EPSON

EPSON TERMINAL PRINTER

LQ-860/1060

TECHNICAL MANUAL

Y571999010-A

NOTICE

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-860/1060.
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	April 4, 1989	*1st* issue

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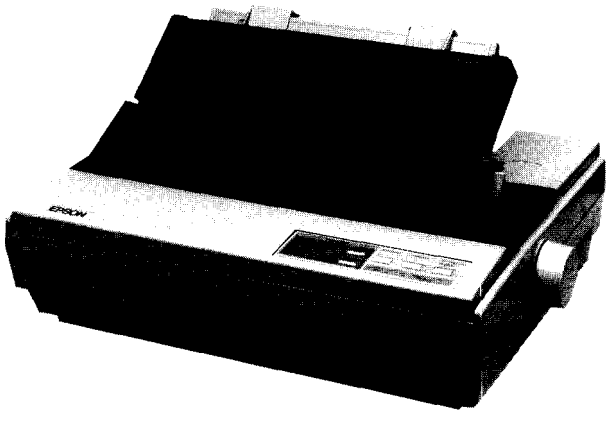
1.1 FEATURES

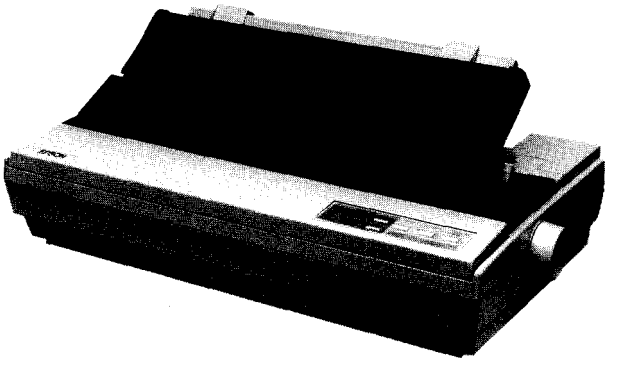
The LQ-860/1060 printers are multifunctional, 24-pin printhead, impact dotmatrix printers. The main features of the these printers are:

- Upward compatibility with the LQ-850/1050
- A maximum print speed of 290 CPS in super draft mode at 10 CPI, of 270 CPS in draft mode at 12 CPI, and of 90 CPS in LQ mode at 12 CPI
- Direct selection of font and pitch in SelecType feature from the control panel
- Both 8-bit parallel and RS-232C serial interfaces
- Color printing capability
- Push and (optional) pull tractor feeding
- Advanced paper handling:
  - Automatic paper-loading/ejecting function
  - Tear-off function
  - Printing of fanfold paper without removal of the cut sheet feeder (option)
- Low-noise acoustics
- Optional interface for the EPSON 8100 series
- Optional low-priced, single-bin and double-bin cut sheet feeders 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-860/1060.



LQ-860



LQ-1060

Figure 1-1. LQ-860/1060 Exterior Views

Table 1-1. Optional Units

No.	Name	LQ-860	LQ-106O
C800071	Pull tractor unit	o	–
C800101	Pull tractor unit		o
C806141	Cut sheet feeder (single-bin)	O	—
C806181	Cut sheet feeder (single-bin)		o
C806151	Cut sheet feeder (double-bin)	o	–
C8O6191	Cut sheet feeder (clouble-bin)	—	o
#7762	Ribbon cartridge (black)	o	
#7763	Ribbon cartridge (color)	o	
#7764	Ribbon cartridge (film)	o	
#7407	Multi font module	o	

Table 1-2. Optional Interface Boards

No.	Name
#8143	New serial interface
#8145	RS-232C current loop interface type II
#8148	Intelligent serial interface
#8149	Intelligent serial interface type II
#8149M	Intelligent serial interface type III
#8161	IEEE-488 interface
#8165	Intelligent IEEE-488 interface
#8172	32K-byte buffer parallel interface
#8172M	128K-buffer parallel interface

1.2 SPECIFICATIONS

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 'I-2 (12x2 staggered, diameter: 0.2 mm).**

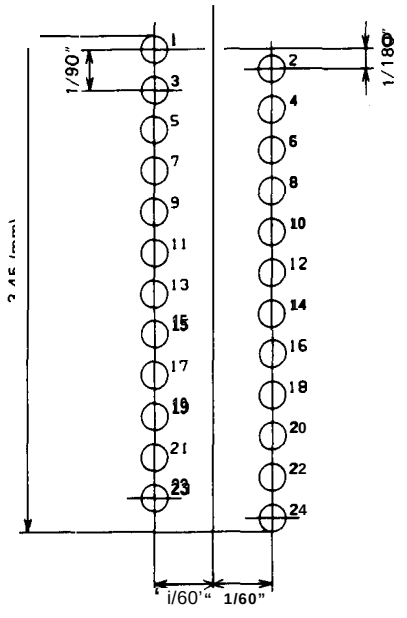


Figure 1-2. Printhead Pin Configuration

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

NOTES : 1. When using friction feed :

Adjust the paper release lever at rear position.

Use the paper tension unit.

Do not use continuous paper.

Do not use a single sheet paper shorter than 182 mm or longer than 257 mm (LQ-860), 364 mm (LQ-106O).

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 " after the paper end has been detected.

Do not use multi-part single sheet forms.

2. When using tractor feed:

. 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:

. Adjust the paper release lever at center position.

· Use the paper tension unit.

- Do not perform reverse feeding for more than 1/6 “.
- 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 :

- Adjust the paper release lever at front position.
- 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 :

Adjust the paper release lever at front position.

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	Inserted from the rear side
Line Spacing	1/6” or programmable (min. 1/360”)
Line Feed Speed	See Table 1-3.

Table 1-3. Line Feed Speeds

Feeding Method	1 /6” line spacing [ins/line]	Continuous [IPS]
Friction without CSF	56.4	3.1
Friction with CSF	67.3	
Tractor	64.1	

Paper specifications

Cut sheet paper — Refer to Table 1-4.

Table 1-4. Cut Sheet Paper Specified Conditions

	LQ-860	LQ-106O
Width [mm]	182-257 (7.2 -10.1 “)	182-364 (7.2- 14.3”)
Length [mm]	182-364 (7.2-14.3”)	
Thickness [mm]	0.065-0.10 (0.0025-0.004”)	
Weight [lb]	14-22 (52-82 g/m^2)	
Quality	Plain paper	
Copies	Not available	

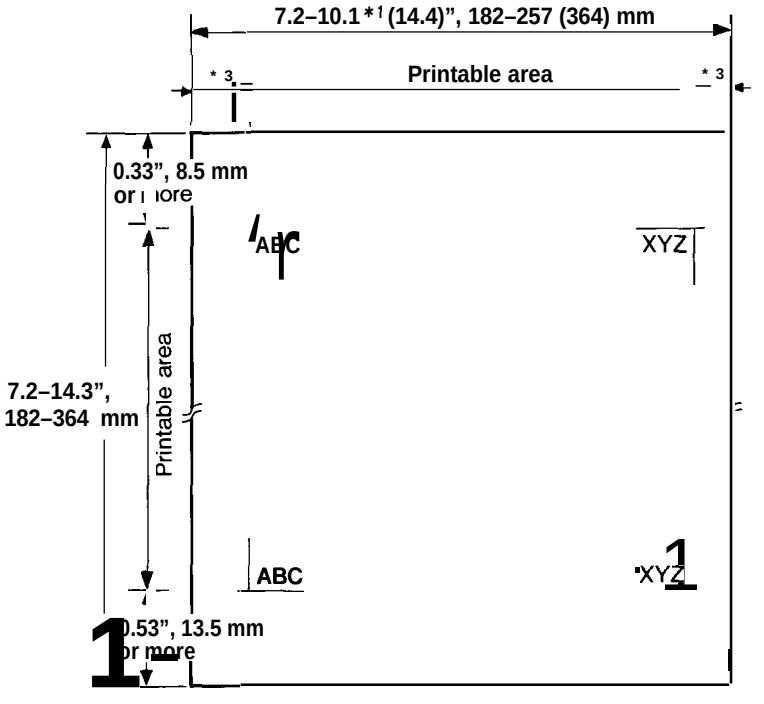
Continuous paper Refer to Table 1-5.

Table 1-5. Continuous Paper Specified Conditions

	LQ-860	LQ-I 060
Width [mm]	101-254 (4.0-10.0")	101-408 (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]	0.085-0.32 (0.0025-0.01 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.

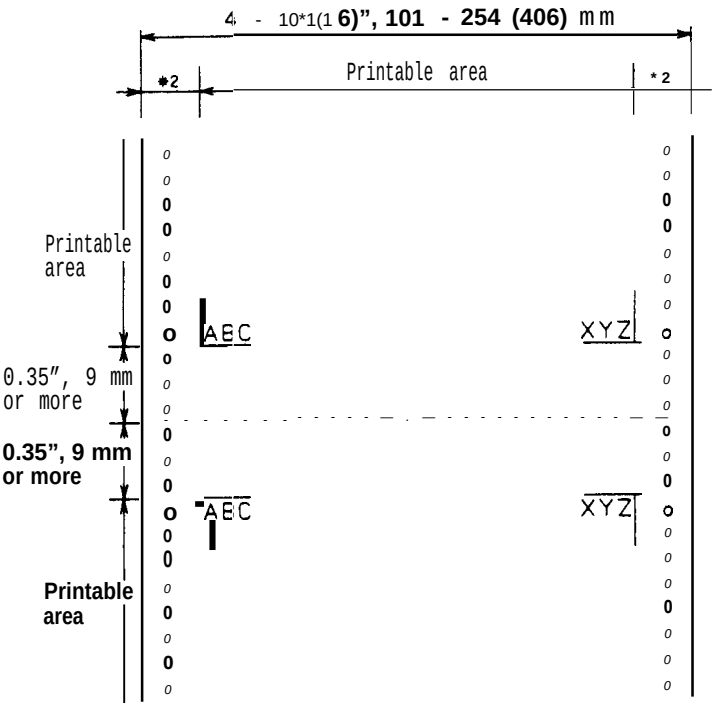


NOTES :

1. Values in the parentheses apply to the LQ-106O.
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.
3. 0.12", 3.0 mm or more when the 12", 305 mm or less width paper is used. 0.58", 15 mm or more when the 13" width paper is used.

Figure 1-3. Cut Sheet Paper Printable Area

Fanfold (continuous) paper **See Figure 1-4.**



NOTES : 1. Values in the parentheses are apply to LQ-106O.

2. 0.47", 12 mm or more when the 101 to 242 mm, 4 to 9.5" (101 to 378 mm, 4 to 14.9") width paper is used. 0.98", 25 mm or more when the 254 mm, 10", (381 to 406 mm, 15 to 16") width paper is used.

Figure 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 (0.0063-0.0197")**

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

Weight	**12-24 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	**2½ X 15/16", 4 X 15/16", 4 X 17/16"**
Thickness	**0.19 mm (0.0075") max.**

NOTES: Thickness excluding the base paper must be less than or equal to 0.12 mm (0.0075").

NOTES : 1. Printing of labes 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 (0.0118") to be printed out under conditions that must be between 5 to 35-C and 10 to 80% RH.
4. Examples of lavels: AVERY CONTINUOUS FORM LABELS
AVERY MINI-LINE LABELS

Lever Adjustment See Figure 1-5 and l-able 1-6.

Table 1-6. Lever Adjustment

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

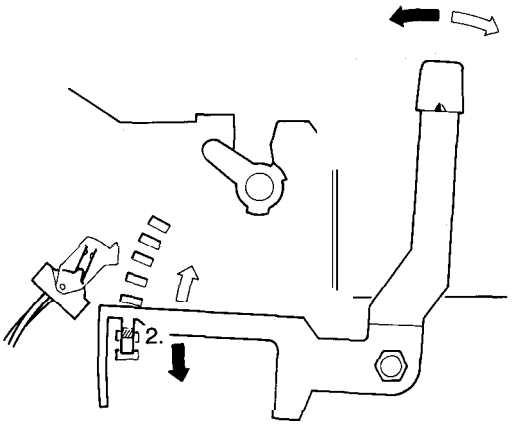


Figure 1-5. Head Adjustment Lever Positioning

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.	#7762	#7764	#7763
Type	Normal	Film	Multi-color
Color	Black		Black, Cyan, Magenta, and Yellow
Life [characters] (48 dot character)	3 million	0.1 million	Black : 1 million Cyan : 0.7 million Magenta : 0.7 million Yellow : 0.5 million

Dimensions See Table 1-8 (Details are shown in Figures A-36 and A-39.)

Weight See Table 1-8.

Table 1-8. Dimensions and Weinght

	Width [mm]	Height [mm]	Depth [mm]	Weight [Kg]
LQ-860	469	194	399	10
LQ-106O	609	194	399	13

NOTE : Excluding paper feed knob and sheet guide.

Electrical Specifications See Table 1-9.

Table 1-9. Electrical Specifications

	100-120 V Version	220-240 V Version
Voltage [V AC]	108-132	198-264
Frequency Range [Hz]	49.5 -60.5	
Rating Current [A]	2	1
Insulation Resistance [M ohm] min. (bitween 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 [℃]	−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-860 :	4000 POH (duty 25 %)
LQ-106O :	6000 POH (duty 25 %)
	(POH . . . . Power On Hours)
Printhead life	200 milion strokes/wire

Safety Approvals

Safety standards	UL478 (U.S.A. version)
	CSA22.2#154
	VDEO806 (TUV) (European version)
Radio Frequency (RFI)	FCC class B (U.S.A. version)
Interference	VDEO871 (self-certification)
	(Europe version)

1.2.2 Firmware Specifications

Control Code	ESC/P-84C	
Printing Direction	Bidirectional with logic seeking	
Input Data Buffer	6 K-byte or none (DIP SW 1-8 selectable)	
Character Code	8 bits	
Character Set	96 ASCII, 14 international, and 1 Legal charactersets	
Family	Roman:	No. O
	Sansserif :	No. 1
Font	Roman:	10, 12, 15, Proportional
	Sansserif :	10, 12, 15, Proportional
	Draft:	10, 12, 15
Printing Mode	Printing quality (Draft/LQ)	
	Character pitch (10, 12, 15 CPI or Proportional)	
	Condensed	
	Double-width	
	Double-height	
	Emphasized	
	Double-strike	
	Italic	
	Underlined	
	Double-underlined	
	Overscore	
	Strike-through	
	Shadow/Outline	

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

Print Speed	Refer to I-able 1-11.
Print Columns	Refer to I-able 1-11.

Table 1-11. Printing Mode

Print Pitch	Condensed	Emphasized	Double Width	Character Pitch [CPI]	Printing Speed [CPS]		Printable Columns	
					Draft	LQ	LQ-860	LQ-1060
10	0	0	0	10	225"'	75	80	136
			1	5	113	38	40	68
		1	0	10	113	75	80	136
			1	5	56	38	40	68
	1	x	o	17.1	193	129	137	233
			1	8.5	96	64	69	117
12	0	0	0	12	270	90	96	164
			1	6	135	45	48	82
		1	0	12	135	90	96	164
			1	6	68	45	48	82
	1	x	o	20	225	150	160	272
			1	10	113	75	80	136
15	0	0	0	15	338	113	120	204
			1	15	169	56	60	102
		1	0	7,5	169	113	120	204
			1	7.5	84	56	60	102
	1	x	x	Ignored				
Proportional	o	x	o	8.6		64	Max. 69	Max. 117
				20	—	150	Min. 160	Min. 272
			1	4.3		32	Max. 34	Max. 59
				10	—	75	Min. 80	Min. 136
	1	x	o	17.1	—	129	Max. 137	Max. 233
				40	—	300	Min. 320	Min. 544
			1	8.6	—	64	Max. 69	Max. 117
				20		150	Min. 160	Min. 272
'proportional Super/ Subscript	o	x	o	12.8	—	96	Max. 103	Max. 175
				30		225	Min. 240	Min. 408
			1	6.4	—	48	Max. 51	Max. 87
				15	—	113	Min. 120	Min. 204
	1	x	o	25.7	–	193	Max. 206	Max. 349
				60	—	450	Min. 480	Min. 816
			1	12.8	—	96	Max. 103	Max. 175
				30	—	225	Min. 240	Min. 408

*1 : 290 CPS at super draft printing (DIP SVV 1-6 is off).

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.

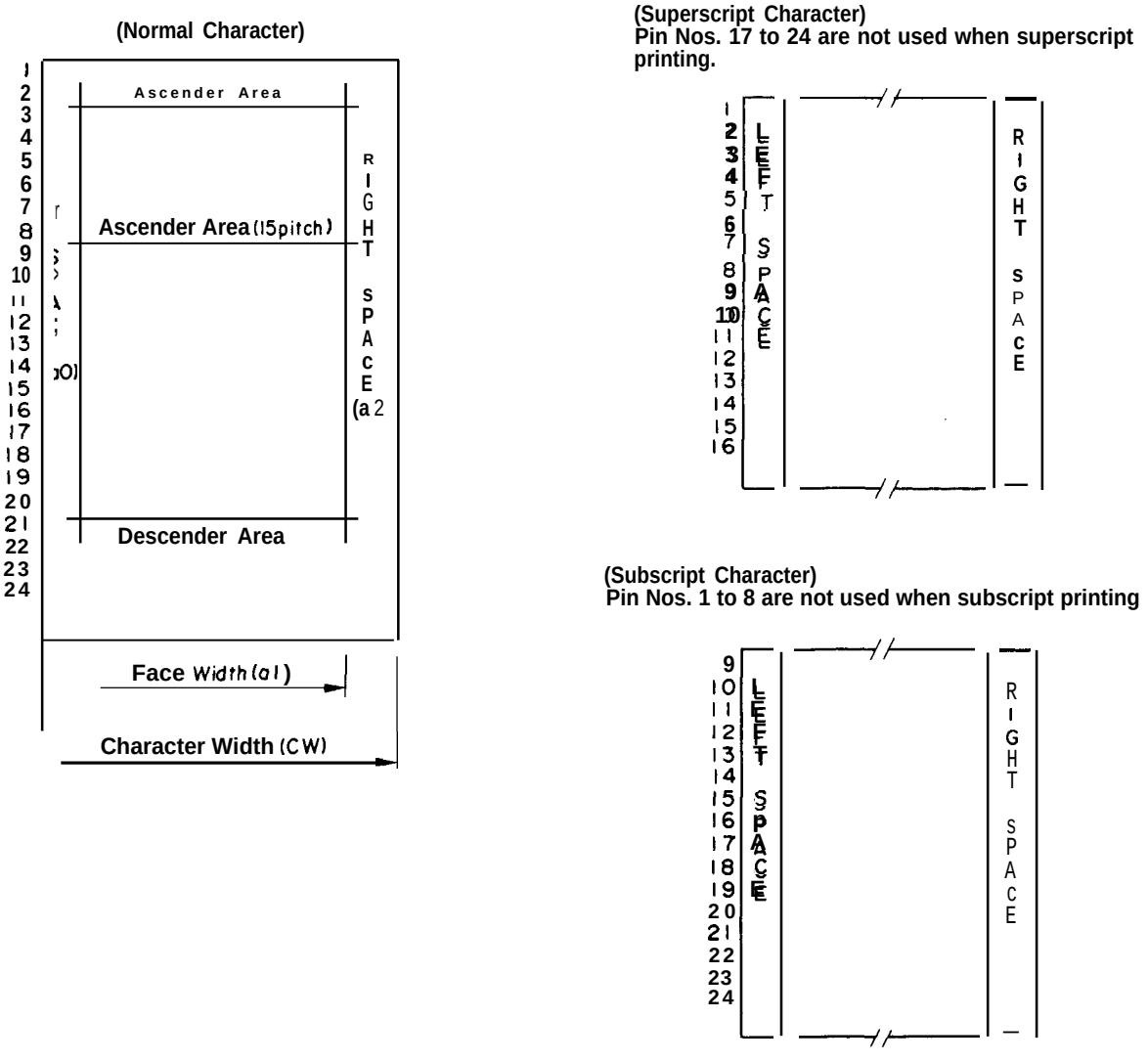


Figure 1-6. Character Matrix

Character Size **See Table I-12.**

Table 1-12. Character Matrix and Character Size

Printing Mode	Face Matrix	HDD	Character Size H. XV. (mm)	Unit ESC sp
DRAFT, 10 pitch	9×23	120	1.9x 3.2	120
DRAFT, 12 pitch	9 X 23	120	1.9x 3.2	120
DRAFT, 15 pitch	9x 16	120	1.0 X 2.3	120
DRAFT, 10 pitch, condensed	···	240	···	120
DRAFT, 12 pitch, condensed	···	240	···	120
LQ, 10 pitch	29X 23	360	2.0x 3.2	180
LQ. 12 pitch	29X 23	360	2.0 x3.2	180
LQ, 15 pitch	15X 16	360	1.0X 2.3	180
LQ, 10 pitch, condensed	···	360	···	180
LQ, 12 pitch, condensed	···	360	···	180
-Q, proportional	max. 37X 23	360	2.6X 3.2	180
	min. 18X 23	360	1.0x 3.2	
-Q, proportional, condensed	···	360	···	180
	···	360	···	
-Q, proportional, super/subscropt	max. 28X 16	360	1.8x 2.3	160
	min. 12x 16	360	0.7X 2.3	
-Q, proportional, super/subscript, condensed	···	360	···	180
	···	360	···	

NOTES : 1. "HDD" means the Horizontal dot density, and the "Unit" shows the number of dots per inch.

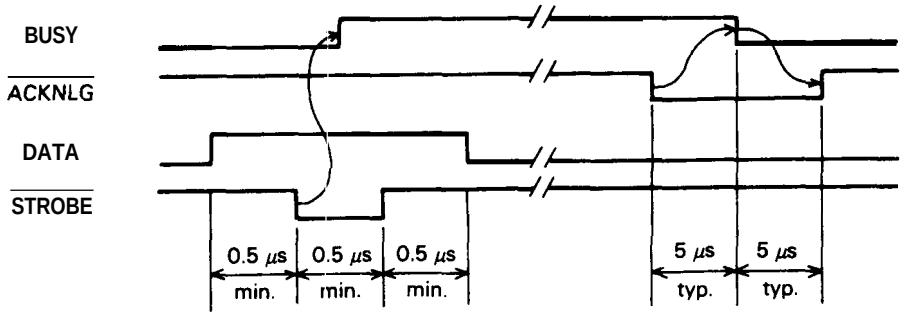
2. "Face matrix" and "character size" indicate the size of maximum characters and this value will be changed condition of paper, ribbon, and etc.
3. "Unit ESC sp" indicates the minimum length which is added to the right of the character that can be specified with ESC sp control code.
4. "···" indicated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

1.3 INTERFACE OVERVIEW

The LQ-860/1060 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 1-20.)

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.
Adaptable Connector	57-30360 (AMPHENOL) or equivalent (See Figure 1-8.)
Connector Pin Assignment	Refer to Table 1-13.
Select/Deselect (DC1/DC3) Control	Refer to Table 1-14.



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

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

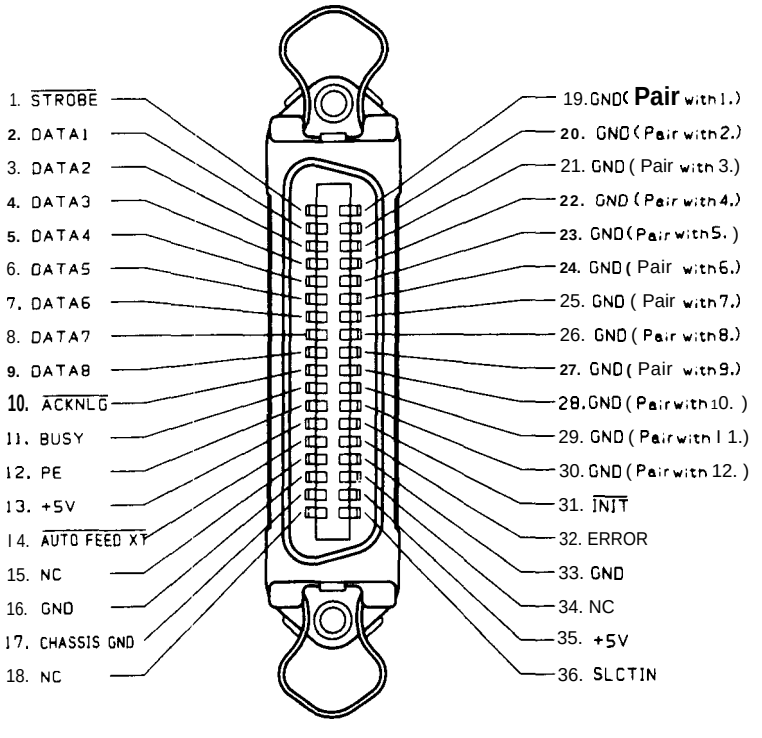


Figure 1-8. 36-Pin Printer Side Connector

Table 1-13. 8-bit Parallel I/F Connector Pin Assignments

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

NOTES : 1. "Direction" of signal flow is as viewed from the printer.
2. "Return" denotes "TWISTED PAIR RETURN" and is to be connected at signal ground level.

As to the wiring for the interface, be sure to use a twisted-pair cable for each signal and never fail to connect the return side. To prevent noise, cables should be shielded and connected to the chassis of the host computer and the printer.

Table 1-14. Select/Deselect Control

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

NOTES : 1. In Table 1-14, it is assumed that no $\overline{\text{ERROR}}$ status exists other than that attributable to the OFF-LINE mode.

2. Once the printer is deselected by the DC3 code, the printer will not revert to the selected state until the DC1 code is input. (In the deselected state, input data is ignored until DC1 is received.)
3. The DC1 and DC3 codes are enabled only when the $\overline{\text{SLCT-IN}}$ signal (Input Connecter Pin No. 36 when the parallel interface unit is used) is HIGH and the printer is initialized.
4. The $\overline{\text{SLCT-IN}}$ signal is “LOW” when the printer is initialized. At this time the DC1/DC3 printer select/deselect control is invalidated, and these control codes are ignored.

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 1-15 and Figure 1-9.)

Table 1-15. Serial Interface Handshaking

DTR Signal	X-ON/OFF protocol	Description
MARK	X-OFF (DC3/13H)	When the number of bytes remaining in the input buffer reaches 256 or less, the signal level goes to MARK, or and X-OFF code is sent to the host computer. This indicates that the printer is not ready to receive data.
SPACE	X-ON (DC1/11 H)	When the number of bytes remaining in the input buffer reaches 528 or more, the signal level goes to SPACE, or an X-ON code is sent to the host computer. This indicates that the priter is ready to receive data.

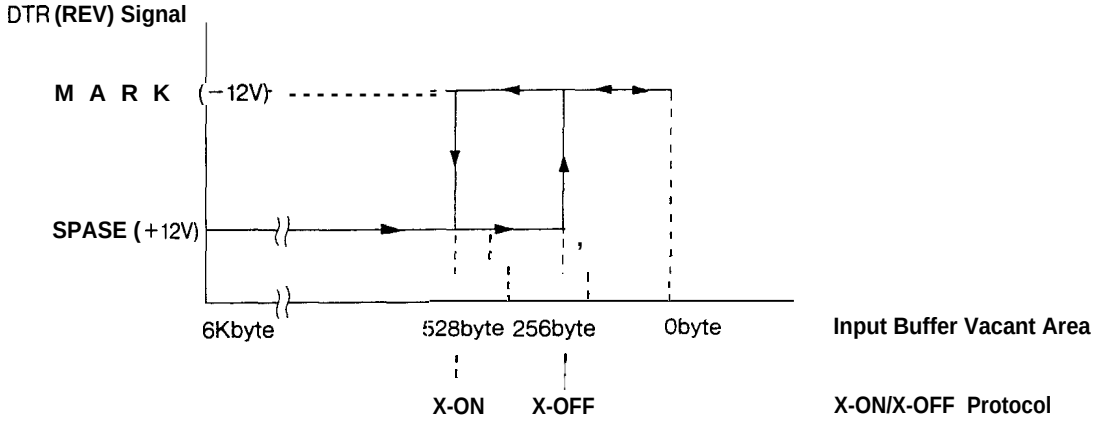


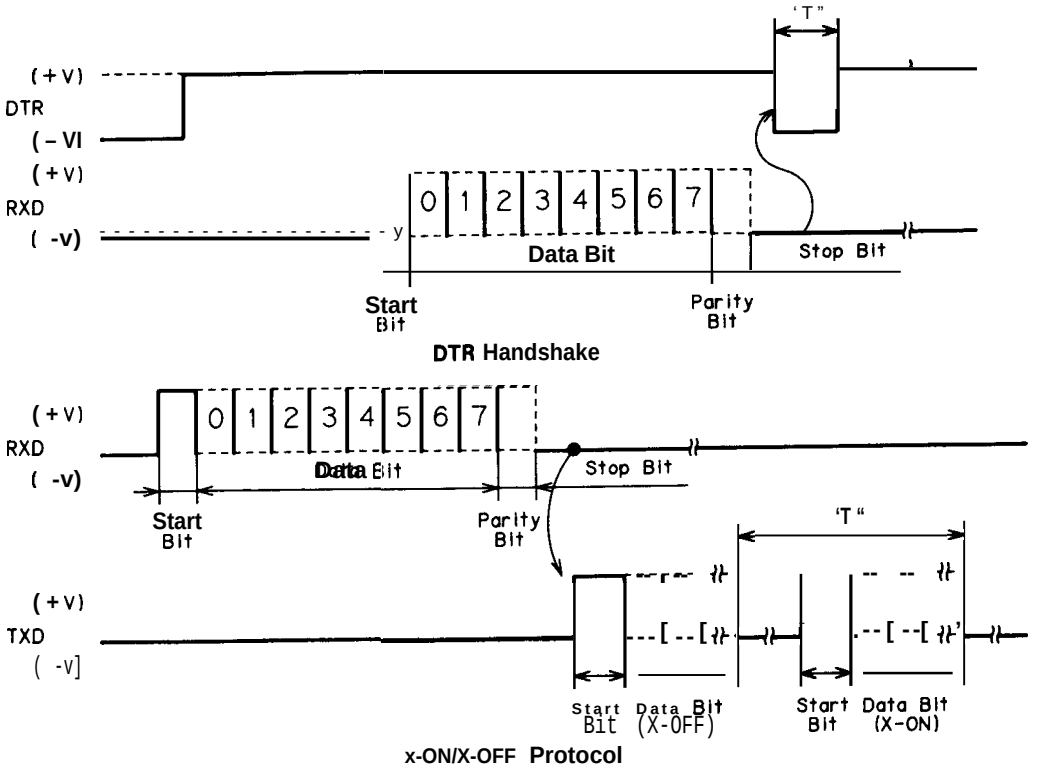
Figure 1-9. RS-232C Interface Handshaking

Word Length

Start bit:	1
Data bits:	8
Parity:	Odd, Even, or none
Stop bits:	1 bit or more

Bit Rate	300, 1200, 9600, or 19200 BPS
Logic Level	EIA level, IMARK: logical 1 (–3- –27 V) SPACE : logical O (+3 ~ +27 V)

Data Transmission Timing **See Figure 1-10.**



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

Figure 1-10. Serial Data Transmission Timing

Error Detection

Parity error : "x" is printed.
Overrun error: Ignored
Framing error: Ignored

Connector D-SUB 25-pin connector (See Figure 1-11.)

Connector Pin Assignments Refer to Table 1-16.

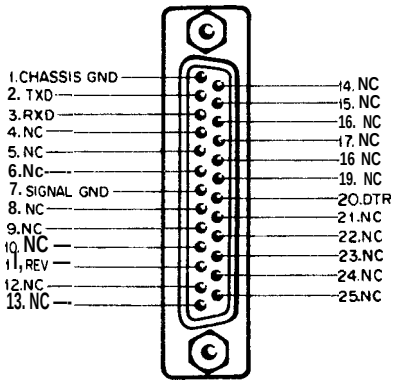


Figure 1-11. Serial Interface Connector

Table 1-16. RS-232C Serial I/F Connector Pin Assignments

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

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

1.4 DIP SWITCH AND JUMPER SETTINGS

This section describes DIP switch settings and jumper settings on the JUNMM board.

1.4.1 DIP Switch Settings

The DIP switches that users can set are SW1 and SW2. These switches are positioned at the left side of the control panel, and have the functions as shown in Tables 1-17 through 1-21, (note that the status of the DIP switches are read only when the printer power on or an INIT signal is input.)

Table "I-17. DIP Switch 1 Settings

DIP SW.	Function	ON	OFF	Factory Setting
1-1 1-2 1-3	International chacter set	See Table 1-18.		ON ON ON
1-4	Code table select	Graphic	Italic	OFF
1-5 1-6 1-7 1-8	Graphic print direction"' Super draft CSF mode Input buffer	Uni-d. off Valid None	Bi-d. On Invalid 6K-byte	OFF OFF OFF OFF

* 1 : "Graphic print" means follows

a) Bit image printing

b) Multi pass printing

- 30 dots graphics . Orator/Orator-S font
- Double height character . Double-strike
- Double overscore/underline . Violet, Orange, Green color printing

Table 1-18. 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
Demarkl	OFF	ON	ON
Sweden	OFF	ON	OFF
Italy	OFF	OFF	ON
Spain1	OFF	OFF	OFF

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

Table 1-19. DIP Switch 2 Settings

DIP SW.	Function	ON	OFF	Factory Setting
2-1	Page length	12"	11"	OFF
2-2	1" skip-over perforation	Valid	Invalid	OFF
2-3	Interface selection	See Table 1-20.		OFF
2-4				OFF
2-5	Baud rate selecton	See Table 1-21.		OFF
2-6				OFF
2-7	Auto fear-off mode	Valid	Invalid	OFF
2-8	Auto LF	Valid	Invalid	OFF

Table 1-20. Interface Selection

2-3	2-4	Function
OFF	OFF	8-bit Parallel
ON	OFF	Serial, Even parity
OFF	ON	Serial, Odd parity
ON	ON	Serial, None parity

Table 1-21. Baud Rate Selection

2-5	2-6	Function
OFF	OFF	19,200
ON	OFF	9,600
OFF	ON	1,200
ON	ON	300

1.4.2 Jumper Settings

Table 1-22 shows the jumper settings.

Table 1-22. Jumper Settings

No.	Type				Location
JI	27256 256	27512 512			6A
J2 J3	4M/2M-BIT MASK-ROM B4 RD	1M-BIT + 5 A16	512K/256K-BIT ROM + 5 RD		3A (CG1)
J4 J5 J6	4M/2M-BIT MASK-ROM B4 RD B1	1M-BIT' + 5 A16 B1	512K/256K-BIT ROM + 5 RD B2	256K-BIT RAM + 5 RD WR	4A (CG2)
J7	SLCT-IN inable SLIN		SLCT-IN disable GND		
J8 J9	LQ-860 Close Open		LQ-106O Open Open		

NOTE : Bold indicates the factory settings.

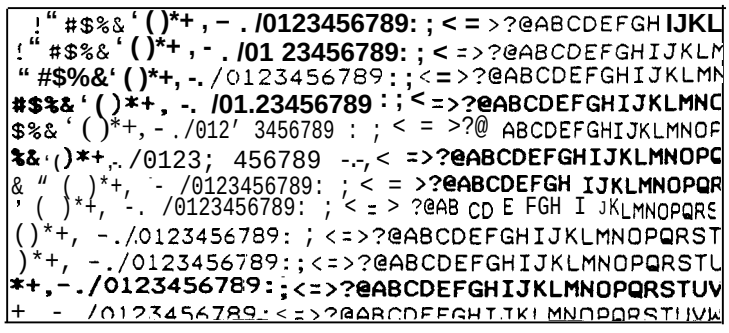
1.5 SELF-TEST OPERATION

The LQ-860/1060 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 1-23 lists the self-test operating instructions and Figure 1-12 shows the self-test printing.

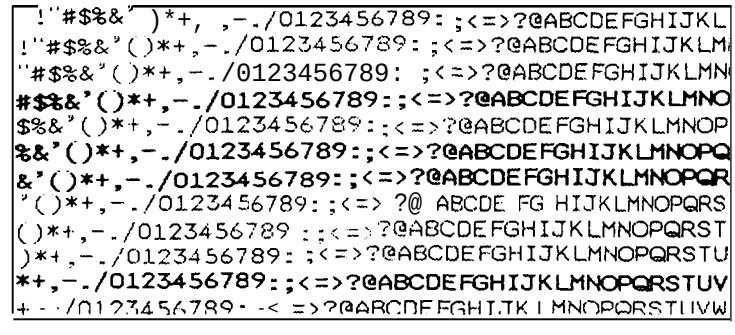
Table 1-23. Self-Test Operation

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

Draft mode



High-speed draft mode



LQ mode

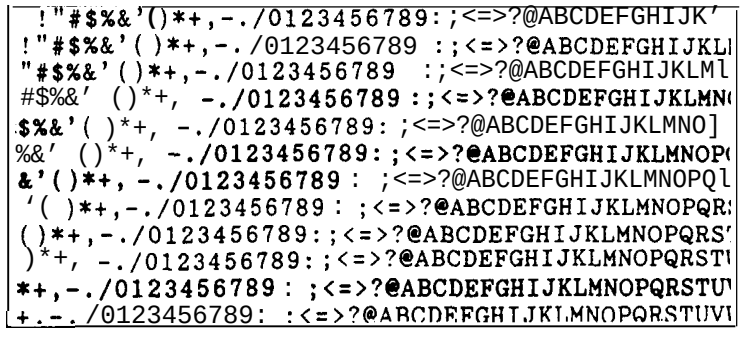


Figure I-12. Self-Test Printing

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 1-24 shows the hexadecimal dump operation and Figure 1-13 shows printout of the operation.

Figure 1-13. Hexadecimal Dump List

Table 1-24. Hexadecimal Dump Operation

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

Data Dump Mode

31	2E	31	20	46	45	41	54	55	52	45	53	OD	0A	00	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	60	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
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of the these pri
nters are: . . . . .
Upward compatib
i 1 i ty with the L
Q-800/1000. . . A
maximum print sp
eed of 264 CPS i
n draft mode at

Figure 1-13. 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 print 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 print buffer
. Sets printer selections to their default values.

1.7.3 Default Values

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"
Vertical Tab Position	Cleared
Horizontal Tab Position	Every 8 characters (relative)
VFU Channel	Channel O
Family Number of Type Style	Last selected font by the control panel
Downloaded Characters	Deselected: Software initialization Cleared: Hardware initialization
Justification	Left justification
Character Per Inch	Last selected pitch by the control panel
Bit Image Mode Assignment	ESC K = ESC * 0, ESC L = ESC * 1, ESC Y = ESC * 2, ESC Z = ESC * 3
Color	Black

1.8 BUZZER OPERATION AND ERROR CONDITIONS

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

1.8.1 Buzzer Opeartion

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 occured

  . Carriage mechanism trouble

  · Color select mechanism trouble

  . C.G. ROM error

  Sounds 5 times (rings for 0.5 sesonds with 0.5 seconds interval.)

  . Paper end

  Sounds 3 times (rings for 0.1 seconds with 0.1 second interval.)

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

  (Refer to Section 1.9.4 for firther 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.

· Carriage and color home positions are 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.

· A paper-out signal is detected and formes-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 Table 1-14.

1.9 MAIN COMPONENTS

The LQ-860/1060 printer includes the following major subassemblies:

- Model-5810/5860 printer machanism
- JUNMM board (main board)
- MONPS/MONPSE board (power supply board, 120V and 220/240V versions)
- Control panel (JUNPNL-W board)

Figure 1-14 shows the LQ-860/1060 component locations.

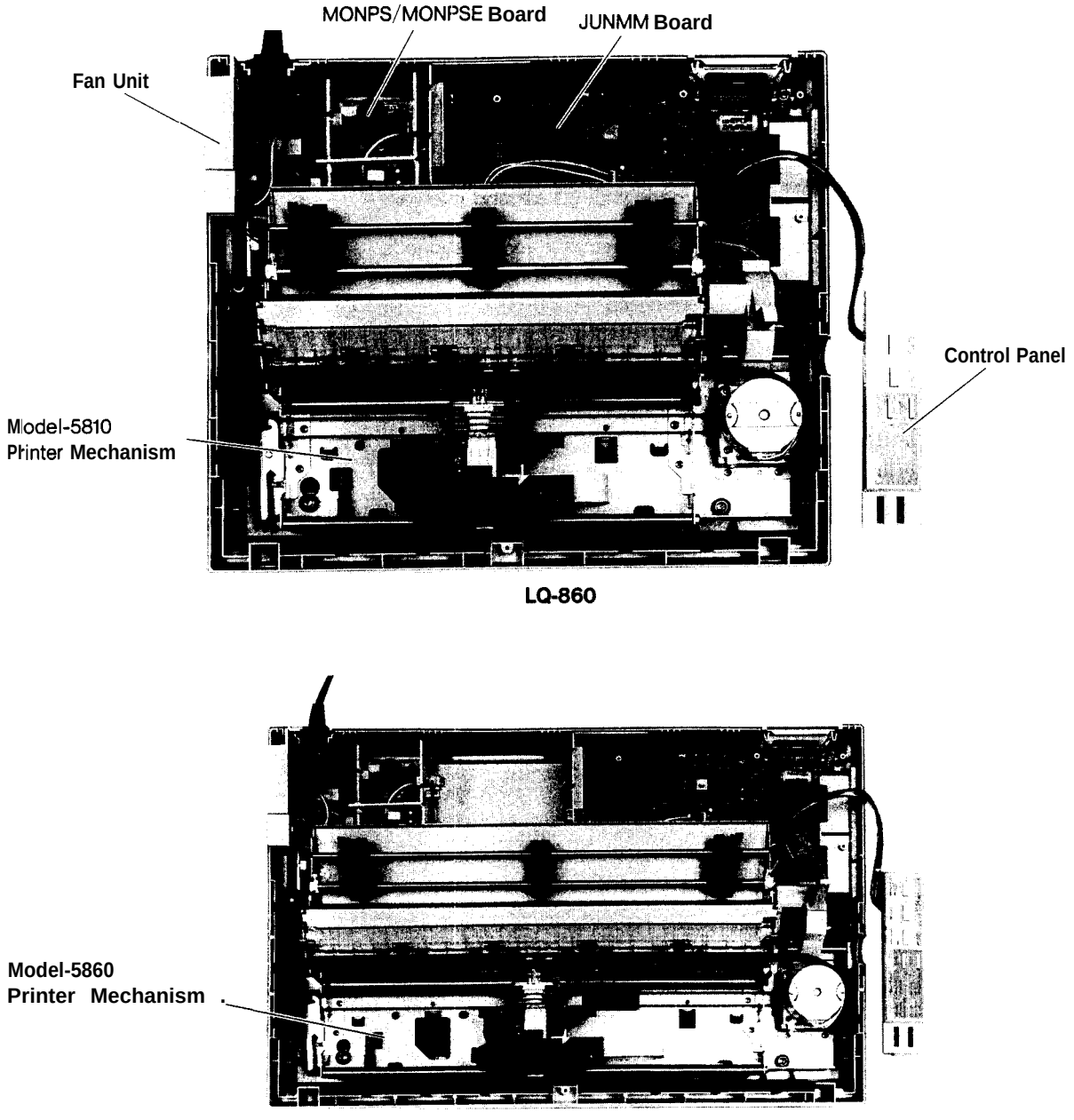


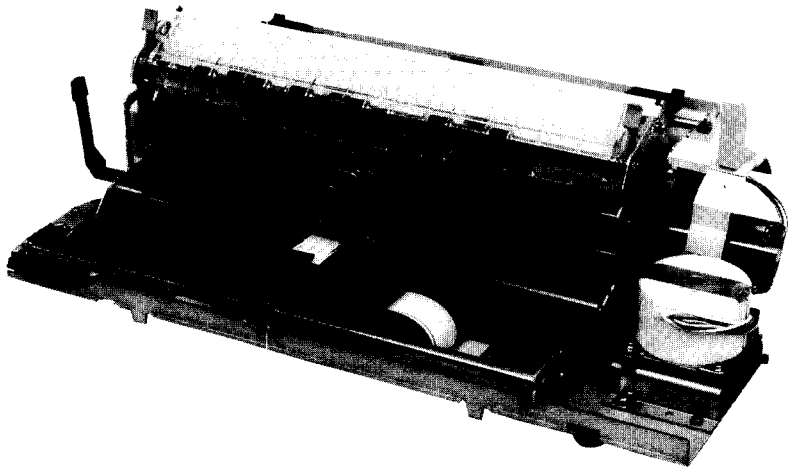
Figure 1-14. LQ-860/1060 Component Locations

1.9.1 Printer Mechanism

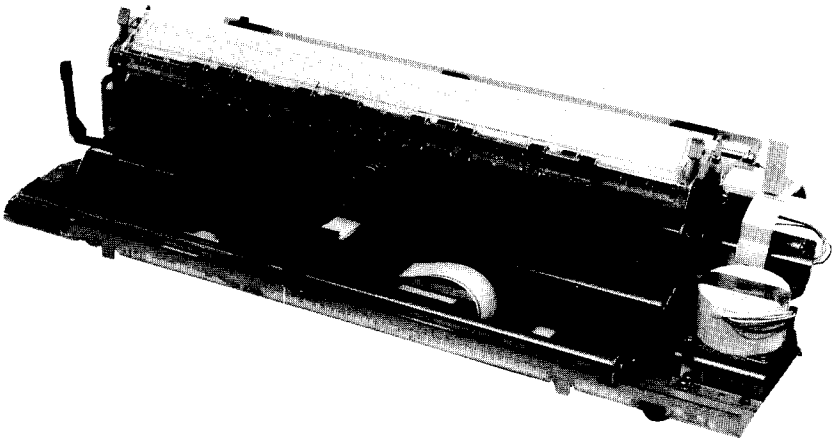
This section describes features and paper feed operations of the printer mechanism.

1.9.1.1 Printer Mechanism Features

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



Model-5810



Model-5860

Figure 1-15. Model-5810/5860 Printer Mechanism

1.9.1.2 Paper Feed Operations

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, adjust the paper release lever at friction feed position, place the page along the sheet 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.

Continuous Paper Loading and Ejection (Back Out)

To load continuous paper, adjust the paper release lever at tractor feed position, 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 continuous paper has been loaded, the printer ejects the paper backward to the push tractor. To back out several pages, press the LOAD/EJECT switch several times, since reverce feed is performed on a page-by-page basis.

The MULTI-PART LED blinks 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 continuously for as long as the switch is held down, and pressing the LINE FEED switch moves the paper in reverse.

Moving the paper with these switches is called "Top-Of-Form adjust". 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.

Tear-Off Function

The paper is advanced to the tear-off position by pressing the TEAR OFF switch or auto tear-off function (depend on DIP SW 2-7 setting) when the tractor feed is selected. Auto tear-off function is enabled and the paper release lever is at the tractor position, the paper will be fed to the tear-off position automatically if the input data buffer is empty and the printer is ON-LINE. At this time, MULTI-PART LED will blink to indicate that the FORM FEED and LINE FEED switches can be used for forward and backword micro feed adjustment. Using the micro feed, adjust the paper to meet the tear-off edge. Once the tear-off position is set, the setting remains valid even after the printer is turned off, reset or initialized. If subsequent data is input to the printer, the paper will be released to the original position automatically and printing will start. If the ON LINE switch is pressed (printer becomes OFF LINE) while the paper is advanced to the tear-off position, then the paper will be released to the original position.

Tear-off function is also valid in the cut sheet feeder mode when the tractor feed is selected.

1.9.2 JUNMM Board (Main Board)

Figure 1-16 shows the JUNMM board, which contains a 8-bit one chip CPU μPD78213 (4B) 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 JUNMM board are:

Gate Array IC

" E05A10AA (8B) ..... Memory management unit (MMU) IC
·E05A24GA (5A) .....8-bit parallel I/F, port expansion IC
·E05A02LA (2A) ..... "..Printhead data control IC

Memory IC

· EP-ROM (6A).....Used for program, 256K-bit
· MASK-ROM (3A) .....Used for character generator, 1M-bit
·PS-RAM (5A) 256K-bit
· ST-RAM*' (7A).....64K-bit

*1 : The data is held by the lithium battery while power is turned off.

Universal IC

·SI7300A (1A) ..... Carriage motor driver IC

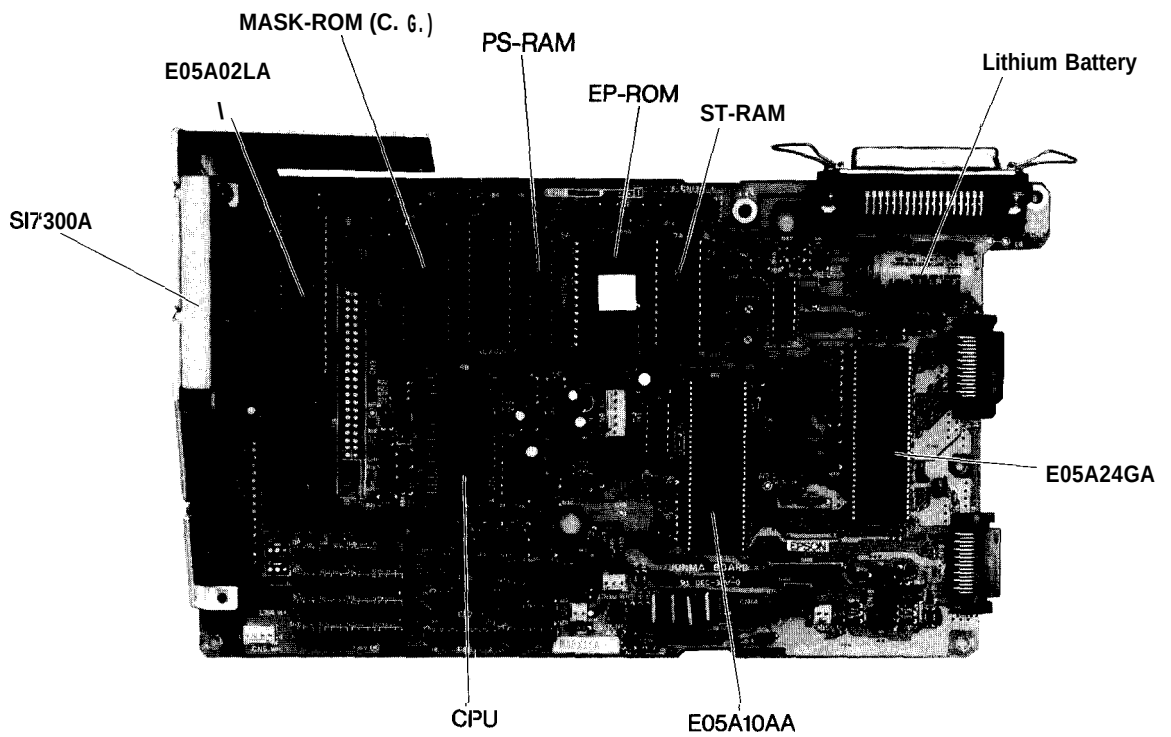


Figure 1-16. JUNMM Board

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 board is the same: each board contains a power switch, fuses, line filter circuit, and switching regulator circuit. Compactness of the circuitly is made possible by use of a DC-to-DC converter.

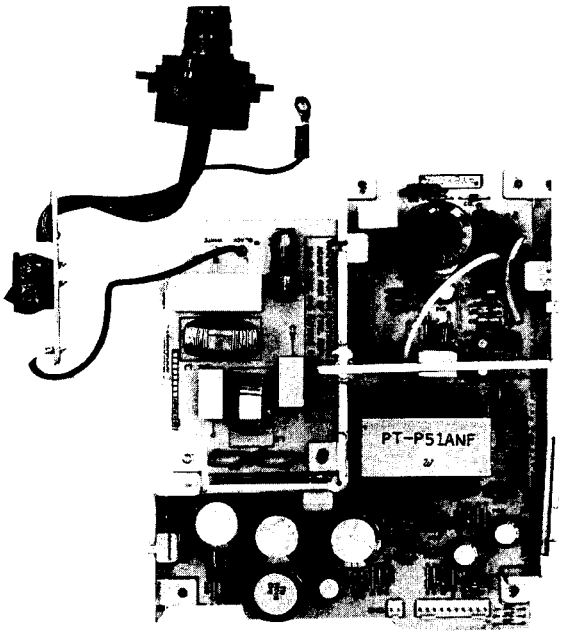


Figure 1-17. MONPS Board

1.9.4 Control Panel

In the control panel, seven switches and seventeen LEDs, as shown in Figure 1-18. The functions of the switches and indicators are given immediately below the illustration.

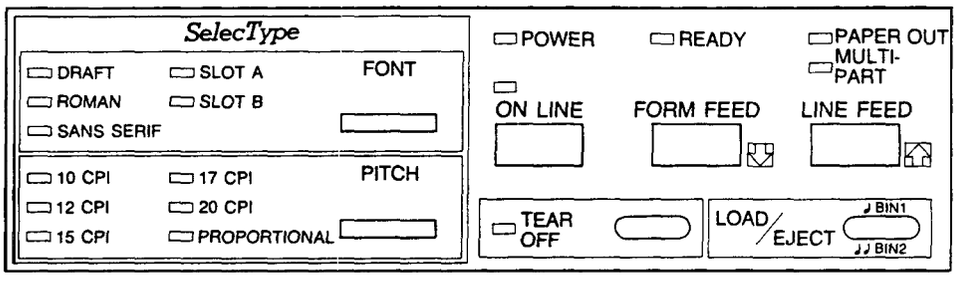


Figure 1-18. Control Panel

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. This switch is also used as the micro forward adjust, refer to Section 1.9.1.2 for details.

LINE FEED Switch

Pressing this switch within 0.5 seconds while the printer is in the OFF-LINE state advances the paper one line at a time. And pressing more than 0.5 seconds performs continuous feeding until this switch is released.

This switch is also used as the micro reverse adjust, refer to Section 1.9.1.2 for details.

LOAD/EJECT Switch

Pressing this switch loads or ejects the paper. Details of the paper loading and ejection process are described in Section 1.9.1.2.

When this switch is pressed in the CSF mode and ON-LINE state, printer beeps once (pi) and selects bin 1, or beeps twice (Pi-, pi-) and selects bin 2 alternately.

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, sequencially.

The PITCH indicator lights beside the currently selected character pitch to confirm its status.

NOTE : Settings by FONT and PITCH switches are stored as defaults. So that the last FONT, PITCH settings becomes effective when the printer is initialized.

TEAR OFF Switch

Advance the paper to the tear-off position. This switch is only effective in the tractor feed.

This switch is effective in both of ON-LINE and OFF-LINE states, refer to Section 1.9.1.2 for details.

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.

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 (10CPI, 12CPI, 15CPI, 17CPI, 20CPI, PROPORTIONAL) LEDs (Orange)

These LEDs indicate the currently selected character pitch.

TEAR OFF LED (Orange)

This indicator the paper is advanced to a tear off position.

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2.1 GENERAL

This chapter will describe features and operations of the Model-5810/5860 Printer mechanism! MONPS/ MONPSE power circuit board, JUNMM control circuit board, and control panel.

In this section, the following abbreviations are used :

CR : Carriage
CS : Color select
F/T: Friction/tractor
HP: Home position
PE : Paper end
PF: Paper feed
PG : Platen gap
RF: Ribbon feed

2.1.1 Connector Descriptions

Figure A-26 shows the connection between the JUNMM board and other units. Table A-12 gives general descriptions of the connectors.

2.1.2 Printer Mechanism Operations

The Model-5810/5860 is a serial printer mechanism equipped with a 24-pin impact dot printhead. This mechanism has various new features to reduce manual paper handling. A block diagram is shown in Figure 2-1.

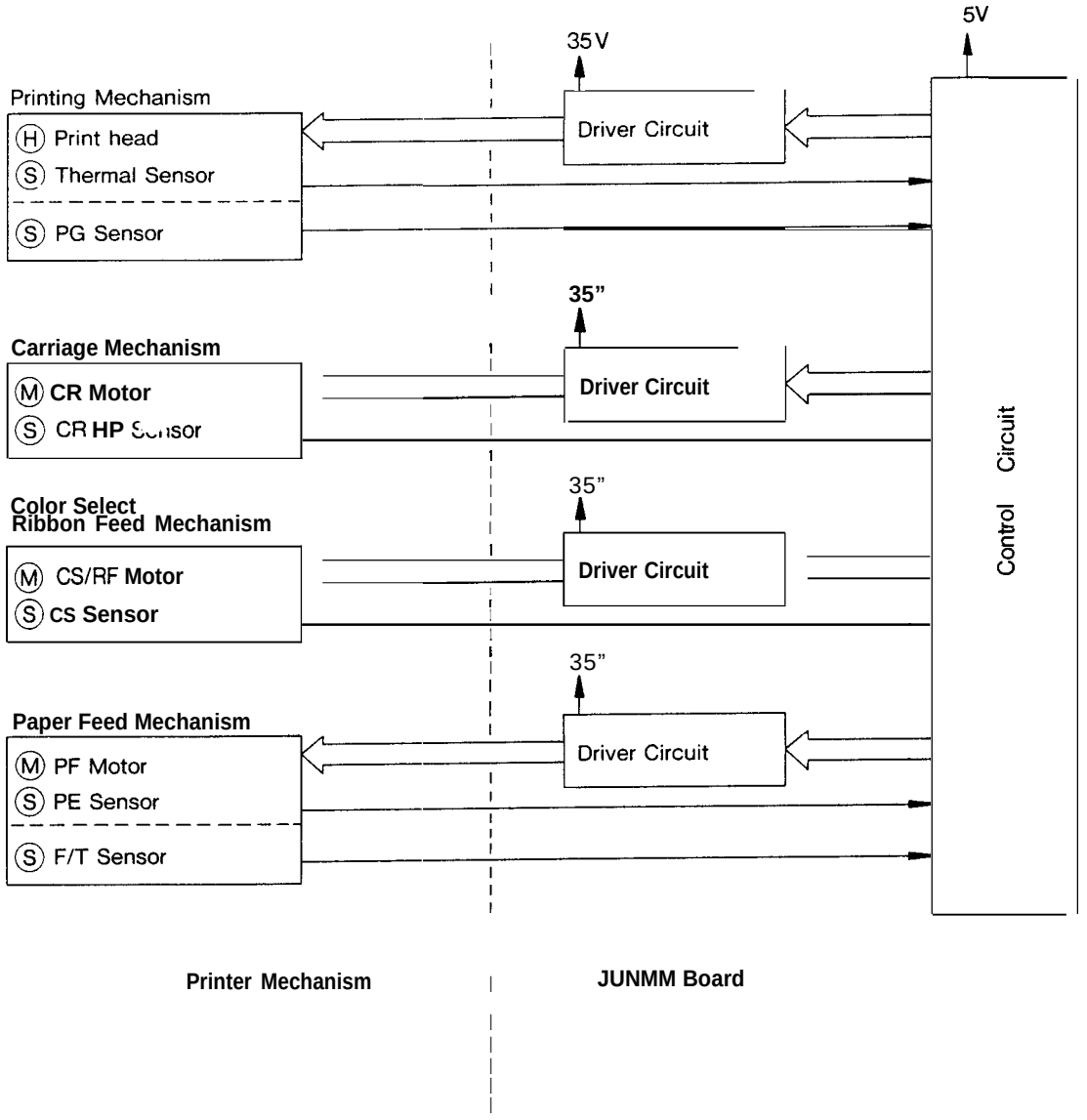


Figure 2-1. Printer Mechanism Block Diagram

2.1.2.1 Printing Mechanism

Figure 2-2 shows the printing mechanism and Table 2-1 lists the printhead specifications.
The printhead has 24 wires arranged in two staggered lines (12 wires for each line). These wires are connected to their own wire drive coils.
The basic printing operations are as follows:

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

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

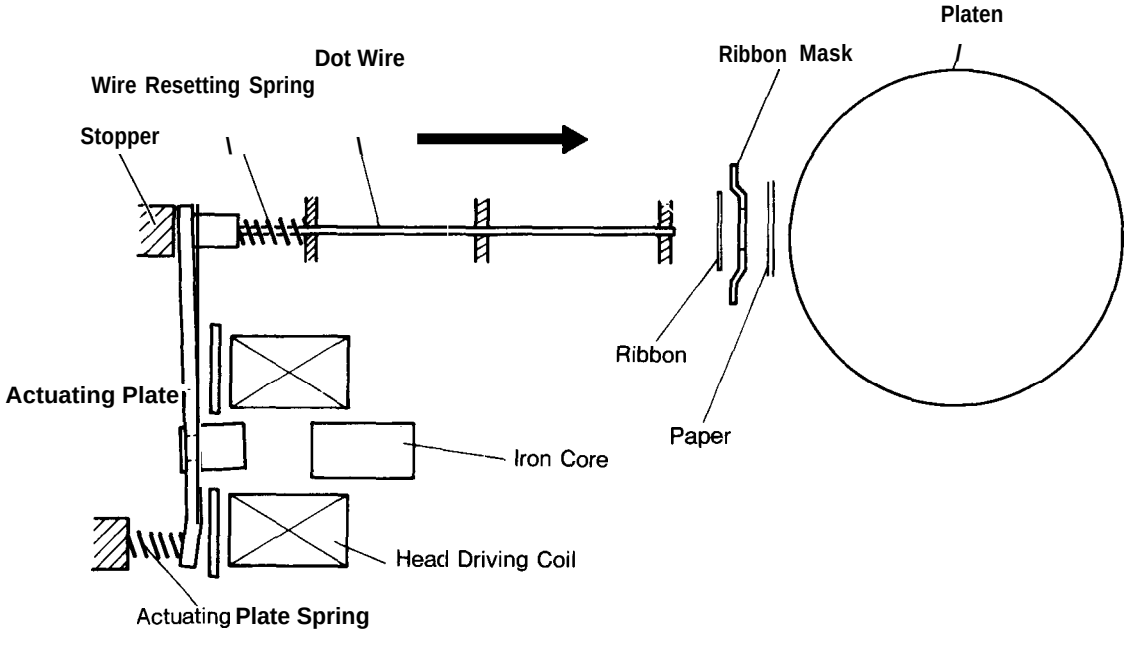


Figure 2-2. Printing Mechanism

Table 2-1. Printhead Specifications

Item	Description	Remarks
Type	Impact dot	Refer to Section 1.2. 1.
Pin Diameter	0.2mm	
Pin Configuration	12 line x 2 col.	
Dot Pitch	1 /180"	
Drive Voltage	35 VDC	±10%
Coil Resistance	29 ohms ± 2 ohms	25°C, for one coil
Drive Frequency	1.37 KHz (Max.) 1.02 KHz (Max.)	Normal mode Copy mode
Drive Mode	Normal copy	Paper thickness* t0 : 0.06mm ≦ t0 ≦ 0.25mm Paper thichness* t1 : 0.25mm ≦ t1 ≦ 0.32mm
Thermal Sensor	Thermistor	Built-in

*: It is detected by the PG sensor (Refer to Table 2-2.).

Table 2-2. PG Sensor Specifications

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

The printhead is equipped with a thermistor as an element which continuously monitors the printhead temperature to prevent the head driving coil in the printhead from being burnt or deteriorated when the printhead temperature rises abnormally due to continuous printing. The printhead temperature monitored by the thermistor is converted into a voltage signal, and is fed back to the control circuit. According to the result, the printhead protection is performed. (Refer to Section 2.3.4.4.)

The platen gap should be adjusted by changing the head adjustment lever position in accordance with the thickness of the paper being used. When printing is performed on thick paper (ex. a post card), set the head adjustment lever at the 4th or latter position. The adjust lever position is detected by the PG sensor (when the lever is set at the 4th or latter position, the PG sensor closes). The control circuit receives the value detected by the PG sensor, and controls printhead drive cycle. (At this time, the carriage speed is also control led.)

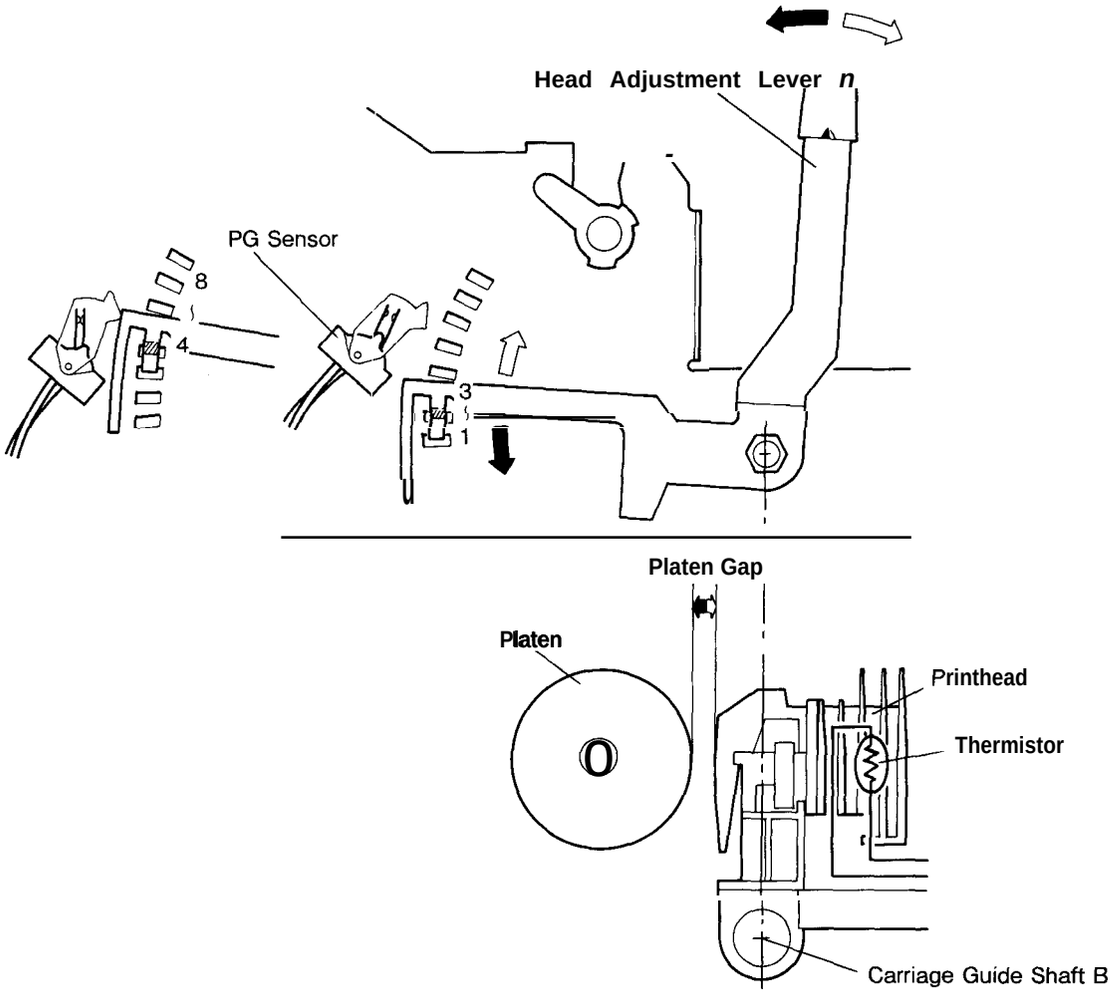


Figure 2-3. Relationship Between PG Sensor and Platen Gap

2.1.2.2 Carriage Movement Mechanism

Figure 2-4 shows the carriage movement mechanism and Table 2-3 lists its specifications. The printhead is mounted on the carriage, and the entire unit is supported by the two carriage guide shafts. The carriage is fixed to the timing belt on one side and is moved when the CR motor drives the timing belt. Printing is accomplished by the combination of printhead and carriage mechanism operations.

The print start position is determined by the CR HP sensor when the mechanism is initialized.

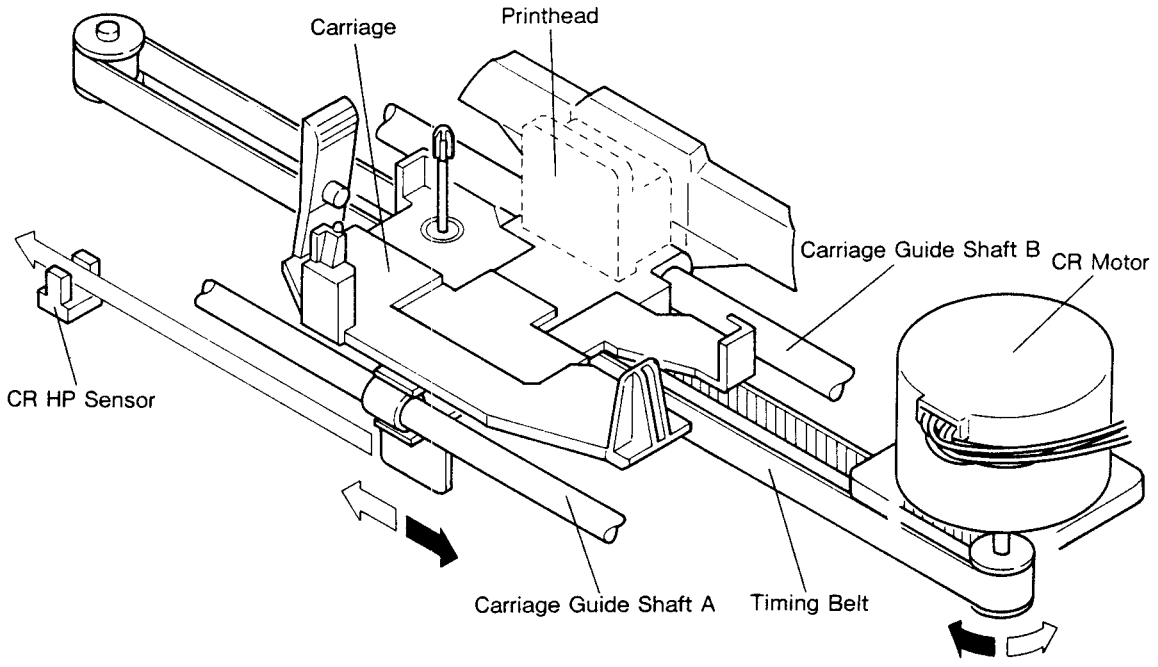


Figure 2-4. Carriage Movement Mechanism

Table 2-3. Carriage Movement Mechanism Specifications

Motor	Driving method	Carrage per step movement	Sensor
CR moter ; Refer to Table 2-4.	Timing belt	1/120″/step (MIN.)	CR HP sensor Refer to Table 2-5.

Table 2-4. CR Motor Specifications

Item	Description	Remarks
Type	Four-phase 200-pole HB type stepper motor	
Drive Voltage	35 VDC	±10%
Coil Rsisitance	2.8 ohms ±7%	25°C, for one coil
Driving Frequency	3600 PPS 2700 PPS	2-2 phase excitation
	1600 PPS 1350 PPS 900 PPS 600 PPS	1-2 phase excitation
Driving Method	Constant current chopper drive	

Table 2-5, CR HP Sensor Specifications

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

2.1.2.3 Ribbon Feed/Color Select Mechanism

The mechanism consists of a ribbon feed mechanism which feeds up the ink ribbon of the ribbon cartridge and the color select mechanism which switches colors of the color ink ribbon. Switching between the above two mechanisms is performed in accordance with the rotational direction of the CS/RF motor.

. When the CS/RF motor rotates in the forward direction (C. W.) : Color select mechanism
. When the CS/RF motor rotates in the reverse direction (C. C. W.) : Ribbon feed mechanism

Ribbon Feed Mechanism

The ribbon feed mechanism consists of the ribbon feed mechanism on the carriage and ribbon cartridge. Figure 2-11 shows the ribbon feed mechanism and Table 2-6 lists its specifications.

Table 2-6. Ribbon feed Mechanism Specifications

Motor	Dirving Method	Ribbon Winding Direction
CS/RF motor ; Refer to Table 2-7.	Gear transmission	C. C. W

Table 2-7. CS/RF Motor Specifications

Item	Description	Remarks
Type	Four-phase 48-pole PM type stepper motor	"
Drive Voltage	35 VDC	±10%
Coil Resistance	150 ohms ±10 ohms	25°C, for one coil
Driving Frequency	500 PPS	2-2 phase excitation
	700, 830, 1200 PPS	1-2 phase excitation
Driving Method	Constant voltage drive	

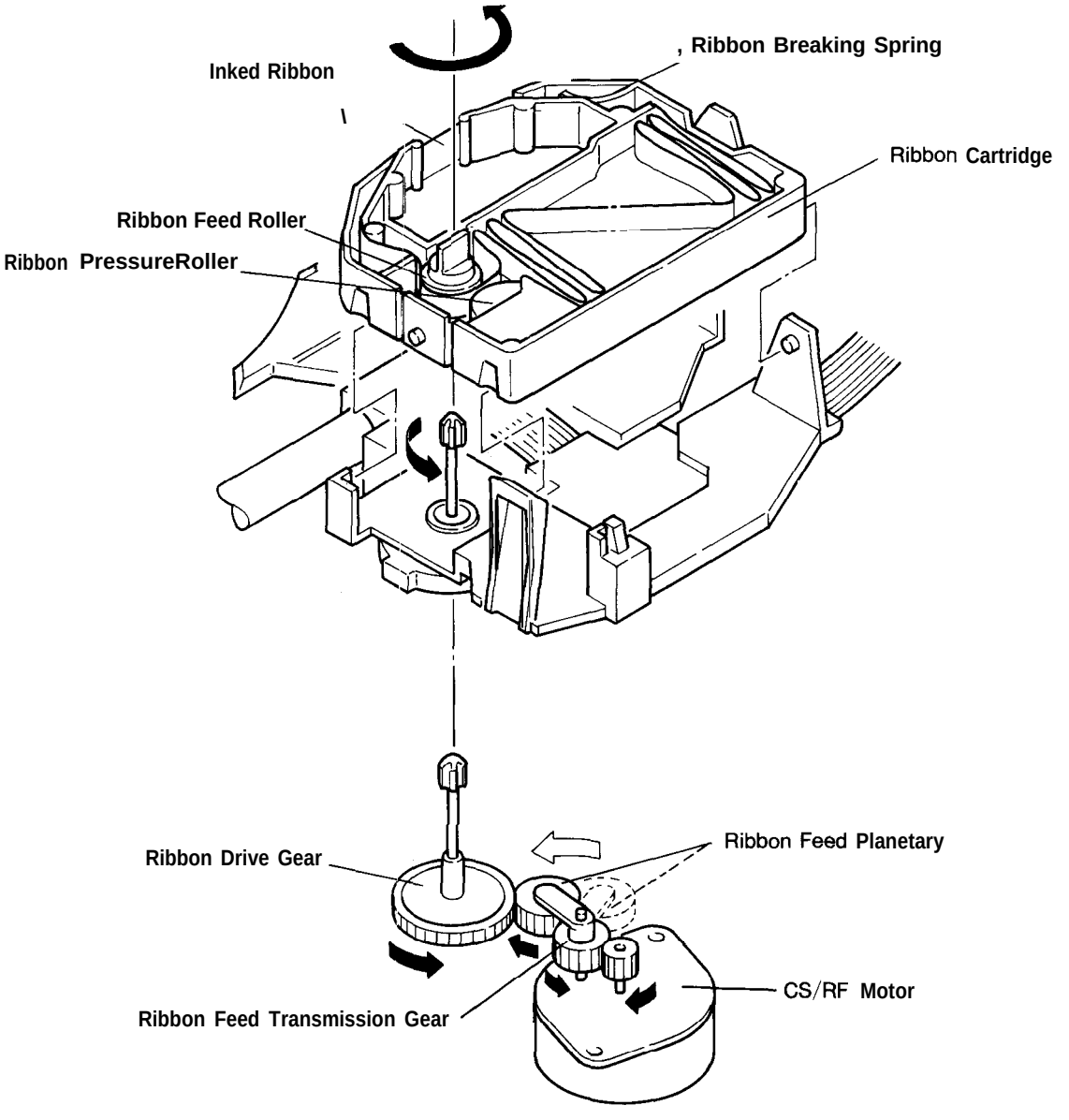


Figure 2-5. Ribbon Feed Mechanism

The ribbon feed mechanism is mounted on the carriage. As the CS/RF motor rotates counterclockwise (C. C.W.), the ribbon drive pulley rotates to feed the ribbon (Refer to see Table 2-8).

Table 2-8. Ribbon Feed Gear Train

CS/RF Motor Rotation	Gear Train
c. c. w.	CS/RF motor pinion gear → Ribbon fed transmission gear → Ribbon feed planetary gear → Ribbon Drive gear

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

Color Select Mechanism

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

Table 2-9 shows the specifications of the color ribbon select mechanism.

Table 2-9. Coler Select Mechanism Specifications

Motor	Driving Method	Ribbon Shift Direction	Color Select*'
CS/RF motor ; Refer to Table 2-7.	Crank gear transmission	Black*2 ← ↓ Cyan ↓ Magenta ↓ Yellow →	Refer to Table 2-10.

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

∗2 : Color **home** position

Table 2-10. Color Select

Print color	Print ribbon	
	1st time	2nd time
Black	Black	—
Magenta	Magenta	—
Cyan	Cyan	—
Violet*'	Magenta	Cyan
Yellow	Yellow	—
Orange*'	Yellow	Magenta
Green*'	Yellow	Cyan

∗1: **When the black ribbon cartridge is installed at printing, then the printer prints characters as double-strike.**

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

Table 2-11. CS Sensor Specifications

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

1. Outline

The color-inked ribbon is divided into four strips as shown in Figure 2-6. One strip can be selected by vertically moving the color ribbon cartridge using point Ⓐ of the carriage as a fulcrum.

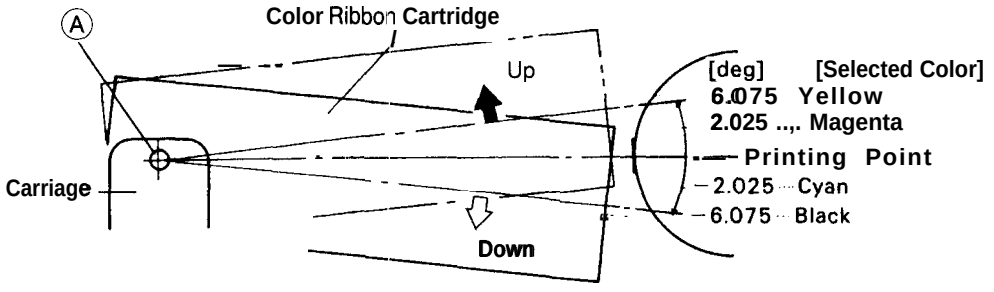


Figure 2-6. Color Ribbon Strip Selection

2. Operations

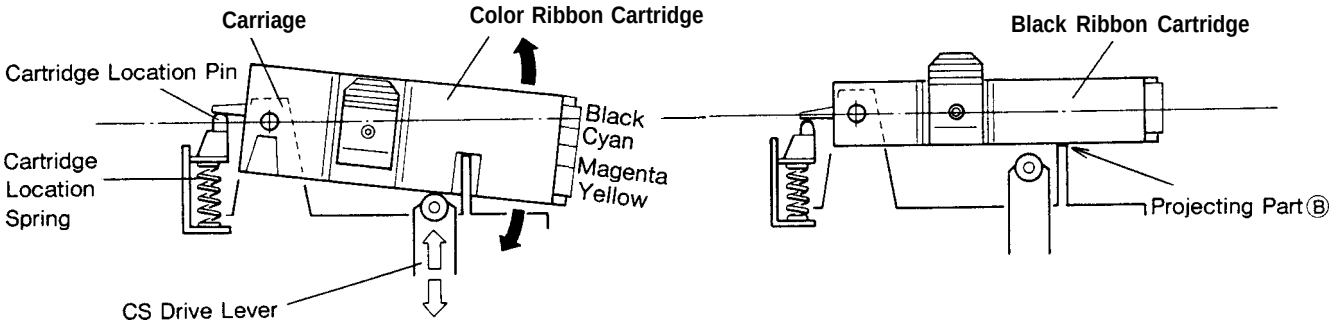
Figure 2-7 shows the color select mechanism. When the CS/RF motor rotates, its rotational movement is converted to up or down movement of the CS drive lever via the various gears (see Table 2-12). As the CS drive lever moves up or down, the color ribbon cartridge moves up or down.

Table 2-12. Color Select Gear Train

CS/RF Motor Rotation	Gear Train
C. W.	CS/RF motor pinion gear → Ribbon feed transmission gear A → Ribbon feed planetary gear → Ribbon feed transmission gear B → CS reduction gear → CS drive cam → CS drive Lever

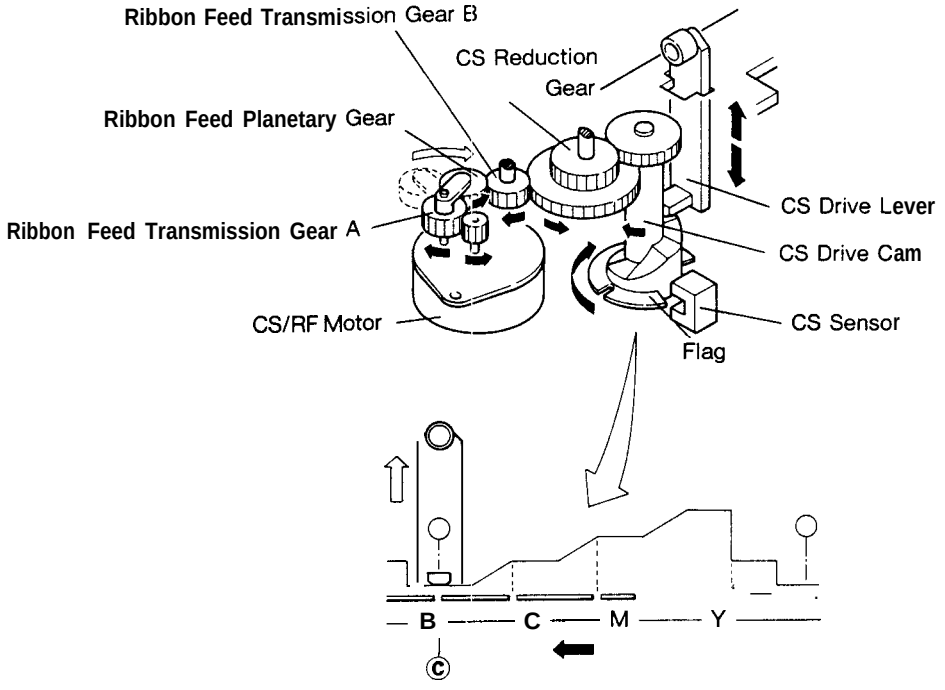
The cartridge location spring pushes the ribbon cartridge to the CS drive lever via the cartridge location pin to lock the ribbon cartridge. A color section of the color ribbon is selected by moving the CS/RF motor to the color ribbon position using point Ⓒ as a start point (color home position: black ribbon position)(See Figure 2-7 a). At this time, the color home position is detected by the CS sensor.

When the black ribbon cartridge is mounted at the carriage, the projection Ⓑ of the carriage prevents the bottom face of the ribbon cartridge from touching the CS driver lever.
As a result, the CS drive lever going up or down never touches the bottom face of the black ribbon cartridge, and the color selection mechanism is functionally canceled. (See Figure 2-7 b).).



a) When a color ribbon is used

b) When a black ribbon is used



CS Reduction Gear Cross Section

c) Gear Train

Figure 2-7. Color Select Mechanism

2.1.2.4 Paper Feed Mechanism

The PF motor drives the platen and tractor via the paper feed transmission gear, and feeds the paper.
If the paper runs out, the PE sensor detects it.
The kind of the paper being used (cut sheet or fan-fold paper) is detected by the F/T sensor (interlocked with the paper release lever).

Table 2-13. Paper Feed Mechanism Specifications

Motor	Dirving Method	Paper Feeding per Step	Sensor	
PF motor ; Refer to Table 2-14.	Gear transmission	1/360″/step	PE Sensor Refer to Table 2-15.	F/T Sensor Refer to Table 2-16.

Table 2-14. PF Motor Specifications

Item	Description	Remarks
Type	Four-phase 96-pole HB type stepper motor	
Drive Voltage	35 VDC	±10%
Hold Voltage	5 VDC	±5%
Coil Resistance	59 ohms±3 ohms	25°C, for one coil
Driving Frequency	1620 PPS (MAX.)	2-2 phase excitation
Driving Method	Constant voltage drive	

Table 2-15. PE sensor Specifications

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

Table 2-"16. F/T Sensor Specifications

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

Push tractor feeding and friction feeding are described below.

The paper feeding methods consist of push tractor feeding (for continuous paper) and friction feeding (for cut sheet paper). Refer to Table 2-17.

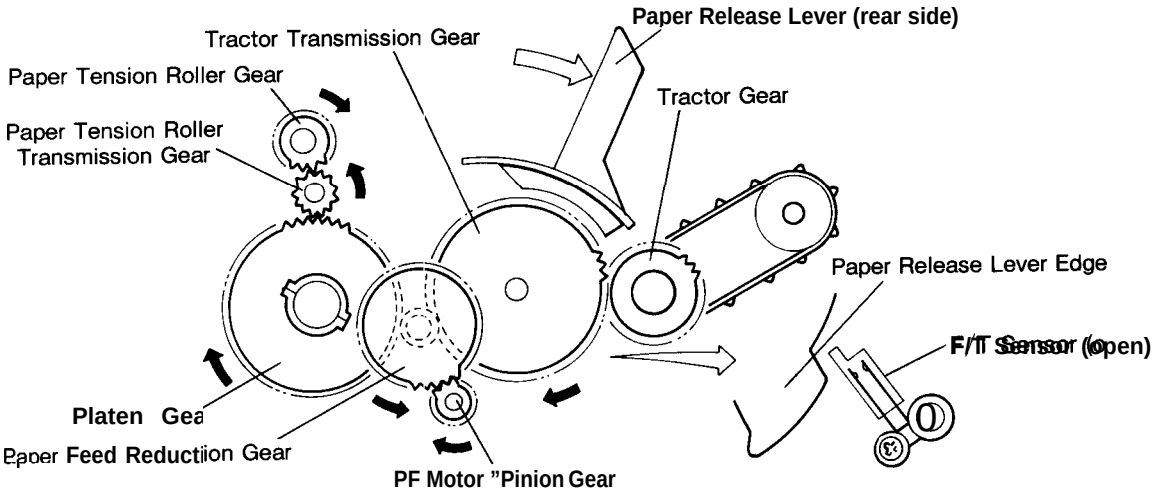
Table 2-17. Paper Feeding Method

Paper Release Lever State	Rear		Center	Front	
Paper	Cut sheet		Continuous		
Push Tractor	Invalid		Valid		
Paper Feeding Method	Friction		Tractor		
	Standard	Cut sheet feeder*	Standard (push)	Pull*	Push & pull*
Paper Tension Unit	O	x	◯	x	x

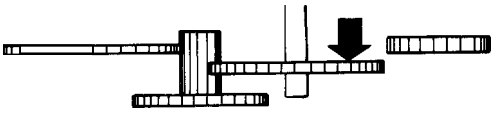
*** : Optional**

Friction Feeding

Figure 2-8 shows the friction feed system paper feed mechanism.
Insert the paper from the paper entrance with the paper release lever being turned backwards. The paper is pushed to the platen by the paper feed roller, and is pulled into the printer due to friction generated between the paper and the platen.
At this time, the tractor gear is released from the tractor transmission gear as the paper release lever shift. Therefore, no power is conveyed to the push tractor.

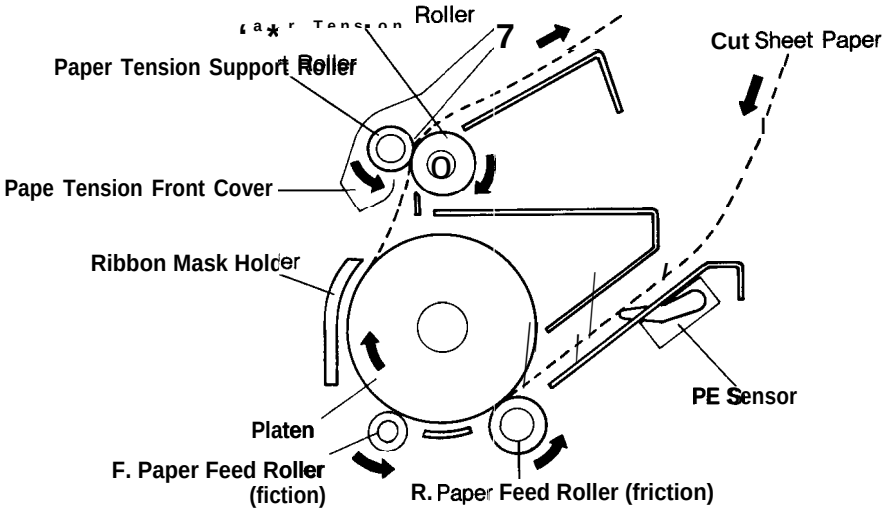


(i) Side View



(ii) Top View

a) Gear Arrangement

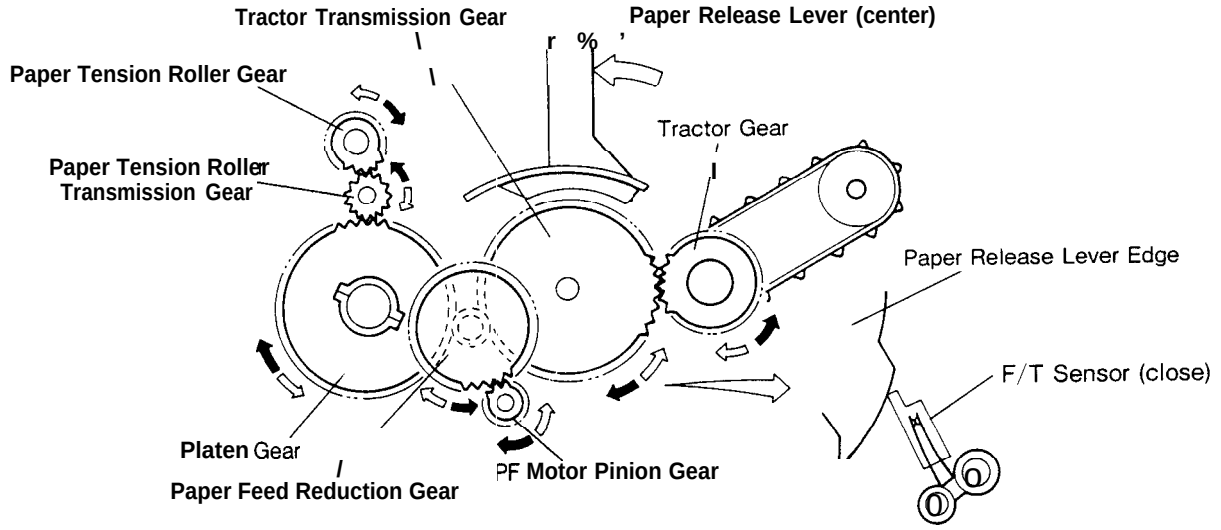


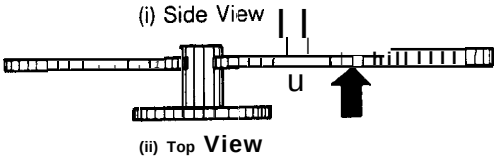
b) Paper Path

Figure 2-8. Friction Feeding

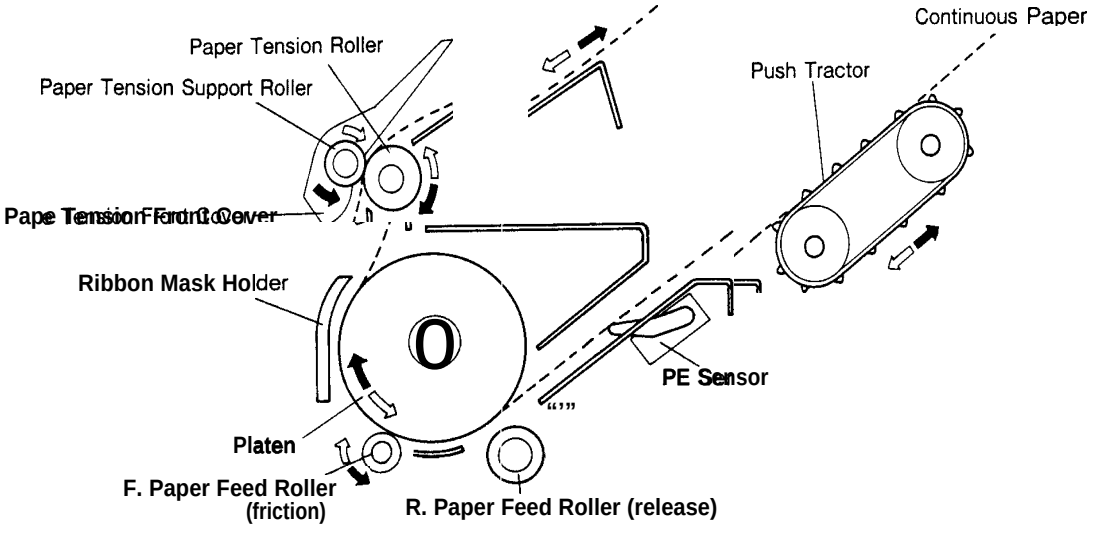
Push Tractor Feeding

Figure 2-9 shows the push tractor feed system paper feed mechanism.
This mechanism feeds paper when the PF rector is driven with the paper release lever being turned center and the fan-fold paper being set at the tractor unit.





a) Gear Arrangement



b) Paper Path

Figure 2-9. Push Tractor Feeding

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 2-18.
Since the MONPS board has almost the same structure as the MONPSE board, this section will describe the MONPS board.

Table 2.,18. Power Supply Voltages

Name	Input AC [V]	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 2-19 to supply the circuits and operate the mechanisms.

. Refer to Figure A-29 and Figure A-30 in Appendix for the entire circuit of the MONPS and MONPSE boards.

Table 2-19. Voltages and Applications

Power Voltage (DC)	Application
+35V−G_P	• CR motor drive . PF motor drive • Printhead solenoid drive • CS/RF motor drive • Fan motor drive
+5V−G_L	• JUNMM board Logic circuit power . Power for various sensors • Control panel power . PF motor hold • CS/RF motor hold • Optional interface board power • Optional cartridge power
/x (5 V)– GL	• Reset circuit . Pull-up H1 to H24 of IC 2A
±12 V−GND	• Optional I/F board power

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

Figure 2-10 shows a block diagram of the power supPIY 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 clue to inductive coupling. This voltage is delivered to the + 35 V line (including +5 V) and the ±12 V line, and separately full-wave rectified and smoothed. The +5 V is generated by a switching regulator IC from the +35 VDC. The +35 V line includes a voltage regulator 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 voltage regulator circuit and + 5 V regulator IC.

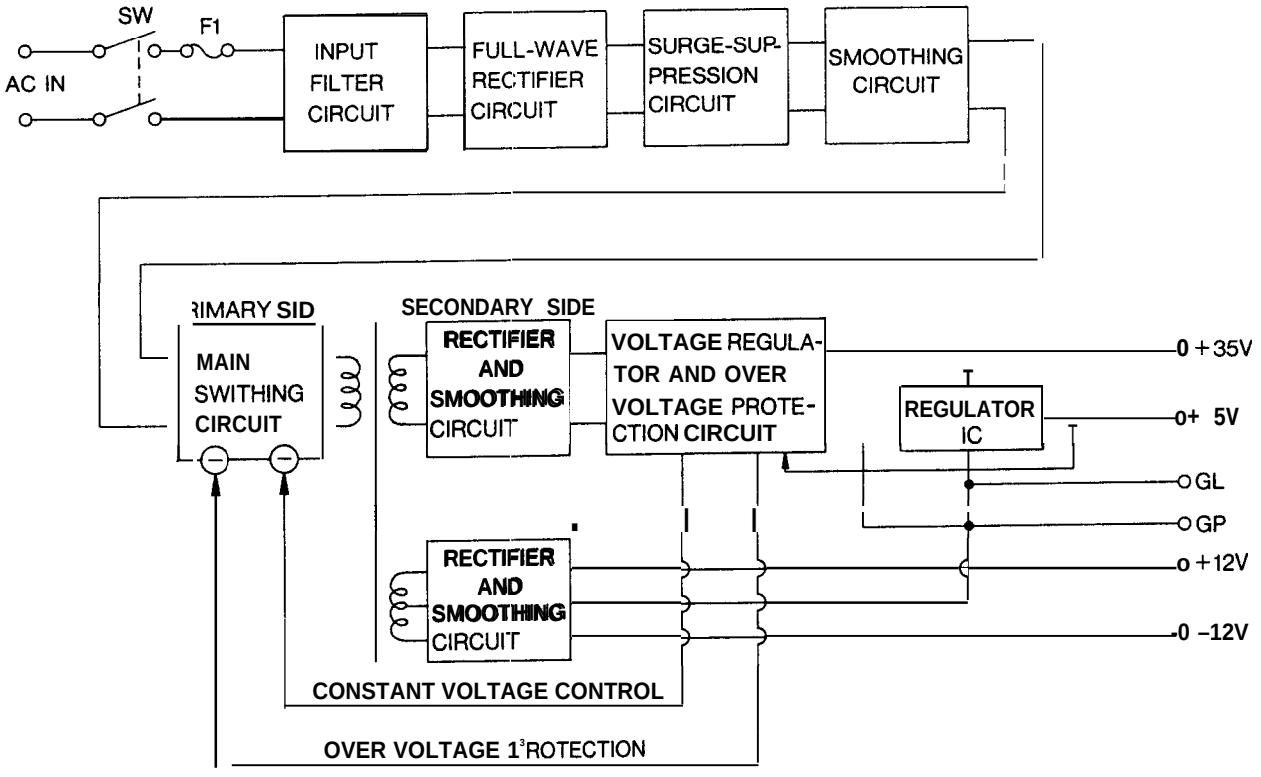


Figure 2-10. MONPS/MONPSE Board Block Diagram

2.2.2 Input Filter Circuit

Figure 2-11 shows the 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.

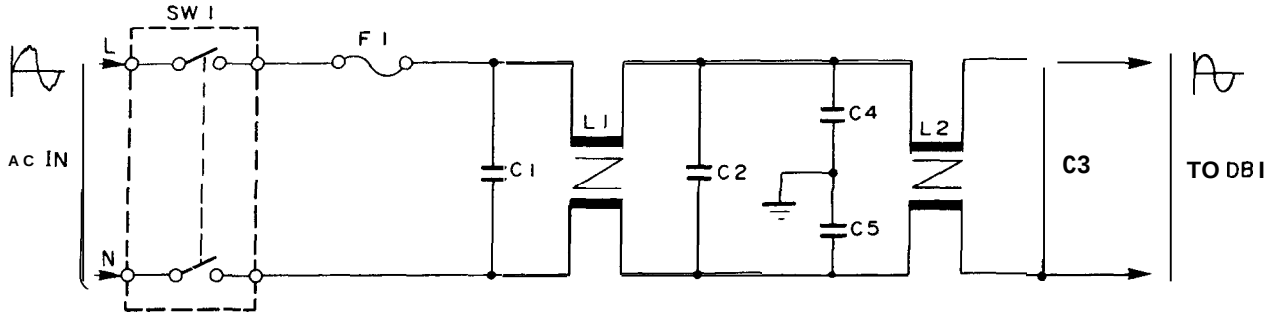


Figure 2-11. Input Filter Circuit

2.2.3 Rectifier, Smoothing, and Surge-Suppression Circuit

As shown in Figure 2-12, the AC input voltage filtered by the input filter is full-wave rectified by diode bridge DBI, 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 DB1 and a large charging current (called a surge current) flows when the power is turned on. Figure 2-13 shows the surge current.
The largest surge current flows if the power supply is turned on at the peak of the input voltage.

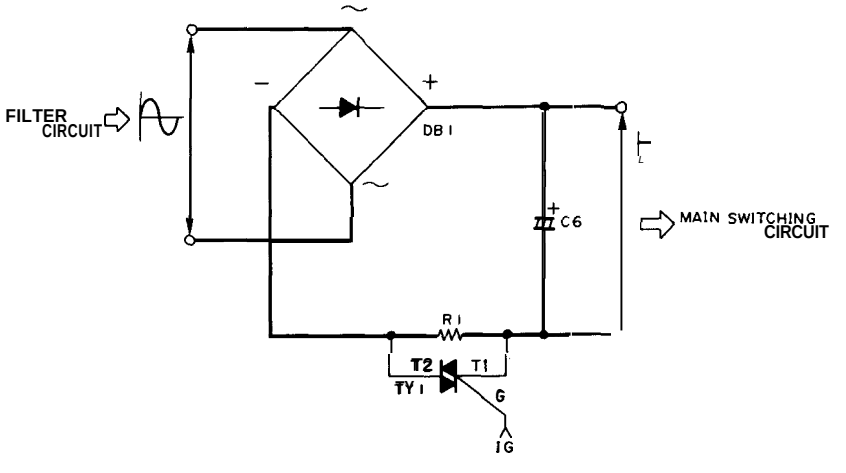


Figure 2-12. Rectifier-Smoothing-Surge Suppression Circuit

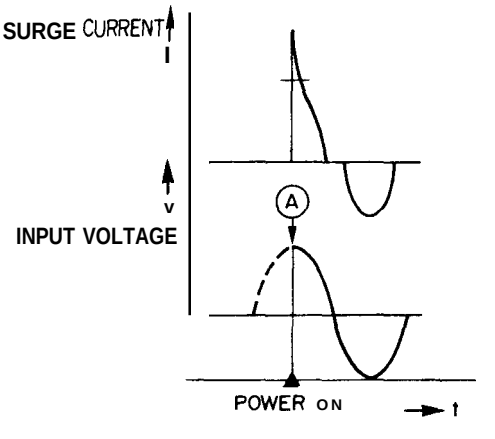


Figure 2-13. Surge Current

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 RI 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 / R1 = 23.5 [A] .
After C6 is fully charged, resistor RI is shorted to keep its temperature low. The circuit includes TRIAC TY1 for this purpose, which shorts TI to T2 by passing current IG to the gate. (When C6 is charged, power is applied to coil T14-12 of transformer T1 so that a voltage is induced in coil T9-10. When this voltage reaches 1.5 V, IG flows to switch on TY1.)

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 2-14 shows the main switching circuit. When the power is applied, drive current I_S flows to the base of switching transistor Q1 via starting resistor R14. Diodes D20, D21, D22 on the secondary side of TI prevent current flow in the secondary side. Therefore, as shown in Figure 2-15, 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 Q1 on. Once Q1 is turned on, the primary side of transformer coil T14-12 receives an input voltage which induces voltages in windings 1-11-8 and T9-10 (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 Q1 to remain on. The value of I_B is constant as shown in the following formula :

$$I_B = \frac{(T11\text{-}8\ /\ T14\text{-}12) \cdot V_{IN} - (V_{D2} + V_{Q1BE})}{R4 + R5 \cdot (1 + h_{FE})}$$

Therefore, when collector current I_C increases as shown in Figure 2-16, 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 Q1 is turned off. As a result, the voltage at T14-12 and T11-8 drops and base current runs out, and QI is quickly switched off.
When QI 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 Q1 is turned off, P is :

$$P = \frac{1}{2} \cdot L1 \cdot I_{LP}^2 = \frac{1}{2} \cdot \left(\frac{V_{IN}}{L1} \cdot ton\right)^2 [W]$$

L1 : Liactance of Coil T14-12
I_{LP} : Peak current of I_L

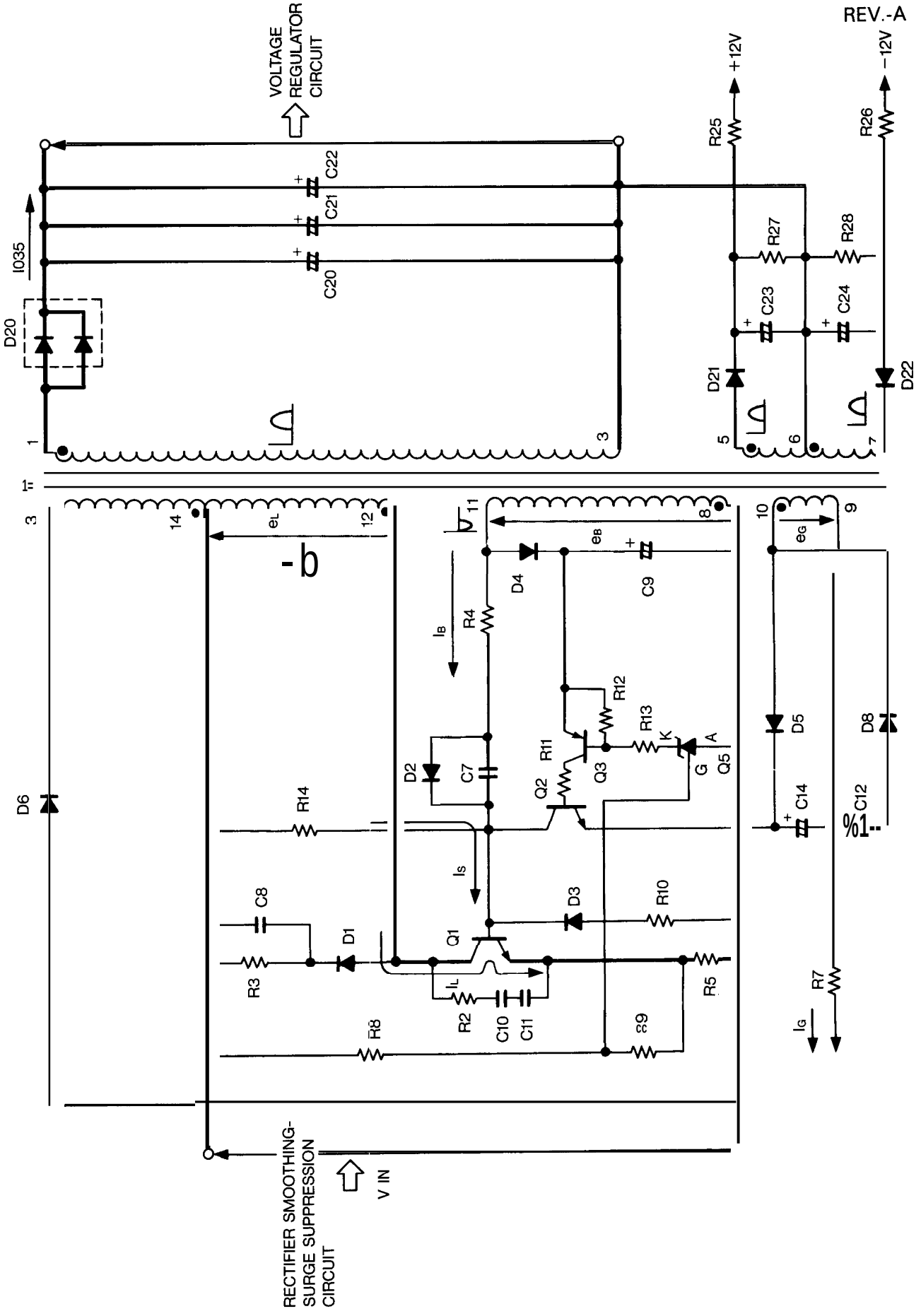


Figure 2-14. Main Switching Circuit

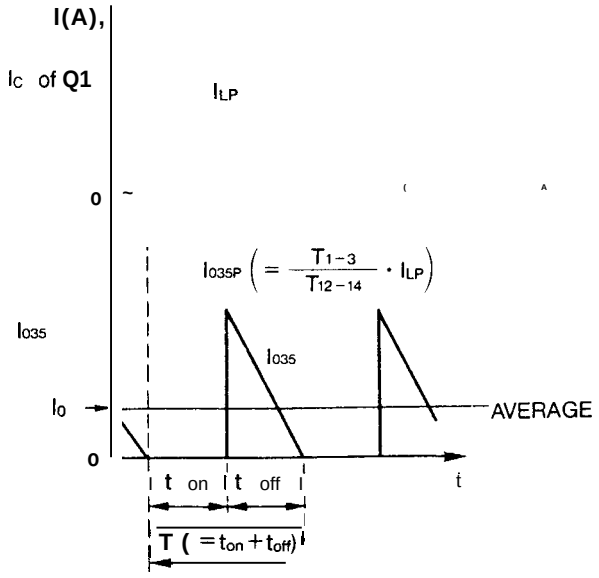


Figure 2-15. Waveforms at Primary and Secondary Sides of T1

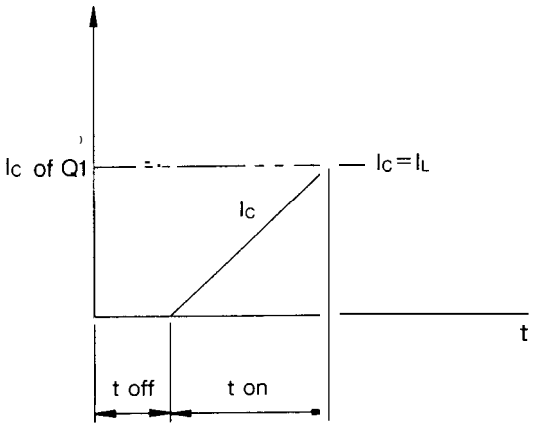


Figure 2-16. RCC System Switching Operation

2.2.5 +35 V Voltage Regurator Circuit

The back electromotive described in Section 2.2.4.1 causes diode D20 on the secondary side of transformer TI 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:

$$p = + \cdot L1 \cdot \left(\frac{V_{IN}}{L1} \cdot ton\right)^2 \cdot f = V_0 \cdot I_0$$

f : switching frequency of Q1
ton : on-time of Q1

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 PC1 is used to feedback the fluctuating output voltage to the switching circuit while still isolating it. Refer to Figure 2-17,

This circuit employs a programmable shunt regulatoiTL431 (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 photo-diode 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 T11-18 to the base of Q1 is shorted to the O V line to tum off switching transistor Q1. Consequently, the period of time that V_{IN} is applied to winding T14-12 on the primary side is cut down, and the voltage induced in winding T1-3 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 the TL431, in this case), and prevents an inductance element from entering the feed back loop and making it oscillate.

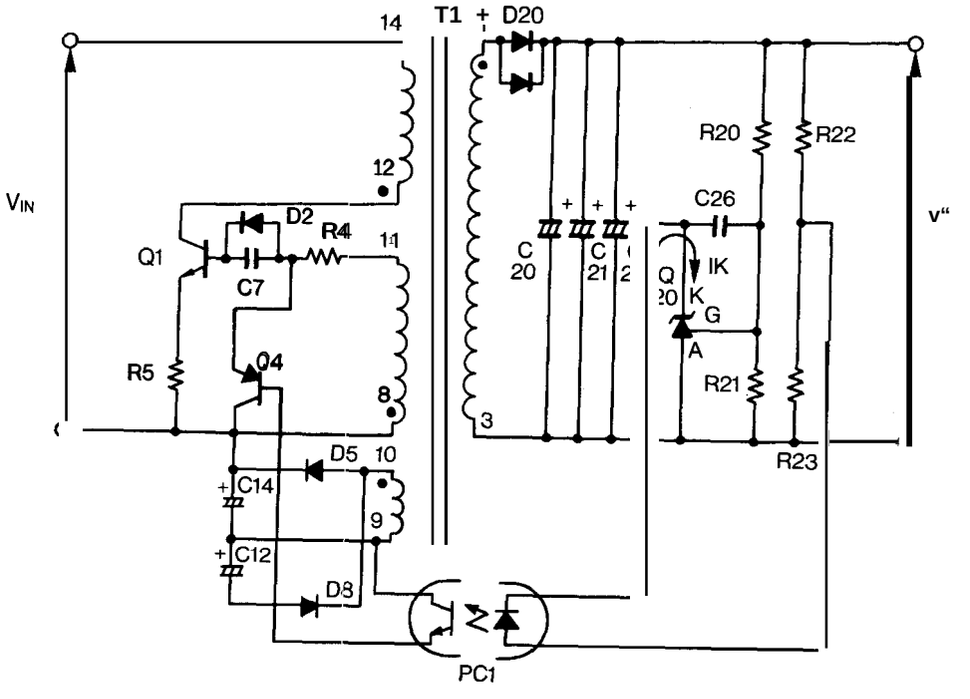


Figure 2-17. Output Voltage Stability Circuit

2.2.6 Over Voltage Protection Circuit

As described in 2.2.5, the power supply circuit of this unit not only uses the voltage regulator 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 voltage regulator circuit.

Figure 2-18 shows the over voltage protection circuit.

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

$Vo > VZD20 + VZD21 = 40\ [V]$,

then the photodiode in PC2 receives current. Consequently, the gate of the thyristor (SCR) on the receiver side conducts to pass the base current of Q1 (I_B) to ground. Q1 is cut off so that the Potential at T14-12 reduces to O [V] and no voltage is induced in the secondary side winding T1-3. The power supply must be switched off to reset the protection circuit.

In the same way, over voltage protection is performed for the output (V_{05}) of the +5 VDC regulator IC (Refer to Section 2.2.5.). When the V_{05} reaches 6 V or more, the voltage limiting is Performed.

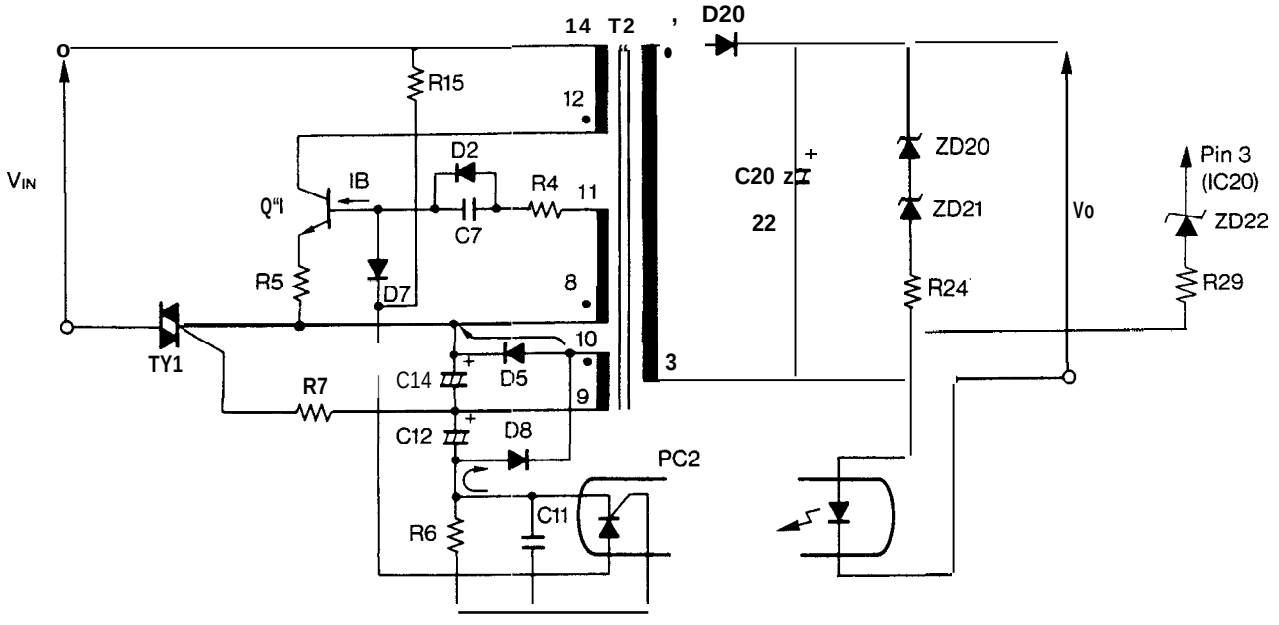


Figure 2-18. Over Voltage Protection Circuit

2.2.7 +5 V Switching Regulator Circuit

Figure 2-19 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.

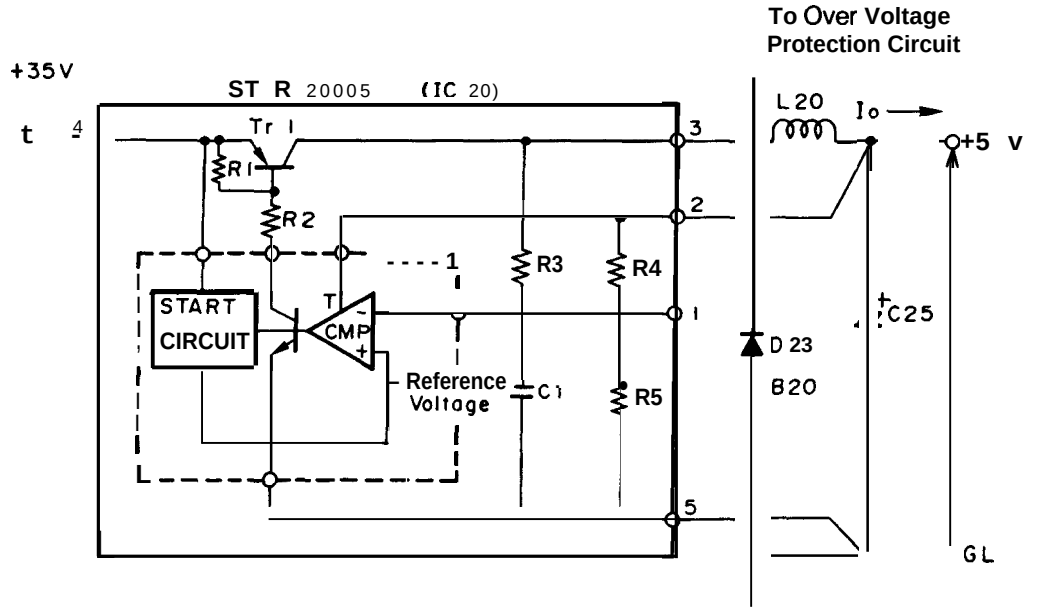


Figure 2-19. +5 V Switching Regulator Circuit

2.2.7.1 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, Trf is turned on so that current flows from the emitter to the collector, and the +5 V line turns on.

2.2.7.2 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 two pins 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 Trl. 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 2-20 shows the PWM sequence.

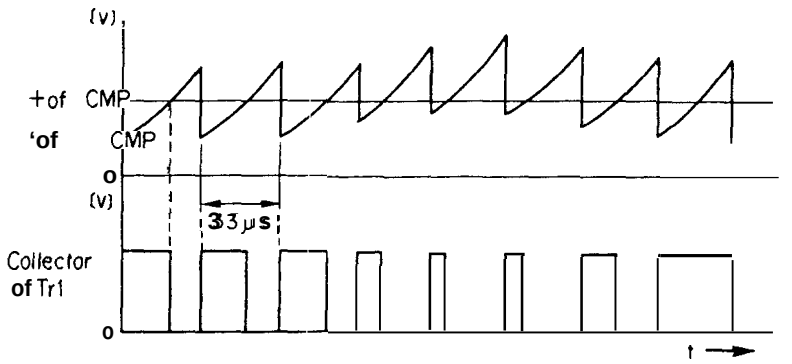


Figure 2-20. CMP Input and Output Voltage Comparison

2.2.7.3 Soft Start

When power is supplied capacitor Cl, connected between the CMP negative side and GND, increases the Trl output at time constant R3 x C2 so that the on-time of Trl gradually becomes longer (Refer to Figure 2-21). This circuit smoothes the rising of output voltage Vo and prevents overshoot.

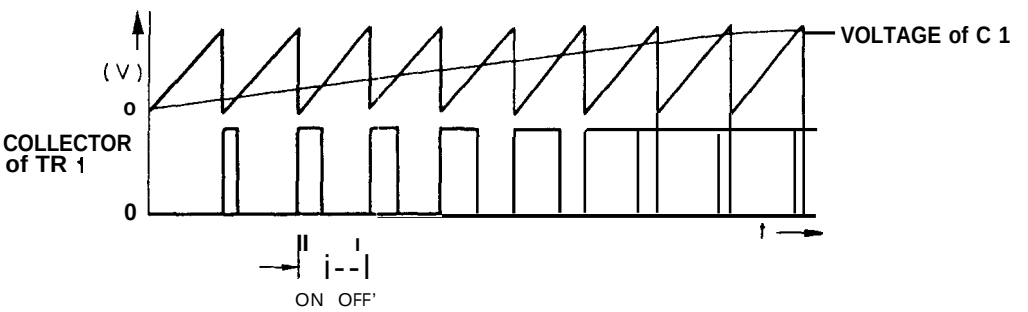


Figure 2-21. Soft Start Timing

2.2.8 ±12 V 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 cosist 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 R26. (Refer to Figure 2-22.)

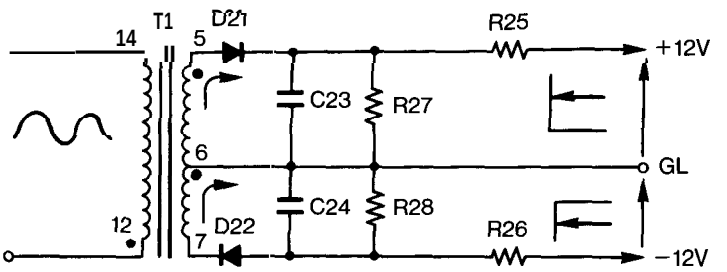


Figure 2-22. ±12 V Half-Wave Rectifier-Smoothing Circuit

2.3 CONTROL CIRCUIT BOARD (JUNMM Board)

Figure 2-23 shows a block diagram of the JUNMM board. The printer employs 8-bit one-chip CPU μPD78213 of which functions and performance are better than those of conventional 8-bit one-chip CPU ,uPD781O, to control all of the printer operation. The printer is driven with a 9.83 MHz clock. Moreover, various gate array ICs and hybrid ICs are employed to lighten load to the CPU, so that the CPU circuit can be simplified and data can be processed at high speed.

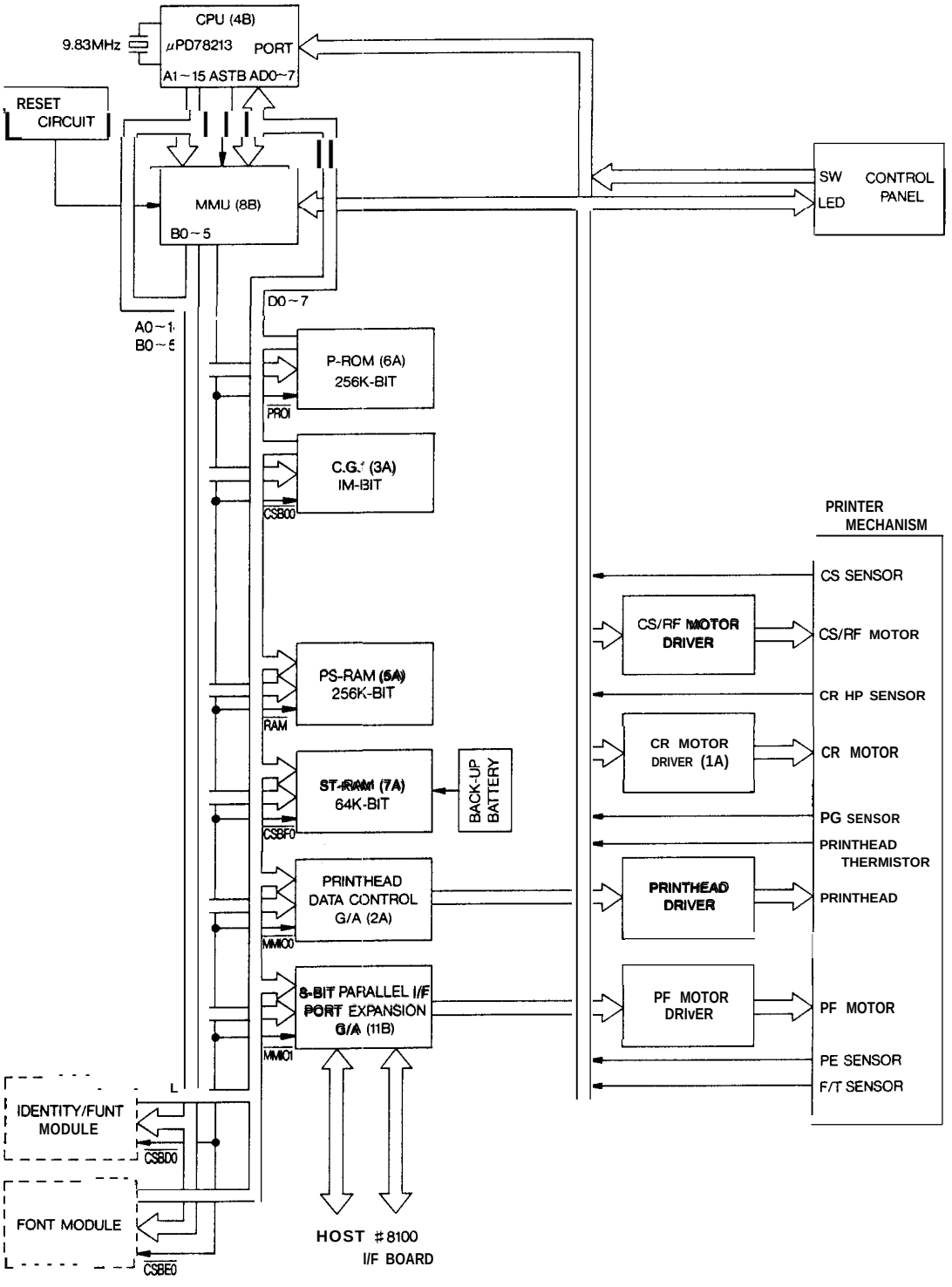


Figure 2-23. JUNMM Board Block Diagram

2.3.1 Reset Circuit

Figure 2-24 shows the reset circuit.

After being input to the E05AIOAA gate array (MMU :8B), the reset signal resets the gate array, then is sent out to the other devices. Reset operation (hardware reset) is performed when:

- The printer power is turned on or off.
- A identity/font module is installed or removed with the power on.

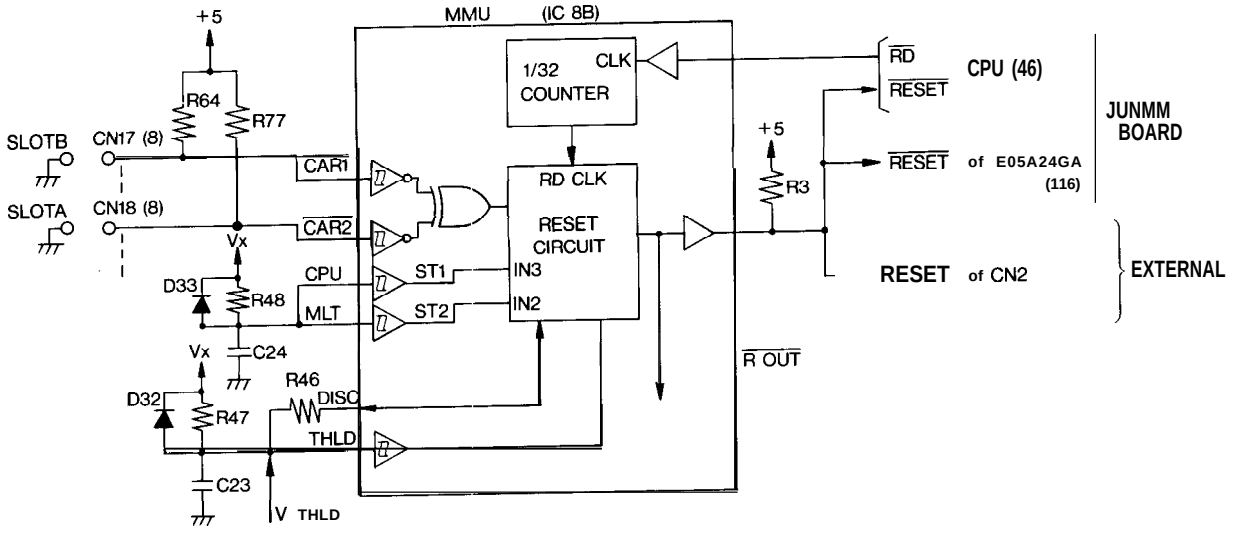


Figure 2-24. Reset Circuit

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

Figure 2-25 shows the Vx voltage supply circuit.

The Vx voltage is used to pull up the bus for the control signals transmitted to the power on reset circuit and drive circuits.

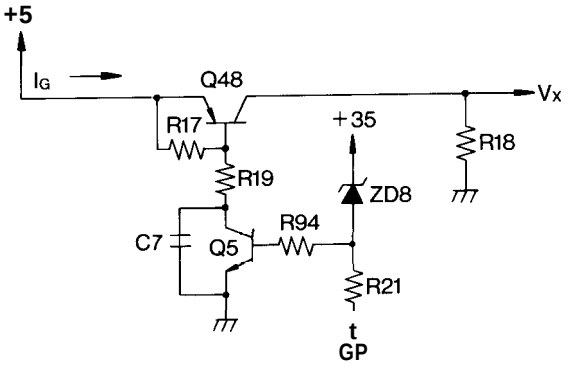


Figure 2-25. Vx Voltage Supply Circuit

After the printer power is turned on, the -t35 V line reaches about 27.7 V, and then Q5 and Q48 are turned on so that current I_G flows from the +5 V line to the Vx line. Therefore, +5 V is applied to the Vx line. If the +35 V line drops below 27.7 V, Q5 and Q48 are turned off so that the Vx line drops to O V. The IC is threfore reset and the printer stops printing.

2.3.1.2 Power ON/OFF Reset

Figure 2-24 shows the reset circuit and Figure 2-26 shows the waveform the this operation.

When the power is switched on and Vx rises, voltage is applied to the integration circuit (composed of R47, C23, D32). The voltage at C23 increases and when V_{THLD} reaches V_P the output switches from low to high (Schmitt trigger), and the reset circuit in the MMU sets the $\overline{ROUT}$ signal high (Figure 2-26, T_{R1}). The reset ($\overline{ROUT}$) signal is sent to the IC's on the JUNMM board and to the outside.

When the power is switched off, the voltage at C23 decreases and, when V_{THLD} reaches V_N the output switches from high to low, and the reset circuit in the MMU sets the $\overline{ROUT}$ signal low. (D32 is a diode used to discharge C23.)

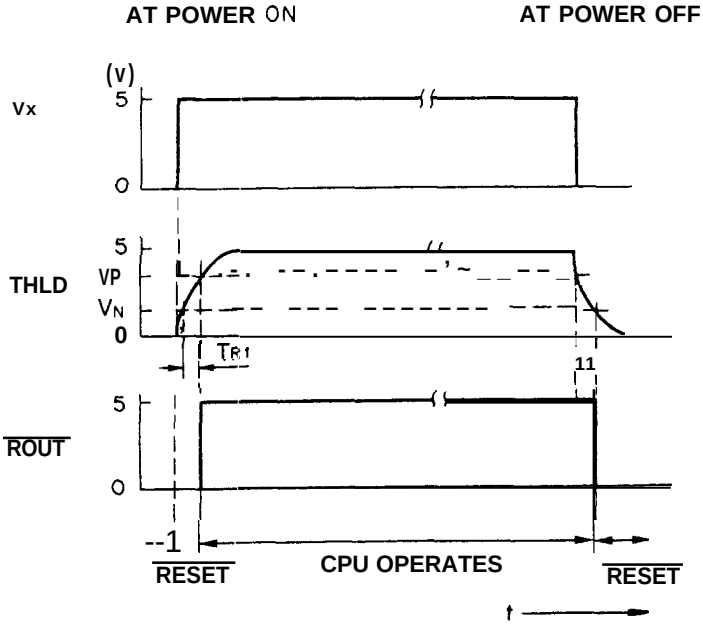


Figure 2-26. Power ON/OFF Reset Timing

2.3.1.3 Font/Identity Module Installation and Removal Reset

Figure 2-24 shows the reset circuit and Figure 2-27 shows the module installed/removed reset timing.

The font and identity modules should not be installed or removed while the power is on. If this is done, the $\overline{\text{ROUT}}$ signal must be set low to prevent a JUNMM board circuit malfunction.
After reset, the CPU starts execution and sends a RD signal to the memory devices. The reset circuit in the MMU counts 32 x RD pulses and then generates a RDCLK pulse. When a module is installed or removed, the exclusive OR value of CAR1 and $\overline{\text{CAR2}}$ changes from the reset default value, and the DISC signal is set low by the rising edge of the second pulse of the synchronized RDCLK signal. Consequently, the $\overline{\text{THLD}}$ voltage begins decreasing. When the $\overline{\text{THLD}}$ voltage drops to VN, the DISC signal goes high and then begins increasing. When it rises to VP, the $\overline{\text{ROUT}}$ signal goes high and the CPU restart.

Also, Table 2-20 shows the relationship between the input at $\overline{\text{CAR1}}$ and $\overline{\text{CAR2}}$ of MMU (8B) and the state of the mudule.

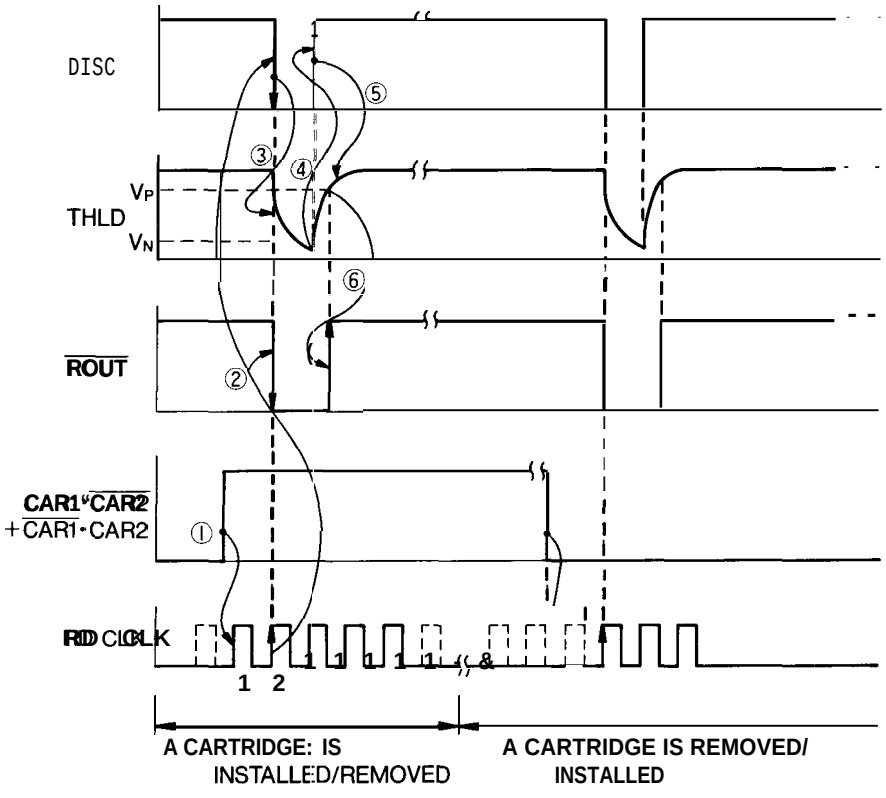


Figure 2-27. Module Installed/Removed Reset Timing

Table 2-20. State of Module

CN17 (SLOT B)	CN18 (SLOT A)	$\overline{CAR1}$	$\overline{CAR2}$	$\overline{ROUT}$
Stay	→ Installing	L	H → L	
	Removing →		L → H	
Not stay	→ Installing	H	H → L	
	Removing →		L → H	
→ Installing	Stay	H → L	L	
Removing →		L → H		
→ Installing	Not stay	H → L	H	
Removing →		L → H		

2.3.1.4 ST-RAM (7A) Battery Backup Circuit

The ST-RAM (7A) employs a lithium battery (3.00 to 3.35 VDC) for backup, and is used to maintain the initial data for the printer mechanism and settings for the control panel when the printer power is turned off. Figure 2-28 shows the ST-RAM (7A) battery backup circuit, and Table 2-21 shows the ST-RAM conditions when the power is turned on or off.

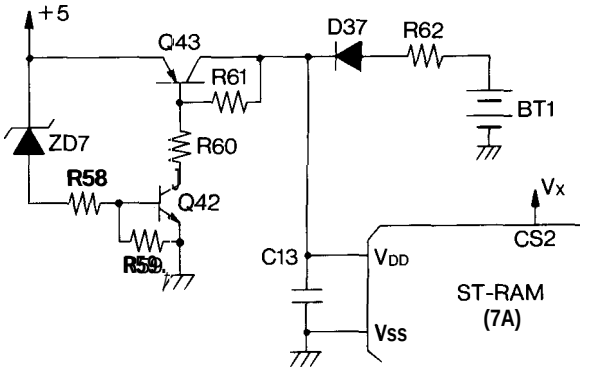


Figure 2-28. Battery Backup Circuit

When the power is turned on under normal conditions, +5 V is applied to V_{DD} of the ST-RAM, and the CPU starts read/write operations. When the power is turned off, and the voltage on the +5 V line drops to about 3.3 V or less, transistors Q42 and Q43 turn off, and the voltage from the lithium battery (BT1) is applied to the V_{DD} terminal of the ST-RAM. In this way, the data in the ST-RAM is maintained.

When the voltage from the lithium battery drops, the initial data for the printer mechanism and settings for the control panel are cleared, and default values are set at power is turned on.

Table 2-21. ST--RAM Conditions with Power On/Off

Printer Power	+5 V Line	CS2 (Pin 26)	V_{DD} [V]	ST-RAM Mode
OFF	L	L	2.4- 2.7	Data holding
ON	H	H	+ 5	Normal

2.3.2 Interface

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

2.3.2.1 8-Bit Parallel Interface

Operating Principles

Figure 2-29 shows the 8-bit parallel interface data transmission timing. Data is transferred between a host computer and the printer using the following sequence:

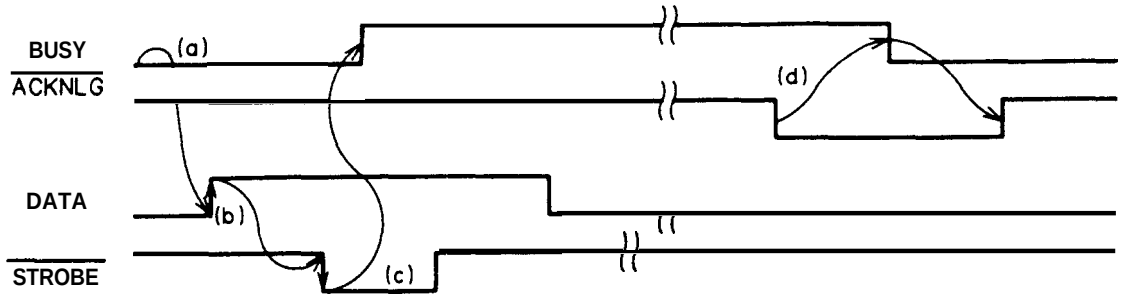


Figure 2-29. 8-bit Parallel Interface Data Transmission Timing

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

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

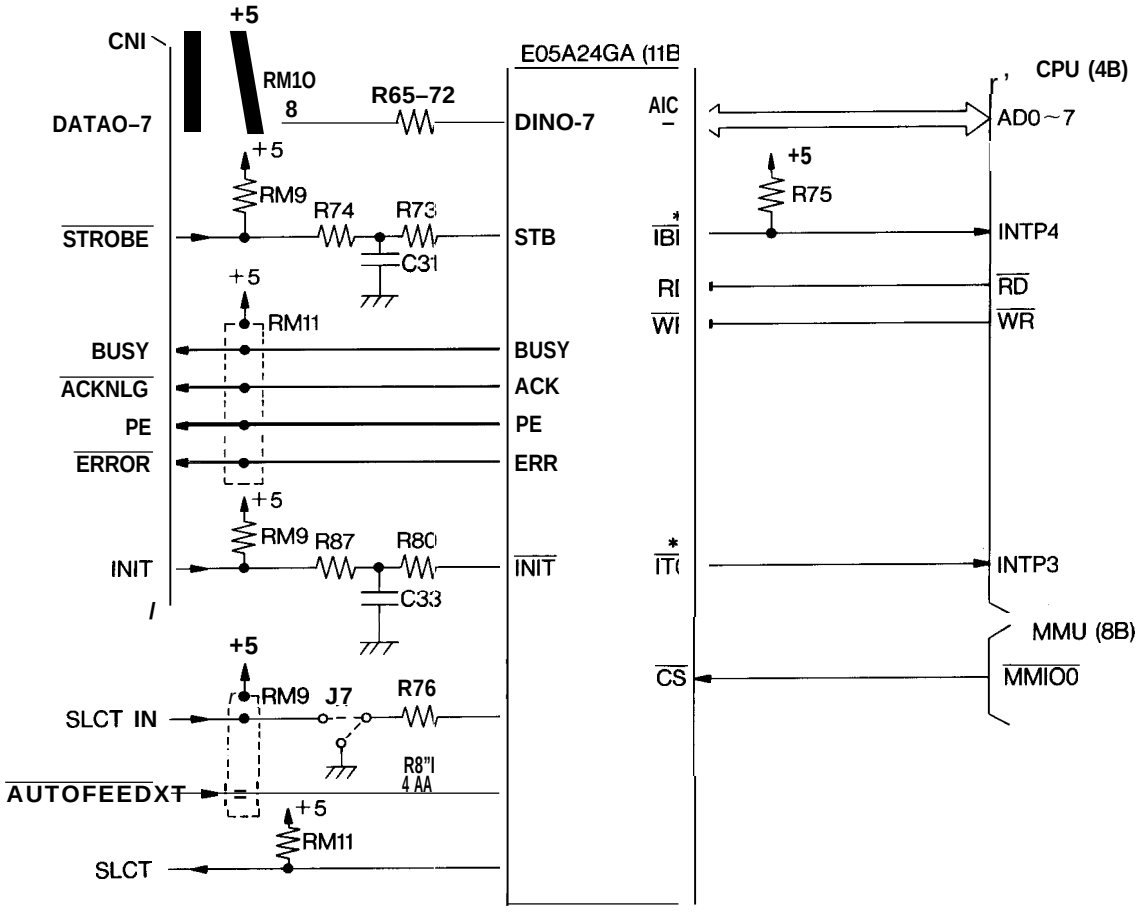
c) After receiving a data word from the host computer, the printer sets the BUSY signal high to inform the host computer that the printer is prosecсing data and is not ready to receive any more data.

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

8-bit Parallel Inteface Circuit

Figure 2-30 shows the 8-bit parallel interface circuit.
Address mapping. for the E05A24GA (11B) is performed by the CPU via the MMU (8B). The gate array IC E05A24GA (11B) is employed to simplify the control required from the CPU.

● Refer to Appendix A.1.1.7 for the details of the E05A24GA.



∗1 : IBF ; It become low when $\overline{\text{STROBE}}$ signal changes from high to low.

∗ 2 : ITO ; it become low when $\overline{\text{INIT}}$ signal changes from high to low.

Figure 2-30. 8-Bit Parellel Interface Circuit

Figures 2-31 and 2-32 show the processing sequence for these signals and the interface signal timing.
Table 2-22 shows the control signals used between the printer and host computer.

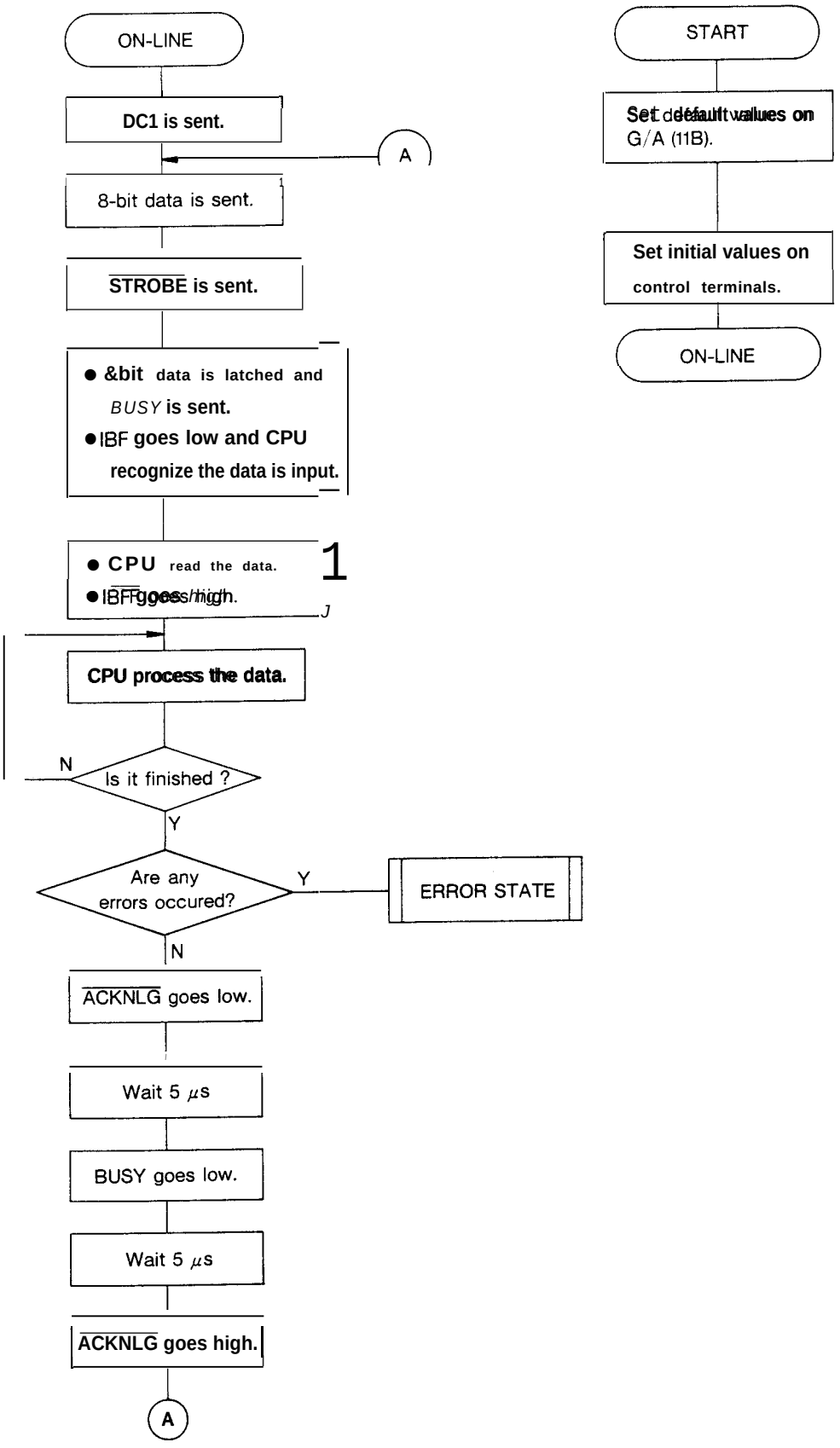


Figure 2-31. 8-Bit Parallel Interface Circuit Operation

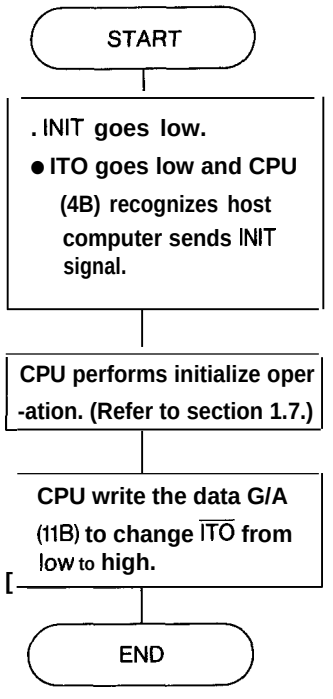


Figure 2-32. INIT Signal Proseccing

Table 2-22. 8-Bit Parallel I/F Signals

READY/ERROR	PE	BUSY	PRINTE	HOST (acknowledge)
H	Disable	Gose high, when STROSE pulse is sent from host.	ON-LINE	READY
L	L	H	OFF-LINE An error has occurred. (for error conditions, refer to Section 1, 7. 1.)	NOT READY
	H		OFF-LINE Paper end has occured.	PAPER END

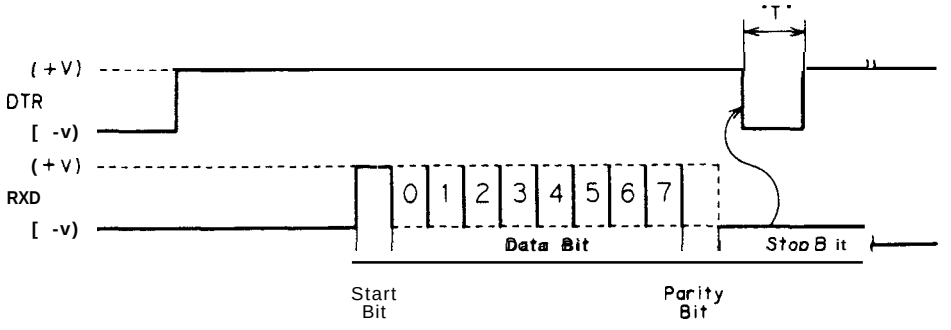
2.3.2.2 RC-232C Serial Interface

Operating Principles

The two handshaking methods are as follows :

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

The DTR signal is set to SPACE (+V) when the printer can accept data and is set to MARK (–V) when the printer is in an error state or when the empty area in the input buffer reaches 256 bytes or less. In this way, handshaking with the host is accomplished by setting the DTR signal to either SPACE or MARK. (Refer to Figure 2-33.)



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

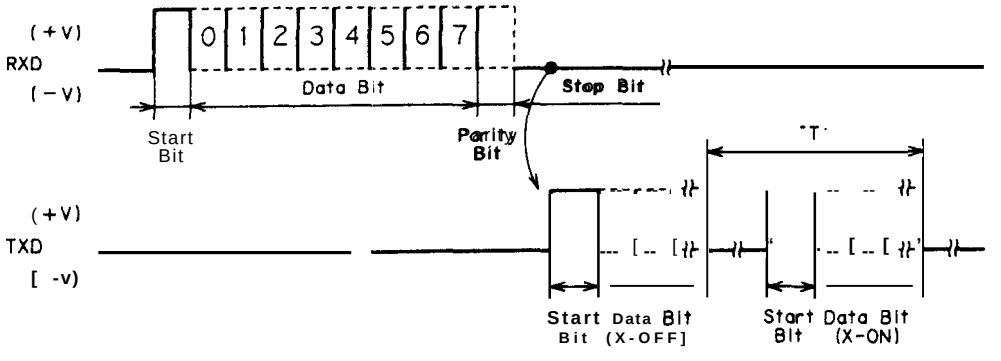
2. The word structure of the serial data is :

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

Figure 2-33. Handshaking with DTR Signal

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

Handshaking is accomplished by sending either X-ON (11H) or X-OFF (13H) over the TXD line to the host. When the printer can accept data, the printer sends an X-ON code. When the printer becomes busy, it sends, an X-OFF code to the host computer. "The X-OFF code is sent to the host when the empty area in the printer input buffer reaches 256 bytes or less, or when the printer is in an error state (Refer to Figure 2-34.).



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

2. The word structure of the serial data is :

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

Figure 2-34. Handshaking with X-ON/X-OFF Protocol

Circuit **Description**

Figure 2-35 shows the RS-232C serial interface circuit. Data transmitted from the host computer is converted from EIA (+3 to +27 V, –3 to –27' V) to TTL O V, +5 V voltage levels by the RS-232C line driver 75189 (10A). The converted data is sent to the CPU via buffers in the E05A24GA (11B). On the contrary, data transmitted from the CPU is sent to the 75188 (9A), converted from TTL to EIA voltage levels, and transmitted to the host computer.

The sequence for the serial interface operation is shown in Figure 2-38, and that for handshaking in Figure 2-37.

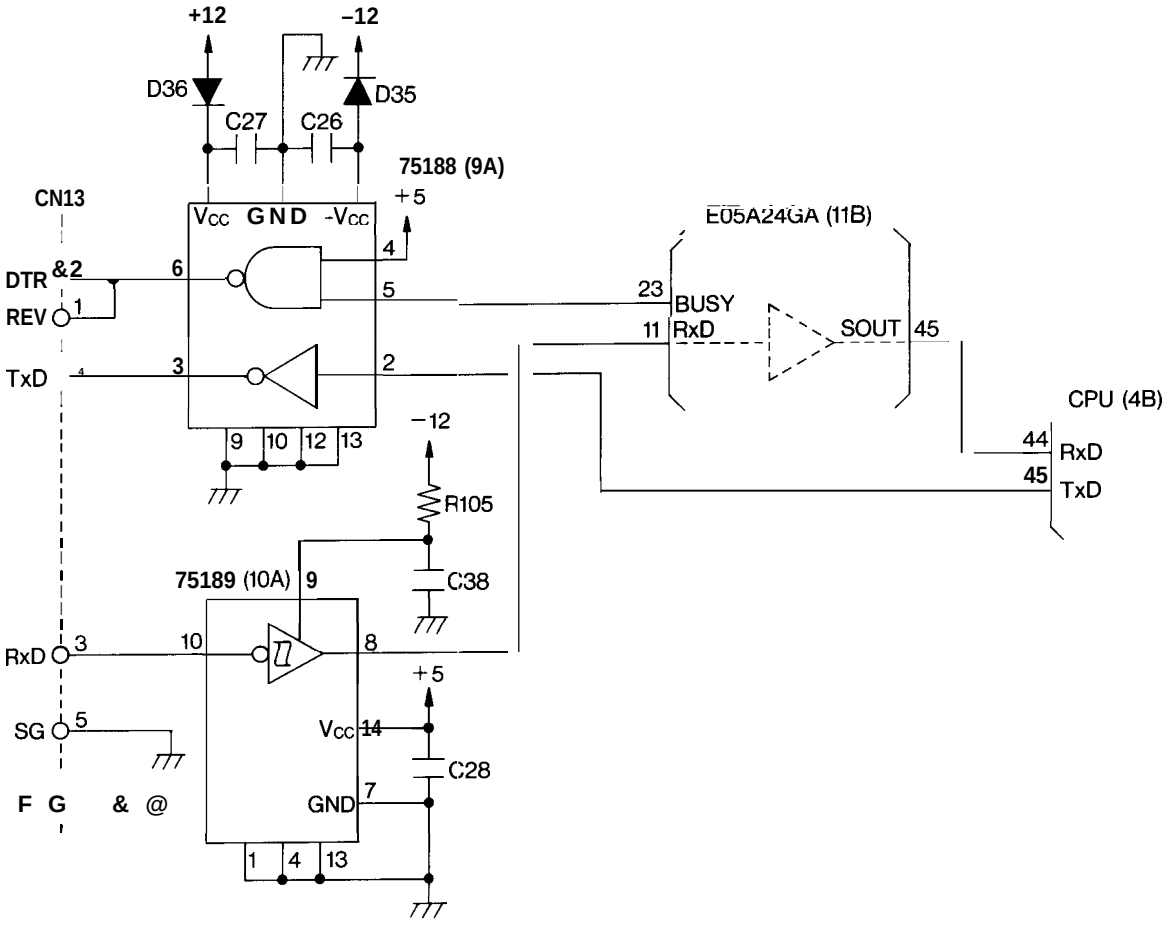


Figure 2-35. RS-232C Serial Interface Circuit

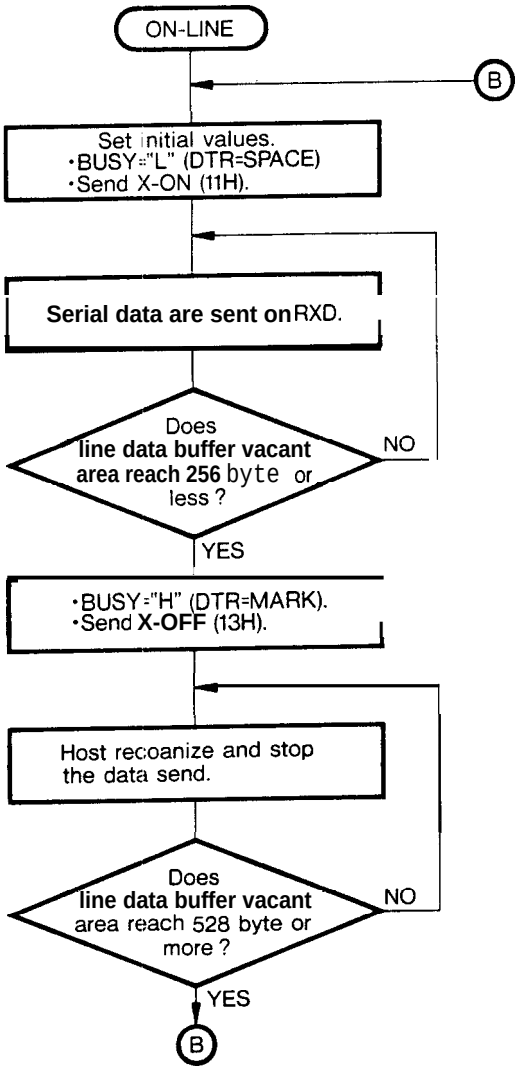


Figure 2-36. RS-232C Serial Interface Circuit Operation

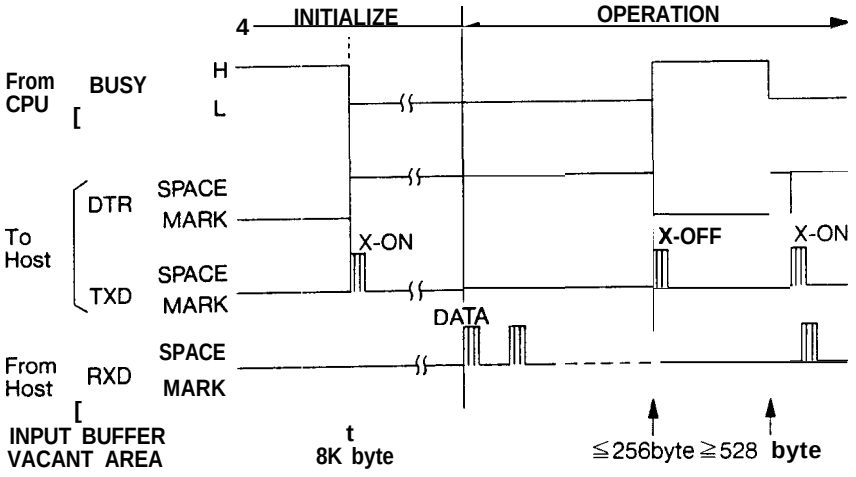


Figure 2-37. RS-232C Data Transmission Timing

2.3.3 Control Panel Interface Circuit

Figure 2-38 shows the control panel interface circuit.

This circuit is mainly divided into the following two blocks:

. LED drive section

● Switch status read section

Descriptions of the above sections will now be given.

● Refer to Figure A-33 for the detailed circuits on the JUNPNL board.

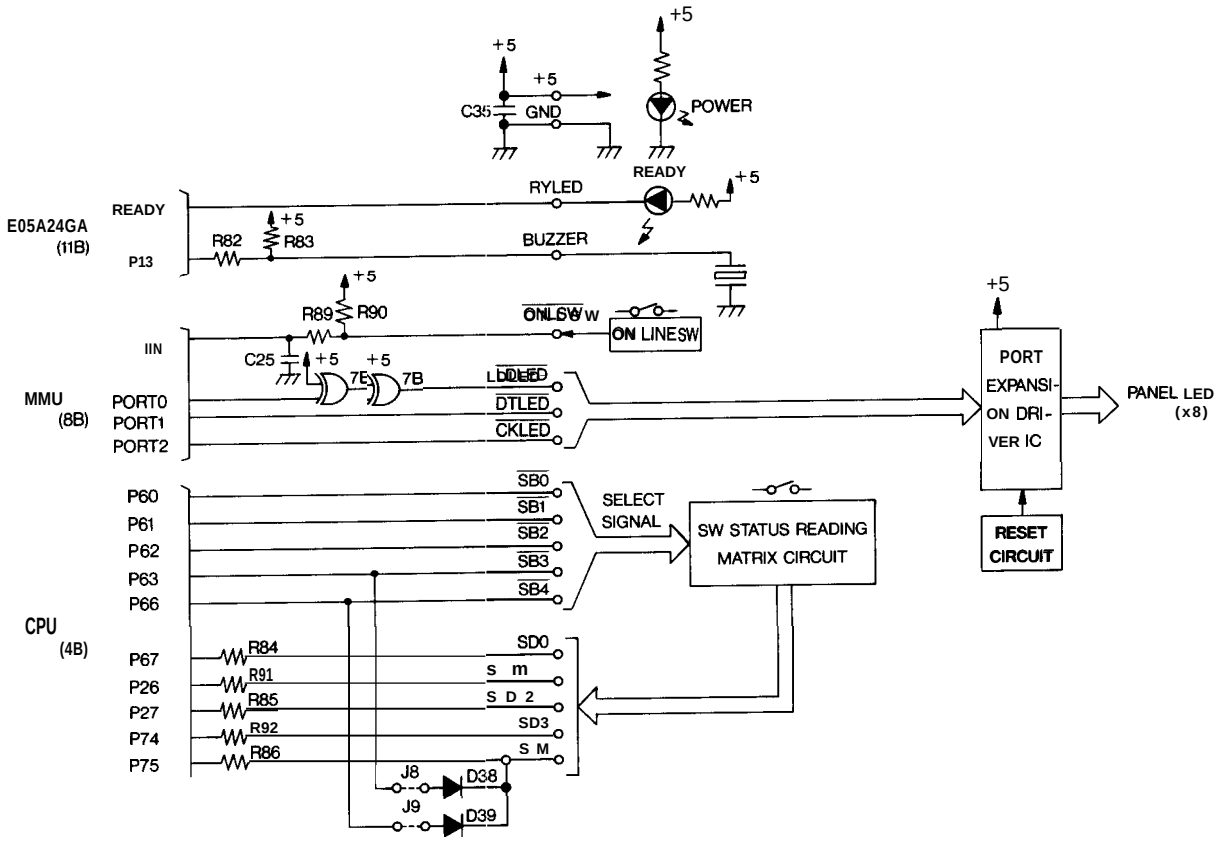


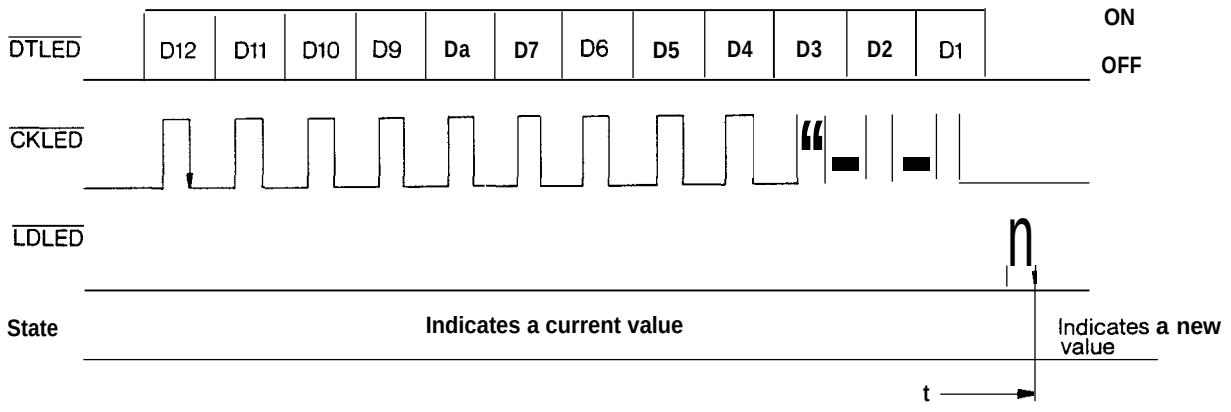
Figure 2-38. Control Panel Interface Circuit

2.3.3.1 LED Drive Section

Each LED is controlled and driven by port expander driver IC MSM58371, which includes a 12-bit shift register and LED drivers.

Figure 2-39 shows the data transfer timing for the MSM58371, and Figure 2-40 shows a block diagram of the MSM58371.

The MSM58371 converts 12-bit serial data ($\overline{DTLED}$) from the CPU into parallel data using a synchronous clock ($\overline{CKLED}$) and trigger signal ($\overline{LDLED}$), then outputs the data to the output ports (01 to 012). Output ports 01 to 08 are used to drive the LEDs, and O9 to 012 are not used.



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

Figure 2-39. MSM58371 Data Transfer Timing

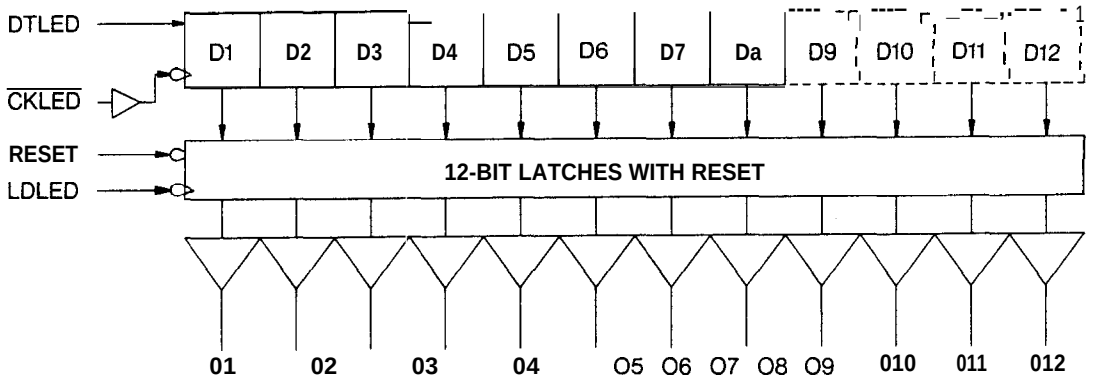


Figure 2-40. MSM58371 Block Diagram

2.3.3.2 Switch Status Read Section

The state of each switch is read periodically by the CPU through five ports (P67, P26, P27, P74, and P75). When the state of a switch is found to be different from the previous value, the new value is transferred to the LED drive section as data to rewrite the switch status.

Since the states of 23 switches and 2 jumper settings must be read using only the five input ports (P67, P26, P27, P74, and P75), a matrix circuit is constructed using five control signals (See Table 2-23).

Table 2-23. Switch Status Reading

CPU									
Control Signal Status (direction : out)					Switches Read (direction : in)				
P60 (SB0)	P61 (SB1)	P62 (SB2)	P63 (SB3)	P66 (SB4)	P67 (SD0)	P26 (SD1)	P27 (SD2)	P74 (SD3)	P75 (SD4)
1	0	0	0	0	SW7	SW9	SW1-4	SW2-1	SW2-6
0	1	0	0	0	SW8	SW3	SW1-5	SW2-2	SW2-7
0	0	1	0	0	SW10	SW1-1	SW1-6	SW2-3	SW2-8
0	0	0	1	0	SW5	SW1-2	SW1-7	SW2-4	[J8]
0	0	0	0	1	SW4	SW1-3	SW1-8	SW2-5	[J9]

NOTES: 1. The parenthesized names are the signal names from connector CN16.

2. The names enclosed in [ ] are jumpers.

2.3.4 State Detection and Sensor Signal Input Circuits

This section describes the state detection circuits on the JUNMM board and sensor signal input circuits. Table 2-24 lists the state detection circuits on the JUNMM board. Table 2-25 lists the sensors connected to the JUNMM board.

Table 2-24. State Detection Circuits

Name	Description	CPU Signal Reading Port	Reference Section
35V Line Voltage Detection Circuit	Monitors the 35 V line voltage	AN1	2. 3.4.2
VR1 Reading Circuit	Reads the correction value for bidirectional printing in the Draft mode	AN2	2. 3.4.3
VR2 Reading Circuit	Reads the correction value for bidirectional printing in the LQ mode	AN3	

Table 2-25. Sensors

Name	Positon	Type	Description	CPU Signal Reading Port	Reference Section
Printhead temperature sensor	Printhead	Thermistor	Detects the printhead temperature	AN0	2. 3.4.4
CR HP sensor	Printer mechanism	Photo interrupter	Detects the carriage home position	P22	2. 3.4.5
CS sensor	Printer mechanism	Photo interrupter	Detects the color ribbon position	P23	2. 3.4.6
PG sensor	Printer mechanism	Mechanical switch	Detects head adjustment lever position	P37	2. 3.4.7
PE sensor	Printer mechanism	Mechanical switch	Detects whether paper exists or not	P21	2. 3.4.8
F/T sensor	Printer mechanism	Mechanical switch	Detects paper feeding meted	P35	2. 3.4.9

2.3.4.1 Reference Voltage Supply Circuit

Figure 2-41 shows the circuit that supplies reference voltage AVREF (4.75 VDC) to the A/D converter in the CPU. In this circuit, programmable shunt a regulator TL431(5B) is used to output the reference voltage.

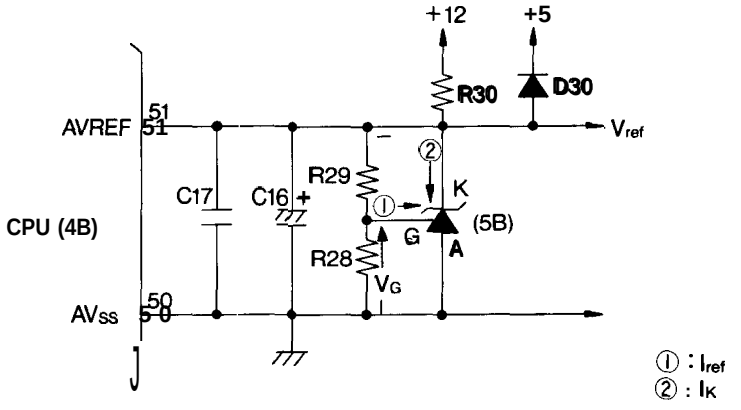


Figure 2-41. Reference Voltage Supply Circuit

Reference voltage AVREF for the A/D converter is determined by the combination of resistors R28 and R29 connected in parallel with the TL431.

$$AVREF = Vref = V_G \cdot \left(1 + \frac{R29}{R28}\right) + Iref \times R29 = 4.75 \ [V]$$

where, Iref = 2 [μA]

V_G = 2.50 [V]

As shown by the above expression, AVREF is regulated to approximately 4.75 [V].

2.3.4.2 35 V Line Voltage Detection Circuit

As shown in Figure 2-42, this circuit detects the voltage on the 35 V line. The detected voltage is divided by R51 and R52, and the voltage at point Ⓐ is input to the AN1 terminal of the CPU.

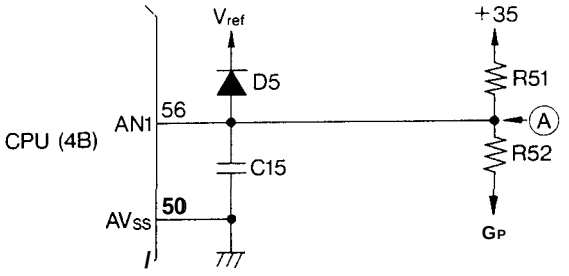


Figure 2-42. 35 V Line Voltage Detection Circuit

In Figure 2-43 and Table 2-26, if the +35 V line drops to +31.7 V or less during high-duty cycle printing, the printer is protected as follows:

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

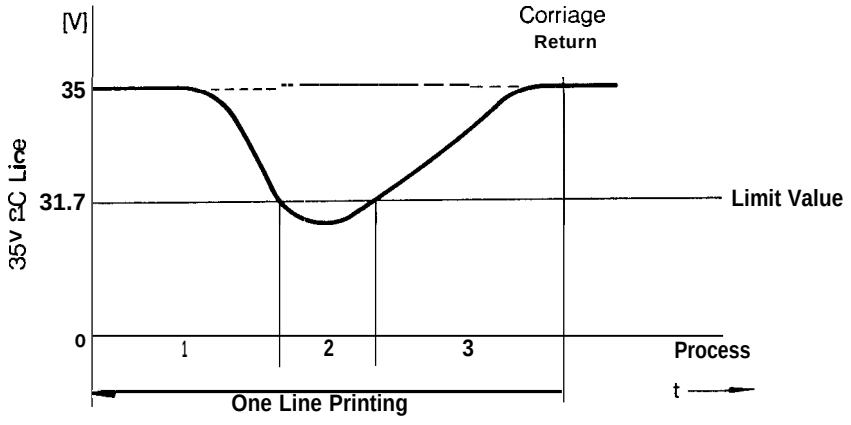


Figure 2-43. 35 V Line Protection

Table 2-26 shows the relationship between the 35 V line voltage and the input voltage at AN1.

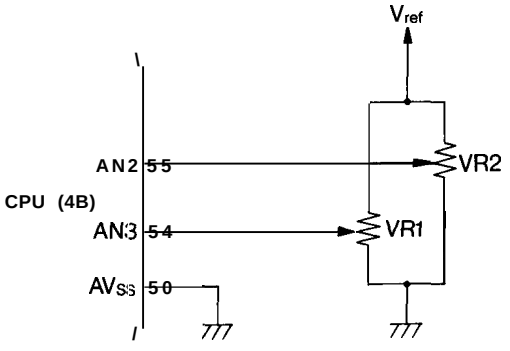
Table 2-26. Relationship 35 V Line and AN1 Voltages

35 V Line Voltage [V]	AN1 Terminal Voltage [V]
35	3.89
31.7*1	3.52

* 1 :Lower limit

2.3.4.3 VR1/VR2 Reading Circuit

Figure 2-44 shows the VR1/VR2 reading circuit. The values (voltages) set by VR1 and VR2 are used to control the corrections for bidirectional printing in the Draft and LQ modes.
VR1 is used for bidirectional printing in the LQ mode, and VR2 is used for bidirectional printing in the Draft mode.



NOTE: Refer to Section 4.3.3.1 for adjustment of VR1 and VR2.

Relationship **Figure 2-44. VR1/VR2 Reading Circuit**

Table 2-27 shows the relationship between the VR1/VR2 values and the terminal voltages at AN3/AN2.

Table 2-27. Relationship VR1/VR2 Values and AN3/AN2 Voltages

VR1/VR2 value	MAX. -MIN. [V]
AN3/AN2 terminal voltage	4.75-o

2.3.4.4 Printhead Temperature Detection Circuit

Figure 2-45 shows the printhead temperature detection circuit. This circuit detects the temperature using a thermistor in the printhead.

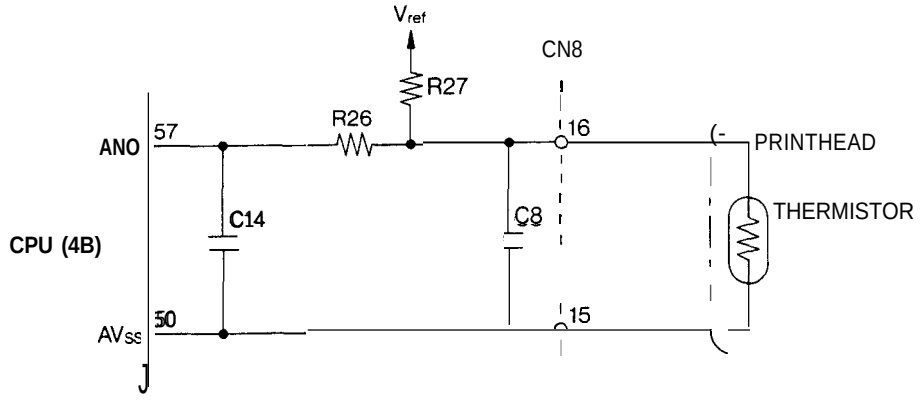


Figure 2-45. Printhead Temperature Detection Circuit

The temperature of the printhead rises as the solenoids in the printhead continue to be driven. To prevent the solenoids from burning, printer operates as shown in Figure 2-46.

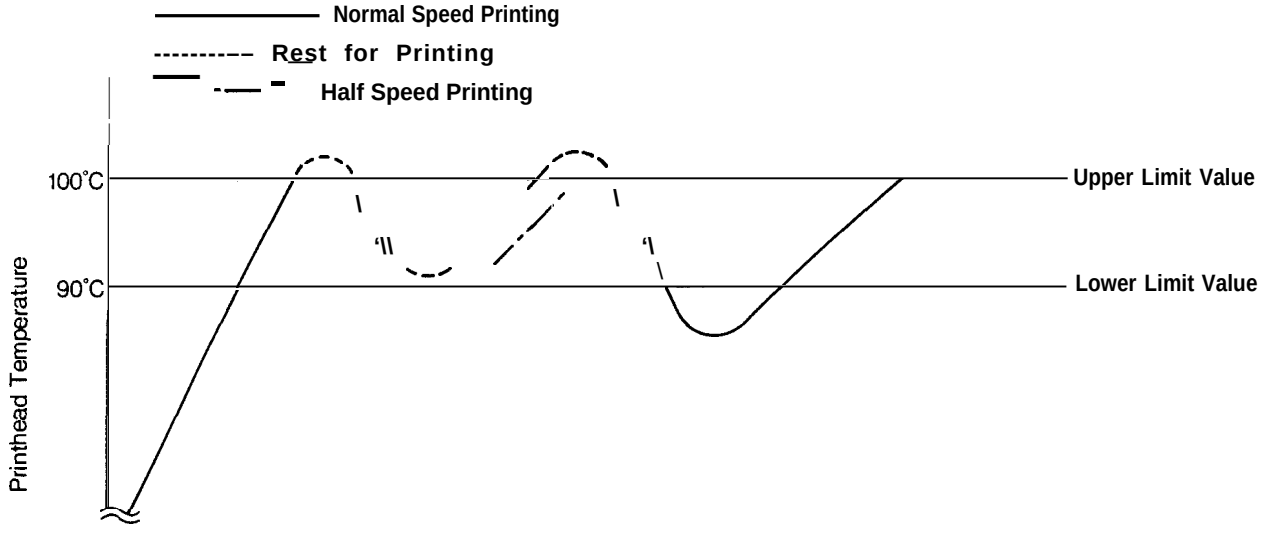


Figure 2-46. Relationship Printhead Temperature and Printing Operation

If the printhead temperature exceeds the upper limit (1 OO"C), printing is automatically stopped. In this state, the ON LINE LED blinks.
When the printhead temperature drops to the upper limit or less, printing is resumed at half speed.
When the printhead temperature drops 1:0 the lower limit (90°C) or less, the normal printing speed is automatically resumed.

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

Table 2-28 shows the relationship between the upper/lower limit values for printhead temperature, and the voltage at the AN0 terminal of the CPU.

Table 2-28. Relationship Printhead Temperature and AN0 Voltage

	Temperature [°C]	AN0 Terminal Voltage [V]
Upper limit	100	0.82
Lower limit	90	1.01

2.3.4.5 CR HP Sensor Circuit

Figure 2-47 shows the CR HP sensor circuit, This circuit determines the home position of the carriage.

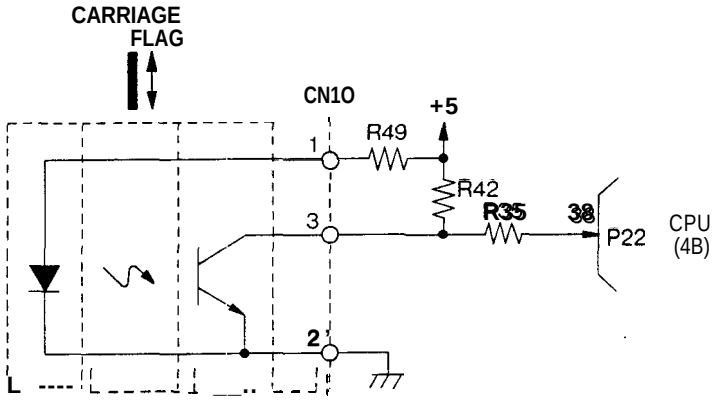


Figure 2-47. CR HP Sensor Circuit

Table 2-29 shows the relationship between the carriage flag and the voltage at the P22 terminal of the CPU.

Table 2-29. Relationship Flag and P22 Voltage

Carriage Flag Position	P22 Terminal Voltage [V]
At the home position	5
Outside the home position	0

2.3.4.6 CS Sensor Circuit

Figure 2-46 shows the CS sensor circuit. When the color printing is executed, the circuit detects the color home position (black) and each color ribbon section (cyan, magenta, and yellow) of the color ribbon.

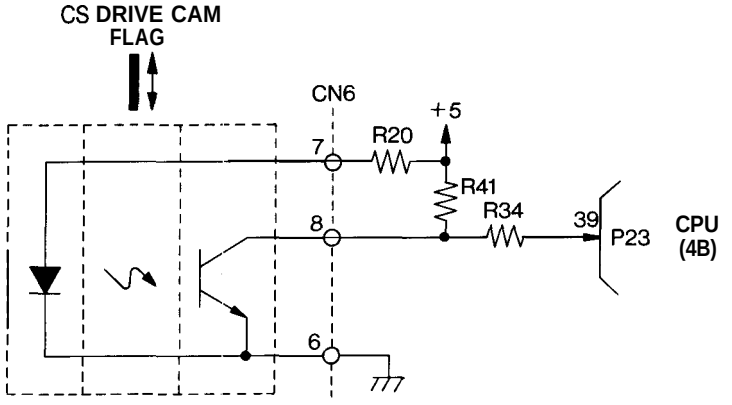


Figure 2-48. CS Sensor Circuit

Table 2-30 shows the relationship between the CS drive cam flag and the voltage at the P23 terminal of the CPU.

Table 2-30. Relationship Flag and P23 Voltage

CS Drive Cam Flag Position	P23 Terminal Voltage [V]
Flag	5
Slit	o

2.3.4.7 PG Sensor Circuit

Figure 2-49 shows the PG sensor circuit. The circuit detects the position (platen gap) of the head adjustment lever of the printer mechanism, and selects either normal or COPY mode at printing.

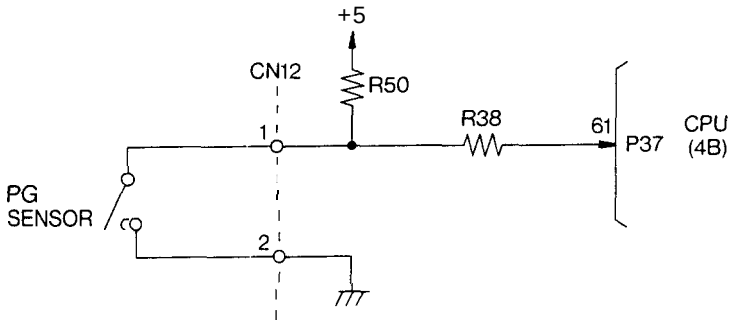


Figure 2-49. PG Sensor Circuit

Table 2-31 shows the relationship between the head adjustment lever position and the voltage at the P37 terminal of the CPU.

Table 2-31. Relationship Head Adjustment Lever Position and P37 Voltage

Head Adjustment Lever Position	P37 Terminal Voltage [V]
1 - 3	5
4 - 8	0

2.3.4.8 PE Sensor Circuit

Figure 2-50 shows the PE sensor circuit. This circuit determines whether paper exists in the printer or not.

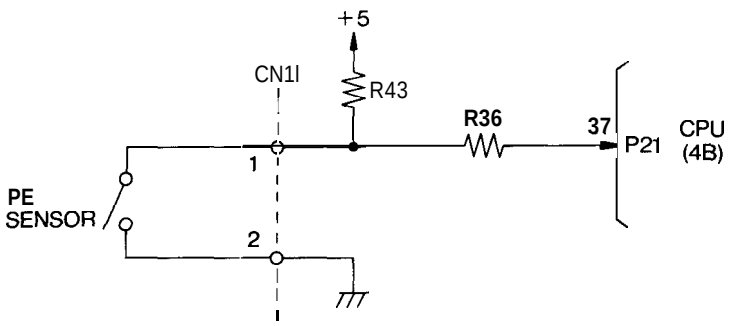


Figure 2-50. PE Sensor Circuit

Table 2-32 shows the relationship between the paper state and the voltage at the P21 terminal of the CPU.

Table 2-32. Relationship Paper State and P21 Voltage

Paper State	P21 Terminal Voltage [V]
Loading (Paper exists)	5
Ejecting (Paper out)	0

2.3.4.9 FIT Sensor Circuit

Figure 2-51 shows the F/T sensor circuit. **The circuit detects the paPer release lever position (paper feed system) of the printer mechanism.**

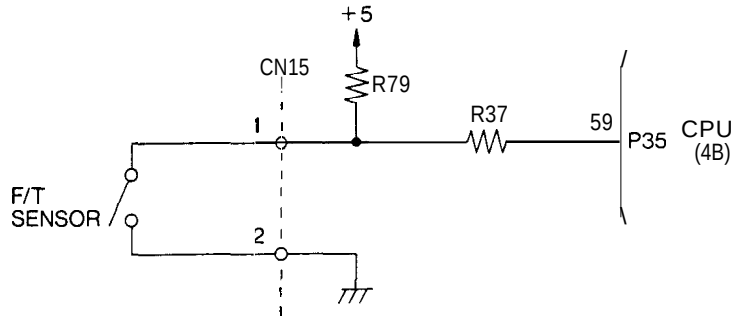


Figure 2-51. F/T Sensor Circuit

Table 2-33 shows the relationship between the paper release lever position and signals at the CPU port P35.

Table 2-33. Relationship Paper Release Lever Position and P35 Voltage

Paper Release Lever Position	P35 CPU Terminal Voltage [V]
Friction	5
Tractor	0

2.3.5 Printhead Control and Drive Circuit

Figure 2-52 shows the printhead control/drive circuit block diagram.
The CPU (4B) transmits print data for one line in three steps (8-bit data x 3 =24 dots) and stores the data in control gate array E05A02LA (2A), then CPU outputs the printhead trigger pulse (HPW) to the E05A02LA. When the HPW signal is low, the drive transistors which drive the printhead coils are activated, and printing is executed.
The CPU monitors the printhead internal temperature to prevent the printhead coil from burning, and also monitors platen gap (depend on the head adjustment lever position) and +35 V line voltage in order to apply the correct print energy to the printhead coils in accordance with the paper thickness.

- **Refer to Appendix A.1.1.5 for the details of the E05A02LA.**

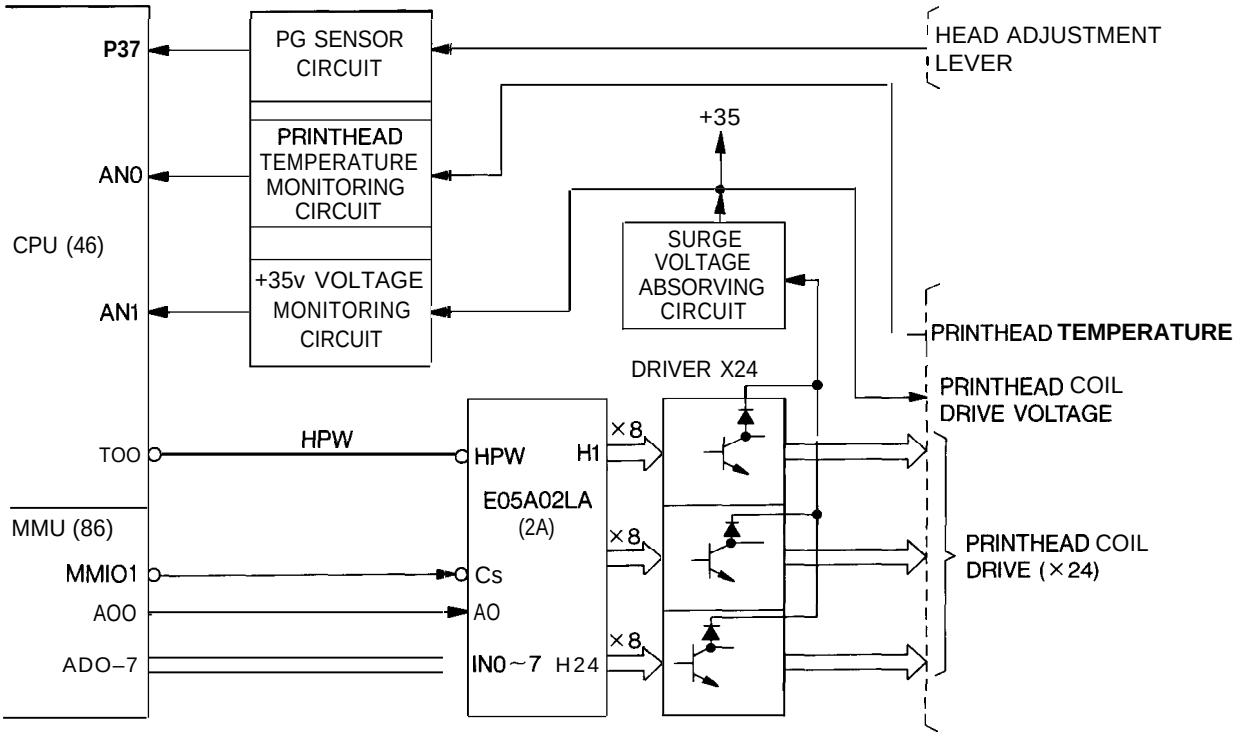


Figure 2-52. Printhead Control/Drive Circuit Block Diagram

2.3.5.1 Relationship Between Paper Thickness and Print Mode

The CPU detects a platen gap value (head adjustment lever position : Ist to 3rd position/4th to 8th position) via the F/T sensor. With this value, the CPU controls the printhead drive cycle and drive pulse so that printing energy will be appropriate. (See Table 2-34.)

Table 2-34. Relationship Printhead Coil Drive Cycle and Print Mode

Print Mode		XI [Hz]	x2 [μs]	DPI*1	Print Mode		Carriage Speed [PPS]
					Text"2	Bit Image	
Normal	o	1350	210	90	Super draft	—	3600
	1	1350	210	120	Draft	8-dot normal-density, double-speed double-density, 24-dot normal-density	2700
	2	1350	210	180	—	8-dot CRT graphics II, 24-dot CRT graphics II	1800
	3	1300	210	240		8-dot double-density, quadruple-density, 24-dot double-density	1350
	4	1350	210	360	LQ	24-dot triple-density	900
copy	5	675	230	90	Normal O copy mode		1800
	6	900	230	120	Normal 1 copy mode		1800
	7	675	230	180	Normal 2 copy mode		900
	8	900	230	2'40	Normal 3 copy mode		900
	9	900	230	360	Normal 4 copy mode	24-dot quadruple-density	600

*1 : including half dots. V/hen number of dots. are counted in dots, the value becomes a half.

*2 : This column shows main printing modes executed at normal pitch.

NOTES : 1. XI and X2 are values when the +35 V line is at 35 VDC. (For XI and X2, see Figure 2-54.)

2. When the head adjustment lever is set at any of 4th to 8th position, the printing mode becomes the copy mode, in this mode, carriage speed and printhead drive cycle change when compared to the normal mode (Ist to 3rd position).

2.3.5.2 Relationship Between Printhead Drive Pulse Width and +35 V Line Voltage

As described in Section 2.3.5.1, this printer has two kinds of printhead drive pulse widths depending on the head adjustment lever position. Figure 2-53 shows the relationship between the printhead drive pulse width and +35 V line voltage.

To keep the energy (W·s [J]) applied to the printhead coil constant, the drive pulse width of the HPW signal (see Figure 2-54) is controlled by the CPU internal clock depending on the +35 V line voltage.

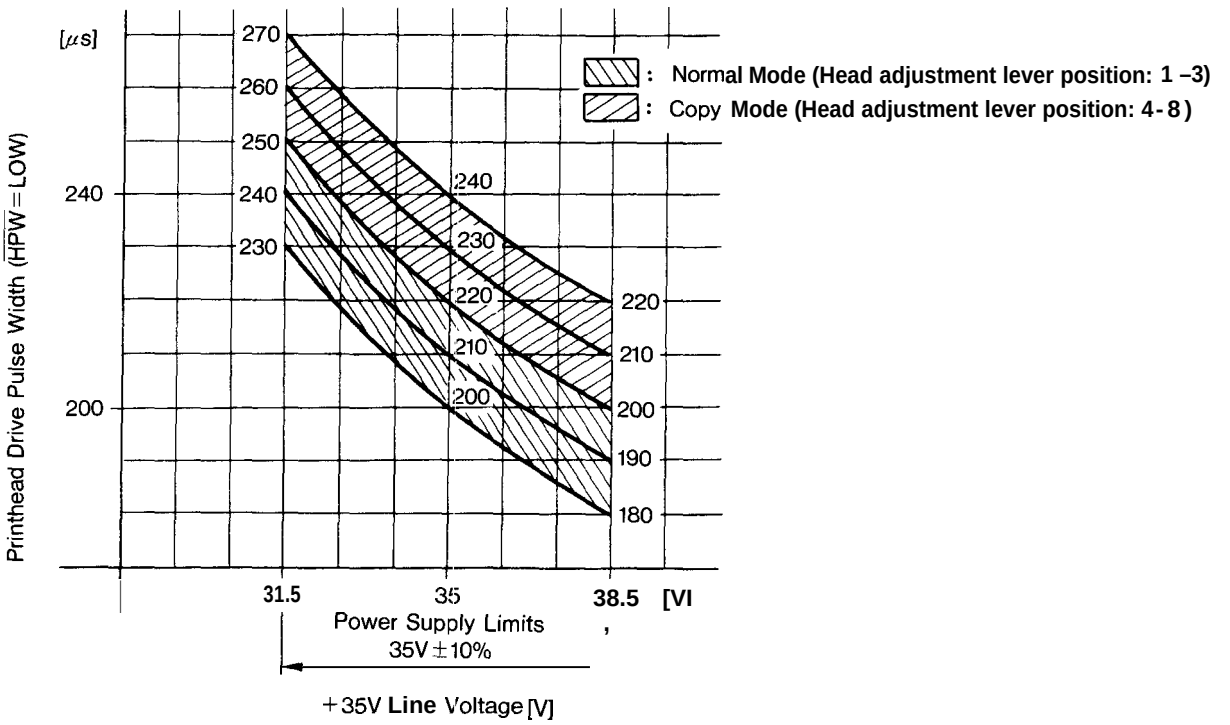
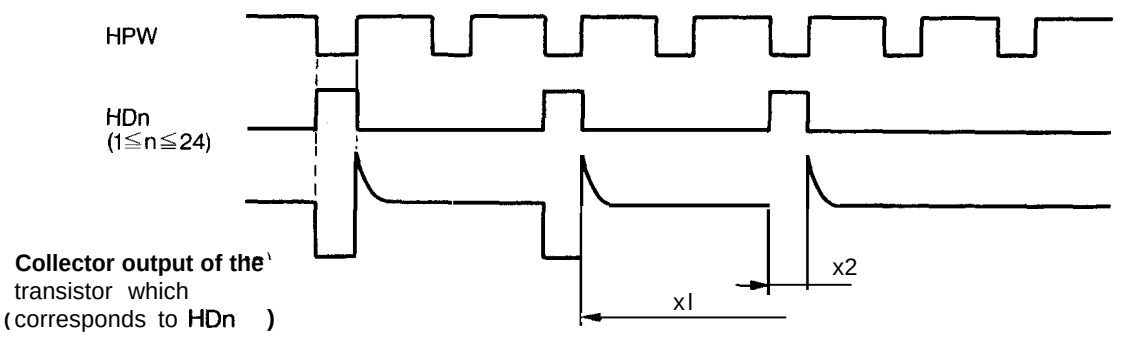


Figure 2-53. Relationship Printhead Drive Pulse Width and +35 V Line Voltage



X1.....1 dot printing cycle

X2..... Printhead drive pulse width

Figure 2-54. Printhead Drive Pulse Timing

2.3.6 CR Motor Control and Drive Circuit

Figure 2-55 shows the CR motor control/drive circuit block diagram.

The CR motor is controlled by the CPU (46). Phase switching signals are output from the CPU ports (P00 to P03) which have the real time output function.

The phase switching signal output from the CPU is sent to the constant current drive IC (1A). In order **to drive the carriage motor at constant speed, the IC inputs the reference voltage which corresponds to the motor speed. The reference voltage is controlled by the CPU via the gate array IC (11B) for extended ports.**

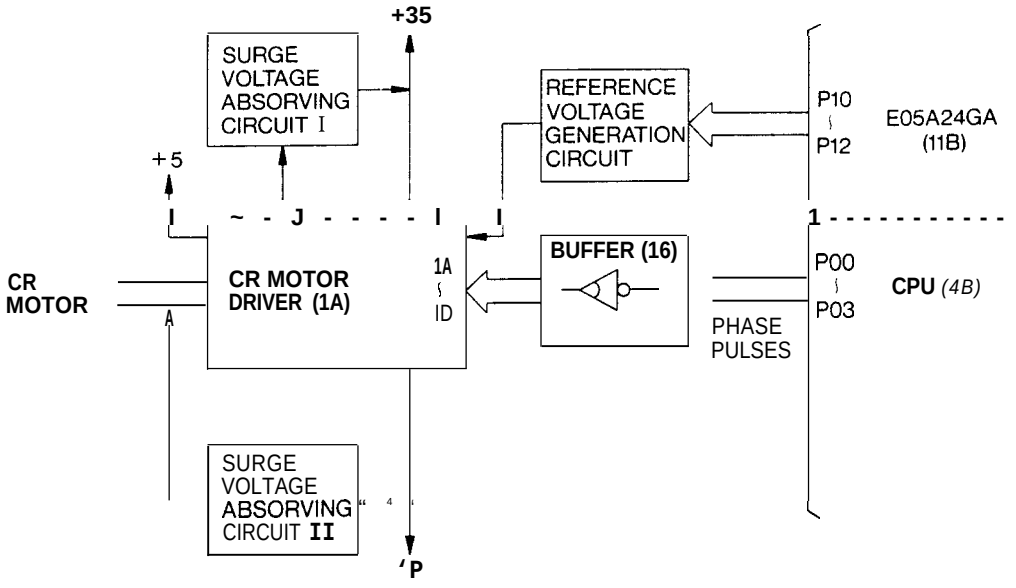


Figure 2-55. CR Motor Control/Drive Circuit Block Diagram

2.3.6.1 Reference Voltage Generation Circuit

Figure 2-56 shows the reference voltage generation circuit and Table 2-35 shows the relationship between each terminal state of the gate array E05A24GA (11B) and CR motor coil current.
This circuit changes the voltage applied to 'the RX terminal of the CR motor driver IC SI7300A (1A) using the combination of R5, R6, R7, and R8 so that the current limiting value for the current flowing to a coil of the CR motor varies.
The current limit is raised as the carriage speed increases by changing the voltage applied to the RX terminal.

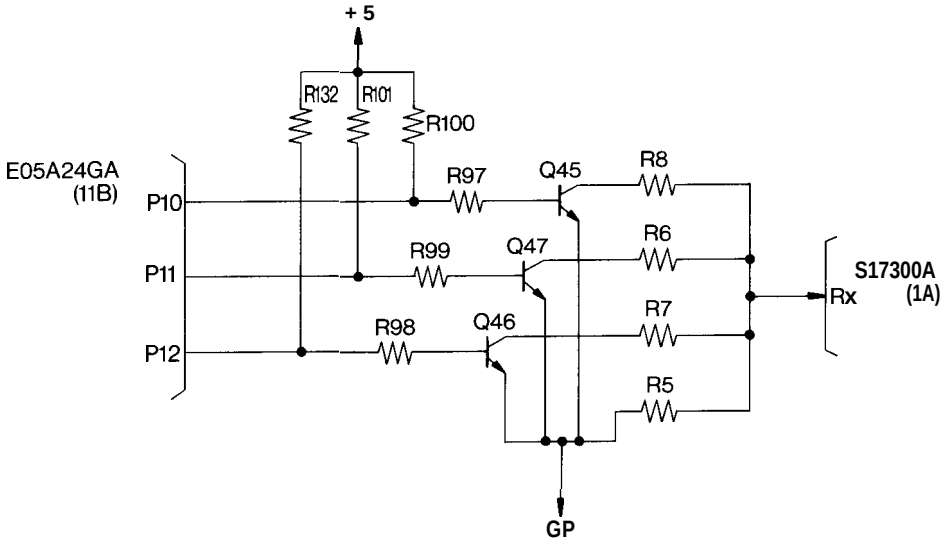


Figure 2-56. Reference Voltage Generation Circuit

Table 2-35. Relationship E05A24GA Terminal States and CR Motor Coil Current

RX Terminal Voltage	P10	P11	P12	State	CR Motor Coil Current [A/Coil]
High	H	H	H	Driving	1.2
	L	H	H		0.8
I	H	L	H		0.6
Low	H	H	L	Holding	0.15

2.3.6.2 CR Motor Drive Circuit

Figure 2-57 shows the CR motor drive circuit. Figure 2-58 shows the **CR** motor drive circuit signal timing. This circuit employs unipolar stepper motor driver IC SI7300A **(1A), and drives the CR motor using constant current chopper type control. The chopper** type **control is performed by a separately-excited system. The + 35 V power supply voltage is applied intermittently to the CR motor coil from** COMAB **and** COMCD **so that a mean voltage is applied to the CR motor** coil, **which keeps the CR motor current constant.**

. Refer to Appendix A.1.1.8 **for details of** the SI7300A.

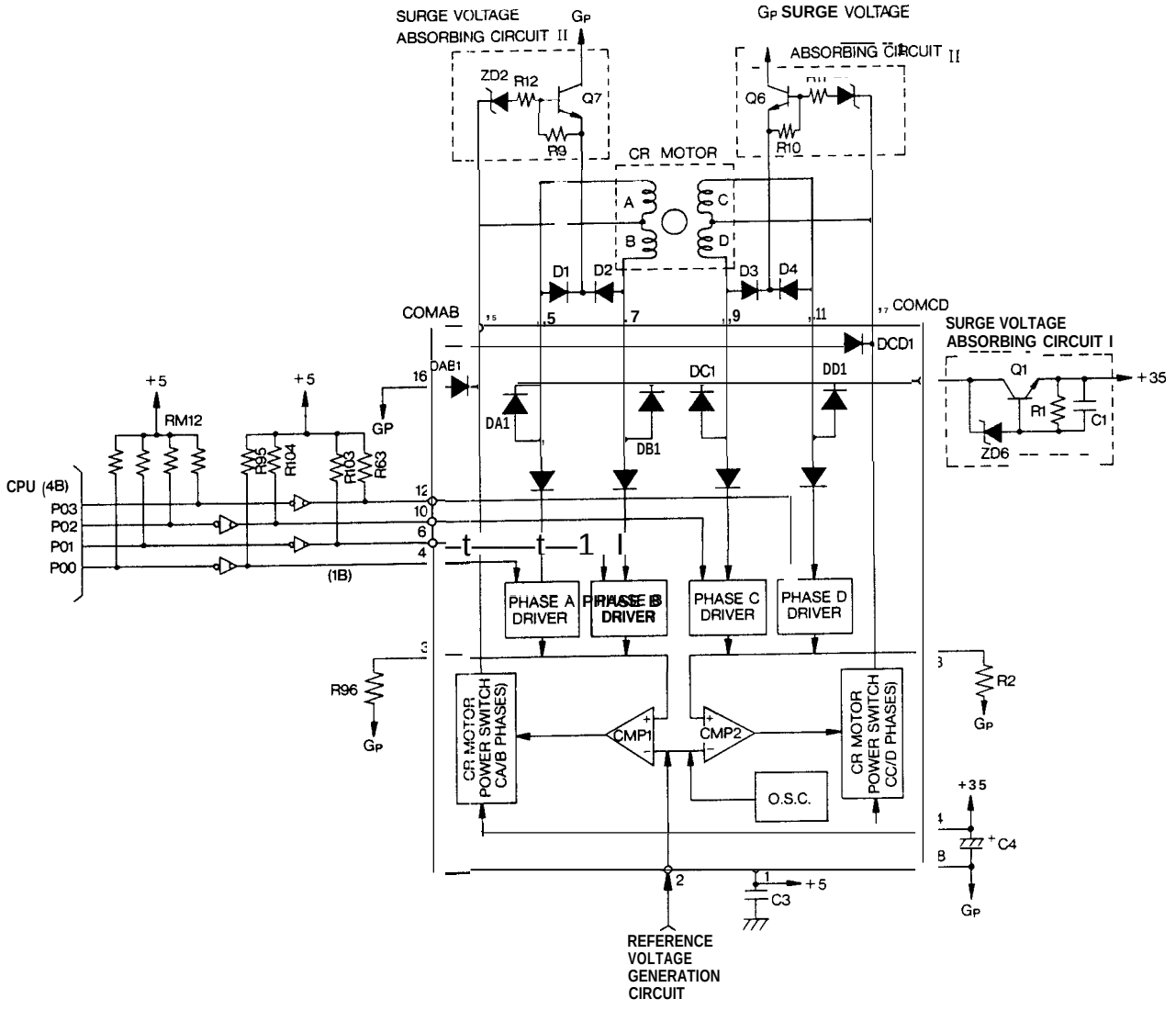
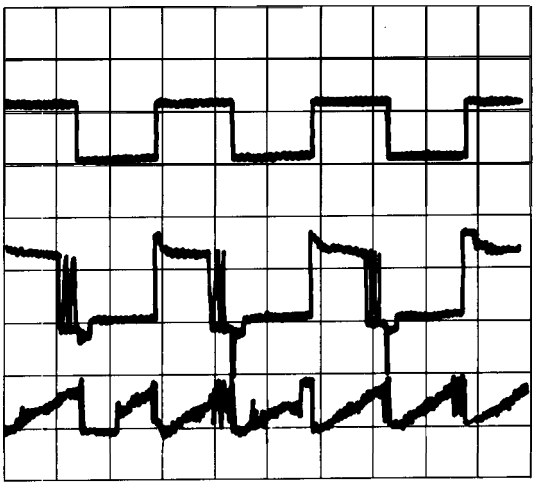


Figure 2-57. CR Motor Drive Circuit



NOTE: In the Draft, normal self test mode:

Figure 2-58. CR Motor Drive Circuit Signal Timing

The blocks are as follows.

Phase Drivers (A to D)

These drivers are turned on and off upon receiving the drive pulses POO to P03 from the CPU (4B) via inverter **(I B). When the drive pulse is LOW, the corresponding phase driver turns on.**

CMP1 and CMP2

CMP1 or CMP2 **compares the reference voltage at the minus terminal with the voltage applied to the plus terminal, which is from the current detection resistor** (R96 or R2). **When the reference voltage is lower than the voltage across the current detection resistor, the CR motor power switch** turms **off, and the voltage applied to COMAB or COMCD is shut off.**

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

This switch is turned on and off upon receiving the output from CMP1(CMP2). **When the output from** CMP1 (CMP2) **is LOW, +35 V is applied to COMAEI** (COMCD).

o. S. C.

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

Current Detection Resistors (R96 and R2)

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

Reference Voltage Generation Circuit

The current applied to the CR motor coil is determined by the reference voltage applied to the minus terminal of CMP1(CMP2). **(Refer to Section** 2.3.6.1 **Reference Voltage Generation Circuit.)**

Surge Voltage Absorbing Circuit 1

When the phase A driver or phase B driver (phase C driver or phase D driver) turns off, positive surge voltage is induced at the CR motor coil. This voltage is absorbed by ZD6 **via flywheel diode DA1 or DB1** (DC1 or DD1).

Surge Voltage Absorbing Circuit II (II')

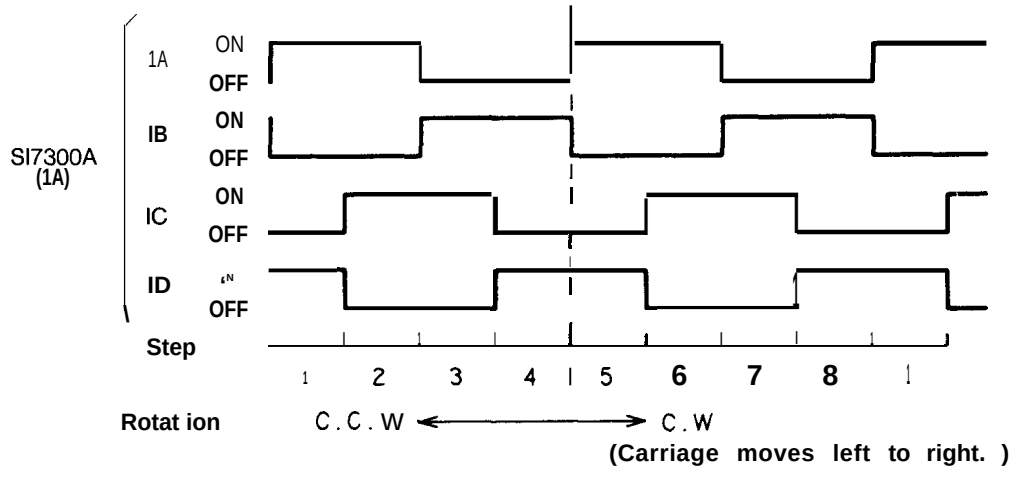
When the phase A driver or phase B driver (phase C driver or phase D driver) turns on, negative surge voltage is induced at the CR motor coil. This voltage is absorbed by ZD2 (ZD1) **via flywheel diode DABI** (DCD1).

2.3.6.3 CR Motor Control

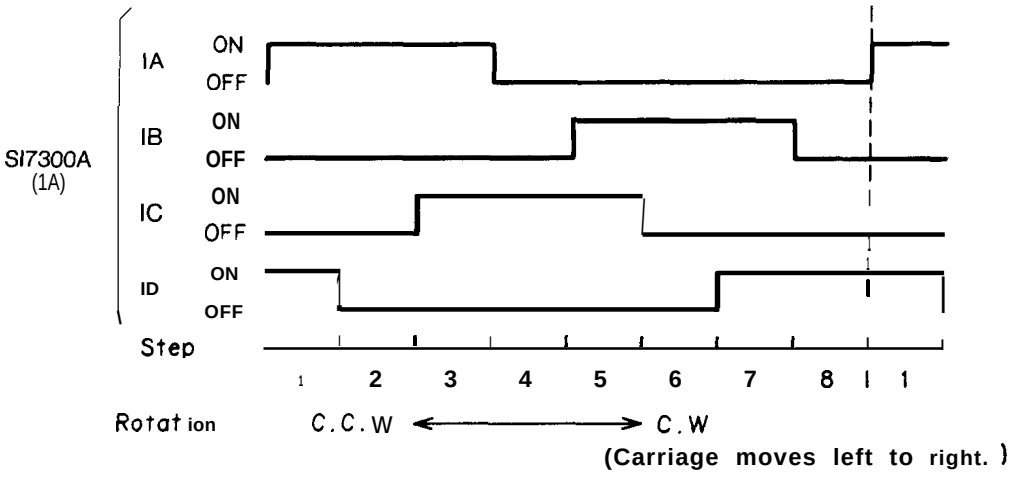
CR Motor Phase Switching System

The CR motor is a 4-phase stepper motor, and each phase is controlled by the corresponding terminal (POO to P03) of the CPU (4B) via the inverter (16). Two phase switching systems are used; 2-2 phase switching and 1-2 phase switching.

One step of the 2-2 phase switching system corresponds to two steps of the 1-2 system. Figure 2-59 shows the CR motor phase switching timing. Table 2-36 shows the relationship between the CR motor speed and the phase switching system.



a) 2-2 Phase Excitation



b) 1-2 Phase Excitation

Figure 2-59. CR Motor Phase Switching Timing

Table 2-36. Relationship CR Motor Speed and Phase Switching System

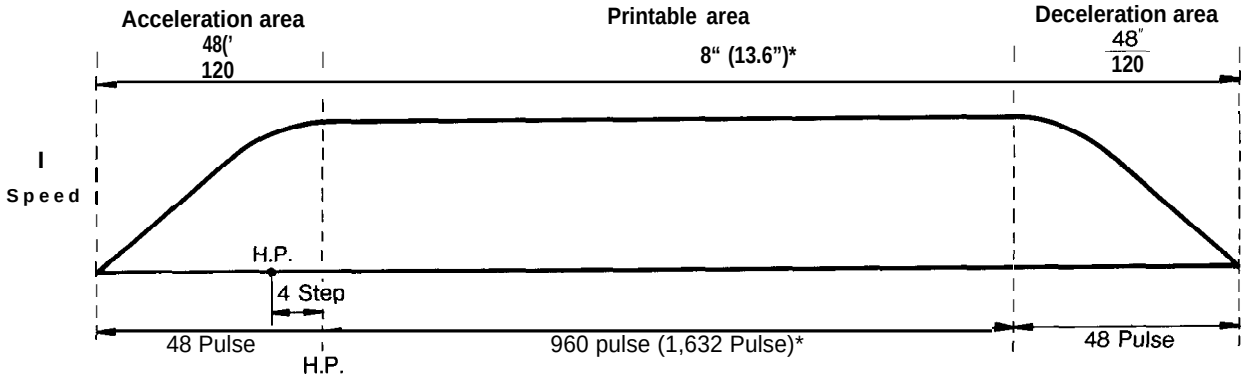
State		Driving						Holding
Speed No.		0	1	2	3	4	5	
Phase Switching System		2-2			1-2			2-2
Carriage Speed [PPS]		3600	2700	1800	1350	900	600	—
Cycle [μs/step]		278	370	556	741	1111	1667	
CR Motor Coil Current [A/coil]	Constant Speed, Deceleration	0.8	0.8	0.6	0.6	0.6	0.6	0.15
	Acceleration	1.2	1.2	0.8	0.6	0.6	0.6	

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

Carriage Motion Area and Speed Control

The carriage motion area is shown in Figure 2-60. This is mainly divided into three areas: 1) acceleration area, 2) printable area, and 3) deceleration area.

The printer has six carriage speeds (Refer to Table 2-36.).



*** : ( ) means LQ-106O.**

Figure 2-60. Carriage Motion Area

1. Acceleration Control

When the carriage speed is O, the carriage is accelerated for 60 steps using 2-2 phase switching.
When the speed is 1 or 2, the carriage is accelerated for 48 steps using 2-2 phase switching.
When the speed is 3, 4, or 5, the carriage is accelerated for 48 steps using 1-2 phase switching.

2. Constant Speed Control

Within the printable area, the carriage moves at a constant speed except when the logic seeking function is active.

3. Deceleration Control

When the speed is O, the carriage is decelerated for 60 steps using 2-2 phase switching.
When the speed is 1 or 2, the carriage is decelerated for 48 steps using 2-2 phase switching.
When the speed is 3, 4, or 5, the carriage is decelerated for 48 steps using 1-2 phase switching.

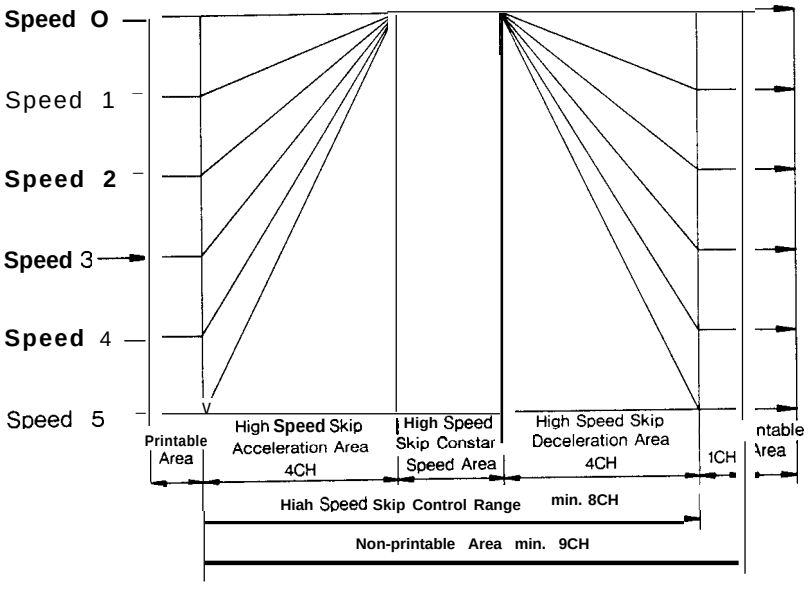
4. High Speed Skip (constant speed + high speed skip)

When spaces (20H) continue for 9 characters or more during text printing (10CPI), high speed skipping will be performed. This function is shown in Figure 2-61 a) and is used to shorten the printing time.

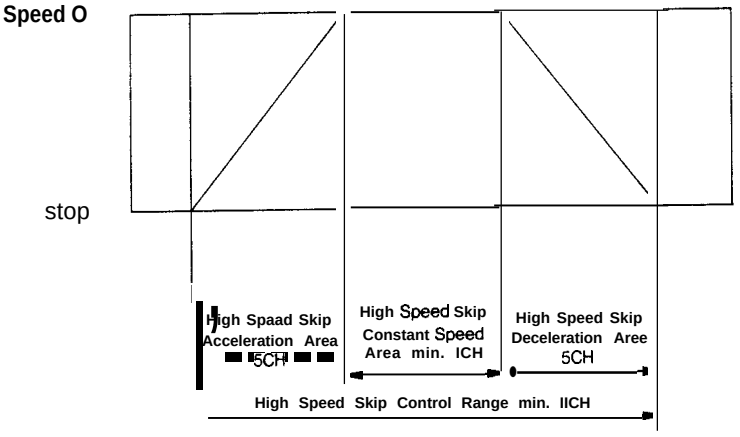
a) Acceleration control : 2-2 phase switching is performed for four characters so that the carriage speed changes from each speed to the constant speed (3600 PPS).
b) Constant speed control : The carriage is moved at 3600 PPS.
c) Deceleration control : Margin for one character is set so that the carriage speed changes from 3600 PPS to each stable speed while printing four characters.

5. High speed skip (stop → high speed skip)

When spaces (20H) continue for 11 characters or more during text printing (1 OCPI), high speed skipping will be performed. This function is shown in Figure 2-61 b) and is used to shorten the printing time.
a) Acceleration control : 2-2 phase swiching is performed for five characters so that the carriage speed changes from stop to the costant speed (3600 PPS).
b) Constant speed control : The carriage is moved at 3600 PPS.
c) Deceleration control : The carriage speed changes from 3600 PPS to stop while five characters.



a) Constant Speed → High Speed Skip



b) Stop → High Speed Skip

Figure 2-61. High Speed Skip

2.3.7 PF Motor Control and Drive Circuit

The PF motor is driven only by the 2-2 phase switching system, and the minimum paper feeding amount is 1/360 inch.

Table 2-37 shows the various PF motor control relationships.

Table 2-37. Various PF Motor Control Relationships

State	PF Motor Coil Current [A/Coil]	Paper Feeding Amount [Inches]	Acceleration/ Deceleration Control	Remarks
Holding	0.08 MAX.	—	.	—
Driving	0.95 MAX.	≦25/360	Not performed.	Refer to Tables 2-38 and 2-39.
		≧25/360	Performed.	

Table 2-38. Relationship PF Motor and Paper Feed Speeds

PF Motor Speed [PPS]	1300	1200	1100
Cycle [μs/step]	769	833	909
Paper Feed Speed [IPS]	3.6	3.3	3.0

Table 2-39. Paper Feed Speeds

Feeding Method	One Line		Continuous	
Mode	Normal	copy	Normal	copy
Cut Sheet [PPS]	1300	1100	1300	1300
Continuous Paper [PPS]	1300	1000	1300	1300
Envelope [PPS]		1300	–	1300
Cut Sheet (with CSF) [PPS]	1000	1200	1300	1300
Continuous Paper (with CSF) [PPS]	1000	1000	1300	1300
Envelope (with CSF) [PPS]		1000	—	1300

2.3.7.1 PF Motor Drive Circuit

The PF motor is driven using only 2-2 phase switching and regulated +35 VDC.
Figure 2-62 shows the PF motor drive circuit and Figure 2-63 shows the pulse timing. Table 2-40 lists the relationships between various PF motor control factors.

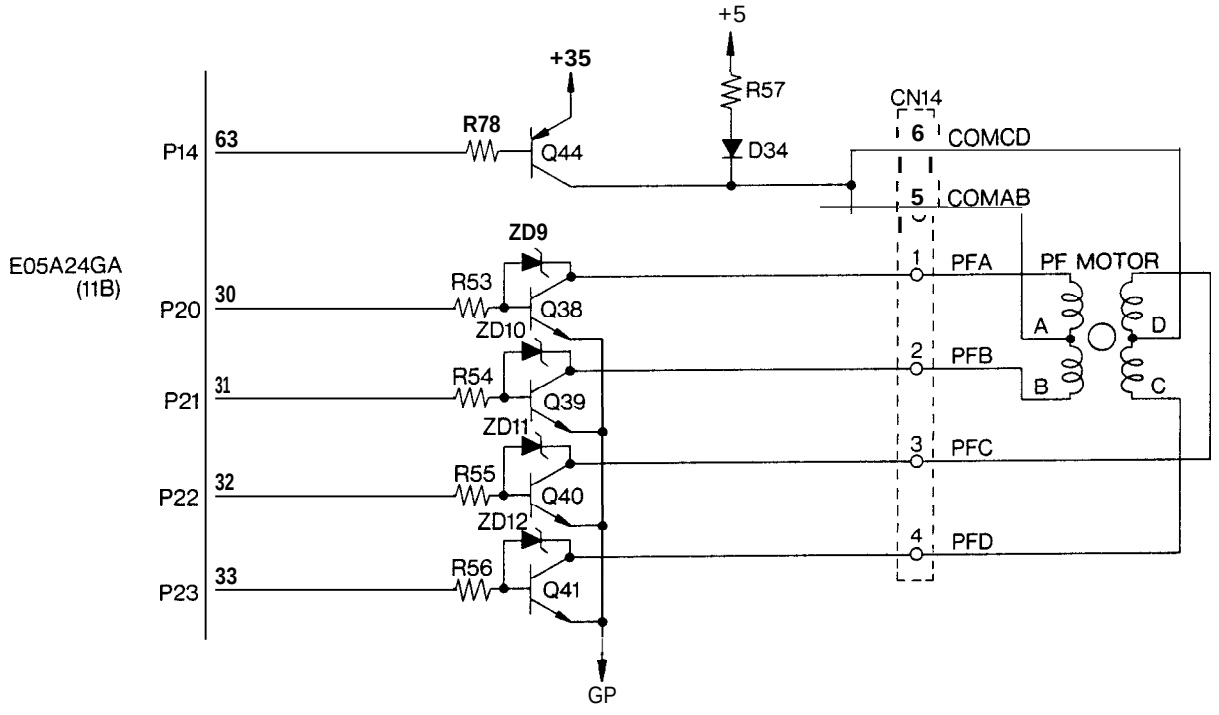
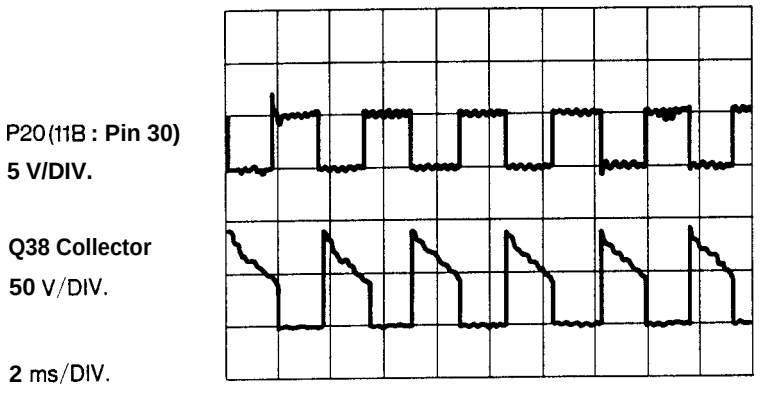


Figure 2-62. PF Motor Drive Circuit



NOTE: Tractor feed, at form feed

Figure 2-63. PF Motor Drive Circuit Signal Timing

Table 2-40. Relationships PF Motor Control Factors

E05A24GA (11 B) P14	PF motor	
	Applied Voltage [V]	State
High	5	Holding
Low	35	Driving

2.3.7.2 PF Motor Phase Switching Timing

The PF motor is a 4-phase stepper motor, and the phases are controlled by E05A24GA (11B) terminals P20 to P23. 2-2 phase switching is used for this motor.
Figure 2-64 shows the PF motor phase switching timing.

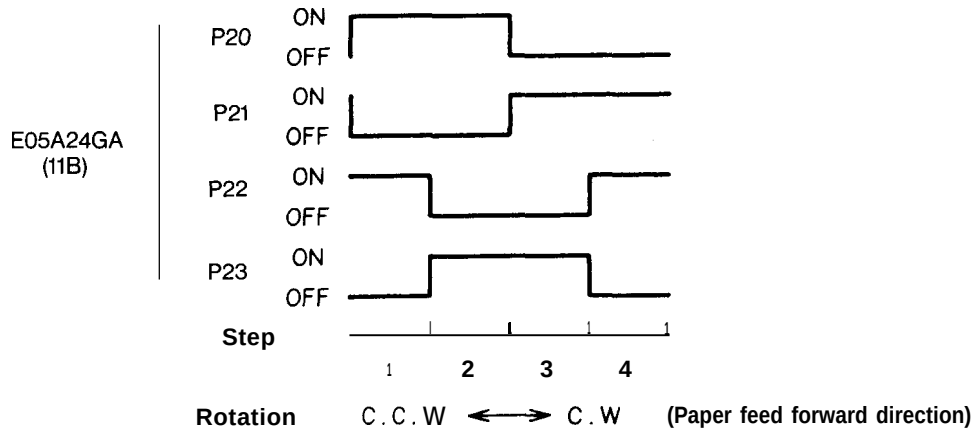


Figure 2-64. PF Motor Phase Switching Timing

2.3.8 CS/RF Motor Control and Drive Circuit

The CS/RF motor is directly controlled by the CPU (4B), and is driven by a constant voltage.
The CS/RF motor has two functions (color select and ribbon feed). Switching between the two functions is performed **in accordance with the rotational direction (forward (C. W.) or reverse (C. W)) of the** CS/RF **motor.**

Table 2-41 shows relationships between the various CS/RF **motor controls.**

Table 2-41. Various CS/RF Motor Control Relationships

CS/RF Motor Rotation	Function	CS/RF Motor Speed [PPS]	Phase Switching System
c. w.	**Color select**	**500**	**2-2**
C. C. W.	Ribbon feed	Refer to Table 2-42.	1-2

Table 2-42. Ribbon Feed Speeds

Normal Mode		Copy Mode		Speed Down
CR Speed No	Ribbon Feed Speed [PPS]	CR Speed No.	Ribbon Feed Speed [PPS]	Ribbon Feed speed [PPS]
o	1200	2	830	830
1	1200	2	830	830
2	830	4	830	830
3	830	4	830	830
4	830	5	830	700

2.3.8.1 CS/RF Motor Drive Circuit

The CS/RF motor is driven using 2-2 and 1-2 phases switching and regulated +35 VDC.
Figure 2-65 shows the CS/RF motor drive circuit and Figure 2-66 shows the pulse timing. Table 2-43 lists the relationships between various CS/RF motor control factors.

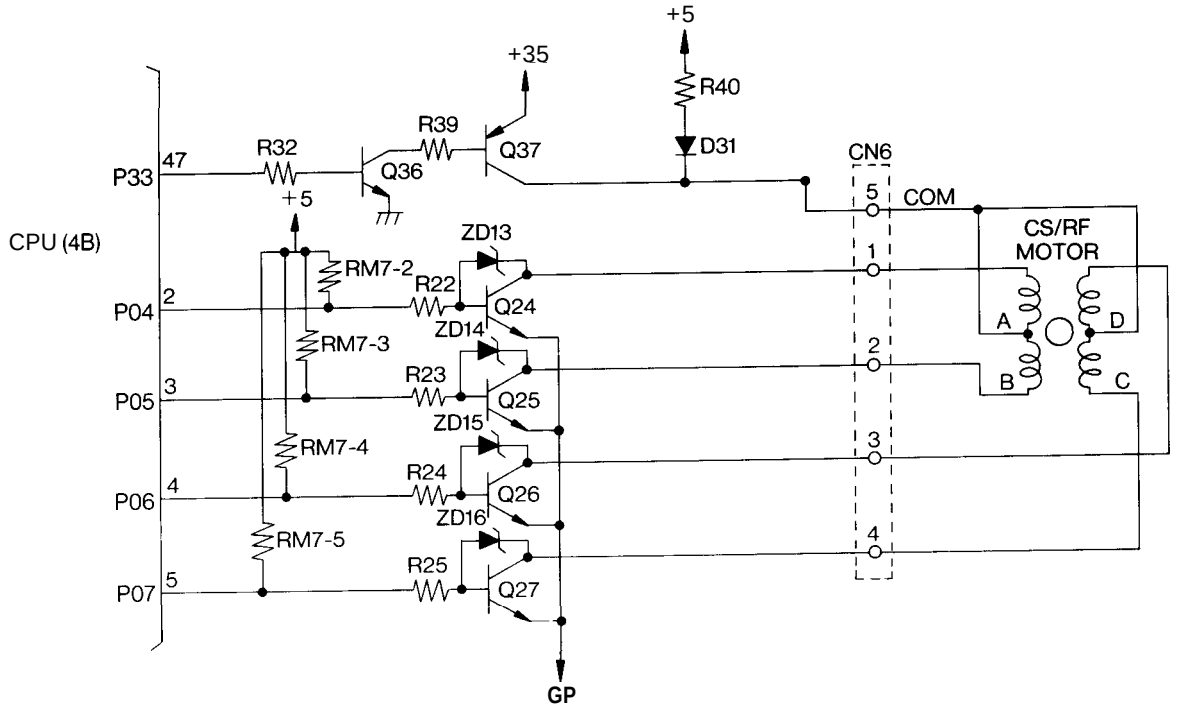
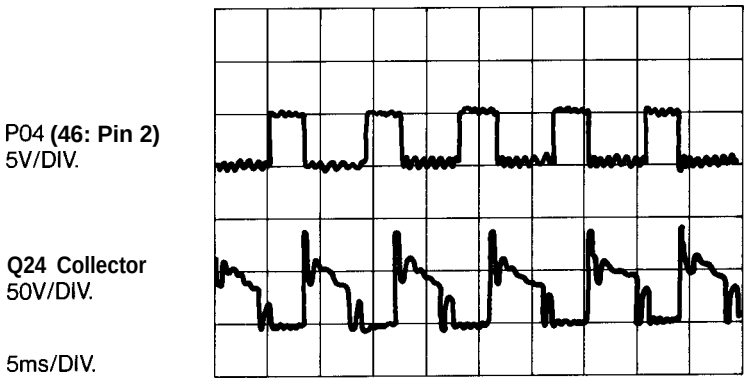


Figure 2-65. CS/RF Motor Drive Circuit



NOTE : draft normal self-test, at ribbon feed

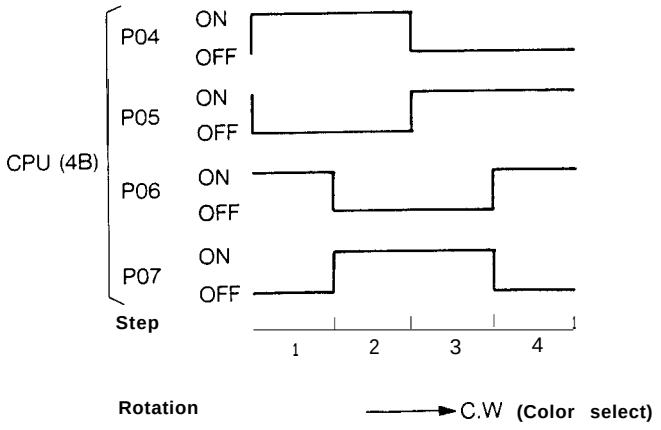
Figure 2-66. CS/RF Motor Drive Circuit Signal Timing

Table 2-43. Relationships CS/RF Motor Control Factors

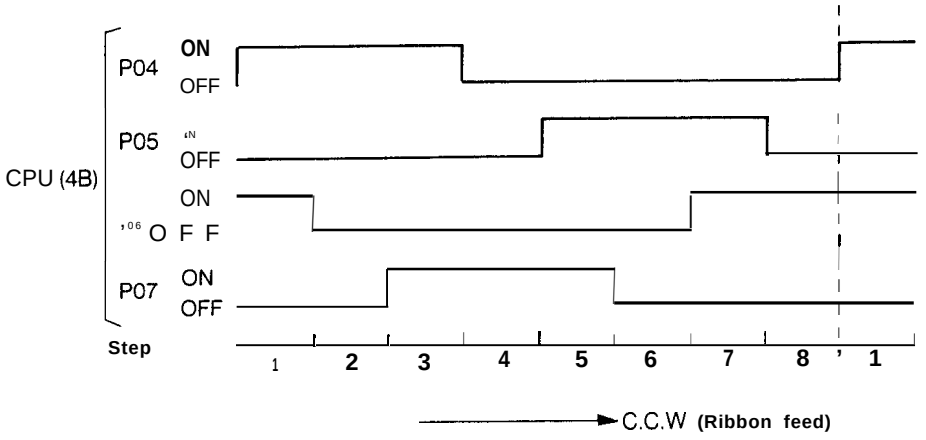
CPU (4B) P33	CS/RF Motor	
	Applied Voltage [V]	State
High	5	Holding
Low	35	Driving

2.3.8.2 CS/RF Motor Phase Switching Timing

The CS/RF motor is a 4-phase stepper motor, and the phases are controlled by CPU (4B) terminals PO4 to P07. 2-2 and 1-2 phase stitchings are used for this motor. Figure 2-67 shows the CS/RF motor phase switching timing.



a) 2-2 Phase Excitation



b) **1-2 Phase Excitation**

Figure 2-67. CS/RF Motor Phase Switching Timing

CHAPTER 3
OPTIONAL EQUIPMENTS

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3.1 GENERAL

This chapter describes the options available for the LQ-860/1060.

3.2 OPTIONAL INTERFACES

The LQ-860/1060 uses the 8100 series optional interlaces. The main optional interfaces are listed in Table 3-1.

Table 3-1. Optional Interfaces

	Cat. No.	Description			
Standard Parallel Interfaces		Buffer Size	Function		
	#81 72	32K	32 K-byte buffer parallel interface		
	#81 72M	128K	128 K-byte buffer parallel interface		
		Buffer Size	Flag Control	X-O N\OFF Control	Max. Bit Rates (BPS)
RS-232C	#8143*	None	o	0	19200
	#8 145	2K	o	x	9600
	#8 148	2K/8K	o	0	19200
Current Loop	#8 149	32K	o	0	19200
	#8 149M	128K	o	0	19200
		Buffer Size	Function	Listen Only Operation	Address Operation
EEE-488	#816 1	None	L	x / o	o
(GP-IB)	#8 165	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, set the printer interface to the parallel interface.

3.2.1 8143 Interface Board

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

Specifications

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

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

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

Jumper Settings

Table 3-2 shows the **8143 interface jumper settings.**

Table 3-2. 8143 Jumper Settings

	Function				
J1	**ON: "TTY TXD" is pulled up to + 12V through 470 ohm resistor.**				
J2	**ON: "TTY TXD RET" is connected to signal ground.**				
J3	ON: "TTY RXD" is pulled up to + 12V through 470 ohm resistor.				
J 4	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 JC	Selects input signal level	ON OFF	RS-232C level	OFF ON	Current loop level
JNOR JREV	Selects polarity to disable data entry	ON OFF	MARK (RS-232C) SPACE (Current loop)	OFF ON	SPACE (RS-232C) MARK (Current loop)
JF JX	**Selects TTY TXD function**	ON OFF	**Outputs DTR flag**	OFF ON	Outputs X-ON/X-OFF signal

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 (JB1)	Bit rate selection	See Table 3-4.	
1-4 (JB2)	Bit rate selection	See Table 3-4.	
1-5 (JO/E)	Parity selection	Even	Odd
1-6 (JPDS)	Parity selection	Enabled	Disabled
1-7 (JB4)	Bit rate selection	See Table 3-4.	
1-8 (P/S)	# 8143 I/F selection	Enabled	Disabled

Table 3-4. Bit Rate Selection

Bit Rate (BPS)	SW1-7 (JB4)	SW1-1 (JB3)	SW1-4 (JB2)	SW1-3 (JB1)	Bit Rate (BPS)	SW1-7 (JB4)	SW1-1 (JB3)	SW1-4 (JB2)	SW1-3 (JB1)
75	ON	ON	ON	ON	1,800	OFF	ON	ON	ON
110	ON	O N	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
2clo	ON	OFF	O N	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 528 bytes.	Sends X-ON when the vacant area of the input buffer reaches 528 bytes.
Impossible	Sets when the vacant area of the input buffer is 256 bytes or less.	Sends X-OFF when the vacant area of the input buffer reaches 256 bytes.

Error Handling

Errors are processed as follows :

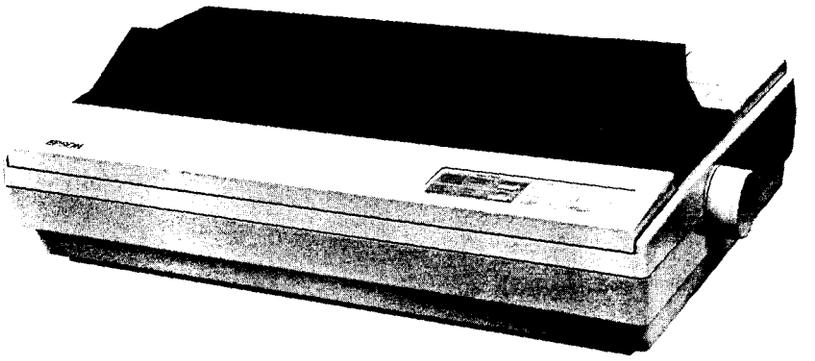
- Parity error: an asterisk " * " is printed.
- Overrun error : ignored.
- Framing error: ignored.

3.3 PULL TRACTOR UNIT

The C800071 and C800101 are optional pull tractor units, available for the LQ-860 and LQ-1060. Pull sprocket feeding and push-pull feeding are possible by mounting the pull tractor unit instead of the PaPer tension unit.

Figure 3-1 shows the exterior views of the LQ-860/1060 with pull tractor unit.

LQ-860 with C800071



LQ-1060 *with* C800101

Figure 3-1. LQ-860/1060 with Pull Tractor Unit

3.3.1 Paper Feed Operations

The operational differences between the standard push tractor and the C800070/C800090 pull tractor unit are described in below.

3.3.1.1 Pull Sproket Feed Operation

Figure 3-2 shows the gear arrangement and paper path used with pull sproket feeding.

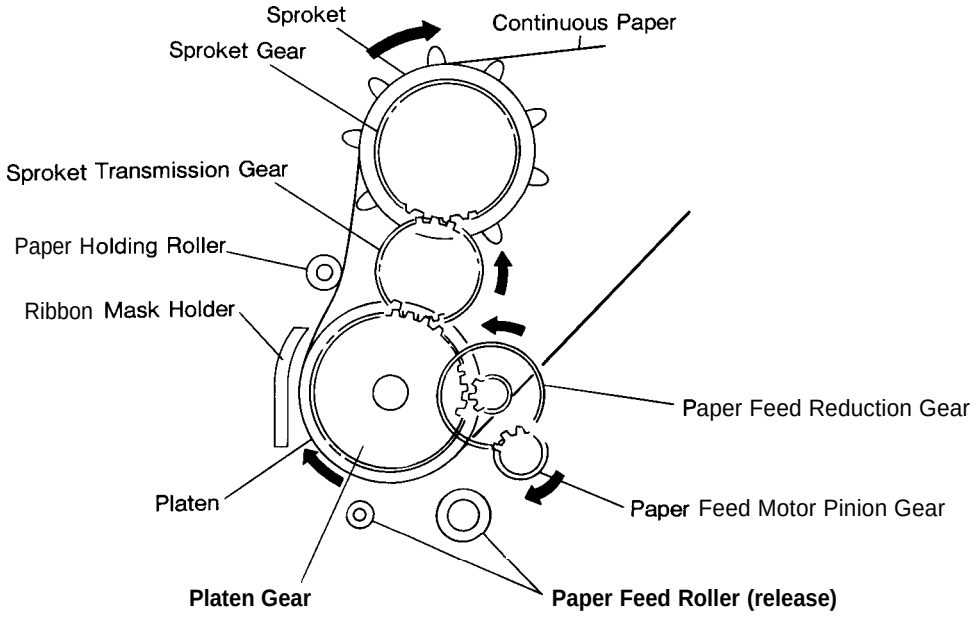


Figure 3-2. Pull Sprocket Feeding Gear Arrangement and Paper Path

3.3.1.2 Push-Pull Feed Operation

Figure 3-3 shows the gear arrangement and paper path used with push-pull sproket feeding.

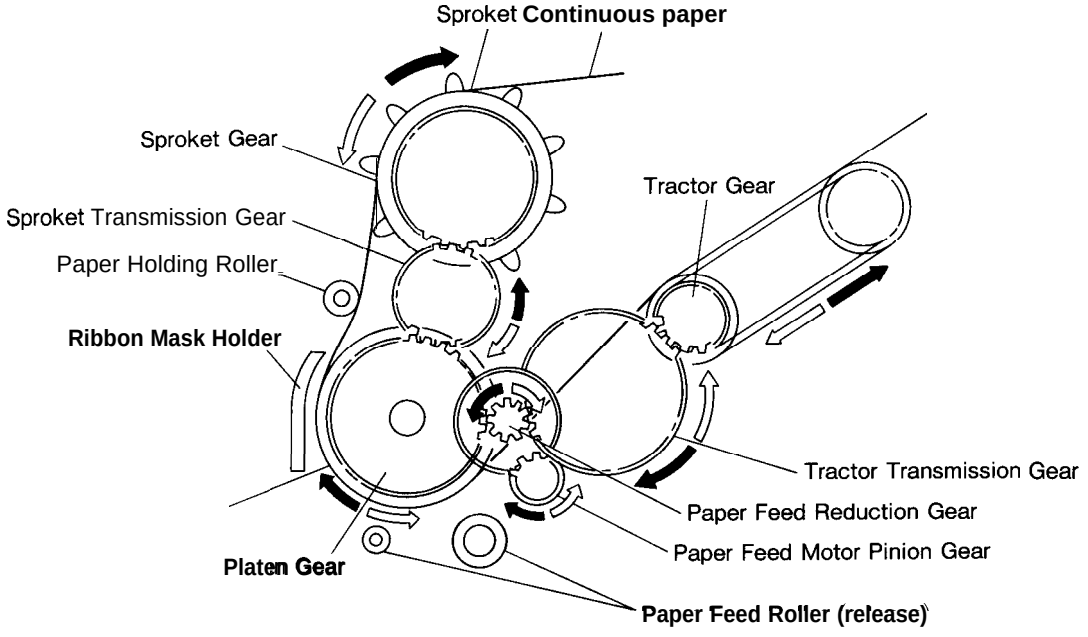


Figure 3-3. Push-Pull Feeding Gear Arrangemnet and Paper Path

3.3.2 Dissasembly and Assembly

This section describes the **pull tractor sprocket assembly L (Left) and R (Right) removal, which requires special explanation.**

Step 1 : **Remove the E-ring RE (2.3) from sprocket** mounting plate **L** (Left), **then remove the sprocket paper holding lever and sprocket paper holding spring L.**

Step 2: **Remove the two HNO (4) nuts from sprocket** mounting plate L.

Step 3: **Remove the platen shaft holder.**

Step 4: **Remove the sprocket frame L.**

Step 5: **Disengage the sprocket holding lever.**

Step 6: **Remove the E-ring RE (5) from the sprocket** shaft.

Step 7: **Remove sprocket assembly L, paper guide roller, and sprocket assembly R.**

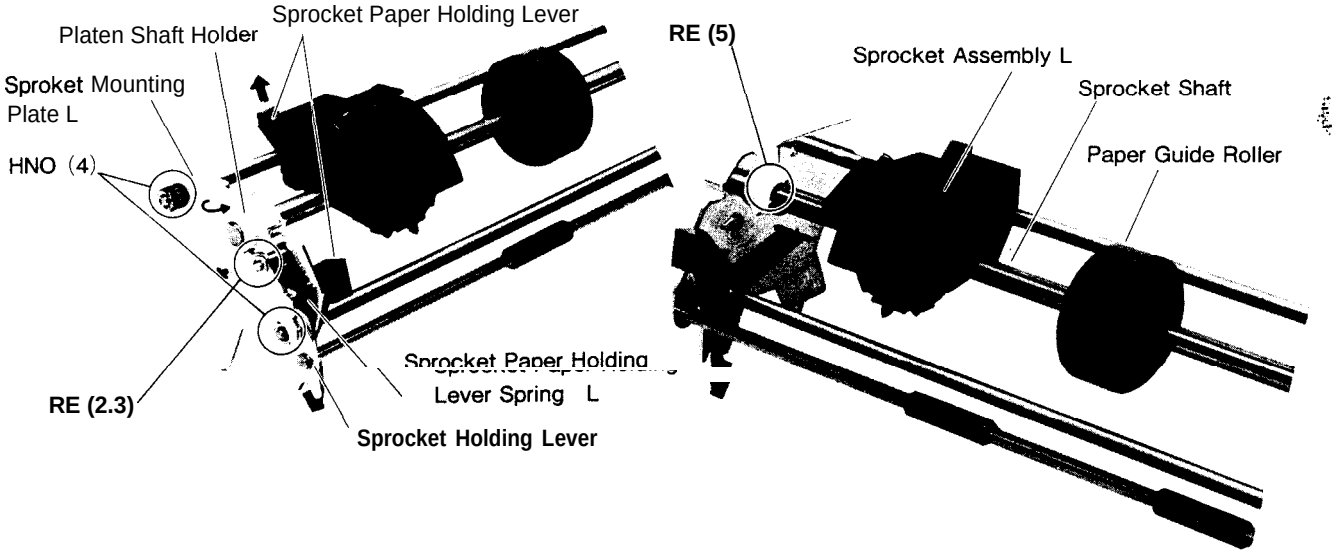


Figure 3-4. Sproket Assembly Removal

ASSEMBLY POINT :

Attach each sprocket wheel to the sprocket shaft, so that the sprocket wheel marks are on the same side and so that the marks on the two wheels line, up as shown in Figure 3-5.

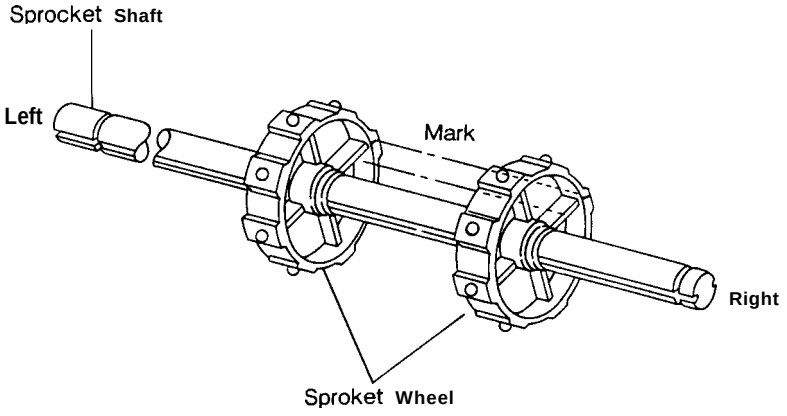


Figure 3-5. Sprocket Wheel Attachment

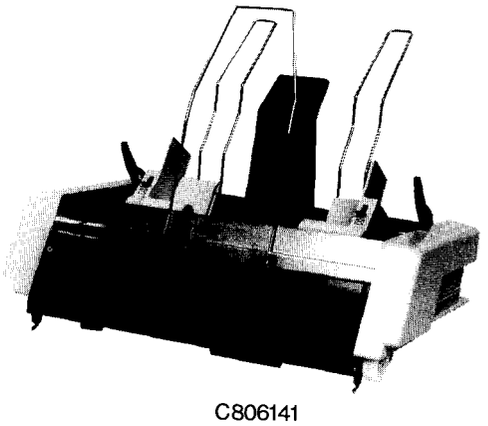
3.4 CUT SHEET FEEDER

For the LQ-860/1060, both the single-bin cut sheet feeder C806141/C806181 and double-bin cut sheet feeder C806151/C806191 are available. Both cut sheet feeders are controlled by the firmware included in the printer.

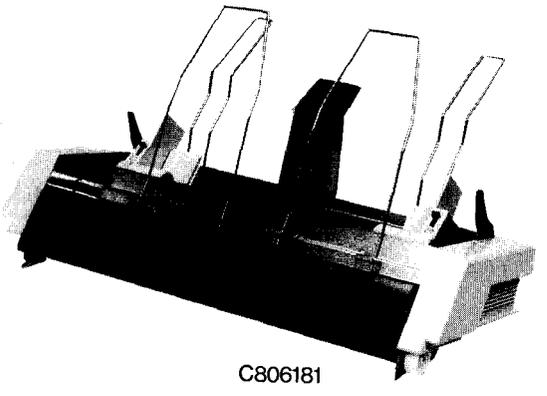
The cut sheet feeder has the following features :

- **Can handle cut sheets and envelopes in the same manner as fanfold paper.**
- **Can use fanfold paper without dismounting the cut sheet feeder.**
- **Allows user to load a sheet by control panel operation.**
- **Requires no electrical connection to and from the printer.**
- **Is easy to mount onto or dismount from the printer.**

Figure 3-6 shows the exterior views of the cut sheet feeders.

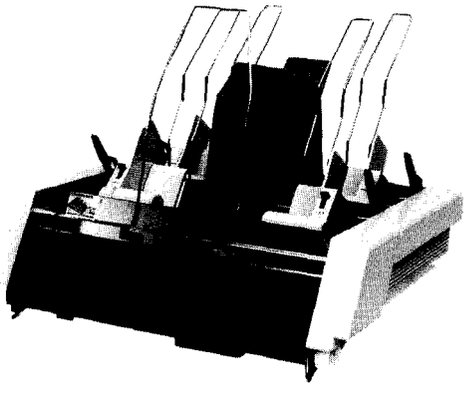


C806141

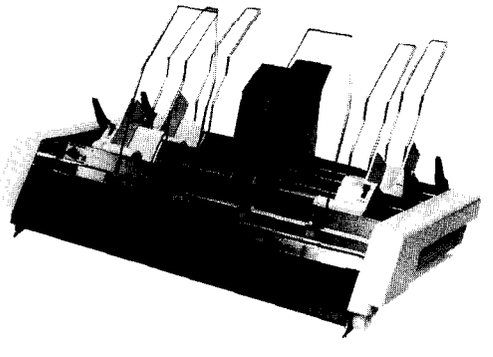


C806181

a) Single Bin CSF



C806151



C806191

b) Double Bin **CSF**

Figure 3-6. Cut Sheet Feeders

3.4.1 Specifications

Cut Sheet Feeder

Hopper Capacity

Cut sheets: 150 sheets.....82 g/m² paper
185 sheets.....,..64 g/m² **paper**

Envelopes: (only for bin 1 of the double bin cut sheet feeder)
25 sheets, maximum..... xerographic or bond paper
30 sheets, maximum..... airmail paper

NOTE : For the double-bin CSF, only bin 1 can be used for envelopes.

NOTE : If the weight of paper differs from above values, total thickness of sheets must be less than O. 59" (15 mm).

Stacker Capacity

Cut sheets : 150 sheets .....82 g/m² **paper**
180 sheets .....64 g/m² paper

Envelopes: 25 sheets, maximum ..... xerographic or bond paper
30 sheets, maximum ..... airmail paper

Print accuracy

Accuracy for the top of paper position (variation in the position of the top center of a printed character with respect to the top of the paper) :

Within ± 1 mm

NOTES : 1. The value is guaranteed only for the cut sheet of which weight is about 64 to 82 g/mm ².
2. Envelopes: within ± 2 mm

Skew accuracy (difference between the right and left top of page positions) :

+ 0.3" (Equivalent to ± 1.1 mm when a A4 paper is used lengthwise)

NOTES : 1. **The above value is guaranteed** only for the cut sheet of which weight is about 64to829/ mm².
2. Envelopes : ± 0.5"

Pitch deviation :

(4.23 mm) + 0.25 mm

Reliability Mean Cycle Between Failure (MCBF) 100,000 cycles

NOTE : For the double-bin CSF, it is assumed that both bins are used equally.

Environmental Conditions

Temperature: operating +5 to +35°C
storage –30 to +65°C
Humidity: operating 15 to 80°/0 (no condensation)
storage 5 to 85% (no condensation)

NOTE: Use the fan-fold type 4-copy (1 original + 3 copies) slip only at a normal room temperature.

Dimensions and Weight

Refer to Table 3-6.

Table 3-6. Dimensions and Weight

CSF	Width [mm]	Depth [mm]	Height [mm]	Weight [Kg]
C806141	384	440	408	Approx. 2.5
C806151	364	548	408	Approx. 3.8
C806181	525	440	408	Approx. 3.2
C806191	525	548	408	Approx. 4.8

NOTE : Dimensions are the measured values with the CSF being mounted on the printer.

Paper

NOTES: 1. All other paper with medium or high wood content and very light or very heavy paper must be operationally tested prior to regular use. Paper with a textured, embossed, glossy, or hammered surface also must be tested individually to prior to regular use.

2. **The cut sheet feeder may not feed smoothly with some kinds of paper.**
3. **Using curled or curved paper causes the paper to jam. Therefore, paper should always be removed from the platen when the printer is not in use.**

Type **Cut sheet, enverope**

Size, Paper Thickness, Paper Weight, and Angular Deviation

Refer to Table 3-7.

Table 3-7. Size, Paper Thickness, Paper Weight, and Angular Deviation

CSF	Paper Type	Width [mm]	Length [mm]	Thickness [mm]	Paper Weight [g/mm²]	Angular Deviation [mm]
C806141	**Cut sheet**	182-257	210-364	0.07-0.10	64-82	0.5 MAX.
	Envelope	166-241	92-104	0.16-0.52"'	12~24[lb]	1.0 MAX.
C806151	Cut sheet	182-257	210-364	0.07-0.10	64-82	0.5 MAX.
	Envelope*2	166-241	92-104	0.16-0.52"'	12~24[lb]	1.0 MAX.
C806181	Cut sheet	182-364	210-364	0.07-0.10	64-82	0.5 MAX.
	Envelope	166-241	92-104	0.16-0.52"'	12~24[lb]	1.0 MAX.
C806191	Cut sheet	182-364	210-364	0.07-0.10	64-82	0.5 **MAX.**
	Envelope*2	**166-241**	**92-104**	**0.16-0.52"'**	12~24[lb]	**1.0 MAX.**

∗1 : Envelopes must not have a difference of more than 0.25 mm (0.010") in thickness throughout the printable area.

∗2 : It can be used only for the bin 1.

Recommended Paper Storage Conditions

Temperature: **+18 to +22°C**

Humidity : **40 to 600/0**

Continuous Paper **Refer to Table 1-5.**

Printable Area

Cut sheet : **Refer to Table 1-4.**

Envelope: **Refer to Table 1-6.**

3.4.2 CSF Operating Principles

The printer can be set to the cut sheet feeder mode by either the hardware or software setting.

Hardware Setting

The cut sheet feeder mode can be set with the DIP SW2-8 at the left side of the control panel. See Table 3-8.

Table 3-8. CSF Mode Setting with DIP SW

DIP SW	Fubction	ON	OFF
2-8	Cut sheet feeder mode	ON	OFF

Software Setting

The cut sheet feeder can be controlled from the host computer by using the following software commands*'.

*1 : Only when the ESC/P protocol is used.

Command : ESC EM
Format: CHR$(27);CHR$ (25) ;"n"
Where: n = 0 Cancels the CSF mode
n = 1 Specifies bin 1
n = 2 Specifies bin 2
n = 4 Specifies the CSF mode
n = R Ejects a sheet

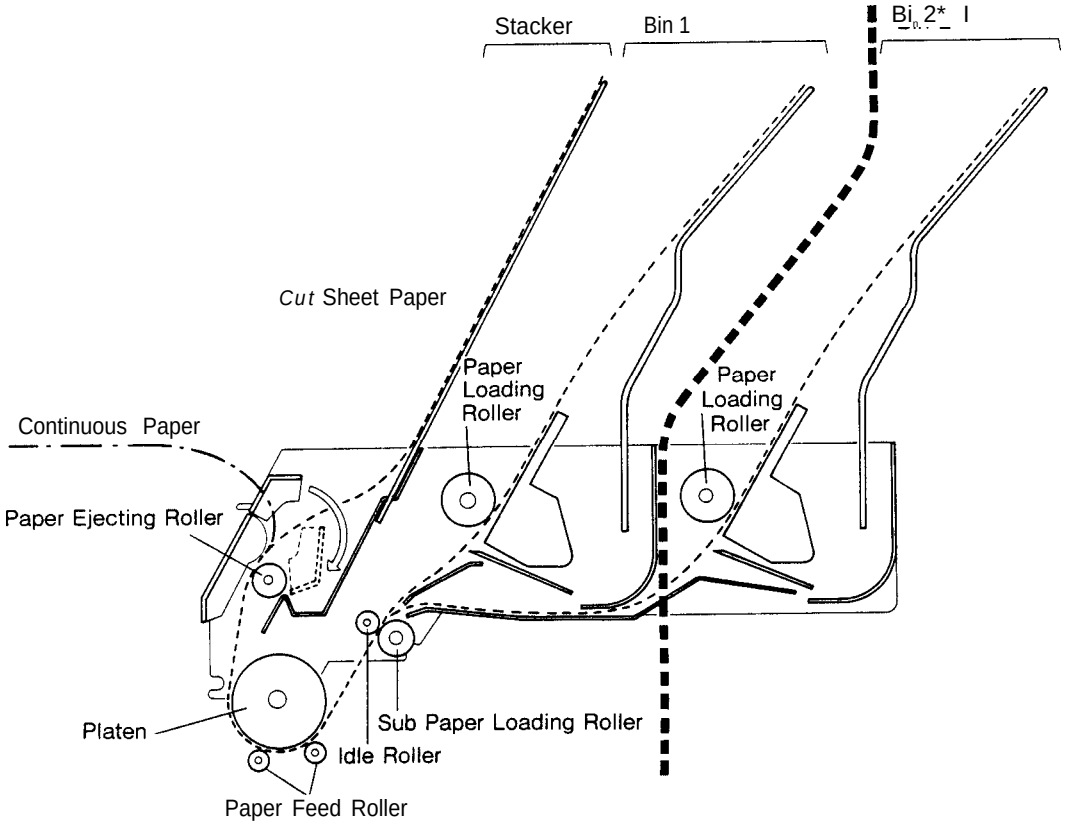
NOTE: This command should be input when paper is loaded.

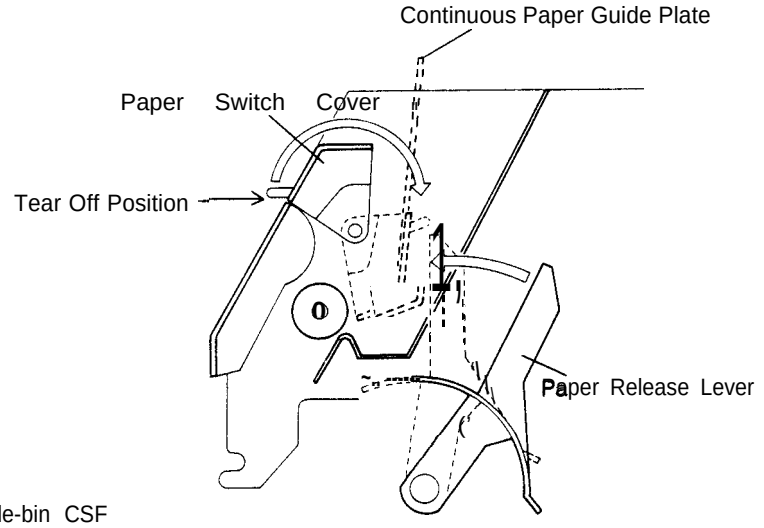
3.4.2.1 Paper Path and Gear Train

Figure 3-7 shows the paper path when the cut sheet feeder is mounted. The LQ-860/1060 with the cut sheet feeder being mounted can handle the fan-fold paper as it is. It is not necessary to dismount the cut sheet feeder.

However, the following operation is required to make the printer handle the fan- fold paper:

- Position the paper release lever at the center.
- Turn the paper switch cover downward, and turn the continuous paper guide plate upward.



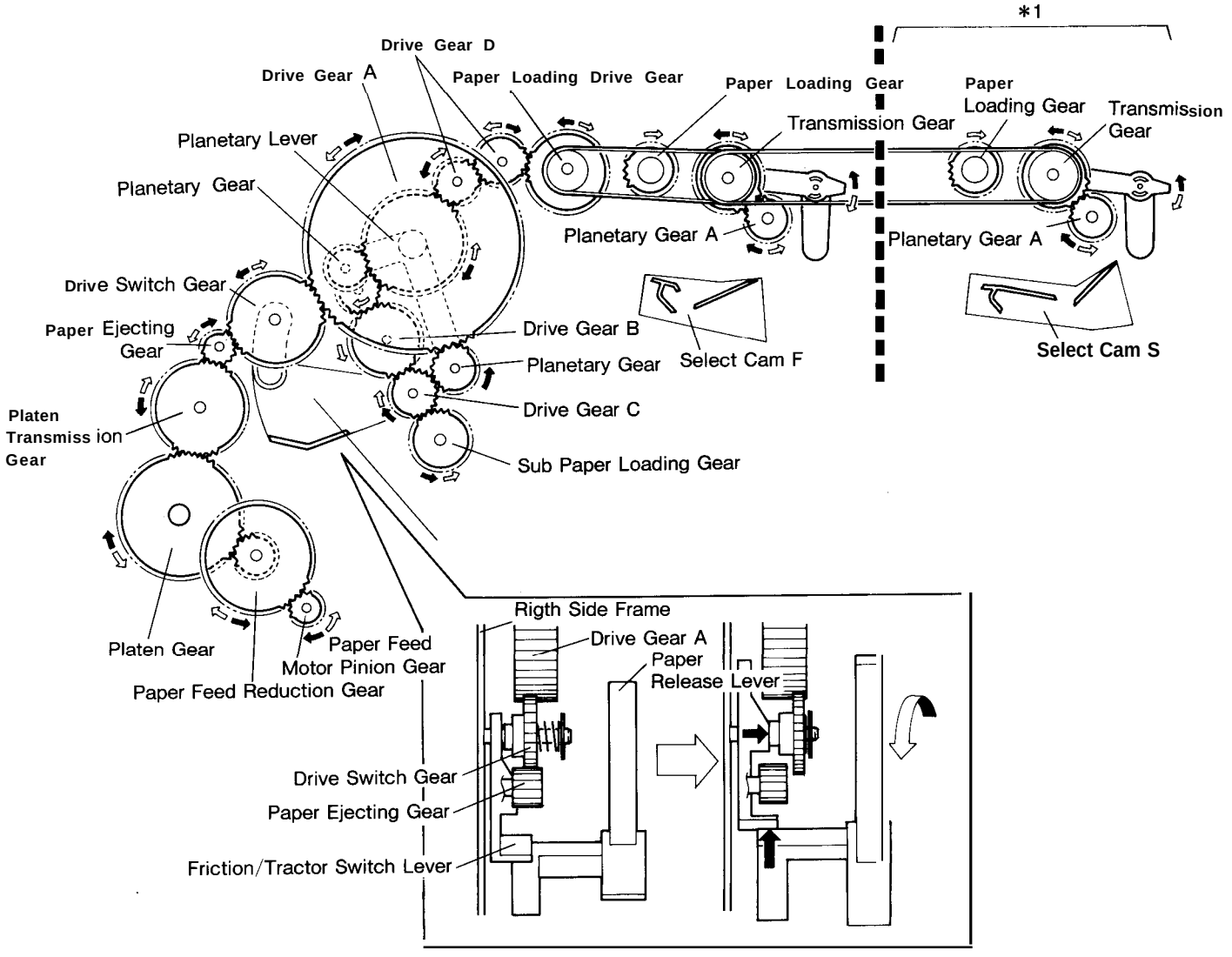


*1 : Only for the double-bin CSF

Figure 3-7. Paper Path

Figure 3-8 shows the gear train.

When the continuous paper is used, the paper release lever pushes up the friction/tractor switch lever. At this time, the drive switch gear is in the release state and cancels the power conveyed from the paper ejecting gear. Therefore, the cut sheet feeder does not perform paper loading but paper ejection.



*1: Only for the double-bin C S F

Figure 3-8. Gear Train

3.4.2.2 Bin Switch Operation

Selection between bin 1 and bin 2 of the cut sheet feeder (double-bin model) **is performed by the panel setting or the software command. How the paper is loaded by the selected** bin is illustrated in Figures 3-9 and 3-10.

Bin 1 or 2 is selected depending on the number of steps for driving the paper feed motor in the reverse **direction at Step 1**

NOTE : Bin selection for the single-bin CSF is performed in the same way as bin 1 selection for the double-bin CSF.

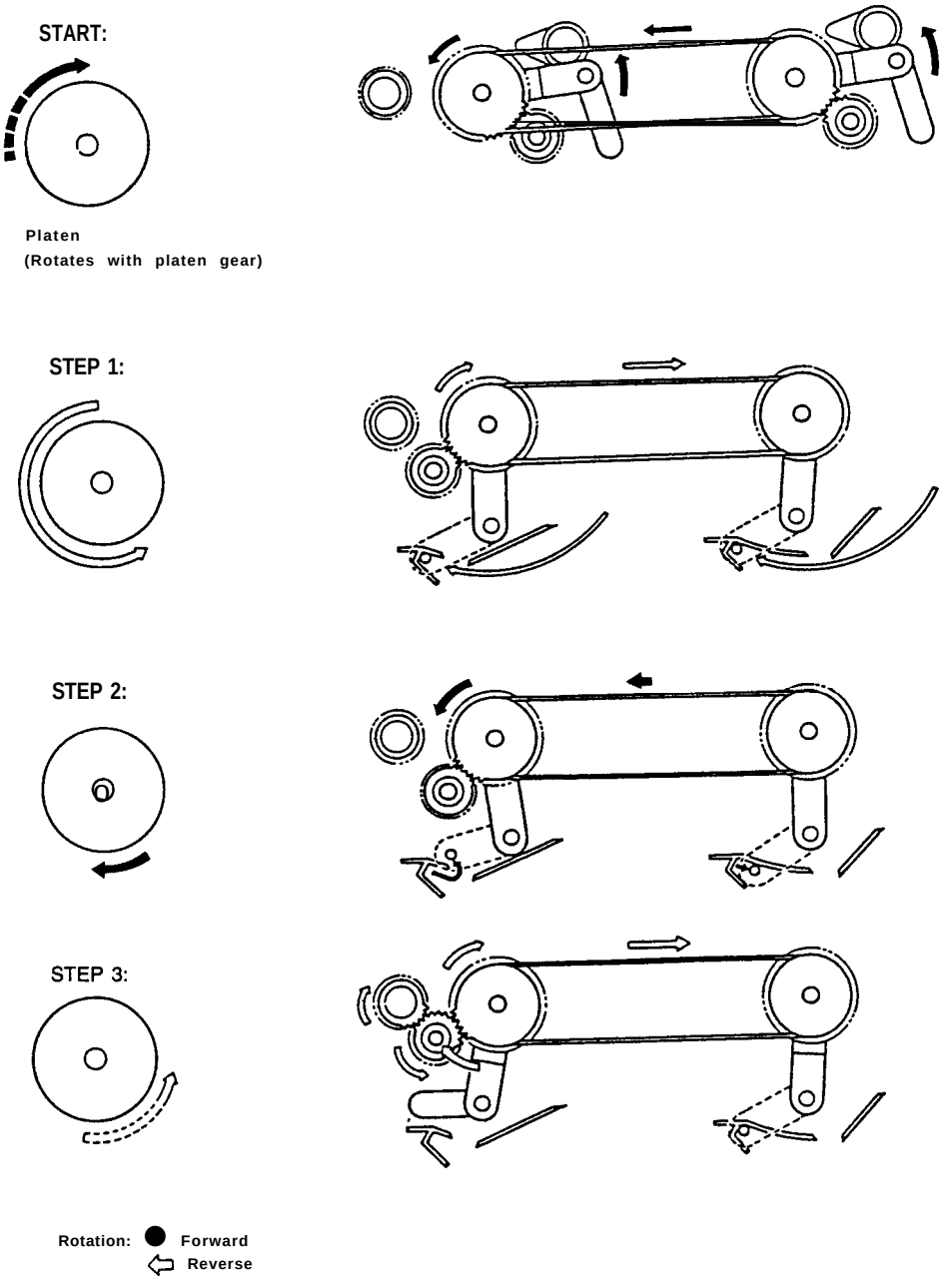


Figure 3-9. Bin 1 Selection

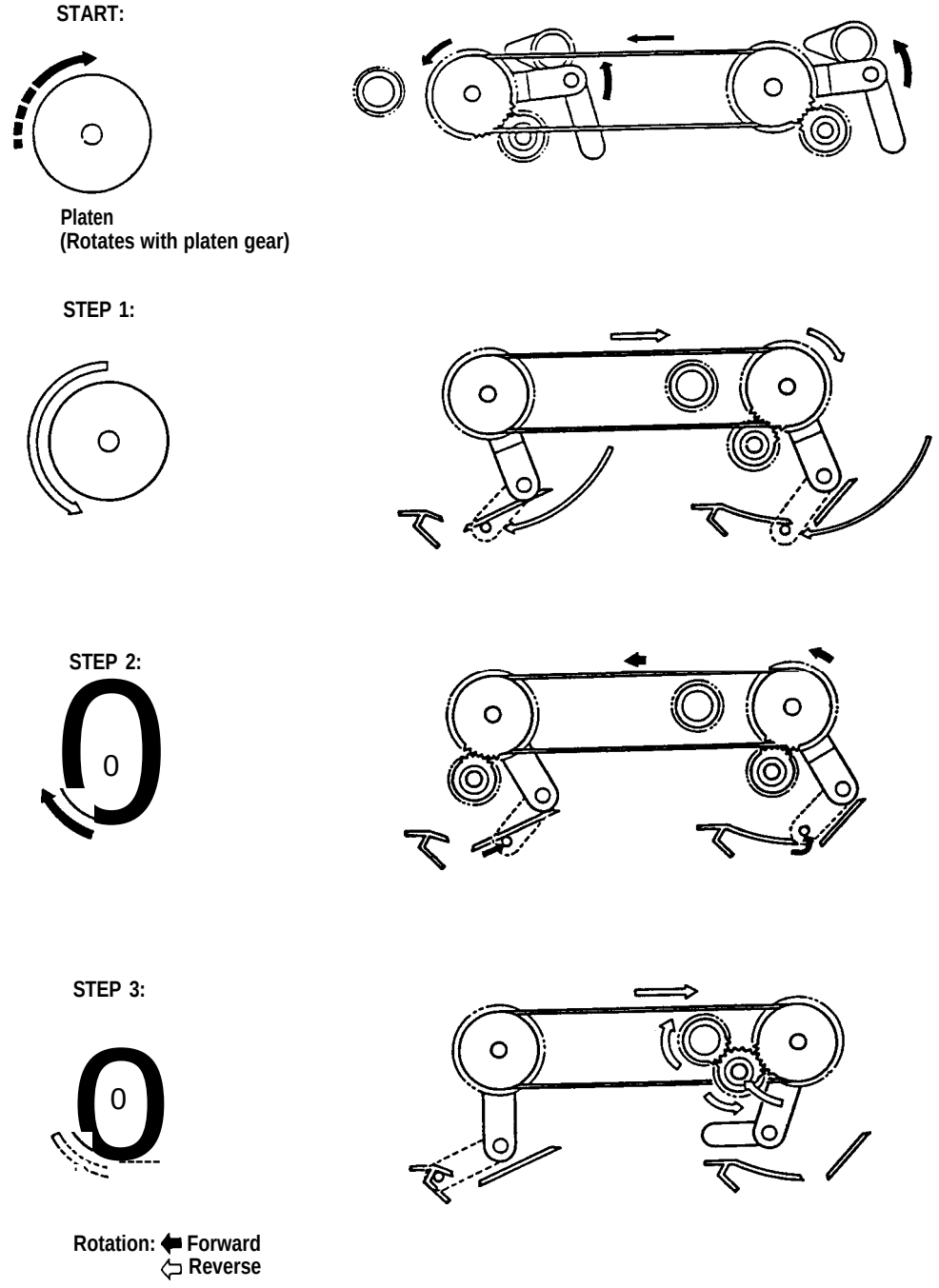


Figure 3-10. Bin 2 Selection

3.4.3 Disassembly and Assembly

This section describes the procedure for removing the hopper unit of the cut sheet feeder. Unless otherwise specified, the disassembled parts are reassembled by simply performing the disassembly operation in the reverse sequence.

The tools are listed in Table 3-9.

Table 3-9. Repair Tools

Designation	Availability	Part NO.
Phillips screwdriver No. 2	0	B743800200
E-ring holder #3	o	B740800500
E-ring holder #4	o	B740800600
E-ring holder #6	0	6740800800

0 : Commercially available tool

DANGER

. For safety, gloves should be worn during disassembly and assembly.
● Dismount the cut sheet feeder from the printer before starting disassembly.
. Do not allow oil and grease to smear the paper path. If they adhere to the paper path, wipe off using alcohol.

Step 1 : Remove the center supports, hopper paper stands, and stacker stands.

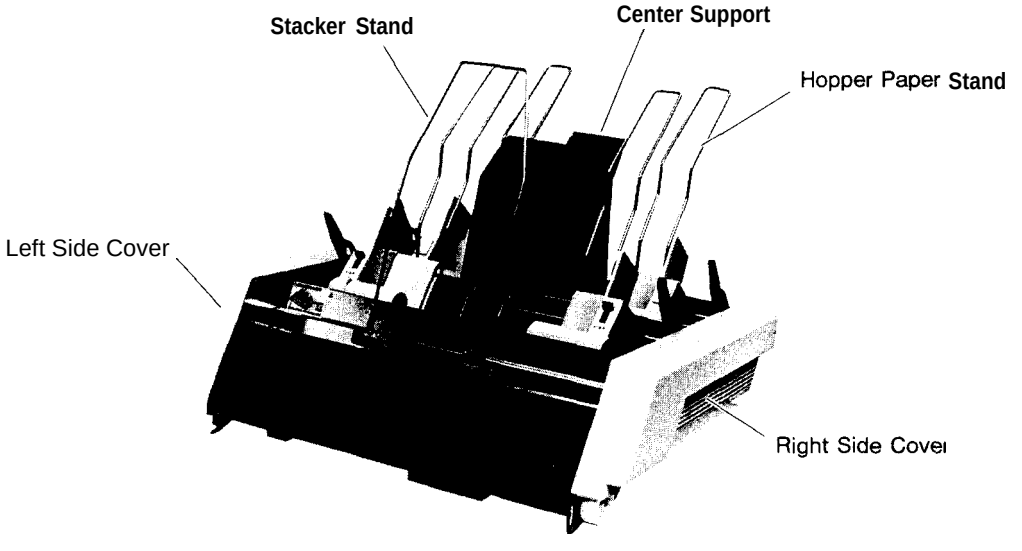


Figure 3-11. Side Cover Removal

Step 2: **Remove the right and left side covers by pulling out the seven tabs for each side cover.**

Step 3: **Take off the E-ring RE (6) securing the paper loading shaft to** the left side frame, then **remove platen shaft holder A outward from the left side frame.**

Step 4: Shift the paper loading shaft to the right, and push platen shaft holder A outward from the right side frame to remove.

Step 5: Remove the two paper support shaft holders securing the paper support shaft to the right and left side frames, then lift the whole hopper unit to remove it from the side frames.

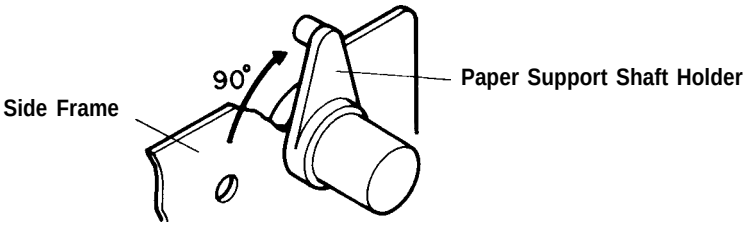


Figure 3-12. Paper Support Shaft Holder Removal

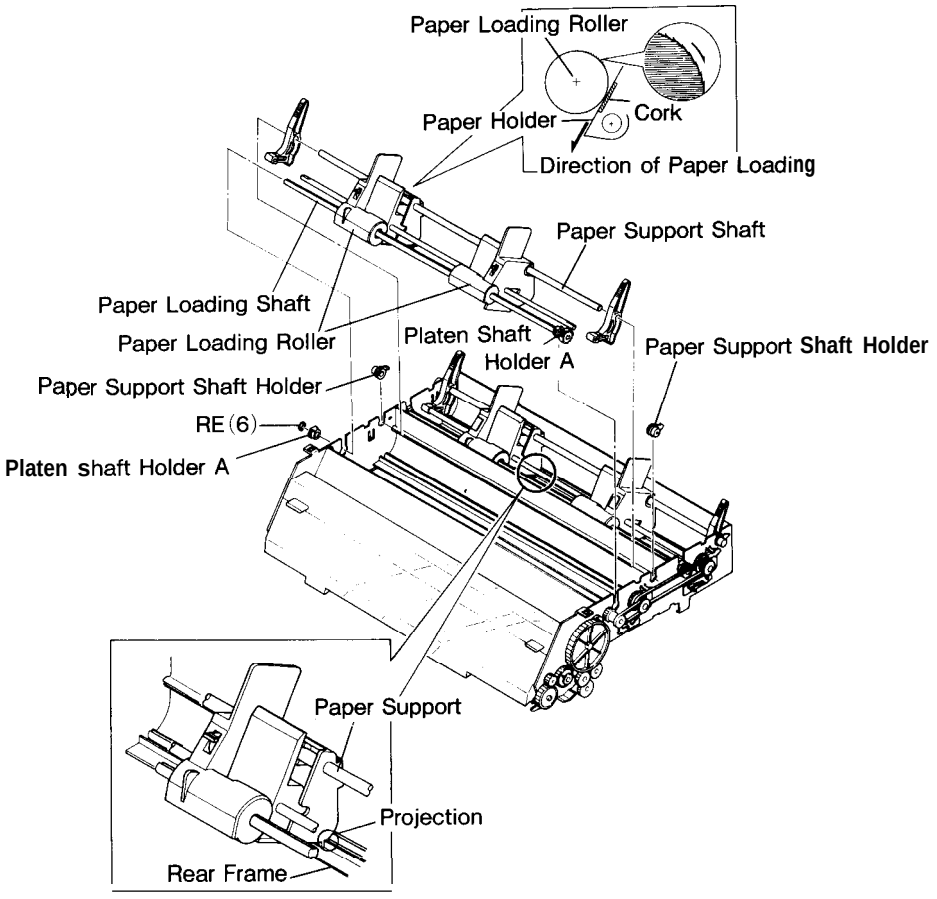


Figure 3-13. Hopper Unit Removal

WARNING

When required to replace one paper loading roller, both right and left rolers must be replaced at the same time.

ASEMBLY POINT:

. When installing the paper loading roller, be sure to verify the direction of the roller on its surface. (Refer to Figure 3-13.)

. Before fixing the paper support shaft holders, confirm that the projections of the right and left paper supports are inserted into the groove of the rear frame. (Refer to Figure 3-13.)

3.4.4 Preventive Maintenance

Due to their proven design, cut sheet feeder requires a minimum of preventive maintenance. Required preventive maintenance includes :

- General cleaning of the device.
- Checking the mechanical functions.

Cleaning of the paper loading rollers and the paper ejecting rollers is necessary at regular intervals and can be carried out after instruction. Intervals are determined by the time in operation and the paper type being used. (Paper-dust accumulation varies with the quality of paper). Table 3-10 shows cut sheet feeder maintenance tools.

Table 3-10. CSF Maintenance Tools

Designation	Availability	Part No.
Cleaning brush	o	B741 600100
Brush No. 1	0	B741 400200
Brush No. 2	0	B741 400100

0 : Commercially available tool

3.4.4.1 Cleaning

. Brush off all paper dust.

- Check the surface of the paper loading rollers and the paper ejecting rollers.

NOTE : If one of the paper loading rollers is damaged or worn unevenly, both rollers must be replaced.

. Clean all rubber rollers using a neutral detergent liquid.

WARNING

- Regularly check the paper loading roller shaft and paper ejecting roller shaft.
- If the paper is not pulled by the printer, open the right side cover, and check the gear wheels for wear or damage.

CHAPTER 4
DISASSEMBLY, ASSEMBLY, AND ADJUSTMENT

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4.1 GENERAL REPAIR INFORMATION

This chapter describes the disassembly procedures to be used for replacing any of the main components of the LQ-860/1060.

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

Table 4-1. Repair Tools

Designation	Necessary	Convenient	Part. No.
Philips screw driver #2	o		B743800200
Box driver (7 mm across)	o		B741700200
Thickness gauge (0.40 mm)	o		B7767OO1O1
Round nose pliers	o		B7404OO1OO
Diagonal cutting nipper	o		B7405OO1OO
Tweezers	o		B641OOO1OO
E-ring holder #2.5	o		6740900400
E-ring holder #3	o		B740800500
E-ring holder #4	o		B740800600
E-ring holder #5	o		B740800700
Alcohol	o		
Electric soldering iron		o	B740200100
Brush No. 1		0	B741400200
Brush No. 2		0	B7414OO1OO
Creaning brush		o	B741600100

O : Commercially available product

E : EPSON exclusive tool

Table 4-2. Measuring Instruments

Designation	Specification	Necessary	Convenient
Multimeter		o	
Oscilloscope	20 MHz or more		o

Table 4-3. Lubricants and Adhesive

Classification	Designation	Capacity	Availability	Part No.
oil	o-2	40 cc	E	B7102OOOOI
Grease	G-26	40 gr	E	B702600001
Grease	G-27	40 gr	E	B702700001
Adhesive tape	Single side		o	
Adhesive tape	Double side		o	

0 : Commercially available product

E : EPSON exclusive product

Figure 4-1 shows some of the parts found on the LQ-860/1060.

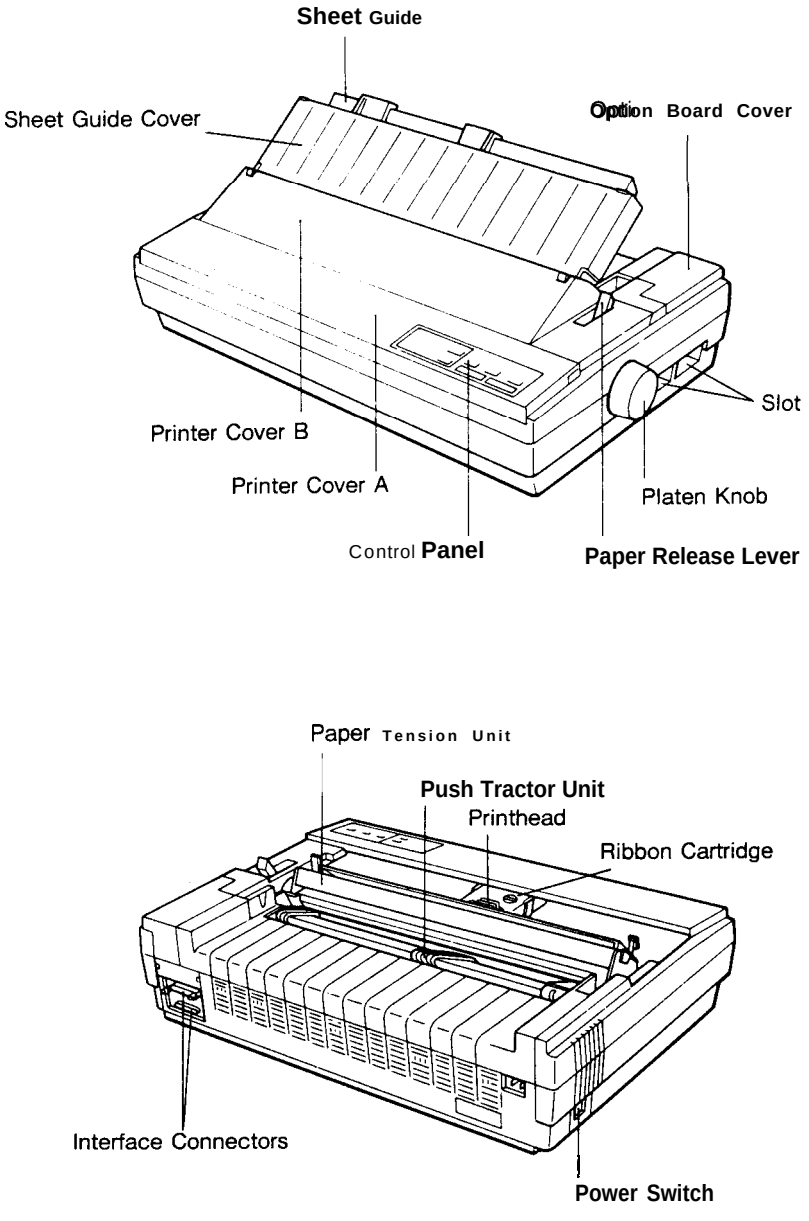


Figure 4-1. LQ-860/1060 Parts

WARNING

There are several precautions you should take after performing troubleshooting and when packing the printer for transport:

1. Slide the printhead to the middle of the printer. Then remove the paper tension unit.

2. Remove the sheet guide, ribbon cartridge, and platen knob.

3. Using a philips screw driver #2, reattach the two transport locking brackets.

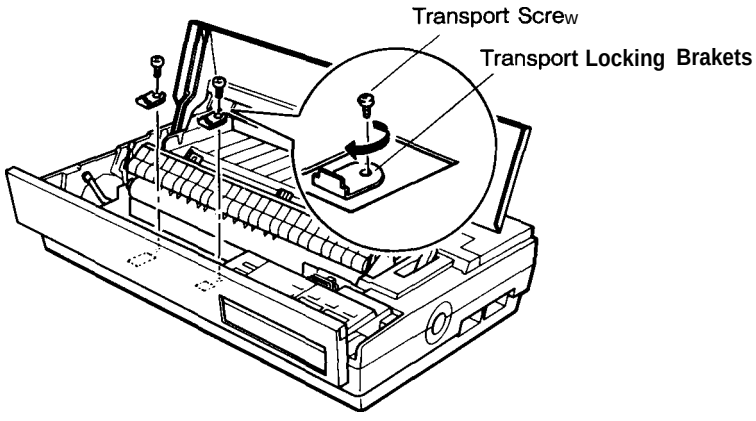


Figure 4-2. Transport Locking Brackets Installation

4. Repack the printer using the original box and packing materials.

- **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, cleaning, and maintenance as indicated in Chapter 6 to maintain optimal printer performance.

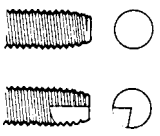
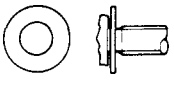
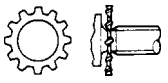
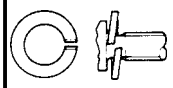
Screws, washers, nuts, etc. are abbreviated using the conventions below.

Table 4-4. Small Parts Abbreviations List

Abbreviation	Part Name
Cs	Cup Screw
CBB (CTBB)	Cross-Bind-head B-tight
CBS (CTBS)	Cross-Bind-head S-tight
CCB	Cross-Cup-head B-tight
CBS (0) (CTB(O))	Cross-Bind-head S-tight with Outside-toothed washer
CBNS (CTBS(N))	Cross-Bind-Notch-head S-tight
CPS (0) (CTPS(O))	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. Screw Forms and Abbreviated Part Names

Heed		Body	Washer (assembled)
ToP	Side		
Cross—recessed head  Slotted head 	1. Bind   (with f! otch) 2. Pan  3. Cup  4. Truss 	1. Normal  2. S-tight  3. B-tight  4. Tapping 	1 plain washer  2. Outside toothed lock washer  3. Spring washer 

4.2 DISASSEMBLY AND ASSEMBLY

Components of the LQ-860/1060 may be assembled simply by performing the disassembly operation in reverse sequence. Assemboly procedures, therfore, 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 push tractor unit, (3) removal of the circuit boards, and (4) disassembly of the printer mechanism. This sequence is shown in Figure 4-3.

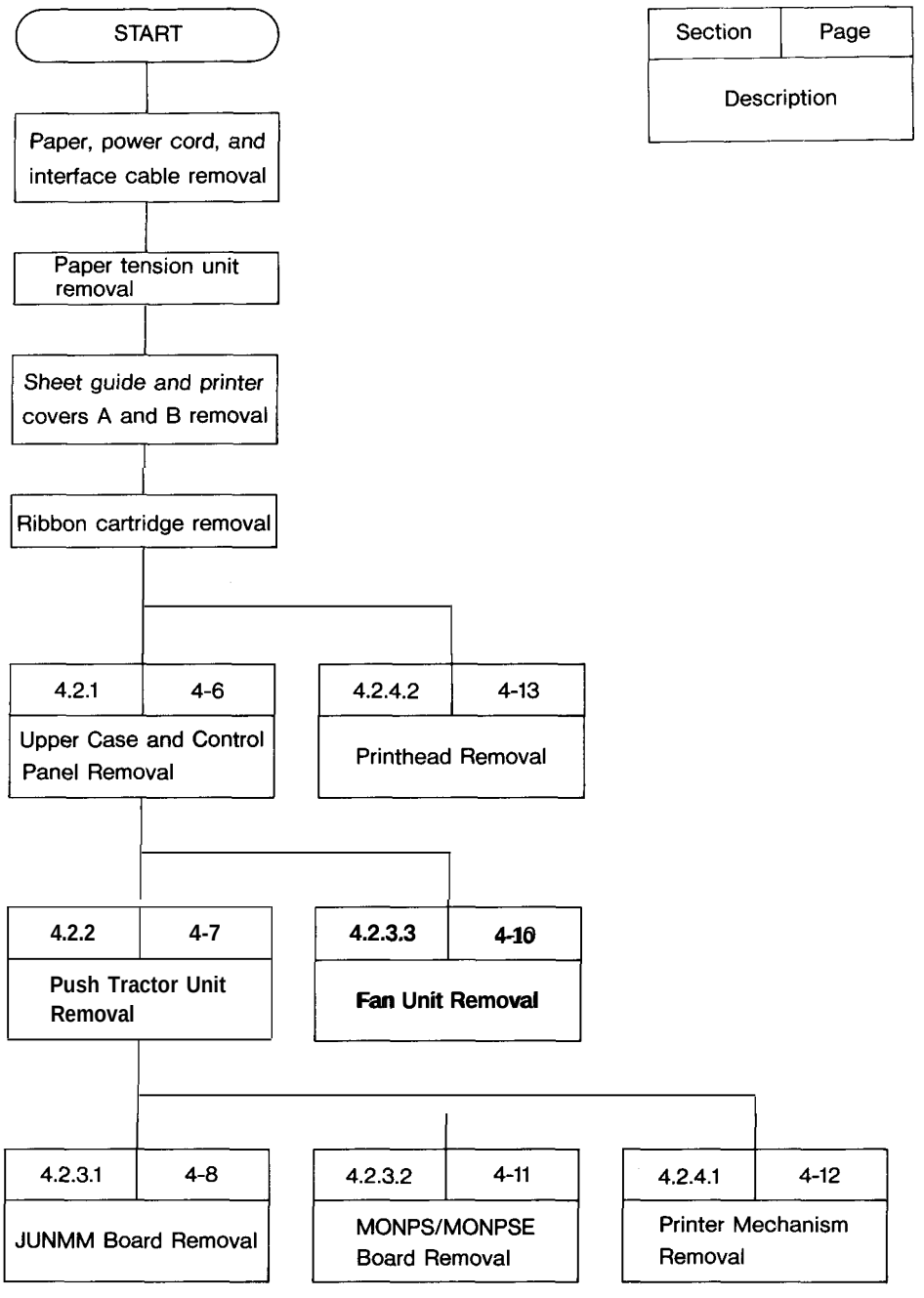


Figure 4-3. Printer Disassembly Procedures

4.2.1 Upper Case and Control Panel 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.

Step 1 : Remove the CBB (M4x25) screw securing the upper and lower cases.

Step 2: Open the tab at the left rear side of the control panel, then remove the control panel from the upper case.

Step 3: Detach the upper case by pressing in on the two retaining tabs inside the front of the printer.

Step 4: Pass the control panel through the hole in the upper case, then remove the upper case.

Step 5: Disconnect CN16 on the JUNMM board, then remove the control panel.

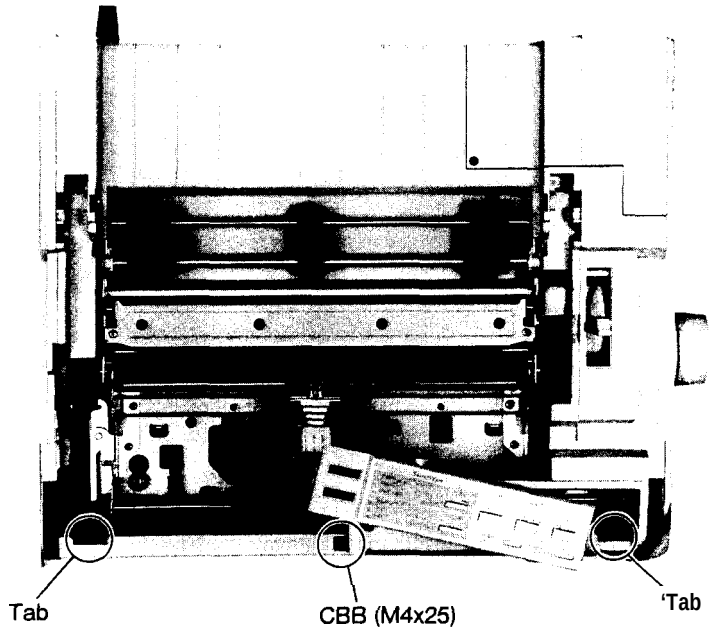


Figure 4-4. Upper Case Removal

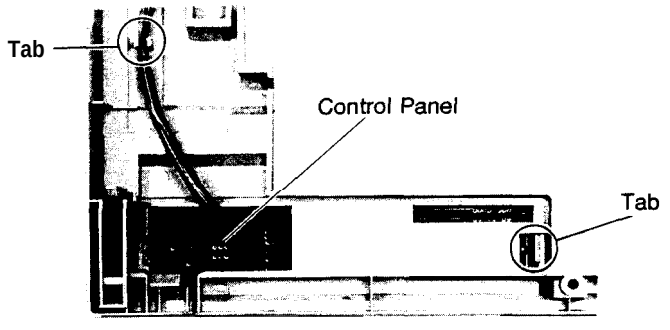


Figure 4-5. Control Panel Removal

ASSEMBLY POINT :

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

● When installing the upper case, confirm that the cables from the control panel run as shown in Figure 4-5.

4.2.2 Push Tractor Unit Removal

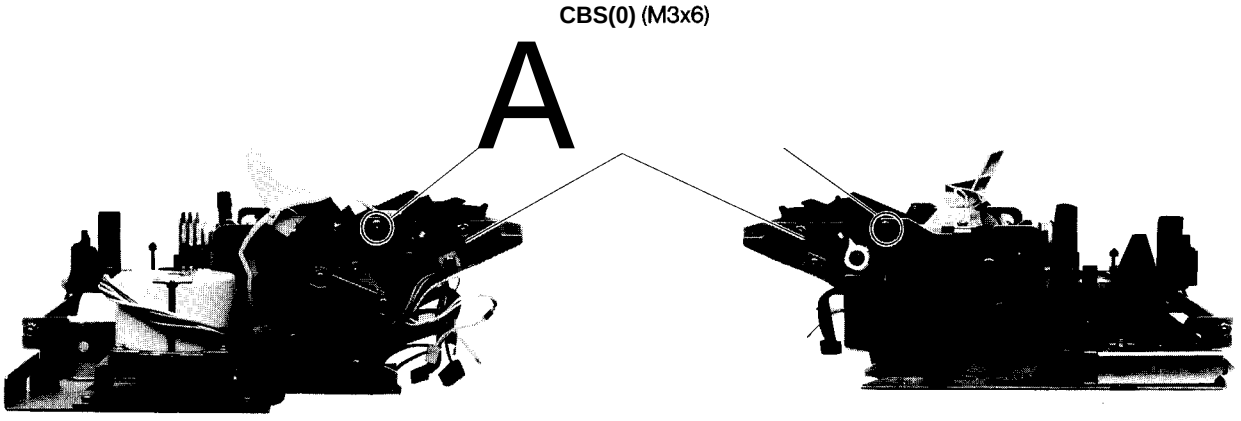
Remove the push tractor unit before removing the circuit boards and the printer mechanism from the lower case.

Step 1 : Remove the upper case (Refer to Section 4.2.1.).

Step 2: Position the paper release lever at the its front setting.

Step 3: Remove the two CBS(0) (M3x6) screws securing the push tractor to the printer mechanism.

Step 4: Remove the push tractor unit by pushing it to the back.



a) Right Side View

b) Left Side View

Figure 4-6. Push Tractor unit Removal

4.2.3 Circuit Board Removal

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

4.2.3.1 JUNMM Board Removal

Step 1: Remove the upper case (Refer to Section 4.2.1.).

Step 2: Remove the push tractor unit (Refer to Section 4.2.2.).

Step 3: Disconnect connectors CN5 and CN9, which connect the MONPS/MONPSE board.

Step 4: Disconnect connectors CN4, CN6, CN7, CN8, CN10, CN11, CN12, CN13, CN14, and CN15, which connect the printer mechanism.

Step 5: Remove the shield plate at the back of the lower case.

Step 6: Remove the two CBS(0) (M3x6) and three CCB (M3x1O) screws securing the JUNMM board.

Step 7: Remove the JUNMM board by lifting the back side of it.

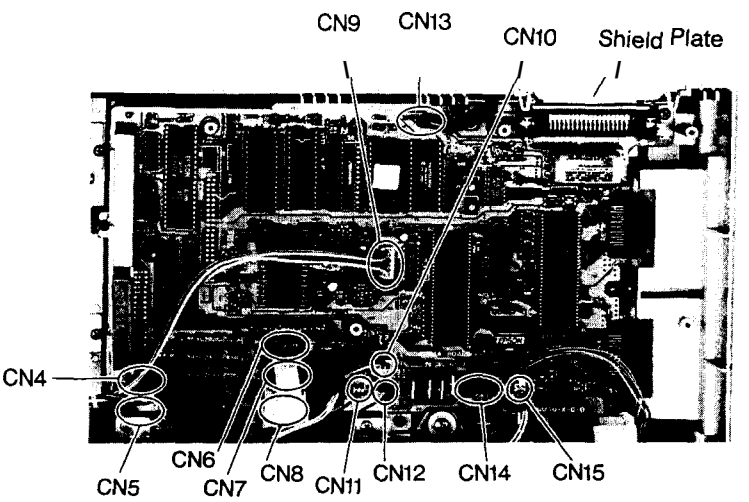


Figure 4-7. Connectors Removal

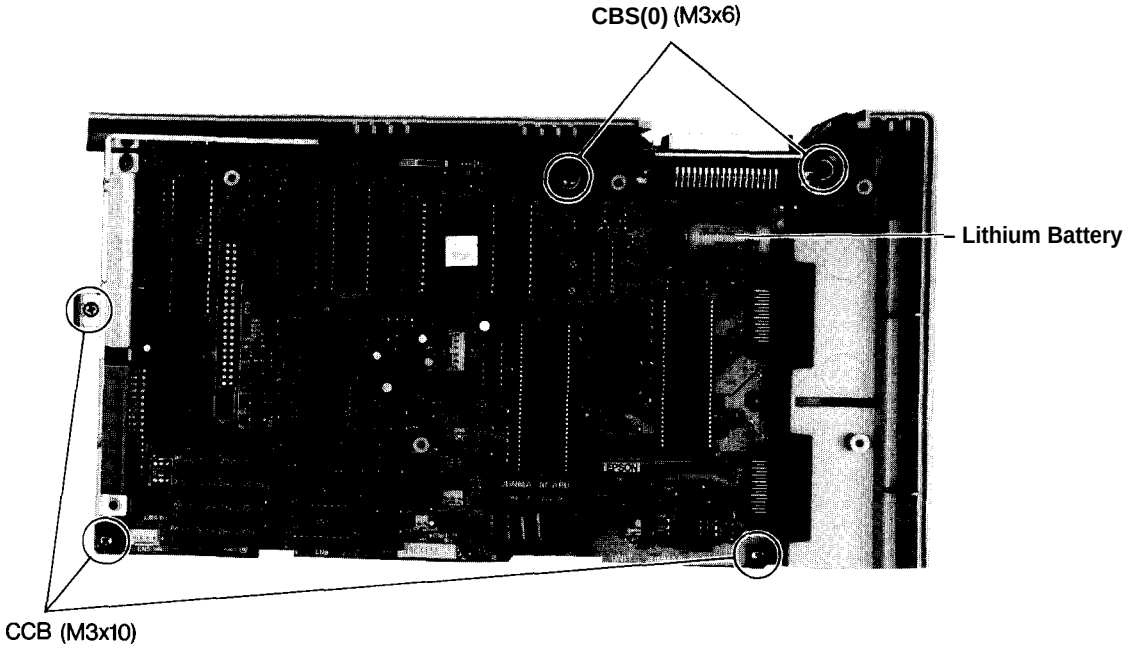


Figure 4-8. JUNMM Board Removal

DANGER

- **A lithium battery is mounted on the JUNMM board. Be careful not to lay the board down on a conductive surface, nor let any metal chips fall on to the board. It is very dangerous to allow the lithium battery to short, because it could burst.**
- **Danger of explosion if the battery is incorrectly replaced. Replace only with same or equivalent type recommended by Seiko Epson Corp.. Discard used batteries according to goverment's safety instruction.**

4.2.3.2 Fan Unit Removal

Step 1: Remove the upper case (Refer to Section 4.2.1.).

Step 2 : Disconnect the connector CN2 on the MONPS/MONPSE board, then remove the fan unit (Refer to Figure 4-lo.).

Step 3: Open the bent tab, then separate the fan motor from the fan adapter.

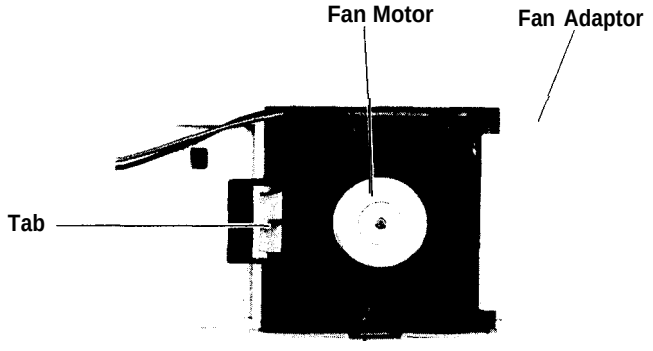


Figure 4-9. Fan Unit Removal

ASSEMBLY POINT :

. When connecting the fan motor to the fan adapter, confirm that the cable runs as shown in Figure 4-9,

4.2.3.3 MONPS/MONPSE Board Removal

Step 1 : Remove the upper case (Refer to Section 4.2.1.).

Step 2: Remove the push tractor unit (Refer to Section 4,2.2.).

Step 3: Remove the fan unit (Refer to Section 4.2.3.2.).

Step 4: Disconnect the connector CN1 which connect the JUNMM board and the CN2 which connect the fan unit.

Step 5: Remove the two CBB (M3x12) and two CBS(0) (M3x8) screws securing to lower case.

Step 6: Remove the CBS(0) (M4x8) screw with the fixing ground which secures the AC ground wire.

Step 7: Remove the MONPS/MONPSE board, along with the power switch and the AC cable (120V version) or AC inlet (220/240V version).

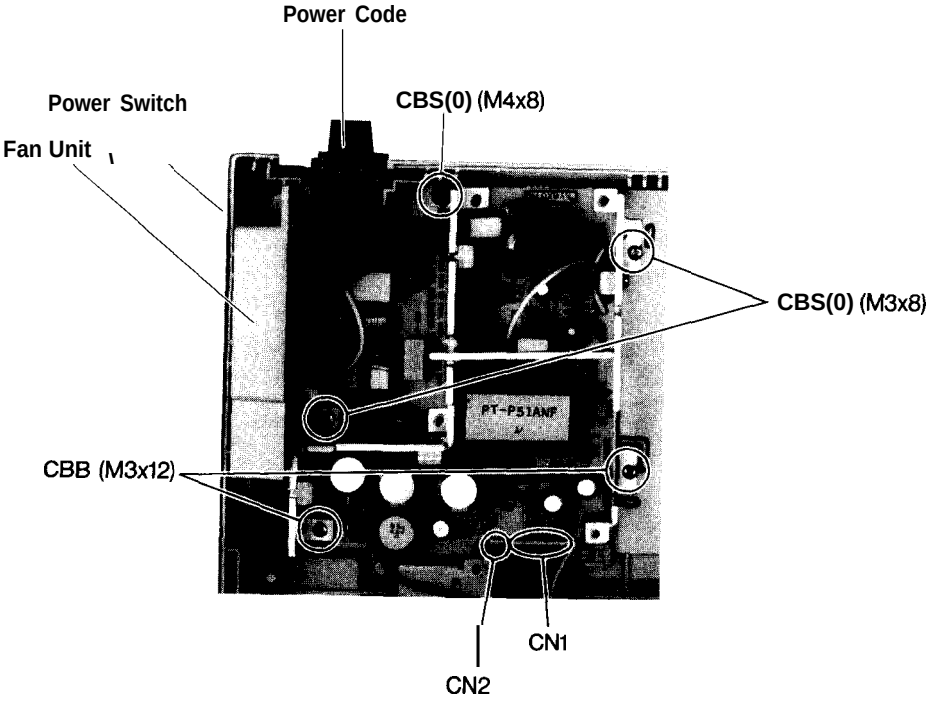


Figure 4-10. MONPS/MONPSE Board Removal

4.2.4 Printer Mechanism Disassembly

This section describes the procedures for disassembling the main components of the printer mechanism. Refer to Figures A-36 and A-37 in Appendix during assembly.

4.2.4.1 Printer Mechanism Removal

Step 1 : Remove the upper case (Refer to Section 4.2.1.).

Step 2: Remove the platen knob.

Step 3: Remove the push tractor unit (Refer to Section 4.2.2.).

Step 4: Disconnect connectors CN4, CN6, CN7, CN8, CN1O, CN11, CN12, CN13, CN14, and CN15 from the JUNMM board (Refer to Figure 4-7.)

Step 5: For the LQ-860 remove the three screws, or for the LQ-1060 remove the four screws, CBS(0) (M3x6), which attach the ground plates to base frame.

Step 6: For the LQ-860 remove the four screws, or for the LQ-1060 remove the five screws, CBB(P) (M4x25), securing the printer mechanism to the lower case.

Step 7: Remove the printer mechanism.

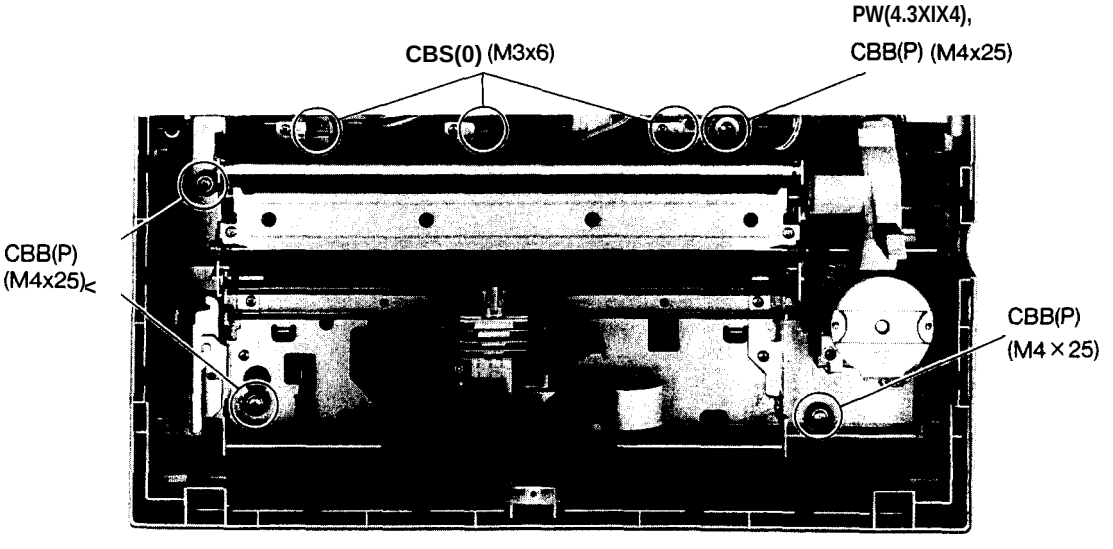


Figure 4-11. Printer Mechanism Removal

Step 8: Remove three for the LQ-860 or four screws for the LQ-1060, CBS(O) (M3x6), securing the ground plates to the base frame of the printer mechanism.

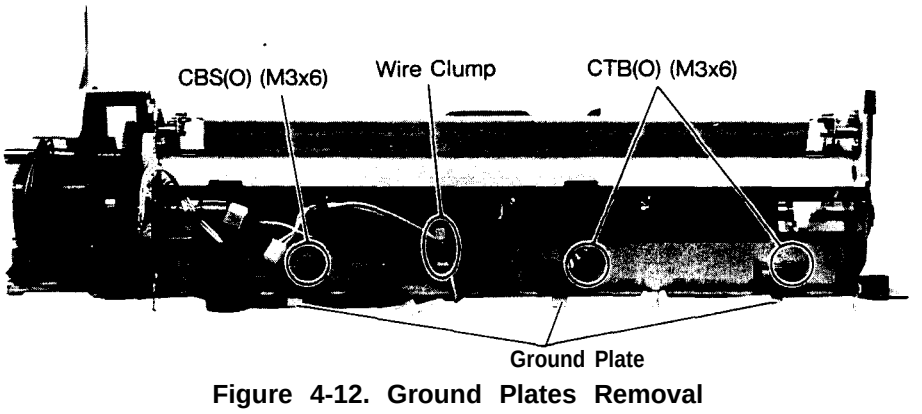


Figure 4-12. Ground Plates Removal

4.2.4.2 Printhead Removal

Step 1: Remove the printer cover A.

Step 2: Slide the carriage to the left, then remove the ribbon cartridge.

Step 3: Move the head lock levers to the outside.

Step 4: Shift the printhead slightly toward the platen side, pull it upward, slide it to the right, and remove from the carriage.

Step 5: Disconnect the two head cables (F and R) from the connectors at the printhead.

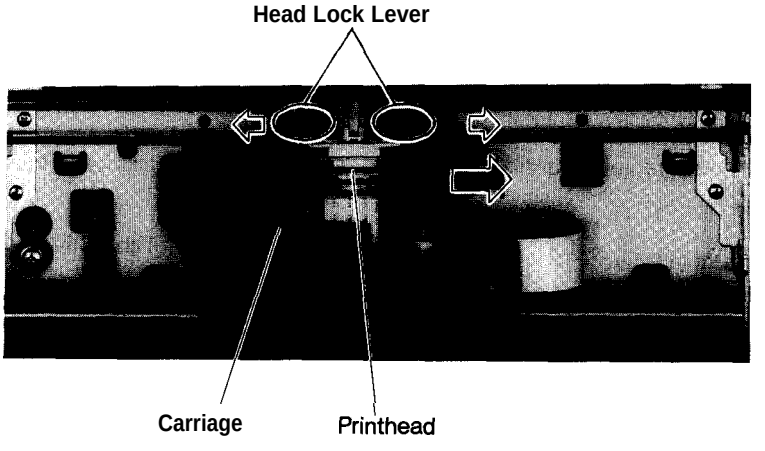


Figure 4-13. Printhead Removal

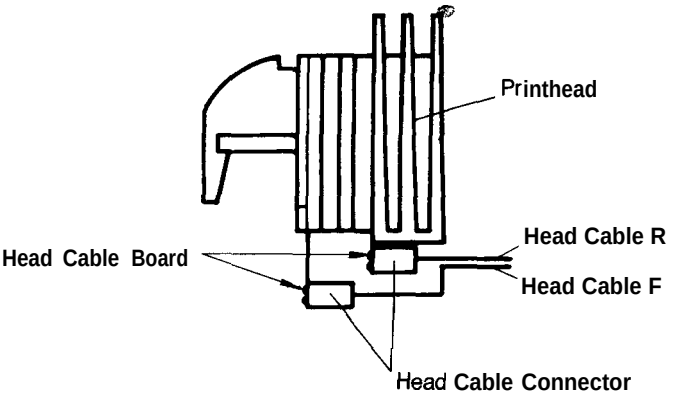


Figure 4-14. Disconnecting Head Cables

WARNING

o When disconnecting or connecting the head cable, be sure to hold the head cable connector to prevent the head cable connector board from being bent or damaged.

4.2.4.3 Head Cables (F and R) and Color Select Cable Board Removal

Step 1 : Remove the printer mechanism (Refer to Section 4.2.4.1.).

Step 2: Remove the printhead (Refer to Section 4.2.4.2.).

Step 3: Disconnect the connector of the color select/ribbon feed motor.

Step 4: Disconnect the connector of the color select sensor.

Step 5: Open the four tabs securing the color select cable board to the carriage, then remove the color select cable board from the carriage.

Step 6: Slide the carriage to the left.

Step 7: Peel off the adhesive tape, which fixes the head cables (F and R) and color select cable to the rear of the base frame, then detach the cables from the base frame.

Step 8: Press the two tabs for the head cable holder at the bottom of the base frame, and remove the head cable holder.

Step 9: Remove the head cables (F and R) and Color select cable from the base frame.

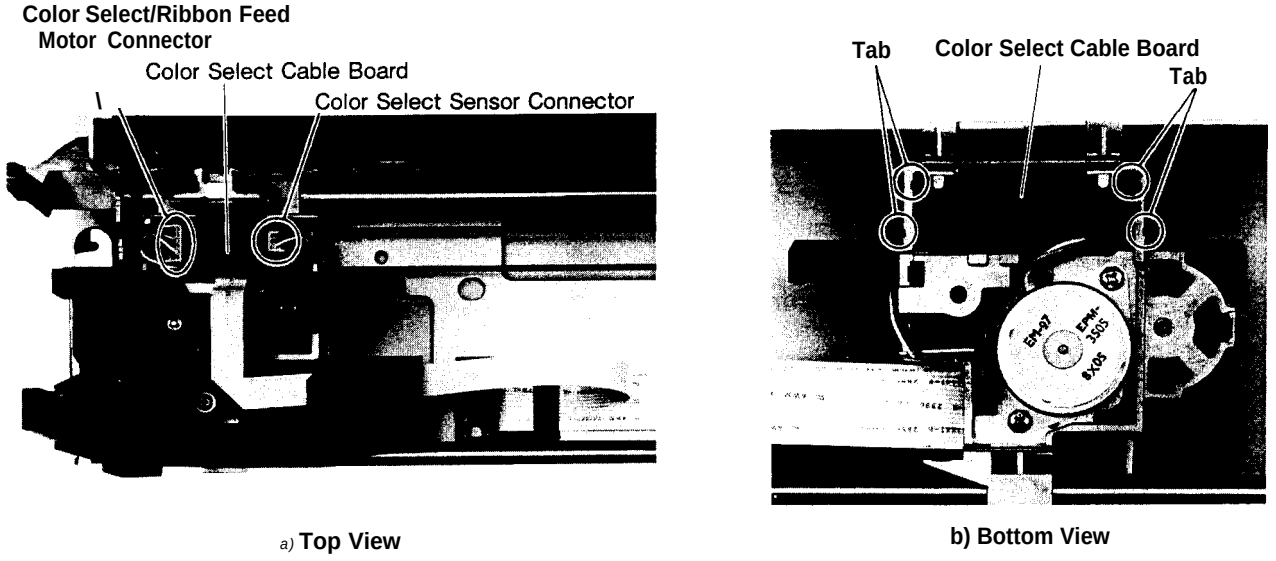


Figure 4-15. Color Select Cable Board Removal

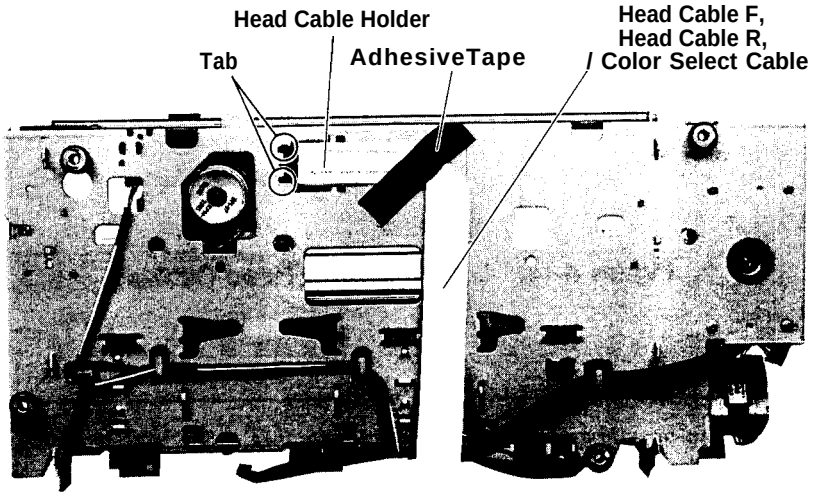


Figure 4-16. Head Cables (F and R) and Color Select Cable Removal (bottom view)

ASSEMBLY POINT :

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

4.2.4.4 Carriage Motor Removal

Step 1 : **Remove the printer mechanism (Refer to Section 4.2.4.1.).**

Step 2: **Cut the wire clamp, then remove the carriage motor lead wire from the base frame. (See Figure 4-12.)**

Step 3: **Remove the belt tension spring.**

Step 4: **Remove the four CBS(0) (M3x6) screws securing the carriage motor to the base frame.**

Step 5: **Remove the carriage motor.**

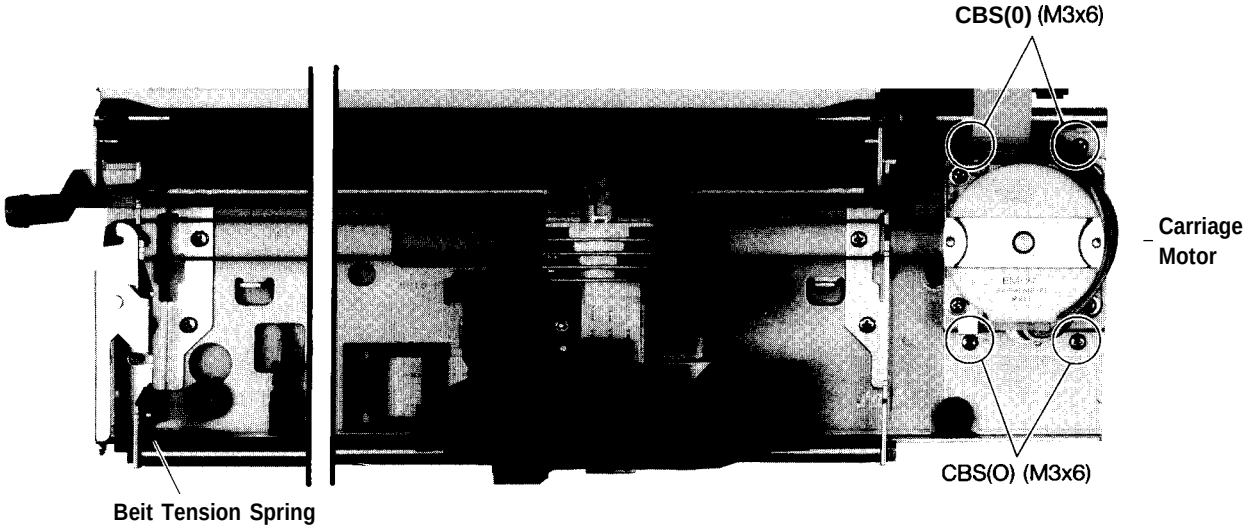


Figure 4-17. Carriage Motor Removal

ASSEMBY POINT:

. When binding the lead wires with the wire clamp, attach the wire clamp around the protective tube.

4.2.4.5 Timing Belt Removal

Step 1 : Remove the printer mechanism (Refer to Section 4.2.4.1.).

Step 2: Remove the carriage motor (Refer to Section 4.2.4.4.).

NOTE : At this time, it is not necessary to cut the wire clamp, which binds the lead wires from the carriage motor.

Step 3: Place the carriage over the notch in middle of the base frame, and release the two engaged parts of the timing belt and carriage from the bottom side of the base frame.

Step 4: Remove the belt driven pulley by moving it to the left, and remove the timing belt.

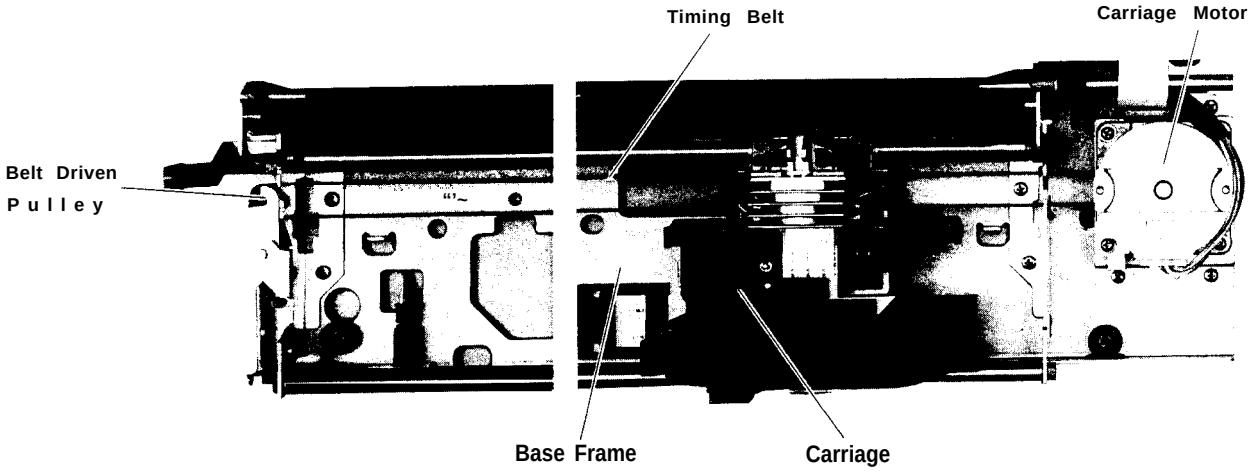


Figure 4-18. Timing Belt Removal (top view)

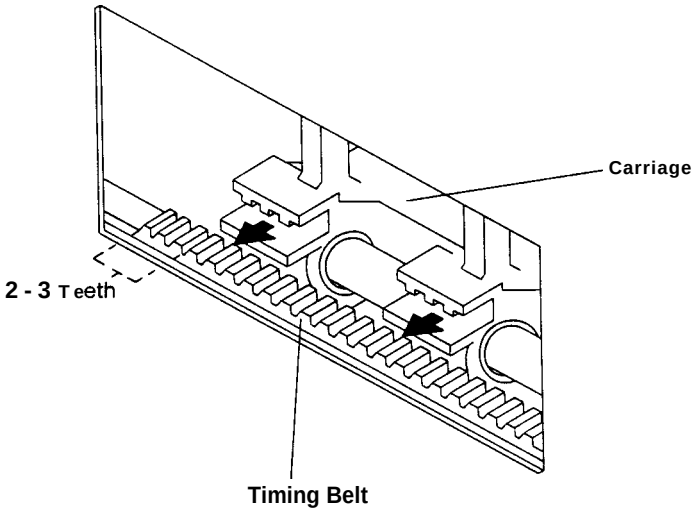


Figure 4-19. Timing Belt Removal (bottom view)

ASSEMBLY POINT :

- **When fixing the timing belt to the carriage, set the carriage so that two or three timing-belt teeth timing belt can be seen at the left of the carriage, as shown in Figure 4-19.**

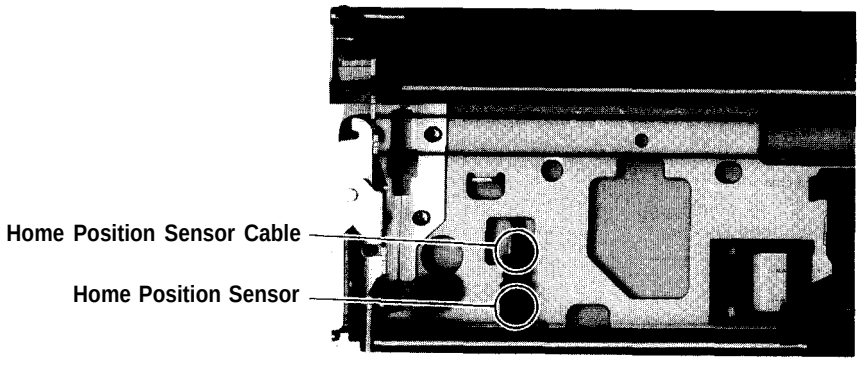
4.2.4.6 Home Position Sensor Removal

Step 1 : Remove the printer mechanism (Refer to Section 4.2.4.1.).

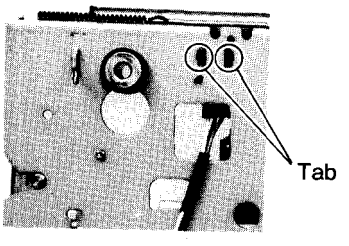
Step 2: Press the two tabs of the home position sensor on the bottom of the base frame.

Step 3: Remove the home position sensor.

Step 4: Disconnect the connector from the home position sensor.



a) **Top View**



b) Botom View

Figure 4-20. Home Position Sensor Removal

4.2.4.7 Platen Gap Sensor Removal

Step 1 : **Remove the printer mechanism (Refer to Section 4.2.4.1.).**

Step 2: **Cut the wire clamp, then remove the carriage lead wires, from the base frame. (See Figure 4-12.)**

Step 3: **Position the head adjustment lever at a setting between the 1st and 2nd positions.**

Step 4: **Remove the two tabs securing the platen gap sensor to the left frame, then remove the sensor.**

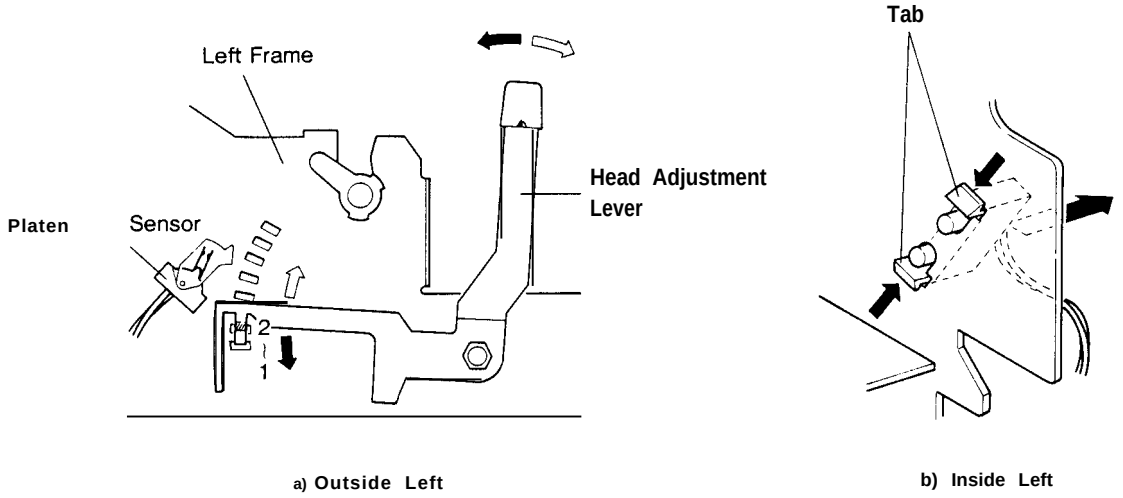


Figure 4-21. Platen Gap Sensor Removal

4.2.4.8 Paper Feed Motor Removal

Step 1 : Remove the printer mechanism (Refer to Section 4.2.4.1.).

Step 2: Remove the two CBS(0) (M3x6) screws.

Step 3: Remove the paper feed motor.

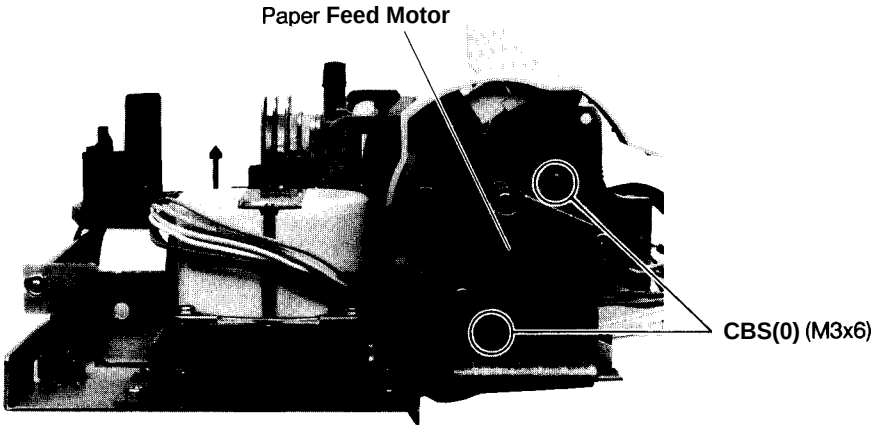


Figure 4-22. Paper Feed Motor Removal

ADJUSTMENT REQUIRED

- **When the paper feed motor is replaced or the fixing screws are loosened, perform the following adjustment :**

  Section 4.3.1.3 Paper Feed Motor Gear Backlash Adjustment

4.2.4.9 Friction/Tractor Sensor Removal

Step 1 : **Remove the printer mechanism (Refer to Section 4.2.4.1.).**

Step 2 : **Position the paper release lever at the its back setting.**

Step 3: **Remove the CPS(P) (M3x10) screw securing the friction/tractor sensor to the right frame, then remove the sensor.**

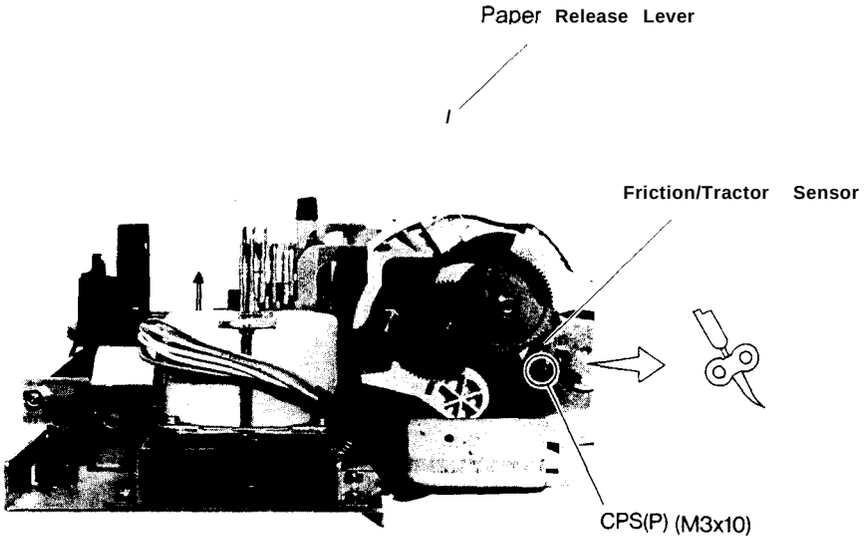


Figure 4-23. Friction/Tractor Sensor Removal

ASSEMBLY POINT :

. Make sure of the sensor direction and set in place before mounting the friction/tractor sensor on the right frame (Refer to Figure 4-23.).

4.2.4.10 Paper End Sensor Removal

Step 1 : Remove the printer mechanism (Refer to Section 4.2.4.1.).

Step 2: Loosen the two bends securing the paper end sensor to the back of the paper guide.

Step 3: Remove the paper end sensor.

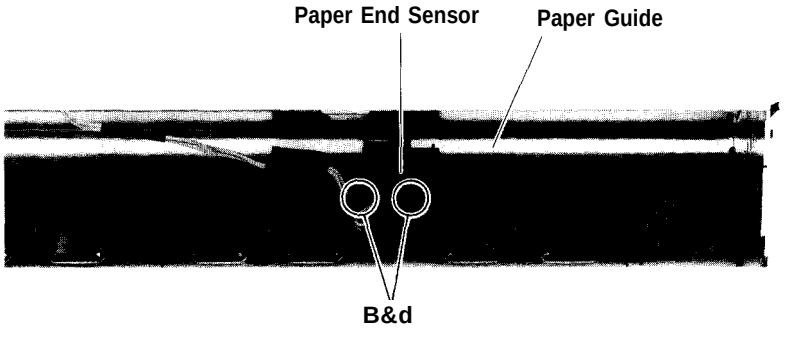


Figure 4-24. Paper End Sensor Removal

4.2.4.11 Platen Unit Removal

Step 1 : Remove the upper case (Refer to Section 4.2.1.).

Step 2: Remove the two CBNS (M3x6) screws securing the platen cover to left and right frames, then remove the platen cover.

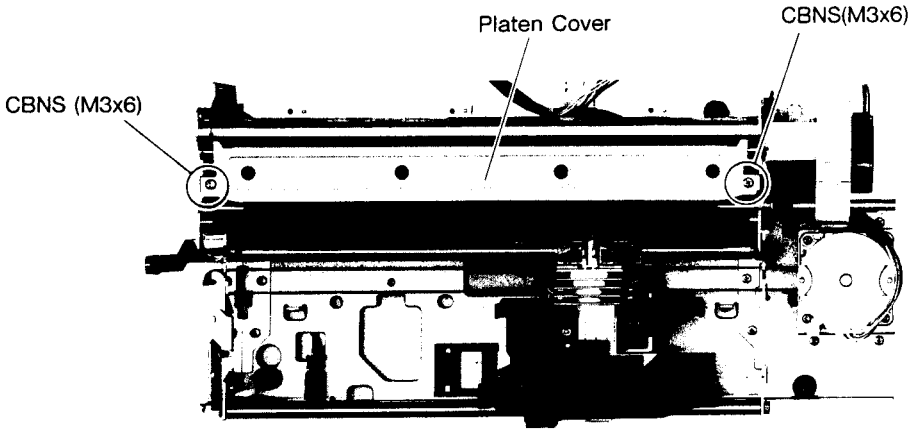


Figure 4-25. Platen Cover Removal

Step 3: Position the paper release lever at the its middle setting.

Step 4: Push on the left shaft holder tab, and rotate it forward.

Step 4: Push on the right shaft holder tab, and rotate it forward.

Step 5: Remove the platen unit by moving it to the right side.

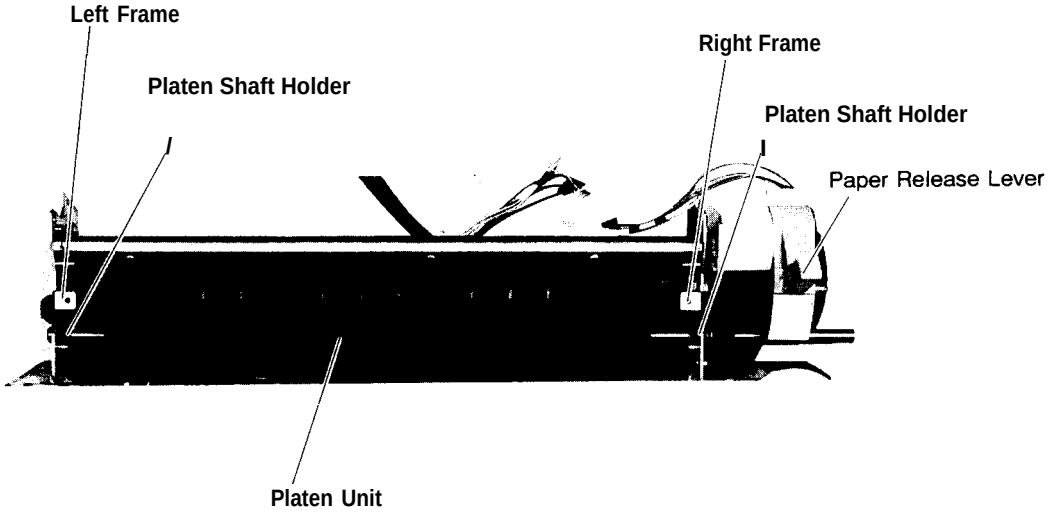


Figure 4-26. Platen Unit Removal

4.2.4.12 Color Select Sensor Removal

Step 1 : **Remove the upper case (Refer to Section 4.2.4.1.).**

Step 2: **Position the color select sensor mounting part of the carriage at the cutout in the base frame.**

Step 3: **Open the tab of the ribbon drive base, then remove the color select sensor from the carriage.**

Step 4: **Disconnect the connector of the color select sensor from the color select cable board.**

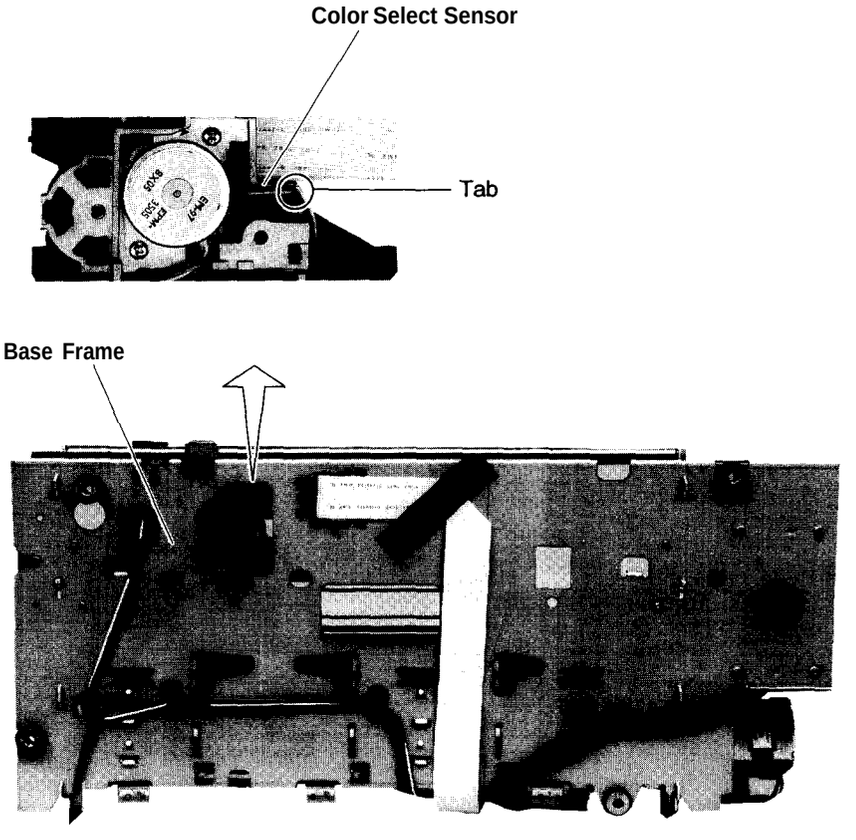


Figure 4-27. Color Select Sensor Removal

4.2.4.13 Color Select/Ribbon Feed Motor Removal

Step 1 : Remove the printer mechanism (Refer to Section 4.2.4.1.).

Step 2 : Remove the printhead and head cable from the carriage. (Refer to Section 4.2.4.2.)

Step 3: Disconnect the color select/ribbon feed motor and color select sensor connectors from the cable board. (Refer to Section 4.2.4.3.)

Step 4: Remove the head cable holder, then remove the cable board from the carriage. (Refer to Section 4.2.4.3.)

Step 5: Remove the CS (M3 x 6) screw.

Step 6: Open the six tabs securing the ribbon drive base to the carriage, then remove the ribbon drive base from the carriage.

Step 7 : Remove the ribbon planetary lever assembly and ribbon transmission gear.

Step 8: Position the color select/ribbon feed motor mounting area of the carriage at the cutout in the base frame.

Step 9: Remove the two CTB (0) screws (M3 x 6), then remove the color select/ribbon feed motor from the carriage.

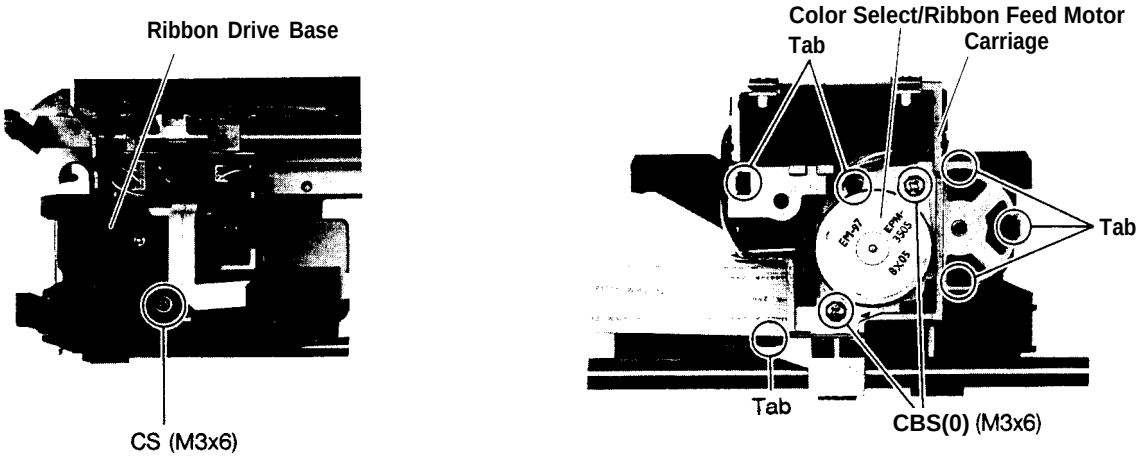


Figure 4-28. Ribbon Drive Base and Color Select/Ribbon Feed Motor Removal

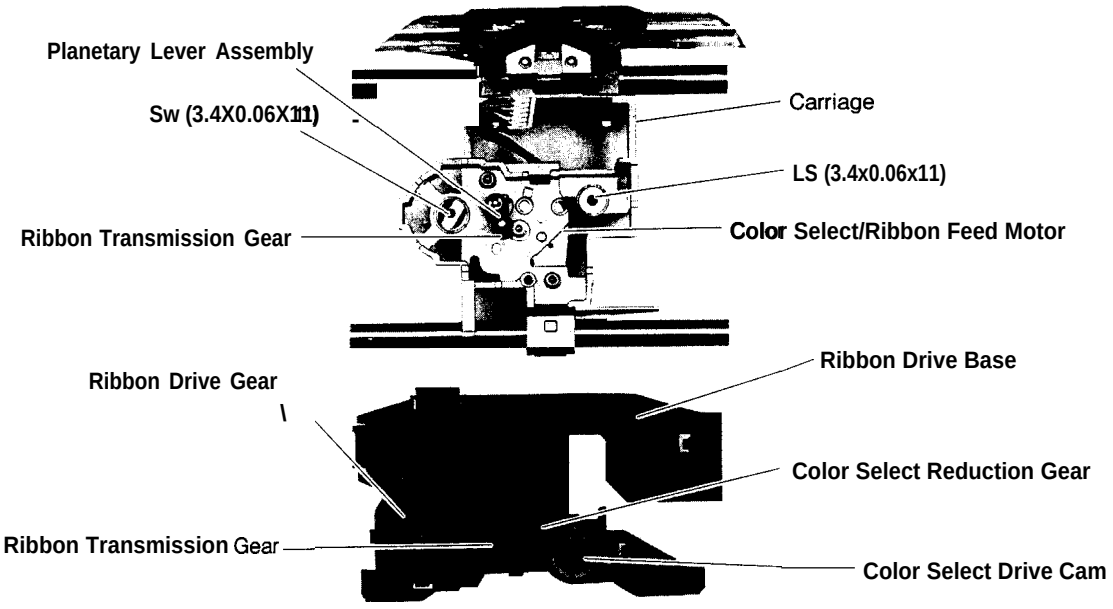


Figure 4-29. Ribbon Transmission Gear Train Removal

ASSEMBLY POINT :

. When installing the ribbon drive gear, set it as shown in Figure 4-30.

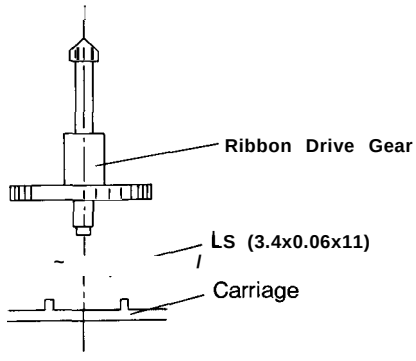


Figure 4-30. Ribbon Drive Gear Setting

4.2.4.14 Paper Release Lever and Sub Paper Release Lever Removal

Step 1 : Remove the printer mechanism (Refer to Section 4.2.4.1.).

Step 2: Remove the paper feed motor (Refer to Section 4.2.4.8.).

Step 3: Remove the tractor transmission gear spring, washer PW (5.2xO.3X1O), paper feed reduction gear, and tractor transmission gear.

Step 4: Remove the platen unit (Refer to Section 4.2.4.11.).

Step 5: Press the paper release lever tab at the inside of the right frame, then remove the lever.

Step 6 : Press the sub paper release lever tab at the inside of the right frame, then remove the lever.

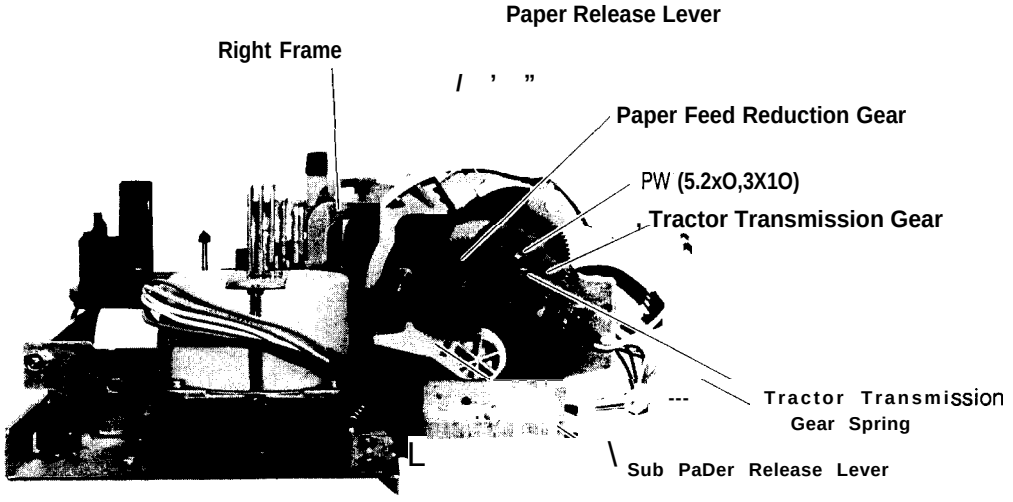


Figure 4-31. Paper Release Lever and Sub Paper Release Lever Removal

ADJUSTMENT REQUIRED

- When the paper feed motor is replaced or the fixing screws are loosened, perform the following adjustment :

  Section 4.3.1.3 Paper Feed Motor Gear Backlash Adjustment

4.2.4.15 Main Frame Unit and Base Frame Unit Separation

Step 1 : Remove the printer mechanism (Refer to Section 4.2.4.1.).

Step 2: Remove the timing belt (Refer to Section 4.2.4.5.).

NOTE: The carriage motor need not be removed.

Step 3: Remove the paper feed motor (Refer to Section 4.3.4.8.).

Step 4: Remove the paper release lever and sub paper release lever (Refer to Section 4.2.4.14.).

Step 5: Remove the platen gap sensor from left frame. (Refer to Section 4.2.4.7.)

Step 6: Remove the head cable and color select cable from the bottom of the base frame, then remove the head cable holder. (See Figure 4-16.)

Step 7: Cut the wire clamp, then remove each lead wire from the base frame. (See Figure 4-12.)

Step 8: Remove four two CBS(0) (M3x6) screws securing the left and right frames to the base frame.

Step 9: Slide the main frame unit (upper portion of the mechanism) backward and the base frame unit (lower portion of the mechanism) frontward, then disconnect the tab to separate them.

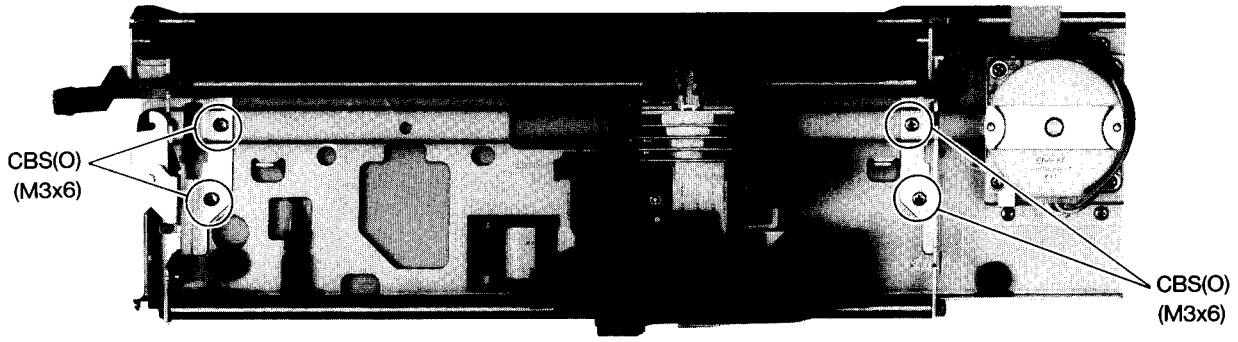


Figure 4-32. Main Frame Unit and Baae Frame Unit Separation (1)

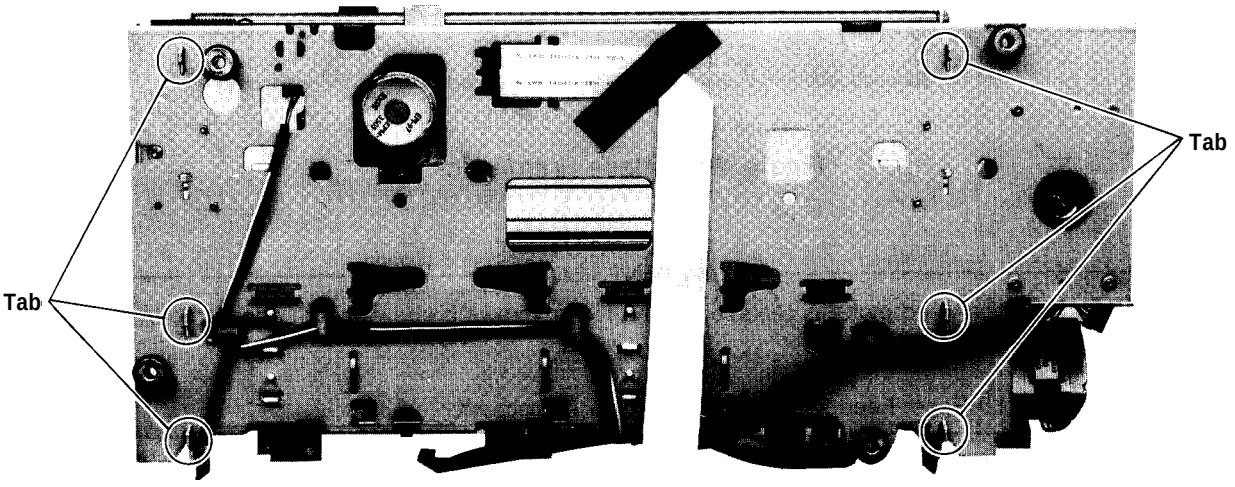


Figure 4-33. Main Frame Unit and Base Frame Unit Separation (2)

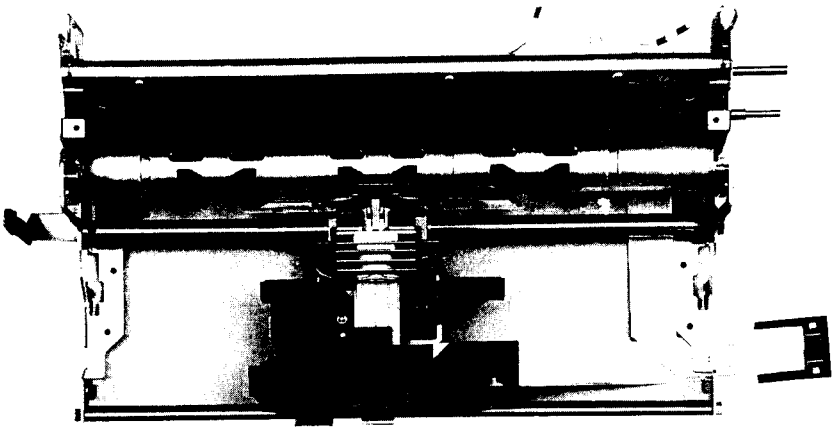


Figure 4-34. Main Frame Unit

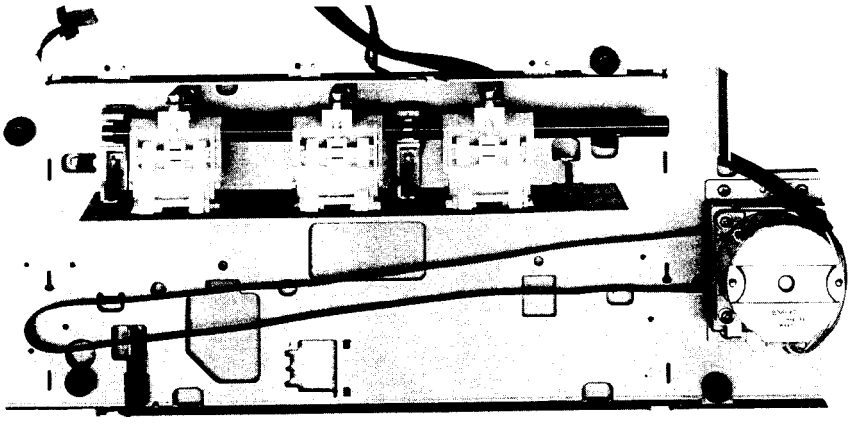


Figure 4-35. Base Frame Unit

ADJUSTMENT REQUIRED

- **When the paper feed motor is replaced or the fixing screws are loosened, perform the following adjustment:**

  Section 4.3.1.3 Paper Feed Motor Gear Backlash Adjustment

4,.2.4.16 Carriage Removal

Step 1 : Remove the printer mechanism (Refer to Section 4.2.4.1.).

Step 2 : Separate the main and the base frame units (Refer to Section 4.2.4.15.).

Step 3: Remove the two HNO (4) nuts from left frame, which secure carriage guide shafts A and B.

Step 4: Remove the HNO (4) nut from the right frame.

Step 5: Spread both left and right frames apart, and remove the carriage guide shafts A and B.

Step 6: Pull the carriage out from the carriage guide shafts A and B.

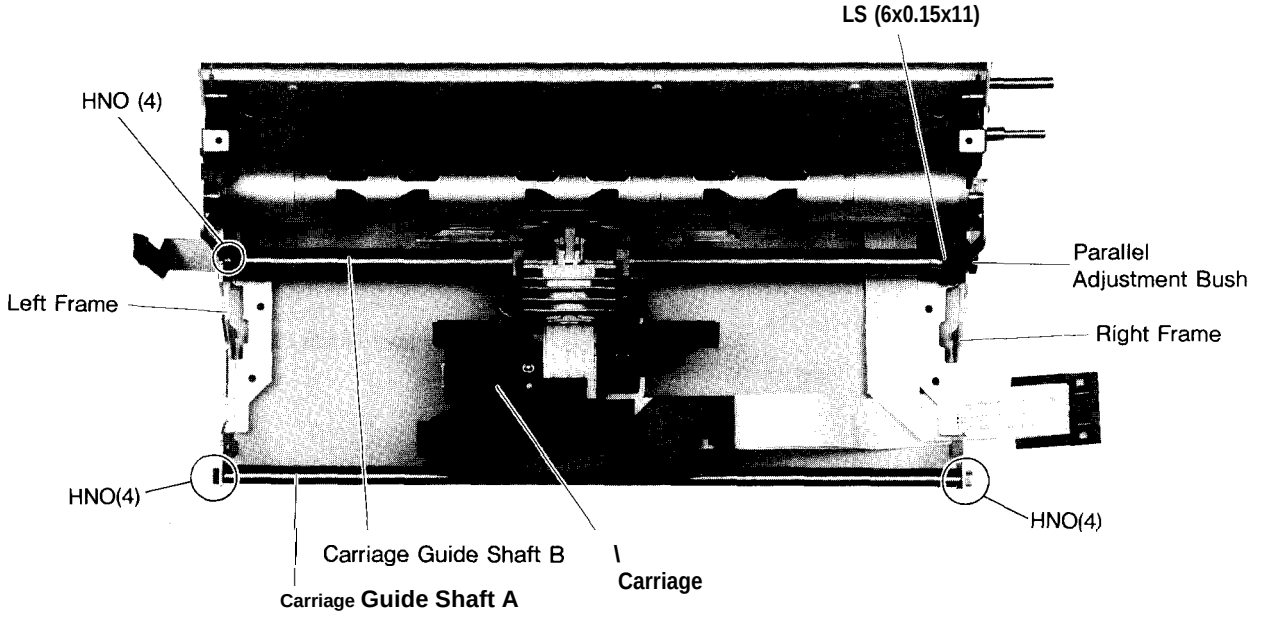


Figure 4-36. Carriage Removal

ASSEMBLY POINT :

- **When installing leaf spring LS (6 x 0.15 x 11) and the parallel adjustment bush at the right side of carriage guide shaft B, be careful of their orientations. (See Figure 4-37.)**

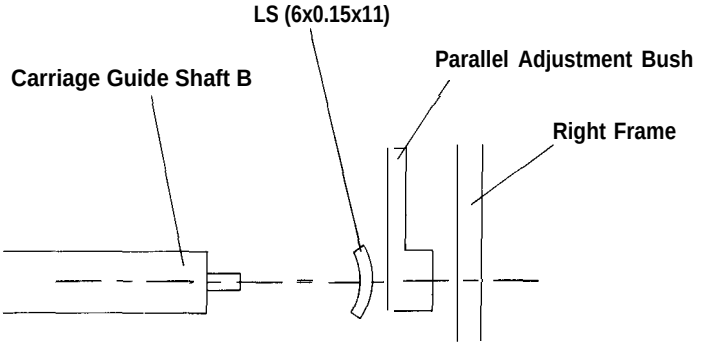


Figure 4-37. Leaf Spring and Parallel Adjustment Bush Installation

ADJUSTMENT REQUIRED

- When the carriage **is removed, the following adjustment is required during the assembly procedure:**

Section 4.3.1.1 Platen Gap Parallelism Adjustment
Section 4.3.1.2 Platen Gap Adjustment
Section 4.3.1.3 Paper Feed Motor Gear Backlash Adjustment

4.2.4.17 Paper Guide Plate Removal

Step 1 : Remove the printer mechanism (Refer to Section 4.2.4.1.).

Step 2: Separate the main and base frame units (Refer to Section 4.2.4.15.).

Step 3: For the LQ-860, remove three paper guide plate springs or for the LQ-106O remove four paper guide plate springs with the mechanism status.

Step 4: Remove the paper guide plate.

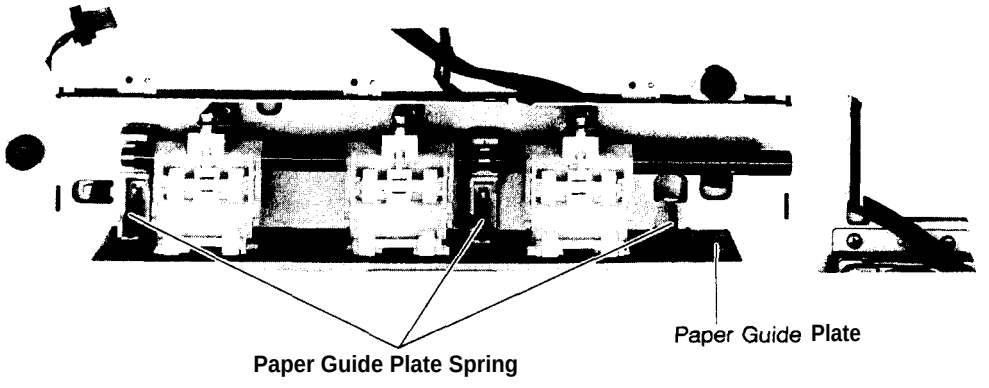


Figure 4-38. Paper Guide Plate Spring and Paper Guide Plate Removal

ASSEMBLY POINT :

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

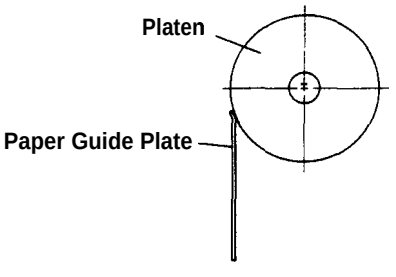


Figure 4-39. Paper Guide Plate Mounting Direction

ADJUSTMENT REQUIRED

- **When the paper feed motor is replaced or the fixing screws are loosened, perform the following adjustment:**

  Section 4.3,1.3 Paper Feed Motor Gear Backlash Adjustment

4.2.4.18 Paper Feed Roller Unit Removal

Step 1 : **Remove the printer mechanism (Refer to Section 4.2.4.1.).**

Step 2 : **Separate the main and base frame units (Referr to Section 4.2.4.15.).**

Step 3: **Remove three paper feed springs for the LQ-860 or four for LQ-106O from the hook on the base frame.**

Step 4; **Remove the paper feed roller unit.**

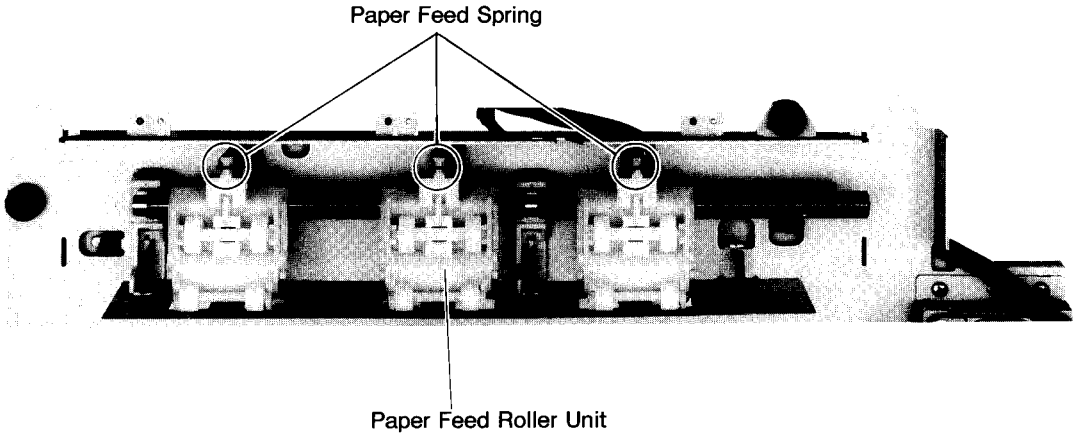


Figure 4-40. Paper Feed Roller Unit Removal

ASSEMBLY POINT :

- **When installing the paper feed roller unit, check that the stopper at the bottom edge of the unit is placed in the groove of the base frame.**

ADJUSTMENT REQUIRED

- When the paper feed motor is replaced or the fixing screws are loosened, perform the following adjustment :

  Section 4.3.1.3 Paper Feed Motor Gear Backlash Adjustment

4.2.4.19 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 reverce order, assembly procedures have been omitted.

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

Step 2: Remove the CBS(0) (M3x6) screw securing tractor left frame to the tractor base frame.

Step 3: Remove the HNO (4) nut securing the tractor guide shaft

Step 4 : Remove the tractor left frame.

Step 5 : Push the tractor lock lever upward, and remove the left tractor assembly from the shafts.

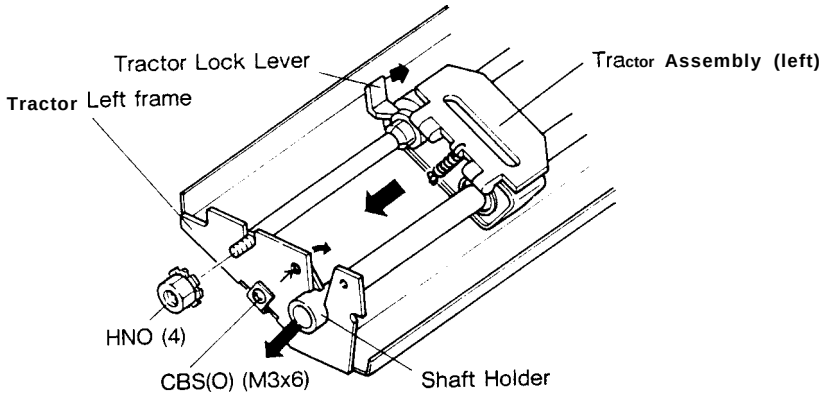


Figure **4-41. Tractor Assembly (left) Removal**

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.**

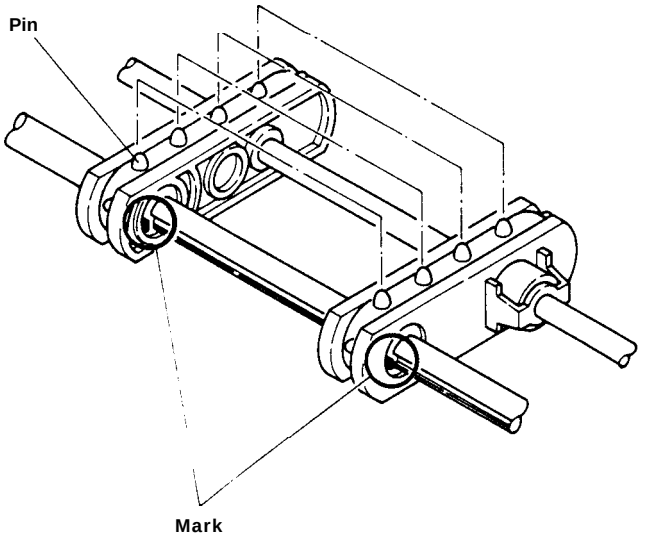


Figure 4-42. Tractor Assembly Phases

4.2.4.20 Paper Tension Unit Disassembly

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

Step 1 : Remove the RE (4) on the paper tension roller shaft at the outside of the paper tension left frame.

Step 2: Disconnect the paper tension shaft holder from the paper tension left frame by sliding it toward the outside, then remove it toward the right side.

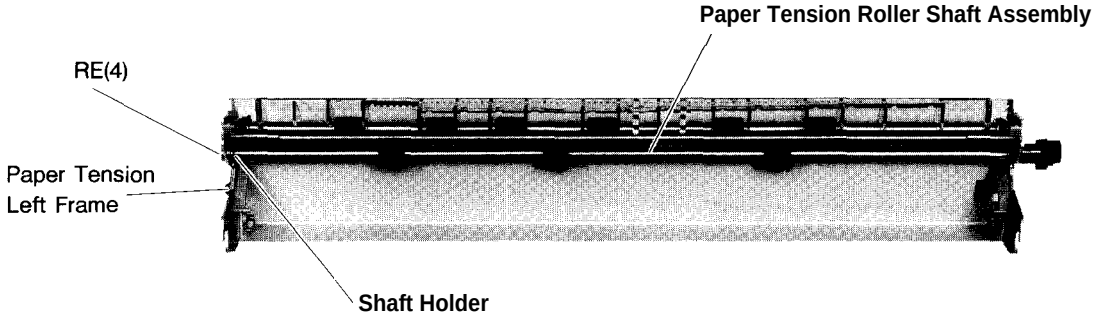


Figure 4-43. Paper Tension Roller Shaft Assembly Removal

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 Printer Mechanism Adjustment

This section describes the printer mechanism adjustment.

4.3.1.1 Platen Gap Parallelism Adjustment

This adjustment corrects the parallelism between the platen and carriage guide shaft B.
Perform this adjustment in the following cases :

- **When the parallel adjustment bush is moved.**
- **When the parallel adjustment bush is removed.**

Step 1 : Remove the printer mechanism (Refer to Section 4.2.4.1.).
Step 2: Remove the printhead (Refer to Section 4.2.4.2.).
Step 3: Remove the ribbon mask holder with the ribbon mask.
Step 4: Reinstall the printhead on the carriage.
NOTES : When reinstalling the printhead, lock the head lock levers while pushing the printhead forward and downwoard.
Step 5: Move the carriage to the left, set the thickness gauge in position, and rotate the carriage guide shaft B so that the gap becomes 0.41 ± 0.02 mm. (At this time, temporarily set the head adjustment lever at the 2nd position from the bottom.)
Step 6: Move the carriage to the right, insect the thickness gauge, and rotate the parallel adjustment bush so that the gap becomes 0.41 ± 0.02mm.
Step 7: Repeat steps 5 and 6 until the left and right platen gaps become the same (until carriage guide shaft B and the platen become parallel).

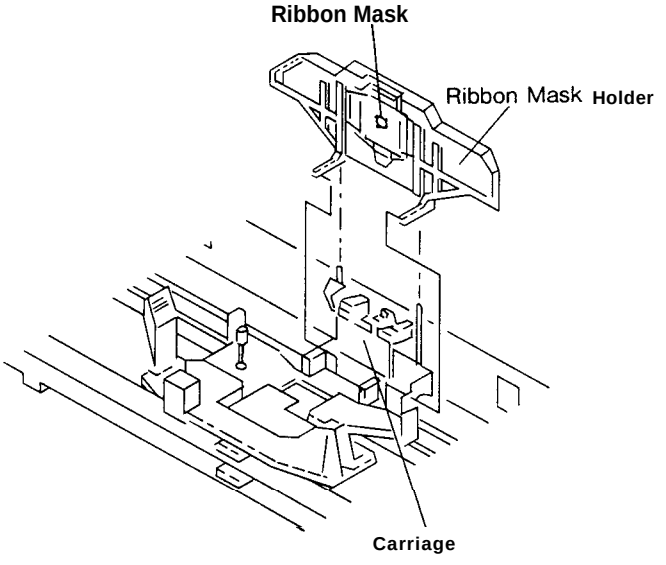


Figure 4-44. Ribbon Mask Holder Removal

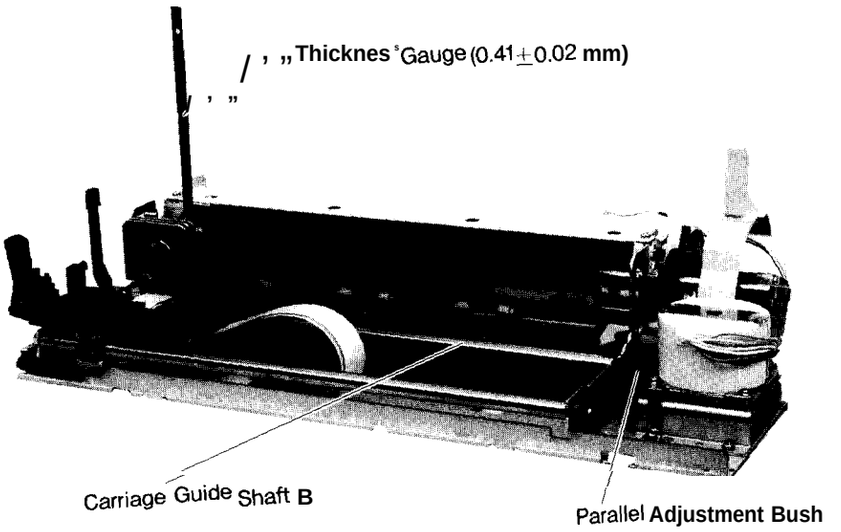


Figure 4-45. Platen Gap Parallelism Adjustment

4.3.1.2 Platen Gap Adjustment

Adjust the gap between the platen and the printhead when :

- **When the mounting positions of carriage guide shaft B and the head adjustment lever are changed.**

Step 1 : Remove the printer mechanism (Refer to Section 4.2.4.1.).
Step 2: Remove the printhead (Refer to Section 4.2.4.2.).
Step 3: Remove the Ribbon mask holder with the ribbon mask (Refer to Figure 4-44.).
Step 4: Reinstall the printhead on the carriage.
NOTE : When reinstalling the printhead, lock the head lock levers while pushing the printhead forward and downwoard.
Step 5: Move the carriage to center.
Step 6: Lighty loosen the HNO (4) nut securing the head adjustment lever.
Step 7: Turn the chamfered edge of carriage guide shaft B so that if faces up.
Step 8: insert the blade of a screw driver (a diameter is approx. 3 mm) into the countersink of carriage guide shaft B.
Step 9: Set the head adjustment lever at the 2nd position.
Step 10: Position the paper release lever at the its backward setting.
Step 11 : Adjust the platen gap using a thickness gage while rotating carriage guide shaft B in the direction of the arrow in Figures 4-47 and A-48.
Gap value: 0.41 ± 0.02mm
Step 12: Fix the carriage guide shaft B, and tighten the HNO (4) nut.
Step 13: Move the carriage to the left end, and measure the gap value again to confirm that it is correct.
Step 14: Move the carriage to the right end, and measure the gap value again to confirm that it is correct.

WARNING

- **Before adjusting the platen gap, confirm that the paper release lever is in the friction position (turned backward).**

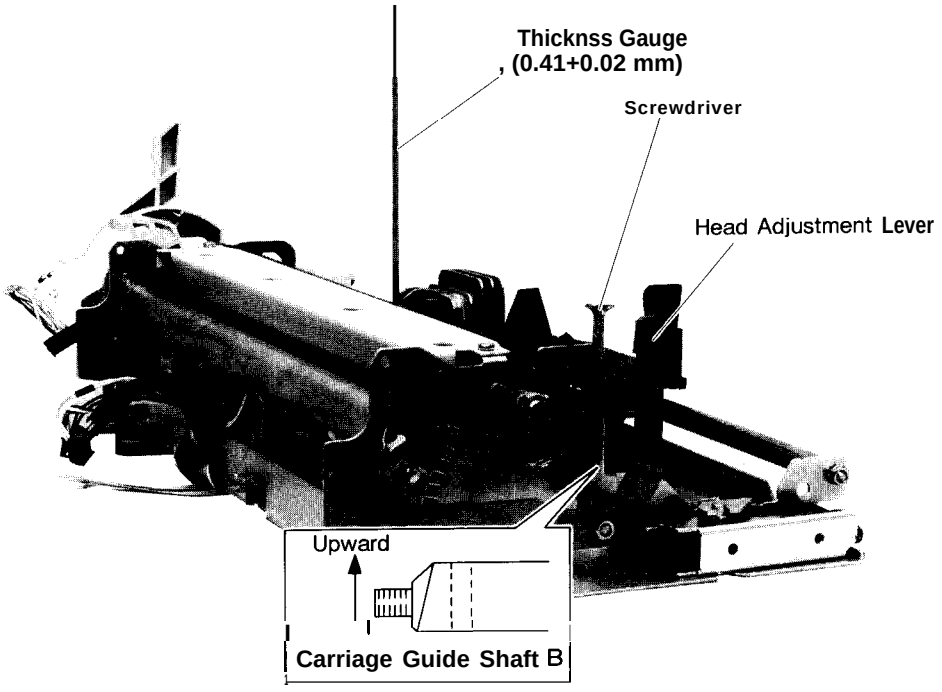


Figure 4-46. Platen Gap Adjustment

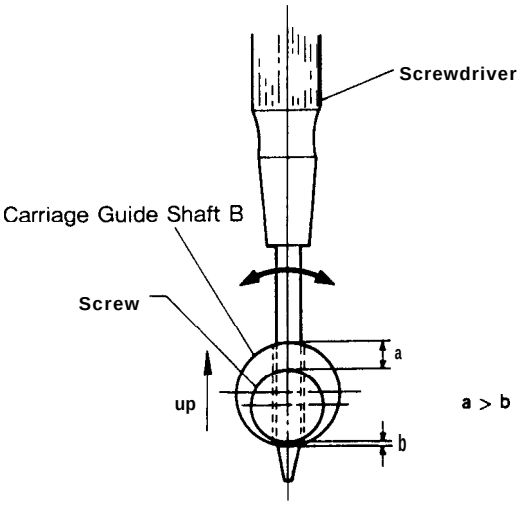


Figure 4-47. Carriage Guide Shaft B Eccentric

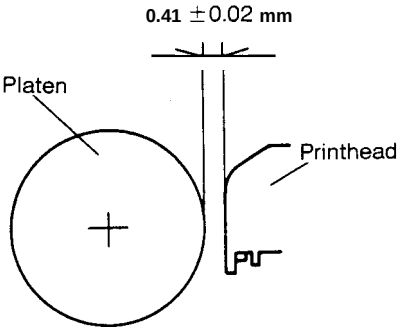


Figure 4-48. Platen Gap

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.**

Step 1 : **Remove the printer mechanism (Refer to Section 4.2.4.1.).**

Step 2: **Loosen the two CPS(O) (M3x6) screws on the paper feed motor.**

Step 3: **Manually rotate the paper feed motor, and adjust the gear backlash between the pinion and the paper feed reduction gear.**
Allowable backlash: 0.10±0.05 mm

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

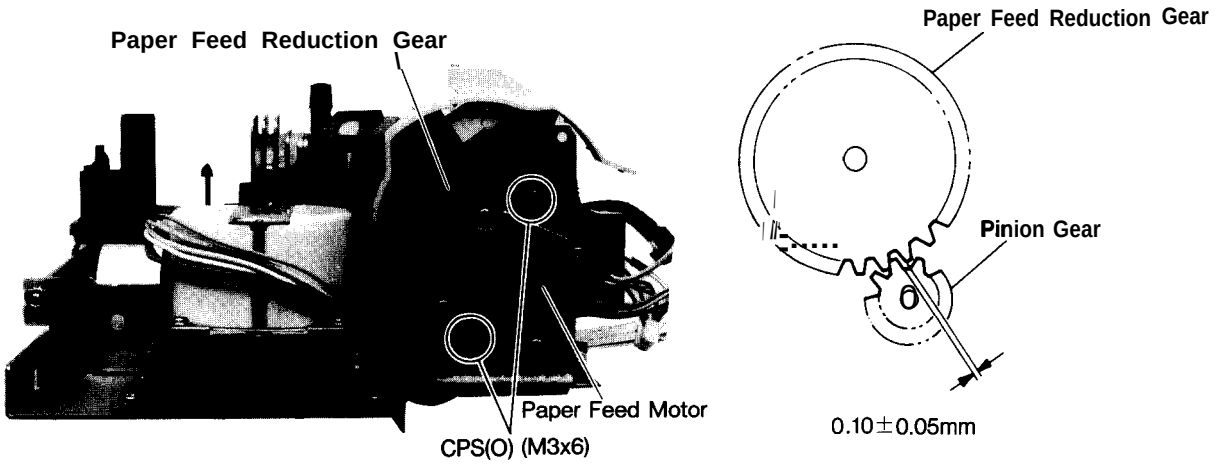


Figure 4-49. Paper Feed Motor Pinion Gear Backlash Adjustment

4.3.3 Electric Board Adjustment

This section describes the JUNMM board adjustment. If replace the JUNMM 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 VR1 and VR2 on the JUNMM board, according to the alignment sequence flowchart shown in Figure 4-50 (Refer to Figure 4-51 for the positions of the switches and VRs).

Table 4-6. VRs and Carriage Speed Mode Relationship

VR1	VR2	Carriage Speed Mode No.
0	—	0 1 4 8 12
—	0	2 3 9 10 11

Initialize Settings

Before enter bidirectional value adjustment, perform the following initialize settings.

. Remove the printer cover B and sheet guide cover.
● Remove the CBB (M3 X1O) screw securing the option board cover.
. Set the head adjustment lever at the 2nd position.
. Set the mono color ribbon cartridge (#7762).
. Position the paper release lever at the its backward setting, and load the fanfold paper (1 sheet, 64 g/m^2, 2 pages).

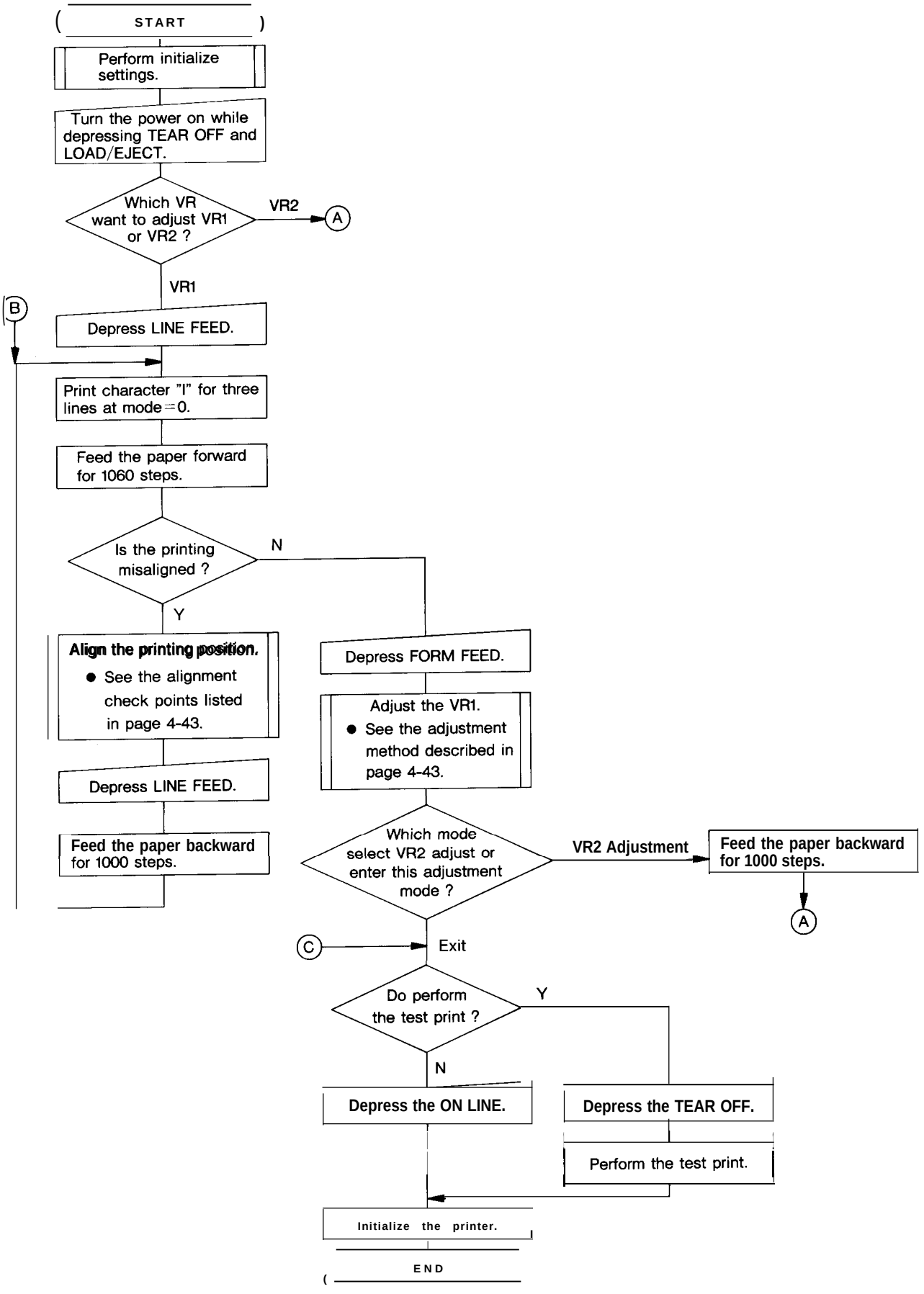


Figure 4-50. Print Position Alignment Sequence

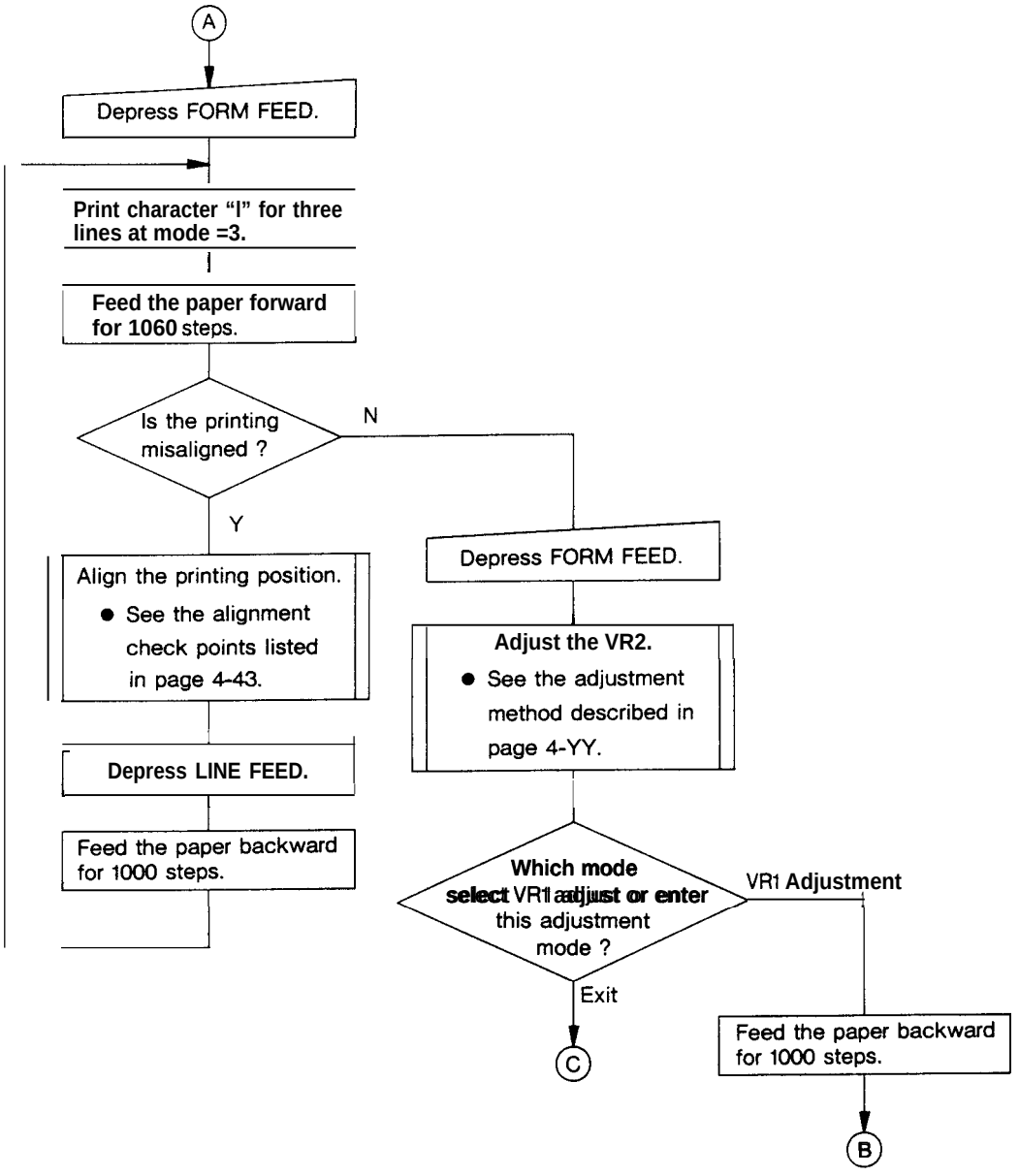


Figure 4-50. Print Position Alignment Sequence

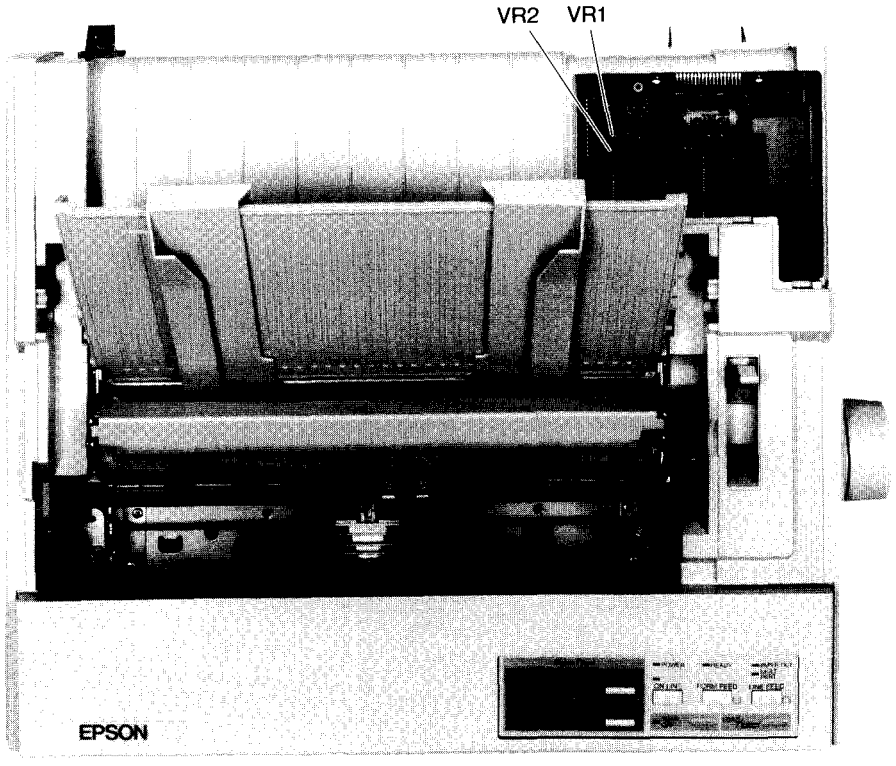


Figure 4-51. Positions of Switches and VRs

Printing Position Alignment Check

Figure 4-52 shows three lines of test printing with characters "1". Using this printout, check the following:

Odd Line..... Reference

Even Line.....Move

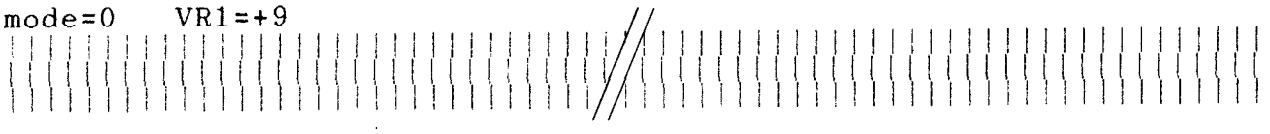


Figure 4-52. Test Printing for Printing Alignment

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

- **To shift the even-numbered iinetothe left, press the TEAR OFF switch. At this time, confirm thatthe buzzer ring once.**
- **Toshift theeven-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=1or 2). turn the VRn(n=1or 2) slowly and carefully, and adjust to a position where the buzzer rings continuously.

CHAPTER 5
TROUBLESHOOTING

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5.3 UNIT REPAIR ····· 5-12
5.3.1 MONPS/MONPSE Board Unit Repair ····· 5-14
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5.1 GENERAL

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

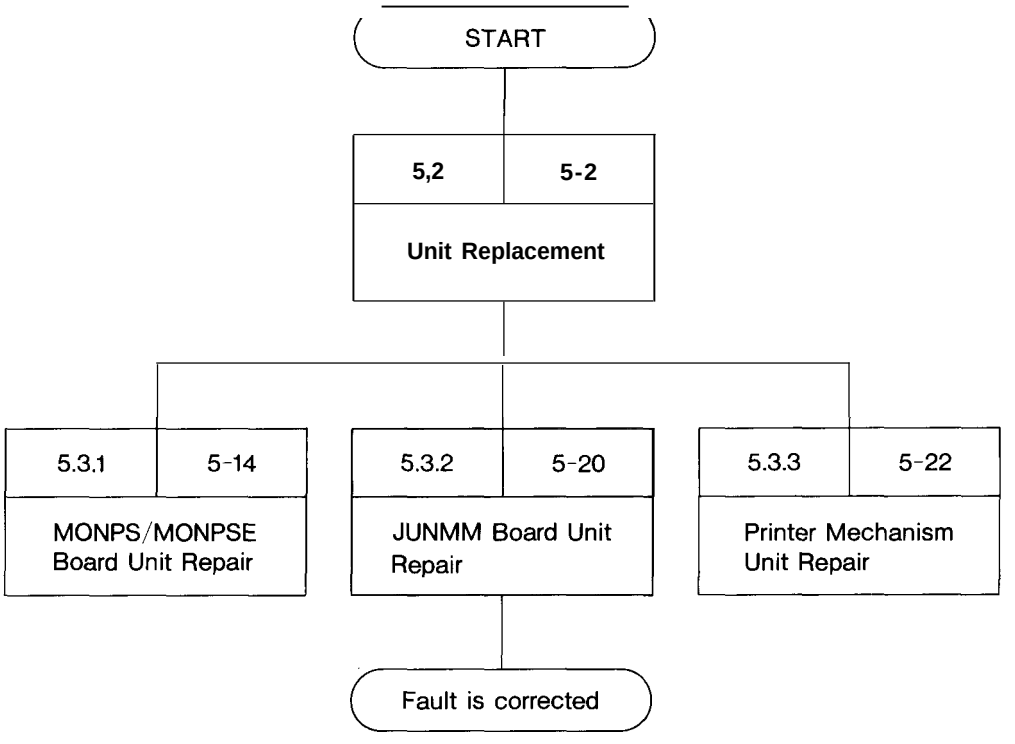


Figure 5-1. Troubleshooting Procedure

First, perform repair by unit replacement to determine defective units. Then replace the defective components in the defective unit. In the unit repair procedure section, possible defective components are indicated for each symptom, and normal waveforms and resistance values are noted in order to help find the defective elements. After replacing the defective components, perform adjustment or lubrication by referring to Chapters 4 and 6.

Table 5-1 shows measuring instruments required for troubleshooting.

Table 5-1. Measuring Instruments

Description	Specification	Necessity	
		Unit Replacement	Unit Repair
Multi meter		◎	◎
Oscilloscope	50 MHz or more	—	◎
Logic Analizer	50 MHz or more	—	○

Necessity : ◎ > ○

5.2 UNIT REPLACEMENT

The unit replacement is based on system analysis. According to the particular symptom found by the multimeter, the units listed in Table 5-2 need to be replaced.
First, find the corresponding symptom by referring to Table 5-3, then check the problem by referring to the flow charts on the pages indicated in the column "Reference Pages."

Table 5-2. Unit Lists

Unit Name	Description	Unit No.
Fuse (Fl)	120V 3.15A UL, CSA 250V 2.0A Time rug	X502O61O6O X50206301 O
MONPS BOARD	100/120V AC (for 100V) (for 120V)	Y571202000 Y571 202100
MONPSE BOARD	220/240V AC (for U. K.)	Y571203000 Y571203100
JUNMM BOARD	Control and drive circuit board	Y571201000
Panel Unit	Control panel (JUNPNL-W BOARD)	Y57I501OOO
Fan Unit	Cooling fan	Y571503000 Y571504000
Model-5810	Printer Mechanism for LQ-860 (for Europe)	Y571590000 Y571 590100
Model-5860	Printer Mechanism for LC)-106O (for Europe)	Y572590000 Y572590100
Printhead	24-pin dot head C CA (for Europe)	F416400000 F41 6500000

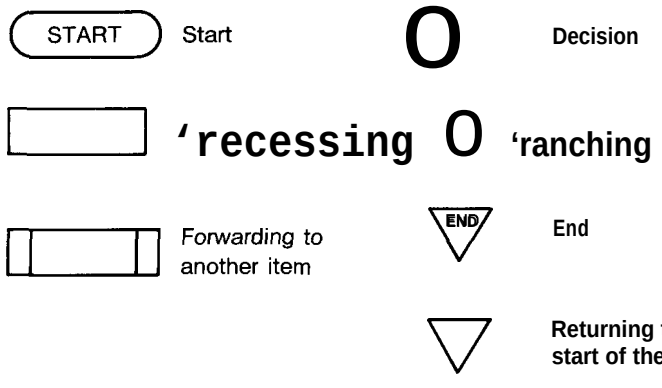
WARNING

Before starting any unit replacement confirm that all connectors are connected firmly, and that no cables are cut.

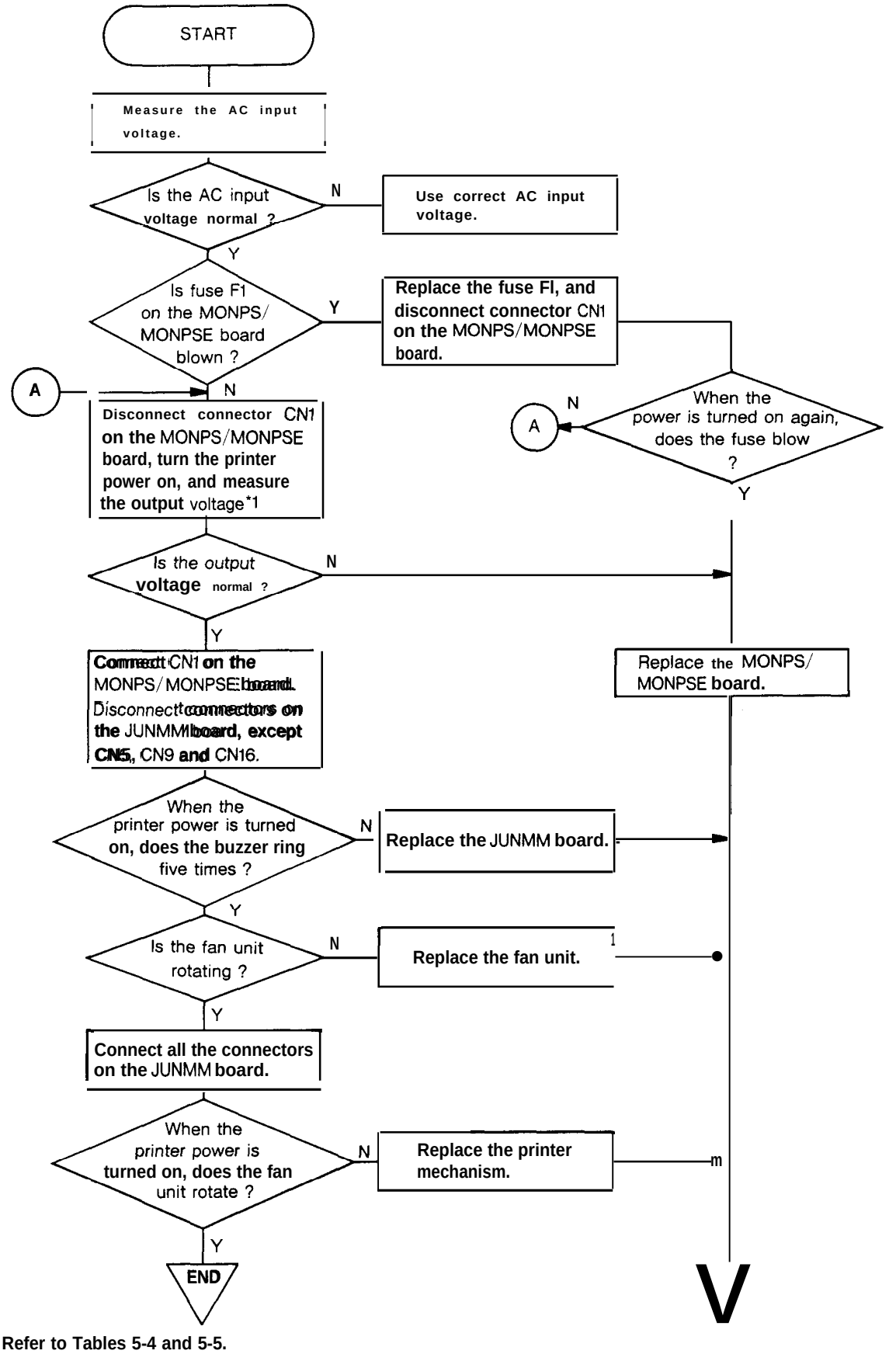
Table 5-3. Symptoms and Reference Pages

Symptom	Problem Indicators	Refere Page
printer does not operate at all with power switch on	● No LEDs are lit on the control panel. ● Fan unit does not operate. ● Printer mechanism is not initialized.	5-4
Carriage mechanism is not initialized	● Carriage does not stop at the home position after the power is turned on. . The buzzer rings (♪ x 5) indicating for an error.	5-5
Incorrect printing with normal carriage operation		
a) When using a black ribbon (in the self test or normal printing mode)	● A specific dot is missing. ● No printing is executed. ● Vertical lines (ruled lines) are misaligned.	5-6
b) When using a color ribbon (in the self test mode)	● Printing colors are not switched correctly. ● Printing positions are misaligned during color printing (violet, orange, and green).	5-7
Abnormal paper feed	● No paper is fed. ● The paper feeding system and the paper being used do not match. ● Line feeding is not uniform during printing.	5-8
Abnormal control panel operation	● Printer does not respond to switches. ● No LEDs are lit.	5-9
ncorrect printing in ON LINE mode	● The rusult of the self test is correct, however, the data from the computer is not printed correctly.	5-1o

The flowcharts on the subsequent pages use the following symbols.

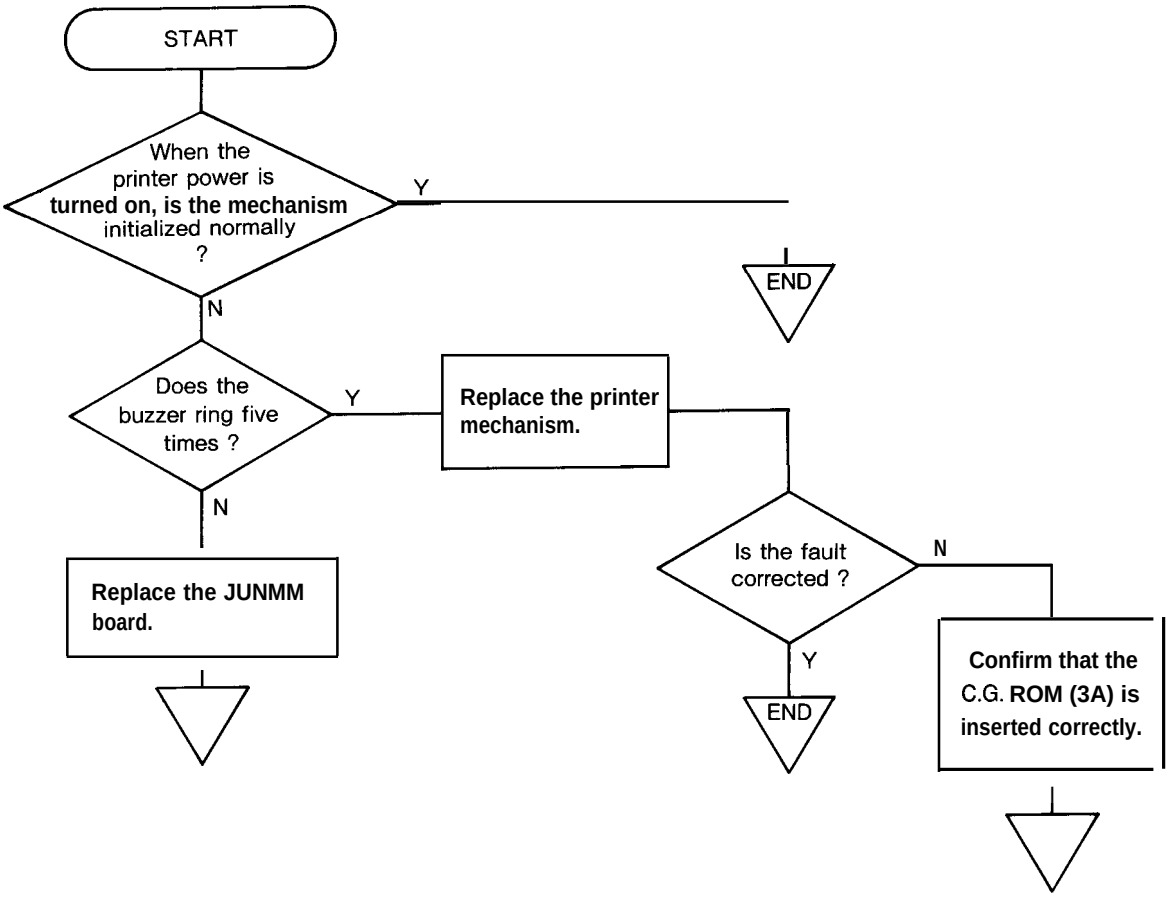


1. **Printer does not operate at all with** power switch on.



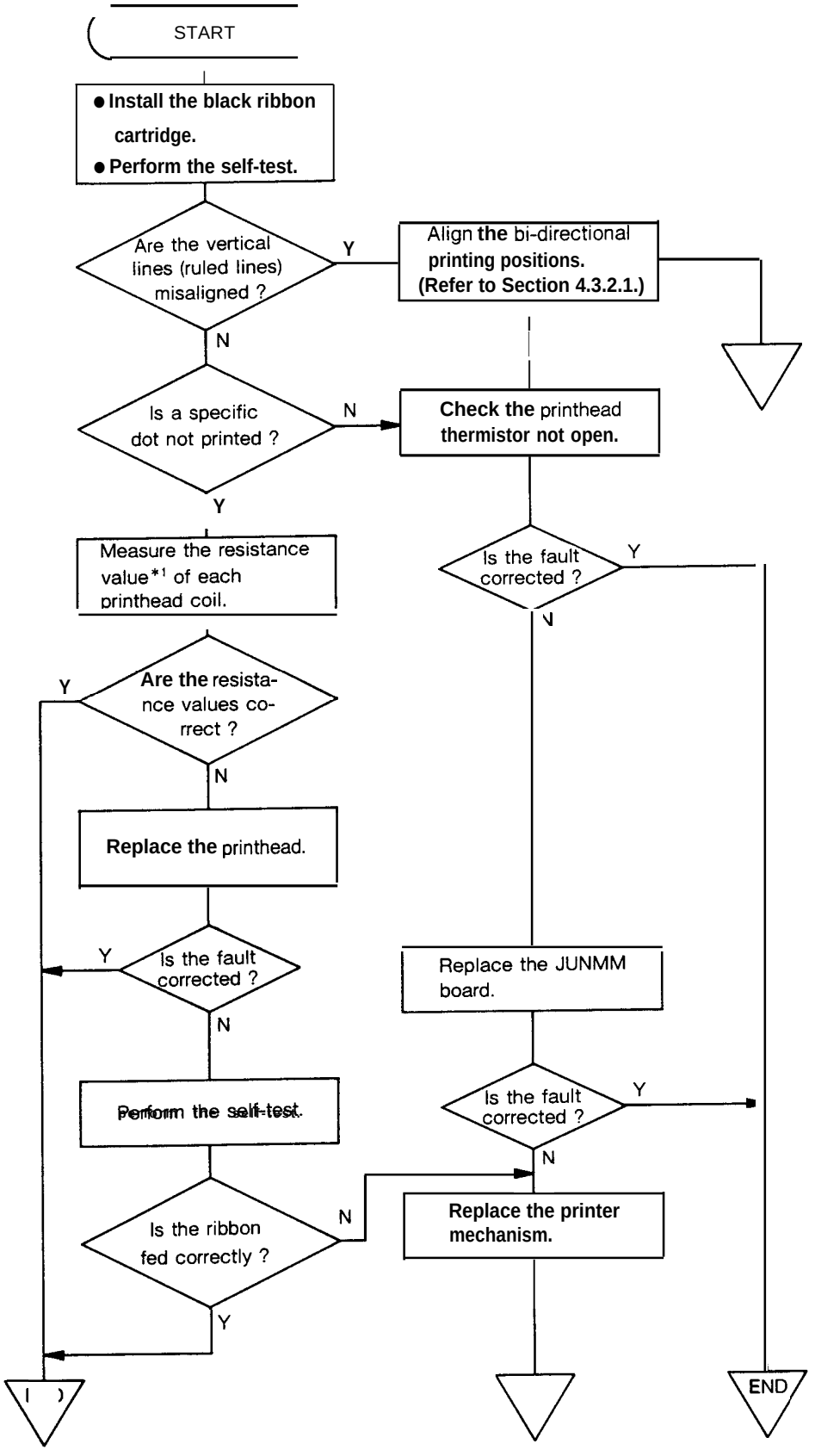
∗1 : Refer to Tables 5-4 and 5-5.

2. Printer mechanism is not initialized



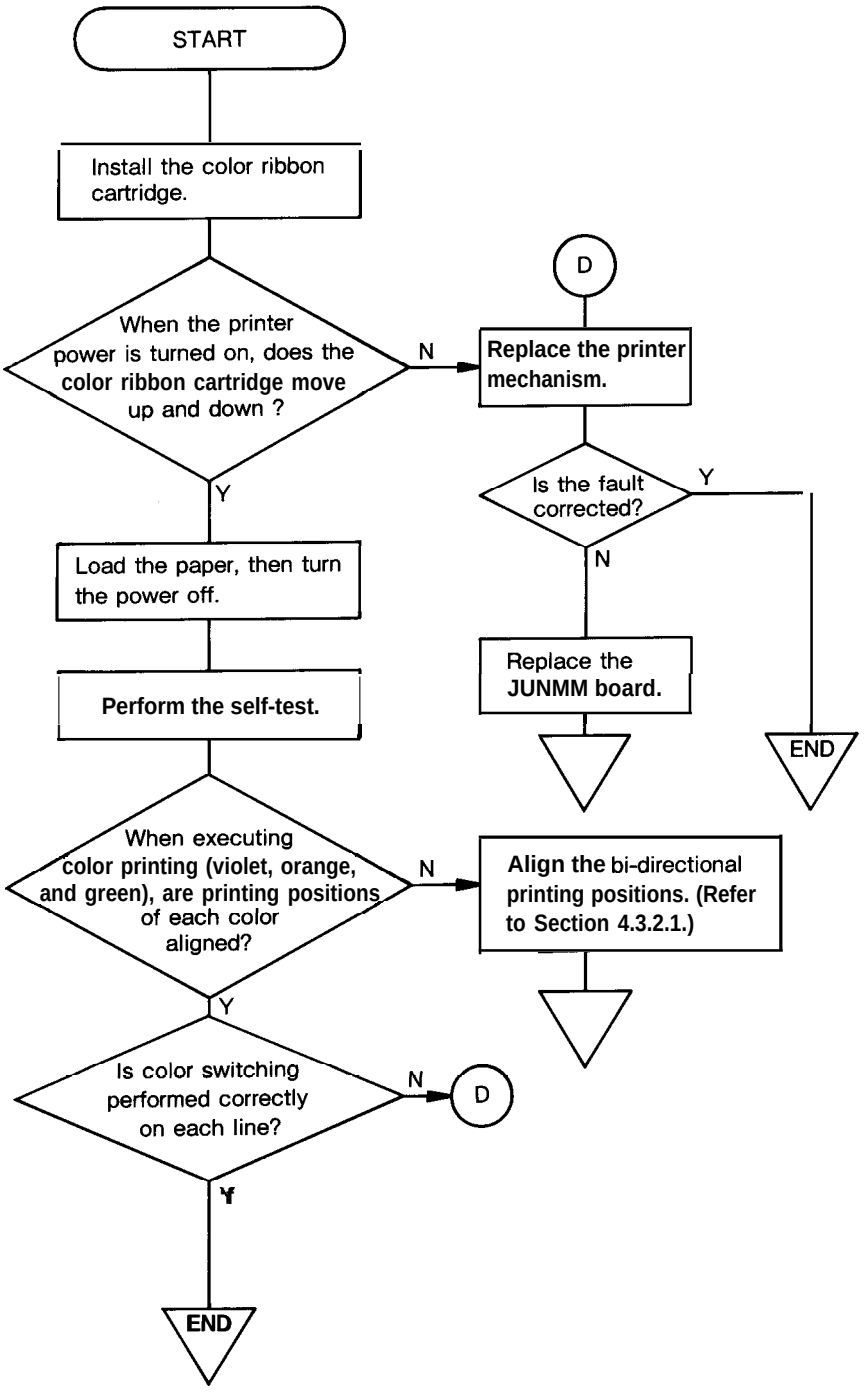
3. Incorrect printing with normal carriage operation

a) **In the self-test or normal printing mode: Using a black ribbon cartridge.**

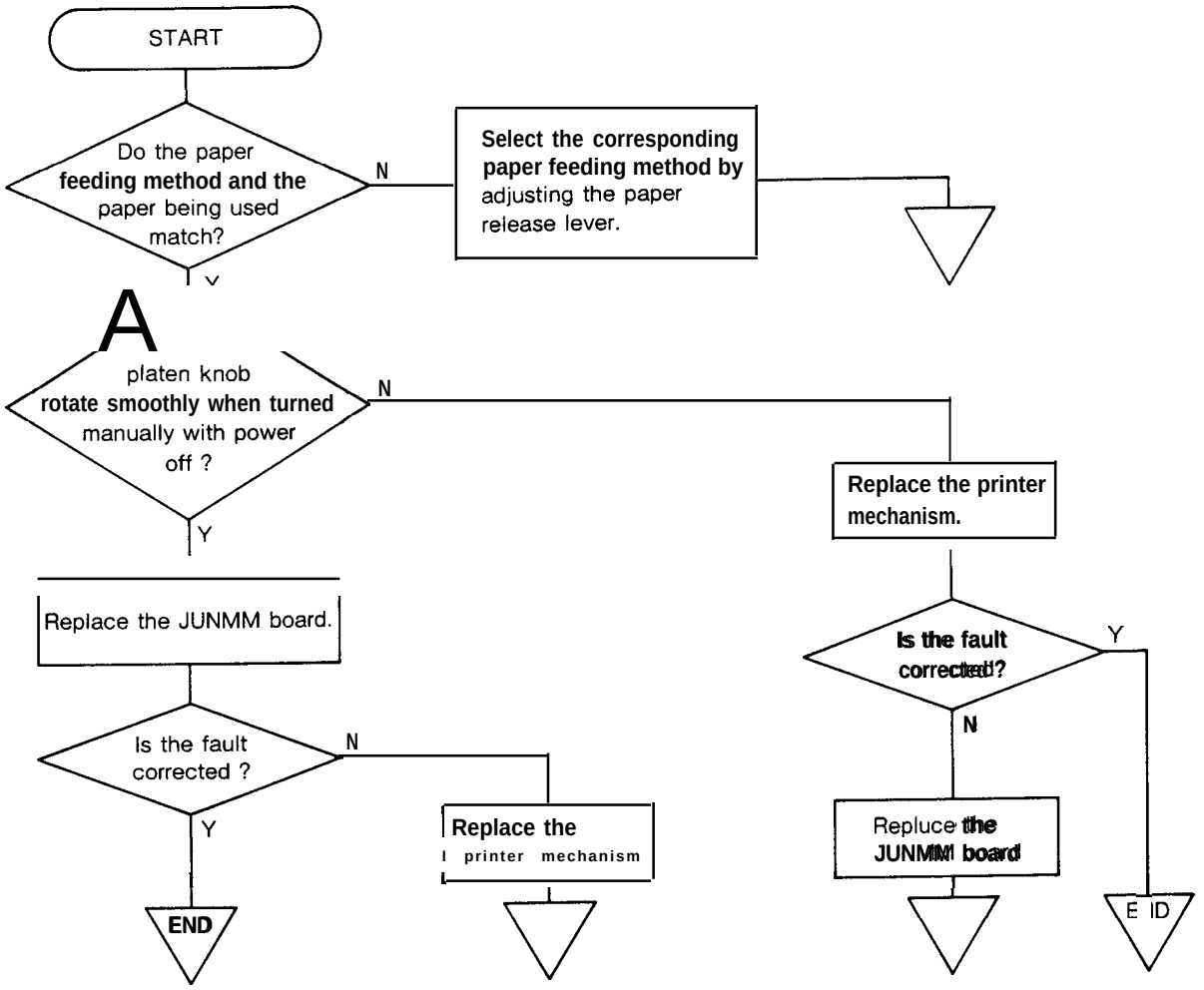


∗1 : **Refer to Figure** 5-2.

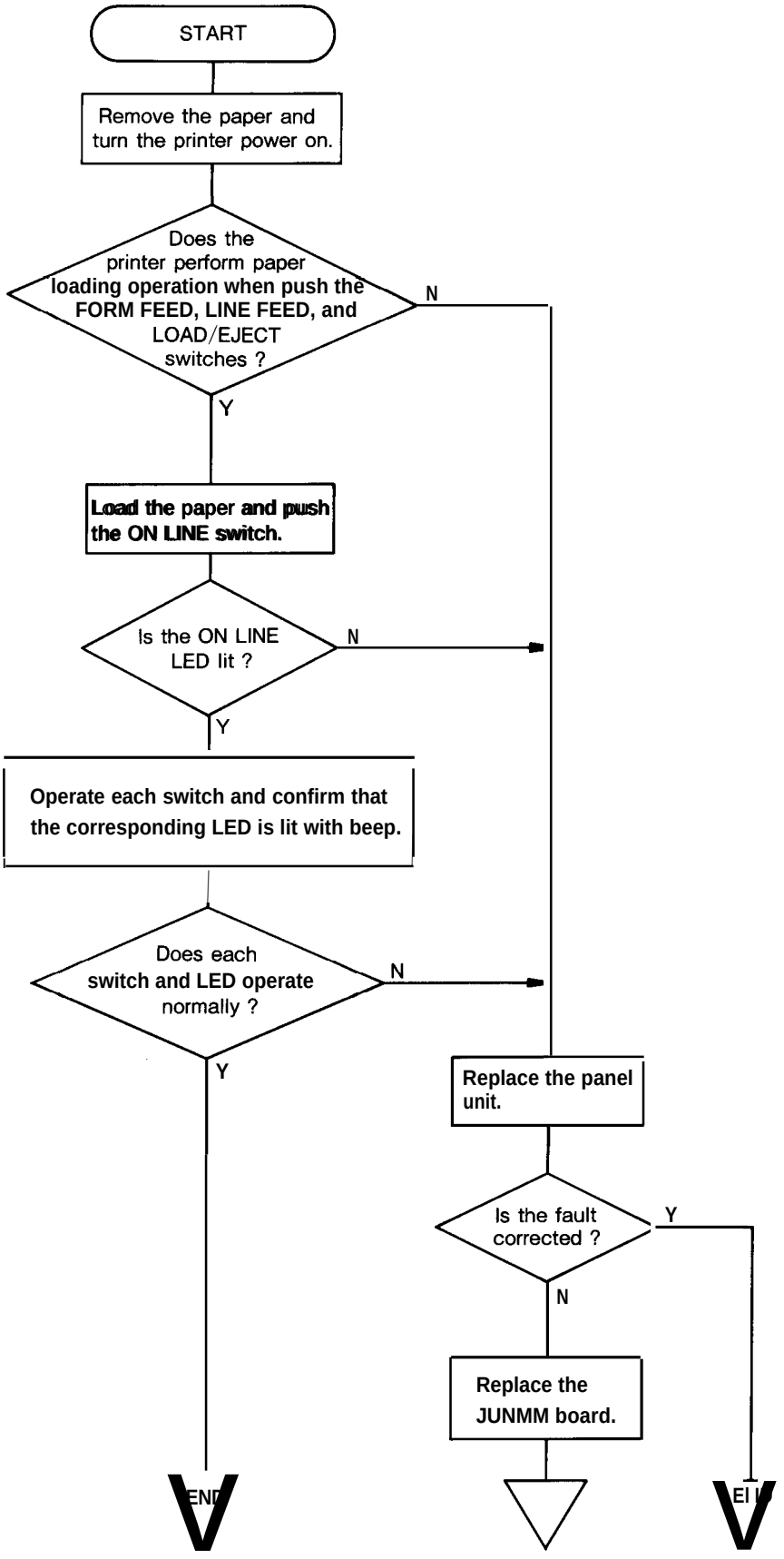
b) In the self-test: Using a color ribbon cartridge



4. Abnormal **paper feed**



5. Abnormal control panel oper



6. Incorrect printing in ON LINE mode

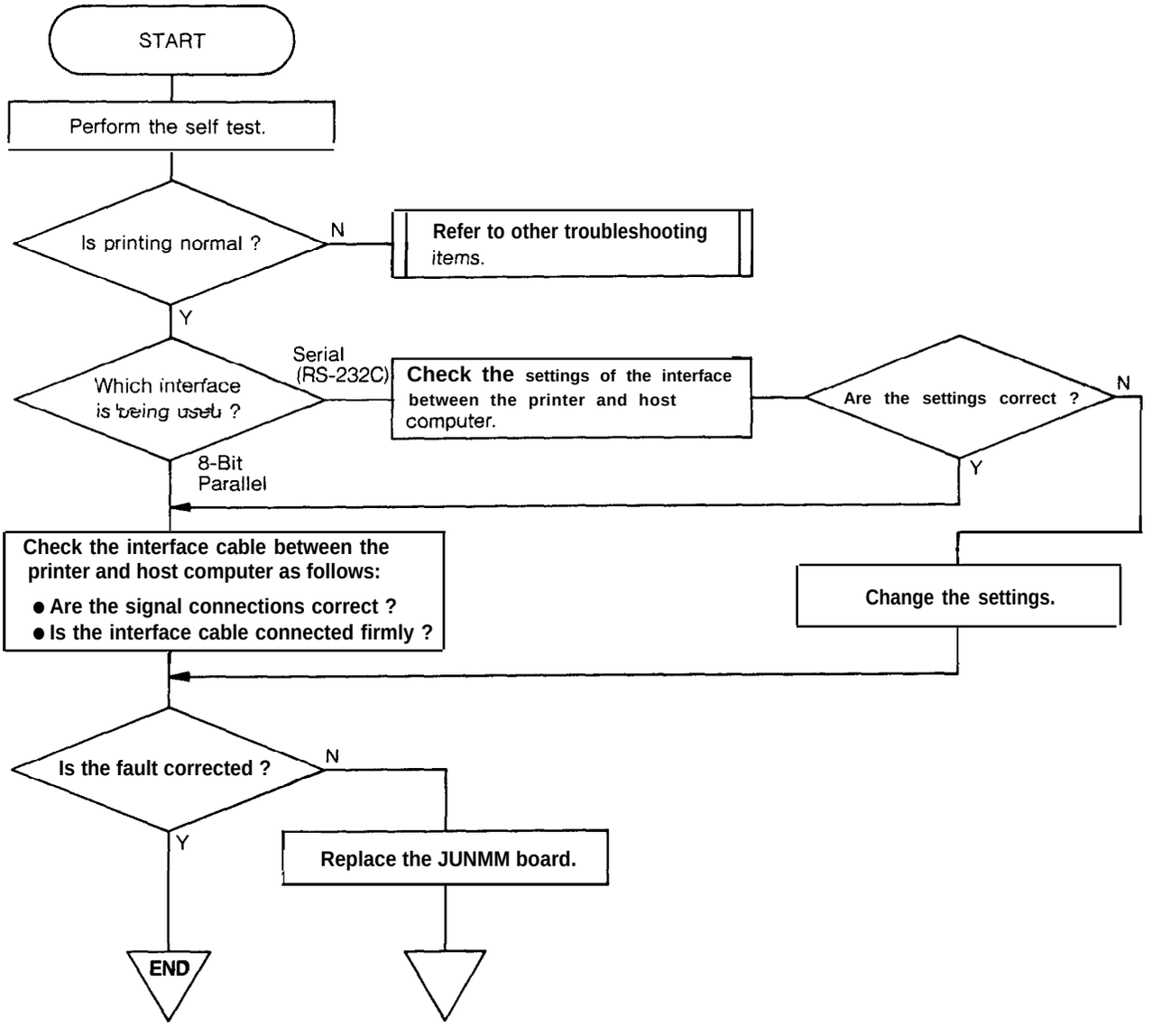


Table 5-4. MONPS Board Environmental Condition

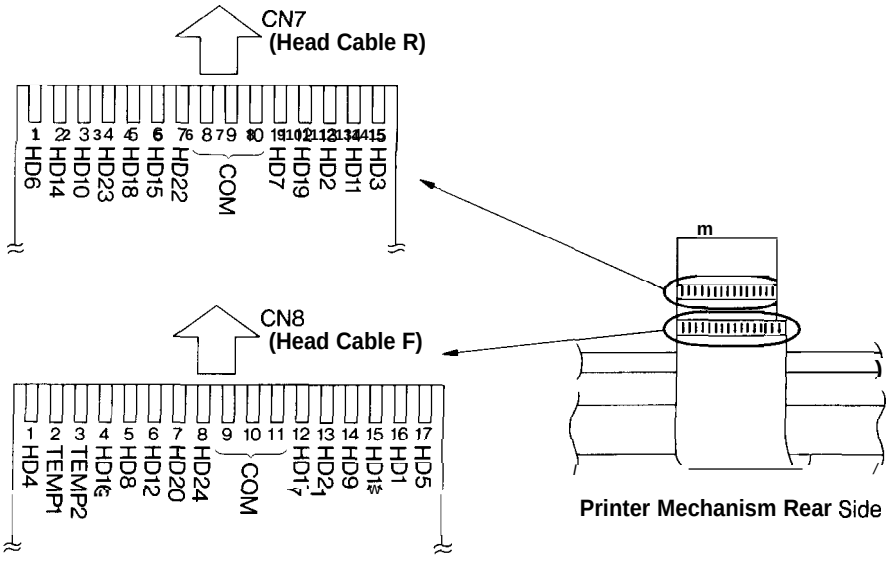
Power Supply Line	Output Voltage [V]		
	0℃	25℃	40℃
+35−G_P	35.5	35.5	35.4
+12−GND	9.7	9.7	9.8
−12− GND	−9.9	−10.0	−10.0
+5−GND	5.1	5.1	5.1

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

Table 5-5. MONPSE Board Environmental Condition

Power Supply Line	Output Voltage [V]		
	0℃	25℃	40℃
+35−G_P	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).

Figure 5-2. Printhead Coil Resistance

5.2 UNIT REPAIR

This section describes unit repair procedure of the defective unit isolated in the former section. The following pages describe repair by replacing defective components or elements in the MONPS/MONPSE board, JUNMM board, and the printer mechanism.

Each section consists of the following five portion :

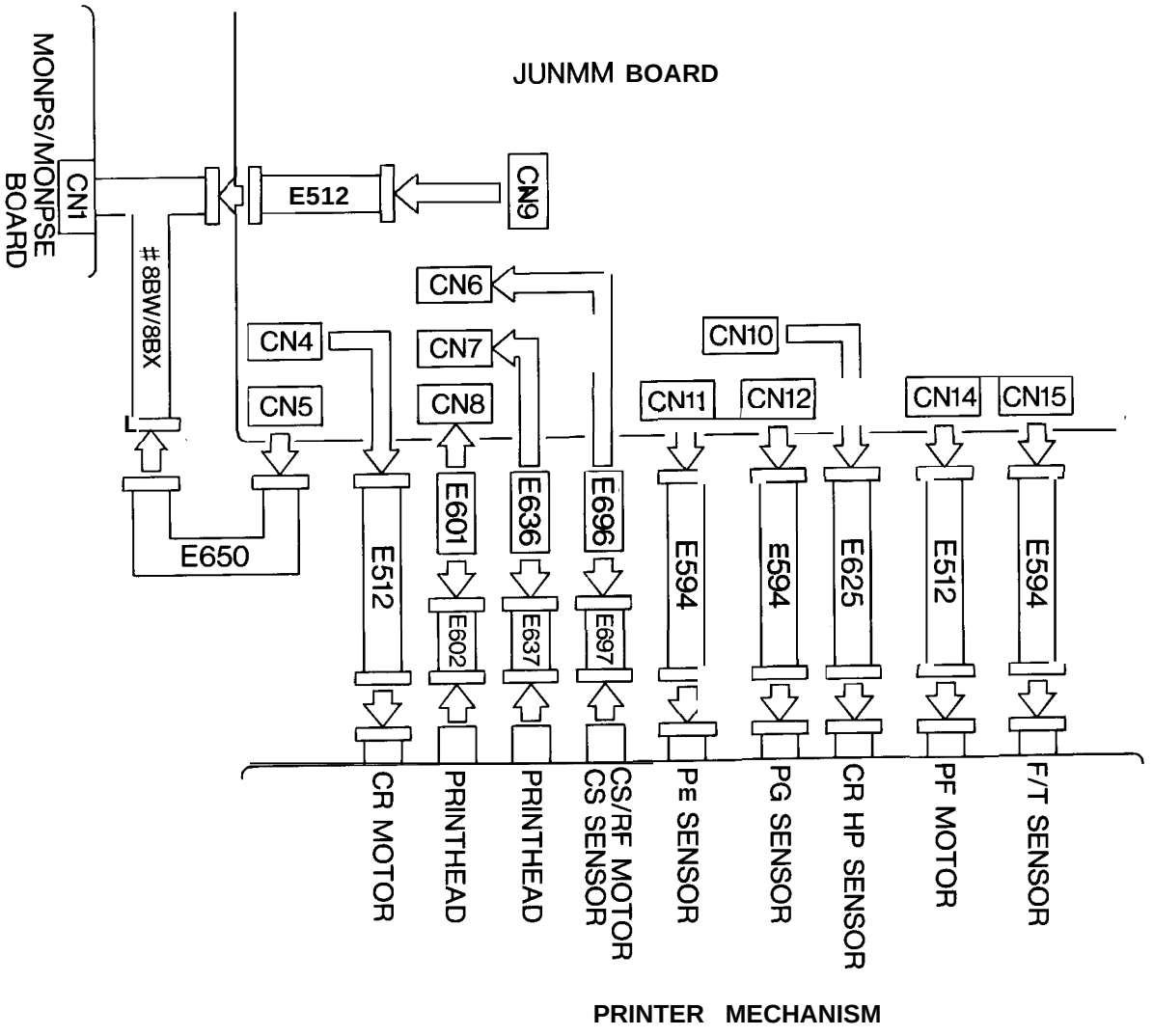
1. Problem: Check problems against those given in this column.
2. Symptom : Compare symptoms to those given in this column.
3. Cause: Possible causes by symptom are listed.
4. Checkpoint: Use the instructions given in this column to measure the portions that might cause the problem, and determine the defective portion.
5. Solution : Replace the defective element/component by referring to this column.

Service tools for troubleshooting are listed in Table 5-6 and Figure 5-3.

● For detailed operation of the electric circuit and printer mechanism, see Chapter 2.

Table 5-6. Troubleshooting Tools

Tool No.	Item	Description	Part No.
E594	Cable (2 pin)	· Between JUNMM board (CN11) and PE sensor · Between JUNMM board (CN12) and PG sensor · Between JUNMM board (CN15) and F/T sensor	B765105401
E625	Cable (3 pin)	. Between JUNMM board (CN10) and CR HP sensor	B765108001
E650	Cable (4 pin)	- Between JUNMM board (CN5) and MONPS/MONPSE board	B765109901
E512	Cable (6 pin)	. Between JUNMM board (CN4) and CR motor · Between JUNMM board (CN14) and PF motor . Between JUNMM board (CN9) and MONPS/NOMPSE board	B765102701
E696	Cable (8 pin)	· Between JUNMM board (CN6 and CS/RF motor, and CS sensor	B765113401
E697	Connector (8 pin)		B765113501
E636	Cable (15 pin)	. Between JUNMM board (CN7) and printhead cable	B765109001
E637	Connector (15 pin)		B765109101
E601	Cable (17 pin)	- Between JUNMM board (CN8) and printhead cable	B765105801
E602	Connector (17 pin)		B765105601



NOTE : These cables and connectors are longer than the distance between the JUNMM board and the printer mechanism, and MONPS/MONPSE board to make troubleshooting easier.

Figure 5-3. Extension Cable Connections

5.3.1 MONPS/MONPSE Board Unit Repair

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

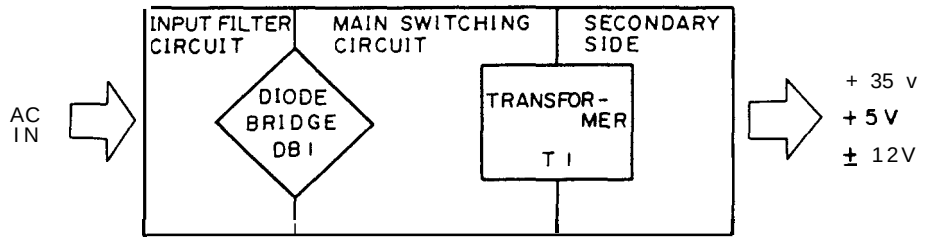


Figure 5-4. MONPS/MONPSE Board Block Separation

If trouble occurs, first determine the faulty block and then find the bad component, referring to Table 5-7 and Figure 5-6.

DANGER

1. Since this power supply is an isoloated switching regulator, do not use a grounded measuring instrument such as a multimeter or oscilloscope. If a grounded instrument is used, fuse F1 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.

NOTE: For Japan

Figure 5-5. AC Connector for Measuring Instruments

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

Table 5-7. MONPS/MONPSE Board Unit Repair

Symptom	Caus	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 DBI input terminal.	Check whether the input filter circuit is partly shorted or open.
	. Q1 is open between the collector and emitter.	・Check the voltage waveform at the $T1_{12-14}$ terminals.	・Replace Q1.
	. R5 is open.	. Check the resistance across R5. Approx. 0.5 [Ω]	・Replace R5.
	. R14 is open.	. Check the resistance across R14. Approx. 9.2K [Ω]	・Replace R14.
The voltage at the +35 V line is less than normal. Normal voltage : +35 V±10%.	Malfunction in the over voltage protection circuit for the transformer secondary side.	Voltage at each terminal under normal conditions. ・Pin 1 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 Q1 is less than normal.	・Check the resistance value across R4. Approx. 27 [Ω] . Check whether D2 is open. . Check whether Q2 is shorted.	

Figure 5-6. MONPS/MONPSE Board Voltage Waveforms

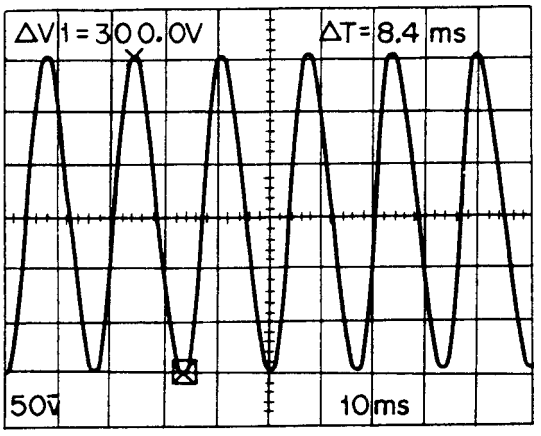
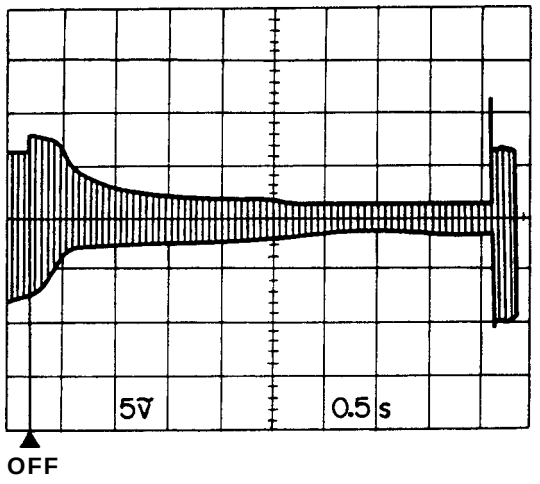
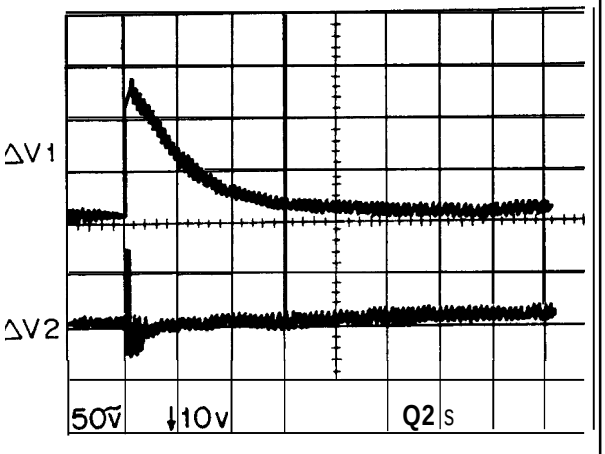
Measuring Position	+Side	−Side	Channel (AVn)	Condition	Voltage Waveform
DB1	Input Side		1	Storage	
Q2	Collecto	Emitter	1	Power OFF	
C6	+		1	Power ON	
TY1	T2	T1	2 (INV.)		

Figure 5-6. MONPS/MONPSE Board Voltage Waveforms

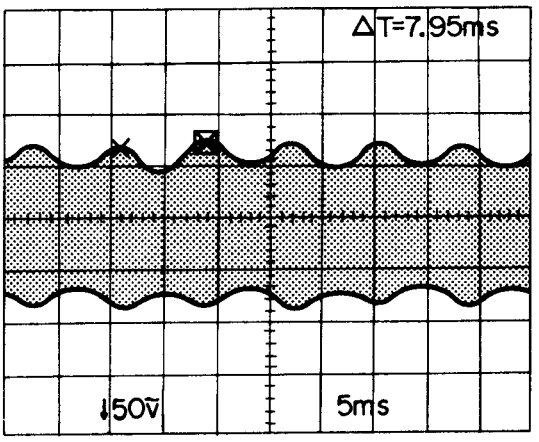
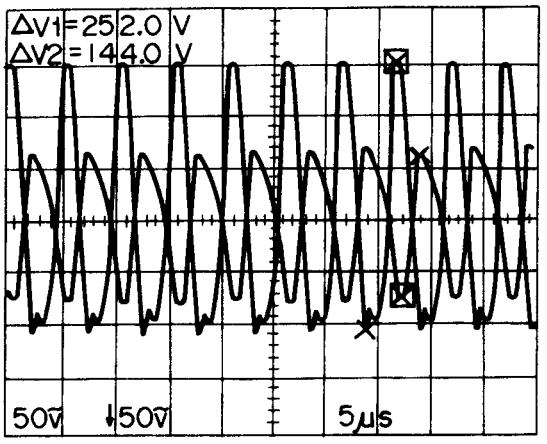
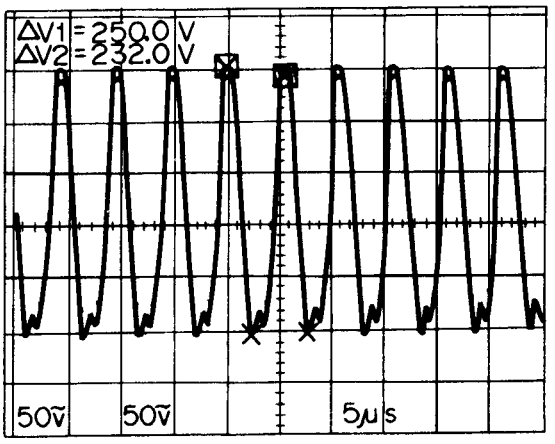
Measuring Position	+Side	−Side	Channel (AVn)	Condition	Voltage Waveform
T1	1pin	3pin	2	Storage	
T1	14pin	12pin	1	Storage	
	1pin	3pin	2 (INV.)		
T1	14pin	12pin	1	Storage	
	10pin	12pin	2 (INV.)		

Figure 5-6. MONPS/ MONPSE Board Voltage Waveforms

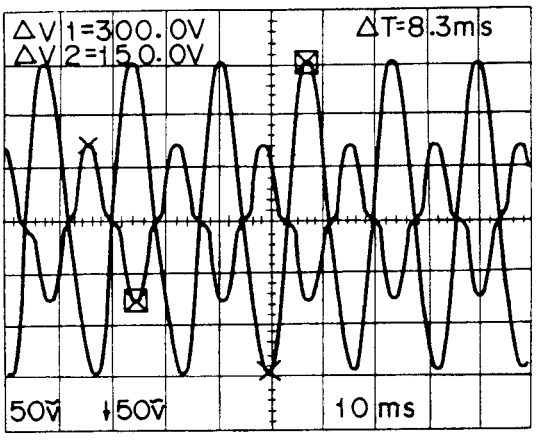
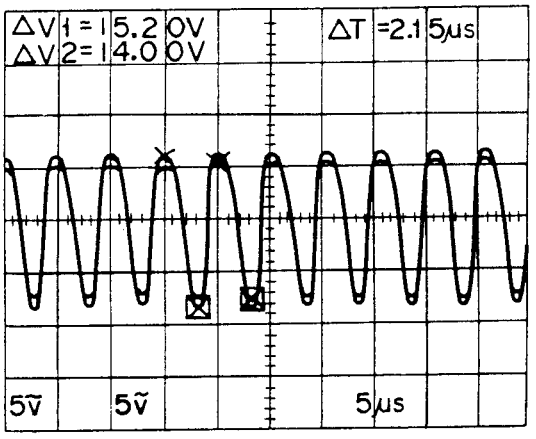
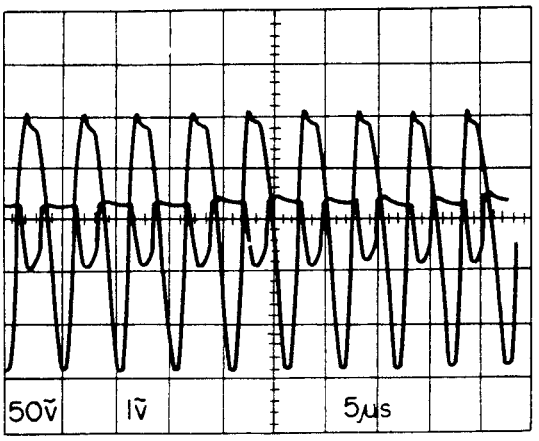
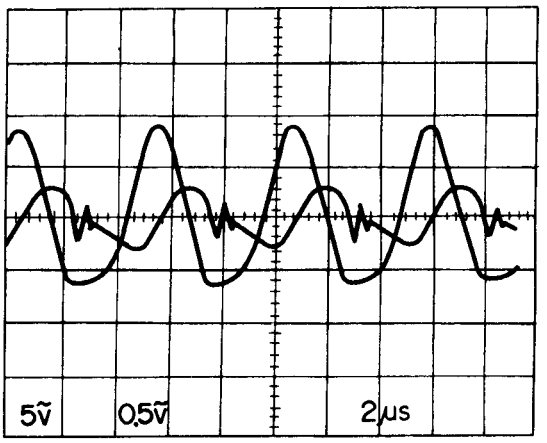
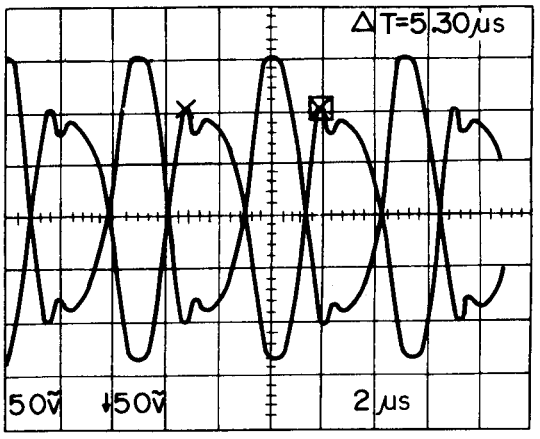
Measuring Position	+Side	−Side	Channel (AVn)	Condition	Voltage Waveform
DB1	Input Side		1	Storage	
	+	−	2 (INV.)		
T1	8pin	11pin	1	Storage	
Q4	Collec-tor	Emitter	2		
Q1	Collec-tor	Emitter	1	Storage	
Q2	Base	Collec-tor	2		

Figure 5-6. MONPS/MONPSE Board Voltage Waveforms

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

5.3.2 JUNMM Board Unit Repair

If trouble occurs with the JUNMM board, troubleshoot it as described in Table 5-8.

Table 5-8. JUNMM Board Unit Repair

Problem	Symptom	Cause	Checkpoint	Solution
The printer does not operate at all. (The POWER LED is lit.)	VX does not reach 5 VDC.	The VX generation circuit is defective.	Check that transistor Q5 is on.	ON : Replace Q48. OFF: Replace Q5 or ZD8.
	The $\overline{\text{RESET}}$ signal is not canceled.	The reset circuit is defective.	Check that pin 21 of the IC (8B) is HIGH (5V).	Replace the IC (8B).
	No mechanism is initialized at all (the printer does not operate at all).	The program ROM is defective.	Check that the IC (6A) is inserted correctly.	Replace the IC (6A).
		The CPU is defective.	Observe the waveforms at pins 16 (+) and 15 (–) of the IC (4B) (see Figure 5-7).	Replace the IC (4B) or CR1.
The printer is initialized, but enters an error state.	No mechanism is initialized at all (the buzzer rings five times).	The carriage does not move at all.	Check that phase switching signals are sent from pins 62, 63, 64, and 1 of the CPU (4B) to the IC (1A) via the IC (1B) when the printer power is turned on (see Figs. 2-58 and 2-59).	Replace either the IC (IB), IC (1A), or IC (4B).
		The CS drive lever does not move up or down.	Check that phase switching signals are sent from pins 2, 3, 4, and 5 of the CPU (4B) to transistors Q24, Q25, Q26, and Q27 when the printer power is turned on (see Figs. 2-66 and 2-67).	Replace the corresponding element.
		The C. G. ROM is defective.	Check that the IC (3A) and IC (4A) are inserted correctly.	Replace the IC (3A) or IC (4A).
Printing quality is not good.	A specific dot is missing.	The IC (2A) or drive transister is defective.	Observe the waveforms to check that the output voltage between the emitter and collector of the drive transistor for the specific dot and the corresponding output (HDn) signal of the IC (2A) synchronize (see Figure 5-8).	Replace the corresponding defective element.
	Printing is not executed.	The IC (2A) is defective.	Observe the waveform to check that the head coil drive pulses are sent from HPW (pin 31) through VSS (pin 9) of the IC (2A).	Replace the IC (2A).

Table 5-8. JUNMM Board Unit Repair

Problem	Symptom	Cause	Checkpoint	Solution
Paper is not fed normally.	The paper feed motor operates abnormally.	Drive transistor is defective.	Observe the waveforms to check that the output signals (at pins 30, 31, 32, and 33) of the IC (11B) and the output voltages between collectors and emitters of the corresponding drive transistors (Q30 through Q41) synchronize (see Figs. 2-57 and 2-58).	Replace the corresponding defective element.

IC (46) (XI : **Pin 16)**
2 V/DIV.
0.1 μs/DIV.

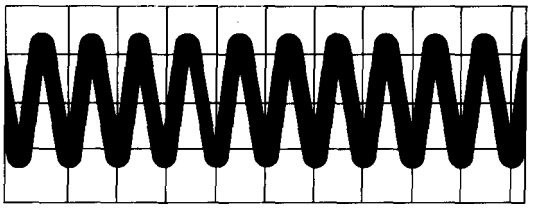
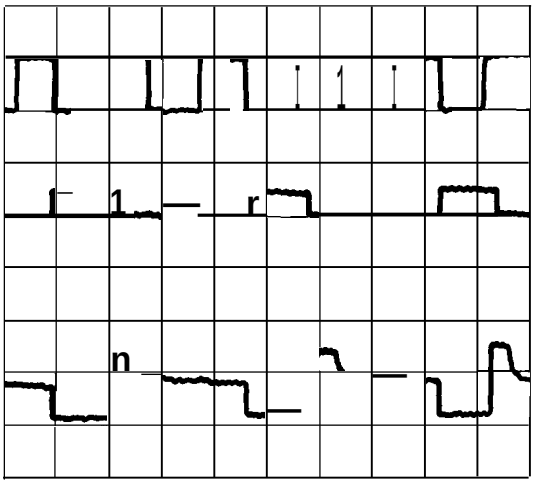


Figure 5-7. CPU Clock Signal Waveform

IC **(2A) (HPW: Pin 31)**
5 V/DIV.

IC(2A) (HD20 **: Pin 37)**
5 V/DIV.

Q21 Collector
50 V/DIV.
0.2 ms/DIV.



NOTE: At normal self-test printing

Figure 5-8. Print Timing

5.3.3 Printer Mechanism Unit Repair

If trouble occurs with the printer mechanism, troubleshoot it as described in Table 5-9. Refer to Sections 4.2 DISASSEMBLY AND ASSEMBLY and 4.3 ADJUSTMENT for replacement and adjustment of parts.

Table 5-9. Printer Mechanism Unit Repair

Problem	Symptom	Cause	Checkpoint	Solution
When the printer mechanism is initialized at power on, the home position error occurs.	The carriage operates abnormally.	The carriage motor is defective.	. Measure each coil resistance of the carriage motor. Resistance value : 2.8 Ω±7% (at 25°C/coil) . Turn the carriage motor shaft manually, and check if the motor rotates smoothly.	
		The timing belt is defective.	. Check that the timing belt is inserted correctly into the bottom of the carriage (see Section 4.2.4. 5). ● Check the timing belt for any abnormality.	Check the portions around the timing belt for any abnormality, or replace the timing bit.
		The CR HP sensor is defective.	Connect the CR HP sensor to the JUNMM board, turn the printer power on, and check that the buzzer indicates the home position error (See Section 1.9),	Replace the CR HP senser.
	Color select operation is abnormal.	The CS/RF motor is defective.	Measure each coil resistance of the CS/RF motor. Resistance value : 158 Ω±5% (at 25°C/coil)	Replace the CS/RF motor.
		The CS sensor is defective.	Connect the CS sensor to the JUNMM board, turn the power on, and check that the buzzer indicates the home position error (see Section 1.9).	Replace the CS sensor.
Printing is abnormal.	A specific dot is missing.	The printhead coil is defective.	. Measure each coil resistance of the printhead (see page 5-11). . Check the printhead wires for any abonrmality.	Replace the printhead.
	Printing color density is not uniform.	The platen and the carriage guide shaft are not , parallel.	. Check the platen surface smoothly. . Adgust the parallelism of the pleten gap (see Section 4.3.1.1).	Replace the platen.

Table 5-9. Printer Mechanism Unit Repair

Problem	Symptom	Cause	Checkpoint	Solutic
Printing is abnormal.	Printing pressure does not change after the head adjustment lever is set to the copy mode position (the carriage speed is not decelerated).	The PG sensor is defective.	Check that the PG sensor opens when the head adjustment lever is set to any of the Ist to 3rd position, and it closes when set at any of the 4th to 8th position.	Replace PG sens
Paper feeding is abnormal.	Paper is not fed smoothly.	The paper feed motor is defective.	● Measure each coil resistance of the paper feed motor. Resistance value : 59 Ω ±3% (at 25°C/coil) . Turn the paper feed motor shaft manually, and check if the motor rotates smoothly.	Replace paper fee motor.
	Paper feed pitch is not uniform.		Adjust the gear backlash of the paper feed motor pinion (see Section 4.3.1. 3).	
	The platen and carriage guide shaft B are not parallel.		Adjust the parallelism of the platen gap (see Section 4.3.1. 1).	
	The platen surface is not flat.			Replace platen.
	Although the printer is set to the pull tractor feed mode and the paper is loaded, the paper is not ejected by pressing the LOAD/EJECT switch.	The F/T sensor is defective.	Check that the F/T sensor opens when the paper release lever is set to the friction feed mode, and it closes when set to the tractor feed mode.	Replace F/T sens
	The printer enters ON LINE at power on without the paper being loaded (DIP SW2-8 : OFF).	The PE sensor is defective.	Check that the PE sensor closes when the paper is ejected, and it opens when the paper is loaded.	Replace t PE senso

CHAPTER 6
MAINTENANCE

6.1 PREVENTIVE MAINTENANCE 6-1
6.2 LUBRICATION APPLICATION 6-1

LIST OF FIGURES

Figure &l. LQ-106o(LQ-MO) Lubrication Application Points Diagram 6-2

LIST OF TABLES

Table 6-1. Lubricants 6-1
Table 6-2. Lubrication Points (Refer to Figure 6-l.) 6-1

6.1 PREVENTIVE MAINTENANCE

Proper maintenance is essential to maintain optimal printer performance for the longest possibly period and to minimize malfunction frequency. Preventive maintenance includes regular cleaning of the case exterior, using neutral detergent, and occasional vacuuming of the mechanism interior to remove dust and paper particles.

Following cleaning, refer to Section 6.2 LUBRICATING APPLICATION to verify that the unit is adequatery lubricated. Before returning the serviced printer to the consumer, inspect the springs, paper feed rollers, and the basic operation of the unit.

WARNING

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

6.2 LUBRICATION APPLICATION

EPSON recommends that the points illustrated in Figures 6-1 and 6-2 be lubricated, according to the schedule listed in Table 6-2, with EPSON O-2, G-26, and G-27, which have been extensively tested and found to comply with needs of this priter. (Refer to Table 6-1 for details.) Be sure that the parts to be lubricated are clean before applying lubricant, and avoid excessive application, which may damage related parts.

Table 6-1. Lubricants

Classification	Designation	Capacity	Availability	Part No.
Oil	o-2	40 cc	E	B710200001
Grease	G-26	40 gr	E	B702600001
Grease	G-27	40 gr	E	B702700001

E : EPSON exclusive product

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

Ref. No.	Lubrication Point	Lubricant
(l)*	Oil pad inside of Carriage	o-2
(2)*	Contact portion of CS drive cam and carriage	G-26
(3)*	Contact portion of paper feed rollers F and R and paper feed roller holder	G-27
(4)*	Contact portion of paper feed lever and paper feed roller holder	G-27
(5)*	Contact portion of sub paper release lever and paper release lever	G-27
(6)*	Contact portion of tractor transmission gear and paper release lever	G-27
(7)*	Contact portion of head adjustment lever tab and holes of side frame L	G-27

* : Lubrication is necessary in the proces of assembly.

APPENDIX

A.1 PRINCIPLE IC SPECIFICATIONS ····· A-1
A.1.1 JUNMM Board ····· A-1
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A.1 PRINCIPLE IC SPECIFICATIONS

This chapter describes the principal ICs used in this printer.

A.1.1 JUNMM Board

Table A-1 shows the primary ICs used on the JUNMM board.

Table A-1. JUNMM Board Primary ICs

Location	IC Name	Type	Description	Reference Section
4B	μPD78213 GQ36	CPU	NMOS 8-Bit	A.1.1.1
6A	27512-20	EP-ROM	Program ROM	A.1.1.2
3A IM1OA 2OYA		Mask-ROM	1M-Bit C. G.	1 -
5A	HM65256BLSP-12	PS-RAM	32K x 8-Bit 120 ns	A.1.1.3
7A	HM6264ALP-I 2	ST-RAM	8K x 8-Bit 120 ns	A.1.1.4
2A	E05A02LA	Gate Array	Printhead Data Control	A.1.1.5
8B	E05AI OAA	Gate Array	Memory Management Unit	A.1.1.6
11B	E05A24GA	Gate Array	Parallel I/F, Port Expansion	A.1.1.7
1A	SI7300A	Hybrid IC	CR Motor Drive	A.1.1.8
5B	TL431CLPB	IC	Adjustable Precision Shunt Regulator	A.1.1.9
1B	74LS06	TTL	Hex. O. C. Inverters	A.1.1.10
7B	74LS86	TTL	Quad 2 Input EX-OR	A.1.1.11
9A	SN75188N	IC	Quad Line Drivers	A.1.1.12
10A	SN75189N	IC	Quad Line Receivers	A.1.1.13

A.1.1.1 μPD78213

μPD78213 is an 8-bit single chip microcomputer that can access a IM byte memory space.

The main functions are as follows :

. High speed : 0.40μs instruction cycle (9.83 MHz)

. Expanded data memory: Memory space IM byte

- Interrupt controller: 2 level priority
  - Vectored interrupt handling
  - Macro service
- 512-Byte RAM built-in
- I/O terminals : 54 (Programmable pullups ; 34 inputs)
- Serial interface
  - UART (Baud rate generator built-in)
  - Clocked synchronous mode serial interface : 3-line serial i/0, serial bus interface
- Real-time output port: Two stepping motors can be controlled independently

. A/D converter (8 analog inputs)

- High capacity timer/counter unit
  - 16 bit x 1
  - 8 bit x 3
- Two 8-bit timers

. Interrupts (3 external, 8 internal)

- General purpose serial I/F
- I/O lines
  - Input and output ports : 28 bits
  - Edge sensor inputs : 4

Figures A-1 and A-2 show the pin diagram and internal block diagram . Table A-2 shows the terminal functions.

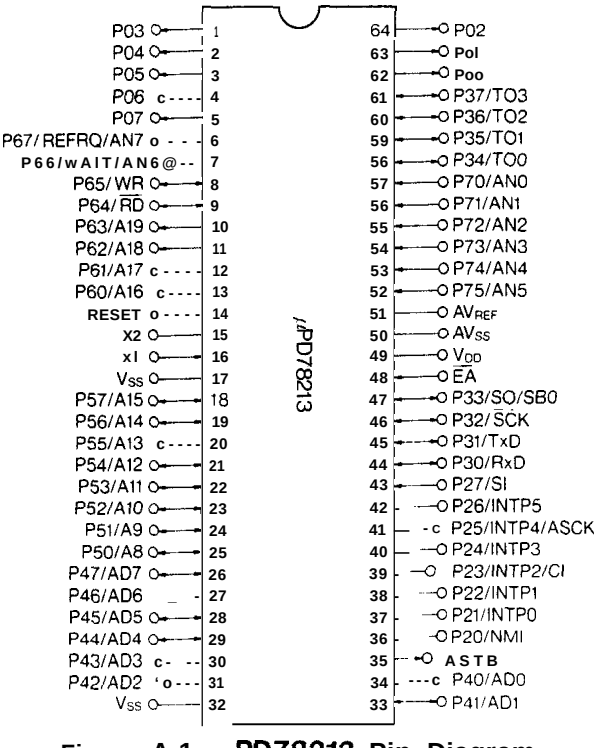


Figure A-1. μPD78213 Pin Diagram

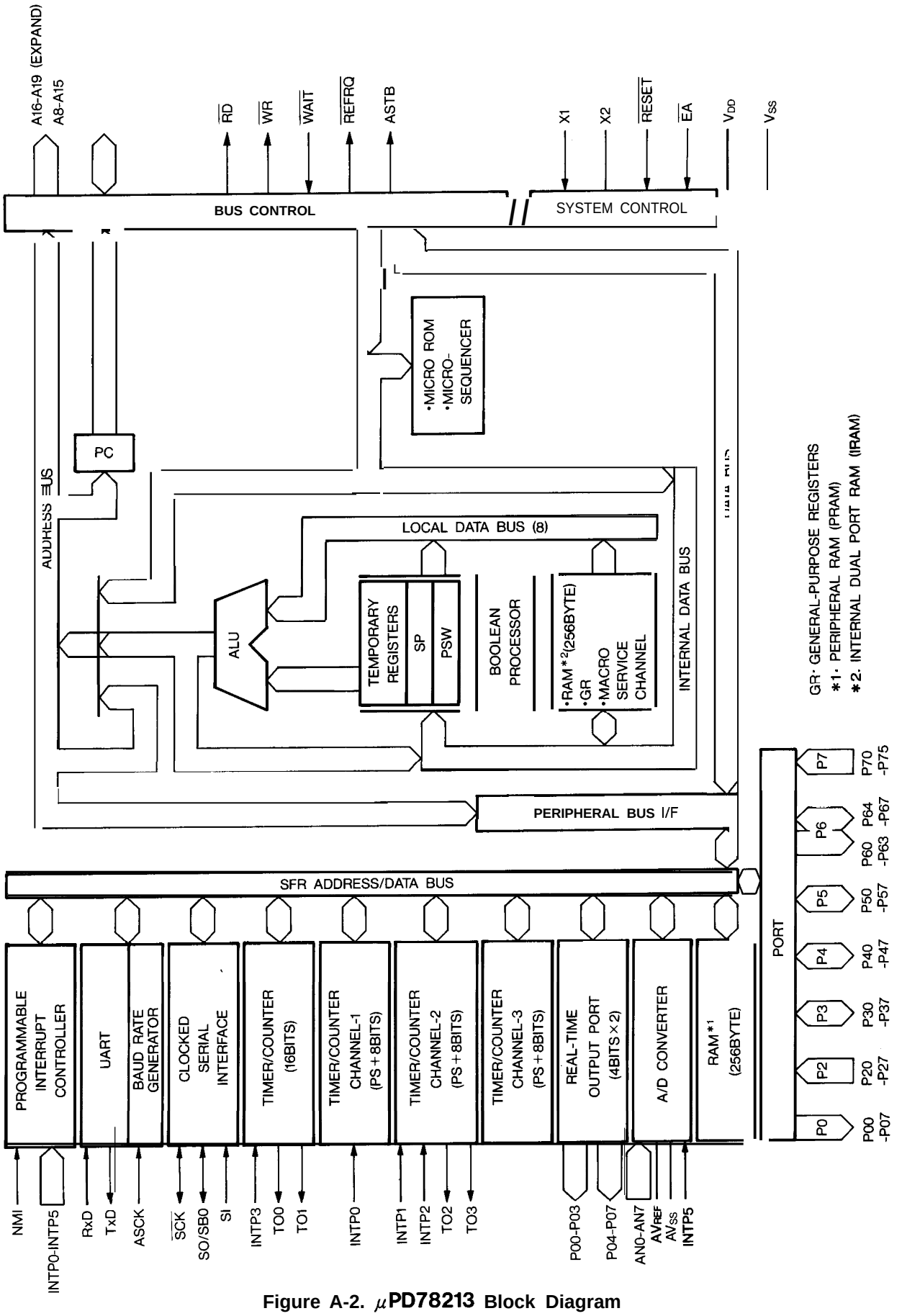


Figure A-2. μPD78213 Block Diagram

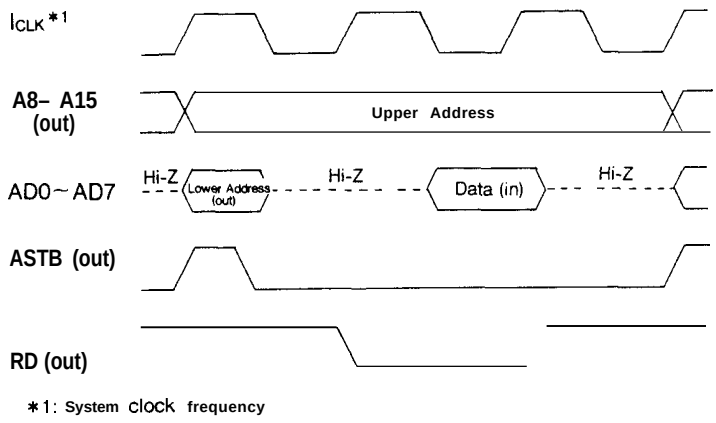
Table A-2. µPD78213 Terminal Functions

Pin No.	Terminal	I/O	Signal Name	Description
49	VDD	I		+5 VDC
17, 32	Vss	—		Ground
48	1. c.	-		Ground
13	P60	o	SBO	Switch bank O
12	P61	o	SB1	Switch bank 1
11	P62	o	SB2	Switch bank 2
10	P63	o	SB3	Switch bank 3
7	P66	o	$\overline{SB4}$	Switch bank 4
6	P67	I	SD0	Switch data O
42	P26	I	SD1	Switch data 1
43	P27	I	SD2	Switch data 2
53	P74	I	SD3	Switch data 3
52	P75	I	SD4	Switch data 4
62	PO0	o	CRA	CR motor coil A drive pulse
63	PO1	o	CRB	CR motor coil B drive pulse
64	PO2	o	CRC	CR motor coil C drive pulse
1	PO3	o	CRD	CR motor coil D drive pulse
2	PO4	o	CSRBA	CS/RF motor coil A drive pulse
3	PO5	o	CSRBB	CS/RF motor coil B drive pulse
4	PO6	0	CSRBC	CS/RF motor coil C drive pulse
5	PO7	0	CSRBD	CS/RF motor coil D drive pulse
47	P33	o	CSRBENB	CS/RF motor drive/hold switch s
39	P23	I	CSHOM	CS sensor signal
37	P21	I	PESW	PE sensor signal
61	P37	I	GAPSW	PG sensor signal
59	P35	I	F/TSW	F/T sensor signal
38	P22	I	CRHOM	CR HP sensor signal
51	AVREF	I		Analog port reference voltage
50	AVSS			Analog port ground
57	ANO	I	TEMP	Printhead temperature detection
56	AN1	I	HDVLT	+35 V line voltage detection
55	AN2	I	VR2	VR2 adjustment value detection
54	AN3	I	VRI	VR1 adjustment value detection
16	x I	I		External oscillator (9.83 MHz)
15	x2	—		
58	TO0/P34	o	HPW	Printhead coil trigger pulse
46	P32	0	P512	P-ROM (6A) address bus 15
9	RD	o		Read strobe
8	WR	0		Write strobe
35	ASTB	o	ALE	Address latch enable

Table A-2. ,uPD78213 Terminal Functions

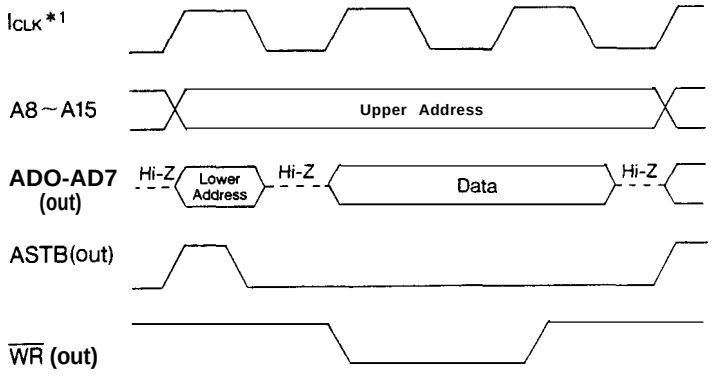
Pin No.	Terminal	1/0	Signal Name	Description
34	A8	o		Address bus 8
33	A9	o		Address bus 9
31	AIO	o		Address bus 10
30	Al 1	0		Address bus 11
29	Al 2	0		Address bus 12
28	A13	o		Address bus 13
27	A14	o		Address bus 14
26	A15	o		Address bus 15
34	ADO	I/O		Address/data bus O
33	AD1	I/O		Address/data bus 1
31	AD2	I/O		Address/data bus 2
30	AD3	I/O		Address/data bus 3
29	AD4	I/O		Address/data bus 4
28	AD5	I/O		Address/data bus 5
27	AD6	I/O		Address/data bus 6
26	AD7	I/O		Address/data bus 7
45	TXD	o		Transmit serial data
44	RXD	I		Receive serial data
14	$\overline{\text{RESET}}$	I	RST	Reset signal
36	NMI	I		Non-maskable interrupt signal
60	T02	o		Clock pulse
40	INTP3	I		Interrupt signal 3
41	INTP4	I		Interrupt signal 4

Figures A-3 and A-4 show bus interface timing for the basic μPD78213



*1: System clock frequency

Figure A-3. Memory Read Timing



*1: System clock frequency

Figure A-4. Memory Write Timing

A.1.1.2 27256

The 27256 is an EP-ROM, which is an ultra-violet erasable and electrically programmable ROM.

Fertures

- .32768 words x 8bits
- . TTL compatible input/output
- +5 VDC single power
- . Access time 200 ns (MAX.)
- .28 pins (DIP)

Terminal Functions

- . AO-A14 Address input
- . CE Chip enable input
- OE Output enable input
- . D0~D7 Data output
- . V_{CC} Power supply (+5 VDC)
- . GND Ground
- V_{PP} : Program power Supplly

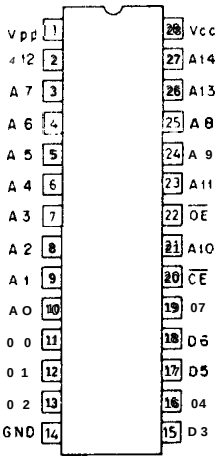


Figure A-5. 27256 Pin Diagram

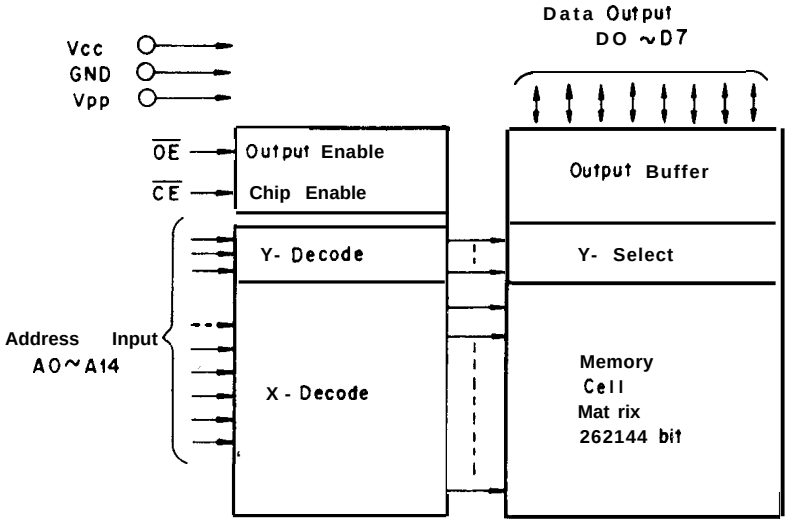


Figure A-6. 27256 Block Diagram

Table A-3. 27256 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	V_{PP}	Vcc	D in
Program Verify	H	L	x	V_{PP}	V_{PP}	D out
Optional Verify	L	L	x	V_{PP}	V_{PP}	D out
Program Inhibit	H	H	x	V_{PP}	Vcc	High Z
Identifier	L	L	VH	Vcc	Vcc	Code

NOTES : 1. X...Don't care
2. VH = 12.OV ± 0.5V
3. Vcc = – 0 . 6 ~ +7V
4. V_{PP} = -0.6 ~ + 14V

A.1.1.3 HM65256BLSP-12

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

Fertures

- **32768 words x 8 bits**
- **TTL compatible input/output**
- **+5 VDC single power**
- **CS access time 120 ns** *(MAX.)*
- **28 pins (DIP)**

Terminal Functions

AO-A14	**Address input**
WE	Write enable input
OE	*Output enable* input
CE	**Chip enable input**
1/00-1/07	**Data input/output**
Vcc	**Power supply (+5 VDC)**
GND	**Ground**

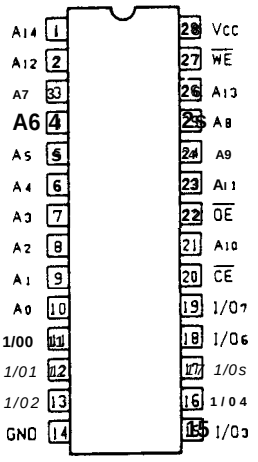


Figure A-7. HM65256BLSP-12 Pin Diagram

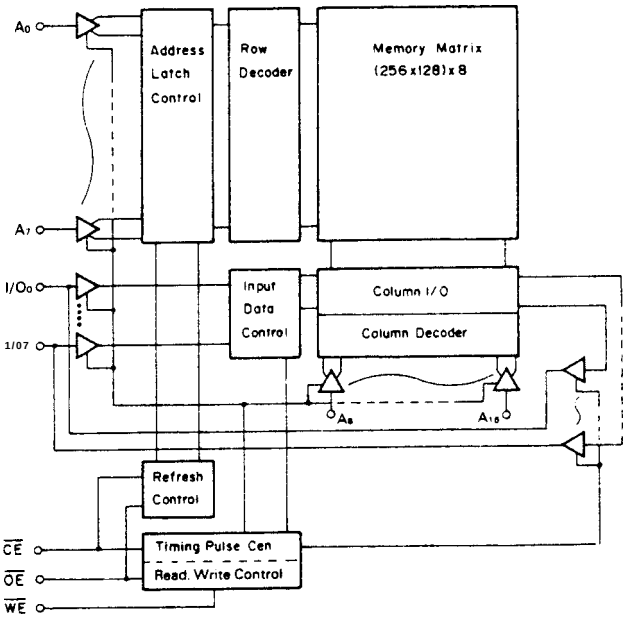


Figure A-8. HM65256BLSP-12 Block Diagram

Table A-4. HM65256BLSP-12 Signal Status

CE	OE	WE	1/0 Terminal	Function
L	L	H	Low impedance	Read
L	X	L	High impedance	Write
L	H	H	High impedance	—
H	L	x	High impedance	Refresh
H	H	x	High impedance	Standby

NOTE : X···Don't care

A.1.1.4 HM6264ALP-12

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

- **.8192 words x 8 bits**
- **. TTL compatible input/output**
- **• +5 VDC single power**
- **. CS access time . . . 120ns (MAX.)**
- **.28 pins (DIP)**

Terminal Functions

- **. AO-A12 Address input**
- **. WE Write enable input**
- **. OE Output enable input**
- **. CS1,CS2 Chip select input**
- **. DO~D7 Data input/output**
- **. V_{DD} Power supply (+5 VDC)**
- **. V_{SS} Ground**
- **. NC No connection**

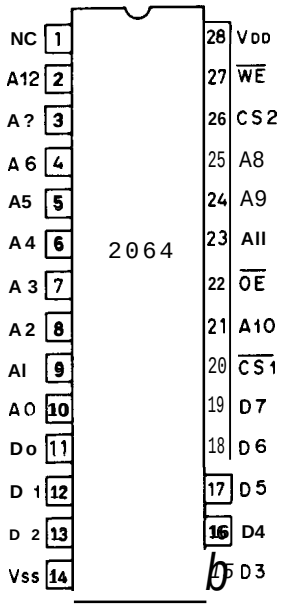


Figure A-9. HM6264ALP-12 Pin Diagram

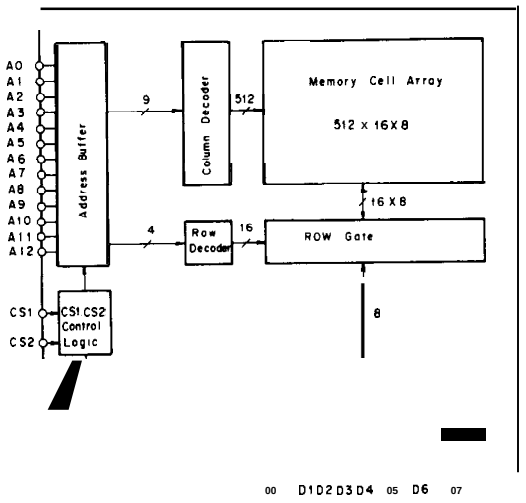


Figure A-10. HM6264ALP-12 Block Diagram

Table A-5. HM6264ALP-12 Signal Status

WE	CS1	CS2	OE	1/0 Terminal	Mode
x	H	x	x	High impedance	Power down
H	L	H	H	High impedance	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)

NOTE : X···Don't care

A.1.1.5 E05A02LA

The E05A02LA is a gate array IC used to lighten the load on the CPU when processing print data.

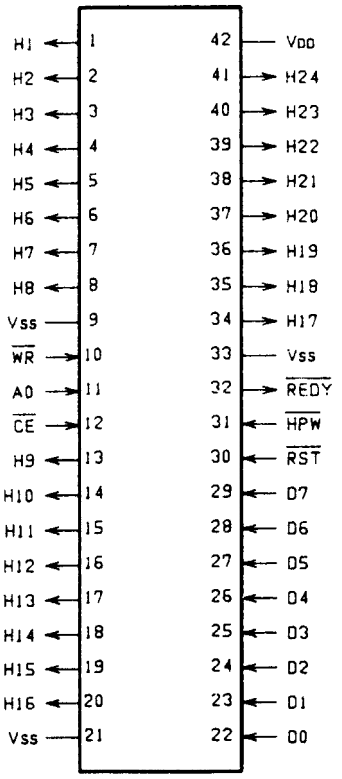


Figure A-II. E05A02LA Pin Diagram

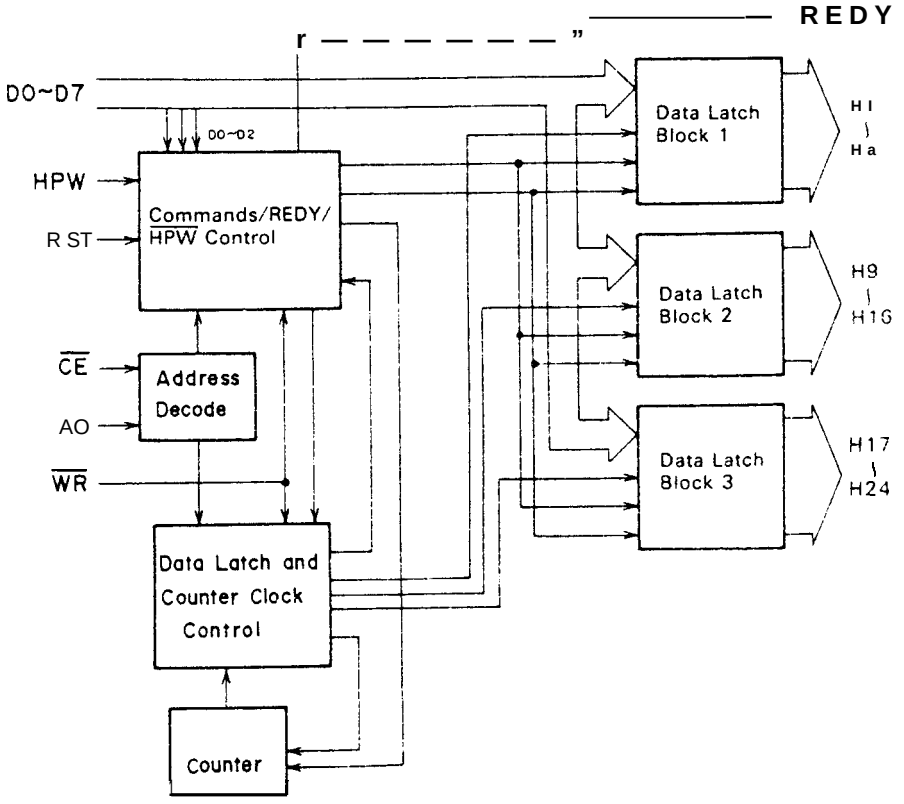


Figure A-12. E05A02LA Block Diagram

Table A-6. E05A02LA Terminal Functions

Pin No.	*Terminal*	*I/O*	*Description*
1 ⟆ 8	HI ⟆ H8	o	Printhead solenoids (1 -8) ON/OFF
13 ⟆ 20	H9 ⟆ H16	o	Printhead solenoids (9--16) ON/OFF
34 ⟆ 41	H17 ⟆ H24	o	Printhead solenoids (17--24) ON/OFF
22 ⟆ 29	DO ⟆ D7	I	Print data/command
11	AO	I	Address bit O
12	CE	I	Chip enable
10	WR	I	Write strobe
30	RST	I	Reset signal
31	HPW	I	Printhead solenoid trigger pulse
32	$\overline{\text{REDY}}$	o	Ready signal
42	V_{DD}	I	+5 VDC
9,21,33	V_{SS}	—	Ground

A.1.1.6 E05A10AA

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

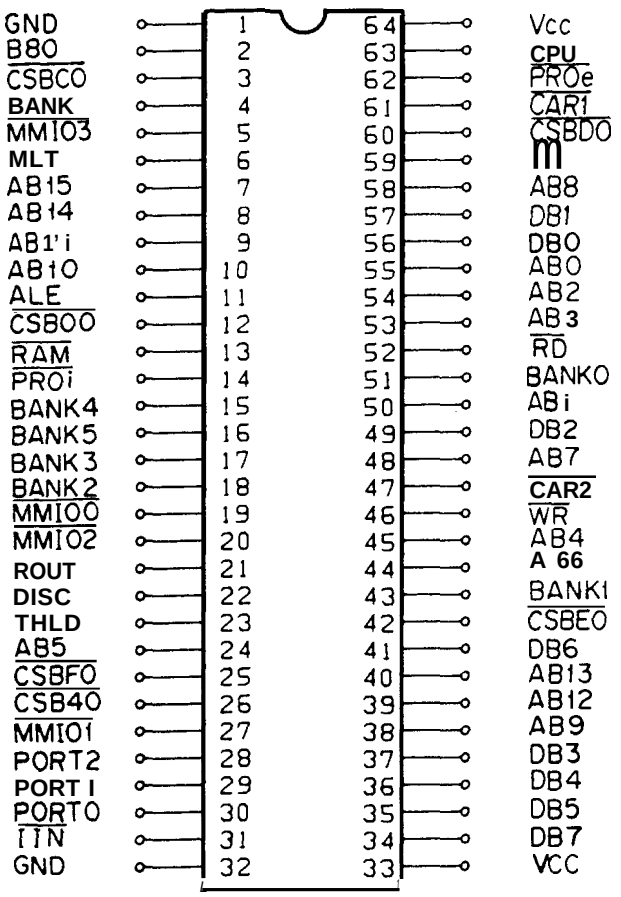


Figure A-13. E05A10AA Pin Diagram

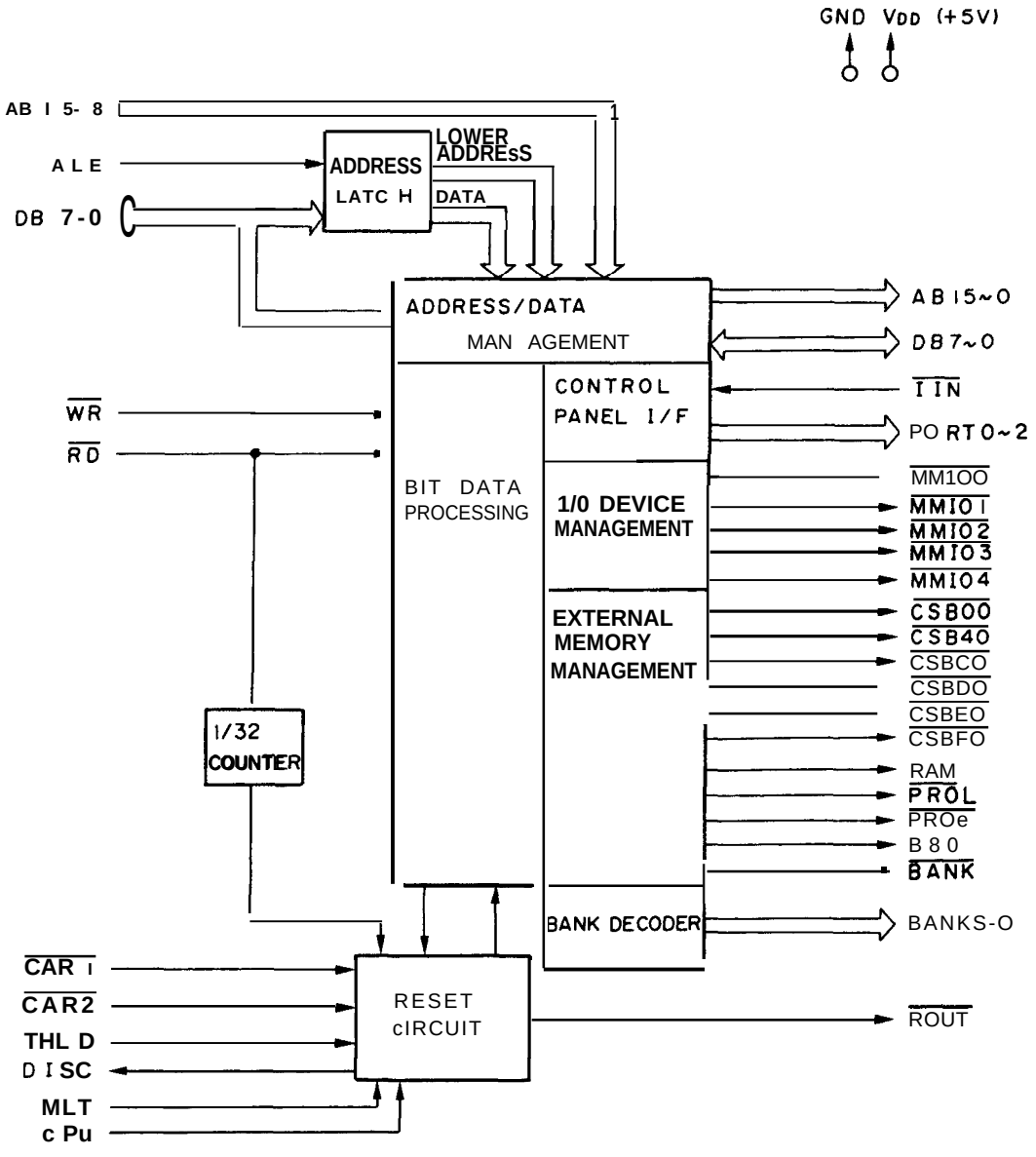


Figure A-14. EO5A1OAA Block Diagram

Table A-7. E05A1 OAA Terminal Functions

Pin No.	Name	I/O	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	AB0	o	Address bus O
50	AB1	o	Address bus 1
54	AB2	o	Address bus 2
53	AB3	o	Address bus 3
45	AB4	o	Address bus 4
24	AB5	o	Address bus 5
44	AB6	o	Address bus 6
48	AB7	o	Address bus 7
58	AB8	I	Address bus 8
38	AB9	I	Address bus 9
10	AB10	I	Address bus 10
9	AB11	I	Address bus 11
39	AB12	I	Address bus 12
40	AB13	I	Address bus 13
8	AB14	I	Address bus 14
7	AB15	I	Address bus 15
56	D O	I/O	Data bus O
57	D 1	I/O	Data bus 1
49	D 2	I/O	Data bus 2
37	D 3	I/O	Data bus 3
36	D 4	I/O	Data bus 4
35	D 5	I/O	Data bus 5
41	D 6	I/O	Data bus 6
34	D 7	I/O	Data bus 7
30	$\overline{\text{RORT0}}$	o	LDLED
29	$\overline{\text{PORT1}}$	o	OTLED
28	$\overline{\text{PORT2}}$	o	CKLED
19	$\overline{\text{MMIO0}}$	o	IC (11 B) select
27	$\overline{\text{MMIO1}}$	o	IC (4B) non-maskable interrupt
20	$\overline{\text{MMIO2}}$	o	Not used
5	$\overline{\text{MMIO3}}$	o	Not used
59	$\overline{\text{MMIO4}}$	–	Not used
12	$\overline{\text{CSB00}}$	O	Chip select bank OOH
26	$\overline{\text{CSB40}}$	O	Chip select bank 40H
3	$\overline{\text{CSBC0}}$	o	Not used
60	$\overline{\text{CSBDO}}$	O	Chip select bank DOH
42	$\overline{\text{CSBEO}}$	o	Chip select bank EOH
25	$\overline{\text{CSBF0}}$	o	Chip select bank F0H

Table A-7. EO5A1OAA Terminal Functions

Pin No.	Name	I/O	Function
52	RD	I	Read strobe
46	WR	I	Write strobe
11	ALE	I	Address latch enable
13	RAM	o	IC (5A) select
14	PROi	o	IC (6A) select
62	$\overline{\text{PROe}}$	o	IC (SLOT-A) select
2	B80	o	Not used
4	$\overline{\text{BANK}}$	o	Not used
31	$\overline{\text{IIN}}$	I	ON LINE switch
33,64	V_{DD}	I	+5 VDC power
1,32	V_{SS}		GND
23	$\overline{\text{THLD}}$	I	Power on reset
21	$\overline{\text{ROUT}}$	o	Reset signal
22	DISC	o	Discharge
6	MLT	I	Pulled down
63	CPU	I	Power on reset
61	$\overline{\text{CAR1}}$	I	$\overline{\text{R}}$ (CN17)
47	$\overline{\text{CAR2}}$	I	$\overline{\text{R}}$ (CN18)

A.1.1.7 E05A24GA

This gate array IC has an 8-bit parallel I/F circuit and an expanded port function.

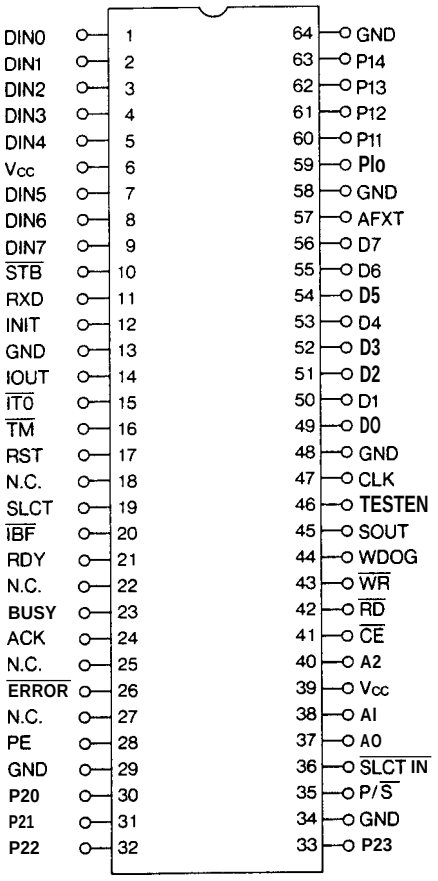


Figure A-15. E05A24GA Pin Diagram

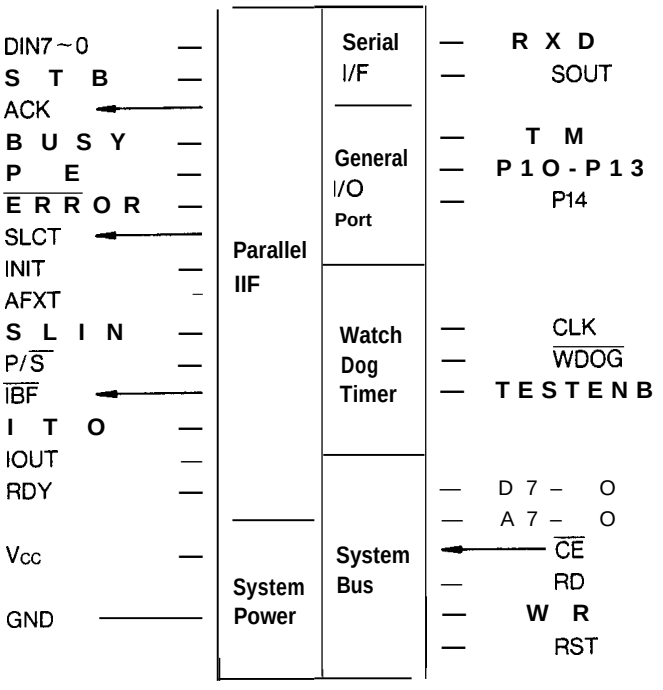


Figure A-16. E05A24GA Block Diagram

Table A-8. E05A24GA Terminal Functions

Pin No.	Name	I/O	Function
11	RXD (IN)	I	Receive serial data
35	P/$\overline{S}$	I	Parallel/serial select
9	DIN7	I	Data bus 7
8	DIN6	I	Data bus 6
7	DIN5	I	Data bus 5
5	DIN4	I	Data bus 4
4	DIN3	I	Data bus 3
3	DIN2	I	Data bus 2
2	DIN1	I	Data bus 1
1	DIN0	I	Data bus O
10	STB	I	$\overline{\text{STROBE}}$ signal
24	ACK	o	$\overline{\text{ACKNLG}}$ signal
23	BUSY	o	BUSY signal
28	PE	o	PE signal
26	ERR	o	$\overline{\text{ERROR}}$ signal
12	INIT	I	INIT signal
36	SLIN	I	$\overline{\text{SLCTIN}}$ signal
57	AFXT	I	$\overline{\text{AUTO FEED XT}}$ signal
19	SLCT	I	SLCT signal
6,39	Vcc	I	+5 VDC
46	ENSTENB	–	Pulled down
13,29, 34,48, 58, 64	GND		Ground
63	P14	o	PF motor drive/hold switch signal
30	P20	o	PF motor coil A drive pulse
31	P21	o	PF motor coil B drive pulse
32	P22	o	PF motor coil C drive pulse
33	P23	o	PF motor coil D drive pulse
16	TM	I	Not used (open)
61	P12	o	IC (1A) reference voltage #O
60	P11	o	IC (1A) reference voltage #1
59	Plo	o	IC (1A) reference voltage #2
62	P13	o	Buzzer
21	$\overline{\text{READY}}$	o	READY LED
20	IBF	o	BUSY Latch signal
15	ITO	o	INIT Latch signal
47	CLK	I	Watch-dog timer clock
42	RD	I	Read strobe
43	WR	I	Write strobe
49	DO	I/O	Data bus O
50	D1	I/O	Data bus 1
51	D2	I/O	Data bus 2
52	D3	I/O	Data bus 3
53	D4	I/O	Data bus 4
54	D5	I/O	Data bus 5
55	D6	I/O	Data bus 6
56	D7	I/O	Data bus 7
37	AO	I	Address bus O
38	AI	I	Address bus 1
40	A2	I	Address bus 2
44	$\overline{\text{WDOG}}$	o	Watch-dog timer

Table A-8. E05A24GA Terminal Functions

Pin No.	Name	I/O	Function
27,22, 25, 18	NC	O	Not used
14	IOUT		Not used
41	Cs	I	Chip select signal
17	RST	I	Reset signal
45	SOUT	O	Output Serial data

A.1.1.8 SI-7300A

The SI-7300A is a unipolar constant current chopper type driver IC, and includes a control/drive circuit for a 4-phase stepper motor.

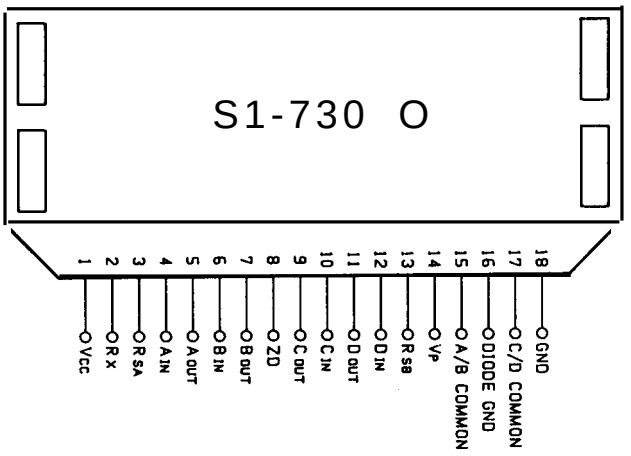


Figure A-17. SI-7300A Pin Diagram

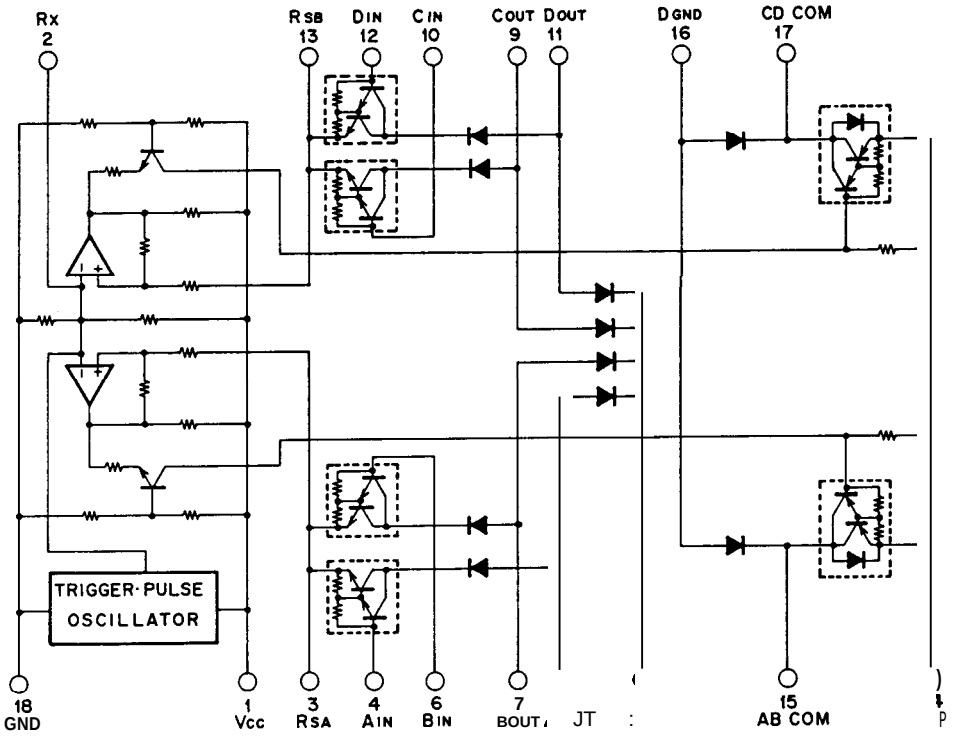


Figure A-18. SI-7300A Internal Circuit

Table A-9. SI-7300A Terminal Functions

Pin No.	Terminal	I/O	Description
14	VCC	I	+35 VDC
16	GND	–	GP
15	COMAB	o	CR motor coil A/B drive voltage
17	COMCD	o	CR motor coil C/D drive voltage
4	1A	I	CR motor coil A drive pulse
6	IB	I	CR motor coil B drive pulse
10	IC	I	CR motor coil C drive pulse
12	ID	I	CR motor coil D drive pulse
5	OA	o	CR motor coil A drive terminal
7	OB	o	CR motor coil B drive terminal
9	OC	o	CR motor coil C drive terminal
11	OD	o	CR motor coil D drive terminal
8	ZD	o	CR motor surge voltage output terminal
18	GND	–	Ground
3	RSA	I	CR motor coil A/B current detection resistor mounting terminal
13	RSB	I	CR motor coil C/D current detection resistor mounting terminal
2	RX	I	Constant current control reference voltage
1	VCC2	I	+5 VDC

A.1.1.9 TL431

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** (50PPM/°C TYP.)
- **Low zener current** (400μA TYP.)
- **High response speed**
- **Low dynamic output impedance**
- **Low noise**

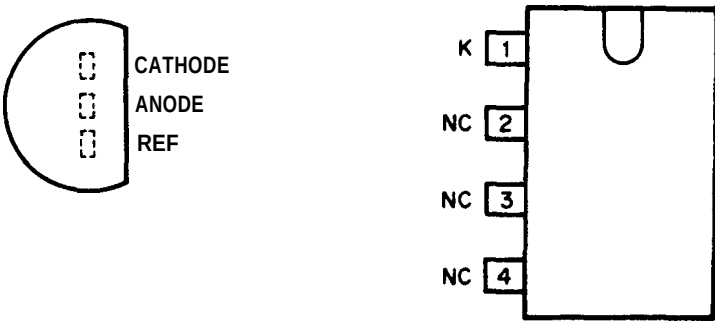


Figure A-19. TL431 Pin Diagram

A.1.1.10 7406

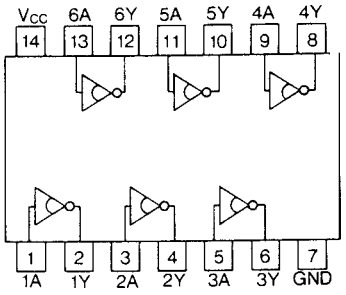


Figure A-20. 7406 Pin Assignment

A.1.1.11 7486

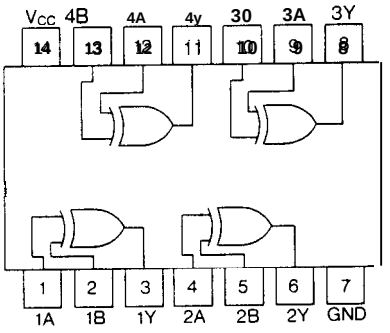


Figure A-21. 7486 Pin Assignment

A.1.1.12 75188

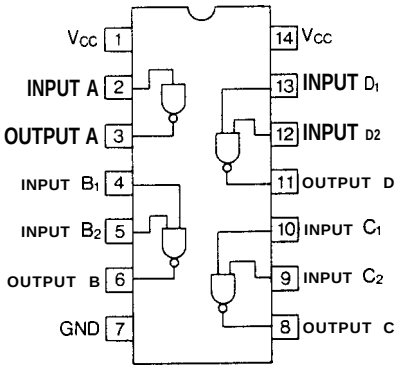


Figure A-22. 75188 Pin Assignment

A.1.1.13 75189

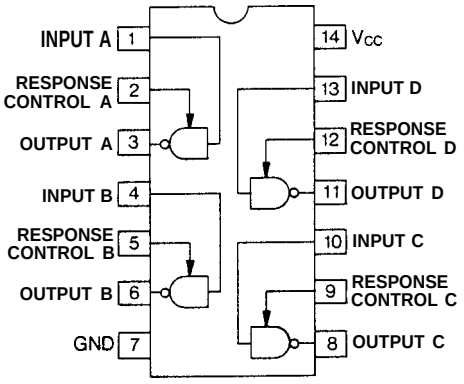


Figure A-23. 75189 Pin Assignment

A.1.2 MONPS/MONPSE Board

Table A-10 shows the primary ICs used on the MONPS/MONPSE board.

Table A-10. MONPS/MONPSE Board Primary ICs

Location	IC Name	Type	Description	Reference Section
Q5. Q20	TL431CLPB	IC	Adjustable Precision Shunt Regulator	A. 1. 1.9
IC20	STR20005	IC	+5 V DC Chopper-type Switching Regulator	A. 1. 2.1

A.1.2.1 STR20005

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

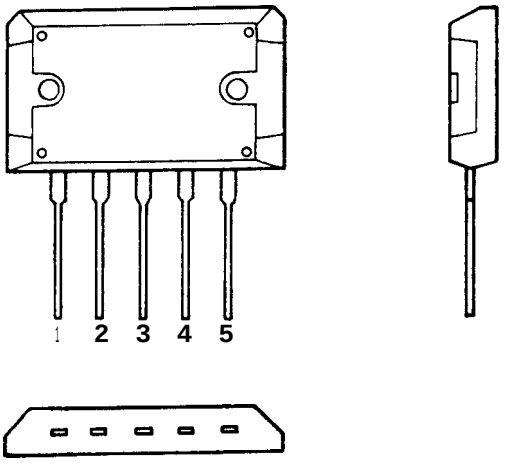


Figure A-24. STR20005 Pin Diagram

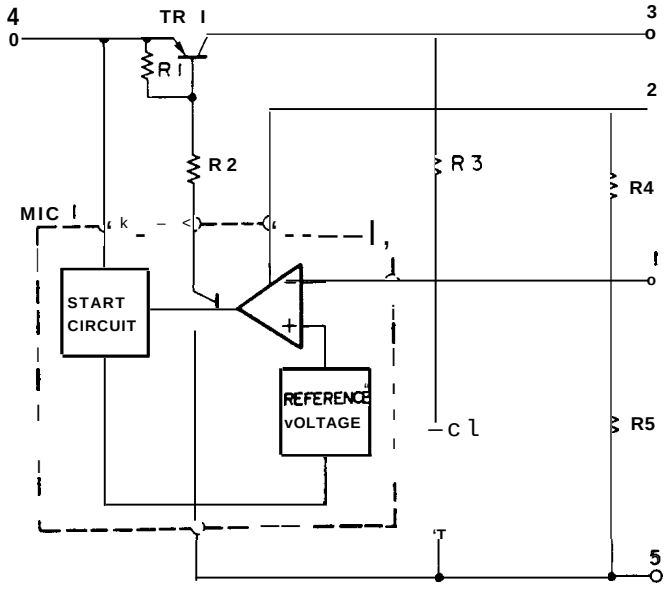


Figure A-25. STR20005 Equivalent Circuit

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	5.1±0.1	11-40	45

A.2 CONNECTOR PIN ASSIGNMENTS

Figure A-26 shows interconnections of the primary connectors and cables. Table A-12 gives a summary of each connector.

NOTE : The signal directions for the connectors are as viewed from the JUNMM board,

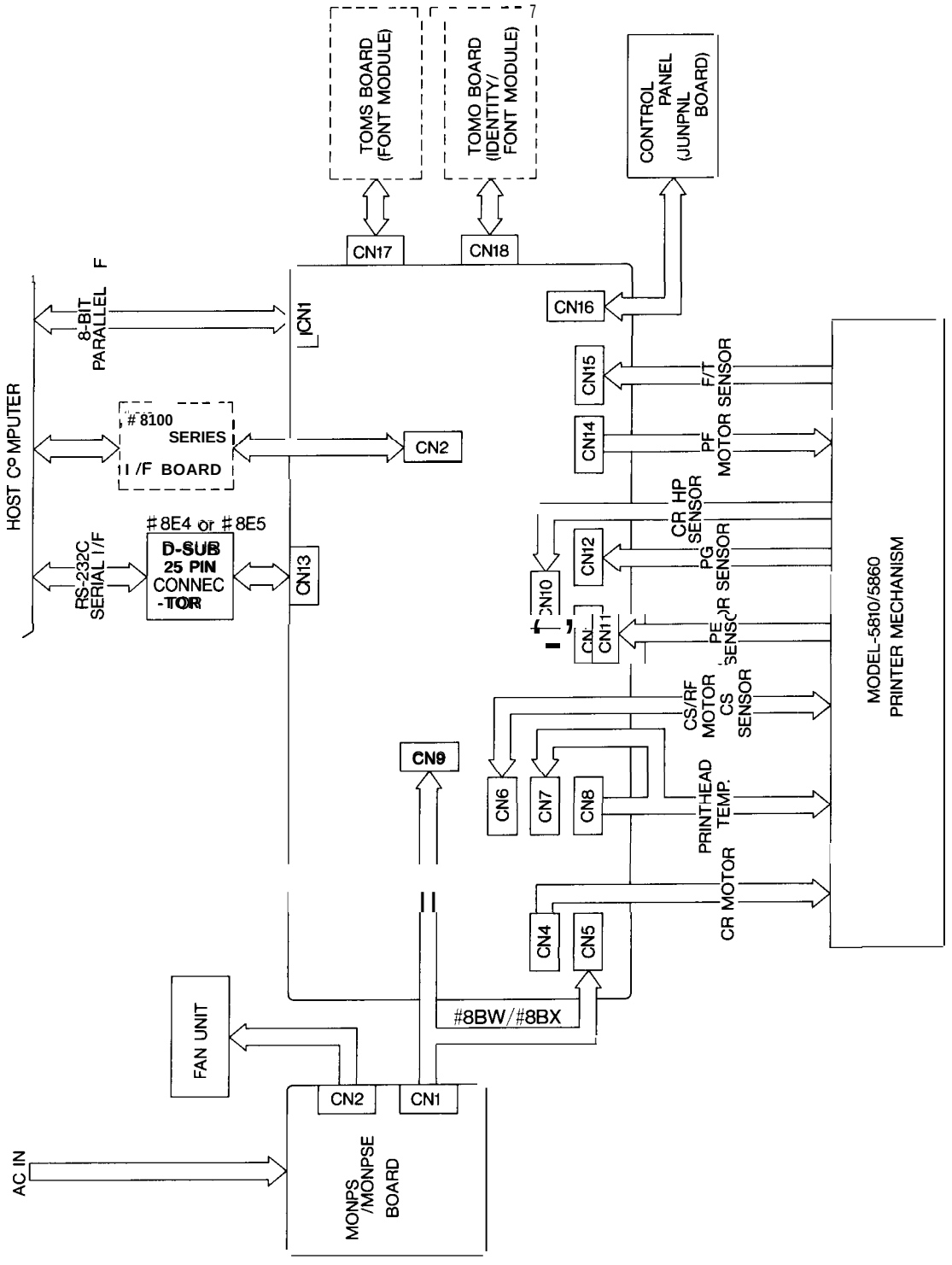


Figure A-26. Cable Connections

Table A-1 2. Connector Summary

Board	Connector	Number of pins	Destination	Description	Cable	Reference Table
JUNMM	CN1	36	Host computer	I/F (8-bit parallel)	·	1-13
	CN2	26	#81 XX I/F board	I/F (option)	—	A-13
	CN3	44	Not used	—	—	
	CN4	6	Printer mechanism	CR motor	—	A-14
	CN5	4	MONPS/MONPSE board	+35V—GP	#8BW*1	A-15
	CN6	6	Printer mechanism	CS/RF motor	—	A-16
	CN7	15	Printer mechanism	Printhead (R)	—	A-17
	CN8	17	Printer mechanism	Printhead (F)	1 -	A-18
	CN9	6	MONPS/MONPSE board	+5V—GND, ±12V—GND	#8BW*1	A-19
	CNIO	3	Printer mechanism	CR HP sensor	·	A-20
	CN11	2	Printer mechanism	PE sensor	—	A-21
	CN12	2	Printer mechanism	PG sensor	—	A-22
	CN13	25	Host computer	I/F (RS-232C)	#8E4*2	1-16
	CN14	6	Printer mechanism	PF motor	—	A-23
	CN15	2	Printer mechanism	F/~ sensor	—	A-24
	CN16	18	Control panel		—	A-25
	CN17	32	Font module	SLOT B	1 -	A-26
	CN18	32	Identity/font module	SLOT A	—	A-27
MONPS/ MONPSE	CN1	10	JUNMM board	+35V—GP, ±12V—GND, +5V—GND	#8BW*1	A-28
	CN2	2	Fan unit	—	—	A-29

*1: LQ-1060 uses #8BX.

*2 : Metric screws are used. Inch screws are used in #8E5.

NOTE : In this section, the following abbreviations are used:

CR: Carriage
CS : Color select
F/T : Friction/tractor
PE : Paper end
PF: Paper feed
PG: Platen gap
RF: Ribbon feed

Table A-13. CN2 Pin Assignments

Pin No.	Signal	I/O	Description
1	$\overline{\text{ERROR}}$	o	Error
2	PE	o	Paper end
3	D6 (B4)	I	Data bit 6
4	BUSY	o	Busy
5	D5 (B3)	I	Data bit 5
6	$\overline{\text{ACKNLG}}$	o	Acknowledge
7	D4 (Par-dis)	I	Data bit 4 (Parity disable)
8	INIT	I	Initialize
9	D3 (0/E)	I	Data bit 3 (Odd/Even parity select)
10	$\overline{\text{STROBE}}$	I	Strobe pulse
11	D7 (RXD)	I	Data bit 7 (Serial signal input)
12	GND	—	Signal Ground
13	$\overline{\text{RESET}}$	o	Reset
14	−12V	o	−12 VDC
15	D2 (B2)	I	Data bit 2 (Bit rate select)
16	+5V	o	+5 VDC
17	D1 (B1)	I	Data bit 1 (Bit rate select)
18	NC	—	No connected
19	DO (8/7)	I	Data bit O (8-bit/7-bit select)
20	+ 12V	o	+12 VDC
21	P/$\overline{\text{S}}$	I	Parallel/Serial select
22	—	—	—
23	$\overline{\text{SLCT IN}}$	I	Select in
24	GND	—	Signal Ground
25	TXD	o	Tramsnit data
26	GND	—	Signal Ground

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

Table A-14. CN4 Pin Assignments

Pin No.	Signal	I/O	Description
1	CRA	o	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	ABCOM	o	Common phases A and B
6	CDCOM	o	Common phases C and D

Table A-15. CN5 Pin Assignments

Pin No.	Name	I/O	Description
1、2	+35	I	+35 VDC
3. 4	GP	—	Power ground

Table A-16. CN6 Pin Assignments

Pin No.	Name	I/O	Description
1	CSRBA	o	Phase A drive pulse
2	CSRBB	o	Phase B drive pulse
3	CSRBC	o	Phase C drive pulse
4	CSRBD	o	Phase D drive pulse
5	COM	o	Common phases A to D
6	GND		Ground
7	CSLED	o	+5 VDC
8	CSHOME	I	Color select sensor signal

Table A-1 7. CN7 Pin Assignments

Pin No.	Name	I/O	Description
1	HD3	o	Printhead solenoid #3
2	HD11	0	Printhead solenoid #1 ı
3	HD2	o	Printhead solenoid #2
4	HD19	o	Printhead solenoid #19
5	HD7	o	Printhead solenoid #7
9	HD22	o	Printhead solenoid #22
10	HD15	o	Printhead solenoid #15
11	HD18	o	Printhead solenoid #18
12	HD23	o	Printhead solenoid #23
13	HDIO	o	Printhead solenoid #lo
14	HD14	o	Printhead solenoid #14
15	HD6	o	Printhead solenoid #6
6. 7. 8	COM	o	+35 VDC

Table A-18. CN8 Pin Assignments

Pin No.	Name	I/O	Description
1	HD5	o	Printhead solenoid #5
2	HD1	o	Printhead solenoid #1
3	HD13	o	Printhead solenoid #13
4	HD9	o	Printhead solenoid #9
5	HD21	o	Printhead solenoid #21
6	HD17	o	Printhead solenoid #17
10	HD24	o	Printhead solenoid #24
11	HD20	o	Printhead solenoid #2o
12	HD12	o	Printhead solenoid #12
13	HD8	o	Printhead solenoid #8
14	HD16	o	Printhead solenoid #16
17	HD4	o	Printhead solenoid #4
7. 8. 9	COM	o	+35 VDC
15	TEMP1	I	Printhead temperature detection
16	TEMP2		Ground

Table A-1 9. CN9 Pin Assignments

Pin No.	Name	I/O	Description
1. 2	GND	—	Ground
3、4	+5	I	+5 VDC
5	+12	I	+12 VDC
6	−12	I	−12 VDC

Table A-20. CN1 O Pin Assignments

Pin No.	Signal	I/O	Description
1	CRLED	o	+5 VDC
2	GND	—	Ground
3	CRHOME	I	Carriage home position signal

Table A-21. CN11 Pin Assignments

Pin No.	Signal	1/0	Description
1	PELED	—	Not used
2	GND	—	Ground
3	PE	I	Paper end signal

Table A-22. CN12 Pin Assignments

Pin No.	Signal	1/0	Description
1	GAP	I	Head adjustment lever position (1 -3/4-8)
2	GND	—	Ground

Table A-23. CN14 Pin Assignments

Pin No.	Signal	I/O	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

Table A-24. CN15 Pin Assignments

Pin No.	Signal	1/0	Description
1	F/~	I	Friction/$\overline{\text{Tracter}}$
2	GND	—	Ground

Table A-25. CN16 Pin Assignments

Pin No.	Signal	I/O	Description
1	$\overline{\text{RYLED}}$	o	READY LED
2	$\overline{\text{BUZZER}}$	o	Buzzer
3	$\overline{\text{ONLSW}}$	I	ON LINE switch
4	$\overline{\text{DTLED}}$	o	Serial data
5	$\overline{\text{LDLED}}$	o	Parallel data output trigger pulse
6	$\overline{\text{CKLED}}$	o	Serial data synchronous clock
7	SB0	o	Switch bank O
8	SBI	o	Switch bank 1
9	SB2	o	Switch bank 2
10	SB3	o	Switch bank 3
11	SB4	o	Switch bank 4
12	SD0	I	Switch data O
13	SD1	I	Switch data 1
14	SD2	I	Switch data 2
15	SD3	I	Switch data 3
16	SD4	I	Switch data 4
17	+ 5	I	+5 VDC
18	GND		Ground

Table A-26. CN17 Pin Assignments

Pin No.	Signal	I/O	Description
1	D5	I/O	Data bus 5
2	D4	I/O	Data bus 4
3	D7	I/O	Data bus 7
4	AB1	o	Bank 1
5	A5	o	Address bus 5
6	A6	o	Address bus 6
7	AIO	o	Address bus 10
8	$\overline{R}$	I	Reset signal
9	GND	—	Ground
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	$\overline{RD}$	0	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	0	Write strobe
23	A7	o	Address bus 7
24	+5	o	+5 VDC
25	Al 1	0	Address bus 11
26	$\overline{PROG}$	I	Program select
27	A12	o	Address bus 12
28	A13	0	Address bus 13
29	AI	o	Address bus 1
30	AB0	o	Bank O
31	A2	o	Address bus 2
32	A3	o	Address bus 3

Table A-27. CN18 Pin Assignments

Pin No.	Signal	I/O	Description
1	D5	I/O	Data bus 5
2	D4	I/O	Data bus 4
3	D7	I/O	Data bus 7
4	AB1	O	Bank 1
5	A5	0	Address bus 5
6	A6	0	Address bus 6
7	A10	0	Address bus 10
8	$\overline{R}$	I	Reset signal
9	GND		GND
10	A9	o	Address bus 9
11	A8	0	Address bus 8
12	D2	I/O	Data bus 2
13	D1	I/O	Data bus 1
14	RD	o	Read strobe
15	D0	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	0	Address bus 4
22	WR	0	Write strobe
23	A7	0	Address bus 7
24	+ 5	0	+5 VDC
25	Al 1	0	Address bus 11
26	$\overline{PROG}$	I	Program select
27	A12	o	Address bus 12
28	A13	0	Address bus 13
29	AI	0	Address bus 1
30	AB0	0	Bank O
31	A2	0	Address bus 2
32	A3	0	Address bus 3

Table A-28. CN1 Pin Assignments

Pin No.	Name	Function
1. 2	+35V	+35 VDC power sourse
3. 4	GP	Power ground
5、6	GL	Logic ground
7. 8	+5V	+5 VDC power sourse
9	+ 12V	+12 VDC power sourse
10	–12V	–12 VDC power sourse

Table A-29. CN2 Pin Assignments

Pin No.	Name	Function
1	+35V	+35 VDC power sourse
2	GP	Power ground

A.3 DRAWINGS

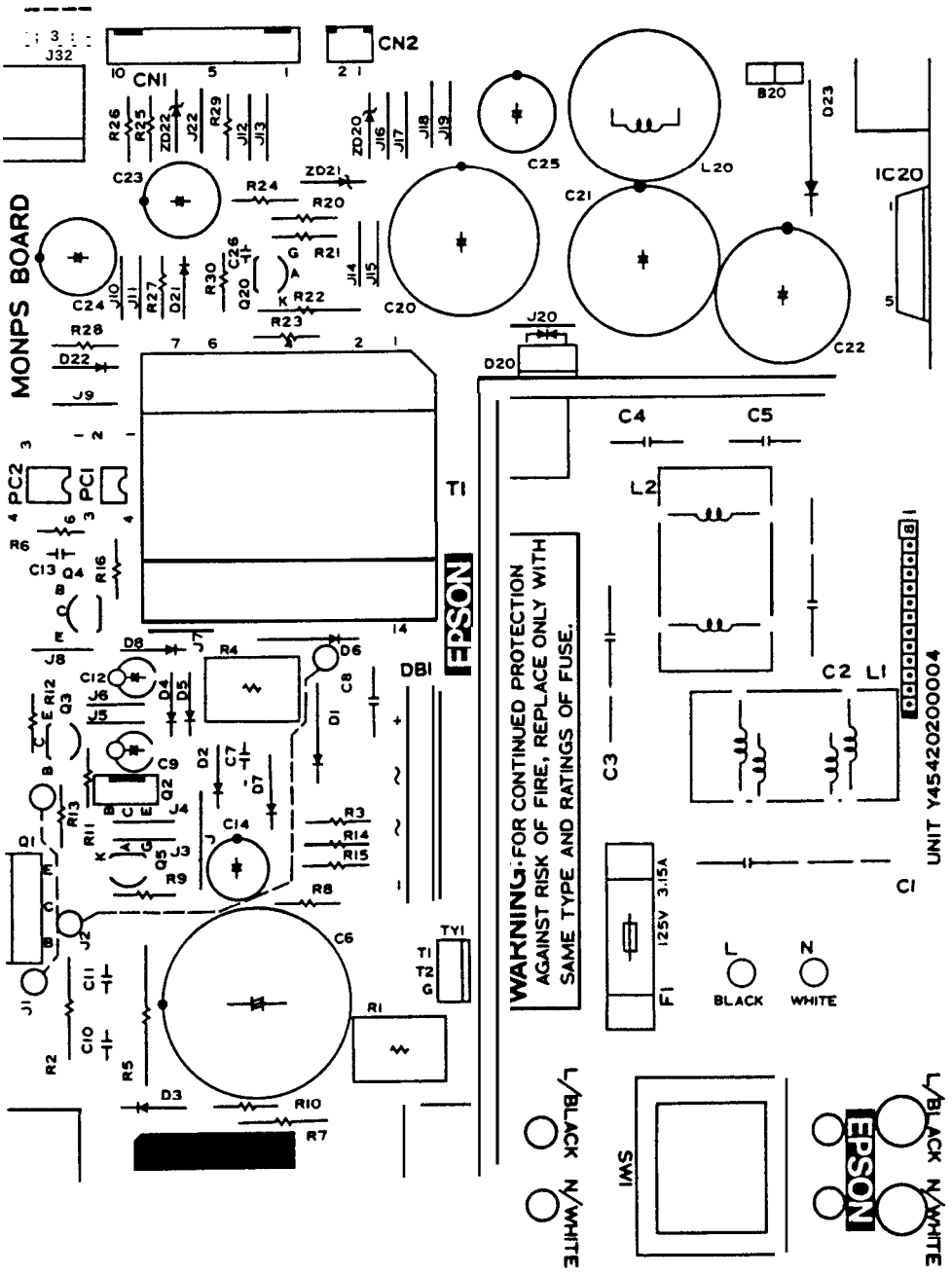


Figure A-27. MONPS Board Component Layout

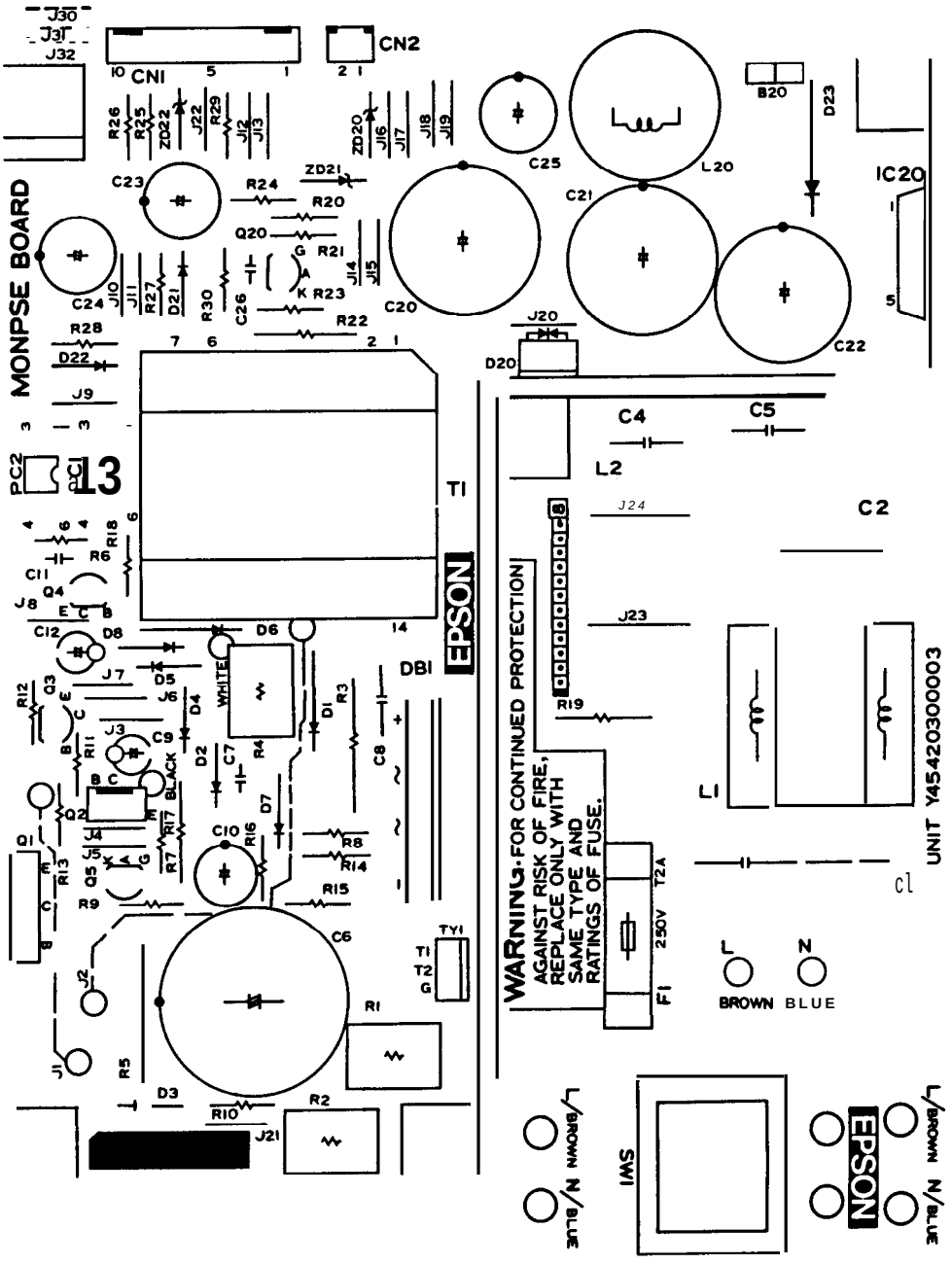


Figure A-28. MONPSE Board Component Layout

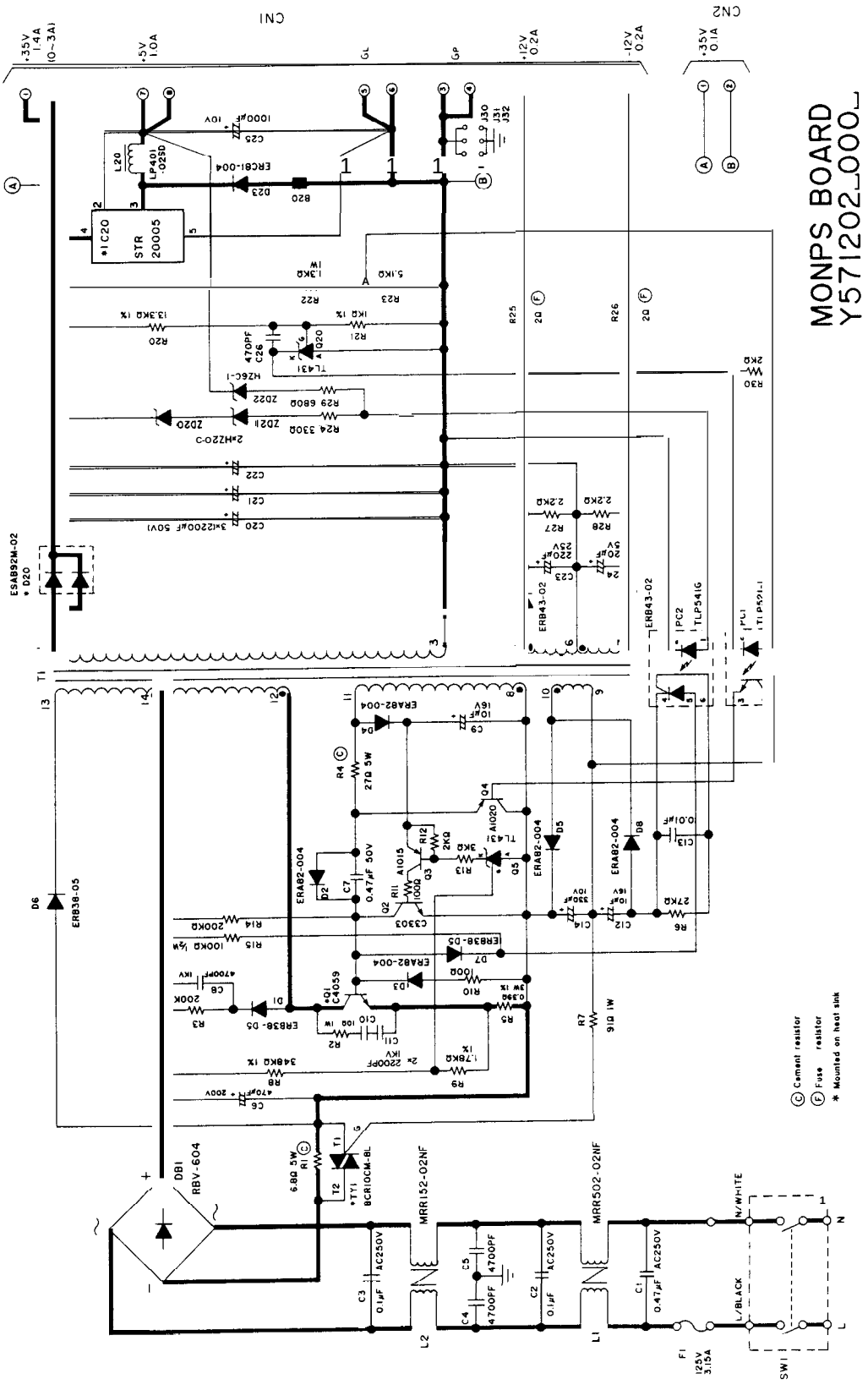


Figure A-29. MONPS Board Circuit Diagram

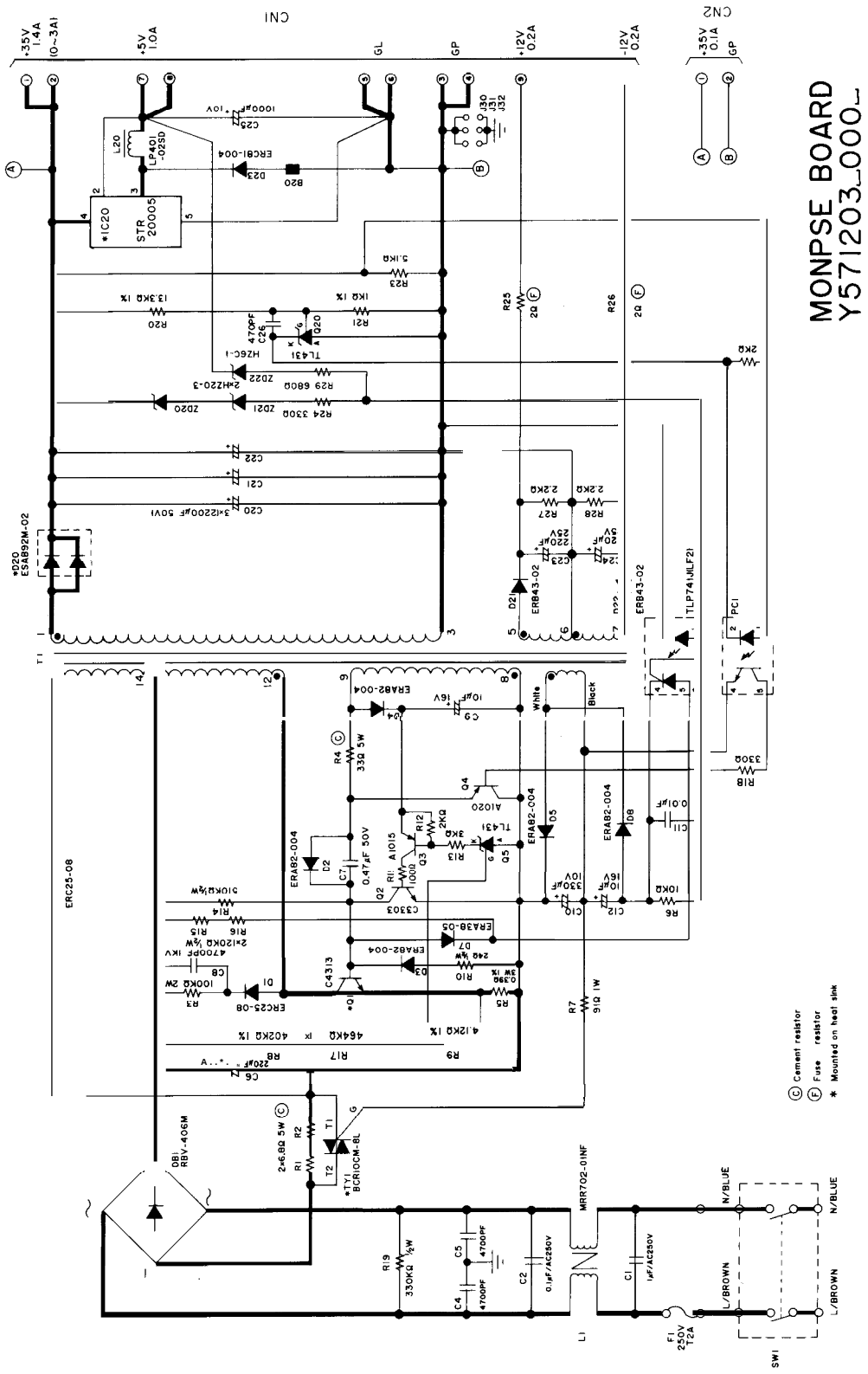


Figure A-30. MONPSE Board Circuit Diagram

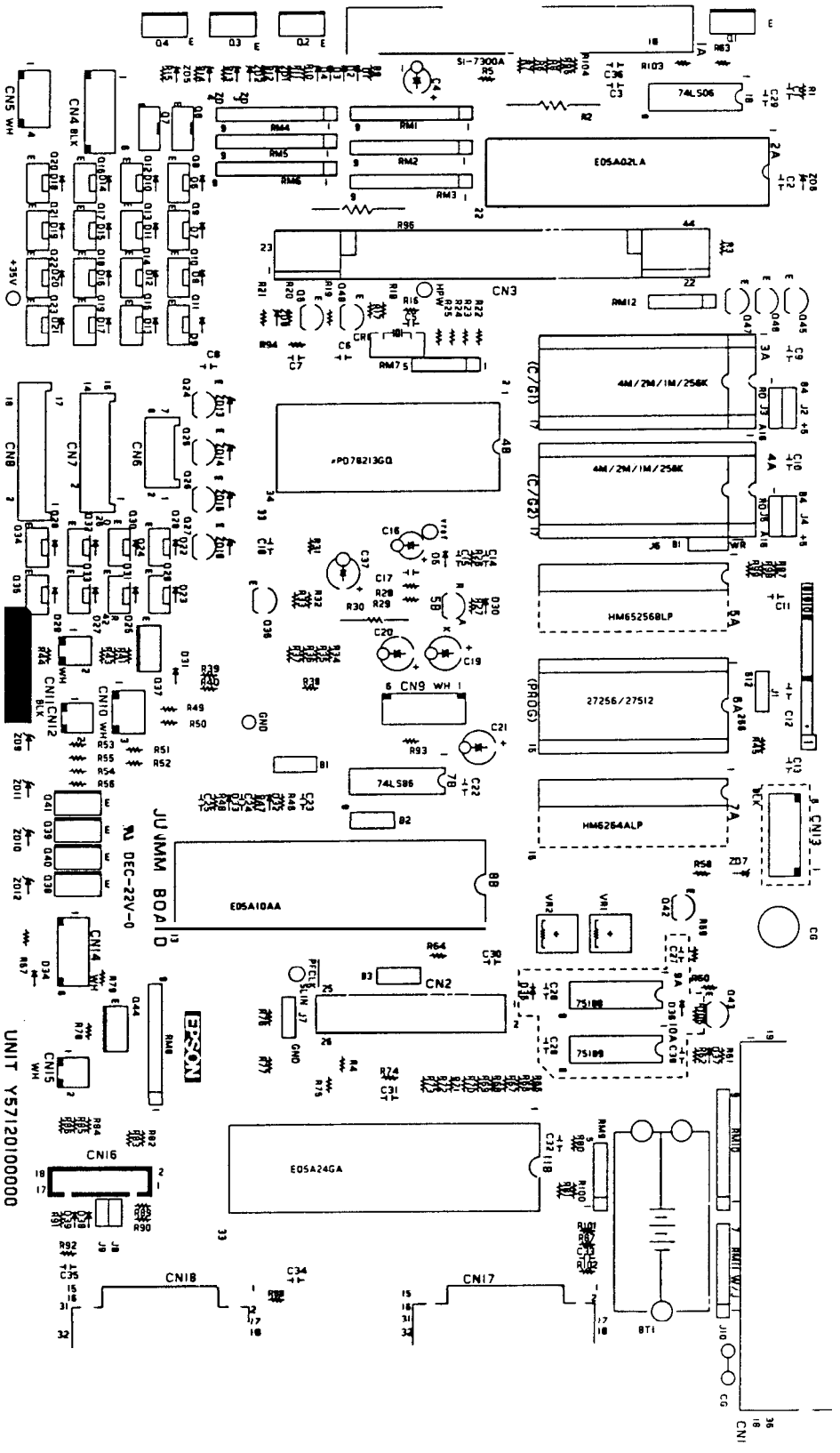


Figure A-31. JUNMM Board Component Layout

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