CITIZEN

Service Manual

Model : LT-286

Line Thermal Printer

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Japan CBM Corporation

Information Systems Div.

Preface

This booklet explains the operational principle, procedure for maintenance work, and others of the line thermal printer, LT-286, and is intended for maintenance personnel in fields.

Characteristics

LT-286 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
* Print as fast as up to 400 dot line/sec.
* Clear print by high resolution of 8 dot/mm.
* Employment of paper 58 mm in width.
* Employment of a very durable head.
* High reliability by simple mechanism.

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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).

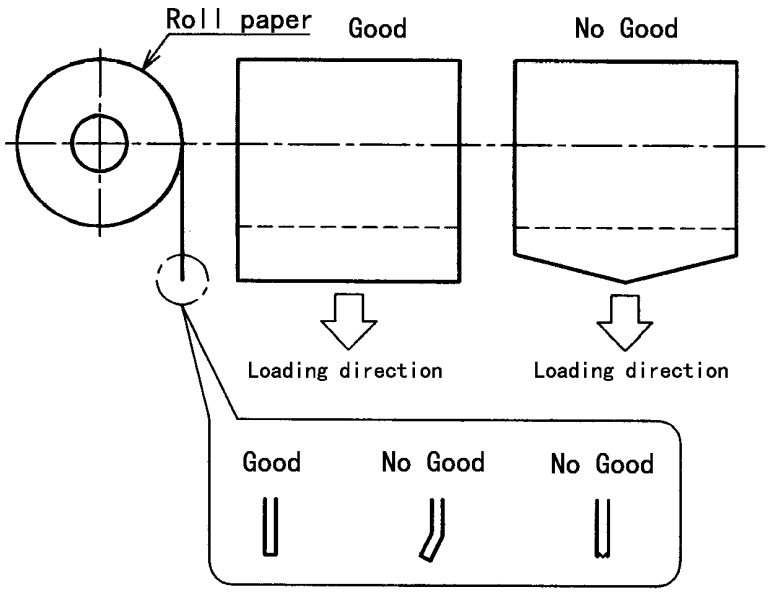
(3) In handling the printer, take anti-static measures and ground the human body to protect the heating elements, ICs, and others from damage due to static electricity.

(4) Wipe off lightly dirt stuck on the surface of heating elements with a cotton swab soaked in ethanol or the like.

(5) During transportation and while the use of the printer is suspended for a long period of time,
put the head in the up condition. Leaving the thermal head pressed to the platen could deform the platen.

(6) Activating the dewed thermal head is likely to damage the head. If dew is present on the head, dry it thoroughly before printing operation.

(7) Feeding Paper
* Feed paper in the head-up condition.
*Cut the forward end of paper straight. Do not insert paper with its forward end fluffed or bent.



Condition of front edge

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

(8) 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	150 dot lines/second 400 dot lines/second	5V, Head temp.>30°C,≤64 dots 7.2V, Head temp.>30°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 Vdd DC4.75~5.25V	Typ. Voltage of Ni-Cd and Li-Ion must be 7.2V(Max). 8.5V would be only after charge a battery.
9	Consumption Current Head(VH) Motor(VH)	Max. Approx. 2.3A Max. Approx. 3.3A Max.Approx. 0.5A, Ave.Approx. 0.3A Max.Approx. 0.8A, Ave.Approx. 0.5A	VH=5V, 142Ω,64dots,25°C VH=7.2V, 142Ω,64dots,25°C VH=5V VH=7.2V
10	Recommended Roll Paper Paper Width Paper Thickness Manufacture Type	 58^{+0}_{-1} mm 60~72μm Shinohji Seishi Co.,Ltd. KF50-HAD	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 φ83mm.
11	Paper Feed Force	50g or more	
12	Paper Holding Force	80g or more	
13	Head Life Pulse Resistance Wear Resistance	 50 million pulses (Printing duty :12.5%) 50 Km	 Normal temperature(25°C) and humidity. Rated energy, recommended paper
14	Environment Operating Environment Storage Environment	 Temperature: 0~45°C Humidity:35~85% Temperature:-20~60°C Humidity:10~90%	 Printing guarantee: 5 to 40°C No condensation Machine stored with head in raised condition
15	Vibration resistance	1G, Frequency 5 to 100Hz in three directions perpendicular to the machine, for one hour	
16	Shock-resistance	60G, 11ms 6 direction, 1 time each	
17	Outer-Dimension	75(W)×56.5(D)×21(H)mm	Excluding paper feed knob, Head up lever and Connectors
18	Weight	Approx. 82g	

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.

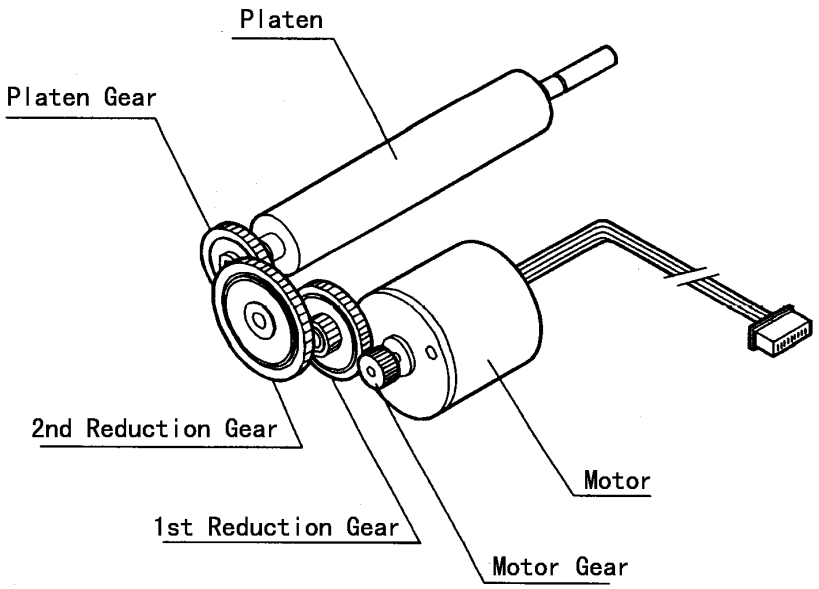
For external circuits and others connected to the printer, refer to respective operation manuals and the like.

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 to transmitted to the platen through the motor gear fixed to the motor gear, the 1st reduction gear, 2nd reduction gear, and platen gear. The platen is rotated by this drive.

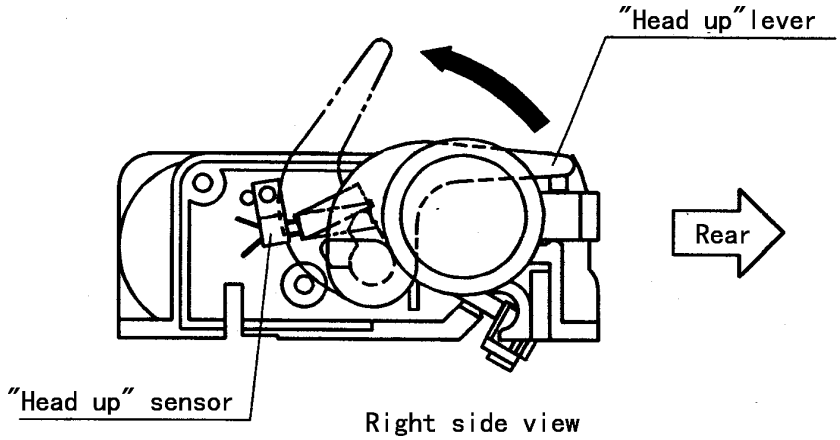


2-3-2 Sensor Mechanism Block

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

(1) Head-up sensor

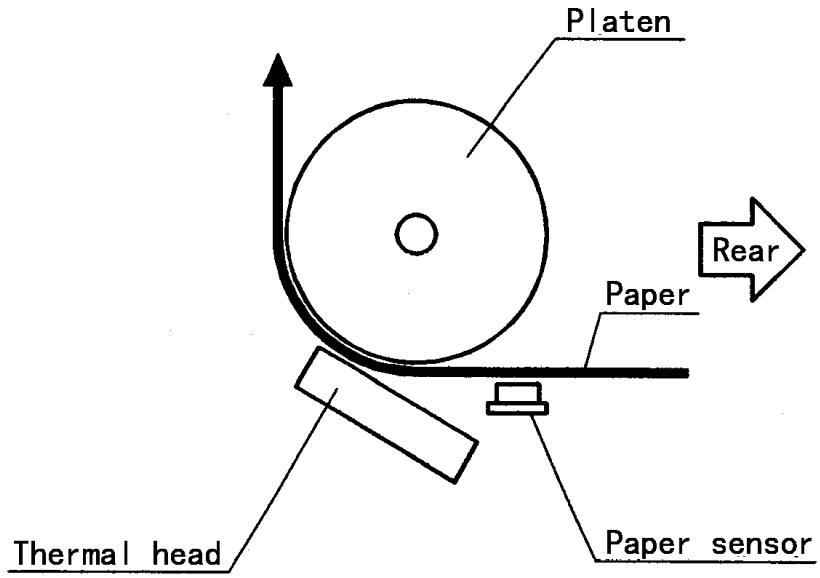
This is a sensor to detect a head up/down condition. Activating the head in the head-up condition is likely to damage the head or decrease the duration significantly. This head-up sensor is used to control such cases. Operating the head-up lever the head-up sensor fixed to the right side of the frame,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



Right side view

(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.

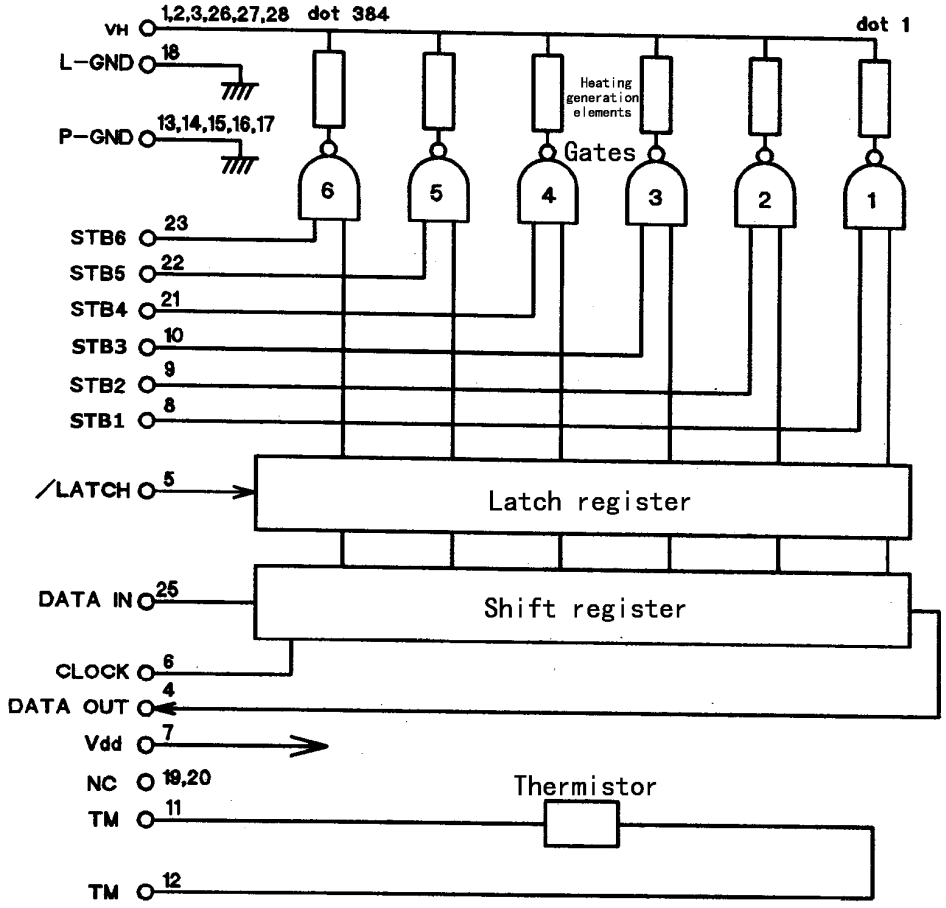


2-3-3 Print Head Mechanism Block

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 DATA IN (DI) are transferred to the shift register in synchronization with CLOCK (CP), and stored in the latch register by the LATCH (LA) 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.



The STB1～STB6 are pulled down in the IC

Equivalent circuit of thermal head

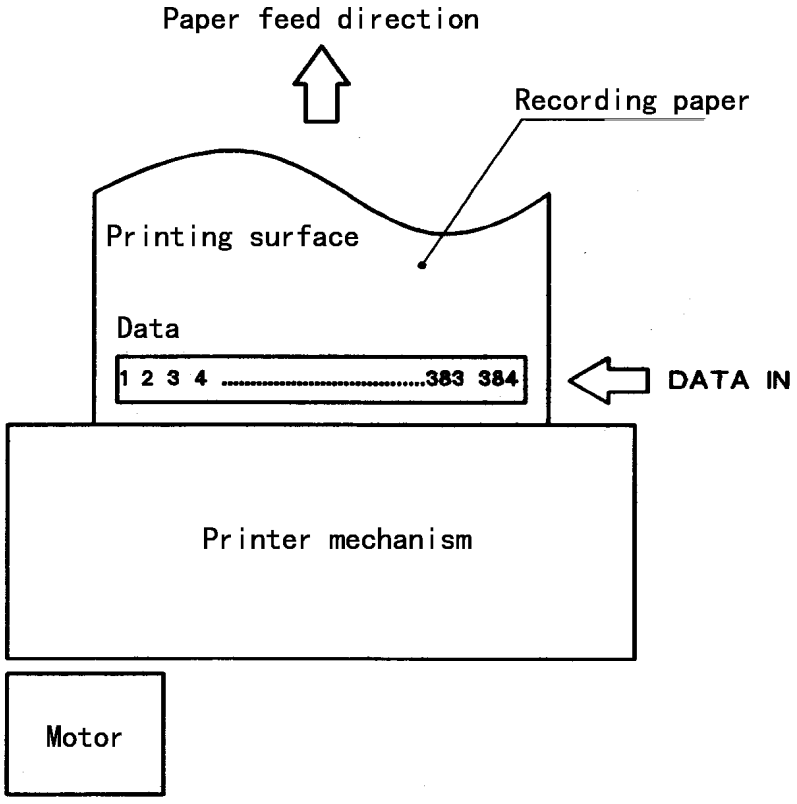
(2) Head separation processing

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

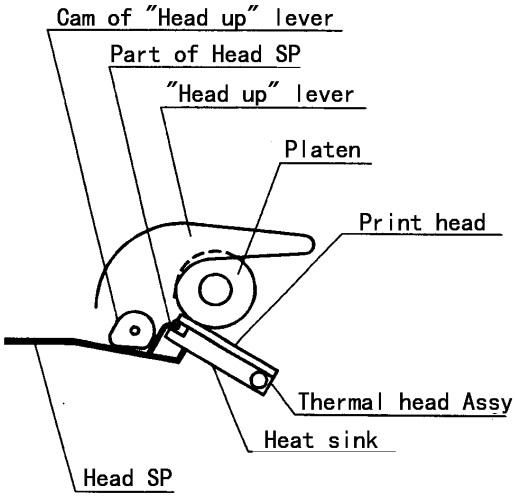
(3) Print data and print location

Data No. 1 to 384 of 384 bits transferred by DATA IN (DI) are printed on the location shown in the following figure.

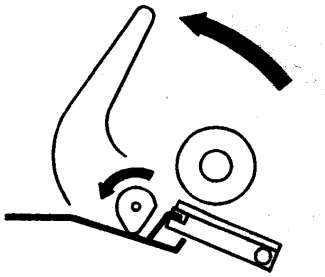


(4) Up/Down mechanism of print head

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 the head SP (head spring) down. The projection of the head SP inserted into the groove provided on the heat sink separates the print head from the platen to put the print head in the up condition.



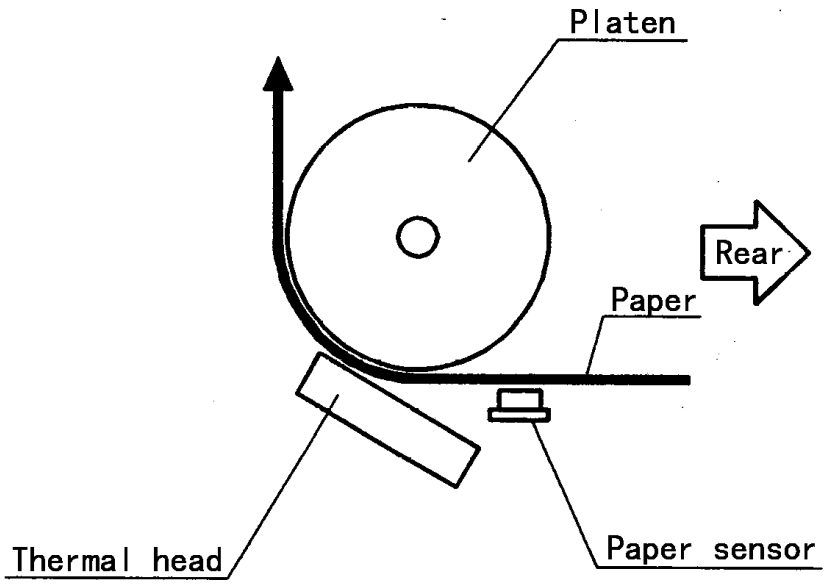
Down condition



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.

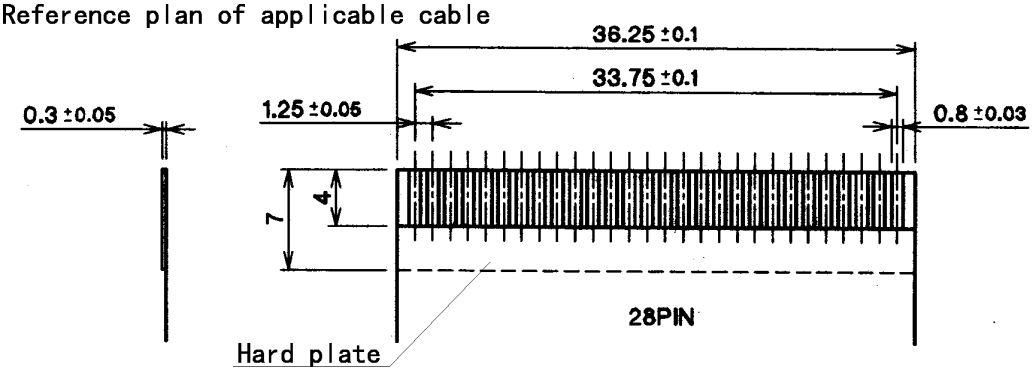


2-4 Connecting Terminal

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

Function	Number of pins	Type	Recommended mated connector
Thermal head	28	Connector for FPC/FFC(Pitch:1.25mm)	Refer to reference plan of applicable cable
"Head up" sensor Paper sensor Motor	10	51021-1000 (Molex)	53047-1010 53048-1010 (Molex)

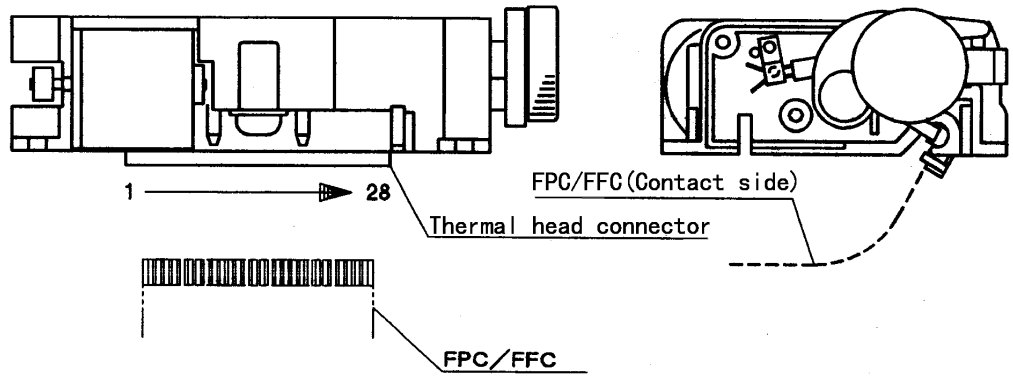
Reference plan of applicable cable



2-4-1 Thermal Head Terminal

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

(1) Terminal Arrangement of Thermal Head Connectors

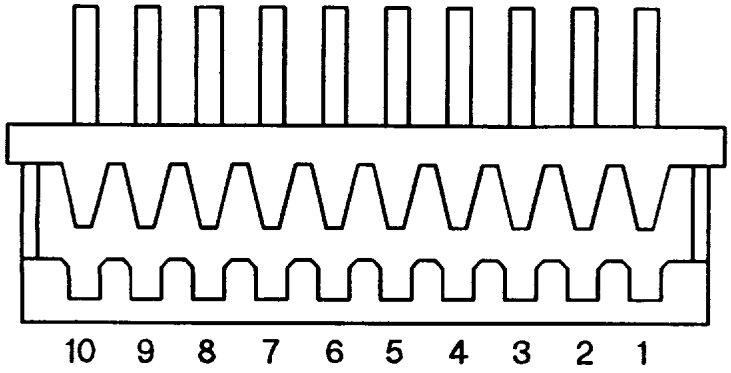


(2) Pin layout of thermal head connector

Pin No.	Signal name	Function
1	VH	Power for thermal head
2	VH	Power for thermal head
3	VH	Power for thermal head
4	DATA OUT	Print data serial output
5	LATCH	Print data latch signal
6	CLOCK	Clock signal for data transfer
7	Vdd	Power for thermal head driver
8	STB1	Strobe 1
9	STB2	Strobe 2
10	STB3	Strobe 3
11	TERMISTOR	Thermistor
12	THERMISTOR	Thermistor
13	P-GND	POWER GND
14	P-GND	POWER GND
15	P-GND	POWER GND
16	P-GND	POWER GND
17	P-GND	POWER GND
18	L-GND	LOGIC GND
19	NC	NO CONNECTION
20	NC	NO CONNECTION
21	STB4	Strobe 4
22	STB5	Strobe 5
23	STB6	Strobe 6
24	NC	NO CONNECTION
25	DATA IN	Print data signal input
26	VH	Power for thermal head
27	VH	Power for thermal head
28	VH	Power for thermal head

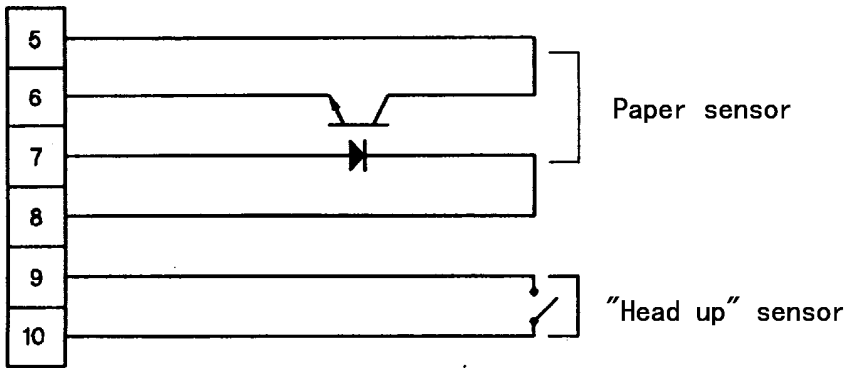
2-4-2 Motor and Sensor connector

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	A	Motor
2	B	
3	$\overline{A}$	
4	$\overline{B}$	
5	Photo-transistor collector	Paper sensor
6	Photo-transistor emitter	
7	LED anode	
8	LED cathode	
9	Head-up sensor output	Head up sensor
10	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 forcibly.

3-1 Tool List

* (+) Screwdriver (No. 0 and 2).
* Pincette.
* Mini-radio-plier.
* Oil brush.
* Mini-nipper.
* Plier exclusive for grip rings.

3-2 Procedure for Disassembling

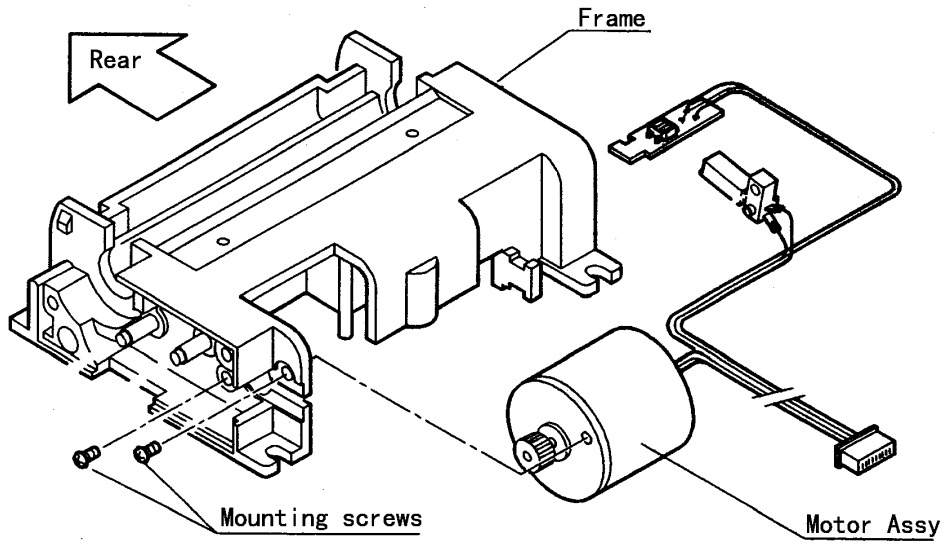
For disassembling the printer, remove parts from the frame according to 3-3 "Procedure for Reassembling", but in the opposite order.

3-3 Procedure for Reassembling

Separating into reassembling of the printer body and that of the platen roller unit, procedure for reassembling is explained in the following. 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.

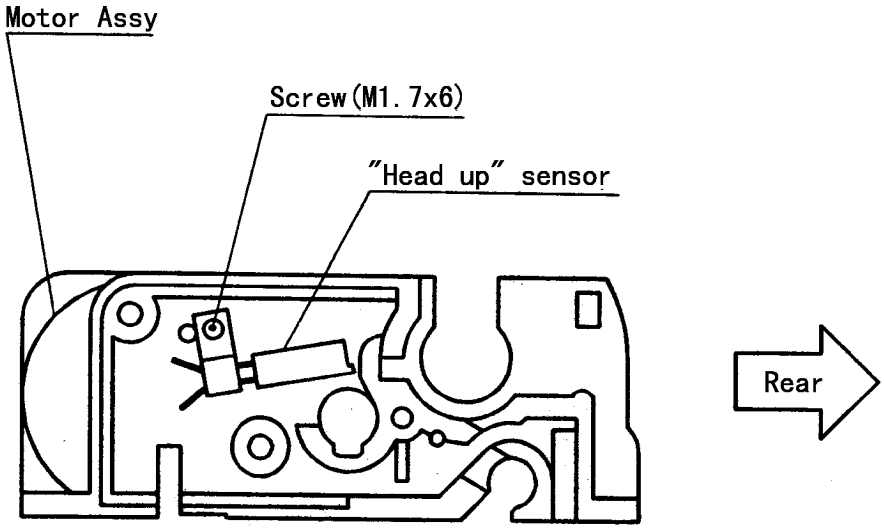
3-3-1 Procedure for Reassembling Printer Body

(1) Incorporate the motor assembly to the frame.
(2) Fix the motor assembly to the frame by two fitting screws (M2 x 3).



(3) Incorporate the head-up sensor to the right side of the frame. Set the head-up sensor in the
direction, and fix it by a fitting screw (M1.7 x 6).

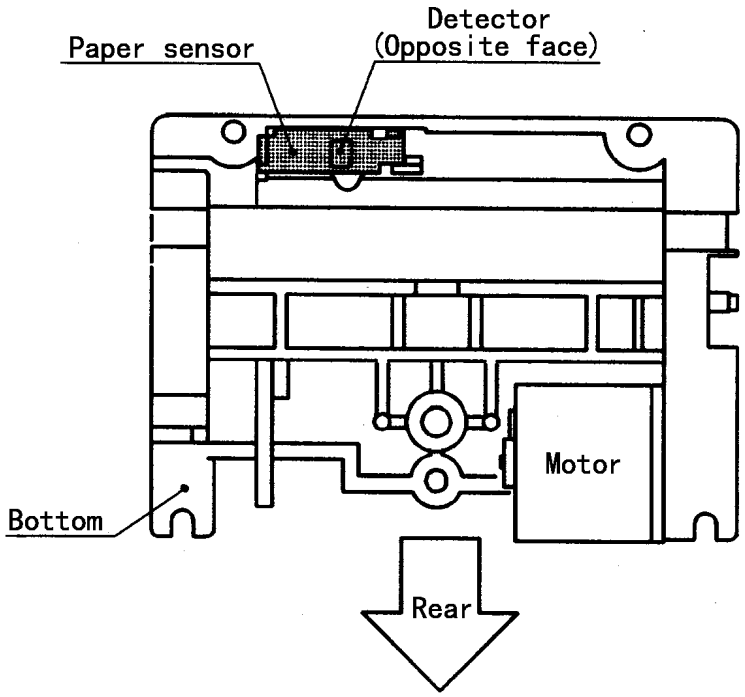
Caution:
In incorporating, check the leaf of the head-up sensor for deformation, loose fitting, and cracks,



Right side view

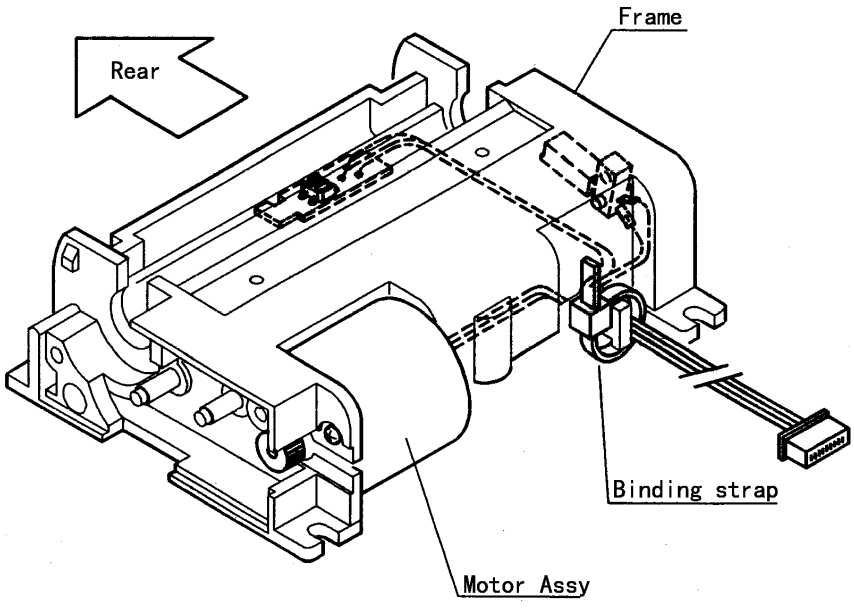
(4) Incorporate the paper sensor to the bottom surface of the frame.

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

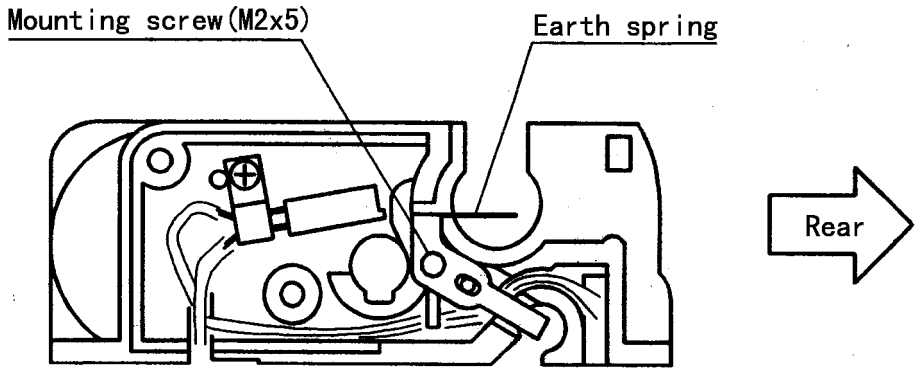


Bottom side view

(5) Fix lead wires for the motor assembly with binder wires for leads not to get loose.

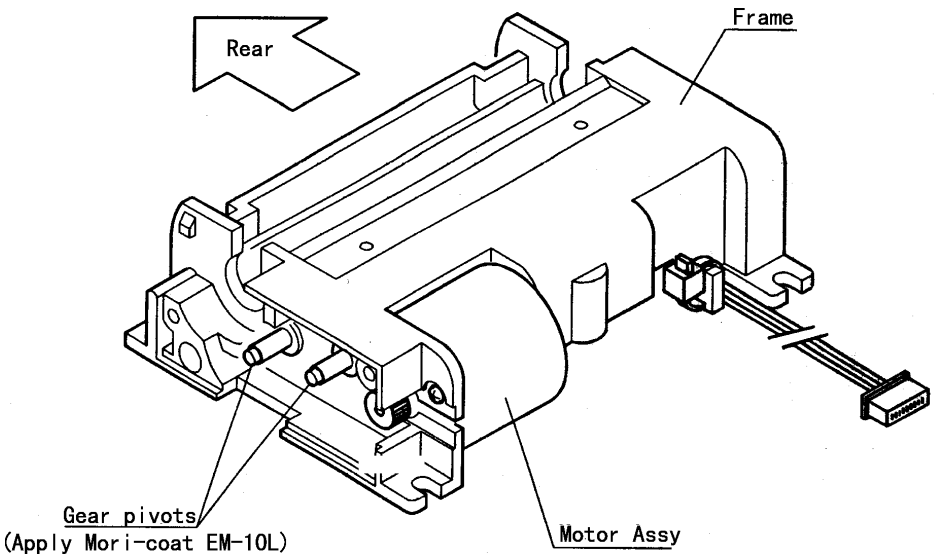


(6) Incorporate the earth spring to the frame by a fitting screw (M2 x 5).

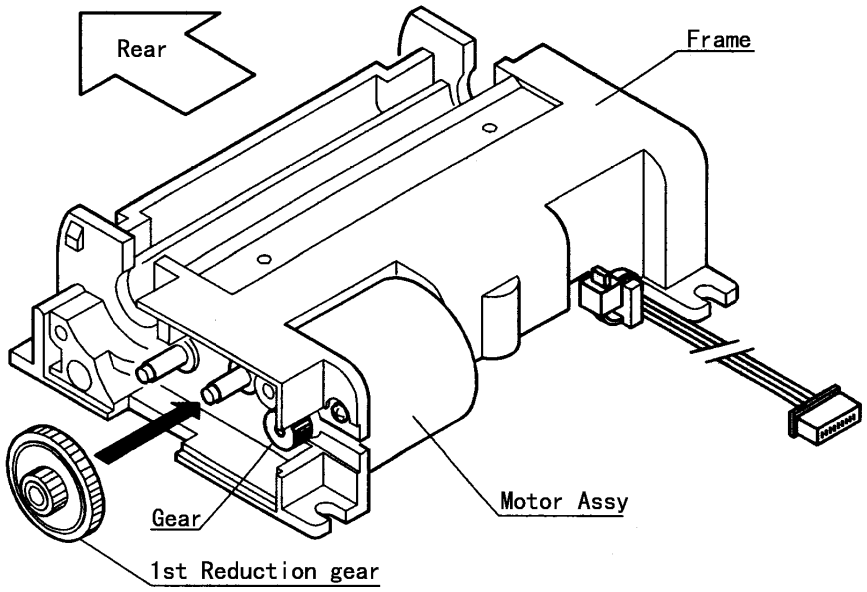


Right side view

(7) Apply grease(Mori-coat EM-10L)to two gear pivots on the left side of the frame.

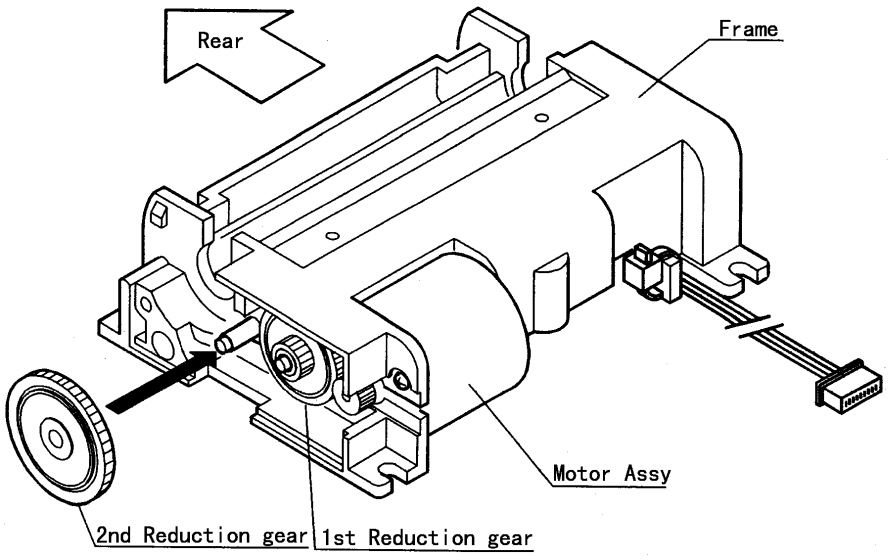


(8) Incorporate the 1st reduction gear so that it may engage with the gear of the motor assembly.

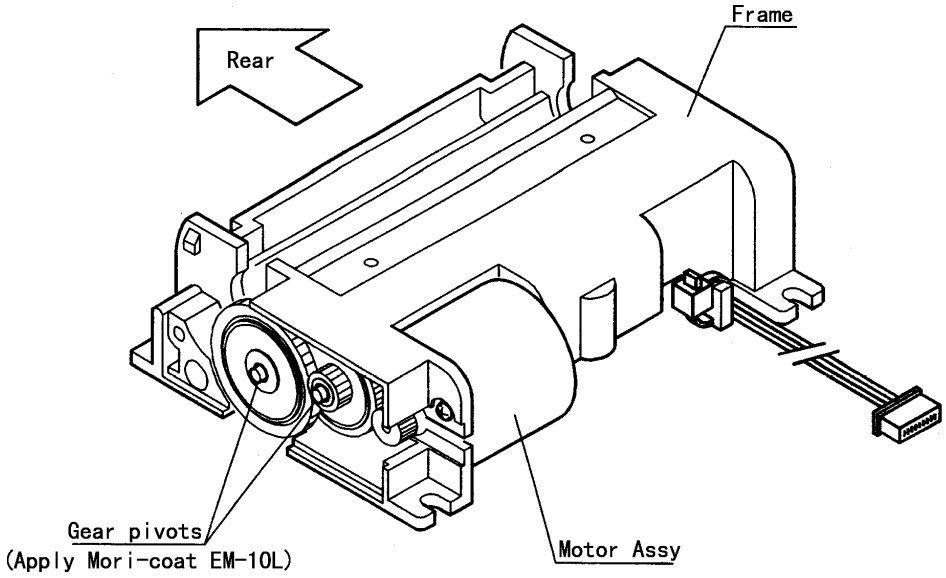


(9) Incorporate the 2nd reduction gear so that it may engage with the 1st reduction gear.

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

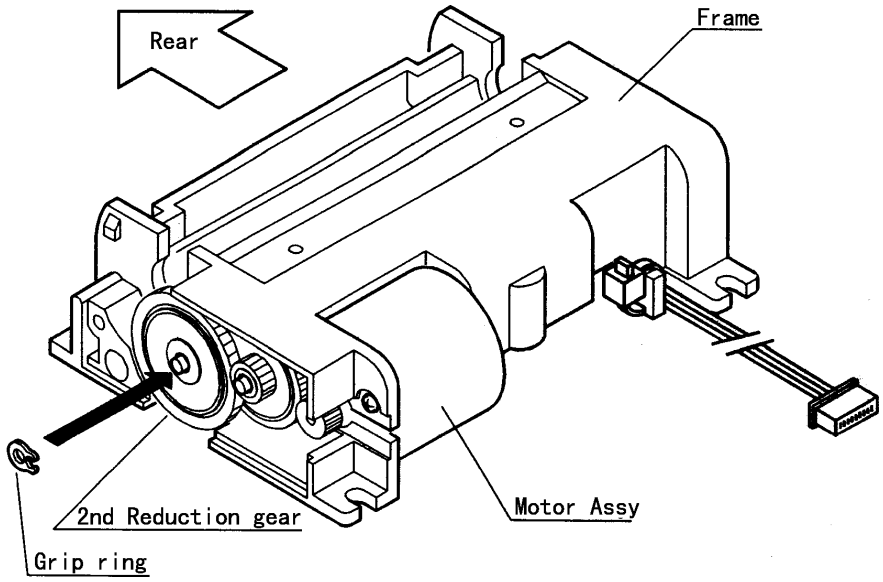


(10) Apply Mori-coat EM-10L to two gear pivots in which gears have been incorporated.



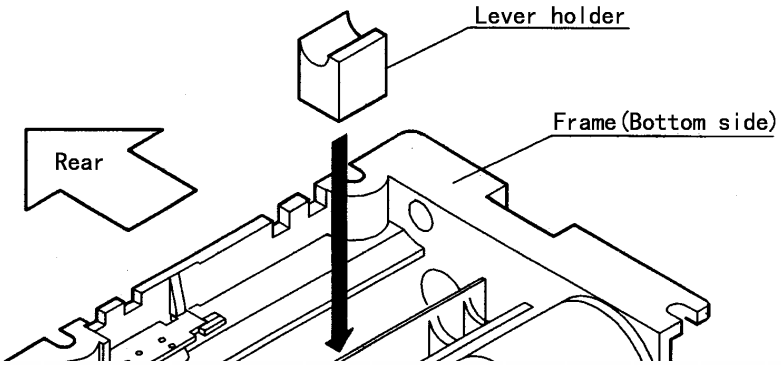
(11) Put and incorporate the grip ring to the stepped portion on the tip of the pivot for the 2nd reduction gear fully to the root of the step using a plier exclusive for grip rings.

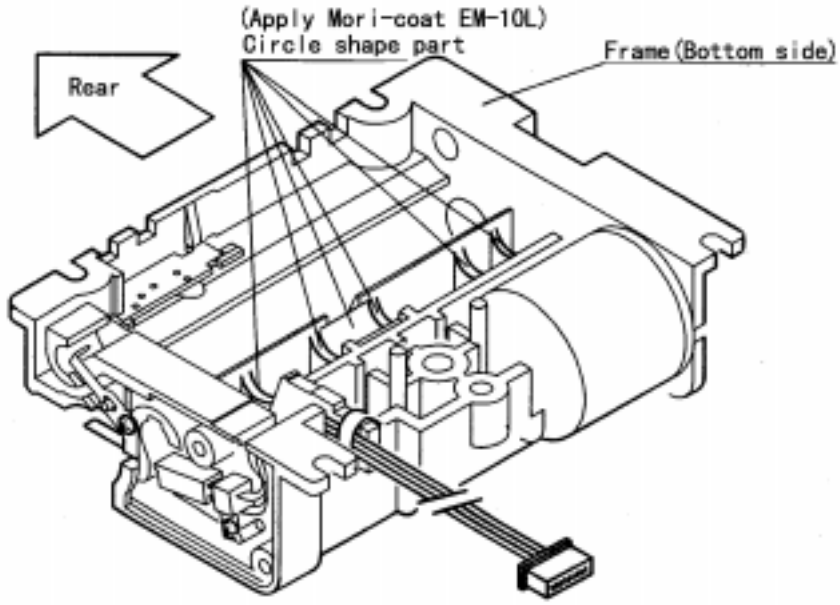
Caution:
(a) Inserting grip rings requires the use of an exclusive plier.
(b) The openness of the grip ring in insertion should not be much more than the outside diameter of the gear pivot. Much openness decreases the spring force to reduce the securing force of the grip ring.



(12) Put the lever holder in the frame.

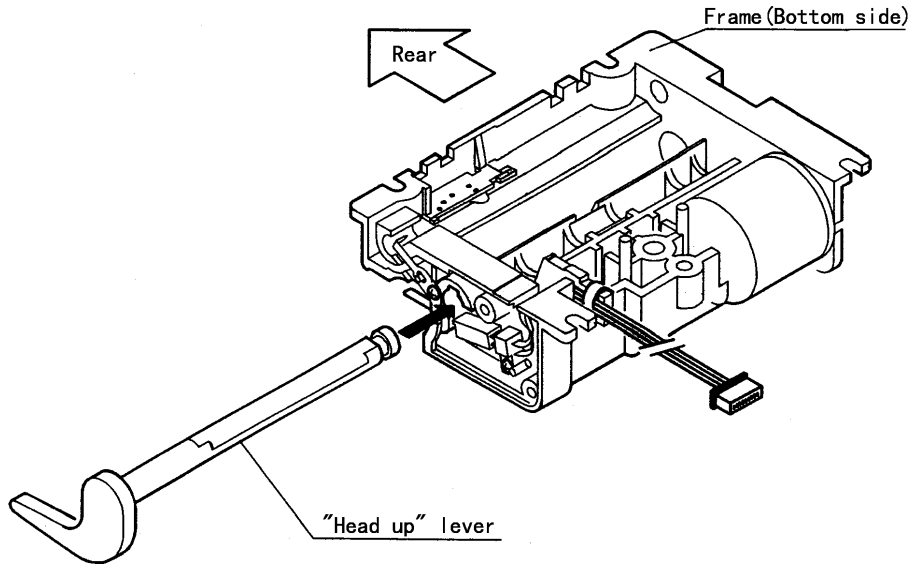
Caution:
Be careful about the direction of inserting the lever holder so that the arc-shaped part comes to the paper insertion inlet side.



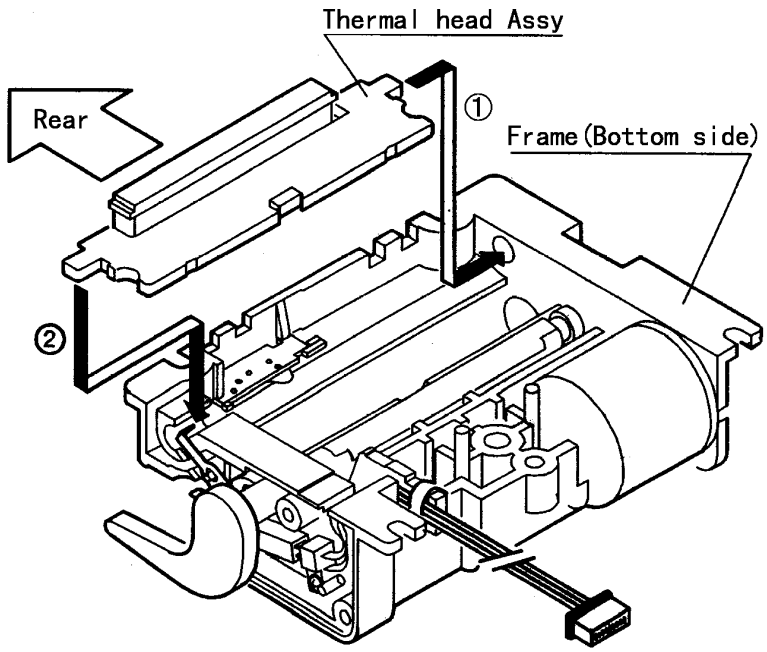


and the arc-shaped

(14) Insert the head-up lever from the right side of the frame.
Caution:
Insert the lever so that the sectional form of the shaft of the head-up lever and that of the hole on the frame agree.

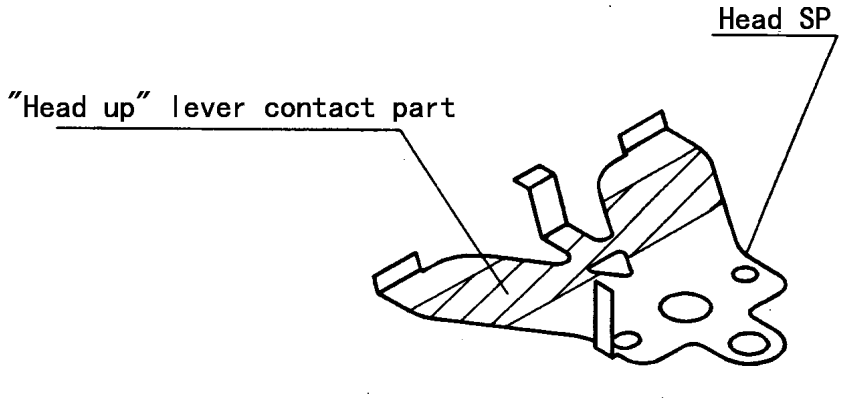


(14) Incorporate the thermal head assembly from the bottom side of the frame. First, insert it from the hole on the side on which the motor is fitted.
Caution:
In inserting the assembly, be careful not to deform the earthing spring fitted on the right side of the frame.

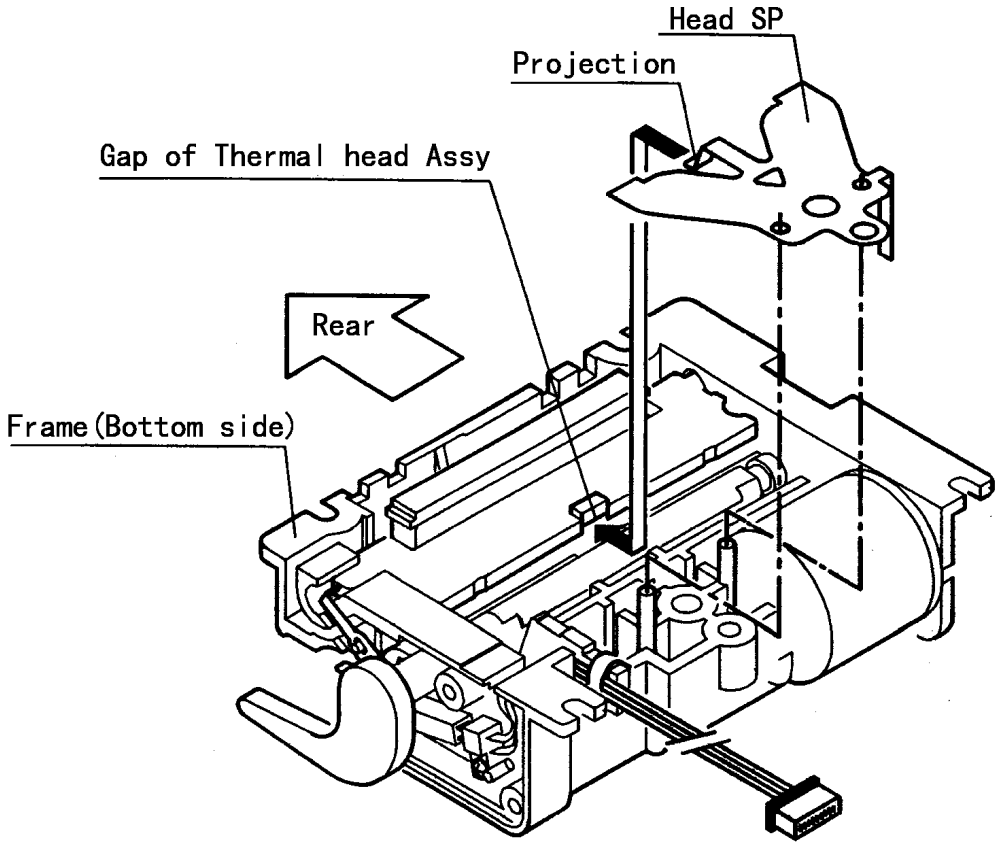


Caution on Handling Thermal Head Assembly:
(a) Do not touch the print surface of the head with bear hands.
(b) After the head is incorporated, keep the head-up lever to the up condition all the time except during print time so that the platen should not touch the head.

(16) Apply Mori-coat EM-10L to the area of the head SP where the head-up lever touches it (the shaded area in the following figure).

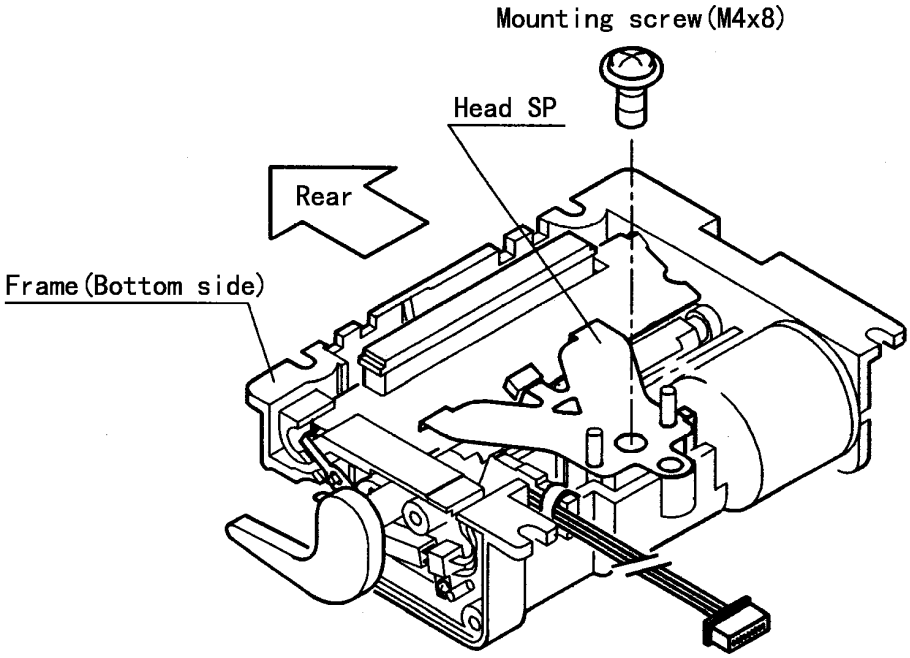


(17) Inserting the projection at the center of the head SP to the groove at the center of the thermal head assembly from the bottom side of the frame, insert the head SP to two shafts of the frame.

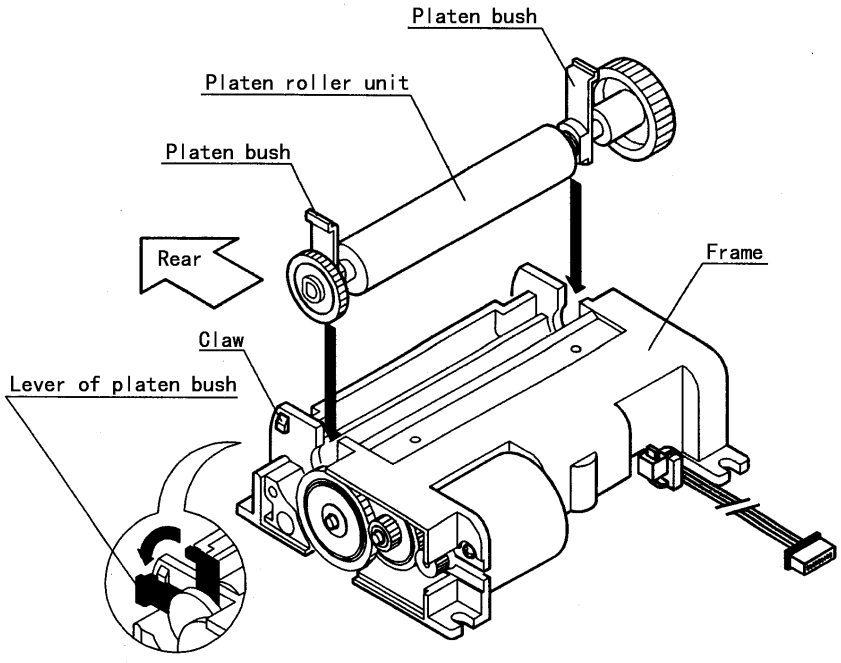


(18) Fix the head SP by a fitting screw (M4 x 8).

Caution:
Fasten the fitting screw carefully since the screw, for which a tapping screw is used, is likely to be fastened diagonally.



(19) Put the platen roller unit in the frame. Push the lever of the platen bushing down by 90 degrees in order to hang it to the claw of the frame.



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

3-3-2 Procedure for Reassembling Platen Roller Unit

(1) Insert platen bushings to both sides of the platen.

(2) Fix the inserted platen bushings at both sides by two E rings.

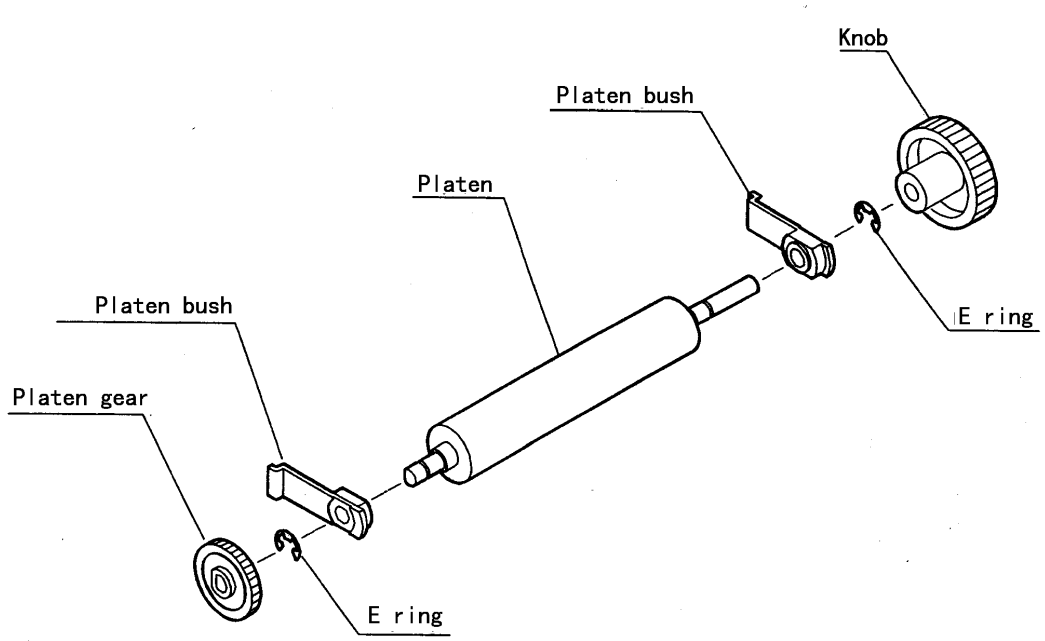
(3) Push and insert the knob to the right side shaft of the platen. In this time, make the D-cut portion of the shaft agree with the D-shaped hole of the knob.

(4) Push and insert the platen gear to the left side shaft of the platen. In this time, make the D-cut portion of the shaft agree with the D-shaped hole of the gear.

Caution:
(a) In incorporating the platen gear, be careful about its direction so that the stamped side comes to the bushing side.

(b) Use a mini-radio-plier or pincette to fix E rings.

This is the end of reassembling the roller unit.



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.		Renew 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.		Renew 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		Renew 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.	Use 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, renew 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.	Renew damaged gear.
		Motor body poor	Measure supply voltage with tester or oscilloscope.	If supply voltage is normal, renew motor assemly.
Sensor Poor	Presence/absene of paper not detected.	Sensor connector (Terminal) connection poor.	Check connector connection.	Connect connector correctly.
		Paper sensor poor		Renew 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, renew sensor assembly.

Chapter 5 Parts List

SERVICEPARTS LIST MODEL: LT-286	REV	DATE	COMMENT	APPROVED	DRAWN	PAGE
	0.00	'97.6.12	New version	Omata	Gonmori	1/1

REF	PARTS No.	DESCRIPTION	QTY	DRAWING No.	OTHERS
1		Flame	1	60-0214	
3	E8016-070	Motor Assy	1	25-0348	
4	E8017-080	Motor SMR30-2031-A	(1)		
5	E8018-080	Head up sensor Assy	(1)	25-0345	
6	E8018-090	PE sensor Assy	(1)	25-0344	
9	E8019-090	1st Reduction gear	1	60-0210	
10	E8019-100	2nd Reduction gear	1	60-0211	
12	E8031-080	Platen roller	1	80-0319	
13	E8019-110	Platen gear	1	60-0209	
14	E8025-070	Platen bush	2	60-0208	
15	E8029-040	Knob	1	60-0212	
17	E8032-110	Head up lever	1	60-0213	
18	E8036-010	Lever holder	1	60-0217	
19	E8037-010	Earth spring	1	50-0200	
24	E66000240	Thermal head KF2002-GF13F	1	10-0081	
26	E8021-120	Head spring	1	50-0201	
32	23G65872	Grip ring No.2	1		
33	23G65915	M4×8	1		
34	23G65880	M1.7×6	1		
35	23G65897	M2×5	1		
36	23G65908	M2×3	2		
38	E2	E ring No.2	2		

Appendix

LT-286 disassemble drawing