CHAPTER 6
MAINTENANCE

6.1 Repair

Before starting the repair

1. Static electricity

- A human being's body is charged with the static electricity which is caused by the friction of his clothes. If his charged fingers contact the elements of the circuit, the static electricity may damage the elements. Therefore, before starting the repair work, touch the case cover with both hands to discharge any static electicity.
- When using a measuring instrument, such as an oscilloscope, which needs to be grounded, touch the conductive portion of the grounding terminal to the case of PX-8 and your fingers, then connect it to the GND terminal on the board.
- Before repairing the MAPLE board, remove the AC adaptor, the main and auxiliary batteries, and wait for approximately 30 second before beginning repair. This will allow residual power to dissipate. Handling before total power dissipation may result in damage to the board.

2. Circuit

- After removing the circuit board from the case for repair, rest it on insulative material, to prevent shortcircuits.
- After turning off the power switch, the RAM and a part of IC are backed up by the battery. Therefore it is necessary to observe the precautions listed above while replacing elements on the control board.
- Before examining the circuit, check to see if the signal lines are backed up.
- Flexible printed cable (FPC) is used in the mark. If the FPC is bent or scratched, it may result in circuit damage.
  Therefore, handle it very carefully.

4. Connectors

- All internal cable connectors in this device are of locking type. When disconnecting the cables, unlock the connectors.

5. Soldering

- When repairing the boards, refer to the section on soldering.

6. Storing or transporting circuit boards on which batteries are mounted.

- When storing or transporting circuit boards on which batteries are mounted, protect them from static hazards by using a static-proof insulator bag, etc. When storing them for a long time, remove the battery(s) to prevent battery deterioration or circuit damage due to possible battery leakage.

6.2 Repair Tools and Equipment

Table 6-1 General Tools

Name	Standard	Q'ty	Use	Commercially available
Oscilloscope	50 MHz dual-beam type	1	Repair of control board	Yes
Digital voltmeter	5 – 25V range	1	Measurement of circuit voltage	Yes
DC regulator	0 – 20V, with current controller	1	Repair of control board	Yes
Multitester	1 – kΩ range	1	Continuity test	Yes
Soldering iron A	B778401501	1	R-920 3.2 x 1.25	Yes
Soldering iron B	B778401601	1	FP-NO2 28 x 25 x 15.5 x 12.5	No
Soldering iron C	B778401701	1	FP-NO1 11 x 15.2	No
Soldering iron D	B778401801	1	1006 23 x 20 x 17 x 14	No
Solder pump		1	Repair of control board	Yes
Nippers	Middy Sure 1178 made by EPE Ltd.	1	Repair of control board	Yes
Tweezers	MM 125 mm	1	Repair of microcassette	Yes
Phillips head screwdriver set		1	Repair of microcassette	Yes
Flat blade screwdriver set		1	Repair of microcassette	Yes
Pincette	MM 125 mm	1	Repair of microcassette	Yes
Phillips head screwdriver No. 2	100 mm	1	Disassembly and assembly of case	Yes
Blade screwdriver No. 2	100 mm	1	Disassembly and assembly of case	Yes
Frequency counter	4 digits, 50 khz or above	1	Microcassette tape drive and internal clock signal adjustment	Yes
Electronic thermometer	Instantaneous tape	1	Control circuit board repair	Yes
Ampere meter	1μA ~ 5A	1	Control circuit board repair	Yes

Table 6.2 Repair Equipment

Name	Standard	Q'ty	Use	Commercially available
Safety goggles		1	Soldering	Yes
Gloves		1	Soldering	Yes
Solder		1	Soldering	Yes
Solder wick		1	Soldering	Yes
Drier		1	Circuit board repair	Yes
Lead wires	AWG #30 or equivalent		Circuit board repair and analyses	Yes

Table 6-3 Special Jigs

Name	Standard	Q'ty	Use	Commercially available
*Extension cable (16-pin)	B778400701	1	Between MAPLE board and LCD unit	NO
*Extension cable (20-pin)	B778400601	1	Between MAPLE board and microcassette	NO
*Extension cable (11-pin)	B778400801	1	Between MAPLE board and microcassette	NO
Azimuth tape	Olympus OA-211 B777600101	1	Adjustment and inspection of microcassette	YES
P reel torque check cassette	Sony TW-1112A B777600201	1	Adjustment and inspection of microcassette	YES
RS-232C MINI WRAP	B778401101	1		NO
Serial MINI WRAP	B778401001	1	Adjustment of azimuth	NO
External speaker connector	B778400201	1	Adjustment of azimuth	NO
Keytop puller	B765000001	1	Keytop removal	YES
Microcassette tape (EPSON C-30)	Y202503000	1	Microcassette tape read/write test	YES
Test program ROM	B778401201	1	Repair	NO

Table 6-4 Oil, Grease, and Chemicals

Name	Standard	Q'ty	Use	Commercially available
Flux remover	—	1	SOLDERING	YES
Instantaneous cooling agent	—	1		YES
Alcohol	—			YES
Silicon lock	—			

6.3 Soldering

Inaduertant soldering of delicate component can cause component damage. Carefully read and fllow the reccauting in Section 6.2.1 for component removal and soldering to safeguard the Maple computer's circuitry.

6.3.1 Removing and Installing Parts

(1) When removing parts such as IC's, transistors, etc. from the board, cut the lead wires of the parts with nippers and remove the solder. Melt the solder rapidly to prevent the parts from absorbing the heat.

(2) Solder each part quickly and use cooling agents to cool the part (to protect the parts and printed circuit board).

(3) When removing parts, remove the solder from the holes using SOLDER REMOVER; pull out the lead wires, which were cut in advance. This should be done without excessive use of force in order to protect the land and print pattern from being removed.

(4) When installing a part, be aware of the bending direction and length of the lead wires. Wire should not contact other lands on the backside of the board, which could cause a short circuit.

(5) When installing a register etc. to the board, take care that the parts do not directly contact the surface of the board (to protect the board from the heat of the parts).

(6) When using a wire to repair the board, keep its length to the necessary minimum. However, if there is a lead wire across the shortest route, take another route.

- If a longer wire must be used, fix it to the surface of the board with epoxy resin adhesive.
- To prevent noise, do not install a long wire in parallel with the print pattern.
- Wind the wires onto the lead wires of parts.

(7) When soldering or removing flat package IC's , use a special soldering iron and rapidly carry out the work. When installing an IC, place some solder on the pattern, then place the IC on the pattern, taking care not to bend its lead pins. Quickly solder it with a soldering iron. When placing the IC, it may be fixed with a little amount of thread tightener or adhesive.

(8) When removing a chip component such as a square resistor, capacitor, or transistor package, from the MAPLE board, heat all its terminal one at a time with the soldering iron.

6.3.2 Soldering

(1) Soldering the through holes

(a) Solder each lead wire as shown in the center of Fig. 6-1. (The slope of the placed solder is 30° - 45°.)

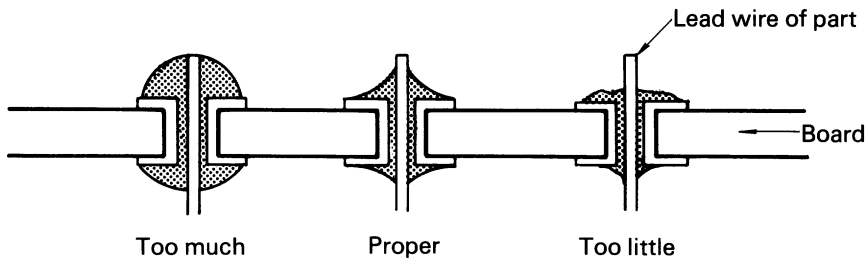


Fig. 6-1

(b) Fill the through hole with the solder.

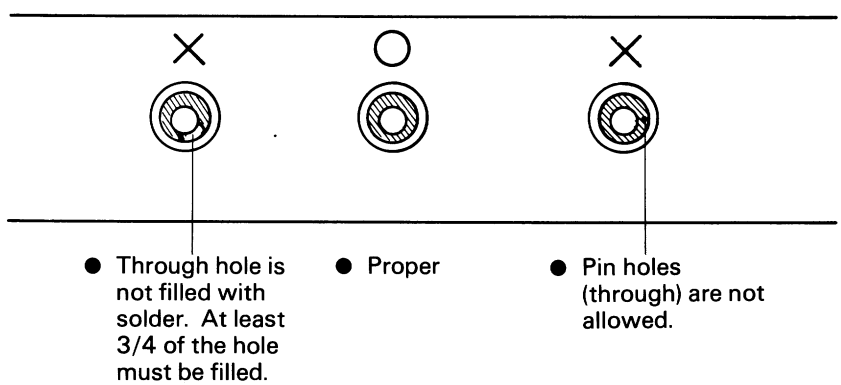
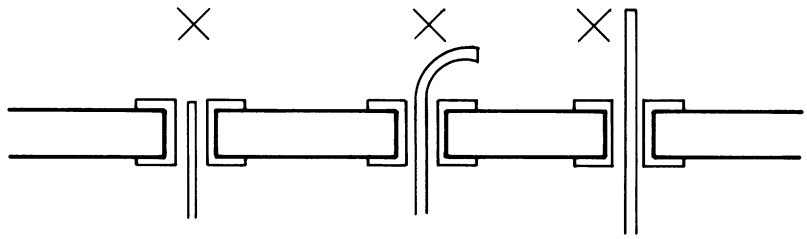


Fig. 6-2

(c) Cut the lead wire to the proper length and do not short-circuit it to other lands.



- Lead wire must be projected from the through hole.
- As a rule, do not bend the lead wire.
- Lead wire must not be too long.

Fig. 6-3

6.3.3 Installing the Parts

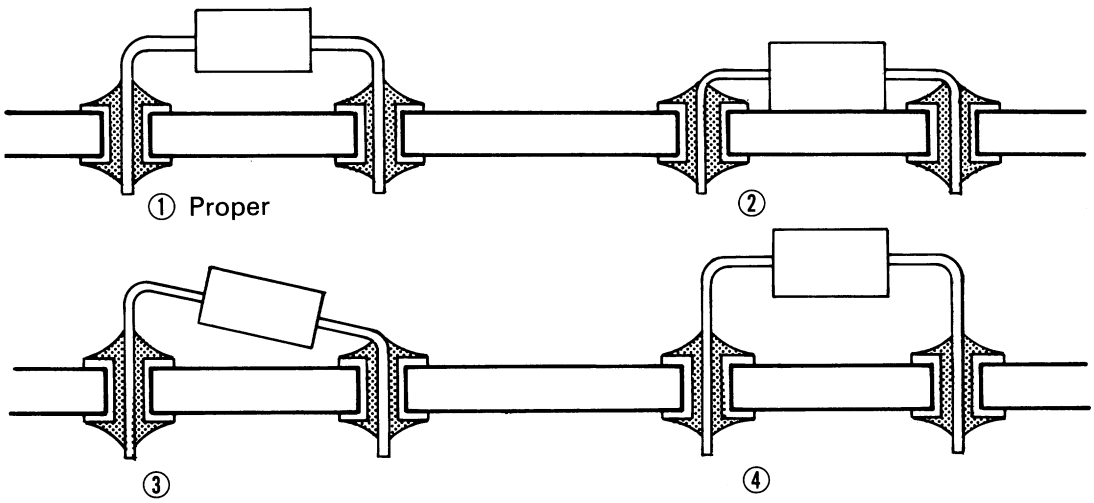


Fig. 6-4

① Proper
② Do not allow the part to contact the board.
③ Install the part in parallel with the surface of the board (The limit of slanting angle is 15°).
④ Do not install the part too far from the surface of the board (to prevent it from short-circuiting other parts).

6.3.4 Installing The Wires

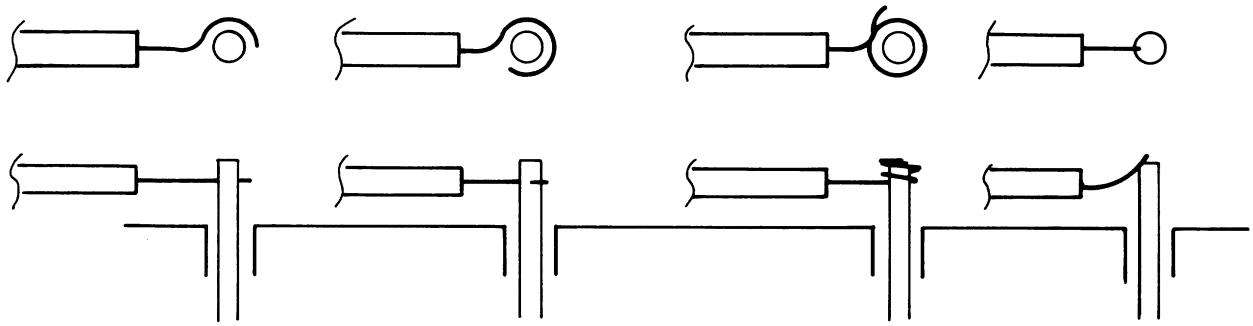


Fig. 6-5 Installing the Wire

- Wind the wire onto the lead wire (pin of IC) from 3/4 to 1 full turn.
- The wire must be covered to near the land. The bare portion of the wire must be less than 1/2 of the land.
- When the lead wire(s) has to be long, secure it on the board with an epoxy adhesive.

< Impossibility of repair >

If the problems listed below occur, the quality and durability of the parts cannot be guaranteed. It is therefore recommended that the board be replaced in the following instances.

- The copper foil in the through hole has come off.
- The land has come off.
- The print pattern has come off.
- The board has been burned.
- The board is cracked.

< Treatment after the repair >

After repairing (soldering) the parts, treat them according to the following procedure.

- Remove all the flux from the soldered portion with a brush etc.
- Clean the patterns which you have touched.
- Clean the connectors, and apply contact recovery agent, if necessary.
- Dry the parts.

* If the parts are not treated as explained above, the patterns will oxidize and corrode.

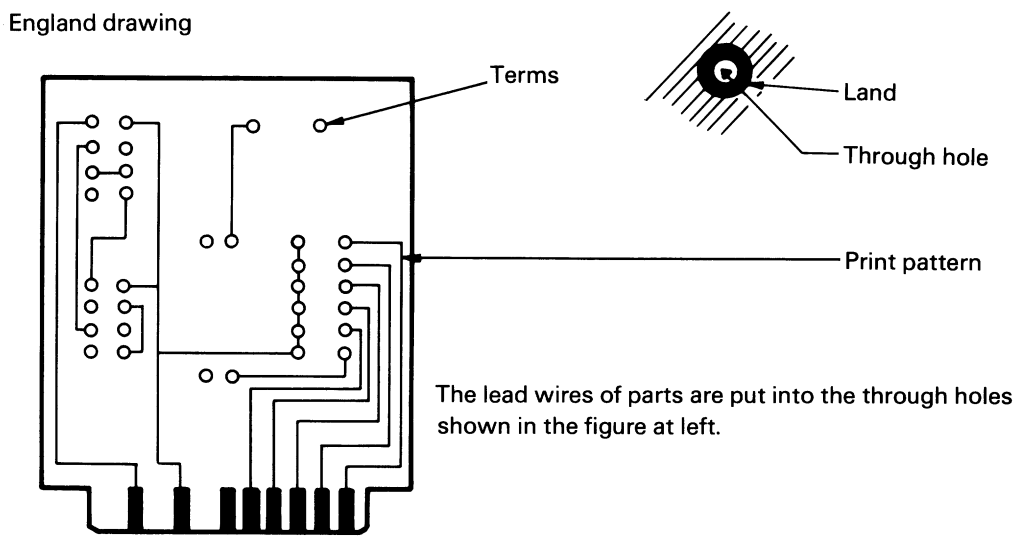


Fig. 6-6 Surface of Board

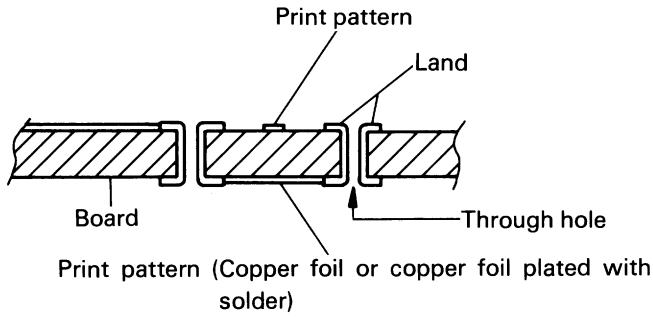


Fig. 6-7 Section of Board

6.4 Component Locking

This computer is portable and may be often subjected to vibrations and shocks. Thus, measures are required to prevent any failure due to possible loose screws, variable resistor adjustment deviations, poor contacts of cables and jumpers, etc. The following measures should be taken after any circuit board or other component replacement or variable register readjustment, etc.

6.4.1 Variable Resistor Locking

After a variable resistor is readjusted, apply a small amount of silicon lock on the variable resistor as shown in Fig. 6-8.
Care must be used to keep the driver groove free from the lock agent.

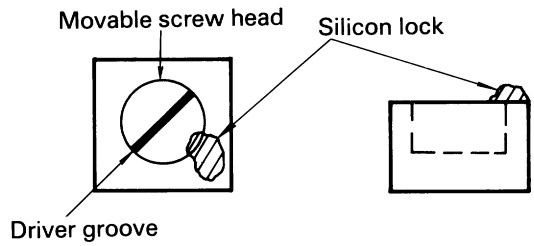


Fig. 6-8 Variable Resistor Locking

6.4.2 Screw Locking

After any circuit board is replaced or any micro-cassette tape drive azimuth adjustment is made, apply a small amount of screw lock agent on the fixing screws or the azimuth adjustment screw as shown in Fig. 6-9.

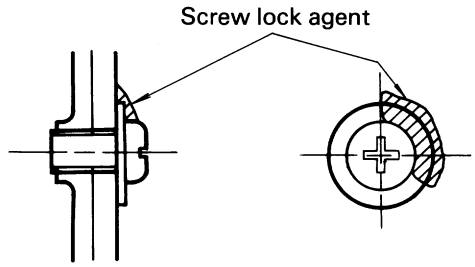


Fig. 6-9 Screw Locking

6.4.3 Ensuring an FPC Cable Connection

Before disconnecting/connecting any FPC cable, unlock its connector. When connecting an FPC cable, make sure that the cable end reaches the bottom of the connector before locking the connector.

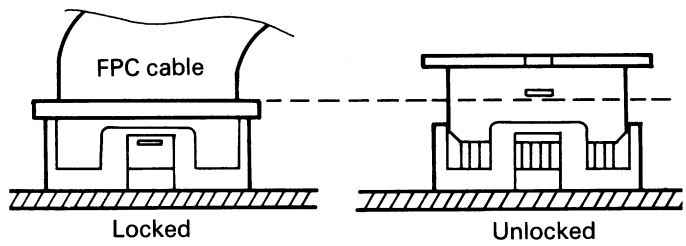


Fig. 6-10 FPC Cable Connection/ Disconnection

6.5 Notes On Repairing/Replacing The MAPLE Board

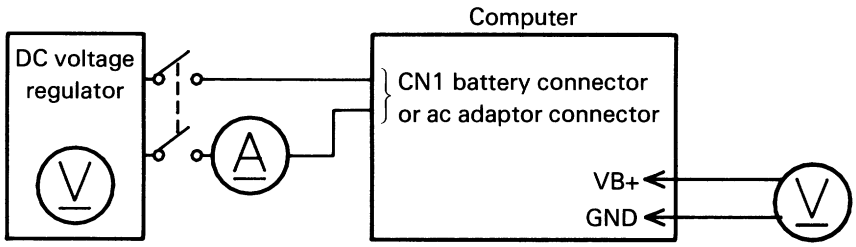
Care must be used on the following points when repairing or replacing the MAPLE board.

6.5.1 Voltage/Current Checks

Non-reproducible program runaways or data changes which cannot be attributed either to software (including the programming) or hardware may occasionally occry. Battery charging problems which are difficult to reproduce may also occasionally occur. In such instances, check the following voltages and the charging current before repairing the board.

1) Setting-up test equipment

Connect a DC voltage regulator in place of the main battery, a voltmeter, and an ampere meter as shown in Fig. 6-11.



* If an ampere meter is incorporated in the DC voltage regulator, no additional ampere meter is required.

Fig. 6-11 Setting-Up a Voltage and Current Measurement Device for Testing the MAPLE Board

If the DC voltage regulator has a current limiting feature, adjust it so that it works above 500 mA. Adjust the voltage output to +5.0V and make sure that the computer is off before applying the regulator output to the computer. If a higher voltage is inadvertently applied, circuit components may be damaged.

- Press the INITIAL RESET switch once and then set the computer POWER switch ON.

2) Voltages

(Low voltage detection level)

Lower the regulator output voltage while observing the VB+ voltage on the MAPLE board. Measure the voltage at the time the message, "CHARGE BATTERY", is diplayed on the LCD panel. The measured voltage should be in the following range:

4.61V ~ 4.82V

Note) When the message appears, the VB+ voltage rises a little higher than the value measured immediately before ; this occurs because the BV+ line is backed up by the auxiliary battery.

(A-D converter voltage)

Adjust the VB+ voltage to 5.0V and then make sure that the voltage across the test terminals VRF is 2.0V.

3) The VB+ line current varies depending on the line voltage and operation. Table 6.5 lists the standard current requirement for the various components. The following current measurements may also vary depending operation mode.

Table 6-5

No.	Computer State/Component	Current	Remarks
1	Operating MAPLE board	60 mA	
2	Operating microcassette tape drive	130 mA	Average including head load/unload – the actual current requirement varies from approximately 90 mA to 160 mA.
3	Operating RS-232C serial interface	110 mA	
4	Operating ROM capsule	90 mA	With two 27128s.
5	Operating speaker	35 mA	At max. sound level
6	Power off 45°C or above	1400 μA	Varies depending on the temperature detected by thermistor TH1.
7	Power off 25°C ~ 45°C	600 μA	
8	Power off below 25°C	300 μA	
9	Power on idle	55 mA	

6.5.2 Test Points

11 test points are provided on the MAPLE board which allow easy access to the VB supply line and major signals for test.

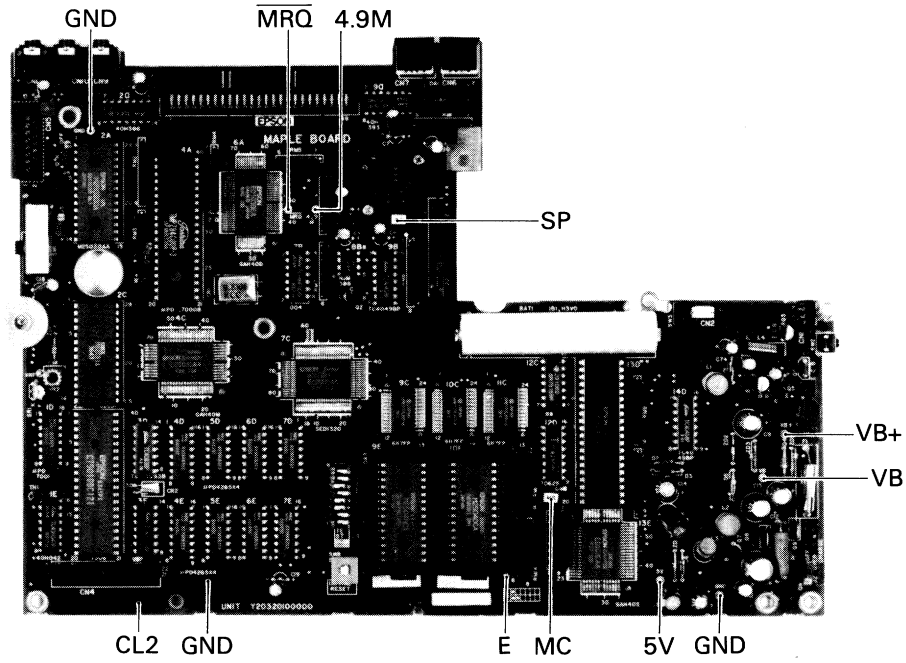


Fig. 6-12 MAPLE Board Test Points

Table 6-6 MAPLE Board Test Points and Their Functions

Name	Function	Remarks
GND	Signal ground	
VB+	Battery voltage	
VB	Backup voltage	Supply for 6kB V-RAM, 64kB D-RAM, 7508 sub-CPU, and A-D converter
+5	Logic circuit voltage supply – VB+ supply through fuse F4 and transistor Q6	
VRF	A-D converter reference voltage	Adjust to 2.0 V.
E	6303 slave CPU enabling signal	
MC	Microcassette tape read data signal	
4.9M	Clock signal halved from the primary frequency of 9.8304 MHz which is used as the control clock signal for the LCD controller SED1320.	
$\overline{MRQ}$	Issued from main CPU when D-RAM memory is read/written or refreshed.	
SP	Microcassette tape read data used as an output to the speaker.	
CL2	Keyboard Scanning clock signal	Adjust the pulse cycle to 11.5 to 12.5 ms.

6.5.3 Variable Resistor Adjustments

There are four variable resistors, three on the MAPLE board (see Fig. 6-13) and one in the LCD unit.

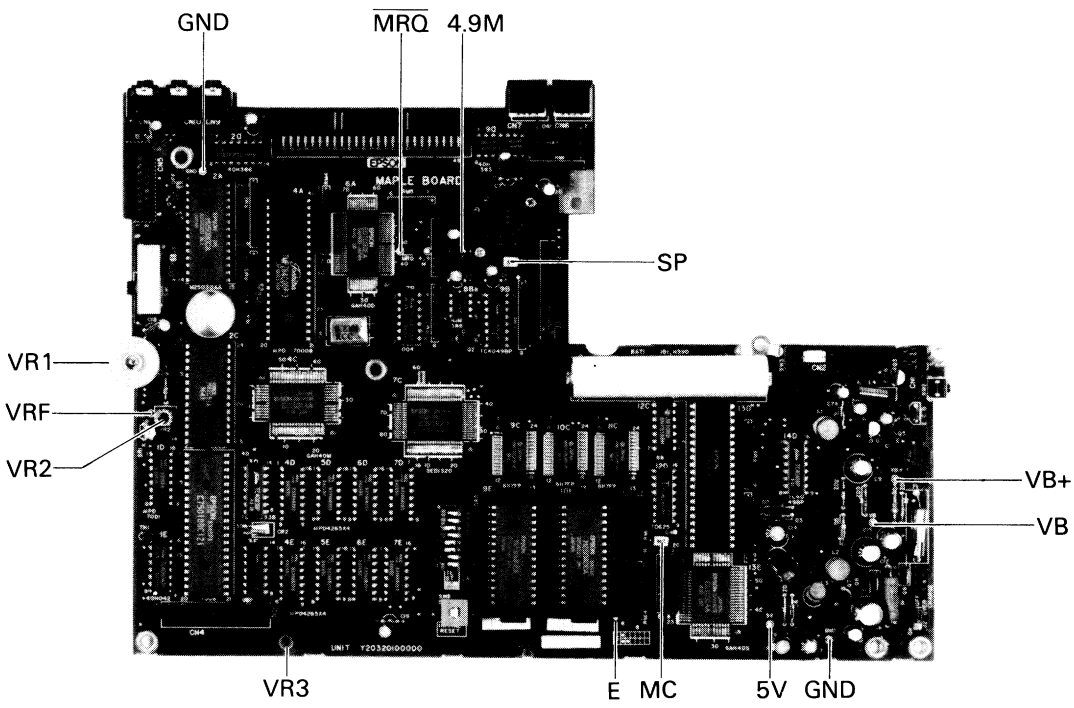


Fig. 6-13 MAPLE Board Variable Resistors

Table 6-7 Variable Resistors and Their Functions

Location	Name	Function
MAPLE Board	VR1	Speaker sound level adjustment
	VR2	A-D converter reference voltage
	VR3	7508 sub-CPU clock signal adjustment (for keyboard scanning)
LCD	VR	LCD view angle adjustment

VR2 and VR3, listed in the Table 6-7 need to be adjusted as follow:

(1) VR2

Adjust the voltage across the VRF terminals to 2.0V with VB+ at 5.0V.

(2) VR3

Adjust the cycle of the pulse signal at point "CL2" or Pin 21 of IC "2E" to 200 kHz ±4%.

6.5.4 Jumper and DIP Switch Settings

When a computer board is replaced, set the jumpers and/or DIP switches according to the following;

(1) Jumpers

Set the jumpers by referring to the old board as well as the descriptions in 2.5, "Jumper and Switch Setting" paying attention to the following:

J1: The J1 setting varies depending on the type of main CPU (μPD 70008). Examine the main CPU chip (4A) on the new board before setting J1.

J5: Use the same setting as the old board, A or B. If a different terminal is wired, ghost displays may appear on the LCD panel.

J2 and J4: Use the same settings as on the old board. The user may use other than the standard setting.

J3: Always use the standard setting; open or OFF.

(2) DIP switch (SW4)

Set the individual switches of this DIP switch assembly according to the descriptions in 2.5 "Jumper and Switch Setting".

6.6 Microcassette Tape Drive Adjustment

The microcassette tape drive requires two regular adjustments, reel torque and azimuth.

However, the test tapes have no directory area and cannot be read by the normal LOAD instruction, resulting in a message, "DEVICE UNAVAILABLE". Therefore the drive must be manually operated as follows:

STEPS:

(1) Turn on the power.

(2) Press "CTRL" and "HELP"; the system display will appear.

(3) The screen shown in Fig. 6-14 should appear.

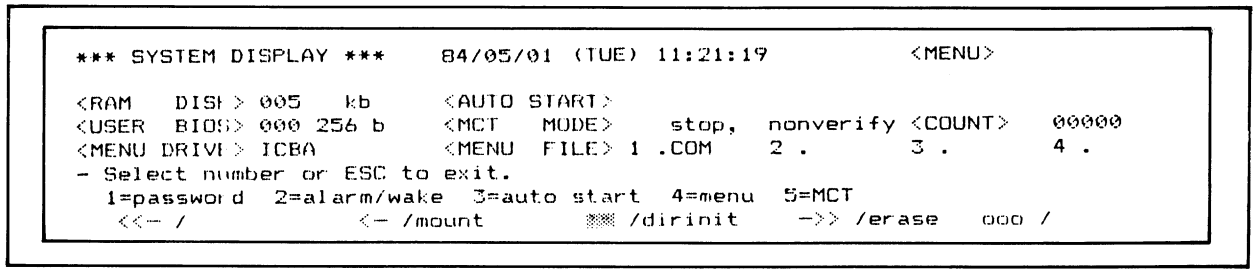


Fig. 6-14

* This screen is a little different from the actual one.

(4) At this time, the operation shown in Table 6-8 can be carried out.

(5) Insert the test cassette tape in the drive and press "PF2."
The drive should be in the "PLAY" state and the tape should be loaded.
(Press PF3 and PF4 respectively when stopping and rewinding the tape.)

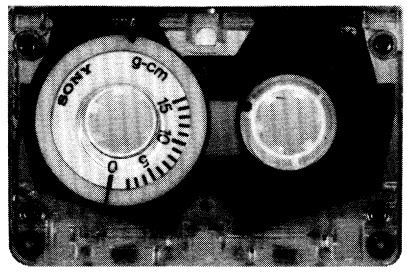
Table 6-8 Test Cassette Tape Routine

Key	Name of operation	Description
SHIFT + PF2	MOUNT	Store the directory on the tape in the memory.
SHIFT + PF1	REMOVE	Write the directory stored in the memory on the tape.
SHIFT + PF3	DIRINIT	Initialize the directory on the tape.
PF4	REWIND	Rewind the tape.
PF2	PLAY	Monitor the contents for the tape through the speaker.
PF1	FF	Feed the tape at a high speed.
SHIFT + PF4	ERASE	Erase the contents of the tape.
PF3	STOP	Stop the tape.
PF5	RESET	Reset the tape counter to 0.

6.6.1 Reel Torque

Mount the Torque check cassette on the microcassette drive, and run the LOAD command. The tape starts. The torque can read directly from the indicator on the left hand reel of the cassette.

Torque check cassette



The proper torque is 5.0 - 11.0 g-cm.

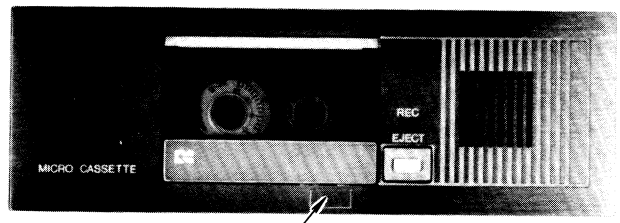
Fig. 6-15

6.6.2 Azimuth Adjustment

This is an important adjustment, required to maintain tape compatibility with other drives. Whenever a read error frequently occurs or whenever the drive is repaired, the azimuth must be checked and adjusted accordingly.

(1) Setting-up

1. Remove the cover of the azimuth hole of the microcassette drive shown in Fig. 6-16.
2. Connect the jack connector to the external speaker interface (SP OUT).



Azimuth hole cover
(adjustment screw below)

Fig. 6-16

3. Connect the probe of the oscilloscope to the lead wire of the connector as shown in Fig. 6-17.

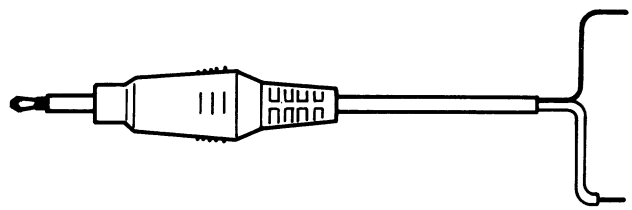


Fig. 6-17

* If the jack connector is not available, solder two lead wires from the MAP-MC board, CN1 connector pins 3 and 5, as shown in Fig. 6-18.

Solder the lead wires to pins 3 and 5 as shown in Fig. 6-18.

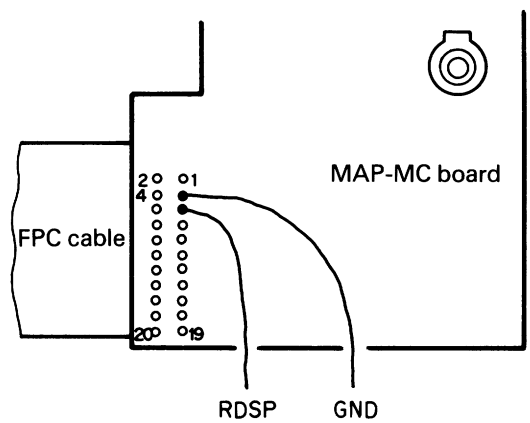


Fig. 6-18 Additional Lead Wires for Azimuth Adjustment

(2) Adjustment

Check the output signal from the test connector (or the RDSP signal of pin 5 on CN1) with an oscilloscope. Turn the azimuth adjustment screw clockwise or counterclockwise until the peak position of the wave is found, then adjust the azimuth according to the following procedure. (For the location of the adjustment screw, see Fig. 6-20.)

1. Turn the adjustment screw slightly in a counterclockwise direction to deviate from the peak.
2. Slowly turn the adjustment screw clockwise to the peak position. (Be sure to adjust the screw to the peak position turning it clockwise.)
3. Lock the adjustment screw.

Set the oscilloscope near the following range.

Sweep DIV. 200 μS

Reference: Output signal of pin 7 of IC4 on MAP-MC board.

The signal wave form should be about 200 mVP-P as shown in Fig. 6-19.

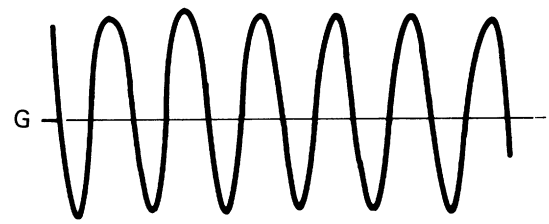
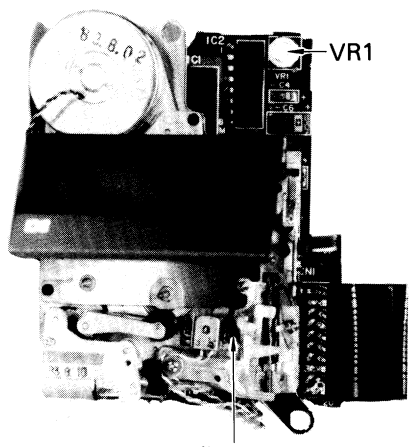


Fig. 6-19

6.6.3 Tape Speed (2.4 cm/s)

Make sure, by using the AZIMUTH test tape, that the output is within a range of 3 kHz ± 15 Hz (as directly measured with a frequency meter). Make sure that the signal at pin 3 of IC2 on the MAP-MC board is in a frequency range within 400 Hz ± 4 Hz (a pulse cycle range from 2.57 to 2.44 ms). If either deviates from the specified range, readjust the tape speed with variable resistor VR1 on the board.

Location



Azimuth adjustment screw
(Located right beneath the azimuth hole cover.)

Fig. 6-20

6.7 Barcode Reader

Connect a low resolution barcode reader and make sure that the patterns shown in Fig. 6-21 can be read with the BARCODE CHECK test program.

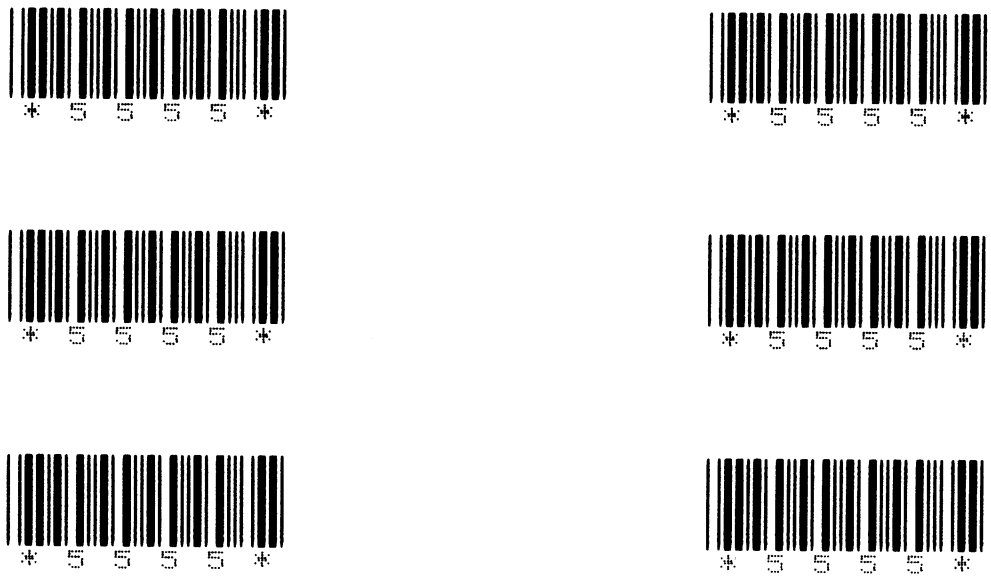


Fig. 6-21