Kundendienst Handbuch
Service Manual
Technical Manual

Schneider
COMPUTER DIVISION

NLQ 401 Matrix Drucker

(B) PRINTER MECHANISM

CONTENTS

1. General Composition

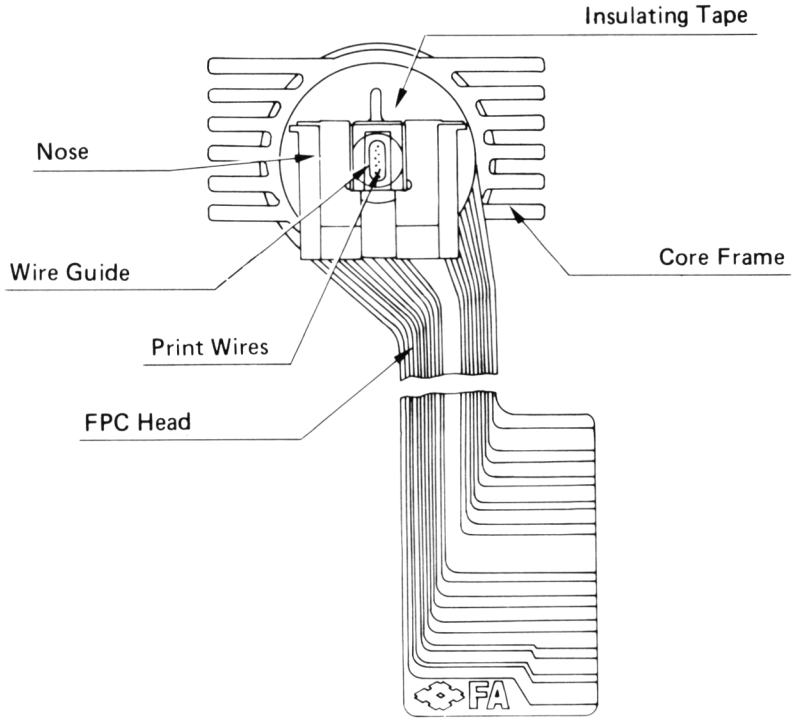
This printer consists of the following major six blocks:

1) Print mechanism
2) Carriage Drive Mechanism
3) Paper Feed and Release Mechanism
4) Ribbon Feed Mechanism
5) Electronic Control Section
6) Cover Units

2. Principles of Operation

2.1 Print Mechanism

This printer is a bidirectional impact wire dot printer. A character is formed by 9 x 9 dot matrix. The print head consists of nine solenoids arranged circularly on a core frame, nine armatures operated by the solenoids, nine print wires, and a wire guide. The nine print wires are arranged vertically by the wire guide at the front end precisely.



As the carriage mounting the print head travels at the printing speed, printing is performed as follows:

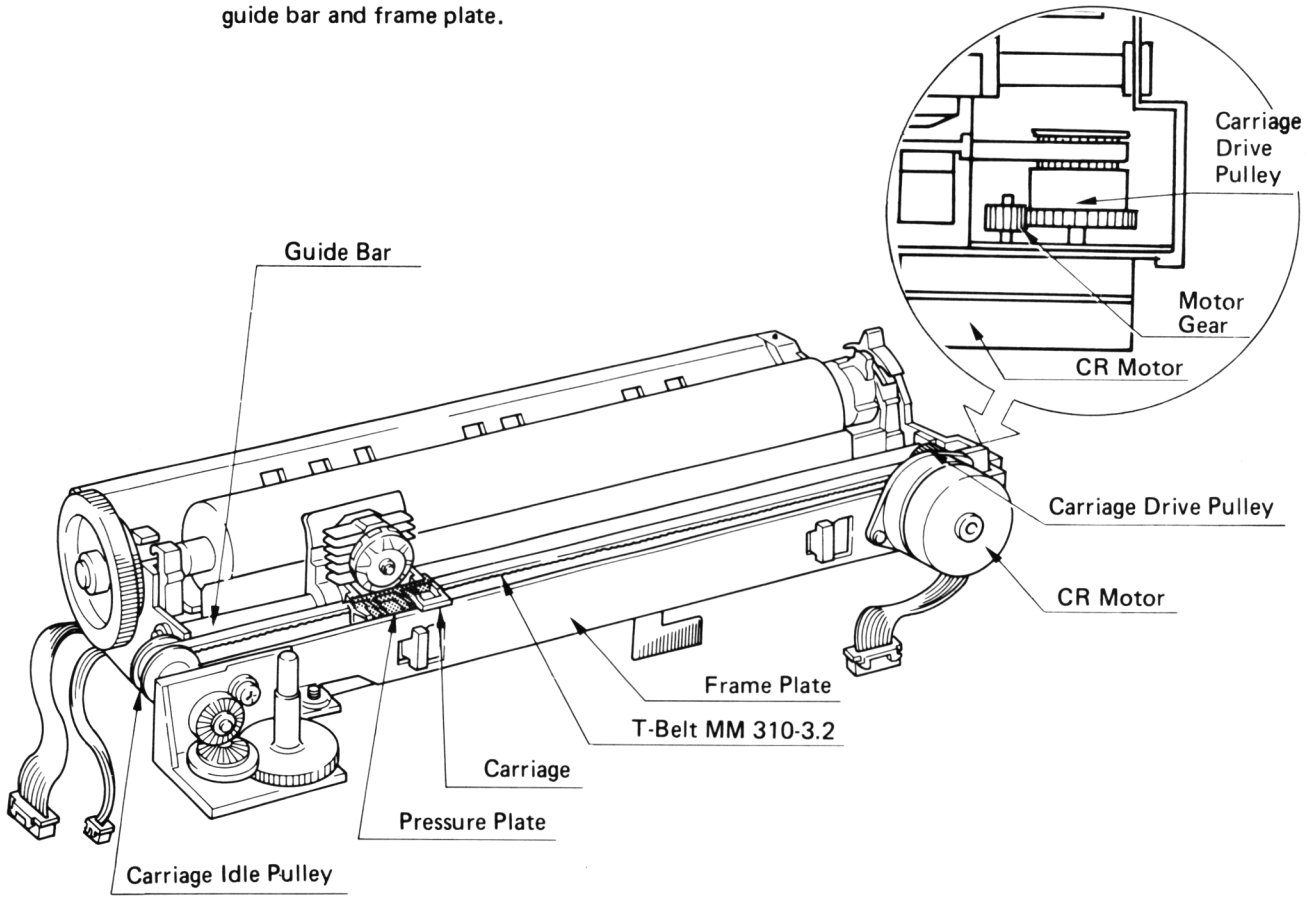
1) Character generator transfers print command pulses, which drive the corresponding solenoids.
2) When each of the solenoids is energized, the corresponding armature forces the print wire against the ink ribbon.
3) The impact against the ribbon and paper produces a dot on the paper.

The print timing is determined by the drive pulses of the pulse motor driven by the carriage.
Nine solenoids are selectively driven according to the ROM (CG) data for each column. When a solenoid is deenergized, the corresponding print wire returns to the original position by the compression spring force.

2.2 Carriage Drive Mechanism

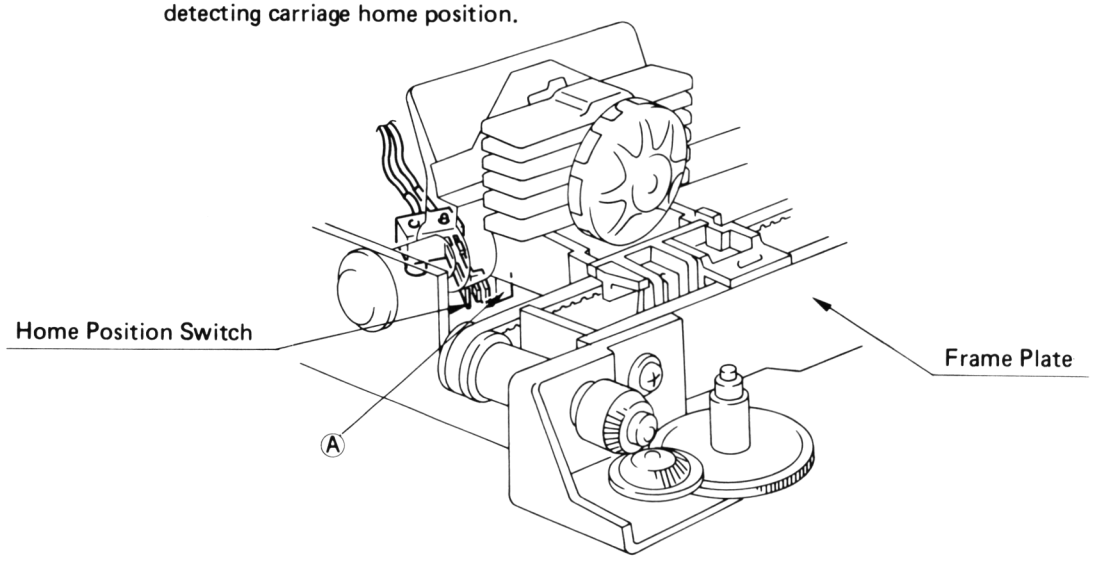
The carriage (CR) motor rotation is transmitted via a motor gear to the carriage drive pulley which is linked with the carriage idle pulley by a timing belt (T-belt) MM310-3.2.

Since the T-belt is secured to the carriage with a pressure plate, clockwise or counterclockwise rotation of the CR motor causes the carriage to move leftward or rightward, being supported and guided by a guide bar and frame plate.



- Home Position (HP) Switch

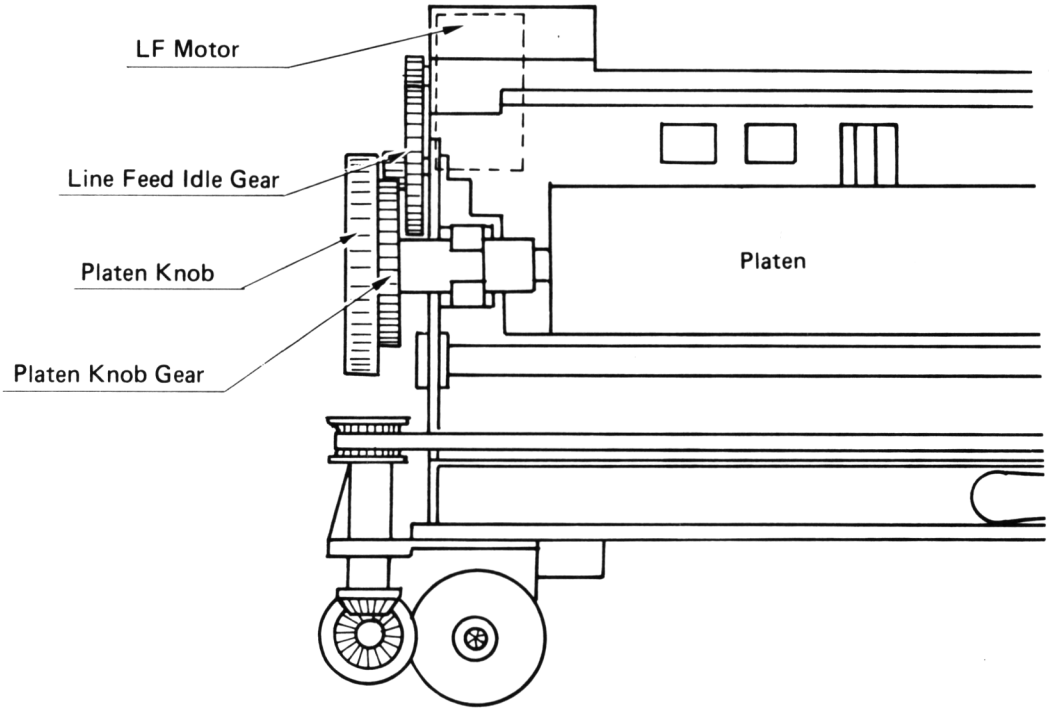
A Home position (HP) switch is installed on the left end of the frame. When the carriage reaches the left end of its movable range, the projecting part Ⓐ of the carriage pushes this HP switch, thereby detecting carriage home position.

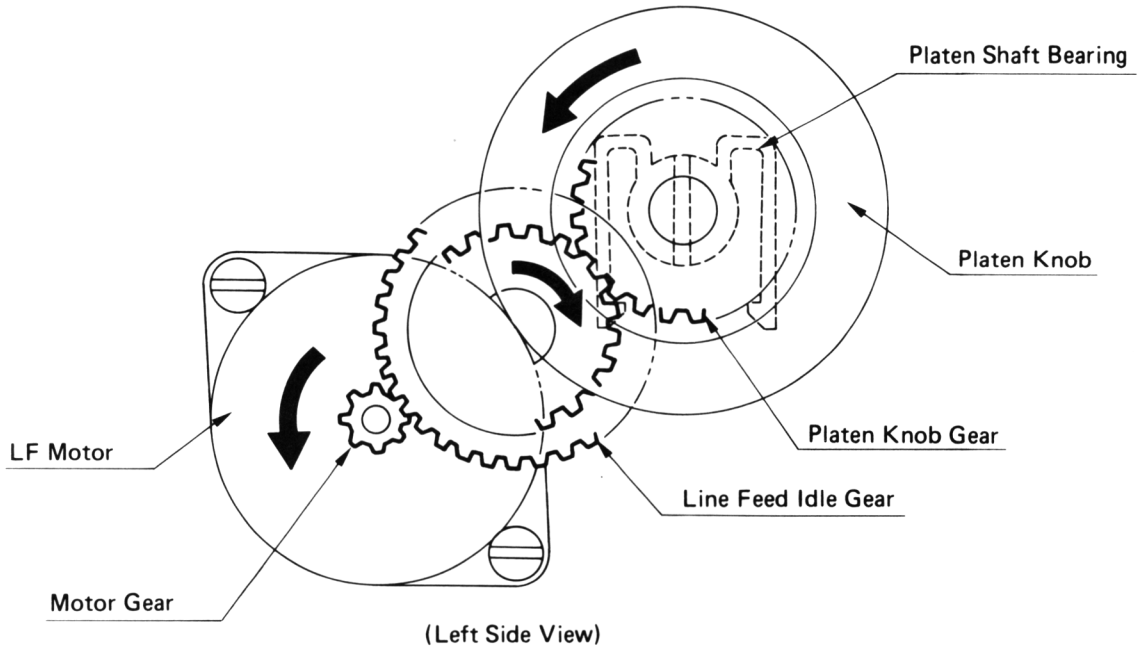


2.3 Paper Feed and Release Mechanism

2.3.1 Paper Feed Mechanism

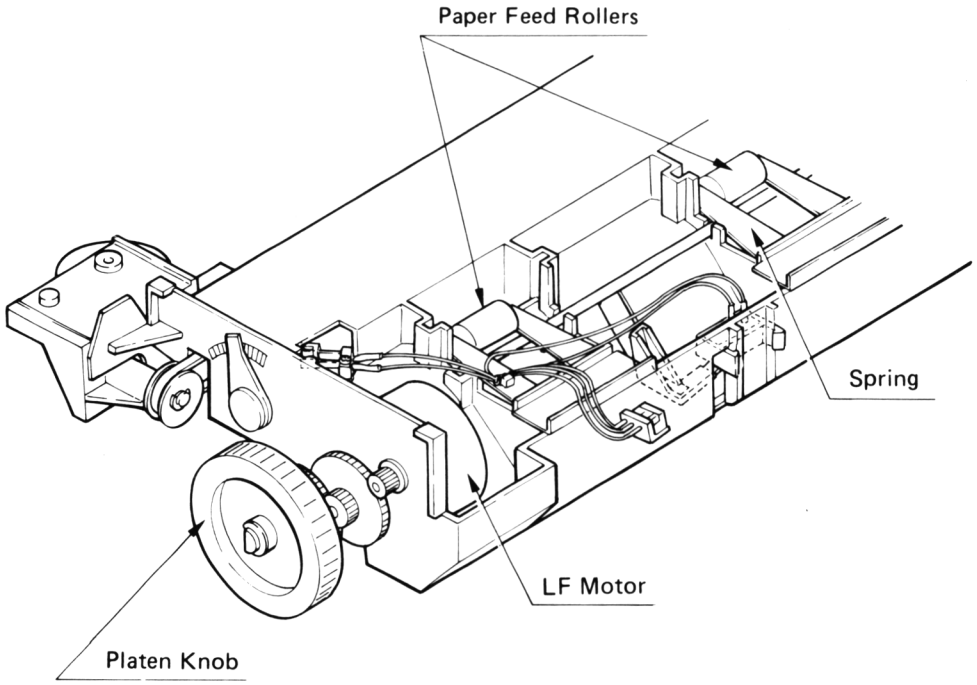
As shown below, rotation of the line feed (LF) motor is transmitted via a motor gear and line feed idle gear to the platen knob gear. Since the platen knob is fixed with the platen, the platen rotates when the LF motor runs.



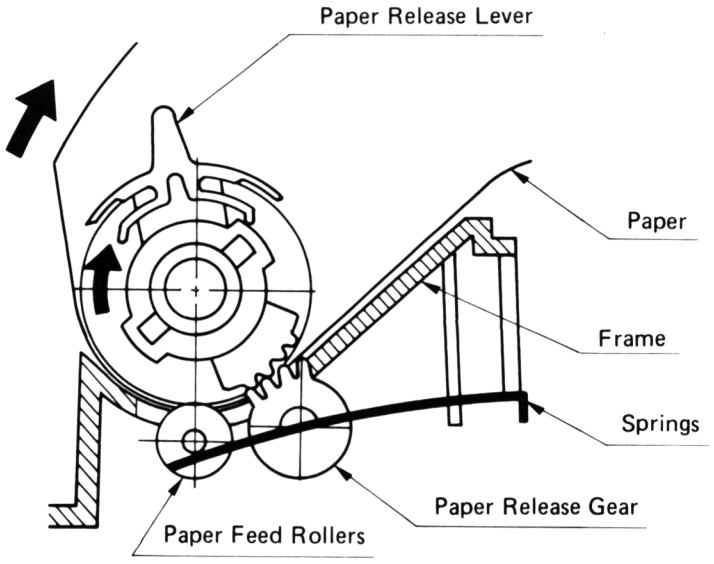


(Left Side View)

Three paper feed rollers are located just below the platen. Since they are pressed against the platen by three springs when the paper release lever is set to the CLOSE position, forms inserted between the platen and the paper feed rollers are fed when the platen rotates.



[Paper is fed.]

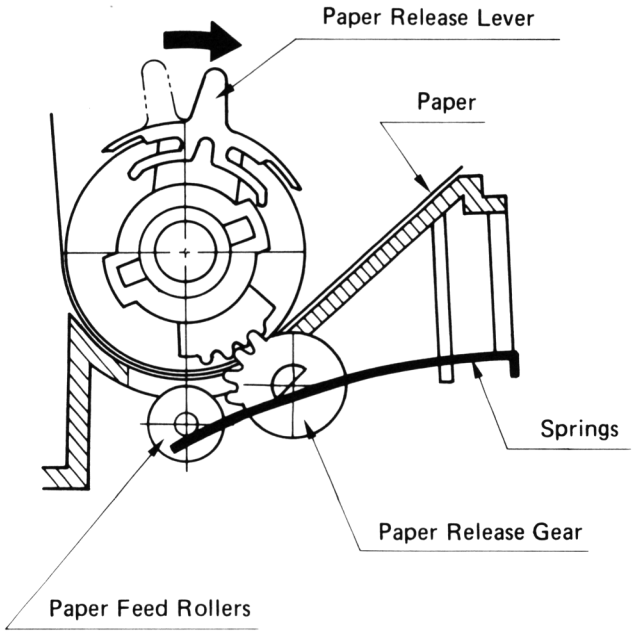


When the line feed switch is pressed once with the ONLINE lamp not lighting, the paper is advanced by one line. If the line feed switch is held down, the paper is advanced continuously line by line.

2.3.2 Paper Release Mechanism

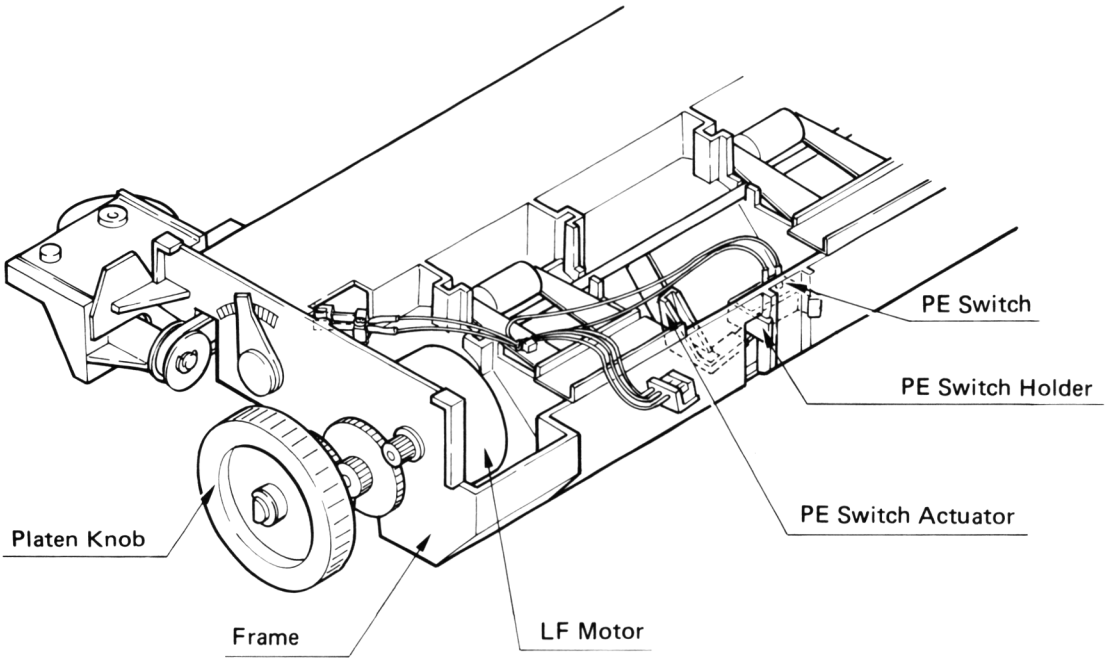
As shown below, when the paper release lever is set to the OPEN position, the paper release shaft is rotated via the release gear. This causes three springs holding the paper feed rollers to be released, thus separating the paper feed rollers from the platen.
This state allows correct paper loading and lateral paper position adjustment.

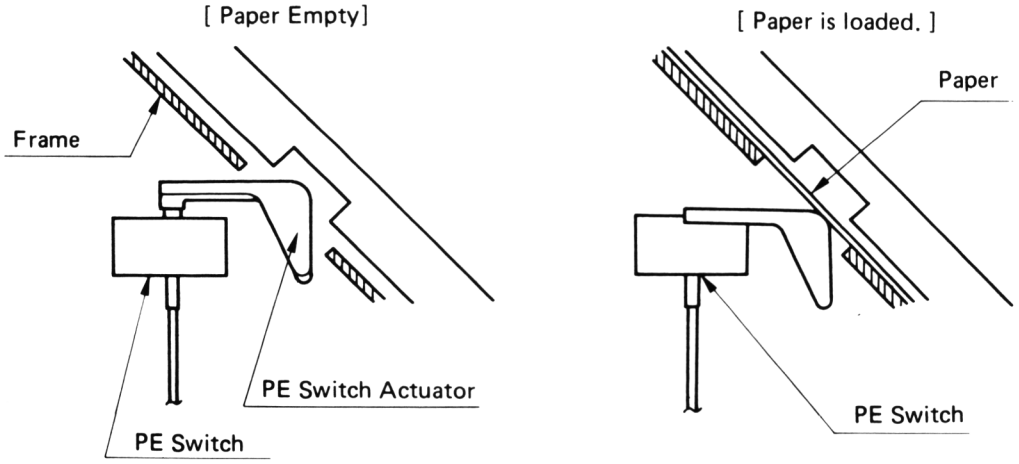
[Paper is released.]



- Paper Empty (PE) Switch

This printer is equipped with a paper empty (PE) switch in the paper path. When paper is loaded, the PE switch actuator is held down, which permits printing. If there is an absence of paper, the PE switch actuator goes up and opens the PE switch, by which the paper empty state is detected and printing is prohibited.

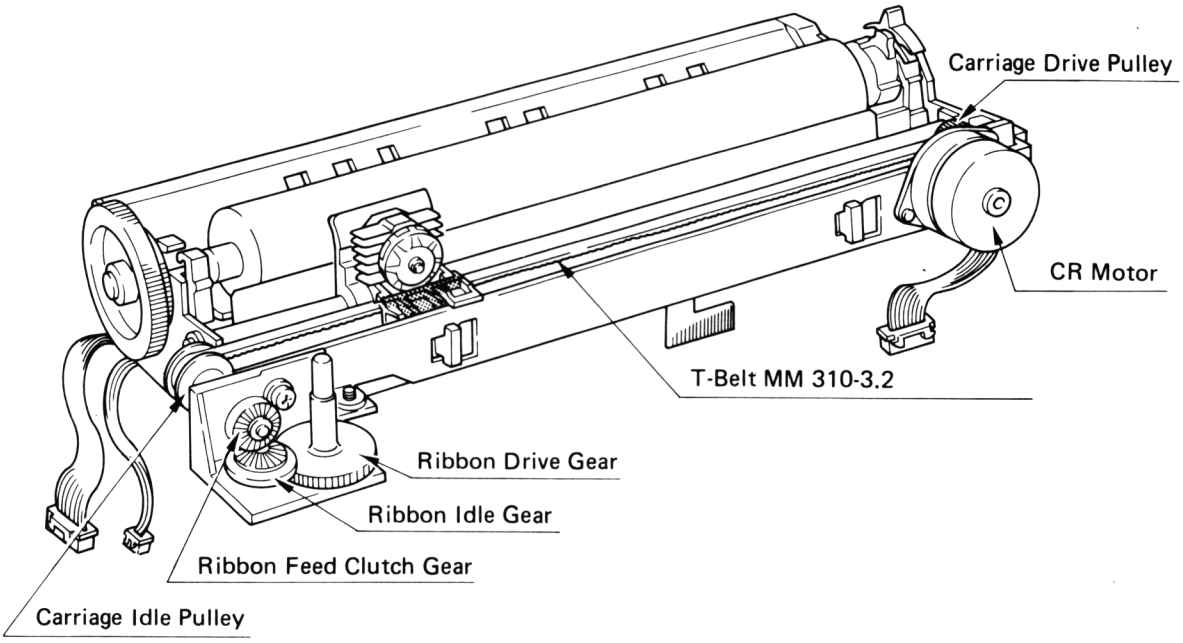


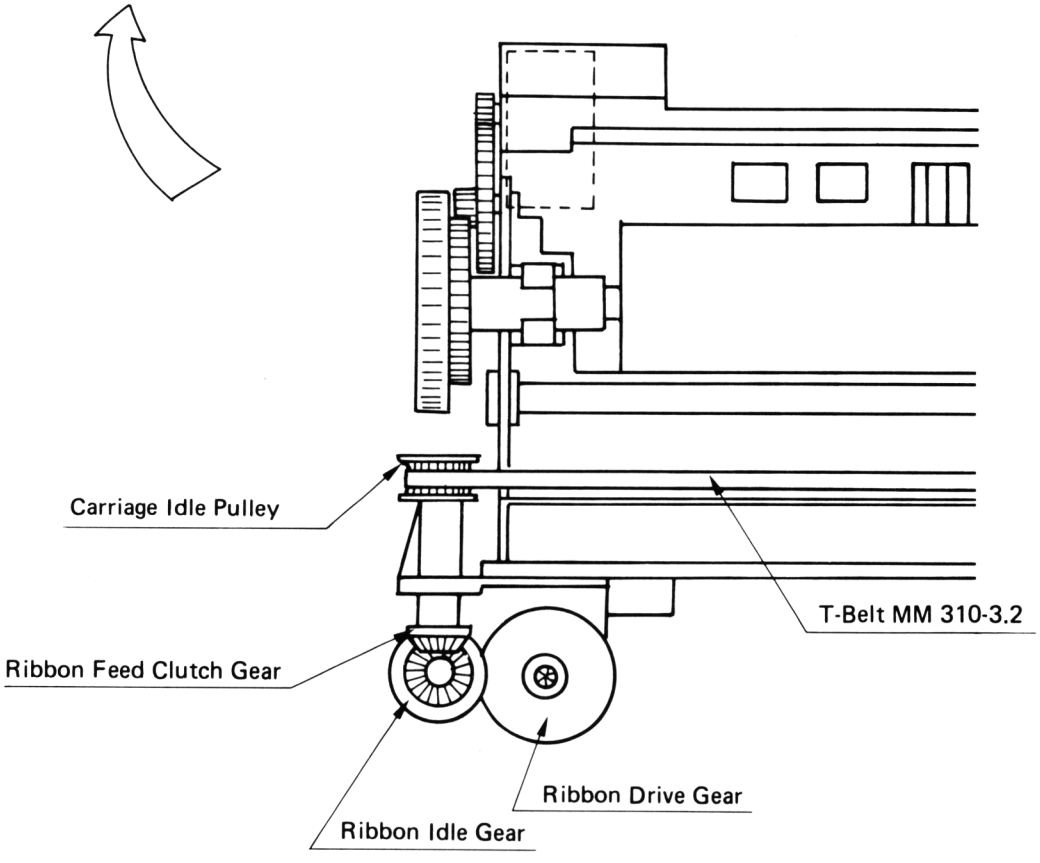


2.4 Ribbon Feed Mechanism

The carriage (CR) motor rotation is transmitted to the carriage idle pulley via a motor gear, carriage drive pulley, and T-belt MM310-3.2. The rotation is further transmitted via an idle pulley shaft fixed to the idle pulley, and a ribbon idle gear to the ribbon drive gear.

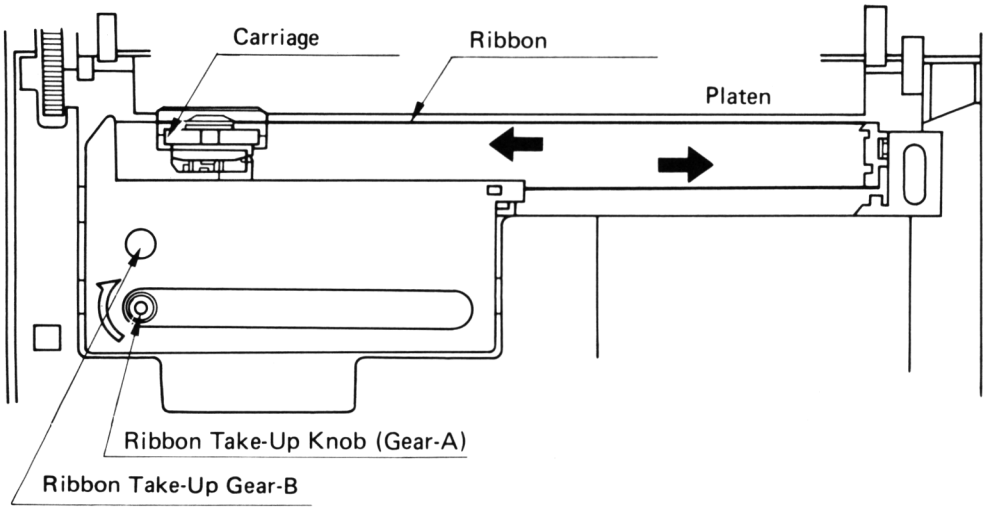
The idle pulley and the ribbon drive gear rotate only in the forward direction (only when the carriage moves from left to right) using each spring clutch installed in their shafts.

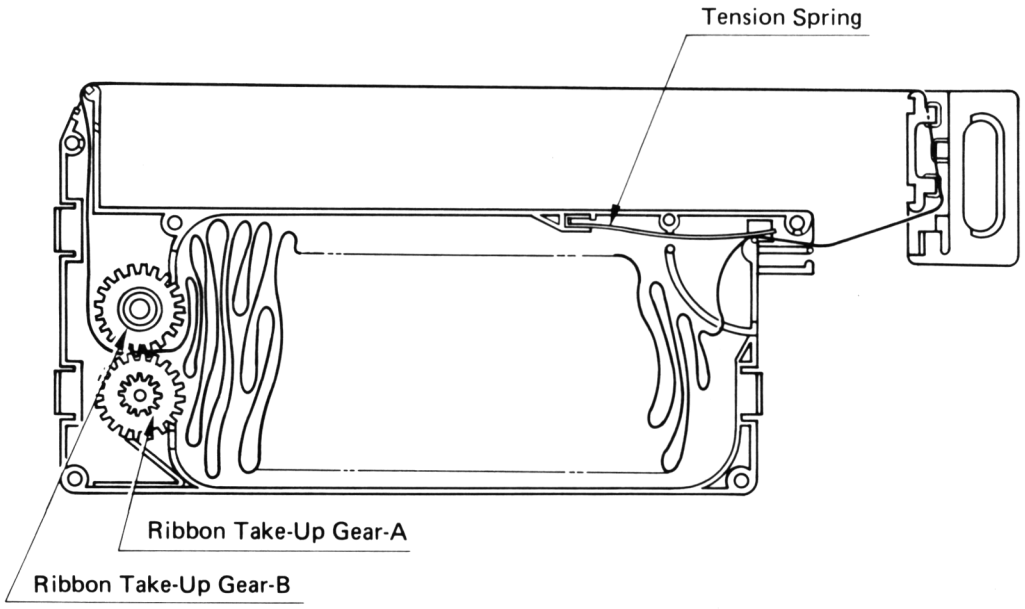




When the ribbon cassette is mounted on the cassette holder of the body cover, the ribbon take-up gear-A meshes with the ribbon drive gear on the frame unit. When the ribbon take-up gear-A rotates, the ribbon take-up gear-B also rotates, feeding the ribbon pinched between those gears.

The proper tension of the ribbon is maintained by the tension spring inside the ribbon cassette.





2.5 Control Electronics

The electronic control section consists of two P.C.B.s; main CPU P.C.B. and switch P.C.B.
For the block diagram of the printer electronics, refer to Chap. C, Control Electronics.

2.5.1 Main CPU P.C.B.

Main CPU P.C.B. is equipped with a one-chip CPU, ROM, I/O ports, clock pulse generator, parallel or serial interface circuit, print head drive circuit, paper feed drive circuit, carriage motor drive circuit, reset circuit, home position detect circuit, and voltage stabilizer.

(1) One-Chip CPU
This is an N-MOS type CPU, which controls the entire electronic system including parallel and serial interfaces, print head drive, carriage and paper feed stepping motors, and indicator LEDs. The CPU also checks ON LINE key and LF key status, their transitions, and system environment.

(2) ROM
The ROM is an 8K byte memory which stores μ computer programs and a character generator.

(3) I/O Ports
I/O ports multiplex the CPU's I/O trunk. Output ports are used to output drive signals from the CPU to the head drive circuit, paper feed motor drive circuit, carriage motor drive circuit, and serial/parallel interface circuit.
Input ports are used to input DIP SW status data and home position detect signal to the CPU.

(4) Clock Pulse Generator
The clock pulse generator is built in the CPU chip described above, which operates with external parts. It supplies a highly stabilized clock pulse (11 MHz) with external ceramic oscillator and ceramic capacitor.

(5) Interface Circuits
There are two types of interface circuits: 8-bit parallel (Centronics) and serial interfaces.

(6) Print Head Drive, Paper Feed Drive, Carriage Motor Drive Circuits
Control signals from the CPU are given through these circuits to each component.

(7) Reset Circuit
This circuit generates and sends a $\overline{\text{RES}}$ signal to the CPU when the power switch is turned on and off.

(8) Home Position Detect Circuit (Limit Switch)
This circuit detects whether the carriage is at the home position or not.

(9) Voltage Stabilizer
This circuit generates +5, +24 and ±9 volt DC outputs rectified and filtered by a diode bridge and capacitor, from the AC source. The +5 volts are stabilized by the 3-terminal regulator.

2.5.2 Switch P.C.B.

This P.C.B. has ON LINE and LF keys, and indicator LEDs (red and green).

3. Replacement of Each Part/Assembly

This section describes the replacement procedures for each major part or assembly.

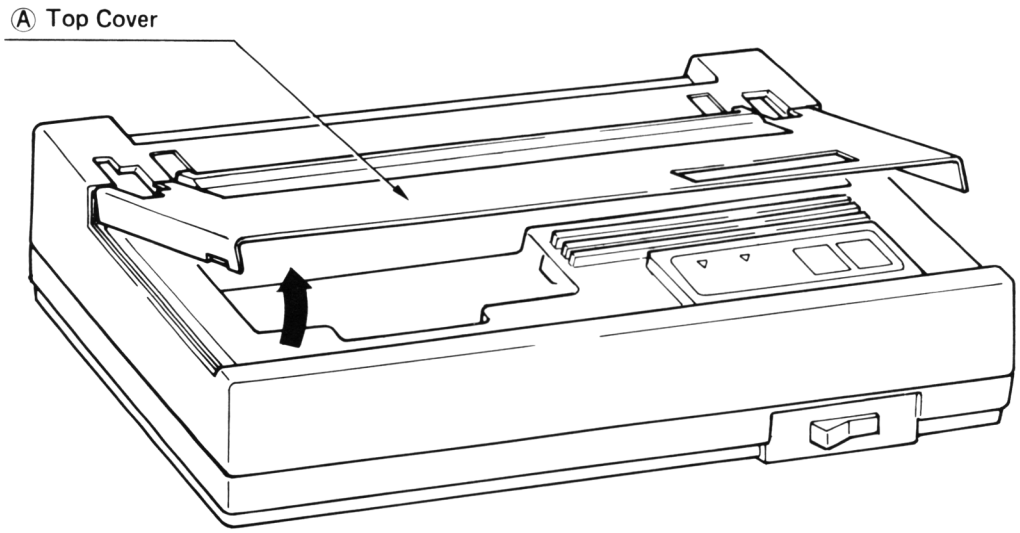
Warning: Always unplug the printer power cord from the AC outlet before assembling or disassembling parts.

3.1 Covers

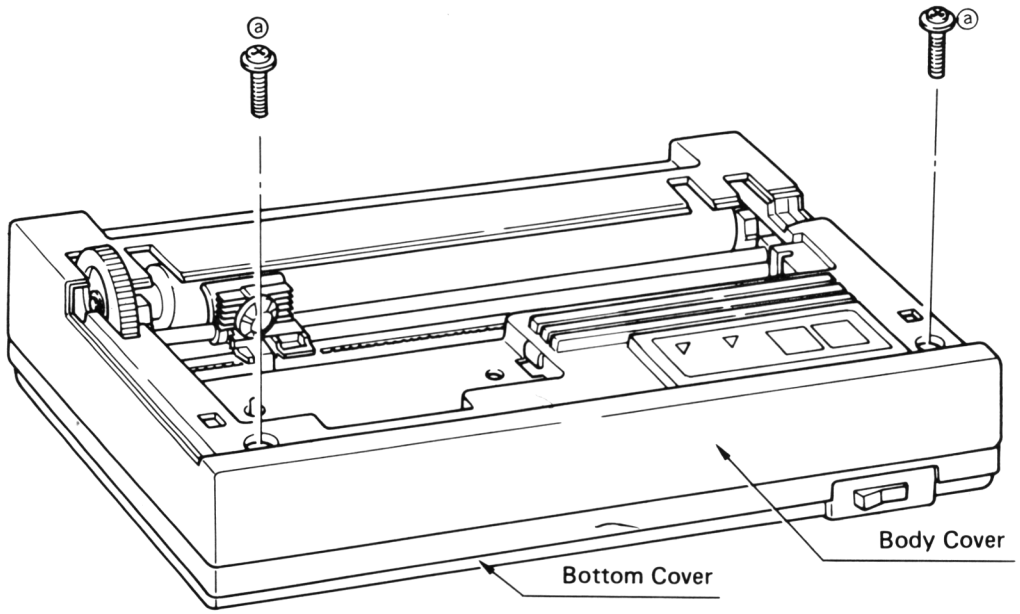
DISASSEMBLY

Caution: When disconnecting connectors, do not pull the wires but the connector body.

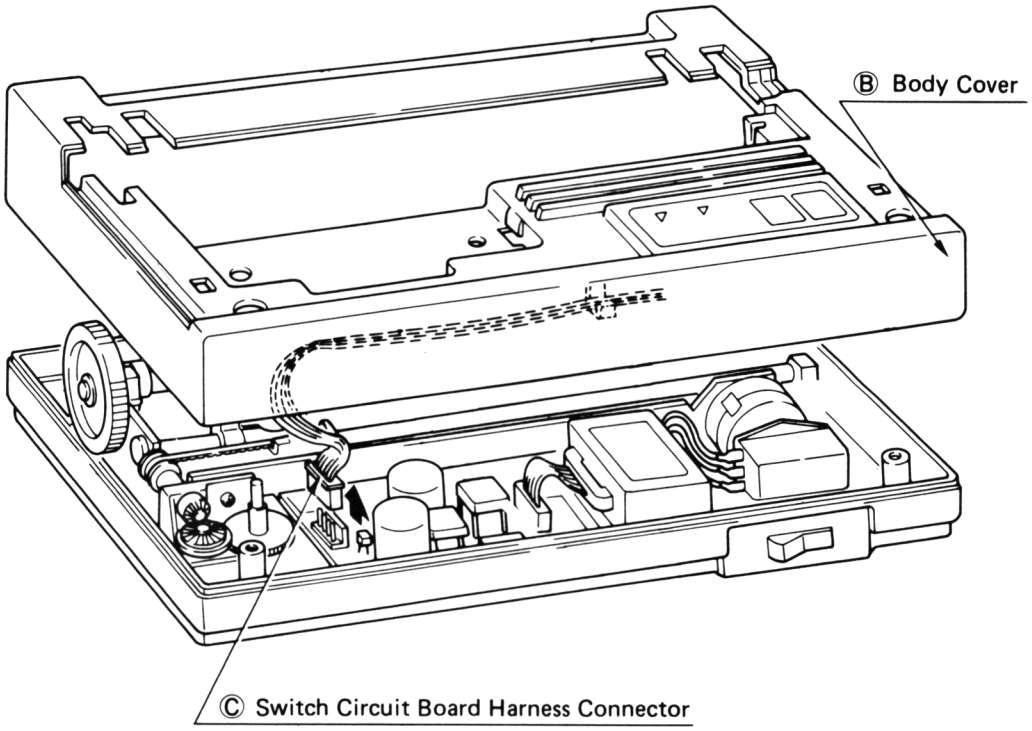
(1) Raise the top cover Ⓐ from the front side to unlock, and remove the top cover by pulling it forward.



(2) Remove the two body cover mounting screws ⓐ .



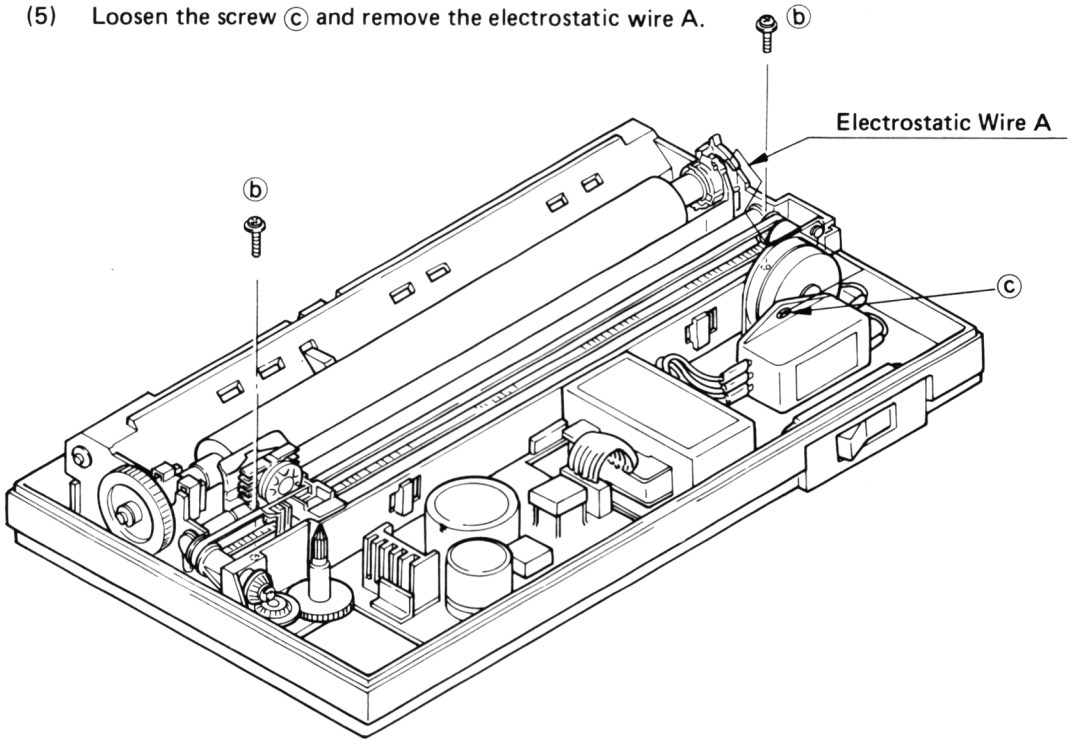
(3) Raising the front side of the body cover Ⓑ slightly, disconnect the switch circuit board harness connector Ⓒ .



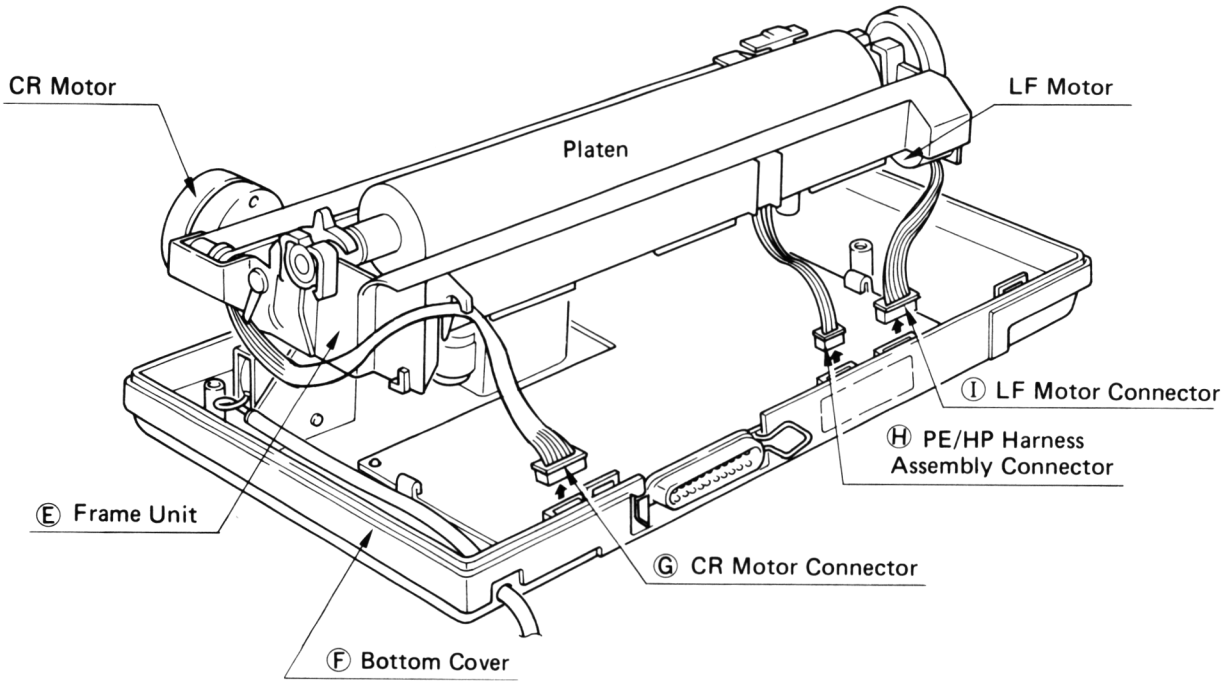
The body cover Ⓑ can be removed from the bottom cover.

(4) Remove the two frame mounting screws ⓑ .

(5) Loosen the screw ⓒ and remove the electrostatic wire A.



(6) Move the print head to the right end, and pull out the tab for the connector of the print head assembly to detach the connector. (See Section 3.2 Print Head.)



(Rear View)

(7) Detach each connector of the CR motor Ⓖ , paper empty/home position (PE/HP) harness assembly Ⓗ and LF motor Ⓘ .

The frame unit Ⓔ and the bottom cover Ⓕ are separated.

ASSEMBLY

Caution: When connecting cables, set the connector correctly along the lead guide.

(8) Holding the frame unit Ⓔ above the bottom cover Ⓕ , connect each connector of the CR motor Ⓖ , PE/HP harness assembly Ⓗ and LF motor Ⓘ .

(9) Taking care not to pinch the lead wires between the frame unit and the bottom cover, reposition the frame unit on the bottom cover.

(10) Tighten the two frame mounting screws ⓑ .

(11) Insert the head cable into the head connector. (See Section 3.2 Print Head.)

(12) Tighten the two frame mounting screws ⓑ .

(13) Reposition the electrostatic wire, and tighten the screw ⓒ .

(14) Fit the rear end of the body cover to the rear end of the bottom cover, and close the body cover.

(15) With the front side of the body cover raised, insert the switch circuit board harness connector Ⓒ .

(16) Taking care not to pinch the wires, reposition the body cover.

(17) Tighten the two body cover mounting screws ⓐ .

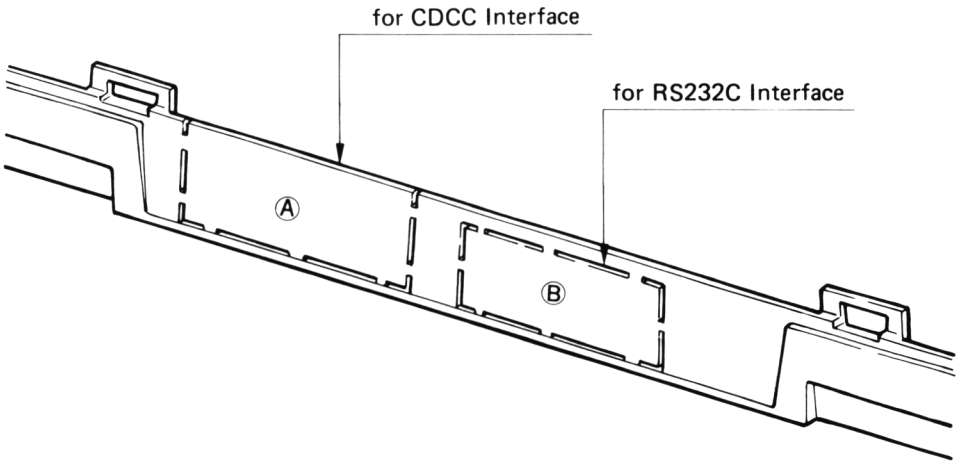
(18) Reposition the top cover in the reverse order of the removal procedure.

Note:

A bottom cover is equipped with knockouts on the rear side for interface connection. The knockouts are cut away when the logic P.C.B. is installed in the factory.

If only a bottom cover is replaced, cut out the knockouts according to the interface to be attached.

For CDCC, cut out knockout Ⓐ using a nipper. For RS 232C, cut out knockout Ⓑ .



(Rear View of Bottom Cover)

3.2 Print Head

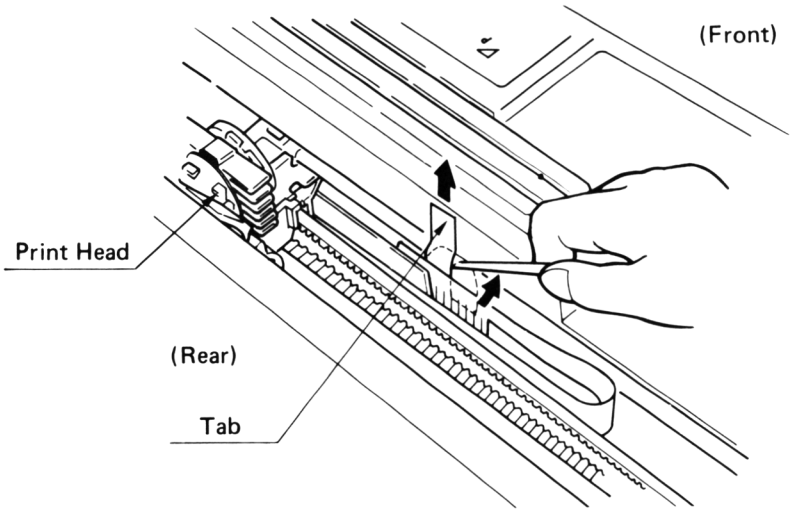
INSTALLING

(1) Remove the top cover, following cover removal procedures described in Section 3.1.

(2) Remove the ribbon cassette, if mounted.

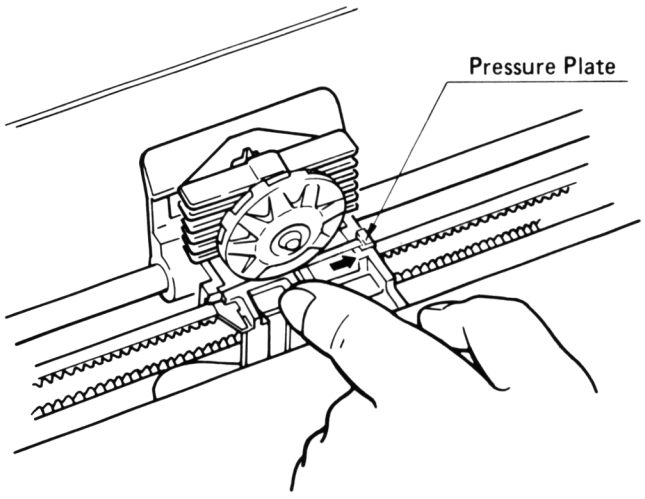
(3) Move the print head to the right end.

(4) Insert a small flat screwdriver or ball-point pen between the flat cable and the folded tab from the left,and pull out the tab.



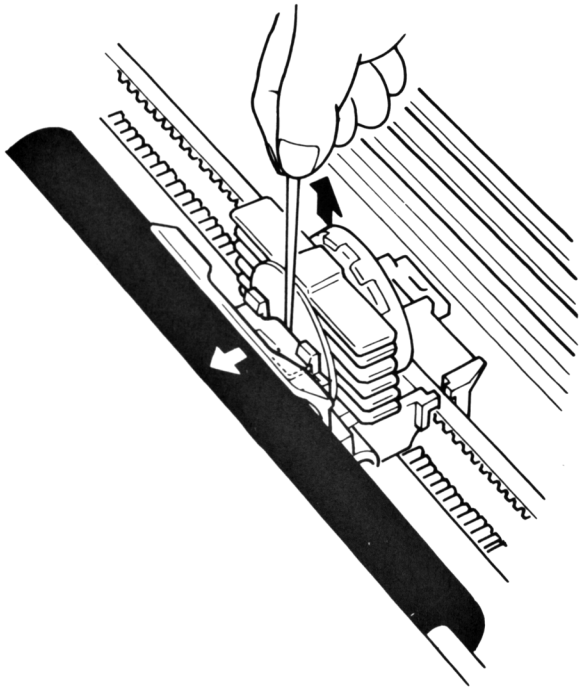
(5) Hold the tab by hand, and pull the cable upward.

(6) Slide the pressure plate to the right.



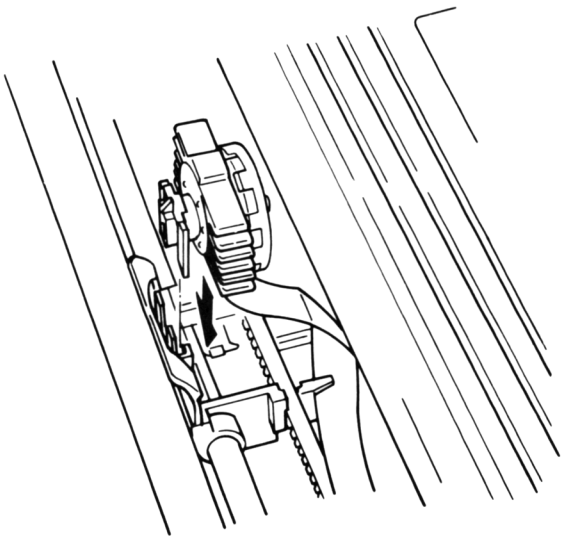
(7) Pull out the print head upward, and the pressure plate also comes off.

— Unless the print head can be pulled out, retry while sliding the head fixing spring toward the platen by using a pointed tool such as tweezers, as shown below.



INSTALLING

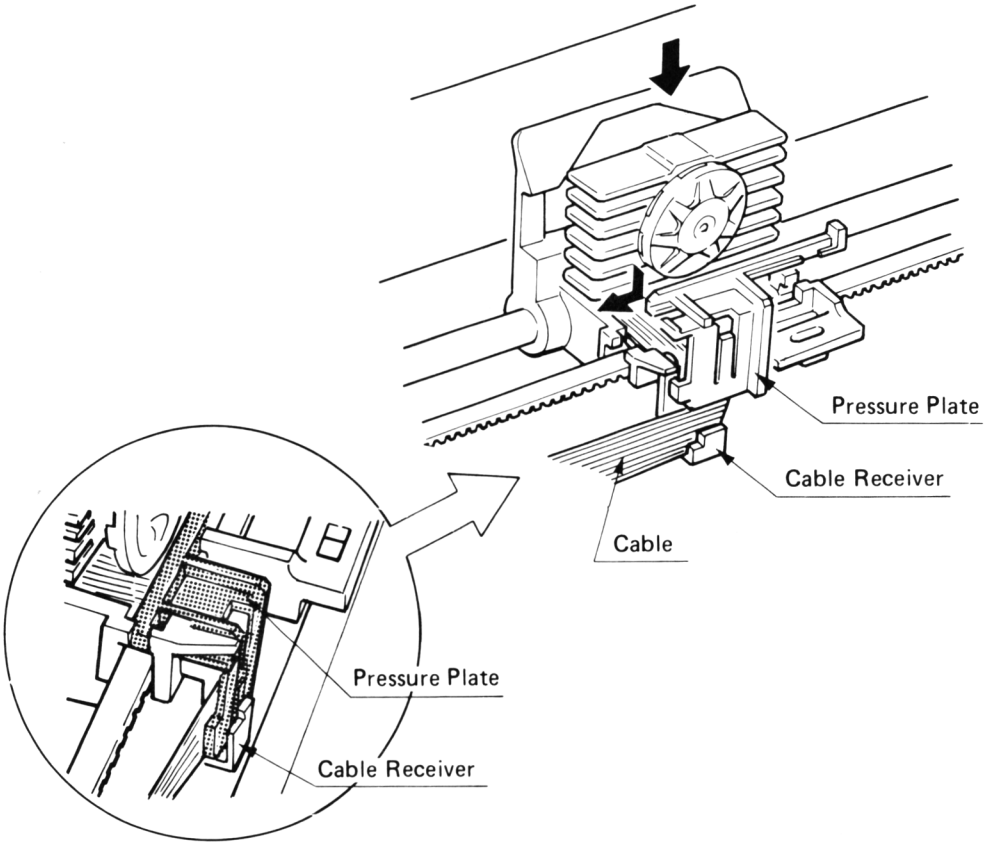
(8) Place a new print head on the carriage, but do not push down the head completely.



(9) Guide the cable between the carriage and the cable receiver.

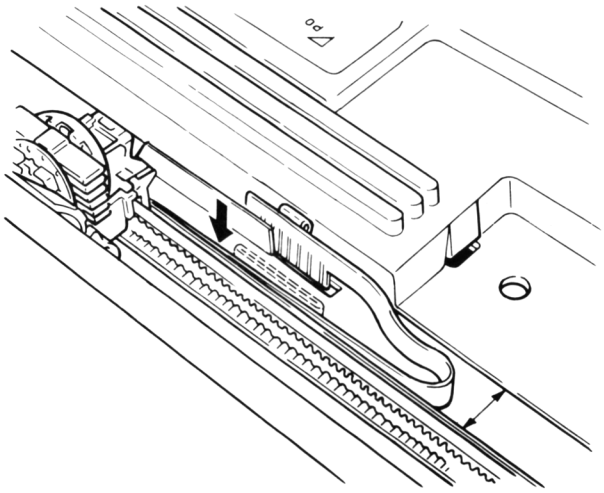
(10) After setting the pressure plate, secure it into position by sliding it to the left.

— Make sure that the lower end of the pressure plate is placed in the cable receiver.



(11) Press the print head downward completely.

(12) Insert the flat cable into the connector with the tab folded.



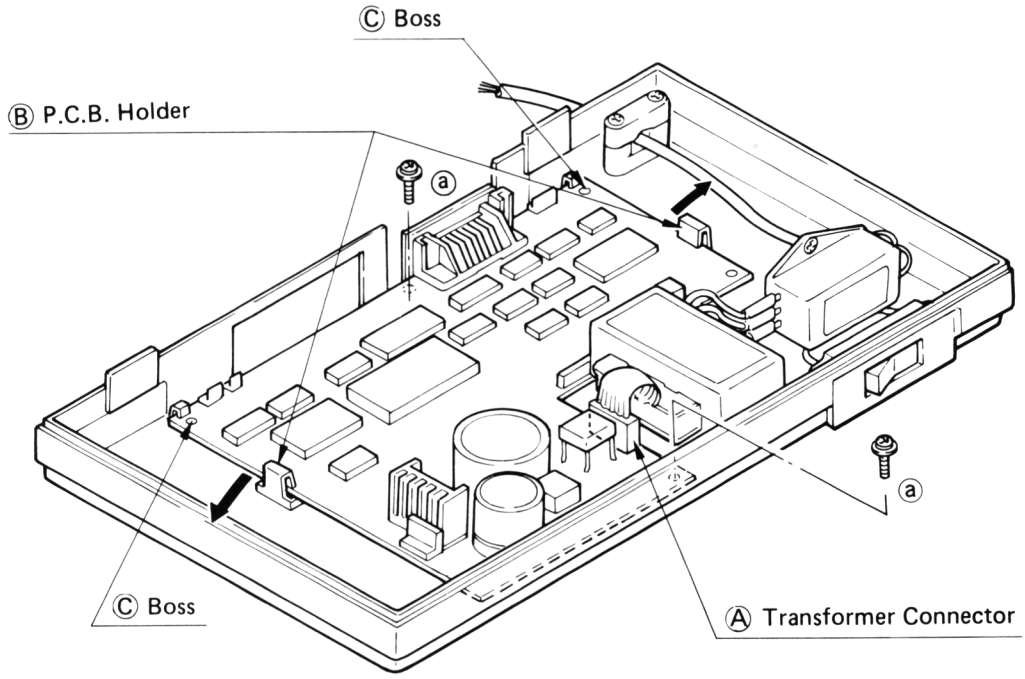
(13) Make sure that the cable is arranged properly and the carriage moves smoothly right and left.

(14) To assure proper print head installation, perform the self test. (See Instruction Manual Section 3.2 Performing Self Test.)

3.3 Logic P.C.B.

DISASSEMBLY

(1) Remove the top cover, body cover and frame unit, following cover removal procedures described in Section 3.1.



(2) Disconnect the connector for transformer assembly Ⓐ .

Caution : When disconnecting connectors, do not pull the wires but the connector body.

(3) Remove logic P.C.B. mounting screw ⓐ .

(4) While manually widening two P.C.B. holders Ⓑ in the direction of the arrows, remove the P.C.B. by raising it upward and forward.

ASSEMBLY

(5) Fit the two holes of a new P.C.B. to each boss Ⓒ on the rear side of the bottom cover, and then lower the P.C.B.

Caution : Make sure that the P.C.B. is firmly fixed to the holders Ⓑ .

(5) Tighten logic P.C.B. mounting screw ⓐ .

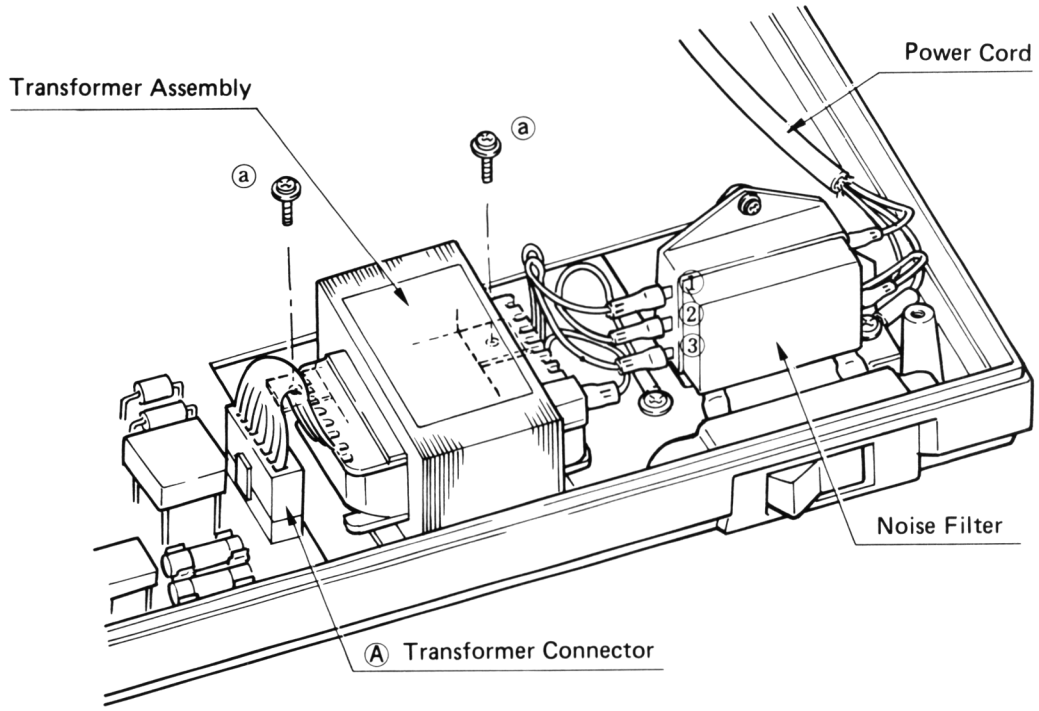
(6) Connect the connector of the transformer assembly Ⓐ .

(7) Reposition the frame unit, body cover and top cover following cover installation procedures described in Section 3.1.

3.4 Transformer Assembly

REMOVAL

(1) Remove the top cover and body cover, following cover removal procedures described in Section 3.1.



(2) Disconnect the transformer connector Ⓐ from the P.C.B.

(3) Extract the two fasten terminals ① and ③ from the noise filter.

(4) Remove the two transformer mounting screws ⓐ .

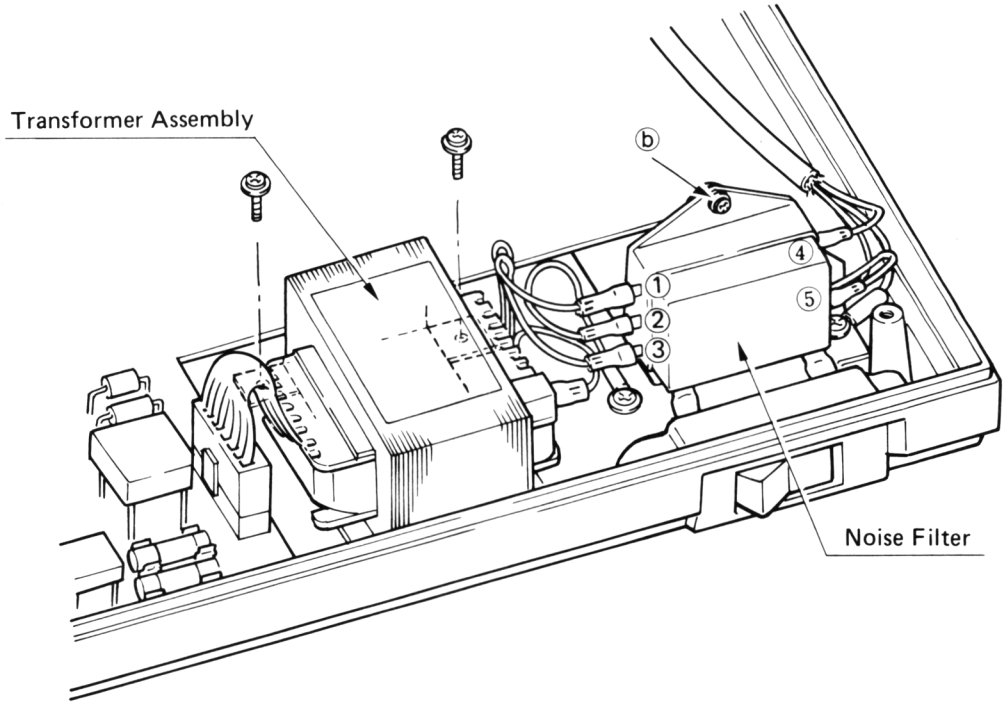
(5) Slide the transformer slightly backward, and remove the transformer.

Install a new transformer assembly in the reverse sequence of the removal procedure.

3.5 Noise Filter

REMOVAL

(1) Remove the top cover and body cover, following cover removal procedures described in Section 3.1.



(2) Extract the five fasten terminals 1 to 5 (1 and 3 for transformer, 2 for ground, 4 for power cord, and 5 for power switch).

(3) Remove the mounting screw ⓑ .

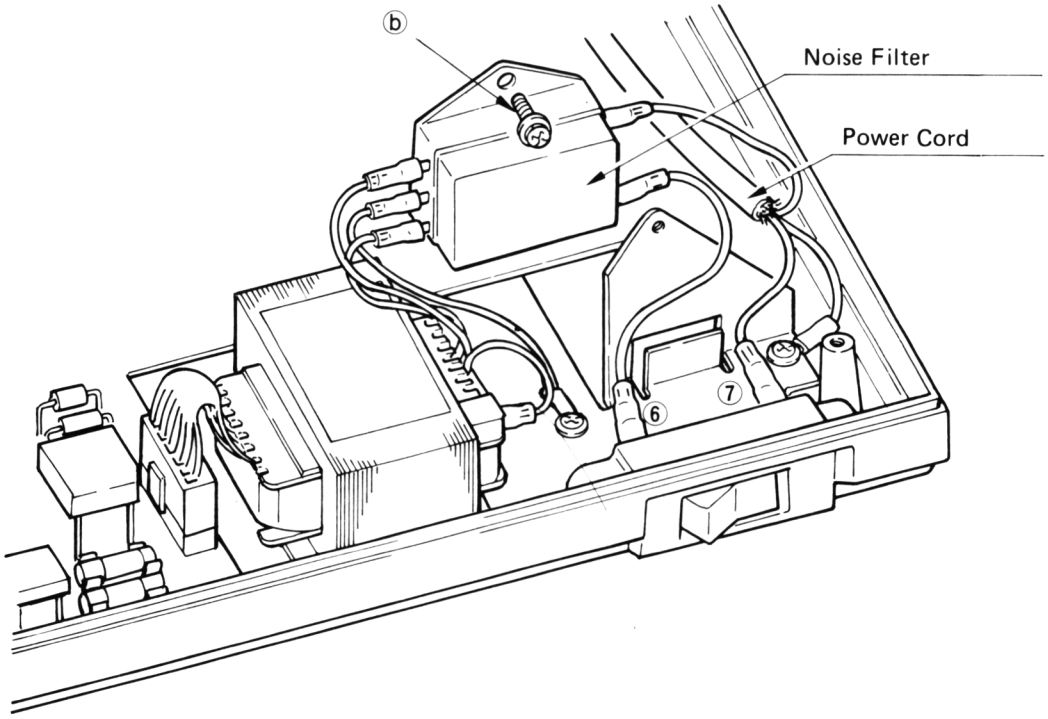
(4) Sliding the noise filter upward, remove it.

Install a new noise filter in the reverse sequence of the removal procedure.

3.6 Power Switch

REMOVAL

(1) Remove the top cover and body cover, following cover removal procedures described in Section 3.1.



(2) Remove the noise filter mounting screw ⓑ, and hold the noise filter upward.

(3) While slacking the two pawls fixing the power switch toward the front, extract the power switch toward the rear.

Caution : Excessively bending of the pawls may cause them to break.

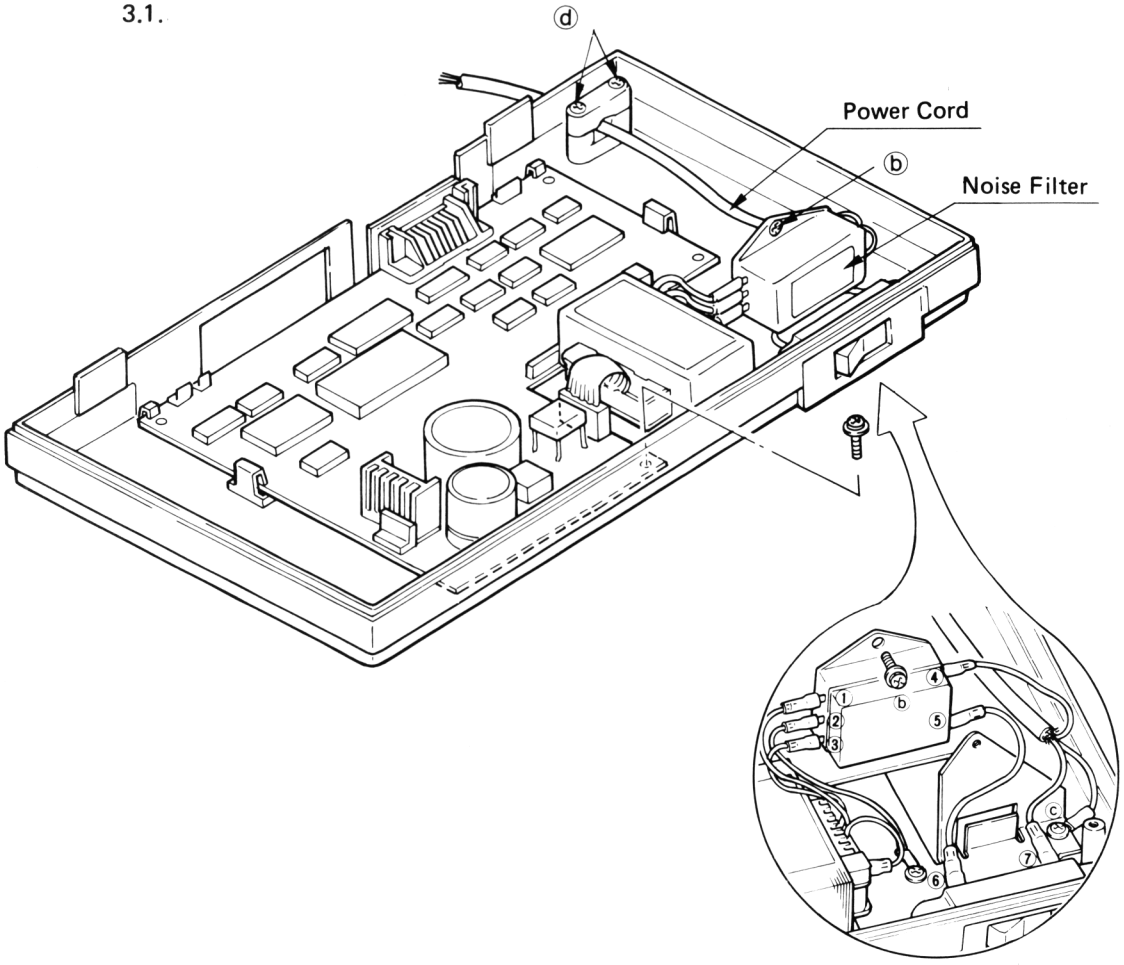
(4) Extract the two fasten terminals 6 and 7 (6 for noise filter and 7 for power cord).

Install a new power switch in the reverse sequence of the removal procedure.

3.7 Power Cord

REMOVAL

(1) Remove the top cover and body cover, following cover removal procedures described in Section 3.1.



(2) Remove the noise filter mounting screw ⓑ , and move the noise filter upward.

(3) Extract the two fasten terminals ④ and ⑦ (④ for noise filter and ⑦ for power switch).

(4) Remove the screw ⓒ for ground terminal.

(5) Remove the two cord holder screws ⓓ , and pull out the cord from the hole on the rear side of the bottom cover.

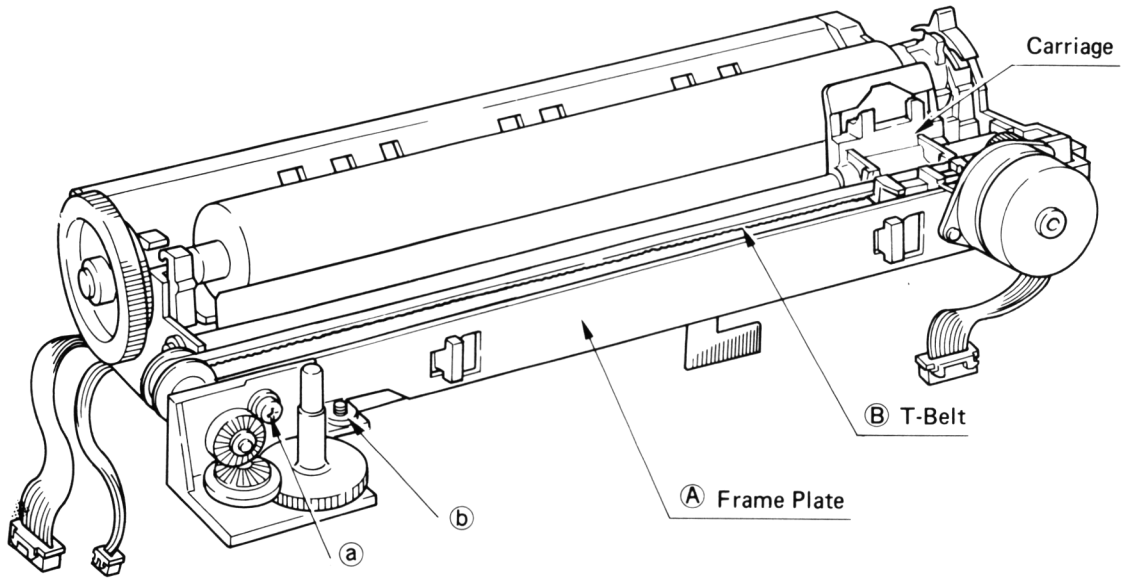
Install a new power cord in the reverse sequence of the removal procedure.

3.8 Timing Belt (T-Belt)

REMOVAL

(1) Following cover removal procedures described in Section 3.1, remove the top cover and body cover, and separate the frame unit from the bottom cover.

(2) Remove the print head following print head removal procedures described in Section 3.2 Print Head.



(3) Remove the ribbon feed (RF) unit mounting scews ⓐ, and RF unit.

(4) Remove the frame plate mounting screw ⓑ.

(5) Sliding the frame plate Ⓐ left, pull it forward.

(6) Take off the T-belt Ⓑ.

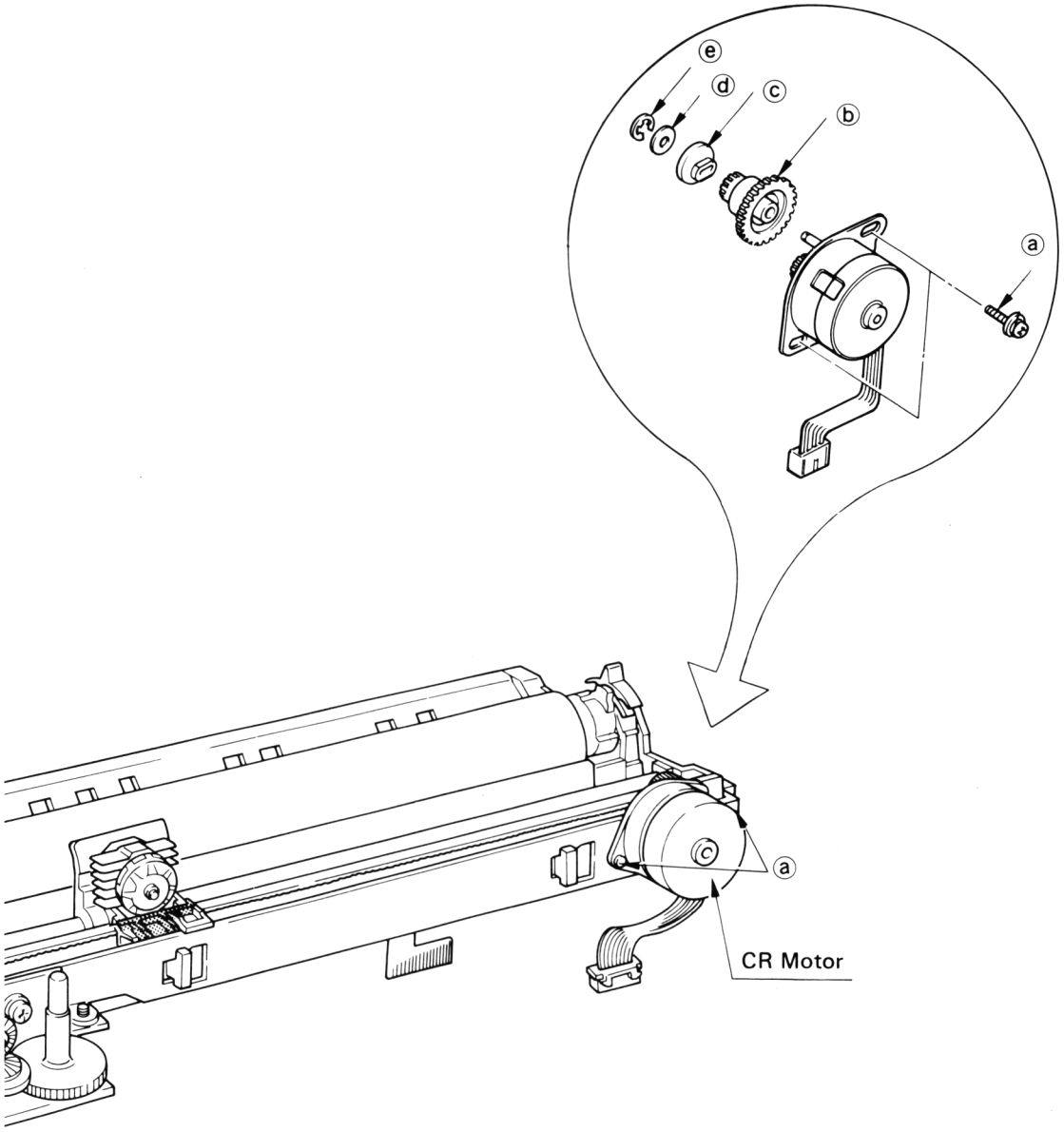
Install a new T-belt in the reverse sequence of the removal procedure.

Caution : After replacement, always adjust the belt tension. (See Section 4.2 T-Belt Tension Adjustment.)

3.9 Carriage (CR) Motor

REMOVAL

(1) Following cover removal procedures described in Section 3.1, remove the top cover and body cover, and separate the frame unit from the bottom cover.



(2) Remove the two motor mounting screws ⓐ , and the CR motor from the frame unit.

(3) Remove snap ring ⓔ .

(4) Pull out plain washer ⓓ , carriage I pulley flange ⓒ , and carriage drive pulley ⓑ from the motor shaft.

(5) Install parts ⓑ , ⓒ , ⓓ and ⓔ removed in step (4) onto a new CR motor.

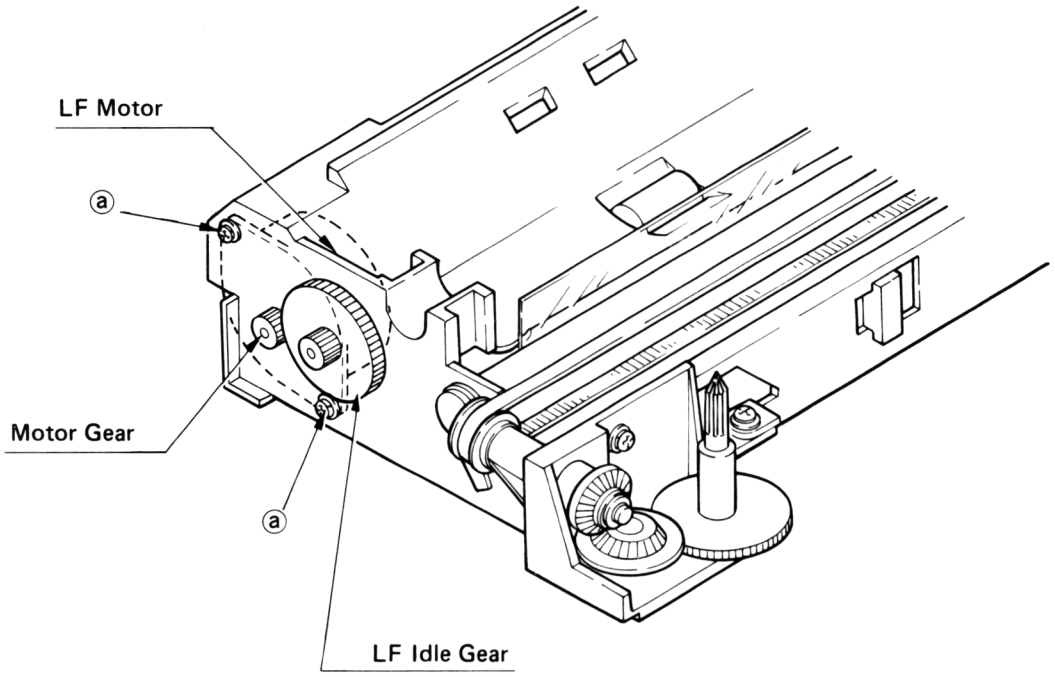
Install the new CR motor in the reverse sequence of the removal procedure.

Caution: After replacement, always adjust the belt tension. (See Section 4.2 T-Belt Tension Adjustment.)

3.10 Line Feed (LF) Motor

REMOVAL

(1) Following cover removal procedures described in Section 3.1, remove the top cover and body cover, and separate the frame unit from the bottom cover.



(2) Turn the frame unit upside down.

(3) Remove the two LF motor mounting screws ⓐ .

(4) Take off the LF motor from the frame unit and the LF idle gear.

INSTALLATION

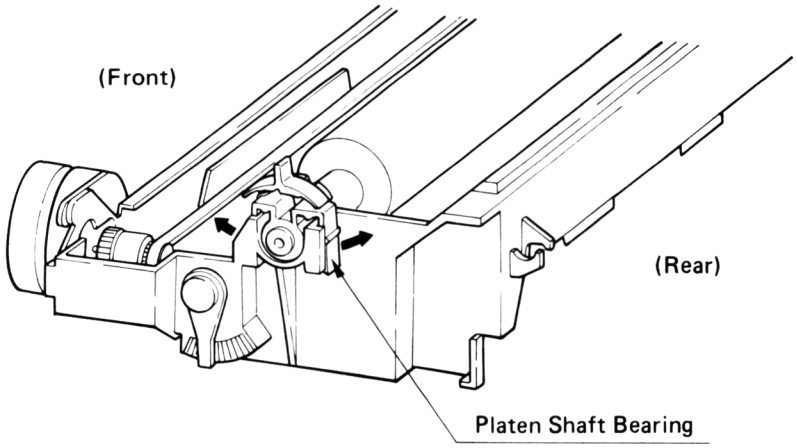
(5) Engaging the motor gear with the LF idle gear and the platen knob gear, install a new LF motor to the frame unit.

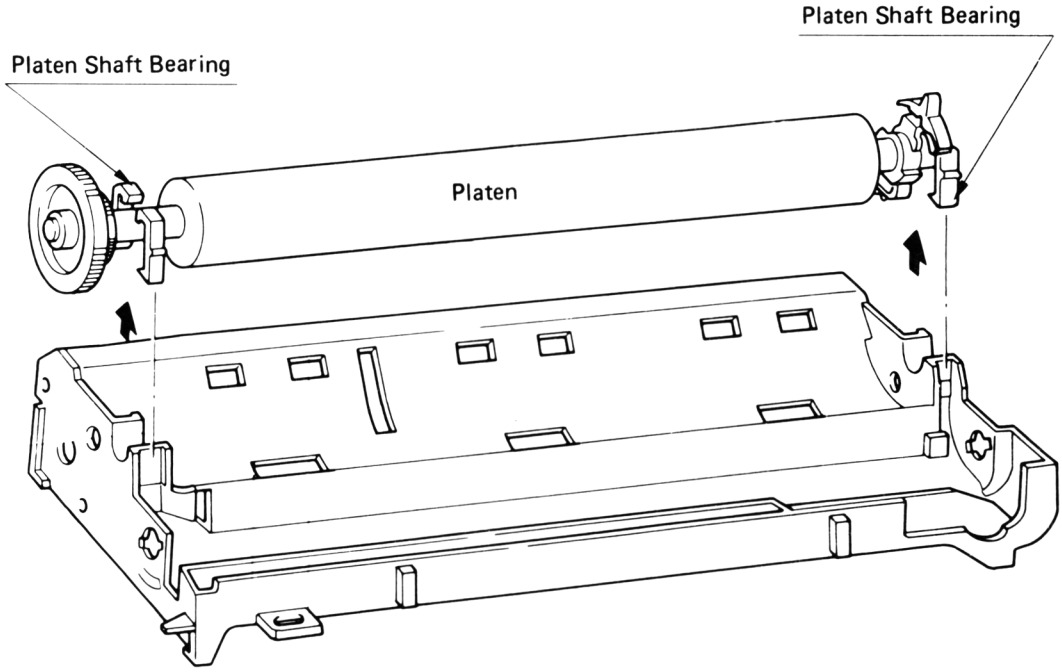
(6) Tighten the two LF motor mounting screws ⓐ .

Caution: When installing the LF motor, be sure to press the motor toward the platen and then tighten the screws.

3.11 Platen Assembly

(1) Following cover removal procedures described in Section 3.1, remove the top cover and body cover, and separate the frame unit from the bottom cover.





(2) Opening the pawls of each platen shaft bearing outward, remove the platen assembly upward.

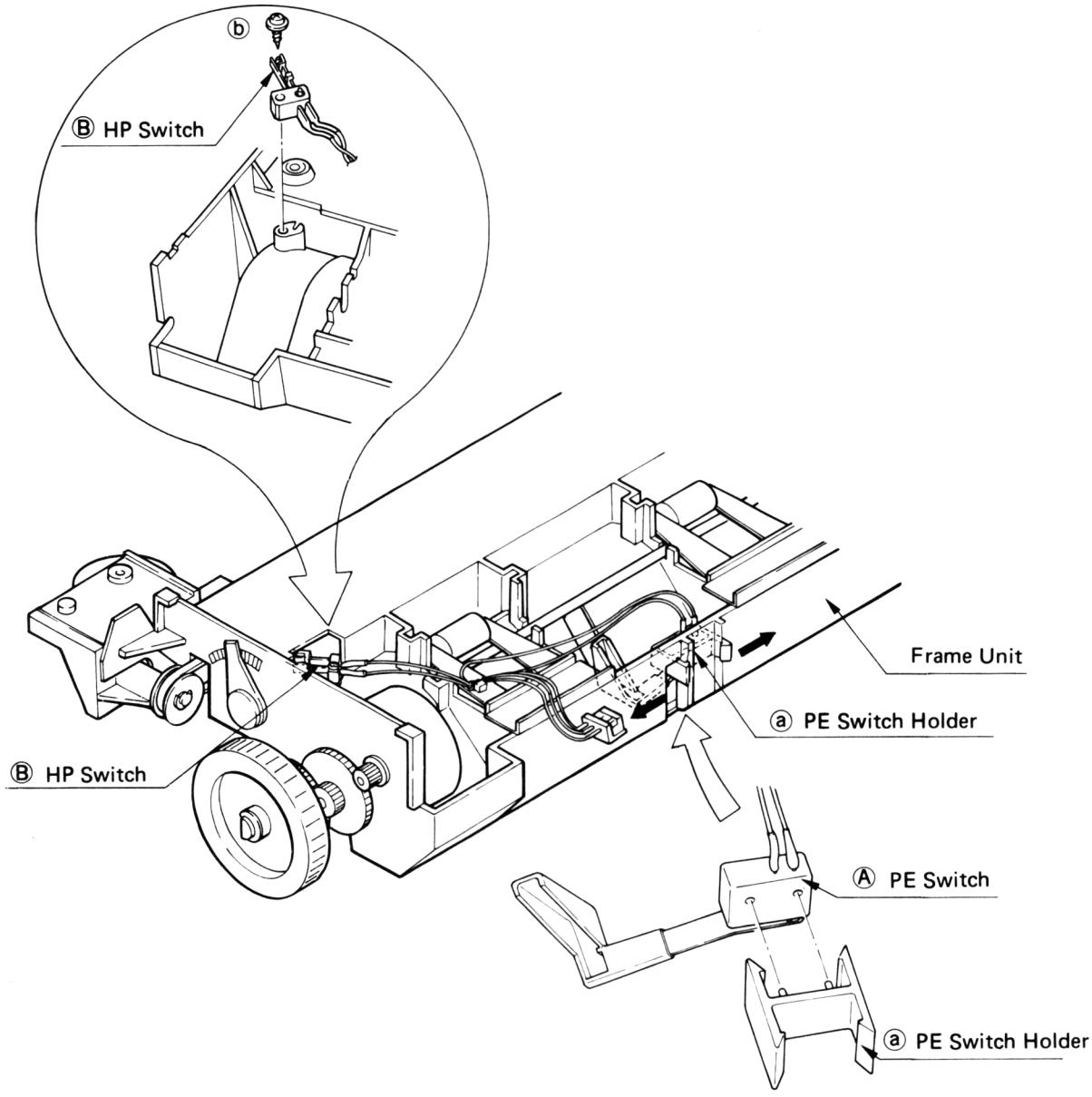
Install a new platen assembly in the reverse sequence of the removal procedure.

Caution: Make sure that the pawls of each platen shaft bearing are firmly inserted to the frame.

3.12 Paper Empty (PE)/Home Position (HP) Switch

(1) Following cover removal procedures described in Section 3.1, remove the top cover and body cover, and separate the frame unit from the bottom cover.

(2) Turn the frame unit upside down.



(3) Opening the pawls of the PE switch holder ⓐ in the direction of the arrows, remove the PE switch holder from the frame unit.

(4) Opening the pawls of the PE switch holder ⓐ outward, remove the PE switch Ⓐ from the holder.

(5) Remove the HP switch mounting screw ⓑ , and remove the HP switch Ⓑ .

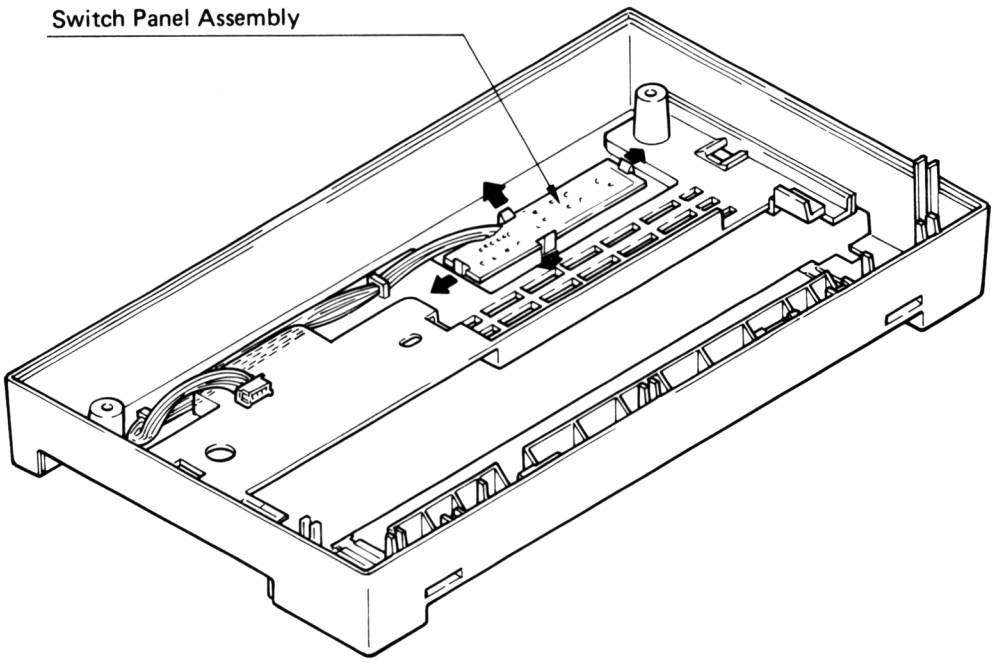
Install a new PE/HP switch assembly in the reverse sequence of the removal procedure.

Caution: Make sure that the pawls of the PE switch holder are holding the PE switch and the frame unit firmly.

3.13 Switch Panel Assembly

(1) Remove the top cover and body cover following cover removal procedures described in Section 3.1.

(2) Turn the body cover upside down.



(3) Opening the four pawls outward, take off the switch panel assembly.

Install a new switch panel assembly in the reverse sequence of the removal procedure.

Caution: Make sure that the switch circuit board is firmly fixed to the body cover by the pawls.

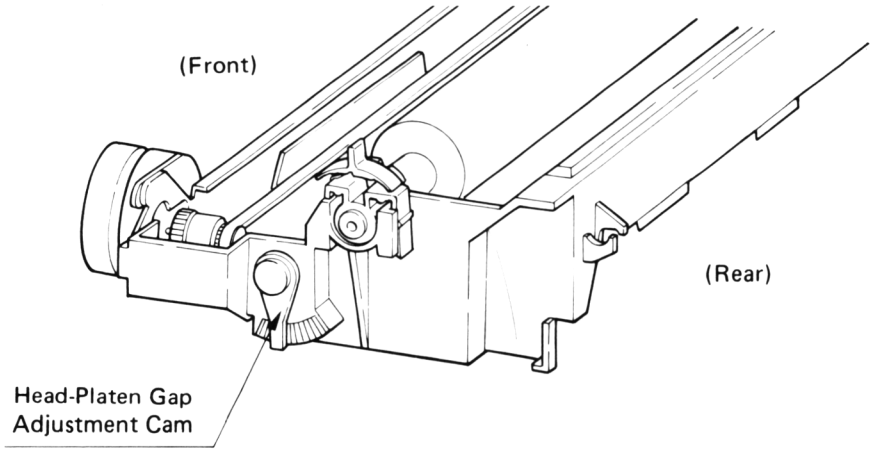
4. Adjustment

This section describes the mechanical adjustment procedures for the head and platen gap, and T-belt tension.

4.1 Head and Platen Gap Adjustment

Improper gap between the head and platen causes poor print quality such as faint or smeared printouts.

If such is the case, adjust the head and platen gap with the head-platen gap adjustment cams located on both sides of the frame, making the gap from 0.4 to 0.48 mm.



4.2 T-Belt Tension Adjustment

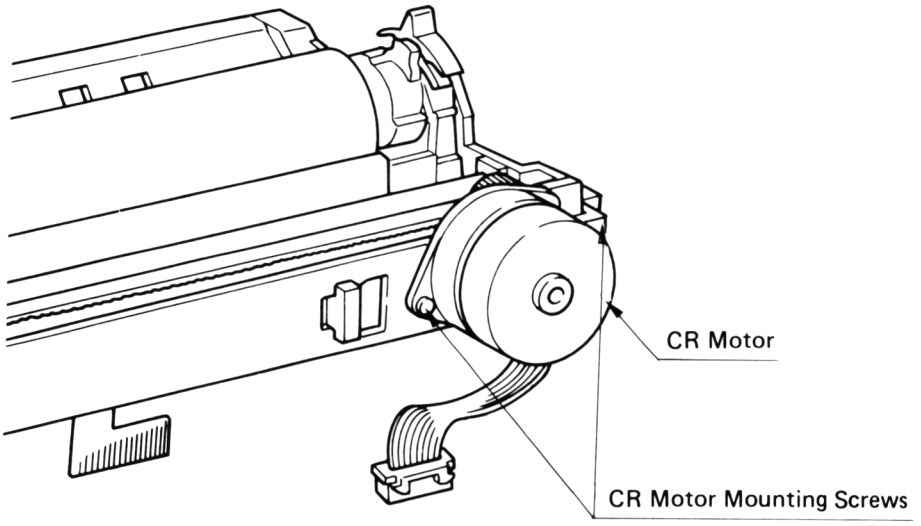
Improper T-belt tension may cause belt tooth skipping or carriage travel overload. After T-belt or CR motor replacement, always adjust the belt tension as described below:

(1) Move the carriage to the left end of the frame.

(2) Loosen the two CR motor mounting screws.

(3) Moving the CR motor, adjust the belt tension so that the belt flexture becomes 8 to 10 mm when a vertical load of 100 g is applied at the center of the belt span.

(4) Fasten the CR motor mounting screws.

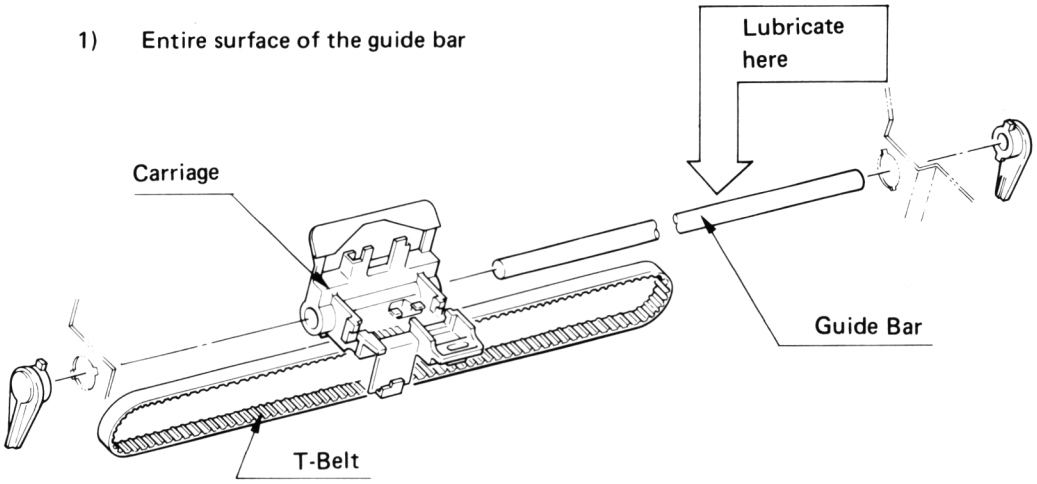


5. Lubrication

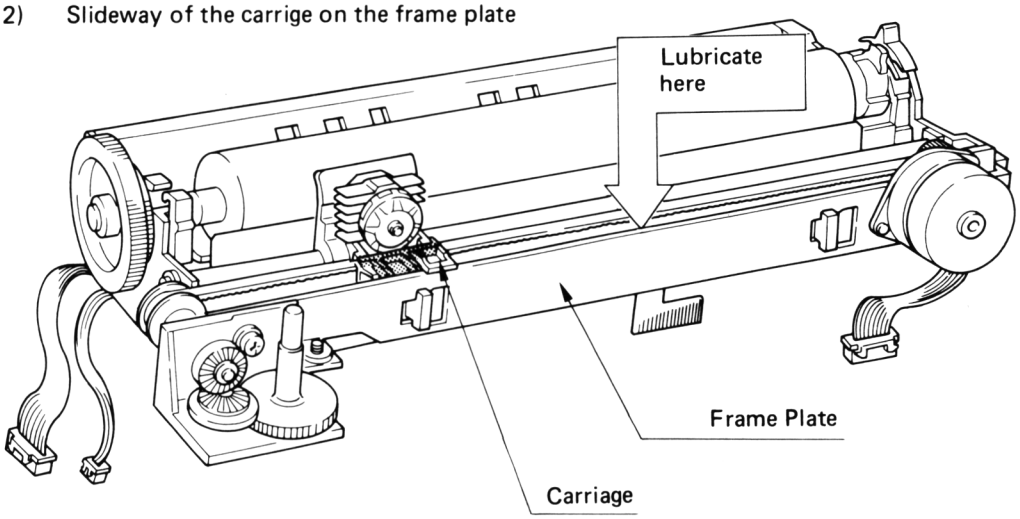
(A) Lubricate the following points with silicone oil KF961 (100 cs) manufactured by Shin-etsu Silicone Ltd. or its equivalent.

Apply small amounts of oil to each lubrication point uniformly so that the oil does not drip.

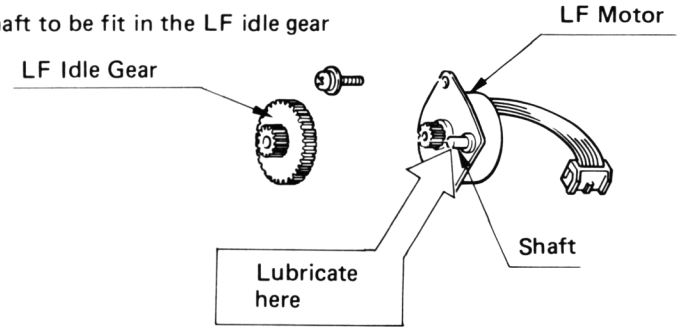
1) Entire surface of the guide bar



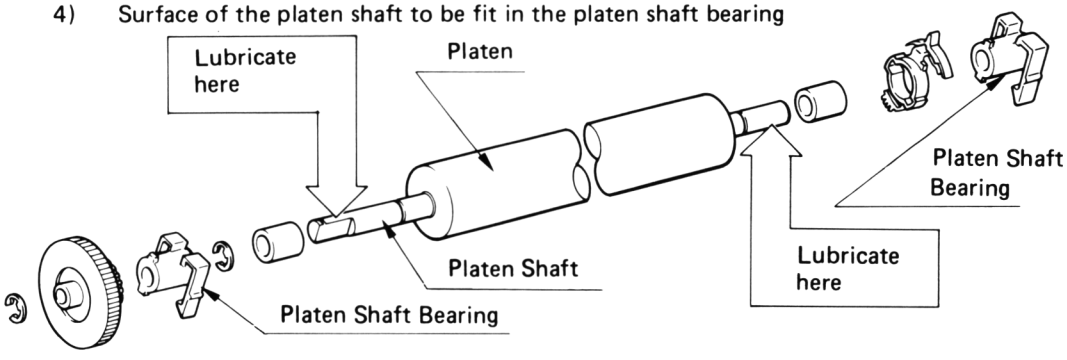
2) Slideway of the carrige on the frame plate



3) Surface of the shaft to be fit in the LF idle gear



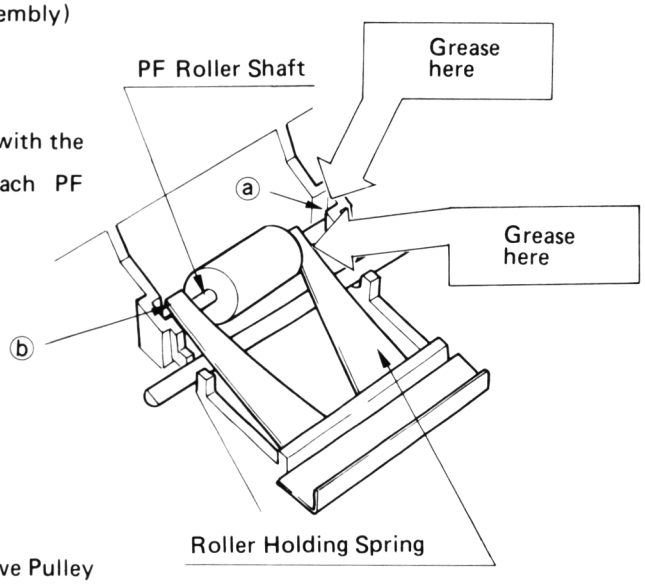
4) Surface of the platen shaft to be fit in the platen shaft bearing



(B) Lubricate the following points with grease B:

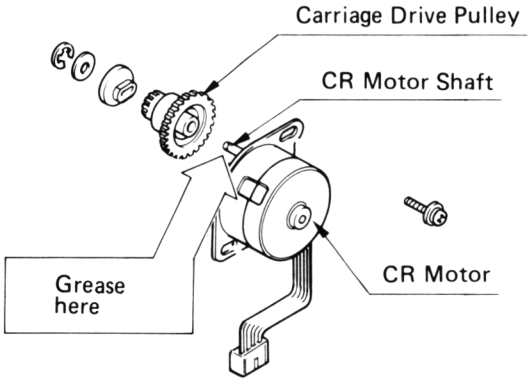
1) Paper Feed (PF) Roller Assembly

- Guide ⓐ for the paper feed (PF) roller shaft assembly (2 points each PF roller assembly)
- PF roller shaft surface ⓑ in contact with the roller holding spring (2 points each PF roller assembly)



2) CR Motor Shaft Fitting the Carriage Drive Pulley

- Grease the CR motor shaft.
- Rotating the carriage drive pulley, fit it to the CR motor shaft.

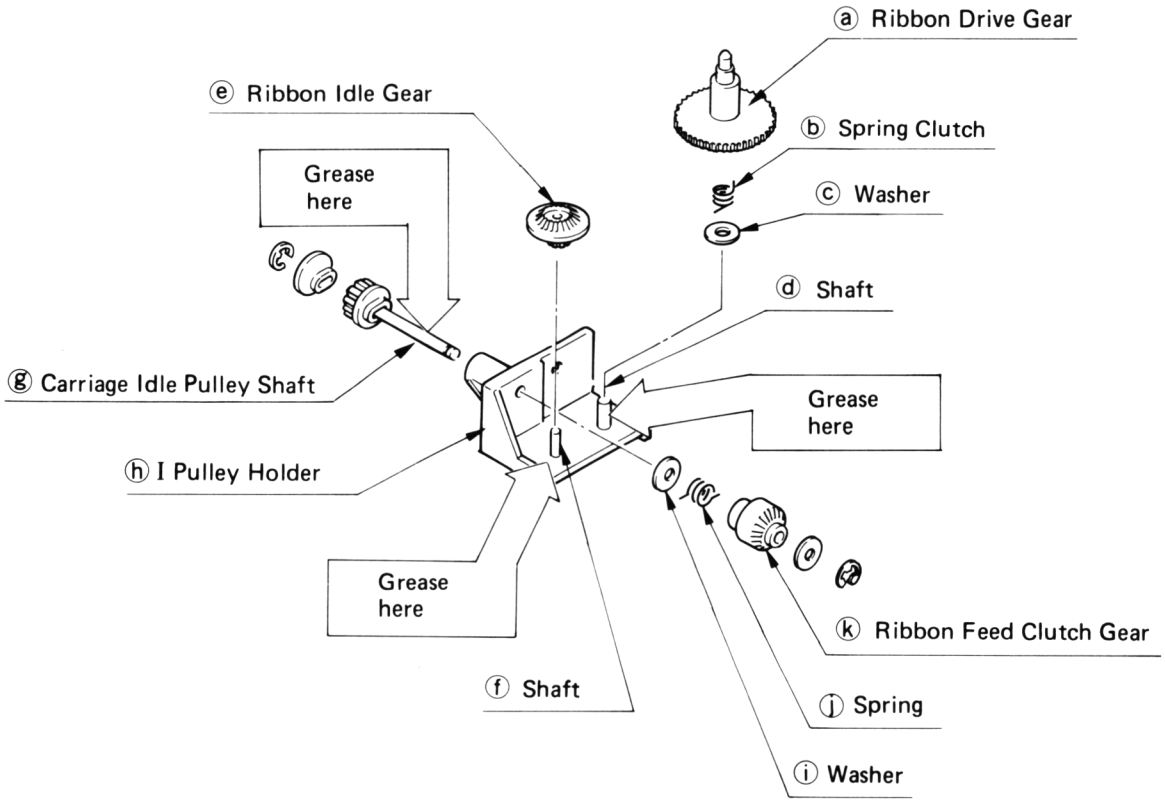


3) Idle Pulley Unit Assembly

- Surface of the shaft ⓓ to be fit in the ribbon drive gear ⓐ .
  - Grease the shaft ⓓ .
  - Set the washer ⓒ and the spring clutch ⓑ to the shaft ⓓ , and grease over the spring clutch so as to be buried in grease.
  - Fit the ribbon drive gear ⓐ to the shaft ⓓ .

- Surface of the shaft ⓕ to be fit in the ribbon idle gear ⓔ .
  - Grease the shaft ⓕ , and then fit the ribbon idle gear ⓔ to the shaft.

- Surface of the carriage idle pulley shaft ⓖ to be fit in the ribbon feed clutch gear ⓚ
  - Grease the carriage idle pulley shaft ⓖ.
  - Mount the shaft ⓖ into the I pulley holder ⓗ .
  - Set the washer ⓘ and the spring clutch ⓙ to the shaft ⓖ , and grease over the spring clutch so as to be buried in grease.
  - Fit the ribbon feed clutch gear ⓚ to the shaft ⓖ .



(C) CONTROL ELECTRONICS

CONTENTS

PRINCIPLES OF OPERATION

1. Configuration

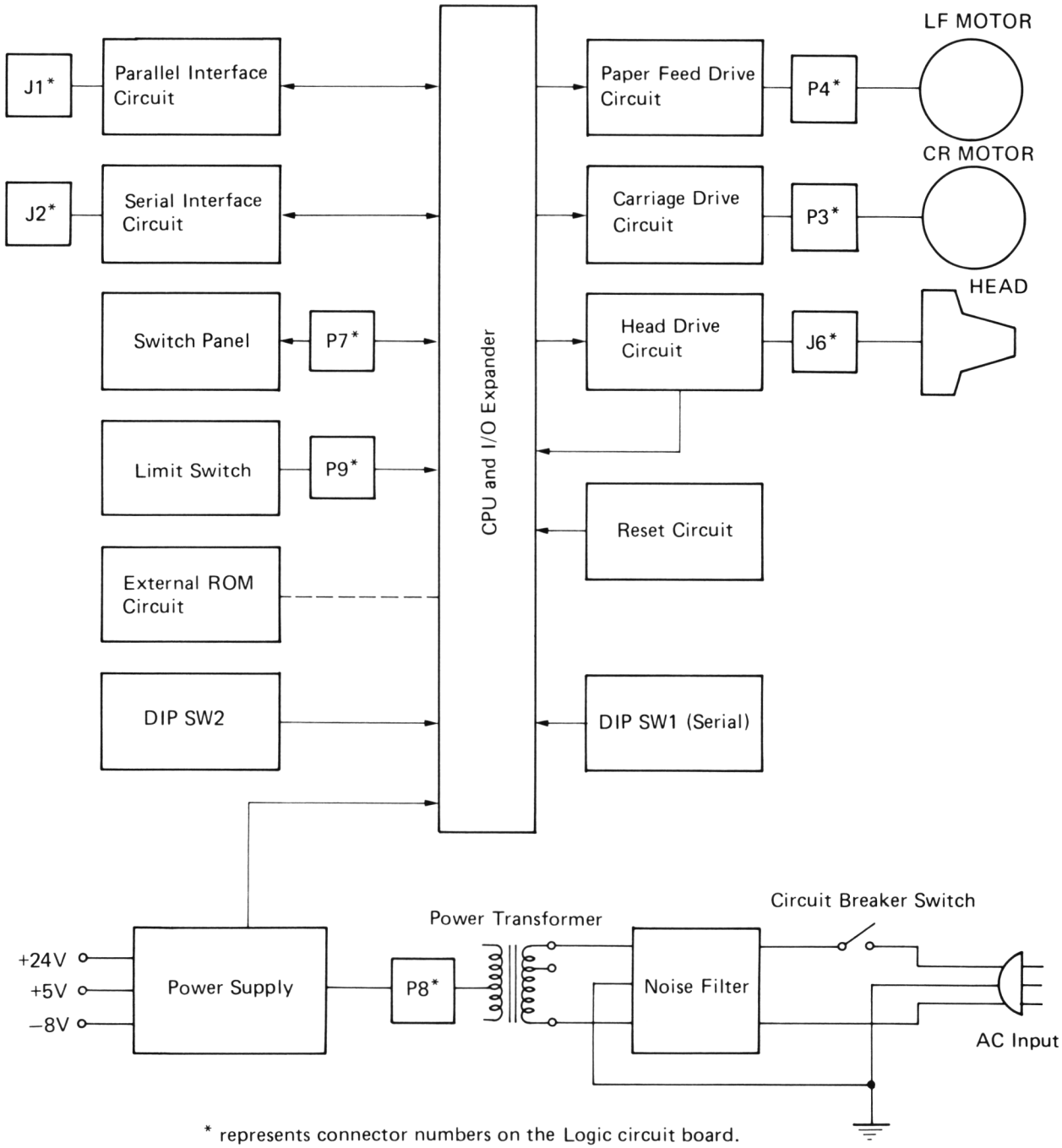


Figure 1.1 Block Diagram of Printer Electronics

○ This printer has either a B488013 or B488009 Logic circuit board.

(1) P.C.B. B488013 has a μPD7810 CPU and external ROM.

(2) P.C.B. B488009 has a μPD7809 CPU and internal masked ROM. It has no external ROM circuit.

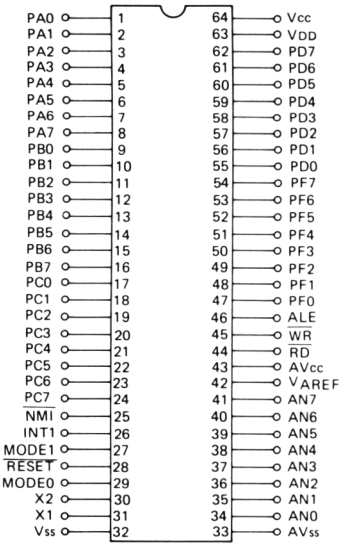
2. CPU

This printer adopts a μPD7810 CPU or μPD7809 CPU (both manufactured by NEC). The μPD7810 and μPD7809 are controlled by an external ROM and by an 8K byte internal masked ROM built in the CPU, respectively.

P.C.B. B488013 has an external ROM circuit, and is controlled by μPD7810 CPU and the external ROM. P.C.B. B488009 has no external ROM circuit, and is controlled by only μPD7809 CPU. Each CPU incorporates 256 byte RAM in it. These two CPUs are not hardware-compatible each other. An 8 bit A/D converter on the μPD7810 is substituted for a 16 level comparator on the μPD7809. However, the basic operations of these CPUs are identical.

Figure 2.1 shows pin connections of each CPU.

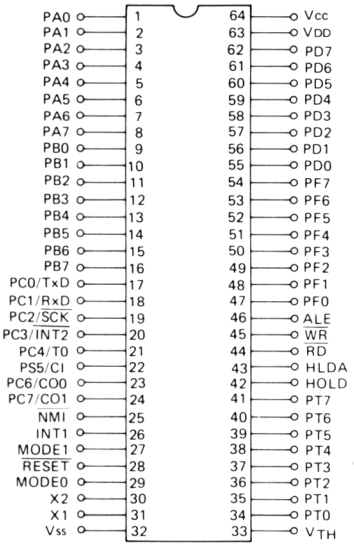
μPD7810 on P.C.B. B488013



PA7–0 : Port A
PB7–0 : Port B
PC7–0 : Port C
PD7–0 : Port D
PF7–0 : Port F
NMI : Non Maskable Interrupt
INT1 : Interrupt Request

MODE0, 1 : Mode0, 1
X1, X2 : Crystal
AN7–0 : Analog Input
RD : Read Strobe
WR : Write Strobe
ALE : Address Latch Enable
RESET : Reset
VAREF : Reference Voltage

μPD7809 on P.C.B. B488009



PA7–0 : Port A
PB7–0 : Port B
PC7–0 : Port C
PD7–0 : Port D
PF7–0 : Port F
NMI : Non Maskable Interrupt
INT1 : Interrupt Request
MODE0, 1 : Mode0, 1
X1, X2 : Crystal

PT7–0 : Port T
RD : Read Strobe
WR : Write Strobe
ALE : Address Latch Enable
RESET : Reset
VTH : Threshold Voltage
HOLD : Hold Request
HLDA : Held Acknowledge

Figure 2.1 Pin Connections (Top View)

Table 2.1 Pin Names and Functions (μPD7810)

Pin No.	Name	I/O	Function
1 – 8	PA0 – PA7	I/O	Port A
9 – 16	PB0 – PB7	I/O	Port B
17 – 24	PC0 – PC7	I/O	Port C
25	$\overline{\text{NMI}}$	Input	Non Maskable Interrupt
26	INT1	Input	Interrupt Request
27	MODE1	I/O	Mode 1
28	$\overline{\text{RESET}}$	Input	Reset
29	MODE0	I/O	Mode 0
30 – 31	X2 – X1		Crystal
32	V_{SS}		Ground
33	AV_{SS}		Signal Ground for A/D Converter
34 – 41	AN0 – AN7	Input	Analog Input
42	V_{AREF}	Input	Reference Voltage
43	AV_{CC}		Power Source for A/D Converter
44	$\overline{\text{RD}}$	Output	Read Strobe
45	$\overline{\text{WR}}$	Output	Write Strobe
46	ALE	Output	Address Latch Enable
47 – 54	PF0 – PF7	I/O	Port F
55 – 62	PD0 – PD7	I/O	Port D
63	V_{DD}		+5V for RAM
64	V_{CC}		+5V

Table 2.2 Pin Names and Functions (μPD7809)

Pin No.	Name	I/O	Function
1 – 8	PA0 – PA7	I/O	Port A
9 – 16	PB0 – PB7	I/O	Port B
17	PC0/TXD	I/O	Port C
18	PC1/RXD	I/O	
19	PC2/$\overline{SCK}$	I/O	
20	PC3/$\overline{INT2}$	I/O	
21	PC4/TO	I/O	
22	PC5/CI	I/O	
23	PC6/CO0	I/O	
24	PC7/CO1	I/O	
25	$\overline{NMI}$	Input	Non Maskable Interrupt
26	INT1	Input	Interrupt Request
27	MODE1	I/O	Mode 1
28	$\overline{RESET}$	Input	Reset
29	MODE0	I/O	Mode 0
30 – 31	X2 – X1		Crystal
32	V_{SS}		Ground
33	V_{TH}	Input	Threshold Voltage
34 – 41	PT0 – PT7	Input	Port T
42	HOLD	Input	Hold Request
43	HLDA	Output	Hold Acknowledge
44	$\overline{RD}$	Output	Read Strobe
45	$\overline{WR}$	Output	Write Strobe
46	ALE	Output	Address Latch Enable
47 – 54	PF0 – PF7	I/O	Port F
55 – 54	PD0 – PD7	I/O	Port D
63	V_{DD}		+5V for RAM
64	V_{CC}		Ground

3. CPU and its Related Circuits

M50780 (Compatible with TMS1025N2LC manufactured by Texas Instruments) is used as an extension port of CPU. This extension port acts as an output port when the MS pin is High; and it acts as an input port when the MS pin is Low.

Four bits controllable in one group can be selected by address pins S0, S1 and S2. R0, R1, R2 and R3 are data pins for the CPU. STD pin transmits data latch signals to the output ports when this extension port acts as an output port. And when this extension port acts as an input port, turning CE pin High transfers data to CPU.

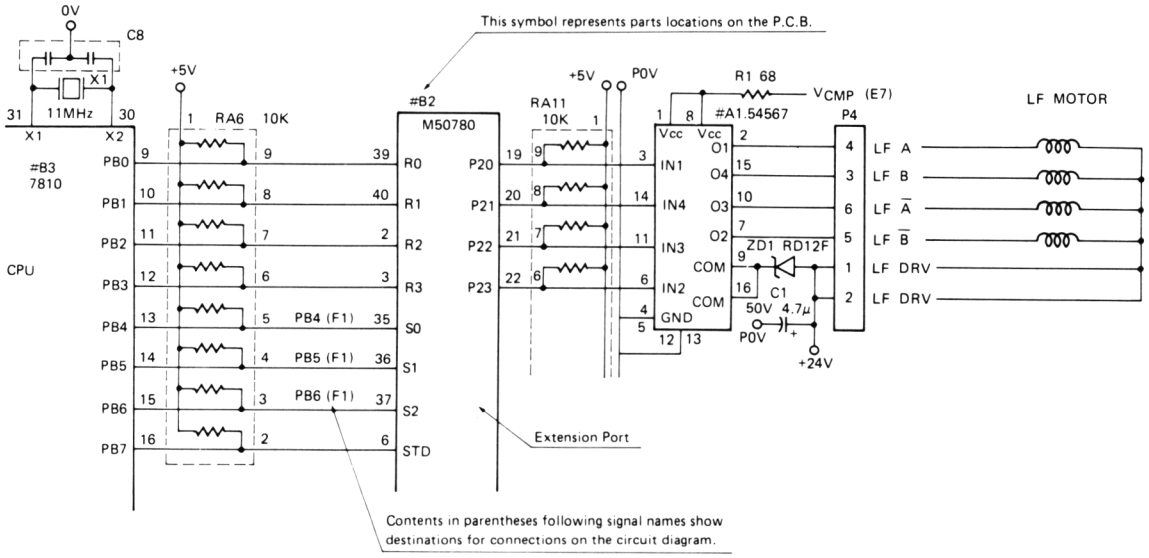


Figure 3.1 Paper Feed Drive Circuit

Figure 3.1 shows a paper feed drive circuit on P.C.B. B488013. P.C.B. B488009 also has the same circuit. The M50780 extension port has 28 (7 x 4) ports. Four ports of P2X group are used in the above example. Address pins S0, S1 and S2 are set to 2, and data is set on the data pins R0, R1, R2 and R3. Turning STD pin Low from High causes the data on the data pins to be latched and output to Ports P20, P21, P22 and P23.

As mentioned before, P.C.B. B488013 is controlled by an external ROM. The ROM circuit is shown in Figure 3.2.

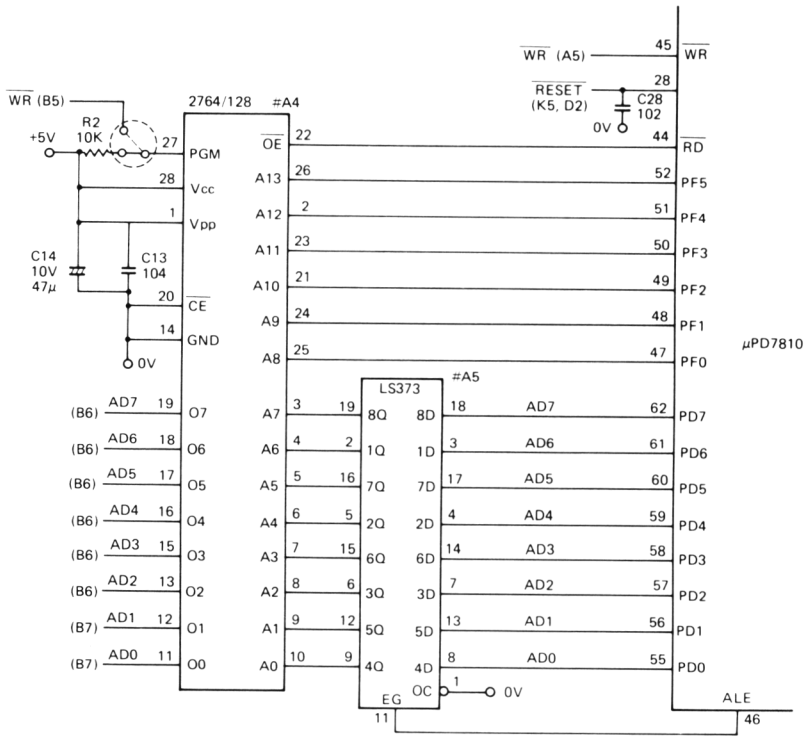


Figure 3.2 External ROM Circuit

The capacity of the ROM is usually 8K bytes, but it is expandable to 16K bytes. The access time must be not more than 350 ns. Ports PD0 ~ PD7 have multiplexing capability of address data, and low-order addresses are latched in 74LS373 by an ALE signal.

No circuit using data bus exists except for this circuit.

P.C.B. B488009 has not this circuit.

4. Interface Circuits

This printer has a Centronic Interface as a standard feature. Optional RS-232C Interface is also available.

4.1 Centronics Interface Circuit

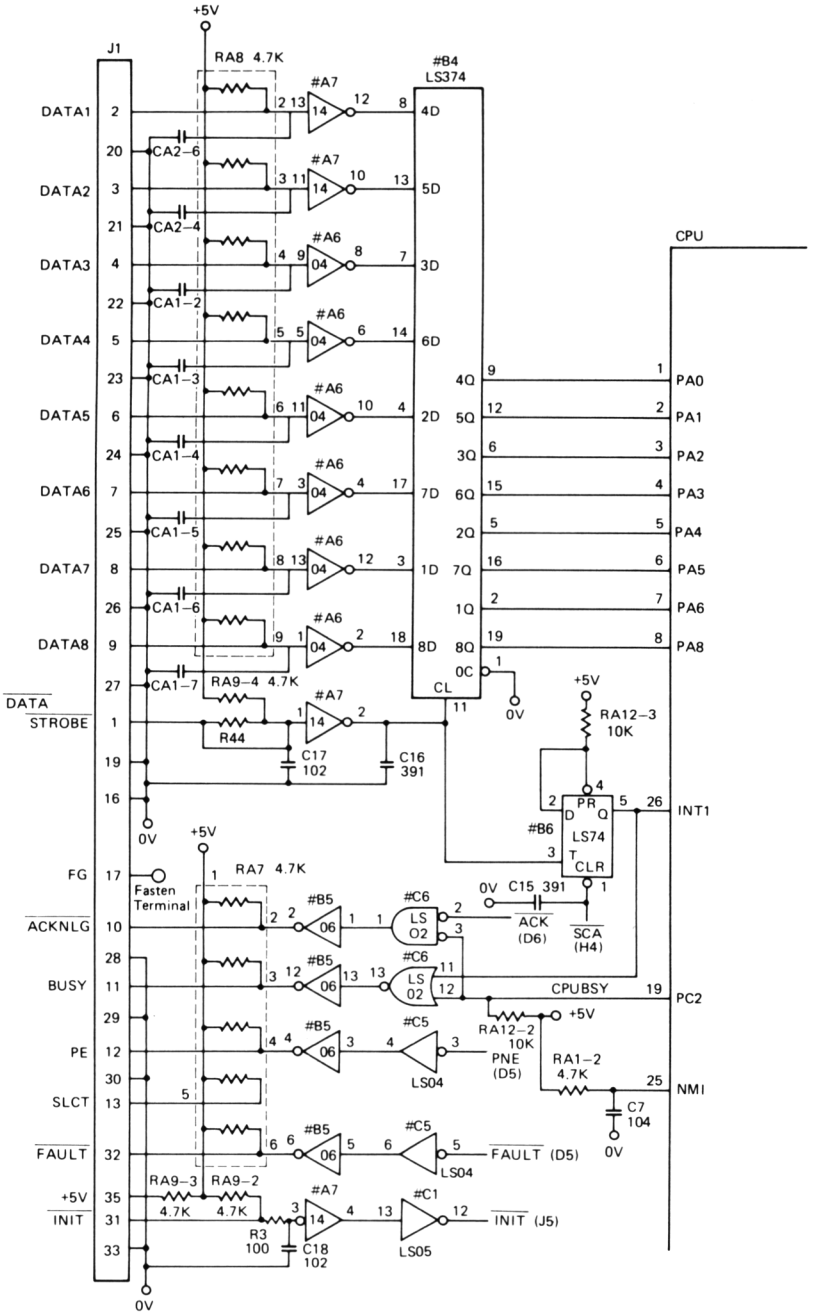


Figure 4.1 Centronics Interface Circuit

Figure 4.1 shows a Centronics Interface circuit on P.C.B. B488013. This configuration is idèntical with that on P.C.B. B488009.

Eight bit data input from the connector J1 is latched in IC74LS374 by $\overline{\text{DATA STROBE}}$ signal. At the same time, F/F IC74LS74 is also set to 1. The output of the DATA F/F is connected to Interrupt pin INT1 of CPU, and also causes BUSY signal to turn High. CPU reads in the latched data of the 74LS374 by the INT1 interruption. After CPU completes the data read operation, the DATA F/F is cleared by

an $\overline{SCA}$ signal. Then, BUSY is turned to Low, and $\overline{ACKNLG}$ is transmitted.

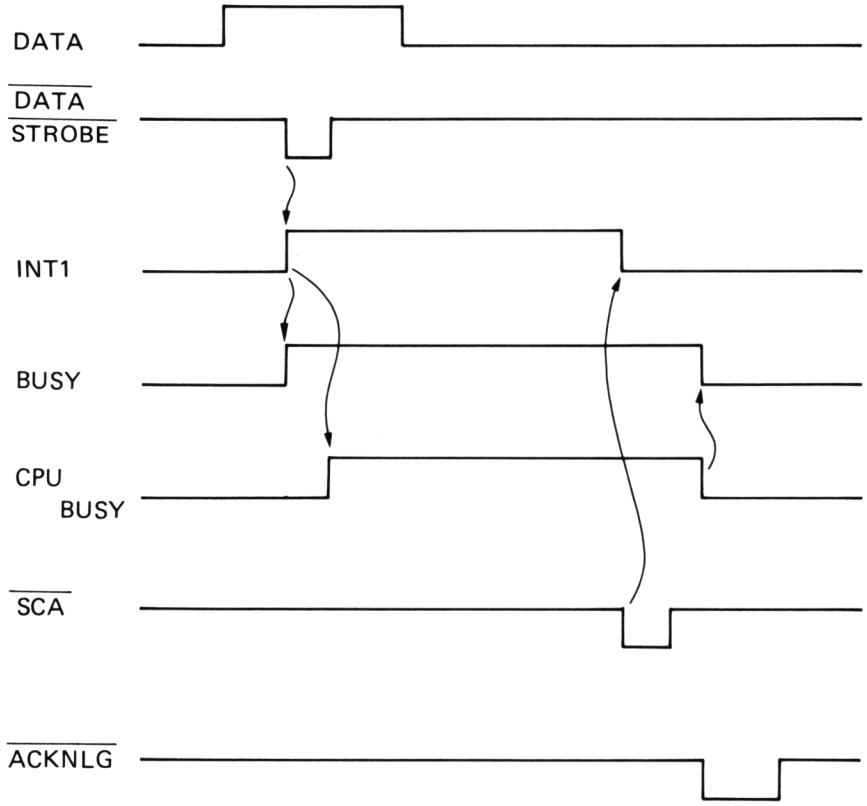


Figure 4.2 Centronics Interface Timing

The BUSY time is approximately 350 μs if the data is alphanumeric Kana data, and the pulse width of the $\overline{ACKNLG}$ is approximately 6 μs.

When there is no paper in the printer, PE signal is turned to High, with more three lines feeding after hardware detects the paper out status. $\overline{FAULT}$ signal is turned to Low when PE, SELECT OFF or MOTOR ERROR occurs. $\overline{INIT}$ signal is fed to reset circuits.

5. Switch Panel

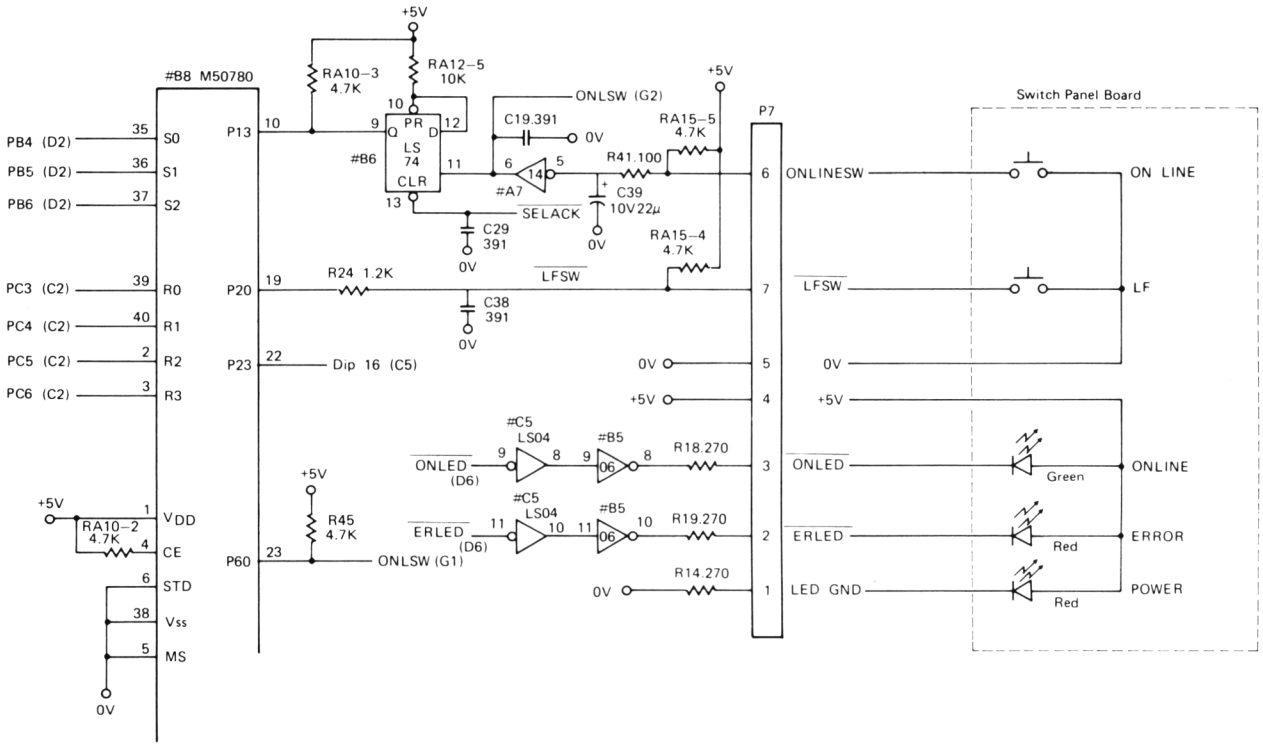


Figure 5.1 Switch Panel and its Related Circuits

The above diagram shows a switch panel and its related circuits of P.C.B. B488013 using input extension port.

On P.C.B. B488009, input signals are connected to I/O ports of the CPU.

ONLINE SW signal is latched and input into IC74LS74 in order to reduce the CPU occupation. ONLSW, which is input to another port, inputs switch status at power on.

The moment $\overline{\text{LFSW}}$ signal is turned to Low (in offline status), one line paper feed is performed.

Continuity of Low status for approx. 0.5 sec. turns the printer into the continuous forms feed mode. The mode is continued until $\overline{\text{LFSW}}$ signal is turned to High.

If only $\overline{\text{LFSW}}$ signal is Low at power on, the printer turns into the self printing mode. If $\overline{\text{LFSW}}$ signal is Low and ONLSW signal is High, the printer is kept in HEX DUMP mode.

"ON LINE" LED indicates online status. If there is not any malfunction in the printer at power on, the printer is in online state automatically.

"ERROR" LED comes on at PE status, and blinks on and off at MOTOR ERROR.

"POWER" LED comes on by only +5V.

6. Limit Switch

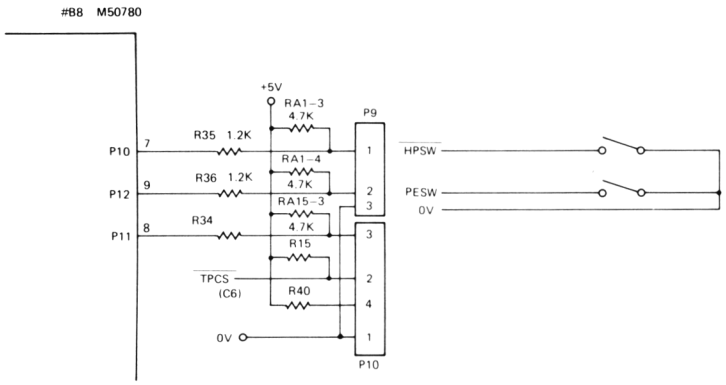


Figure 6.1 Limit Switch and its Related Circuits

The above figure shows a limit switch and its related circuits of P.C.B. B488013 using input extension port. On P.C.B. B488009, input signals are connected to I/O ports of the CPU. Connector P10 shown in this figure is not used.

$\overline{\text{HPSW}}$ signal is turned to Low when the carriage is sensed at the left end.

PESW signal is turned to High when there is no paper in the printer.

A carriage is automatically moved to the left end at power on or reset. In this operation, if it takes longer than the specified time, MOTOR ERROR occurs.

After the carriage is normally sensed at the left end, the carriage is moved right up to the position immediately preceding the print start position. If the carriage has been sensed at the left end longer than the specified time, MOTOR ERROR occurs.

7. Paper Feed Drive Circuit

See Figure 3.1 for a paper feed drive circuit.

The LF motor is a PM type stepping motor (200 pps) utilizing 2-2 phase excitation system. While the motor is stopped, the holding torque depends on the detent torque of the motor.

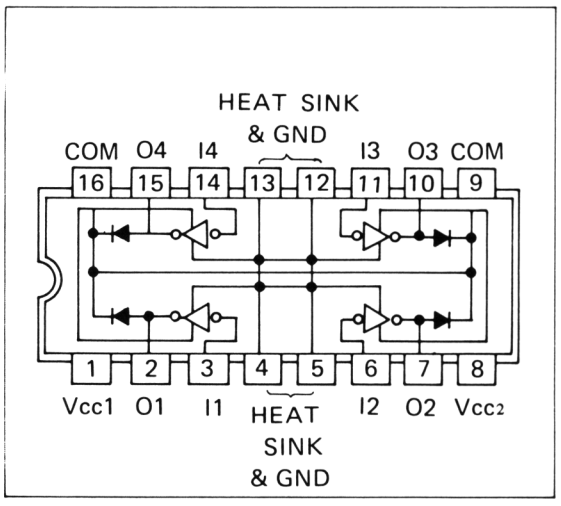
The paper feed rate is 1/216" per step, or 1/6" for 36 steps.

$\overline{B}$	$\overline{A}$	B	A
1	1	0	0
0	1	1	0
0	0	1	1
1	0	0	1

↓ Paper feed operation is performed by the excitation order shown on the left.

In this circuit, 8 pulse slew up/down system is utilized basically. Driver IC M54567 can be replaced with its second source TD62308AP.

Pin Allocation



Basic Circuit Diagram

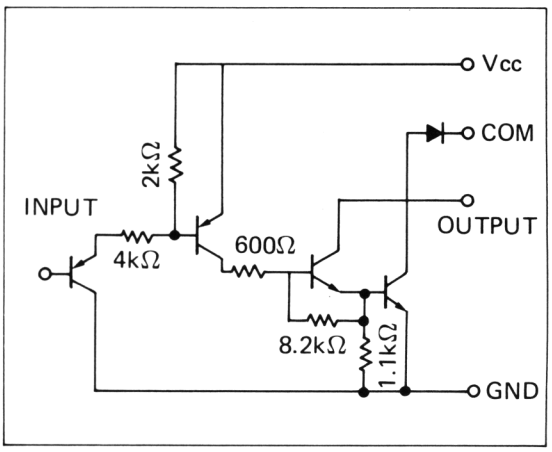


Figure 7.1 Paper Feed Drive IC

8. Carriage Drive Circuit

Figure 8.1 shows a carriage drive circuit on P.C.B. B488013. The same circuit is configured also on P.C.B. B488009.

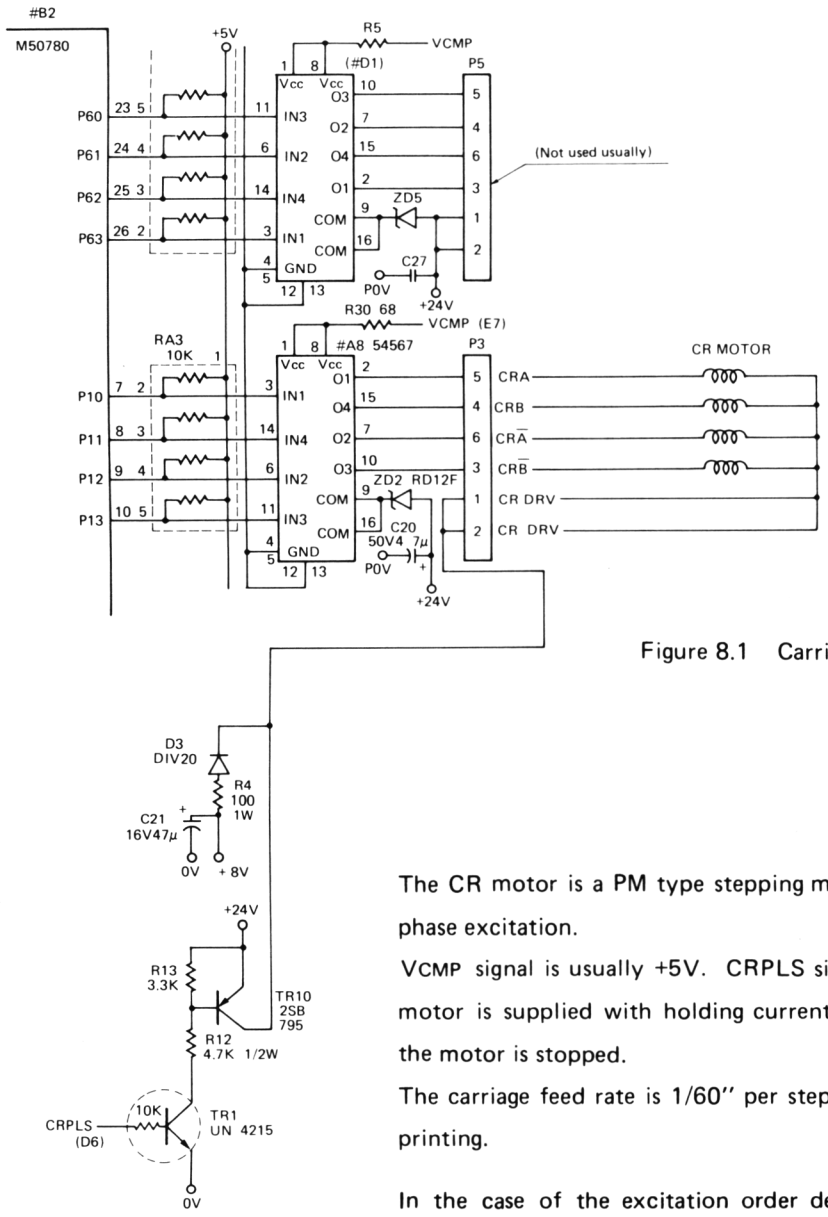


Figure 8.1 Carriage Drive Circuit

The CR motor is a PM type stepping motor. The exciting system is 2-2 phase excitation.

VCMP signal is usually +5V. CRPLS signal is turned to Low, and the motor is supplied with holding current from +8V power source while the motor is stopped.

The carriage feed rate is 1/60" per step, and 300 pps at the pica pitch printing.

In the case of the excitation order described in Sect. 7 Paper Feed Drive Circuit, the carriage is moved in a reverse direction.

In this circut, 8 pulse slew up/down system is utilized basically. CRPLS signal is turned to High, and the motore is driven by +24V power source while the motor is rotating.

Same drive IC is used on the paper feed drive circuit.

Pica size is 1/10", and one pica letter printing requires 6 steps.

9. Print Head Drive Circuit

Figure 9.1 shows a head drive circuit of P.C.B. B488013.

The same circuit is configured on P.C.B. B488009 except for some port names of CPU.

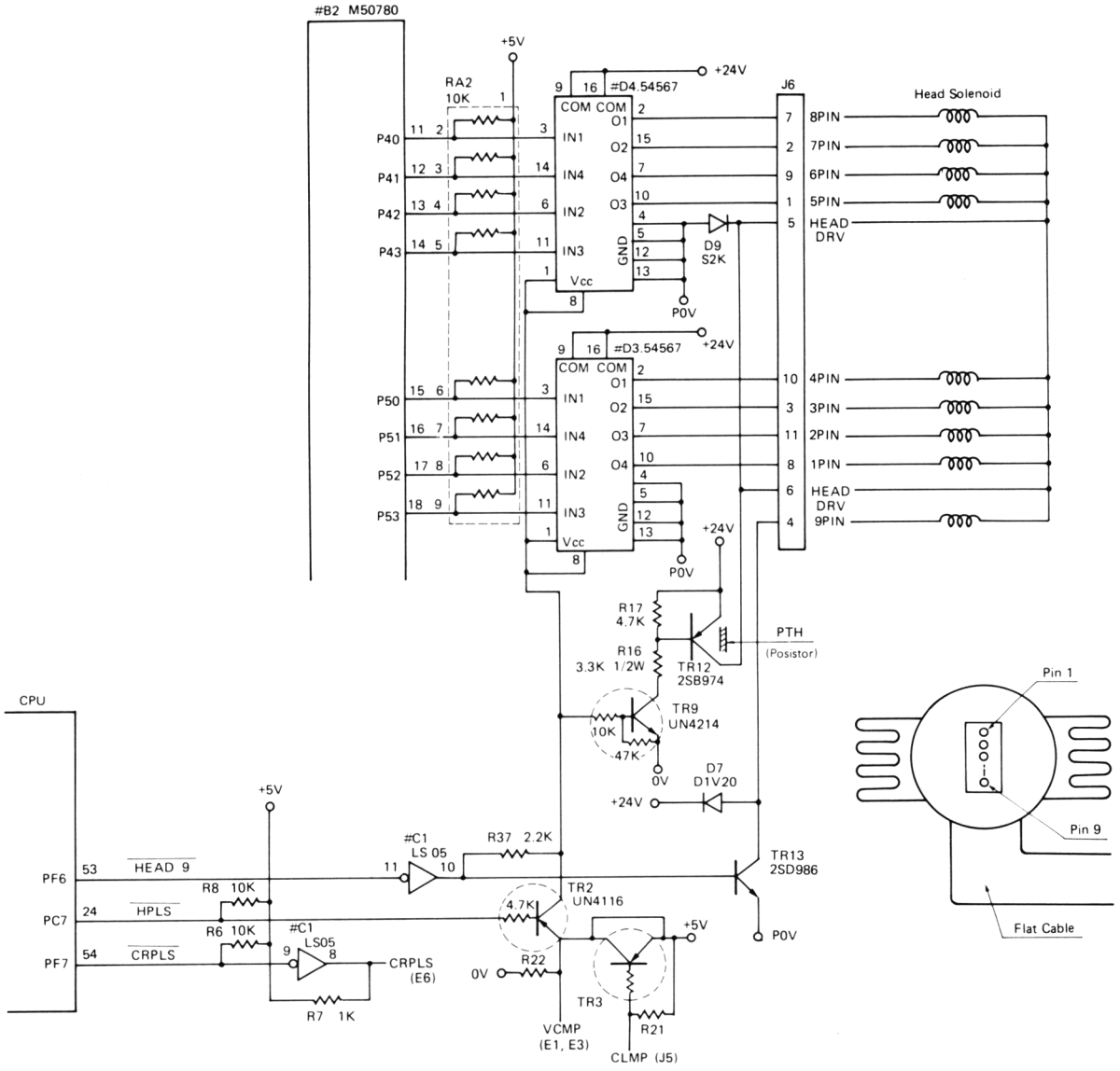


Figure 9.1 Head Drive Circuit

The head solenoid is driven by keeping $\overline{\text{HPLS}}$ signal Low after the data is set on output port with negative logic.

At this time V_{CC} pins of the driver IC are activated.

It means that the both head solenoid drive transistors at the power source side and at the ground side are always concurrently activated.

The transistor TR12 at the power source side is equipped with a thermal sense resistor (PTH). When the PTH with a positive thermal coefficient senses approx. 60° C, the voltage level of the A/D converter input port AN6 soars to 2.5V. While the AN6 maintains 2.5V, BUSY time is extended approx. 0.5 sec. after printing in order to protect the print head from overheating.

Since the +24V power source is non-stabilized, it is required to properly adjust the head drive time according to the power source voltage in order to stabilize the print quality. For this purpose, the A/D converter input

port AN7 is used. Deviation of the 24V power source divided by the Zener diode and resistors is applied to the AN7 pin of the CPU as shown below.

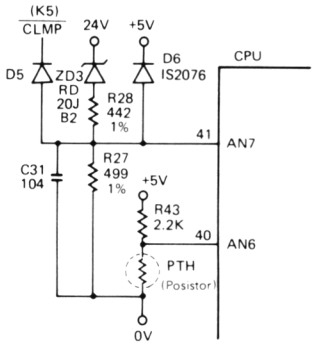


Figure 9.2 A/D Converter Input Port

Figure 9.2 shows an A/D converter input port on the P.C.B. B488013 with μPD7810 CPU. The input pins "AN" for A/D converter ports are named "PT" for comparator input ports on P.C.B. B488009 with μPD7809 CPU.

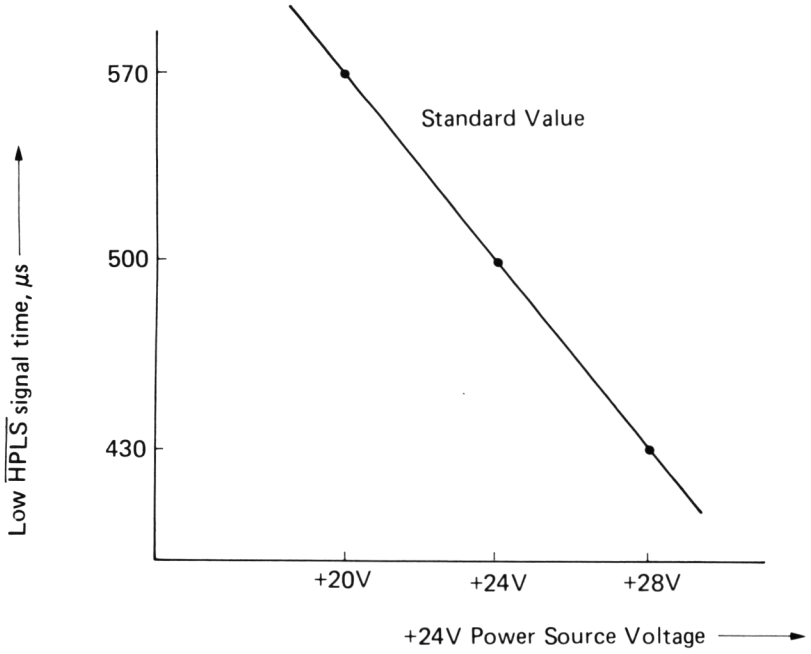


Figure 9.3 Right Pulse Width to +24V Power Source Voltage

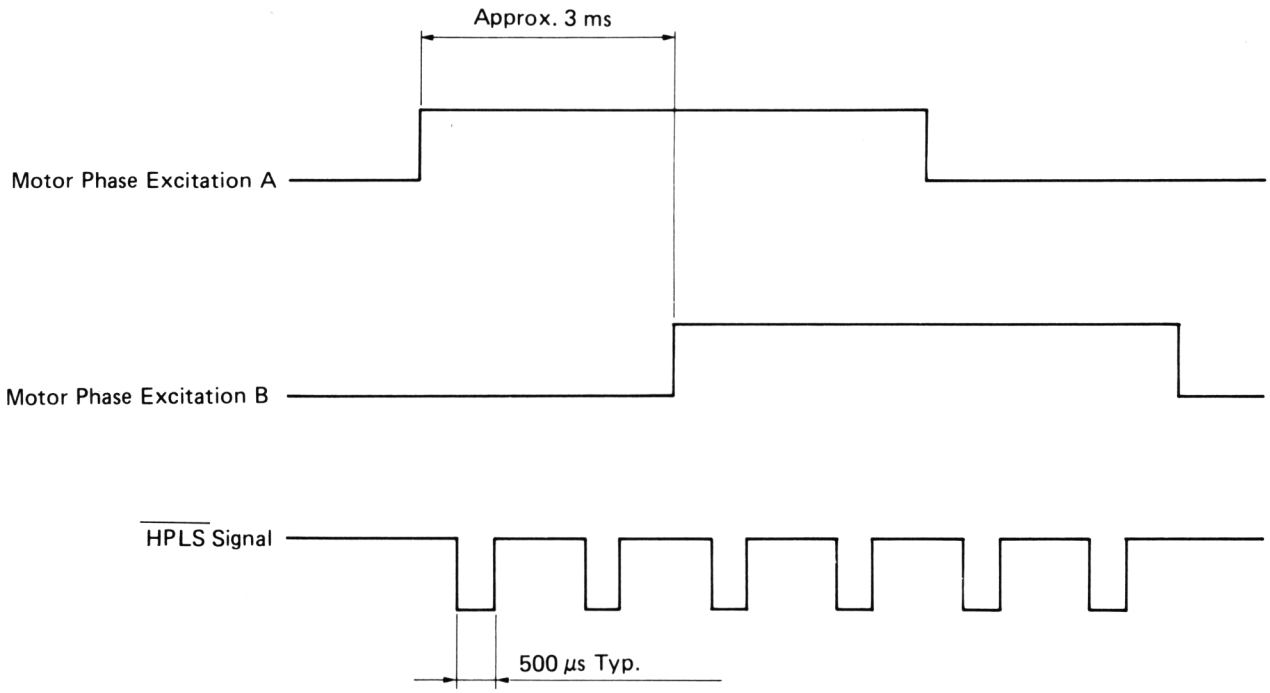


Figure 9.4 Head Drive Timing

Three ms cycle of $\overline{\text{HPLS}}$ signal is equal to full dot timing, and the center timing is for half dot printing.

10. DIP SW

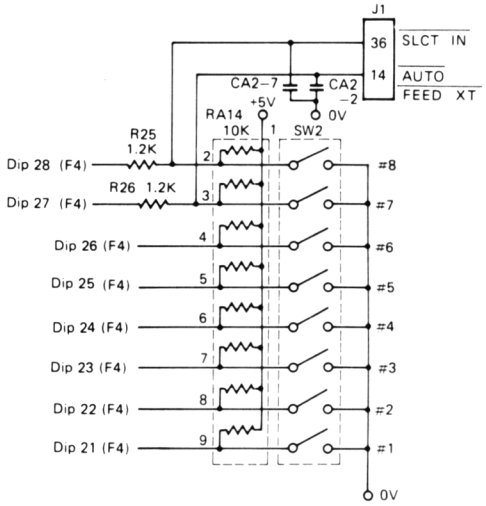


Figure 10.2 DIP SW

DIP SW is for function selection. It should be noted that SW#7 and SW#8 are wire-ORed to the parallel interface connector J1.

Refer to each manual, since definitions of other switches differ depending on each specification.

The switch state exchanges are only allowed in power-off state.

P.C.B. B488013 has an input extension port, while on P.C.B. B488009 DIP SW signals are directly input to CPU.

11. Reset Circuit

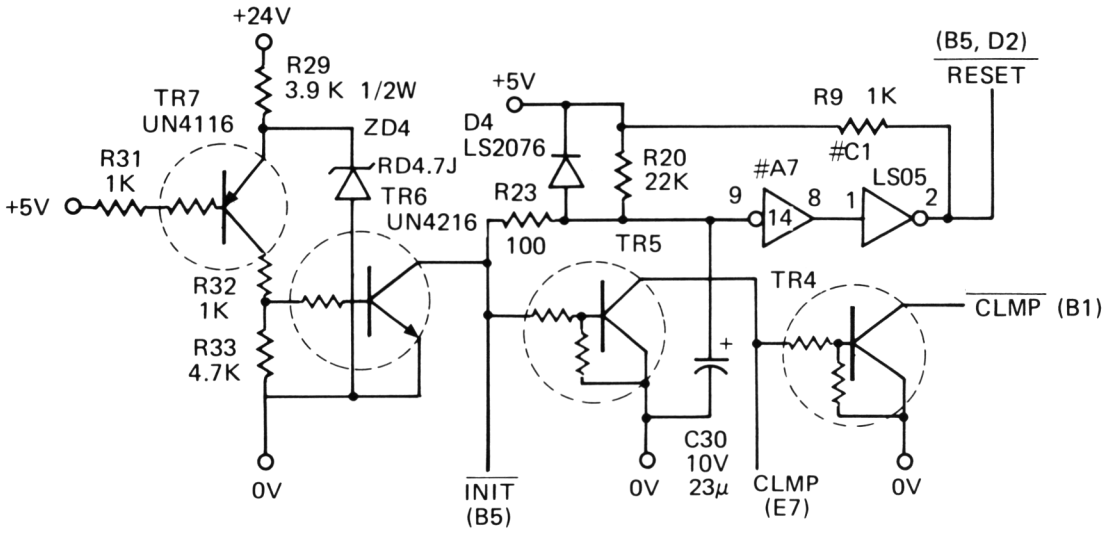


Figure 11.1 Reset Circuit

During any of the following periods, $\overline{\text{RESET}}$ signal is turned to Low, and CPU is in initial status.

(1) Charging time to C30 through R20 at power-on.

(2) Period during +5V power source voltage $<$ 4.0V at power-off.

(3) Period while $\overline{\text{INIT}}$ signal from interface remains Low. (20 ms or more required)

The width of the $\overline{\text{RESET}}$ signal at power-on is approximately 50 ms.

Figure 11.1 shows a reset circuit of P.C.B. B488013. The same circuit is configured on P.C.B. B488009.

Note: Both CLMP and $\overline{\text{CLMP}}$ signals are not used usually.

12. Power Supply Unit

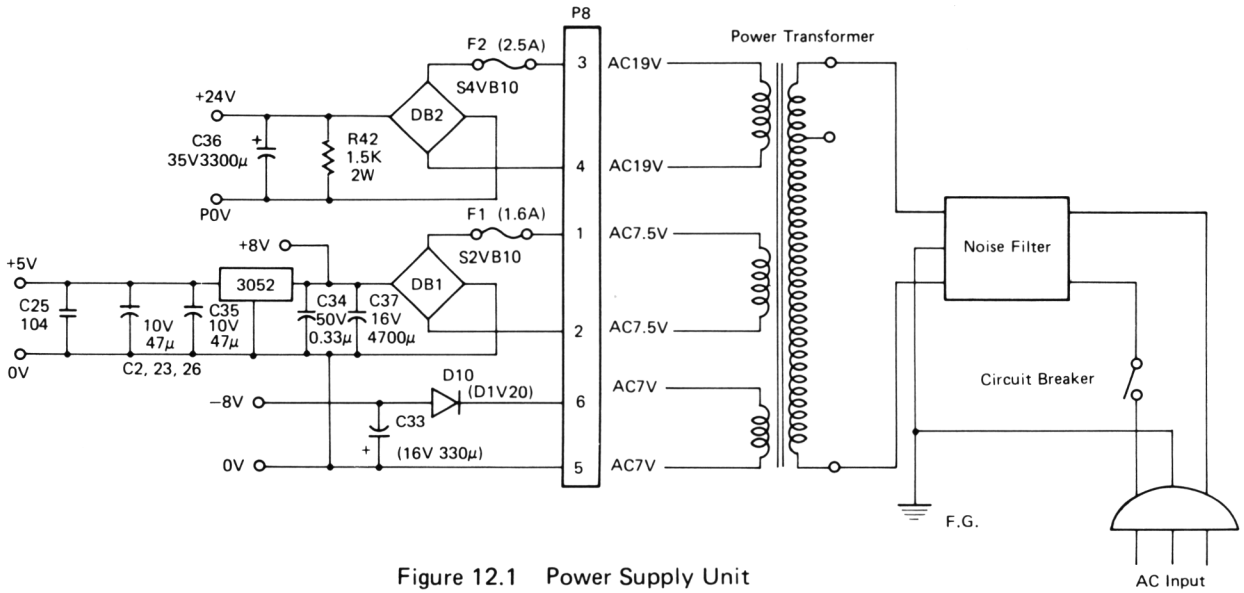


Figure 12.1 Power Supply Unit

+24V power source is non-stabilized. The output voltage is approximately 27V at nominal input and no load, and is approximately 24V when self-printing is performed at nominal input.

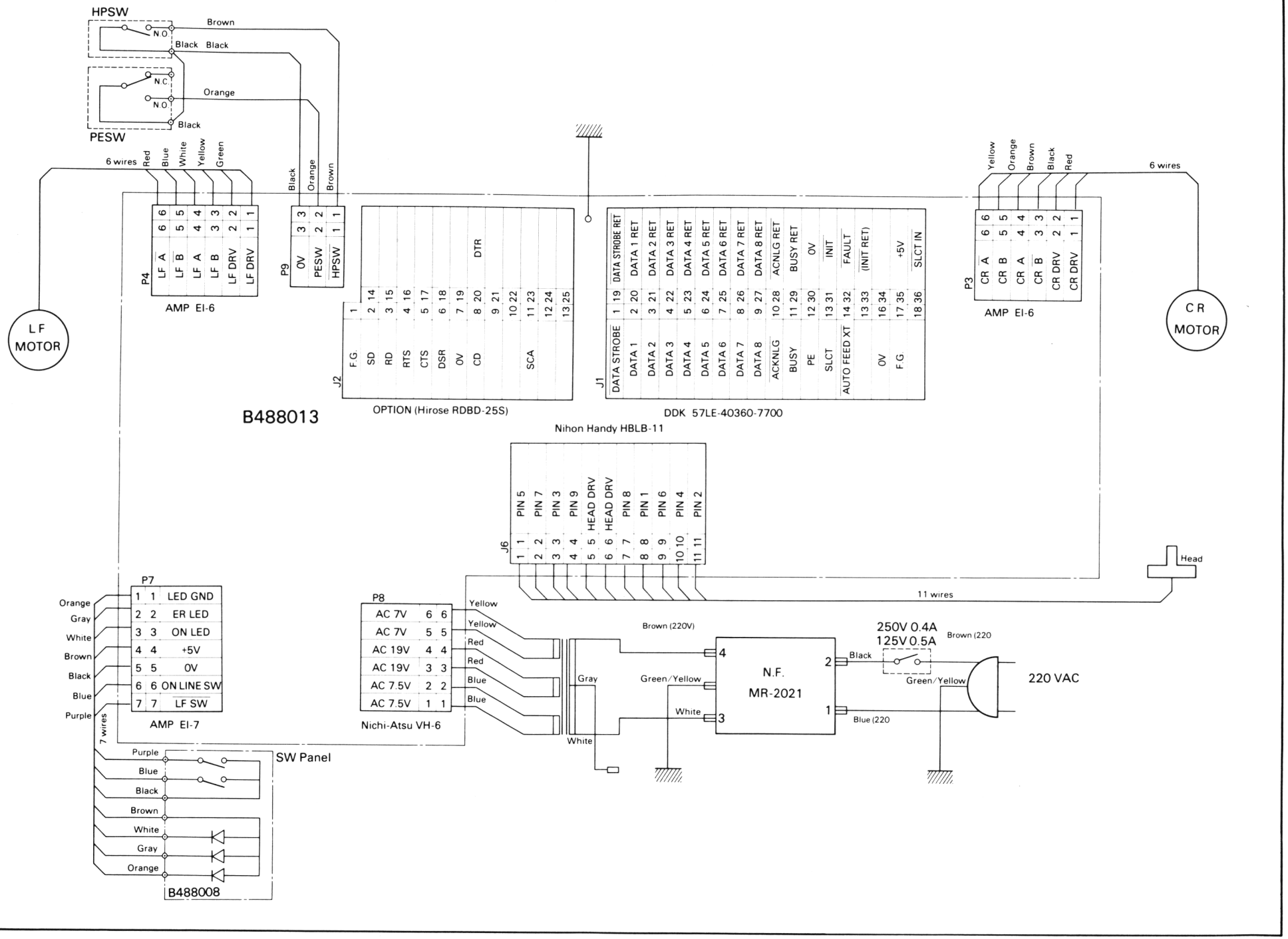
+5V power source is stabilized by 3-terminal regulator 3052. The output voltage is usually 5±5%V.

+8V power source is fed from input of the regulator.
The output voltage is approximately 7.5V at nominal input.

−8V power source is required for optional serial interface installation. The output voltage is approximately −9V at nominal input.

The power switch has break capability. Even if the breaker is fired and the AC input is cut off, the indicator remains ON. This status is released by the switch operation, OFF and ON.

The power transformer has input taps. Unused lead wires of the taps must be completely stored in the pocket of the transformer.


HPSW
N.O.
Brown
Black
Black
N.C.
N.O.
Orange
Black
PESW
6 wires
Red
Blue
White
Yellow
Green
Black
Orange
Brown
P4
LF A
LF B
LF A
LF B
LF DRV
LF DRV
AMP EI-6
P9
0V
PESW
HPSW
LF MOTOR
J2
F.G.
SD
RD
RTS
CTS
DSR
0V
CD
DTR
SCA
OPTION (Hirose RDBD-25S)
J1
DATA STROBE
DATA 1
DATA 2
DATA 3
DATA 4
DATA 5
DATA 6
DATA 7
DATA 8
ACKNLG
BUSY
PE
SLCT
AUTO FEED XT
0V
F.G
+5V
DATA STROBE RET
DATA 1 RET
DATA 2 RET
DATA 3 RET
DATA 4 RET
DATA 5 RET
DATA 6 RET
DATA 7 RET
DATA 8 RET
ACNLG RET
BUSY RET
0V
INIT
FAULT
(INIT RET)
+5V
SLCT IN
DDK 57LE-40360-7700
Nihon Handy HBLB-11
Yellow
Orange
Brown
Black
Red
6 wires
P3
CR A
CR B
CR A
CR B
CR DRV
CR DRV
AMP EI-6
CR MOTOR
B488013
J6
PIN 5
PIN 7
PIN 3
PIN 9
HEAD DRV
HEAD DRV
PIN 8
PIN 1
PIN 6
PIN 4
PIN 2
Head
11 wires
P7
LED GND
ER LED
ON LED
+5V
0V
ON LINE SW
LF SW
Orange
Gray
White
Brown
Black
Blue
Purple
7 wires
AMP EI-7
P8
AC 7V
AC 7V
AC 19V
AC 19V
AC 7.5V
AC 7.5V
Nichi-Atsu VH-6
Yellow
Yellow
Red
Red
Blue
Blue
Gray
White
Brown (220V)
Green/Yellow
White
N.F.
MR-2021
4
3
2
1
250V 0.4A
125V 0.5A
Brown (220
Black
Green/Yellow
Blue (220
220 VAC
SW Panel
Purple
Blue
Black
Brown
White
Gray
Orange
B488008

(D) TROUBLESHOOTING

Failure Mode	Check Procedures	Probable Fault Locations
(1) Inoperable at Power ON ("POWER" LED is OFF)	○Is the power cable connected properly ? ○Is the fuse normal ? ○Are power outputs normal ?	○Faulty connection from power cable to the connector of the power transformer. ○Fault in fuse on the Logic circuit board. ○Fault in the regulator 3052.
(2) Inoperable at Power ON ("POWER" LED is ON.)	○Is "ERROR" LED flickered ? ○Is +24V power source normal ? ○Does MOTOR ERROR occur ?	[If flickered] ○MOTOR ERROR including CR drive circuit and motor itself. [If +24V source has been failed.] ○Fault in fuse on the Logic circuit board. ○Fault in the bridge rectifier or the power transformer. [Otherwise] ○Fault in reset circuits or CPU.
(3) Print head does not come to the print start position.		○Faults in the positions described in (2) or in HP switch.
(4) Misprinting	○Is the interface cable connected properly ?	○ Fault in the interface circuit.
(5) Carriage is moving but no printing.	○Is the head cable connected properly ?	○Wrong connection of the head cable ○Fault in the head drive circuit, particularly in the HPLS signal circuit.
(6) No impact on certain pin(s)	○After the head replacement, is it still wrong ?	○Fault in the print head ○Fault in the head drive IC or in the prestage expansion ports. * Reference Data Resistance of the head solenoid coils is approx. 33 Ω to common pins 5 and 6.
(7) LF motor is out of control.	○Any heavy load in the related mechanism ? ○Any slip on the related gears ?	[If there are not such mechanical faults] ○Fault in the paper feed drive IC on Logic circuit board. ○Fault in the extension port. * Reference Data Terminal to terminal (green to common) resistance of LF motor is approx. 160 Ω.
(8) CR motor is out of control.	○Any heavy load in the related mechanism or ribbon path ? ○Any slip on the related gears ?	[If there are not such mechanical faults] ○Fault in the carriage drive circuit. * Reference Data Terminal to terminal (red to common) resistance of CR motor is approx. 130 Ω.
(9) Serial input is inoperable even with serial I/O option.	○Is DIP SW1 specified properly ? ○<Particularly, is No. 8 off ?>	[If DIP SW1 is properly specified.] ○Fault in the RS-232 circuit or − 8V power source. ○Fault in the serial I/O port of CPU (rarely)

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2728500-72400 DRUCKER NLQ 401 — BLATT 1

BEST-NUMMER	ARTIKELBEZEICHNUNG		ZEICH POS.	PREIS O.MST
2922700-501	RAHMEN KPL.	U23000002		41,90
2922900-429	RAHMEN	U23001002	1	12,80
2923400-4181	PAPIERLOESER STANGE	U23003001	2	3,85
2923500-4217	PAPIERLOESER GETRIEBE	U23004000	3	0,50
2976200-4186	PAPIERTRANSPORTROLLE	U22077001	5	1,20
2923700-429	PAPIERHALTER	U23002000	7	0,95
2921900-429	ABDECKUNG FUER DIP-SCHALTER	U23176000	9	0,75
2976300-429	ANDRUCKSCHLITTEN	U23006000	3-1	3,90
2976400-429	DRUCKPLATTE FUER ANTRIEBSRIEMEN	U23007001	3-2	0,60
2976500-501	MOTOR DRUCKKOPFANTRIEB KPL.	U23236001		85,60
2976600-3282	MOTOR DRUCKKOPFANTRIEB	Z20460001	4-1	79,50
2976700-4152	ZAHNRIEMEN	U23017001	4-9	12,70
2976800-501	GETRIEBE FUER FARBBANDANTRIEB KPL.	U23018001		14,30
2976900-418	FUEHRUNGSWELLE	U23009001	5-1	9,20
2977000-429	HALTERUNG FUER FUEHRUNGSWELLE	U23010001	5-2	0,60
2977100-501	MOTOR ZEILENVORSCHUB KPL.	Z20276001	6-1	57,80
2925200-501	GUMMIWALZE KPL.	U23029001		55,50
2925300-429	GUMMIWALZE	U23030001	6-4	39,00
2925400-502	SCHALTERPLATINE KPL.	U32252001	7-1	26,70
2925500-502	HAUPTPLATINE KPL.	U23413001	7-2	518,20
2925600-327	SCHALTER (PAPIERENDE)			12,20
2925700-3243	TRANSFORMATOR	U32291001	10-1	73,30
2925800-3251	STOERSPANNUNGSFILTER	U32151001	10-3	47,50
2925900-3272	NETZSCHALTER	U32160001	10-5	9,60
2926000-4161	FEDER	U23175000	10-14	0,80
2926100-3411	NETZANSCHLUSSKABEL	U32294001		11,50
2926200-3251	FERRITKERN KPL.	U32517001		12,60
2926300-501	DRUCKKOPF KPL.	U23324001	11-1	57,90
2926400-424	GEHAEUSE-UNTERTEIL	U23107002	12-1	49,10
2926500-424	GEHAEUSE-OBERTEIL	U23113001	12-2	31,00
2926600-424	ABDECKUNG	U23114001	12-3	28,80
2926700-433	SCHALTERABDECKUNG	U23117001	12-5	9,20
2926800-72800	BENUTZER-HANDBUCH NLQ 401	596504001		14,80
2926900-212	FK NLQ 401	562906001	14-1	10,50

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BEST-NUMMER	ARTIKELBEZEICHNUNG		ZEICH POS.	PREIS O.MST
2927000-213	STYROPOR RECHTS	562891000	14-2	2,50
2927100-213	STYROPOR LINKS	562892000	14-3	2,50
2927200-214	GRIFF FUER KARTON	562721001	14-5	0,80
2927300-429	TRAKTORFUEHRUNG RECHTS	U23075001	15-1	6,20
2927400-429	TRAKTORFUEHRUNG LINKS	U23071001	15-5	6,20
2927500-429	RAHMEN	U23062004	15-14	
2927600-4221	ABDECKHAUBE	U23110001	15-16	
2927900-212	FK TRAKTORFUEHRUNG	U64005001	15-21	
2927700-213	STYROPOR OBEN	U64011000	15-17	
2927800-213	STYROPOR UNTEN	U64012000	15-18	
2928400-302	IC UP MOSLSI UPD7810	U32258001	B3	
2928500-302	IC TMS 1025	U32259001	B2,8	
2928600-302	IC ROM PROMO 71	U31724001	A4	
2928700-302	IC TR ARRAY TO 62308	U32444000	A1,8	
2928800-302	IC BIPIC74LS374	091100374	B4	5,70
2612200-302	IC SN 74 LS 74 AN	091100074	B6	1,60
2929000-302	IC SN 74LS02	091100002	C6	2,40
2929100-302	IC SN7417	091000014	A7	2,70
2929200-302	IC SN74LS05	091100005	C1	2,40
1524100-302	IC 7406 N 6-FACH INVRTER	091000006	B5	1,60
2929400-302	IC SN74LS04	091100004	C5	2,10
2635300-302	IC HD 74 LS 373	091100373	A5	7,40
2929600-302	IC SN7404	091000004	A6	2,40
2929700-3219	WIDERSTANDS MATRIX R ARRAY J103X8	U31275000		3,60
2929800-3219	WIDERSTANDS MATRIX R ARRAY J472X6	U31273000	R1,7	3,10
2929900-3219	WIDERSTANDS MATRIX R ARRAY J103X4	576237000	R3,12	2,40
2930000-3219	WIDERSTANDS MATRIX R ARRAY J472X4	U31272000	R9,10	2,40
2930100-3219	WIDERSTANDS MATRIX R ARRAY J472X8	U31274000	R8	3,60
2930200-319	METALLOXYD-WIDERST.442 OHM 1%	U32262000	R28	1,50
2930300-319	METALLOXYD-WIDERST.499 OHM 1%	U32263000	R27	1,50
2930400-318	WIDERSTAND 100 1W	U32264000	R4	1,20
2930500-318	WIDERSTAND 1K52W	U32030000	R42	1,50
2930600-307	ELKO 3300 UF/35V	U32034000	C36	7,20
2930700-307	ELKO 4700 UF/16V	U32265000	C37	8,40

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2930300-302	SPANNUNGSREGLER 5V	U32268001	3052	6,60
2930900-301	TRANS N 4215	U32059000	1	2,40
2931000-301	TRANS N 4116	U32057000	2,7	2,40
2931100-301	TRANS N 4214	U3205800	9	2,50
2931200-301	TRANS N 4216	U32060000	6	5,10
2931300-301	TRANS 2 SB 951	575525000	12	6,30
2931400-301	TRANS 2 SB 795	U30807000	10	6,90
2931500-301	TRANS 2 SD 986	U3247500	13	5,60
2931600-3041	DIODE D1 V20	538237000	3,7	2,50
2931700-30410	DIODE 2S 2076	341786000	4,6	1,50
2931800-3041	DIODE S2K 49	U32044000	9	8,70
0622700-3044	ZENERDIODE ZPD 12	U32045000	1,2	0,50
0244200-3044	ZENERDIODE ZPD 20	U32269000	3	0,30
1481300-3044	ZENERDIODE ZPD 4,7	U32046000	4	1,00
2931900-305	GLEICHRICHTER 52VB	U32048000	1	8,40
2932000-305	GLEICHRICHTER S4VB	U32270000	2	9,30
2932100-3259	QUARZ-OSZILLATOR	U50643000		14,50
2932200-3218	PTC	U32063000		14,50
2932300-327	DIP-SCHALTER	U31260000	SW2	8,70
0604500-3327	IC-FASSUNG 28-POL RM 2,5 DIL B 28P-10	U1592600		1,60
2928000-3045	LEUCHTDIODE (ROT)	U32146001		1,80
2928100-3045	LEUCHTDIODE (GRUEN)	U32255001		1,80
2928200-327	SCHALTER	U32145001		1,70

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