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Technical Manual

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Technical manual

TM-U950/TM-U950P

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Printed in Japan E96010130-0000SE

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Introduction

The TM-U950 printer is an ESC/POS® compatible high-performance point of sale (POS) printer which can handle receipt, journal, and slip paper. There are two models: the TM-U950 and the TM-U950P. The TM-U950P has a parallel interface. Differences between the two models are noted throughout this manual.

The main features of the TM-U950 and TM-U950P printers are the following:

- Usable with a wide range of slip paper types.
- Non-protruding interface connectors integrated in the body of the printer.
- Bidirectional logic seek for high throughput.
- Paper feed pitch of 1/144 inch.
- Integrated printer buffer with 32 byte or 2 KB capacity.
- Slip paper eject sensor.
- ASB (Automatic Status Back) function to send the printer status automatically.
- EPSON intelligent module connection (Not available on the TM-U950P).
- EPSON customer display series connection (Not available on the TM-U950P).
- Optional Magnetic Ink Character Recognition (MICR) reader that enables the printer to perform consecutive reading and processing of MICR characters and printing endorsements (not available for the TM-U950P).

About This Manual

- ❑ Chapter 1 provides general specifications and hardware configuration information.
- ❑ Chapter 2 provides general operating principles and printer mechanism configuration information.
- ❑ Chapter 3 provides handling and maintenance information.
- ❑ Chapter 4 provides troubleshooting information.
- ❑ Chapter 5 provides printer disassembly, assembly, and adjustment instructions.
- ❑ Chapter 6 (Appendix) provides circuit board and exploded diagrams.

Notes and Cautions



Note:

Notes have important information and useful tips on the operation of your printer.



CAUTION:

Cautions must be observed to avoid damage to your equipment.

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Chapter 1

Features and General Specifications

Features

The TM-U950 printer is an ESC/POS™ compatible high-performance point of sale (POS) printer which can handle receipt, journal, and slip paper. There are two models: the TM-U950 and the TM-U950P. The TM-U950P has a parallel interface. Differences between the two models are noted throughout this manual.

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- ASB (Automatic Status Back) function to send the printer status automatically.
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- Optional Magnetic Ink Character Recognition (MICR) reader that enables the printer to perform consecutive reading and processing of MICR characters and printing endorsements (not available for the TM-U950P).

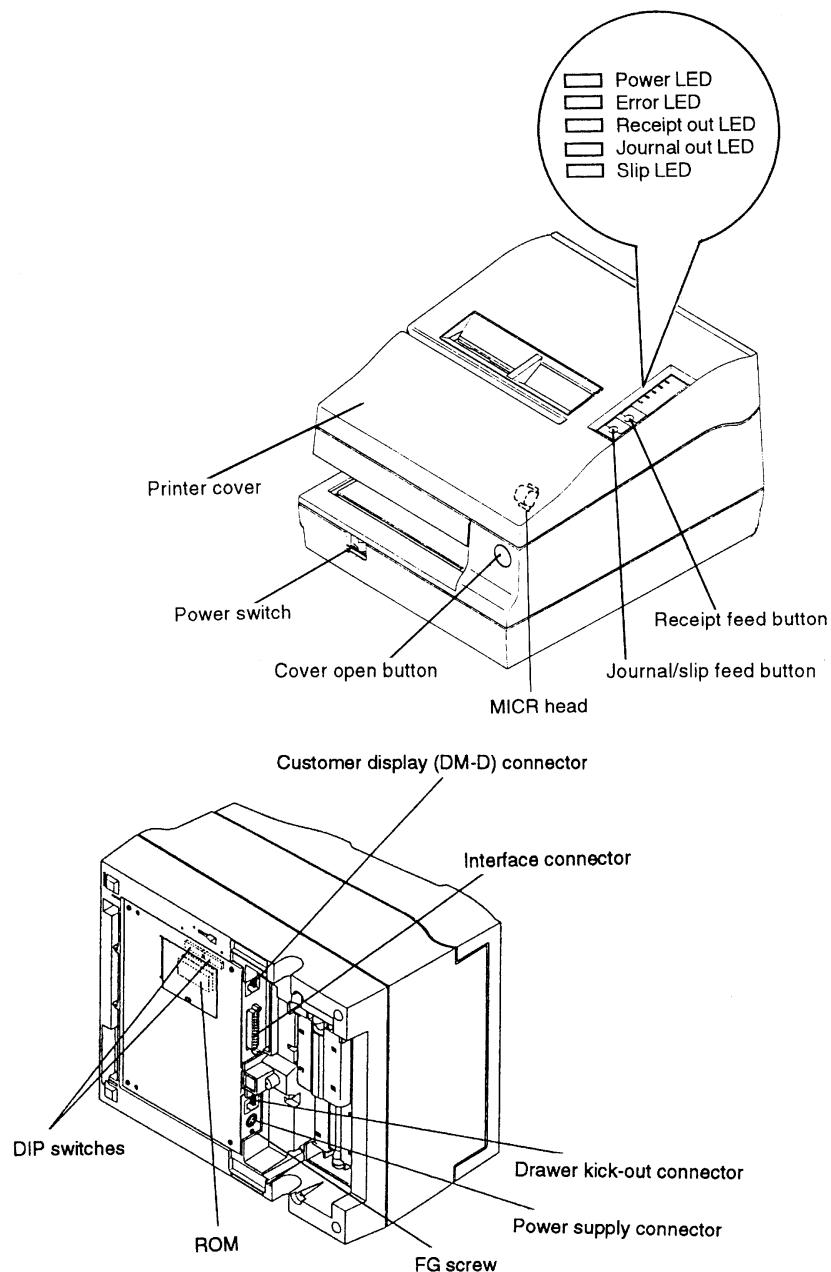


Figure 1-1. TM-U950 Appearance

General Specifications

Printing Specifications

Operation principle

Serial impact dot-matrix printer

Print head wire layout

Serial 9-pin

Dot pitch

0.353 mm (1/72")

Dot wire diameter

0.29 mm (.01")

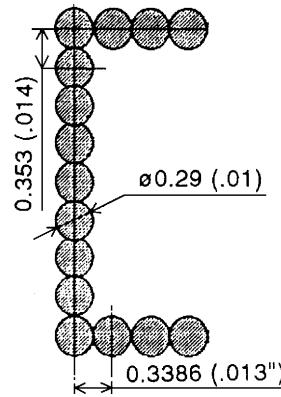


Figure 1-2. Dot Configuration

Print direction

Bidirectional logic seek

Print width (printable area)

Paper roll: 61.1 mm (2.41")

Slip paper: 135.6 mm (5.34")

Paper feed pitch

4.233 mm (1/6") (default setting) adjustable (by commands) in 1/144-inch steps

Paper feed principle

Friction feed

Paper feed rate

Approx. 3.4 IPS (continuous paper); 60.3 ms per line (1/6-inch paper feed)

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Printing format

See CPI in Table 1-2.

Character spacing

See Table 1-2.

Total dot count

70 mm paper roll (2.76"):
Slip paper:

180 dots (360 positions) per line
400 dots (800 positions) per line

Printing speed

See Table 1-2.

As shown in the table below, the TM-U950 has three printing modes, which differ in printing speed and head power time (impact).

Table 1-1. Printing Operation Mode

Operation mode	Printing speed	Head power time (impact)
Standard	High	Standard
Copy	Low	Copy
Low-speed	Low	Standard

Character Specifications

Character set

Alphanumeric: 95
International: 32
Extended graphics: 128 x 8 pages

Character matrix

(Alphanumeric, international, extended graphics)

7 x 9 (spacing: 2 half-dots)

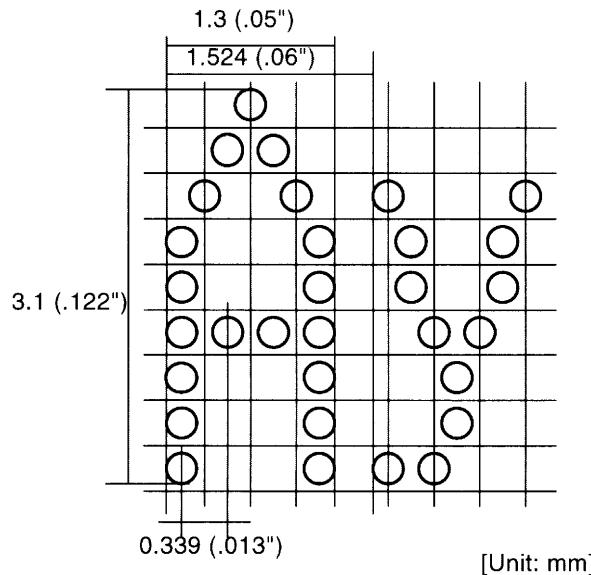
0 x 9 (spacing: 3 half-dots)

Larger spacing can be set by using ESC SP.

Table 1-2. CPI, CPS, CPL, Character Size

CG Mode (Horizontal dots x vertical dots)	Character Spacing (half dots)	Characters Per Inch (CPI)	Characters Per Second (CPS) (Carriage moving speed)		Characters Per Line (CPL)		Character Size Width x Height
			High speed	Low speed	Paper roll	Slip paper	
9 x 9	3 dots	12.5	233	200	30	66	1.6 mm x 3.1 mm (0.6" x .12")
7 x 9	2 dots	16.7	311	267	40	88	1.3 mm x 3.1 mm (0.5" x .12")

(Example: 7 x 9 font)



[Unit: mm]

Figure 1-3. Character Size

Paper Specifications

Paper type

- Paper roll

Wood-free paper (single layer only)

- Slip paper

Plain paper

Carbon copy paper

Pressure-sensitive paper

Paper dimensions

- Paper roll

Paper width: 69.5 + 0.5 mm (2.74 + 0.02")

Maximum diameter: 83 mm (3.27")

Paper thickness: 0.06 to 0.09 mm (.002 to .004")

Paper weight: 52.3 to 64 g/m² (13.9 to 171 lbs)
(45 to 55 kg/1000 sheets; 788 x 1091 mm)
(20.41 to 24.94 lbs/1000 sheets; 31.02 x 42.95")

Core diameter: 10 mm (0.39") or more

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Slip paper

Dimensions: 70 x 70 to 210 x 297 mm (W x H)
(2.76 x 2.76 to 8.27 x 11.69")

Thickness: 0.09 to 0.36 mm (.004 to .014")

Temperature and copying capability

As copying capability is influenced by the ambient temperature, printing must be performed under the conditions described in Table 1-3.

Table 1-3. Relationship Between Ambient Temperature and Number of Copies

Number of Copies	Ambient Temperature
Original + 4 copies	approx. 20° to 40°C (68° to 104°F)
Original + 1 to 3 copies	5° to 40°C (41° to 104°F)

Paper thickness and copying capability

Plain paper (single sheet): 0.09 to 0.2 mm (.0035 to .0079")

Carbon copy paper (original + 4 copies)

Backing paper 0.06 to 0.15 mm (.002 to .006")

Copy paper and original paper 0.04 to 0.07 mm (.0016 to .003")

Carbon paper Approx. 0.035 mm (.001")

Total thickness 0.30 mm (.012") or less (1 to 1 + 3)
0.36 mm (.014") or less (1 + 4)

Pressure-sensitive paper (original + 4 copies)

Backing paper 0.06 to 0.15 mm (.002 to .006")

Copy paper and original paper 0.06 to 0.075 mm (.002 to .003")

Total thickness 0.24 mm (.009") or less (1 to 1 + 3)
0.30 mm (.012") or less (1 + 4)

Note:

When using multi-ply paper that consists of an original and three copies, be sure to print with a 9 x 9 font. If a 7 x 9 font is used, some characters on some of the copies may not be readable.

Check paper (only when the printer is used with the MICR reader)

Paper type: Normal paper

Total thickness: 0.09 to 0.2 mm (.0035 to .0079")

Size: 68 to 102 mm x 152 to 210 mm
(2.68 to 4.02" x 2.98 to 8.27")

Weight: 70 to 90 kg paper

Notes on setting the print operation mode

- The GS E command sets print mode (printing speed and print head energizing time).
- When the power is turned on, normal mode is selected as the default. The printer automatically switches from normal mode to copy mode when slip is selected by ESC c 0.

Notes on slip paper

- The slip paper must be flat, without curls or wrinkles, especially at the top edges. Otherwise, the paper may rub against the ribbon and become dirty.
- There must be no glue on the bottom edge of slip paper. It is desirable for the glue to be on the top edge. Choose slip paper carefully when the glue is on the right or left edge, since paper feeding and insertion are affected by gluing conditions (e.g., glue quality, method, and length) and glue location (see Figure 1-4). Be especially careful when slip paper is wide and has the glue on the right or left edge, since meandering may occur.
- Since the slip insertion sensor uses a photo sensor, paper that has holes at the sensor position, or is translucent, must not be used (see Figure 1-5).
- Since the slip ejection sensor uses a reflective photo sensor, paper that has holes or dark portions with low reflection (less than 40% reflection) at the sensor position must not be used (see Figure 1-6).
- Be sure to perform slip printing with a paper roll loaded to avoid incorrect paper feeding due to paper jams.
- Use thinner paper (N30 or equivalent) between the top and bottom sheets of multi-ply paper. If thick paper is used, the copy capability is lowered.

Notes on using personal check paper (for printers with an MICR reader)

- The personal checks must be flat, without curls, folds, or wrinkles (especially at the edges). Otherwise, the check may rub against the ribbon and become ink-stained.

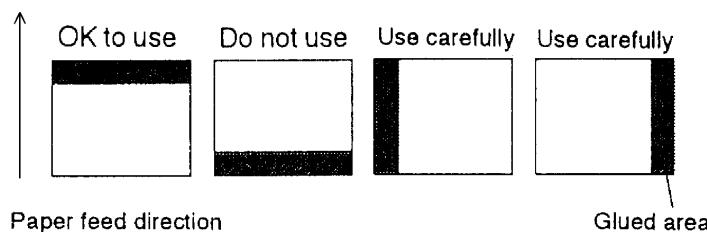


Figure 1-4. Slip Paper Glued Area

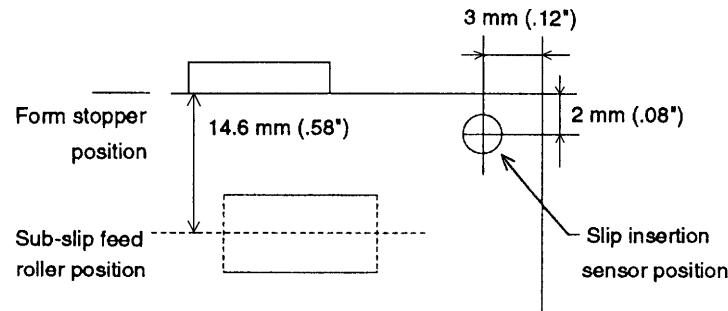


Figure 1-5. Slip Insertion Sensor Position

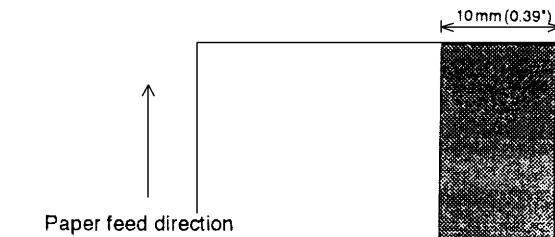


Figure 1-6. Paper Holes and Low Reflection Prohibited Area

Print area

- ## Paper roll

Paper width: 70 mm (2.76")

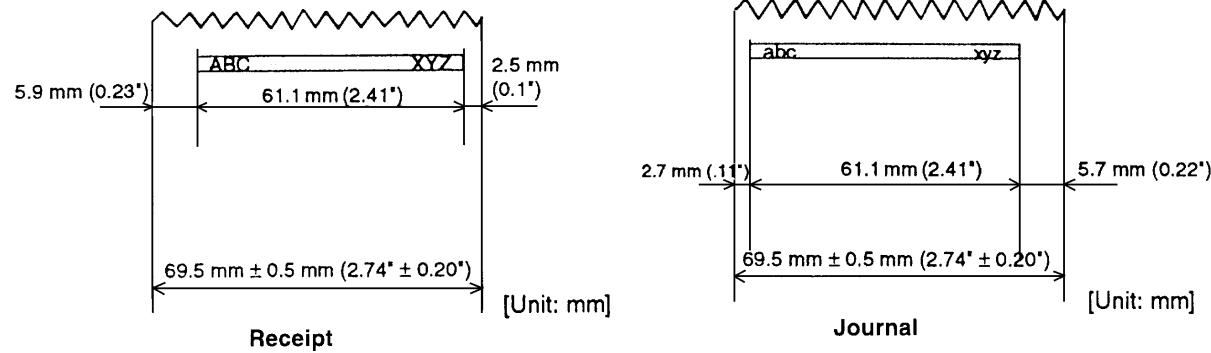


Figure 1-7. Paper Roll Print Area

Slip paper

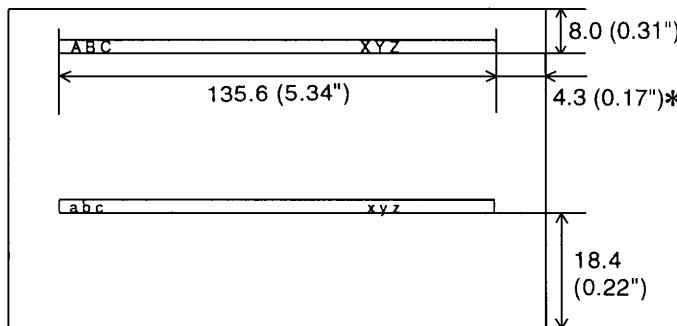


Figure 1-8. Slip Paper Print Area

***Note**

When the printer uses an MICR reader, this width is 5.0mm (0.20").

Paper Roll Feed Mechanism

Feed principle

Drop-in loading

Paper roll near-end detection

Separate sensors for receipt paper and journal paper.

Journal Paper Take-up Mechanism

Automatic take-up by journal paper feed motor.

Auto-cutter

Auto-cutter is installed only on receipt side, for full and partial cuts.

Electrical Specifications

Printer operation voltage (using supplied AC adapter)

+24 V DC ± 10%

Ripple voltage: 300 mVpp or less (only when the printer is used with the MICR reader)

Current consumption

During printing

Average approx. 1.8 A

(R/J, α - N, 40-character printing)

Peak approx. 8 A

During slip paper feed to printing position:

Average approx. 0.3 A (for approx. 1.4s)

- ❑ During standby
Average approx. 0.3 A
 - ❑ Operating MICR reader

(when the printer used with the MICR reader)
Mean - approximately 2.3 A
(Approximately 1.4 seconds)

Stamp

Stamp mechanism is available as a factory option for the receipt side.

Recommended stamp: Fuji Copian CSP-2042C

Recommended ink: Fuji Copian Super Ink

Print area: 42 x 20 mm (1.65 x 0.79")
(W x H)

Dimensions of stamp pad: See Figure 1-9.

Dimensions of stamp set: See Figure 1-10.

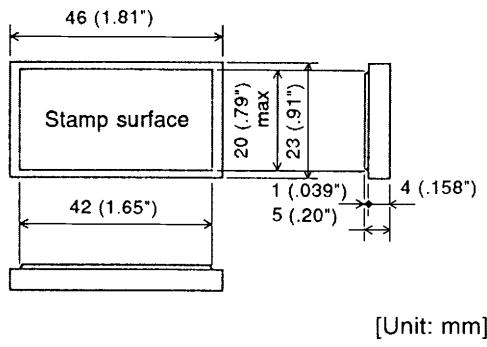


Figure 1-9. Stamp Pad Dimensions

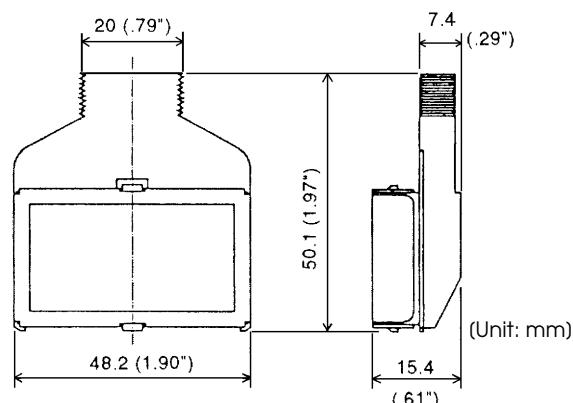


Figure 1-10. Stamp Set Dimensions

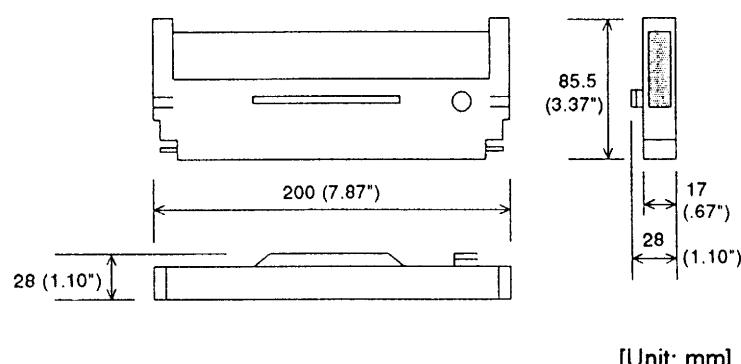
Ink Ribbon

Ribbon cassette

ERC-31 (P)
ERC-31 (B)

Color

Purple: ERC-31 (P)
Black: ERC-31 (B)



Ribbon life (18 dots per character)

7 000 000 characters

Figure 1-11. Ribbon Cassette Dimensions

Dimensions, Weight, Finish

Dimensions

251 x 298 x 194.5 mm (9.88 x 11.73 x 7.66") (W x D x H)

Weight

Approx. 5.6 kg (12.3 lbs)

Color

EPSON Standard Gray

Environmental Specifications

Temperature

Operation: 5° to 40°C (41° to 104°F)

Storage: -10° to +50°C (14° to 122°F) (except ribbon)

Humidity

Operation: 30 to 80% (non-condensing; limit above 30°C: 30°C, 80%)

Storage: 30 to 90% (non-condensing; except ribbon)

Vibration resistance (in standard EPSON packing)

Frequency: 5 to 55 Hz

Acceleration: 2 G

Sweep: 5 minutes (one way)

Time: 1 h

Directions: X, Y, Z

No visible external or internal problems or operation failure after the above vibration test.

Shock resistance (in standard EPSON packing)

With packing

Drop height: 50 cm (19.69")

Angle: 1 angle, 3 surfaces, 6 sides

No visible external or internal problems or operation failure after the above drop test.

Without packing

Drop height: 5 cm (1.97")

Angle: 4 sides, one-point support

No damage when dropped while printer is off.

Noise

63 dB (operating, measured in ANSI bystander position; printing on receipt and journal paper roll)

Reliability

Mechanics

MCBF	5,000,000 lines (auto-cutter and stamp once every 15 lines)
Life expectancy	7,500,000 lines (The printer's life is considered over when the printer cannot function due to worn-out main parts such as motor, solenoids, frames, and shafts.)
Life expectancy of print head	150,000,000 characters (average 2 dot/wire/1 character)

MICR reader mechanism (only when the printer is used with the MICR reader):

MCBF:	160,000 passes
Life:	240,000 passes
	1 pass: reading characters to printing endorsements on a U.S. personal check (152 mm (5.98") long)

The MICR reader is defined to have reached the end of its life when it cannot function properly because of wearing out of the main parts (magnetic head, head holding roller, etc).

Certifications

Japan:	EMI: VCCI Class 1
North America:	EMI: FCC Class 1
	Safety standards: UL1950-2TH-D3 C-UL
Europe:	CE marking (printer with MICR reader under application) EN55022 EN50082-1 EN45501 (except when connected to IM) Safety standard: TÜV

Hardware Configuration

Main Unit Configuration

Printer mechanism

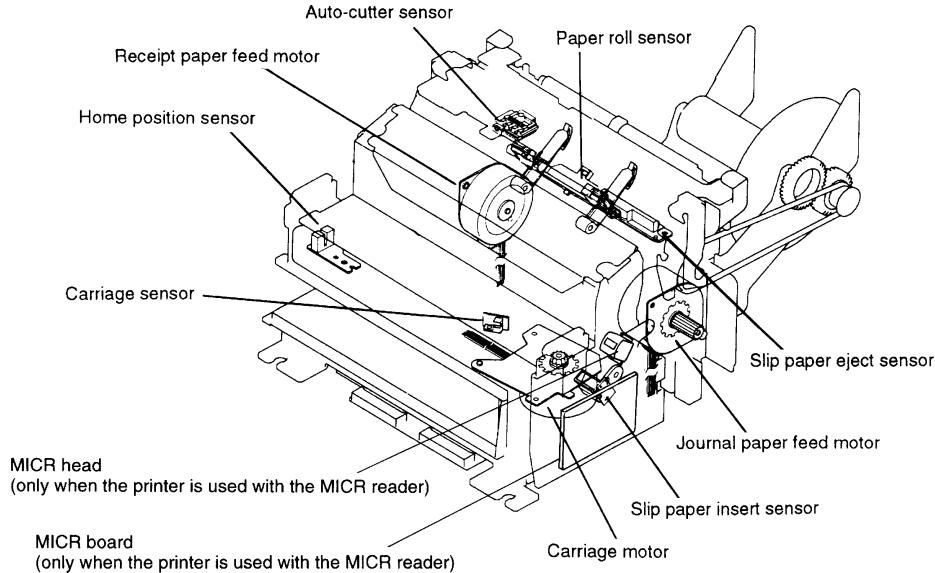


Figure 1-12. TM-U950 Printer Mechanism Main Unit Configuration

Electrical circuit and unit on cases

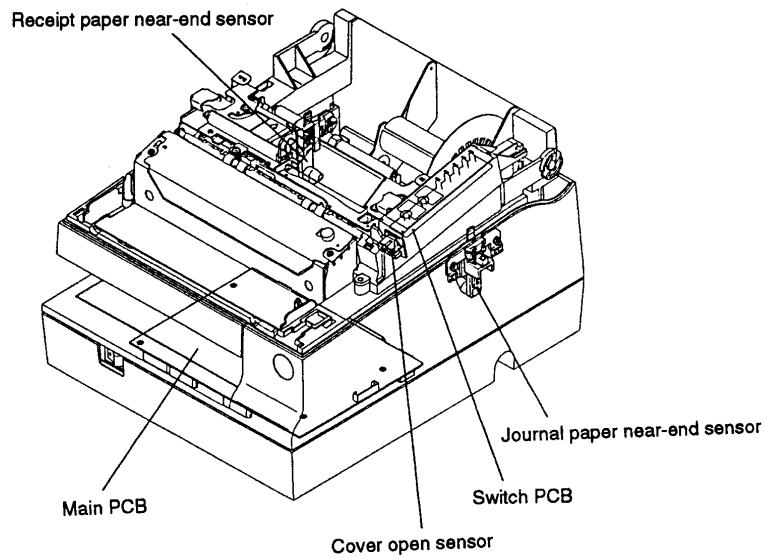


Figure 1-13. TM-U950 Electrical Circuit and Unit on Cases Main Unit Configuration

Main Unit Specifications

Paper feed motors

Receipt and journal paper feeding is performed by dedicated feed motors. Slip paper feeding is performed by using the journal paper feed motor and a journal/slip switching solenoid.

Motor type

4-phase, 48-pole PM type stepping motor

Drive voltage

24 V DC + 10% (including voltage drop caused by drive transistor)

Winding resistance

Journal paper feed motor	35 Ω ± 7% at 25°C (77°F), per phase
Receipt paper feed motor:	42 Ω ± 7% at 25°C (77°F), per phase

Current consumption (per motor)

Journal paper feed motor

Peak current: 1.94A in worst case

Average current: 615 mA at rated speed; 25°C (77°F), 24 V DC, 500 pps
930 mA max. in worst case

Hold current 92.5+42.5 mA per phase at normal hold, 25°C (77°F)

Receipt paper feed motor

Peak current: 1.5 A in worst case

Average current: 510 mA at rated speed; 25°C (77°F), 24 V DC, 500 pps
770 mA max. in worst case

Hold current: Approx. 130 ± 50 mA per phase at normal hold, 25°C (77°F)

Drive frequency

500 pps (minimum pulse interval 2.00 ms)

Drive principle

Constant voltage drive, 2-2 phase induction

Carriage motor

Motor type

4-phase, 48-pole PM type stepping motor

Drive voltage

24 V DC ± 10% (including voltage drop caused by drive transistor)

Winding resistance

9 Ω ± 7% at 25°C (77°F), per phase

Current consumption (per motor)

Peak current:	1.5 A in worst case
Average current:	550 mA at rated speed
Hold current:	150 mA ± 8% per phase

Drive frequency

Standard mode:	1400 pps (pulse interval 714 µs)
Copy mode:	1200 pps (pulse interval 834 µs)

Drive principle

Constant-current chopper drive, 2-2 phase induction

Carriage feed pitch

0.3386 mm (1/75") per pulse

Print head unit (print solenoids)

Number of solenoids:	9
Drive voltage:	24 V DC ± 10% (including voltage drop caused by drive transistor)
DC resistance:	6.65 Ω ± 4% at 25°C (77°F)

Near-end sensors (journal, receipt)

A sensor is provided for the receipt and journal paper roll respectively. The sensors check the diameter of each roll and activate the near-end alarm when the diameter falls below a user-determined value.

Sensor type:	Microswitch
Voltage:	5 V DC ± 5%
Output level:	Low when near-end is detected

Paper roll sensors (journal, receipt) (*)

A sensor is provided in the paper path (receipt and journal side, respectively) of the printer mechanism. These sensors check for the presence of paper, and accordingly control loading of the paper roll.

Sensor type:	Microswitch
Switch rating:	10 to 100 mA, 5 V DC (resistive load)
Contact condition:	On when paper is present

(*) If the paper roll sensor detects the "no paper" condition while the cover is open, semi-automatic loading can be performed by inserting the paper roll into the paper path.

Slip paper insert sensor

This sensor is located in the slip paper loading path to detect the insertion of slip paper.

Sensor type:	Photosensor
Voltage:	5 V DC ± 5%
Input current:	Approx. 20 mA
Output level:	High when slip paper is detected

Slip paper eject sensor

This sensor is located in the slip paper eject path to detect ejection of slip paper. If ejection is not detected, the printer does not proceed to the next step.

Sensor type:	Photosensor
Voltage:	5 V DC ± 5%

Cover open sensor (*)

This sensor detects the condition of the printer cover. If the cover is open, the printer automatically goes off-line after the current printing operation and the carriage returns to the home position at slow speed. The printer goes back on-line when the cover is closed.

Sensor type:	Photosensor
Voltage:	5 V DC ± 5%
Input current:	10 mA
Output level:	High when cover open is detected

- (*) If the paper roll sensor detects the “no paper” condition while the cover is open, semi-automatic loading can be performed by inserting the paper roll into the paper path.

Auto-cutter sensor

Sensor type:	Mechanical contact sensor
Voltage:	5 V DC ± 5%
Current rating:	0.1 to 0.5 mA

Home position sensor

This sensor detects the carriage initial position (on the receipt paper side) and the carriage abnormal operation.

Sensor type:	Photosensor
Voltage:	5 V DC ± 5%
Output level:	High when the carriage home position is detected

Carriage sensor

This sensor outputs signal synchronized with the carriage operation, and detects whether the carriage operation is abnormal.

Sensor type:	Photosensor
Voltage:	5 V DC ± 5%
Output level:	High when sensor plate is detected

MICR Reader (when the printer is used with the MICR reader) (Not available for the TM-U950P)

Available fonts: E-13B, CMC7
Recognition rating: 98% or more (at 25°C)

Recognition rating is defined as follows:

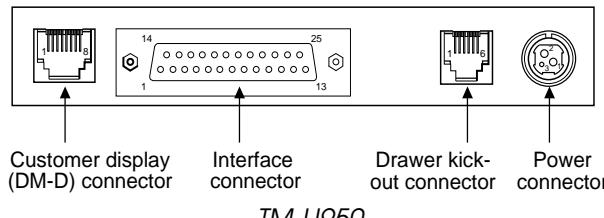
$$\text{Recognition rating (\%)} = \frac{\text{Total number of checks} - (\text{number of sheets misread and those not identified})}{\text{Total number of checks}} \times 100$$

Check paper used for test is EPSON standard check paper. Checks must be flat, without curls, folds, or wrinkles.

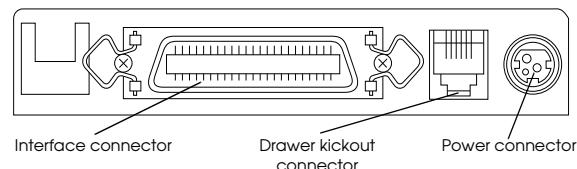
Connectors

All connectors are located on the rear panel of the printer. (Refer to Figure 1-1.)

Connector panels



TM-U950



TM-U950P

Figure 1-14. Rear Panel Connectors

Interface

See the Interface section in this chapter.

Power supply connector

This connector is for the AC adapter.

Connector type: TCS7960-53-2010 (Hoshiden) or equivalent

Table 1-4. Power Supply Pin Assignment

Pin number	Function
1	24 VDC
2	Signal ground
3	NC
Shell	Frame ground

Note:

Be sure to ground the printer via the frame ground terminal on the metal strip on the rear panel.

Drawer kick-out connector (modular connector)

Pulse specified by ESC p command is output to this connector. The host can confirm the status of the input signal by using the DLE EOT, ESC u, GR r, or GS a (ASB) commands.

Connector type:

Printer side	52065-6615 (Molex) or equivalent
User side	6-position 6-contact (RJ12 telephone jack)

Table 1-5. Drawer Kick-out Connector Pin Assignment

Pin number	Signal name	I/O
1	Frame ground	—
2	Drawer kick-out drive signal 1 (*1)	O
3	Drawer open/close signal (*2)	I
4	+ 24 V	—
5	Drawer kick-out drive signal 2 (*1)	O
6	Signal ground	—

(*1) Drawer kick-out drive signal

The signal specified by the ESC p command is output from pins 2 and 5 of the connector.

Output voltage: Approx. 24 V
Output current: 1 A max.

Output waveform: The waveform of the signal at pins 2 and 5 is shown in Figure 1-15. (The ON time n1 and OFF time n2 are determined by the ESC p command.)

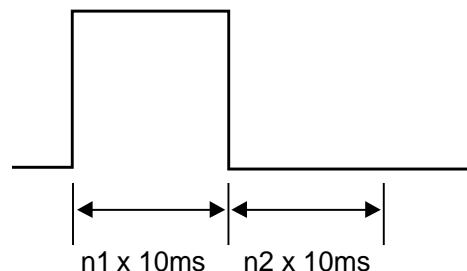


Figure 1-15. Drawer Kick-out Drive Signal Timing

(*2) Drawer open/close signal

The host computer can check the drawer open/close status with the DLE EOT, ESC u, GR r, or GS a (ASB) commands.

Input signal level (connector pin 3)

Low = 0 to 0.8 V
High = 2 to 5 V

Notes

- Use a shielded cable for the drawer connection.
- It is not possible to drive two drawers at the same time.
- Use a solenoid rated for at least $24\ \Omega$ as the drawer kick-out solenoid. Otherwise, excessive current may damage the solenoid.
- The drawer must be powered from the printer (connector pin 4).
- Do not drive the drawer continuously.

Customer display connector (not supported on the TM-U950P)

This connector is for Epson customer display (DM-D series). Do not connect other customer displays.

Connector type:

Receptacle 52065-8845 (Molex) or equivalent

Table 1-6. Customer Display Connector Pin Assignment

Pin number	Signal name	I/O
1	Frame ground	—
2	NC	—
3	TXD	O
4	DTR	O
5	DSR	I
6	Signal ground	—
7	+24V DC	—
8	Power ground	—

Interface

Serial interface

Data transfer principle	Serial (RS-232 interface)
Synchronization	Asynchronous
Handshake (*)	DTR/DSR or XON/XOFF
Signal level	
MARK:	-3 to -15 V (logical "1"/OFF)
SPACE:	+3 to +15 V (logical "0"/ON)
(Voltage measured at connector, referenced to SG)	
Baud rate (*)	1200, 2400, 4800, 9600 bps
Word length (*)	7 or 8 bit

Parity (*)	None, even, odd
Number of stop bits	1 or more
Connector type	D-SUB 25 female or equivalent

(*)Can be set with DIP switches on the bottom of the unit (See Tables 1-9 and 1-10.)

On-line/off-line switching

This printer has no on-line/off-line switch. It automatically goes off-line in the following cases:

- During self-test.
- When the cover is open.
- When the paper feed button (receipt or journal/slip) is used to advance the paper.
- When printing has stopped due to no paper ("no paper" condition selected with ESC c 4).
- During the interval between power-on (including reset using the interface) and the end of the initialization sequence, until data can be received.
- When an error has occurred
- During the macro execution switch waiting status.

Table 1-7. Interface Connector Specifications and Functions

Pin number	Signal name	I/O	Function
1	FG	—	Frame ground
2	TXD	○	Transmit data
3	RXD		Receive data
4	RTS	○	DIP SW1-6 off: Same as DTR signal (Pin20) DIP SW1-6 on: Logical product of DTR signals of DM-D and TM (if both are SPACE, the printer can receive data).
6	DSR		Indicates whether the host is ready to receive data. SPACE indicates "ready," and MARK indicates "not ready." If DTR/DSR control is used, the printer checks this signal before sending data (except when sending data by GS ENG, DLE ENQ, GS a). If XON/OFF control is used, this signal is not checked. This signal can be used to reset the printer according the DIP switch settings. The printer is reset when the signal is MARK with more than 1 ms pulse width.
7	SG	—	Signal ground

Table 1-7. Interface Connector Specifications and Functions

Pin number	Signal name	I/O	Function
20	DTR	O	<p>1) When DTR/DSR control is selected, this signal indicates whether the printer is busy. MARK indicates busy and SPACE indicates not busy. The busy condition is changed using DIP switch 5 of the bank 2 as shown in Table 1-7a.</p> <p>2) When XON/OFF control is selected, the signal indicates whether the printer is correctly connected and is ready to receive data. SPACE indicates "ready". The signal is always SPACE except in the following two cases:</p> <ul style="list-style-type: none"> (o) During the interval between power-on and the time when the printer is ready to receive data. (o) During the self-test.
25	INIT	I	Changing the DIP switch setting enables this signal to be used as a reset signal for the printer. The printer is reset when the signal remains SPACE for 1 ms or more.

Table 1-7a. Pin 20 Information

Printer status	DIP SW 2-5 status	
	ON	OFF
During the interval between power-on (reset using interface) and the time when the printer is ready to receive data.	BUSY	BUSY
During the self-test	BUSY	BUSY
When the cover is open.	—	BUSY
During paper feeding with the paper feed button.	—	BUSY
When the printing has stopped due to a paper-end.	—	BUSY
When an error has occurred.	—	BUSY
When the receive buffer becomes full (*1).	BUSY	BUSY

(*1) The "buffer full" condition in this case starts when remaining buffer space falls to 16 bytes or less and ends when it becomes 26 bytes or more. The printer ignores the data when the remaining space in the receive buffer is 0 bytes.

Note

Pins 8 - 19 and 21 - 24 are not used.

XON/XOFF control

When XON/XOFF control is selected, the XON and XOFF output timing is as described below. (XON code: 11H; XOFF code: 13H) Transmit timing differs depending on the DIP switch 5 of the bank 2.

Table 1.8. XON/XOFF Transmit Timing

	Printer status	DIP SW 2-5 status	
		ON	OFF
XON transmission	When the printer goes on-line after the power-on or reset with interface.	Transmit	Transmit
	When the receive buffer is released from the buffer full state.	Transmit	Transmit
	When the printer changes to on-line. (*1)	—	Transmit
	When the printer recovers from an error by the DLE ENQ 1 or DLE ENQ 2.	—	Transmit
XOFF transmission	When receive buffer becomes full.	Transmit	Transmit
	When the printer changes to off-line. (*2)	—	Transmit

(*1) XON is not transmitted when the receive buffer is full.

(*2) XOFF is not transmitted when the receive buffer is full.

Notes on setting DIP switch 2-5 on

- The printer stops printing mechanism operation but does not go off-line when an error has occurred, printing stops due to a paper-end, or paper is fed using the paper feed button.
- When setting DIP SW 2-5 on to enable handshaking with the host computer, be sure to check the printer status by the GS a command and automatic status transmission function. In this setting, the default values of n for GS a is 2, and the printer automatically transmits the changes in on-line/off-line.
- When using DLE EOT, DLE ENQ, and GS ENQ, be sure that the receive buffer does not become full.

a) When using a host that cannot transmit data when the printer is busy:

If an error has occurred, DLE EOT, DLE ENQ, and GS ENQ cannot be used when the printer is busy due to receive buffer-full.

b) When using a host that can transmit data when the printer is busy:

When the receive buffer becomes full while transmitting data, DLE EOT, DLE ENQ, or GS ENQ using between the bit image data is processed as bit image data. The data transmitted when the receive buffer is full may be lost.

The following illustrates an example serial interface connection:

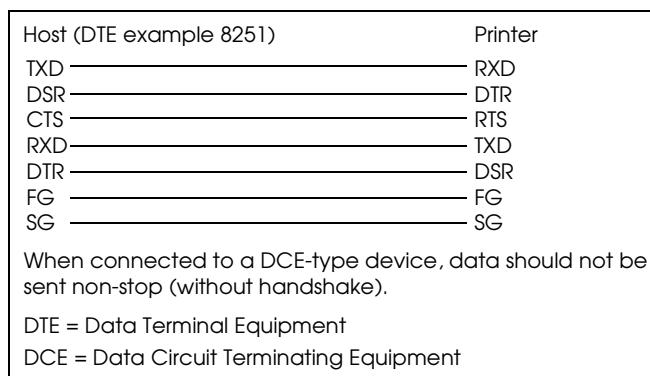


Figure 1-16. Serial Interface Connection Example

Parallel interface

(Bidirectional parallel interface in accordance with the IEEE 1284 nibble/byte modes).

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Compatibility mode

(Data transmission from host to printer: Centronics compatible)

Data transmission:	8-bit parallel
Synchronization:	Externally supplied nStrobe signals
Handshaking:	nAck and Busy signals
Signal levels:	TTL compatible
Connector:	57RE-40360-830E(DDK) or equivalent (IEEE 1284 Type B)

Reverse mode

(Data Transmission from printer to host)

The STATUS data transmission from the printer to the host is accomplished in the Nibble or Byte mode.

This mode allows data transmission from the asynchronous printer under the control of the host. Data transmission in the Nibble mode are made via the existing control lines in units of four bits (Nibble). In the Byte mode, data transmission is accomplished by making the 8-bits data lines bidirectional.

Neither mode can operate at the same time as the compatibility mode, so switching is always required.

The 1284 Nibble/Byte modes may be subject to change without notice.

TM-U950P printer status and signals

Pin No.	Source	Compatibility mode	Nibble mode	Byte mode
1	Host	nStrobe	HostClk	HostClk
2	Host/Printer	Data0 (LSB)	Data0 (LSB)	Data0 (LSB)
3	Host/Printer	Data1	Data1	Data1
4	Host/Printer	Data2	Data2	Data2
5	Host/Printer	Data3	Data3	Data3
6	Host/Printer	Data4	Data4	Data4
7	Host/Printer	Data5	Data5	Data5
8	Host/Printer	Data6	Data6	Data6
9	Host/Printer	Data7 (MSB)	Data7 (MSB)	Data7 (MSB)
10	Printer	nAck	PtrClk	PtrClk
11	Printer	Busy	PtrBusy/Data3, 7	PtrBusy
12	Printer	PError	AckDataReq/ Data2, 6	AckDataReq
13	Printer	Select	Xflag/Data1, 5	Xflag
14	Host	nAutoFd	HostBusy	HostBusy
15		NC	ND	ND
16		GND	GND	GND
17		FG	FG	FG
18	Printer	Logic-H	Logic-H	Logic-H
19 to 30		GND	GND	GND
31	Host	nInit	nInit	nInit
32	Printer	nFault	nDataAvail/Data0, 4	nDataAvail
33		GND	ND	ND
34	Printer	DK_STATUS	ND	ND
35	Printer	+5V	ND	ND
36	Host	nSelectIn	1284-Active	1284-Active

NC: Not connected, ND: Not defined

Notes:

- A prefix "n" to signal names refers to low active signals.
- If the host does not have any one of the signal lines listed above, two-way communication fails.
- For interfacing, signal lines should use twisted pair cables with the return sides connected to the signal ground level.

- Interfacing conditions should be all based on the TTL level. In addition, both the rise time and fall time of each signal must be 0.5 µs or less.
- Data transmission should not ignore the signal nAck or Busy. An attempt to transmit data with either signal, nAck or Busy, ignored can cause lost data. (Data transmission to the printer should be made after verifying the nAck signal or while the Busy signal is low.)
- Interface cables should be as short as possible.

Precautions on receiving status from the printer

The printer status transmission is available by using the both-way communication facility in the Nibble/Byte mode in accordance with the IEEE 1284 mode.

The following precautions must be taken for receiving the status from the printer.

- The allowable capacity of the printer's internal buffer is 100 bytes. Status signals exceeding this capacity will be discarded. To prevent possible loss of status data, the host should always be ready for data reception (reverse mode).
- When ASB is used, the host should be in the wait state for data reception (reverse idle mode). When this state is not available, the host should enter the reverse mode to always monitor the presence of data.
- When ASB is used, preference should be given to the ASB status for transmission over the other status signals. Any accumulated ASB status signals left for transmission from the last to the newest ASB status transmission should be transmitted together at one time as one ASB status showing the change has been made, followed by the latest ASB status.

Example: In the normal (wait) state, the ASB status is configured as follows:

1st status	2nd status	3rd status	4th status
0000 0000	0000 0000	0000 0000	0000 0000

When the following sequence of operations is performed, near end detection, cover open, cover closed, the following pieces of data are accumulated.

	1st status	2nd status	3rd status	4th status	
1	0000 0000	0000 0000	0000 0011	0000 0000	Near end detection
2	0010 1000	0000 0000	0000 0011	0000 0000	Cover open
3	0000 0000	0000 0000	0000 0011	0000 0000	Cover closed

When the ASB status is received following this, a total of 8 bytes of ASB will be transmitted as follows.

	1st status	2nd status	3rd status	4th status
Accumulated ASB (1+2+3)	0010 1000	0000 0000	0000 0011	0000 0000
+	1st status	2nd status	3rd status	4th status
The latest ASB (3)	0000 0000	0000 0000	0000 0011	0000 0000

Switching between on-line and off-line

The TM-U950P printer does not have an on-line/off-line button. The printer goes off-line in the following conditions:

- Between the time when the power is turned on (including reset using the interface) and when the printer is ready to receive data.
- During the self-test.
- When the cover is open.
- During paper feeding using the paper feed button.
- When the printer stops printing due to a paper-end (when the paper-end sensor detects a paper end or when the paper near-end sensor is enabled by ESC c 4 and detects a paper-end).
- During the macro execution standby state. (The macro is executed by pressing the paper feed button.)
- When an error has occurred.

Notes on setting DIP switch 2-5 to ON

The printer mechanism stops but does not become busy when an error has occurred, the cover is open, printing stops due to a paper end, or paper is fed using the PAPER FEED button.

When setting DIP switch 2-5 to ON to enable handshaking with the printer, be sure to check the printer status using the GS a command and the ASB function. In this setting, the default value of n for GS a is 2. The printer automatically transmits the printer status, depending on on-line/off-line changes.

When using DLE EOT, DLE ENQ and GS ENQ, be sure that the receive buffer does not become full.

- When using a host that cannot transmit data when the printer is busy and if an error occurs, DLE EOT, DLE ENQ and GS ENQ cannot be used when the printer is busy due to a receive buffer-full state.
- When using a host that can transmit data when the printer is busy and the receive buffer becomes full while transmitting bit-image data, a DLE EOT, DLE ENQ or GS ENQ used while sending bit-image data is processed as bit-image data, not as a command. Secondly, any data transmitted when the receive buffer is full may be lost. Thirdly, data sent during data entry or data sent when the printer is busy may be lost regardless of the DIP switch setting.

Example: Check the printer status using ESC v or ESC u after transmitting each line of data and use the 2K byte receive buffer. Transmit one line of data so that the receive buffer does not become full.

Switches and Buttons

The power switch is located on the front side of the printer, at the lower left. The operation panel buttons are located on the right top side of the printer. Two banks of DIP switches are located on the bottom of the printer. (See Figure 1-1.)

Power switch

Turns the printer on or off.

Power switch cover guards the power switch from incorrect operation.

For using the cover see Mounting the Power Switch Cover in Chapter 3.

Operation panel buttons

The ESC c 5 command determines whether or not the operation panel buttons are active.

RECEIPT FEED button

Type: Non-locking push button

Function: If this button is pushed once and released, the printer feeds receipt paper for one line based on the line spacing set by ESC 2 and ESC 3. If this button is held down, the printer feed paper continuously.

The paper is fed after the carriage is moved to the center of the receipt paper roll.

JOURNAL/SKIP FEED button

Type: Non-locking push button

Function: If this button is pushed once and released, the printer feeds journal paper for one line based on the line spacing set by ESC 2 and ESC 3. If this button is held down, the printer feeds paper continuously.

When this button is pushed in slip mode (slip LED lights or blinks), the printer feeds slip paper.

In 2-sheet mode, the paper is fed after the carriage is moved to the center of the journal paper roll.

In slip mode, the paper is fed after the carriage is moved to the right edge of the slip paper.

Notes

- When the printer cover is open, these buttons are active regardless of the ESC c 5 setting.
- Be careful not to catch your finger in the printer when you push these buttons with the printer cover open.

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DIP switch settings for the TM-U950

Table 1-9. DIP Switch Bank 1

Switch number	Function	ON	OFF
1	Data word length	7 bit	8 bit
2	Parity check	Yes	No
3	Parity type	Even	Odd
4	Data transfer rate		
	Transfer rate (bps)	4	5
	1200	On	On
	2400	Off	On
	4800	On	Off
	9600	Off	Off
6	Connection of customer display (*)	Connected	Not connected
7	Data reception error handling	Disregard	Print "?"
8	Handshake	XON/XOFFD	DTR/DSR

- (*) Effective when a direct connection customer display is connected to the DM-D connector of the printer.

Table 1-10. DIP Switch Bank 2

Switch number	Function	ON	OFF
1	Automatic CR	Always yes	Always no
2	Reception buffer size	32 bytes	2048 bytes
3	Font selection (default setting)	9 x 9	7 x 9
4	Carriage speed (paper roll initial setting)	Low speed	High speed
5	Handshake operation (condition for BUSY)	Receive buffer full	Off line or receive buffer full
6	Internal use	Fixed	—
7	Interface pin 6 reset signal	Used	Not used
8	Interface pin 25 reset signal	Used	Not used

- When the interface connector pin 6 is used to reset the printer, the printer is reset at MARK with the RS-232C level.
- When the interface connector pin 25 is used to reset the printer, the printer is reset at SPACE with the RS-232C level, and is reset at high with the TTL level.

Notes

- DIP switches (excluding switches 1, 7, and 8 of switch bank 2) are effective only while the printer power is turned on. If the DIP switch setting is changed after the printer power is turned on, the change is not effective.
- If DIP switch 7 or 8 of the switch bank 2 is on while the printer power is turned on, the printer may be reset, depending on the signal state. DIP switches should not be operated while the printer power is turned on

DIP switch settings for the TM-U950P

Table 1-9a. DIP Switch Bank 1

Switch number	Function	ON	OFF
1	Undefined	—	—
2	Undefined	—	—
3	Undefined	—	—
4	Undefined	—	—
5	Undefined	—	—
6	Internal use	—	Fixed
7	Undefined	—	—
8	Undefined	—	—

Table 1-10a. DIP Switch Bank 2

Switch number	Function	ON	OFF
1	Auto line feed	Always enabled	Always disabled
2	Receiver buffer	32 bytes	2048 bytes
3	Font selection (default)	9x9	7x9
4	Carriage moving speed (default for paper roll printing)	Low	High
5	Handshaking (BUSY condition)	Receive buffer-full	Off-line or receive buffer-full
6	Internal use	Fixed	—
7	Undefined	—	—
8	Internal use	Fixed	—

Note

- ❑ DIP switches are effective only while the printer power is turned on. If the DIP switch setting is changed after the printer power is turned on, the change is not effective.

Indicators

The indicators are located on the operation panel. (See Figure 1-1.)

POWER LED (green)

- On: Stable power (+5 V) is supplied.
- Off: Stable power (+5 V) is not supplied.

ERROR LED (red)

- On: Printer is off-line (except when paper is being advanced with the FEED buttons and during self test printing).
- Off: Normal operation
- Flashing: An error has occurred. (See Error Types and Countermeasures on page 4-23).

RECEIPT OUT LED (red)

- On: Near-end condition or paper end is detected for paper roll at receipt side.
- Off: Paper roll at receipt side is sufficient.
- Flashing: Stand by for test printing

JOURNAL OUT LED (red)

- On: Near-end condition or paper end is detected for paper roll at journal side.
- Off: Paper roll at journal side is sufficient.
- Flashing: Stand by for test printing

SLIP LED (green)

- On: Slip paper mode
- Off: Two-sheet (paper roll) mode

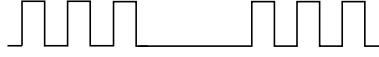
Blinking: Stand by for slip paper insertion
Blinking pattern



Blinking: Stand by for slip paper removal
Blinking pattern



Blinking: Personal check waiting state (when the printer is used with the MICR reader)



Functions

Error Processing

Error detection

When the printer detects an error, it carries out the following operation sequence:

- All running operations are stopped.
- The printer goes off-line
- The ERROR LED flashes. (See Error Types and Countermeasures on page 4-23.)

Error recovery

The commands DLE ENQ 1 and DLE ENQ 2 are used to recover from a recoverable error (*1).

Notes

- If slip paper is selected and DLE ENQ 1 is used to recover from a recoverable error, the printer ejects the remaining slip paper and repeats the loading process.
- When recovering from a slip paper eject error, the printer ejects the paper but does not repeat loading.
- When the printer recovers from an error using DLE ENQ 2 while slip paper is selected, the printer first ejects the slip, then goes to 2-sheet mode.
- When an unrecoverable error (*2) has occurred, turn off the printer as soon as possible.

(*1) Errors (6) to (10) in Table 4-5 in Chapter 4 are the recoverable errors.

(*2) Errors (1) to (5) in Table 4-5 in Chapter 4 are the unrecoverable errors.

Data receive error

When an error is detected in data received by the printer (parity, framing, or overrun error), the data is either ignored or replaced to "?", depending on the DIP switch setting.

Self-test

The self-test checks the following items:

- Control circuit operation
- Printer mechanism operation
- Print quality
- Control ROM version (on status printout)
- DIP switch settings (on status printout)
- MICR reader circuit function check (for printers with an MICR reader)

For details about the self-test, please see Self-test in Chapter 4.

Hexadecimal Dumping

Hexadecimal dumping function

This function prints the data transmitted from the host computer in hexadecimal numbers and in its corresponding characters.

Starting hexadecimal dumping

Open the cover and turn the power on while pressing the RECEIPT FEED button, then close the cover. The printer first prints "Hexadecimal Dump" on the paper roll and prints the received print data in hexadecimal numbers and in its corresponding characters.

Notes

- If no characters correspond to the data received, the printer prints ".".
- During hexadecimal dumping, any commands other than DLE EOT, DLE ENQ, and GS ENQ do not function.

Ending hexadecimal dumping

Hexadecimal dumping ends by turning the power off or resetting the printer after printing has finished.

Printing example.

Hexadecimal Dump											
1B	21	00	1B	26	02	40	40	:	.!.&.@@		
1B	25	01	1B	63	34	00	1B	:	.%..C4..		
41	42	43	44	45	46	47	48	:	ABCDEFGHI		

Printing Operation

Sensors and printing operation

The ESC c 4 command can be used to select whether the printer should stop or continue printing when the “no paper” condition is detected. The following sensors are involved:

- | | |
|------------------|--|
| Two-sheet mode: | Journal near-end sensor
Receipt near-end sensor
Journal paper sensor (*1)
Receipt paper sensor (*1) |
| Slip paper mode: | Slip paper insert sensor |

(*1) The journal and receipt paper roll sensors are used for auto-loading and cannot be used for paper-end detection. Printing may not be stopped even if the sensors are selected by ESC c 4. Therefore, use the near-end sensors to detect the paper roll end.

When “stop printing” is selected

- Two-sheet mode

When the “no paper” condition is detected, the printer automatically goes off-line. To resume printing, close the cover after inserting a new paper roll.

- Slip paper mode

When the “no paper” condition is detected, the printer continues to print on the printable area, ejects the paper, and waits for the paper to be removed. The printer then stands by for paper insertion.

Buffer full printing

After the maximum number of characters per line has been received and processed, the line is printed and the paper is advanced automatically when additional data is received.

Options

AC Adapter (PS-150)

Specifications

Input specifications

Rated input voltage: (specified at time of purchase):	90 to 110 V AC 108 to 132 V AC 198 to 264 V AC
Frequency:	48 to 62 Hz
Rated input current:	1.0 A (100 V type) 1.0 A (120 V type) 0.5 A (230 V type)
Power switch:	None
Power LED:	None

Output specifications

Output voltage:	24 V DC + 7%
Rated output current:	1.9 A {North American model} 2.0 A {Japanese and European model}

(If the adapter is not connected to a DC load of 2.0 A or less during power-on, the voltage will not build up sufficiently for operation.)

Rated output power:	Approx. 48 W
Output peak current:	6 A (within 10 ms)

Compliance to safety regulations

UL/CSA/TÜV

Dimensions and weight

Dimensions:	86 x 166 x 44 mm (3.39 x 6.54 x 1.73") (W x D x H) without protruding parts
Weight:	700 g (1.54 lbs) excluding AC adapter

Journal Lock

Journal lock mechanism is a factory option. It protects journal paper roll from being taken away. For handling, see Journal lock key handling in Chapter 3.

Chapter 2

Mechanism Configuration and Operating Principles

Printer Mechanism Components

The TM-U950 impact dot matrix printer consists of the following eight components:

- Printing assembly
- Sensor assembly
- Paper feed assembly
- Slip paper assembly
- Ribbon feed assembly
- Stamp assembly (for printers with a stamp assembly)
- Auto-cutter assembly
- Paper roll-take-up assembly

These components are described in detail in the following sections.

Printer Mechanism Operating Principles

Printing Assembly

The printing assembly consists of the print head unit with nine vertical wires, and the parts shown in Figure 2-1.

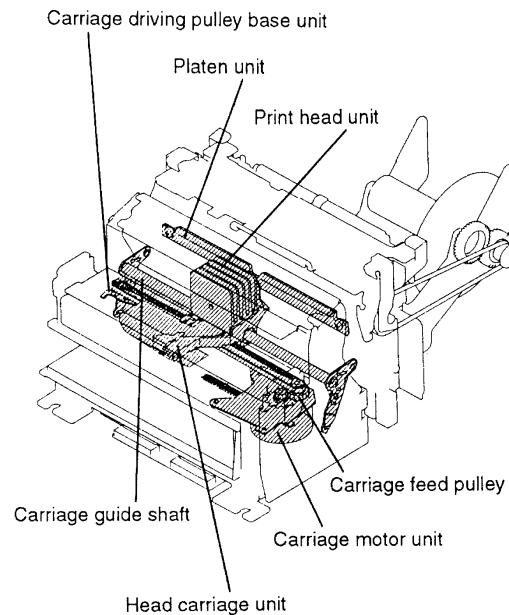


Figure 2-1. Printing Assembly

Print head unit movement

When the carriage motor is driven, the gear wheel turns in the direction indicated by the arrow \Rightarrow , and the carriage feed pulley and carriage drive belt transmit the driving force so that the head carriage fastened to the carriage drive belt moves in the direction of the arrow \Rightarrow . When the carriage motor turns in the direction indicated by the arrow \blacktriangleright , the head carriage moves in the direction of the arrow \blacktriangleright .

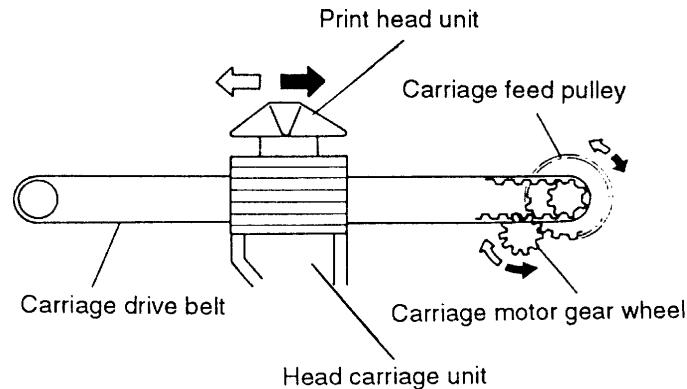


Figure 2-2. Print Head Unit Movement

Printing operation

Wire movement for printing a single dot

1. When the drive pulse is sent through the drive coil, a magnetic field is induced in the core, and the lever plate is pulled in the \rightarrow direction ①, the dot wire is pushed by the spring force of the wire towards the lever plate, which moves towards the platen assembly \rightarrow direction ②.
2. The pushed-out dot wire contacts the platen via the ink ribbon and paper, so that one dot is printed.
3. The drive coil current is cut, causing the dot wire and lever plate to return to their original positions due to the spring action of the wire and the plate.

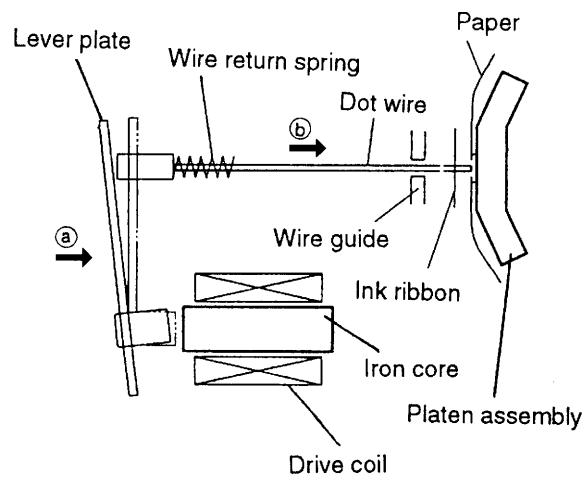


Figure 2-3. Dot Wire Operation

Forming a character

(9 x 9 dot matrix)

The carriage motor phase switching signal serves as a reference signal for powering the print solenoids in accordance with the carriage movement, to form a character. One rotation step of the carriage motor (7.5°) moves the print head unit by approximately 0.339 mm (0.013").

For example, to form the character “2”, print solenoids 2 and 9 are first powered in sync with the carriage motor phase switching signal. Next, a half-dot timing delay T_{nH} is introduced, and print solenoid 8 is powered. By continuing in this way, the character “2” is formed.

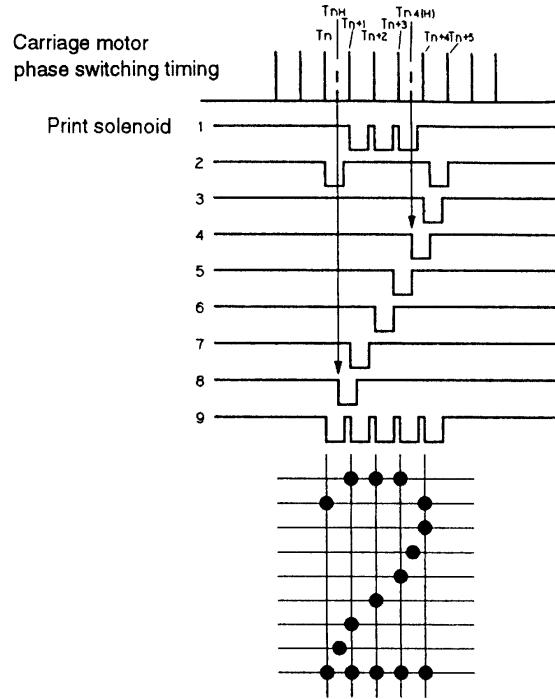


Figure 2-4. Print Timing Chart

Sensor Assemblies:

The sensor functions of the TM-U950 and TM-U950P are as follows:

Sensor Assembly	Function
Home position sensor assembly	Initial TM-U950/TM-U950P setting
Carriage sensor assembly	Detection of head carriage operation problems
Auto-cutter sensor assembly	Auto-cutter stroke detection
Slip paper insert sensor assembly	Slip paper presence detection
Slip paper eject sensor assembly	"
Paper sensor assembly	Roll paper presence detection
Near-end sensor assembly (*)	"

(*) The near-end sensor is mounted on the case at the paper feed section

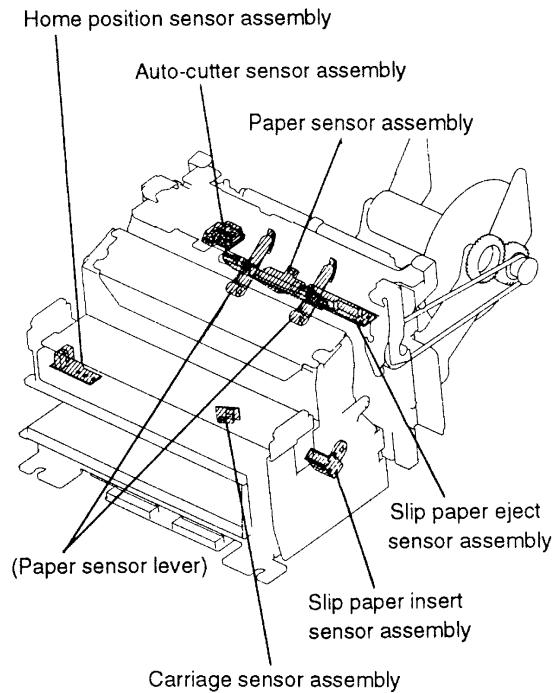


Figure 2-5. Sensor Assembly

Home position sensor assembly

The home position sensor assembly is mounted on the left side of the stroke of the head carriage. The sensor detects the movement of the sensor plate in the rear section of the head carriage, to determine the position of the head carriage and any possible malfunction.

The home position sensor assembly consists of an LED and a photo IC. When the head carriage moves, the sensor plate passes between the LED and the photo IC, therefore blocking the light from the LED and causing a change in the output level of the photo IC. This change is used to generate the head carriage position signal.

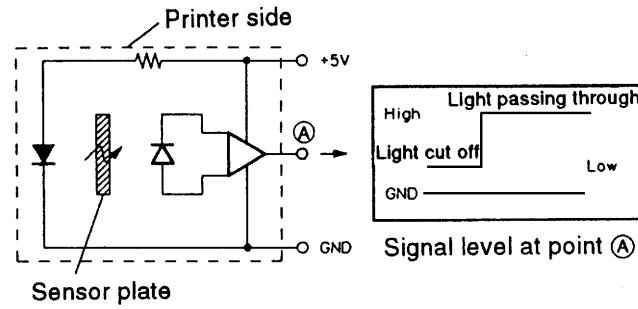


Figure 2-6. Home Position Sensor Circuit Diagram

Carriage sensor assembly

The carriage sensor assembly detects carriage motor rotation problems by using a rotary encoder. It consists of a set of gears mounted on the carriage motor wheel and a carriage sensor. This sensor uses an LED and photo IC arrangement. On the outer circumference of the carriage sensor gear, six sensor plates are mounted with equal spacing. This gear is driven by the carriage motor via carriage motor gear and ribbon feed transmission gear. The sensor plates pass between the LED and photo IC, blocking the light and causing a change in the output level of the photo IC. This change is used to generate the carriage motor rotation signal.

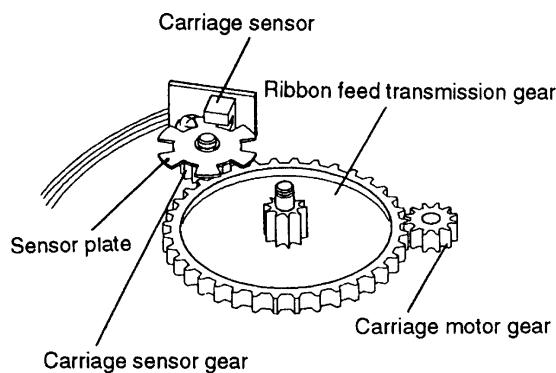


Figure 2-7. Carriage Sensor Assembly

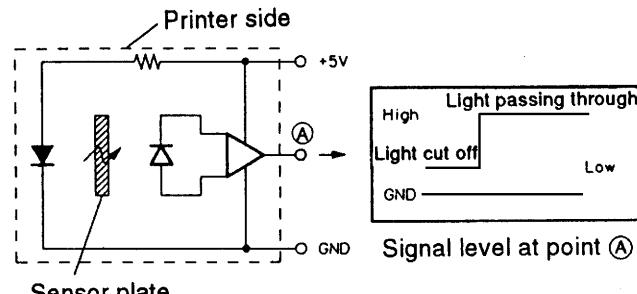


Figure 2-8. Carriage Sensor Circuit Diagram

Auto-cutter sensor assembly

The auto-cutter sensor assembly uses the brush contact principle and consists of the cutter slider assembly and a contact pin holder sub-assembly. This sub-assembly carries three contact pins: for ground, reset signal, and full cut/partial cut (F/P) position signal. The contact pins contact the print pattern on a sensor board mounted on the cutter slider assembly. When the drive gear moves the cutter slider assembly, the reset and F/P signals are generated.

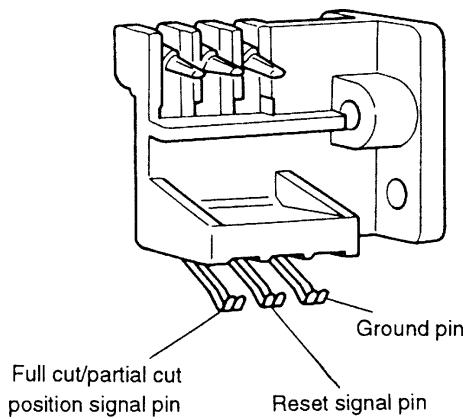


Figure 2-9. Contact Pin Holder Sub-assembly

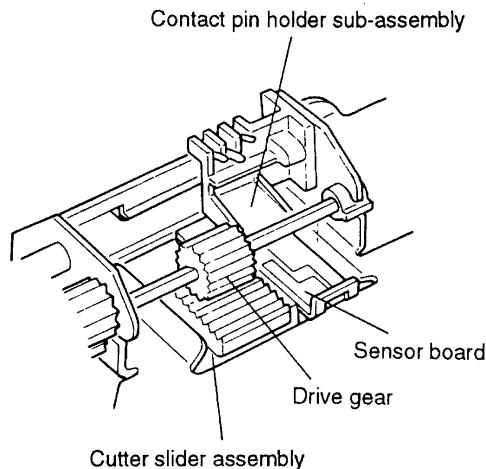


Figure 2-10. Relation of Contact Pin and Contact Board

Slip paper insert sensor assembly

The slip paper insert sensor assembly detects the tip of the paper when slip paper is being inserted and detects the end of the paper during printing. It is mounted immediately to the right of the paper set position.

The sensor sub-assembly uses an LED and photo transistor arrangement. When slip paper is inserted, it blocks the light from the LED and causes a change in the output level of the photo transistor. This change is used to generate the slip paper presence signal.

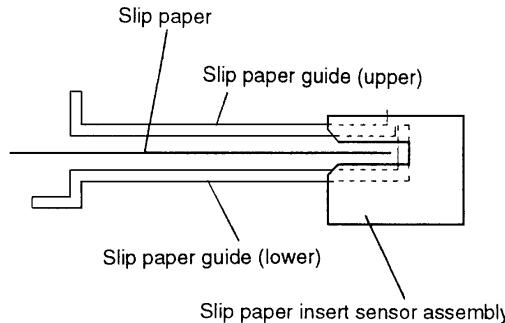


Figure 2-11. Slip Paper and Slip Paper Insert Sensor Sub-assembly

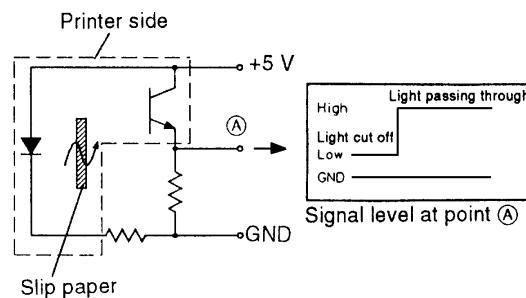


Figure 2-12. Slip Paper Insert Sensor Circuit Diagram

Slip paper eject sensor assembly

The slip paper eject assembly is mounted on the right side of the slip paper eject slot. It detects whether or not the paper has been properly ejected after printing.

The sensor sub-assembly uses an LED and photo transistor arrangement to detect light reflected by the paper. Since the photo transistor is also subject to external light, the light of the LED is modulated by turning it on and off with a 2-kHz pulse. The output of the photo transistor is then extracted via a 2-kHz filter to inhibit the influence of external light.

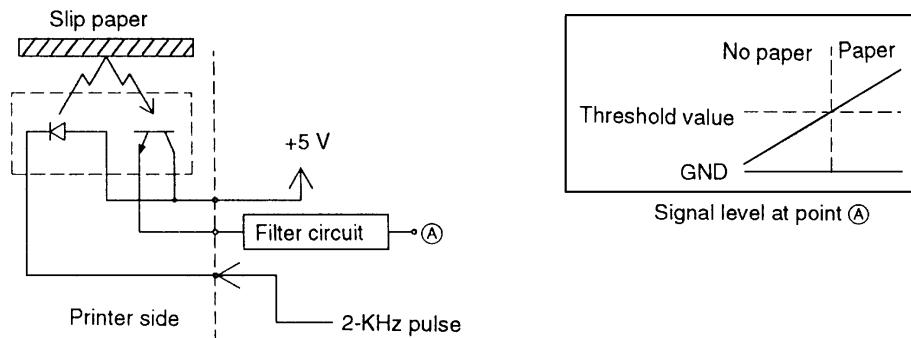


Figure 2-13. Slip Paper Eject Sensor Circuit Diagram

Paper roll sensor assembly

The paper roll sensor assembly consists of the paper roll sensor, and paper sensor lever. The assembly detects the presence of the paper roll.

The paper sensor lever can rotate freely above the upper paper guide and is in constant contact with the paper roll, due to the internal spring pressure of the microswitch and its own weight. Therefore, when paper is present in the paper path, the paper sensor lever contacts the paper at an angle, as shown by the solid line in Figure 2-14, and the microswitch is on. When there is no paper, the lever moves in the \rightarrow direction and the microswitch is off, so that the detection signal is generated.

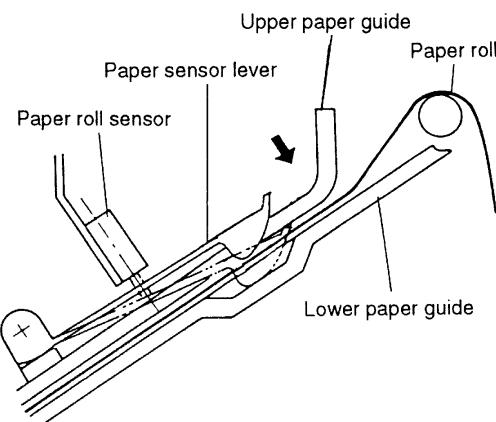


Figure 2-14. Paper Roll Sensor Assembly

Near-end sensor assembly

The near-end sensor assembly consists of the near-end sensor lever, and a microswitch. This assembly is mounted on the right and left sides of the lower case paper feed section and detects the remaining amount of paper on the paper roll.

The tip of the near-end sensor lever is pressed against the side of the paper roll by the internal spring pressure of the microswitch. Therefore, when the paper roll is full, the lever contacts the paper at an angle, as shown by the solid line in Figure 2-15, and the microswitch is on. When the diameter of the paper roll falls below a user-determined value, the lever moves in the \rightarrow direction and drops into the paper roll core opening, so that the microswitch is off and the detection signal is generated.

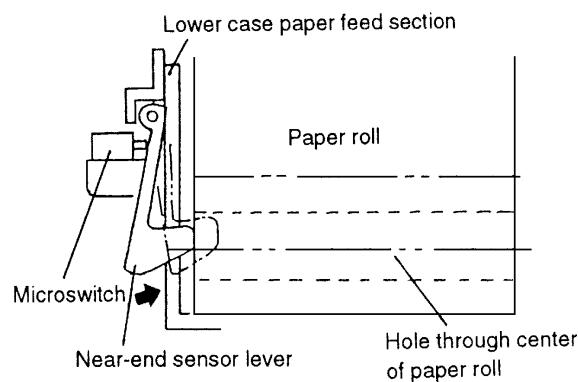


Figure 2-15. Near End Sensor

Paper Feed Assembly

The paper feed assembly consists of the parts shown in Figure 2-16. The paper feed motors drive the entire paper feed operation.

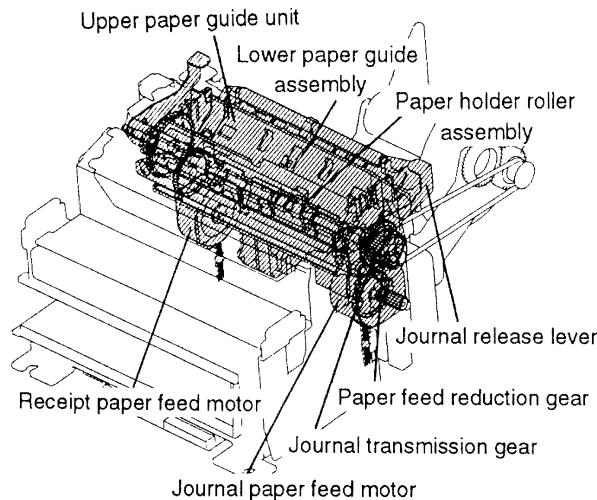


Figure 2-16. Paper Roll Feed Assembly

Semi-auto loading

A pair of auxiliary paper feed rollers installed on the upper paper guide is linked with the auxiliary paper holder rollers at constant pressure. The paper feed rollers are linked with the paper holder rollers at constant pressure. The paper feed rollers and the auxiliary paper feed rollers are driven by the journal and receipt paper feed motors via the J/S switching gear, paper feed reduction gear, journal transmission gear, and receipt transmission gear.

Immediately before the paper roll insertion point, there is the auxiliary paper feed rollers driven by the journal and receipt paper feed motors. When paper from the paper roll is handfed to the auxiliary paper feed rollers, semi-automatic loading is initiated. Paper from the paper roll is fed through the upper paper guide, lower paper guide, paper holder plate, platen, head carriage, and auxiliary paper guide to the paper feed rollers.

Immediately before the journal and receipt paper feed motors are driven, the carriage motor is activated and positions the carriage in the center of the paper width. After passing the paper feed rollers, the paper lifts the pawl of the auxiliary paper guide and thereby closes the guide. Therefore the paper from the paper roll cannot be advanced to the paper feed rollers merely by manual operation.

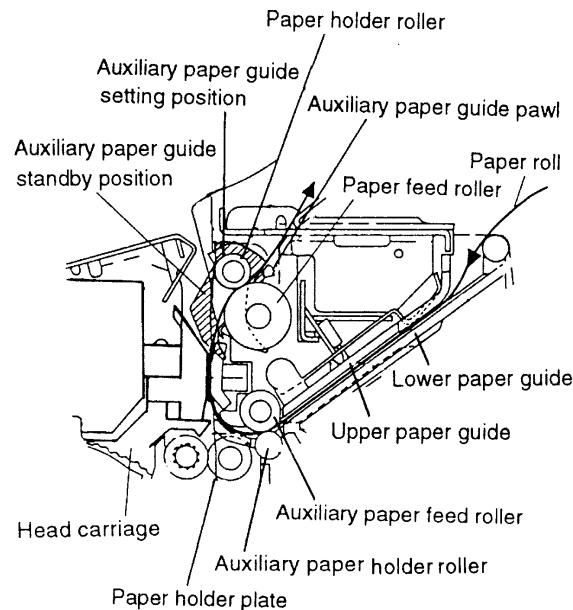


Figure 2-17. Paper Roll Insertion

Paper feed operation

The paper feed roller at the upper paper guide is linked with the paper holder roller at constant pressure, and paper on the paper roll is fed in from the paper feed roller. The paper feed roller shaft in the paper feed roller assembly is equipped with a gear that is driven by the journal paper feed motor via the J/S switching gear, paper feed reduction gear, paper feed transmission gear, and journal transmission gear.

By driving the journal paper feed motor as described above, the journal-side paper feed roller turns and advances the paper by a predetermined amount. For receipt side, the paper feed gear is driven by the receipt paper feed motor via the paper feed reduction gear, paper feed transmission gear, and receipt transmission gear. By the operation above, the receipt-side paper feed roller turns and advances the paper by a predetermined amount.

The auxiliary paper feed roller is set to a slightly smaller value than the paper advance amount. The difference becomes the slip in the friction clutch between the auxiliary paper feed roller and the transmission gear.

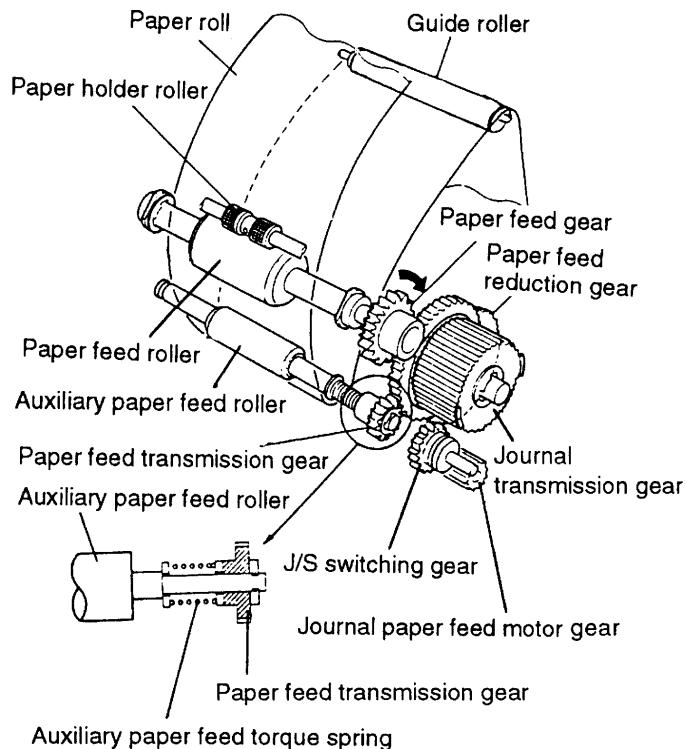


Figure 2-18. Paper Feed Operation (Journal Side)

Paper release operation

Paper release is performed by separate release levers on the journal and release sides. The release levers are in constant contact with the paper holder roller shaft. When the levers are moved in the \Rightarrow direction shown in Figure 2-19, the paper holder roller moves, the link with the paper feed roller is released, and the paper can be removed.

As indicated by the solid line in Figure 2-19, the release lever is linked to the paper holder roller shaft at both sides, in order not to disturb the paper feed roller and paper holder roller. When section (A) of the release lever is pushed in the \Rightarrow direction, the lever rotates in the \rightarrow direction, pivoting around section (B). The paper holder roller shaft and release lever therefore are

separated from the paper feed roller (the dotted line in Figure 2-19). When section (A) of the release lever is not pushed farther, the paper holder spring returns the lever to the original position.

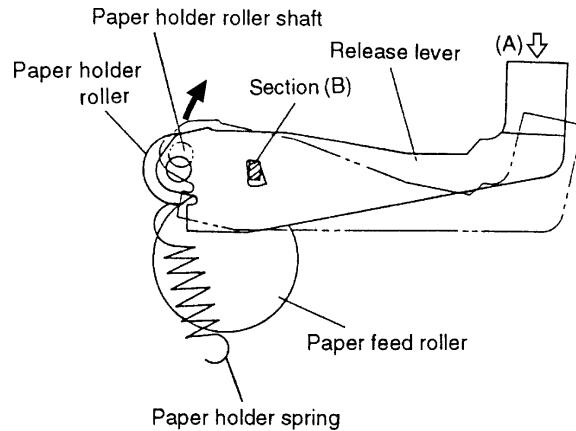


Figure 2-19. Paper Release Operation

Slip Paper Assembly

The slip paper assembly consists of the parts shown in Figure 2-20.

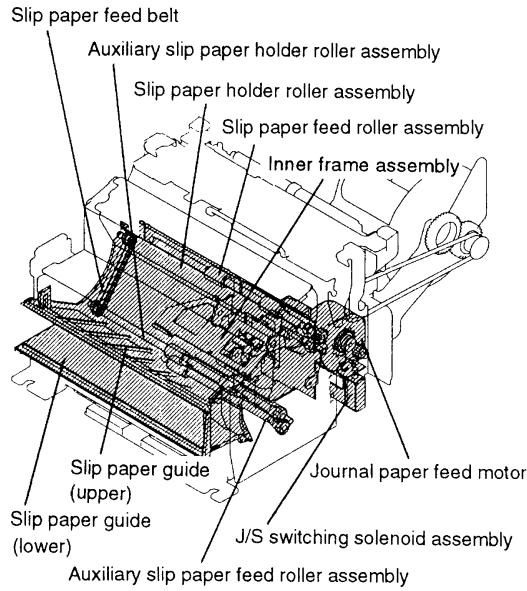


Figure 2-20. Slip Paper Feed Assembly

Slip paper positioning operation

A form stopper placed at a right angle in the slip paper path blocks the path due to the action of the form stopper spring (Figure 2-21).

When the slip paper is inserted along the slip paper guide (lower) in the \Rightarrow direction, the paper can enter as far as the stopper (Figure 2-21).

Next, the J/S switching solenoid is powered while rotating the journal paper feed motor several steps in the forward and backward directions. The J/S change lever now causes the J/S switching gear, which has been positioned to feed the journal paper up to this point, to move to a position to feed the slip paper. The auxiliary slip paper feed solenoid is then powered, causing the auxiliary slip paper feed shaft lever linked to the ferrite core to move in the \Rightarrow ① direction. The roller of the auxiliary slip paper feed roller is pushed up against the auxiliary slip paper holder roller. The auxiliary slip paper feed shaft lever moves the form stopper in the \Rightarrow ② direction, thus opening the slip paper path and completing the preparations for slip paper feeding (Figure 2-21).

The journal paper feed motor now rotates a certain number of steps (depending on the slip paper format) in the \Rightarrow direction, causing the J/S switching gear, paper feed reduction gear, slip paper holder roller, slip paper feed belt, auxiliary slip paper holder roller, and auxiliary slip paper feed roller to move in turn and thus bring the slip paper into the printing position (Figure 2-23).

Immediately before the operating sequence described above, the head carriage is moved to the right most position. When positioning is completed, the auxiliary slip paper feed solenoid is turned off, and the J/S switching solenoid is set to hold (during slip paper printing and paper feeding).

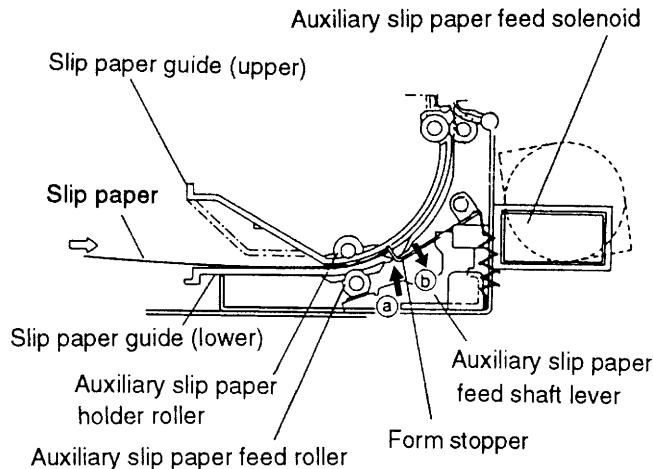


Figure 2-21. Slip Paper Positioning (1)

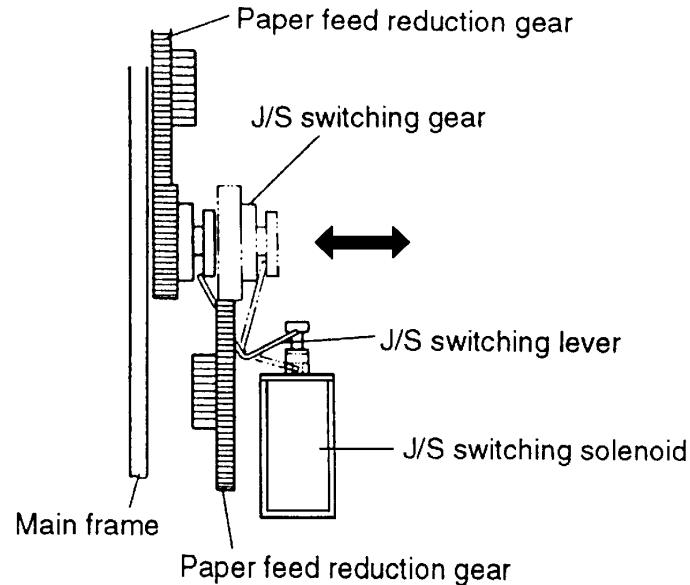


Figure 2-22. Slip Paper Positioning (2)

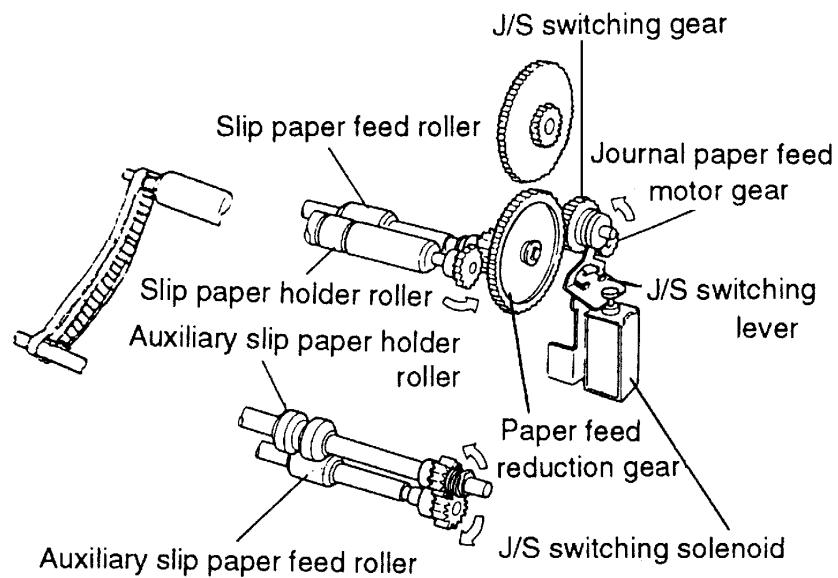


Figure 2-23. Slip Paper Positioning (3)

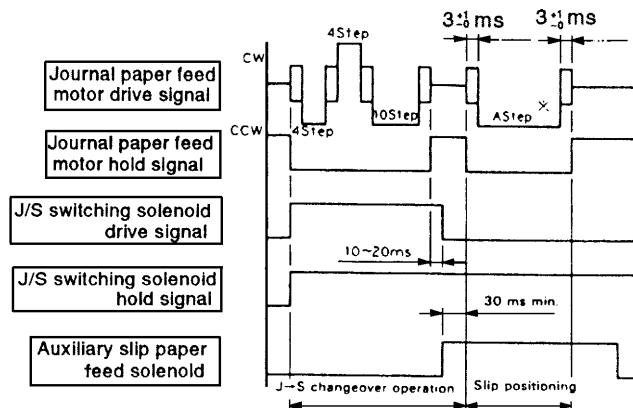


Figure 2-24. Slip Paper Positioning Timing Chart

Slip paper feed operation

Following slip paper positioning, printing can be performed. After each line is printed, the journal paper feed motor is activated and turns the slip paper feed roller to advance the paper by a predetermined amount. Slip paper forward feed and reverse feed is controlled by selecting the journal paper feed motor drive signal.

The gear train of the slip paper feed assembly consists of the journal paper feed motor gear, J/S switching gear (moved by the J/S switching solenoid to the slip paper feed gear train), paper feed reduction gear, slip paper feed roller, and gear of auxiliary slip paper feed roller.

Since the driving force of the journal paper feed motor is transmitted via the gear train to the slip paper feed roller and the slip paper holder roller, the slip paper is controlled from both sides.

For forward feed, each gear turns in the \rightarrow ① direction, \rightarrow ② direction, and the \rightarrow ③ direction. The slip paper feed roller and slip paper holder roller turn in the \rightarrow ④ and ⑤ directions, so that the slip paper moves in the \Rightarrow direction. For reverse feed, the above directions are reversed.

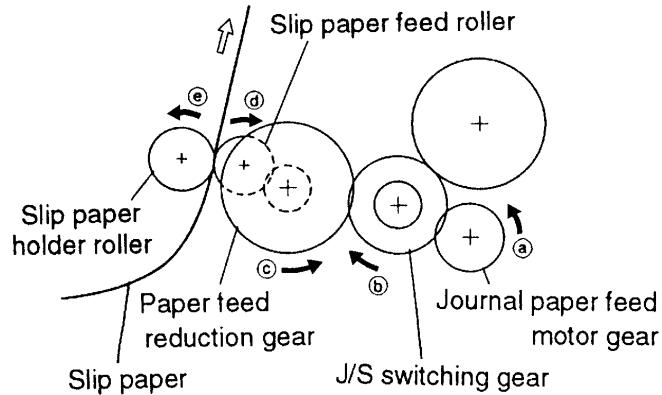


Figure 2-25. Slip Paper Feed Operation

MICR Reader Assembly (for printers with a MICR reader) (not available for the TM-U950P)

The main components of this assembly include those shown in the slip assembly section of this chapter, namely the MICR head assembly, carriage motor assembly, head carriage assembly, frame carriage assembly, MICR head holder change lever, MICR head holder frame, MICR head holder lever, MICR head holder roller, MICR transmission pulley, and MICR transmission belt. This assembly is installed at the factory, as an option, in the paper path of the slip assembly shown later in this chapter.

MICR reading and reverse-side printing operations

Check paper is inserted in the same way as slip paper, with the check paper following along below the right end of the slip paper guide and being inserted from the \Rightarrow direction. After reaching the form stopper, the check paper is positioned for printing (see Figure 2-26).

At this point, the slip entrance detector detects the presence of the check paper. Next, the top of the check paper is positioned by the slip assembly, as described in the Slip Paper Assembly section of this chapter, so that the check paper is ready for feeding (see Figure 2-26).

Next, the journal motor rotates in the same way as with slip feeding, at the MICR reading speed, and begins to carry the leading edge of the check paper the specified number of steps from the form stopper to the MICR head assembly.

At this point, the head carriage assembly is moved by the carriage motor assembly the specified number of steps, then waits (see Figure 2-27).

In response to this movement of the head carriage assembly, the MICR head holder change lever moves in the \Rightarrow \circlearrowleft direction, and the MICR head holder roller is pressed against the MICR head assembly, in the \Rightarrow \circlearrowleft direction, so that the check paper is caught between the roller and the assembly.

Because the MICR head holder roller comes between the MICR transmission belt and the MICR transmission pulley and is normally synchronized to the rotation of the slip holder roller assembly, the movement of the head carriage assembly causes the shifted MICR head holder roller, with the check paper caught in it, to transport the check paper from the point where it is pressed against the MICR head assembly at the MICR reading speed to be read by the MICR.

Next, the check paper moves to a position conforming to the reverse-side printing format, and the check paper is confirmed to be effective.

At this point, if the MICR characters could not be discerned easily, the reading operation is repeated. (If problems occur with the second reading, or if the MICR character waveform cannot be detected, the check paper is ejected without being printed.)

When the check paper has been confirmed to be effective, printing is carried out on the reverse side by the head carriage assembly, in the specified format, and the paper is ejected, thus concluding the printing operation.

The gear operation of this assembly, which carries out MICR reading of the check paper, backfeeding, and reverse-side printing, is the same as that of the slip feeding assembly. The only element which differs from the slip feeding assembly is the speed.

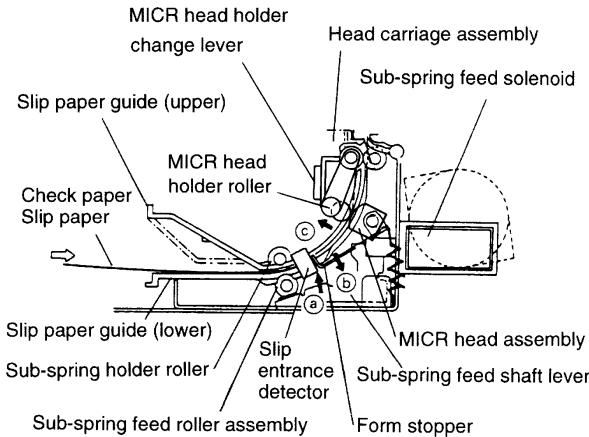


Figure 2-26. Check Paper Positioning (1)

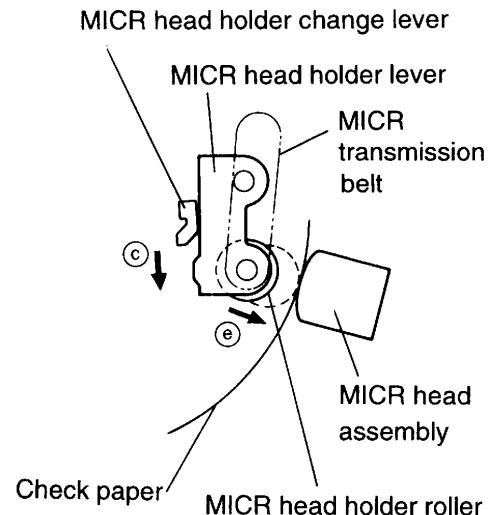


Figure 2-27. Inserting the Check Paper

Ribbon Feed Assembly

The ribbon feed assembly is mounted on the right side of the carriage frame and consists of the parts shown in Figure 2-28.

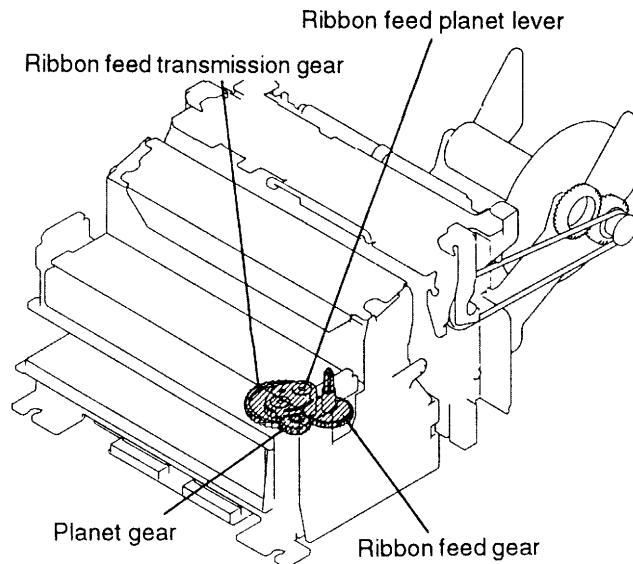


Figure 2-28. Ribbon Feed Assembly

Ribbon feed operation

When the carriage motor gear turns in the \Rightarrow ④ direction, the rotation is transmitted to the ribbon feed transmission gear and planet gear. The planet gears ① and ② rotate around the small gear wheel of the ribbon feed transmission gear, moving in the \Rightarrow ⑤ direction. This movement causes the ribbon feed planet lever to rotate in the \Rightarrow ⑥ direction, and the planet gear ② moves until it interlocks with the planet gear ③. Since the planet gear ③ is always interlocked with the ribbon feed gear, the ribbon feed gear rotates in the \Rightarrow ⑦ direction.

When the carriage motor gear rotates in the \blacktriangleright ⑧ direction, the ribbon feed transmission gear rotates in the \blacktriangleright ⑨ direction, and the planet gears ① and ② rotate and move in the \blacktriangleright ⑩ direction.

This movement causes the ribbon feed planet lever to rotate in the \blacktriangleright ⑪ direction, so that the planet gear ① moves until it interlocks with the ribbon feed gear, causing this gear to rotate in the \Rightarrow ⑫ direction.

Therefore, the ribbon feed gear always turns in the \Rightarrow ⑥ direction, regardless of the rotation direction of the carriage motor. The ribbon feed gear is interlocked with the ribbon feed roller and ribbon feed holder roller inside the ribbon cassette, thus feeding the ribbon.

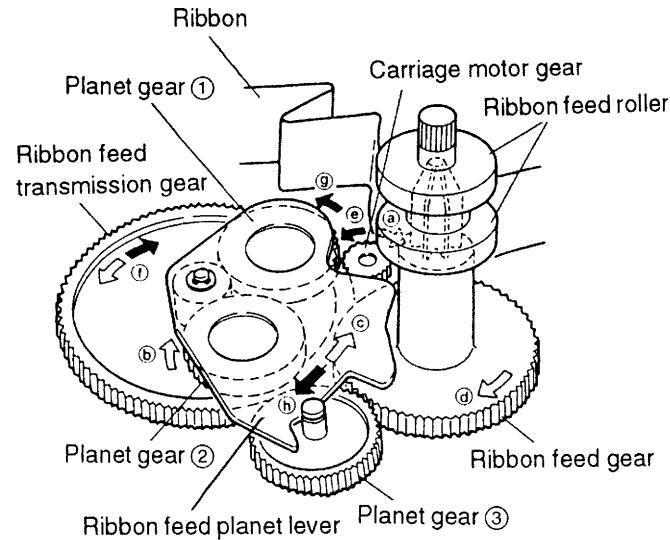


Figure 2-29. Ribbon Feed Operation

Stamp Assembly (for printers with a stamp assembly)

The optional stamp assembly consists of the parts shown in Figure 2-30. The assembly is installed below the paper inlet on the receipt side.

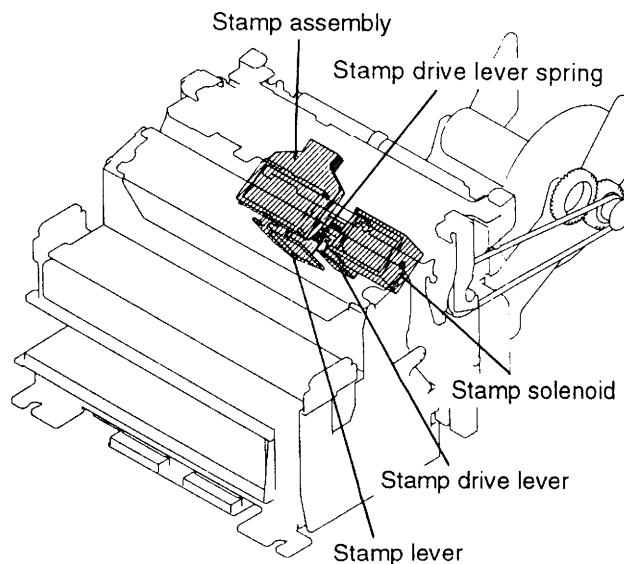


Figure 2-30. Stamp Assembly

Stamp operation

When the stamp solenoid is powered, the ferrite core moves in the \rightarrow direction. Since the ferrite core serves as the pivot for the stamp drive lever, the lever rotates in the \rightarrow direction, causing the linked stamp lever to move in the \rightarrow direction. Therefore, the stamp assembly attached to the lever also moves in the \rightarrow direction and is pushed up against the upper paper guide, thus stamping the paper. When the stamp solenoid goes off, the force of the stamp drive lever spring returns the stamp to its original position.

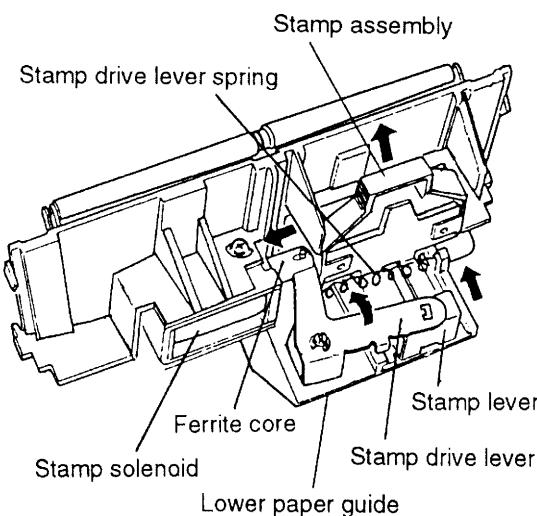


Figure 2-31. Stamp Operation

Auto-cutter Assembly

The auto-cutter assembly consists of the transmission mechanism, sensor, and cutter. For easy maintenance and paper removal, this assembly can be completely opened. For the sensor, see auto-cutter sensor assembly on page 2-6.

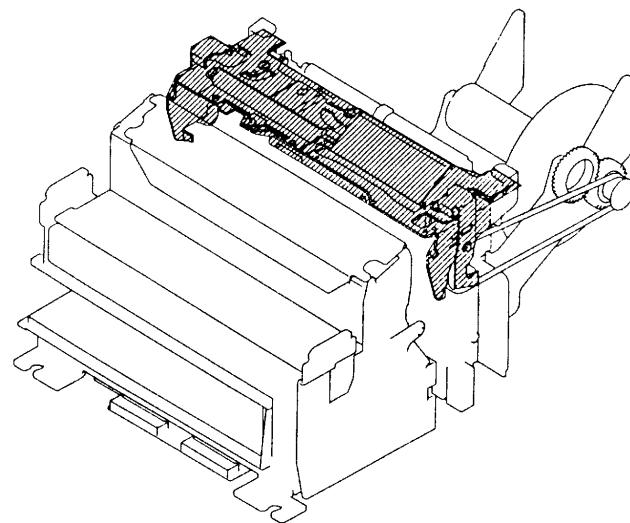


Figure 2-32. Auto-cutter Assembly

Transmission mechanism

The transmission mechanism consists of the cutter motor gear fastened on the cutter motor shaft, two reduction gears A, the reduction gear B, two drive gears on the drive gear shaft, and the cutter slider assembly. The cutter motor rotation is reduced and transmitted to the drive shaft via the reduction gears A and B. The gears on the drive shaft then translate the rotary motion into a sliding motion for operation of the cutter slider.

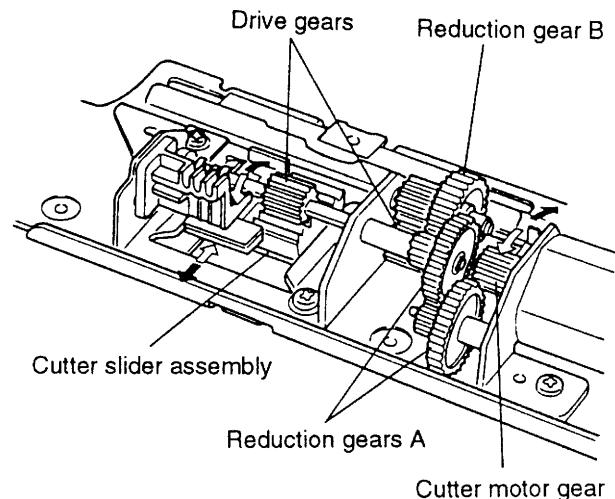


Figure 2-33. Auto-cutter Transmission Mechanism

Cutter mechanism

The cutter mechanism consists of the cutter blade frame, cutter blade, and cutter blade cover. The mechanism performs either a full or a partial cut, depending on the F/P position signal supplied by the sensor assembly.

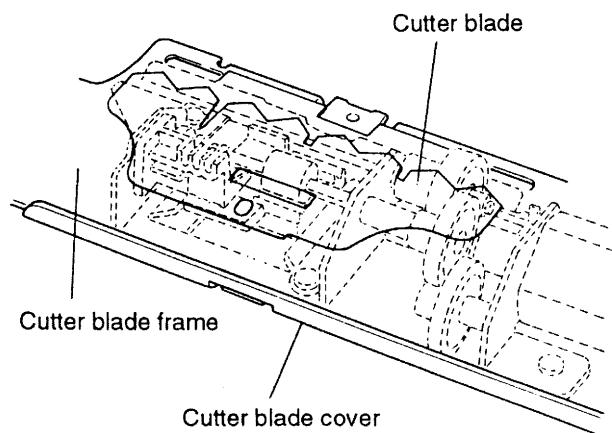


Figure 2-34. Auto-cutter Mechanism

Cutting operation

When the cutter motor is activated while the mechanism is in the home position (when the cutter blade does not protrude through the slit of the cutter blade cover and the reset signal is at high), the cutter motor rotates in the \rightarrow direction and the rotational force is transmitted to the transmission gear train. This in turn causes the drive gear in the upper section of the cutter slider assembly to turn, thereby moving the cutter slider in the \rightarrow direction.

Since the cutter blade is linked to the dowel on the rear of the cutter slider assembly, it moves with the slider and cuts the paper at the slit.

After the cut is performed, the polarity of the cutter motor drive current is reversed, so that the reverse motion returns the cutter blade to the home position.

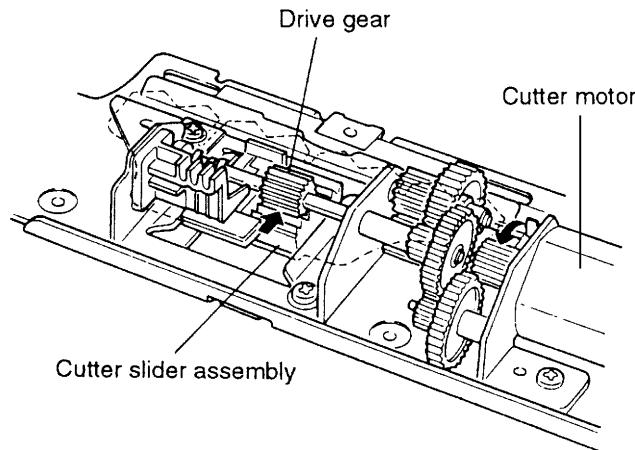


Figure 2-35. Auto-cutter Operation

Full cut operation

When the cutter motor is activated while the mechanism is in the home position, the reset signal changes from high to low, but the F/P position signal is maintained at high. When the motor continues to be powered and cutting starts, the F/P position signal changes from high to low. If the cutter motor is only turned off when this signal again becomes high, the cutter slider assembly movement stops after a full cut.

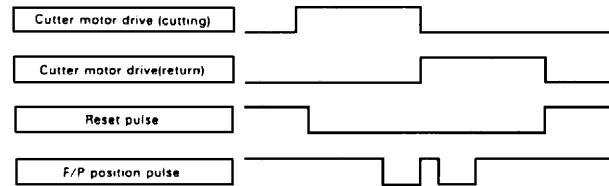


Figure 2-36. Full Cut Operation Timing Chart

Partial cut operation

When the cutter motor is activated while the mechanism is in the home position, the reset signal changes from high to low, but the F/P position signal is maintained at high. When the motor continues to be powered and cutting starts, the F/P position signal changes from high to low. If the cutter motor is only turned off at this point, the cutter slider assembly movement stops after a partial cut.

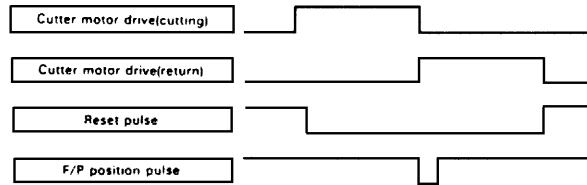


Figure 2-37. Partial Cut Operation Timing Chart

Paper Roll Take-up Assembly

This assembly consists of the take-up frame, journal transmission gear, take-up belt, take-up pulley, and take-up gear. It assures stable take-up of the paper roll.

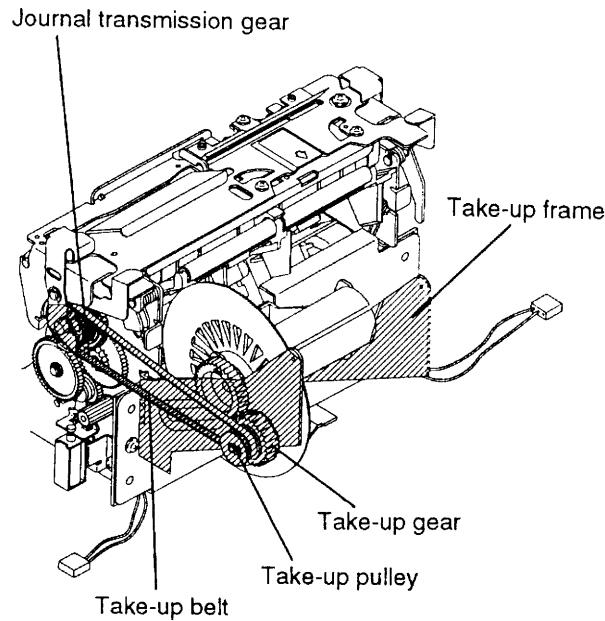


Figure 2-38. Paper Roll Take-up Assembly

Take-up operation

When the journal paper feed motor turns, the journal paper feed motor gear rotates in the ➡ direction, and the rotational force is transmitted to the J/S switching gear and paper feed reduction gear. This causes the journal transmission gear to rotate in the ➡ direction. Since this

gear is linked to the take-up belt, the take-up pulley turns in the ➡ direction. The take-up clutch spring mounted between the take-up pulley and take-up gear transmits the force to the take-up gear and thus to the take-up shaft, which turns to take up the paper.

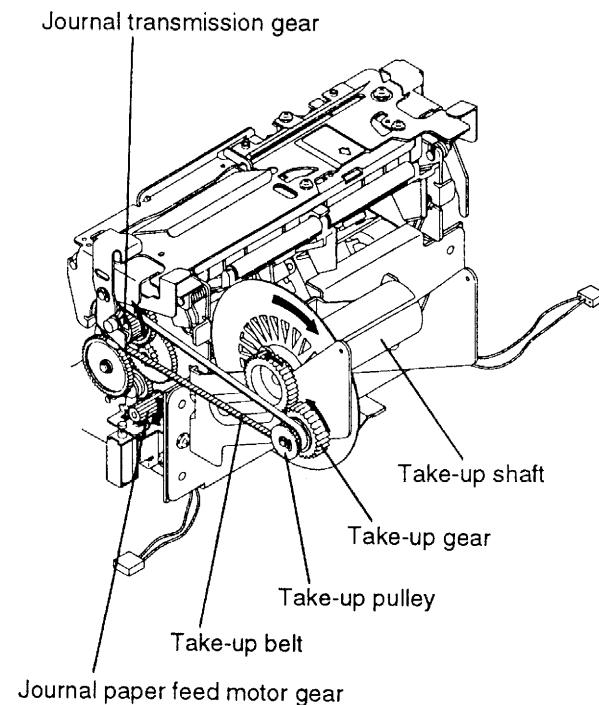


Figure 2-39. Take-up Operation

Electrical Circuitry Operating Principles

Hardware Configuration

The electrical circuitry of the TM-U950 is divided into the main PCB and the switch PCB unit. These connections are shown in Figs. 2-40, 2-41, and 2-42.

- MICR board (for printers with an MICR reader) (not available for the TM-U950P)

■ Component connections

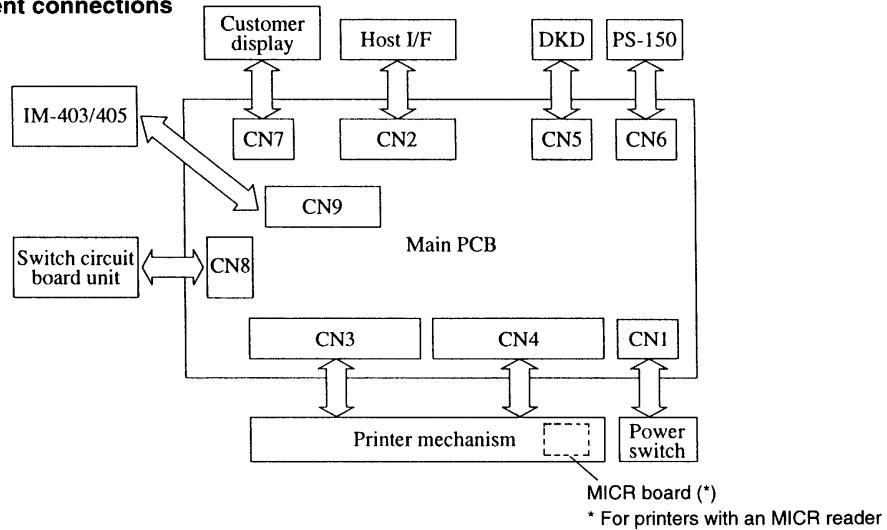


Figure 2-40. TM-U950 Component Connection Chart

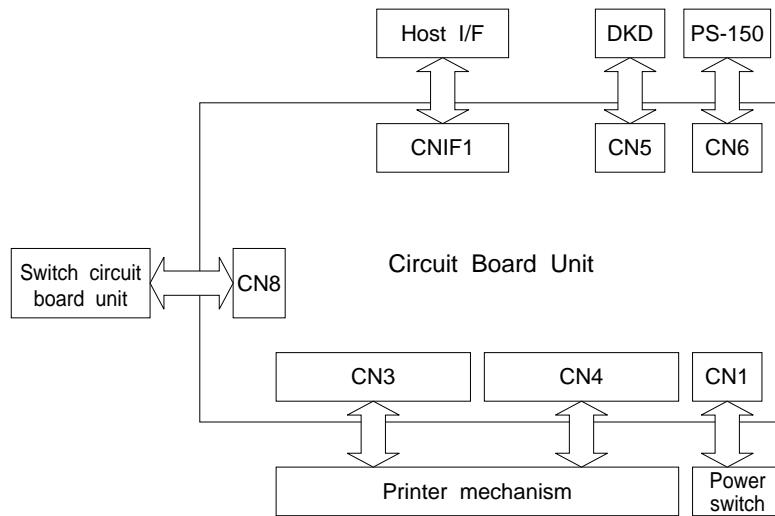


Figure 2-40a. TM-U950P Component Connection Chart

The main board, switch board, and MICR board (on printers with an MICR reader) contain the following electrical circuits.

CONFIDENTIAL

Switch PCB unit

- FEED buttons
- LEDs (power, paper status, and error)
- Cover open sensor

Main PCB

- Power supply circuit
- Reset circuit
- CPU
- Memory (ROM: 512 KB, RAM: 64 KB, EEPROM)
- Gate array
- Operation panel control circuit
- Host interface circuit
- Drawer kick-out circuit
- Print head drive circuit
- Solenoid drive circuits
- Paper feed motor drive circuit
- Auto-cutter control
- Carriage motor drive circuit
- Actuator irregular operation protection circuit
- Mechanism sensor circuits
- IM-403/405 connection circuit (not supported by the TM-U950P)

MICR board (on printers with an MICR reader) (not available on the TM-U950P)

- Power supply section (eliminates power supply noise)
- Input section (protects against excessive voltage)
- Amplifier section
- Signal limiting section
- Signal switching section
- Self-bias current supplier

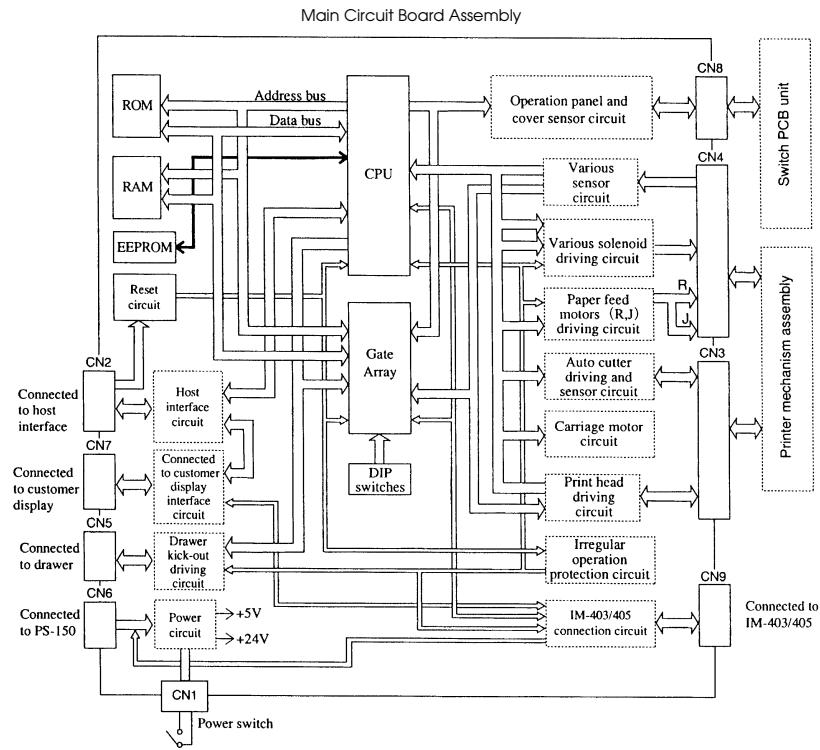


Figure 2-41. Block Diagram of TM-U950 Main Board

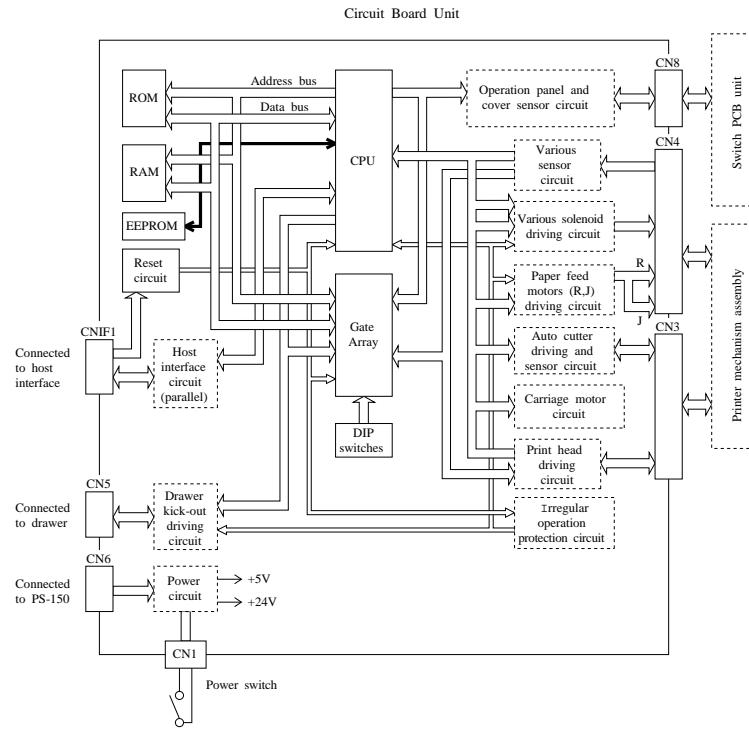


Figure 2-41a. Block Diagram of TM-U950P Main Board

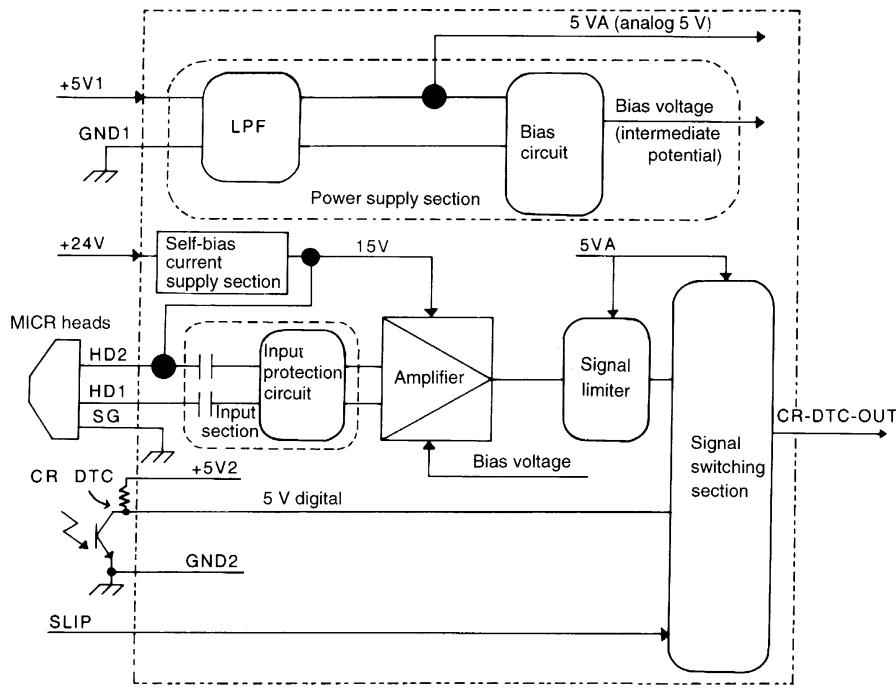


Figure 2-42. MICR Board Block Diagram (on printers with an MICR reader)
(not available for the TM-U950P)

Memory map

This printer incorporates a 512 KB ROM (1 M in printers with an MICR reader, which is not available for the TM-U950P) and 64 KB of RAM. The memory map is as shown below.

1M (in printers with an MICR reader) 512 KB	
00000H	CPU with internal RAM
00200H	CPU with internal RAM
00800H	Unused
01000H	Gate array for port expansion
03000H	External RAM area
08000H	Unused
10000H	Program area
18000H	Unused
18000H	Program area
20000H	Unused
80000H	Character generator area
85600H	(Blank page data area)
88000H	(Blank page data area)
90000H	Unused
98000H	Program area

Figure 2-43. Memory Map

Reset circuit for the TM-U950

The reset IC (M51953BFP) monitors the +5 V voltage. When the voltage becomes more than 4.5 V, the IC releases the reset condition for the CPU and other circuits, thus enabling normal printer operation. When a reset signal from the host is sent from the host interface (DSR, #25) more than 1 ms, the output of the reset IC becomes low and the CPU and other circuits are reset.

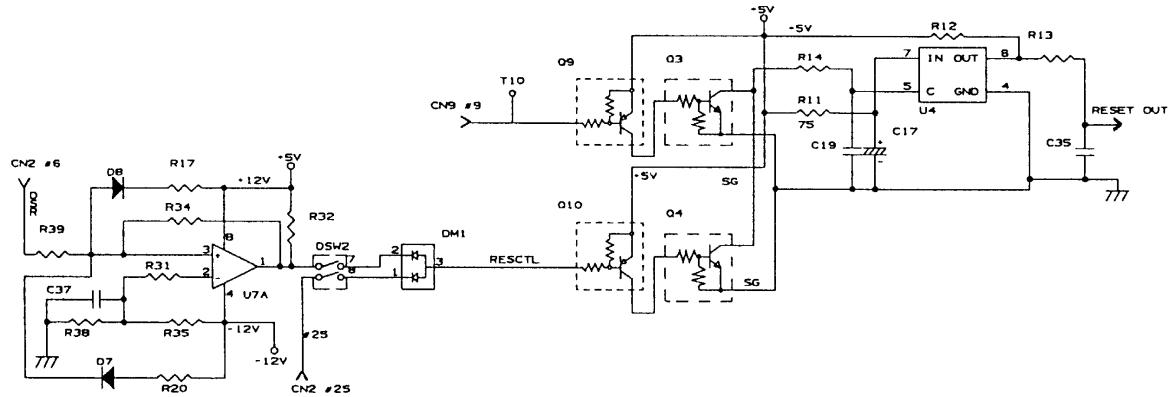


Figure 2-44. Reset Circuit for the TM-U950

Reset circuit for the TM-U950P

The reset IC (M51953BFP) monitors the +5 V voltage. When the voltage becomes more than 4.5 V, the IC releases the reset condition for the CPU and other circuits, thus enabling normal printer operation. When the interface reset signal (nInit, #31) is added to the reset circuit more than 50 μ s when the host interface is in forward direction transmission (I/F signal 1284 ACT, #36 is low), the reset IC becomes low and the CPU and other circuits are reset.

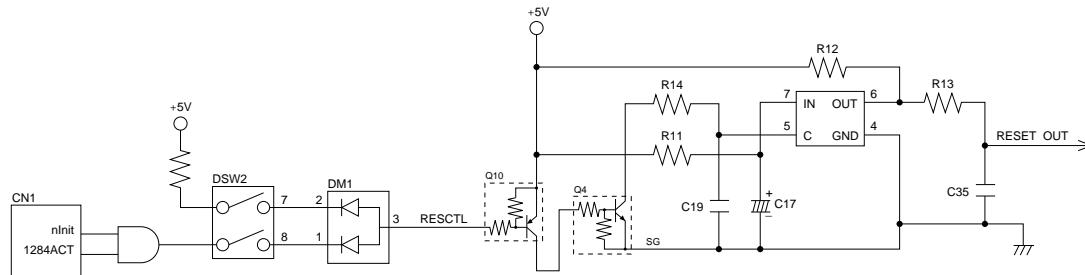


Figure 2-44a. Reset Circuit for the TM-U950P

Main Board Operating Principle

Power supply circuit for the TM-U950

The 24 V DC at CN6 (when IM-403/405 is not connected) or at CN9 (when IM-403/405 is connected) is filtered and supplied to the +24 V line and the +5 V regulator circuit. The +5 V regulator circuit uses the switching method to convert the +24 V input into a +5 V output. The switching regulator IC (U9) switches the +24 V DC. The voltage is smoothed by L18, D13, and C49, and is supplied as the +5 V output.

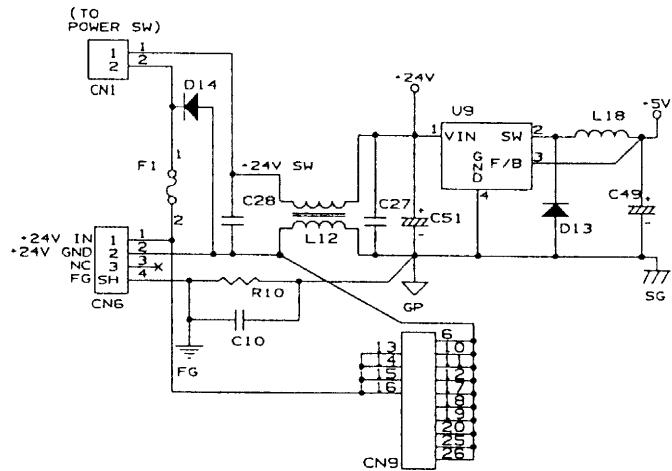


Figure 2-45. Power Supply Circuit for the TM-U950

Power supply circuit for the TM-U950P

The 24 V DC at CN6 is filtered and supplied to the +24 V line and the +5 V regulator circuit. The +5 V regulator circuit uses the switching method to convert the +24 V input into a +5 V output. The switching regulator IC (U9) switches the +24 V DC. The voltage is smoothed by L18, D13, and C49, and is supplied as the +5 V output.

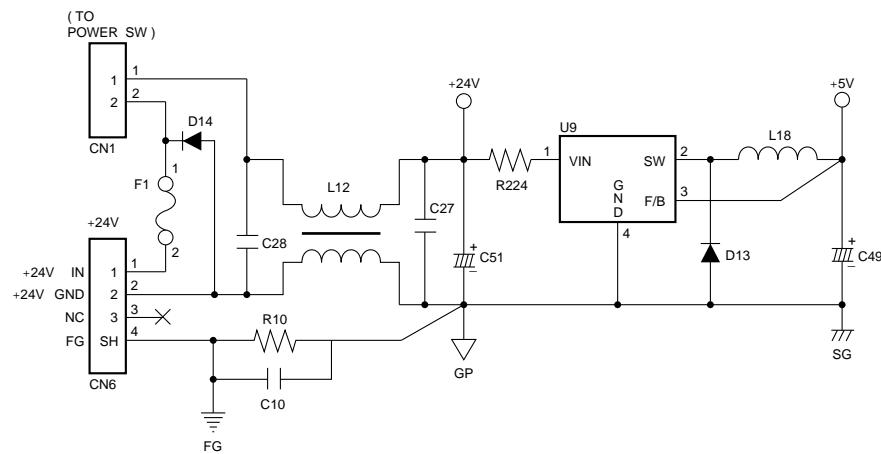


Figure 2-45a. Power Supply Circuit for the TM-U950P

Control circuitry

CPU (M37702)

The CPU controls all printer operations according to a control program in ROM. The CPU pin assignments are shown in Table 2-1.

Table 2-1. CPU Pin Assignments

Pin number	CPU function	Signal designation	I/O	Level	Description
1	ANO	V_DTC	I	Analog	Detect 24 V voltage
2	P67	PFR2	O	TTL	Receipt paper feed motor Phase C,D
3	P66	PFR1	O	TTL	Receipt paper feed motor Phase A, B
4	P65	PFJ2	O	TTL	Journal paper feed motor Phase C, D
5	P64	PFJ1	O	TTL	Journal paper feed motor Phase A, B
6	P63	DSR	I	TTL	DSR signal input from serial interface on the host
7	P62	CSTRB(CSTB for the TM-U950P)	I	TTL	Not used (receive interrupt for the TM-U950P)
8	P61	PFR_HL	I/O	TTL	Receipt paper feed motor hold H = hold
9	P60	PFJ_HL	I/O	TTL	Journal paper feed motor hold H = hold
10	P57	DKD_2	O	TTL	Drawer kick-out drive signal 1 L = drive
11	P56	DKD_1	O	TTL	Drawer kick-out drive signal 2 L = drive
12	P55	AC_2	O	TTL	Auto-cutter motor drive signal 2
13	P54	AC_1	O	TTL	Auto-cutter motor drive signal 1
14	P53	SHB	O	TTL	Slip paper holder solenoid drive signal L=drive
15	P52	ER_LED	O	TTL	Error LED drive signal L = ON
16	P51	SL_LED	O	TTL	Slip paper LED drive signal L = ON
17	P50	CSOK	O	TTL	Slip paper eject detector LED drive signal L = ON
18	P47	STB	O	TTL	Stamp solenoid drive signal L = ON
19	P46	CR_NM	O	TTL	Carriage motor control signal H = normal rotation
20	P45	CR_HL	O	TTL	Carriage motor control signal H = hold
21	P44	CR_2	O	TTL	Carriage motor control signal Phase C, D
22	P43	CR_1	O	TTL	Carriage motor control signal Phase A, B
23	(0)	FAI	O	TTL	Receive interrupt
24	(RDY)	(RDY)	I	TTL	Fixed to H (pulled up to +5V)
25	(HOLD)	(HOLD)	I	TTL	Fixed to H (pulled up to +5 V)
26	BYTE	BYTE	I	TTL	Fixed to H (pulled up to +5V)
27	(CNV _{ss})	(CNV _{ss})	I	TTL	Fixed to H (connected to +5 V)
28	(RESET)	(RESET)	I	TTL	Reset signal input L = reset

Table 2-1. CPU Pin Assignments (continued)

Pin number	CPU function	Signal designation	I/O	Level	Description
29	X_{in}	(X_{in})	I	TTL	Clock input
30	X_{OUT}	(X_{OUT})	O	TTL	Clock input
31	(\bar{E})	(\bar{E})	O	TTL	Enable signal L = Data read/write)
32	(V_{ss})	(V_{ss})	-	GND	Power supply
33	HLDA	HLDA	O	TTL	Unused (open)
34	ALE	ALE	O	TTL	Address latch enable signal H = address latch
35	BHE	BHE	O	TTL	Unused (open)
36	(\bar{R}/W)	(\bar{R}/W)	O	TTL	Read/write signal H = read, L = write
37	A23/D7	A23	O	TTL	Address signal Bit 23
		D7	I/O	TTL	Data signal Bit 7
38	A22/D6	A22	O	TTL	Address signal Bit 22
		D6	I/O	TTL	Data signal Bit 6
39	A21/D5	A21	O	TTL	Address signal Bit 21
		D5	I/O	TTL	Data signal Bit 5
40	A20/D4	A20	O	TTL	Address signal Bit 20
		D4	I/O	TTL	Data signal Bit 4
41	A19/D3	A19	O	TTL	Address signal Bit 20
		D4	I/O	TTL	Data signal Bit 3
42	A18/D2	A18	O	TTL	Address signal Bit 18
		D2	I/O	TTL	Data signal Bit 2
43	A17/D1	A17	O	TTL	Address signal Bit 17
		D1	I/O	TTL	Data signal Bit 1
44	A16/D0	A16	O	TTL	Address signal Bit 16
		D0	I/O	TTL	Data signal Bit 0
45	A15	A15	O	TTL	Address signal Bit 15
46	A14	A14	O	TTL	Address signal Bit 14
47	A13	A13	O	TTL	Address signal Bit 13
48	A12	A12	O	TTL	Address signal Bit 12
49	A11	A11	O	TTL	Address signal Bit 11
50	A10	A10	O	TTL	Address signal Bit 10
51	A9	A9	O	TTL	Address signal Bit 9
52	A8	A8	O	TTL	Address signal Bit 8
53	A7	A7	O	TTL	Address signal Bit 7
54	A6	A6	O	TTL	Address signal Bit 6
55	A5	A5	O	TTL	Address signal Bit 5

Table 2-1. CPU Pin Assignments (continued)

Pin number	CPU function	Signal designation	I/O	Level	Description
56	A4	A4	O	TTL	Address signal Bit 4
57	A3	A3	O	TTL	Address signal Bit 3
58	A2	A2	O	TTL	Address signal Bit 2
59	A1	A1	O	TTL	Address signal Bit 1
60	A0	A0	O	TTL	Address signal Bit 0
61	P87	TXD	O	TTL	TXD signal output for the interface circuit board
62	P86	RXD	I	TTL	RXD signal input from the interface circuit board
63	P85	DTR	O	TTL	DTR signal output for the interface circuit board
64	P84	CTS1	O	TTL	Unused (pulled down to (Vss))
65	P83	IMSD	I	TTL	SD signal output for the IM-403/405 serial interface (not used on the TM-U950P)
66	P82	IMSD	I	TTL	RD signal input from the IM-403/405 serial interface (not used on the TM-U950P)
67	P81	IMDTR_TM	O	TTL	DTR signal output for the IM-403/405 serial interface (not used on the TM-U950P)
68	P80	CTSO	O	TTL	Unused (pulled down to (Vss))
69	(V _{cc})	-	-	+5V	Power supply
70	(AV _{cc})	-	-	+5V	Analog power supply
71	(V _{ref})	-	-	+5V	Analog reference voltage
72	(AV _{ss})	-	-	GND	Analog power supply
73	(V _{ss})	-	-	GND	Power supply
74	P77	CACT	I	TTL	Auto-cutter full/partial signal
75	P76	CACR	I	TTL	Auto-cutter reset signal
76	P75	CCRP	I	TTL	Carriage detachment sensor signal
77	P74	CHP	I	TTL	Home position sensor signal
78	AN3	CSOE	I	Analog	Slip paper eject sensor signal
79	AN2	CSLPIN	I	Analog	Slip paper insert sensor signal
80	AN1	CHDTH	I	Analog	Print head temperature sensor signal

ROM (512 KB, (1 M in printers with an MICR reader))

The ROM contains the printer control program and the character generator. The control program governs the basic printer functions. The CPU operates entirely under the control of this program.

RAM (64 KB)

The RAM is used for the following:

- As input buffer for data received via the connector interface.

- As print buffer for pattern data to be sent to the print head
- As storage area for CPU processing functions (flags, pointers, etc.)

EEPROM

The EEPROM stores the slip paper insert sensor level. Data exchange with the CPU is performed via a serial link.

Gate array

The gate array is a five I/O port type with an eight-bit (see Table 2-2). It serves two purposes. It can be used by the CPU for I/O port expansion, as specified in the memory map (port expansion function). When the ALE signal goes high, the gate array also latches to the multiplexed address/data signal output by the CPU and extracts the address signal (address latch function).

Table 2-2. Gate Array Pin Assignments

Pin number	Gate array function	Signal designation^	I/O	Level	Description
1	(RSET)	(RSET)	I	TTL	Reset signal input L = reset
2	PA 0	HEAD 8	O	TTL	Print head 8 L = ON
3	PA 1	HEAD 7	O	TTL	Print head 7 L = ON
4	PA 2	HEAD 6	O	TTL	Print head 6 L = ON
5	PC 6	JN_LED	O	TTL	Print head 5 L = ON
6	PA 3	HEAD 5	O	TTL	Print head 4 L = ON
7	PA 4	HEAD 4	O	TTL	Print head 3 L = ON
8	PA 5	HEAD 3	O	TTL	Print head 2 L = ON
9	PA 6	HEAD 2	O	TTL	Print head 1 L = ON
10	PA 7	HEAD 1	O	TTL	Print head 0 L = ON
11	GND	-	-	GND	Power supply
12	PB 0	SW1I	I	TTL	DIP switch bank 1 serial input
13	PB 1	SW2I	I	TTL	DIP switch bank 1 serial input
14	PB 2	SWCK	I	TTL	DIP switch settings read clock
15	PB 3	SWSL	I	TTL	DIP switch bank select
16	PB 4	SCB	O	TTL	S/J switching solenoid drive signal L = drive
17	PB 5	S/J HL	O	TTL	S/J switching solenoid hold signal L = hold
18	PB 6	HD_COM	O	TTL	Print head common L = ON
19	PB 7	HEAD 9	O	TTL	Print head L = ON
20	PC 0	E2DI	I	TTL	Data input from EEROM
21	PC 1	E2DO	O	TTL	Data output from EEROM
22	PC 2	E2CK	O	TTL	EEROM select output
23	PC 3	E2CE	O	TTL	EEROM select output
24	PC 4	IMDSR	I	TTL	DSR signal input from the IM-403/405 serial interface (unused on the TM-U950P)

Table 2-2. Gate Array Pin Assignments (continued)

Pin number	Gate array function	Signal designation`	I/O	Level	Description
25	PC 5	POW_TRG	O	TTL	Power control trigger signal
26	PD 0	IF_DET	I	TTL	Unused (connected to GND) on TM-U950 I/F circuit board identify signal on TM-U950P
27	PD 1	CLK_REQ	I	TTL	Unused (connected to GND) on TM-U950 synchronization clock request signal for TM-U950P
28	GND	-	-	GND	Power supply
29	GND	-	-	GND	Power supply
30	VDD	-	-	+5V	Power supply
31	PD 2	SRTS	O	TTL	Unused (connected to GND) on TM-U950, software RTS output on TM-U950P
32	PD 3	N. C	I	TTL	Unused (connected to GND)
33	PD 4	N. C	I	TTL	Unused (connected to GND)
34	PD 5	N. C	I	TTL	Unused (connected to GND)
35	PD 6	N. C	I	TTL	Unused (connected to GND)
36	PD 7	N. C	I	TTL	Unused (connected to GND)
37	PD 0	CJNE	I	TTL	Journal near-end signal
38	PE 1	CRNE	I	TTL	Receipt near-end signal
39	PE 2	CJPE	I	TTL	Journal paper-end signal
40	PE 3	CRPE	I	TTL	Receipt paper-end signal
41	PE 4	PFR_SW	I	TTL	Receipt FEED switch L = ON
42	PE 5	PFJ_SW	I	TTL	Journal FEED switch L = ON
43	PE 6	COVER	I	TTL	Cover open detection
44	PE 7	DK_S	I	TTL	Drawer status signal
45	PC 7	PC_LED	O	TTL	Receipt LED L = ON
46	(STRB)	CLK	I	TTL	Unused (connected to GND) on TM-U950 synchronization clock interrupt for the TM-U950P
47	BUSY	RTS	O	TTL	Unused (open) for TM-U950. RTS output for the I/F circuit board for the TM-U950P
48	(CSTRB)	CSTB	O	TTL	Unused on TM-U950, receive interrupt on TM-U950P
49	(CRDY)	SRTS	I	TTL	Unused (connected to GND) for the TM-U950, software RTS input for TM-U950P
50	GND	-	-	GND	Power supply
51	CRIN	CRIN	I	TTL	Unused (connected to GND)
52	(CROUT)	(CROUT)	O	TTL	Unused (open)
53	AB 0	A 0	I	TTL	Address signal Bit 0
54	AB 1	A 1	I	TTL	Address signal Bit 1

Table 2-2. Gate Array Pin Assignments (continued)

Pin number	Gate array function	Signal designation^	I/O	Level	Description
55	AB 2	A 2	I	TTL	Address signal Bit 2
56	AB 3	A 3	I	TTL	Address signal Bit 3
57	AB 4	A 4	I	TTL	Address signal Bit 4
58	(R/W)	(R/W)	I	TTL	Read/write signal
59	(CS)	(CS)	I	TTL	Chip select signal L = select
60	(E)	(E)	I	TTL	Enable signal
61	ASTB	ASTB	I	TTL	Address latch enable signal
62	ALB 0	A 16	O	TTL	Address signal Bit 16
63	ABL 1	A 17	O	TTL	Address signal Bit 17
64	ABL 2	A 18	O	TTL	Address signal Bit 18
65	ABL 3	A 19	O	TTL	Address signal Bit 19
66	ABL 4	N. C	O	TTL	Unused (open)
67	ABL 5	N. C	O	TTL	Unused (open)
68	ABL 6	N. C	O	TTL	Unused (open)
69	ABL 7	N. C	O	TTL	Unused (open)
70	GND	—	—	GND	Power supply
71	GND	—	—	GND	Power supply
72	(V _{ss})	—	—	+5V	Power supply
73	DB 0	D 0	I/O	TTL	Data signal Bit 0
74	DB 1	D 1	I/O	TTL	Data signal Bit 1
75	DB 2	D 2	I/O	TTL	Data signal Bit 2
76	DB 3	D 3	I/O	TTL	Data signal Bit 3
77	DB 4	D 4	I/O	TTL	Data signal Bit 4
78	DB 5	D 5	I/O	TTL	Data signal Bit 5
79	DB 6	D 6	I/O	TTL	Data signal Bit 6
80	DB 7	D 7	I/O	TTL	Data signal Bit 7

Operation panel and cover open sensor circuits

There are five LEDs on the operation panel (POWER, ERROR, RECEIPT OUT, JOURNAL OUT, and SLIP) and two buttons (RECEIPT FEED, and JOURNAL/SLIP FEED). The cover open sensor uses a photosensor.

These parts are mounted directly on the switch PCB unit, which is linked to the main PCB assembly via connectors (CN8).

LED drive as well as switch and photosensor status detection is performed by the CPU. For signal I/O, the CPU ports and the expansion ports on the gate array are used.

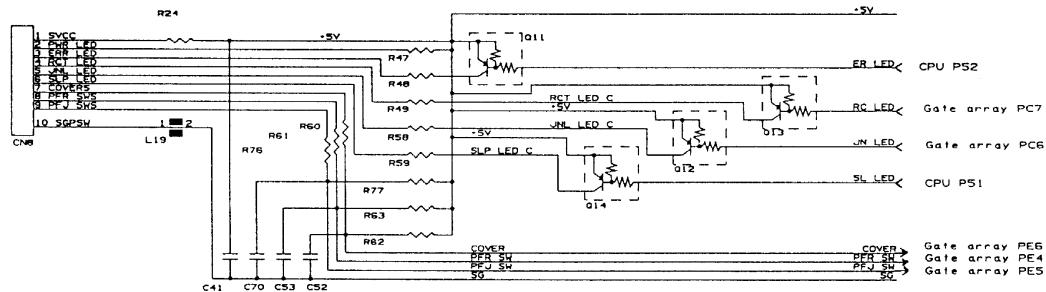


Figure 2-46. Operation Panel and Cover Open Sensor Circuits

DIP switch circuit

Parallel-to-serial conversion of the settings of DIP switch banks 1 and 2 is performed by the conversion IC (U10, U17), and the result is input to the gate array port (PB0, PB1). DIP switch selection is made by the SWSL signal (PB3). The SWCL signal (PB2) is used as a clock signal and the switch settings are read one bit at a time.

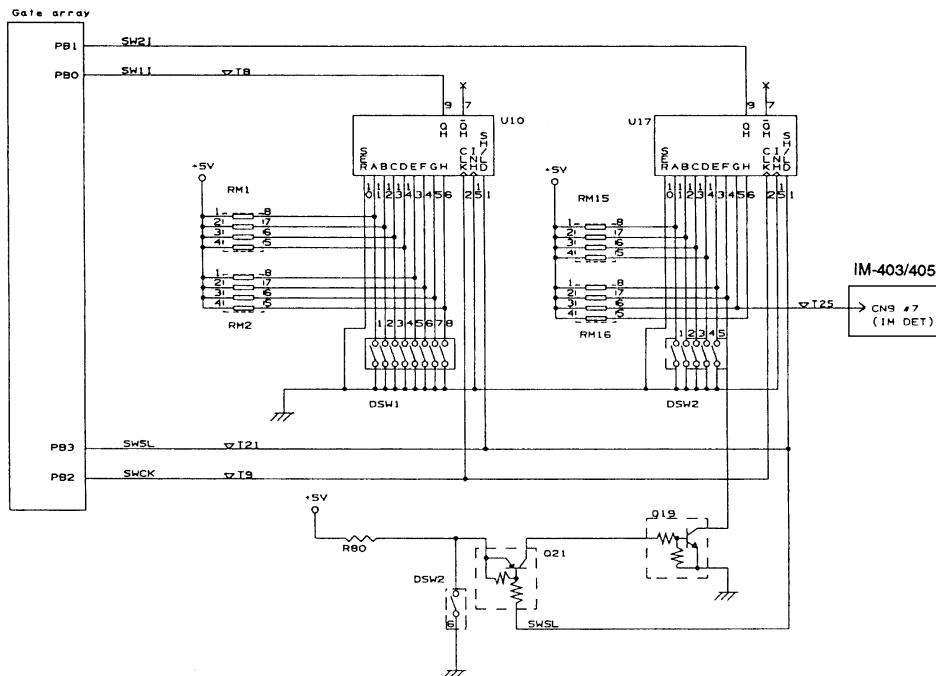


Figure 2-47. DIP Switch Circuit for the TM-U950

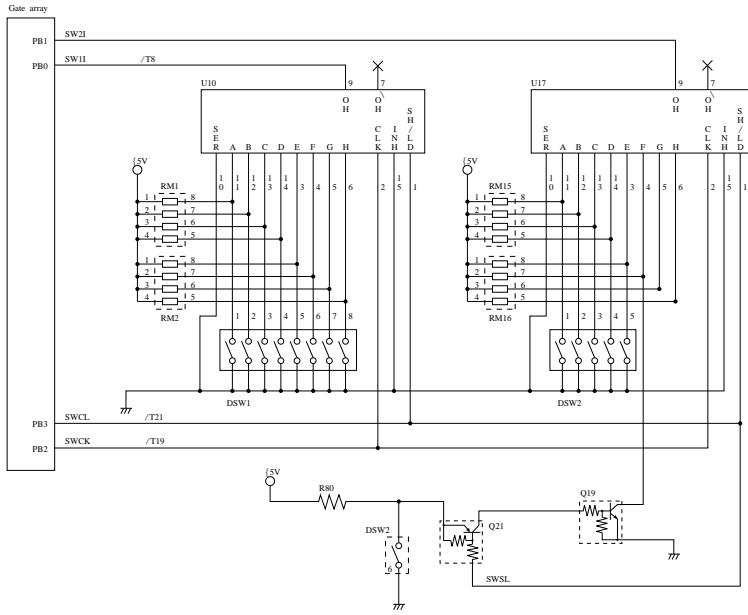


Figure 2-47a. DIP Switch Circuit for the TM-U950P

Host interface circuit for the TM-U950

The printer has an RS-232C interface for connection to the host computer and a DM interface for connection to the customer display (DM).

The driver/receiver ICs (U2 and U3) handle level conversion ($TTL \leftrightarrow \pm 12V$) for the RS-232C and customer display interface signals.

Figure 2-45 shows device connection block diagrams illustrating the connections between the printer (TM), host computer (HOST) and customer display (DM).

In connection (b), printing on the TM is possible by using the passthrough function of the DM. In connection (c), to send data to the DM through the TM, the RXD signal terminal (pin 3) of the host interface connector (CN2) on the TM and is connected directly to the RXD signal (pin 3) of the customer display interface connector (CN7).

Pins 6 and 25 of the interface connector carry the printer reset signal, which is selectable by DIP switch. (Refer to SW 7 and 8 of switch bank 2 in Table 1-8, *DIP switch settings*.) Then select the Seiko Epson customer display by setting DIP switch 6 on the bank 1 to ON. When this setting is in effect, the RTS signal which is output will be the AND of the DTR signal from the customer display and the DTR signal from the printer.

When neither the customer display nor the printer DTR signal is SPACE, the RTS signal is not SPACE either. When DIP switch 6 of the bank 1 is OFF, the same signal as the printer's DTR signal is output to the RTS signal.

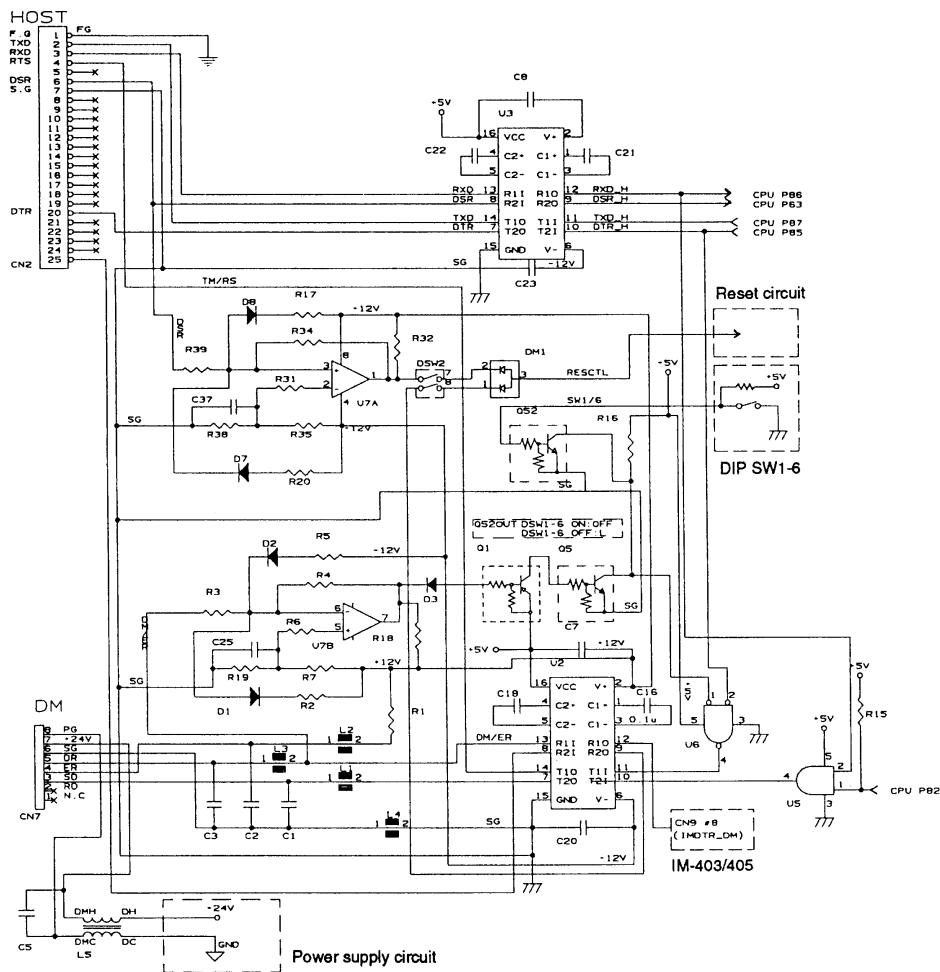


Figure 2-48. Host Interface Circuit and Customer Display Interface Circuit

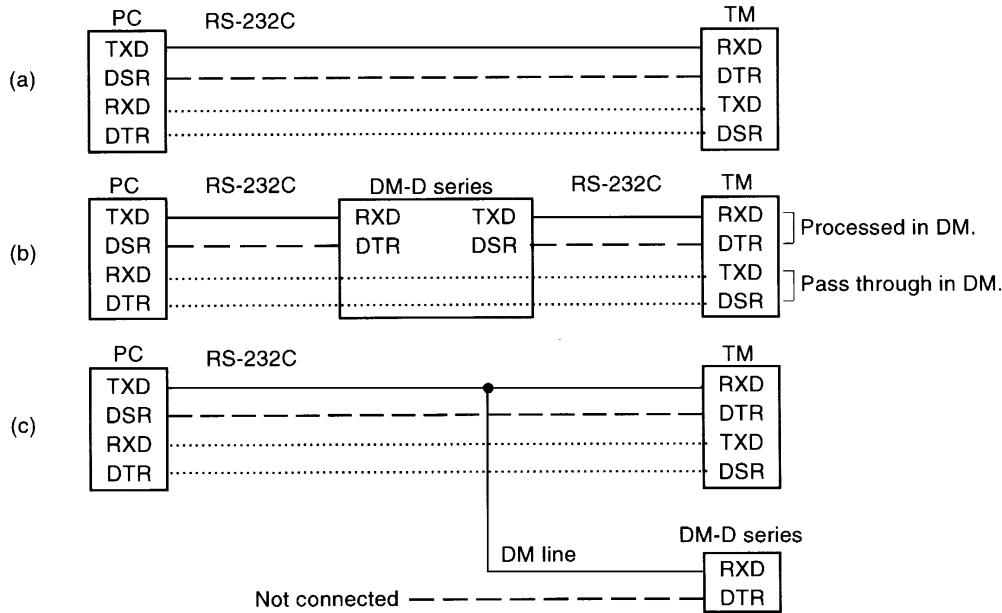


Figure 2-49. Device Connection Block Diagram

Host interface circuit for the TM-U950P

TM-U950P printer has an IEEE 1284 interface for connection to the host computer. Control CPU (I/F circuit board U2) controls the transmission between the host computer, and the CPU converts the received data to the serial data, and then the CPU sends the data to the main circuit board. TTL IC (I/F circuit board U1, U9, U10) drives or receives the interface signal. Transmission between host has other mode, IEEE 1284 Nibble/Byte mode which is the reverse directional transmission.

Drawer kick-out circuit

The DKD_1 and DKD_2 signals from the CPU set the drawer kick-out driver transistors Q7 and Q8 to on; they in turn output the drawer open signal. The drawer status signal DK_S is input to the gate array, allowing the host to check the status via the interface.

The +24 V drawer power supply is controlled by the three-pin regulator (U1) which cuts off the supply in case of excessive current.

The drawer drive signal is also supplied to the IM-403/405 through CN9 for the TM-U950 only.

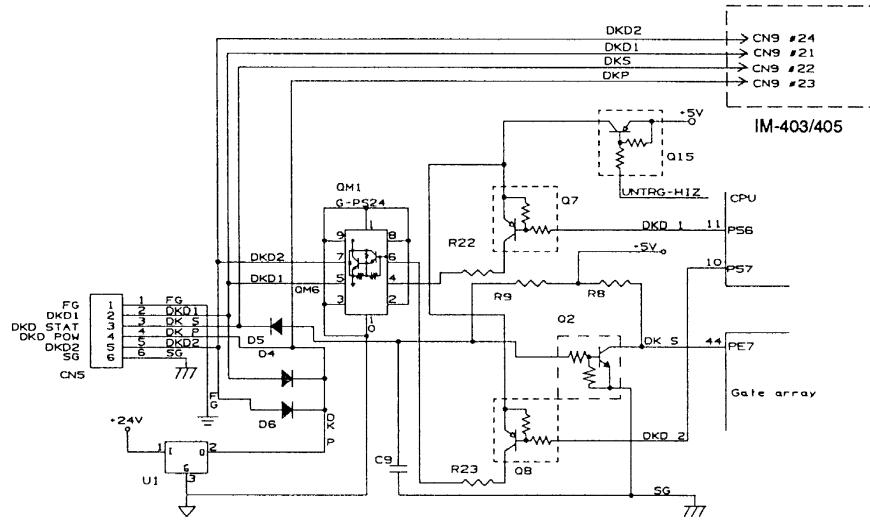


Figure 2-50. Drawer Kick-out Circuit for the TM-U950

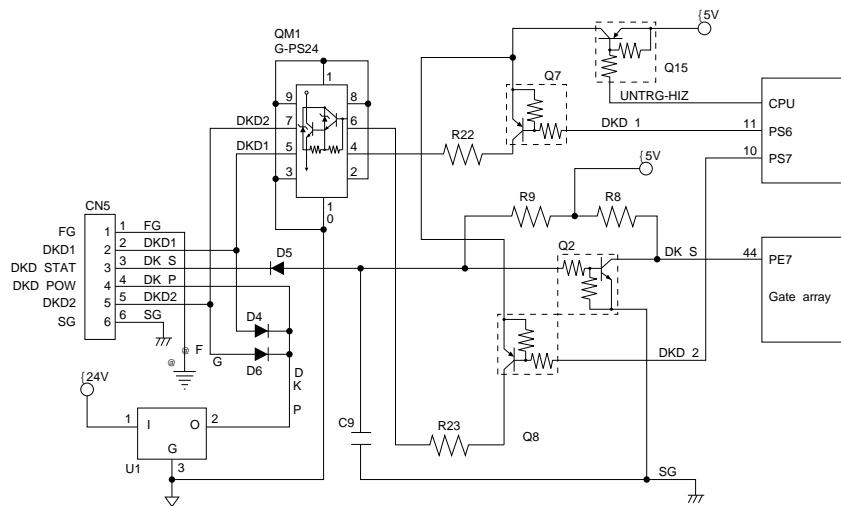


Figure 2-50a. Drawer Kick-out Circuit for the TM-U950P

Print head drive circuit

The print head has nine pins that are driven by dedicated solenoids. Ports PA0 - PA7 and PB7 of the gate array carry the solenoid signals (HEAD1 - 9). PB7 carries the common signal for the solenoids (HD_COM). The HEAD1 - 9 signals activate the sync transistors (QM3 - QM5). The HD_COM signal activates the source transistors (Q24, Q33, and Q34) to power the solenoids. When the source transistors go off, the energy stored by the solenoids is dissipated via the flywheel diodes (D39, D40, D44, D45, D46, and D47). When the sync transistors go off, the solenoid current is cut.

The HDBC signal is a head current limiter. When the head current duration exceeds 0.1s due to an error, this signal turns the head off. The limit time is determined by C20 and R44 and retriggered at the falling edge of the HD_COM signal.

Head temperature is measured by feeding the voltage divided by the thermistor and R134 to the CPU via the analog port AN1.

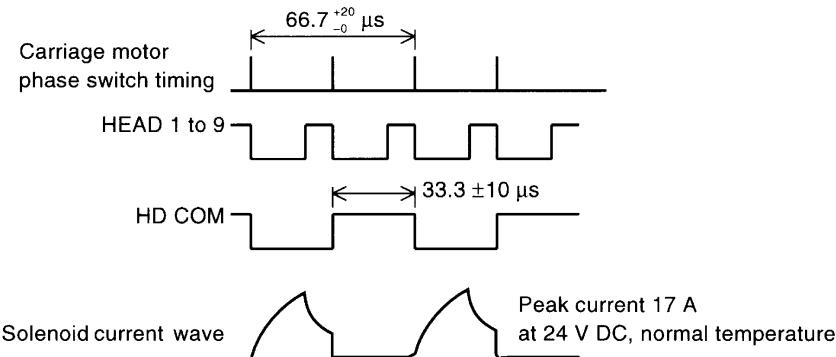


Figure 2-51. Print Head Timing Chart

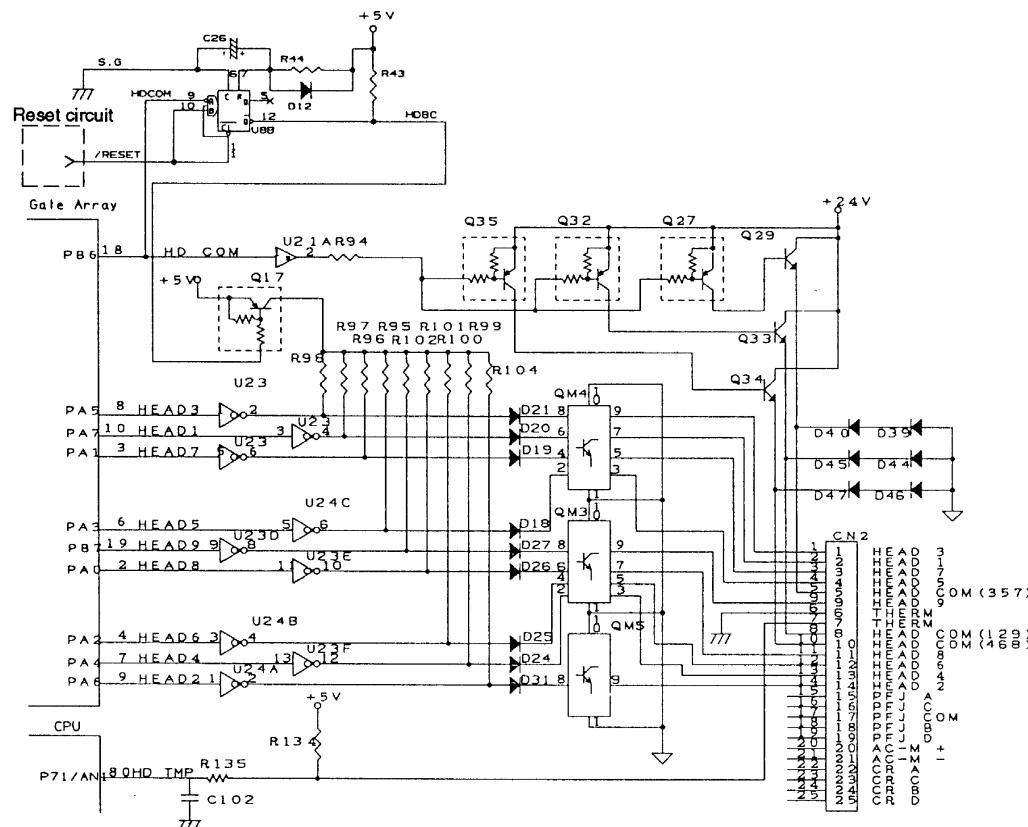


Figure 2-52. Print Head Drive Circuit

S/J switching solenoid drive circuit

The solenoid hold and off status is controlled by the SCB and S/J_HL signals.

S/J_DR	S/J_HL	Operation
L	L	Drive
L	H	Hold
H	H	Off

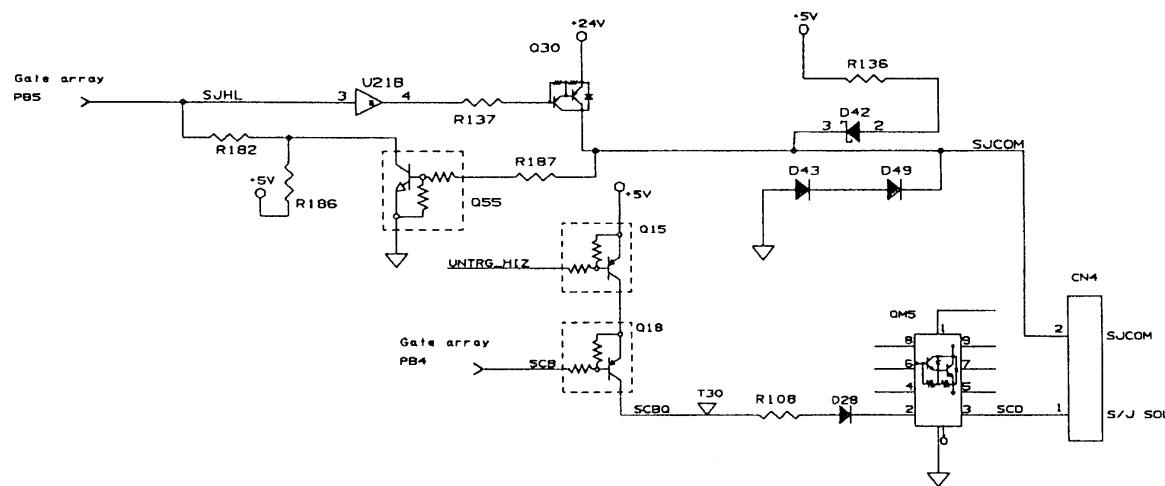


Figure 2-53. S/J Switching Solenoid Drive Circuit

Auxiliary slip paper feed solenoid/stamp solenoid drive circuit

These solenoids are driven by transistors QM5 according the STB and SHB signals from the CPU.

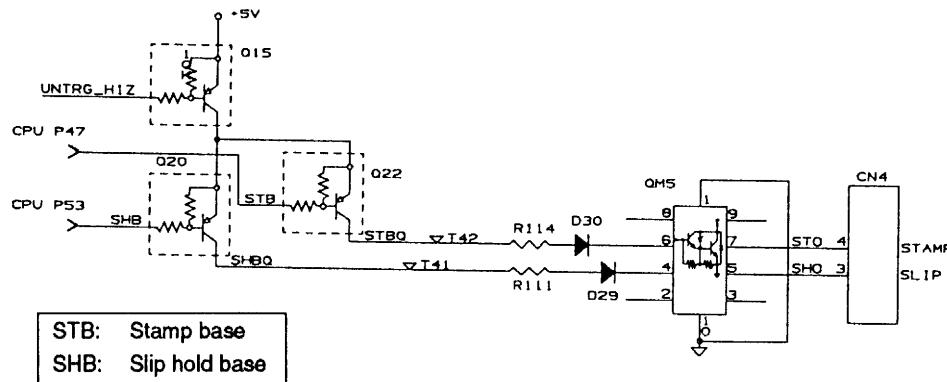


Figure 2-54. Auxillary Slip Paper Feed Solenoid/Stamp Solenoid Drive Circuit

Paper feed motor drive circuit (journal)

When transistor QM2 becomes on in response to the PFJ1 and PFJ2 switching signals from the CPU, the paper feed motor is activated. The PFJ_HL signal switches the motor between drive and hold. During hold, Q28 goes off and a current is supplied from the 5 V power supply.

The same circuit is provided for the receipt side.

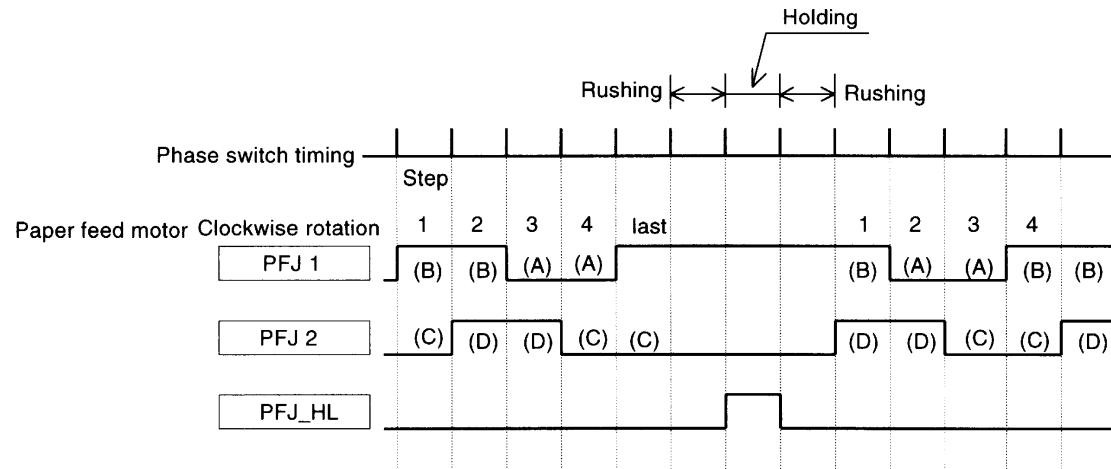


Figure 2-55. Paper Feed Motor Timing Chart

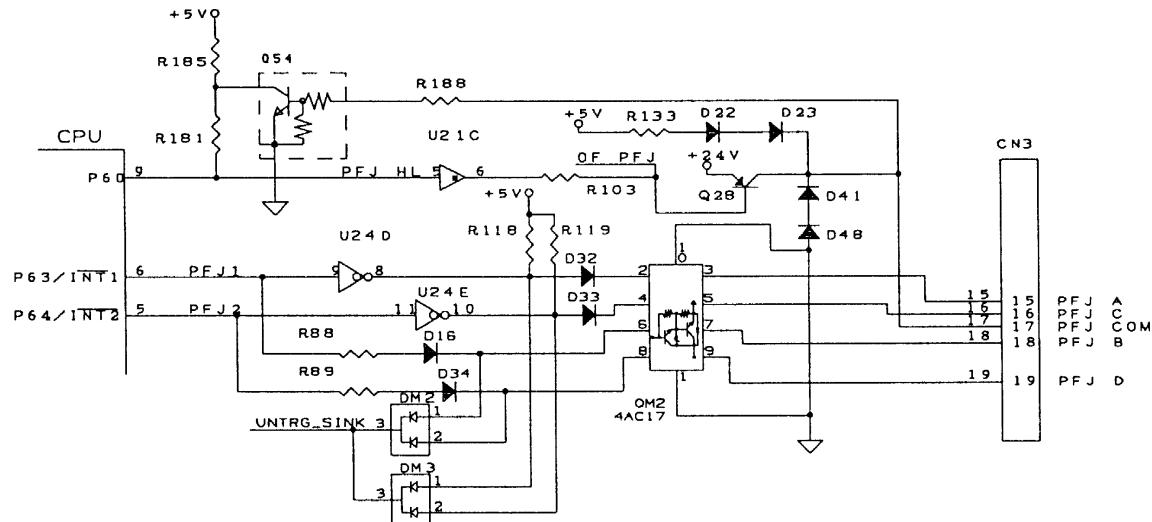


Figure 2-56. Paper Feed Motor Drive Circuit

Auto-cutter drive circuit

The auto-cutter drive circuit uses the dedicated DC motor drive IC TA8428K. The CPU issues the AC_1 and AC_2 signals to control off, normal, reverse, and braking operations of the auto-cutter motor.

AC_1	AC_2	Operation
L	L	Off
H	L	Normal
L	H	Reverse
H	H	Brake

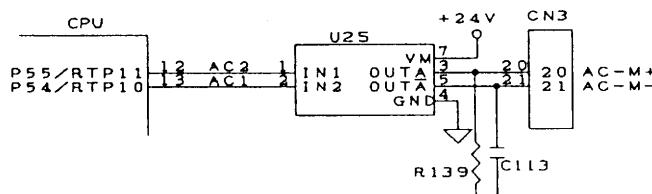


Figure 2-57. Auto-cutter Drive Circuit

Carriage motor drive circuit

The carriage motor is driven by a dedicated constant-current IC. The CPU issues the mutual switching signals CR_1 and CR_2 and the constant-current switching signals CR_HL and CR_NM. In response to these signals, the IC controls the carriage motor via the OUTA, OUTA-bar, OUTB, and OUTB-bar terminals.

CR_HL	CR_NM	Operation
0	0	Speed up / slow down
0	1	Normal rotation
1	0	Hold

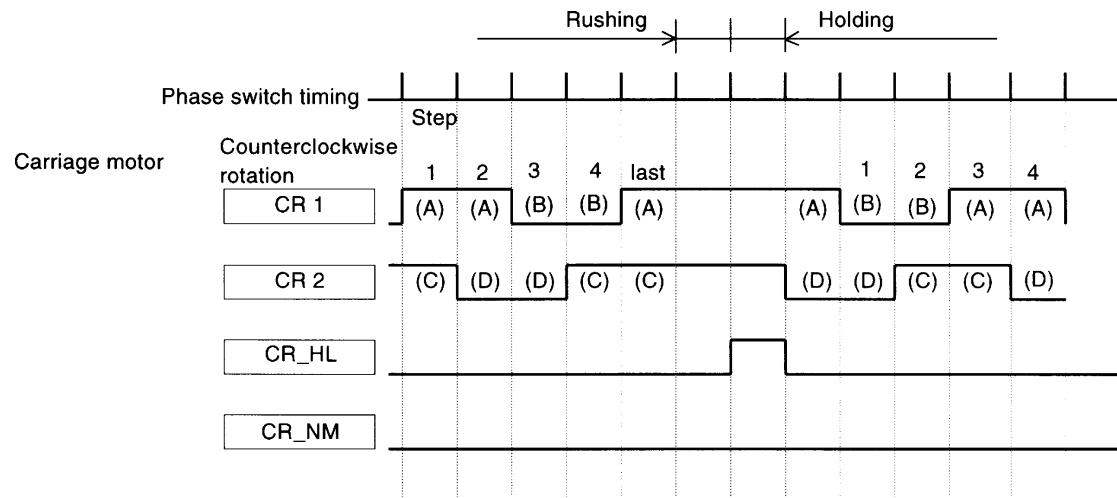


Figure 2-58. Carriage Motor Timing Chart

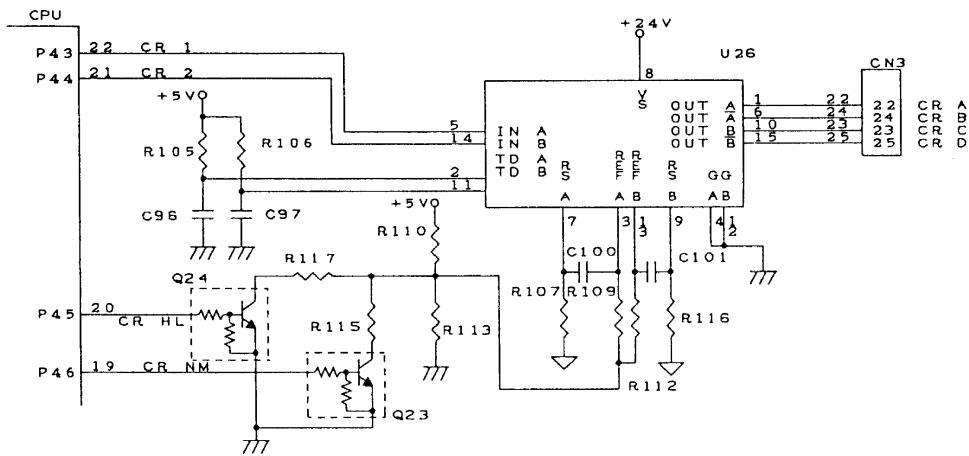


Figure 2-59. Carriage Motor Drive Circuit

Actuator irregular operation protection circuit

This circuit protects the printer from a current duration due to CPU abnormal operation. POW_TRG signal is connected to gate array PC5 and U8A is triggered by the signal. POW_TRG signal is a trigger for power supply control, and the signal is cut when CPU operates abnormally. As a result of the cut, all the actuator drivers except the print head and the auto-cutter are turned off.

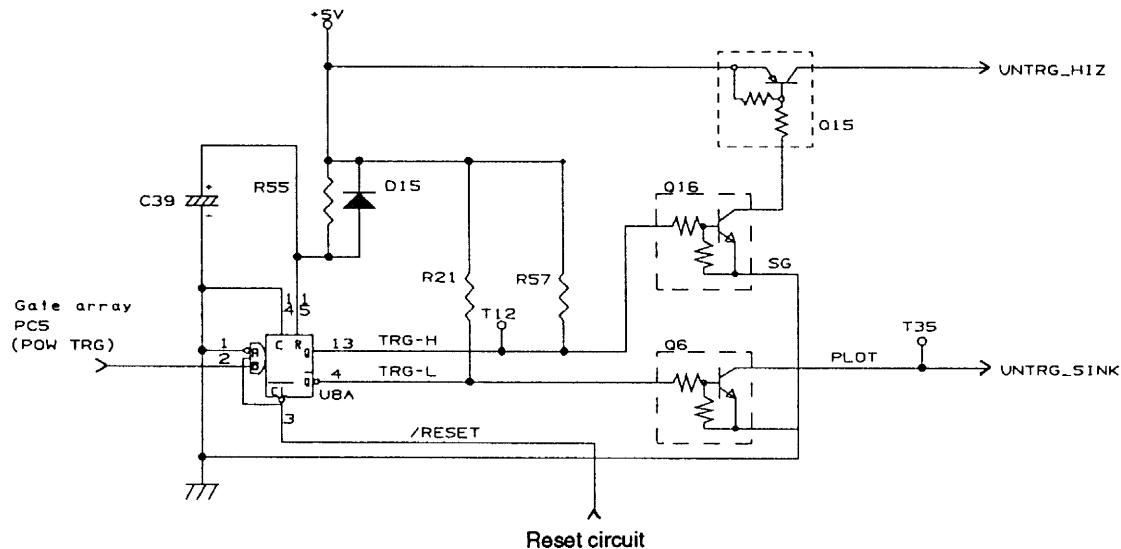


Figure 2-60. Irregular Operation Protection Circuit

Mechanism sensor circuits

All the sensors except the slip paper insert and eject sensors receive signals from the printer mechanism, and the signals are input to CPU and gate array via pull-up resistance and integral circuit.

Slip paper insert sensor circuit

The slip paper insert sensor signal is output to CPU analog port via pull-down resistance and integral circuit. Slip paper existence is judged by comparison between the threshold value in U20 and the detected value. (For the threshold value, see Adjustment in Chapter 5.)

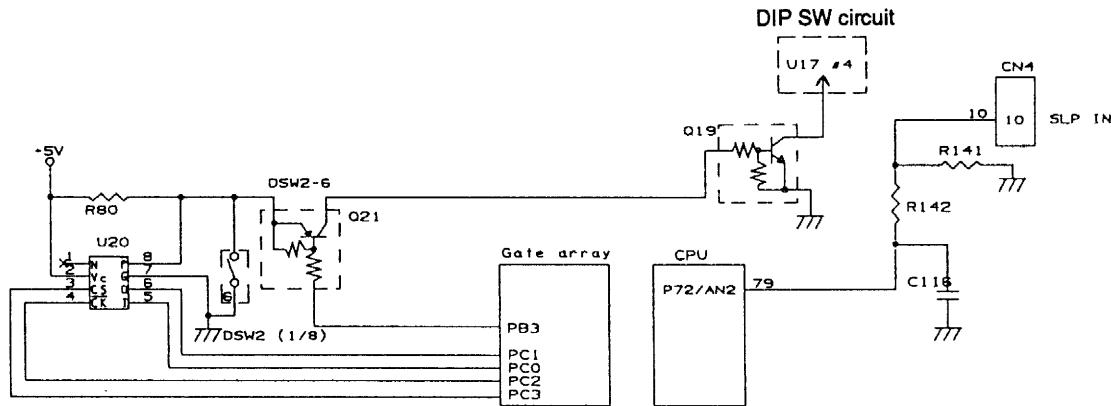


Figure 2-61. Slip Paper Insert Sensor Circuit

Slip paper eject sensor circuit

Slip paper eject detection is performed using a reflecting photosensor. To prevent errors due to external light, 2-kHz frequency modulation is used. The SO_K signal (light source drive) is turned on and off by the CPU in a 2-kHz cycle. The SO_E signal (light source detection) passes a 2-kHz filter and amplifier. The CPU then reads the level of this signal (CSOE) via an analog port to determine the presence or absence of paper.

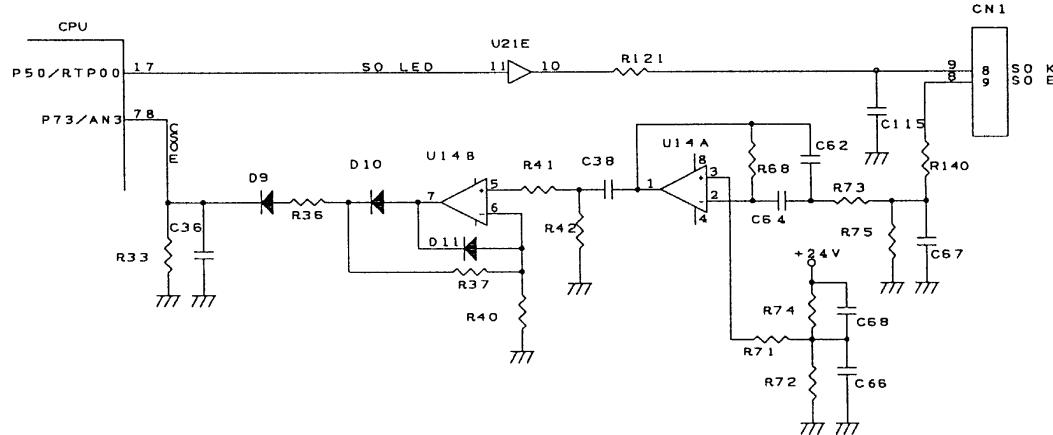
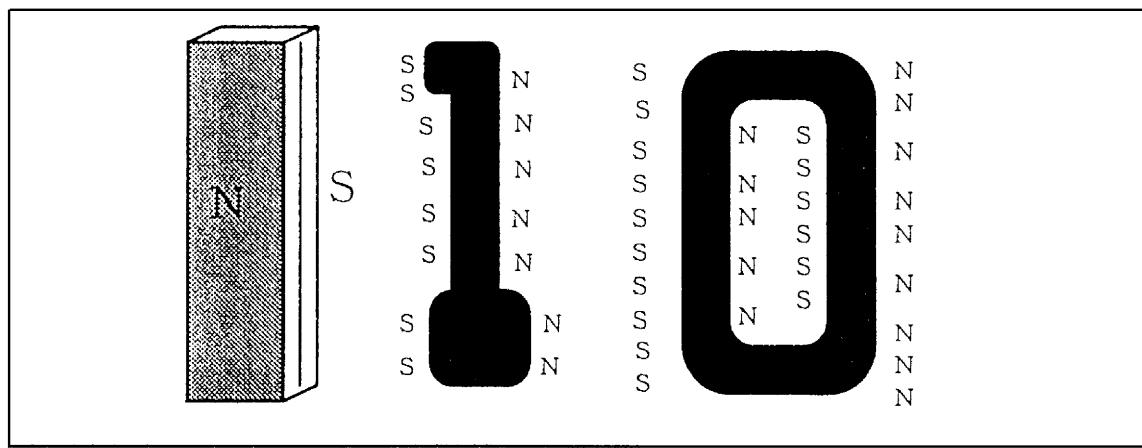


Figure 2-62. Slip Paper Eject Sensor Circuit

MICR Board Operating Principle (on printers with an MICR reader) (not available for the TM-U950P)***Operating principle of the MICR reader***

"MICR" stands for "Magnetic Ink Character Recognition". Magnetic ink is different from ink normally used for printing in that it contains magnetic particles such as iron filings which magnetize the ink.

When a magnetic field is applied from a certain direction to the magnetic ink characters printed on check paper, the characters are magnetized, as shown in the diagram below. (The term "magnetic ink" is used in this manual, but in actuality, the characters are read by sending current to a magnetic reading head and forming a magnet.)



Direction in which check paper moves →

Figure 2-63. Magnetization of the Magnetic Ink Characters.

Characters magnetized in this way are read by the magnetic reading head, and character recognition is carried out.

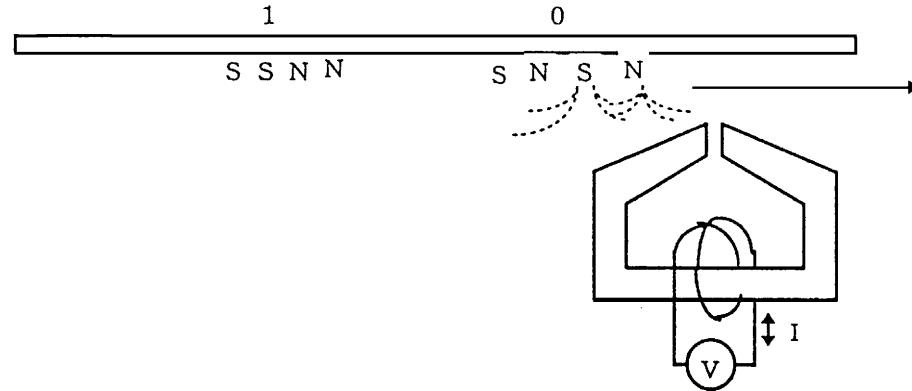


Figure 2-64. Operation of the Magnetic Reading Head

The voltage waveform output from the magnetic reading head produces a different pattern for each individual character, and characters are recognized by their patterns.

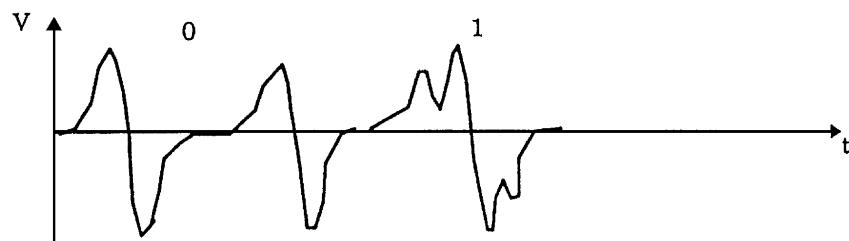


Figure 2-65. Voltage Waveform Output From the Magnetic Reading Head

Overview of MICR board operation

The following drawing shows a simplified diagram of the functions of the MICR board.

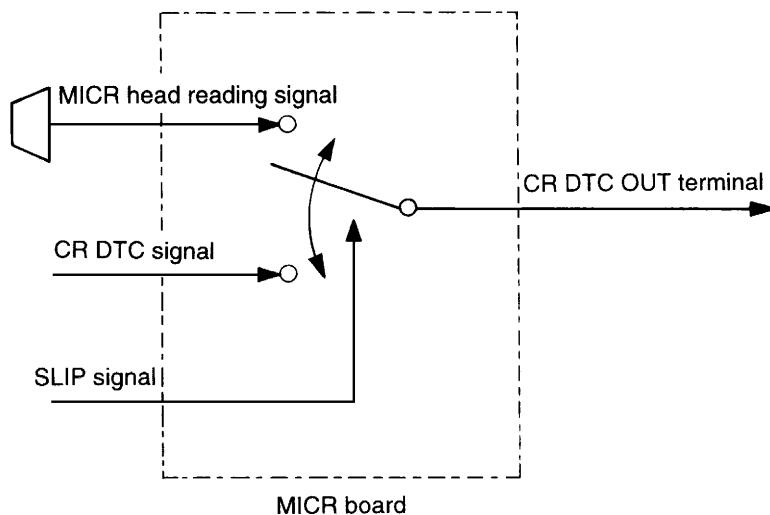


Figure 2-66. General Operation of the MICR Board

The MICR head reading signal and CR DTC signal are output to the CR DTC OUT terminal. Switching of these two signals is controlled by the SLIP signal as shown below.

SLIP signal	CR DTC OUT terminal
High	CR DTC signal output
Low	MICR head reading signal output

(Note: Only the logic for High and Low is shown. These are different from the TTL levels.)

Chapter 3

Handling and Maintenance

Handling

Handling Precautions

Transport Precautions

- When transporting the printer, insert the protective material in the slip paper path and pack the printer in a specially provided package so that the printer does not come into contact with other products. Also, be careful not to drop it or apply any kind of external stress.

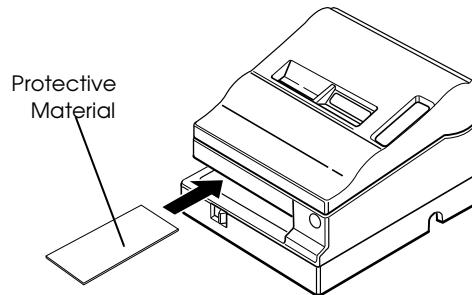


Figure 3-1. Inserting the Protective Material

Storage Precautions

- Avoid storing the printer in an area that is dusty, humid, or subject to excessively low temperatures. Also avoid areas which are exposed to direct sunlight for long periods of time.
- For long-term storage, put the printer in a polyethylene bag with anti-rust paper (VCI paper), and keep it in a dry place.

Use Precautions

- Always install a ribbon cassette and load paper before printing. If paper runs out, be sure to load new paper before resuming printing.

If printing is executed when there is no paper or no ribbon cassette in the printer, the print quality may deteriorate (the printing color may become uneven or some dots may not be printed) because of damage to the surface of the platen, printing wires, or ribbon.

- Do not touch the print head unit after printing. It becomes very hot during printing.
- There is a set screw for the frame ground (FG.) Use it for grounding the printer.
- Be careful when wiring and connecting the interface, power, and drawer kick-out cables to avoid subjecting the connectors to excessive pressure.

Ribbon Cassette Handling Precautions

- Use only the ribbon cassette specified in this manual. (See the Ink Ribbon section in Chapter 1.)

If another ribbon cassette is used, the print quality may deteriorate, the life of the printer may be shortened, ink may leak, or the ribbon may be caught on a print head pin.

- Do not reink a ribbon.

If a ribbon is reinked, the print quality could deteriorate due to a malfunction of the print wires or the ink may leak.

Notes on using the MICR reader (only when the printer is used with MICR)

- Be sure to perform personal check printing with a paper roll loaded. If MICR reading and/or printing is performed without a paper roll loaded, the check cannot be fed correctly or may be damaged due to paper jams.
- The personal checks must be flat, without curls, folds, or wrinkles (especially at the edges).

Otherwise, the check may rub against the ribbon and become ink-stained.

Loading the Paper Rolls

1. Cut the end of the paper rolls straight as shown in the figure below:

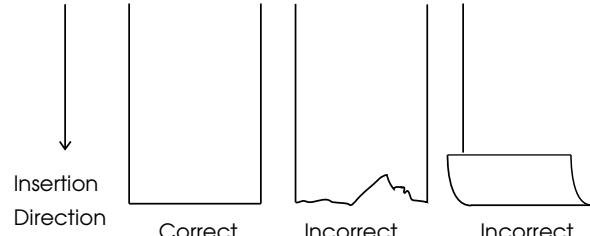


Figure 3-2. Paper Roll Edge

2. Turn on the printer, open the printer cover, and remove the take-up spool.
3. Insert paper rolls in both the receipt and journal sides of the printer.

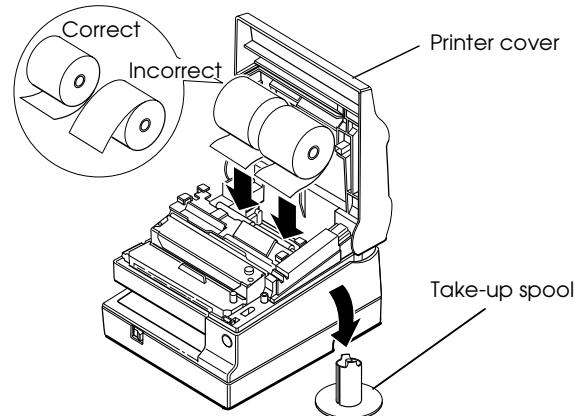


Figure 3-3. Inserting Paper Roll

4. Insert the tip of the paper from each roll into the corresponding paper inlet. The paper will automatically be detected and fed into the printer.

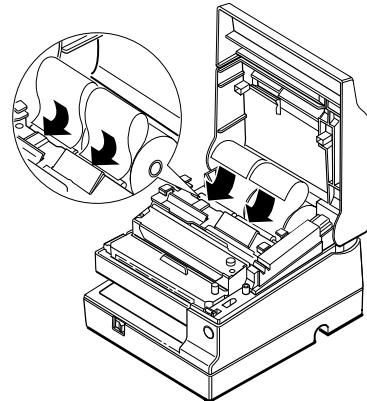


Figure 3-4. Inserting Paper into the Paper Inlet

5. Tear off the receipt paper on the paper cutter. If the paper was not fed far enough, press the RECEIPT FEED button to feed additional paper.
6. Press the JOURNAL/SKIP FEED button to feed an additional 30 cm (a foot) or so of journal paper.
7. Insert the tip of the journal paper into the groove on the take-up spool and rotate the spool two or three times to secure the paper.

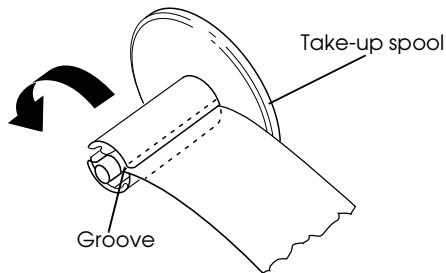


Figure 3-5. Inserting the Paper into the Spool

8. Install the take-up spool in the printer and close the printer cover.

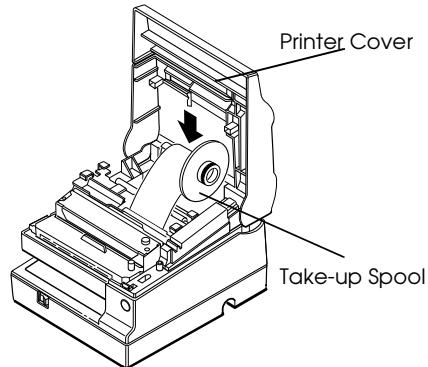


Figure 3-6. Installing the Spool and Closing the Printer Cover

Removing the Paper Rolls

1. If you want to remove the paper roll in the journal paper side, cut the journal paper with a pair of scissors or a knife; then remove the take-up spool.

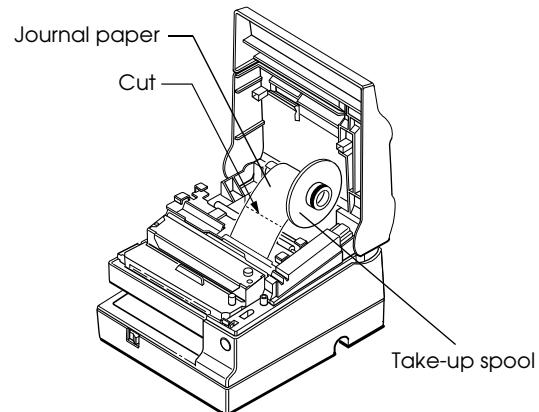


Figure 3-7. Cutting the Journal Paper

2. Hold down the paper release lever (marked PRESS) and pull out the paper roll in the direction of the arrow. As there is a paper release lever on both the receipt and journal sides of the printer, you can remove either (or both) of the paper rolls in this way.

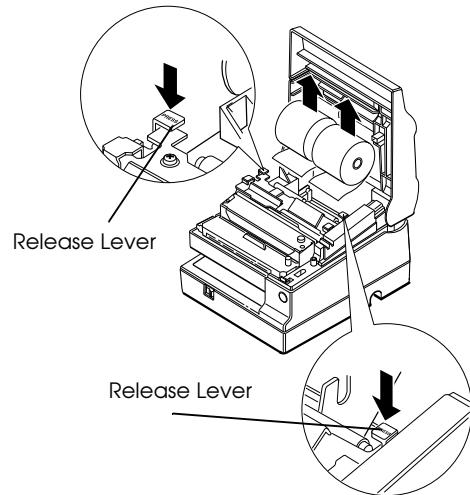


Figure 3-8. Removing the Paper Rolls

Inserting Slip Paper and Printing on Slip Paper

Inserting Slip Paper

Note:

Be sure to install the paper rolls in the printer, even if you plan to print only on slip papers. This will prevent paper jams. You can also prevent paper jams by using only flat paper, without wrinkles, creases, or folds.

1. Send ESC c 04 command from the computer, so that the printer enters slip paper mode. When the printer enters slip paper mode, the SLIP indicator flashes.

2. When the SLIP indicator flashes, insert the slip paper into the slip paper inlet using the right side edge of the inlet. Make sure you insert the slip paper into the inlet as far as it will go (i.e. insert the slip paper until the mark on the left side of the printer.) See Figure 3-9.

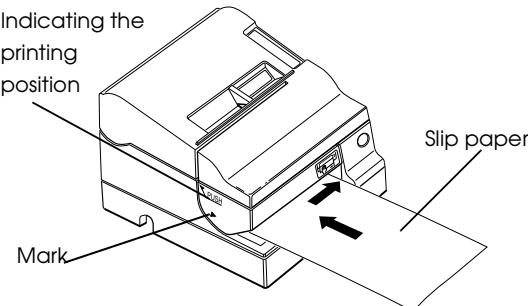


Figure 3-9. Inserting Slip Paper

Printing on Slip Paper

Step	User Operation	Printer Operation
1	Transmit ESC f.	Mechanically switches to slip paper mode and waits for slip paper to be inserted. The SLIP LED flashes. To cancel the slip paper waiting state, transmit DLE ENQ3.
2	Insert the paper.	Detects the slip paper, lights the SLIP LED, and feeds the slip paper to the print starting position.
3	Transmit print data and commands.	Prints data and feeds the slip paper.
4	Transmit FF.	After the printing, ejects the slip paper. The SLIP LED keeps flashing until the slip paper is removed.
5	Remove the paper.	Enters roll paper (two-sheet) mode and SLIP LED goes out.

Printing on Personal Checks (only on printers with an MICR reader) (not available for the TM-U950P)

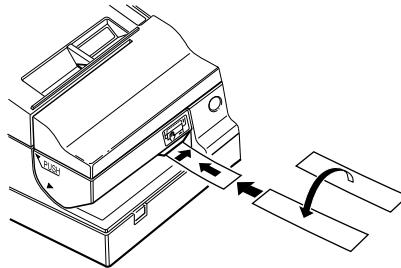
Setting the personal check paper in place

Notes:

- Be sure to perform personal check printing with a paper roll loaded. If MICR reading and/or printing is performed without a paper roll loaded, the check cannot be fed correctly or may be damaged due to paper jams.
 - The personal checks must be flat, without curls, folds, or wrinkles (especially at the edges). Otherwise, the check may rub against the ribbon and become ink-stained.
 - Do not insert checks with staples. This may cause paper jams, MICR reading errors, and damage to the MICR head.
1. The FS a 0 command is issued to access the MICR mode. When the MICR mode is accessed, the SLIP LED flashes.
 2. When the SLIP LED is flashing, the personal check paper can be inserted.

Procedure for Inserting Personal Check Paper

- (a) Set the paper so that the side on which the magnetic ink characters have been printed is facing down, with the characters at the right side of the paper.
- (b) Insert the paper until it comes in light contact with the back of the printer. (The paper should be inserted until the leading edge of the paper reaches the arrow mark on the left of the printer.)

*Figure 3-10. Inserting a Personal Check*

3. When the personal check paper is detected, the SLIP LED stops flashing and lights steadily.
4. The personal check paper is fed, and the magnetic ink characters on the paper are read and printing is carried out on the reverse side of the paper.
5. The personal check paper is ejected. Remove it by pulling it upward. Do not pull it out in the horizontal direction. The SLIP LED continues to flash until the paper is removed from the printer.
6. The SLIP LED goes out when the personal check paper has been removed.

Printing on personal check paper (when the printer is used with the MICR reader)

Use the following procedure to read MICR characters.

Step	User Operation	Printer Operation
1	Transmit FS a 0 <00>H. (Transmit DLE ENQ 3.)	Mechanically switches to MICR mode and waits for a personal check to be loaded. The SLIP LED blinks. (When the check waiting state is canceled)
2	Insert a check.	Detects the check, lights the slip LED, and reads MICR characters. After reading, transmits the reading results.
3	(Transmit FS a 0<00H>.)	(Re-reads the check and transmits the reading result.)
4	Transmit FS a 1.	Loads the check paper to the print starting position.
5	Transmit endorsement printing data.	Prints data and feeds paper.
6	Transmit FF.	After printing, ejects paper. The SLIP LED blinks until the check is removed.
7	Eject the check paper.	Switches to two sheet mode. The SLIP LED blinks.

Notes:

- Personal check is ejected in the forward direction only.
- The paper roll must be loaded onto both the receipt and journal sides correctly before selecting MICR function by transmitting FS a 0. Otherwise, check paper is not fed properly.
- The check waiting state is canceled using DLE ENQ 3.
- After the personal check is ejected, the SLIP LED indicator lights and the printer does not proceed to the next operation until the check is removed.
- The check waiting time and the interval from when a check is inserted to when the operation starts can be set using ESC f.
- To check the MICR function status exactly, DLE EOT BS 1 should be used.

Installing and Removing the Ribbon Cassette

Installing the Ribbon Cassette

1. Open the printer cover.
2. Turn the ribbon cassette's knob in the direction of the arrow, to take up any slack in the ribbon.
3. Insert the ribbon cassette in the printer and rotate the cassette's knob five or six more times. This is necessary to place the ribbon in the correct position.

Notes:

- Make sure that the ribbon is installed in front of the print head without wrinkles or creases. If it is hard to see, open the print head cover.
- Never turn the ribbon cassette's feed knob in the opposite direction of the arrow marked on the cassette.

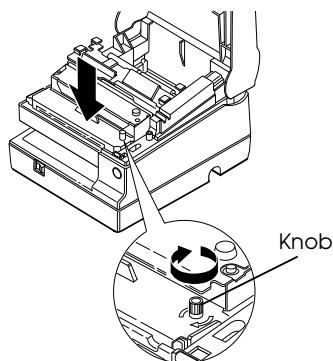


Figure 3-11. Installing the Ribbon Cassette

Removing the Ribbon Cassette

To remove the ribbon cassette, grasp the ribbon cassette's tab and pull it out of the printer.

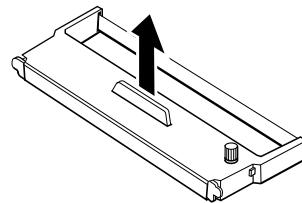


Figure 3-12. Removing the Ribbon Cassette

Inserting the Stamp Set

If your printer has the stamping feature, follow the steps below to install the stamp set in the printer.

1. Open the printer cover.
2. Insert the stamp set into the printer as shown in the figure below. Then close the printer cover.

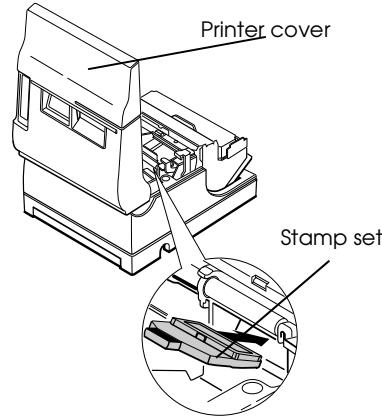


Figure 3-13. Installing the Stamp Set

Note:

To remove the stamp set, pull it out of the printer in the opposite direction of the arrow in the figure above.

Mounting the Power Switch Cover

To guard the power switch from incorrect operation, attach the power switch cover on the printer power switch as shown in Figure 3-14.

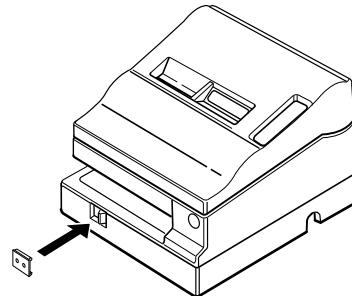


Figure 3-14. Installing the Power Switch Cover

Journal Lock Key Handling

The journal lock is located inside the printer cover as shown in Figure 3-15. The lock is closed when the key is turned to the right. The lock is open when the key is turned to the left.

Note:

Make sure that you remove the key from the lock before you close the printer cover, otherwise the printer cover may be damaged.

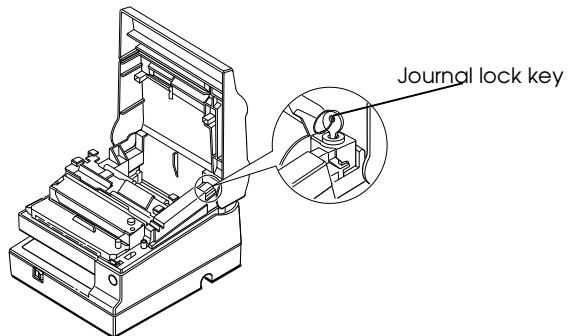


Figure 3-15. Using the Journal Lock Key

Removing the Jammed Paper

To clear a paper jam inside the printer, follow the steps below:

1. Turn the printer off and open the printer cover.
2. If the paper is jammed in the journal paper side, cut the journal paper with a pair of scissors or a knife referring to Figure 3-7; then remove the take-up spool.

3. Cut the paper on the lines shown in the figure below, using a pair of scissors or a knife; then remove the paper roll. (See Figure 3-16.)

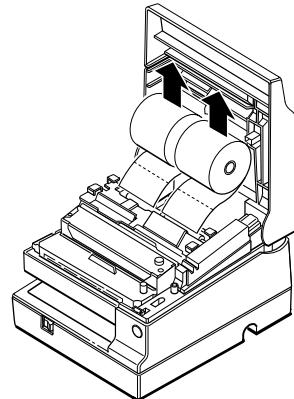


Figure 3-16. Cutting the Paper

4. If the paper is caught in the cutter blade inside the auto-cutter, open the cutter blade by rotating the gear in the direction shown in the figure below.

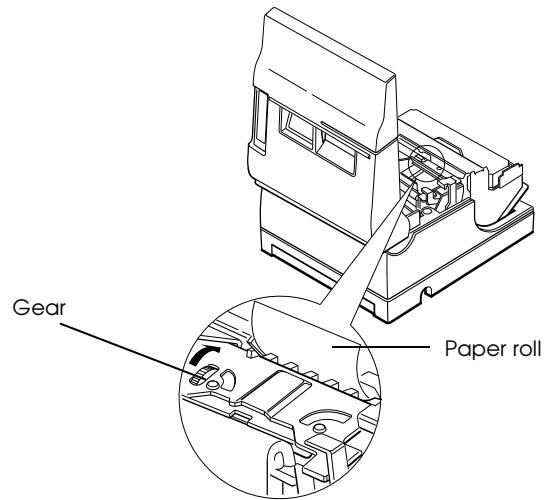


Figure 3-17. Opening the Cutter Blade

5. Move the OPEN ↔ LOCK lever on each side of the printer in the direction in the figure below; then the cutter unit opens automatically.

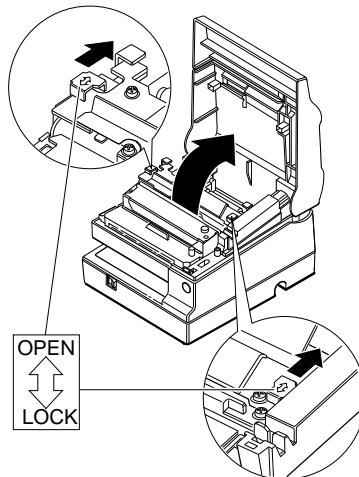


Figure 3-18. Opening the Cutter Unit

6. Pull the paper out gently. If the paper tears, make sure you remove any remaining pieces.
7. Close the cutter unit and lock it by moving both OPEN ↔ LOCK levers in the direction marked with LOCK.

If you encounter difficulty in clearing a paper jam, remove the print head cover by loosening the screw on the right side of the cover, as shown in the figure below.

Be careful not to touch the print head unit, as it can be very hot after printing continuously for a long time.

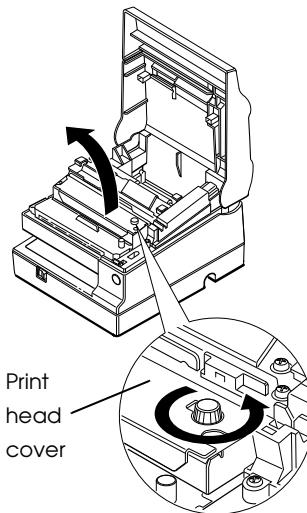


Figure 3-19. Removing the Print Head Cover

Maintenance

For optimal printer performance over the longest possible period and to prevent problems, it is important to maintain the printer as described below.

Periodic Checks

The only user maintenance required on a regular basis is to follow the precautions described in Handling at the beginning of this chapter.

Table 3-1 describes periodic maintenance, which should be performed only by experienced persons who specialize in printers.

Table 3-1. Periodic Checks

Checkpoints	Standards	Remedies
Dust, paper particles, or dirt on and in the mechanism unit	No dust, paper particles, or dirt should be allowed to build up on or in the mechanism unit. No foreign materials should be in the printer	Clean the mechanism unit thoroughly with a vacuum cleaner.
	No small pieces of paper should be left in the paper path.	Remove any pieces of paper from the paper path.
Shape of the springs	No spring should be bent or deformed.	Replace any deformed springs.
Lubrication	Refer to Lubrication.	Lubricate at the points listed in Table 3-2 or 3-3, Lubrication Points.
Ribbon cassette	The ribbon cassette should be properly installed on the ribbon frame assembly.	See installing and removing the ribbon cassette.
	The ribbon cassette should be the one specified in this manual	Replace the ribbon cassette if it is not the one specified or its print quality is poor.
	The ribbon should never be reinked.	Replace the ribbon cassette.
Operation check	When each printer component is observed, no abnormalities should be found.	Refer to the Troubleshooting flowchart in Chapter 4.

Cleaning

Wiping off Stains

Wipe off stains with a clean dry cloth. If the stains cannot be wiped off, use a neutral detergent.

Note:

To avoid damaging the printer, do not use benzine, alcohol, thinner, trichloroethylene, or ketone-based solvents on plastic and rubber components of the printer.

Cleaning Dust, Paper Particles, and Dirt

Cleaning with a vacuum cleaner is recommended. Thoroughly clean the printer components.

Note:

After cleaning is completed, verify that each lubrication point is adequately lubricated. If not, lubricate with the specified lubricant.

Cleaning the MICR Mechanism (when the printer is used with MICR reader)

Foreign matter on the MICR mechanism can cause MICR reading errors. To clean the MICR mechanism, execute the cleaning command (FS c). Then insert cleaning paper in the same way you insert check paper to clean the MICR head, roller, and paper path.

Cleaning period: Once per month or every 6000 passes

Example cleaning sheet: KIP Products PRESAT brand check reader cleaning card or equivalent

Lubrication

To maintain optimal printer performance over the longest possible period, apply the specified lubricant to the lubrication points according to the lubrication schedule below.

Lubrication Standards

When lubricating parts during assembly and disassembly of the printer, clean the parts before lubricating them.

If lubricant is wiped off during cleaning, or disassembly or parts replacement is performed, be sure to lubricate the appropriate points, even if it is not yet time for the periodic lubrication.

Lubricants

The performance and life of the printer is greatly affected by the lubricant applied. Therefore, pay careful attention to lubricant specifications, especially to the low temperature characteristics.

The lubricants for the printer are chosen based on technical information analysis and tests on various lubricants by EPSON. EPSON supplies EPSON specified lubricants in 40 cc (gr) plastic containers (the minimum supply unit).

Two lubricants, G-15, G-19, G-20, G-36 and O-2, may be applied to the printer.

Lubrication Points

See the General Lubrication Points Diagrams in the Appendix (Chapter 6). The numbers in the left column of Table 3-2 correspond to the numbers in the figures in Chapter 6.

Lubrication schedule: When the printer is overhauled or after every 5 million print lines.

Table 3-2. Lubrication Points for Printer Mechanism Unit (for printers without an MICR reader)

No.	Lubrication Point (See lubrication point diagrams at end of Chapter 6 (Appendix))	Type
1	Roller-sub paper feed assembly mounting U-cut notches (four) of paper guide-upper	G-36
2	Roller mounting portions of sub paper hold roller	G-36
3	Shaft of paper guide-lower	G-15
4	Lever-stamp sliding portions (three) of paper guide-lower	G-36
5	Lever-stamp drive hooding portion of lever-stamp	G-15
6	Iron core notch	G-15
7	Shaft of cutter motor mount plate sub assembly	G-36
8	Bigger wheel of deceleration gear A	G-36
9	Two holes of each paper hold roller	G-36
10	Two shafts of cutter frame sub assembly	G-36
11	Center wheel of cutter drive shaft sub assembly	G-36
12	Both wheel of deceleration gear B	G-36
13	Bigger wheel of deceleration gear A	G-36
14	Cutter slider contact portion of frame-cutter blade receiving assembly	G-36
15	Circuit pattern on cutter slider assembly	G-20
16	Shaft of pulley base-carriage transmission assembly	G-36
17	Oil ring	O-2
18	Two shafts of frame-carriage assembly	G-15
19	Carriage catching surface (above) of frame-carriage assembly (five)	G-19
20	Carriage catching whole surface (below) of frame-carriage assembly	G-19
21	Five shafts of frame-carriage assembly	G-36
22	Wheel of carriage feed pulley	G-36
23	Ribbon feed transmission gear	G-36
24	Gear-ribbon feed	G-36
25	Two shafts of roller-slip paper hold assembly	G-15
26	Four dowels of frame-inner	G-15
27	Lever-sub slip paper feed shaft contact portion with roller-sub slip paper feed	G-15
28	Iron core notch	G-15
29	Contact portion of form stopper and lever-sub slip paper feed shaft	G-15
30	Contact portion of J/S changeover solenoid mount plate and J/S changeover solenoid	G-15
31	Shaft of frame-paper take-up sub assembly	G-36
32	Two U-cut notches of frame-paper take-up sub assembly	G-36
33	Paper take-up gear contact portion with Paper take-up spring	G-36
34	External surface of paper take-up spring	G-36

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Table 3-2. Lubrication Points for Printer Mechanism Unit (for printers without an MICR reader)

No.	Lubrication Point (See lubrication point diagrams at end of Chapter 6 (Appendix))	Type
35	Six shafts of frame-main assembly	G-36
36	Roller-sub slip paper feed assembly mounting two U-cut notches of frame-main assembly	G-15
37	Gear of roller-slip paper feed assembly	G-36
38	Paper feed deceleration gear	G-36
39	Receipt transmission gear	G-36
40	Notch of J/S changeover gear	G-36
41	Paper feed deceleration gear	G-36
42	Bigger wheel gear of gear-journal transmission	G-36

Table 3-3. Lubrication Points for Printer Mechanism Unit (for printers with an MICR reader)

No.	Lubrication Point (See lubrication point diagrams at end of Chapter 6 (Appendix))	Type
1	Roller-sub paper feed assembly mounting U-cut notches (four) of paper guide-upper	G-36
2	Roller mounting portions of sub paper hold roller	G-36
3	Shaft of paper guide-lower	G-15
4	Lever-stamp sliding portions (three) of paper guide-lower	G-36
5	Lever-stamp drive hooking portion of lever-stamp	G-15
6	Iron core notch	G-15
7	Shaft of cutter motor mount plate sub assembly	G-36
8	Bigger wheel of deceleration gear A	G-36
9	Two holes of each paper hold roller	G-36
10	Two shafts of cutter frame sub assembly	G-36
11	Center wheel of cutter drive shaft sub assembly	G-36
12	Both wheel of deceleration gear B	G-36
13	Bigger wheel of deceleration gear A	G-36
14	Cutter slider contact portion of frame-cutter blade receiving assembly	G-36
15	Circuit pattern on cutter slider assembly	G-20
16	Shaft of pulley base-carriage transmission assembly	G-36
17	Oil ring	O-2
18	Two shafts of frame-carriage assembly	G-15
19	Carriage catching surface (above) of frame-carriage assembly (five)	G-19
20	Carriage catching whole surface (below) of frame-carriage assembly	G-19
21	Five shafts of frame-carriage assembly	G-36
22	Wheel of carriage feed pulley	G-36
23	Ribbon feed transmission gear	G-36
24	Gear-ribbon feed	G-36
25	Five points on lever-MICR head holder change	G-15

Table 3-3. Lubrication Points for Printer Mechanism Unit (for printers with an MICR reader)

No.	Lubrication Point (See lubrication point diagrams at end of Chapter 6 (Appendix))	Type
26	Four dowels of frame-inner	G-15
27	Lever-sub slip paper feed shaft contact portion with roller-sub slip paper feed	G-15
28	Iron core notch	G-15
29	Contact portion of form stopper and lever-sub slip paper feed shaft	G-15
30	Contact portion of J/S changeover solenoid mount plate and J/S changeover solenoid	G-15
31	Shaft of frame-paper take-up sub assembly	G-36
32	Two U-cut notches of frame-paper take-up sub assembly	G-36
33	Paper take-up gear contact portion with Paper take-up spring	G-36
34	External surface of paper take-up spring	G-36
35	Six shafts of frame-main assembly	G-36
36	Roller-sub slip paper feed assembly mounting two U-cut notches of frame-main assembly	G-15
37	Gear of roller-slip paper feed assembly	G-36
38	Paper feed deceleration gear	G-36
39	Receipt transmission gear	G-36
40	Notch of J/S changeover gear	G-36
41	Paper feed deceleration gear	G-36
42	Bigger wheel gear of gear-journal transmission	G-36
43	Two axles of roller-MICR head holder	G-36
44	Notch in sleeve of roller-MICR head holder	G-36

Tool List

Table 3-4. Tools Required for Servicing the Printer (all are commercially available)

Tool Name
Brush #1
Brush #2
Cleaning brush
Phillips screwdriver no. 1
Phillips screwdriver no. 2
Flatblade screwdriver
Hexagon screwdriver 5 mm (0.2")
Tweezers
Round-nose pliers
Clearance gauges, 0.5 mm (0.02")
ET holders (#1.5, #2.3, and #3)

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Measuring Equipment List

Table 3-5. Equipment Required for Checking and Assembling the Printer

Name	Standard
Tester	DC voltage, resistance
Oscilloscope	50 Mhz with storage
Spring scale	2 Kg (4.4 lb)

Lubricant List

Table 3-6. Lubricants for the Printer

Type	Name	Quantity	Commercial Availability
Grease	G-15	40 gr	E
Grease	G19	40 gr	E
Grease	G-20	40 gr	E
Grease	G-36	40 gr	E
Oil	O-2	40 gr	E

E : EPSON-exclusive product

Chapter 4

Troubleshooting

Troubleshooting

Use the following to troubleshoot and repair the printer:

Self-test

Use the self-test to check the operation of the control circuitry and the printer mechanism.

Troubleshooting flowchart

When the source of the problem is not clear, use the flowchart to find and replace a defective component.

Troubleshooting tables

Follow the steps outlined in these tables to repair a defect whose symptoms are known.

Self-test

The self test can be performed for paper rolls or for slip paper. Make sure the printer is turned off before starting the self-test with either paper type.

Initiating the self-test

Paper roll self-test

1. Insert paper rolls in both receipt and journal sides of the printer, and close the printer cover.
2. Turn on the printer while keeping the RECEIPT FEED button depressed. The self-test starts and status information is printed on the receipt paper roll.

Slip paper self test

1. Insert paper rolls in both receipt and journal sides of the printer, and close the printer cover.

Note:

When printing on slip paper, paper rolls should also be inserted in both sides of the printer. This prevents paper jams.

2. Turn on the printer while keeping the JOURNAL/SЛИP FEED button depressed. The SLIP LED flashes.
3. Feed a sheet of slip paper into the printer. The self-test starts, loading the paper automatically and then printing status information.

Self-test standby

Paper roll self test

1. When the status information printing is complete, the following is printed:

“Self-test printing. Please press RECEIPT FEED button.”

The RECEIPT OUT and JOURNAL OUT LEDs flash alternately to indicate the standby condition.

2. Press the RECEIPT FEED button to continue self-test.

Slip paper self test

When the status information printing is complete, the slip paper is ejected, and the printer waits for insertion of the next sheet (SLIP LED flashes). To continue the self-test, continue to feed slip paper into the printer.

Ending the self-test (both paper roll and slip paper)

The printer prints “***completed***” and ends the self-test. The printer automatically becomes ready to receive data after the self-test.

Version 1.0 ESC/POS

Serial Interface

Baud rate : 9600 bps
Data bits : 8 bits
Parity : none
Stop bit : 1 bit or more
Handshaking : DTR/DSR
Receive error: Prints '?'

Buffer Capacity
2048 bytes

Carriage Speed Mode
normal

Character Code Table
00

International Character Set
00

SLIP IN DETECTOR Threshold Value
13

Self-test printing.
Please press RECEIPT FEED button.

! "#\$%&(')*+,-./0123456789:;<=>?@ABCDEFGHIJ
! "#\$%&(')*+,-./0123456789:;<=>?@ABCDEFGHIJ
"#\$%&(')*+,-./0123456789:;<=>?@ABCDEFGHIJ
#\$%&(')*+,-./0123456789:;<=>?@ABCDEFGHIJ
\$%"(>)*+,-./0123456789:;<=>?@ABCDEFGHIJK
%"(>)*+,-./0123456789:;<=>?@ABCDEFGHIJKL
&"(>)*+,-./0123456789:;<=>?@ABCDEFGHIJKLM
~"(>*+,-./0123456789:;<=>?@ABCDEFGHIJKLM
~~z{}~ ! #\$%&(')*+,-./0123456789:;<=>?@ABC~~
~~{})~ ! #\$%&(')*+,-./0123456789:;<=>?@ABC~~
~~{})~ ! #\$%&(')*+,-./0123456789:;<=>?@ABCD~~
~~)~ ! #\$%&(')*+,-./0123456789:;<=>?@ABCDE~~
~~~ ! #\$%&(')\*+,-./0123456789:;<=>?@ABCDEF~~

\*\*\* completed \*\*\*

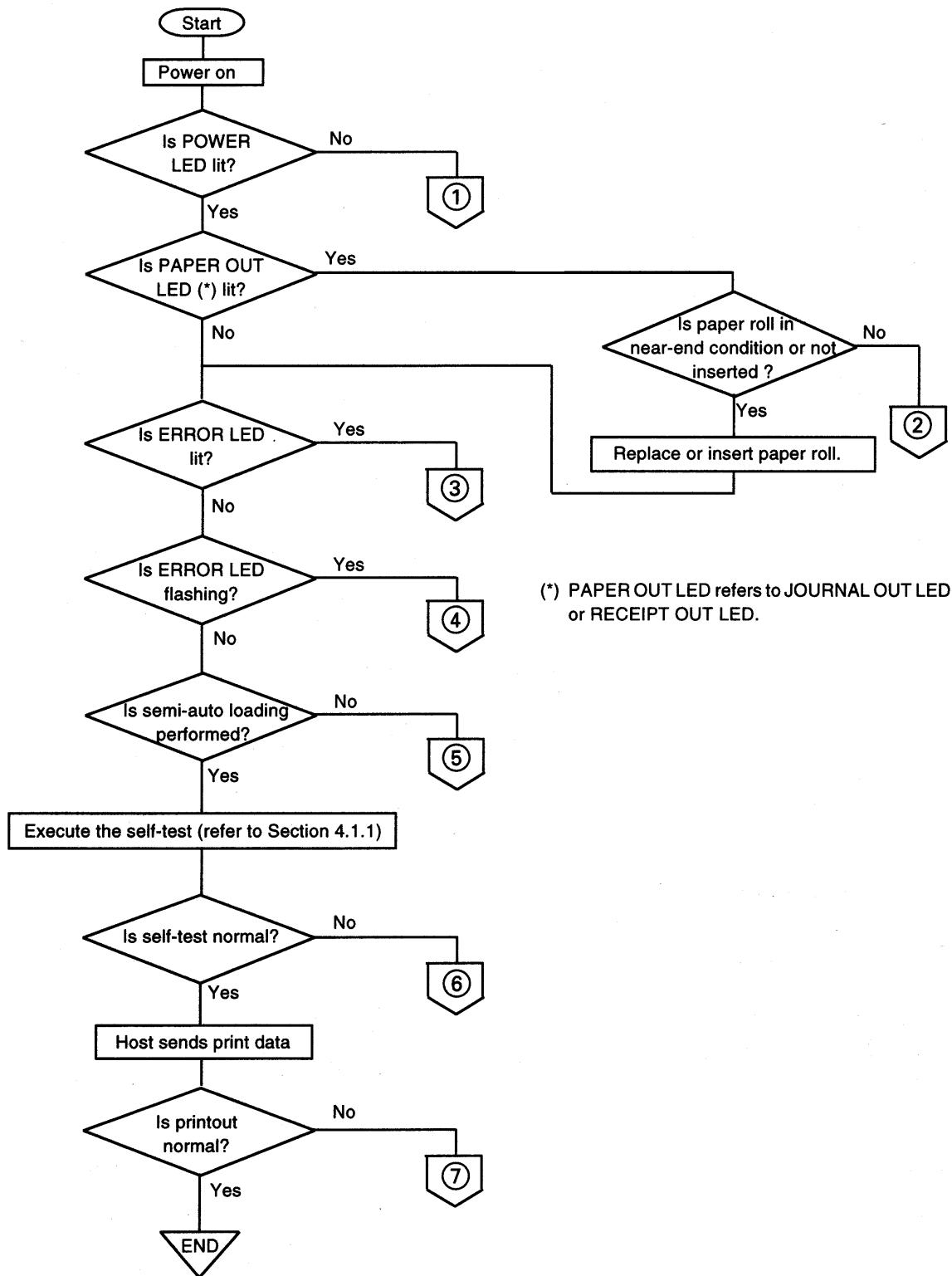
#### (\*) Printer status information printing

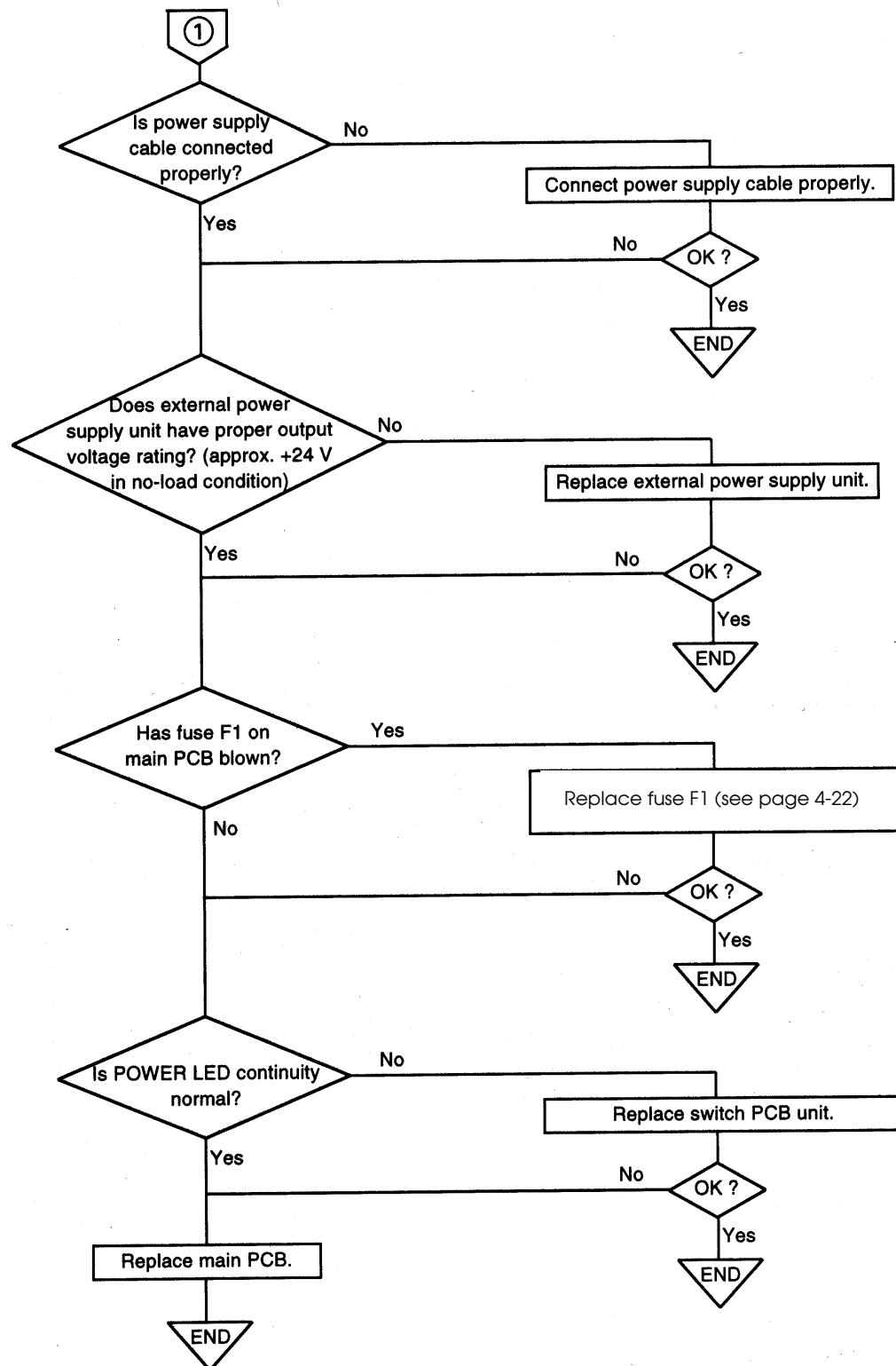
#### (\*2) Test printing

*Figure 4-1. Paper Roll Self-test Printing Example*

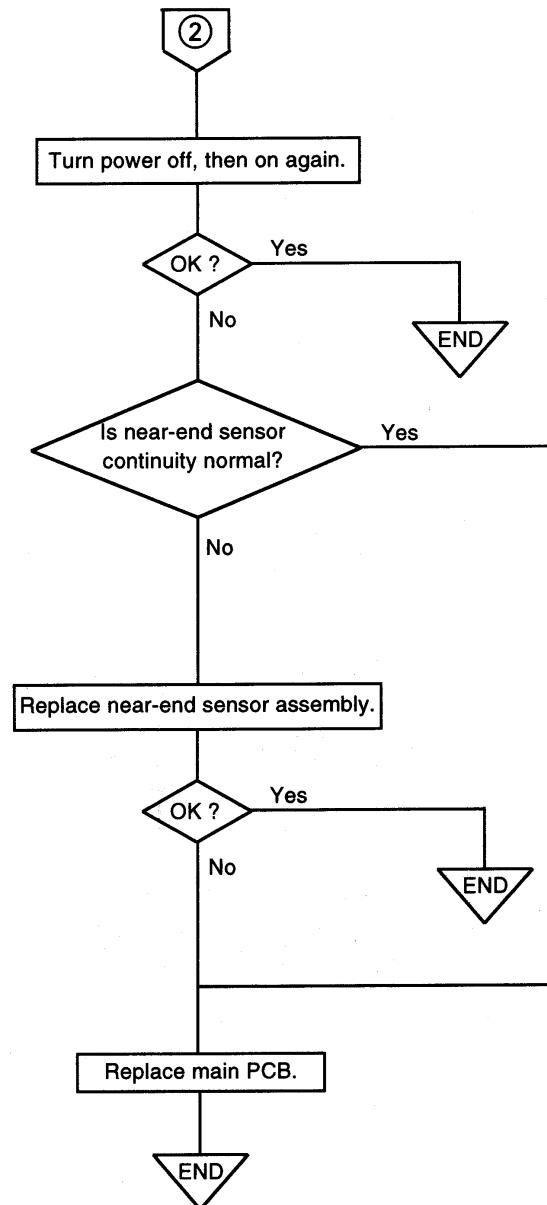
## Troubleshooting Flowchart

If the source of a problem is not clear, use the flowchart below to find and replace a defective component. Normally servicing should be performed by component replacement. Repairs of the PCBs and other components should be performed only by technicians.

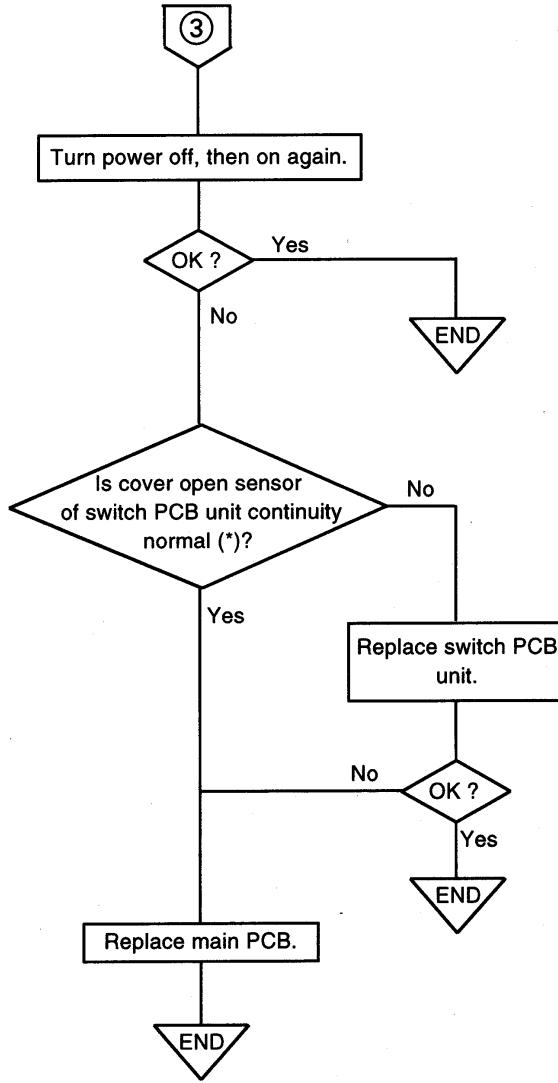


**① POWER LED does not light**

② PAPER OUT LED is lit

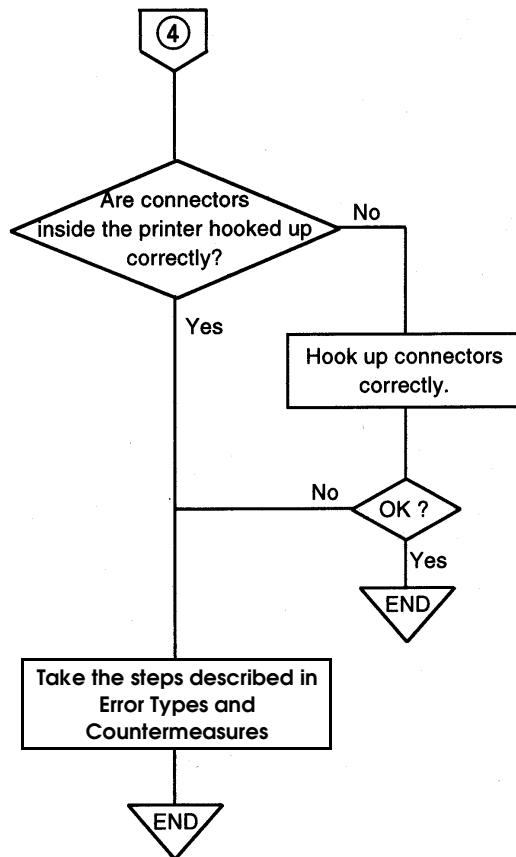
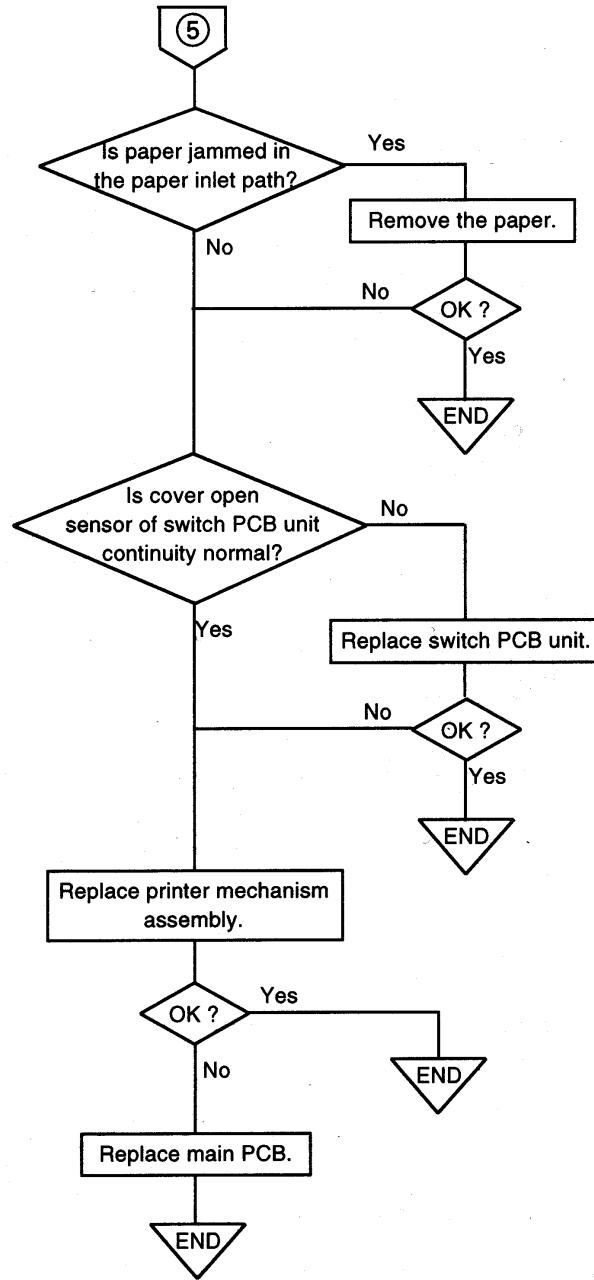


③ ERROR LED is lit

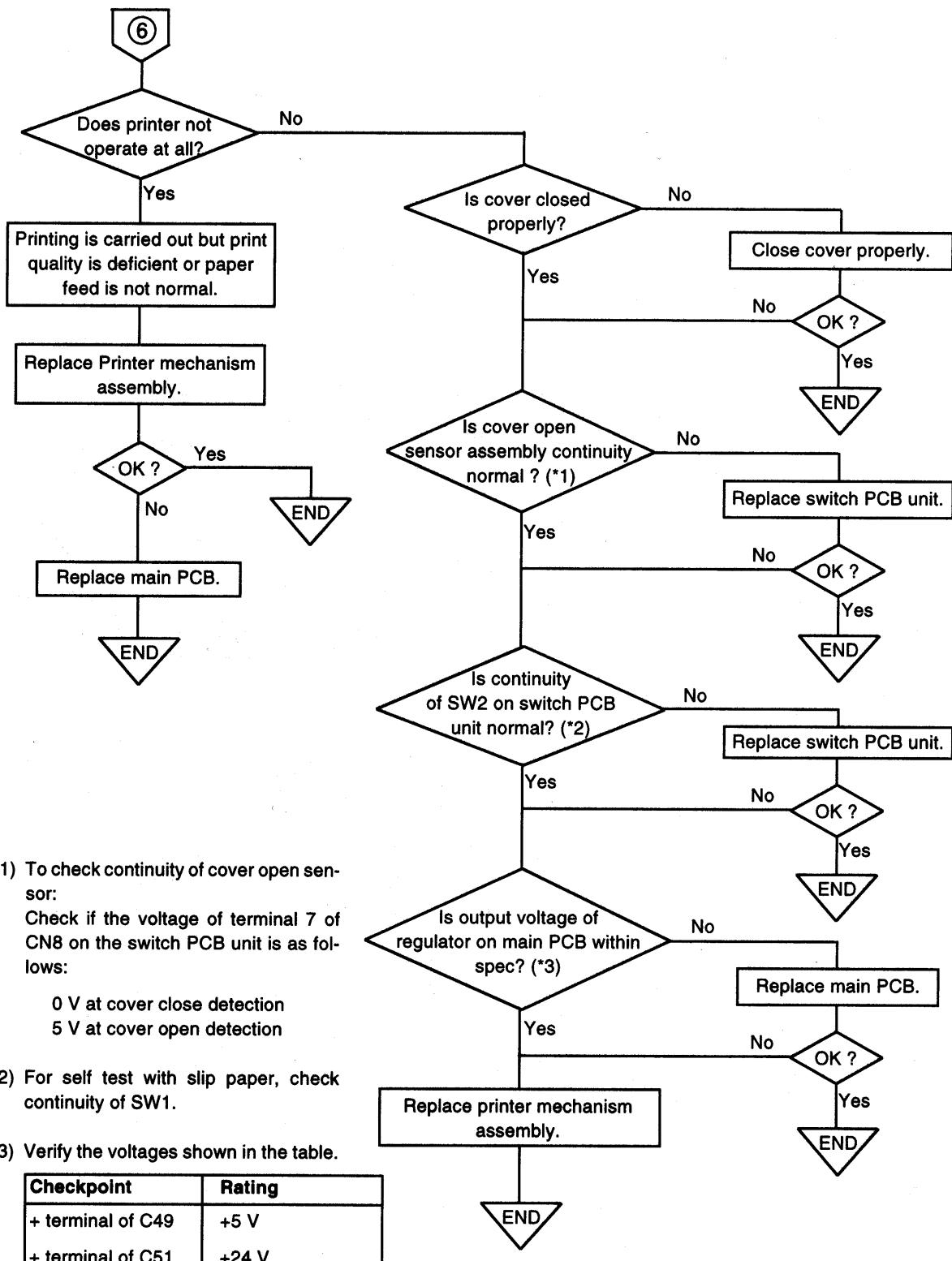


(\*) To check continuity of cover open sensor:  
Check if the voltage of terminal 7 of CN8 on the switch PCB unit is as follows:

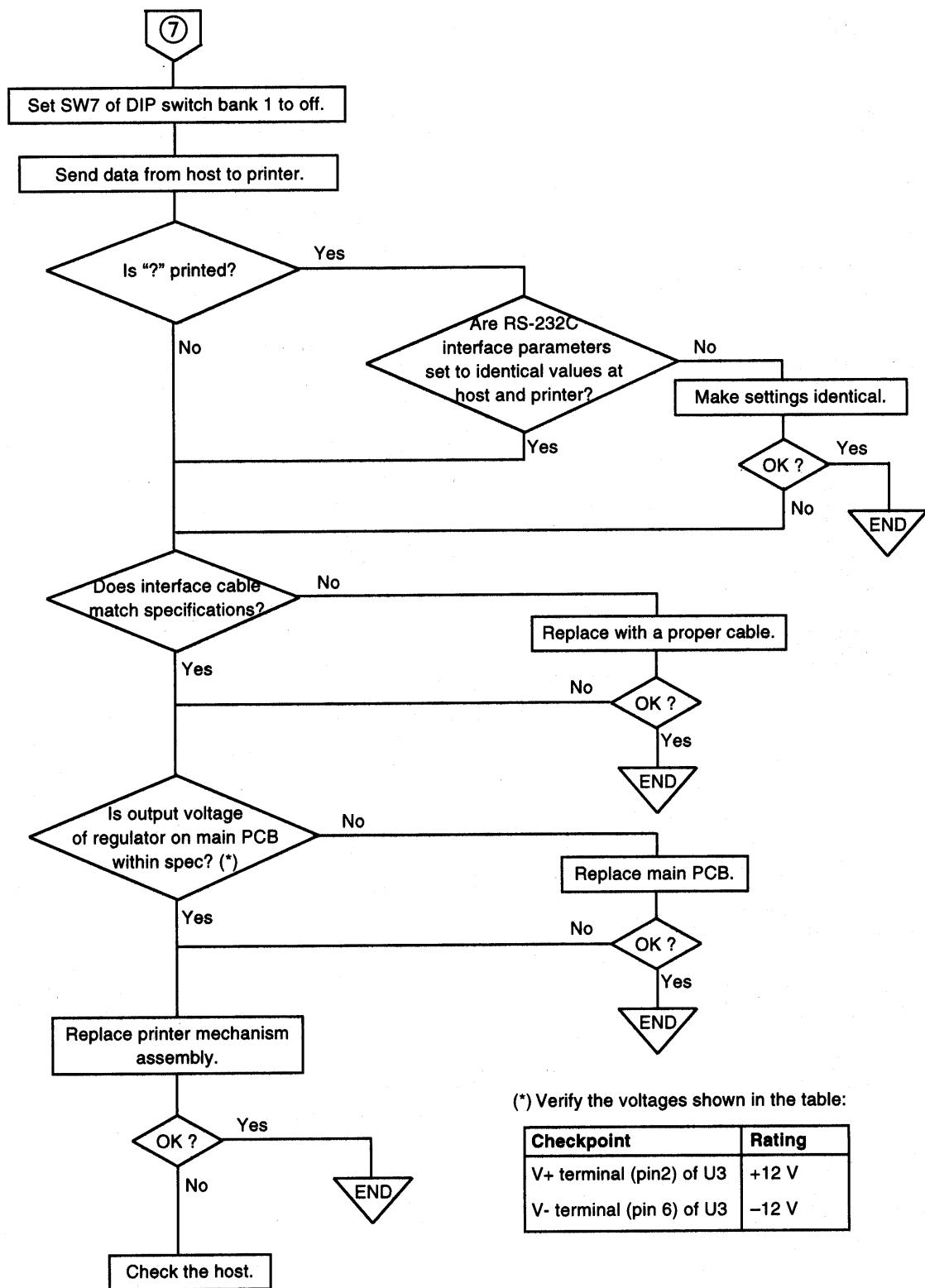
0 V at cover close detection  
5 V at cover open detection

**④ ERROR LED is flashing.****⑤ Semi-auto loading is not performed.**

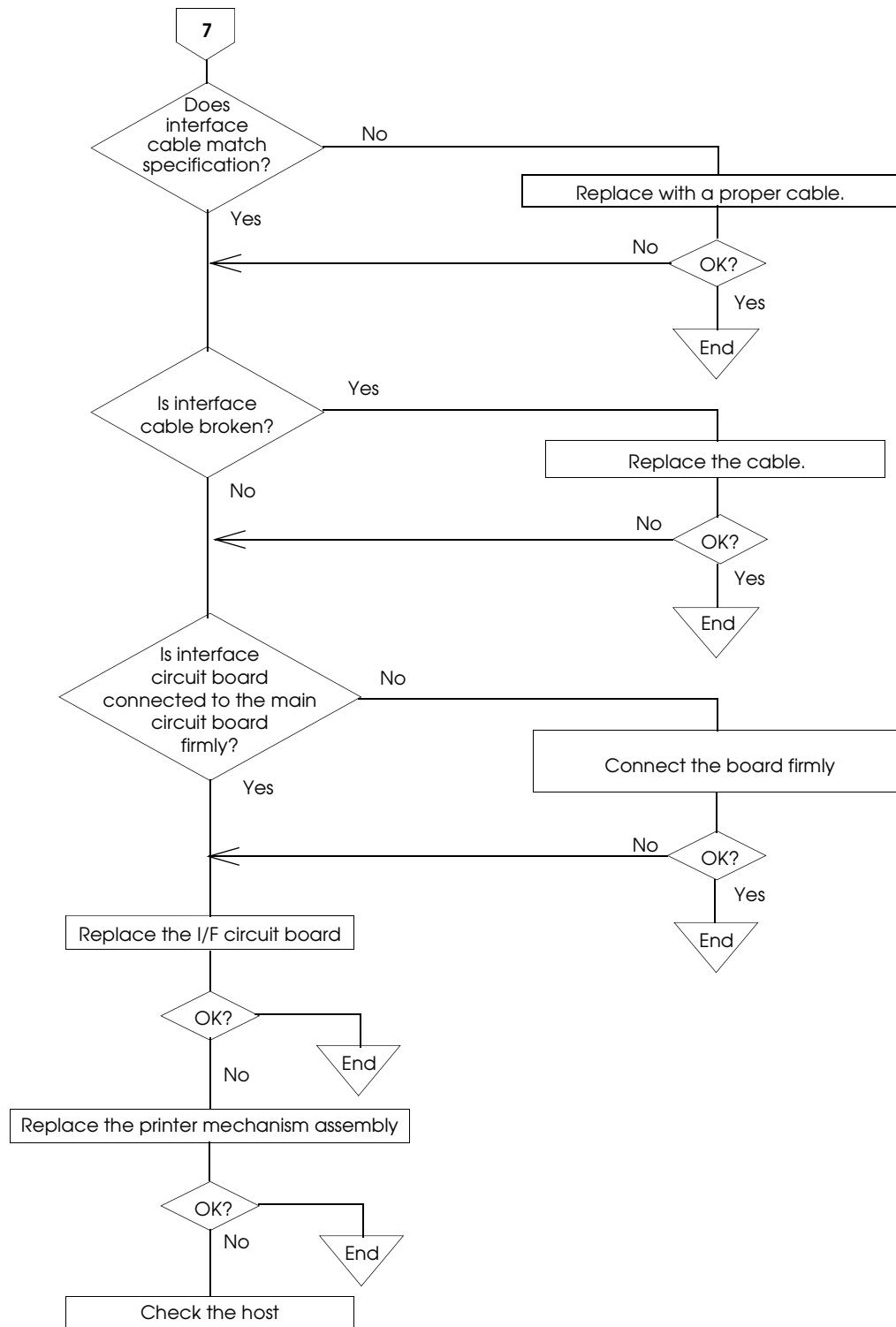
**⑥ Self-test is not carried out normally.**

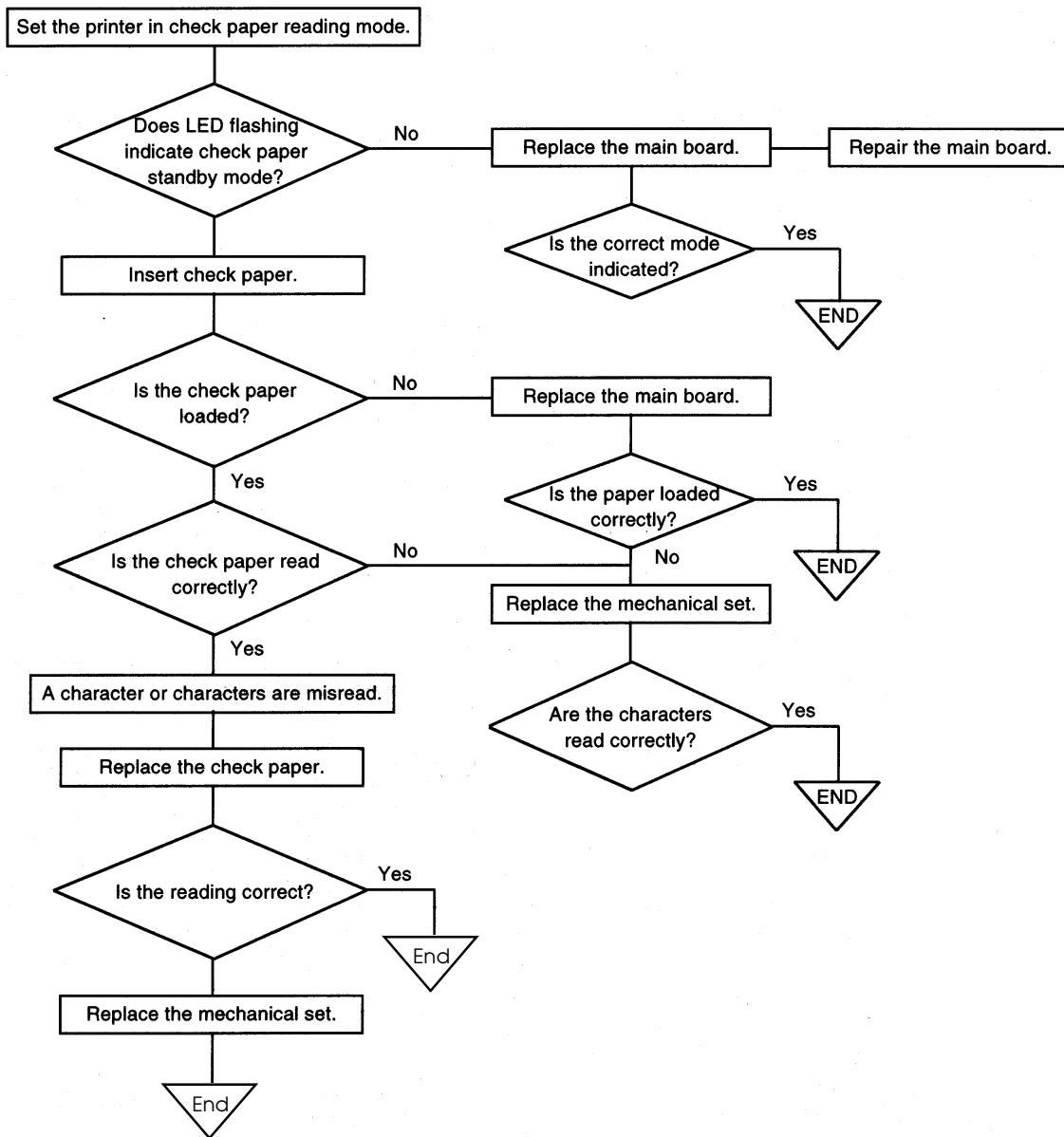


## (7) Data from host is not printed normally.



⑦ Data from host is not printed normally for the TM-U950P



**(8) Check paper cannot be read**

## **Troubleshooting Tables**

If a problem that can be verified by visual examination has occurred, use the tables below to determine the cause and perform repairs.

There are three tables, divided by symptom category:

- Table 4-1 Initialization Problems
- Table 4-2 Printing Quality Problems
- Table 4-3 Printer Mechanism Problems

The tables contain the following columns:

### ***Problem***

This is the symptom that can be verified.

### ***Probable Cause***

This is a listing of one or several possible causes that should be examined.

### ***Level***

#### **Level A**

The problem can be corrected by persons who are familiar with the printer and have general knowledge, but special technical skills are not required.

#### **Level B**

The problem requires thorough knowledge and familiarity with the printer that should be checked.

### ***Checkpoint***

These are one or more areas in the printer that should be checked.

### ***Action***

These are the steps to correct the problem. If the problem persists after taking these steps, check the other possible causes listed

Table 4-1. Initialization Problems

| Problem                                                                                                          | Probable Cause                                                                            | Level | Checkpoint                                                                                          | Action                                                                   |
|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Printer does not operate at all.                                                                                 | Output voltage of external power supply unit or internal regulator circuit is not normal. | B     | Check 24 V input voltage at CN4 and output voltage of switching regulator.                          | Replace regulator IC (U9). Replace external power supply unit.           |
|                                                                                                                  | Reset circuit failure                                                                     | B     | Check voltage level at RESET pin (pin 28) of CPU (U12), U5 (reset: LOW).                            | Replace IC (U4.)                                                         |
|                                                                                                                  | CPU oscillator circuit failure                                                            | B     | Check oscillator output.                                                                            | Replace oscillator (X1).                                                 |
|                                                                                                                  | Program ROM selection failure                                                             | B     | Check input at pin 22 of IC (U15).                                                                  | Replace CPU (U12), gate array (U19), and IC (U11, 13, and 18).           |
|                                                                                                                  | RAM selection failure                                                                     | B     | Check input at pin 20 of IC (U16).                                                                  | Replace CPU (U12), gate array (U19), and IC (U11, 13, and 18).           |
|                                                                                                                  | Gate array selection failure                                                              | B     | Check input at pin 59 of IC (U19).                                                                  | Replace CPU (U12) and IC (U11, 13, and 18).                              |
| Carriage-head vibrates, emits an unusual sound, and becomes error at power-on.                                   | Excessive tension of carriage transmission belt                                           | A     | Check tension of carriage transmission belt. Nominal value: 190 ( $\pm$ )10g(.42 ( $\pm$ ).022 lbs) | Adjust the tension as described in the adjustment section of Chapter 5.  |
|                                                                                                                  | Detector-H.P. sub assembly failure                                                        | B     | Use an oscilloscope to check the detector output signal when the carriage-head passes the detector. | Replace the detector-H.P. sub assembly.                                  |
| Carriage-head vibrates, emits an unusual sound, and becomes error at power-on.                                   | Wire break or bad solder point between connector and carriage motor terminals.            | B     | Check continuity between respective terminals.                                                      | Replace wiring board assembly.                                           |
|                                                                                                                  |                                                                                           | B     | Check solder condition.                                                                             | Resolder as required.                                                    |
|                                                                                                                  | Motor-carriage defective                                                                  | B     | None of the above checks solves the problem.                                                        | Replace motor-carriage.                                                  |
| Carriage-head first moves normally, but then hits the left border of the frame-carriage making an unusual sound. | Too little backlash between carriage motor gear and carriage feed pulley.                 | A     | Check backlash. Nominal value: 0.1( $\pm$ )0.05mm (.0039 ( $\pm$ ).0020")                           | Adjust the backlash as described in the adjustment section of Chapter 5. |
|                                                                                                                  | Gear wear, damage, or contamination                                                       | A     | Check gears for wear and damage.                                                                    | Replace any damaged gear.                                                |
|                                                                                                                  |                                                                                           | A     | Check for dirt deposits or other foreign matter.                                                    | Remove any dirt deposits or foreign matter.                              |

*Table 4-1. Initialization Problems (continued)*

| <b>Problem</b>                                                                    | <b>Probable Cause</b>                                                          | <b>Level</b> | <b>Checkpoint</b>                                                               | <b>Action</b>                                |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------|---------------------------------------------------------------------------------|----------------------------------------------|
| Motor-carriage does not operate at all when power is turned on and becomes error. | Carriage motor drive signal failure                                            | B            | Check motor drive signal at connector with an oscilloscope.                     | Repair motor drive signal generator circuit. |
|                                                                                   | Wire break or bad solder point between connector and carriage motor terminals. | B            | Check continuity between respective terminals.                                  | Replace wiring board assembly.               |
|                                                                                   |                                                                                | B            | Check solder condition.                                                         | Resolder as required.                        |
|                                                                                   | Motor carriage defective                                                       | B            | Above three checks have been passed.                                            | Replace motor-carriage.                      |
|                                                                                   | Detector-carriage sub assembly failure                                         | B            | Move the carriage-head and check the detection signal by using an oscilloscope. | Replace detector-carriage subassembly.       |

*Table 4-2. Printing Quality Problems*

| <b>Problem</b>                                 | <b>Probable Cause</b>                                                                    | <b>Level</b> | <b>Checkpoint</b>                                                                  | <b>Action</b>                                                       |
|------------------------------------------------|------------------------------------------------------------------------------------------|--------------|------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| All dots do not print, or print is very faint. | FPC is disconnected.                                                                     | A            | Check FPC connector.                                                               | Insert FPC again.                                                   |
|                                                | Wire break or bad solder point in common wire inside print head.                         | A            | Check common wire for continuity.                                                  | Replace print head unit.                                            |
|                                                | Wire break or bad solder somewhere on the line between print head unit and connector.    | B            | Check common wire for continuity.                                                  | Resolder parts or replace wire break parts.                         |
|                                                | Platen gap is not adjusted correctly.                                                    | A            | Check platen gap.<br>Nominal value:<br>$0.50(\pm)0.05$ mm<br>(.020( $\pm$ ).0020") | Adjust the gap as described in the adjustment section in Chapter 5. |
|                                                | Input pulse irregularity                                                                 | B            | Check dot wire input pulse with an oscilloscope.                                   | Repair input pulse control circuit or input pulse drive circuit.    |
| A certain dot does not print.                  | FPC wire break                                                                           | B            | Check FPC for continuity.                                                          | Replace print head unit.                                            |
|                                                | Wire break between soldered point of flat cable on wiring board and connector terminals. | B            | Check wire between terminals for continuity.                                       | Replace wiring board assembly.                                      |
|                                                | Print head coil wire break                                                               | B            | Check coil resistance with a multimeter.                                           | Replace print head unit.                                            |
|                                                | Bad solder point between connector and head coil.                                        | B            | Check wire between terminals for continuity.                                       | Resolder.                                                           |
|                                                | Print head wire break                                                                    | B            | Check for dot wire break.                                                          | Replace print head unit.                                            |

Table 4-2. Printing Quality Problems (continued)

| Problem                              | Probable Cause                                                            | Level | Checkpoint                                                                               | Action                                                                  |
|--------------------------------------|---------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Dots are dropped irregularly.        | Print head FPC break                                                      | B     | Check FPC for continuity.                                                                | Replace print head unit.                                                |
|                                      | Print head operation failure                                              | B     | Check wire tip for paper or ink deposits.                                                | Clean wire tip.                                                         |
|                                      | Print head wear                                                           | B     | Above two checks have been passed.                                                       | Replace print head unit.                                                |
| Character width changes irregularly. | Carriage transmission belt tension is too low.                            | A     | Check carriage transmission belt tension. Nominal value: $190 \pm 10$ g (.42 ± .022 lbs) | Adjust the tension as described in the adjustment section in Chapter 5. |
|                                      | Gears, carriage feed pulley, or carriage transmission belt wear or damage | B     | Check parts for wear or damage.                                                          | Replace parts as necessary.                                             |
|                                      | Print head wear                                                           | B     | Above two checks have been passed.                                                       | Replace print head unit.                                                |

Table 4-3. Printer Mechanism Problems

| Problem                                                            | Probable                                                                                 | Level | Checkpoint                                                  | Action                                                       |
|--------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------|-------------------------------------------------------------|--------------------------------------------------------------|
| Paper roll does not advance, and printing is all on the same line. | Paper roll supplying problem                                                             | A     | Check whether paper roll corresponds to specifications.     | Use paper roll that corresponds to specifications.           |
|                                                                    |                                                                                          | A     | Check paper roll path for obstacles.                        | Remove any obstacles and repair paper roll path as required. |
|                                                                    | Roller-paper feed wear                                                                   | B     | Check surface of roller-paper feed for wear and damage.     | Replace roller-paper feed assembly.                          |
|                                                                    | Gear wheel wear                                                                          | B     | Check gear wheels for wear and damage.                      | Replace gear wheels as required.                             |
|                                                                    | Paper hold roller wear                                                                   | B     | Check surface and core of paper hold roller for wear.       | Replace paper hold roller.                                   |
|                                                                    | J and R paper feed motors drive signal failure                                           | B     | Check motor drive signal at connector with an oscilloscope. | Repair motor drive signal generator circuit.                 |
|                                                                    | Wire break or bad solder point in wiring between connector and motor-paper feed-J and -R | B     | Check connection for continuity.                            | Replace wiring board assembly.                               |
|                                                                    |                                                                                          | B     | Check solder condition.                                     | Resolder as required.                                        |
| Paper roll does not advance, and printing is all on the same line  | Motor-paper feed-J and -R failure                                                        | B     | Above eight checks have been passed.                        | Replace motor-paper feed -J and -R.                          |

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Table 4-3. Printer Mechanism Problems (continued)

| Problem                                           | Probable                                                                                                                                                                                                                           | Level | Checkpoint                                                                                                                                                   | Action                                                           |
|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| Paper roll feed pitch is irregular.               | Paper roll supplying problem                                                                                                                                                                                                       | A     | Check whether paper roll corresponds to specifications.                                                                                                      | Use paper roll that corresponds to specifications.               |
|                                                   |                                                                                                                                                                                                                                    | A     | Check paper roll path for obstacles.                                                                                                                         | Remove any obstacles and repair paper roll path as required.     |
|                                                   | Paper hold roller lubrication is insufficient.                                                                                                                                                                                     | B     | Check whether paper hold roller turns smoothly.                                                                                                              | Lubricate as required.                                           |
|                                                   | Roller-paper feed wear                                                                                                                                                                                                             | B     | Check surface of roller-paper feed for wear and damage.                                                                                                      | Replace roller-paper feed assembly.                              |
|                                                   | Gear wheel wear                                                                                                                                                                                                                    | B     | Check gear wheels for wear and damage.                                                                                                                       | Replace gear wheels as required.                                 |
|                                                   | Paper hold roller wear                                                                                                                                                                                                             | B     | Check surface and core of paper hold roller for wear.                                                                                                        | Replace paper hold roller assembly.                              |
| Slip paper is not fed properly to print position. | Slip paper problem                                                                                                                                                                                                                 | A     | Check whether slip paper corresponds to specifications.                                                                                                      | Use slip paper that corresponds to specifications.               |
|                                                   | Slip paper was improperly inserted.                                                                                                                                                                                                | A     | Check whether slip paper is properly aligned with guide portion of paper guide-slip-lower.                                                                   | Insert slip paper aligning with guide portion.                   |
|                                                   | Obstacle in paper path inside printer                                                                                                                                                                                              | A     | Check paper path in printer for obstacles.                                                                                                                   | Remove any obstacles.                                            |
|                                                   | J/S changeover solenoid or sub slip paper feed solenoid drive signal failure                                                                                                                                                       | B     | Check drive signal.                                                                                                                                          | Repair drive signal circuit.                                     |
|                                                   | J/S changeover solenoid or solenoid sub slip paper feed failure                                                                                                                                                                    | B     | Check solenoid coil resistance (nominal value for 25° C: J/S changeover solenoid $45 \Omega \pm 10\%$ ; solenoid-sub slip paper feed $19 \Omega \pm 10\%$ ). | Replace J/S changeover solenoid or solenoid-sub slip paper feed. |
|                                                   | Wear or damage on lever-J/S changeover, J/S changeover lever spring, J/S changeover gear, paper feed deceleration gear, gear and roller of roller-sub slip paper feed assembly, pulley-carriage transmission, belt-slip paper feed | A     | Check parts for wear and damage.                                                                                                                             | Replace parts as required.                                       |

Table 4-3. Printer Mechanism Problems (continued)

| Problem                                                                               | Probable                                                                                                                                           | Level  | Checkpoint                                                                                                                                                       | Action                                                                                                                                                   |
|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Line spacing irregular during use of slip paper, or printing is all on the same line. | Slip paper problem<br><br>No paper rolls are inserted.                                                                                             | A<br>A | Check whether slip paper corresponds to specifications.<br><br>Check whether receipt paper/journal paper is inserted.                                            | Use slip paper that corresponds to specifications.<br><br>Insert receipt paper or journal paper.                                                         |
| Line spacing irregular during use of slip paper, or printing is all on the same line. | Pressure balance of roller-slip paper hold is not correct.<br><br>Roller slip paper feed and roller-slip paper hold are defective or contaminated. | A<br>A | Check the right/left balance of the roller-slip paper hold<br><br>Check surface of roller-slip paper feed and roller-slip paper hold for wear or foreign matter. | Adjust as described in the Adjustment Section of Chapter 5.<br><br>Replace or clean roller-slip paper feed assembly and roller-slip paper hold assembly. |
|                                                                                       | Wear or damage on J/S changeover gear, paper feed deceleration gear, or gear of roller-sub slip paper feed assembly                                | A      | Check gear wheels for wear and damage.                                                                                                                           | Replace gear wheels as required.                                                                                                                         |
|                                                                                       | J paper feed motor drive signal failure                                                                                                            | B      | Check J paper feed motor drive signal.                                                                                                                           | Repair drive signal circuit.                                                                                                                             |
|                                                                                       | Motor-paper feed-J is defective.                                                                                                                   | B      | Above six checks have been passed.                                                                                                                               | Replace motor-paper feed-J.                                                                                                                              |

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Table 4-3. Printer Mechanism Problems (continued)

| Problem                               | Probable                                                                                 | Level | Checkpoint                                                                                                             | Action                                                                                  |
|---------------------------------------|------------------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Semi-auto loading is not carried out. | Paper guide-assist operation problem                                                     | B     | Check paper guide-assist for paper deposits or other contamination. Check deformation of auxiliary paper guide spring. | Remove any paper deposits or other contamination. Replace auxiliary paper guide spring. |
|                                       | Paper roll is not inserted properly.                                                     | A     | Check paper roll alignment and paper edge shape.                                                                       | Insert paper roll properly (see Chapter 3).                                             |
|                                       | Paper roll supplying problem                                                             | A     | Check whether paper roll corresponds to specifications.                                                                | Use paper roll that corresponds to specifications.                                      |
|                                       |                                                                                          | A     | Check paper roll path for obstacles.                                                                                   | Remove any obstacles and repair paper roll path as required.                            |
|                                       | Roller-sub paper feed wear or damage                                                     | B     | Check surface of roller-sub paper feed for wear and damage.                                                            | Replace roller-sub paper feed assembly.                                                 |
|                                       | Paper sub hold roller wear or damage                                                     | B     | Check surface and core of sub paper hold roller for wear and damage.                                                   | Replace sub paper hold roller.                                                          |
|                                       | Insufficient lubrication of friction lever in roller-sub paper feed assembly             | B     | Check lubrication condition and wear.                                                                                  | Lubricate as required or replace roller-sub paper feed assembly.                        |
|                                       | Gear wheel wear or damage                                                                | B     | Check gear wheels for wear and damage.                                                                                 | Replace gear wheels as required.                                                        |
|                                       | J/R paper feed motor drive signal failure                                                | B     | Check motor drive signal at connector with an oscilloscope.                                                            | Repair motor drive signal generator circuit.                                            |
|                                       | Wire break or bad solder point in wiring between connector and motor-paper feed-J and -R | B     | Check connection for continuity.                                                                                       | Replace wiring board assembly.                                                          |
|                                       |                                                                                          | B     | Check solder condition.                                                                                                | Resolder as required.                                                                   |
|                                       | Motor-paper feed-J and -R failure                                                        | B     | Above eleven checks have been passed.                                                                                  | Replace motor-paper feed -J and -R.                                                     |

Table 4-3. Printer Mechanism Problems (continued)

| Problem                                                      | Probable                                                                    | Level | Checkpoint                                                                              | Action                                                              |
|--------------------------------------------------------------|-----------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| Ribbon feed mechanism does not operate.                      | Ribbon cassette and ribbon gear are not interlinked properly.               | B     | Check whether ribbon cassette is inserted properly.                                     | Insert ribbon cassette as described in Chapter 3.                   |
|                                                              | Lever-ribbon feed planet assembly failure                                   | B     | Check spring washer for wear or deformity.                                              | Replace lever-ribbon feed planet assembly.                          |
|                                                              |                                                                             | B     | Check planet gear and spring washer lever for wear.                                     | Lubricate as required or replace lever-ribbon feed planet assembly. |
|                                                              | Ribbon slips in ribbon cassette.                                            | A     | Turn ribbon cassette knob to check ribbon feed.                                         | Replace ribbon cassette.                                            |
|                                                              | Gear wear, damage, or contamination                                         | B     | Check gears for wear, damage, or foreign matter.                                        | Replace gears as required or remove any foreign matter.             |
| Paper roll is not taken up, or is taken up loosely.          | Paper take-up shaft wear or damage                                          | B     | Check paper take-up shaft for wear and damage.                                          | Replace paper take-up shaft.                                        |
|                                                              | Paper take-up pulley wear or damage                                         | B     | Check paper take-up pulley for wear and damage.                                         | Replace paper take-up pulley.                                       |
|                                                              | Gear wheel wear or damage                                                   | B     | Check gear wheels for wear and damage.                                                  | Replace gear wheels as required.                                    |
|                                                              | Paper take-up belt is dislodged, worn, or extended.                         | A     | Check seating, wear, and extension condition of paper take-up belt.                     | Position belt properly or replace belt.                             |
| Cutter motor does not operate when cutting command is given. | Cutter motor input signal failure                                           | B     | Check voltage at cutter motor terminals (nominal value: 24 V ( $\pm$ ) 10%)             | Repair drive signal circuit.                                        |
|                                                              | Cutter motor is defective.                                                  | B     | Remove cutter motor and check operation by connecting a 24 V power supply.              | Replace cutter motor.                                               |
|                                                              | Wire break or bad solder point in wiring between connector and cutter motor | B     | Check connection for continuity and check solder condition.                             | Replace cutter motor or resolder as required.                       |
| Cutter motor turns, but cutter blade does not operate.       | Gear is damaged or dislodged.                                               | B     | Turn cutter motor gear and deceleration gear A by hand to check cutter blade operation. | Replace damaged gear or mount gear properly.                        |

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Table 4-3. Printer Mechanism Problems (continued)

| Problem                                                                     | Probable                                                           | Level | Checkpoint                                                                                                                                | Action                                                                                                                                                                                    |
|-----------------------------------------------------------------------------|--------------------------------------------------------------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cutter blade operates but full cut is not performed or becomes error.       | Output signal failure                                              | B     | Check output signals at contact pin holder sub assembly with an oscilloscope (blue: F/P position pulse; red: reset pulse; black: common). | Replace contact pin holder sub assembly and cutter slider assembly if irregular chattering (more than 2 ms pulse width) is generated. Remove any contamination on cutter slider assembly. |
|                                                                             | Paper dust or other contamination has accumulated on cutter blade. | B     | Check for paper dust or other contamination                                                                                               | Remove cover-cutter blade receiving assembly and remove paper dust or other contamination.                                                                                                |
| Cutter blade operates but full cut is not performed or becomes error.       | Gear wheel wear or damage                                          | B     | Check gear wheels for wear and damage.                                                                                                    | Replace gear wheels as required.                                                                                                                                                          |
|                                                                             | Paper roll supplying problem                                       | A     | Check whether paper roll corresponds to specifications.                                                                                   | Use paper roll that corresponds to specifications.                                                                                                                                        |
|                                                                             |                                                                    | A     | Check paper feed path.                                                                                                                    | Repair paper feed mechanism as required.                                                                                                                                                  |
| Slip paper is positioned correctly, but printer does not detect it.         | Detector-slip paper insertion sub assembly failure                 | B     | Insert paper and check detector output signal with an oscilloscope.                                                                       | Replace detector-slip paper insertion sub assembly.                                                                                                                                       |
|                                                                             | Slip paper problem                                                 | A     | Check whether slip paper corresponds to specifications.                                                                                   | Use slip paper that corresponds to specifications.                                                                                                                                        |
|                                                                             | EEPROM (U20) failure                                               | B     | Check EEPROM (U20) output signal.                                                                                                         | Replace EEPROM (U20).                                                                                                                                                                     |
| Slip paper eject waiting status is not released when slip paper is removed. | Detector-slip paper ejection sub assembly failure                  | B     | Check detection signal by using an oscilloscope when slip paper is removed.                                                               | Replace detector-slip paper ejection sub assembly.                                                                                                                                        |
|                                                                             | Slip paper eject detection circuit failure                         | B     | Check pin 70 of CPU (U12) with an oscilloscope.                                                                                           | Replace detector-slip paper ejection assembly.                                                                                                                                            |
| Paper roll near-end detection does not work properly.                       | Microswitch failure                                                | A     | Check continuity between microswitch terminals and check on/off operation.                                                                | Replace microswitch.                                                                                                                                                                      |
| Slip paper is not released.                                                 | Internal diameter of paper roll core is too small.                 | A     | Check internal diameter of paper roll core. Nominal value: 10 mm (.39") or more                                                           | Use paper roll that corresponds to specifications.                                                                                                                                        |

Table 4-3. Printer Mechanism Problems (continued)

| Problem                                                                                                            | Probable                                              | Level | Checkpoint                                                                                          | Action                             |
|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------------|------------------------------------|
| Stamp does not operate.                                                                                            | Printer is in slip paper insertion standby condition. | B     | Turn power off and on again and check whether paper is released.                                    | Remove any pieces of jammed paper. |
|                                                                                                                    | Lever-stamp drive is worn or damaged.                 | B     | Check lever-stamp drive for wear and damage                                                         | Replace lever-stamp drive.         |
|                                                                                                                    | Solenoid-stamp is worn or damaged.                    | B     | Check solenoid-stamp for wear and damage.                                                           | Replace solenoid-stamp.            |
|                                                                                                                    | Wire break in solenoid-stamp.                         | B     | Check solenoid-stamp coil resistance. (Nominal value for 25° C; $19\Omega \pm 10\%$ )               | Replace solenoid-stamp.            |
|                                                                                                                    | Stamp drive signal failure                            | B     | Check stamp drive signal.                                                                           | Repair drive circuit.              |
| Different character than input code is printed.                                                                    | Receiver or drive IC (U3) failure                     | B     | Check IC (U3) output.                                                                               | Replace IC (U3).                   |
| Characters are not displayed normally on the customer display that is connected to DM connector of the TM printer. | Receiver or driver IC (U2) failure                    | B     | Check if V + terminal (pin 2) of IC (U2) is +12V. Check if V - terminal (pin 6) of IC (U2) is -12V. | Replace IC (U2).                   |

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Table 4-4. MICR Malfunction

| Problem                                                                            | Probable                                                                          | Level | Checkpoint                                                                                                                                                          | Action                                                                                                |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| None of the magnetic printing can be read.<br>(The paper is processed as an error) | Carriage head malfunction                                                         | B     | Check to see if the carriage head stops at the right end when the check paper is read.                                                                              | Refer to related items under the previous section on carriage head malfunction.                       |
|                                                                                    | MICR component malfunction                                                        | B     | Insert check paper, move the carriage head to the right end, and see if the printer enters paper holding mode (the check paper is hard to pull out of the printer). | Replace the MICR mechanism part.                                                                      |
|                                                                                    | Defective rotation of check paper holder roller                                   | B     | Check to see if the transfer belt on the check paper holder roller is cut someplace, and if the roller turns smoothly.                                              | Replace the transfer belt on the check sheet holder roller.<br>Replace the check sheet holder roller. |
|                                                                                    | Defective MICR head and MICR circuit board                                        | B     | See if the MICR head is damaged. Also, check circuits and lead wires for disconnected wires, and see if a sinewave is produced in the circuit output.               | Replace the MICR head unit (including the circuits).                                                  |
| Magnetic printing is misread. (The paper is processed normally.)                   | Dirty carriage head                                                               | A     | Clean the carriage head, using cleaning paper.                                                                                                                      | Clean the MICR head.                                                                                  |
|                                                                                    | Deformation of check paper, or magnetic ink characters do not conform to standard | A     | Check to see if the check paper is misshapen, or if there is any bleeding, protrusion, or missing lines in the magnetic ink characters on the check paper.          | Replace the check paper.                                                                              |
|                                                                                    | Carriage head malfunction                                                         | B     | Check to see if the carriage head stops at the right end when the check paper is read.                                                                              | Refer to related items under the previous section on carriage head malfunction.                       |
|                                                                                    | MICR component malfunction                                                        | B     | Insert check paper, move the carriage head to the right end, and see if the printer enters paper holding mode (the check paper is hard to pull out of the printer). | Replace the MICR mechanism part.                                                                      |
|                                                                                    | Defective rotation of check paper holder roller                                   | B     | Check to see if the transfer belt on the check paper holder roller is cut someplace, and if the roller turns smoothly.                                              | Replace the transfer belt on the check sheet holder roller. Replace the check sheet holder roller.    |
|                                                                                    | Defective MICR head and MICR circuit board                                        | B     | See if the MICR head is damaged. Also, check circuits and lead wires for disconnected wires, and see if a sinewave is produced in the circuit output.               | Replace the MICR head unit (including the circuits).                                                  |

## ***Major Part Replacements***

### ***Fuse replacement***

Follow the steps below to replace a blown fuse:

1. Turn the printer off.
2. Disconnect the external power supply unit.
3. Perform Main Assembly 6 and 7 in Chapter 5 in reverse.
4. Replace the blown fuse (125 V, 3.15 AT).
5. Perform steps (1) through (3) in reverse.

If the printer still does not operate properly, or if the fuse blows again, use the flowchart in Chapter 4 to check for other problems.

### ***Print Head Unit Replacement***

Follow the steps below to replace the print head unit:

1. Turn the printer off.
2. Disconnect the external power supply unit.
3. Disassemble the printer following the procedure described in Replacing the Print Head Unit in Chapter 5.
4. Replace the print head unit.
5. Perform gap adjustment referring to page 5-58.
6. Perform steps (1) through (3) in reverse.

### ***Cutter Blade Replacement***

Follow the steps below to replace the cutter blade:

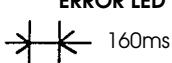
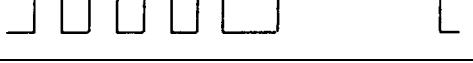
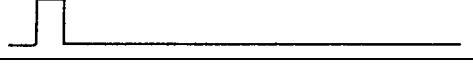
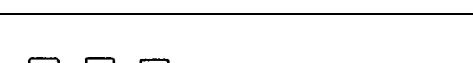
1. Turn the printer off.
2. Disconnect the external power supply unit.
3. Disassemble the printer following the procedure described in Replacing the Cutter Blade in Chapter 5.
4. Replace the cutter blade. (Make sure the cutter blade is only one leaf.)
5. Perform steps (1) through (3) in reverse.

## Error Types And Countermeasures

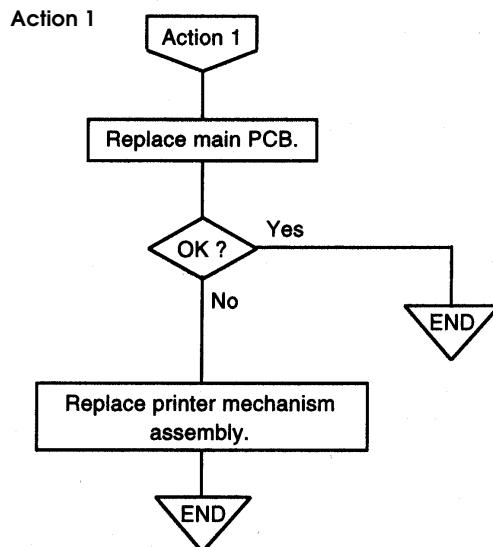
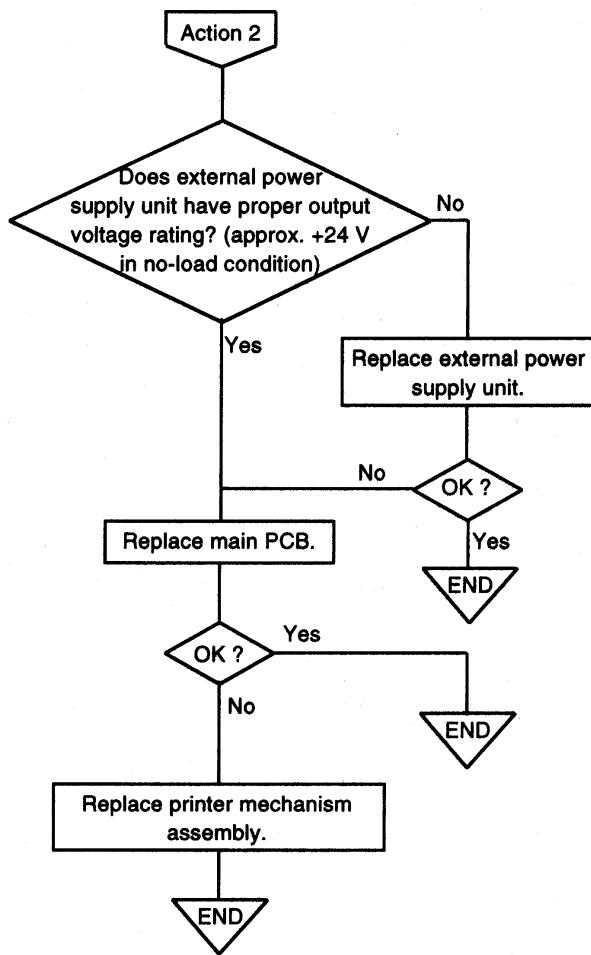
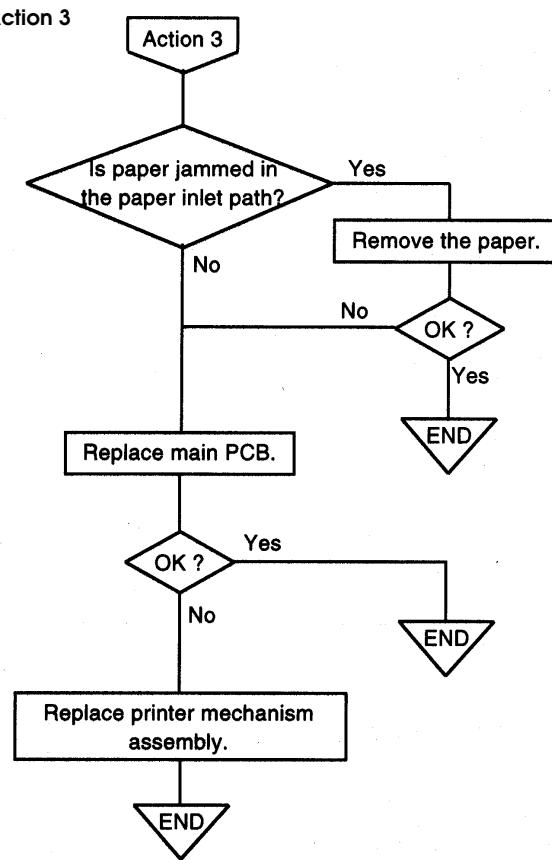
Follow the flowcharts on the next page depending on the ERROR LED blinking pattern, and repair the printer. When an error occurs:

- The printer stops all operation
- The printer goes off-line
- The ERROR LED blinks

Table 4-5. ERROR LED Blinking Pattern

| Error                                     | Error Description                                                                  | ERROR LED blinking pattern<br> | Action        |
|-------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------|
| (1) Memory or gate array read/write error | Read/write check has failed.                                                       |                               | Action 1      |
| (2) High-voltage error                    | Power supply voltage is too high.                                                  |                               | Action 2      |
| (3) Low-voltage error                     | Power supply voltage is too low.                                                   |                              | Action 2      |
| (4) CPU execution error                   | CPU is trying to execute an invalid address.                                       |                             | Action 1      |
| (5) Thermistor error                      | Print head temperature is abnormal.                                                |                             | Action 1      |
| (6) Auto-cutter error                     | Auto-cutter does not operate properly.                                             |                             | Action 3      |
| (7) Home position detection error         | Home position could not be detected properly due to paper jam in carriage etc.     |                             | Action 3      |
| (8) Carriage detection error              | Carriage motor has gone out of step due to paper jam in carriage or other problem. |                             | Action 3      |
| (9) Slip paper eject error                | Slip paper is not ejected properly after being advanced.                           |                             | Action 1      |
| (10) Head high-temperature error (*1)     | Print head temperature is too high.                                                |                             | Action 1 (*1) |

(\*1) This error occurs for a short time during normal printing when print head reaches high temperature. In this case no repair is necessary.

**Action 1****Action 2****Action 3**

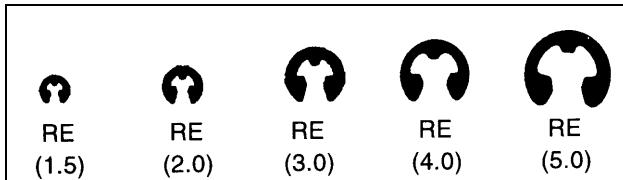
## Chapter 5

# **Disassembly, Assembly, and Adjustments**

### **Small Part Specifications**

This section uses abbreviations for small parts such as screws and washers. The following tables list these abbreviations as well as E-type retaining ring sizes.

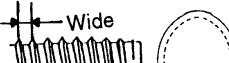
#### **Actual Size E-type Retaining Rings**



#### **Small Part Abbreviations**

|               |                                                                                      |
|---------------|--------------------------------------------------------------------------------------|
| CB            | : Cross-recessed Binding head screw                                                  |
| CC            | : Cross-recessed Cup head screw                                                      |
| CP            | : Cross-recessed Pan head screw                                                      |
| CP (P4)       | : Cross-recessed Pan head screw with Plane washer 4                                  |
| CP (S. P1)    | : Cross-recessed Pan head S2W1                                                       |
| CBB-tite      | : Cross-recessed Binding head B-tite self-tapping screw                              |
| CBT-B         | : Cross-recessed Binding head self-tapping screw without fluted class 2              |
| CCS-tite      | : Cross-recessed Cup head S-tite self-tapping screw                                  |
| CCS-tite F    | : Cross-recessed Cup head S-tite self-tapping screw with flat end                    |
| CPS-tite      | : Cross-recessed Pan head S-tite self-tapping screw                                  |
| CPS-tite (O)  | : Cross-recessed Pan head S-tite self-tapping screw with Outside toothed lock washer |
| CPS-tite (P2) | : Cross-recessed Pan head S-tite self-tapping screw with Plane washer 2              |
| CPS-tite (P4) | : Cross-recessed Pan head S-tite self-tapping screw with Plane washer 4              |
| CPP-tite      | : Cross-recessed Pan head P-tite self-tapping screw                                  |
| CPT-B         | : Cross-recessed Pan head self-tapping screw without fluted class 2                  |
| CPB-tite (P2) | : Cross-recessed Pan head B-tite self-tapping screw with Plane washer 2              |
| RE            | : Retaining ring E-type                                                              |
| HL            | : Hexagon Lock screw                                                                 |
| PW            | : Plane Washer                                                                       |

## Screw Types

| Head (top)                                                                                              | Head (side)                                                                                                                                                                                                                                                                                   | Body                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Washer (assembled)                                                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| C (Cross-recessed)<br> | P (Pan)<br><br>B (Bind)<br><br>C (Cup)<br> | S-tite<br><br>B-tite<br><br>P-tite<br><br>T-B<br><br>S-tite F<br> | (P2)<br><br>(P4)<br><br>(O)<br> |

## Disassembly

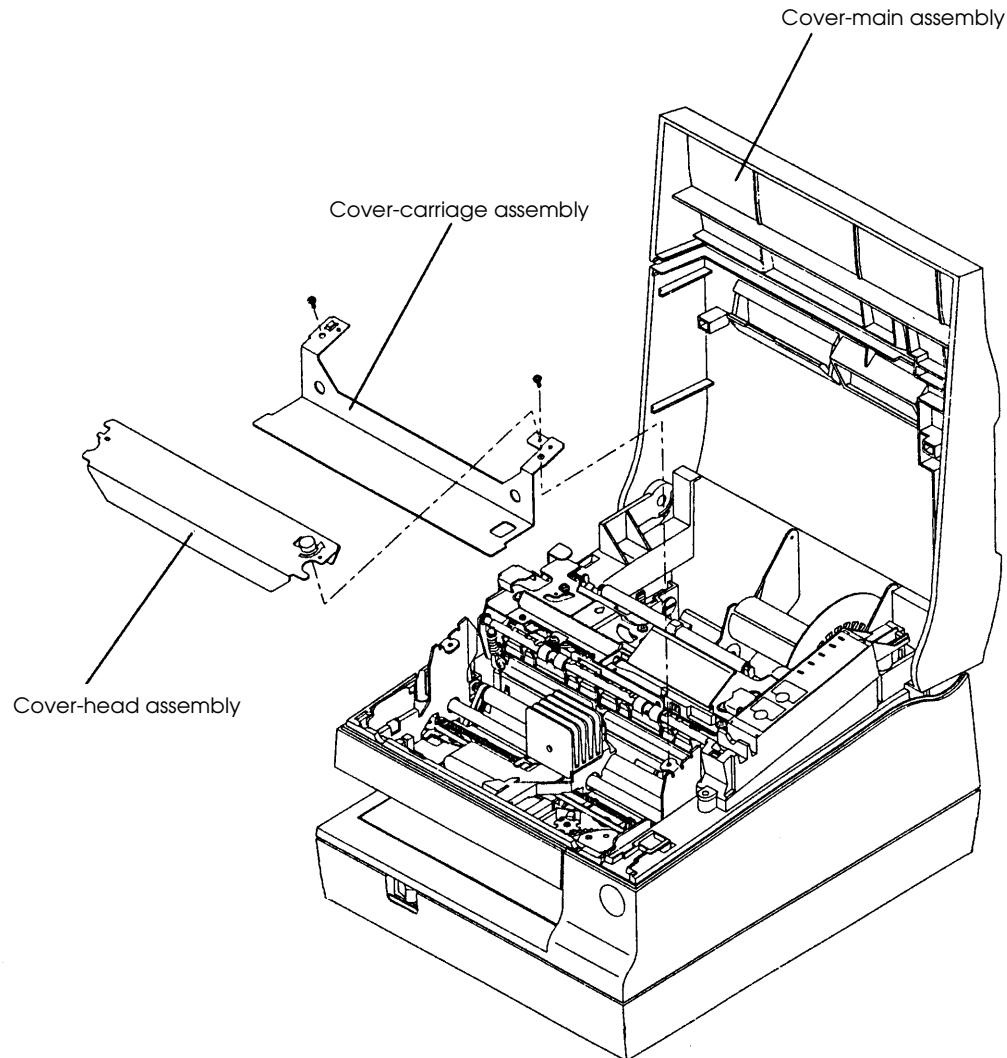
This section describes disassembly procedures for replacing the following two parts:

- Print head unit
- Cutter blade

For other disassembly procedures, see Printer Mechanism Assembly and Whole Unit Assembly in this chapter. The disassembly procedures are basically the reverse of the assembly steps described in these sections.

## Replacing the Print Head Unit

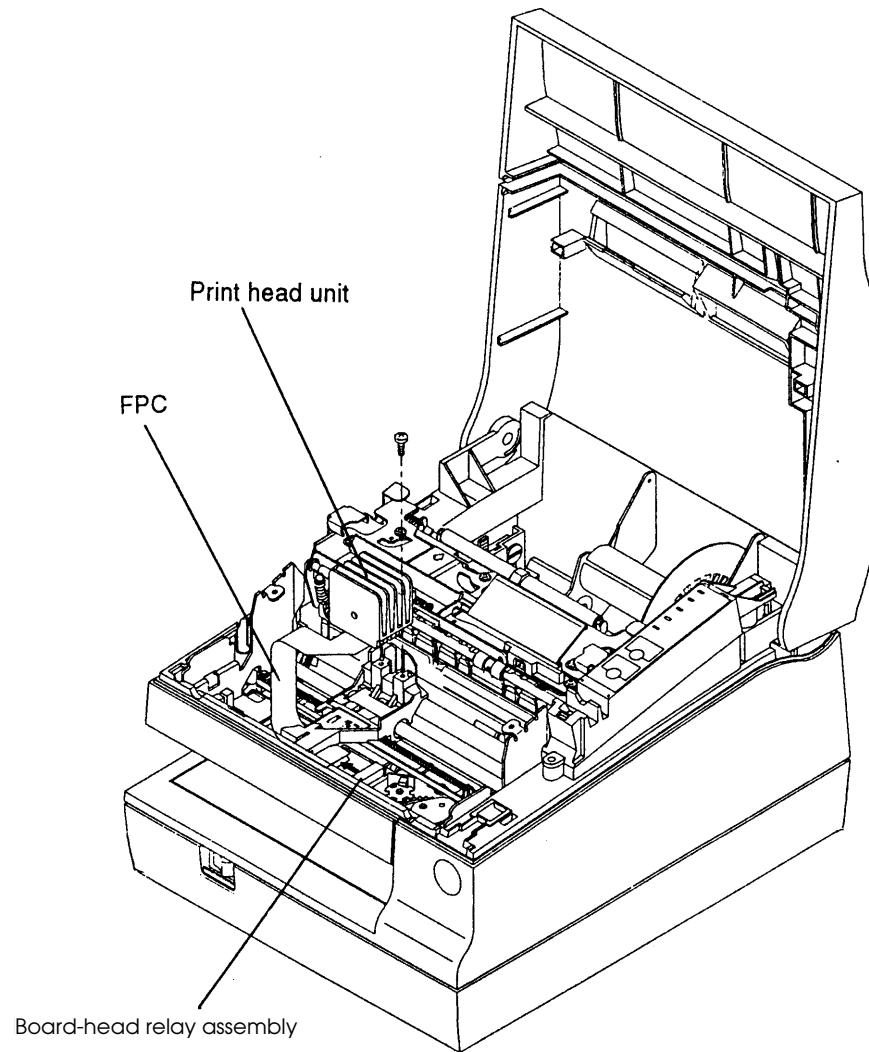
1. Open the cover-main assembly.
2. Remove the cover-head assembly.
3. Remove the cover-carriage assembly.



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4. Remove the screw from the print head unit.
  5. Disconnect the FPC from the connector on the board-head relay assembly.

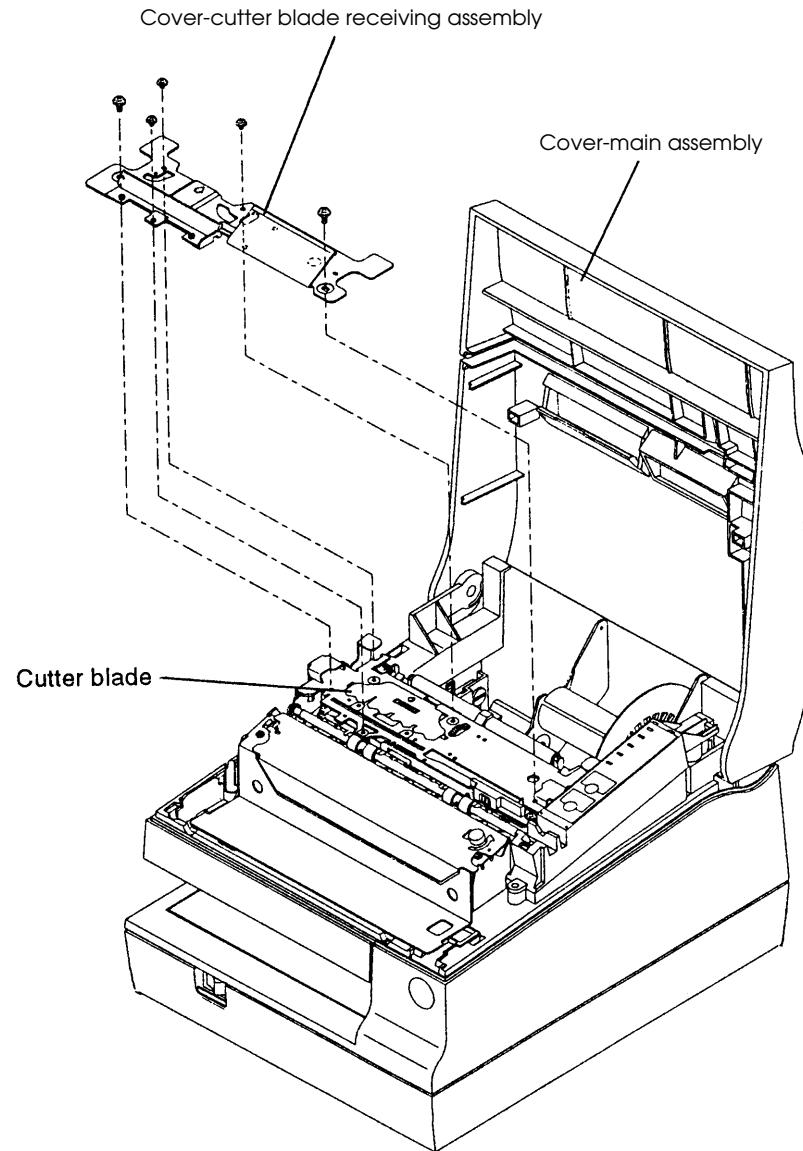
**[Adjustment]** After replacing the print head unit, adjust the print head and platen gap as described in Adjustment F in this chapter.



**Replacing the Cutter Blade**

1. Open the cover-main assembly.
2. Remove the screws from the cover-cutter blade receiving assembly and replace the cover.

*[Adjustment] Make sure to perform the cutter blade play after the replacement. See Adjustment A in this chapter.*



## ***Printer Mechanism Unit Assembly***

The assembly process is divided into sub-assembly and main assembly.

Perform the sub-assembly first to construct each unit from the parts. Then proceed to the main assembly.

When assembling the printer, check each part and its attachment position by referring to the exploded diagrams in Chapter 6.

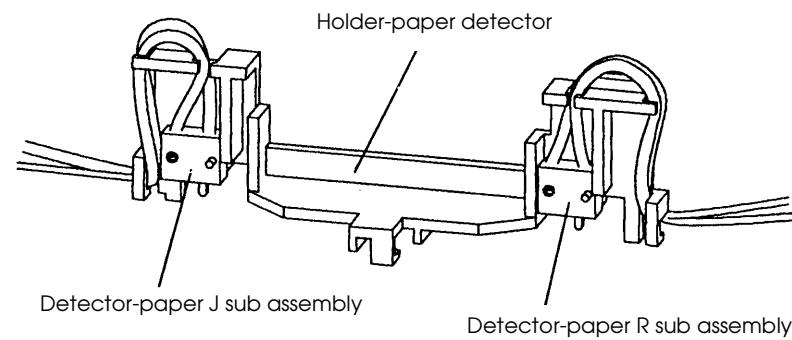
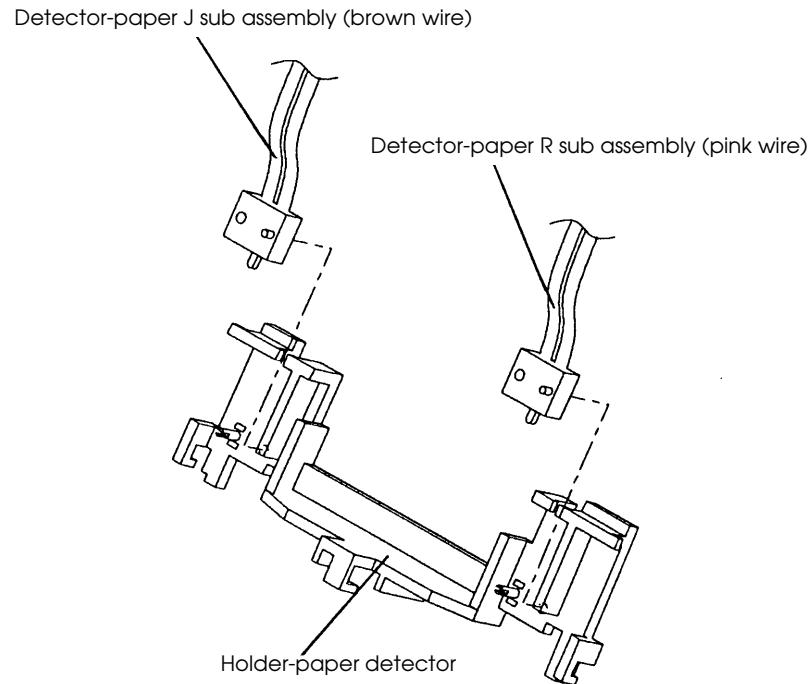
An asterisk after a step number (such as 2.\* ) indicates that lubrication must be performed. Lubricants should be applied when assembling the parts, since it is difficult to do so afterwards. Perform lubrication by referring to the lubrication section at the end of Chapter 6.

For adjustments, follow the descriptions in the Adjustments sections in this chapter. Whenever disassembly is performed even for just one part, check whether adjustment is necessary before assembly.

All illustrations show the printer with a MICR reader installed, unless marked "Without MICR reader."

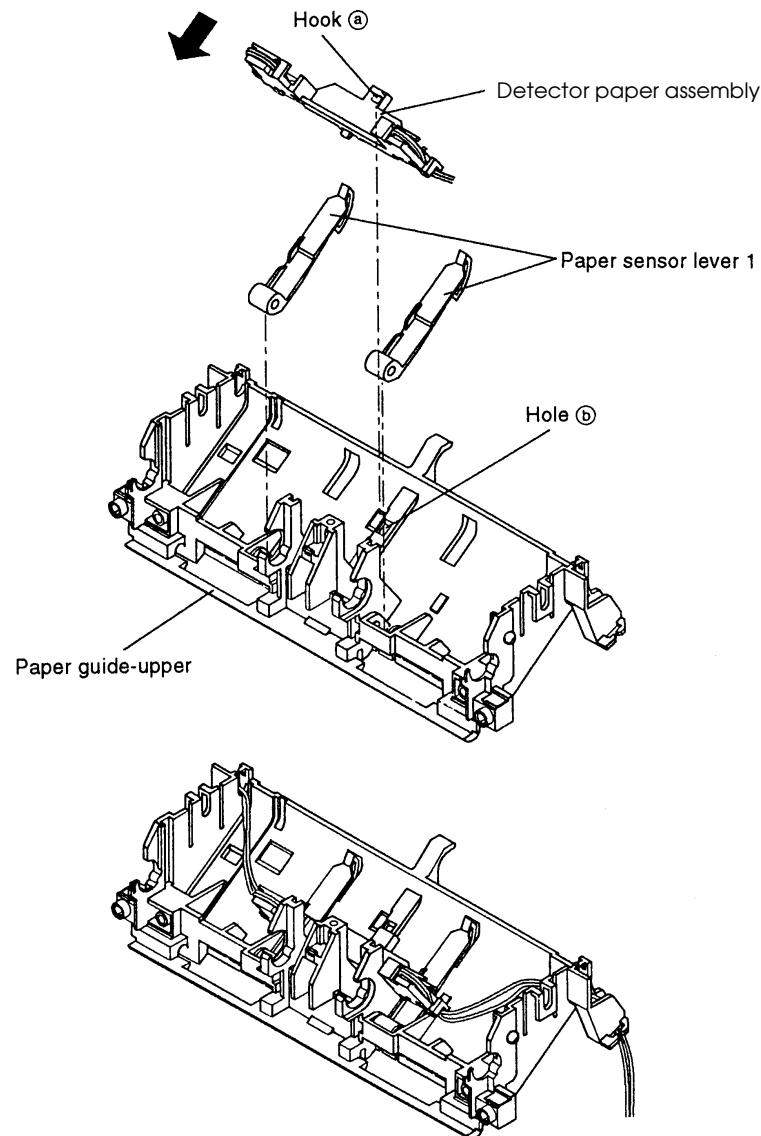
***Sub-assembly******Sub-assembly A: Detector-Paper Assembly***

1. Attach the detector-paper J sub assembly and detector-paper R sub assembly to the holder-paper detector.
  2. Dress the wires as shown in the illustration.
- ✓ Do not mix up the J and R paper detectors.



## ***Sub-assembly B: Paper Guide-Upper Unit Assembly***

- 1.\* Attach both paper sensor levels to the paper guide-upper.
2. Fit hook ④ of the detector-paper assembly into hole ⑤ and move it in the → direction to lock.
3. Dress the wires of the paper sensors as shown in the illustration.



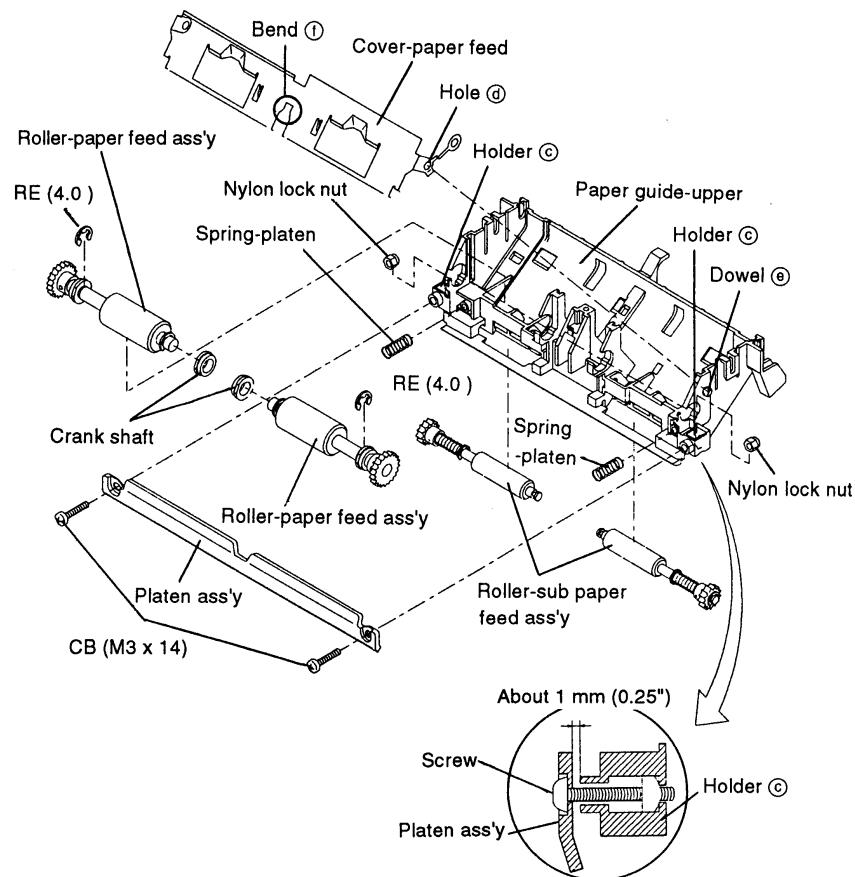
***Sub-assembly B***

4. Push the roller-sub paper feed assembly into the groove on the paper guide-upper
5. Mount the nylon lock nuts on holder © of the paper guide-upper.
6. Mount the crank shafts on the paper guide-upper, so that the U-shaped cutouts match
7. Place the roller-paper feed assembly on the paper guide-upper. Move the crank shafts near the gear into its set position, and fasten it with the RE.
8. Align holder ® on the cover-paper feed with dowel ® on the paper guide-upper and push the parts together.
9. Mount the spring-platen.
10. Secure the platen assembly to the paper guide-upper with the screws.

**✓ Checkpoints**

Make sure that bend ® on the cover-paper feed matches the cutout on the paper guide-upper.

There should be clearance of about 1 mm (0.25") between platen assembly and paper guide-upper.

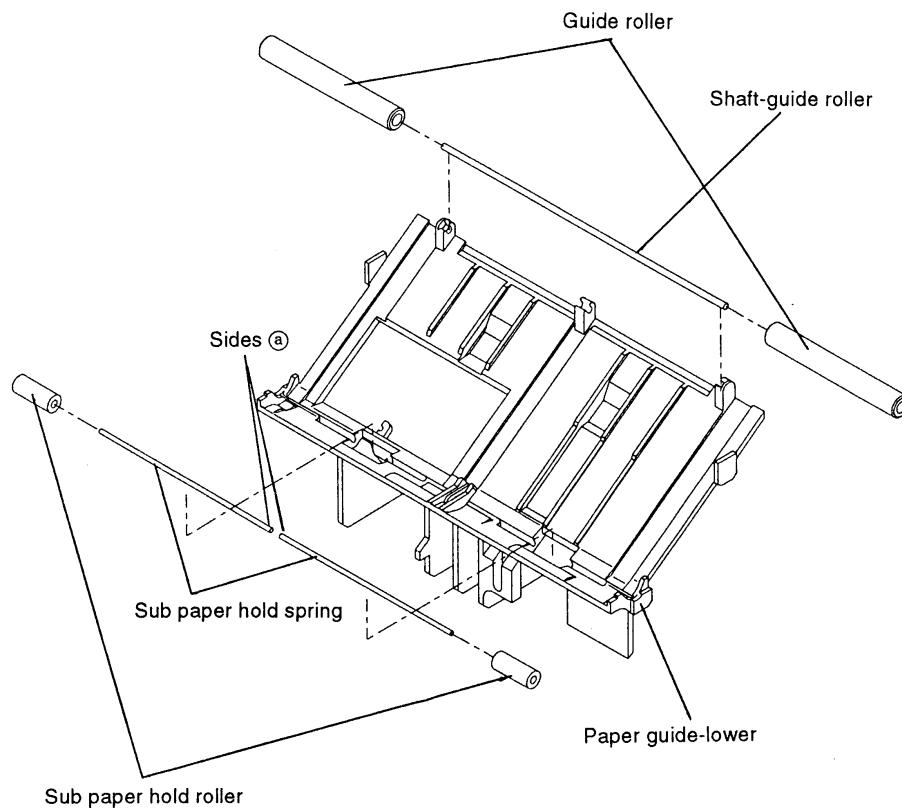


## **Sub-assembly C: Paper Guide-Lower Unit Assembly**

1. Pass the two guide rollers onto the shaft-guide roller and push the shaft into the paper guide-lower.
- 2.\* Pass the sub paper hold rollers onto the paper hold springs.
3. Insert sides ④ of the paper hold springs into the groove on the paper guide-lower and press the other end to fasten.

✓ **Checkpoint**

Make sure that the sub paper hold springs are not bent.

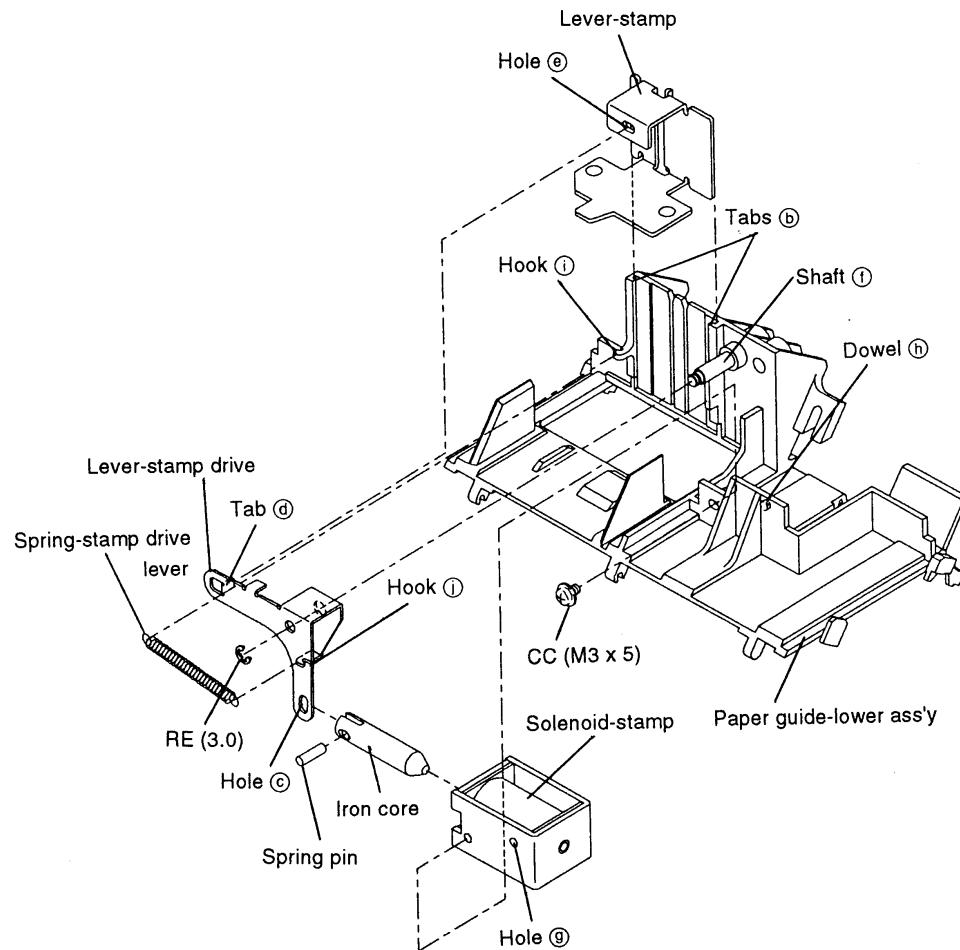


### Sub-assembly C: (For printers with stamp function)

- 4.\* Slide the lever-stamp into tabs ⑤ on the paper guide-lower.
5. Align hole ⑥ of the lever-stamp drive with the cutout on the iron core and secure the lever with the spring pin.
6. Mount the resulting part onto shaft ⑦, so that tab ⑧ of the lever-stamp drive enters the lever-stamp hole ⑨.
7. Align hole ⑩ of the solenoid-stamp with dowel ⑪ of the paper guide-lower and secure it with the screw.
8. Hook the spring-stamp drive lever between hooks ⑫ and ⑬.

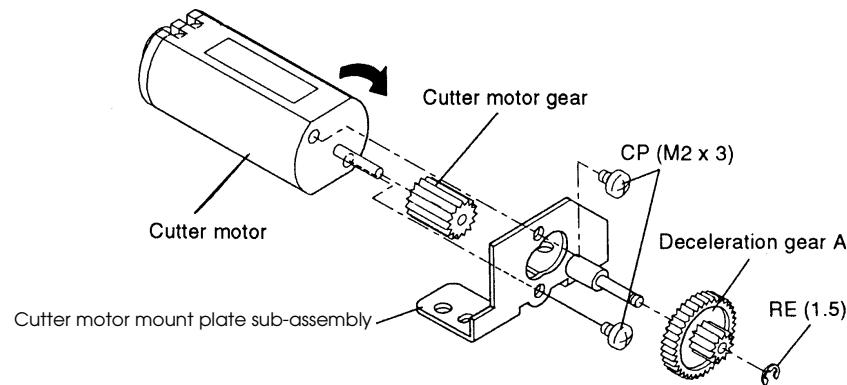
#### ✓ Checkpoint

Make sure that the lever-stamp moves smoothly.



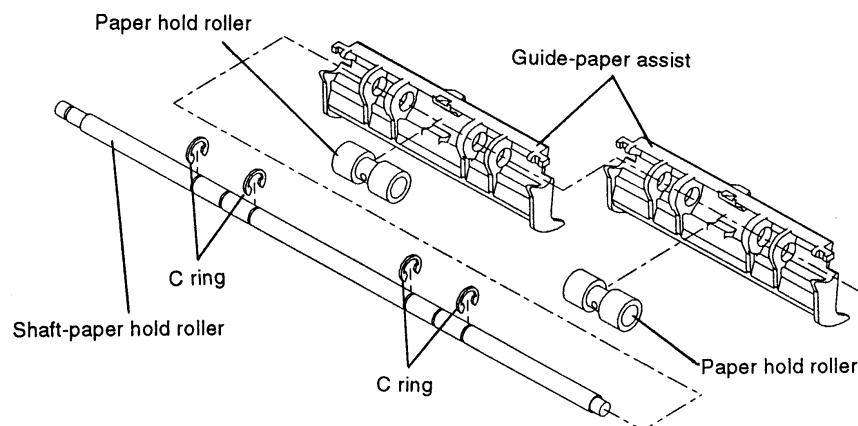
## **Sub-assembly D: Cutter Motor Mount Plate Assembly**

1. Mount the cutter motor gear onto the cutter motor.
- 2.\* Hold the motor with the label facing up and insert it into the cutter motor mount place sub-assembly. Turn it in the → direction and secure it with the screws.
- 3.\* Mount the deceleration gear A and fasten it with the RE.



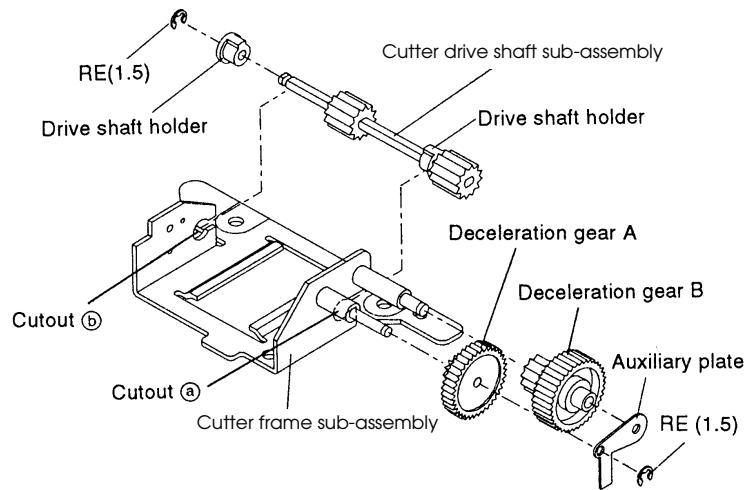
## **Sub-assembly E: Roller-Paper Hold Assembly**

1. Mount the paper hold rollers onto the paper guide-assist.
- 2.\* Pass the shaft-paper hold roller through the guides-paper assist and the paper hold rollers.
3. Clip the C rings onto the grooves on the shaft-paper hold roller.



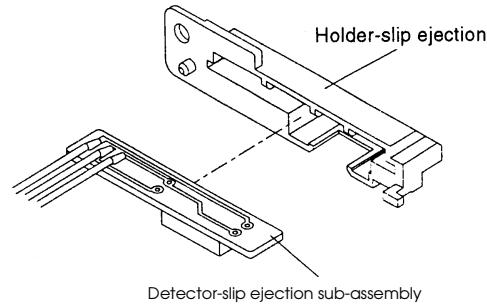
## ***Sub-assembly F: Cutter Frame Assembly***

- 1.\* Fit the drive shaft holder of the cutter drive shaft sub-assembly into cutout ④ .
- 2.\* Pass the drive shaft holder onto the cutter drive shaft sub-assembly and fit it into cutout ⑤ . Then attach the RE.
- 3.\* Attach the deceleration gear B to the cutter frame sub-assembly shaft.
- 4.\* Attach the deceleration gear A to the cutter frame sub-assembly shaft.
5. Mount the auxiliary plate to the cutter frame sub-assembly shaft and secure it with the RE.



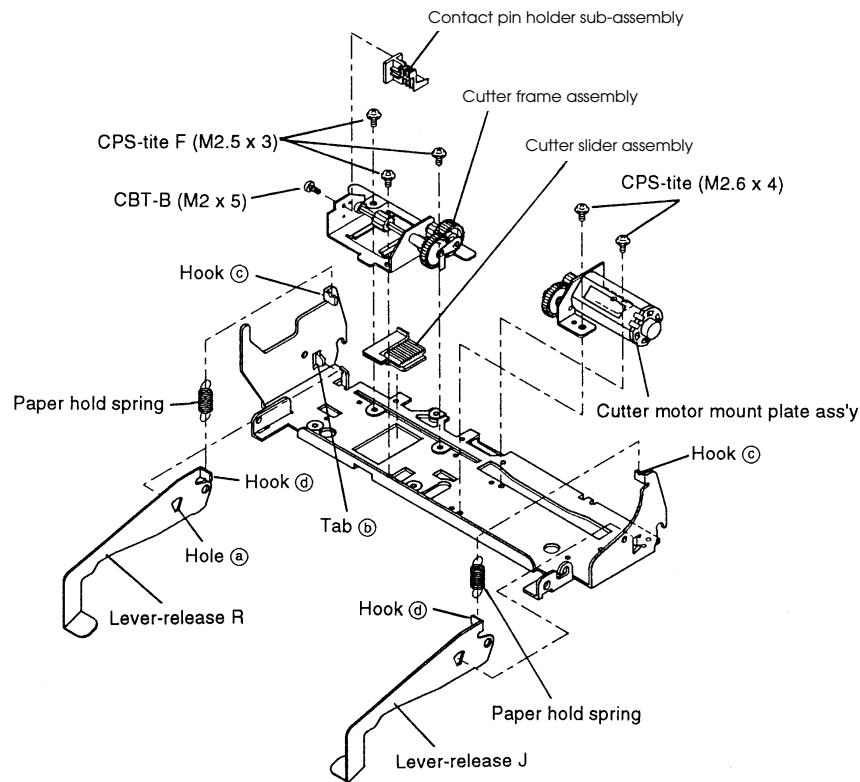
## ***Sub-assembly G: Detector-Slip Ejection Assembly***

1. Push the detector-slip ejection sub-assembly into the holder-slip ejection.



## **Sub-assembly H: Auto-cutter Unit Assembly**

- 1.\* Place the cutter slider assembly on the frame-cutter blade receiving assembly.
- 2.\* Fasten the contact pin holder sub-assembly to the cutter frame assembly with the screw.
3. Align the dowel with the dowel hole and fasten the cutter motor mount plate assembly to the frame-cutter blade receiving assembly with the screws.
4. Align the dowel with the dowel hole and fasten the cutter frame assembly to the frame-cutter blade receiving assembly with the screws.
5. Align hole ⑧ with tab ⑥ and attach the lever-release R.
6. Attach the lever-release J in the same way.
7. Engage the paper hold springs in hooks ③ and ④ .

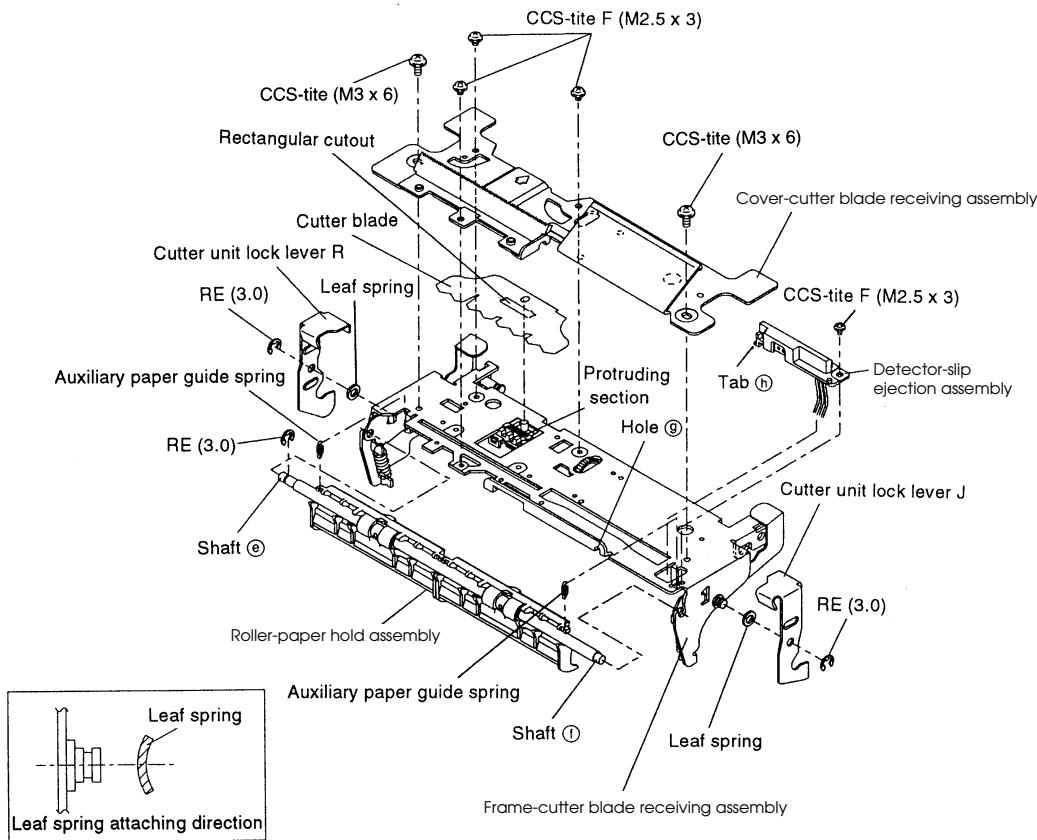


***Sub-assembly H***

8. Pass the roller-paper hold assembly shaft ④ then shaft ① through holes and fasten the RE.
9. Attach the auxiliary paper guide springs.
10. Make sure that there is only one leaf of the cutter blade, and align the rectangular cutout on the cutter blade with the protruding section on the cutter slide assembly.
11. Fasten the cover-cutter blade receiving assembly to the frame-cutter blade receiving assembly with the screws.
12. Pass the leaf springs onto the shaft, mount cutter unit lock levers R and J, and fasten them with REs.
13. Align hole ⑨ with tab ⑩ on the detector-slip ejection assembly and tighten the screws.

**✓ Checkpoint**

Make sure that the roller-paper hold assembly and the leaf springs are mounted in the correct orientation.



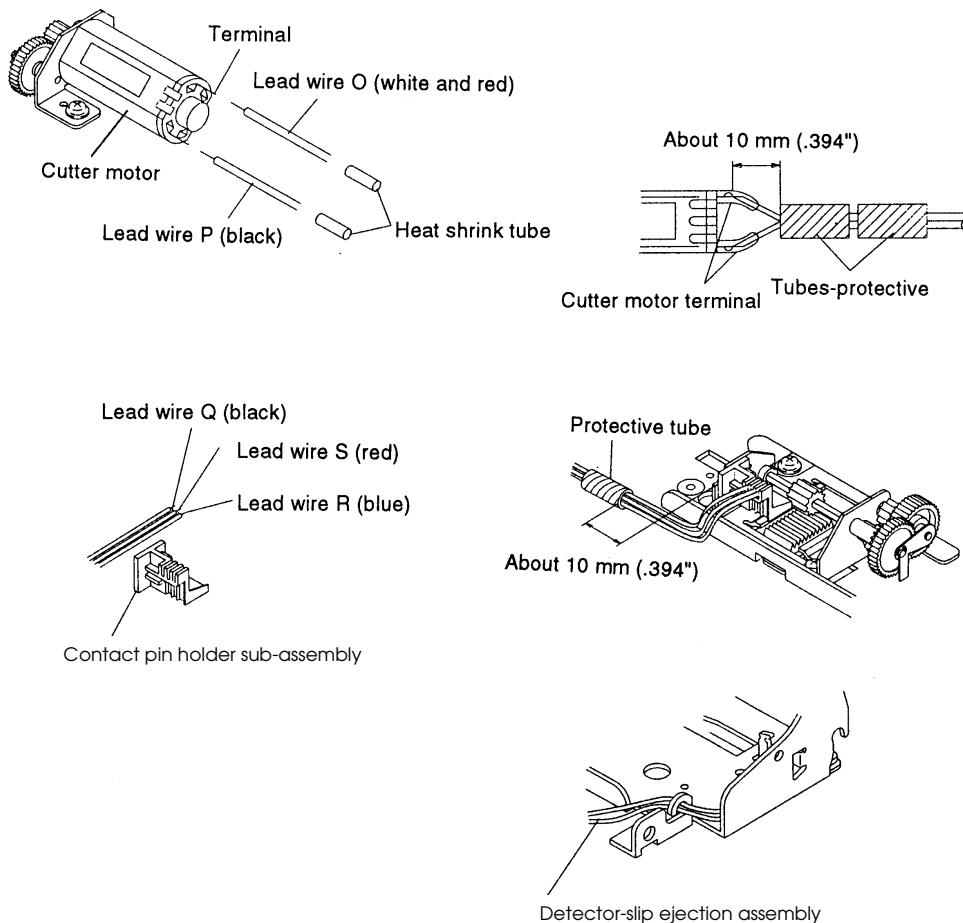
## Sub-assembly H

14. Solder lead wires O and P to the cutter motor terminals.
15. Slide the heat shrink tubes fully onto the terminals and shrink the tubes.
16. Pass the two tubes-protective onto the lead wires.
17. Solder lead wires Q, R, and S to the contact pin holder terminals.
18. Pass lead wires through the protective tube.
19. Dress the lead wires of the detector-slip ejection assembly as shown in the illustration.

✓ **Checkpoint**

Make sure not to mix up the lead wire colors.

*[Adjustment] See auto-cutter blade play adjustment A on page 5-30.*

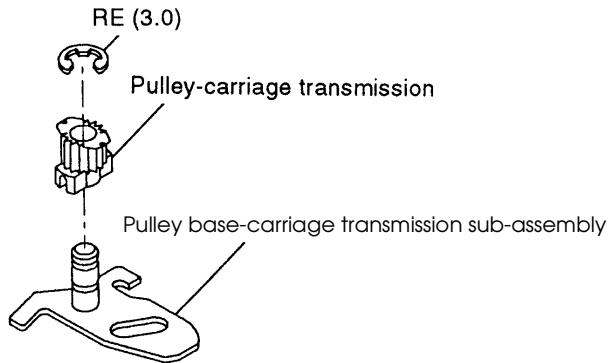


## ***Sub-assembly I: Pulley Base-Carriage Transmission Assembly***

- 1.\* Mount the pulley-carriage transmission to the pulley base-carriage transmission sub-assembly and fasten it with the RE.

### **✓ Checkpoint**

Make sure to mount the pulley-carriage transmission with the correct orientation.

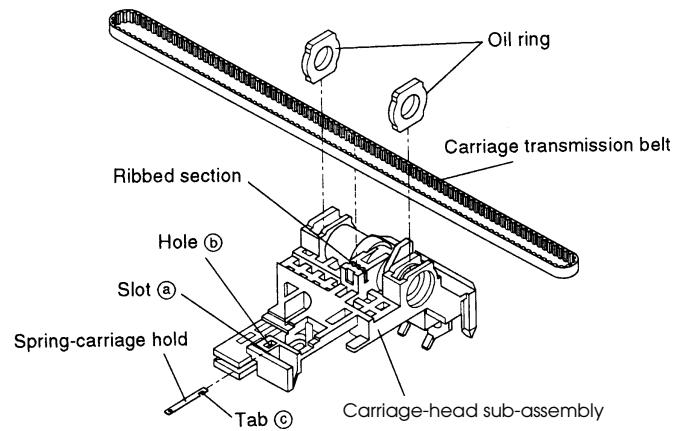


## ***Sub-assembly J: Carriage-Head Assembly***

- 1.\* Mount the oil rings on the carriage-head sub-assembly
2. Align the ribbed section of the carriage transmission belt with the ribbed section on the carriage-head and mount the belt.
3. Insert the spring-carriage hold into slot ④ of the carriage-head, depress tab ⑥ with tweezers by inserting the tip into hole ⑤, and then push the spring to insert it to the end so that it is fixed.

### **✓ Checkpoint**

Make sure to mount the belt with correct orientation.

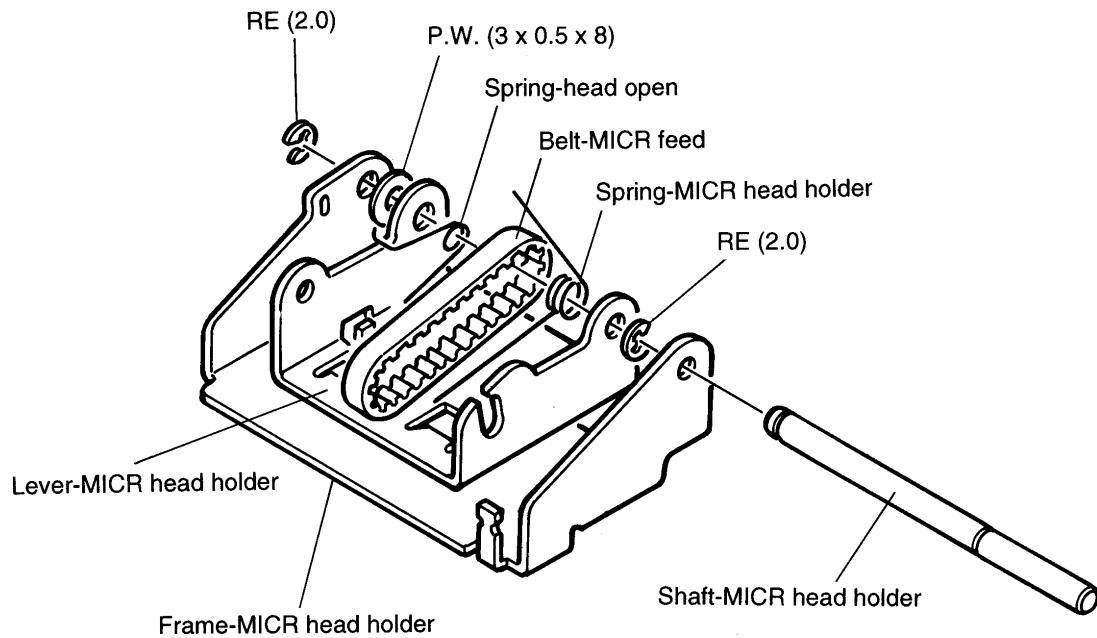


## **Sub-assembly K: Assembling the MICR Head Holder Assembly (for printers with a MICR reader)**

1. Pass the shaft through the MICR head holder, as shown below.

✓ **Checkpoint**

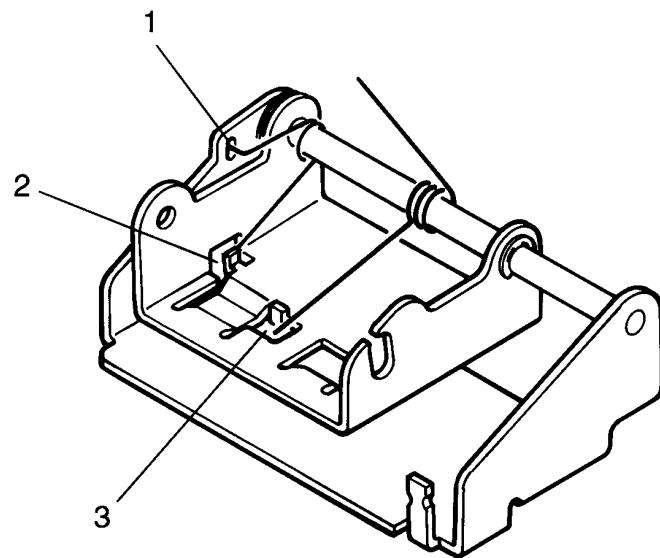
Make sure the spring-head open and the shaft MICR head holder are facing the correct direction.



2. Secure the shaft-MICR head holder with the two RE fittings.

***Sub-assembly K***

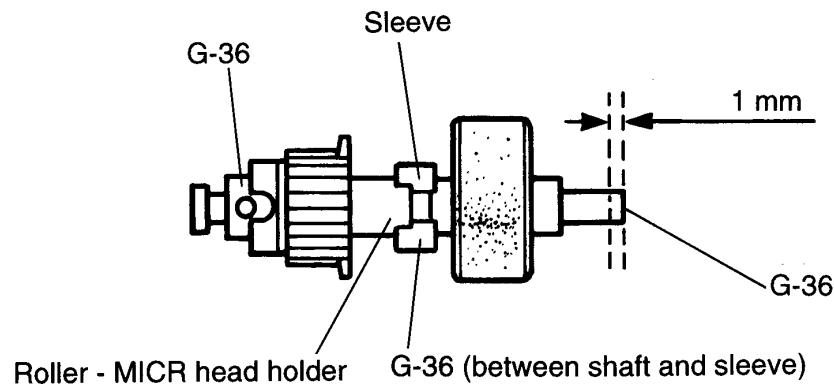
3. Fit the two springs into the three locations shown below.



4. Pass the belt-MICR feed through the roller - MICR head holder.

**✓ Checkpoint**

See the illustration below when lubricating the roller-MICR head holder. Be sure that the correct grease is used.

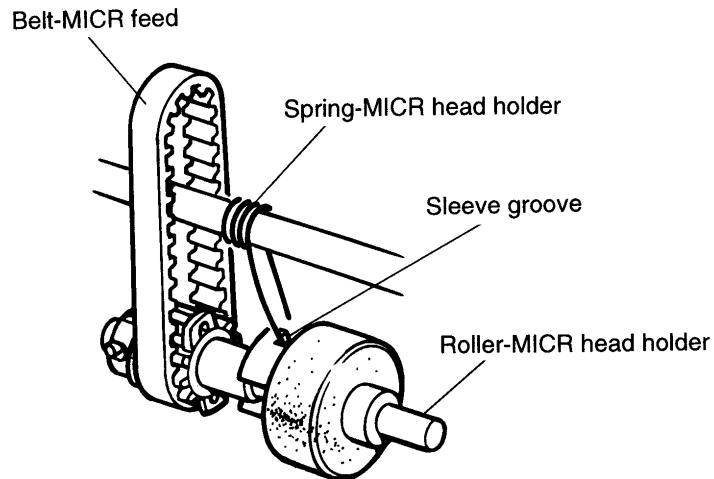


## Sub-assembly K

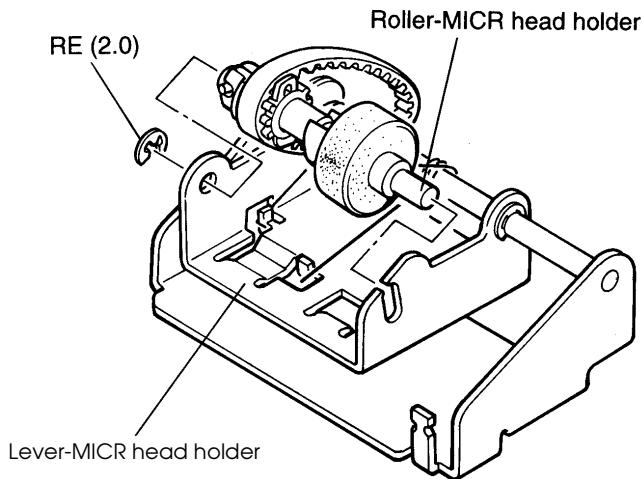
5. As shown in the illustration below, set one end of the spring-MICR head holder in the groove in the sleeve of the roller-MICR head holder.

✓ **Checkpoint**

Be careful that the sleeve is facing the right direction



6. Set the roller-MICR head holder on the lever-MICR head holder, as shown below, and secure it with the RE fittings.

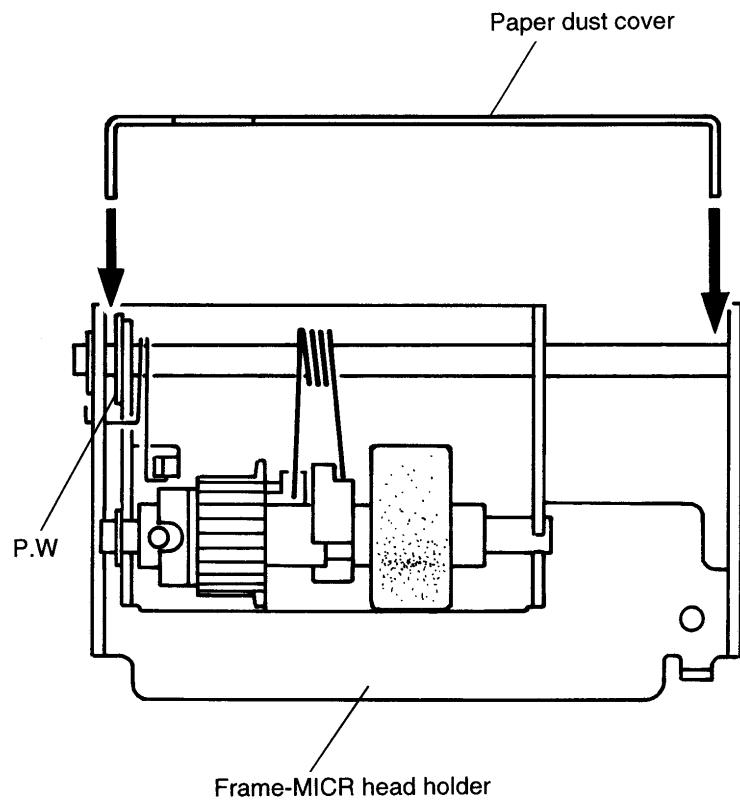


***Sub-assembly K***

7. Fit the paper dust cover onto the shaft-MICR head holder.

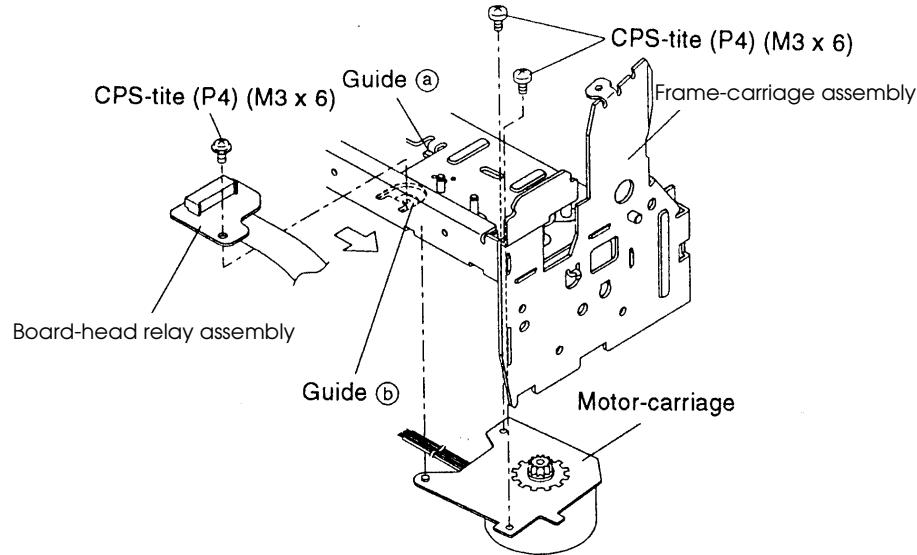
**✓ Checkpoint**

Fit the paper dust cover between the P.W. and the frame - MICR head holder, as shown below.



## Sub-assembly L-(1): Frame-Carriage Unit Assembly (for printers without a MICR reader)

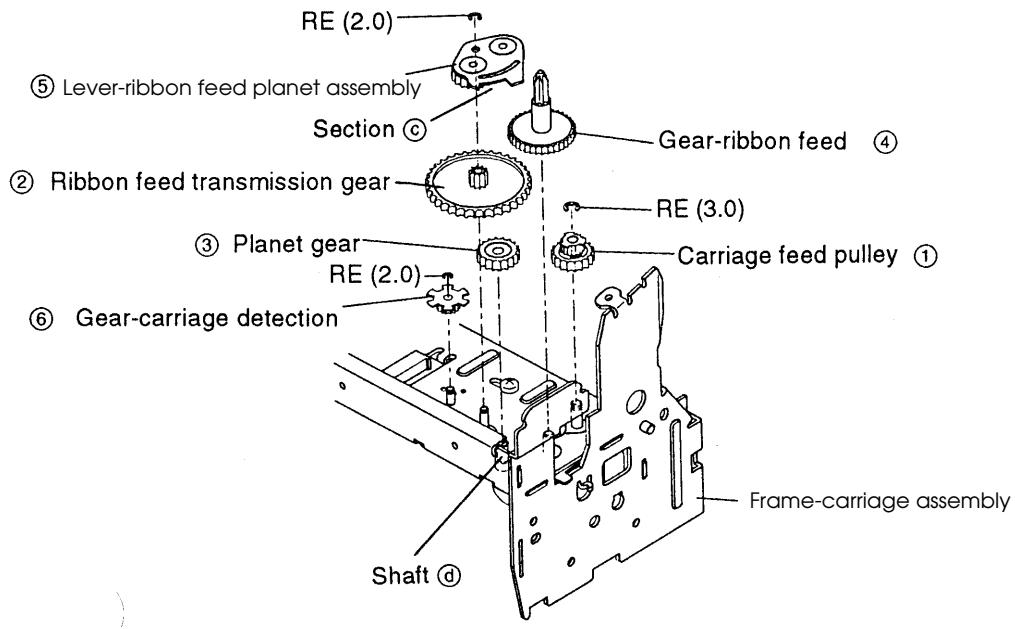
- 1.\* Attach the motor-carriage to the frame-carriage assembly with the screws.
2. Slide the board-head relay assembly into position along guides ① and ②, and fasten it with the screw.



- 3.\* Mount the gears in the order ① to ⑥ in the illustration, and fasten them with the REs.

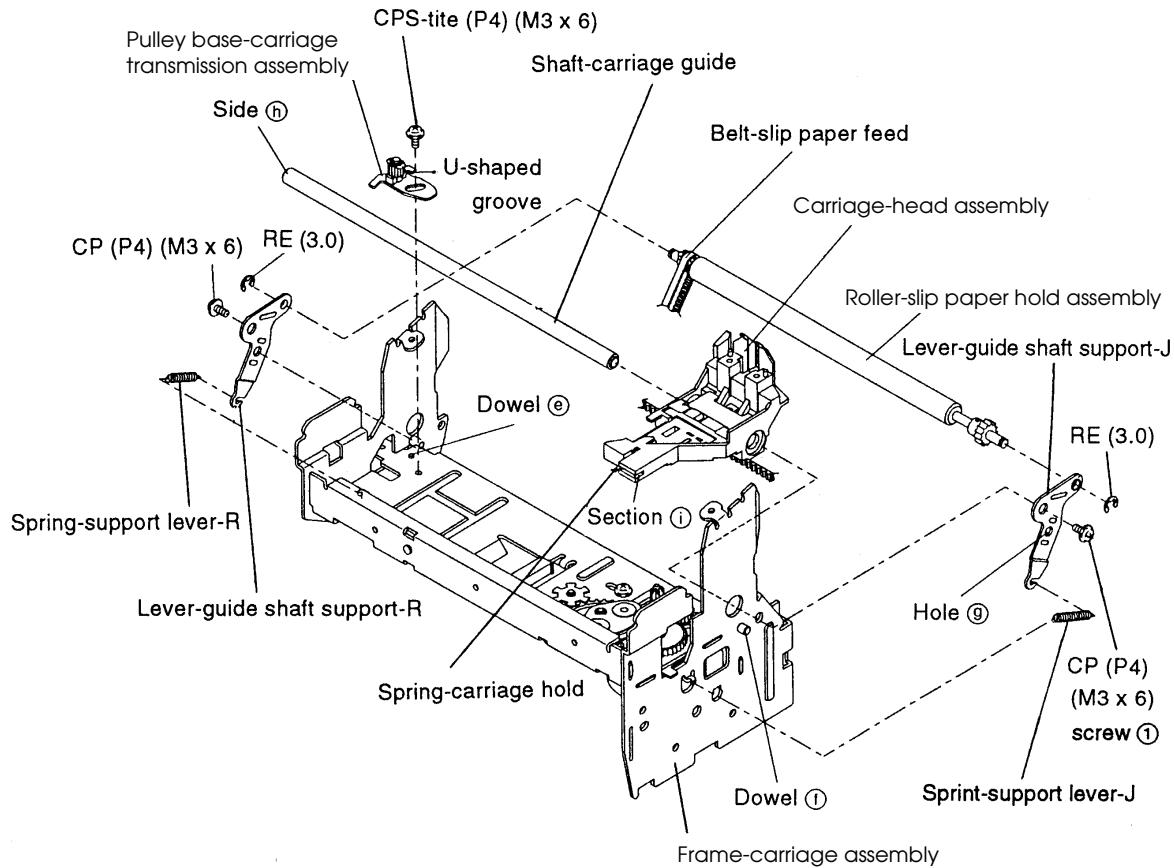
4. Attach the lever-ribbon feed planet assembly so that the section ③ encloses shaft ④.

*[Adjustment] Backlash adjustment of carriage feed pulley and carriage motor (see Adjustment B on page 5-54).*



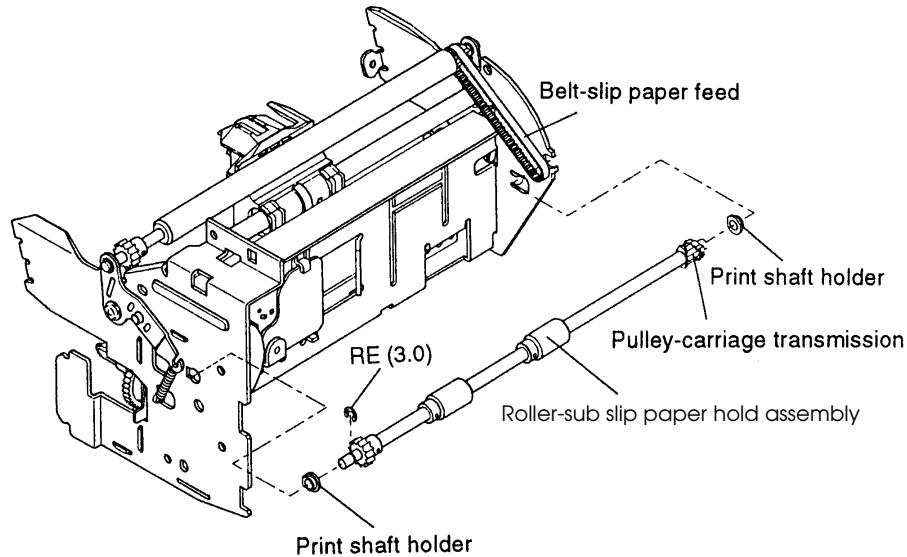
**Sub-assembly L-(1)**

5. Align the U-shaped groove with dowel ⑧ and mount the pulley base-carriage transmission assembly. Provisionally tighten the screw. (Final tightening is in carriage transmission belt tension adjustment on page 5-56.)
- 6.\* Mount the lever-guide shaft support-J on the roller-slip paper hold assembly and fasten it with the RE.
7. Align the resulting part with dowel ⑨ and hole ⑩ and position the parts on the frame-carriage assembly.
8. Pass the shaft-carriage guide through the carriage-head assembly and then through the frame-carriage assembly from side ⑪. Then tighten screw ⑫ in the illustration. The spring-carriage hold must come below the frame and lock with the frame at section ⑬ of the carriage.
9. Engage the belt of the carriage-head assembly on the pulley-carriage transmission and the carriage feed pulley.
10. Engage the belt-slip paper feed on the roller-slip paper hold assembly.
11. Attach the lever-guide shaft support-R and fasten it with the screw and RE.
12. Attach the support lever springs J (long) and R (short).

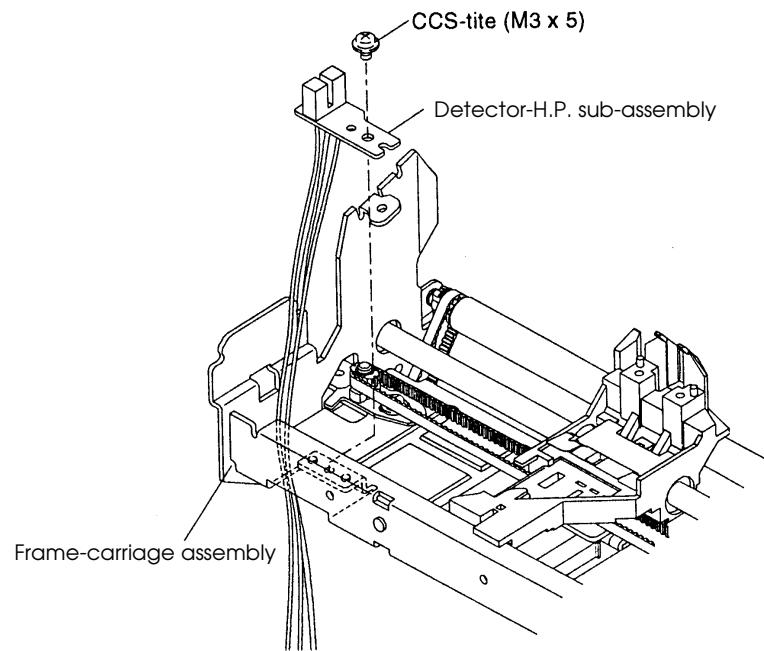


### **Sub-assembly L-(1)**

13. Engage the belt-slip paper feed on the pulley-carriage transmission. Mount the print shaft holders and roller-sub slip paper hold assembly, and fasten with the RE.

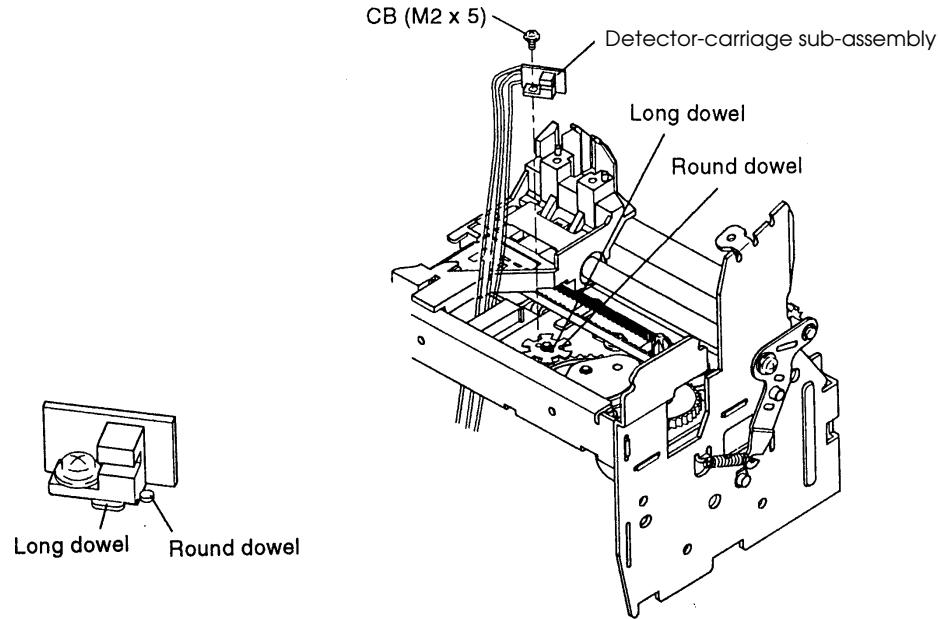


14. Pass the wires through the frame-carriage assembly, attach the detector-H.P. sub-assembly to the frame, and tighten the screw.



**Sub-assembly L-(1)**

15. Mount the detector-carriage sub-assembly so that it is flush with the round dowel and long dowel, as shown in the illustration. Then tighten the screw.

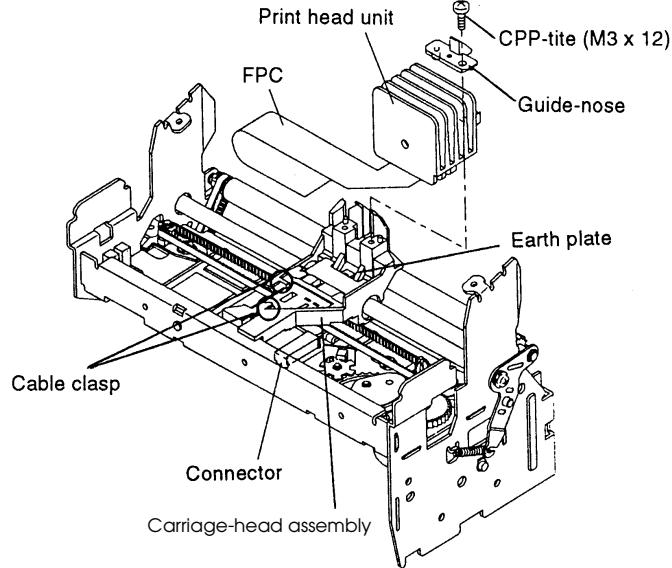


16. Engage the FPC on the cable clasp. Mount the guide-nose onto the print head unit, and then attach them and tighten the screw.
17. Plug the FPC into the board-head relay assembly.

**✓ Checkpoint**

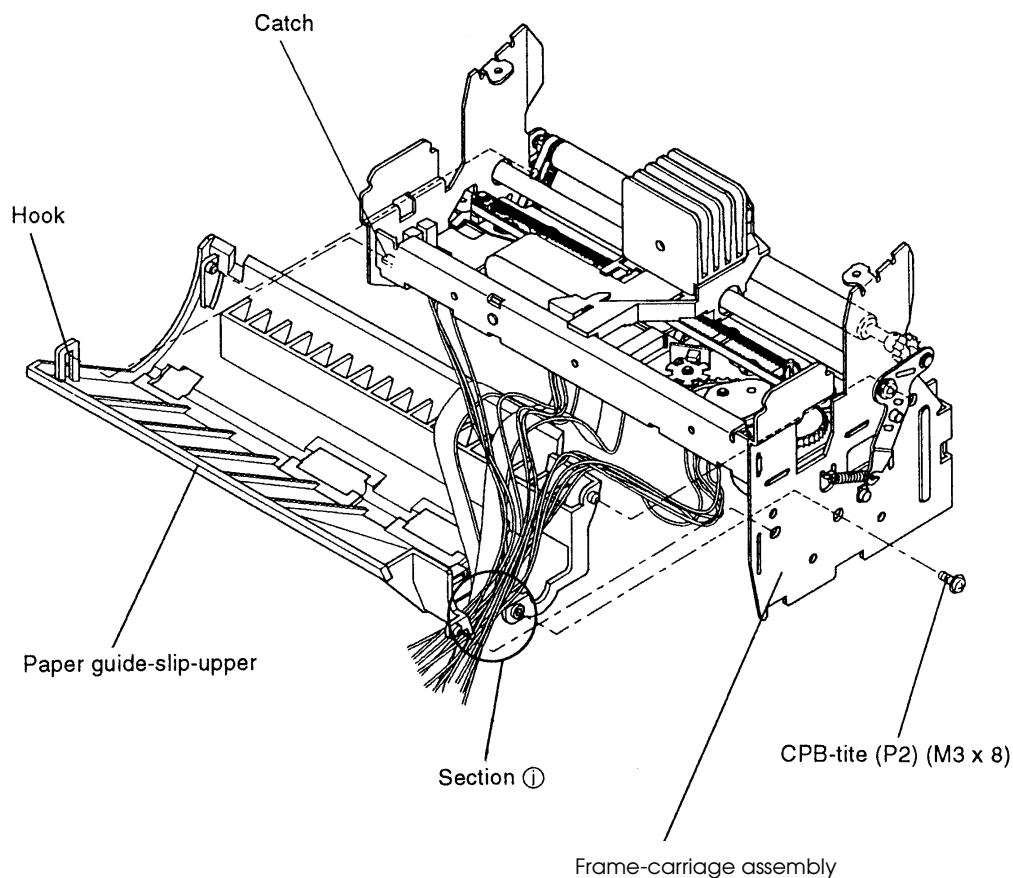
Verify that the FPC is not deformed.

Verify that the print head unit is in contact with the ground plate.



***Sub-assembly L-(1)***

18. Assemble all cables at section ① .
19. Mount the paper guide-slip-upper on the frame-carriage assembly so that the three dowels match the respective dowel holes, and the hook is engaged in the catch. Then tighten the screw.

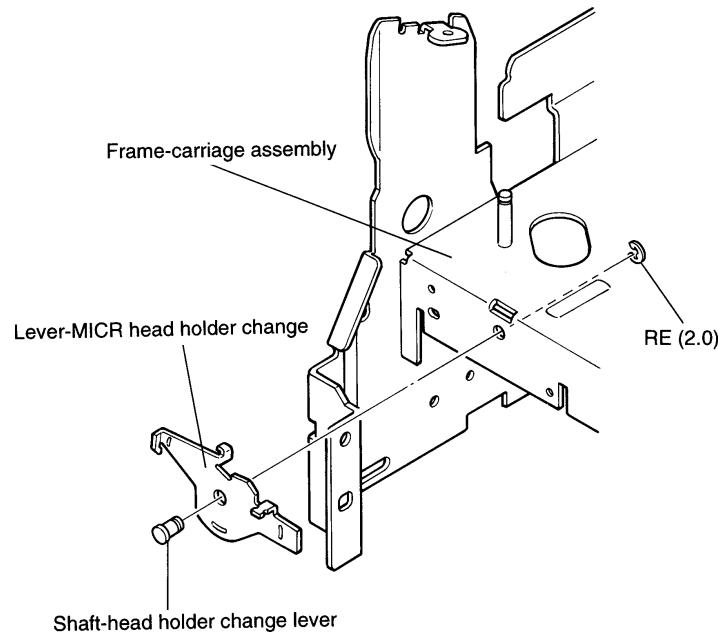
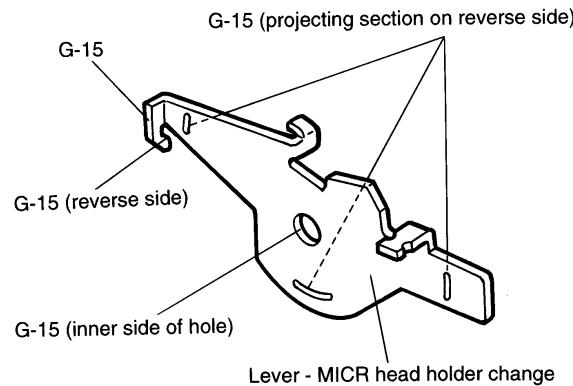


***Sub-assembly L-(2): Frame-Carriage Unit Assembly (for printers with a MICR reader)***

- 1.\* As shown below, attach the lever-MICR head holder change to the frame-carriage assembly, and secure it with the RE fittings.

**✓ Checkpoint**

Refer to the illustration below when lubricating the lever-MICR head holder change.

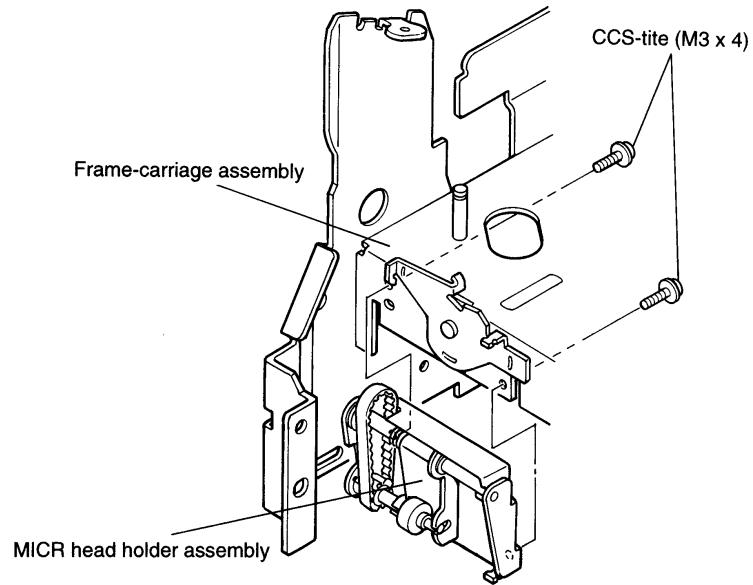


## Sub-assembly L-(2)

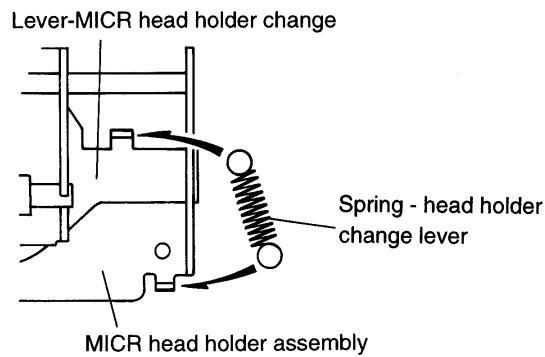
- As shown below, attach the MICR head holder assembly to the frame-carriage assembly, and secure it with the two screws.

### ✓ Checkpoints

Make sure the two dowels of the MICR head holder assembly are inserted in the two holes in the frame carriage assembly.

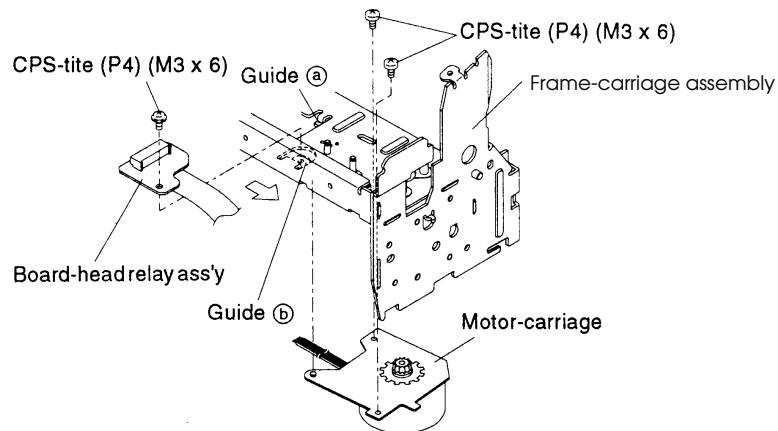


- Attach the spring-head holder change lever as shown below.



***Sub-assembly L-(2)***

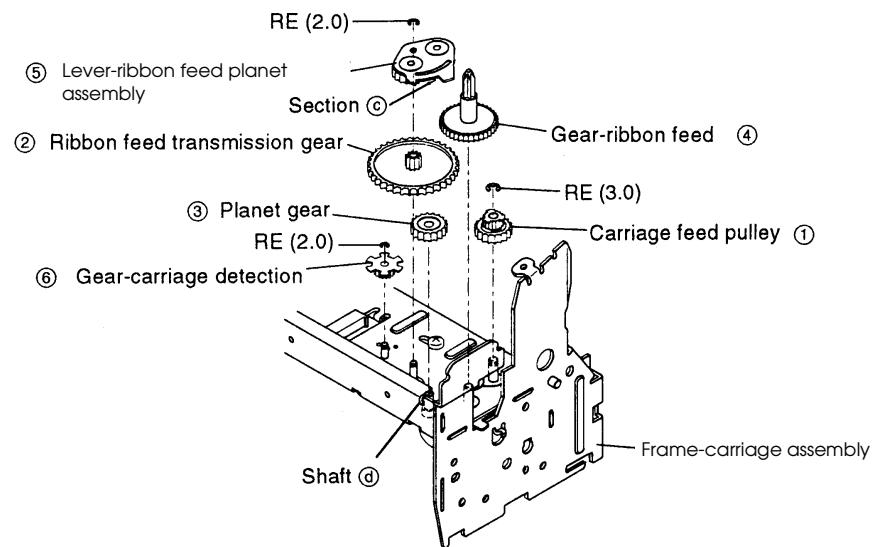
4. Attach the motor-carriage to the frame-carriage assembly with the screws.
5. Slide the board-head relay assembly into position along guides Ⓐ and Ⓑ , and fasten it with the screw.



- 6.\* Mount the gears in the order ① to ⑥ in the illustration, and fasten them with the REs.

7. Attach the lever-ribbon feed planet assembly so that the section Ⓓ encloses shaft ④ .

**[Adjustment]** Backlash adjustment of carriage feed pulley and carriage motor (see Adjustment B on page 5-54).



## Sub-assembly L-(2)

8. Align the U-shaped groove with dowel ⑧ and mount the pulley base-carriage transmission assembly. Provisionally tighten the screw. (Final tightening is in carriage transmission belt tension adjustment on page 5-56.)
9. Attach the shaft holder-slip feed roller to the lever-guide shaft support.
- 10.\*Pass the roller-slip hold assembly B through the belt-MICR feed, and fit the belt onto the gear.
11. Pass the roller-slip hold assembly B over the shaft holder-slip feed roller attached to the lever-guide shaft support-JB, and attach it using the RE fittings.
12. Align the dowel ① and hole ⑨ of the assembled lever-guide shaft support-JB, and fit it onto the frame-carriage assembly.
13. Pass the shaft-carriage guide over the carriage-head assembly, and with the ⑩ side first, insert it into the hole in the frame-carriage assembly, and tighten the screw marked ① in the illustration.

### ✓ Checkpoint

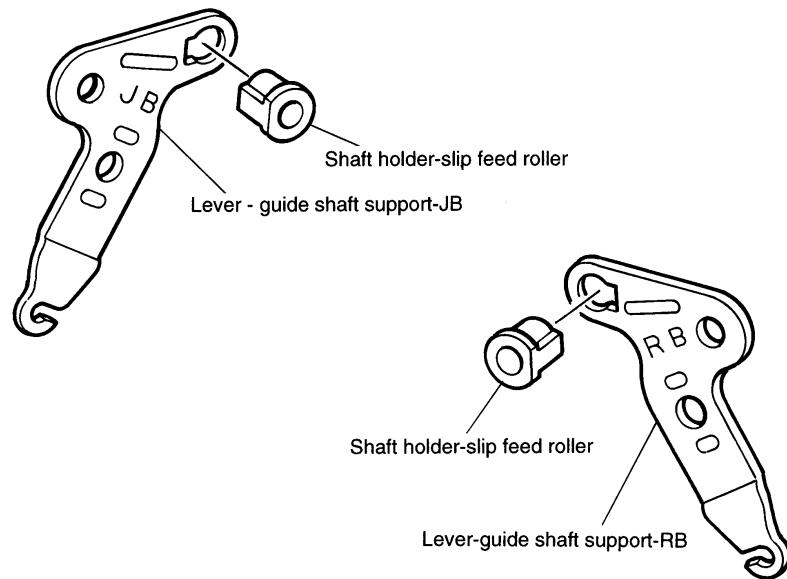
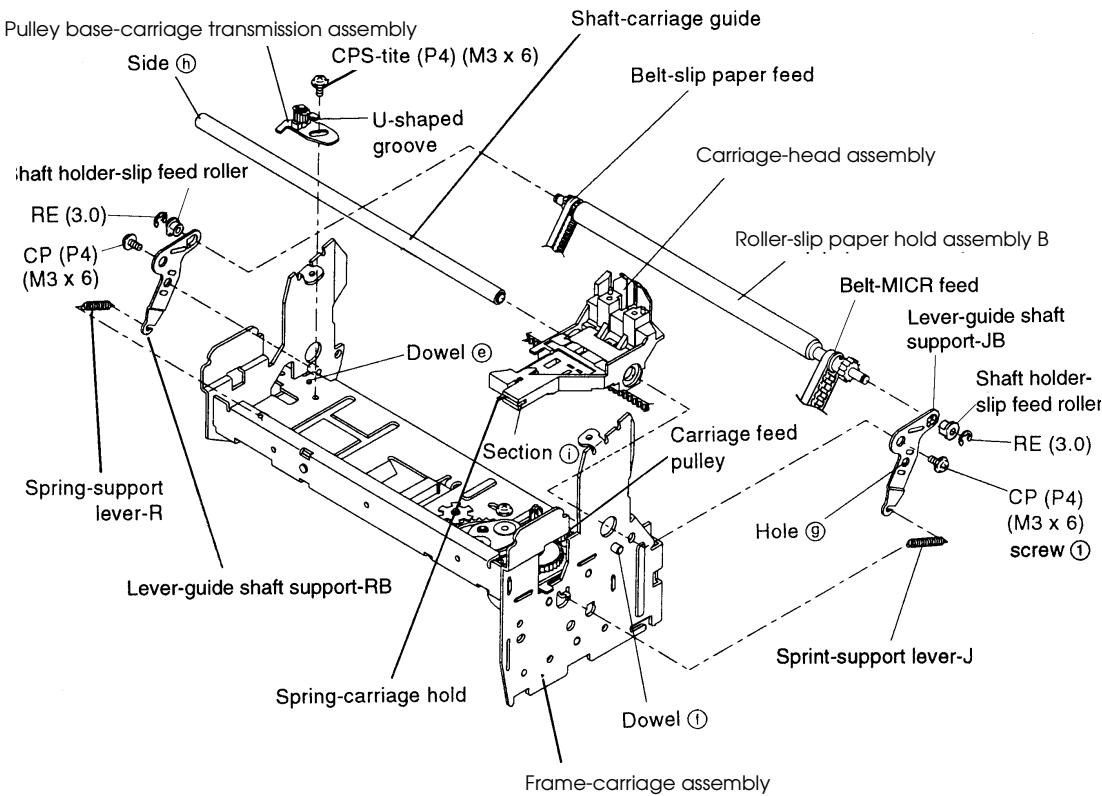
When attaching the assembly, the spring-carriage holder should be under the frame, with the part marked ① cutting into the frame.

14. Fit the belt of the carriage-head assembly onto the pulley-carriage transmission and carriage feed pulley.
15. Fit the belt-slip paper feed onto the roller-slip hold assembly B.
16. Attach the lever-guide shaft support-RB to the shaft holder-slip feed roller.
17. Pass the roller-slip hold assembly B over the shaft holder - slip feed roller attached to the lever-guide shaft support-RB, and set it on the frame-carriage assembly.
18. Secure the lever-guide shaft support-RB to the carriage guide with screws.
19. Secure the roller-slip hold assembly B with the RE fittings.

### ✓ Checkpoints

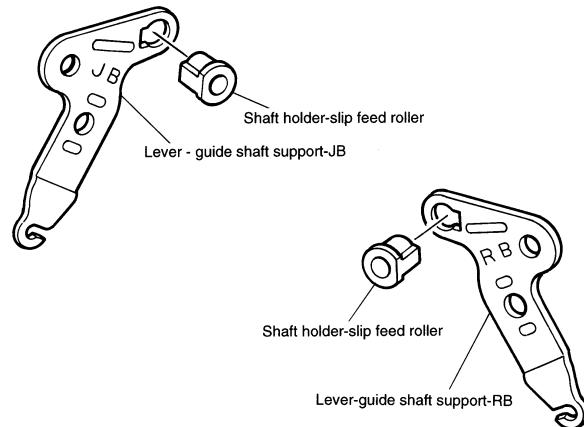
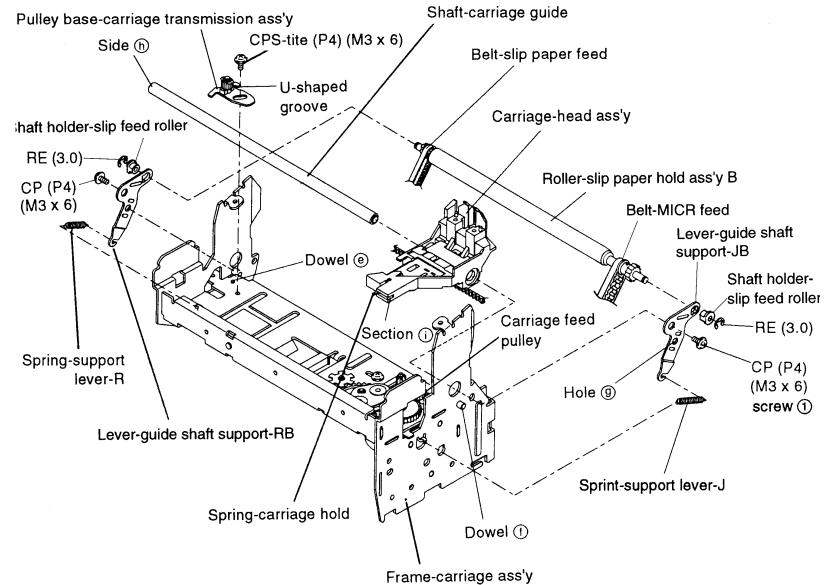
Make sure the belt-MICR feed is meshed with the gears of the roller-slip hold assembly B and roller-MICR head holder.

Attach the support lever springs J (long) and R (short).

**Sub-assembly L-(2)**

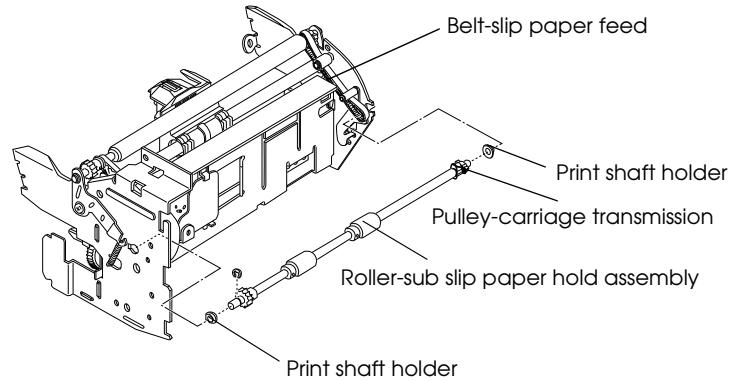
## Sub-assembly L-(2)

20. Attach the tension-pulley to the lever-slip tension and fix it with the RE.
21. Attach the lever to the frame-carriage assembly and secure it with the screw.
22. Attach the pulley-slip tension to the frame-carriage assembly and secure it with the RE.

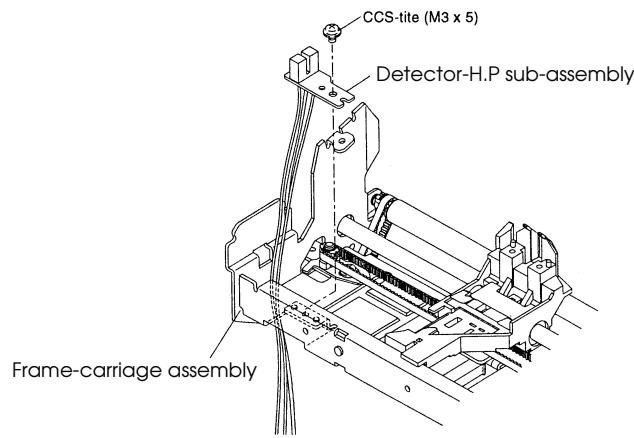


**Sub-assembly L-(2)**

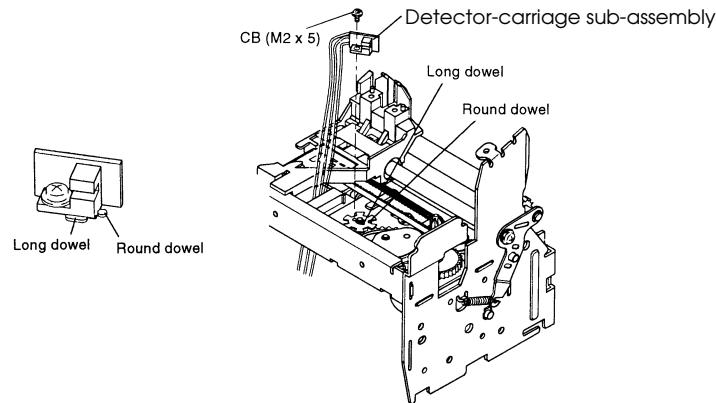
23. Engage the belt-slip paper feed on the pulley-carriage transmission. Mount the print shaft holders and roller-sub slip paper hold assembly, and fasten with the RE.



24. Pass the wires through the frame-carriage assembly, attach the detector-H.P. sub-assembly to the frame, and tighten the screw.



25. Mount the detector-carriage sub assembly so that it is flush with the round dowel and long dowel, as shown in the illustration. Then tighten the screw.



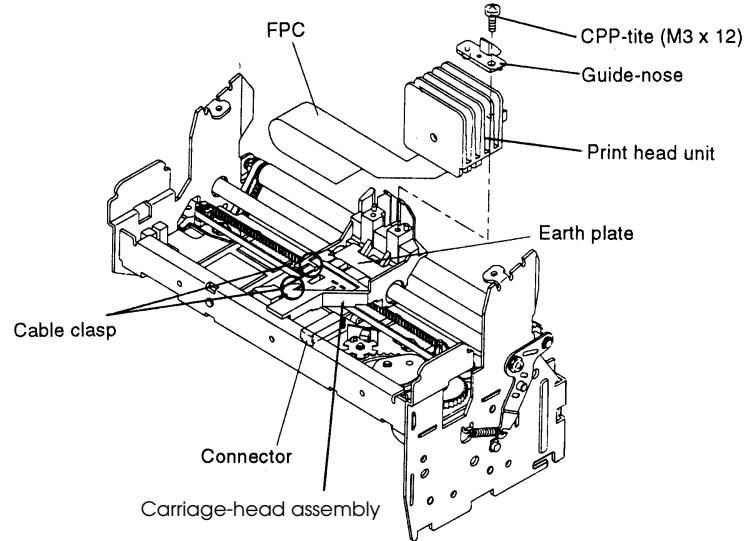
## Sub-assembly L-(2)

26. Engage the FPC on the cable clasp. Mount the guide-nose onto the print head unit, and then attach them and tighten the screw.
27. Plug the FPC into the board-head relay assembly.

### ✓ Checkpoints

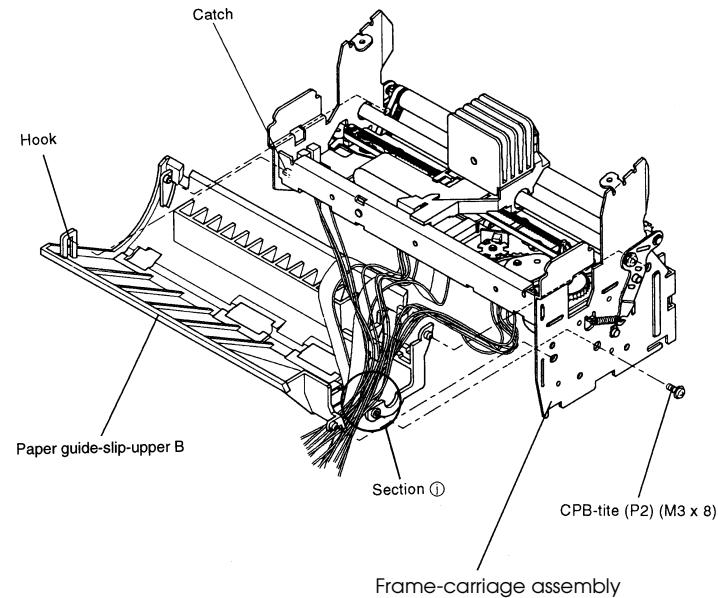
Verify that the FPC is not deformed.

Verify that the print head unit is in contact with the ground plate.



28. Assemble all cables at section ① .

29. Mount the paper guide-slip-upper B on the frame-carriage assembly so that the three dowels match the respective dowel holes, and the hook is engaged in the catch. Then tighten the screw.



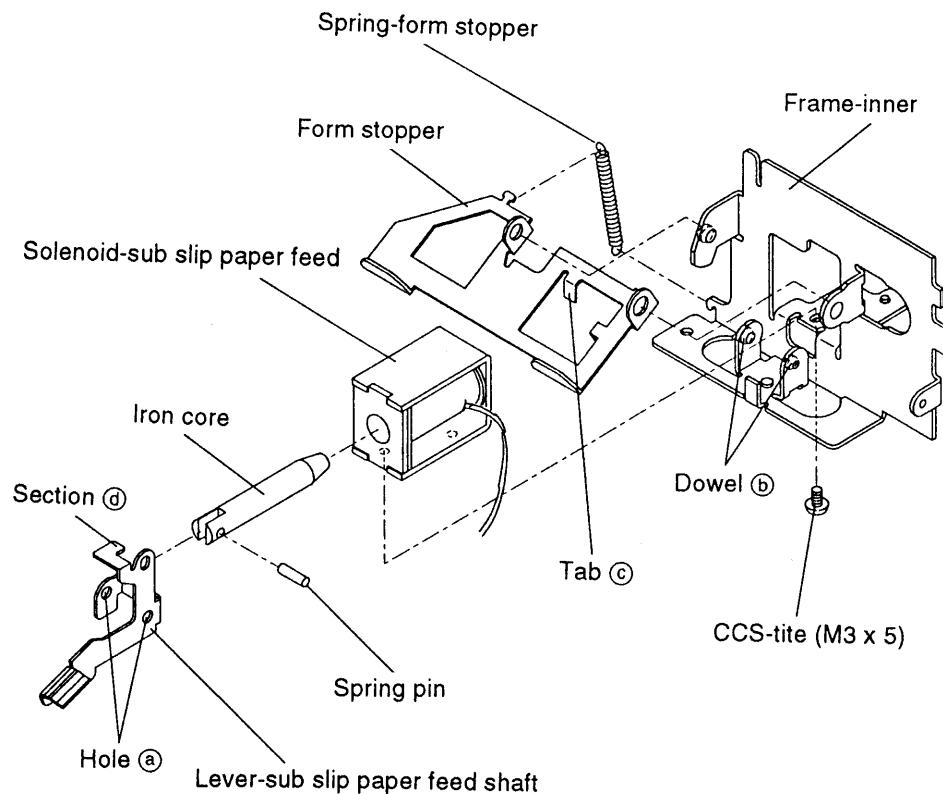
**Sub-assembly M: Frame-Inner Assembly**

- 1.\* Pass the iron core through the lever-sub slip paper feed shaft and secure it with the spring pin.
- 2.\* Position the resulting part so that **a** is aligned with dowel **b**.
- 3.\* Attach the form stopper to the frame-inner so that the cut face of section **c** contacts tab **c**.
4. Align the hole on the solenoid-sub slip paper feed with the dowel of the frame-inner and fasten the solenoid with the screw.
5. Attach the spring-form stopper.

**✓ Checkpoints**

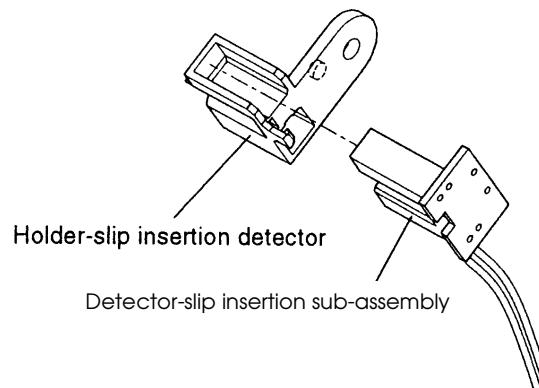
Verify that the form stopper moves smoothly when the lever-sub slip paper feed shaft is moved.

Verify that the cut face of section **c** contacts tab **c**.



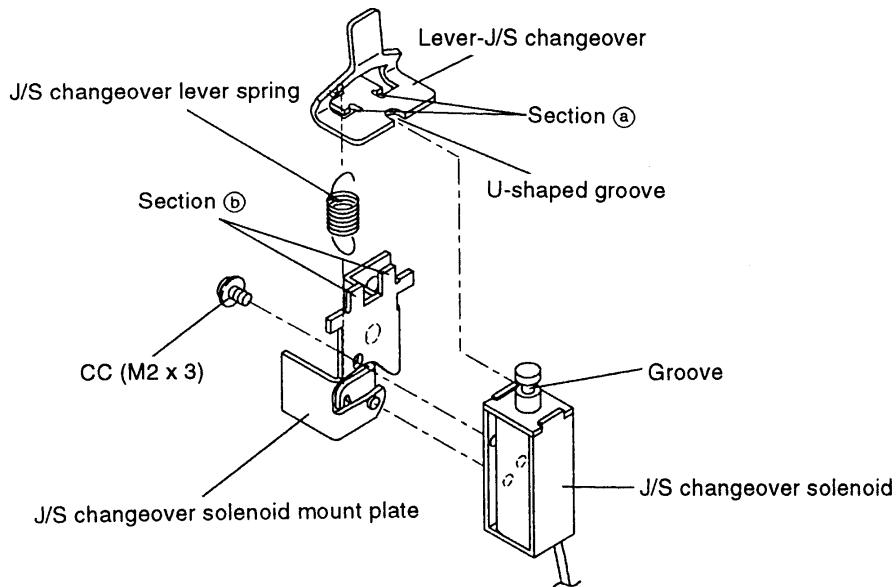
## ***Sub-assembly N: Detector-Slip Insertion Assembly***

1. Push the detector-slip insertion sub assembly into the holder-slip insertion detector.



## ***Sub-assembly O: Solenoid J/S Changeover Assembly***

- 1.\* Attach the J/S changeover solenoid to the J/S changeover solenoid mount plate and tighten the screw.
2. Align the U-shaped groove of the lever-J/S changeover with the groove on the side of the J/S changeover solenoid and attach the lever by joining sections ① and ② .
3. Engage the J/S changeover lever spring.

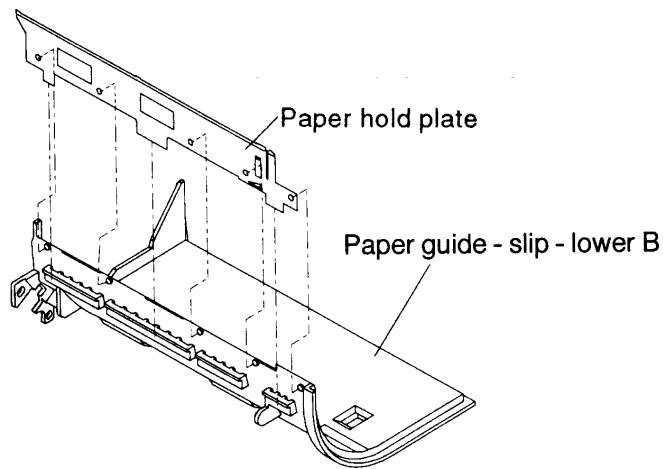


**Sub-assembly P: Paper Guide-Slip-Lower Assembly (If the printer has a MICR reader, assemble the paper guide-slip-lower assembly B.)**

1. Insert the paper holder plate into the paper guide-slip-lower or lower-B so that the dowels match the five holes.

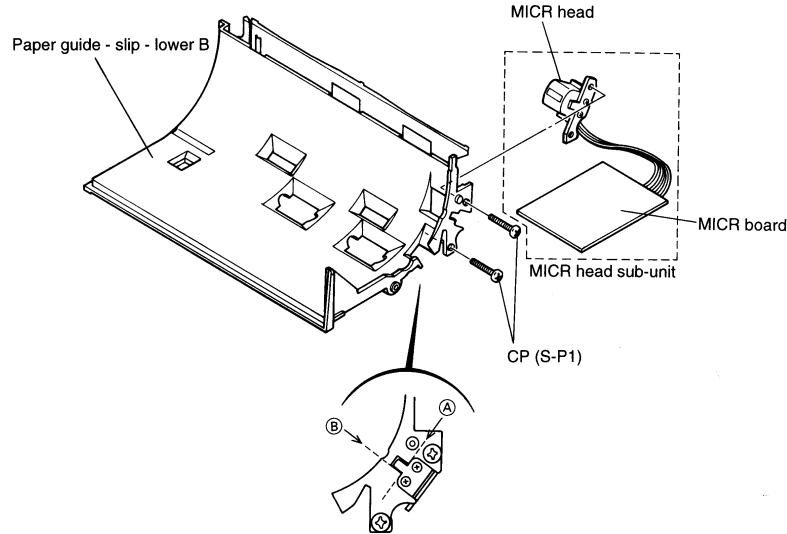
✓ **Checkpoint**

Verify that the paper hold plate is not deformed.



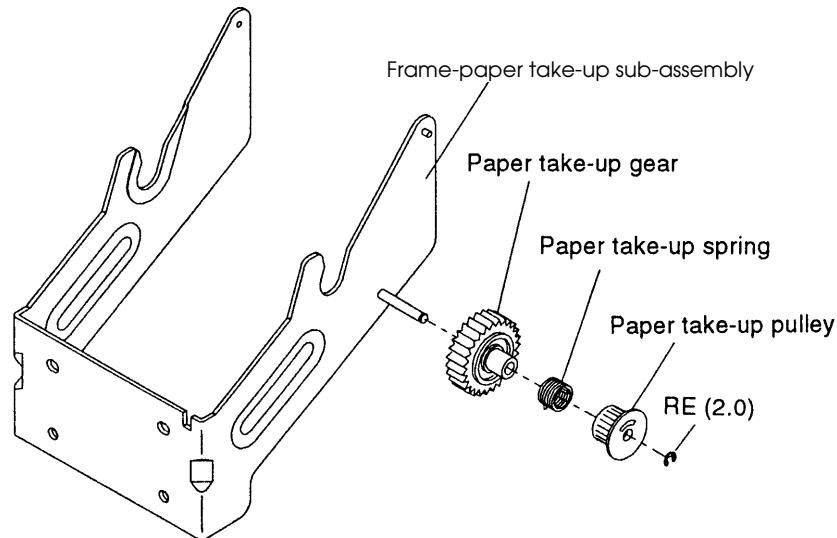
The procedure below is carried out only when the printer is equipped with a MICR reader.

2. Attach the MICR head to the paper guide-slip-lower B.
3. Pressing the MICR head against the parts marked ① and ② in the following illustration, secure it with the two screws.



## ***Sub-assembly Q: Frame-Paper Take-up Assembly***

- 1.\* Mount the paper take-up spring on the paper take-up gear.
- 2.\* Attach the paper take-up pulley to the paper take-up gear.
- 3.\* Attach the above assembly to the frame-paper take-up sub-assembly, and fasten it with the RE.

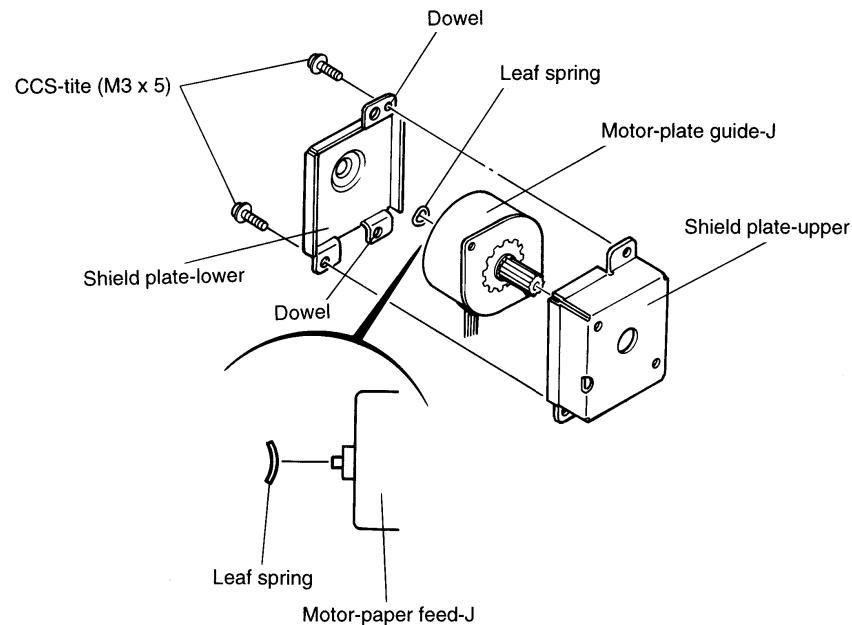


## ***Sub-assembly R: Assembling the motor-paper guide-J assembly (for printers with a MICR reader)***

1. With the leaf spring positioned as shown below, set the spring on the motor-paper guide-J, and then attach the shield plate-upper and the shield plate-lower.
2. Secure the shield plate-upper to the shield plate-lower, using the two screws.

### **✓ Checkpoint**

Make sure the two dowels in the shield plate-upper match the holes in the shield plate-lower.



## Main Assembly (Part 1)

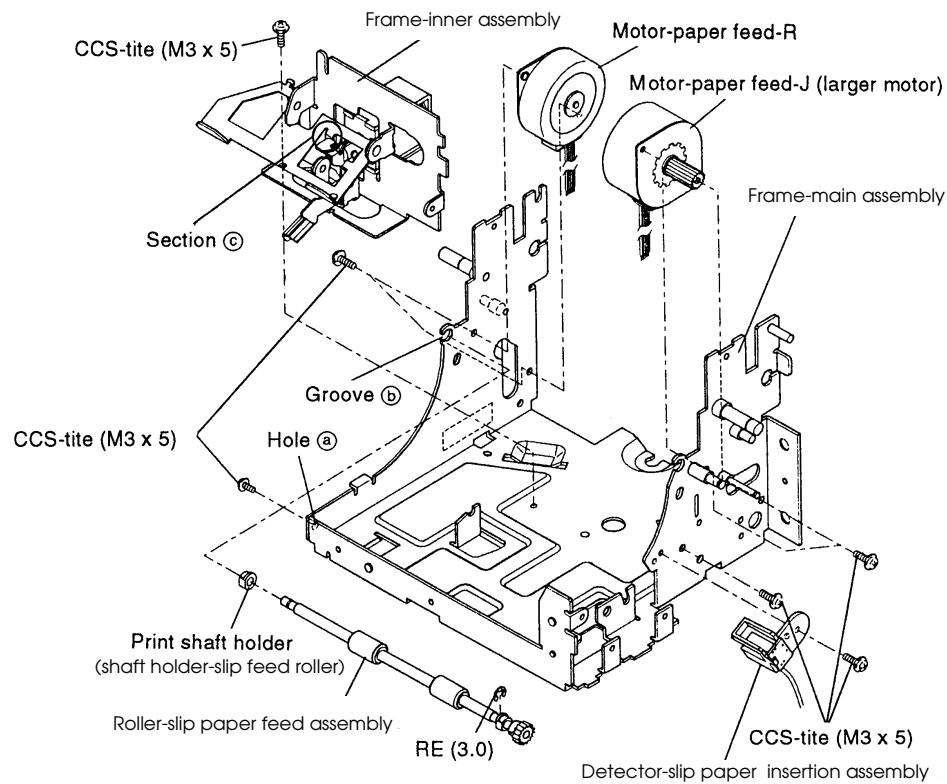
### Main Assembly 1-1: Frame-Main Unit Assembly

- 1.\* Mount the screw in hole ④ .
2. Attach the frame-inner assembly and secure it with the screw.
3. Mount the motor-paper feed-J (larger motor) and motor-paper feed-R and secure them with the screws.
- 4.\* Insert the print shaft holder (shaft holder-slip feed roller for printers with a MICR reader) in groove ⑤ , mount the roller-slip paper feed assembly on the holder, and fasten it with the RE.
5. Mount the detector-slip paper insertion assembly and fasten it with the screw.

#### ✓ Checkpoints

Make sure not to mix up the paper feed motors.

Make sure that section ⑥ on the frame-inner is properly seated. (For the details see the Checkpoint on page 5-35.)



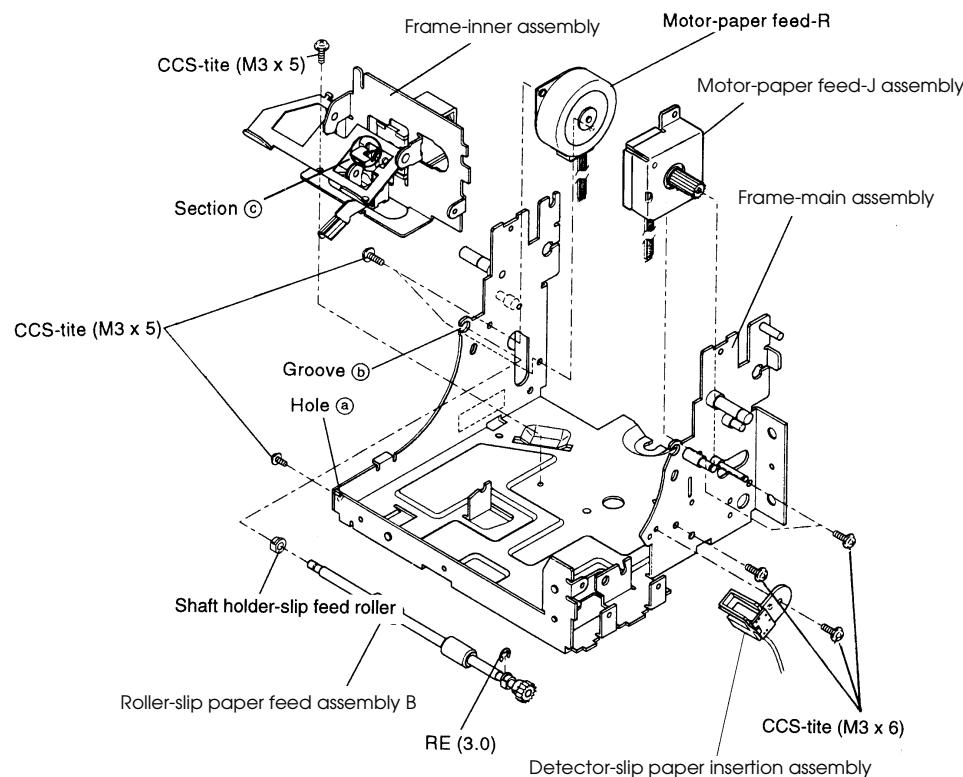
**Main Assembly 1-1-(2): Frame-Main Unit Assembly (for printers with a MICR reader)**

- 1.\* Mount the screw in hole ② .
2. Attach the frame-inner assembly and secure it with the screw.
3. Attach the motor-paper feed-J assembly (the larger assembly) and R assembly (the smaller assembly), and secure them with the screws.
- 4.\* Fit the shaft holder-slip feed roller into the groove ⑤ , attach the roller-slip paper feed assembly, and secure it with the RE fittings.
5. Mount the detector-slip paper insertion assembly and fasten it with the screw.

**✓ Checkpoints**

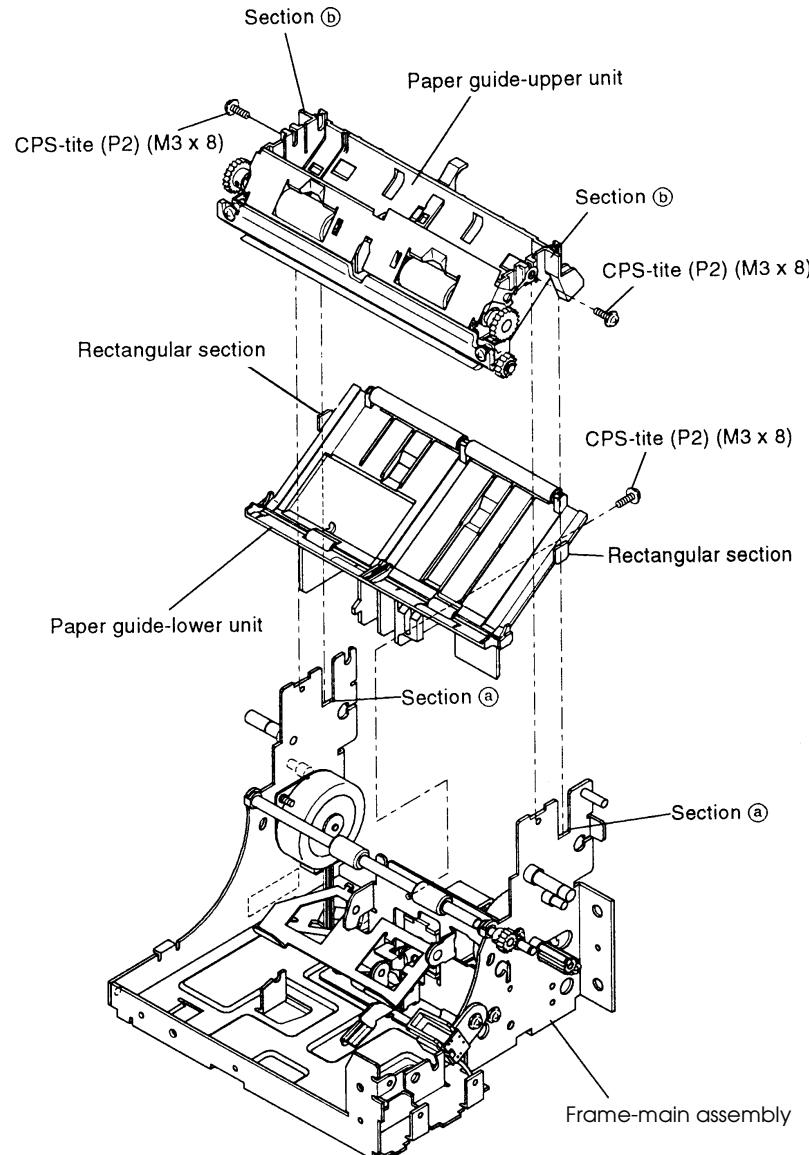
Be careful that the motor-paper feed-J and R assemblies are attached correctly.

Make sure that section ④ on the frame-inner is properly seated. (For details see the Checkpoint on page 5-35.)



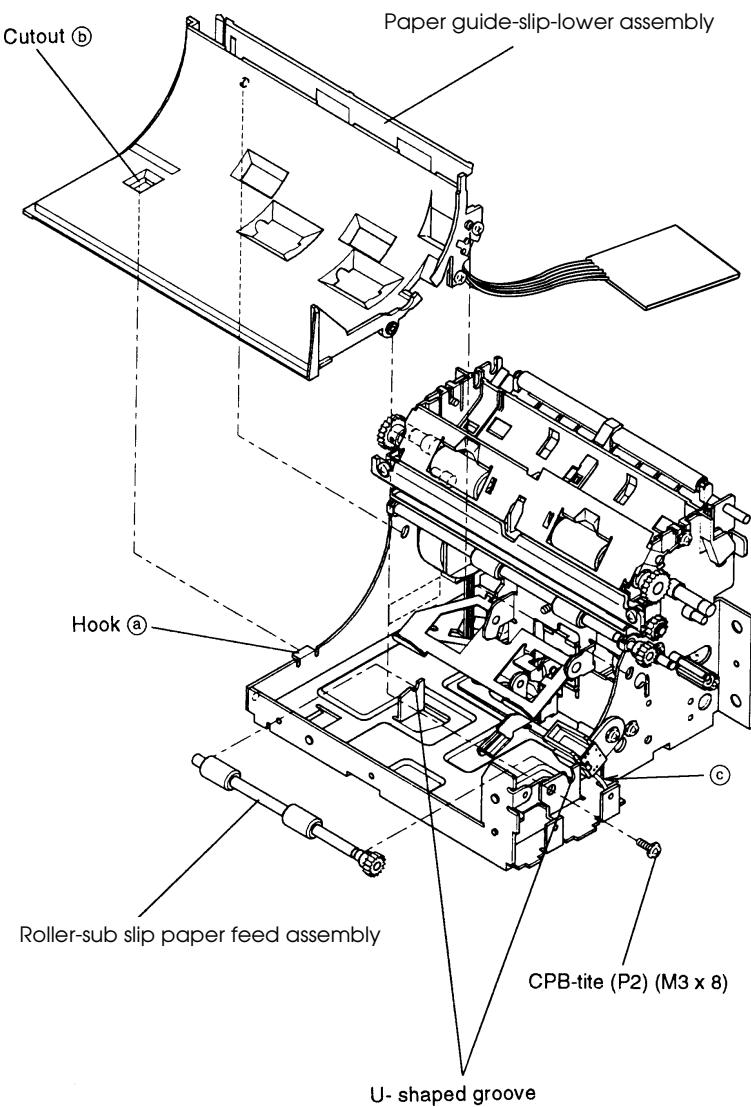
## Main Assembly 1-2: Attachment of Lower and Upper Paper Guide Unit

1. Slide the rectangular section of the paper guide-lower unit into the frame-main assembly and fasten the screw.
2. Align sections ⑤ of the paper guide-upper unit with sections ④ of the frame-main assembly and fasten the screws.



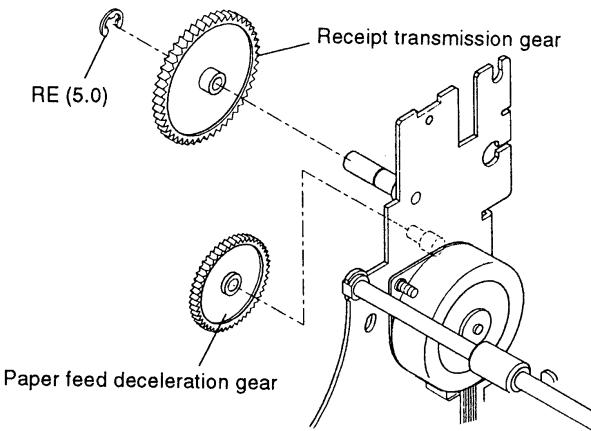
**Main Assembly 1-3: Attachment of Paper Guide-Slip-Lower and Roller-Sub Slip Paper Feed Assembly**

1. Mount the roller-sub slip paper feed assembly in the U-shaped grooves of the frame-main assembly.
2. Align the dowel and dowel hole of the paper guide-slip-lower assembly and engage hook **a** of the frame-main in cutout **b** of the paper guide. Then slide the paper guide into place and fasten it with the screw.
3. If the printer has a MICR reader, the cable for the MICR board will be coming out of the section marked **c**.

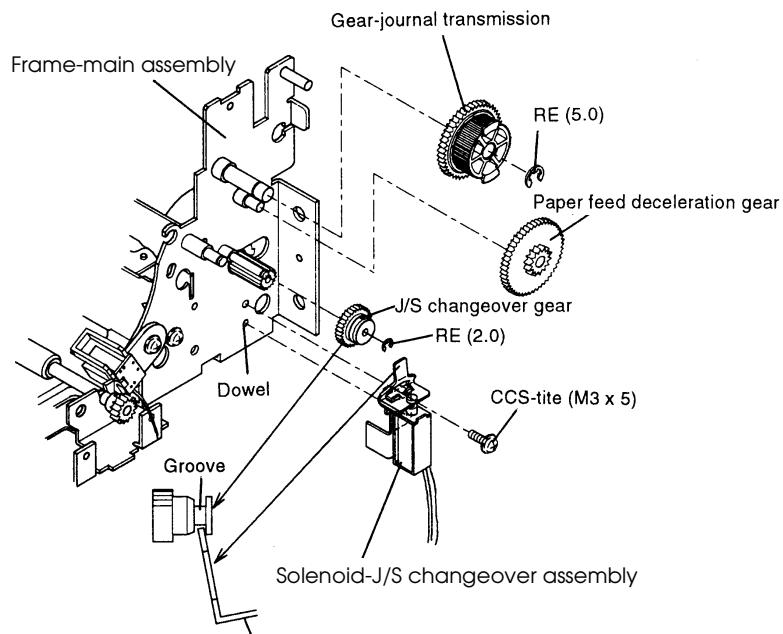


**Main Assembly 1-4: Attachment of Solenoid-J/S Changeover and Various Gears**

- 1.\* Mount the paper feed deceleration gear and then the receipt transmission gear on the frame-main assembly and fasten with the RE.



- 2.\* Align the tip of the lever-J/S changeover with the groove on the J/S changeover gear. Align the hole on the lever with the dowel on the frame-main assembly and secure the solenoid-J/S changeover assembly with the screw.
- 3.\* Mount the paper feed deceleration gear and then the gear-journal transmission on the frame-main assembly, and fasten with the RE.

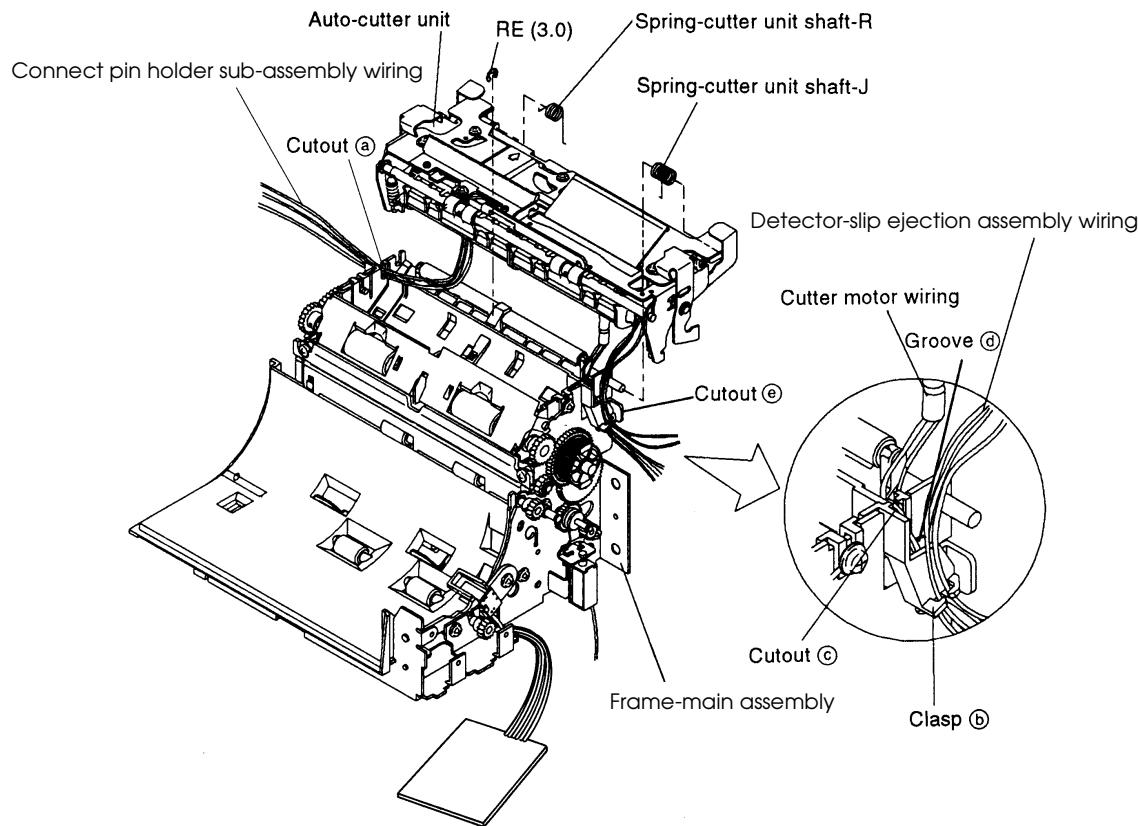


**Main Assembly 1-5: Attachment of Auto-cutter Unit**

1. Place the spring-cutter unit shaft-R onto the shaft of the auto-cutter unit with the short end first.
2. Place the spring-cutter unit shaft-J in the same way.
3. Thread the wiring from the contact pin holder sub-assembly through cutout ② to the outside.
4. Thread the wiring from the detector-slip ejection assembly through clasp ⑤ .
5. Thread the cutter motor wiring through cutout ④ and then along groove ③ . The two protective tubes should not protrude from cutout ④ .
6. Mount the auto-cutter unit on the frame-main assembly and engage the cutter unit shaft springs J and R. Secure it with the RE.

**✓ Checkpoint**

Make sure that the spring-cutter unit shaft-J is not caught in the detector-slip ejection assembly wiring.

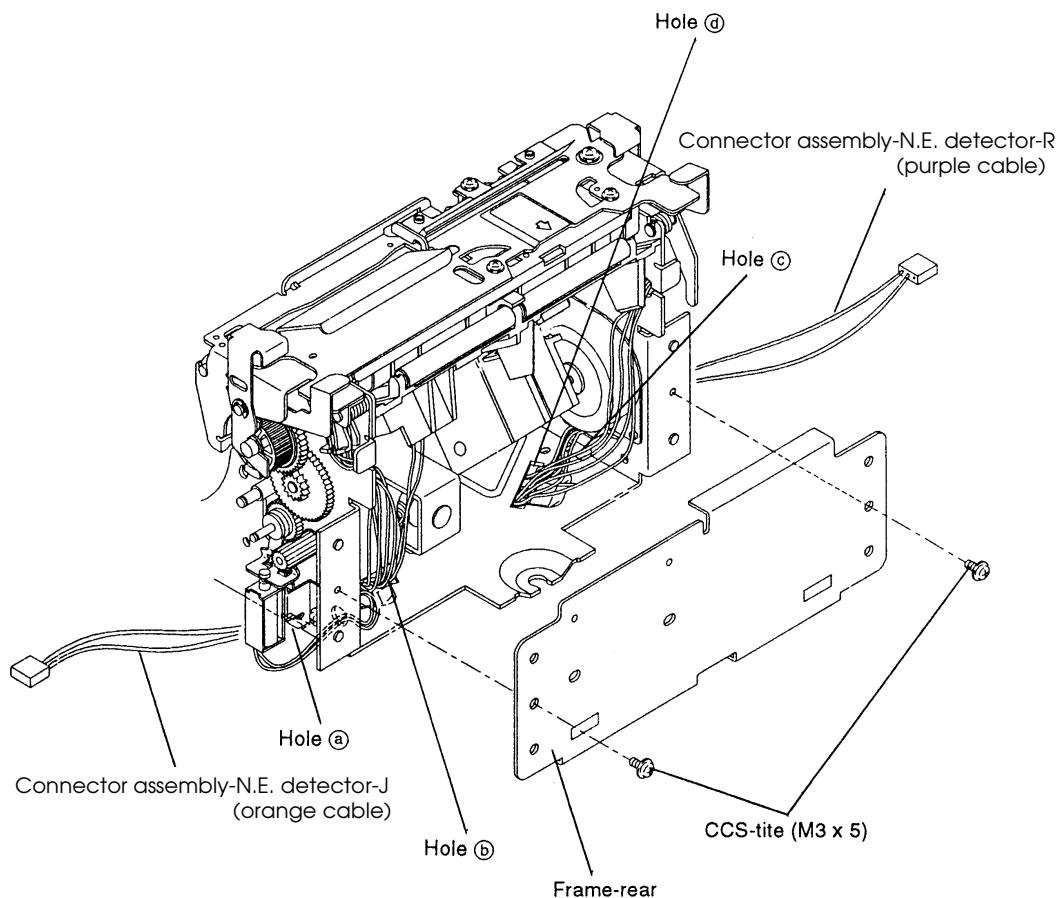


## Main Assembly 1-6: Wiring, and Frame-Rear and Connector Assembly-N.E. Detector Mounting

1. Dress the wires as shown in the illustration.
2. Attach the frame-rear to the frame-main assembly and secure it with the screw.
3. Pass the connector assembly-N.E. detector-J through hole ④ and then hole ⑤ .
4. Pass the connector assembly-N.E. detector-R through hole ⑥ and then hole ⑦ .

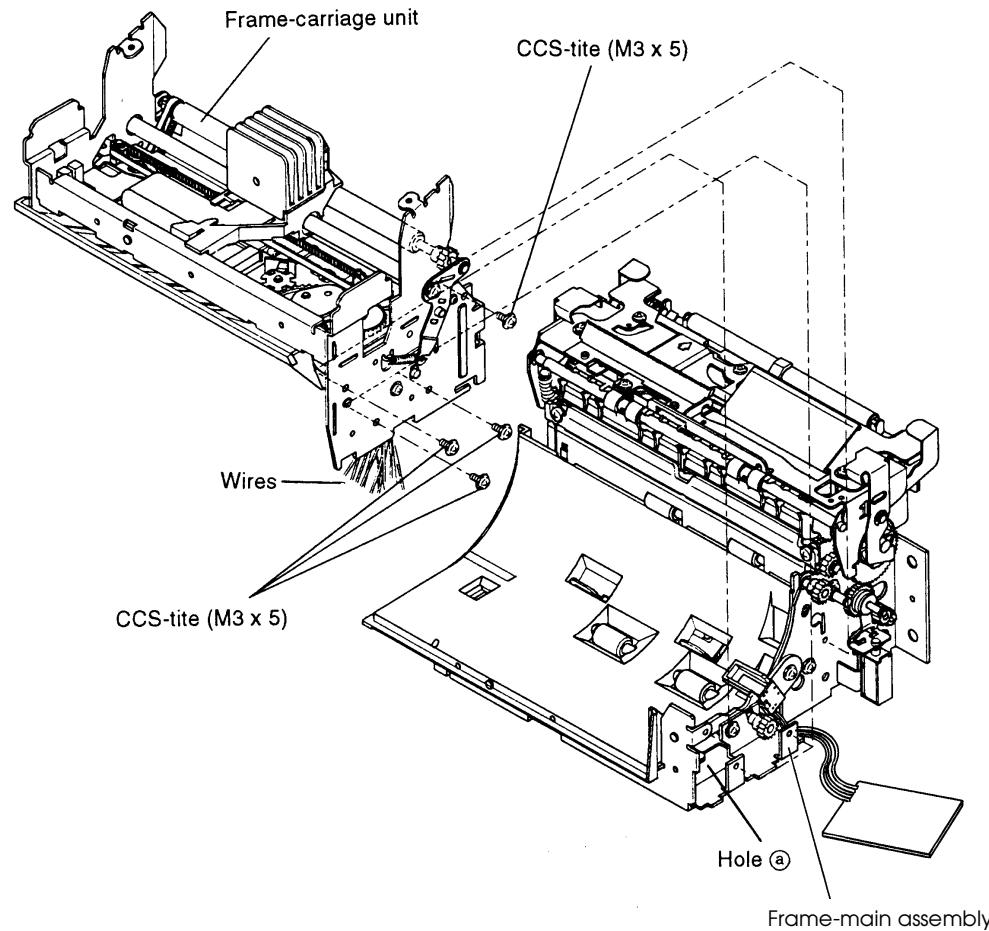
### ✓ Checkpoint

Make sure not to mix up the J and R connector cables.



## Main Assembly 1-7: Attachment of Frame-Carriage Unit

1. Pass the lead wires through hole ⑧ .
2. Mount the frame-carriage unit on the frame-main assembly and tighten the screws provisionally. (Final tightening is done in Adjustment C on the next page.)



## Main Assembly 1-8: Attachment of Frame-Front

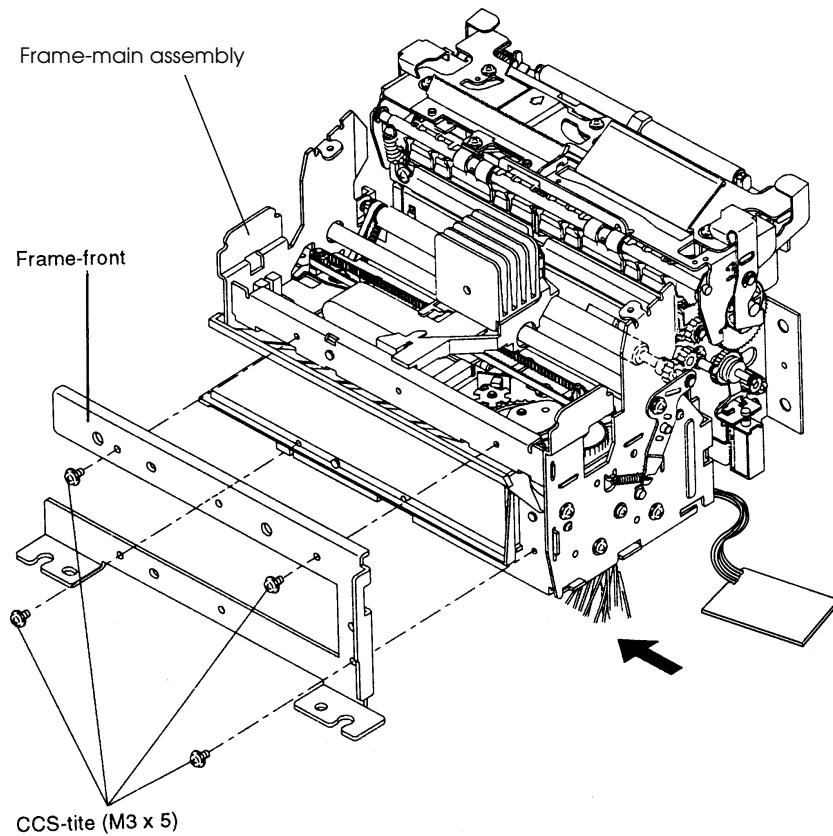
1. Mount the frame-front on the frame-main assembly by sliding the frame-front from the direction of the arrow and tighten the screws.

[Adjustments] See pages 5-55 through 5-57 for details of these adjustments.

Slip paper guide adjustment (Adjustment C)

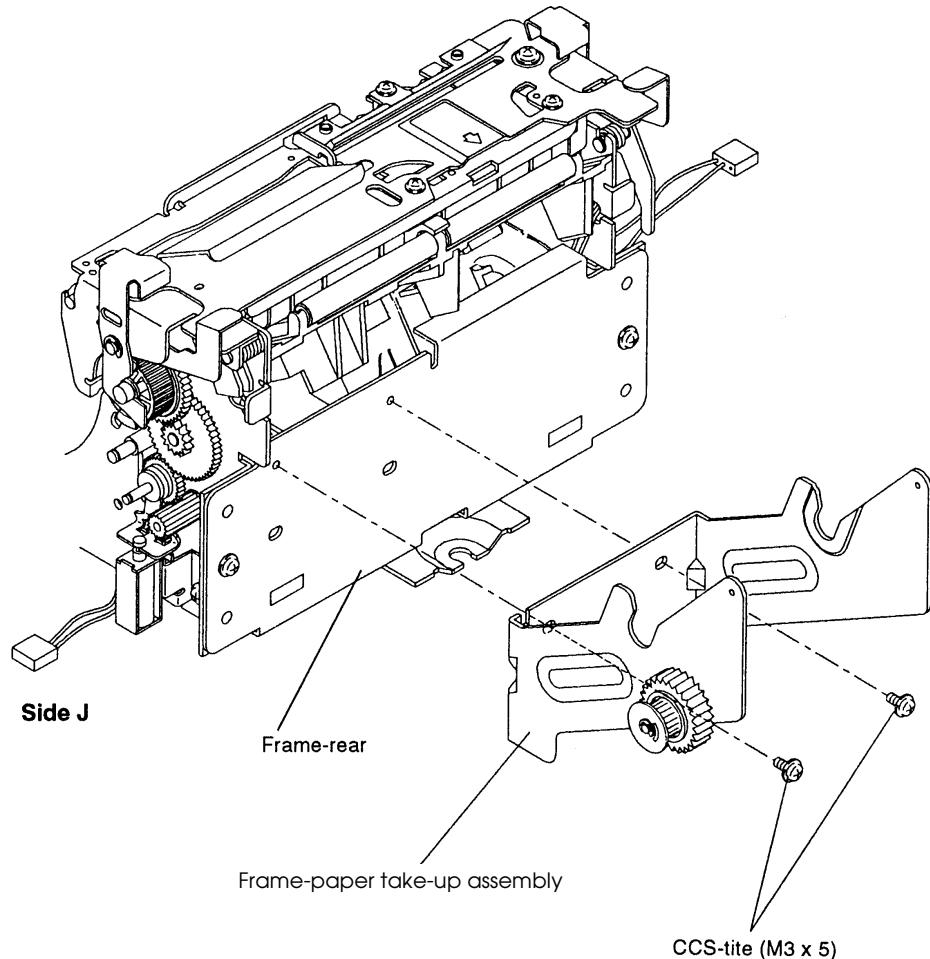
Carriage transmission belt tension adjustment (Adjustment D)

Slip paper feed parallelism adjustment (Adjustment E)



**Main Assembly 1-9: Attachment of Frame-Paper Take-up Assembly**

1. Mount the frame-paper take-up assembly on the frame-rear by fully aligning the frame to side J and tighten the screws.

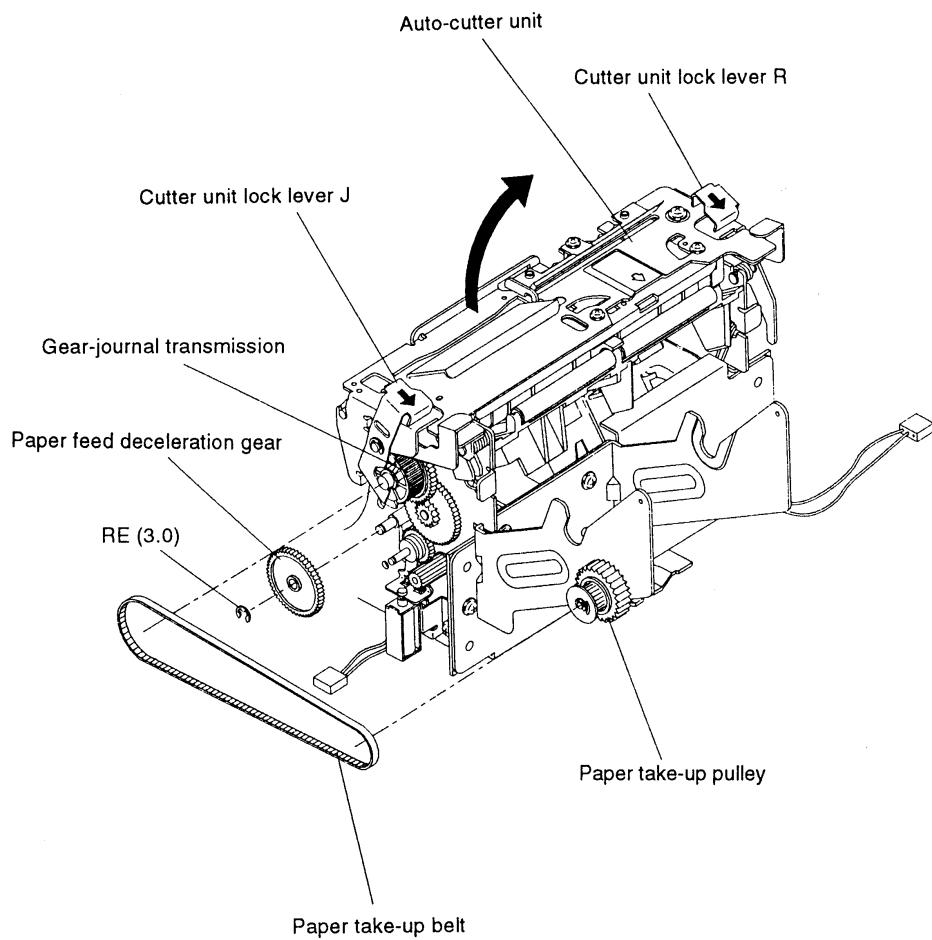


## Main Assembly 1-10: Attachment of Paper Take-up Belt and Paper Feed Deceleration Gear

1. Release the cutter unit lock levers of the auto-cutter unit and lift the unit in the ➡ direction.
2. Mount the paper feed deceleration gear and fasten it with the RE.
3. Engage the paper take-up belt on the gear-journal transmission and the paper take-up pulley.

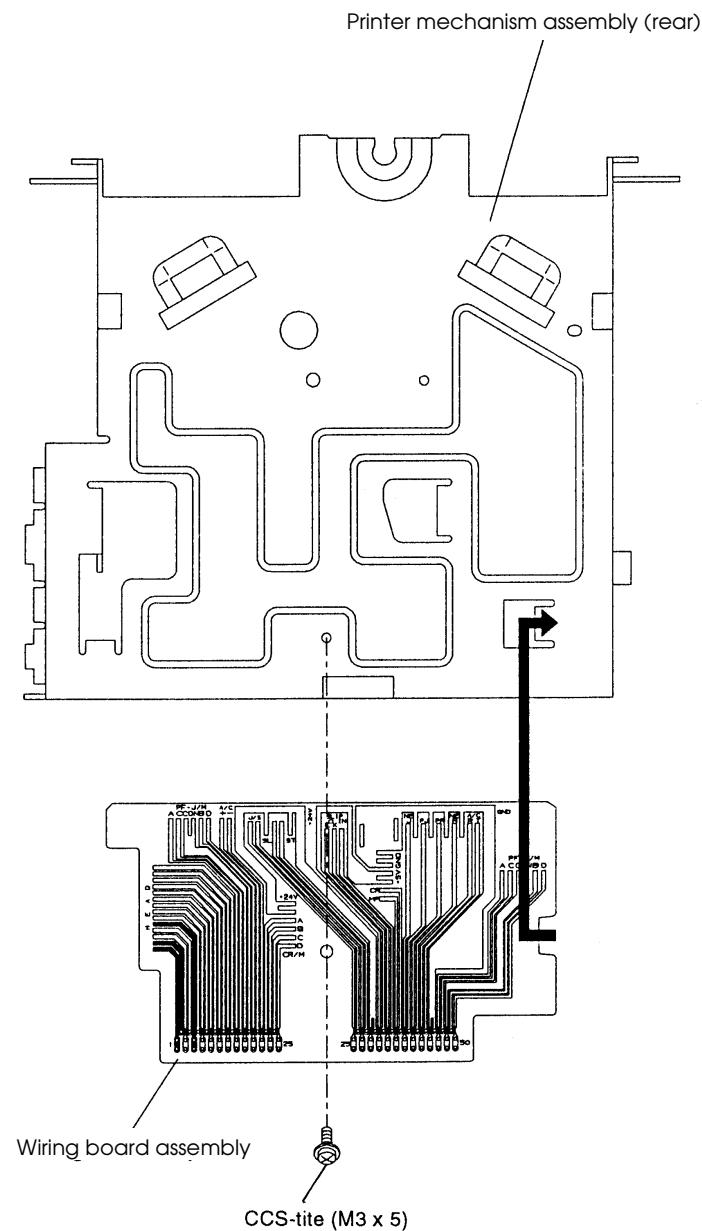
### ✓ Checkpoint

Print head and platen gap adjustment. (See Adjustment F on page 5-58.)



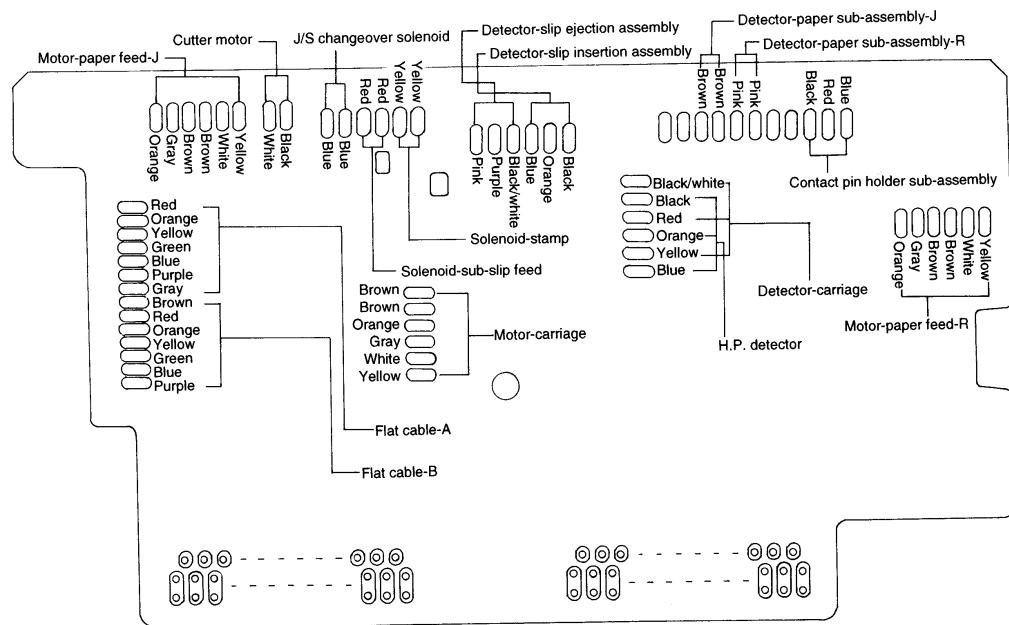
**Main Assembly 1-11: Attachment of Wiring Board Assembly**

1. Attach the wiring board assembly to the rear of the printer mechanism assembly and secure it with the screw.



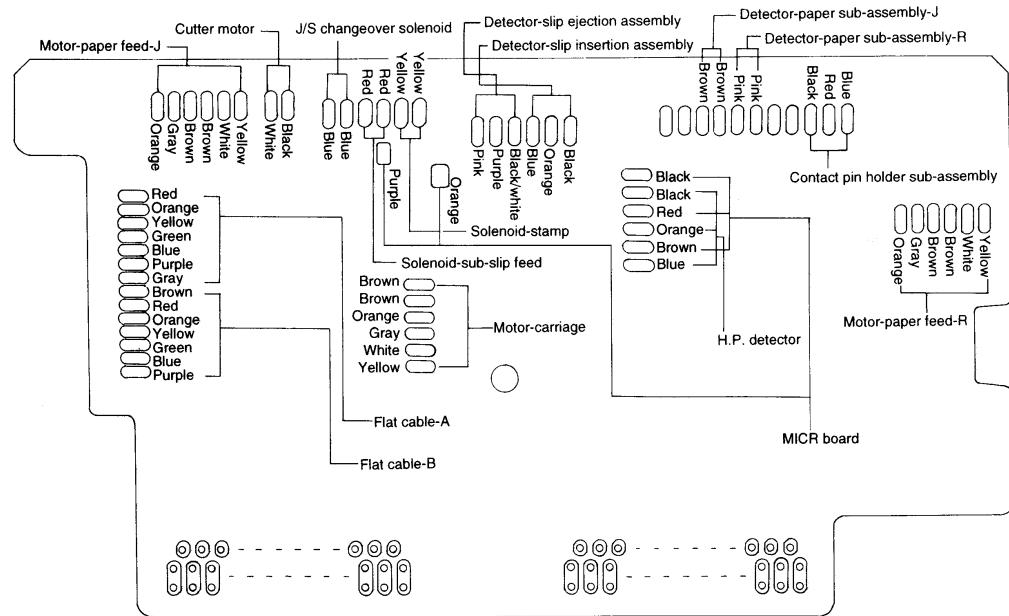
## Main Assembly 1-12-(1): Soldering of Lead Wires (for printers without a MICR reader)

1. Solder the wires as shown in the illustration.



## Main Assembly 1-12-(2): Soldering of Lead Wires (for printers with a MICR reader)

1. Solder the wires as shown in the illustration.

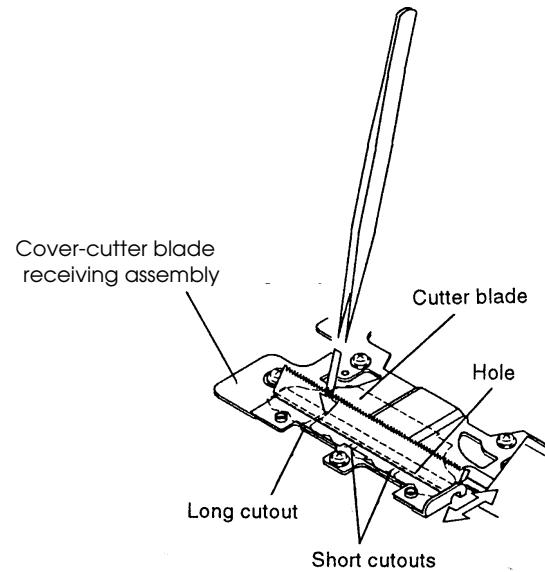


## Adjustments

When servicing or repairing the printer and after replacing any parts, be sure to perform the following adjustments to assure correct operation.

### Adjustment A: Auto-cutter Blade Play

1. Move the cutter blade so that the short cutouts on the blade just disappear when seen from the hole on the cover-cutter blade receiving assembly.
2. Insert tweezers into the long cutout of the blade and verify that there is sufficient play left and right.
3. If there is no play, there must be more than one blade sticking together. Disassemble the auto-cutter unit and separate the blades.

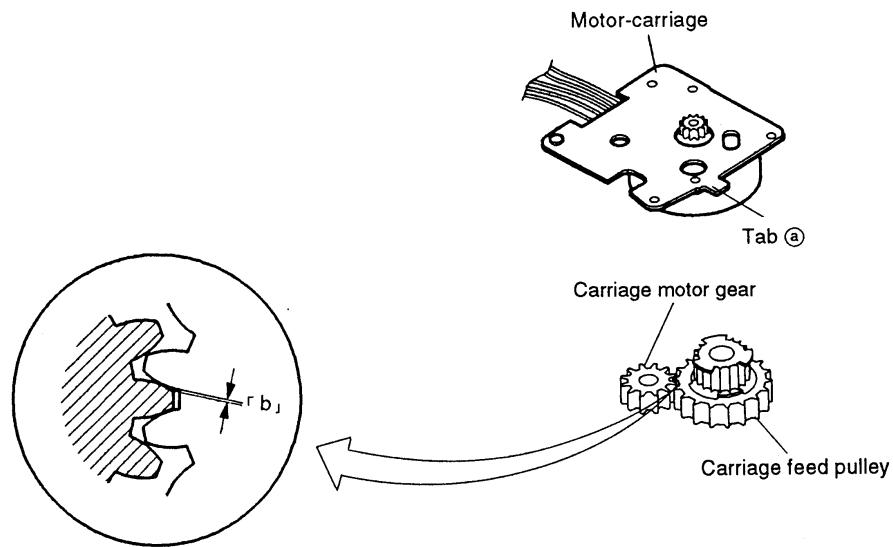


## **Adjustment B: Carriage Motor Gear and Carriage Feed Pulley Backlash**

1. Loosen the fastening screw of the motor-carriage.
2. Move tab ④ of the motor-carriage to adjust the backlash.
3. Tighten the fastening screw of the motor-carriage.

✓ **Checkpoint**

Nominal value:  $b = 0.1 \pm 0.05 \text{ mm (.0039} \pm .0020\text{"})$ .

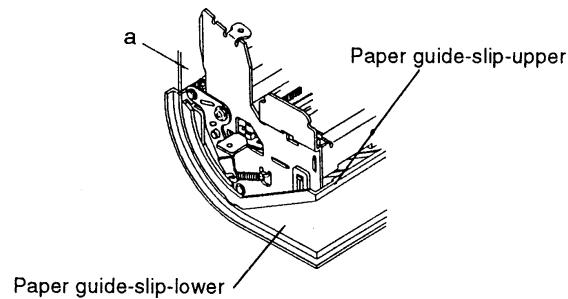
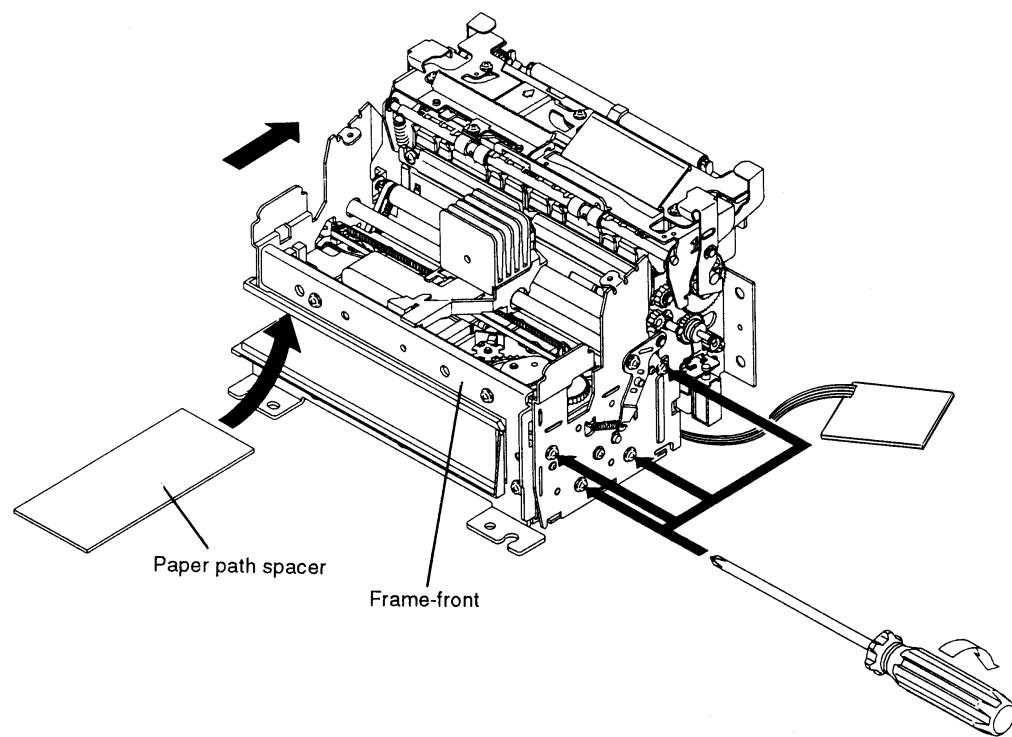


### Adjustment C: Slip Paper Guide

1. Insert the slip paper path spacer between the upper and lower slip paper guides.
2. Push the frame-front in the  direction and tighten the screws firmly.
3. Remove the spacer.

✓ **Checkpoint**

Nominal value:  $a = 2 \text{ mm}$

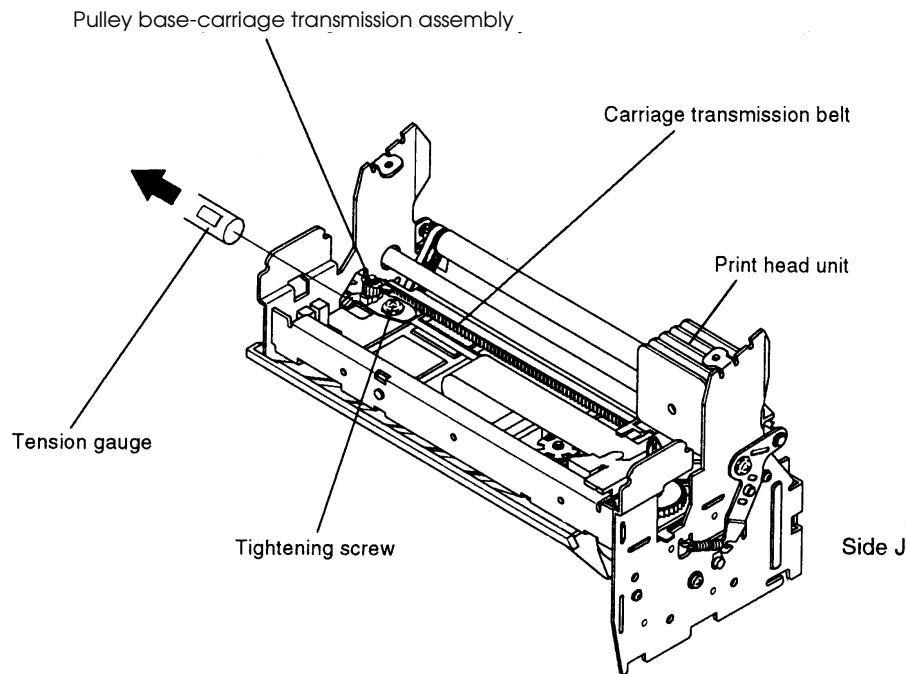


## Adjustment D: Carriage Transmission Belt Tension

1. Move the print head unit to the J side.
2. Loosen the fastening screw of the pulley base-carriage transmission assembly.
3. Apply a tension gauge to the pulley base-carriage transmission and adjust the tension while pulling the base horizontally.
4. Firmly tighten the fastening screw of the pulley base-carriage transmission.

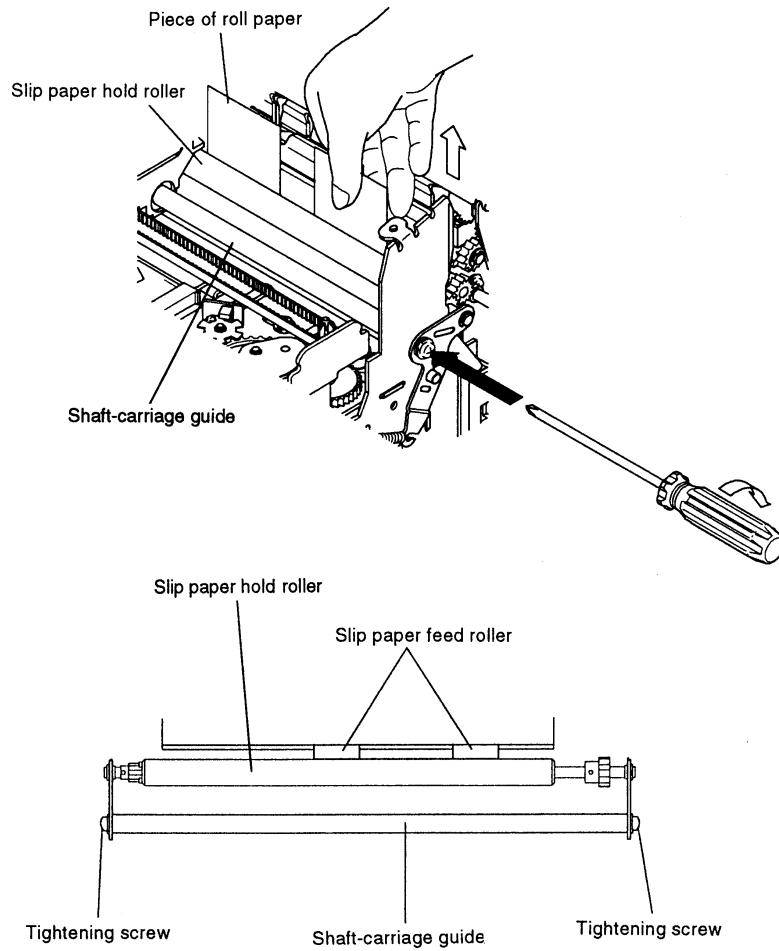
✓ **Checkpoint**

Nominal tension value:  $190 \text{ g} \pm 10 \text{ g}$  (.42 ± .022 lbs)



### **Adjustment E: Slip Paper Feed Parallelism**

1. Insert a piece of roll paper (45 to 55 Kg) 99 to 121 lbs) between the left and right slip paper feed rollers and slip paper hold rollers.
2. Pull out one of the piece of paper and check whether the paper feed amount is identical for each side.
3. If the paper feed amount differs between sides, readjust the carriage guide shaft fastening screw.



## Adjustment F: Print Head Unit and Platen Gap

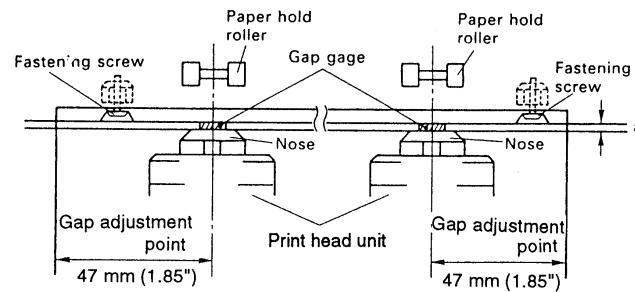
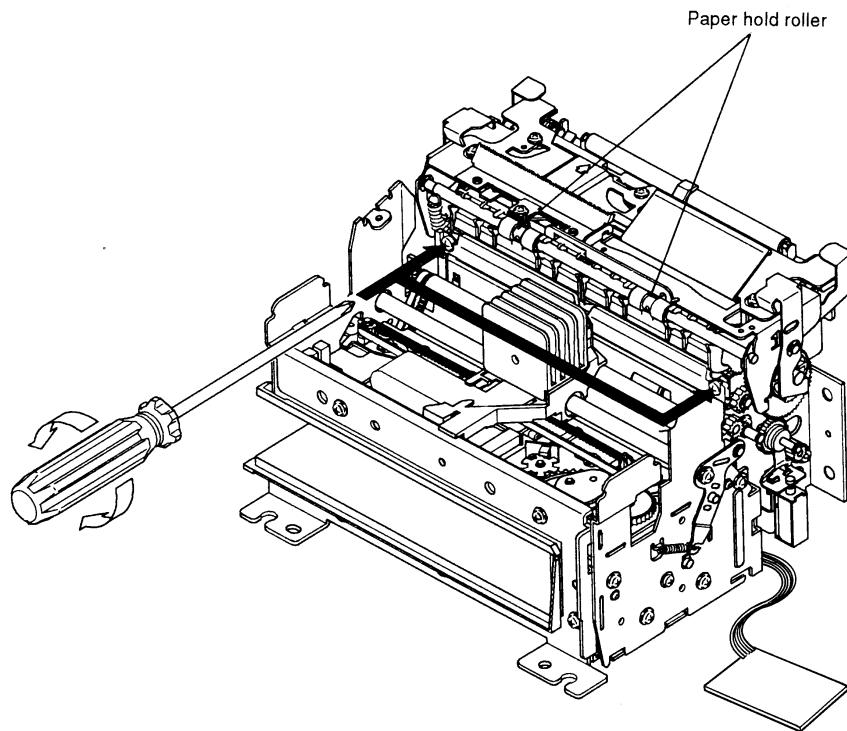
1. Move the print head unit to the two adjustment points (see the illustration below) and perform step 2 for each point.
2. Insert a clearance gauge between the print head unit and the platen, and adjust the gap to get the nominal value by turning the platen assembly fastening screw.

**Note:**

Align the print head nose with the paper hold roller.

✓ **Checkpoint**

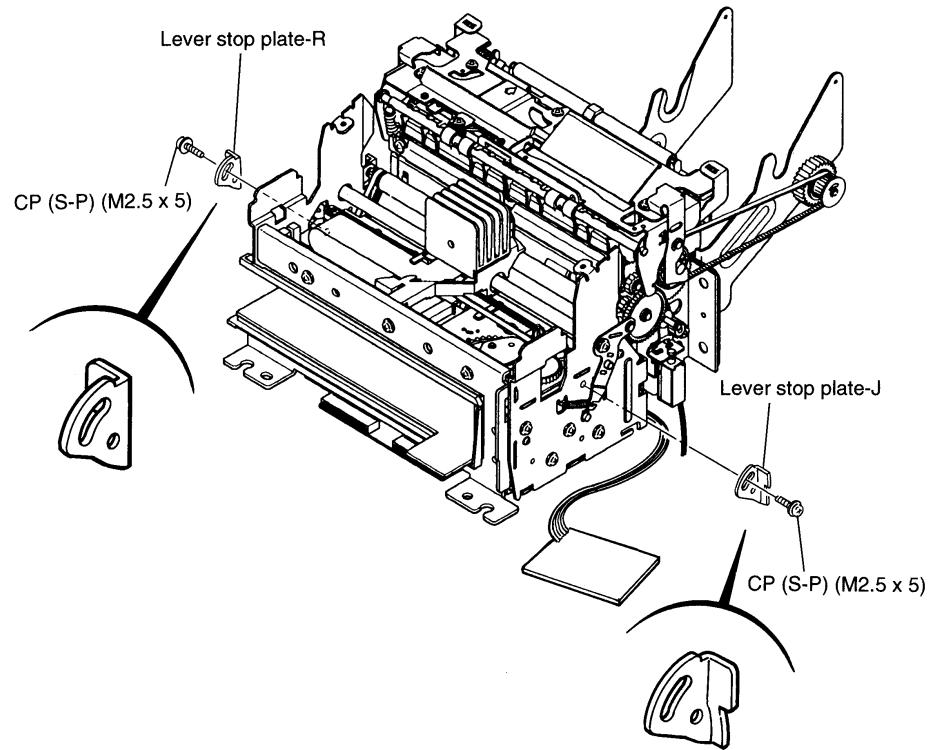
Nominal value:  $a = 0.5 \pm 0.05 \text{ mm (.020} \pm .0020")$



**Main Assembly (Part 2)****Main Assembly 2-1: Attaching lever stop plates-J and -R and adjusting their positions (for printers with a MICR reader)**

Always adjust the following items before carrying out the assembly: (See pages 5-53 - 58.)

- Check the auto cutter blade for looseness. Adjustment A.
  - Adjust the backlash between the carriage motor gear and the carriage feed slip. Adjustment B.
  - Adjust the slip paper guide. Adjustment C.
  - Adjust the tension of the carriage transmission belt. Adjustment D.
  - Adjust the parallelism of the slip paper feed. Adjustment E.
  - Adjust the gap between the print head unit and the platen assembly. Adjustment F.
1. As shown in the illustration below, attach the lever stop plates-J and -R, securing each temporarily with one screw.

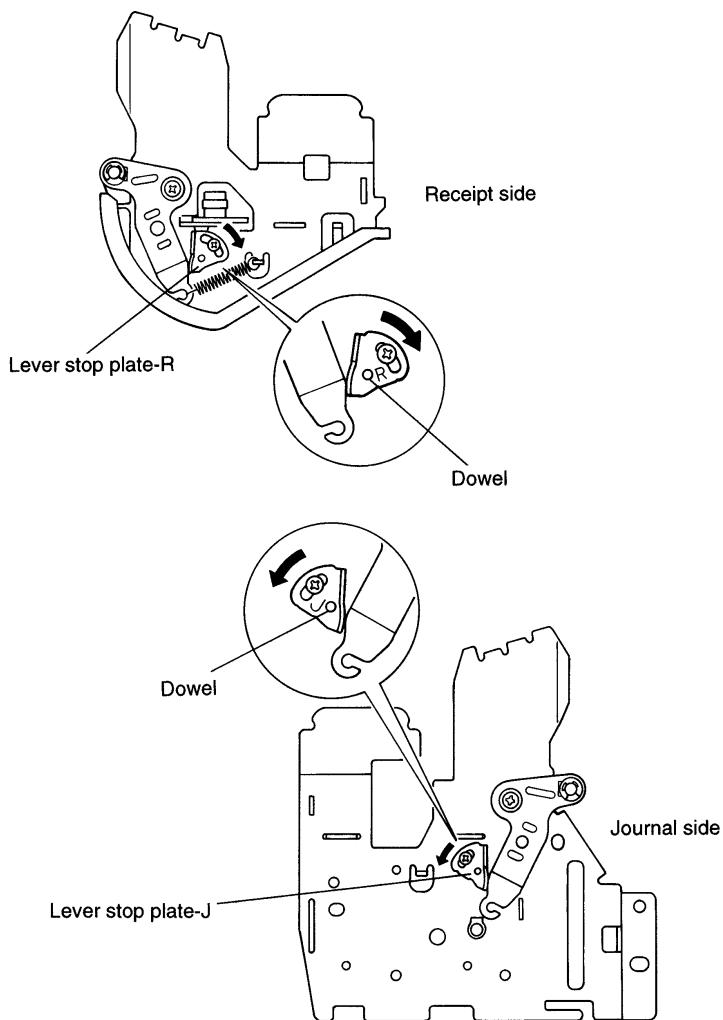


## Main Assembly 2-1:

2. With the dowel at the center, turn lever stop plates-J and -R in the direction of the arrow, until they come in contact with the lever-guide shaft supports-JB and -RB.
3. Secure the lever stop plates-J and -R with the screws so that they cannot move.

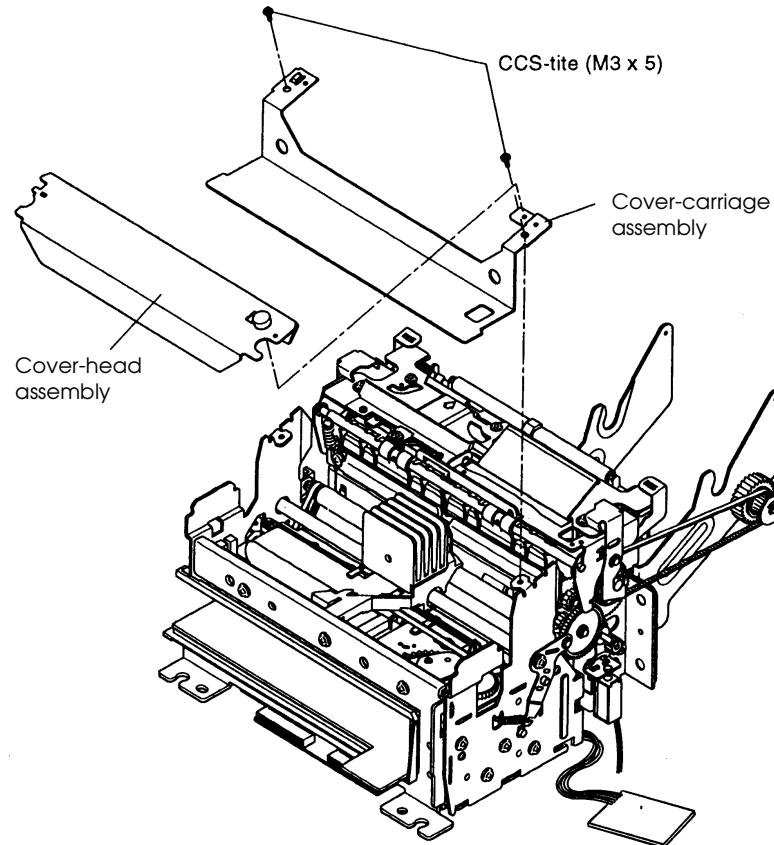
### ✓ Checkpoint

Make sure the lever stop plates-J and -R are in tight contact with the lever-guide shaft supports, so that there is no gap between them. Do not press on the lever-guide shaft supports-JB and -RB when bringing the lever stop plates-J and -R in contact with them..



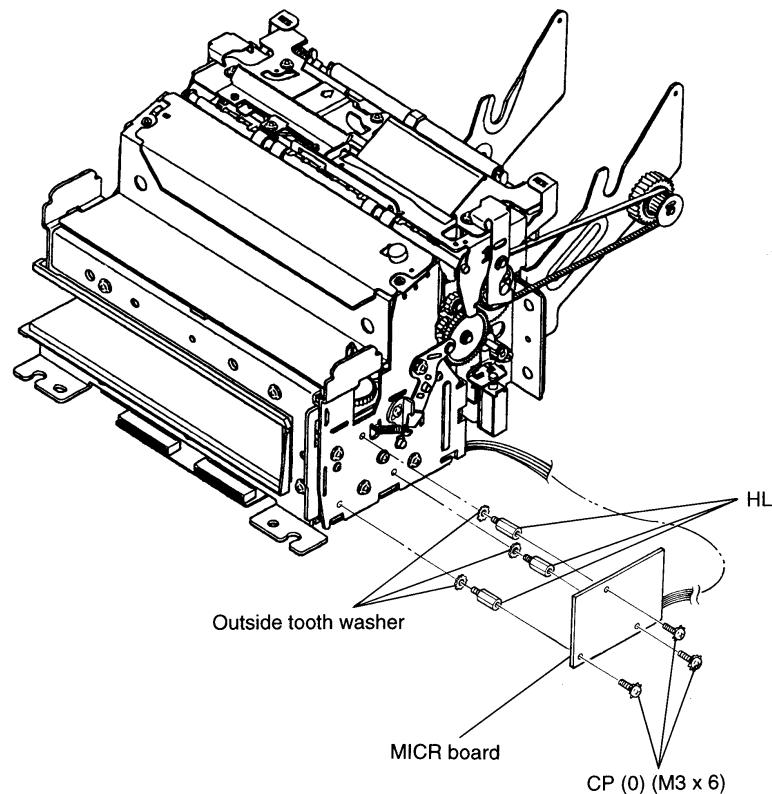
**Main Assembly 2-2: Cover-Carriage Assembly and Cover-Head Assembly Mounting**

1. Mount the cover-carriage assembly on the frame-main assembly and secure it with the screw.
2. Mount the cover-head assembly on the cover-carriage assembly and tighten the facing screw.



## Main Assembly 2-3: Attaching the MICR board (on printers with a MICR reader)

1. Attach the outside tooth washers and the H.L. fittings in the three locations shown in the illustration below.
2. Secure the MICR board with the three screws.

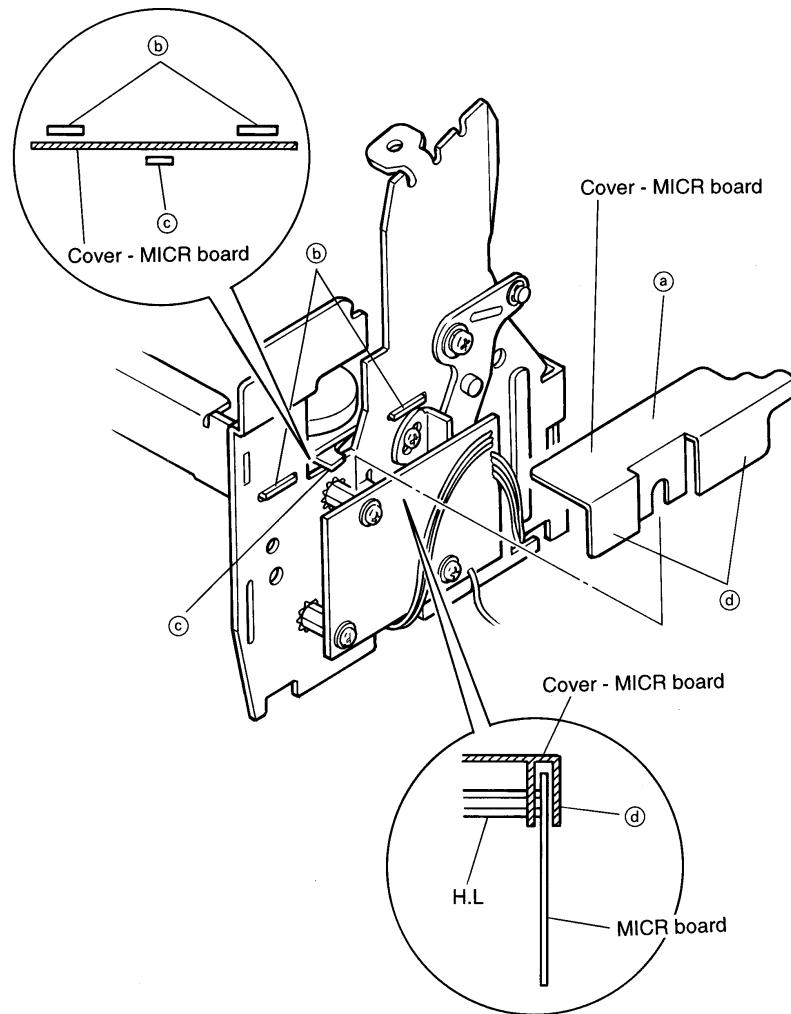


**Main Assembly 2-3:**

3. Bend the cover-MICR board as shown in the illustration (if it is not already bent).
4. Fit the cutaway section of the cover-MICR board into the H.L. as shown in the illustration.

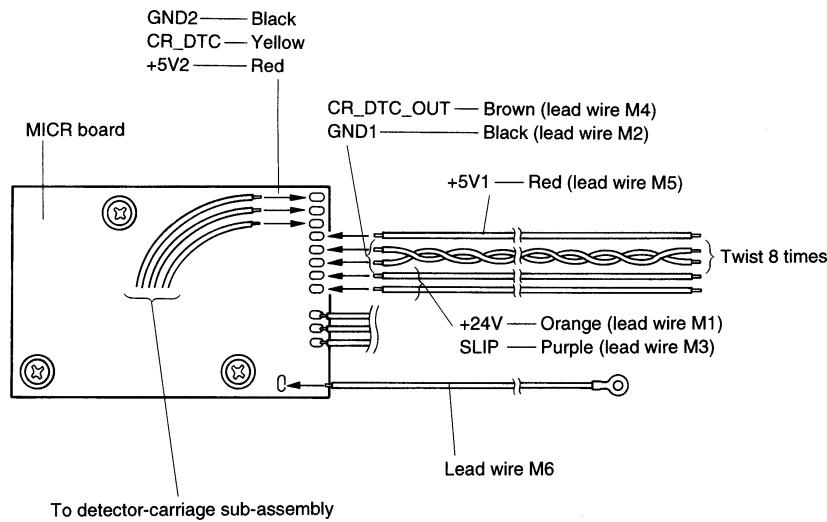
**✓ Checkpoint**

Make sure the sections of the cover-MICR board marked ③ and ④ are positioned as shown in the illustration.

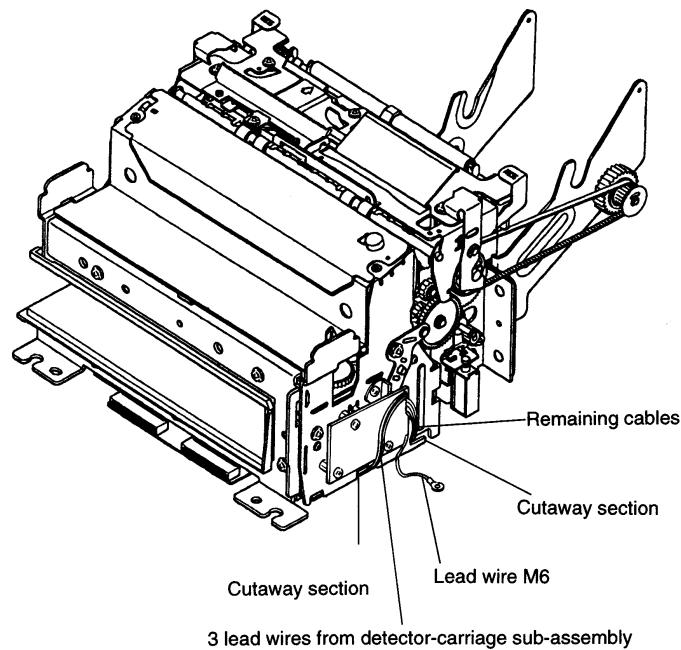


## Main Assembly 2-3:

5. Twist lead wires M2 and M4 eight times, and solder them to the MICR board.
6. Solder lead wires M1, M3, M5, and M6 to the MICR board.
7. Solder the three lead wires from the detector-carriage sub-assembly to the MICR board.



8. Position the lead wires as shown in the illustration below.



## **Whole Unit Assembly**

The assembly process is divided into sub-assembly and main assembly.

Perform the sub-assembly first to construct each unit from the parts. Then proceed to the main assembly.

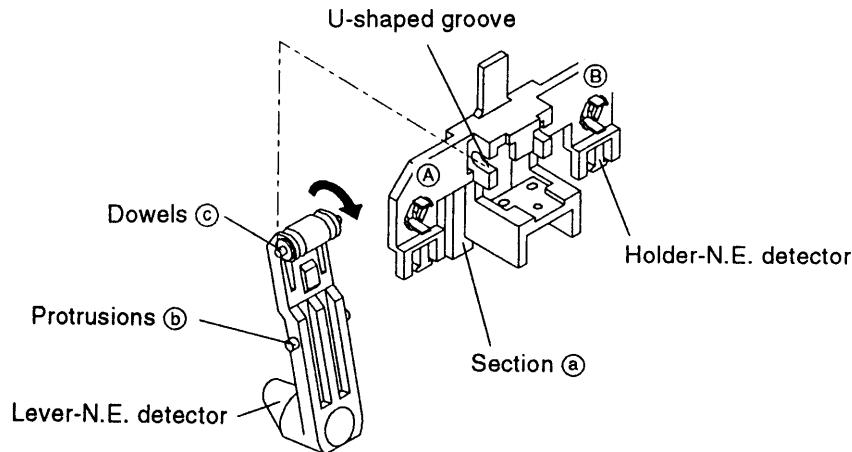
When assembling the printer, check each part and its attachment position by referring to the exploded diagrams in Chapter 6.

For adjustments, follow the descriptions at the end of this chapter. Whenever disassembly is performed even for just one part, check whether adjustment is necessary before assembly.

### ***Sub-assembly***

#### ***Sub-assembly A: N.E. Detector-J Assembly and N.E. Detector-R Assembly***

1. Place protrusions **(b)** of the lever-N.E. detector onto sections **(a)** of the holder-N.E. detector.
2. Align the U-shaped grooves with dowels **(c)** by turning the lever-N.E. detector in the direction of the arrow with protrusions **(a)** as the center.



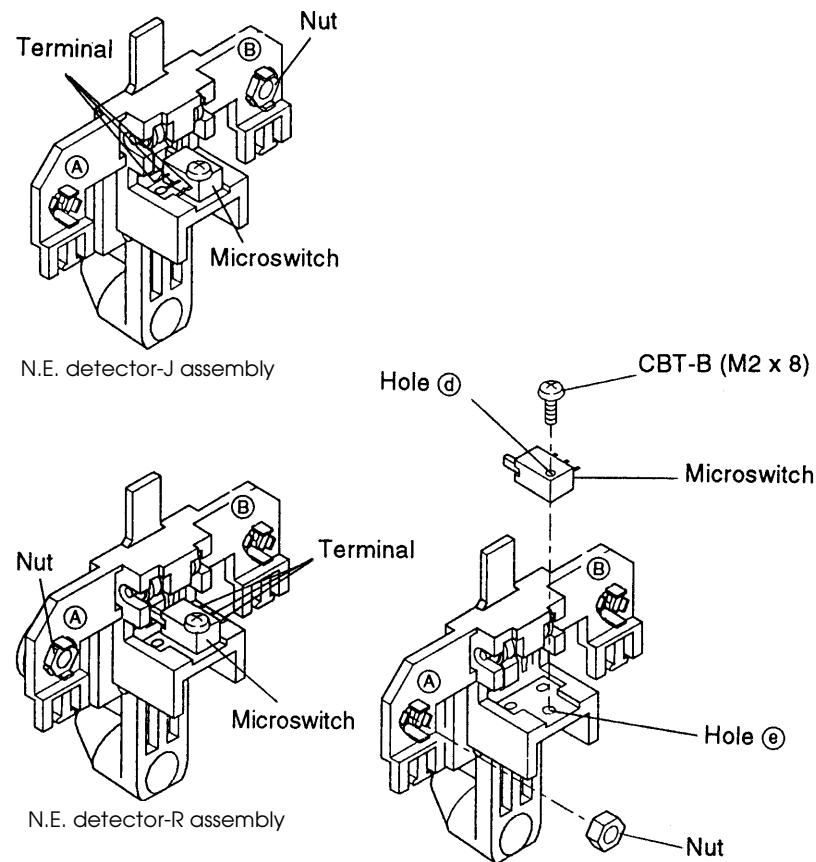
3. Attach the microswitch to the holder-N.E. detection by positioning hole ④ over hole ⑤ ; then secure the switch with the screw.
4. Place a nut on each holder-N.E. detector.

### ✓ Checkpoints

For N.E. detector-J assembly, make sure to attach the nut on the holder marked with ⑥ , and attach the microswitch so that the terminal faces mark ⑦ .

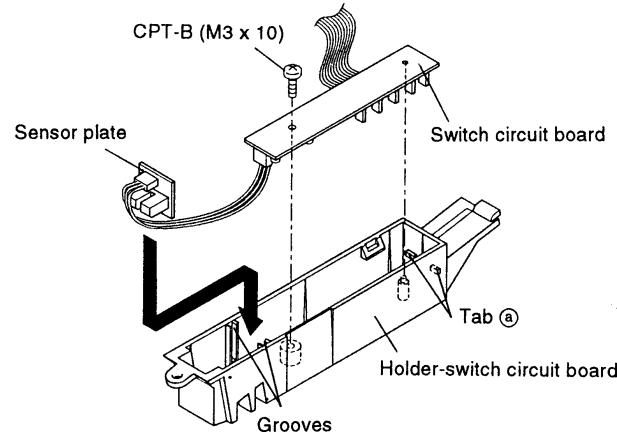
For N.E. detector-R assembly, make sure to attach the nut on the holder marked with ⑧ , and attach the microswitch so that the terminal faces mark ⑨ .

Verify that the nuts are installed correctly with their curved surfaces facing outward.

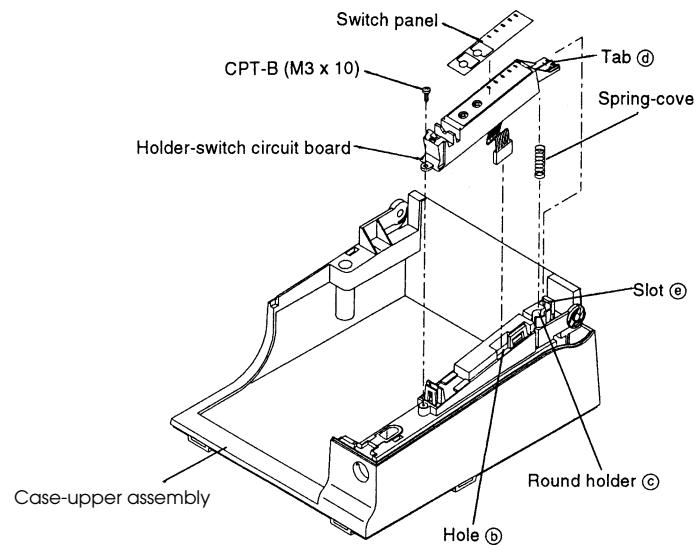


**Sub-assembly B: Holder-Switch Circuit Board Assembly**

1. Attach the switch circuit board to the holder-switch circuit board so that the board comes under tabs ④, and secure the board with the screw.
2. Position the sensor plate by sliding it along the grooves of the holder-switch circuit board and by passing the cables below the plate. Pay attention not to close the sensor with the wires.2

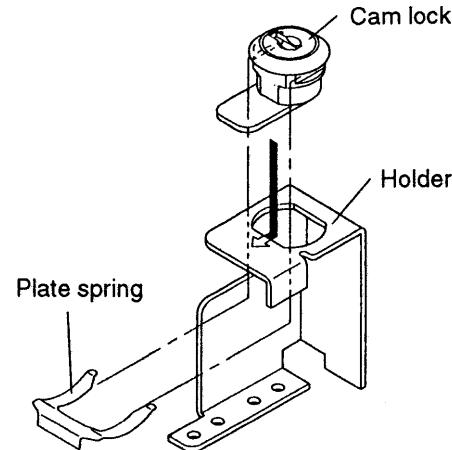


3. Pass the connector and cable through hole ⑤.
4. Place the spring-cover on round holder ⑥ of the case-upper assembly.
5. Mount the holder-switch circuit board on the case-upper assembly by aligning tabs ④ with slot ⑥ and pushing the holder down.
6. Paste the switch panel along the positioning adjustment line of the holder-switch circuit board.

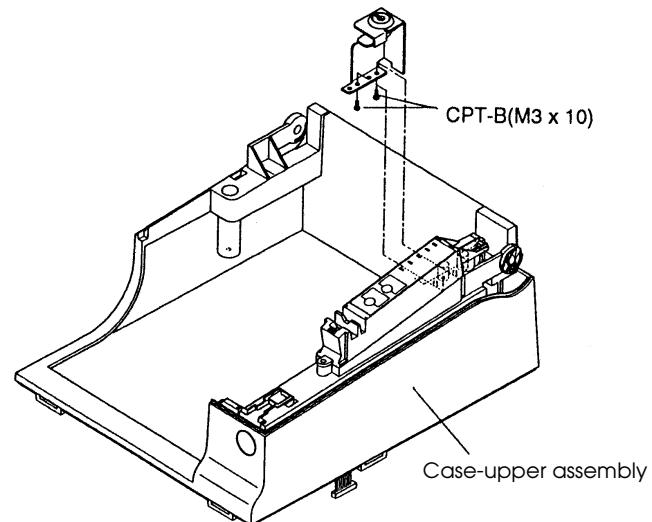


## ***Sub-assembly C: Journal Lock and Cover-Paper Take-up Assembly (Option)***

1. Insert the plate of the cam lock into the hole of the holder.
2. Attach the plate spring to the indents of the cam lock to position it to the holder.

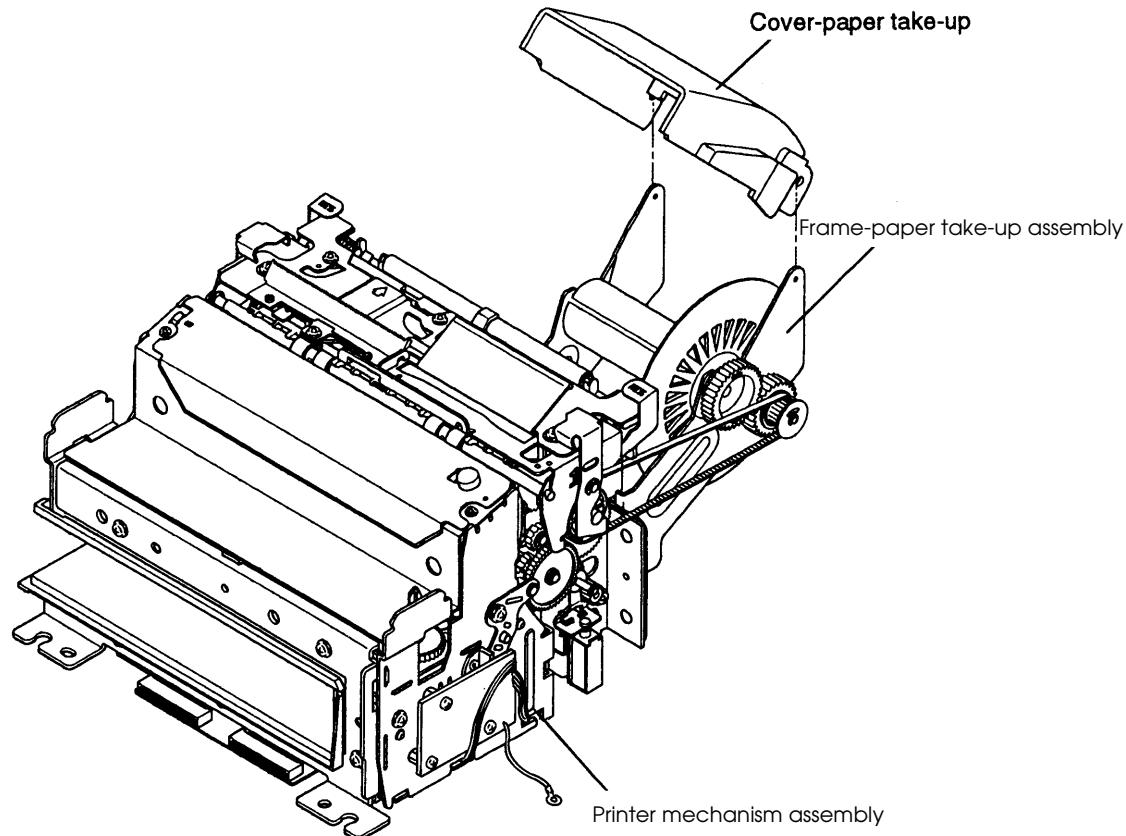


3. Attach the assembled cam lock to the case-upper assembly and secure the cam lock with the screws.



***Sub-assembly D: Cover Paper Take-up***

1. Attach the cover-paper take-up to the frame-paper take-up assembly on the printer mechanism assembly.



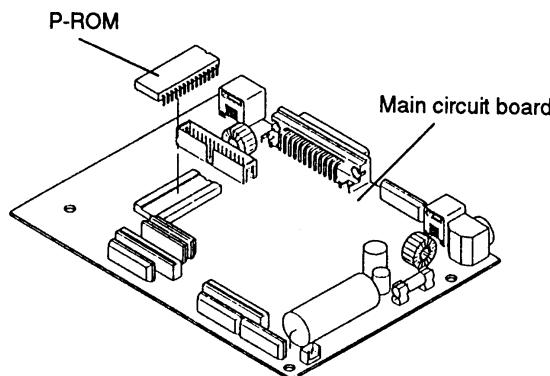
## Main Assembly

### Main Assembly 1: Main Circuit Board, P-ROM, and Plate-Main Mounting

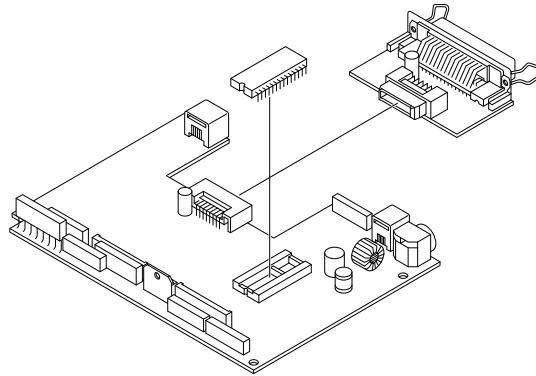
1. Attach the P-ROM to the socket of the main circuit board, matching the U-shaped grooves of the socket to the P-ROM.
2. Attach the interface circuit board to the main circuit board (TM-U950P only).

✓ **Checkpoint**

Make sure not to mistake the direction of the P-ROM.

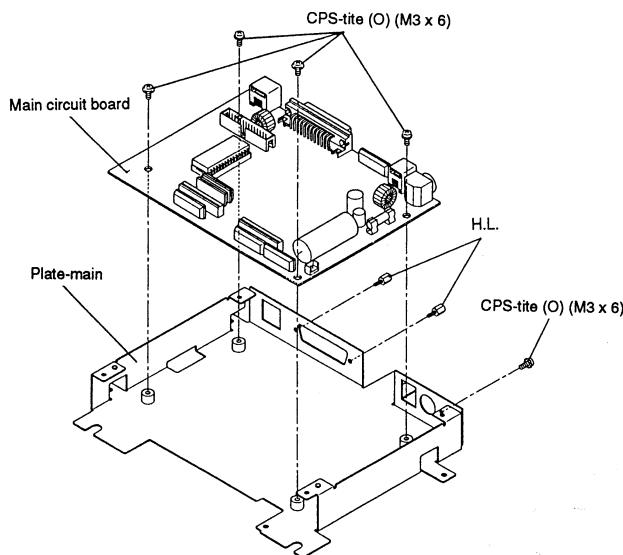


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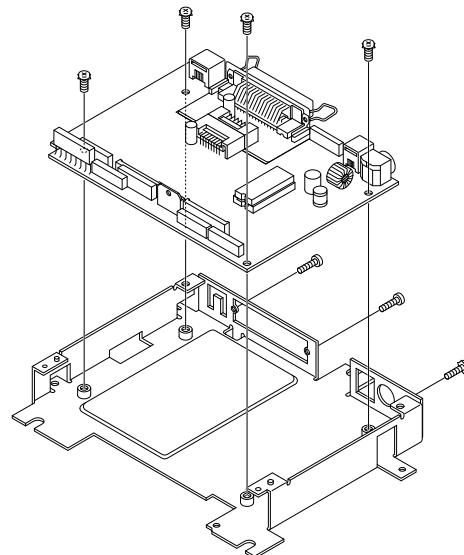


TM-U950P

3. Mount the main circuit board on the plate-main and secure it with four screws.
4. Attach the screws to the interface connector.
5. Attach the screw to the plate-main as a frame ground screw.



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## Main Assembly 2: FFC, Power Cable, and Plate-Circuit Board Attachment

1. Insert two FFCs into connectors CN3 and CN4, and then bend the FFCs as in the illustration.
2. Insert the power cable into connector CN1.
3. Mount the plate-circuit board by aligning its indentations with the tabs on the plate-main.

### ✓ Checkpoint

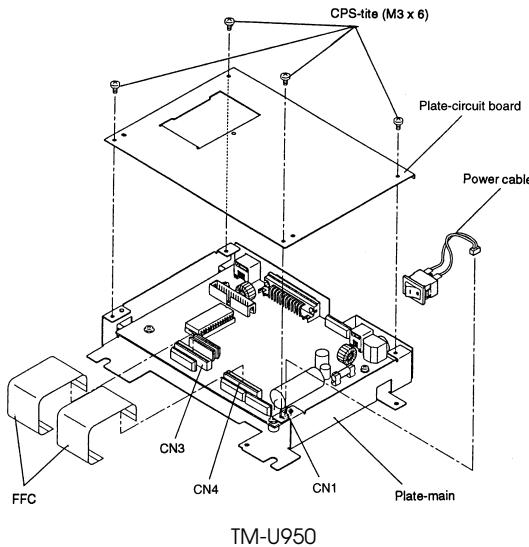
Make sure that the power cable and FFCs are firmly locked into their connectors.  
Make sure not to mistake the direction of the FFCs.

### ⚠ CAUTION:

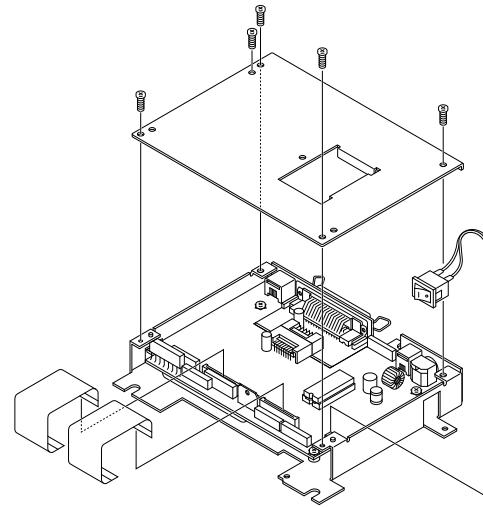
*When you disconnect the FFCs from their connectors, be sure to pull them out straight. Otherwise you may damage the connector pins.*

### ⚠ CAUTION:

*When unplugging the FFC from the mechanical assembly, pull it straight, and not at an angle.  
Pulling it at an angle can damage the pins of the connector.*



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## Main Assembly 3: Printer Mechanism Assembly Attachment on Plate-Main

1. Turn over the assembled plate-main.
2. Gently place the printer mechanism assembly on the plate-main by aligning holes ① with dowels ② .

### ✓ Checkpoints

Position the three cables (marked ③ in the illustration) so that they are aligned with the cutaway section ④ . If the cables are not positioned properly, short circuits may occur, and the circuit board may be damaged.

3. Insert the two FFCs on the plate-main into the connectors on the printer mechanism assembly.
4. Mount the spacer-vibration assemblies in the U-shaped grooves of the plate-main.

### ✓ Checkpoints

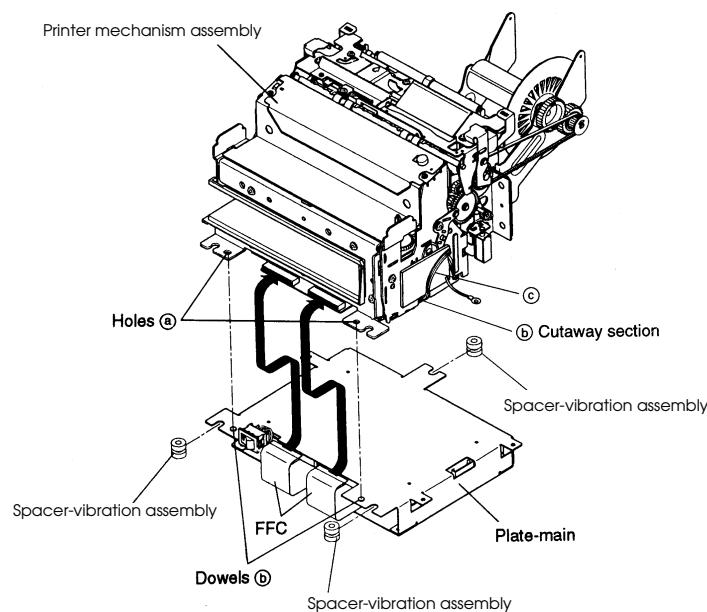
Be sure to mount the spacer-vibration assemblies so that the rubber side faces up. Make sure that the FFCs are firmly locked into their connectors.

## ⚠ CAUTION:

*When you disconnect the FFCs from its connectors, be sure to pull it out straight. Otherwise you may damage connector pins.*

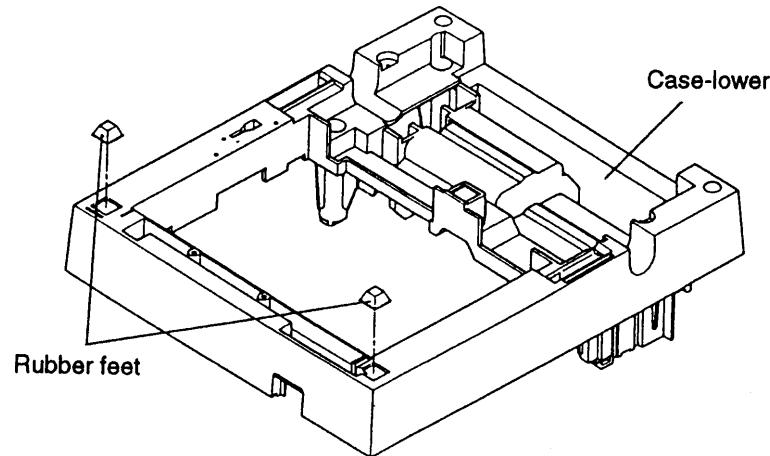
## ⚠ CAUTION:

*When unplugging the FFC from the mechanical assembly, pull it straight, and not at an angle. Pulling it at an angle can damage the pins of the connector.*

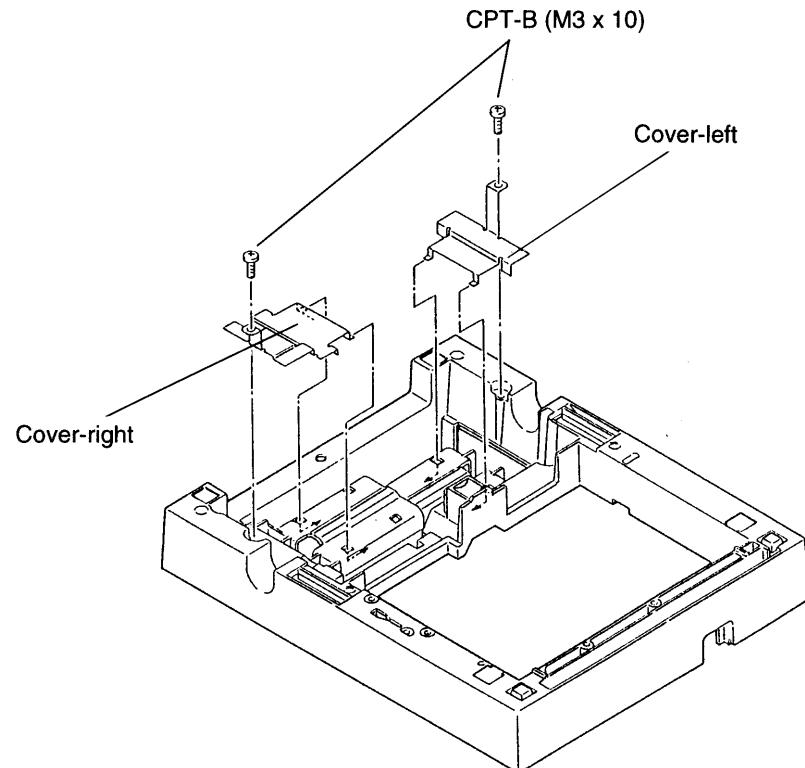


**Main Assembly 4: N.E. Detector-R and -J Assemblies Attachment**

1. Turn over the case-lower, remove any dust and dirt from the rubber foot mounting locations, and paste the feet in these locations.

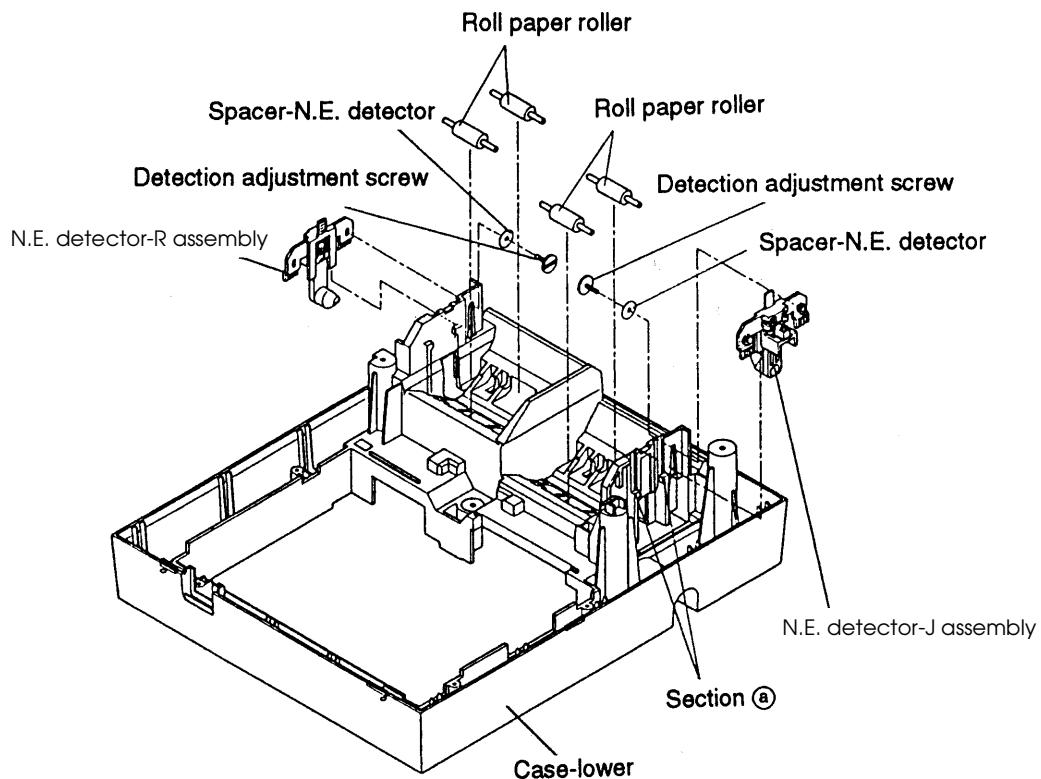


2. Attach the cover-right and cover-left to the underside of the case, and secure it with screws.



3. Attach the roll paper rollers to the case-lower.
4. Attach the spacers-N.E. detector to the detector adjustment screws.
5. Attach the N.E. detector-R assembly and -J assembly to the case-lower by sliding section ⑧ ; then secure them with the assembled detector adjustment screws.

*[Adjustment] Adjust the N.E. detectors. Refer to Adjustment G at the end of this chapter.*



**Main Assembly 5: Printer Mechanism Assembly Attachment on Case-Lower Assembly**

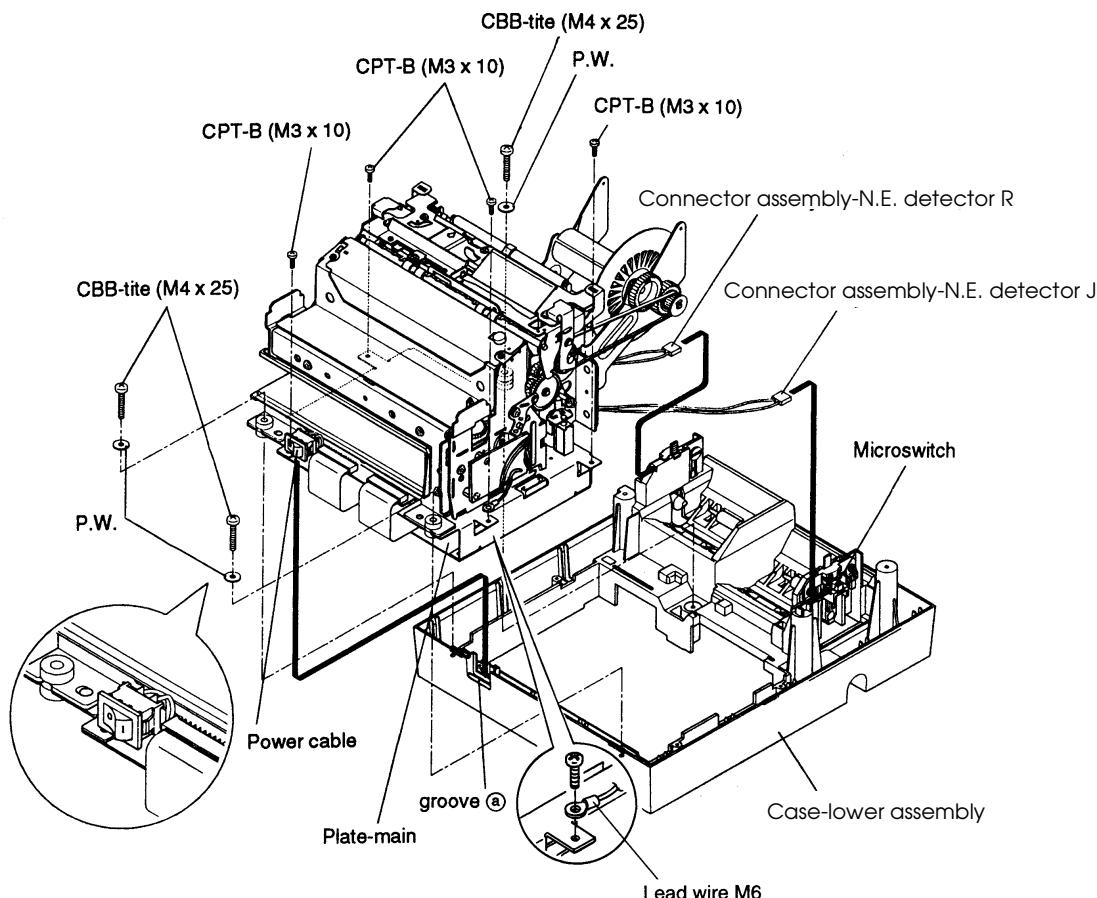
1. Gently place the printer mechanism assembly on the case-lower assembly.
2. Attach the power switch to groove <sup>Ⓐ</sup>.
3. Connect the connector assembly N.E. detector-J and -R from the printer mechanism assembly to the microswitches.
4. Secure the printer mechanism assembly with the screws and washers. If the printer has a MICR reader, secure lead wire M6 with a screw, as shown below.

**✓ Checkpoints**

Be sure to attach the power switch in the proper direction.

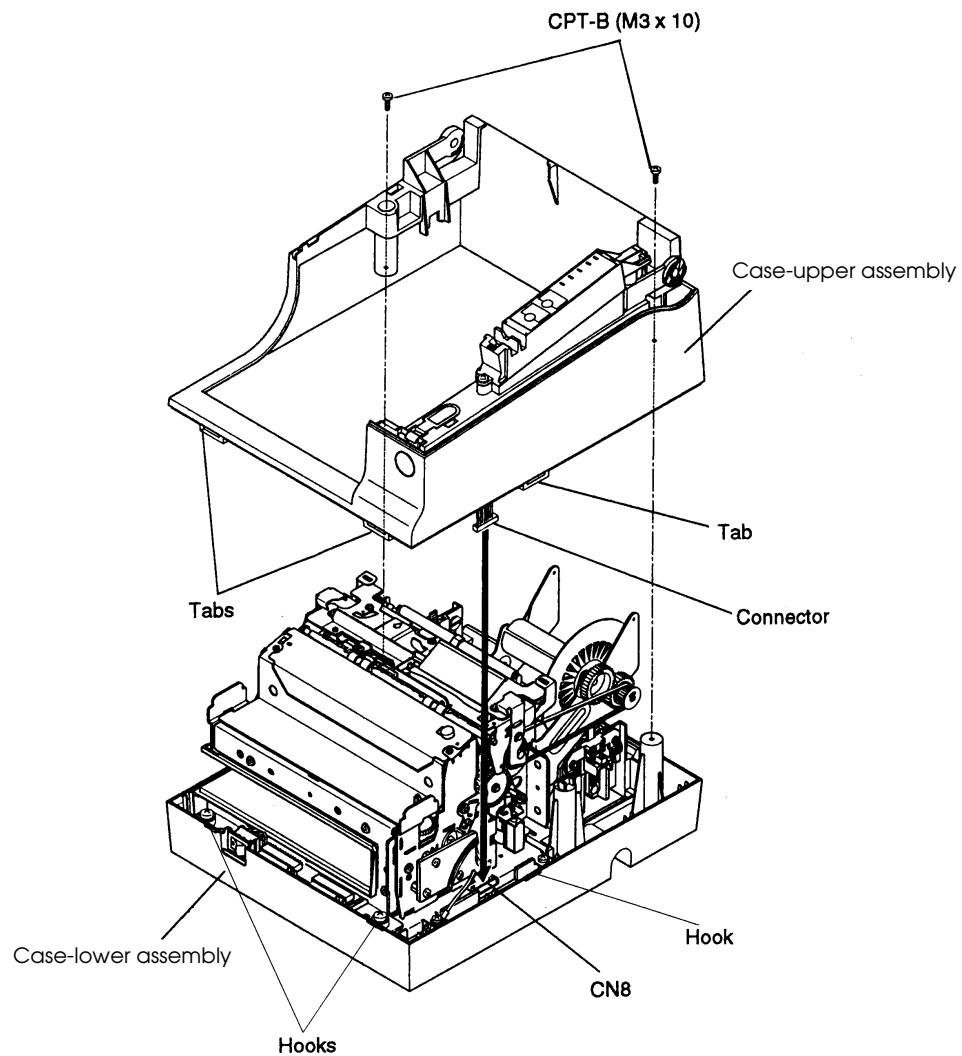
Make sure that each cable is firmly connected to its corresponding microswitch.

Be sure that the power cable is not caught between the plate-main and the case-lower assembly.



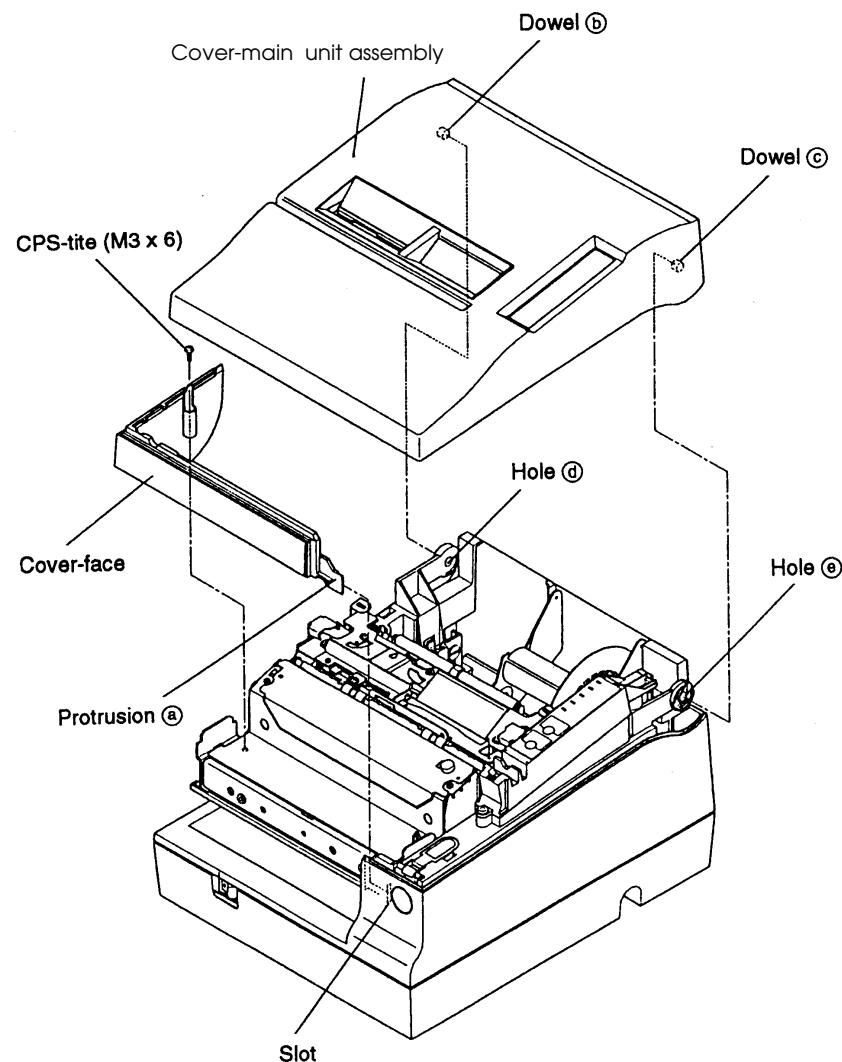
## Main Assembly 6: Case-Upper Assembly Mounting

1. Connect the cable from the switch circuit board to the CN8 on the main circuit board unit.
2. Mount the case-upper assembly on the case-lower assembly by hooking the three tabs on the case-upper assembly to the three hooks on the case-lower; then secure the case-upper with two screws.



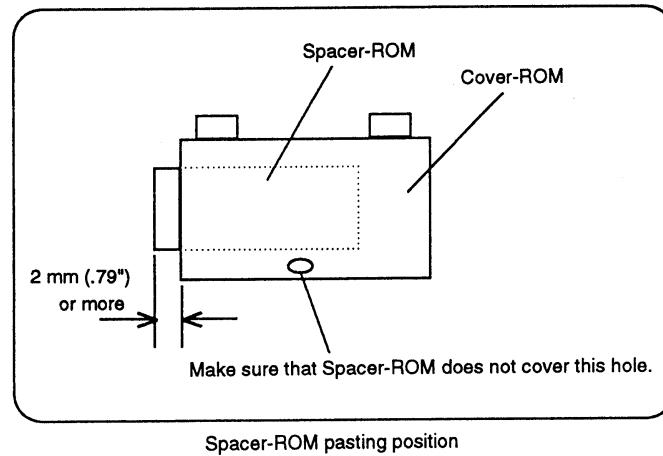
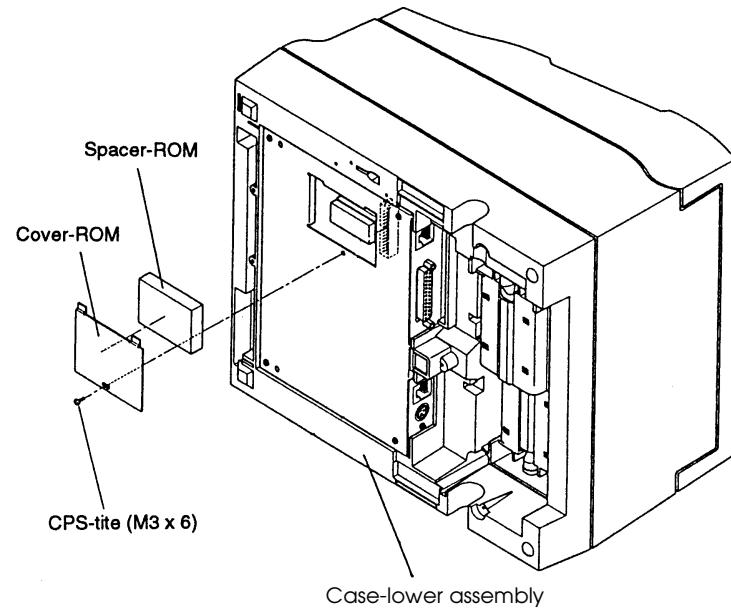
**Main Assembly 7: Cover-Face and Cover-Main Assembly Attachment**

1. Insert protrusion ④ on the cover-face into the slot of the printer mechanism assembly; then secure the cover with the screw.
2. Attach the cover-main unit assembly to the printer mechanism assembly by aligning holes ① and ⑤ with dowels ④ and ⑥.



## Main Assembly 8: Cover-ROM Attachment

1. Secure the cover-ROM with the screw.

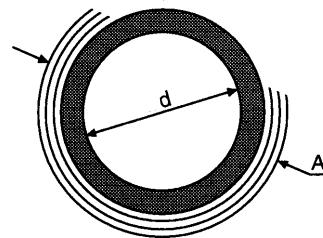


## **Adjustments**

### **Adjustment G: Adjusting the Paper Roll Near-end Detector Location**

Adjust the remaining paper roll amount to be detected as the near end by following the instructions below, because the amount differs depending on the inner and outer diameter of the paper roll core.

1. Use a paper roll for which the inner diameter of the paper core is 10 mm (.394") or more.
2. Select a near-end thickness A, which is the thickness of the paper core including the remaining paper roll, according the chart below.



*The dimension A values in the table are obtained by calculation only. Therefore, they may not be appropriate for all printers.*

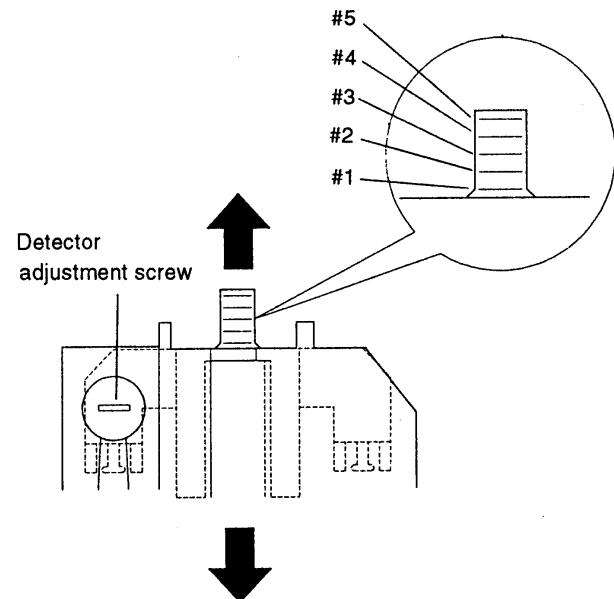
*When a red end mark is painted on the end of the paper roll, the entire roll may be pulled up because the end mark acts as an adhesive. In this case, dimension A is not correct.*

*If the paper on the paper roll becomes loose due to the paper quality, the paper roll near-end detector may operate incorrectly.*

| Dimension A   | Adjustment position |
|---------------|---------------------|
| 10 mm (.394") | #1                  |
| 8 mm (.315")  | #2                  |
| 6 mm (.236")  | #3                  |
| 4 mm (.157")  | #4                  |
| 2mm (.079")   | #5                  |

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3. Loosen the detector adjustment screws on both receipt and journal sides, and place the selected line of the N.E. detector-R and -J assembly so that the appropriate adjustment value is obtained.
  4. After the adjustment, check that the lever-N.E. detector moves smoothly.



**Adjustment H: Detector-Slip Insertion Assembly Threshold Value Adjustment**

After replacing detector-slip insertion assembly, main circuit board, or printer mechanism assembly, be sure to perform the following adjustment to assure correct operation of the printer.

| Step | Printer Operation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | User Operation                                                                                                                                                                                                                                                                                                                                     |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | <b>Preparing to enter special setting mode</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Set DIP switch 6 of switch bank 2 to off.                                                                                                                                                                                                                                                                                                          |
| 2    | <b>Enter special setting mode</b><br>Prints the following message when user operation 1 to 4 is finished.<br><div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> *****Special Setting Mode*****<br/> This mode is used for<br/> changing internal setting mode.<br/> Turn off the power, if not necessary. </div>                                                                                                                                                                                                                                           | Execute the following steps 1 to 4.<br>1 Open the cover-main assembly. Turn on the printer while pressing both the RECEIPT FEED and JOURNAL/SLIP FEED buttons.<br>2 Release RECEIPT FEED button then JOURNAL/SLIP FEED button.<br>3 Press RECEIPT FEED button or JOURNAL/SLIP FEED button more than six times.<br>4 Close the cover-main assembly. |
| 3    | <b>EEPROM read/write test</b><br>Prints the following message after the test depending on the result.<br>When no error was found:<br><div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> (1) EEPROM Read/Write Test is completed. </div> When error was found:<br><div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> (1) EEPROM Read/Write ERROR!!<br/> EEPROM process STOP. </div>                                                                                                                                                     | This is an unrecoverable error. Reset the printer and confirm that the initialization is executed correctly. Replace the main circuit board if this error message is still printed after executing the adjustment two times.                                                                                                                       |
| 4    | <b>EEPROM threshold value check</b><br>Checks the threshold value in EEPROM, and prints the following message.<br><div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> (2) SLIP IN DETECTOR THRESHOLD VALUE<br/> in the EEPROM : ( ** ) </div><br>(** shows threshold value in hexadecimal.)                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                    |
| 5    | <b>Detection value measurement without slip paper</b><br>Measures the slip paper insert detection value without slip paper. The result is printed as follows:<br><div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> (3) A/D-converted value<br/> Paper OUT : ( ** ) </div><br>(** shows detection value in hexadecimal.)                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                    |
| 6    | <b>Detection value measurement with slip paper</b><br>Measures the slip paper insert detection value with slip paper, and prints the following message.<br><div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> (4) Please SET paper<br/> on SLIP IN detector position.<br/> If ready, Press panel switch. </div><br>Prints the detection value of the measurement as follows:<br><div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> (5) A/D-converted value<br/> Paper IN : ( ** ) </div><br>(** shows detection value in hexadecimal.) | When message (4) is printed, insert the slip paper in the slip paper insert detection position, and press either panel operation button.                                                                                                                                                                                                           |

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| Step | Printer Operation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | User Operation                                                                                                                                                                                                                                                                          |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7    | <p><b>Is the measure value correct?</b><br/>           Confirms if the measured detection value is correct, and prints message as follows depending on the result:<br/>           When the value is correct:<br/>           (6) The measured value is available.</p> <p>When the value is not correct:<br/>           (6) The measured value is NOT AVAILABLE.<br/>           Special setting mode is finished.</p>                                                                                                                                                                                                                                                                              | <p>There might have been some mistakes of user operation. Go to step 1 and execute the adjustment again. Replace the detector-slip insertion assembly if this error message is still printed after executing the adjustment two times.</p>                                              |
| 8    | <p><b>Find and set threshold value</b><br/>           Calculates and sets the threshold value for both cases of with and without paper using the detected values. The threshold value set is printed as follows:<br/>           (7) Threshold value : ( ** )</p> <p>(** shows threshold value in hexadecimal.)</p>                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                         |
| 9    | <p><b>Write threshold value in EEPROM</b><br/>           Prints the following message.<br/>           (8) Please REMOVE paper<br/>           for writing value into the EEPROM</p> <p>Writes the threshold value in EEPROM when the slip paper is removed. Confirms whether the value is written correctly, and prints the following message depending on the result.<br/>           When the value is written correctly:<br/>           (9) Writing is completed.<br/>           Threshold value : ( ** )</p> <p>(** shows threshold value in hexadecimal.)<br/>           When the value is written correctly:<br/>           (9) EEPROM Write ERROR!!<br/>           EEPROM process STOP.</p> | <p>Remove the slip paper from the printer</p> <p>This is an unrecoverable error. Reset the printer and confirm if the initialization is executed correctly. Replace the main circuit board if this error message is still printed after executing the adjustment a couple of times.</p> |
| 10   | <p><b>End special setting mode</b><br/>           Prints the following message and ends special setting mode. The printer automatically enters printing mode when special setting mode is finished.<br/>           Please turn ON DIP SW 2-6.<br/>           Special setting mode is finished.</p>                                                                                                                                                                                                                                                                                                                                                                                               | <p>Set DIP switch 6 of the switch bank 2 to off after the message is printed.</p>                                                                                                                                                                                                       |

**Note:**

During the special setting mode, the printer checks several times that DIP switch 2-6 is off. If the switch is on, the printer prints the following message and ends special setting mode.

EEPROM is write-protected!!  
 Special setting mode is finished.

## Adjustment I: MICR mechanism check

Follow the procedure below to check the MICR mechanism. Make sure to install paper rolls before performing the check. For the checking, please use paper that meets specifications.



### Note:

\* marks may be printed after the measurement values. But ignore the marks and check according to each standard value.

#### 1. Entering the MICR test mode

1. Install paper rolls on both the journal and receipt side, and turn the printer power off.
2. Open the printer cover, and turn the printer power on while pressing the JOURNAL/SLIP FEED button.
3. Press the JOURNAL/SLIP FEED button at least 3 times, and close the printer cover.

Printer prints the following message and the SLIP LED flashes.

\*\*\* TEST PRINT MODE \*\*\*

(1) Magnetic ink character  
reading check.  
Please set personal check.  
If you want to cancel  
check waiting,  
press SLIP FEED button.

#### 2. Magnetic character recognition test

Perform the test with the check sheet on the market.

1. Set the check sheet to the printer.
2. Remove the sheet after the printer recognized the sheet.

The printer prints the following messages:



### Notes:

*It may take a while for the printer to start printing.*

*The printer prints either E13B or CMC7 according to the characters on the sheet.*

(2) Reading result.

E13B: [52525252525,  
252525252525,  
5252]  
CMC7: [??????????,  
??????????,  
????]

(3) Noise reading check.

Please set paper without  
Magnetic ink printing.

If you want to cancel  
paper waiting,  
press SLIP FEED button.

Perform the following according to the recognition result:

- When "?" is printed sporadically

MICR mechanism may be dirty. Clean(\*1) the magnetic head and head holding roller.  
Go on to the next test if "?" are still printed after the cleaning.

- When "?" is printed continuously

MICR mechanism may be dirty or be damaged. Clean(\*1) the magnetic head and head holding roller. Go on to the next test if "?" are still printed after the cleaning.

(\*1) To clean the head holding roller, insert the roller cleaning sheet by EPSON into the printer. To clean the magnetic head, insert the magnetic head cleaning sheet into the printer. For the cleaning sheets, refer to the Check sheet specification later in this section.

If you don't proceed to the next test, press SLIP FEED button to skip the test, or turn the printer power off to quit the test.

The tests numbered 3 and 4 are to check the MICR mechanism functions. For the tests, use the specified sheets. See page 5-86.

### 3. Noise test

Noise level of the MICR mechanism is checked. Some sheets may have magnetic ingredients, so please use the specified sheet.

1. Set the card-M by EPSON to the printer.
2. The printer starts noise check, and prints the results as follows:

#### (4) Checking result

|                      |                                                                            |
|----------------------|----------------------------------------------------------------------------|
| MAX=*.** [V]:        | Noise wave maximum value.                                                  |
| MIN=*.** [V]:        | Noise wave minimum value.                                                  |
| P-P=*.** [V]:        | Difference between the maximum and minumum value.<br>Standard: under 0.40V |
| mean=*.*** [V]:      | Noise wave average. Standard: 2.5 +/- 0.1 V                                |
| $\sigma$ =*.*** [V]: | Noise wave standard declination. Standard: under 0.045 V                   |

#### (5) Wave form check. (1st)

Please set check with  
magnetic ink calibration.  
If you want to cancel  
calibration check waiting,

press SLIP FEED button.

If P-P, mean, or  $\sigma$  value is over the standard value, MICR mechanism may be dirty.  
Clean(\*1) the magnetic head and head holding roller.

(\*1) To clean the head holding roller, insert the roller cleaning sheet by EPSON to the printer. To clean the magnetic head, insert the magnetic head cleaning sheet to the printer. For the cleaning sheets, refer to the Check sheet specification later in this section.

#### 4. Output voltage test

The output voltage level at the magnetic character reading is checked. Use E13 side when performing the test.

1. Set the calibration check sheet by EPSON to the printer.

2. Printer starts the test, and prints the result as follows:

(6) Checking result

Peak level

upper

MIN=\*.\*\* [V] Output voltage minimum value at upper side. Standard: above 3.0 V

P-P=\*.\*\* [V] Output voltage difference between maximum and minimum value. Standard: below 1.2 V

lower

MAX=\*.\*\* [V] Output voltage maximum value at lower side. Standard: below 2.0 V

P-P=\*.\*\* [V] Output voltage difference between maximum and minimum value. Standard: below 1.2 V

(7) Wave form check. (2nd)

Please set check with

magnetic ink calibration.

If you want to cancel

calibration check waiting,

press SLIP FEED button.

If the values are out of the standard, the magnetic head may be dirty or the MICR mechanism may be damaged. Insert a magnetic head cleaning sheet to the printer to clean the head. If the output voltage value is out of the standard value but the noise level is within the standard value, disassemble the printer to check the magnetic head and paper holding roller.

Please note that all of the MAX, MIN and P-P values are printed for upper and lower side if the printer's ROM version is 1.00 ESC/POS. But only the items in the printing result sample shown above is required. Also the pitch value is printed, but ignore the value as it is not needed.

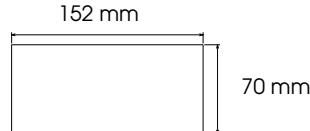
Press SLIP FEED button to end the test.

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## *Check sheet specification*

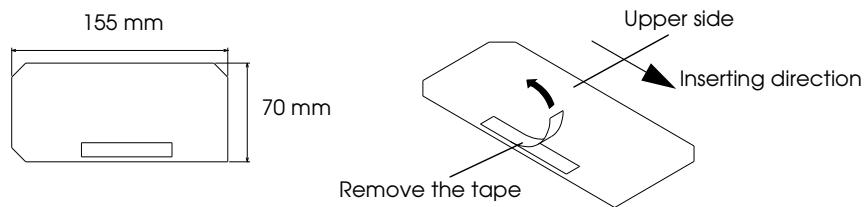
Please use the following sheets for the MICR test and cleaning.

- Seiko Epson card-M (code: 102590100).

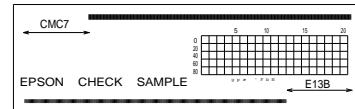


- Seiko Epson roller cleaning sheet (code: 102590200).

Remove the tape as shown before you use the sheet.



- Seiko Epson calibration check sheet (code: 102590000)



- Magnetic head cleaning sheet

Recommendation: PRESAT brand (KIC) Check-Reader Cleaning Card or equivalent

## Chapter 6

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## Appendix

### **Electrical Circuit Drawings**

#### **Main board**

Main circuit board contains circuit 1 to circuit 8 and main circuit which are shown in the following pages.

Figure 6-1 indicates the main circuit board block diagram.

Circuit 1 to circuit 8 are included in the main circuit.

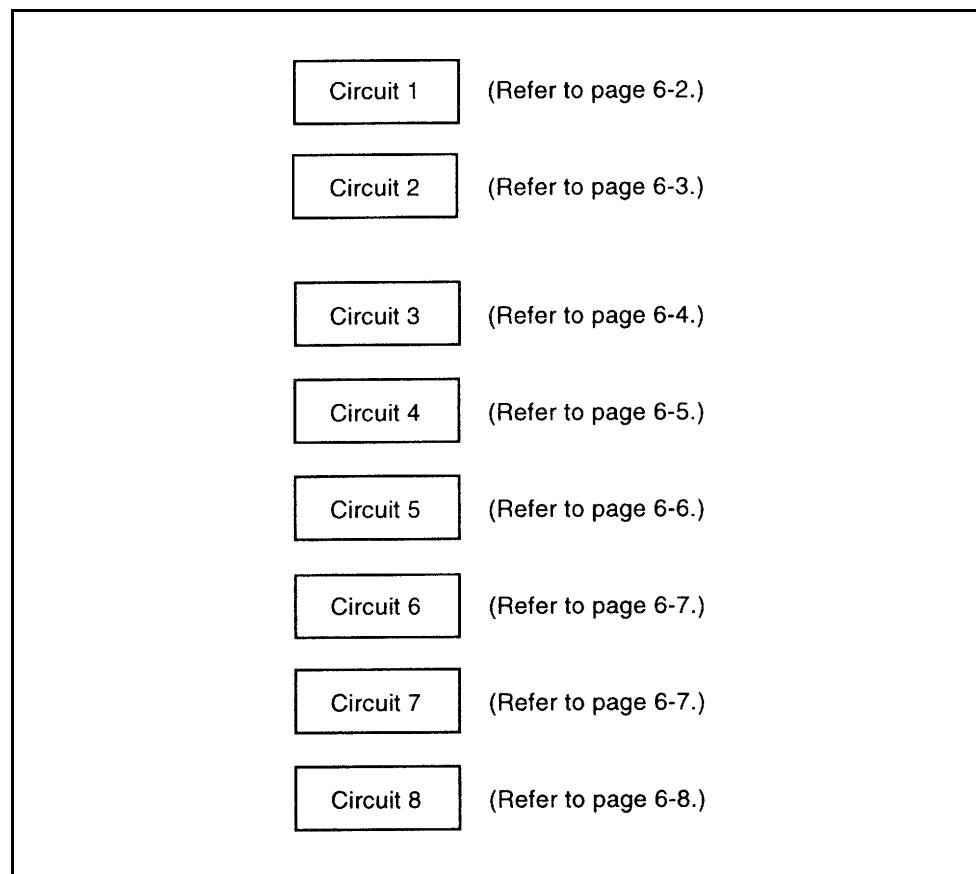
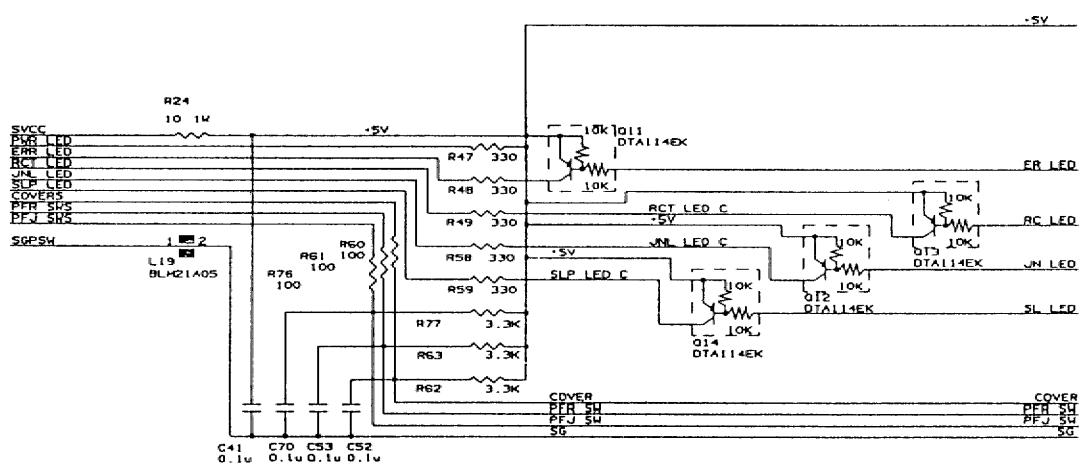


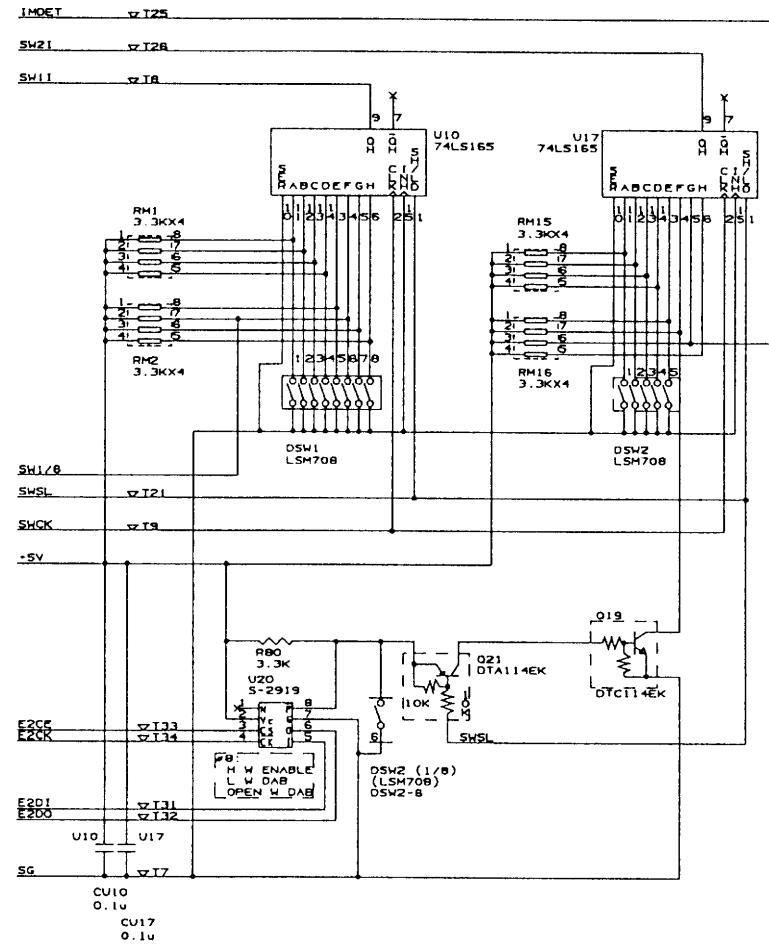
Figure 6-1. Main Circuit Block Diagram

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Resistance's rated power consumption with no value indicated is 1/10 W.

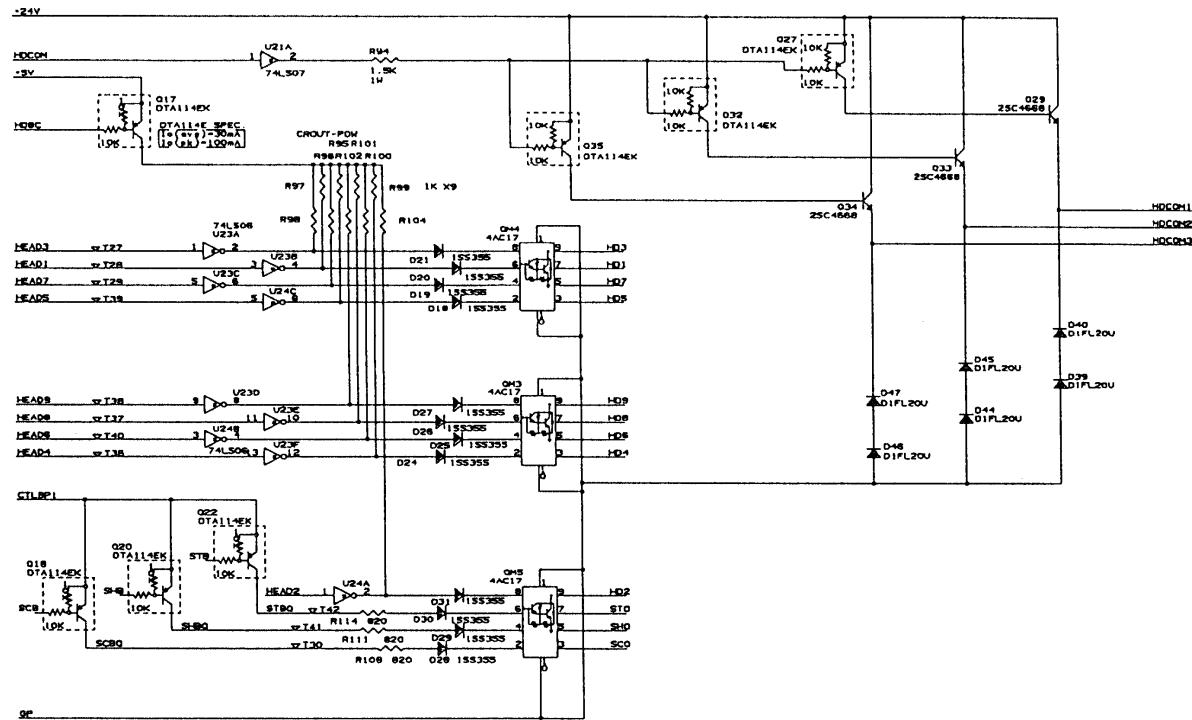
### *Circuit 1*



Resistance's rated power consumption with no value indicated is 1/10 W.

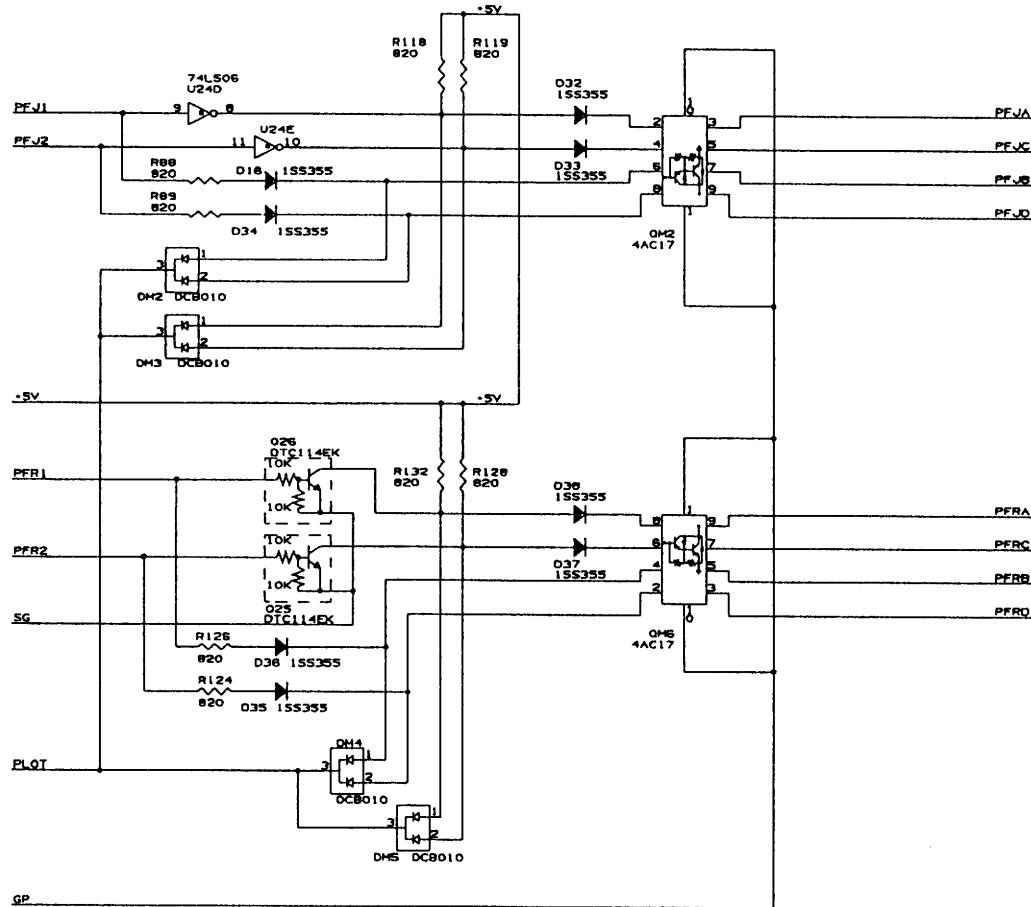
*Circuit 2*

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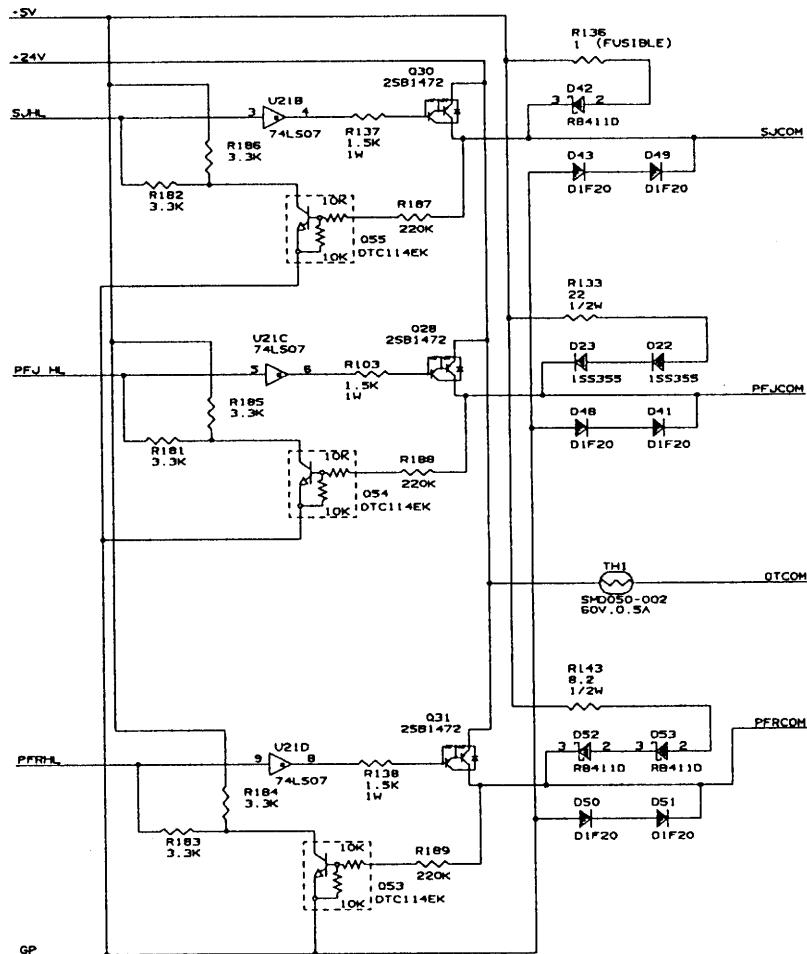


Resistance's rated power consumption with no value indicated is 1/10 W.

*Circuit 3*

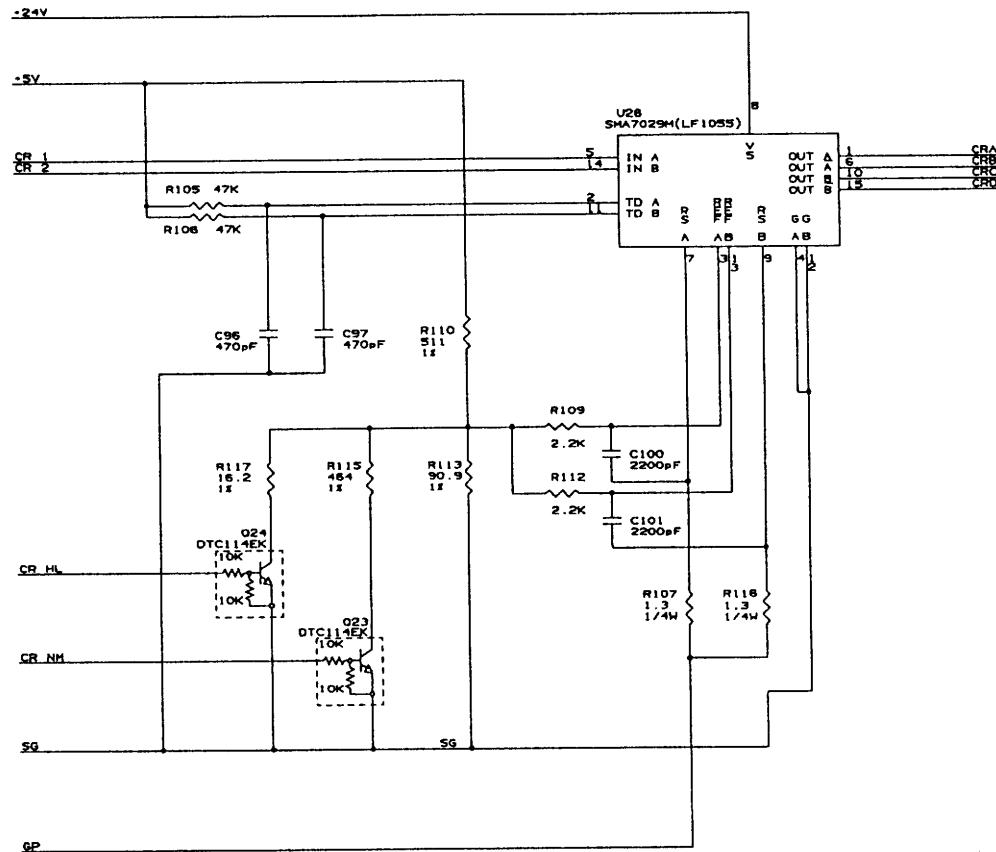


Circuit 4



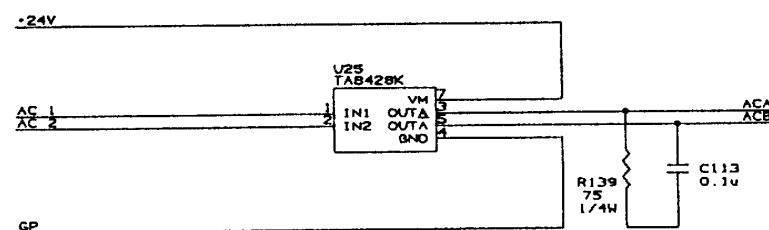
Resistance's rated power consumption with no value indicated is 1/10 W.

Circuit 5

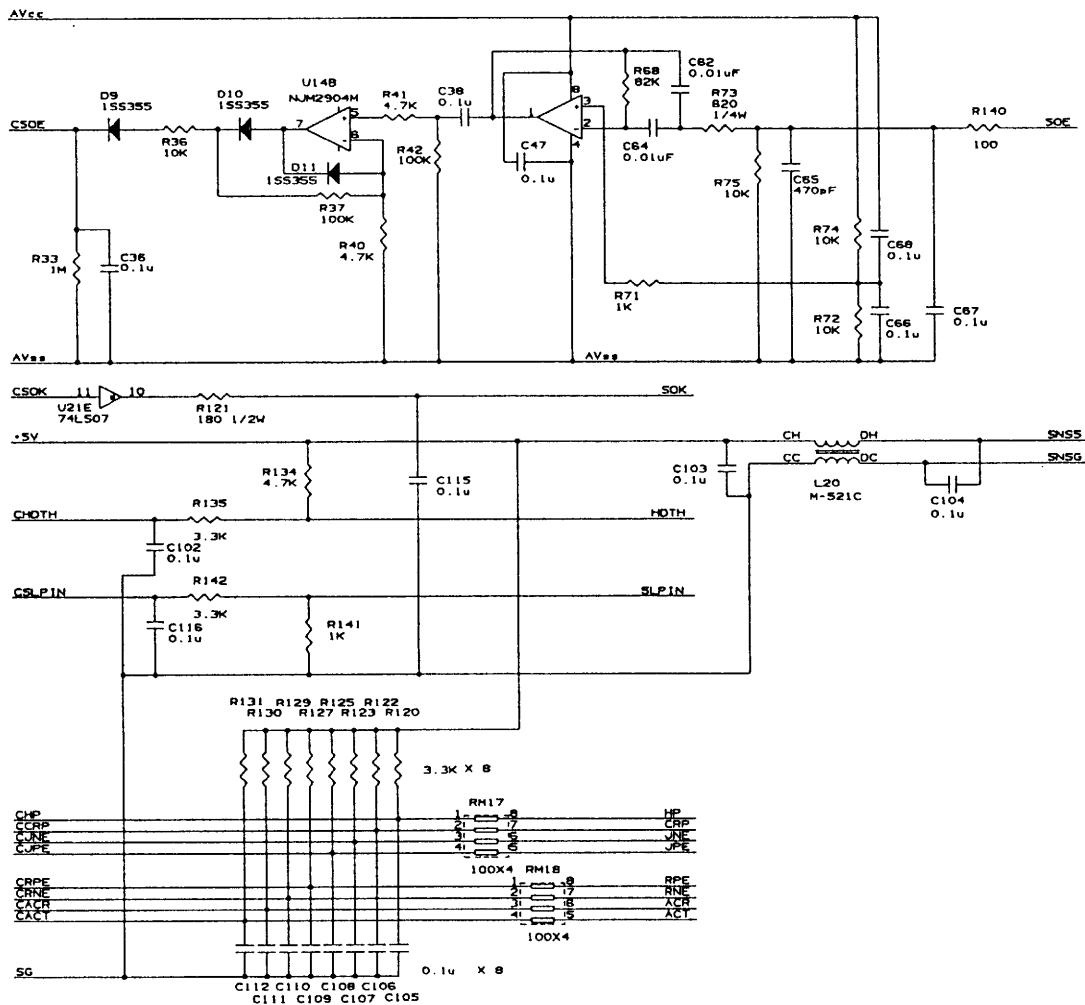


Resistance's rated power consumption with no value indicated is 1/10 W.

*Circuit 6*

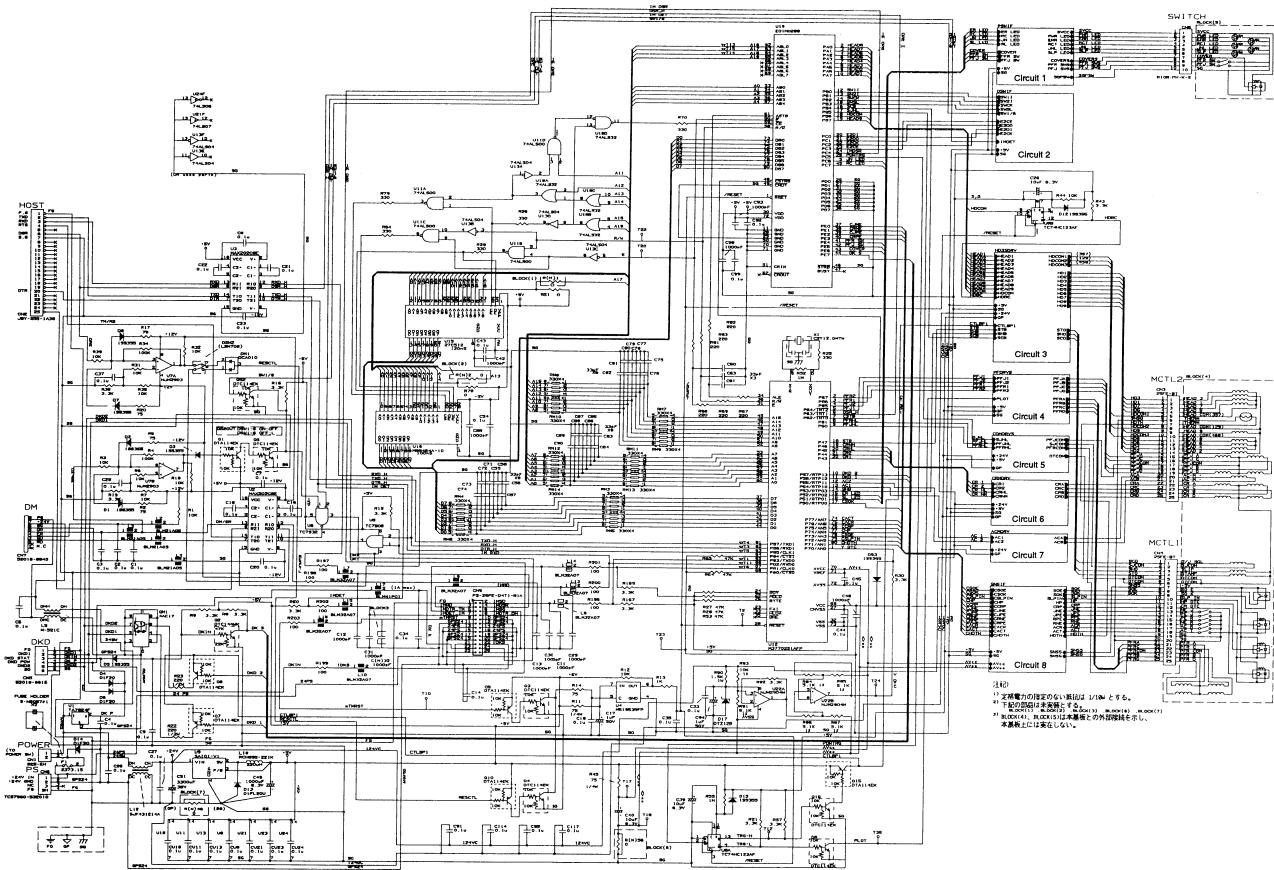


*Circuit 7*



Circuit 8

## **Main Unit Circuit Drawing for TM-U950**



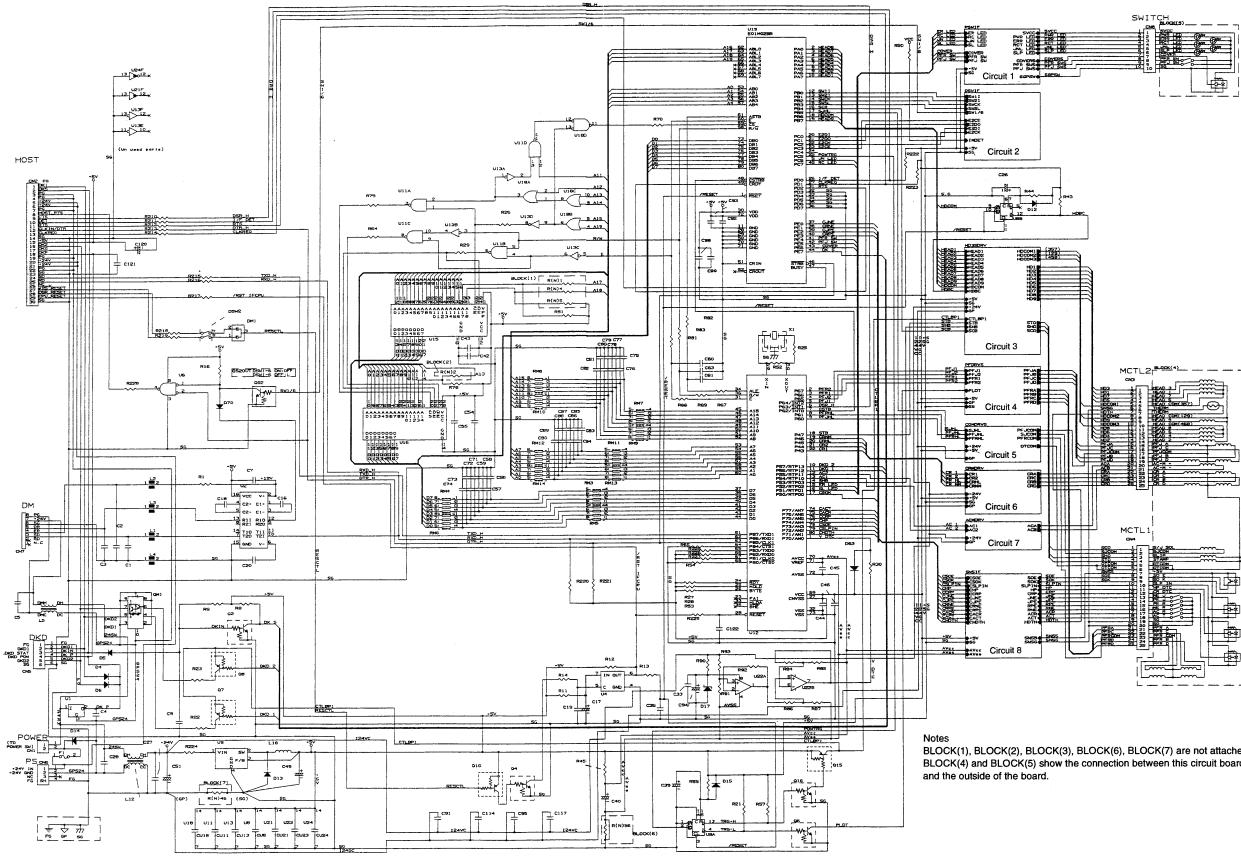
Appendix 6-9

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Main Unit Circuit Drawing for TM-U950P

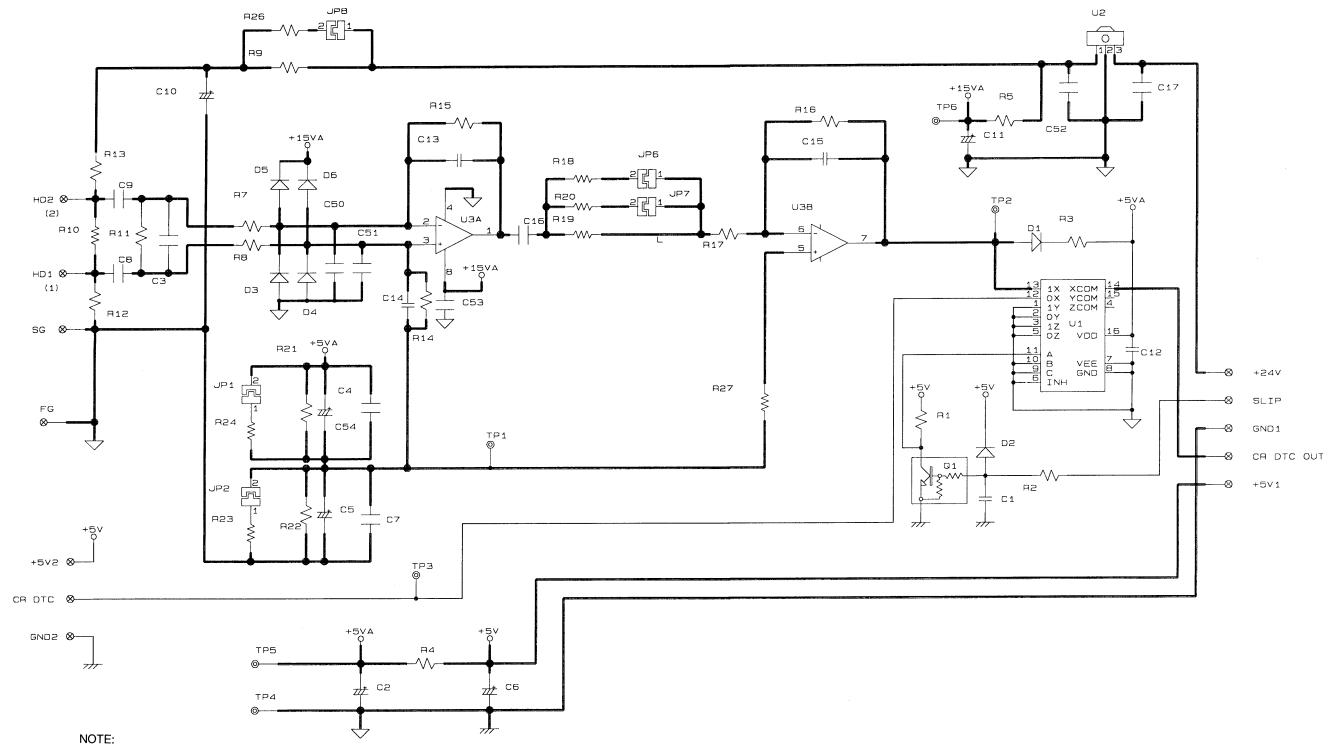
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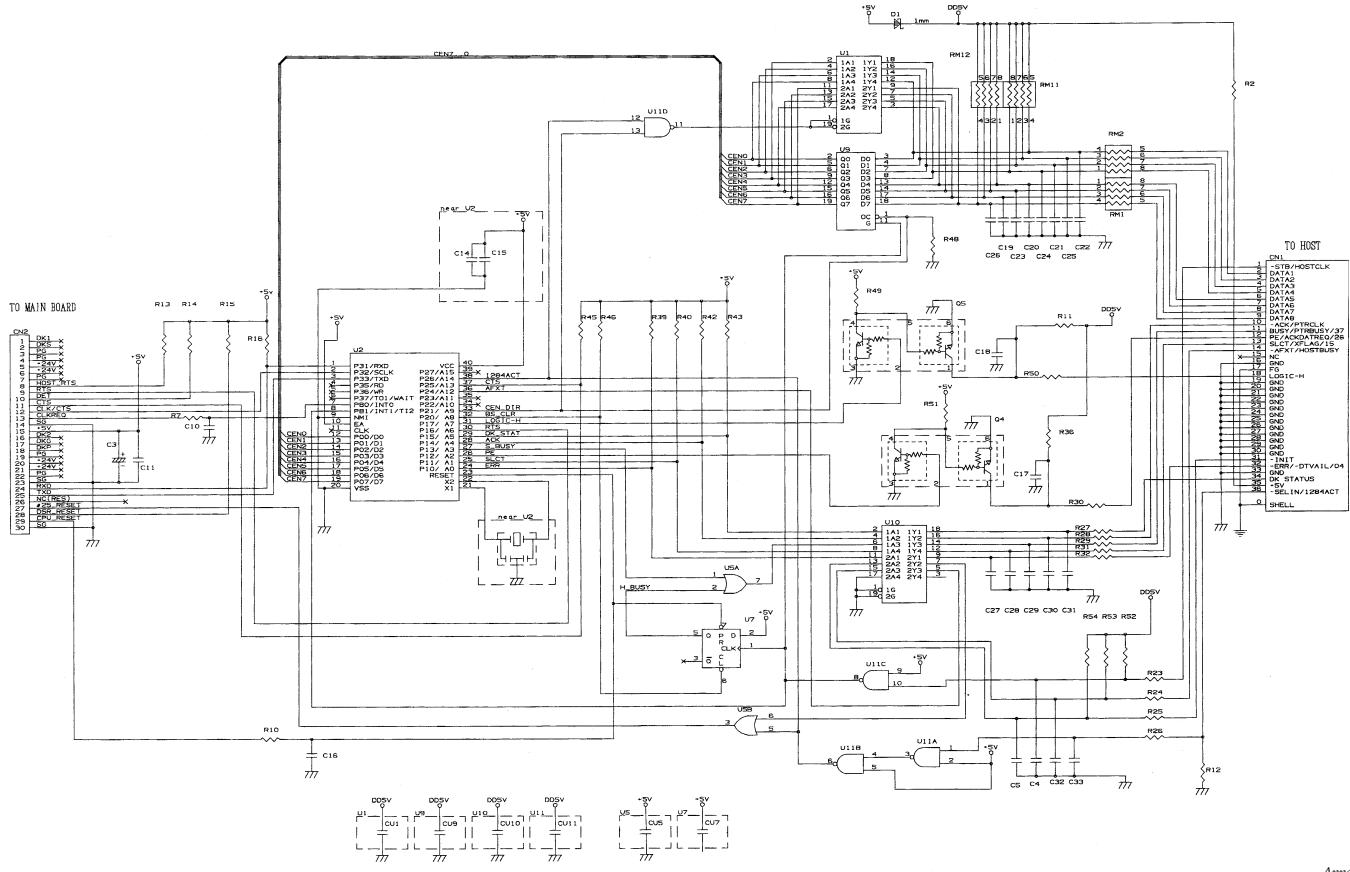
## MICR Board (for printers with a MICR reader) (Not Available for the TM-U950P)

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## Parallel Interface Circuit Board Diagram

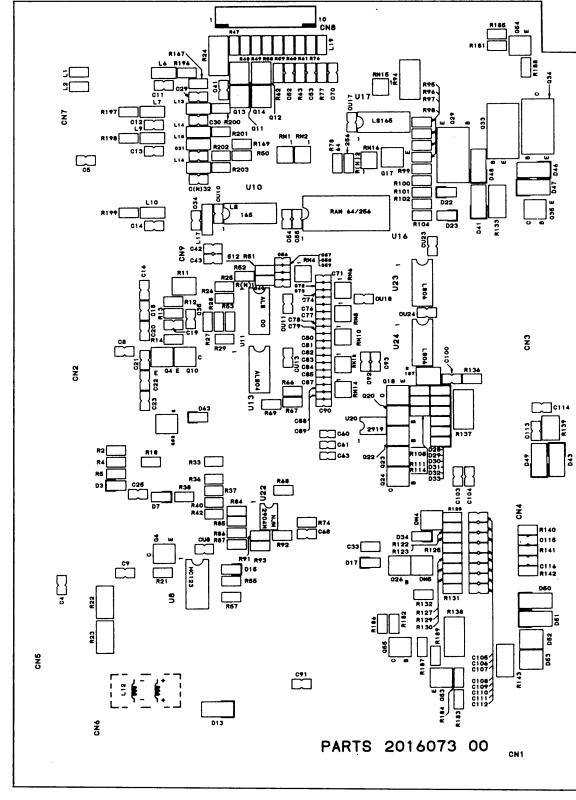
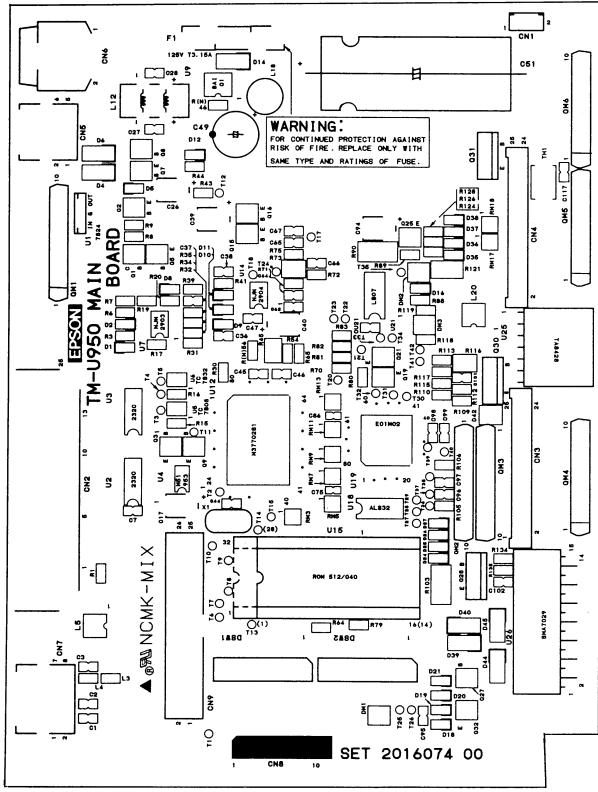
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Main Circuit Board Parts Layout for TM-U950

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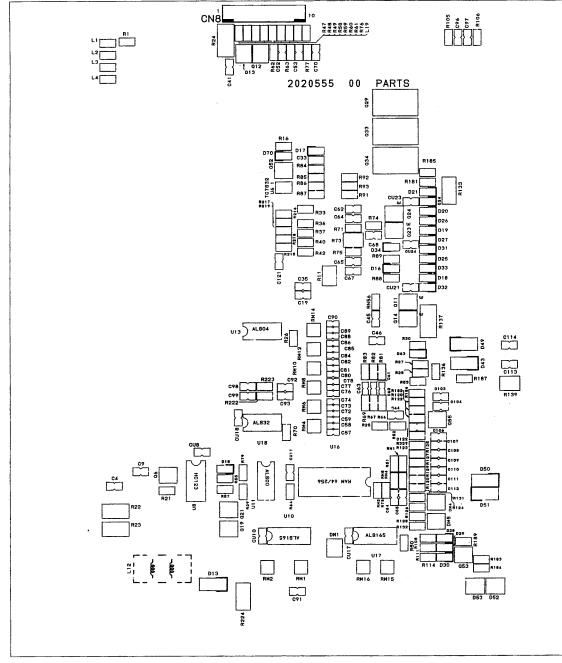
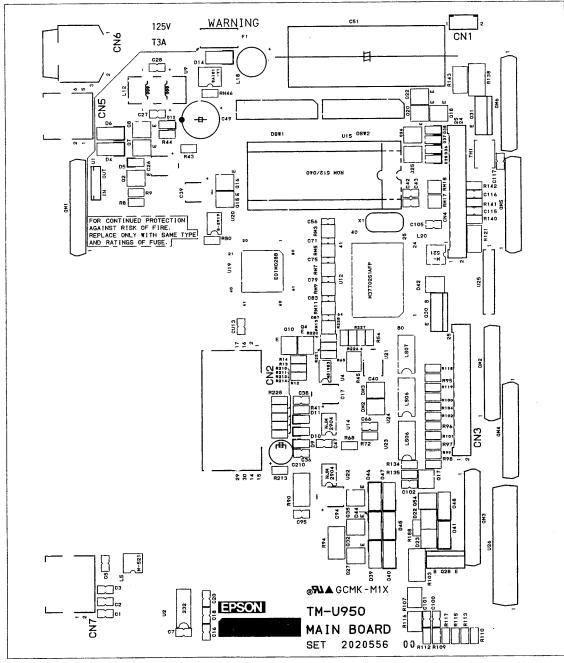


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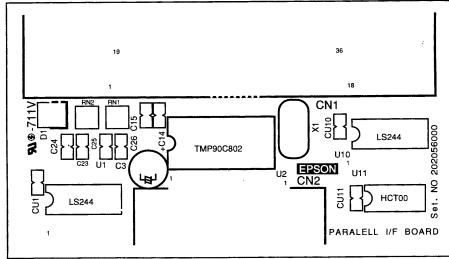
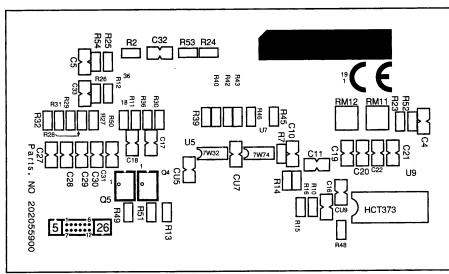
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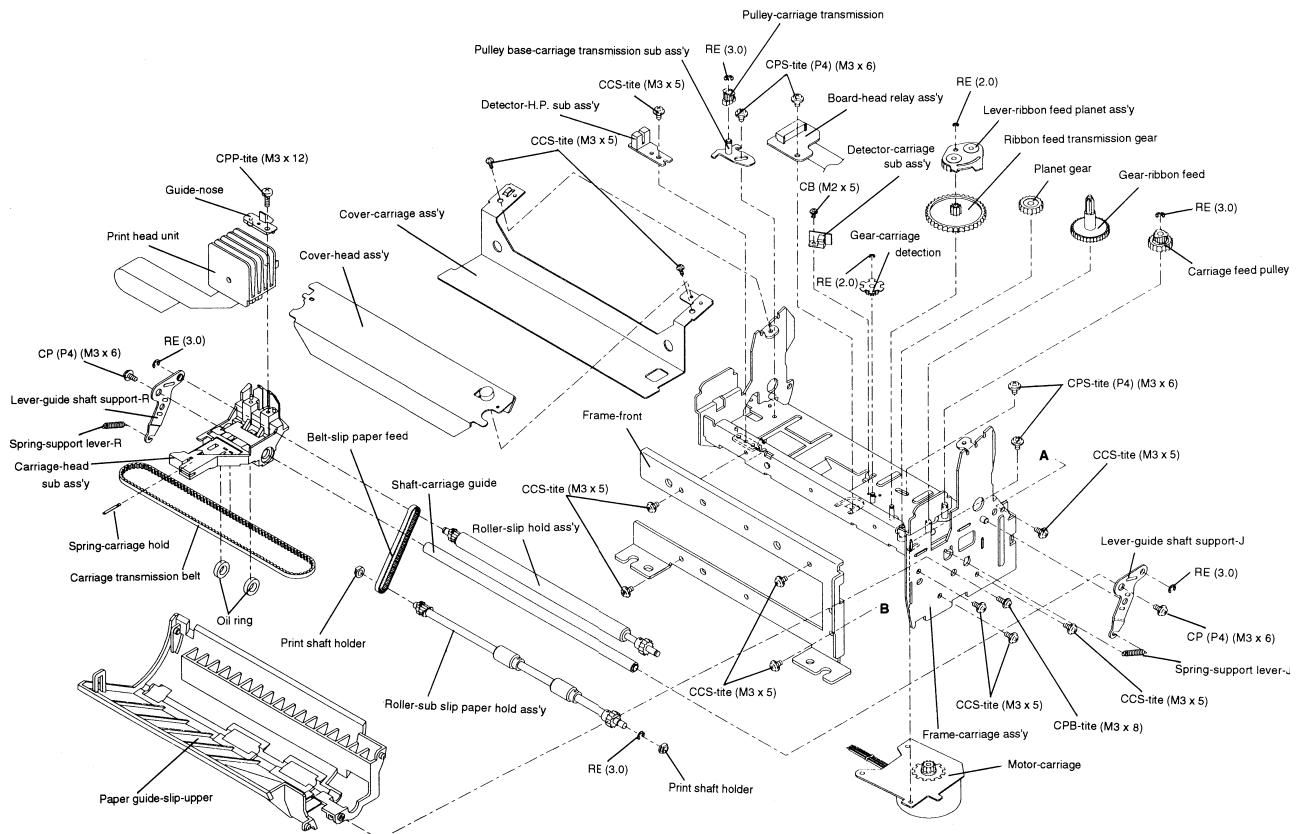
Main Circuit Board Parts Layout for TM-U950P

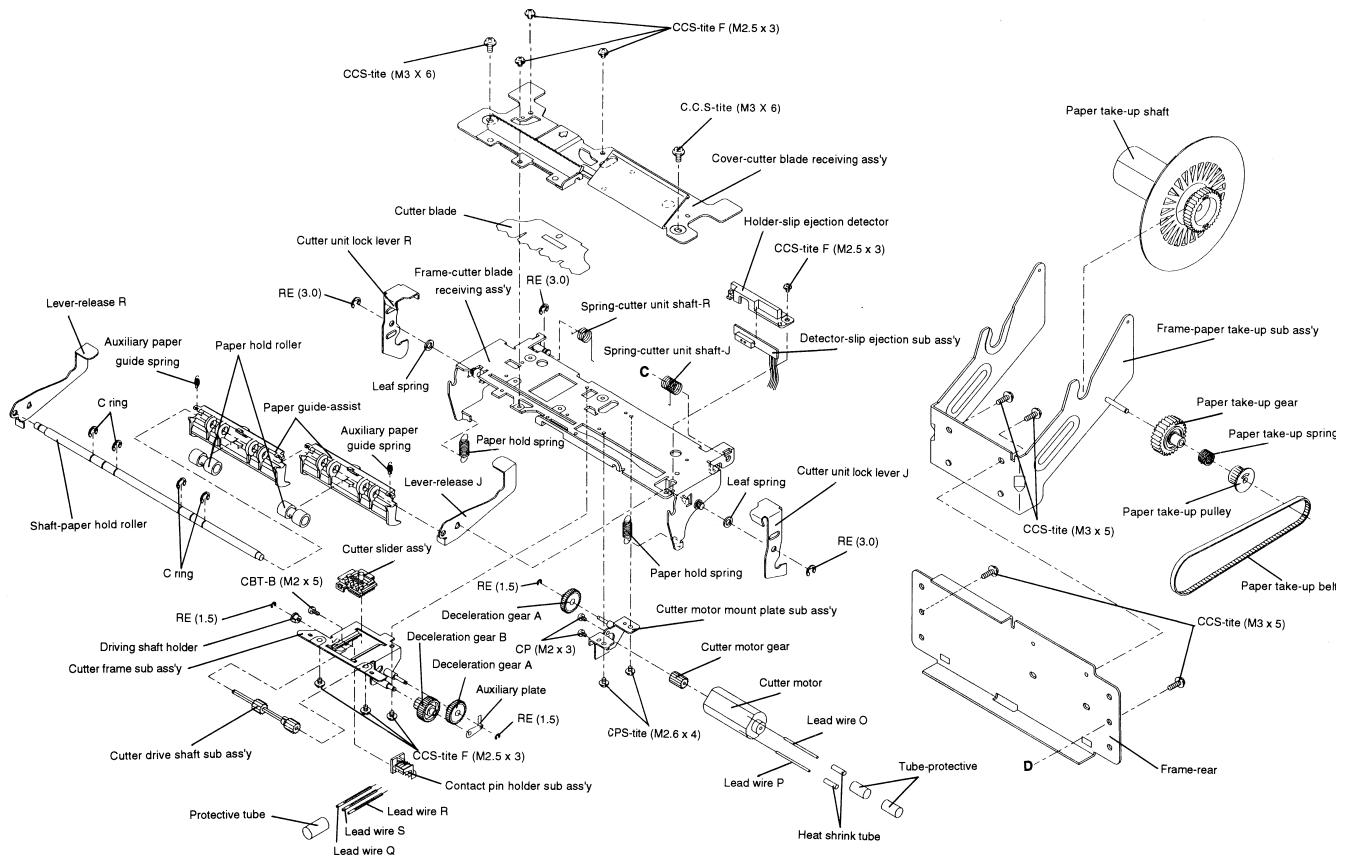
TM-U950/U950P Technical Manual

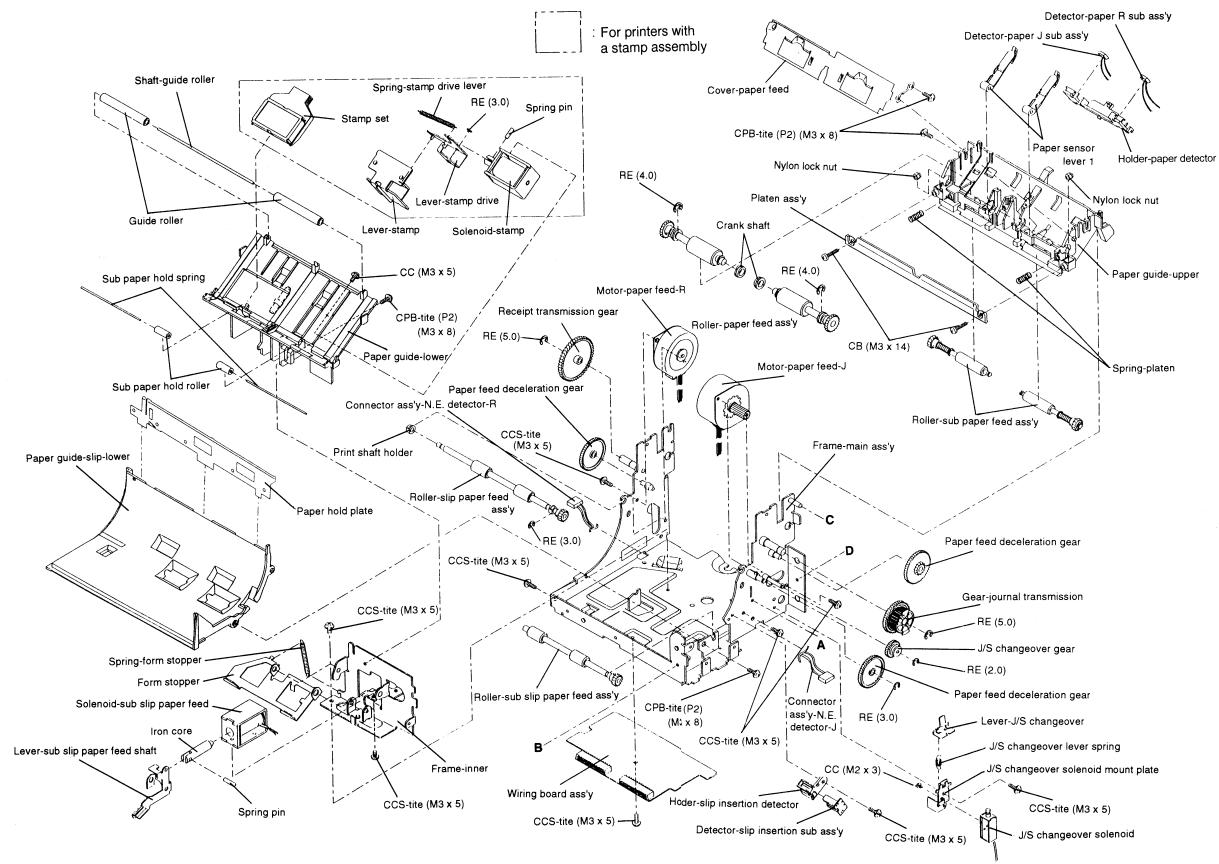


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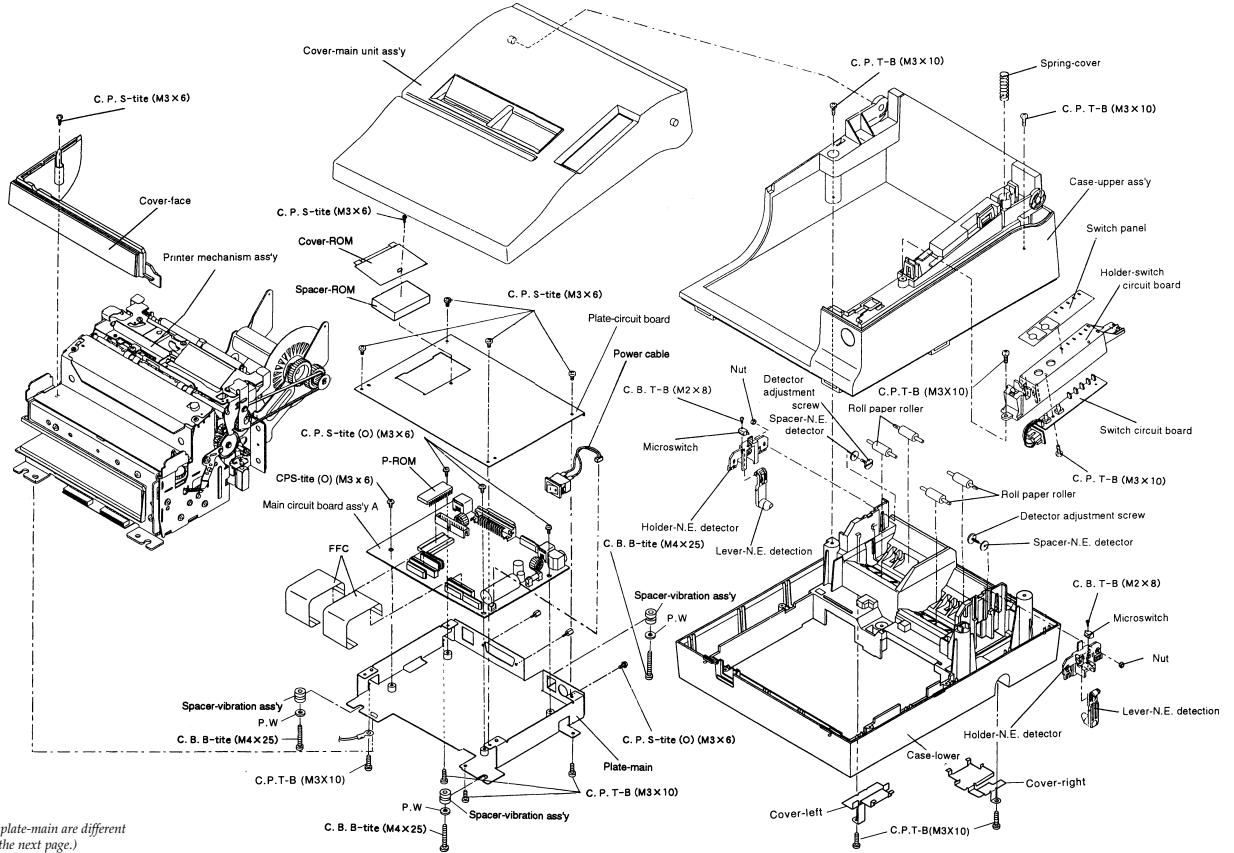
**Parallel Interface Circuit Board Parts Layout**

**Overall Exploded Diagrams****Printers Without a MICR Reader (1/4) (Both TM-U950 and TM-U950P)**

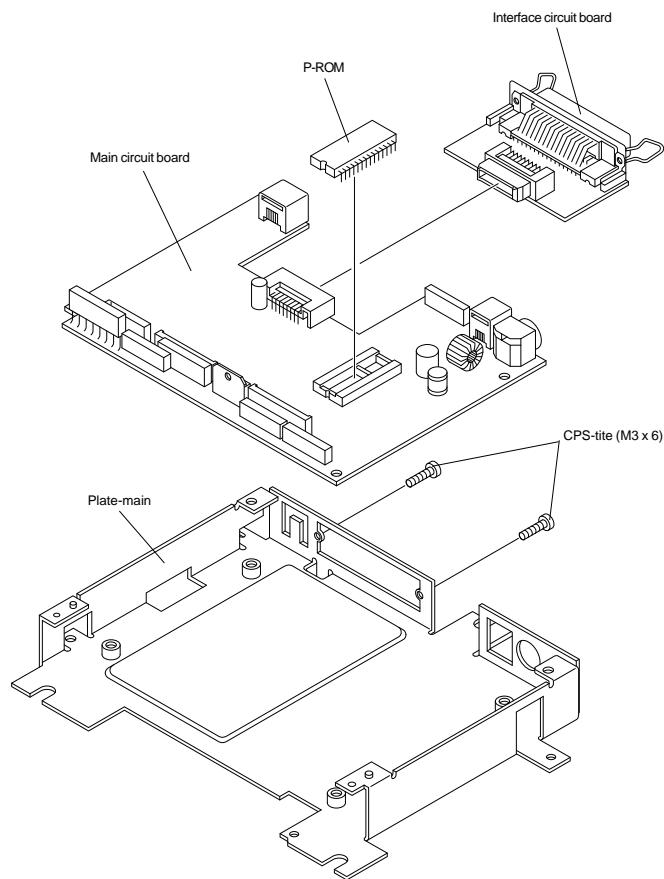




#### **Printers Without a MICR Reader (4/4)**

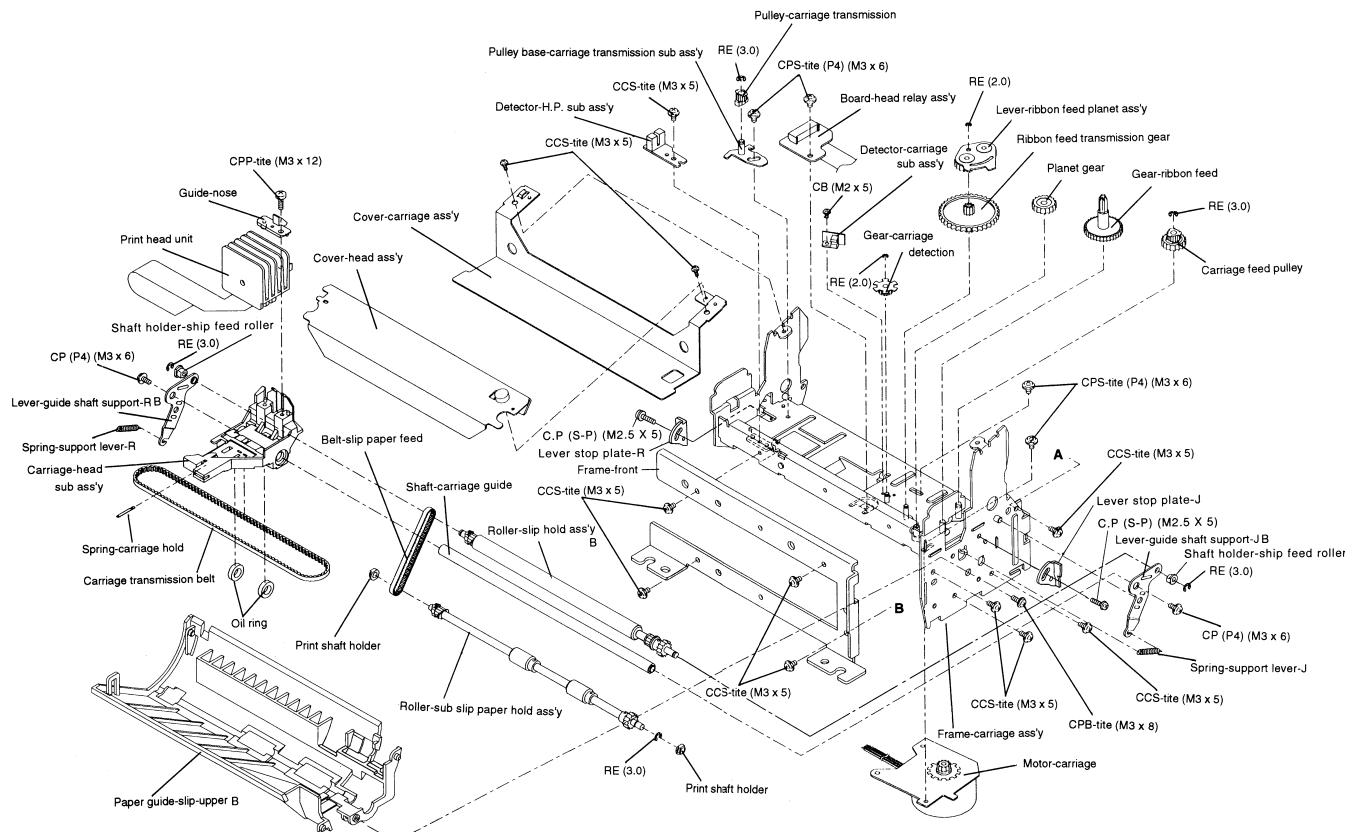


\*The current boards, H.L., and plate-main are different for the TM-U950P. (Please see the next page.)

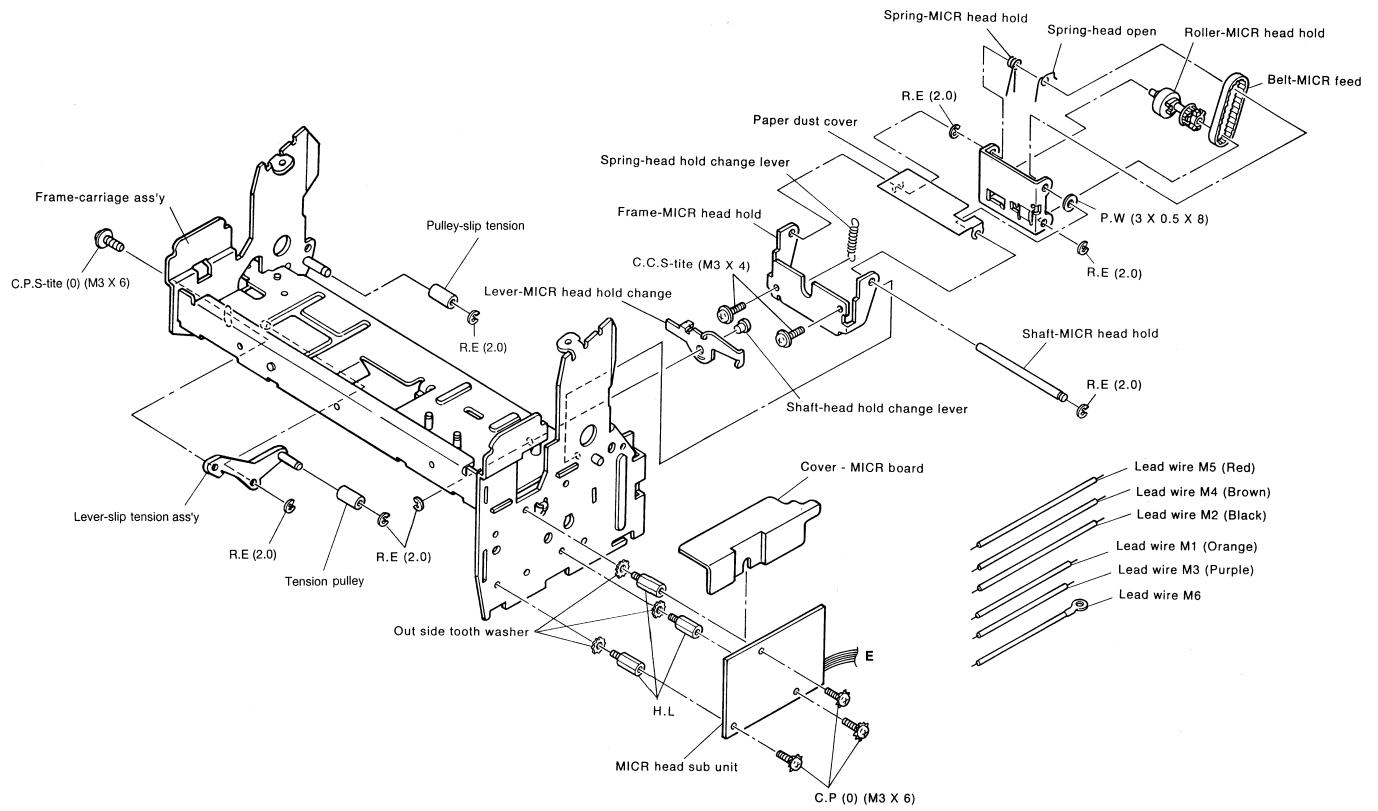


Note: These parts are different for the TM-U950P.  
All other parts are the same as the TM-U950.

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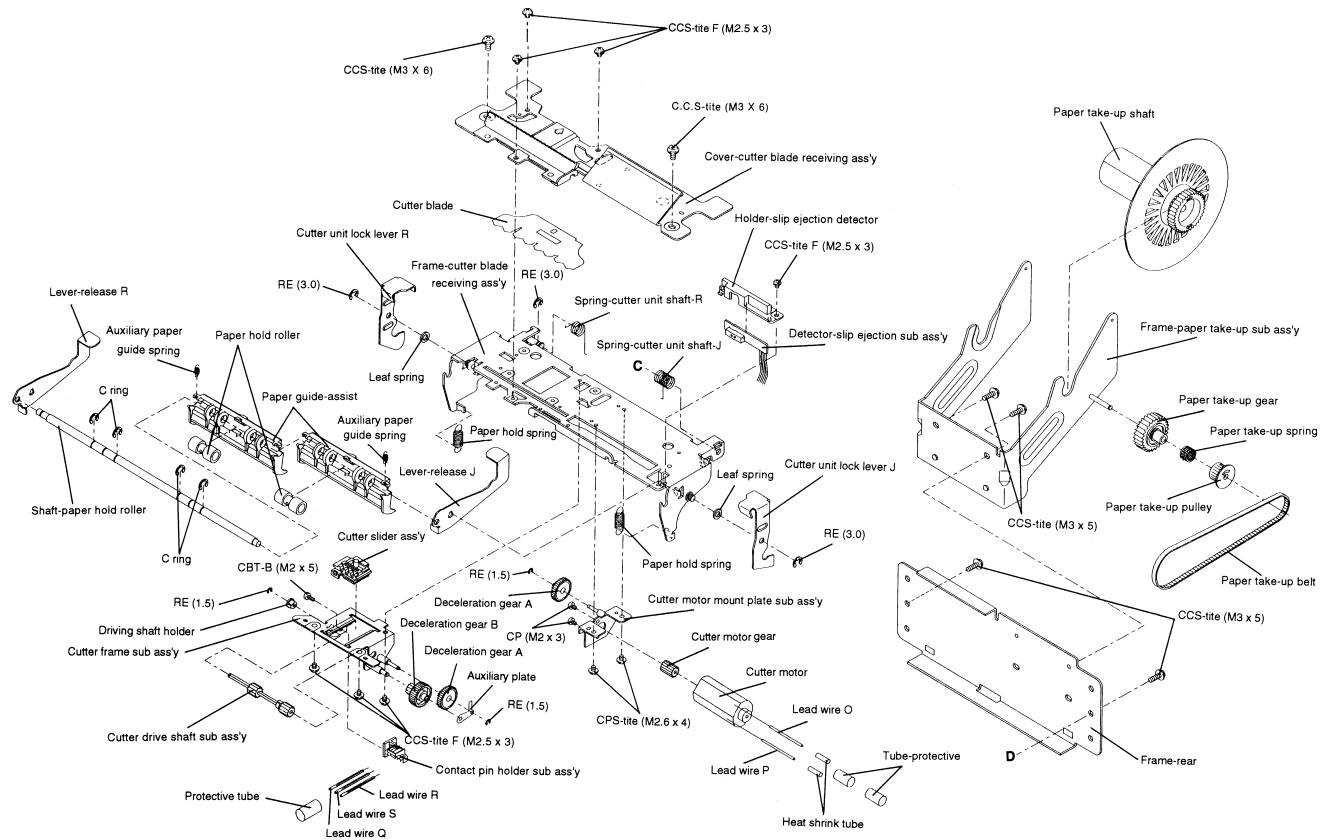


## Printers With a MICR Reader (2/5)

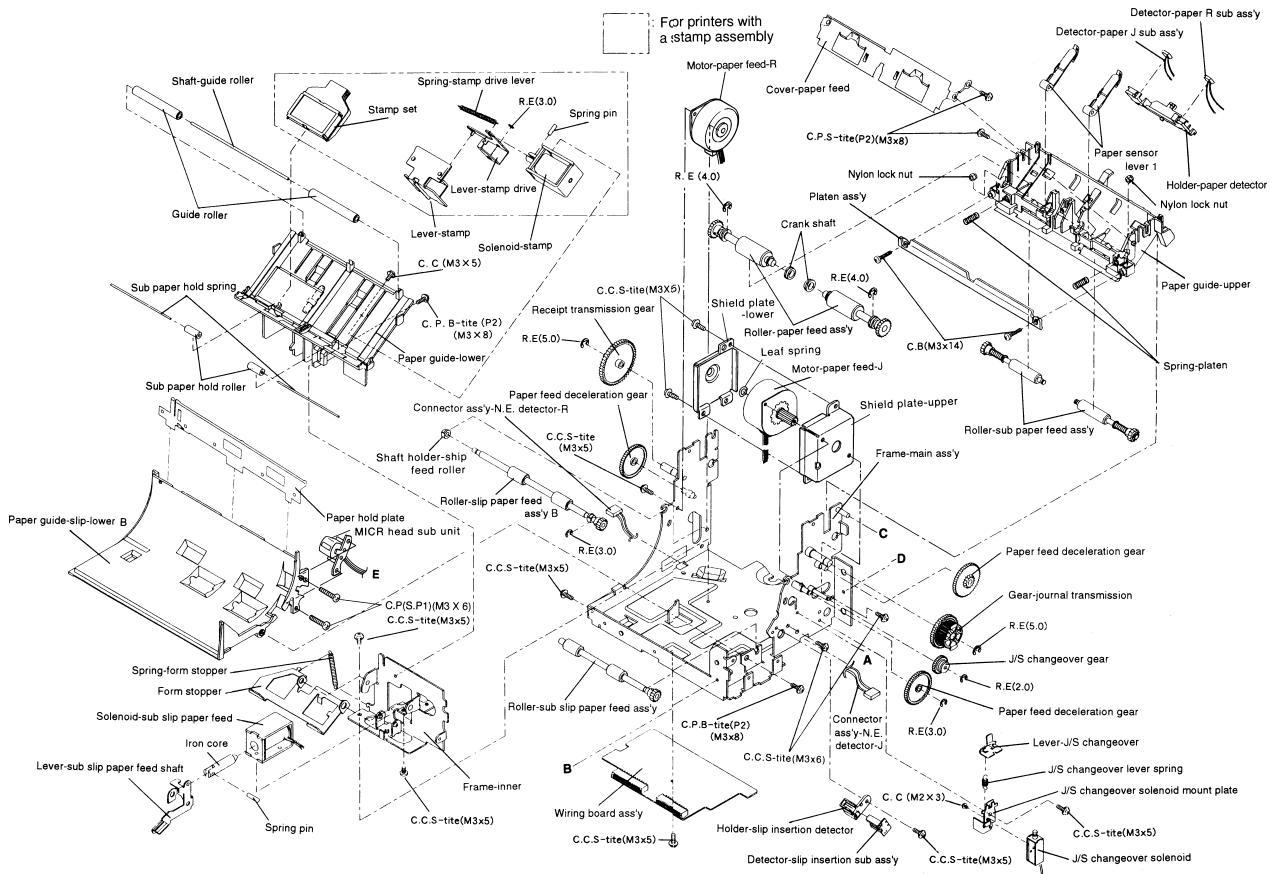


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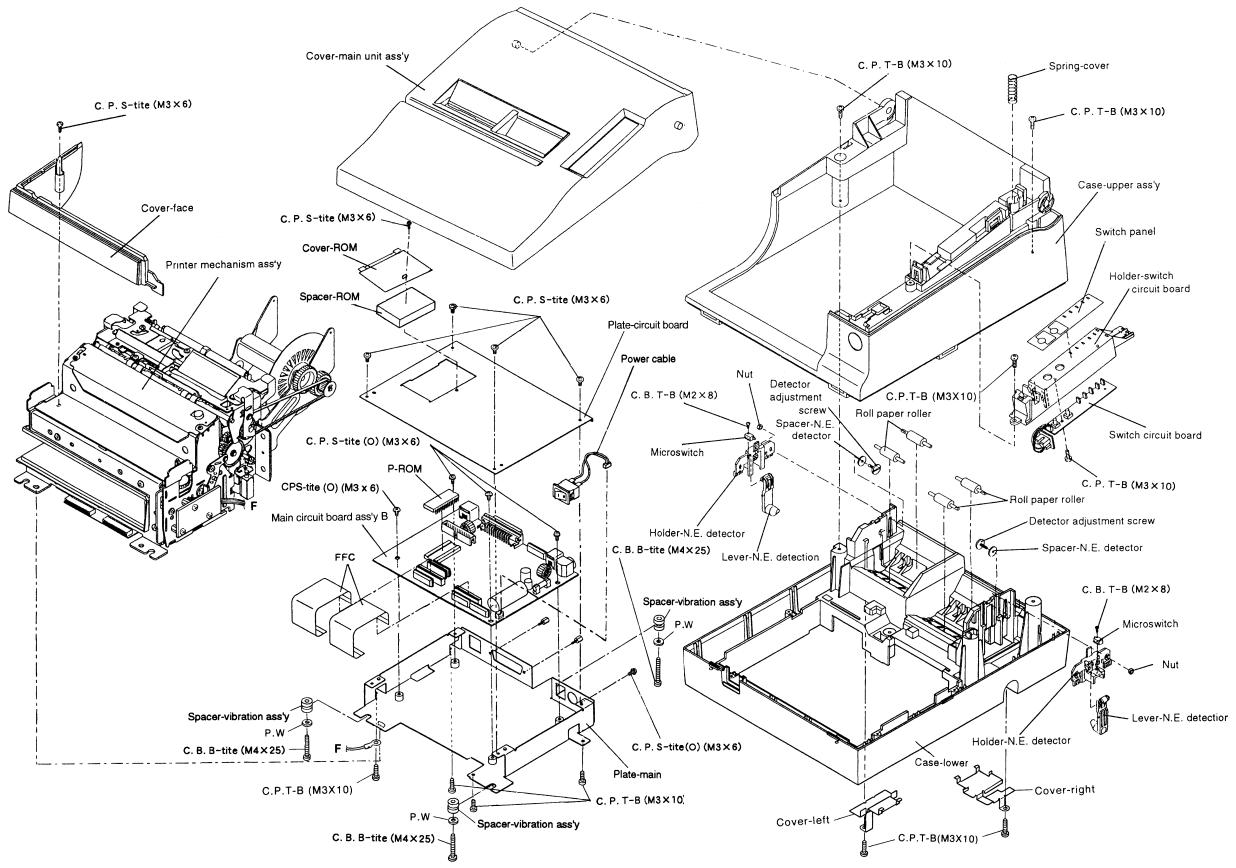
### **Printers With a MICR Reader (4/5)**



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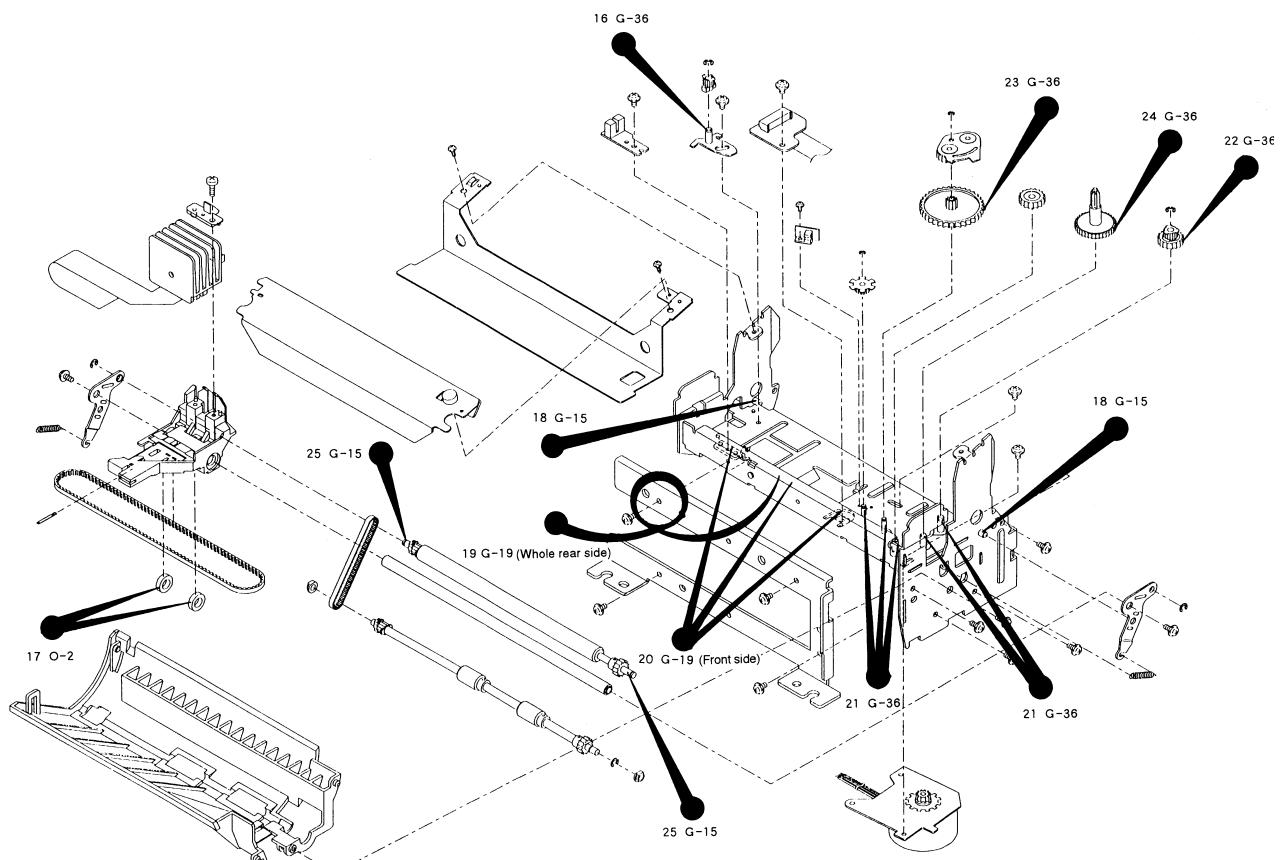
Printers With a MICR Reader (5/5)

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## Lubrication Points Diagram for Printers Without a MICR Reader (1/3)



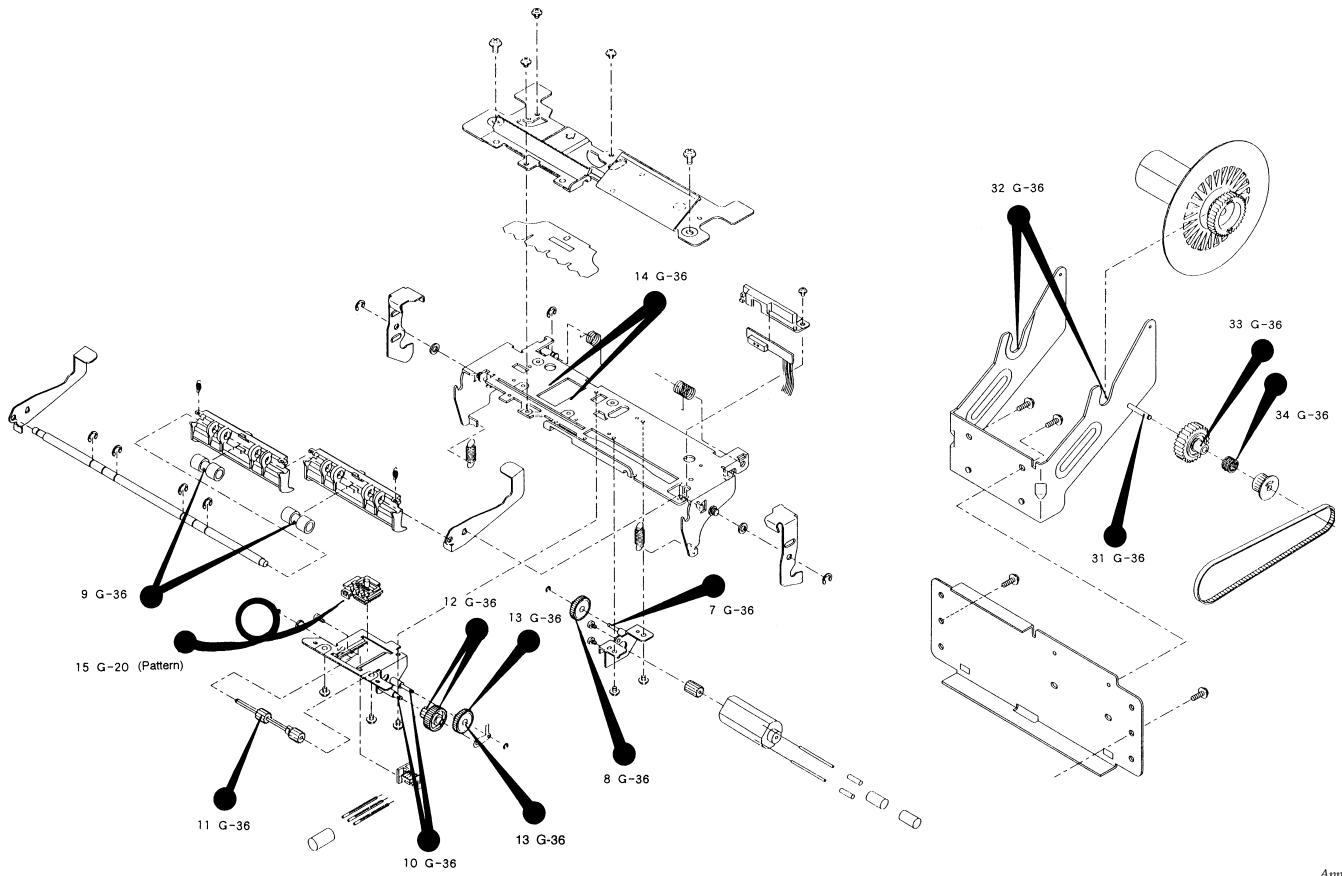
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Lubrication Points Diagram for Printers Without a MICR Reader (2/3)

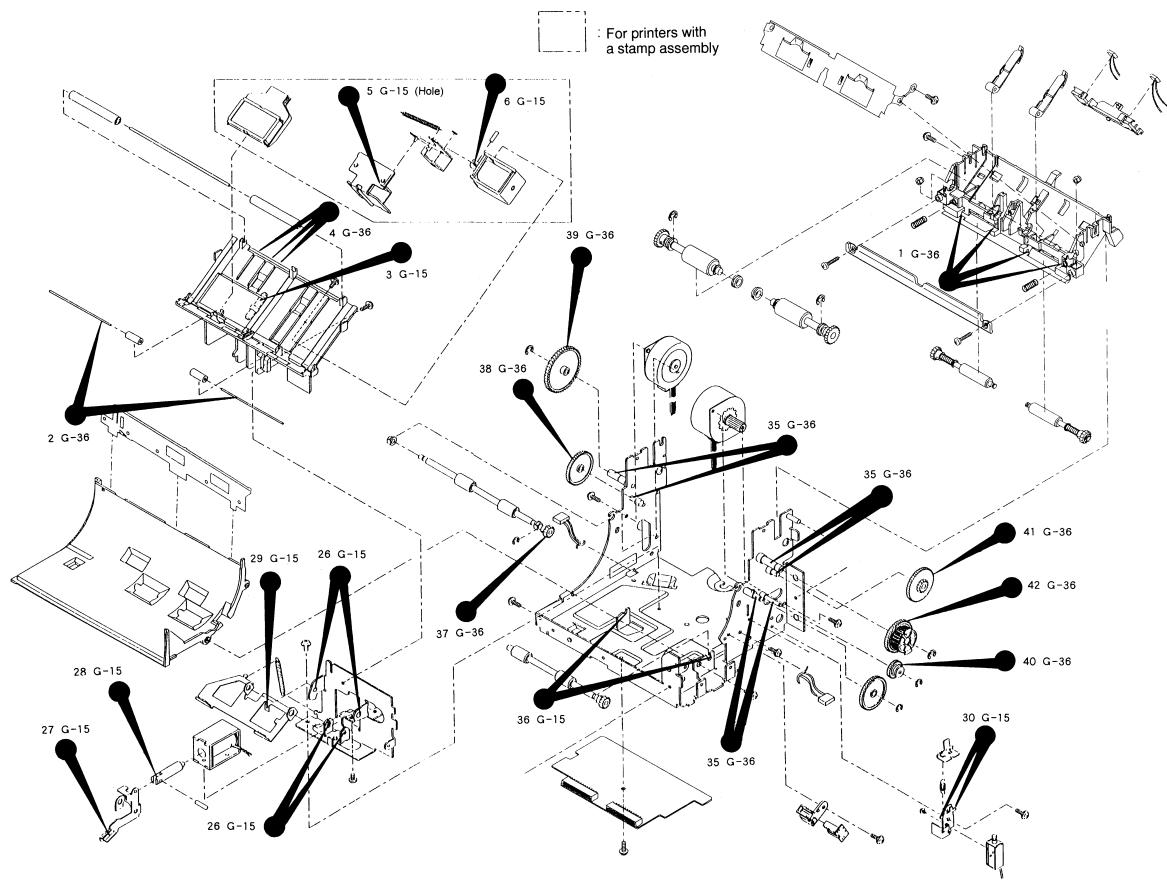
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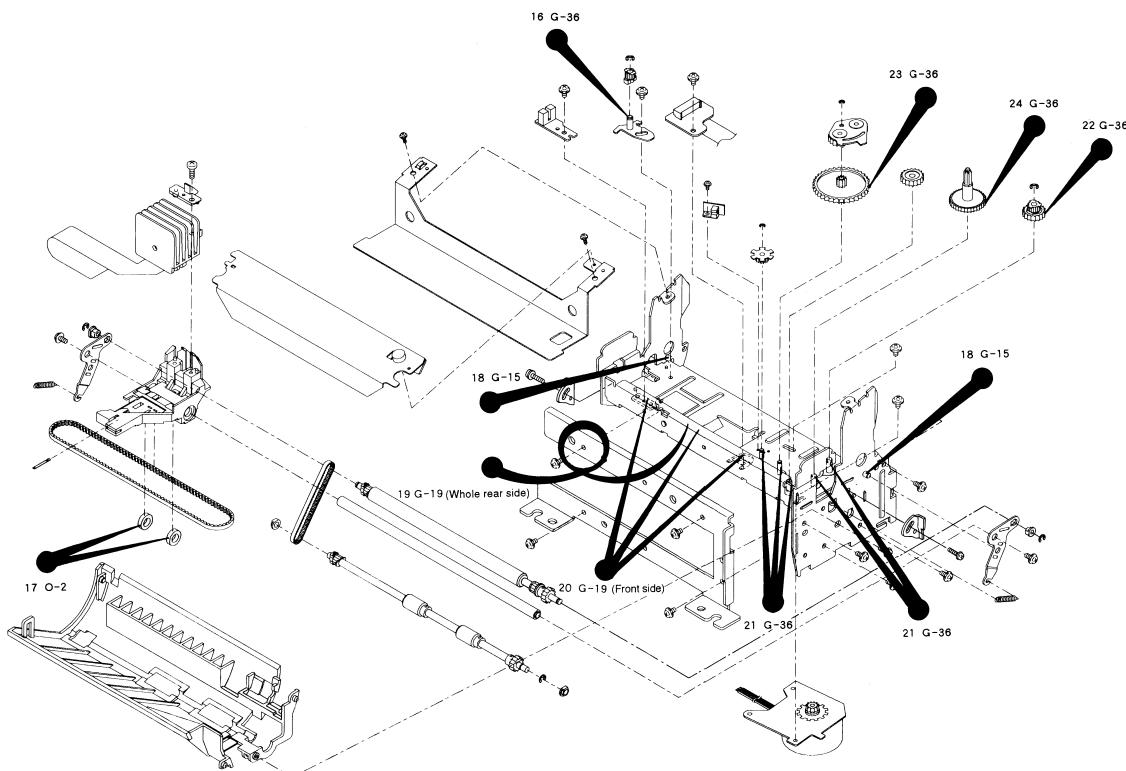
## Lubrication Points Diagram for Printers Without a MICR Reader (3/3)

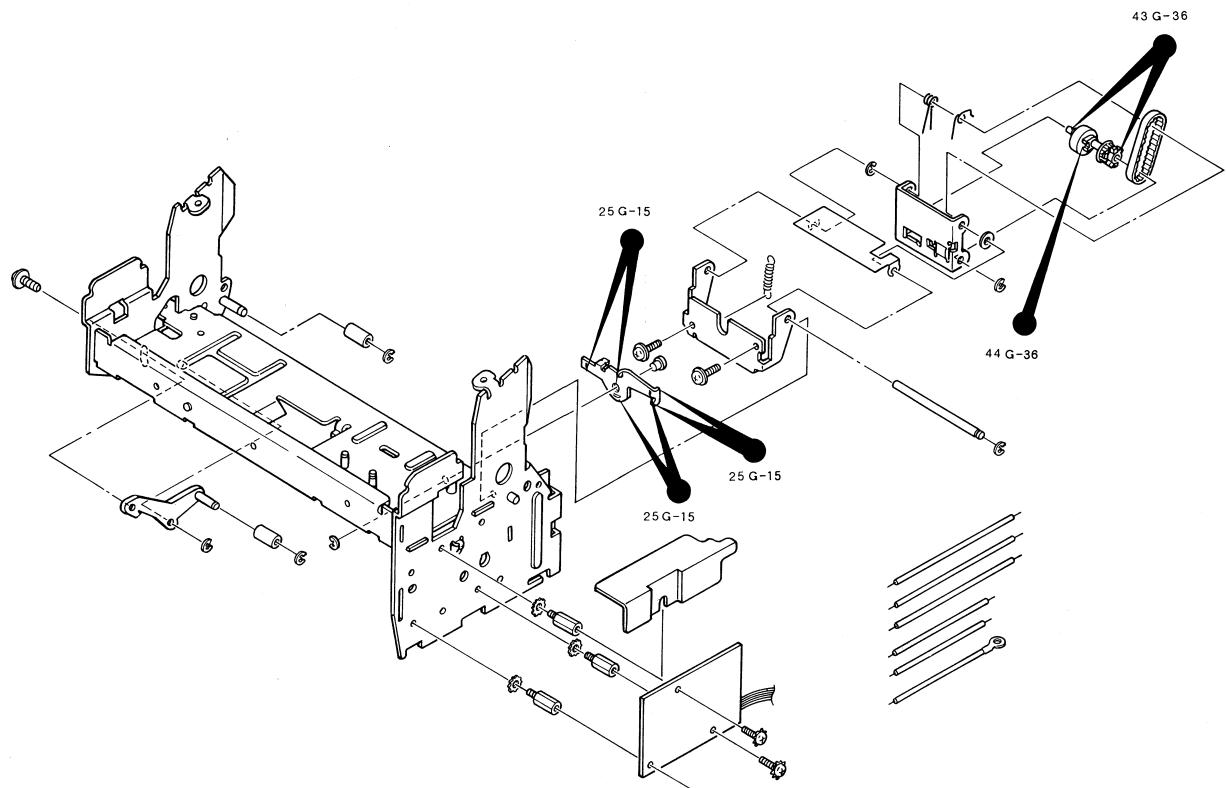
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## Lubrication Points Diagram for Printers With a MICR Reader (1/4)





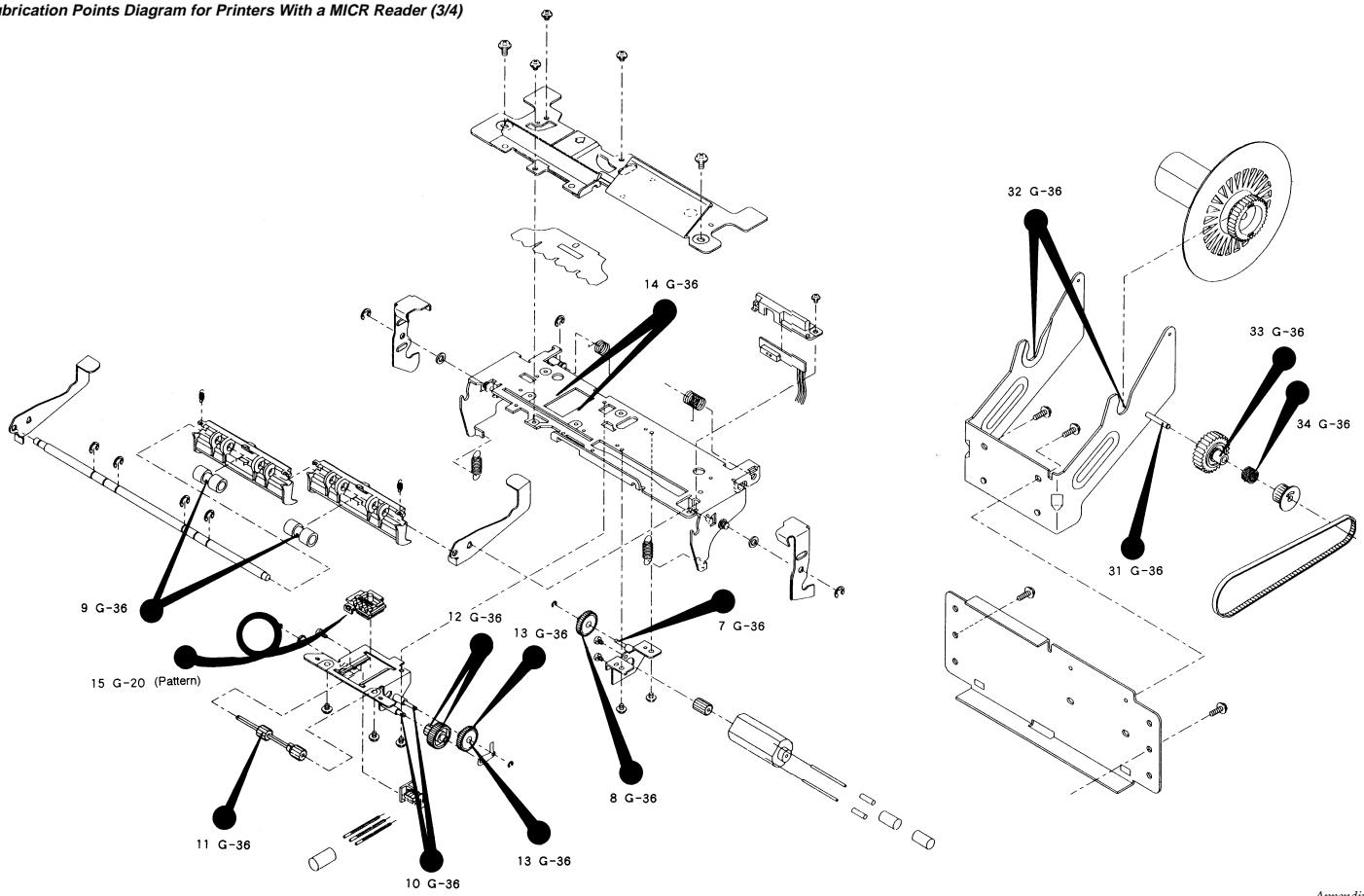
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Lubrication Points Diagram for Printers With a MICR Reader (3/4)

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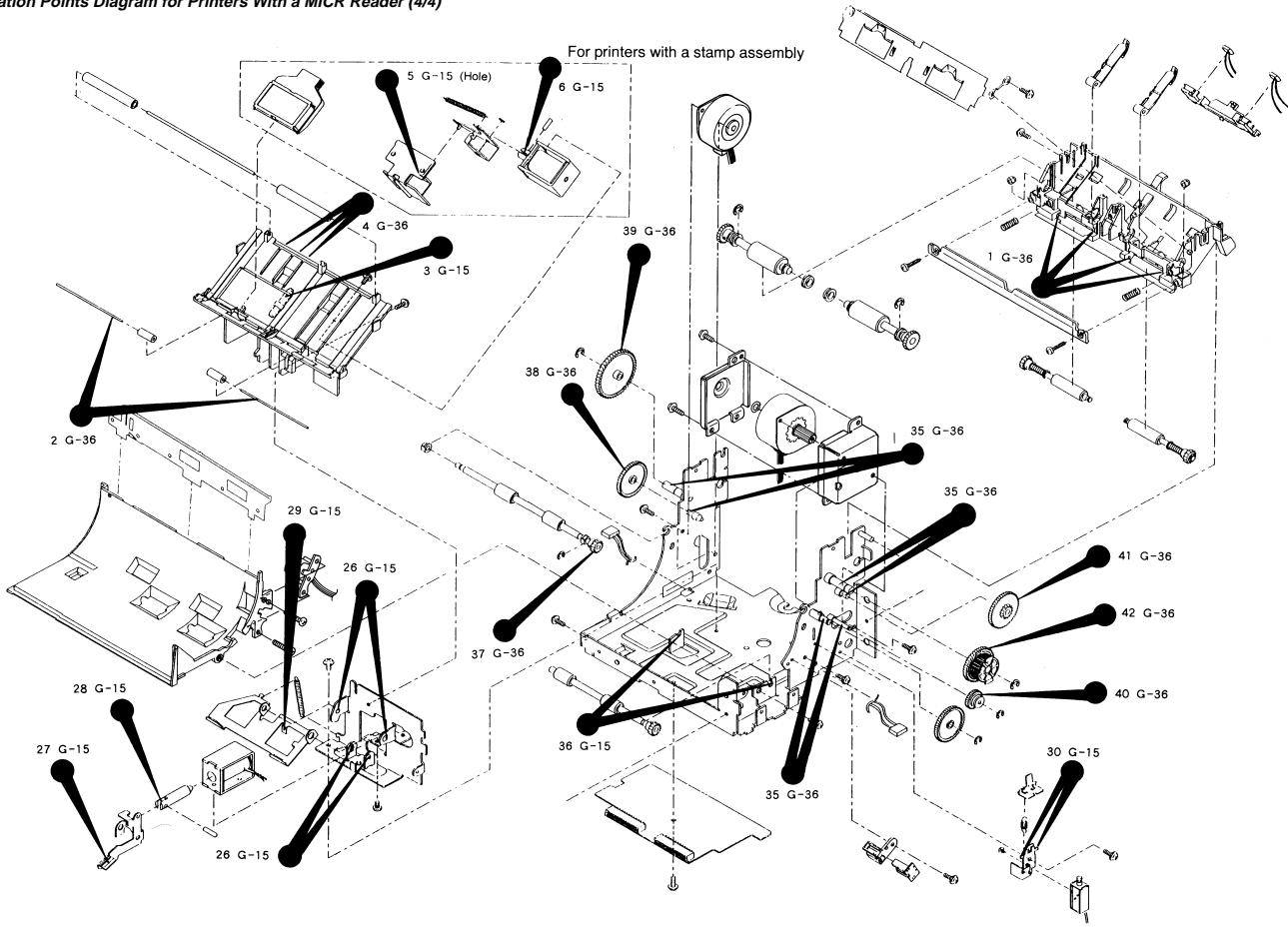


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Lubrication Points Diagram for Printers With a MICR Reader (4/4)

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