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Toshiba Libretto 50CT/70CT Maintenance Manual

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Preface

This maintenance manual describes how to perform hardware service maintenance for the Toshiba Personal Computer Libretto 50CT/70CT.

Information on the Libretto 70CT has been incorporated into this manual since its original release. Information added that is specific to the Libretto 70CT is noted by an asterisk (*).

The procedures described in this manual are intended to help service technicians in the field isolate and replace faulty Field Replaceable Units (FRUs).

SAFETY PRECAUTIONS

Four types of messages are used in this manual to bring important information to your attention. Each of these messages will be italicized and identified as shown below.

DANGER: “*Danger*” indicates the existence of a hazard that could result in death or serious injury if the safety instruction is not observed.

WARNING: “*Warning*” indicates the existence of a hazard that could result in bodily injury if the safety instruction is not observed.

CAUTION: “*Caution*” indicates the existence of a hazard that could result in property damage if the safety instruction is not observed.

NOTE: A “*Note*” contains general information that relates to safe maintenance services.

Improper repair of the computer may result in safety hazards. Toshiba requires service technicians and authorized dealers or service providers to ensure that the following safety precautions are strictly adhered to.

- Be sure to fasten screws securely with the correct screwdriver. If a screw is not fully fastened, it could loosen and create a short circuit, which could cause overheating, smoke, or fire.
- If you replace the battery pack, RTC battery, or backup battery, be sure to use only the same model battery or an equivalent battery recommended by Toshiba. Installation of the wrong battery can cause the battery to explode.

The manual is divided into the following parts:

- Chapter 1 ***Hardware Overview*** describes the system unit and each FRU.
- Chapter 2 ***Troubleshooting Procedures*** explains how to diagnose and resolve FRU problems.
- Chapter 3 ***Tests and Diagnostics*** describes how to perform test and diagnostic operations for maintenance service.
- Chapter 4 ***Replacement Procedures*** describes the removal and replacement of the FRUs.
- Appendices The appendices describe the following:
 - Handling the LCD module
 - Board layout
 - Pin assignments
 - Key layout
 - Wiring diagrams
 - BIOS Rewrite Procedures
 - Reliability

Conventions

This manual uses the following formats to describe, identify, and highlight terms and operating procedures.

Acronyms

On the first appearance, and whenever necessary for clarification, acronyms are enclosed in parentheses following their definition. For example:

Read Only Memory (ROM)

Keys

Keys are used in the text to describe many operations. The keytop symbol as it appears on the keyboard is printed in **boldface** type.

Key operation

Some operations require you to simultaneously use two or more keys. We identify such operations by the keytop symbols separated by a plus (+) sign. For example, **Ctrl + Pause (Break)** means you must hold down **Ctrl** and at the same time press **Pause (Break)**. If three keys are used, hold down the first two and at the same time press the third.

User input

Text that you are instructed to type in is shown in the boldface type below:

DISKCOPY A: B:

The display

Text generated by the Libretto 50CT, that displays on the screen, is presented in the typeface below:

```
Format complete
System transferred
```

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Chapter 1

Hardware Overview

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1.1 Features

The Libretto 50CT/70CT uses Toshiba's advanced Large Scale Integration (LSI) and Complementary Metal-Oxide Semiconductor (CMOS) technology extensively to provide compact size, minimum weight, low power usage, and high reliability. The following features and benefits are incorporated:

Microprocessor

The Libretto 50CT has a 64-bit microprocessor, Intel Pentium processor running at a clock speed of 75MHz.

*The Libretto 70CT has a 64-bit microprocessor, Intel Pentium processor with MMX technology running at a clock speed of 120MHz.

Memory

Standard 16MB of Extend Data Out (EDO) DRAM.

Hard Disk Drive (HDD)

The Libretto 50CT has a 2.5-inch HDD with a capacity of 815MB.

*The Libretto 70CT has a 2.5-inch HDD with a capacity of 1.58GB.

Display

A 6.1-inch, Thin Film Transistor (TFT) color Liquid Crystal Display (LCD), that enables a display of up to 16M colors at a resolution of 640 x 480 pixels.

A video controller and 1MB of VRAM enable an external monitor to display 16M colors at a resolution of 1280 x 1024 pixels.

Keyboard

An easy-to-use 80/82-key keyboard provides: a numeric keypad overlay for fast numeric data entry and cursor/page control; two keys that have special functions in Microsoft Windows 95; and software that supports a 101- or 102-key enhanced keyboard.

Batteries

Two batteries: a Lithium-Ion main battery pack and RTC battery that backs up the Real Time Clock and CMOS memory.

Expansion

An optional 8 or 16MB memory kit can be installed in the memory slot.

Parallel port

A Centronics compatible parallel port on the I/O adapter enables connection of a printer or other parallel device and supports the Extended Capabilities Port (ECP) conforming to IEEE-1284.

 Serial port

A standard, 9-pin, serial port only on the I/O adapter enables connection of such serial devices as a serial printer, mouse, or modem. A Universal Asynchronous Receiver/Transmitter (UART) is 16550A equivalent.

 External monitor port

The port is available only on the I/O adapter and enables connection of an external SVGA compatible monitor.

 PC card slot

A PC card slot accommodates one 5mm card (Type II). The slot supports PCMCIA Release 2.01 cards and an optional external FDD.

 Docking interface port

A 132-pin, docking interface port enables connection of the I/O port adapter or an optional Enhanced Port Replicator.

The Enhanced Port Replicator has one additional PC card slot that accommodates a 10.5mm card (Type III) and duplicates the ports available on the I/O adapter, in addition to the connection of the PS/2 compatible mouse and keyboard.

 AccuPoint

The pointer control stick, located on the right of the display panel, provides convenient control of the cursor without requiring desk space for a mouse.

 Infrared port

An Infrared Data Association (IrDA) 1.0 standard infrared port, which enables cableless 115.2Kbps data transfer.

 Sound system

A Sound Blaster Pro compatible, 16-bit sound system enables the computer to play back sound. The sound system is equipped with a built-in speaker and stereo headphone jack.

 External Floppy Disk Drive (FDD) (Option)

A 3.5-inch external FDD is connected to the PC card slot and accommodates both 2HD (1.44MB) and 2DD (720KB) disks.

The front of the computer is shown in Figure 1-1.

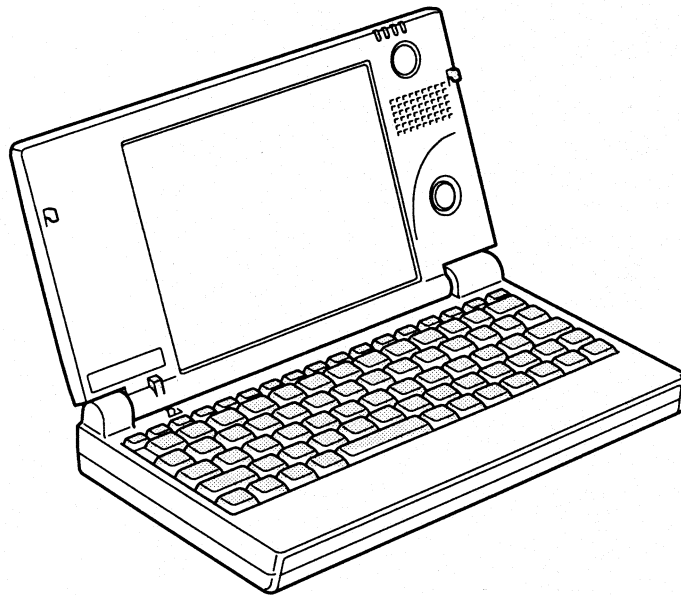


Figure 1-1 Front of the computer

The system unit configuration is shown in Figure 1-2.

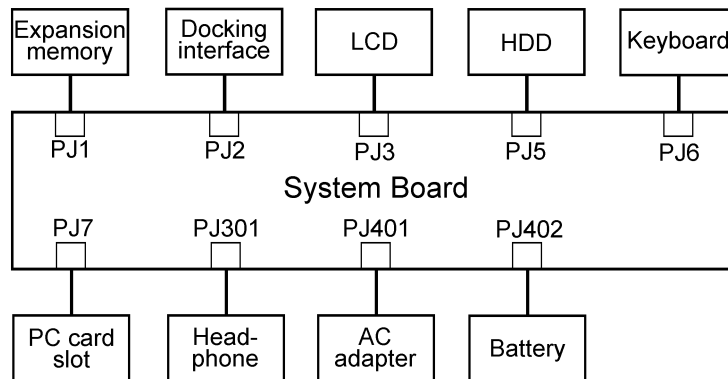


Figure 1-2 System unit configuration

1.2 System Unit Block Diagram

Figure 1-3 is a block diagram of the system unit.

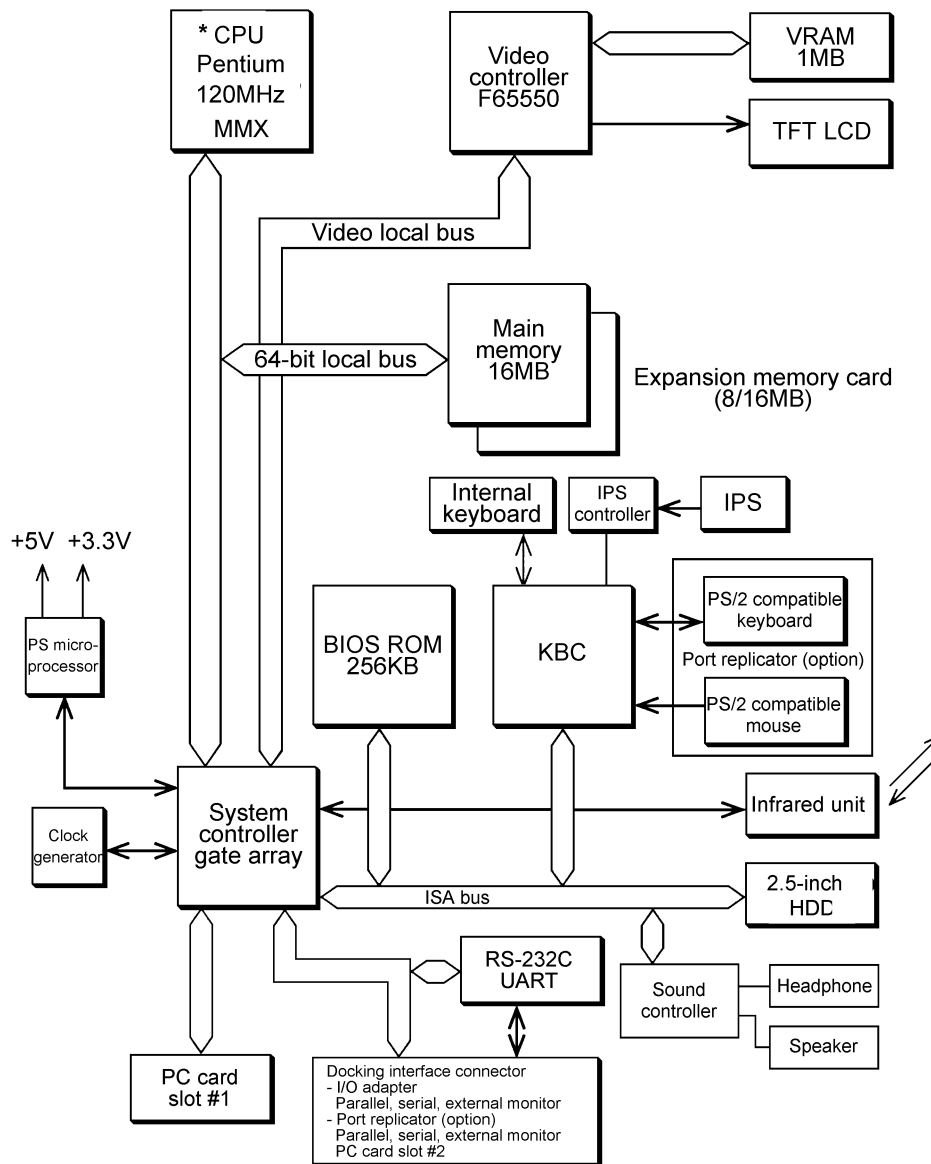


Figure 1-3 System unit block diagram

The system unit is composed of the following major components:

Microprocessor

Libretto 50CT: Intel 75 MHz Pentium processor operates at 2.9/3.3 volts and incorporates the math co-processor and 16 KB cache memory.

*Libretto 70CT: Intel 120 MHz Pentium processor with MMX technology operates at 2.9/3.3 volts and incorporates the math co-processor and 16 KB cache memory.

Standard RAM

- 16 MB, eight 1M x 16-bit EDO DRAM chips
- 3.3 volt operation
- No parity bit
- Access time 70 ns
- Data transfer is 64-bit width

BIOS ROM (Flash EEPROM)

- 256 KB, one 256K x 8-bit chip
 - 64 KB are used for system BIOS
 - 40 KB are used for VGA BIOS
 - 152 KB are reserved
- Access time 120 ns
- Data transfer is 8-bit width

Expansion memory

One expansion memory slot is available for 8 and 16 MB memory kits, which consist of 1M x 16-bit EDO DRAM chips.

- 3.3 volt operation
- No parity bit
- Access time 70 ns
- Data transfer is 64-bit width

Video Controller

Chips & Technologies F65550 is used. The video controller integrates an LCD/CRT graphics controller, RAMDAC, and clock synthesizers.

Video RAM

- 1 MB, two 256K x 16-bit DRAM chips
- 3.3 volt operation
- Access time 50 ns

❑ System Controller Gate Array

This gate array has the following functions:

- Two PICs: 82C59 equivalent
- Two UARTs: 16550A equivalent (one SIO is used for SIR)
- One PIT: 82C54 equivalent
- One RTC: T9934 equivalent
- Two DMACs: 82C37 equivalent
- I/O port decode
- SIO port control
- Parallel (ECP) port control
- Speaker control
- Power supply microprocessor interface
- PnP support
- CPU control
 - SMI control
 - Clock speed control
- Memory control
 - 64-bit memory bus control
- Video local bus control
 - 64 to 32-bit, 32 to 64-bit data bus interface
- Address latch control
 - Address conversion
 - Address latch
- Hibernation control
- Ring wake up control
- PC card control
 - Memory card control
 - I/O card control
- BIOS-ROM interface
- Infrared port control
- Sound control

❑ Keyboard Controller (KBC)

This KBC includes: the keyboard scan controller and keyboard interface controller; and controls: the internal keyboard, external keyboard, IPS and PS/2 mouse.

Internal Pointing Stick Controller (IPSC)

Provides simultaneous control of both an AccuPoint and a PS/2 mouse.

Sound Controller

The Libretto 50CT uses one OPL3-SA2 that incorporates: OPL3 FM synthesizer, Digital Analog Converter (DAC), and MPU401 MIDI interface.

*The Libretto 70CT uses one OPL3-SA3 that incorporates: OPL3 FM synthesizer, Digital Analog Converter (DAC), and MPU401 MIDI interface.

1.3 3.5-inch External FDD (Option)

The 3.5-inch external FDD is a thin, high performance reliable drive that supports 720KB (formatted) 2DD and 1.44MB (formatted) 2HD disks. The FDD can be connected to the PC card slot.

The FDD is shown in Figure 1-4.

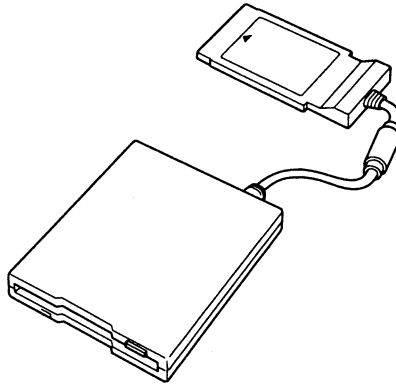


Figure 1-4 3.5-inch FDD

The specifications for the FDD are listed in Table 1-1.

Table 1-1 FDD specifications

Item	2MB mode	1MB mode
Storage capacity (KB)		
Unformatted	2,000	1,000
Formatted	1,440	720
Number of heads	2	2
Number of cylinders	80	80
Access time (ms)		
Track to track	3	3
Average	181	181
Head settling time	15	15
Recording track density (tpi)	135	135
Data transfer rate (Kbps)	500	250
Rotation speed (rpm)	300	300
Recording method	Modified Frequency Modulation (MFM)	

1.4 2.5-inch HDD

The removable HDD is a random access non-volatile storage device. It has a non-removable 2.5-inch magnetic disk and mini-winchester type magnetic heads.

The Libretto 50CT computer supports a 815MB HDD.

*The Libretto 70CT computer supports a 1.58GB HDD.

The HDD is shown in Figure 1-5.

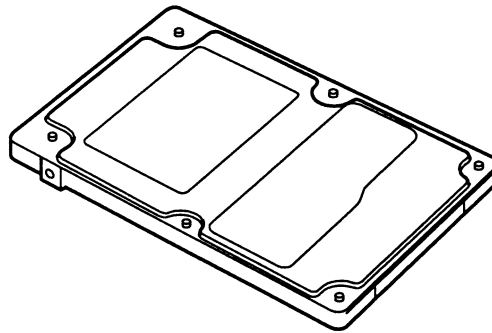


Figure 1-5 2.5-inch HDD

The specifications for the HDDs are listed in Table 1-2.

Table 1-2 HDD specifications

Libretto 50CT: 815MB HDD

Item	Specifications
Formatted capacity (MB)	815
Number of disks	1
Logical heads	2
Bytes per sector	512
Rotation speed (rpm)	4,000
Recording method	8-9 RLL

*Libretto 70CT: 815MB HDD

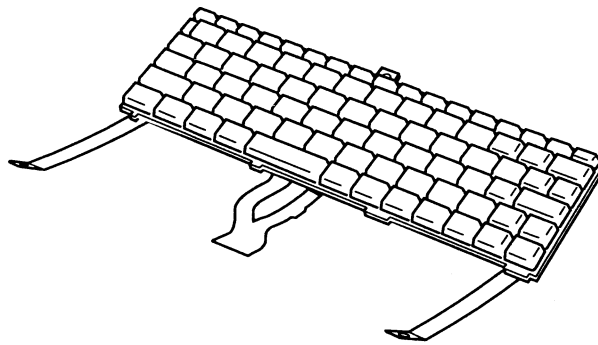
Item	Specifications
Formatted capacity (GB)	1.58
Number of disks	1
Logical heads	2
Bytes per sector	512
Rotation speed (rpm)	4,000
Recording method	8-9 RLL

1.5 Keyboard

The 80- (USA) or 82- key (European) keyboard is mounted on the system unit. The keyboard is connected to the keyboard controller on the system board through one 20-pin flat cable. The AccuPoint, located on the right of the display panel, provides convenient control of the cursor without requiring desk space for a mouse. The keyboard is shown in Figure 1-6.

See Appendix D for optional keyboard configurations.

Figure 1-6 Keyboard



The specifications for the keyboard are listed in Table 1-3.

Table 1-3 Keyboard specifications

Item	Specifications
Input method	Pantograph (Function keys use cylinders)
Pitch	15mm
Thickness	6mm

1.6 LCD Panel

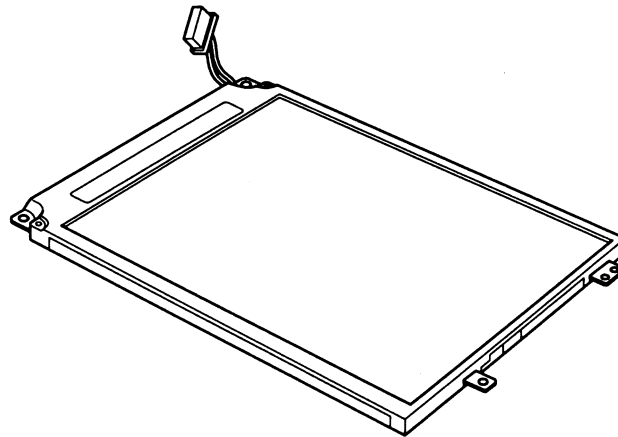
The display panel contains a TFT color LCD module, a fluorescent lamp (FL), and an FL inverter board.

1.6.1 LCD Module

The TFT color LCD enables display of up to 16M colors at a resolution of 640 x 480 pixels.

The LCD module is shown in Figure 1-7.

Figure 1-7 LCD module



The specifications for the LCD are listed in Table 1-4.

Table 1-4 LCD specifications

Item	Specifications
Number of Pixels (pixels)	640x480
Dot pitch (mm)	0.192x0.192
Display area (mm)	122.8(H)x92.16(V)
Contrast	100:1
FL current (mA)	4.6/4.0/2.8/2.4* (Bright/Semi-bright)

***NOTE:** The FL currents at power on are:

	Bright	Semi-bright
Universal AC Adapter connected	4.6 mA	2.8 mA
Universal AC Adapter not connected	4.0 mA	2.4 mA

1.6.2 FL Inverter Board

The FL inverter board supplies high frequency current to light the LCD Fluorescent Lamp.

The specifications for the FL inverter are listed in Table 1-5.

Table 1-5 FL inverter board specifications

Item		Specifications
Input	Voltage (V)	5
	Power (W)	2.2
Output	Voltage (Vrms)	800
	Current (mA)	(4.6/4.0/2.8/2.4)* (Bright/Semi-bright)

***NOTE:** *The FL currents at power on are:*

	Bright	Semi-bright
<i>Universal AC Adapter connected</i>	4.6 mA	$\frac{3}{4}$ 2.8 mA
<i>Universal AC Adapter not connected</i>	4.0 mA	$\frac{3}{4}$ 2.4 mA

1.7 Power Supply

The power supply provides two kinds of voltages to the system board, has one microprocessor operating at 2 MHz, and performs the following functions:

1. Determines if the Universal AC Adapter or Main Battery Pack is connected to the computer.
2. Detects DC output and circuit malfunctions.
3. Controls the LED icon and the speaker.
4. Detects a fully charged Main Battery Pack.
5. Controls power on/off.
6. Provides more accurate detection of a low Main Battery Pack.
7. Calculates the remaining Main Battery Pack capacity.

The power supply output rating is specified in Table 1-6.

Table 1-6 Power supply board output rating

Use	Name	DC voltage (V)	Regulation tolerance (%)
CPU, RAM, GA, VGA, VRAM	B3V	+3.3	±5
GA, BIOS ROM, KBC, PC card	VCC	+12.0	±5

1.8 Batteries

The computer has two types of batteries:

- Main battery pack
- RTC battery

Battery specifications are listed in Table 1-7.

Table 1-7 Battery specifications

Battery name	Material	Output voltage	Capacity
Main battery pack	Lithium-Ion	10.8 V	1,200 mAh
RTC battery	Nickel Metal Hydride	2.4 V	11 mAh

1.8.1 Main Battery Pack

The removable main battery pack is the computer's main power source when the Universal AC Adapter is not connected. The main battery pack maintains the state of the computer when the computer enters into hibernation mode.

1.8.2 Battery Icon

The icon color shows the status of the removable battery pack. Each color indicates:

- Orange The battery is being charged. (Universal AC Adapter connected)
- Green The battery is full charged. (Universal AC Adapter connected)
- Blinking orange The battery is low when the power is on.
- No light Under any other conditions, the LED does not light.

1.8.3 Battery Charging Control

A power supply microprocessor mounted on the system board controls whether the battery charge is on or off and also detects a full charge when the Universal AC Adapter and battery are connected to the computer. The system charges the battery using quick charge or trickle charge.

- Quick Battery Charge

The battery quick charges when the Universal AC Adapter is connected and the system is powered off or in stand-by mode.

Table 1-8 Time required for quick charge

Item	Charging time
Power off or standby	About 4.5 hours

If one of the following occurs, the Main Battery Pack quick charge process stops.

1. The Main Battery Pack becomes fully charged.
 2. The Universal AC Adapter or Main Battery Pack is removed.
 3. The Main Battery Pack or output voltage is abnormal.
- Trickle Battery Charge

The Main Battery Pack will trickle charge when the Universal AC Adapter is connected and the system is on or when the main battery pack becomes fully charged. The microprocessor automatically changes quick charge to trickle charge.

1.8.4 RTC battery

The RTC battery provides power to keep the current date, time, and other setup information in memory while the computer is turned off. Table 1-9 shows the charging time and data preservation period of the RTC battery.

Table 1-9 RTC battery charging/data preservation time

Item	Time
Charging Time	48 hours
Data preservation period (full charge)	About 1 month

Chapter 2

Troubleshooting Procedures

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2.1 Troubleshooting Overview

Chapter 2 describes how to determine if a Field Replaceable Unit (FRU) is causing the computer to malfunction. The FRUs covered are:

- Power Supply
- System Board
- FL Inverter Board
- Floppy Disk Drive
- Hard Disk Drive
- Keyboard
- Pointing Device
- Display

The Tests and Diagnostics are described in Chapter 3 and Replacement Procedures are detailed in Chapter 4.

The following tools are necessary for implementing the troubleshooting procedures:

1. Diagnostics disk
2. Phillips screwdriver (2 mm)
3. Toshiba MS-DOS system disk(s)
(You must install the following onto the disk: SYS.COM, FORMAT.COM, FDISK.COM and FDISK.EXE)
4. 2DD or 2HD formatted work disk for floppy disk drive testing
5. Cleaning kit for floppy disk drive troubleshooting
6. Printer port LED
7. Serial port wraparound connector
8. Multimeter
9. Printer port wraparound connector
10. PC card wraparound card
11. I/O Adapter
12. FDD

2.2 Troubleshooting Flowchart

Use the flowchart in figure 2-1 as a guide to determine which troubleshooting procedures to execute. Before going through the flowchart steps, do the following:

- Verify with the customer that Toshiba Windows 95 is installed on the hard disk. Non-Toshiba operating systems can cause the computer to malfunction.
- Make sure all optional equipment is removed from the computer.
- Make sure the floppy disk drive is empty.

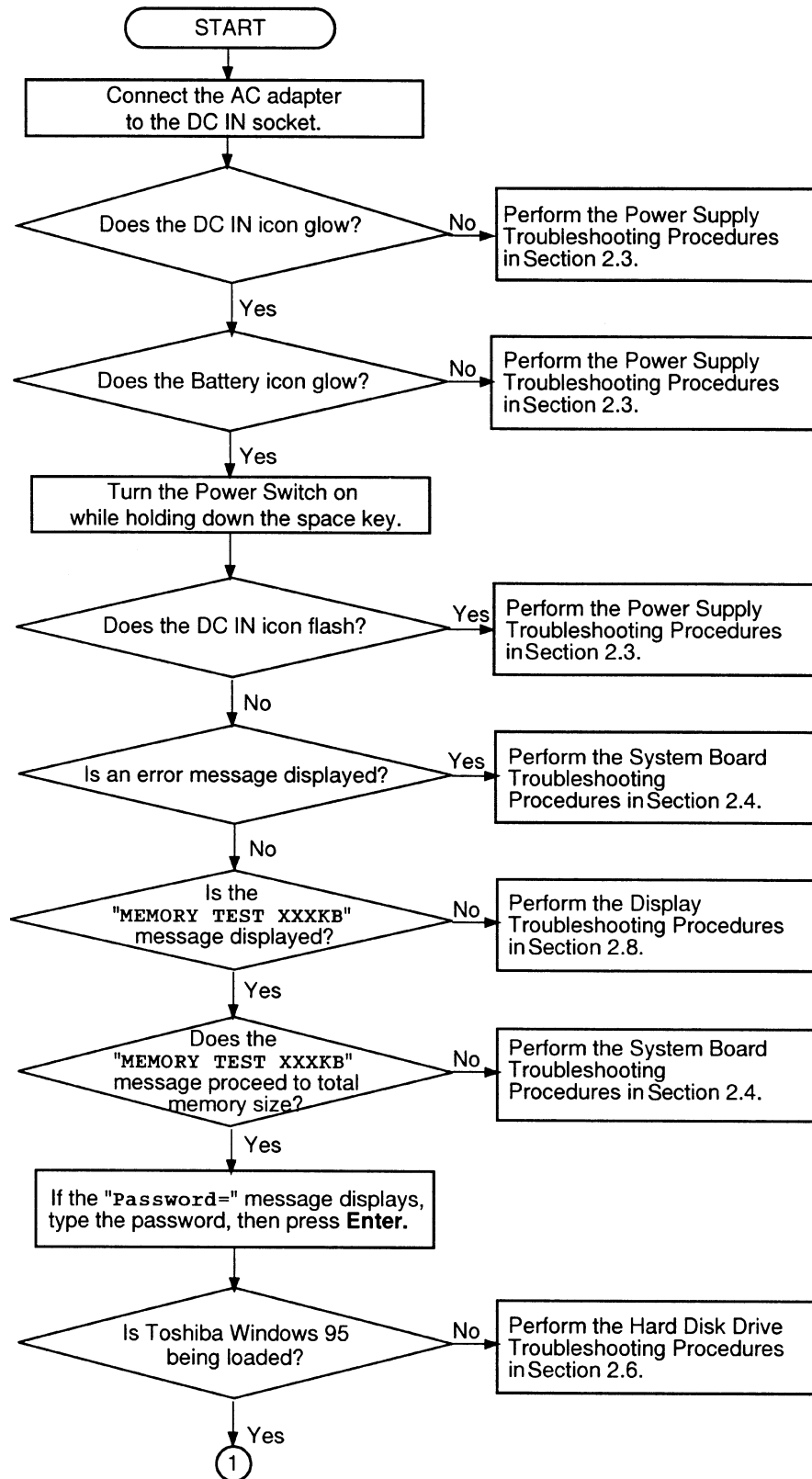


Figure 2-1 Troubleshooting flowchart (1/2)

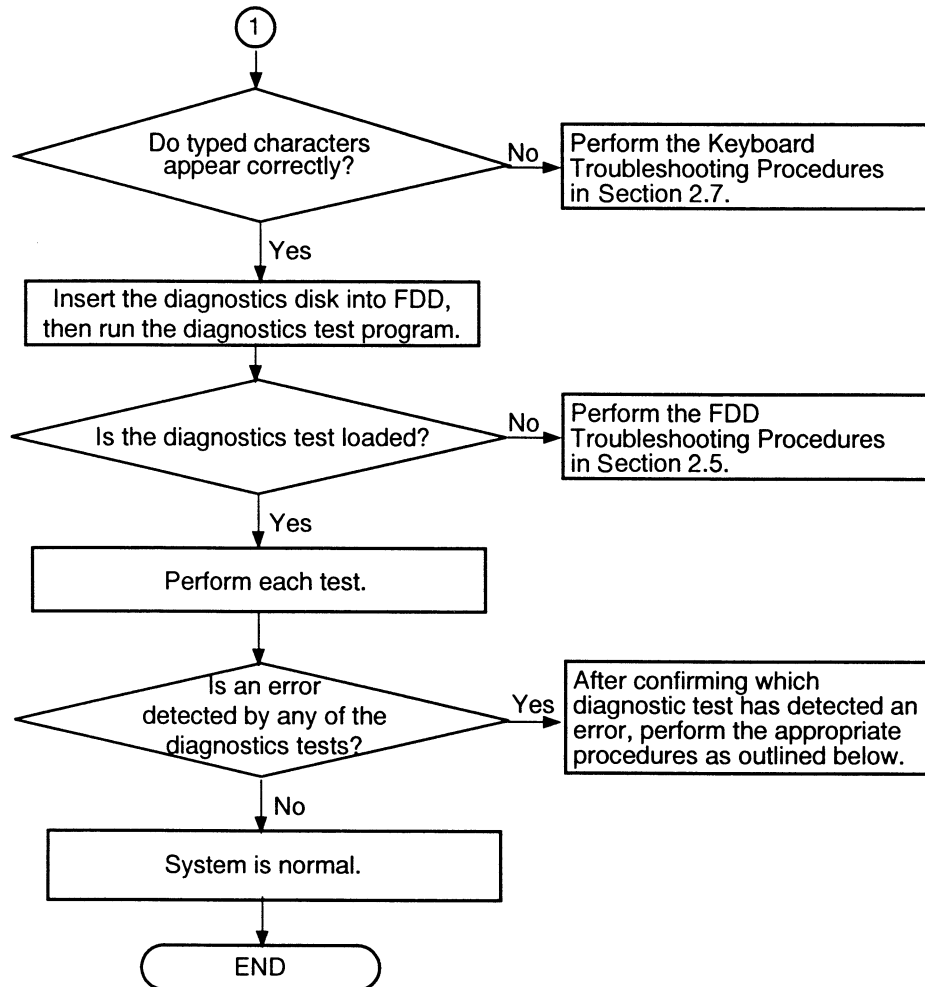


Figure 2-1 Troubleshooting flowchart (2/2)

If the diagnostics program cannot detect an error, the problem may be intermittent. The Running Test program should be executed several times to isolate the problem.

Check the Log Utilities function to confirm which diagnostic test detected an error(s), then perform the appropriate troubleshooting procedures as follows:

1. If an error is detected on the system test, memory test, display test, ASYNC test, printer test, expansion test, sound test, or real timer test do the System Board troubleshooting procedures in Section 2.4.
2. If an error is detected on the floppy disk test, do the FDD troubleshooting procedures in Section 2.5.
3. If an error is detected on the hard disk test, do the Hard Disk Drive troubleshooting procedures in Section 2.6.
4. If an error is detected on the keyboard test, do the Keyboard troubleshooting procedures in Section 2.7.
5. If an error is detected on the display test, do the Display troubleshooting procedures in Section 2.9.

2.3 Power Supply Troubleshooting

The power supply controls many functions and components. To determine if the power supply is functioning properly, start with Procedure 1 and continue with the other Procedures as instructed. The procedures described in this section are:

Procedure 1: Power Status Check

Procedure 2: Error Code Check

Procedure 3: Connection Check

Procedure 4: Replacement Check

Procedure 1 Power Status Check

The following icons indicate the power supply status:

- Battery icon
- DC IN icon

The power supply controller displays the power supply status through the Battery and the DC IN icons as shown in the tables below.

Table 2-1 Battery icon

Battery icon	Power supply status
Lights orange	Quick charge ^{*1}
Lights green	Battery has a full charge and the AC adapter is connected
Blinks orange (even intervals)	The battery level becomes low while operating the computer on battery power ^{*2}
Doesn't light	Any condition other than those above. If the battery becomes too hot, charging will stop and the battery icon will go out even if the AC adapter is connected

*1 One of two battery levels becomes low.

*2 AutoResume Off will be executed soon.

Table 2-2 DC IN icon

DC IN icon	Power supply status
Lights green	DC power is being supplied from the AC adapter
Blinks orange	Power supply malfunction ^{*3}
Blinks green	Stand-by state
Doesn't light	Any condition other than those above

*3 When the power supply controller detects a malfunction, the DC IN icon blinks and an error code is displayed.

To check the power supply status, install a battery pack and connect an AC adapter.

Check 1 If the DC IN icon flashes orange, go to Procedure 2.

Check 2 If the DC IN icon does not light, go to Procedure 3.

Check 3 If the Battery icon does not light orange or green, go to Procedure 4.

CAUTION: Use only an AC adapter that is manufactured specifically for the Libretto 50CT/70CT. If you use a different AC adapter, the computer's power supply may malfunction or a fuse on the system board may be blown.

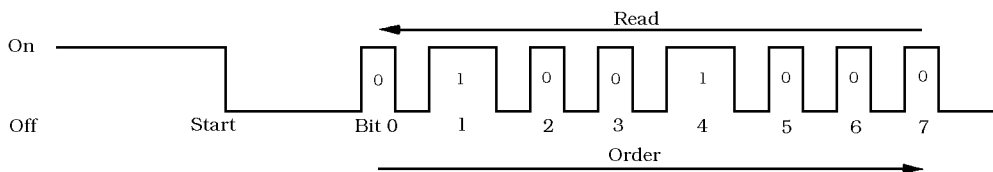
Procedure 2 Error Code Check

If the microprocessor detects a malfunction, the DC IN icon blinks orange. The blink pattern indicates an error as shown below.

- Start Off for 2 seconds
- Error code (8 bit)
 - “1” On for one second
 - “0” On for half second
 - Interval between data bits Off for half second

Error codes begin with the least significant digit. For example:

Error code 12h (Error codes are given in hexadecimal)



Check 1 Convert the DC IN icon blink pattern into the hexadecimal error code and compare it to the tables below.

- DC power supplied through AC adapter

Error code	Meaning
01h	AC adapter voltage is over the limit (16.5 V)

Battery pack

Error code	Meaning
10h	Battery voltage is over the limit
11h	Battery charge current is over the limit
12h	Battery discharge current is over the maximum allowed limit when there is no load
13h	Battery voltage is under the limit

 B5V,VCC output

Error code	Meaning
20h	VCC voltage is over the limit
21h	VCC voltage is under the limit
22h	VCC does not start up when power supply is turned on

 B3V output

Error code	Meaning
30h	B3V voltage is over the limit
31h	B3V voltage is under the limit
33h	B3V does not start up when the power supply is turned on

 Power supply microcontroller

Error code	Meaning
50h	Firmware or program error

 CPU environmental condition

Error code	Meaning
80h	CPU temperature is outside the allowable range
88h	CPU overheat (The CPU heat sensor has detected overheating and has automatically shut down)

Check 2 If error code 01h displays:

- Be sure the AC adapter is firmly connected to the computer DC IN socket and to the power source. If these cables are connected correctly, go to the following step:
- Replace the AC adapter with a new one.

If the error still exists, go to Procedure 4.

Check 3 If error code 10h displays:

- Make sure the battery pack is correctly installed in the computer.

If it is, go to the following step:

- Replace the battery pack with a new one.

If the error still exists, go to Procedure 4.

Check 4 When 88h displays, it indicates that the CPU temperature is outside the allowable operating range. Do the following:

- Leave the computer in an area that is about room temperature until the CPU's internal temperature is within the allowable operating range.

If the error still exists, go to Procedure 4.

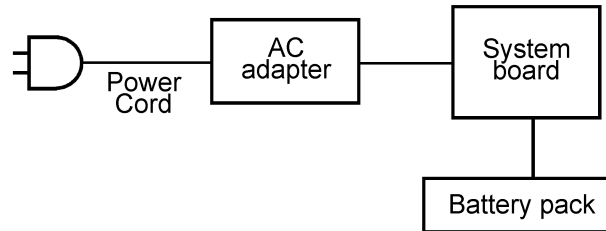
Check 5 If error code 11h displays:

- Go to Procedure 3.

Check 6 For any other error, go to Procedure 4.

Procedure 3 Connection Check

The power supply related wiring diagrams are shown below:



Any of the connectors may be disconnected. Go to Check 1.

Check 1 Make sure the AC adapter is firmly connected to the computer's DC IN socket and to a power source. If these cables are connected correctly, go to Check 2.

Check 2 Replace the AC adapter with a new one. If the DC IN icon does not glow green, go to Procedure 4.

Procedure 4 Replacement Check

The AC adapter may be disconnected or damaged. Disassemble the computer following the steps described in Chapter 4, *Replacement Procedures*. After checking the connection, do the following checks:

Check 1 Replace the AC adapter with a new one. If the problem still exists, go to Check 2.

Check 2 Replace the system board with a new one. Refer to Chapter 4 for instructions on how to remove and replace the system board.

2.4 System Board Troubleshooting

This section describes how to determine if the system board is defective or not functioning properly. Start with Procedure 1 and continue with the other procedures as instructed. The procedures described in this section are:

Procedure 1: Message Check

Procedure 2: Printer Port LED Check in Boot Mode

Procedure 3: Printer Port LED Check in Hibernation Mode

Procedure 4: Diagnostic Test Program Execution and Replacement Checks

Procedure 5: Connection Check

Procedure 1 Message Check

When the power is turned on, the system performs the Initial Reliability Test (IRT) installed in the BIOS ROM. The IRT tests each IC on the system board and initializes it.

- If an error message is shown on the display, perform Check 1.
- If there is no error message, go to Procedure 2.
- If Toshiba MS-DOS or Toshiba Windows 95 is properly loaded, go to Procedure 3.

Check 1 If one of the following error messages displays on the screen, press the **F1** key as instructed. These errors occur when the system configuration preserved in the RTC memory (CMOS type memory) is not the same as the actual configuration or when the data is lost.

Press the **F1** key as the message instructs and the TSETUP screen displays to set the system configuration. If error message (b) displays often when the power is on, replace the RTC battery. If any other error message displays, do Check 2.

- (a) *** Bad HDD type ***
Check system. Then press [F1] key
- (b) *** Bad RTC battery ***
Check system. Then press [F1] key
- (c) *** Bad configuration ***
Check system. Then press [F1] key
- (d) *** Bad memory size ***
Check system. Then press [F1] key
- (e) *** Bad time function ***
Check system. Then press [F1] key
- (f) *** Bad check sum (CMOS) ***
Check system. Then press [F1] key
- (g) *** Bad check sum (ROM) ***
Check system. Then press [F1] key

Check 2 If the following error message displays on the screen, press any key.

```
WARNING:  CAN'T RESTORE HIBERNATED STATE.  
PRESS ANY KEY TO CONTINUE.
```

This error message displays when the HDD has a bad sector in the area where the Hibernation data was stored or when the system board is faulty. Go to Procedure 4.

***NOTE:** If necessary, you can bypass Hibernation by pressing the backspace key while you power on the computer. The computer will start up in boot mode.*

If any other message displays, go to Check 3.

Check 3 The IRT checks the system board. When the IRT detects an error, the system stops or an error message displays.

If one of the following error messages (1) through (17), (24) or (25) displays, replace the system board.

If error message (18) displays, go to the Keyboard Troubleshooting Procedures in Section 2.7.

If error message (19), (20) or (21) displays, go to the HDD Troubleshooting Procedures in Section 2.6.

If error message (22) or (23) displays, go to the FDD Troubleshooting Procedures in Section 2.5.

- (1) PIT ERROR
- (2) TIMER CH.2 OUT ERROR
- (3) MEMORY REFRESH ERROR
- (4) FIRST 64KB MEMORY ERROR
- (5) CRT ERROR
- (6) CRTIC ERROR
- (7) KBC ERROR
- (8) VRAM ERROR
- (9) SYSTEM MEMORY ERROR
- (10) SYSTEM MEMORY PARITY ERROR
- (11) EXTENDED MEMORY ERROR
- (12) EXTENDED MEMORY PARITY ERROR
- (13) DMA PAGE REGISTER ERROR
- (14) DMAC #1 ERROR
- (15) DMAC #2 ERROR
- (16) PIC #1 ERROR

- (17) PIC #2 ERROR
- (18) KB ERROR
- (19) HDC ERROR
- (20) HDD #0 ERROR
- (21) HDD #1 ERROR
- (22) NO FDD ERROR
- (23) FDC ERROR
- (24) TIMER INTERRUPT ERROR
- (25) RTC UPDATE ERROR

Procedure 2 Printer Port LED Check in Boot Mode

The printer port LED displays the IRT status and test status by turning lights on and off as an eight-digit binary value for boot mode. Figure 2-2 shows the printer port LED.

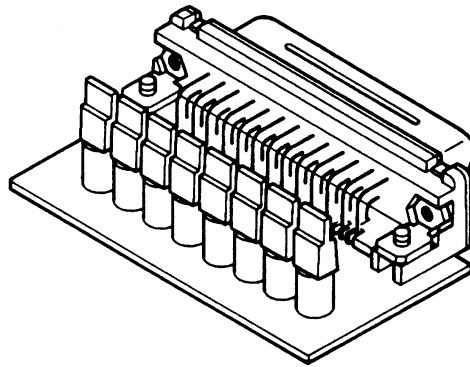


Figure 2-2 Printer port LED

To use the printer port LED follow these steps:

1. Plug the printer port LED into the computer's parallel port.
2. Hold the space bar down and turn the computer on.
3. Read the LED status from left to right as you are facing the back of the computer.
4. Convert the status from binary to hexadecimal notation.
5. If the final LED status is FFh (normal status), go to Procedure 3.
6. If the final LED status matches any of the test status values in Table 2-3, do Check 1.

NOTE: If an error condition is detected by the IRT test, the printer port LED displays an error code after the IRT test ends. For example, when the printer port LED displays 1F and halts, the IRT test has already completed the Display initialization. In this instance, the IRT indicates an error has been detected during the system memory test.

Table 2-3 Printer port LED boot mode status (1/2)

LED status	Test item	Message
00H	KBC initialization	—
	ROM Check	—
02H	PIT test	PIT ERROR
	PIT initialization	—
	PIT function check	MEMORY REFRESH ERROR TIMER CH.2 OUT ERROR
03H	CMOS check	CMOS CHECKSUM ERROR CMOS BAD BATTERY ERROR
	KB initialization	—
04H	Initialization of memory configuration	—
05H	SM-RAM check	—
06H	ROM/RAM copy	—
07H	Selftest skip check	—
	Read PS Information	—
08H	Initialization of internal VGA	
0AH	First 64 KB memory test	FIRST 64KB MEMORY ERROR FIRST 64KB MEMORY PARITY ERROR
0BH	System memory clear	—
0CH	System clear	—
0DH	Interrupt vector initialization	—
18H	PIC initialization	—
1FH	Display initialization	VRAM ERROR
25H	System memory test	SYSTEM MEMORY ERROR SYSTEM MEMORY PARITY ERROR
30H	Extended memory test	EXTENDED MEMORY ERROR EXTENDED MEMORY PARITY ERROR
40H	DMA page register test	DMA PAGE REGISTER ERROR
41H	DMAC test	DMAC #X ERROR

Table 2-3 Printer port LED boot mode status (2/2)

LED status	Test item	Message
42H	DMAC initialization	—
4AH	PIC test	PIC #X ERROR
	Mouse initialization	—
55H	KBC initialization	KBC ERROR
60H	HDD initialization	HDC ERROR/HDD #0 ERROR
65H	FDD initialization	FDC ERROR/NO FDD ERROR
70H	Printer initialization	—
80H	SIO initialization	—
90H	Timer initialization	RTC UPDATE ERROR TIMER INTERRUPT ERROR
A0H	NDP initialization	—
A6H	Initialization of expansion ROM	—
C0H	Password check	—
FEH	Setup boot check	*** Bad xxxx xxxx *** Check system. Then press [F1] key.
	Boot load	—

Check 1 If the following error codes display, go to Procedure 5.

00h, 02h, 03h, 04h, 05h, 06h, 07h, 08h, 0Ah, 0Bh, 0Ch, 0Dh, 18h,
1Fh, 25h, 30h, 40h, 41h, 42h, 55h, 65h, 70h, 80h, 90h, A0h, A6h

Check 2 If error code 4AH displays, go to the Keyboard Troubleshooting procedures in Section 2.7

Check 3 If error code 55H displays, go to the HDD Troubleshooting Procedures in Section 2.6.

Check 4 If error code 60H displays, go to the FDD Troubleshooting Procedures in Section 2.5.

Procedure 3 Printer Port LED Check in Hibernation Mode

The printer port LED displays the IRT status and test status by turning lights on and off as an eight-digit binary value for Hibernation mode.

To use the printer port LED follow these steps:

1. Be sure the computer is in Hibernation mode.
2. Plug the printer port LED into the computer's parallel port.
3. Turn the computer on.
4. Read the LED status from left to right as you face the back of the computer.
5. Convert the status from binary to hexadecimal notation.
6. If the final LED status is FFh (normal status), go to Procedure 4.
7. If the final LED status matches any of the test status values in Table 2-4, go to Procedure 5.

Table 2-4 Printer port LED Hibernation mode error status

Error status	Meaning of status
F1H	System BIOS RAM checksum error
F2H	Optional ROM or Optional Card (CGA,MDA) is connected
F7H	Extended memory checksum error
E1H	Instant on error (extended memory checksum error)

Procedure 4 Diagnostic Test Program Execution and Replacement Checks

Execute the following tests from the Diagnostic Test Menu. Refer to Chapter 3, *Tests and Diagnostics*, for more information on how to perform these tests.

- System test (1)
- Memory test (2)
- Printer test (6)
- ASYNC test (7)
- Real Timer test (9)
- NDP test (10)
- Expansion test (11)
- Sound test (12)

If an error is detected during these tests, replace the System Board with a new one. If the problem still exists, go to Procedure 5.

Procedure 5 Connection Check

Check each cable connection shown in Figure 2-3, then retry the computer's operation. If the problem still exists, another I/O interface may be faulty.

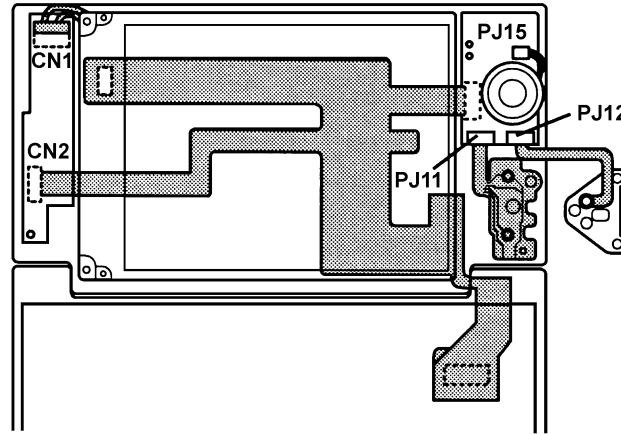


Figure 2-3 Cable connection diagram

2.5 Floppy Disk Drive (FDD) Troubleshooting

This section describes how to determine if the 3.5-inch FDD is functioning properly. Perform the steps below starting with Procedure 1 and continuing with the other procedures as required.

Procedure 1: FDD Head Cleaning Check

Procedure 2: Diagnostic Test Program Execution Check

Procedure 3: Connector Check and Replacement Check

Procedure 1 FDD Head Cleaning Check

FDD head cleaning is one option available in the Diagnostic Program. Detailed operation is given in Chapter 3, *Tests and Diagnostics*.

Insert the Diagnostics disk in the computer's floppy disk drive, turn on the computer, and run the test; then clean the FDD heads using the cleaning kit. If the FDD still does not function properly after cleaning, go to Procedure 2.

If the test program cannot be executed on the computer, go to Procedure 2.

Procedure 2 Diagnostic Test Program Execution Check

Insert the diagnostics disk into the FDD, turn on the computer, and run the test. Refer to Chapter 3, *Tests and Diagnostics*, for more information about the diagnostics test procedures.

Floppy disk drive test error codes and their status names are listed in Table 2-5. Be sure the floppy disk in the FDD is formatted correctly and that the write protect tab is disabled. If any other errors occur while executing the FDD diagnostics test, go to Check 1.

Table 2-5 FDD error codes and statuses

Code	Status
01h	Bad command
02h	Address mark not found
03h	Write protected
04h	Record not found
06h	Media removed on dual attach card
08h	DMA overrun error
09h	DMA boundary error
10h	CRC error
20h	FDC error
40h	Seek error
60h	FD not in drive
80h	Time out error (Not ready)

EEh	Write buffer error
-----	--------------------

- Check 1 If the following message is displayed, disable the write protect tab on the floppy disk. If any other message displays, perform Check 2.

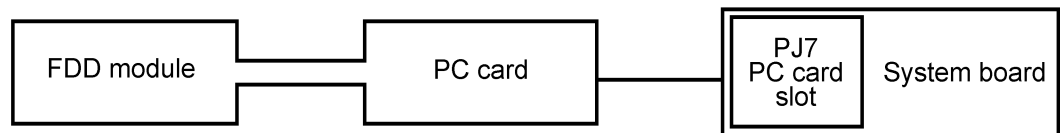
Write protected

- Check 2 Make sure the floppy disk is formatted correctly. If it is, go to Procedure 3.

Procedure 3 Connector Check and Replacement Check

The FDD, cable, and PC card is a single unit. Install the PC card in the computer, then begin with Check 1 below.

- Check 1 Make sure the PC card is properly connected to the system board.



If the connection is loose, reinstall the PC card and repeat Procedure 2. If there is still an error, go to Check 2.

- Check 2 The FDD may be defective or damaged. Replace the FDD with a new one. If the FDD is still not functioning properly, perform Check 3.
- Check 3 Replace the system board with a new one following the steps in Chapter 4, *Replacement Procedures*.

2.6 Hard Disk Drive (HDD) Troubleshooting

To determine if the hard disk drive is functioning properly, do the procedures below starting with Procedure 1. Continue with the other procedures as instructed.

Procedure 1: Partition Check

Procedure 2: Message Check

Procedure 3: Format Check

Procedure 4: Diagnostic Test Program Execution Check

- NOTES:**
- 1. The contents of the hard disk will be erased when the HDD troubleshooting procedures are executed. Transfer the contents of the hard disk to floppy disk or other device. If the customer has not or cannot perform the backup, create backup disks as described below.*
 - 2. Check to see if the Microsoft Create System Disks Tools (MSCSD.EXE) still exists in the System Tools Folder. (This tool can be used only once.) If it exists, use it to back up the preinstalled software, then use the Backup utility in the System Tools folder to back up the entire disk, including the user's files.*

Refer to the operating system instructions.

Procedure 1 Partition Check

Insert the Toshiba MS-DOS system disk, turn the computer on, then perform the following checks:

- Check 1 Type **C:** and press **Enter**. If you cannot change to drive C, go to Check 2. If you can, go to Procedure 2.
- Check 2 Type **FDISK** and press **Enter**. Choose Display Partition Information from the FDISK menu. If drive C is listed, go to Check 3. If not, return to the FDISK menu and choose the option to create a DOS partition on drive C. Recheck the system. If the problem still exists, go to Procedure 2.
- Check 3 If drive C is listed as active in the FDISK menu, go to Check 4. If not, return to the FDISK menu and choose the option to set the active partition for drive C. Recheck the system. If the problem still exists, go to Procedure 2.
- Check 4 Remove the system disk from the FDD and cold-boot the computer. If the problem still exists, go to Procedure 2. Otherwise, the HDD is operating normally.

Procedure 2 Message Check

When the HDD does not function properly, some of the following error messages may appear on the display. Start with Check 1 below and perform the other checks as instructed.

Check 1 If any of the following messages display, go to Check 5. If not, go to Check 2:

```
HDD ERROR
or
HDD #x ERROR
(After 5 seconds this message will disappear.)
```

Check 2 If either of the following messages displays go to Check 3. If not, go to check 5.

```
Insert system disk in drive
Press any key when ready .....

or

Non-System disk or disk error
Replace and press any key
```

Check 3 Use the Toshiba MS-DOS system disk to install a system program on the hard disk, using the SYS command.

If the following message displays, the system program has been transferred to the HDD. Restart the computer. If the error message still displays, go to Check 4.

```
System transferred
```

Check 4 If the HDD is firmly connected to the system board, go to Check 5.

Check 5 The HDD connector may be defective or damaged. Replace the HDD connector with a new one following the steps in Chapter 4, *Replacement Procedures*. If the HDD is still not functioning properly, go to Procedure 3.

Procedure 3 Format Check

The HDD is formatted using the low level format program and the MS-DOS FORMAT program. To format the HDD, start with Check 1 below and do the other steps as required.

Check 1 Format the hard disk using **FORMAT C:/S/U** to transfer the system program to the HDD. If the following message displays, the HDD is formatted.

```
Format complete
```

If any other error message displays, refer to the Toshiba MS-DOS Manual for more information and do Check 2.

- Check 2 Use the Toshiba MS-DOS system disk to partition the hard disk, using the FDISK command.
- Check 3 Using the Diagnostic Disk, format the HDD with a low level format option. Refer to Chapter 3, *Tests and Diagnostics* for more information about the diagnostics program.

If the following message displays, the HDD low level format is complete. Partition and format the HDD using the MS-DOS FORMAT command.

```
Format complete
```

If you cannot format the HDD using the Tests and Diagnostics program, go to Procedure 4.

Procedure 4 Diagnostic Test Program Execution Check

The HDD test program is stored on the Diagnostics Disk. Do all of the HDD tests in the Hard Disk Drive Test. Refer to Chapter 3, *Tests and Diagnostics*, for more information about the HDD test program.

If an error is detected during the HDD test, an error code and status will display; do Check 1. The error codes and statuses are listed in Table 2-6. If an error code is not generated, the HDD is operating properly.

Table 2-6 Hard disk drive error codes and statuses

Code	Status
01h	Bad command
02h	Bad address mark
03h	Write Protected
04h	Record not found
06h	HDC not reset
08h	DMA overrun error
09h	DMA boundary error
10h	CRC error
20h	FDC error
40h	Seek error
60h	FD not in drive
80h	Time out error
EEh	Write Buffer error
FFh	Data compare error

- Check 1 Replace the HDD unit with a new one following the instructions in Chapter 4, *Replacement Procedures*. If the HDD is still not functioning properly, do Check 2.
- Check 2 Replace the system board with a new one following the instructions in Chapter 4.

2.7 Keyboard Troubleshooting

This section describes how to determine if the keyboard is functioning properly. To troubleshoot the keyboard, start with Procedure 1 and continue with the other procedure as instructed.

The procedures described in this section are:

Procedure 1: Diagnostic Test Program Execution Check

Procedure 2: Connector and Replacement Check

Procedure 1 Diagnostic Test Program Execution Check

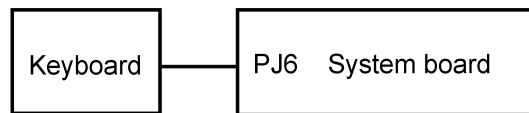
Execute the Keyboard Test in the Diagnostic Program. Refer to Chapter 3, *Tests and Diagnostics*, for more information on how to perform the test program.

If an error occurs, go to Procedure 2. If an error does not occur, the keyboard is functioning properly.

Procedure 2 Connector and Replacement Check

The keyboard is connected to the system board by flat cables. These cables or connectors may be disconnected or damaged. If there is a problem with the keyboard, disassemble the computer as described in Chapter 4, *Replacement Procedures*, and do Check 1.

Check 1 Be sure the following cables are not damaged and are connected to the system board.



If the cables are damaged, replace the keyboard with a new one. If the cable is disconnected, firmly connect it. Do Procedure 1 again. If the error still exists, go to Check 2.

Check 2 The system board may be damaged. Replace the system board with a new one. Refer to Chapter 4 for more information.

2.8 Pointing Device Troubleshooting

This section describes how to determine if the pointing device is functioning properly. To troubleshoot the pointing device, start with procedure 1 and continue with the other procedure as instructed.

Procedure 1: Diagnostic Test Program Execution Check

Procedure 2: Connector and Replacement Check

Procedure 1 Diagnostic Test Program Execution Check

Execute the Pointing Device Test in the Diagnostic Program. Refer to Chapter 3, *Tests and Diagnostics*, for information on how to do the test program. If an error occurs, go to Procedure 2. If an error does not occur, the pointing device is functioning properly.

Procedure 2 Connector and Replacement Check

The pointing device is connected to the system board by flat cables. These cables or connectors may be disconnected or damaged. If there is a problem with the pointing device, disassemble the computer as described in Chapter 4, *Replacement Procedures*, and do Check 1.

Check 1 The AccuPoint board or flat cables may be damaged. Replace the AccuPoint board or flat cables with new ones.

2.9 Display Troubleshooting

This section describes how to determine if the display is functioning properly. Start with Procedure 1 and continue with other procedures as instructed.

Procedure 1: Diagnostic Test Program Execution Check

Procedure 2: Connector Check

Procedure 3: Replacement Check

Procedure 1 Diagnostic Test Program Execution Check

The Display Test program is stored on the Diagnostics Disk. This program checks the display controller on the system board. Insert the Diagnostics disk into the floppy disk drive, turn on the computer, and run the test. Refer to Chapter 3, *Tests and Diagnostics*, for details.

If an error is detected, go to Procedure 3. If an error is not detected, the display is functioning properly.

Procedure 2 Connector Check

The Display unit has an LCD module, FL, and FL inverter board.

Disassemble the display unit and check the cable connections. Refer to Chapter 4, *Replacement Procedures*, for more information about how to disassemble the computer.

If any cable is not connected, firmly reconnect it and repeat Procedures 1 and 2. If the problem still exists, go to Procedure 4.

Procedure 3 Replacement Check

The FL, FL inverter board, LCD module, LCD flat cable, and system board are connected to the display circuits. Any of these components may be damaged. Refer to Chapter 4, *Replacement Procedures*, for instructions on how to disassemble the computer and then do the following checks:

If the FL does not light, go to Check 4.

If characters are not displayed clearly, go to Check 3.

If some screen functions do not operate properly, go to Check 3.

Check 1 Replace the LCD flat cable with a new one and test the display again. If the problem still exists, go to Check 2.

- Check 2 Replace the LCD module with a new one and test the display again. If the problem still exists, go to Check 3.
- Check 3 Replace the FL inverter board with a new one and test the display again. If the problem still exists, go to Check 4.
- Check 4 Replace the FL with a new one and test the display again. If the problem still exists, go to Check 5.
- Check 5 The system board may be damaged. Replace the system board with a new one.

Chapter 3

Tests and Diagnostics

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3.1 The Diagnostic Test

This chapter explains how to use the Diagnostic Test Program to test the functions of the computer hardware modules. The Diagnostics Program is stored on the diagnostics disk.

NOTES: To start the diagnostics, follow these steps:

1. Check all cables for loose connections.
2. Exit any application you may be using and close Windows.

The DIAGNOSTICS MENU consists of the following functions:

- DIAGNOSTIC TEST
- HARD DISK FORMAT
- HEAD CLEANING
- LOG UTILITIES
- RUNNING TEST
- FDD UTILITIES
- SYSTEM CONFIGURATION
- EXIT TO MS-DOS
- SETUP

The DIAGNOSTIC TEST MENU contains the following functional tests:

- SYSTEM TEST
- MEMORY TEST
- KEYBOARD TEST
- DISPLAY TEST
- FLOPPY DISK TEST
- PRINTER TEST
- ASYNC TEST
- HARD DISK TEST
- REAL TIMER TEST
- NDP TEST
- EXPANSION TEST
- SOUND TEST

You will need the following equipment to perform some of the Diagnostic test programs.

- Diagnostics Disk (all tests)
- Formatted working disk for the floppy disk drive test
- External FDD
- Cleaning kit to clean the floppy disk drive heads (Head Cleaning)
- PC card wraparound connector (PCMCIA test)
- Serial port wraparound connector (RS-232C test)
- Parallel port wraparound connector (Printer test)
- I/O Adapter
- Serial port direct cable

The following sections detail the tests within the Diagnostic Test function of the DIAGNOSTIC TEST MENU. Refer to Sections 3.19 through 3.24 for detailed information on the remaining Service Program Module functions.

3.2 Executing the Diagnostic Test

Toshiba MS-DOS is required to run the Diagnostics Program. To start the Diagnostics Program follow these steps:

1. Connect a wraparound connector to the I/O adapter printer port and RS-232C port. Connect the I/O adapter to the computer. Next, connect the FDD and insert the diskette containing the test program.
2. Turn the computer on to execute the test program and the test menu will display.

The following menu displays:

```
TOSHIBA personal computer xxx DIAGNOSTICS
version X.XX (c) copyright TOSHIBA Corp. 19XX

DIAGNOSTICS MENU :

1 - DIAGNOSTIC TEST
2 - HARD DISK FORMAT
3
4 - HEAD CLEANING
5 - LOG UTILITIES
6 - RUNNING TEST
7 - FDD UTILITIES
8 - SYSTEM CONFIGURATION
9 - EXIT TO MS-DOS
0 - SETUP
```

```
↑↓→← : Select items
Enter  : Specify
Esc    : Exit
```

NOTE: To exit the **DIAGNOSTIC TEST MENU**, press the **Esc** key. If a test program is in progress, press **Ctrl + Break** to exit the test program or press **Ctrl + C** to stop the test program.

3. To execute the Diagnostic Test Menu from the Diagnostics Menu, set the highlight bar to **1**, and press **Enter**. The following Diagnostic Test Menu displays:

```
TOSHIBA personal computer xxx DIAGNOSTICS
version X.XX (c) copyright TOSHIBA Corp. 19XX
```

```
DIAGNOSTIC TEST MENU :
```

```
1 - SYSTEM TEST
2 - MEMORY TEST
3 - KEYBOARD TEST
4 - DISPLAY TEST
5 - FLOPPY DISK TEST
6 - PRINTER TEST
7 - ASYNC TEST
8 - HARD DISK TEST
9 - REAL TIMER TEST
10 - NDP TEST
11 - EXPANSION TEST
12 - SOUND TEST
88 - ERROR RETRY COUNT SET [HDD & FDD]
99 - EXIT TO DIAGNOSTICS MENU
```

```
↑↓→← : Select items
Enter : Specify
Esc   : Exit
```

Refer to Sections 3.4 through 3.15 for detailed descriptions of Diagnostic Tests 1 through 12. Function 88 sets the floppy disk drive and hard disk drive error retry count. Function 99 exits the submenus of the Diagnostic Test and returns to the Diagnostics Menu.

4. Select the option you want to execute and press **Enter**. The following message displays:

SYSTEM TEST XXXXXXXX

```
xxx DIAGNOSTIC TEST VX.XX
[Ctrl]+[Break] ; test end
[Ctrl]+[C] ; key stop
```

SUB-TEST : XX

PASS COUNT: XXXXX ERROR COUNT: XXXXX

WRITE DATA: XX READ DATA : XX

ADDRESS : XXXXXX STATUS : XXX

SUB-TEST MENU :

01 - ROM checksum

02 -

03 -

04 - Fan ON/OFF

05 -

06 -

07 - DMI read

08 - DMI write

99 - Exit to DIAGNOSTIC TEST MENU

↑↓→← : Select items
 Enter : Specify
 Esc : Exit

NOTE: The menu displayed by your computer may be slightly different from the one shown above.

5. Select the desired subtest number from the subtest menu and press **Enter**. The following message displays:

TEST LOOP : YES

Error Stop : YES

Select **YES** for **TEST LOOP** to set the test to run continuously until it is halted by the user. Select **NO** to return to the main menu after the test is complete.

Select **YES** for **ERROR STOP** to stop the test program when an error is found and display the operation guide on the right side of the display screen as shown below:

ERROR STATUS NAME [[HALT OPERATION]]

1: Test end

2: Continue

3: Retry

These three selections have the following functions respectively:

1. Terminates the test program and exits to the subtest menu.
2. Continues the test.
3. Restarts the test from the error.

Use the arrow keys to move the cursor to the desired option and press **Enter**.

Select **NO** for **ERROR STOP** to keep the test running even if an error is found.

Table 3-1 in Section 3.3 lists the function of each test on the subtest menu. Table 3-2 in Section 3.16 lists the codes and statuses for each error.

3.3 Subtest Names

Table 3-1 lists the subtest names for each test program on the Diagnostic Test Menu.

Table 3-1 Subtest names (1/2)

No.	Test name	Subtest No.	Subtest item
1	SYSTEM	01	ROM checksum
2	MEMORY	01	RAM constant data
		02	RAM address pattern data
		03	RAM refresh
		04	Protected mode
		05	Memory module
		06	Cache memory
3	KEYBOARD	01	Pressed key display
		02	Not used
		03	PS/2 mouse connect check
		04	Pointing stick
4	DISPLAY	01	VRAM read/write for VGA
		02	Gradation for VGA
		03	Gradation for LCD
		04	Gradation & mode test for VGA
		05	All dots on/off for LCD
		06	"H" pattern display
5	FDD	01	Sequential read
		02	Sequential read/write
		03	Random address/data
		04	Write specified address
		05	Read specified address
6	PRINTER	01	Ripple pattern
		02	Function
		03	Wraparound

Table 3-1 Subtest names (2/2)

No.	Test name	Subtest No.	Subtest item
7	ASYNC	01	Wraparound (board)
		02	Point to point (send)
		03	Point to point (receive)
		04	Interrupt test
		05	Infra_red wrap_around test
		06	Infra_red transmit mode
		07	Infra_red receive mode
8	HDD	01	Sequential read
		02	Address uniqueness
		03	Random address/data
		04	Cross talk & peak shift
		05	Write/read/compare (CE)
		06	Write specified address
		07	Read specified address
		08	ECC circuit
		09	Sequential write
		10	W-R-C specified address
9	REAL TIMER	01	Real time
		02	Backup memory
		03	Real time carry
10	NDP	01	NDP test
11	EXPANSION	01	PCMCIA wraparound
12	SOUND	01	FM synthesizer
		02	SINE-wave playback

3.4 System Test

To execute the System Test select **1** from the Diagnostic Test Menu, press **Enter** and follow the directions on the screen. The System Test contains one test that tests the system. Move the highlight bar to the subtest you want to execute and press **Enter**.

Subtest 01 ROM checksum

This subtest executes a checksum test of the BIOS ROM on the system board.

3.5 Memory Test

To execute the Memory Test select **2** from the Diagnostic Test Menu, press **Enter** and follow the directions on the screen. The Memory Test contains six subtests that test the computer's memory. Move the highlight bar to the subtest you want to execute and press **Enter**.

Subtest 01 RAM constant data (real mode)

This subtest writes a 256-byte unit of constant data to conventional memory (0 to 640 KB), then reads the new data and compares the result with the original data.

The constant data is FFFFh, AAAAh, 5555h, 0101h, and 0000h.

Subtest 02 RAM address pattern data (real mode)

This subtest writes address pattern data created by the exclusive-ORing (XORing), to the address segment and address offset in conventional memory (from program end to 640 KB), then reads the new data and compares the result with the original data.

Subtest 03 RAM refresh (real mode)

This subtest writes a 256-byte unit of constant data to conventional memory (0 to 640 KB), then reads the new data and compares the result with the original data.

The constant data is AAAAh and 5555h.

NOTE: *There is a short delay between write and read operations, depending on the size of the data.*

Subtest 04 Protected mode

This subtest writes constant data and address data to extended memory (maximum address 100000h), then reads the new data and compares the result with the original data.

Subtest 05 Memory module

***NOTE:** To execute this subtest, an optional memory card must be installed in the computer.*

This subtest functions the same as subtest 04, except it is used for testing an optional memory card. Memory module capacity is 8 MB or 16 MB.

After selecting subtest 05, the following message displays:

```
Extended memory size  
(1:8 MB, 2:16 MB)?
```

Select the number that corresponds to the memory card installed in the computer.

Subtest 06 Cache memory

To test the cache memory, a pass-through write-read comparison of '5A' data is run repeatedly to the test area ('7000':'Program' size to '7000':'7FFF' (32 KB)) to check the hit-miss ratio (on/off status) for CPU cache memory. One test takes 3 seconds.

Number of misses < Number of hits → OK
Number of misses ≥ Number of hits → Fail

3.7 Display Test

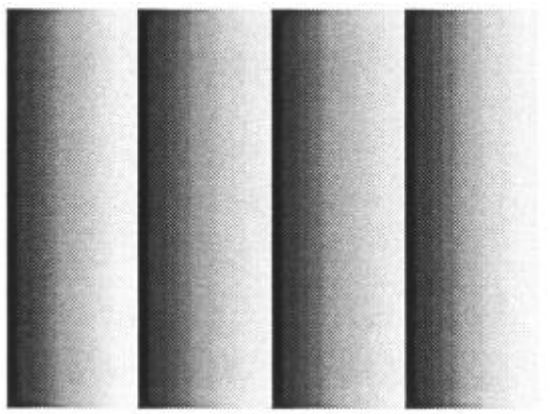
To execute the Display Test select **4** from the Diagnostic Test Menu, press **Enter** and follow the directions on the screen. The Display test contains six subtests that test the display in various modes. Move the highlight bar to the subtest you want to execute and press **Enter**.

Subtest 01 VRAM Read/Write for VGA

This subtest writes constant data AAh and 55h and address data to video RAM (2MB: A0000h-AFFFFh). This data is then read from the video RAM and compared to the original data.

Subtest 02 Gradation for VGA

This subtest displays four colors: red, green, blue, and white from left to right across the screen from black to maximum brightness. The image below displays on the screen when this subtest executes.



To exit this subtest and return to the DISPLAY TEST menu, press **Ctrl + Break**.

Subtest 03 Gradation for LCD

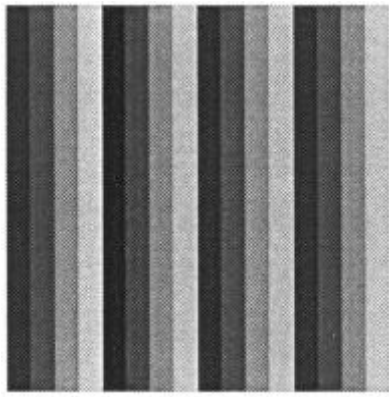
This subtest displays eight colors: red, semi-red, green, semi-green, blue, semi-blue, white, and semi-white. Each color displays full screen for three seconds.

Subtest 04 Gradation & mode test for VGA

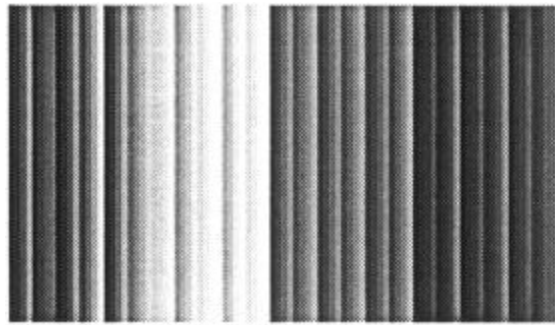
This subtest displays gradations for each mode. Execute the test, then press **Enter** to change the mode.

Resolution	Mode
640 x 480	3, 12, 13

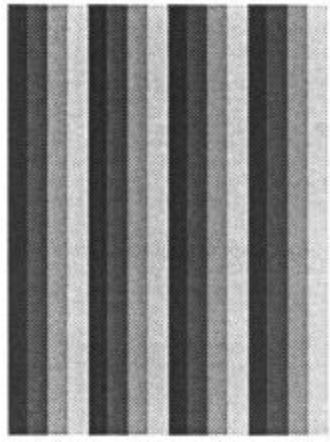
The image below displays on the screen when this subtest executes.



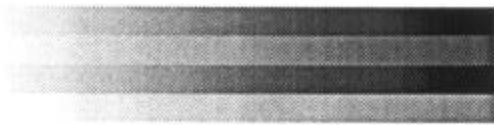
Pressing **Enter** changes the size of the displayed image.



Pressing **Enter** changes the size of the displayed image.



Pressing **Enter** changes the size of the displayed image.



Pressing **Enter** changes the size of the displayed image.

To exit this subtest and return to the DISPLAY TEST menu, press **Ctrl + Break**.

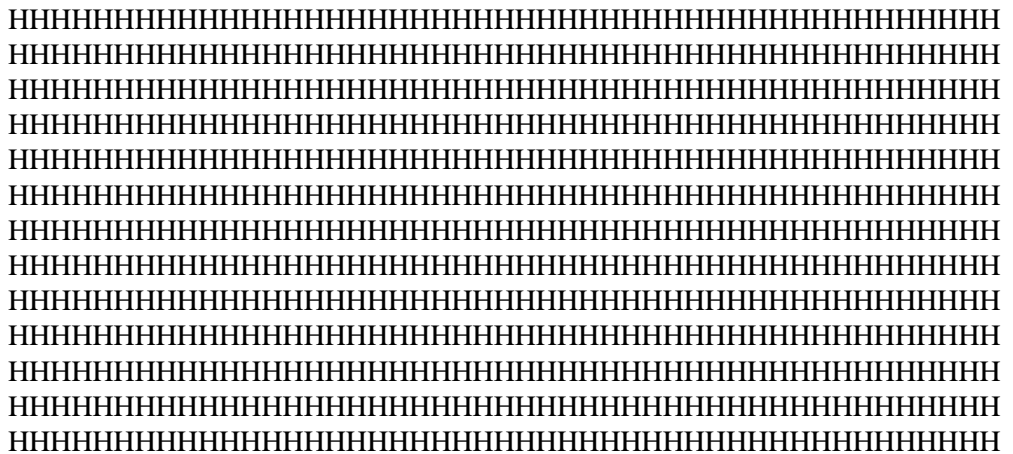
Subtest 05 All dots on /off for LCD

This subtest displays an all-white screen (all dots on) for three seconds then an all-black screen (all dots off) for three seconds.

To exit this subtest and return to the DISPLAY TEST menu, press **Ctrl + Break**.

Subtest 06 "H" pattern display

This subtest displays a full screen of "H" patterns.



To exit this subtest and return to the DISPLAY TEST menu, press **Ctrl + Break**.

3.8 Floppy Disk Test

NOTE: Before running the floppy disk test, prepare a formatted work disk. Remove the Diagnostics Disk and insert a work disk into the FDD. The contents of the floppy disk will be erased. Use one of the following commands depending on the FDD capacity:

FORMAT A:/F:720 2DD(720 KB)

FORMAT A:/F:1.44 2HD(1.44 MB)

To execute the Floppy Disk Test select **5** from the Diagnostic Test Menu, press **Enter** and follow the directions on the screen. The Floppy Disk test contains five subtests that test the FDD. To execute a test, enter an appropriate response to the messages that display after selecting the Floppy Disk Test.

1. Select the test drive number of the floppy disk drive to be tested and press **Enter**.

Test drive number select (1:FDD#1,2:FDD#2,0:FDD1&2) ?

2. Select the media type of the floppy disk in the test drive to be tested, and press **Enter**.

Media in drive #X mode (0:2DD,1:2D,2:2D-2HD/2DD,3:2HD) ?

If you enter **2** or **3**, the following message will display:

2HD Media mode (1:1.20MB:21.44MB) ?

3. Select the track you want the test to start on and press **Enter**. Simply pressing **Enter** sets the start track to zero.

Test start track (Enter:0/dd:00-79) ?

4. The floppy disk test menu displays after you select the start track number. Select the number of the subtest you want to execute and press **Enter**. The following message displays during the floppy disk test.

```
FDD          XXXXXXXX
SUB TEST    : XX
PASS COUNT  : XXXXX ERROR COUNT   : XXXXX
WRITE DATA : XX READ DATA   : XX
ADDRESS     : XXXXX STATUS    : XX
```

SUB-TEST MENU :

```
01 - Sequential read
02 - Sequential read/write
03 - Random address/data
04 - Write specified address
05 - Read specified address
99 - Exit to DIAGNOSTIC TEST MENU
```

Exit to DIAGNOSTIC TEST MENU

```
↑↓→←      : Select items
Enter      : Specify
Esc        : Exit
```

5. When you type in the subtest number and press **Enter**, the Diagnostics Menu will display (see Section 3.2), or an error message will display. Select subtest **01**, **02**, or **03** in step four above, and the diagnostic test will automatically begin. Select subtest **04** or **05** and the following lines will display, one after another:

```
Test data ?? (subtest 04 only)
Track No.
Head No.
```

After you enter the test data (subtest 04 only), track number, and head number, the test will automatically begin.

6. The following message displays during the FDD test.

```
FDD                                XXXXXXXX

SUB TEST      :  XX
PASS COUNT    :  XXXXX
WRITE DATA   :  XX
ADDRESS       :  XXXXX

Track No. _____
Head No.  _____
Sector No. _____

ERROR COUNT   :  XXXXX
READ DATA    :  XX
STATUS        :  XXX

Drive No. _____
Error status _____
```

Subtest 01 Sequential read

This subtest performs a Cyclic Redundancy Check (CRC), that continuously reads all the tracks on a floppy disk. The following tracks are read according to the media type in the floppy disk drive:

Double-sided, double-density (2D): Tracks 0 to 39.

Double-sided, double-density, double-track (2DD) and double-sided, high-density, double-track (2HD): Tracks 0 to 79.

The start track is specified when the FDD test is started from the Diagnostic Test Menu. Refer to step 3 at the beginning of this section to set the start track.

Subtest 02 Sequential read/write

This subtest continuously writes data pattern B5ADADh to all the specified tracks selected in Subtest 01. The data is then read and compared to the original data.

Subtest 03 Random address/data

This subtest writes random data to random addresses on all tracks defined in Subtest 01. The data is then read and compared to the original data.

Subtest 04 Write specified address

This subtest writes specified data to a specified track, head, and address.

Subtest 05 Read specified address

This subtest reads data from a specified track, head, and address.

3.9 Printer Test

To execute the Printer Test select **6** from the Diagnostic Test Menu, press **Enter** and follow the directions on the screen. The Printer Test contains three subtests that test the output of the printer connected to the computer.

NOTE: An IBM compatible printer must be connected to the system to execute this test.

1. The following message displays when the printer test is selected:

```
channel#1 = 0378h
channel#2 = 0000h
channel#3 = 0000h
Select the channel number (1-3) ?
```

2. Enter the channel number for the printer port and press **Enter**. If you are running Subtest 03, the test will automatically start when you press Enter. If you are running Subtests 01, 02, or 04, the following message displays:

```
Select the printer mode ( 1:80/2:136 ) ?
```

3. Enter **1** or **2** to select the printer mode. That is, **1** for 80 characters per line or **2** for 136 characters. Press **Enter** and the following message displays:

```
Select the test mode ( 1:page / 2:all ) ?
```

If you select **page**, one page will be printed; if you select **all**, printing will be continuous.

4. Enter **1** or **2** to select the printer output parameter, then press **Enter**. If you are running Subtest 01 or 02, the test will automatically start after you press Enter.

Subtest 01 Ripple pattern

This subtest prints characters for codes 20h through 7Eh line-by-line while shifting one character to the left at the beginning of each new line.

```
:"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnop
:"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnop
:"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopq
#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqr
$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrs
%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrst
&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstu
'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstuv
()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvw
)+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvwx
*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvwxy
```

Subtest 02 Function

This subtest is for IBM compatible printers, and tests the following functions:

- Normal print
- Double-width print
- Compressed print
- Emphasized print
- Double-strike print
- All characters print

This subtest prints the various print types shown below:

```

PRINTER TEST
1.  THIS LINE SHOWS NORMAL PRINT.
2.  THIS LINE SHOWS DOUBLE-WIDTH PRINT.
3.  THIS LINE SHOWS COMPRESSED PRINT.
4.  THIS LINE SHOWS EMPHASIZED PRINT.
5.  THIS LINE SHOWS DOUBLE-STRIKE PRINT.
6.  ALL CHARACTERS PRINT
   !"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstu
   vwxyz{|}~

```

Subtest 03 Wraparound

NOTE: To execute this subtest, a parallel port wraparound connector must be connected to the printer port. The parallel port wraparound connector (34M741986G01) wiring diagram is described in Appendix E.

This subtest checks the output and bi-directional modes of the data control and the status of lines through the printer wraparound connector.

3.10 Async Test

To execute the Async Test select **7** from the Diagnostic Test Menu, press **Enter** and follow the directions displayed on the screen. The async test contains seven subtests that test the asynchronous communication functions. Move the highlight bar to the subtest you want to execute and press **Enter**.

Subtests 01 through 07 require the following data format:

Method: Asynchronous
 Speed: 9600BPS (Subtests 01 to 04)
 38400BPS (Subtests 05 to 07)
 Data: 8 bits and one parity bit (EVEN)
 Data pattern: 20h to 7Eh

The following message displays at the bottom of the screen when Subtests 01, 03, and 04 are selected:

```
Channel#1 = XXXXh
Channel#2 = XXXXh
Channel#3 = XXXXh
Select the Channel number (1/2/3)
```

The serial I/O port address is specified by the XXXXh number. Select the serial port channel number, and press **Enter** to start the subtest.

Subtest 01 Wraparound (board)

NOTE: To execute this subtest a serial port wraparound connector (34M741621G01) must be connected to the serial port. The serial port wraparound connector wiring diagram is described in Appendix E.

This subtest checks the data send/receive function through the wraparound connector.

Subtest 02 Point to point (send)

NOTE: To execute this subtest, two machines must be connected with a serial port direct cable. One machine should be set as “send”(Subtest 02) and the other set as “receive” (Subtest 03). The wiring diagram for the serial port direct cable is described in Appendix E.

This subtest sends 20h through 7Eh data to the receive side, then receives the sent data and compares it to the original data.

Subtest 03 Point to point (receive)

This subtest is used with Subtest 02 described above. This subtest receives the data from the send side, then sends the received data.

Subtest 04 Interrupt test

This subtest checks the Interrupt Request Level of IRQ 3, 4, and 5 from the send side.

Subtest 05 Infra_red wrap_around test

This subtest checks the data send/receive function through the Infra_red port.

Subtest 06 Infra_red transmit mode

This subtest checks the data send function through the Infra_red port.

Subtest 07 Infra_red receive mode

This subtest checks the data receive function through the Infra_red port.

3.11 Hard Disk Test

To execute the Hard Disk Test select **8** from the Diagnostic Test Menu, press **Enter**, and follow the directions on the screen. The hard disk test contains ten subtests that test the hard disk drive functions. Answer each of the displayed questions with an appropriate response to execute the test.

***NOTE:** The contents of the hard disk will be erased when Subtest 02, 03, 04, 05, 06, 08, 09, or 10 is executed. Before running the test, transfer the contents of the hard disk to floppy disk.*

Check to see if the Microsoft Create System Disks Tools (MSCSD.EXE) still exists in the System Tools Folder. (This tool can be used only once.) If it exists, use it to back up the preinstalled software, then use the Backup utility in the System Tools folder to back up the entire disk, including the user's files.

Refer to the operating system instructions.

1. Select the hard disk drive number to be tested.

```
Test drive number      #1
                       #2
                       #1&#2
```

2. This message is used to select the retry operation when the hard disk controller detects an error. Select **yes** or **no**.

```
HDC F/W error retry    yes
                       no
```

3. This message is used to select the error dump operation when a data compare error is detected. Select **yes** or **no**.

```
Data compare error dump  yes
                          no
```

4. This message is used to select whether or not the HDD status is displayed on the screen. The HDD status is described in Section 3.18. Select **yes** or **no**.

```
Detail status display    yes
                          no
```

5. The Hard Disk Test message will display when you select the number of the subtest you want to execute and press **Enter**. The following message displays during each subtest.

```

HARD DISK TEST      XXXXXXXX

SUB-TEST : XX
PASS COUNT: XXXXX  ERROR COUNT: XXXXX
WRITE DATA: XX  READ DATA : XX
ADDRESS : XXXXXX STATUS : XXX

```

SUB-TEST MENU :

```

01 - Sequential read
02 - Address uniqueness
03 - Random address/data
04 - Cross talk & peak shift
05 - Write/read/compare (CE)
06 - Write specified address
07 - Read specified address
08 - ECC circuit
09 - Sequential write
10 - W-R-C specified address
99 - Exit to DIAGNOSTIC TEST MENU

```

```

↑↓→←      :      Select items
Enter     :      Specify
Esc       :      Exit

```

6. Type the number of the subtest that you want to run and press **Enter**. The following displays:

```

TEST LOOP : YES
ERROR STOP : YES

```

After you select **TEST LOOP** or **ERROR STOP**, the test will automatically start.

Subtest 01 Sequential read

This subtest is a sequential reading of all the tracks on the HDD starting at track 0. When all the tracks on the HDD have been read, the test starts at the maximum track and sequentially reads the tracks on the HDD back to track 0.

Subtest 02 Address uniqueness

This subtest writes unique address data to each sector of the HDD track-by-track. The data written to each sector is then read and compared with the original data. There are three ways the HDD can be read:

- Forward sequential
- Reverse sequential
- Random

Subtest 03 Random address/data

This subtest writes random data to random addresses on the HDD cylinder, head, and sector. This data is then read and compared to the original data.

Subtest 04 Cross talk & peak shift

This subtest writes eight types of worst pattern data (shown below) to a cylinder, then reads the data while moving from cylinder to cylinder.

Worst pattern data	Cylinder
B5ADAD	0 cylinder
4A5252	1 cylinder
EB6DB6	2 cylinder
149249	3 cylinder
63B63B	4 cylinder
9C49C4	5 cylinder
2DB6DB	6 cylinder
D24924	7 cylinder

Subtest 05 Write/read/compare (CE)

This subtest writes B5ADADh worst pattern data to the CE cylinder on the HDD, then reads the data from the CE cylinder and compares it with the original data.

Subtest 06 Write specified address

This subtest writes specified data to a specified cylinder and head on the HDD.

Subtest 07 Read specified address

This subtest reads data which has been written to a specified cylinder and head on the HDD.

Subtest 08 ECC circuit

This subtest checks the Error Check and Correction (ECC) circuit functions of the specified cylinder and head on the HDD.

Subtest 09 Sequential write

This subtest writes specified 2-byte data to all of the cylinders on the HDD.

Subtest 10 W-R-C specified address

This subtest writes data to a specified cylinder and head on the HDD, then reads the data and compares it to the original data.

3.12 Real Timer Test

To execute the Real Timer Test select **9** from the Diagnostic Test Menu, press **Enter** and follow the directions on the screen. The real timer test contains three subtests that test the real timer functions. Move the highlight bar to the subtest you want to execute and press **Enter**.

Subtest 01 Real time

A new date and time can be input during this subtest. To execute the real time subtest follow these steps:

1. Select Subtest 01 and the following message displays:

```
Current date : XX-XX-XXXX
Current time : XX:XX:XX
```

```
Enter new date:
```

```
PRESS [ENTER] KEY TO EXIT TEST
```

2. If the current date is not correct, input the correct date at the “Enter new date” prompt and press **Enter**. The following prompt will display:

```
Enter new time :
```

3. If the current time is not correct, input the correct time in 24-hour format.

Press **Enter** to toggle between the time and the date. To exit, press **Ctrl + Break**.

Subtest 02 Backup memory

This subtest performs the following backup memory check:

```
Writes 1-bit of “on” data to addresses 01h; 02h, 04h through 80h
Writes 1-bit of “off” data to addresses FEh, FB, FD through 7Fh
Writes the data patterns AAh and 55h to 50-byte memory
(addresses 0Eh to 7Fh)
```

The subtest reads and compares this data with the original data.

To exit, press **Ctrl + Break**.

Subtest 03 Real time carry

CAUTION: When this subtest is executed, the current date and time are erased.

This subtest checks the real time clock increments, making sure the date and time are displayed in the following format:

```
Current date : 12-31-1995
Current time  : 23:59:58
```

Press **Enter** to display the following:

```
Current date : 01-01-1996
Current time  : 00:00:00
```

PRESS [Enter] KEY TO EXIT TEST

Press **Ctrl + Break** to exit.

3.13 NDP Test

To execute the NDP test select **10** from the Diagnostics Test Menu, press **Enter** and follow the directions on the screen. The NDP test contains one subtest that tests the NDP functions.

Subtest 01 NDP Test

This test checks the following functions of the coprocessor:

- Control word
- Status word
- Bus
- Addition
- Multiplication

Press **Ctrl + Break** to exit.

3.14 Expansion Test

To execute the Expansion Test select **11** from the Diagnostics Test Menu, press **Enter** and follow the directions on the screen. The expansion test contains one subtest.

NOTE: To execute this subtest, the PC card wraparound connector is required.

Subtest 01 PCMCIA wraparound

This test checks the following signal line of the PC card slot:

- Address line
- REG#, CE#1, CE#2 line
- Data line
- Speaker line
- Wait line
- BSY#, BVD1 line

This subtest is executed in the following order:

Sub#	Address	Good	Bad	Contents
01	00001 00001	nn nn	xx xx	Address line REG#, CE#1, CE#2 nn=A0, 90, 80, 00
02	00002	ww	rr	Data line ww=write data,rr=read data
03	00003	—	—	Speaker line
04	00004	40, 80	xx	Wait line (40<xx<80)
05	00005	nn	xx	Other lines (BSY#, BVD1) nn=21, 00

3.15 Sound Test

To execute the Sound Test select **12** from the Diagnostics Test Menu, press **Enter** and follow the directions on the screen. The sound test contains two subtests that test the sound functions.

NOTE: To execute this subtest, the internal microphone and external headphone (or external speaker) are required.

WARNING: The system is capable of producing high volume sound, so when you use the headphones, be careful to set the volume low and adjust it as necessary. Using the headphones at full volume could damage your hearing.

Subtest 01 FM synthesizer

Load the COM file. Connect headphones or speakers, and execute the OPL3-SA3 (YMF711) function test. The eight-note musical should play through both sides of the headphones or through both speakers.

Subtest 02 SINE-wave playback

Load the COM file. This subtest expands the sine-wave data table to 64KB and creates sine-wave data. The play data is transferred between DMA and CODEC, and plays the sound. (It is a long beep.) Use the oscilloscope to observe the sine-wave form.

3.16 Error Codes and Error Status Names

Table 3-2 lists the error codes and error status names for the diagnostics tests.

Table 3-2 Error codes and error status names (1/3)

Device name	Error code	Error status name
(COMMON)	FF	Data Compare Error
System	01	ROM Checksum Error
Memory	01	Parity Error
	02	Protected Mode Not Changed
	14	Memory Read/Write Error
	DD	Cache Memory Error
Keyboard	01	Mouse Interface Error
	02	IPS Interface Error
	03	Interface Error
	04	Retransmit Error
	05	Mouse Handler Not Supported
	06	PS/2 Mouse & IPS Not Supported
FDD	01	Bad Command
	02	Address Mark Not Found
	03	Write Protected
	04	Record Not Found
	06	Media Removed
	08	DMA Overrun Error
	09	DMA Boundary Error
	10	CRC Error
	20	FDC Error
	40	Seek Error
	60	FDD Not In Drive Error
	80	Time Out Error
	EE	Write Buffer Error
Printer	01	Time Out
	08	Fault
	10	Select Line
	20	Out of Paper
	40	Power Off
	80	Busy Line
ASYNC	01	DSR On Time Out
	02	CTS On Time Out
	04	RX-READY Time Out

Table 3-2 Error codes and error status names (2/3)

Device name	Error code	Error status name
ASYNC (cont.)	08	TX-BUFFER Full Time Out
	10	Parity Error
	20	Framing Error
	40	Overrun Error
	80	Line Status Error
	88	Modem Status Error
	33	No Carrier (Card Modem)
	34	Error (Card Modem)
	36	No Dial Tone (Card Modem)
HDD	01	Bad Command Error
	02	Address Mark Not Found
	04	Record Not Found
	05	HDC Not Reset Error
	07	Drive Not Initialized
	08	HDC Overrun (DRQ)
	09	DMA Boundary Error
	0A	Bad Sector
	0B	Bad Track Error
	10	ECC Error
	11	ECC Recover Enabled
	20	HDC Error
	40	Seek Error
	80	Time Out Error
	AA	Drive Not Ready
	BB	Undefined Error
	CC	Write Fault
	E0	Status Error
	EE	Access Time Out Error
NDP	01	No Co-Processor
	02	Control Word Error
	03	Status Word Error
	04	Bus Error
	05	Addition Error
	06	Multiply Error

Table 3-2 Error codes and error status names (3/3)

Device name	Error code	Error status name
PCMCIA	C1	Address Line Error
	C2	REG# Line Error
	C3	CE#1 Line Error
	C4	CE#2 Line Error
	C5	DATA Line Error
	C6	WAIT Line Error
	C7	BSY# Line Error
	C8	BVD1 Line Error
	CD	No PCMCIA

3.17 Hard Disk Test Detail Status

When an error occurs in the hard disk test, the following message displays:

```
HDC status = XXXXXXXX
```

Detailed information about the hard disk test error displays on the screen by an eight-digit number. The first four digits represent the hard disk controller (HDC) error status number and the last four digits are not used.

The hard disk controller error status is composed of 2 bytes; the first byte displays the contents of the HDC status register in hexadecimal form and the second byte displays the HDC error register.

The contents of the HDC status register and error register are listed in Tables 3-3 and 3-4.

Table 3-3 Hard disk controller status register contents

Bit	Name	Description
7	BSY (Busy)	"0" — HDC is ready "1" — HDC is busy
6	DRDY (Drive ready)	"0" — Hard disk drive is not ready to accept any command "1" — Hard disk drive is ready to accept any command
5	DWF (Drive write fault)	"0" — DWF error is not detected "1" — Write fault condition occurs
4	DSC (Drive seek complete)	"0" — The hard disk drive heads are not settled over a track "1" — The hard disk drive heads are settled over a track
3	DRQ (Data request)	"0" — Drive is not ready for data transfer "1" — Drive is ready for data transfer
2	CORR (Corrected data)	"0" — Not used "1" — Correctable data error is corrected
1	IDX (Index)	"0" — Not used "1" — Index is sensed
0	ERR (Error)	"0" — Normal "1" — The previous command was terminated with some error

Table 3-4 Error register contents

Bit	Name	Description
7	BBK1 (Bad block mark)	"0" — Not used "1" — A bad block mark is detected
6	UNC (Uncorrectable)	"0" — There is no uncorrectable data error "1" — Uncorrectable data error has been detected
5	—	Not used
4	IDNF (Identification)	"0" — Not used "1" — There was no ID field in the requested sector
3	—	Not used
2	ABRT (Abort)	"0" — Not used "1" — Illegal command error or a drive status error occurs
1	TK00 (Track 0)	"0" — The hard disk has found track 0 during a recalibrate command "1" — The hard disk could not find track 0 during a recalibrate command
0	—	Not used

3.18 Hard Disk Format

This command executes hard disk formatting. There are two types of hard-disk formatting:

- Low-level (physical) formatting
- MS-DOS (logical) formatting

This hard disk format function performs a low-level format of the hard disk and executes the following hard disk formats and check:

1. All track FORMAT
2. Good track FORMAT
3. Bad track FORMAT
4. Bad track CHECK

NOTE: *The contents of the hard disk will be erased when this program is executed. Before executing the function, transfer the contents of the hard disk onto floppy disk. Check to see if the Microsoft Create System Disks Tools (MSCSD.EXE) still exists in the System Tools Folder. (This tool can be used only once.) If it exists, use it to back up the preinstalled software, then use the Backup utility in the System Tools folder to back up the entire disk, including the user's files. Refer to the operating system instructions.*

3.18.1 Function Description

1. All track FORMAT

This option performs a low-level format of all the tracks on the hard disk as shown in Table 3-5 below:

NOTE: *Before executing the all track format option, check for bad tracks using the Bad Track CHECK option or display a list of bad tracks on the HDD.*

Table 3-5 Hard disk formatting sequence

Items	(MT800)
Storage capacity	815
Heads	2
Bytes per sector	512
Rotation speed (rpm)	4,000

Recording method	8-9 RLL
------------------	---------

2. Good track FORMAT

This option formats a specified cylinder and track as a good track. If a good track is formatted as a bad track, use this option to change the track to a good track.

3. Bad track FORMAT

This option formats a specified cylinder and track as a bad track. If a bad track is detected, use this option to label it as a bad track.

4. Bad track CHECK

This option searches the hard disk for bad tracks by reading data to all the tracks on the hard disk. A list of bad tracks is displayed when the program is complete. If an error other than a bad track is detected, the program is automatically terminated.

3.18.2 Operations

***NOTE:** After the HDD has been formatted, execute the Toshiba MS-DOS FDISK command, to partition the HDD. Next, execute the Toshiba MS-DOS FORMAT command. Refer to the Toshiba MS-DOS manual for more information about using these commands.*

Select **2** and press **Enter** on the Diagnostic Menu, to display the following messages:

```
DIAGNOSTICS - HARD DISK FORMAT : VX.XX
```

- 1 - All track FORMAT
- 2 - Good track FORMAT
- 3 - Bad track FORMAT
- 4 - Bad track CHECK
- 9 - Go to TEST MENU

↑↓→←: Select items, Enter: Finish, Esc: Exit

1. All track FORMAT

Press **1** to select All track FORMAT, which lets you format the entire disk.

```
[All track FORMAT]
```

```
Drive : #1 = HDD   #2 = Non
Cylinder : XXXX
Head : XX
Sector : XX
```

```
<<< Model name = >>>
```

The following selections also display at the bottom of the screen, in succession:

```
Drive number select (1:#1,2:#2) ?
```

- (a) Select a drive number and press **Enter**. The following message displays:

```
Interleave number (1/1 ~ 8) ?
```

- (b) Select an interleave number, **1 ~ 8** and press **Enter**. Pressing only **Enter** selects 1.
- (c) Bad track register

Next, the Bad Track register prompt displays as shown below. Enter the cylinder and head numbers of bad tracks and press **Enter**. Note that if there are no bad tracks, pressing **Enter** alone is the same as executing All Track Format described in item (d) below.

```
[ WARNING : Current DISK data will be  
completely destroyed ]
```

```
Press Bad cylinder number (dddd)] key ?  
Press Bad head number (dd)] key ?
```

Enter the cylinder and head number in the format above by decimal notation. Repeat for each bad track you want to format.

After entering the bad tracks, press **Enter** to execute the format.

- (d) All track format

All tracks are formatted as good tracks except those registered as bad tracks in item (c) above or those identified as bad tracks in track verification described in item (e) below.

- (e) Track verification

A check is made of all tracks and if an ECC error, ECC correctable data error or record-not-found error is detected at a track, that track is automatically formatted as a bad track.

2. Good track FORMAT

If a good track has been erroneously formatted as a bad track, you can use this subtest to reformat the track as a good track. To format a track as a good track, enter the number for drive, interleave, cylinder, and head as indicated in the screen prompt shown below.

```
Drive number select (1:#1, 2:#2) ?
Interleave number (1 / 1 - 8) ?
  Press [Cylinder number (dddd)] ?
  Press [Head number (dd)] ?
```

Press **Enter** to return to the Hard Disk Format menu.

3. Bad track FORMAT

To format a track as a bad track, enter the number for drive, interleave, cylinder, and head as indicated in the screen prompt shown below.

```
Drive number select (1:#1, 2:#2) ?
Interleave number (1 / 1 - 8) ?
  Press [Cylinder number (dddd)] ?
  Press [Head number (dd)] ?
```

Press **Enter** to return to the Hard Disk Format menu.

4. Bad track CHECK

This subtest reads the entire disk and displays a list of bad tracks. The test is terminated in case of a bad track check error. To initiate the subtest enter the drive number at the prompt shown below.

```
Drive number select (1:#1, 2:#2) ?
```

Bad tracks will display in the format shown below.

```
[[cylinder, head = 0123 03]]
```

Press **Enter** to return to the Hard Disk Format menu.

3.19 Head Cleaning

3.19.1 Function Description

This function cleans the heads in the FDD by executing a series of head load/seek and read operations. A cleaning kit is necessary to perform this program.

3.19.2 Operations

1. Select **4** from the Diagnostic Menu and press **Enter** to display the following messages:

```
DIAGNOSTICS - FLOPPY DISK HEAD CLEANING : VX.XX
```

```
Mount cleaning disk(s) on drive(s).
```

```
Press any key when ready.
```

2. Remove the Diagnostics Disk from the FDD, insert the cleaning disk, and press **Enter**.
3. When the “cleaning start” message displays, the FDD head cleaning has begun.
4. The display automatically returns to the Diagnostic Menu when the program is completed.

2. The error information displayed on the screen can be manipulated by the following number keys:

The **1** key scrolls the display to the next page.

The **2** key scrolls the display to the previous page.

The **3** key returns to the Diagnostic Menu.

The **4** key erases all error log information in RAM.

The **5** key outputs the error log information to a printer.

The **6** key reads the log information from a floppy disk.

The **7** key writes the log information to a floppy disk.

3. In the case of “error retry OK,” a capital “R” will be placed at the beginning of the error status. However, it is not added to the error count.

3.21 Running Test

3.21.1 Function Description

This function automatically executes the following tests in sequence:

- 1 System test (subtest number 01)
- 2 Memory test (subtest number 01, 02, 04, 06)
- 3 Display test (subtest number 01 to 08)
- 4 FDD test (subtest number 02)
- 5 HDD test (subtest number 01, 05)
- 6 Real timer test (subtest number 02)
- 7 Printer test (subtest number 03) if selected
- 8 Async test (subtest number 01) if selected

The system automatically detects the number of floppy disk drives connected to the computer for the FDD test.

3.21.2 Operations

NOTE: Do not forget to load a work disk in the FDD. If a work disk is not loaded, an error will be generated during the FDD test.

1. Remove the diagnostics disk from the floppy disk drive and insert the work disk.
2. Select **6** from the Diagnostic Menu and press **Enter**, the following message displays:
Printer wrap around test (Y/N) ?
Select **Y (yes)** to execute the printer wraparound test. A printer wraparound connector must be connected to the parallel port of the computer to properly execute this test.
3. Select **Y** or **N** and press **Enter**. The following message displays:
Serial #A wrap around test (Y/N) ?
Select **Y (yes)** to execute the ASYNC wraparound test. An RS-232C wraparound connector must be connected to the serial port of the computer to properly execute this test.
4. Select **Yes** or **No** and press **Enter**. The following message displays:
Mount the work disk(s) on the drive(s),
then press [Enter] key.
[Warning : The contents of the disk(s),
will be destroyed.]
5. This program is executed continuously. To terminate the program, press **Ctrl + Break**.

3.22 Floppy Disk Drive Utilities

3.22.1 Function Description

This function formats the FDD, copies the floppy disk, and displays the dump list for both the FDD and HDD.

1. FORMAT

***NOTE:** This program is only for testing a floppy disk drive. The option is different from the Toshiba MS-DOS FORMAT command.*

- (a) This program can format a 5.25-inch or 3.5-inch floppy disk in the following formats:

2DD: Double-sided, double-density, double-track, 96/135 TPI, MFM mode, 512 bytes, 9 sectors/track.

- (b) 2HD: Double-sided, high-density, double-track, 96/135 TPI, MFM mode, 512 bytes, 18 sectors/track.

2. COPY

This program copies data from a source floppy disk to a target floppy disk.

3. DUMP

This program displays the contents of the floppy disk and the designated sectors of the hard disk on the display.

3.22.2 Operations

1. Select **7** from the DIAGNOSTIC MENU and press **Enter** to display the following message:

```
[ FDD UTILITIES ]  
  
1 - FORMAT  
2 - COPY  
3 - DUMP  
9 - EXIT TO DIAGNOSTICS MENU
```

2. FORMAT program

- (a) Select FORMAT to display the following message:

```
DIAGNOSTICS - FLOPPY DISK FORMAT : VX.XX
```

```
Drive number select (1:A, 2:B) ?
```

- (b) Select a drive number to display the following message:

```
Type select (0:2DD,3:2HD) ?
```

- (c) Select a media/drive type number and press **Enter**. A message similar to the one below displays:

```
Warning : Disk data will be destroyed.
```

```
Insert work disk into drive A:
```

```
Press any key when ready.
```

- (d) Remove the diagnostics disk from the FDD, insert the work disk, and press any key.

The following message displays when the FDD format is executed:

```
[ FDD TYPE ] : TRACK = XXX
```

```
[ FDD TYPE ] : HEAD = X
```

```
[ FDD TYPE ] : SECTOR = XX
```

```
Format start
```

```
[[track, head = XXX X]]
```

After the floppy disk is formatted, the following message displays:

```
Format complete
```

```
Another format (1:Yes/2:No) ?
```

- (e) Type **1** to display the message from step (c) above. Type **2** to return the test to the Diagnostic Menu.

3. COPY program

- (a) When COPY is selected, the following message displays:

```
FLOPPY DISK FORMAT & COPY : VX.XX
```

```
Type select (0:2DD,3:2HD) ?
```

- (b) Select a media/drive type number to display a message similar to the one below:

```
Insert source disk into drive A:
```

```
Press any key when ready.
```

- (c) Remove the diagnostics disk from the FDD, insert the source disk, and press any key. The following message displays, indicating the program has started.

```
[ FDD TYPE ] : TRACK  = XXX
[ FDD TYPE ] : HEAD   = X
[ FDD TYPE ] : SECTOR = XX
```

Copy start

```
[[ track,head = XXX X ]]
```

- (d) Remove the source disk from the FDD, insert a formatted work disk, and press any key. The [[track, head = XXX X]] message displays and starts copying to the target disk. When the amount of data is too large to be copied in one operation, the message from (b) displays again. After the floppy disk has been copied, the following message will display:

Copy complete

Another copy (1:Yes/2:No) ?

- (e) To copy another disk, type **1** and the message from (a) will display again. Enter **2** to return the test program to the Diagnostic Menu.

5. DUMP program

- (a) When dump is selected, the following message displays:

```
DIAGNOSTICS-HARD DISK & FLOPPY DISK DUMP : VX.XX
Drive type select (1:FDD, 2:HDD) ?
```

- (b) Select a format type number. If **1** is selected in step (a), the following message displays:

Select drive number (1:A, 2:B) ?

Select an FDD drive number. The display will go to step (c).

If **2** is selected, the following message displays:

Select drive number (1:C, 2:D) ?

After selecting the HDD, the display will go to step (f).

- (c) The following message displays:

Format type select (1:2DD, 2:2D, 3:2HD)

- (d) Insert a source disk, press any key, and the following message displays:

```
Insert source disk into drive A:  
Press any key when ready.
```

- (e) Insert a source disk, press any key, and the following message displays:

```
— Max. address —  
[Track ] = xxx  
[ Head ] = xx  
[Sector] = xx
```

```
Track number ??
```

- (f) Set the track number you want to dump. The system will access the disk and dump a list.

3.23 System Configuration

3.23.1 Function Description

The System Configuration program contains the following configuration information for the computer:

1. BIOS ROM version
2. Boot ROM version
3. KBC version
4. PS microprocessor version
5. System memory size
6. Number of floppy disk drives
7. Number of ASYNC ports
8. Number of hard disk drives
9. Number of printer ports
10. Extended memory size
11. Number of math co-processors
12. CPU clock

3.23.2 Operations

Select **8** from the Diagnostic Menu and press **Enter** to display the following system configuration:

```
SYSTEM CONFIGURATION :  
  
- BIOS ROM VERSION = VX.XX  
- BOOT ROM VERSION = VX.XX  
- KBC VERSION      = VX.XX  
- PS MICOM VERSION = VX.XX  
- 639K MEMORY  
- 1 FLOPPY DISK DRIVE(S)  
- 1 ASYNC ADAPTER  
- 1 HARD DISK DRIVE(S)  
- 1 PRINTER ADAPTER  
- XXXMB EXTENDED MEMORY  
- 1 MATH CO-PROCESSOR  
- CPU CLOCK = P75MHz
```

Press [Enter] Key

Press **Enter** to return to the Diagnostic Menu.

3.24 SETUP

3.24.1 Function Description

This program displays the current system setup information as listed below:

1. Memory
 - (a) Total
 - (b) Base
 - (c) Extended
 - (d) Shadow BIOS ROM
2. Display
 - (a) Display Adapter
 - (b) LCD Display Colors
 - (c) Power On Display
 - (d) VGA Segment Address
 - (e) Text Mode Stretch
3. Hard Disk
4. Password
5. I/O Ports
 - (a) Serial Port
 - (b) Infrared Port
 - (c) Parallel Port
 - (d) Sound System
6. Others
 - (a) Power-up Mode
 - (b) CPU Cache
 - (c) System Auto Off
 - (d) Alarm Volume
 - (e) System Beep
 - (f) Panel Power On/Off
 - (g) Alarm Power On
 - (h) Pointing Devices
 - (i) Boot Priority

3.24.2 Accessing the SETUP Program

Select **0** from the Diagnostics Menu and press **Enter** to display the TSETUP screen.

SYSTEM SETUP		BIOS Version = x.xx																																									
<p style="text-align: center;">MEMORY</p> <table border="0" style="width: 100%;"> <tr><td>Total</td><td>=</td><td>16384 KB</td></tr> <tr><td>Base</td><td>=</td><td>640 KB</td></tr> <tr><td>Extended</td><td>=</td><td>15488 KB</td></tr> <tr><td>Shadow BIOS ROM</td><td>=</td><td>256K</td></tr> </table>	Total	=	16384 KB	Base	=	640 KB	Extended	=	15488 KB	Shadow BIOS ROM	=	256K	<p style="text-align: center;">I/O PORTS</p> <table border="0" style="width: 100%;"> <tr><td>Serial</td><td>=</td><td>COM1 (3F8H/IRQ4)</td></tr> <tr><td>Infra_red</td><td>=</td><td>COM2 (2F8H/IRQ3)</td></tr> <tr><td>Parallel</td><td>=</td><td>LPT1 (378H/IRQ7/CH3)</td></tr> <tr><td>Sound</td><td>=</td><td>Enabled</td></tr> </table>	Serial	=	COM1 (3F8H/IRQ4)	Infra_red	=	COM2 (2F8H/IRQ3)	Parallel	=	LPT1 (378H/IRQ7/CH3)	Sound	=	Enabled																		
Total	=	16384 KB																																									
Base	=	640 KB																																									
Extended	=	15488 KB																																									
Shadow BIOS ROM	=	256K																																									
Serial	=	COM1 (3F8H/IRQ4)																																									
Infra_red	=	COM2 (2F8H/IRQ3)																																									
Parallel	=	LPT1 (378H/IRQ7/CH3)																																									
Sound	=	Enabled																																									
<p style="text-align: center;">DISPLAY</p> <table border="0" style="width: 100%;"> <tr><td>Display Adapter</td><td>=</td><td>VGA Compatible</td></tr> <tr><td>LCD Display Colors</td><td>=</td><td>222K Colors</td></tr> <tr><td>Power on Display</td><td>=</td><td>Internal/External</td></tr> <tr><td>VGA Segment Address</td><td>=</td><td>E400H</td></tr> <tr><td>Text Mode Stretch</td><td>=</td><td>Enabled</td></tr> </table>	Display Adapter	=	VGA Compatible	LCD Display Colors	=	222K Colors	Power on Display	=	Internal/External	VGA Segment Address	=	E400H	Text Mode Stretch	=	Enabled	<p style="text-align: center;">OTHERS</p> <table border="0" style="width: 100%;"> <tr><td>Power-Up Mode</td><td>=</td><td>Hibernation</td></tr> <tr><td>CPU Cache</td><td>=</td><td>Enabled</td></tr> <tr><td>System Auto Off</td><td>=</td><td>Disabled</td></tr> <tr><td>Alarm Volume</td><td>=</td><td>High</td></tr> <tr><td>System Beep</td><td>=</td><td>Enabled</td></tr> <tr><td>Panel Power on/off</td><td>=</td><td>Disabled</td></tr> <tr><td>Alarm Power On</td><td>=</td><td>Disabled</td></tr> <tr><td>Pointing Devices</td><td>=</td><td>Auto-Selected</td></tr> <tr><td>Boot Priority</td><td>=</td><td>FDD→HDD</td></tr> </table>	Power-Up Mode	=	Hibernation	CPU Cache	=	Enabled	System Auto Off	=	Disabled	Alarm Volume	=	High	System Beep	=	Enabled	Panel Power on/off	=	Disabled	Alarm Power On	=	Disabled	Pointing Devices	=	Auto-Selected	Boot Priority	=	FDD→HDD
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<p style="text-align: center;">HARD DISK</p> <table border="0" style="width: 100%;"> <tr><td>HDD Mode</td><td>=</td><td>Enhanced IDE (Normal)</td></tr> </table>	HDD Mode	=	Enhanced IDE (Normal)																																								
HDD Mode	=	Enhanced IDE (Normal)																																									
<p style="text-align: center;">PASSWORD</p> <p>Not Registered</p>																																											

↑↓→← : Select items Space, BkSp : Change values

Esc: Exit without saving Home: Set default values End: Save changes and Exit

NOTE: The Panel Power On/Off and System Auto Off items appear only when the computer is in Hibernation mode.

3.24.3 Moving Within the SETUP Menu and Changing Values

1. Press ← and → to move between the two columns. Press ↑ and ↓ to move between items in a column.
2. Press either the **space bar** or **BkSp** to change the value.

NOTES: 1. On either page, you can go directly to a specific group by pressing the first letter (highlighted) of the group's name. For example, **B**, go to the Battery group.

2. To change pages, press the **PgUp** (page up) or **PgDn** (page down) key.

3.24.4 Accepting Changes and Exiting the SETUP Window

1. Press **End** to accept the changes you made.

If the changed item does not require the system to reboot, the following message displays:

Are you sure? (Y/N)

If the changed item requires the system to reboot, the following message displays:

Are you sure? (Y/N)
The changes you made will cause the system to reboot.

2. To make other changes, press **N**. Repeat the steps above.
3. To accept the changes, press **Y**.

NOTE: You can press **Esc** to quit at any time without saving changes. **SETUP** asks you to confirm that you don't want to save your changes.

3.24.5 The Factory Preset Configuration

When you access SETUP, the current configuration displays.

1. To show the factory preset configuration, press **Home**.
2. To accept the default settings, press **End** and then press **Y**.

NOTE: When you execute the default setting, the following settings are not changed:

HDD Mode
Password
Sound System
Write Policy (CPU Cache)

3.24.6 SETUP Options

The SETUP screen is divided into functionally related groups. This section describes each group and its options.

1. Memory

These options configure the computer's memory. You cannot change these values.

(a) Total

Displays the total amount of memory installed and is automatically calculated by the computer.

(b) Base

Displays 640 KB, the base amount of conventional memory automatically calculated by the computer.

(c) Extended

Displays the amount of memory beyond base memory that the computer can access.

(d) Shadow BIOS ROM

Displays 256 KB, the amount of RAM used to copy ROM files.

2. Display

These options configure the computer's display.

(a) Display Adapter

Enables or disables the internal controller for the VGA internal display.

VGA compatible Enables the internal VGA controller. (Default)

Not Used Disables the internal VGA controller.

(b) LCD Display Colors

Used to select the color palette of the TFT display when the LCD mode is set to **Color**.

222K(Default), 4096 and 16M(256k) colors

(c) Power On Display

Used to select the display when booting up.

<i>Internal/External</i>	Selects an external CRT if one is connected, otherwise it selects the internal LCD. (Default)
<i>Simultaneous</i>	Selects both the internal LCD and the external CRT for simultaneous display.

NOTE: When starting the computer in Resume mode, the last configuration is remembered. If data does not appear on the display you are using after starting in Resume mode, press **Fn+F5**.

Pressing **Fn+F5** changes the display setting as follows: internal LCD, to simultaneous, to external CRT.

(d) VGA Segment Address

E4000h (Default) C0000h or E0000h

(e) Text Mode Stretch

Text Mode Stretch enables a larger display area of the screen.

<i>Enabled</i>	Enables the LCD display stretch feature.
<i>Disabled</i>	Disables the LCD display stretch feature. (Default)

3. Hard Disk

Use this item to select the hard disk mode.

<i>Enhanced IDE (Normal)</i>	Select this mode when using Windows 95, Windows for Workgroups, MS-DOS, or OS/2. (Default)
<i>Standard IDE</i>	Select this mode when using Novell NetWare or UNIX. When this mode is selected, up to 50MB is logically available even though the disk capacity is larger than 504MB.
<i>Not used</i>	HDD is not used.

To see the capacity of the hard disk, use the CHKDSK command. See your DOS documentation for details on using CHKDSK.

NOTE: *The formats for Enhanced IDE and Standard IDE are different, so if you change the setting, you will have to reformat the hard disk for the appropriate setting.*

4. Password

This option allows you to set or reset the user password for power on and instant security.

<i>Registered</i>	The user password has been registered.
<i>Not registered</i>	The user password has not been registered.

5. I/O ports

This option controls settings for serial and parallel ports, the sound system, and the setting for the joystick on the optional Desk Station V Plus.

NOTE: *Do not assign the same interrupt request level and I/O address to the serial port and PC card.*

(a) Serial Port

This option allows you to set the COM level for the serial port.

The serial port interrupt request level (IRQ) and I/O port base address for each COM level are shown below:

(c) Parallel Port

This option sets the interrupt level and I/O address for the parallel port. When the Printer Port Type (see settings below) is set to Std. Bi-directional, the options are:

LPT setting	Interrupt level	I/O address
LPT 1	7	378H
LPT 2	5	278H
LPT 3	7	3BCH
Not Used	(Default)	
Others		(Other settings are made automatically by the Plug-and-Play operating system.)

When the Printer Port Type (see settings below) is set to ECP, the DMA channel can also be set to 1, 2, or 3. The default is 3.

LPT setting	Interrupt level	I/O address	DMA Channel
LPT 1	7	378H	3
LPT 2	5	278H	3
LPT 3	7	3BCH	3
Not Used		(Default)	
Others			(Other settings are made automatically by the Plug-and-Play operating system.)

When you select one of the above options, except for **Not used**, a subwindow similar to the one below displays to let you set the parallel port mode. The options for this setting are **ECP** (default) and **Std. Bi-Directional**.

OPTIONS			
Mode	=	ECP	
DMA	=	Channel 3	

For most printers, the port should be set to **ECP**. With other parallel devices, the setting should be **Std. Bi-Directional**.

(d) Sound System

This option allows you to enable or disable the sound system.

Enabled Enables the sound system. (Default)

Disabled Disables the sound system.

When Enabled is selected, a subwindow similar to the one below displays to let you set the **WSS I/O** address, **SBPro I/O** address, **WSS & SBPro & MPU401 IRQ** levels, **WSS(Play) DMA**, and **SBPro DMA** for the sound system. (Some of the values displayed cannot be changed on the Libretto.)

SOUND SYSTEM	
WSS I/O Address	= 530H
SBPro I/O Address	= 220H
Synthesizer I/O Address	= 388H
WSS & SBPro & MPU401 IRQ Level	= IRQ5
WSS(Play) DMA	= Channel 1
SBPro DMA	= Channel 0
Control I/O Address	= 370H
MPU401 (MIDI I/F)	= 330H

WSS I/O Address

Use this option to set the WSS I/O address from among the following settings:

530h (default), 540h, 550h, 560h

SBPro I/O Address

Use this option to set the SBPro I/O address from among the following settings:

220h (default), 240h

Synthesizer I/O Address

You cannot change this value.

WSS & SBPro & MPU401 IRQ Level

This option sets the WSS & SBPro & MPU401 IRQ level for the sound system. The available settings are:

IRQ5 (default), IRQ7, IRQ9, IRQ11, IRQ15

WSS(Play) DMA

This option sets the WSS(Play) DMA for the sound system. The available settings are:

Channel 0, Channel 1 (default), Channel 3

SBPro DMA

This option sets the SBPro DMA for the sound system. The available settings are:

Channel 0 (default), Channel 1, Channel 3

Same as play

Control I/O Address

You cannot change this value.

MPU401 (MIDI I/F) IRQ Level

You cannot change this value.

6. Others

Whether or not you need to configure the computer with these options depends primarily on the kind of software or peripherals you use.

(a) Power-up Modes

This option lets you choose between AutoResume and boot mode. You can also set this option using hotkeys.

Boot Turns on boot mode. (Default)

Hibernation Turns on hibernation feature.

(b) CPU Cache

Use this feature to enable or disable the CPU cache.

Enabled Enables the CPU cache. (Default)

Disabled Disables the CPU cache.

When Enabled is selected, a subwindow similar to the one below displays to let you select the cache write policy. The options for this setting are **Write-back** (default) and **Write-through** for CPU cache.

```

                OPTION
    _____|_____
    | Write policy = Write-back |
    |_____|_____
  
```

Write-back policy provides better system performance, because main memory is accessed only when necessary to update the cache contents with changes in main memory. Write-through policy accesses main memory every time data is handled by the processor.

(c) System Auto Off

Used to enable or disable the system automatic off function in hibernation mode when you are working in DOS. In Boot mode, it is disabled and not displayed.

<i>Disabled</i>	Disable system automatic power off.
<i>xx Min</i>	Automatically turns off power to the system if it is not used for the duration set. The duration xx can be set to 10, 20, 30, 40, 50, or 60 minutes.

(d) Alarm Volume

This option disables or sets the volume level of the alarm. Setting this option to off disables the computer's sound function for alarms. This option can also be set by hotkeys.

<i>Off</i>	Disables the alarm.
<i>Low</i>	Sets the alarm volume to low.
<i>Medium</i>	Sets the alarm volume to medium.
<i>High</i>	Sets the alarm volume to high. (Default)

When Alarm Volume is selected, the subwindow below displays to let you enable or disable certain functions.

```

    _____|_____
    | Low Battery Alarm = Enabled |
    | Panel Close Alarm = Enabled |
    |_____|_____
  
```

<i>Enabled</i>	Enables the feature. (Default)
<i>Disabled</i>	Disables the feature.

(e) System Beep

Use this feature to enable or disable the system beep.

Enabled Enables the feature. Default

Disabled Disables the feature.

(f) Panel Power On/Off

This option allows you to automatically turn your computer on or off by opening or closing the display panel. If this feature is enabled when the computer is in Resume mode, the system is automatically powered off when the display panel is closed and powered on when the panel is opened. This option does not appear when the computer is in boot mode.

Enabled Enables the feature. Default

Disabled Disables the feature.

NOTE: Do not remove the AC adapter and battery pack at the same time when you use this feature. If you do, data saved by AutoResume will be lost. You must also reset this option.

(g) Alarm Power On

This option lets you set a time and date for automatic power on and lets you enable or disable the ring indicator feature. **Ring Indicator** is displayed only when the computer is in Resume mode and **Alarm Date Option** is displayed when **Alarm Time** is enabled.

	OPTIONS	
Alarm Time	=	xx:xx:00
Alarm Date Option	=	xx - xx
Ring Indicator	=	Enabled

Alarm Time is set in the sequence of hours and minutes. Seconds cannot be changed. **Alarm Date Option** is set in the sequence of month and day. If Alarm Date is set to Disabled, the computer will be powered on at the same time every day. Press ↓ to move the cursor to the right and ↑ to move the cursor to the left when you set the date and time.

- NOTES:**
1. Do not remove the AC adapter and battery pack at the same time when you use this feature. If you do so, data saved by AutoResume will be lost. You must also reset this option.
 2. If you have set a password and the computer boots by the Auto Power On function and Resume is on, the computer will start with the instant security function enabled. The **Password =** message is not displayed; however, you must enter the password to use the computer.

(h) Pointing Devices

This option enables or disables the AccuPoint.

- | | |
|----------------------|--|
| <i>Auto selected</i> | If the PS/2 mouse is connected to the computer when you turn the power on, the PS/2 mouse is enabled and the AccuPoint is disabled. Otherwise, the AccuPoint is enabled. (Default) |
| <i>Simultaneous</i> | Enables both the AccuPoint and PS/2 mouse. |

(i) Boot Priority

Use this option to select the disk drive priority for boot up.

- | | |
|----------------|---|
| <i>FDD@HDD</i> | The computer looks for bootable files first on the FDD and next on the HDD. (Default) |
| <i>HDD@FDD</i> | The computer looks for bootable files first on the HDD and next on the FDD. |

You can reverse the order by holding the **F10** key down while the computer is booting. This procedure alternates the setup setting.

Chapter 4

Replacement Procedures

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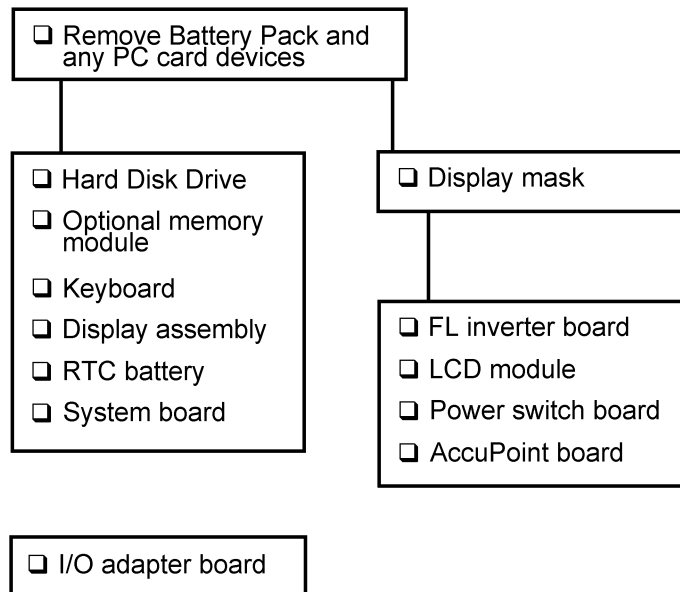
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4.1 Overview

This section explains how to disassemble the computer and replace Field Replaceable Units (FRUs). It may not be necessary to remove all the FRUs in order to replace one. The chart below is a guide to which FRUs need to be removed in order to remove others. Always start by removing the battery pack, then follow the lines on the chart to determine which FRU you must remove next in order to repair the one you think is causing the computer to operate improperly.



Safety Precautions

Before you begin disassembly, read the following safety precautions and observe them carefully as you work.

- DANGER:**
1. Always use the lithium ion battery pack or backup battery that is authorized by Toshiba or compatible with the unit. Since other battery packs have different specifications, they may be incompatible with the unit, and may burst or explode. Heating or disassembling the battery pack could cause leakage of alkaline solution. Throwing the battery pack into a fire could cause the battery pack to explode.
 2. The power supply, FL inverter and other components carry high voltages. To avoid the risk of electric shock when you need to turn on the power of a partially disassembled computer to check its operation, be careful not to touch connectors or components. Also, do not disassemble individual components during first-level maintenance.

- WARNING:** *To avoid the risk of electric shock or other injury:*
1. Always turn the power off and disconnect the AC power cord from the power source.
 2. Remove any metal jewelry or accessories such as necklaces, bracelets, or rings. Batteries in the computer retain electrical charge so there is danger of electrical shock even when the computer is disconnected from an AC power source.
 3. Never work with wet or damp hands.
 4. The computer contains many sharp edges and corners, so be careful not to injure yourself.
 5. Make sure that all replacement components meet the specifications for the computer and that all cables and connectors are securely fastened.

- CAUTION:** *To avoid damage to the computer:*
1. When you change a component, be sure the replacement component meets the required specifications.
 2. Metal objects such as screws or paper clips which fall into the unit can cause short-circuit, fire, or other internal damage.
 3. When assembling the computer make sure you use the correct screws to secure the various pieces in place. Screw sizes are listed in the corresponding figure. Make sure all screws are securely fastened. Loose screws can cause short circuits, resulting in heat, smoke, or fire.
 4. Before removing an FRU or other component, make sure all cables to the component have been removed.
 5. If you use AC power, be sure to use the cable that came with the computer or one recommended by Toshiba.

Before You Begin

Look over the procedures in this section before you begin disassembling the computer. Familiarize yourself with the disassembly and reassembly steps. Begin each procedure by removing the AC adapter and the battery pack as instructed in Section 4.2.

1. Do not disassemble the computer unless it is operating abnormally.
2. Use only the correct and approved tools.
3. Make sure the working environment is free from the following elements whether you are using or storing the computer:
 - Dust and contaminants
 - Static electricity
 - Extreme heat, cold and humidity
4. Make sure the FRU you are replacing is causing the abnormal operation by performing the necessary diagnostics tests described in this manual.
5. Do not perform any operations that are not necessary and use only the described procedures for removing and installing FRUs in the computer.
6. After removing parts from the computer, place them in a safe place away from the computer so they will not be damaged and will not interfere with your work.
7. You will remove and replace many screws when you disassemble the computer. When you remove screws, make sure they are put in a safe place and are identified with the correct parts.
8. When assembling the computer, be sure you use the correct screws to secure the various pieces in place. Screw sizes are listed in the corresponding figures.
9. The computer contains many sharp edges and corners, be careful not to injure yourself.
10. After you have replaced an FRU, be sure the computer is functioning properly by performing the appropriate test on the FRU you have fixed or replaced.

Disassembly Procedures

There are three basic types of cable connectors.

- Pressure plate connector
- Normal pin connector
- Flexible Cable Connector

To disconnect a Pressure Plate connector, lift up the tabs on either side of the plastic pressure plate and slide the cable out of the connector. To connect the cable to a Pressure Plate connector, make sure the pressure plate is fully lifted and slide the cable into the connector. Secure the cable in place by pushing the sides of the pressure plate down so the plate is flush with the sides of the connector. Gently pull on the cable to make sure the cable is secure. If the connector comes out, connect it again making sure the pressure plate is fully lifted when you insert the cable.

Standard pin and flexible cable connectors are used for all other cables. The cables can be connected to and disconnected from these connectors by simply pulling or pushing.

Reassembly Procedures

After you have disassembled the computer and fixed or repaired the problem that was causing the computer to operate abnormally, you will need to reassemble the computer.

While assembling the computer, remember the following general points:

- Take your time, making sure you follow the instructions closely. Most problems arise when you hurry to assemble the computer.
- Be sure all cables and connectors are securely fastened.
- Before securing the FRU or other parts, be sure that no cables will be pinched by screws or the FRU.
- Check that all latches are closed securely in place.
- Be sure the correct screws are used to secure all FRUs. Using the wrong screw can damage the threads on the screw or the head of the screw and may prevent proper seating of an FRU.

After installing an FRU in the computer confirm that the FRU and the computer are functioning properly.

Tools and Equipment

The use of Electrostatic Discharge (ESD) equipment is very important for your safety and the safety of those around you. Proper use of these devices will increase the success rate of your repairs and lower the cost for damaged or destroyed parts. The following equipment is necessary to disassemble and reassemble the computer:

- One M2 Phillips screwdriver to remove and replace screws.
- Tweezers, to lift out screws that you cannot grasp with your fingers.
- ESD mats for the floor and the table you are working on.
- An ESD wrist strap or heel grounder.
- Antistatic carpeting or flooring.
- Air ionizers in highly static sensitive areas.
- Plastic card the size of a credit card.

Screw Tightening Torques

When you fasten screws, be sure to follow the torque list below. Overtightening can damage components and screws; undertightening can result in electrical shorts or other damage if screws or components come loose.

- | | |
|---|------------------------------|
| <input type="checkbox"/> M2 | 0.22 N•m (2.2 kgf•cm) |
| <input type="checkbox"/> M2.5 | 0.36 N•m (3.5 kgf•cm) |
| <input type="checkbox"/> FDD (External) | 0.22 N•m (2.2 kgf•cm) |
| <input type="checkbox"/> HDD | 0.3 N•m (3.1 kgf•cm) or less |
| <input type="checkbox"/> M3 | 0.49 N•m (5.0 kgf cm) |
| <input type="checkbox"/> Thin-head M2.5 | 0.22 N•m (2.2 kgf.cm) |

4.2 Battery Pack

Removing the Battery Pack

To remove the battery pack, follow the steps below and refer to Figure 4-1.

1. Turn the computer off. Disconnect the AC adapter and other optional units from the computer.
2. Turn the computer upside down.
3. Slide the battery **release latch** to the left to unlock it.
4. With the **battery** facing up, slide it out.

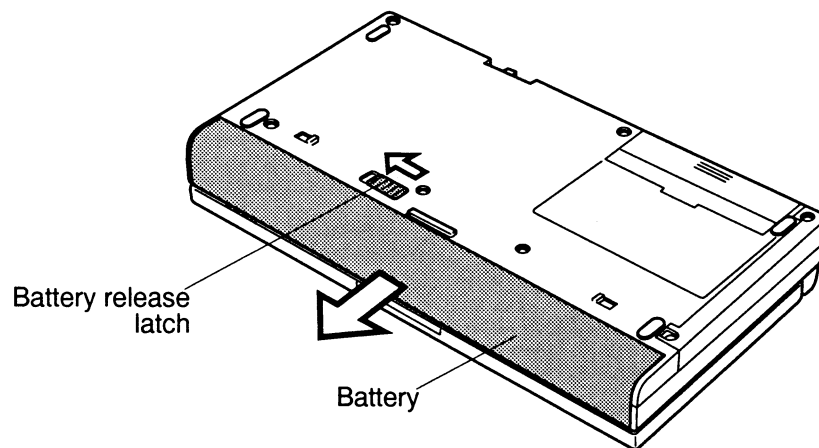


Figure 4-1 Removing the battery pack

NOTE: For environmental reasons, do not throw away a spent battery pack. Please return spent battery packs to your Toshiba dealer.

Installing the Battery Pack

To install the battery pack, follow the steps below and refer to Figure 4-1.

WARNING: *The battery is a lithium ion battery. The battery can explode if not properly replaced, used, handled, or disposed of. Use only batteries recommended by Toshiba as replacements.*

NOTE: *Check the battery terminals visually. If they are dirty, wipe them clean with a dry cloth.*

1. Turn the computer off. Disconnect the AC adapter and all the external cables from the computer.
2. Hold the battery in line with the guide rail.
3. Push the battery into position and close the cover.

4.3 Optional PC Card

Removing the Optional PC Card

To remove the optional PC card, be sure the computer is in boot mode. Follow the steps below and refer to Figure 4-2.

1. Turn the computer off.
2. Slide the **PC card release lever** to the right.
3. The PC card comes out slightly. Hold it securely and pull it out.

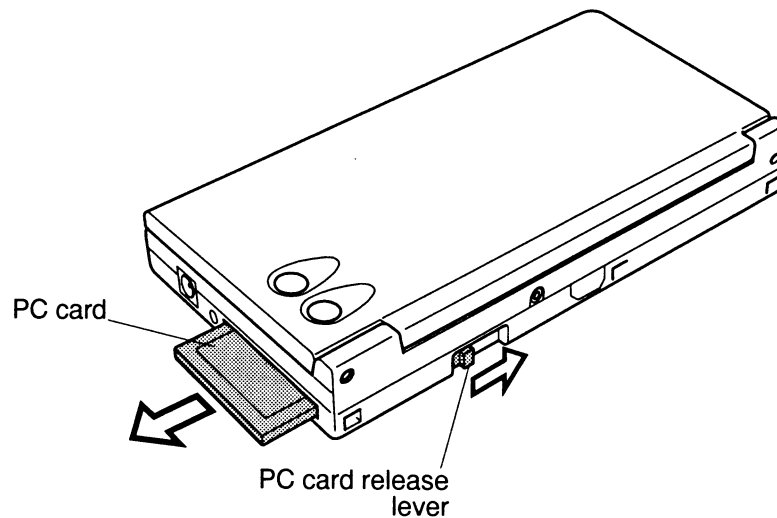


Figure 4-2 Removing the PC Card

NOTE: The unit may contain a dummy card which is inserted or removed in the same manner as a normal PC card.

Installing the Optional PC Card

To install the optional PC card, follow the steps below and refer to Figures 4-3 and 4-2.

NOTE: Before installing the PC card, be sure that the computer is in boot mode.

1. Turn the computer off.
2. Insert the PC card. Carefully push it into place.

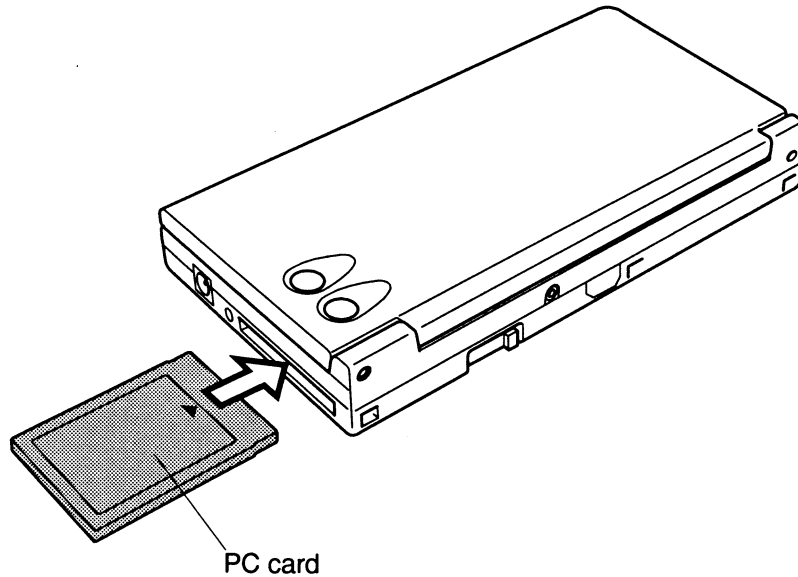


Figure 4-3 Installing the PC card

3. Visually check that, when the PC card is fully inserted, the PC card release lever is positioned on the left.

NOTE: The unit may contain a dummy card which is inserted or removed in the same manner as a normal PC card.

4.4 Hard Disk Drive (HDD)

Removing the HDD

To remove the HDD, follow the steps below and refer to Figures 4-4 to 4-6.

1. Turn the computer upside down.
2. Remove **two M2x14 silver screws** and then the HDD cover.

CAUTION: Be careful not to press on the top or bottom of the HDD. Undue pressure can destroy data or damage the drive.

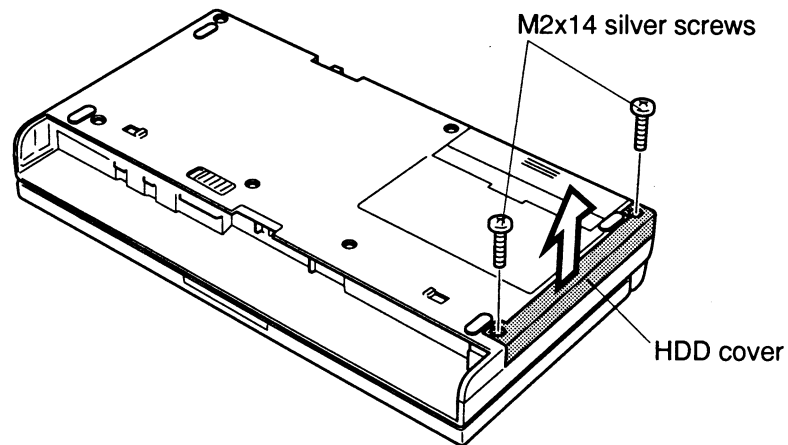
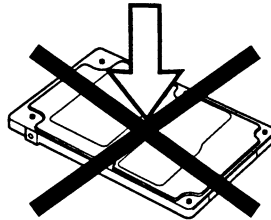


Figure 4-4 HDD cover removal

3. Loosen the HDD bracket handle with a thin object. Grasp the handle and pull the HDD out.

NOTE: When pulling the HDD out, be sure to hold both corners of the bracket as shown below so as not to bend the bracket.

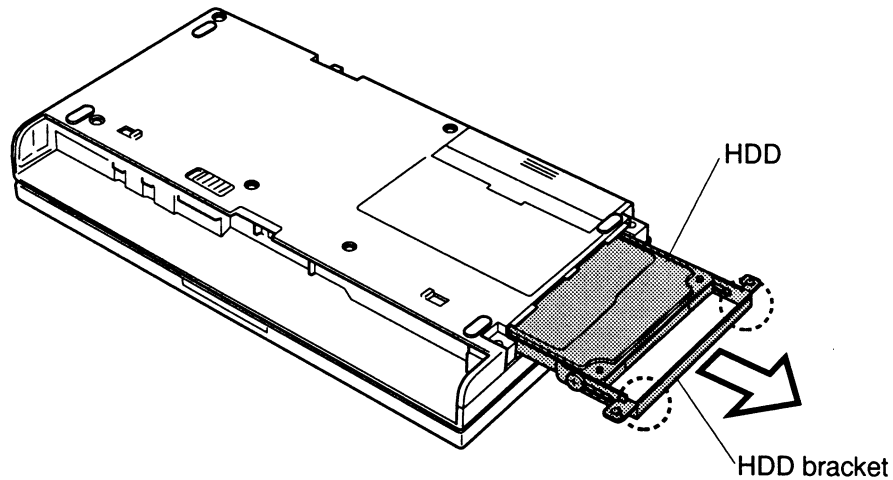


Figure 4-5 HDD removal

4. Remove **two thin-flat-head M3 screws** from the HDD bracket, and separate the bracket and the HDD.

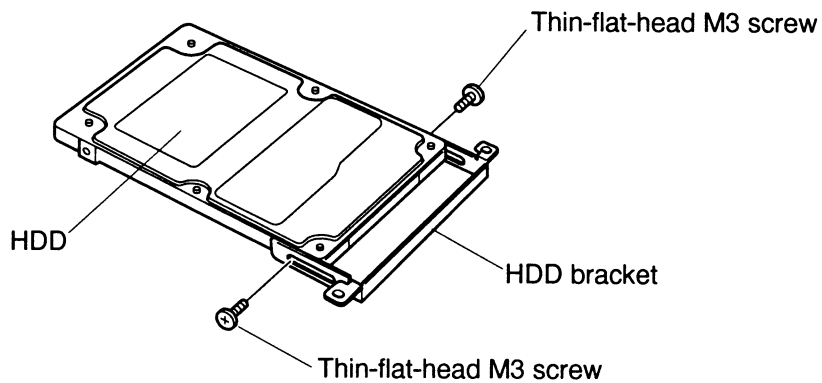


Figure 4-6 HDD bracket removal

Installing the HDD

To install the HDD, follow the steps below and refer to figures 4-6 back through 4-4.

1. Secure the HDD bracket to the HDD with **two thin-flat-head M3 screws**.
2. Insert the HDD, board side up, into the HDD slot and push it carefully and securely into place.
3. Place the HDD cover in position and secure it with **two M2x14 silver screws**.

4.5 Optional Memory Module

Removing the Optional Memory Module

To remove the optional memory module, follow the steps below and refer to Figures 4-7 to 4-9.

1. Open the display fully.
2. Release the keyboard brace at six points by lifting it from right to left. Remove the keyboard brace.

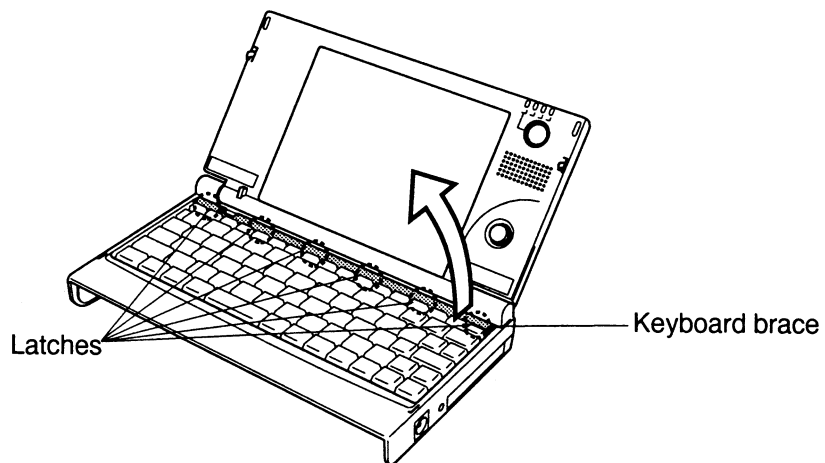


Figure 4-7 Keyboard brace removal

3. Remove **one M2x4 screw** that secures the keyboard, then lift the keyboard out from the top. Note the extensions on the bottom of the keyboard that fit into the base. Lay the keyboard, with the cables still connected, face down on the edge of the base.

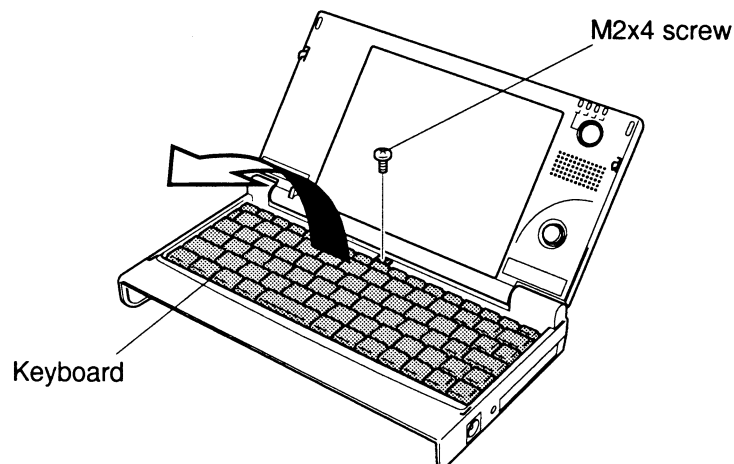


Figure 4-8 Screw removal

4. Remove **one thin-head M2.5 screw**, and then disconnect the memory module from **PJ140** on the system board.

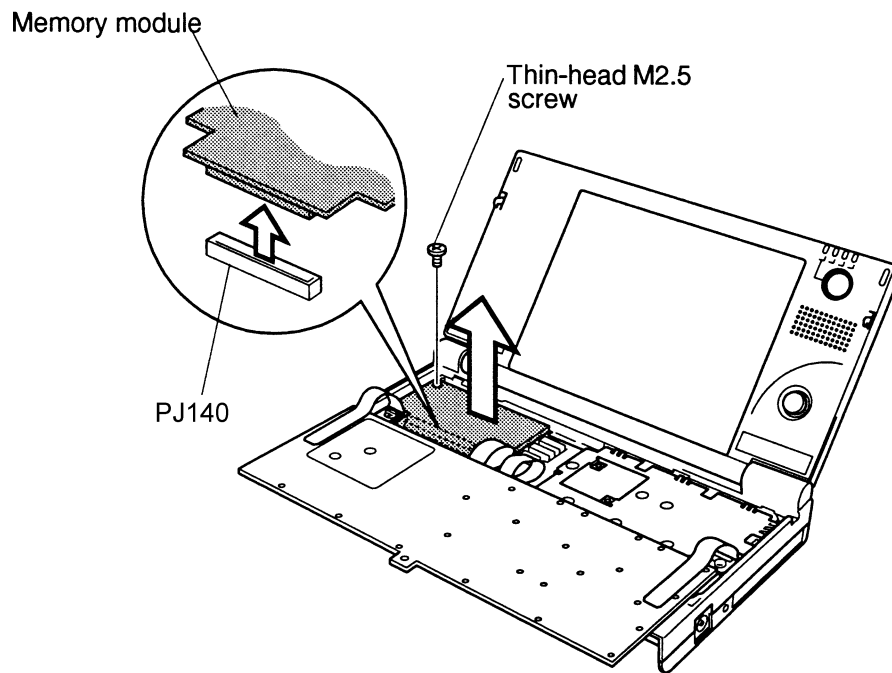


Figure 4-9 Optional memory module removal

Installing the Optional Memory Module

To install the optional memory module, follow the steps below and refer to Figures 4-9 back through 4-7.

1. Connect the memory module to **PJ140** on the system board.

CAUTION: Do not touch the connectors of the memory module or computer. Memory access trouble may arise from foreign matter adhering to the connectors.

2. Secure the memory module with **one thin-head M2.5 screw**.
3. Place the keyboard. The keyboard has tabs on the front, so install it by inserting from the front, taking care to not bend the flexible cable.
4. Secure the keyboard with **one M2x4 screw**.
5. Replace the keyboard brace and press to engage the latches.

4.6 Keyboard

Removing the Keyboard

To remove the keyboard, follow the steps below and refer to Figure 4-10.

1. Turn the computer off. Disconnect the AC adapter and any optional units from the computer. Remove the battery as described in Section 4.2.
2. Release the **keyboard brace** at six points by lifting it from right to left. Remove the keyboard brace.
3. Remove **one M2x4 screw** that secures the keyboard.

NOTE: The keyboard brace and M2x4 screw may have already been removed in Section 4.5, *Optional Memory Module*.

4. Raise the keyboard toward the display to access the keyboard cable.
5. Remove **two M2x3 silver screws** from the keyboard straps on the right and left.
6. Disconnect the **flexible cable** from **PJ6** and remove the keyboard.

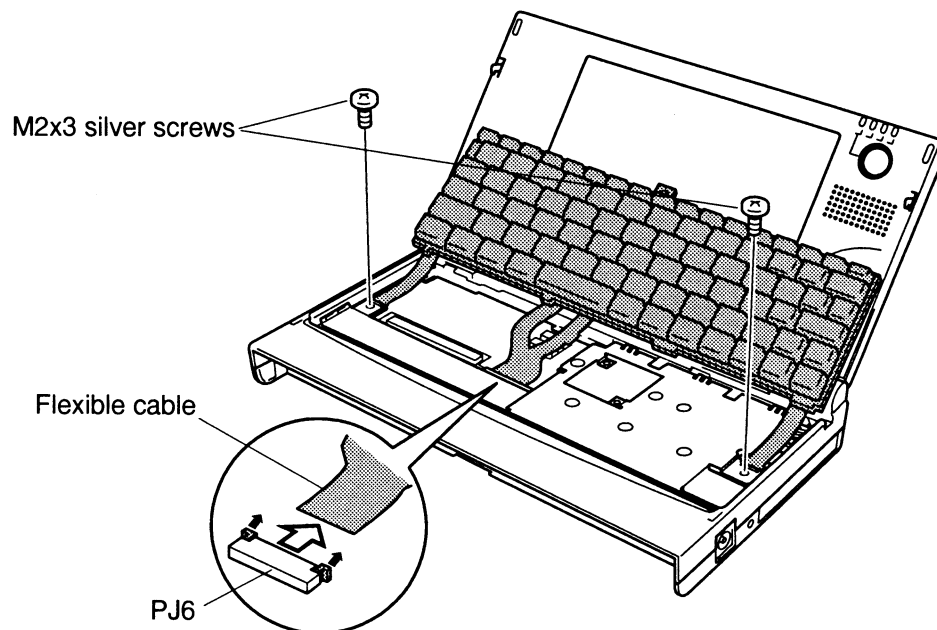


Figure 4-10 Keyboard removal

Installing the Keyboard

To install the keyboard, follow the steps below and refer to Figure 4-10.

1. Connect the **flexible cable** to **PJ6**.
2. Replace **two M2x3 silver screws** that secure the keyboard straps.
3. Place the keyboard by inserting the tabs on the bottom of the keyboard into the corresponding holes in the base, taking care not to bend the flexible cable.
4. Secure the keyboard with **one M2x4 screw**.
5. Replace the keyboard brace.

NOTE: *If you are installing an optional memory module, do that procedure first.*

6. Replace the battery as described in Section 4.2.

4.7 Display Assembly

Removing the Display Assembly

To remove the display assembly, follow the steps below and refer to Figures 4-11 to 4-14.

1. Remove the battery, optional PC card, HDD, optional memory module, and keyboard as described in Sections 4.2 through 4.6.
2. Remove **two thin-head M2.5 screws**, and then the metal cover.

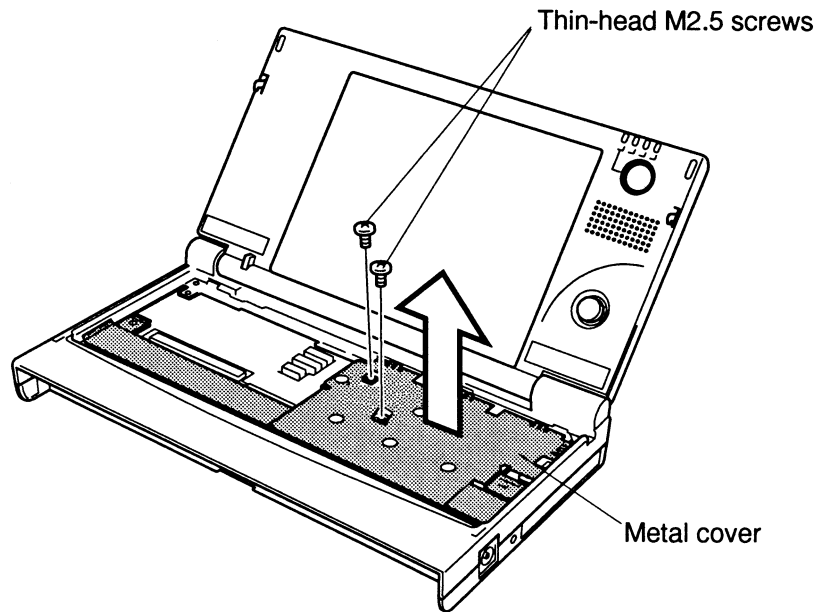


Figure 4-11 Metal cover removal

3. Disconnect the **display flexible cable** from **PJ3** on the system board.

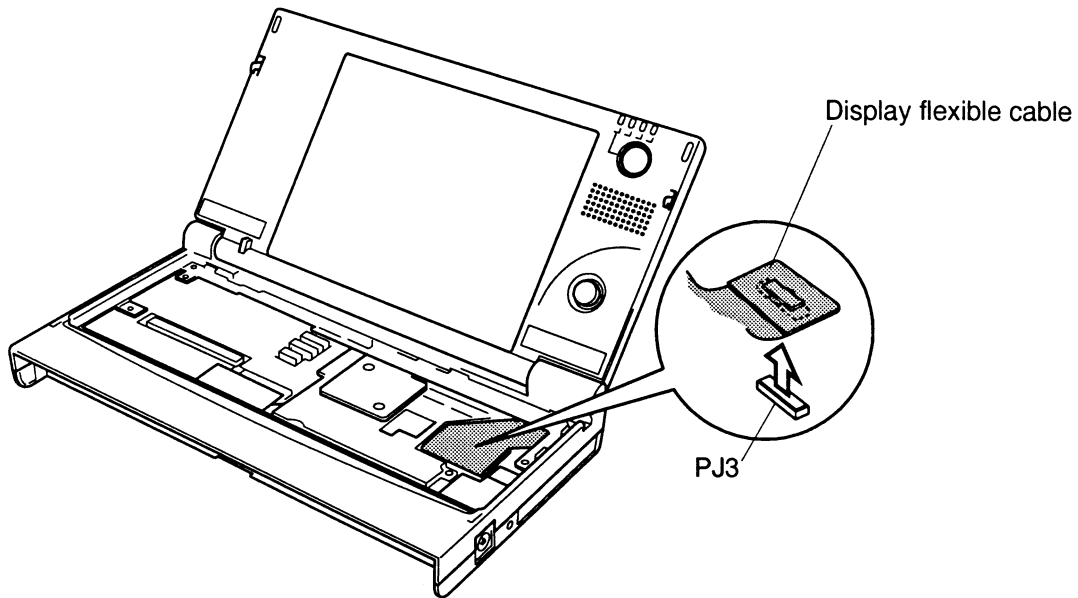


Figure 4-12 Display flexible cable removal

4. Close the display, turn the computer upside down, and remove **five M2x14 silver screws**.

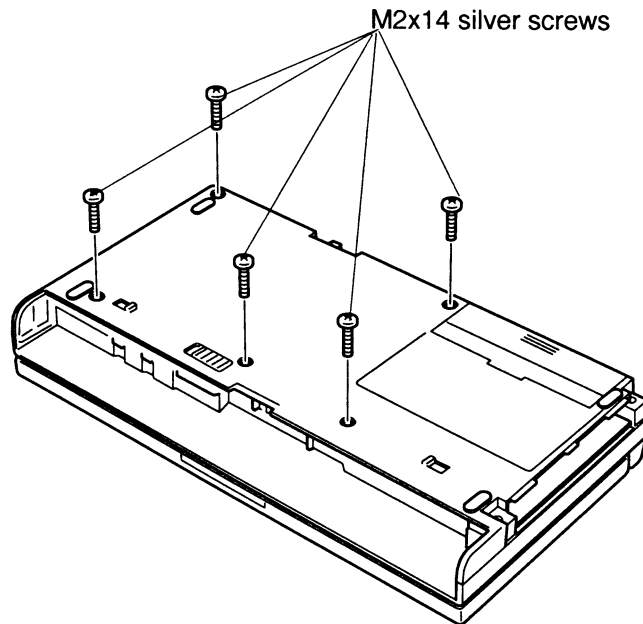


Figure 4-13 Five screws removal

5. Turn the computer back over and open the display.

6. Lift up to remove the display assembly.

CAUTION: Be sure that the flexible cable has been disconnected from PJ3 on the system board before removing the display assembly. An attempt to forcibly remove the display assembly when the flexible cable is still connected to PJ3 may result in a broken flexible cable.

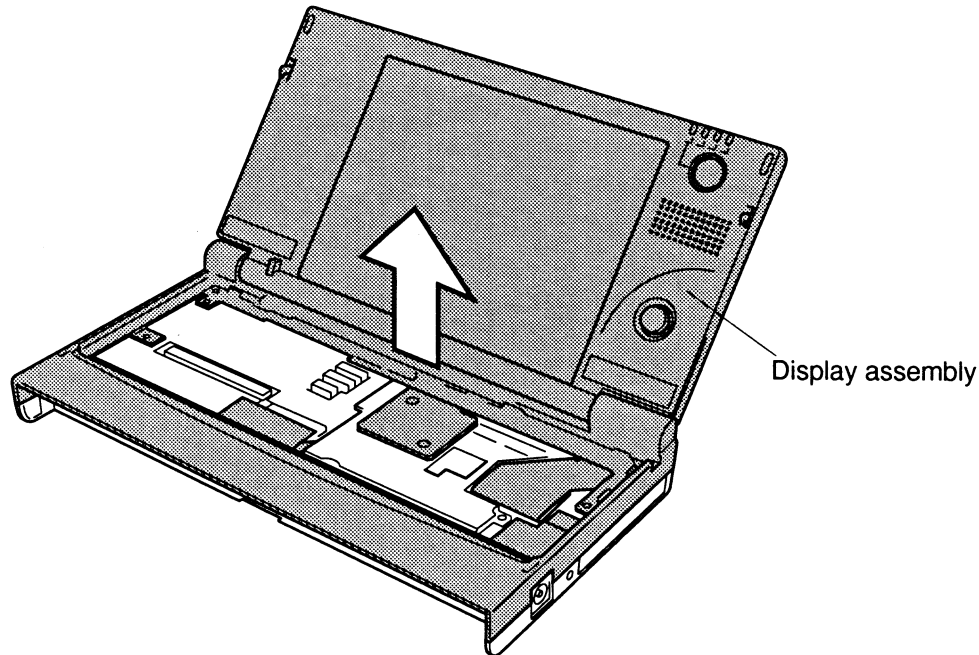


Figure 4-14 Display assembly removal

Installing the Display Assembly

To install the display assembly, follow the steps below and refer to Figures 4-14 back through 4-11.

1. Connect the **display flexible cable** to **PJ3** on the system board.
2. Place the display assembly onto the base.
3. Secure the **metal cover** with **two thin-head M2.5 screws**.
4. Close the display, turn the computer upside down, and secure the display with **five M2x14 silver screws**.
5. Install the keyboard, optional memory module, HDD, optional PC card, and battery as described in Sections 4.6 back through 4.2.

4.8 RTC Battery

Removing the RTC Battery

To remove the RTC battery, follow the steps below and refer to Figure 4-15.

1. Remove the battery, optional PC card, HDD, optional memory module, keyboard, and display assembly as described in Sections 4.2 through 4.7.
2. Disconnect the **RTC battery cable** from **PJ4** on the system board and remove the RTC battery.

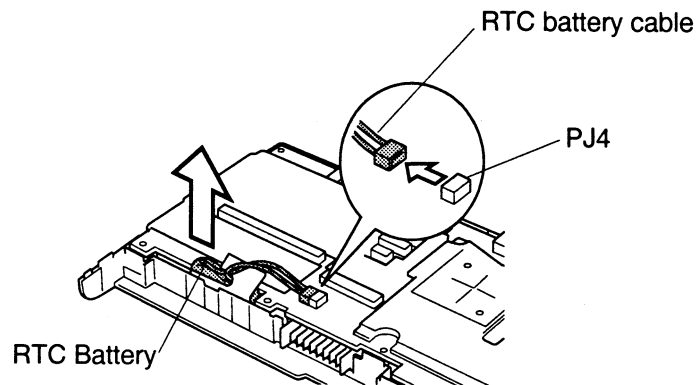


Figure 4-15 RTC battery removal

Installing the RTC Battery

To install the RTC battery, follow the steps below and refer to Figure 4-15.

1. Connect the **RTC battery cable** to **PJ4** on the system board.
2. Secure the RTC battery.
3. Install the display assembly, keyboard, optional memory module, HDD, optional PC card, and battery as described in Sections 4.7 back through 4.2.

4.9 System Board

Removing the System Board

To remove the system board, follow the steps below and refer to Figure 4-16.

1. Turn the computer off. Disconnect the AC adapter and optional units from the computer.
2. Remove the battery, optional PC card, HDD, optional memory module, keyboard, display assembly, and RTC battery as described in Sections 4.2 through 4.8.
3. Gently lift up on the system board near the DC Jack Harness and remove the board.

NOTE: Be careful of the IR lens cover, it may fall out of the base. Also, the stereo jack plate is not attached and may fall off the system board.

4. Disconnect the **DC Jack Harness** from **PJ401** on the system board.

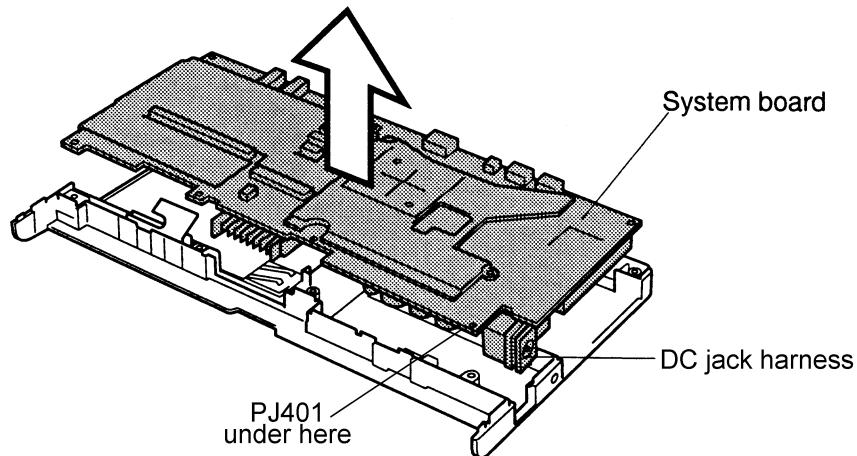


Figure 4-16 System board removal

Installing the System Board

To install the system board, follow the steps below and refer to Figure 4-16.

1. Attach the **DC Jack Harness** to **PJ401** on the system board, then place the system board in the base.

NOTE: Be sure the stereo jack plate and the IR lens cover are in place.

2. Install the RTC battery, display assembly, keyboard, optional memory module, HDD, optional PC card, and battery as described in Sections 4.8 back through 4.2.

4.10 Display Mask

Removing the Display Mask

To remove the display mask, follow the steps below and refer to Figures 4-17 and 4-18.

1. Turn the computer off. Disconnect the AC adapter and optional units from the computer.
2. Remove the battery as described in Section 4.2.
3. Remove **two mask seals** on the right and left in the lower part of the display mask, to reveal two M2.5x5 screws.
4. Remove **two M2.5x5 screws** concealed under the seals.

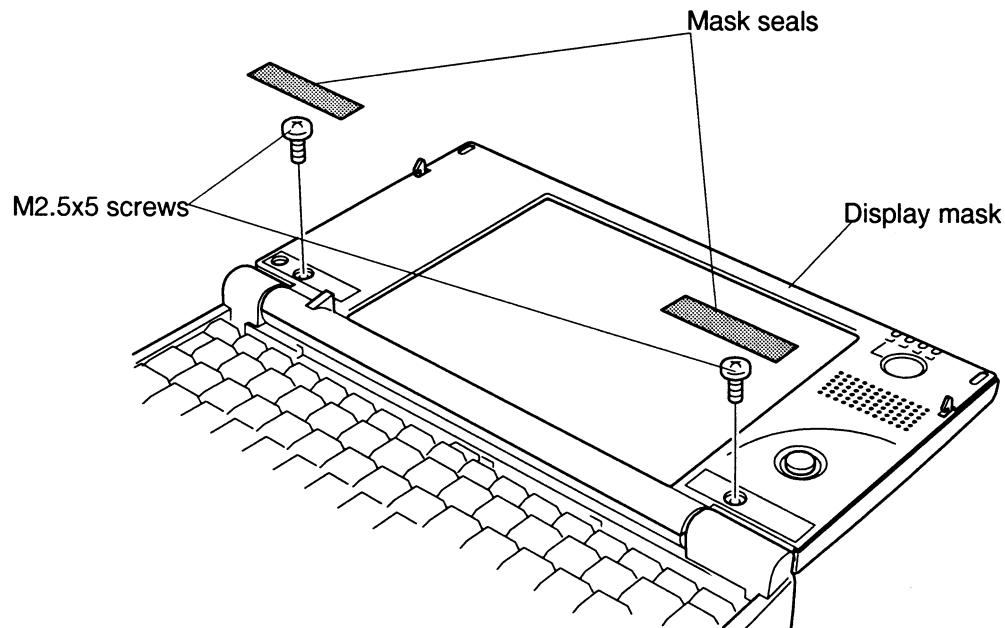


Figure 4-17 Mask seal removal

5. Remove the pointing cap.
6. Carefully insert the fingers of both hands between the mask and LCD panel and release the latches, starting with the five latches in the upper part of the display mask.

7. Continue to release the display mask, using the fingers of both hands, on the sides (1 each) and at the bottom (6).

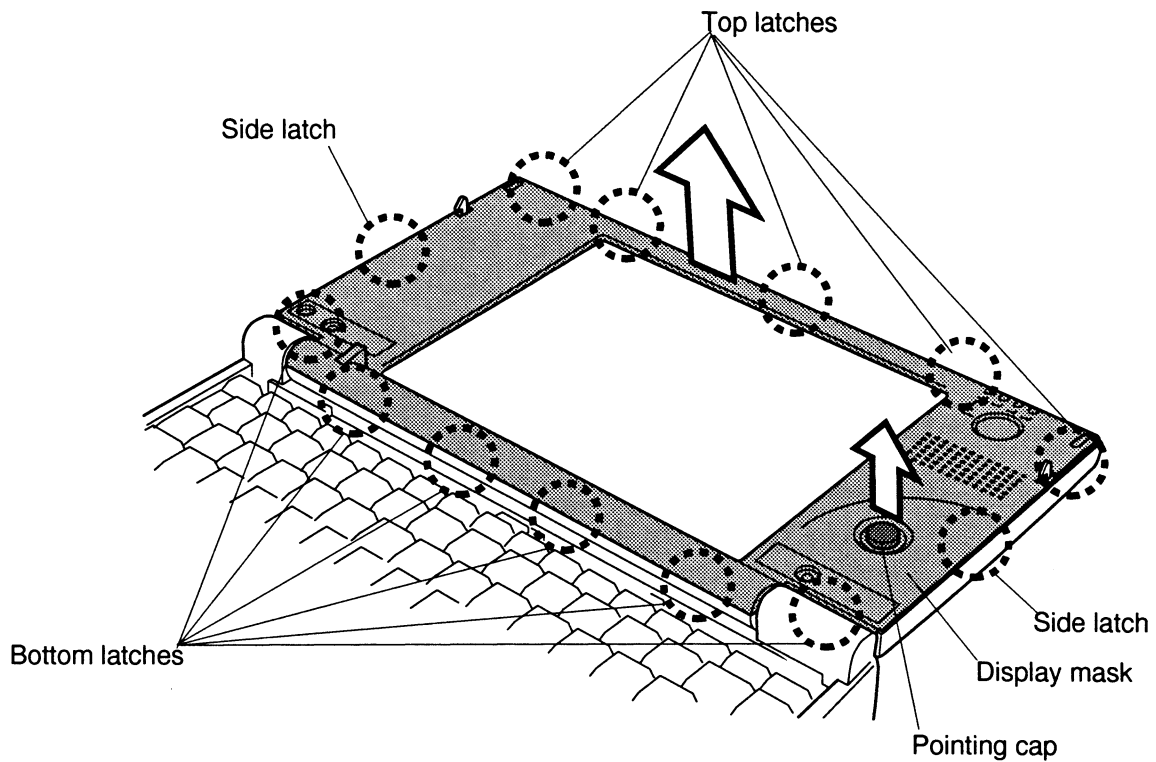


Figure 4-18 Display mask removal

Installing the Display Mask

To install the display mask, follow the steps below and refer to Figures 4-18 and 4-17.

1. Set the display mask in place.
2. Press firmly to secure the latches as follows: the bottom (6 latches), sides (1 each), and top (5 latches).
3. Replace the pointing cap.
4. Secure the display mask with **two M2.5x5 screws**.
5. Replace the **two mask seals**.
6. Replace the battery as described in Section 4.2

4.11 FL Inverter Board

Removing the FL Inverter Board

To remove the FL inverter board, follow the steps below and refer to Figure 4-19.

1. Turn the computer off. Disconnect the AC adapter and optional units from the computer.
2. Remove the battery and display mask as described in Sections 4.2 and 4.10.
3. Remove **one silver M2x3 screw** that secures the FL inverter board.
4. Remove the **FL inverter board** from the board clamp, then carefully turn it to disconnect the **FL cable** from CN1 and the **display flexible cable** from CN2.

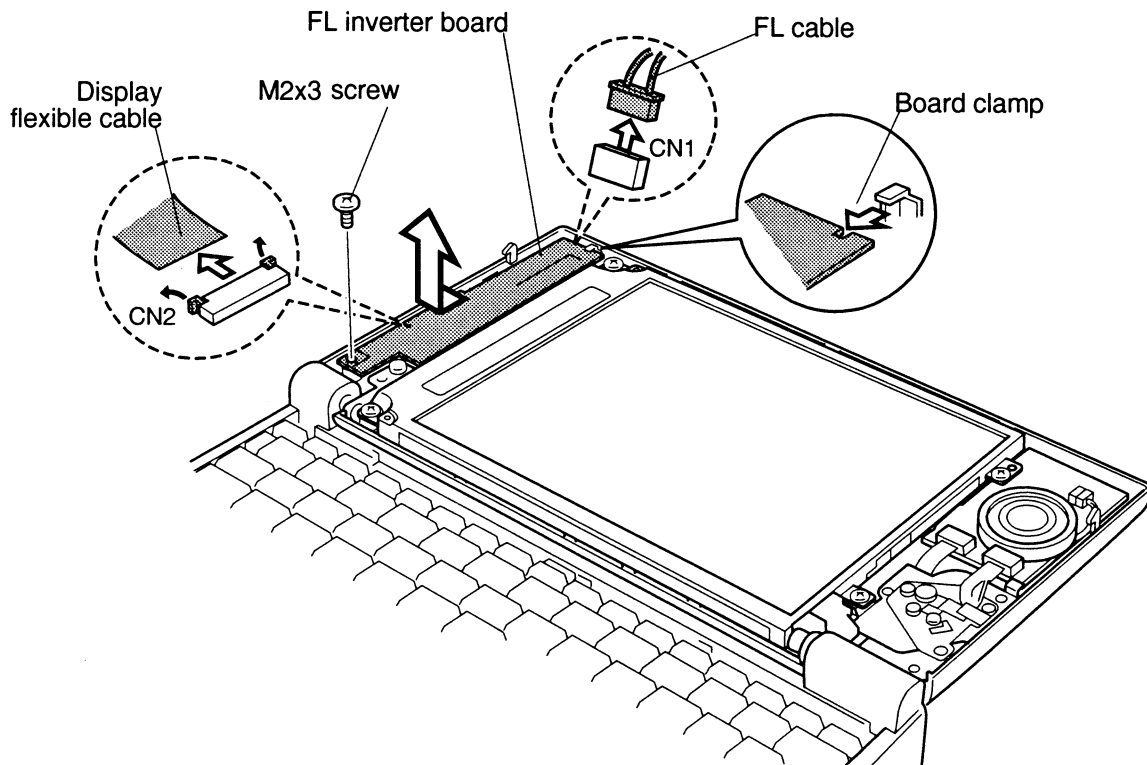


Figure 4-19 FL inverter board removal

Installing the FL Inverter Board

To install the FL inverter board, follow the steps below and refer to Figure 4-19.

1. Connect the **display flexible cable** to CN2 and the **FL cable** to CN1 on the FL inverter board.
2. Replace the FL inverter board and secure it with **one silver M2x3 screw**.
3. Install the and display mask and battery as described in Sections 4.10 and 4.2.

4.12 LCD Module

Removing the LCD Module

To remove the LCD module, follow the steps below and refer to Figure 4-20.

1. Turn the computer off. Disconnect the AC adapter and optional units from the computer.
2. Remove the battery, display mask, and FL inverter board as described in Sections 4.2, 4.10 and 4.11.
3. Remove **four silver M2x3 screws** that secure the LCD module to the LCD cover.
4. Carefully turn the **LCD module** to remove it from the display cover, and disconnect the **display flexible cable** from CN1 on the LCD module.

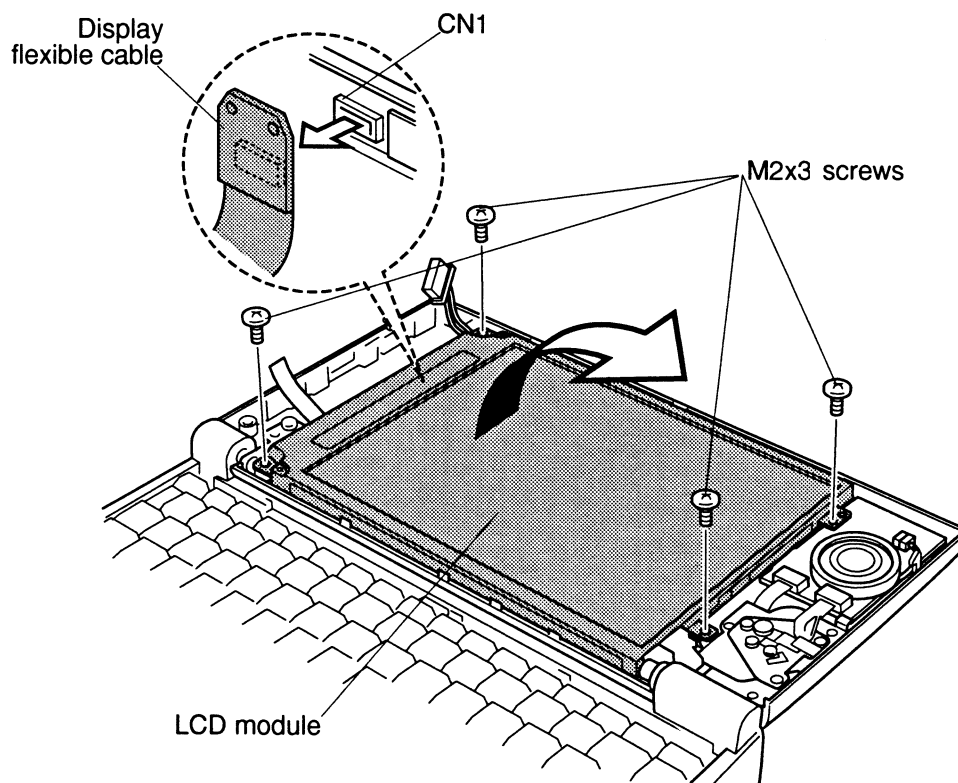


Figure 4-20 LCD module removal

Installing the LCD Module

To install the LCD module, follow the steps below and refer to Figure 4-20.

1. Connect the **display flexible cable** to CN1 on the LCD module.
2. Replace the **LCD module** and secure it to the LCD cover with **four silver M2x3 screws**.
3. Install the FL inverter board, display mask, and battery as described in Sections 4.11, 4.10, and 4.2.

4.13 Power Switch Board

Removing the Power Switch Board

To remove the power switch board, follow the steps below and refer to Figures 4-21 and 4-22.

1. Turn the computer off. Disconnect the AC adapter and optional units from the computer.
2. Remove the battery, display mask, FL inverter board, and LCD module as described in Sections 4.2 and 4.10 through 4.12.
3. Disconnect **three flexible cables** from **PJ3**, **PJ11**, and **PJ12** then remove the power switch board.

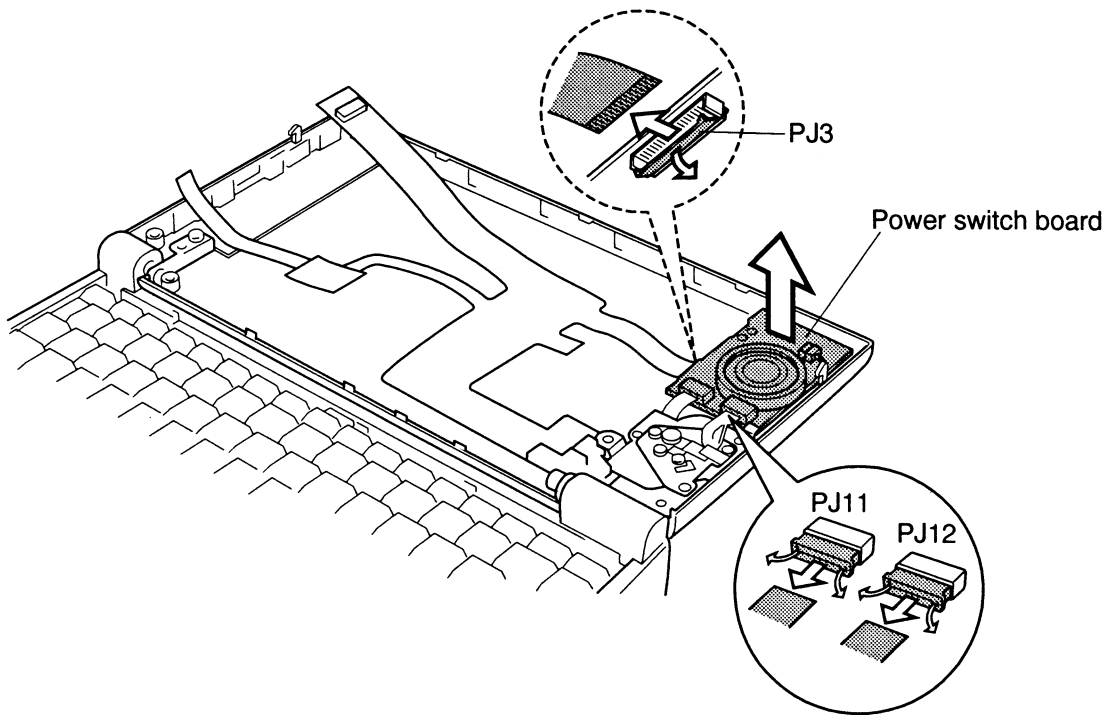


Figure 4-21 Power switch board removal

4. Disconnect the **speaker cable** from **PJ5** on the power switch board and remove the speaker.

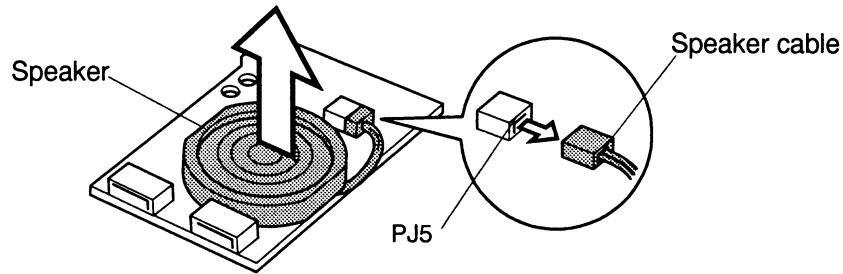


Figure 4-22 Speaker removal

Installing the Power Switch Board

To install the power switch board, follow the steps below and refer to Figures 4-23 back through 4-21.

1. Connect the **power switch cable** to **PJ5** on the power switch board.
2. Place the power switch into position on the power switch board.
3. Insert the **speaker fix shaft** into the power board to secure the speaker.

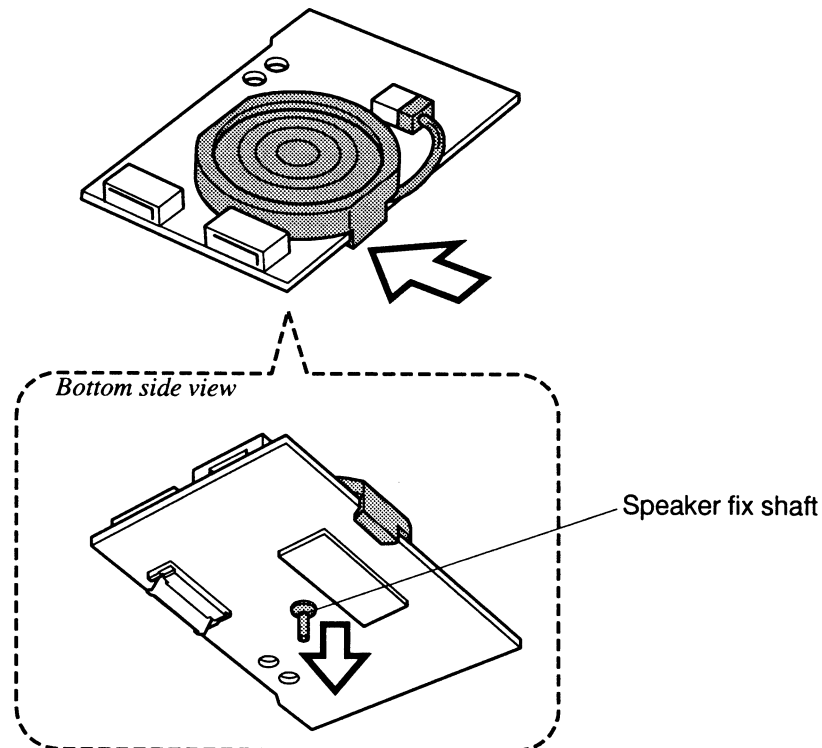


Figure 4-23 Inserting the speaker fix shaft

4. Connect the flexible cables to **PJ3**, **PJ11**, and **PJ12**.

5. Install the LCD module, FL inverter board, display mask, and battery as described in Sections 4.12, 4.11, 4.10, and 4.2.

4.14 AccuPoint Board

Removing the AccuPoint Board

To remove the AccuPoint board, follow the steps below and refer to Figure 4-24.

1. Turn the computer off. Disconnect the AC adapter and optional units from the computer.
2. Remove the battery, display mask, FL inverter board, LCD module, and power switch board as described in Sections 4.2 and 4.10 through 4.13.
3. Remove **two silver M2x3 screws**, then the **AccuPoint board**, **metal plate**, and **AccuPoint flexible cable**.

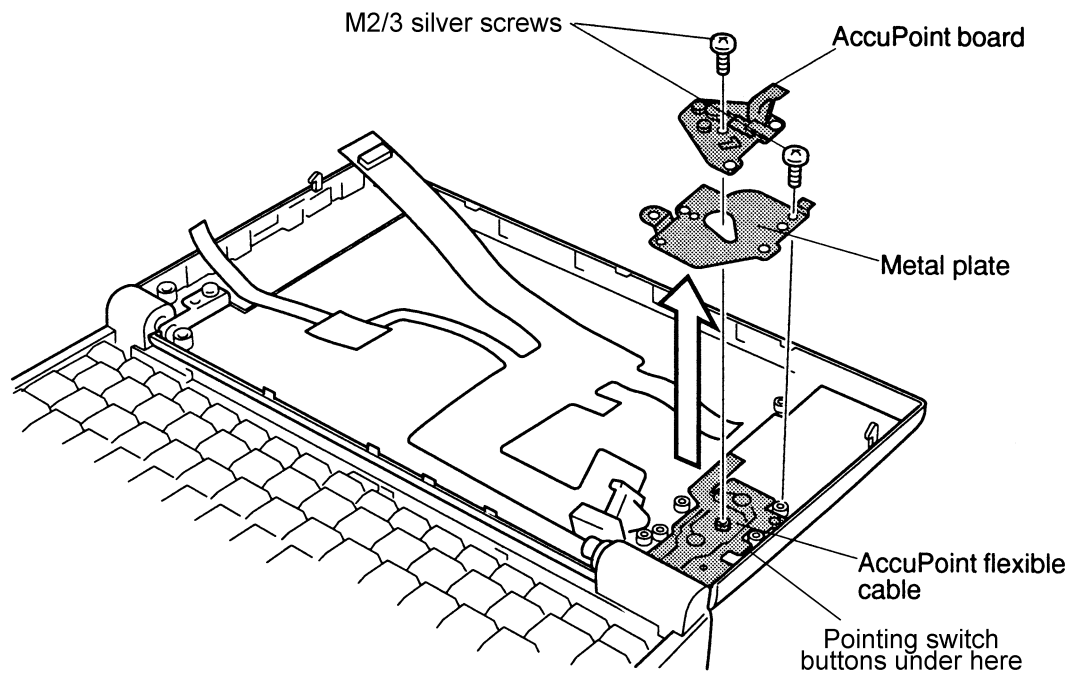


Figure 4-24 AccuPoint board removal

4. Lift out the **pointing switch buttons**.

Installing the AccuPoint Board

To install the AccuPoint board, follow the steps below and refer to Figure 4-24.

1. Replace the pointing switch buttons.
2. Place the **AccuPoint flexible cable** into position, then the **metal plate** and the **AccuPoint board** on top.
3. Secure the AccuPoint board and metal plate with **two silver M2x3 screws**.
4. Install the power switch board, LCD module, FL inverter board, display mask, and battery as described in Sections 4.13 back through 4.10, and 4.2.

4.15 LCD Flexible Cable

Removing the LCD Flexible Cable

To remove the LCD flexible cable, follow the steps below and refer to Figure 4-25.

1. Turn the computer off. Disconnect the AC adapter and optional units from the computer.
2. Remove the battery, display mask, FL inverter board, LCD module, power switch board, and AccuPoint board as described in Sections 4.2 and 4.10 through 4.14.
3. Turn the Display Assembly upside down and remove **one silver M2x3 screw** which secures the **LCD flexible cable** to the top cover. Remove the **tape** and the **plastic cover** over the LCD flexible cable connected to the right side hinge.
4. Remove **one M2.5x5 screw** which secures the left side hinge to the LCD cover.
5. Carefully remove the LCD flexible cable from the display assembly. Be careful not to cut the screw terminal area on the cable.

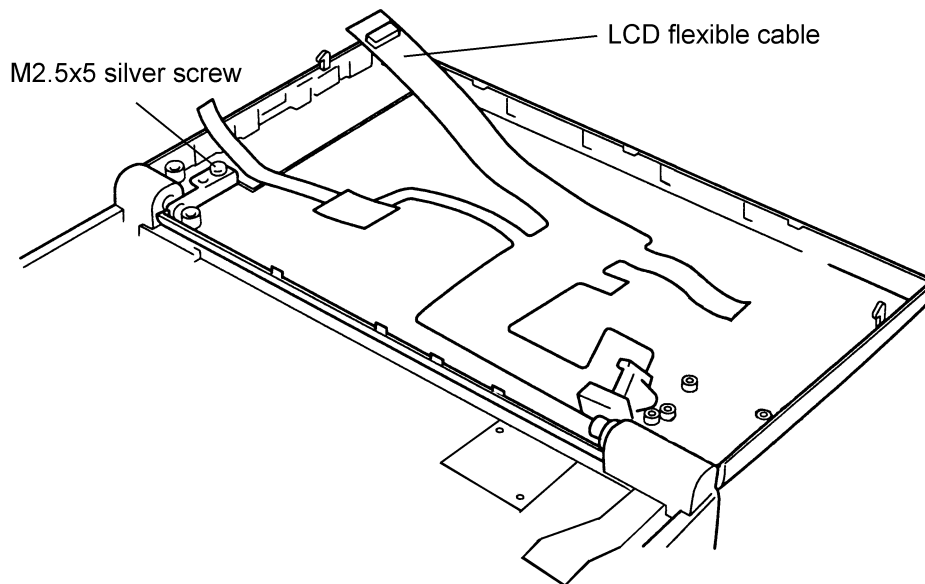


Figure 4-25 Flexible cable removal

Installing the LCD Flexible Cable

To install the LCD flexible cable, follow the steps below and refer to Figures 4-26 and 4-25.

1. Tuck the right side hinge on the cable **roll-center**.
2. Preform the cable by making a 1.5 turn coil around the roll-center.

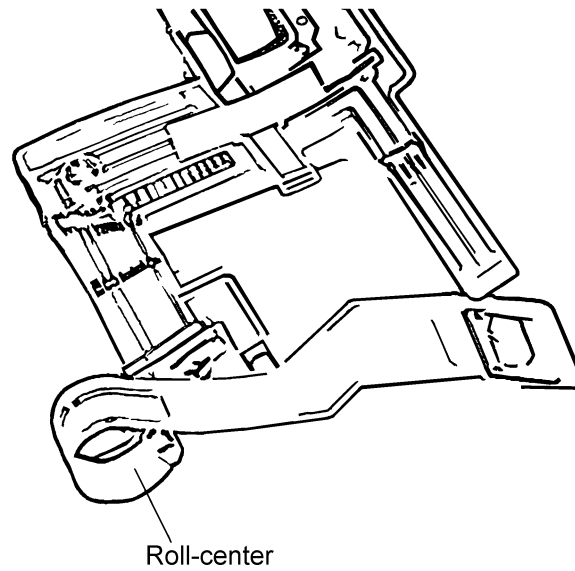


Figure 4-26 Preforming the LCD flexible cable

3. While holding the hinge area roll, put the LCD flexible cable back into the display assembly and place it into position.
4. Place the right side hinge **plastic cover** into position and replace the tape that covers the hinge cover.
5. Replace **one M2x3 silver screw** to secure the LCD flexible cable to the top cover.
6. Replace **one M2.5x5 screw** to secure the left side hinge.
7. Install the AccuPoint board, power switch board, LCD module, FL inverter board, display mask, and battery as described in Sections 4.14 back through 4.10 and 4.2.

4.16 I/O Adapter Board

Removing the I/O Adapter Board

To remove the I/O adapter board, follow the steps below and refer to Figures 4-27 to 4-29.

1. Remove the I/O adapter from the computer. Disconnect all the external cables from the I/O adapter.
2. Turn the I/O adapter upside down and remove: **three M2x4 silver screws** and **one M2x5 silver screw** on the bottom, and **three M2x4 silver screws** at the back.

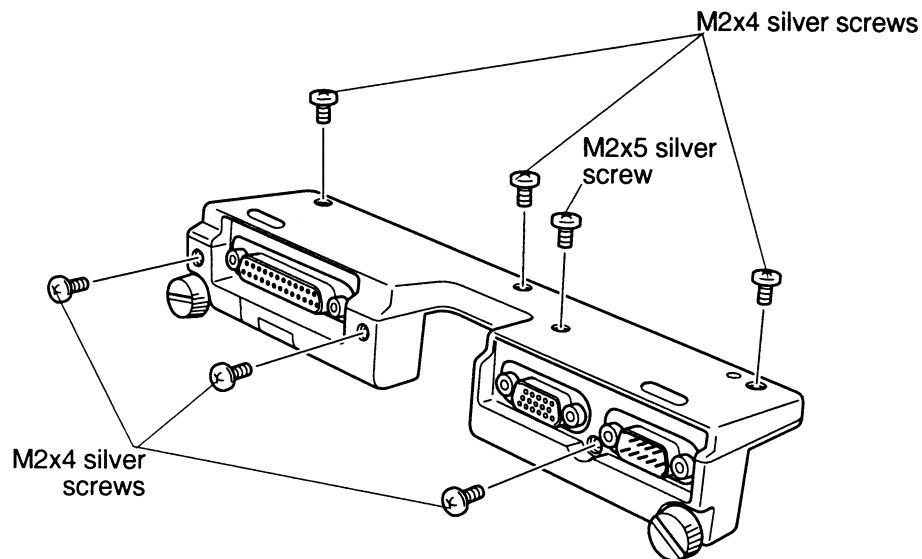


Figure 4-27 Silver screw removal

3. Release **five latches** and remove the **upper cover**.

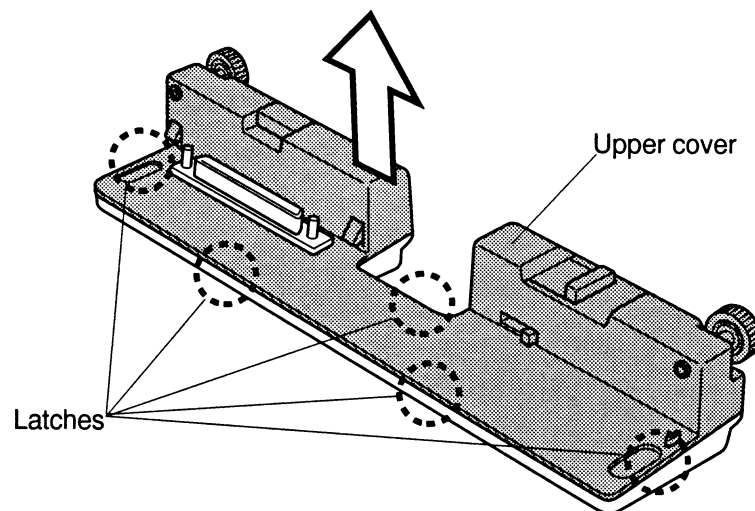


Figure 4-28 Upper cover removal

4. Remove **five M2x4 screws**.
5. Remove the I/O adapter board.

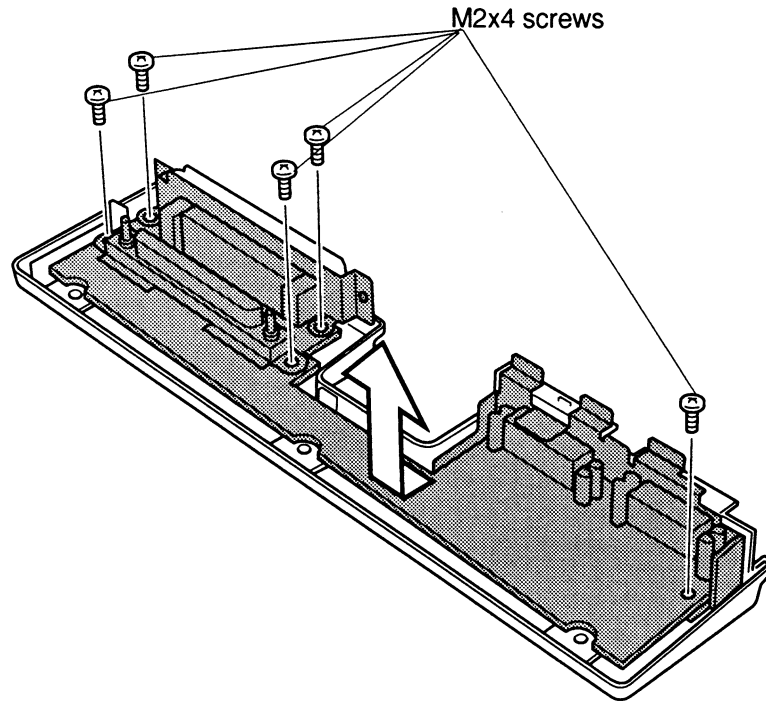


Figure 4-29 I/O adapter board removal

Installing the I/O Adapter Board

To install the I/O adapter board, follow the steps below and refer to Figures 4-29 back through 4-27.

1. Reseat the I/O adapter board and secure it with **five M2x4 screws**.
2. Replace the upper cover.
3. Turn the I/O adapter upside down, and secure **three M2x4 silver screws** and **one M2x5 silver screw** on the bottom, and **three M2x4 silver screws** at the back.

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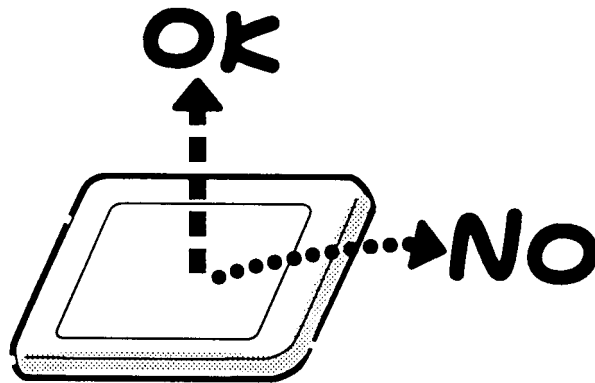
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Appendix A Handling the LCD Module

Precautions for handling the LCD module

The LCD module can be easily damaged during assembly or disassembly. Therefore, please observe the following precautions when handling it:

1. When installing the LCD module in its cover, be sure to seat it so that it is properly aligned and maximum visibility of the display is maintained.



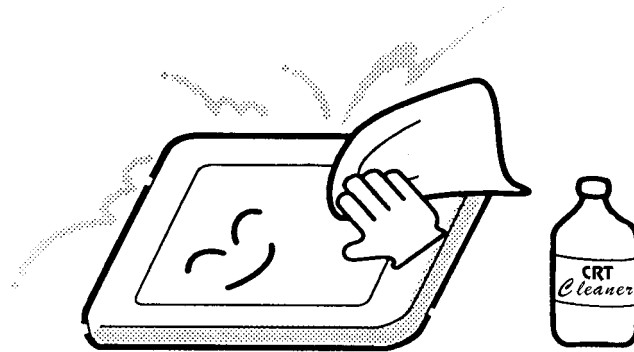
2. Be careful to align the holes at the four corners of the LCD module with the corresponding holes in its cover before securing the module with screws. Do not force the module into place, because stress can affect its performance.

Note: The panel's polarized surface is easily scarred, so handle it carefully.

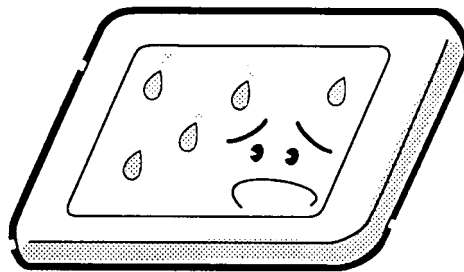


3. If the panel's surface gets dirty, wipe it with cotton or a soft cloth. If it is still dirty, try breathing on the surface to create a light condensate and wipe it again.

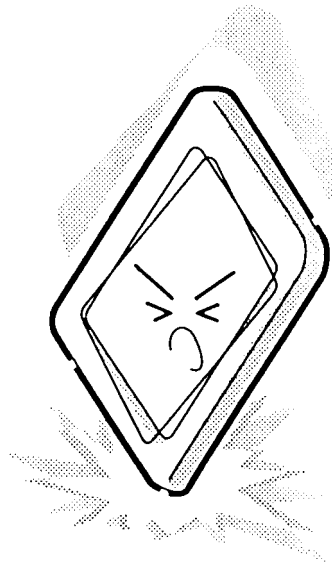
If the surface is very dirty, use a CRT cleaning agent. Apply the agent to a cloth and then wipe the panel's surface. Do not apply cleanser directly to the panel.



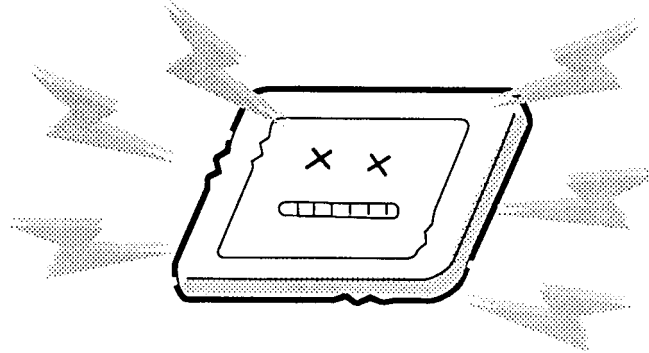
4. If water or other liquid is left on the panel's surface for a long period, it can change the screen's tint or stain it. Be sure to quickly wipe off any liquid.



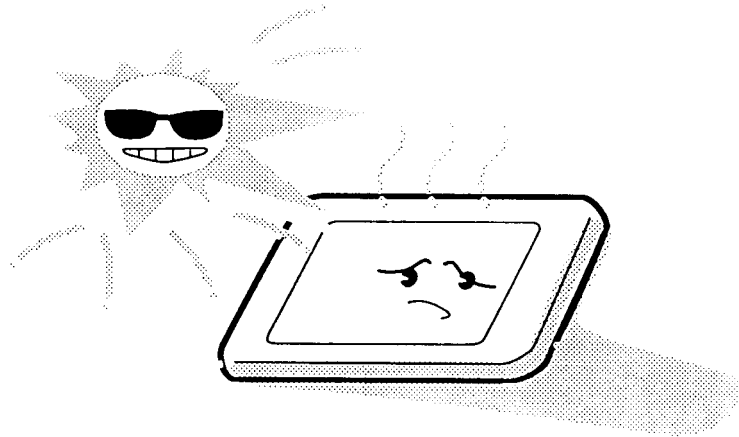
5. Glass is used in the panel, so be careful not to drop it or let it strike a hard object, which could cause breakage or cracks.



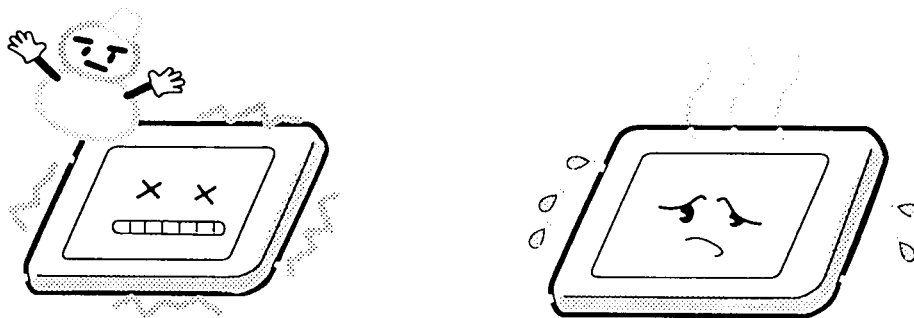
6. CMOS-LSI circuits are used in the module, so guard against damage from electrostatic discharge. Be sure to wear a wrist or ankle ground when handling the module.



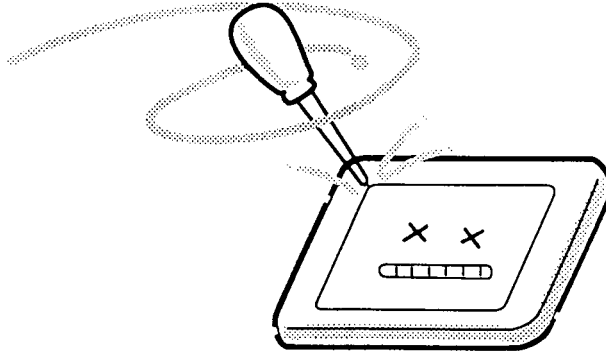
7. Do not expose the module to direct sunlight or strong ultraviolet rays for long periods.



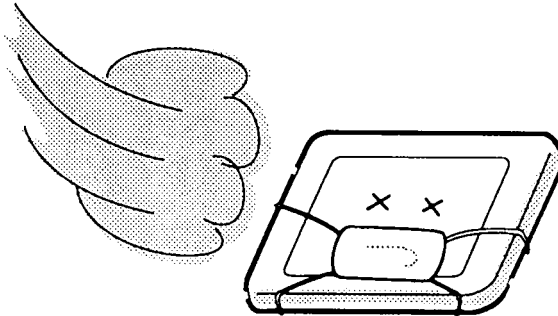
8. Do not store the module at temperatures below specifications. Cold can cause the liquid crystals to freeze, lose their elasticity or otherwise suffer damage.



9. Do not disassemble the LCD module. Disassembly can cause malfunctions.



10. If you transport the module, do not use packing material that contains epoxy resin (amine) or silicon glue (alcohol or oxime). These materials can release gas that can damage the panel's polarization.



B.2 System Board Back View

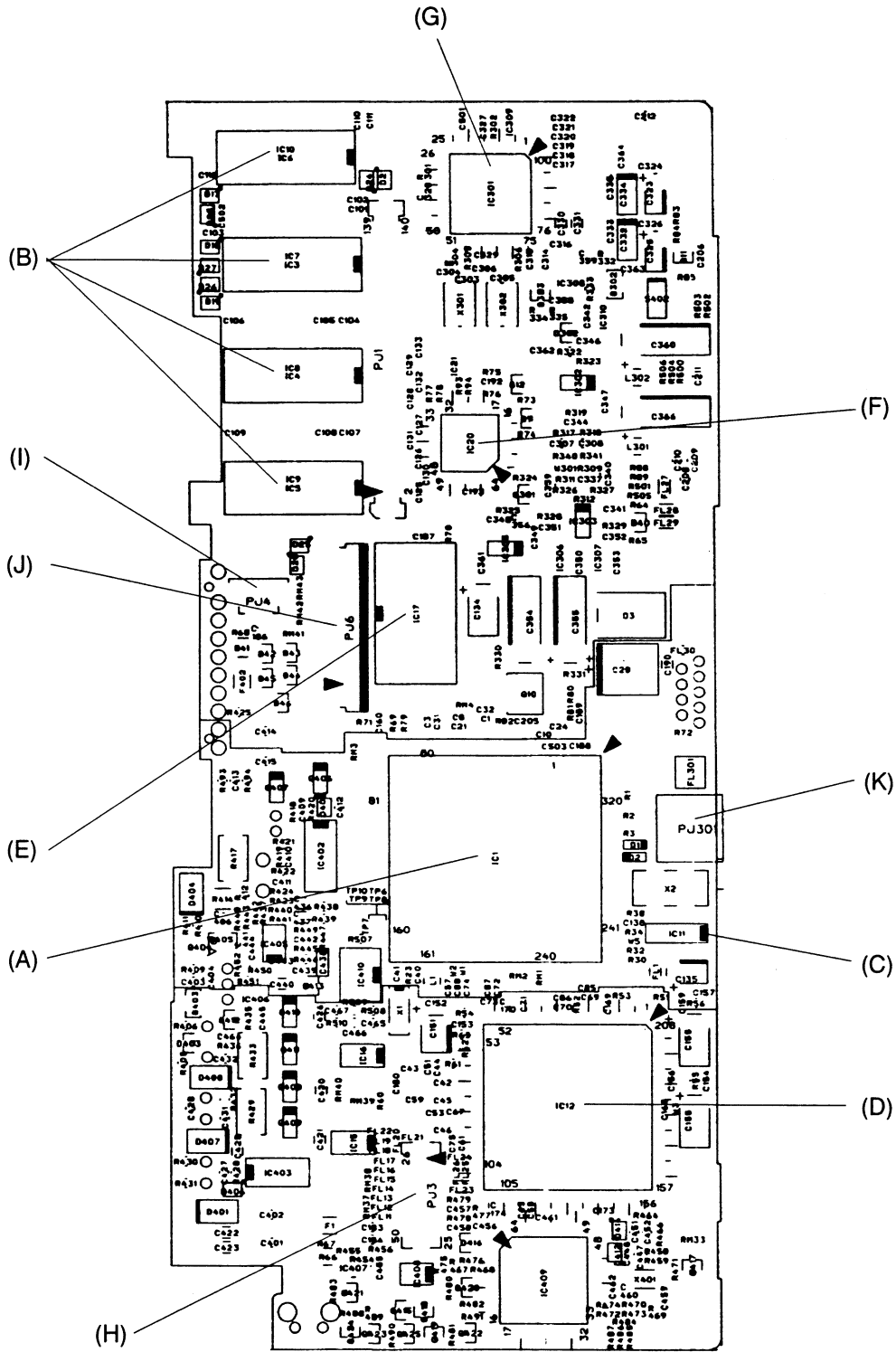


Figure B-2 System board layout (back)

Table B-1 System board (front)

Mark	Number	Name
(A)	IC2	PETUNIA2 GA
(B)	IC13,IC14	VRAM
(C)	IC19	SIR
(D)	PJ2	Docking I/F connector
(E)	PJ5	HDD I/F connector
(F)	PJ7	PC card connector
(G)	PJ401	DC IN connector

Table B-2 System board (back)

Mark	Number	Name
(A)	IC1	CPU
(B)	IC3,IC4,IC5,IC6	16M DRAM
(C)	IC11	Clock generator
(D)	IC12	VGA GA
(E)	IC17	Flash BIOS
(F)	IC20	Keyboard controller
(G)	IC301	Libretto 50CT: OPL3SA2 *Libretto 70CT: OPL3SA2
(H)	PJ3	Display assembly I/Fconnector
(I)	PJ4	RTC battery connector
(J)	PJ6	Keyboard I/F connector
(K)	PJ301	Headphone connector

Appendix C Pin Assignments

C.1 PJ1 Exp. Memory Connector (140-pin)

Table C-1 Exp. Memory connector pin assignments (140-pin) (1/2)

Pin No.	Signal Name	I/O	Pin No.	Signal Name	I/O
01	B3VEXT	-	02	B3VEXT	-
03	GND	-	04	D36;100	I/O
05	D35;100	I/O	06	D37;100	I/O
07	D34;100	I/O	08	D38;100	I/O
09	D33;100	I/O	10	GND	-
11	B3VEXT	-	12	D39;100	I/O
13	D32;100	I/O	14	D40;100	I/O
15	D44;100	I/O	16	D41;100	I/O
17	D45;100	I/O	18	B3VEXT	-
19	GND	-	20	D42;100	I/O
21	D46;100	I/O	22	D43;100	I/O
23	D47;100	I/O	24	D16;100	I/O
25	D20;100	I/O	26	GND	-
27	B3VEXT	-	28	D17;100	I/O
29	D21;100	I/O	30	D18;100	I/O
31	D22;100	I/O	32	D19;100	I/O
33	D23;100	I/O	34	B3VEXT	-
35	GND	-	36	D24;100	I/O
37	D28;100	I/O	38	D25;100	I/O
39	D29;100	I/O	40	D26;100	I/O
41	D30;100	I/O	42	GND	-
43	B3VEXT	-	44	D27;100	I/O
45	D31;100	I/O	46	D0;100	I/O
47	D4;100	I/O	48	D1;100	I/O
49	D5;100	I/O	50	B3VEXT	-
51	GND	-	52	D2;100	I/O
53	D6;100	I/O	54	D3;100	I/O
55	D7;100	I/O	56	D8;100	I/O
57	D12;100	I/O	58	GND	-
59	B3VEXT	-	60	D9;100	I/O
61	D13;100	I/O	62	D10;100	I/O
63	D14;100	I/O	64	D11;100	I/O
65	D15;100	I/O	66	B3VEXT	-

Table C-1 Exp. Memory connector pin assignments (140-pin) (2/2)

Pin No.	Signal Name	I/O	Pin No.	Signal Name	I/O
67	GND	-	68	D48;100	I/O
69	D52;100	I/O	70	D49;100	I/O
71	D53;100	I/O	72	D50;100	I/O
73	D64;100	I/O	74	GND	-
75	B3VEXT	-	76	D51;100	I/O
77	D55;100	I/O	78	D56;100	I/O
79	D60;100	I/O	80	D57;100	I/O
81	D61;100	I/O	82	D58;100	I/O
83	D62;100	I/O	84	D59;100	I/O
85	D63;100	I/O	86	GND	-
87	CAS1;010	O	88	CAS0;010	O
89	CAS3;010	O	90	CAS2;010	O
91	CAS5;010	O	92	CAS4;010	O
93	CAS7;010	O	94	CAS6;010	O
95	NC	-	96	NC	-
97	NC	-	98	NC	-
99	WE1;010	O	100	GND	-
101	GND	-	102	GND	-
103	GND	-	104	NC	-
105	RAS0;010	O	106	RAS2;010	O
107	RAS1;010	O	108	RAS3;010	O
109	NC	-	110	NC	-
111	NC	-	112	NC	-
113	NC	-	114	NC	-
115	NC	-	116	NC	-
117	GND	-	118	GND	-
119	NC	-	120	NC	-
121	GND	-	122	GND	-
123	NC	-	124	NC	-
125	GND	-	126	GND	-
127	MA0;110	O	128	MA1;110	O
129	MA2;110	O	130	MA3;110	O
131	MA4;110	O	132	MA5;110	O
133	MA4;110	O	134	MA6;110	O
135	MA7;110	O	136	MA9;110	O
137	MA8;110	O	138	MA11;110	O
139	MA10;110	O	140	GND	-

C.2 PJ2 Docking I/F Connector (132-pin)

Table C-2 Docking I/F connector pin assignments (132-pin) (1/2)

Pin No.	Signal Name	I/O	Pin No.	Signal Name	I/O
01	GND	-	02	GND	-
03	MOUSDT;120	I/O	04	MOUSCK;120	I/O
05	EXKBCK;101	I/O	06	EXKBDT;101	I/O
07	DCD1;010	I	08	DSR1;010	I
09	RXD1;110	I	10	CTS1;010	I
11	RI1;010	I	12	RTS1;000	O
13	TXD1;110	O	14	DTR1;000	O
15	E232CZ;000	O	16	ACK;000	I
17	BUSY;100	I	18	PE;000	I
19	SELCT;100	I	20	ERROR;000	I
21	STROB;000	O	22	AUTFD;000	O
23	SLIN;000	O	24	PINT;000	O
25	PD0;100	I/O	26	PD1;100	I/O
27	PD2;100	I/O	28	PD3;100	I/O
29	PD4;100	I/O	30	PD5;100	I/O
31	PD6;100	I/O	32	PD7;100	I/O
33	PCD00B;100	I/O	34	PCD01B;100	I/O
35	PCD02B;100	I/O	36	PCD03B;100	I/O
37	PCD04B;100	I/O	38	PCD05B;100	I/O
39	PCD06B;100	I/O	40	PCD07B;100	I/O
41	PCD08B;100	I/O	42	PCD09B;100	I/O
43	PCD10B;100	I/O	44	PCD11B;100	I/O
45	PCD12B;100	I/O	46	PCD13B;100	I/O
47	PCD14B;100	I/O	48	PCD15B;100	I/O
49	CV121B;100	O	50	PCP51B;000	O
51	CVCCB;000	O	52	CRTEN;000	O
53	CVSYNC;100	O	54	CHSYNC;100	O
55	AVEXKB	I	56	VCC	-
57	VCC	-	58	VCC	-
59	VCC	-	60	NC	-
61	PRDCIN	-	62	PRDCIN	-

Table C-2 Docking I/F connector pin assignments (132-pin) (2/2)

Pin No.	Signal Name	I/O	Pin No.	Signal Name	I/O
63	PRDCIN	-	64	NC	-
65	GND	-	66	GND	-
67	GND	-	68	GND	-
69	CRSETB;100	O	70	CE1B;000	O
71	CE2B;000	O	72	REGB;000	O
73	WEB;000	O	74	OWB;000	O
75	IORB;000	O	76	IOWB;000	O
77	CAD00B;100	O	78	CAD01B;100	O
79	CAD02B;100	O	80	CAD03B;100	O
81	CAD04B;100	O	82	GND	-
83	GND	-	84	CAD04B;100	O
85	CAD05B;100	O	86	CAD07B;100	O
87	CAD08B;100	O	88	CAD09B;100	O
89	CAD10B;100	O	90	CAD11B;100	O
91	CAD12B;100	O	92	CAD13B;100	O
93	CAD14B;100	O	94	CAD15B;100	O
95	CAD16B;100	O	96	CAD17B;100	O
97	CAD18B;100	O	98	CAD19B;100	O
99	GND	-	100	GND	-
101	CAD20B;100	O	102	CAD21B;100	O
103	CAD22B;100	O	104	CAD23B;100	O
105	CAD24B;100	O	106	CAD25B;100	O
107	BSYB;100	I	108	BVD1B;100	I
109	BVD2B;100	I	110	CD1B;000	I
111	CD2B;000	I	112	WPB;000	I
113	WAITB;000	I	114	PNLST;100	I
115	MONID1;110	I/O	116	MONID3;110	I/O
117	CBLUE;110	O	118	CGREEN;110	O
119	CRED;110	O	120	GND	-
121	NC	-	122	VCC	-
123	VCC	-	124	VCC	-
125	VCC	-	126	NC	-
127	PRDCIN	-	128	PRDCIN	-
129	PRDCIN	-	130	NC	-
131	GND	-	132	GND	-

C.3 PJ3 LCD I/F Connector (50-pin)

Table C-3 LCD I/F connector pin assignments (50-pin)

Pin No.	Signal Name	I/O	Pin No.	Signal Name	I/O
01	IPSCCLK;100	I/O	02	VCC	-
03	VCC	-	04	VCC	-
05	VCC	-	06	LCDVDD;100	-
07	LCDVDD;100	-	08	PNLD09;120	O
09	PNLD10;120	O	10	PNLD11;120	O
11	ENDATA;120	O	12	LP;120	O
13	FP;120	O	14	SHFCLK;120	O
15	PNLST;100	I	16	GND	-
17	GND	-	18	GND	-
19	GND	-	20	GND	-
21	GND	-	22	GND	-
23	GND	-	24	GND	-
25	GND	-	26	IPSDAT;100	I/O
27	SPKRTN;120	I/O	28	PNLD08;120	O
29	PNLD07;120	O	30	PNLD06;120	O
31	PNLD05;120	O	32	PNLD04;120	O
33	PNLD03;120	O	34	PNLD02;120	O
35	PNLD01;120	O	36	PNLD00;120	O
37	ISARST;000	O	38	SPKOUT;100	I/O
39	DCGRN;000	O	40	PLED	-
41	DCORG;000	O	42	CHGGRN;000	O
43	CHGORG;000	O	44	HDDLED;000	O
45	PWR;000	I	46	FLVDD;100	-
47	FLVDD;100	-	48	FLVDD;100	-
49	FL0;100	O	50	FL1;100	O

C.4 PJ4 RTC Battery I/F Connector (3-pin)

Table C-4 RTC Battery I/F connector pin assignments (3-pin)

Pin No.	Signal Name	I/O	Pin No.	Signal Name	I/O
01	VCC	-	02	NC	-
03	GND	-			

C.5 PJ5 HDD I/F Connector (44-pin)

Table C-5 HDD I/F connector pin assignments (44-pin)

Pin No.	Signal Name	I/O	Pin No.	Signal Name	I/O
01	ISARST;000	O	02	GND	-
03	SD7;100	I/O	04	SA8;100	O
05	SD6;100	I/O	06	SA9;100	O
07	SD5;100	I/O	08	SA10;100	O
09	SD4;100	I/O	10	SA11;100	O
11	SD3;100	I/O	12	SA12;100	O
13	SD2;100	I/O	14	SA13;100	O
15	SD1;100	I/O	16	SA14;100	O
17	SD0;100	I/O	18	SA15;100	O
19	GND	-	20	NC	-
21	NC	-	22	GND	-
23	FIOW;010	O	24	GND	-
25	FIOR;010	O	26	GND	-
27	IOCRDY;100	I	28	NC	-
29	NC	-	30	GND	-
31	IRQ14;100	O	32	IOCS16;000	I
33	SA1;100	O	34	NC	-
35	SA0;100	O	36	SA2;100	O
37	HDCS0;000	O	38	HDCS1;000	O
39	HDDLLED;000	I	40	GND	-
41	VCC	-	42	VCC	-

43	GND	-	44	NC	-
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C.6 PJ7 PC Card Connector (68-pin)

Table C-6 PC Card connector pin assignments (68-pin)

Pin No.	Signal Name	I/O	Pin No.	Signal Name	I/O
01	GND	-	02	PCD03A;100	I/O
03	PCD04A;100	I/O	04	PCD05A;100	I/O
05	PCD06A;100	I/O	06	PCD07A;100	I/O
07	CE1A;000	O	08	CAD10A;100	O
09	OEA;000	O	10	CAD11A;100	O
11	CAD09A;100	O	12	CAD08A;100	O
13	CAD13A;100	O	14	CAD14A;100	O
15	WEA;000	O	16	BSYA;000	I
17	MCVCCA	-	18	MCVCCA	-
19	CAD16A;100	O	20	CAD15A;100	O
21	CAD12A;100	O	22	CAD07A;100	O
23	CAD06A;100	O	24	CAD05;100	O
25	CAD04;100	O	26	CAD03;100	O
27	CAD02;100	O	28	CAD01;100	O
29	CAD00A;100	O	30	PCD00A;100	I/O
31	PCD01A;100	I/O	32	PCD02A;100	I/O
33	WPA;000	I	34	GND	-
35	GND	-	36	CD1A;000	I
37	PCD11A;100	I/O	38	PCD12A;100	I/O
39	PCD13A;100	I/O	40	PCD14A;100	I/O
41	PCD15A;100	I/O	42	CE2A;000	O
43	NC	-	44	IORA;000	O
45	IOWA;000	O	46	CAD17A;100	O
47	CAD18A;100	O	48	CAD19A;100	O
49	CAD20A;100	O	50	CAD21A;100	O
51	MCVCCA	-	52	MCVCCA	-
53	CAD22A;100	O	54	CAD23A;100	O
55	CAD24A;100	O	56	CAD25A;100	O
57	NC	-	58	CRSESTA;100	O
59	WAITA;000	I	60	NC	-
61	REGA;000	O	62	BVD2A;100	I
63	BVD1A;100	I	64	PCD08A;100	I/O
65	PCD09A;100	O	66	PCD10A;100	O
67	CD2A;000	I	68	GND	-

C.7 PJ301 Headphone Connector (5-pin)

Table C-7 Headphone connector pin assignments (5-pin)

Pin No.	Signal Name	I/O	Pin No.	Signal Name	I/O
01	GND	-	02	PHONEL	O
03	PHONER	O	10	SPKL	I
11	SPKR	I			

C.8 PJ401 DC IN Connector (2-pin)

Table C-8 DC IN connector pin assignments (2-pin)

Pin No.	Signal Name	I/O	Pin No.	Signal Name	I/O
01	VCC	-	02	GND	-

C.9 PJ402 Battery Connector (10-pin)

Table C-9 Battery connector pin assignments (10-pin)

Pin No.	Signal Name	I/O	Pin No.	Signal Name	I/O
01	BATV	-	02	ATBAT	I
03	BATGATE	I	04	P12C	-
05	SCL;000	I/O	06	SDA;000	I/O
07	GND	-	08	BATOV;000	I
09	GND	-	10	BATGND	-

Appendix D Key Layouts

D.1 United States (US) Keyboard

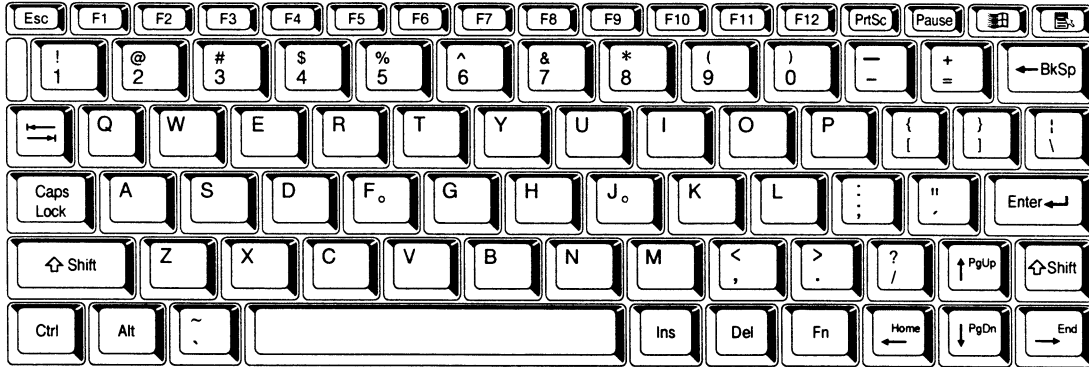


Figure D-1 US keyboard

D.2 United Kingdom (UK) Keyboard

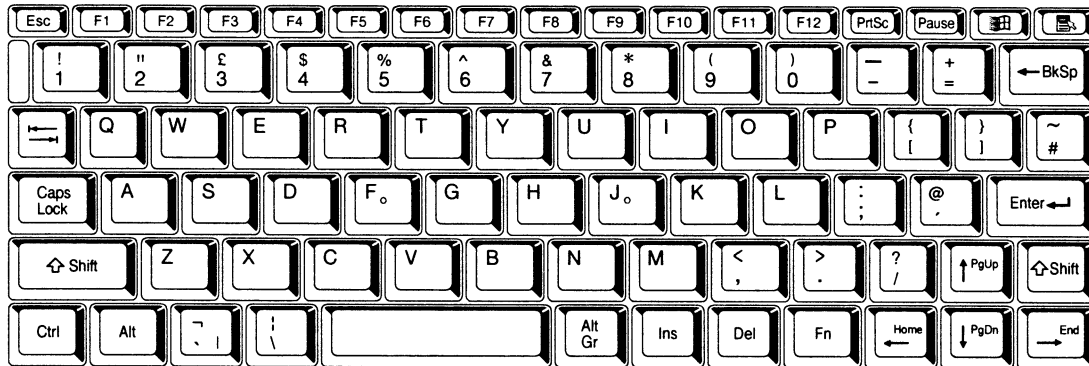


Figure D-2 UK keyboard

D.3 German (GR) Keyboard



Figure D-3 GR keyboard

D.4 French (FR) Keyboard

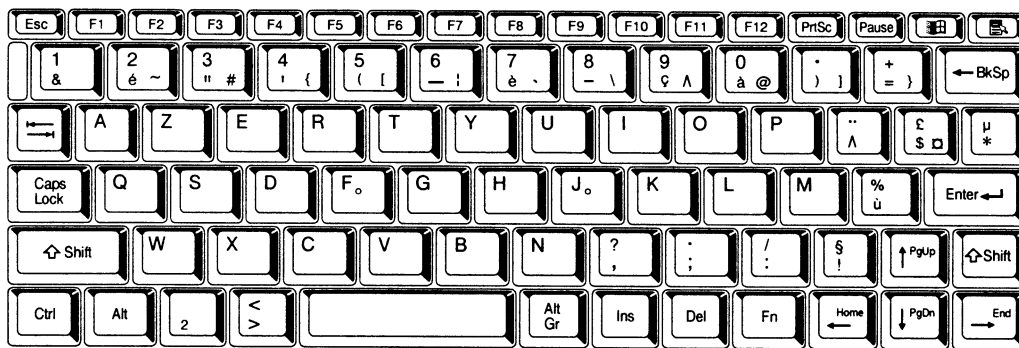


Figure D-4 FR keyboard

Appendix E Wiring Diagrams

E.1 Parallel Port Wraparound Connector

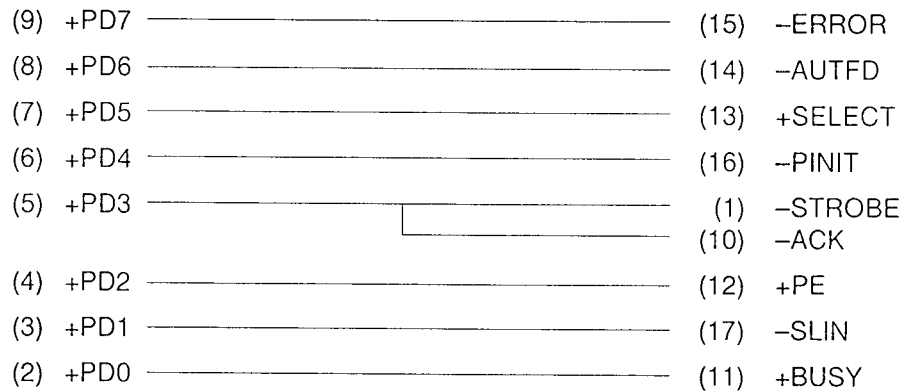


Figure E-1 Parallel port wraparound connector

E.2 Serial Port Wraparound Connector

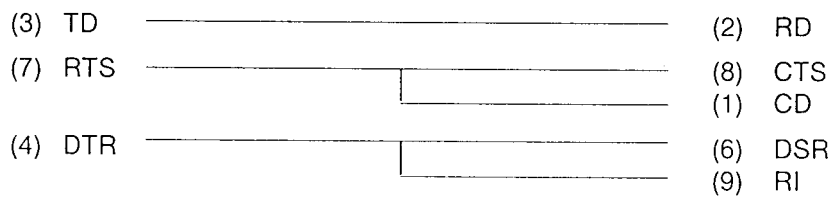


Figure E-2 Serial port wraparound connector

E.3 Serial Port Direct Cable (9-Pin to 9-Pin)

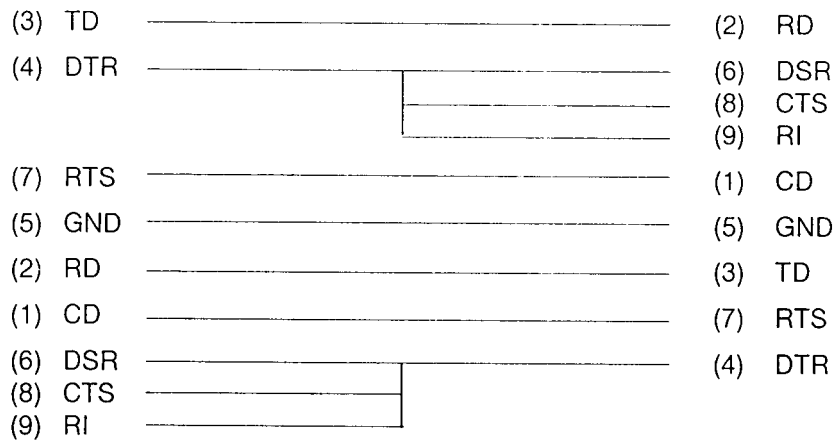


Figure E-3 Serial port direct cable (9-pin to 9-pin)

E.4 Serial Port Direct Cable (9-Pin to 25-Pin)

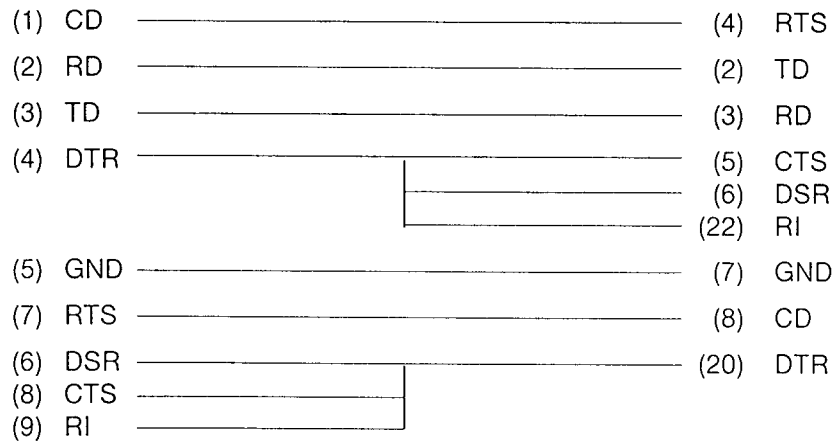


Figure E-4 Serial port direct cable (9-pin to 25-pin)

Appendix F BIOS Rewrite Procedures

This Appendix explains how to rewrite the system BIOS program to update the BIOS on the Libretto 50CT/70CT/70CT.

Tools

To rewrite the BIOS, you need the following tool:

- Diagnostics disk for the computer

Rewriting the BIOS

1. Set the system to boot mode.
2. Turn the power off.
3. Remove the external cable and any optional memory or PC card.
4. Turn the power on while holding the **F12** key down. (Keep holding the key down until the system speaker sounds a beep.)
5. When the BIOS message displays, insert the diagnostics disk into the FDD, then press **Enter** to start the BIOS rewrite program.
6. When the process is completed, eject the diagnostics disk and press the reset switch to restart the system.

Appendix G Reliability

The following table shows Mean Time Between Failures (MTBF) for each component.

Table G-1 MTBF

Component	Time (hours)
LCD	50,000
Keyboard	37,000
HDD	300,000
FDD (option)	30,000
AccuPoint	37,000
FL Inverter	50,000
AC Power Unit	50,000

