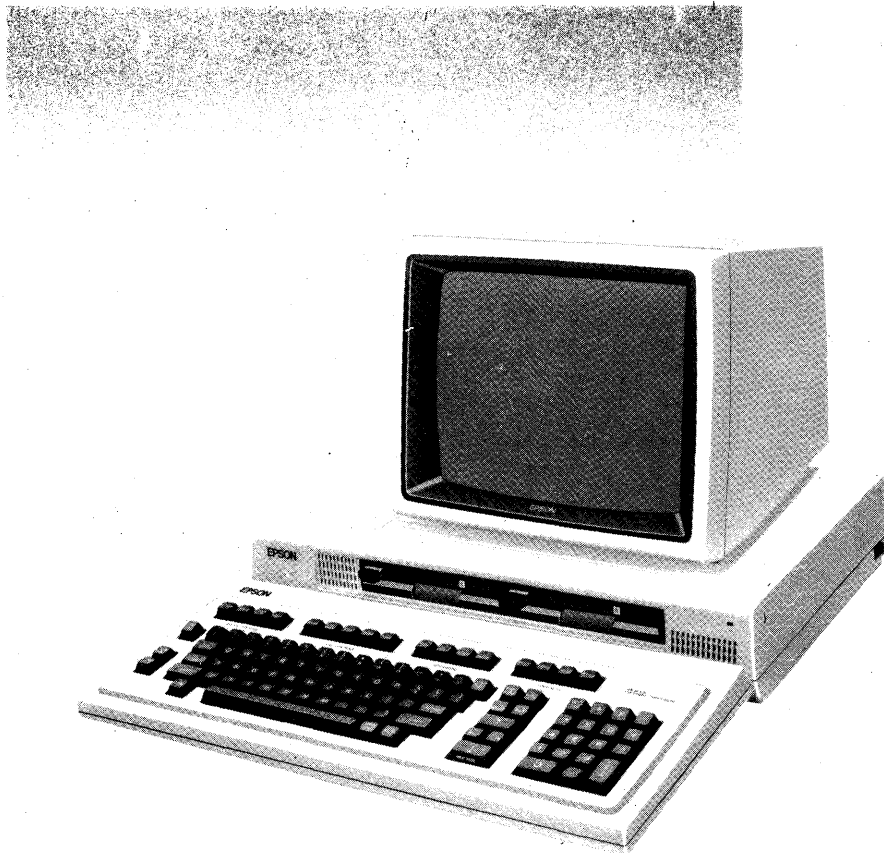


QX10

TECHNICAL MANUAL

TROUBLESHOOTING



EPSON

TECHNICAL MANUAL TROUBLESHOOTING



This Technical Manual provides technical information on the structure, maintenance, and repairs of the QX-10.

For the details of the operation, refer to the Technical Manual of QX-10 (Principles of Hardware Operation).

Major technical modifications, if made in the future, will be notified through Service Bulletins, and the Technical Manual should be revised accordingly. The details of the Manual are subject to change without notice.

All the information given in the Manual concerns the QX-10 to others.

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CHAPTER 1 GENERAL

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1.1 Features

The QX-10 is an all business computer system. It consists of a Z80A-compatible CPU, a memory of 256 KB maximum, two floppy disk drivers of double-sided, double-density, 5-1/4" disks, and a 12" full-graphic CRT display with a resolution of 640 by 400 dots.

The standard configuration includes a programmable timer, Centronics-compatible printer interface, RS-232C interface, C-MOS RAM backed up by battery, clock and calendar, and separate keyboard. It has five card slots which permit installation of optional cards as required.

Optional cards available include character generators of varying fonts, IEEE-488 interface, optical fiber interface, color CRT interface, and pulse transformer interface.

1.2 Hardware configuration

1.2.1 General

The QX-10 is composed of three units: the main system unit, the keyboard unit, and the monitor unit.

The main system unit, the heart of the QX-10 system, includes the main circuit board, sub circuit board, power supply, two 5-1/4" floppy disk drives developed by Epson, and five slots permitting installation of optional cards.

The keyboard unit is connected to the main system unit with a curled cord through which signals may be transmitted in any direction.

The standard monitor unit is a 12" high resolution green monitor capable of displaying bit images.

1.2.2 Hardware

Main system

CPU	μ PD780AC-1 (Z80A compatible, 4 MHz)
Memory	RAM : 256 KB (maximum on main board) VIDEO RAM : 128 KB (maximum on CRT board) C-MOS RAM : 2 KB (standard, backed up by battery) EPROM : 2/4/8 KB (for IPL)
Clock	C-MOS real-time clock (backed up by battery)
Speaker	Permanent magnet speaker
Interfaces	Printer interface (Centronics-compatible) RS-232C communications interface
DMA	7 channels
Interrupt levels	15
Counter/timer	6 channels
FDD	5-1/4" FDD x 2 320 KB x 2 drives 48 TPI, double sided & double density
Card slots	5
Monitor	12" green monitor 640 x 400 dots
Keyboard	ASCII, HASCI

1.3 Specifications

1.3.1 External Dimensions and Weight

(1) External dimensions

	(W)	(D)	(H)
Main system unit	ca. 508	x 340	x 103 (mm)
Green monitor unit	ca. 312	x 340	x 270 (mm)
Keyboard unit	ca. 508	x 224	x 48 (mm)
	(510)		
Optional card	280	x 80	(mm)

(2) Weight: approx. 18kg

1.3.2 Environmental Conditions

- (1) Temperature during operation : 5°C to 40°C
storage : -30°C to 70°C
- (2) Humidity..... during operation : 20 - 80% (no condensation)
storage : 10 - 90% (no condensation)
- (3) Resistance to shock during operation : max. 1 G, 1 msec
storage : max. 5 G, 1 msec
- (4) Resistance to vibration.... during operation : max. 0.25 G, 5-50 Hz
storage : max. 3 G, 5-50Hz

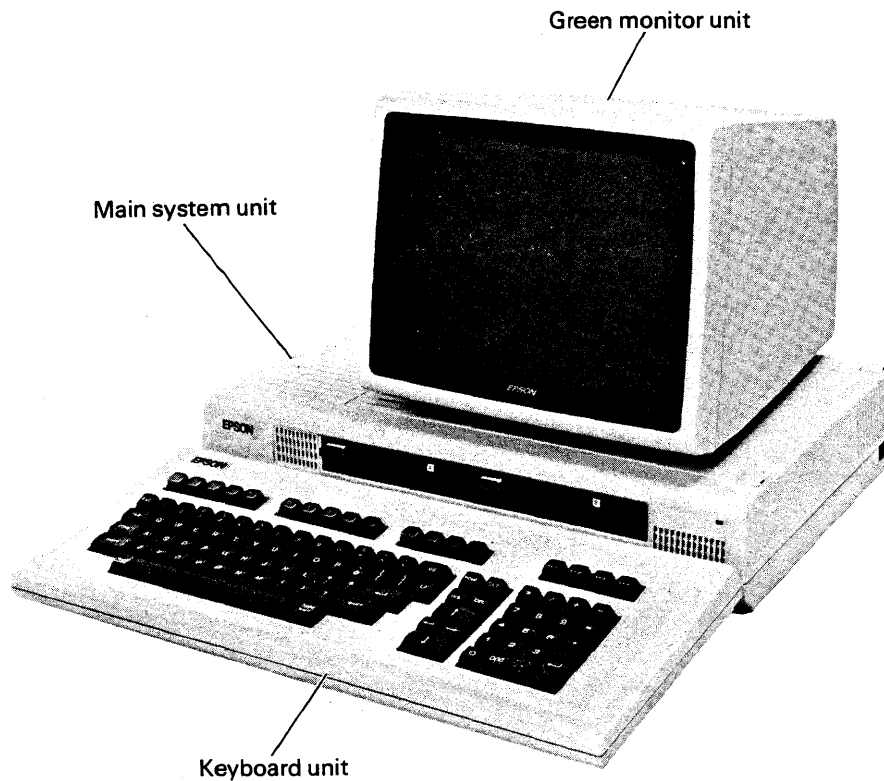


Fig 1-1 Hardware configuration of QX-10

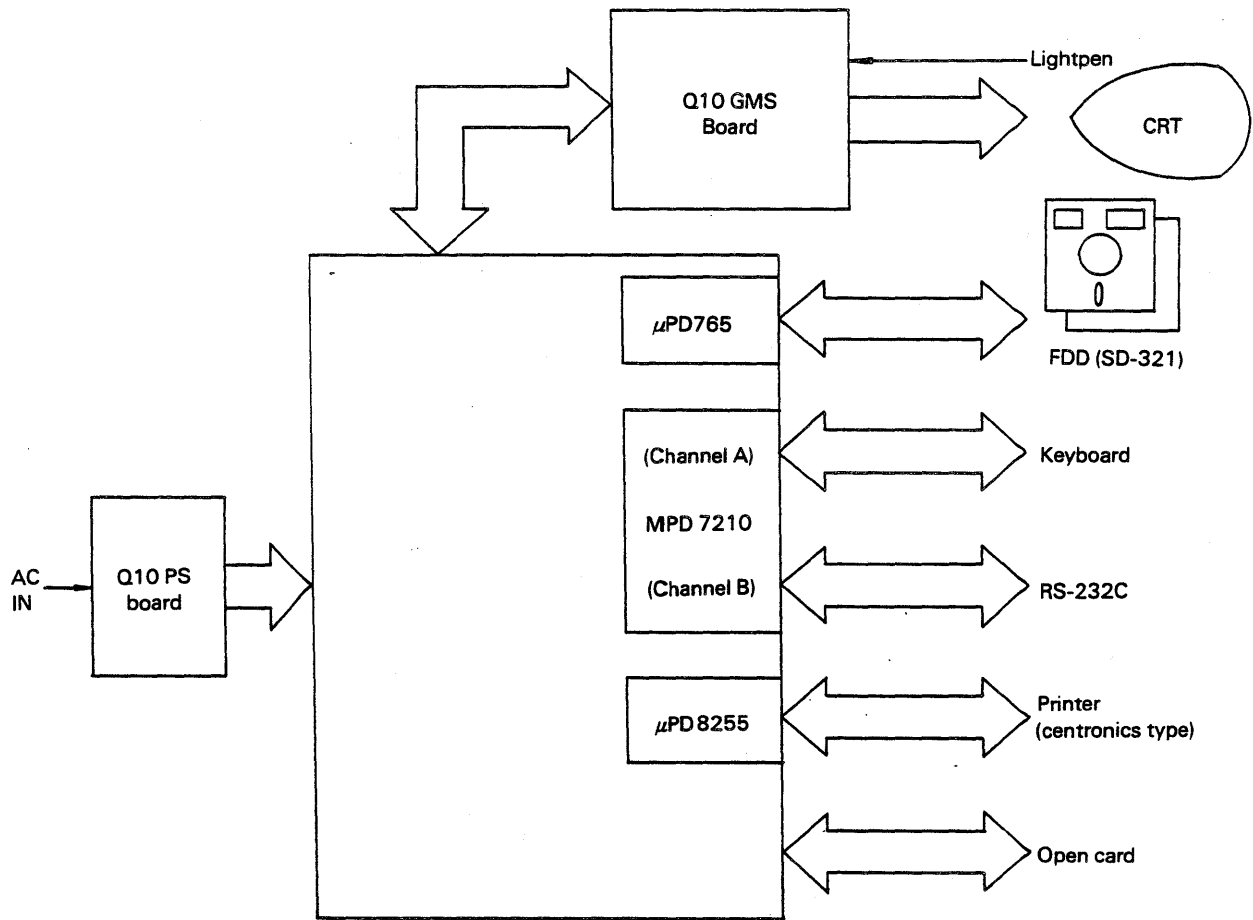


Fig 1-2 Block diagram of main component

(A) Q10S SYM board

This is a main control board including CPU, compatible with Z80A, Z80A family LSI and main memory.

Name	Model	Q'ty	Function
CPU	μ PD780C	1	CPU (4MHz) compatible with Z80A.
DMA controller	8237A	2	Provided with total of 7 channels for FDD, monitor and options.
Interrupt controller	8259AC	2	Controls the interrupt priority of total 15 levels interrupt including PWD output keyboard interrupt.
Interval timer	8253C	2	Controls the baud rate of keyboard clock and RS-232C.
Serial controller	7201C	1	Allocates channel A to the keyboard and B to RS-232C, and controls serial data transfer with CPU.
Printer controller	8255AC	1	Provided with an 8-bit parallel port. Acts as an interface with printer conformable to Centronix.
Real time clock	46818P	1	Provided with clock and calendar functions.
Floppy disk controller	765AC	1	Interface with FDD (SD-321)
I/O selector	LS154	1	Accesses each I/O point by decoding the 4-bit low order address (A2 ~ A5) of CPU.
Main memory	416/4164	8 32	Dynamic RAM is used. Provided with 4 banks maximum.
P-ROM	2716/32/ 64	1	Stores IPL programs.
C-MOS RAM	449	1	Protects the data on power failure. (Backed up by an NiCd battery.)

Table 1-1 Primary configuration of Q10 SYM

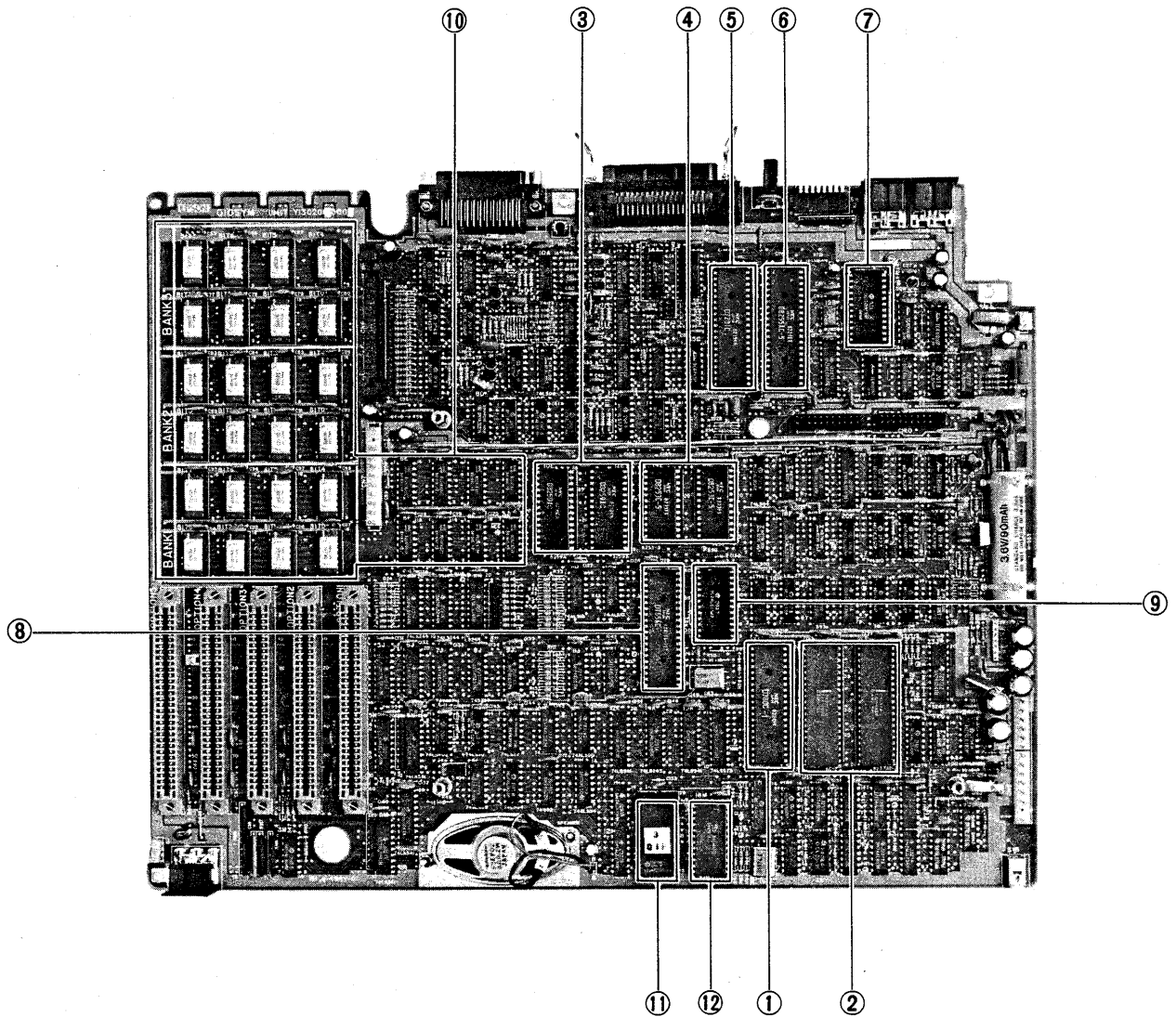


Fig. 1-3

- 1 μ PD780C (Z80A compatible CPU)
- 2 8237A (Programmable DMA Controller)
- 3 8259AC (Programmable Interrupt Controller)
- 4 8253C (Programmable Interval Timer)
- 5 7201C (Multi-protocol Serial Controller)
- 6 8255AC (Programmable peripheral Interface)
- 7 46818P (Real-time clock plus RAM)
- 8 765AC (Programmable Floppy Disk Controller)
- 9 LS154 (I/O Selector)
- 10 416/4164 (D-RAM)
- 11 2716/32/04 (P-ROM for IPL)
- 12 449 (C-MOS RAM)

(B) Q10 GMS board includes graphic display controller

The board includes graphic display controller μ PD7220 and V-RAM, and controls display of the green monitor.

Name	Model	Q'ty	Function
Graphic display controller	7220	1	A display controller with high speed drawing and magnifying functions.
Video RAM	416/4164	16	Dynamic RAM is used.
Character generator	2732/64	1	ROM storing display fonts to be sent to the display unit.

Table 1-2 Primary configuration of Q10 GMS

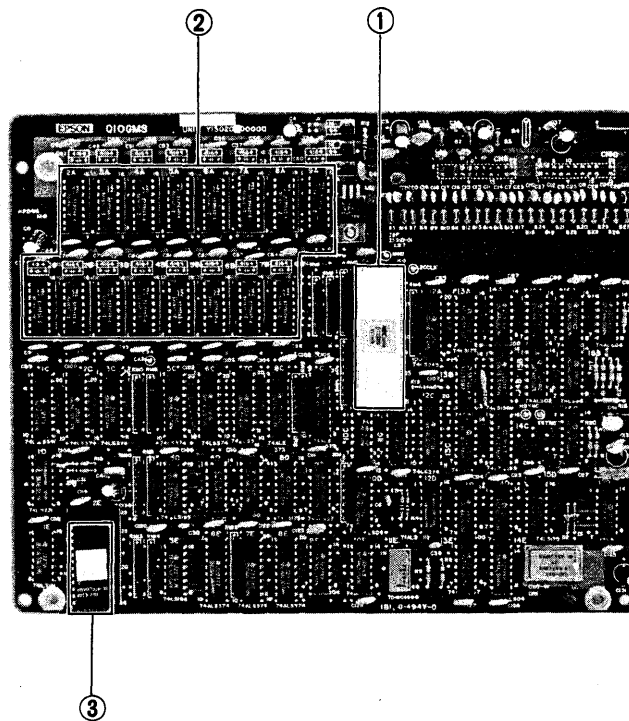


Fig. 1-4

- 1 7220 (Graphic Display Controller)
- 2 V-RAM (16/64 k bit dynamic RAM)
- 3 P-ROM (Character Generator)

(C) Q10 PS board

This is a power supply unit for the QX-10 system and a switching regulator with a flyback transformer. It accommodates to power supplies of 100V and 200V levels by switching jumper wire J1.

Specifications

- (1) Input voltage: 100V - 10% ~ 120V + 10%
200V channel 220V - 10% ~ 240V + 10%
- (2) Frequency: 50/60 Hz
- (3) Power consumption: Approx. 75W
- (4) Input surge current: 30A for 20 ms maximum
- (5) Leak current: 1 mA maximum
- (6) Insulation strength: 100V channel Can withstand 1 kV applied between AC power supply and case for 1 minute.
200V channel Can withstand 1.25 kV applied between AC power supply and case for 1 minute.
- (7) Insulation resistance: 10 MΩ for 500V DC minimum.
- (8) Output Voltage:

Output voltage	Limits of output voltage	Standard current	USE
+5	5.0 ~ 5.1 V	3.6 A	logic circuit
+12(C)	11.6 ~ 12.4 V	0.9 A	green monitor
+12(F)	11.4 ~ 12.6 V	1.2 A	floppy disk drive
+12(L)	11 ~ 13 V	0.45 A	keyboard, RS-232C
-12	-11 ~ -13 V	0.02 A	D-RAM, RS-232C

Table 1-3

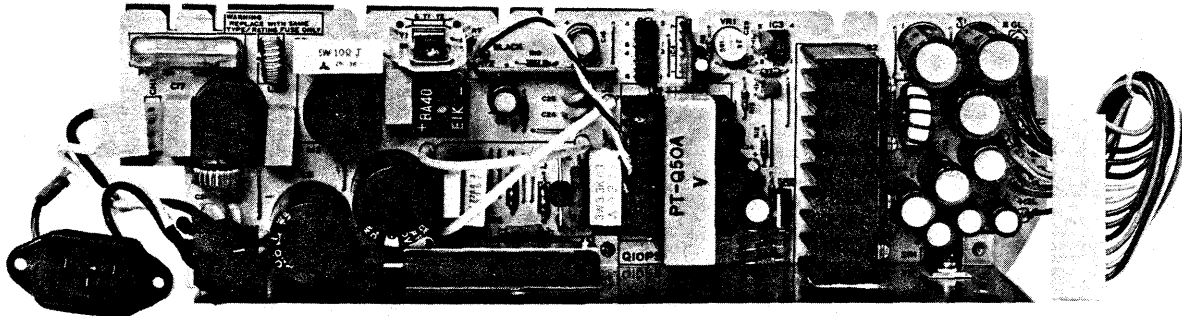


Fig. 1-5

(D) CRT display unit

Fig. 1-6 shows the standard green monitor unit of QX-10.

The CRT is characterized by high resolution of 640 x 400 dots and non-glare coating, preventing reflection.

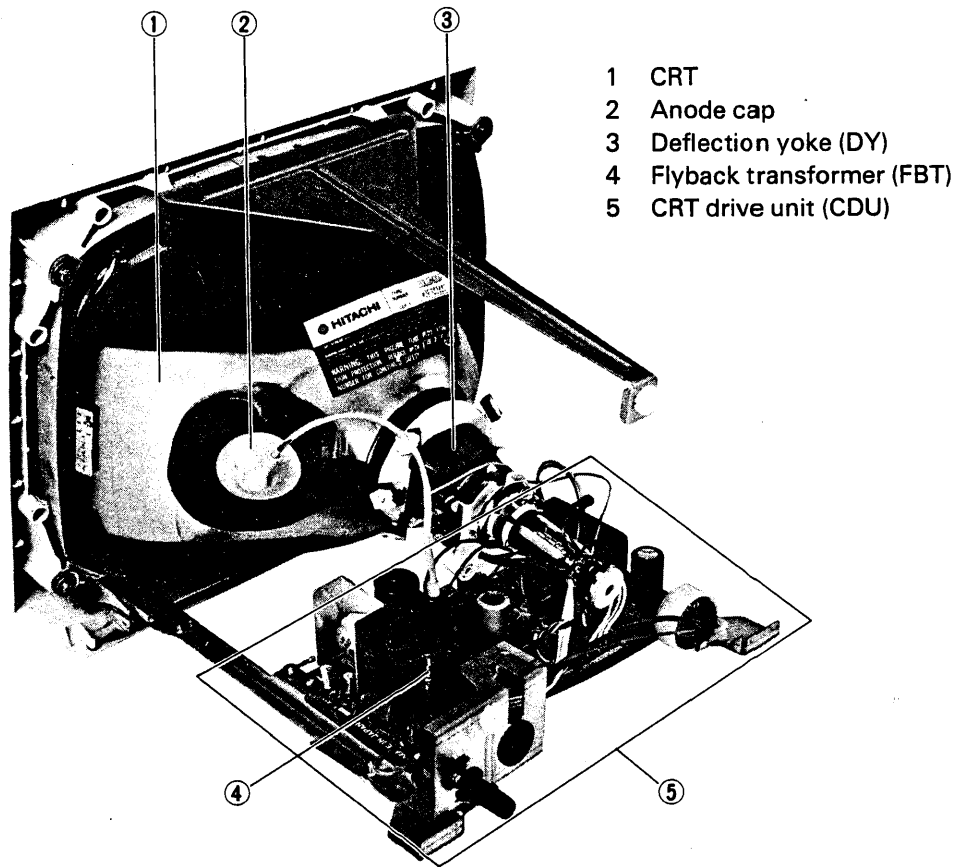


Fig. 1-6

1) Pin Definition

Pin No.	Function
1	Video signal
2	Vertical synchronizing signal
3	Horizontal synchronizing signal
4	Power supply + 12V DC
5	Grounding (power supply, horizontal)
6	Grounding (video vertical)
7	Grounding (power supply, horizontal)
8	Frame grounding

Table 1-4

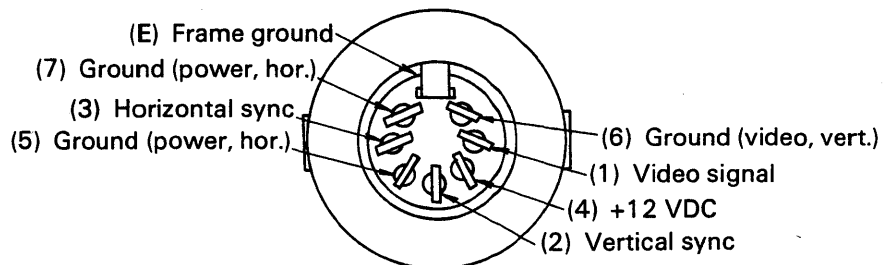


Fig. 1-7

2) Input Conditions

(1) Video signal:

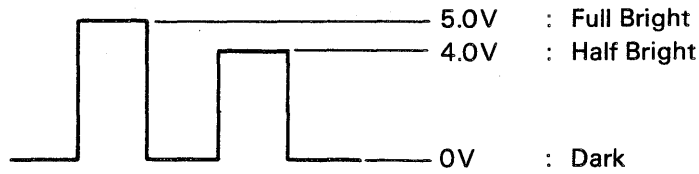


Fig 1-8

- (2) Video input impedance: 300 Ω min. 40 pF max.
- (3) Horizontal driving signal: TTL (positive)
L: 0 - 0.8 V H: 2.4 - 5.5 V
- (4) Horizontal input impedance: 500 Ω min.
- (5) Vertical driving signal: TTL (positive)
L: 0 - 0.8 V H: 2.4 - 5.5 V
- (6) Vertical input impedance: 3.0 k Ω min.

3) Input signal timing

(a) Horizontal driving signal

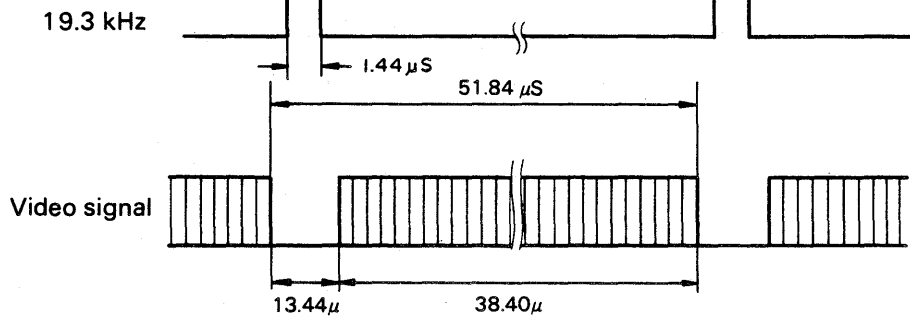


Fig. 1-9

(b) Vertical driving signal

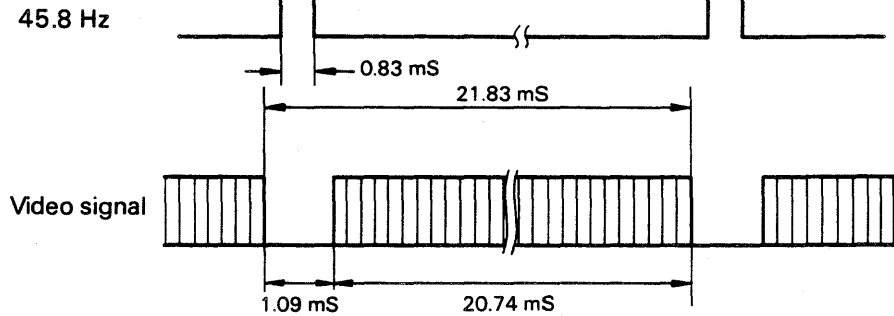


Fig. 1-10

(c) Video signal

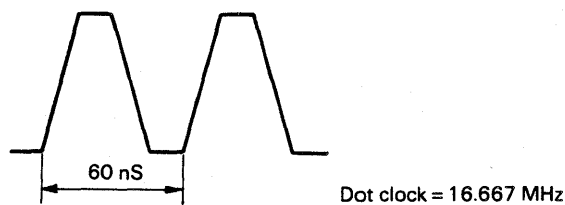


Fig. 1-11

(E) Keyboard

The keyboard of QX-10 is available in ASCII type and HASCI type, according to applications.

These two types are almost the same in hardware.

Keyboard data transfer is controlled by the CPU μ PD8049 used as a keyboard controller separately from the main CPU.

Data transfer is made with the main system unit in the start-stop turning system at the rate of 1200 BPS.

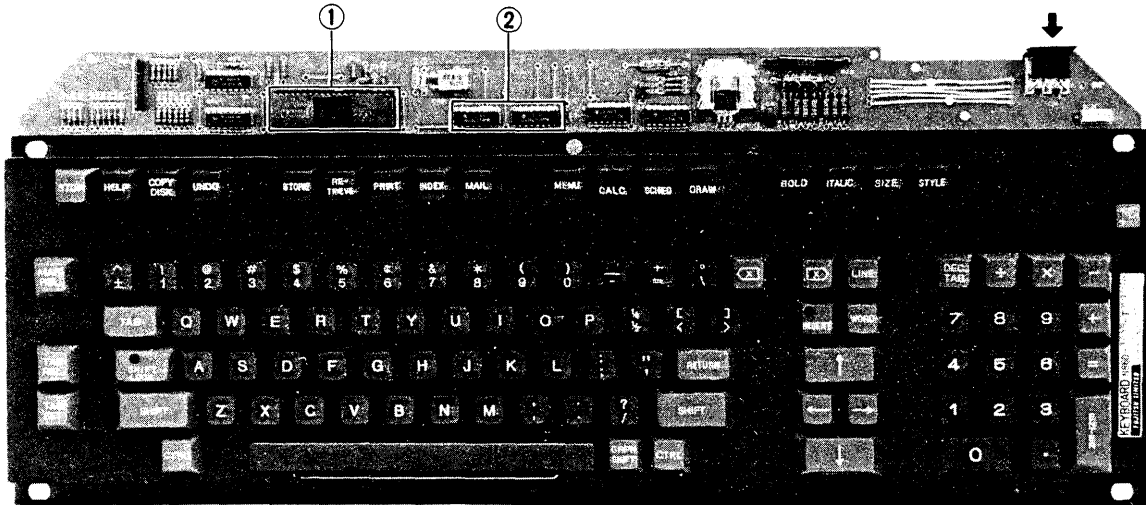


Fig 1-12

- 1 Keyboard controller (μ PD8049)
- 2 Key scan signal decoder (LS145)

Pin Definition

Pin No.	Signal Direction	Description of Signal
1	OUT	Received data
2	OUT	Clock (1200 BPS)
3	OUT	+12 V
4	IN	Transmitted data
5	-	Ground
6	-	Ground
7	-	Ground
8	-	Ground

Note: The direction of signal is as viewed from the Q10SYM board

Table 1-5

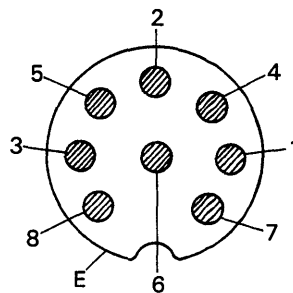


Fig. 1-13 Pin locations

(F) Floppy Disk Drive SD-321

Double sided, double density type of 5-1/4" floppy disk drive SD-321 has the features as described below:

- 1) SD-321 produces an ultra thin structure of 1/2 – 1/3 the conventional models.
- 2) In order to miniaturize the circuit board and get high reliability, most of the control circuit is integrated to two LSIs.

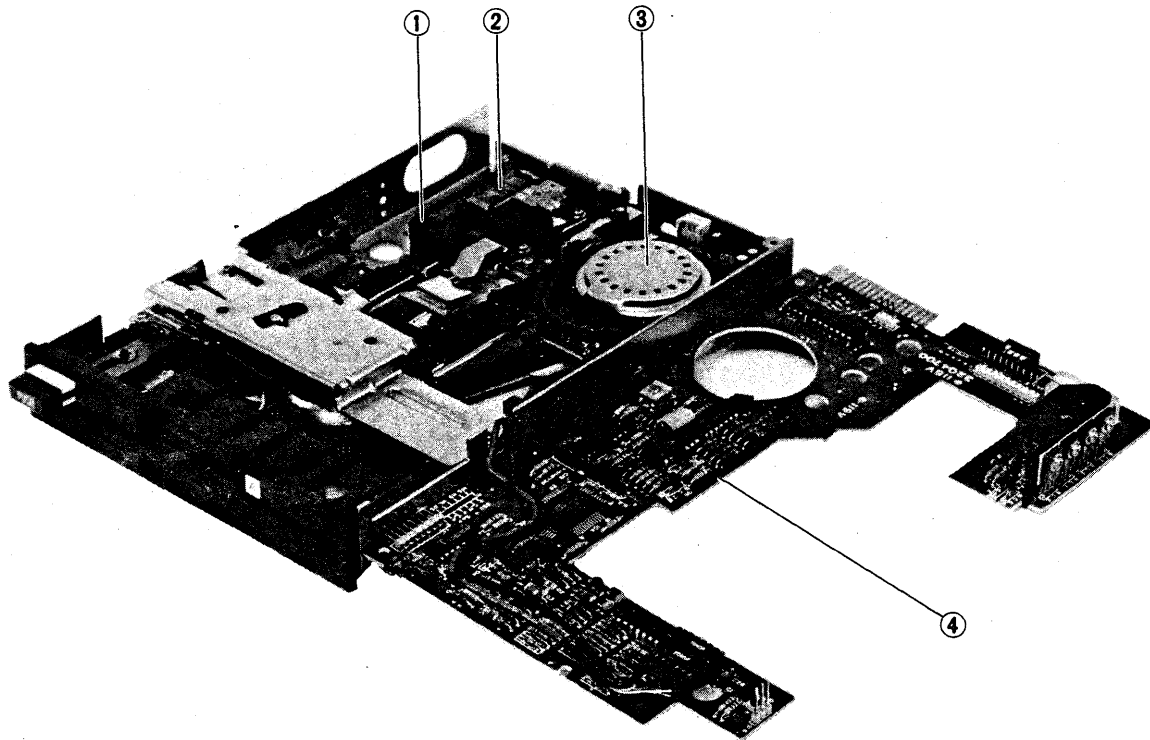


Fig. 1-14

- 1 Head pad
- 2 VCM
- 3 Drive motor
- 4 Main PCB

► **Specifications of SD-321**

1. Memory capacity
 - (1) Unformatted : 500 k byte (Double density recording)
 - (2) Formatted (16 sectors/track) : 328 k byte (Double density recording)
2. Recording density (side 1, trk 39) : 5876 BPI (Double density recording)
3. Transmission speed : 250 k bit/sec (Double density recording)
4. Track mean speed waiting time : 100 msec
5. Access time
 - (1) Between tracks : 15 msec
 - (2) Between tracks moving average : 220 msec
 - (3) Settling time : 15 msec
6. Motor starting time : 0.5 sec
7. Motor speed : 300 rpm
8. Track density : 48 TPI
9. Total number of tracks : 80
10. Inner circumference track radius : 36.52 mm (trk 39, side 0)
55.03 mm (trk 00, side 1)
11. Outer circumference track radius : 36.52 mm (trk 39, side 0)
34.40 mm (trk 39, side 1)
12. Recording system : MFM
13. R/W head positioning : Voice coil motor
14. Main axis motor : Outer rotor-type brushless transistor motor
15. Detectors
 - (1) Index hole detector : Photoelectric conversion
 - (2) Track No.00 detector : Photoelectric conversion
 - (3) Wright protect detector : Photoelectric conversion
 - (4) Track address detector : Photoelectric conversion
16. Ambient conditions
 - (1) Temperature : 4°C to 43°C
 - (2) Relative humidity : 20% to 80% (no condensation)
 - (3) Maximum wet-bulb temperature : 29°C
 - (4) Vibration : 0.6G, 5 ~ 60 Hz
17. Transportation and storage condition
 - (1) Temperature : -40°C to 65°C
 - (2) Relative humidity : less than 95% (no condensation)
 - (3) Vibration : less than 3G, 50 ~ 60 Hz
 - (4) Impact : less than 50G

- 18. Power supply
 - (1) +12V ($\pm 5\%$) : 0.7 A (typ) (at reading/writing)
1.9 A (max) (at motor starting)
 - (2) +5V ($\pm 5\%$) : 0.25 A (typ) (at reading/writing)
0.4 A (max) (at motor starting)

- 19. Power consumption : 9.7 W (typ)

- 20. Reliability
 - (1) MTBF : 1000 HOURS (POH)
 - (2) MTTR : 30 minutes
 - (3) Soft error rate : less than once every 10^9 bits
 - (4) Hard error rate : less than once every 10^{12} bits
 - (5) Seek error rate : less than once every 10^6 seeks

- 21. Connectors
 - (1) Power supply connector : AMP. P/N 1-480424-0 or equivalent
 - (2) Signal connector : 3M P/N 3463-0001 or equivalent

CHAPTER 2 DISASSEMBLY AND REASSEMBLY

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2.1 Precautions for disassembly and reassembly

Before disassembling or reassembling the QX-10, pay attention to the following.

- 1) Make sure the power switch is turned off.
Disconnect the AC cable from the AC inlet.
- 2) Disconnect the cables of the keyboard, CRT unit, etc. connected to the QX-10.
- 3) Power is charged in the electrolytic condenser in the power supply unit for a few minutes after the power switch is turned off. So take care to avoid electric shock.
- 4) Take special care to keep the CRT unit away from cathode rays or the yoke coil.
If the anode cap is removed, it must be properly discharged with a resistor of about 10m interposed between the cap and GND.
- 5) When a substrate using ICs such as a circuit board is handled, be sure to touch a grounded device with your hands to discharge static electricity prior to handling.
- 6) Be sure to use the specified screws. (See Table 2-1)
- 7) Do not touch the contact surfaces of connectors with bare hands.
- 8) When the Q10 SYM substrate is removed or transported, disconnect the battery connector CN12.

Abbreviations for screws and small parts


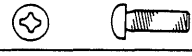
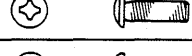
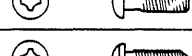
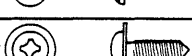
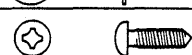
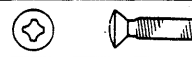

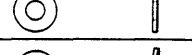
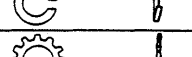
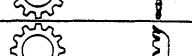



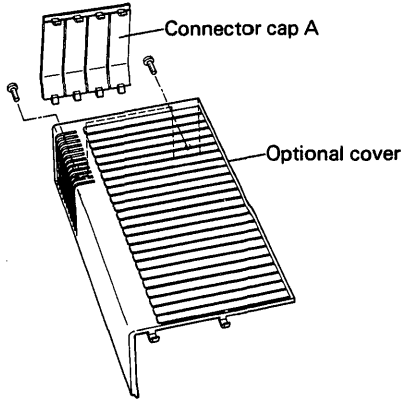
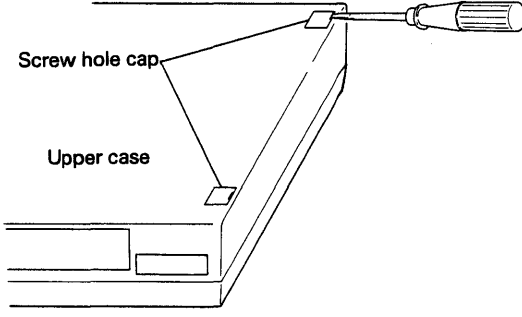
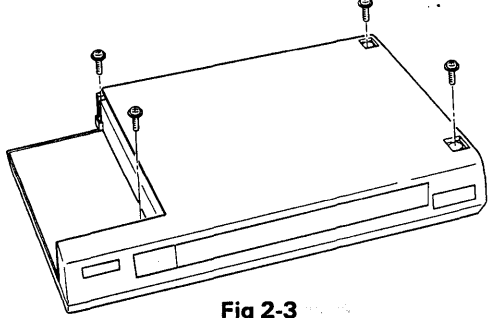
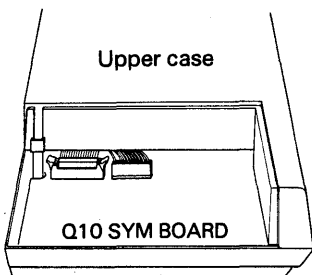
Abbreviation	Name	Rough Sketch
CS	Cup screw	
CP	Cross-recessed pan head machine screw	
CB	Cross-recessed head blind tapping screw	
CPO	Cross-recessed head C.P.screw (with outside toothed lock washer)	
CTB	Cross-recessed head blind tapping screw	
CTC	Cross-recessed head cup tapping screw	
CTBR	Cross-recessed head Brajier head tapping screw	
CO	Cross-recessed head oval counter sunk screw	
HH	Hexagon socket half-point set screw	
PW	Plane washer	
SW	Spring washer	
OW	Outside toothed lock washer	
CW	Conical toothed lock washer	
HN	Hexagon nut	

Table 2-1

2.2 Disassembly and reassembly of the main unit

2.2.1 Optional cover and upper case

Disassembly procedure	Notes on disassembly
<p>1. Remove two screws of the optional cover shown in Fig. 2-1.</p> <p>CB: M4 × 12 × 4</p>	 <p>Fig. 2-1</p>
<p>2. Remove the connector cap A between the option cover and lower case.</p>	<p>● To replace connector cap A, first replace the optional cover and then insert the lower part of connector cap A into the groove of the lower case and push the upper part.</p>
<p>3. Remove two screw hole caps located in the right end of the upper case top with a (-) screwdriver.</p>	 <p>Fig 2-2</p>
<p>4. Remove the the four set screws of the upper case shown in Fig. 2-3.</p> <p>CS: M4 × 12 × 4</p>	 <p>Fig 2-3</p>
<p>5. Remove the two connectors shown in Fig. 2-4.(CN6 and CN7 on the Q10 SYM substrate)</p>	 <p>Fig. 2-4</p>

Disassembly procedure

6. Note: Upper and lower cases are connected via the grounding wire.
Lift the upper case by hand and remove it so that the rear part come to the front, and put it in front of the lower case.

7. Remove the screw on the right side of the speaker of Q10 SYM board, and disconnect the grounding wire.

CTC: M3 × 12 × 1

- Carry out above procedure in reverse for reassembly.

Notes on disassembly

- The CN6 us 1 Upper case lock type, and s should be removed by opening left and right levers.
- When replacing, make sure the cables of CN7 and CN7 are not trapped by the case or Q10 GMS board.

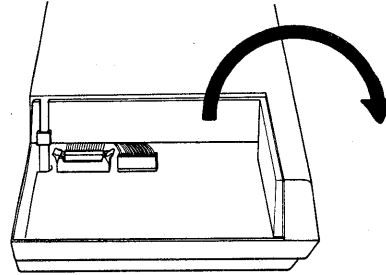


Fig. 2-5

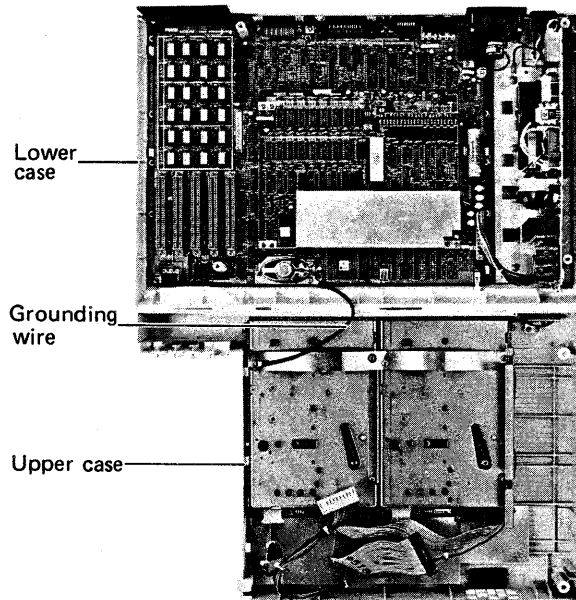


Fig. 2-6

- When replacing, make sure the cables of CN7 and CN7 are not trapped by the case or Q10 GMS board.

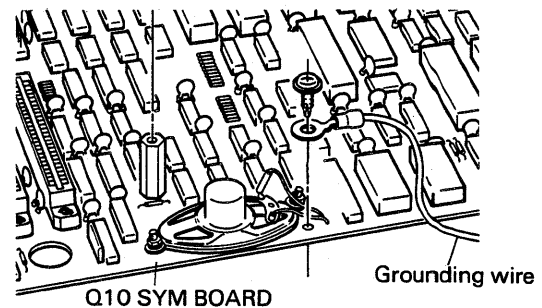
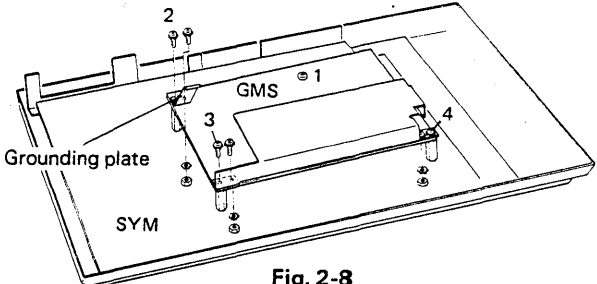
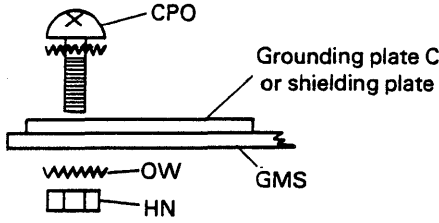


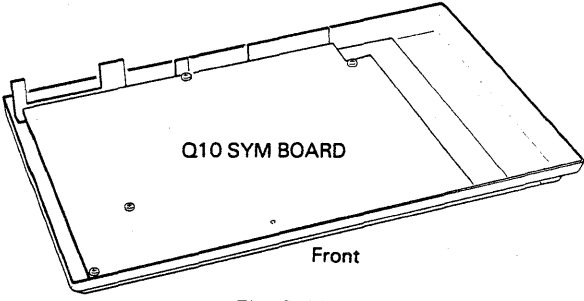
Fig. 2-7

- The tightening torque is 5 kg·cm.

2.2.2 Q10 GMS board

Disassembly procedure	Notes on disassembly
<p>1. Remove the upper case referring to 2.2.1.</p> <p>2. Remove screws No. 1 ~ 4 shown in drawing on the right.</p> <p>CTB: M3 × 10 × 1 CPO: M3 × 8 × 3</p> <p>3. Hold the Q10 GMS board by both hand and lift it straight up. Then the connector on the right of the screw 1 shown in Fig. 2-8 comes off.</p> <p>4. Remove grounding plate C and shielding plate attached to the Q10 GMS board.</p> <p>CPO: M3 × 8 × 3 OW: M3 × 3 HN: M3 × 3</p>	 <p style="text-align: center;">Fig. 2-8</p> <ul style="list-style-type: none"> ● Before handling the board, be sure to discharge the static electricity from your body. ● To replace the board, set connectors CN9 and CN10 correctly and securely in the Q10 SYM board. ● When replacing the board, pay attention to the direction of grounding plate C. <p>Note: When a defective Q10 GMS board is replaced, grounding plate C and shielding plate are not included in spare parts.</p> <ul style="list-style-type: none"> ● The tightening torque of screw 1 shown in Fig. 2-8 is 5 kg·cm.
 <p style="text-align: center;">Fig. 2-9</p> <ul style="list-style-type: none"> ● Carry out above procedure in reverse for reassembly. 	

2.2.3 Q10 SYM board

Disassembly procedure	Notes on disassembly
<p>1. Remove the upper case and Q10 GMS board referring to 2.2.1 and 2.2.2.</p> <p>2. Remove the four screws indicated by arrow marks in the drawing on the right.</p> <p>CTB: M3 × 10 × 4</p> <p>3. Remove the connector on the Q10 SYM board.</p> <p>CN8 – Power supply CN13 – FAN CN12 – Battery</p> <p>4. Remove the board by opening the claws provided on the left and right sides of the board.</p> <p>5. Take off the board.</p> <p>● Carry out above procedure in reverse for reassembly.</p>	 <p>Fig. 2-10</p> <ul style="list-style-type: none">● The tightening torque of the screws is 5 kg·m. <p>Note: The connector for connection between CN12 and battery must also be removed when the board itself is transported to prevent shorting of the battery</p> <ul style="list-style-type: none">● Before holding the board, be sure to discharge the static electricity from your body.● Take off the board lifting the front side first.● To replace it, insert the rear side first.

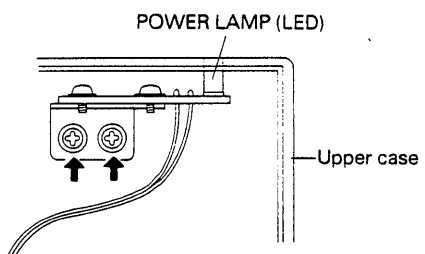
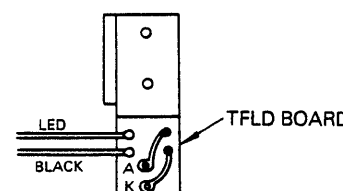
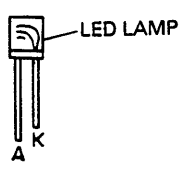
2.2.4 Q10PS board (Power supply unit)

Disassembly procedure	Notes on disassembly
<p>1. Remove the upper case according to 2.2.1.</p> <p>2. Disconnect the AC input connector CN1 and the connector connected to CN8 of the Q10 SYM board.</p> <p>3. Remove the four screws shown in the drawing on the right. CS: M4 × 8 × 4 OW: M4 × 4</p> <p>4. Remove the grounding plate.</p> <p>5. Lift the power supply unit and take it off.</p> <p>● Carry out above procedure in reverse for reassembly.</p>	<div data-bbox="938 428 1419 751" data-label="Image"> </div> <p data-bbox="1101 772 1198 800">Fig. 2-11</p> <ul data-bbox="883 831 1435 974" style="list-style-type: none"> ● To replace the grounding plate, pay attention to the direction (with the tooth tip facing up and left). ● In the part A shown in Fig. 2-11, attach screws, grounding wire press terminal and toothed washer in that order. <div data-bbox="883 1031 1317 1163" data-label="Image"> </div> <p data-bbox="1101 1188 1198 1215">Fig. 2-12</p> <ul data-bbox="883 1247 1435 1331" style="list-style-type: none"> ● When a defective power supply unit is replaced, insulating paper A shown in Fig. 2-11 is not included in spare parts.

2.2.5 FDD (SD-321) unit

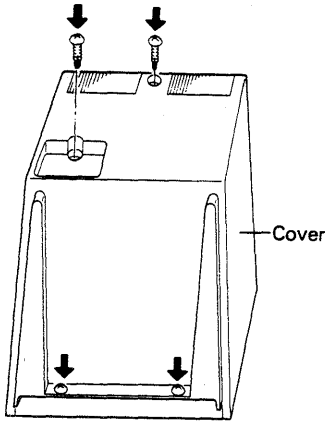
Disassembly procedure	Notes on disassembly								
<p>1. Remove the upper case according to 2.2.1.</p> <p>2. Remove screws A,B and C or D,E and F (FDD-A/B side) shown in Fig. 2-13</p> <p>CPO: M4 × 8 × 5 (Screws B ~ F in Fig. 2-13)</p> <p>CS: M4 × 8 × 1</p> <p>OW: M4 × 1 (Screw A in Fig. 2-13)</p> <p>3. Remove the two connectors of FDD.</p> <p>4. Pull out the FDD in the direction of the arrow shown in Fig. 2-13 (case front side).</p>	<div data-bbox="820 241 1307 598" style="text-align: center;"> <p>Fig. 2-13</p> <ul style="list-style-type: none"> ● The lead of the grounding wire of screw A should be attached in the direction shown in Fig.2-13 ● Grounding plate B is mounted like a wave. </div> <p>● When a defective FDD is replaced, make secure setting of the following DIP switch and mounting of the terminator.</p>								
<p>● Carry out above procedure in reverse for reassembly.</p>	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th colspan="2" data-bbox="771 1087 1063 1123">FDD-A</th> <th colspan="2" data-bbox="1063 1087 1356 1123">FDD-B</th> </tr> </thead> <tbody> <tr> <td data-bbox="771 1123 901 1333"> <p>Only 1 ON</p> </td> <td data-bbox="901 1123 1063 1333"> <p>Without terminator</p> </td> <td data-bbox="1063 1123 1193 1333"> <p>Only 2 ON</p> </td> <td data-bbox="1193 1123 1356 1333"> <p>With terminator</p> </td> </tr> </tbody> </table> <p style="text-align: center;">Fig. 2-14</p>	FDD-A		FDD-B		<p>Only 1 ON</p>	<p>Without terminator</p>	<p>Only 2 ON</p>	<p>With terminator</p>
FDD-A		FDD-B							
<p>Only 1 ON</p>	<p>Without terminator</p>	<p>Only 2 ON</p>	<p>With terminator</p>						

2.2.6 Power lamp

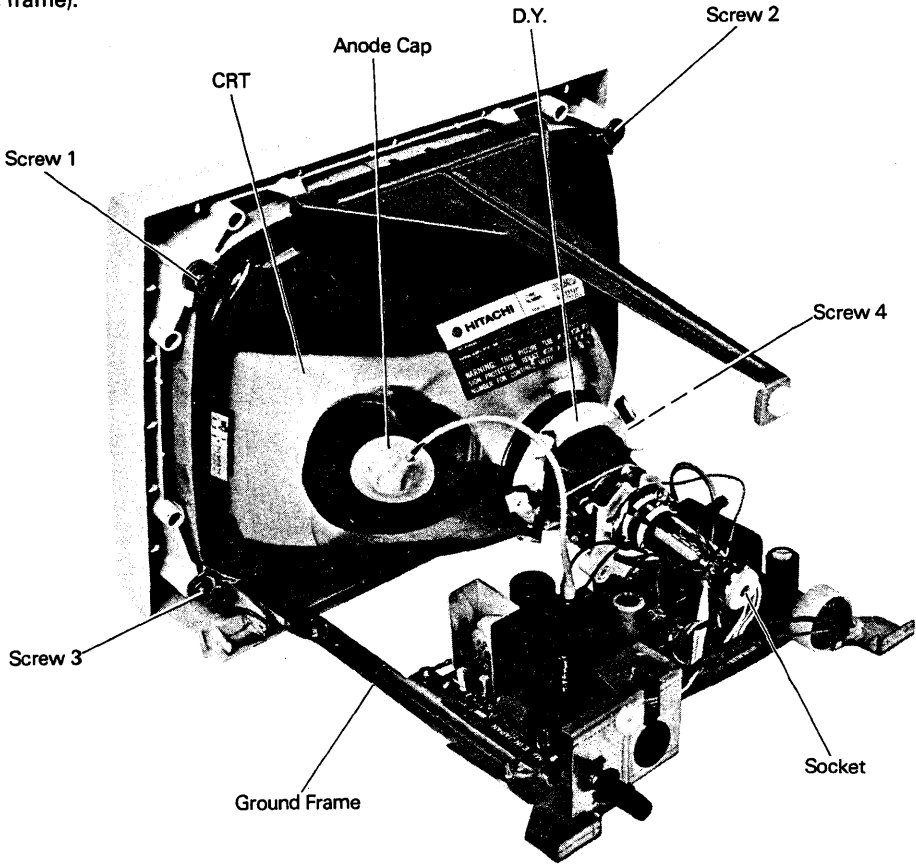
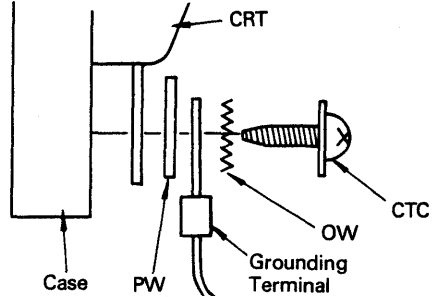
Disassembly procedure	Notes on disassembly
<p>* Disassembly is necessary when the power lamp is found to be defective.</p> <p>1. Remove the upper case according to 2.2.1.</p> <p>2. Remove the two screws indicated by arrows in Fig. 2.15.</p> <p>CTC: M3 × 8 × 2</p> <p>3. Remove the solder of A and K shown in Fig. 2-16, and remove the LED lamp.</p> <p>4. The pole with the longer lead wire as shown in Fig. 2-17 is the anode of the LED lamp. Insert the lamp into the TFLD board shown in Fig. 2-16 in the correct direction, ensuring close contact.</p> <p>5. Solder the lamp</p> <p>6. Tighten the two screws mentioned in step 2.</p>	 <p>POWER LAMP (LED)</p> <p>Upper case</p> <p>Fig. 2-15</p>  <p>LED</p> <p>BLACK</p> <p>A</p> <p>K</p> <p>TFLD BOARD</p> <p>Fig. 2-16</p>  <p>LED LAMP</p> <p>A</p> <p>K</p> <p>Fig. 2-17</p>

2.3 Disassembly and reassembly of CRT (green monitor unit)

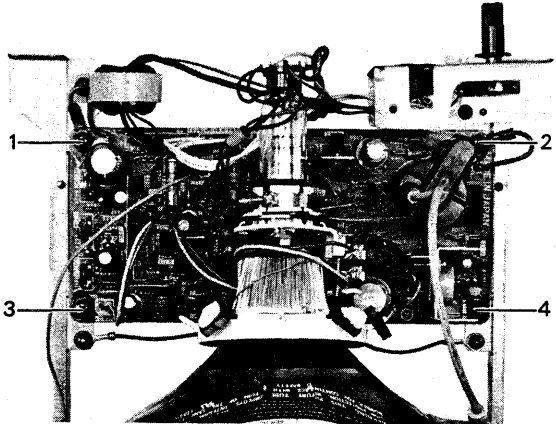
2.3.1 Cover

Disassembly procedure	Notes on disassembly
<p>1. Set the unit with the CRT screen down.</p> <p>2. Remove the four screws indicated by arrows in Fig. 2-18.</p> <p>CTBR: M4 × 16 × 4</p> <p>3. Lift the cover.</p> <p>● Carry out above procedure in reverse for reassembly.</p>	<p>● There are many high voltage parts in the green monitor. Be careful not to touch them.</p>  <p>Fig. 2-18</p>

2.3.2 CRT

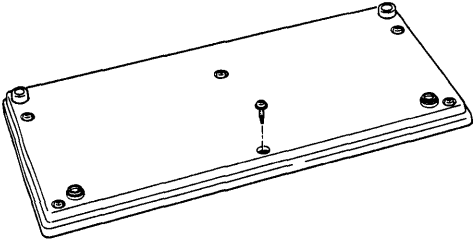
Disassembly procedure	Notes on disassembly
<p>1. Discharge through a resistor of about 25 MΩ inserted between the anode cap terminal and GND (ground frame).</p>  <p>2. Disconnect the cable connectors (2) coming from the DY (deflection yoke) shown in Fig. 2-19 from the board.</p> <p>3. Disconnect the grounding wire connector coming from the middle of the wire which makes connection between the CRT fixing screws 2 and 3, from the board.</p> <p>4. Remove the socket shown in Fig. 2.19.</p> <p>5. Remove four screws 1 ~ 4 shown in fig. 2-19.</p> <p>CTC: M4 x 116 x 4 OW: M4 x 2 PW: M4 x 0.8 x 16 x 2</p> <p>● Carry out above procedure in reverse for reassembly.</p>	<p>● High voltage is applied to the CRT. Keep this in mind and take care.</p> <p>● Screws 3 and 4 should be used as shown below.</p>  <p>Fig. 2-20</p>

2.3.3 Board (CRT drive unit)

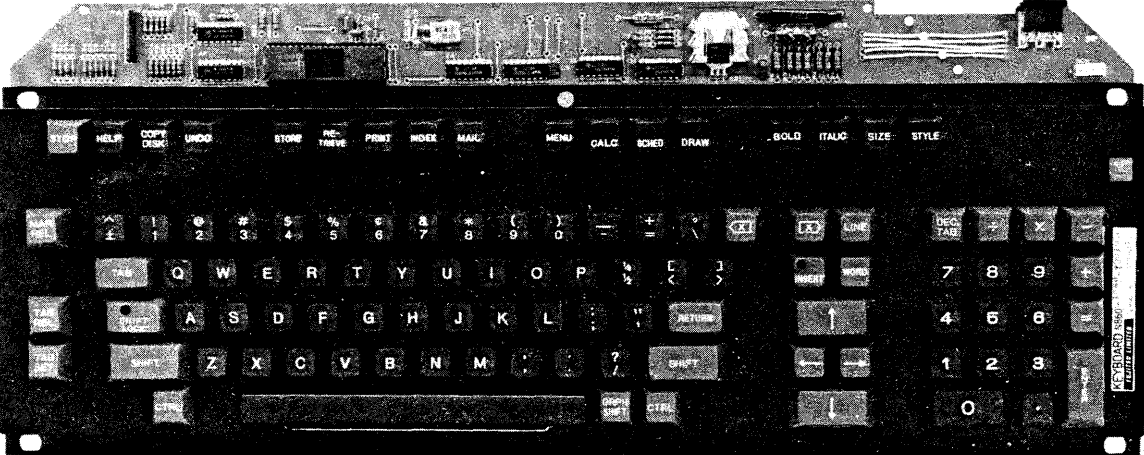
Disassembly procedure	Notes on disassembly
<p>1. Carry out steps 1 ~ 4 of 2.3.2.</p> <p>2. Remove screws 1 ~ 4 shown in Fig. 2-21.</p>	<p>● High voltage is applied to the board. Keep in mind and take care.</p>  <p>Fig. 2-21</p>

2.4 Disassembly and reassembly of the keyboard unit

2.4.1 Cover

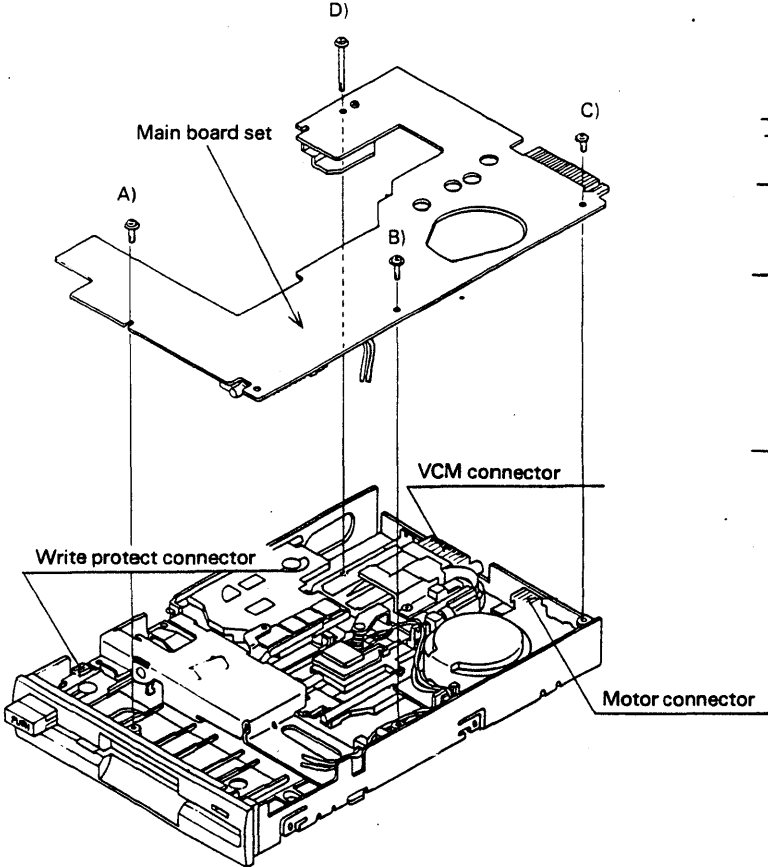
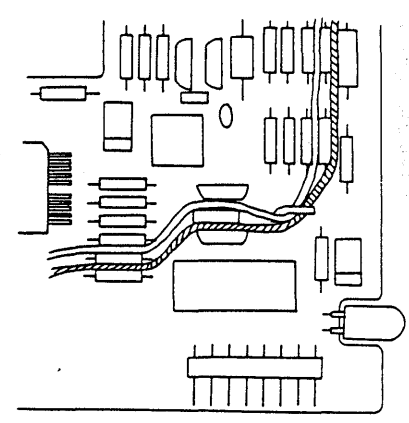
Disassembly procedure	Notes on disassembly
<p>1. Set the unit with the key top down.</p> <p>2. Remove the six screws shown in Fig. 2-21</p> <p>CTC M4 x 12 x 4</p> <p>3. Remove upper and lower cases, and take off the keyboard unit.</p>	 <p>Fig. 2-22</p>

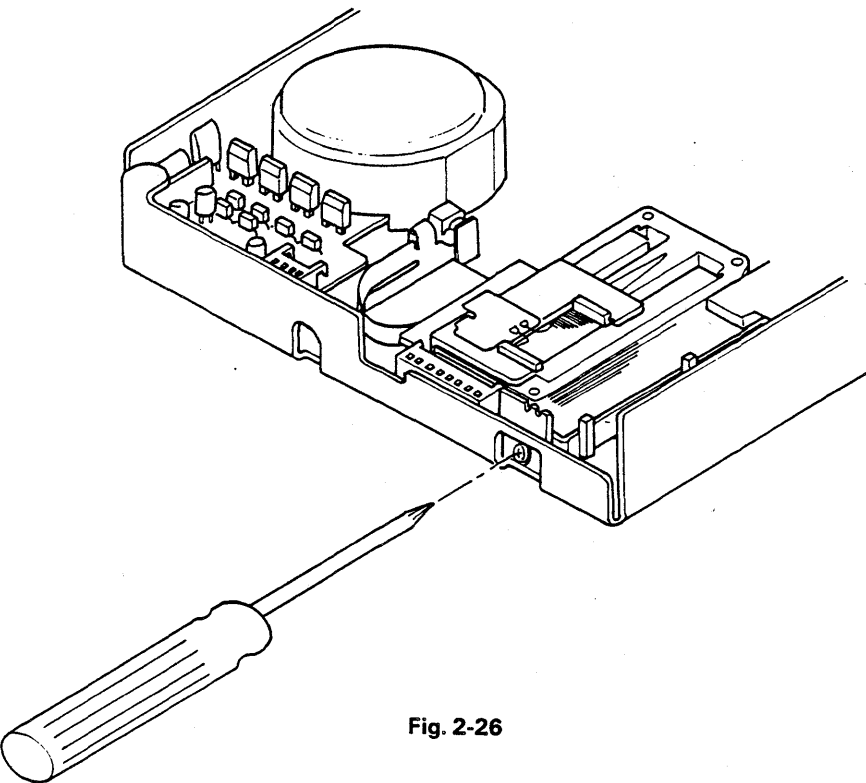
2.4.2 Replacement of key switches and LED lamps

Disassembly procedure	Notes on disassembly
<p>* Replacement is necessary when the key switch malfunctions. Check continuity using a circuit tester.</p> <ol style="list-style-type: none">1. Remove all the the screws (cup and tapping screws) on the soldered surface of the keyboard unit.2. Lift the unit straight up holding part { } shown in Fig. 2-23 with the key top up.	
	
Fig. 2-23	
<ol style="list-style-type: none">3. Key switch Desolder the defective key switch and replace it. <p>LED lamp Desolder the defective LED and replace it.</p> <ul style="list-style-type: none">● Carry out above procedure in reverse for reassembly.	

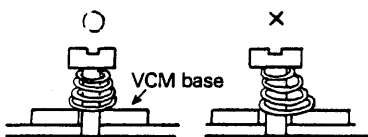
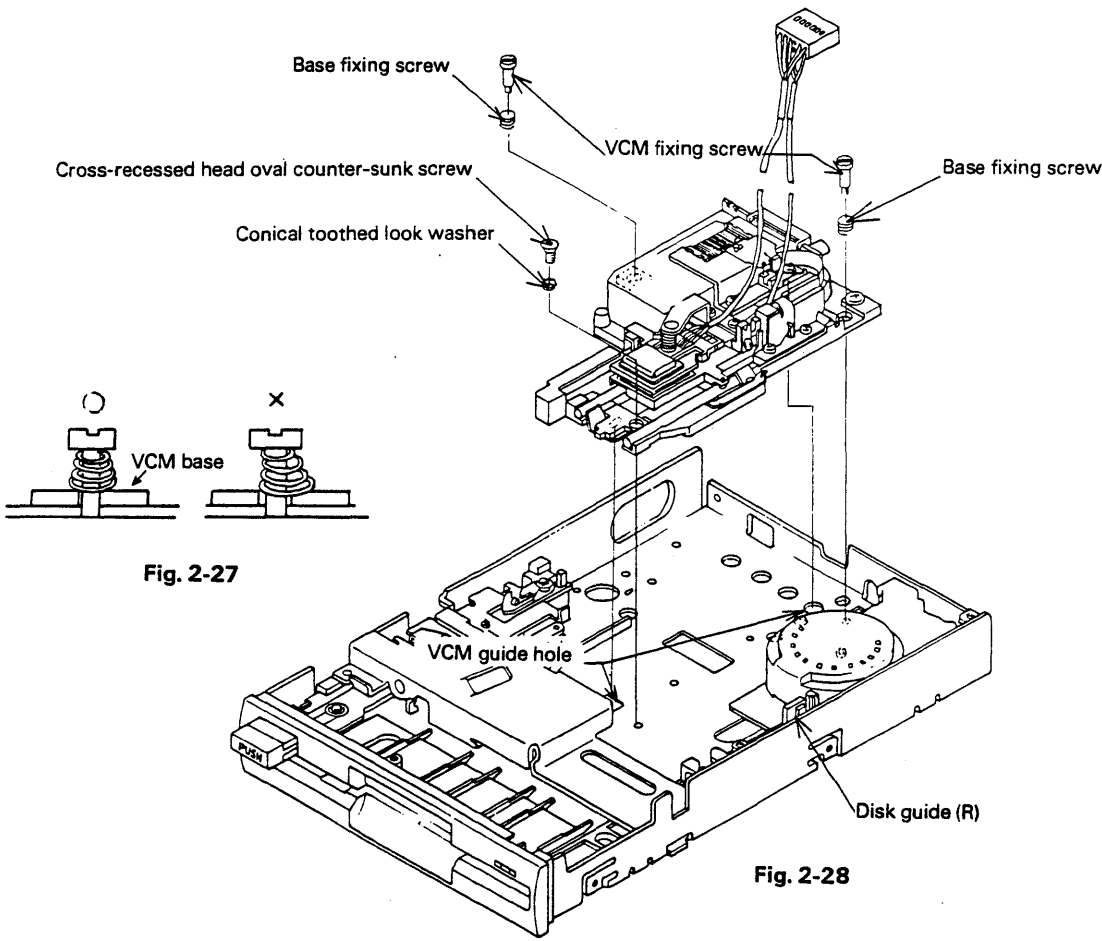
2.5 SD-321 mechanism

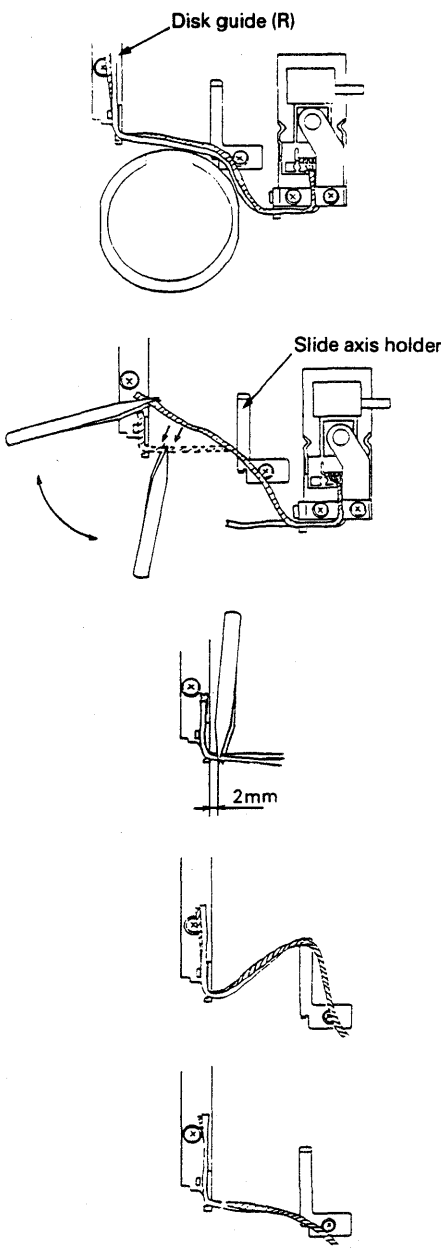
2.5.1 Main board set

Disassembly procedure	Notes on disassembly
<p>1) Remove the main board fixing screws. (See Fig. 2-24)</p> <p>A) Front panel CTC M2.5 × 6 B) Disk guide R CTC M2.5 × 6 C) Disk drive motor CS M2.5 × 4 D) Radiator plate CS M2.5 × 25</p> <p>2) Lift the main board so that it is almost parallel to the main frame.</p> <p>3) Disconnect the connector of the head lead wire. (See Fig. 2-25.)</p>	
 <p>Fig. 2-24</p>	 <p>Fig. 2-25</p>

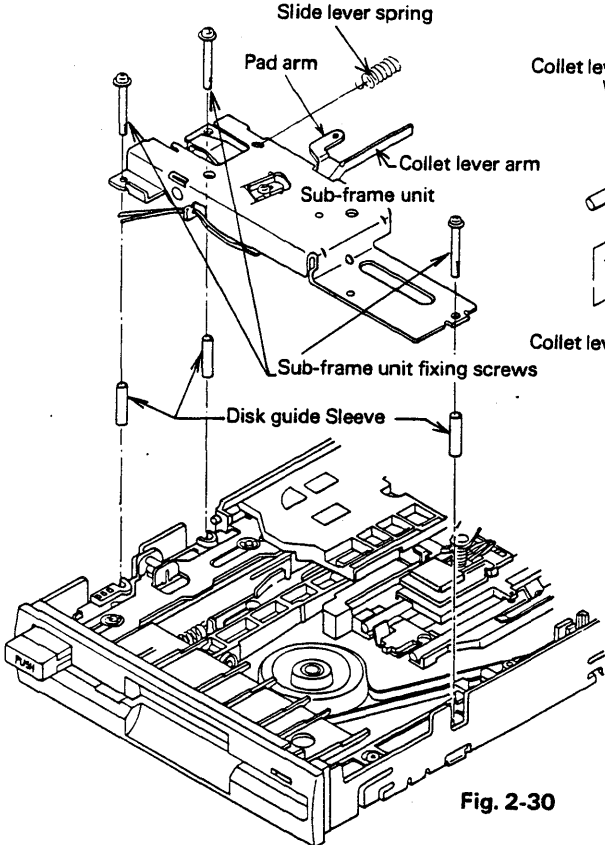
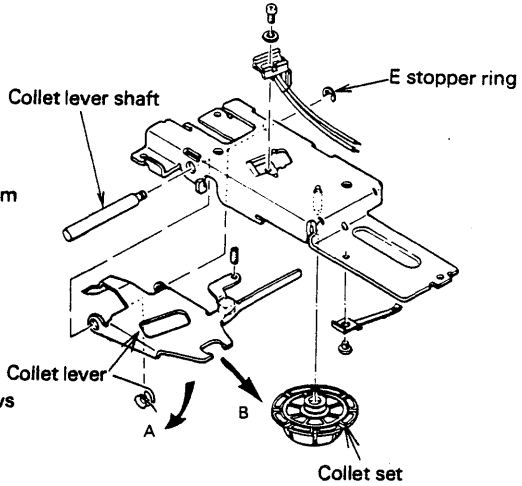
Disassembly procedure	Notes on disassembly
<p>1) Check the head lead wire follows the specified route. (Fig. 2-25)</p> <p>2) Check each connector is in the correct position, and set the main board set.</p> <p>3) Tighten the main board set fixing screws. Tightening torque: 4.0kg·m for A ~ D</p>	<p>Note 1. Take care not to damage the terminal when the connector is connected or disconnected.</p> <p>Note 2. If the VCM connector does not coincide with the main board connector, loosen the VCM flexible lead plate fixing screw a little, adjust the connectors and then retighten the screw. (Fig. 2-26)</p> <p>Note 3. Before tightening the main board fixing screws, make sure that the head lead wire is not trapped by the front panel.</p>
	
<p>Fig. 2-26</p>	

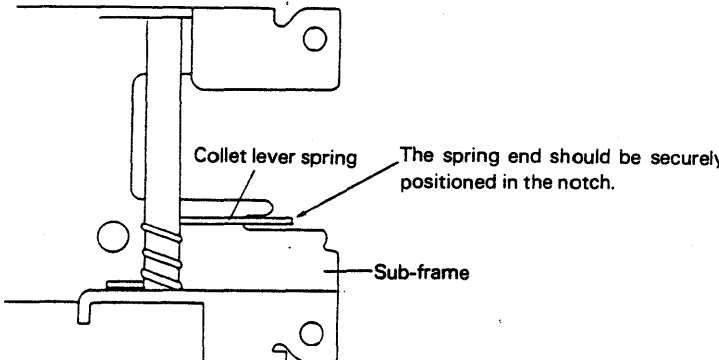
2.5.2 Voice coil motor unit (VCM unit)

Disassembly procedure	Notes on disassembly
<p>1) Take off the main board set. (See 2.5.1.)</p> <p>2) Remove the clamp of the head lead wire.</p> <p>3) Remove the VCM fixing screws and cross-recessed head oval counter-sunk screw, and take off the VCM unit from the main frame. (Fig. 2-28)</p>	<p>● Insert insulating paper between upper and lower heads.</p>
 <p>Fig. 2-27</p>	 <p>Fig. 2-28</p>

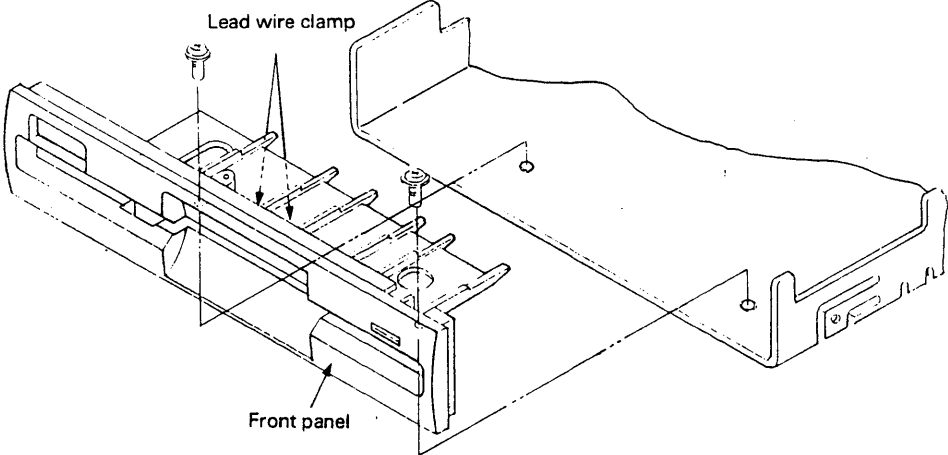
Disassembly procedure	Notes on disassembly
<p>1) Set the VCM unit so that it fits in the guide hole of the main frame.</p> <p>2) Set the base fixing screw, VCM fixing screws, conical toothed lock washer and cross-recessed head oval counter-sunk screw. Fix the VCM unit while pushing it toward the disk guide (R) and rear side. (Screw tightening torque: 5.0 kg·cm)</p> <p>3) Connect the head lead wire to the disk guide (R) and the specified positions of the main board set. (Figs. 2-25 and 2-26)</p> <p>4) Mount the main board set. (Refer to 2.5.1) (Fig. 2-28)</p> <p>* Method of clamping the head lead wire to the disk guide (R) Fig. 2-29</p> <p>1. Set the head lead wire to the head lead wire clamping position of the disk guide (R). Set the head lead wire as follows:</p> <p>A) Move the VCM drive coil to track 00.</p> <p>B) Set the upper head lead wire so that it touches the front end of the clamp position wall of the disk guide (R)</p> <p>C) Hold the part making contact between the wire and wall with tweezers, move it to the right of the clamping position and set it in the clamping position as it is.</p> <p>D) Hook the lower head lead wire on the bent and raised part of the slide axis holder B and bring it to the disk guide (R) clamping position.</p> <p>E) Set the wire in the clamping position with tweezers so that the clearance between the wire and the clamping position is about 2 mm.</p> <p>Note 1. In the lower head holder and disk guide (R) clamping position, upper and lower head lead wires are upside down.</p> <p>Note 2. The upper head lead wire crossed the lower head lead wire from the front panel side.</p> <p>2. Check sliding of the head lead wire.</p> <p>1) The lead wire should not be over tightened in track 00.</p> <p>2) The lead wire should not come out of the slide axis holder B in track 39.</p> <p>3. Connect the head lead wire to the disk guide (R). Route the head lead wire through the lead wire guide provided on the disk guide (R).</p>	<p>● The base fixing spring should not incline beyond the VCM base. (Fig. 2-27)</p>  <p>The diagram illustrates the process of clamping head lead wires to the disk guide (R). It consists of several parts: a top view showing the wire being inserted into the disk guide; a side view showing the wire being hooked onto a slide axis holder; a detail view showing the wire being clamped with a 2mm clearance; and a final view showing the wire routed through a guide.</p> <p>Fig. 2-29</p>

2.5.3 Sub-frame, collet set, collet lever and pad arm

Disassembly procedure	Notes on disassembly
<ol style="list-style-type: none"> 1) Remove the main board set. (Refer to 2.5.1) 2) Remove the slide lever spring. 3) Remove the sub-frame unit fixing screws. (Fig. 2-30) CS M2. 5 × 19 × 3 4) Remove the sub-frame unit from the main unit. 5) Remove the pad arm fixing screw from the sub-frame unit, and pull the pad arm to the front (in the direction of the arrow shown in Fig. 2-30). SF thin M2 × 4 (P 0.25) × 1 6) Push the collet lever down until the collet set is disengaged in arrow A direction from the collet guide shaft. Move the collet set gently in arrow B direction shown in Fig. 2-31 and remove it from the collet lever. 7) Remove the E stopper ring of the collet lever shaft and take off the shaft. RE ETWJ-2.3 × 1 	<ul style="list-style-type: none"> ● Since the upper head arm is placed on the collet bar arm, care should be taken not to drop the upper head onto the lower head.
 <p style="text-align: center;">Fig. 2-30</p>	 <p style="text-align: center;">Fig. 2-31</p>

Disassembly procedure	Notes on disassembly
<ol style="list-style-type: none"> 1) Set the collet lever and collet lever spring in the sub-frame, and fix the unit with the E stopper ring through the collet lever shaft. 2) Rotate the collet lever and set the collet in the collet lever groove. 3) Adjust the collet center hole to the sub-frame guide shaft, and set the collet in the sub-frame. 4) Check the collet rotation and collet lever operation. 5) Make sure the disk guide sleeves have been set in the disk guide (L) and (R) units. 6) Set the sub-frame unit in the main unit. Push the sub-frame unit backward toward the disk guide (L) unit, and fix it with the sub-frame unit fixing screws. (Screw tightening torque: 6.0 kg-cm) 7) Hook the slide lever spring between the sub-frame and slide lever. 8) Mount the main board set. (Refer to 2.4.1) 	<ul style="list-style-type: none"> ● Pay attention to the set of the collet lever spring (Fig. 2-32).
 <p data-bbox="565 1495 987 1522">(View of sub-frame unit seen from the bottom)</p>	
<p>Fig. 2-32</p>	

2.5.4 Front panel

Disassembly procedure	Notes on disassembly
<ol style="list-style-type: none">1) Remove the main board set. (Refer to 2.5.1)2) Remove the front panel fixing screws, and take off the front panel by pulling it to the front. CS M2.5 × 4 × 2	<ul style="list-style-type: none">● The front panel should be taken off taking care that it not caught by the lead wire of index detector B located under the front panel lead wire clamp.
	
Fig. 2-33	
<ol style="list-style-type: none">1) Set the front panel, and hook the lead wire of index detector B on the front panel lead wire clamp.2) Fix the front panel to the main unit with the front panel fixing screws. (Screw tightening torque: 4.0 kg-cm)3) Mount the main board set. (Refer to 2.5.1)	<ul style="list-style-type: none">● Insert the lead wire of the index detector B inside the claws (2) of the lead wire clamp. (Refer to Fig. 2-33)

2.5.5 Disk guide (L) unit, write protect detector set and eject transmission level

Disassembly procedure	Notes on disassembly
<ol style="list-style-type: none"> 1) Remove the main board set (Refer to 2.5.1) 2) Remove the sub-frame unit. (Refer to 2.5.3) 3) Remove the front panel fixing screws and take off the front panel by pulling it to the front. (Refer to 2.5.4) CS M2.5 x 4 x 2 4) Remove the disk guide (L) unit fixing screw, and take off the disk guide (L) unit from the main unit. 5) Remove the write protect detector fixing screw, and take off the write protect detector from the disk guide (L). 6) Push the slide lever push buttonhook up, and remove the pushbutton. 	

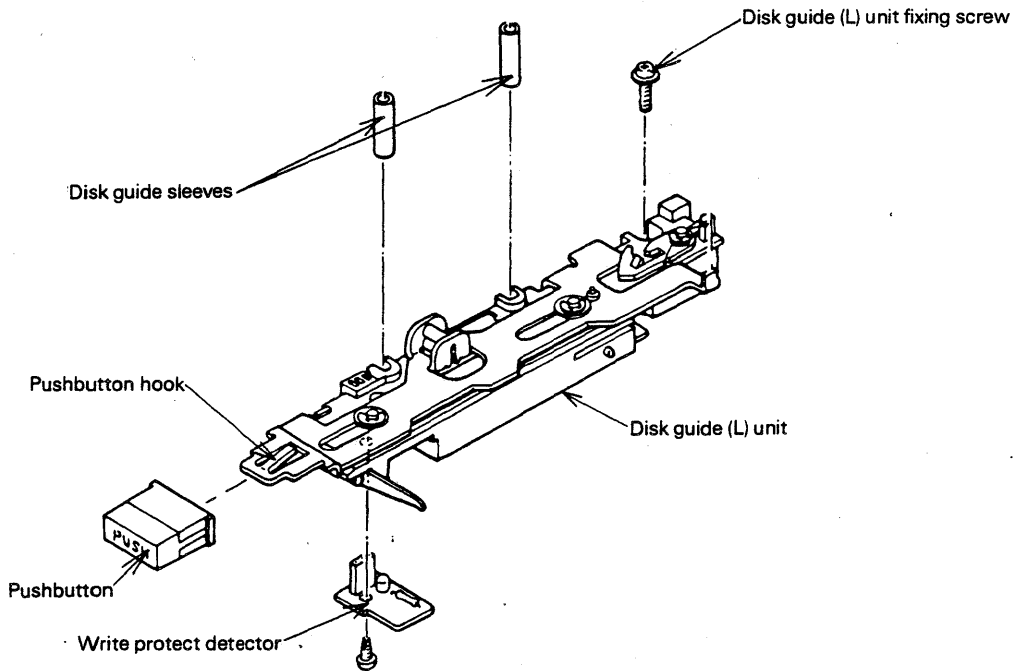
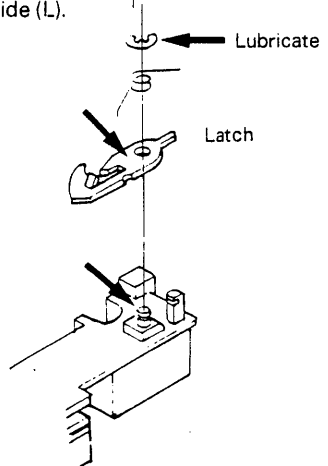
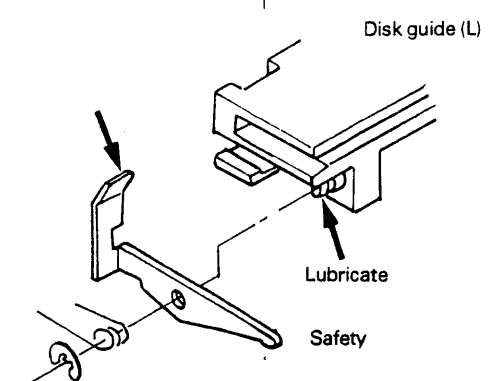
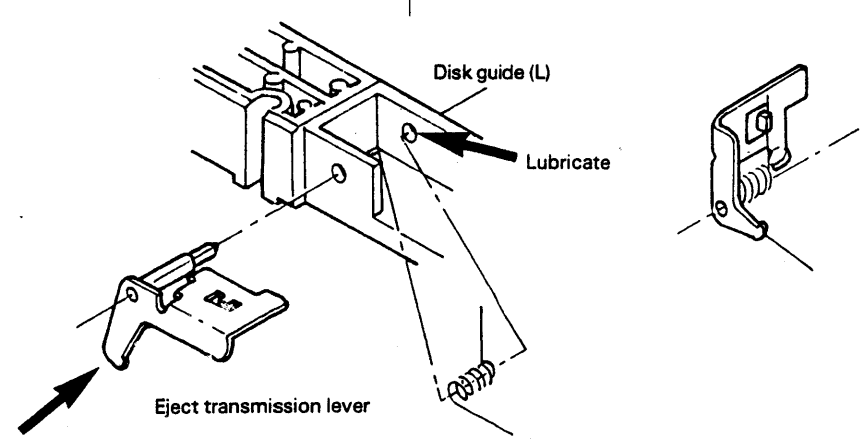


Fig. 2-34

Disassembly procedure	Notes on disassembly
<p>1) Lubricate the latch receiver of the disk guide (L).</p>	 <p style="text-align: right;">Lubricate</p> <p style="text-align: right;">Latch</p> <p style="text-align: center;">Fig. 2-35</p>
<p>2) Lubricate the part making contact between the safety lever and disk guide (L).</p>	 <p style="text-align: right;">Disk guide (L)</p> <p style="text-align: right;">Lubricate</p> <p style="text-align: right;">Safety</p> <p style="text-align: center;">Fig. 2-36</p>
<p>3) Lubricate the eject transmission lever bearing of the disk guide (L).</p>	 <p style="text-align: right;">Disk guide (L)</p> <p style="text-align: right;">Lubricate</p> <p style="text-align: center;">Eject transmission lever</p> <p style="text-align: center;">Fig. 2-37</p>
<p>4) Push the pushbutton into the disk guide (L).</p>	

Disassembly procedure

Notes on disassembly

- 5) Set the write protect detector board in the disk guide(L) and fix it with screw.
(Screw tightening torque: 1.0 kg-cm)

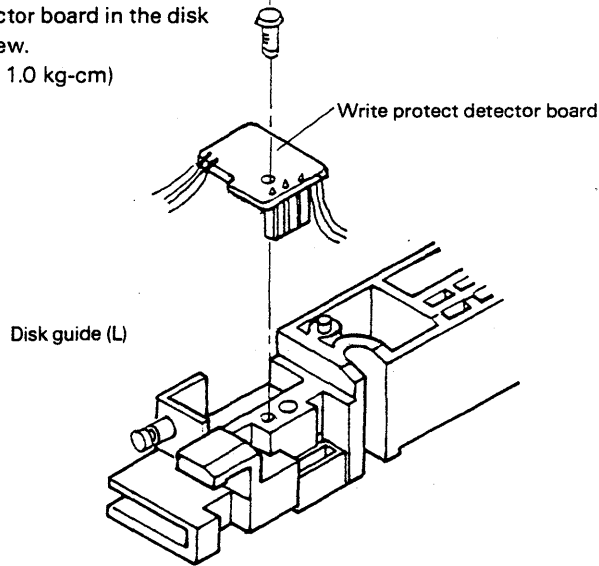


Fig. 2-38

- 6) Route the cable connecting the index detector B and write protect detector board pass under the eject lock lever.
(Fig. 2-39)

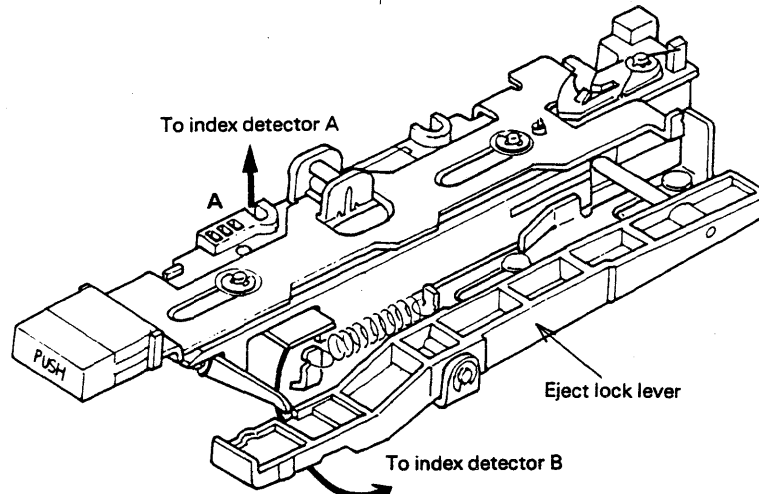
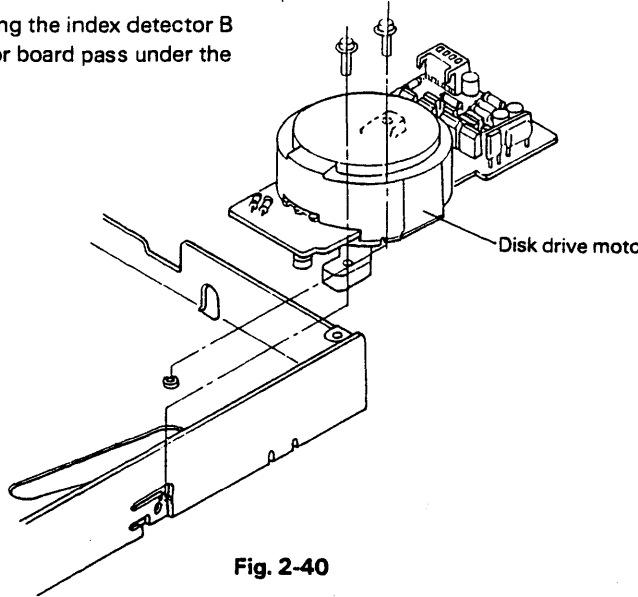
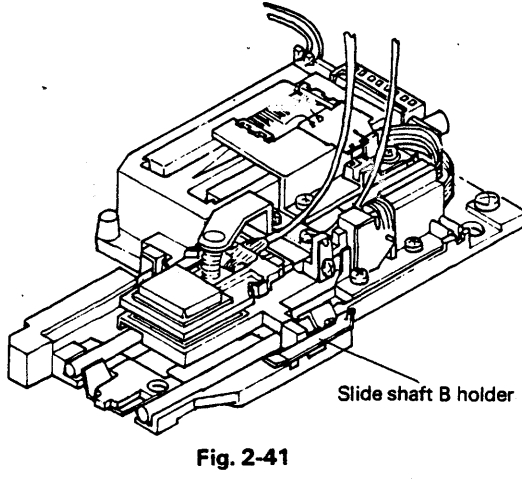


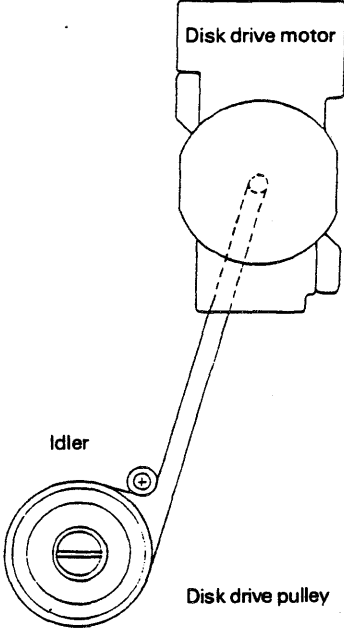
Fig. 2-39

- 7) Fix the disk guide (L) unit to the main unit with the disk guide (L) unit fixing screws.
(See A of Fig. 2-39.)
- 8) Mount the front panel. (Refer to 2.5.4)
- 9) Mount the sub-frame unit. (Refer to 2.5.3)
- 10) Mount the main board set. (Refer to 2.5.1)

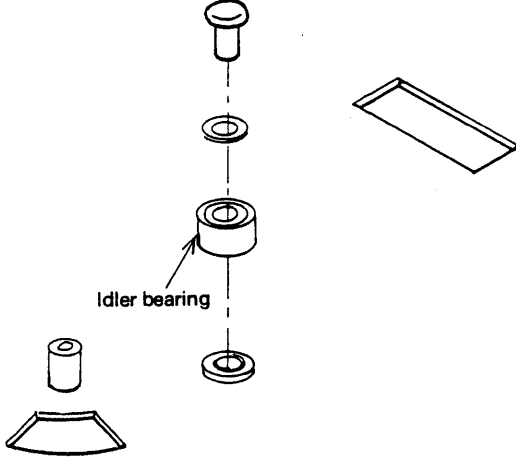
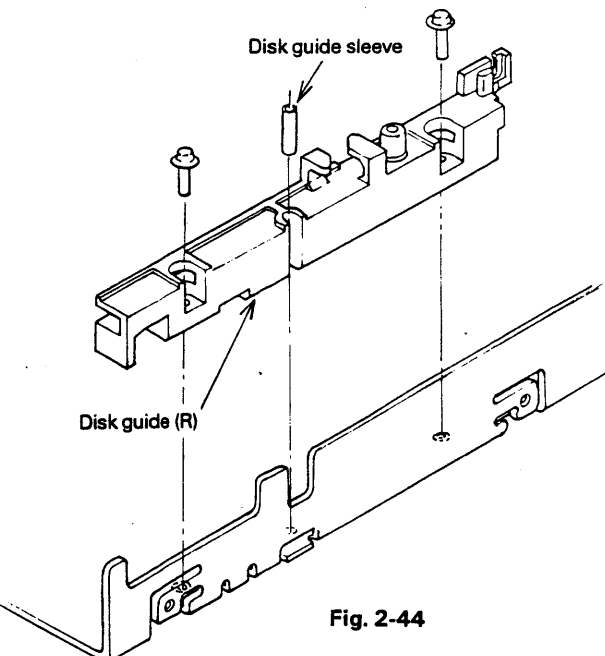
- Insert the cable connecting the write protect detector board and index detector A into the groove of the disk guide (L) unit.

2.5.6 Disk drive motor and endless belt

Disassembly procedure	Notes on disassembly
<p>1) Remove the main board set. (Refer to 2.5.1)</p> <p>2) Remove the sub-frame unit. (Refer to 2.5.3)</p> <p>3) Remove the disk drive motor fixing screws. (Fig. 2-39)</p> <p style="padding-left: 40px;">CS M2.5 × 6 × 2</p> <p>4) Remove the slide shaft B holder fixing screw, and take off the slide shaft B holder from the VCM unit. (Fig. 2-40)</p> <p>5) Remove the endless belt. Remove the disk drive motor from the main unit.</p>	
<p>6) Route the cable connecting the index detector B and write protect detector board pass under the eject lock lever. (Fig. 2-39)</p>	 <p style="text-align: center;">Fig. 2-40</p>  <p style="text-align: center;">Fig. 2-41</p>

Disassembly procedure	Notes on disassembly
<ol style="list-style-type: none"> 1) Fix the disk motor with the disk drive motor fixing screws. (Screw tightening torque: 5.0 kg-cm) 2) Mount the endless belt on the disk drive motor pulley, idler bearing and disk drive pulley in that order. (Fig. 2-42) 3) Fix the slide shaft B holder to the VCM unit with the slide shaft B holder fixing screw. 4) Mount the sub-frame. (Refer to 2.5.3) 5) Mount the main board set. (Refer to 2.5.1) 6) Check the disk speed. (Refer to 3.4.2) <ul style="list-style-type: none"> Note 1. Check the disk rotates smoothly without generating abnormal noise. Note 2. Check the belt is not frayed or cracked. 	
 <p>The diagram illustrates the belt drive mechanism. At the top is the 'Disk drive motor' with a pulley. A belt is looped around this pulley, an 'Idler' pulley, and a 'Disk drive pulley' at the bottom. A dashed line indicates the alignment of the motor's shaft with the pulley.</p>	
<p>Fig. 2-42</p>	

2.5.7 Disk guide (R), idler set and disk drive pulley set

Disassembly procedure	Notes on disassembly
<ol style="list-style-type: none"> 1) Remove the main board set. (Refer to 2.5.1) 2) Remove the sub-frame unit. (Refer to 2.5.3) 3) Remove the endless belt. 4) Remove the idler fixing screw. Remove the flat washer and idler bearing. (Fig. 2-43) <p style="text-align: center;">CP: M3 × 7 × 1</p> <ol style="list-style-type: none"> 5) Remove the disk guide sleeve from the disk guide (R). 6) Remove the disk guide (R) fixing screws. (Fig. 2-44) <p style="text-align: center;">CS: M2.5 × 8 × 2</p> <ol style="list-style-type: none"> 7) Remove the disk drive pulley screw. Remove the disk drive pulley set. 	
 <p style="text-align: center;">Fig. 2-43</p>	 <p style="text-align: center;">Fig. 2-44</p>

Resassembly procedure	Notes on resassembly
<ol style="list-style-type: none"> 1) Make sure the flat washer has been set in the disk drive pulley shaft. Put the disk drive pulley set on the pulley shaft by mounting it downward on the shaft. 2) Tighten the disk drive pulley and fix it with a screw. (Screw tightening torque: 5.0 kg-cm) 3) Rotate the disk drive pulley 2 ~ times to make sure it rotates smoothly without abnormal noise or unevenness. 4) Set the disk guide (R) and disk guide pulley. Tighten the disk guide (R) fixing screws. (Screw tightening torque: 3.5 kg-cm) 6) Mount the endless belt. (Refer to 2.5.6) 7) Mount the sub-frame unit. (Refer to 2.5.3) 8) Mount the main board set (Refer to 2.5.1) 9) Check the disk speed. (Refer to 3.4.2) 	
<p>Fig. 2-45</p>	

2.5.8 Index detector A set

Disassembly procedure	Notes on disassembly
<p>1) Remove the main board set. (Refer to 2.5.1)</p> <p>2) Remove the index detector A set fixing screw. (Fig. 3-23) CP: M2.5 × 4 × 1</p> <p>3) Remove the sub-frame unit (Refer to 2.5.3)</p> <p>4) Remove the front panel. (Refer to 2.5.4)</p> <p>5) Remove the disk guide (L) unit. (Refer to 2.5.5)</p> <p>6) Remove the write protect detector. (Refer to 2.5.5)</p> <p>7) Desolder the cable of the index detector A set from the write protect detector board.</p>	

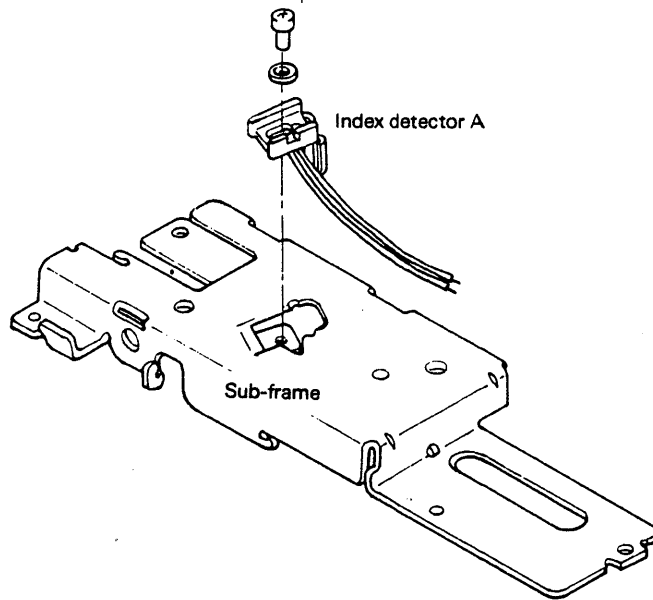
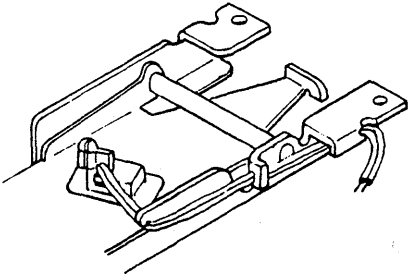
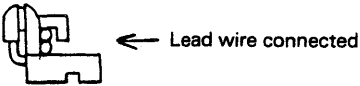


Fig. 2-46

Resassembly procedure	Notes on resassembly
<ol style="list-style-type: none"> 1) Solder the cable of index detector A to the write protect detector board. 2) Carry out disassembly procedure in reverse. 3) Fix the index detector A set temporarily to the sub-frame with the index detector A set fixing screw. 4) Route the lead wire of the index detector through the specified circuit. (Fig. 2.47) 5) Mount the main board set. (Refer to 2.5.1) 6) Adjust the index. (Refer to 3.4.5) 	<ul style="list-style-type: none"> ● Solder the black wire of the cable to "B".
	
	
<p>Fig. 2-47</p>	

2.5.9 Index detector B set

Disassembly procedure	Notes on disassembly
<ol style="list-style-type: none">1) Remove the main board set. (Refer to 1.5.1)2) Remove the sub-frame unit. (Refer to 2.5.3)3) Remove the index detector B fixing screw (Fig. 3-25) CP: M2.5 × 8 × 14) Remove the front panel. (Refer to 2.5.4)5) Remove the disk guide (L) unit. (Refer to 2.5.5)6) Remove the write protect detector. (Refer to 2.5.5)7) Desolder the cable of the index detector B set from the write protect detector board.	

Index detector B

Fig. 2-48

Resassembly procedure	Notes on resassembly
<ol style="list-style-type: none">1) Solder the cable of index detector B to the write protect detector board.2) Fix the index detector B set to the main unit with the index detector B set fixing screws. (Screw tightening torque: 3.5 kg-cm)3) Route the lead wire of the index detector B through the specified circuit.4) Mount the disk guide (L) unit. (Refer to 2.5.5)5) Mount the front panel. (Refer to 2.5.4)6) Mount the sub-frame unit. (Refer to 2.5.3)7) Mount the main board set. (Refer to 2.5.1)8) Adjust the index. (Refer to 3.4.2)9) Eject lock lever set	<ul style="list-style-type: none">● Solder the red wire of the cable to "R" and white wire to "W".

2.5.10 Eject lock lever set

Disassembly procedure	Notes on disassembly
<ol style="list-style-type: none"> 1) Remove the main board set. (Refer to 2.5.1) 2) Remove the sub-frame unit. (Refer to 2.5.3) 3) Remove the front panel. (Refer to 2.5.4) 4) Remove the disk guide (L) unit. (Refer to 2.5.5) 5) Remove the ejector spring. 6) Loosen and remove the E stopper ring of the disk drive pulley side of the eject lock lever. RE: ETWJ - 2.3 × 1 	
Resassembly procedure	Notes on resassembly
<ol style="list-style-type: none"> 1) Set the eject lock lever set in the main unit. Insert the eject lock lever shaft from the disk guide (L) unit and fix it with the E stopper ring. 2) Hook the eject spring between the ejector and main unit. 3) Mount the disk guide (L) unit (Refer to 2.5.5) 4) Mount the front panel (Refer to 2.5.4) 5) Mount the sub-frame unit. (Refer to 2.5.3) 6) Mount the main board set. (Refer to 2.5.1) 	<ul style="list-style-type: none"> ● Check the eject lock lever spring is attached to the eject lock lever set.

CHAPTER 3 ADJUSTMENT AND MAINTENANCE

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3.1 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 in a place where the system may be exposed to much vibration or shock.)

(2) Handling

Storage and Use

- Place the QX-10 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 QX-10 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.

Care

- When cleaning the QX-10, 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 QX-10, check the connections from time to time.

3.2 Adjustment of VFO circuit

1. Check the GND terminal and TP terminal (check points between IC8B and IC8D on the Q10 SYM board) with the synchroscope probe.
2. Adjust the synchroscope range as specified in Table 3-1.

Range	Setting
AC-GND-DC	DC
VOLT/DIN (on the screen)	1
TIME/DIV	50 μ S

Table 3-1

3. Read and write the floppy disk drive, and adjust it to obtain 2.6 ~ 2.7V as shown in fig. 3-1.

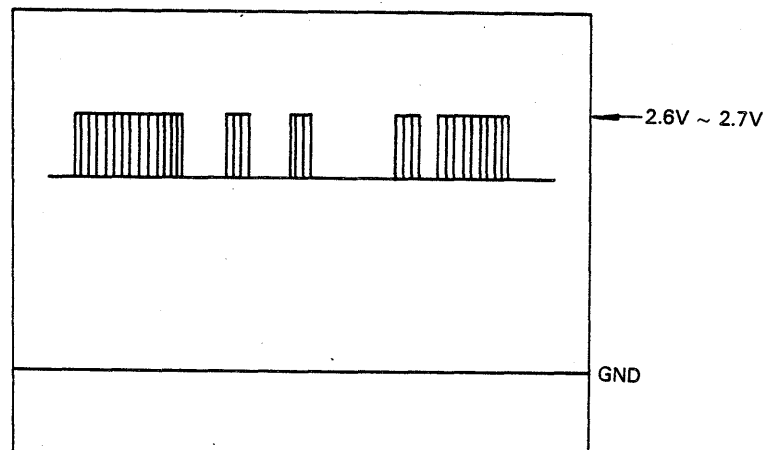


Fig. 3-1

3.3 Operation check of Q10 PS board

After the Q10 PS board is repaired, check the operation according to the following procedure:

- (1) Make connection between the Q10 PS board and connector CN1 (Q10 SYM board), and turn on the power switch.
- (2) Check pin 15 of IC1 to see if a normal waveform is obtained there.
- (3) Check R2 (10 Ω) for any abnormal heat.
- (4) Check the output voltages (+5, +12(C), +12(F), +12(L) and 12V).
- (5) Turn the power on and off, and check the PWD waveform normally appears.
- (6) Short pins 4 and 5 of PC1, and check all the out put voltages are not obtained.
- (7) Turn the power on and off, and check the voltages are normally restores then.

If any abnormality is detected by the above checks, re-check according to troubleshooting for Q10 PS board unit.

3.4 Adjustment of FDD SD-321

The SD-321 is made of precision parts and assembled with high precision. It needs no re-adjustment by the user as long as it is used normally. When it is disassembled for replacement of parts and then reassembled, the following adjustments are necessary:

- 1) Disk speed adjustment
- 2) Off-track adjustment
- 3) Azimuth adjustment
- 4) Index timing adjustment

3.4.1 Positions and functions of test points

The control circuit of SD-321 is provided with 8 test points for observing singal waveforms needed for adjustment and inspection. All the electronic elements of SD-321 are incorporated in the interior of the main unit.

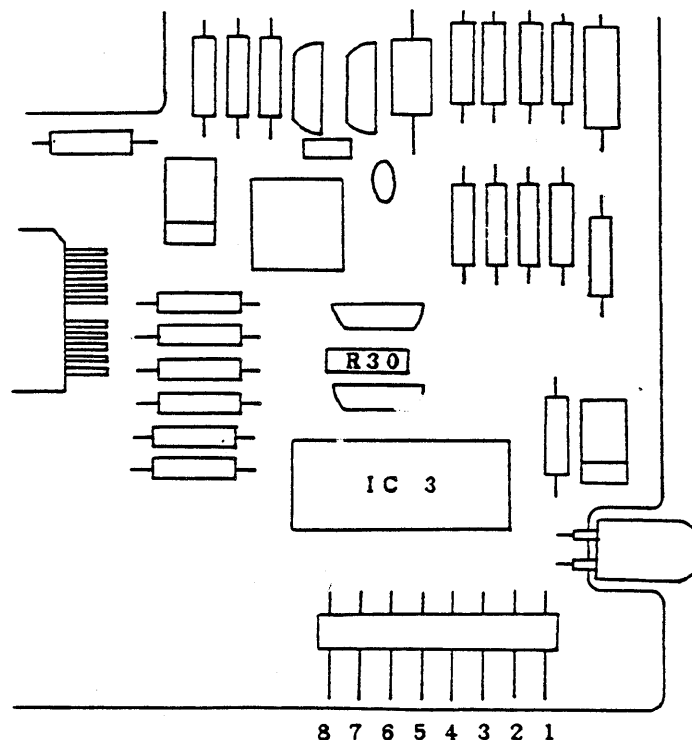


Fig. 3-2 Location of test points

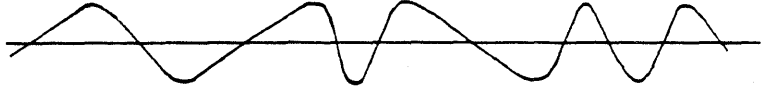
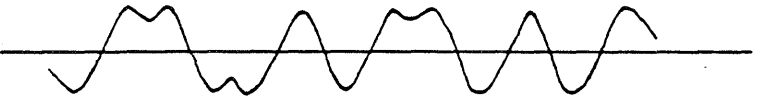


Test point	Function
TP 1	A zero volt line of the signal channel. Used as a reference point in observation of signal waveforms of TP2 ~ TP7.
TP 2/TP 3 Video amplifier outputs	Test points for observing the video amplifier ($\mu A 733$) outputs. the video amplifier has two outputs: one is displaced 180 in phase (differential) and the other is 100mVp-p or greater. Each output can be observed at TP 2 and TP 3. These test points are used for checking the read/write head characteristics and adjustment of the head access mechanism (off-track and azimuth). 
TP 4/TP 5 Differential amplifier outputs	Test points for observing the differential amplifier outputs. Like the video amplifier, the differential amplifier has two outputs: one is displaced 180° in phase (differential) and the other is greater than about 500mVp-p. Each output can be observed at TP4 and TP5. These test points are used for general checking of the read/write head and amplifier and adjustment of the head access mechanism. 
TP 6	Apply a false index signal to this test point when the main PCB is checked as a single body. Not used for adjustment and inspection.
TP 7 Index	A test point for observing the index detection output. Indicates the level inverse to the index output signal and is set to high level while the index hole is being detected. This test point is used for checking the disc speed period and trigger signals for signal observation of off-track, azimuth, etc. 
TP 8 Drive select	A test point for observing a drive select signal. Set to low level when a drive select signal is transmitted from the host controller to the FDD. 

Table 3-2

3.4.2 Adjustment of disk speed

A) Tools to be used

- 1) (-) screwdriver (2mm or equivalent tip size)
- 2) Disk
- 3) Frequency counter
- 4) FDD controller

B) Procedure (when the frequency counter is used)

- 1) Connect the frequency counter to point TP7 on the control circuit.
- 2) Rotate the disk drive motor and set the disk.
- 3) Rotate the disk drive motor and load the head
- 4) Set the head to track 20.
- 5) Adjust VR2 on the disk drive motor PCB, and set the pulse interval at TP7 to 200 ± 0.6 mS.

C) Procedure (when the strobo disk is used)

- 1) Raise the main unit so that the strobo disk can be seen.
- 2) Adjustment will be easy if the unit is set with the pushbutton switches down.)
- 2) Rotate the disk drive motor and set the disk.
- 3) Rotate the disk drive motor and load the head.
- 4) Set the head to track 20.
- 5) Adjust VR2 on the disk drive motor PCB and set it so that the stripe is seen stationary. (Adjust VR2 so that the motion of the stripe becomes less than one frame per 3 seconds.)

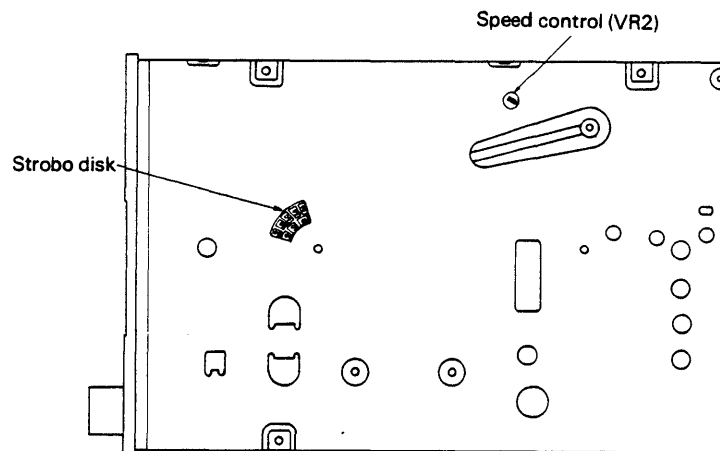


Fig. 3-3

3.4.3 Adjustment of off-track

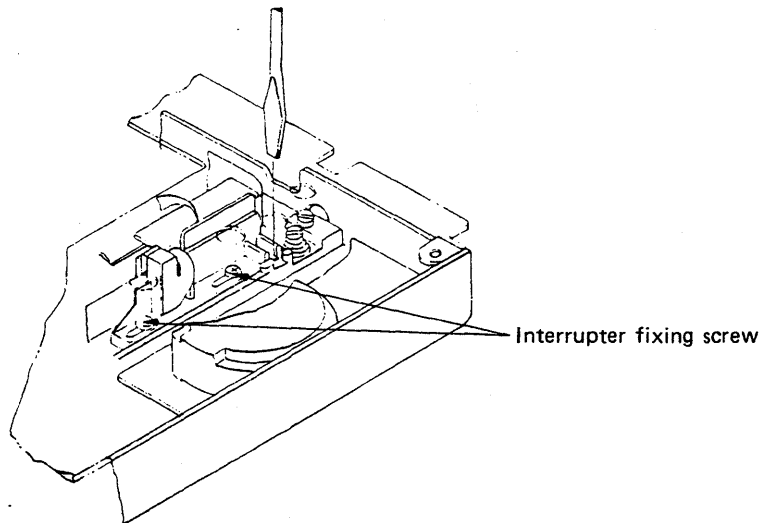


Fig. 3-4 Adjustment of off-track

A) Tools to be used

- 1) (+) screwdriver # 1
- 2) CE disk
- 3) Oscilloscope
- 4) FDD Controller

B) Procedure

- 1) Make connections between CH1 of the oscilloscope and TP2, CH2 and TP3 and the external trigger and TP7, respectively.
(The trigger should be in the positive direction.)
- 2) Set the oscilloscope signal conditions as specified below.

Switch	CH 1	CH 2
AC-GND-DC	AC	AC
VERT MODE	ADD	
INVERT	-	ON
VOLT/DIN (on the screen)	50mV	50mV
TIME/DIV	20mS	

Table. 3-3

- 3) Rotate the disk drive motor.
- 4) Set the CE disk.
- 5) Move the head to track 34.
- 6) Observe the waveforms on the oscilloscope.

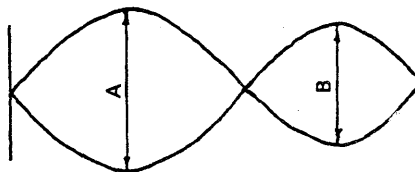


Fig. 3-5 TP2 + TP3

- 7) When the ratio (small/large) of the waveforms A to B in Fig. 3.5 is lower than 0.7, tighten the interrupter fixing screws (2) on the VCM unit.
- 8) Move the interrupter forward and backward using the (-) screwdriver so that the ratio of A to B becomes 1 ~ 0.7.
- 9) Tighten the interrupter fixing screw taking care not to move the adjusted position of the interrupter.
- 10) Apply Neji-lock green to the interrupter fixing screw. (See 3.5.6.)

3.4.4 Azimuth adjustment

A) Tools to be used

- 1) (-) screwdriver # 1
- 2) Hexagonal wrench key 1.5
- 3) CE disk
- 4) Oscilloscope
- 5) FDD controller
- 6) Neji-lock green

B) Procedure

- 1) Make connections between CH1 of the oscilloscope and TP2, CH2 and TP3 and the external trigger and TP7, respectively.
- 2) Set the oscilloscope signal conditions as specified below.

Switch	CH 1	CH 2
AC-GND-DC	AC	AC
VERT MODE	ADD	
INVERT	-	ON
VOLT/DIV (on the screen)	50mV	50mV
TIME/DIV	0.5mS	

Table. 3-4

- 3) Rotate the disk drive motor.
- 4) Set the CE disk.
- 5) Move the head to track 34.
- 6) Observe the waveforms on the oscilloscope.

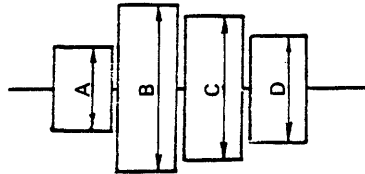


Fig. 3-6 Waveforms of TP2 + TP3

- 7) When the ratio (small/large) of the waveforms A to D in Fig. 3-6 is lower than 0.65, and the ratio of B to C is lower than 0.8, loosen the eccentric pin fixing screw with the hexagonal wrench key.
- 8) Adjust the eccentric pin so that the ratio of A to D becomes 1.0 ~ 0.65 and the ratio of B to C becomes 1.0 ~ 0.8.
- 9) Tighten the eccentric pin fixing screw taking care not to move the setting.

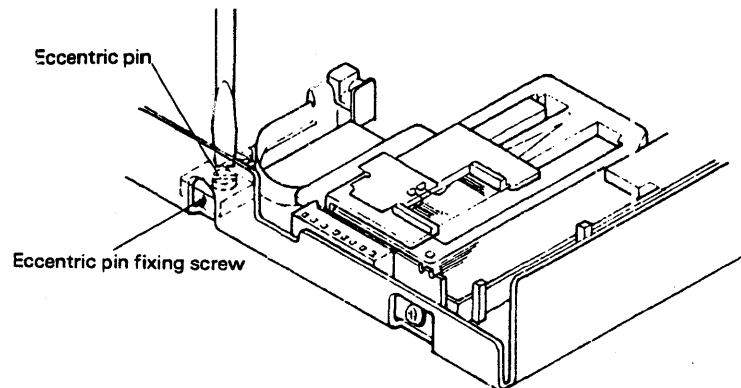


Fig. 3-7 Azimuth adjustment

3.4.5 Adjustment of index position

A) Tools to be used

- 1) (+) screwdriver # 1
- 1) (-) screwdriver # 1
- 2) CE disk
- 3) Oscilloscope
- 4) FDD Controller
- 5) FDD controller
- 6) Neji-lock green

B) Procedure

- 1) Make connections between CH1 of the oscilloscope and TP2, CH2 and TP3 and the external trigger and TP7, respectively.
- 2) Set the oscilloscope signal conditions as specified below. The trigger should be in the positive (+) direction.

Switch	CH 1	CH 2
AC-GND-DC	AC	AC
VERT MODE	ADD	
INVERT	-	ON
VOLT/DIV (on the screen)	50mV	50mV
TIME/DIV	50 μ S	

Table. 3-5

- 3) Rotate the disk drive motor.
- 4) Set the CE disk.
- 5) Move the head to track 34.
- 6) Observe the waveforms on the oscilloscope.

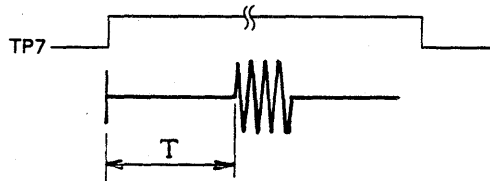


Fig. 3-8 Waveforms of TP2 + TP 3

- 7) When T of the waveform shown in Fig. 3.8 is not the range 150 ~ 500 μ S in SIDE 1, loosen the index detector A fixing screw.
- 8) Adjust index detector A by inserting the screwdriver (-) in to the triangular hole so that T comes into the range 150 ~ 500 μ S in both SIDE 0 and SIDE 1.
- 9) Tighten the index detector A fixing screw taking care not to move the set value.
- 10) Apply Neji-lock green to the index detector A fixing screw.

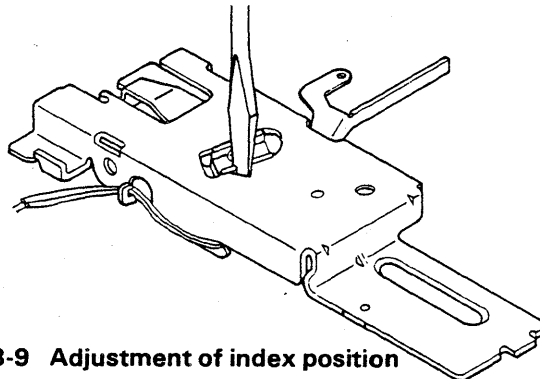


Fig. 3-9 Adjustment of index position

3.5 Maintenance of FDD SD-321

3.5.1 Periodic maintenance

Check and lubricate the SD-321 periodically every two years in order to maintain the initial performance for a long period of time and prevent faults.

3.5.2 Check items

Item	Action
Presence of foreign matter in the main unit	Remove the foreign matter.
Presence of oil at lubrication points	Lubricate.
Smudged head	Clean the head.
Smudged belt	Clean the belt.
Damaged or worn belt parts	Replace the belt.
Presence of dust and nap	Clean.

Table 3-6 Check items

3.5.3 Cleaning

The SD-321 should be carefully cleaned.

Except for the head, wipe off smudges with the gauze or cotton bar soaked with alcohol. Absorb the dust and nap using an electric cleaner. The head has been precisely adjusted in the factory. Use a cleaning disk to clean the head. Avoid cleaning it in by other methods.

Note: 1. Thinner, trichloroethylene and ketone solvents may damage the plastic parts, and must not be used for cleaning.

Note: 2. After cleaning, check the oil quantity and replenish the oil if it is found insufficient after removal of dust and nap.

3.5.4 Head cleaning

The head should be cleaned in the following manner.

- 1) Set the head cleaning disk in the main unit.
- 2) Start the disk drive motor.
- 3) When 20 seconds have passed after starting the disk drive motor, take out the head cleaning disk.
- 4) Set the disk and read and write it to check if any smudges remain.

Note: If the smudges are not removed, repeat the procedure from step 1).

3.5.5 Lubrication

the head should be cleaned in the following manner.

A) Type of oil

The type of oil has a large influence on performance and durability. Pay special attention to the low temperature characteristic. The type of oil used for the SD-321 is specified by us, based on our analysis of much technical information on various types of oil and on tests.

B) Lubrication standard

Use G-51 for lubrication of the SD-321.

When lubricating parts before starting lubrication.

For the lubricating parts, see the table of lubrication, parts or lubrication diagram.

Lubricate periodically according to the table of lubrication parts.

* For details of lubrication parts, see the disassembly diagram provided in CHAPTER 2.

C) Lubrication parts

The type of oil has a large influence on performance and durability. Pay special attention to the low temperature characteristic. The type of oil used for the SD-321 is specified by us, based on our analysis of much technical information on various types of oil and on tests.

Position in diagram	Parts to be lubricated	Classification	Quantity
G-1	Sliding parts (2) of the slide lever and washer	A	B
G-2	Latch fulcrum and latch tail	A	A
G-3	Latch groove and latch pin head	B	B
G-4	Slide roller	B	B
G-5	Part making contact between the ejector and ejector guide	B	B
G-6	Part making contact between the ejector and eject lock pin	B	B
G-7	Part making contact between the ejector and eject transmission lever shaft	B	B
G-8	Eject lock lever flucums (2)	B	B
G-9	Collet lever fulcrums (2)	B	B
G-10	Parts making contact between the slide lever and safety lever	A	B
G-11	Part making contact between the slide lever and eject transmission lever	A	B
G-12	Safety lever shaft	B	A
G-13	Part making contact between the disk guide (L) and eject transmission lever	A	B
G-14	Ejector spring and spring hook	B	A

Table 3-7 Lubrication parts

Classification: A: Lubricate every 2 years or 5,000 hours.

B: Lubricate at overhaul or every 15,000 hours.

Quantity: A: 1 ~ 2 drops

B: 2 ~ 3 drops

3.5.6 Bonding

An adhesive is used in some parts and screws of SD-321 for the purpose of reinforcement and to prevent screws being loosened during transportation. So, after disassembly or reassembly, apply the adhesive to these parts according to the table of bonding parts and the drawings.

The adhesive used in the SD-321 is Neji-lock green (Threebond).

Position in drawing	Port to be bonded
F-1	Index detector A
F-2	Interrupter fixing screw (2)

Table 3-8 Bonding parts

* For the bonding parts, see the disassembly diagram.

3.5.7 Maintenance tools and measuring instruments

The minimum required tools and instruments are shown in the following table:

Name of tool	Commercial availability
Soldering iron	Yes
Oblique blade nippers	"
Tweezers	"
Screwdriver (+) # 1	"
Screwdriver (-) # 2	"
Screwdriver (-) # 1	"
ET holders # 2 and 5	"
ET holder # 3	"
Hexagonal wrench key 1.5	"
Writing brush # 1	"
Writing brush # 2	"
Washing bucket	"
Head cleaning disk	"
Adjusting disk DYMEK No.0592-11	"
Precision screwdriver (-) # 3	"

Table 3-9 List of maintenance tools

B) List of maintenance parts

Name of part	Commercial availability
Cotton bar	Yes
Gauze	"
Pure alcohol	"
Oil (G-51, Plus guard SG)	"
Adhesive (Neji-lock green)	"

Table 3-10 List of maintenance parts

C) List of measuring instruments

Measuring instrument
FDD controller
Oscilloscope (2-channel)
Frequency counter

Table 3-11 List of measuring instruments

CHAPTER 4 REPAIRS

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4.1 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 QX-10 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) Soldering

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

4.2 Repair Tools and Instruments

4.2.1 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, 80W	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	FDD SD-321 repair	Yes
10	ET holder No.1.5	ETH1.5	FDD SD-321 repair	Yes
11	ET holder No.2	ETH 2	FDD SD-321 repair	Yes
12	Philips precision screwdriver set		FDD SD-321 repair	Yes
13	Regular precision screwdriver set		FDD SD-321 repair	Yes
14	Pliers	No.0	FDD SD-321 repair	Yes
15	Brush (medium)		FDD SD-321 repair	Yes
16	Brush (fine)		FDD SD-321 repair	Yes
17	Tension gauge	200g	FDD SD-321 repair	Yes
18	Solder		Control circuit board repair	Yes
19	Safety goggles		Protection during soldering and use of oil, grease, chemicals	Yes Yes
20	Gloves		Soldering	Yes

Table 4-1

4.3 Soldering

4.3.1 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.

4.3.2 Soldering

- (1) Through-hole soldering
 - a) Solder part leads as shown in the center of the below sketch. (Solder builds up about 30° to 45° to the land.)

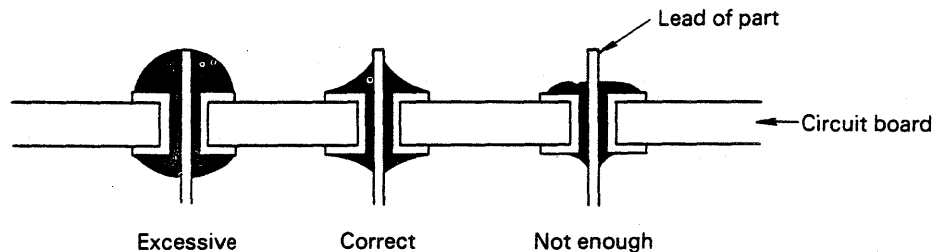


Fig. 4-1

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

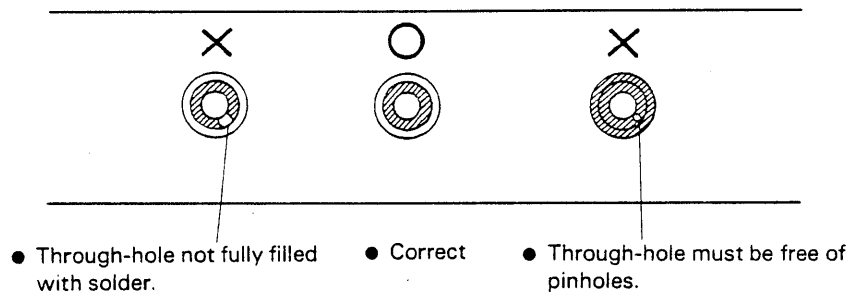


Fig. 4-2

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

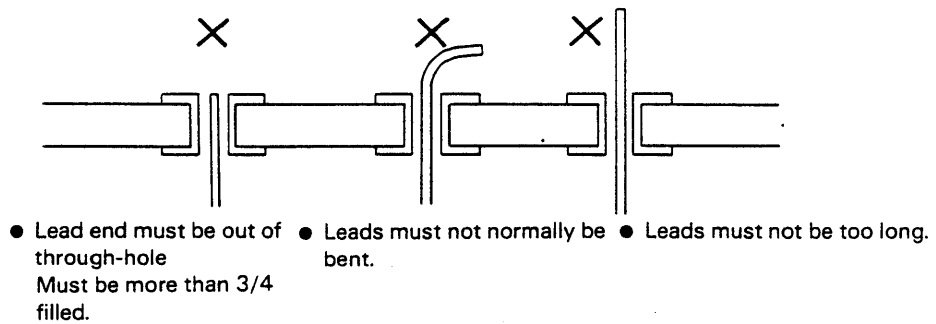


Fig. 4-3

(2) Parts Installation

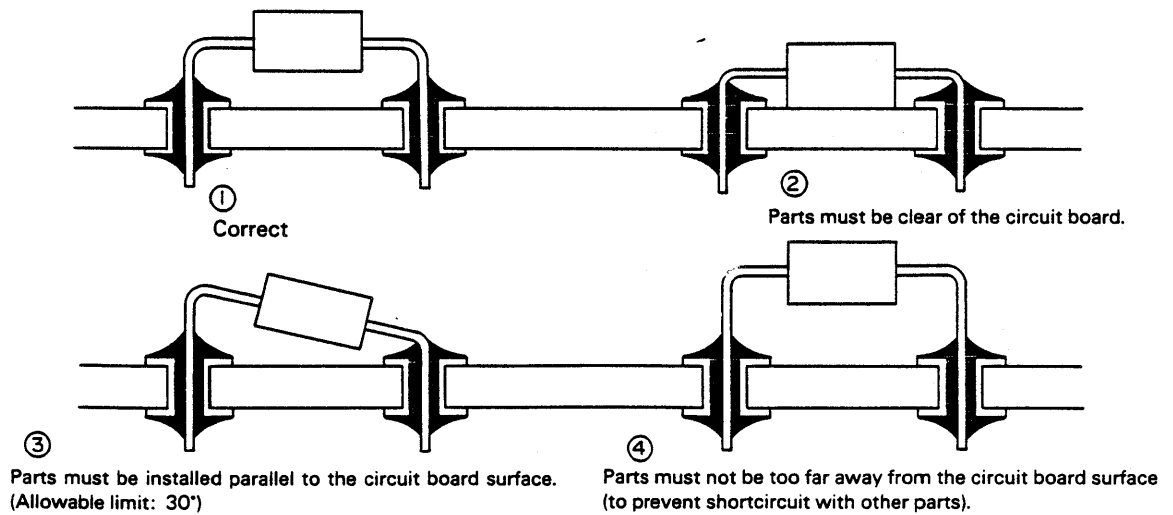


Fig. 4-4

(3) Wire connection

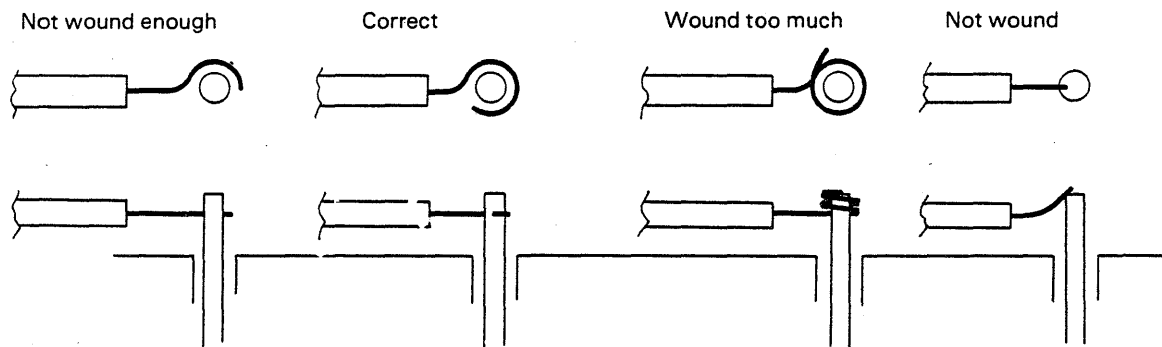


Fig. 4-5

- 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.

4.3.3 Unreparable

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.

4.3.4 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.

4.3.5 Terms

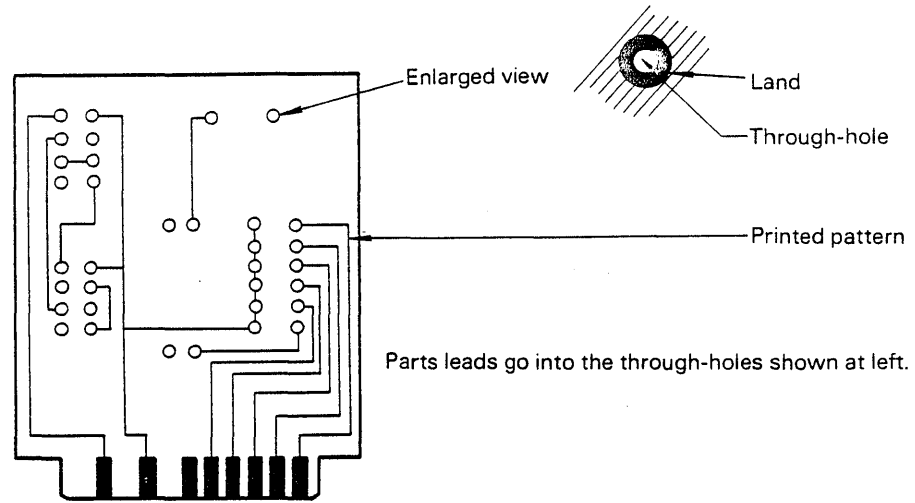


Fig. 4.6 Front of Circuit Board

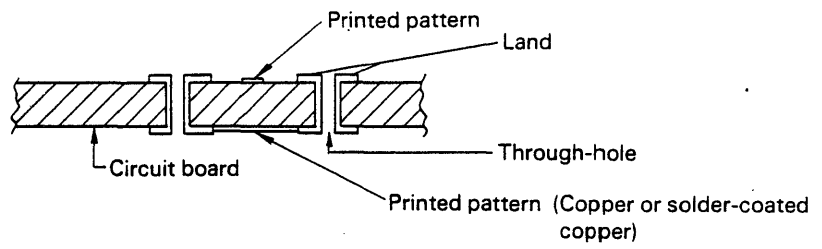


Fig. 4.7 Cross Section of Circuit Board

CHAPTER 5 Q10GMS BOARD

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5.1 Guideline for Troubleshooting

Troubleshooting is not easy, because symptoms differ according to the faulty parts. A guide line for troubleshooting is easily provided by the following two means:

1. Check out procedure

Purpose: Guideline for troubleshooting for faults with indefinite symptoms.

Level: Replace corresponding units. (Repairable by persons who have a basic mechanical knowledge.)

2. Unit troubleshooting flowchart

Purpose: Repair individual faulty unit at part level.

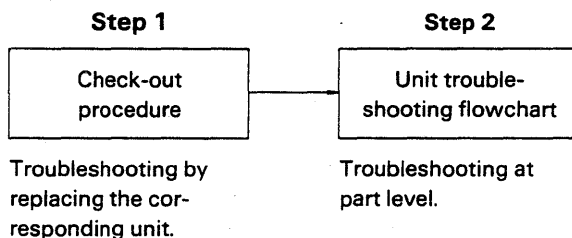
Level: Since troubleshooting is made at part level, it requires deep knowledge and high technical skill.

Troubleshooting Method

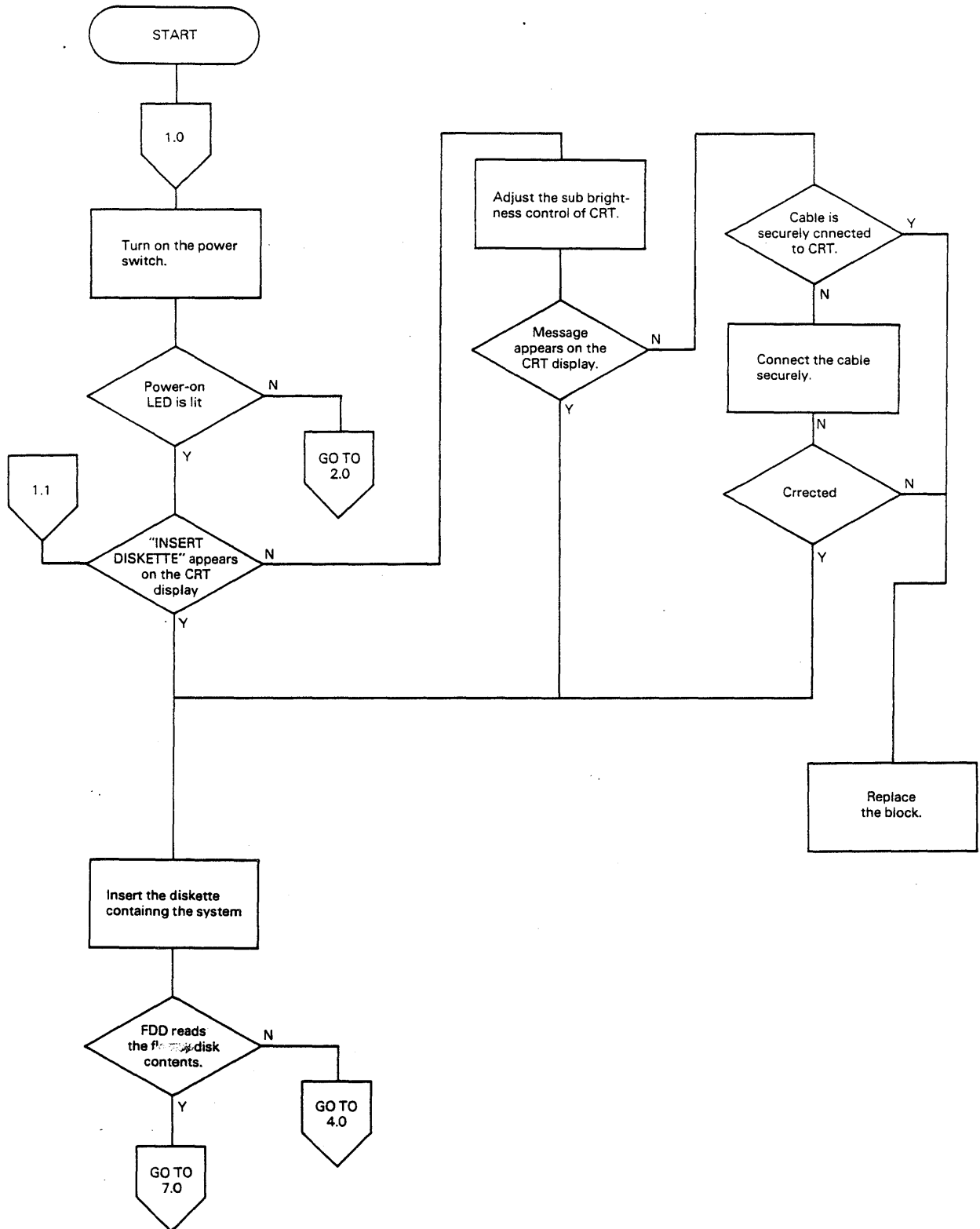
- As the first step, use the check out procedure and perform troubleshooting by replacing the corresponding units. In this case, be sure to check again that the replaced unit is not defective. (This is done to distinguish the fault from those caused by contact failure of connectors.)
- As the second step, replace the defective element in the corresponding unit according to the unit flowchart or table of faults.

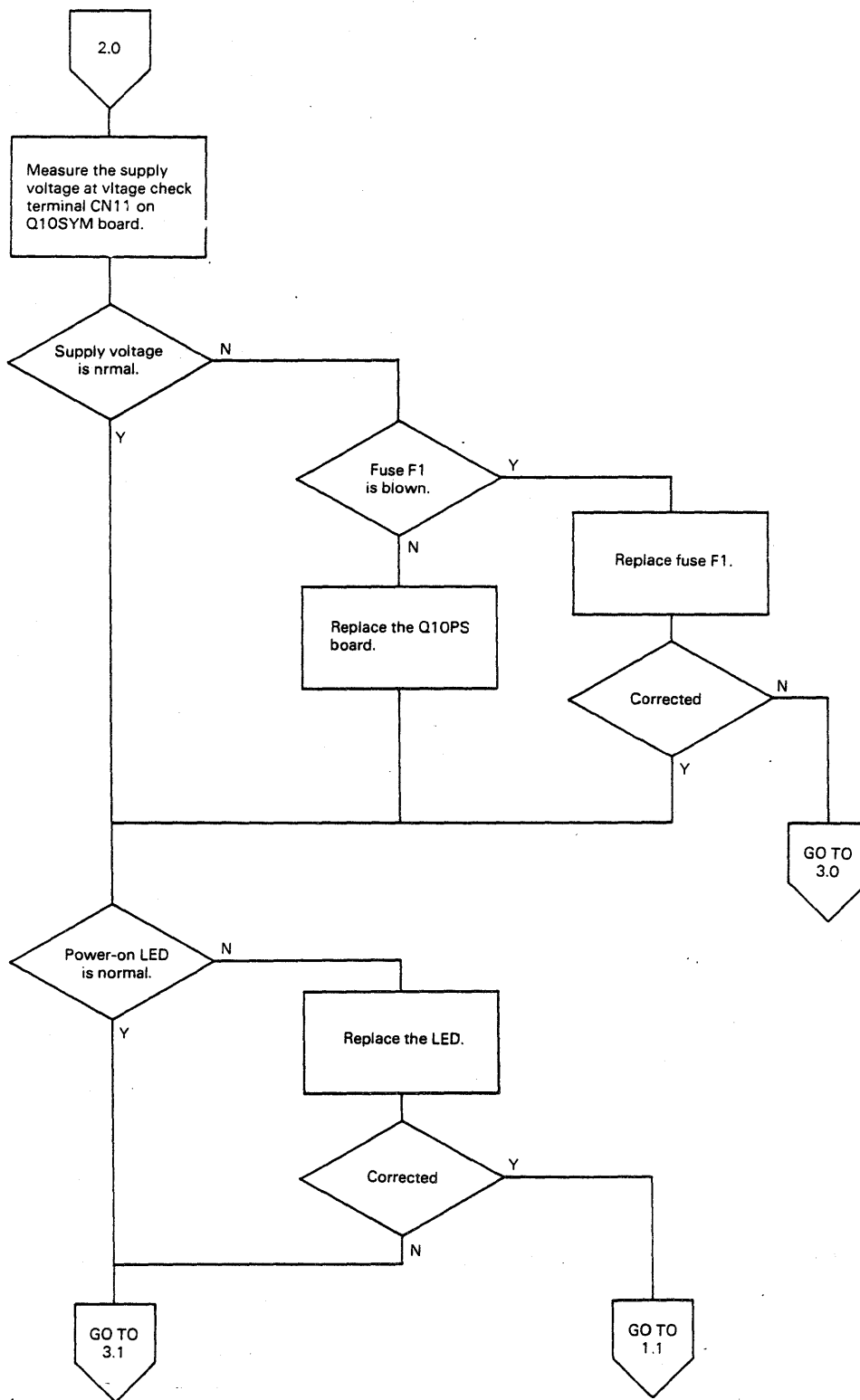
Notes 1: When a checking item appears in the flowchart, be sure to do it. If a part or unit is replaced without checking, the new part or unit may be damaged again.

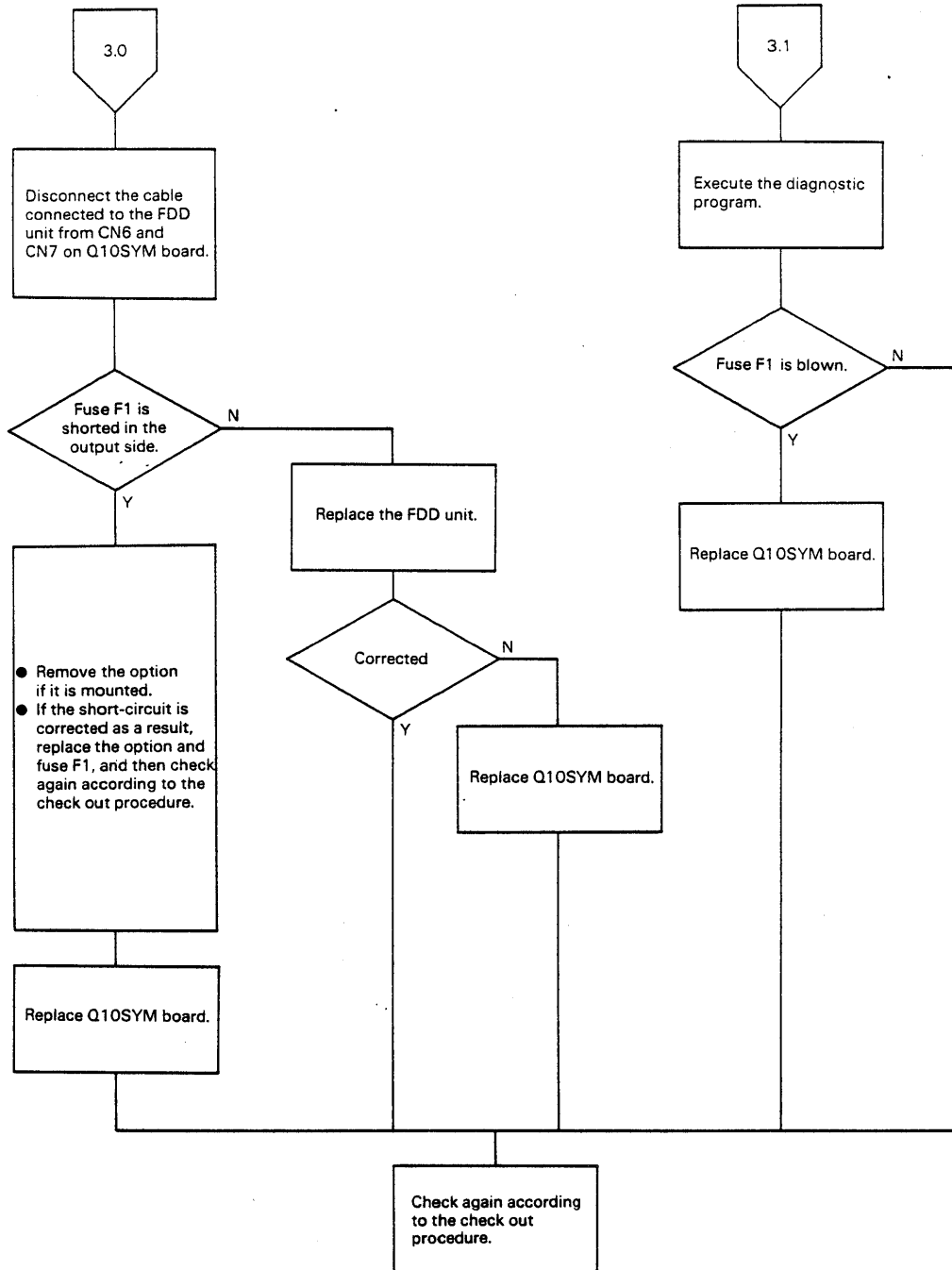
2: When the troubleshooting procedure becomes indefinite halfway, be sure to return to the first entry and restart the procedure.

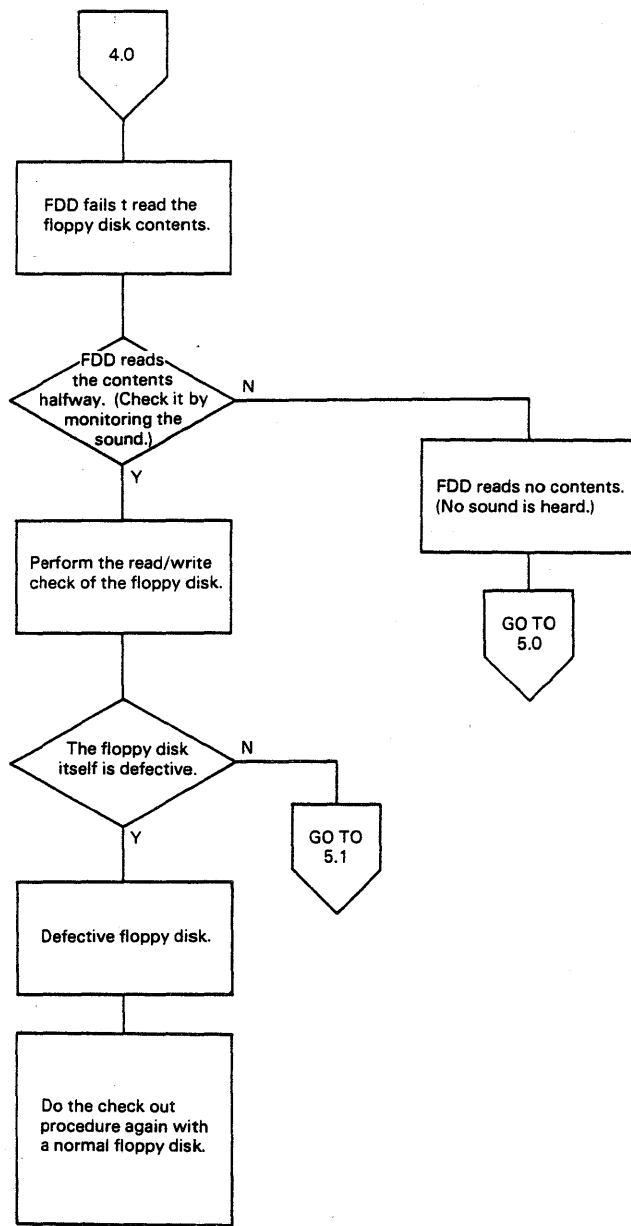


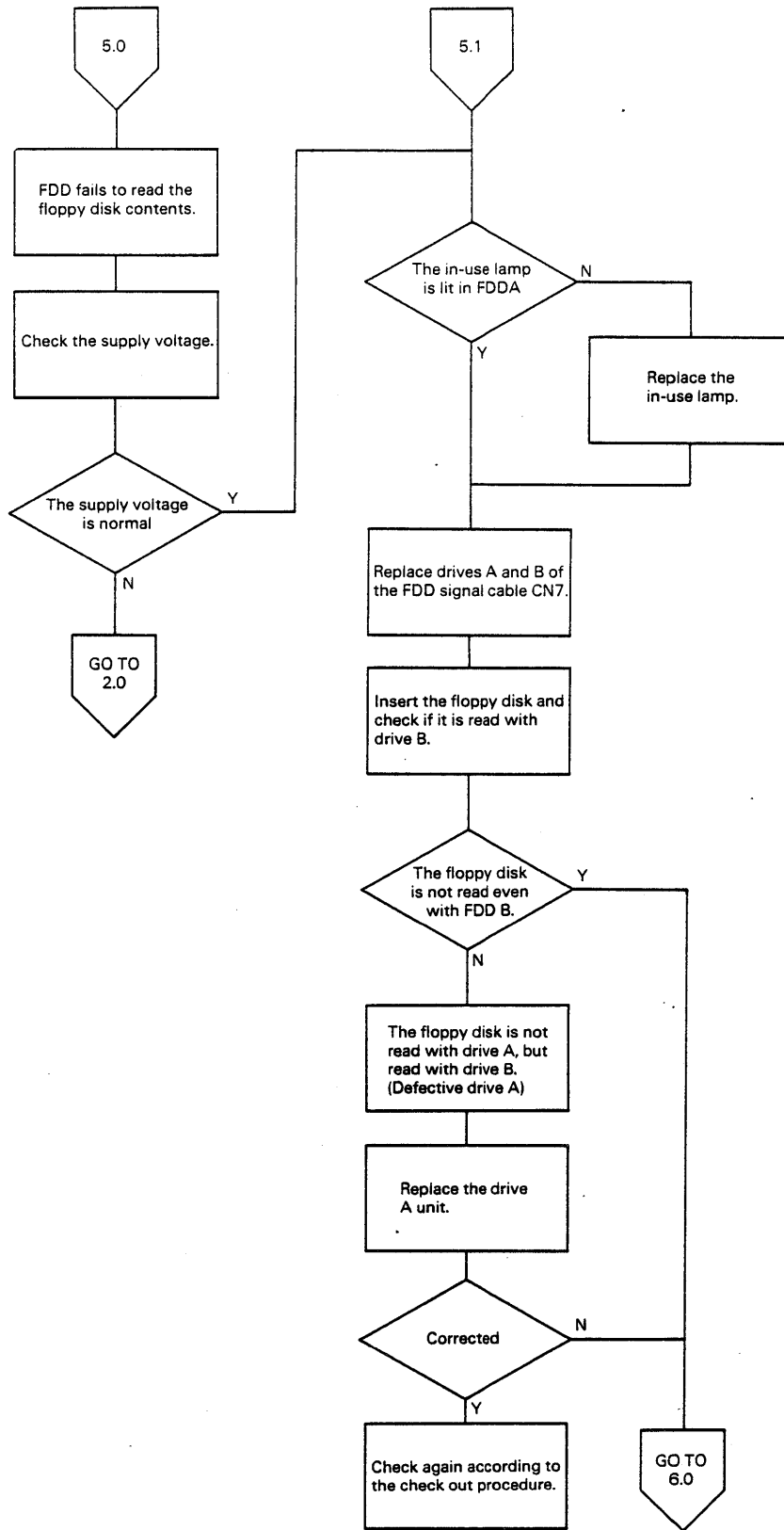
5.2 Check-out Procedure

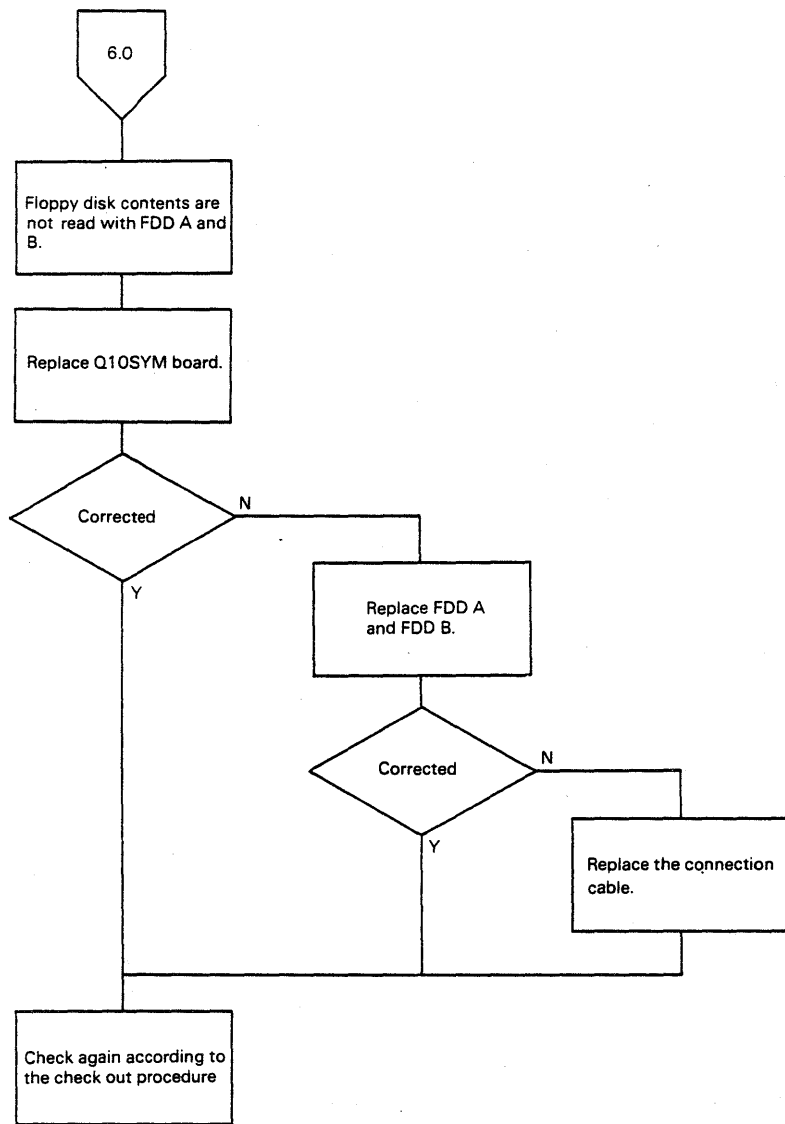


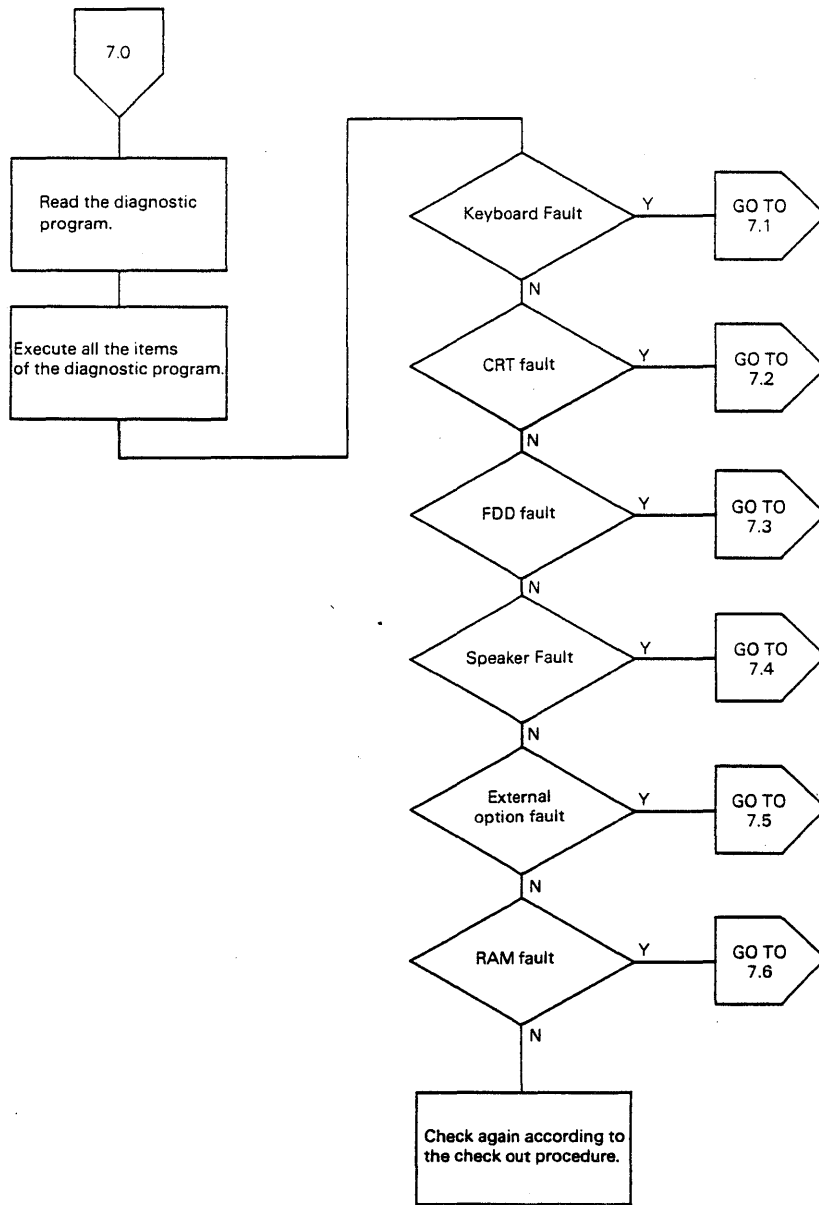


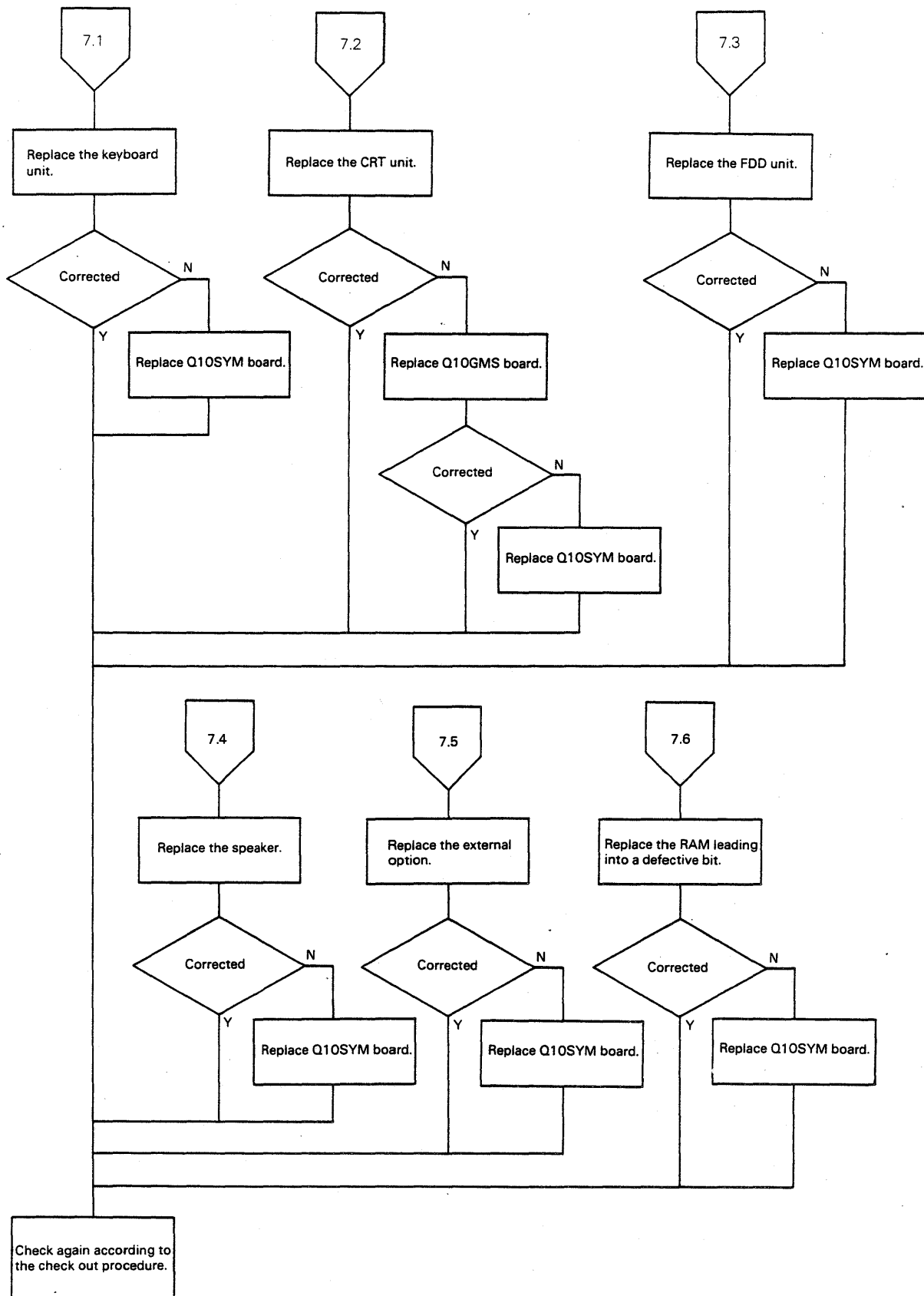












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