EPSON

EPSON TERMINAL PRINTER

SQ-850/2550

TECHNICAL MANUAL

Y502999010-A

SQ-850/2550
TECHNICAL MANUAL

EPSON

PRECAUTIONS

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

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

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

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

DANGER

1. DANGER OF EXPLOSION IF BATTERY IS INCORRECTRY REPLACED.
   REPLACE ONLY WITH SAME OR EQUIVALENT TYPE RECOMMENDED BY SEIKO EPSON CO. DISCARD USED BATTERIES ACCORDING TO GOVERNMENTS, SAFETY INSTRUCTION.
2. ALWAYS DISCONNECT THE PRODUCT FROM BOTH THE POWER SOURCE AND THE HOST COMPUTER BEFORE PERFORMING ANY MAINTENANCE OR REPAIR PROCEDURE.
3. 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.
4. 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 SQ-850/2550.
The instructions and procedures included herein are intended for the experienced repair technician, and attention should be given to the precautions on the preceding page. The chapters are organized as follows:

Chapter 1	–	Provides a general product overview, lists specifications, and illustrates the main components of the printer.
Chapter 2	–	Describes the theory of printer operation.
Chapter 3	–	Discusses the options
Chapter 4	–	Includes a step-by-step guide for product disassembly, assembly, and adjustment.
Chapter 5	–	Provides Epson-approved techniques for troubleshooting.
Chapter 6	–	Describes preventive maintenance techniques and lists lubricants and adhesives required to service the equipment.

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

REVISION TABLE

REVISION	DATE ISSUED	CHANGE DOCUMENT
A	April 28, 1989	1st issue

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CHAPTER 1
GENERAL DESCRIPTION

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1.1 FEATURES

The SQ is a high speed 24-nozzle ink jet printer which provides high performance, a low price, high speed printing, and an advanced auto paper handling mechanism. The SQ has the following features, in addition to those of the conventional SQ-series printers.

- With the standard printer driver ESC/P-84, this printer is compatible with the widest range of computers of any of the SQ-and LQ-series models.
- Advanced auto paper handling mechanism. Paper selection and load/eject operation can be performed using only the control panel. When the optional CSF (Cut Sheet Feeder) is mounted, switching between cut sheets and fan-fold paper (using the standard push tractor) can be performed without removing the CSF.
- Low noise: 50 dB (A) or less
- Highest printing speed in its class
  Draft characters: 500 CPS
  LQ characters: 165 CPS
- An 80-column model for personal use and a 136-column model for office work are available.
- Printer operation and selection of various settings are made easier due to the employment of a control panel with a multifunctional LCD (Liquid Crystal Display).
- The amount of ink remaining can be seen at a glance because the ink cartridge includes an ink-level indicator. The ink cartridge can be easily replaced from the front of the printer.
- Printing labels or envelopes is possible. Envelopes can be printed automatically with the optional CSF.
- Optional ID modules are available for easy interfacing to various computers, and font modules provide a wide range of fonts.
- Maintenance is easier than for the conventional SQ-series printers.

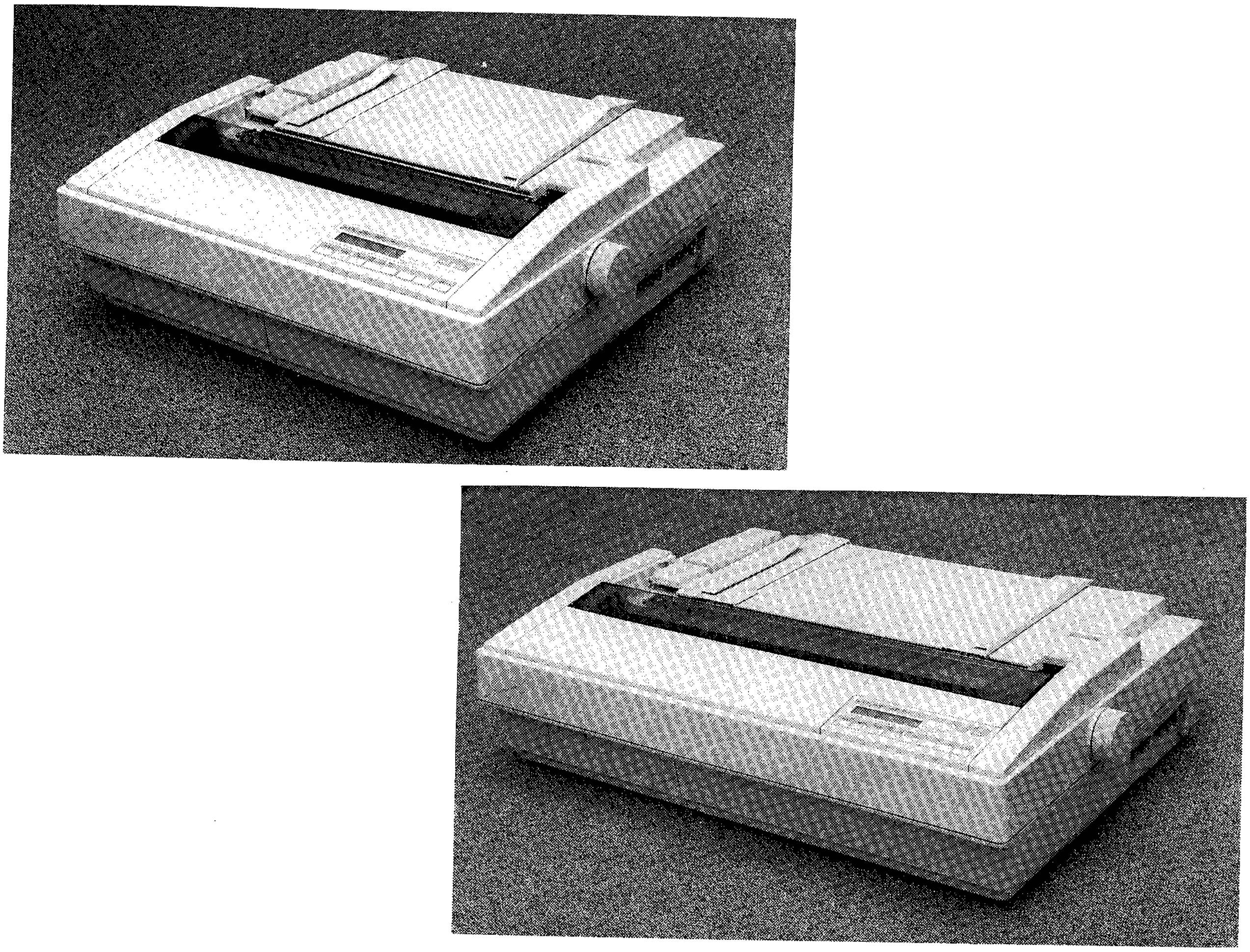


Figure 1-1. SQ-850/SQ-2550 Exterior View

Table 1-1 lists the expendables and options.

Table 1-1. Expendables and Options

	Code number	Name and Description
Expendable	S020002	Exclusive ink cartridge
Option	C806111	Double-bin cut sheet feeder for the SQ-2550
	C806101	Single-bin cut sheet feeder for the SQ-2550
	C806091	Double-bin cut sheet feeder for the SQ-850
	C806081	Single-bin cut sheet feeder for the SQ-850
	C800042	Pull tractor unit for the SQ-2550
	C800032	Pull tractor unit for the SQ-850
		#8143 New serial interface
		#8148 Intelligent serial interface
		#8165 Intelligent IEEE-488 interface

1.2 SPECIFICATIONS

This section describes the hardware and software specifica ions of the printer.

1.2.1 Hardware Specifications

This section describes the hardware specifications of the printer.

1.2.1.1 Printing

Printing method:	On-demand type ink-jet system
Pin configuration:	24 nozzles (12 nozzles x 2 rows)
Dot pitch:	0.14 mm (1/180")
Column spacing:	2.54 mm (10 CPI) 0.14 mm (180 DPI)

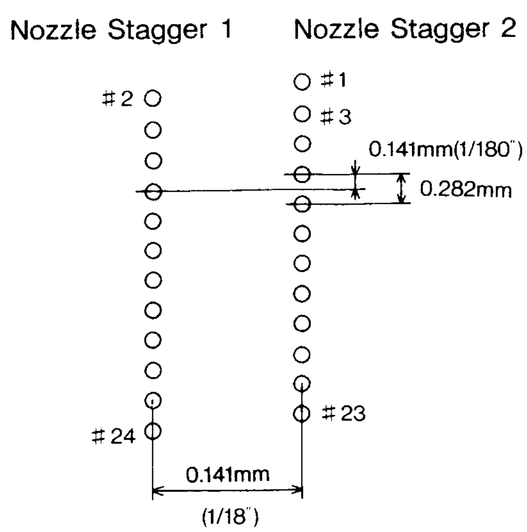


Figure 1-2. Nozzle Configuration

Gap between the printhead and platen: 1.2 + 0.1 mm (from the nozzle surface to the platen)

NOTE: When printing on thick paper, such as an envelope, the platen gap can be adjusted manually to prevent the paper from being stained with ink.

- Dashed line: Standard (1.2 mm)
- Solid line: Wide (1.8 mm)

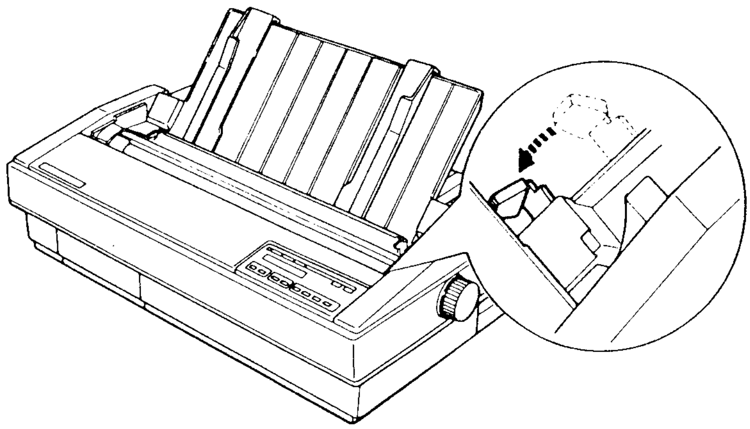


Figure 1-3. Head Adjust Lever

1.2.1.2 Paper Feed

Feeding methods: Friction feed
Push tractor feed
Push-pull tractor feed (when the optional tractor is used)

Minimum line spacing: 1/360" (0.07 mm)

Line spacing: 1/6" or 1/8", or any of n/60", n/180", and n/360" (programmable: "n" is a user-defined value)

Paper insertion: From the rear
Cut sheets and envelopes: From the upper paper entrance
Fan-fold paper and labels: From the lower paper entrance

Paper feeding speed: 62 msec. (Line spacing: 1/6")
4.0 IPS (inches/sec., continuous paper feeding)

WARNING

- Do not turn the manual paper feed knob, unless a paper jam occurs. The reasons are as follows:
  - Usually, reverse paper feeding is prohibited by the software to prevent the paper from becoming stained. If the knob is operated manually, this protection is defeated.
  - Positions set in the SelecType mode, such as TOF or tear-off positions, will be shifted.
- Never feed the paper in reverse when printing labels, Because the labels could adhere to the printer.

1.2.1.3 Paper

Cut sheets

Paper width:	SQ-850 : 182 to 257 mm (7.17 to 10.12") SQ-2550: 182 to 364 mm (7.17 to 14.33")
Paper length:	94 to 364 mm (3.70 to 14.33")
Paper thickness:	0.065 to 0.10 mm (0.0026 to 0.004")
Paper quality:	High quality paper (see Table 1-2.)
Paper weight:	52 g/m² to 82 g/m² (45 to 70 kg/14 to 22 lb)

WARNING

- Set the printer in the friction drive mode.
- Do not use paper that is wide than the specified limit.
- Do not manually feed paper in the reverse direction after printing is completed.

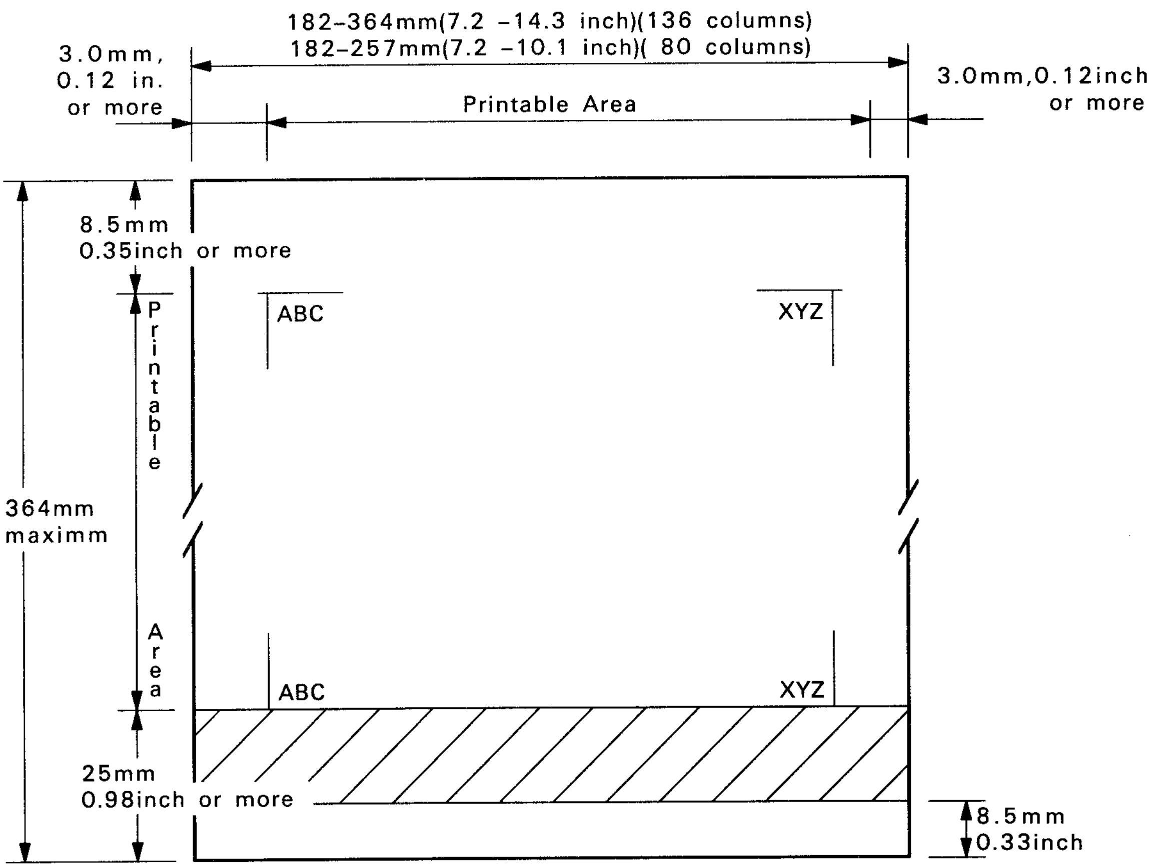


Figure 1-4. Cut Sheet Printable Area

NOTE 1: The parenthesized values apply for the SQ-2550.

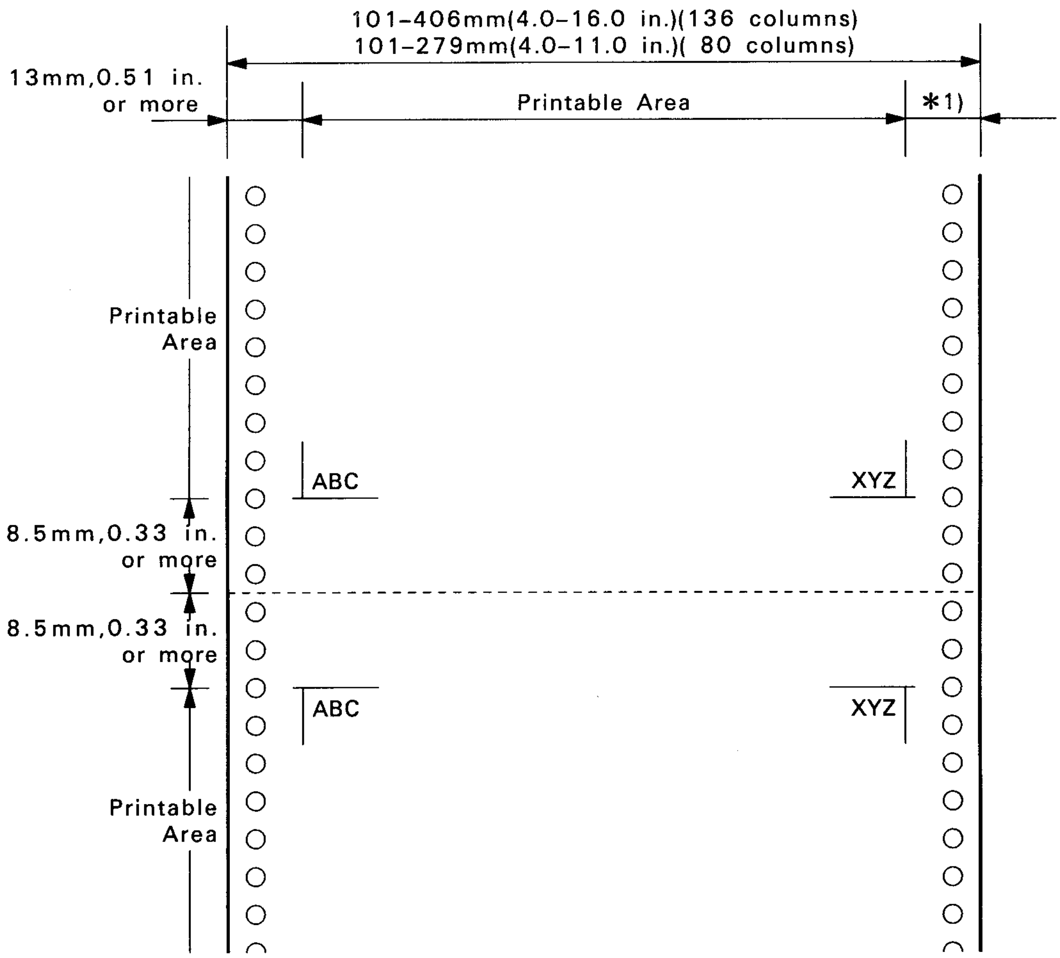
NOTE 2: The form override function enables printing as close as approximately 13.5 mm from the bottom edge of the paper. However, paper feed accuracy is not guaranteed outside of the printable area shown above by the oblique lines.

Fan-fold paper

Paper width:	SQ-850 : 101 to 279 mm (4.00 to 11.00") SQ-2550: 101 to 406 mm (4.00 to 16.00")
Paper thickness:	0.065 to 0.10 mm (0.0026 to 0.004")
Paper quality:	High quality paper (See Table 1-2.)
Paper weight:	52 to 82 g/m^2 (45 to 70 kg/14 to 22 lb)

WARNING

- Release the friction feed mechanism.
- Do not manually feed the paper in the reverse direction after printing is completed.
- When using push-pull feed, be sure to match the vertical positions of the sprockets on the push tractor and the pull tractor.
- When using push-pull feed, set the paper so that there is no slack between the push tractor and the pull tractor.



*1) 80 columns:

13mm or more when using 4-9 in. width paper
21mm or more when using 10 in. width paper
46mm or more when using 11 in. width paper

136 columns:

13mm or more when using 4–15 in. width paper
31mm or more when using 16 in. width paper

Figure 1-5. Fan-fold Paper Printable Area

Envelopes
See Table 1-2.

Table 1-2. Envelope Specifications

Type	No.6	No.10
Height	92 (3.625")	105 mm (4.125")
Width	165 (6.5")	241 mm (9.5")
Thickness	0.16 mm to 0.52 mm	(0.0063" to 0.0205")
Weight	12 lb to 24 lb	(45g/m2 to 91g/m2)

NOTE: The form override function enables printing as close as approximately 8.5 mm from the bottom edge of an envelope. However, paper feed accuracy is not guaranteed outside of the printable area shown above by the oblique lines.

WARNING

- Set the envelope so that the longer side is becomes parallel to the platen.
- Print at normal room temperature.
- Do not manually feed the paper in the reverse direction after printing is comp leted.
- Total paper thickness at the printable area and the non-printable area must not vary more than 0.25 mm (0.0098").

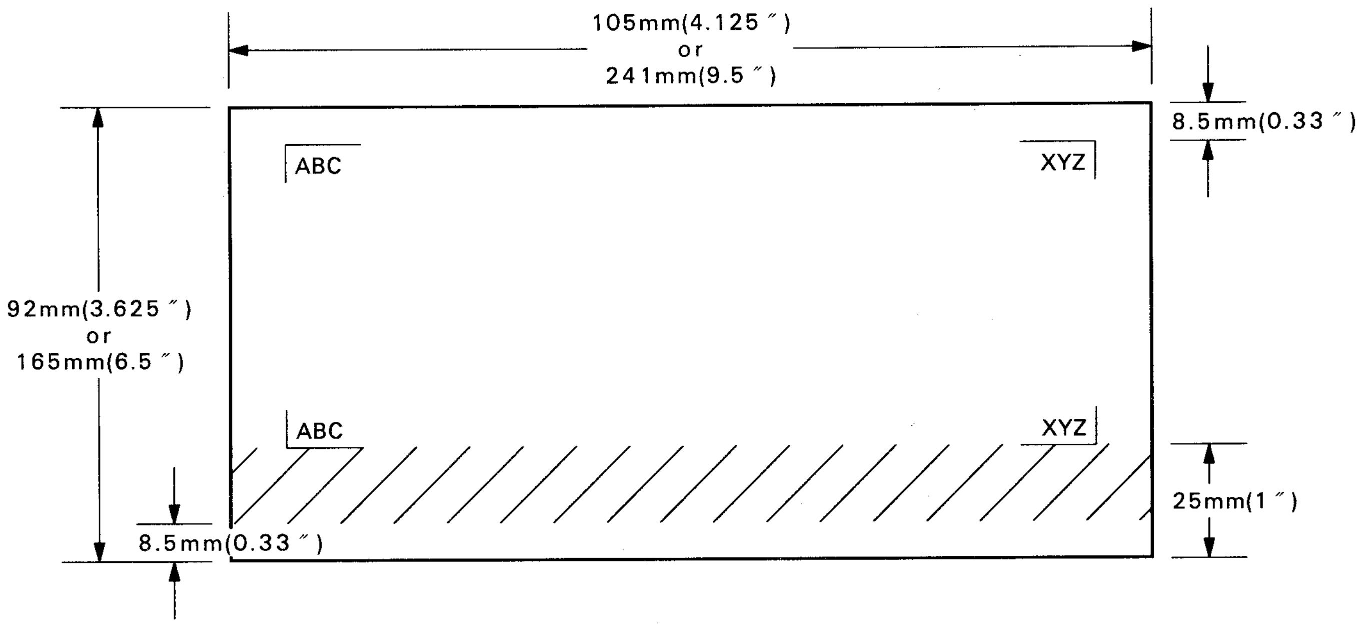


Figure 1-6. Envelope Printable Area

Labels

Dimensions: 63.5 × 23.8 mm (2.5 × 15/16")
101.6 × 23.8 mm (4.0 × 15/16")
101.6 × 36.5 mm (4.0 × 23/16")

NOTE: Dimensions are those of one label on a sheet.

Total paper thickness: 0.19 mm or less

Notes for handling:

- Print labels at normal room temperature.
- Use only tractor feed labels.
- The dimensions shown above are for the label itself. For the dimensions of the entire sheet, those for fan-fold paper are applicable.
- Never manually feed the paper in the reverse direction. (A label might adhere to the printer.)

Recommended paper: AVERY CONTINUOUS FROM LABELS
AVERY MINI-LINE LABELS

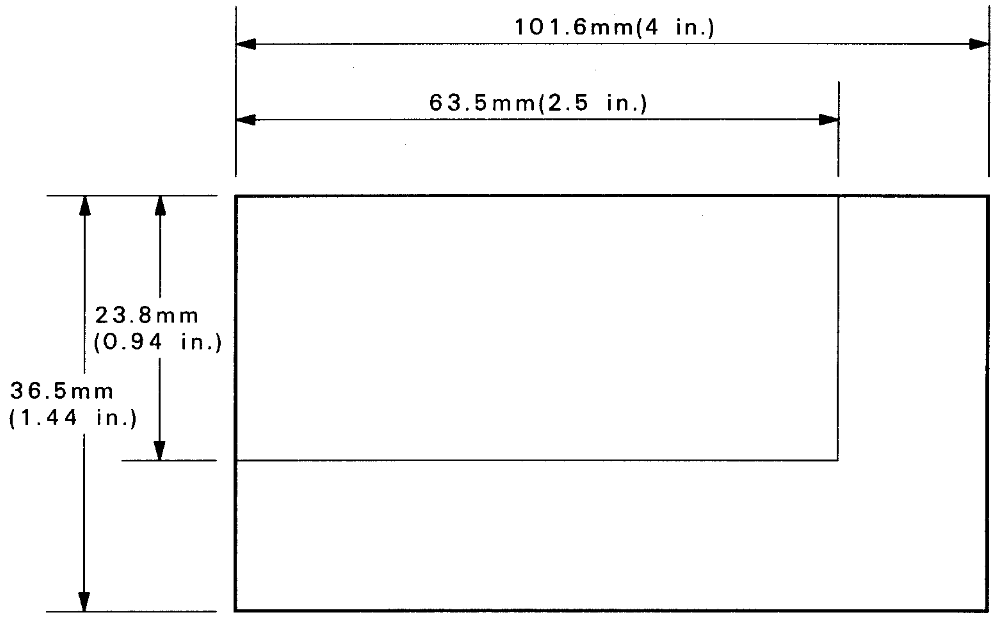


Figure 1-7. Label Dimensions

1.2.1.4 Ink

Type:	Exclusive ink cartridge
Color:	Black
Ink cartridge capacity:	105 to 115 cc
Unused residual ink:	20 cc (average value)
Cartridge dimensions:	109(W) × 157(D) × 44.5(H) mm
Cartridge weight:	Approx. 320 g
Ink consumption:	0.05 μcc (per 1 dot, see Sections 1.4.1.6 and 1.4.1.7.)
Life of ink cartridge:	Approx. 6 million characters (continuous Draft printing/25 dots per character) Approx. 3 million characters (continuous LQ printing/48 dots per character)

NOTE 1: The figures shown above are for when approximately 75 cc of the, total 115 cc is used for actual printing.

Shelf life:	Within two years from the production date (at normal room temperature)
Temperature range:	−30° to 65°C (transit) −30° to 40°C (storage)

NOTE 2: If the cartridge is transported at 65°C, it must not remain at that temperature for more than 120 hours. If it is transported at 40°C, it should not remain at that temperature for more than one month.

NOTE 3: When the cartridge is stored at 40°C, the shelf life is reduced to one month.

NOTE 4: Ink will freeze if it is stored for a long time at −7°C or less. If this occurs, use the ink after thawing it. (The time for thawing ink (from −30°C to 25°C) is approximately 2.5 hours at room temperature.)

Impact resistance:	Within one drop from 90 cm height (packed/unpacked)
Vibration resistance:	2G, 5 to 55 Hz (packed/unpacked)

NOTE 5: The word "packed" means packed in the cartridge packing box.

Ink safety: No flash point

- Irritant to eyes and skin due to strong alkalinity.
- The result of the AMES test (mutagenicity test for Salmonellas) was negative.
- It is not immediately poisonous if swallowed. (LD50 = 5,000mg or more)
- pH is 12.9 (at 20 C).

DANGER

- If the ink comes into contact with eyes or a wound, consult a doctor immediately.
- If the ink comes into contact with skin (hands), wash it off immediately with soap and plenty of water. If any irritation develops, consult a doctor.

1.2.1.5 Electrical Specifications

Power supply voltage: 108 to 132 VAC (120 V version)
198 to 264 VAC (220/240V version)

Frequency range: 49.5 to 60.5 Hz

Rated current: Max. 1.0 A/AC (120 V version)
Max. 0.6 A/AC (220/240 V version)

Insulation resistance: 10 M ohms or more at 500 VDC
(between the AC line andchassis)

Dielectric strength: 1250 VAC (RMS) 1 min. (between the AC line and chassis)
(120 V version)
3750 VAC (RMS) 1 min. (between the AC line and chassis)
(220/240 V version)

1.2.1.6 Reliability

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

MTBF (Mean Time Between Failure): SQ-850 : 4000 POH (Power On Hour, Duty: 25%)
SQ-2550: 6000 POH (Duty: 25%)

Printhead MCBF: 30,000 lines (Can be reused after cleaning.)

Life of printhead: 200 million dots or more (per nozzle), or two years or more nrmal use

1.2.1.7 Environmental Conditions

Temperature:
Operating .... 5° to 35°C (NOTE 1)
Storage .... −30° to 40°C (NOTE 2)
Transit .... −30° to 65°C (NOTE 3)

NOTE1: For the printhead or mechanism only, 5°C to 40°C.
NOTE2: When the printer is stored at 40°C, the shelf life of the ink will be reduced to one month.
NOTE3: When the printer is transported at 65°C, it should not remain at that temperature for more than 120 hours. When it is transported at 40°C, it should not remain at that temperature for more than one month.

Humidity:
Operating .... 10 to 80% (non-condensing) (NOTE 4)
Storage .... 5 to 85% (non-condensing) (NOTE 5)
Transit .... 5 to 85% (non-condensing) (NOTE 5)

NOTE4: For the printhead only, 10 to 85% (non-condensing).
NOTE5: For the printhead only, 5 to 90% (non-condinsing).

Vibration resistance:
Operating .... 0.15G, 10 to 55 Hz (X, Y, and Z directions)
Storage .... 0.50G, 10 to 55 Hz (X, Y, and Z directions)

Impact resistance:
Operating .... 1G, within 1 msec. (X, Y, and Z directions)
Storage .... 2G, within 1 msec. (X, Y, and Z directions)

1.2.1.8. Dimensions and Weight

See Table 1-3.

Table 1-3. Dimensions and Weight

	SQ-850	SQ-2550	Model-4410	Model-4460
Height	177 mm		142.5 mm	
Width	537 mm (NOTE)	664 mm (NOTE)	486.5 mm	613.5 mm
Depth	449.6 mm		265 mm	
Weight	Approx. 12.0Kg	Approx. 14.4Kg	Approx. 6.4 Kg	Approx. 7.7 Kg

NOTE: Include paper feed knob

1.2.2. Software Specifications

This section describes the standard software specifications of the printer.

1.2.2.1 Control Code Level

EPSON ESC/P 24-84

1.2.2.2 Input Data Buffer Size

Approx. 8K bytes

1.2.2.3 Characters

Character code: 8 bits

Character set: 96 ASCII characters
14 international character sets

Fonts: See Table 1-4.

Table 1-4. Fonts

	Family No.	10CPI	12CPI	15CPI	Proportional
EPSON Roman	0	○	○	○	○
EPSON Sans Serif	1	○	○	○	○
EPSON Courier	2	○	○	○	*
EPSON Prestige	3	○	○	○	*
EPSON Script	4	○	○	○	*
EPSON OCR-B	5	○	*	x	*
EPSON OCR-A	6	○	*	x	*
EPSON Orator	7	○	*	x	*
EPSON Orator-S	8	○	*	x	*
EPSON Draft	——	○	○	○	xx

NOTE: o ..... resident
* ..... desired pitch is made by software using selected font
x ..... print Roman 15CPI font
xx ... print LQ proportional font selected by ESC k

1.2.2.4 Printing

Print direction: Bidirectional logic seeking

Print speed, printable columns, and character pitch: See Table 1-5.

Table 1-5. Print Speed, Printable Columns, and Character Pitch

Printing Mode		Printable Columns (CPL)		Character Pitch (CPI)	Print Speed (CPS)	
		SQ-850	SQ-2550		Draft	LQ
10 pitch						
Normal		80	136	10	500	165
Emphasized		80	136	10	248	165
Enlarged		40	68	5	248	83
Emphasized+enlarged		40	40	5	124	83
Condensed		137	233	17.1	424	283
Condensed + enlarged		68	116	8.5	212	141
12 pitch						
Normal		96	163	12	600	198
Emphasized		96	163	12	297	198
Enlarged		48	81	6	297	99
Emphasized + enlarged		48	81	6	297	99
Condensed		160	272	20	495	330
Condensed + enlarged		80	136	10	248	165
15 pitch						
Normal		120	204	15	743	247
Emphasized		120	204	15	371	247
Enlarged		60	102	7.5	371	124
Emphasized + enlarged		60	102	7.5	186	124
Proportional						
Normal	Max.	68	116	8.6	—	141
	Min.	160	272	20	—	330
Enlarged	Max.	34	58	4.3	—	71
	Min.	80	136	10	—	165
Condensed	Max.	137	233	17.1	—	283
	Max.	320	544	40	—	660
Condensed + enlarged	Max.	68	116	8.6	—	142
	Min.	160	272	20	—	330
Proportional, super/subscript						
Normal	Max.	102	174	12.8	—	212
	Min.	240	408	30	—	495
Enlarged	Max.	51	87	6.4	—	106
	Min.	120	204	15	—	248
Condensed	Max.	205	349	25.7	—	424
	Min.	480	816	60	—	990
Condensed + enlarged	Max.	102	174	12.8	—	212
	Min.	240	408	30	—	495

NOTE: Max. .... indicates the value when only maximum width characters are printed.
Min. .... indicates the value when only minimum width characters are printed.

Character matrix: See Table 1-6 and Figures 1-8 to 1-10. The upper two dots are the ascender area, and the lower four dots are the descender area. The lowest dot is used for printing an underline.

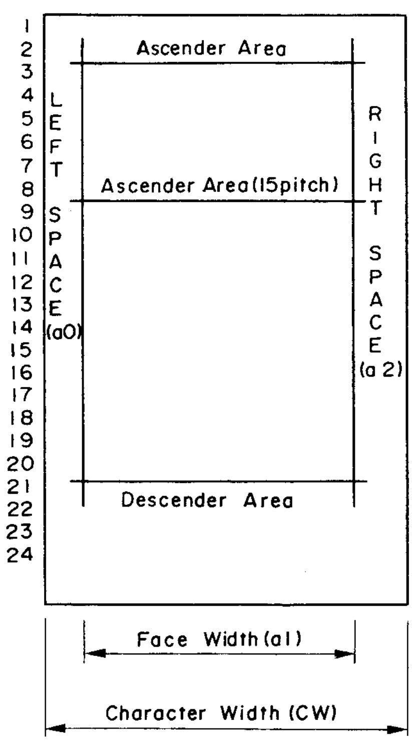


Figure 1-8. Nomal Character Matrix

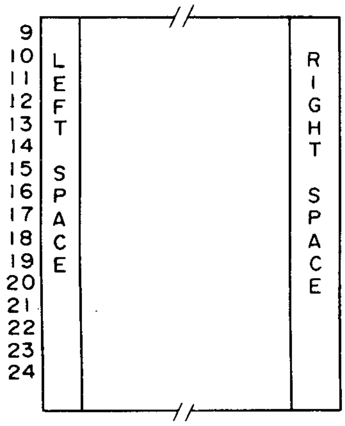


Figure 1-9. Subscript Character Matrix

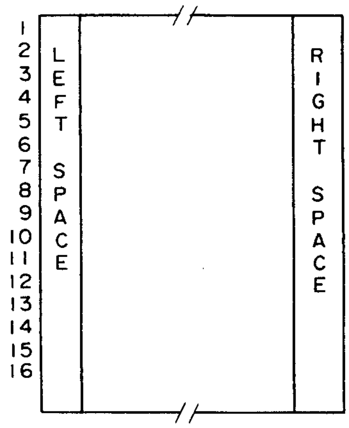


Figure 1-10. Superscript Character Matrix

Table 1-6. Printing Mode, Horizontal Dot Density, and Character Size

Printing Mode	Horizontal Dot Density	Character Width (a0 + a1 + a2)	Character Height (W × H mm)
Draft, 10 pitch	120	12	1.9 × 3.2
Draft, 12 pitch	120	10	1.9 × 3.2
Draft, 15 pitch	120	8	1.9 × 3.2
Draft, 10 pitch, Condensed	240	14	1.0 × 3.2
Draft, 12 pitch, Condensed	240	12	1.0 × 3.2
LQ, 10 pitch	360	36	2.2 × 3.2
LQ, 12 pitch	360	30	1.9 × 3.2
LQ, 15 pitch	360	24	1.9 × 2.3
LQ, 10 pitch, condensed	360	21	1.2 × 3.2
LQ, 12 pitch, condensed	360	18	1.0 × 3.2
LQ, proportional	360	Max. 42	2.6 × 3.2
		Min. 18	1.0 × 3.2
LQ, proportional, densed	360	Max. 21	1.3 × 3.2
		Min. 9	0.5 × 3.2
LQ, proportional,super/subscript	360	Max. 28	1.8 × 2.3
		Min. 12	0.7 × 2.3
LQ, proportional, super/subscript, condensed	360	Max. 14	0.9 × 2.3
		Min. 6	0.4 × 2.3

NOTE 1: Character size in the above table is for the largest character, and the value changes depending on the paper or ribbon being used.

NOTE 2: The 3.2 mm high character and the 2.3 mm high character are constructed using 23 dots (vertical) and 16 dots (vertical), respectively.

NOTE 3: Dots that adjoin horizontally are not printed.

Bit image printing: See Table 1-7.

Table 1-7. Bit Image Printing

	m	Name	Dot Density (DPI)	Adjacent Dot Printing Possible?	Maximun Number of Printable Dots	Print Speed (IPS)
8-pin	0	Normal-density	60	Yes	816 (480)	49.50
	1	Double-density	120	Yes	1632 (960)	24.75
	2	Double-speed, double-density	120	No	1632 (960)	49.50
	3	Quadruple-density	240	No	3264 (1920)	24.75
	4	CRT graphics	80	Yes	1088 (640)	24.75
	5	CRT graphics II	90	Yes	1224 (720)	33.00
24-pin	32	Normal-density	60	Yes	816 (480)	49.50
	33	Double-density	120	Yes	1632 (960)	24.75
	38	CRT graphics II	90	Yes	1224 (720)	33.00
	39	Triple-density	180	Yes	2448 (1440)	16.50
	40	Sextuple-density	360	No	4896 (2880)	16.50

NOTE1: The parenthesized values apply to the SQ-850.

NOTE2: 'm" is the m in the command format <ESC * m n1 n2>.

NOTE3: 'Yes" and "No" in the column "Adjacent Dot Printing Possible?" are equivalent to "including half dots" and "excluding half dots" in the normal printing mode.

NOTE4: 'Maximum Number of Printable Dots" is the maximum value of $n1 + 256 \times n2$ in the command format <ESC * m n1 n2>.

1.3 INTERFACE SPECIFICATIONS

The printer is equipped with standard 8-bit parallel and RS-232C compatible interfaces. Moreover, it is possible to interface to various computers using the optional interface board. This section describes the specifications of the standard interfaces. (For details of the optional interface board, see Chapter 3 or the "Option Interface Manual."

1.3.1 Parallel Interface Specifications

Data transmission mode:	8-bit parallel
Communication mode:	Uses a $\overline{\text{STROBE}}$ pulse from outside the printer.
Handshake:	Uses the $\overline{\text{ACKNLG}}$ and BUSY signals.
Signal levels:	Input data and all interface control signals are TTL compatible.
Adaptable connector:	36-pin Amphenol 57-30360 or equivalent

NOTE: It is recommended that the interface cable be as short as possible.

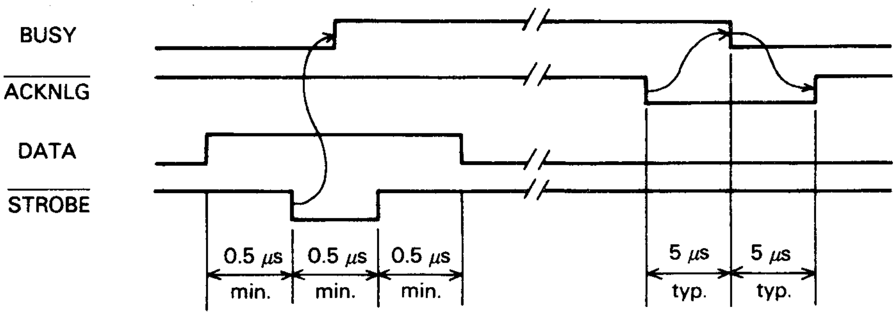


Figure 1-11. Interface Timing Chart

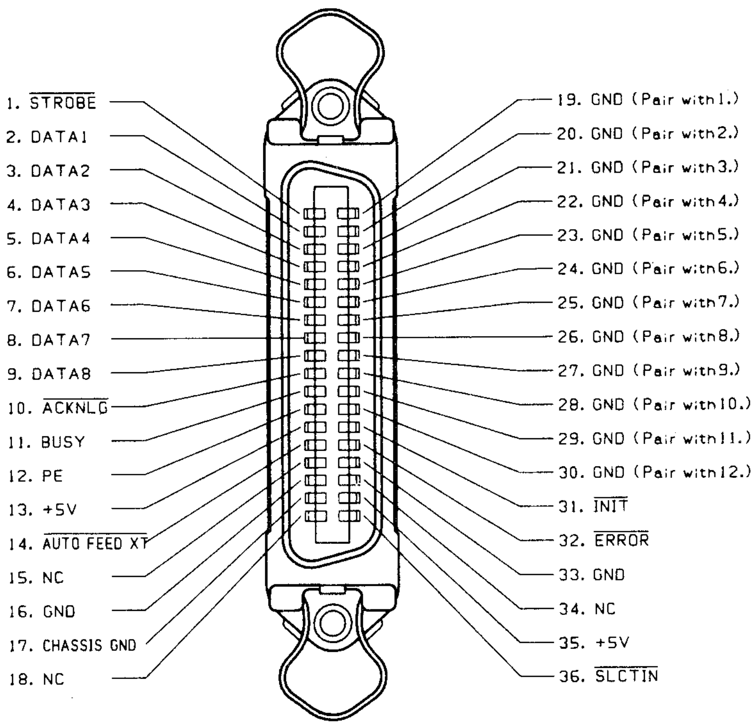


Figure 1-12. 57-30360 36-pin Connector

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

Pin No.	Signal	Return	I/O	Description
1	$\overline{\text{STROBE}}$	19	I	Strobe pulse to read the input data. Pulse width must be more than 0.5 μs. Input data is latched after falling edge of this signal.
2 3 4 5 6 7 8 9	DATA1 DATA2 DATA3 DATA4 DATA5 DATA6 DATA7 DATA8	20 21 22 23 24 25 26 27	I I I I I I I I	Parallel input data to the printer. "HIGH" level means data "1". "LOW" level means data "0".
10	$\overline{\text{ACKNLG}}$	28	O	This pulse indicates data are received and the printer is ready to accept next data. Pulse width is approx. 10 μs. (See NOTE5)
11	BUSY	29	O	"HIGH" indicates printer can not accept data. (See NOTE5)
12	PE	30	O	"HIGH" indicates paper-out. This signal is effective only when 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. (See NOTE6)
15				Not used.
16	GND			Ground for twisted-pair.
17	Chassis GND	—	—	Printer chassis ground.
18				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	$\overline{\text{ERROR}}$		O	"LOW" indicates that some error has occurred in the printer. (Refer to section 1.4.3.4)
33	GND	—	—	Ground for twisted-pair.
34		—	—	Not used.
35		—	O	Always "HIGH". (Pulled up to +5V through 3.3 K ohms resistor.)
36	$\overline{\text{SLCT-IN}}$	—	I	If the signal is "LOW" when printer is initialized, the DC1/DC3 control is disabled. (See NOTE6 and Table 1-9)

NOTE 1: The signals with a bar over the name are active-low.

NOTE 2: "Return" denotes a twisted pair return line, connected to signal ground. When interfacing the printer to the host machine, use twisted pairs for each signal and be sure to connect the return sides. Shield the twisted pairs, and connect the shield to the GND of the host machine in order to reduce noise.

NOTE 3: All interface conditions are based on TTL levels. Both the rise and fall times of all signals must be 0.2 μsec. or less.

NOTE 4: Refer to the Interface Timing Chart (Figure 1-11) for details on each signal.

NOTE 5: Data transfer protocol must not ignore the $\overline{\text{ACKNLG}}$ or BUSY signal. (Data can be transferred after either recognizing the $\overline{\text{ACKNLG}}$ signal or when the BUSY signal is LOW.)

NOTE 6: The $\overline{\text{AUTO FEED XT}}$ and $\overline{\text{SLCT IN}}$ signals will be valid when "AUTO LF" and "DC1/DC3" are set "ON" and "VALID", respectively, in the SelecType mode.

NOTE 7: Printing tests, including those of the interface circuits, can be executed without using external equipment by setting the DATA1 to DATA8 lines of the interface connector to certain codes (1 for GND open, and 0 for short) and connecting the $\overline{\text{ACKNLG}}$ signal to the $\overline{\text{STROBE}}$ signal.

Table 1-9. Printer Select/Deselect Control with the DC1/DC3 Code

Printer State	$\overline{\text{SLCT IN}}$ Signal Input	Receive Code	$\overline{\text{ERROR}}$ Signal	BUSY Signal	$\overline{\text{ACKNLG}}$	Data Processing
OFF LINE	High	DC1	Low (Error)	High	Not output	Data entry disabled
		DC3				
	Low	DC1				
		DC3				
ON LINE	High	DC1	High	Low (NOTE1)	Output after each data entry	Data entry (normal processing).
		DC3	High	Low (NOTE 1)	Output after each data entry	Data entry enabled, However, input data is ignored (waits for DC1, NOTE 2).
	Low	DC1	High	Low (NOTE1)	Output after each data entry	Data entry enabled (normal processing)
		DC3	High	Low (NOTE1)	Output after each data entry	

NOTE 1: BUSY = LOW" is the state before data is input. During data processing, the BUSY signal goes HIGH and LOW alternately.

NOTE 2: After the DC3 code is input, input data is ignored until the DC1 code is input.

NOTE 3: In the above table, it is assumed that no ERRORs other than those due to OFF LINE occur.

NOTE 4: The DC1/DC3 control is valid only when "DC1/DC3" is set to"VALID" (default setting in the SelecType mode) at printer initialization and the $\overline{\text{SLCT IN}}$ signal from the host computer is HIGH. At this time, the printer starts operation in the DC1 state.

NOTE 5: The DC1/DC3 control will be invalid even with "DC1/DC3" set to "VALID" (default setting in the SelecType mode) at printer initialization, if the $\overline{\text{SLCT IN}}$ signal from the host computer is LOW.

1.3.2 RS-232C Serial Interface Specifications

Table 1-10. Serial Interface Handshaking

DTR Signal	X-ON/OFF protocol	Description
MARK	X-OFF (DC3/13H)	When the number of bytes remaining in the input buffer reaches 256 or less, the signal level goes to MARK, or an X-OFF code is sent to the host computer. This indicates that the printer is not ready to receive data.
SPACE	X-ON (DC1/11H)	When the number of bytes remaining in the input buffer reaches 512 or more, the signal level goes to SPACE, or an X-ON code is sent to the host computer. This indicates that the printer is ready to receive data.

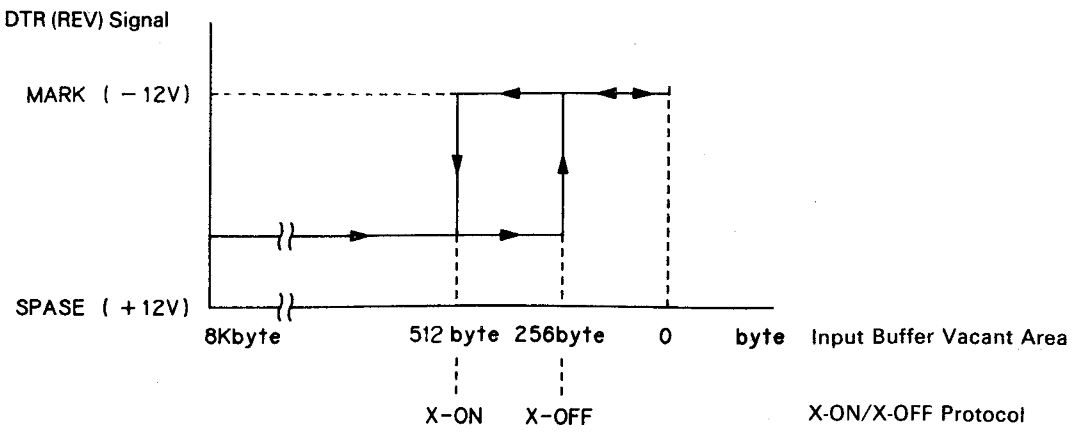


Figure 1-13. Handshaking for RS-232C Interface

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

Bit Rate: 300, 600, 1200, 2400, 4800, 9600, or 19200 BPS

Logic Level:
EIA level, MARK.....logical 1 (−3 - 27 V)
SPACE....logical 0 (+3 - +27 V)

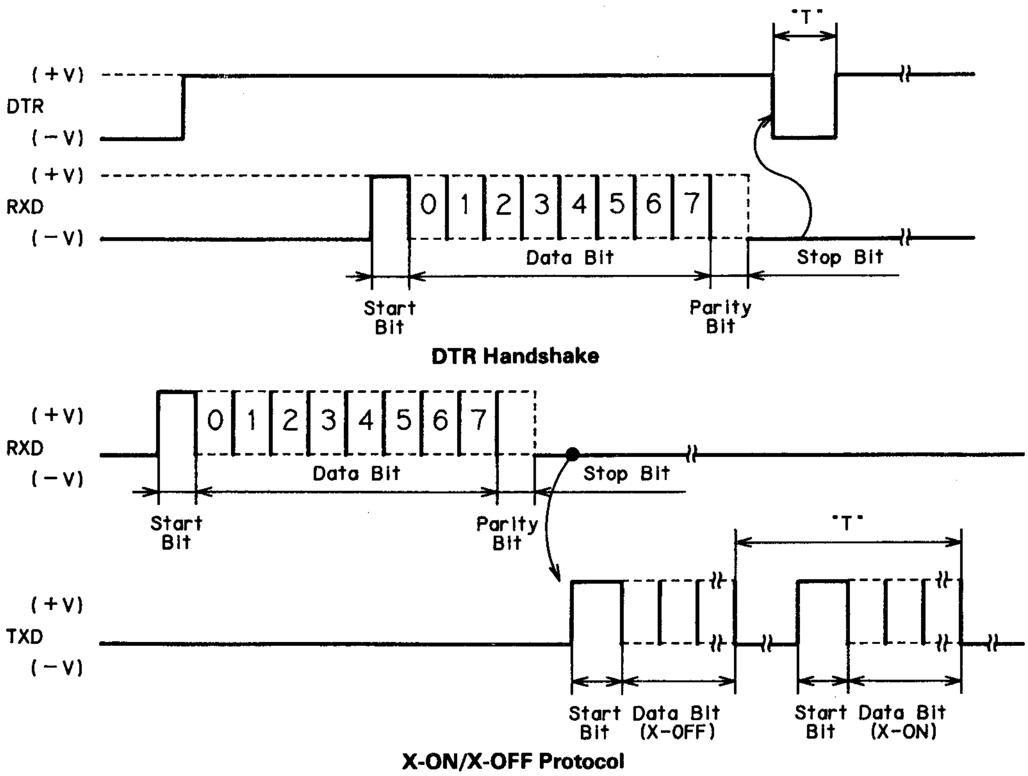


Figure 1-14. Serial Data Transmission Timing

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 + bits + parity (Odd, Even, or none) + 1 or more stop bits.

Error Detection: Parity error....."*" is printed.
Overrun error....Ignored
Framing error....Ignored

Connector: D-SUB 25-pin connector (See Figure 1-5.)

Connector Pin Assignments: Refer to Table 1-11.

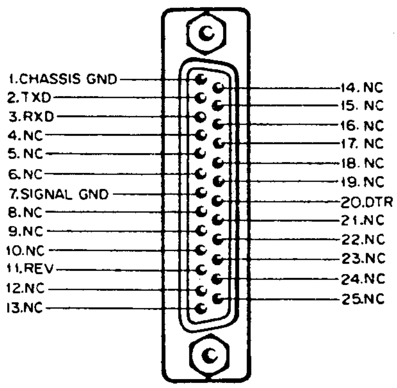


Figure 1-15. Serial Interface Connector

Table 1-11. RS-232C Serial Interface 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 indicates printer is not ready to receive data.
11	REV(=2nd RTS)	O	Same as DTR.
3	RXD	I	Receive data.
7	SIGNAL GND	—	Signal (Logic) ground level.
1	CHASSIS GND	—	Printer chassis ground.

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

1.4 FUNCTIONS

This section describes functions of the printer other than printing.

1.4.1 Operating Controls

This section describes the functions that the user controls, and the functions that display messages for the user.

1.4.1.1 Power Switch

The POWER switch on the left side of the printer is used to turn the printer on and off. When the printer is turned on or off, it is reset (see Section 1.4.2).

NOTE: Do not turn the printer power on when the ink cartridge is not mounted.

1.4.1.2 Control Panel

This section describes switches and indicators on the control panel. The control panel consists of nine switches, six indicators, and a 20-column LCD (Liquid Crystal Display). Figureure 1-16 shows the control panel. (The letter identifying each description below match those in the figure.)

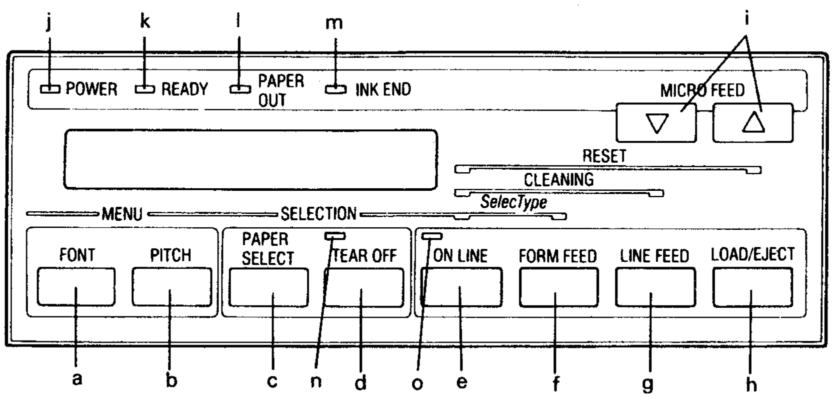


Figure 1-16. Control Panel

Switches

a. FONT

This switch is used to select the standard or external (option) font. The current font is always displayed on the LCD. Each time this switch is pressed, the font selection changes. This switch is valid in both the ON LINE and OFF LINE modes. Font selection changes in the sequence shown in Table 1-4.

b. PITCH

This switch is used to select the print pitch. The current print pitch is always displayed on the LCD. Each time this switch is pressed, the pitch selection changes. This switch is valid in both the ON LINE and OFF LINE modes. Print pitch selection changes in the sequence shown below.

c. PAPER SELECT

This switch is used to select the paper type. Each time this switch is pressed, the display on the LCD and the paper feed mechanism selection change in the sequence shown below.

Tracor → Friction → CSF bin1 → CSF bin2 → Tractor → Friction → • • • • • • • • • • •

The CSF setting "CSF Bin 1/2" is displayed only when the CSF is mounted. When the CSF is mounted, the word "Friction" will be omitted from the display. This switch is valid only in the OFF LINE mode.

d. TEAR OFF

This switch is valid only when fan-fold paper is used. Pressing this switch advances the paper to the tear off (paper cut off) position. Pressing it again feeds the paper in reverse to the TOF position. This switch is valid both in the ON LINE and OFF LINE modes.

e. ON LINE

This switch sets the printer either ON LINE or OFF LINE. Normally, the printer is ON LINE when the printer is turned on, and waits for data from the host computer. When the printer is set OFF LINE, it immediately stops printing, and enters the BUSY state.

f. FORM FEED

Pressing this switch advances the paper to the first line (TOF position) of the next page. This switch is valid only in the OFF LINE mode.

g. LINE FEED

Lightly pressing this switch once advances the paper one line. When the switch is pressed continuously (for 0.5 sec. or more), the paper advances continuously.The switch is valid only in the OFF LINE mode.

h. LOAD/EJECT

This switch is used to load or eject paper automatically. When the paper is covering the paper-out sensor, pressing this switch ejects the paper. When the paper is out, pressing this switch loads the paper. This switch is valid only in the OFF LINE mode.

i. MICRO FEED
These switches are used to adjust the paper position. When the switch or the switch are pressed, the paper advances forward or backward a little bit (micro feed). These switches can be used to adjust the paper position during TOF position adjustment or tear-off position adjustment.
(See Sections 1.4.1.9 and 1.4.1.10.)

Some of the above switches can be used in combination. The operation is identified by the printer when the switches are released.

e + f. SelecType mode
When the ON LINE and FORM FEED switches are pressed simultaneously, the printer enters the SelecType mode (Panel setting mode). This operation is valid both in the ON LINE and OFF LINE modes. (See Section 1.4.1.3.)

e + g. CLEANING
When the ON LINE and LINE FEED switches are pressed simultaneously, head cleaning is executed. This operation is valid only in the OFF LINE mode.
(See Section 1.4.1.6.)

e + h. RESET
When the ON LINE and LOAD/EJECT switches are pressed simultaneously, the printer is reset. This operation is valid both in the ON LINE and OFF LINE modes. (See Section 1.4.2.)

Indicators

j. POWER (Green LED)
Lights when the power switch is on (AC power is supplied) and the power supply circuit is operating normally.

k. READY (Green LED)
Lights when the printer is ready to receive data (ON LINE: READY).

l. PAPER OUT (Red LED)
Lights when the printer detects the paper out state.

m. INK END (Red LED)
Lights when the printer detects the ink-out state or when the ink cartridge is not mounted.

n. TEAR OFF (Orange LED)
Lights while the TEAR OFF switch is pressed and the tear off operation is being executed.

o. ON LINE (Green LED)
Lights when the printer is ON LINE. Goes off when the printer is OFF LINE.

LCD

The printer has an LCD (20 columns x 1 row) on the control panel. The LCD displays the current font in the 1st to 8th columns, the current character pitch at the center, and the current paper feed mechanism in the 13th to 20th columns.

Prestige 10 Friction

- Font
  - Draft
  - Roman
  - S Serif (Sans Serif)
  - Courier
  - Prestige
  - Prestige
  - Script
  - OCR-A
  - OCR-B
  - Oractor
  - Oractor-S
- Pitch
  - 10 (10cpi)
  - 12 (12cpi)
  - 15 (15cpi)
  - 17 (17.cpi)
  - 20 (20cpi)
  - PS (Proportional)
- Paper feed mechanism
  - Friction
  - Tractor
  - CSF bin1
  - CSF bin2

Other messages displayed on the LCD and their meanings are as follows:

PAPER OUT	:Indicates the printer is out of paper.
INK END	:Indicates the printer is out of ink, or no ink cartridge is mounted.
SELF TEST	:Indicates that a self test is being executed.
HEX DUMP	:Indicates that the printer is in the hexadecimal dump mode.
TOF ADJUST	:Displayed during TOF position adjustment (See Section 1.4.1.9.)
TEAR OFF ADJUST	:Displayed during the tear off position adjustment (See Section 1.4.1.10.)
COVER OPEN	:Displayed if the printer cover is open.
ERROR □□	:Displayed if an error occurred. The error number is displayed to indicate the error type. (For details, see Section 1.4.3.4 and Chapter 5.) 0 = No C.G. ROM is mounted, or the C.G. ROM is defective. 3 = Defective READ/WRITE operation of the EEPROM 10 = Carriage motor control error 20 = CPU error
CLEANING	:Displayed during head cleaning (See Section 1.4.1.6.)
INK CHARGE (time)	:Displayed during ink supply operation. The time it takes to complete supplying the ink is also displayed. (See Section 1.4.1.7.)
PLEASE TEAR OFF	:Instruction displayed during tear off operation. (See Section 1.4.1.10.)
CAN NOT BACK OUT	:This is displayed if the paper cannot be ejected after feeding the paper 22" (maximum paper length).
MEMORY CLEAR	:Indicates that the entire contents of the memory were cleared. (See Sections 1.4.1.3. and 1.4.2.1.)

1.4.1.3 SelecType

This section describes the SelecType (Panel setting) function.
In the SelecType mode, default value settings can be selected using the four switches on the control panel and messages displayed on the LCD.

- Entering the SelecType mode.

Press both the $\boxed{\text{ON LINE}}$ and $\boxed{\text{FORM FEED}}$ switches.

- If these switches are pressed again, the printer exits the SelecType mode (exits the panel setting mode).

Values will become valid as they are set in the SelecType mode. However, the following settings will become valid the next time the printer power is turned on.

ON/OFF of Auto LF
Valid/Invalid of DC1/DC3

Once the values are set, they are stored in the memory, which is backed up. Since the settings will remain even after the printer power is turned off, the values displayed on the LCD will be set as default values the next time the printer power is turned on. Therefore, the printer has no DIP switches. Back up is performed with a battery, and requires no maintenance.
The following page shows the operation flow in the SelecType mode.

If you want to reset the default settings to the factory set values, clear the memory as described below:

- Clearing the memory

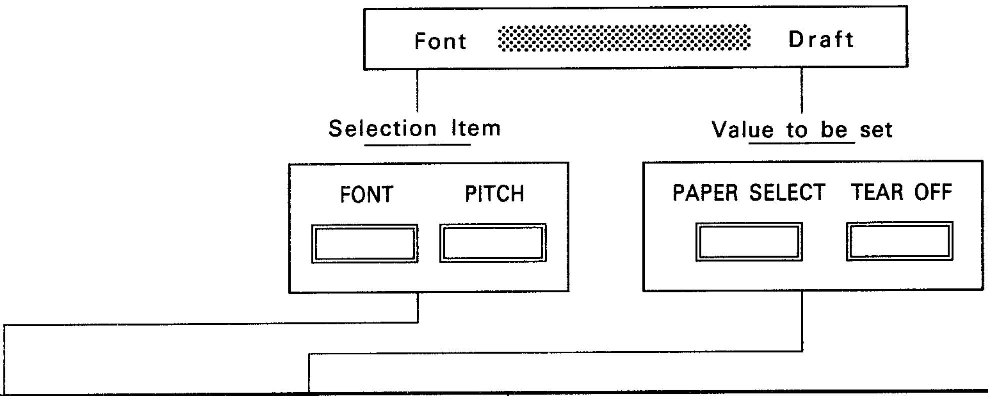
Turn the printer power on while pressing both the $\boxed{\text{ON LINE}}$ and $\boxed{\text{LOAD/EJECT}}$ switches.

When the memory is cleared correctly, the following message will be displayed on the LCD:

MEMORY CLEAR

Messages displayed on the LCD change in the sequence shown in the Table below, and the buzzer rings.

Table 1-12. Operation Flow in the SelecType Mode



		Explanatory Note
Font	Draft, Roman, Sans Serif, Courier, Prestige, Script, OCR-A, OCR-B, Orator, Orator-s	Font selection (standard internal or optional external)
PITCH	10CPI, 12CPI, 15CPI, 17CPI 20CPI, Propo.	Character pitch (number of characters/inch) selection
LINE SPACING	1/6 inch, 1/8 inch	Set the line feed amount
PAGE TRACTOR	line (= 24 to 132 lines)	Set the number of lines per page for fan-fold paper. (one line = 1/6")
PAGE CSF BN1	line (= 24 to 132 lines)	Set the number of lines per page for the paper in the single-bin CSF. (NOTE 1)
PAGE CSF BN2	line (= 24 to 132 lines)	Set the number of lines per page for the paper in the double-bin CSF. (NOTE 2)
1" SKIP	On, OffSet 1" skip-over perforation function for fan-fold paper.	
AUTO TEAR OFF	On, Off	Set the auto tear-off function. (See Section 1.4.1.10.)
LEFT MARGIN	(= number of columns at 10 CPI)	Set the left margin in columns. (NOTE 2)
RIGHT MARGIN	(= number of columns at 10 CPI)	Set the right margin in columns. (NOTE 3)
CG TABLE	Italic, Graphic, Download	Select the character code table (ASCII code: 80H through FFH).
COUNTRY	USA, France, Germany, UK, Demmark 1, Sweden, Italy, Spain 1, Japan, Norway, Denmark 2, Spain 2, L.America, Korea, Legal	Select the International character set.
PRINT DIR.	Bi-D, Uni-D	Select printing direction for text characters. (NOTE 4)
INTERFACE	Parallel, Serial	Select the interface. (Functions of the deselected interface become invalid.)
BAUD RATE	300, 600, 1200, 2400, 4800, 9600, 19200 (BPS)	Set the bit rate for the serial interface. (NOTE 5)
PARITY	None, Even, Odd, Ignore	Set parity for the serial interface. (NOTE 5)
AUTO LINE FEED	On, Off	Set AUTO LINE FEED XT. (See Section 1.3.1.)
DC1/DC3	Disable, Enable	Set DC1/DC3 code control. (See Section 1.3.1.)

NOTE 1: Displayed only when the CSF is mounted.

NOTE 2: Range of the left margin is as follows:

SQ-850 : 0 to 45 columns
SQ-2550: 0 to 80 columns

The left margin must not exceed the right margin.

NOTE 3: Range of the right margin is automatically calculated from the left margin as shown below:

SQ-850 : Left margin + 1 to 80 columns
SQ-2550: Left margin + 1 to 136 columns

NOTE 4: Displayed only when the serial interface is selected. (Not displayed when the parallel interface is selected.)

NOTE 5: Displayed only when the Serial interface is selected.

NOTE 6: Since the following combinations are impossible, they will be automatically ignored.

Draft + Proportional
OCR-A + 15 CPI
OCR-B + 15 CPI
Orator + 15 CPI
Orator-S + 15 CPI

NOTE 7: The values set in the SelecType mode will be printed when the self test is executed.

1.4.1.4 Self Test Function

The printer has self test functions to check the following items:

- PROM version number
- Panel settings
- Control circuit functions
- Printer mechanism functions and print quality

The settings changed in the SelecType mode are printed in the self test mode. When a self test is executed using paper from the CSF, the page length is calculated by feeding the paper using 1/6" line feeds, and "This is the first line." and "This is □□ line." are printed on the first and last lines of the first page, respectively. In this way, you can confirm the number of printable lines.

When an error occurs, the location of the problem (the host computer or the printer) can be determined by executing the self test. The self test operation flow is shown below:

Starting the self test in the Draft mode
Turn the printer power on while pressing the LINE FEED switch.

Starting the self test in the LQ mode
Turn the printer power on while pressing the FORM FEED switch.

Stopping or resuming the self test
Press the ON LINE switch. (The ON LINE LED does not light.)

Exiting the self test mode
Stop printing by pressing the ON LINE switch, then turn the printer power off.

WARNING

- To exit the self test mode, be sure to stop printing first as described above. If the stop operation is omitted, the printhead cannot be capped correctly. This might cause problems (e.g. the printhead could clog or the carriage may operate abnormally).

1.4.1.5 Hexadecimal Dump Function

The hexadecimal dump (HEX. dump) function causes the printer to print the received data in hexadecimal. The printer prints 16 values in hexadecimal, followed by the corresponding ASCII characters on one line. If there is no corresponding printable character for a value (e.g. a control code), a period (.) is printed. If less than 16 values remain at the end of the dump, the last line can be printed by pressing the ON LINE switch.

When the printer is in the hexadecimal dump mode, it cannot enter the SelecType mode. (Some of the settings changed in the SelecType mode are reflected in the printing format.)

If trouble occurs, the hexadecimal dump function can be used to check if the data from the host computer is correct.

Entering the hexadecimal dump mode

Turn the printer power on while pressing both the FORM FEED and LINE FEED switches.

Stopping and exiting the hexadecimal dump mode

Stop printing by pressing the ON LINE switch, then turn the printer power off.

NOTE: To exit the hexadecimal dump mode, be sure to stop printing first as described above. If the stop operation is omitted, the printhead cannot be capped correctly. This might cause trouble (e.g. the printhead could clog or the carriage might operate abnormally).

1.4.1.6 Printhead Cleaning and Capping

The printer has cleaning and capping functions to protect the printhead from damage (for details of each operation, see Chapter 2). There are two types of cleaning, arbitrary and automatic. Normally, the printhead is capped to prevent from damage. Arbitrary cleaning is required when printing becomes abnormal (e.g. a specific dot is missing, or the printing color is not uniform).

WARNING

- Turn the printer power off only after confirming that the printhead is capped. If the printhead has been uncapped for a long time, printing might be abnormal (e.g. a specific dot is missing) because the printhead gets dried out and clogs.
- Never turn the printer power off during cleaning. (The reasons are the same as those described above.)
- Do not execute cleaning unnecessarily. The life of the ink cartridge will be shortened.

Arbitrary cleaning

Press both the ON LINE and LINE FEED switches when the printer is OFF LINE.

Automatic cleaning

The printer automatically executes cleaning in the following cases:

- When the printer power is turned on after 145.6 hours or more have passed since the last cleaning operation.

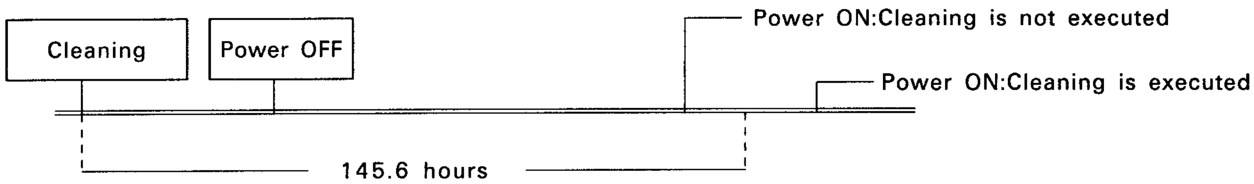


Figure 1-17. Head Cleaning Timing Chart

- When the printer power is turned on and the printhead is found to be uncapped.
- When the printer is reset with the printhead uncapped.

Similarly, capping will be executed in the following cases:

- If printing is not executed continuously while the printer power is on. (When a few seconds have passed after printing had been stopped.)

For reference, the amount of ink consumed when cleaning or capping is executed or when printer initialization is executed at power on are as follows:

Automatic cleaning at time-out	:Approx. 0.5 cc
Arbitrary cleaning	:Approx. 2.0 cc
Normal capping	:Approx. 0.009 cc
Capping when the carriage is at any position other than the home position (assuming that the printhead has been uncapped for a long time)	:Approx. 0.5 cc
Initial sequence at power on	:Approx. 0.03 cc

1.4.1.7 Ink Charge Function

The following operations are performed before the printer is delivered from the factory to prevent the printhead from being damaged (so that it can be stored indefinitely):

- The ink path is cleaned using a special cleaning liquid.
- The cleaning liquid is completely discharged.
- The printhead is capped.
- The ink cartridge is removed.

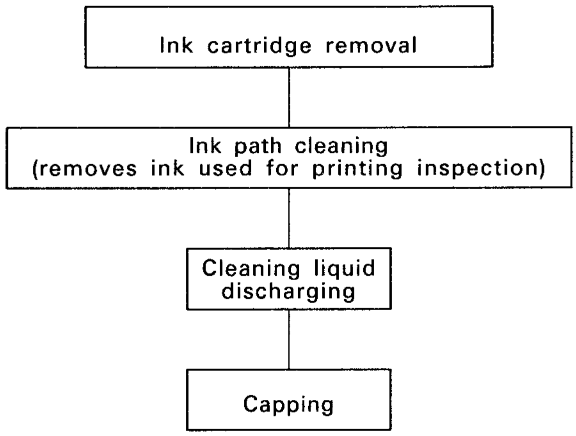


Figure 1-18. Ink Path Conditions at Delivery from the Factory

The ink supply operation is used to prepare the printer after storage.

Step 1: Remove all protective parts that were installed for transit. (For the protective parts, see Chapter 4.)
Step 2: Mount the ink cartridge.
Step 3: Turn the printer power on while pressing both the ON LINE and LINE FEED switches.

During the ink supply operation, the LCD displays "INK CHARGE XXX." XXX indicates the time required to complete the operation, and it will be completed when the value reaches 000.

For reference, the amount of ink consumed during the ink supply operation is approximately 15cc.

1.4.1.8 Paper Load/Eject Function

WARNING

- Do not turn the manual paper feed knob, unless a paper jam occurs. The reasons are as follows:
  Usually, reverse paper feeding is prohibited by the software to prevent the paper from being smudged. If the feed knob is operated manually, this protection is overriden.
  Positions set in the SelecType mode, such as TOF or tear off positions, will be shifted.
- Never feed the paper in the reverse direction when printing labels. Otherwis a label might adhere to the printer.

Paper handling in this printer is completely automated. By pressing the corresponding switch on the control panel, the printer executes as follows:

- Loading/ejecting a cut sheet
  1. Set a cut sheet at the sheet guide.
  2. Press the [LOAD/EJECT] switch.
     - When the printer is in the paper out state: Loads the paper (advances the paper to the TOP position, then stops).
     - When the paper is in the printer: Ejects the paper.

- Loading/ejecting fan-fold paper
  1. Set the paper at the sprockets of the tractor.
  2. Press the [LOAD/EJECT] switch.
     - When the printer is in the paper out state: Loads the paper (advances to the TOF position, then stops).
     - When the paper is in the printer: Executes back out.

  (Back out: Feeds the paper in the reverse direction, then ejects it.)

- Switching between tractor and friction feed (cut sheet/CSF) mechanisms

  Switching from the tractor to the friction mechanism
  1. Press the PAPER SELECT switch.
  2. Back out the fan-fold paper.
  3. Cancel the push tractor mechanism, then select the friction mechanism.
  4. Load the paper from the sheet guide or the CSF.

  Switching from the friction to the tractor mechanism
  1. Press the PAPER SELECT switch.
  2. Eject the cut sheet.
  3. Cancel the friction mechanism, then select the push tractor mechanism.
  4. Load the fan-fold paper set at the push tractor.

NOTE 1: When executing push-pull feed with the pull tractor mounted, the paper load/eject function cannot be used because the paper comes out the pull side each time a back out is executed. (For details, see Chapter 3.)

NOTE 2: When the paper is loaded, the default TOF position is 8.5 mm from the top edge of the paper. (This is factory set.)

1.4.1.9 TOF Adjustment Function

The TOF position can be adjusted (set to any position) just after the paper is loaded (NOTE 1) by using the MICRO FEED switch on the control panel. Once the TOF value is set, it is stored in the memory, and remains in effect even after the printer power is turned off.

When the MICRO FEED switch is pressed;

TOF ADJUST

The message shown above is displayed on the LCD. Since a TOF value can be set for four types of paper as shown below, it is not necessary to check the value after changing the paper type. (The right side indicates the TOP range.)

- Cut sheet (NOTE 2) : 8.5 to 27.5 mm
- Fan-fold paper : 8.5 to 34 mm
- Paper for the single-bin CSF : 8.5 to 34 mm
- Paper for the double-bin CSF : 8.5 to 34 mm

During micro adjustment, the buzzer rings at 8.5 mm and 22 mm from the top edge of the paper to indicate these reference positions.

NOTE 1: If printing or paper feeding is executed after loading the paper, the printer cannot enter the TOF adjustment mode.

NOTE 2: When loading the paper from the sheet guide without the CSF mounted.

1.4.1.10 Tear Off Function

The tear off function matches the position to be cut (paper bail position) with the perforation for tearing-off the fan-fold paper. This function has two modes, manual and automatic.

- The paper can be fed to the paper cut position (tear off position) as follows:

Manual mode

Press the TEAR OFF switch.

Automatic mode

Select"AUTO TEAR OFF ON" in the SelecType mode. This function will be valid only when the following conditions are met. (The auto tear off function will be ignored if any of the following conditions is not met.)

No data is being received from the host computer after printing is completed.

The waiting position at that time is the TOF position of the paper.

- When the tear off function is started in either the manual or auto mode, the printer advances the perforation to the paper bail position, and displays the following message on the LCD.

PLEASE TEAR OFF

- After the paper is torn off, it is returned to the original position regardless of the mode (manual or auto), in any of the following cases:

  When the TEAR OFF switch is pressed.

  When the printer is set ON LINE by pressing the ON LINE switch.

  When print data is received from the host computer.

In the tear off mode, the tear off position can be adjusted using the MICRO FEED switch. The following message will be displayed on the LCD panel when the MICRO FEED switch is pressed in the tear off mode.

TEAR OFF ADJUST

The value set is stored in the memory, and remains even after the printer power is turned off. The paper is fed to the new tear off position when a tear off operation is executed after the setting.

1.4.1.11 Reverse Paper Feed Protection

Since the ink is still wet just after printing, the paper will be smudged if it is rubbed by something.

In this printer, nothing rubs the paper when it is fed in the forward direction. However, as shown in Figure 1-22, the paper touches the paper guide plate when it is fed in the reverse direction.

Therefore, reverse paper feeding is prohibited by the software (soft protect operation) to prevent the paper from being smudged. The soft protect operates as follows:

- Cut Sheets

  If reverse paper feeding is executed by pressing the MICRO FEED switch after printing, the paper will only be fed until the line printed last reaches the paper guide plate position. (The platen will not rotate in the reverse direction any farther.)

- Fan-fold paper

  If reverse paper feeding is executed by pressing the MICRO FEED switch after printing, the paper will only be fed until the line printed last reaches the paper guide plate position. (The platen will not rotate in the reverse direction any farther.)
  If an eject (back out) operation is attempted just after printing, it will be ignored, and the following message will be displayed on the LCD.

PLEASE TEAR OFF

  The paper cannot be ejected unless the paper is cut off by pressing the TEAR OFF switch.

- CSF

  When printing is executed with the CSF mounted, reverse paper feeding cannot be executed at all.

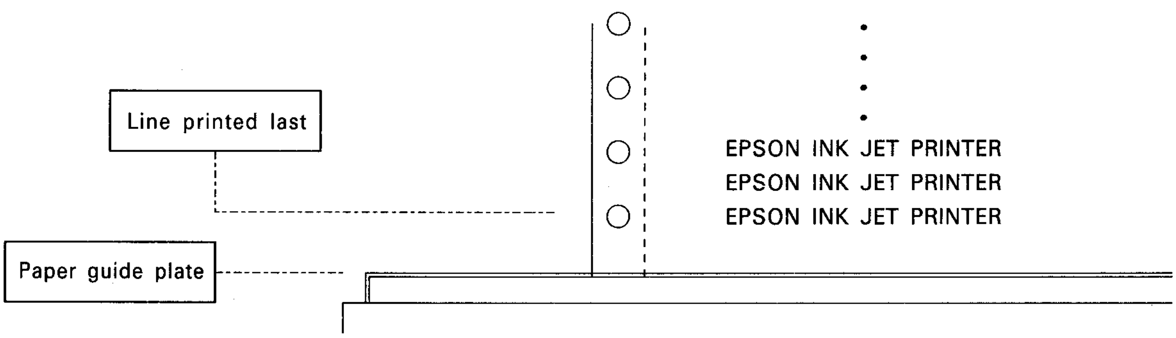


Figure 1-19. Paper Conditions Just After Printing

Since the above described reverse paper feed protection is controlled by the software, it will not work if the paper feed knob is operated manually.

1.4.2 Reset Function

This section describes the printer initialization (reset) operations and their timings, and the default values.

1.4.2.1 Initialization Timing and Operation

The following shows the timings when printer initialization is executed systematically:

Initialization
- Hardware reset
  - Internal power reset circuit (when the printer power is turned on or off)
  - When the INIT signal is received from the host computer: (NOTE)
  - When reset operation is executed manually:
    Press both the ON LINE and LOAD/EJECT switches, simultaneously.
- Software reset
  - When the ESC @ code is received from the host computer:

Hardware reset operation

- Printer mechanism is reset (including head cleaning).
- Input data buffer is cleared.
- Print buffer is cleared.
- Default values are set.

Software reset operation

This differs from the hardware reset operation in the following points:

- The printer mechanism is not reset.
- The input data buffer is not cleared.
- The following values set in the SelecType mode do not change from those set at the previous hardware reset.
  ON/OFF of Auto LF
  Select/deselect of DC1/DC3

NOTE: In this case only, head cleaning is not executed.

1.4.2.2 Default Values

The values set as defaults are as follows:

Page position:	The current paper position becomes the top-of-page position.
Vertical tab positions:	Nothing is set.
Horizontal tab positions:	Every eight characters (relative setting)
VFU channel:	Channel 0
Download characters:	Deselect. All download characters are cleared.
Justification:	Left justification only is selected.
Character spacing:	No additional spacing is selected.
Bit image mode assignment:	ESC K = ESC * 0
	ESC L = ESC * 1
	ESC Y = ESC * 2
	ESC Z = ESC * 3

Other settings

- The values selected in the SelecType mode are set. When the software reset is executed, the following settings will be reset:
  ON/OFF of auto LF
  Select/deselect of DC1/DC3
  ON/OFF of superscript mode
- Items listed neither in the above lists nor in the SelecType mode are basically set OFF.

1.4.3 Various Detection Functions

This section describes each detection function of the printer.

1.4.3.1 Ink-End Detection Function

This printer has an ink-end detection function. An ink end is detected by the ink-end sensor in the printer mechanism. The ink-end is detected when any of the following occurs:

Ink-end
- a. Ink cartridge runs out of ink.
- b. No ink cartridge is mounted or the ink cartridge is removed during printing

When the printer detects the ink-end, it rings the buzzer, lights the INK END LED on the control panel, and displays the following message on the LCD.

INK END

Then, the printer operates as follows:

When a. occurs: 200 lines can be printed after the message is displayed. Then, the printer automatically goes OFF LINE, and enters an error state.

When b. occurs: The printer automatically goes OFF LINE immediately after displaying the message, and enters an error state.

To make the printer recover from the ink end state, mount a new ink cartridge and set the printer ON LINE. (Printing executed when the ink-end was detected will be resumed. No data will be lost.)

1.4.3.2 Paper-Out Detection and Forms Override Functions

The printer has a paper-out detection function. A paper-out is detected by the paper-out sensor (at the lower left of the platen) in the printer mechanism.

Paper-out
- When a cut sheet or fan-fold paper is used:
  - No paper is loaded.
  - The end of the paper is detected.
- When the CSF is mounted:
  - The printer does not exit the paper-out state after the paper is loaded.

Even after the end of the paper is detected, the printer does not immediately enter the paper out state so that printing can be continued up to 13.5 mm from the actual paper end by the forms override mechanism. Therefore, the printer enters the paper out state after feeding paper until the printhead reaches the position 13.5 mm from the bottom edge of the paper.

When the printer enters the paper-out state, it rings the buzzer, lights the PAPER OUT LED on the control panel, and displays the following message on the LCD.

PAPER OUT

The paper-out state is identified as an error state. Therefore, the printer sets the following interface signals as shown below, then automatically goes OFF LINE.

- Parallel interface
  - BUSY signal : HIGH
  - PE signal : HIGH
  - ERROR signal : LOW
  - ACKNLG signal : Does not return it.
- Serial interface
  - REV signal : MARK
  - X code : Outputs XOFF.

To make the printer recover from the paper-out state, load new paper and set the printer ON LINE. (Printing executed when the paper out was detected will be resumed. No data will be lost.)

1.4.3.3 Cover Open Detection Function

Because the printhead moves from left to right and right to left repeatedly at high speed during printing, it is very dangerous to execute printing with the printer cover open. The printer has a cover-open detection function to prevent the user from putting his/her hand inside or from dropping something in the printer mechanism by mistake.

Whenever the printer cover is opened, the printer goes OFF LINE, rings the buzzer, and displays the following message on the LCD panel.

COVER OPEN

To make the printer recover from the cover-open state, shut the printer coverb and set the printer ON LINE. (Printing executed when the cover was opened will be resumed. No data will be lost.)

1.4.3.4 Error Detection Mechanism

The printer enters an error state when any of the following occurs:

- Printer is set OFF LINE:
- Paper-out is detected: (See Section 1.4.3.2.)
- Ink-end is detected: (See Section 1.4.3.1.)
- Cover-open state is detected:

For the following errors, the defective component can be determined from the message displayed on the LCD:

- C.G. error : Error 0
- EEROM READ/WRITE error : Error 3
- Carriage control error : Error 10
- CPU error : Error 20

NOTE: For the causes of the above errors, see Chapter 5.

If an error occurs, the printer sets the interface signals as shown below, and inhibits data transmission.

- Parallel interface
  - BUSY signal : HIGH
  - ERROR signal : LOW
- Serial interface
  - REV signal : MARK
  - X code : Outputs XOFF.

1.4.1.5 Buzzer

The buzzer rings as follows:

When the BEL code of the ESC command is input:	! x specified times
When an ink-end is detected :	! ! ! ! ! (five times)
When paper-out is detected :	! ! ! (three times)
When the cover-open state is detected :	! ! ! ! ! (five times)
When an error is detected :	! ! ! ! ! (five times)
When the printer enters the SelecType mode :	!
During the TOF position adjustment (at 8.5 mm and 22 mm positions):	!

1.5 MAIN COMPONENTS

The printer consists of the following major components:

- Printer mechanism unit: Model-4410 (SQ-850)
Model-4460 (SQ-2550);
- Power supply circuit board: SEIPS (120 V operation)
SANPSE (220/240 V operation);
- Control circuit board (main board): SEIMA board unit;
- Control panel unit: SEIPNL board unit;
- Housing;

1.5.1 Printer Mechanism

The model numbers of the printer mechanisms are 4410 for the 80-column model and 4460 for the 136-column model. The main difference between the two is the number of printable columns. Otherwise they are basically the same.

The printer mechanism is composed of a printing mechanism (carriage and printhead), paper feed mechanism, ink supply mechanism, and pump.

The printer mechanism has the following features when compared with the conventional basic printer mechanism used in the SQ-series printers:

- A paper top edge holding mechanism that enables use of the entire paper effectively, and an auto release mechanism to automate paper handling, are newly added to the paper feed mechanism.
- Replacement of the ink cartridge is made easier by locating the ink cartridge holder at the front of the printer mechanism.

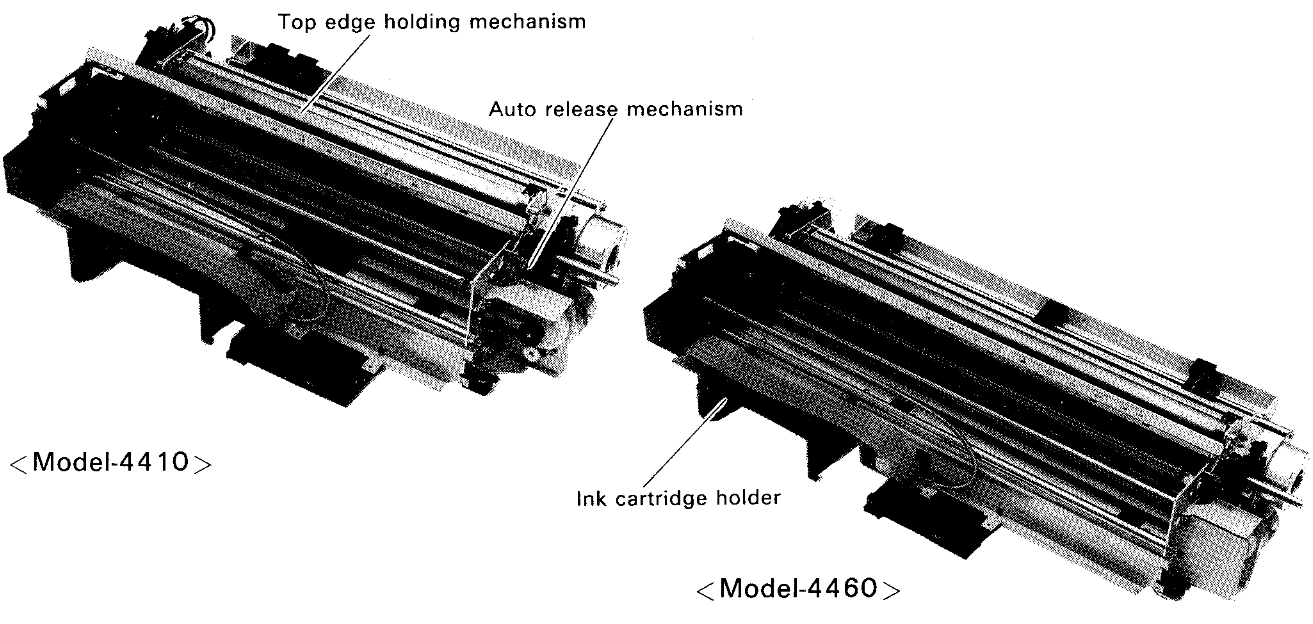


Figure 1-20. Printer Mechanism Model-4410/4460

1.5.2 SEIPS/SANPSE Board Unit

The SEIPS and SANPSE board units are the power supply units designed for 120 V and 220/240 V operation, respectively.

The SEIPS/SANPSE board unit is a power supply which supplies DC voltages to the mechanisms and control/drive circuits, and is composed of an AC cable, switching board, and regulator circuit.

By employing a switching regulator (DC to DC converter), circuits in the SEIPS/SANPSE board were made very compact but which work very efficiently. The 494 is employed as a controller in the regulator circuit.

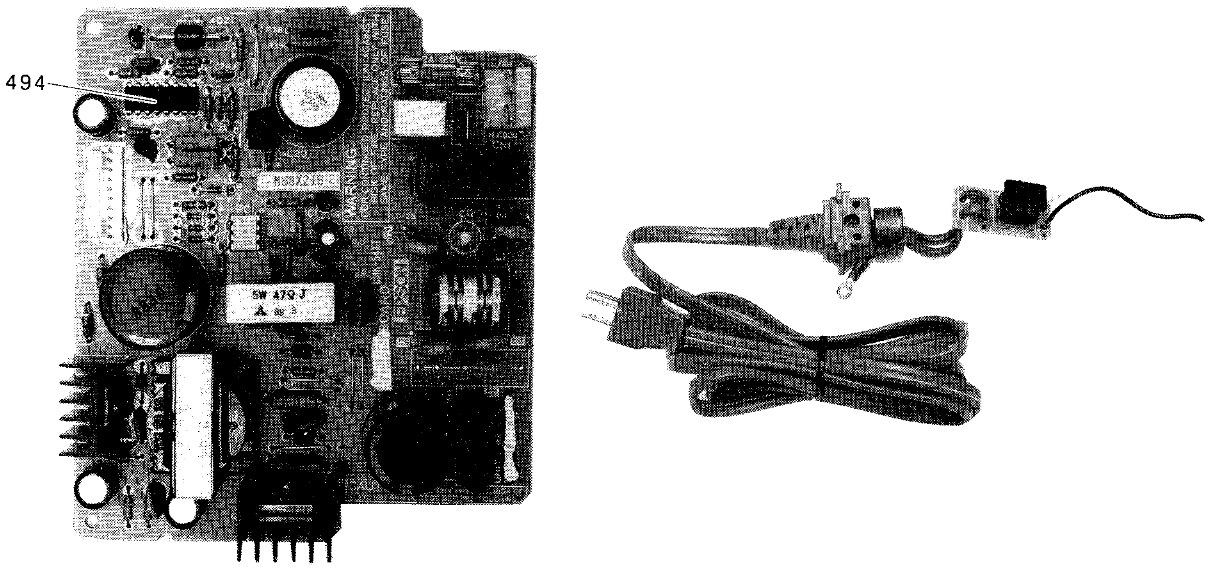


Figure 1-21. SEIPS Board Unit

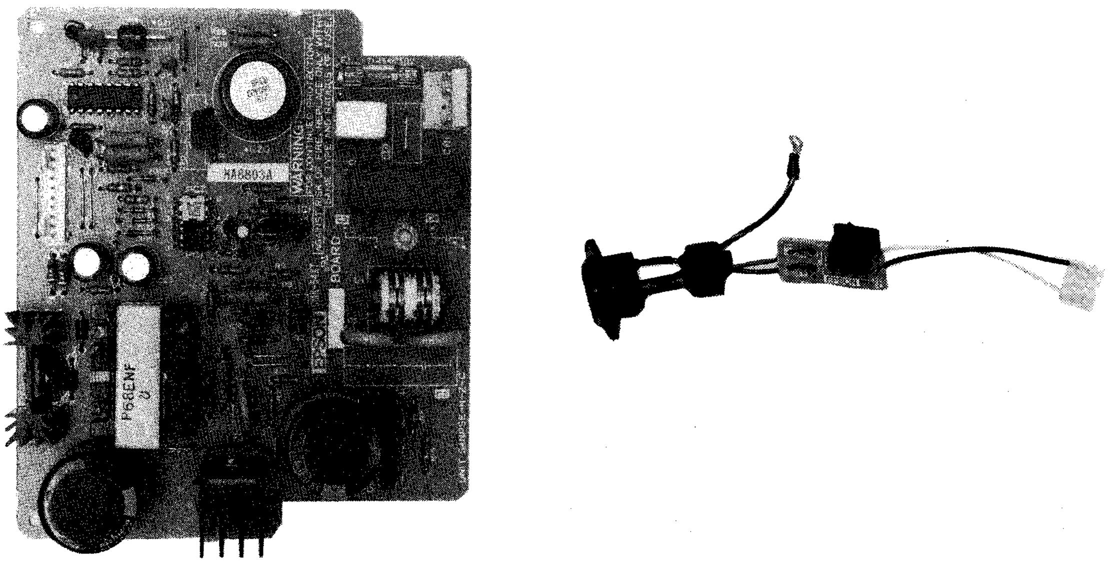


Figure 1-22. SANPSE Board Unit

1.5.3 SEIMA Board

The SEIMA board is the main board in the printer, and contains a logic control circuit and an analog circuit. The parallel interface connector for the host computer, the connector for the external font/PROM cartridge, and the connector for other units are also included.

The HD64180 CPU (10C) is used, and the following memories and gate arrays are assigned in the 262K-byte external address space.

- Memories

512K-byte CPU program ROM	:12B
4M-byte C.G. (Character Generator)	:10B
256K-byte PSRAM	:11B
256K-byte SRAM	:13C

- Gate arrays

Parallel Interface (PIF)	:12C
Memory Management Unit (MMU)	:8B
Printhead Controller (PHC)	:6B
DC Motor Control Unit (DCU)	:4B
Motor Control Unit (MCU)	:2A

The logic circuits are composed of the above ICs.

The analog circuits consist of the circuits for each mechanism, a buzzer circuit, and a battery circuit. A lithium battery in the battery circuit backs up the head cleaning timer, in addition to the SRAM (13C) which stores the values set in the SelecType mode, while the printer power is off. The lithium battery requires no maintenance.

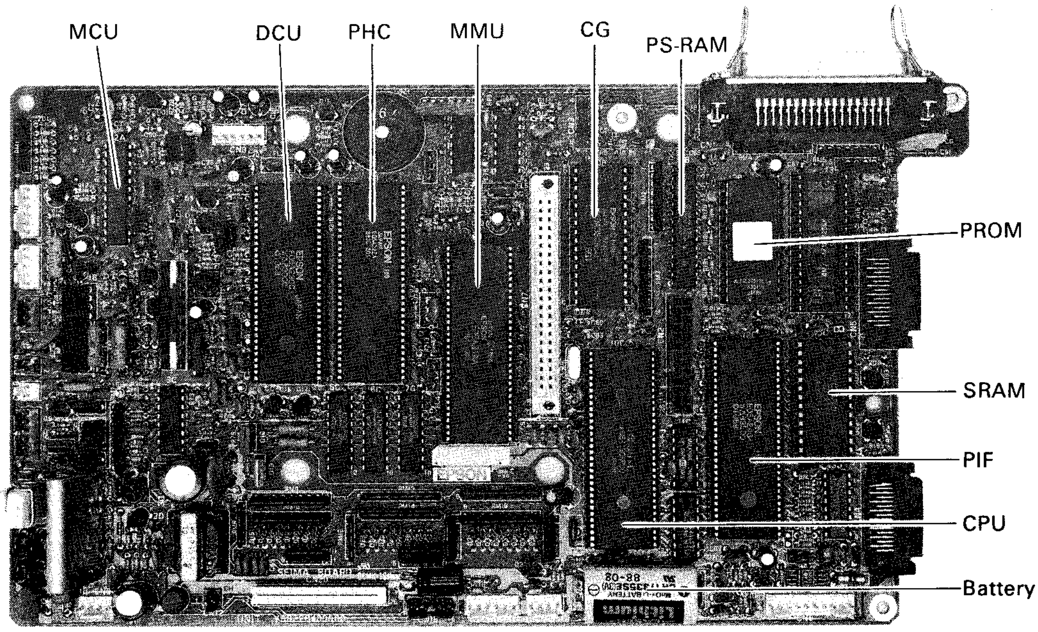


Figure 1-23. SEIMA Board

1.5.4 SEIPNL Board

The SEIPNL board is composed of a board and a case. The following are mounted on the board:

- 20 column LCD (Liquid Crystal Display)
- LCD controller
- Non-volatile memory: 256K-byte EEPROM
- Switches and LEDs
- Cover-open sensor
- Other general purpose TTL ICs

All of the above are contained on the single SEIPNL board.
The SEIPNL board is controlled by a serial connecting to the SEIMA board.

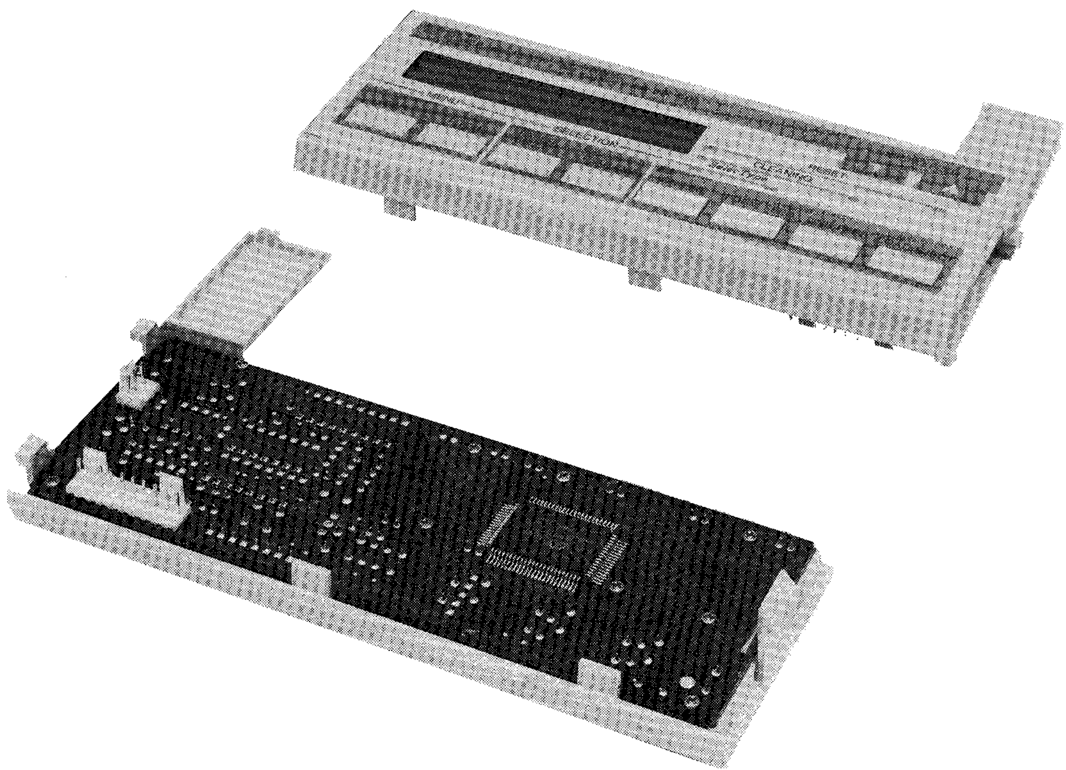


Figure 1-24. SEIPNL Board

1.5.5 Housing

The basic configuration of the housing is the same as that of a conventional printer. The components mounted on the lower case are covered by the upper case. Differences between this and a conventional case are as follows:

- A door for replacing the ink cartridge has been added at the front of the lower case.
- An option board cover for replacing the optional interface has been added to the upper case.
- The printer cover is divided into two pieces, and one of them is a half-fixed type.
- The direction of the slot for the optional cartridge was changed from vertical to horizontal.

The paper support (separator) was normally used for both cut sheets and fan-fold paper, but it should be removed when the CSF is mounted. When the optional pull tractor is mounted, replace it with the special separator.

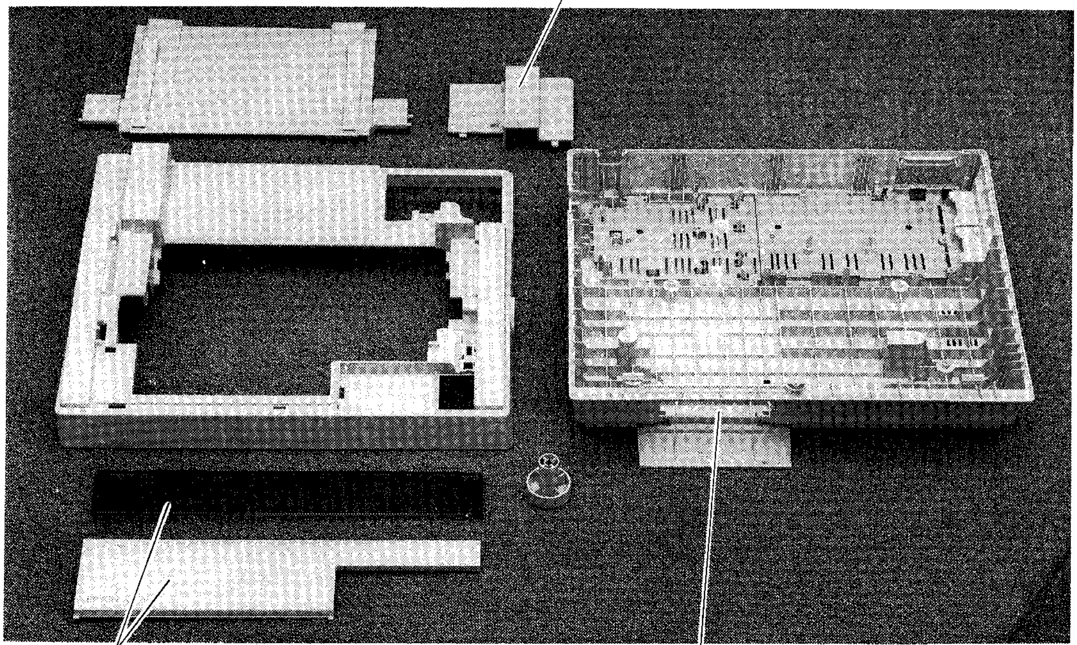


Figure 1-25. Housing

CHAPTER 2
OPERATING PRINCIPLES

CHAPTER 2

LIST OF FIGURES

LIST OF TABLES

2.1 OVER VIEW

This chapter explains the theory of operation of the main printer.
Section 2.2 gives a summary of the theory of operation of the main printer as preparation for explaining the main printer in detail. Section 2.2 onward explains the relationship between the circuitry and mechanisms for the theory of operation for the various components. A variety of IC's are used in the electrical circuits. Please read this chapter in addition to the Appendix for details.

2.2 Summary of the Theory of Operation

The theory of operation for the component connections, mechanisms, and electrical circuits are explained here. Although the basic contents of the explanations given here are subjective, 2.3 explains the meanings of abbreviations and the various mechanical connections. Accordingly, if you don't read the main section first, section 2.3 will be difficult to understand.

2.2.1 Component Connections

Figure 2-1 shows the component connections for the main unit, and Table 2-1 provides a summary of the connectors.

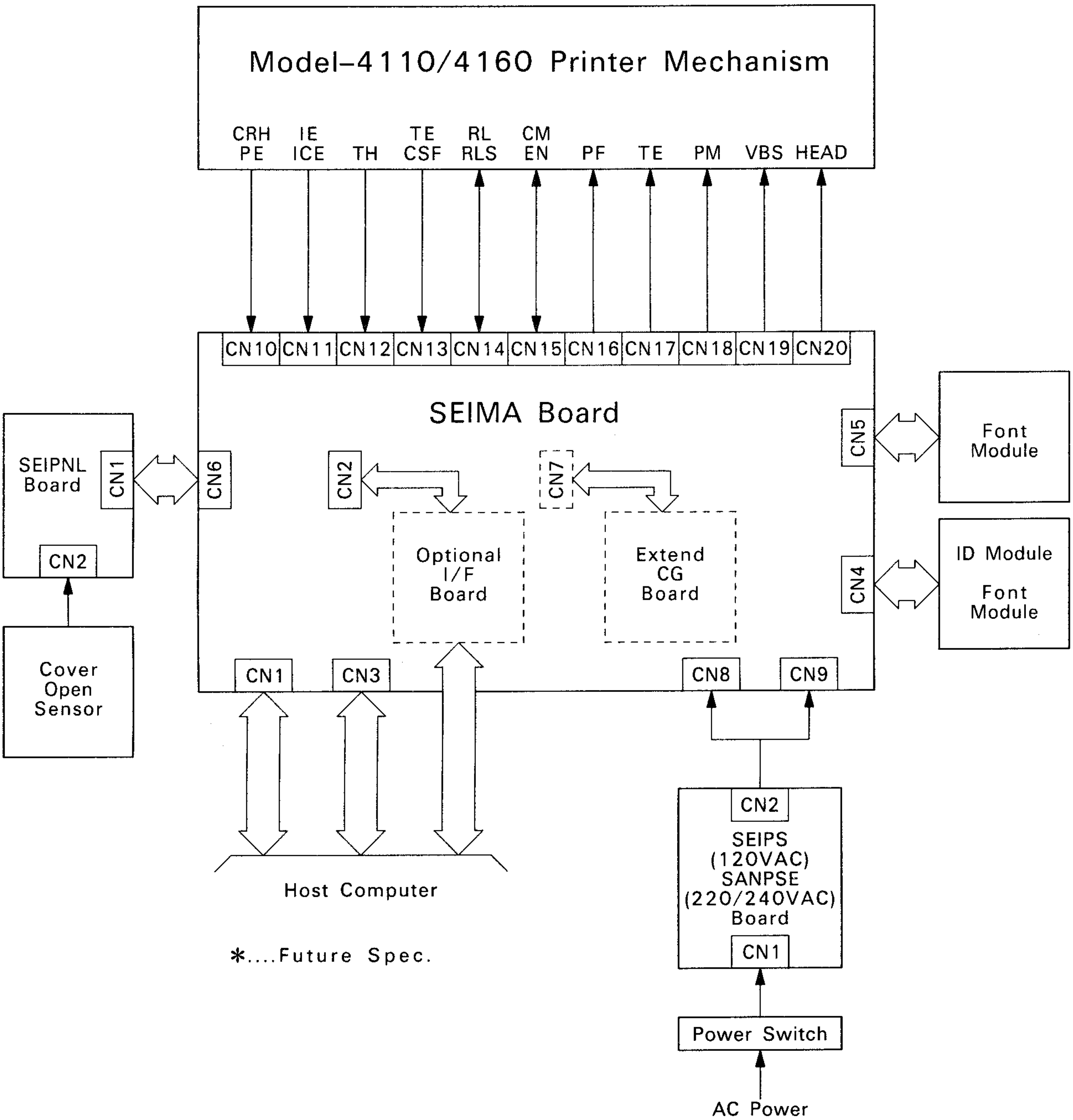


Figure 2-1. SQ-850/2550 Component Connections

Table 2-1. Connector Summary

Unit	Connector Number	Description	Number of Pins	Color	Reference Table
SEIPS SEIPSE	CN1	AC power source input	3	White	
	CN2	DC voltage (to SEIMA board)	10	White	
SEIMA	CN1	8-bit standard parallel interface connector	36	—	
	CN2	Option interface connection	26	Black	
	CN3	RS-232C standard serial interface connector	26	Black	
	CN4	Option ID module connection (Slot A)	32	Black	
	CN5	Option font module connection (Slot B)	32	Black	
	CN6	Control panel (SEIPNL) control signal I/O	10	White	
	CN7	CG extension board expansion (See Note)	44	—	
	CN8	DC voltage input (+24VDC)	4	White	
	CN9	DC voltage input (+5VDC, +12/−12VDC)	6	White	
	CN10	Carriage home position	6	Yerllow	
	CN11	Ink-end sensor signal input	4	Red	
	CN12	Ink thermistor connection	2	Black	
	CN13	TE, CSF sensor signal input	5	White	
	CN14	Release solenoide drive signal output, Re-lease sensor signal input	4	White	
	CN15	Carriage motor drive signal output, encoder signal input	6	White	
	CN16	Paper feed motor drive signal output	6	Black	
	CN17	Edge holding motor drive signal output	6	Red	
	CN18	Pump motor drive signal output	2	White	
	CN19	Valve solenoid drive signal output	2	Red	
	CN20	Print head drive signal output	26	White	
SEIPNL	CN1	Control panel control signal I/O	10	White	
	CN2	Cover open sensor signal input	3	White	

NOTE: Not provided

2.2.2 Summary of the Operation of the Printer Mechanism

Figure 2-2 provides a summary of the mechanisms of printer models 4110/4160.
These printer mechanisms consist of the print mechanism (carriage mechanism), the paper feeding mechanism, and the ink mechanism.

Print mechanism
This print mechanism consists of the carriage mechanism and the printhead. The printhead moves vertically according to the carriage movement. The carriage is driven by the carriage motor.

The encoder unit generates carriage position and speed control signals, and provides feedback to the control circuit.

The carriage home position sensor generates carriage reference position signals.

Paper feed mechanism
This main printer paper feed mechanism, as opposed to the previous paper feed mechanism, includes the top edge (TE) holder and the paper exchange mechanism. Paper feed is carried out by the paper feed motor, and the paper end (PE) sensor detects whether there is any paper for paper feed routing.

The TE holder mechanism holds the paper to prevent it from flying up, widens the print area, and drives the TE holder motor. The TE sensor generates signals to detect whether the paper is being held properly or not.

The paper exchange mechanism is used to drive the paper feed motor, and converts the paper feed method to either friction or tractor. This conversion is carried out by the release solenoid. The release sensor generates a signal to detect the state of conversion.

The CSF sensor generates a CSF signal to detect whether the optional CSF is installed or not.

Ink mechanism
This ink mechanism contains the ink cartridge (holder), pump unit, and printhead. The ink cartridge supplies ink to the head. Head cleaning is carried out by the pump unit; with ink being discharged to the nozzle, and then replenishing the nozzle with fresh ink. Wasted ink is filled into the wasted ink pack cartridge.

The pump unit contains a capping mechanism that prevents air from entering the ink mechanism by capping the head, a cleaner that cleans the surface of the head nozzle, and a pump mechanism, with their operations being conducted by the valve solenoid and pump motor.

The holder ink end sensor detects the no ink and no cartridge signals. The thermistor detects the ink heat (TH signal) and provides feedback to the head drive circuit. Accordingly, a uniform print level is maintained without being affected by the thermal conditions.

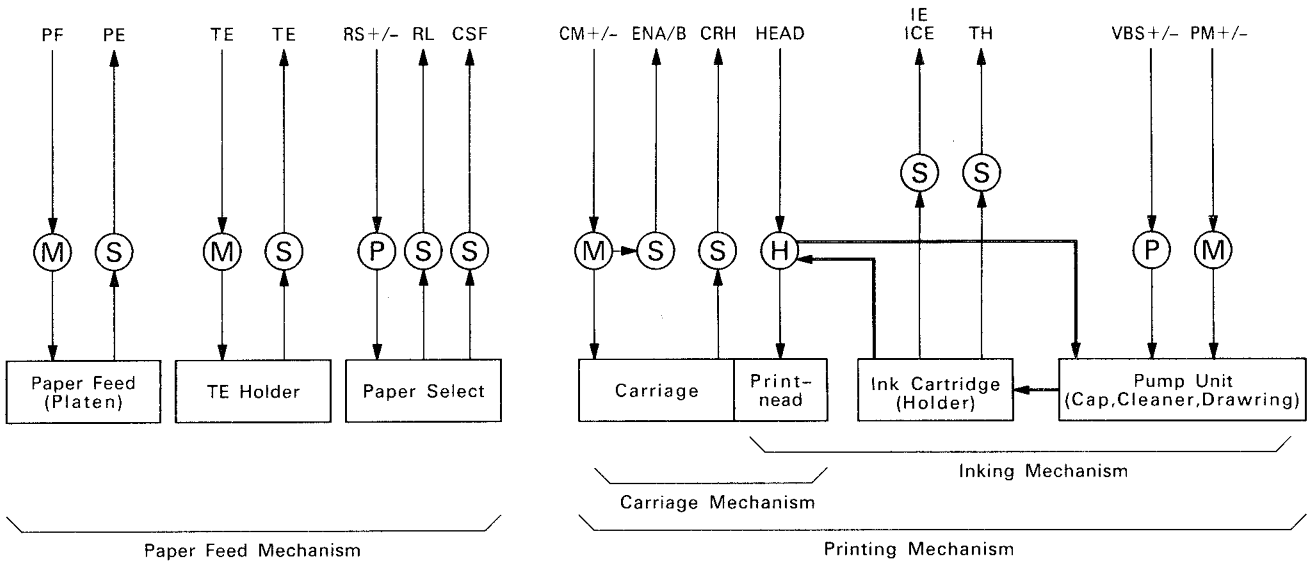


Figure 2-2. Summary of the Printer Mechanism

PF:	Paper feed motor drive signal
PE:	Paper end sensor signal
TE:	Top edge holder motor drive signal
TE (SENSOR):	Top edge sensor signal
RS +/−:	Release solenoid drive signal
RL:	Release sensor signal
CSF:	CSF Sensor signal
CM +/−:	Carriage motor drive signal
ENA/B:	Carriage motor encoder signal
CRH:	Carriage home position sensor signal
HEAD:	Print head drive signal
IE:	Ink end sensor signal
ICE:	Ink cartridge sensor signal
TH:	Ink thermal sensor signal
VBS +/−:	Valve solenoid drive signal
PM +/−:	Pump motor drive signal

2.2.3 Summary of the Power Supply Circuit

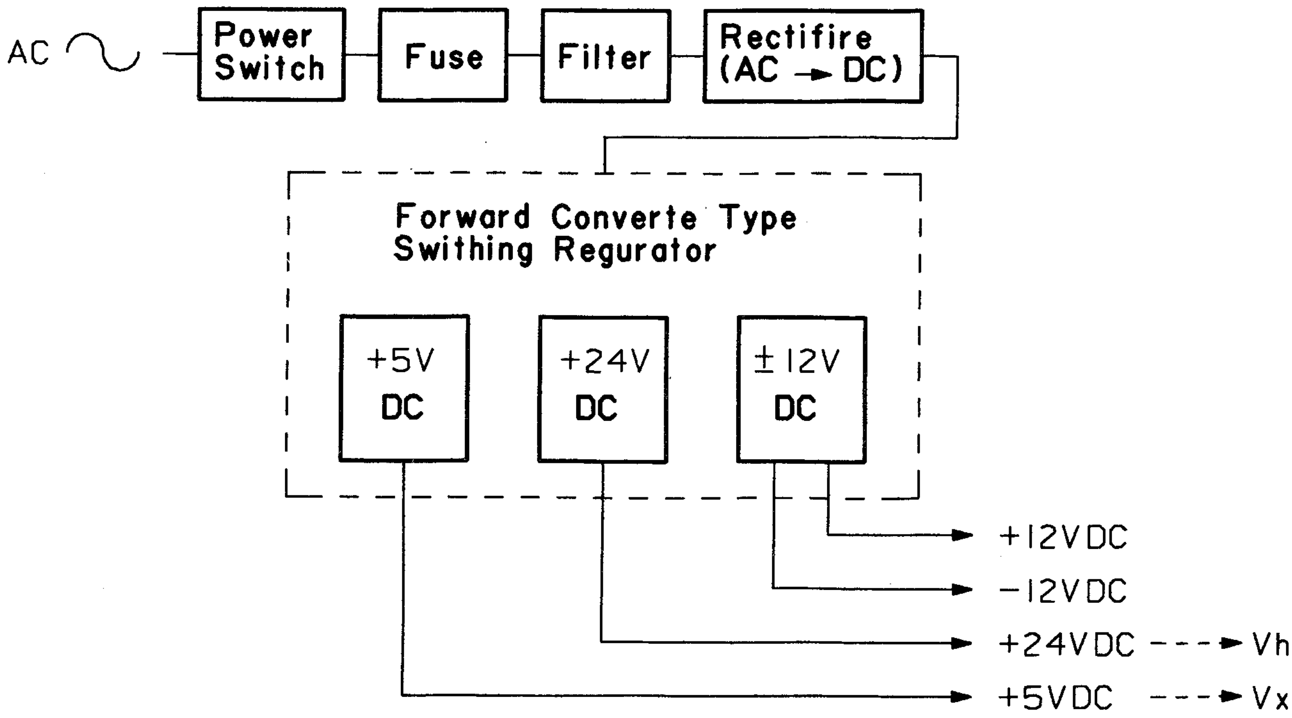


Figure 2-3. Overview of Power Supply circuit Operation

Table 2-2. Power Supply Applications

Voltage	Application
+5 V DC	Circuit drive voltage * Logic circuit * Sensors
+24 V DC	Printer mechanism drive * Carriage motor drive voltage * Pump motor drive voltage * TE motor drive voltage * Paper feed motor drive voltage * Release solenoid drive voltage * Valve solenoid drive voltage
+/−12 V CD	Optional I/F voltage
Vh	Printhead drive voltage
Vx	Protection voltage for abnormal power supply operation is detected * Reset circuit * Printhead data signal pull-up voltage * TE motor phase data signal pull-up voltage

NOTE1: The voltage Vh is generated on the SEIMA board using the +24V DC power supply
NOTE2: The voltage Vx is generated on the SEIMA board using the +5V DC power supply.

2.2.4 Summary of the Control Circuit

Figure 2-4 shows the block diagram for the control circuit. The control circuit is comprised of the SEIMA board and the SEIPNL board. The SEIMA board drives the mechanisms for interfacing between the host computer and data and print data expansion. LSI's are used in most of the logic circuits for CPU load reduction (which increase data throughput). These data arrays contain the address codes for mode registers and command execution. After each mode has been set according to the program at initialization, the operation is controlled by a single easy instruction. The SEIPNL board controls the operation by serial interfacing with the SEIMA board. The main IC's used in the logic control part of the control circuit are described below.

CPU:

HD64180 (CPU,1OC)

The HD64180 is a single chip equipped with a high-speed CPU, a memory management unit (MMU), a DMA controller, a timer, an asynchronous serial communications interface (ASCI), and a block synchronous serial I/O command port. The internal program (12B) is executed by the RESET command, and oscillation is carried out by the oscillator and is driven in 9.216 MHz (18.432/2 MHz). 512 Kbytes of physical address space can be accessed by the MMU, which controls the memory and gate arrays described below. Data buses and lower-position address buses are connected between each gate array and the CPU, and interfacing is carried out according to MMIO (Memory Mapped I/O) address Read/Write.

Memory:

27512 (PROM, 12B)

The memory is the CPU program ROM which contains the firmware that controls the mechanisms, handles ESC/P, and controls the interface and all of the control programs for the main printer.

M40A33CA (4-Mbyte CG: Character Generator, 10B)

A mask ROM which contains multi-font character generation is provided as standard equipment.

HM65256 (256-Kbyte PSRAM, 11B)

This PSRAM is used as the CPU working area. Internally, it is mapped as the print data expansion area for the data input buffer, line buffer, image buffer, etc.

D43257 (256-Kbyte SRAM, 13C)

This SRAM stores data for SELECTYPE settings, TOF positions, TEAR OFF amount, etc. When power is off, these data are protected by the lithium batter (BAT 1).

ER59256 (EEPROM, SEIPNL Board)

This EEPROM stores and protects the hardware settings for the bi-directional adjustment value, the TE holder position adjustment value, PROM ID's for columns 80-136, etc. If the combination of panels and mechanisms changes, the settings are rewritten by the adjustment cartridge.

Gate array:

The gate array listed below is one of the control circuit chips. Installed parts on the outside of the gate array form one control and drive circuit.

E0521AA (MMU: Memory Management Unit, 8B)

The E05A21AA MMU provides the following functions on a single chip. According to these functions, the expanded memory area of the main control circuit can be controlled without complicated circuitry.

- Lower address position latched output
- Bank latch, output
- Bit operand
- MMIO decode, output
- CG, Program, Ram decode
- Reset for internal/external program change or replacement
- ON LINE/OFF LINE process (switch)

E05A24GA (PIF: Parallel Interface Controller, 12C)

This E05A24GA PIF provides the following functions on a single chip. According to these functions, interfacing between the main control circuit and the host can be controlled without complicated circuitry.

- Parallel interface data latch (lead) and output to the printer.
- Latch timing selection is possible.
- Set, reset, and lead of control signals (ACK, BUSY, ERROR, etc.)
- INIT signal latch from the host and output to the printer
- READY lamp ON/OFF
- RXD signal exchange (serial interface)
- I/O sensor and switch signal reading (LOAD/EJECT, RL) and drive signal output (LOAD/EJECT lamp, Release solenoid)

E05A22EA (PHC: Print Head Controller, 6B)

This E05A22EA PHC provides the following functions on a single chip. According to these functions, all of the print head drive controls can be controlled without complicated circuitry.

- Head data latch
- Head (piezo solenoid) charge/discharge control (timing, power range)
- Direct control of the dot data to the head nozzle line (vertical dot pitch control)
- Half protect
- Print timing sample
- I/O sensor signal reading (IE,ICE,TE,PE,CSF) and pump unit control signal output (pump motor, valve solenoid)

E05A23GC (DCU: DC Motor Control Unit, 4B)

This E05A23GC DCU is a gate array that carries out all of the main printer carriage motor controls on a single chip, and it provides the functions listed below. The DCU is connected to the carriage motor drive circuit, motor encoder, and the carriage home-position sensor, and according to these, performs carriage motor positioning, speed control, and print timing generation without complicated circuitry.

- PLL, PRC motor speed control
- Full power acceleration and breaking control
- Drive current interrupt circuit
- Motor stop detection and signal output
- Generation and output of print timing signals (PTS) to the print head control circuit
- Carriage position counter
- Home position detection and print start position (line position) setting functions

EO5A09BA (MCU: Motor Control Unit, 2A)

This EO5A09BA MCU is a gate array that controls with a single chip the stepping motor used in the main printer, and it provides the functions listed below.
This MCU is connected to the paper feed motor and the TE holder drive circuit, and carries out motor control as a single circuit, thereby reducing the CPU load.

- Automatic control of phase data (normal/reverse revolutions counter) and output for stepping motor control
- Time control for phase switch over stepping Two channels

SED1200 (LCD Driver, SEIPNL Board)

The SED1200, which contains the CG for the LCD, is a 20-column LCD controller.
In addition to the CG, the SED1200 also contains a CPU and internal memory, and carries out operation by external commands.

The analog circuits are as follows:

Reset circuit

The reset circuit supplies a reset signal to the logic circuit. The Vx voltage that generates the power-on reset signal is supplied as the pull up voltage for analog circuit protection.

Head voltage generating circuit

This is a DC-DC converter circuit which converts +24VDC into the voltage (93-160V) necessary for driving the print head.

Timer circuit

This is a timer circuit that counts the operation intervals for automatic head cleaning.

Backup

This backup controls the Vbak supply, and is the backup voltage when power to the SRAM (13C) is off.

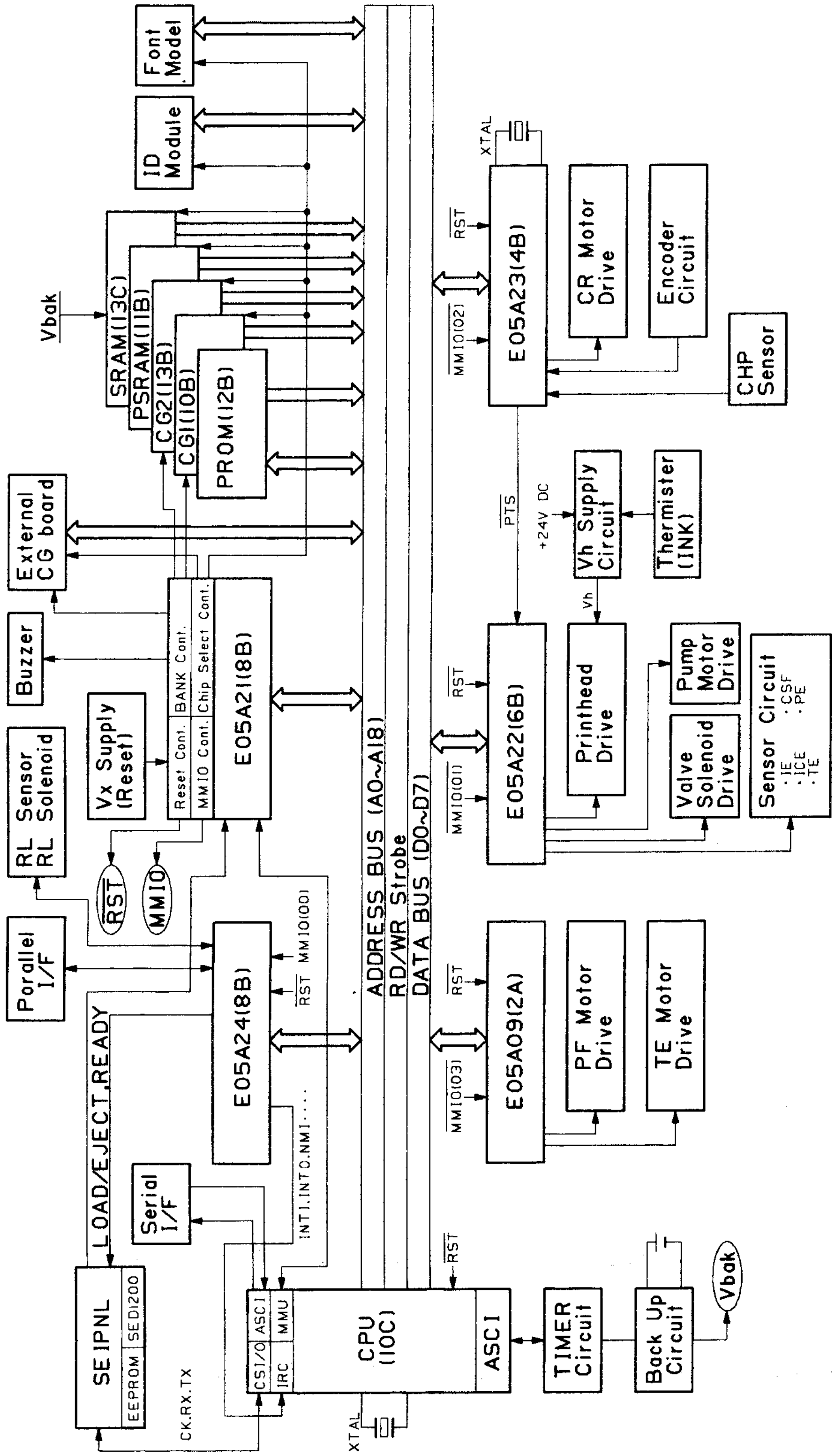


Figure. 2-4. Control Circuit Block Diagram

2.3 OPERATION OF THE POWER SUPPLY CIRCUIT

The power circuit used in the printer is either a 120V SEIPS board (for the U.S., Taiwan, and the Middle East) or a 220/240V SANPSE board (for Europe, Oceania, and Southeast Asia). The basic operation of both boards is the same, however, and they are treated as one in this manual.

2.3.1 Power Supply Circuit Block Diagram

Figure 2-5 shows the power supply circuit block diagram.

The SEIPS board uses a forward-converter type switching regulator circuit, and outputs +5, +24, and +12 V DC.

The incoming AC power passes first through a noise filter, then through a full-wave rectifying circuit. The power then passes into the main switching circuit, which outputs +24V and ±12V DC. Stabilization is provided by an over-voltage limiting circuit located on the 24V line, which feeds back to the main switching circuit. The 24V line is also used to generate the 5V output.

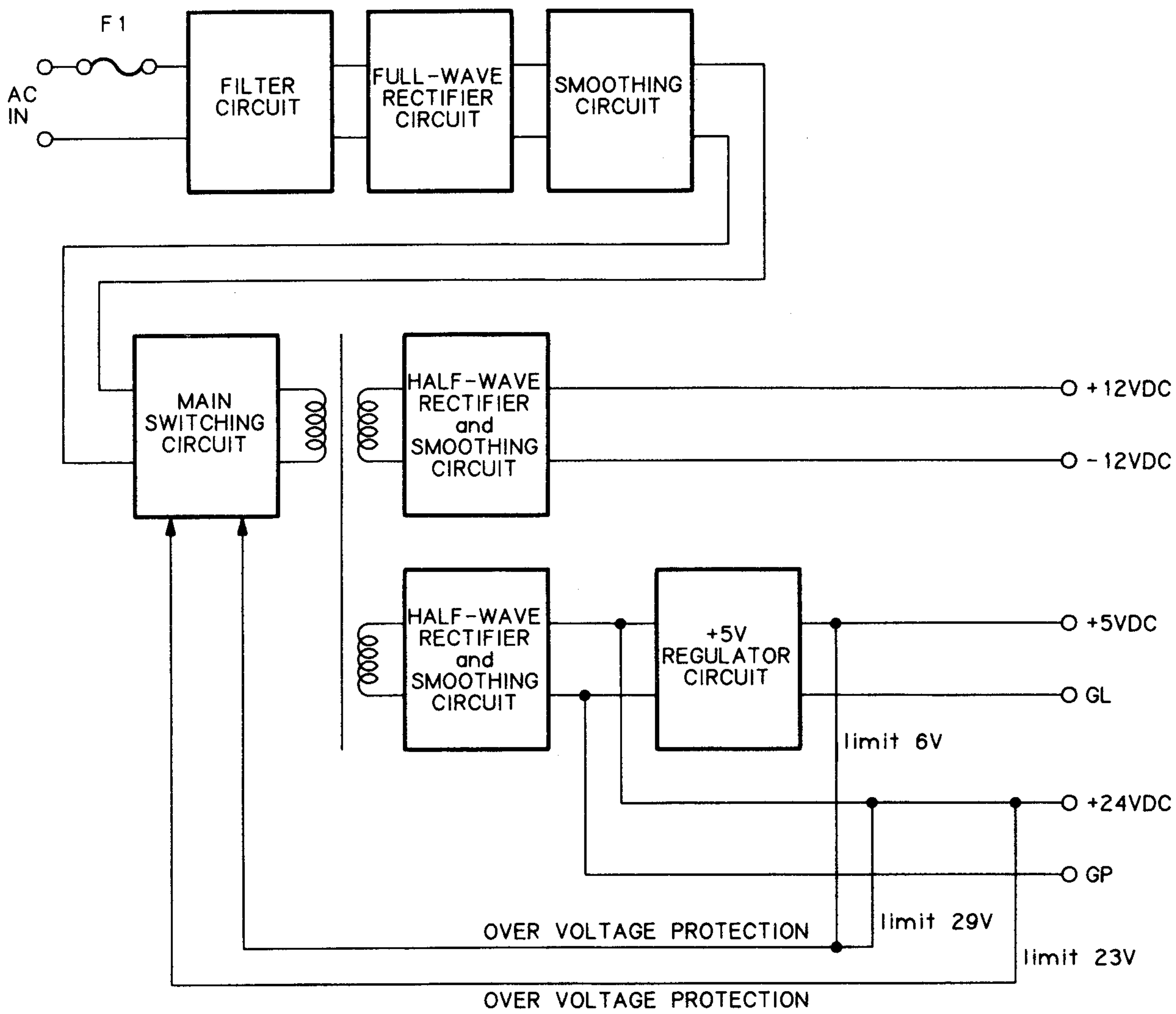


Figure 2-5. Power Supply Circuit Block Diagram

2.3.2 Filter Circuit

The input filter is a conventional LC filter circuit, and functions both to dampen incoming noise and to prevent externally-generated noise from running though the AC line. All the circuit's coils and condensers are designed to withstand fluctuations in the incoming AC power.

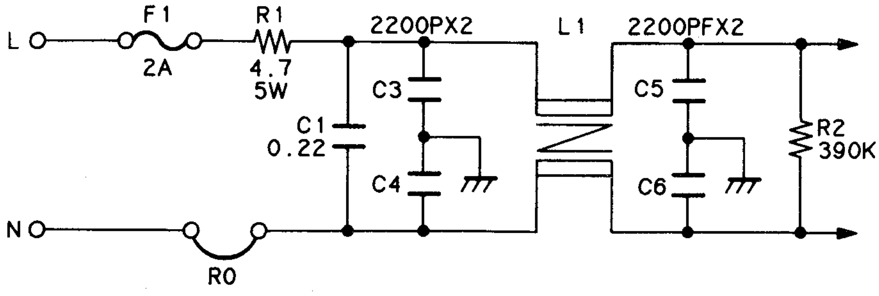


Figure 2-6. Filter Circuit (SEIPS Board, 120 V Version)

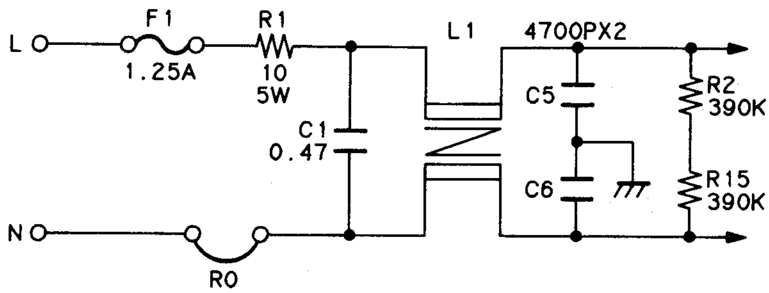
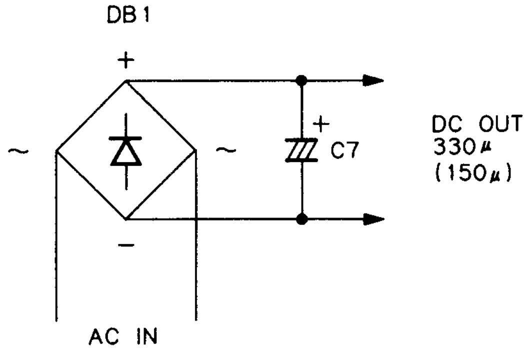


Figure 2-7. Filter Circuit (SANPSE Board, 220/240 V Version)

2.3.3 Rectifier and Smoothing Circuit

The AC IN voltage from the filter circuit is full-wave rectified by diode bridge DB1, and converted to approximately 2 × AC IN voltage by smoothing capacitor C7. The +24 VDC, +5 VDC, and ± 12 VDC voltages are converted from this DC voltage.



( ): 220/240 V Version

Figure 2-8. Rectifier and Smoothing Circuit

2.3.4 Starting Circuit (Main Switching Circuit)

Figure 2-9 shows the starting circuit. The operation sequence is as follows.

(1) When the main power source is connected, the AC input passes through the input filter, and is then rectified and smoothed. The resulting DC voltage V_{IN} is input into the circuit.

(2) PV_{IN} is applied to starting resistance R7 and passes through point Ⓐ. Base current I_B flows through transistor Q1, causing the transistor to conduct.

(3) At the same time, V_{IN} is applied to coil ④-③ of pulse transformer T1, causing a voltage of (7/60T)(V_{IN}) at ⑥-②, so that the positive feedback current of switching circuit I_B flows in the direction of Ⓑ. This causes a sharp rise, and Q1 quickly switches on.

(4) Current I_L through coil ④-③ increases linearly over time.
During this time, a voltage of (10/60T) V_{IN} is induced through coils ⑦-⑧ and ⑧-⑪, and a voltage of (19/60T) V_{IN} through coil ⑨-⑩. For all these coils, then, current attempts to flow in the direction of Ⓓ; however, this direction opposes the direction of diodes D22, D23, and D20, so that no current flows through the secondary side of the circuit.

(5) Current I_L in the primary winding increases, but because the potential at point ⑥ of coil ⑥-② is fixed, Q1 base current I_B cannot surpass a specified level. Because of this, the value of current Ic (= I_L) flowing from coil ④-③ to the Q1 collector cannot surpass a maximum of (h_{fe})(I_B).
Therefore, the ④-③ current value stops changing, and the coil voltage drops. At the same time, a reverse voltage is applied to coil ⑥-②, I_B drops, and current flows through D3 opposite to direction Ⓑ. At this time, the potential at point Ⓐ is higher than that at point Ⓔ, and C10 absorbs the current flowing in the Ⓐ-Ⓔ direction. Q1 is quickly shut off by the resulting sharp drop.

(6) The above causes the energy previously induced in the secondary side (in step (4), above) to be released from coils ⑦-⑧, ⑧-⑪, and ⑨-⑩ in the direction opposite to Ⓓ, and current flows in the easy-flow direction of the diodes.
The secondary side therefore outputs a voltage

(7) The release of energy declines linearly over time. When energy release is completed, all T1 coil voltages momentarily reach zero. R3, however, again induces switching current Ⓑ in the direction of Ⓑ, and Q1 conducts. Because the potential at point Ⓔ then surpasses that at point Ⓐ, the energy in C10 is released, so that Ⓑ is maintained.

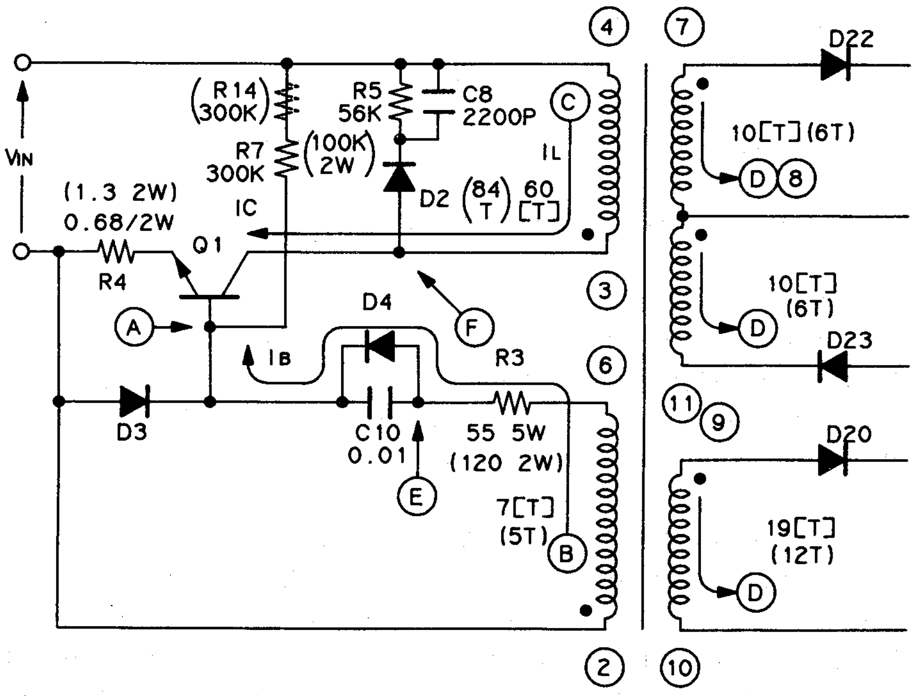
(8) The sequence returns to the stage described in (3) above.
This repetition enables the circuit to maintain oscillation. R7 is involved, however, only at the time of starting.

The above sequence is generally known as a self-excitation type ringing choke converter (R.C.C.) configuration.

Note that, at the instant when Q1 goes off (in step (5), above), the potential at point Ⓕ jumps violently upwards, but because of the action of D2, the energy is fed into R5 and consumed.

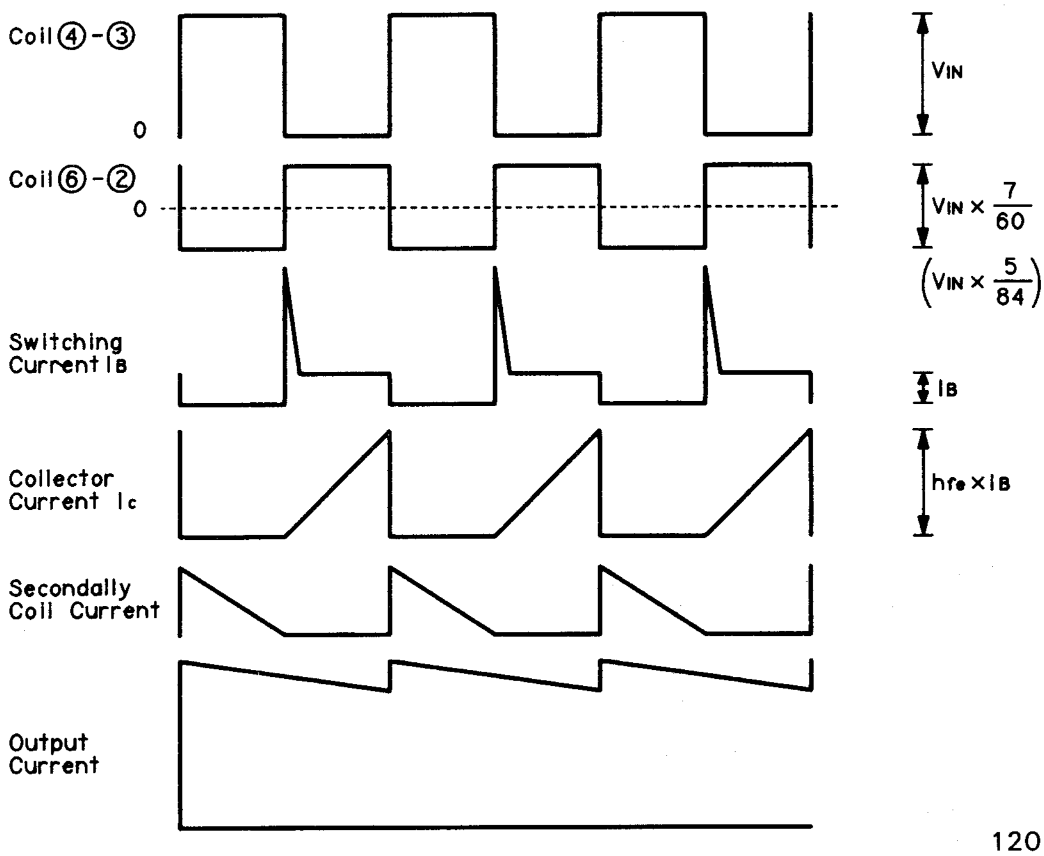
Below are shown the waveforms for each part of the circuit.

As Figure 2-10 makes clear, the output voltage is controlled by the time period that Q1 is off. In other words, the circuit is controlled by controlling the period during which Q1 is off.



120 V Version
( ),.....: 220/240 V Version

Figure 2-9. Starting Circuit (Main Switching Circuit)



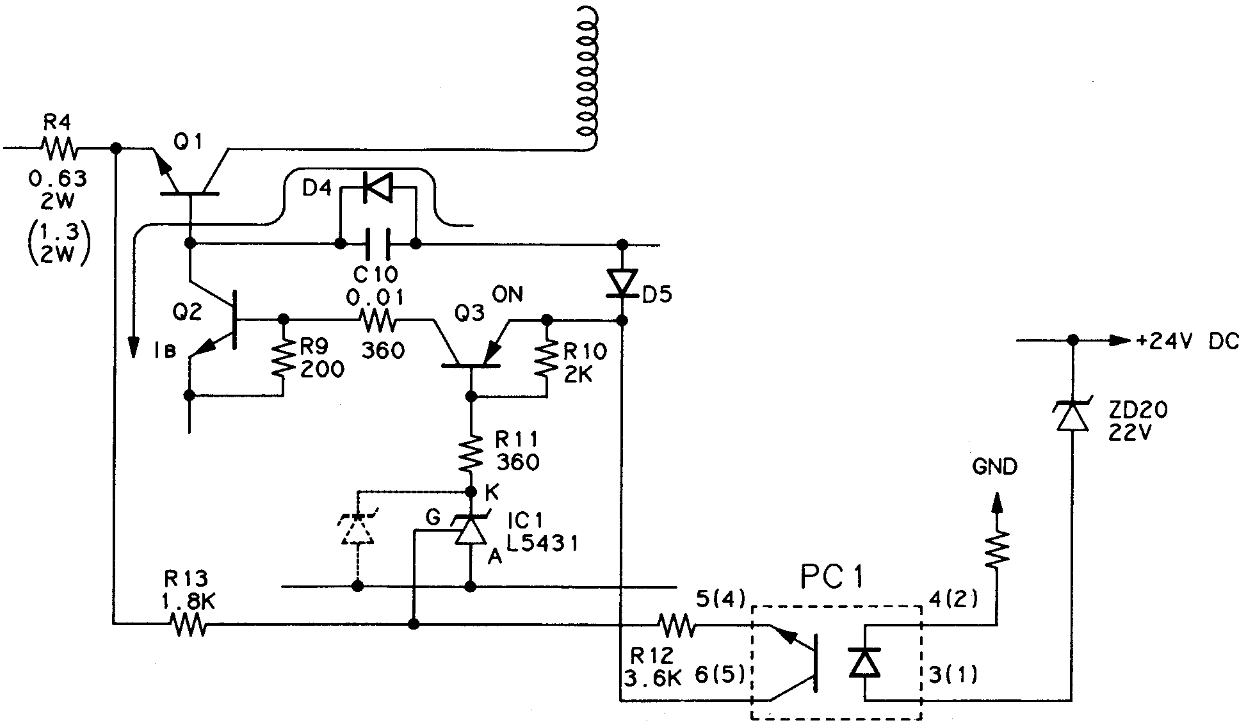
120 V Version
( ): 220/240 V Version

Figure 2-10. Main Switching Circuit Waveforms

2.3.5 +24 VDC Voltage Control Circuit

Figure 2-11 shows the +24 VDC Voltage Control Circuit.

In order to maintain the correct voltage on the +24V line, the main switching transistor will go off if the voltage exceeds 24V. If excess voltage occurs, reverse current will flow through Zener diode ZD20, PC1 will be activated, and the condition of the switching circuit will be as shown in Figure 2-12.



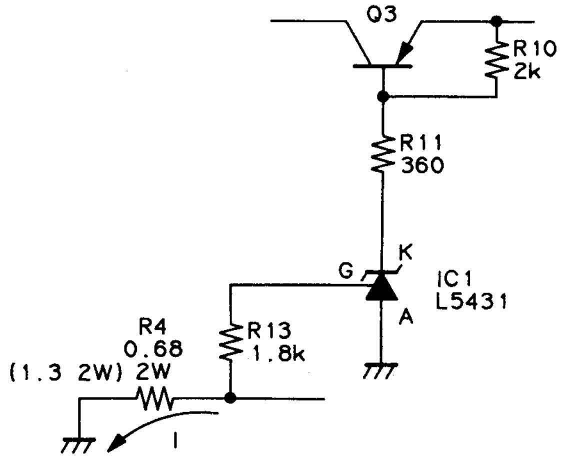
120 V Version

( )....: 220/240 V Version

Figure 2-11. +24 VDC Voltage Control Circuit

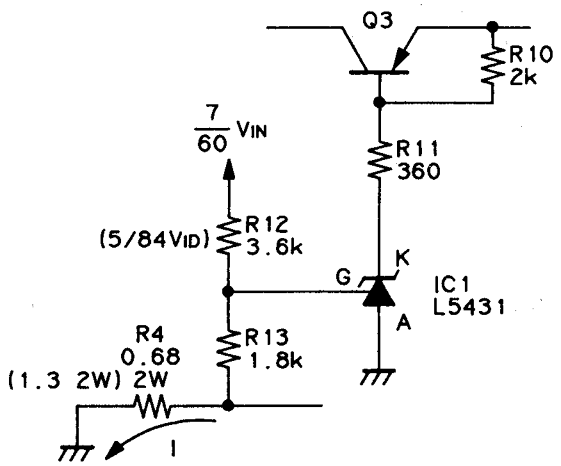
When PC1 is activated, the voltage at shunt regulator gap G reaches at least 2.5V, K-A become a conductor, Q3 goes on, Q2 goes on, and shunt transistor Q1 goes off.

Even if PC1 is not activated, K-A will conduct if current I in the transformer's primary winding surpasses a certain value, creating a potential difference of at least 2.5V across resistance R4. Resistance R4, in other words, serves as an excess current detector.



120 V Version
( ): 220/240 V Version

Figure 2-12. Switching Circuit (When PC1 Operation)



120 V Version
( ): 220/240 V Version

Figure 2-13. Over-Current Protection (OCP)

2.3.6 +5 VDC Regulator Circuit

Figure 2-14 shows the +5 VDC Regulator Circuit.

The +5V DC is generated from the +24V DC by means of a chopper-type switching regulator circuit utilizing a TL494. Through the 13-pin of the output control terminal, the TL494 can cause the IC to operate in either push-pull or parallel mode. Here, the 13-pin is LOW, and parallel action is in effect. In other words, the operation of the IC's two output transistors will be exactly alike.

The IC incorporates an internal oscillating circuit. The oscillating frequency is determined by the external inputs to pins 5 and 6. In this circuit, the frequency, set by R29 and C25, is about 27kHz.

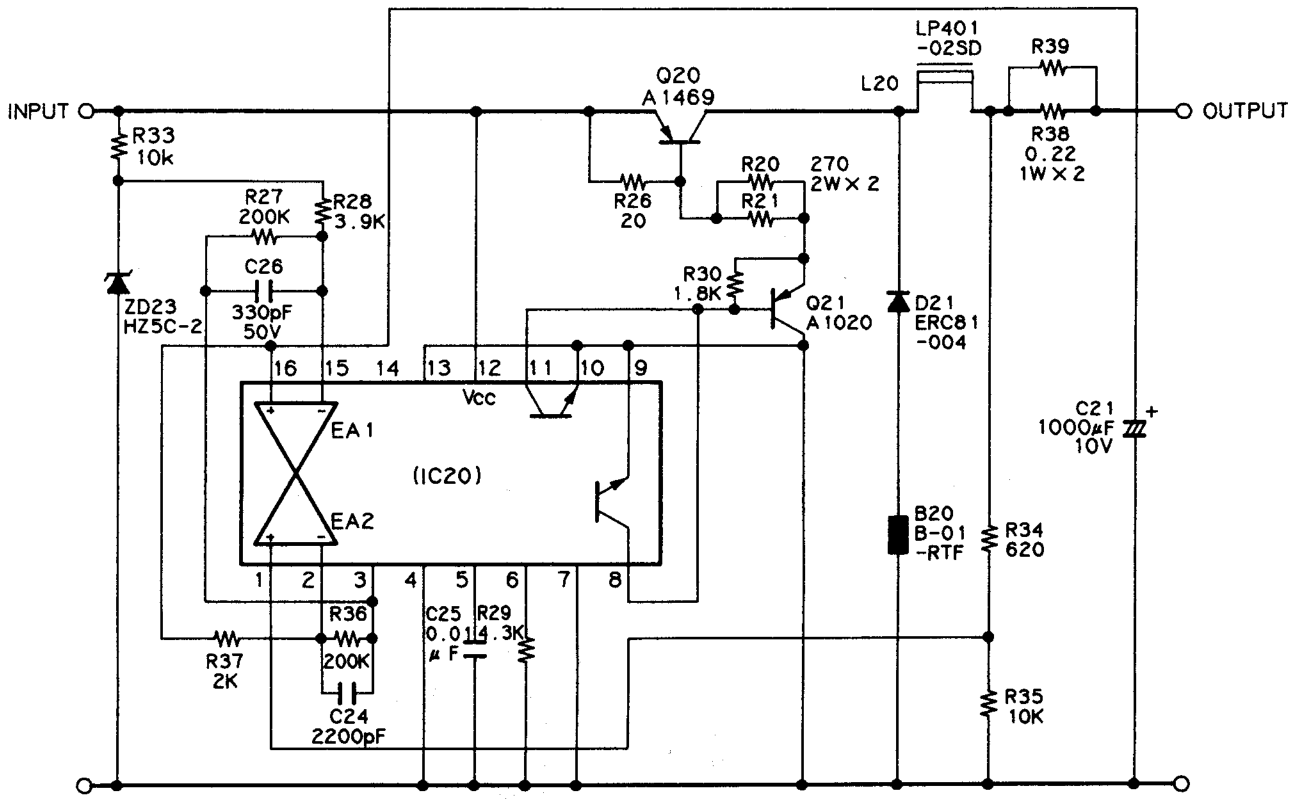


Figure 2-14. +5 VDC Regulator Circuit

EA1 and EA2 in the IC are error amplifiers. EA2 is used to detect the output voltage. Figure 2-16 illustrates the setting of the output voltage.

The rated voltage of Zener diode ZD23 is 5V. Accordingly, 5V is input at the negative terminal of EA2.

The error amplifier works to bring the voltages at the positive and negative terminals into conformance. Voltage is output, when necessary, to bring the voltage at the positive terminal to 5V.

Figure 2-17 shows the EA2 output conditions. If the voltage of pin 16 becomes higher than that of pin 15 (i.e., if over-voltage occurs), EA2 begins output. PWM is activated on the basis of the output level, and the circuit's output voltage is lowered. (Further details are provided subsequently).

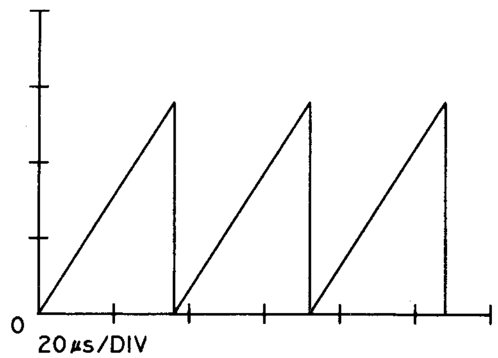


Figure 2-15. Oscillator Waveforms

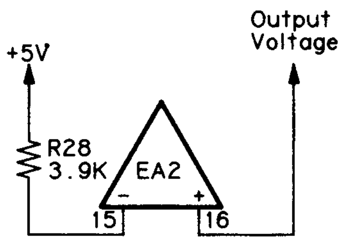


Figure 2-16. Constant Voltage Control

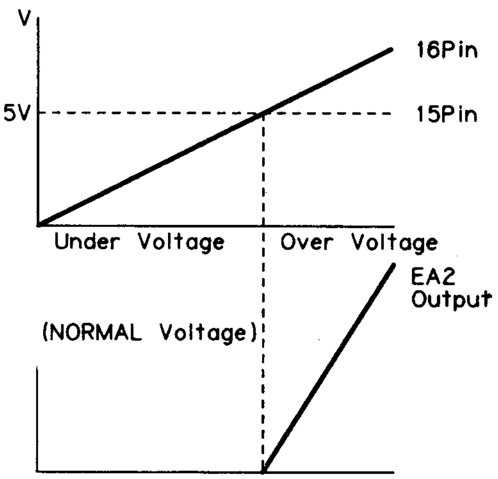


Figure 2-17. EA1 Output

EA1 is used to detect excessive output current. Figure 2-18 illustrates the mechanism.

The output voltage is input to the negative terminal, and, in order for equal voltage to appear at the positive terminal,

$$\frac{\text{(OUTPUT VOLTAGE)}}{\text{R35}} \times \text{R34/(R39//R38)} = 1$$

R35 becomes the load current flow (see Figure 2-18). In other words, higher current than this will trigger over-current protection, the output voltage will be reduced, and the current will thereby be restricted.

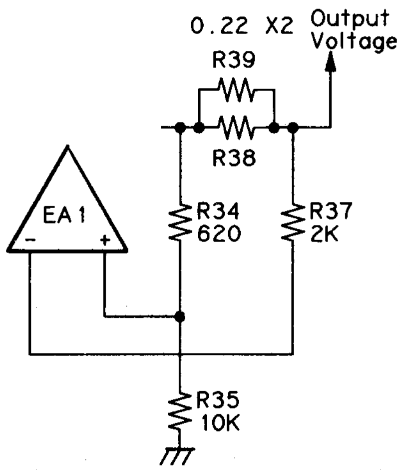


Figure 2-18. Over-Current Protection (OCP)

Pulse Width Modulation (PWM) Circuit

Figure 2-19 shows the internal circuit of the TL494IC.

The output control (pin 13) is fixed at "L", and the IC's internal push-pull circuit is therefore never used.

The wired OR of the EA1 and EA2 outputs is input to the negative terminal of the PWM, a sawtooth waveform from the oscillator is input to the positive terminal, and the PWM modulated waveform is output as shown in Fig. 2-20.

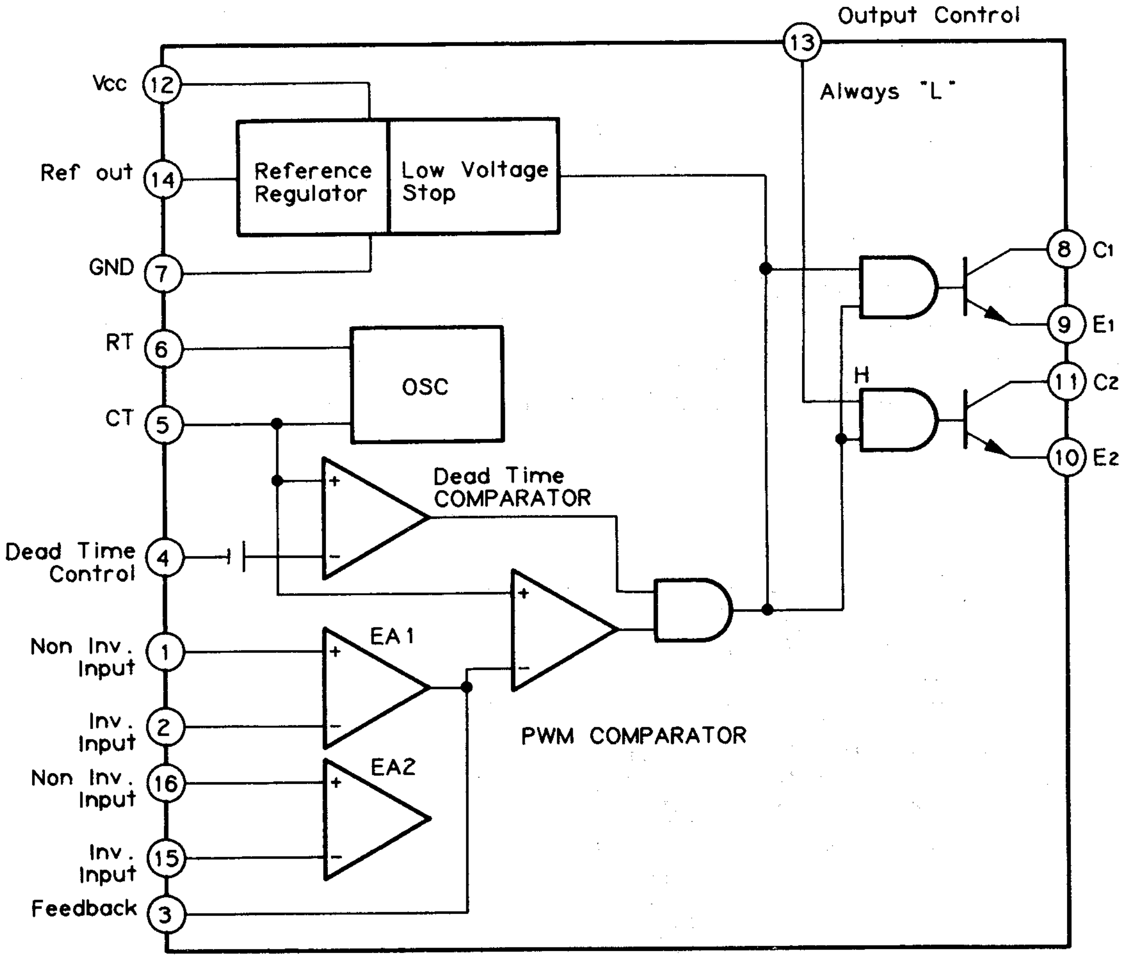


Figure 2-19. IC 494 Internal Circuit

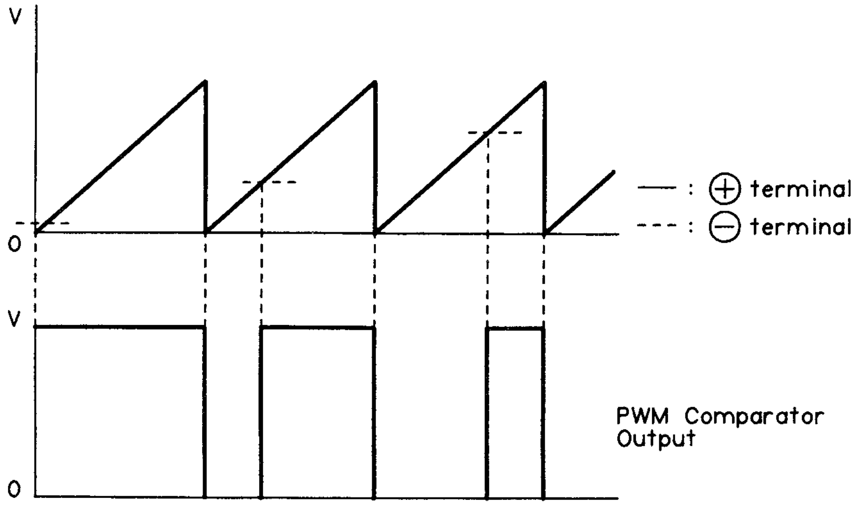


Figure 2-20. PWM Output

This circuit does not perform dead time control.

2.3.7 Voltage Limiting Circuit

Figure 2-21 shows the Voltage Limiting Circuit.

In this circuit, switching transistor Q1 will go off if the voltages on the +24V line reaches about +30V, or if the voltage on the +5V line reaches about +6V. Zener diode ZD22 is used to detect abnormal voltage on the +24V line; Zener diode ZD21 is used on the +5V line.

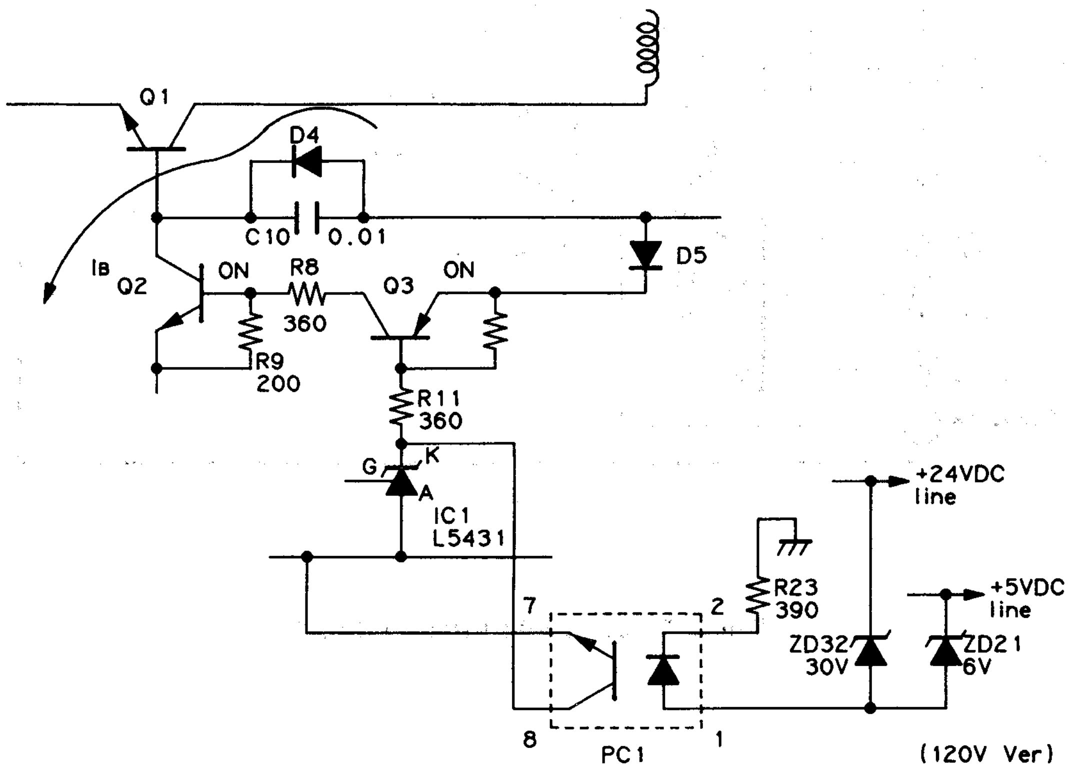


Figure 2-21. Voltage Limiting Circuit

2.3.8 ±12 VDC Supply Circuit

The voltage from the transformer is rectified by D22 or D23, and + 12V DC is produced. Theory suggests that load variations can cause large variations in the output voltage. In particular, output voltage may be quite high under no-load conditions. To prevent this problem, dummy resistors R24 and R25 are inserted into the circuit.

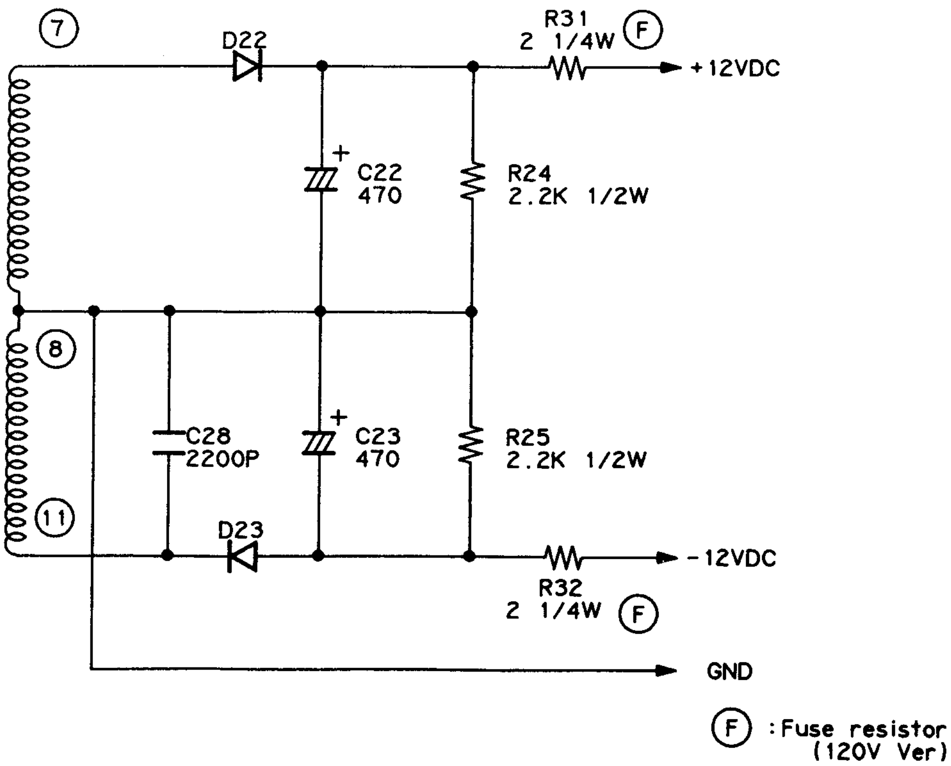


Figure 2-22. ±12 VDC Supply Circuit

2.4 CONTROL CIRCUIT AND PRINTER MECHANISM OPERATION

This section explains in detail the operation theory of the various parts of thecontrol circuit and printer mechanism.

2.4.1 Operation of the Paper Feed Mechanism

The operation of the paper feed mechanism, the drive circuit, and control circuit are explained here. The paper feed mechanism contains the following parts.

- Paper feed mechanism that drives the platen and tractor.
- TE holder mechanism
- PE sensor and TE sensor
- Paper change mechanism (friction tractor)
- CSF sensor

2.4.1.1 Paper feed mechanism

The paper feed mechanism is driven by the paper feed motor. The paper feed motor is a 4-phase stepping motor capable of bi-directional rotation, rotation in arbitrary amounts, and stopping. Motor power is transferred by the paper feed change mechanism to the platen (friction) and to the pull tractor unit (tractor). Specifications for the paper feed motor are shown below.

Type:	4-phase, 96-pole PM type pulse motor.
Drive voltage:	24VDC ±10% (applied voltage to driver)
Coil resistance:	2.7 ±0. 4ohm/phase (at 25oC)
Drive method:	2-2 phase excitation. Constant-current control.
Consumption current:	
Drive time:	Acceleration control time 1.0A/phase ±10% (Maximum chopping current, minimum average value). Speed reduction, constant-speed control time 0.74A/phase ±10%
Hold time:	0.04A/phase ±0.01A/phase (DC ammeter average current value)
Drive frecuency:	1440 pps (4.00 IPS) 950 pps (2.64 IPS) 800 pps (2.22 IPS) 500 pps (1.39 IPS) 340 pps (0.94 IPS)
Minimum feed pitch:	1/360" (approx. 0.07mm)/1 step

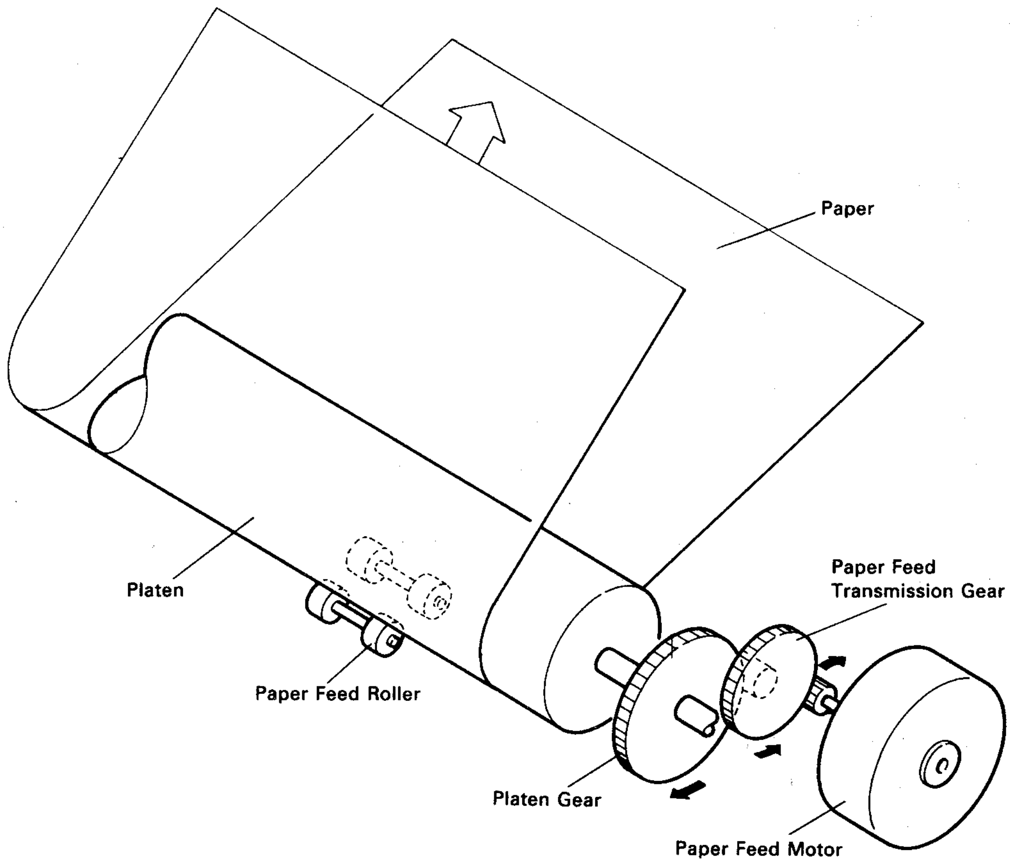


Figure 2-23. Friction Feed

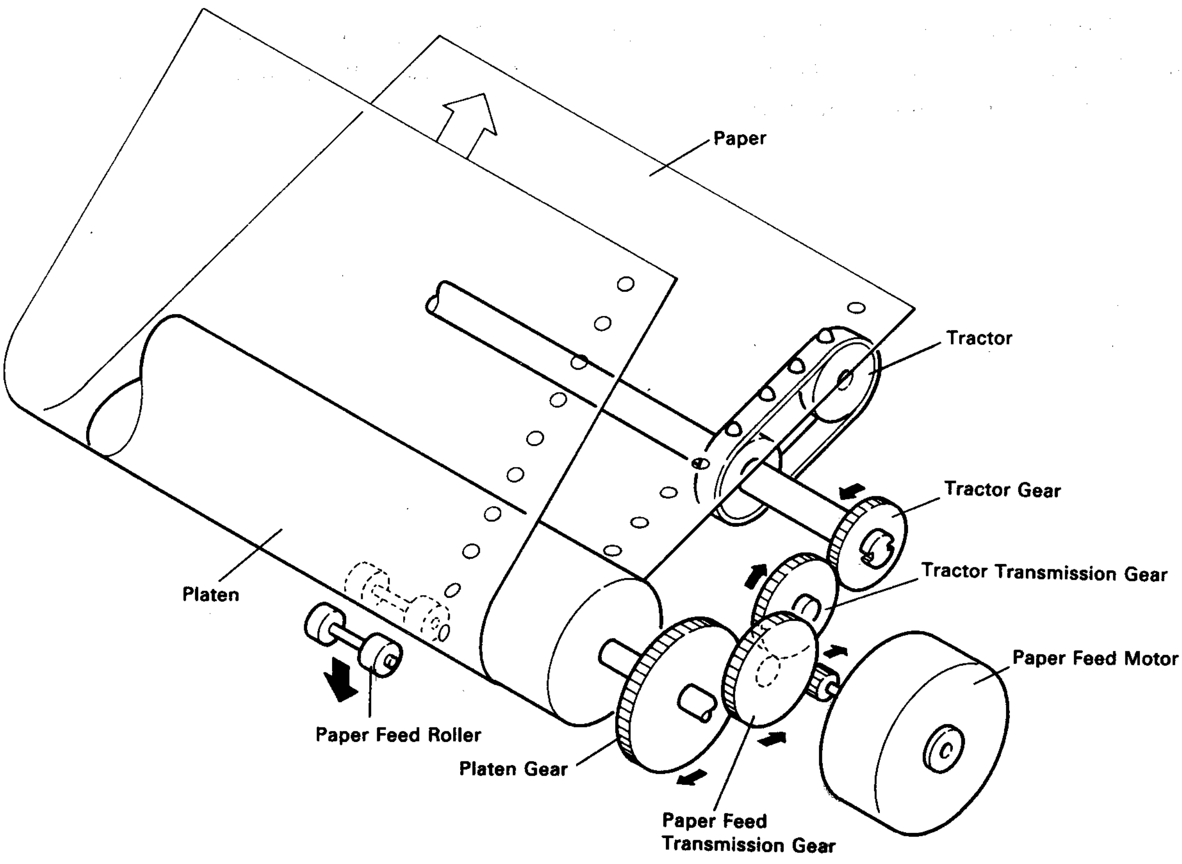


Figure 2-24. Tractor Feed

2.4.1.2 Paper Feed Motor Control

The block diagram for the paper feed motor control circuit is shown in Figure 2-25. In the main circuit, the paper feed motor phase switching is not directly carried out by the CPU, but is instead carried out by the DCU (2A) according to the pulse sent from the MMU (8B). The DCU is enabled by the MMIO 03 signal sent LOW from the MMU. After the DCU first sets addresses A0-A3, it sets the excitation method (2-2 phase or 1-2 phase) and the rotation direction (CW or CCW) according to the SCK/RCK port settings and, if the pulse (PTFM signal) is input from the MMU to the TM1 terminal, automatic phase switching of the stepping motor is carried out.

The operation wave forms for the TM1 and DFA/A signals are shown in Figure 2-26. Furthermore, HIGH/LOW is set to ports P1-P3 according to similar address settings and the SCK/RCK port settings. Accordingly, control of the constant-current circuit is carried out.

The paper feed motor controls bi-directional rotation and paper feed stop at selected positions. From start to finish of one rotation sequence, there are five modes:

1. Pre-drive rush
2. Acceleration control
3. Deceleration control
4. Constant speed control
5. Post-drive rush

The phase switching time settings (PFTM pulse switching time) are different for each mode. Refer to Figure 2-27. As Figure 2-27 shows, the firmware determines time setting data (PFTM pulse switching time) for five speeds and selects the correct speed for the drive state (micro feed, continuous feed, one-line feed, and CSF). Constant-current control is carried out to achieve phase switching, to vary the motor torque, and to regulate the level.

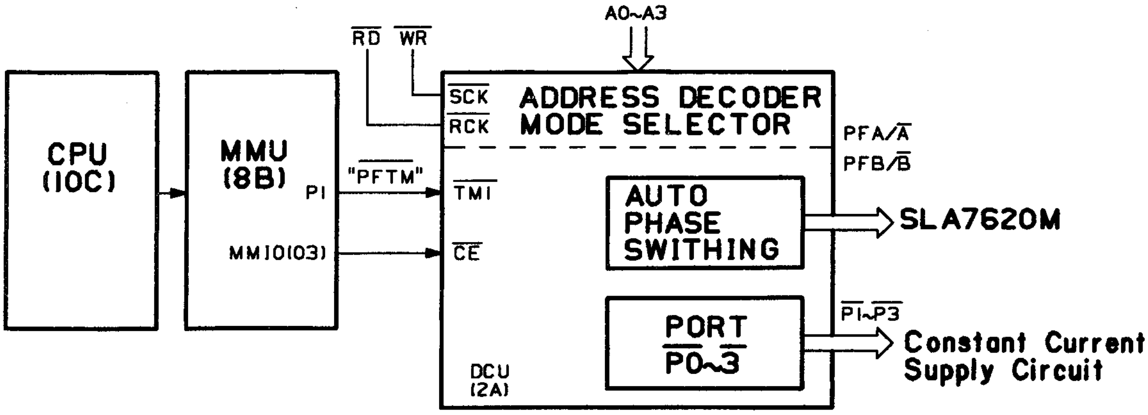
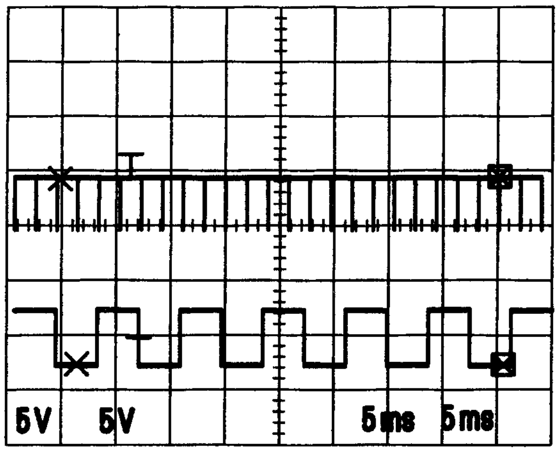


Figure 2-25. Paper Feed Motor and Control Circuit Block Diagram



Upper step: TM1 signal Lower step: PFA/A signal

Figure 2-26. TM1 Signal and PFA/A Signal Operation Wave Forms

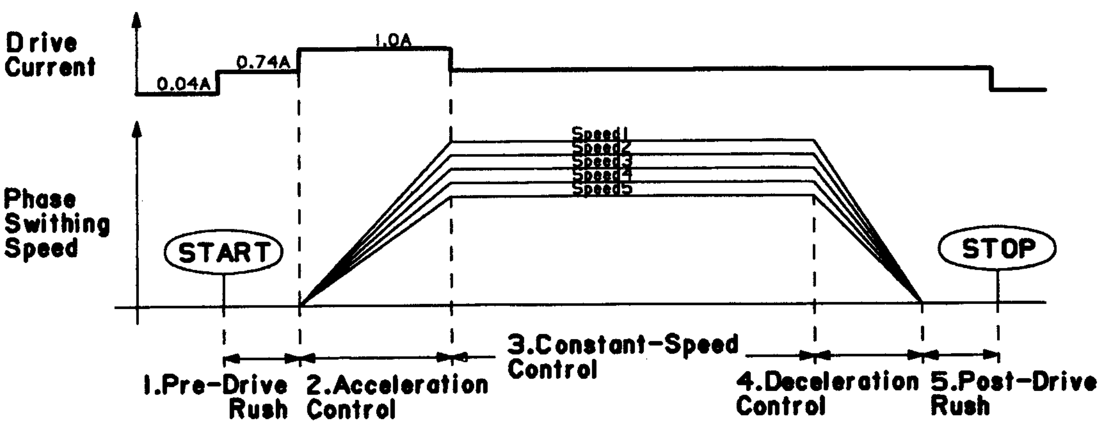


Figure 2-27. Paper Feed Motor Control Sequence

2.4.1.3 Paper Feed Motor Drive Circuit

This circuit uses the SLA7020M to drive the paper feed motor at a constant speed. Refere to the Appendix for the SEIMA Board Circuit Diagram (location 2-3/I-J).

The SLA7020M is a hybrid IC that uses a constant-current driven stepping motor. The value of the current is determined by the value of the external voltage input. The IC is divided into two phases, AB (AA) and CD (BB), that use the same circuit.

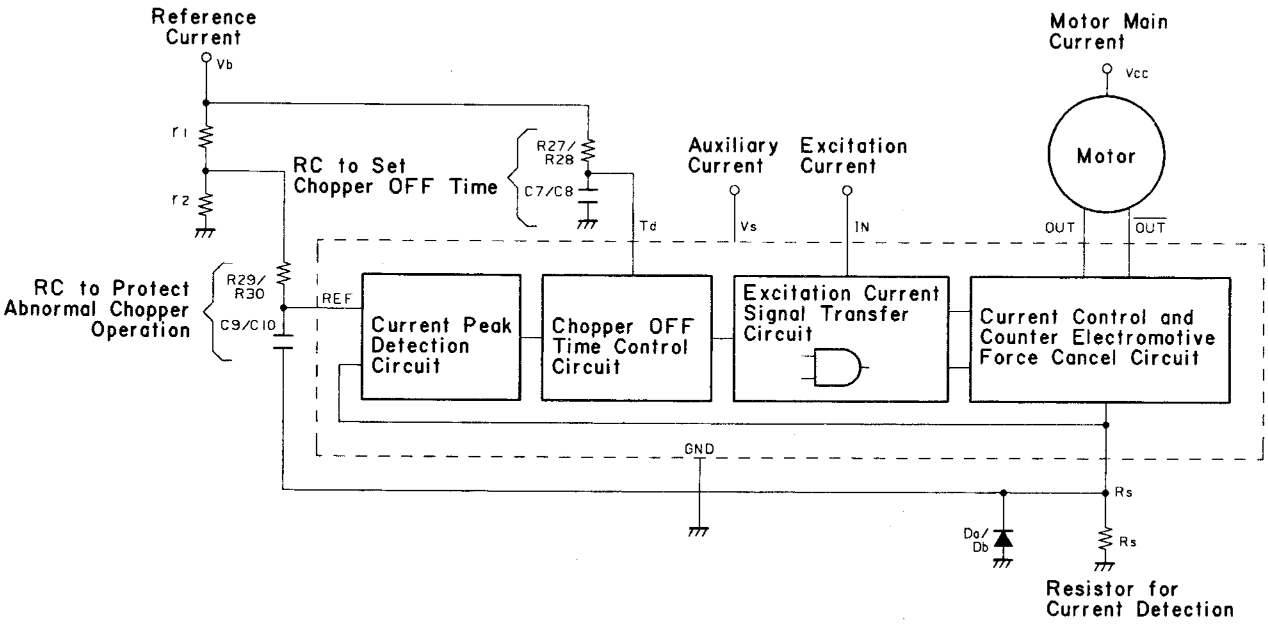


Figure 2-28. SLA 7020M Internal Block Diagram

- Constant-Current Drive Circuit

  The constant-current drive circuit (A phase only) is shown in Figure 2-29, and the various operation wave forms are shown in Figure 2-30. Figure 2-28 shows current peak detection, chopper off time controller, current control, and counter electromotive force cancellation circuits for the constant-current drive circuit. Vref in Figure 2-29 shows the standard voltage which determines the amount of peak current that flows to resistors R27 and R28. Resistors R21, R22, and condensers C6, C7 determine the chopper OFF time. The operation process for the constant-current controller of the main circuit is shown below.

Peak Current Detection (t0, t1):

(1) MOS FET Q1 when excitation input I (A1,B1) is ON. Current I ON then flows to the wave line channel to excite the A coil.

(2) The voltage of resistors R27 and R28 rises in proportion to the I ON gain.

(3) f the voltage that runs to resistors R27 and R28 exceeds Vref, COMP 1 reverses, and the Td voltage drops to 0V.

(4) If Vtd drops and falls below the COMP 2 threshold voltage, COMP 2 reverses.

(5) According to the reversal of COMP 2, Q1 gate voltage goes LOW, and COMP 2 turns Q1 OFF.

Chopper OFF Time (t1, t2) Control:

(6) f Q1 goes OFF, a counter electromotive force is generated to the motor coil. For this purpose, the coil current channel switches from I ON to I OFF.

(7) When I OFF flows, the direction of the current that flows to resistors R27 and R28 changes. The COMP 1 feedback voltage VRS (V-) drops from Vref, and COMP 1 again reverses.

(8) The COMP 1 output stage is housed in the open collector circuit. In (7), because COMP 1 output goes HIGH, the Td voltage Vtd slowly operates according to the time constants of resistor R10 and condenser C46.

(9) Until the Td voltage reaches the standard voltage (2V) of COMP 2, the FET gate voltage maintains the OFF state.

The operation time from 0-2V for the Vtd is suitable for the OFF time TOFF.

Chopper ON Time (t2, t3) Control:

(10)When the Td voltage Vtd reaches the standard voltage (2V) of COMP 2, COMP 2 reverses, and Q1 goes ON.

(11) When Q1 goes ON, the current flow switches from I OFF to I ON.

(12) For the power voltage Vcc, I ON waits a long time according to the constant time of motor coil A, and then slowly begins to operate.

(13) The electric potential of resistors R27 and R28 rise in proportion to the I ON gain. Until Vrs reaches Vref, Q1 supplies I ON current from the power source to the motor while maintaining the ON state. The time for VRS to reach Vref is suitable for ON time T ON.

Hereafter, steps (6)-(13) repeat, chopper operation is carried out, and the motor current is controlled. Furthermore, the sum of the chopper ON and OFF times is suitable for the motor drive frequency.

● DCU Constant-Current Control

Table 2-3 shows the standard voltage Vref. According to the combination state of DCU (2A) ports P1 and P2, the potential ratio combination of resistors R23, R11, R12, and R29 switches, and the applied standard voltage switches to RF terminals A and B of SLA7020M. The stepping motor is powered by the current propor-tionalized to Vref voltage. Transistors Q7 and Q8 go ON by port P3 of the XDCU (2A) going LOW. Accordingly, if the Td terminal is ground level, the motor can be stepped arbitrarily.

Table 2-3. Standard Voltages

P1	P	Standard Voltage (V:Calculated Value)
H	H	0.054
H	L	0.914
L	H	0.055
H	H	1.268

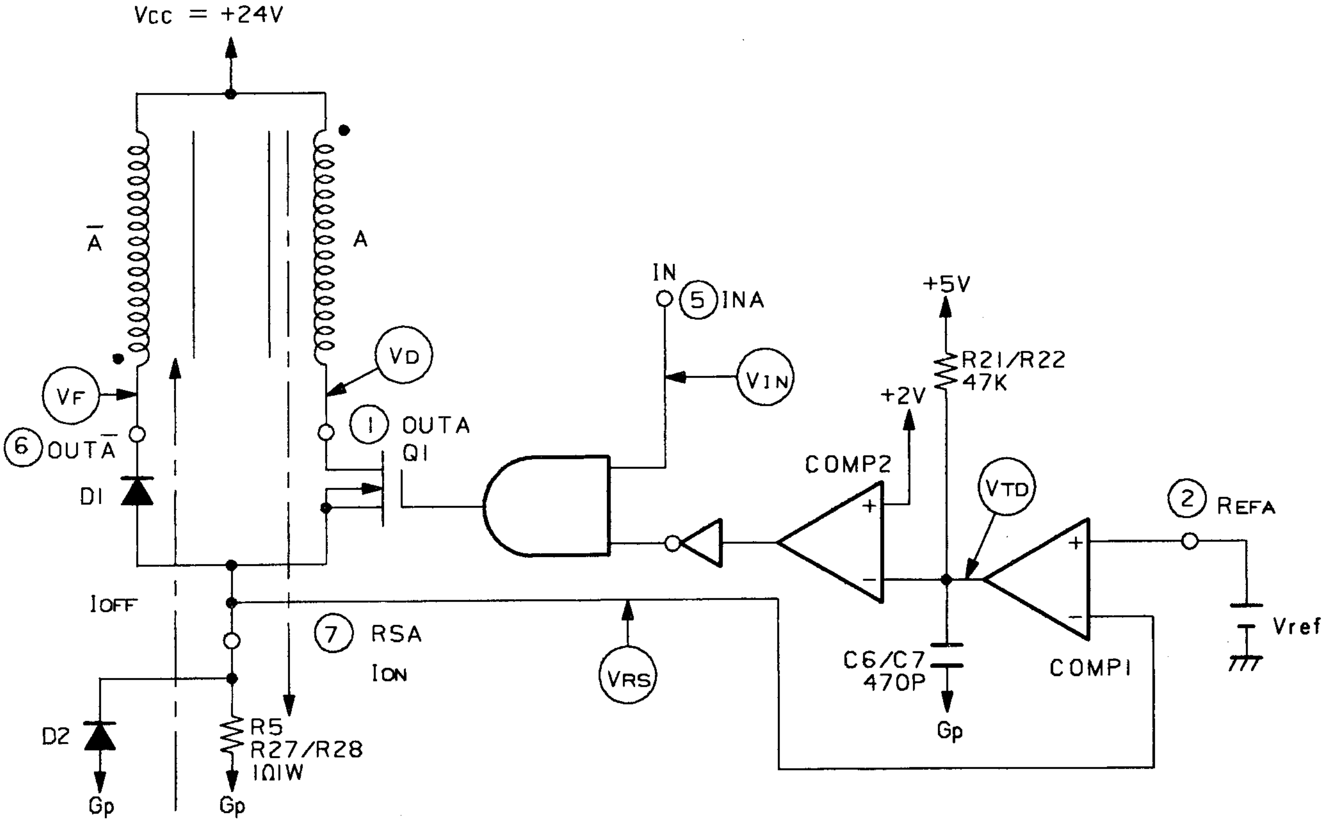


Figure 2-29. Constant-Current Drive Circuit

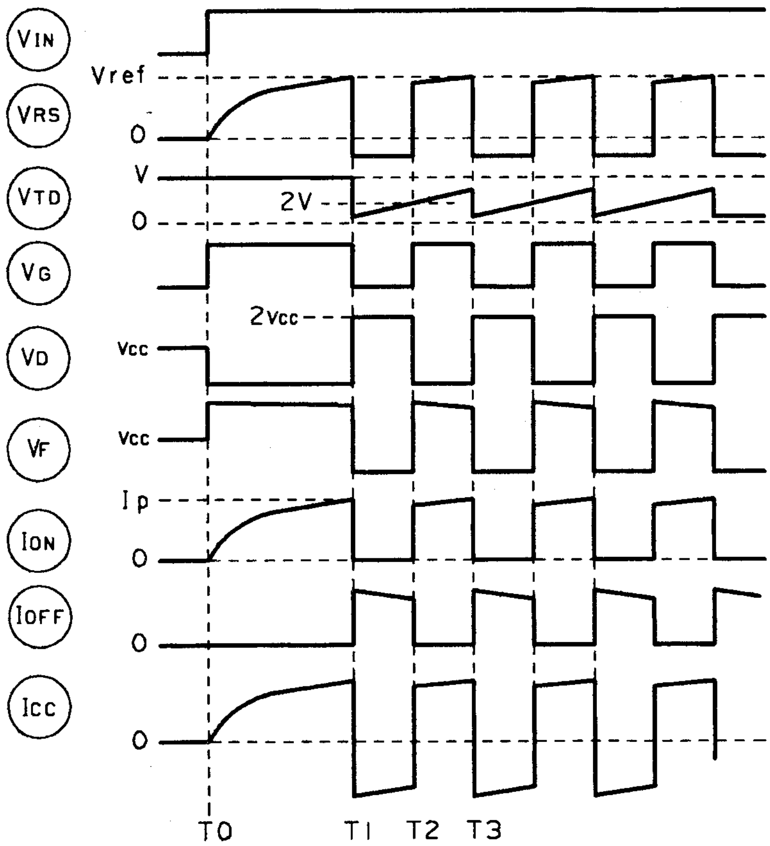


Figure 2-30. Section Operation Wave Forms

● Excitation Signal Send Circuit Section

In a normal stepping motor controller IC, 4-phase data is directly input into the IC, but with the SLA7020M, special phase data must be input. In the main unit, motor drive control is 2-2 phase only. Figure 2-31 shows the excitation signal send circuit. The SLA7020M has only one A phase side excitation signal input. The output is divided into the A phase output and the A phase output that passes through the converter. For this reason, when the excitation signal input IN goes HIGH, the A phase output side goes ON, and when input IN is LOW, the A phase output goes ON. The B phase works in the same way. Figure 2-32 shows the 2-2 phase excitation timing chart.

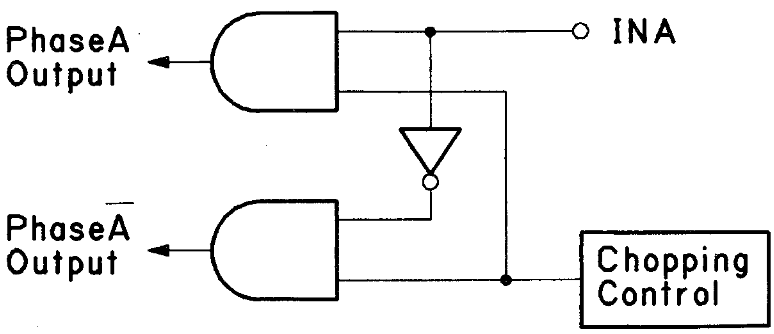


Figure 2-31. Excitation Signal Input Circuit

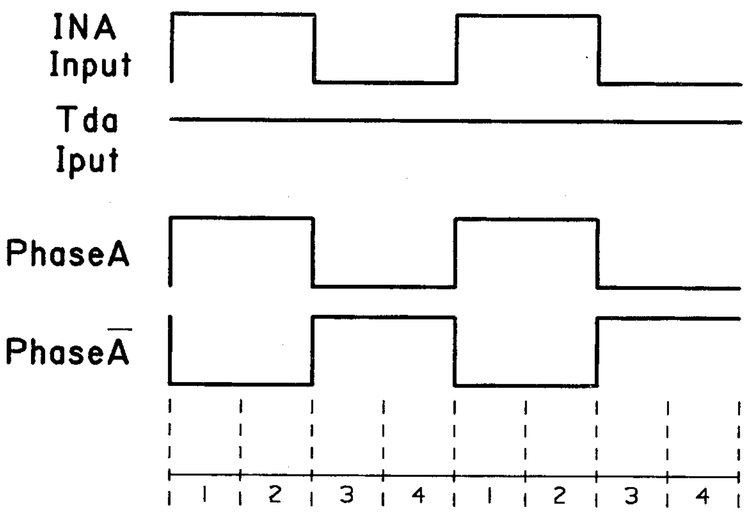


Figure 2-32. 2-2 Phase Excitation Timing Chart

2.4.1.4 Top Edge Holder Mechanism Operation

The top edge holder (TE holder) is driven by the power of the top edge holder motor (TE motor). The TE motor is a 4-phase stepping motor capable of bi-directional rotation, rotation in arbitrary amounts, and stopping. Motor power is transferred to the TE holder arm by the TE reduction gear. Accordingly, the TE holder plate moves forward and backward.

TE holder motor specifications are listed below.

Type	4-phase, 8-pole PM type pulse motor
Drive voltage	24VDC ±10%
Coil resistance	42±2.1 ohms/phase (25°C)
Drive method	2-2 phase excitation, constant-voltage control
Consumption current	Maximum time: 0.66 A/phase (26.4V, 39.9 ohms)
	Drive time: ave. 0.32 A/phase
	Hold time: 100mA/phase
Drive frequency	360 pps (4 IPS)
Feed pitch	4/360" (approx. 0.279)/1 step

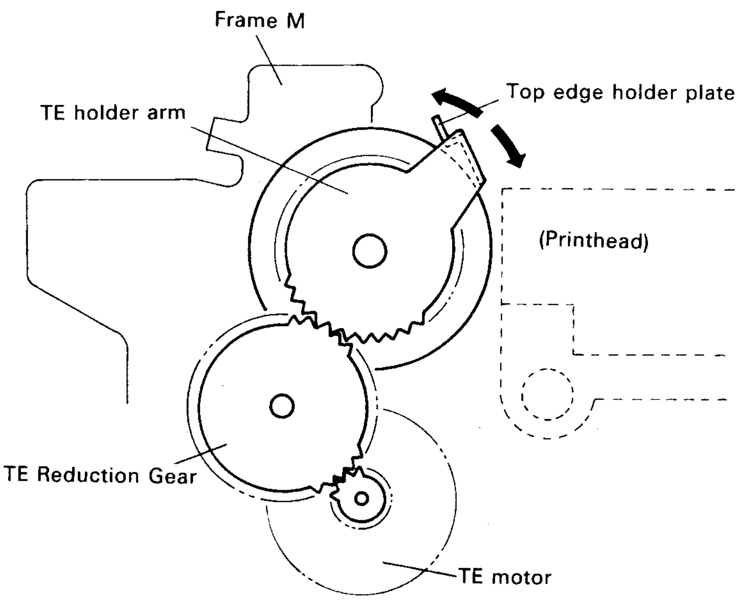


Figure 2-33. TE Holder Mechanism

2.4.1.5 TE Holder Motor Control

Figure 2-34 shows the block diagram of the TE holder motor control circuit. In the main circuit, motor phase switching is not directly carried out by the CPU, but is instead carried out by the DCU (2A) according to the pulses sent from the MMU (8B). The DCU is enabled by the MMIO3 signal LOW sent from the MMU. After the DCU first sets addresses A0-A3, it sets the excitation method (2-2 phase or 1-2 phase) and the revolution direction (CW or CCW) according to the SCK/RCK port settings and, if the pulse (TETM signal) is input to the TM2 terminal by the MMU, automatic switching of the stepping motor is carried out. The operation wave forms for the TM2 and TEA signals are shown in Figure 2-35. Furthermore, HIGH/LOW is set to port PO according to similar address settings and SCK/RCK port settings. Accordingly, switchover of the common voltage is carried out (TEENB signal). The firmware drives the TE holder motor with the two different speeds shown below.

(1) Synchronous mode

This drive is for when the platen (paper feed motor) turning speed and the TE holder plate speed are approximately equal, such as when the print characters are near the top edge of the paper, micro feed, and line feed. While the paper feed motor is driven in the 4-phase mode, the TE holder is driven in the 1-phase mode.

(2) Independent mode

When re-supplying paper, this drive is for when the TE holder plate only operates independently, such as when it moves to the paper guide auxiliary plate position or when it returns to its home position. This operation is for normal and independent revolution operations, and from the revolution operation until it stops, the following operations are realized:

1. Acceleration control
2. Constant-speed control
3. Main control

In each mode, the phase switching time settings (TETM pulse switchover time) differ. (See Figure 2-36)

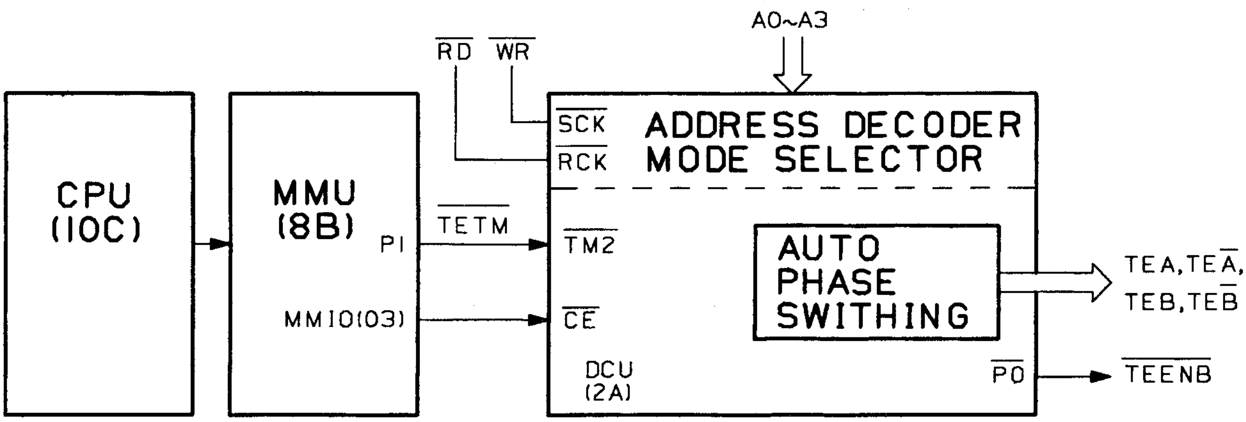
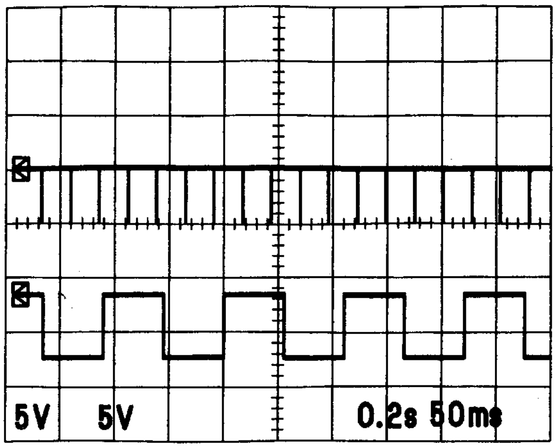


Figure 2-34. Top Edge Holding Control Circuit Block Diagram



Upper step: TM2 signal Lower step: TEA signal

Figure 2-35. TM2 Signal and TEA Signal Operation Wave Forms

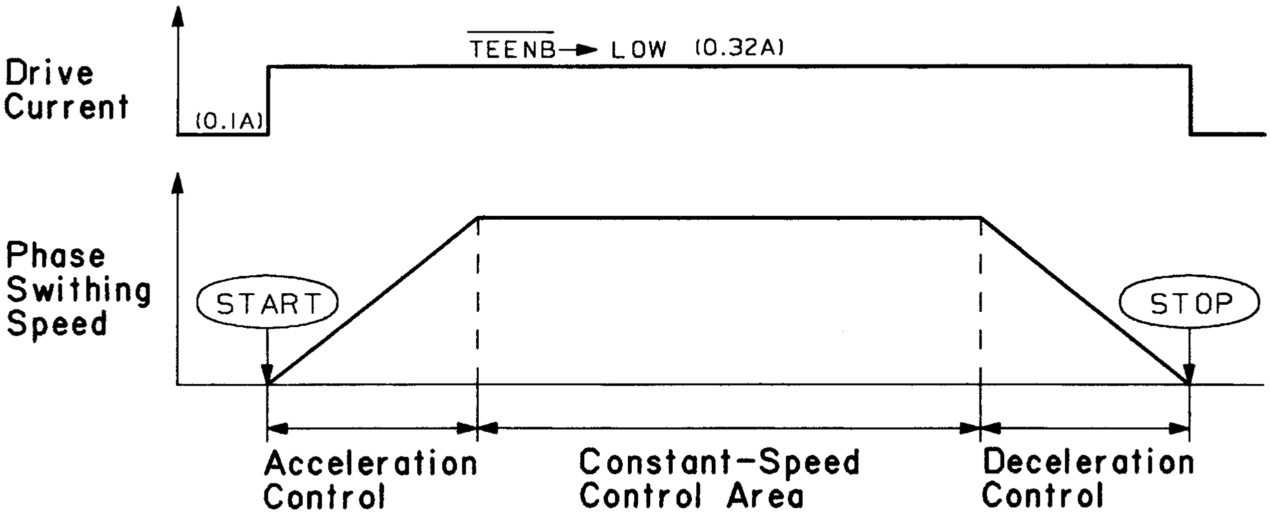


Figure 2-36. Top Edge Holding Motor Control Sequence (Independent Mode)

2.4.1.6 Top Edge Holder Motor Drive Circuit

Figure 2-37 shows the drive circuit of the top edge holder motor. (Refer also to Locaton 2-3/J-K of the SEIMA Board Circuit Diagram in the Appendix).

The motor is operated by common voltage switching based on the TEENB signal, and by phase switching of transistors Q11-Q14. In A2 – D2 of the phase switching signal board, only those phase coils which become high receive the common voltage. The waveforms at point A and B of Figure 2-37 are shown in Figure 2-38.

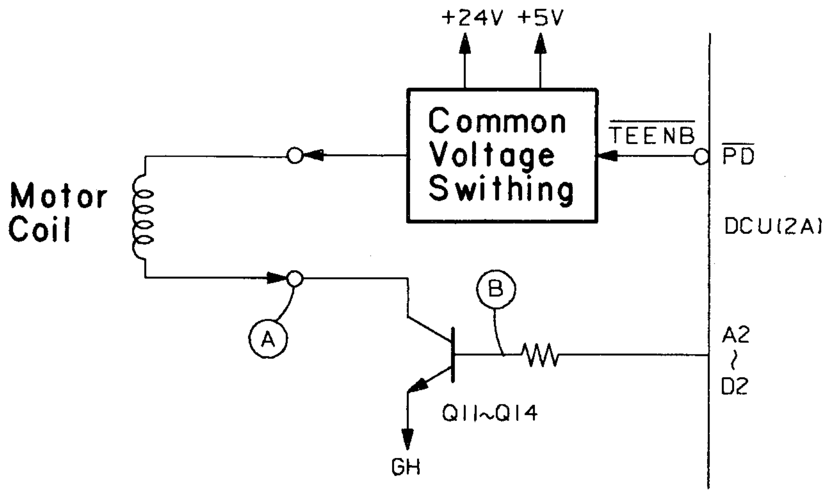
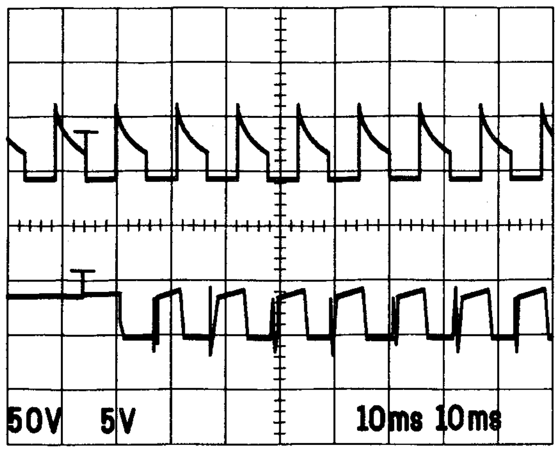


Figure 2-37. Top Edge Holder Motor Drive Circuit



Upper: Q11 – Q14 collectors (A waveform)
Lower: Q11 – Q14 Bases (B Waveform)

Figure 2-38. Operating Waveforms for the Top Edge Holder Motor Driver Circuit

2.4.1.7 Paper-end Sensor and Top-edge Sensor

This section describes the basic operating principles of the PE (paper-end) and TE (top-edge) sensors.

The PE sensor is located beneath the platen and paper guide, and senses the presence or absence of paper. Sensing is performed using a photo-interrupter.
If paper is supplied and the lever is depressed, the lever that normally covers the photo-sensor will be released, and a LOW signal will be output.

The TE sensor detects the presence or absence, at the paper bail, of the top edge of the paper. Operation is as follows. The TE roller is linked to the photo-interrupter through the lever. If the paper-end is present, there will be pressure on the roller, which will cause the lever that normally covers the photo-sensor to be released, which in turn will cause a LOW signal to be output.

Paper feed, paper eject, paper changeover, and the TEAR OFF function are controlled in accordance with the signals generated by the PE and TE sensors.

For both PE and TE sensors:

Detection Method:	Photo-interrupter
Collector withstand voltage:	30VDC
Shunt regulator:	0.3mA or less (at 10VDC)

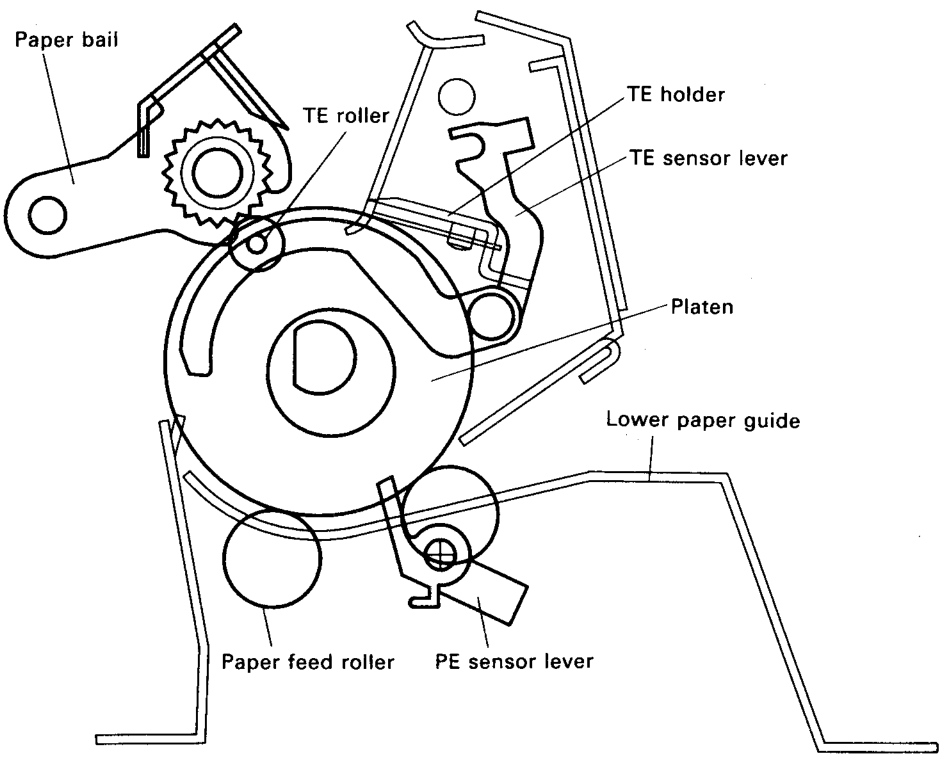


Figure 2-39. PE Sensor and TE Sensor

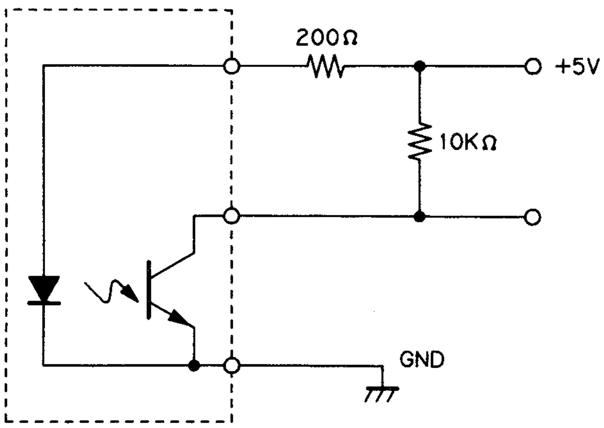


Figure. 2-40 Sensor Interface

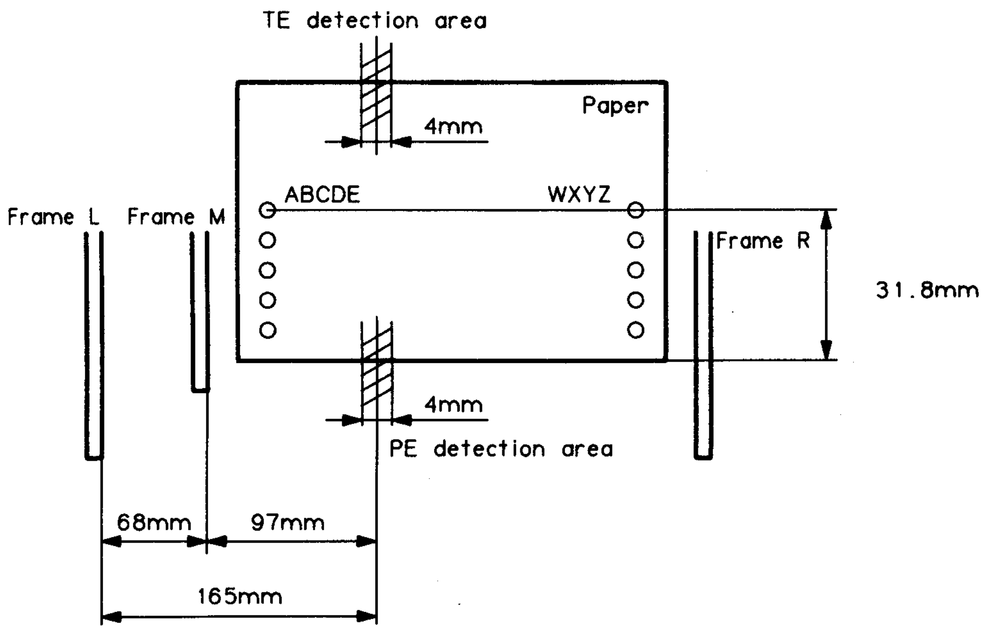


Figure 2-41. Senor Detection Area

2.4.1.8 Paper Change Mechanism (Friction Tractor)

Paper changeover is effected by means of the release planetary gear, which leads the paper feed motor's power based on the action of the release solenoid. The release solenoid generates switching of the trigger lever.

When the trigger lever is "closed," the release planetary gear is locked, so that the planetary gear does not interact with the paper feed gear. Therefore, the paper feed motor can only perform normal paper feed.
When the trigger lever is "open," the planetary gear is connected to the paper-feed motor, and the motor's operation is as follows:

When feeding is in normal direction: switchover is from friction mode to tractor.
When feeding is in reverse direction: switchover is from tractor mode to friction mode.

The type of mode in use is detected by means of the release sensor, which is a microswitch attached to the release lever. When friction mode is in effect, the release lever is open; and when tractor mode is in effect, the release lever is closed.

Release Lever Specifications

Detection method:	Microswitch
Voltage:	5VDC±5% (Resistance load)
Current:	1.0 – 5 mA

Release Trigger Solenoid Specifications

Type:	DC solenoid
Drive voltage:	24VDC±10%.
Coil resistance:	33.5 ±7%
Drive current:	Average – 716mA
	Maximum – 847mA

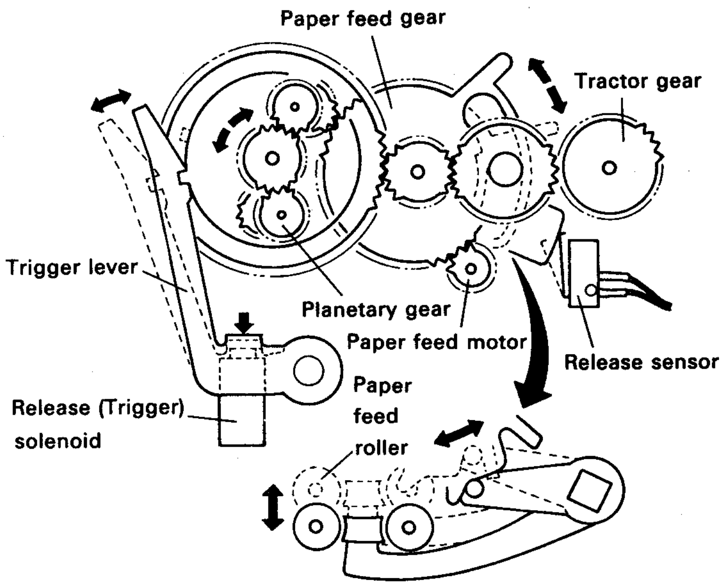


Figure 2-42. Paper Change Mechanism

2.4.1.9 Control Circuit for the Paper Change Mechanism

Figure 2-43 is a block diagram of the control circuit for the paper change mechanism. (Refer also to Location 2-H of the Seima Board Circuit Diagram in the APPENDIX).

The release solenoid is driven in accordance with the RSEN signal sent from the general-purpose port P10 of the PIF gate array (12C).

When RSEN is HIGH, +24VDC is applied to the release solenoid; the release sensor signal is also input to PIF port P11. An RSEN signal LOW is used to indicate that tractor feed has been selected.

Figure 2-44 shows the operating waveforms for the release solenoid drive.

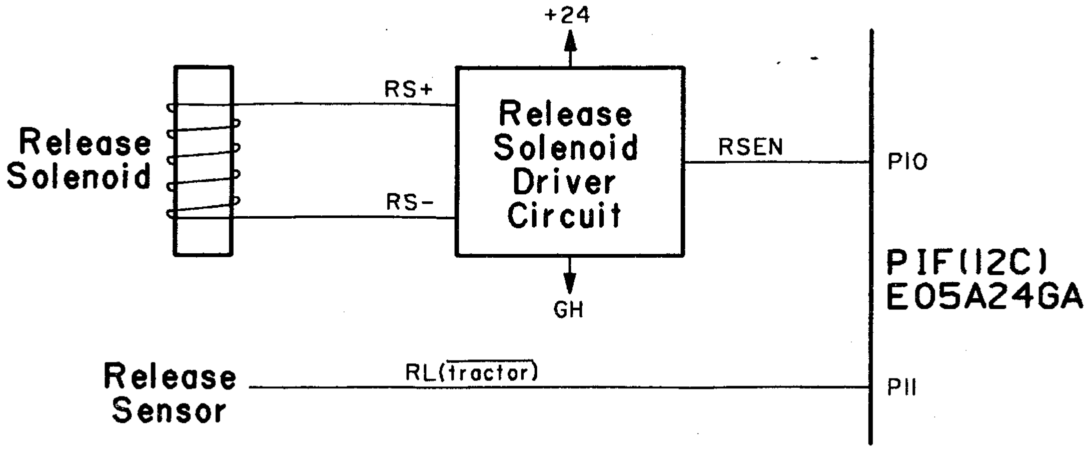
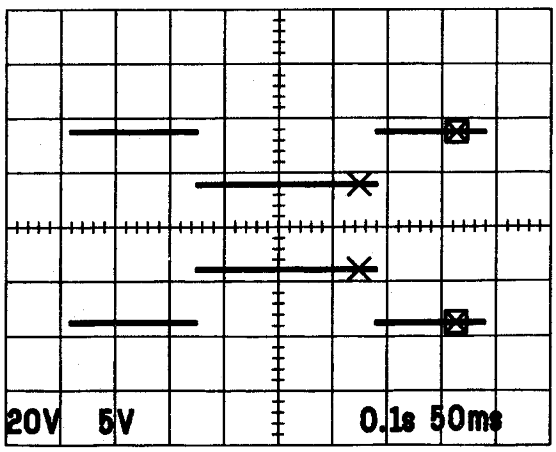


Figure 2-43 Block Diagram of Paper Change Mechanism Control Circuit



Upper: RSEN signal
Lower: Collector for transistor Q20

Figure 2-44. Waveforms for Release Solenoid Drive Operation

2.4.1.10 CSF Sensor

The CSF sensor, which is a leaf switch, is located at the bottom side of the frame (M). The detects the presence or absence of the CSF unit. If the CSF unit is not in place, the leaf switch is open; otherwise, the leaf switch is closed.

CSF Sensor Specifications

Sensing method:	Leaf switch
Voltage:	5VDC$\pm$5% (Resistance load)
Current:	0.6 – 1.0 mA

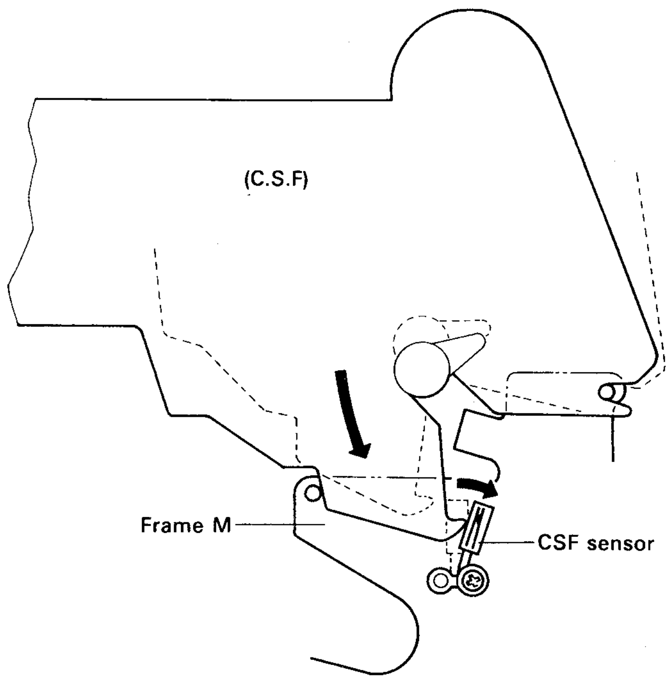


Figure 2-45. CSF sensor

2.4.2 Operation of the Print Mechanism

The print mechanism is constituted of the following:

- Carriage mechanism (carriage, carriage motor, and carriage home position sensor)
- Printhead

2.4.2.1 Carriage Mechanism

A timing belt is fixed to the base of the carriage, and is driven by the carriage motor by means of a pulley. The operation of the timing belt causes the carriage (together with the printhead) to move left and right along the axle.
Carriage guide shaft A, the cross-sectional shape of which is elliptical, forms the mechanism that allows the platen gap to be adjusted with the lever.

Encoders A and B are located within the axle of the carriage motor's rotor, and guide the generation of the signals that control the carriage movement. Both encoders A and B output 120 signal pulses for each revolution of the carriage motor.

The encoder A phase (advance signal) and the encoder (delayed signal) have a 90 deg. phase difference, and the revolution direction of the carriage motor can be determined by a phase comparison. The encoder A phase detects carriage motor revolutions and control the speed; in addition, the A phase signals standard head drive (printing) timing.

The carriage home position sensor generates the carriage home position signal, based on which the print starting location is calculated. The sensor is comprised of a photosensor and the carriage detection board; when the board blocks the photosensor light, a HIGH signal is output. The interface of the carriage home position sensor and the control circuit is detailed in Section 2-40. (Identical to TE/PE sensors)
Figure 2-6 shows the carriage mechanism.

Carriage Motor Specifications

Type:	Encoder-attached DC motor (Bipolar, 7 slots)
Drive voltages:	24VDC$\pm$10% (motor section)
	5 VDC$\pm$5% (encoder section)
Maximum current:	3.0A (based on current limiting circuit)

Motor Section Specifications

Rated voltage:	24VDC
Rated current:	typ. 800mA
Rated torque:	200gf-cm
Rated revolution speed:	typ. 6400 rpm
No-load revolution speed:	typ. 7400 rpm
No load current:	typ. 150mA
Starting current:	typ. 5A
DC resistance:	3.2 $\pm$7% (at 20°C)
Insulation resistance:	min. 10M (at 500V)

Encoder Section Specifications

Type:	Magnetic-style encoder
Output phases:	A, B
Source voltage:	5VDC ±5%
Current:	max. 70mA
Response frequency:	min. 20.0kHz
Signal detection section:	Magnetic resistance element
Resolution:	120 p/r (equivalent to 180 pulses/inch)
Output levels:	"H" – min. 4.5VDC "L" – max. 0.4VDC
Output waveform:	Short waves
Duty ratio:	50%±20%
Phase difference:	90±30%

Carriage Home Position Sensor Specifications

Detection method:	photo-interruptor
Withstandable voltage:	to 30VDC
Sink current:	0.3mA (at 10VDC)

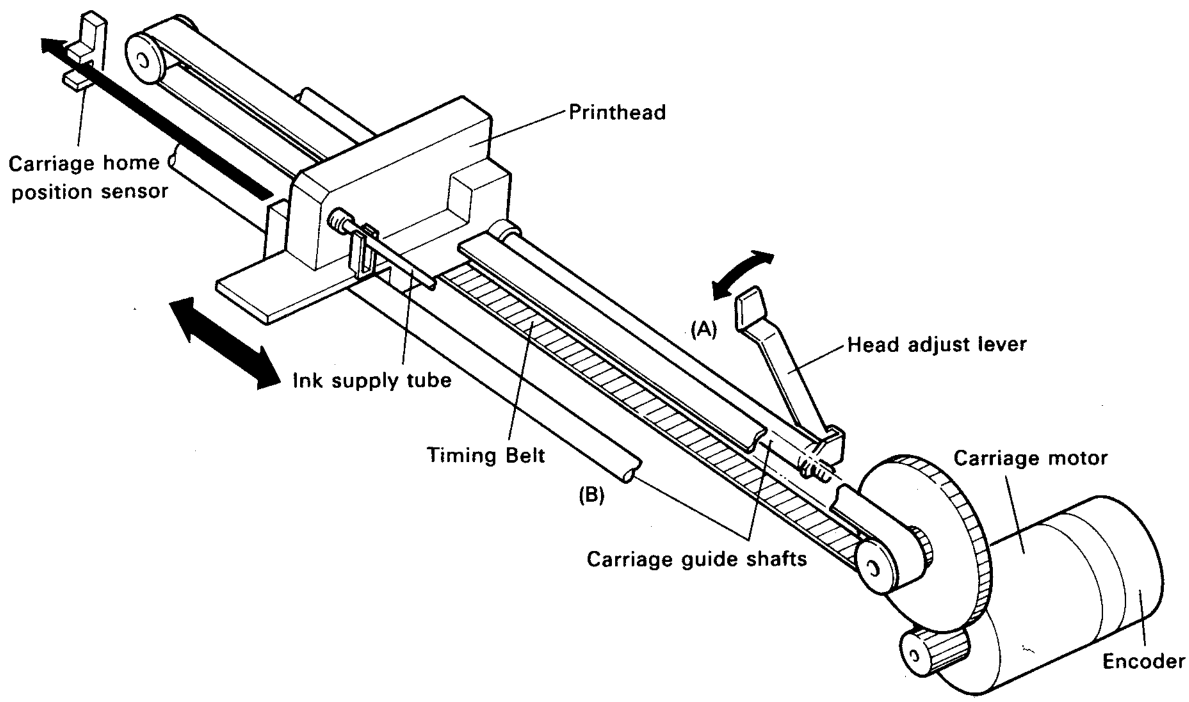


Figure 2-46. Carriage Mechanism

2.4.2.2 Carriage Motor Control

A block diagram of the carriage motor control circuit is shown in Figure 2-47.
(Refer also to Location 14-16/F-1 of the Seima Board Circuit Diagram in the Appendix).

Carriage motor control is not performed directly by the CPU. Rather, the DCU(4B) controls the motor based on the signals it receives from the CPU (MMIO control).

The DCU is enabled by a LOW MMIOO2 signal from the MMU.
The CPU sends motor control commands and revolution speed data to the DCU; this allows the motor speed to be controlled as desired. The DCU, meanwhile, detects position data and stop signals from the encoder and the carriage home position sensor, and provides this information to the CPU.

The encoder signal is also used as a basis for generating the print timing signal, which is output to the printhead control circuit. The functions of the carriage motor control circuit can be broadly divided into the following:

- Speed (revolution speed) control
- Drive current control
- Carriage position control (revolution counter, home position recognition, stop signal output)
- Print timing signal (PTS) generation

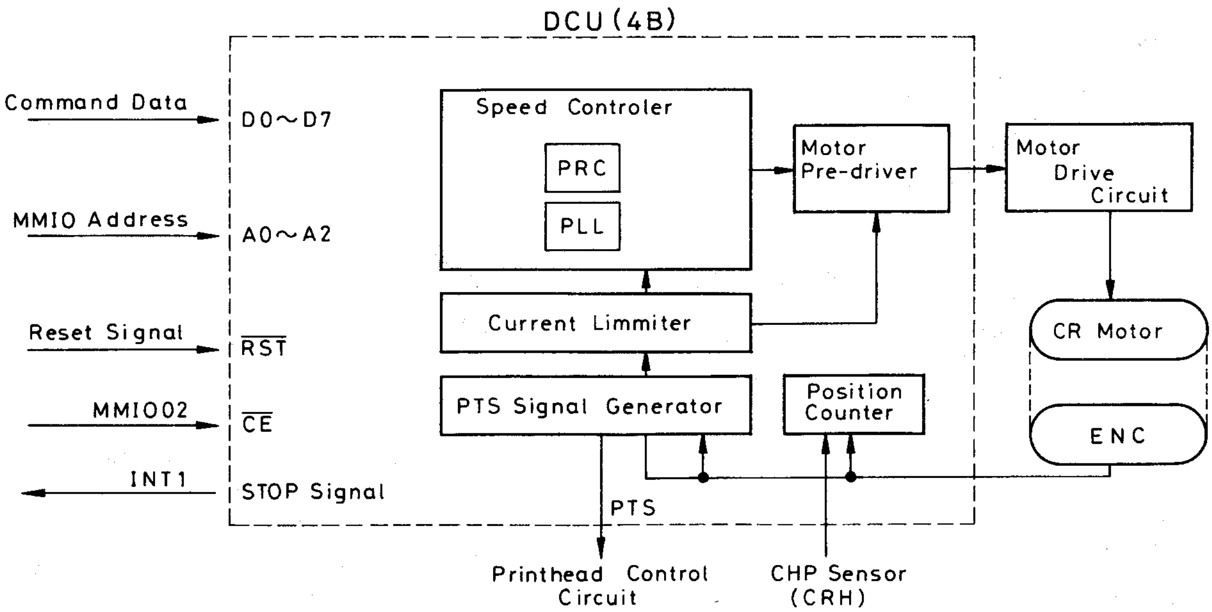


Figure 2-47. Block Diagram of Carriage Motor Control Circuit

2.4.2.3 Revolution Control

There are five basic motor revolution speeds (carriage speeds), each of which will operate in print speed, accelerated speed, or reduced speed mode. The speed setting is provided in the form of speed data; pulses from the standard data clock are counted; and the relevant frequency is provided to the control circuit. Revolution speed control is performed in accordance with the comparison, by the encoder, of this frequency with the pulse count that the encoder detects. In accordance with the speed selected, the speed control method is either phase-locked loop (PLL) or period control (PRC).

Table 2-4. Carriage speeds

Mode No.	Set speed (kHz)	Set frequency (μS)	Control type	Print density (DPI)
3	2.97	337	PLL	360
2	4.45	225	PRC	240
1	5.94	168		180
0	8.91	112		120

The set speeds shown above are the basic speed modes; i.e., the speeds which normally apply during printing. "Accelerated speed" or "reduced speed" modes are applied to these standard speeds on a line-by-line basis. This application is effected by supplying the necessary additional data to the DCU.

The clock used for this operation is provided by external oscillator CRI, with connects to DCU (4B) terminals XIN and XOUT.

If there are problems with this oscillator or its connection to the DCU, therefore, the carriage will completely fail to operate. The oscillation frequency is 614.4kHz.

<PLL Control>
The method by which PLL control is carried out by the control circuit may be explained as follows.

Movements away from the set speed are detected based on a phase comparison of the positive-going edge of the A phase signal (leading signal) against the set speed signal (the requested frequency). Energizing signals which correspond to these errors are determined and are sent to the motor. These signals control the ON or OFF state of motor energizing, and thereby maintain the set motor speed.

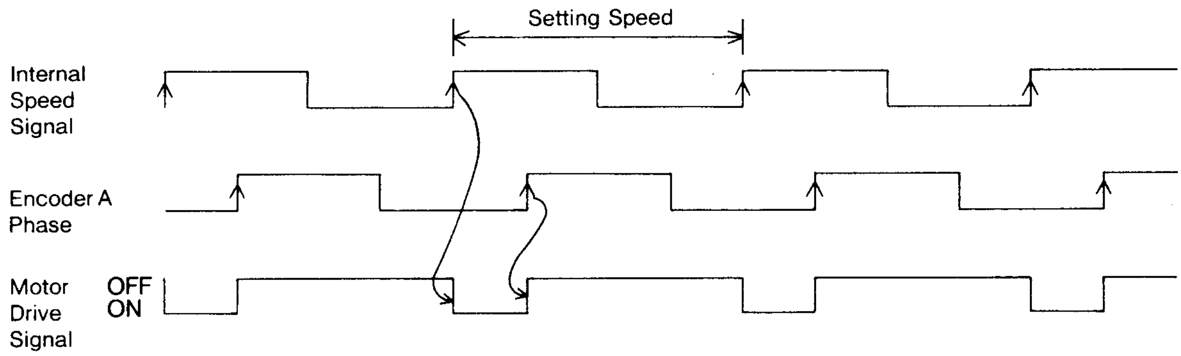


Figure 2-48. PLL control (at normal speed)

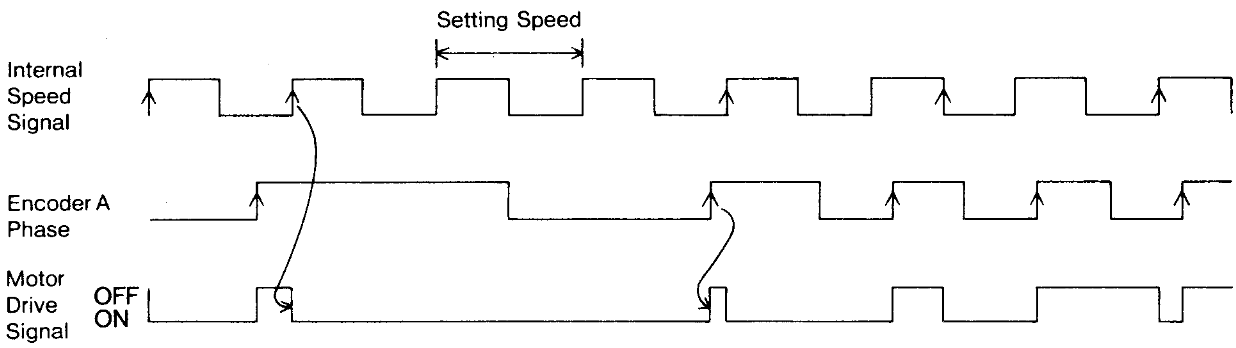


Figure 2-49. PLL control (at accelerated speed)

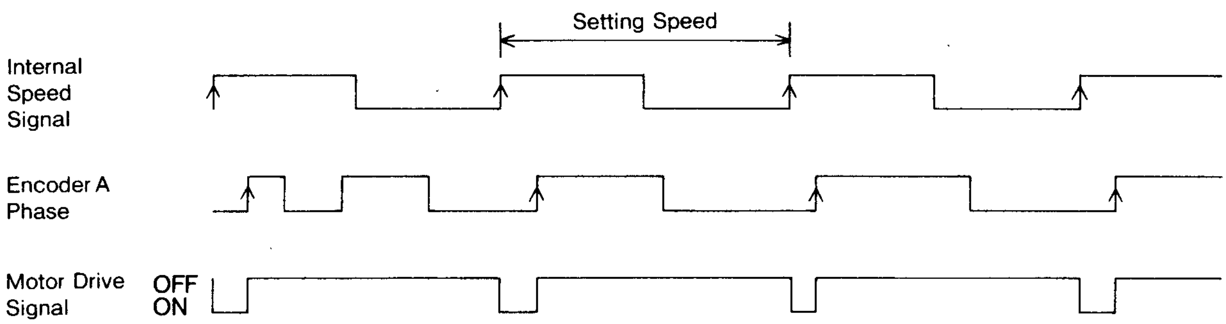


Figure 2-50. PLL control (at reduced speed)

<PRC>

The method by which PRC is carried out by the control circuit may be explained as follows. An internal trigger pulse used to control motor linkage is created in sync with the positive-going edge of the encoder A phase signal.

This trigger pulse is used to generate a one-shot signal that is in line with the set speed. The following positive-going edge of the encoder A phase signal is then used to compare the time lapse from the one-shot pulse against the positive going edge.

If the positive-going edge of the encoder A phase signal is later than the one-shot time lapse, then the motor will be energized for the single cycle time of the next encoder A phase signal. If, on the other hand, the positive-going edge is earlier than the one-shot time lapse, energizing will not occur. Thus, the circuit maintains the desired set speed by causing motor energizing to be switched ON and OFF in sync with the encoder A phase signal.

Figure 2-51 illustrates the PRC energizing signal.

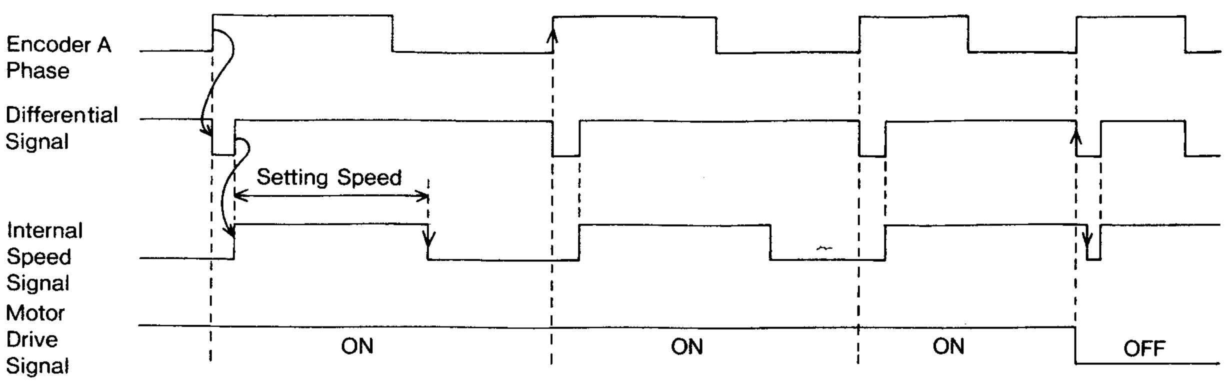


Figure 2-51. PRC (Accelerated speed)

Accelerated, normal, and reduced speed control are made available based on the writing of the set speed into the internal register of the gate array.

<Fully Energized Acceleration or Speed Reduction>

A "full-energizing" circuit in the DCU enables the forced energizing of the DC motor for a given interval. PRC control does not occur in the absence of an encoder signal; therefore, this energizing circuit is used to allow acceleration of the motor, from the stopped condition, under PRC control. The circuit, when ON, causes forced energizing. The activation of the circuit is enabled by a command written into the gate array.

For speed reduction modes under both PLL and PRC control, activation of the full energizing circuit enhances the features of the motor's negative-going edges, causing forced energizing that is in opposition to the motor. This allows for rapid braking.

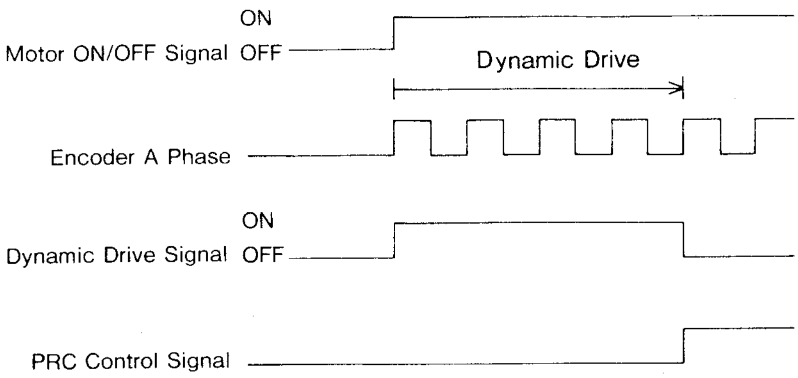


Figure 2-52. Acceleration by Full Energizing

2.4.2.4 Drive Circuit Control

The drive circuit is shown in Figure 2-53. The drive circuit consists of transistors with corrector follower bridge connection. The motor current signal to the current motor is provided as it is pre-driven at each port of the DCU, NPN1,2 and PNP1,2. Here the term "pre-drive" or "pre-driven" means overcurrent control. A more detailed description will be provided later.

Table 2-5 shows a variety of current signal combinations given at each port.

Table 2-5. Current Signals

Motor Operation	Rotation	PNP1	PNP2	NPN1	NPN2	Contents
Acceleration/ constant velocity	CW	LOW	HIGH	HIGH	LOW	Current flow from CM+ to CM−
	CCW	HIGH	LOW	LOW	HIGH	Current flow from CM− to CM+
Hold	—	LOW	LOW	HIGH	HIGH	CM+ and CM− have the same electrical potential.
Reverse braking	CW	HIGH	LOW	LOW	HIGH	Reverse braking against clockwise rotation.
	CCW	LOW	HIGH	HIGH	LOW	Reverse braking against counterclockwise rotation.

The voltage drop at R49 is given at the minus terminal of the compartor in the DCU for comparison with the reference voltage provided to the plus terminal.
Compartor output will work for current chopping at the motor pre-driven circuit in the DCU. The current level detected at R49 and then cut off is set at approximately 2.5A by Resistor R77. Wave forms are shown in Figure 2-54.

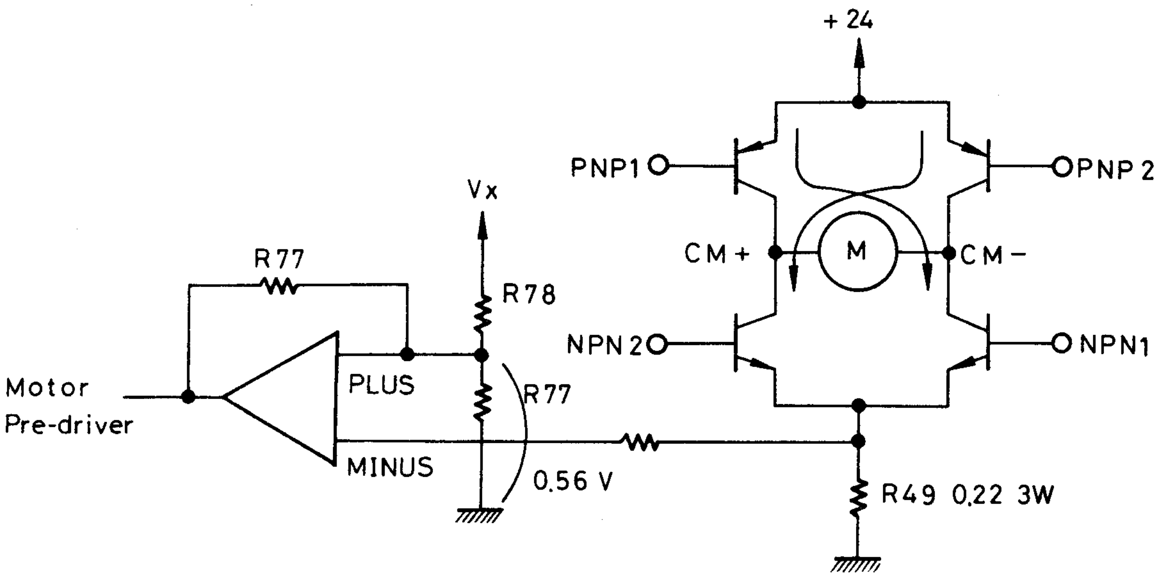
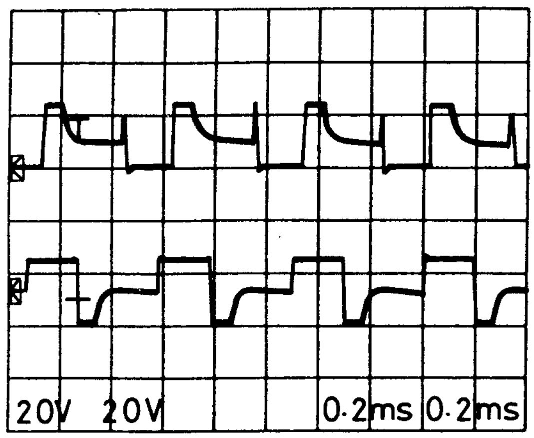


Figure 2-53 Carriage Motor Drive Circuit



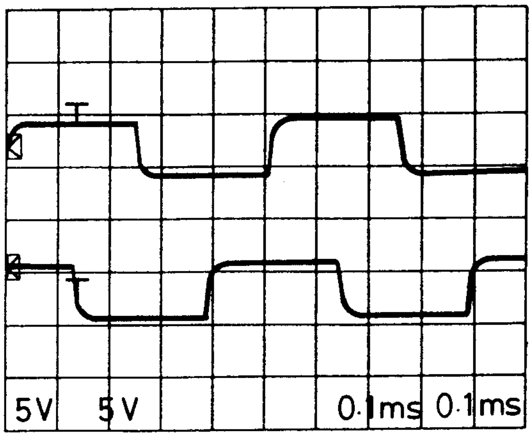
Upper: CM+ (D6 cathode)
Lower: CM− (D7 cathode)

Figure 2-54 Carriage Motor Current Wave Forms

2.4.2.5 Carriage Position Control

The encoder output functions in the DCU to detect velocity and provide positional data by detecting 90o of the phase difference (carriage rotational direction) and rotation counts. Position counting is based on home position signal recognition. A stop signal is generated upon detection of positional count suspension. Figure 2-55 shows a wave pattern the motor is driven at constant speed. Note that the pulse signal is constant with the 90o phase lag.

The reverse phase difference is observed if the motor is driven in the opposite direction. During acceleration or deceleration of the motor, the pulse cycle is not constant. Figure 2-56 shows the relational control positions.



Upper wave: ENA signal
Lower wave: ENB signal

Figure 2-55. Encoder Output Wave Form

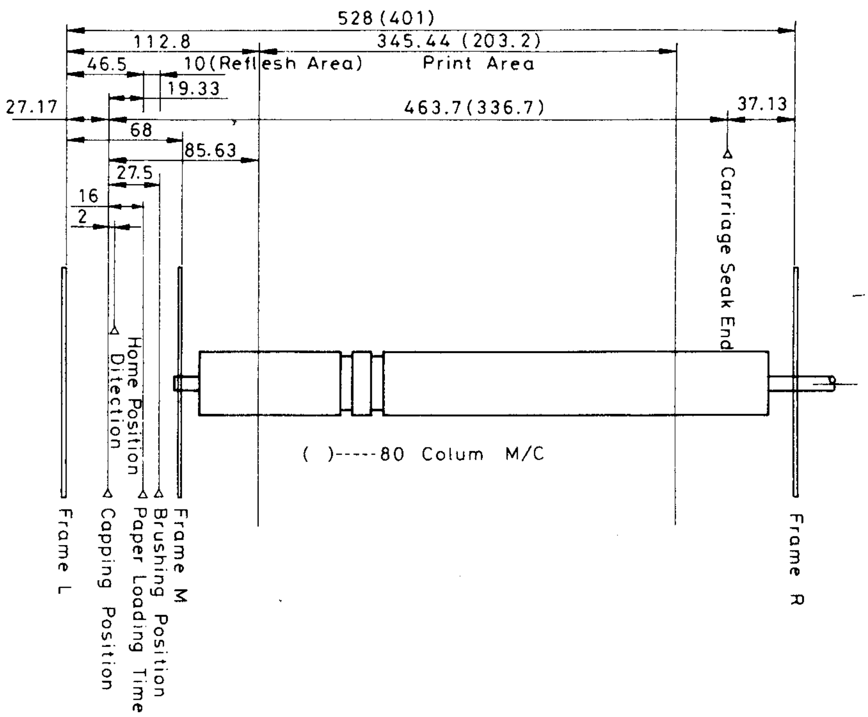
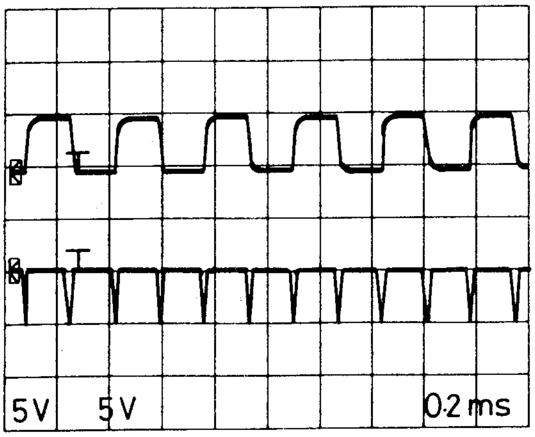


Figure 2-56. Control Positions

2.4.2.6 Print Timing Signal Generation

The encoder signal also serves the PTS (print timing signal) generation in the DCU. PTS is a print timing signal that works the printer head. The DCU determines the proper pulse cycles for a variety of printing densities which have specific values for each printing mode. The calculated pulse cycle goes to the PHC (Print Head Controller:68) gate array. Figure 2-56 shows the operational wave form. The PTS, the wave form shown on the lower side, changes its cycles for the required printing mode (velocity and print density). PTS alteration is conducted by a command execution to the DCU.



Upper wave: Encoder pulse (ENA)
Lower wave: PTS signal

Figure 2-57. PTS Signal Wave Form

2.4.2.7 Print Head

This printer employs the on-demand method for the print head. With the on-demand method, ink is injected on demand. This means ink is usually charged inside the print head, ready for injection, in coordination with print timing. After an injection of ink, ink is recharged for the next injection.

Another method, called the continuous method, keeps a steady supply of ink on the print head and attempts to eliminate the problem of ink drying on the head.
A print had that uses the continuous method of ink supply requires a more complicated mechanism.

The on-demand type mechanism increases the injection force at the nozzle for printing. The continuous type printer, on the other hand, shuts off unnecessary nozzles. The continuous type printer has a higher running cost because a steady flow is ink is required. Some printers try solve this problem by re-cycling unused ink.

Printer Head Specifications

Print method:	On-demand ink jet
Nozzles:	24 nozzles
Nozzle configuration:	Arranged alternately
Drive conditions:	Ink temperature driving voltage follow control (See Table 2-6)

Table 2-6. Drive Voltage

Temperature (°C)	5	25	40
Voltage (V)	150-160	115-121	93-100

Applied pulse width:	70$\pm$5 μsec. (discharging pulse width + interval)
Discharging pulse width:	62$\pm$5 μsec.
Interval:	8 μsec.
Charging pulse width:	47.5$\pm$7.5 μsec.
Response frequency:	2.97 kHz
Ink dot weight:	approx. 0.5 μg/dot (room temperature)
Platen gap:	1.2 mm $\pm$ 0.1 mm (distance between head nozzle and platen).
Remarks:	The platen gap can be manually adjusted up to 1.8mm for printing on thicker paper (such as envelopes). However, printing quality is not guaranteed when the platen gap exceeds 1.3mm.

Head construction is shown in Figure 2-57. Each part is described below.

<Head damper>
Slides the ink tube with carriage movement. The head damper absorbs pressure changes which take place in the tube. This prevents excessive flow of ink to the reservoir.

<Reservoir>
Ink flowing to the inside of the print head accumulates in the reservoir.

<Nozzle>
Accumulated ink in the reservoir is injected through the nozzles. Nozzle construction is shown in Figure 2-58.

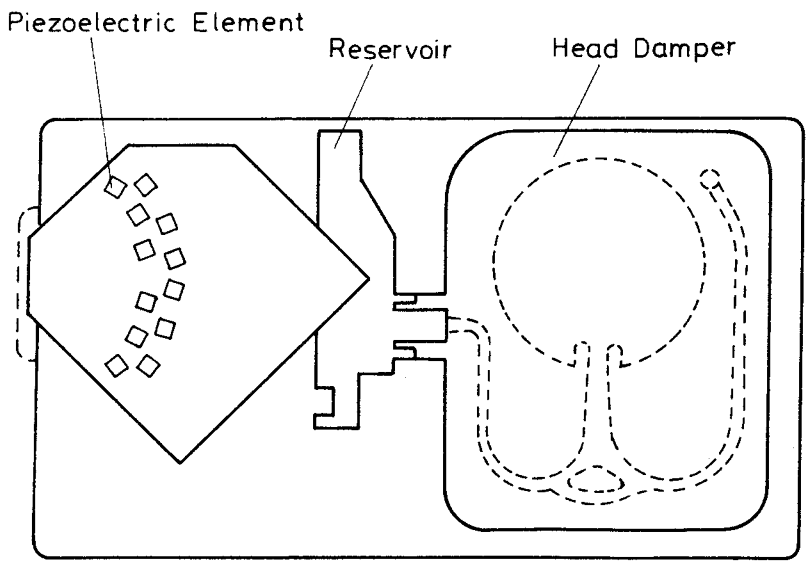


Figure 2-58. Head Construction

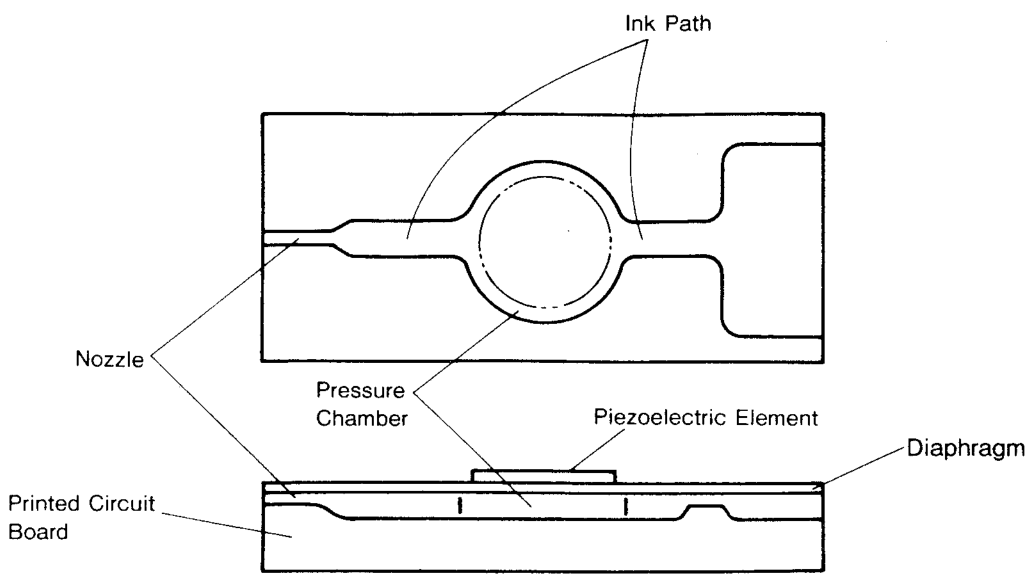


Figure 2-59. Nozzle Construction

<Printing>
The basic principles of how printing works for a single nozzle is described next.

(1) Ordinary situation. The piezoelectric element is electrically charged and distorted.

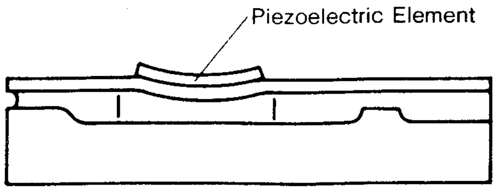


Figure 2-60. Printing Principle (1)

(2) Charging. Prior to injection, the piezoelectric element makes a gradual electric discharge to expand the pressure chamber and allow ink to flow into the pressure chamber.

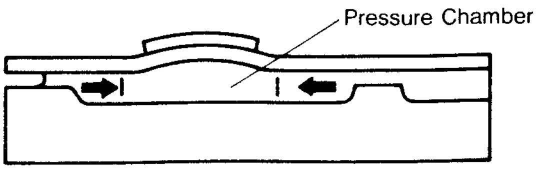


Figure 2-61. Printing Principle (2)

(3) Discharging. Ink injection is carried out by distortion of the piezoelectric element as it is rapidly charged.

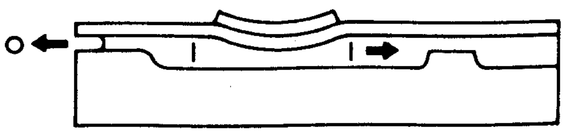


Figure 2-62. Printing Principle (3)

In short, printing occurs only when the piezoelectric element is distorted or expanded. Suction and injection of ink during initial ink charging and cleaning requires operation of the pump to such ink from the head.

2.4.2.8 Printer Head Controls

A block diagram of the print head control circuit is shown in Figure 2-62. (For the exact location, refer to the Appendixes for the SEIMA board circuit diagram and 8-13/I-J.)

This circuit is designed for indirect control of data and the entire drive circuit by the print head controller E05A22EA (PHC:6B) and does not rely on direct control by the CPU. The PHC is enabled by the MMIO01 signal from the MMU.
The CPU reads and writes instruction data for MMIO addresses (A0-A3). The PHC functions after decoding that instruction data.

<Character data>
Character data is developed as "image data" that is needed to drive the print head and actually form the pattern of the character. The PIF, in response to DREQ signals, demands direct memory access (DMA) transmission of image data and reads it from the character generator (CG). Read image data is developed by the internal selector/register to coincide with the printing direction and nozzle arrangement (even/odd). Therefore, the CPU has to begin the printing process and the actual printing task is executed automatically by the direct memory access controller and the DCU.

<Charge and discharge control>
Developed character data is latched at output ports H1 to H24. The PHC generates printing pulses (charge and discharge pulses) separately for odd and even nozzle lines, based upon the PTS signals generated at the DCU. External crystal CR2 provides a reference pulse for timing and width of charge and discharge pulse.

Discharge signals are sent to port Hn (n is 1 to 24). A charge pulse is given to port CHA and CHB of the PHC and works for charge selection of the head drive voltage Vh, for odd or even line nozzles.

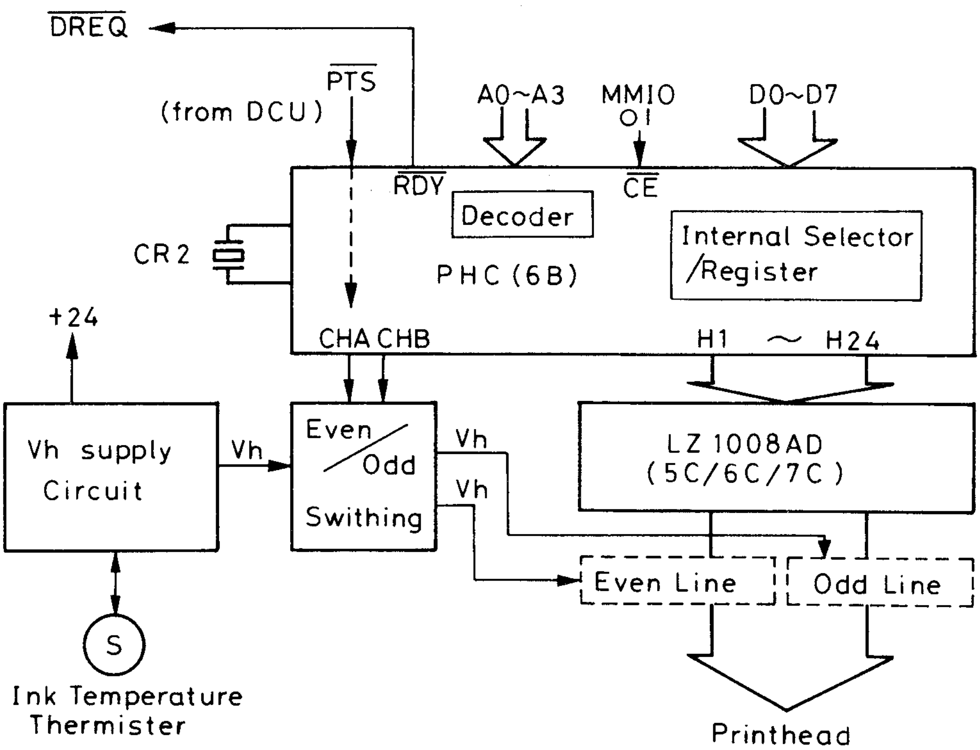


Figure 2-63. Print Head Control Circuit Block Diagram

2.4.2.9 Printer Head Drive Circuit

The printer head drive circuit is divided into two main parts, the charging/discharging circuit and the printer head voltage supply circuit.

<Charging/Discharging Circuit>

The charging/discharging circuit is show in Figure 2-63. Its main functions are as follows.

- Discharge pulse:
  The DCU generates pulses with a length of approximately 62us duration based on the PTS signal. Signals internally generated in the DCU are provided from head data output terminal Hn. On printing, the head output goes HIGH. This makes LZ1008AD of the FET come on, and the electric charge of the piezoelectric element discharges through the source terminal of the FET. The piezoelectric element is usually charged with voltage Vh. The discharge time depends on the drive pulse which the DCU generates.

- Charge pulse:
  High pulses are provided from CHA and CHB of the DCU. The leading edge of the pulse makes transistors QC1 and QC2 turn on, then the piezoelectric element is charged by the Vh voltage which comes through the resistor RCH and diode DCH. Charging and discharging wave forms are shown in Figures 2-64 through 2-66.

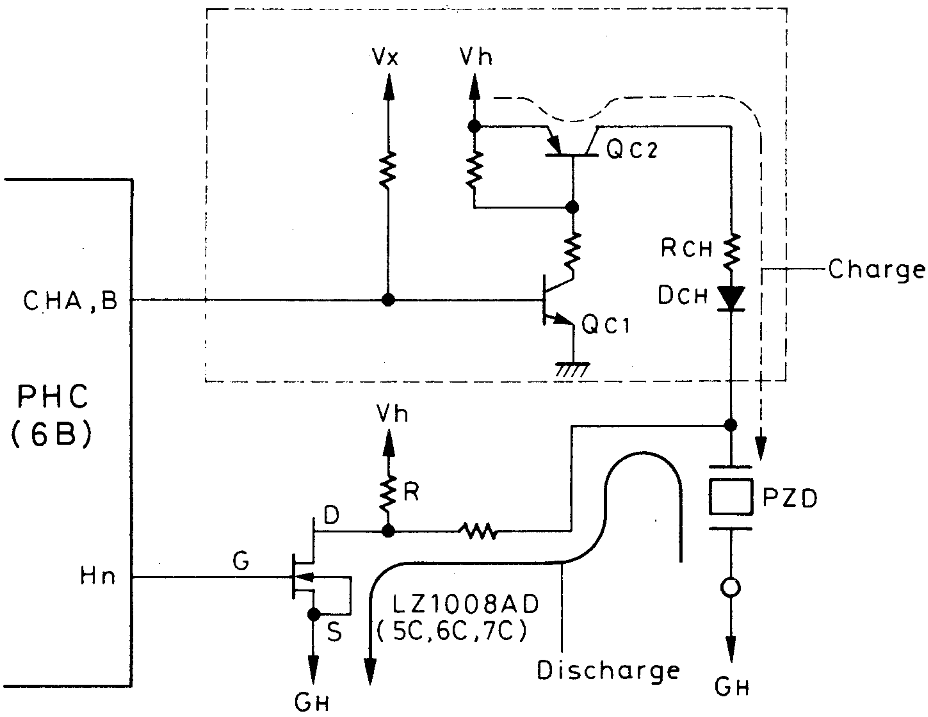
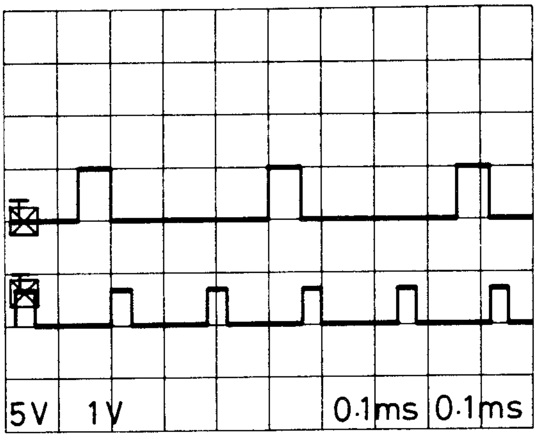
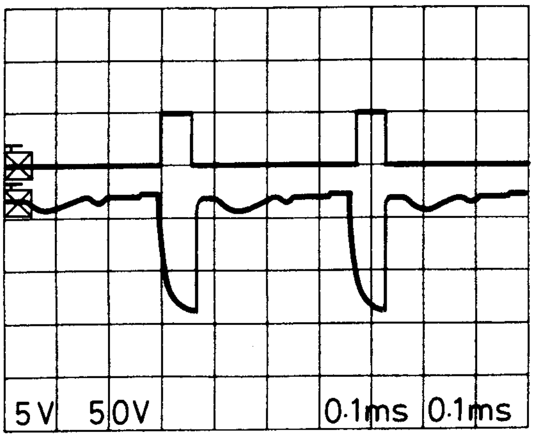


Figure 2-64. Charge and Discharge Circuit



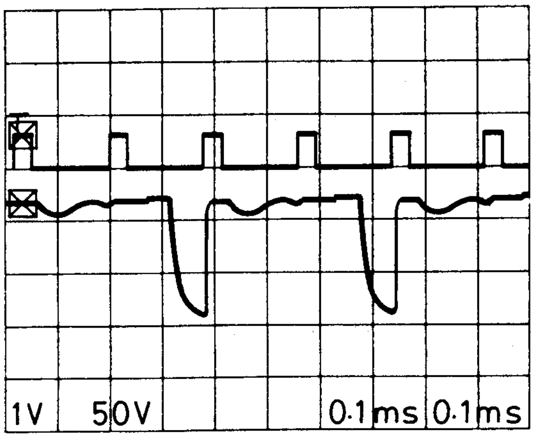
Upper: Discharge pulse (PHC, Port Hn)
Lower: Charge pulse (PHC, CHA/B)

Figure 2-65. Charge and Discharge Pulse Timing



Upper: Discharge pulse (PHC, CHA/B)
Lower: Piezoelectric voltage (CN20)

Figure 2-66. Discharging Wave Form



Upper: Charge pulse (PHC, CHA/B)
Lower: Piezoelectric voltage (CN20)

Figure 2-67. Charging Wave Form

- Printer head voltage supply circuit

  This circuit transforms the 24VDC source power supply up to a range of 93-160VDC to supply the printer head voltage. Control of the head drive requires the ink temperature as its parameter. The ink temperature detected by the thermal resistor in the ink cartridge is fed back to the constant voltage controller.

- Main circuit:

  The main circuit is shown in Figure 2-67. For more details, refer to the SEIMA board circuit diagram, location 9-10/I. The circuit employs the DC-DC converter method. The +24VDC supplied to the primary stage of the voltage transformer T1 is controlled by the switching motion of the chopper switching controller 494 (3C). Two error amplifiers, EA1 and EA2, form the constant voltage control and current limit circuits, respectively, of the main switching board.

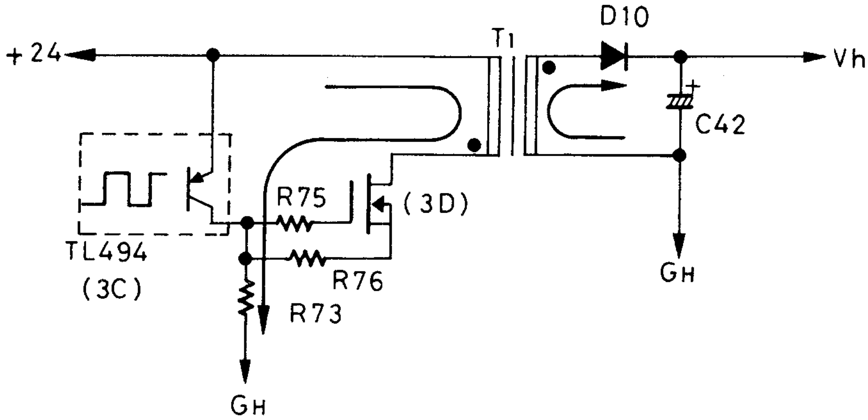


Figure 2-68. Vh Supply Main Circuit

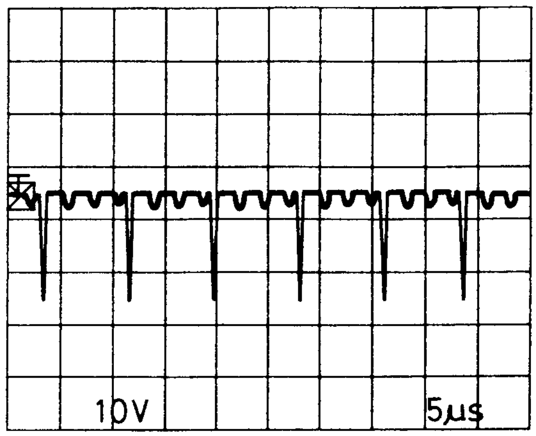


Figure 2-69. 494 Switching Wave Form

Constant voltage control:

The constant voltage circuit is shown in Figure 2-69. EA1 of 494 functions for constant voltage control. The reference voltage (Vref) is supplied to the reverse terminal of EA1. The constant voltage circuit of the shunt regulator L5431 is a constant power supply for setting Vref voltage. The output voltage is maintained at +3VDC by R51 and R50 settings. Ink viscosity will vary with temperature, so ink injection will be difficult at high viscosity levels.

Therefore, the head drive voltage changes according to the ink temperature detected by the temperature resistor to ensure that the ink is injected at a constant rate.

The value of Vref changes proportionally with the fluctuation resistance of the temperature sensor. The Vref fluctuation range is set by the adjustment of the variable resistor VR1. Figure 2-70 shows the relationship between ink temperature and drive voltage.

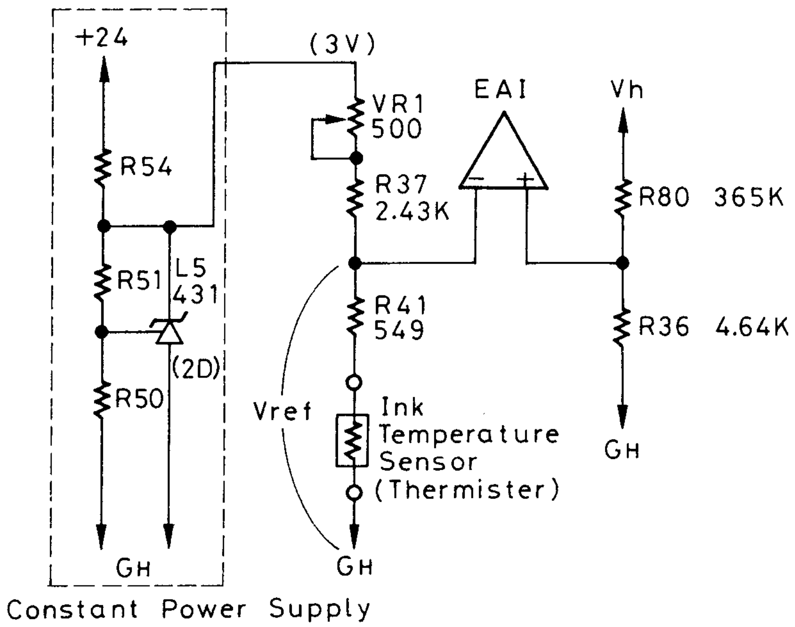


Figure 2-70. Constant Voltage Control Circuit

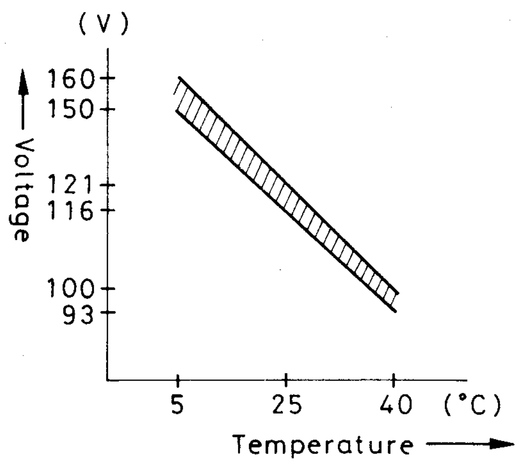


Figure 2-71. Relationship Between Ink Temperature and Drive Voltage

Current limit control:

The current limit control circuit is shown in Figure 2-71. EA2 of 494 limits current. The reverse terminal of EA2 supplies voltage that is divided +36VDC by the zenadiode ZD5 for the voltage drop level of R52. The non-reverse terminal of EA2 is connected to the source current detection resistor R73 of FET (3D). This limits the current to approximately 0.14A.

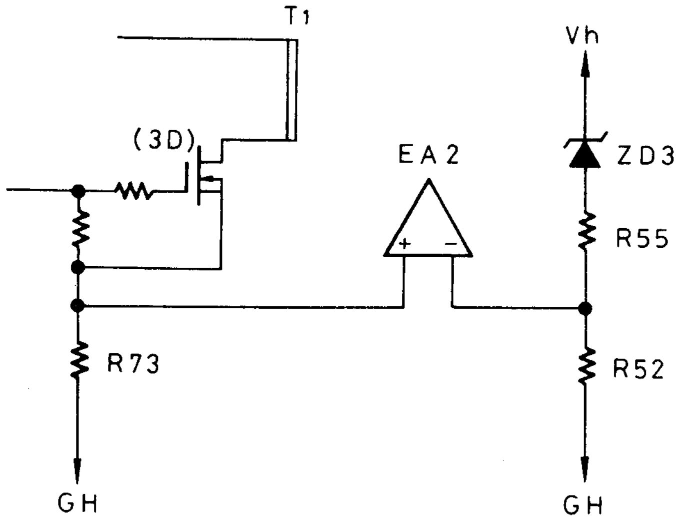


Figure 2-72. Current Limit Circuit

Over-voltage limit circuit:

The over-voltage limit circuit is a cut off circuit to protect the piezoelectric element of the head from damage due to excessive Vh. The voltage setting at +27.6 (27+0.6)VDC by zenadiode ZD3 and VBE of Q24 maintains a voltage drop level of R218+R217 at about 168VDC. Accordingly, if the Vh output level exceeds 168VDC, the Q24 turns off, and the error amplifier feedback terminal FB (3-pin) of 494 (3C) declines to the ground level to cut off Vh.

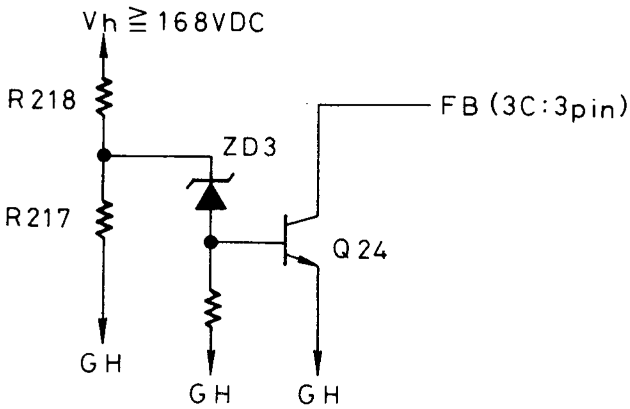


Figure 2-73. Over-voltage Limit Circuit

2.4.3 Ink Mechanism

The ink mechanism is shown in Figure 2-73. The ink mechanism consists of the following parts.

- Ink cartridge
  Cartridge holder
  Ink end sensor
  Cartridge sensor
- Pump unit
  - Pump mechanism (pump motor)
  - Cap mechanism (head cap, cap damper, valve solenoid)
  - Cleaner mechanism (brush mechanism)

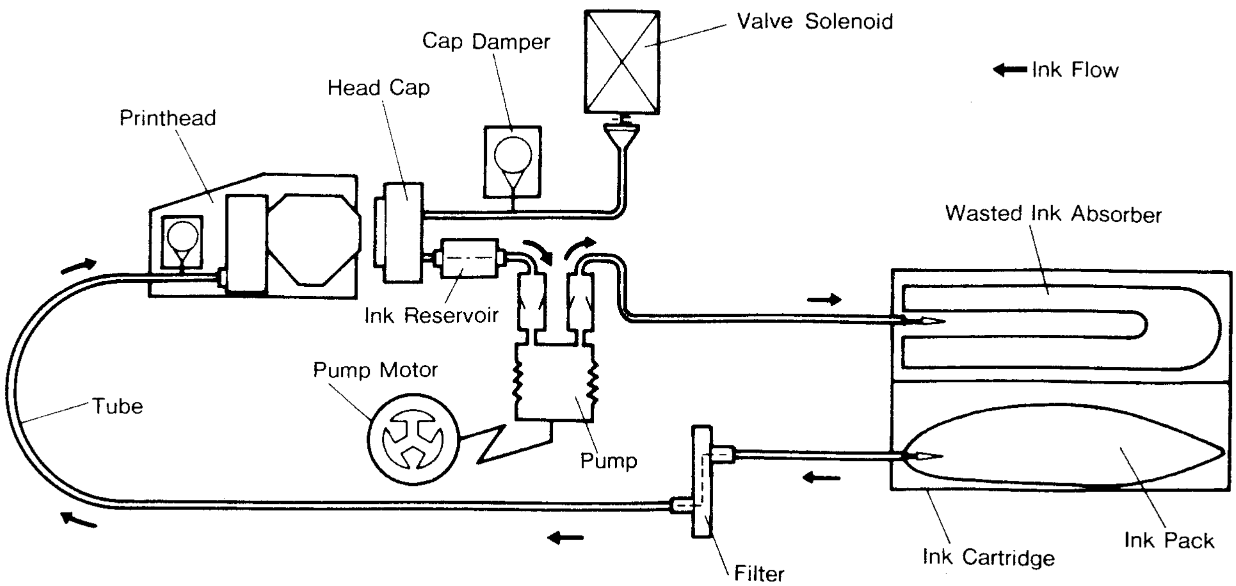


Figure 2-74. Outlined Ink Mechanism System

2.4.3.1 Pump Motor

Pumping, capping, and brushing is fully driven by a pump motor (P motor). As rotation of the P motor is transmitted to the P drive gear, then the pump pin plate, the cap clutch can and cleaner drive gear all operate accordingly. Every operation of pumping, capping, and brushing is respectively provided.

Pump Motor Specifications

Type: DC motor

Specifications

- Rated voltage: 24VDC ±10%
- Starting torque: More than 180 g-cm (at 20o, 21.6V)
- Rated torque: 30 g-cm
- Rated speed: 3800 rpm
- Coil resistance: 60 ohms

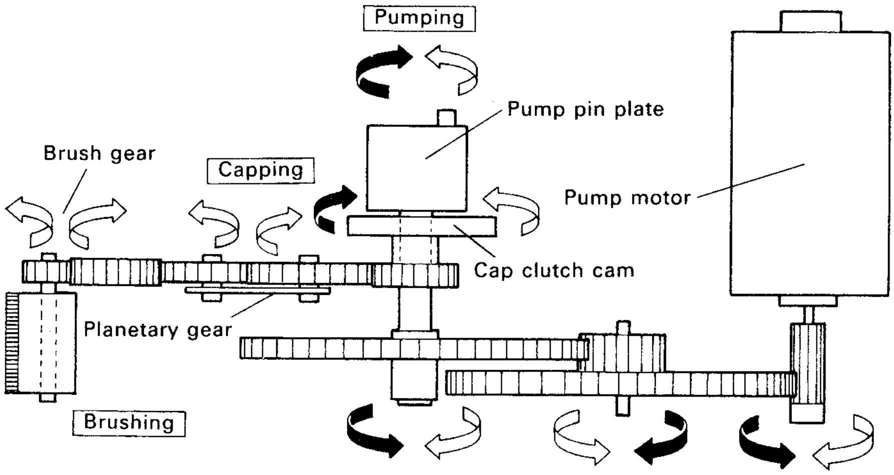


Figure 2-75. P Motor Power Transmission

Table 2-7. Rotation of P Motor and Movement of Others

P motor drive direction	CCW	CW
Pump operation	Draws ink from head, disposes to ink cartridge.	
Cap operation	Close	Open
Brush operation	Rotation	Stop

2.4.3.2 Pump Motor Control and Drive Circuit

A block diagram of the pump motor control and drive circuits is shown in Figure 2-75. (Refer also to Location 7/I-J of the SEIMA Board Circuit Diagram in the Appendix).

The pump motor is DC, and the drive circuit is formed by collector follow bridge TH3C10 (1B). During driving, the CPU provides clockwise (CW) or counterclockwise (CCW) signals to PHC ports P1 and PO. For forward rotation, the CCW signal is high, and current ICCW flows to the motor by means of bipolar connection TH3C10.

(The opposite is true for reverse rotation.) No acceleration or deceleration control is provided for the motor control.

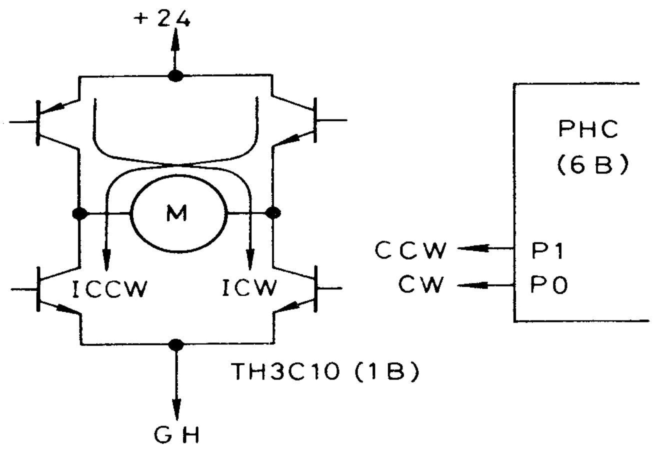


Figure 2-76. Pump Motor Control and Drive Circuit Block Diagram

2.4.3.3 Pump Mechanism

The pump sucks ink from the head toward the wasted ink pack side of the ink cartridge, by which means it keeps the head full of ink, and the nozzle free of bubbles and dust. Pump reciprocation is the same regardless of motor drive direction; therefore, the ink flow direction also remains the same (from the cap side to the ink cartridge side).

Driving of the pump rotates the pump drive gear (see Figure 2-74). Because it is on the same axle as the drive gear, the pin plate also rotates; the pin on the plate therefore moves in a circle. The pin follow converts the circular motion to a reciprocating motion. The piston axis, mounted on the pin follower, generates the pumping.

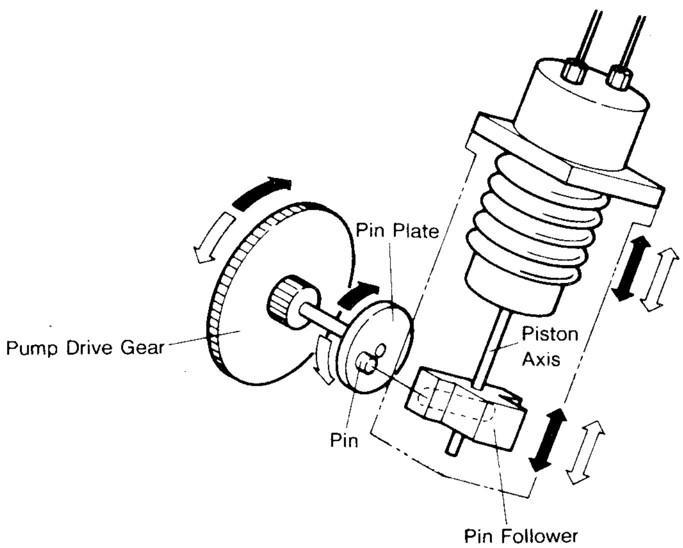


Figure 2-77. Pump movement

2.4.3.4 Pump Construction

Two check valves are installed in the pump. As the piston moves up and down, the bellows pressure changes, causing one or the other of the valves to open, so that ink is either sucked in or blown out. Specifically, when the piston is moving downwards, the bellows pressure is negative, which causes the inlet check valve to open (and the outlet check valve to close); ink is thereby drawn into the pump. When the piston moves upwards, these conditions are reversed, and ink is discharged from the pump.

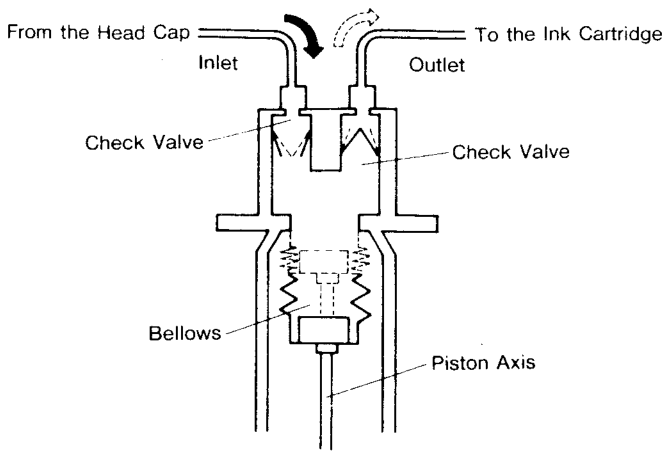


Figure 2-78. Pump Construction

2.4.3.5 Capping Mechanism

The capping mechanism protects the head from drying and from bubbles. Negative pressure is generated inside the cap as the pump is driven while the valve is closed. Ink can therefore flow, through the cap, from the head to the pump. The clutch cam, which is driven by the pump motor by means of the pump drive gear, is in direct contact with the cap support; therefore, cam movement generates a reciprocating movement of the cap.

The travel of the cam is limited by the clutch spring; should the pump motor continue to rotate in a single direction, the transmission of rotation will cease when the limit imposed by the spring is reached. Therefore, cap opening and closing is determined only on the basis of the rotational direction.

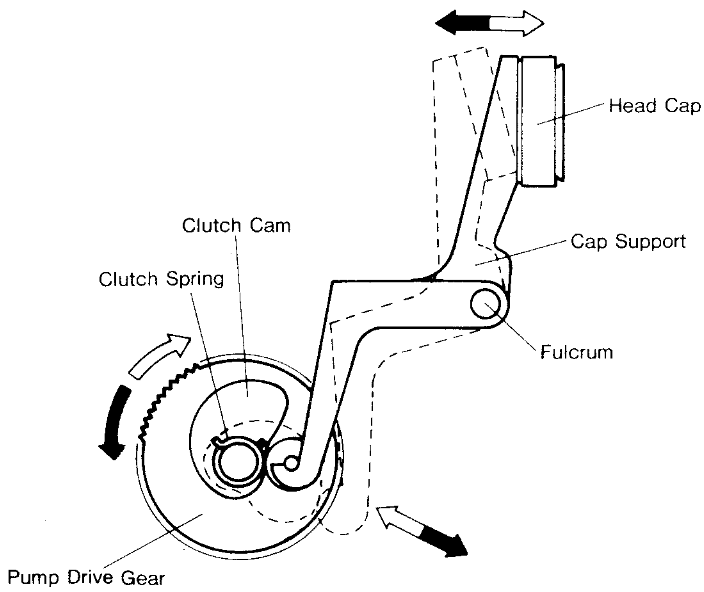


Figure 2-79. Cap Movement

2.4.3.6 Brushing Mechanism

Rotation of the brush removes any dust lodged on the front surface of the head.

The cleaner support, to which the cleaner is attached, is linked to the cap support, and therefore reciprocates together with it. (See Figure 2-78.)

The cleaner is rotated by the cleaner drive gear, which is driven by the planetary gear, which is driven by the motor. The cleaner rotates only when the pump motor is moving forward.

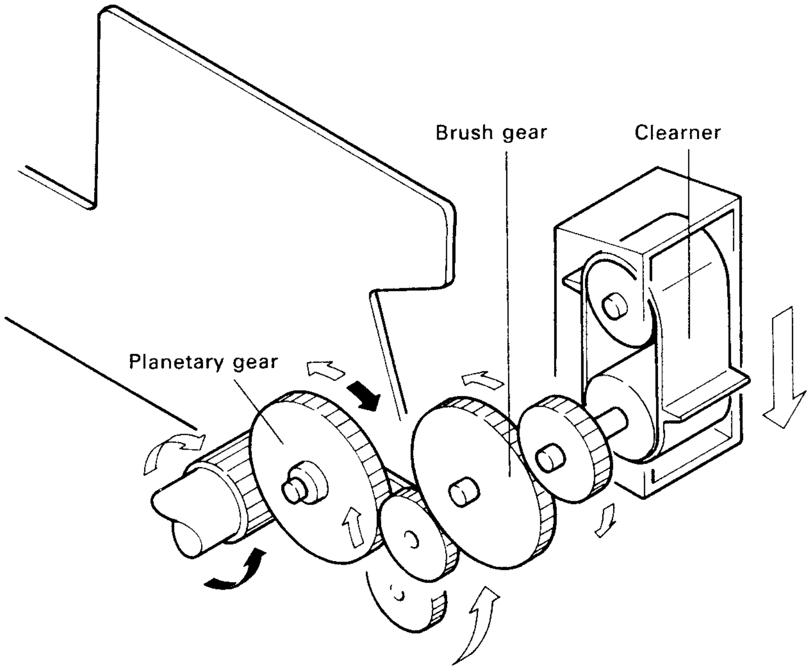


Figure 2-80. Cleaner Movement

2.4.3.7 Valve Mechanism

The valve set is tied to the head cap by tubes; activation by the solenoid opens the valve-side tube tops (in the absence of activation, the valves are closed).

When the valve is closed, air is shut in between the valve and the cap; therefore, if the pump is operated while the cap is firmly attached to the front surface of the head, ink will flow into the pump. When the valve is open, on the other hand, ink cannot flow under any circumstances, and regardless with whether or not the pump is operating.

When ink is being sucked in, the inside of the cap is being subjected to negative pressure; a relatively large force is therefore required to pull the cap away from the head. To release this condition, the valve is opened, allowing air to enter. Valve opening also releases air from the cap, enabling firm attachment between cap and head, and preventing the drawing back of ink at the nozzle top due to temperature change.

Air flow is enabled when a gap is created by the movement of the iron core driven by the solenoid.

Valve Solenoid Specification

Type:	DC Solenoid
Voltage:	24VDC$\pm$10%
Coil Resistance:	80 ohms $\pm$ 5% (at 20°C)
Draw Force:	at least 130g (at 20°C, 21.6V, with 1mm stroke)

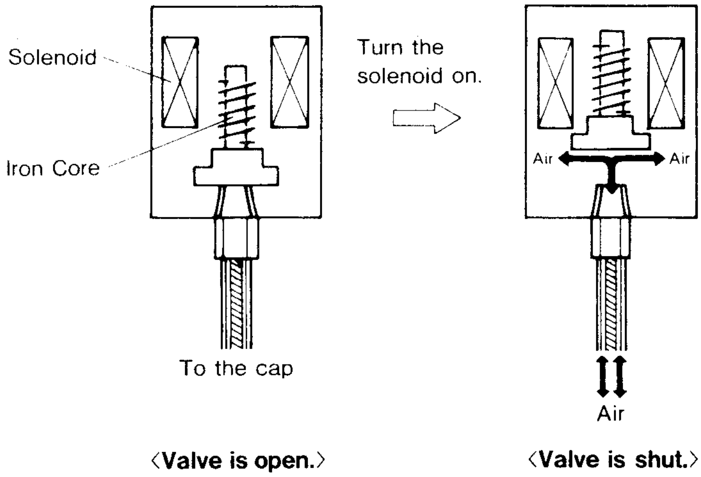
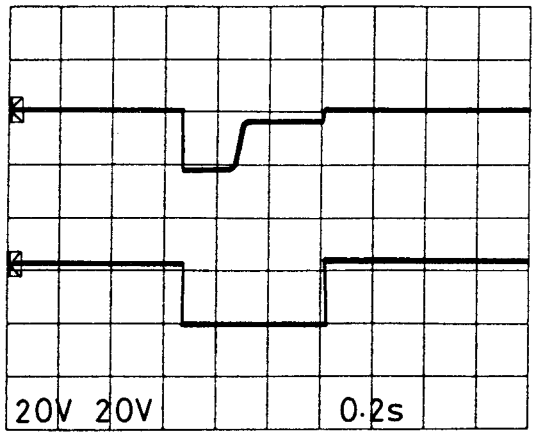


Figure 2-81. Valve movement

2.4.3.8 Valve Solenoid Driving Circuit

The valve solenoid driving circuit is shown in Figure 2-81. (Refer also to Location 6/I-J of the SEIMA Board Circuit Diagram in the Appendix). When the solenoid draws (for valve opening), a rush current first occurs, which then switches to a maintaining current. Transistor Q3 normally switches wile Q4 is turned on during discharge of the charge accumulated at C5. This discharge provides the rush current.



Upper: Q4 collector terminal
Lower: Q3 collector terminal

Figure 2-82. Valve Solenoid Driving Waveform

2.4.3.9 Cap Damper and Ink Reservoir

A cap damper is installed between the head cap and the valve. The cap damper expands, or shrinks, to absorb the pressure fluctuations which occur when the cap is opened or closed.
If capping is maintained, air within the cap expands as the temperature rises, and cause ink to retract in the nozzle; this can cause dot failure. The damper prevents this problem by absorbing the expanding air.

The ink reservoir is installed between the head cap and the pump. An absorbent material in the reservoir is continually moistened by wasted ink. The moisture is transferred, through the head, to the cap; this prevents the nozzle from drying.

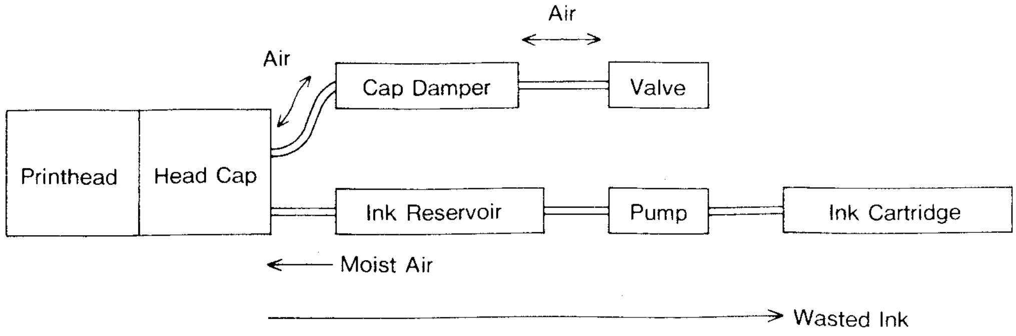


Figure 2-83. Cap Damper and Ink Reservoir

2.4.3.10 Ink Cartridge and Ink End Sensor

The composition of the ink cartridge is shown in Figure 2-83. The cartridge is formed of two layers: the upper layer is an absorbent that takes in wasted ink, and the lower layer is the ink pack. The ink pack also contains the cleaner cartridge, which holds the cleaning liquid used for maintenance. The draining cartridge contains only the wasted ink absorbent.
The ink pack is continuously compressed by the ink-end detection plate spring. As ink is consumed and the pack shrinks, the ink-end detection lever rotates counterclockwise, causing to ink-end detection plate (to the right, as indicated in the Figure). This movement drives the ink level indicator.

At the moment when the ink completely runs out, the part of the ink-end detection lever marked as A in the Figure completely unlocks, and the detection plate jumps out.
The composition of the ink cartridge holder is shown in Figure 2-84. When the cartridge is installed, the ink supply needle penetrates the ink pack, and the ink disposal needle penetrates the wasted ink absorbent. Because a small amount of ink always remains at the tip of the ink supply needle, a special cover is provided to prevent ink from dripping into the case; when the cartridge is removed, the cover, pulled by a string, covers the needle.
There are two microswitches within the cartridge holder: an ink-end sensor (the upper switch), and an ink-cartridge sensor. The ink-end sensor detects the status of the ink-end detecting plate; the ink-cartridge sensor detects the presence or absence of the cartridge. Detection signals (IE, ICE) are sent to PHC I/O ports P6 and P7.

If a full ink pack is utilized to completion, it will be empty, and the ink-end indication will be output, after about 200 lines of printing. If no ink cartridge is detected, the ink-end indication will be output immediately.

Table 2-8. Ink-end Signal

Situation	IE Sensor Switch	ICE sensor switch	IE Signal	ICE Signal
Ink cartridge present/ ink present	closed	closed	LOW	LOW
Ink cartridge present/ no ink remaining	open	closed	HIGH	LOW
Ink cartridge not installed	open	open	HIGH	HIGH

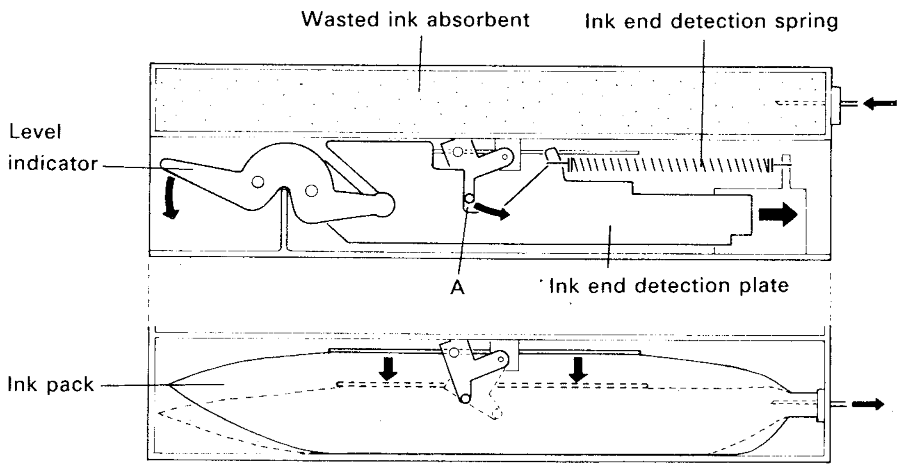


Figure 2-84. Composition of Ink Cartridge

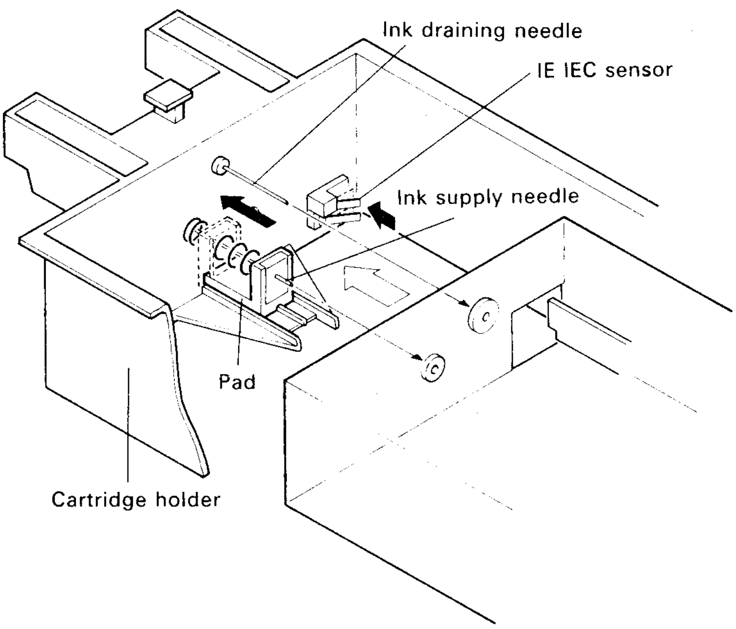


Figure 2-85. Composition of Ink Cartridge Holder

2.4.3.11 Operation Sequence of Pump Unit

The pump unit has various roles. Basic operations are as follows:

● Capping:

A firm attachment of the cap to the head prevents air from contacting the head, which protects the ink in the head nozzles.

(1) Transfers the head to the position of the cap.
(2) Advances the cap set, forming firm contact.

● Brushing:

Brushing removes any dust and ink adhering to the front surface of the head.

(1) Transfers the head to the brush position.
(2) Rotates the cleaner to perform brushing.

● Ink charging:

Charging of fresh ink serves to eliminate bubbles in the nozzle.

(1) Transfers the head to the position of the brush.
(2) Through the valve mechanism, maintains atmospheric pressure inside of the cap.
(3) Firmly attaches the head to the cap.
(4) By means of the valve mechanism, shuts in air between cap and valve.
(5) The pump sucks ink from the head, and charges fresh ink into the head.
(6) By means of the valve mechanism, the vacuum within the cap is released.
(7) Detaches the cap from the head

Note the following explanations that pertain to operations.

a. Power on under normal conditions:
Capping – Ink charging – (1 sec.) – Release capping – All nozzles inject 100 times – wait

b. Power on under normal conditions for automatic cleaning:
Ink charging (1,2 sec.) – Wait

c. Power on, head uncapped:
Home position seek – Brushing (3 sec.) – Ink charging (1-2 sec.) – Wait

d. Manual cleaning:
Brushing (10 sec.) – Ink charging (6 sec.) – Wait (off line)

e. 3 seconds pass after previous printing, next printing data not received:
Capping – Wait (When next data arrives, printing starts after capping unlocked)

f. Initial ink charging:
Ink charging (15 sec.) – Brushing (10 sec.) – Capping (45 sec.) – Ink charging (5 sec.) – Wait

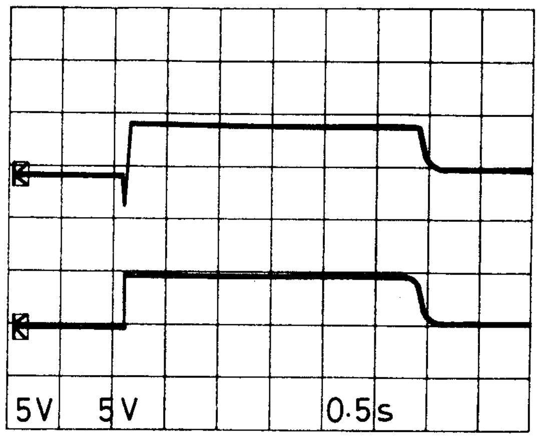
g. Refresh during printing (1 time/3 min.):
Head is transferred to refresh area – All nozzles inject 10 times – Return

2.4.4 Vx Power Supply Circuit and Reset Signal Circuit

The Vx power supply circuit generates a power on reset signal. See SEIMA board circuit diagram of the Appendixes, location A-B/11-12.
When operation begins, transistor Q1 and Q2 come on when the voltage of the +24VDC line reaches 18.8VDC (ZD1 voltage 18.2 + 0.6V) to induce +5VDC to the Vx line. At this time, Vx is ground level. Vx and +5VDC wave forms are shown in Figure 2-85.

The Vx signal is connected to THLD and DISC terminals of the MMU (8B). The reset generator is equipped with an MMU that generates power-on reset signals for various chips. This is described in the block diagram of Figure 2-86.

The initialization signal from the host is latched at the 12-pin PIF (12C) from where it goes to the INT2 terminal of the CPU (10C) where the interrupt software is reset. (For more details about the circuit, see the SEIMA board circuit diagram, location 4/E).



Upper: Vx line
Lower: +5VDC

Figure 2-86. Vx Power Supply Wave Form

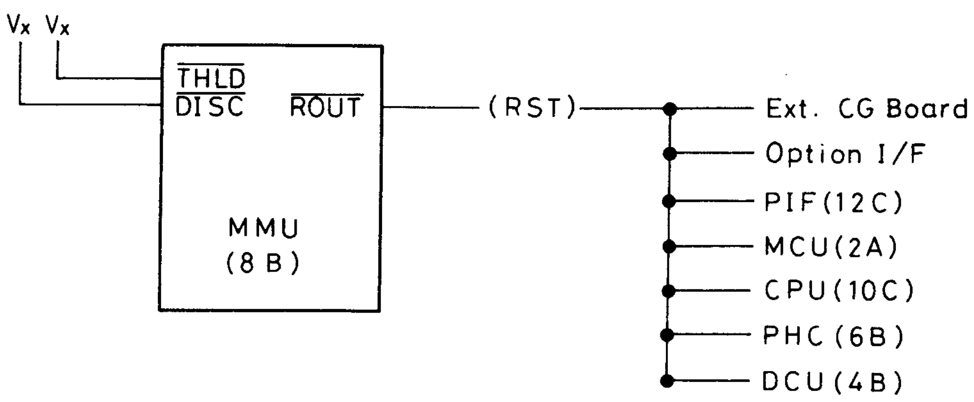


Figure 2-87. Block Diagram of Power-On Reset Pulse Supply

2.4.5 Timer and Backup Circuitry

The timer and backup circuit are shown in Figure 2-87. (For more details about the circuit, refer to the SEIMA board circuit diagram of the Appendix, location 8-10/G-H).

The timer circuit provides the timing needed for pump unit operation to the CPU, regardless of the power status (ON/OFF). The timer circuit consists of a clock and a counter. Both CTSO and RTSO signals form a serial interface with the CPU.

The CTSO signal is a timer check signal. The counter 292 (13D) of the timer circuit makes the signal go LOW when the preset time value (approximately 145.6 hours) is up. The RTSO signal is a timer reset signal. When the RTSO signal is LOW, the CLR terminal of counter 292 in the timer circuit goes to ground level to reset the timer.

The backup circuit backs up SRAM (43257:13C) and the timer circuit while the power supply is off. SRAM stores the panel settings and is maintained even when power is off. The circuit also monitors +5VDC.

When power is supplied, +5VDC is provided to the Vbak line. If the voltage of the +5VDC line drops down to +4.6VDC (ZD2 voltage 4.0V + Q22 VBE0.6V), +3.6VDC of the lithium battery BAT1 is supplied to the Vbak line. The operation status of the backup circuit when power is off is shown in Figure 2-88.

The timer circuit works with +5VDC while the power supply is turned on and works with Vbak voltage if the power supply is off. Figure 2-89 shows a wave form of the clock circuit while the power supply is off. The figure clearly shows that working voltage is switched from +5VDC to +3.6VDC.

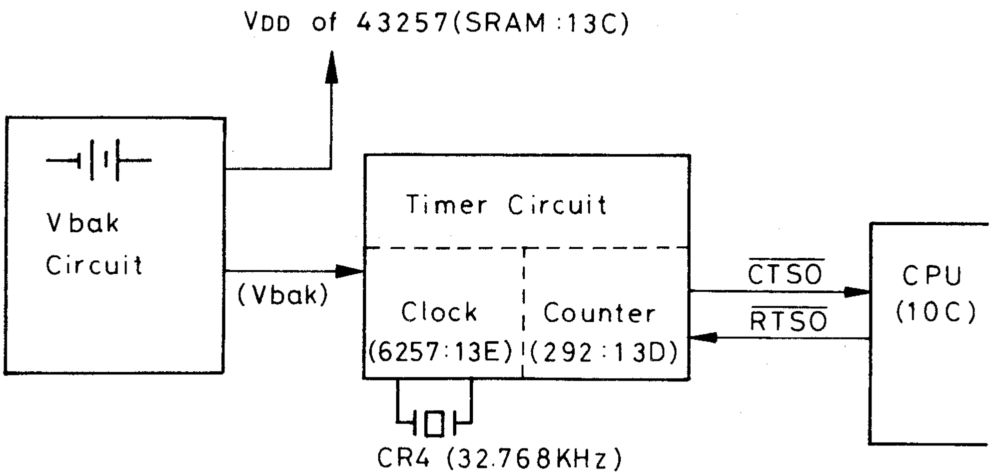
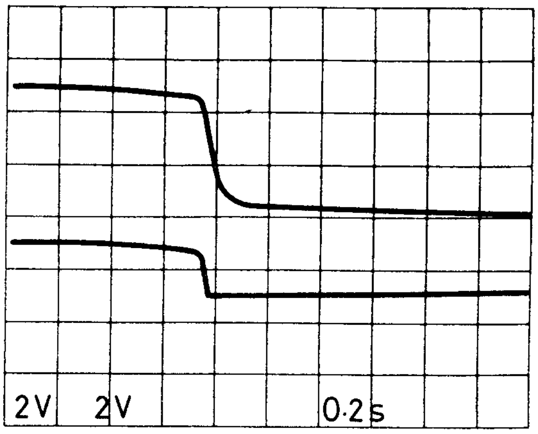
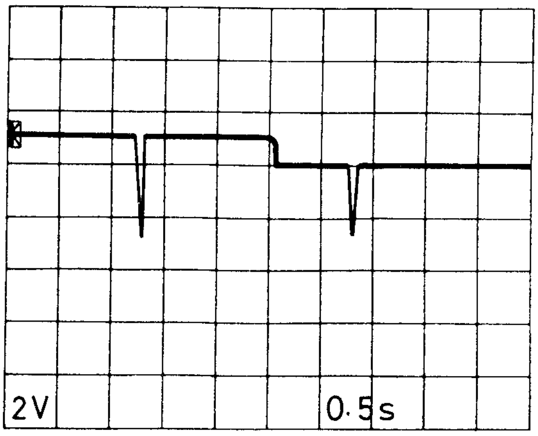


Figure 2-88. Timer and Backup Circuit Block Diagram



Upper: +5VDC line
Lower: Vbak line

Figure 2-89. Backup Circuit Operation While Power Off



292 (13D) CLK1 input clock

Figure 2-90. Clock Circuit While Power Off

CHAPTER 3

OPTIONAL EQUIPMENTS

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CHAPTER 3

LIST OF TABLES

3.1 GENERAL

This chapter describes the options available for the SQ-850/2550.

3.2 OPTIONAL INTERFACES

The SQ uses the EPSON optional interface series. The major optional interfaces are listed in Table 3-1.

Table 3-1. Major Optional Interfaces

	Cat.No.	Description			
Standard Parallel Interfaces		Buffer Size	Function		
	#8172	32K	32 K-byte buffer parallel interface		
	#8172M	128K	128 K-byte buffer parallel interface		
		Buffer Size	Flag Control	X-ON/OFF Control	Max. Bit Rates (BPS)
RS-232C	#8143*	None	O	O	19200
	#8145	2K	O	×	9600
	#8148	2K/8K	O	O	19200
Current Loop	#8149	32K	O	O	19200
	#8149M	128K	O	O	19200
		Buffer Size	Function	Listen Only Operation	Address Operation
IEEE-488	#8161	None	L	×/O	O
(GP-IB)	#8165	2K/8K	AH,L,DC	O	O

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

NOTES: 1. Refer to the "Optional Interfaces Technical Manual" for details.
2. When optional interface is used, 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 "0" (+3 to +27 V)
Current loop	MARK = logical "1" (current ON) SPACE = logical "0" (current OFF)
Handshaking	By REV (DTR) signal or X-ON/X-OFF code (Signal polarity can be inverted by jumper setting.)

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

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

Jumper Settings

Table 3-2 shows the 8143 interface jumper settings.

Table 3-2. 8143 Jumper Settings

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

DIP Switch Settings

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

Table 3-3. DIP Switch Settings

DIP SW No.	Function	ON	OFF
1-1 (JB3)	Bit rate selection	See Table 3-4.	
1-2 (J8/7)	Data length selection	7 bits	8 bits
1-3 (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	ON	ON	OFF	2,400	OFF	ON	ON	OFF
134.5	ON	ON	OFF	ON	4,800	OFF	ON	OFF	ON
150	ON	ON	OFF	OFF	9,600	OFF	ON	OFF	OFF
200	ON	OFF	ON	ON	19,200	OFF	OFF	ON	ON
300	ON	OFF	ON	OFF	19,200	OFF	OFF	ON	OFF
600	ON	OFF	OFF	ON	19,200	OFF	OFF	OFF	ON
1,200	ON	OFF	OFF	OFF	19,200	OFF	OFF	OFF	OFF

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

Handshaking Timing

The handshake controls are shown in Table 3-5.

Table 3-5. 8143 Handshaking Control

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

Error Handling

Errors are processed as follows:

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

3.3 CUT SHEET FEEDER

The SQ can use the double-bin and single-bin cut sheet feeders.
Total 4 types (both 80-column and 136-column models for double and single bin CSFs) are available.
The difference between 80-column and 136-column model is only line length.
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.
- Has two bins so that two types sheet can be used. (Double-bin type)
- Allows user to load a sheet by manual insertion.
- Is easy to change the stacker either to bin1 or bin2 by the control panel operation. (Double-bin type)
- Requires no electrical connection to and from the printer.
- Is easy to mount onto or dismount from the printer.
- Is high cost performance.

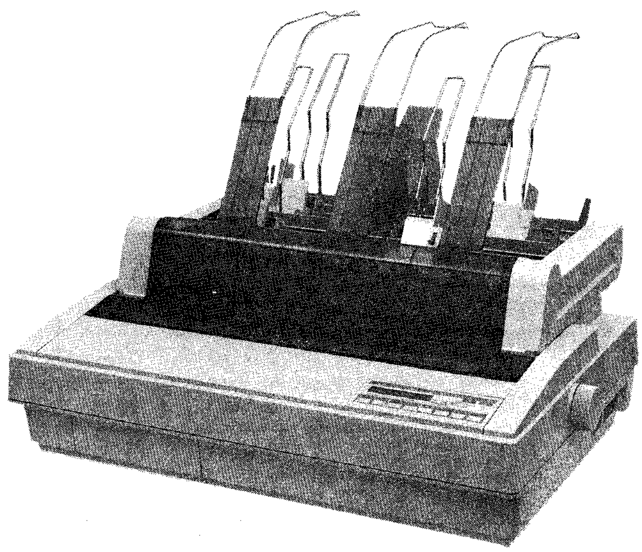

Figure 3-1. SQ-2550 with Double-bin CSF

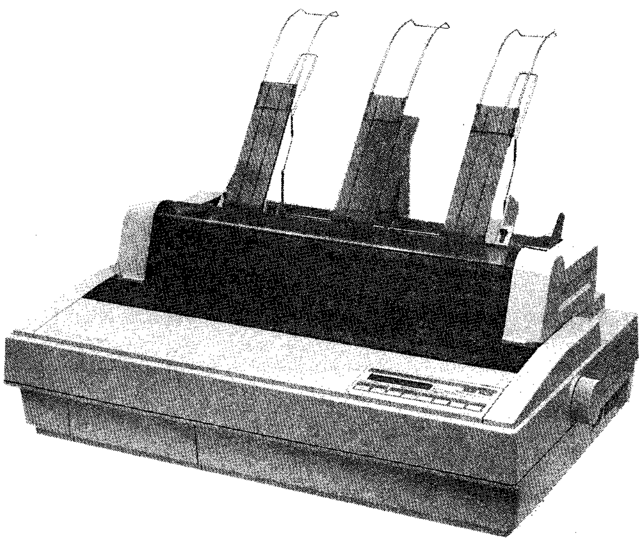

Figure 3-2. SQ-850 with Single-bin CSF

3.3.1 CSF Specifications

Hopper Capacity

Cut sheets	185 sheets, maximum .... 64 g/m² paper
	150 sheets, maximum .... 82 g/m² paper
Envelopes	Only 1st bin
	25 sheets, maximum .... xerographic or bond paper
	30 sheets, maximum .... airmail paper

NOTE: If the weight of paper differs from above values, total thickness of sheets must be less than 0.59" (15 mm).

Stacker Capacity

Cut sheets:	100 sheets, maximum
Envelopes:	10 sheets, maximum

Loading Position

Cut sheets: ± 1 mm (±0.039")
Within the following conditions:
- Paper weight 64 ~ 82 g/m²
- Temperature 5 ~ 35 °C
- Humidity 15 ~ 80%

Envelopes: ± 2 mm (±0.079")
Within the following conditions:
- Paper weight 45 ~ 91 g/m²
- Temperature 5 ~ 35 °C
- Humidity 15 ~ 70%

Paper Skew

Cut sheets: ± 0.3 °
Within the following conditions:
- Paper weight 64 ~ 82 g/m² paper
- Temperature 5 ~ 35 °C
- Humidity 15 ~ 80%

Envelopes: ± 0.5 °
Within the following conditions:
- Paper weight 45 ~ 91 g/m²
- Temperature 5 ~ 35 °C
- Humidity 15 ~ 70%

Reliability

MCBF: 100,000 cycles

Environmental Conditions

Temperature	operating: +5 ~ +35°C
	storage: −30 ~ +70 °C
Humidity	operating: 15 ~ 80% (15 ~ 70%)
	storage: 5 ~ 90% (5 ~ 70%)

NOTE: Humidity conditions must no condensation. And parenthesis value indicated range for feeding envelopes.

Paper Type and Quality

The cut sheet feeder requires plain bond, typewriter, or xerographic quality paper with a minimum of wood pulp.

Cut sheet paper and envelopes must be in as a good condition as new: must be flat, not be curled or curved, and must be without damage at the surface or the edges. Additionally, envelopes must be well creased.

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 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.

Paper Width and Length

Cut sheets	Width: 182 mm (7.17″) ~ 364 mm (14.3″) .... 136 column model
	182 mm (7.17″) ~ 216 mm (8.5″) .... 80 column model
	Length: 210 mm (8.27″) ~ 305 mm (12.0″)
Envelopes	Width: 166 mm (6.54″) ~ 241 mm (9.49″)
	Length: 92 mm (3.62″) ~ 104 mm (4.09″)

Paper Thickness

Cut sheets	0.07 mm (0.0028″) ~ 0.1 mm (0.0039″)
Envelopes	0.25 mm (0.0098″) ~ 0.5 mm (0.0197″

Paper Weight

Cut sheets	64 ~ 82 g/m²
Envelopes	45 ~ 91 g/m²

Angular Deviation

Cut sheets	Less than ± 0.5 mm (0.02″)
Envelopes	Less than ± 1.0 mm (0.04″)

Recommended Paper Storage Conditions

Temperature	+18 ~ +22 °C
Humidity	40 ~ 60%

Dimensions and Weight

See Table 3-6 and Figure 3-3, 3-4.

Table 3-6. Dimensions and Weight

	Width	Depth	Height	Weight
Cut sheet feeder				
136 col. Double	555mm (21.9")	437mm (17.2")	346mm (13.6")	5.6Kg
136 col. Single	555mm (21.9")	337mm (13.3")	346mm (13.6")	3.2Kg
80 col. Double	428mm (16.9")	437mm (17.2")	346mm (13.6")	3.5Kg
80 col. Single	428mm (16.9")	337mm (13.3")	346mm (13.6")	2.6Kg
Cut sheet feeder with printer				
136 col. Double	664mm (26.4")	608mm (23.9")	470mm (18.5")	20.0Kg
136 col. Single	664mm (26.4")	508mm (20.0")	470mm (18.5")	17.6Kg
80 col. Double	537mm (21.1")	608mm (23.9")	470mm (18.5")	15.5Kg
80 col. Single	537mm (21.9")	508mm (20.0")	470mm (18.5")	14.6Kg

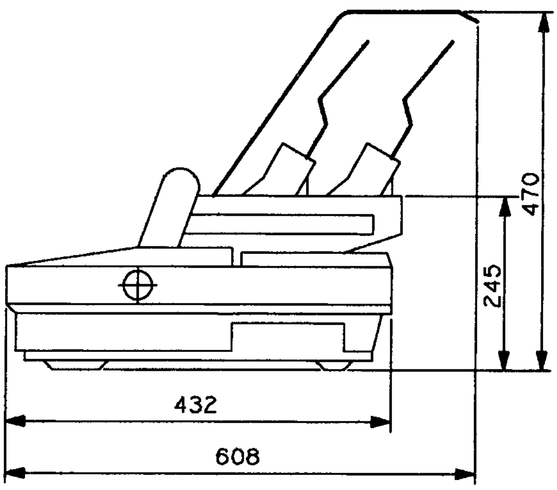

Figure 3-3. Double-bin CSF with Printer Dimension Diagram

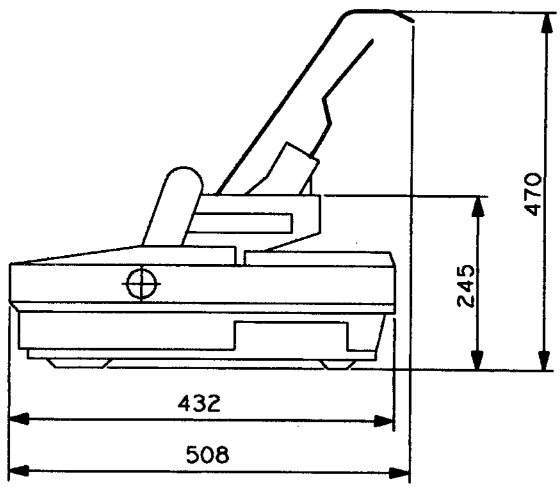

Figure 3-4. Single-bin CSF with Printer Dimension Diagram

3.3.2 CSF Software Control

This cut sheet feeder is driven by the firmware incorporated into the printer and need not be electronically connected to it. It also contains two bins so that two different sizes of paper can be handled.
The panel setup or control command (ESC EM) can be used to select a bin and specify the cut sheet feeder mode.

Command: ESC EM

Format:	LPRINT 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.

3.3.3 Mechanism Operation

This section briefly describes paper loading by the cut sheet feeder.

Power is conveyed to the cut sheet feeder via the platen transmission gear which engages the platen gear. The paper is caught between the paper holder and paper loading roller.

When loading the paper, the paper feed motor rotates in reverse so that the paper is sent out from the hopper by the paper loading roller. The paper caught by the paper feed sub-roller and the idler on the idle lever is sent to the paper guide. When the paper reaches the position where the paper is caught by the platen, the paper feed motor rotates forward so that the paper is loaded by the platen and paper feed roller. The combination of the gears makes the paper feed sub-roller always rotate in the same direction (paper loading direction), egardless of the rotational direction (forward or reverse) of the paper feed motor.

The hopper unit sends out cut sheets one by one using the paper holder which holds the paper against the paper loading roller and the separation notches positioned at the left and right edges of the sheet. Thick paper such as a envelope may not be fed correctly if it is held by the separation notches. Release the separation notches using the separation notch release lever when using thick paper.

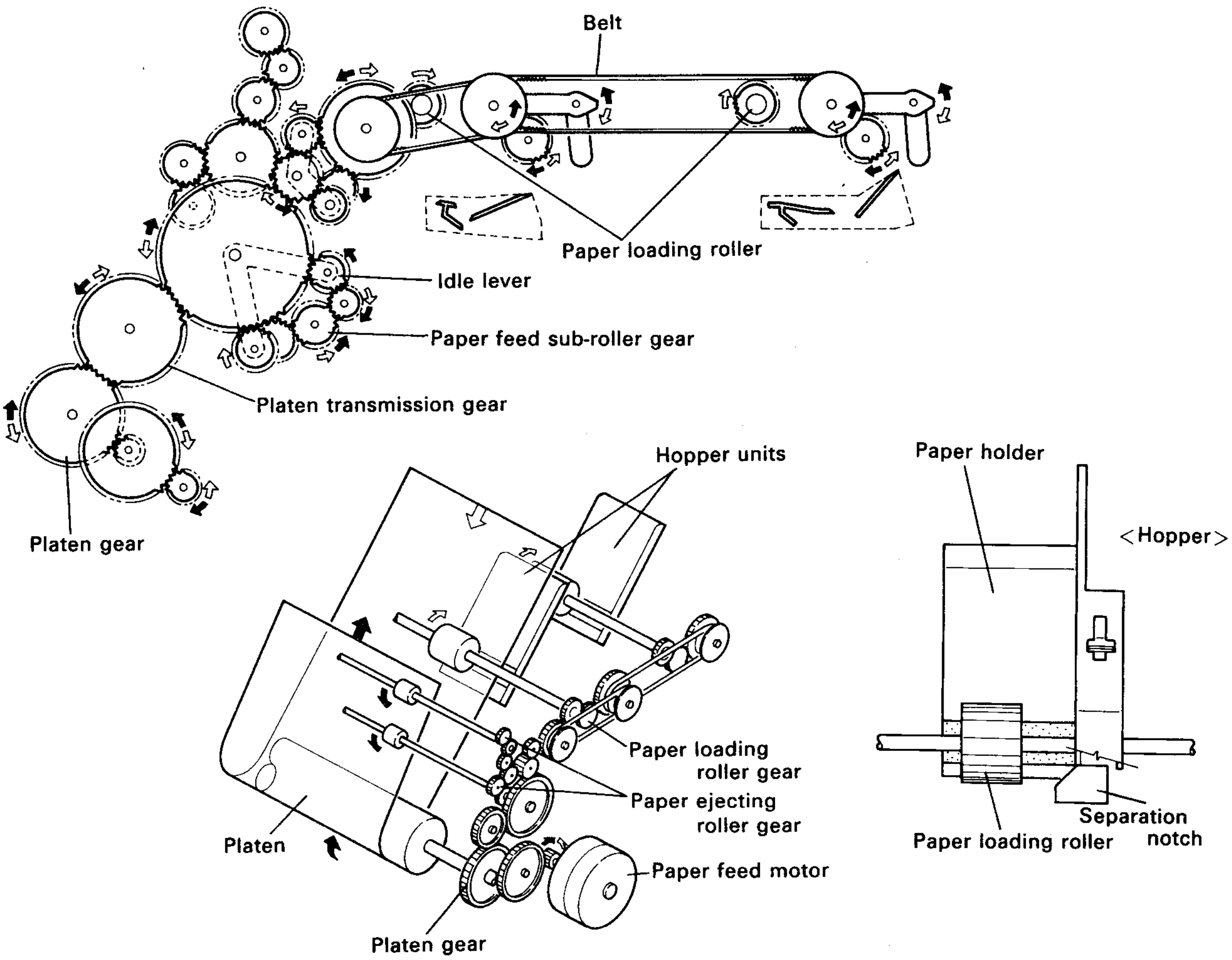

Figure 3-5. Cut Sheet Feeder Operation

3.3.4 Disassembly and Assembly

This section briefly describes disassembly and assembly of the cut sheet feeder using the double-bin type CSF (136-column model)as an example. Figure 3-6 shows a flow chart of the cut sheet feeder disassembly procedure.

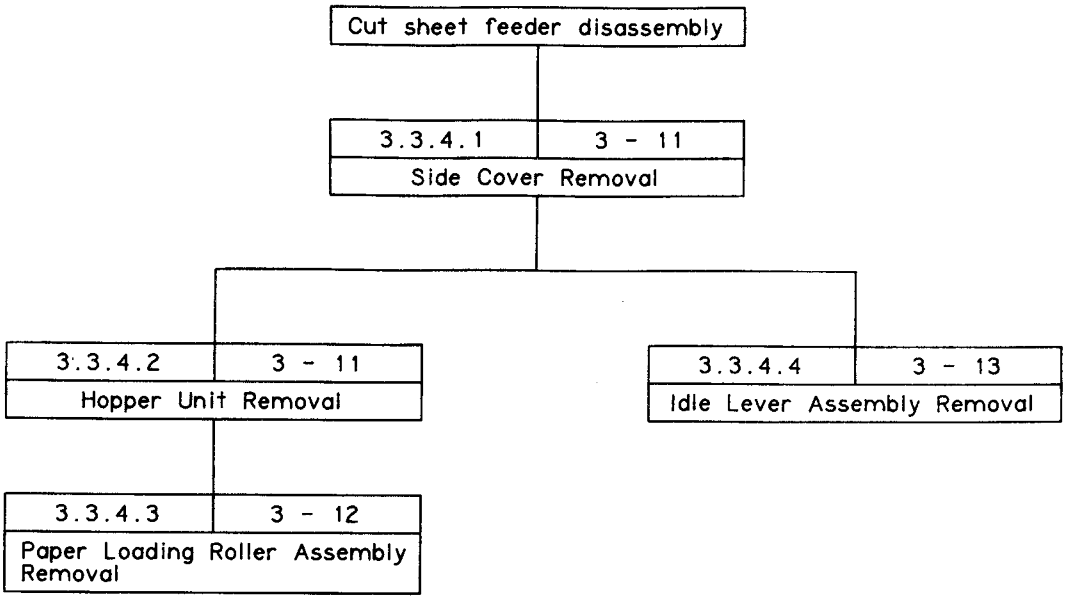

Figure 3-6. Cut Sheet Feeder Disassembly

3.3.4.1 Side Cover Removal

[Step 1] Remove the three stacker supports, four hopper fittings, three stacke fittings, and two paper supports from the CSF.

[Step 2] Remove side covers L and R from side frames L and R. (Side cover L (R) is fixed to side frame L (R) with the seven tabs.)

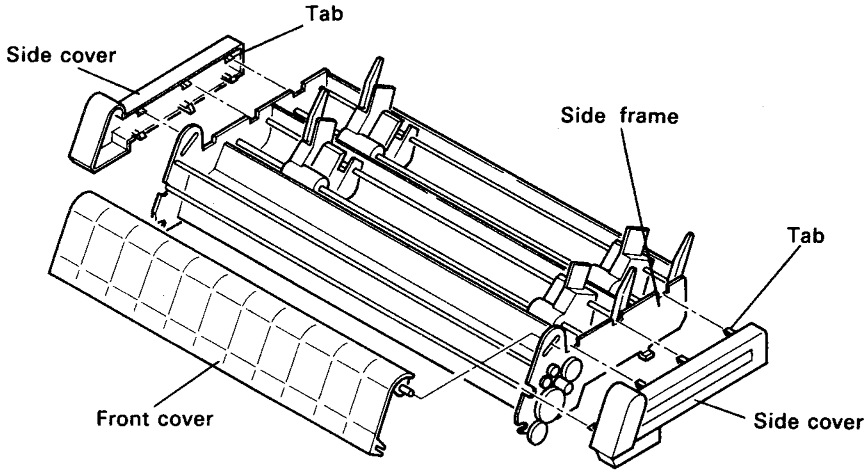

Figure 3-7. Side Cover Removal

3.3.4.2 Hopper Unit Removal

[Step 1] Remove the side covers.

[Step 2] Remove the projecting portion of paper support shaft holder L from the hole in side frame L, then rotate shaft holder L 90° so that the projecting portion faces up. Do the same thing for shaft holder R.

[Step 3] Remove the E ring at the left of the paper loading roller shaft, then slide the paper loading roller shaft to the right to remove the shaft holder from side frame L.

[Step 4] Remove the shaft holder at the right of the paper loading roller shaft from side frame R, then remove the whole hopper unit. The double-bin CSF hoper unit can be removed in the same way as for the single-bin CSF.

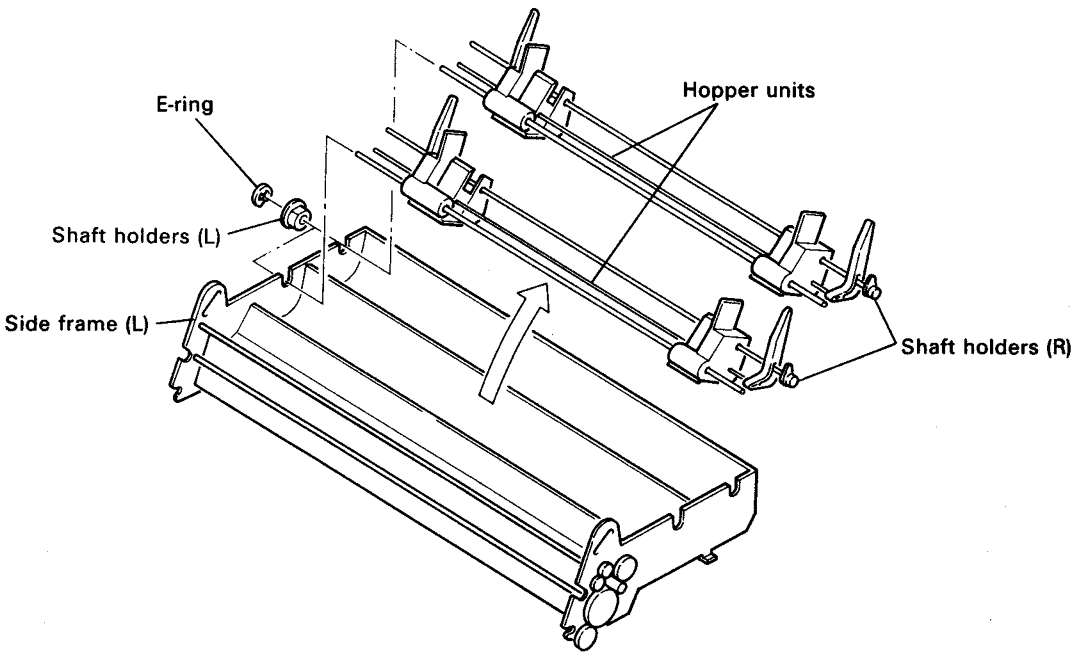

Figure 3-8. Hopper Unit Removal

ASSEMBLY POINT:

- When installing the hopper unit, install it so that the grooves at the lower portions of paper support L (R) engages the rear frame rail.

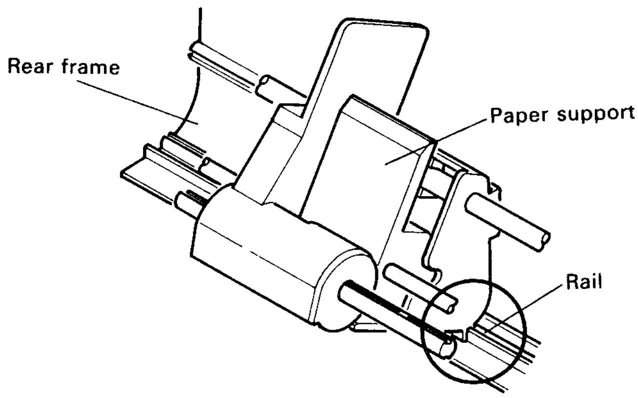

Figure 3-9. Hopper Unit Installation

3.3.4.3 Paper Loading Roller Assembly Removal

[Step 1] Remove the hopper unit.

[Step 2] Remove paper loading roller covers L and R. (The paper loading roller cover is secured with two studs.)

[Step 3] Take out the paper loading roller shaft by pulling it in the R direction, then remove the paper loading roller L assembly and the paper loading roller R assembly.

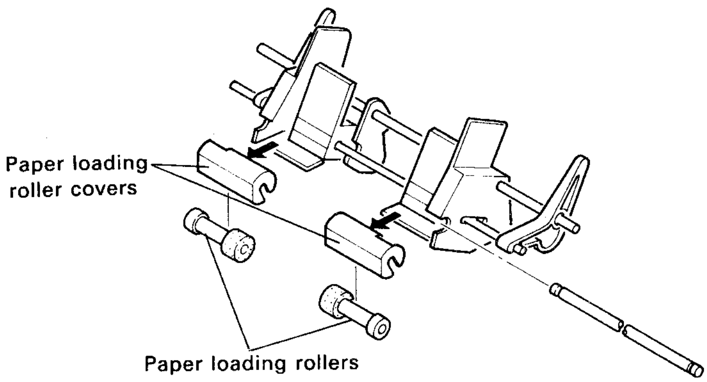

Figure 3-10. Paper Loading Roller Assembly Removal

ASSEMBLY POINTS:

- When installing the paper loading roller assembly, be careful of the correct left-right orientation.
- When replacing the paper loading roller assembly, replace both the L and R assemblies.

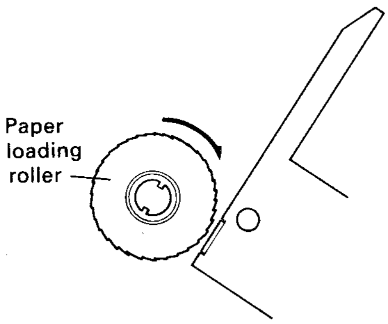

Figure 3-11. Paper Loading Roller Assembly

3.3.4.4 Idle Lever Assembly Removal

[Step 1] Remove the side covers.

[Step 2] Remove the three E rings from drive transmission gear A, the platen transmission gear, and drive transmission gear C, then remove the three gears.

[Step 3] Remove the planetary lever A assembly and planetary lever C assembly from the shaft of drive transmission gear A.

[Step 4] Remove the sheet guide lever spring.

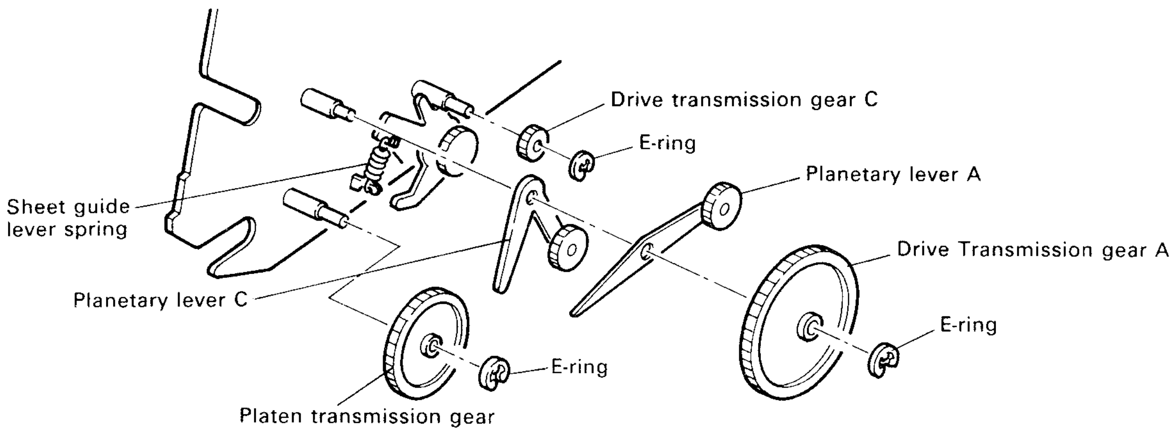

Figure 3-12. Idle Lever Assembly Removal (1)

[Step 5] Remove the E ring from the paper loading sub roller shaft at the side frame L side, then remove the paper loading sub roller shaft holder.

[Step 6] Remove the four CBS set screws (M3 x 6) from paper guide plate A, and remove paper guide plate A with the paper loading sub roller shaft assembly (with the sheet guide lever and paper loading sub gear still assembled).

[Step 7] Remove the left idle lever shaft holder lock pin from the stud on side frame L, then rotate the shaft holder so that it becomes parallel to the cutout in the side frame.

[Step 8] Remove the idle lever assembly with the two idle lever shaft holders.

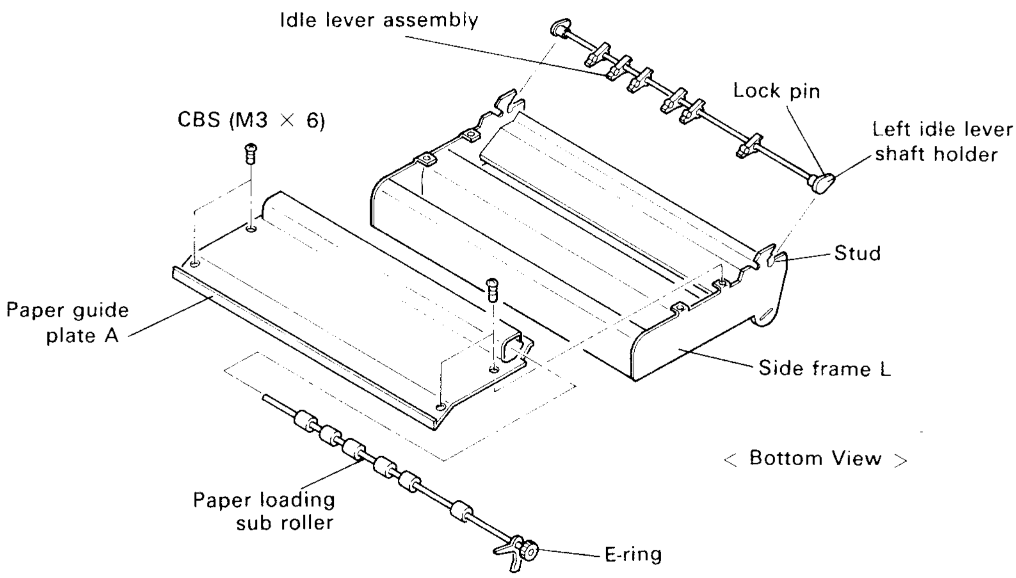

Figure 3-13. Idle Lever Assembly Removal (2)

ASSEMBLY POINTS:

- Lubricate (G-14) the shafts at both sides of the six idlers in the idle lever assembly.
- Lubricate (O-3) the paper loading sub roller shafts holes in of side frames L and R.
- When reassembling the idle lever assembly, check that the plastic film on the front frame is not caught by the idle lever assembly.

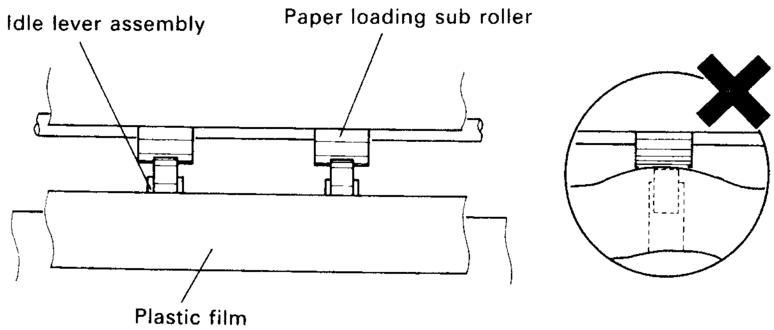

Figure 3-14. Idle Lever Assembly Installation

CHAPTER 4
GENERAL DESCRIPTION

CHAPTER 4

LIST OF FIGURES

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4.1 BEFORE DISASSEMBLY

This chapter describes the disassembly procedure for replacing any of the major components of the printer. Before disassembling the printer, be sure to read the following cautions.

DANGER

- Before disassembling, assembling, and adjusting the printer, be sure to disconnect the AC power cord.
- Wear protective glasses to protect your eyes from the ink. If any ink comes into contact with the eyes or a wound, wash it off immediately with plenty of water, then consult a doctor.
- If the ink comes into contact with skin (i.c. hands), wash it off with soap and plenty of water. If any irritation develops, consult a doctor.
- The main board of the printer is equipped with a lithium battery. Before disassembling the main board, read the following cautions so that you can handle the battery safely. Also be careful of its storage condition.
  a. Do not store lithium batteries stacked together or with other metal parts, to prevent the + and − sides from making electrical contact, which could cause a short circuit.
  (If a battery is shorted, a large current can flow. The battery could ignite or burst due to the heat generated.)
  b. Do not heat the battery. Do not throw it away into a fire.
  c. Do not solder any portion other than the connection terminals.
  (The battery might burn or burst if the internal solution leaks out or if it shorts internally. If the solution in the battery leaks and it is left as it is for a long time, the printer components around the battery could be damaged.)
  d. Do not charge the battery.
  (If it is charged, gas would be generated, and it could ignite or burst.)
  e. Do not disassemble the battery, or deform it using pressure.
  (The gas in the battery could irritate your throat, or the battery might burst or ignite, and the solution might leak.)
  f. Do not mount the battlery (+ and − sides reversed).
  (If the + and −-sides are reversed, the battery might ignite or burst due to a short circuit.)

WARNING

- Before transporting or repairing the printer or printer mechanism, observe the notes indicated in the repair procedure below to keep the repair personnel safe and keep the printer clean. Also, be sure to start repairs by draining the ink, and only transport the printer under the correct conditions.
- Please instruct customers on the precautions for transporting the printer whenever you have a chance to talk to them.
- Use the specified tools to maintain optimal printer performance. Epson will not take responsibility for printer parts being damaged by tools other than those specified.
- Be sure to perform the specified lubrication and adhesive application. (See Chapter 6.)
- Be sure to perform the specified adjustments.
- Be sure to read the following notes, which give details on the above WARNINGS.

The following notes apply to the disassembly, assembly and adjustment procedures for the printer.

- Repair procedure
  Because this is an ink-jet printer, some ink always remains in the ink path in the ink mechanism. This could cause trouble. To prevent problems from occurring, the countermeasures indicated in Table 4-1 below are required.

Table 4-1. Ink Handling and Countermeasures

Condition	Problem	Countermeasure
● When disassembling the printer to replace the print-head or to perform maintenance:	Ink leakage during the process	● Drain the remaining ink. ● Cap the printhead.
● When transporting the printer: ● When sending the repaired printer to the customer:	Ink leakage due to vibration or impact	● Discharge the remaining ink ● Cap the printhead parts. ● Attach the protective the customer:
	Clogged printhead due to the printer being sotred for a long time with ink in the system. (A specific dot does not print.)	● Clean the ink path (then to the printer being drain the cleaning liquid). ● Cap the printhead.

NOTE 1: When only a small the amount of ink remains (after cleaning), the ink does not leak easily due to the ink tension.

NOTE 2: The words "a long time" used to refer to storage conditions means 30 days or more, which means the transportation or storage time is not certain.

The customers are instructed to do the following when transporting the printer:

- Clean the ink path, if possible.
- Cap the printhead.
- Remove the ink cartridge.
- Attach the protective parts, and pack the printer in the packing correctly.

The service personnel are required to do the following after the repair is completed:

- Draining the ink
  The ink can be drained by mounting the special "ink draining cartridge" in the ink cartridge holder and executing a cleaning. All the remaining ink in the ink path can be removed (drained).
- Cleaning
  After the maintenance is completed, clean the ink path before sending the printer back to the customer. The ink path can be cleaned by mounting the special "cleaning cartridge" in the cartridge holder and executing a cleaning. After cleaning, drain the cleaning liquid by executing the ink draining operation.

- Capping
- Attaching the protective parts and packing
  Attach the protective parts, and pack the printer in the specified package as shown in Figure 4-1.

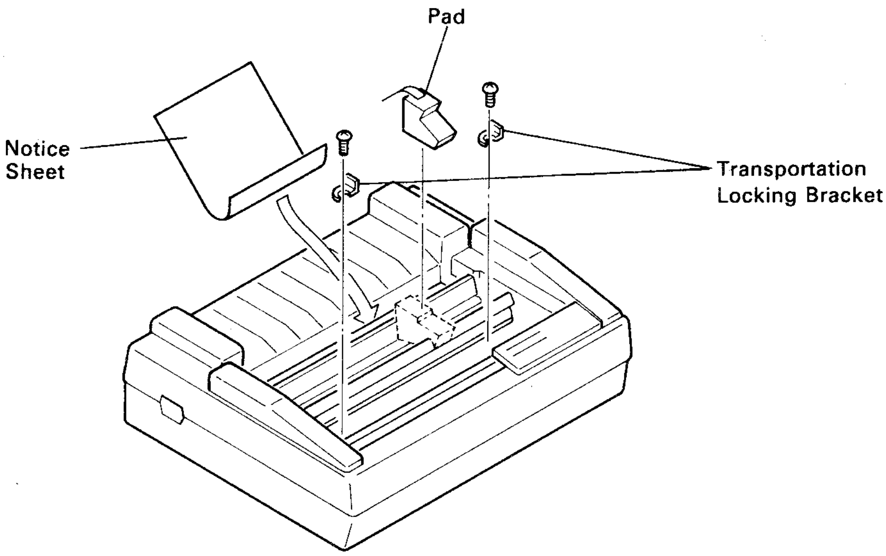


Figure 4-1. Attaching the Protective Parts

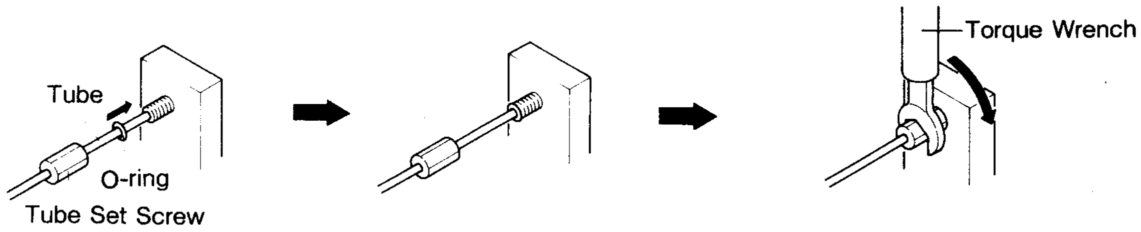
The above described procedures are arranged as a repair process in Table 4-2 below. Use this table as a check list when performing repairs.

Table 4-2. Repair Process

Procedure	Process	Contents	Cartridge to be used	Operation
1	Capping	Protect the printhead from being damaged.	—	Turn the printer power on/off.
2	Ink draining	Remove the remaining ink from the ink path.	Draining cartridge	Cleaning (two times);
3	Repair	—	—	—
4	Self test	Check the results of the repair.	Ink cartridge	Self test
5	Ink draining	Drain the ink used in the self test.	Draining cartridge	Cleaning (two times)
6	Ink path cleaning	Clean the ink path with the special cleaning liquid.	Cleaning cartridge	Cleaning (once)
7	Draining the cleaning	Draining the remaining cleaning liquid.	Draining cartridge	Cleaning (three times)
8	Capping	Protect the printhead from being damaged.	—	Turn the printer power on/off.
9	Packing	Attach the protective parts for transportation.	—	

- Tools

The recommended tools and measuring instruments required for disassembly, assembly, and adjustment are listed in Tables 4-3 and 4-4. Use only the specified tools. In particular, use the specified torque wrench when tightening the tube set screw that secures the tubes to the filter and the pump unit. If another wrench is used and the screw is tightened too far, the "O" ring might be cut or cracked, which could cause ink leakage. When tightening the tube set screw, the tube must be fully inserted.



1. Insert the tube fully. 2. Set the O-ring. 3. Tighten the tube set screw.

Figure 4-2. Tightening Tube Set Screw

- Lubrication

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

- Adjustment

After replacing any part and reassembling the printer, perform the adjustments indicated in Section 4.3.

Table 4-3. Tools

Designation		Type (NOTE 1)	Part No.
Round nose pliers		O	B740400100
Nipper		O	B740500100
Tweezers		O	B741000100
Soldering iron		O	B740200100
E ring holder #3		O	B740800500
E ring holder #4		O	B740800600
Philips screwdriver No. 2		O	B743800200
Sloted head screwdriver		O	B743000100
Box driver (7 mm)		O	B741700200
Torque driver (max. 3 kgf cm)		O	B740101900
Torque driver bit (#1, L = 75)		O	B740101702
Cleaning brush		O	B741600100
Thickness gauges (NOTE 2)	(T=0.5 mm)	O	B776700301
	(T=0.4 mm)	O	B776700101
	(T=0.6 mm)	O	B776700501
Tension gauge (3,000 g)		O	B747700200
Torque wrench (6 mm × 1 kg) #E589		E	B765106901
Position alignment tool #E693		E	F765113301
Adjustment cartridge #E687		E	Y591008020
Cleaning cartridge #E691		E	F348881000
Draining cartridge #E690		E	F348871000

NOTE 1: O = Standard commercial tool, E = Epson exclusive tool

NOTE 2: Select either combination, 0.5 mm × 2 or 0.4 mm + 0.6 mm, so that the total thickness becomes 1.0 mm.

Table 4-4. Necessary Measuring Instruments

Designation	Specification	Class
Osciloscope		A
Tester		A
Calipers		A

NOTE: A = Mandatory, B = Recommended

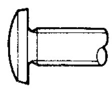
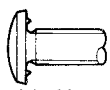
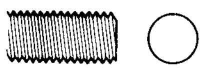
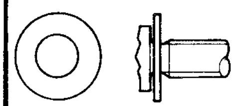
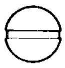
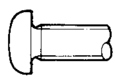
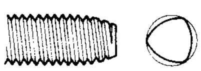
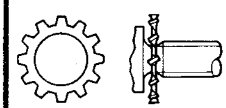
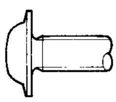
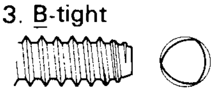
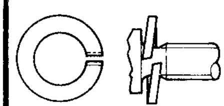
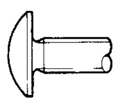
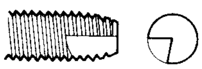
- Screw designation

All small parts, such as screws and washers, are indicated by abbreviated names.

Table 4-5. Abbreviations List of Small Parts

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

Table 4-6. Form and Abbreviated Part Name of Screw

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

4.2 DISASSEMBLY AND ASSEMBLY

This section describes the procedures for disassembling the major components of the printer. Unless otherwise specified, assembly can be performed by simply reversing the order of disassembly. For items needing special attention, notes on assembly appear as "ASSEMBLY POINTS." For assembly procedures which require adjustment, the necessary adjustment is indicated as "ADJUSTMENT REQUIRED."

WARNING

- Read Section 4.1 before disassembly.
- Remove the protective parts for transportation before disassembly.
- Remove paper and the ink cartridge before disassembly.

The disassembly sequence in this section is grouped into five parts: (1) Printhead replacement, (2) Case removal, (3) Circuit removal, (4) Printer mechanism removal, and (5) Printer mechanism disassembly.

This manual describes in detail the disassembly and assembly procedures for the following:

1. Major components
2. Procedures which require special attention. For the disassembly and assembly procedures for the other components, refer to the exploded diagrams in APPENDIX.

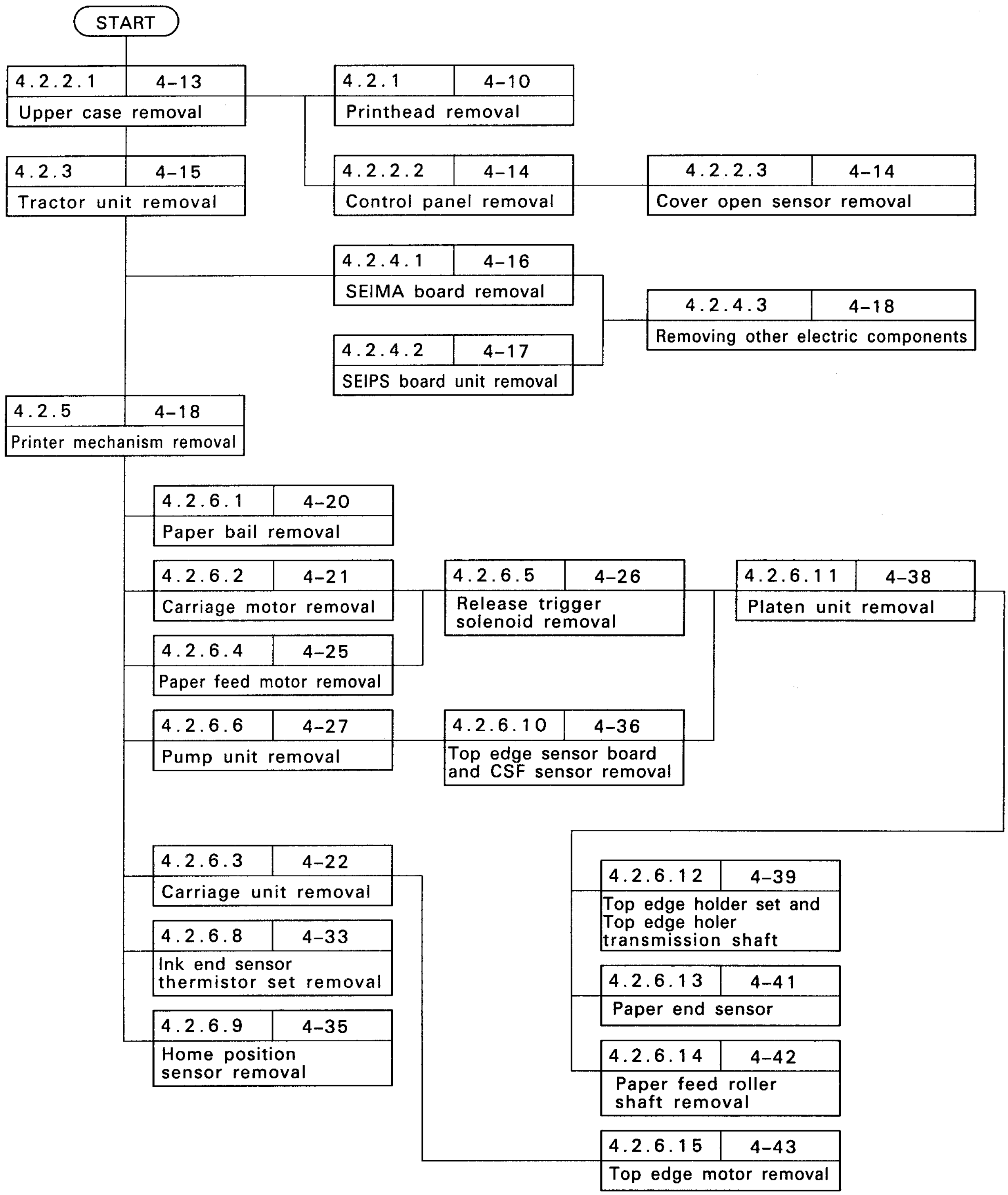


Figure 4-3. Disassembly Flow Chart

4.2.1 Printhead Replacement

This section describes the printhead removal and assembly procedures.

NOTE: The printhead unit includes a filter. Since the length of the ink supply tube cover varies depending of the number of printable columns, the cord to the printhead unit and the assembly procedures are different between the 80-and 136-column models.

Step 1 Drain the ink. (See Table 4-2.)
Step 2 Remove the upper case. (See Section 4.2.2.1.)
Step 3 Move the paper bail up. Move the printhead to a position near the 20th column by moving the carriage manually while pressing the head cap set.

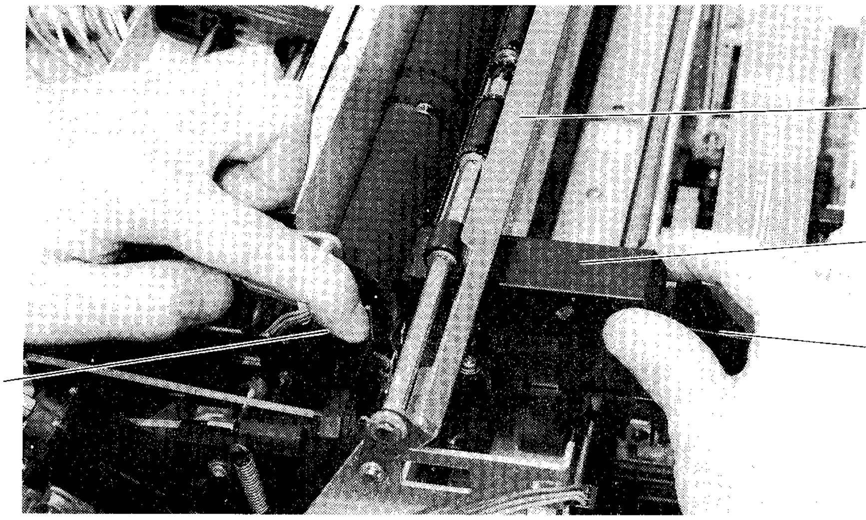


Figure 4-4. Moving the Printhead

Step 4 Remove the CC screw (3 × 12) at the rear of the printer, which secures the FPC cover, then remove the FPC cover.
Step 5 Disconnect the FPC from the connector.
Step 6 Remove the two screws securing the printhead to the carriage.
Right side: CP(P) (M3 × 6)
Left side: CP(P) (M3 × 12)

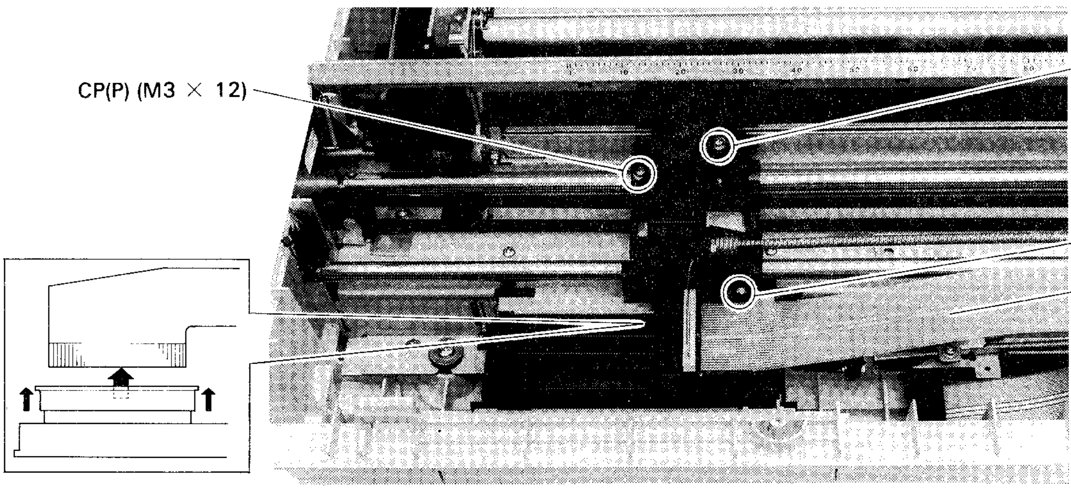


Figure 4-5. FPC Removal

Step 7 Loosen the tube set screw (hexagonal) connecting the filter set and ink supply needle set, then remove the screw and O ring.

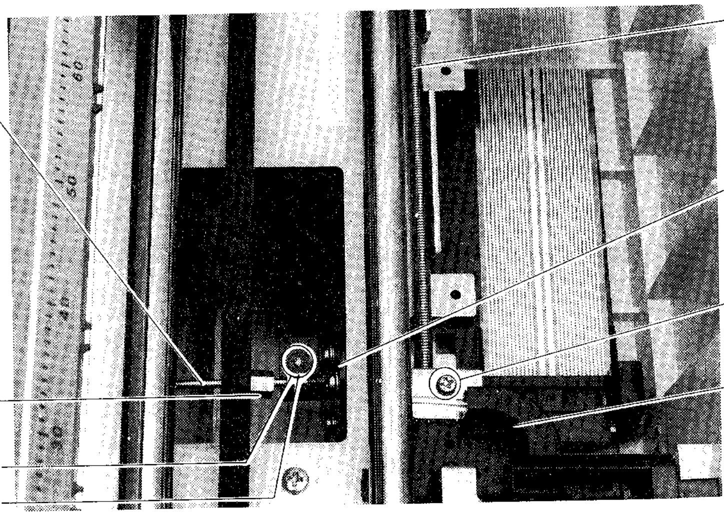
Step 8 136-column model: Remove the CCS screw (M3 × 6) securing the tube cover, then remove the tube cover.

80-column model: Remove the CCS screw (M3 × 15) securing the tube cover base, then remove the base. Remove the tube which is wound from the base.

Step 9 136-column model: Remove the CCS screw (M3 × 8) securing the filter set to the base frame, then remove the filter set.

80-column model: Remove the CPB screw (M3 × 8) securing the filter set to the tube cover base, then remove the filter set.

Remove the printhead unit.



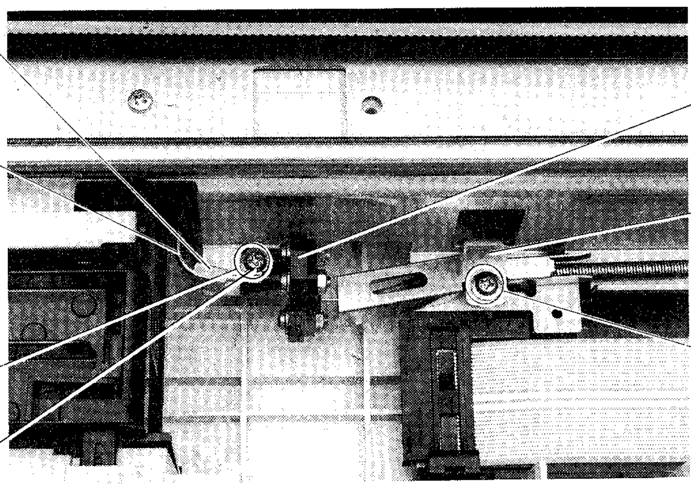


Figure 4-6. Printhead Removal

ASSEMBLY POINT:

WARNING

When connecting the ink supply needle set and filter set, be sure to tighten the set screw using the specified torque wrench.

136-and 80-column models:

- When reattaching the head adjusting pin, set the pin so that the projection faces the left. (See Figure 4-64)

136-column model:

- When reconnecting the ink supply needle set, filter set, and head tube, be sure that they are arranged in line. (See Figure 4-6)

80-column model:

- When reattaching the tube cover spring to the tube cover spring base, check that it is set correctly. Check that the connected portions between the ink supply needle set and filter set, and the tube cover base and tube cover spring, are straight. (See Figure 4-6)
- When reattaching the tube cover spring base, first set the tube against the base, then attach the tube cover spring hook using your finger. Pass the tube cover spring base under the base frame of the printer mechanism while holding the tube cover spring hook to the tube base with your finger.

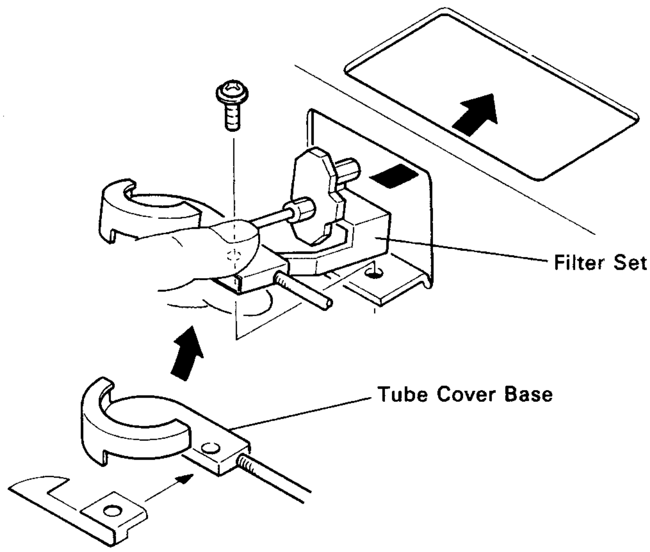


Figure 4-7. Tube Cover Spring Base Assembly

ADJUSTMENT REQUIRED

After replacing the printhead, the following adjustment is required:

- Platen gap adjustment (See Section 4.3.4)
- Printing alignment (See Section 4.3.5)

4.2.2. Case Removal

This section describes the upper case removal and the control unit panel (SEIPNL) and cover open sensor removal.

4.2.2.1 Upper Case Removal

Step 1 Remove the sheet guide, printer cover, paper feed knob, options (tractor unit, paper guide, and CSF).

Step 2 Remove the CBB screw (M4 × 25) in the groove at the front side of the upper case. (136-column model: two, 80-column model: one)

Step 3 Unlock the two hooks at the front by inserting a hand from the rear side of the upper case, then lift the upper case a little bit. Insert your hand through the space at the right side, and disconnect the control panel cable from connector CN6 on the SEIMA board.

Step 4 Lift the front of the upper case by using the back of the case as a fulcrum.

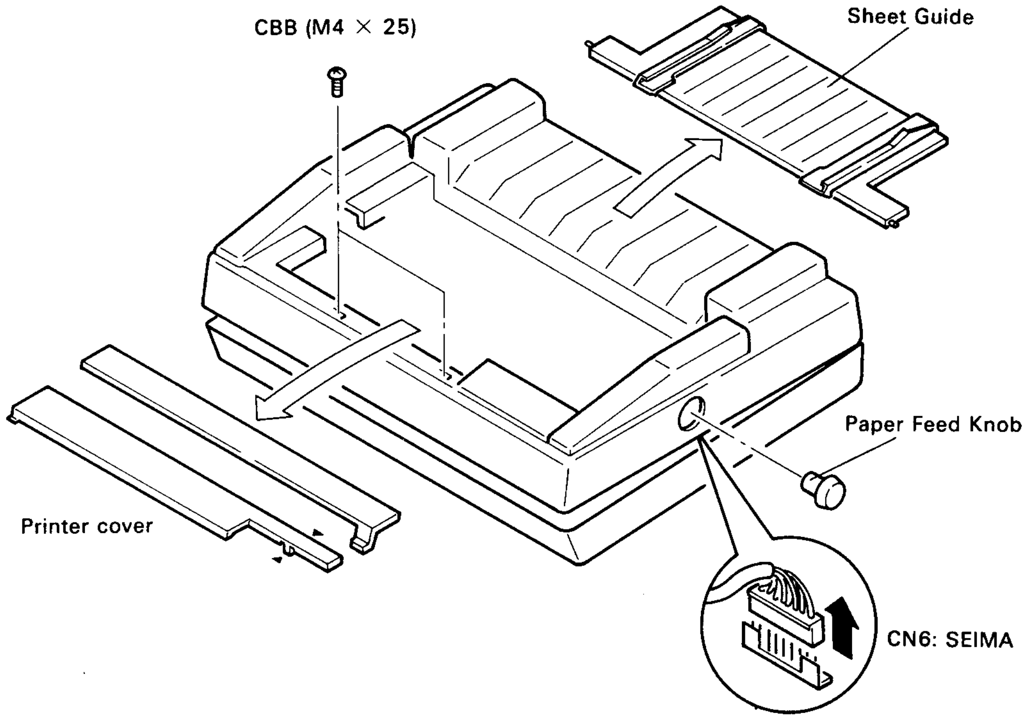


Figure 4-8. Upper Case Removal

ASSEMBLY POINT:

- When reattaching the upper case, check that the control panel cable is fixed by the bent tabs on the inside (right side) of the upper case. (See Figure 4-9)

4.2.2.2 Control Panel Removal

Step 1 Remove the upper case. (See Section 4.2.2.1)

Step 2 Turn the upper case over, and remove the control panel cable from the tabs (A) inside of the upper case cover.

Step 3 Disconnect the cables from the two connectors on the SEIPNL board. Cover open sensor and control panel)

Step 4 Push the notch (B) securing the control panel to the upper case, then remove the panel.

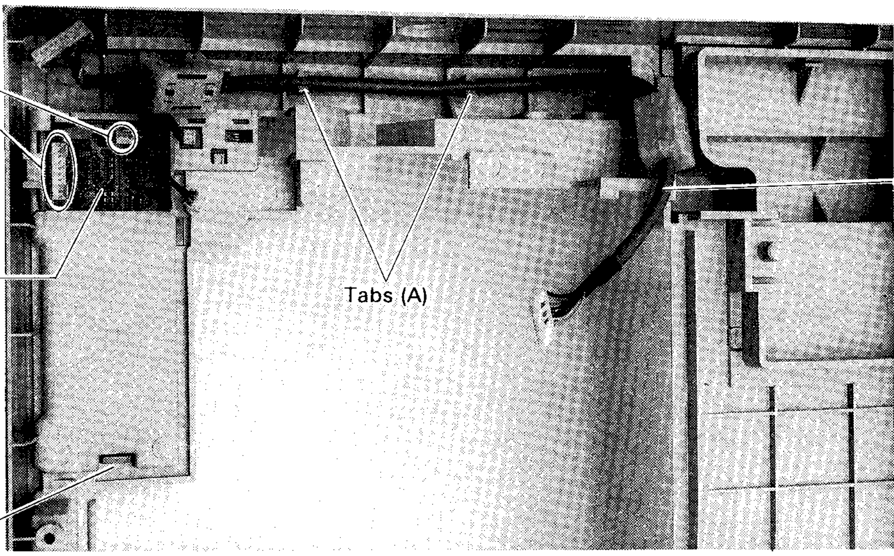


Figure 4-9. Control Panel Removal

ADJUSTMENT REQUIRED

After replacing the control panel, the following adjustment is required:

- Printing alignment (See Section 4.3.5)

4.2.2.3 Cover Open Sensor Removal

Step 1 Remove the control panel. (See Section 4.2.2.2.)

Step 2 Turn the upper case over again to the original face.

Step 3 Push the notch securing the cover open sensor, then remove the sensor.

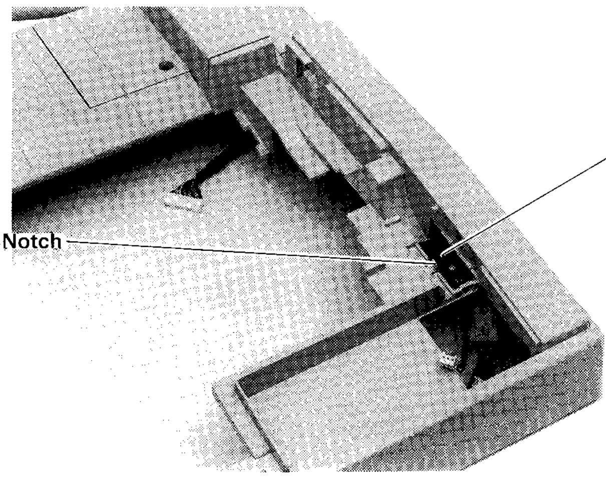


Figure 4-10. Cover Open Sensor Removal

4.2.3 Tractor Unit Removal

The tractor unit must be removed before removing the various other units.

Step 1 Remove the upper case. (See Section 4.2.2.1)
Step 2 Remove the two CB(N)S screws (M3 × 6) at the left and right, which secure the tractor unit.
Step 3 Pull the tractor unit backward.

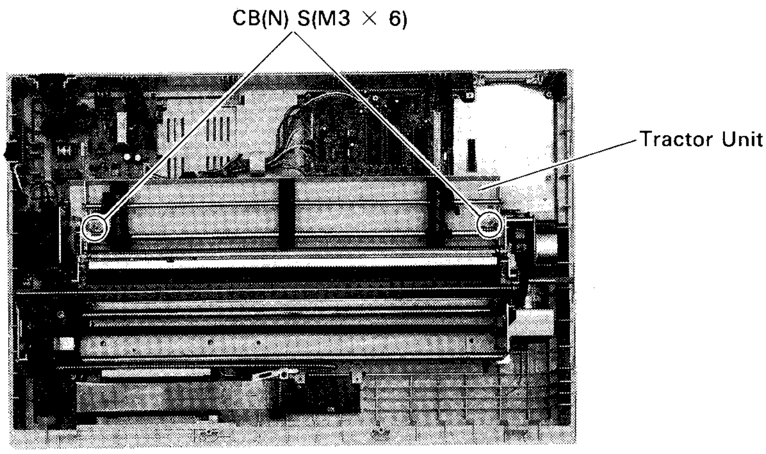


Figure 4-11. Tractor Unit Removal

ASSEMBLY POINT:

- When reattaching the tractor unit, match the unit and the guide pin, and tighten the screw while pushing the unit frontward.

4.2.4 Electric Circuit Board Removal

This section describes the SEIMA board unit and SEIPS/SANPSE board unit removal.

4.2.4.1 SEIMA Board Removal

DANGER

- The SEIMA board includes a lithium battery. Read the notes in Section 4.1 thoroughly before starting the removal.

WARNING

- When disconnecting the connector, pull the female connector out slowly while holding the board with a finger to prevent the board from being damaged.
- Since the construction of connector CN20 is different from that of the others, handle it with care to prevent it from being damaged.

Step 1 Remove the upper case. (See Section 4.2.2.1)
Step 2 Remove the tractor unit. (See Section 4.2.3)
Step 3 Remove the connector cover (for optional interface).
Step 4 Disconnect the cables from the all connectors on the SEIMA board. (14 cables: CN3 and CN8 through CN20)
Step 5 Remove the two CPS(P) screws (M3 × 8) securing the shield plate to the (lower) paper guide.
Step 6 Remove the two CPS(P) screws (M3 × 8) securing the board and the noise shield to the base plate.
Step 7 Remove the CPS(P) screw (M3 × 8) securing the SEIMA board to the base plate.
Step 8 Loosen the four bent tabs fixing the SEIMA board to the lower case,then remove the SEIMA board.

NOTE 1: To disconnect the cable from connector CN20, the harness latch must be removed.
NOTE 2: When removing the shield plate from the board, remove the two cable latch set screws, CBS (M3 × 5), at the parallel interface connector.

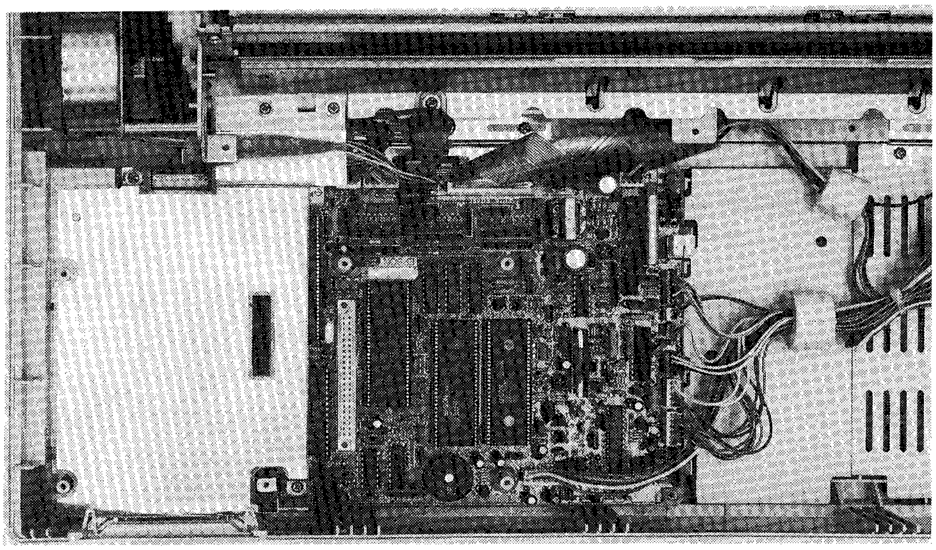


Figure 4-12. SEIMA Board Removal

4.2.4.2 SEIPS/SANPSE Board Unit Removal

Step 1 Remove the upper case. (See Section 4.2.2.1.)

Step 2 Remove the tractor unit. (See Section 4.2.3.)

Step 3 Disconnect the cable from connector CN2 on the board.

Step 4 Remove the CPS(P) screw (M3 × 8) securing the board to the base plate. Remove the CB(O) screw (M4 × 8) securing the ground wire of the AC cable (inlet) to the base plate.

Step 5 Remove the AC cable (inlet) and the POWER switch from the lower case.

Step 6 Loosen the three bent tabs fixing the board to the lower case, then remove the board.

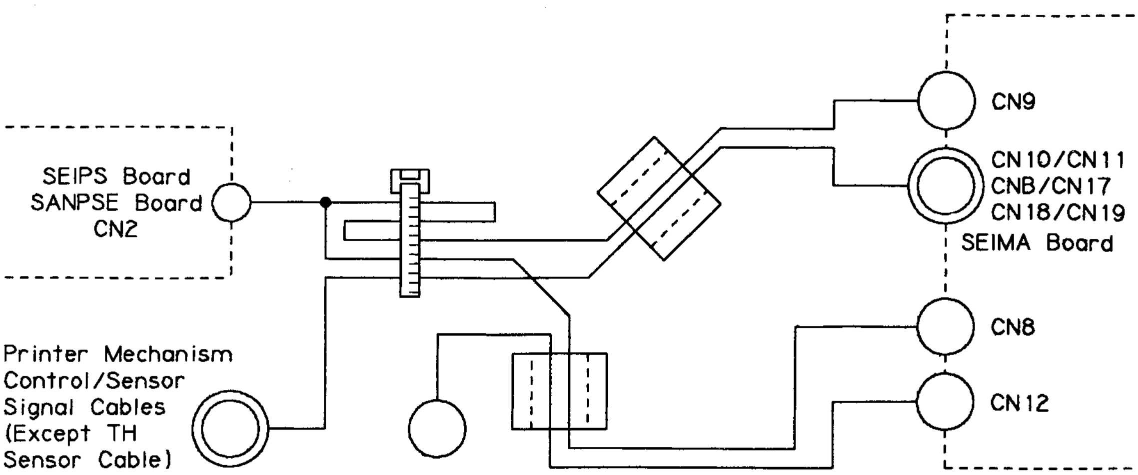


Figure 4-13. SEIPS/SANPSE Board Removal

4.2.4.3 Removing Other Electrical Components

- The base plate can be removed by removing the three CBB screws (M3 × 12) securing the base plate to the lower case after removing the SEIMA and SEIPSJ/SEIPS/SANPSE boards. (See Sections 4.2.4.1 and 4.2.4.2)
- The serial interface connector can be removed by removing the two CP screws (M3 × 6) securing the connector to the plate after removing the base plate.
- Figure 4-14 shows the cable wiring.

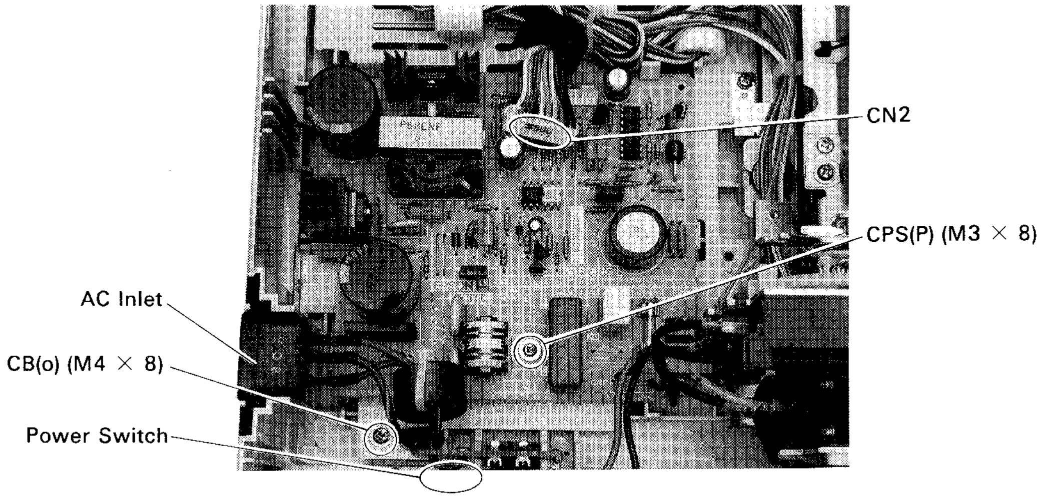


Figure 4-14. Cable Wiring

4.2.5 Printer Mechanism Removal

This section describes the printer mechanism removal.

DANGER

- When removing the printer mechanism, special care is required for handling the ink. Read the notes in Section 4.1 thoroughly before starting the removal.

WARNING

- Be sure to check that the printhead is capped correctly before removing the unit.
- Be sure to remove the ink cartridge before removing the unit.
- Even after the above two steps, some ink remains between the printhead and ink needle. Because the ink might leak (due to impacts) and get the inside of the printer dirty, we recommend that you remove the ink before removing the printer mechanism. (See Section 4.1.)

Step 1 Remove the upper case. (See Section 4.2.2.1)

Step 2 Remove the tractor unit. (See Section 4.2.3)

Step 3 Remove the two CPS(P) screws (M3 × 8) securing the SEIMA board shield plate to the (lower) paper guide. (See Figure 4-12)

Step 4 Remove the two cable clamps (iron core) on the base plate which binds the cables, to release the cables.

Step 5 Disconnect the cables from connectors CN10 through CN20 on the SEIMA board. To disconnect the cable from connector CN20, the harness latch must be removed. (See Figure 4-12)

Step 6 Remove the CPS (O) screws (M3 × 6) securing the mechanism ground plate to the base plate. Be careful not to remove the ground plate from the mechanism but from the base plate.

Step 7 Remove the four mounting screws securing the printer mechanism to the lower case. Take out the printer mechanism from the lower case.

NOTE: The mechanism mounting screw at the left front is hidden under the printhead when the printhead is capped. You can see the screw by moving the printhead to the right while holding the cap section with your finger as shown in Figure 4-4.

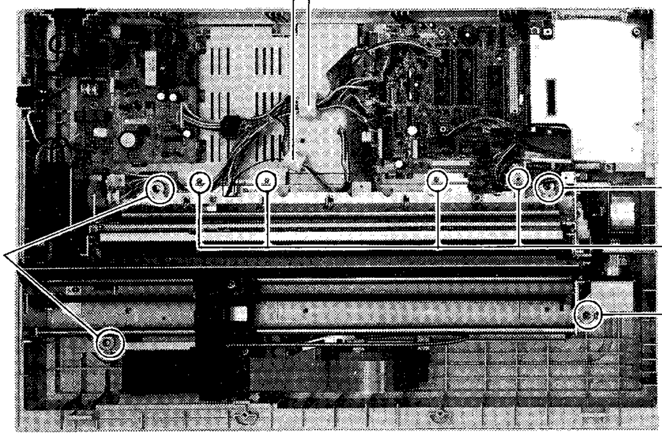


Figure 4-15. Printer Mechanism Removal

ASSEMBLY POINT:

- When reattaching the mechanism to the lower case, be careful of the rubber damper at the screw-clamped point. (Do not attach the unit with the rubber damper deformed.)

ADJUSTMENT REQUIRED

After replacing the printer mechanism, the following adjustment is required:

- Printing position alignment (See Section 4.3.5)

4.2.6 Printer Mechanism Unit Disassembly

This section describes how to remove each major component of the printer mechanism.

DANGER

- When disassembling the printer mechanism, special care is required for handling the ink. Read the notes in Section 4.1 thoroughly before starting the disassembly.

4.2.6.1 Paper Bail Removal

Step 1 Remove the printer mechanism. (See Section 4.2.5)

Step 2 Move the carriage to the center of the platen. (See Figure 4-4)

Step 3 Remove the paper bail spring each from frame (L and R).

Step 4 Remove the E ring from each frame (L and R), then remove the paper bail with the scale, paper bail shaft holder, and paper bail spring.

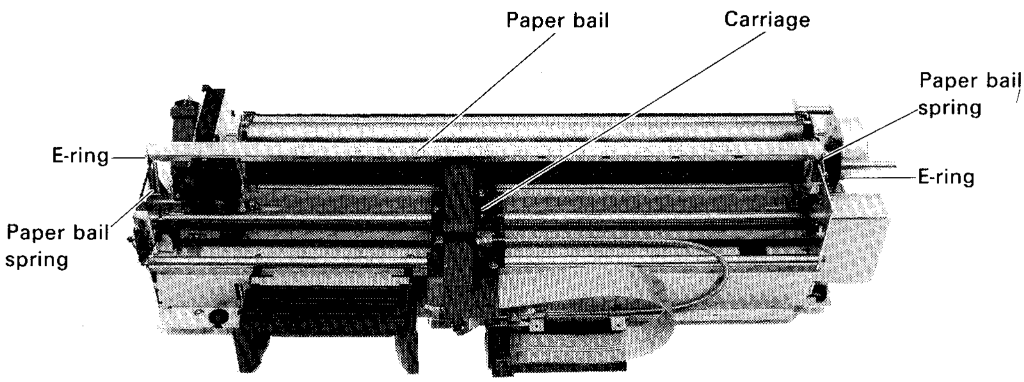


Figure 4-16. Paper Bail Removal (1)

Step 5 Remove the E ring (with no gear attached) at the left side of the paper bail, then remove the paper bail with the paper bail shaft holder.

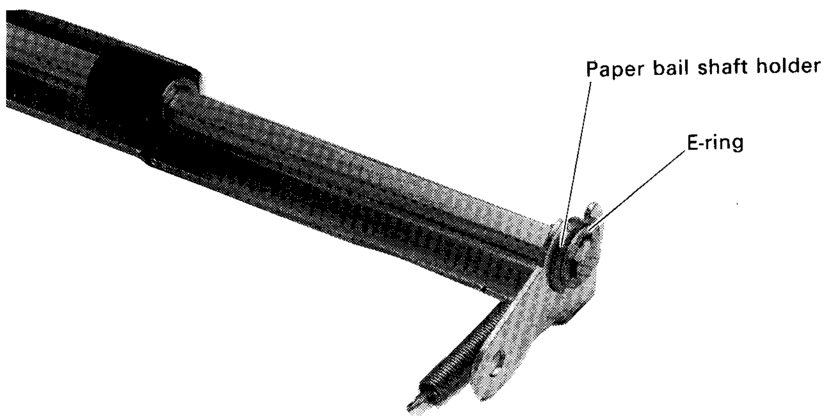


Figure 4-17. Paper Bail Removal (2)

4.2.6.2 Carriage Motor Removal

Step 1 Remove the printer mechanism. (See Section 4.2.5)

Step 2 Remove the lead wire of the carriage motor from the cable clamp.

Step 3 Remove the CP(P) screw (M3 × 6) securing the carriage motor gear cover, then remove the carriage motor gear cover.

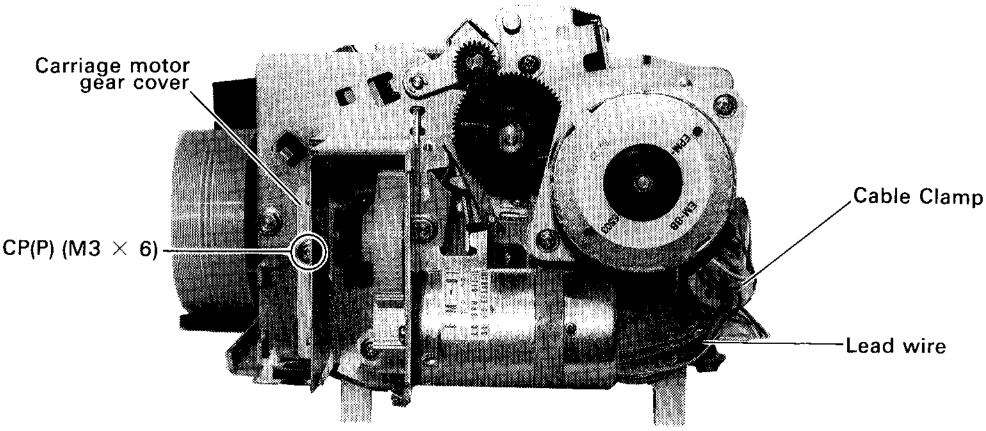


Figure 4-18. Carriage Motor Removal (1)

Step 4 Remove the two CP(P) screws (M3 × 6) securing the carriage motor, then remove the carriage motor.

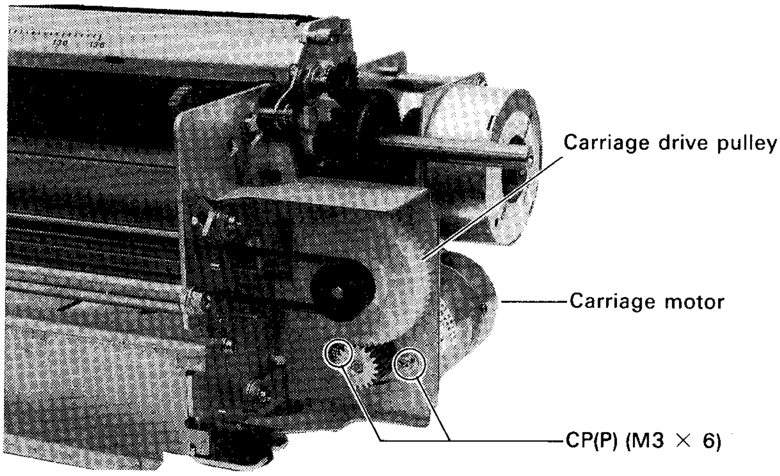


Figure 4-19. Carriage Motor Removal (2)

ASSEMBLY POINTS:

- Reattach the carriage motor so that the label on the carriage motor faces up.
- When reassembling the carriage motor, adjust the backlash between the carriage motor and carriage drive pulley. If the backlash is too tight, printing pitch might become abnormal or printing noise might become louder.

ADJUSTMENT REQUIRED

After the carriage motor is removed and reassembled, the following adjustment is required:

- Printing alignment (only for the bidirectional printing) (See Section 4.3.5.)

4.2.6.3 Carriage Unit Removal

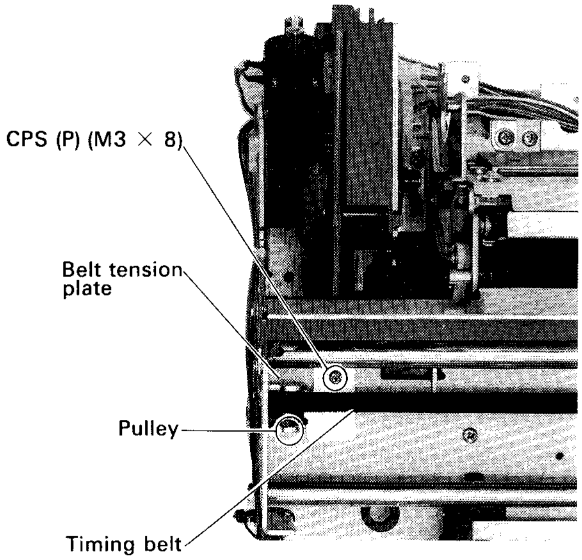
Step 1 Remove the printer mechanism. (See Section 4.2.5)

Step 2 Remove the printhead. (See Section 4.2.1)

Step 3 Remove the CPS(P) screw (M3 × 8) securing the belt tension plate, loosen the timing belt, then remove the belt from the pulley.

Step 4 Remove the two CCS screws (M3 × 8) securing the motor mounting plate set to frame R, then remove the motor mounting plate from frame R.

NOTE: Be careful not to apply stress to the lead wires of the CR motor.



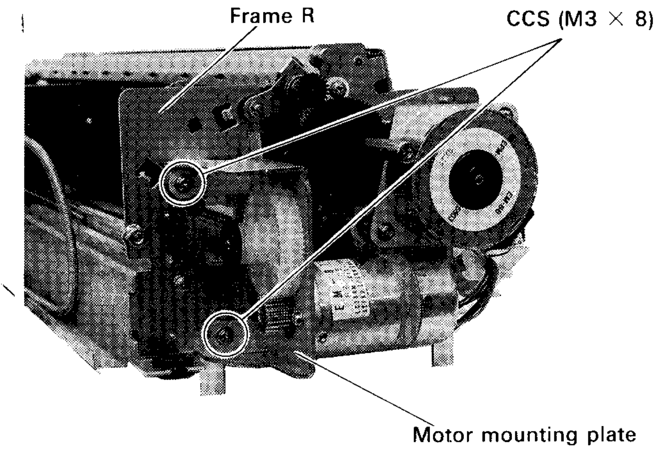


Figure 4-20. Motor Mounting Plate Removal

Step 5 Remove the two N4 nuts securing carriage guide shafts A and B to frame R, then remove the adjust lever from carriage guide shaft A.

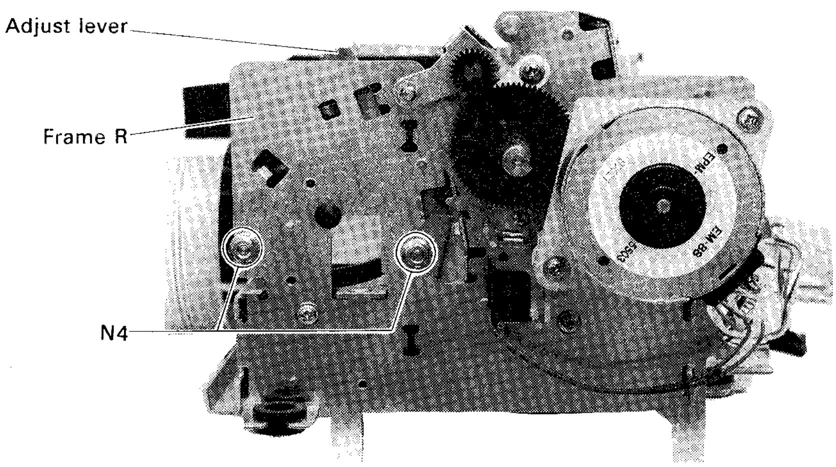


Figure 4-21. Adjust Lever Removal

Step 6 Remove the two N4 nuts securing carriage guide shafts A and B to frame L, then remove the shaft holder link from guide shaft A.

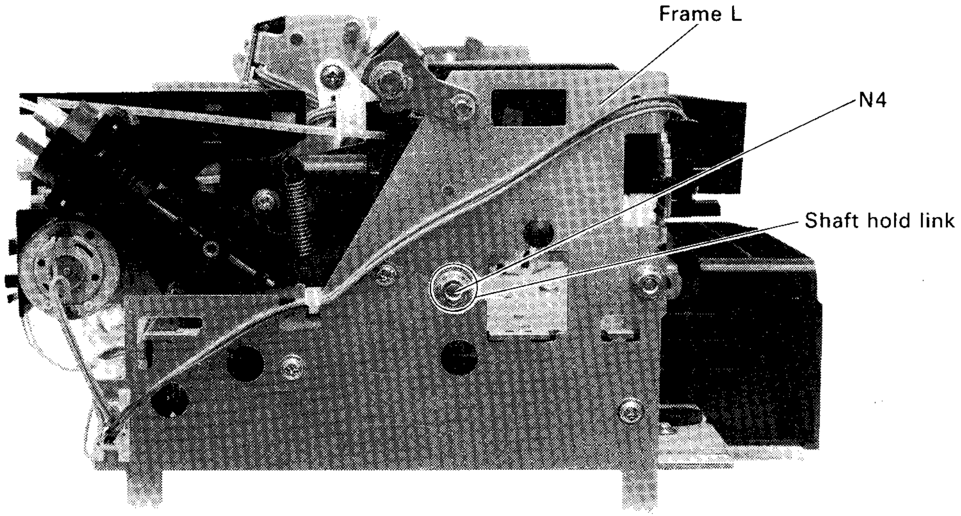


Figure 4-22. Shaft Holder Link Removal

Step 7 Remove carriage guide shafts A and B from frame L by sliding them along the U groove of frame L, then remove them from frame R.

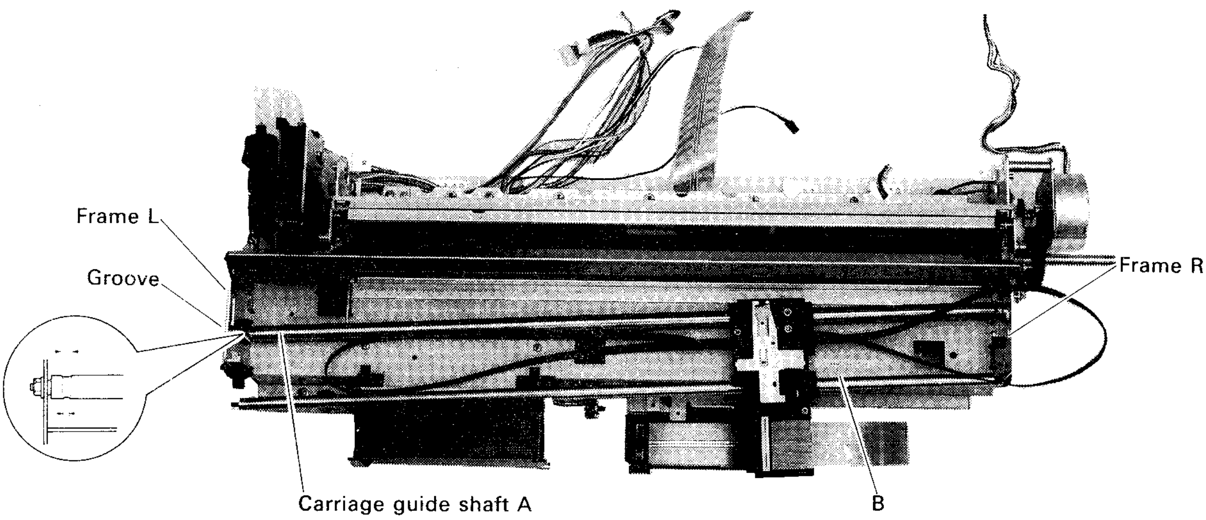


Figure 4-23. Carriage Removal

Step 8 Remove carriage guide shafts A and B from the carriage by pulling them.

Step 9 Remove the CS screw (M3 × 12) securing the belt holder, then remove the timing belt from the carriage.

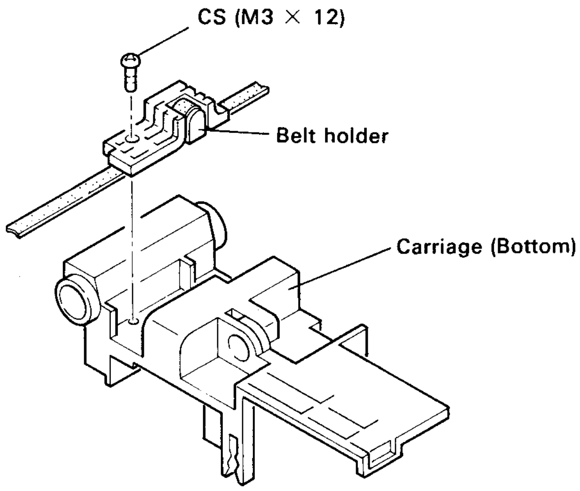


Figure 4-24. Timing Belt Removal

ASSEMBLY POINTS:

- Reattach the timing belt so that no gap exists between the walls of the belt holder and the timing belt, and the crests of the timing belt and the grooves(nine) of the belt holder match. (See Figure 4-25)
- Apply adhesive lock to the belt holder set screw. (See Chapter 6)
- Lubricate the felt (O-2) before inserting the carriage guide shafts into the carriage unit. When inserting them, be careful not to move the felt. (See Chapter 6)
- Reattach carriage guide shaft A so that the larger chamfer of eccentric cut is on the upper side. (See Figure 4-23)

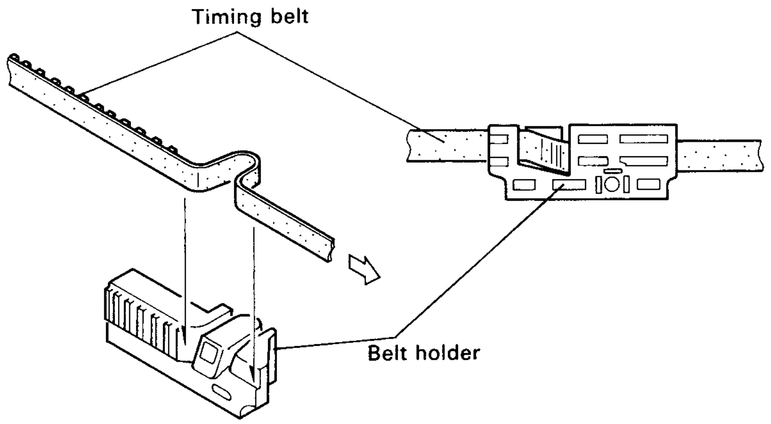


Figure 4-25. Timing Belt Assembly

ADJUSTMENT REQUIRED

After removing and reassembling the carriage, the following adjustments are required:

- Carriage timing belt tension adjustment (See Section 4.3.3.)
- Platen gap adjustment (See Section 4.3.4.)
- Printing position alignment (only for the bidirectional printing positions) (See Section 4.3.5.)

4.2.6.4 Paper Feed Motor Removal

Step 1 Remove the printer mechanism. (See Section 4.2.5)

Step 2 Remove the paper feed motor lead wire from the spacer clip.

Step 3 Remove the two CP(P) screws (M3 × 6) securing the paper feed motor ,then remove the paper feed motor.

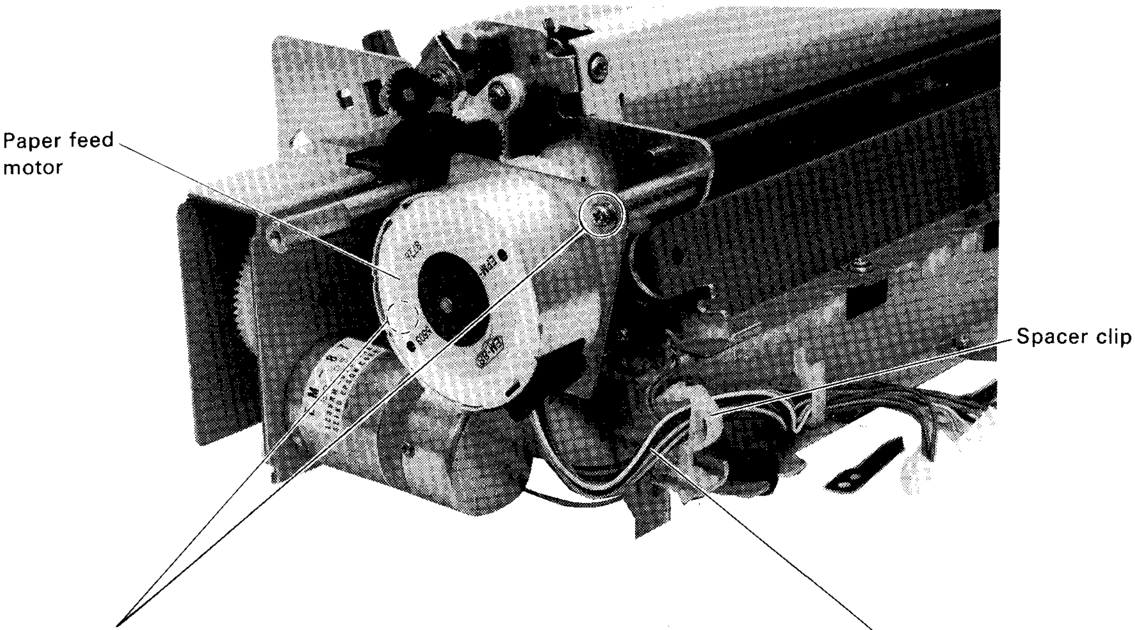


Figure 4-26. Paper Feed Motor Removal

ASSEMBLY POINT:

- When reattaching the paper feed motor, adjust the backlash between the gear pinions tightly. However, be careful if the backlash is hot too tight, or the printing pitch might be abnormal and printing noise might become loud.

4.2.6.5 Release Trigger Solenoid Removal

The release trigger solenoid set is composed of the release trigger solenoid and release sensor.

Step 1 Remove the carriage motor. (See Section 4.2.6.2)
Step 2 Remove the paper feed motor and paper feed transmission gear. (See Section 4.2.6.4)
Step 3 Remove the lead wire of the release trigger solenoid set from the cable clamp.
Step 4 Remove the release trigger lever spring.
Step 5 Remove the CP(P) screw (M3 × 6) securing the release trigger solenoid, then remove the release trigger solenoid with the release trigger lever set.
Step 6 Remove the CC screw (M2 × 10) securing the release sensor, then remove the release sensor.

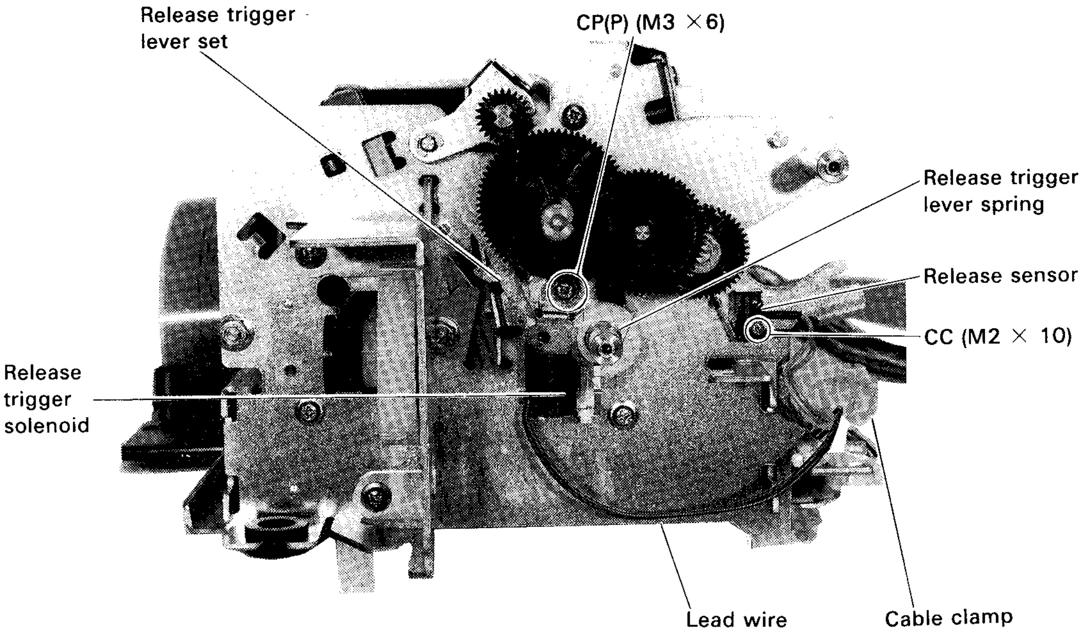


Figure 4-27. Release Trigger Solenoid Set Removal

ASSEMBLY POINT:

- Apply adhesive to the release sensor set screw. (See Chapter 6.)

ADJUSTMENT REQUIRED

After disassembling the release trigger solenoid set, the following adjustment is required during the assembly procedure:

- Release trigger solenoid position adjustment (See Section 4.3.1.)
- Printing position alignment (only for the bidirectional printing positions) (See Section 4.3.5.)

4.2.6.6 Pump Unit Removal

WARNING

- Because there is ink remaining in the pump unit and ink tube, be sure to drain the ink before starting the pump unit removal.

Step 1 Remove the printer mechanism . (See Section 4.2.5)

Step 2 Loosen the tube set screw at the ink draining side (upper side) of the pump,and remove the ink draining tube from both the pump and the hook of the valve.

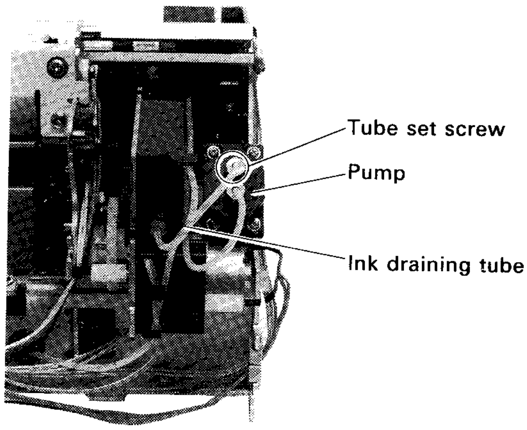


Figure 4-28. Ink Discharge Tube Removal

Step 3 Move the carriage to the right.

Step 4 Remove the CC screw (M3 × 6) and CCS screw (M3 × 8), which secure the pump unit to frame L and the base frame, respectively, then remove the pump unit.

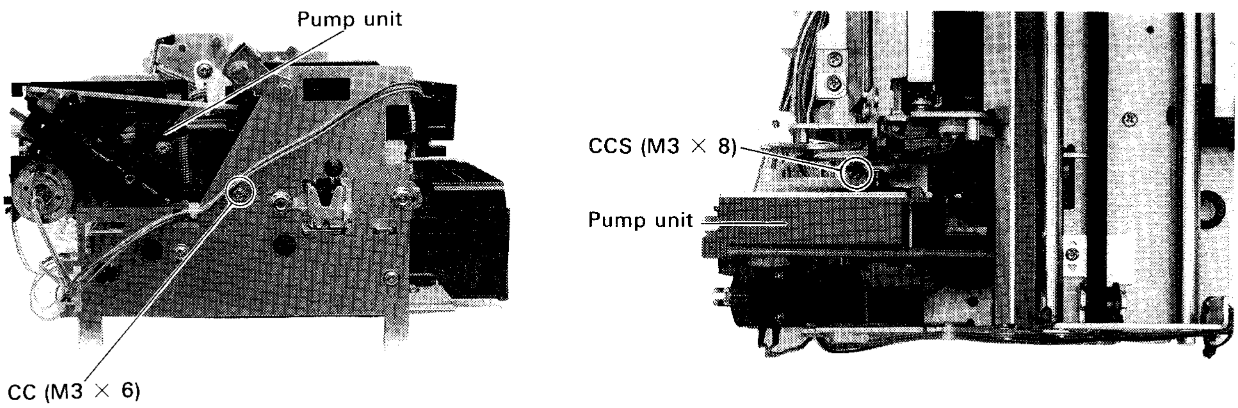


Figure 4-29. Pump Unit Removal

ASSEMBLY POINT:

- After installing the pump unit, check that the ink discharge tube is fixed to the hook section at the back of the valve set.

4.2.6.7 Pump Unit Disassembly

This section describes how to remove each component of the pump unit. Figure 4-30 shows the pump unit disassembly procedure.

WARNING

- When disassembling the pump unit, be careful because the remaining ink in the pump unit and ink tube might leak .
- When installing the pump unit, check that the ink tube and O ring are not cut or damaged, and insert the ink tube fully.

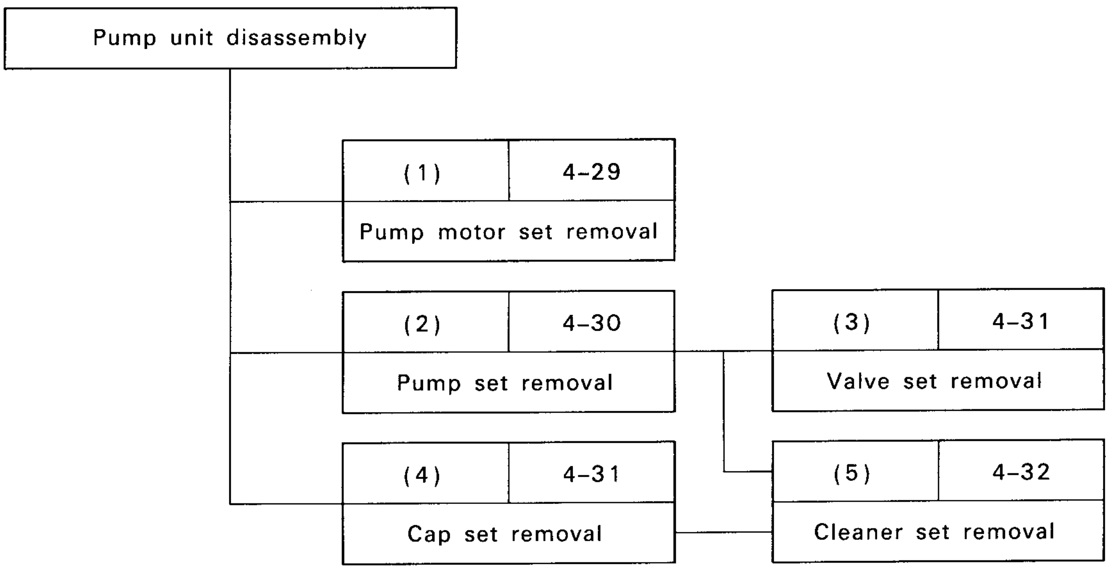


Figure 4-30. Pump Unit Disassembly Procedure

(1) Pump motor set removal

Step 1 Remove the two CB screws (M2.6 × 5) securing the pump motor to the P frame, then remove the pump motor set.

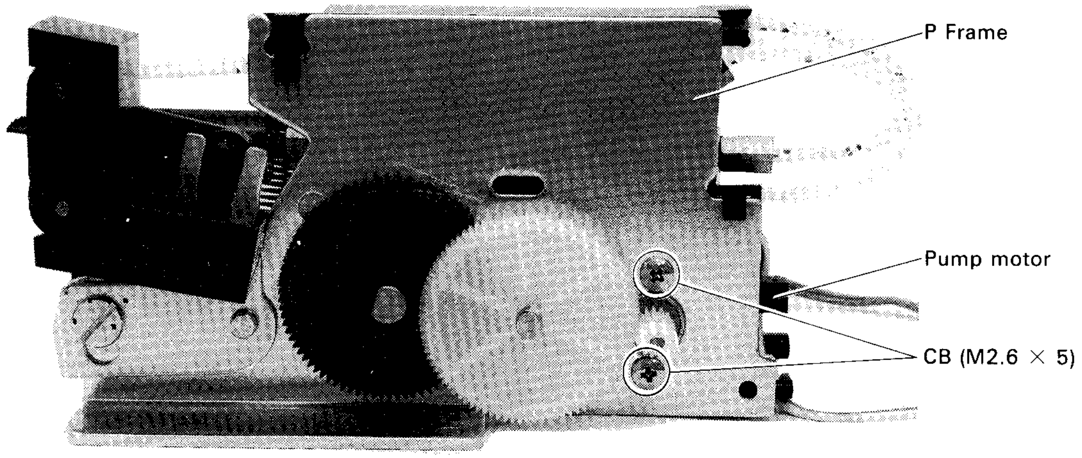


Figure 4-31. Pump Motor Set Removal

ASSEMBLY POINTS:

- Install the pump motor so that the label side faces down, and apply abhesive to the two screws securing the pump motor. (See Chapter 6)
- After installing the pump motor set, lubricate the point at which where the pump motor pinion, pump transmission gear, and pump drive gear engage one another.

(2) Pump set removal

Step 1 Loosen the tube set screw, then remove the ink tube from the head cap set.

Step 2 Remove the two CC screws (M3 × 5) securing the pump set, then remove the pump set.

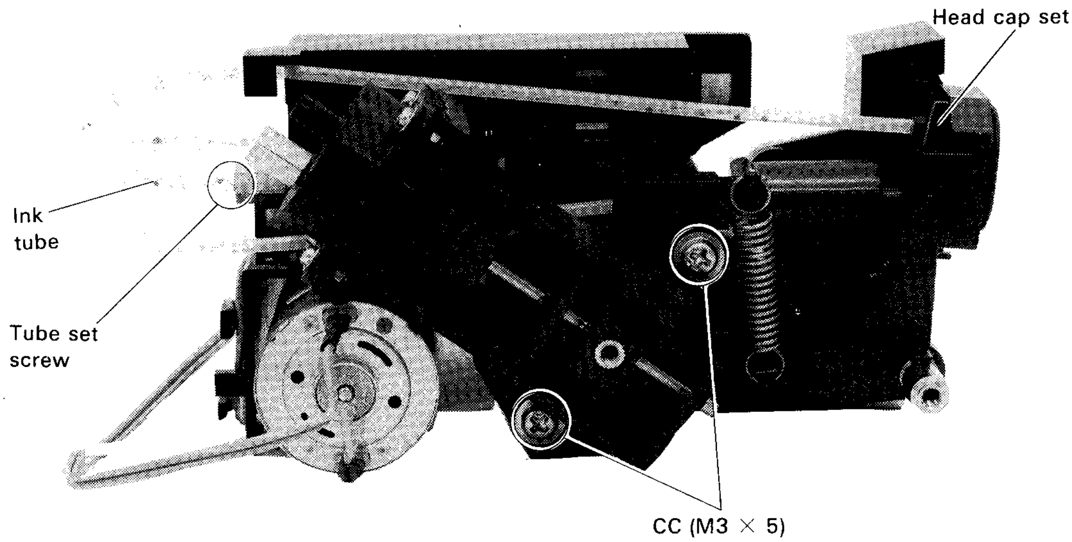


Figure 4-32. Pump Set Removal

ASSEMBLY POINTS:

- Install the pump set so that the pin follower of the pump set and the pin of the pin plate mate correctly.
- Apply locking compound to the two screws securing the pump set.

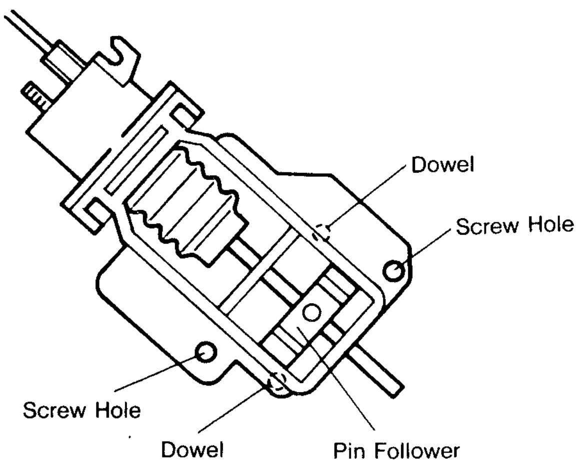


Figure 4-33. Pump Set Installation

(3) Valve set removal

Step 1 Loosen the tube set screw on the valve set, then remove the ink tube from the valve set.

Step 2 Remove the pump set. (See (2))

Step 3 Unlock the bent tab and stud, which fix the valve set to the P frame, then remove the valve set. (See (2))

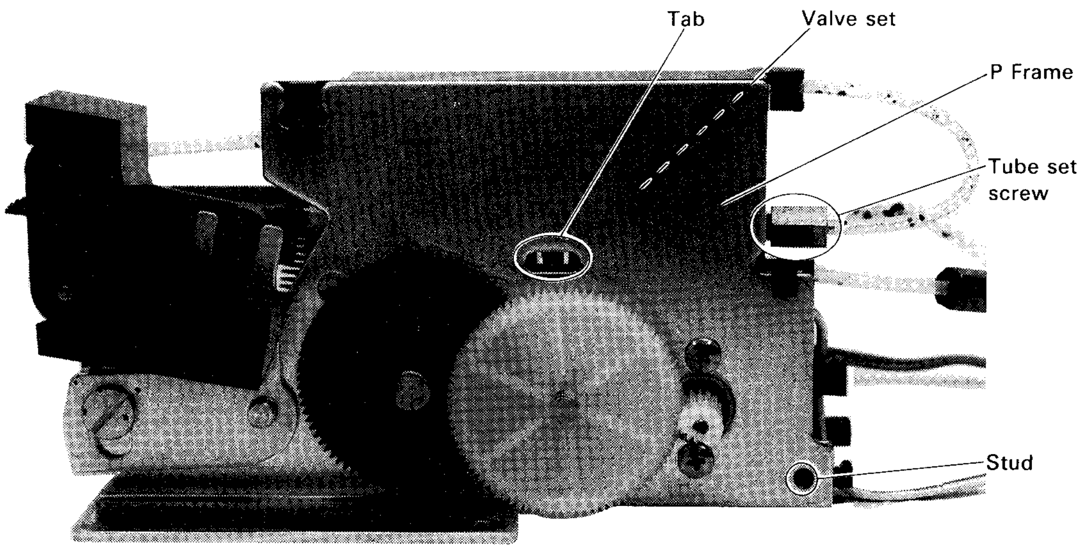


Figure 4-34. Valve Set Removal

(4) Head cap set removal

WARNING

- Be careful not to deform the head cap aligning spring.

Step 1 Take the head cap aligning spring out using tweezers.

Step 2 Loosen the tube set screw on the pump set, then remove the ink tube from the pump set.

Step 3 Loosen the tube set screw on the valve set, then remove the ink tube from the valve set.

Step 4 Remove the head cap set from the two hooks of the head cap support.

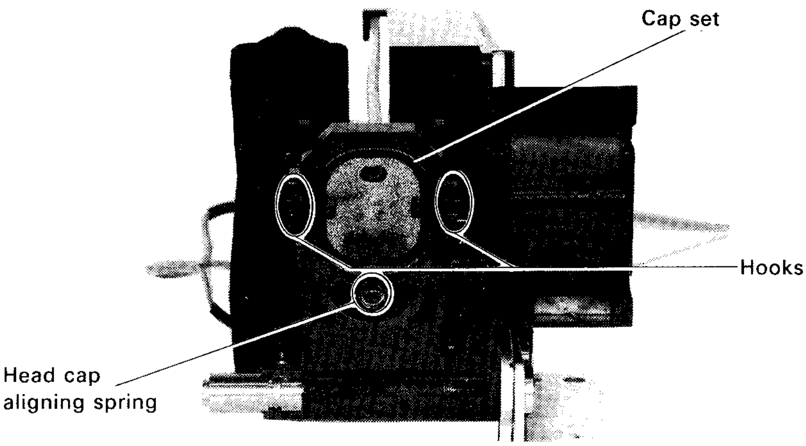


Figure 4-35. Head Cap Set Removal

(5) Cleaner set removal

Step 1 Remove the pump set. (See (2))

Step 2 Remove the head cap set. (See (4))

Step 3 Remove the head cap spring.

Step 4 Spread the snap fit of the head cap support, then pull out the head cap support from the P frame prop.

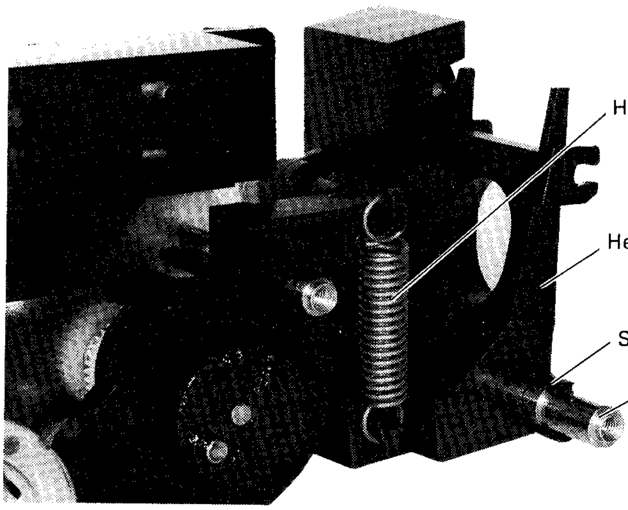


Figure 4-36. Head Cap Support Removal

Step 5 Pull the cleaner set out from the P frame prop.

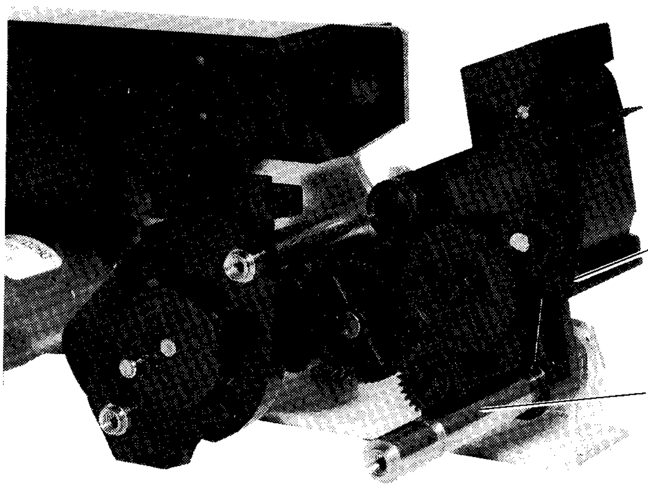


Figure 4-37. Cleaner Set Removal

ASSEMBLY POINTS:

- When installing the snap fit, attach it so that a click can be heard, which means the notch of the snap fit has mated with the groove of the prop.
- During this installation, remember to lubricate. (See Chapter 6.)

4.2.6.8 Ink End Sensor and Thermistor Set Removal

DANGER

- The ink supply needle and ink draining needle may be removed during this disassemble procedure. In this case, be careful of the tips of the needles, which might prick your finger.

Step 1 Remove the printer mechanism. (See Section 4.2.5)

Step 2 Loosen the tube set screw at the ink discharge side (upper side) of the pump set, and remove the ink discharge tube from both the pump set and the hook of the valve set. (See Figure 4-28 in Section 4.2.6.6)

Step 3 Loosen the tube set screw at the metal tube side of the filter set, then remove the ink supply needle from the filter set.

Step 4 Remove the four CBB screws (M3 × 12) securing the cartridge holder unit to the base frame.

Step 5 Shift the cartridge holder unit a little bit toward the front of the printer mechanism, unlock the three hooks of the holder from the cut outs of the base frame, then remove the cartridge holder unit.

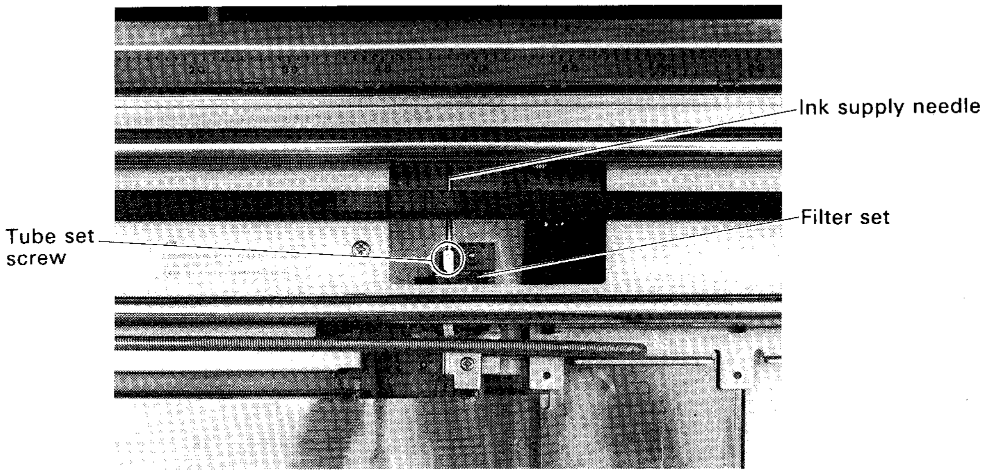


Figure 4-38. Ink Supply Needle Removal (80-column machine)

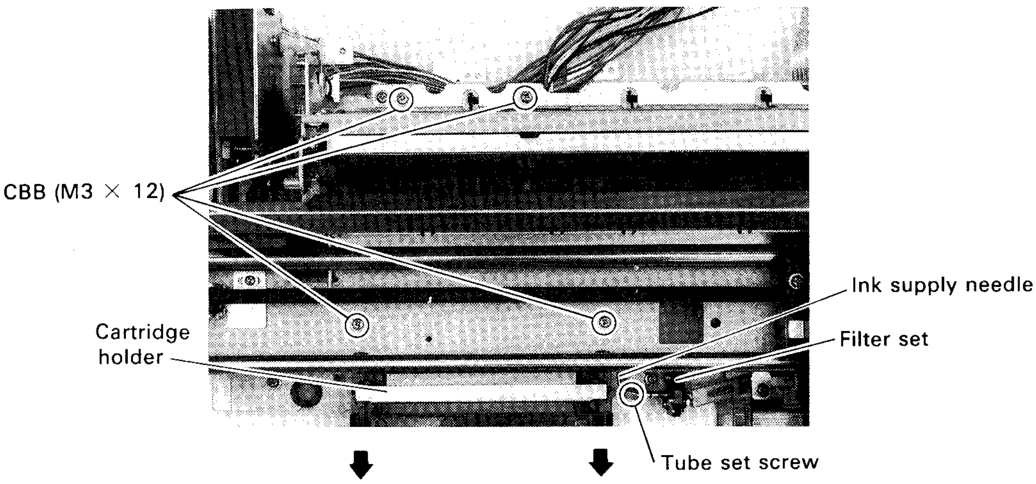


Figure 4-39. Cartridge Holder Unit and Ink Supply Needle (136-column machine) Removal

NOTE: When taking the cartridge holder unit out, be careful not to damage the tube, needle, or lead wire.

Step 7 Remove the lead wires from the ink end sensor and thermistor set from the hooks of the cartridge holder. And remove the thermistor.

Step 8 Pull out the ink end sensor from the two sensor supporting pins while using your finger reloosen the hook securing the ink end sensor.

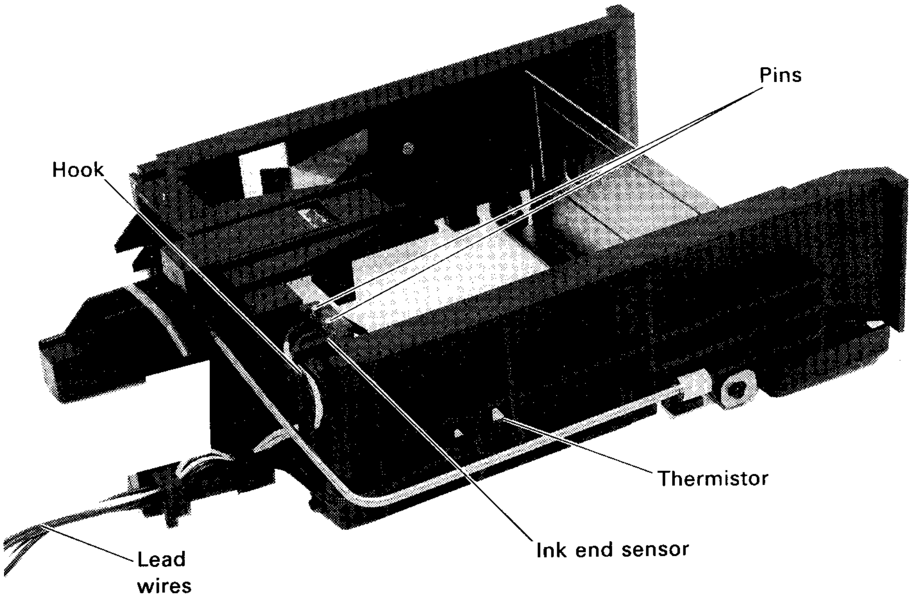


Figure 4-40. Ink End Sensor and Thermistor Removal

ASSEMBLY POINTS:

- When attaching the micro switch to the ink end sensor, be careful of the assembly procedure (the black lead wirte must be installed first) and mounting direction (see Figure 4-41).
- Check that the lead wires from the ink end sensor set and thermistor set run correctly.
- When attaching the cartridge holder unit to the base frame, turn the printer mechanism over so that the unit can be attached easily, and check that the hooks of the cartridge holder mate correctly with the cutouts in the base frame.

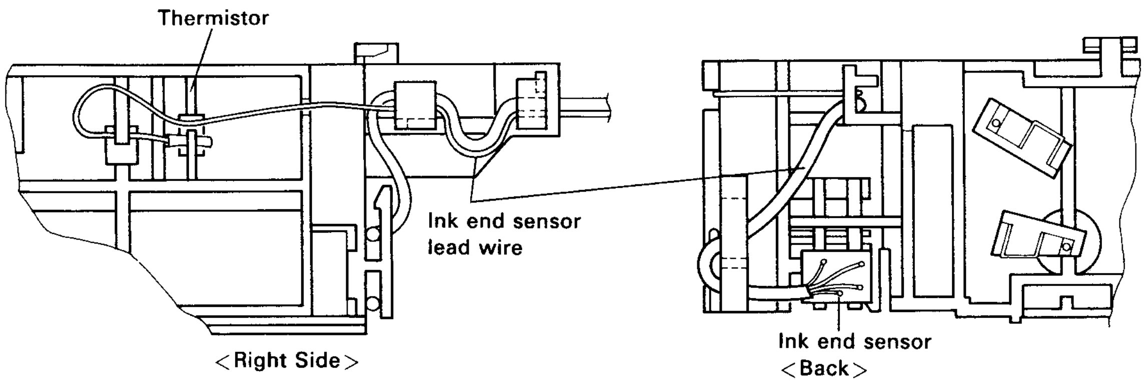


Figure 4-41. Ink End Sensor and Thermistor Installation

4.2.6.9 Home Position Sensor Removal

Step 1 Remove the upper case. (See Section 4.2.2.1)

Step 2 Move the carriage to the center of the platen.

Step 3 Cut the wire band securing the home position sensor to the Frame L.

Step 4 Remove the home position sensor from frame L, then pull out the lead wire connector.

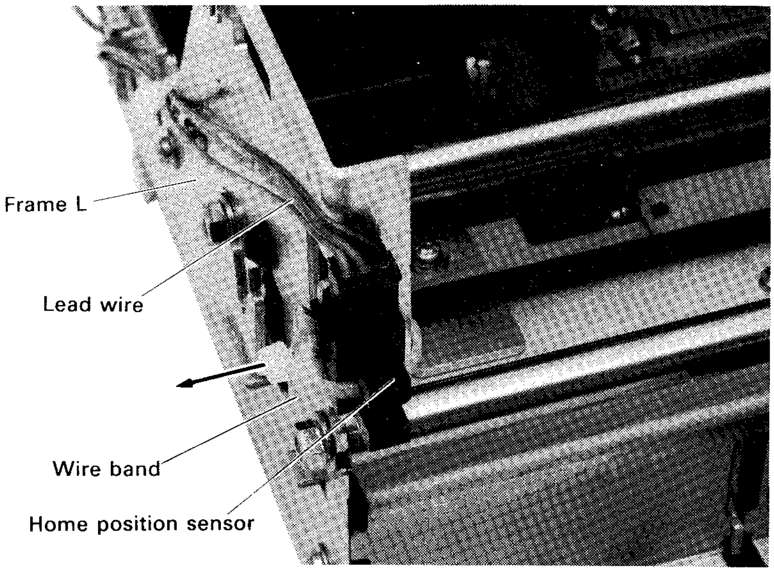


Figure 4-42. Home Position Sensor Removal

NOTE: Be careful not to stress the lead wire of the home position sensor.

ASSEMBLY POINT:

- Install the wire band securing the home position sensor so that the cable clamping section comes outside of frame L. (See Figure 4-42)

4.2.6.10 Top Edge Sensor Board and CSF Sensor Removal

WARNING

Be careful not to drop the top edge sensor lever spring in to the printer mechanism.

NOTE: If you only remove the TE sensor board, you can pass the Steps 1 and 6.

Step 1 Remove the pump unit. (See Section 4.2.6.6)

Step 2 Remove the two CB(N) screws (M3 × 6) securing the both sides of platen cover, then remove the platen cover.

Step 3 Remove the paper eject guide plate spring from the papger eject guide plate and frame M (middle).

Step 4 Remove the E ring from the shaft of frame M, then remove the paper eject guide plate and paper eject paper guide plate spring.

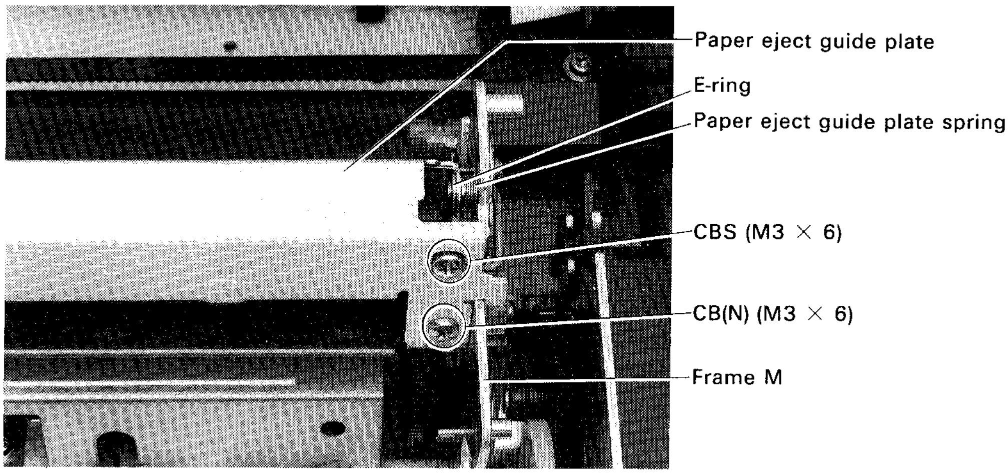


Figure 4-43. Paper Eject Guide Plate Removal

Step 5 If necessary, cut the cable clamp which binds the lead wires from the top edge sensor board and CSF sensor to frame M, then remove the lead wires from the hook of the platen shaft holder.

Step 6 Remove the CP(P) screw (M3 × 8) securing the CSF sensor to frame M, then remove the CSF sensor.

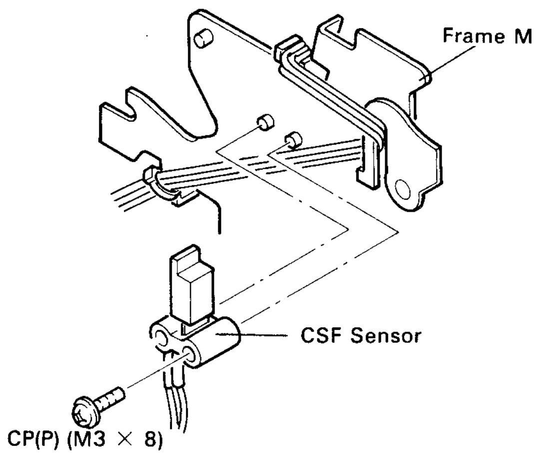


Figure 4-44. CSF Sensor Removal

Step 7 Remove the top edge sensor lever spring from the top edge sensor board using the tweezers.

Step 8 Remove the CB screw (M2.5 × 4) securing the top edge sensor board set.

Step 9 Remove the two CBS screws (M3 × 6) securing the both sides of (upper) paper guide, then remove the (upper) paper guide. (See Figure 4-44.)

Step 10 Remove the top edge sensor board with the lead wire and CSF sensor.

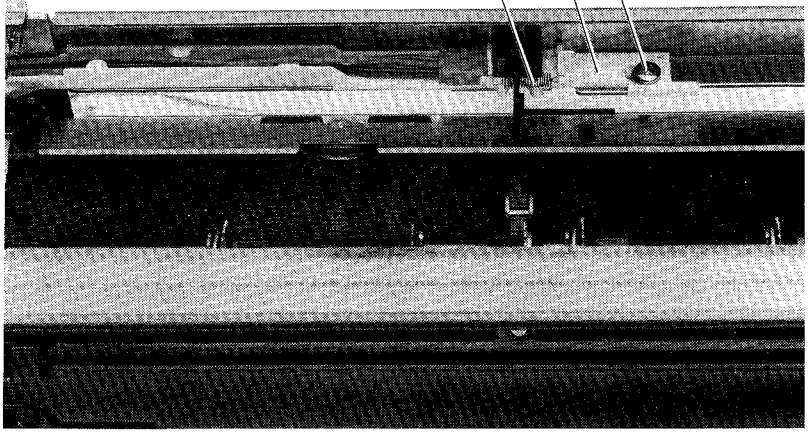


Figure 4-45. Top Edge Sensor Removal

ASSEMBLY POINTS:

- Before installing the (upper) paper guide, insert the top edge sensor board into frame M.
- Apply adhesive to the screws securing the top edge sensor board and CSF sensor. (See Chapter 6)
- Adjust the positions of the (upper) paper guide and top edge sensor board so that the lever will be positioned at the center of the photo coupler on the top edge sensor board.
- Hook the paper eject guide plate spring at frame M as shown in Figure 4-46.

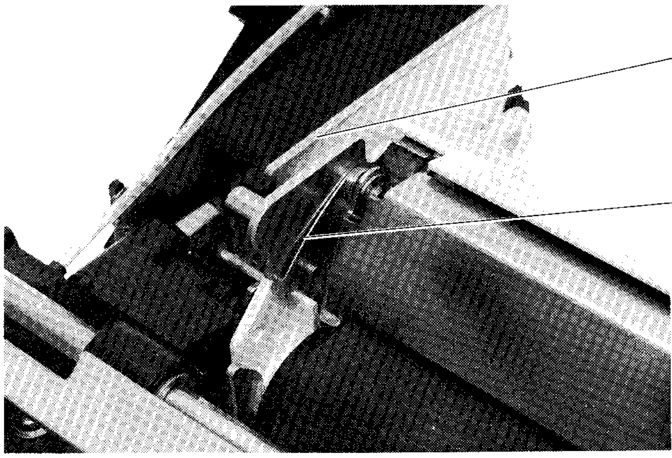


Figure 4-46. Paper Eject Guide Plate Spring

ADJUSTMENT REQUIRED

After removing the top edge sensor board, the following adjustment is required during the assembly procedure:

- TE sensor roller position adjustment (See Section 4.3.2)

4.2.6.11 Platen Unit Removal

Step 1 Remove the (upper) paper guide with the top edge sensor board attached. (See Section 4.2.6.10)

Step 2 Remove the CBS screw (M3 × 6) securing each platen shaft holder, L (left) and R (right).

Step 3 Remove the platen unit with the top edge holder and the top edge holder transmission shaft by moving the platen unit along the slits of frames M and R.

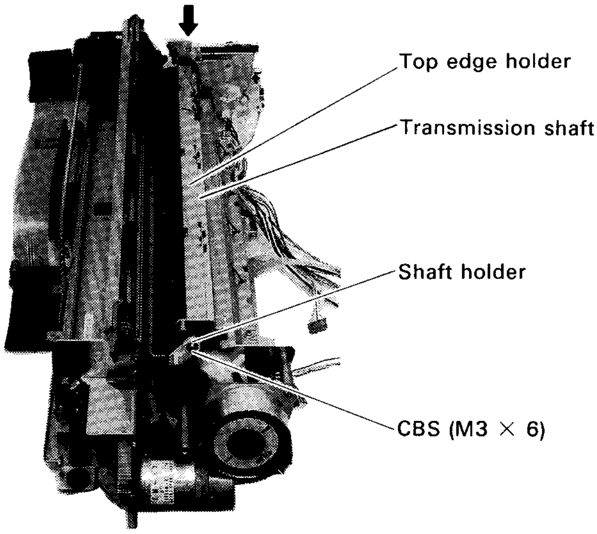


Figure 4-47. Platen Unit Removal

ASSEMBLY POINT:

- Apply abhesive to the screws securing each of the platen shaft holders, L and R.

ADJUSTMENT REQUIRED

After removing the platen unit, the following adjustment is required during the assembly procedure:

- TE sensor roller position adjustment (See Section 4.3.2)
- Platen gap adjustment (See Section 4.3.4)

4.2.6.12 Top Edge Holder Set and Top Edge Holder Transmission Shaft Set Removal

NOTES:
- Be careful so that the top edge sensor lever is not caught by the slit of the platen.
- Because the plain washer and two reaf springs are used at the right side of the top edge holder transmission shaft, be careful not to lose them while removing the top edge holder transmission shaft.
- Because the top edge holder arm L, plain washer, and disc springs are released when the top edge holder set is removed, be careful not to lose them.
- Disc springs are also used at the right side of the platen. Moreover, the disc springs are different from those of the disc springs used on the left side. When removing the disc springs used on the right side, keep them separated from those used at the left side.

Step 1 Remove the platen unit. (See Section 4.2.6.11)
Step 2 Pull out platen shaft holder L from the platen shaft.
Step 3 Remove the top edge holder transmission shaft set.
Step 4 Remove the two CB screws (M2.5 × 3) securing the top edge holder set, then remove the top edge holder set.

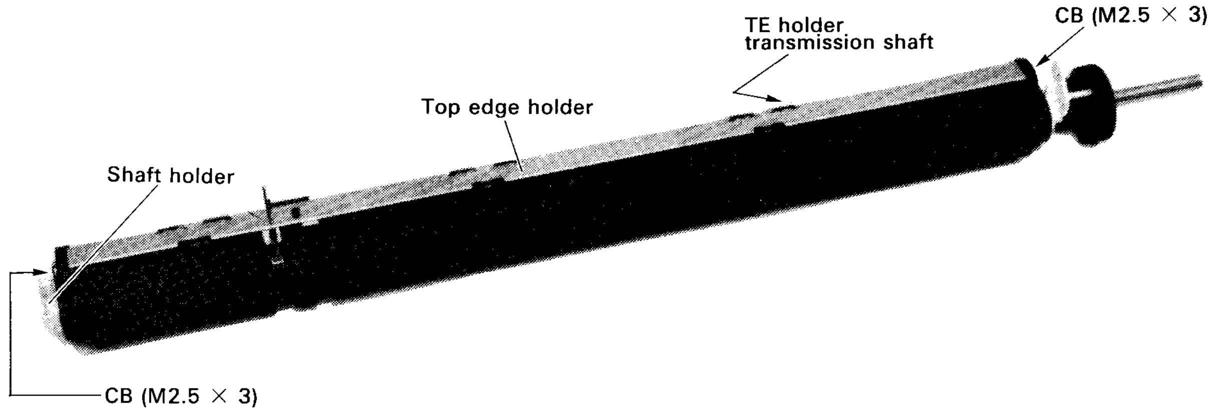


Figure 4-48. Top Edge Holder Set and Top Edge Holder Transmission Shaft Set Removal

ASSEMBLY POINTS:

- When installing the top edge holder set, confirm that the studs of platen shat holder L and R are inserted correctly in the holes of the top edge holder transmission shaft set, then tighten the screws.
- When installing the top edge holder transmission shaft set, insert the plain washer and two reaf springs into platen shaft holder R. (See Figure 4-48.)
- After matching the phases of the left and right sides of the top edge holder transmission shaft set and top edge holder set so that they are parallel, insert platen shaft L into the platen shaft.

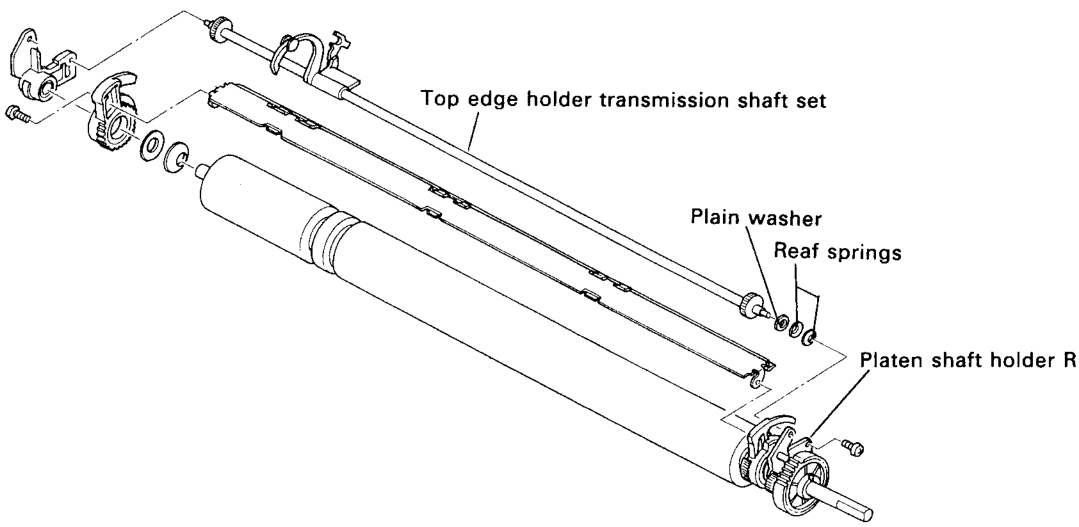


Figure 4-49. Top Edge Holder Transmission Shaft Set Installation

ADJUSTMENT REQUIRED

After removing the top edge holder set and top edge holder transmission shaft set, the following adjustments are required during the assembly procedure:

- TE sensor roller position adjustment (See Section 4.3.2.)
- Platen gap adjustment (See Section 4.3.2.)

After replacing either the top edge holder set or the top edge holder transmission shaft set, the following adjustment is required in addition to the above two:

- Printing alignment – TE holder position adjustment (See Section 4.3.5.)

4.2.6.13 Paper End Sensor Removal

Step 1 Remove the platen unit. (See Section 4.2.6.11)

Step 2 Remove the two CCS screws (M3 × 6) securing the lower paper guide to the base frame, then remove the lower paper guide.

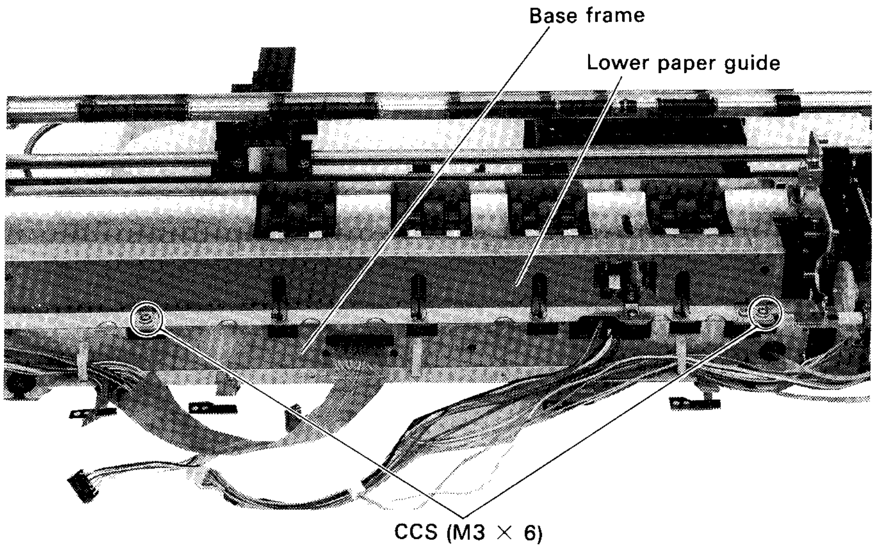


Figure 4-50. Lower Paper Guide Removal

Step 3 Remove the CCS screw (M3 × 8) securing the paper end sensor set, then remove the paper end sensor set.

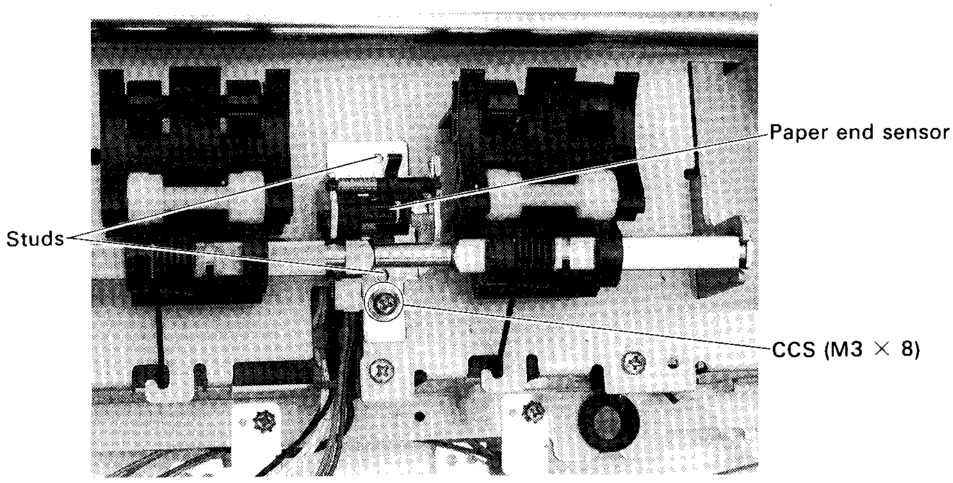


Figure 4-51. Paper End Sensor Set Removal

ASSEMBLY POINT:

- When installing the paper end sensor set, confirm that the two studs of the sensor are inserted correctly in the holes of the base frame, then tighten the screws.

4.2.6.14 Paper Feed Roller Shaft Set Removal

Step 1 Remove the platen unit. (See Section 4.2.6.11)

Step 2 Remove the lower paper guide. (See Section 4.2.6.13)

Step 3 Remove the four paper feed lever springs from the hooks of the base frame, then remove the paper feed roller shaft set.

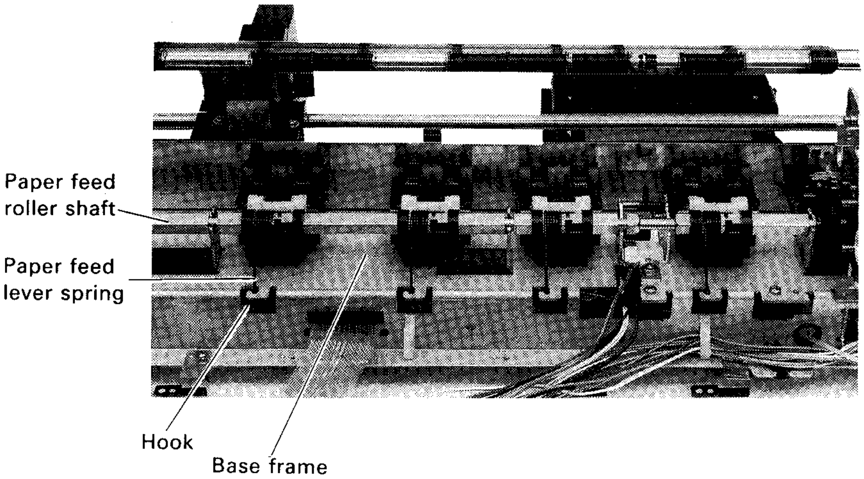


Figure 4-52. Paper Feed Roller Shaft Set Removal

ASSEMBLY POINT:

- Before installing the paper feed roller shaft set, perform lubrication as indicated in Figure 6-4 in Chapter 6.

4.2.6.15 TE Motor Removal

Step 1 Remove the carriage unit. (See Section 4.2.6.3)

Step 2 Remove the platen unit. (See Section 4.2.6.11)

Step 3 Remove the (lower) paper guide. (See Section 4.2.6.11)

Step 4 Remove the paper bail. (See Section 4.2.6.1)

Step 5 Remove the two screws (+S tight up set hexagonal (M3 × 6)) securing the paper guide plate, then remove the paper guide plate set.

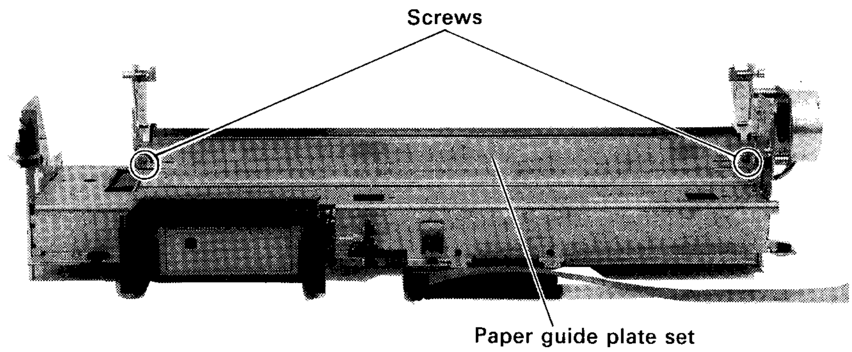


Figure 4-53. Paper Guide Plate Set Removal

Step 6 Remove the two CCS screws (M3 × 8) securing the support frame, then remove the support frame.

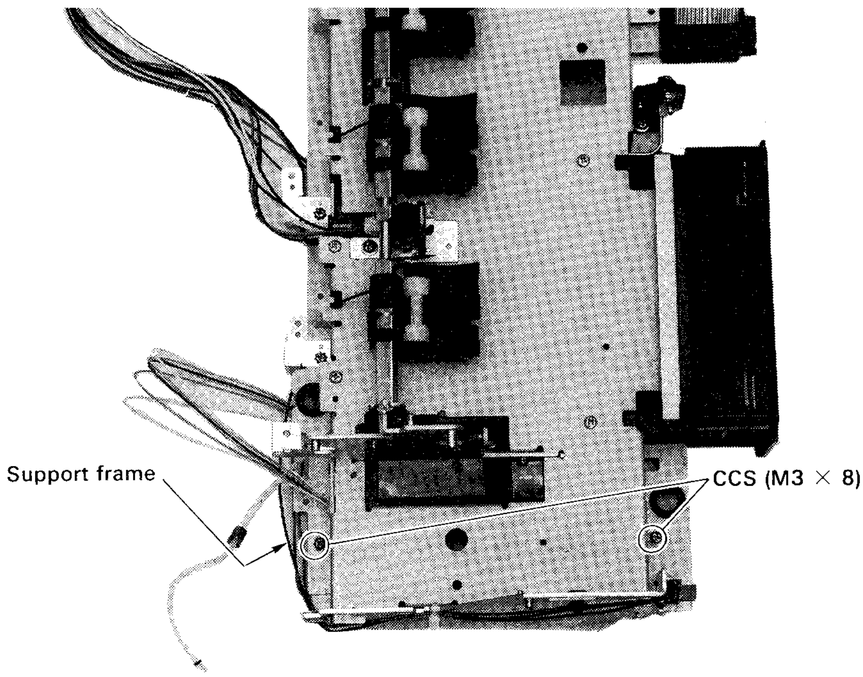


Figure 4-54. Support Frame Removal

Step 7 Remove the TE motor lead wire from the wire clip.

Step 8 Remove the two CCS screws (M3 × 8) securing frame M by inserting a screwdriver through the holes (two) in frame L.

Step 9 Remove frame M from the cutout in the base frame while tilting frame M.

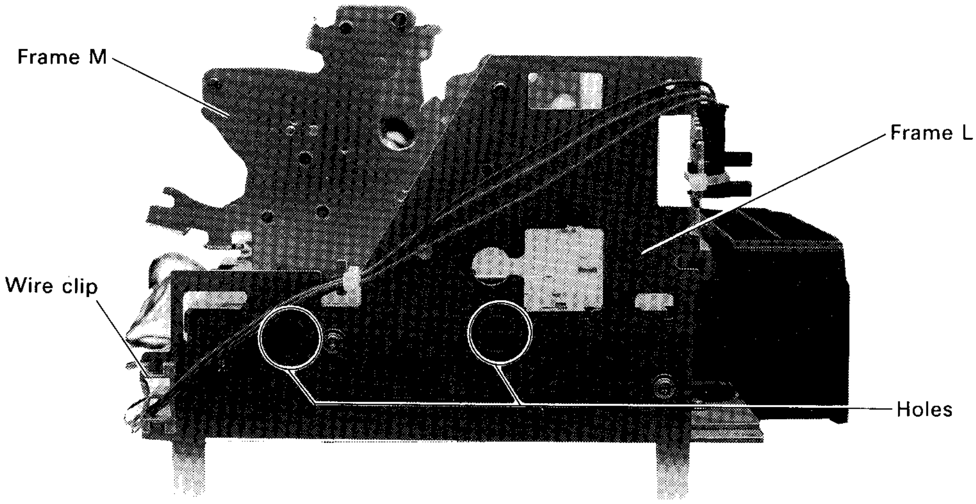


Figure 4-55. Frame M Removal

Step 10Unlock the three bent tabs of the TE motor cover, then remove the TE motor cover from frame M.

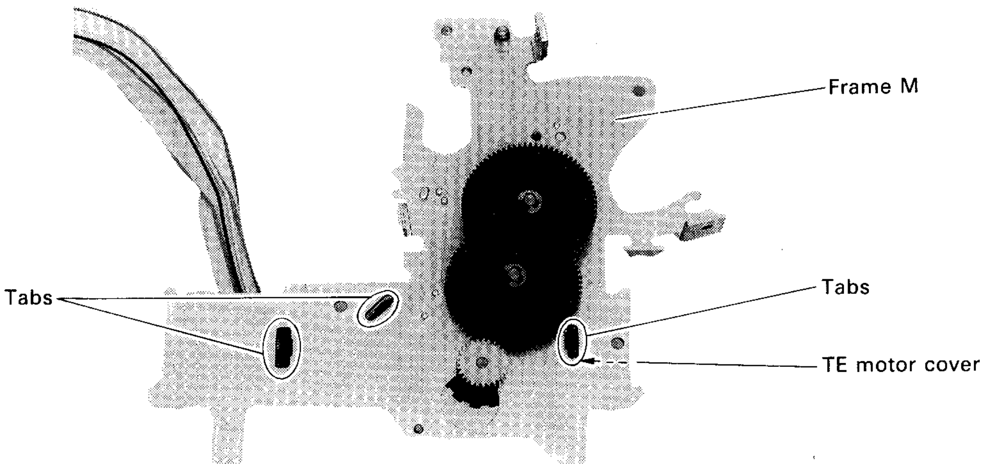


Figure 4-56. TE Motor Cover Removal

Step 11 Remove the two CB screws (M2.5 × 3) securing the TE motor, then remove the TE motor from frame M.

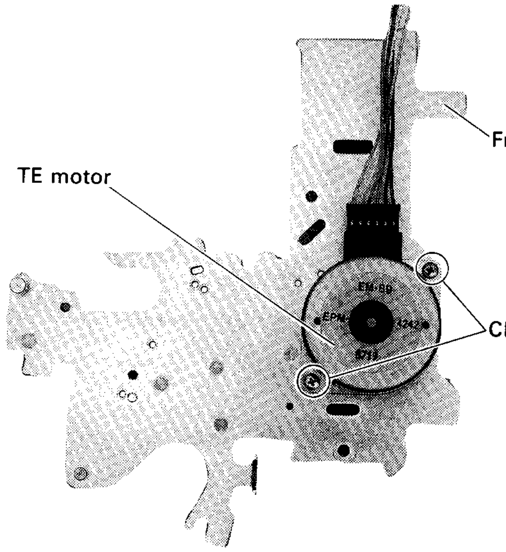


Figure 4-57. TE Motor Removal

ASSEMBLY POINTS:

- Lubricate the paper feed reduction gear and top edge holder paper feed transmission gear. (See Chapter 6)
- When installing the TE motor, attach it so that no space exists between frame M and the stopper of the base frame.

ADJUSTMENT REQUIRED

After replacing the TE motor, the following adjustments are required:

- TE sensor roller position adjustment (See Section 4.3.2)
- Carriage timing belt tension adjustment (See Section 4.3.3)
- Platen gap adjustment (See Section 4.3.4)
- Printing position alignment (See Section 4.3.5)

NOTE: When you want to remove only the paper guide plate set and you have a 5.5 mm hexagonal wrench, you can omit steps 1 through 4.

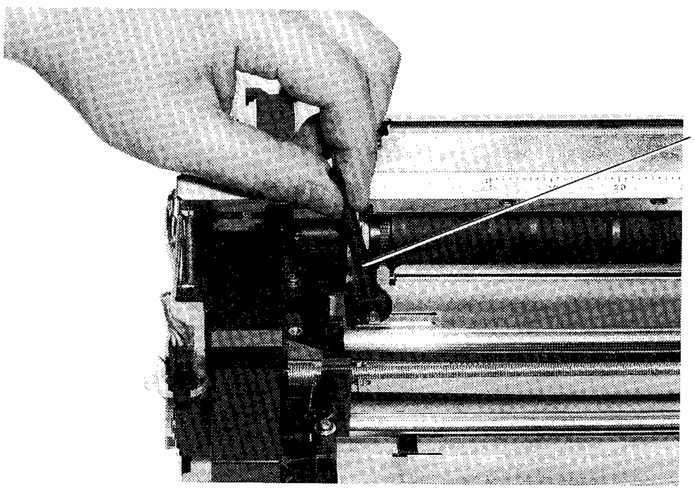


Figure 4-58. Paper Guide Plate Removal

4.3 ADJUSTMENT

This section describes the adjustment procedures required when reassembling the printer. If disassembly or replacement is performed during maintenance or repairs, be sure to perform the following adjustments. Although each section explains when these adjustments are required, they can also be performed when the printer doesn't work as usual or when print quality is not good.

DANGER

Perform the adjustment with the power source disconnected, unless otherwise mentioned.

4.3.1 Trigger Solenoid Adjustment

This adjustment is performed when assembling the trigger solenoid. Be sure to perform this adjustment prior to attaching the other parts such as the carriage motor. This adjustment is required in the following case.

- When the trigger solenoid or trigger lever is removed.

This adjusts the clearance at the point where the trigger solenoid lever meets the release planetary gear set. (Clearance should not be too narrow nor too wide.) If this adjustment is not performed correctly, the following may result.

- Paper selection (selection of tractor or friction feed) won't be performed correctly.
- Paper feed motor will continue to rotate during paper selection.

Step 1 Fix the paper feed knob and rotate the platen (5 or 6 times) by pulling the trigger lever with your finger. (Paper select will switch.)

Step 2 Remove your finger from the trigger solenoid and remove the paper feed knob.

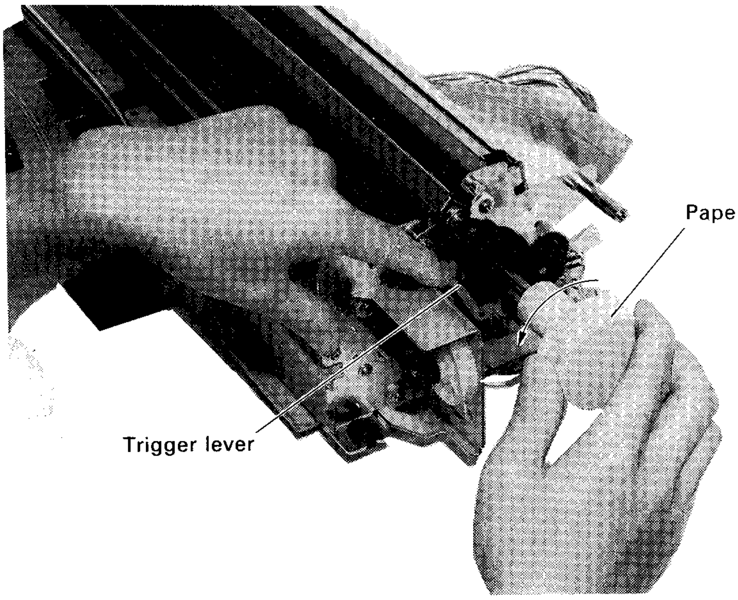


Figure 4-59. Preparation of The Trigger Solenoid Adjustment

Step 3 Loosen the lock screw CP (P)(M3 × 6) clamping the trigger solenoid and trigger lever.

Step 4 Place the finger of your left hand on the bottom of the trigger solenoid and push it up lightly. (When the carriage motor is installed, push it up over the motor.)

Step 5 While maintaining this situation, place the thickness gauge (0.5 mm) between the trigger lever and release planetary gear set (Fig. A) and hold the gauge using the finger that is pushing up the solenoid. (Keep pushing strongly.)

Step 6 Tighten the screw firmly using your other hand.

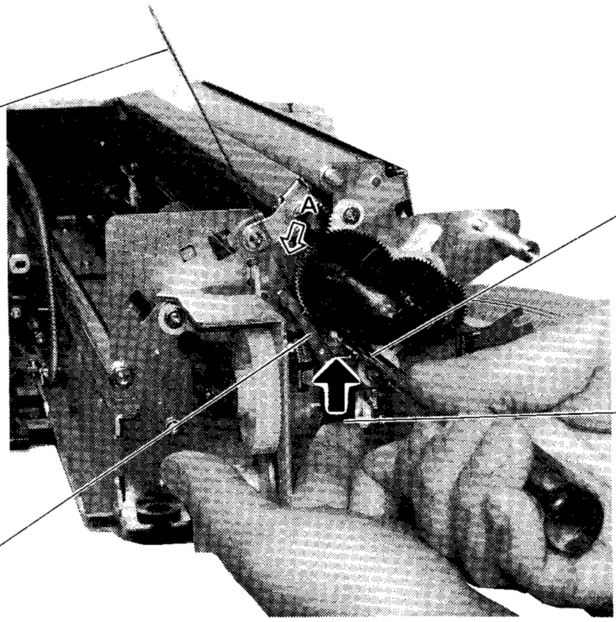


Figure 4-60. Tightening Down The Trigger Solenoid

4.3.2 TE Sensor Roller Adjustment

This adjustment can be performed without removing the printer mechanism. But the following parts should be removed, besides the upper case.

- Paper eject guide plate
- Platen cover

This adjustment is required in the following cases.

- When the TE sensor roller is removed.
- When the TE sensor is removed.

The TE roller detects the top of the paper and the location of the roller influences the sensor's reception. If this adjustment is not performed correctly, the following may result.

- The position of paper top edge won't be detected correctly.
  (Paper loose → paper jam)
- Top edge holder system won't work.
  (Top edge is always detected → paper jam)
- Top edge holder doesn't operate.
  (Top edge is never detected → paper jam)

Step 1 Tighten the screw CB (M2.5 × 4) clamping the TE sensor to the paper guide temporarily.

Step 2 Confirm that the roller moves up and down by holding the right edge of the TE sensor and moving it forward and backward.

Step 3 Set position alignment tool #693 so that the TE roller shaft and the surface of the platen line up. (When viewed from the position shown in Figure 4-62, the roller shaft must not be visible because it should be covered by the position alignment tool.)

Step 4 Adjust the TE sensor roller position by moving the TE sensor set forward or backward so that the dimension of the projected portion above the platen surface becomes the same as that of the cutout on the position alignment tool. (First set the TE roller to the lowest position, then adjust the roller position upward step by step until the roller is stopped by the position alignment tool.)

Step 5 Tighten the TE sensor set screw and glue it (Refer to section 6). At this time, pay attention to the orientation of the TE sensor, so that the sensor lever is located at the center of the photo interrupter.

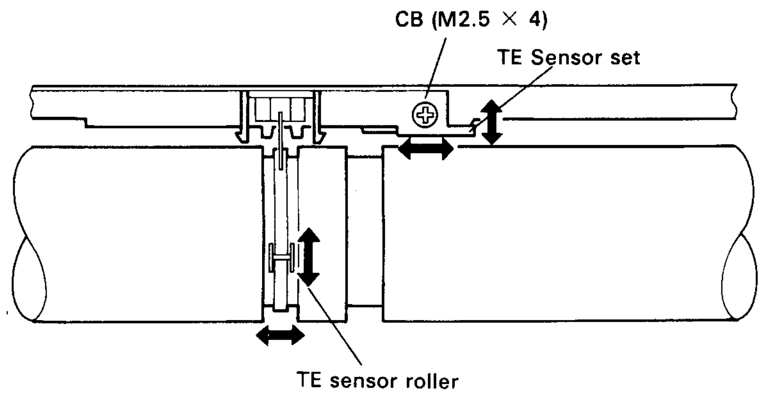


Figure 4-61. Top Edge Sensor

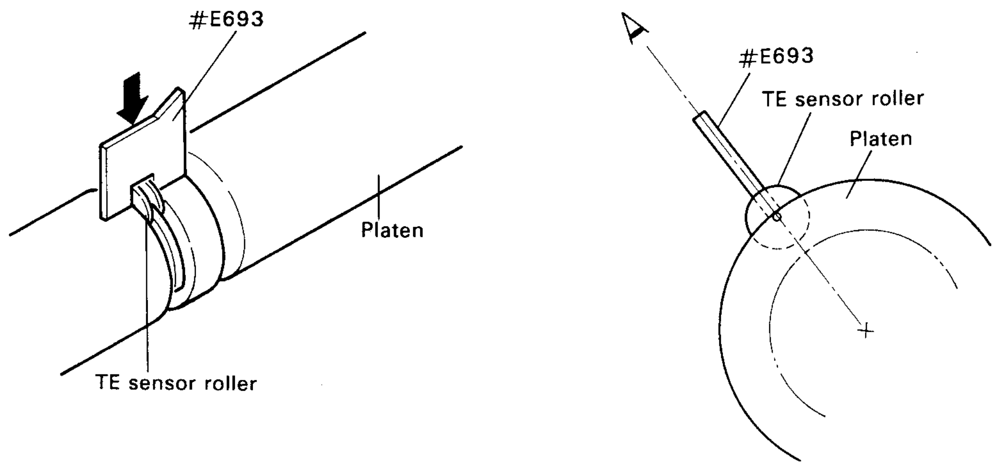


Figure 4-62. TE Sensor Roller Adjustment

4.3.3 Carriage Timing Belt Tension Adjustment

This adjustment is performed on the printer mechanism alone. Be sure to perform this adjustment prior to installing the printer mechanism in the lower case.
This adjustment is required in the following cases.

- When the carriage motor is removed.
- When the parts affiliated with the carriage mechanism are removed.

Tension should not be too high nor too low. If this adjustment is not performed collectly, the following may result.

- The print pitch will not be correct. (Bi-d adjustment won't correct it.)
- Carriage errors will occur. (In the worst case.)

Step 1 Tighten the screw CCS (M3 × 8) clamping the belt tensioner on the left side of the carriage mechanism temporarily.

NOTE: Confirm that the carriage timing belt is not twisted.

Step 2 Place the top of the tension gauge in the hook of the belt tensioner.

Step 3 Clamp the mechanism, pull the tension gauge, and tighten the screw firmly with the gauge reading as follows:

Tension: 2.6 ± 0.2 Kg

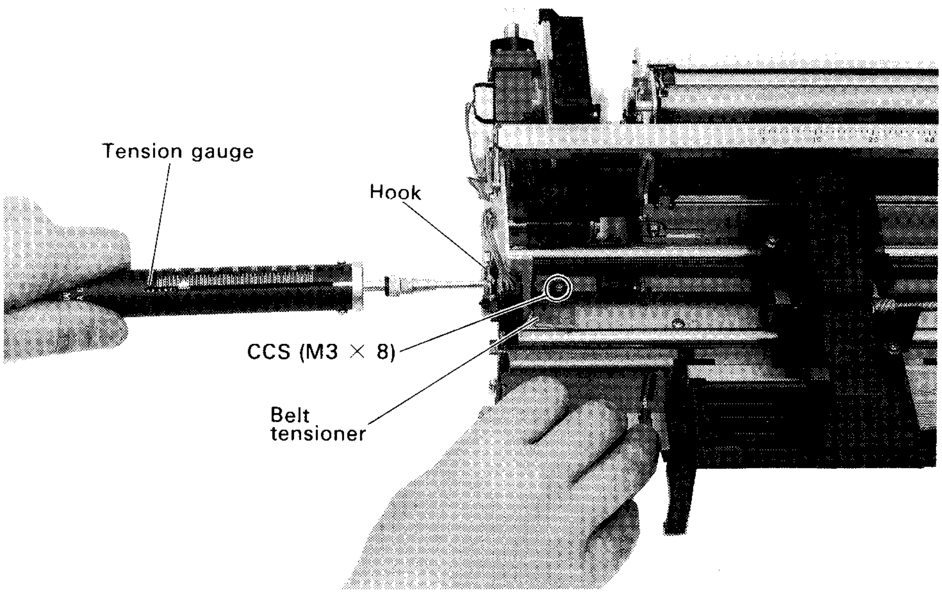


Figure 4-63. Carriage Timing Belt Tension Adjustment

4.3.4 Platen Gap Adjustment

This adjustment can be performed without removing the printer mechanism. This adjustment is required in the following cases.

- When the print head is removed.
- When the platen is exchanged or removed.
- When the carrige, guide shaft, and frame are exchanged or removed. (The parts affecting the head's location.)

The platen gap determine proper printing (= distance between nozzle and paper) and affects the print quality (dot allignment). If this adjustment is not performed correctly, the following may be affected.

- Dot condition
- Print density

WARNING

Both sides of the nozzle have protective guards. When you place the thickness gauge between the platen and head, be careful not to touch the gauge to the nozzle. (If it touches the nozzle, the nozzle surface could be damaged and printing will be affected.) In this adjustment, the gap between the guard and the platen is adjusted.

Step 1 Remove the printer cover and upper case. (Refter to section 4.2.2.1)

Step 2 Move the paper bail up. Move the printhead to the left side of the platen (near the position where the scale marking "1" aligus with the right side of the head) by moving the carriage manually while pressing the pump unit. (Refer to Figure 4-2)

Step 3 Tighten the two screws clamping the print head to the carriage temporarily so that you can move it manually.

Right side: CP(P)(M3 × 6)
Left side: CP(P)(M3 × 12)

Step 4 Confirm that the head adjust lever is in the usual place (at the narrow side). (Refer to section 1.2.1.1)

Step 5 Confirm that the inclined adjusting pin on the left side is at the center (the direction of the projection is exactly to the left). If it isn't, remove the head and replace it. (Refer to section 4.2.1.)

Step 6 Place the thickness gauge between the head and the platen (i.e. between the nozzle guard and the platen) from the side and tighten the screw using the torque driver so that the thickness gauge can be removed easily.

Platen gap: 1.0 ± 0.1 mm
Screw torque: 3 Kg. cm

Step 7 Check the gap at the center and right side of the platen. If it is too narrow (less than 0.9 mm) or too wide (more than 1.1 mm), go back to Step 6 and adjust it again.

Step 8 When the gap is correct, glue the adhesive to left and right screws. (Refer to section 6)

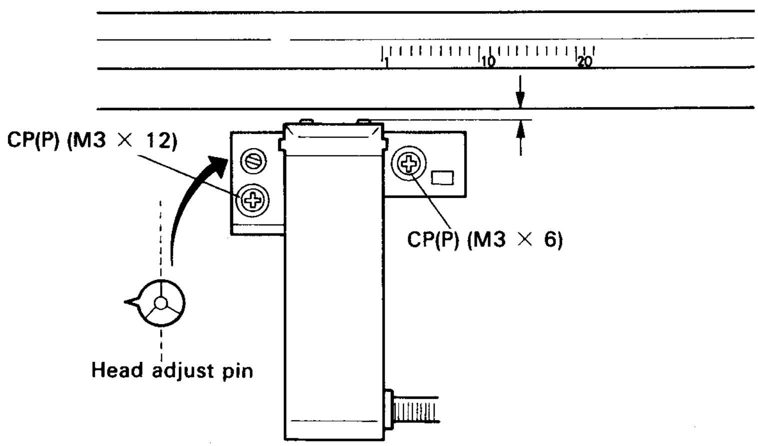


Figure 4-64. Platen Gap Adjustment

4.3.5 Printing Alignment

This section describes the various printing alignment procedures.

4.3.5.1 Printing Alignment Items

The printing alignment can be divided into the following items:

- Top edge holder position adjustment
- Head slant adjustment
- Bidirectional printing adjustment

All of the above adjustments can be executed without removing the printer mechanism.

Because the programs for the above adjustments are included in the adjustment cartridge, service personnel can perform the adjustments (correct the control circuits for the printer mechanism operation) in accordance with the messages displayed on the LCD panel. The resulting values overwrite the previous data stored in the control panel EEPROM. Only the head slant adjustment is performed by actually adjusting the physical mounting position. This means that no data is stored for this adjustment. Therefore, the program for this adjustment included in the adjustment cartridge is only a test program. If any of the adjustments are skipped (see Figure 4-65), the previous data remains. Be careful not to overwrite the data unnecessarily. The printing alignment is represented in two different ways in "ADJUSTMENT REQUIRED" indicated in Section 4.2. What each representation means is described below:

Example

- Printing alignment (see Section 4.3.5):
  Perform all the adjustment items described in this section.
- Printing alignment (only for bidirectional printing) (see Section 4.3.5):
  Perform only the bidirectional printing alignment described in this section. Skip the other adjustment items.

When the control panel is replaced, no data is present in the new EEPROM.
Therefore, all the adjustment items must be performed. Each adjustment is described below:

Top edge holder position adjustment

This adjustment is required in the following cases:

- When the TE motor is replaced
- When the top edge holder is replaced
- When any part related to the top edge holder mechanism is disassembled or replaced

This adjustment corrects for the difference between the number of steps the motor is driven to position the top edge holder at the reference position and the actual position the top edge holder is at after the motor is driven for the specified number of steps. The following problems might occur if the top edge holder position at paper feeding time is not correct:

- A paper jam could occur because the paper is not fed correctly during the paper feed/eject operation.
- Printing may not be possible if the printhead strikes the top edge holder.

Head slant adjustment

This adjustment is required in the following cases:

- When the horizontal dot spacing becomes too wide (extra space is added between the characters)
- When the printhead is replaced
- When any part related to carriage and head installation, such as the carriage, guide shaft, or frame, is replaced or removed

The head slant adjustment corrects the head slant angle when the printhead is installed using the head adjust pin (this is required because every head and carriage has different dimensions within the specified tolerances). If the head slant is not correct, the following problem could occur if two rows of nozzles on the printhead were misaligned:

- Extra space is added between horizontal dots (the printed dots shift).

Bidirectional printing adjustment

This adjustment is required in the following cases:

- When the horizontal printing positions (characters) are misaligned.
- When either the control panel, printer mechanism, or both are replaced (unit replacement).
- When any part related to carriage operation, such as the carriage, carriage motor, timing belt, guide shaft, or frame, is replaced or removed.

The bidirectional printing alignment uses the control circuit to correct any differences in timing for the odd-numbered lines and even-numbered lines in the bidirectional printing mode (These differences are due to the tolerances of the printer mechanism parts). If the printing positions are misaligned, the following might occur:

- During bidirectional printing, columns printed in the odd-numbered lines are shifted with respect to those in the even-numbered lines.
- Vertical ruled lines are misaligned.

4.3.5.2 Adjustment Procedure

Figures 4-65 through 4-68 show the flow charts for the adjustment programs.
Once the first step (START) is executed, the subsequent steps in the flow charts must be executed up to the last step.

● Start

Remove the printer cover and printer lid, insert the adjustment cartridge in optional cartridge slot A, and turn the printer power on.

● Basic operation

- To skip an adjustment item: Press the MICRO FEED switch.
- To execute an adjustment item: Press the LOAD/EJECT switch.

NOTE: Select either the 80-or 136-column model. (Since the PROM used is common to both the 80-and 136-column models, this mode must be reset each time the adjustment is started so that the PROM can identify the model type to be adjusted.)

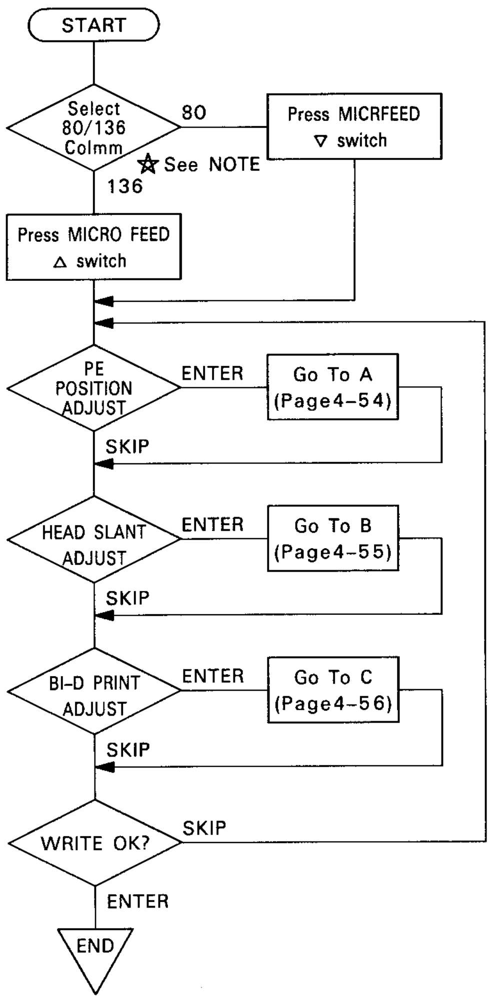
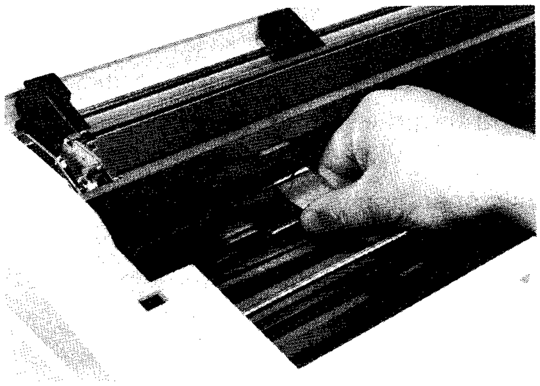


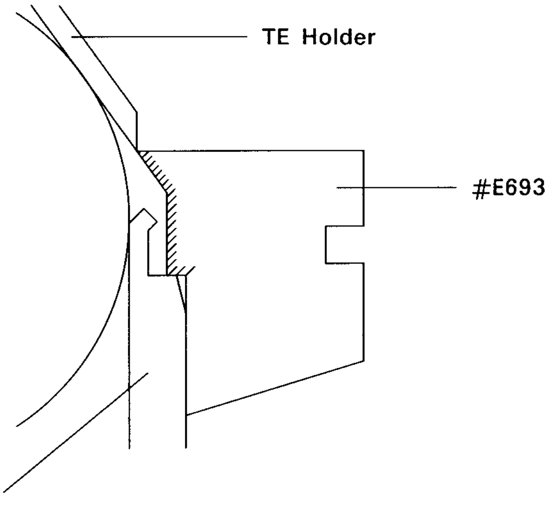
Figure 4-65. Main Flow Chart

A

The top edge holder moves to the adjustment position.

Set the exclusive position alignment tool #E693 as shown in the Figure below. (Do not tilt the tool, but attach it closely.)





Is the position collect?

OK → Press the LOAD/EJECT switch. → RETURN

NG → For the dimension indicated by the tool

Wide → Press the MICRO FEED △ switch as many times as needed.

Nallow → Press the MICRO FEED ▽ switch as many times as needed.

Press the LOAD/EJECT switch.

Figure 4-66. Top Edge Holder Position Adjustment

WARNING

When turning the adjusting pin for the head slant adjustment, be sure to first loosen the printhead fixing screw to float the printhead. If you try to turn the pin forcibly, the screw head might break.

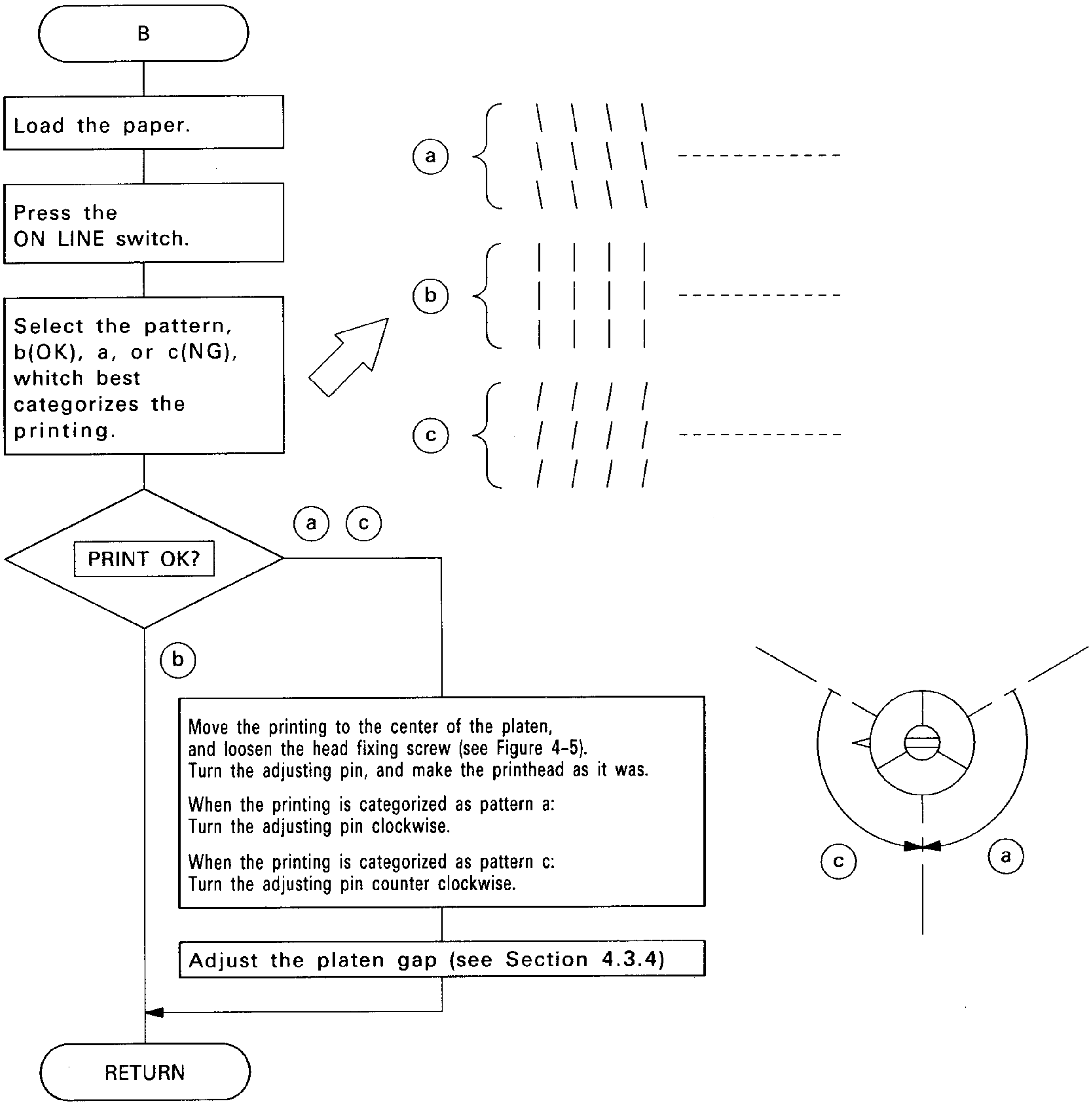


Figure 4-67. Head Slant Adjustment

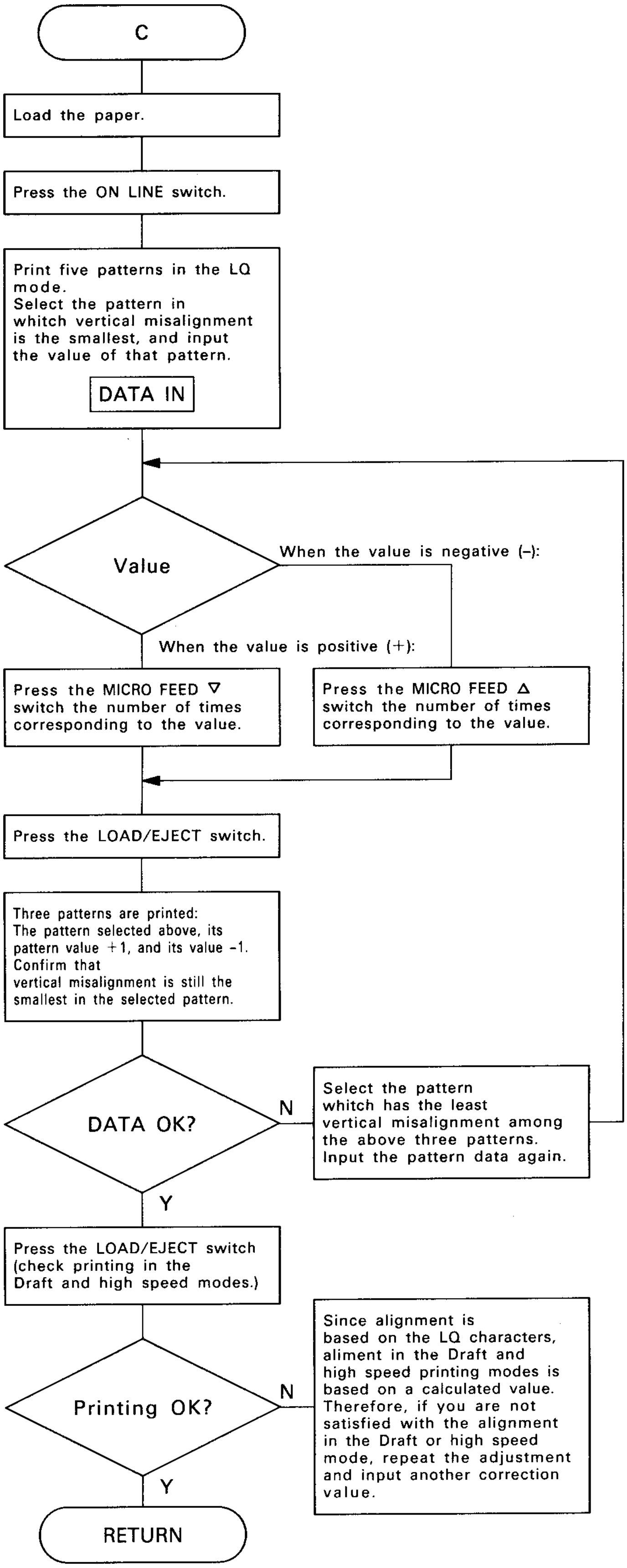


Figure 4-68. Bidirectional Printing Adjustment

CHAPTER 5
TROUBLESHOOTING

LIST OF FIGURES

LIST OF TABLES

5.1 GENERAL

Troubleshooting is based on the idea that error symptoms vary according to the defective component. Troubleshooting may involve either unit replacement or unit repair, each of which is treated separately below.

First try to determine the defective unit by referring to section 5.2. The flowcharts in the section should help you to isolate the defective unit. Then refer to section 5.3 for instructions for further checking and for replacement of power supply board components. Section 5.3 lists, for various symptoms, the potentially defective unit that may account for them. In addition, the section mentions the appropriate waveforms and resistance values that should be checked for.

If trouble occurs in the printer mechanism and main board, refer to section 5.4, which specifies procedures for identifying defective components by using the diagnostics tool.

5.2 UNIT REPLACEMENT

This section correlates symptoms with the potentially defective units that may be causing them. The unit numbers are listed in Table 5-1.

Table 5-1. Unit Replacement Numbers

Name of Unit	Description	Unit No.
SEIPS Board	Power Board of 120V	Y502202000
SANPSE Board	Power Board of 220/240V	Y567204000
SAMA Board	Main Board	Y502204100
SAPNAL-W	Control Panel Board	Y502502000
Model-4460	Printer Mechanism for SQ-2550	Y503590200
Model-4410	Printer Mechanism for SQ-850	Y502590200
Printhead for SQ-2550	Type-A	Y426110000
Printhead for SQ-850	Type-B	Y426210000
Fuse (SEIPS)	ULTSC2.0 A-N1	X502061011
Fuse (SANPSE)	BET 1.25A	X502063040

DANGER

If you need to turn the printer power on without upper case while troubleshooting, be careful to **Do not touch the live part** of power line. You should be cover the live part by taping or wareing rubber glove when you turned ON the power

Table 5-2. Symptom and Reference Pages

Problem	Symptoms	Reference Page
Printer does not operate at all with power switch on	● No LEDs are lit on the control panel. ● Carriage, pump, and so on don't operate at all.	5-3
Printer detects an error and the buzzer rings	● An error code is displayed on the control panel LCD.	5-4
Printing error occurs (in self-test)	● Nothing is printing. ● A specific dot is missing. ● Print quality is bad (print density or other).	5-5
Abnormal paper feed	● No paper is fed. ● The amount of paper fed is irregular. ● Paper jam occurs.	5-6
Control panel does not operate correctly	● No paper is fed when you press the return key or change pages key in OFF LINEmode. ● You can not select function modes using panel switches. ● You can not select ON LINE or OFF LINE mode. ● You can not set panel settings.	5-7
Incorrect printing in ON LINE mode	● The result of the self-test is correct, but data from the host computer isnot printed correctly. ● When printer is operating, an error occurs in the host computer.	5-8

1. The printer does not operate at all with power switch on. (No LEDs are lit.)

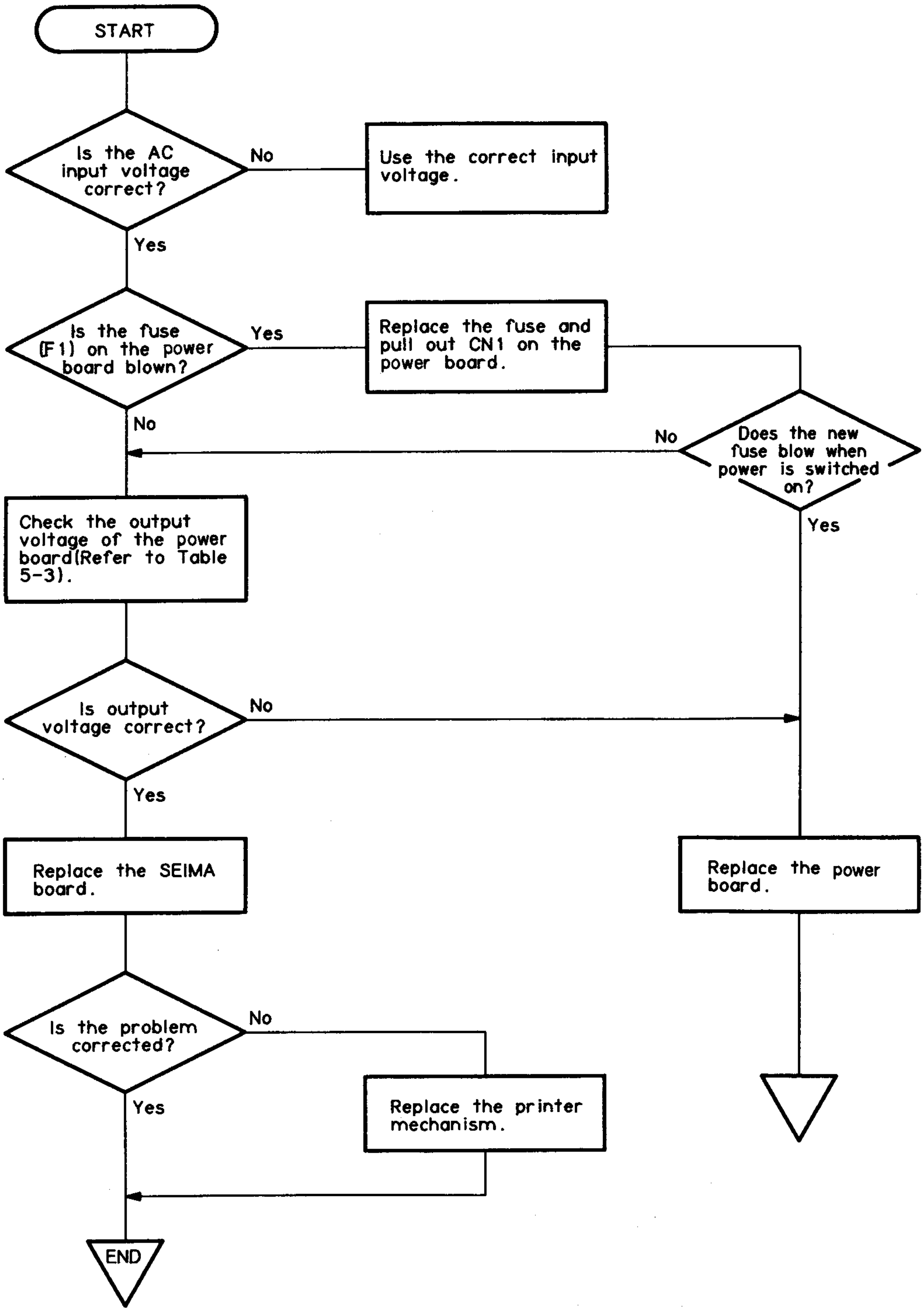


Figure 5-1. Unit Replacement-1

Table 5-3. SEIPS/SANPSE Board (CN2) Output Voltage

Connector Terminal		Voltage
3,4(GND)	1,2	Approx. +24 V
5,6(GND)	7,8	Approx. +4.8 V
	9	Approx. +12.3 V (+ 11.7 V)
	10	Approx. −12.3 V (− 11.7 V)

NOTES 1: The voltages shown in Table 5-3 are measured when the printer is onstandby.
2: The voltages in parentheses are measured with the optional interfaceboard installed.

2. Printer detects an error (buzzer rings).

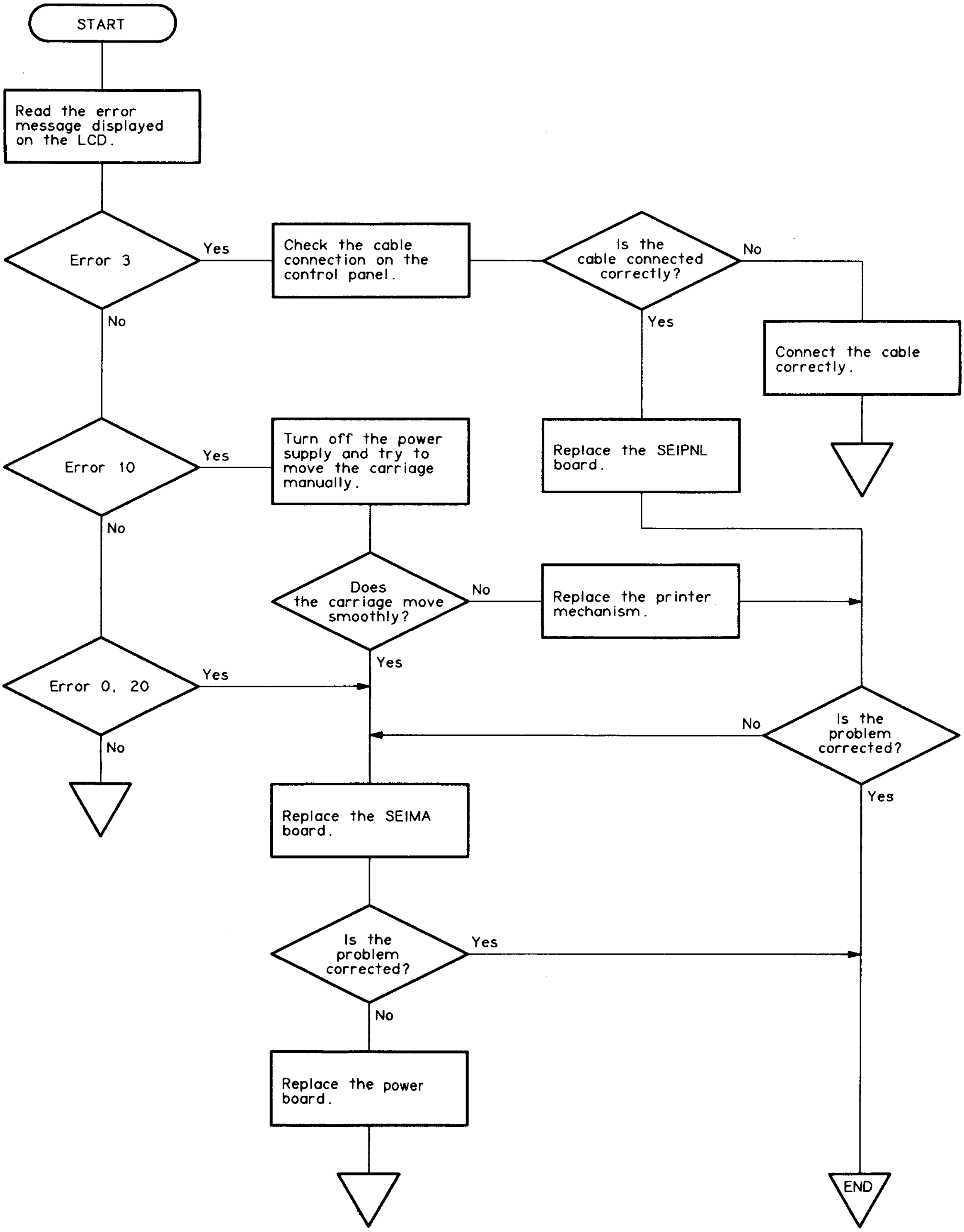


Figure 5-2. Unit Replacement-2

3. Printing error occurs (in self-test)

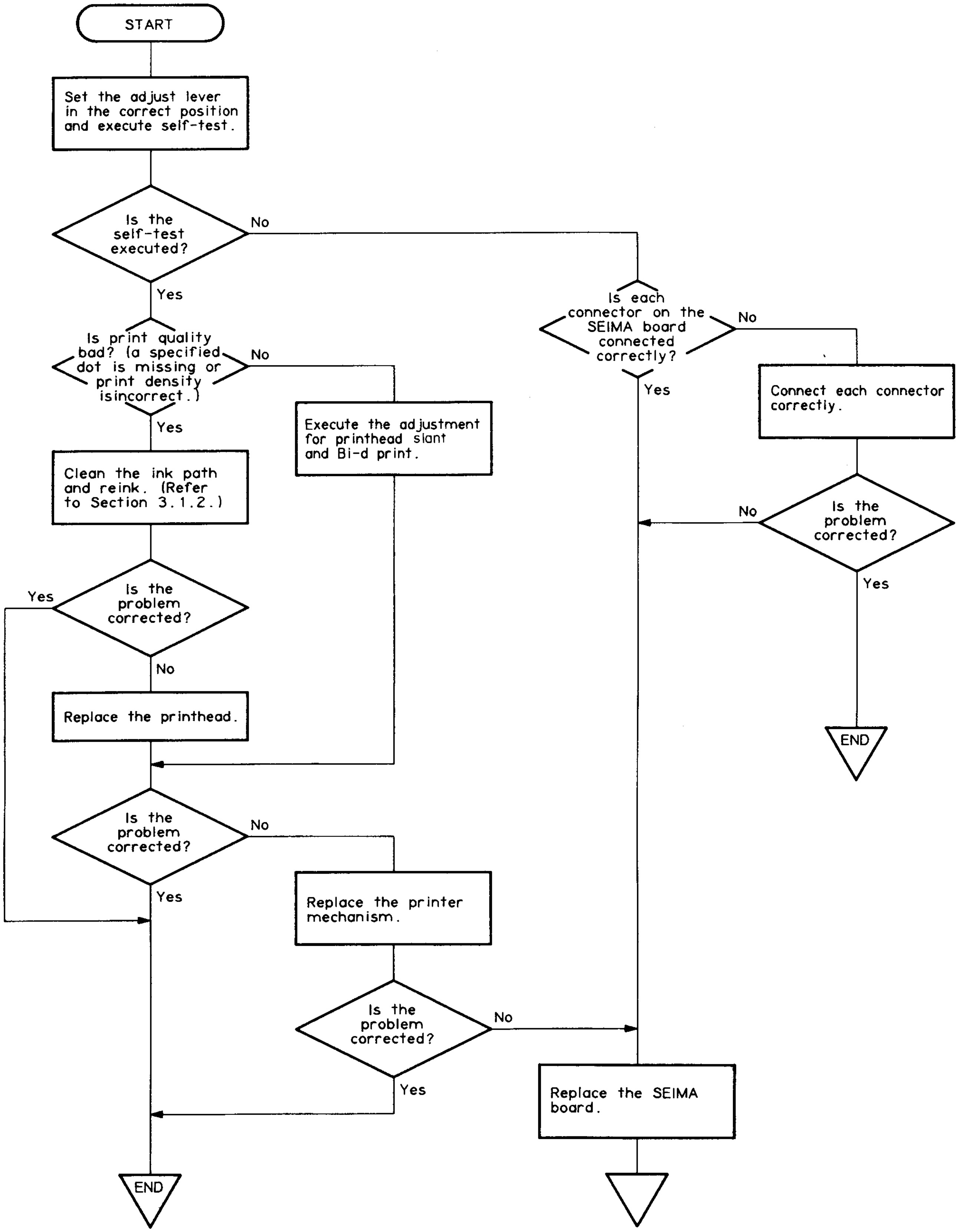


Figure 5-3. Unit Replacement-3

4. Abnormal paper feeding

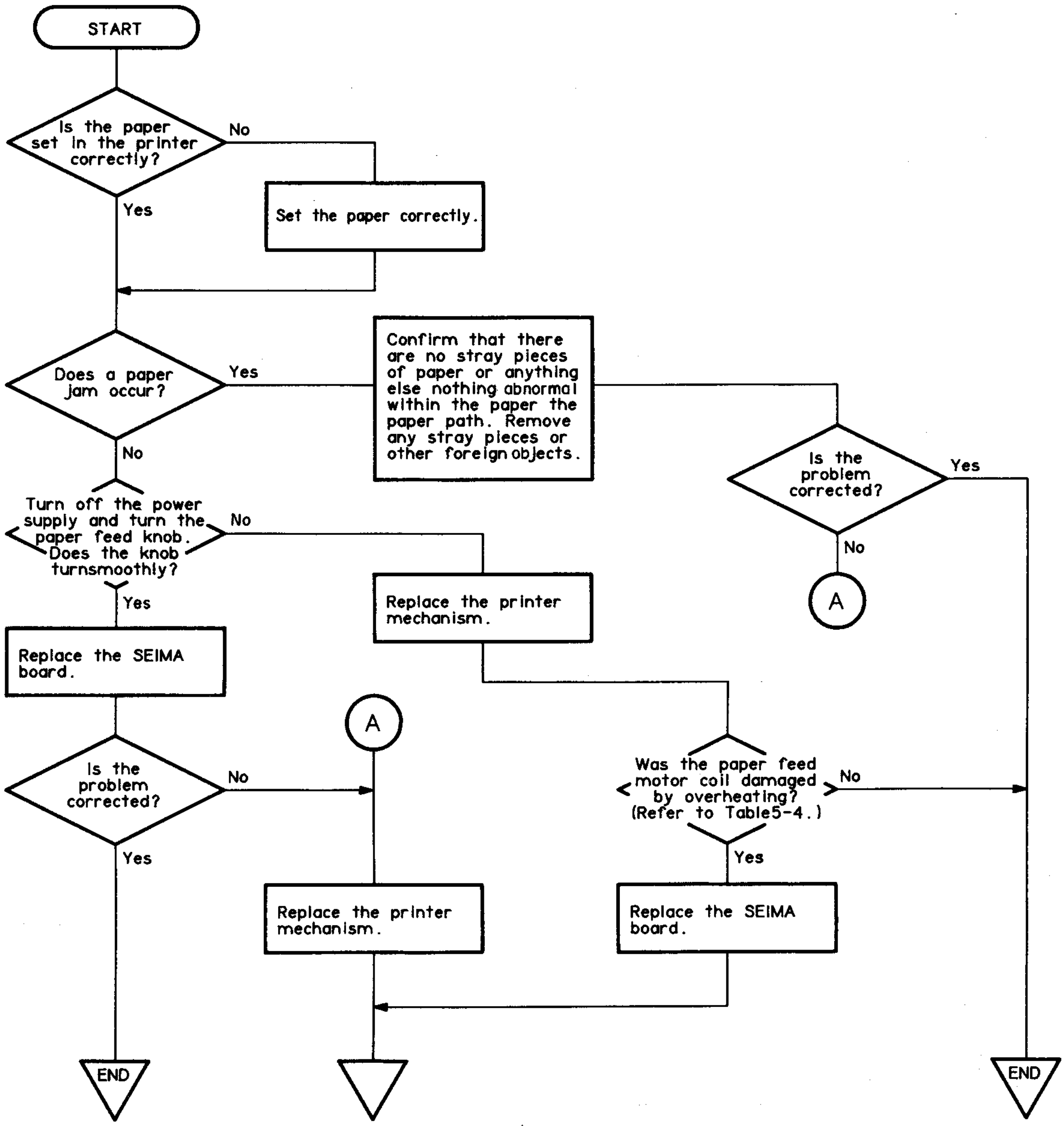


Figure 5-4.Unit Replacement-4

Table 5-4. Paper Feed (PF) Motor Coil Resistance

Measurement Terminal (PF motor reed wire connector)		Resistance
5 pin	1 pin	27±0.4 ohmns
	2 pin	
6 pin	3 pin	
	4 pin	

5. The control panel does not operate correctly.

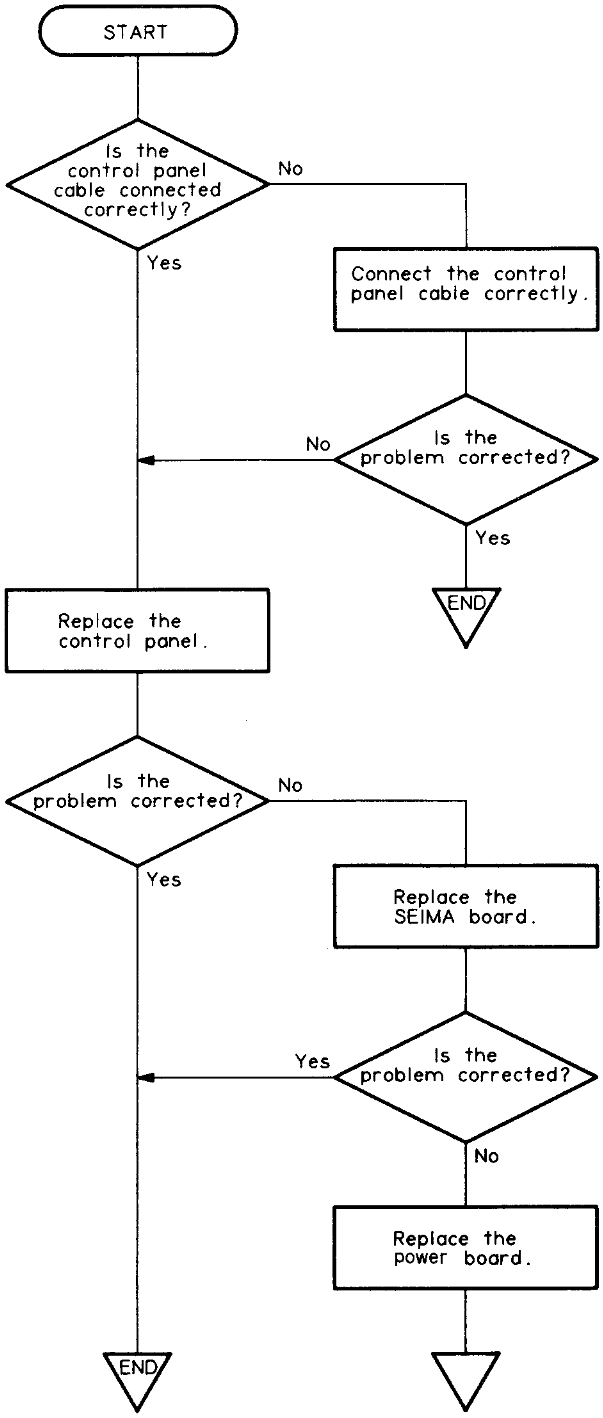


Figure 5-5. Unit Replacement-5

6. Incorrect printing in ON LINE mode

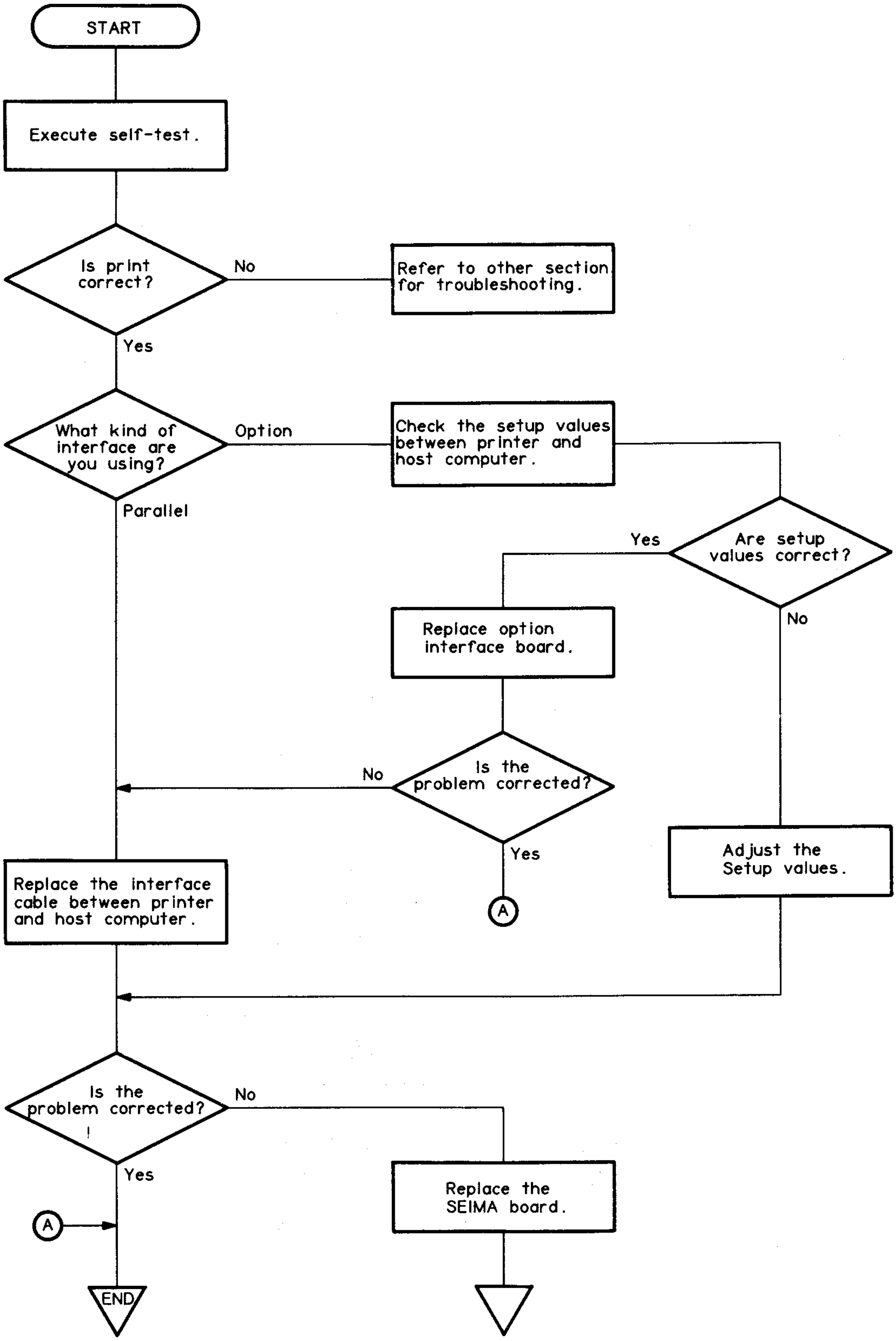


Figure 5-6. Unit Replacement-6

5.3 SANPS/SANPSE POWER BOARD UNIT REPAIR

This section indicates the points to be checked in response to problems, and the measures to be taken based on the result of the check. Utilize the checkpoints to determine and correct defective components.

Table 5-6 is divided into the five following columns:

- Problem: Indicates the problem
- Symptom: Indicates potential condition which may be underlying the problem. You must check to see which if any of the symptoms apply.
- Cause: Indicates the potential cause of the problem.
- Checkpoint: Perform this check to determine whether the problem is the result of the cause listed at left.
- Solution: Indicates the repair that will correct the fault.

The Table 5-3 shows the main components used on the SEIPS/SANPSE boards.

Table 5-5. SEIPS/SANPSE Board Parts List

Board Name	Location	Parts Name	Description	Parts No.
SEIPS/ SANPSE	IC1	L5431-AA	Adjustable Plesison REG.	X440164319
	IC20	TL494CN	PWM Control	X440034940
	Q20	2SA1469	Transistor 60V 5A 20W	X300146900
	Q3,21	2SA1020	Transistor 50V 2A 900mW	X300102009
	Q2	2SC3746	Transistor 60V 5A 20W	X302374600
	R31,32		Fusible resistor 2 ohm 1/4W ± 5%	X175400207
SEIPS	Q1	2SC3831	Transistor 500V 10A	X302383100
	DB1	D3SBA40	Diode Bridge 400V 4.0A	X340330120
	F1	ULTSC 2.0A-N1	Fuse 125V 2.0A	X502061011
	T1	PT-P68A-NF	Transformer	Y567204003
SANPSE	Q1	2SC3460	Transistor 800V 6A 100W	X302346000
	DB1	RBV-406	Diode Bridge 600V 4.0A	X340400321
	F1	BET 1.25A	Fuse 1.25A 250V	X502063040
	T1	PT-P68E-NF	Transformer	Y567204002

Table 5-6. SIEPS/SANPSE Power Board Unit Repair

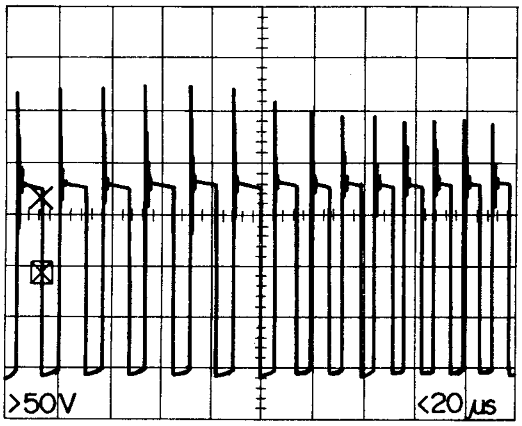
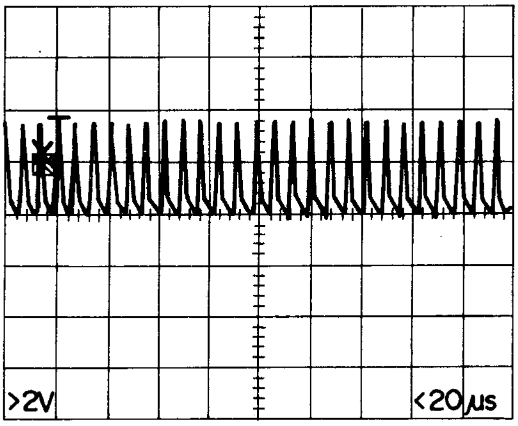
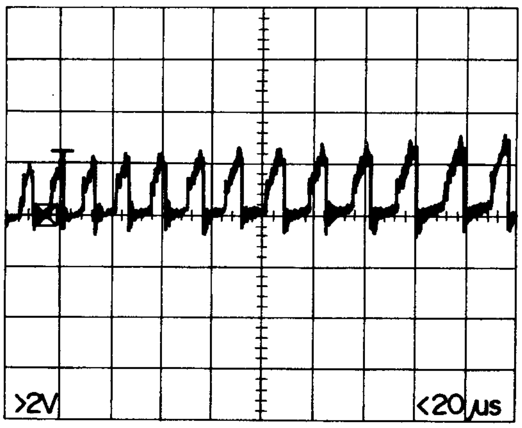
Problem	Symptom	Cause	Checkpoint	Solution
The printer does not operate at all.	The +24V line is dead.	Transformer coils are open.	Measure the resistance of T1 transformer coils. 4-3, 6-2, 11-12.	Replace T1.
		Q1 is dead.	Check the voltage waveforms at Q1 (collector).  	Replace Q1.
	The voltage on the +24V line is below normal.	Q3, IC1, PC1, or ZD20 is dead.	Check the voltage waveforms at Q3 (collector).  	Replace Q3, IC1, PC1, or ZD20.
		Q2 is dead.	Check the voltage waveforms at the Q2 (collector).  	Replace Q2.

Table 5-6. SEIPS/SANPSE Power Board Unit Repair (Continued)

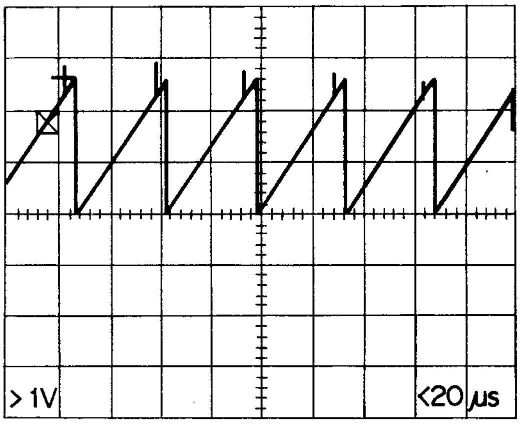
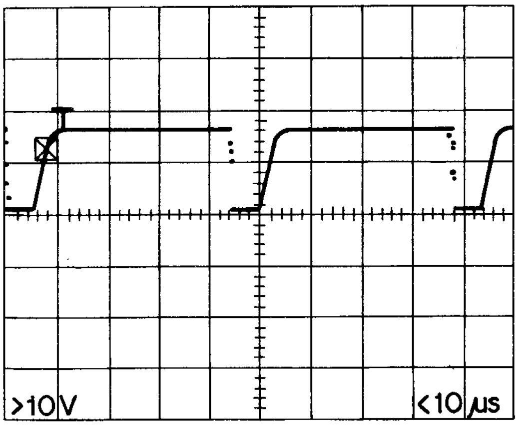
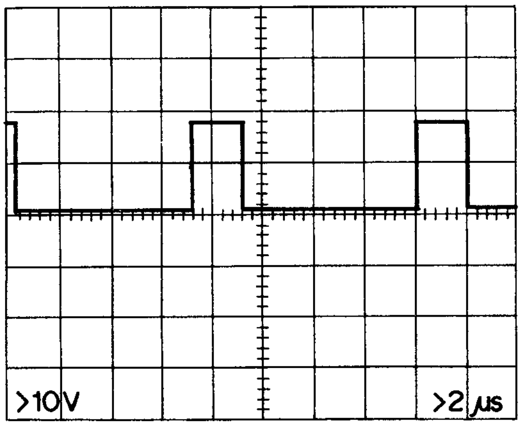
Problem	Symptom	Cause	Checkpoint	Solution
The printer does not operate at all.	The voltage at +5V line is dead.	The +24V line is dead.	Check the +24V line.	
		IC20 is dead.	Check the oscillation waveform and the switching waveform.  Oscillation Waveform (IC20, 5Pin)  Switching Waveform (IC20, 8Pin)	Replace IC20.
		Q20 or Q21 is dead.	Check the switching waveform.  Q20, Collector	Replace either Q20 or Q21.

Table 5-6 SEIPS/SANPSE Power Supply Unit Repair (Continued)

Problem	Symptom	Cause	Checkpoint	Solution
The printer does not operate at all.	The voltage on the ±12V line is dead.	The +24V power supply circuit is dead.	Check the +24V line.	
		Fuse resistor R31 or R32 is open.	Measure the resistance values of R31 and R32.	Replace either R31 or R32.
		Transformer coils are open.	Measure the resistances of transformer coils 7-8, 8-11.	Replace T1.

5.4 DIAGNOSTICS TOOL

This section describes how to use the tool and explains its functions.

5.4.1 Overview

Epson supplies this diagnostic ROM cartridge as a tool for repair and analysis of the SQ-2550/850. With this tool, the SQ-2550/850 can be repaired very easily.
Because the tool consists simply of the single ROM cartridge, handling is also very easy.

5.4.2 Description

The diagnostic ROM cartridge tool consists of the following items:

- ROM cartridge (27256 ROM)
- Operation manual

5.4.3 How to setup

Check that the printer power is off, then insert the diagnostic cartridge in the printer's option slot A.

ROM cartridge	→	<Printer> Option slot A

5.4.4 Functions and use of diagnostic ROM

This ROM is equipped with 36 diagnostic modes, which can be selected and executed using the LCD panel and 10 switches.

a) Power-on

If power is turned on with the diagnostic ROM installed, the CPU first lights the READY LEDs on the control panel.
This indicates that the CPU is operating. If the READY LEDs do not turn on, the CPU is not operating so check the clock signal (IC10C pins 2 and 3), Vx voltage Q2 collector), reset signal (IC8B pin 47), and ROM select signals (IC11D pins 3 and 11).

Power on	
Power LED turns on	+5V supply to the circuit.
READY LED turns on	Indicates that The CPU is working.
RAM check start	

Next, the CPU starts the RAM check.
The diagnostic ROM performs three types of RAM tests: a read/write check, an address check, and a refresh check, and if an error occurs the LCD panel displays the location of the IC containing the error. If the CPU finds an error, it will be indicated on the display as follows:

For the backup RAM (IC13C), the CPU checks only the RAM area used for the input buffer and the system area.

In the case of an error on IC11B only:

RAM0(11B) RD/WR ERR.	Replace RAM chip IC11B.
RAM0(11B) ADDR. ERR.	Replace RAM chip IC11B.
RAM0(11B) REF. ERROR	Replace RAM chip IC11B or IC8B.

In case of an error on IC13C only:

RAM1(13C) RD/WR ERR.	Replace IC13C.
RAM1(13C) ADDR. ERR.	Replace IC13C.

In case of errors on both IC11B and IC13C:
The READY LED blinks on/off. Replace IC11C and IC8B.

When the RAM check finishes, the buzzer eill sound.
After the above diagnostic operation is finished, the following message will be displayed on the LCD panel.

RAM CHECK FINISHED !	The RAMs are normal.
Diagnostic ROM(X.00)	ROM version is displayed.

Then the mode selection screen is displayed on the LCD panel.

FF:dwn LF:up L/E:set	Mode selection screen displayed.

b) Mode selection

The following screen is displayed to explain how to select a mode.

FF:dwn LF:up L/E:set	Mode selection screen.

'LF'(line feed) key proceeds to the next diagnostic mode.
'FF'(form feed) key returns to the previous diagnostic mode.
'L/E'(load/eject) key executes the selected diagnostic mode.

The 'LF' and 'FF' keys are used to select the 36 diagnostic modes, and the 'L/E' key executes it. The modes available for this ROM are shown below:

00:Boot(RAM check)
01:Switch check
02:LCD(LCDC) check
03:Panel LED check
04:Prog. ROM check
05:CG0/10B ROM check
06:CG1/13B ROM check
07:Case open sensor
08:HP sensor
09:Ink cart. sensor
10:Ink end sensor
11:PE sensor
12:TE sensor
13:C.S.F sensor
14:CR encoder check
15:CR position reg.
16:Release sensor
17:Buzzer check
18:Bsy.Ack.Pe.Er H/L
19:At.Sin.P/S.Int RD
20:Parallel data RD
21:RS-232C loop back
22:PF motor drive
23:PF phase HI/LO
24:Trig. plug on/off
25:CHANGE FR./TR.
26:TE motor drive
27:TE phase HI/LO
28:CR motor check
29:Valve plug on/off
30:Pump motor drive
31:All head ON/OFF
32:EEPROM check
33: 146H timer check
34:Rotator check
35:Head refresh
36:EEPROM Edit

00: Boot(RAM check)

Select this mode to check the RAM. When this mode is selected, the CPU resets the external system.

01: Switch check

Select this mode to check the switches on the control panel. When a switch is pressed, the name of the switch is displayed on the LCD panel. To exit this mode, press the ON-LINE switch.

02: LCD(LCDC) check

Select this mode to check the functions of the LCD controller (LCDC) mounted on the control panel board. All the characters that are defined in the LCDC are displayed.
To exit this mode, press the ON-LINE switch.

03: Panel LED check

When this mode is selected, all the LEDs on the control panel blink. To exit this mode, press the ON-LINE switch. Note that the POWER LED does not turn off.

04: Program ROM check

Use this mode to check the ROM in the diagnostic ROM cartridge.
When this is selected, the read address and data from the ROM is displayed on the LCD.
When the checksum is displayed at the end of this check, compare it with the correct value. They should both match.
To exit this mode, press the ON-LINE switch.

AD=xxxx BK=00 DT=xx

AD : read address
BK : bank number(In this mode, BK is always 00)
DT : read data

05: CG0/10B ROM check

Use this mode to check the CG ROM (IC10B).
When this is selected, a menu is displayed for selecting the CGROM capacity as follows;

Select CG ROM size	
FF:up LF:down L/E:set	Switch explanation.
CG ROM size = 4M bit	Select CGROM size (256K,1M,2M,4M bit)

Select the CGROM size (256K,1M,2M,4M) by pressing 'FF' or 'LF', and press 'L/E' to start the check.
The address and data read from the CGROM are displayed on the LCD.
When the checksum is displayed at the end of the check, compare it with the correct value.
To exit this mode, press the ON-LINE switch.

AD=xxxx BK=00 DT=xx

AD : read address
BK : bank number (In this mode, BK ranges from 00 to 3Fh)
DT : read data

06: CG1/13B ROM check
Use this mode to check the CG ROM (IC13B).
When this is selected, a menu is displayed for selecting the CGROM capacity as follows;

Display	
Select CG ROM size	
FF:up LF:down L/E:set	Switch explanation.
CG ROM size= 1M bit	Select CGROM size (256K,1M,2M,4M bit)

Select the CGROM size (256K,1M,2M,4M) by pressing 'FF' or 'LF', and press 'L/E' to start the check. The address and data read from the CGROM are displayed on the LCD.

When the checksum is displayed at the end of the check, compare it with the correct value.
To exit this mode, press the ON-LINE switch.

AD=xxxx BK=00 DT=xx

AD : read address
BK : bank number (In this mode, BK ranges from 40H to 7FH)
DT : read data

07: Case open sensor
Select this mode to check the case open sensor. The state of the case open sensor is displayed on the LCD panel. Check case open sensor by operating it manually (i.e. open and close the printer cover).
To exit this mode, press the ON-LINE switch.

08: HP sensor
Select this mode to check the home position sensor. The state of the home position sensor is displayed on the LCD panel. Check the home position sensor by operating it manually (i.e. move the carriage in front of the home position sensor).
To exit this mode, press the ON-LINE switch.
If a problem can not be corrected by replacing the home position sensor, replace IC4B (G.A.).

09: Ink cartridge sensor

Select this mode to check the ink cartridge sensor. The state of the ink cartridge sensor is displayed on the LCD panel. Check the ink cartridge sensor by operating it manually (i.e. install and remove the ink cartridge in the ink cartridge holder).
To exit this mode, press the ON-LINE switch.
If a problem can not be corrected by replacing the ink cartridge sensor, replace IC6B (G.A.).

10: Ink end sensor

Select this mode to check the ink end sensor. The state of the ink end sensor is displayed on the LCD panel. Check that the ink end sensor by operating it manually (i.e. move the ink end sensor using your hand).
To exit this mode, press the ON-LINE switch.
If a problem can not be corrected by replacing the ink end sensor, replace IC6B (G.A.).

11: PE sensor

Select this modes to check the paper end sensor. The state of the paper end sensor is displayed on the LCD panel. Check the paper end sensor by operating it manually (i.e. move the paper in front of the paper end sensor).
To exit this mode, press the ON-LINE switch.
If a problem can not be corrected by replacing the paper end sensor, please replace IC6B (G.A.).

12: TE sensor

Select this mode to check the paper sensor. The state of the paper sensor is displayed on the LCD panel. Check the paper sensor by operating it manually (i.e. move the paper in front of the sensor).
To exit this mode, press the ON-LINE switch.
If a problem can not be corrected by replacing the paper exist sensor, replace IC6B (G.A.).

13: CSF sensor

Select this mode to check the CSF sensor. The state of the CSF sensor is displayed on the LCD panel. Check the CSF sensor by operating it manually (i.e. move the CSF sensor usin your hand).
To exit this mode, press the ON-LINE switch.
If a problem can not be corrected by replacing the C.S.F sensor, replace IC6B (G.A.).

14: CR encoder check

Select this mode to check the CR encoder. The state of the CR encoder and CR moving direction are displayed on the LCD panel. Check the CR encoder signal and CR direction detection circuit in IC4B by moving thecarriage with your hand).
To exit this mode, press the ON-LINE switch.
If a problem can not be corrected by replacing the carriage motor, replace IC4B (G.A.).

```
ENA=H ENB=L dir=CW
```

ENA : CR encoder A signal
ENB : CR encoder B signal
dir : CR direction CW : to the right
CCW : to the left

15: CR position regulator

Select this mode to check the CR position register in IC4B (G.A.).
The register value in IC4B is displayed on the LCD panel in hexadecimal format.
Select this mode after checking modes '08' and '14'.
Check the CR position register in IC4B by moving the carriage with your hand).
To exit this mode, press the ON-LINE switch.
If a problem can not be corrected by replacing the carriage motor, replace IC4B (G.A.).
The CR position register is reset by the home position signal and it is incremented by moving the carriage to the right.

16: Release sensor

Select this mode to check the release sensor. The state of the release sensor is displayed on the LCD panel. Check the release sensor operates normally by operating it manually (i.e. move the release sensor with your hand).
To exit this mode, press the ON-LINE switch.
If a problem can not be corrected by replacing the C.S.F sensor, replace IC12C (G.A.).

17: Buzzer check

Select this mode to check the buzzer drive circuit. When this mode is selected, the buzzer drive circuit is activated.
To exit this mode, press the ON-LINE switch.

18: Bsy,Ack,Pe,Er H/L

Select this mode to check the operation of the control signal output lines on the parallel interface.
When this mode is selected, the PE, ERROR, BUSY and ACK signal lines change between HIGH and LOW at a constant rate so that the operation of each line can be checked easily.
To exit this mode, press the ON-LINE switch.

19: At,Sin,P/S,Int RD

Select this mode to check the operation of the control signal input lines on the parallel interface.
When this mode is selected, the AUTOFEED-XT, SELECT-IN, P/S (PARALLEL/SERIAL), and INIT signals lines are displayed on the LCD panel so that operation of each line can be checked easily.
To exit this mode, press the ON-LINE switch.

20: Parallel data RD

Select this mode to check the parallel interface.
When this mode is selected, data input through the parallel interface is displayed on the LCD panel in hexadecimal.
To exit this mode, press the ON-LINE switch.

21: RS-232C loop back

Select this mode to check the operation of the RS-232C serial interface.
Connect the RxD and TxD terminals on the serial interface connector using a jumper.
In this mode, the LCD displays the followint:

Select RS interface.

LF:8143 FF:Internal

LF key: select #8143 (optional serial interface)
FF key: select internal serial interface as standard.

This mode starts a loop back test.
In this mode, the printer itself outputs serial data, receives the data, and checks if communication is normal.
The data transmitted and received are displayed on the LCD.
If transmission or reception cannot be executed, press any switch. The LCD displays which is not working, transmission or reception.
In this mode, operation at 150, 300, 600, 1200, 2400, 4800, 9600, and 19200 BPS is tested.

22: PF motor drive
Select this mode to drive the paper feed motor.
In this mode, the following displays appear on the LCD:

LF:speed L/E:start

MODE=0 COUNTER=1000

LF: Select the paper feed speed (mode).
L/E:Execute paper feed.
COUNTER: Step value of paper feed motor.

Press the ON-LINE switch during paper feeding to stop the paper feed motor.
Press the ON-LINE switch again to exit this mode.

23: PF phase HI/LO
Whe thal the waveforms from IC2A and IC3B for the paper feed motor can be easily observed.
To exit this mode, press the ON-LINE switch.

24: Trig. plug on/off
Use this mode to check the operation of the release trigger plunger.
When this mode is selected, the plunger is driven (turned on or off).
Check that operation is normal by listening to the sound made by the plunger.

LF→ON, FF→END

LF: Trigger plunger ON
FF: Exit this mode

25: Change FR./TR.

When this mode is selected, the release/friction function is driven.
Before entering this mode, please check modes '16','23' and '24'.
Press the ON-LINE switch to exit this mode, or when an error occurs.
An error is indicated when the paper feed motor is stepped, but the state of the release sensor does not change.

26: TE motor drive

Select this modes to drive the TE motor.
The TE motor is driven CW for 160 steps and CCW for 160 steps.
To exit this mode, press the ON-LINE switch.

27: TE phase HI/LO

When this mode is selected, IC2A (GA) outputs the phase signals A to D for the TE motor at a constant rate under the holding voltage (+5V).
Using this mode, the waveforms of IC2A and Q11 to Q14 for the TE motor drive circuit can be easily observed.
To exit this mode, press the ON-LINE switch.

28: CR motor check

Select this mode to drive the carriage motor.
In this mode, the carriage speed selection menu is displayed on the LCD as follows:

F:speed L/E:start

speed=0 L/E:start

LF: Select CR speed (mode)
L/E: Drive the CR motor

Press the ON-LINE switch during while the CR motor to stop it.
Press ONLINE switch again to exit this mode.
NOTE: This mode can not detect carriage errors.

29: Valve plug on/off

Use this mode to check the operation of the valve plunger.
When this mode is selected, the plunger is driven (turned on or off).
Check that operation is normal by listening to the sound made by the plunger.
To exit this mode, press the ON-LINE switch.

LF→ON, FF→END

LF: Valve plunger ON
FF: Exit this mode

30: Pump motor drive

Select this mode to drive the pump motor.
When this mode is entered, the LCD panel displays the following menu for selecting the carriage speed.

LF→CW(CL) FF→CCW(OP)

LF: drive pump motor CW(Cap close)
FF: drive pump motor CCW(Cap open)

The pump motor is driven while the panel switches are pressed.
To exit this mode, press the ON-LINE switch.
Note that the valve plunger is always open in this mode.

31: All head ON/OFF

When this mode is selected, IC6B (GA) outputs head data at a constant rate.
Using this mode, the waveforms from IC6B and IC5C to 7C in the head drive circuit can be easily observed.
To exit this mode, press the ON-LINE switch.
Note that the PTS signal from IC4B is not used in this mode. The head drive timing is performed by the CPU internally.

32: EEPROM check

Select this mode to check the EEPROM on the control panel unit.
This mode performs two tests: a read/write check and an address check.
This EEPROM stores very important data for the mechanism.
In this test, if the CPU does not detect an error in the EEPROM, the current data is restored to the EEPROM, so do not turn the printer power off until the test is completely finished.

33: 146H timer check

Select this mode to check the 146 hour hardware timer.
When this mode is selected, the LCD displays the following:

LF:Rst. TIMER=xxxxxx

LF : This key resets the timer.
xxxxx : Current state of timer
OVER : over 146h
WITHIN: within 146h

If the timer indicate 'over 146h', please press the LF key to reset the timer.
If LCD screen changes from 'OVER' to 'WITHIN' then the timer circuit is normal.
In this mode, CPU pin 42 can be switched between HIGH and LOW from the control panel, so operation of the timer reset circuit can be easily checked.
To exit this mode, press the ON-LINE switch.

34: Rotator check

Select this mode to check the rotator in the IC8B gate array.
This gate array has the following functions:

VERTICAL→HORIZONTAL	8 × 8-bit vertical-horizontal change function
HALF PROTECT	24-bit half-protection function
Triple	Tripled data function
Double	Doubled data function
MSB ←→ LSB	Exchange msb and lsb.

If an error is found 'IC8B error' is displayed.
To exit this mode, press the ON-LINE switch.

35: Head refresh

Select this mode to execute a head cleaning or to drain the ink from the printer mechanism. When this mode is selected, the LCD displays the following:

LF:clean FF:charge

LF: same as cleaning operation (same as pressing the cleaning switch)
FF: same as charging operation (same as pressing cleaning switch while turning power on)

If the LF key is pressed:
The LCD panel displays the following to select loop time:

LF:No. FF:Start

Loop=00 FF:Start

LF: select loop Number.
FF: start

If the FF key is pressed:
Performs one ink charge.

36: EEPROM check

This mode is used to check or edit the data in the EEPROM. The EEPROM stores following data.

Bi-directional printing position adjustment value
TE motor adjustment value
Column width setting flag

When this mode is selected, the LCD panel displays the data in the EEPROM.

L/E:Edit FF:NEXT

L/E switch: Press this switch to enter the editing mode.
FF switch: Press this switch to display the next byte of data.

ADD=00H DATA=01

ADD : address
DATA: data in the EEPROM

When the L/E switch is pressed, the display is as follows:

ON:Next FF:+1 LF:-1

ON (ON-LINE) switch: Press this switch to exit the editing mode and display the next byte of data.
FF switch: Increment the data in the EEPROM
LF switch: Decrement the data in the EEPROM

ADD=00H E DATA=01

E: Indicates the editing mode.

After exiting the editing mode, press the ON-LINE switch to exit this mode.
The data in the EEPROM is as follows:

ADDRESS	00	DATA 01H	; EEPROM ID (01:Standard Format)
ADDRESS	01	DATA xx	; CR Bi-D in 120DPI L→R
ADDRESS	02	DATA xx	; L←R
ADDRESS	03	DATA xx	; 180DPI L→R
ADDRESS	04	DATA xx	; L←R
ADDRESS	05	DATA xx	; 240DPI L→R
ADDRESS	06	DATA xx	; L←R
ADDRESS	07	DATA xx	; 360DPI L→R
ADDRESS	08	DATA xx	; L←R
ADDRESS	09	DATA xx	; Head Bi-D 120DPI L→R
ADDRESS	0A	DATA xx	; L←R
ADDRESS	0B	DATA xx	; 180DPI L→R
ADDRESS	0C	DATA xx	; L←R
ADDRESS	0D	DATA xx	; 240DPI L→R

```
ADDRESS  0E  DATA xx     ; Head Bi-D 240DPI L←R
ADDRESS  0F  DATA xx     ;           360DPI L→R
ADDRESS  10  DATA xx     ;                  L←R
ADDRESS  11  DATA xx     ; TE Motor Position Adjust
ADDRESS  12  DATA xx     ; Country Setting
ADDRESS  13  DATA xx     ; Other Setting
                         ; bit 2 : Ink charge Finish (1)
                         ;     1 : Japan (1)/World (0)
                         ;     0 : 136 (1)/80 (0)
ADDRESS  14  DATA 00H    ; reserved
ADDRESS  15  DATA 00H    ; reserved
ADDRESS  16  DATA 00H    ; reserved
ADDRESS  17  DATA 00H    ; reserved
ADDRESS  18  DATA 00H    ; reserved
ADDRESS  19  DATA 00H    ; reserved
ADDRESS  1A  DATA 00H    ; reserved
ADDRESS  1B  DATA 00H    ; reserved
ADDRESS  1C  DATA 00H    ; reserved
ADDRESS  1D  DATA 00H    ; reserved
ADDRESS  1E  DATA 00H    ; reserved
ADDRESS  1F  DATA 00H    ; reserved
ADDRESS  20  DATA 00H    ; CHECK SUM
```

CHAPTER 6
MAINTENANCE

LIST OF FIGURES

LIST OF TABLES

6.1 PREVENTIVE MAINTENANCE

Proper maintenance is essential to assuring optimal and long-term printer performance and to minimize malfunction frequency.
The case exterior should be regularly cleaned with alcohol. Vacuum cleaning should be occasionally applied to the mechanism's interior to remove accumulated dust and paper particles.

After the unit has been cleaned, check that it is adequately lubricated (refer to section 6.2, immediately below). Before returning the printer to the customer, inspect the springs, paper-feed rollers, and the basic operation of the unit.

WARNING

Be sure to disconnect the printer from the power supply before maintenance. Do not apply thinner, trichloroethylene, or ketone-based solvents to any of the printer's plastic components.

6.2 LUBRICATION AND ADHESIVE APPLICATION

EPSON recommends lubrication at the points illustrated in Figure 6-2 through 6-5. Table 6-2 provides a list of these points, and the recommended lubricant to be used for each. The lubricants--EPSON O-2, and EPSON G-14---have all been thoroughly tested and fully meet the needs of this printer. (Table 6-1 lists details of these lubricants.)

Before applying any lubricant, make sure that the part to be lubricated is clean. Do not apply excess lubrication, as this could potentially cause damage.

Following its disassembly or replacement, adhesive must be applied to the part indicated in Table 6-3. EPSON recommends application of Neji lock #2 (G) adhesive to the point illustrated in Figure 6-1. When applying the adhesive, be careful that no excess overflows onto nearby parts.

Table 6-1. Lubrication and Adhesive

Type	Name	Capacity	Availability	Part No.
Oil	O-2	40cc	Ⓔ	B710200001
Grease	G-14	40gm	Ⓔ	B701400001
Adhesive	Neji lock #2 (G)		Ⓔ	B730200200

Ⓔ:EPSON-exclusive product

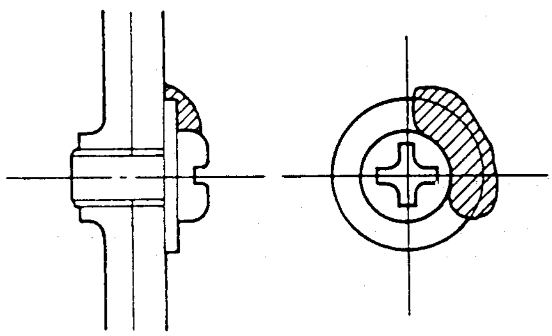


Figure 6-1. Correct Adhesive Application

Table 6-2. Lubrication Points (Refer to Figures 6-2 to 6-5)

Ref. No.	Lubrication Points	Lubricant	Fig. No.
(1)	Release lever shaft (1/3 of the way from the end)	G-14	6-2
(2)	Tractor transmission gear shaft (1/3 of the way from the end)	G-14	6-2
(3)	Movement portion of release lever and tractor transmission gear	G-14	6-2
(4)	Paper feed reduction gear holder (1/3 of the way from the end)	G-14	6-2
(5)	1/4 perimeter of paper feed reduction gear	G-14	6-2
(6)	Top edge holding transmission gear shaft (1/3 of the way from the end)	G-14	6-2
(7)	1/4 perimeter of top edge holding transmission gear	G-14	6-2
(8)	Platen shaft holder (R and L)	G-14	6-2
(9)	Paper feed lever shaft (following points) ● Portion contacting the base frame (Two points) ● Portion contacting the right frame ● Portion contacting the release lever ● Paper feed lever shaft support portion of the base frame	G-14	6-3
(10)	Top of the self-aligning bearing of the paper feed lever (four points)	G-14	6-3
(11)	Platen unit and paper guide plate set stopper (two points)	G-14	6-2
(12)	1/4 perimeter of platen gear, 1/4 center gear	G-14	6-2
(13)	Paper feed transmission gear shaft (1/3 of the way from the end)	G-14	6-2
(14)	1/4 perimeter of paper feed	G-14	6-2
(15)	1/4 perimeter of tractor transmission gear	G-14	6-2
(16)	1/4 gear perimeter of top edge holding transmission shaft set (Both left and right sides)	G-14	6-2
(17)	Portion of the shaft contacting frames M and R of eject paper guide board (Two points)	G-14	6-2
(18)	Felt portion of carriage shaft holder (Three points)	O-2	6-2
(19)	Points of contact between release pin and release roller	G-14	6-4
(20)	Points of contact paper feed lever shaft and paper feed lever spring (Four points)	G-14	6-4
(21)	Points of contact between paper feed roller and paper feed roller holder (Four points)	G-14	6-2, 6-4
(22)	Engaging portion of the clutch cam and clutch spring of the pump unit (two points)	G-14	6-5
(23)	Pump unit cam follower (Lubricate before installation)	G-14	6-5

Ref. No.	Lubrication Points	Lubricant	Fig. No.
(24)	Pump unit (Contact points of following parts) ● Pump motor cam follower and pump transmission gear ● Pump drive gear and pump transmission gear ● Cleaner drive gear and cleaner transmission gear ● Cleaner planetary gear and cleaner transmission gear ● Cleaner driven gear of cleaner set and cleaner transmission gear	G-14	6-5
(25)	Pin follower of pump set (two points)	G-14	6-5
(26)	Bellows set shaft of pump set (two points)	G-14	6-5
(27)	Contact portion of the gear and disc spring of the cleaner planetary gear set (Total four points)	G-14	6-5

Table 6-3 Adhesive Application Points (Refer to Figure 6-6)

Ref. No.	Adhesive Application Points	Point Quantity
(1)	Set screw CB(M2.5X3) for top edge holder board	2
(2)	Set screw CB(M2.5X4) for Top edge sensor board set (screw threads)	1
(3)	Set screw CP(P)(M3X8) for CSF sensor (screw head)	1
(4)	Lock screw SCP(P)(M3X6, M3X12) for head unit	2
(5)	Top edge sensor holder shaft center holder cutout	1
(6)	Lock screw CS(M3X14) for cable clip contacted to CN8	1
(7)	Set screw CS(M2X10) for trigger solenoid release sensor	1
(8)	Set screw CS(M3X12) for carriage belt holder	1
(9)	Set screw CS(M3X5) for pump set	2
(10)	Set screw CS(M2X6) for pump lid	4
(11)	Lock screws CBS(M3X6) for L and R platen shaft holders (1/4 perimeter of screw head)	2

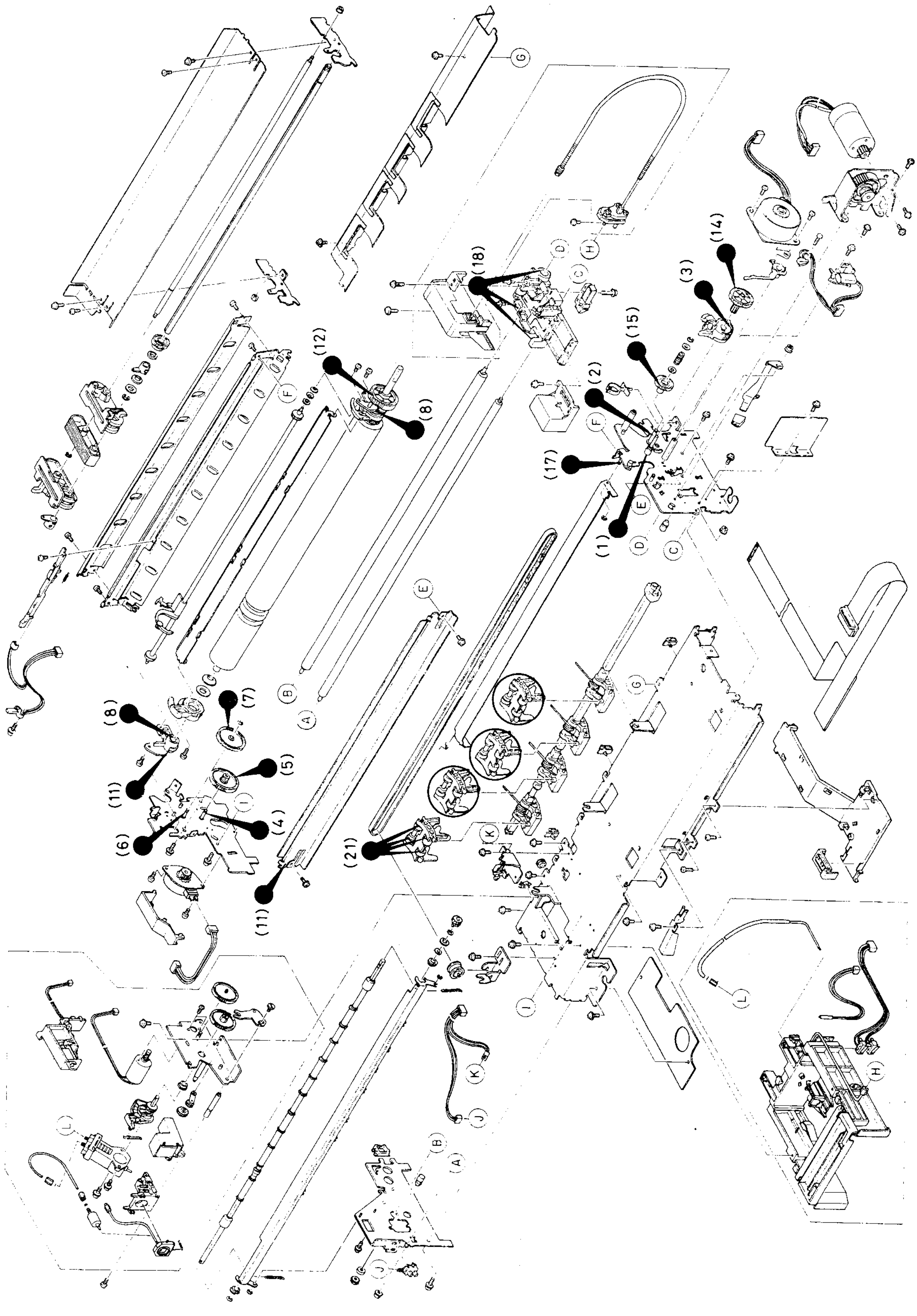


Figure 6-2. Lubrication Points Diagram – 1

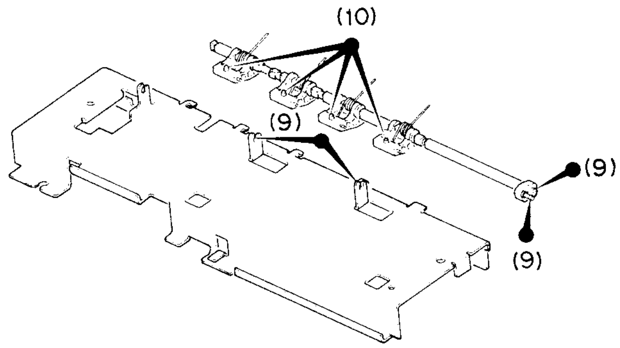


Figure 6-3. Lubrication Points Diagram – 2

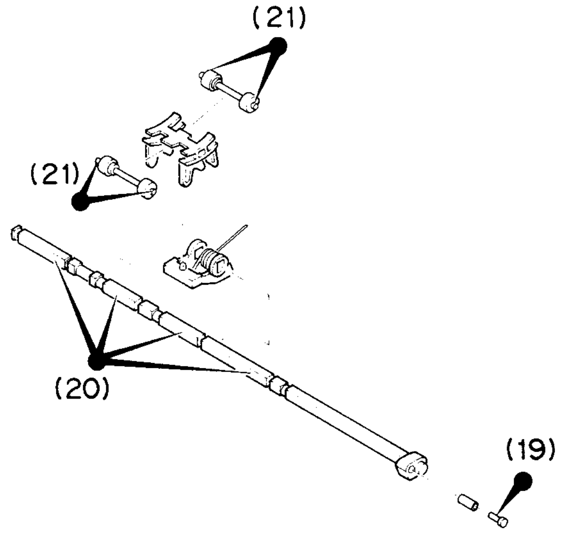


Figure 6-4. Lubrication Points Diagram – 3

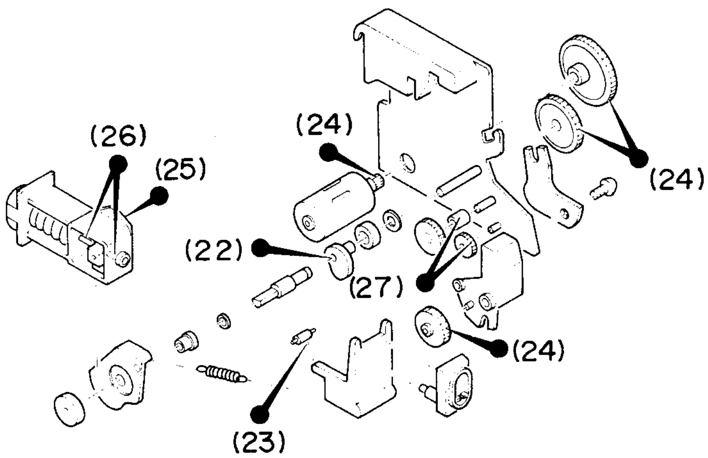


Figure 6-5. Lubrication Points Diagram – 4

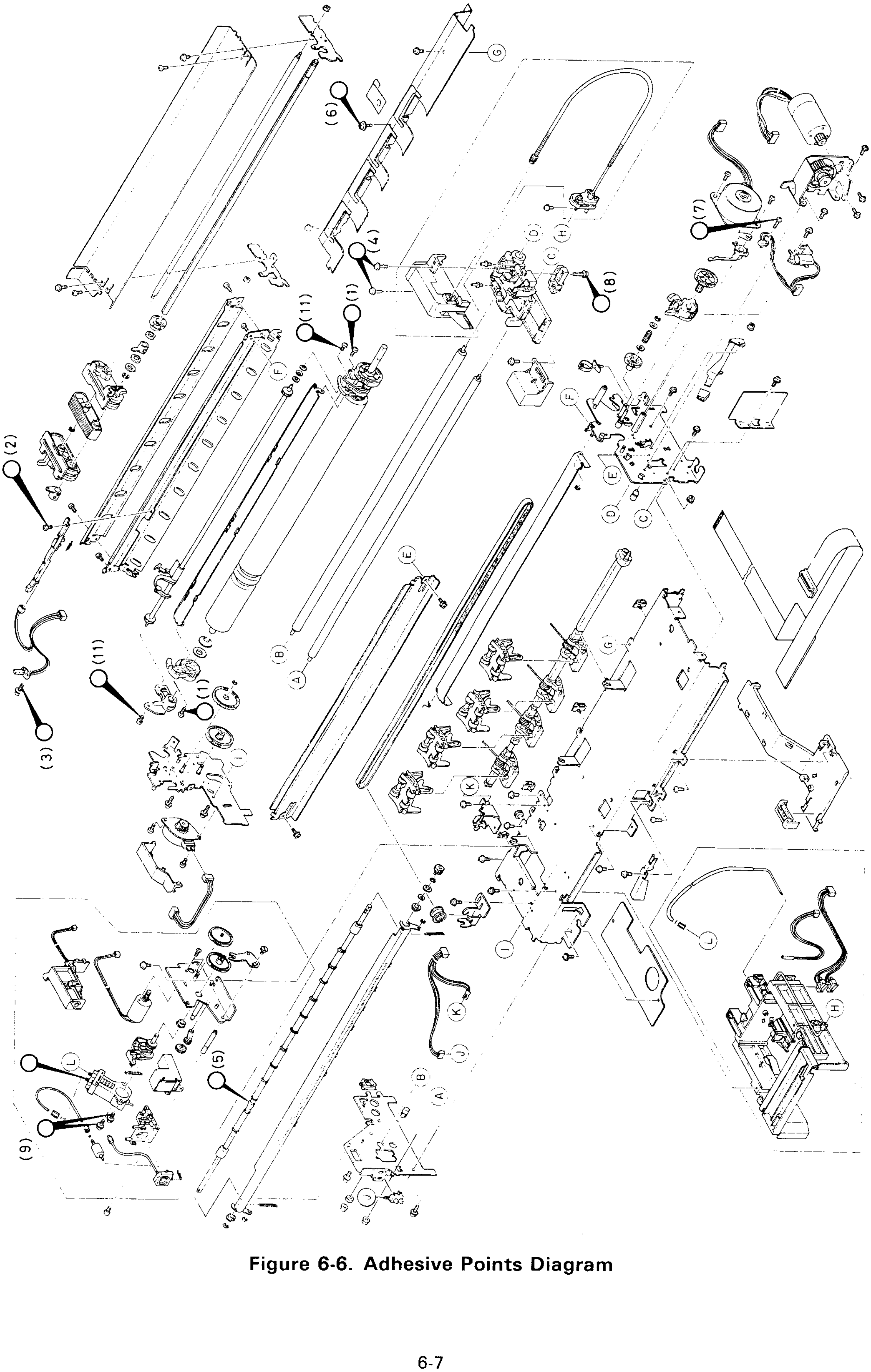


Figure 6-6. Adhesive Points Diagram

APPENDIX

LIST OF FIGURES

LIST OF TABLES

A.1 PRIMARY IC SPECIFICATIONS

This chapter describes the primary ICs used in this printer.

A.1.1 SEIMA Board

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

Table A-1. SEIMA Board Primary ICs

Location	Name	Description
10C	HD64180R1P10	CPU
2A	E05A09BA	MCU
8B	E05A21AA	MMU
6B	E05A22EA	PHC
12C	E05A24GA	PIF
4B	E05A23GC	DCU
1D	SLA4390	HIC
3B	SLA7020M	HIC
5C,6C,7C	LZ1008AD	FET array
3C	TL494CN	PWM controler
2D	L5431-AA	Adjustable presision shant regurator
BT1	CR17335SE-FT1	Litium battery
13E	MN6275A	C-MOS
13D	HD74HC292P	C-MOS
11C	74LS00	TTL
11D	74LS32	TTL
9A	SN75188N	Quad line transmitter
8A	SN75189N	Quad line receiver

A.1.1.1 HD64180

The HD64180 is an 8-bit one-chip CPU, and is software compatible with model Z-80 and higher models. The chip includes a DMA controller (DMAC), asynchronous serial communication interface (ASCI) (2 channels), serial I/O port, and timers (one with internal and one with external output), in addition to the CPU.

The main features are as follows:

- MMU: 512K-byte physical address space
- DMAC (2 channels): High speed data transfer between memories (including memory mapped I/O)
- ASCI (2 channels): Start-stop asynchronous system (full duplex) SCI modem control signals
- CS I/O port (1 channel): Serial to parallel conversion shift register
- 16-bit timer (2 channels): Pulse output function
- Interrupts: Internal (4), external (8)
- Bus I/F: 80 CPU-line bus I/F
- Dynamic RAM refresh controller: Programmable refresh interval
- Low speed memory input/output I/F: Programmable number of weight states
- Built-in clock oscillator circuit
- CMOS

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

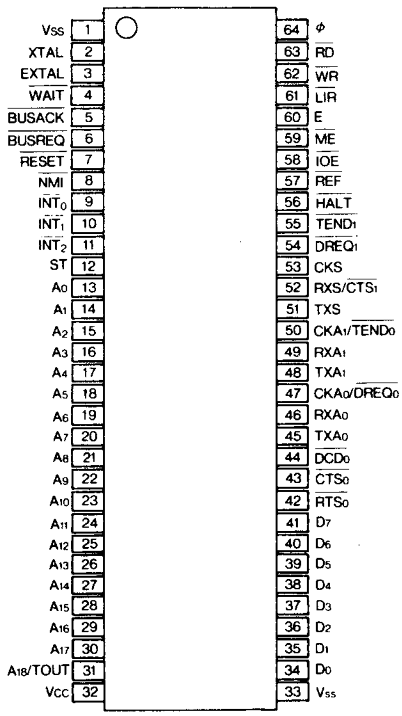


Figure A-1. HD64180 Pin Diagram

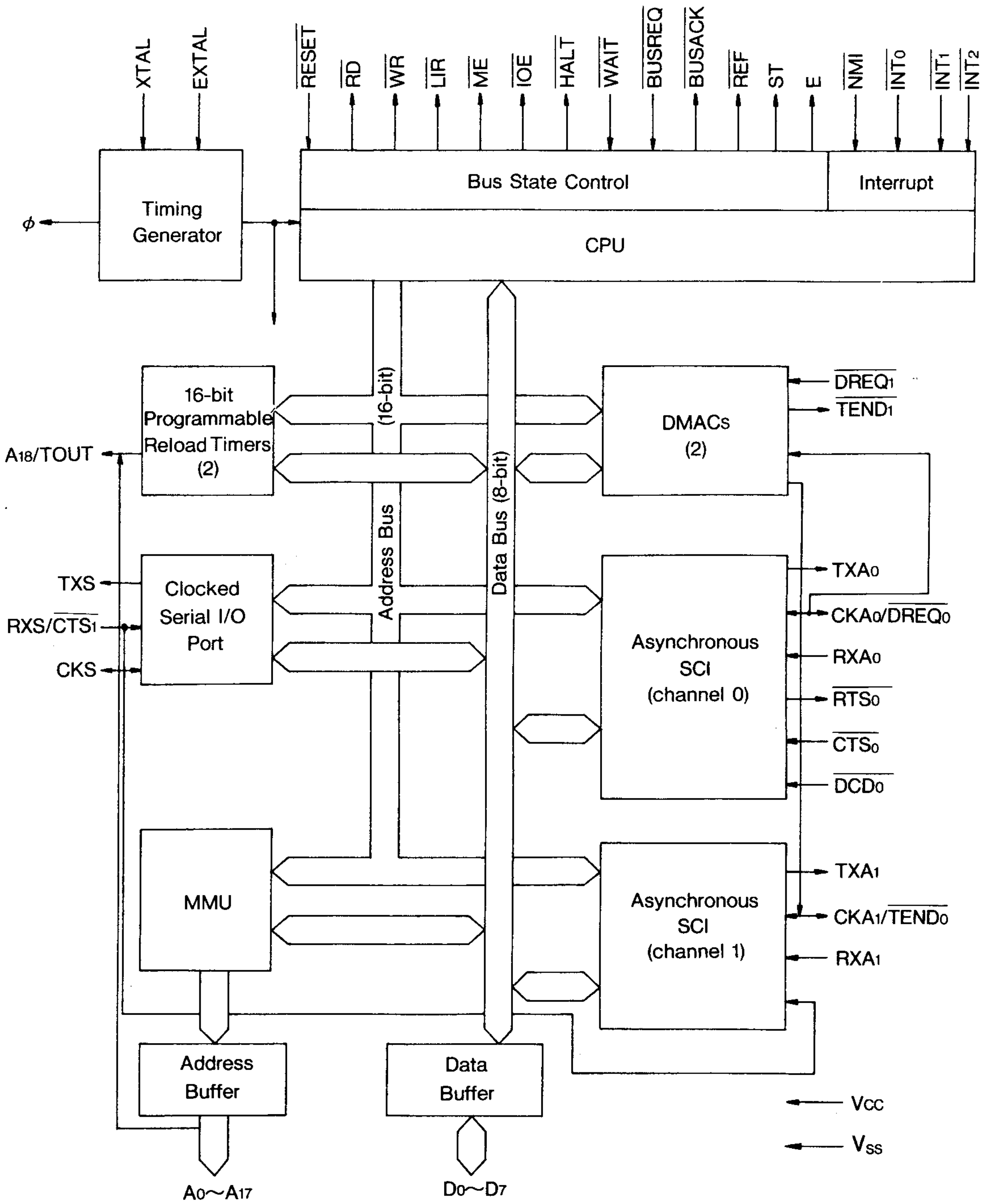


Figure A-2. HD64180 Block Diagram

Table A-2. HD64180 Terminal Functions

Pin No.	Terminal	I/O	Description	Notes
32	Vcc	I	+5 VDC	
1, 33	Vss	—	GND	
2	XTAL	I	External oscillator (12.2 MHz)	
3	EXTAL	I		
64	ϕ	O	Pulled up	
7	$\overline{\text{RESET}}$	I	Reset signal	
13~31	A0~A18	O	Address bus (19-bit, 512K-byte)	
34~41	D0~D7	I/O	Data bus (8-bit)	
63	$\overline{\text{RD}}$	O	Read pulse	
62	$\overline{\text{WR}}$	O	Write pulse	
59	$\overline{\text{ME}}$	O	Memory enable	
58	$\overline{\text{IOE}}$	O	Pulled up	
4	$\overline{\text{WAIT}}$	I	Pulled up	
60	E	O	Enable (synchronous clock)	
6	$\overline{\text{BUSREQ}}$	I	Pulled up	
5	$\overline{\text{BUSACK}}$	O	Pulled up	
58	$\overline{\text{HALT}}$	O	Pulled up	
61	$\overline{\text{LIR}}$	O	Pulled up	
12	ST	O	Pulled up	
57	$\overline{\text{REF}}$	O	Refresh signal	
8	$\overline{\text{NMI}}$	I	Pulled down	
9	$\overline{\text{INT0}}$	I	Pulled up	
10	$\overline{\text{INT1}}$	I	Pulled up	
11	$\overline{\text{INT2}}$	I	Interrupt 2	
47	$\overline{\text{DREQ0}}$	I	Data request signal	
54	$\overline{\text{DREQ1}}$	I	Pulled up	
55	$\overline{\text{TEND1}}$	O	Pulled up	
45	TXA0	O	Pulled up	
46	RXA0	I	Pulled up	
42	$\overline{\text{RTS0}}$	O	SCI channel 0 RTS	
43	$\overline{\text{CTS0}}$	I	SCI channel 0 CTS	
44	$\overline{\text{DCD0}}$	I	Pulled down	
48	TXA1	O	SCI channel 1	
49	RXA1	I	SCI channel 1	
50	CKA1	I/O	Pulled up	
51	TXS	O	CSO I/O TXD	
52	RXS	I	CSO I/O RXD	
53	CKS	I/O	CS I/O clock	

CPU Timing

- Two oscillator cycles define one state.
- One machine cycle, such as OP (operational) code fetch or memory read/write, requires three states.

a) OP code fetch timing

During the first half of state T1, the contents of the program counter (PC) are output on address bus lines A0 to A18. During the latter half of state T1, the $\overline{\text{ME}}$ and $\overline{\text{RD}}$ signals go active, and the memory is accessed.
The OP codes on the data busses are fetched at the trailing clock of state T2.
The $\overline{\text{LIR}}$ signal goes active from the first half of state T1 to that of state T3, and indicates that this cycle is an OP code fetch cycle.

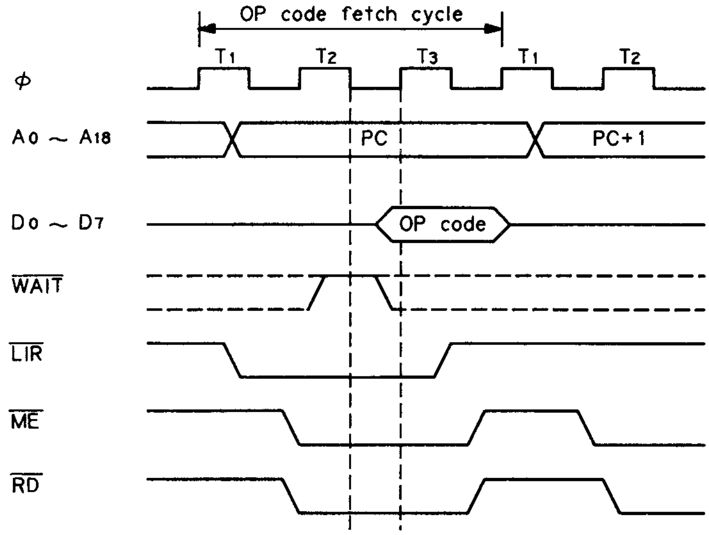


Figure A-3. OP Code Fetch Timing

b) Memory Data Read/Write Timing

The memory data access timing is different from the OP code fetch timing in the following points:

- The $\overline{\text{LIR}}$ signal does not go active.
- Read data is valid a half clock later, as comparing with the OP code fetch timing. (The data is fetched at the trailing clock of state T3.)

For memory data write timing, the $\overline{\text{ME}}$ signal and $\overline{\text{WR}}$ signal are activated at the latter half of state T1 and the first half of state T2, respectively, and the write data is output on D0 to D7 from the latter half of state T1. The $\overline{\text{ME}}$ and $\overline{\text{WR}}$ signals go inactive in the latter half of state T3, and the write data remains valid on the data bus unitl just before state T1 starts.

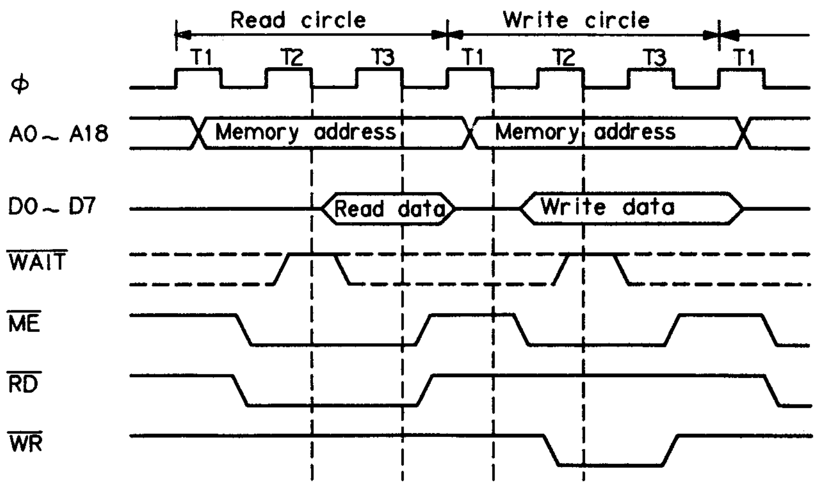


Figure A-4. Memory Data Read/Write Timing

A.1.1.2 E05A09BA

The E05A09BA is a gate array used to separately control two 4-phase stepper motors.

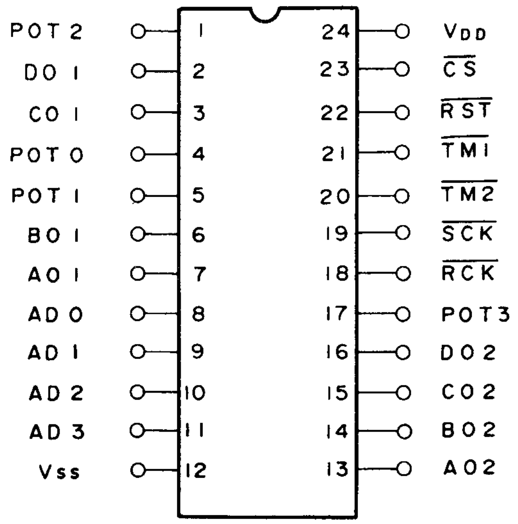


Figure A-5. E05A09BA Pin Diagram

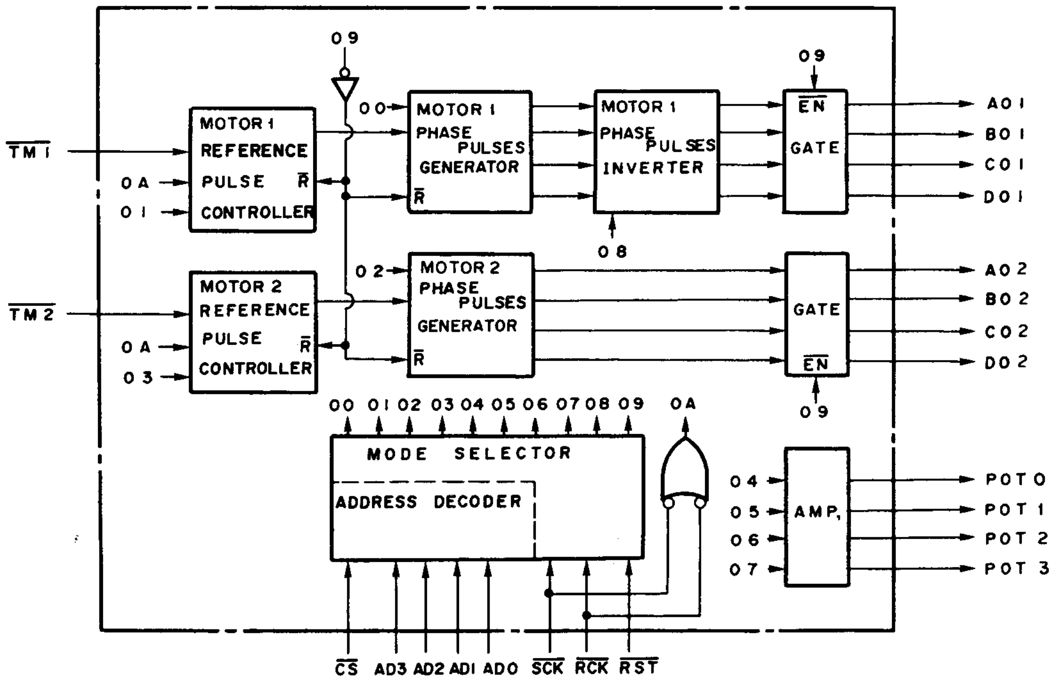


Figure A-6. E05A09BA Block Diagram

Table A-3. E05A09BA Terminal Functions

Pin No.	Terminal	I/O	Description
8	AD0	I	Address bus 0
9	AD1	I	Address bus 1
10	AD2	I	Address bus 2
11	AD3	I	Address bus 3
21	$\overline{\mathrm{TM1}}$	I	Motor synchronous pulse
20	$\overline{\mathrm{TM2}}$	I	Motor synchronous pulse
18	$\overline{\mathrm{RCK}}$	I	Read pulse
19	$\overline{\mathrm{SCK}}$	I	Write pulse
4	$\overline{\mathrm{POT0}}$	O	Motor reference voltage #0 OFF/$\overline{\mathrm{ON}}$
5	$\overline{\mathrm{POT1}}$	O	Motor reference voltage #1 OFF/$\overline{\mathrm{ON}}$
1	$\overline{\mathrm{POT2}}$	O	Motor reference voltage #2 OFF/$\overline{\mathrm{ON}}$
17	$\overline{\mathrm{POT3}}$	O	Motor reference voltage #3 OFF/$\overline{\mathrm{ON}}$
7	A01	O	Motor coil A
6	B01	O	Motor coil B
3	C01	O	Motor coil C
2	D01	O	Motor coil D
13	A02	O	Motor coil A
14	B02	O	Motor coil B
15	C02	O	Motor coil C
16	D02	O	Motor coil D
22	$\overline{\mathrm{RST}}$	I	Reset signal
23	$\overline{\mathrm{CS}}$	I	Chip select
24	V_{DD}	I	+5 VDC
12	V_{SS}	—	Ground

A.1.1.3 E05A21AA

- Lower address latch, and out put
- Bank latch output
- Bit caluculation
- MMIO address decode, MMIO signal output
- Character genelator, PROM, RAM decode and chip enable signal output
- Select built-in PROM / external PROM
- Reset signal generator (power on reset / cartridge mount, dismount)
- ON LINE SW state reading

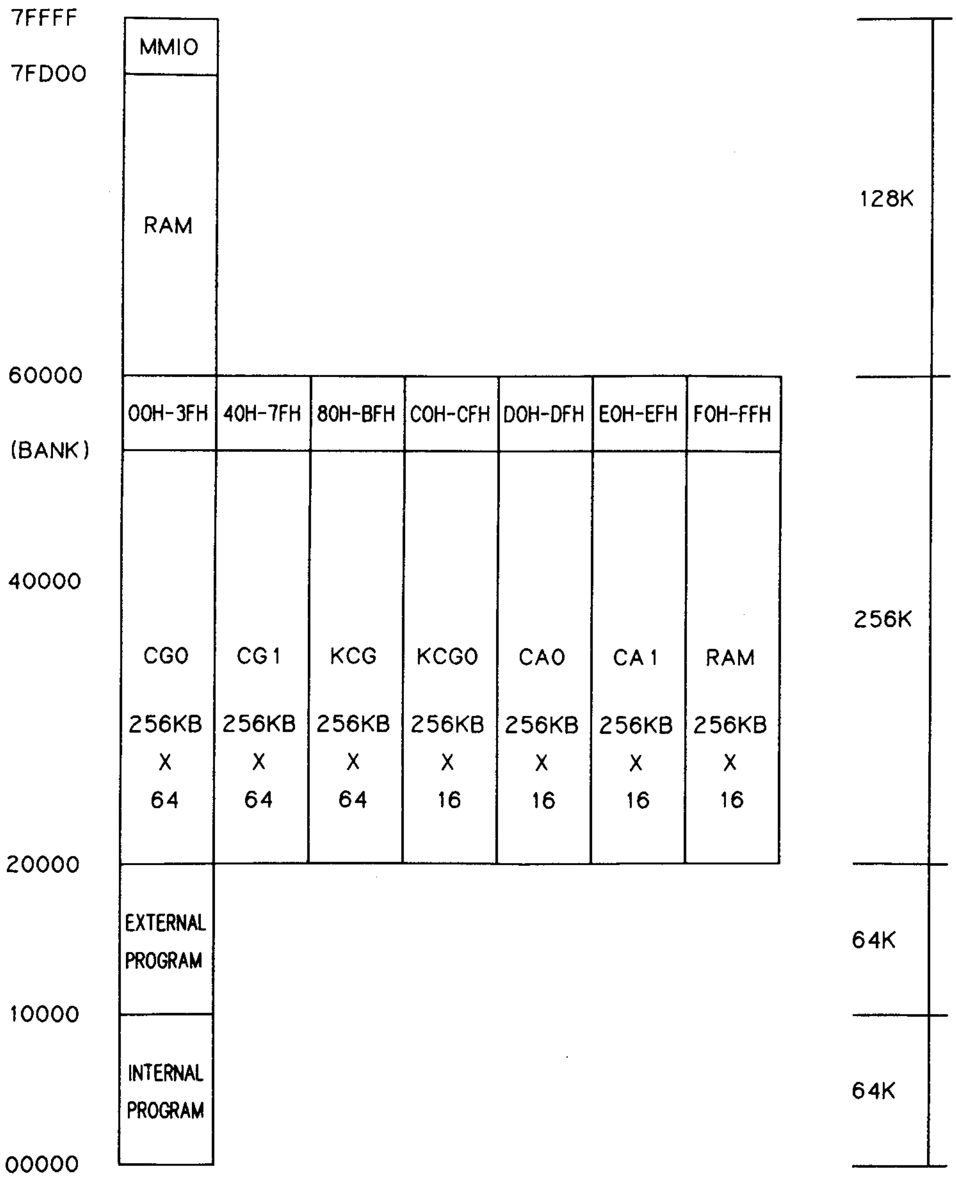


Figure A-7. E05A21AA Memory Map

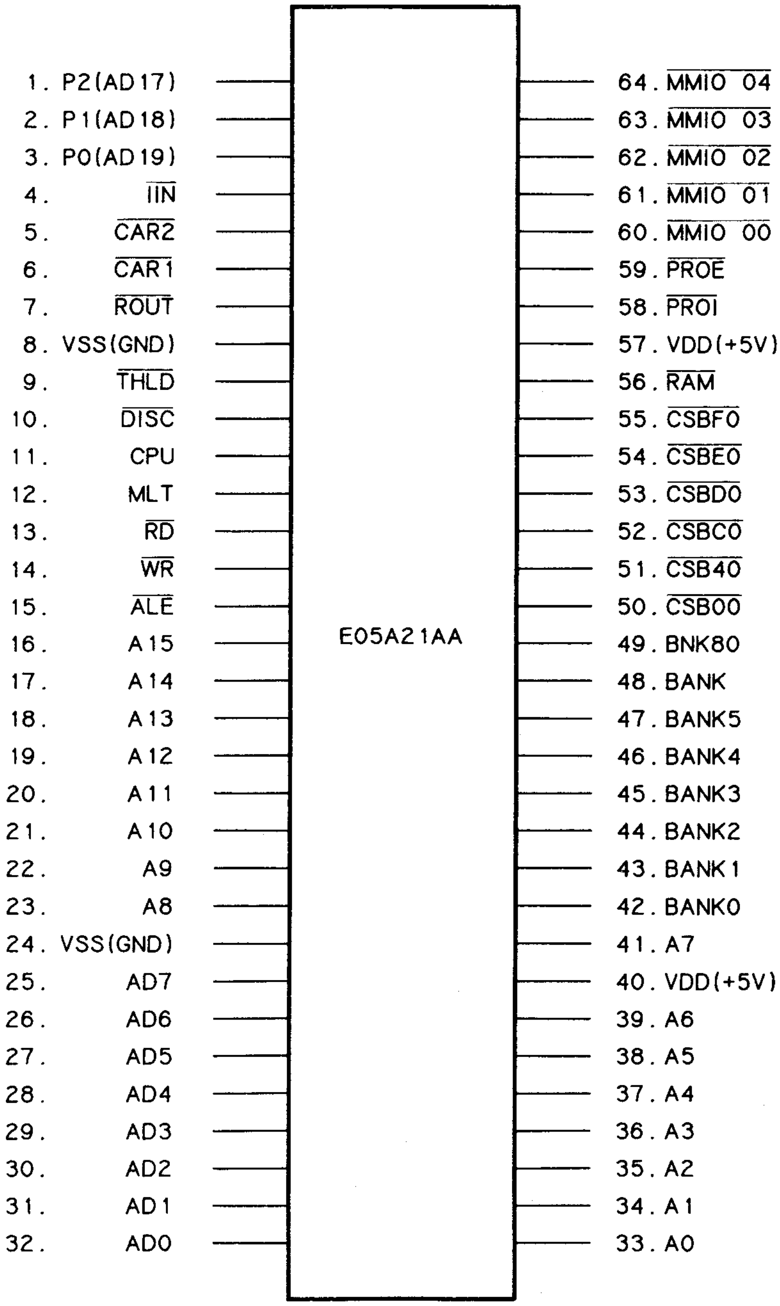


Figure A-8. E05A21AA Pin Diagram

Table A-4. E05A21AA Terminal Functions

Pin No.	Terminal	I/O	Description
1 – 3	P2(AD17) – P0(AD19)	I/O	Address bus 17 – 19
4	$\overline{\text{IIN}}$	I	ON LINE switch read (interrupt)
5	$\overline{\text{CAR2}}$	I	Cartridge install signal 2 (reset signal)
6	$\overline{\text{CAR1}}$	I	Cartridge install signal 1 (reset signal)
7	$\overline{\text{ROUT}}$	O	Power ON reset signal output
8	VSS(GND)	-	GND
9	$\overline{\text{THLD}}$	I	Reset signal generator thleshold lebel input
10	$\overline{\text{DISC}}$	O	Reset signal generator discharge control
11	CPU	I	CPU initialize signal
12	MLT	I	
13	$\overline{\text{RD}}$	I	Read strobe
14	$\overline{\text{WR}}$	I	Write strobe
15	$\overline{\text{ALE}}$	I	Address latch enable
16 – 23	A15 – A8	I	Address bus 15 – 8
24	VSS(GND)	-	GND
25 – 32	AD7 – AD0	I/O	Multiplexed lower address bus 7 – 0 / data bus 7 – 0
33 – 39	A0 – A6	I/O	Address bus 0 – 6
40	VDD(+5V)	-	Power sourse
41	A7	I/O	Address bus 7
42 – 47	B0 – B5	O	Bank change signal 0 – 5
48	BANK	O	Bank signal for external CG board
49	BNK80	O	Bank signal for external CG board (KCG area)
50	$\overline{\text{CSB00}}$	O	Decoded Chip Select signal (CG0 area)
51	$\overline{\text{CSB40}}$	O	Decoded Chip Select signal (CG1 area)
52	$\overline{\text{CSBC0}}$	O	Decoded Chip Select signal (KCG0 area)
53	$\overline{\text{CSBD0}}$	O	Decoded Chip Select signal (CA0 area)
54	$\overline{\text{CSBE0}}$	O	Decoded Chip Select signal (CA1 area)
55	$\overline{\text{CSBF0}}$	O	Decoded Chip Select signal (RAM area)
56	RAM	O	RAM bank change signal
57	VDD(+5V)	-	Power sourse
58	$\overline{\text{PROI}}$	O	Internal program ROM enable signal
59	$\overline{\text{PROE}}$	O	External program ROM enable signal
60 – 64	$\overline{\text{MMIO 00}}$ – $\overline{\text{MMIO 04}}$	O	Memory Mapped I/O signal

A.1.1.4 E05A22EA

- Printhead discharge/charge control
  Discharge/charge pulse width variable setting
  Discharge pulse timing valiable setting (depends on print direction and nozzle line stuggerd)
- Printhead data conversion
  Print data → image data → printhead (nozzle) data
- Half protect enable/disable
- Print Timing Signal (PTS) sampling and dammy PTS genelate
- Data Request (DREQ) signal output for DMA control
- Equipped general purpose I/O port
- Push-pull/open drain FET head nozzle drive port

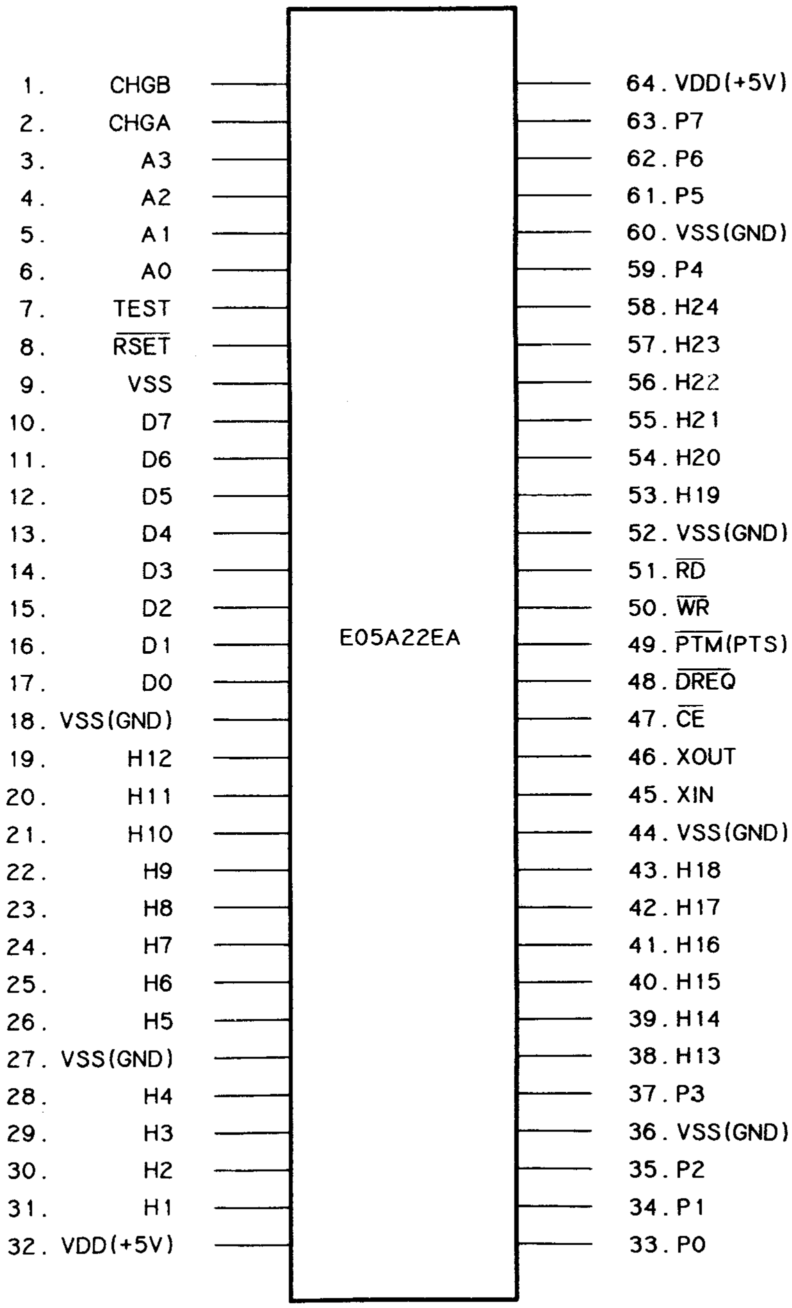


Figure A-9. E05A22EA Pin Diagram

Table A-5. E05A22EA Terminal Functions

Pin No.	Terminal	I/O	Description
1	CHA	O	Printhead charge pulse A
2	CHB	O	Printhead charge pulse B
3 – 6	AB3 – AB0	I	Address bus 3 – 0
7	TEST	-	Test terminal for production
8	$\overline{\text{RST}}$	I	Reset signal terminal
9	Vss	-	GND
10 – 17	D7 – D0	I/O	Data bus 7 – 0
18	Vss	-	GND
19	H12	O	Head data output 12th nozzle
20	H11	O	Head data output 11th nozzle
21	H10	O	Head data output 10th nozzle
22	H 9	O	Head data output 9th nozzle
23	H 8	O	Head data output 8th nozzle
24	H 7	O	Head data output 7th nozzle
25	H 6	O	Head data output 6th nozzle
26	H 5	O	Head data output 5th nozzle
27	VSS(GND)	-	GND
28	H 4	O	Head data output 4th nozzle
29	H 3	O	Head data output 3rd nozzle
30	H 2	O	Head data output 2nd nozzle
31	H 1	O	Head data output 1st nozzle
32	VDD(+5V)	-	Power sourse
33 – 35	P0 – P2	I/O	Multi purpose I/O (TTL level)
36	VSS(GND)	-	GND
37	P3	I/O	Multi purpose I/O (TTL level)
38	H 13	O	Head data output 13th nozzle
39	H 14	O	Head data output 14th nozzle
40	H 15	O	Head data output 15th nozzle
41	H 16	O	Head data output 16th nozzle
42	H 17	O	Head data output 17th nozzle
43	H 18	O	Head data output 18th nozzle
44	VSS(GND)	-	GND
45	XIN	I	External x'tal terminal
46	XOUT	O	
47	$\overline{\text{CS}}$	O	Chip Select signal
48	$\overline{\text{DREQ}}$	O	DMA Request signal
49	$\overline{\text{PTM}}$(PTS)	I	Print Timing Signal input
50	$\overline{\text{WR}}$	I	Write strobe
51	$\overline{\text{RD}}$	I	Read strobe
52	VSS(GND)	-	GND

Table A-5. E05A22EA Terminal Functions (Continued)

Pin No.	Terminal	I/O	Description
53 54 55 56 57 58	H19 H20 H21 H22 H23 H24	O O O O O O	Head data output 19th nozzle Head data output 20th nozzle Head data output 21th nozzle Head data output 22th nozzle Head data output 23th nozzle Head data output 24th nozzle
59	P4	I/O	Multi purpose I/O (TTL level)
60	VSS(GND)	-	GND
61 – 63	P5 – P7	I/O	Multi purpose I/O (TTL level)
64	VDD(+5V)	-	Power sourse

A.1.1.5 E05A24GA

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

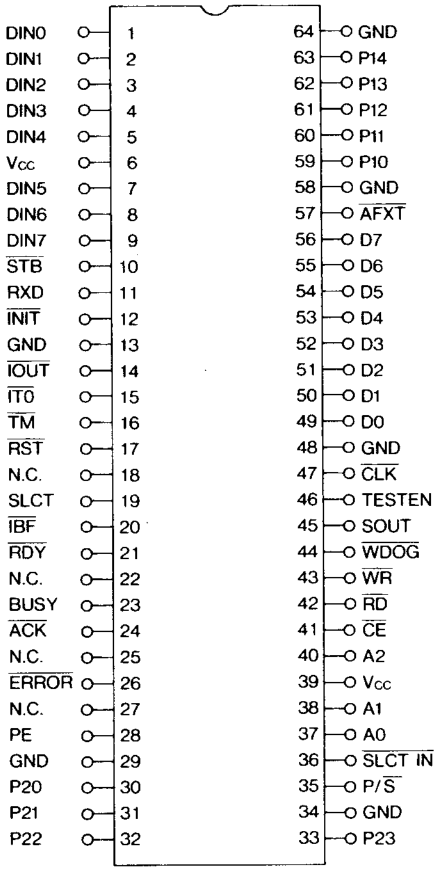


Figure A.10 E05A24GA Pin Diagram

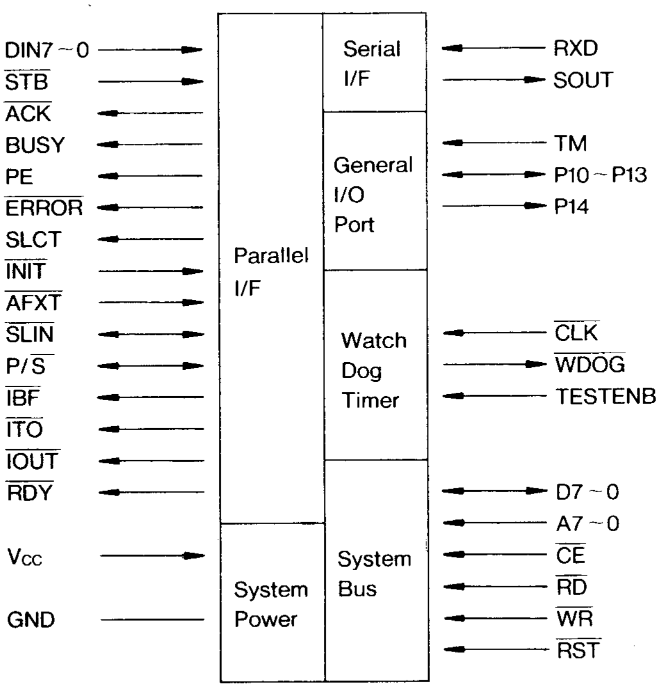


Figure A.11 E05A24GA Block Diagram

Table A-6. E01A24GA Terminal Functions

Pin No.	Name	I/O	Function
11	RXD (IN)	I	Receive serial data
35	P/$\overline{\text{S}}$	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 0
10	$\overline{\text{STB}}$	I	$\overline{\text{STROBE}}$ signal
24	$\overline{\text{ACK}}$	O	$\overline{\text{ACKNLG}}$ signal
23	BUSY	O	BUSY signal
28	PE	O	PE signal
26	$\overline{\text{ERR}}$	O	$\overline{\text{ERROR}}$ signal
12	$\overline{\text{INIT}}$	I	$\overline{\text{INIT}}$ signal
36	$\overline{\text{SLIN}}$	I	$\overline{\text{SLCTIN}}$ signal
57	$\overline{\text{AFXT}}$	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	Multi purpose I/O
30	P20	O	Multi purpose I/O
31	P21	O	Multi purpose I/O
32	P22	O	Multi purpose I/O
33	P23	O	Multi purpose I/O
16	$\overline{\text{TM}}$	I	Not used (open)
61	P12	O	Multi purpose I/O
60	P11	O	Multi purpose I/O
59	P10	O	Multi purpose I/O
62	P13	O	Buzzer
21	$\overline{\text{READY}}$	O	READY LED
20	$\overline{\text{IBF}}$	O	BUSY Latch signal
15	$\overline{\text{ITO}}$	O	$\overline{\text{INIT}}$ Latch signal
47	$\overline{\text{CLK}}$	I	Watch-dog timer clock
42	$\overline{\text{RD}}$	I	Read strobe
43	WR	I	Write strobe
49	D0	I/O	Data bus 0
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	A0	I	Address bus 0
38	A1	I	Address bus 1
40	A2	I	Address bus 2
44	$\overline{\text{WDOG}}$	O	Watch-dog timer

Table A-6. E02A24GA Terminal Functions

Pin No.	Name	I/O	Function
27, 22, 25, 18	NC	O	Not used
14	$\overline{\text{IOUT}}$	—	Not used
41	$\overline{\text{CS}}$	I	Chip select signal
17	$\overline{\text{RST}}$	I	Reset signal
45	SOUT	O	Output Serial data

A.1.1.6 E05A23GC

- DC motor control by selected built in PLL or PRC controler
- Abailable full braking, full acceleration control
- Print Timing Signal (PTS) generate
- STOP signal output and automatically enter the short brake mode
- Moving position count and direction detection
- Home position sensor signal detection and load
- Print start position setting fuction

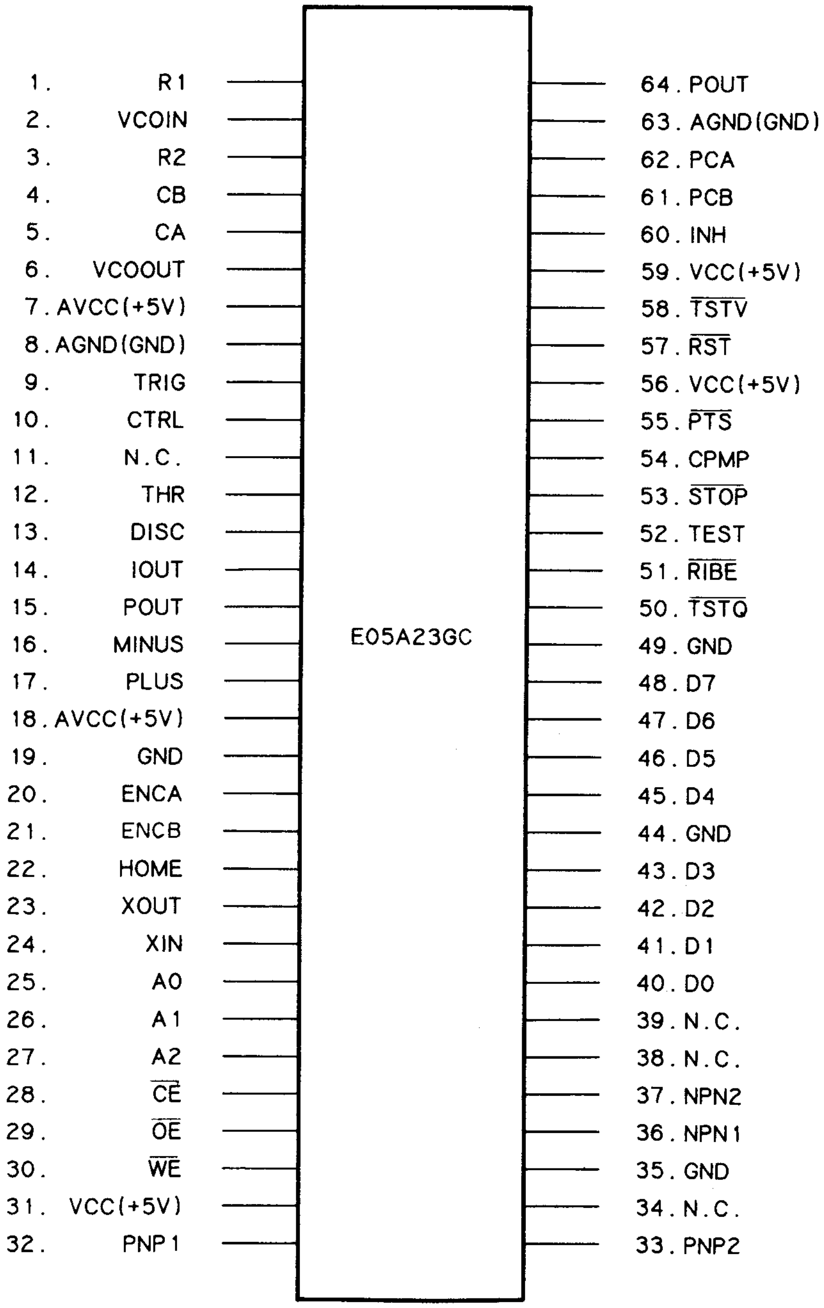


Figure A-12. E05A23GC Pin Diagram

Table A-7. E05A23GC Terminal Functions

Pin No.	Terminal	I/O	Description
1	R1	I	Internal VCO unit oscilation setting resister
2	VCOIN	I	VCO input (from phase comperator)
3	R2	I	Internal VCO unit oscilation setting resister
4	CB	I	VCO Charge/discharge control
5	CA	O	
6	VCOOUT	O	VCO output * 4046 compatible
7	AVcc	-	Analog power sourse
8	AGND	-	Analog GND
9	TRIG	I	Internal timer trigger signal
10	CTRL	I	Timer control signal
11	N.C.	-	
12	THR	I	Timer threshold signal
13	DISC	O	Timer discharge output
14	IOUT	O	Timer output * 555 compatible
15	POUT	O	Internal voltage comperater output
16	MINUS	I	Comperater input
17	PLUS	I	Comperater input
18	AVcc	-	Analog power sourse
19	GND	-	GND
20	ENC A	I	Encoder signal input (CMOS schmitt trigger)
21	ENC B		
22	HOME	I	Home position siganal input
23	XOUT	O	External x'tal terminal
24	XIN	I	
25 - 27	A0 - A2	I	Address decoder input
$\overline{28}$	CE	I	Chip enable signal
$\overline{29}$	OE	I	Output enable signal
$\overline{30}$	WE	I	Write enable signal
31	Vcc(+5V)	-	Power sourse
32	PNP1	O	PNP transistor drive signal (open drain)
33	PNP2	O	PNP transistor drive signal (open drain)
34	N.C.	-	
35	GND	-	
36	NPN1	O	NPN transistor drive signal (push-pull)
37	NPN2	O	NPN transistor drive signal (push-pull)
38	N.C.	-	
39	N.C.	-	
40 - 43	D0 - D3	I/O	Data bus
44	GND	-	GND
45 - 48	D4 - D7	I/O	Data bus
49	GND	-	GND
$\overline{50}$	TSTQ	I	Clock input for timer output simulation (N.U.)

Table A-7. E05A23GC Terminal Functions (Continued)

Pin No.	Terminal	I/O	Description
51	$\overline{\text{RIBE}}$	O	PNP transistor drive signal (N.U.)
52	TEST	-	Test terminal for production
53	$\overline{\text{STOP}}$	O	Stop signal output
54	CPMP	O	Phase comperator charge signal output for timer (CTRL)
55	$\overline{\text{PTS}}$	O	Print Timing Signal generator output
56	Vcc(+5V)	-	Power sourse
57	$\overline{\text{RST}}$	I	Reset signal input (Low: all counter, register initialized)
58	$\overline{\text{TSTV}}$	I	Clock input for VCO output simulation (N.U.)
59	Vcc(+5V)	-	Power sourse
60	INH	I	VCO outout initialize signal
61	PCB	I	Internal phase comperater test signal input (N.U.)
62	PCA	I	Phase comperater test signal input (N.U.)
63	AGND	-	Analog GND
64	POUT	O	Comperater output (N.U.)

A.1.1.7 SLA4390

The SLA4390 is a four-circuits, darlington transistor array.

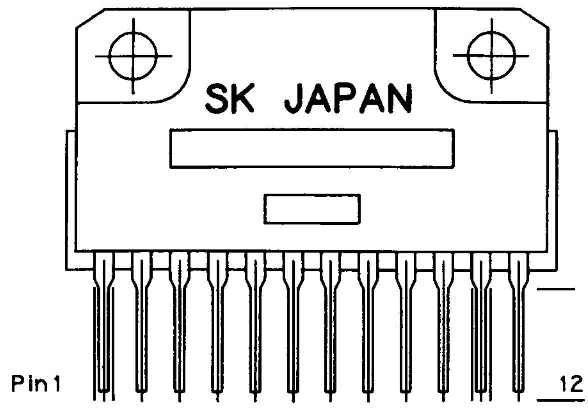


Figure A-13. SLA4390 Case Outline Drawing

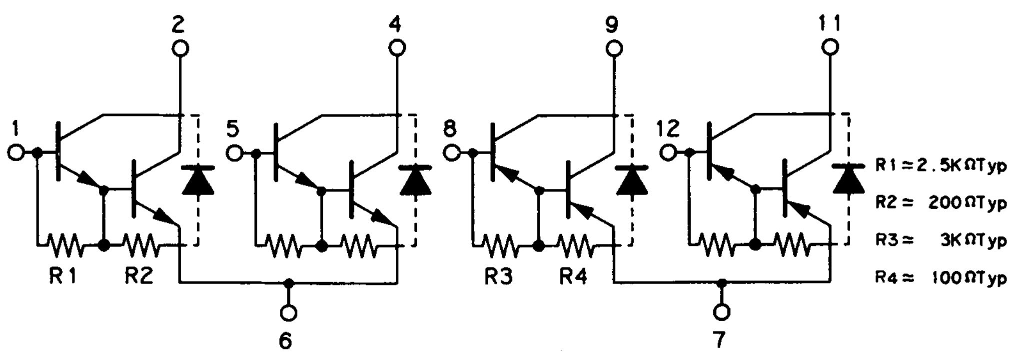


Figure A-14. SLA4390 Functional Equivalent Circuit

A.1.1.8 SLA7020M

The SLA7020M ia a two-circuit, 4-phase step motor driver for unipolar constant current driving.

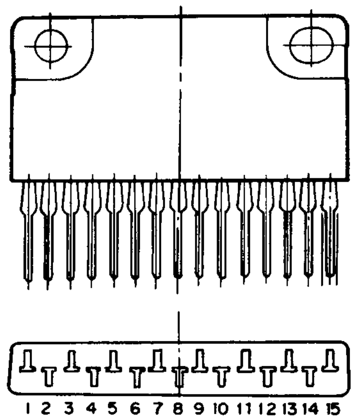


Figure A-15. SLA7020M Case Outline Drawing

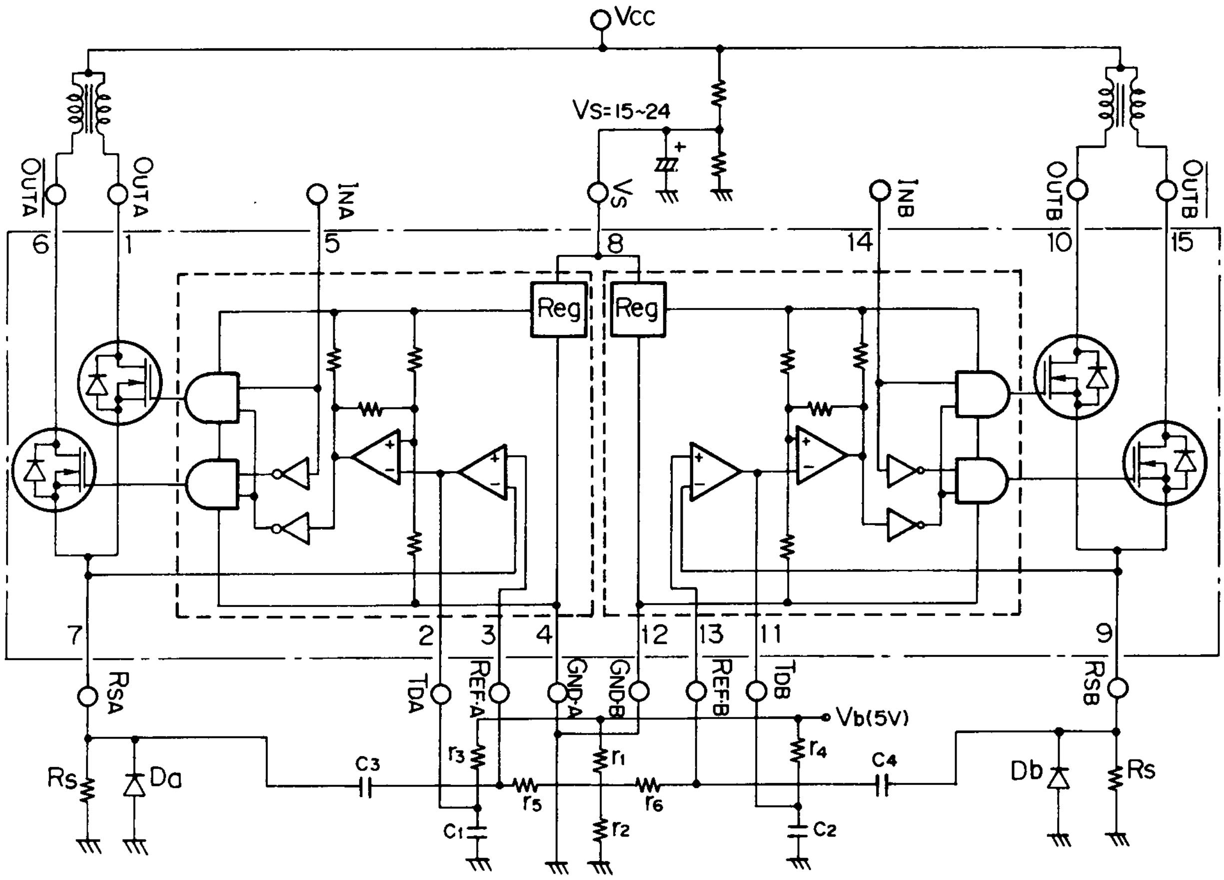


Figure A-16. SLA7020M Functional Equivalent Circuit

A.1.1.9 TL494CN

The TL494 is pulse width modulation control. The block diagram is shown in Figure A-17 shows

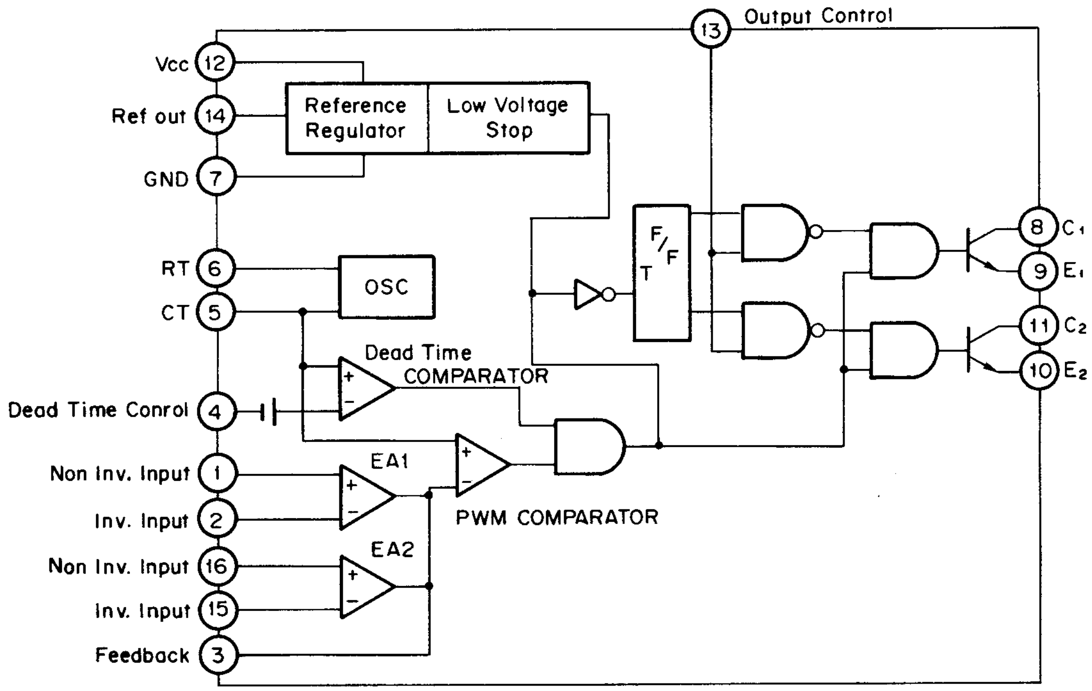


Figure A-17. TL494 Block Diagram

A.1.1.10 L5431-AA

The 431 is a high-accuracy temperature-compensated shunt regulator. The output voltage can be set anywhere between 2.5 V and 36 V through addition of two external resistors. The 431 is highly stable and outputs a large current, so that it is capable of replacing various Zener diodes. The 431 is especially suitable for driving the photodiode in the photocoupler section of the feedback circuit used in the RCC system switching regulator.

- Temperature-compensated reference voltage (50 ppm/C TYP)
- High response speed
- Low noise

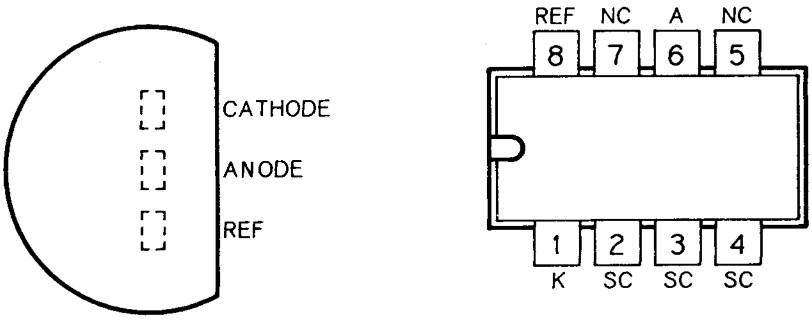


Figure A-18. L5431-AA Pin Diagram

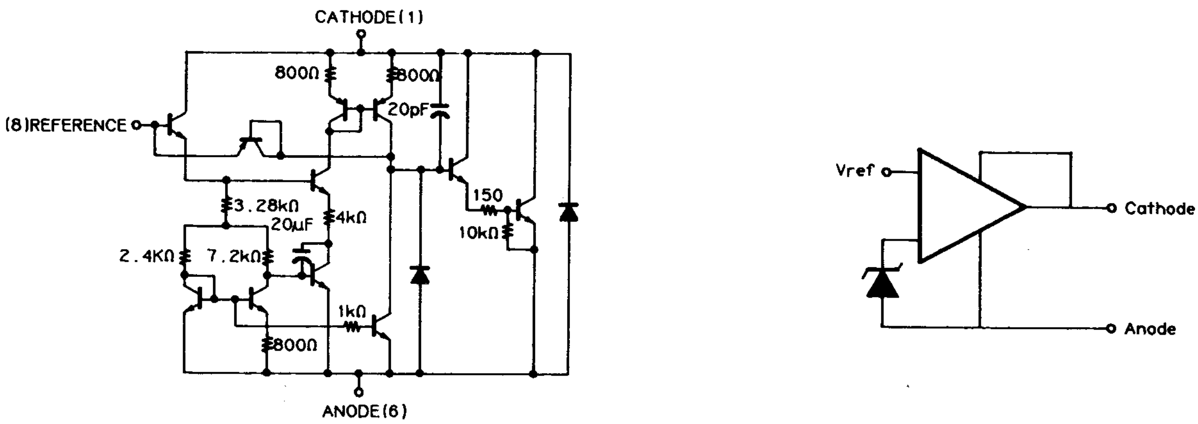


Figure A-19. L5431-AA Internal Circuit

A.1.1.11 MN6275AS

The MN6275AS is a C-MOS circuit for a analog-type quartz clocks. The device operates with a 32-KHz quartz crystal unit and provides driving pulse outputs for a 1-Hz stepper motor. The device is also provided with a 4096-Hz intermittent alarm output, and has a voltage stabilizer.

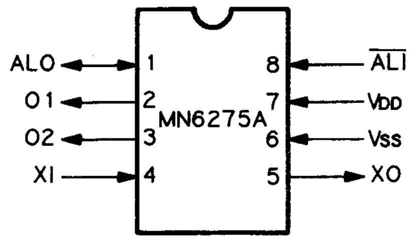


Figure A-20. MN6275AS Pin Assignment

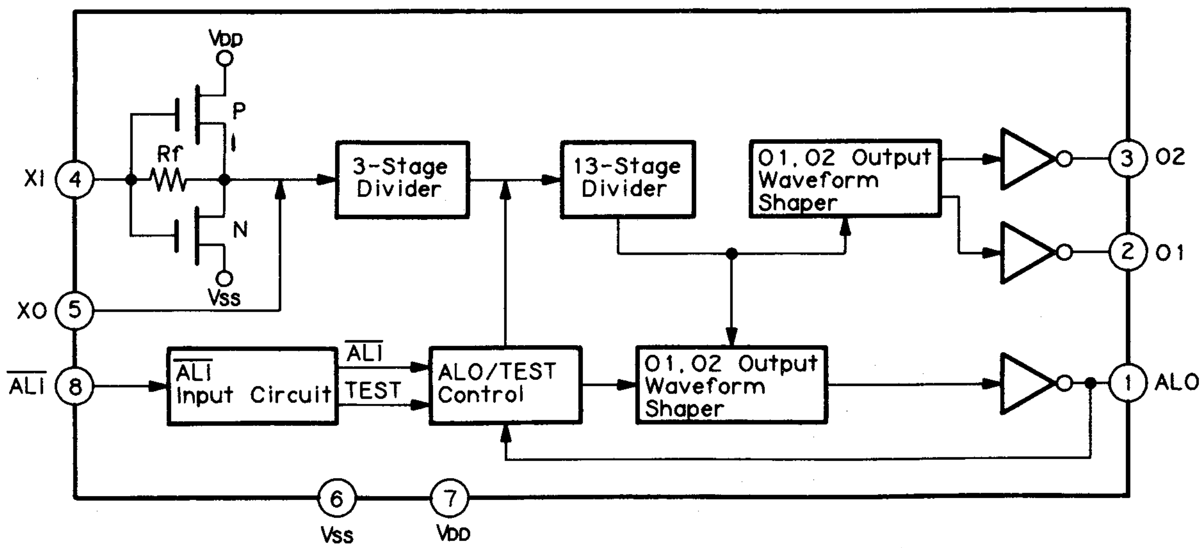


Figure A-21. MN6275AS Block Diagram

A.1.1.12 HD74HC292P

THe HD74HC292P is a programable frequency divider/digital timer.

Table A-8. HD74HC292P Function Table

Clear	Clock1	Clock2	Q Output Mode
L	X	X	Clear to L
H	↑	L	Count
H	L	↑	Count
H	H	X	Inhibit
H	X	H	Inhibit

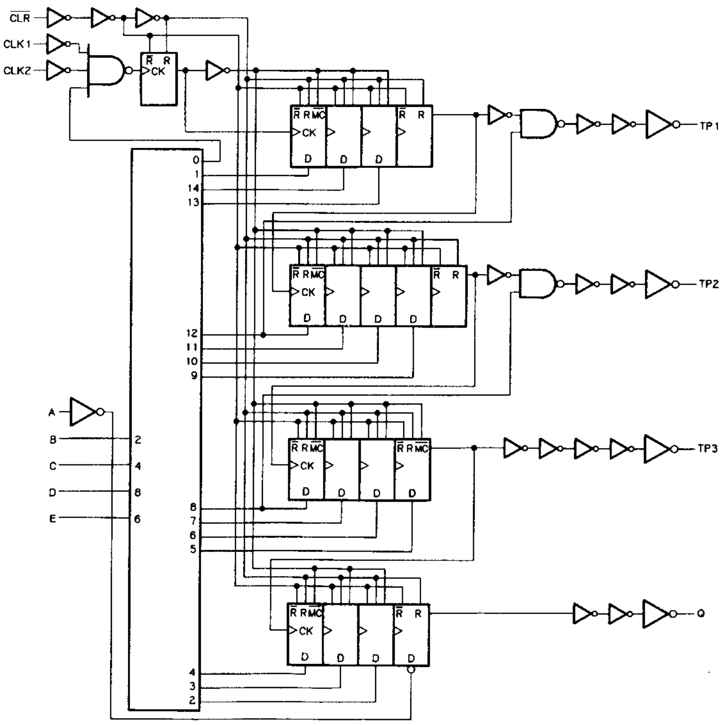


Figure A-22. HD74HC292 Block Diagram

A.1.2 SEIPS/SANPSE Board

Table A-9 shows the primary ICs used on the SEIPS/SANPSE board.

Table A-9. SEIPS/SANPSE Board Primary ICs

Location	Name	Description
IC1	L5431-AA	Adjustable presision shant regurator
IC20	TL494CN	PWM controler

A.2 DIAGRAMS AND SCHEMATICS

The exploded and schematic diagrams shown in Figures A-23 to A-35 are provided as additional reference.

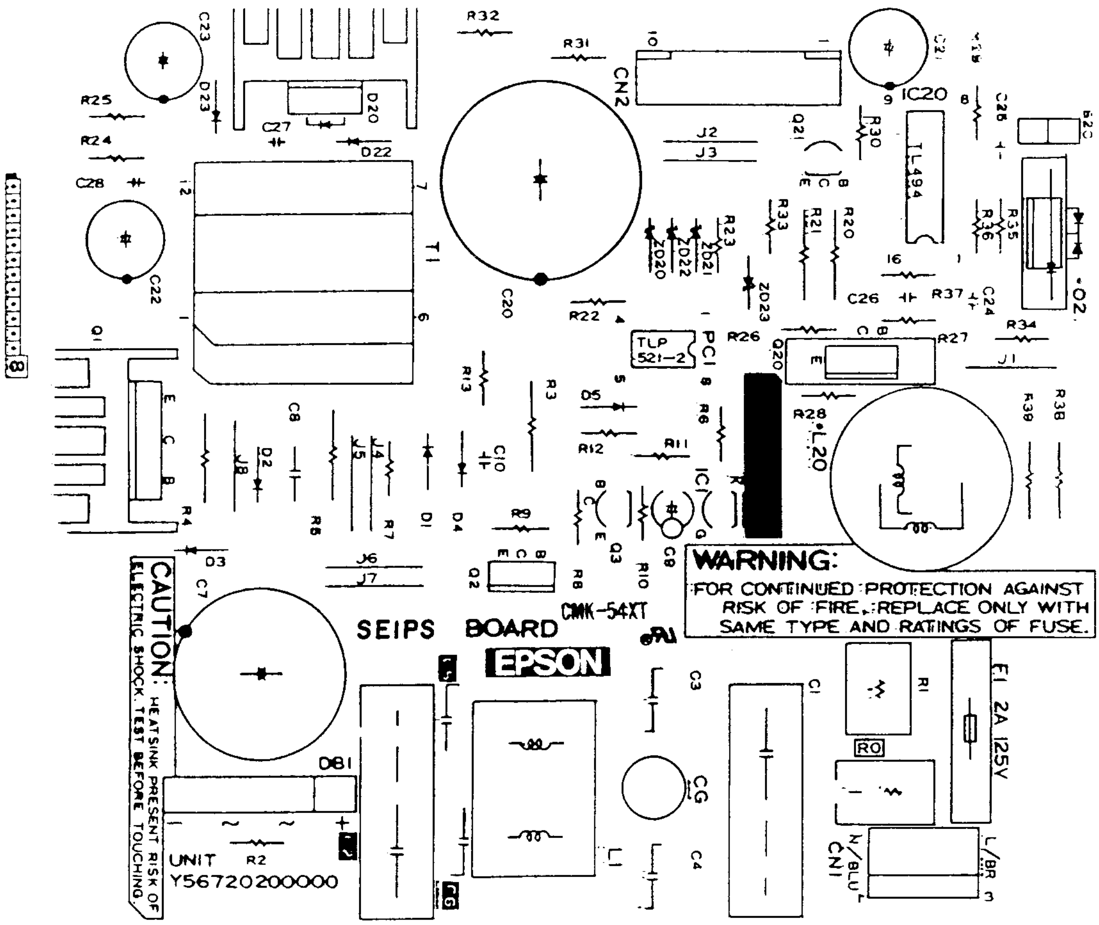


Figure A-23. SEIPS Board Component Layout

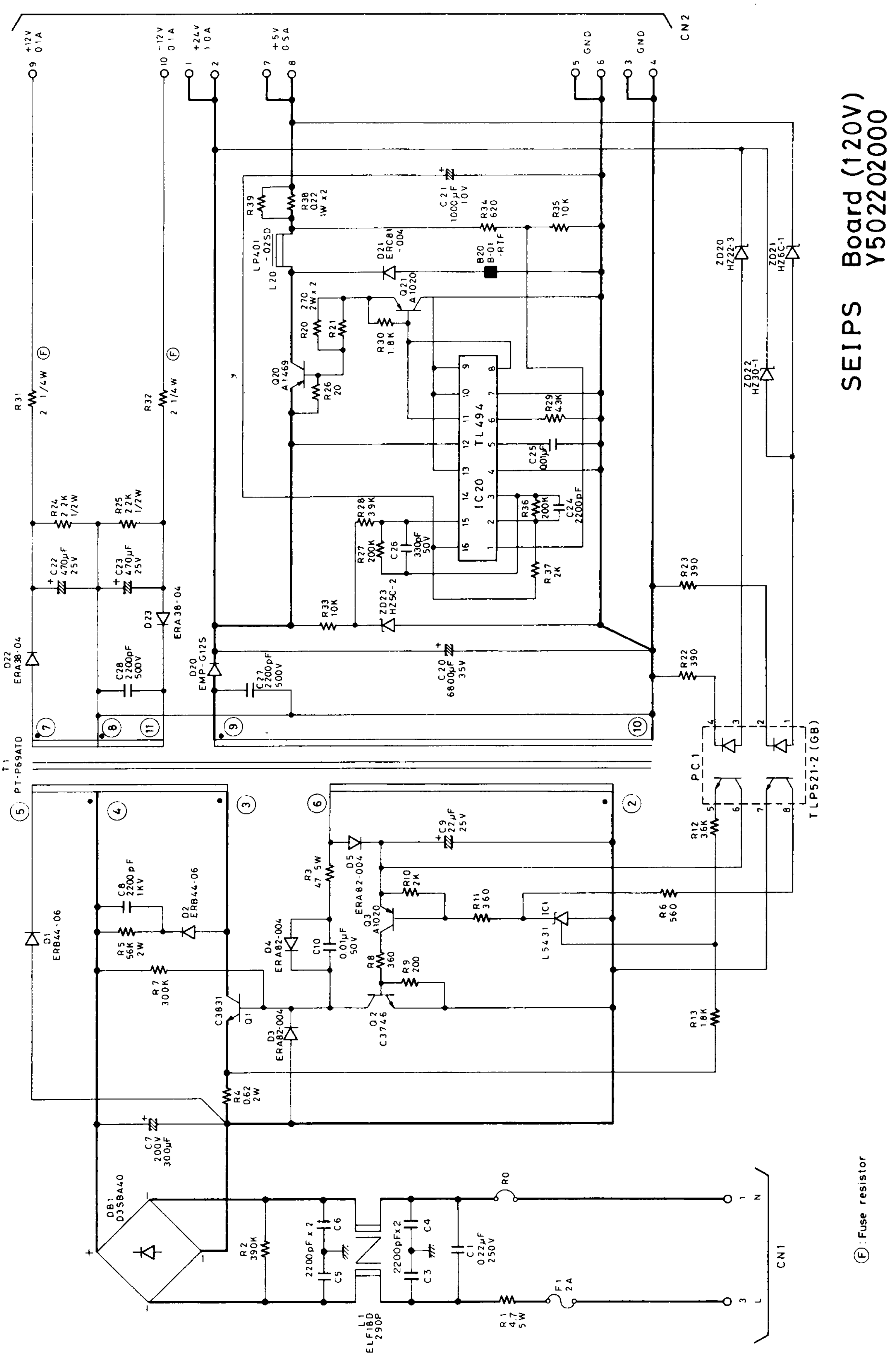


Figure A-24. SEIPS Board Circuit Diagram

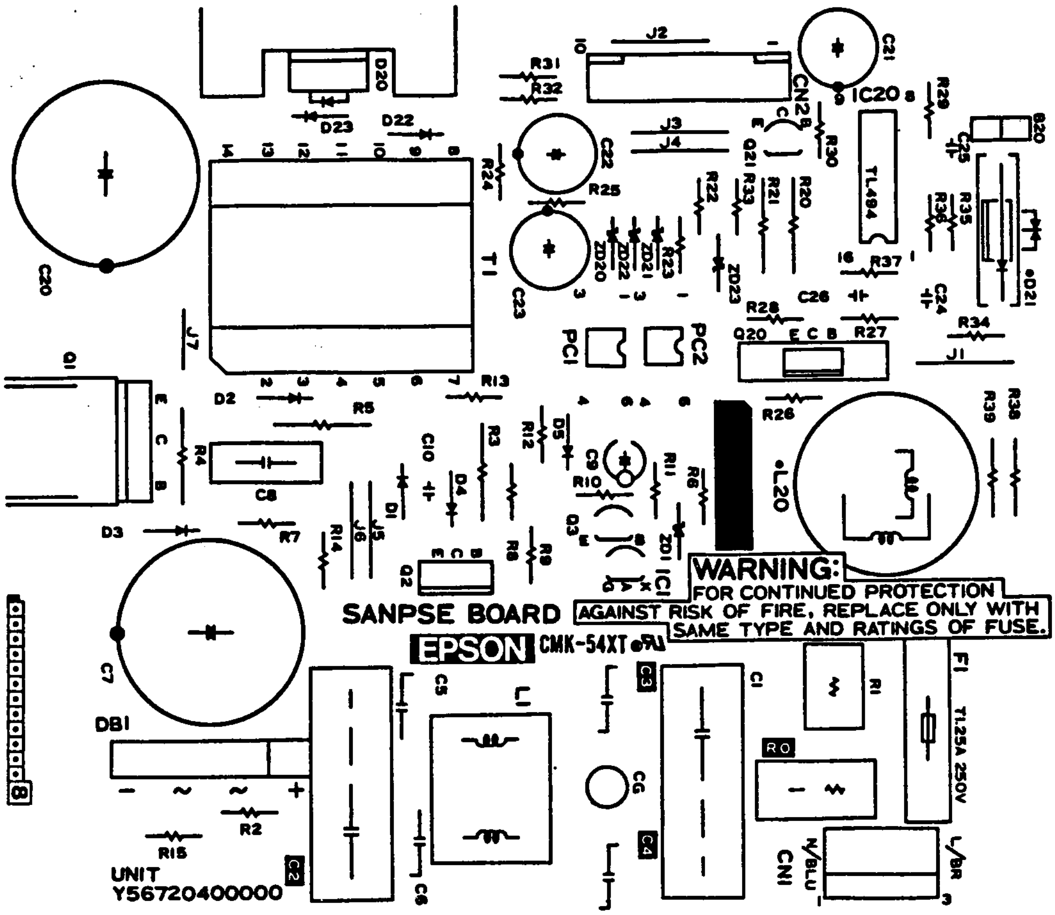


Figure A-25. SANPSE Board Component Layout

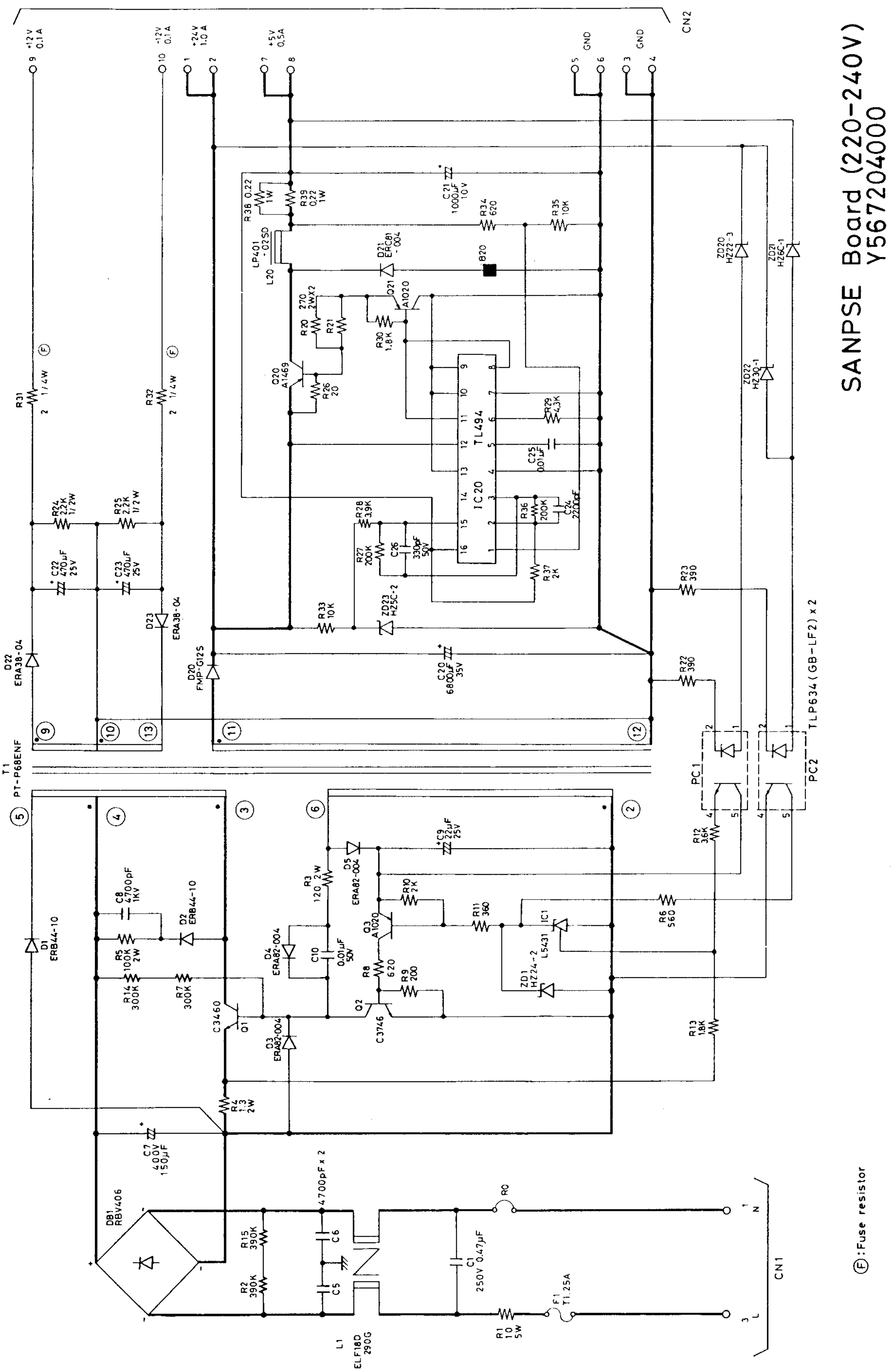


Figure A-26. SANPSE Board Circuit Diagram

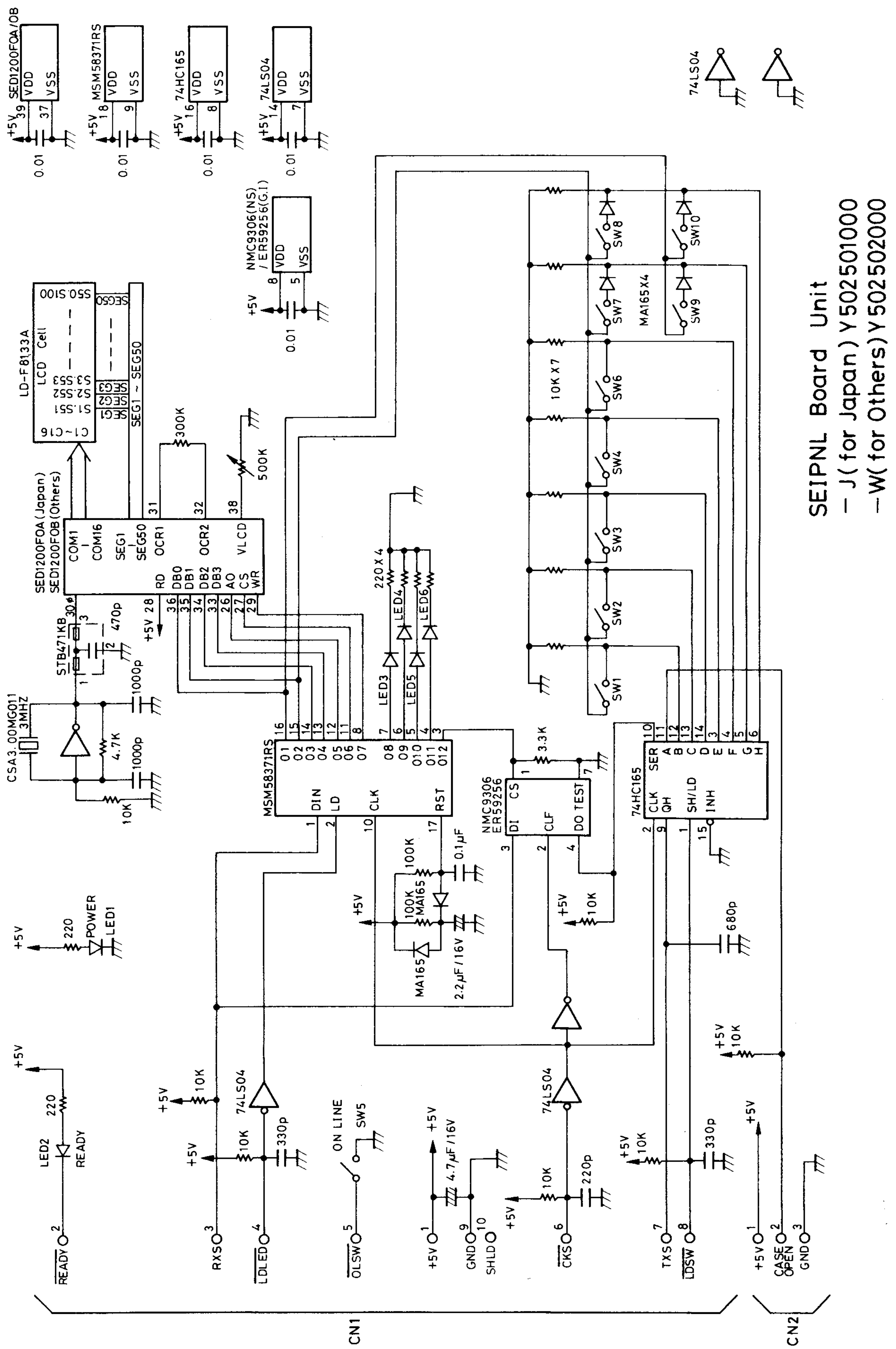


Figure A-27. SEIPNL-W Board Circuit Diagram

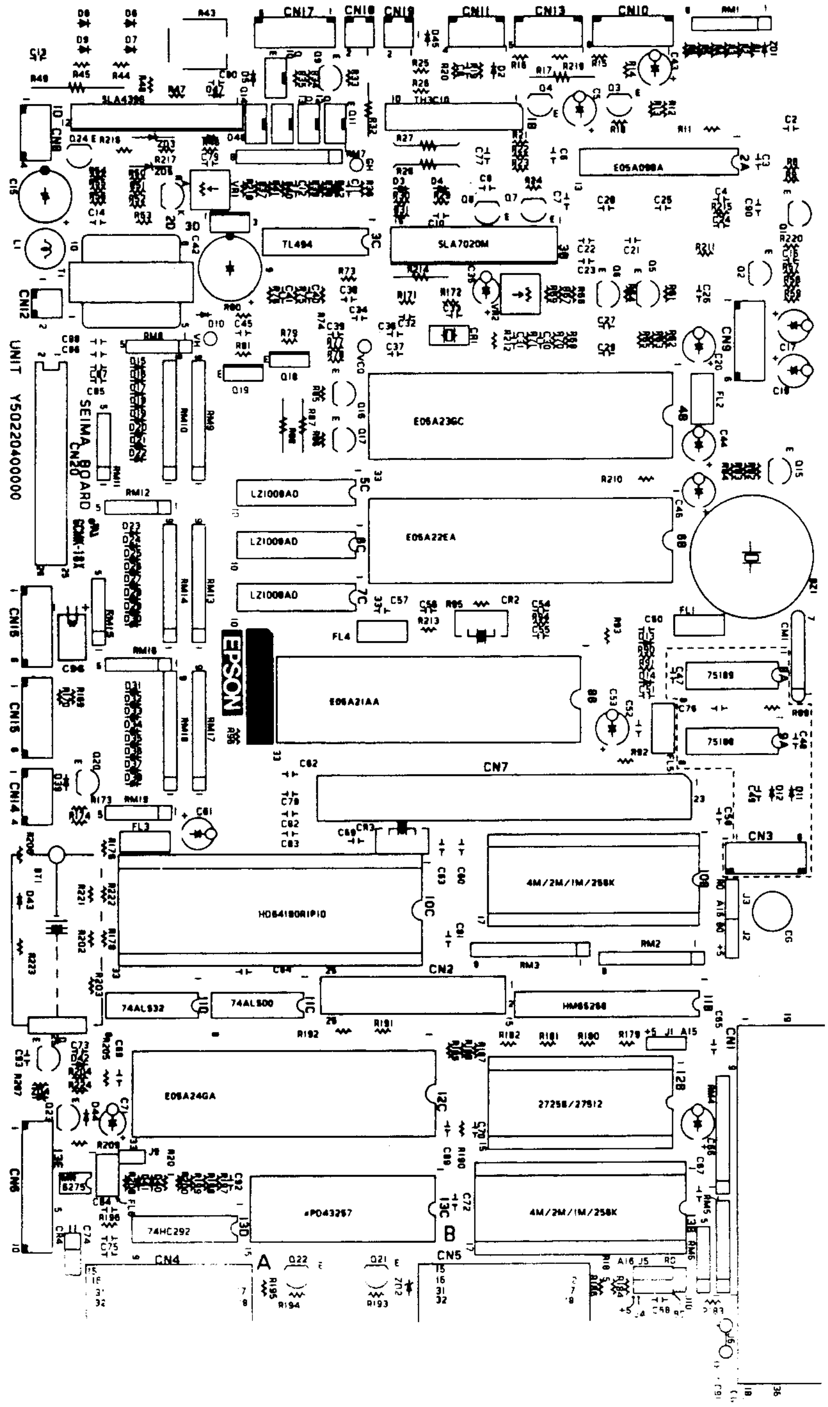


Figure A-28. SEIMA Board Component Layout

REV.-A

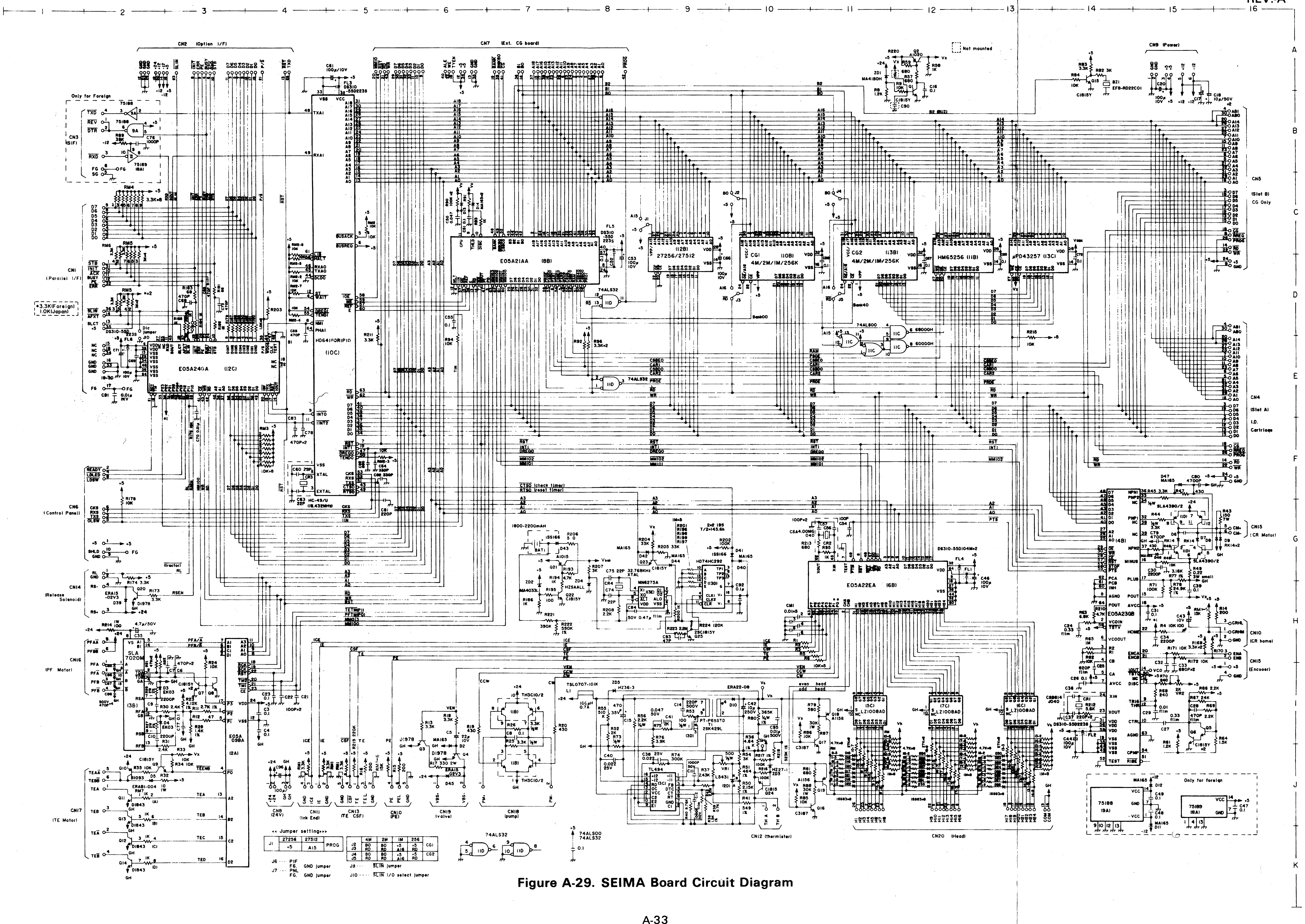


Figure A-29. SEIMA Board Circuit Diagram

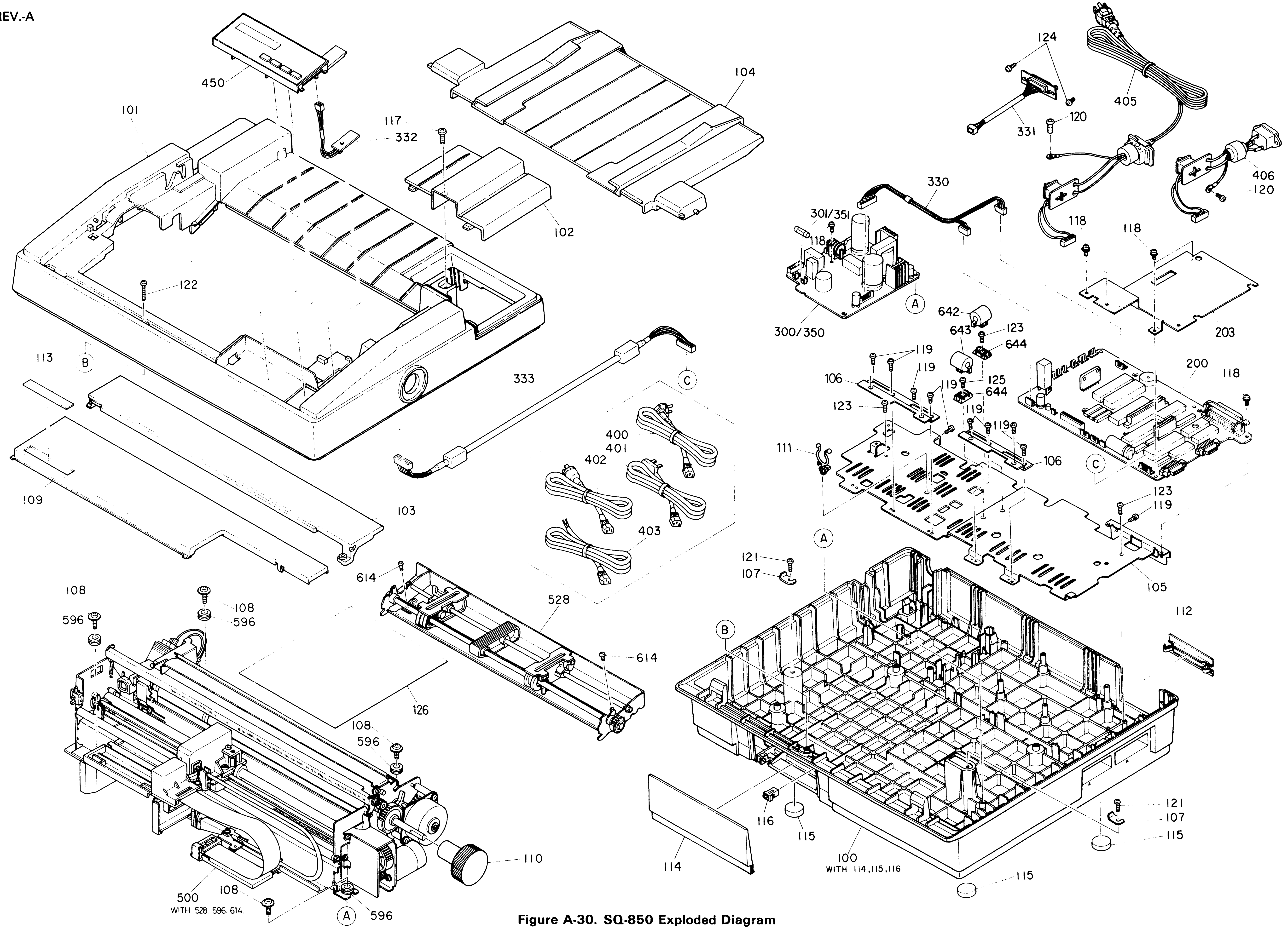


Figure A-30. SQ-850 Exploded Diagram

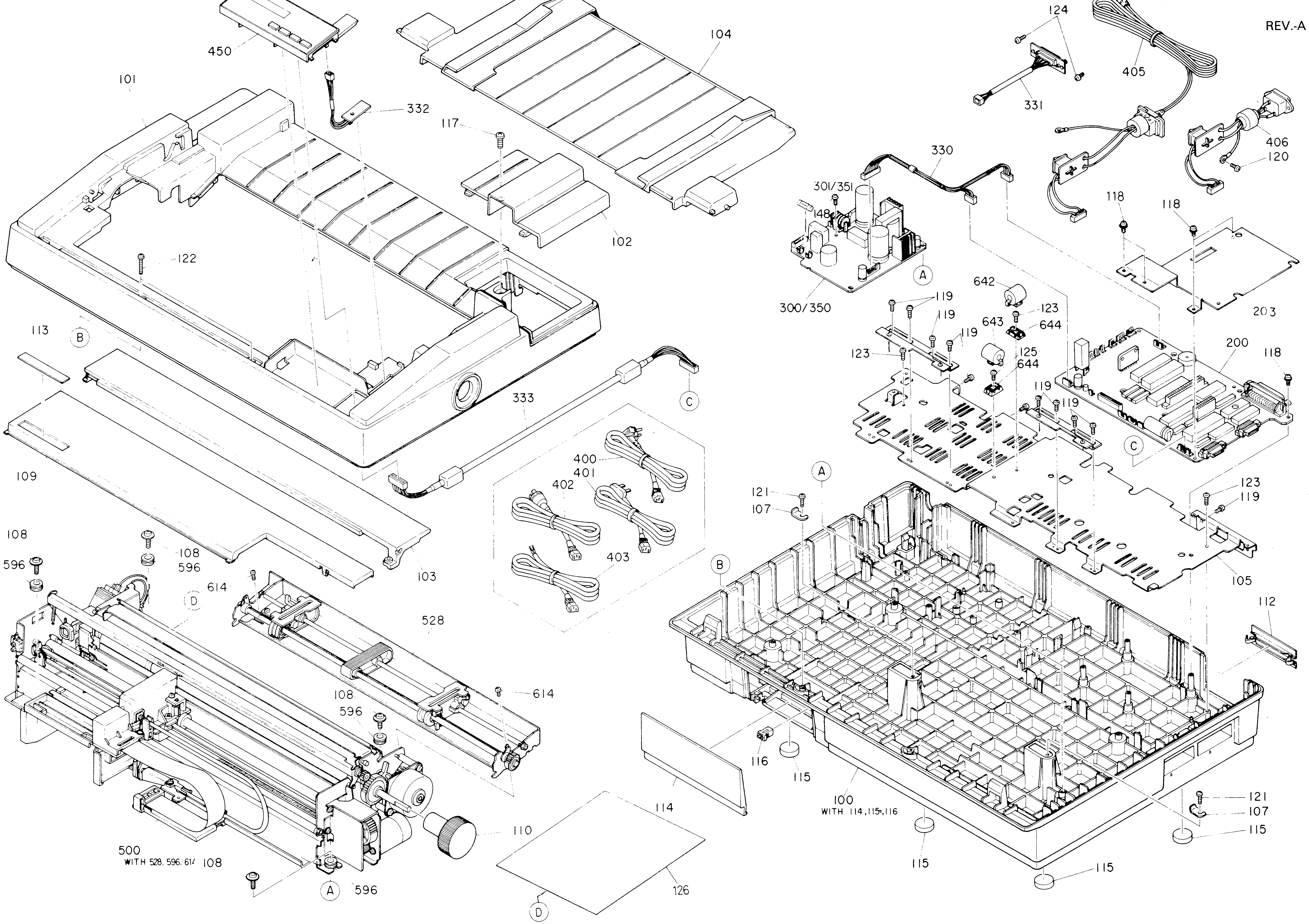


Figure A-31. SQ-2550 Exploded Diagram

REV.-A

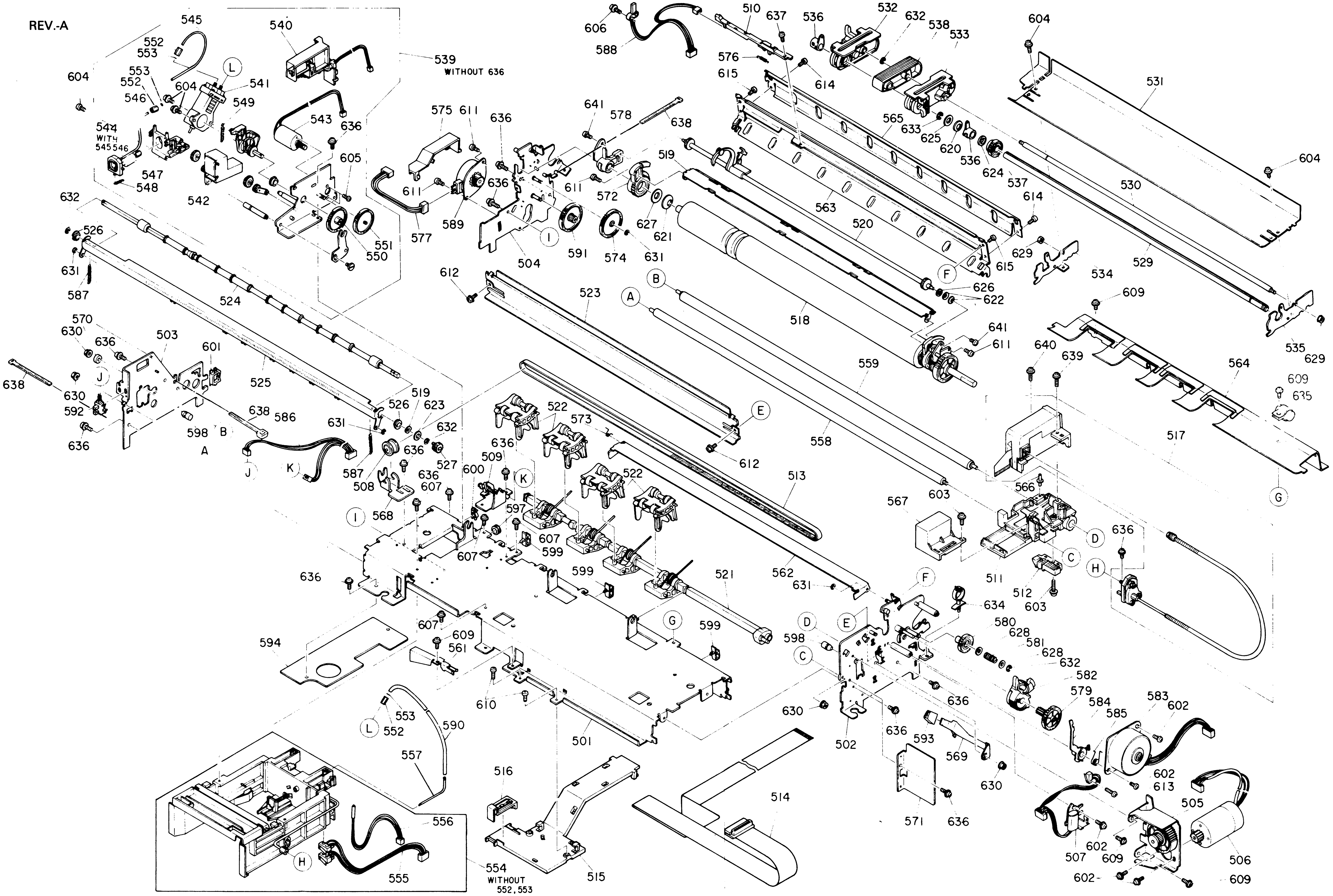


Figure A-32. Model-4410 Printer Mechanism Exploded Diagram

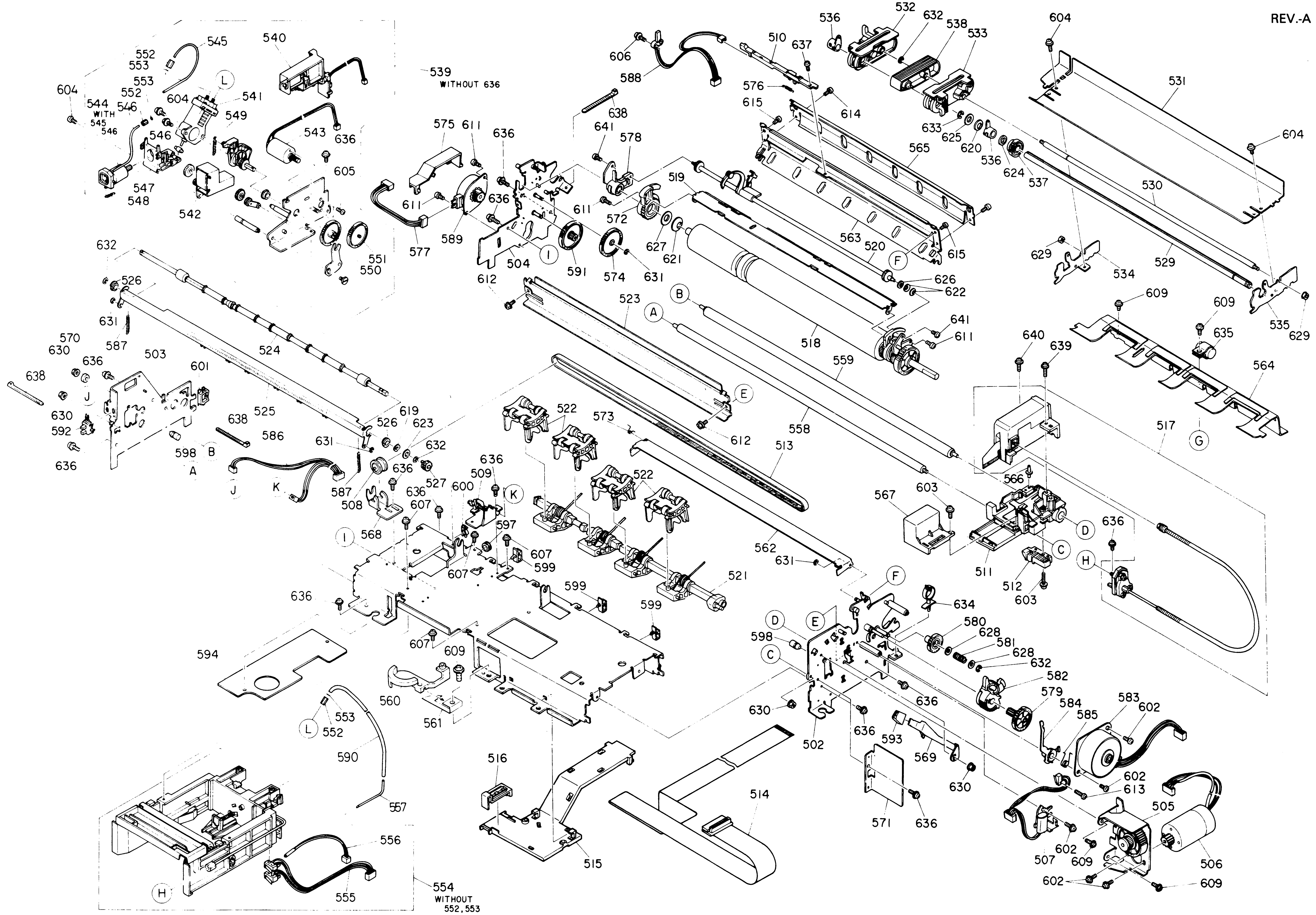


Figure A-33. Model-4460 Printer Mechanism Exploded Diagram

Table A-10. Parts Name Reference Table

Ref. No.	Name	Ref. No.	Name
100	Lower Case Assembly	503	Frame Assembly (Left)
101	Upper Case	504	Frame Assembly (Middle)
102	Option Board Cover	505	Motor Mounting Plate
103	Printer Cover A	506	Carriage Motor
104	Sheet Guide Assembly	507	Paper Release Trigger Assembly
105	Base Plate	508	Belt Driven Pulley
106	Ground Plate	509	Paper End Sensor
107	Transport Locking Bracket	510	Top Edge Sensor
108	Printer Mechanism Mounting Screw	511	Carriage Assembly
109	Printer Cover B	512	Timing Belt Holder
110	Platen Knob	513	Timing Belt
112	Shield Plate	514	Relay Flexible Printed Cable
113	Logo Plate	515	Cable Holder B
114	Ink Cartridge Cover	516	Cable Holder A
115	Rubber Foot	517	Printhead Unit A (for SQ-2550)
116	Latch	517	Printhead Unit B (for SQ-850)
117	CBB (M4X14)	518	Platen Assembly
118	CPS(P) (M3X8)	519	Top Edge Holder Plate Assembly
119	CPS(O) (M3X8)	520	Top Edge Holder Transmission Shaft
120	CBO (M4X8)	521	Paper Feed Roller Shaft Assembly
121	CBB (M4X12)	522	Paper Feed Roller Assembly
122	CBB (M4X25)	523	Paper Guide Plate
123	CBB (M3X12)	524	Paper Holding Roller Assembly
124	CP (M3X6)	525	Paper Holder Mouting Plate
125	CBS(F) (M3X6)	526	Paper Holding Shaft Holder
126	Notice Sheet	527	Paper Holding Drive Gear
200	SEIMA Board Unit	528	Tractor Unit
201	Heat Sinker	529	Tractor Shaft
202	CBS (M3X5)	530	Tractor Support Shaft
203	Shield Plate A	531	Tractor Base Frame
300	SEIPS Board Unit	532	Tractyor Assembly (Left)
301	Fuse 125V/2A	533	Tractyor Assembly (Right)
302	Heat Sinker	534	Tractor Frame (Left)
303	Heat Sinker	535	Tractor Frame (Right)
304	CP (M3X6)	536	Platen Shaft Holder
305	Cup (M3X8)	537	Tractor Gear
306	Insulation Spacer	538	Paper Support
330	Cable Set #8DZ	539	Pump Unit
331	Cable Set #8E5	540	Valve Assembly
332	Cable Set #8DF	541	Pump Assembly
333	Cable Set #8DE	542	Head Cleaner Assembly
334	Cable Set #8E4	543	Pump Motor
350	SANPSE Board Unit	544	Head Cap Assembly
351	Fuse 250V/1.25A	545	Pump Tube
352	Heat Sinker	546	Nozzle Tube Assembly
353	Heat Sinker	547	Cap Support
354	CP (M3X6)	548	Sub Cap Spring
355	Cup (M3X8)	549	Cap Spring
356	Insulation Spacer	550	Pump Tension Gear
400	Power Cable	551	Pump Driving Gear
401	Power Cable	552	Tube Set Screw
402	Power Cable	550	Pump Transmission Gear
403	Power Cable	551	Pump Driving Gear
404	Cable Set #8DW	552	Tube Set Screw
405	Cable Set #8EY	553	O Ring
450	SEIPNL-W PANEL	554	Cartridge Holder Unit
500	Printer Mechanism	555	Ink End Sensor
501	Base Frame	556	Thermistor
502	Frame Assembly (Right)	557	Discharged Ink Needle

Table A-10. Parts Name Reference Table (Continued)

Ref. No.	Name	Ref. No.	Name
558	Guide Shaft B	622	Leaf Spring (6)
559	Guide Shaft	623	Plain Washer (12)
561	Tube Cover Holder	624	Plain Washer (13)
562	Paper Eject Guide Plate	625	Plain Washer (15)
563	Paper Guide (Upper)	626	Plain Washer (6.1)
564	Paper Guide (Lower)	627	Plain Washer (22.2)
565	Platen Cover	628	Plain Washer (10)
566	Head Adjustment Pin	629	Hexagon Nut with OW (M4)
567	Connector Cap	630	Hexagon Nut with Frange (M4)
568	Belt Driven Pulley Mounting Plate	631	Retaining Ring E (3)
569	Adjustment Lever	632	Retaining Ring E (4)
570	Shaft Holder Ring	633	Retaining Ring E (6)
571	Carriage Motor Gear Cover	634	Cable Clip
572	Top Dege Holder Arm (Left)	635	Ferrite Clanp
573	Paper Eject Guide Plate Spring	636	CCS (M3X8)
574	Top Edge Holding Transmission Gear	637	CB (M2.5X4)
575	Top Edge Holder Motor Cover	638	Wire Band
576	Top Edge Sensor Spring	639	SCC(P) (M3X6)
577	Top Edge Holder Motor Cable	640	SCC(P) (M3X12)
578	Platen Shaft Holder (Left)	641	CBS(F) (M3X6)
579	Paper Feed Reduction Gear	642	Ferrite Clamp
580	Tractor Transmission Gear	643	Ferrite Clamp
581	Tractor Transmission Gear Spring	644	Ferrite Clamp Base
582	Paper Release Lever		
583	Paper Feed Motor		
584	Trriger Lever Assembly		
585	Trriger Lever Spring		
586	Paper End Sensor Cable		
587	Paper Holding Spring		
588	CSF Sensor		
589	Top Edge Holder Motor		
590	Discharged Ink Tube		
591	Paper Feeding Reductiongear		
592	Home Position Sensor		
593	Head Adjustment Bush		
594	Support Frame		
595	Pump Cover		
596	Base Rubber		
597	Wire Edging		
598	Stopper Rubber		
599	Mini Clamp		
600	Wire Clip		
601	Edge Saddle		
602	CP(P) (M3X6)		
603	Cup (M3X12)		
604	Cup (M3X5)		
605	CB (M2.6X5)		
606	CP(P) (M3X8)		
607	CBB (M3X12)		
609	CCS (M3X6)		
610	CCS (M3X10)		
611	CB (M2.5X3)		
612	CHS (M3X6)		
613	Cup (M2X10)		
614	CB(N)S (M3X6)		
615	CBS (M3X6)		
619	Leaf Spring (11)		
620	Leaf Spring (15)		
621	Leaf Spring (22)		

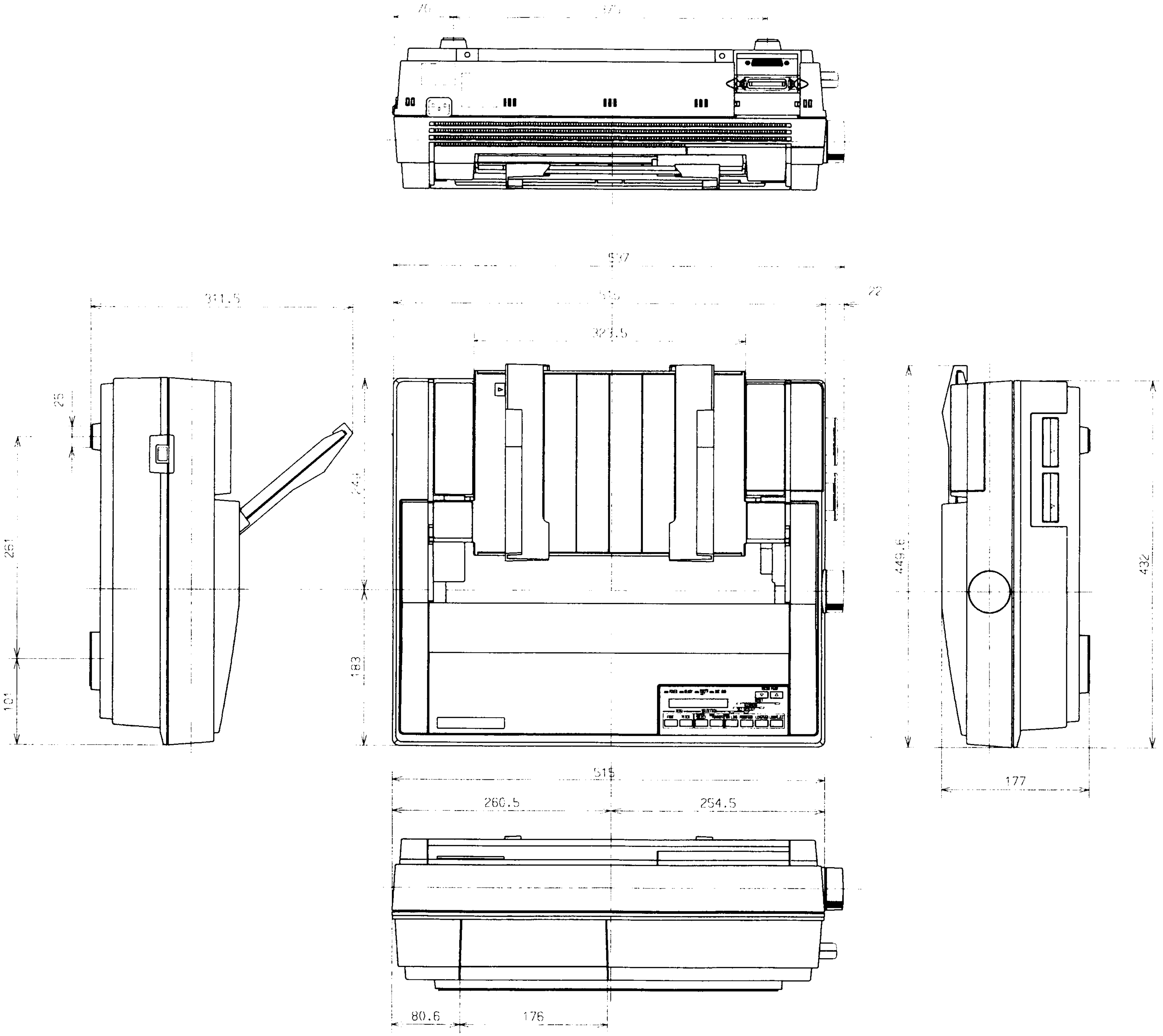


Figure A-34. SQ-850 External Dimension Diagram

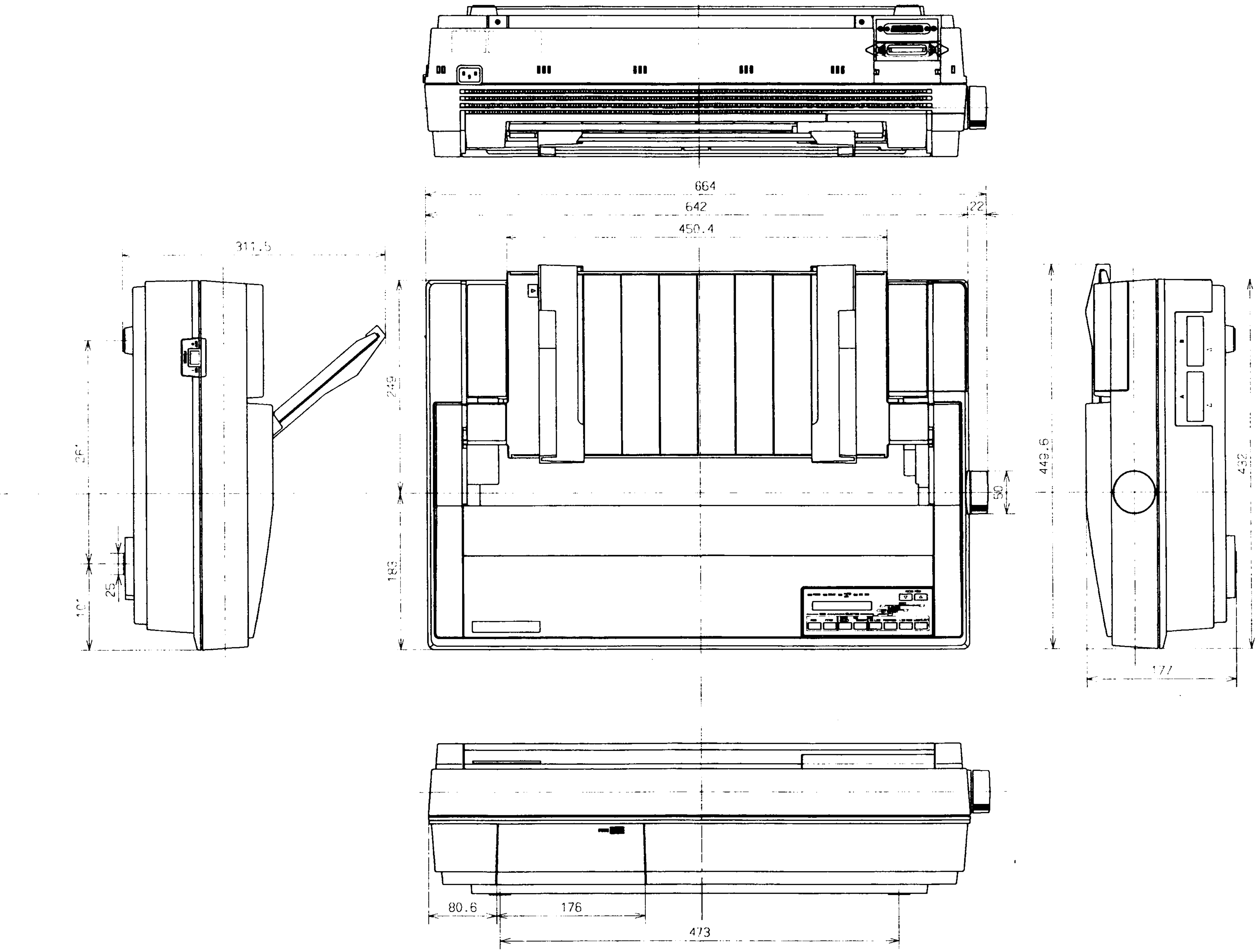


Figure A-35. SQ-2550 External Dimension Diagram

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