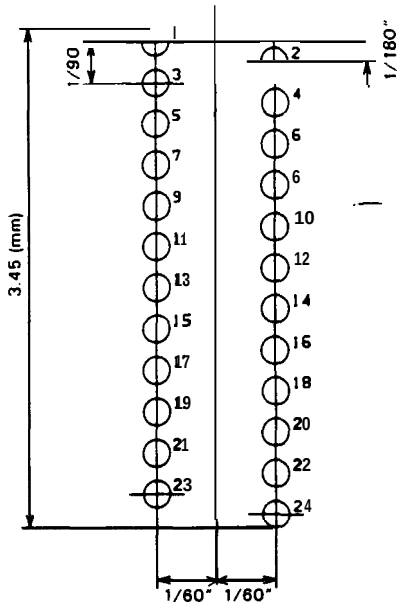


Fig. 1-2. Printhead Pin Configuration

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

NOTES: 1. When using friction feed:

- Use the paper tension unit.
- Do not use fanfold paper.
- Do not perform any reverse paper feed operations within the top 8.5 mm and bottom 22 mm area of the paper.
- Do not perform reverse feed beyond than 1/6 inches after the paper end has been detected.
- Do not use multi-part, single-sheet forms.

2. When using tractor feed:

- Release the friction feed mechanism.
- Multiple copies for printing must be finished by pasting them together at the line or dots.
- Copy paper must be a carbonless multi-part paper.

a) When using push tractor feed:

- Use the paper tension unit.

- Do not perform reverse feeding for more than 1/6 inches.
- Because accuracy of paper feed cannot be assured, do not perform reverse feeding after the paper end has been detected.

b) When using pull tractor feed:

- Remove the paper tension unit and mount the pull tractor unit.
- Use the paper path when a single sheet is inserted.

c) When using push-pull tractor feed:

- Remove the paper tension unit and mount the pull tractor unit.
- Do not loosen the paper between the platen and the pull sprocket.
- Precisely 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.

Paper Loading Directions

Fanfold paper	Inserted from the rear side
Cut sheet paper	Inserted from the up side

Line Spacing 1/6" or programmable (min. 1/180")

Line Feed Speed See Table 1-3

Table 1-3. Line Feed Speeds

Feeding Method	1/6" Line Spacing [ins/line]	Continuous [IPS]
Friction w/o CSF	60	3.0
Friction w/ CSF	65	2.7
Tractor	65	2.7

Paper specifications

Cut sheet paper Refer to Table 1-4.

Table 1-4. Cut Sheet Paper Specified Conditions

	LQ-850	LQ-1 050
Width [mm]	182-257 (7.2 - 10.1")	182-364 (7.2 - 14.4")
Length [mm]	182 - 305 (7.2 - 12.0")	
Thickness [mm]	0.065 -0.10 (0.0025 - 0.004")	
Weight [lb]	14 -22 (52 -82 g/m²)	
Quality	Plain paper	
Copies	Not available	

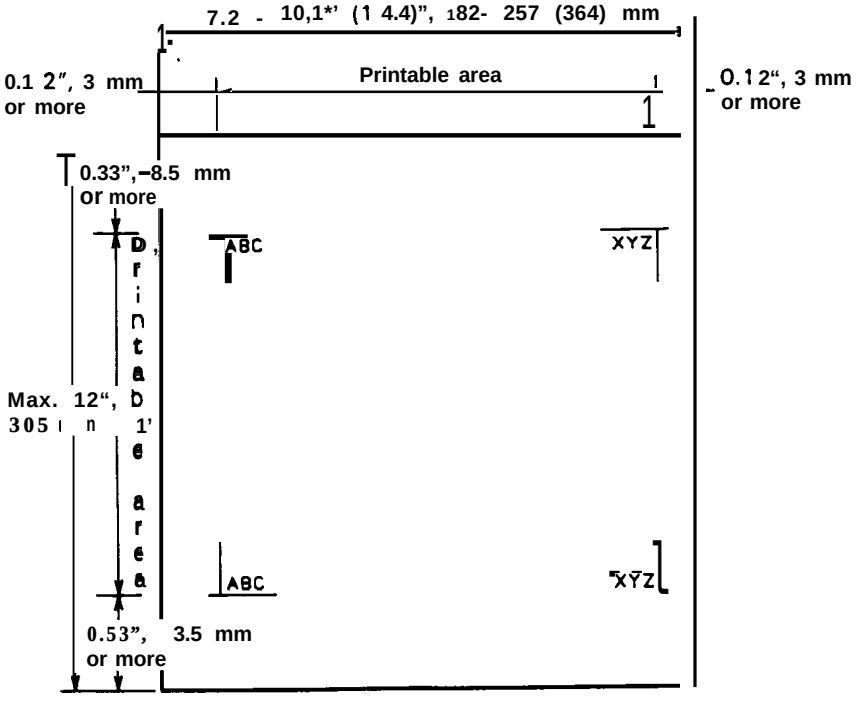
Fanfold paper Refer to Table 1-5,

Table 1-5. Fanfold Paper Specified Conditions

	LQ-850	LQ-1 050
Width [mm]	101 - 254 (4.0 - 10. O")	101 - 406 (4.0 - 16.0")
Copies [sheet]	4 (1 original + 3) at normal temperature 3 (1 original + 2) at all temperature range	
Quality	Plain paper	
Total Thickness [mm]	0.06 - 0.32 (0.0023 -0.01 2")	
Weight [lb]	1 sheet .....14 - 22 (52 - 82 g/m²) 4 sheets .....12 - 15 (40 - 58.2 g/m²) for each	

Printable Area

— Cut sheet paper See Figure 1-3.



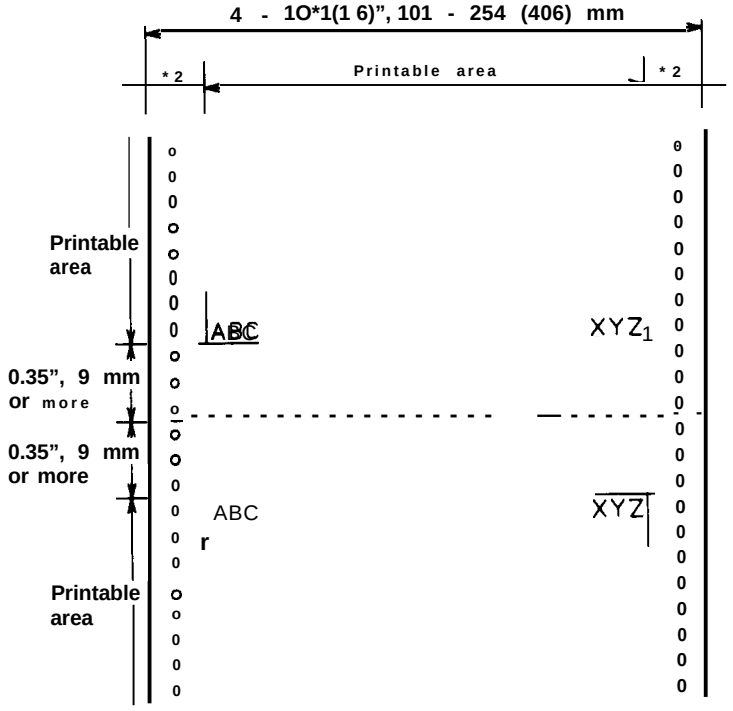
NOTES: 1. Values in the parentheses apply to the LQ-105O.

2. Printing is possible for approximately 42 mm after the bottom edge of a page has been detected. Thus, the value 13.5 mm (lowest print position) is given for reference only. Paper feed accuracy cannot be assured in the area approximately 22 mm (0.87") from the bottom edge of the page.

Fig. 1-3. Cut Sheet Paper Printable Area

REV.-A

Fanfold paper See Figure 1-4.



NOTE: 1. Values in the parentheses are apply to LQ-105O.

2. 0.47", 12 mm or more when the 101 to 242 mm (4 to 9.5") width paper is used.
   0.98", 25 mm or more when the 254 mm (1 O") width paper is used.

Fig. 1-4. Fanfold Paper Printable Area

Envelopes

Size	No. 6 (166 X 92 mm), No. 10 (240 X 104 mm)
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	121 - 241 lb (45 -91 g/m²)

NOTES: 1. Envelope printing is only available at normal temperature.
2. Keep the longer side of the envelope horizontally at setting.
3. Set the left of No. 6 envelope at the setting mark of the sheet guide.

Label

Size	2 1/2 X 15/1 6", 4 X 15/16", 4 X 17/16"
Thickness	O.19 mm (0.0075) max.

NOTE: Thickness excluding the base paper must be less than or equal to O.12 mm (0.0075").

NOTES: 1. Printing of labels is only available at normal temperature.
2. Labels must be fanfold.
3. Labels with pressure-sensitive paper must be jointed by pasting along the dots or lines, and the total thickness must be less than or equal to 0.3 mm (O. 11 8“) to be printed out under conditions that must be between 5 to 35 “C and 20 to 80% RH.
4. Examples of labels: AVERY CONTINUOUS FROM LABELS
AVERY MINI-LINE LABELS

Lever Adjustment See Figure 1-5 and Table 1-6.

Table 1-6. Lever Adjustment

Lever Position	Paper Thickness [mm]
2nd	0.06 - 0.12
3rd	0.13 -0.17
4th	0.18 -0.25
5th	0.26 -0.32

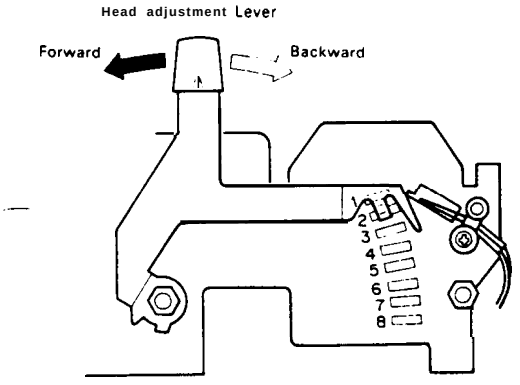


Fig. 1.5. Head Adjustment Lever Posisitioning

NOTES: 1. When printing density becomes lighter, set the head adjustment lever one position lower.
2. When using thicker paper than shown in the above table, set the head adjustment lever to the 6th or higher appropriate position by performing the self-test operation.

Ribbon Cartridge See Table 1-7.

Table 1-7. Ribbon Cartridge Specification

Ribbon Model No.	#7753	#7754
Printer	LQ-850	LQ-1 050
Color	Black	
Life [characters]	2 million (LQ, self-test)	
Dimension [mm] (W) X (h) X (d)	290 X 34 X 71	468 X 34 X 80

Dimensions See Table 1-8 (Details are shown in Figures A-45 and 46.)

Weight See Table 1-8.

Table 1-8. Dimensions and Weight

	Width [mm]	Height [mm]	Depth [mm]	Weight [Kg]
LQ-850	430	142	360	10
LQ-1 050	605	142	360	12

NOTE: Excluding paper feed knob and paper guide.

Electrical Specifications See Table 1-9.

Table 1-9. Electrical Specifications

	120 V Version	220/240 V Version
Voltage [V AC]	108 - 132	198 - 264
Frequency range [Hz]	49.5 - 60.5	
Rating current [A]	2	
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

Environmental Conditions Refer to Table 1-10.

Table 1-10. Environmental Conditions

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

Reliability

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

MTBF LQ-850: 4000 POH (duty 25%)
LQ-105O: 6000 POH (duty 25%)

Printhead life 200 million strokes/wire

Safety Approvals

Safety standards	UL478 (U.S.A. version)
	CSA22.2#I 54
	VDE0806(TUV) (Europe an version)
Radio Frequency (RFI)	FCC class B (U.S.A. version)
Interference	VDE871 (self-certification) (Europe version)

1.2.2 Firmware Specifications

Control Code	ESC/P-83
Printing Direction	
Text	Bidirectional with logic seeking
Bit-image	Unidirectional
Character Code	8 bits
Character Set	96 ASCII and 13 international character sets
Family	Roman: No. O
	Sansserif: No. 1
Font	Roman: 10, 12, 15, Proportional
	Sansserif: 10, 12, 15, Proportional
	Draft: 10, 12, 15, Proportional
Printing Mode	Printing quality (Draft/LQ)
	Character pitch (10, 12, 15 CPI or Proportional)
	Condensed
	Double-width
	Double-height
	Emphasized
	Double-strike
	Italic
	Underlined

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

Print Speed	Refer to Table 1-11.
Print Columns	Refer to Table 1-11.

Table 1-11. Printing Mode

Print Pitch	Con-densed	Empha-sized	Double Width	Charac-ter Pitch	Printing Speed [CPS]		Printable Columns	
				[cPI]	Draft	LQ	LQ-850	LQ-1 050
0	0	0	0	10	220	73	80	136
			1	5	110	36	40	68
		1	0	10	110	73	80	136
			1	5	55	36	40	68
	1	x	o	17.1	188	125	137	233
			1	8.5	94	62	58	116
I 2	0	0	0	12	264	88	96	163
			1	6	132	44	48	81
		1	0	12	132	88	96	163
			1	6	66	44	48	81
	1	x	o	20	220	146	160	272
			1	10	110	73	80	136
I 5	0	0	0	15	330	110	120	204
			1	@ 7 <	165	55	120	204
		1	0	7.5	165	110	60	102
			1	7.5	82	55	60	102
	1	x	x	Ignored				
‘proportional	o	x	o	8.6	—	62	Max. 68	Max. 116
				20		146	Min. 160	Min. 272
			1	4.3	—	31	Max. 34	Max. 58
				10	—	73	Min. 80	Min. 136
	1	x	o	17.1	—	125	Max. 137	Max. 233
				40	—	293	Min. 320	Min. 544
			1	8.6	—	68	Max. 68	Max. 116
				20	—	146	Min. 160	Min. 272
Proportional S uper/ Subscript	0	x	o	12.8	—	94	Max. 102	Max. 174
				30	—	220	Min. 240	Min. 408
			1	6.4	—	47	Max. 51	Max. 87
				15	—	110	Min. 120	Min. 204
	1	x	o	25.7	—	188	Max. 204	Max. 174
				60	—	440	Min. 480	Min. 816
			1	12.8	—	94	Max. 102	Max. 87
				30	—	220	Min. 240	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 and Table 1-12.**

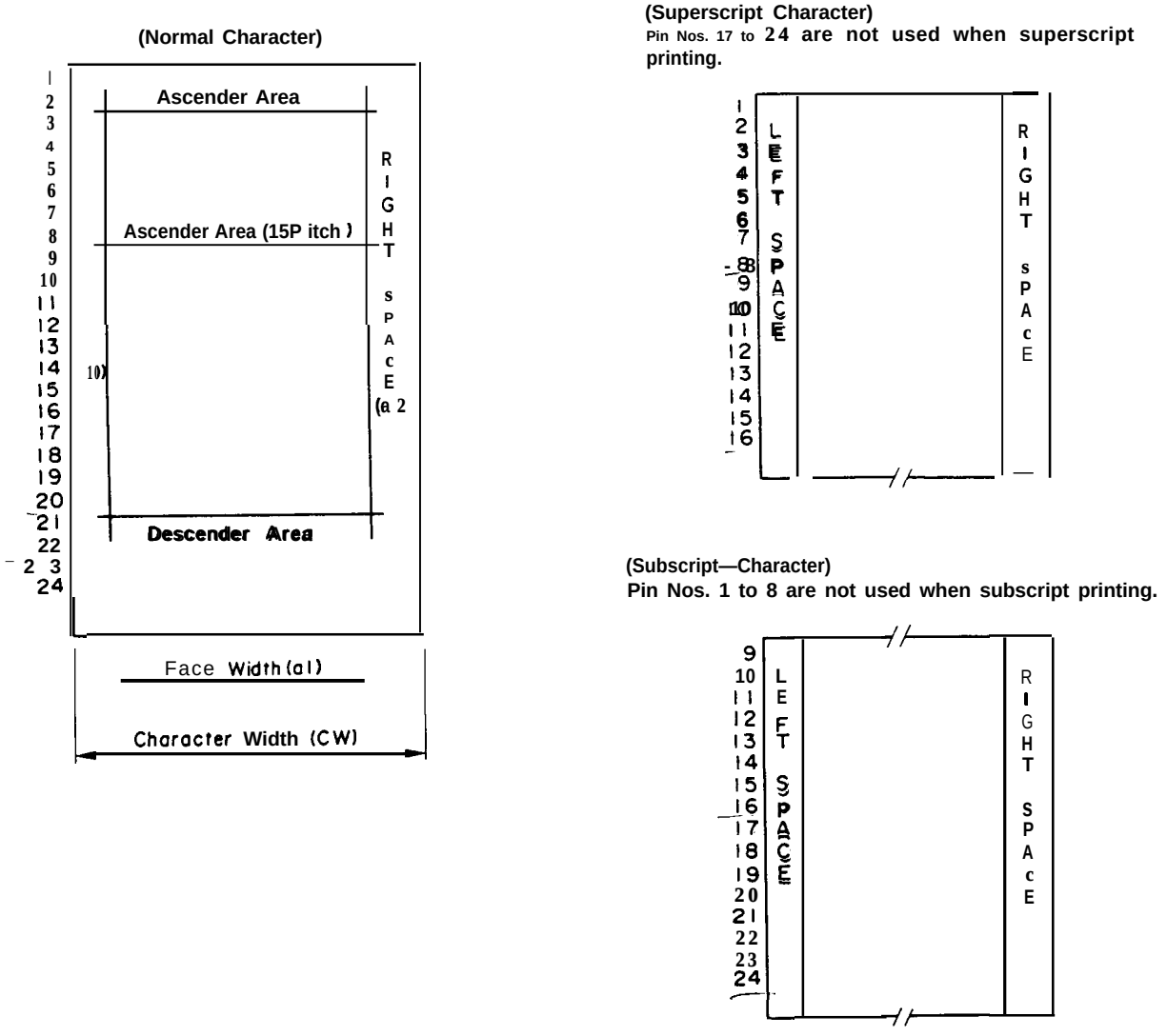


Fig. 1-6. Character Matrix

Character Size See Table 1-12.

Table 1-12. 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 "Unit" shows the number of dots per inch.

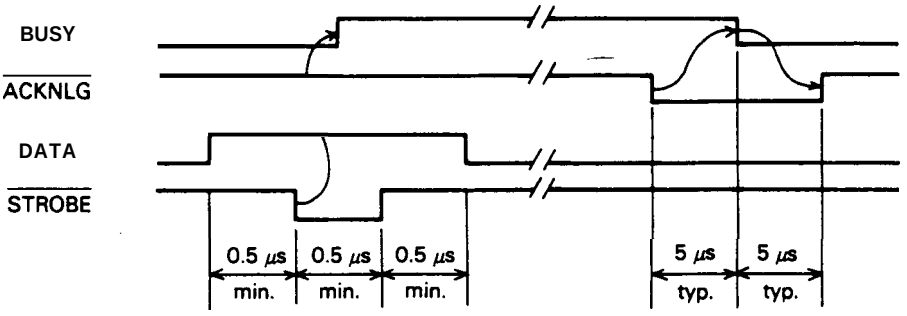
2. "Face matrix" and "character size" indicate the size of maximum characters and this value will be changed with condition of paper.
3. "Unit ESC sp" indicates the minimum length which is added to the right of the character that can be specified with ESC sp control code.
4. "..." indicates that the character matrix is reformed by printer firmware. Character width becomes half of a non-condensed character.

1.3 INTERFACE OVERVIEW

The LQ-850/1050 has both 8-bit parallel interface and RS-232C serial interface as standard. They can be selected by DIP switches 2-3 and 2-4 respectively. (This detail of DIP switch settings, refer to Table 1-17.)

1.3.1 8-bit Parallel Interface Specifications

Data Transmission Mode	**8-bit pallarel**
Synchronization	**By $\overline{\text{STROBE}}$ pulse**
Hand Shaking	**By BUSY and $\overline{\text{ACKNLG}}$ (either or both)**
Logic Level	**TTL compatible**
Data Transmission Timing	**See Figure 1-7.**
Connector	**57-30360 (AMPHENOL) or equivalent (See Figure 1-8.)**



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

Fig. 1-7. Data Transmission Timing of 8-bit Parallel Interface

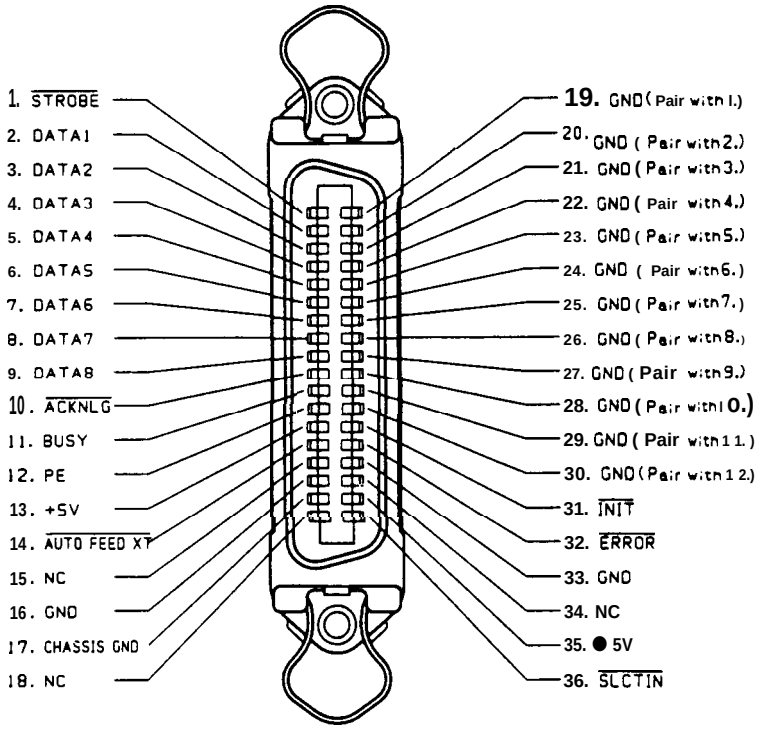


Fig. 1-8. 36-Pin 57-30360 Connector

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 1-13 and Figure 1-9.

Table 1-13. Serial Interface Handshaking

DTR Signal	X-ON/OFF protocol	Description
MARK	X-OFF (13H)	When the number of bytes remaining in the input buffer reaches 256 or less, the signal level goes to MARK, or a X-OFF code is sent out to the host computer. This indicates that the printer is not ready to receive data.
SPACE	X-ON (1 1 H)	When the number of bytes remaining in the input buffer reaches 512 or more, the signal level goes to SPACE, or a X-ON code is sent out to the host computer. This indicates that the printer is ready to receive data.

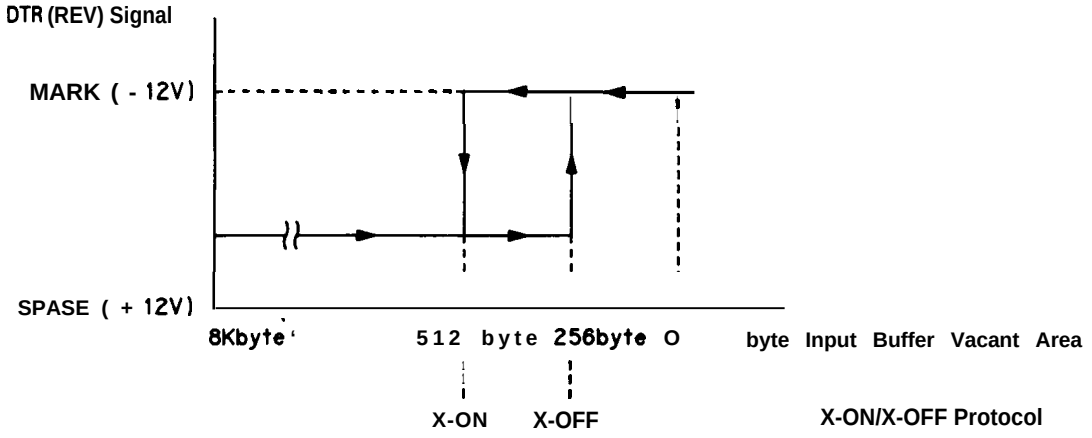
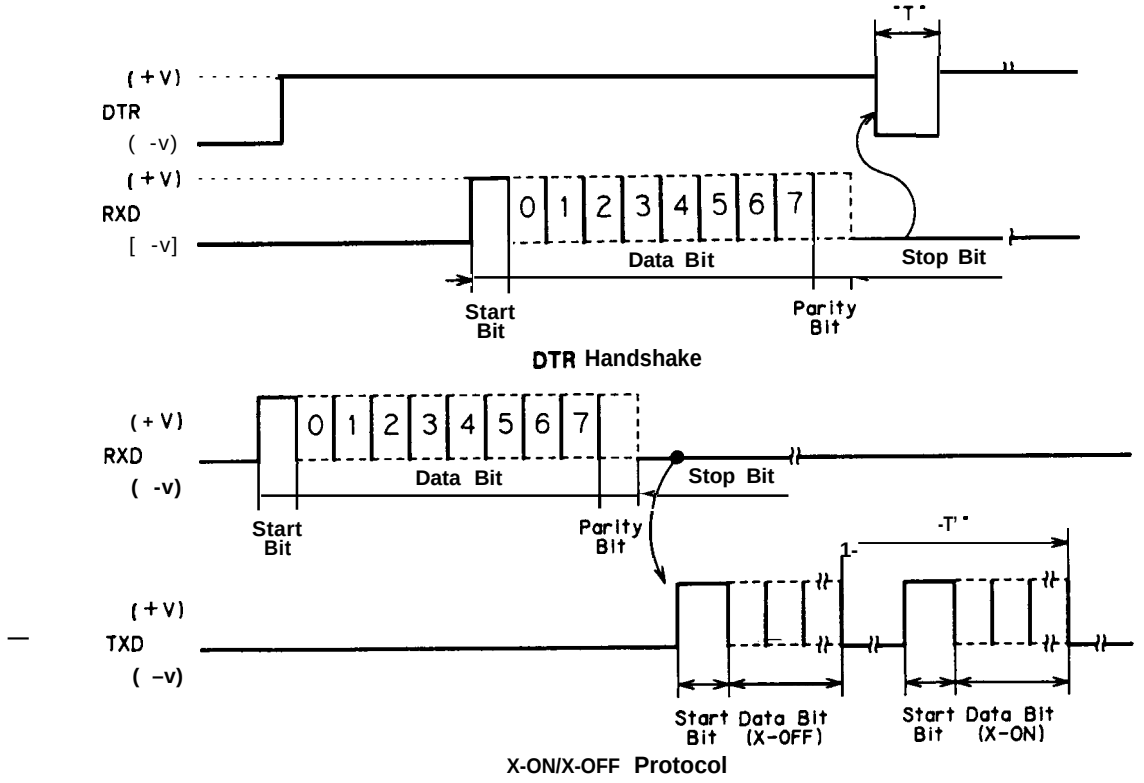


Fig. 1-9. Hand Shaking of RS-232C Interface

Word Length		
	Start bit	1
	Data bit	8
	Parity bit	Odd, Even, or none (selectable by DIP switches 2-3 and 2-4)
	Stop bit	1 bit or more
Bit Rate		300, 1200, 4800, or 9600 BPS (selectable by DIP switches 2-5 and 2-6)
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 bit.

Fig. 1-10. Serial Data Transmission Timing

Error Detection	**Parity error: "*" is printed.**
	Overrun error: Ignored
	Framing error: Ignored
Connector	**6-pin DIN connector (See Figure 1-1 1.)**

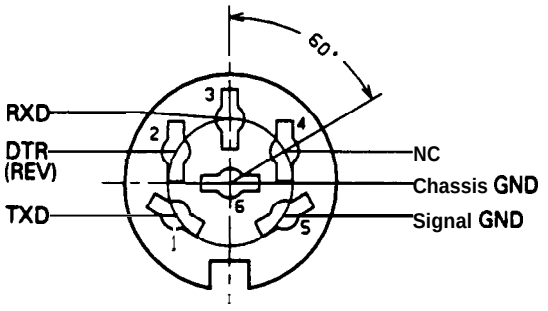


Fig. 1-11. Serial Interface Connector

1.4 DIP Switch and Jumper Settings

The DIP switches that users can set are SW1 and SW2. These switches are positioned at the rear of the printer, and have the functions as shown in Tables 1-14 through 1-18, (note that the status of the DIP switches are read only when the printer power on or an INIT signal is input.)

Table 1-14. DIP Switch 1 Settings

DIP SW.	Function	ON	OFF
1-1	International characher set	See Table 1-15.	
1-2			
1-3			
1-4	Table select	Graphic	Italic
1-5	Not used	—	—
1-6	Not used	—	—
1-7	CSF mode	Valid	Invalid
1-8	Input buffer	None	6K-byte

Table 1-15. International Character Set Designation

Country	1-1	1-2	1-3
U.S.A.	ON	ON	ON
France	ON	ON	OFF
Germany	ON	OFF	ON
U. K.	ON	OFF	OFF
Denmarkl	OFF	ON	ON
Sweden	OFF	ON	OFF
Italy	OFF	OFF	ON
Spain 1	OFF	OFF	OFF

NOTE: The above settings can be changed to any country's characters set by inputting ESC R control codes.

Table 1-16. DIP Switch 2 Settings

DIP SW.	Function	ON	OFF
2-1	Page length	12“	11“
2-2	1“ skip-over perforation	Valid	Invalid
2-3	Interface selection	See Table 1-17.	
2-4			
2-5	Baud rate selection	See Table 1-18.	
2-6			
2-7	Tear off mode	Valid	Invalid
2-8	Auto LF	Valid-	Invalid

Table 1-17. Interface Selection

2-3	2-4	Function
OFF	OFF	Parallel
ON	OFF	Serial, Even parity
OFF	ON	Serial, Odd parity
ON	ON	Serial, None parity

Table 1-18. Baud Rate Selection

2-5	2-6	Function
OFF	OFF	9600
ON	OFF	4800
OFF	ON	1200
ON	ON	300

Fiugre 1-12 shows the factory settings for DIP switches SW-1 and SW-2.

Country	SW1-	1	2	3	4	5	6	7	8	SW2-	1	2	3	4	5	6	7	8
U. S. A., Southeast Asia, Middle and Near East	ON				■	■	■	■	■	ON	■	■	■	■	■	■	■	■
	OFF	■	■	■						OFF								
Germany, Northern Europe	ON		■		■	■	■	■	■	ON		■	■	■	■	■	■	■
	OFF	■		■						OFF	■							
U. K., Australia	ON		■	■	■	■	■	■	■	ON	■	■	■	■	■	■	■	■
	OFF	■								OFF								
France, Itary, Spain	ON					■	■	■	■	ON	■	■	■	■	■	■	■	■
	OFF	■	■	■	■					OFF								

White areas indicate the setting.

Fig. 1-12. DIP switches 1 and 2 Factory Settings

Jamper Setting See Table 1-19.

Table 1-19. Jumper Setting

No.	Type					Location
	1 M-bit	256 K-bit			64 K-bit	
	Mask-ROM		P-ROM	PS-RAM	ST-RAM	
J1	B2	N.C.	+ 5	B1	N.C.	CG1
J2	**B1**	B1	B1	WR	WR	
J3	B3	RD	RD	RD	RD	
J4	ROM	ROM	ROM	RAM	ROM	
	4M-bit	2M-bit	1 M-bit	256 K-bit		
	Mask-ROM					
J5	RD	**RD**	B3	RD		CGO
J6	B4	B4	+ 5	+ 5		
	LQ-850		LQ-1 050			—
J7	80		136			
	27256		27512			
J8	256		512			PROG
	$\overline{\text{SICTIN}}$ enable		**$\overline{\text{SLCTIN}}$** disable			—
J9	SLIN		GND			

Bold indicates the factory settings.

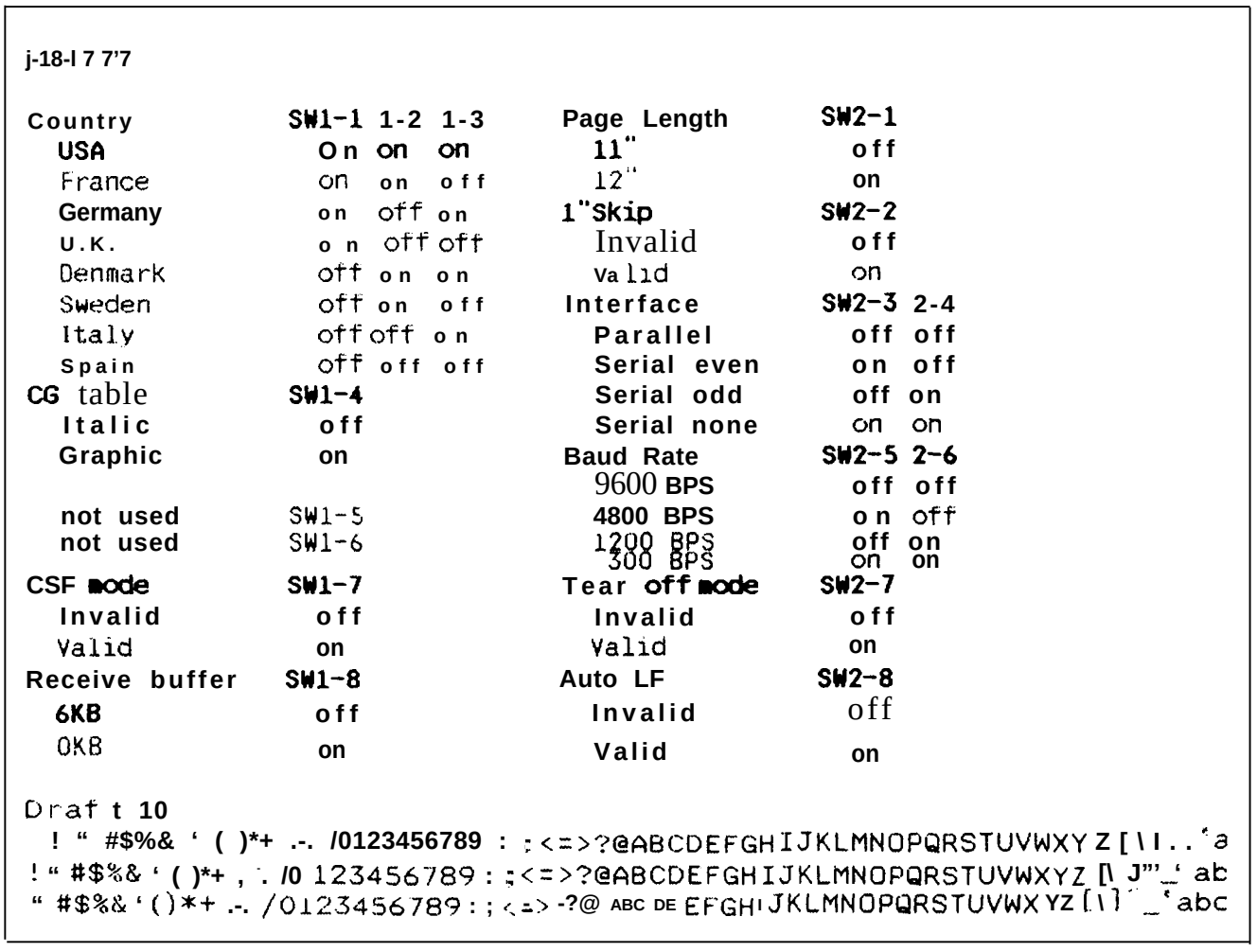
1.5 SELF-TEST OPERATION

The LQ-850/1050 printer has the following self-test operation. The control ROM version No. and the DIP switch settings also printout when the self-test is performed.

Table 1-20 lists the self-test operating instructions and Figure 1-13 shows the self-test printing.

Table 1-20. 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 (Roman)	Turn the power OFF while pressing the FORM-FEED switch.	



Bold indicates the current DIP switch settings.

Fig. 1-13. Self-Test Printing

1.6 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 1-21 shows the hexadecimal dump operation and Figure 1-14 shows printout of the operation.

Table 1-21. Hexadecimal Dump Operation

Function	Operation	stop
Hexadecimal dump mode	Turn the power on while pressing both the LF and FF switches.	Turn the power off.

Data Dump Mode

31	2E	31	20	46	45	41	54	55	52	45	53	OD	0A	0D	0A
54	68	65	20	4C	51	2D	38	35	30	2F	31	30	35	30	20
70	72	69	6E	74	65	72	73	20	61	72	65	20	6D	75	6C
74	69	66	75	6E	63	74	69	6F	6E	61	6C	2C	20	32	34
2D	70	69	6E	20	70	72	69	6E	74	68	65	61	64	2C	20
69	6D	70	61	63	74	20	64	6F	74	2D	OD	0A	6D	61	74
72	69	78	20	70	72	69	6E	74	65	72	73	2E	20	54	68
65	20	6D	61	69	6E	20	66	65	61	74	75	72	65	73	20
6F	66	20	74	68	65	20	74	68	65	73	65	20	70	72	69
6E	74	65	72	73	20	61	72	65	3A	20	OD	0A	OD	0A	2E
20	55	70	77	61	72	64	20	63	6F	6D	70	61	74	69	62
69	6C	69	74	79	20	77	69	74	68	20	74	68	65	20	4C
51	2D	38	30	30	2F	31	30	30	30	OD	0A	2E	20	41	20
6D	61	78	69	6D	75	6D	20	70	72	69	6E	74	20	73	70
65	65	64	20	6F	66	20	32	36	34	20	43	50	53	20	69
6E	20	64	72	61	66	74	20	6D	6F	64	65	20	61	74	20

```
1.1 FEATURES. . .
The LQ-850/1050
printers are mul
tifunctional, 24
-pin print head,
impact dot-. mat
rix printers. Th
e main features
of the these pri
nters are: . . ...
 Upward compatib
ility with the L
Q-800/1000. . .A
maximum print sp
eed of 264 CPS i
n draft mode at
```

Fig 1-14. Hexadecimal Dump List

1.7 PRINTER INITIALIZATION

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

1.7.1 Hardware Initialization

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

- **Initializes printer mechanism**
- **Clears downloaded character set**
- **Clears the input data buffer**
- **Clears the image buffer**
- **Sets printer selections to their default values**

1.7.2 Software Initialization

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

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

NOTE: The printer's default values are as follows:

Page Position	**Preset paper position becomes top of form position**
Left and Right Margin	**Released**
Line Spacing	**1/6 inches**
Vertical Tab Position	**Cleared**
Horizontal Tab Position	**Every 8 characters (relative)**
VFU Channel	**Channel O**
Family Number of Type Style	**Roman (Family Number O)**
Downloaded Characters	**Deselected: Software initialize**
	Cleared: Hardware initialize
Justification	**Left justification**
Character Per Inch	**10**
Bit Image Mode Assignment	**ESC K = ESC *0, ESC L = ESC *1, ESC = ESC * 2,**
	ESC Z = ESC *3
Printing Effects	**Cleared**

1.8 BUZZER OPERATION AND ERROR CONDITIONS

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

1.8.1 Buzzer Operation

The buzzer ring as follows:

. When a BEL code is sent to the printer, the buzzer sounds for 0.5 seconds

. When an error has occurred

Carriage Trouble: Sounds 5 times (rings for 0.5 seconds with 0.5 seconds interval.)

Paper End: Sounds 3 times (rings for 0.1 seconds with 0.1 seconds interval.)

- When a panel setting is accepted, the buzzer sounds for 0.1 seconds (Refer to Section 1.9.4 for further information concerning control panel settings.)

1.8.2 Error Conditions

If any of the following errors occur, the printer automatically enters the OFF-LINE mode.

- Home position is not detected at printer mechanism initialization.
- Home position is detected during printing.
- The OFF-LINE switch is pressed, causing the printer to enter OFF-LINE mode.
- Paper-out is detected when forms-override is finished.
- A paper-out signal is detected and forms-override is finished.
- A paper-out signal is detected after the printer has performed a paper-loading operation with the cut sheet feeder enabled.

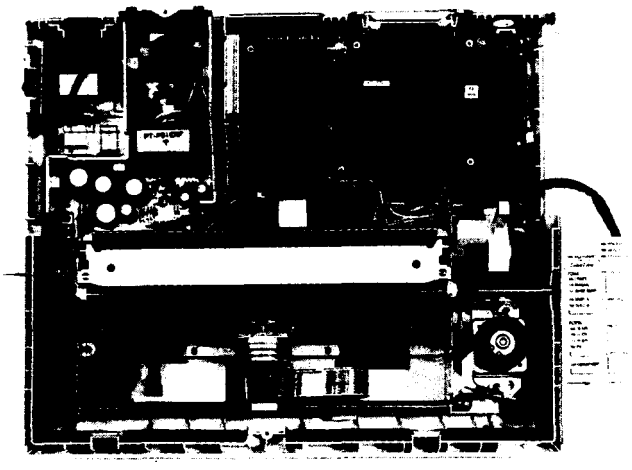
For information concerning the status of the interface signals, refer to Section 2.3.2.

1.9 MAIN COMPONENTS

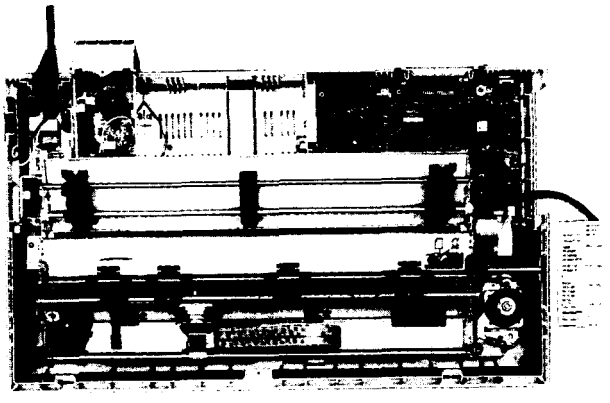
The LQ-850/ 1050 printer includes the following major subassemblies:

- Model-53 10/5360 printer mechanism
- MONMA board (main board)
- MONPL board (control panel)
- MONPS/MONPSE board (power supply board, 120V and 220/240V versions)

Figure 1-15 shows the LQ-850/1 050 component locations.



LQ-850



LQ-1 050

NOTE: In LQ-850, the paper tension unit and push tractor unit are excluded.

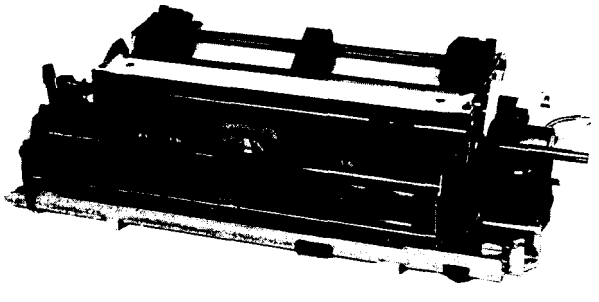
Fig. 1-15. LQ-850/1 050 Component Locations

1.9.1 Printer Mechanism

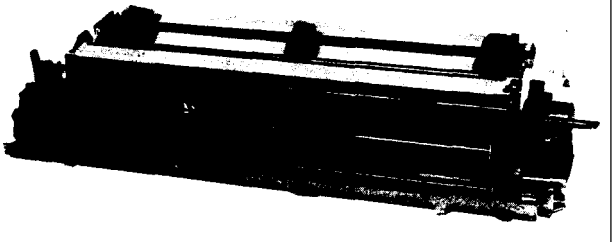
The printer mechanism is composed of two stepper motors used in carriage move and paper feed, a 24-pin printhead, four sensors (home position, paper end, friction/tractor, and platen gap sensors), and metal frames.

The printer mechanism has two paper guides (depending on the paper type), a push type tractor unit, and an optional pull type tractor unit. These features enable the LQ-850/ 1050 printers to print on a wide range of usable paper types.

The construction of the mechanism has been simplified to make maintenance very easy.



Model-531 O



Model-5360

Fig. 1-16. Model-5310/5360 Printer Mechanism

1.9.1.1 Paper Loading and Paper Ejection

The paper release lever has a disengage capability for the optional pull tractor unit's drive mechanism. Therefore, these printers provide some improved paper handling functions that can be performed by using a combination of the paper release lever and LOAD/EJECT switch on the control panel.

Single Sheet Loading and Ejection

To load a sheet of paper, position the paper release lever back, place the page along the paper guide, and press the LOAD/EJECT switch. This loads the paper at the top-of-form position. If LOAD/EJECT switch is pressed after paper has been loaded, it causes the paper to be ejected.

Fanfold Paper Loading and Ejection (Back Out)

To load fanfold paper, move the paper release lever forward, and insert the paper into the push tractor. 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 from 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.

The SelecType LEDs light only after the paper has been loaded and the ON-LINE switch has been pressed. After ON-LINE has been pressed, the user can adjust the paper loading position for the next sheet loaded into the printer and the top-of-form position for the currently loaded sheet.
Pressing the FORM-FEED switch advances the paper forward in increments of 1/180 inches continuously for as long as the switch is held down, and pressing the LINE-FEED switch moves the paper in reverse in increments of 1/180 inches.

Moving the paper with these switches is called "micro adjustment". After the paper has been adjusted in this way, the printer uses that position as the loading position for each subsequent page. When the printer is initialized, the loading position for a single sheet returns to the default value.

1.9.1.2 Auto-Tear-OFF Function

To enable the auto-tear-off function, set DIP switch 2-7 to ON prior to turning on the printer. When this function is activated and the paper release lever is placed in its forward position, paper is fed in the following way: after the input data buffer becomes empty, while printer is in the ON-LINE mode, the printer feeds the paper so that the perforation at the form's end is moved automatically to the tear-off edge of the sheet guide cover.
After the printer has positioned the paper, the SelecType LEDs flash to indicate that the FORM-FEED and LINE-FEED switches are available for micro adjustment of the tear-off position, as long as the printer is ON-LINE. If subsequent data is input to the printer, then 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.

1.9.2 MONMA Board (Main Board)

Figure 1-17 shows the MONMA board, which contains a μPD78 10HG CPU to control the operation of the printer.
Driver circuits for the motors, sensors, and printhead are also included on this board. Other main ICs on the MONMA board are:

Universal IC

- M546 10P (5A) . . . 8-bit parallel interface IC
- STK6722H (1A) . . . Carriage motor driver IC

Gate Array IC

- E05A10AA (10C) . . . Memory management unit (M MU) IC
- E05A09BA (2A) . . . Carriage and paper feed motors phase pulses control unit (MCU) IC
- E05A02AA (3A) . . . Printhead data driver IC

Memory IC

- EP-ROM (9A) . . . Used for program, 256 K-bit
- MASK-ROM (6A) . . . Used for character generator, 1 M-bit
- ST-RAM (7A) . . . 256 K-bit
- ST-RAM (8A) . . . 64 K-bit

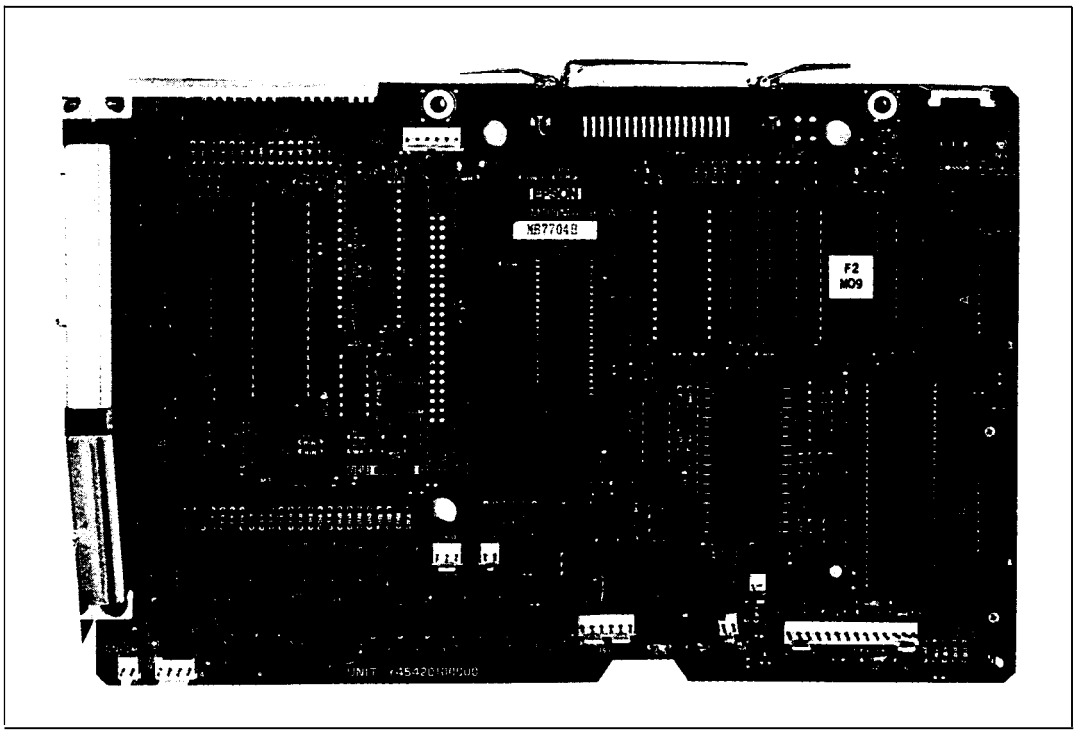


Fig. 1-17. MONMA Board

1.9.3 MONPS/MONPSE Board (Power Supply Circuit Board)

The power supply circuit board is located on one of two boards, the MONPS for 120 V AC operation and the MONPSE for 220/240 V operation. The basic construction of the two boards is the same: each board contains a power switch, fuses, line filter circuit, and switching regulator circuit. Compactness of the circuitry is made possible by use of a DC-to-DC converter.

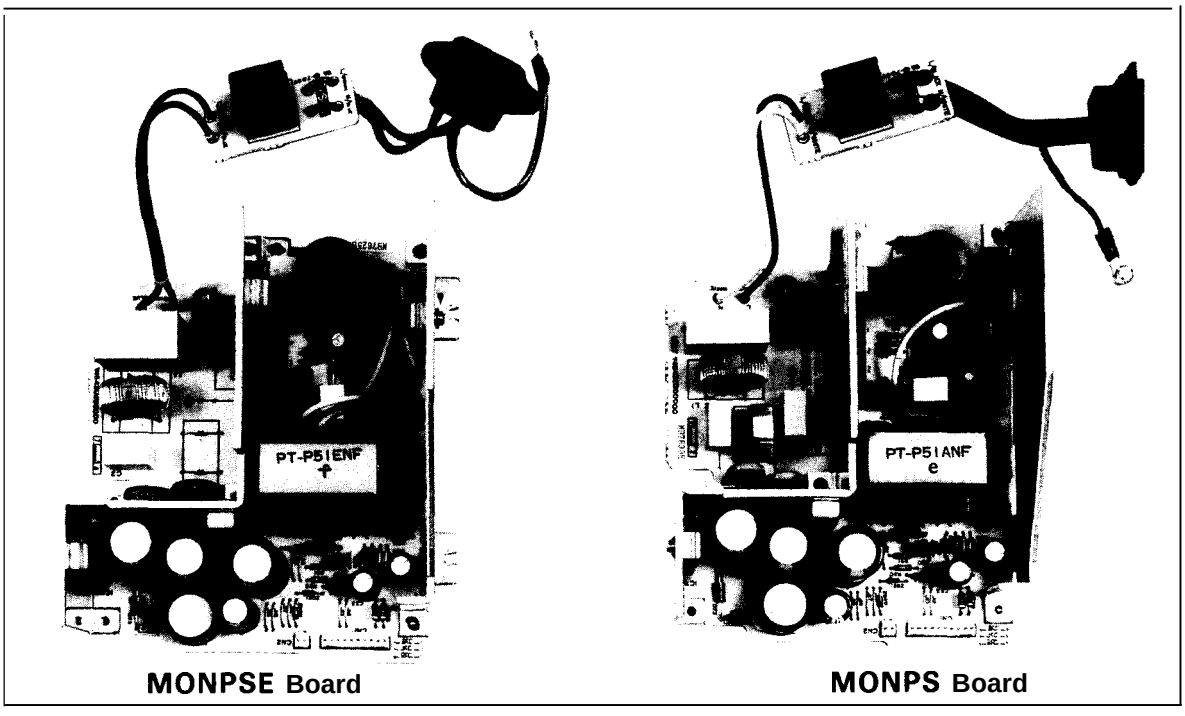


Fig. 1-18. MONPS/MONPSE Board

1.9.4 Control Panel

In the control panel, there are four square switches, three rectangular switches, and fifteen LEDs, as shown in Figure 1-19. The functions of the switches and indicators are given immediately below the illustration.

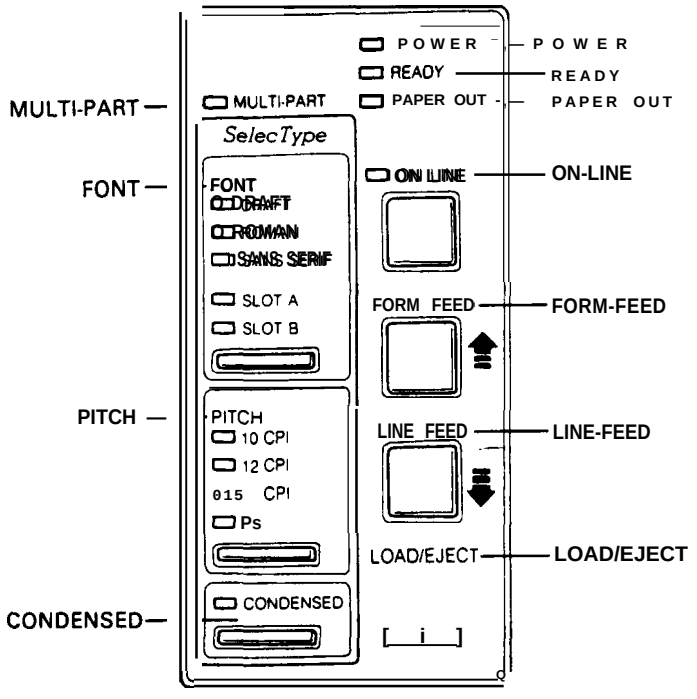


Fig. 1-19. Control Panel

ON-LINE Switch

This switch toggles the printer between ON-LINE and OFF-LINE modes. The printer is automatically set to ON-LINE mode and becomes ready at power on. If the printer is set to OFF-LINE mode, printing is stopped and the printer becomes BUSY.

FORM-FEED Switch

Pressing this switch once while the printer is in the OFF-LINE mode advances the paper vertically to the next top-of-form position. Pressing this switch is while the printer is in the ON-LINE mode advances the paper forward in increments of 1/180 inches. The top-of-form position for the beginning page is set to the current position in any one of the following cases:

a) Power on
b) Receipt of the INIT signal host computer
c) Receipt of the reset command ESC @
d) Receipt of the page length setting command ESC C

LINE-FEED Switch

When the printer is in the OFF-LINE mode, the paper advances continuously one line at a time while this switch is depressed. The space between lines of text is set using the line spacing command. When the printer is in the ON-LINE mode and the LINE-FEED switch is pressed, the paper moves in reverse in increments of 1/1 80 inches.

LOAD/EJECT Switch

Pressing this switch loads or ejects the paper (If a page is inserted into 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 1.9.1.1.

FONT Switch

Pressing this switch selects a font, and continuing to press the switch for more than 0.5 seconds select the next font, sequentially. The FONT indicator lights beside the currently selected font.

PITCH Switch

Pressing this switch selects the character pitch, and continuing to press the switch for more than 0.5 seconds select the next character pitch, sequentially. The PITCH indicator lights beside the currently selected character pitch to confirm its status.

CONDENSED Switch

Pressing this switch selects normal or condensed printing. The CONDENSED indicator lights while selecting the condensed mode.

POWER LED (Green)

Lights when power is ON.

READY LED (Green)

Lights when printer can receive the data.

PAPER OUT LED (Red)

Lights when the paper is end,

ON-LINE LED (Green)

Lights in the ON-LINE mode.

MULTI-PART LED (Orange)

Lights when the head adjustment lever is set for 4th or higher. The light should not be lit unless multi-part forms are being printed.

FONT (DRAFT, ROMAN, SANS-SERIF, SLOT A, SLOT B) LEDs (Orange)

These LEDs indicate the currently selected font. If slots A and B contain font modules, they each may be selected using the FONT switch, and the indicator beside either SLOT A or SLOT B will be lit. If no font module is installed in the slot when the FONT switch is pressed, SLOT A and SLOT B selections will be skipped.

PITCH (10 CPI, 12 CPI, 15 CPL PROPORTIONAL) LEDs (Orange)

These LEDs indicate the currently selected character pitch.

NOTE: When 15 CPI is selected, condensed printing may not be used,

CONDENSED LED (Orange)

This indicator lights when condensed mode printing is selected.

1.9.5 Housing

The housing consists of the upper and lower cases and accommodates the printer mechanism, control circuit board, and power circuit. The optional cartridges (i.e., font and identity modules) can be mounted easily without removing the upper case. Figure 1-20 shows the LQ-850/ 1050 housings.

Fig. 1-20. Housings

CHAPTER 2
OPERATING PRINCIPLES

LIST OF FIGURES

LIST OF TABLES

2.1 OVERVIEW

This chapter describes the signals at the various connectors that connect the primary components of the LQ-850/1 050, including the model-53 10/5360 printer mechanism, MONPS/MONPSE power supply board, MONMA control board, and the control panel. This chapter also describes the operation of the printer's electric circuitry and printer mechanism.

2.1.1 Connector Summary

The interconnection of the primary components is shown in Figure 2-1. Table 2-1 summarizes the function, size, and type of the connectors designated in the figure.

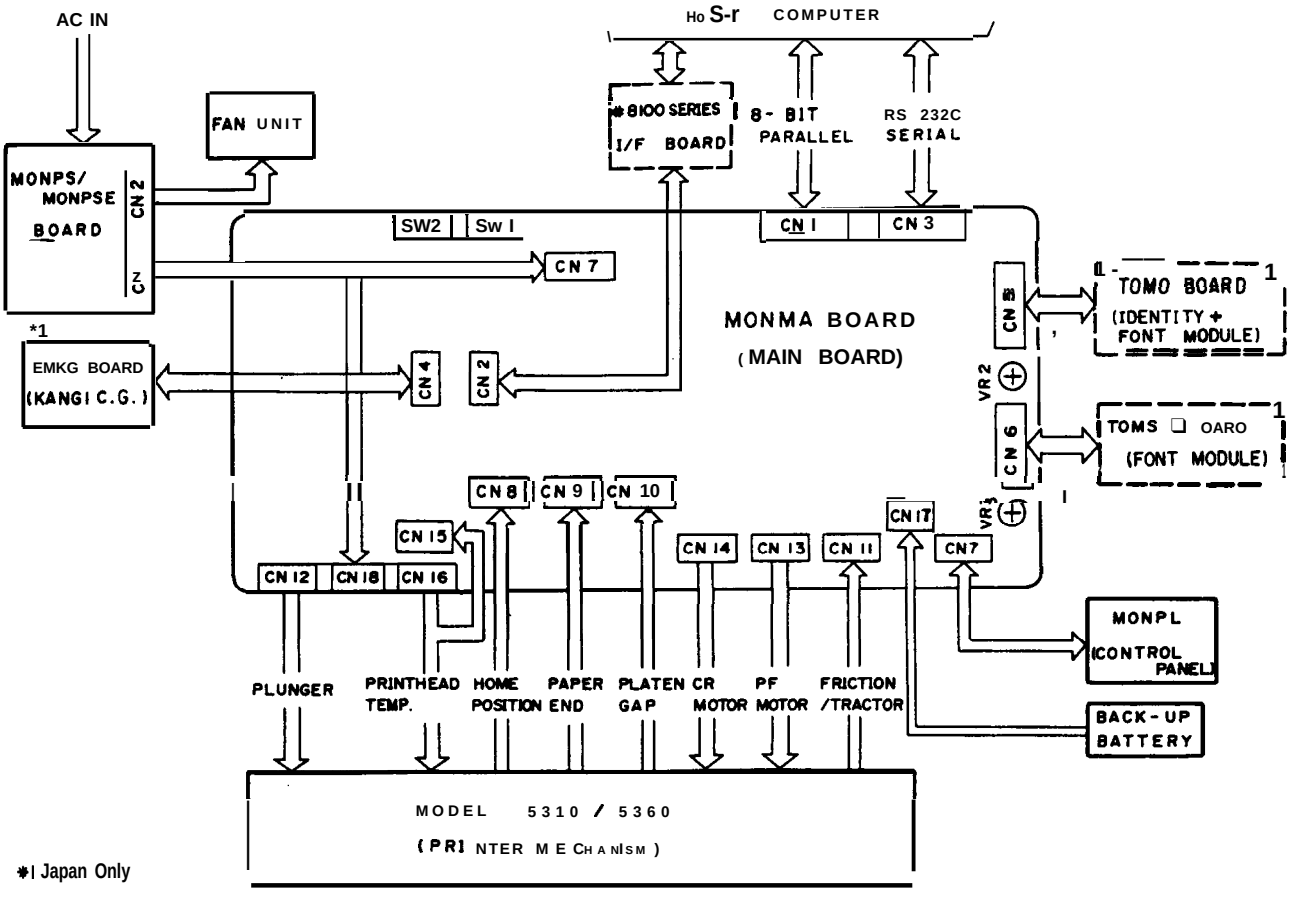


Fig. 2-1. Cable Connections

Table 2-1. Boards Connector Summary

Board	Connector No.	To or From	Description	Pins	Reference Table
MONMA	CN 1	Host computer	I/F (parallel)	36	A-1 2
	CN2	Option I/F board	I/F	2 6	A-1 3
	CN3	Host	I/F (RS-232C)	6	A-14
	CN4	Not used	Japan only	4 4	A-1 5
	CN5	Font module	Slot B	3 2	A-1 6
	CN6	Font module	Slot A	32	A-1 7
	CN7	Control panel		14	A-1 8
	CN8	Printer mechanism	Home position sensor	3	A-1 9
	CN9		Paper end sensor	2	A-20
	CN 10		Platen gap sensor	2	A-2 1
	CN 11		Friction/Tractor sensor	2	A-22
	CN 12		Plunger	2	A-23
	CN 13		Paper feed motor	6	A-24
	CN 14		Carriage motor	6	A-25
	CN 15		Printhead (front)	17	A-26
	CN 16		Printhead (rear)	15	A-27
	CN 17	MONPS/MONPSE	+ 5 V/&12 V DC power	6	A-28
	CN 18		+35 V DC power	4	A-29
	CN19	Backup battery	+5V DC power	2	A-30
MONPS/ MONPSE	CN 1	MOMMA board	Power supply board	10	A-3 1
	CN2	Fan unit		2	A-32

2.1.2 Printer Mechanism Operation

The Model-53 10/5360 is a serial printer mechanism equipped with a 24-pin impact dot printhead. Two new features have been added for more efficient paper handling: automatic paper loading/ejecting, and top margin fine adjustment (tear-off mode).

The printer mechanism is divided into three parts: 1) the printing mechanism; 2) the carriage mechanism; 3) the paper feed mechanism. These will be explained in the following sections.

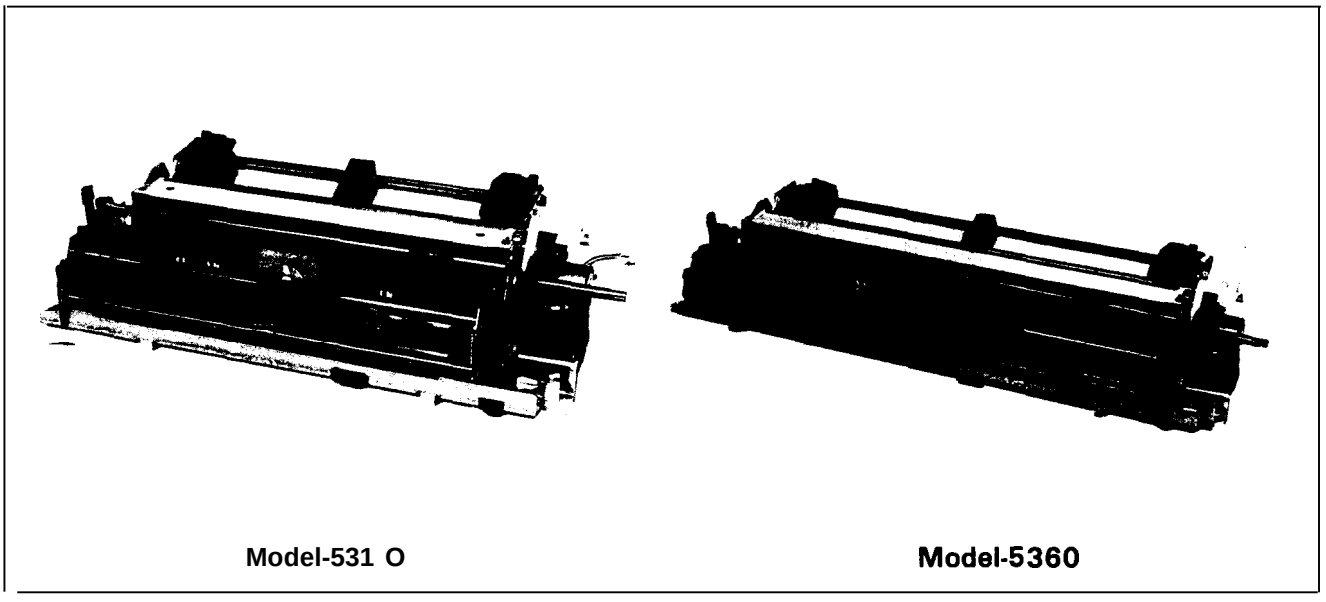


Fig. 2-2. Model-531 0/5360 Printer Mechanism

2.1.2.1 Printing Mechanism

The printing mechanism includes the printhead, inked ribbon, and platen. Figure 2-3 shows the printing mechanism and Table 2-2 lists the printhead specifications. The printhead has 24 dot wires which are arrayed in two 12 wire lines. Each dot wire is connected to its own drive coil.

The basic printing operations are as follows:

1. The drive signals, transferred from the control circuit to the printhead drive circuit, are converted into printhead drive voltages which energize the head driving coils for the dot wires. The coil is therefore magnetized which generates a magnetic force in the iron core.
2. Because of this force, the iron core attracts the actuating plate which is in contact with the dot wire, and the dot wire is pushed toward the platen.
3. The dot wire strikes the inked ribbon and the paper against the platen to print a dot on the paper.
4. When the coil is de-energized, the iron core loses its 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.

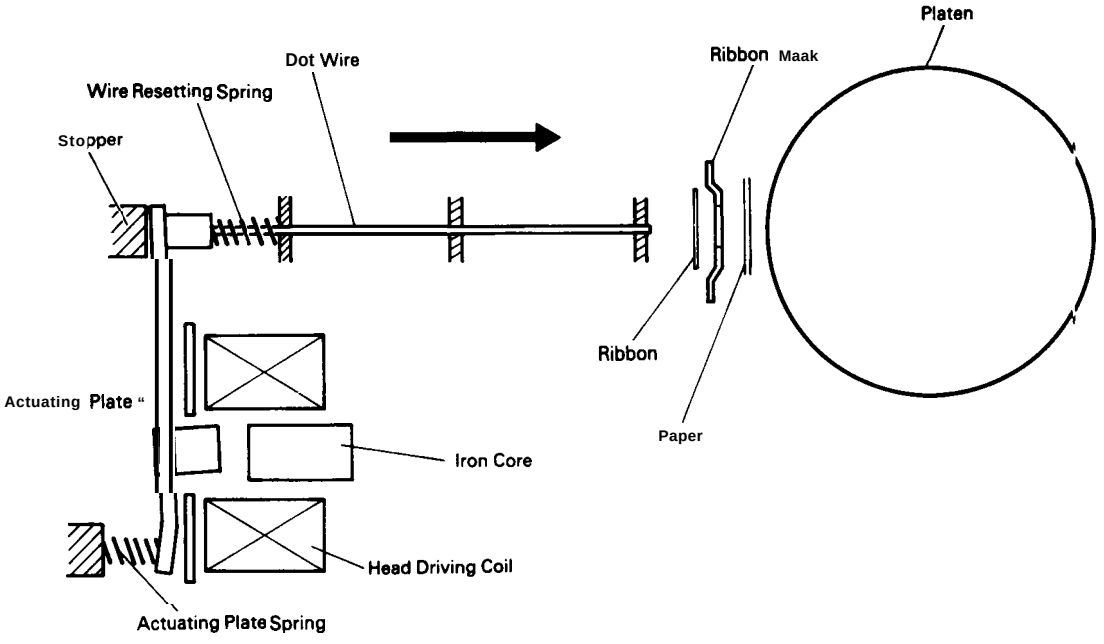


Fig. 2-3. Printing Mechanism

This is the sequence used to print a dot on the paper. The printhead contains a thermistor to monitor its temperature so that the dot wire drive coils are protected against overheating. The printhead temperature detected by the thermistor is converted into a voltage and fed back to the control circuit, to provide a mechanism for printhead protection. Refer to Section 2.3.5.2 for details.

Table 2-2. Printhead Specification

Type	Pin Diameter [mm]	Dot Pitch ["1	Pin Configuration	Drive Voltage [v]	Drive pulse width [μs]	Sensor
Impact dot	0.2	1/1 80	12 line X 2 col.	35	379	Thermistor

2.1.2.2 Carriage Mechanism

Carriage mechanism

Figure 2-4 shows the carriage mechanism. 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 carriage motor drives the timing belt. A four-phase 200-pole hybrid type stepper motor is used for this operation.

Motor phase drive signals are generated by the control circuit and converted into motor drive voltages in the motor drive circuit to rotate the carriage motor by driving phases A to D of the motor.

Printing is performed by a combination of printing and carriage mechanism operations.

The print start position is determined by the home position sensor when the mechanism is initialized. Details are provided in Section 2.3.7.

Table 2-3 lists the specifications of the carriage mechanism.

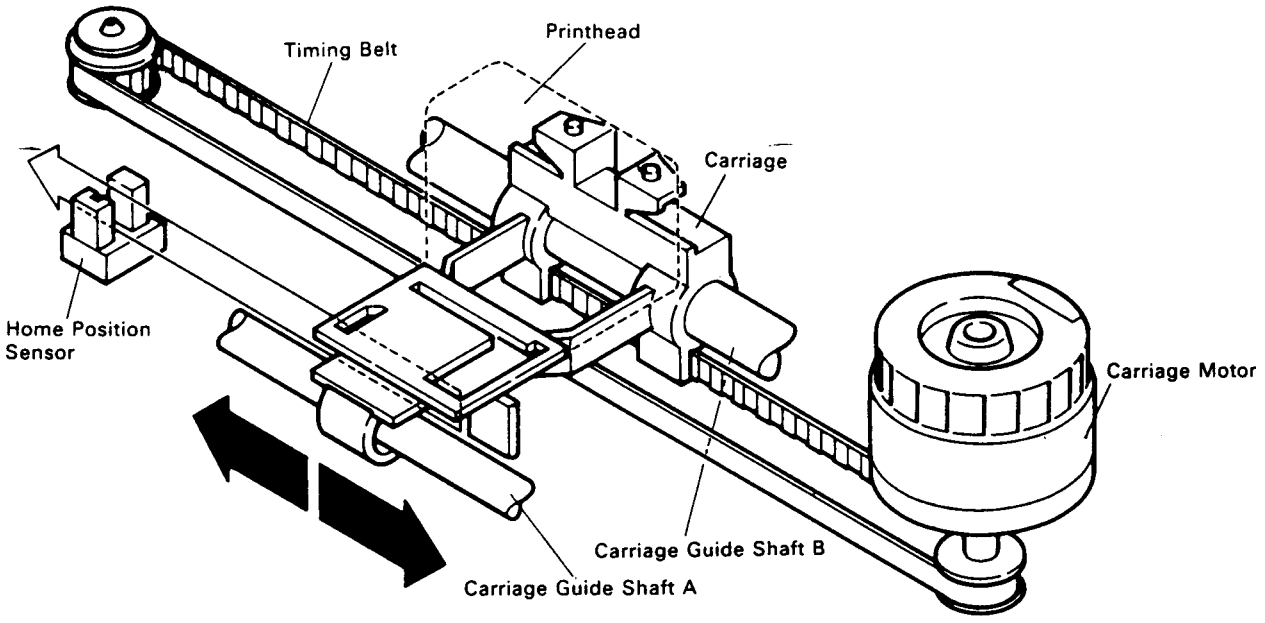


Fig. 2-4. Carriage Mechanism

Table 2-3. Carriage Mechanism Specification

Carriage Motor					Driving Method	Carriage Movement Per Step ["/step]	Sensor	
Type	Number of step	Drive Voltage [V]		Control Method				
		Hold	Run					
Hybrid stepper motor, 4 phases	200	5	35	Open loop	Timing belt	1/120	Home position	Platen gap

Ribbon Feed Mechanism

The ribbon feed mechanism consists of the ribbon feed mechanism and ribbon carriage. Figure 2-5 shows the ribbon feed mechanism.

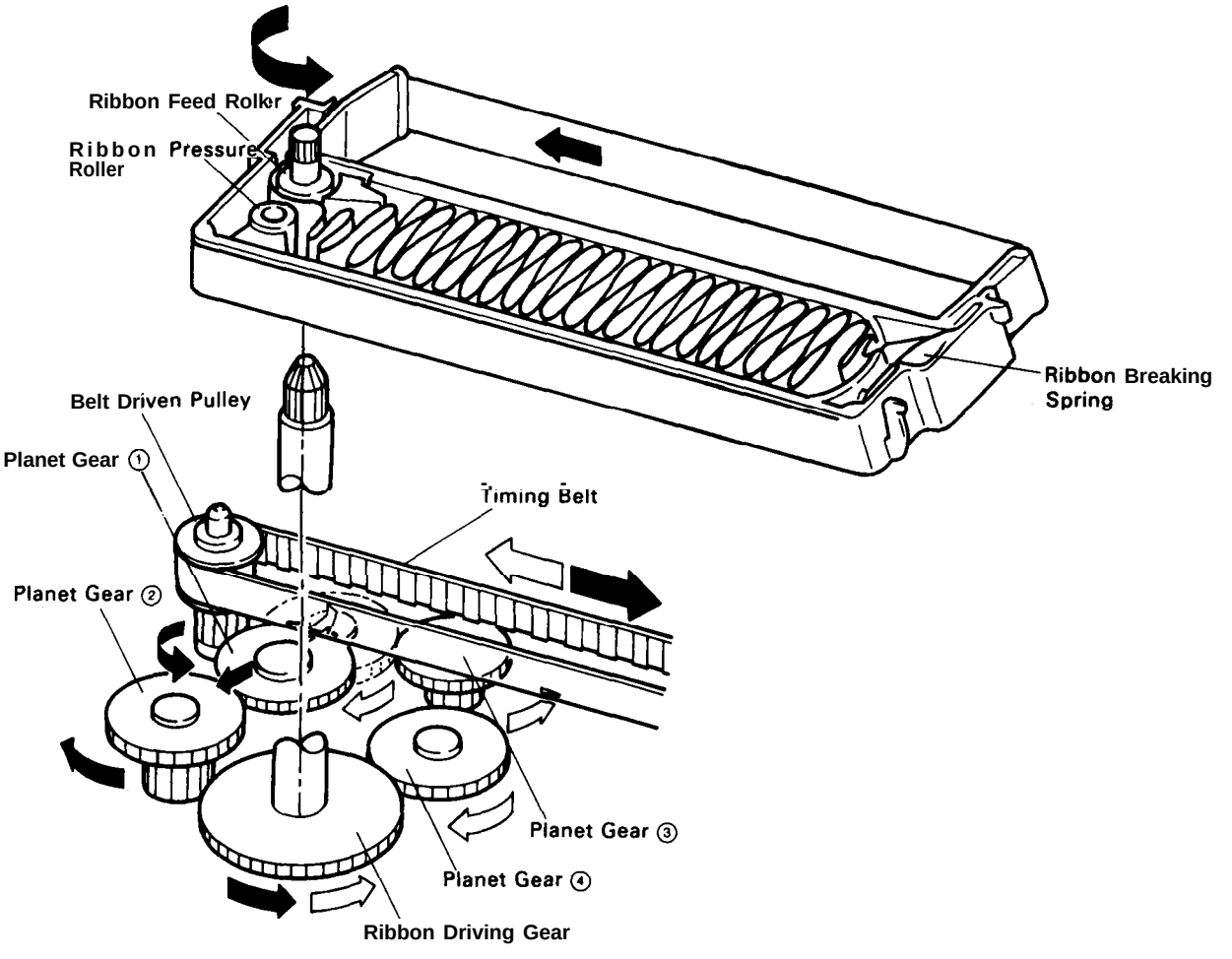


Fig. 2-5. Ribbon Feed Mechanism

The ribbon feed mechanism operates so that the ribbon drive gear always turns counterclockwise, via the gear trains shown in Table 2-4, regardless of whether the timing belt moves to the right or to the left.

Table 2-4. Ribbon Feed Gear Train

Direction of Movement of Carriage	Gear Train
Left to right (arrow ●)	Belt driven pulley → Planet gear ① → Planet gear ② → Ribbon driving gear
Right to left (arrow ⇨)	Belt driven pulley → Planet gear@ → Planet gear ③ → Planet gear@ → Ribbon driving gear

The inked ribbon is a loop contained in the cartridge case, and 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.

2.1.2.3 Paper Feed Mechanism

The paper feed mechanism feeds the paper after the printing mechanism and the carriage mechanism finish printing one line. The paper feed motor is driven to rotate the platen *or* tractor via the paper feed gears. The paper feed mechanism includes two sensor mechanisms: A paper end sensor to detect the presence/absence of the paper, and a friction/tractor sensor to detect the paper feeding mode (push tractor feed or friction feed).

The paper feed mechanism has been enhanced with a new automatic paper ejection feature and an automatic paper back-out feature. These new features are controlled by the firmware to improve paper handling. Table 2-5 lists the specifications of the paper feed mechanism and Table 2-6 lists the relationship between paper type and various paper feed operations.

Table 2-5. Paper Feed Mechanism Specification

Paper Feed Motor					Driving Method	Paper Feeding Per/Step ["/step]	Sensor		Solenoid ,	
Type	Number of step	Drive Voltage [V]		Control Method					Drive Voltage [V]	
		Hold	Run						Hold	Pull
PM stepper motor, 4 phases	48	5	35	Open loop	Gear trans-mission	1/1 80	Paper end	Friction/ tractor	5	35

Table 2-6. Paper Feeding Method and Paper Type

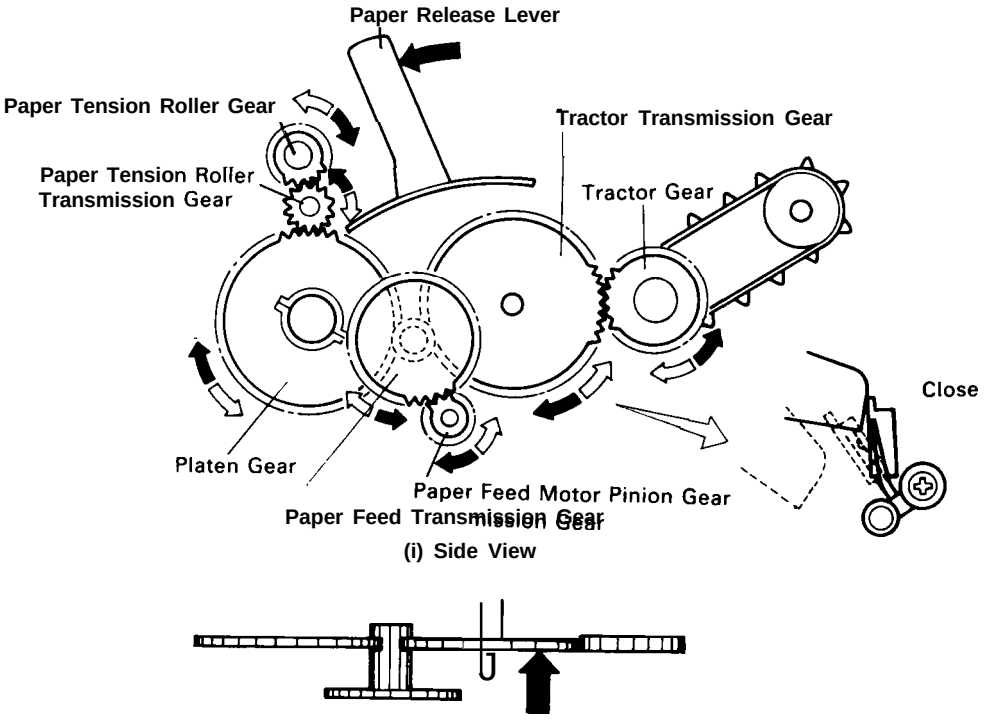
Paper Release Lever Position	Friction		Tractor		
Paper Type	Cut Sheet		Continuous		
Paper Feeding Method	Normal	CSF*1	Push	Pull*1	Push-Pull*1
Paper Tension Unit	o	x	o	x	x

O:Need x: Needless

*1) Optional, the detail is described in Chapter 3.

Push Tractor Feeding Method (Figure 2-6)

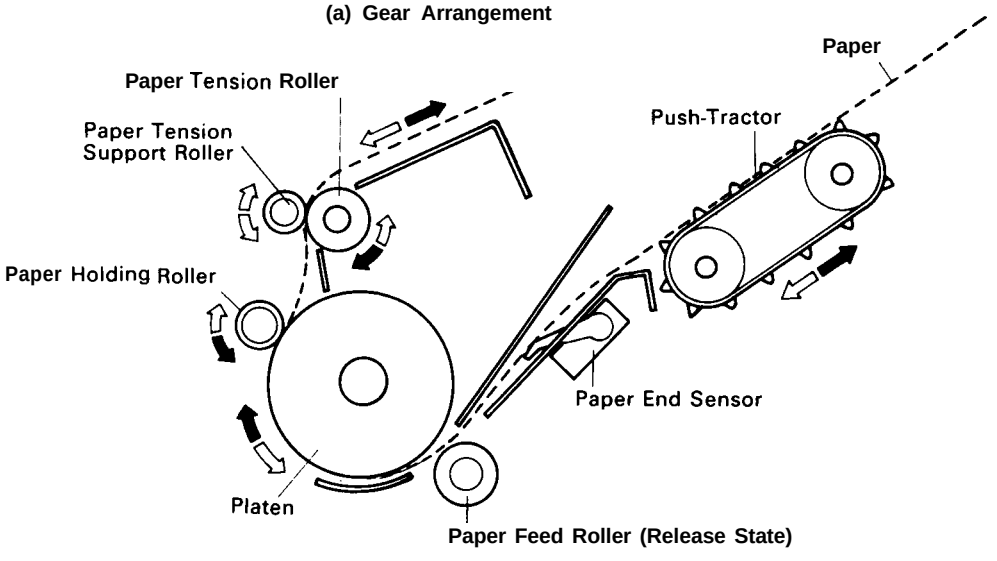
Paper feeding is performed by driving the paper feed motor with the paper release lever set forward to load fan-fold paper into the tractor unit. A paper tension unit is installed at the exit of the case to prevent irregular paper feeding and slackening.



(i) Side View

(ii) Top View

(a) Gear Arrangement

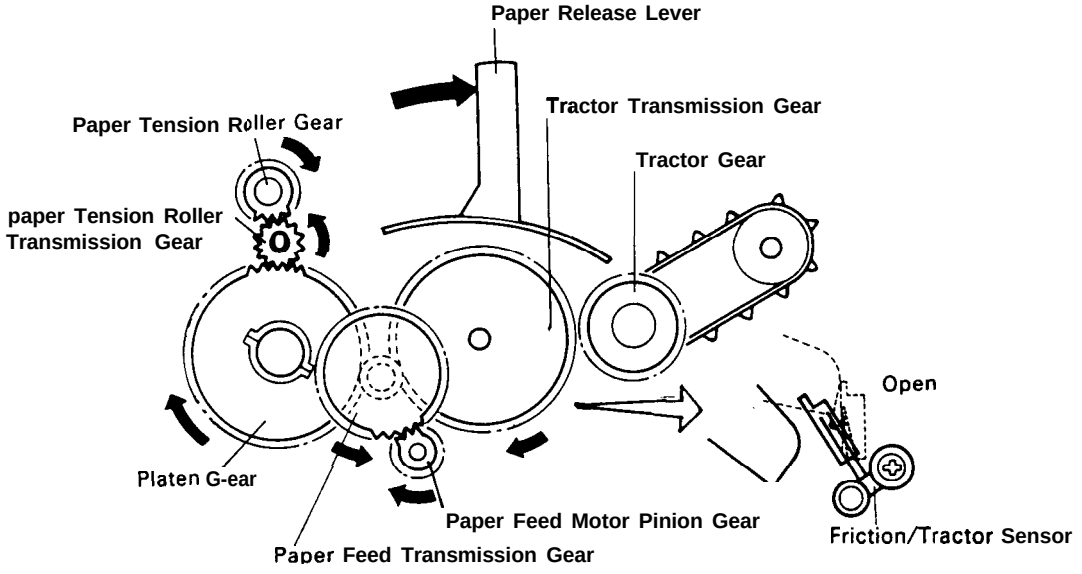


(b) Paper Path

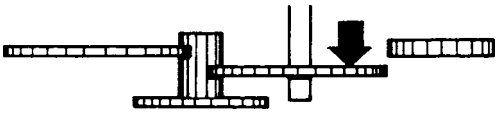
Fig. 2-6. Push Tractor Feeding Method

Friction Feeding Method (Figure 2-7)

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 with the platen and paper feed roller. As in the push tractor feed method, the paper tension unit is used to prevent paper feed problems.

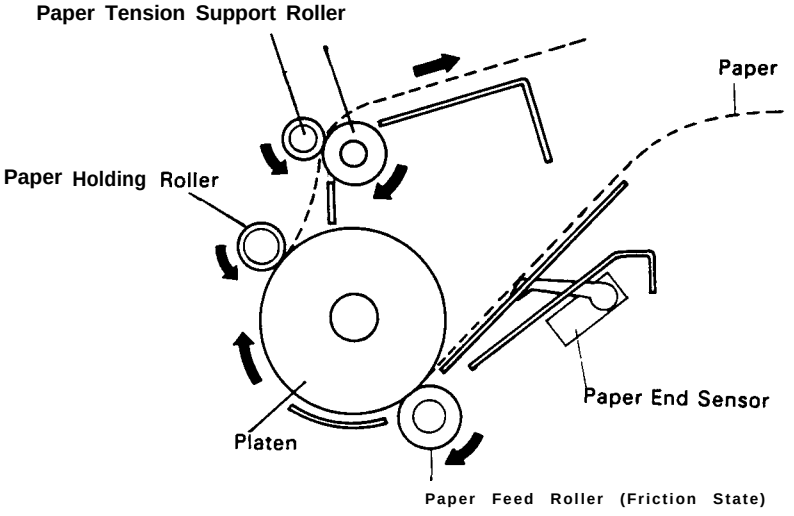


(i) Side View



(ii) Top View

(a) Gear Arrangement



(b) Platen Path

Fig. 2-7. Friction Feeding Method

2.2 POWER SUPPLY CIRCUIT OPERATION (MONPS/MONPSE board)

The DC voltages required to operate the mechanisms and control circuits are supplied from the supply board in this unit. There are two kinds of power supply boards, the MONPS board for 100 V or 120 V operation and the MONPSE board for 220 V or 240 V operation. Refer to Table 2-7.
Since the MONPS board has almost the same structure as the MONPSE board, this section will describe the MONPS board.

Table 2-7. Power Supply Voltages

Name	Input AC	Rated Fuse F1
MONPS	100 or 120	125V, 3. 15A
MONPSE	220 or 240	250V, T2A

2.2.1 MONPS/MONPSE Boards

The MONPS and MONPSE boards generate the DC voltages shown in Table 2-8 to supply the circuits and operate the mechanisms.

* Refer to Figure A-34 and Figure A-35 in the Appendix for the entire circuit of the MONPS and MONPSE boards.

Table 2-8. Voltages and Applications

Power Voltage (DC)	Application
+35V - Gp	(1) Carriage motor drive (2) Paper feed motor drive (3) Printhead solenoid drive (4) Plunger drive (5) Fan motor drive
+5V - GND	(1) MONMA board logic circuit power (2) Power for various sensors (3) Indicator lamps on the control panel power (4) Optional interface board power (5) Paper feed motor holding (6) Plunger holding (7) Optional cartridge power
Vx (+5V) - GND	(1) Reset circuit (2) Pull-up H 1 to H24 of IC 3A

NOTE: The voltage Vx is generated on the MONMA board. Refer to Section 2.3.1.1.

Figure 2-8 shows a block diagram of the power supply circuit. External noise on the AC line is first attenuated by the input filter circuit. Then the AC voltage is converted to DC by the full-wave rectifier, and is smoothed by the smoothing circuit.

The surge-suppression circuit suppresses surge current that flows when the power is turned on.

The main switching circuit is activated so that an induced electromotive force is developed from the primary side to the secondary side of the transformer due to inductive coupling. This voltage is delivered to the +35 V line (including + 5 V) and the ± 12 V line, and separately half wave rectified and smoothed. The + 5 V is generated by a switching regulator from the +35 VDC. The +35 V line includes constant voltage generation circuit and an over voltage protection circuit. The former regulates the +35 V line and the feed back to the main switching circuit, and the latter protects against malfunctions of the constant voltage generation circuit.

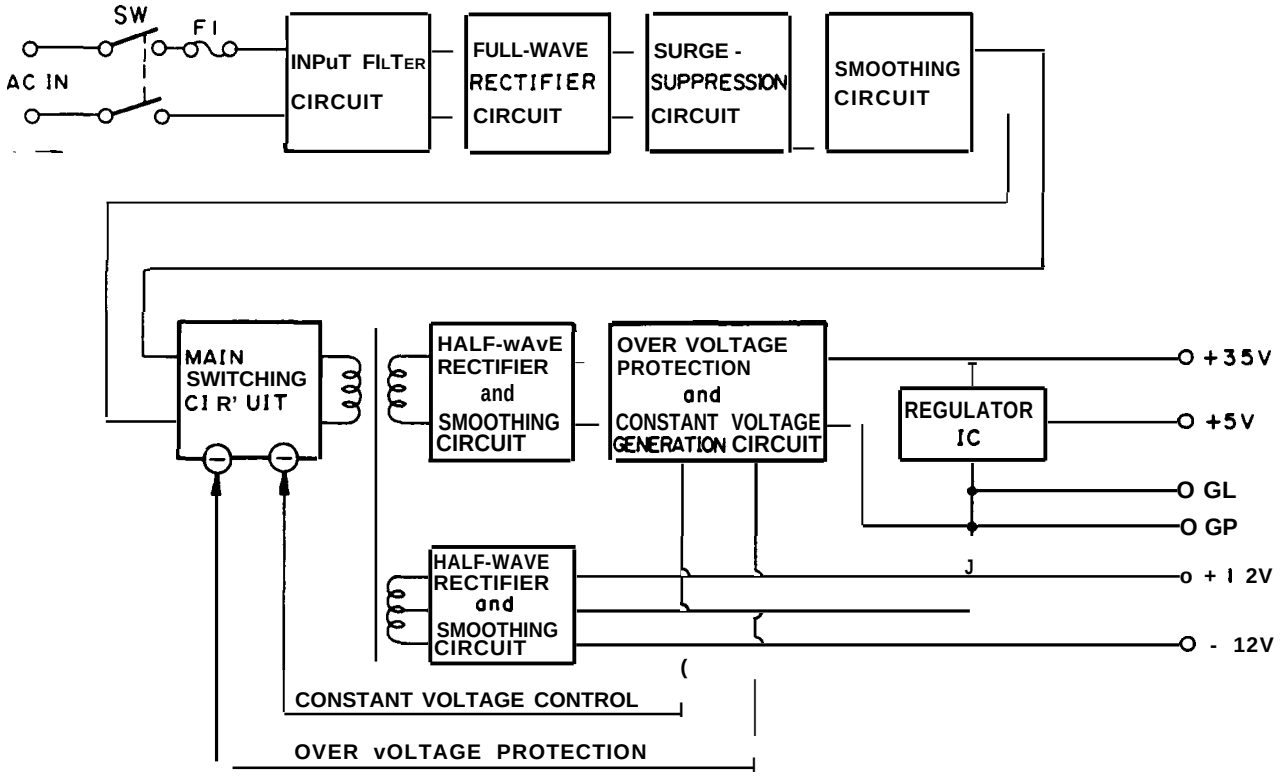


Fig. 2-8. MONPS/MONPSE Board Block Diagram

2.2.2 Input Filter Circuit

Figure 2-9 shows Input filter circuit. The filter circuit attenuates external noise and inhibits noise generated in the printer from going out over the AC line. The coils-and capacitors employed in this filter are able to handle fluctuations of the AC input line. Frame ground (F. G.) is connected between C4 and C5, which handle leakage current from the frame to the AC line.

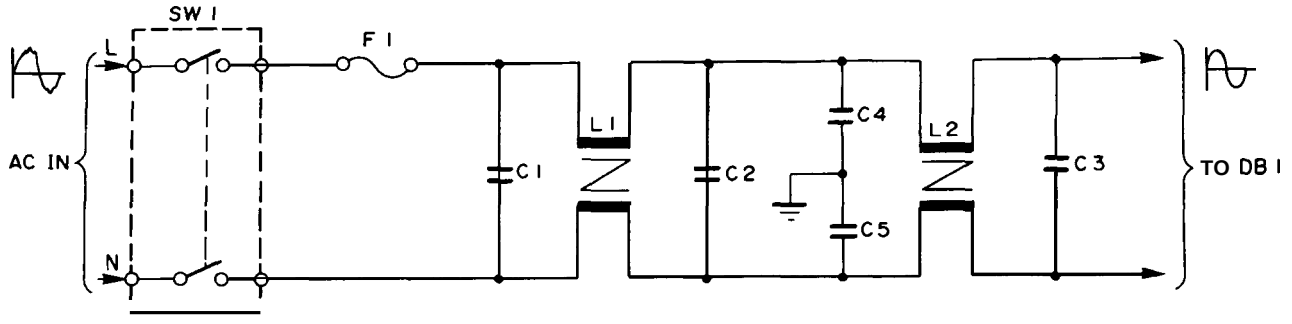


Fig. 2-9. Input Filter Circuit

2.2.3 Rectifier, Smoothing, and Surge-Suppression Circuit

As shown in Figure 2-10, the AC input voltage filtered by the input filter is full-wave rectified by diode bridge DB 1, and is smoothed by C6. The voltage across C6 is normally O V before the power is turned on. Therefore, the initial input current is shorted by C6 via DB 1 and a large charging current (called a surge current) flows when the power is turned on. Figure 2-11 shows the surge current.
The largest surge current flows if the power supply is turned on at the peak of the input voltage.

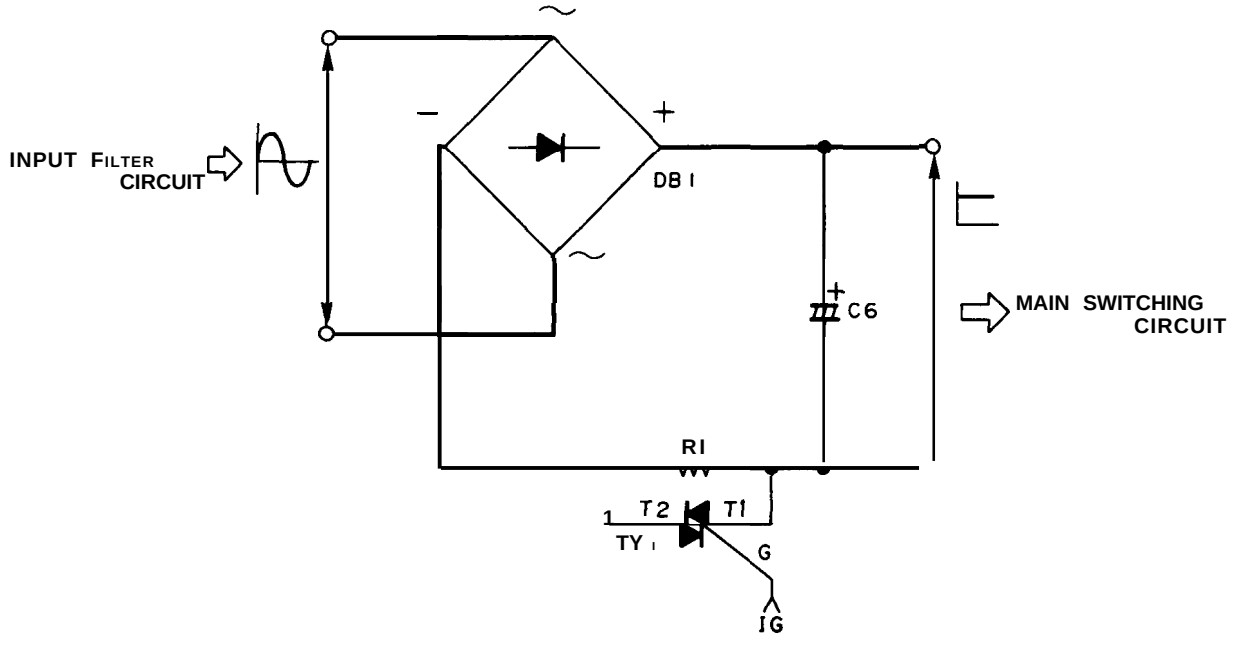


Fig. 2-10. Rectifier-Smoothing-Surge Suppression Circuit

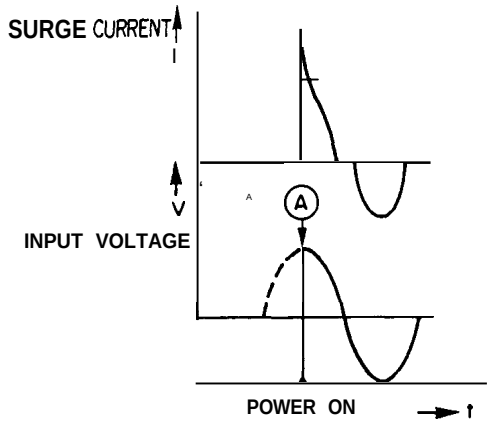


Fig. 2-11. Surge Current

The voltage across C6 increases after the power is applied, and the current is accordingly stabilized. Until the voltage across C6 becomes stable, the surge current is limited by a resistor in series with capacitor C6. When 120 VAC is applied, the voltage across C6 increases to about 160 VDC. In this circuit, the surge current is limited to around 23 A, based on the formula: 160 ÷ R 1 = 23.5 [A]. After C6 is fully charged, resistor R1 is shorted to keep its temperature low. The circuit includes TRIAC TY 1 for this purpose, which shorts T1 to T2 by passing current I_G to the gate. (When C6 is charged, power is applied to coil 14-12 of transformer T1 so that a voltage is induced in coil 9-10. When this voltage reaches 1.5 V, I_G flows to switch on TY 1.)

2.2.4 Main Switching Circuit

This circuit uses a ringing choke converter (RCC) AC input switching power circuit. This system has the merits of using fewer parts and a smaller transformer, and is often used when a smaller power supply is required.

2.2.4.1 Circuit Operation

Figure 2-12 shows the main switching circuit. When the power is applied, drive current Is flows to the base of switching transistor Q 1 via starting resistor R 14. Diodes D20, D21, D22 on the secondary side of T1 prevent current flow in the secondary side. Therefore, as shown in Figure 2-13, collector current I_L from Q1 reaches the same level of current which flows in the coils, and starts from O A so that a small base current can switch Q 1 on. Once Q 1 is turned on, the primary side of transformer coil $T_{14\text{-}12}$ receives an input voltage which induces voltages in windings $T_{11\text{-}8}$ and $T_{9\text{-}10}$ (represented by e_B and e_G respectively).

e_G releases current I_G in the direction which causes the gate of the TRIAC (Refer to 2.2.3.) to conduct, and e_B releases base current I_B in the direction which causes Q 1 to remain on. The value of I_B is constant as shown in the following formula: $I_B = \dfrac{(T_{11\text{-}8}/T_{14\text{-}12}) \cdot V_{IN} - (V_{D2} + V_{Q1BE})}{R4 + R5 \cdot (1 + h_{FE})}$

Therefore, when collector current $I_C (= I_L)$ increases as shown in Figure 2-14, the relationship between I_B and DC current amplification rate h_{FE} can be expressed by the formula, $h_{FE} \times I_B = I_C$, where I_B is fixed and h_{FE} is insufficient because of carrier saturation so Q 1 is turned off. As a result, the voltage at $T_{14\text{-}12}$ and $T_{11\text{-}8}$ drops and base current runs out, and Q 1 is quickly switched off.

When Q 1 is switched off, the back electromotive force which has the opposite polarity from the previous momentarily flows through the windings of the transformer. Since the amount of energy P [W] is equal to that stored in the transformer before Q 1 is turned off, P is:

$$P = \frac{1}{2} \cdot L_1 \cdot I_{LP}^2 = \frac{1}{2} L_1 \left(\frac{V_{IN}}{L_1} \cdot ton\right)^2 [W]$$

L_1: Liactance of $Coil_{14\text{-}12}$

I_{LP}: Peak current of I_L

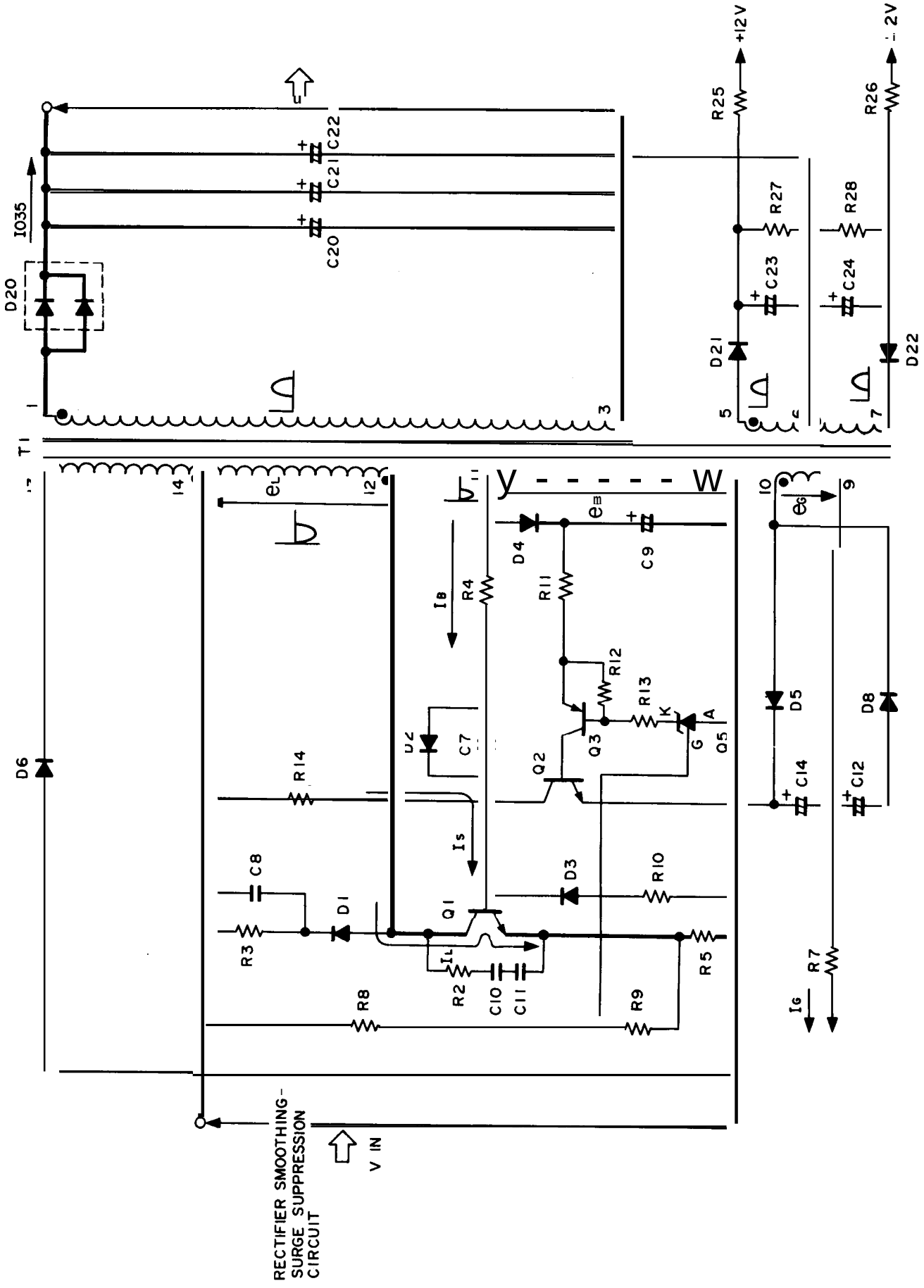


Fig. 2-12. Main Switching Circuit

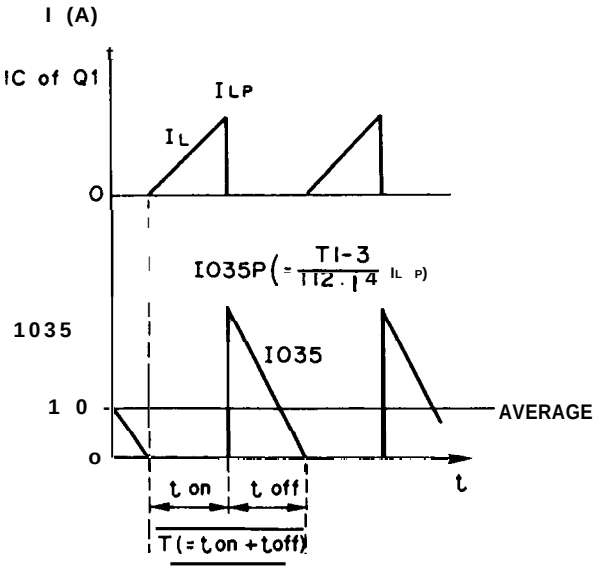


Fig. 2-13. Waveforms at Primary and Secondary Sides of T1

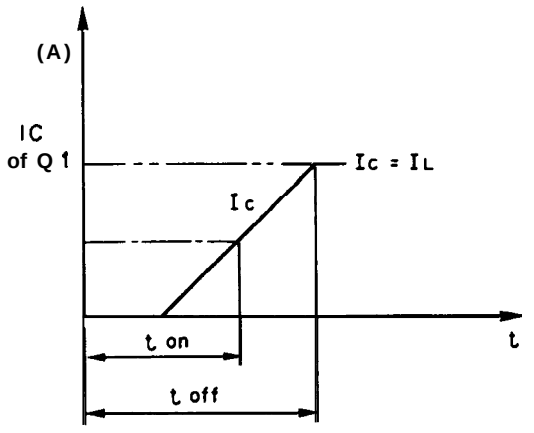


Fig. 2-14. RCC System Switching Operation

2.2.4.2 Surge Absorber

When switching transistor Q1 is turned off, a large opposite-polarity surge voltage is produced to amplify the collector voltage of Q 1. The power of this surge voltage is first stored by capacitor C8 via diode D 1, and converted into DC, then dissipated in resistor R3. This is called a snubber circuit.

When the switching transistor is turned off, the generated surge current flows through T_{14-12} and induces a back electromotive force in T_{11-8} as another surge current. This current amplifies the GND level of the main switching section and is applied to coil T_{13-12} via fry-wheel diode D6. At this time, the resistance of the input coil temporarily increases (T_{13-12}/T_{14-11}) so that the induced power in T_{11-8} accordingly goes up. Then the emitter voltage at Q3 exceeds the normal level and Q3 is turned on because the base of Q3 is stabilized by Q5.

Correspondingly, Q2 is also turned on to short the base of Q1 to main switching GND, and remains off until the surge voltage is dissipated through GND.

2.2.4.3 +35 V Line Output Voltage Limiting

The back electromotive described in 2.2.4.1 causes diode D20 on the secondary side of transformer T1 to conduct, which supplies power. Consequently, the amount of energy stored by the transformer during a unit period of time becomes equal to the power output. That is:

$P = \frac{1}{2} L_1 \left(\frac{V_{IN}}{L_1} t_{on}\right)^2 \times f \times Vo \times 10$ f: switching frequency of Q 1

ton: on-time of Q 1

The output voltage is detected by R22 and R23. In an AC input switching power circuit, the AC line and switching circuit are not isolated, but the transformer isolates the DC output (secondary side). Therefore, photo-coupler PC 1 is used to feedback the fluctuating output voltage to the switching circuit while still isolating it. Refer to Figure 2-15.

This circuit employs a programmable shunt regulator TL431 (Q20) as a constant voltage element to keep the output voltage (Vo) at 35 V. When Vo goes up, cathode current I_K in Q20 increases so that the photodiode receives more current. This action produces an increase in the collector current in the photo-transistor side which becomes a constant voltage signal for Q4, and then the current from T_{11-18} to the base of Q 1 is shorted to the O V line to turn off switching transistor Q 1. Consequently, the period of time that V_{IN} is applied to winding T_{14-12} on the primary side is cut down, and the voltage induced in winding T_{1-3} on the secondary side is reduced.

The switching circuit includes C26 between the cathode terminal and gate terminal for phase correction (of the amplifier in theTL431, in this case), and prevents an inductance element from entering the feed back loop and making it oscillate,

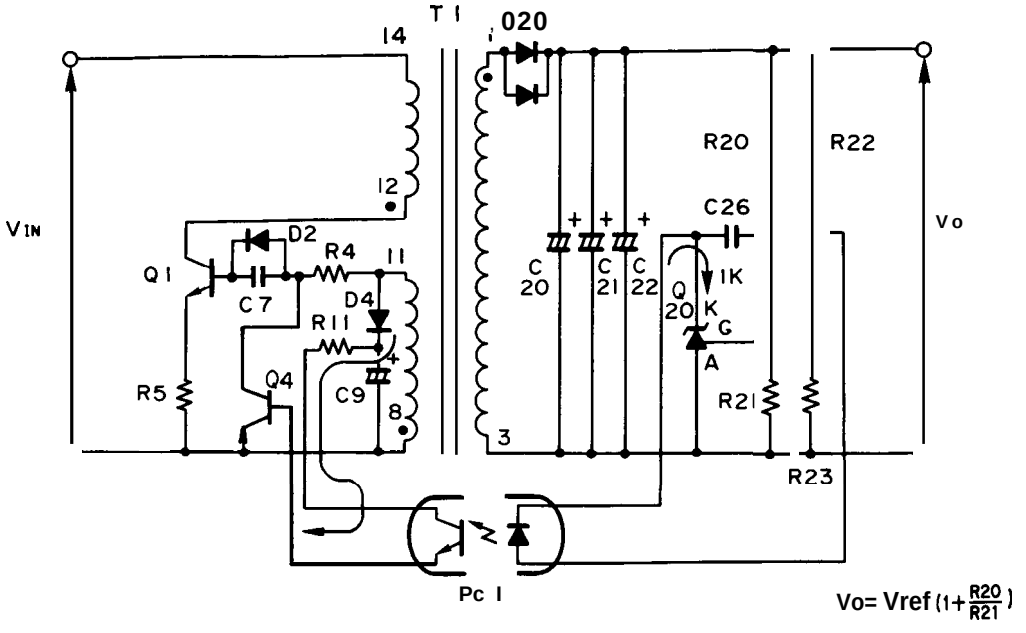


Fig. 2-15. Constant Voltage Generation Circuit

2.2.4.4 Over Voltage Protection Circuit

As described in 2.2.4.3, the power supply circuit of this unit not only uses the output voltage stabilizing circuit to stabilize the output voltage (Vo) and provide feedback to the switching circuit, but it also contains an over voltage protection circuit to protect against malfunctions of the constant voltage generation circuit.

Figure 2-16 shows the over voltage protection circuit.

If the output voltage stabilizing circuit malfunctions and the output voltage (Vo) goes over the limit:

$Vo > V_{ZD20} + V_{ZD21} \cdot 4\,0$ [V],

then the photodiode in PC2 receives current. Consequently, the gate of the thyristor (SCR : TY 1) on the receiver side conducts to pass the base current of Q 1 (I_B) to ground. Q 1 is cut off so that the potential at T_{14-12} reduces to O V and no voltage is induced in the secondary side winding T_{1-3}.

The power supply must be switched off to reset the protection circuit.

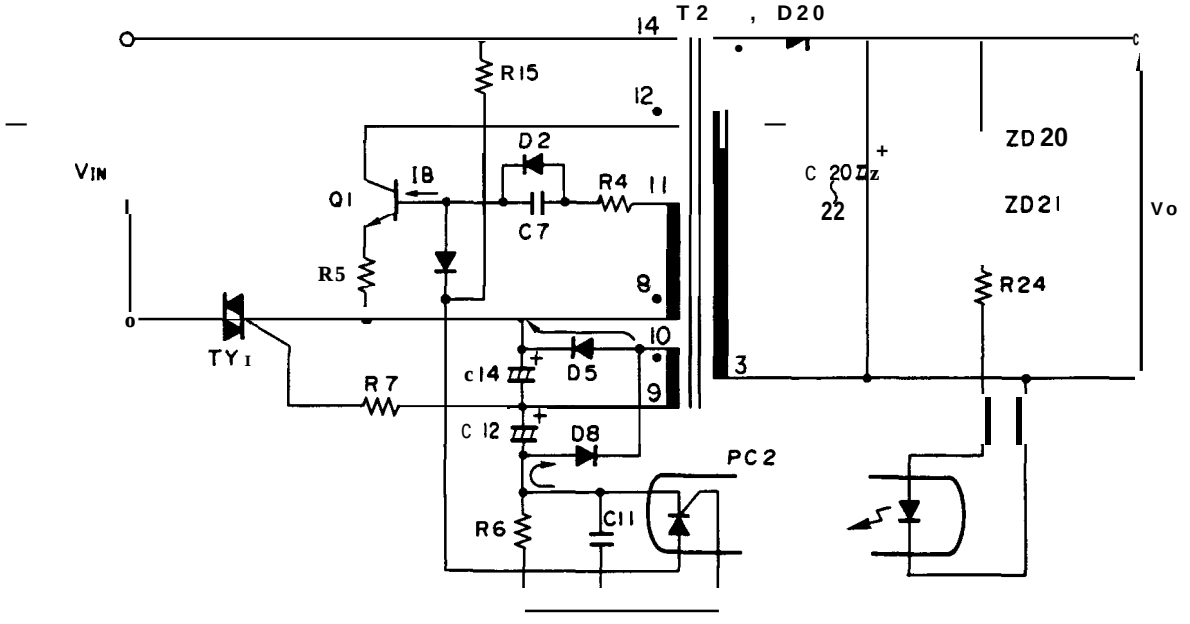


Fig. 2-16. Over Voltage Protection Circuit

2.2.5 +5 VDC Switching Regulator Circuit

Figure 2-17 shows the +5 VDC switching regulator. This circuit employs a hybrid type switching regulator IC STR20005 (IC20) which consists of a voltage regulator circuit along with coil L20 and capacitor C25 at the external output section.

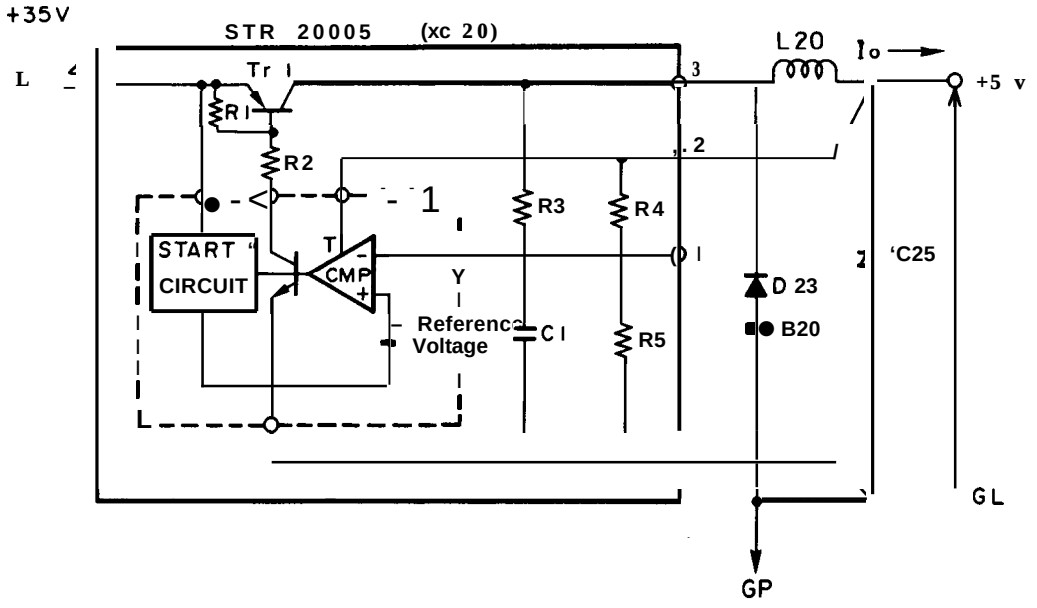


Fig. 2-17. +5 VDC Switching Regulator Circuit

2.2.5.1 Activation

When the +35 VDC rises, the start circuit of IC20 is activated, and a reference voltage is applied to the positive terminal of comparator CMP in IC20. Since the negative side of CMP still remains at O V at this time, the CMP output goes high, Tr 1 is turned on so that current flows from the emitter to the collector, and the + 5 V line turns on.

2.2.5.2 Voltage Regulator Circuit

Resistors R4 and R5 in IC20 regulate the +5 V output voltage. L20 and C25 compose a differentiation circuit and prevent noise and abnormal oscillation. The output voltage is fed back from 2 pin of IC20 and is delivered to R4 and R5 and then input to the negative side of CMP.

The voltage input to the negative side regulates the output voltage by controlling the on-time of Tr1. It is compared with the reference voltage, and if it is larger than +5 V, it switches on the CMP output so as to turn on Tr1. This operation is called Pulse Width Modulation (PWM) control.

Figure 2-18 shows the PWM sequence.

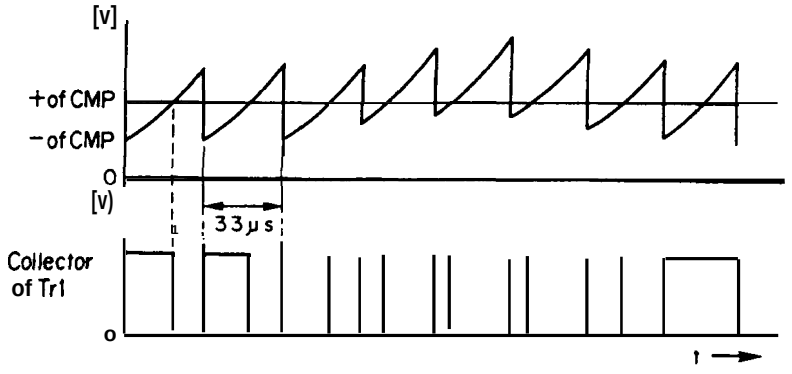


Fig. 2-18. CMP Input and Output Voltage Comparison

2.2.5.3 Soft Start

When power is supplied capacitor C 1, connected between the CMP negative side and GND, increases the Tr1 output at time constant R3 X C2 so that the on-time of Tr1 gradually becomes longer (Refer to Figure 2-1 9.). This circuit smoothes the rising of output voltage Vo and prevents overshoot.

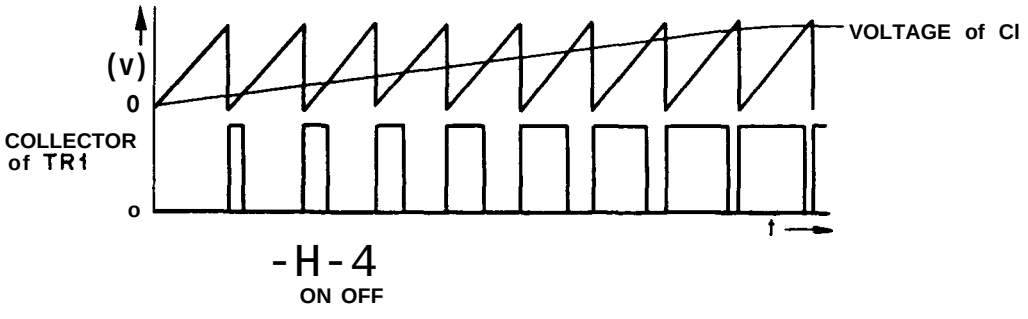


Fig. 2-19. Soft Start Timing

2.2.6 ±12 VDC Half-Wave Rectifier-Smoothing Circuit

The power from this circuit is mainly supplied to the RS-232C Interface on the optional interface board. Both the + 12 V and – 12 V lines have their own half-wave rectifier circuits. The smoothing circuits consist of capacitors C23 and C24, and include dummy resistors R27 and R28 which control the rise of voltage when the ± 12 V lines have no load, as well as current limiting resistors R25 and R28. (Refer to Figure 2-20.)

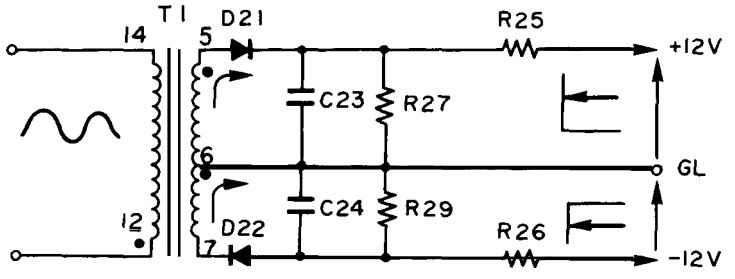


Fig. 2-20. Half-Wave Rectifier-Smoothing Circuit

2.3 CONTROL CIRCUIT (MONMA) BOARD OPERATION

This printer employs an 8-bit one-chip CPU (μPD78 10HG) with a clock frequency of 14.75 MHz as the main control device. It also employs an E05A01 LA gate array (10C) containing a memory I/O management circuit so as to extend the memory and I/O areas and simplify the CPU support circuitry. Figure 2-21 shows a block diagram of the control circuit.

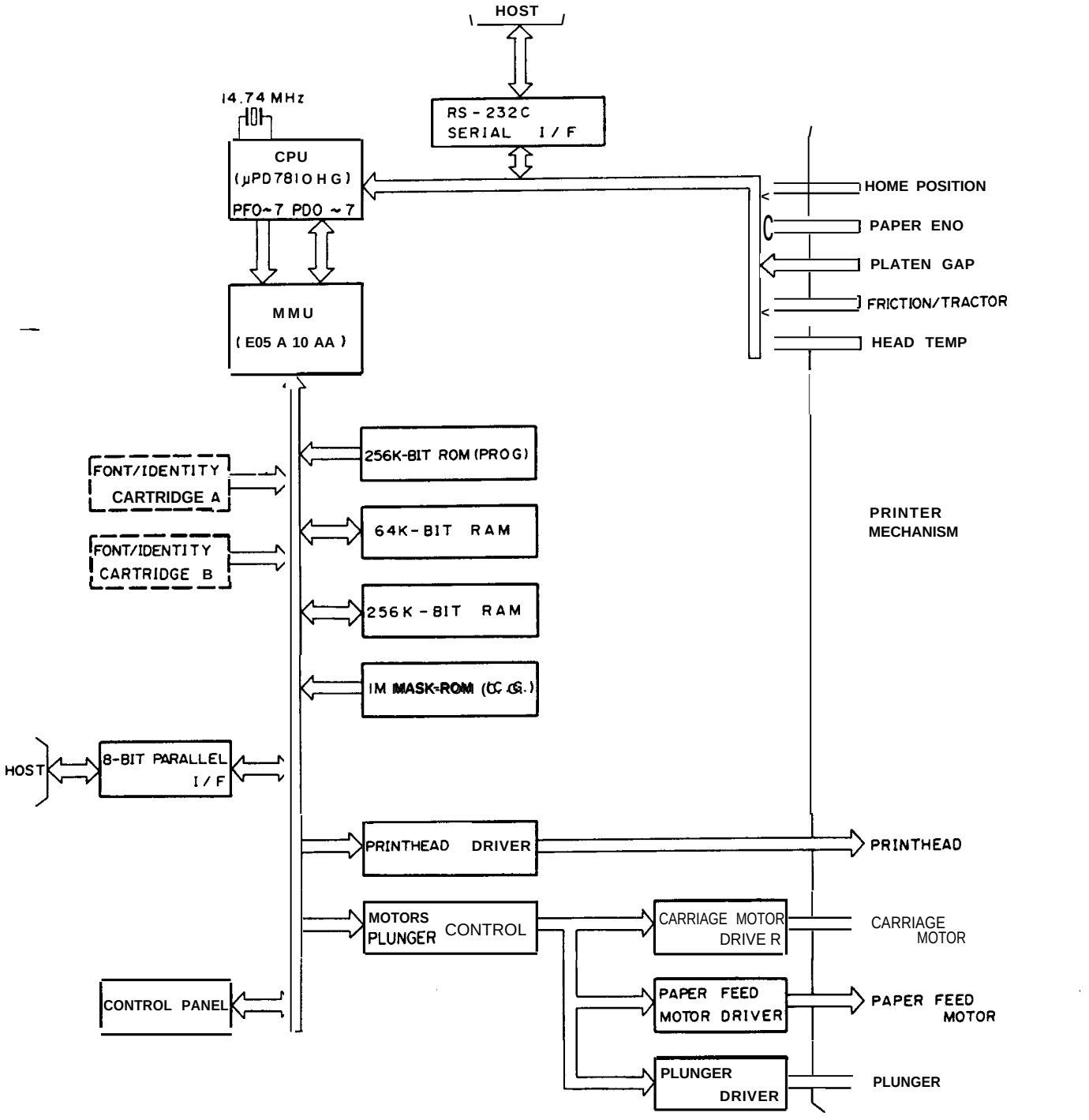


Fig. 2-21. MONMA Board Block Diagram

2.3.1 Reset Circuit

Figure 2-22 shows the reset circuit. After being input to gate array EO5A1OAA (MMU: 10C), the RESET signal resets the gate array and is then sent out to the other devices.

Hardware reset is performed when:

1. The printer power is turned on or off.
2. A low INIT signal is input from the host computer.
3. A cartridge is installed or removed with the power on.

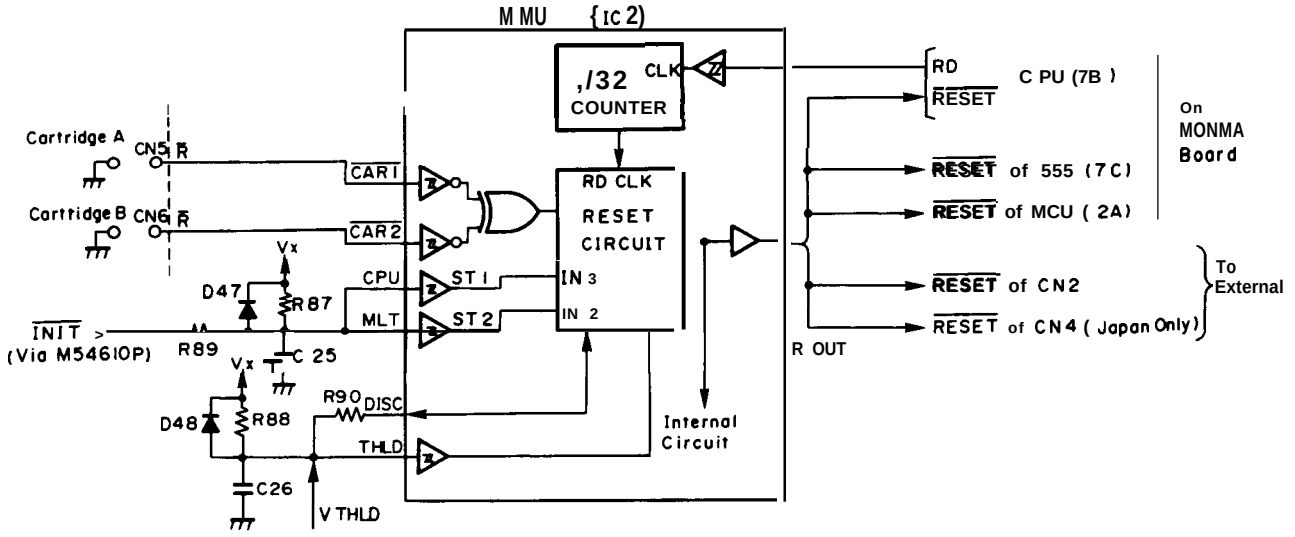


Fig. 2-22. Reset Circuit

2.3.1.1 Vx Voltage Supply Circuit

Power voltage Vx is supply to the power-on reset circuit and INIT reset circuit. It is also used to pull up the output of buzzer driver 6B and the head data control output port of G/A (3A).

Figure 2-23 shows the circuit diagram.

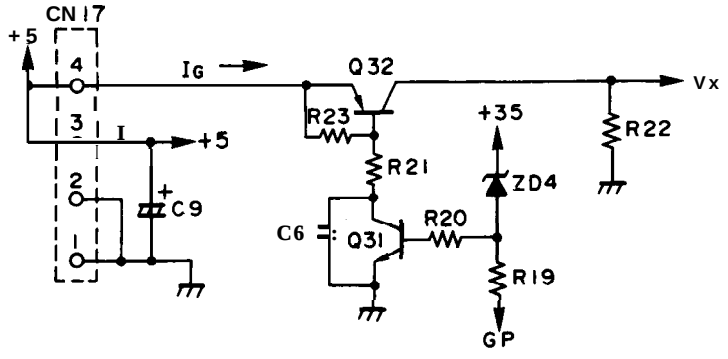


Fig.2-23. Vx Power Supply Circuit

After power is applied, the 35 V line reaches about 27.7 V, and then Q31 and Q32 are turned on so that current IG flows from the + 5 V line to the Vx line. Therefore, + 5 V is applied to the Vx line. (The resistance between the emitter and collector of Q32 is assumed to be O ohms.) If the +35 V line drops below 27.7 V, Q31 and Q32 are turned off so that the Vx line drops to O V. The IC is therefore reset and the printer stops printing.

2.3.1.2 Power ON/OFF

When the power is switched on and Vx rises, voltage is applied to the integration circuit (composed of R88, C26, D48). The voltage at C26 increases according to $V_{THLD} = Vx\ (1 - e^{-})$ and when V_{THLD} reaches Vp the output is switched from low to high (Schmitt trigger), and the reset circuit in the MMU sets the $\overline{ROUT}$ signal high (TR 1). The reset ($\overline{ROUT}$) signal is sent to the IC's on the MONMA board and to the outside via CN2 and CN4. D47 is a diode used to discharge C25.

When the power is switched off, the voltage at C26 decreases according to $V_{THLD} = Vx\ (e^{-\frac{t}{T}} - 1)$ and, when V_{THLD} reaches V_N the output is switched from high to low, and the reset circuit in the MMU sets the $\overline{ROUT}$ signal low.

Figure 2-24 shows the waveform for this operation.

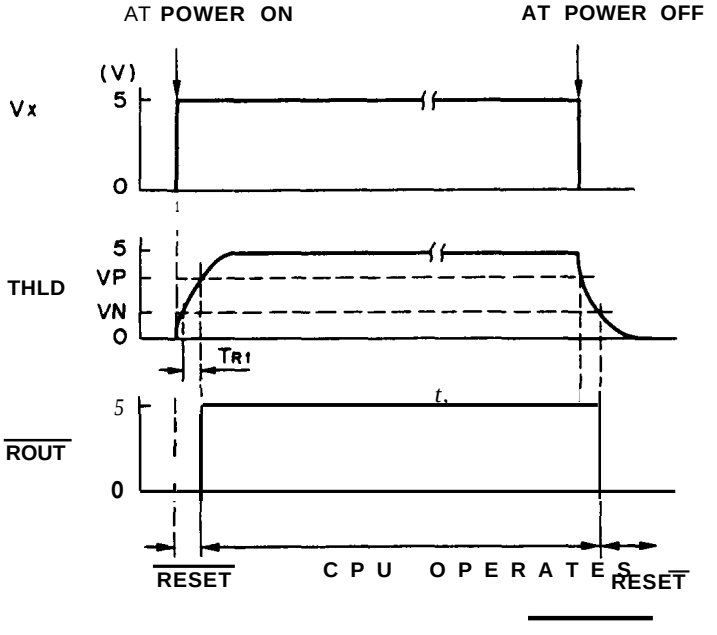


Fig. 2-24. Power ON Reset

2.3.1.3 INIT Signal Input from CN1 or CN2

When the I NIT signal is input from outside (it should be low for 50 μs or more), it reduces the voltage at the CPU and MLT terminals via the integration circuit (R89, C26, and D48), the M546 10P (5A), and R89. When the voltage at the MLT and CPU terminals reaches VN, the reset circuit (in the MMU) is activated to set the DISC signal low. When the DISC signal goes low, the ROUT signal subsequently goes low, and the voltage at the THLD terminal drops to VN (the pulse width should be: TR2 > INIT = low), and then the DISC signal goes high after the reset circuit is initialized. When the THLD terminal voltage increases to Vp, the ROUT signal goes high again. Figure 2-25 shows the timing of the signals during this operation.

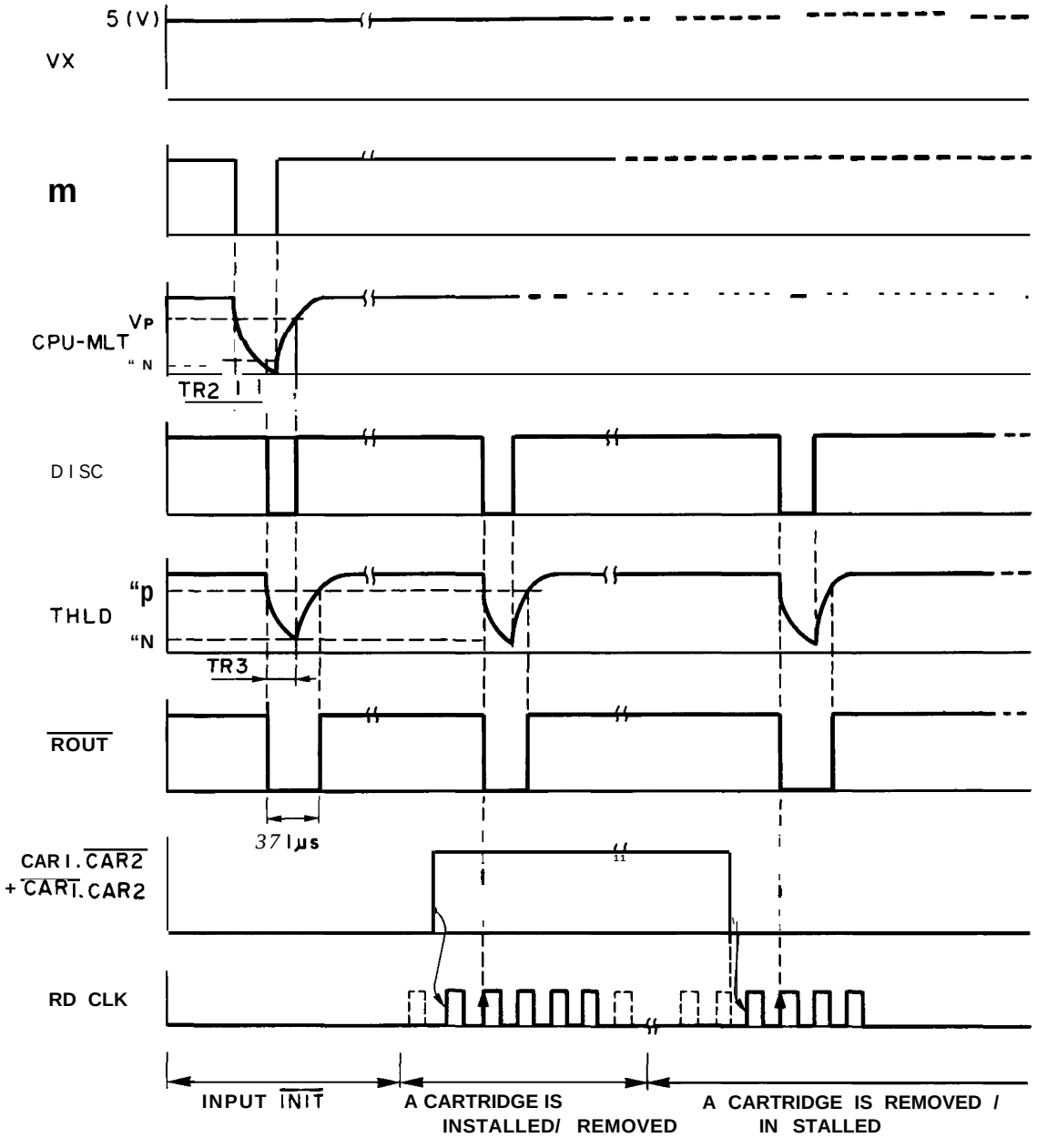


Fig. 2-25. INIT and A Cartridge Installed/Removed Reset Timing

2.3.1.4 Font/Identity Cartridge Installation and Removal

The font and identity cartridges should not be installed or removed while the power is on. If this is done, the $\overline{ROUT}$ signal must be set low to prevent a main board circuit malfunction.

After reset, the CPU starts execution from address 0000H and sends a RD signal to the external memory devices. The reset circuit in the MMU counts 32 $\overline{RD}$ pulses and then generates a RDCLK pulse.

When a cartridge is mounted or removed, the exclusive OR value of $\overline{CAR1}$ and $\overline{CAR2}$ 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 THLD voltage begins decreasing. When the THLD voltage drops to V_N, the DISC signal goes high and then it begins increasing. When it rises to Vp, the $\overline{ROUT}$ signal goes high and the CPU restarts from address 0000H. Figure 2-25 shows the timing of the signals during this operation.

Also, Table 2-9 shows the relationship between the input at $\overline{CAR1}$ and $\overline{CAR2}$ of MMU (10C) and the state of cartridge.

Table 2-9. State of Cartridge

— CN5 Side	CN6 Side	$\overline{CAR1}$	$\overline{CAR2}$	$\overline{ROUT}$
Stay	Mounting	L	H → L	⌐└⌐
	Removing		L→H	
Not stay	Mounting	H	H → L	
	Removing		L → H	
Mounting	Stay	H → L	L	
Removing		L → H		
Mounting	Not stay	H→L	H	
Removing		L→H		

2.3.1 .5" Static RAM (8A) Battery Backup Circuit

The memory static RAM (8A) employs a lithium battery (3.00 to 3.35 VDC) for backup, to maintain parameters and data when the power is turned off. Figure 2-26 shows the static RAM (8A) battery backup circuit.

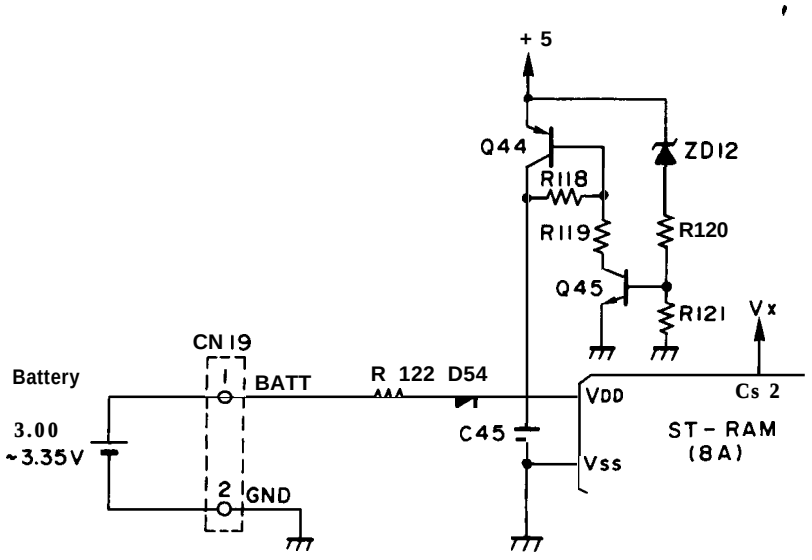


Fig. 2-26. Battery Backup Circuit

When the power is turned on under normal conditions, +5 V is applied to V_{DD} of the RAM and the CPU starts reading and writing. When the power is turned off, and the voltage on the + 5 V line decreases to about 3.3 V, transistors Q45 and Q44 are switched off and the voltage from the external lithium battery is applied to the V_{DD} terminal. The data in the static RAM is therefore maintained. Table 2-10 lists the static RAM conditions when the power is on or off.

Table 2-10. ST-RAM Conditions

Power	+5V Line	CS2	VDD [V]	ST-RAM mode
OFF	L	L	+3.0 - 3.3	Data holding
ON	H	H	+ 5	Normal

2.3.2 Interface

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

2.3.2.1 8-Bit Parallel Interface

Operating Principle

Figure 2-27 shows the 8-bit parallel interface data transmission timing. Data is transferred between a host computer and the printer using the following sequence:

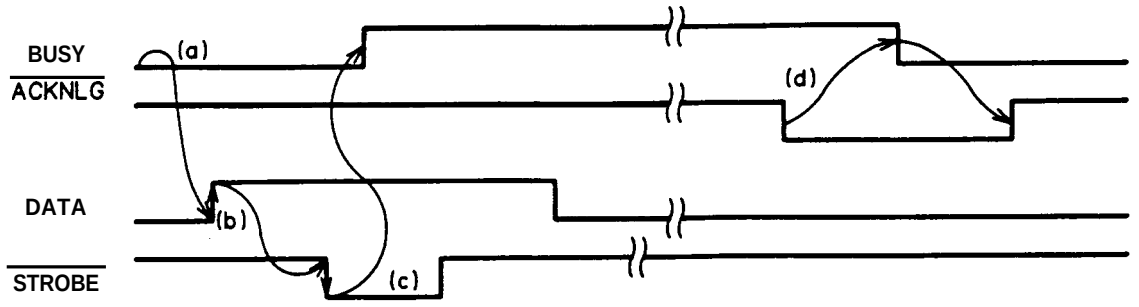


Fig. 2-27. Data Transmission Timing of 8-bit Parallel Interface

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 processing data. Therefore, the host computer does not transfer data until the BUSY signal changes from high to low. (Some host computers confirm the states of both the BUSY and $\overline{\text{ACKNLG}}$ signals, and others confirm the state of either the BUSY or $\overline{\text{ACKNLG}}$ signal.)**

b) **After the host computer has confirmed that the BUSY signal is low, it transmits data (8 bits per ward) in parallel on the data bus (D0-D7), and the printer reads the data at the falling edce of the $\overline{\text{STROBE}}$ pulse.**

c) **After receiving data from the host computer, the printer sets the BUSY signal high to inform the host computer that the printer is processing data and can not receive data.**

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

Operation

This circuit employs a general-purpose 8-bit parallel interface ICM546 10P (5A). Table 2-11 lists the pin assignments of the M546 10P.

Table 2-11. M5461OP Terminal Function

Pin No.	Name	Direction	Function
9	BUSY	→ Host	BUSY signal
11 ∫ 18	DIN8 ∫ DIN 1	+ Host	8-bit parallel data
19	STB	+ Host	$\overline{\text{STROBE}}$ pulse
20	Psw	← CPU	Output timing of the BUSY signal O: Positive edge of $\overline{\text{STROBE}}$ 1: Negative edge of $\overline{\text{STROBE}}$
6,21,35	GND	—	GND
22 ∫ 29	DOU1 ∫ DOU8	→ CPU	8-bit parallel data
30	RD	← CPU	$\overline{\text{READ}}$ pulse
31	WR	← CPU	$\overline{\text{WRITE}}$ pulse
32	CS	← G/A	$\overline{\text{Chip select}}$ signal
33	ACKI	← CPU	$\overline{\text{Acknowledge}}$ signal
34	BSSL	← CPU	BUSY select signal O: BUSY signal goes to LOW when ACKI goes to HIGH 1: BUSY signal goes to LOW when CS • WR goes to LOW
36	EBSY	← CPU	BUSY signal
37	BSYF	→ CPU	BUSY flug
38	RDY	—	Not used
42	Vcc	In	+ 5 V DC power
1	BI1	In	PE signal
8	BO1	out	$\overline{\text{PE LED}}$ to control panel
3	BI2	In	INIT from host
2	BO2	out	INIT to reset circuit
5	BI3	In	READY signal
40	BO3	out	$\overline{\text{RY LED}}$ to control panel
38	$\overline{\text{BI4}}$	In	$\overline{\text{PE}}$ from CPU
7	BO4	out	PE to host
41	BI5	In	ERROR from CPU
4	BO5	out	$\overline{\text{ERROR}}$ to host

The 8-bit parallel interface circuit is shown in Figure 2-28. External data on DIN 1-8 is input at the falling edge of the STROBE signal and a data exchange is performed by sending the ACKNLG and BUSY signals from the IC to the external device.
Control signals EBSY, WR, RD, and ACKI are input from the CPU and cause the IC to output either DOU1 through DOU8, or a BUSY signal. Figure 2-29 shows the sequence for these signals and Figure 2-30 shows the interface timing.
Table 2-12 lists the control signals between the printer and the host computer.

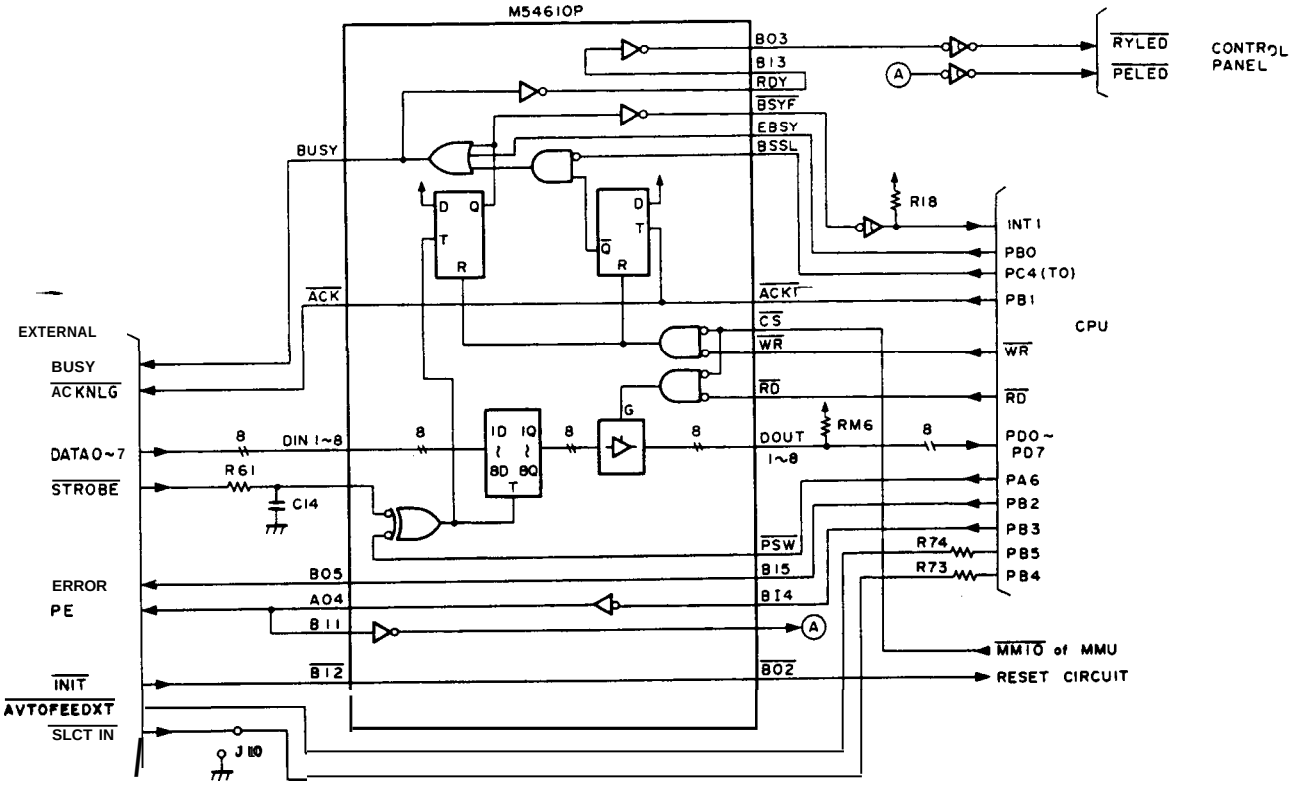


Fig.2-28. 8-Bit Parallel Interface Circuit

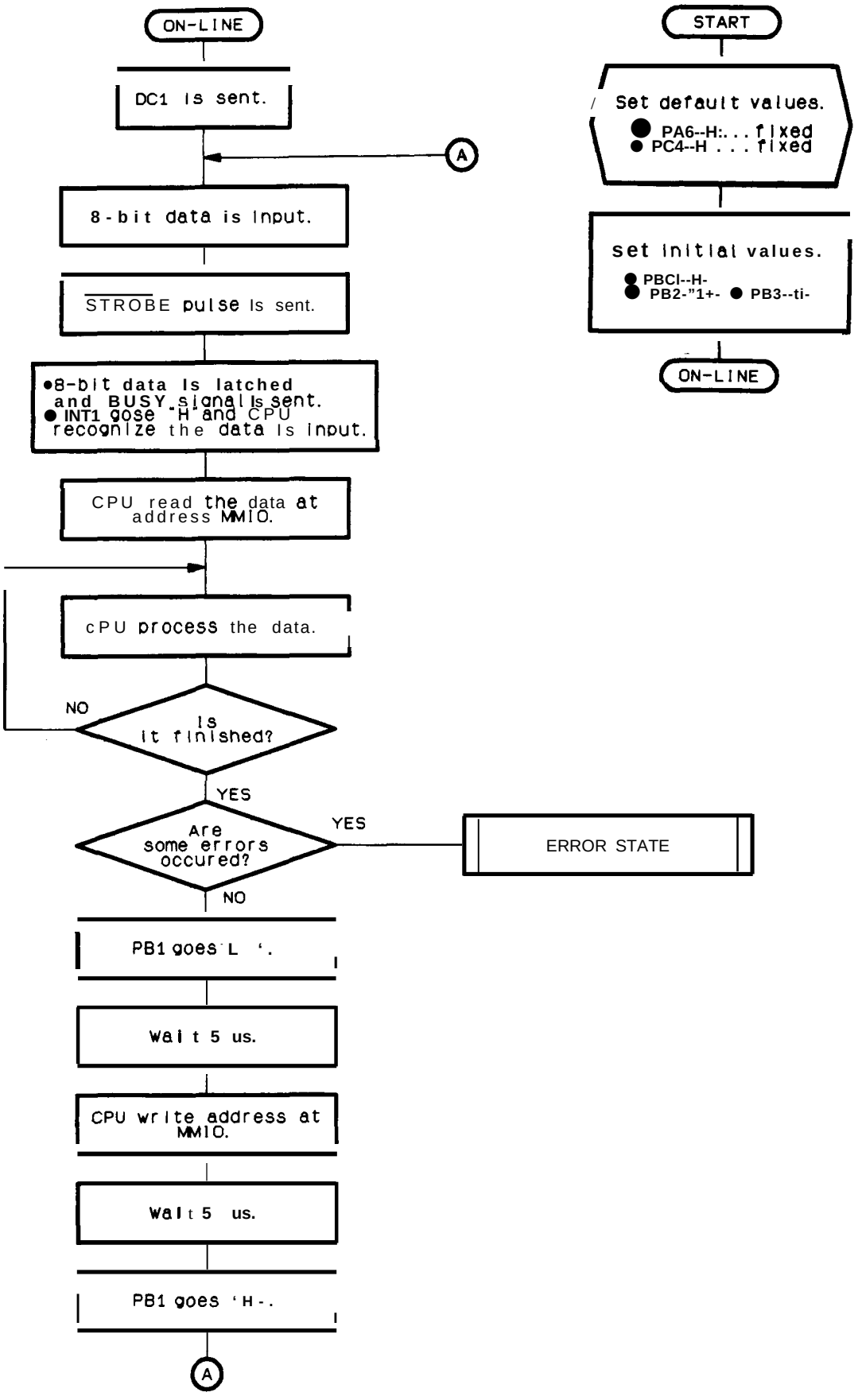


Fig. 2-29. 8-Bit Parallel Interface Circuit Operation

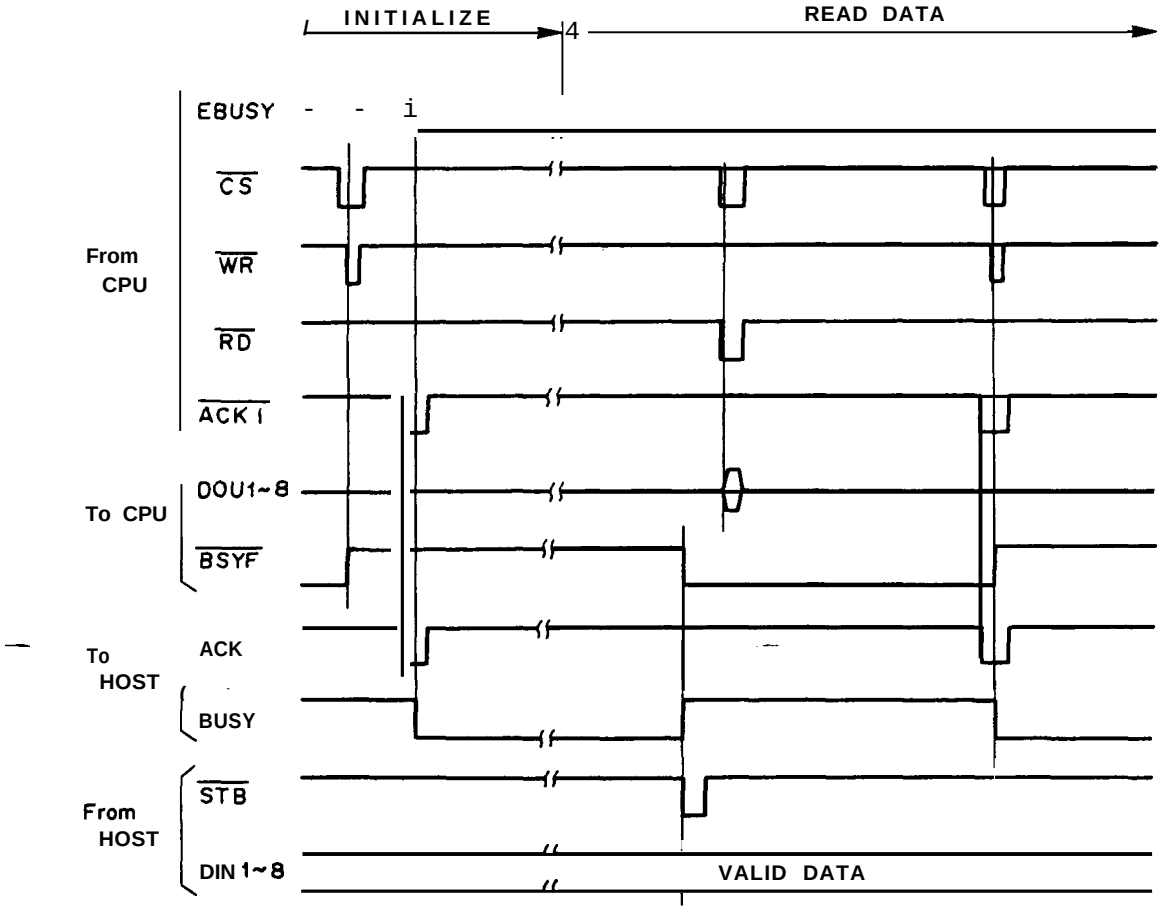


Fig. 2-30. 8-Bit Parallel Interface Signal Timing

Table 2-12. Relationship 8-Bit Parallel I/F Signals

READY/$\overline{\text{ERROR}}$	PE	BUSY	PRINTER	HOST acknowledge:
H	Disable	When $\overline{\text{STROBE}}$ pulse is sent from host, then goes high.	ON-LINE	READY
L	L	H	OFF-LINE Error is occured. (About error condition, refer to section 1.8.)	NOT READY
	H		OFF-LINE Paper end is occured.	PAPER END

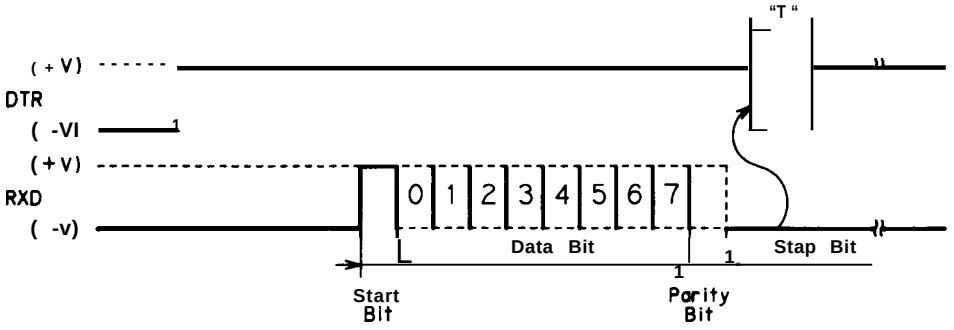
2.3.2.2 RC-232C Serial Interface

Operating Principle

The two handshaking methods are as follows:

a) status flug . . . 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 printer is in an error state or when the vacant area of the input buffer reaches 256 byte or less. In this way, handshaking with the host is accomplished by setting the status flug to either SPACE or MARK using the DTR signal. (Refer to Figure 2-3 1.)



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

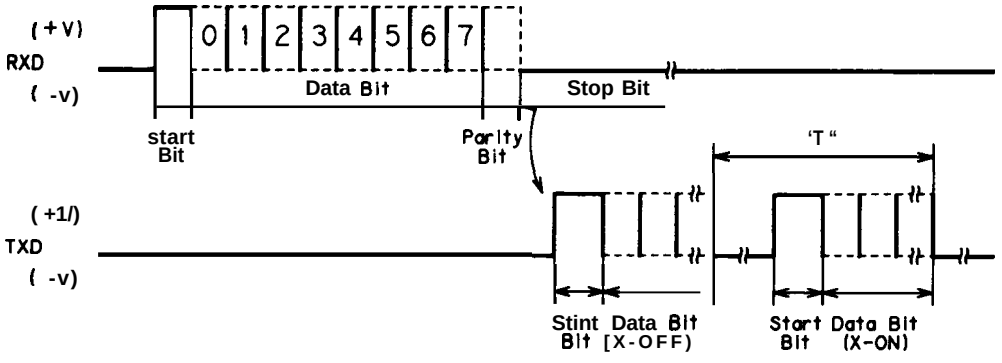
2. The word structure of serial data is:

1 start bit + 8 data bits + parity (Odd, Even, or none) + 1 or more stop bit.

Fig. 2-31. Handshaking with DTR Signal

b) X-ON/X-OFF protocol . . . Sent on the TXD line

Handshaking is accomplished by sending either X-ON (11 H) or X-OFF(13H) over the TXD line to the host. When the printer can accept data, the printer send a X-ON code, the printer becomes busy, then send a X-OFF code to the host computer. The X-OFF code is sent to the host when the vacant area of the printer input buffer reaches 256 byte or less, or when the printer is in an error state (Refer to Figure 2-32.).



NOTES: 1. The value of "T" veries 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 bit.

Fig. 2-32. Handshaking with X-ON/X-OFF Protocol

Circuit Description

Figure 2-33 shows the RS-232C serial interface circuit. Data transmitted from the host computer is converted from EIA to TTL voltage levels by the RS-232C line driver 75189 (9 B). The converted data is sent to CPU via buffer (6 B). On the contrary, data transmitted from the CPU is sent to 75188 (9A), converted from TTL to EIA voltage levels, and is transmitted to the host computer.

The sequence for the serial interface operation is shown in Figure 2-34, and that for handshaking in Figure 2-35.

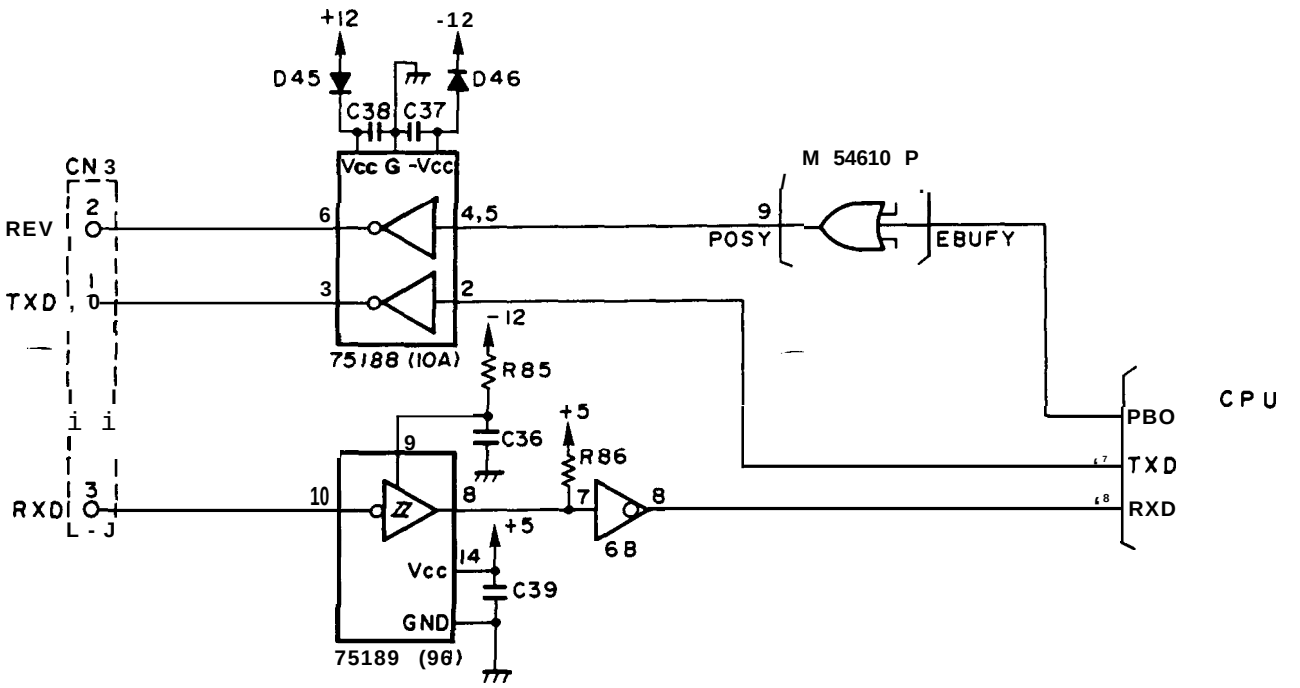


Fig.2-33. RS-232C Serial Interface Circuit

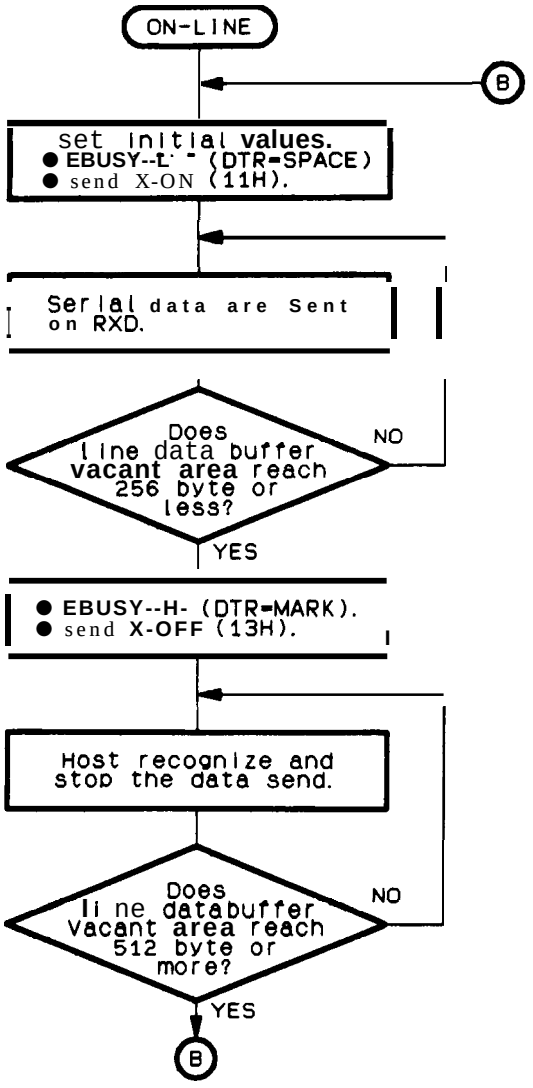


Fig. 2-34. RS-232C Serial Interface Circuit Operation

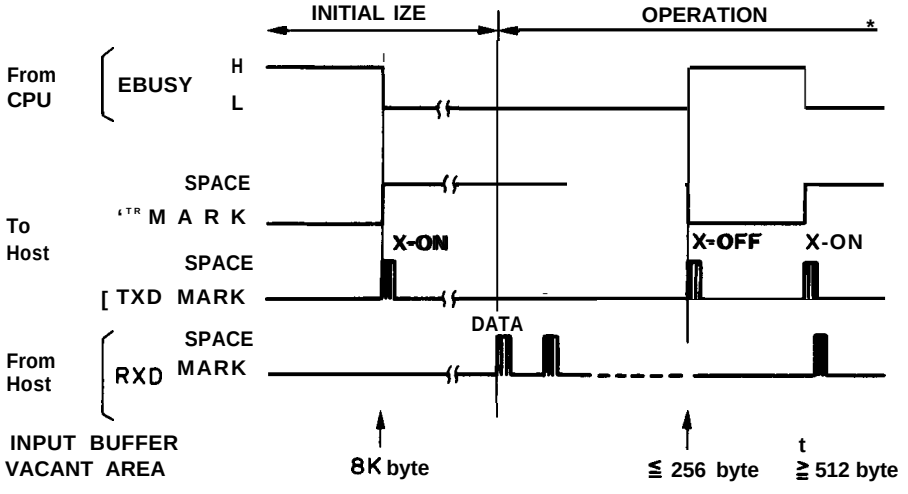


Fig. 2-35. RS-232C Data Transmission Timing

2.3.3 Control Panel Interface Circuit

Figure 2-36 shows the main board control panel circuit. The seven switches, 15 LEDs, and one buzzer are installed on the control panel. The firmware periodically reads the state of the switches. The conditions at which the switch states are read are listed in Table 2-13. If the firmware detects a value different from the previous one, the value is reloaded. This value is stored in the memory as parallel data and shifted into the IC M5837 as serial data uisng the timing shown in Figure 2-37.

A block diagram of shift register IC MSM5837 is shown in Figure 2-38.

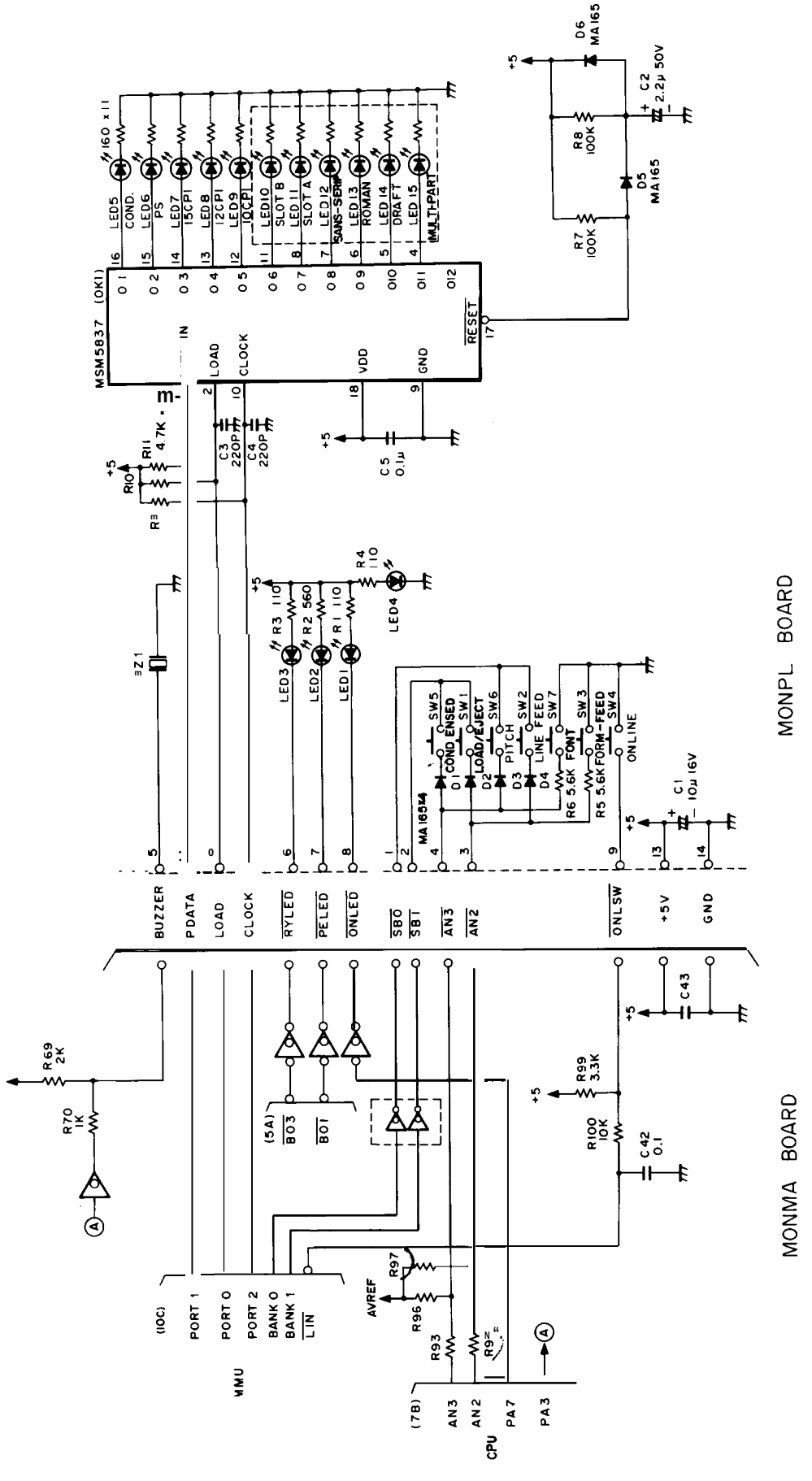


Fig. 2-36. Relationship Between MONMA Board and MONPL Board

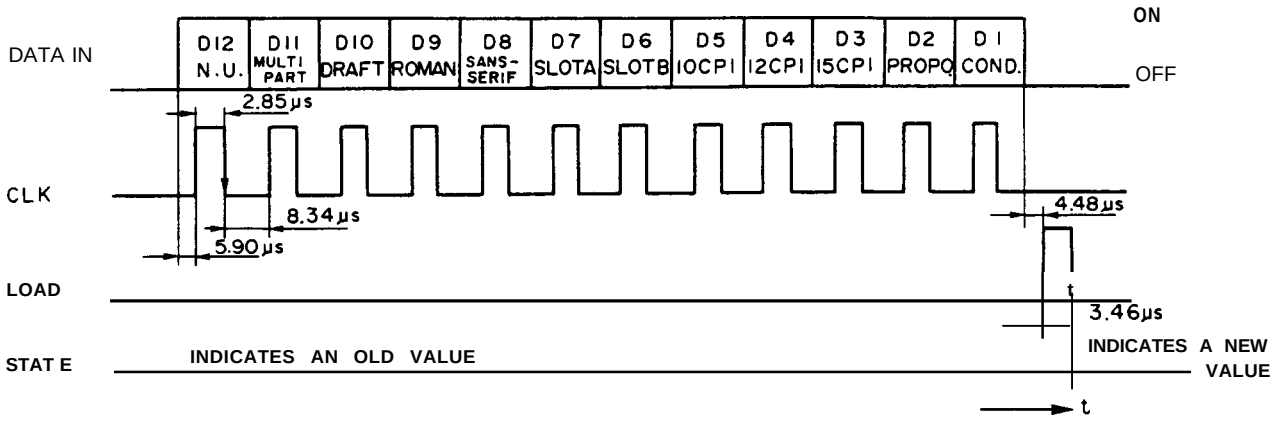


Fig. 2-37. MSM5837 Data Transfer Timing

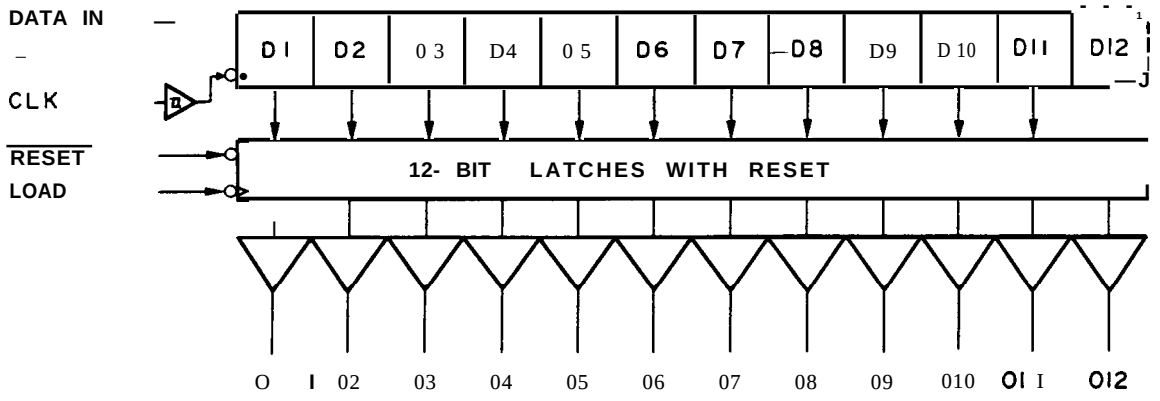


Fig. 2-38. MSM5837 Block Diagram

Table 2-13. CPU/MMU Board Switch Reading

MMU (IOC)			SB1	SB0	AN3	AN2	THLD [V]	Switch	At ON [v]	At OFF [v]
BANK2	BANK1	BANK0								
o	0	1	1	0	R	x	2.25	PITCH	1.4	4.7
0	0	1	1	0	R	x	4.16	FONT	2.96	4.7
0	1	0	0	1	R	x	2.25	CONDENSED	1.4	4.7
0	1	0	0	1	X	R	4.16	FF	2.96	4.7
0	0	1	1	0	x	R	2.25	LF	1.4	4.7
0	1	0	0	1	x	R	4.16	LOAD/EJECT	2.96	4.7

2.3.4 CPU Address Mapping

Figure 2-39 shows a block diagram of the CPU, gate arrays and memories. Since all of the memory cannot be situated within the address space of the CPU (0000H to FFFFH) (O to 65535 D), the CPU addressing is extended by bank switching using the MMU (Memory Management Unit) IC 10C. Figure 2-40 shows the address assignments.

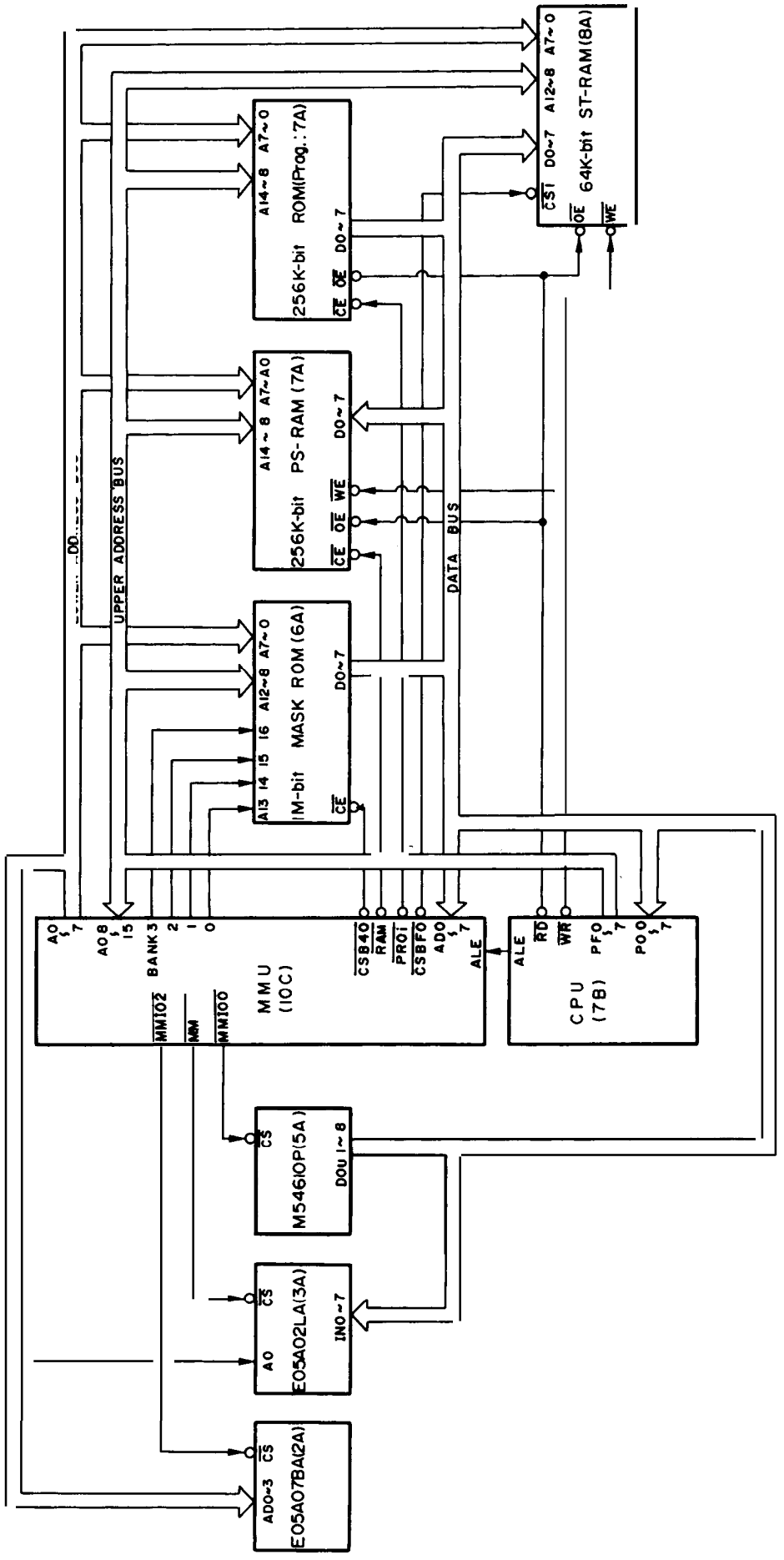


Fig. 2-39. CPU·Gate Arrays"Memories Block Diagram

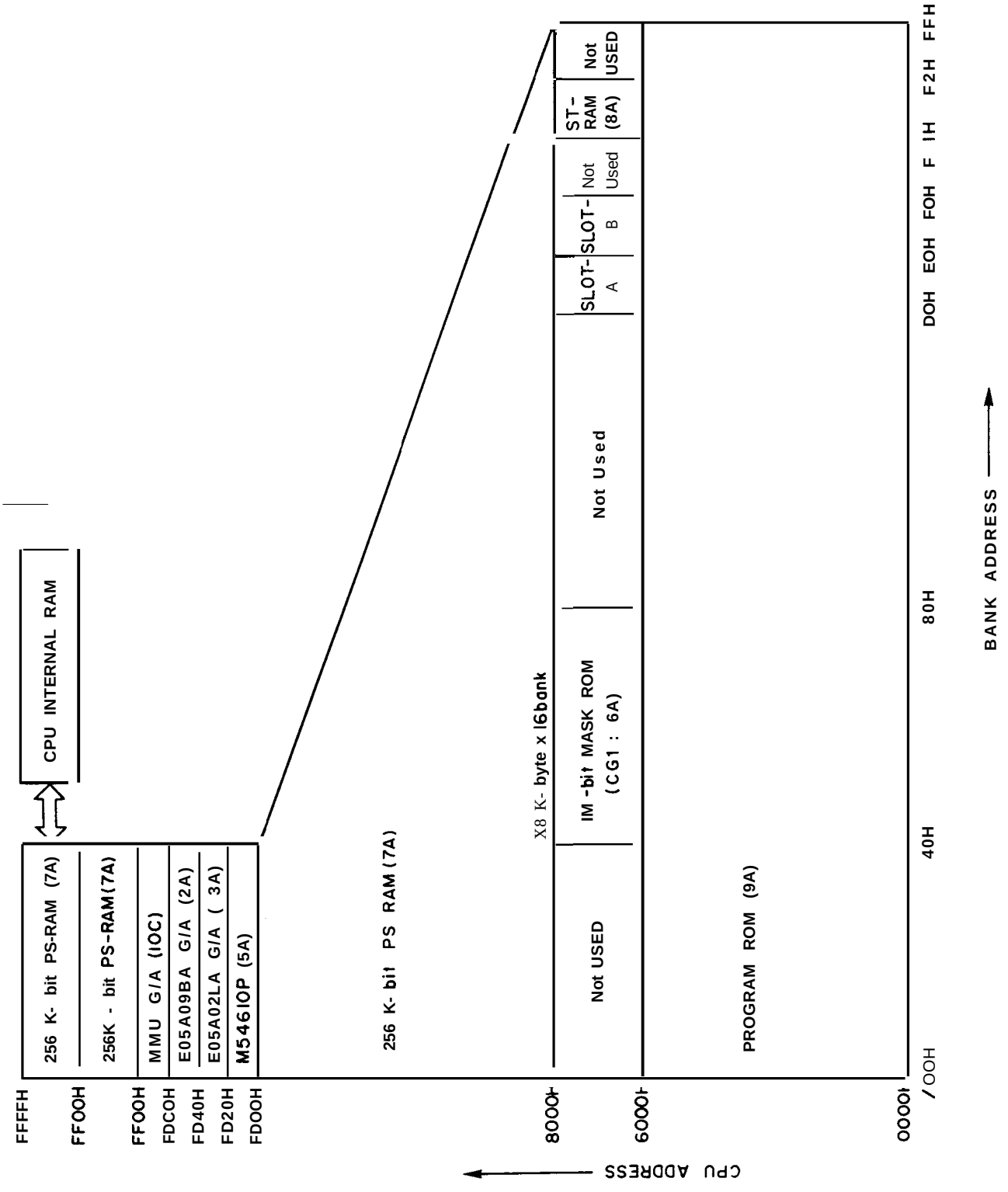


Fig. 2-40. IC Address Location Map

2.3.5 Status Monitoring Circuits

The state of each sensor and switch associated with the printer mechanism is detected by the A/D converter (ports AN0-7) of the CPU. The detected value (analog data) input to each port is converted to 8-bit digital data and is compared with a reference value by the firmware. The detected signals are shown in Table 2-14.

Table 2-14. CPU Analog Ports Function

Analog port	Name	Description	
		At operation (monitoring)	At initialization (reading)
AN0	TEMP	Printhead temperature	—
AN1	VOLT	+35V DC power line voltage	—
AN2	AN2	Switches status on the control panel	DIP SW 1-5
AN3	AN3	Switches status on the control panel	DIP SW 1-6
AN4	AN4	—	DIP SWs 1-3, 1-8, 2-2, 2-6
AN5	AN5	—	DIP SW 1-4, 2-3, 2-7, 2-8
AN6	AN6	—	DIP SW 1-1, 1-7, 2-4 VR2 value
AN7	AN7	—	DIP SW 1-2, 2-1, 2-5 VR3 value
AV_{CC}	5.0V DC	Power for the A/D converter	
AV_{SS}	—	GND for the A/D converter	
AV_{REF}	4.75V DC	Reference voltage for the A/D converter	

2.3.5.1 Reference Voltage Generation Circuit

Figure 2-41 shows the generation circuit for reference voltage V_{AREF} (4.75 VDC) used in the A/D converter in the CPU. This circuit employs a programmable shunt regulator TL431 (CY 1) for the reference voltage supply.

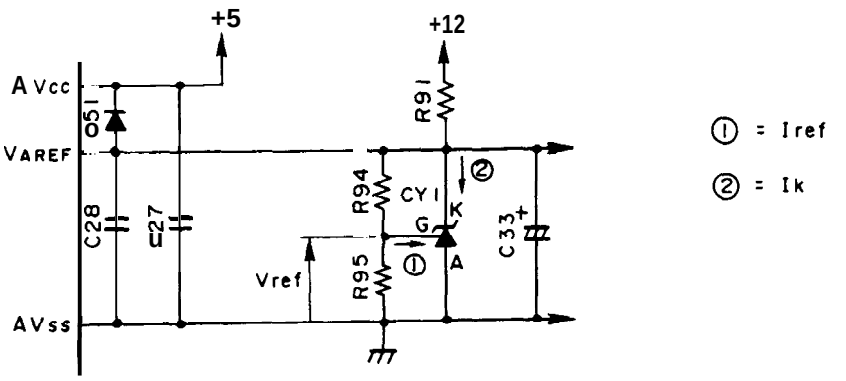


Fig. 2-41. Reference Voltage Generation Circuit

Reference voltage V_{AREF} depends on the combination of resistors R95 and R94 connected in parallel to TL431 .

$$V_{AREF} = Vref\left(1 + \frac{R94}{R95}\right) + Iref \cdot R94 = 4.75\ [V]$$

$$\therefore Iref = 2\ [\mu A]$$

$$Vref = 2.495\ [V]$$

Using the above formula, Varef is stabilized at about 4.75 V.

2.3.5.2 Printhead Temperature Monitoring Circuit

Figure 2-42 is the printhead temperature monitoring circuit. This circuit detects the printhead temperature using a thermistor included the printhead.

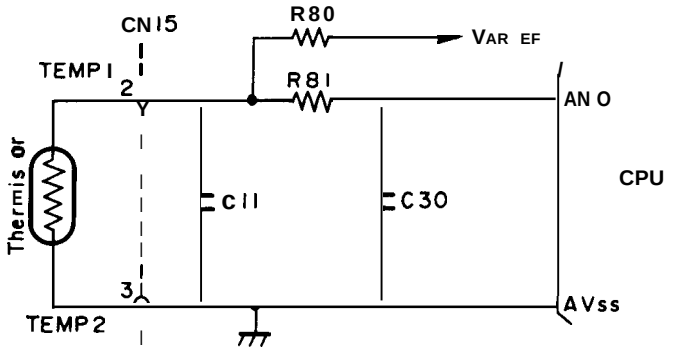


Fig. 2-42. Printhead Temperature Monitoring Circuit

The temperature of the printhead rises as the high duty cycle printing continues. To prevent damage to printhead, the printer operates as shown in Figure 2-43.

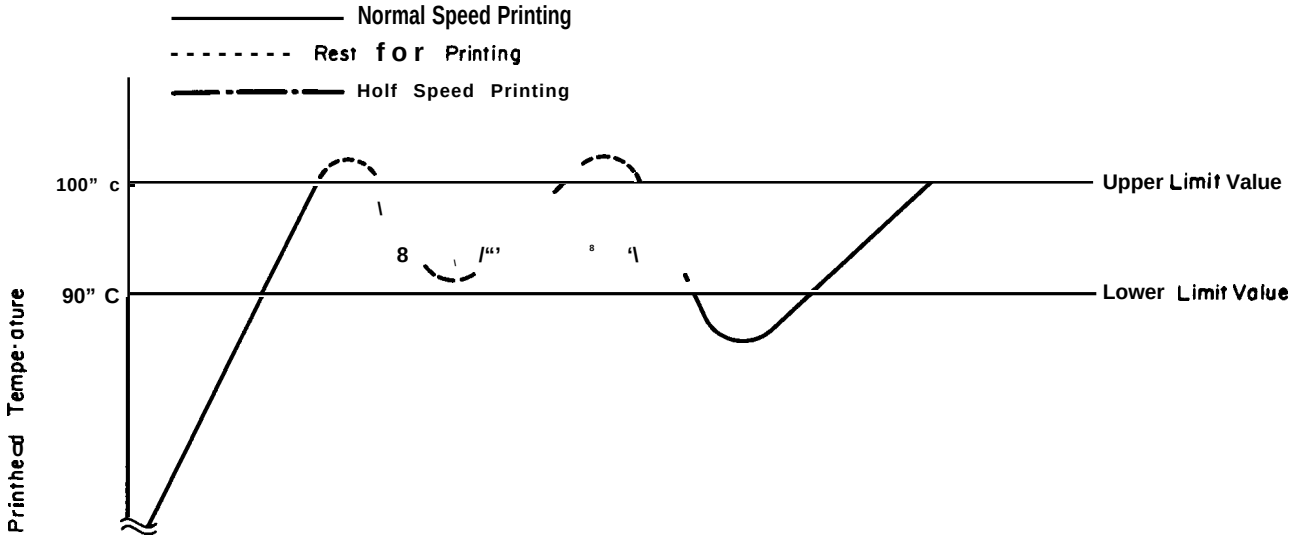


Fig. 2-43. Relationship of the Printhead and Printing

If the thermistor in the printhead temperature exceeds the upper limit value (1 OO"C), printing is automatically stopped, but the carriage motion is continued to help cool down the printhead. At this time, the ON-LINE LED is blinking to indicate that printing is suspended.

Then, the printing starts again at half-speed untill the printhead temperature drops to lower limit value (90 "C) or less.

If the printhead temperature decreasing from the lower limit value, the printing speed is returned to normal speed automatically.

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

Table 2-15 shows the relationship between head temperature at limit values and voltages at AN0 of the CPU.

Table 2-15. Relationship Limit Value and Voltage

	Temperature ["C]	Voltage at AN0 [V]
Upper Limit	100	0.82
Lower Limit	90	1.01

2.3.5.3 +35V DC Line Voltage Monitoring Circuit

As shown in Figure 2-44, this circuit detects voltage fluctuation in the +35V DC power supply line. Detected voltage is divided by R82 and R83, and the voltage at point Ⓐ is input to AN 1 of the CPU.

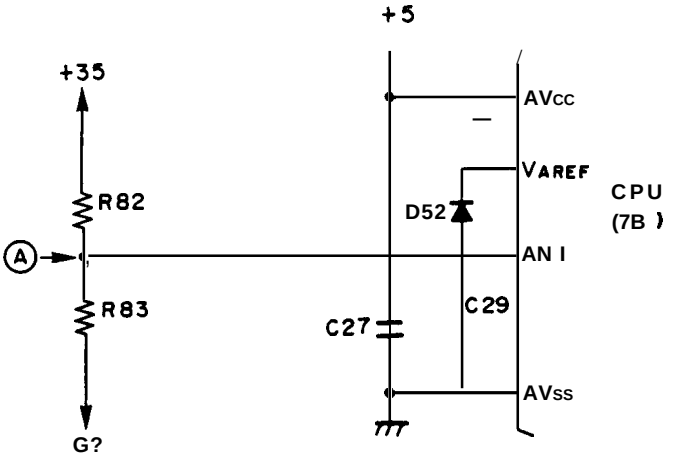


Fig. 244. +35V DC Line Voltage Monitoring Circuit

In Figure 2-45 and Table 2-16, if the +35V DC line drops to +3 1.7V or less during high-duty cycle printing, the printer is protected as follows:

1. Printing is performed at normal speed.
2. If the +35V DC line voltage drops to 31.7V or less, the printing is stopped (no-load state).
3. The voltage is checked IOms after printing is suspended. If the voltage is higher than 31.7V, the remainder of the printing line is printed at half-speed.

NOTE: If the voltage is not to higher than 3 1.7V again, printer changes to OFF-LINE status.

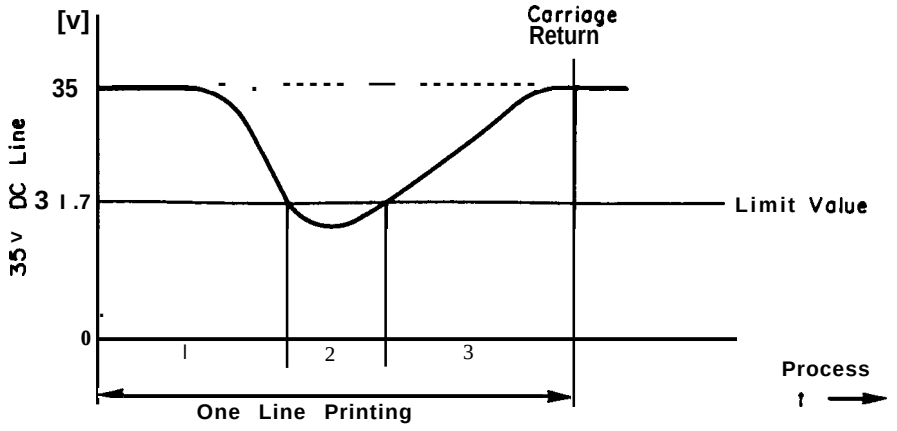


Fig. 2-45. +35V DC Line Voltage Compensation Sequence

Table 2-16. Relationship Between +35V Line and AN1

	+35V Line [V]	AN1 [V]
Normal	35	3.9
Lower limit	31.7	3.6

2.3.5.4 DIP Switch Read Circuit

DIP switch settings are read using analog ports AN2 through 7 after the power is applied or the INIT input initializes the CPU. Figure 2-46 shows the circuit diagram.

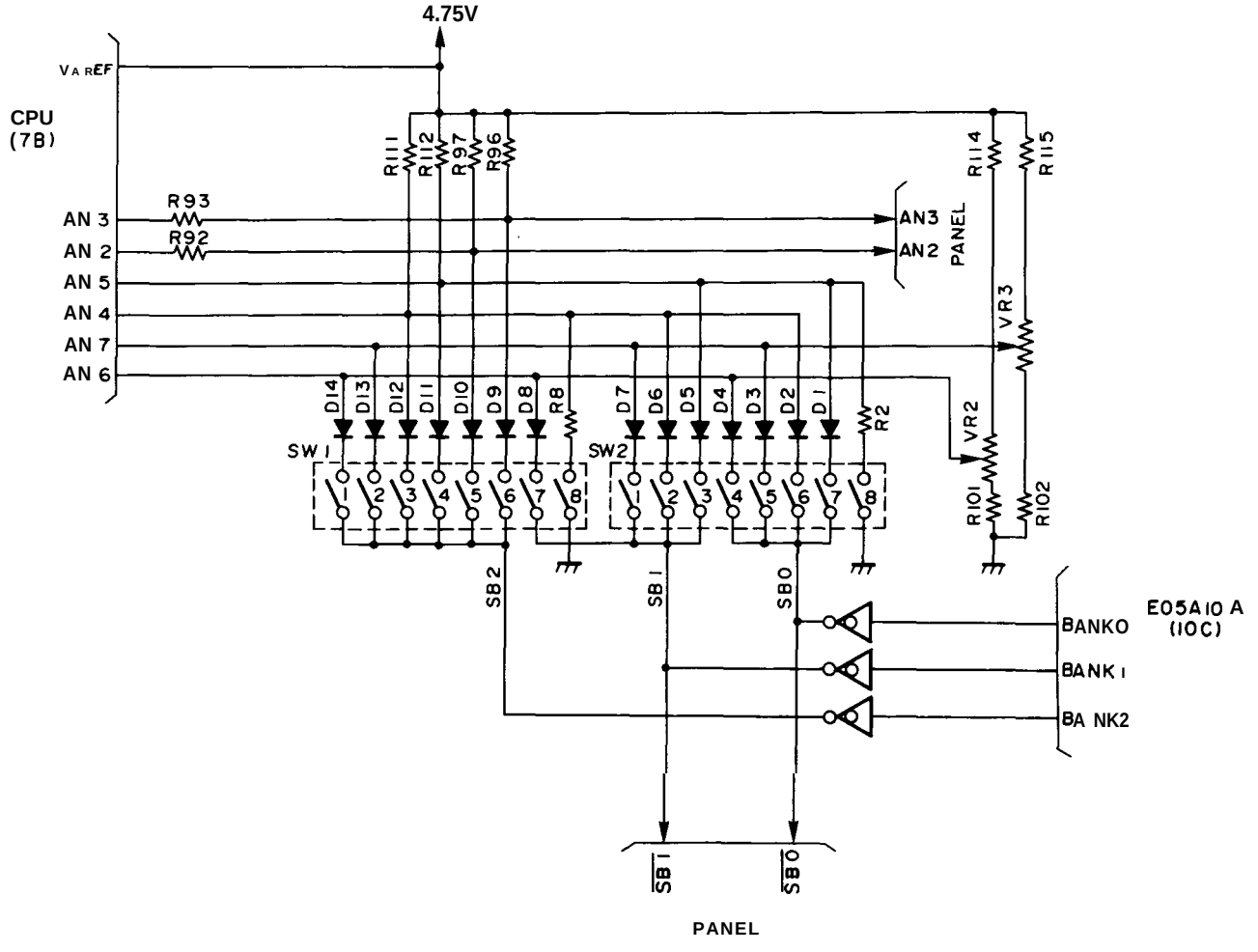


Fig. 2-46. DIP Switch Read Circuit

DIP switches SW 1-1 through 1-8 and SW 2-1 through 2-8 are read by selecting them using the three bank signals BANK 0,1, and 2 of the E05A1 OAA gate array (10C). Table 2-17 lists the BANK signals and analog ports.

Table 2-17. BANK Signals and Analog Ports

BANK			Read Switch						Threshold Voltage (Refer to Table 2-18.)
2	1	0	AN7	AN6	AN5	AN4	AN3	AN2	
L	L	L	-	-	2-8	1-8	-	-	①
L	L	H	2-5	2-4	2-7	2-6	-	-	②
L	H	L	2-1	1-7	2-3	2-2	-	-	
H	L	L	1-2	1-1	1-4	1-3	1-6	1-5	

Table 2-18. Threshold Levels for DIP Switch Reading

Port	Depend on	Voltage [V]		Threshold [V]	
		Max.	Min.	①	②
AN2 AN3	SB0·SB1= high	4.75	4.75		1.90
AN4	SW 2-8	4.75	3.00	3.95	
AN5	SW 1-8				
AN6	VR2	4.58	2.00		1.40
AN7	VR3				

The DIP switch settings read via the CPU analog port are stored in the firmware table and used as the firmware default values.

2.3.6 Carriage and Paper Feed Motors Control Circuit

This printer employs an E05A09BA gate array (MCU: 2A) to control the two stepper motors (the carriage motor and paper feed motor). This gate array can independently control the stepper motors so that the CPU load is reduced. Figure 2-47 shows a block diagram of this circuit.

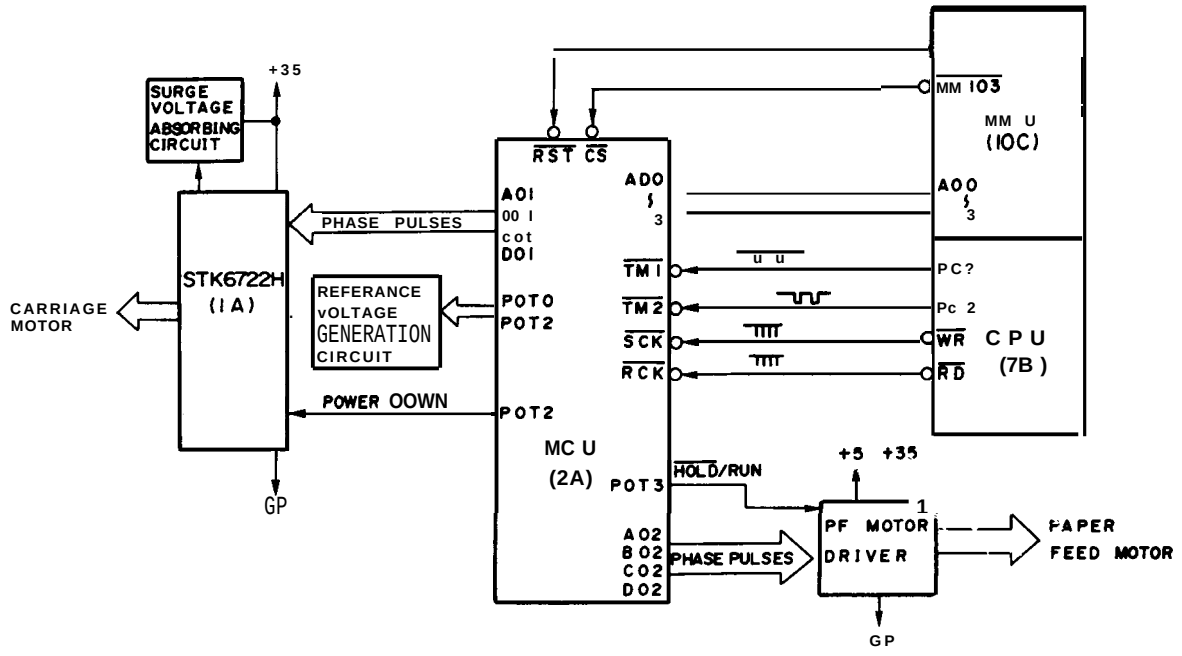


Fig.2-47. Carriage and Paper Feed Motors Control Circuit

2.3.6.1 Gate Array EO5A09BA (2A)

This gate array contains two phase switching pulse generation circuits for 4-phase stepping motors, so that two motors can be controlled separately. The timing of the phase switching, for normal rotation, reverse rotation, or stop, and the phase switching method are controlled by control signals from the CPU. The gate array also controls the three ports. Figure 2-48 shows a block diagram of the EO5A09BA (2A).

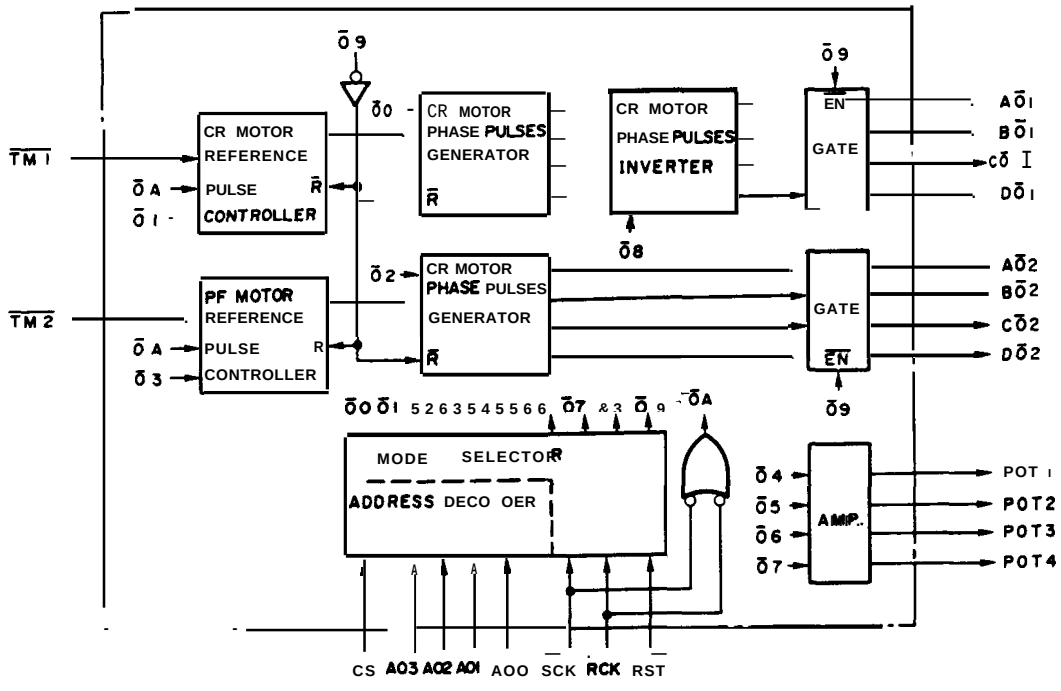


Fig. 248. EO5A09BA Block Diagram

This gate array becomes active when $\overline{MMIO2}$ is low, and the operational mode is selected using the low 4 address lines along with $\overline{RD}$ (RCK) and $\overline{WR}$ (SCK). Table 2-19 lists the modes.

2.3.7 Carriage Motor Control Circuit

The carriage motor control system in this printer employs an open-loop control system.

2.3.7.1 Home Position Seek Operation

The function which moves the carriage to the home position after CPU inputs $\overline{\text{RESET}}$ signal is called home position seek. This is operated by driving the carriage motor. Figure 2-49 shows the operation flow and Figure 2-50 shows the phase state of home position seek.

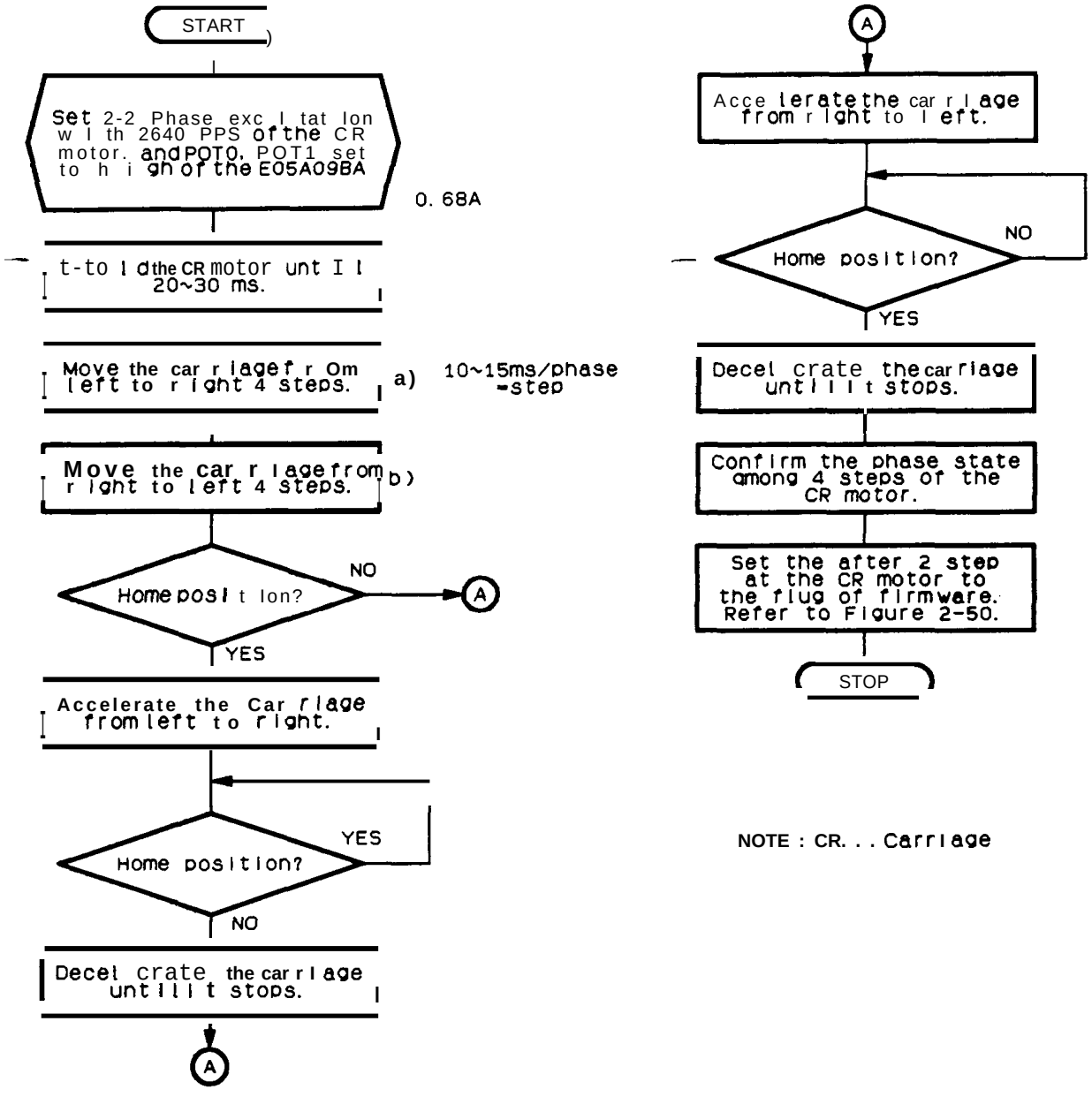


Fig. 2-49. Home Position Seek Operation

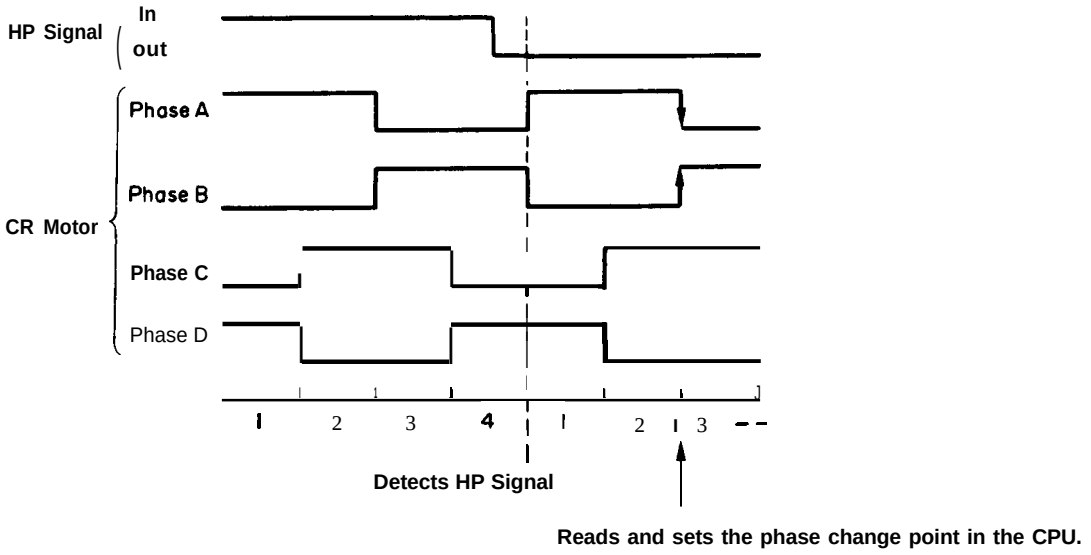
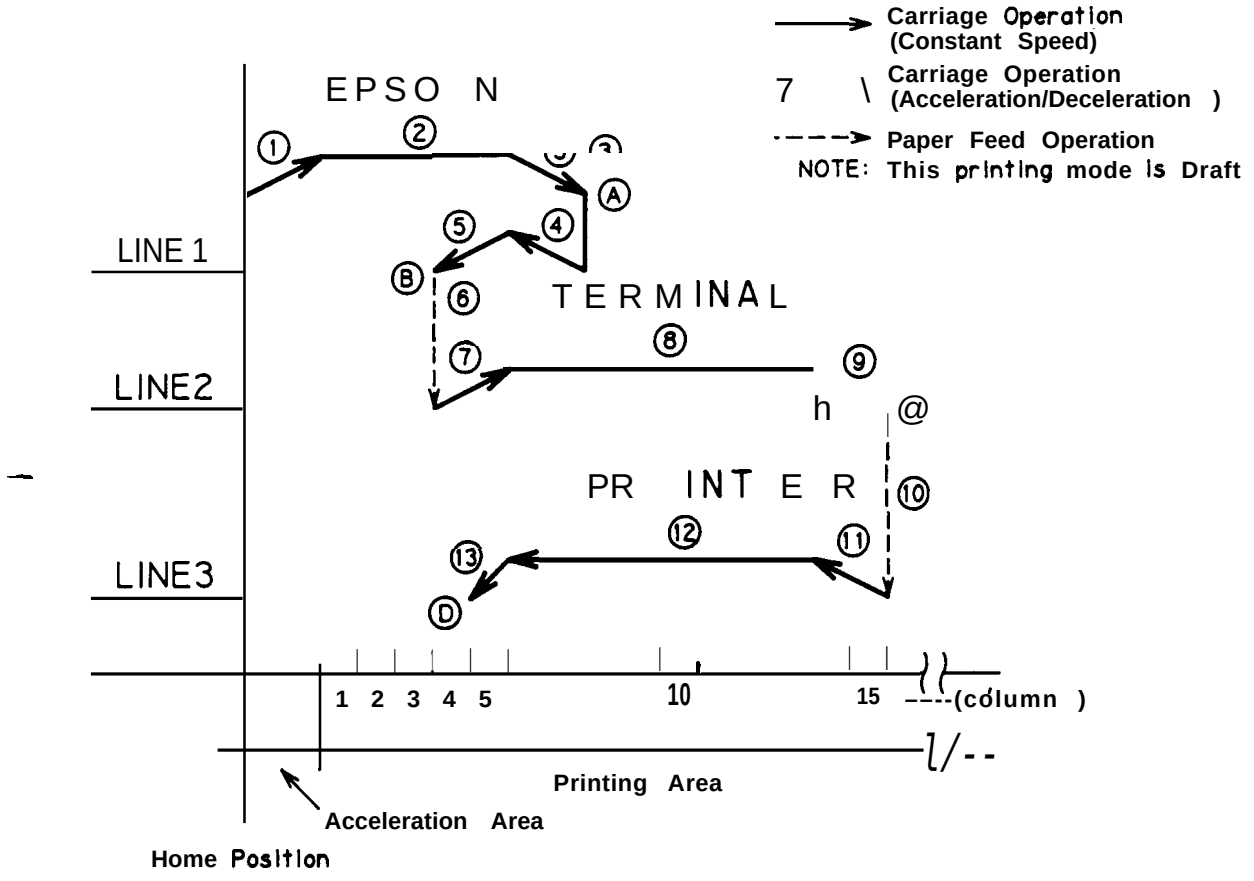


Fig. 2-50. Home Position Seek Phase States

2.3.7.2 Logic Seeking

The logic seeking maximizes operation speed of the bidirectional printer. It does away with the necessity to start printing from the home position (left position) after each line of printing, but permits printing from any position after a line feed. Figure 2-51 shows the sequences of logic seeking.



- 1-3 Printing of the 1st line
- 4-5 Logic seeking
- 6 Paper feed
- 7-9 Printing of the 2nd line
- 10 Paper feed

. 11-12 Printing of the 3'rd line

Fig. 2-51. logic Seeking

Operation

a) Upon receive in print data "EPSON" for a line from the host computer, the printing is performed in an action of ① to ③ with the carriage and printhead moving to position Ⓐ.

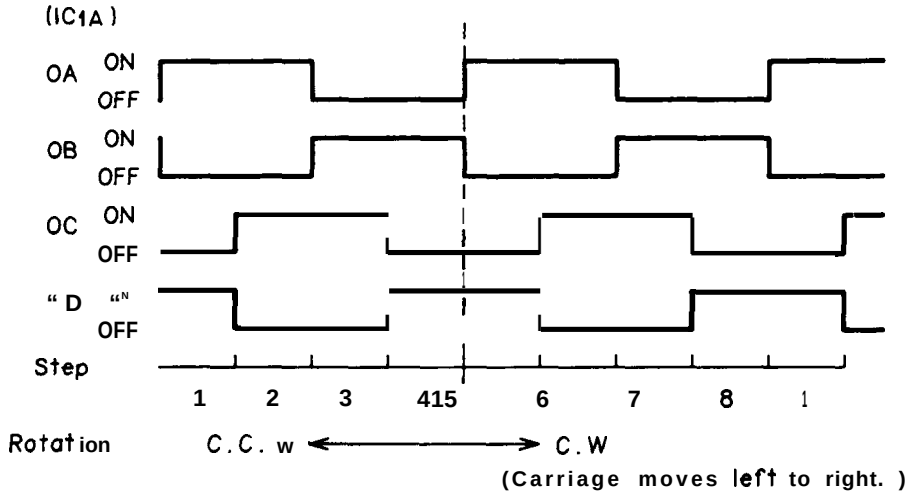
b) The CPU, receiving the next data from the host computer, analyzes it and determines the acceleration start position of the carriage.

c) In an action of ④ to ⑤, the carriage is moved to position Ⓑ, here paper feed is operated ⑥. Then the carriage goes through acceleration printing and deceleration ⑦,⑧,⑨ to position Ⓒ, next paper feed is operated ⑩.

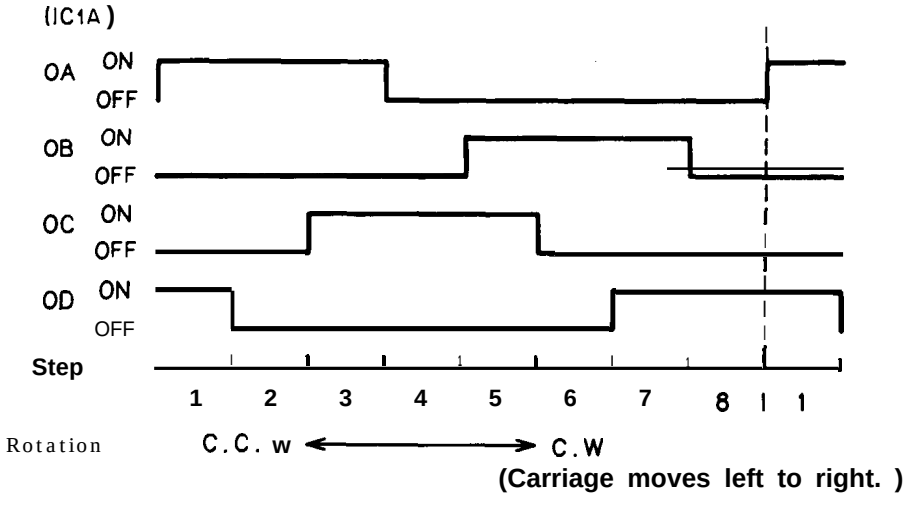
d) In an action of ⑪ to ⑬, acceleration, printing, and deceleration are performed Ⓓ.

2.3.7.3 Carriage Motor Excitation System

The carriage motor is controlled by the carriage motor constant current drive circuit. The phases of the carriage motor are controlled by AO l-DO 1 of the E05A09BA (2A). Two drive systems, 2-2 phase and 1-2 phase excitation, are used. Because the carriage motor has one driving transistor per winding (unipolar drive), two drivers become active in the 2-2 phase excitation system and one and two drivers become active alternately in the 1-2 phase excitation system. One step in the 2-2 phase excitation system is equivalent to two steps in the I-2 phase excitation system. Figure 2-52 shows the carriage motor drive sequence.



(a) 2 Phase Excitation

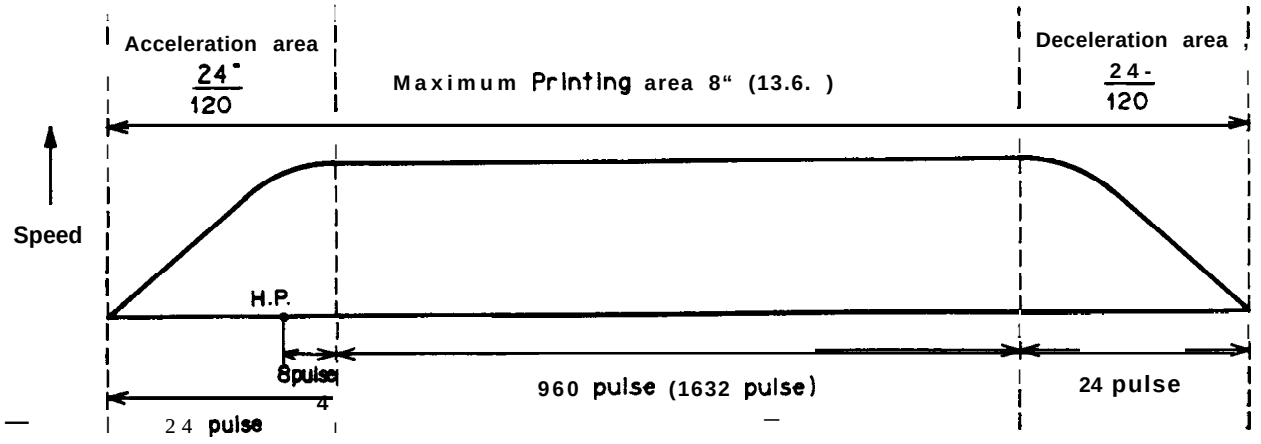


(b) 1-2 Phase Excitation

Fig. 2-52. Carriage Motor Drive Sequence

2.3.7.4 Carriage Movement Area and Speed Control

The carriage movement area is shown in Figure 2-53. The area is roughly divided into three parts: 1) acceleration area, 2) printing area, and 3) deceleration area. There are six constant speeds for the carriage movement, as shown in Table 2-20.



LQ-850 (LQ-1 050)

Fig. 2-53. Carriage Movement Area

Acceleration Speed Control

When the speed is 1 or 2, the carriage motor is accelerated for 24 pulses in the case of the 2-2 phase excitation system.

When the speed is 3, 4, or 5, the carriage motor is accelerated for 48 pulses in the case of the 1-2 phase excitation system.

Constant Speed Control

a) **Printing**

During printing (including spaces) within the printing area, the carriage moves at constant speed except when being accelerated or decelerated by the logic seeking function.

b) **High Speed Skip (Figure 2-54)**

This printer operates the high speed skip when there are contiguous spaces (20H) of seven characters or more in the character printing. When the CPU judges the character codes arrangement as above, the carriage operate accerelation to high speed skip (speed: 3200 PPS). This operation is good for efficiency of print time.

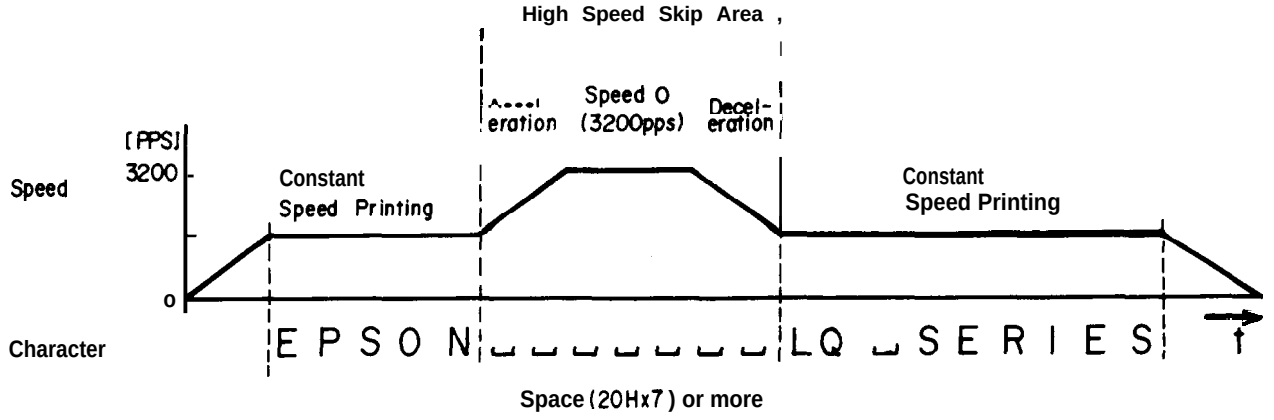


Fig. 2-54. High Speed Skip

Deceleration Speed Control

When the speed is 1 or 2, the carriage motor is decelerated for 24 pulses in the case of the 2-2 phase excitation system.

When the speed is 3, 4, or 5, the carriage motor is decelerated for 48 pulses in the case of the 1-2 phase excitation system.

Table 2-20. Carriage Motor Drive Circuit Specification

Speed Mode		o	1	2	3	4	5
Phase Excitation		2 - 2			1 - 2		
Carriage Speed [PPS]		3200	2640	1760	2640	1760	1174
Set Time [ins/step]		313	379	568	379	568	852
Current [A/phase] (constant, decelerate)		0.68	0.38	0.38	0.38	0.38	0.31
MCIJ (2A)	POT0	H	H	H	H	H	L
	POT1	H	L	L	L	L	L
Current [A/phase] (accelerate)		0.68	0.68	0.68	0.48	0.48	0.38
MCU (2A)	POT0	H	H	H	L	L	H
	POT1	H	H	H	H	H	L
DPI [dot/inch]		—	120	180, 120	240, 180	360, 240	360
Print Mode		High speed skip	Draft normal (pica,elite)	ESC *5 (plotter 1:1)	NLQ normal (pica, elite)	ESC *7 (plotter double density)	NLQ Condensed (pica, elite)

NOTE: The carriage speeds and number of pulses for the 1-2 phase excitation system are transformed into these for the 2-2 phase excitation system.

2.3.7.5 Carriage Motor Drive Circuit

This printer has STK6722H (1A) which is a unipolar stepper motor driver IC used to drive the carriage motor, using a constant current chopping method.

Reference Voltage Generation Circuit

Figure 2-55 shows the reference voltage generation circuit, and Table 2-21 shows the relationship between ports of E05A09BA (2A) and the reference voltage.

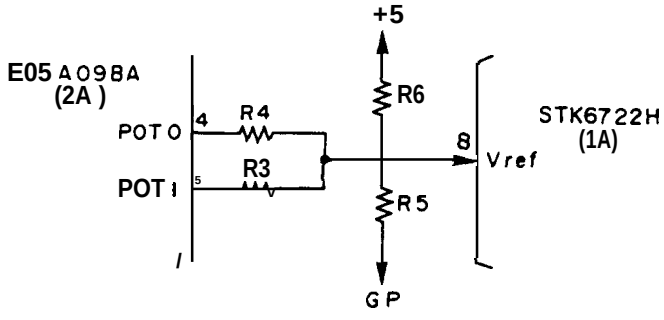


Fig. 2-55. Reference Voltage Generation Circuit

Table 2-21. Relationship Between POT0, POT1 and Reference Voltage

POT1	POT0	Vref [V]
H	H	$5 \times \frac{R5}{R5 + R6}$
H	L	$5 \times \frac{R4 // R5}{R4 // R5 + R6}$
L	H	$5 \times \frac{R3 // R5}{R3 // R5 + R6}$
L	L	$5 \times \frac{R3 // R4 // R5}{R3 // R4 // R5 + R6}$

General Operation

Figure 2-56 shows the carriage motor drive circuit block diagram. The carriage motor has four coils A, B, C, and D, and each coil is driven by the corresponding phase driver A to D. These phase drivers are switched directory by the output pulses from ports AO 1 to DO 1 of the MCU (2A). When the phase drivers are turned off, the surge voltage (e = – L X di/dt) generated from the coils of the carriage motor is applied to the surge voltage absorber via the flywheel diode attached to each phase driver, and is absorbed.

This circuit drives the carriage motor using a constant current chopper type drive system. Most of this circuit is included in the STK6722H(1 A). Chopper control is performed using a separately-excited system (oscillation frequency: approximately 24 KHz). The carriage motor supply voltages V_{CAB} and V_{CCD} are applied intermittently so that the coil current is kept constant.

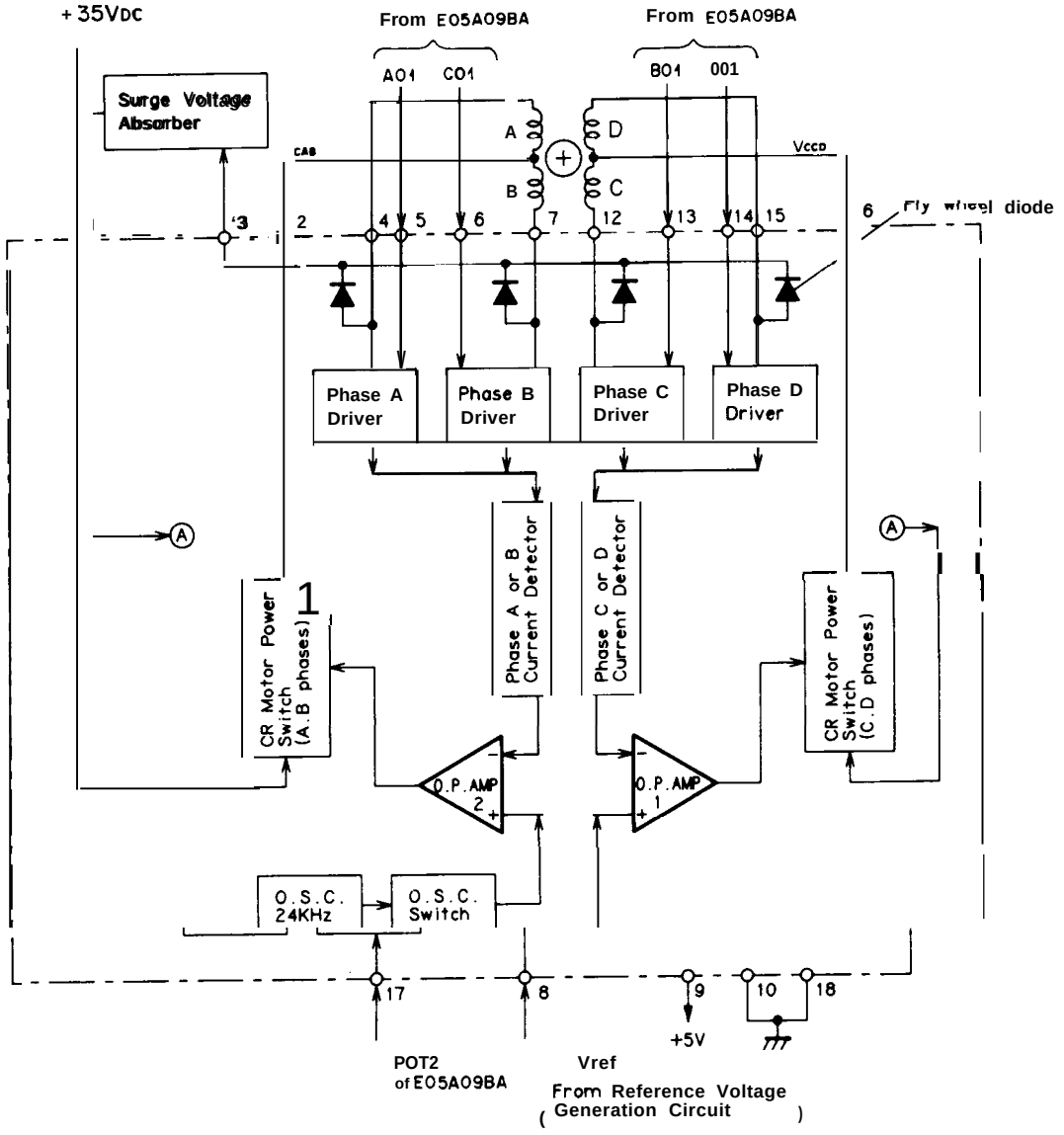


Fig. 2-56. Carriage Motor Drive Circuit Blockdiagram

Detailed Operation (Figure 2-57.)

- When the + 5V supply voltage is applied to the STK6722H (H-IC:1 A), the triangular waveform circuit in the H-IC starts oscillation and outputs the reference signal (approx. 24 KHz) for chopper control.
- Because the output of comparator IC2 (point Ⓐ) is high (input at the PIUS side > input at the minus side) when the printer power is turned on, TR7 turns on and base current flows to TR 1. When a high signal (AO 1: low) is input to the base of TR3, TR3 turns on, and coil current I_{CA} flows from V_{CC1} to TR 1 to phase A to D5 to TR3 to R 13. I_{CA} gradually increases due to the reactance of the motor coil. Voltage V_{R13} across limiter resistance R13 increases. When V_{R13} becomes the same as the V_{REF} at pin 8 (from the reference voltage generation circuit), the output of IC2 (point Ⓐ) goes low, TR7 turns off, and TR 1 turns off. Then I_{CA} starts decreasing. When V_{R13} becomes less than V_{ref}, the output of IC2 goes high again.
- The surge voltage (also called flyback voltage) generated when TR3 turns off is cut off by the zener diode ZD 1 (approx. 47V) between the collector and base of Tr Q5, and is absorbed by Tr Q5 to protect TR3 from being damaged.
- When the carriage motor stops, the motor drive pulses are fixed at a set value to hold the carriage motor. At this time, H4C is powered down to prevent it from overheating. When the power down operation is performed (when the carriage motor is held), P02 of the E05A09BA (2A) goes low, and TR11 turns on to drop the reference voltage at the plus side of IC2. As a result, the load on $V_{COM}AB$ is reduced and H-IC is effectively powered down. At this time, approximately 5V is supplied to $V_{COM}AB$ by PWM control.

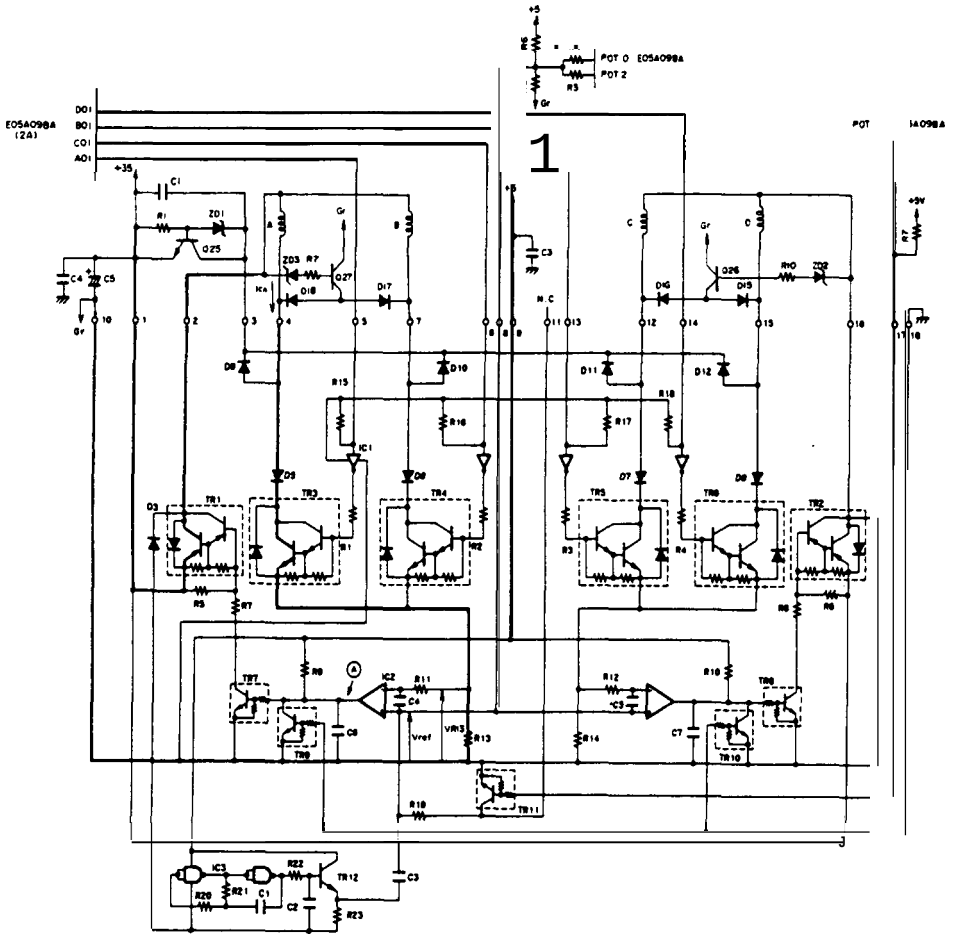


Fig. 2-57. Carriage Motor Control Circuit

2.3.7.6 Home Position Sensor

The home position (HP) sensor is used for detecting the carriage home position. The details are described in below.

Detection System: Photo-electric conversion
Output System: Open-collector
Signal Status: See Table 2-22.

Table 2-22. HP Sensor Signal Status

Carriage position	PAO (1 pin) of CPU (7B)
Home position	High
Not home position	Low

Circuit: See Figure 2-58.

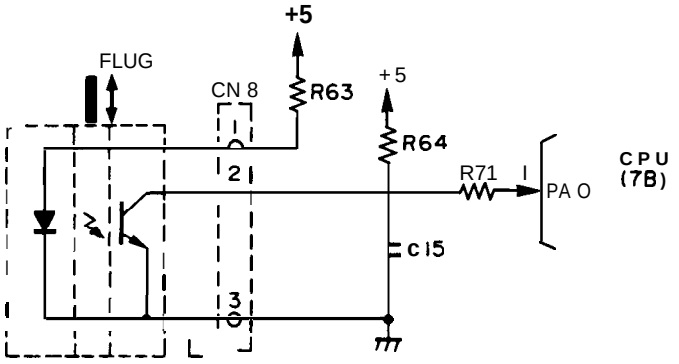


Fig. 2-58. HP Sensor Circuit

2.3.8 Paper Feed Motor Control Circuit

This printer uses a PM stepper motor, and the minimum paper feed pitch is 1/180 inch. Only the 2-2 phase excitation system is employed for this mechanism, and the paper feed motor is driven by a constant voltage of + 35V DC.

2.3.8.1 Auto Paper Loading/Ejecting Operation

This printer has auto paper loading/ejecting system. These operations are shown in Figures 2-59 through 2-64.

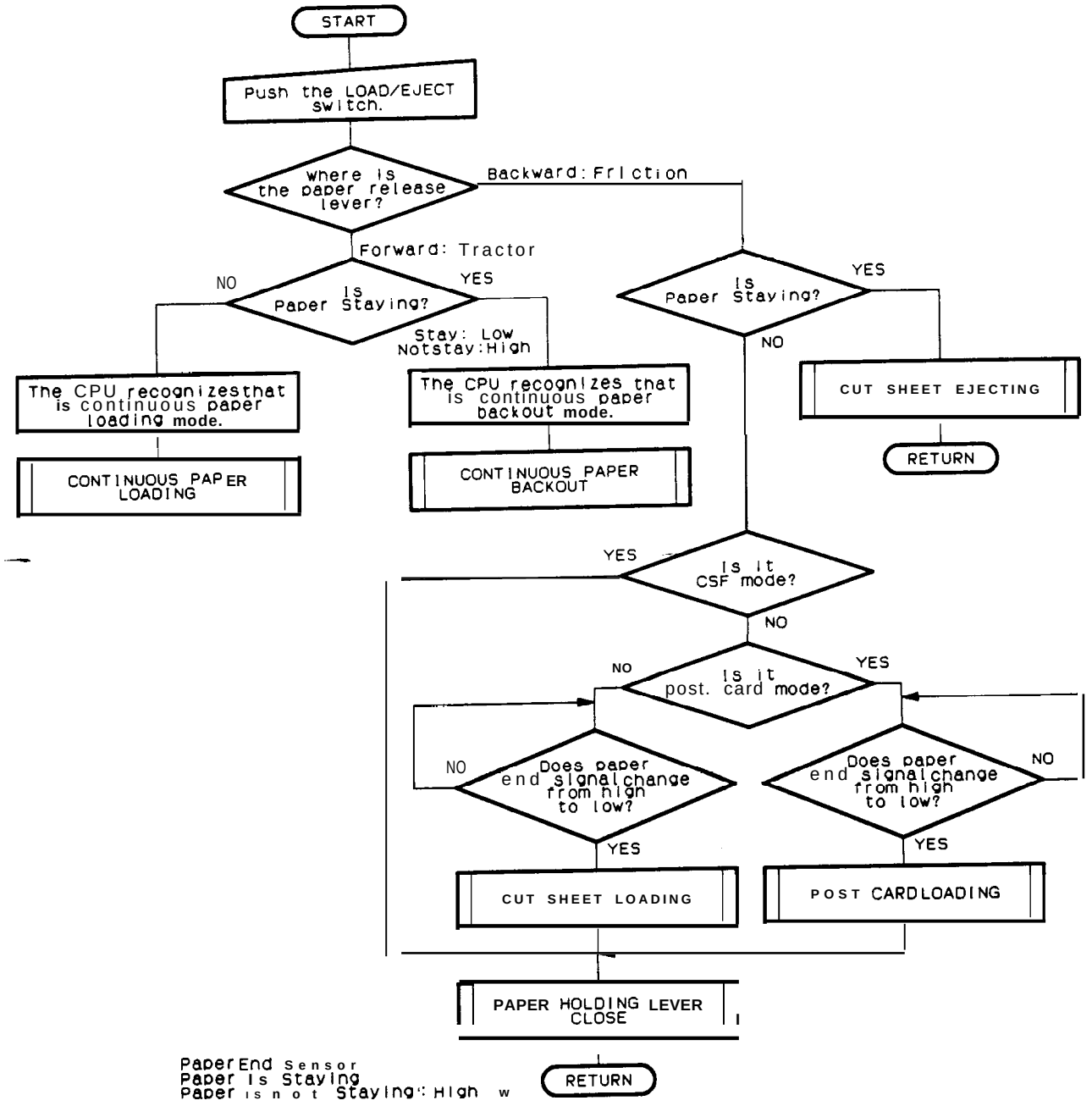


Fig. 2-59. Paper Loading/Ejecting Mechanism Drive Sequence

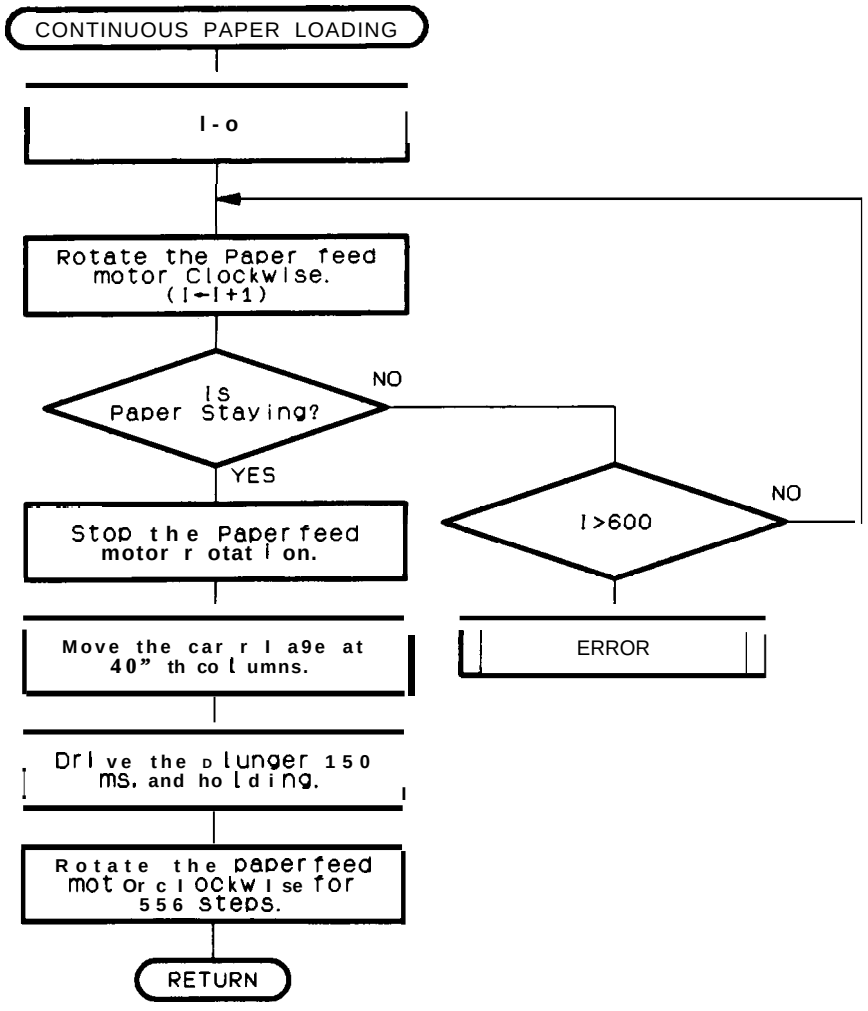


Fig. 2-60. Continuous Paper Loading Sequence

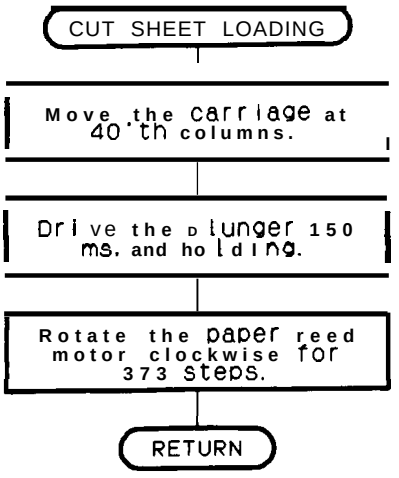


Fig. 2-61. Cut Sheet Loading Sequence

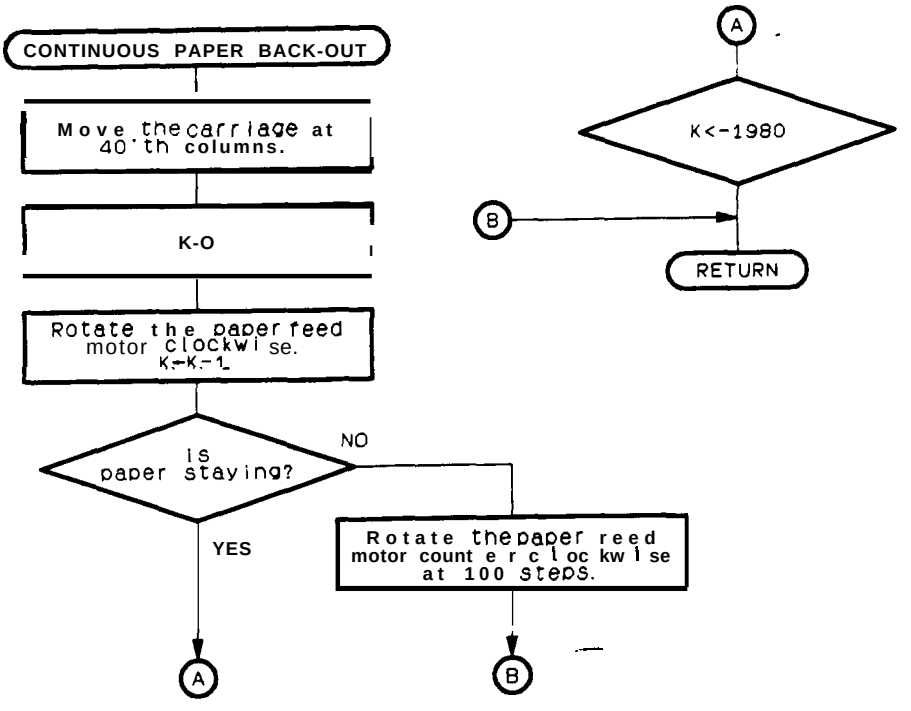


Fig. 2-62. Continuous Paper Ejecting Sequence

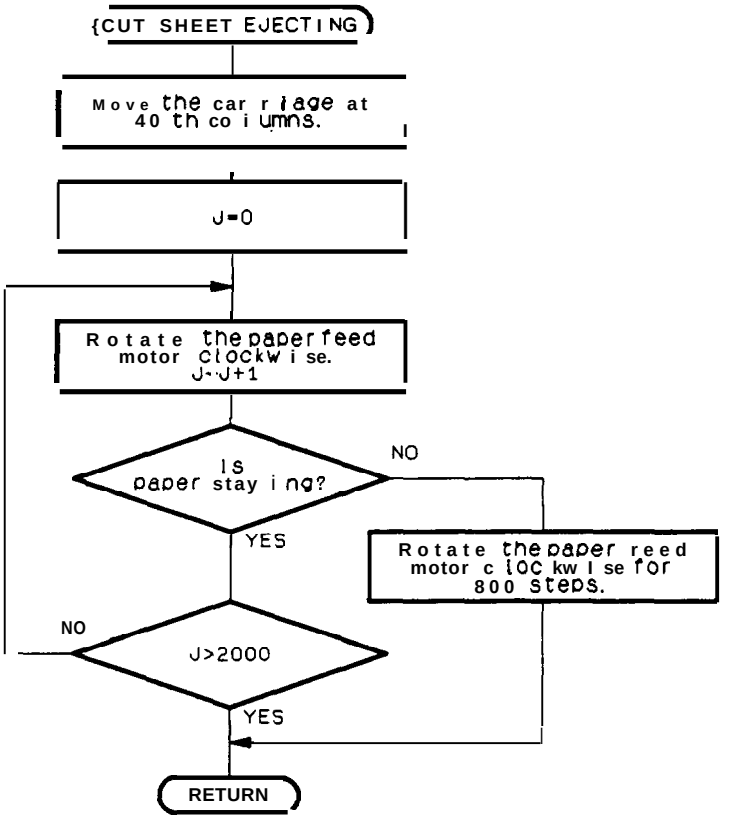


Fig. 2-63. Cut Sheet Paper Ejecting Sequence

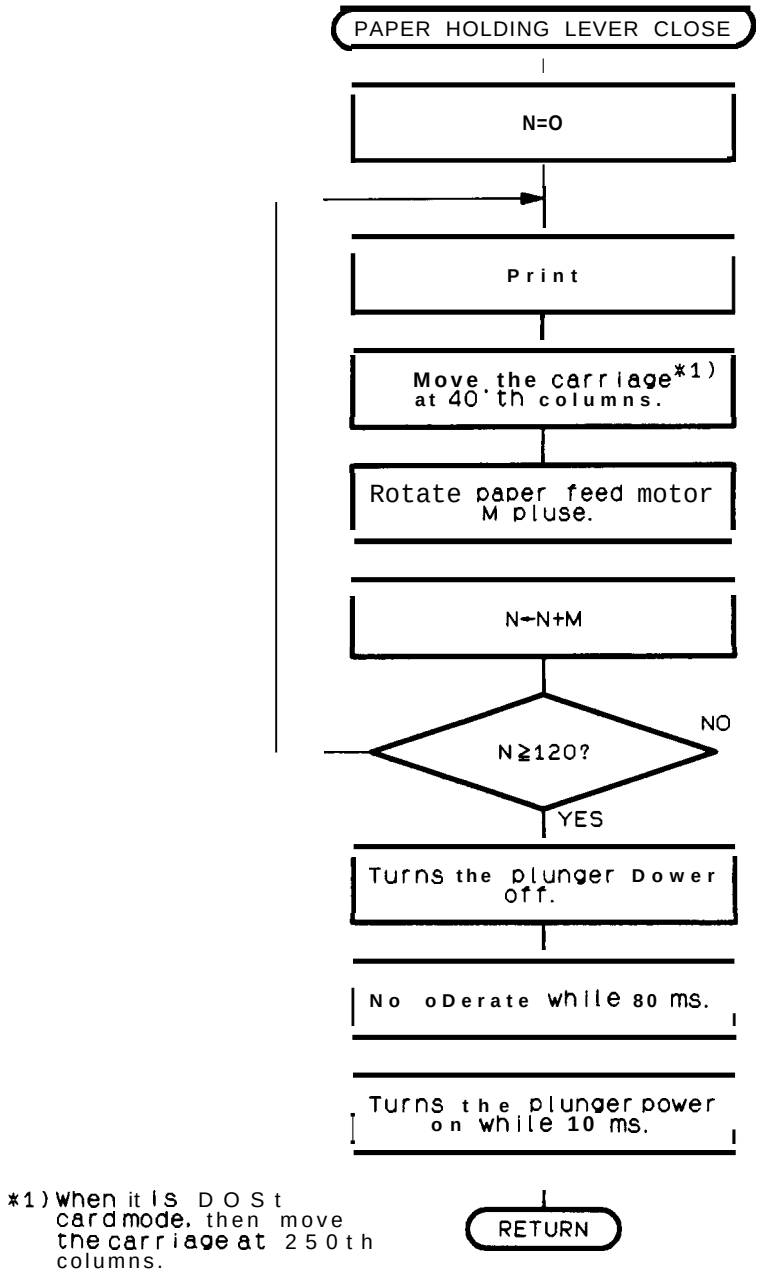


Fig. 2-64. Papar Holding Lever Close Sequence

2.3.8.2 Paper Feed Motor Speed Control

When the amount of paper to be fed is 14 steps or less (amount of paper feed step is 1/180 inch), the paper feed motor is controlled to rotate at constant speed.

When the amount of paper to be fed exceeds 14 steps, the paper feed motor is accelerated and decelerated.

Figure 2-65 shows the 2-2 phase excitation system drive sequence and Table 2-23 shows the paper feed motor drive circuit specification, and Table 2-24 shows the paper feed speeds.

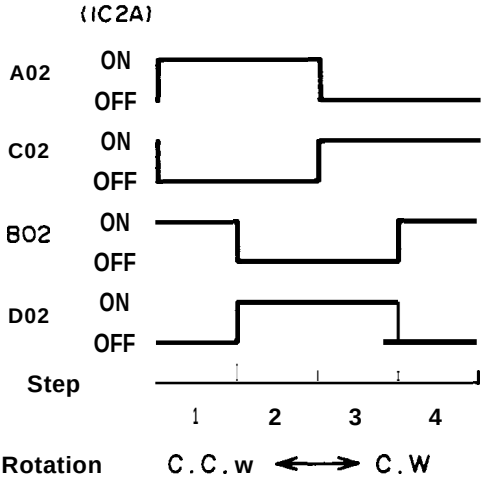


Fig. 2-65. 2-2 Phase Excitation System

Table 2-23. Paper Feed Motor Drive Circuit Specification

Speed Mode	0	1	2
Phase Excitation	2 - 2		
Paper Feed Speed [PPS]	550	600	650
Set Time [ins/step]	1.82	1.67	1.54
Current (average) [A/motor]	o.17	0.15	0.13

Table 2-24. Paper Feed Speeds

Feeding Method	Intermittent		Continuous	
Mode	Normal	Postcard	Normal	Postcard
Cut Sheet [PPS] (Paper feed speed [IPS])	600 (3.3)	600 (3.3)	650 (3.6)	650 (3.6)
Continuous Paper [PPS] (Paper feed speed [IPS])	550 (3.0)		550 (3.0)	

2.3.8.3 Paper Feed Motor Drive Circuit

Figure 2-66 shows an open-loop circuit for constant voltage drive and the 2-2 phase excitation system driven by +35 V DC. AO2 through DO2 of the MCU (2A) control the coil excitation system, and POT3 switches between the hold/run modes.

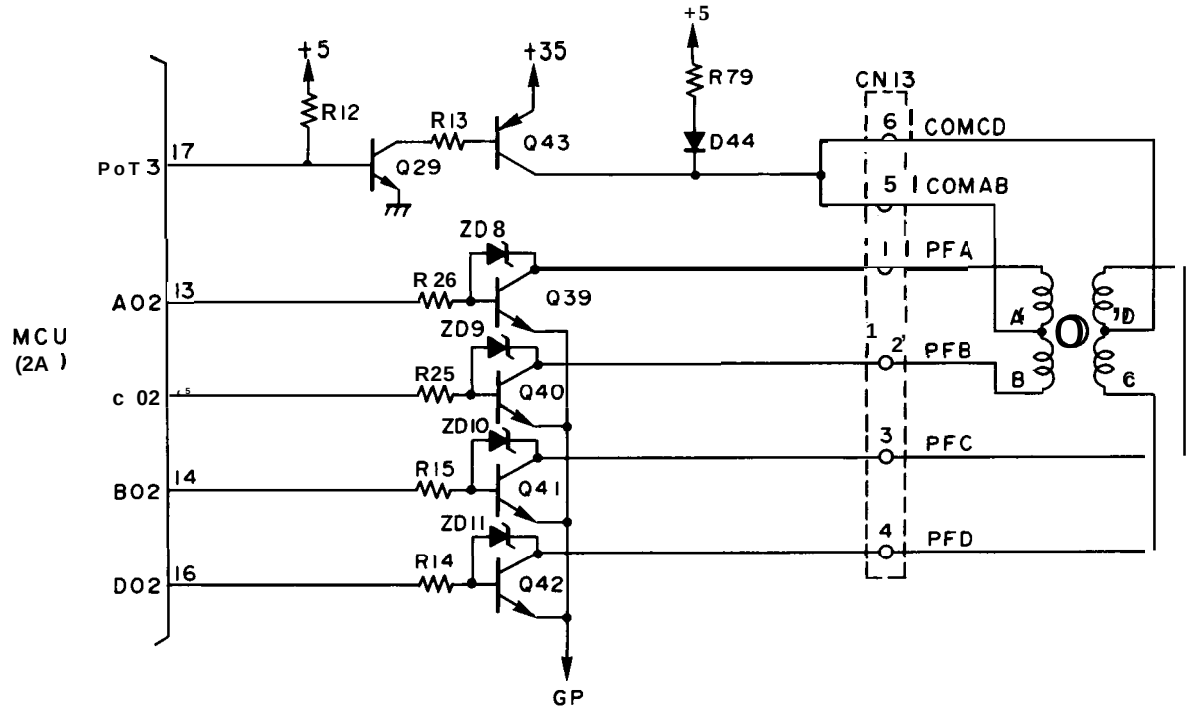


Fig. 2-66. Paper Feed Motor Driving Circuit

Hold Mode

When POT3 is low, transistor Q29 and Q43 cut off and applies + 5V to the paper feed motor common lines via R79 and D44, so that the motor is held. At this time, motor driving pulses AO2 through DO2 does not change.

Run Mode

When POT3 is high, transistor Q29 and Q43 turn on and applies +35V DC to the paper feed motor common lines. At this time, AO2 through DO2 control driving transistors Q39 to Q42 which drive the paper feed motor. At this time, AO2 = C02 and B02 = DO2.

2.3.8.4 Sensor Circuits

This control circuit employs two sensor circuit. One is the paper end sensor circuit which detects the paper stays or not in printer mechanism. The other is the release/friction sensor circuit which detects the paper release lever position.

Paper End (PE) Sensor

Detection System: Mechanical switch

Signal Status: See Table 2-25.

Table 2-25. PE Sensor Signal Status

Paper	PA1 (2 pin) of CPU (76)
Presence	High
Absence	Low

Circuit: See Figure 2-67.

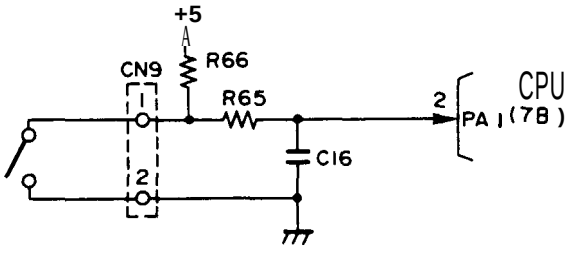


Fig. 2-67. PE Sensor Circuit

Detectable Position: See Figure 2-68.

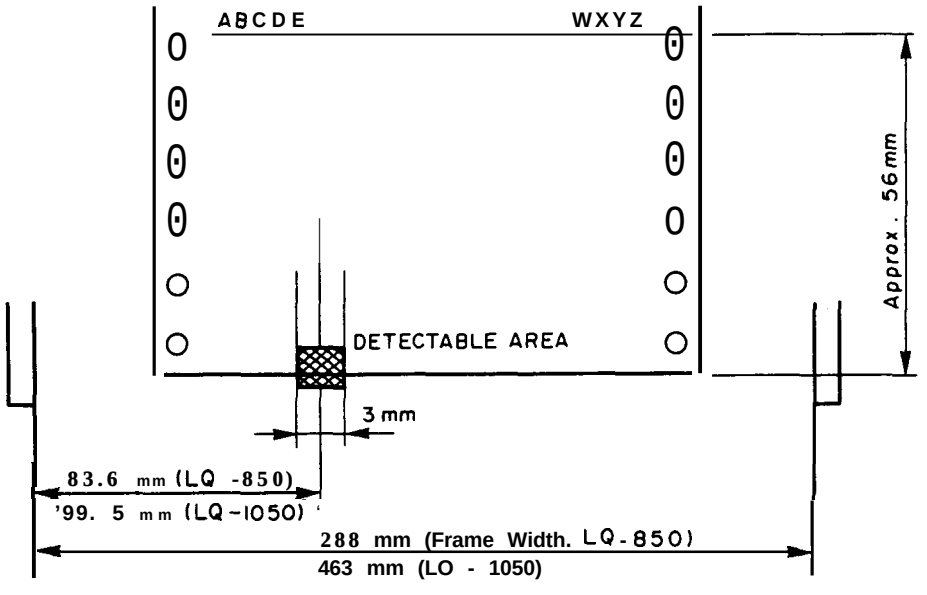


Fig. 2-68. Paper Detectable Position

NOTE: When narrow paper is used, set the paper so that neither the holes for paper feeding nor the holes for filing go into the detectable area (portion shown by the oblique lines in the above figure).

Release/Friction (R/F) Sensor

Detection System: Mechanical switch

Signal Status: See Table 2-26.

Table 2-26. R/F Sensor Signal Status

Paper Release Lever Position	PB6 (15 pin) of CPU (7B)
Forward (release)	Low
Backward (friction)	High

Circuit: See Figure 2-69.

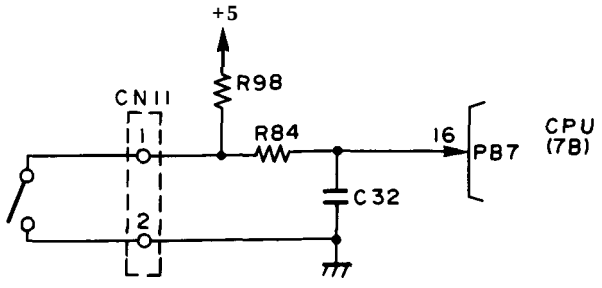


Fig. 2-69. F/T Sensor Circuit

2.3.9 Plunger Drive Circuit

The CPU controls this circuit to drive the plunger to open and close the paper holding lever for paper auto loading/ejection. Figure 2-70 shows the drive mechanism, Figure 2-71 shows the plunger drive circuit and Figure 2-72 and Table 2-27 show the on/off timing of the transistors during the plunger drive and paper holding.

Refer to Section 2.3.8.1 for the paper auto loading/ejection sequence.

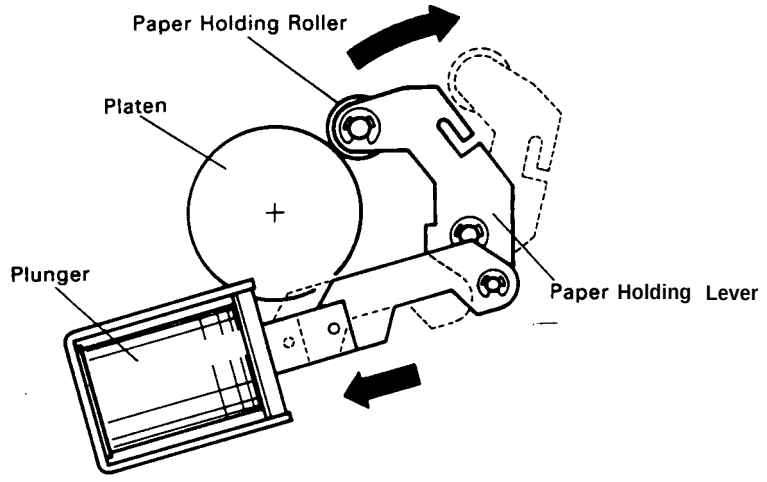


Fig. 2-70. Plunger Mechanism

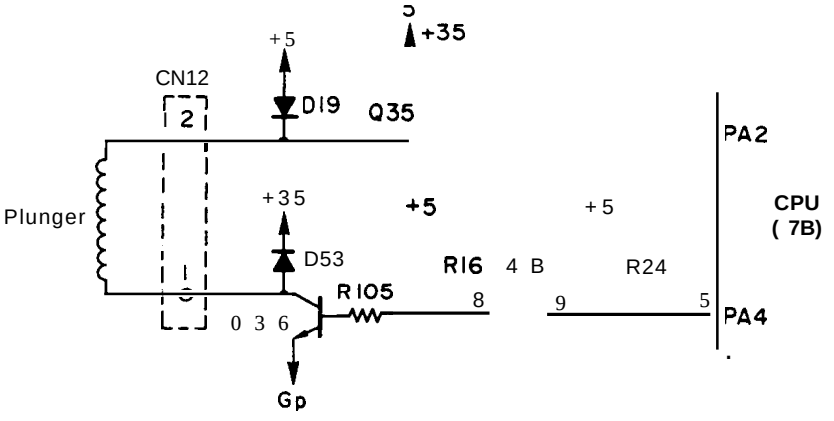
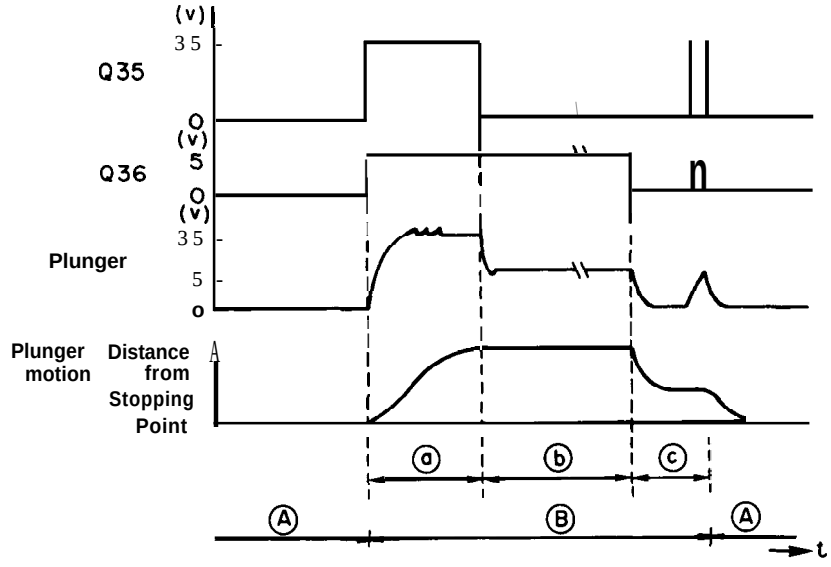


Fig. 2-71. Plunger Drive Circuit



ⓐ: plunger drive state I
ⓑ: Plunger hold state
ⓒ: Plunger drive state II

Ⓐ Paper holding lever close state
Ⓑ Paper holding lever open state

Fig. 2-72. Relationship Between Transistors and Plunger

Table 2-27. Relationship Between CPU ports and Plunger Voltage

Supplied power [V] (Plunger)	Q36	Q35	PA4	PA2
0	OFF	OFF	H	L
5	ON	OFF	L	L
35	ON	ON	L	H

2.3.10 Printhead Control Circuit

Figure 2-73 shows a block diagram of the printhead control circuit. In this circuit, the print data is stored in the head data control gate array E05A02LA (3A) by the CPU. The CPU sends three sets of 8-bit data (for 24 dots), and then sends a printhead drive pulse to the E05A02LA via the print drive pulse width control circuit. When this pulse $\overline{\text{HPW}}$ goes low, the printhead coil drive transistors controlling the printhead coils are activated and the printer starts printing. The power supplied to the printhead coils must be tightly controlled so as not to burn the coils. Therefore, the CPU monitors the +35 VDC line and the temperature within the printhead, and feeds this information to the control circuit.

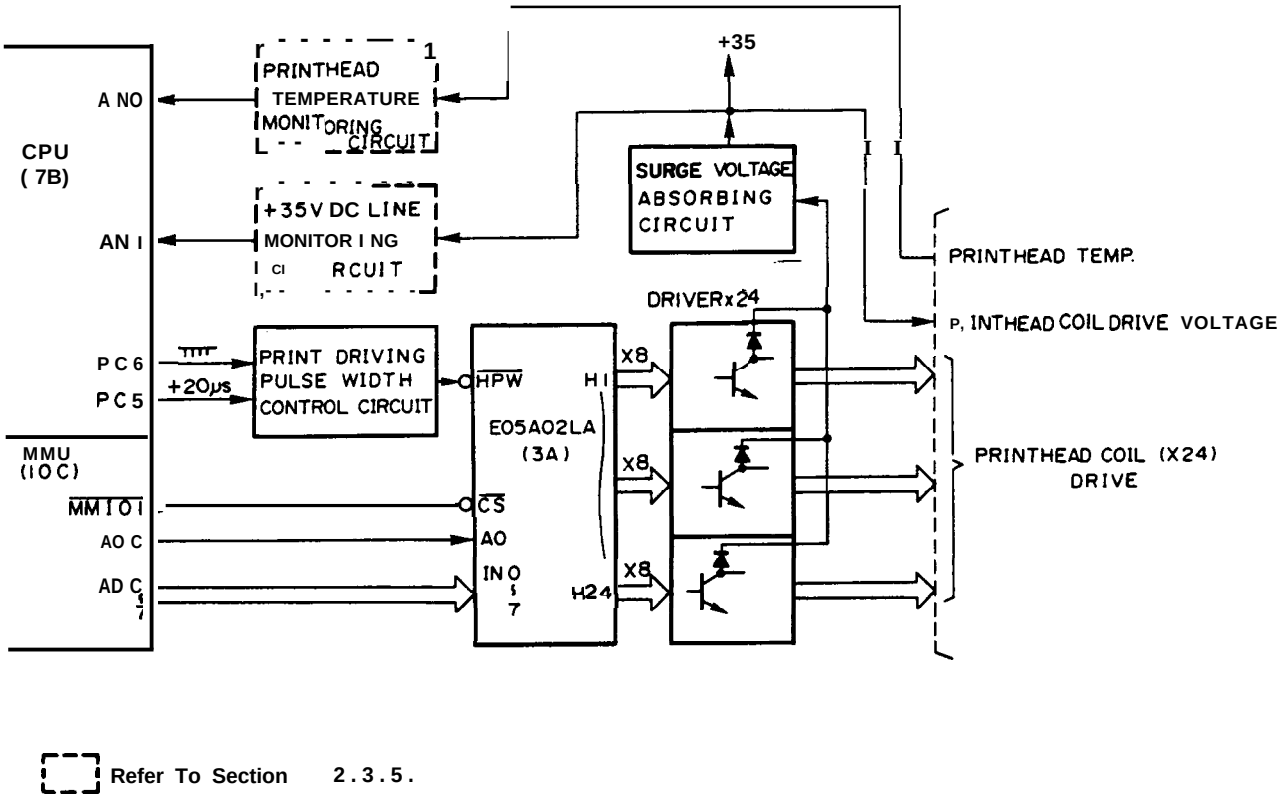


Fig. 2-73. Printhead Control Circuit Block Diagram

2.3.10.1 EO5A02LA Gate Array

The EO5A02LA Gate Array includes circuits to interface the CPU and printhead. This general purpose gate array has special commands that lighten the load on the CPU when outputting printhead data.

Figure 2-74 is a block diagram of the EO5A02LA gate array. The gate array mainly consists of data latches: 8 bits X 3 = 24 bits. The gate array has functins (commands) for writing data to all 24 bits of the data latches efficiently.

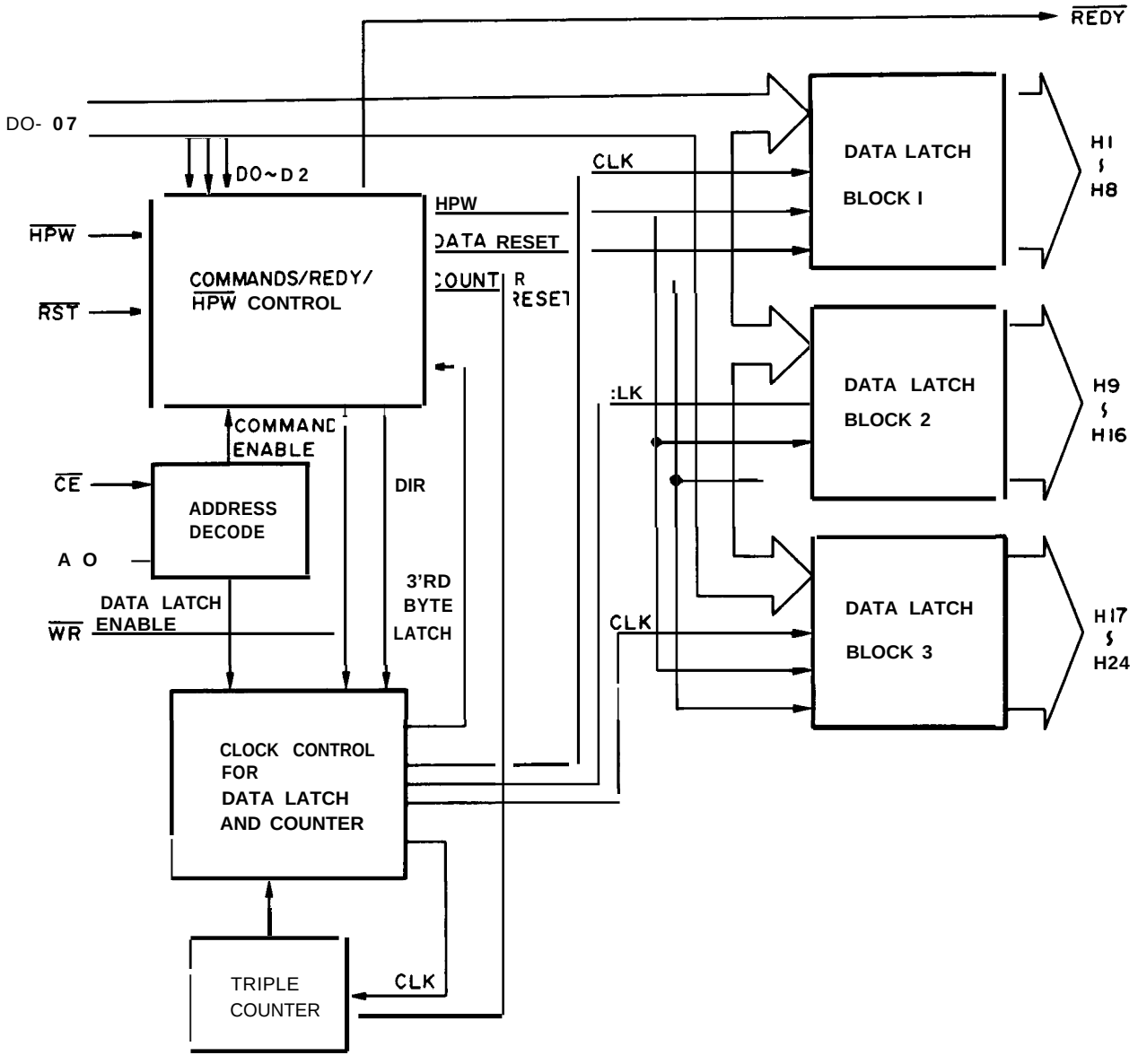


Fig. 2-74. EO5A02LA Block Diagram

Because the $\overline{CS}$ terminal of this gate array is activated by accessing address FD2 X H, the command output address and data output address are determined as shown in Table 2-28.

Table 2-28. EO5A02LA Gate Array Functions

1/0 Address	Function
FD20H	Outputs a command: Bit 7: Data latch writing sequence setup O: Ascending order 1: Dscending order Bit 6: $\overline{HPW}$ valid/invalid setting Bit 5: Counter resetting Bit 4 J Bit O } Optional
FD21 H	Laches data and increases the counter: When latching data, the data is NANDed with the contents of the current latch and is protected against double writes (the same data cannot be output twice in succession). Latching data into all the data latches is completed by latching three bytes, one at a time. The $\overline{REDY}$ output goes high upon receiving the $\overline{WR}$ signal that latches the third byte, and further data transfer is automatically inhibited. When $\overline{HPW}$ is valid as a command, the latched head data is inverted, then is output while $\overline{HPW}$ is low. The $\overline{REDY}$ output goes low at the leading edge of $\overline{HPW}$ and informs the CPU that the gate array can accept more data.

NOTE: When $\overline{HPW}$ is set invalid, the $\overline{HPW}$ output will be in the open-drain ON state independent of the $\overline{HPW}$ input. The drive pulse is input to the $\overline{HPW}$ terminal.

Figure 2-75 also shows the EO5A02LA initialization sequence.

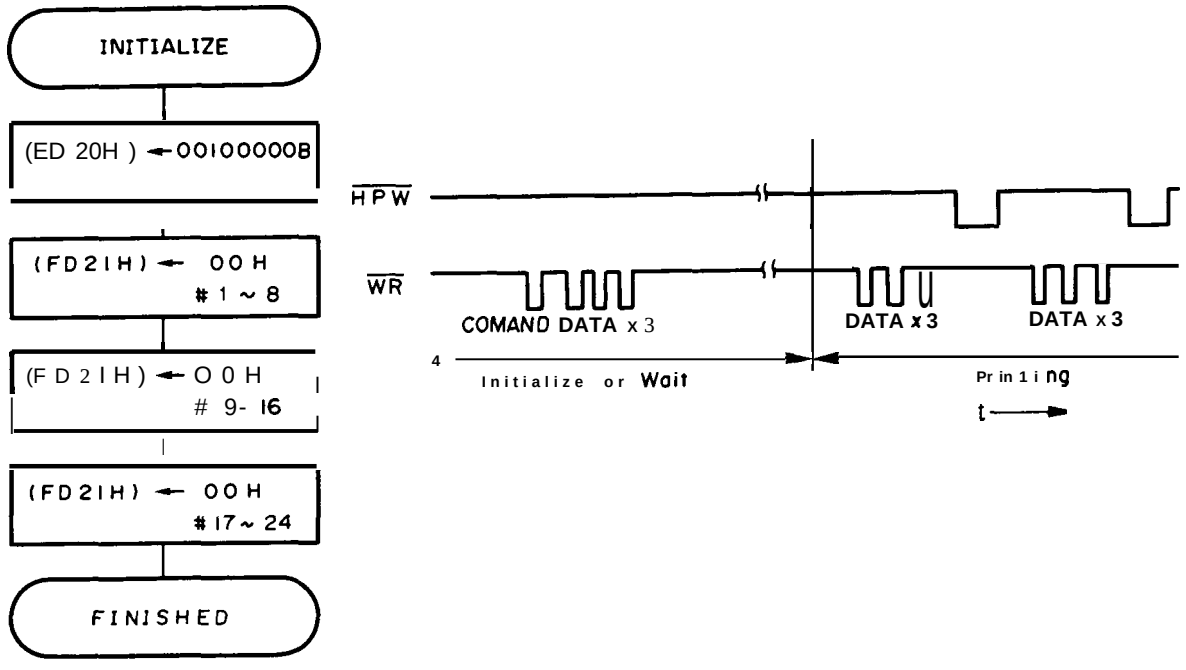


Fig. 2-75. E05A02LA Initialize Sequence

2.3.10.2 $\overline{HPW}$ Trigger Pulse Generation Circuit

Figure 2-76 shows the $\overline{HPW}$ trigger pulse generation circuit. Figure 2-77 and Table 2-29 show the state and time of each terminal respectively. This circuit employs a 555 timer IC (7C) as a monostable oscillator. When the PC6 (pin 23) pulse from the CPU is applied to the trigger terminal (pin 2), the duty cycle of the reference trigger pulse is determined by time constant T, which is controlled by PC5 from the CPU. When output Q (pin 3) goes high and capacitor C31 is charged to 2/3 Vcc (about 3.2 V), TH (pin 6) turns on and Q goes low. At that time, C31 is discharged through DIS (pin 7). Every time a pulse is applied to Trg, the sequence described above is repeated. The $\overline{HPW}$ low time is controlled (head trigger pulse width control) by switching PC5 on and off. Figure 2-78 lists is relationship.

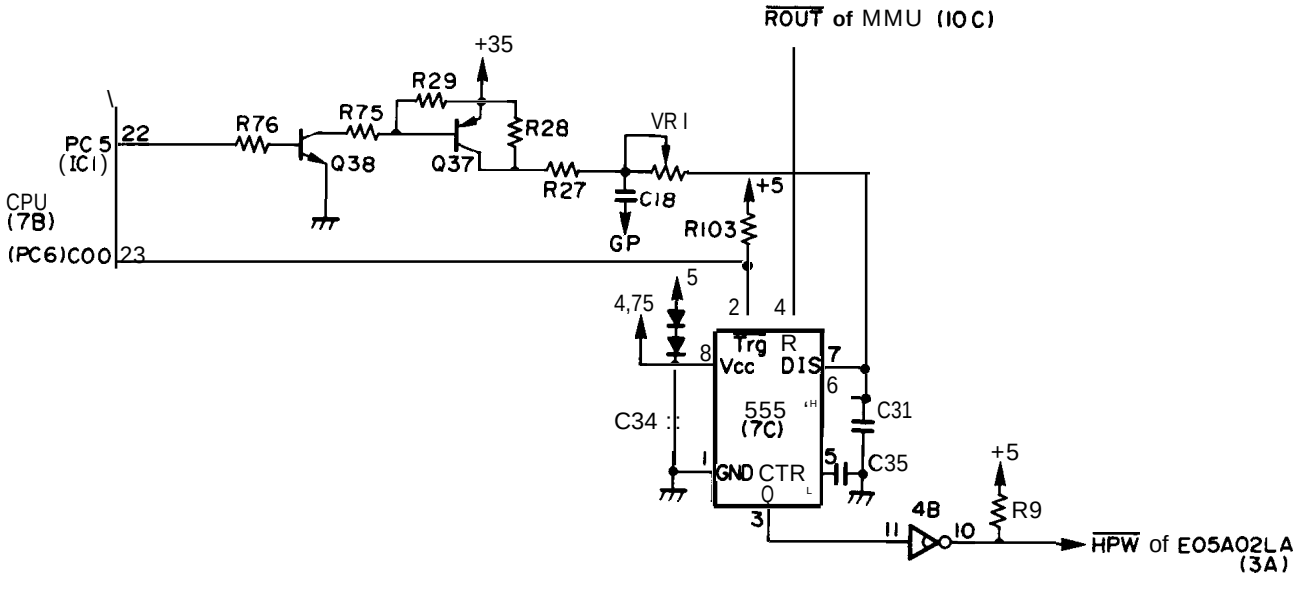
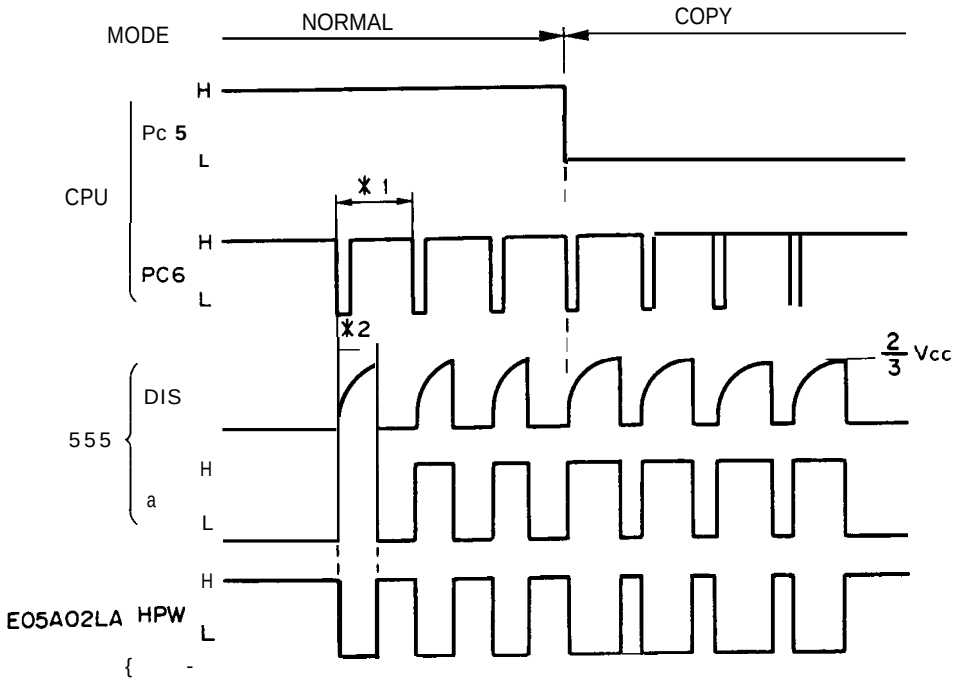


Fig. 2-76. $\overline{HPW}$ Trigger Pulse Generation Circuit



NOTES: 1. This cycle varies according to the voltage of the +35 V line.

2. This drive pulse width depends on the value of PC5.

Fig. 2-77. $\overline{\text{HPW}}$ Trigger Pulse Generation Circuit Waveforms

Table 2-29. $\overline{\text{HPW}}$ Trigger Pulse Generation Circuit Signal Status

Terminal	CPU		555	E05A02LA
	PC5	PC6	Q	$\overline{\text{HPW}}$
State	x	H	L	H
	H	⊓	n -	⊓
	L		⊔	u

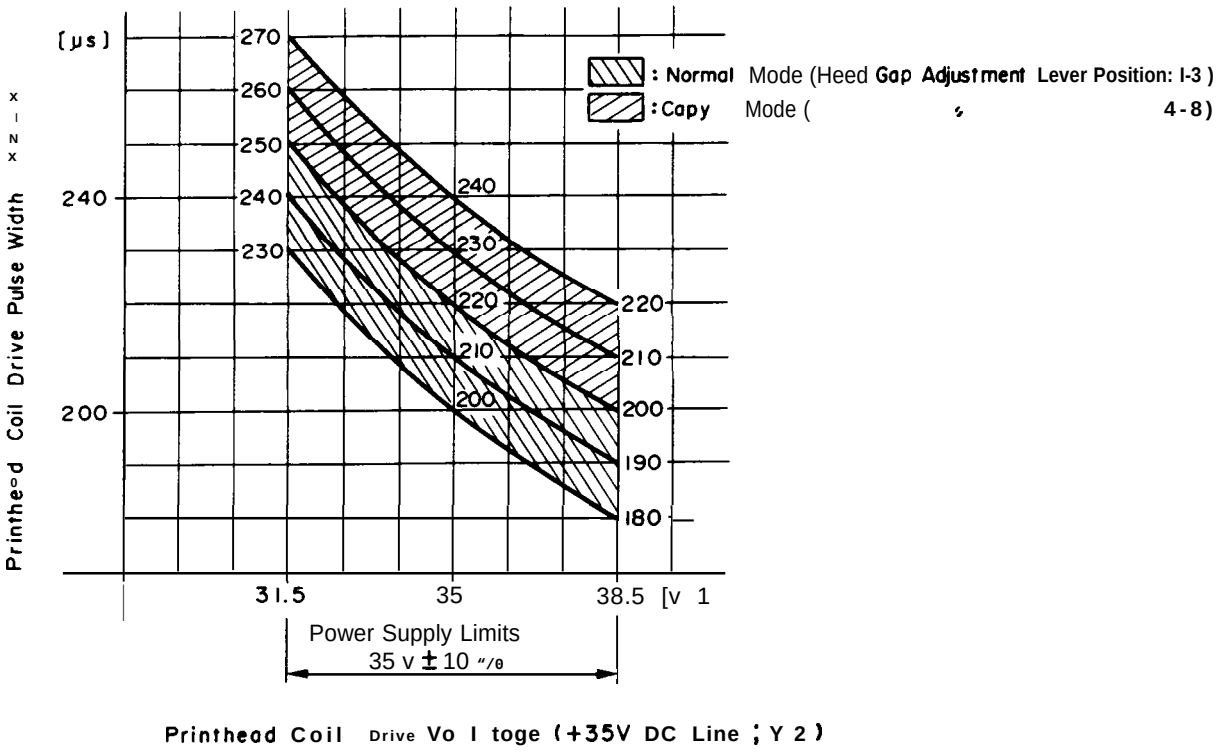
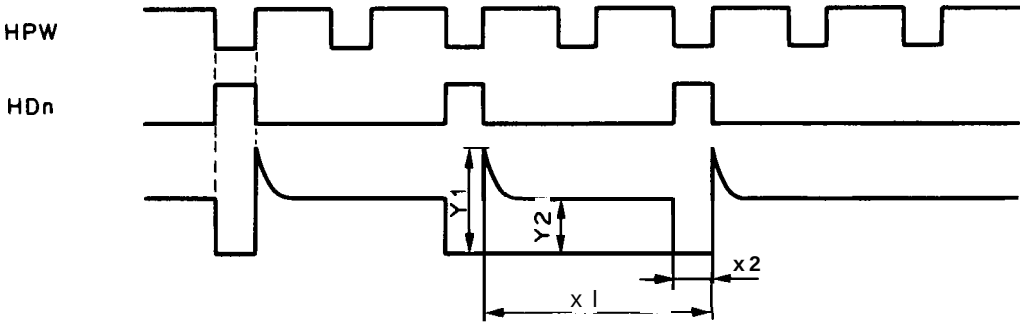


Fig. 2-78. Relationship Between Printhead Coil Drive Pulse Width and Drive Voltage

2.3.10.3 Printhead Solenoid Drive Circuit

The clock in the CPU changes the head trigger pulse width ($\overline{HPW}$) as the +35 V line varies, to stabilize the power delivered to the printhead solenoid. Figure 2-79 shows the collector waveform for the printhead solenoid drive transistor 2SC 1981 and the timing of the $\overline{HPW}$ and HDs signals.



Head Adjustment Lever Position	Print Mode	Temperature ["c]	X, [ins]	X_2 [ins]	Y, [v]	Y_2 [v]
2	Draft	25	0.745	0.200	76	36
4	Draft	25	1.145	0.220	74	34

Fig. 2-79. Relationship Between Printhead Drive Pulse Width and Collector Voltage at HD n.

2.3.10.4 Platen Gap Sensor Circuit

The platen gap (pg) sensor is used for detecting the Head adjustment lever position. The details are described in below.

Detection System: Mechanical Switch

Signal Status: See Table 2-30.

Table 2-30. Platen Gap Sensor Signal Status

Head Adjustment Lever Position	PB7 (16 pin) of CPU (76)
1st to 3rd	Low
4th to 8th	High

Circuit: See Figure 2-80.

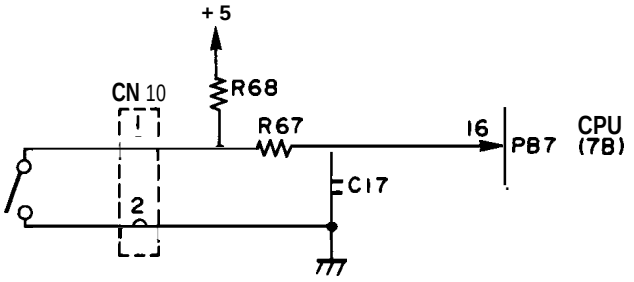


Fig. 2-80. Platen Gap Sensor Circuit

Operation: When the head adjustment lever is positioned at 4th to 8th, the printing mode becomes copy mode, and printhead trigger pulse width is changed as shown in Table 2-31.

Table 2-31. Pulse Width in Normal and Copy Modes

Normal Mode			Copy Mode		
PPS	DTS	Pw (35V)	PPS	DTS	Pw (35V)
2640	1.32 KHz	210 μs	1760	0.88 KHz	230 μs
1760	1.32 KHz	210 μs	1320	0.99 KHz	230 μs
1320	1.32 KHz	210 μs	880	0.88 KHz	230 μs
880	1.32 KHz	210 μs	587	0.88 KHz	230 μs

CHAPTER 3
OPTIONAL EQUIPMENTS

LIST OF TABLES

3.1 GENERAL

This chapter describes the options available for the LQ-850/1050.

3.2 OPTIONAL INTERFACES

The LQ-850/1050 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	#8143"	None	O —	0	19200
	#8145	2K	o	x	9600
	#8 148	2K/8K	o	0	19200
Current Loop	#8 149	32K	o	0	19200
	#8149M	128K	o	0	19200
		Buffer Size	Function	Listen Only Operation	Address Operation
IEEE-488	#816 1	None	L	x / o	o
(GP-IB)	#8165	2K/8K	AH,L,DC	o	0

O... Available X... Not available X... 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 "I" (–3 to –27 V)
	SPACE = logical "O" (+3 to +27 V)
Current loop	MARK = logical "I" (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)	SW14 (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 tha 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

LIST OF FIGURES

LIST OF TABLES

4.1 GENERAL REPAIR INFORMATION

This chapter describes the disassembly procedures to be used for replacing any of the main components of the LQ-850/1 050.

Required and helpful tools, measuring instruments, and lubricants listed in Tables 4-1 through 4-3.

Table 4-1. Repair Tools

Description	Necessary	Convenient	Part No.
Philips screw driver #2	o		B743800200
Box driver (7 mm across)	o		B74 1700200
Thickness gauge (0.45 mm)	o		B776700001
Round nose pliers	o		B740400 100
Diagonal cutting nipper	o		B740500 100
Tweezers	o		B64 1000100
E-ring holder #2.5	o		B740900400
E-ring holder #3	o	—	B740800500
E-ring holder #4	o		B740800600
E-ring holder #5	o		B740800700
Alcohol	o		
Electric soldering iron		o	B740200 100
Brush No. 1		0	B74 1400200
Brush No. 2		0	B74 1400100
Cleaning brush		o	B74 1600100

O: Commercially available product

E: EPSON exclusive tool

Table 4-2. Measuring Instruments

Description	Specification	Necessary	Convenient
Multimeter	———	o	
Oscilloscope	20 MHz or more	0	
Logic analizer			o

Table 4-3. Lubricants and Adhesive

Description	Capacity	Availability	Part No.
o-2	40 cc	E	B7 10200001
G-27	40 gr	E	B702700001
Neji lock #2(G)	1000 gr	E	B730200200
Adhesive tape		o	

O: Commercially available product

E: EPSON exclusive product

Figure 4-1 shows some of the parts found on the LQ-850/1050.

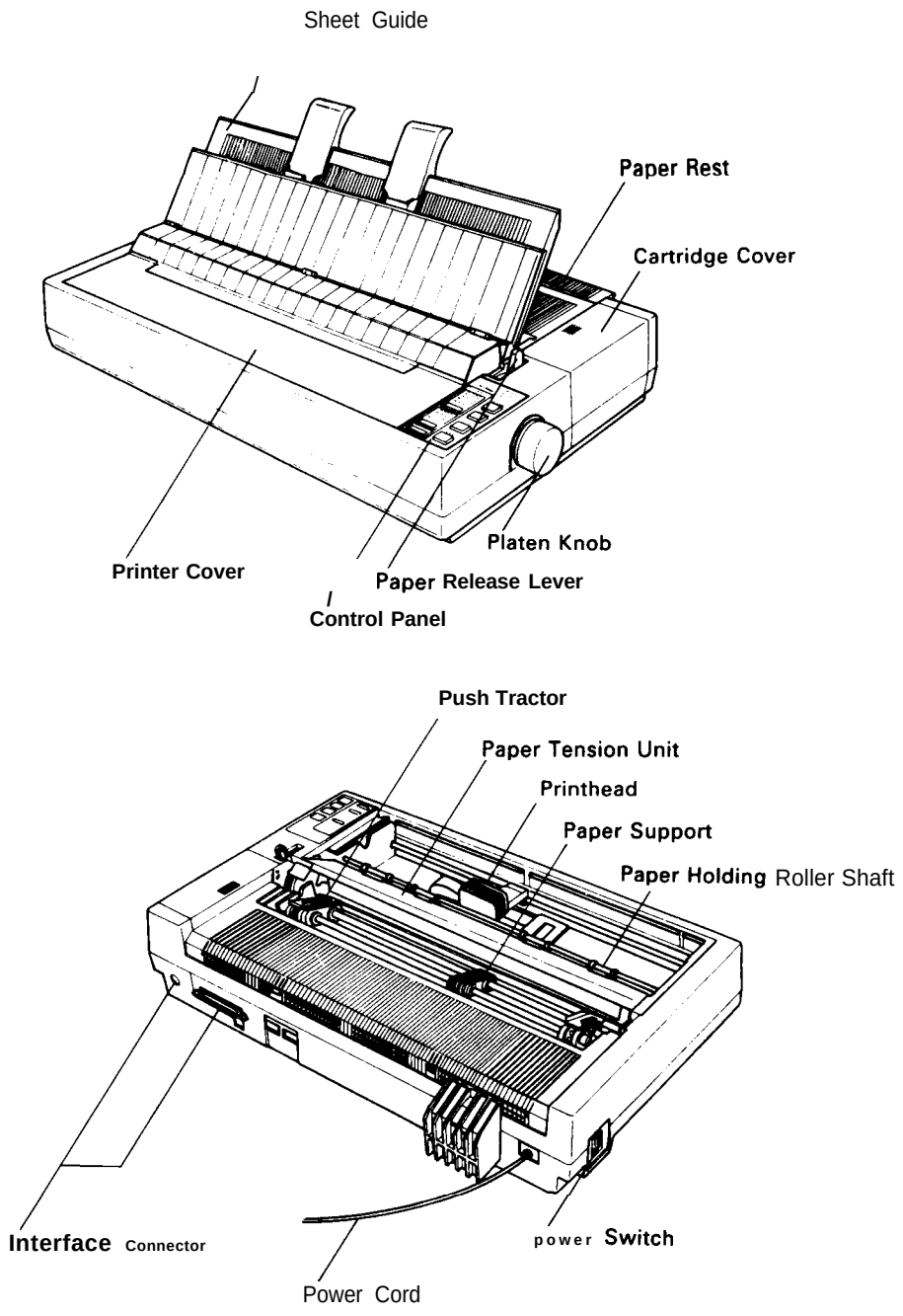


Fig. 4-1. Parts of the LQ-850/1050

WARNING

'here are several precautions you should take after performing troubleshooting and when packing he printer for transport:

. Slide the printhead to the middle of the printer. While holding the paper holding roller shaft open, reattach the locking tabs to left and right of the printer mechanism.

!. Then slide the printhead all the way to the right, and insert the printhead protector between the paper holding roller shaft and platen.

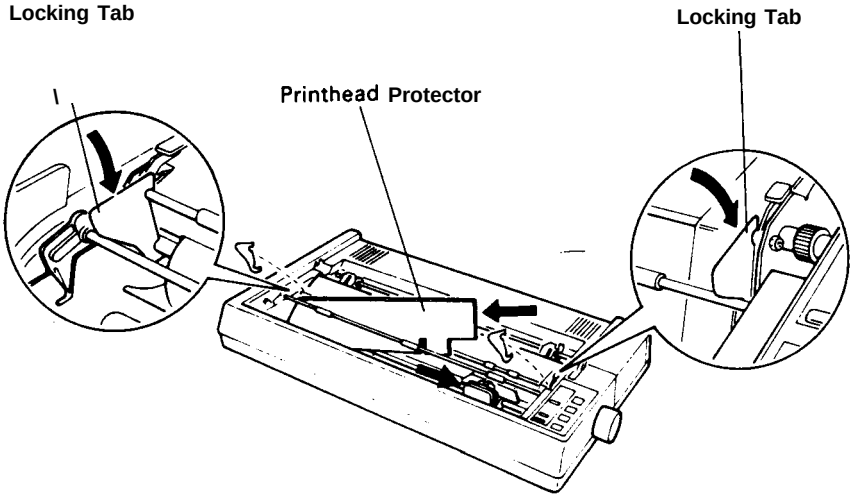


Fig. 4-2. Locking Tabs and Printhead Protector Installation

3. Then, using a philips screw driver #2, reattach the two transport locking brackets by two CTBB (4X 12) screws.

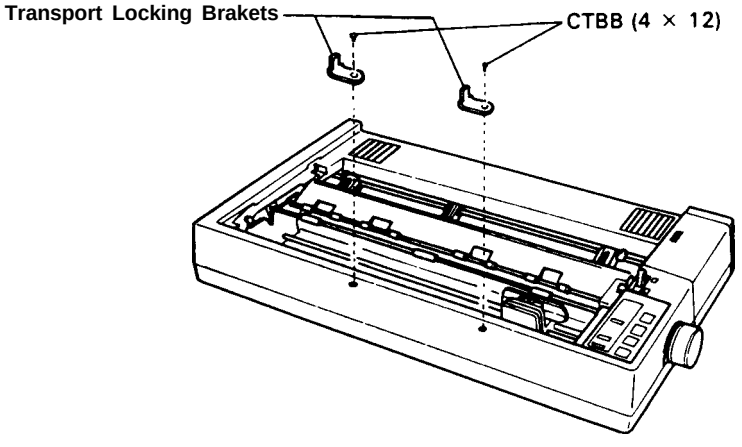


Fig. 4-3. Transport Locking Brackets Installation

4. Repack the printer using the original box and packing materials.
5. Also, before disassemble or checking the printer, remove the protective materials described above by reversing the sequence used for packing procedures.

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

4.2 **DISASSEMBLY** AND ASSEMBLY

Components of the LQ-850/1 050 may be assembled simply by performing the disassembly operation in reverse sequence. Assembly procedures, therefore, have been omitted.

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

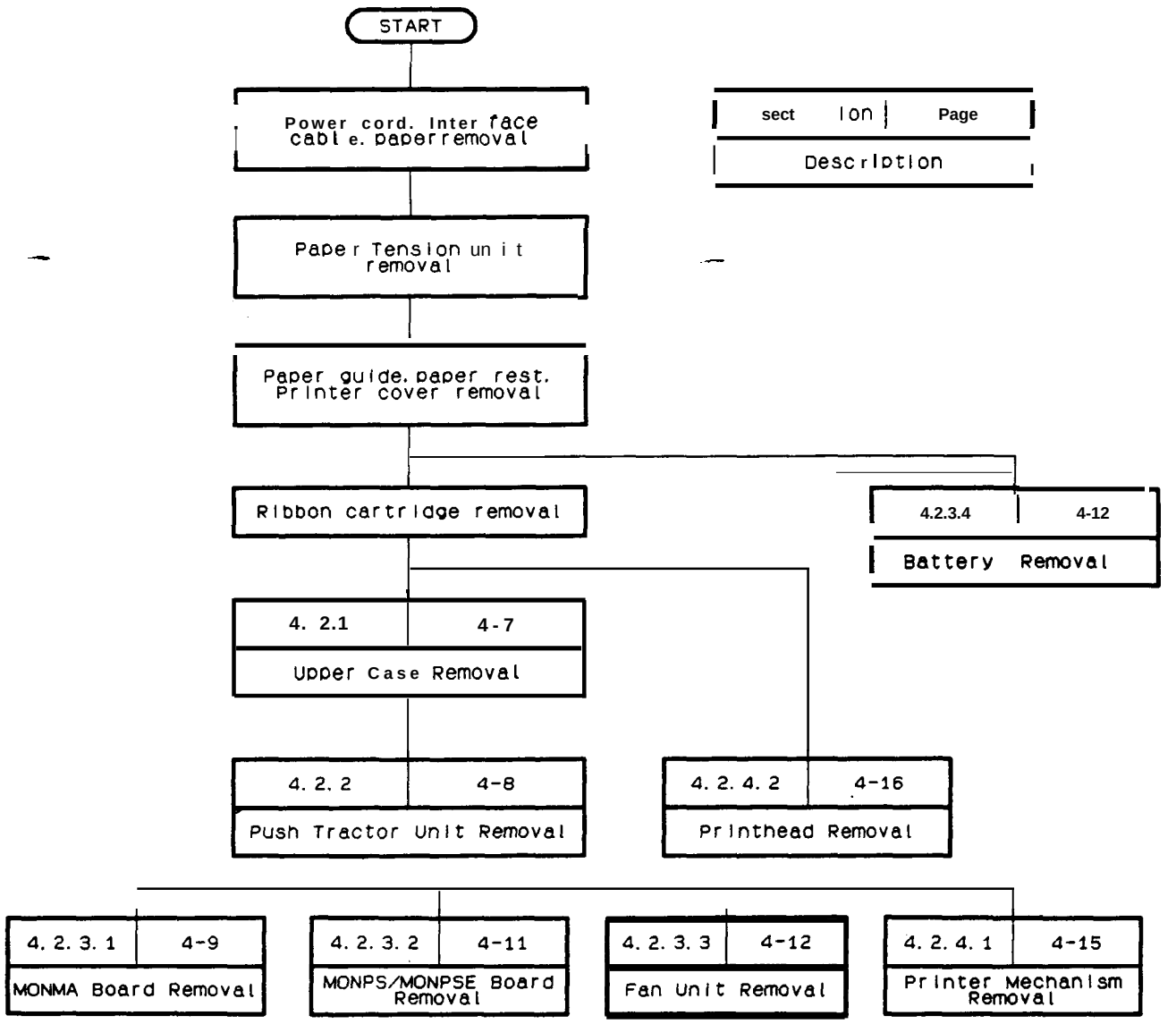


Fig. 4-4. Printer Disassembly Procedures

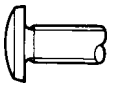
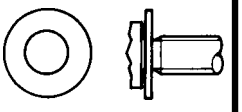
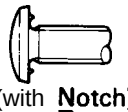
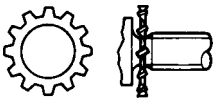
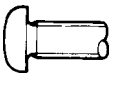
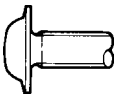
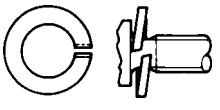
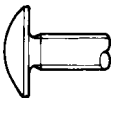
Screws, washers, nuts, etc. are abbreviated using the conventions below.

Table 4-4. Abbreviations List of Small Parts

Abbreviation	Part Name
CBB (CTBB)	Cross-Bind-head B-tight
CBS (CTBS)	Cross-Bind-head S-tight
CBS (0) (CTB (0))	Cross-Bind-head S-tight with Outside-toothed washer
CBNS (CTBS (N))	Cross-Bind-Notch-head S-tight
CPS (0) (CTPS (0))	Cross-Pan-head S-tight with Outside-toothed washer
CPS (P) (CTPS (P))	Cross-Pan-head S-tight with Plain washer
CTB (0)	Cross Truss-head B-tight with Outside-toothed washer
HNO	Hexagon Nut with Outside toothed lock washer
RE	Retaining E-ring
PW	Plain Washer
LS	Leaf Spring

Table 4-5 illustrates the relationship between a screw's physical characteristics and its abbreviated part name.

Table 4-5. Form and Abbreviated Part Name of Screws

Head		Body	Washer (assembled)
Top	Side		
1. Cross—recessed head	1. Bind	1. Normal	1. Plain washer
			
2. Slotted head	 (with Notch)	2. S-tight	2. Outside toothed lock washer
	2. Pan		
		3 & ~	
	3. Cup	4. Tapping	3. Spring washer
			
	4. Truss		
			

4.2.1 Upper Case Removal

To check the interior of this printer, first remove the upper case using the steps listed in the paragraphs below.

DANGER

Prior to beginning the following procedures, be sure to disconnect the power cord and interface cable, and remove the paper installed in the printer.

1. Remove two CBB (4 X 12) screws securing the upper and lower cases.

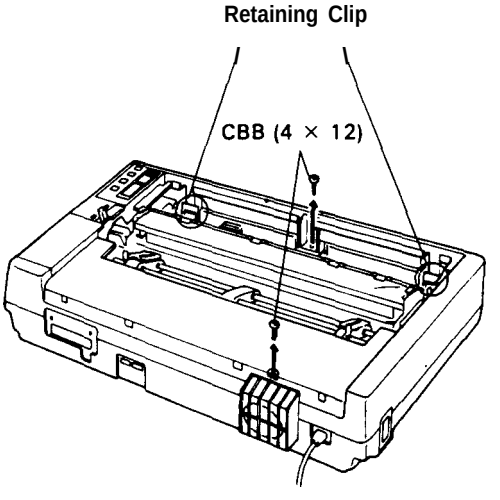
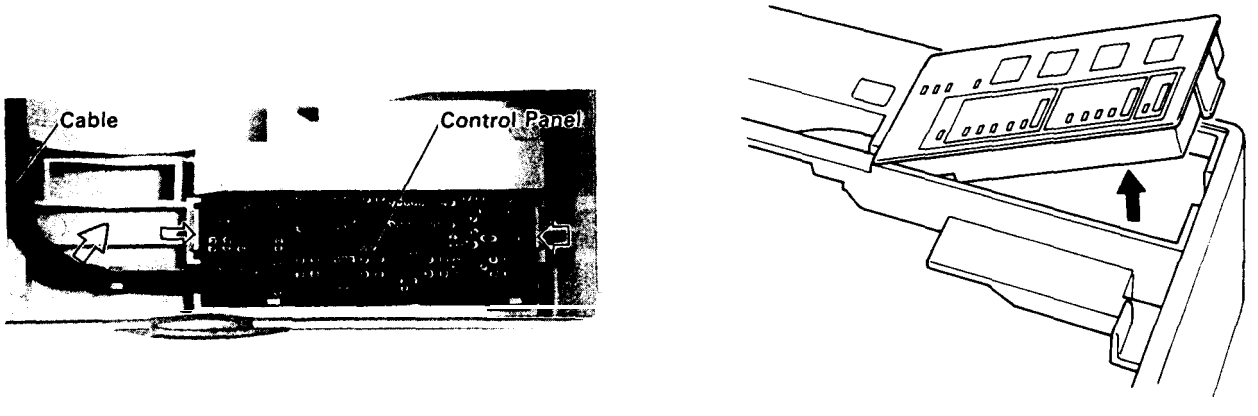


Fig. 4-5. Upper Case Removal

2. Detach the upper case by pressing in on the two retaining clips inside the front of the printer.
3. Remove the control panel from the upper case depressing two hooks and disconnect the cable.



(a) Bottom View **(b) Top View**

Fig. 4-6. Disconnect the Control Panel from the Upper Case

4. Remove the upper case.

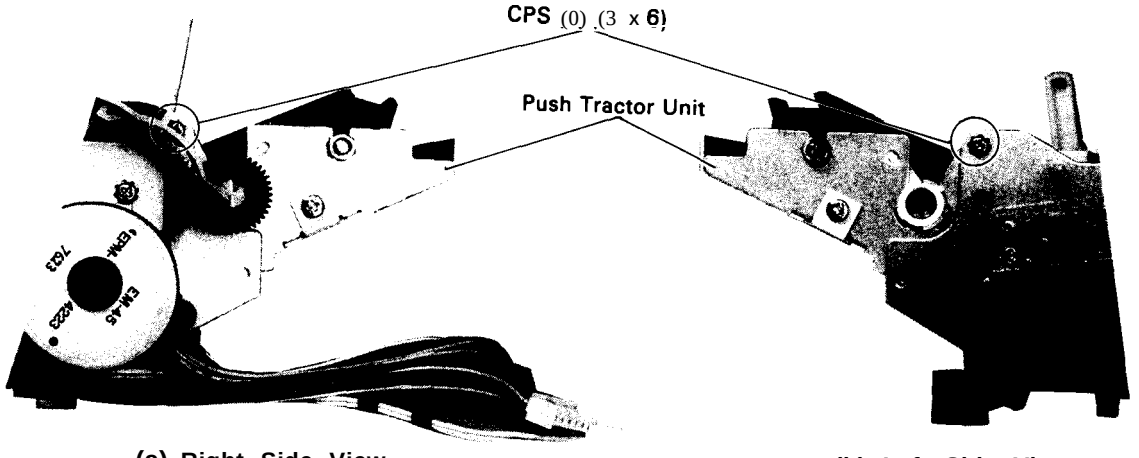
ASSEMBLY POINT

Before setting the upper case back onto the lower case, adjust the paper release lever toward the back.

4.2.2 Push Tractor Unit Removal

Remove the push tractor unit before removing the circuit boards and the printer mechanism from the lower case.

1. Remove the upper case (Refer to Section 4.2. 1.).
2. Remove the two CPS(O) (3X 6) screws securing the push tractor to the printer mechanism.
3. Remove the push tractor unit by pushing it to the back.



(a) Right Side View

(b) Left Side View

Fig. 4-7. Push Tractor Unit Removal

4.2.3 Circuit Board Removal

This printer includes two circuit boards: the MONMA controller circuit board and MONPS/MONPSE power supply circuit board.

4.2.3.1 MONMA Board Removal

1. Remove the upper case (Refer to Section 4.2. 1.).
2. Remove the push tractor unit (Refer to Section 4.2.2.).
3. Disconnect connectors CN 17 and CN 18, which connect the MONPS/MONPSE board.
4. Disconnect connectors CN 12, CN 15, CN 16, CN8, CN9, CN 10, CN 14, CN 13, and CN 11, which connect the printer mechanism.
5. Disconnect connector CN 19, which connects the battery.

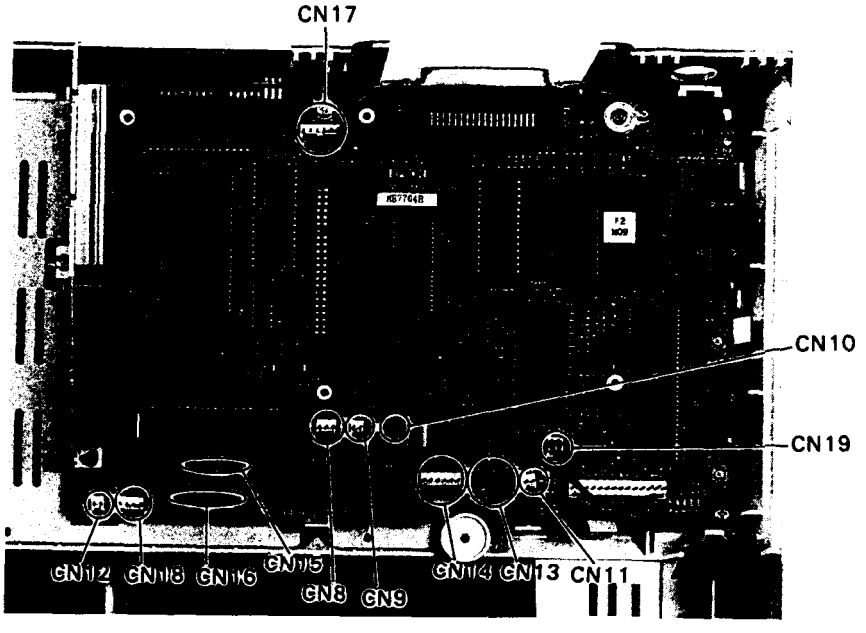


Fig. 4-8. Connectors Removal

6. Remove the shield plate at the back of the lower case.

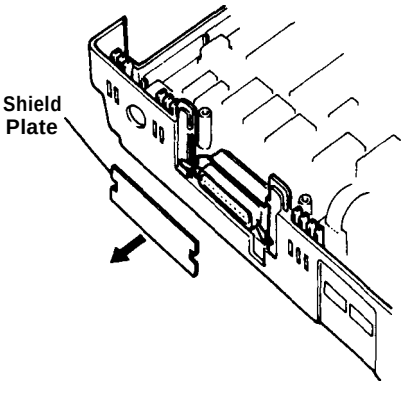


Fig. 4-9. Shield Plate Removal

7. Remove the two CBS (3 X 10) and two CBB (3 X 10) screws securing the MONMA board.
8. Release three tabs securing the MONMA board.
9. Remove the CPB (3X 12) screw and spacer securing the MONMA board.
10. Remove the MONMA board and disconnect connector CN7 from the control panel.

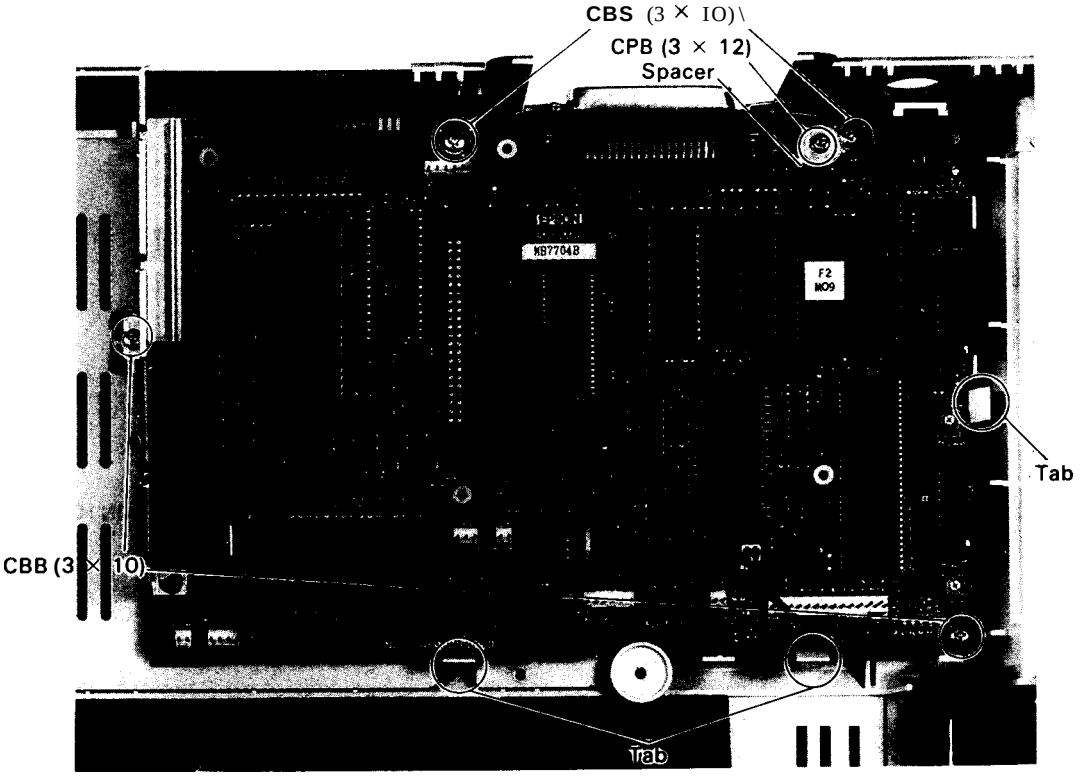


Fig. 4-10. MONMA Board Removal

4.2.3.2 MONPS/MONPSE Board Removal

1. Remove the upper case (Refer to Section 4.2. 1.).
2. Remove the push tractor unit (Refer to Section 4.2.2.).
3. Disconnect connector CN 1 which connect the MONMA board and CN2 which connect the fan unit.
4. Remove the two CBS (3 X 10) and two CBB (3 X 10)screws securing to lower case.
5. Remove the CBS(0) (4 X 8) screw with the fixing ground which secures the AC ground wire.
6. Remove the MONPS/MONPSE board, along with the power switch and the AC cable (120V version) or AC inlet (220/240V version).

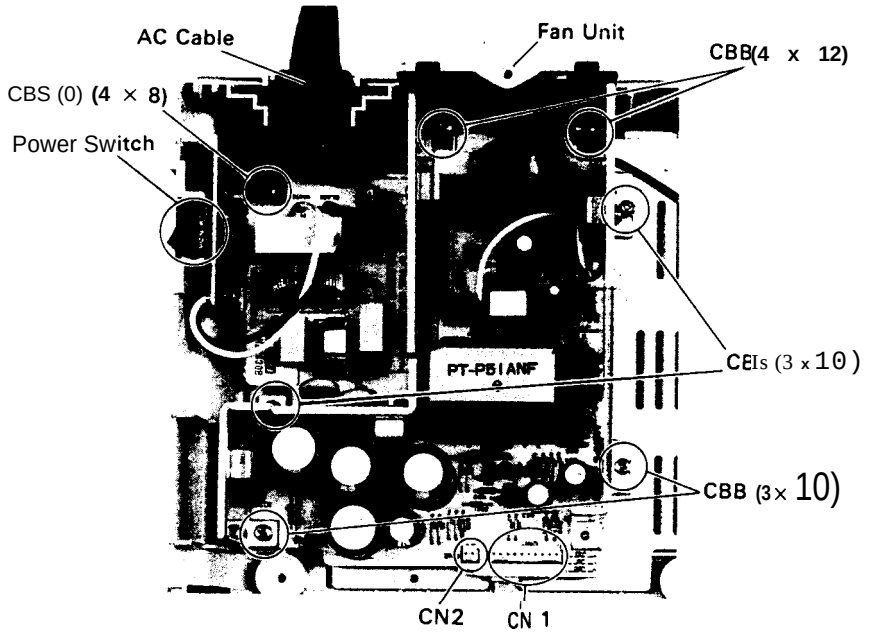


Fig. 4-11. MONPS/MONPSE Board Removal

4.2.3.3 Fan Unit Removal

1. Remove the upper case (Refer to Section 4.2. 1.).
2. Remove the push tractor unit (Refer to Section 4.2.2.).
3. Remove the MONPS/MONPSE board (Refer to Section 4.2.3.2.).
4. Remove the two CBB (4 X 12) screws securing to lower case.
5. Remove the fan unit.
6. Separate the fan motor and fan adaptor.

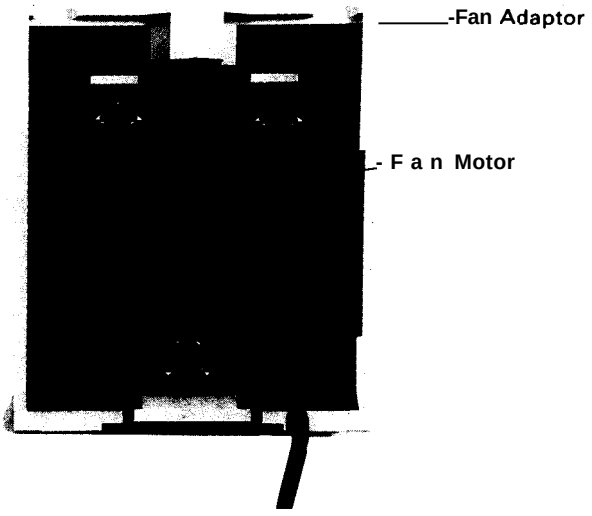


Fig. 4-12. Fan Unit Removal

4.2.3.4 Battery Removal

1. Remove the upper case (Refer to Section 4.2.1.).
2. Remove the CBB (4 X 12) screws securing the battery case.
3. Release a tab securing the battery case.
4. Remove the battery from the battery case.

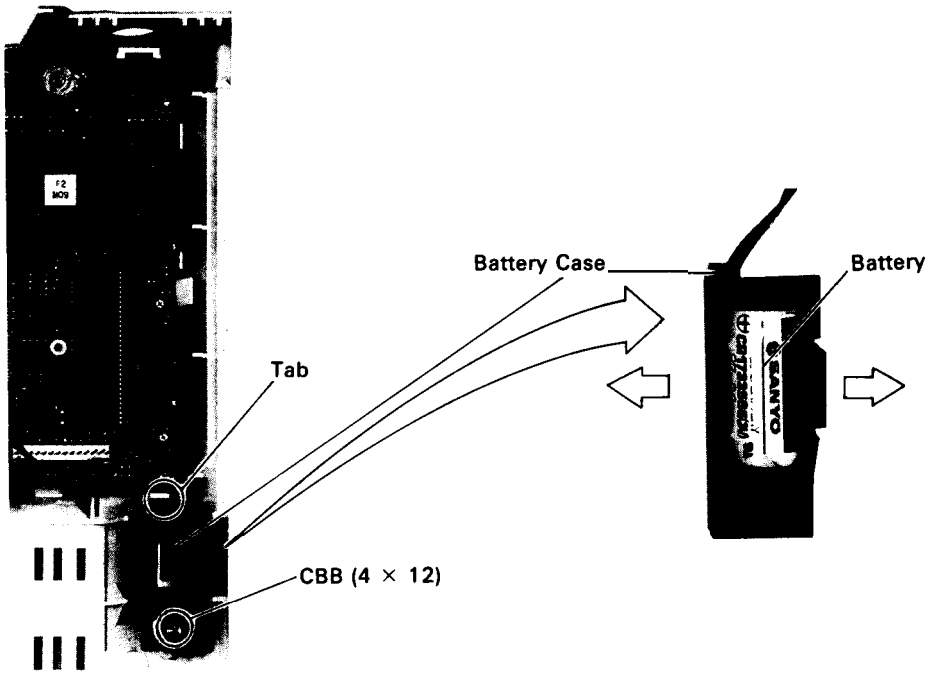


Fig. 4-13. Battery Removal

4.2.4 Printer Mechanism Disassembly

This section describes the procedures for disassembling the main components of the printer mechanism. Figure 4-14 shows the relationship of the printer mechanism's majour components for reference during assembly.

Refer to Figures A-37 through A-44 in the Appendix during assembly.

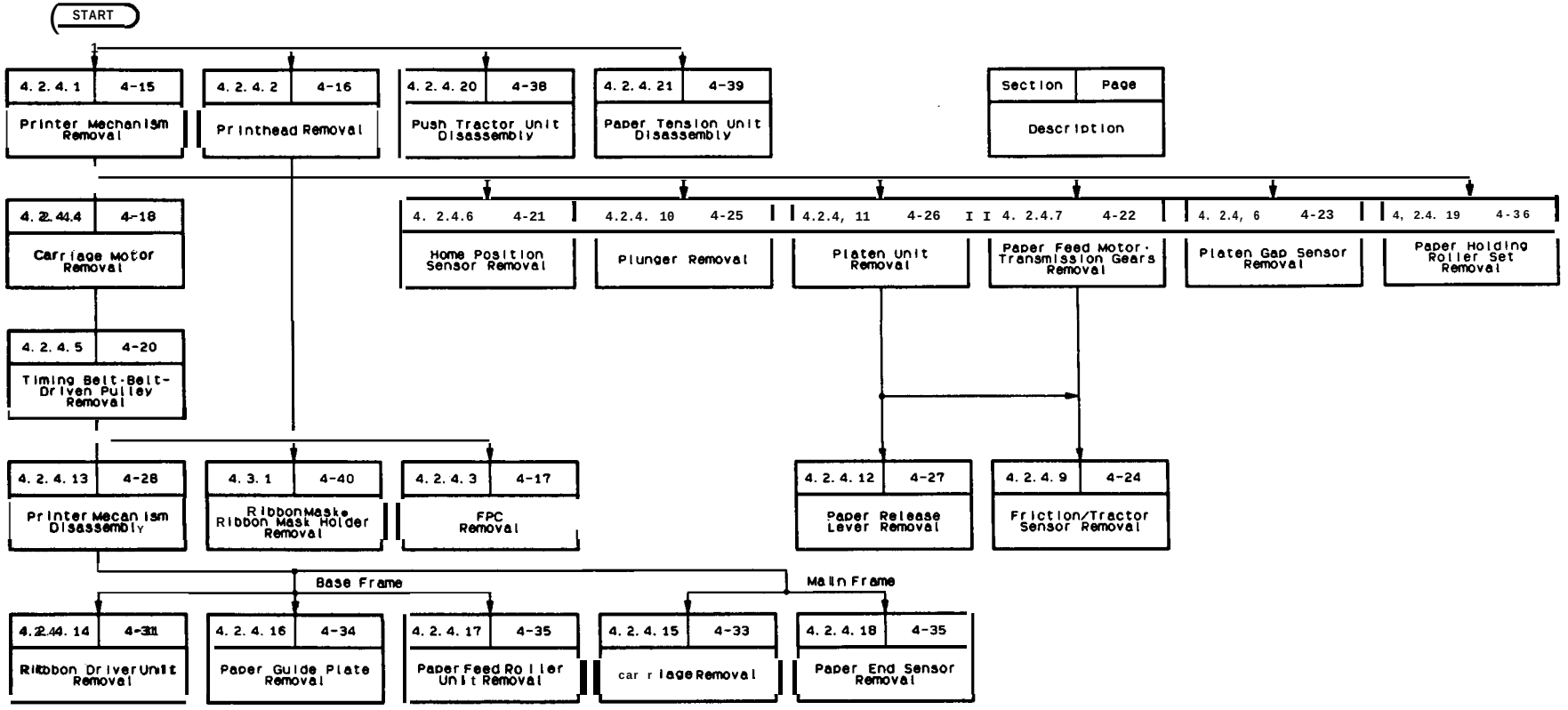


Fig. 4-14. Printer Mechanism's Component Relationship

4.2.4.1 Printer Mechanism Removal

1. Remove the upper case (Refer to Section 4.2. 1.).
2. Remove the platen knob.
3. Remove the push tractor unit (Refer to Section 4.2.2.).
4. Disconnect connectors CN 12, CN 15, CN 16, CN8, CN9, CN 10, CN 14, CN 13, and CN 11 from the MONMA board (Refer to Figure 4-8.)
5. For the LQ-850 remove the three screws, or for the LQ-105O remove the four screws, CPS(O) (3 X 6), which attach the ground plates to base frame.
6. For the LQ-850 remove the four screws, or for the LQ-1 050 remove the five screws, CTB(O) (4 X 22), securing the printer mechanism to the lower case.

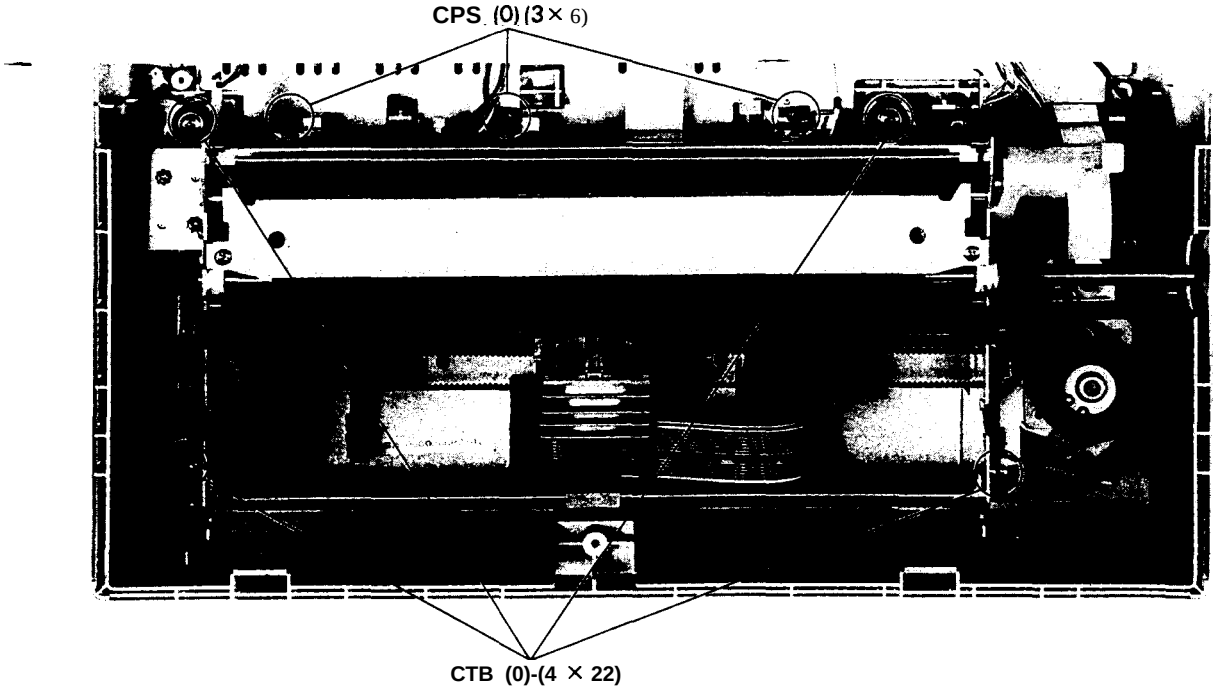


Fig. 4-15. Printer Mechanism Removal

7. Remove the printer mechanism.
8. Remove three for the LQ-850 or four screws for the LQ-105O, CPS(O) (3 X 6), securing the ground plates to the base frame of the printer mechanism.

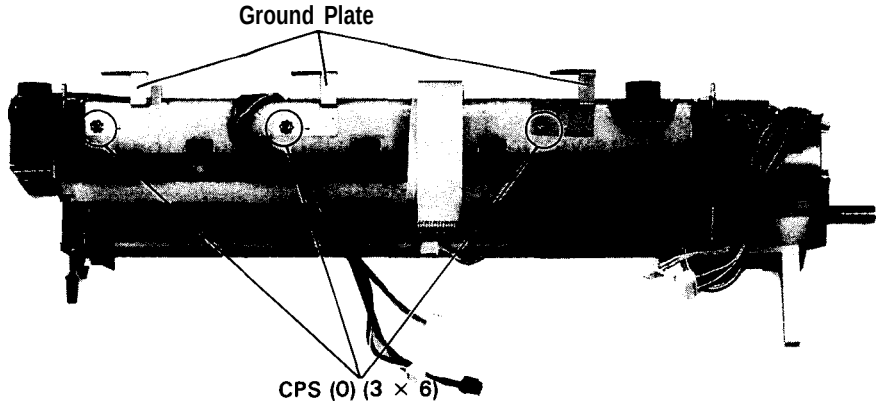


Fig. 4-16. Ground **Plates** Removal

4.2.4.2 **Printhead** Removal

1. Remove the printer cover.
2. Remove the ribbon cartridge.
3. Move the head lock levers to the outside.
4. Shift the **printhead** slightly toward the platen side (1) pull it upward, (2) slide it to the right, and (3) remove from the carriage.

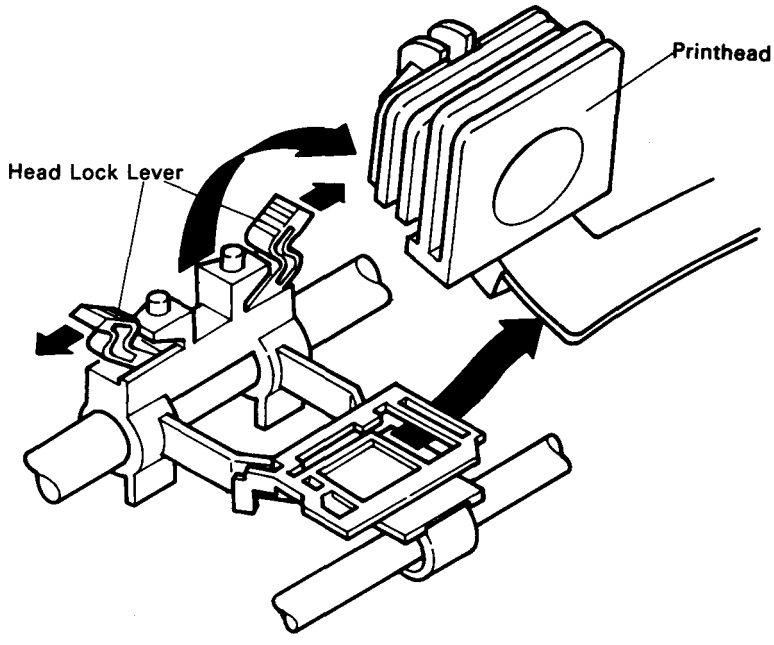


Fig. 4-17. **Printhead** Removal

5. Disconnect the two flexible printed cables (FPCs) from the connectors at the printhead.

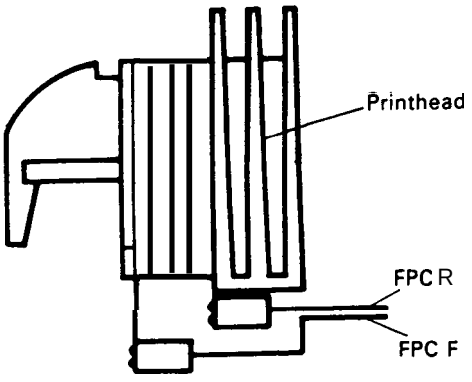


Fig. 4-18. Disconnecting FPC

ASSEMBLY POINT

Insert FPCs to the connector as shwon in Figure 4-18.

4.2.4.3 FPC (Flexible Printed Cable) Removal

1. Remove the printer mechanism (Refer to Section 4.2.4. 1.).
2. Remove the printhead (Refer to Section 4.2.4.2.).
3. Remove the two pairs of the FPCs at the bottom of the base frame.
4. Press the two tabs for the head cable guide at the bottom of the base frame, and remove the head cable holder.
5. Remove FPCs.

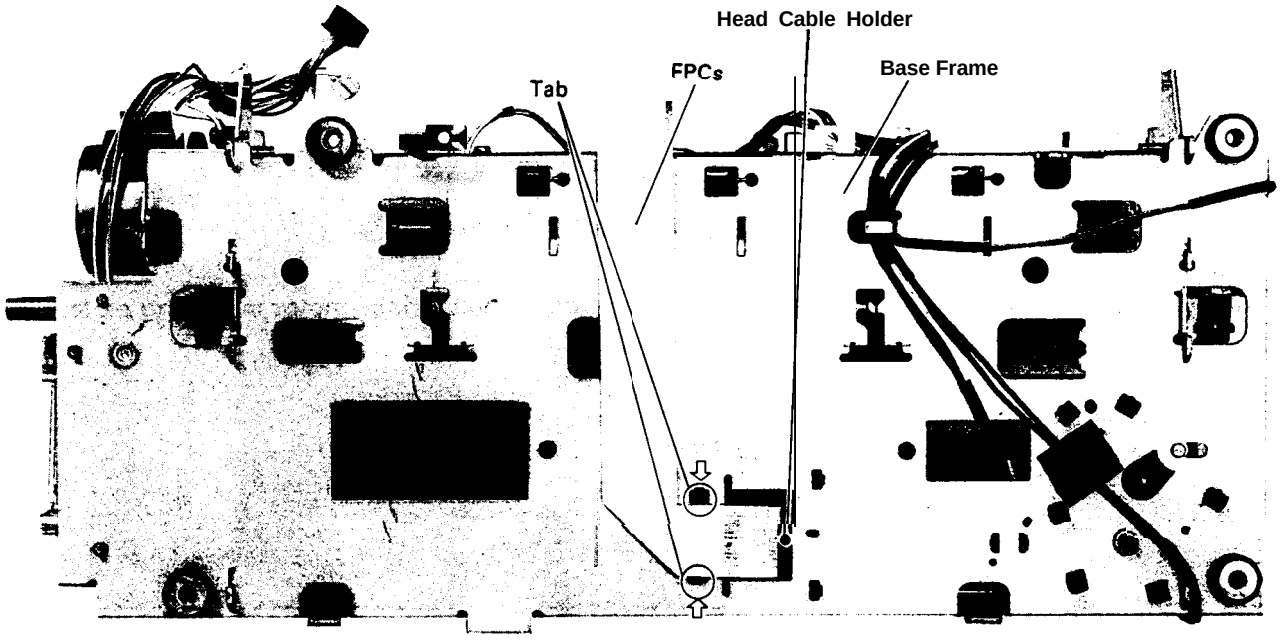


Fig. 4-19. FPC Removal

ASSEMBLY POINT

The FPCs are taped to the base frame with a double-sided adhesive tape. Before retaping the FPC to the base frame, use alcohol to clean the area where the adhesive stuck the FPC to the base frame.

4.2.4.4 Carriage Motor Removal

1. Remove the printer mechanism (Refer to Section 4.2.4.1.).
2. Remove the carriage motor wires from the wire holder.
3. Remove the timing-belt tension spring.
4. Remove the two CPS (0)(3 X 10) screws securing the carriage motor mounting plate to base frame via carriage motor mounting bush.
5. Remove the carriage motor mounting plate together with the carriage motor.

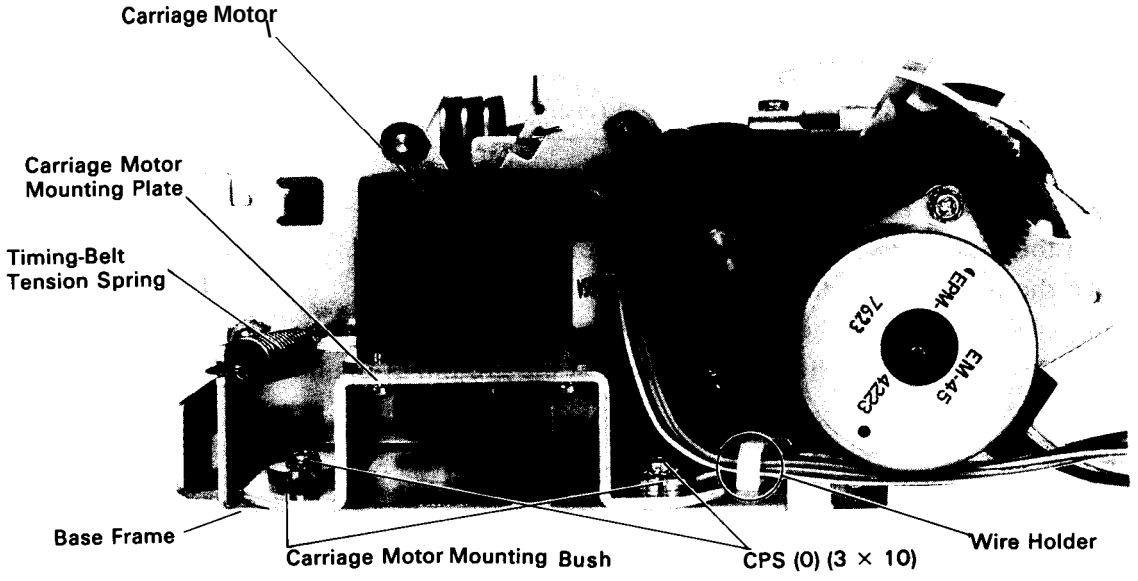


Fig. 4-20. Carriage Motor Removal (1)

6. Remove the four CPS(O) (3 X 6) screws on the rear side of the carriage motor mounting plate, which secure the carriage motor.

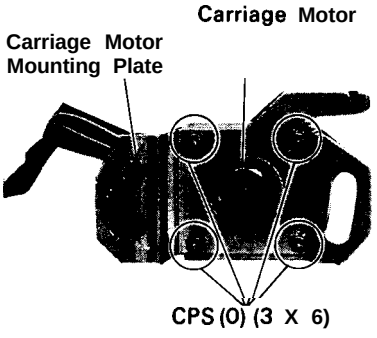


Fig. 4-21. Carriage Motor Removal

ASSEMBLY POINT

1. Set the timing belt correctly at the drive pulley of the carriage motor.
2. Mount the carriage motor with carriage motor mounting plate and carriage motor mounting bushes on base frame by lightly tightening two CPS (0) (3 × 10) screws.
3. Attach thetiming-belttension spring to hooks on both the base frame and carriage motor mounting plate.
4. Tighten the screws on the carriage motor mounting plate.

4.2.4.5 Timing Belt* Belt-Driven Pulley Removal

1. Remove the printer mechanism (Refer to Section 4.2.4.1 .).
2. Remove the timing-belt tension spring.
3. Loosen the two CPS(O)(3 X 10) screws which fixing carriage motor mounting plate to the base frame.
4. Pull the timing belt out from carriage motor pulley.
5. Place the carriage over the notch in right side of the base frame, and release the two engaged parts of the timing belt and carriage from the bottom side of the base frame.
6. Remove the belt-driven pulley by moving it to the left, and remove the timing belt.

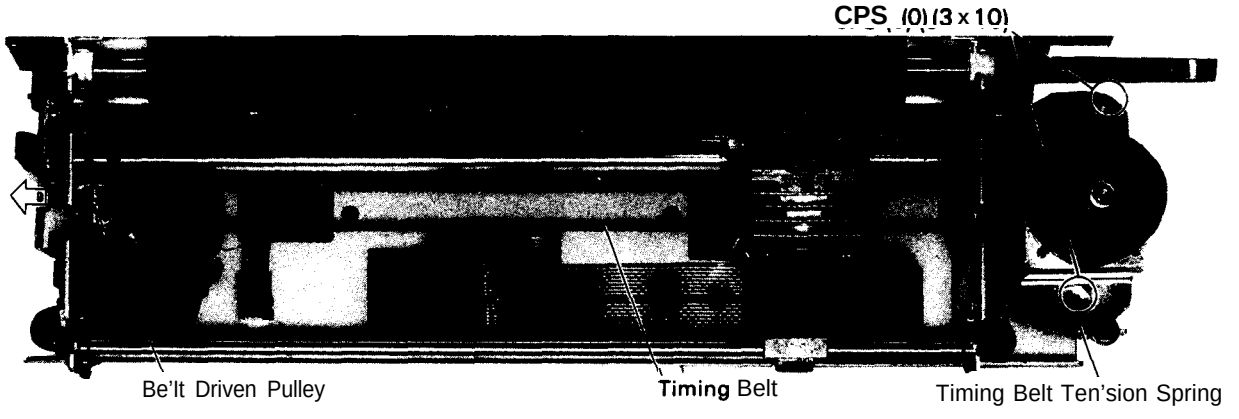


Fig. 4-22. Timing Belt Removal

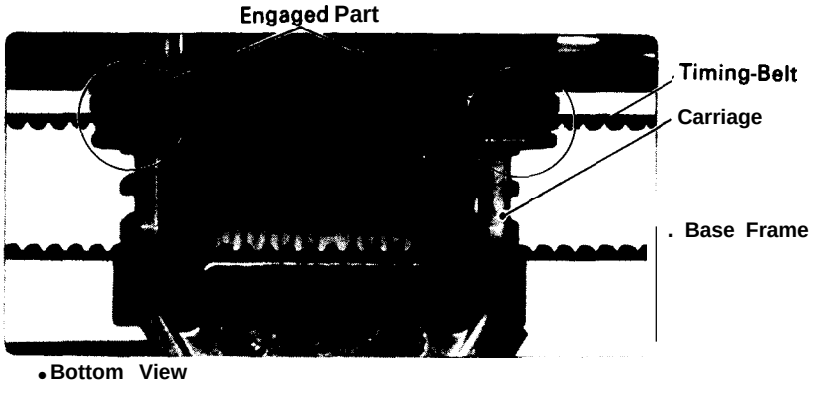


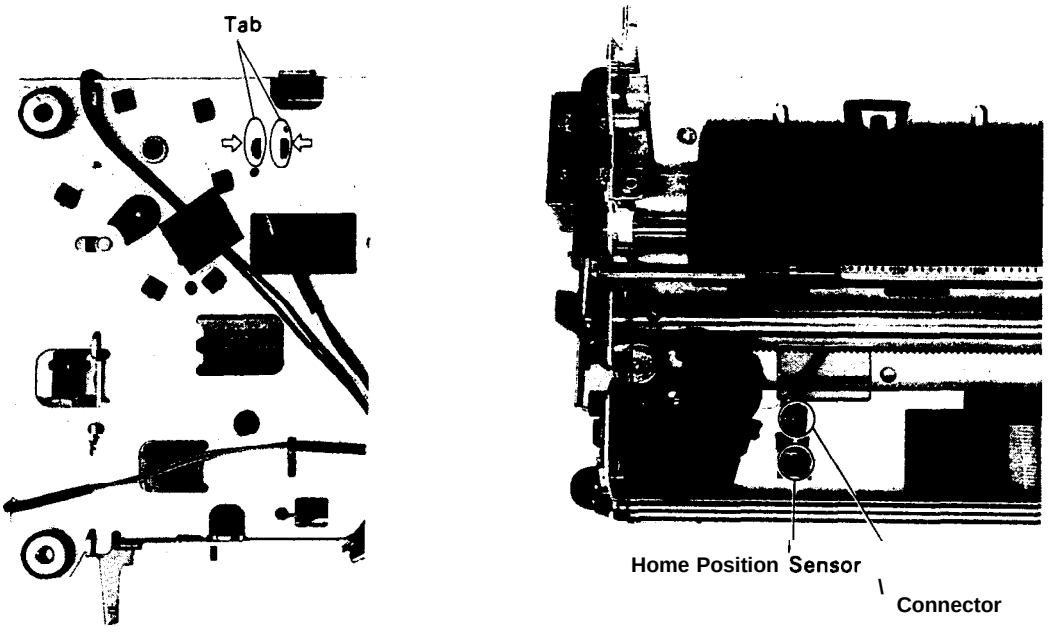
Fig. 4-23. Timing Belt Insertion

ASSEMBLY POINTS

1. Verify that the timing belt runs around the belt-driven pulley and the belt-driving pulley of the carriage motor shaft.
2. Insert the timing belt firmly into the carriage, utilizing the notch in the base frame, in the same way as when removing it. After insertion, apply adhesive at the engaged parts of the carriage and the belt (Refer to Section 6.2, Lubrication and Adhesive Application.). Insert the belt until the undersurfaces of the belt mesh with the inserted parts of the carriage.
3. Hang the timing-belt tension spring on hooks for both base frame and carriage motor mounting plate.
4. Tighten the screws on the carriage motor mounting plate.

4.2.4.6 Home Position Sensor Removal

1. Remove the printer mechanism (Refer to Section 4.2.4.1.).
2. Press the two tabs of the home position sensor on the bottom of the base frame.
3. Remove the home position sensor.
4. Disconnect the connector from the home position sensor.



(a) Bottom View (b) Top View

Fig. 4-24. Home Position Sensor Removal

4.2.4.7 Paper Feed Motor* Transmission Gears Removal

1. **Remove the printer mechanism (Refer to Section 4.2.4.1 .).**
2. **Remove the two CPS(O) (3 X 6) screws.**
3. **Remove the paper feed motor.**

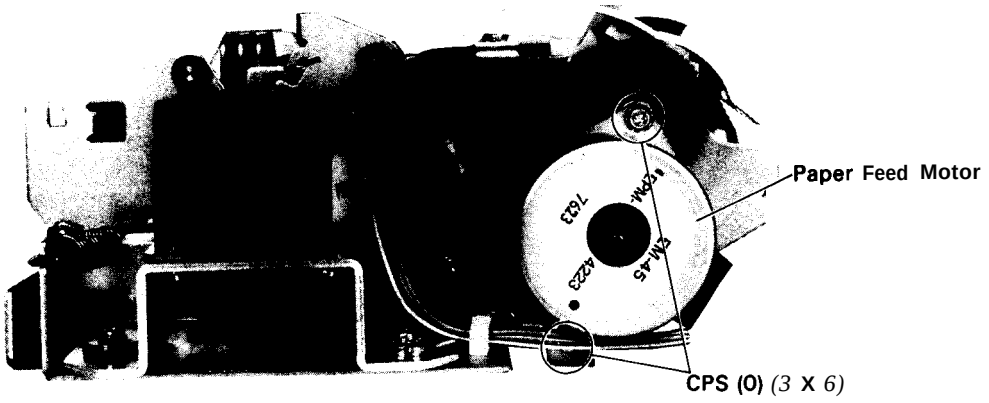


Fig. 4-25. Paper Feed Motor Removal

4. **Remove the tractor transmission gear spring.**
5. **Remove the paper feed transmission gear.**
6. **Remove the PW (5.2 X 0.3 X 10) and tractor transmission gear.**

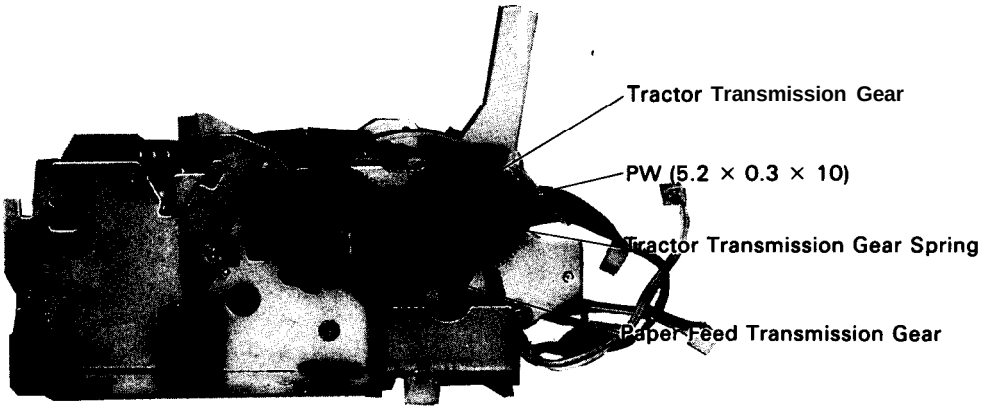


Fig. 4-26. Transmission Gears Removal

ADJUSTMENT REQUIRED

When the paper feed motor is replaced or the fixing screws are loosened, perform the Section 4.3.2. Paper Feed Motor Gear Backlash Adjustment.

4.2.4.8 Platen Gap Sensor Removal

1. **Remove the printer mechanism (Refer to Section 4.2.4.1.).**
2. **Position the head adjustment lever at a setting between the 4th and 8th positions.**
3. **Remove the CPS(P) (3 X 10) screw securing the platen gap sensor to the side frame L, then remove the sensor.**

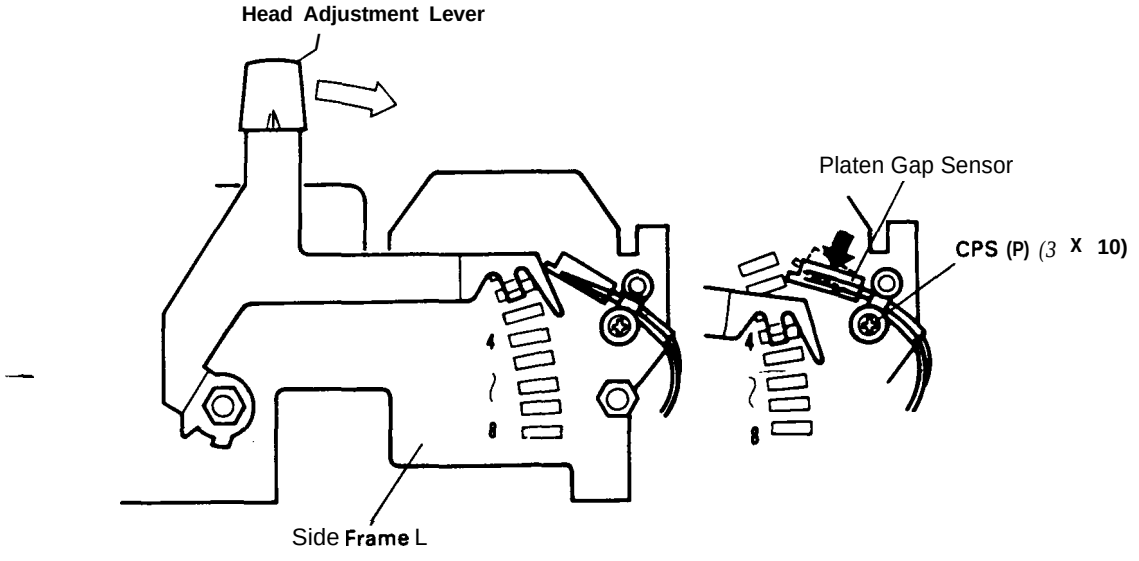


Fig. 4-27. Platen Gap Sensor Removal

ASSEMBLY POINT

Make sure that the sensor direction and set position before mount the platen gap sensor on the side frame L.

4.2.4.9 Friction/Tractor Sensor Removal

1. Remove the printer mechanism (Refer to Section 4.2.4. 1.).
2. Position the paper release *lever* at the its back setting.
3. Remove the paper feed motor (Refer to Section 4.2.4.7).
4. Remove the CPS(P) (3 X 10) screw securing the friction/tractor sensor to the side frame R, then remove the sensor.

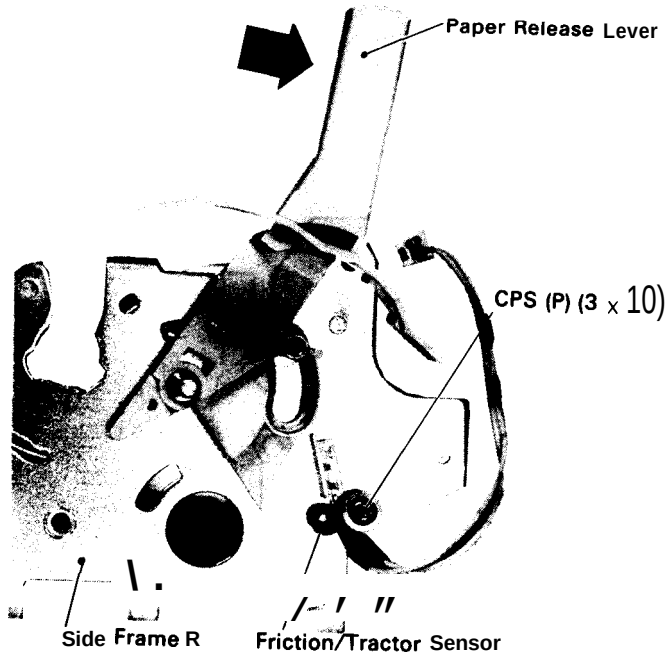


Fig. 4-28. Friction/Tractor Sensor Removal

ASSEMBLY POINT

Make sure of the sensor direction and set in place before mounting the friction/tractor sensor on the side frame R.

4.2.4.10 Plunger Removal

1. Remove the RE (3), and disconnect loading lever of the plunger from the paper holding lever L.
2. Remove two CPS (0) (3 X 6) screws, which secure the plunger to the side frame L, then remove the plunger.

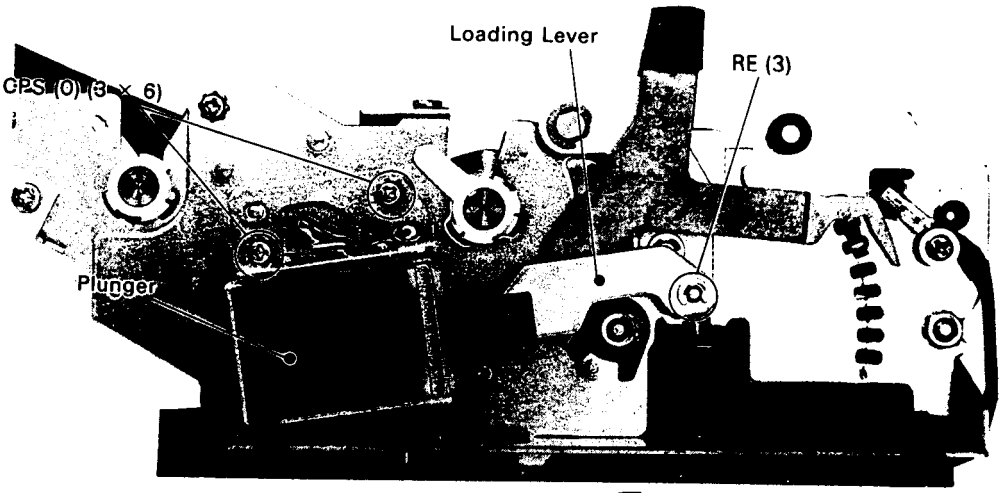


Fig. 4-29. Plunger Removal

ASSEMBLY POINTS

1. Mount plunger on side frame L by tightening the two CPS (0) (3 × 6) screws lightly.
2. Set loading lever onto paper holding lever L, and put on RE (3).
3. Hold the pulnger and cylinder as shown in Figure 4-30, and position it where move smoothly the cylinder, and tight screws.

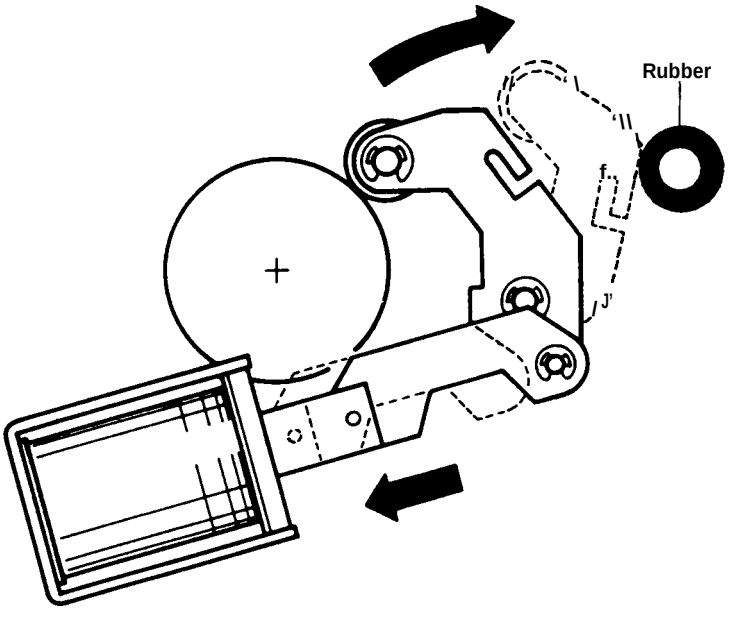


Fig. 4-30. Plunger Positioning

4.2.4.11 Platen Unit Removal

1. Remove the upper case (Refer to Section 4.2. I.).

2. Remove the two CBNS (3 X 6) screws securing the platen cover to side frames L and R, then remove the platen cover.

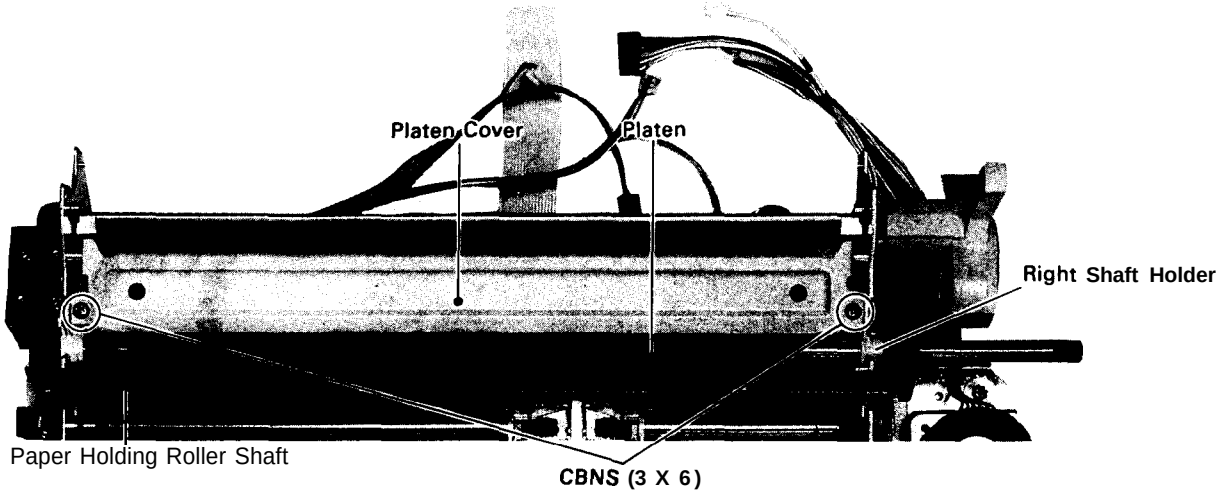


Fig. 4-31. Platen Cover Removal

3. **Push on the right shaft holder clip, and rotate it forward.**

4. Remove the platen unit by moving it to the right side while pulling paper holding roller shaft forward.

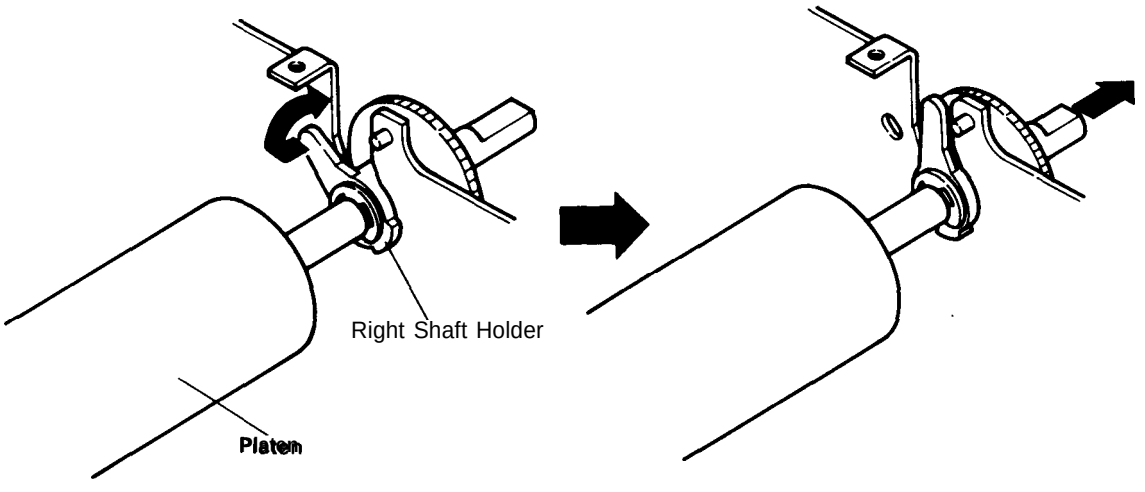


Fig. 4-32. Platen Removal

4.2.4.12 Paper Release Lever Removal

1. **Remove the printer mechanism (Refer to Section 4.2.4.1.).**
2. **Remove the paper feed motor and transmission gears (Refer to Section 4.2.4.7.).**
3. **Remove the platen unit (Refer to Section 4.2.4.1 1.).**
4. **Press the paper release lever tab at the inside of the side frame R, then remove the lever.**

Fig. 4-33. Paper Release Lever Removal

4.2.4.13 Printer Mechanism Disassembly

1. **Remove the printer mechanism (Refer to Section 4.2.4.1.).**
2. **Remove the printhead (Refer to Section 4.2.4.2.).**
3. **Remove the carriage motor (Refer to Section 4.2.4.4.).**
4. **Remove the belt-driven pulley (Refer to Section 4.2.4.5.).**
5. **Remove the paper feed motor (Refer to Section 4.3.4.7.).**
6. **Cut wire clumps fix cables to the base frame.**

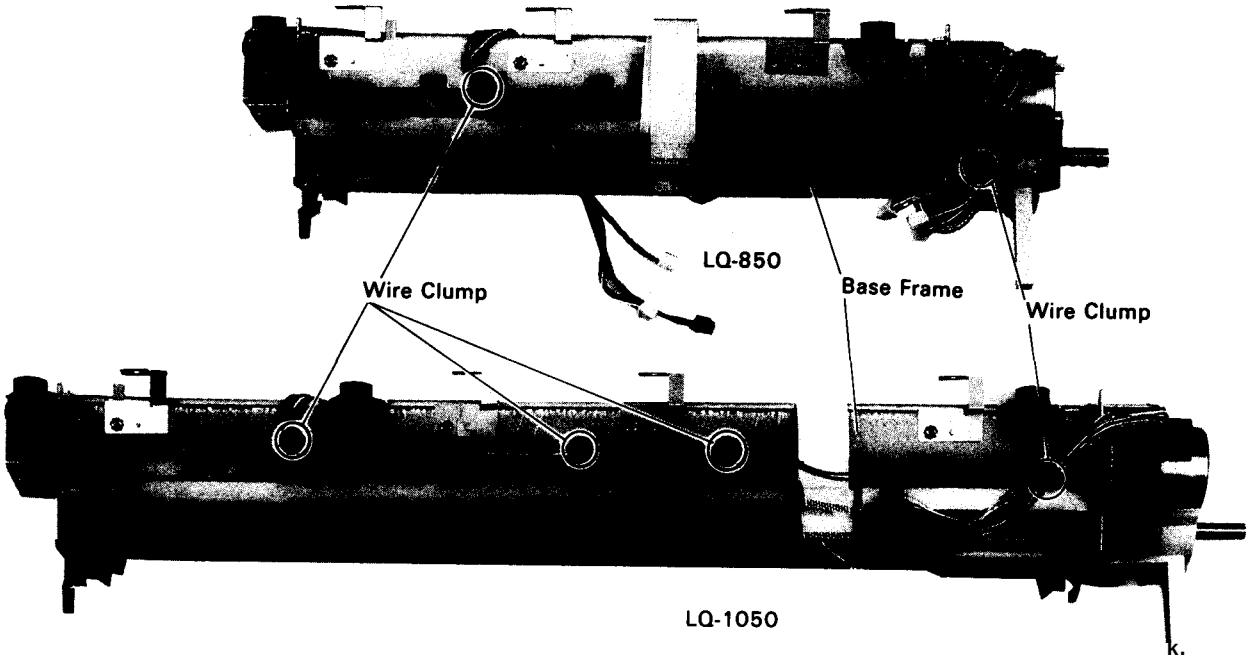


Fig. 4-34. Wire Clump Positions

7. **Remove the adhesive tape.**
8. **Remove the home position sensor, platen gap sensor, and plunger cables from the base frame.**

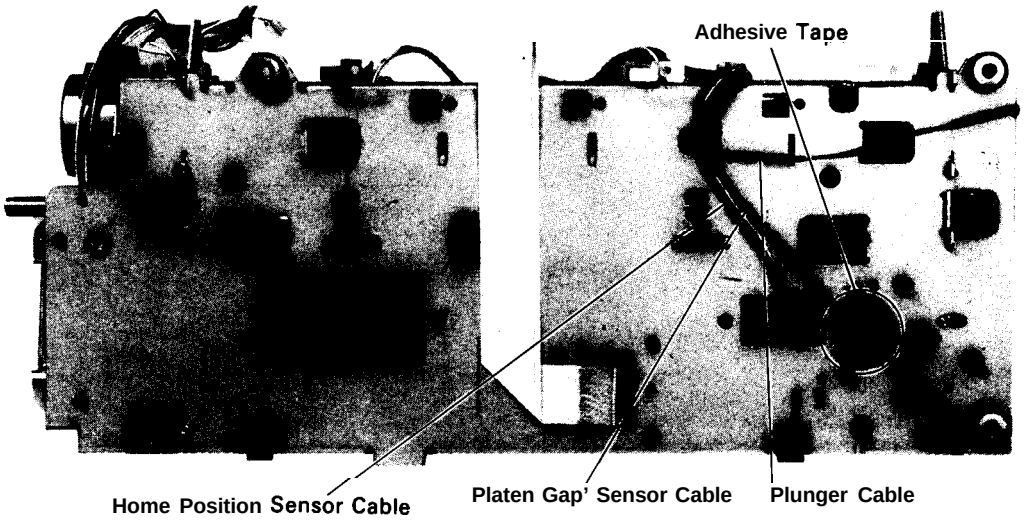


Fig. 4-35. Adhesive Tape and Cable Positions on the Base Frame

9. Remove two CPS (0) (3 × 10) screws securing both side frames L and R to the base frame.

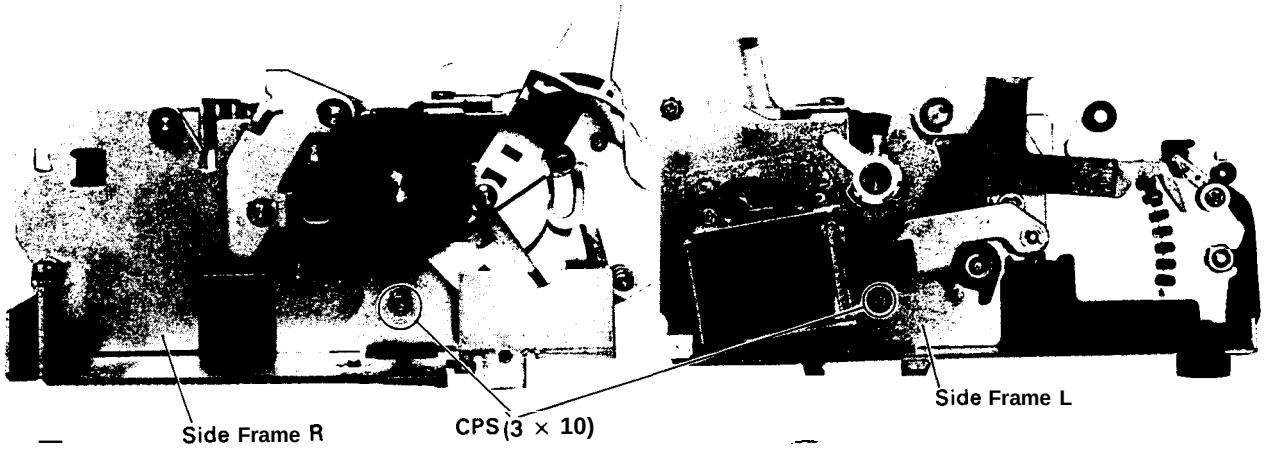


Fig. 4-36. Screws Removal

10. Detach the hooks on the main unit from the base frame, and pull the main unit up.

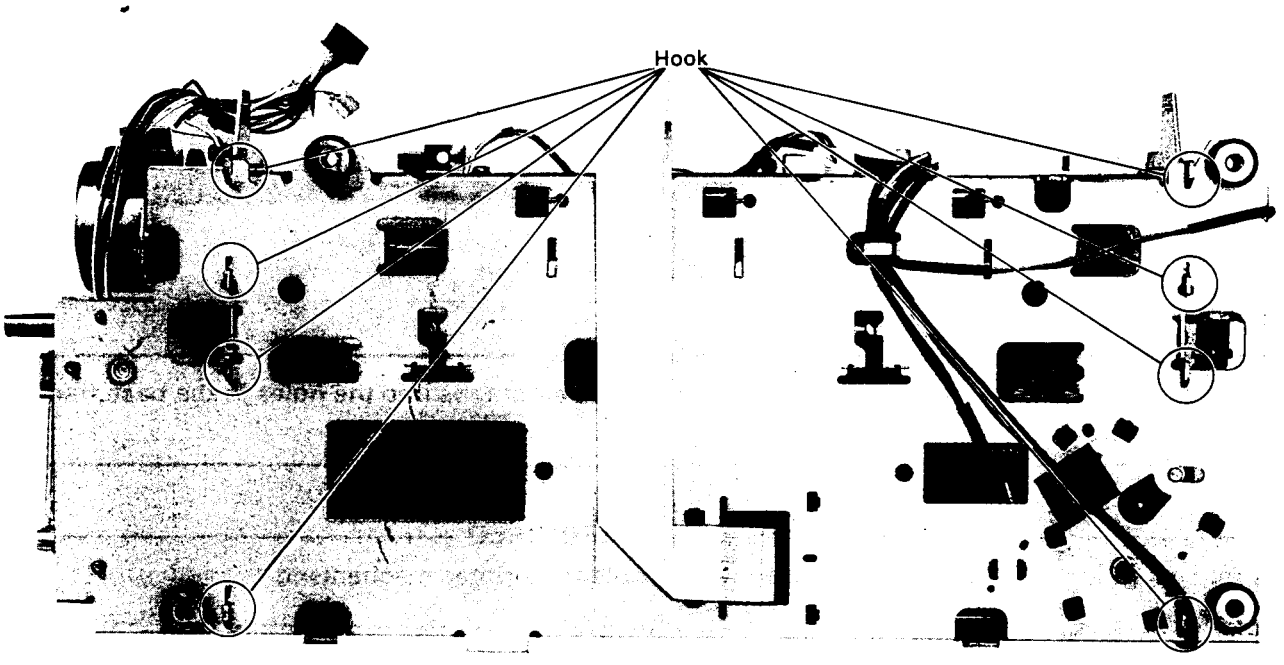


Fig. 4-37. Printer Mechanism Separation

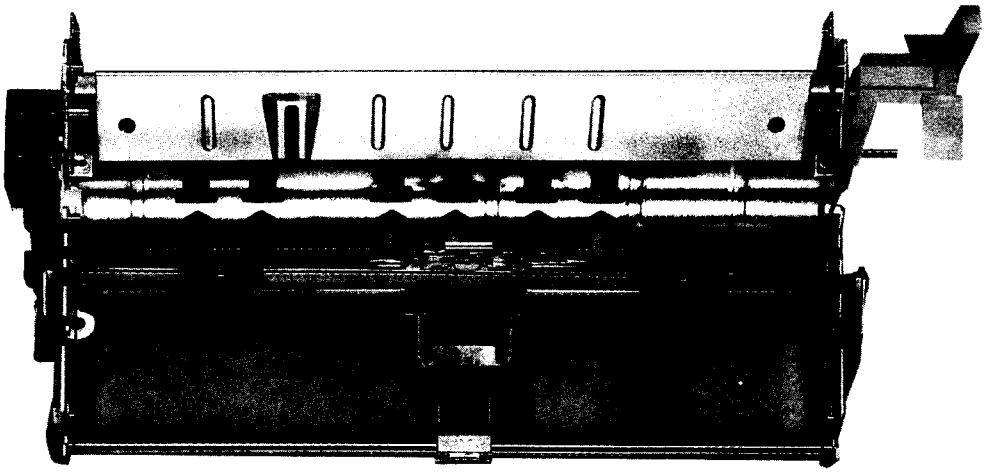


Fig. 4-38. Main Frame Unit

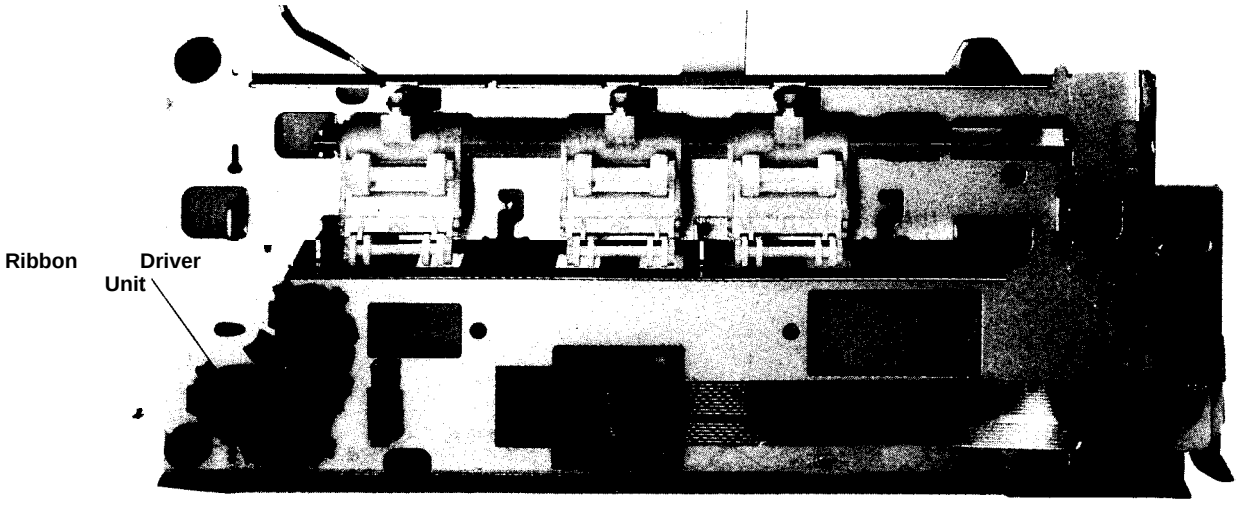


Fig. 4-39. Base Frame Unit

ASSEMBLY POINT

When fitting the main frame to the base frame, hook the eight tabs into the holes in the base frame, and pull it forward.

ADJUSTMENTS REQUIRED

The following adjustments are required to reassemble the printer mechanism:

4.3.2 Paper Feed Motor Backlash Adjustment
4.3.3 Timing Belt Tension Adjustment

4.2.4.14 Ribbon **Driver** *Unit Removal*

1. **Remove the printer mechanism (Refer to Section 4.2.4. l.).**
2. **Separate the main and base units (Refer to Section 4.2.4.1 3.).**
3. **Press the six tabs for the ribbon driver unit at the bottom of the base frame, and remove it.**

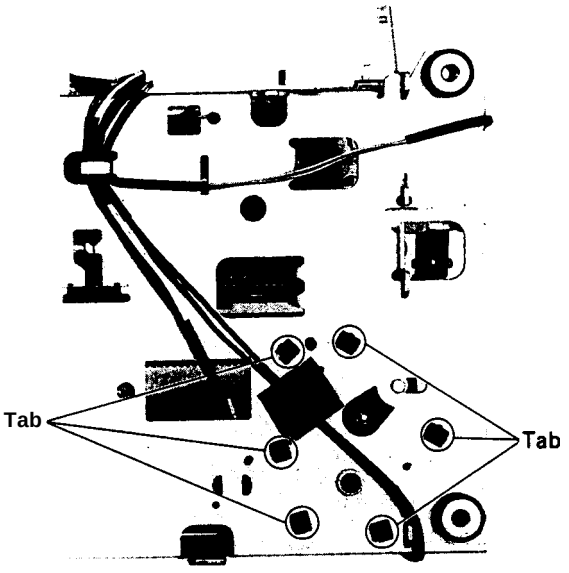
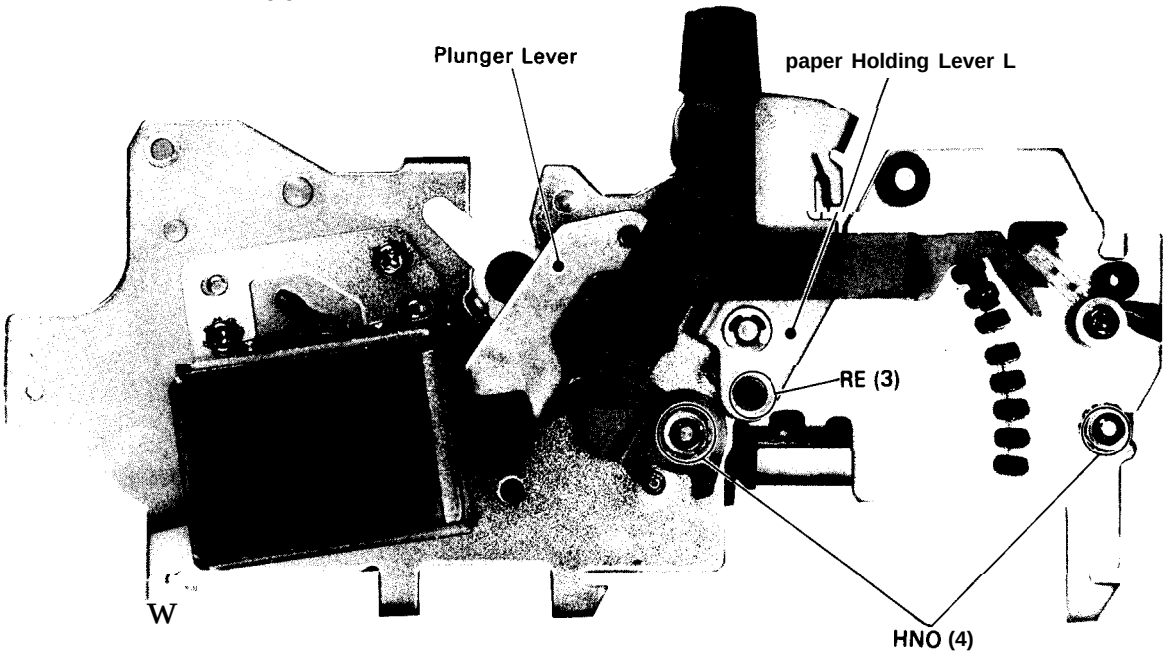


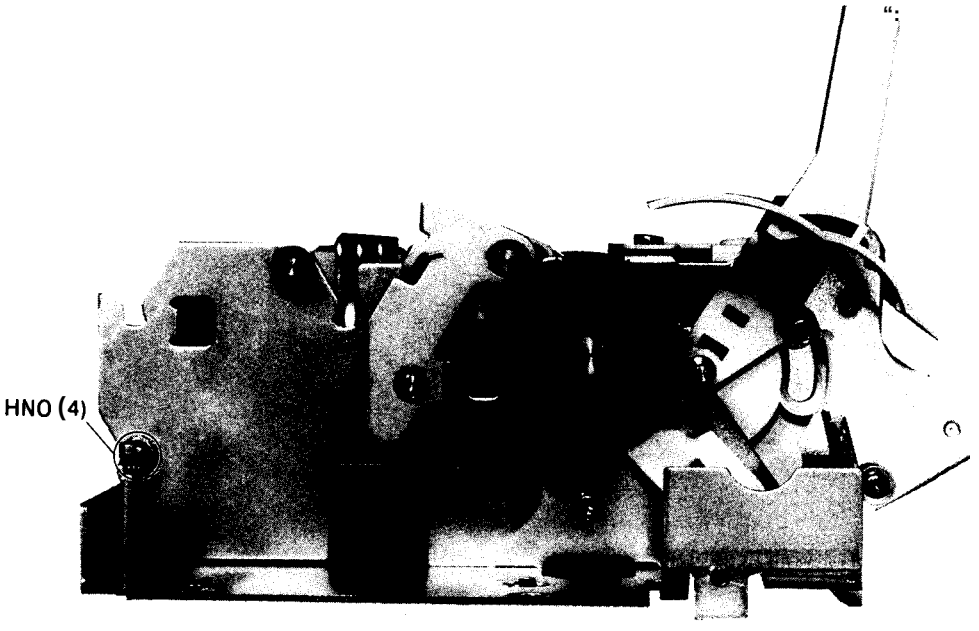
Fig. 4-40. Ribbon Driver Unit Removal

4.2.4.15 Carriage Removal

1. Remove the printer mechanism (Refer to Section 4.2.4.1.).
2. Separate the main and the base units (Refer to Section 4.3.4. 12.).
3. Remove the RE (3) securing the loading lever of the plunger to paper holding lever L.
4. Remove the two HNO (4) nuts from the side frame L.
5. Remove the HNO (4) nut from the side frame R.



(a) Left Side View



(b) Right side View

Fig. 4-41. Carriage Removal

6. Spread both frames L and R apart, and remove the carriage guide shafts A and B.

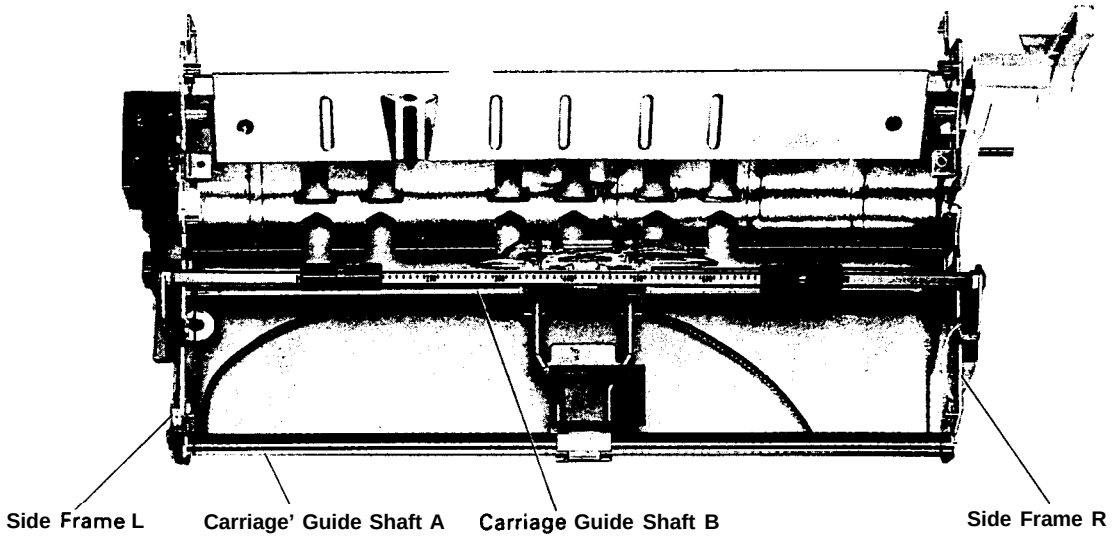


Fig. 4-42. Carriage Guide Shafts A-and B Removal

7. **Pull the carriage out from the carriage guide shafts A and B.**

ASSEMBLY POINTS

1. **While passing the carriage guide shaft B through the carriage, fit the felt to the bottom of the carriage.**
2. **Set one LS (6 X 0.15 X 1 1) and the parallel adjustment bush to the right side of the carriage guide shaft B.**

NOTE: LS and parallel adjustment bush has direction, set as shown in Figure 4-43.

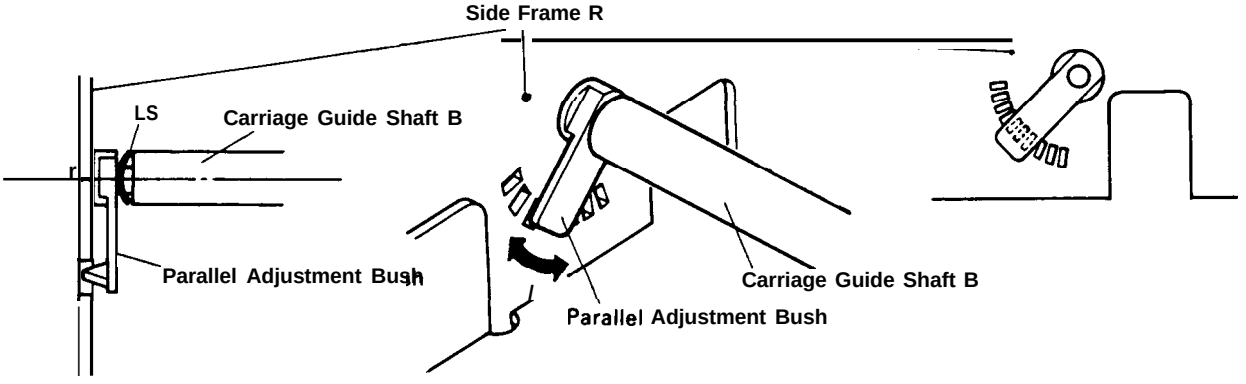


Fig. 4-43. *LS and Parallel Adjustment Bush Removal*

3. **Adjust the parallel adjustment bush where the printhead moves along the platen in parallel.**

ADJUSTMENTS REQUIRED

For assembly, the following adjustments are required:

4.3.1 *Platen Gap Adjustment*

4.3.2 Paper Feed Motor Backlash Adjustment

4.2.4.16 Paper Guide Plate Removal

1. **Remove the printer mechanism (Refer to Section 4.2.3. 1.).**
2. **Separate the main and base units (Refer to Section 4.2.4.1 2.).**
3. **For the LQ-850, remove the two paper guide plate springs or for the LQ-1 050 remove three paper guide plate springs with the mechanism status.**

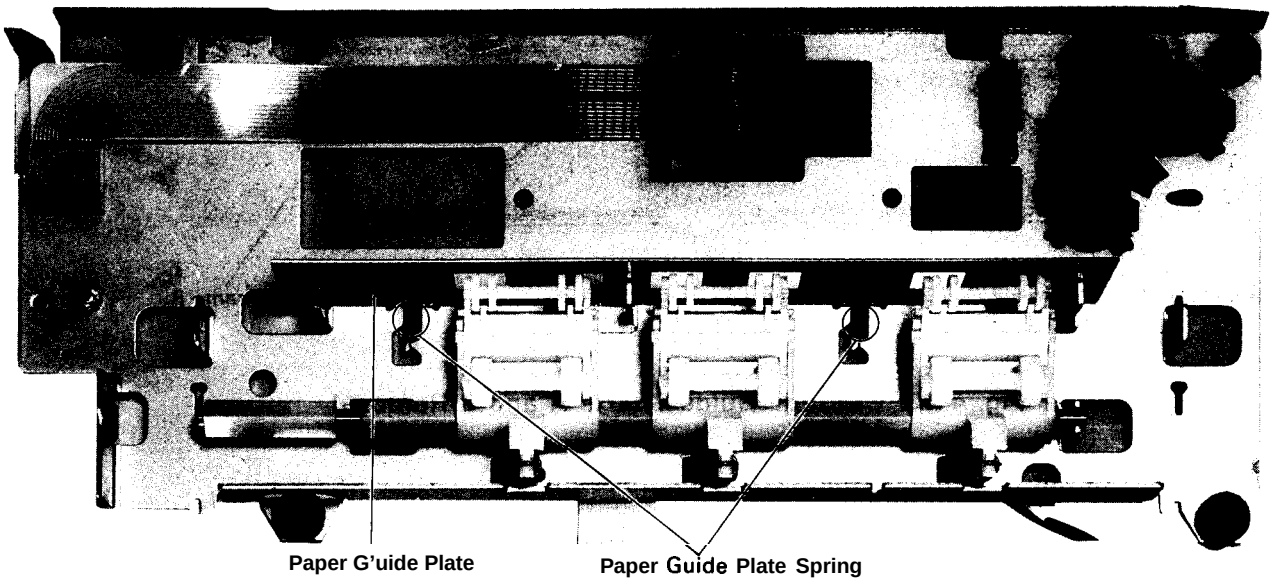


Fig. 4-44. Positional Relationship Between Paper Guide Plate and Paper Guide Plate Springs

4. **Remove the paper guide plate.**

ASSEMBLY POINT

When setting the paper guide plate, verify that its direction is correct.

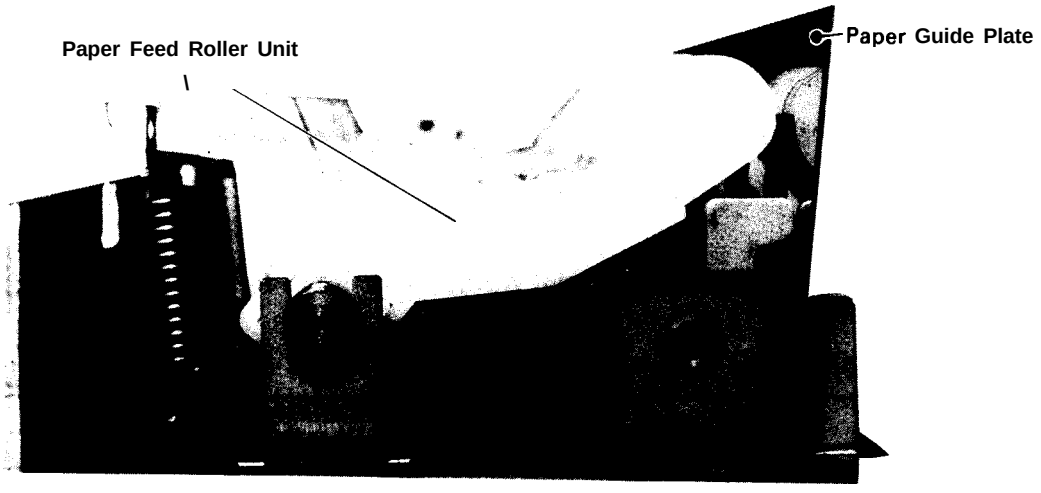


Fig. 4-45. Paper Guide Plate and Paper Feed Roller Unit Relationship

4.2.4.17 Paper Feed Roller Unit Removal

1. **Remove the printer mechanism (Refer to Section 4.2.3.1 .).**
2. **Separate the main and base units (Refer to Section 4.2.4.1 2.).**
3. **Remove three paper feed springs for the LQ-850 or four for LQ-1 050 from the hook on the base frame.**

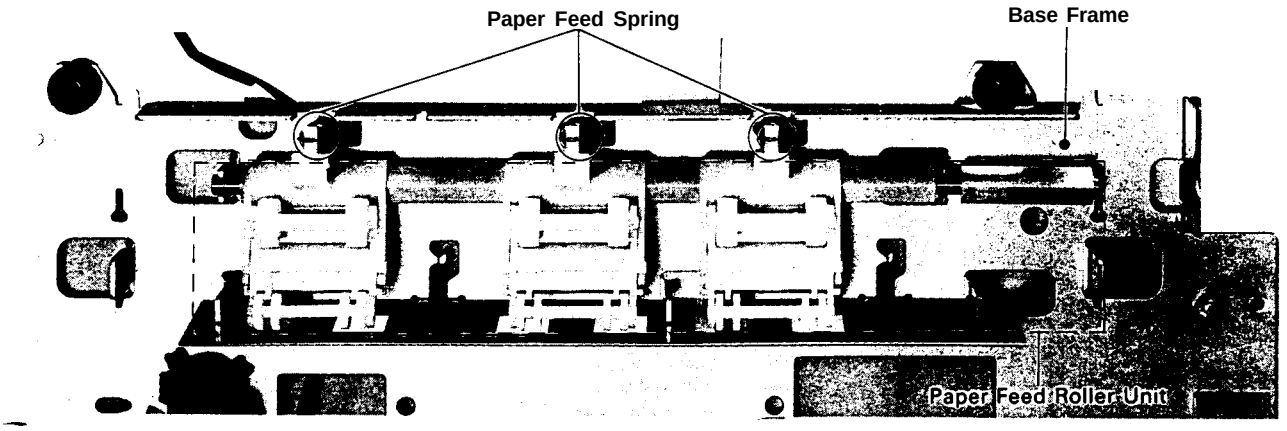


Fig. 4-46. Paper Feed Roller Unit Removal

4.2.4.18 Paper End Sensor Removal

1. **Remove the printer mechanism (refer to Section 4.2.3. 1.).**
2. **Separate the main and base units (Refer to Section 4.2.4.1 2.).**
3. **Loosen the two bends securing the paper end sensor to the back of the paper guide.**
4. **Remove the paper end sensor.**

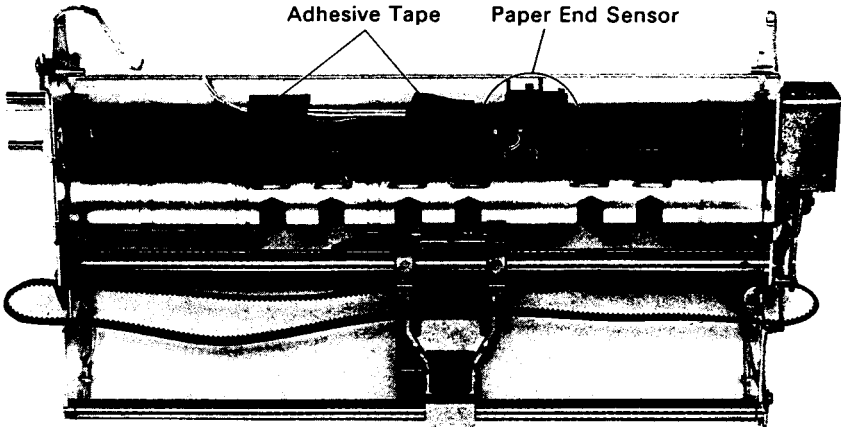


Fig. 4-47. Paper End Sensor Removal

4.2.4.19 Paper Holding *Roller Set and Paper Holding Levers L and R Removal*

1. **Remove RE (3) at the outside of the paper holding lever R on the paper holding roller set.**
2. **Remove the right and left sides of the paper holding roller shaft from the paper holding levers.**
3. **Remove the carriage motor (Refer to Section 4.2.4.4.).**

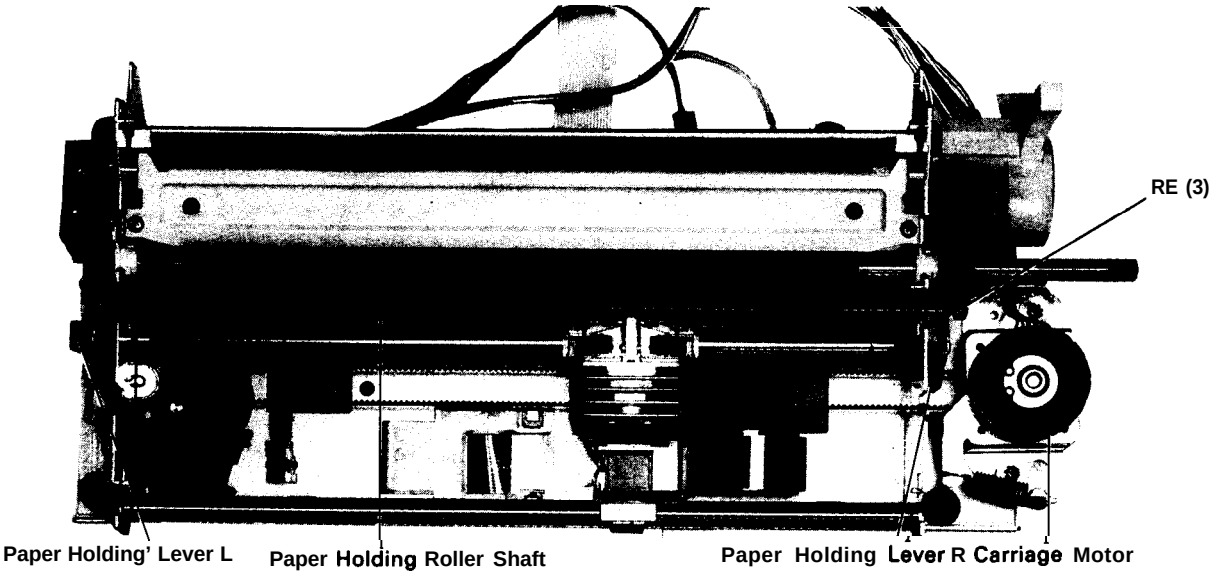


Fig. 4-48. Paper Holding Roller Shaft Removal

4. **Remove RE (3) at the side frame R.**
5. **Detach the paper holding lever R spring from the paper holding lever R.**
6. **Remove the paper holding lever R.**

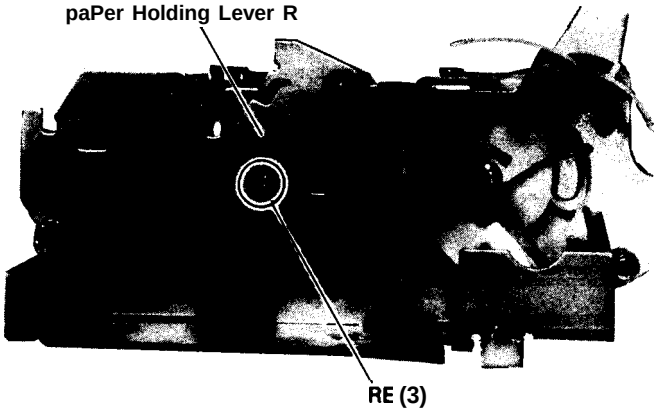


Fig. 4-49. Paper Holding Roller Lever R Removal

4.2.4.20 Push Tractor Unit Disassembly

This section describes the removal of the tractor assembly (left). Since disassembled parts can be reassembled by using the removal procedures in reverse order, assembly procedures have been omitted.

1. Remove the shaft holder from the tractor mounting plate L.
2. Remove the CPS (0) (3 X 6) screw securing tractor mounting plate L to the tractor base frame.
3. Remove the HNO (4) nut securing the tractor guide shaft.
4. Remove the tractor side frame L.
5. Push the tractor lock lever upward, and remove the left sprocket assembly from the shafts.

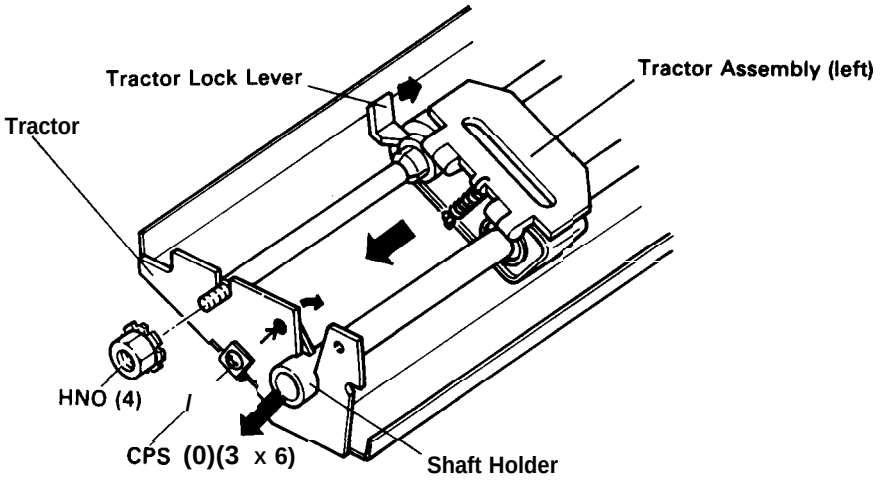


Fig. 4-51. Tractor Assembly (left) Removal

ASSEMBLIY POINT

When mounting the tractor assemblies to the shafts, set them so that the marks on the right and left tractor frames are at the same position. Make sure that the pins on the right and left tractor belts are aligned in parallel.

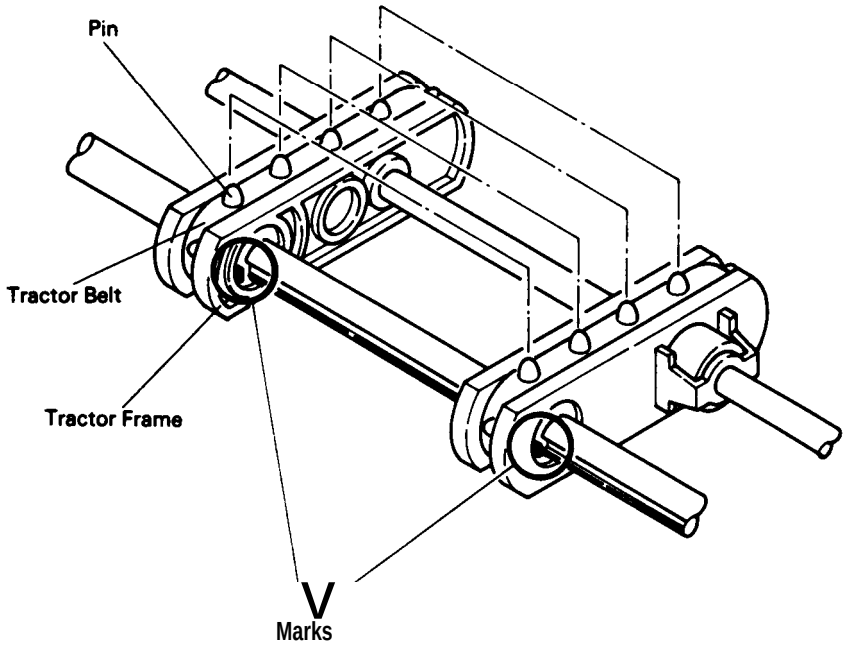


Fig. 4-52. Tractor Assembly Phases

4.2.4.21 Paper Tension Unit Disassembly

This section describes the removal of the paper tension roller assembly. Since disassembled parts can be reassembled by using these procedures in reverse order, the assembly procedures have been omitted.

1. **Remove the RE (4) on the paper tension roller shaft at the inside of the paper tension frame R.**
2. **Remove the RE (4) on the paper tension roller shaft at the outside of the paper tension frame L.**
3. **Remove the CPS(O) (3 X 10) screw securing paper tension frame L to paper tension base frame.**
4. **Remove the HNO (4) nut.**
5. **Disconnect the paper tension shaft holder from the paper tension frame R by sliding it toward the outside, then remove it.**

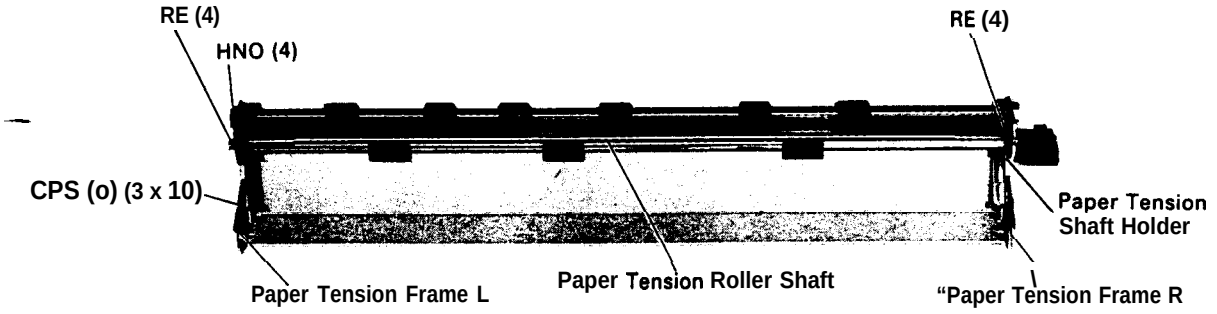


Fig. 4-53. Paper Tension Roller Assembly Removal

4.3 ADJUSTMENT

This section describes the adjustment procedures required when reassembling this printer. When disassembly or replacement is performed during maintenance or repaires “of the parts described in this section, the following adjustments should be performed to ensure proper operation.

4.3.1 Platen Gap Adjustment

Adjust the gap between the platen and the printhead when carriage guide shaft B is rotated or removed.

1. Remove the printer mechanism (Refer to Section 4.3.2.1 .).
2. Remove the printhead (Refer to Section 4.3.2.2.).
3. Remove the Ribbon mask holder with ribbon mask.

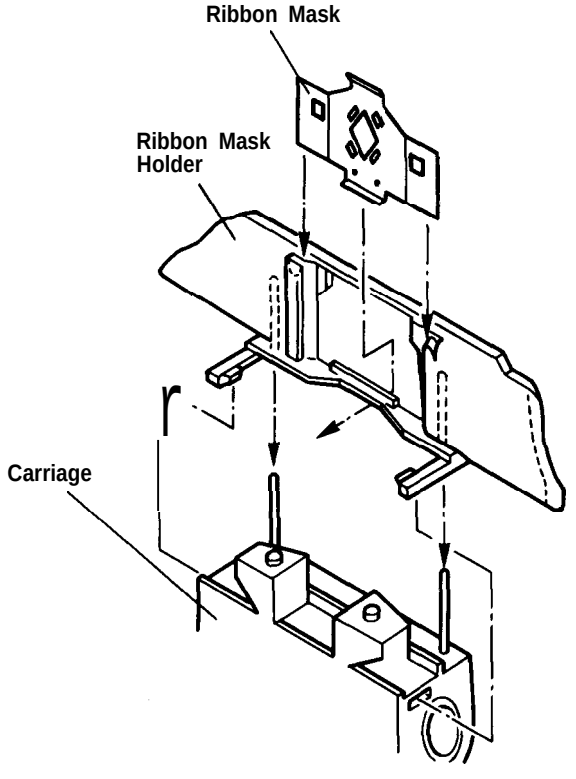


Fig. 4-54. Ribbon Mask Holder and Ribbon Mask Configuration

4. Reinstall the printhead on the carriage.

NOTE: When reinstalling the printhead, lock the head lock levers while pushing the printhead forward and downwoard.

5. Move the carriage to center.
6. Remove the RE (3) securing the shaft of the plunger to paper holding lever L.
7. Lighty loosen the HNO (4) nut securing the head adjustment lever.
8. Turn the larger countersink of carriage guide shaft B upward.
9. Position the paper holding roller shaft to its forward setting and secure with adhesive tape.
10. Insert the blade of a screw driver (a diameter is approx. 3 mm) into the countersink of carriage guide shaft B.

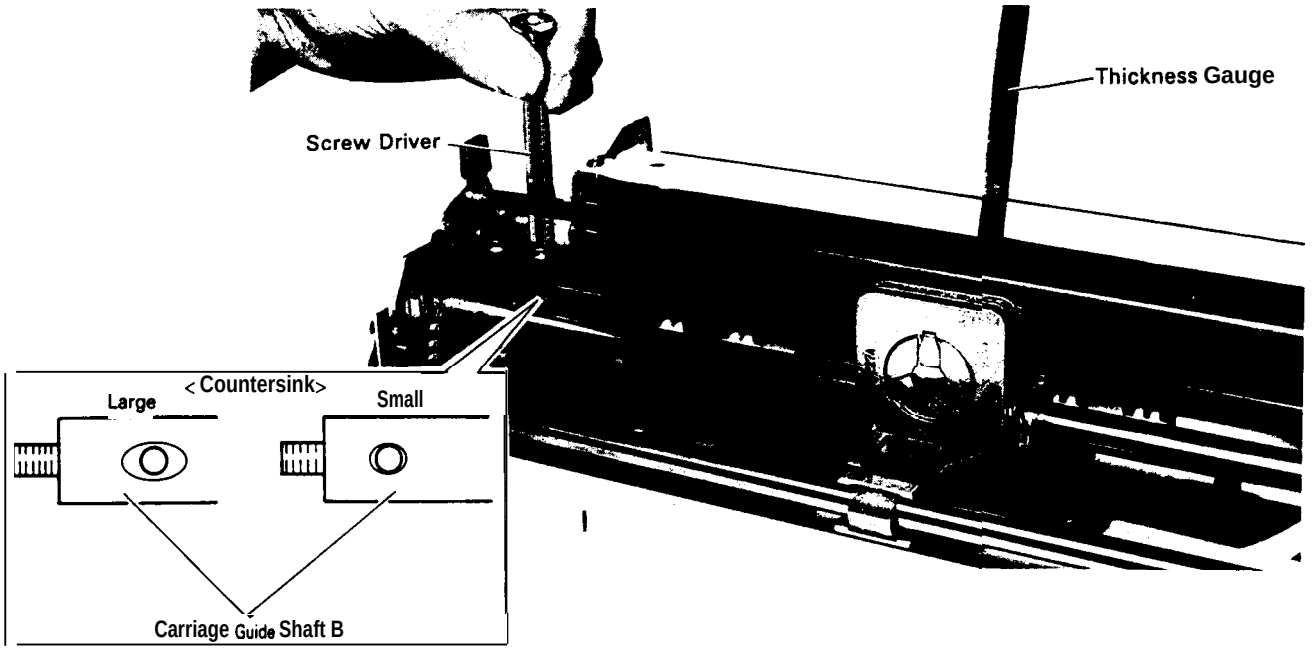


Fig. 4-55. Platen Gap Adjustment

11. Set the head adjustment lever at the 2nd position.
12. Push the paper release lever all the way back.
    Gap value: 0.45 ± 0.05 mm

13. Adjust the platen gap using a thickness gauge while rotating carriage guide shaft B in the direction of the arrow in Figure 4-56.

WARNING

At this time, the paper release lever must be in the friction feed position. (Do not turn it forward.)

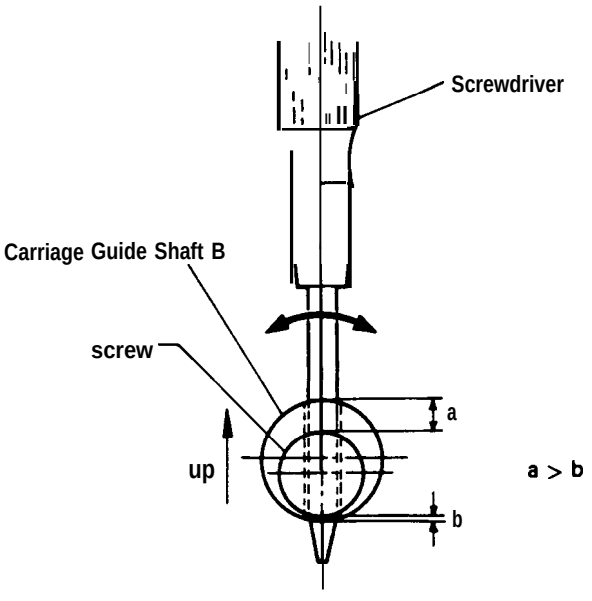


Fig. 4-56. Eccentric of Carriage Guide Shaft B

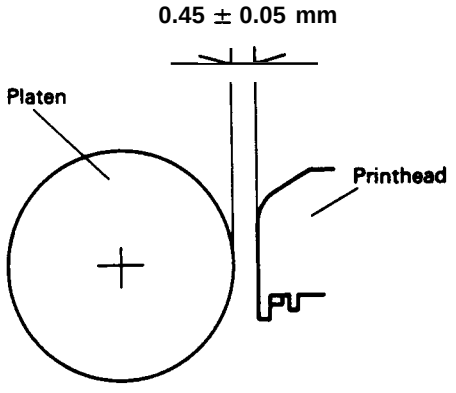


Fig. 4-57. Platen Gap

14. Hold carriage guide shaft B in place and tighten the HNO (4) nut.
15. Move the carriage to the left end, and measure the gap value again to confirm that it is correct.
16. Move the carriage to the right end, and measure the gap value again to confirm that it is correct.
17. Remove the printhead.
18. Reinsert the ribbon mask holder with ribbon mask into the carriage.
19. Connect the FPCS to the printhead, and reinstall the printhead onto the carriage.

4.3.2 Paper Feed Motor Gear Backlash Adjustment

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

1. **Remove the printer mechanism (Refer to Section 4.2.4.1 .).**
2. **Loosen the two CPS(O) (3 X 6) screws on the paper feed motor.**
3. **Manually rotate the paper feed motor, and adjust the gear backlash between the pinion and the paper feed transmission gear.**

Allowable backlash: 0.10 ± 0.05 mm

4. **Tighten the screws on the paper feed motor.**

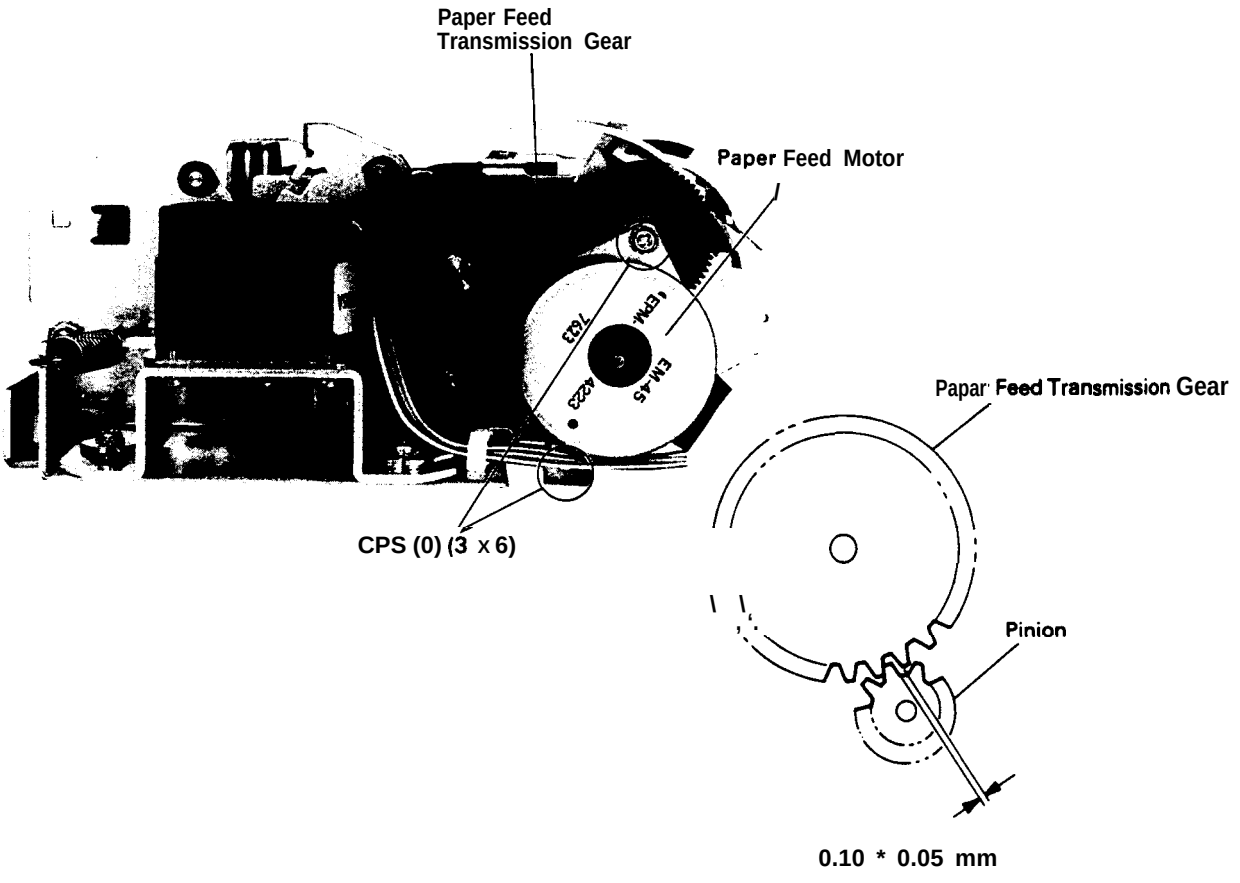


Fig. 4-58. Paper Feed Motor Pinion Gear Backlash Adjustment

4.3.3 Electric Board Adjustment

This section describes the MONMA board adjustment. If replace the MONMA board or printer mechanism, perform the adjustment in below.

4.3.3.1 Bidirectional Value Adjustment

If printing is misaligned in during bidirectional printing, align the printer by adjusting VR2 and VR3 on the MONMA board, according to the alignment sequence flowchart shown in Figures 4-59 and 4-60 (Refer to Figure 4-61 for the positions of the switches and VRs).

NOTE: Before performing this adjustment, set the head adjustment lever at 2nd position.

Table 4-6. Relationship Between VRs and Print Mode

VR 2	VR 3	Print Mode No.
o	—	o 1 4
—	o	3 2 5 6 7

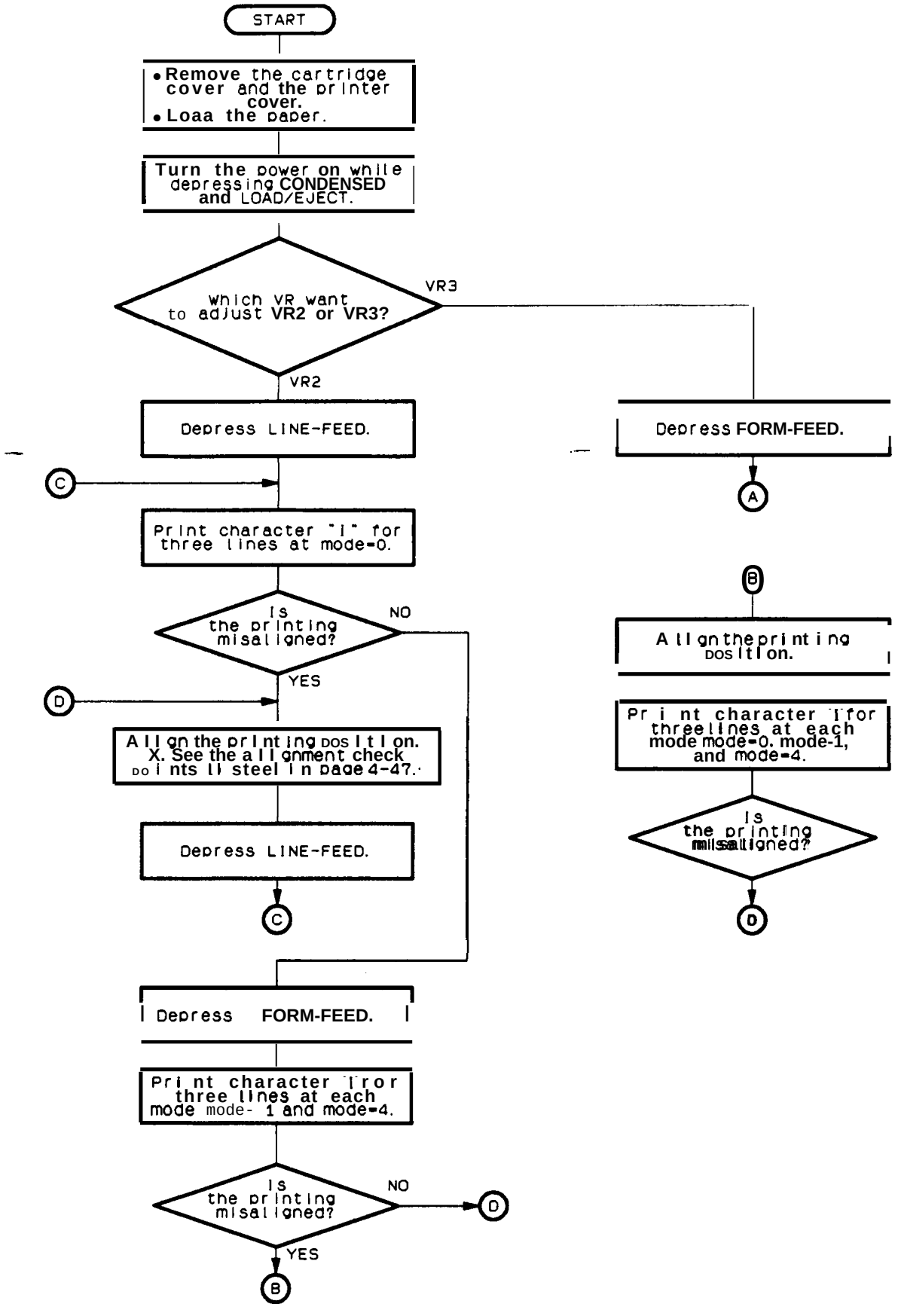


Fig. 4-59. **Print Position Alignment Sequence**

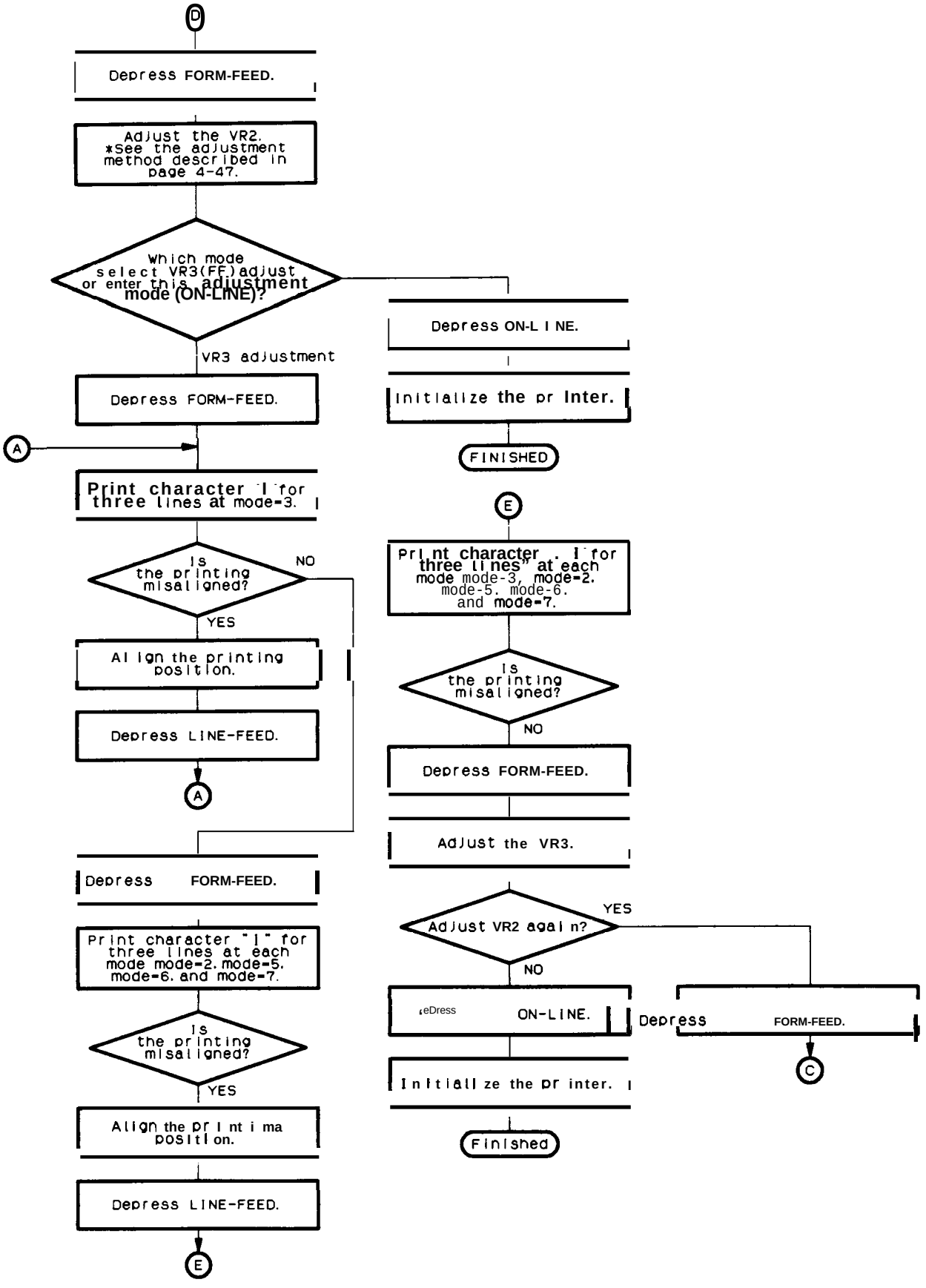


Fig. 4-60. Print Position Alignment Sequence (cont.)

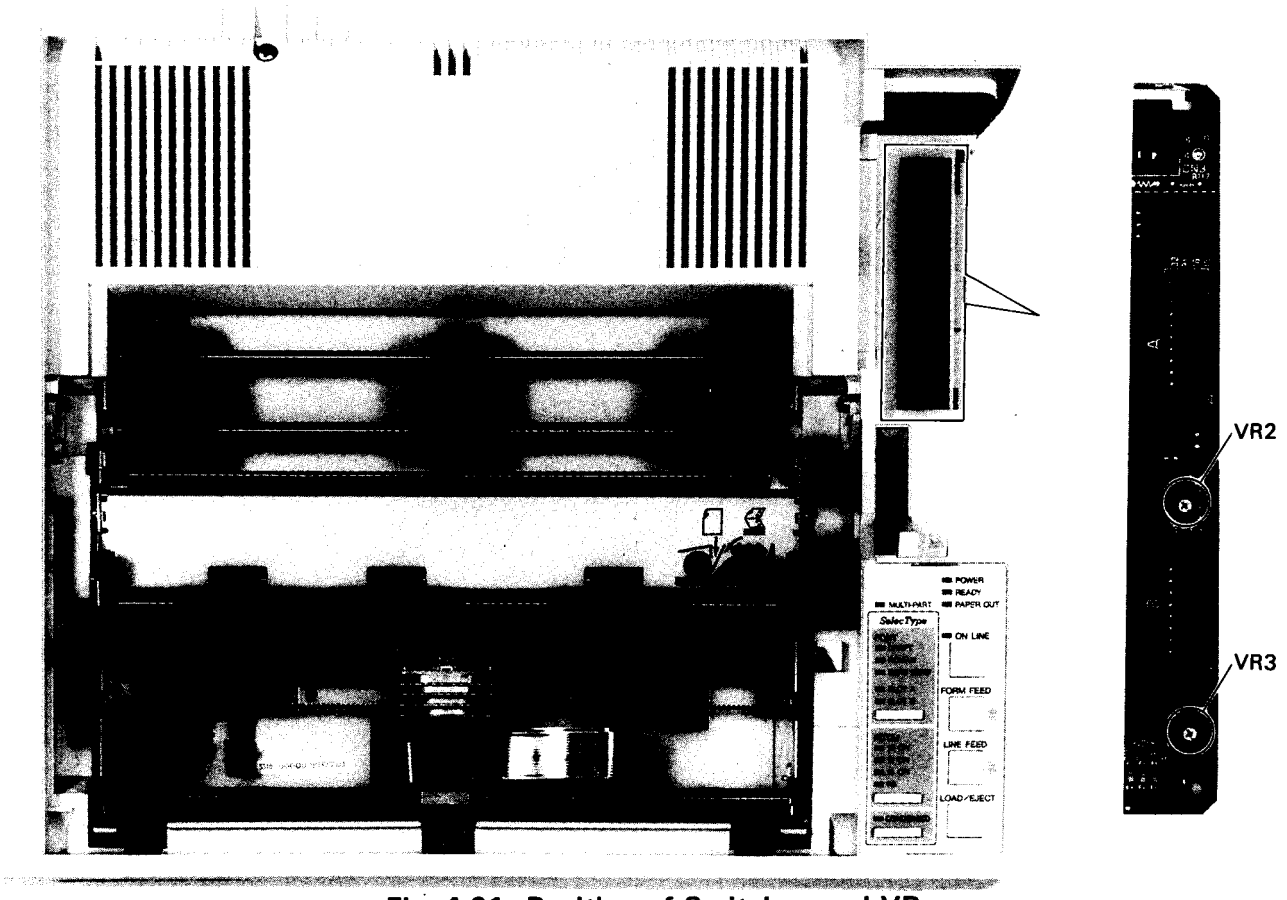


Fig. 4-61. Position of Switches and VRs

Printing Position Alignment Check

Figure 4-62 shows three lines of test printing with characters "I". Using this printout, check the following:

Odd Line . . . . . Reference
Even Line . . . . . Move

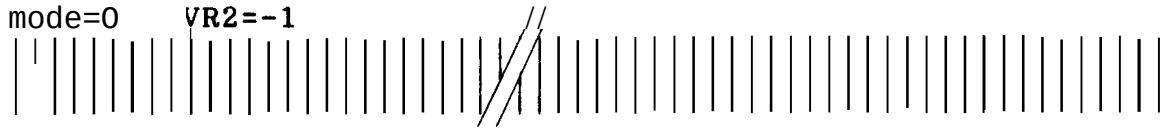


Fig. 4-62. Test Printing for Printing Alignment

Check which direction of the even-numbered line (2'nd) is shifted as compared to the odd-numbered lines (1'st and 3'rd).

- To shift the even-numbered line to the left, press the CONDENSED switch. At this time, confirm that the buzzer ring once.
- To shift the even-numbered line to the right, press the LOAD/EJECT switch. At this time, confirm that the buzzer ring once.

VR (Variable Resistor) Adjustment

Turn VRn to the left most position (n= 2 or 3). Turn the VRn (n= 2 or 3) slowly and carefully, and adjust to a position where the buzzer rings continuously.

CHAPTER 5
TROUBLESHOOTING

LIST OF FIGURES

LIST OF TABLES

5.1 GENERAL

Because various types of trouble can occur, troubleshooting is not easy to perform. Here, a simple procedure is provided to perform troubleshooting, as shown in Figure 5-1.

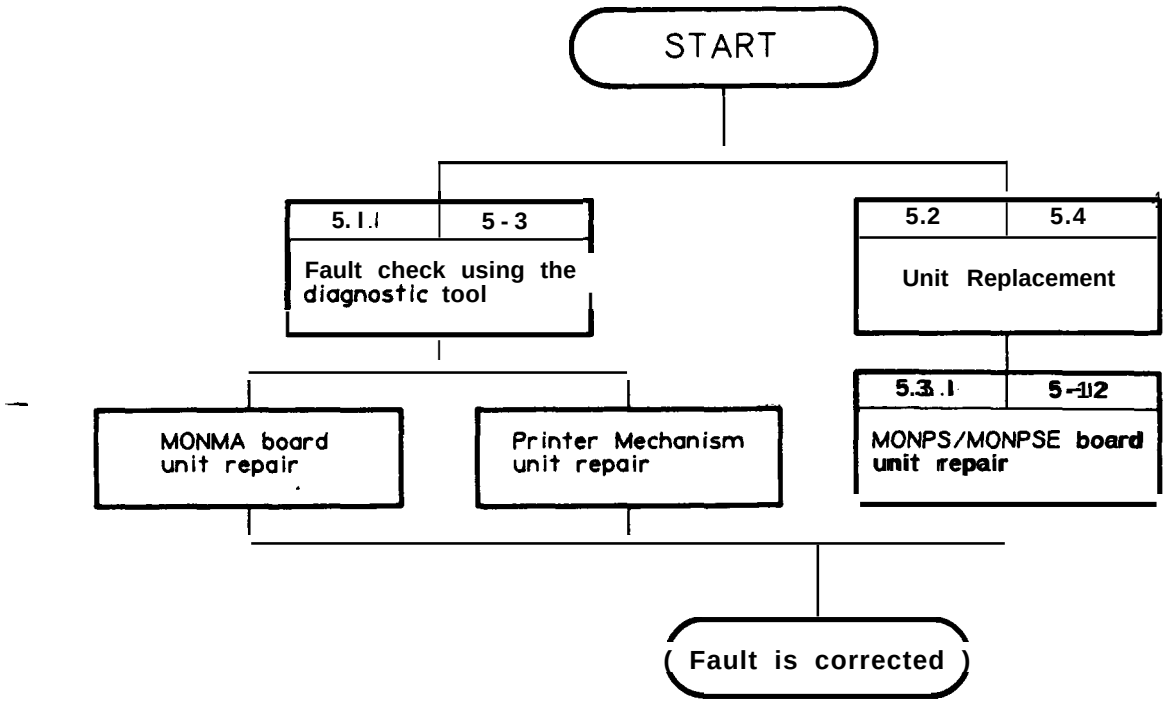


Fig. 5-1. Troubleshooting Procedure

Table 5-1 lists the troubleshooting tools contained in the printer.

Table 5-1. Troubleshooting Tools

Tool No.	Item	Description	Part No.
E638	Diagnostic Tool	Use together with EPSON PC (EQUITY) series	B765 108801
E639		Use together with EPSON QX-16	B765 108901
E594	Cable (2pin)	● Between MONMA board (CN9) and paper end sensor ● Between MONMA board (CN 10) and platen gap sensor ● Between MONMA board (CN 1 1) and friction/tractor sensor ● Between MONMA board (CN 12) and plunger	B765 105401
E625	Cable (3pin)	● Between MONMA board (CN8) and home position sensor	B765 108001
916	Cable (4pin)	● Between MONMA board (CN 18) and MONPS/MONPSE board.	Y427307000
E512	Cable (6pin)	● Between MONMA board (CN 13) and paper feed motor ● Between MONMA board (CN 14) and carriage motor . Between MONMA board (CN 17) and MONPS/MONPSE board	B765 102701
E601	Cable (17pin)	● Between MONMA board (CN 15) and printhead	B765 105801
E602	Connector (17pin)		B765 105601
E636	Cable (15pin)	● Between MONMA board (CN 16) and printhead	B765 109001
E637	Connector (15pin)		B765 109101

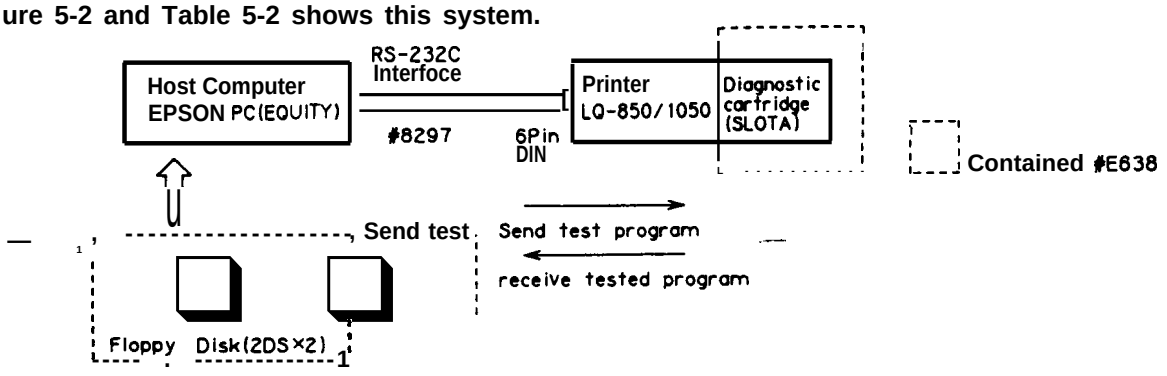
5.1.1 Diagnostic Tools

The diagnostic tools enable anyone to troubleshoot the electric components, regardless of their experience.

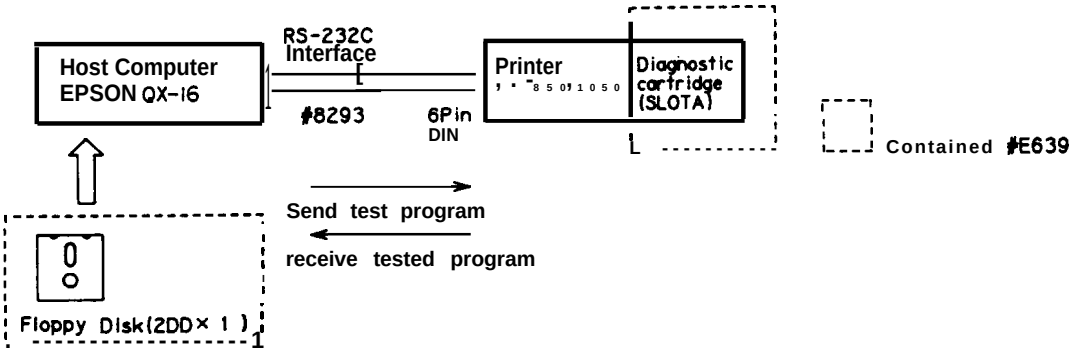
5.1.1.1 System Outline

This system is connected to an MS-DOS-based computer (EPSON QX16 or 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 5-2 and Table 5-2 shows this system.



(a)#E638 with EPSON PC (EQUITY)



(b)#E639 With EPSON OX-16

Fig. 5-2. Printer Diagnostic System

Table 5-2. Printer Diagnostic System

Printer	LQ-850/1050	
Computer	EPSON PC (EQUITY)	EPSONQX-16
Diagnostic Tool	#E638	#E639
Interface Cable	#8297	#8293

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.
- **The defective unit can be easily identified.**

5.2 UNIT REPLACEMENT

The unit replacement is based on system analysis. According to the particular symptom found by the multi meter, the units listed in Table 5-3 need to be replaced.

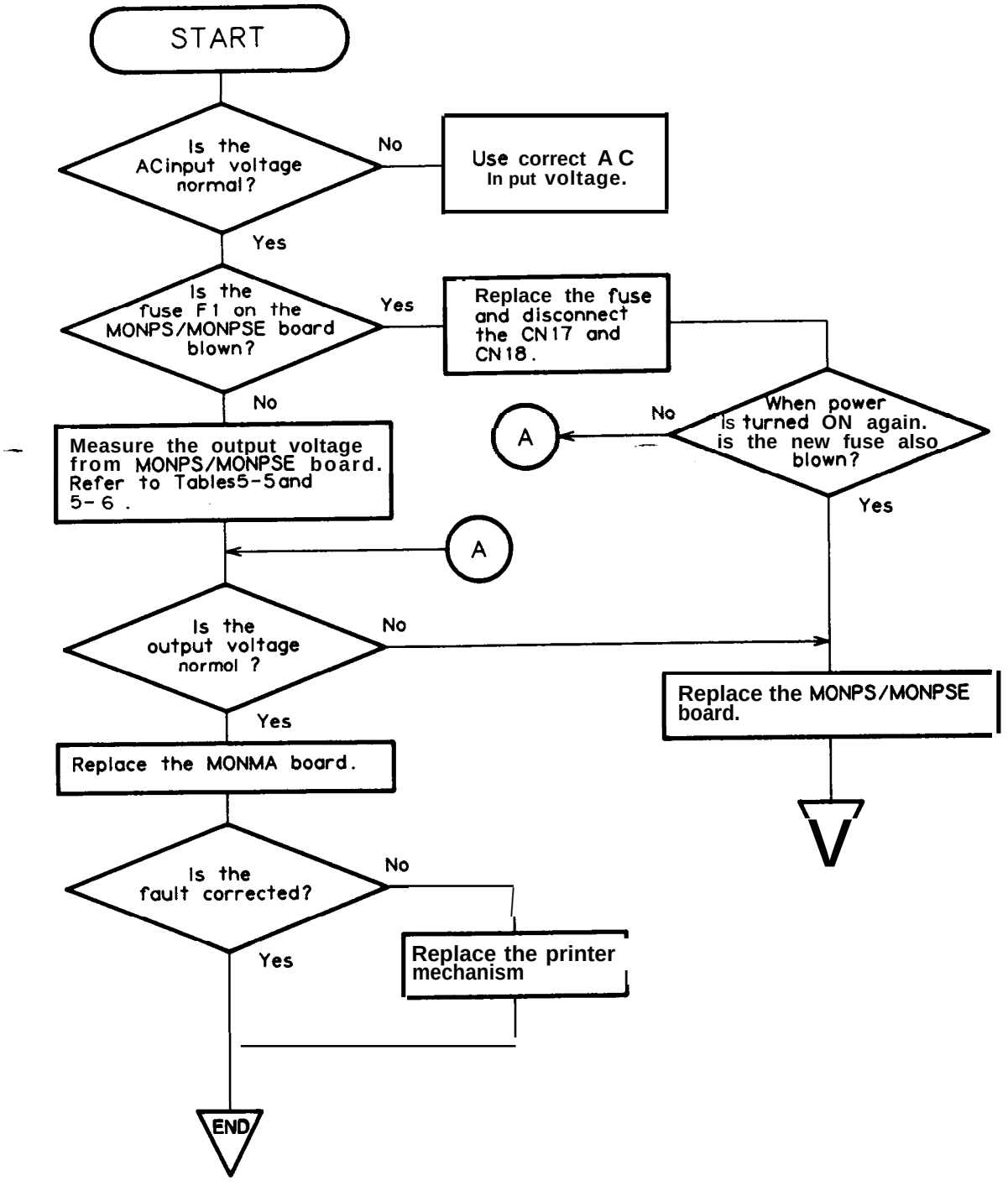
Table 5-3. Unit Replacement Numbers

Unit Name	Description	Unit No.
Fuse (Fl)	120V 3. 15A UL, CSA 250V 2.0A Time rug	X50206 1060 X502 O63O1O
MONPS BOARD MONPSE BOARD	100/1 20V AC 220/240V AC	Y454202000 Y454203000
Model-53 10 Model-5360	Printer Mechanism for LQ-850 Printer Mechanism for LQ-1 050	Y454590000 Y455590000
Printhead	24-pin dot head	F416 100000

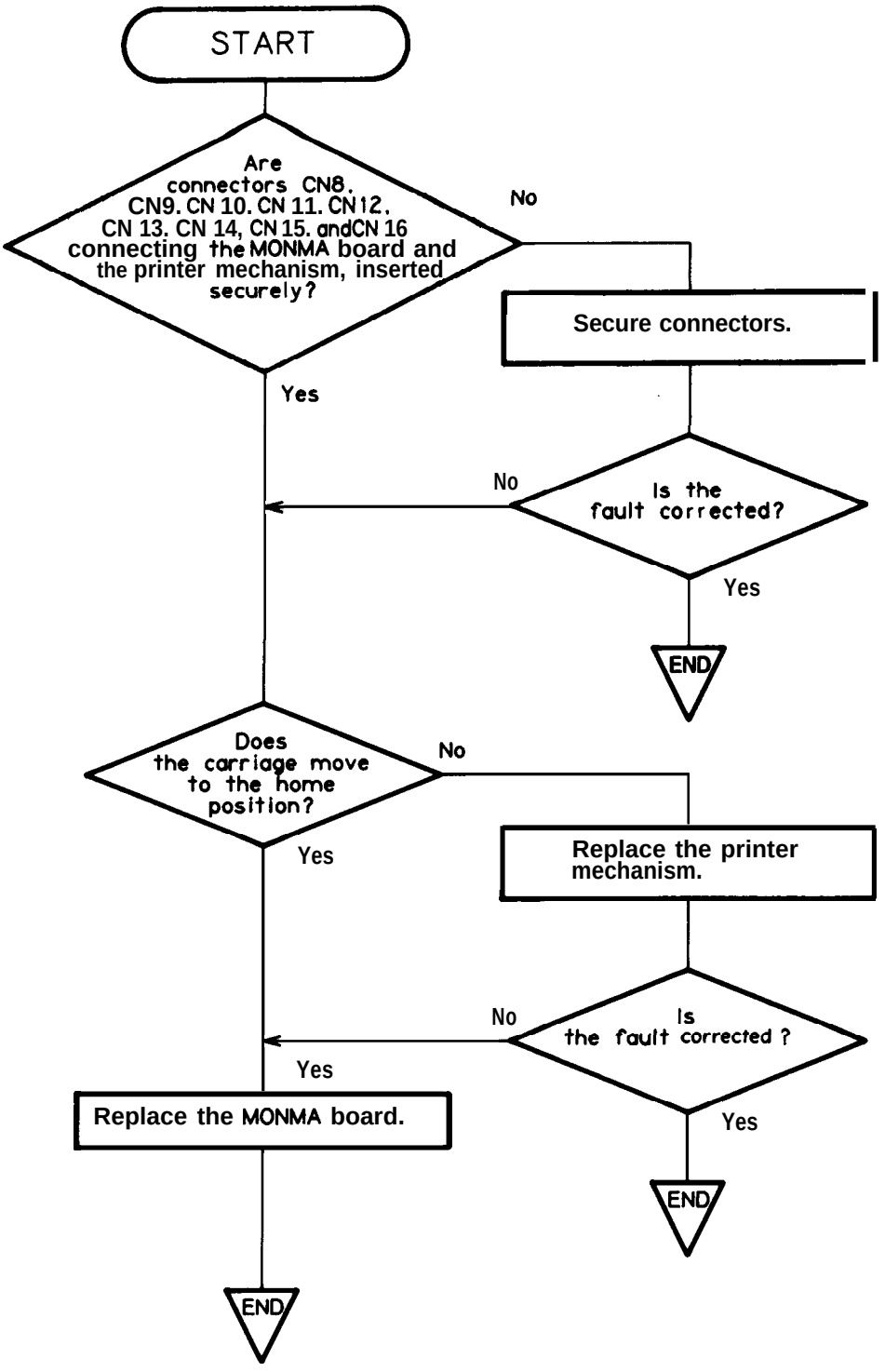
Table 5-4. Symptom and Reference Pages

Symptom	Problem Indicators	Reference Page
Printer Does Not Operate with Power Switch ON	● No indicator on the control panel lights. ● Carriage does not move.	5-5
Abnormal Carriage Operation	● Carriage moves away from home position at power ON. ● Although the carriage returns to the home position, the printer does not enter READY mode.	5-6
Incorrect Printing (in self-test) with Normal Carriage Operation	. No printing is executed. ● Some dots do not appear.	5-7
Abnormal Paper Feed	● No paper is fed. ● Separation between lines varies with irregular paper feed.	5-8
Abnormal Operation of Control Panel	● No paper is fed (by operation of the LF or FF switch) in OFF-LINE mode. ● No operation mode is set from the control panel. ● ON-LINE or OFF-LINE mode is not obtained.	5-9
Incorrect Printing in ON-LINE Mode	● Carriage operates normally at power ON and the result of the self-test is correct. However, the print data from the computer is not output normally.	5-1o

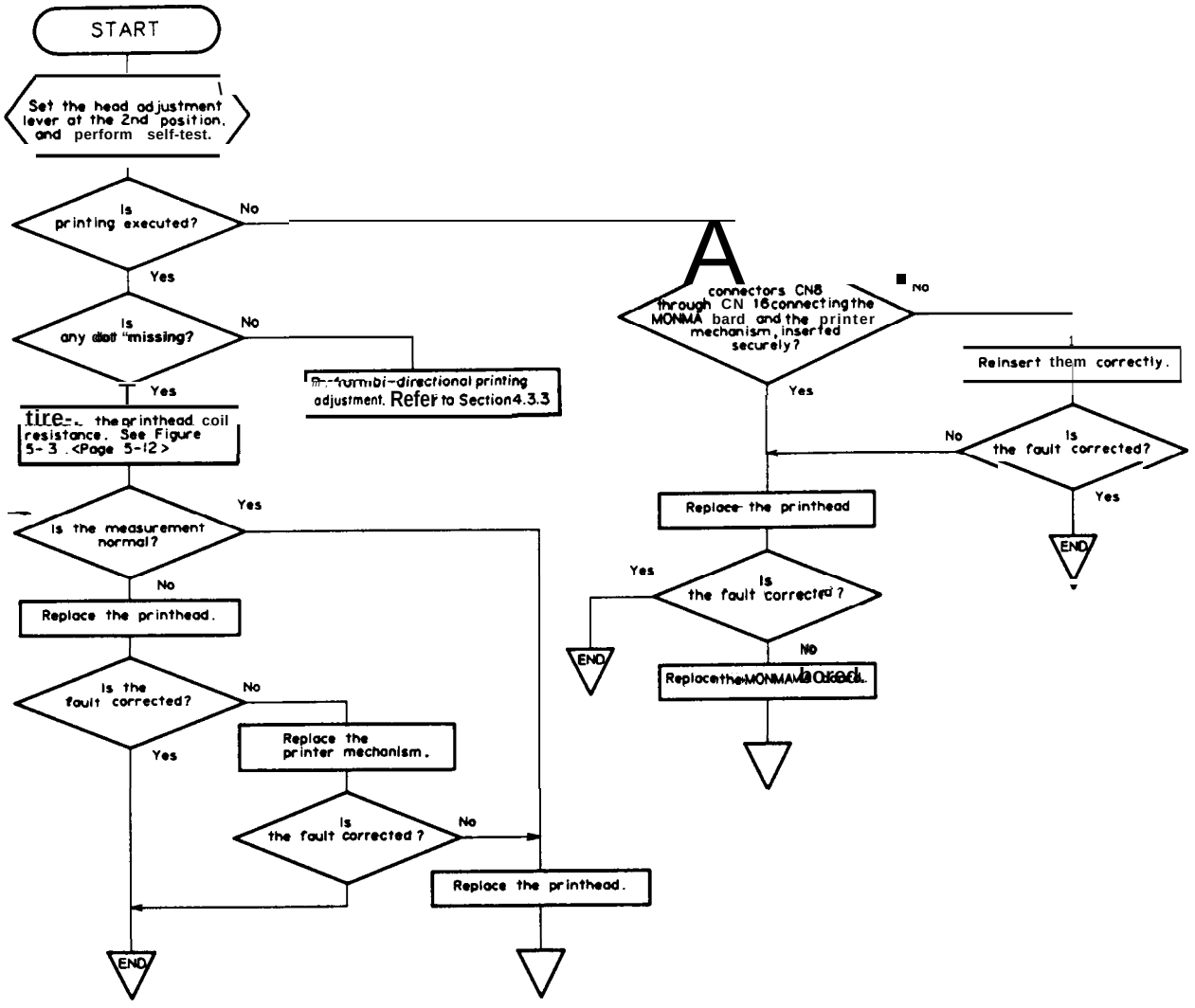
1. Printer does not operate with power switch ON (power LED does not bright.)



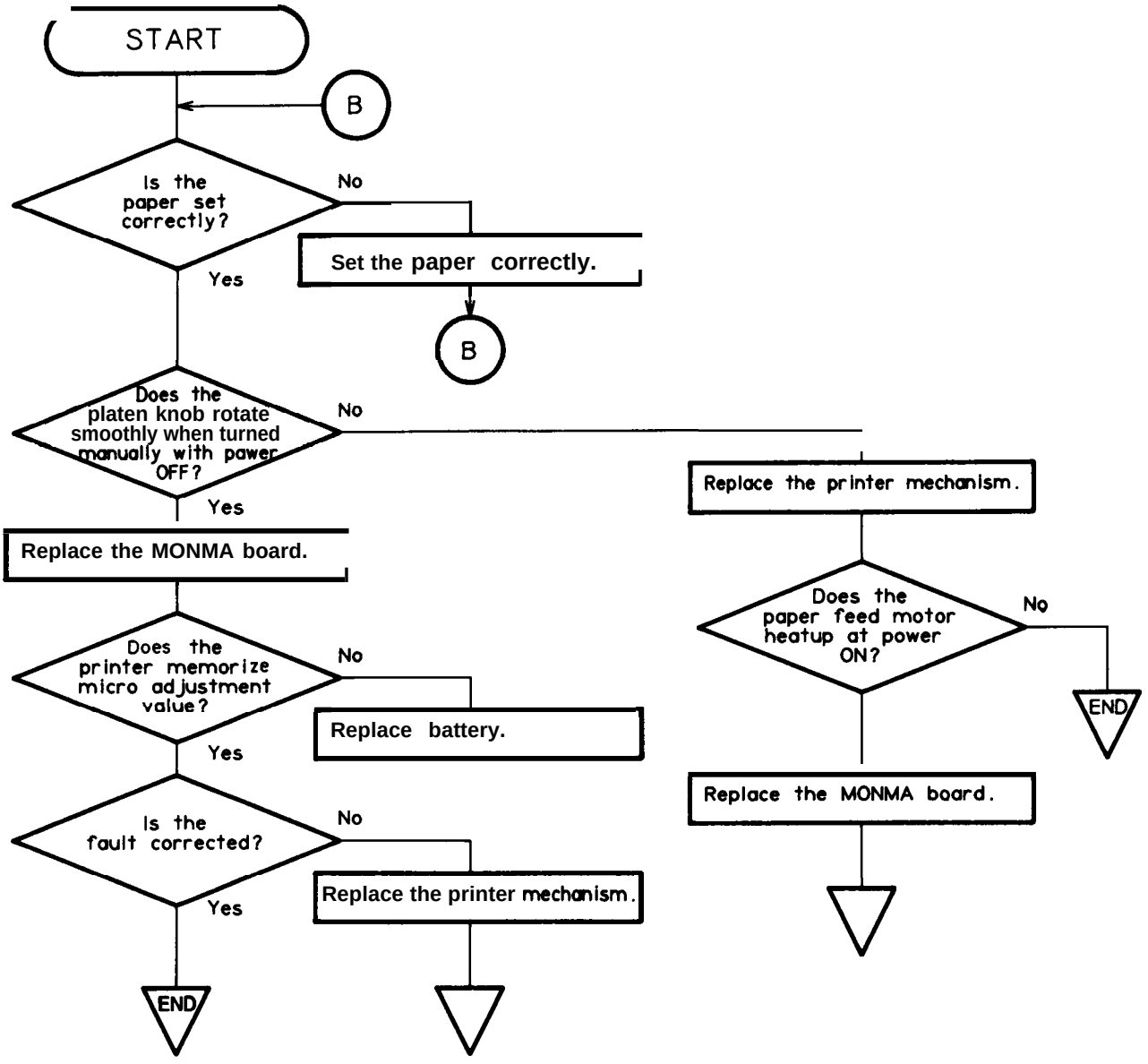
2. The carriage does not operate correctly.



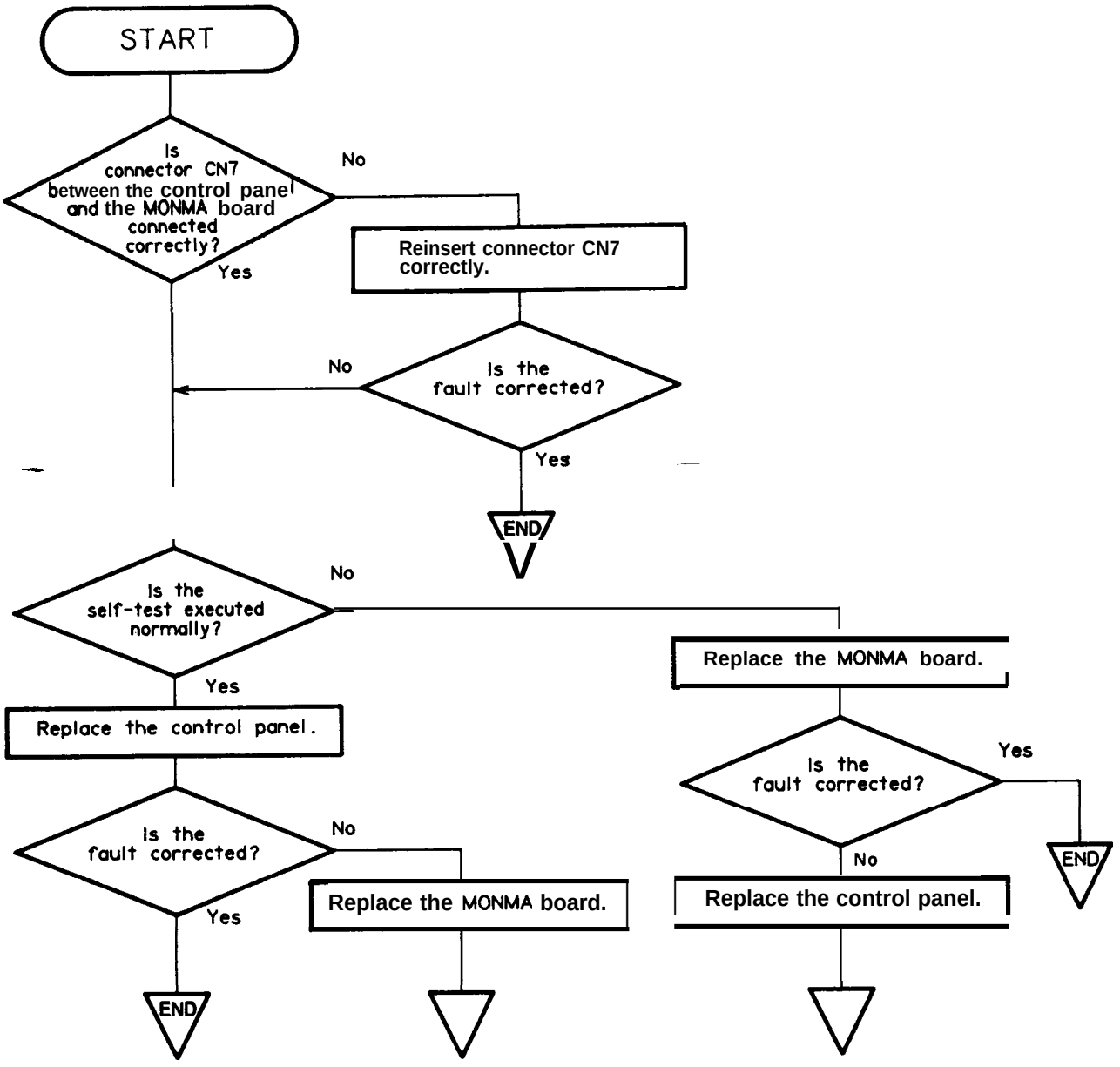
3. The carriage operate normally, but the self-test printing is incorrect.



4. The self-test printing is normal, but the paper is not fed properly.



5. The control panel does not operate correctly.



6. The printing is incorrect in the ON-LINE mode.

NOTE: It is assumed that the host computer operates normally.

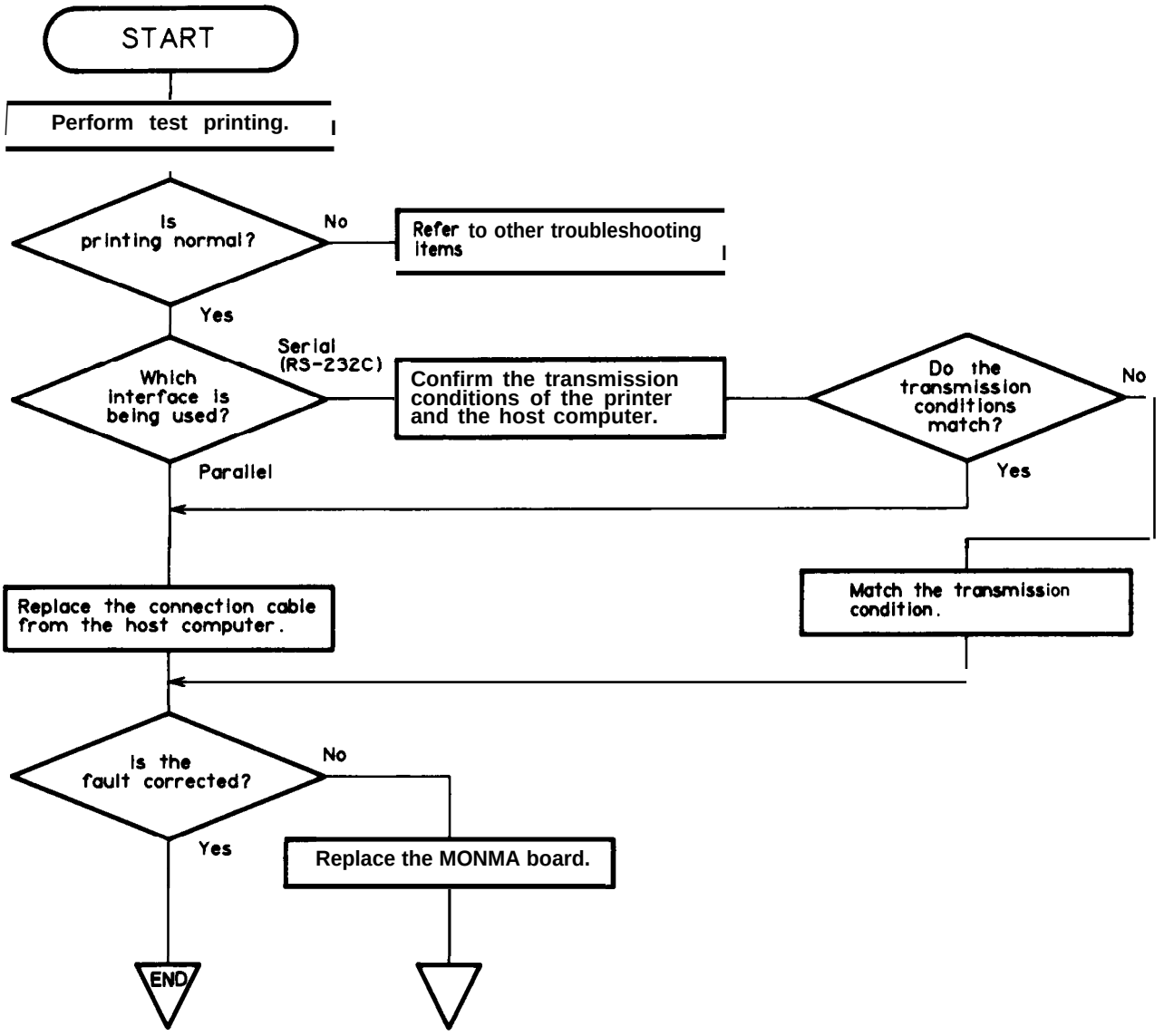


TAble 5-5. MONPS Board Environmental Condition (Reference Value)

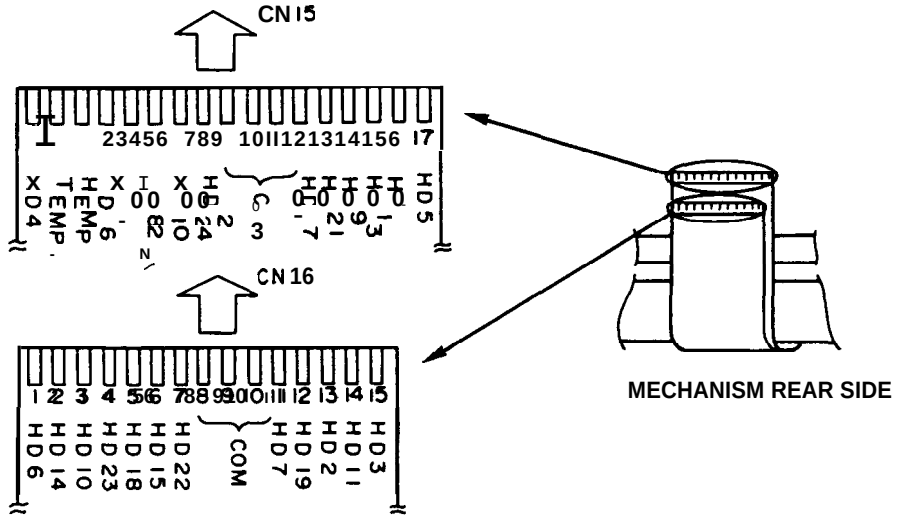
Power Supply Line	Output Voltage [V]		
	0°C	25°C	40°C
+35 - GP	35.5	35.5	35.4
+12 - GND	9.7	9.7	9.8
-12 - GND	-9.9	- 10.0	- 10.0
+5 - GND	5.1	5.1	5.1

NOTES: 1. These voltage are measured when printer is in waiting mode.
2. Input voltage is 120V AC.

Table 5-6. MONPSE Board Environmental Condition (Reference Value)

Power Supply Line	Output Voltage [V]		
	0°C	25°C	40°C
+35 - Gp	35.4	35.4	35.4
+ 12 - GND	11.8	11.8	11.8
-12 - GND	- 12.1	- 12.1	- 12.2
+5 - GND	5.1	5.1	5.1

NOTES: 1. These voltage are measured when printer is in waiting mode.
2. Input voltage is 240V AC.



- HDn (n = 1 to 24) corresponds to the pins in the printhead. The resistance of COM-HDn is measured to check whether the printhead coil is normal or not. The resistance value of the head coil is 29 ± 2.0 ohms under normal conditions (at 25°C).

Fig. 5-3. *Printhead Coil* Resistance

5.3 UNIT REPAIR

Unit repair is divided into three parts: (1) The MONPS/MONPSE board; (2) The MONMA board; (3) The Printer mechanism.

This section will describe (1), the MONPS/MONPSE board unit repair. If (2) MONMA board or (3) Printer mechanism should need repair, use the diagnostic tool introduced in Section 5.1.1.

5.3.1 MONPS/MONPSE Board

The power supply circuit MONPS/MONPSE board is divided into three blocks: (1) Input filter circuit, (2) Main switching circuit, and (3) Secondary side.

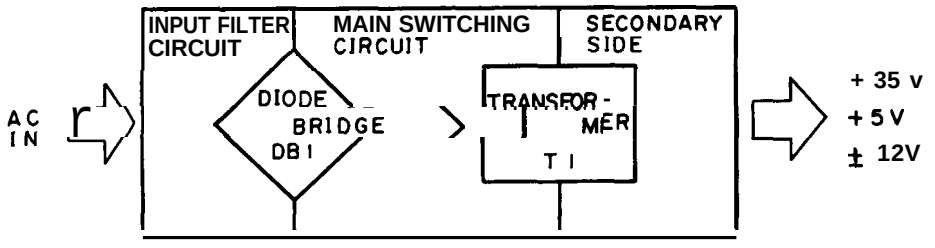


Fig. 5-4. MONPS/MONPSE Board

If trouble occurs, first determine the faulty block and then find the bad component, referring to Table 5-7 and Figure 5-6. In addition, Table 5-8 lists the parts used in the MONPS\MONPSE board.

DANGER

1. 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 5-5 will avoid this problem.

Fig. 5-5. AC Connector for Measuring Instruments

2. Measure the resistance value on the circuit board after turn the power off.

Table 5-7. MONPS/MONPSE Board Unit Repair

Symptom	Cause	Checkpoint	Solution
+5 V line is dead.	IC20 malfunction		Replace IC20.
	+35 V line is dead.	Refer to the checkpoint list for the +35 V line.	
+35 V line is dead.	Input filter circuit malfunction	Check the input voltage waveform at the DB 1 input terminal.	Check whether the input filter circuit is partly shorted or open.
—	● Q1 is open between the collector and emitter. ● R5 is open. ● R14 is open. ● R14 is open.	● Check the voltage waveform at the T 112-14 terminal. ● Check the resistance across R5.: Approx. 0.5 [Ω] ● Check the resistance across R14.: Approx. 9.2 [KΩ]	● Replace Q1. . Replace R5. . Replace R14.
The voltage at +35 V line is less than normal. Normal voltage: +35 v ± 10 %.	Malfunction in the over voltage detection circuit for the transformer secondary side.	Voltage at each terminal under normal conditions. ● pin of PC1 -GP: approx. 29.9 [V] . cathode-anode of Q20: approx. 32.6 [V]	Replace the defective part.
	Current flowing through the base of Q 1 is less than normal.	. Check the resistance value across R4.: Approx. 27 [Ω] ● Check whether D2 is open. ● Check whether Q2 is shorted.	

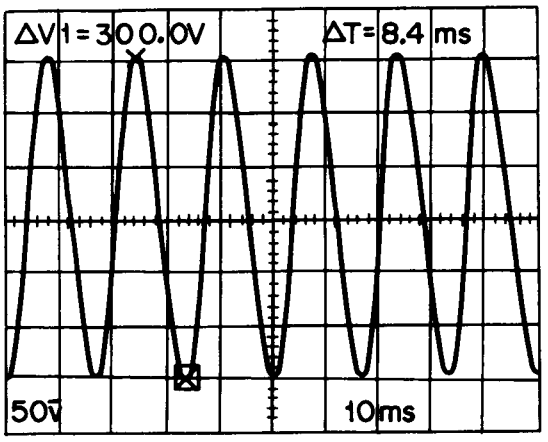
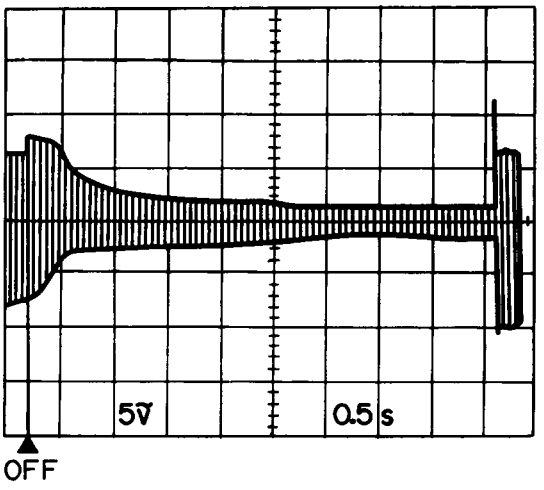
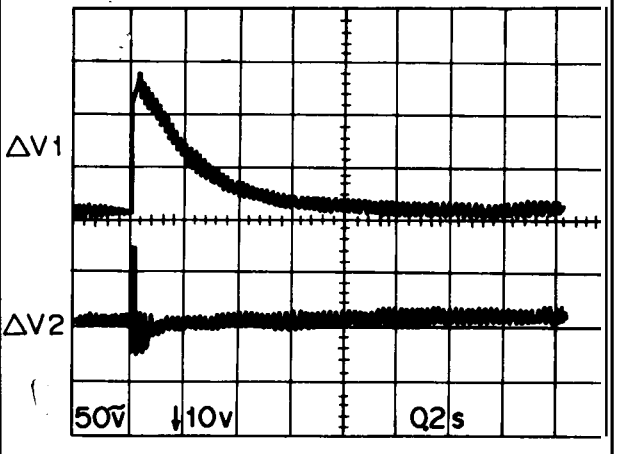
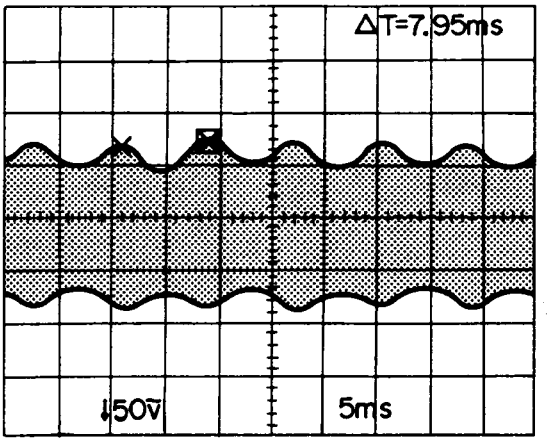
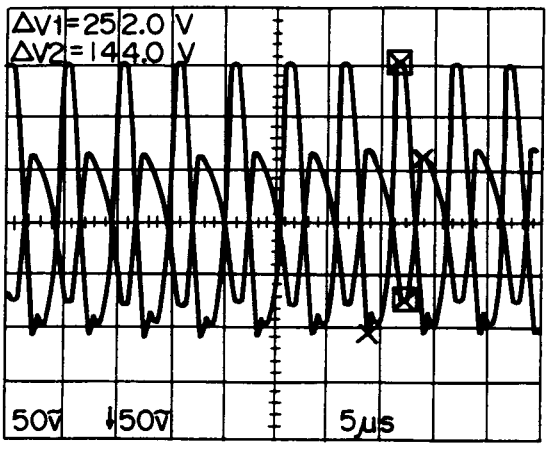
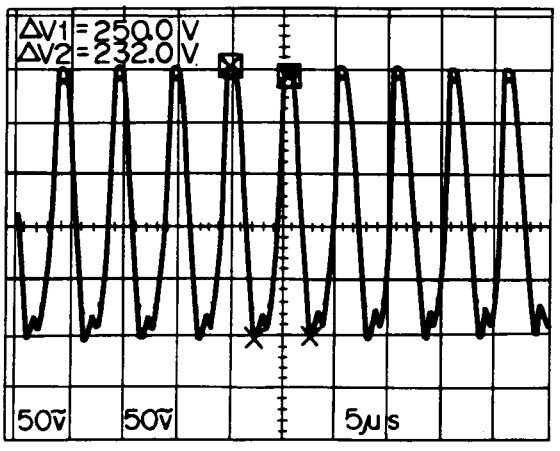
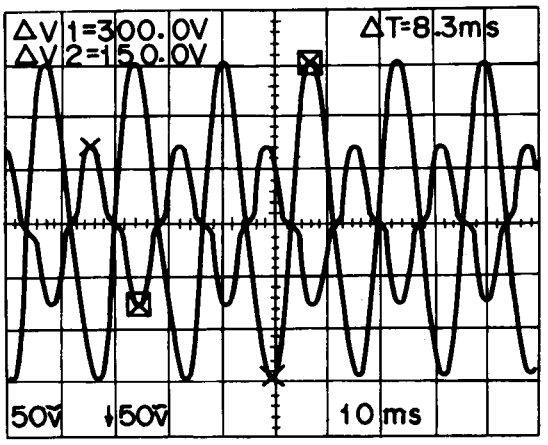
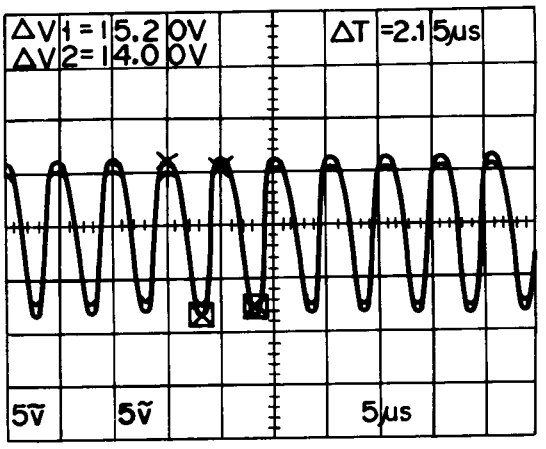
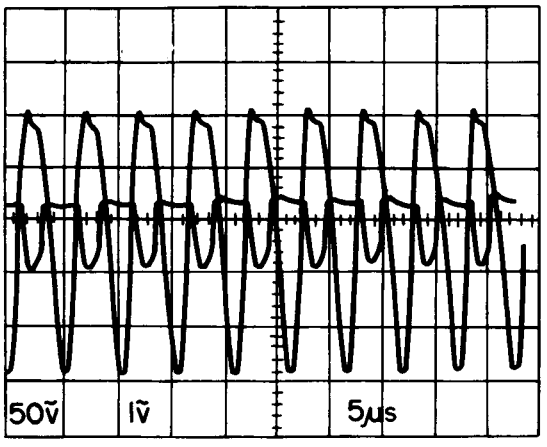
Measuring Position	+ Side	− Side	Channel (ΔVn)	Condition	Voltage Waveform
DB1	Input Side		1	Storage	
Q2	Colle-ctor	Emitter	1	Power OFF	
C6	+	−	1	Power ON	
TY1	T2	T1	2(INV.)		

Fig. 5-6. MONPS/MONPSE Board Voltage Waveforms

Measuring Position	+ Side	− Side	Channel (△Vn)	Condition	Voltage Waveform
T1	1pin	3pin	2	Storage	
T1	14pin	12pin	1	Storage	
	1pin	3pin	2(INV.)		
T1	14pin	12pin	1	Storage	
	10pin	12pin	2		

Measuring Position	+ Side	− Side	Channel	Condition	Voltage Waveform
)B1	Input Side		1	Storage	
	+	−	2(INV.)		
Γ1	8 pin	11 pin	1	Storage	
Q4	Colle-ctor	Emitter	2		
Q1	Colle-ctor	Emitter	1	Storage	
Q2	Base	Colle-ctor	2		

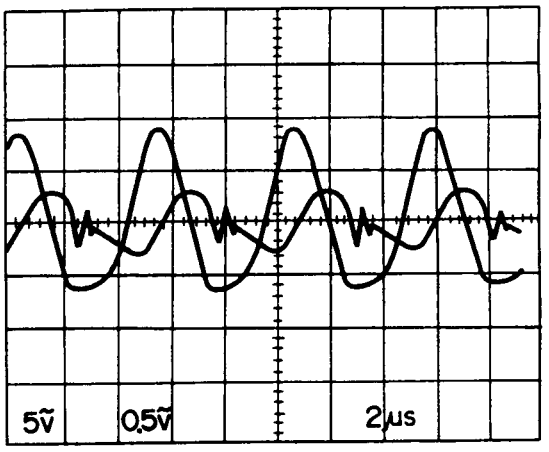
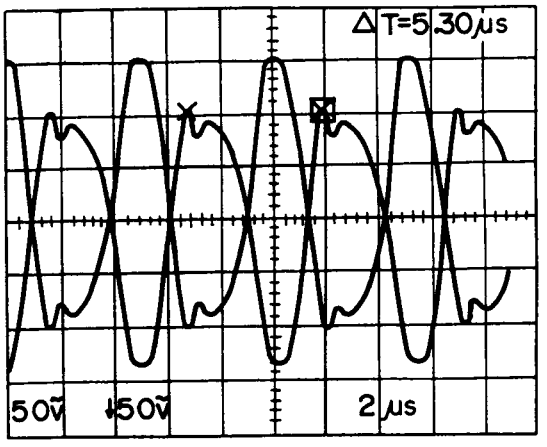
Measuring Position	+ Side	− Side	Channel	Condition	Voltage Waveform
T1	11 pin	8 pin	1	Storage	
Q5	Gate	Anode	2		
T1_	14 pin	12 pin	1	Storage	
	14 pin	10 pin	2		

Table 5-8. MONPS/MONPSE Board Main Parts List

Location	MONPS Board		MONPSE Board	
	Name	Description	Name	Description
~D20,zD21	HZ 20-3TD	20.2 -21.1 v 200mA 500mW	←	←
Q3	2SA 10 15-TPE2	50V, 150mA 400mW	←	←
Q1	2SC4059	600V, 15A, 130W	2SC4313	800V, 10A
Q2, Q4	2SC3303Y	80V, 5A, 1W	←	←
Q5, Q20	TL431CLPB	I Shunt Regulator	←	←
Pcl	TLP52 1-1 GB	35V, 500mA 100mW	TLP732GB (LF2)	
PC2	TLP541 G	400V, 10A	TLP74 1J(LF2)	600V
TY1	BCR10CM-8L	400V, 10A	←	←
'C20	STR 20005	45V, 2.0A, 55W	←	←
F1	ULTSC-3. 1 5A-N 1	125V, 3. 15A UL,CSA	BET 2A	250V, 2.0A Time-rug

5.3.2 MONMA Board

The MONMA board can be repaired using the diagnostic tool. Table 5-9 lists the main parts of the MONMA board.

Table 5-9. MONMA Board Main Parts List

Location	Name	Description
4B	74LS05	Hex inverters with open-collector output
6B	74LS07	Hex buffer with open-collector output
10A	SN75 188N	Quad line drivers
9B	SN75 189N	Quad line receivers
7B	pPD7810HG	8 bit CPU
5A	M546 10P	8bit parallel I/F IC
2A	E05A09BA	Stepper motors control gate array
3A	E05A02LA	Printhead data control gate array
10C	E05A 10AA	Memory management unit gate array
1A	STK6722H	Stopper motor drive IC
7A	HM65256 BLSP-12	32K X 8 bit 120 ns PS-RAM
8A	HM6264 ALSP-12	8K X 8 bit 120 ns ST-RAM
ZD2,ZD3	MA4300H-TA	30.2- 3 1.8V 250mA 370 mW
ZD4	MA4240M-TA	23.5 - 24.7V 250mA 370 mW
ZD5-ZD7	MA4330H-TA	33.2- 34.9V 250mA 370 mW
ZD 12	MA4033L-TA	3.12- 3.28V 250mA 370 mW
ZD1	05A247	44 - 49V 5mA 500 mW
ZD8-ZD 11	RD91 EB	85.0- 96.0V 2mA 500 mW
CY1	TL431 CLPB	Adjustable presison shunt regulator
7C	NE555P	Precision Timer
Q1 ~ Q24	2SD 1978-12	120V 1.5A 0.9W
Q25	2SC3293	50V 2A 20W
Q26, Q27	2SD152 1	50V 1.5A 1 Ow
Q28, Q29	2SC 18 15Y-TPE2	50V 150mA 400mW
Q31, 038, Q45		
Q30, Q33, Q34	2SC3 157	1 Oov 10A 60W
Q32, Q37	2SA 1020-TPE6	50V 2A 900mW
Q35, Q43	2SB765K	120V 3A 30W
Q36	2SD 1579-T	80V 3A 1W
Q39-Q42	2SD560(4)	120V 5A 1 .5W
Q44	2SA 10 15-TPE2	50V 150mA 400mW

5.3.3 Model-5310/5360 Printer Mechanism

Use the diagnostic tool to detect malfunctions among the carriage motor, paper feed motor, sensor and plunger. Table 5-10 lists the specifications for these components. For other components, use the printing test, and also inspect visually.

Table 5-10. Electric Device List

Name	Description
Carriage Motor	Type: 4 phases 200 pole HB stepper motor Voltage: 35V ± 10% (3 1.5 - 38.5V) Coil Resistance: 10.5 ohms ± 7% (at 20°C, /phase)
Paper Feed Motor	Type: 4 phases 48 pole PM stepper motor Voltage: 35V ± 10% Coil Resistance: 79 ± 3ohms (at 25°C, /phase)
Plunger	Voltage: 35V ± 10% Coil Resistance: 22 ± 2ohms (at 20°C)

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 possible period and to minimize malfunction frequency. Preventive maintenance includes regular cleaning of the case exterior, using alcohol, 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 surviced printer to the consumer, inspect the sproings, paper feed rollers, and the basic operation of the unit.

WARNING

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

6.2 LUBRICATION AND ADHESIVE APPLICATION

EPSON recommends that the points illustrated in Figure 6-2 be lubricated according to the schedule listed in Table 6-2, with EPSON O-2 and G-27, which have been extensively tested and found to comply with—the need of this printer (Refer to Table 6-1 for details of O-2 and G-27.). Lubrication should be performed regularly according to the A and B classification of Table 6-2. Be sure that the parts to be lubricated are clean before applying lubricant, and aboid 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 6-2. Avoid overview of excess to related parts.

Table 6-1. Lubricants and Adhesive

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

E: EPSON exclusive product

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

Ref. No.	Lubrication Point	Lubricant
(1)*	Contact portion of carriage motor mounting plate and base frame	G27
(2)*	Contact portion of sub paper release lever and paper release lever	G27
(3)'	Contact portion of tractor transmission gear and paper release lever	G27
(4)*	Contact portion of paper holding lever R and shaft	G27
(5)*	Contact portion of paper holding lever L and shaft	G27
(6)*	Contact portion of loading lever and shaft	G27
(7)*	Contact portion of head adjustment lever tab and holes of side frame L	G27
(8)*	Contact portion of paper feed roller holder and paper feed roller	G-27
(9)*	Carriage felt	02

*: Lubrication is necessary in the process of assembly,

Table 6-3. Adhesive Application Point (Refer to Figure 6-2.)

Ref. No.	Adhesive Application Point	Number of point
(11)	Engaging parts between timing belt and carriage	2

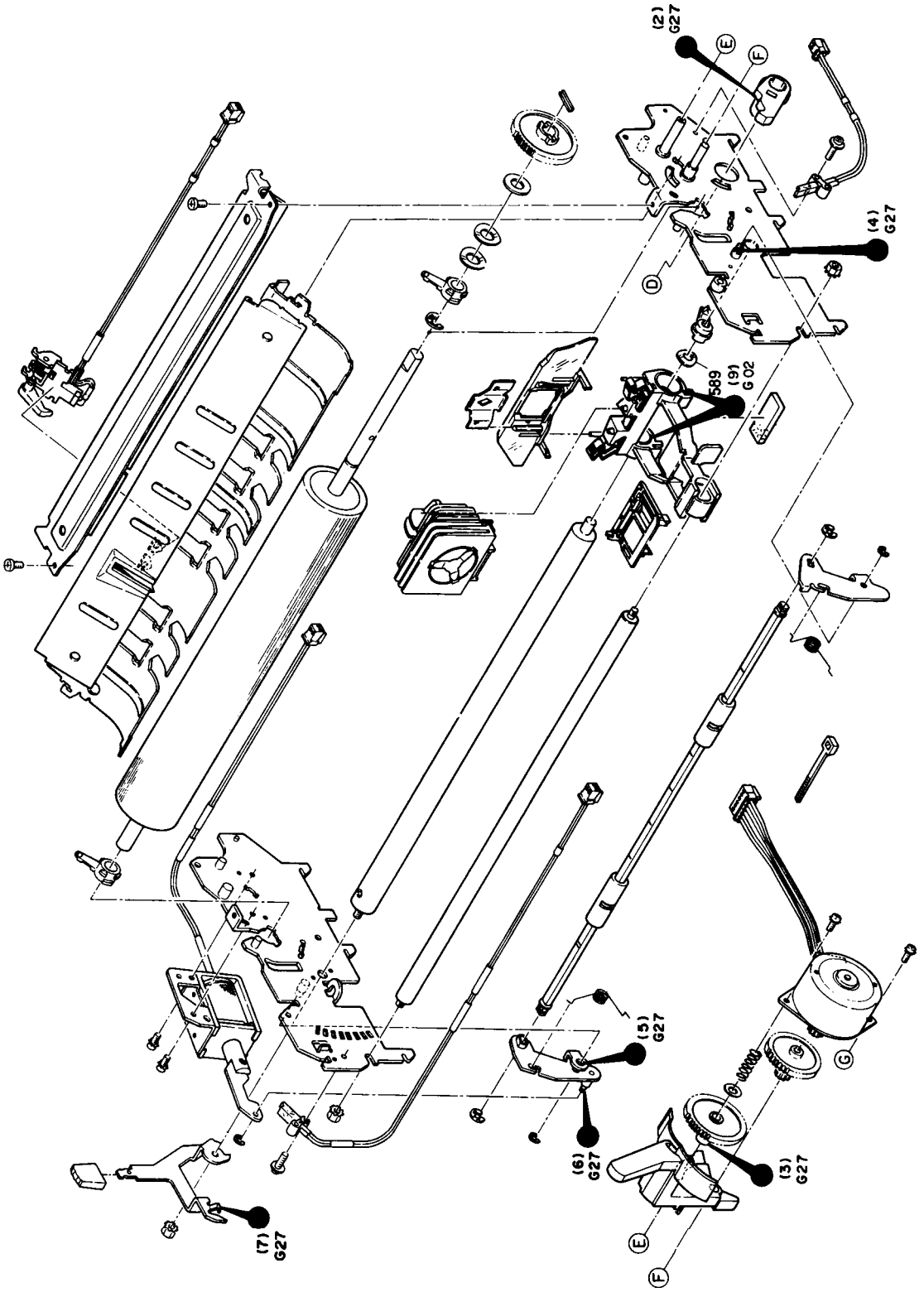


Fig. 6-1. LQ-850 (LQ-105O) Lubrication Points Diagram

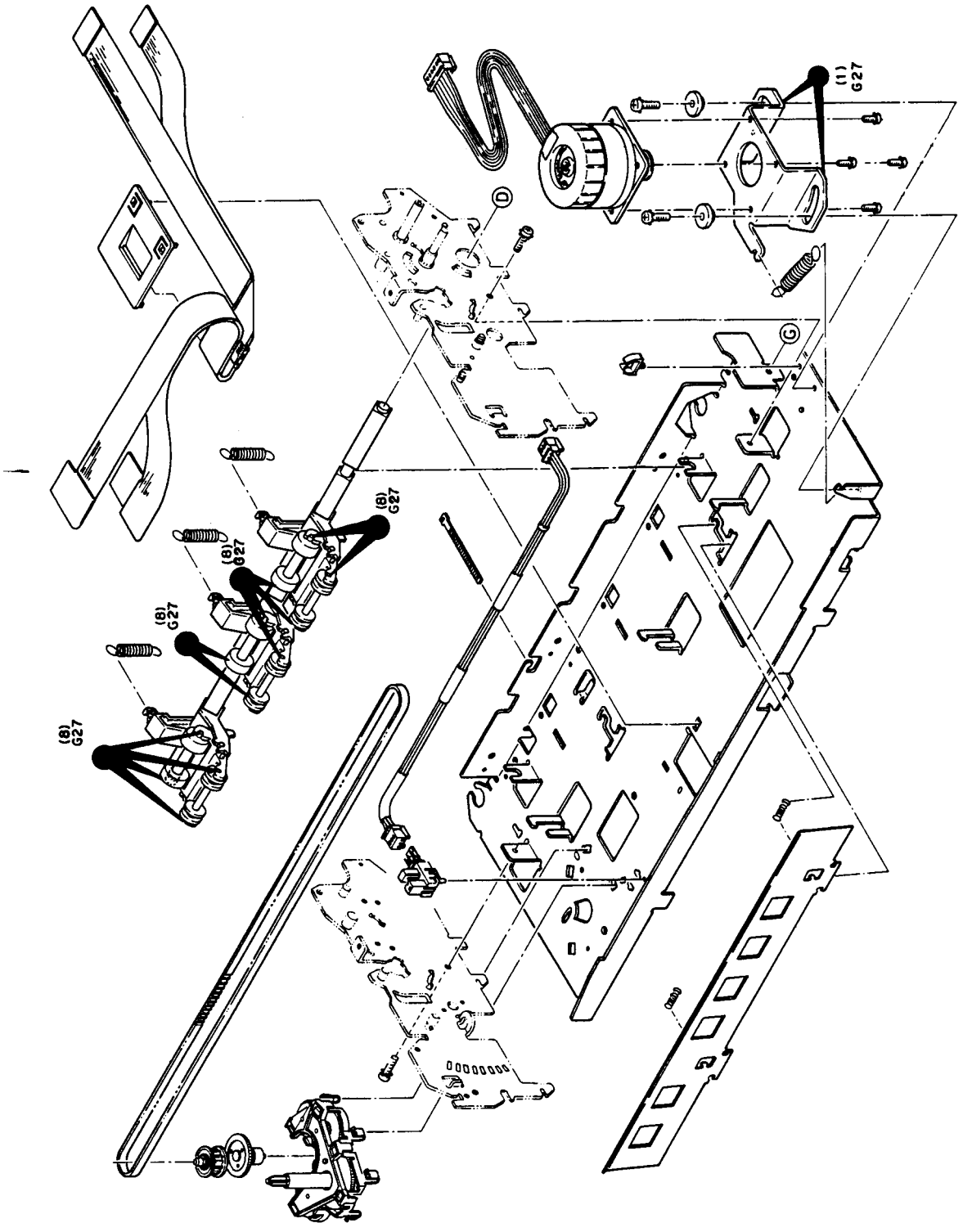
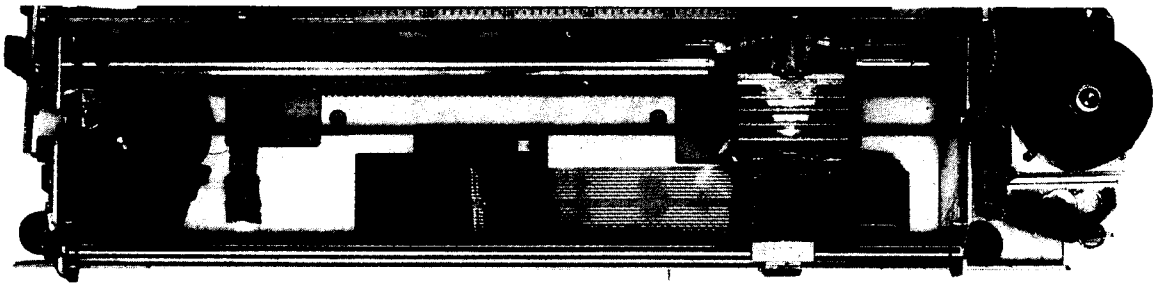
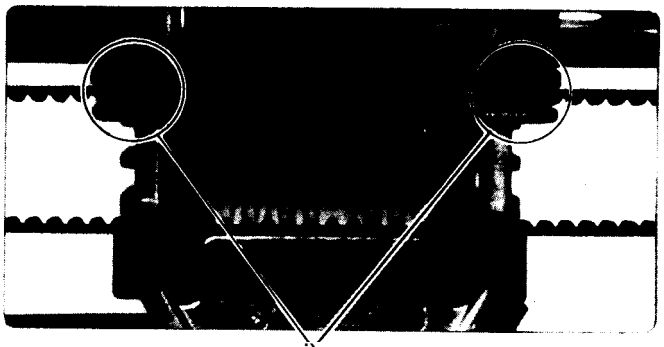


Fig. 6-1. LQ-850 (LQ-105O) Lubrication Application Points Diagram (Cont.)



(a) Carriage Position



(b) Bottom View

Fig. 6-2. Adhesive Application Point

APPENDIX

APPENDIX

LIST OF FIGURES

LIST OF TABLES

A.1IC DESCRIPTIONS

This section describes the primary ICs used in the LQ-850/ 1050, and supplements the data provided in Chapter 2.

A.1.1 μPD7810HG CPU (7B)

The μPD78 10HG is an 8-bit CPU and includes two 8-bit timercounters, an 8-bit A/D converter, 256 bytes of RAM, and a serial interface. The main features of this IC are as follows.

- 256 bytes built-in RAM (addresses FFOOH - FFFFH)
- Direct addressing of up to 64K bytes

. 8-bit A/D converter

- 158 instructions
- 0.8 μs 1 instruction cycle (15 MHz)
- 16-bit event counter
- Two 8-bit timer counters
- General purpose serial interface (asynchronous, synchronous, and I/O modes)

. I/O line (24 bit edge detection, 4 inputs)

- Zero cross detection
- Standby function
- Built-in clock pulse circuit
- NMOS

Figures A-1 and A-2 describe the 7810 microprocessor, and Tables A-1 through A-4 describe its functions.

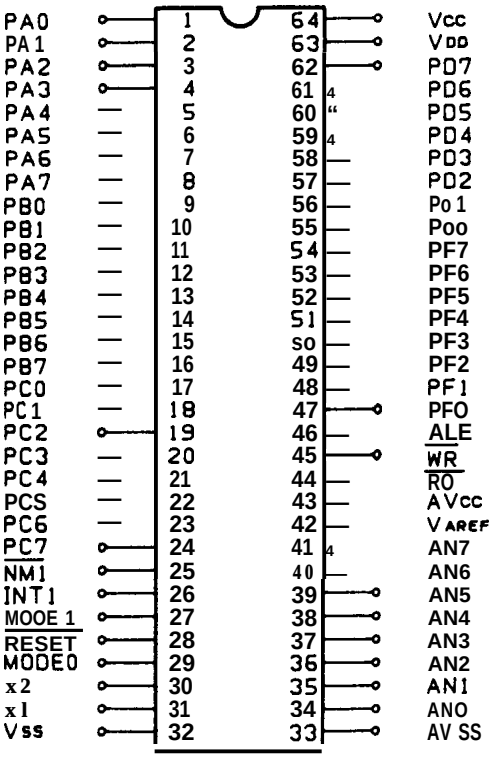


Fig.A-l. PPD781OHG Pin Diagram

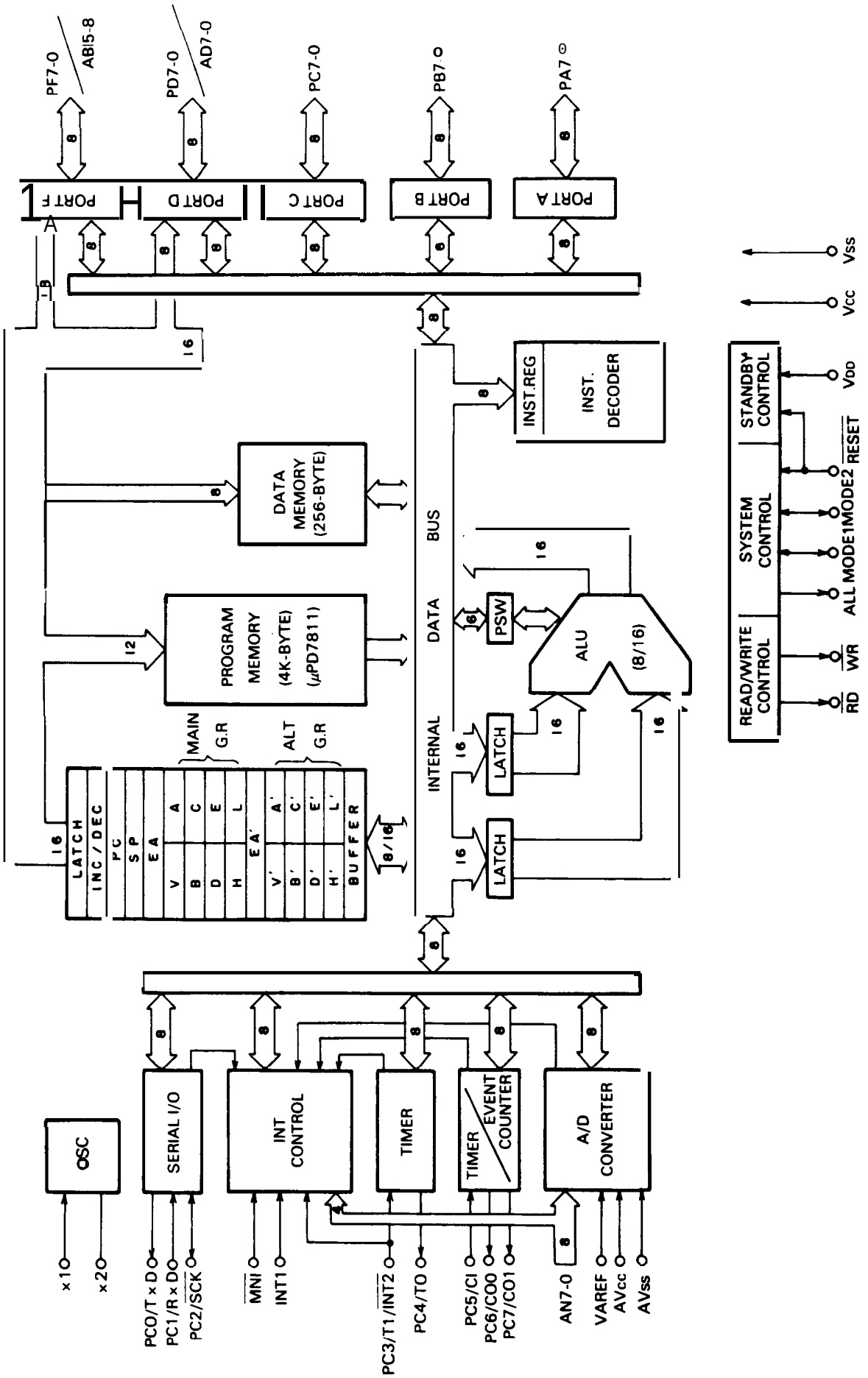


Fig. A-2. KPD781OHG Block Diagram

Table A-1 lists the terminal functions of the IC 7B.

Table A-1. μPD781 OHG Terminal Function

Pin No,	Signal	Dir.	Description	Status
1	PA 0	I	Carriage home position signal	HOME/OUT
2	PA 1	I	Paper end signal	STAY/OUT
3	PA 2	0	PLUNGER2 drive	ACT/NON
4	PA 3	0	Buzzer	O N / ~
5	PA 4	0	PLUNGER1 drive	NON/ACT
6	PA 5	I	I/F Parallel/Serial signal	P/$\overline{S}$
7	PA 6	O	$\overline{\text{STROBE IN}}$ signal	FALL/$\overline{\text{RAISE}}$
8	PA 7	0	ON-LINE LED	NON/$\overline{\text{BRIGHT}}$
9	PB O	0	EBUSY signal	BUSY/$\overline{\text{READY}}$
10	PB 1	0	ACKNLG	ACKNLG/$\overline{\text{READY}}$
'1 1	PB 2	0	ERROR signal	ERROR/$\overline{\text{READY}}$
12	PB 3	O	PAPER END signal	STAY/END
13	PB 4	I	SLCT IN signal	$\overline{\text{SELECT}}$
14	FB 5	I	AUTO FEED XT signal	$\overline{\text{AUTOFEEDXT}}$
15	PB 6	I	Friction/Tractor signal	F/$\overline{T}$
16	PB 7	I	PLATEN GAP signal	1-3/$\overline{4\text{-}6}$
17	TXD	O	Transmits data	—
18	RXD	I	Receives data	—
19	Pc 2	0	TM2 pulse (PF motor clock)	—
20	PC3	I	Parallel I/F interrupt	—
21	Pc 4	0	BUSY and ACKNLG control	DIS/$\overline{\text{ENABLE}}$
22	Pc 5	0	$\overline{\text{HPW}}$ pulse width control	NORMAL/$\overline{\text{NORMAL}+20\mu s}$
23	PC 6	O	Printhead drive pulse	E
24	PC 7	O	$\overline{\text{TM1}}$ pulse (CR motor clock)	
25	NMI	I	Selected by J7	80col/$\overline{\text{136col}}$
26	INT 1	I	BSYF	BUSY/NON
27	MODE1	I	Mode 3 select (fixed)	
29	MODE2		Address OOOOH - EFFFH (External) FFOOH - FFFFH (Internal RAM)	—
28	$\overline{\text{RESET}}$	I	Reset signal	$\overline{\text{RESET}}$
30	X2	I	External clock 14.74 MHz	
31	X1			
32	Vss	-	Signal GND	—
33	AVss	-	Analog port GND	—
34	AN O	I	Printhead temperature monitoring	—

Table A-1. I.LPD781OHG Terminal Function (cont.)

Pin No.	Signal	Dir.	Description	Status
35	AN 1	I	+ 35V line monitoring	—
36	AN 2	I	DIP SW 1-5 read	O F F / ~
37	AN 3	I	DIP SW 1-6 read	O F F / ~
38	AN 4	I	DIP SWs 1-3, 1-8, 2-2, 2-6 read	O F F / ~
39	AN 5	I	DIP SWs 1-4, 2-3, 2-7, 2-8 read	O F F / ~
40	AN 6	I	DIP SWs 1-1, 1-7, 2-4 read/VR2 value read	—
41	AN 7	I	DIP SWs 1-2, 2-1, 2-5 read/VR3 value read	—
42	VAREF	I	Referance voltage of analog port	—
43	AVCC	-	Analog port power	—
44	$\overline{RD}$	o	Read pulse	—
45	WR	o	Write pulse	—
46	ALE	o	Address latch enable	—
47 ∫ 54	PF O ∫ PF 7	0	Upper address (A8 - Al 5) bus	— — —
55 ∫ 62	PD O ∫ PD 7	I/O	Lower address (AO - A7) bus or data (DO - D7) BUS Selected by ALE signal	—
63	VDD	I	+5V DC power	—
64	Vcc			—

CPU Timing (Figures A-3 through A-5)

Three oscillations define one state. The OP code fetch requires four states: during T1 to T3, program memory is read; instructions are interpreted during T4. Address bus 15 - 8 are output from T1 to T4. Address bus 7 - 0 (PD7 ~ O) are used in the multiplex mode; the address is latched during T1 at the ALE signal. Since the memory addressed is enabled after disengaging the driver (AD7 - O), $\overline{RD}$ is output from T1 - T3, fetched at T#, and processed internally at T4. The ALE and $\overline{RD}$ signals are executed from T1 - T3; the OP code fetch for these two signals is performed at T4. The WR signal is output from the middle of T1 to the beggining of T3. The address and ALE timing is the same as that for memory read; however, following address output AD7 - 0 (PD7 - PDO) are not disabled, and write data are output at AD7 - 0 at the beggining of T1 and the end of T3.

NOTE: When PD7 - 0 are set to the multiplexed address data bus (AD7 - O) and PF7 - 0 to the address bus (AB7 - O), the $\overline{RD}$ and $\overline{WR}$ signals in the machine cycle are high when memory is not being accessed.

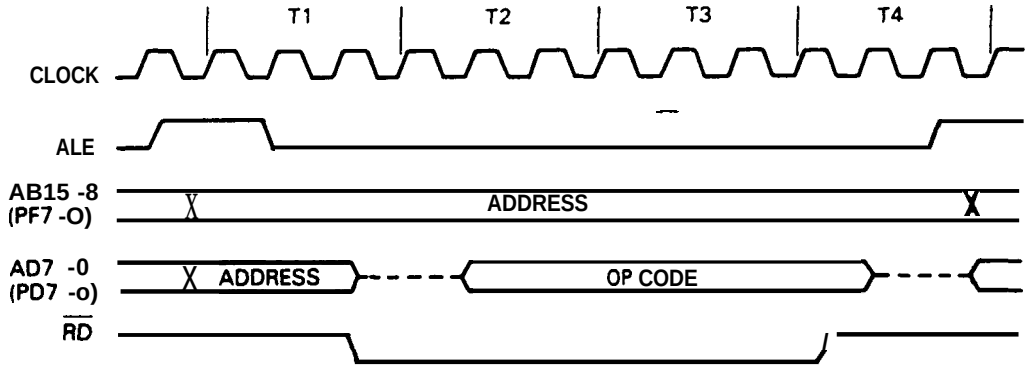


Fig.A-3. OP Code Fetch Timing

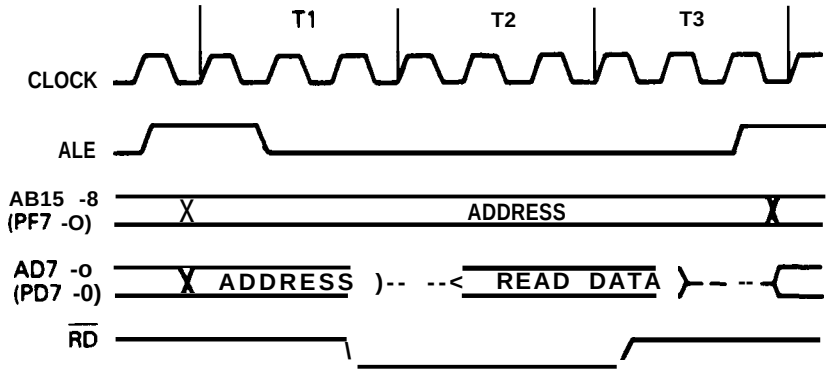


Fig.A-4. Memory Read Timing

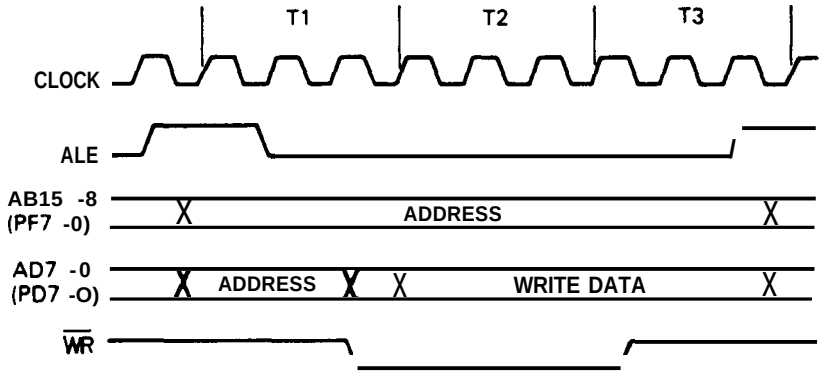


Fig.A-5. Memory Write Timing

A.1.2 E05A10AA Gate Array (1OC)

The gate array is a memory management unit IC which contains reset circuit, address latch, memory management unit, and so on.

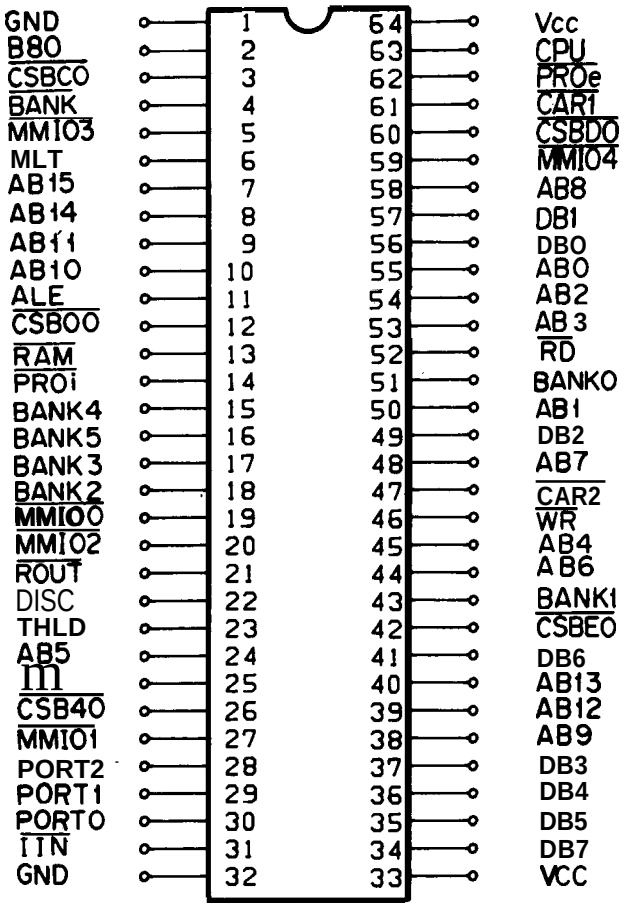


Fig. A-6. E05A10AA Pin Diagram

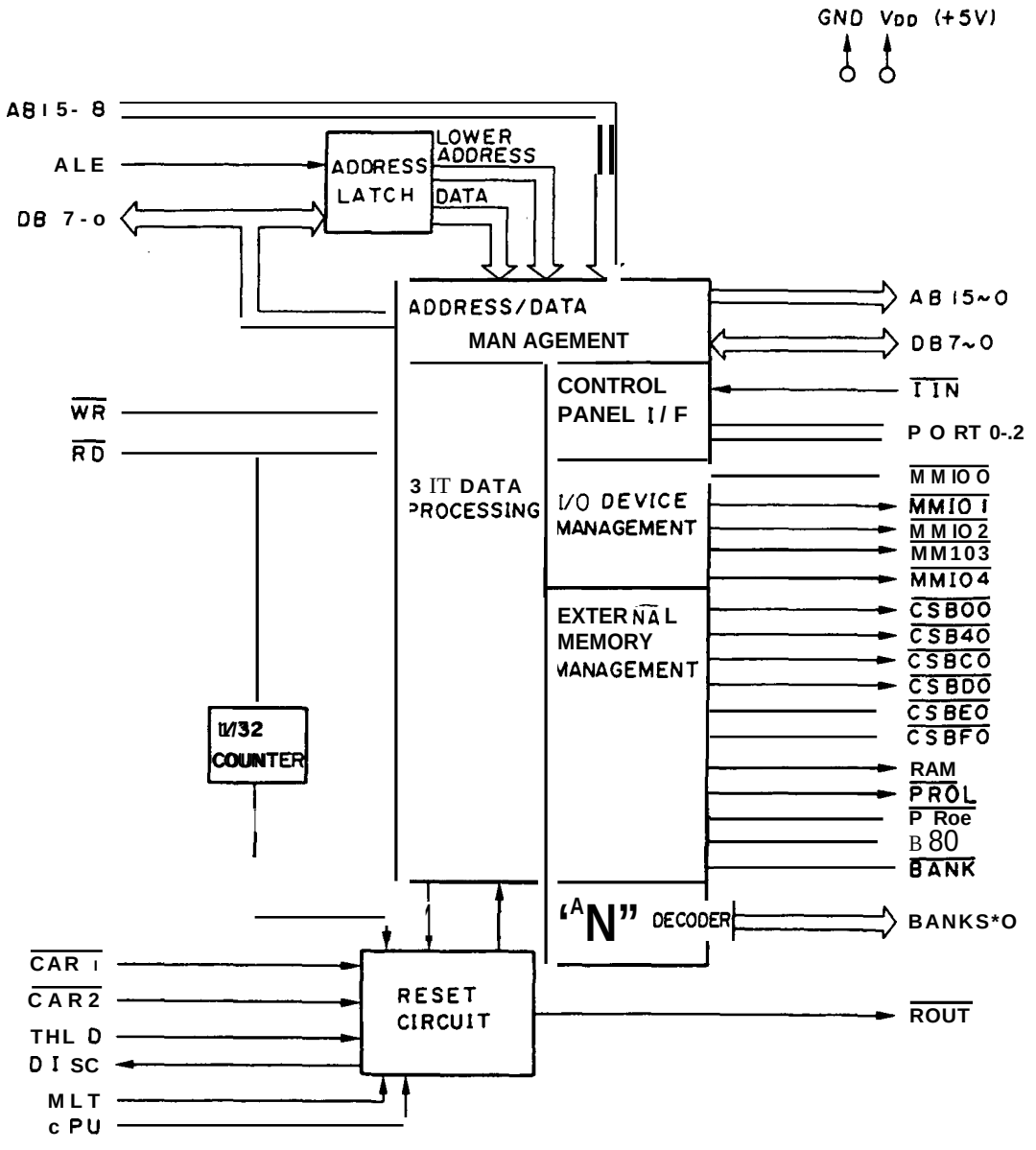


Fig. A-7. EO5A1OAA Block Diagram

Table A-2. E05A1 OAA Terminal Function

Pin No.	Name	Dir.	Function
51	BANK0	o	Bank select O
43	BANK1	o	Bank select 1
18	BANK2	o	Bank select 2
17	BANK3	o	Bank select 3
15	BANK4	o	Bank select 4
16	BANK5	o	Bank select 5
55	AD O	0	Address bus O
50	AD 1	0	Address bus 1
54	AD 2	0	Address bus 2
53	AD 3	0	Address bus 3
45	AD 4	0	Address bus 4
24	AD 5	0	Address bus 5
44	AD 6	0	Address Bus 6
48	AD 7	0	Address bus 7
58	AD 8	0	Address bus 8
38	AD 9	0	Address bus 9
10	AD 10	0	Address bus 10
9	AD 11	0	Address bus 11
39	AD 12	0	Address bus 12
40	AD 13	0	Address bus 13
8	AD 14	0	Address bus 14
7	AD 15	0	Address bus 15
56	DB O	I/O	Data bus O
57	DB 1	I/O	Data bus 1
49	DB 2	I/O	Data bus 2
37	DB 3	I/O	Data bus 3
36	DB 4	I/O	Data bus 4
35	DB 5	I/O	Data bus 5
41	DB 6	I/O	Data bus 6
34	DB 7	I/O	Data bus 7
30	PORT0	o	LOAD
29	PORT1	o	PDATA
28	PORT2	o	CLOCK
19	$\overline{\text{MMIO0}}$	o	M546 10P (5A) select
27	$\overline{\text{MMIO1}}$	0	E05A02LA (3A) select
20	$\overline{\text{MMIO2}}$	o	E05A09BA (2A) select
5	$\overline{\text{MMIO3}}$	o	$\overline{\text{DIP}}$ (CN4)

Table A-2. EO5A1OAA Terminal Function (cont.)

Pin. No.	Signal	Dir.	Function
59	$\overline{\text{MMIO4}}$	o	N.C.
12	$\overline{\text{CSB00}}$	o	IC 4A select
26	$\overline{\text{CSB40}}$	o	IC 6A select (correspond to J4)
3	$\overline{\text{CSBCO}}$	o	CG3 (CN4)
60	$\overline{\text{CSBDO}}$	o	$\overline{\text{CG}}$ (CN5)
42	$\overline{\text{CSBEO}}$	o	$\overline{\text{CG}}$ (CN6)
25	CSBFO	o	IC 6A and IC 8A select (correspond to J4)
52	$\overline{\text{RD}}$	I	Read strobe
46	WR	I	Write strobe
13	RAM	o	IC 7A select
14	PROi	o	IC 9A and $\overline{\text{PROG}}$ (CN4) select
62	PROe	o	$\overline{\text{PROG}}$ (CN5)
2	B80	0	KANJ (CN4)
4	$\overline{\text{BANK}}$	o	CG (CN4)
61	$\overline{\text{CAR1}}$	I	$\overline{\text{R}}$ (CN5)
47	$\overline{\text{CAR2}}$	I	$\overline{\text{R}}$ (CN6)
31	$\overline{\text{IIN}}$	I	ONLSW(CN7)
11	ALE	I	Address latch enable
33,64	VCC	I	+ 5V DC power
1, 32	GND	-	GND
23	THLD	I	Power on reset
21	$\overline{\text{ROUT}}$	O I	$\overline{\text{RESET}}$ signal
22	DISC	o	Discharge
6	MLT	I	Power on reset and $\overline{\text{INIT}}$ reset
63	CPU	I	Power on reset and $\overline{\text{INIT}}$ reset

A.1.3 E05A09BA Gate Array (2A)

The gate array is 4 phases stepper motors control IC which contains two motor's phase excitation control circuit.

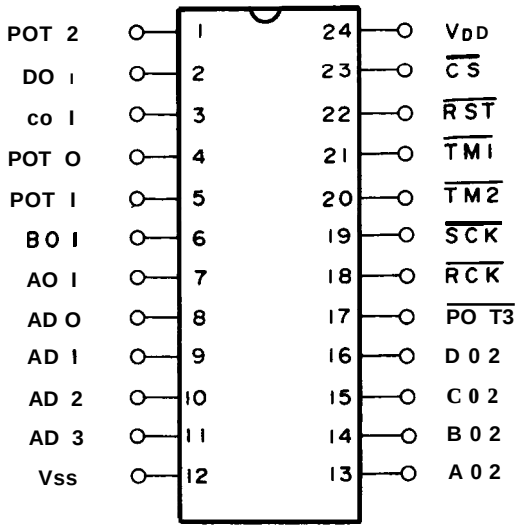


Fig. A-8. E05A09BA Pin Diagram

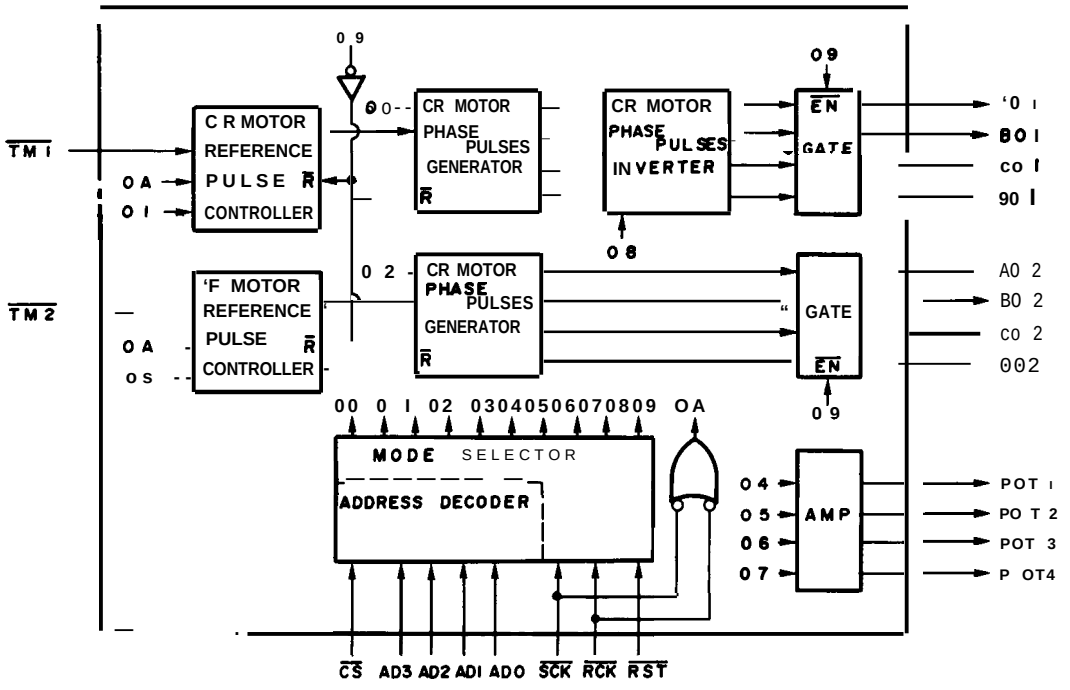


Fig. A-9. E05A09BA Block Diagram

Table A-3. E05A09BA Terminal Function

Pin No.	Name	Dir.	Description
8	ADO	I	Address bus O
9	AD 1	I	Address bus 1
10	AD2	I	Address bus 2
11	AD3	I	Address bus 3
21	TM 1	I	Carriage motor clock pulse
20	TM2	I	Paper feed motor clock pulse
18	RCK	I	$\overline{RD}$ pulse
19	SCK	I	$\overline{WR}$ pulse
17	POT3	o	Paper feed motor RUN/$\overline{HOLD}$
13	A02	o	Paper feed motor phase A
14	B02	o	Paper feed motor phase C
15	C02	o	Paper feed motor phase B
16	D02	0	Paper feed motor phase D
4	POTO	o	Reference voltage control
5	POT1	o	
1	POT2	o	Carriage motor HOLD/RUN
7	AO 1	0	Carriage motor phase A
6	BO1	o	Carriage motor phase C
3	Col	o	Carriage motor phase B
2	DO1	o	Carriage motor phase D
22	$\overline{RST}$	I	Reset signal
23	$\overline{CS}$	I	Chip select
24	VDD	I	+5V DC power
12	Vss	-	GND

A.1.4 E05A02LA Gate Array (3A)

This gate array is used to simplify the interface between the CPU and the printhead.

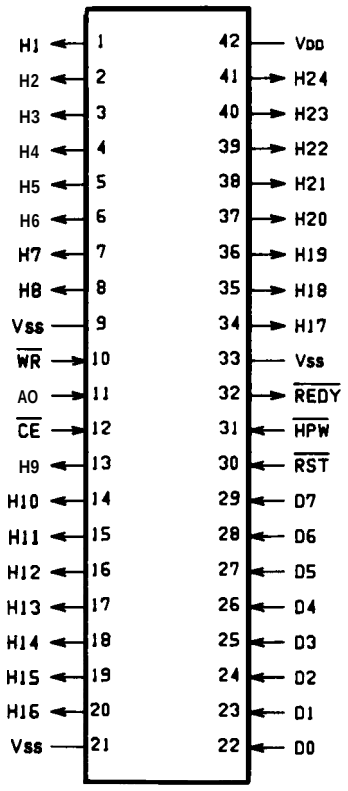


Fig. A-10. E05A02LA Pin Diagram

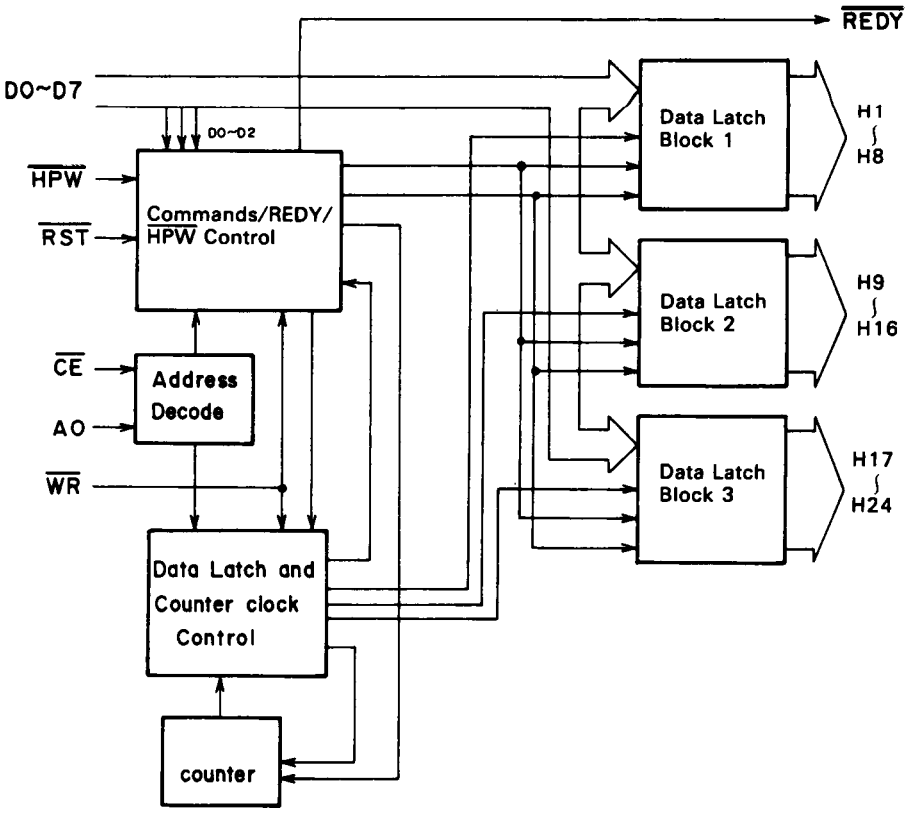


Fig. A-1 1. E05A02LA Block Diagram

Table A-4. E05A02LA Terminal Function

Pin No.	Signal	1/0	Function
1 ∫ 8	HI J H8	o	Head Data 1 - 8 output
9	Vss	—	GND
10	WR	I	Write enable
11	AO	I	Address bit O
12	CE	I	Chip enable
13 ∫ 20	H9 ∫ H16	o	Head Data 9 - 16 output
21	Vss	—	GND
22 ∫ - 2 9	DO J D7	I	DATA/COMMAND INPUT
30	RST	I	RESET
31	HPW	I	Head Driving Pulse width
32	REDY	I	READY
33	Vss	—	GND
34 ∫ 41	H17 ∫ - H24	o	Head Data 17 - 24 Output
42	V_{DD}	I	+5V

A.1.5 M54610P 8-Bit Parallel VF (5A)

The IC contains 8-bit parallel interface function so that the interface between host computer and CPU is simplify.

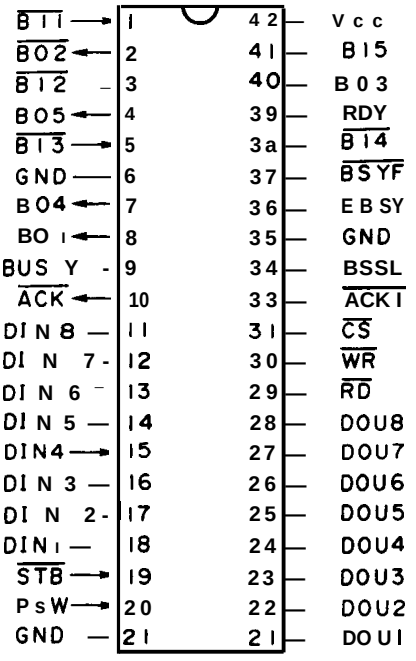


Fig. A-1 2. M54610P Pin Diagram

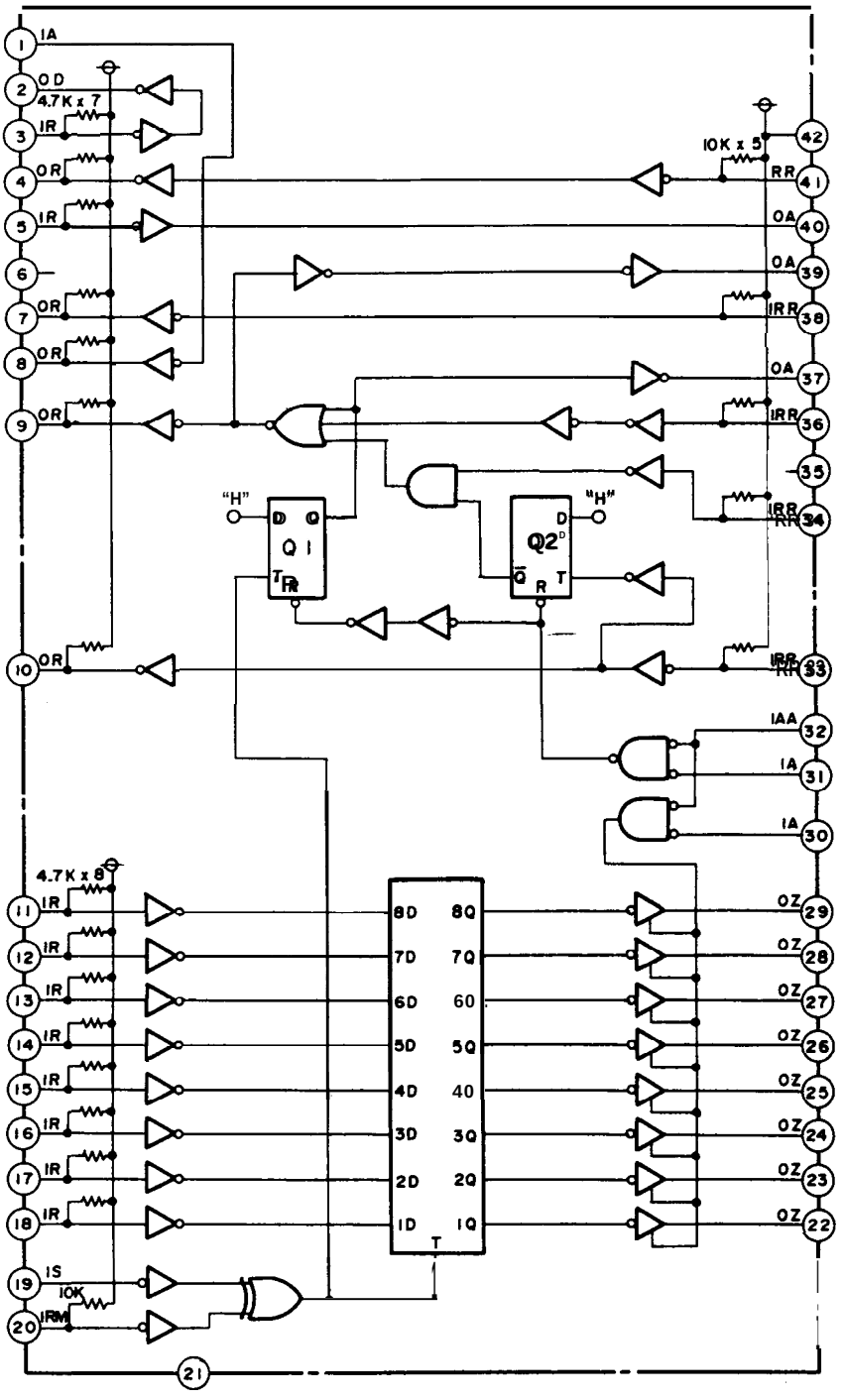


Fig. A-1 3. M5461OP Internal Circuit

Table A-5. M5461OP Terminal Function

Pin No.	Name	Direction	Function
9	BUSY	→ Host	BUSY signal
11 ∫ 18	DIN8 ∫ DIN 1	← Host	8-parallel data
19	STB	← Host	$\overline{\text{STROBE}}$ pulse
20	PSW	← CPU	Output timing of the BUSY signal O: Positive edge of $\overline{\text{STROBE}}$ 1: Negative edge of $\overline{\text{STROBE}}$
6,21,35	GND	–	GND
22 J 29	DOU1 ∫ DOU8	→ CPU	8-bit parallel data
30	RD	← CPU	$\overline{\text{READ}}$ pulse
31	WR	← CPU	$\overline{\text{WRITE}}$ pulse
32	Cs	← G/A	$\overline{\text{Chip select}}$ signal
33	ACKI	← CPU	$\overline{\text{Acknowledge}}$ signal
34	BSSL	← CPU	BUSY select signal O: BUSY signal goes to LOW when ACKI goes to HIGH 1: BUSY signal goes to LOW when $\overline{\text{CS WR}}$ goes to low
36	EBSY	← CPU	BUSY signal
37	BSYF	→ CPU	BUSY flug
38	RDY	-	Not used
42	Vcc	In	+5VDC power
1	BI1	In	PE signal
8	BO1	out	$\overline{\text{PE LED}}$ to control panel
3	BI2	In	INIT from host
2	BO2	out	INIT to reset circuit
5	BI3	In	READY signal
40	BO3	out	RY LED to control panel
38	$\overline{\text{BI4}}$	In	$\overline{\text{PE}}$ from CPU
7	BO4	Out	PE to host
41	BI5	In	ERROR from CPU
4	$\overline{\text{BO5}}$	Out	$\overline{\text{ERROR}}$ to host

A.1.6 STK6722H 4-Phases Stepper Motor Driver (1A)

The STK6722H is a uni-pauller constant current chopper driver IC for the four phases stepper motor.

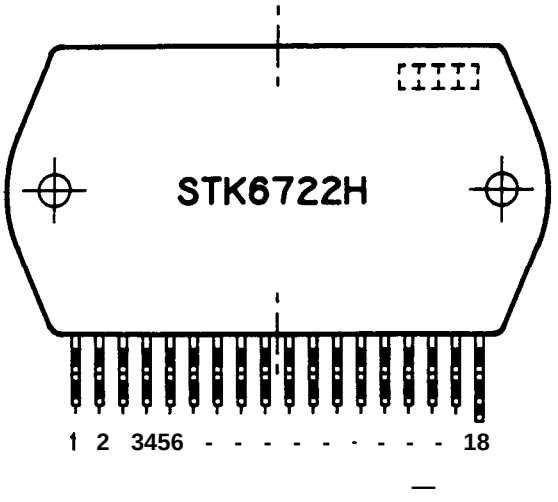


Fig. A-14. STK6722H Pin Diagram

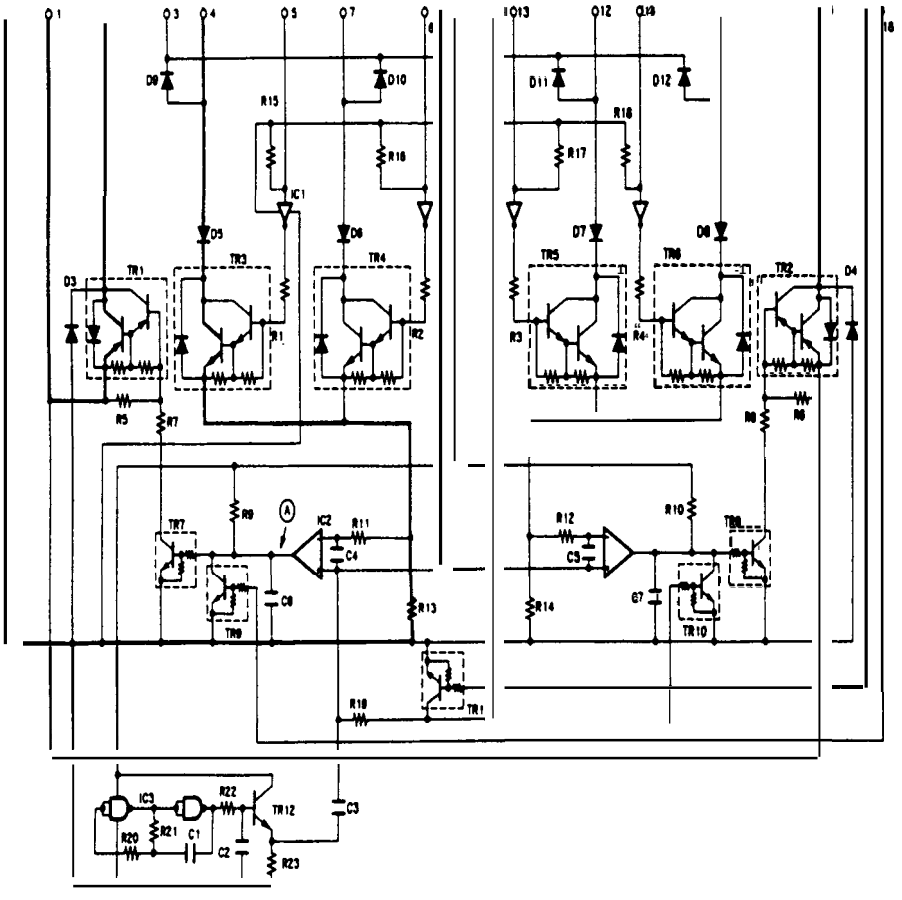


Fig. A-1 5. STK6722H Internal Circuit

Table A-6. STK6722H Terminal Function

Pin No.	Signal	Direction	Function
1	Vcc1	In	+ 35V DC power
2	CAB	out	CR motor phases A and B common
3	S.out	out	Surge voltage of CR motor coils
4	OA	out	CR motor phase A drive
5	1A	In	CR motor phase A drive pulse
6	IB	In	CR motor phase B drive pulse
7	OB	out	CR motor phase B drive
8	Vref	In	Reference voltage for CR motor phases
9	Vcc2	In	+5V DC (internal circuit power)
10	Vss	—	GND
11	N.C	—	Not connected
12	Oc	out	CR motor phase C drive
13	IC	In	CR motor phase C drive pulse
14	ID	In	CR motor phase D drive pulse
15	OD	out	CR motor phase D drive
16	C CD	out	CR motor phases C and D common
17	P.D.	In	Power down
18	Rush	—	fixed to low

A.1.7 HM27256G-25 EP-ROM (9A)

This EP-ROM is a ultra-violet erasable and electrically programmable ROM of 32 K-bytes.

Features

- Capacity of 32768 words X 8 bits
- I/O with TTL compatible
- Power supply +5V DC
- Access time 250 ns
- 28 pins (DIP)

Terminal Functions

- AO - Al 4 Input address
- = Chip enable
- m Output enable
- DO - D7 Input/Output data

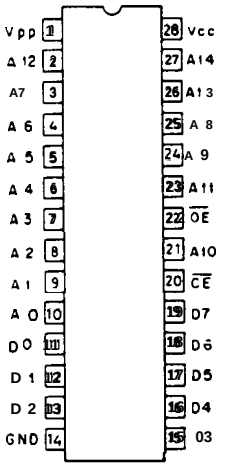


Fig. A-16. HM27256G-25 Pin Diagram

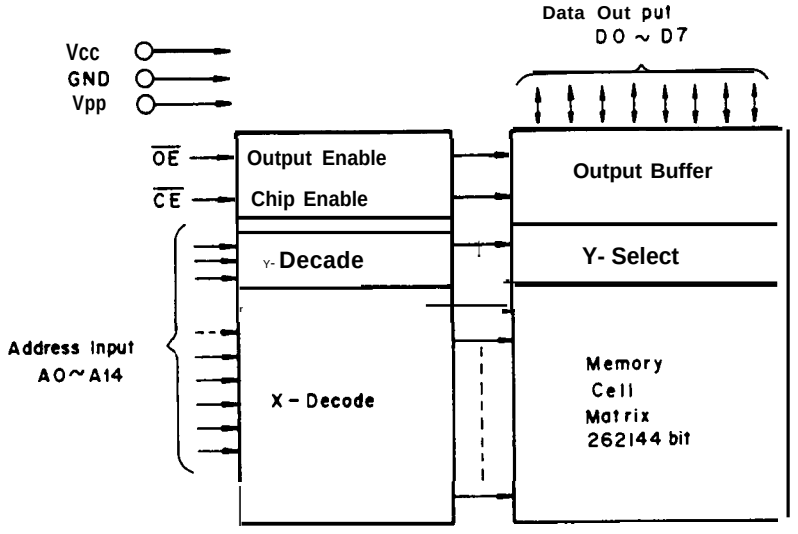


Fig. A-1 7. HM27256G-25 EP-ROM Block Diagram

Table A-7. HM65256 EP-ROM Signal Status

Mode	CE	OE	A9	V_{PP}	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	V_H	Vcc	Vcc	Code

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

2. VI-I = 12.OV ± 0.5V

3. Vcc = −0.6 - +7V

4. Vpp = − 0 . 6 - + 14V

A.1.8 HM65256BLSP-12 CMOS PSEUDO ST-RAM (7A)

This is a 8K-byte CMOS static RAM which has low power consumption, and its input/output level is compatible with the TTL ICs.

Features

- Capacity of 32768 words X 8 bits
- 1/0 with TTL compatible
- . Power supply +5V DC
- . $\overline{CE}$ access time . . . 120ns
- 28 pins (DIP)

Functions

- AO - A14 Input address
- WE Write enable
- OE Output enable
- $\overline{CE}$ Chip enable
- '$\overline{I/O}$0 - 1/07 Input/Output data
- NC No connection

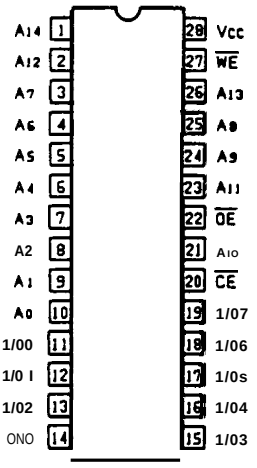


Fig. A-18. HM65256BLSP-12 Pin Diagram

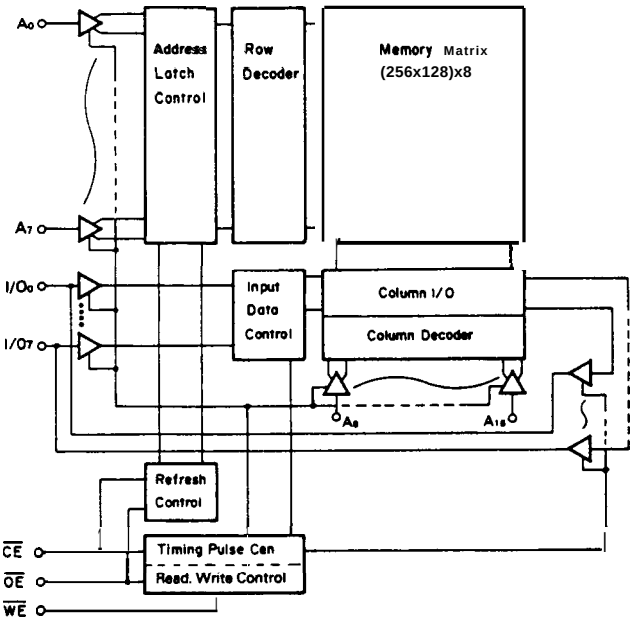


Fig. A-1 9. HM65256BLSP-12 Block Diagram

Table A-8. HM65256BLSP-12 Signal Status

$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	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

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

REV.-A

A.1.9 HM6264ALSP-12 CMOS ST-RAM (8A)

This is a 8K-byte CMOS static RAM which has low power consumption, and its input/output level is compatible with the TTL ICs.

Features

- Capacity of 8192 words X 8 bits
- I/O with TTL compatible
- Power supply +5V DC
- $\overline{CS}$ access time . . . 120ns
- 28 pins (DIP)

Functions

- AO - Al 2 Input address
- WE Write enable
- m Output enable
- $\overline{CS1}$, CS2 Chip select
- DO - D7 Input/Output data
- NC No connection

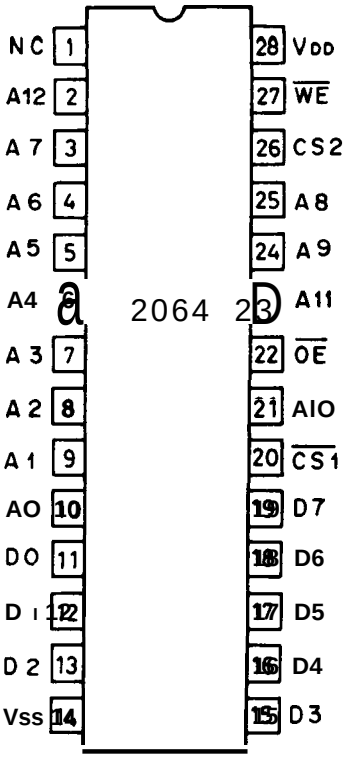


Fig. A-20. HM6264ALSP-12 Pin Diagram

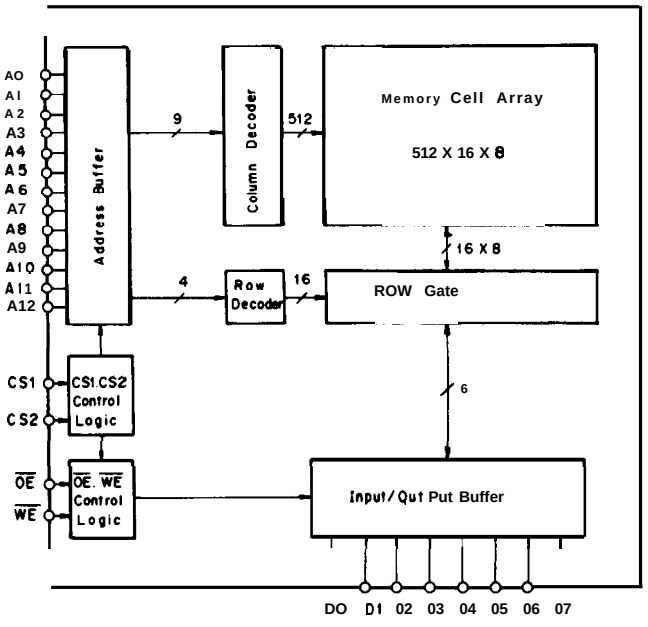


Fig. A-21. HM6264ALSP-12 Block Diagram

Table A-9. HM6264ALSP-12 Signal Status

$\overline{WE}$	CS1	CS2	$\overline{OE}$	I/O Terminal	Mode
X	H	x	x	High Z	Power down
H	L	H	H	High Z	Output disable
H	L	H	L	Data out	Read cycle
L	L	H	H	Data in	Write cycle (1)
L	L	H	L	Data in	Write cycle (2)

A.1.1O SN75188N Line Driver (1OA)

The 75188 is a quad line driver IC which is used for exchanging the signal level from TTL to RS-232C with the 75189.

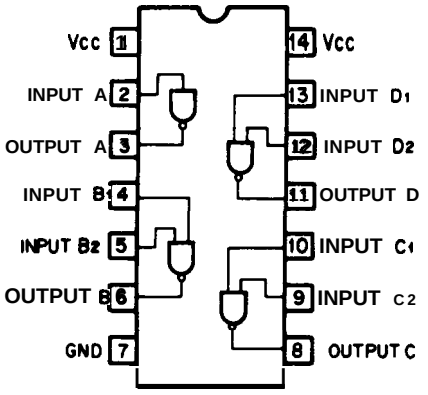


Fig. A-22. 75188 Pin Diagram

A.1.1 1 SN75189N Line Receiver (9B)

The 75189 is a quad line receiver IC which is used for exchanging the signal level from RS-232C to TTL with the 75188.

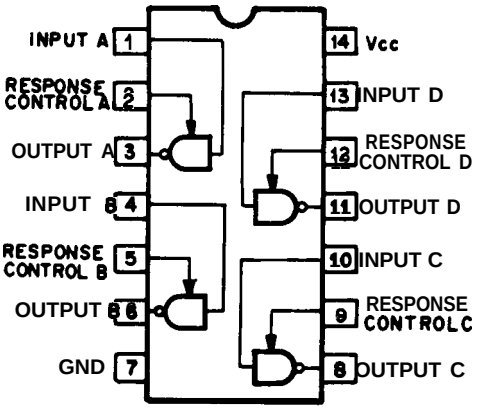


Fig. A-23. 75189 Pin Diagram

A.1.12 NE555P General Purpose Timer (7C)

The 555 is a one circuit general purpose timer, which can be used to construct a timing generator circuit such as a one-shot/multi oscillator using a few external parts.

Features

. Wide timing range (μs to hours)

● Valious timing circuits can be constructed

. Variable duty cycle

● TTL compatible output

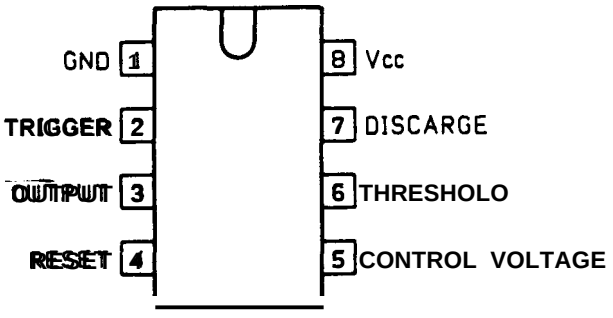


Fig. A-24. NE555P Pin Diagram

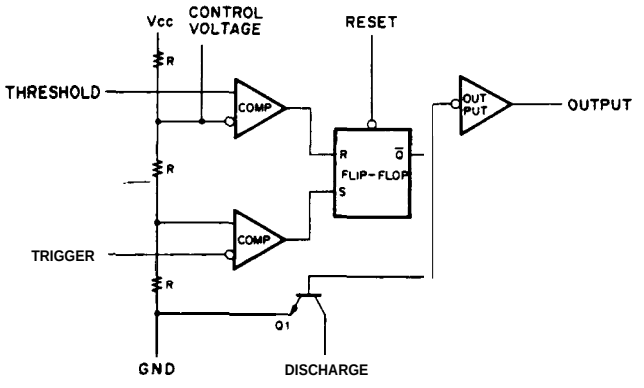


Fig. A-25. NE555P Block Diagram

Table A-10. NE555P Function

Reset	Trigger	Threshold	output	Transistor for Timing Capacitor Discharge
Low	Independent from the voltage level	Independent from the voltage level	Low	ON
High	$< \frac{1}{3}$ Vcc	Independent from the voltage level	High	OFF
High	> 4 Vcc	$> \frac{2}{3}$ Vcc	Low	ON
High	$> \frac{1}{3}$ Vcc	$< \frac{1}{3}$ Vcc	Holds the former state	

● Applications:

Monostable multivibrator, pulse width modulation circuit, a stable multivibrator, missing pulse detector, and pulse position modulation circuit.

A.1.13 74LS05 Inverter with Open-Collector Output (4B)

This IC has hex open-collector invertors.

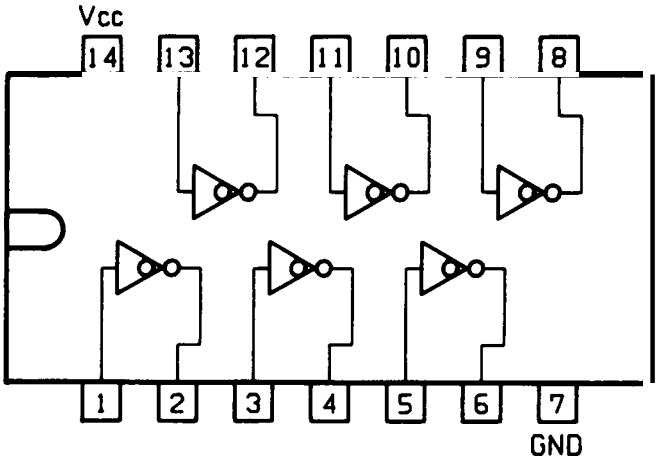


Fig. A-26. **74LS05** Pin Diagram

A.1.14 74LS07 Dutter with Open-Collector Output (6B)

This IC has hex open-collector buffers.

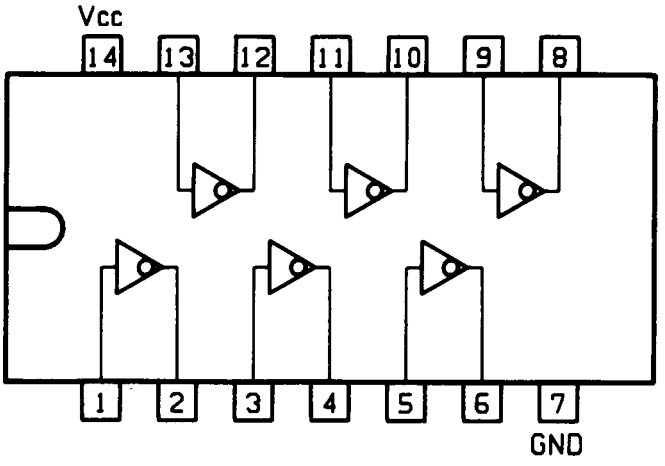


Fig. A-27. **74LS07** Pin Diagram

A.1.15 TL431CLPB Shunt Regulator (CY1..MONMA Board, Q5.Q20..MONPS/MONPSE Board)

The TL431 is a high accuracy temperature compensated shunt regulator. The output voltage can be changed between 2.5 to 36V by adding two external resistors. The TL431 has high stability and outputs a large current so that it can replace various zener diodes.

Features

- Temperature compensated reference voltage (50 PPM/C)
- Low zener current (400μA)
- High response speed
- Low dynamic output impedance
- Low noise

Output Voltage Vo Setting

- Setting range . . . Vref to 36V
- Vo = Vref X (1 + R1/R2)

'Vref: = 2.5V

R1 and R2: External resistors

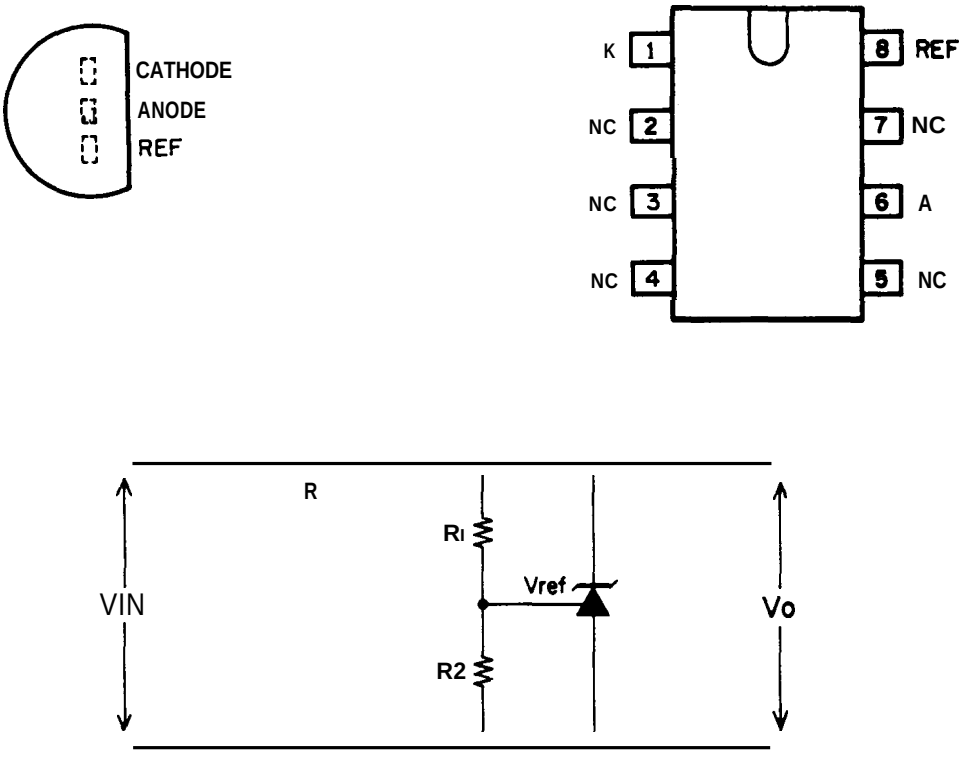


Fig. A-28. TL431CLPB Pin Diagram and Output Voltage Setting Circuit

A.1.16 STR20005 Chopper-Type Switching Regulator (IC20)

The STR20005 is a chopper type switching regulator IC which obtains a stable output voltage of +5V.

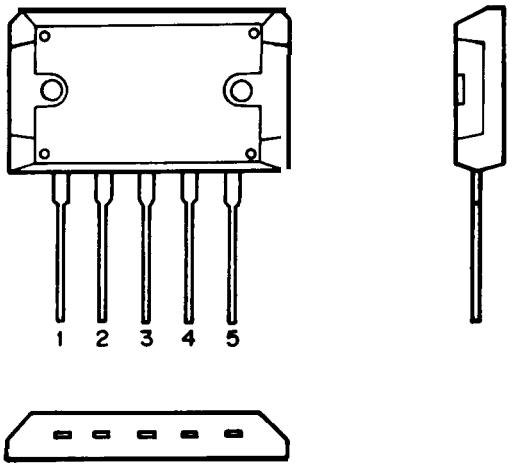


Fig. A-29. STR20005 Pin Diagram

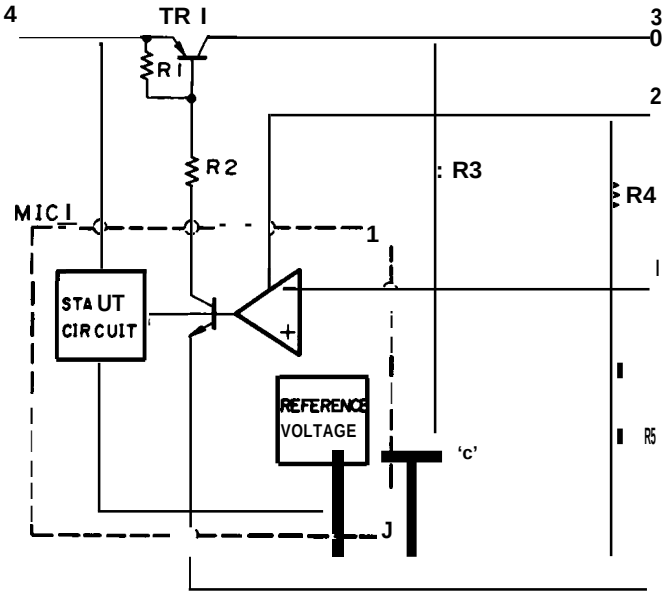


Fig. A-30. STR20005 Equivalent Circuit

Table A-1 1. STR20005 Specification

Maximum Rating (Ta=25°C)				Electric Characteristic		
VIN [V]	VOUT [A]	PD [W]	ToP ["C]	VOUT [V]	VIN [V]	Ripple Atteneter [dB]
45	2.0	75	–20 to 100	5.0 ± 0.1	11-40	45

A.2 CONNECTOR PIN ASSIGNMENTS

Thes section describes the connector pin assignments in the electric circuit boards.

A.2.1 MONMA Board

A.2.1.1 CN1

Use: To connect the printer to the host computer.

Number of Pins: 36

Table A-1 2. CN1 Pin Assignments

Signal Pin No.	Return Pin No.	Signal	Dir.	Description
1	19	$\overline{\text{STROBE}}$	I	$\overline{\text{STROBE}}$ pulse to read data in. Pulse with must be more than 0.5 μs at receving terminal.
2	20	DATA 1	I	These signals represent information of the 1'st to 8'th bits of parallel data, respectively. Each signal is at "HIGH" level when data is logical, "1" and "LOW" when logical "O".
3	21	DATA 2	I	
4	22	DATA 3	I	
5	23	DATA 4	I	
6	24	DATA 5	I	
7	25	DATA 6	I	
8	26	DATA 7	I	
9	27	DATA 8	I	
10	28	$\overline{\text{ACKNLG}}$	o	Approx. 11 μs pulse. "LOW" indicates that data has been received and that the printer is ready to accept other data.
11	29	BUSY	o	A "'HIGH" signal indicates that the printer can not receive data. The signal becomes "HIGH" in the following cases: 1. During data entry 2. During printing operation 3. In OFF-LINE state 4. During printer error state
12	30	PE	o	A "HIGH" signal indicates that the printer is out of paper.
13	—	SLCT	—	Pulled up to +5V through 3.3K ohms resister.
14	—	$\overline{\text{AUTO FEED XT}}$	I	With this signal at "LOW" level, the paper is automatically fed one line after printing. (The signal level can be fixed to "LOW" with DIP SW2-8.)
15	—	N.C.	—	Not used.
16	—	GND	—	Logic GND.
17	—	CHASSIS GND	—	Printer chassis GND. In the printer, the chassis GND and the logic GND are isolated from each other.
18	—	NC	—	Not connected
19 - 30	—	GND	—	TWISTED-PAIR RETURN signal GND level.
31	—	INIT	I	When the level of this signal becomes "LOW", the printer controller is reset to its initial state and the print buffer is cleared. This signal is normally at "HIGH" level, and its pulse width must be more than 50 μs at the receiving terminal.

Table A-12. CN1 Pin Assignments (Cont.)

Signal Pin No.	Return Pin No.	Signal	Dir.	Description
32	—	$\overline{\text{ERROR}}$	o	The level of this signal becomes "LOW" when the printer is in: 1. PAPER END state 2. OFF-LINE state 3. Error state
33	—	GND	—	Same as with Pin No. 19 to 30
34	—	NC	—	Not connected
35	–	—	—	Pulled up to +5V through 3.3K ohms resister.
36	—	$\overline{\text{SLCT IN}}$	I	The DC1/DC3 code is only valid when this signal is "HIGH" level.

NOTES: 1. "Direction" of the 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 complete connection on the return side. To prevent noise, cables should be shielded and connected to the chassis of the host computer and the printer, respectively.
3. All interface conditions are based on TTL level. Both the rise and fall times of each signal must be less than 0.2 μs.
4. Data transfer to this printer can be carried out only after confirming the $\overline{\text{ACKNLG}}$ signal or when the level of the BUSY signal is "LOW".

A.2.1.2 CN2

Use: To exchange data between the optional interface board and the MONMA board.

Number of pins: 26

Table A-1 3. CN2 Pin Assignments

Pin No.	Signal	Dir.	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	I NIT	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	– 12V	o	–12V DC
15	D2 (B2)	I	Data bit 2 (Bit rate select)
16	+5V	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	+ 12V	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	Tramsnit data
26	GND	—	Signal GND

NOTES: 1. "Direction" of the signal flow is as viewed from the MONMA board.

2. The parenthesized descriptions in the "signal" column are for the 8143 interface board.

A.2.1.3 CN3

Use: To connect the printer to the host computer which has the RS-232C interface.

Number of pins: 6

Table A-14. CN3 Pin Assignments

Pin No.	Signal	Dir.	Description
1	TXD	o	Transmit data for X-ON/X-OFF handshake.
2	DTR (REV)	o	Indicates whether data input is ready or not. When data input is inhibited, REW="MARK".
3	RXD	I	Receive data
4	NC	—	Not connected
5	SG	—	Signal GND
6	FG	—	Flame GND

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

A.2.1.4 CN4 (Contained only JAPAN)

Use: To exchange data between the EMKG board and the MONMA board.

Number of pins: 44

Table A-1 5. CN4 Pin Assignments

Pin No.	Signal	Dir.	Description
1	AI 2	0	Address bus 12
2	AD7	o	Address bus 7
3	AD6	o	Address bus 6
4	AD5	o	Address bus 5
5	AD4	O	Address bus 4
6	AD 10	0	Address bus 10
7	AD 1	0	Address bus 1
8	ADO	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 power
13	GND	—	GND
14	B3	o	Bank 3
15	NC	—	Not connected
16	BO	o	Bank O
17	B2	o	Bank 2
18	$\overline{TYEN}$	O	Pulled up (+5V DC)
19	$\overline{CG}$	o	CG select
20	DIP	o	DIP select
21	$\overline{RD}$	O	Read pulse
22	NC	—	Not connected
23	A13	o	Address bus 13
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

Table A-1 5. CN4 Pin Assignments (Cont.)

Pin No.	Signal	Dir.	Description
34	+ 5	o	+ 5V DC power
35	GND	—	GND
36	B4	o	Bank 4
37	NC	—	Not connected
38	B1	o	Bank 1
39	KANJI	o	
40	ALE		Address latch enable
41	CG3	o	CG3 select
42	PROG	o	$\overline{\text{PROG}}$ select
43	WR	o	Write pulse
44	$\overline{\text{RS}}$	o	Reset signal

A.2.1.5 CN5

Use: Interface with optional cartridge

Number of pins: 32

Table A-16. CN5 Pin Assignments

Pin No.	Signal	Dir.	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	$\overline{R}$	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	$\overline{RD}$	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	AI 4	0	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 power
25	AI 1	0	Address bus 11
26	$\overline{PROG}$	I	Program select
27	AI 2	0	Address bus 12
28	AI 3	0	Address bus 13
29	A1	o	Address bus 1
30	ABO	o	Bank O
31	A2	o	Address bus 2
32	A3	O	Address bus 3

A.2.1.6 CN6

Use: Interface with optional cartridge

Number of pins: 32

Table A-1 7. **CN6** Pin Assignments

Pin No.	Signal	Dir.	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	AlO	O I	Address bus 10
8	$\overline{R}$	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	$\overline{RD}$	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 power
25	A11	0	Address bus 11
26	$\overline{PROG}$	I	Program select
27	Al 2	0	Address bus 12
28	A13	o	Address bus 13
29	A I	o	Address bus 1
30	ABO	o	Bank O
31	A2	o	Address bus 2
32	A3	o	Address bus 3

A.2.1.7 CN7

Use: Control panel interface

Number of pins: 12

Table A-1 8. CN7 Pin Assignments

Pin No.	Signal	Dir.	Description
1	$\overline{SB0}$	o	Switches status select O
2	SB 1	0	Switches status select 1
3	AN2	I	Read switches status
4	AN3	I	Read switches status
5	BUZZER	o	Buzzer
6	$\overline{RYLED}$	o	READY LED $\overline{on}$/off
7	$\overline{PELED}$	o	PAPER OUT LED $\overline{on}$/off
8	$\overline{ON\ LED}$	o	ON LINE LED ~/off
9	$\overline{ONLSW}$	I	ON LINE switch ~/off
10	LOAD	o	Parallel data output trigger
11	PDATA	o	Serial data
12	CLOCK	o	clock
13	+5V	o	+5VDC Power
14	GND	—	GND

A.2. 1.8 CN8

Use: Detects carriage home position signal

Number of pins: 3

Table A-1 9. CN8 Pin Assignments

Pin No.	Signal	Dir.	Description
1	LED+	o	Sensor power (+5V DC)
2	GND	—	GND
3	HOME	I	Home position signal home/$\overline{not}$

A.2.1.9 CN9

Use: Detects paper end

Number of pins: 2

Table A-20. CN9 Pin Assignments

Pin No.	Signal	Dir.	Description
1	PESW	I	Paper end signal stay/$\overline{out}$
2	GND	–	GND

A.2.1.10 CN10

Use: Detect paper thickness lever position

Number of pins: 2

Table A-21. CN10 Pin Assignments

Pin No.	Signal	Dir.	Description
1	GAPSW	I	Head adjustment lever position ~/4-8
2	GND	—	GND

A.2.1.11 CN11

Use: Friction or tractor feed selected signal

Number of pins: 2

Table A-22. CN11 Pin Assignments

Pin No.	Signal	Dir.	Description
1	F/$\overline{T}$SW	I	Friction/$\overline{\text{Tractor}}$
2	GND	-	GND

A.2.1.12 CN12

Use: Plunger drive

Number of pins: 2

Table A-23. CN12 Pin Assignments

Pin No.	Signal	Dir.	Description
1	$\overline{\text{PLNGR1}}$	o	Drive signal
2	PLNGR2	o	Power (+35/+5V DC)

A.2.1 .13 CN13

Use: Paper feed motor drive

Number of pins: 6

Table A-24. CN13 Pin Assignments

Pin No.	Signal	Dir.	Description
1	PFA	o	Phase A drive pulse
2	PFB	o	Phase B drive pulse
3	PFC	o	Phase C drive pulse
4	PFD	o	Phase D drive pulse
5	COMAB	o	Common phases A and B
6	COMCD	o	Common phases C and D

A.2.1 .14 CN14

Use: Carriage motor drive

Number of pins: 6

Table A-25. CN14 Pin Assignments

Pin No.	Signal	Dir.	-- -Description
1	CRA	0	Phase A drive pulse
2	CRB	o	Phase B drive pulse
3	CRC	o	Phase C drive pulse
4	CRD	o	Phase D drive pulse
5	COMAB	o	Common phases A and B
6	COMCD	o	Common phases C and D

A. 2.1.15 CN15

Use: Printhead solenoids drive

Number of pins: 17

Table A-26. CN15 Pin Assignments

Pin No.	Name	Dir.	Description
1	HD4	o	Drive pin 4
4	$\overline{\text{HD 16}}$	0	Drive pin 16
5	HD8	o	Drive pin 8
6	$\overline{\text{HD12}}$	o	Drive pin 12
7	$\overline{\text{HD20}}$	o	Drive pin 20
8	$\overline{\text{HD24}}$	o	Drive pin 24
12	$\overline{\text{HD 17}}$	0	Drive pin 17
13	$\overline{\text{HD21}}$	o	Drive pin 21
14	HD9	o	Drive pin 9
15	$\overline{\text{HD 13}}$	0	Drive pin 13
16	HD 1	0	Drive pin 1
17	HD5	o	Drive pin 5
2	TEMP1	I	Printhead temperature detection
3	TEMP2	—	GND of TEMP1
9,10,11	COM	o	+35V DC power

A.2.1 .16 CN16

Use: Printhead solenoids drive

Number of pins: 15

Table A-27. **CN16** Pin Assignments

Pin No.	Name	Dir.	Function
1	HD6	o	Drive pin 6
2	$\overline{\text{HD14}}$	o	Drive pin 14
3	$\overline{\text{HD 10}}$	0	Drive pin 10
4	$\overline{\text{HD23}}$	o	Drive pin 23
5	$\overline{\text{HD18}}$	o	Drive pin 18
6	$\overline{\text{HD 15}}$	0	Drive pin 15
7	$\overline{\text{HD22}}$	o	Drive pin 22
11	HD7	o	Drive pin 7
12	$\overline{\text{HD 19}}$	0	Drive pin 19
13	$\overline{\text{HD2}}$	O	Drive pin 2
14	$\overline{\text{HD11}}$	0	Drive pin 11
15	$\overline{\text{HD3}}$	O	Drivepin3
8,9,101	COM	O	+35V DC power

A.2.1 .17 CN17

Use: +5V DC and ± 12V DC are supplied

Number of pins: 6

Table A-28. **CN17** Pin Assignments

Pin No.	Name	Dir.	Function
1, 2	G_L	—	Logic circuit GND
3, 4	+ 5	I	+ 5V DC power
5	+ 12	I	+ 12V DC power
6	– 12	I	– 12V DC power

A.2.1.18 CN18

Use: V_H (+35V DC) is supplied

Number of pins: 4

Table A-29. **CN18** Pin Assignments

Pin No.	Name	Dir.	Function
1,2	+35	I	+35V DC power
3,4	G_P	—	Power GND

A.2.1 .19 CN19

Use: Back up battery power is supplied

Number of pins: 2

Table A-30. CN19 Pin Assignments

Pin No.	Nama	Dir.	Function
1	BATT	I	Battery + side
Z	GND	—	GND

A.2.2 MONPS/MONPSE Board

A.2.2.1 CN1

Use: Send various powers to MONMA board.

Number of pins: 10

Table A-31. CN1 Pin Assignments

Pin No.	Name	Function
1, 2	+35V	+35V DC power source
5, 6	GL	Logic GND
7, 8	+ 5V	+ 5V DC power source
5, 6	GP	Power GND
9	+ 12V	+ 12V DC power source
10	– 12V	– 12V DC power source

A.2.2.2 CN2

Use: Send power to the fan unit.

Number of pins: 2

Table A-32. CN2 Pin Assignments

Pin No.	Name	Function
1	+35V	+35V DC power source
2	GP	Power GND

A.2.3 EXPLODED DIAGRAMS AND SCHEMATICS

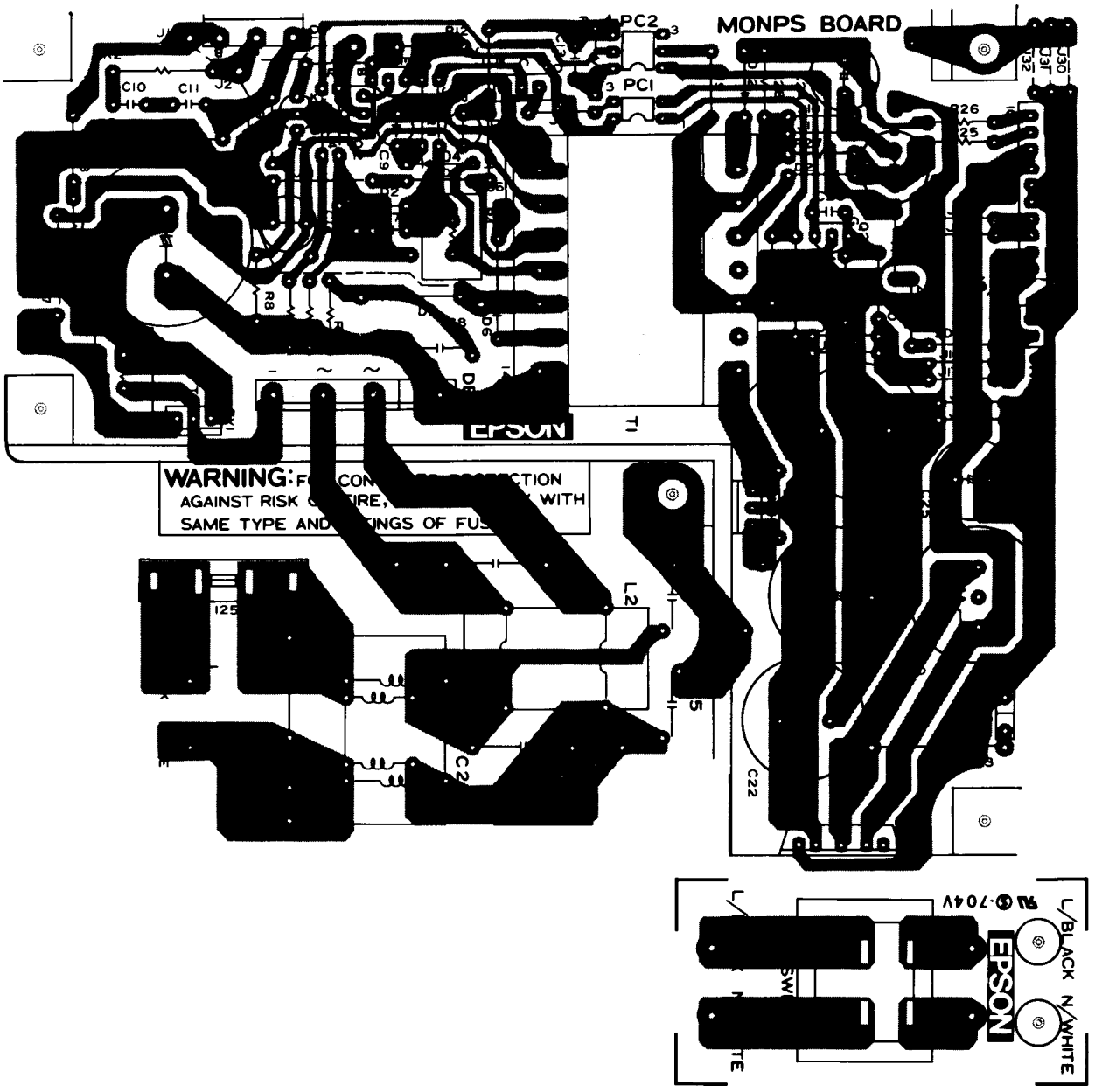


Fig. A-31. MONPS Board Component Layout

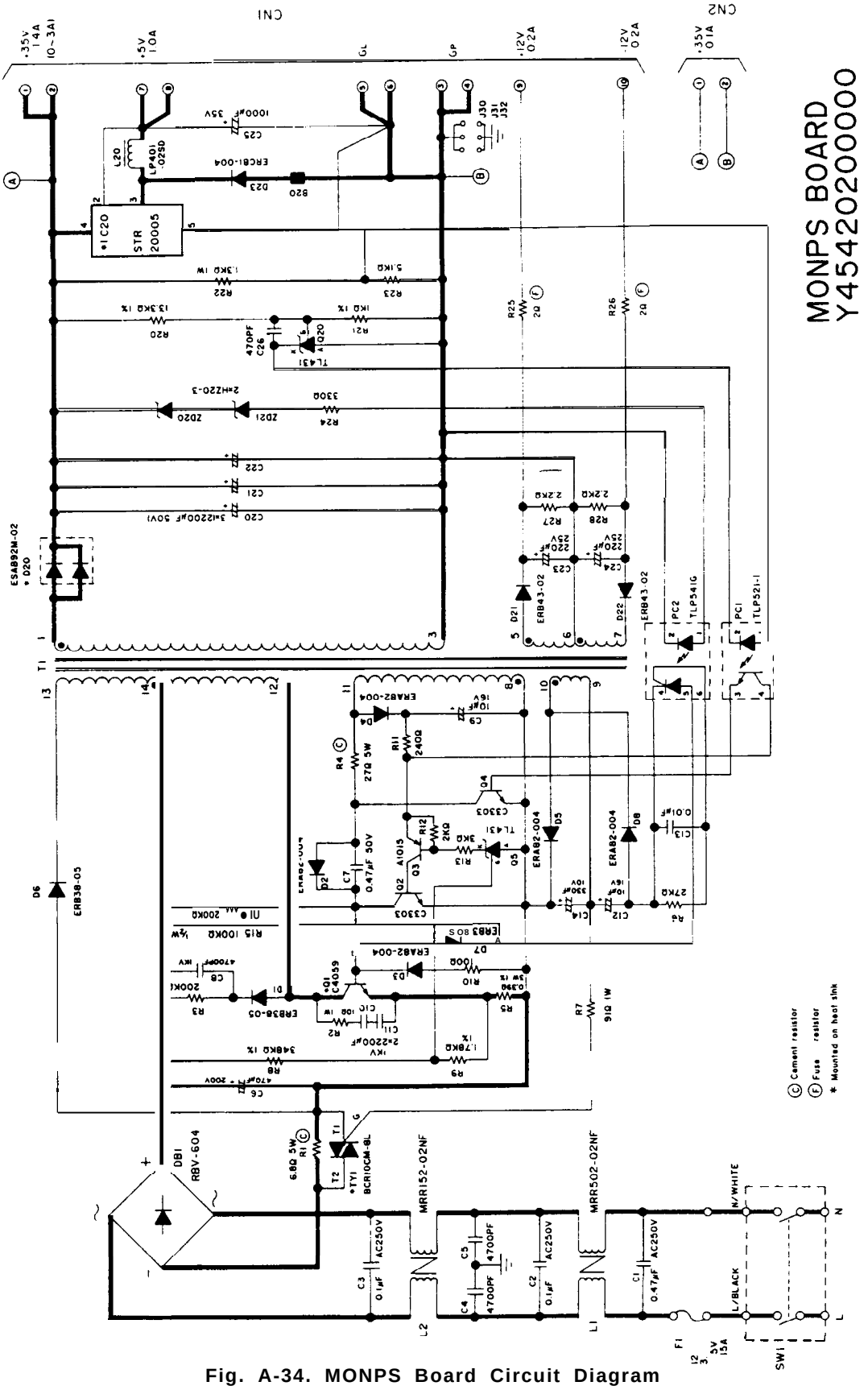


Fig. A-34. MONPS Board Circuit Diagram

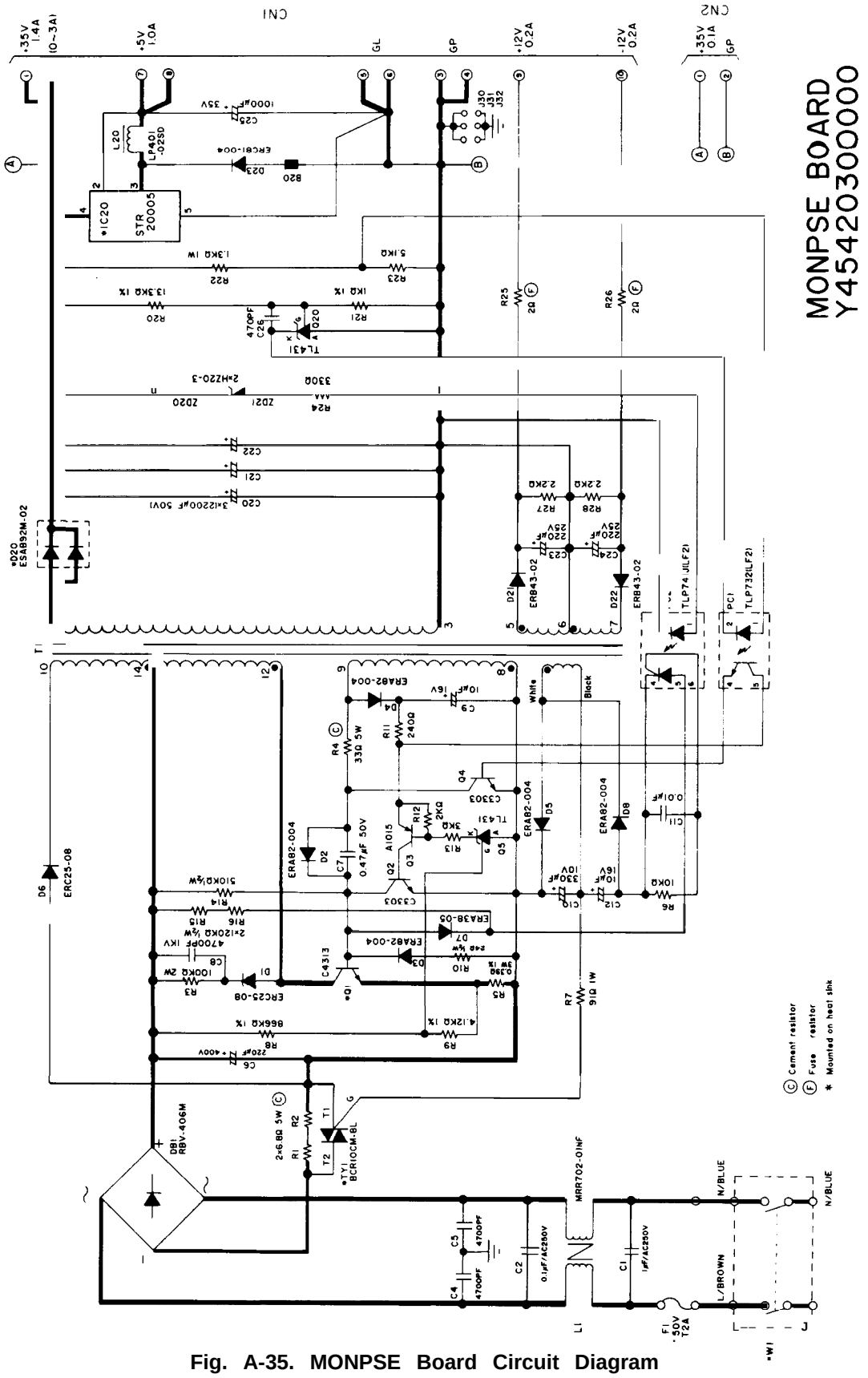


Fig. A-35. MONPSE Board Circuit Diagram

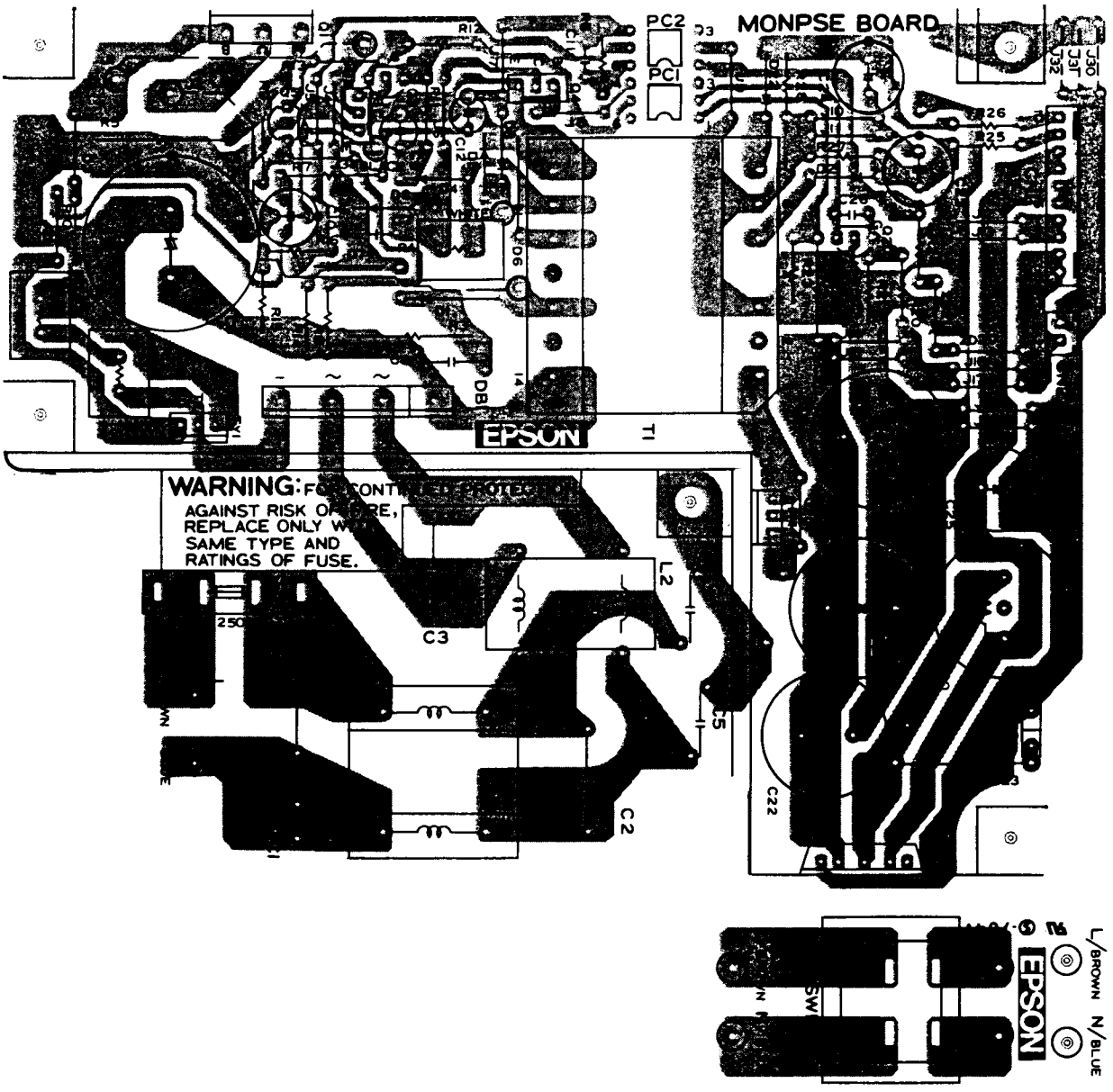


Fig. A-32. MONPSE Board Component Layout

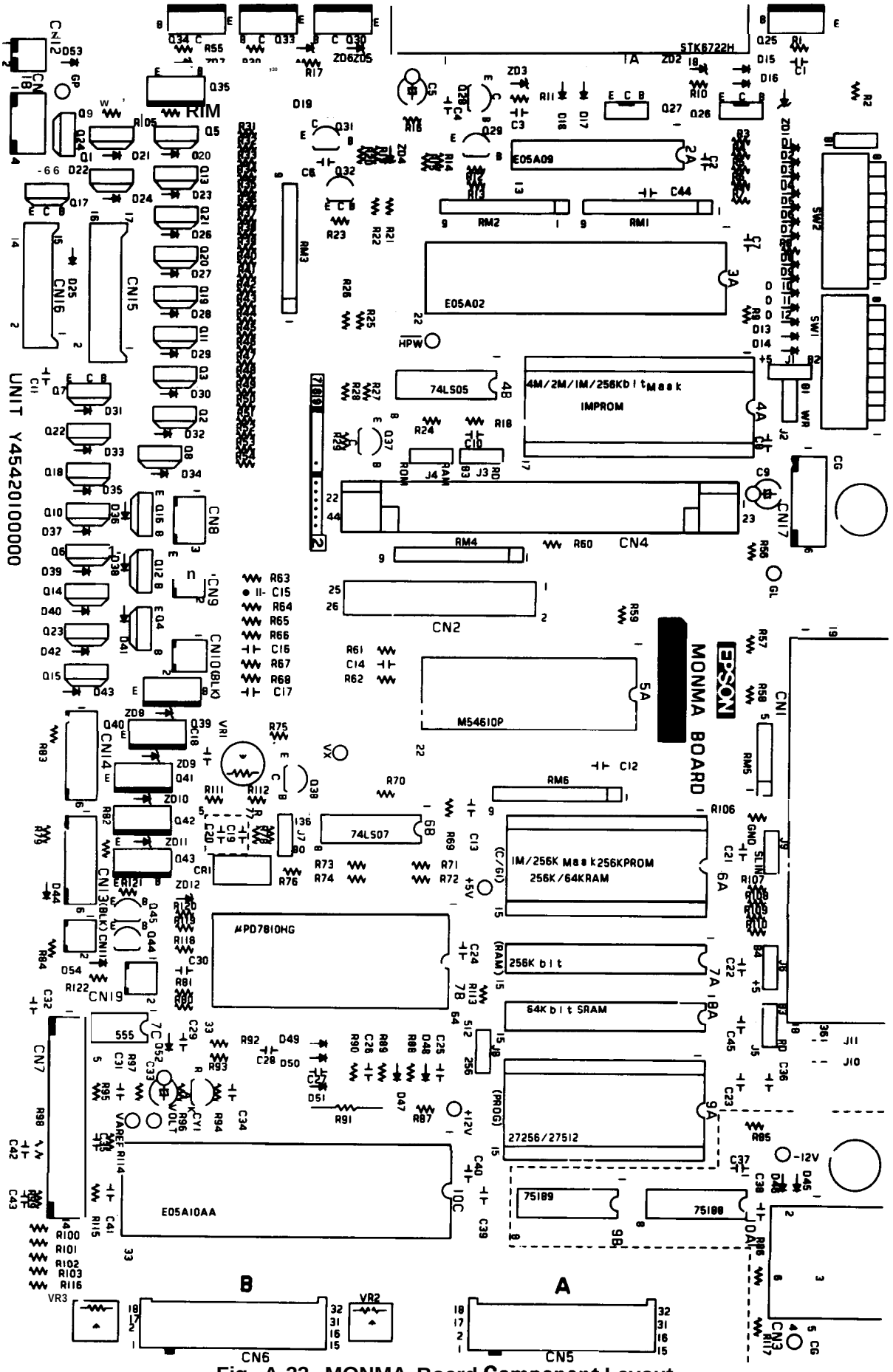


Fig. A-33. MONMA Board Component Layout

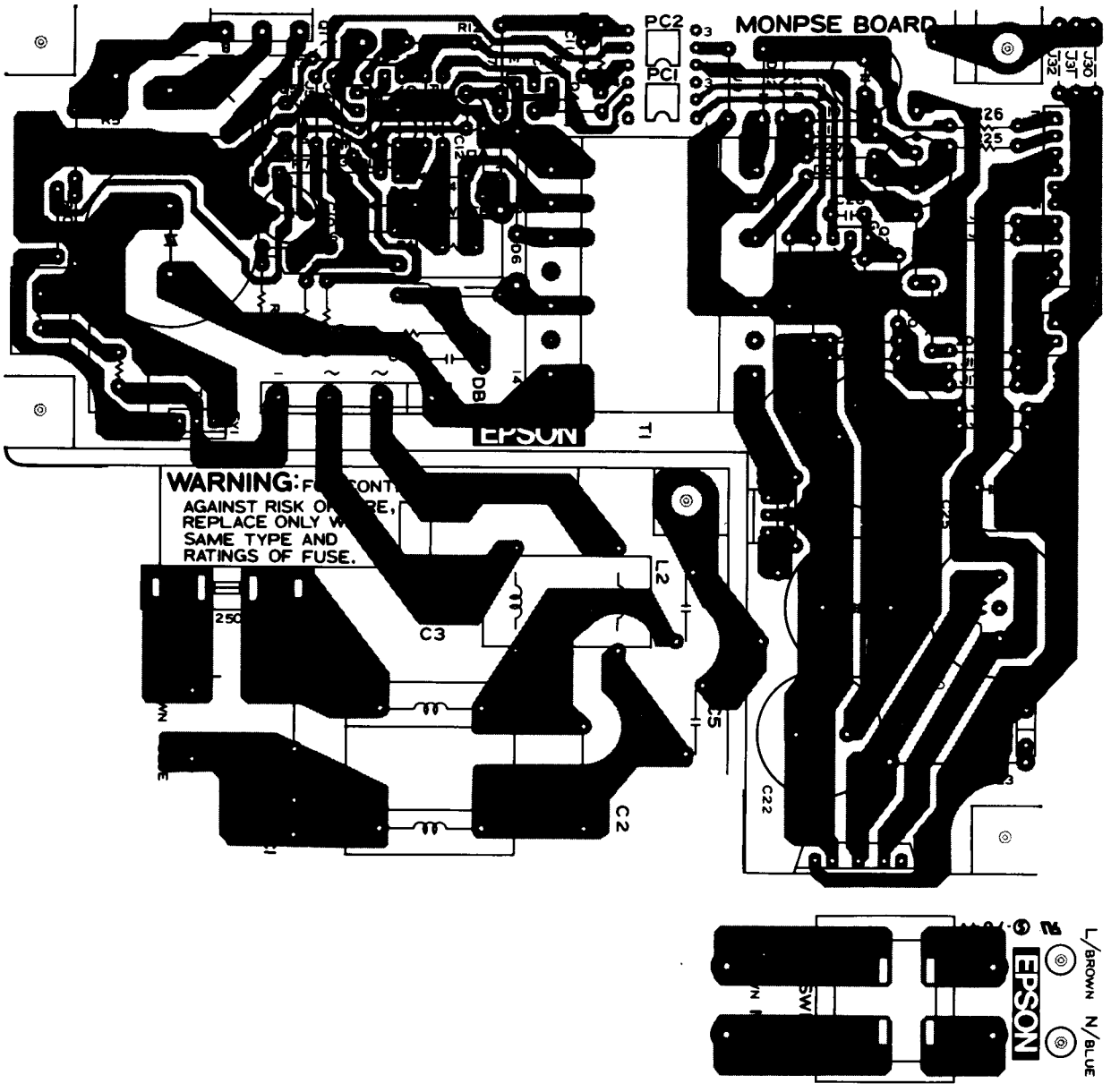
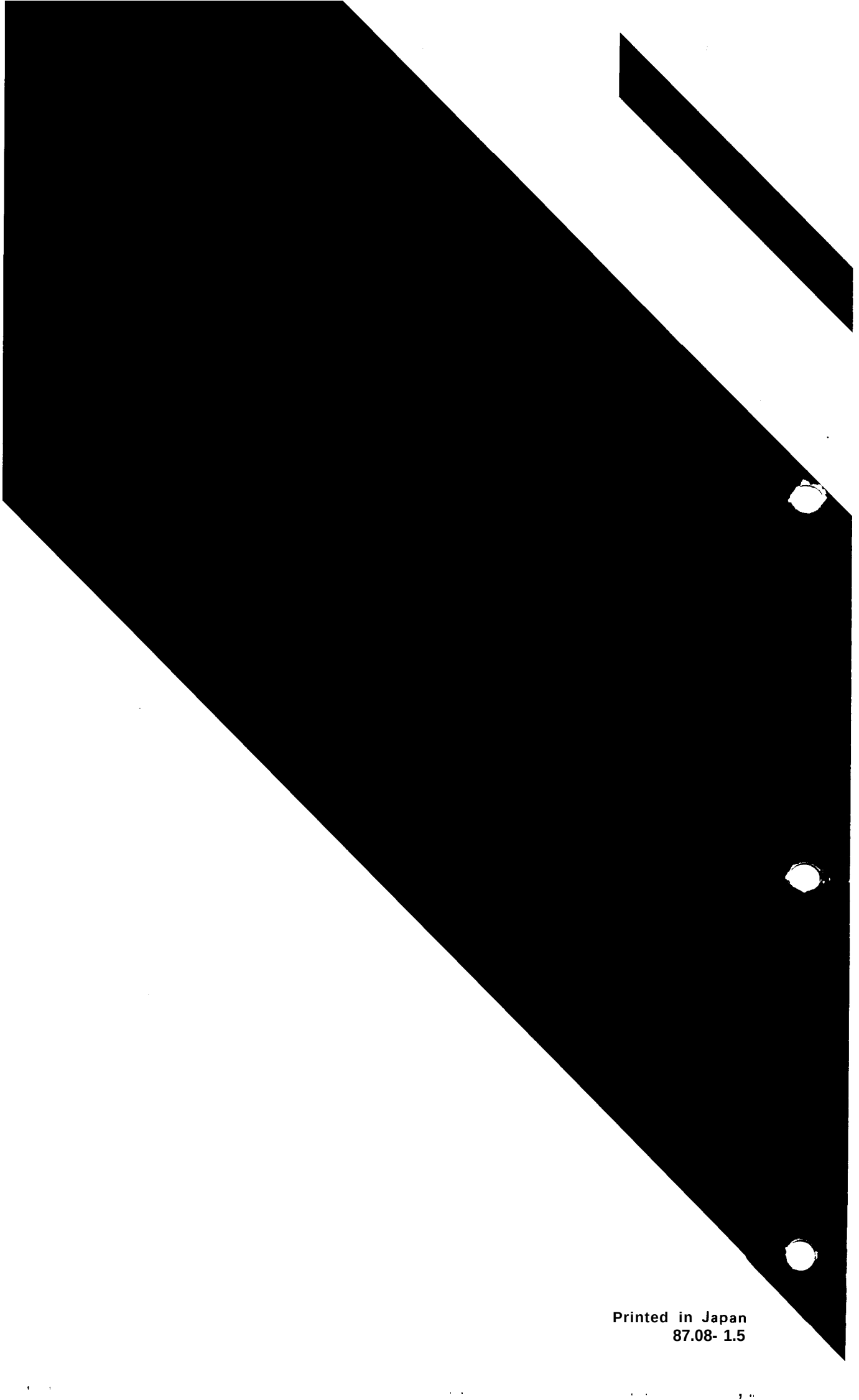


Fig. A-32. MONPSE Board Componant Layout



Printed in Japan
87.08- 1.5