

# CHAPTER 6

## MAINTENANCE AND INSPECTION

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## 6.1 Handling

### (1) Ambient Conditions

- Avoid use and storage in a humid place because moisture can cause troubles.
- Avoid use and storage at extremely high or low temperatures, and be careful not to expose to sharp temperature change.  
(Avoid use and storage in direct sunlight or near an air conditioner or a heater.)
- Avoid use in a place where the system may be exposed to much vibration or shock.

### (2) Handling

#### **Storage and Use**

- Place the HX-20 on a flat surface, such as a table or the like.
- Be careful not to place a heavy object on the machine or twist it during storage or transit.
- The HX-20 is composed of precision-made parts so do not subject it to shock, and avoid using it without the case cover. Otherwise, dust and static can adversely affect it to cause troubles.

#### **Power Supply**

- Operate the HX-20 normally on the built-in batteries. (Do not connect the AC adaptor.)
- The HX-20 can be used with the AC adaptor connected, but repeated use for a long time overcharges the batteries, resulting in a short battery life.
- The built-in batteries can discharge completely if the machine is left unused for a long period of time. If the batteries discharge completely, the programs stored in the RAMs disappears, and the batteries themselves are degraded. If the machine is unused for a long period of time, push the power switch on from time to time, and check the batteries if they operate normally and that the warning "CHARGE BATTERY!" shows on the screen.
- Refer to the "6.2 Built-In Batteries" on the attached sheet for the recharging procedure and the use of the AC adaptor.

#### **Care**

- When cleaning the HX-20, use a dry cloth and wipe it gently. Do not use alcohol or volatile solvent.
- If an option or the cable for an option is connected to the HX-20, check the connections from time to time.

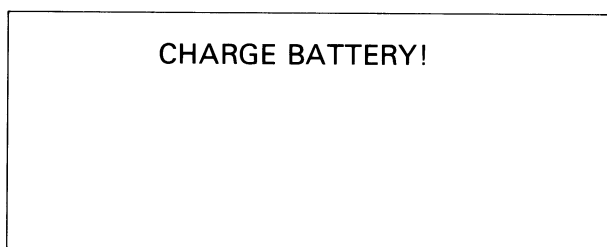
## 6.2 Built-In Batteries

### 6.2.1 Recharging

The HX-20 has rechargeable nickel cadmium batteries in it. If the battery voltage falls below the required level, the warning "CHARGE BATTERY!" flashes 60 times on the LCD screen as shown at right, and then power is automatically switched off.

All operations are stopped when power is switched off. If the warning shows on the screen, immediately recharge the batteries as described below. The batteries may be recharged even if the warning appears on the screen, but repeated recharging for a long time can overcharge the batteries, possibly shortening the battery life.

\* The HX-20 can be used while the batteries are being recharged.



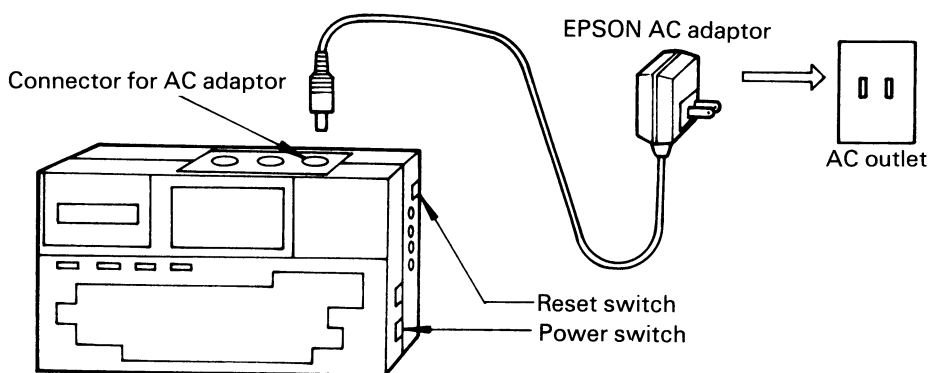
**Fig. 6-1**

### 6.2.2 HX-20 Recharging Method

- (1) Push the power switch off, and confirm that the LCD screen is completely blank. If the screen still shows something, press the reset switch.
- (2) Insert the supplied AC adaptor into an electrical outlet, and insert the AC adaptor plug into the connector on the HX-20. (The batteries start to be recharged.)
- (3) Recharge the batteries for 8 hours. The batteries are fully recharged in about 8 hours. If the batteries are kept being recharged for long after that, they will be overcharged, resulting in a short battery life. (The batteries are warm during recharging, but this is a normal phenomenon.)

#### Cautions

- Use the supplied AC adaptor for recharging the batteries, and unplug it from the electrical outlet and the HX-20 connector after use.
- If the batteries get too hot during recharging, immediately stop recharging.
- The batteries may be recharged at normal temperature (+5°C to +35°C).
- Avoid using the HX-20 with the AC adaptor connected to it. If the AC adaptor is kept connected, the batteries will be kept recharged and possibly become overcharged.
  - \* Overcharging can shorten the battery life and in some cases break down the batteries.
- If the batteries are fully discharged, it will deteriorate them and shorten their life. If the warning "CHARGE BATTERY!" flashes on the LCD screen, suspend HX-20 operation and recharge the batteries soon.



**Fig. 6-2 Connection Diagram**

### 6.2.3 Cautions in using AC Adaptor

- Use the supplied AC adaptor for recharging the batteries. If an adaptor other than the supplied AC adaptor is used, it can deteriorate the batteries and circuit parts, and possibly damage them.
- Use an AC outlet of the voltage specified on the supplied AC adaptor.
- Do not connect the AC adaptor if the batteries are removed from the HX-20. It causes an overvoltage to deteriorate or damage the circuit elements.
- Keep the AC adaptor disconnected from an AC outlet and the HX-20 except when recharging the batteries.
- Do not use the supplied AC adaptor for other than the HX-20. The device to which the AC adaptor is connected or the AC adaptor itself can become damaged due to the differences in voltage and current between them.

### 6.2.4 Batteries

#### (1) Monitoring battery voltage

The battery voltage is monitored when power is switched on and during HX-20 operation, and if the voltage falls below the required level (about 4.5V), the warning "CHARGE BATTERY!" immediately flashes on the LCD screen. After 60 times of its flashing, power is automatically turned off.

\* The programs are stopped and the HX-20 cannot be used under this condition.

#### Steps to Be Taken

Immediately push the power switch off, connect the supplied AC adaptor, and recharge the batteries. If the batteries are not recharged, the programs stored in the RAMs can disappear.

#### (2) Battery life

The nickel cadmium batteries normally have a life of 3 years, though it varies with ambient temperature, recharging duration and time. Replace the batteries with new ones soon after the end of their life.

If the batteries last very short after they are recharged, replace them with new ones.

#### (3) Battery replacing method

If programs are stored in the RAMs, save them in microcassettes or audio cassettes before replacing the batteries. Disconnect the AC adaptor from the HX-20 before replacing them.

**Notes** 1: If the batteries are removed when the AC adaptor is still connected to the HX-20, an overvoltage will be applied to the circuit elements to shorten their life and possibly break them down.

2: If the batteries are removed, the programs stored in the RAMs are cancelled.

#### Replacing Procedure

1) Save the programs stored in the RAMs in cassette tapes or the like.

2) Disconnect the AC adaptor from the HX-20.

3) Remove the case cover from the HX-20. Remove the 7 screws and the FPC cable for the cartridge option.

4) Remove the battery holding plate that holds the batteries in place. (1 screw)

5) Disconnect the battery connector from the control circuit board.

6) Remove the batteries, and insert new batteries.

\* Take Steps 4, 5 and 3 in this order for installing the new batteries.

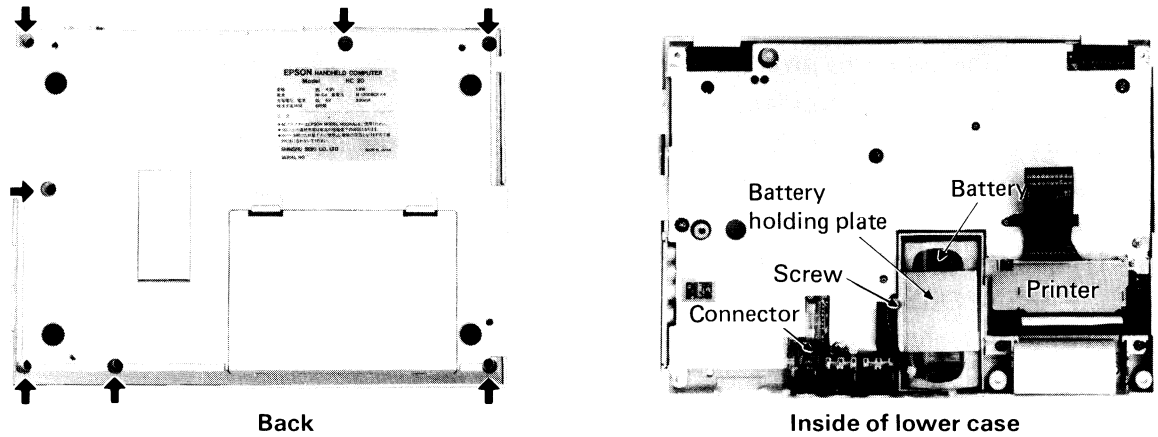


Fig. 6-3

### 6.3 Maintenance of Micro Printer (Model-160)

Proper maintenance is essential for the EPSON Micro Dot Printer Model-160 to keep its designed performance for the longest possible period, and to prevent the occurrence of trouble. Carry out maintenance according to the following instructions:

#### 6.3.1 Cleaning

- (1) Removal of dirt and stains:

Remove any dirt and stains using alcohol or benzene.

**Note:**

Never employ thinner nor trichloroethylene- or ketone-based solvents, which might deteriorate plastic parts.

- (2) Removal of paper particles, dusts and naps:

To remove any paper particles, dusts and naps from the surface and inside of the printer, it is recommended that a vacuum cleaner be used.

**Note:**

After cleaning, check the lubrication points for quantity of lubricant. If the removal of paper particles, dusts and naps has resulted in insufficient quantity of lubricant, resupply the specified lubricant as required. (Refer to "Lubrication Requirements".)

#### 6.3.2 Insertion and Removal of Rolled Paper:

- (a) Be sure to use the specified paper
- (b) Before passing the paper into the printer, cut squarely the top of the paper.

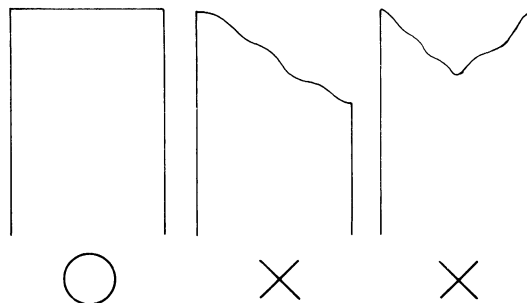


Fig. 6-4 Processing of Paper Top for Insertion

- (c) Insertion of the paper:
- 1) Insert the paper to straight into the paper inlet of the printer. Never attempt to insert the paper with its top faced obliquely to the inlet.
  - 2) Pushing the paper in the feeding direction facilitates its engagement with the paper feeding roller, thus permitting easy insertion.
- (d) Removal of the paper:
- 1) Feed the paper out the printer by electrical operation (turn the power ON and push the PAPER FEED button).
  - 2) Alternatively, remove the paper by pulling straight. If the paper is pulled obliquely, it may be caught by the internal parts of the printer.

### 6.3.3 Replacement of Ribbon Cassette

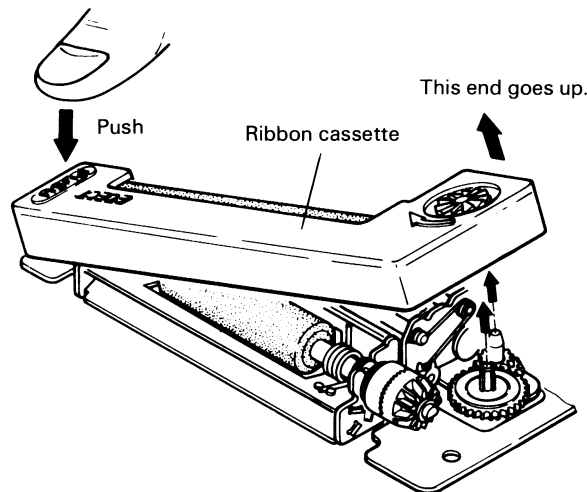
- (a) Be sure to use the specified ribbon cassette.

**Note:**

The ribbon cassette is of the throw-away type; replenishment of ink is absolutely impossible.

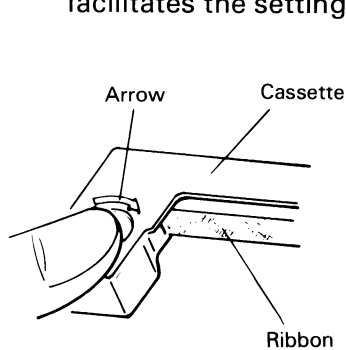
- (b) Replacing procedure:

- 1) Push down the cassette at one end marked "PUSH" until the other end is disengaged.

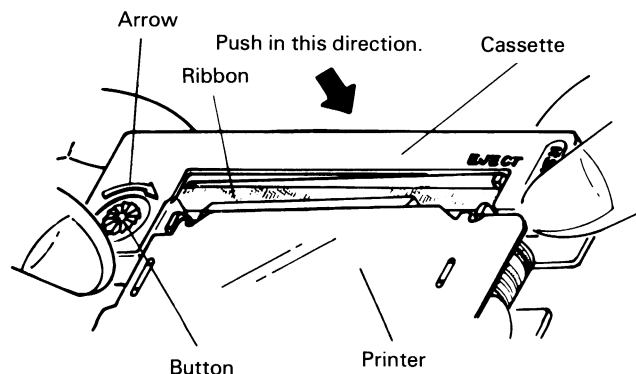


**Fig. 6-5 Removal of Ribbon Cassette**

- (c) In setting the new cassette into position, pay attention to the following points:
- Prior to setting the cassette (as well as to removing it), be sure to remove the paper from the printer.
  - Before placing the cassette, turning the button at one end in the direction of the arrow until the ribbon becomes tense (Fig. 6-6).
  - Turning the button also during the operation of placing the cassette on the printer facilitates the setting.



**Fig. 6-6**



**Fig. 6-7**

- After placing the cassette, give two or three turns to the button.
- Finally, check the condition of the ribbon.

### 6.3.4 Handling of Printer as a Separate Unit

(a) Carrying:

- 1) When carrying the printer as a separate unit, be careful not to hold by the FPC (flexible printed cable), the patterns on the circuit board, the ribbon cassette nor the gears (see Fig. 6-8).
- 2) Be careful that the printer not be subjected to shock from fall onto the floor or collision against other objects or printers.



**Fig. 6-8 Handling of Printer as a Separate Unit**

(b) Storage:

- 1) Avoid storing the printer in a very dusty or humid place or in a place subject to direct sunlight.
- 2) When the printer is to be stored for a relatively long period of time, wrap in anticorrosive paper (VPI paper), place in a polyethylene bag and store in a dry place.

(c) Cautions in using:

- 1) Since this printer uses permanent magnets (in detectors) and electromagnets, avoid using it in a place where a nonnegligible amount of iron dust exists, or in a very dusty place.
- 2) Never operate the printer with the printing paper not being in position.
- 3) Since a reed switch is used for the reset detector, never place any magnetic equipment within the range of 7 mm from the top cover to prevent the reed switch from being subject to its adverse effect.

### 6.3.5 Inspection

Have the printer inspected by such persons every six months for the check items given in the table below and have the necessary maintenance actions performed.

Check item	Condition to be remedied	Action
1) Deposit of dust, dirt and/or nap	<ul style="list-style-type: none"> <li>● Too much deposit of dust, dirt and/or nap; presence of foreign matters inside the printer.</li> <li>● Presence of torn pieces of paper or foreign matters in and/or on paper guide.</li> <li>● Deposit of dust, dirt and/or nap on detectors.</li> </ul>	<ul style="list-style-type: none"> <li>● Such materials can effectively be removed with vacuum cleaner.</li> <li>● Removal all such materials.</li> <li>● Remove.</li> </ul>
2) Condition of spring	<ul style="list-style-type: none"> <li>● No deformation</li> </ul>	<ul style="list-style-type: none"> <li>● Replace deformed springs</li> </ul>
3) Lubrication	<ul style="list-style-type: none"> <li>● Refer to "Lubrication Requirements on page 6-8".</li> </ul>	<ul style="list-style-type: none"> <li>● Quantity of lubricant being found insufficient, resupply the specified lubricant.</li> </ul>
4) Operation of printer mechanism	<ul style="list-style-type: none"> <li>● Abnormal action of printing mechanism.</li> <li>● Abnormal feeding of paper.</li> <li>● Check all mechanisms for abnormal action due to worn, deformed or paper-clogged parts or loosened screws.</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to "Troubleshooting Table".</li> <li>● Ditto.</li> <li>● Replace; retighten loosened screws, if any, to specified torque in accordance with the instructions in Par. 3.2 "ASSEMBLY".</li> </ul>

### 6.3.6 Lubrication

Proper lubrication is essential for the EPSON Micro Dot Printer Model-160 to keep its designed performance for the longest possible period, and to prevent the occurrence of trouble. Carry out lubrication according to following instructions:

#### (1) Lubricants

The properties of lubricants used have a great influence on the performance and durability of the printer. In particular, attention must be paid to the low temperature characteristics. It is strongly recommended to use only those lubricants that EPSON has selected after an extensive study of technical information and a series of tests on many types of lubricants.

EPSON can supply such lubricants in a metallic can or a plastic container of 40 cc (40g), which is the minimum supply unit available.

#### Remarks:

The number of Model-160 Printer units for which 40 cc of lubricant is sufficient is as follows:

<u>Lubricant</u>	<u>Number of printer units</u>
G-2	Approx. 100

#### (2) Lubrication Requirements

The lubricant to be used for the Model-160 Printer is G-2. Supply the specified quantity of G-2 to the lubrication points indicated in the table below. Prior to application of lubricant, be sure to thoroughly clean the printer elements or parts concerned.

#### (3) Lubrication Points

The Ref. Nos. in the table below correspond to the Nos. used in Fig. 6-9.

The application quantity of lubricant increases with the number of black points (●).



Ref. No.	Lubrication points	Lubricant	Application quantity
L-1	Part to receive spool gear shaft	G-2	●●
L-4	Lead cam internal gear (whole perimeter)		●●
L-5	Lead cam groove (whole perimeter)		●●●
L-6	Contacting parts of cam shaft and cam shaft bearing		●●
L-7	Tip of push rod (four points)		●
L-8	Circumference of plunger (four points)		●
L-9	Contacting parts of printing lever and its shaft		●●
L-10	Engagement parts of printing lever and its spring		●
L-11	Contacting parts of print head carriage and print head guide shaft (two points on R side)		●●●
L-12	Contacting parts of print head carriage and print head guide shaft (two points on L side)		●●●
L-13	Contacting parts of paper holding spring and paper holding roller spring (two points)	●	
L-14	Part to receive paper feeding roller shaft on R side	G-2	●●
L-15	Contacting parts of paper feeding roller shaft and its bearing		●●
L-16	Contacting parts of paper feeding roller shaft and one-way spring		●●
L-17	Engagement parts of paper feeding lever pin and paper feeding gear		●
L-18	Contacting parts of paper feeding lever shaft and paper feeding		●●●
L-19	External toothed part of ribbon feeding cam (whole perimeter)		●●
L-20	Internal cam part of ribbon feeding cam (whole perimeter)		●●●
L-21	Contacting parts of paper feeding lever spring and paper feeding lever		●●
L-22	Reduction gear		●●
L-23	Part of holder to receive motor gear		●
L-24	Contacting parts of head cam and frame L	●●	
L-25	Intermediate gear (large and small)	●●	

**Note:** Oil quantity ● ..... less  
●● ..... ordinary  
●●● ..... much

- (4) Carry out periodic lubrication on every occasion of overhaul of the printer and every 500,000 lines printed. Lubrication must also be performed when the quantity of lubricant at any lubrication point has become insufficient as a result of cleaning of the printer parts concerned and on the occasion of disassembly or replacement of the parts concerned.

## 6.4 Microcassette

### 6.4.1 Cleaning

If the microcassette is used for a long time, the parts exposed to the cassette tape become stained, causing read/write troubles. Clean those parts (1), (2) and (3) with a tape head cleaner solution or alcohol.

- (1) Surfaces of the read/write head
- (2) Capstan shaft
- (3) Pinch rollers

### 6.4.2 Head Adjustment/Speed Check

If the read/write head is worn, head signal output level falls. Use a 3 kHz azimuth tape, and make an adjustment so that the output level of signals from the R/W head will be maximum. Also check the 3 kHz period and speed variation.

### 6.4.3 Reel Torque Check

Use a torque check tape, and confirm that the torque is as specified ( $7g \pm 2g$ ).

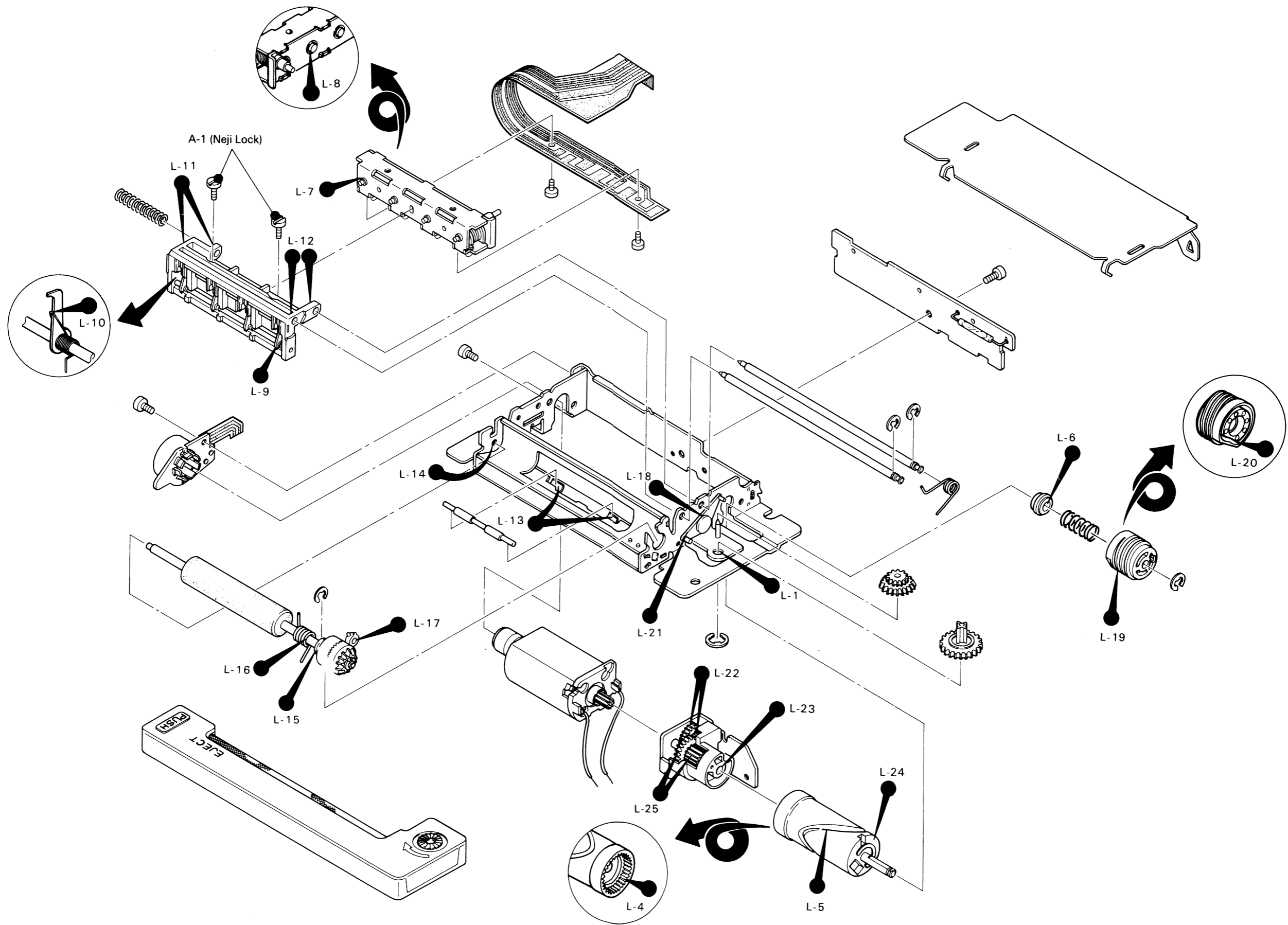


Fig. 6-9 Lubrication Points

# CHAPTER 7

## REPAIRS

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## 7.1 Repairs

### Before starting repairs

#### (1) Static electricity

- Human bodies carry the static generated by friction of the clothes, etc. If a man with a static charge touches circuit elements with his fingers, for example, the static can break down the elements. Before starting repairs, touch the case cover with both hands to discharge the static that you may have in the body.
- When using an oscilloscope or other instrument whose ground terminal must be grounded, contact the conductive part of the ground terminal with the casing of the HX-20 or your fingers, and then connect it to the GND terminal on the circuit board.

#### (2) Circuits

- Even if the power switch is pushed off, the RAMs and some of the ICs are backed up by the batteries. When conducting a continuity test on circuits, disconnect the battery connector and wait for about 30 seconds before starting the test.
- Follow the same procedure when replacing circuit elements on the control circuit board.

#### (3) Cables

The HX-20 uses FPCs (flexible printed cables), which can break if folded, bent, or damaged. Exercise good care when handling the cables.

#### (4) Connectors

All the internal cable connectors used for the HX-20 are a lock type. When disconnecting the cables, unlock the connectors before.

#### (5) Soldering

Refer to the section on soldering before making repairs on the circuit boards.

## 7.2 Repair Tools and Instruments

### 7.2.1 Tools and Instruments

No.	Tool/Instruments	Spec.	Use	Commercial available
1	Oscilloscope	50 MHz 2-channel	Control circuit board repair	Yes
2	Digital voltmeter	5V range, 3 digits	Battery voltage measurement	Yes
3	Multi-tester	Resistance	Continuity test, element check	Yes
4	Electric soldering iron	100V 15W	Control circuit board repair	Yes
5	Solder wick (or pump)		Removing (unsoldering) elements from circuit board	Yes
6	Nippers	Midishure 1178 made by EPE	Removing (unsoldering) elements from circuit board	Yes
7	Philips screwdriver No. 2	100 mm		Yes
8	Tweezers	MM 125 mm		Yes
9	ET holder No. 1.2	ETH 1.2	Microprinter repair	Yes
10	ET holder No. 1.5	ETH 1.5	Microprinter repair	Yes
11	ET holder No. 2	ETH 2	Microprinter repair	Yes
12	Philips precision screwdriver set		Microcassette repair	Yes
13	Regular precision screwdriver set		Microprinter repair	Yes
14	Pliers	No. 0	Microprinter repair	Yes
15	Brush (medium)		Microprinter repair	Yes
16	Brush (fine)		Microprinter repair	Yes
17	Stick tension gauge	200g	Microcassette repair	Yes
18	Solder		Control circuit board repair	Yes
19	Safety goggles		Protection during soldering and use of oil, grease, chemicals	Yes
20	Gloves		Soldering	Yes

### 7.2.2 Test Items

No.	Item	Spec.	Use	Commercial available
1	Test program ROM	2764	HX-20 function test	No
2	Extension cable (20-conductor)	FPC cable with connector	Extension cable between MOSU circuit board and KB connector	No
3	Extension cable (14-conductor)	FPC cable with connector	Extension cable between KB and LCD	No
4	Test tape (Azimuth)	Olympus OA-A211	Adjustment for AZIMUTH	Yes
5	P-reel torque check cassette	SONY TW-1112A	Microcassette winding torque measurement	Yes

### 7.2.3 Oil, Grease and Chemicals

No.	Item	Spec.	Use	Commercial available
1	Grease	G2	M-160 repair	No
2	Screw lock	Three Bond No. 1406	M-160 repair	Yes
3	Grease	Nippon Koyu Photo-lube 023P	Microcassette	Yes
4	Oil	Maruzen Oil Swafluid No. 56	Microcassette	Yes
5	Anaerobic adhesive	Kanebo Veil Lock K-SM	Microcassette	Yes
6	Screw lock	Three Bond No. 1401B	Microcassette	Yes
7	Instant adhesive	Cemedyne 3000RP or Arron Alpha (Toa Synthetic Chemicals)	Microcassette	Yes
8	Rubber adhesive	Cemedyne High Contact or EC-1770 (3 M's)	Microcassette	Yes
9	Solvent	Ligroin (Nippon Oil)	For cleaning various parts	Yes

## 7.3 Soldering

### 7.3.1 Parts Removal and Installation

- (1) When removing an IC or transistor from a circuit board, it is necessary, as a rule, to cut off its leads with nippers and unsolder the part. (Reason: To prevent lengthening of solder melting time due to heat absorption by the part.)
- (2) Solder parts as quickly as possible. In some cases, a cooling agent may have to be used to prevent the parts from overheating. (Reason: To protect the parts and circuit board)
- (3) When removing parts, remove the solder adhering to the through-holes and lands, and remove the leads without using undue force. (Reason: If the leads are forcibly pulled out, the lands or printed pattern can be stripped.)
- (4) When installing parts, be careful of the lead bending direction and lead length so that the leads will not contact other lands on the back of the circuit board. (Reason: To prevent short circuit on the back)
- (5) When install a register on a circuit board, make sure that the parts are not in direct contact with the circuit board surface. (Reason: To protect the circuit board from damage due to the heating of the parts)
- (6) When using a wire for repair, make it as short as possible. If the leads of other parts stand in the shortest route, select other route.
  - If a long wire must be used, bond it to the circuit board surface with an epoxy adhesive.
  - Do not lay a wire parallel to a printed pattern over a long distance. (Reason: To prevent noise)
  - Wind the wire around the part lead.

### 7.3.2 Soldering

#### (1) Through-hole soldering

- a) Solder part leads as shown in the center of the below sketch. (Solder builds up about  $30^\circ$  to  $45^\circ$  to the land.)

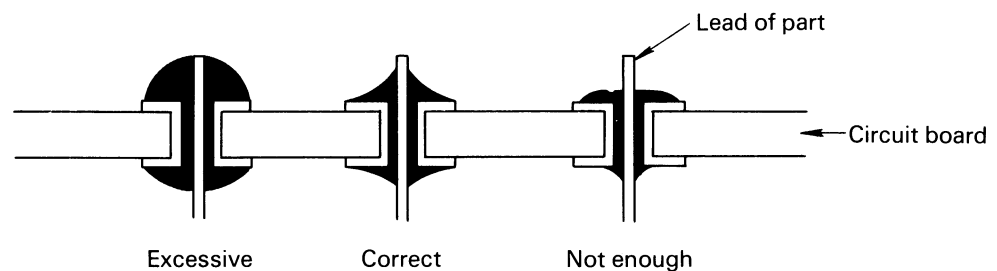


Fig. 7-1

b) Through-holes must be fully filled with solder.

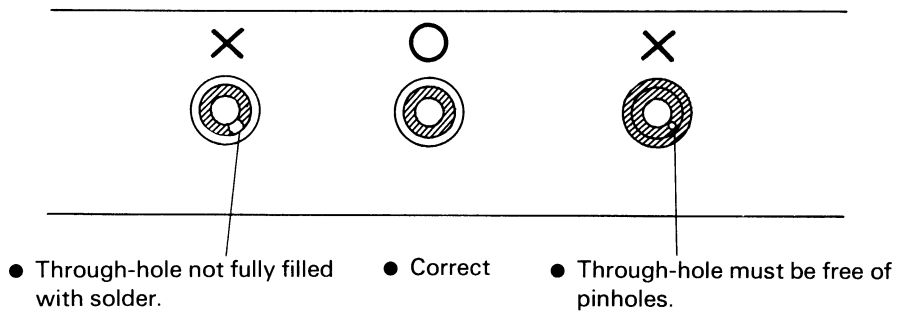


Fig. 7-2

c) Leads must be of proper length, and clear of other lands.

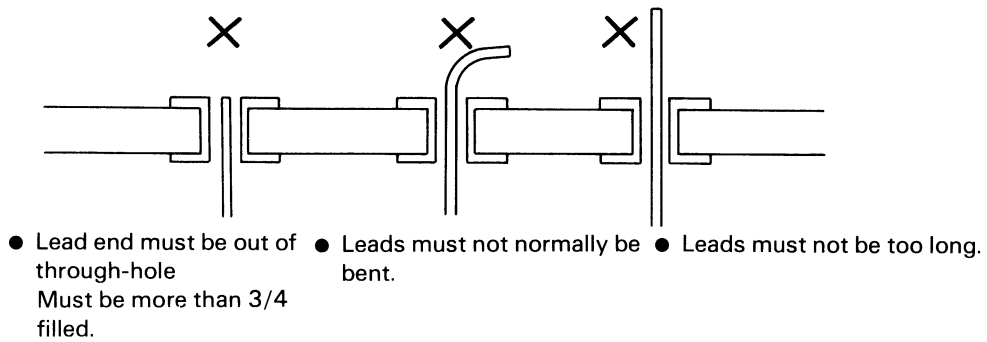


Fig. 7-3

(2) Parts Installation

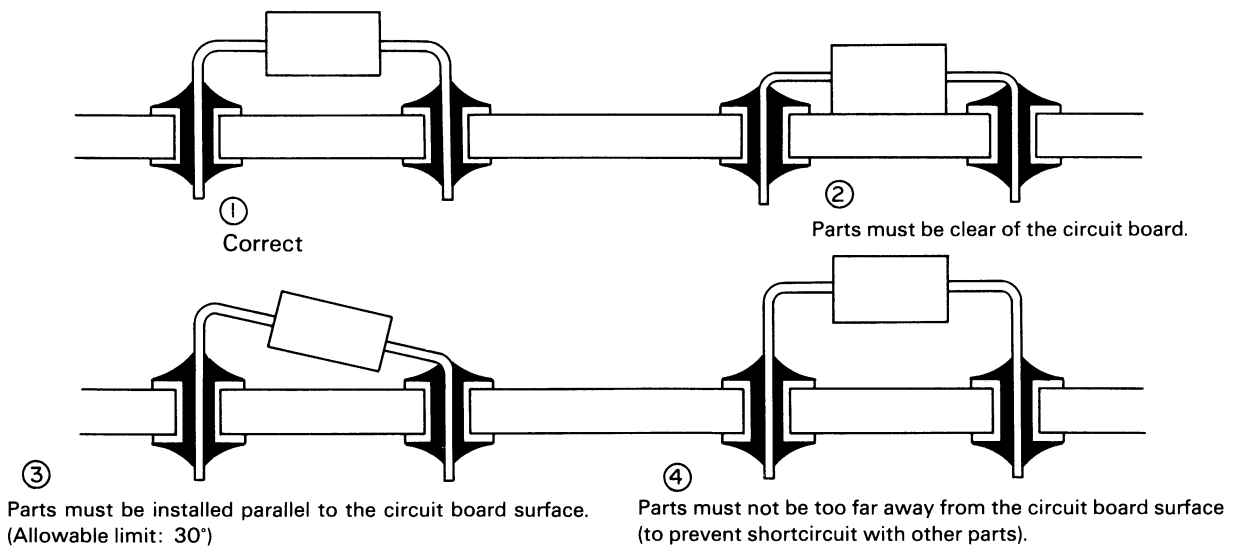


Fig. 7-4



### (3) Wire connection

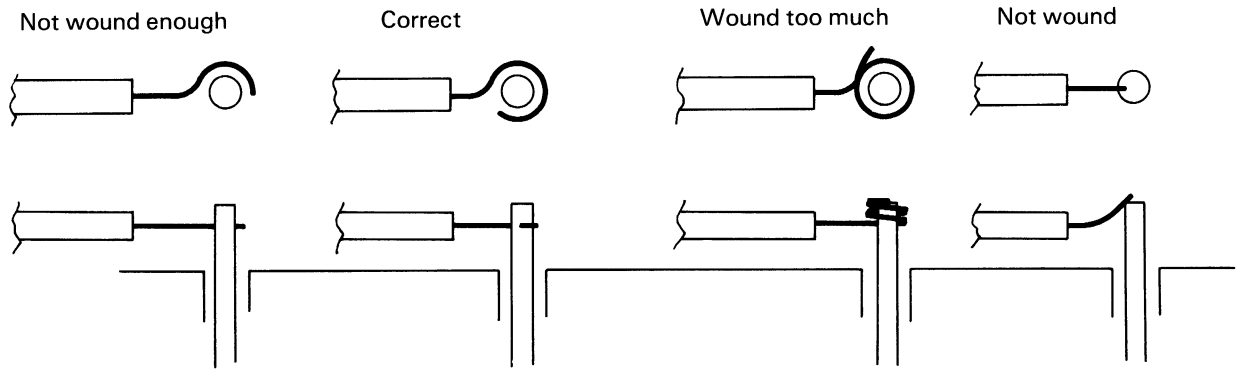


Fig. 7-5

- Wind wire more than 3/4 of a turn or about a turn around leads (IC pins).
- Wire ends must be covered to a point near the land. Exposed wire ends must be less than one half the land length.

#### 7.3.3 Unrepairable

Dispose of the following without repairing because quality and durability problems remain even if repairs are attempted.

- Through-hole with peeled copper lining
- Peeled land
- Peeled printed pattern
- Burnt circuit board
- Cracked circuit board

\* Replace the circuit board itself if it has any of the above defects.

#### 7.3.4 After Repairs

Take the following steps after repairing (soldering).

- Completely wipe off the flux from soldered points with a brush or the like.
- If patterns are touched by hand, wipe them clean.
- Wipe the connectors clean, and apply a contact lubricant where necessary.
- Dry.

\* If the above steps are not taken, the patterns can corrode due to oxidation, which causes troubles.

## 7.3.5 Terms

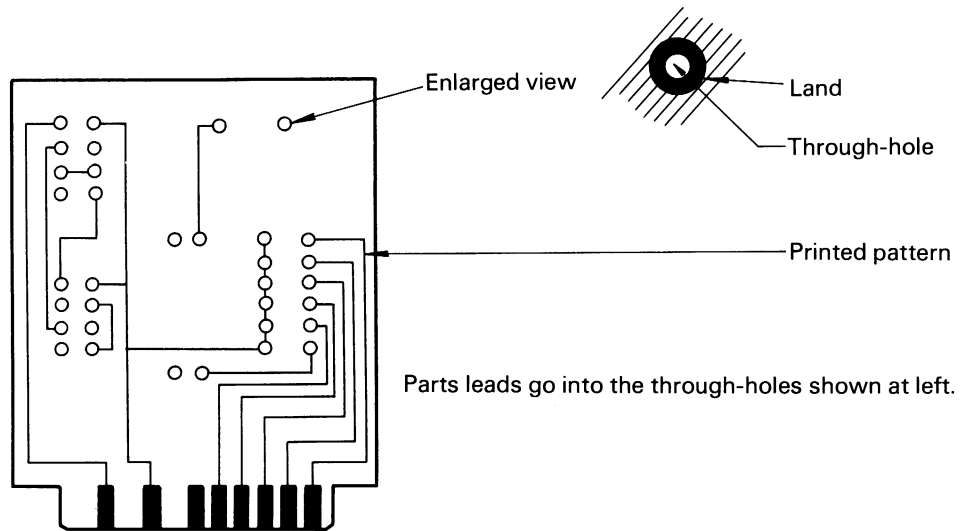


Fig. 7-6 Front of Circuit Board

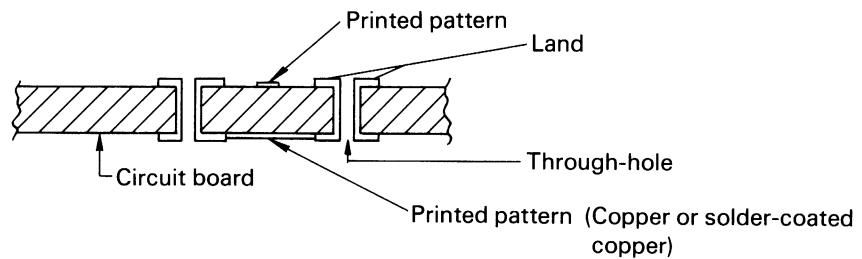


Fig. 7-7 Cross Section of Circuit Board

## 7.4 MOSU Circuit Board Repairs

### 7.4.1 Circuit Board Setting Methods

- (1) Both the soldered and element sides of the circuit board are silk-printed so that circuit signals can be checked with the circuit board installed in the lower case.
- 1) Remove the 7 screws that fasten the upper and lower cases to the casing on the back.
- 2) Slowly raise the upper case at the rear end, and disconnect the FPC cable, which connects the cartridge option connector to the MOS circuit board's CN8, from the MOSU circuit board.

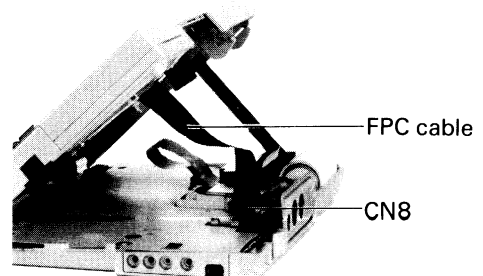
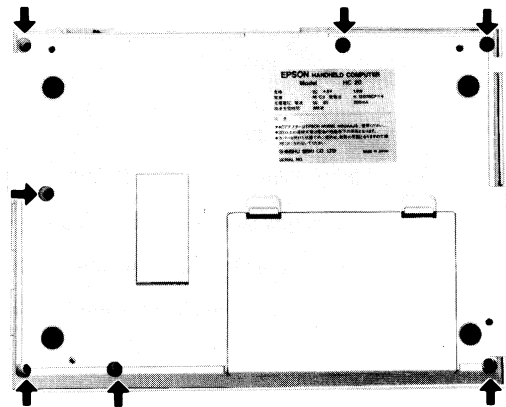


Fig. 7-8

(2) Checking circuit signals with the MOSU circuit board installed.

- 1) Raise the upper case and let it rest on a wall, for example, as shown at right so that the keyboard switches will not be depressed.
- 2) The circuit board has 4 check terminals for checking its voltages and circuit signals with an oscilloscope and other instruments.

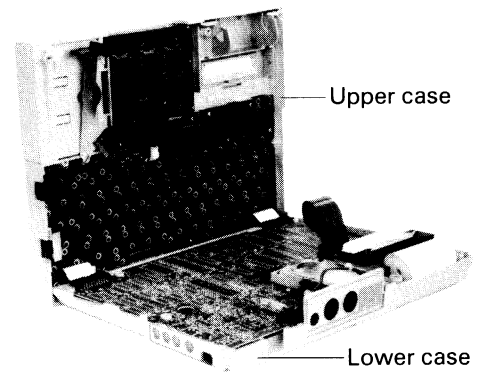


Fig. 7-9

(3) Checking circuit signals with the MOSU circuit board removed.

- 1) Disconnect the battery cable from the battery connector on the circuit board.
- 2) Remove the two screws that fasten the printer mount, and disconnect the FPC cable, which connects the printer to the circuit board, from the connector.
- 3) Disconnect the two FPC cables, which connect the keyboard (upper case) to the circuit board, from the connectors.
- 4) Slightly raise the left side (battery connector side) of the circuit board, slide it a little, exercising care not to contact the circuit board's CN7 hard with the case, and take the circuit board from the lower case.
- 5) Reconnect the cables which were disconnected in Steps 1), 2) and 3).
  - Two keyboard FPC cables
  - One printer FPC cable
  - One battery cable

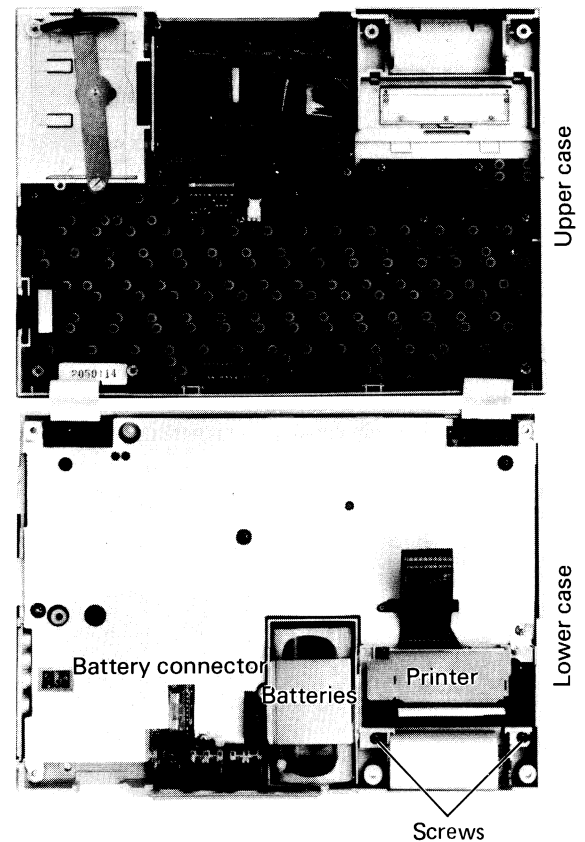


Fig. 7-10

6) Connect the upper case block to the circuit board as shown below, and check the circuit signals.

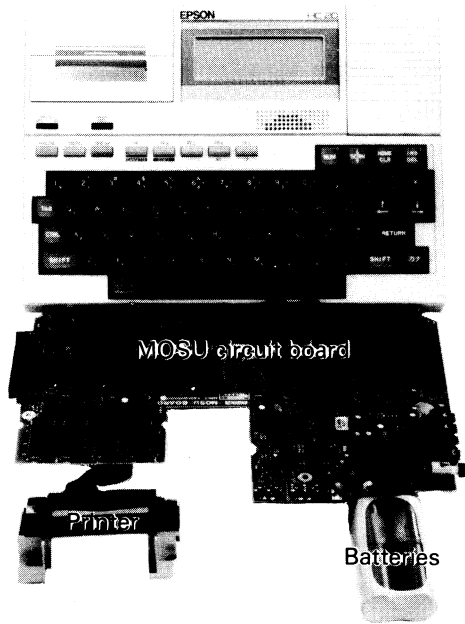


Fig. 7-11

#### 7.4.2 Check Terminals

The MOSU circuit board has 4 check terminals on the back (soldered side) of it as shown below. These check terminals may be used for maintenance purposes.

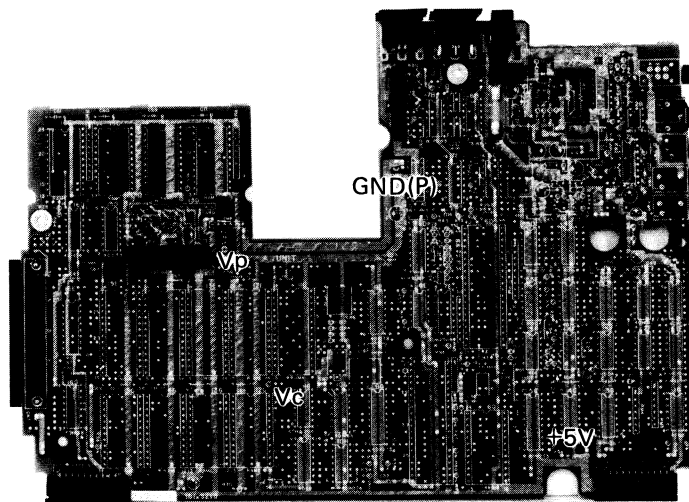


Fig. 7-12

Point	Purpose
Vp	Printer voltage (+5V)
Vc	RAM backup voltage (Approx. 3V when power is off)
GND (P)	Printer grounding
+5V	Circuit voltage (+5V)