

CITIZEN

Service Manual

LINE THERMAL PRINTER MECHANISM

MODEL MLT-288

Rev.1.00 Newly issued on Sep. 29, 2000

Japan CBM Corporation

REVISION

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Preface

This booklet explains the operational principle, procedure for maintenance work, and others of the line thermal printer, MLT-288, and is intended for maintenance personnel in fields.

Characteristics

MLT-288 is a line dot type small-sized printer provided with a line thermal head. This printer has been developed for the output terminals for POS terminals, measuring and analyzing equipment, medical equipment, communication data equipment, and the like, and is small-sized as far as possible.

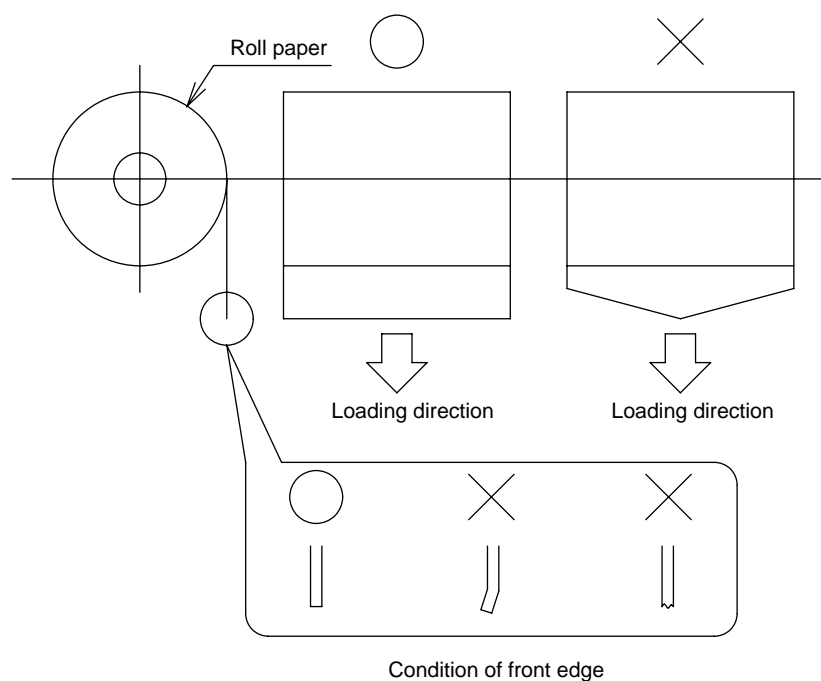
- * Small-sized and light-weighted printer
- * High speed printing up to 420 dot line/sec.
- * Clear printing with 8 dot/mm high resolution.
- * Use of paper 58 mm in width.
- * Use of a long-life head.
- * Simple mechanism with high reliability.

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Chapter 1 Handling and Maintenance of Printer

- (1) The use of paper other than our recommended paper can not guarantee print quality and duration. Be sure to use paper with a width within the specified range.
- (2) Do not give the surface of the head circuit board (heating elements) a mechanical shock (including penetration of foreign matters).
- (3) In handling the printer, take anti-static measures and ground the human body to protect the heating elements, ICs, and others from damage due to static electricity.
- (4) Wipe off lightly dirt stuck on the surface of heating elements with a cotton swab soaked in ethanol or the like.
- (5) Activating the dewed thermal head is likely to damage the head. If dew is present on the head, dry it thoroughly before printing operation.
- (6) Feeding Paper
 - * Feed paper in the head-up condition.
 - * Cut the front edge of paper straight. Do not insert paper with its front edge fluffed or bent.



- * When the front edge of paper comes out of the thermal head, confirm that the paper has been set straight before putting the head down.

(7) Removing Paper

- * Take paper out in the head-up condition.
- * Take paper out slowly and straight to the direction in which paper comes out.

Chapter 2 Specifications and Principle of Operation

2-1 General Specifications

	Item	Specifications	Remarks
1	Printing Method	Thermal Line Dot Method	
2	Total number of dot	384 dots/line	
3	Dot density	8 dots/mm	
4	Printing width	48.0 mm	
5	Printing Speed	200 dot lines/second	5V, Head temp. $\geq 50^{\circ}\text{C}$, ≤ 64 dots
		420 dot lines/second	7.2V, Head temp. $\geq 30^{\circ}\text{C}$, ≤ 64 dots
6	Paper feed pitch	0.125mm	Two motor steps
7	Detection Function Print Head Temperature Paper Detection Head Up Detection	Thermistor Photo interrupter Mechanical switch	
8	Operation Voltage Range	VH DC4.2~8.5V	Typ. Voltage of Ni-Cd or Li-Ion must be 7.2V(Max). 8.5V would be only after charging a battery.
		Vdd DC4.75~5.25V	
9	Consumption Current	Max. Approx. 1.7A	VH=5V, 64dots, 25°C
	Head (VH)	Max. Approx. 2.4A	VH=7.2V, 64dots, 25°C
	Motor (VH)	Max.Approx. 0.5A, Ave.Approx. 0.3A	VH=7.2V, 840 PPS
10	Recommended Roll Paper Paper Width Paper Thickness Manufacture Type	58 ⁺⁰ ₋₁ mm 60~72mm Nippon Seishi Co.,Ltd. TF50KS-E2C	Printing face must be the surface of the roll paper. Between paper and core must be non adhesion. Roll paper diameter must be less than Ø60mm.
11	Paper Feed Force	0.49N or more	
12	Paper Holding Force	0.78N or more	
13	Reliability		
	life	6 million lines	Normal temperature(25°C) and humidity. Printing rate 12.5%, Rated energy, recommended paper
	MC BF	15 million lines	
	Head life		
	Pulse Resistance	50 million pulses or more	
14	Environment		
	Operating Environment	Temperature: 0~45°C Humidity: 35~85%	Printing guarantee: 5~40°C No condensation
	Storage Environment	Temperature: -20~60°C Humidity: 10~90%	Machine stored with head in raised condition
15	Vibration Resistance	6G, Frequency 10~55Hz in three directions perpendicular to the machine, for one hour	
16	Shock Resistance	60G, 11ms 6 direction, 1 time each	
17	Outer Dimension	72.7(W) × 38(D) × 13(H)mm	Excluding Head up lever, Connectors and Projection sections
18	Weight	Approx. 45g	

2-2 Outline of Mechanism

The mechanism of this printer is roughly separated into the following six blocks.

- * Power transmission mechanism block.
- * Sensor mechanism block.
- * Print head mechanism block.
- * Paper feed mechanism block.
- * Frame block.
- * Motor block.

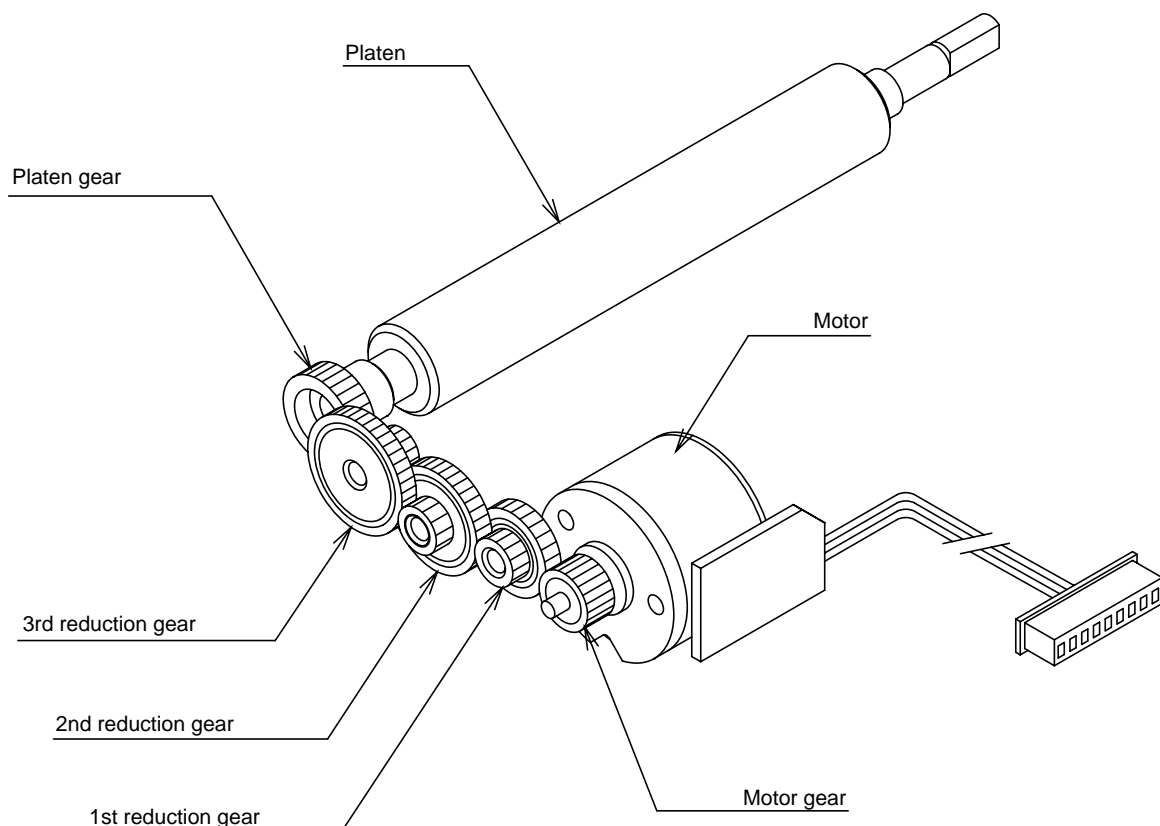
For external circuits and others connected to the printer, refer to respective operation manuals and the like.

2-3 Mechanism and Operational Principle

The construction and operational principle of four blocks other than the frame and motor blocks in the above-mentioned six mechanism blocks are described in the following.

2-3-1 Power Transmission Mechanism Block

This mechanism block is located at the left side of the printer. Motor drive is transmitted to the platen through the motor gear fixed to the motor, the 1st reduction gear, 2nd reduction gear, 3rd reduction gear and platen gear. The platen is rotated by this drive.

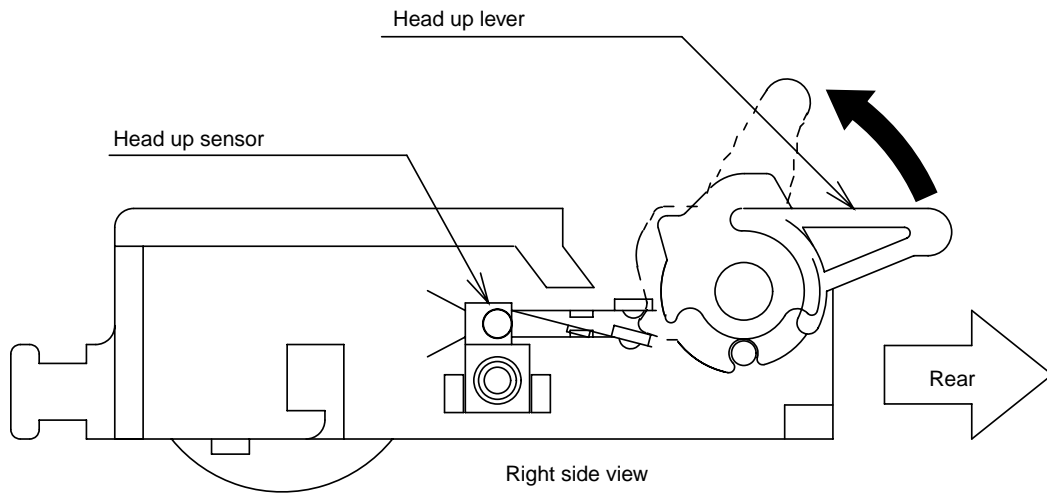


2-3-2 Sensor Mechanism Block

This sensor mechanism block is composed of a head-up and paper sensors.

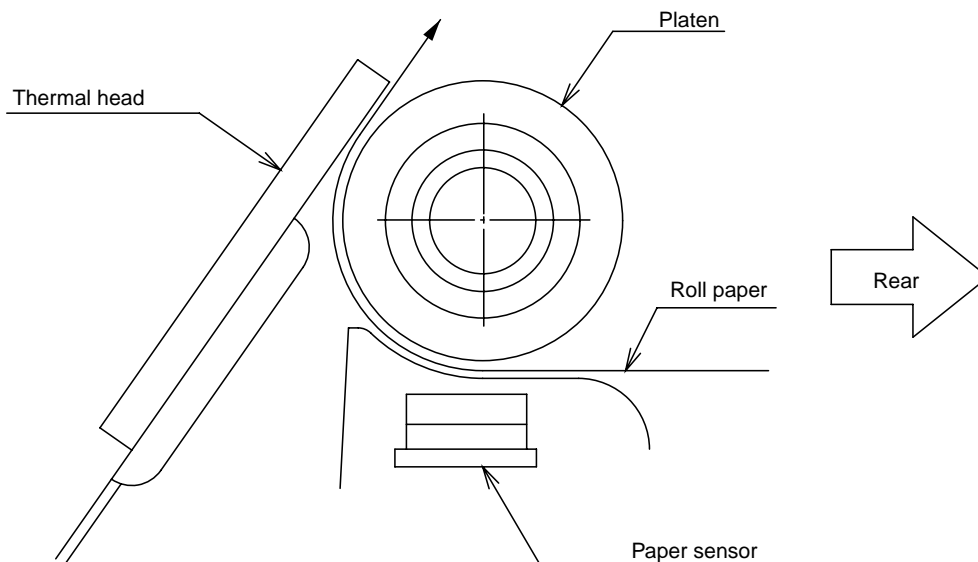
(1) Head-up sensor

This is a sensor to detect a head up/down condition. Activating the head in the head-up condition is likely to damage the head or decrease the duration significantly. This head-up sensor is used to control such cases. Operating the head up lever activates the head up sensor fixed to the right side of the frame.



(2) Paper sensor

This is a sensor to detect the presence/absence of paper. Activating the head when paper is not set is likely to damage the head or decrease the duration significantly. This paper sensor is used to control such cases.

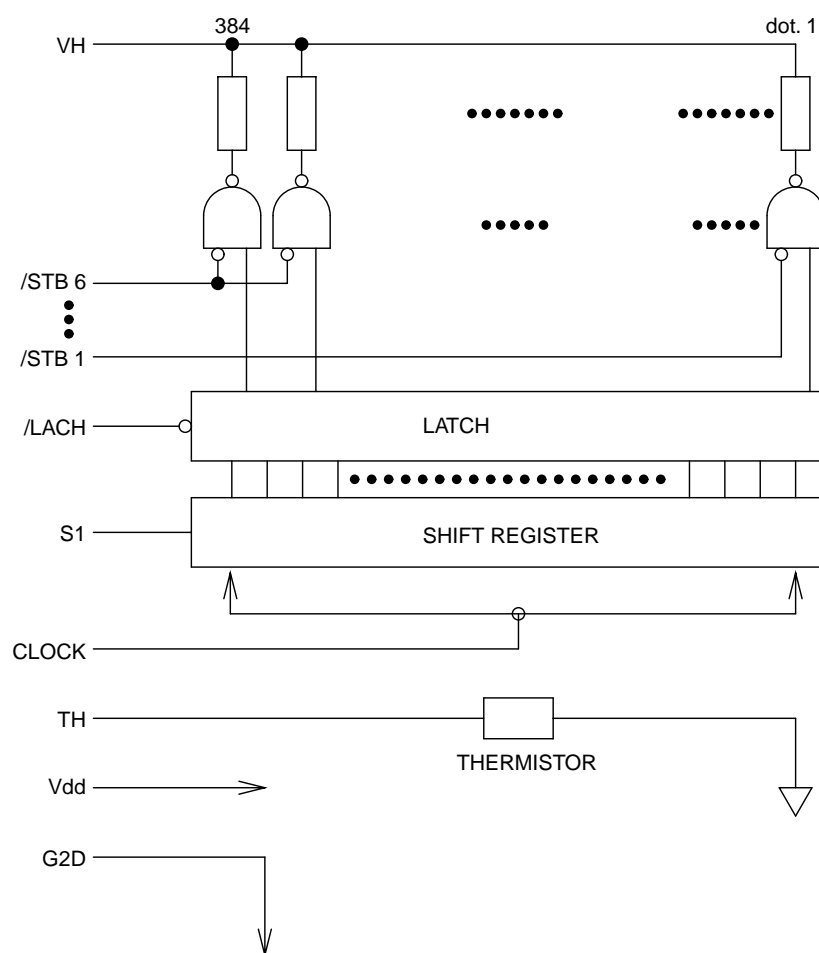


2-3-3 Print Head Mechanism Block

A thermal head is used as the print head of this printer. The thermal head is composed of heating elements and a head driver to drive and control the elements.

(1) Outline of drive control

Serial print data input from SI are transferred to the shift register in synchronization with CLOCK and stored in the latch register by the LATCH signal. When the gate is turned ON by the head activation signal (print commands, STB1 to 6), the heating element corresponding to the stored print data is activated, and this heat prints on paper.



Equivalent circuit of thermal head

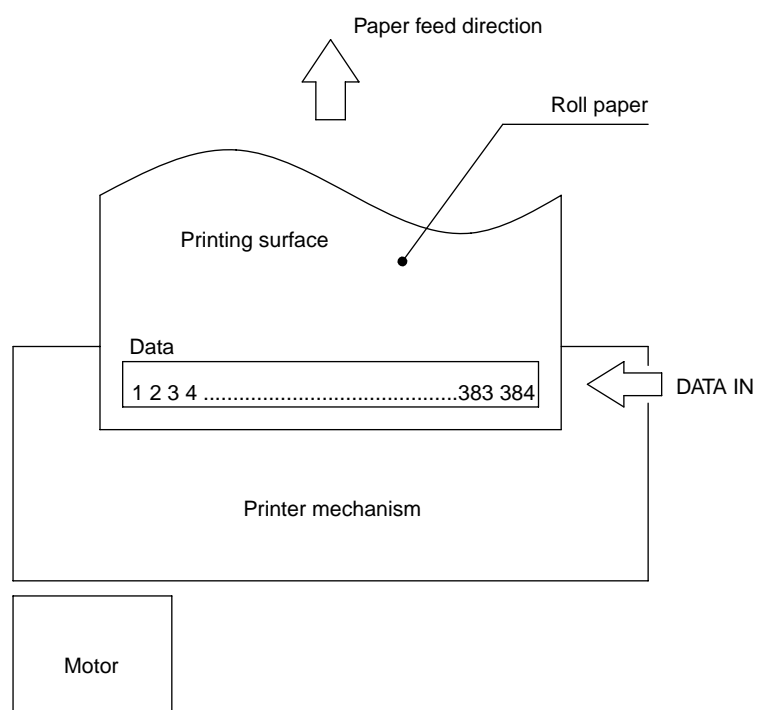
(2) Head separation processing

There are six thermal head strobes. The relationship between the strobe and heating element positions are as follows:

STB No.	Elements No.	Number of dots /STB
1	1~64	64
2	65~128	64
3	129~192	64
4	193~256	64
5	257~320	64
6	321~384	64

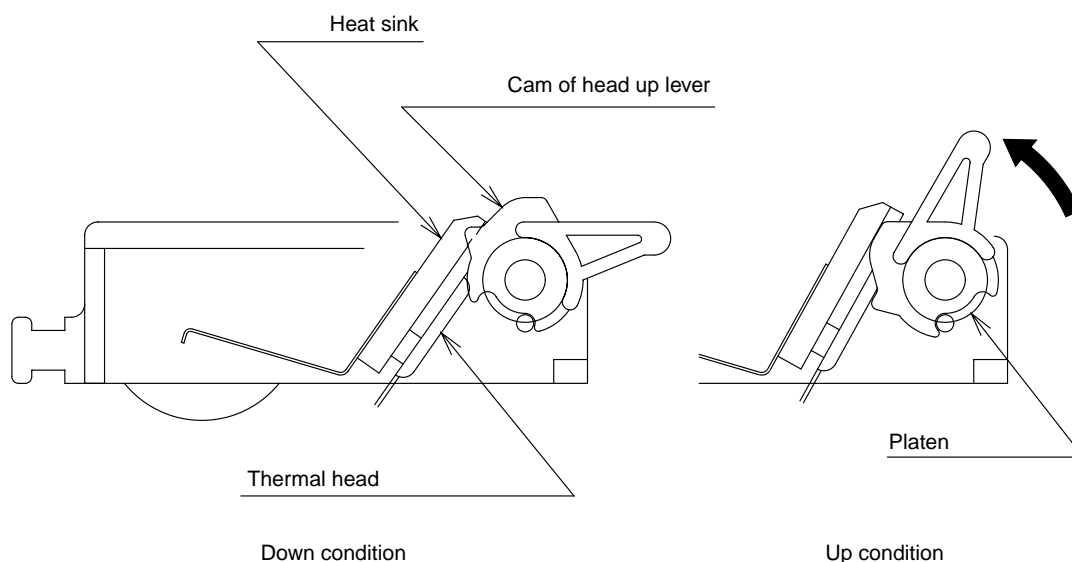
(3) Print data and print location

Data No. 1 to 384 of 384 bits transferred by SI are printed on the location shown in the following figure.

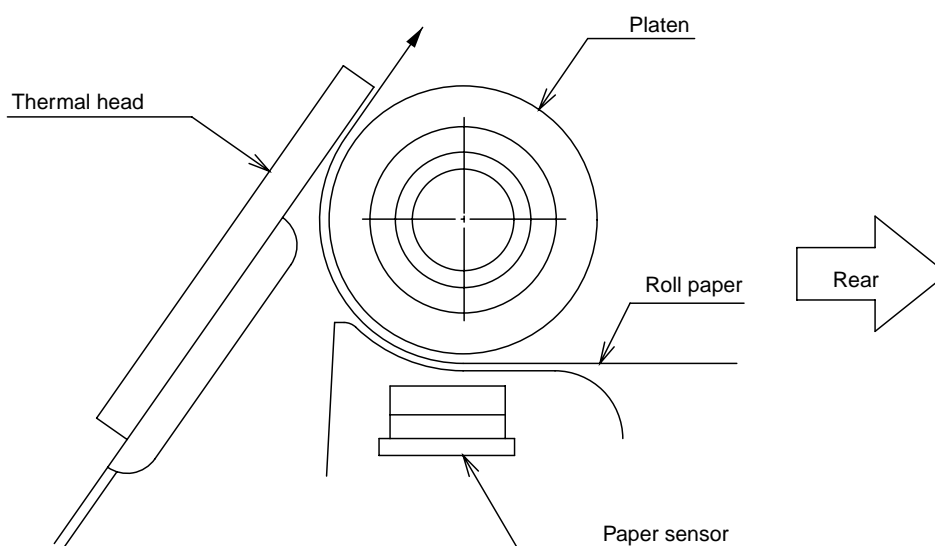


(4) Up/Down mechanism of print head

The print head is normally held in the down condition. When the head-up lever is pushed up, the cam of the lever rotates to push heat sink up and to separate the thermal head from the platen to put the thermal head in the up condition.

**2-3-4 Paper Feed Mechanism Block**

For the paper feed mechanism, the platen, that is the core of the paper feed mechanism, rotates being driven by the power transmission mechanism. Paper is supplied from the rear side of the printer, and transferred to the upper part again through between the platen and head. Then, the paper is pressed to the platen by the head, and is sent as the platen rotates.



2-4 Connecting Terminal

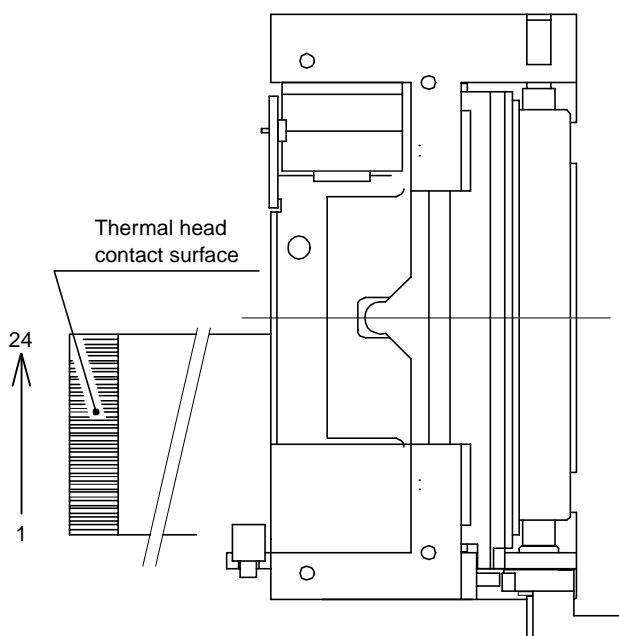
The connecting terminal is composed of two connectors. Details are described in the following.

No.	Function	Number of pins	Type	Recommended mated connector
1	Thermal head	24	FFC Cable (Pitch: 1mm)	52806-2410 (Molex)
2	“Head up” sensor	9	51021-0900 (Molex)	53047-0910
	Paper sensor			53048-0910
	Motor			(Molex)

2-4-1 Thermal Head Terminal

The arrangement of thermal head cables and the function of each terminal are as follows:

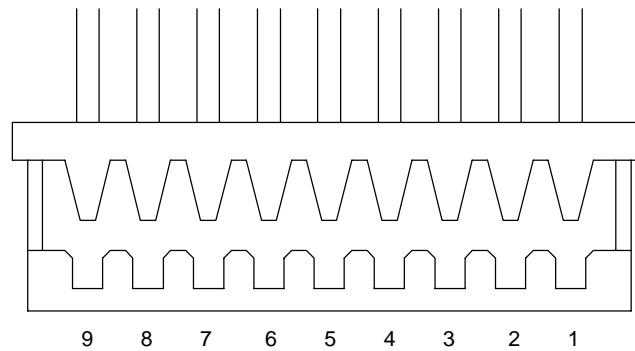
(1) Terminal Arrangement of Thermal Head cables



Pin No.	Signal name
1	VH
2	VH
3	SI
4	GND
5	TM
6	/STROBE1
7	/STROBE2
8	Vdd
9	/LATCH
10	GND
11	/STROBE6
12	CLOCK
13	GND
14	/STROBE5
15	/STROBE3
16	GND
17	GND
18	/STROBE4
19	GND
20	GND
21	GND
22	VH
23	VH
24	VH

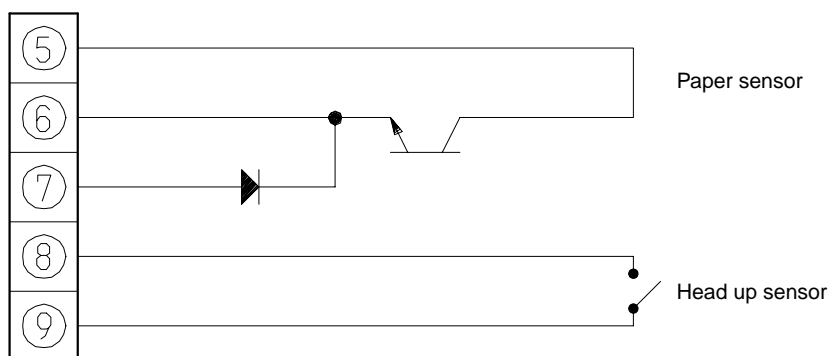
2-4-2 Motor and Sensor connector

The pin layout of the each sensors and motor connector and the name of each pin are as follows.



Pin layout of motor and sensors connector

Pin No.	Pin name	Remarks
1	\bar{B}	
2	\bar{A}	Motor
3	B	
4	A	
5	Photo-interrupter collector	
6	Photo-interrupter emitter + cathode	Paper sensor
7	Photo-interrupter anode	
8	Head-up sensor output	Head up sensor
9	Head-up sensor output	



Sensor connector circuit diagram

Chapter 3 Disassembling and Reassembling

Pay attention to the following matters in maintenance work

Caution:

- (1) Do not disassemble, reassemble, nor adjust the printer without reasons, if it works normally.
Do not undo carelessly screws for fixing components in particular.
- (2) Upon completion of inspections, be sure to check the printer for an anomaly before turning power on.
- (3) Never print without setting paper to the printer.
- (4) Confirm that paper has been set normally.
- (5) Be careful not to leave parts, screws, or others used for maintenance work in the printer.
- (6) In handling the print head, do not use gloves that are easy to generate static electricity.
- (7) In disassembling and reassembling work, check cables and cords for damage or defects, and do not lay them facibily

3-1 Tool List

- * (+) Screwdriver (No. 0).
- * Pincette.
- * Mini-radio-plier.
- * Oil brush.
- * Mini-nipper.

3-2 Procedure for Disassembling

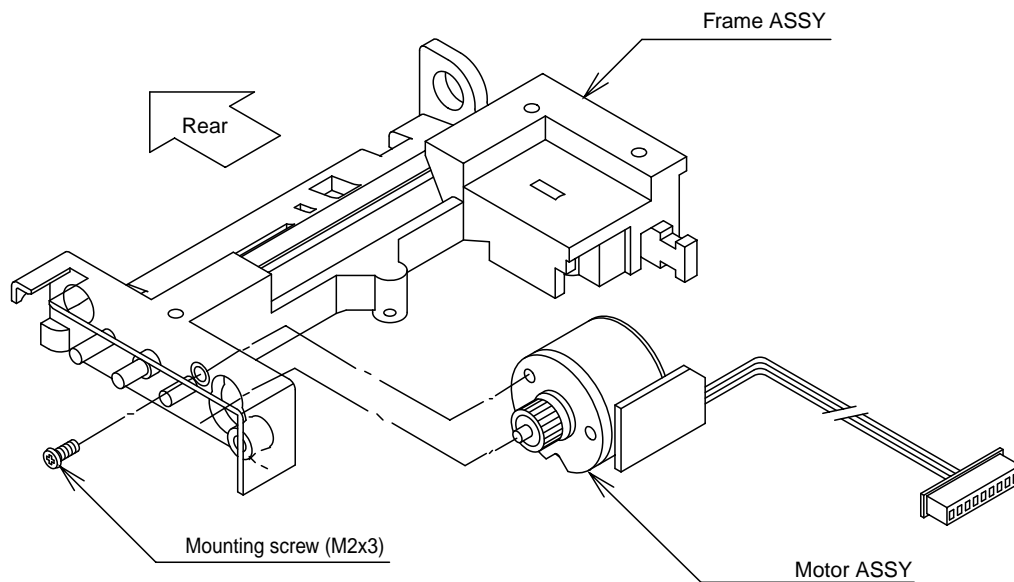
For disassembling the printer, remove parts from the frame assembly according to 3-3 “Procedure for Reassembling”, but in the opposite order.

3-3 Procedure for Reassembling

Parts names used in the explanation are based on those in shown in “Parts List” in Chapter 5. These part names are commonly used over this service manual.

3-3-1 Procedure for Reassembling Printer Body

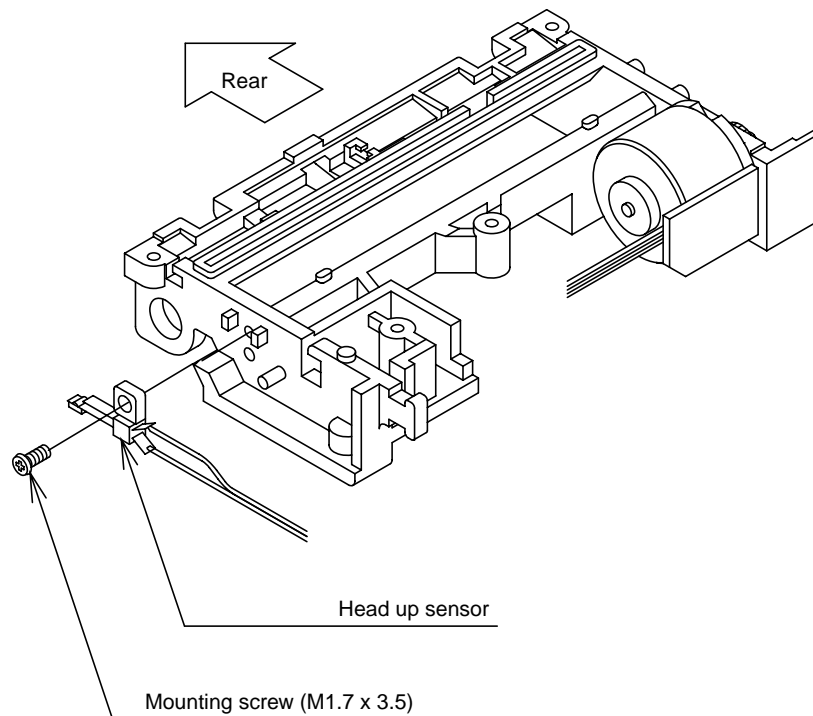
- (1) Incorporate the motor assembly to the frame assembly.
- (2) Fix the motor assembly to the frame assembly by a fitting screw (M2 x 3).



- (3) Incorporate the head-up sensor to the right side of the frame assembly. Set the head-up sensor in the direction, and fix it by a fitting screw (M1.7 x 3.5).

Caution:

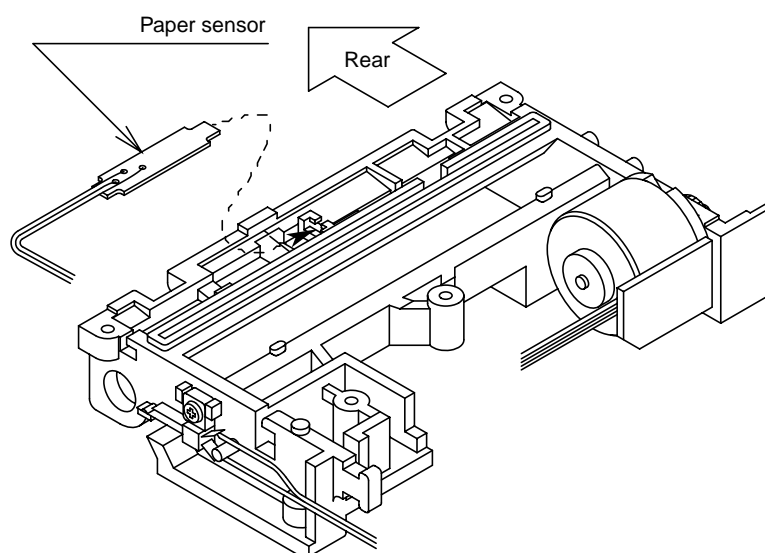
In incorporating, check the leaf of the head-up sensor for deformation, loose fitting, and cracks,



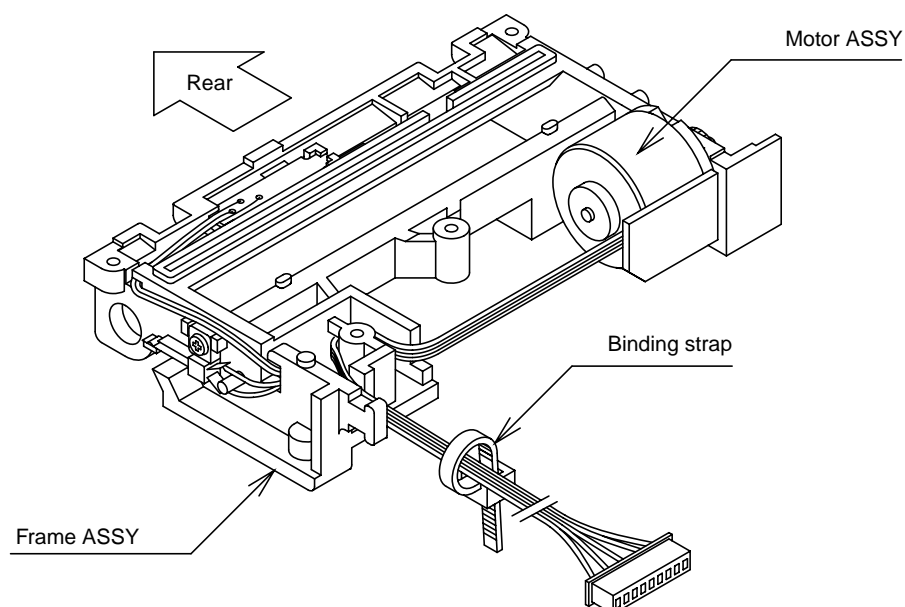
- (4) Incorporate the paper sensor to the bottom surface of the frame assembly.

Caution:

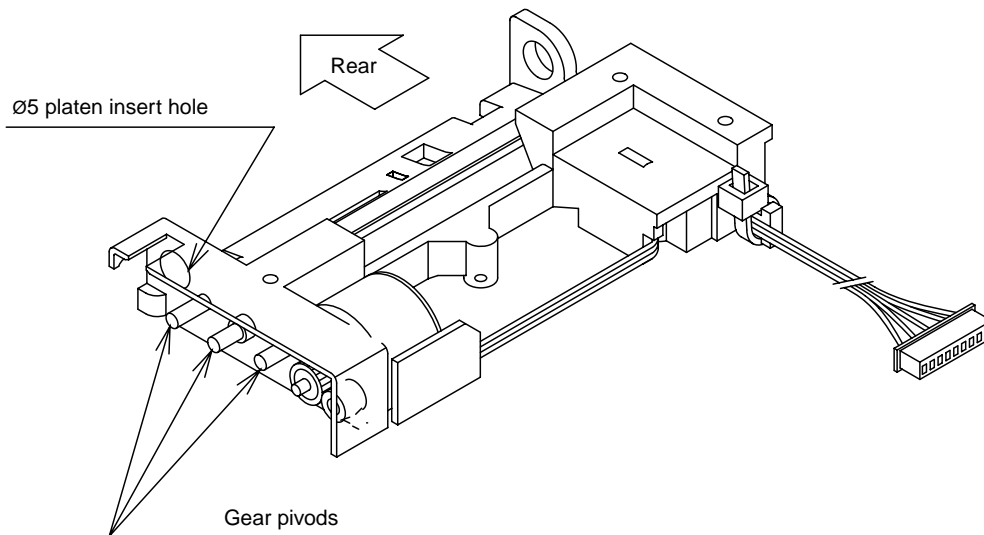
Be careful not to break the cover of lead wires in incorporating work.



- (5) Fix lead wires for the motor assembly with binding strap for lead wires not to get loose.

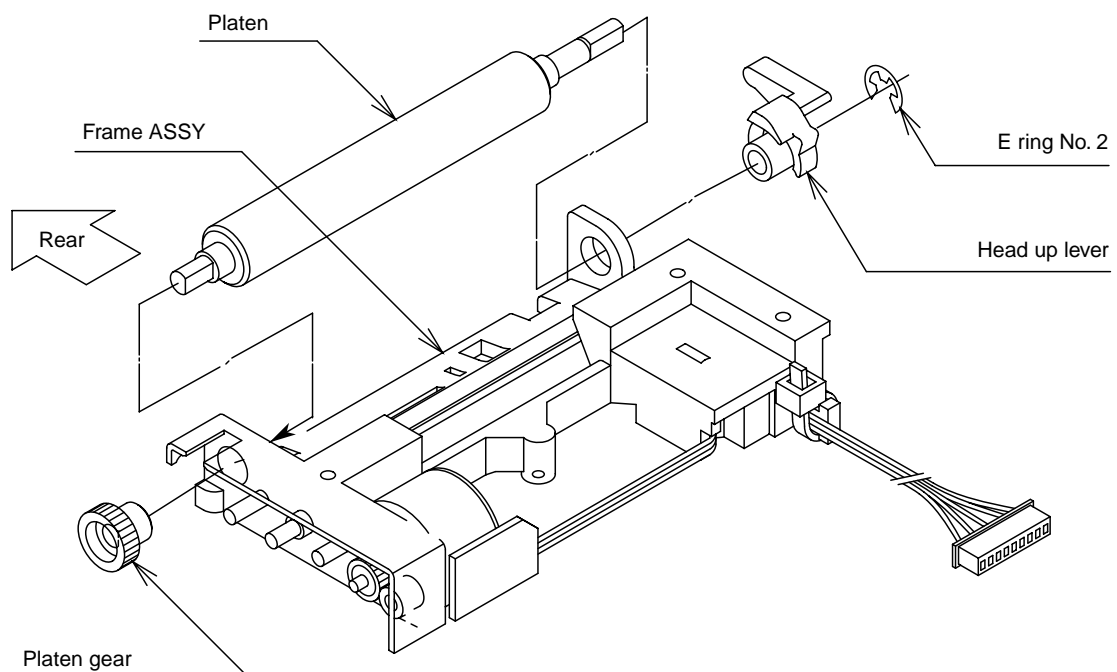


- (6) Apply furoyl G-943 to the three gear pivots on the left side of the frame assembly and to the Ø5 platen insert hole.



- (7) Assemble the platen in the frame assembly.

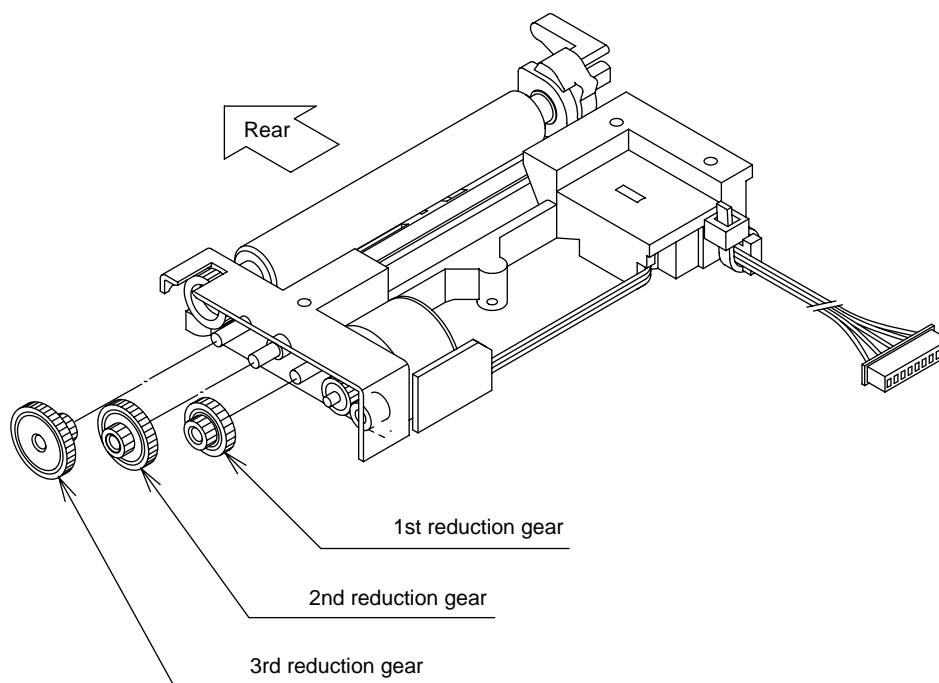
Start by inserting the platen into the hole on the right-side of the frame assembly and then inserting it into the hole on the left side. Next align the profile shape of the platen gear with the left-side metal shaft of the platen and press it on. Insert the head-up lever on the right-side metal shaft of the platen and assemble with No. 2 E ring.



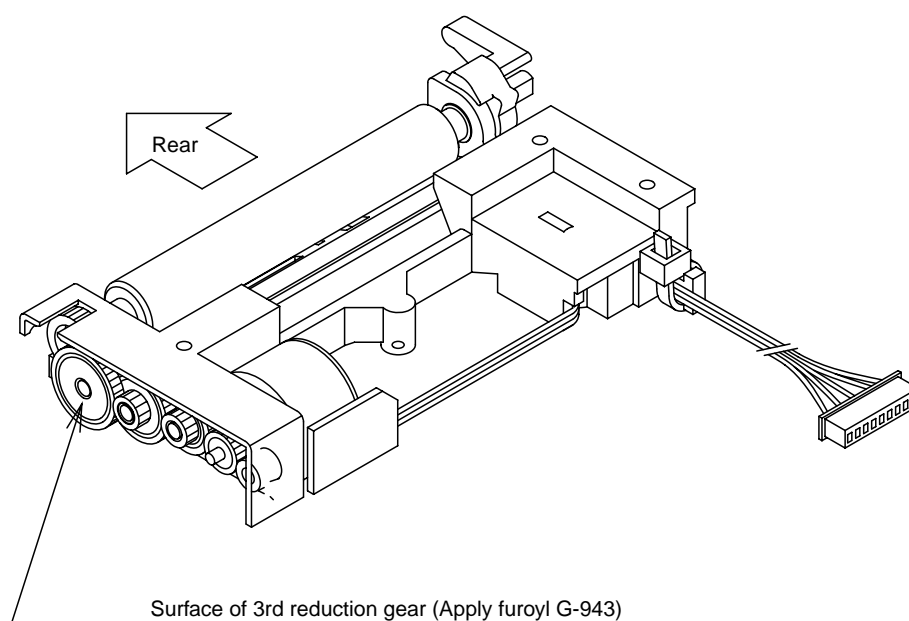
- (8) Incorporate the 1st reduction gear so that it may engage with the gear of the motor.
Incorporate the 2nd reduction gear so that it may engage with the 1st reduction gear.

Caution: In incorporating, be careful about the direction so that the smaller gear comes to the upper side.
Incorporate the 3rd reduction gear so that it may engage with the 2nd reduction gear and platen gear.

Caution: In incorporating, be careful about the direction so that the larger gear comes to the upper side.

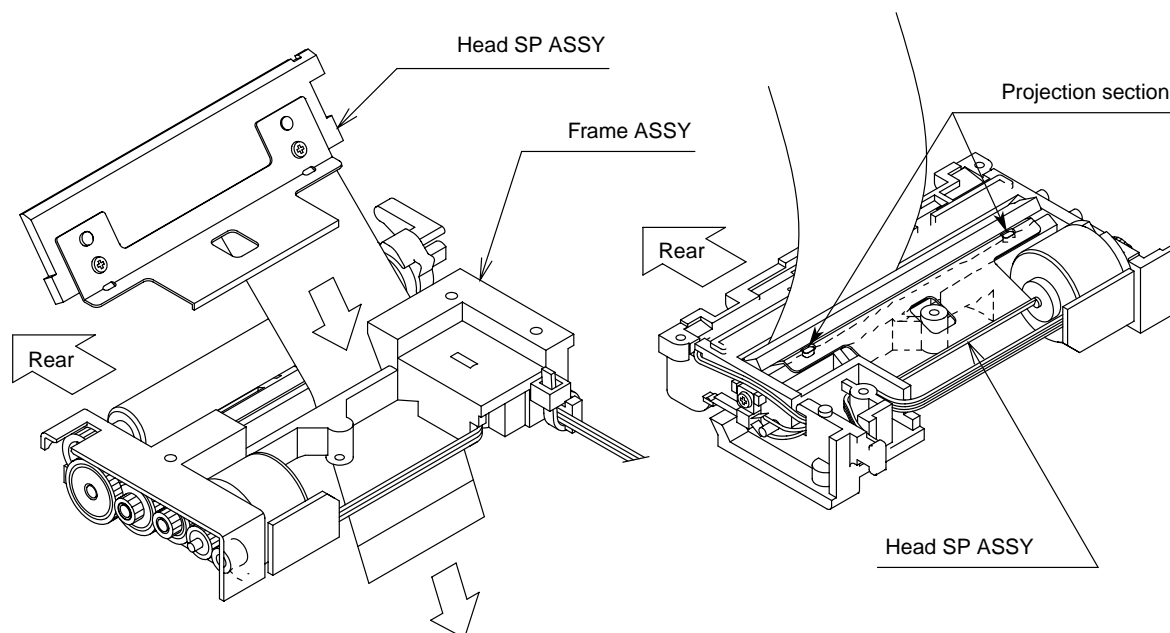


- (9) After assembling each gear, apply furoyl G-943 to the surface of 3rd reduction gear.

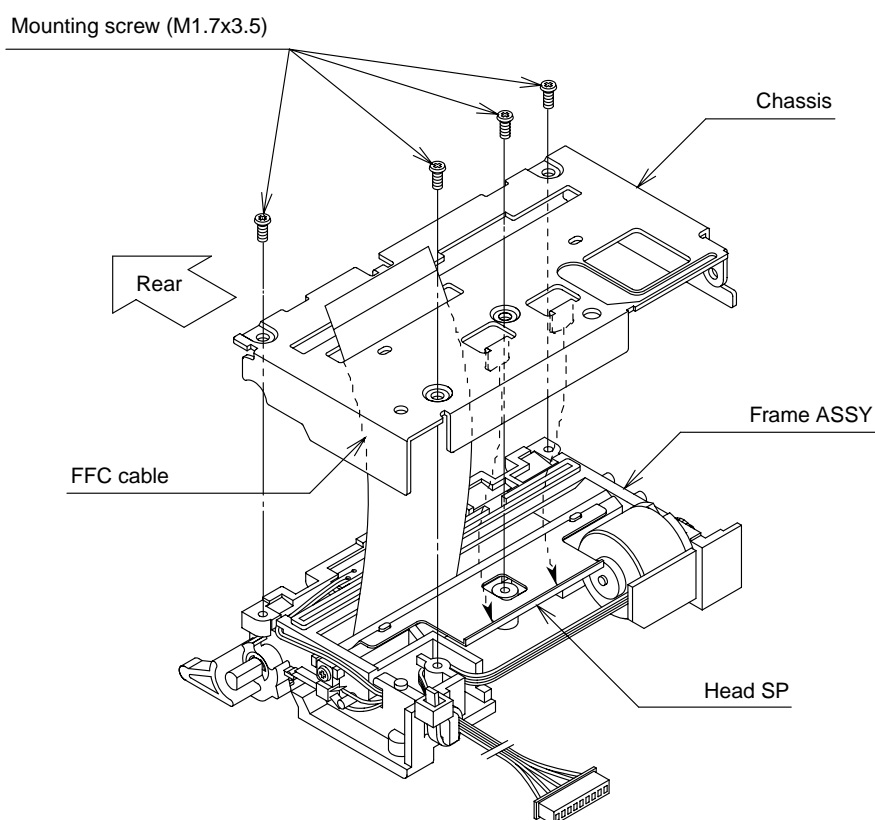


- (10) Insert the head SP assembly from the frame assembly top surface and insert the two holes for the head SP assembly into the projection at the bottom of the frame assembly.

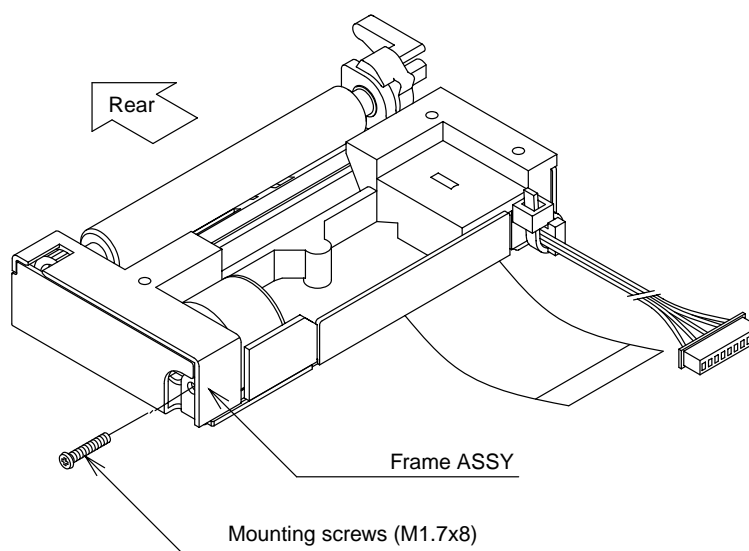
Caution on Handling Thermal Head Assembly: Do not touch the print surface of the head with bare hands.



- (11) Insert the FFC cable for the head SP assembly into the chassis hole. Slightly bend the head SP at two locations near the center and fit it onto the frame assembly. Secure by tightening the four mounting screws (M1.7 x 3.5), starting from the center hole.



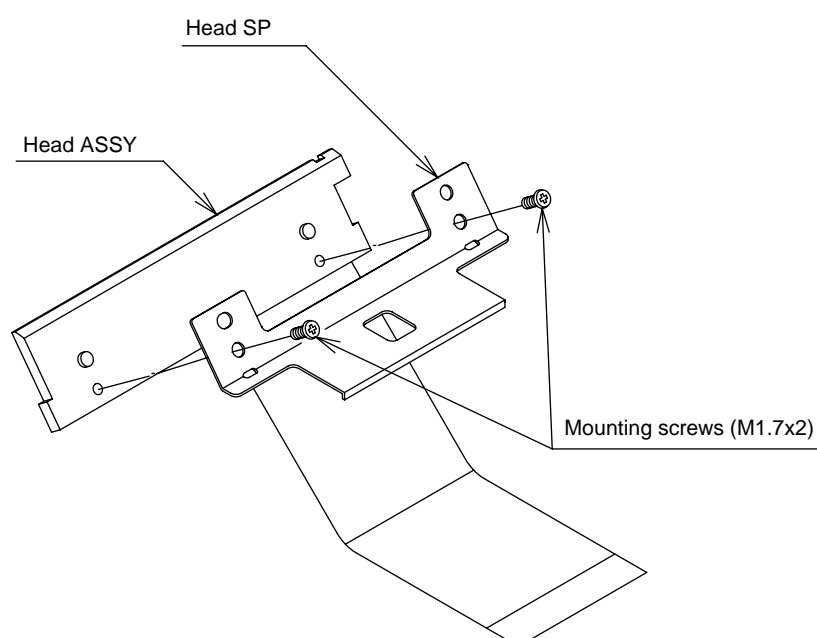
- (12) Insert the mounting screw (M1.7 x 8) into the mounting hole for the motor on the left side of the frame assembly and secure the motor.



This is the end of reassembling work of the printer body.

3-3-2 Head SP ASSY Reassembling Procedure

- (1) Align the head SP with the two projections on the head assembly and insert. Secure with two mounting screws (M1.7 x 2).
This completes the assembly of the head SP ASSY.



Chapter 4 Trouble-Shooting

4-1 Procedure for Repairs

When the printer is out of order, observe the phenomenon of the trouble carefully to specify what is the trouble according to 4-2 “Guide to Repairs.” Then, repair it according to the prescribed method.

*** Phenomenon**

Look for the phenomenon of the trouble in the column of “Phenomenon” in the following list. In the case of phenomena more than one, take up all applicable items. This can specify hidden defects.

*** Causes**

Possible causes are listed as many as possible. Assume possible causes, and specify the cause from the check methods mentioned in the next column.

*** Check Method**

This mentions check methods to specify the cause of the trouble.

*** Repair Method**

Repair the failure according to the method mentioned in this column.

Repairs done according to the above-mentioned procedure can reduce wrong judgment and secure effective trouble-shooting.

4-2 Guide to Repair

4-2-1 Guide to repair

1/2

	Phenomenon	Cause	Check method	Repair method
Print Trouble	Print impossible	Power supply to head poor.	Measure power supply voltage with tester or oscilloscope.	If out of rating, correct power supply circuit.
		Thermal head connection poor.	Check connected condition of connector.	Connect connector correctly.
		Thermal head assembly poor.	—	Replace thermal head assembly.
	Print Light-colored	Power supply to head poor.	Measure power supply voltage with tester or oscilloscope.	If out of rating, correct power supply circuit.
		Thermal head assemble poor.	—	Replace thermal head assembly.
	Dots missing	Foreign matters stuck on thermal head.	Check if foreign matters stuck on thermal head.	Wipe foreign matters off with soft cloth soaked in ethanol.
		Thermal head assembly poor	—	Replace thermal head assembly.
	Print very dirty	Power supply to head poor.	Measure power supply voltage with tester or oscilloscope.	If out of rating, correct power supply circuit.
		Dirt stuck on thermal head	Check if dirt stuck on thermal head.	Wipe dirt with soft cloth soaked in ethanol
	Print quality poor	Paper poor	Check if paper that meets specification is used.	Replace paper that meets specification.

4-2-2 Guide to repair

2/2

	Phenomenon	Cause	Check method	Repair method
Paper Feed Poor	Paper feed motor does not work, or works unstably	Motor connector (Terminal) connection poor	Check connected condition of connector.	Connect connector correctly.
		Power supply to motor poor	Measure power supply voltage with tester or oscilloscope.	If out of rating, correct power supply circuit.
		Lead wire broken in motor assembly	Check conductivity of lead wires in motor assembly.	If lead wire broken, renew motor assembly.
		Motor body poor	Measure power supply voltage with tester or oscilloscope.	If supply voltage is normal, replace motor assembly.
	No paper feed	Paper supply poor	Check if paper jammed or broken to get caught in paper course.	Set paper correctly.
		Foreign matters penetrated in gears	Check if foreign matters get caught in gears.	Remove foreign matters.
		Gear damaged	Check gear for damage.	Replace damaged gear.
		Motor body poor	Measure supply voltage with tester or oscilloscope.	If supply voltage is normal, replace motor assembly.
Sensor Poor	Presence/absence of paper not detected.	Sensor connector (Terminal) connection poor.	Check connected condition of connector.	Connect connector correctly.
		Paper sensor poor	—	Replace sensor assembly.
	Head down not detected.	Sensor connector (Terminal) connection poor.	Check connected condition of connector.	Connect connector correctly.
		Head up sensor poor	Check actuator of head up sensor for deformation.	If sensor is normal, replace sensor assembly.

Chapter 5 Parts List

MLT-288

Ref. No.	Parts No.	Description	Q'ty		Remarks
			-A	-B	
1	100091-00	FRAME ASSY	1		
2	600300-00	FRAME		1	
4	500277-00	CHASSIS	1	1	
5	800396-00	PLATEN	1	1	
6	600301-00	HEADUP LEVER	1	1	
7	600302-00	REDUCTION GEAR 1	1	1	
8	600303-00	REDUCTION GEAR 2	1	1	
9	600304-00	REDUCTION GEAR 3	1	1	
10	600305-00	PLATEN GEAR	1	1	
11	500278-00	HEAD SP	1	1	
12	100092-00	HEAD ASSY	1	1	
16	200001-00	MOTOR ASSY	1	1	
20	200002-00	PE SENSOR ASSY	1	1	
23	200003-00	HEADUP SW ASSY	1	1	
25	H560001-10	CABLE TIE(T18S)	1	1	
26					
27					
28					
29					
30					
31	F16417-035	SCREW,No.0,PHT(BT#1),(GUIDELESS),M1.7x3.5	5	5	
32	F01817-03	SCREW,No.0,PH(#1), M1.7x3	1	1	
33	F01917-08	SCREW,No.0,PH(#1), M1.7x8	1	1	
34	F15917-02	SCREW,No.0,PHT(ST#1), M1.7x2	2	2	
36	F60120-00	E-RING No.2	1	1	
37					
38					
39					

Chapter 6 Disassemble Drawing

MLT-288 disassemble drawing

