

## 1.1 Features

The 110 series computer is one of the lightest and most advanced portable computers available. Utilizing advanced technology and high-speed components, the computer offers multimedia functions, excellent display legibility, battery operation, and IBM PC/AT compatibility. The unit's features are:

- ❑ Microprocessor

A Pentium processor with Voltage Reduction Technology (VRT) that operates at 100 MHz and 3.3/2.9 volts.

- ❑ Memory

Standard with 8 MB of CMOS RAM. This includes 640 KB of conventional memory and 7360 KB of extended memory.

- ❑ Hard Disk Drive (HDD)

An internal 810 million byte (772 MB) HDD.

- ❑ Floppy Disk Drive (FDD)

A 3.5-inch FDD supports 2HD (1.44 MB) floppy disks and 2DD (720 KB) floppy disks.

- ❑ Display

The 110CS has an 11.3-inch Dual-scan Supertwist Nematic (DSTN) color LCD with 800 x 600 pixels. The 110CT has an 11.3-inch Thin-Film Transistor (TFT) color LCD with 800 x 600 pixels. The built-in display controller supports 640 x 480 resolution with 16M colors capability and up to 1024 x 768 resolution with 256 colors on an external CRT.

- ❑ Keyboard

An easy-to-use 82/84-key keyboard provides a numeric keypad overlay for fast numeric data entry or for cursor and page control. The keyboard supports software that uses a 101- or 102-key enhanced keyboard.

- ❑ Batteries

Three different batteries: main battery, backup battery (for memory backup), and Real Time Clock (RTC) battery.

Expansion Memory Slot

An optional 8, 16, or 32 MB memory module can be installed in the memory slot.

Parallel Port

This port can be used to connect a Centronics compatible printer or other parallel device. The port supports ECP (Extended Capabilities Port) conforming to IEEE-1284.

Serial Port (9-Pin)

The serial controller is 16550UART compatible. This port can be used to connect serial devices such as a serial printer, serial mouse, or external modem.

External Monitor Port

The female, 15-pin, D-shell connector can be connected to an external SVGA monitor.

External Keyboard/Mouse Port

Either a PS/2-compatible keyboard or mouse can be connected to this port. The computer automatically recognizes which device is connected.

PC Card Slot

A PC card slot supports up to two Personal Computer Memory Card International Association (PCMCIA) standard version release 2.0 cards. The upper and lower slots can each accommodate one Type II (5.0 mm) card, or the lower slot can accommodate one Type III (10.5 mm) card when the upper slot is empty.

Enhanced Port Replicator Port

This port enables connection of an enhanced port replicator. The enhanced port replicator has two PC card slots (Type III), and expands connections to the following devices: PS/2 keyboard, PS/2 mouse, serial port, parallel port, external CRT, AC-in, and AC-out.

AccuPoint

A pointer control stick, located in the center of the keyboard, provides convenient control of the cursor without requiring desk space for a mouse.

The 110 Series Personal Computer is shown in Figure 1-1.

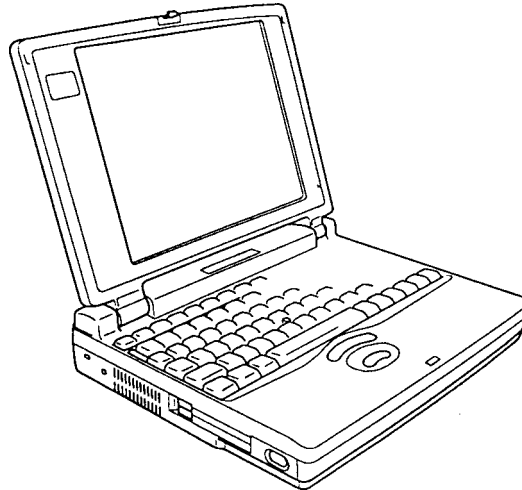


Figure 1-1 110 series personal computer

The system configuration is shown in Figure 1-2.

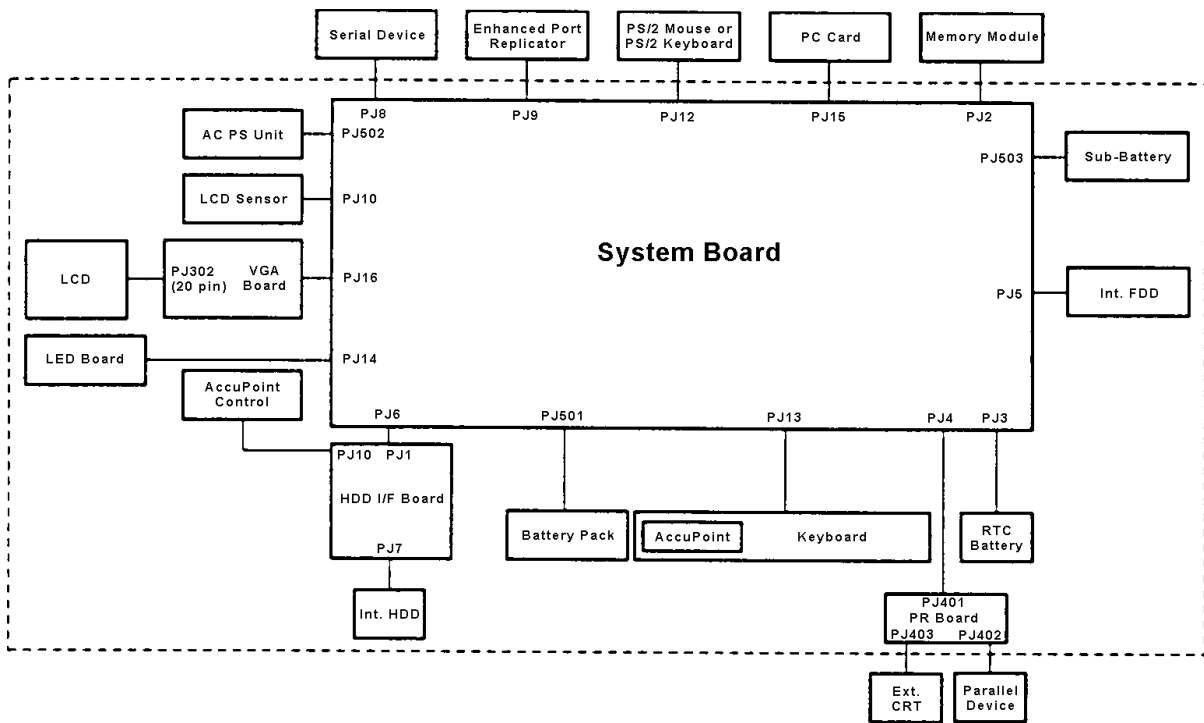


Figure 1-2 System unit configuration

## 1.2 System Unit Block Diagram

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

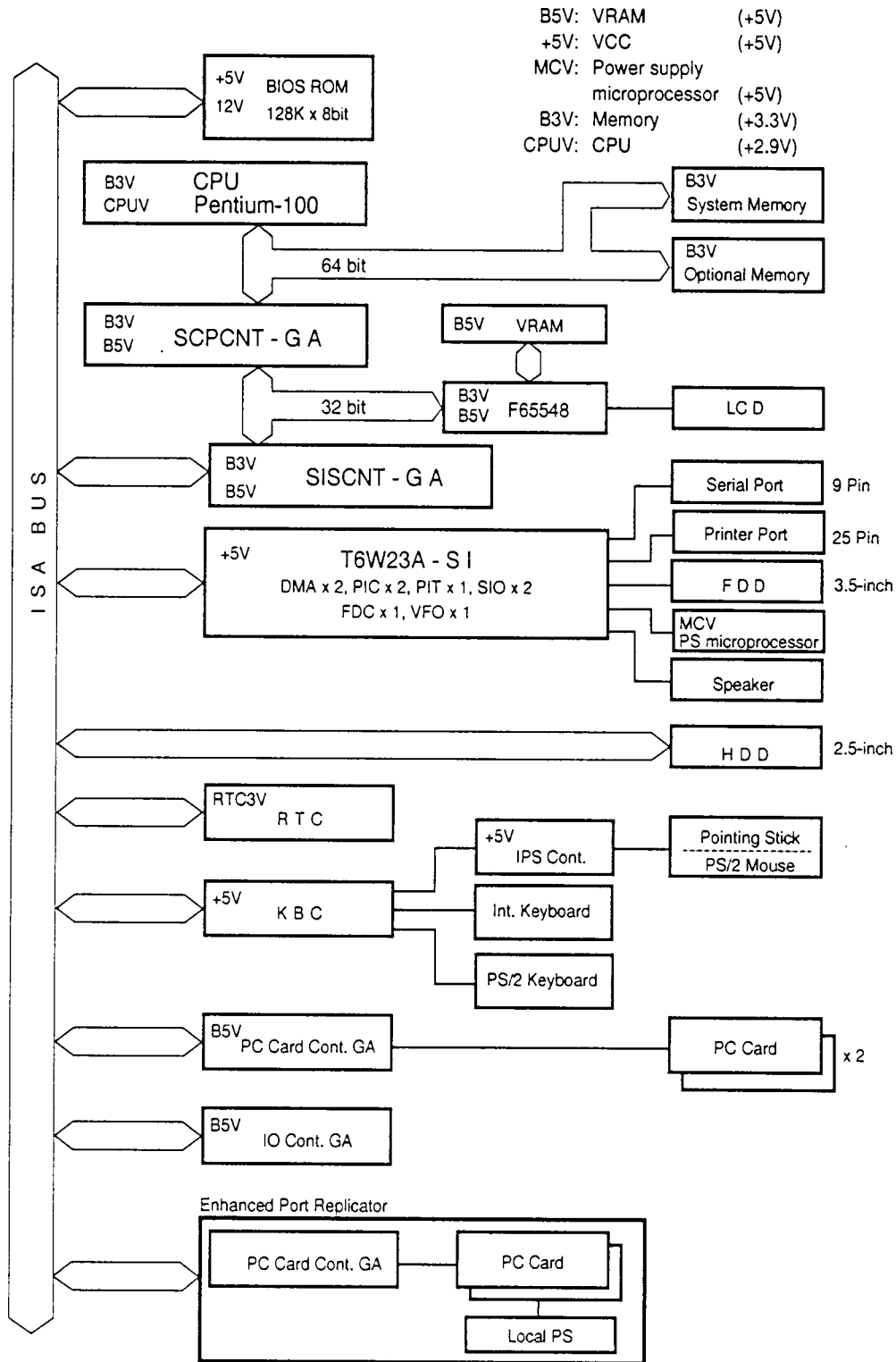


Figure 1-3 System board block diagram

The system board's major components are:

- ❑ Microprocessor
  - One Pentium processor with VRT 64-bit microprocessor
  - The Pentium processor operates at 100 MHz and 3.3/2.9 volts
  - The math co-processor and 16 KB cache memory are integrated into the Pentium
  
- ❑ Standard RAM
  - 8 MB, four 1M x 16-bit chips
  - 3.3 volt operation
  - No parity bit
  - Access time is 60 ns
  - Data transfer is 64-bit width
  - EDO (Extended Data Output) supported
  
- ❑ BIOS ROM (Flash EEPROM)
  - 128 KB (one 128K x 8-bit chip) memory
  - 64 KB in the ROM are used for system BIOS
  - 48 KB in the ROM are used for VGA BIOS
  - 16 KB in the ROM are reserved
  - Access time is 150 ns
  - Data transfer is 8-bit width
  
- ❑ Video RAM
  - 1 MB (two 256K x 16-bit DRAM)
  - 5 volt operation
  
- ❑ Optional Memory
  - One expansion memory slot is available for 8, 16, and 32 MB memory modules, which consist of 1 MB x 16-bit chips
  - Total maximum memory size is 40 MB (if a 32 MB memory module is installed)
  - 3.3 volt operation
  - No parity bit
  - Access time is 60 ns
  - Data transfer is 64-bit width
  - EDO (extended data output) supported

❑ One Super Integration (SI)

Contains the following components:

- Two DMACs ..... 82C37 equivalent
- Two PICs ..... 82C59 equivalent
- Two SIOs ..... 16550 equivalent (One SIO is not used)
- Two UART ..... 16550 equivalent
- One PIT ..... 82C54 equivalent
- One FDC ..... TC8565 equivalent
- One VFO ..... TC8568 equivalent
- One I/O port decode
- One SIO port control
- One printer port control supported ECP
- One FDD control
- One speaker control
- One power communication control

❑ System Controller Gate Array (SCPCNT-GA)

This gate array's functions:

- CPU control
  - SMI control
  - CPU clock control
- Memory control
  - 64-bit bus memory control
  - 32-bit bus memory control
- Bus control
  - 64-bit data bus <==>32-bit data bus
  - 32-bit local bus control
- Address latch control
- I/O register control
- Processing speed control

❑ ISA Bus Controller Gate Array (SISCNT-GA)

This gate array's functions:

- Bus control
  - 32-bit data bus <==> 16-bit data bus
  - ISA bus interface control
  - ISA bus access control
  - DMAC control
  - DMA address generation
  - I/O control
  - Suspend/resume sequence
- Memory control
  - ISA bus interface control
  - Refresh address generation
- I/O register control
- Suspend/resume sequence

PC Card Controller Gate Array (PCMCIA-GA)

This gate array's functions:

- PCMCIA memory card control
- PCMCIA I/O card control

I/O Controller Gate Array (IOCNT-GA)

This gate array's functions:

- Internal Communication controller
  - KBC, main CPU communication register file
  - KBC interrupt controller
  - KBC communication controller
  - I<sup>2</sup>C bus control (Not used)
- Others
  - Speaker volume adjust PWM control
  - Sound board interface (Not used)
  - BIOS-ROM interface
  - SMI control
  - IrDA (SIR) control (Not used)

Video Controller

C&T F65548 is used.

This video controller controls internal DSTN/TFT color LCD and external SVGA compatible CRT.

Keyboard Controller (KBC)

One M38802M4 chip is used.

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

AccuPoint Controller (IPSC)

One KPAAC0062A chip is used.

This controller provides simultaneous control of both the AccuPoint and a PS/2 mouse.

Real Time Clock (RTC)

One T9934 chip is used.

The T9934 has 128 bytes of memory. Fourteen bytes of memory are used for the calendar and clock. The remaining 114 bytes are used for the system configuration data.

### 1.3 3.5-Inch Floppy Disk Drive

The 3.5-inch Floppy Disk Drive (FDD) is a thin, high-performance reliable drive that supports 720-KB (formatted) 2DD and 1.44-MB (formatted) 2HD 3.5-inch floppy disks.

The FDD is shown in Figure 1-4.

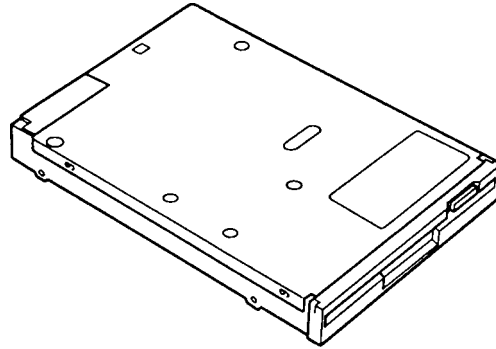


Figure 1-4 3.5-inch FDD

Table 1-1 lists the FDD specifications.

Table 1-1 3.5-inch FDD specifications

Item	2-MB mode	1-MB mode
Storage capacity (KB)		
Unformatted	2,000 *1	1,000 *2
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: 18 sectors/track (512 bytes/sector)

\*2: 9 sectors/track (512 bytes/sector)

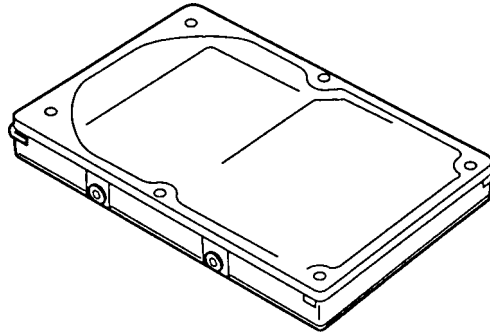


## 1.4 2.5-Inch Hard Disk Drive

The Hard Disk Drive (HDD) is a random access nonvolatile storage device. It has a non-removable 2.5-inch magnetic disk and mini-Winchester type magnetic heads.

The computer supports the 720 MB HDD.

The HDD is shown in Figure 1-5.



*Figure 1-5 2.5-inch HDD*

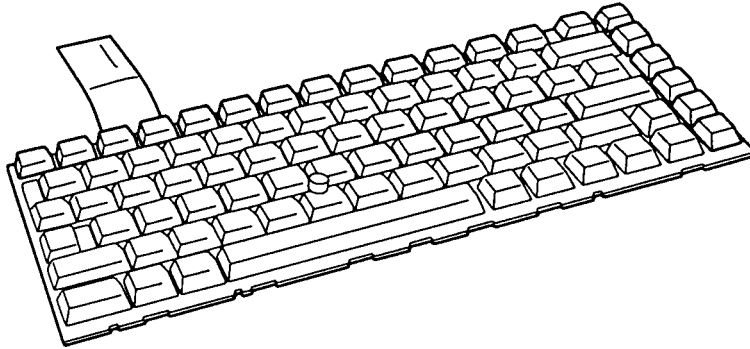
Table 1-2 lists the HDD specifications.

*Table 1-2 2.5-inch HDD specifications*

Item	Toshiba MK1926FCV	IBM DBOA-20810
Formatted capacity (bytes)	814,915,584	812,851,200
Disks	3	2
Logical heads	16	16
Logical cylinders	1,579	1,575
Bytes per sector	512	512
Rotation speed (rpm)	4200	4009
Recording method	8 - 9 RLL	1 - 7 RLL

## 1.5 Keyboard

The 82- (USA) or 84- (European) keyboard is mounted on the computer's system unit. The keyboard is connected to the keyboard controller on the system board through a 25-pin flat cable. The computer pointer control stick, located in the center of the keyboard, provides convenient control of the cursor without requiring desk space for a mouse. The keyboard is shown in Figure 1-6. See Appendix E for optional keyboard configurations.



*Figure 1-6 Keyboard*

## 1.6 DSTN Color LCD (110CS)

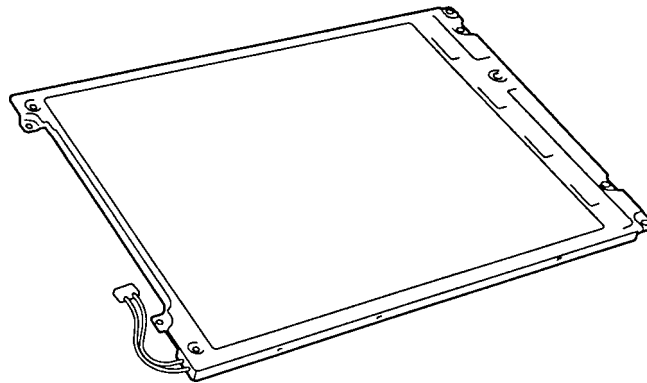
The 110CS has a DSTN Color Liquid Crystal Display (LCD), which contains an LCD module, a Fluorescent Lamp (FL), and an FL inverter board.

### 1.6.1 DSTN Color LCD Module

The DSTN color LCD is backlit and supports 800 x 600 pixels with a video controller. This controller includes the functions of Video Graphics Array (VGA) and Super VGA (SVGA) for external display.

The display controller is F65548. It enables an LCD display of a maximum 256 colors.

The DSTN LCD is shown in Figure 1-7.



*Figure 1-7 DSTN color LCD (110CS)*

Table 1-3 lists the LCD's specifications.

*Table 1-3 DSTN color LCD specifications (110CS)*

<b>Item</b>	<b>Specifications</b>
Number of dots (dots)	800 x 600
Dot pitch (mm)	0.288 x 0.288
Display area (mm)	230.4 (W) x 172.8 (H)
Contrast (Typically)	30:1
FL current (mA)	5.0/3.0 (Bright/Semi-bright)

## 1.6.2 DSTN Color FL Inverter Board

The FL inverter board supplies high frequency current to light the LCD's fluorescent lamp. Table 1-4 lists the FL inverter board's specifications.

*Table 1-4 DSTN color FL inverter board specifications (110CS)*

Item		Specifications
Input	Voltage (V)	5
	Power (W)	4.25
Output	Voltage (Vrms)	1,100
	Current (mA)	5.0/3.0 (Bright/Semi-bright)

## 1.7 TFT Color LCD (110CT)

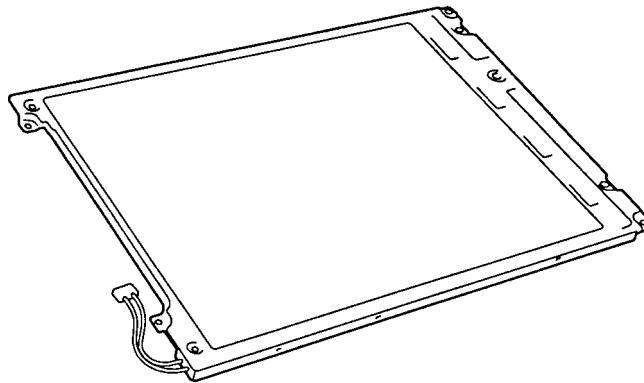
The 110CT has a TFT Color Liquid Crystal Display (LCD), which contains an LCD module, a Fluorescent Lamp (FL), and an FL inverter board.

### 1.7.1 TFT Color LCD Module

The TFT color LCD is backlit and supports 800 x 600 pixels with built-in display controller. This controller includes the functions of VGA and SVGA for external display.

A display controller is F65548. This controller enables an LCD display of a maximum 64 K colors.

The TFT LCD is shown in Figure 1-8.



*Figure 1-8 TFT color LCD (110CT)*

Table 1-5 lists the LCD's specifications.

*Table 1-5 TFT color LCD specifications (110CT)*

Item		Specifications
Number of Dots	(dots)	800 x 600
Dot pitch	(mm)	0.288 x 0.288
Display area	(mm)	230.4 (W) x 172.8 (H)
Contrast	(Minimum)	100:1
FL current	(mA)	4.6/2.8 (Bright/Semi-bright)

## 1.7.2 TFT Color FL Inverter Board

The FL inverter board supplies high frequency current to light the LCD's Fluorescent Lamp. Table 1-6 lists the FL inverter board's specifications.

*Table 1-6 TFT color FL inverter board specifications (110CT)*

Item		Specifications
Input	Voltage (V)	5
	Power (W)	4.25
Output	Voltage (Vrms)	1,100
	Current (mA)	4.6/2.8 (Bright/Semi-bright)

## 1.8 Power Supply

The power supply provides five kinds of voltages to the system board. The power supply has one microprocessor and it operates at 500 KHz. It contains the following functions:

1. Determines if the AC cable or battery is connected to the computer.
2. Detects AC output and circuit malfunctions.
3. Controls the LED icon and speaker.
4. Turns the battery charging system on and off and detects a fully charged battery.
5. Determines if the power can be turned on and off.
6. Provides more accurate detection of a low battery.
7. Calculates the remaining battery capacity.

The power supply output rating is specified in Table 1-7.

*Table 1-7 Power supply output rating*

<b>Use</b>	<b>Voltage name</b>	<b>DC voltage</b>	<b>Regulation tolerance (%)</b>
System logic, FDD, HDD, Display	VCC	+5	±5
CPU	CPUV	+2.9	±5
Flash ROM, PC card	12V	+12	±5
CPU, RAM, GA	B3V	+3.3	±0.3V
VRAM, GA	B5V	+4.7	±5

## 1.9 Batteries

The computer has three types of batteries:

- Main battery pack
- Backup battery
- Real Time Clock (RTC) battery

The removable main battery pack is the computer's main power source when the AC adapter is not attached. The backup and main batteries maintain the state of the computer when AutoResume is enabled. The RTC battery provides power to keep the current date, time, and other setup information in memory while the computer is off.

Battery specifications are listed in Table 1-8.

*Table 1-8 Battery specifications*

Battery Name	Material	Output Voltage	Capacity
Main battery	Nickel Metal Hydride	12 V	2,800 mAH
Backup battery	Nickel Metal Hydride	7.2 V	110 mAH
RTC battery	Nickel Metal Hydride	3.6 V	30 mAH

### 1.9.1 Main Battery

The removable main battery pack is the computer's main power source when the AC power cord is not attached. The main battery recharges the backup battery. The backup and main battery maintain the state of the computer when you enable AutoResume.

#### Battery Icon

The battery icon is located on top of the back rim of the computer. The color of the icon shows the status of the removable main battery pack.

Orange	The AC power cord is connected and charging the battery with the power off.
Green	The AC power cord is connected and the battery is fully charged whether the power is on or off.
Blink orange	The battery is low. The AC power cord must be connected to recharge the battery.
No light	Under any other conditions, the LED does not light.



## Battery Charging Control

Battery charging is controlled by a power supply microprocessor that is mounted on the power supply. The microprocessor controls whether the charge is on or off and detects a full charge when the AC power cord and battery are attached to the computer. The system charges the battery using quick charge or trickle charge.

### Quick Battery Charge

When the AC power cord is attached, there are two types of charge: quick charge when the system is powered off and trickle charge when the system is powered on.

*Table 1-9 Time required for quick charges*

<b>Power</b>	<b>Charging time</b>
Off	2 to 3 hours
On	3 to 11 hours

If one of the following occurs, the battery quick-charge process stops:

1. The battery becomes fully charged.
2. The battery is removed.
3. The battery or AC output voltage is abnormal.
4. The charge current is abnormal.
5. The fixed time limit for quick charge is exceeded.

### Trickle Battery Charge

When the main battery is fully charged and the AC power cord is attached, the power supply microprocessor automatically changes from quick charge to trickle charge.

### 1.9.2 Backup Battery

The backup battery maintains data for AutoResume. The power source used to back up the AutoResume data is determined according to the following priority:

AC power > Main battery > Backup battery

The backup battery is charged by the main battery or AC power cord. Table 1-10 shows the backup battery's charging time and data preservation period.

*Table 1-10 Backup battery charging/data preservation time*

Item		Time
Charging Time	Power On	20 hours
	Power Off (with AC power)	20 hours
	Power Off (without AC power)	Does not charge
Data preservation period (full charge)		4 hours

### 1.9.3 Real Time Clock (RTC) Battery

The RTC battery provides power to keep the current date, time, and other setup information in memory while the computer is off. Table 1-11 shows the RTC battery's charging time and data preservation period.

*Table 1-11 RTC battery charging/data preservation time*

Item		Time
Charging Time	With AC power or main battery	48 hours
Data preservation period (full charge)		1 month

## 2.1 Troubleshooting

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

1. System Boards
2. VGA Board
3. HDD I/F Board
4. Floppy Disk Drive
5. Hard Disk Drive
6. Keyboard
7. Display

The Diagnostics Disk operations are described in Chapter 3 and detailed replacement procedures are given in Chapter 4.

You will need the following tools to implement the troubleshooting procedures:

1. Diagnostics Disk
2. Phillips screwdrivers (M2 and M3)
3. Toshiba MS-DOS system disks  
(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. RS-232-C wraparound connector
8. Printer wraparound connector
9. Multimeter
10. External CRT
11. PS/2 or compatible keyboard
12. PS/2 or compatible mouse
13. Serial port wraparound connector
14. PC card wraparound card

## 2.2 Troubleshooting Flowchart

Use the flowchart in Figure 2-1 as a guide for determining which troubleshooting procedures to execute. Before proceeding with the flowchart steps, do the following:

- Ask the user if a password is registered and, if it is, ask the user to enter the password. If the user has forgotten the password, connect the printer port wraparound board (F31PRT), then turn the power switch on. The computer will override the password function by erasing the current password.
- Verify with the customer that Toshiba MS-DOS is installed on the hard disk drive. Non-Toshiba operating systems can cause the computer to malfunction.
- Make sure all optional equipment is disconnected from the computer.
- Make sure the floppy disk drive is empty.

If the Diagnostics Program cannot detect an error, the problem may be intermittent. Execute the Running Test program several times to isolate the problem.

Check the Log Utilities function to confirm which diagnostic test detected errors, 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, or Real Timer Test, perform the system board troubleshooting procedures in Section 2.4.
2. If an error is detected on the Floppy Disk Test, perform the floppy disk drive troubleshooting procedures in Section 2.5.
3. If an error is detected on the Hard Disk Test, perform the hard disk drive troubleshooting procedures in Section 2.6.
4. If an error is detected on the Keyboard Test, perform the keyboard troubleshooting procedures in Section 2.7.
5. If an error is detected on the Display Test, perform the display troubleshooting procedures in Section 2.8.

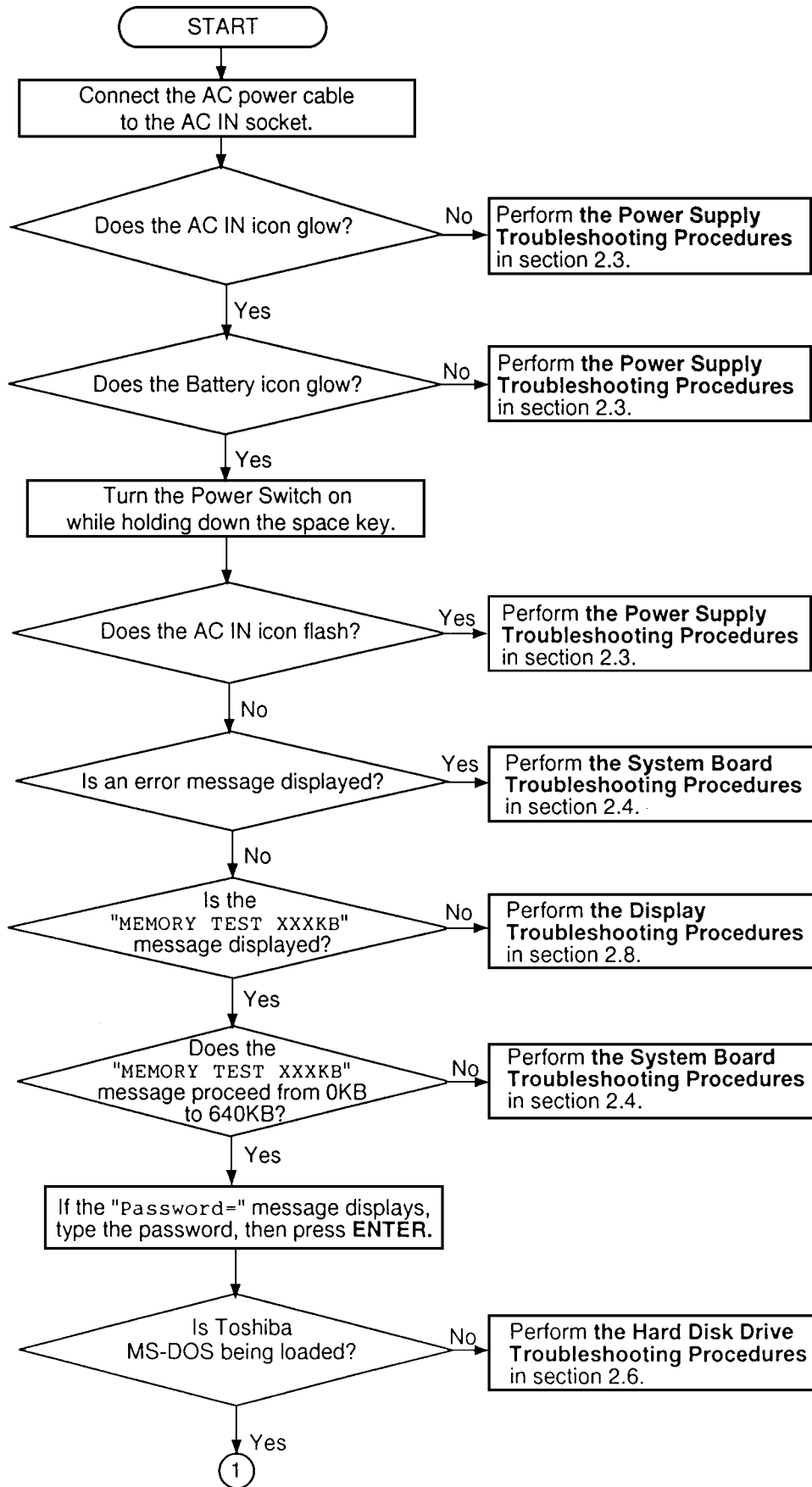


Figure 2-1 Troubleshooting flowchart (1/2)

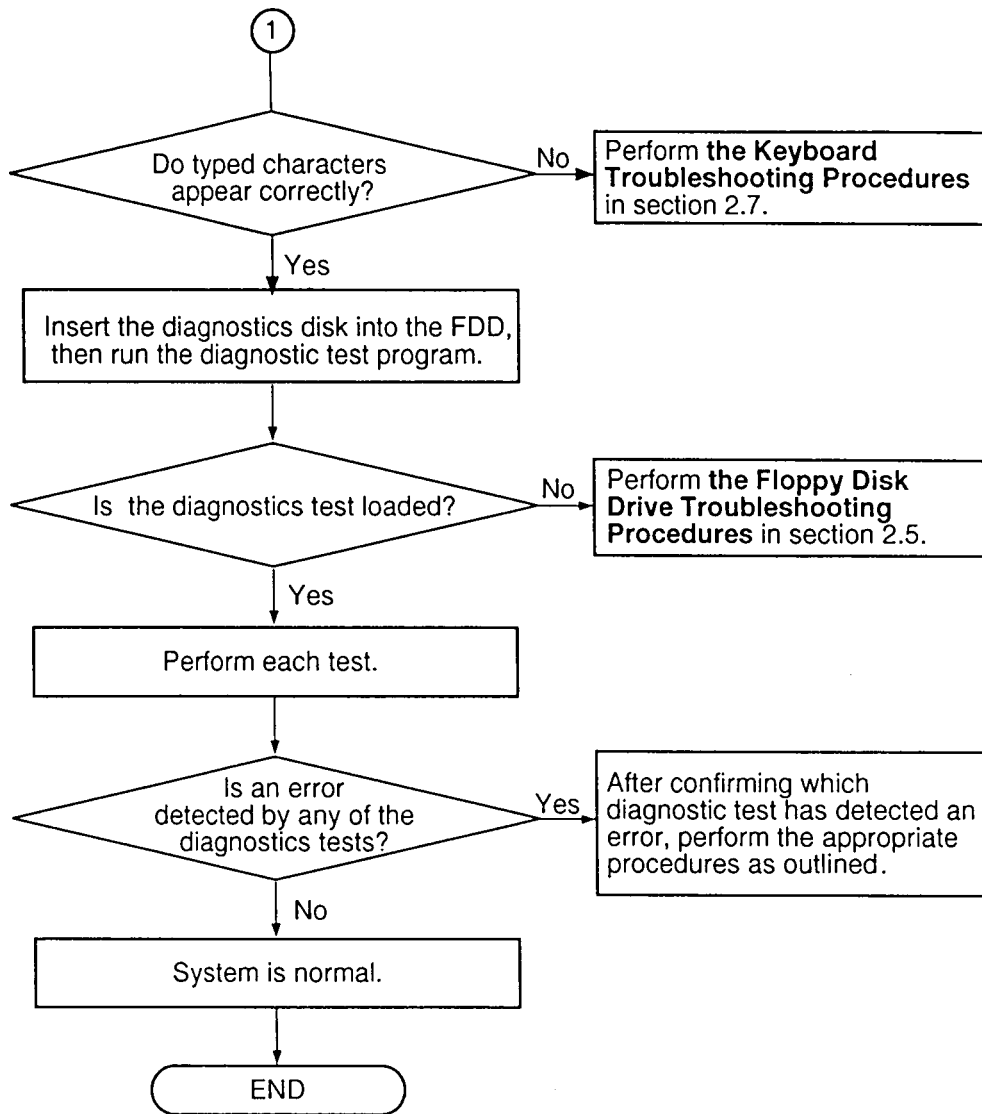


Figure 2-1 Troubleshooting flowchart (2/2)

## 2.3 Power Supply Troubleshooting

The power supply controls many functions and components in the computer. 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: AC IN Icon Check
- Procedure 2: Error Code Check
- Procedure 3: Battery Icon Check
- Procedure 4: AC PS Unit Replacement Check

### Procedure 1 AC IN Icon Check

The AC PS unit converts AC power to DC power and contains a charging circuit which charges the computer's batteries. The AC power cord connects to the AC IN socket connector on the back side of the computer. When the AC power cord is connected to the computer, the AC PS unit charges the batteries.

The AC IN icon displays whether the AC power cord is connected and supplying power.

When the AC IN icon is green, the AC power cord is connected and supplying power to the computer.

If the AC IN icon does not light, the AC power cord is not supplying power to the computer or the AC power cord is not attached to the computer. Go to Check 1.

If the AC IN icon is flashing orange, the AC power cord's voltage supply is abnormal or the power supply is not functioning properly. Go to Check 2.

If any of the above indicator conditions are abnormal, make sure the icon lights are not burned out before performing the following checks:

- Check 1 Make sure the correct AC power cord is firmly plugged into the AC IN socket on the back of the computer.
- Check 2 If the AC IN icon flashes orange when the AC power cord is connected, output voltage is abnormal. Connect a new AC power cord and turn the computer on again to verify the indicator condition.
- Check 3 The battery pack may be malfunctioning. Replace the battery pack with a new one and turn the computer on again. If the problem still exists, go to Procedure 2.

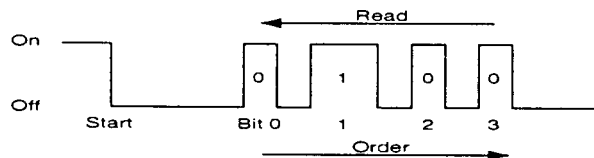
## Procedure 2 Error Code Check

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

- ❑ Start Off for 2 seconds
- ❑ Error code (4 bit)
  - “1” On for 1 second
  - “0” On for 1/2 second
  - Interval between data bits Off for 1/2 second

Error code begins with the least significant digit.

Example: Error code 2h (error codes are in hexadecimal)



- Check 1 Convert the AC IN icon blink pattern into the hexadecimal error code and compare it to the table below.

Error code	Meaning
1h	VCC (+5V) voltage is over the maximum allowed limit.
2h	VCC (+5V) voltage is below the minimum allowed limit.
3h	P12V (+12V) voltage is over the maximum allowed limit.
4h	P12V (+12V) voltage is below the minimum allowed limit.
5h	B3V (+3.3V) voltage is over the maximum allowed limit.
6h	B3V (+3.3V) voltage is below the minimum allowed limit.
7h	B5V (+5V) voltage is over the maximum allowed limit.
8h	B5V (+5V) voltage is below the minimum allowed limit.
9h	Current for the external keyboard is over the maximum allowed limit.
Ah	Voltage of the main battery is over the maximum allowed limit.
Bh	Current of the internal AC PS unit is abnormal.
Ch	The CPU overheats.
Dh	Voltage of the internal AC PS unit is over the maximum allowed limit.
Eh	Voltage of the internal AC PS unit is below the minimum allowed limit.
Fh	A nonstandard battery is installed.



Check 2 For error code 9h:

- Make sure the PS/2 mouse or keyboard is not connected. If connected, turn off the power and disconnect it.
- Connect the AC cord to the computer and turn on the power.
- If the error still exists, go to Procedure 3.

Check 3 For error code Ah:

- Make sure the battery pack is correctly installed in the computer. If the battery pack is correctly installed, go to the following step:
- Replace the battery pack with a new one.
- If the error still exists, go to Procedure 3.

Check 4 When error code Ch displays, it indicates that the CPU temperature is too high. The computer automatically enters Resume mode and shuts down.

- Leave the computer off until the AC IN icon stops blinking. We recommend that the computer remain off until its interior reaches room temperature even though the AC IN icon stops blinking.
- If the error still exists, go to Procedure 3.

Check 5 For error codes Dh or Eh:

- Make sure no optional device is connected. If one is connected, turn off the power and disconnect it.
- Connect the AC cord to the computer and turn on the power.
- If the error still exists, go to Procedure 4.

Check 6 For error code Fh:

- Disconnect the AC cord and remove the main battery pack from the computer.
- Check the main battery pack model name. If a nonstandard pack is installed, replace it with a standard model.
- If the error still exists, go to Procedure 3.

Check 7 For any other error, go to Procedure 3.

### **Procedure 3 Battery Icon Check**

The Battery icon shows the battery charging status.

If the Battery icon glows green, the AC power cord is connected and the battery is fully charged.

If the Battery icon glows orange, the AC power cord is connected and the battery is being charged.

If the Battery icon does not glow, go to Check 1.

Check 1 Make sure the AC power cord is firmly plugged into the AC IN socket and wall outlet. If these cables are connected correctly, go to Check 2.

Check 2 Make sure the main battery pack is installed in the computer correctly. If the battery pack is installed correctly, go to Check 3.

Check 3 Remove the battery pack and check that the battery terminal is clean and not bent.

If the terminal appears dirty, clean it gently with a cotton swab dipped in alcohol.

If the terminal looks bent or damaged, replace the system board.

If the battery terminal is clean and not bent, go to Check 4.

Check 4 Connect a new AC power cord. If the Battery icon still does not glow, go to Check 5.

Check 5 Install a new battery pack. If the Battery icon still does not glow, go to Procedure 4.

#### **Procedure 4 AC PS Unit Replacement Check**

The system board incorporates the power supply. Power is supplied to the system board through the AC IN plug located on the AC PS unit. The AC PS unit may be damaged. Refer to Chapter 4 for instructions on disassembling the computer and then perform the following checks:

Check 1 Replace the AC PS unit with a new one and restart the system. If the system is still not functioning properly, perform Check 2.

Check 2 Replace the system board with a new one and restart the system. If the problem still exists, other FRUs may be damaged.

## 2.4 System Board and HDD I/F Board Troubleshooting

This section describes how to determine if the system board and sound board are 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 on Boot Mode
- Procedure 3: Printer Port LED Check on Resume Mode
- Procedure 4: Diagnostic Test Program Execution Check
- Procedure 5: Replacement 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 and initializes each IC on the system board.

- If an error message displays on the screen, perform Check 1.
- If there is no error message, go to Procedure 2.
- If the Toshiba MS-DOS 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 the message instructs. 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.

If you press the **F1** key as the message instructs, the Setup Screen appears so that you can set the system configuration. If error message (b) appears often when the power is turned on, replace the RTC battery. If any other error message displays, perform 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, then data stored in RAM under the Resume function is lost because the battery has become discharged or the system board is damaged. Press any key as the message instructs. Go to Procedure 3.

```
WARNING: RESUME FAILURE.  
PRESS ANY KEY TO CONTINUE.
```

If any other message appears, perform Check 3.

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

If error message (1) through (19), (26), or (27) displays, replace the system board.

If error message (20) displays, go to the Keyboard Troubleshooting Procedures in Section 2.7.

If error message (21), (22), or (23) displays, go to the HDD Troubleshooting Procedures in Section 2.6.

If error message (24) or (25) displays, go to the FDD Troubleshooting Procedures in Section 2.5.

- (1) BIOS is damaged
- (2) PIT ERROR
- (3) MEMORY REFRESH ERROR
- (4) TIMER CH.2 OUT ERROR
- (5) FIRST 64KB MEMORY ERROR
- (6) CMOS CHECKSUM ERROR
- (7) CMOS BAD BATTERY ERROR
- (8) FIRST 64KB MEMORY ERROR
- (9) FIRST 64KB MEMORY PARITY ERROR
- (10) VRAM ERROR
- (11) SYSTEM MEMORY ERROR
- (12) SYSTEM MEMORY PARITY ERROR
- (13) EXTENDED MEMORY ERROR
- (14) EXTENDED MEMORY PARITY ERROR
- (15) DMA PAGE REGISTER ERROR
- (16) DMAC #1 ERROR
- (17) DMAC #2 ERROR
- (18) PIC #1 ERROR
- (19) PIC #2 ERROR
- (20) KBC ERROR
- (21) HDC ERROR
- (22) HDD #0 ERROR
- (23) HDD #1 ERROR
- (24) NO FDD ERROR
- (25) FDC ERROR
- (26) TIMER INTERRUPT ERROR
- (27) RTC UPDATE ERROR

## Procedure 2 Printer Port LED Check on 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.

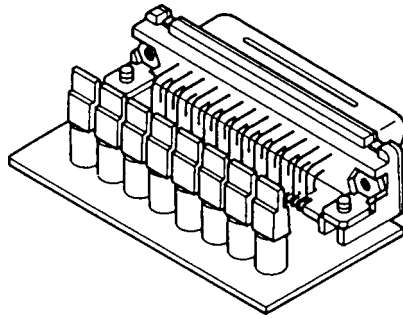


Figure 2-2 Printer port LED

To use the printer port LED, follow these steps:

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

LED status	Test item	Message
01H	ROM checksum test	BIOS is damaged!
	KBC initialization	—
02H	Special register initialization	—
	PIT test	PIT ERROR
	PIT initialization	—
03H	PIT function check	MEMORY REFRESH ERROR TIMER CH.2 OUT ERROR
	CMOS check	CMOS CHECKSUM ERROR CMOS BAD BATTERY ERROR
04H	KB initialization	KBC ERROR
	Initialization of memory configuration	—
05H	SM-RAM check	—
06H	ROM/RAM copy	—
08H	Self-test check	—
	Read of Power Supply information	—
	Initialization of internal VGA	—
0AH	First 64 KB memory test	FIRST 64KB MEMORY ERROR FIRST 64KB MEMORY PARITY ERROR
0BH	System memory initialization	—
0CH	System initialization	—
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
42H	DMAC initialization	—
4AH	PIC test	PIC #X ERROR
50H	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	—

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

LED status	Test item	Message
A6H	Initialization of expansion ROM	—
C0H	Password check	—
FFH	Setup boot check	*** Bad xxxx xxxx *** Check system. Then press [F1] key.
FFH	Boot load	—

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

01h, 02h, 03h, 04h, 05h, 06h, 07h, 08h, 0Ah, 0Bh, 0Ch, 0Dh, 18h, 1Fh, 25h,  
30h, 40h, 41h, 42h, 4Ah, 65h, 70h, 80h, 90h, A0h, A6h, C0h, FFh

Check 2 If error code 50h 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 on Resume 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 Resume mode.

To use the printer port LED, follow these steps:

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

*Table 2-2 Printer port LED Resume mode error status*

<b>Error status</b>	<b>Meaning</b>
F1H	RAM BIOS error.
F2H	The system has optional ROM, or optional card (CGA, MDA).
F5H	Main memory checksum error.
F6H	Video RAM checksum error.
F7H	Extended memory checksum error.

## Procedure 4 Diagnostic Test Program Execution Check

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.

1. System Test
2. Memory Test
3. Printer Test
4. Async Test
5. Real Timer Test
6. Expansion Test

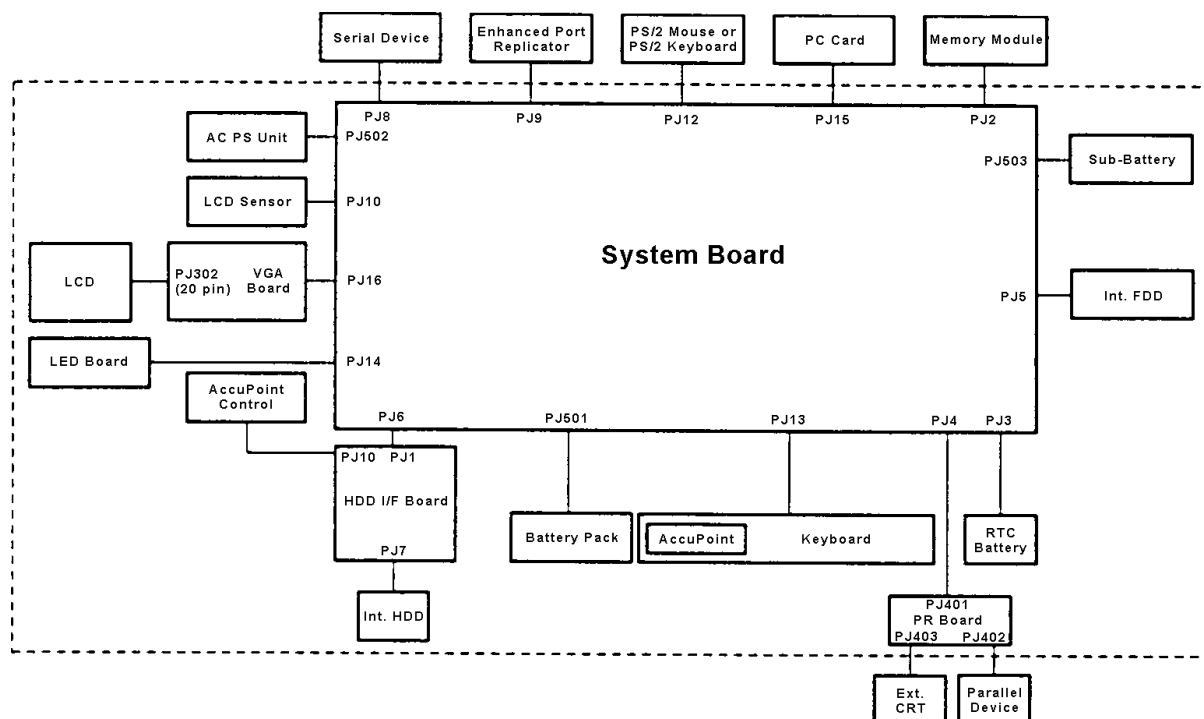
If an error is detected during these tests, go to Procedure 5.

## Procedure 5 Replacement Check

The system board or the HDD I/F board may be damaged. Disassemble the computer following the steps described in Chapter 4, *Replacement Procedures*, and perform the following checks:

Check 1 Replace the system board with a new one. Refer to Chapter 4 for instructions on how to remove and replace the system board.

Check 2 Replace the HDD I/F board with a new one. Refer to Chapter 4 for instructions on how to remove and replace the sound board.



## 2.5 Floppy Disk Drive Troubleshooting

This section describes how to determine if the 3.5-inch floppy disk drive 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 Diagnostics Program. For detailed operation, see Chapter 3, *Tests and Diagnostics*.

After Toshiba MS-DOS loads, run the Diagnostics Program. Then clean the FDD heads using the cleaning kit. If the FDD still does not function properly, go to Procedure 2.

If the test program cannot be executed on the computer, go to Procedure 3.

## Procedure 2 Diagnostic Test Program Execution Check

The Floppy Disk Drive Diagnostic Test Program is stored on the Diagnostics Disk. After loading Toshiba MS-DOS, run the Diagnostics Program. Refer to Chapter 3, *Tests and Diagnostics*, for more information about the diagnostics test procedures.

Each floppy disk drive test error code and its status is described in Table 2-3. Make 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 2-3 Floppy disk drive error code and status

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	FDD not drive
80h	Time out error (Not ready)
EEh	Write buffer error
FFh	Data compare error

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

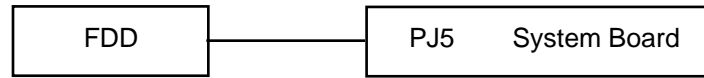
Write protected

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 3.5-inch Floppy Disk Drive is connected to the system board by a flexible cable. This cable may be damaged or disconnected from the 3.5-inch FDD port. Perform the following checks:

Check 1 Make sure the flexible cable is firmly connected to the 3.5-inch FDD.



If this cable is disconnected, connect it to the system unit and repeat Procedure 2. If the FDD is still not functioning properly, perform Check 2.

Check 2 The cable may be defective or damaged. Replace the flexible cable. If the FDD is still not functioning properly, perform Check 3.

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

Check 4 Replace the system board with a new one following the steps in Chapter 4.

## 2.6 Hard Disk Drive Troubleshooting

To determine if the hard disk drive is functioning properly, perform 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

***CAUTION:** The contents of the hard disk drive will be erased when the HDD troubleshooting procedures are executed. Transfer the contents of the hard disk drive to floppy disks using the **BACKUP** command in the Toshiba companion utility. Refer to the User's Manual for more information about how to perform **BACKUP**.*

### Procedure 1 Partition Check

Insert the Toshiba MS-DOS system disk, turn on the computer, and 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 change to drive C, 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 drive C is not listed, 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 drive C is not listed as active, 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 appear, perform Check 2. If the following messages do not appear, perform Check 4.

```
HDC ERROR
  (After 5 seconds, this message disappears.)
      or
HDD #0 ERROR
  (After 5 seconds, this message disappears.)
      or
HDD #1 ERROR
  (After 5 seconds, this message disappears.)
```

Check 2 If either of the following messages appears, perform Procedure 3. If the following messages do not appear, perform Check 3.

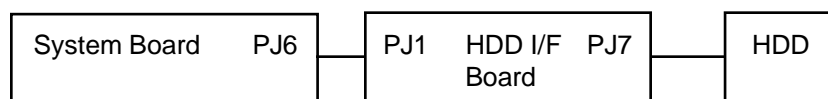
```
Insert system disk in drive
Press any key when ready .....
      or
Non-System disk or disk error
Replace and press any key
```

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

If the following message appears on the display, the system program has been transferred to the HDD. Restart the computer. If the error message still appears, perform Check 4.

```
System transferred
```

Check 4 The HDD is directly connected to the system board. This connection can become disconnected or damaged. Disassemble the computer as described in Chapter 4, *Replacement Procedures*. If the HDD is not connected, connect it to the system board and return to Procedure 1. If the HDD is firmly connected to the system board, perform 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 perform the other steps as required.

- Check 1    Using the Toshiba MS-DOS system disk, partition the hard disk drive using the FDISK command. Format the hard disk drive using **FORMAT C:/S/U** to transfer the system program to the HDD. If the following message appears on the display, the HDD is formatted.

```
Format complete
```

If any other error message appears on the display, refer to the *Toshiba MS-DOS Manual* for more information and perform Check 2.

- Check 2    Using the Diagnostics 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 appears on the display, 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 Diagnostics Program, go to Procedure 4.



## Procedure 4 Diagnostic Test Program Execution Check

The HDD test program is stored on the Diagnostics Disk. Perform all of the HDD tests in the Hard Disk 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 its status will display; perform Check 1. The error codes and statuses are listed in Table 2-4. If an error code is not generated, the HDD is operating properly.

Table 2-4 Hard disk drive error code and status

Code	Status
01h	Bad command
02h	Bad address mark
04h	Record not found
05h	HDC not reset
07h	Drive not initialized
08h	HDC overrun (DRQ)
09h	DMA boundary error
0Ah	Bad sector error
0Bh	Bad track error
10h	ECC error
11h	ECC recovery enabled
20h	HDC error
40h	Seek error
80h	Time out error
AAh	Drive not ready
BBh	Undefined error
CCh	Write fault
E0h	Status error
EEh	Access time out 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, perform Check 2.

Check 2 Replace the system board with a new one following the instructions in Chapter 4.

## 2.7 Keyboard Troubleshooting

To determine if the keyboard is functioning properly, perform the following procedures. Start with Procedure 1 and continue with Procedure 2 as instructed.

- Procedure 1: Diagnostic Test Program Execution Check
- Procedure 2: Connector and Replacement Check

### Procedure 1 Diagnostic Test Program Execution Check

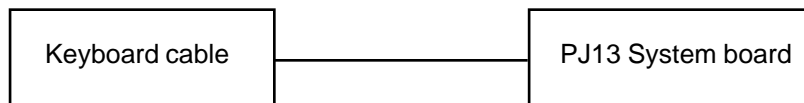
Execute the Keyboard Test in the Diagnostics Program. Refer to Chapter 3, *Tests and Diagnostics*, for more information on how to perform the test program.

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 a flat cable. This cable may be disconnected or damaged. Disassemble the computer as described in Chapter 4, *Replacement Procedures*, and perform the following checks:

- Check 1 Make sure the keyboard cable is not damaged and is connected to the system board.



If this cable is damaged, replace the keyboard with a new one. If the cable is disconnected, firmly connect it. Perform Procedure 1 again. If the keyboard is still not functioning properly, perform Check 2.

- Check 2 The keyboard controller on the system board may be damaged. Replace the system board with a new one. Refer to Chapter 4, *Replacement Procedures*, for more information.

## 2.8 Display and VGA Board Troubleshooting

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

- Procedure 1: Contrast Control Check
- Procedure 2: External CRT Check
- Procedure 3: Diagnostic Test Program Execution Check
- Procedure 4: Connector Check
- Procedure 5: Replacement Check

### Procedure 1 Contrast Control Check

Use the contrast dial to change the contrast. If the display is blank, go to Check 1. If you cannot change the contrast, go to Check 3.

If the contrast does not change when you turn the contrast dial, perform Procedure 2.

### Procedure 2 External CRT Check

Connect the external CRT to the external monitor port, then boot the computer. The computer automatically detects the external CRT even if Resume mode is enabled.

If the external CRT works correctly, the internal LCD display may be damaged. Go to Procedure 4.

If the external CRT appears to have the same problem as the internal LCD, the display controller may be damaged. Go to Procedure 3.

### Procedure 3 Diagnostic Test Program Execution Check

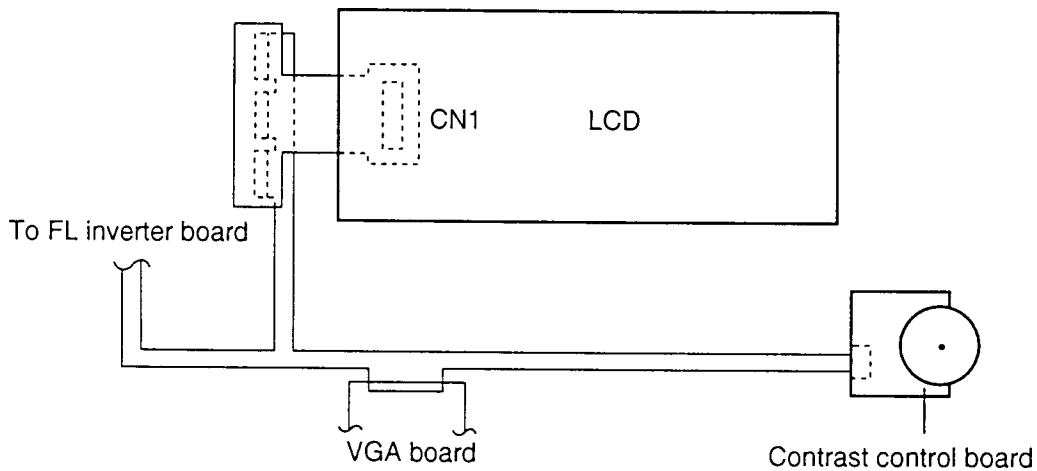
The Display Test program is stored on the computer Diagnostics Disk. This program checks the display controller on the system board. After loading Toshiba MS-DOS, run the Diagnostics Program. Refer to Chapter 3, *Tests and Diagnostics*, for details.

If an error is detected, go to Procedure 4. If an error is not detected, the display is functioning properly.

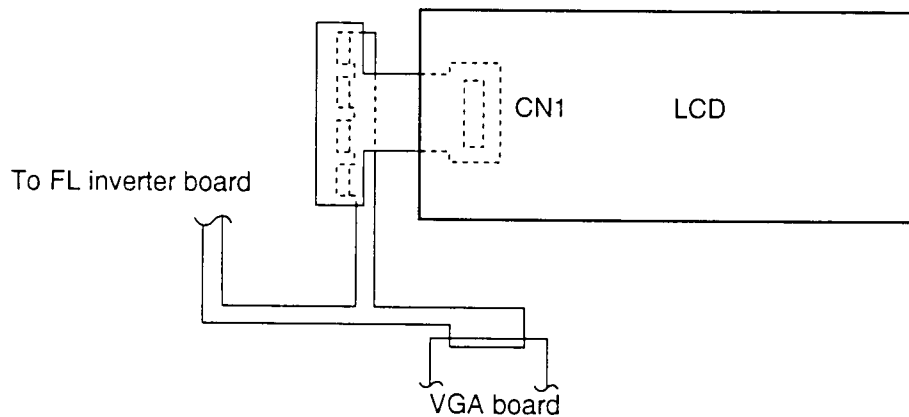
## Procedure 4 Connector Check

The Display unit has an LCD module, FL, Display switch, and FL inverter board. The FL and FL inverter board are connected by two cables. The LCD module and system board are connected by two signal cables as shown below. Any of these cables may be disconnected.

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



*Figure 2-3 110CS display connection*



*Figure 2-4 110CT display connection*

If any of these cables is not connected, firmly reconnect it and repeat Procedures 1 and 2. If the problem still exists, perform Procedure 5.

## Procedure 5 Replacement Check

The FL, FL inverter board, LCD module, 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. Perform the following checks:

If the FL does not light, perform Check 1.

If characters do not display clearly, perform Check 3.

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

If the FL remains lit when the display is closed, perform Check 4.

Check 1 Replace the FL with a new one and test the display again. If the problem still exists, perform Check 2.

Check 2 Replace the FL inverter board with a new one and test the display again. If the problem still exists, perform Check 3.

Check 3 Replace the LCD module with a new one and test the display again. If the problem still exists, perform Check 6.

Check 4 Replace the display switch with a new one and test the display again. If the problem still exists, perform Check 5.

Check 5 Replace the display cable with a new one and test the display again. If the problem still exists, perform Check 6.

Check 6 The system board may be damaged. Replace the system board with a new one.



## 3.1 The Diagnostic Test

This chapter explains how to use the Diagnostic Test Program to test the functions of the computer's hardware modules. The Diagnostics Program is stored on the Diagnostics Disk and consists of 11 programs that are grouped into the Service Program Module (Diagnostics Menu) and the Test Program Module (Diagnostic Test Menu).

**NOTES:** *To start diagnostics, follow these steps:*

1. *Check all cables for loose connections.*
2. *Exit any application you may be using and close Windows.*
3. *Be sure the computer is not in virtual 86 mode. The test will not run in that mode.*

*If you try to run the test in virtual 86 mode, the following message displays:*

*Cannot execute in a virtual 8086 mode.*

*If the preceding message displays, remove memory managers from your CONFIG.SYS file. See your MS-DOS documentation for information on the CONFIG.SYS file.*

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

Diagnostic Test (the first option of the Diagnostics Menu) contains the following 11 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

The service programs are the remaining Diagnostics Menu functions (hard disk format, etc.).

To perform some of the Diagnostic Test functions, you will need the following equipment.

- Diagnostics Disk (All tests)
- Formatted working disk for the Floppy Disk Test
- 3.5-inch 2HD/2DD disk for internal 3.5-inch FDD
- Cleaning kit to clean the floppy disk drive heads (Head cleaning)
- PC card wraparound card for the I/O card test (Expansion Test)
- Printer wraparound connector for the printer wraparound test (Printer Test)
- RS-232-C wraparound connector for the RS-232-C port wraparound test (Async Test)
- External CRT (All tests)
- PS/2 or compatible keyboard (All tests)
- PS/2 or compatible mouse (Keyboard Test)
- Serial port wraparound connector (Async Test)
- Enhanced port replicator (Expansion Test)

For detailed information about the Diagnostic Test functions, see Sections 3.2 through 3.16. Refer to Sections 3.17 through 3.23 for detailed information on the service program functions.



## 3.2 Executing the Diagnostic Test

Running diagnostics requires Toshiba MS-DOS. To start the Diagnostic Test programs, follow these steps:

1. Insert the Diagnostics Disk in the floppy disk drive and turn on the computer.

The Diagnostics 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 computer Diagnostics Menu, press the **Esc** key. If a test program is in progress, press **Ctrl + Break** to exit or **Ctrl + C** to stop the test program.

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

```
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
88 - ERROR RETRY COUNT SET [HDD & FDD]
99 - EXIT TO DIAGNOSTICS MENU
      ↑↓→←      :      Select items
      Enter      :      Specify
      Esc        :      Exit
```

Refer to Sections 3.4 through 3.14 for detailed descriptions of Diagnostic Tests 1 through 11. 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.

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

```
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 -
05 - Thermistor check
99 - Exit to DIAGNOSTIC TEST MENU
      ↑↓→←      :      Select items
      Enter      :      Specify
      Esc        :      Exit
```

**NOTE:** The menu your computer displays may differ slightly from the one shown above.

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

```
TEST LOOP : YES
```

Selecting **YES** increases the pass counter by one each time the test cycle ends and also restarts the test cycle.

Selecting **NO** returns the subtest menu to the Diagnostic Test Menu after the test is complete.

**NOTE:** Use the left or right arrow key to select the option, YES or NO, and use the up or down arrow key to move the highlight bar.

5. The following message appears:

```
ERROR STOP : YES
```

Selecting **YES** stops the test program when an error is found and displays the operation guide on the right side of the 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.

Selecting **NO** keeps the test running even if an error is found.

6. Press **Enter** to start the test program.

Table 3-1 in Section 3.3 describes the function of each test on the subtest menu.  
Table 3-2 in Section 3.15 describes each error code and its status.

### 3.3 Subtest Names

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

*Table 3-1 Diagnostic Test Menu's subtest names (1/2)*

Test no.	Test name	Subtest no.	Subtest item
1	SYSTEM	01	ROM checksum
		05	Thermistor check
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	Pressed key code display
		03	PS/2 mouse connect check
		04	Pointing stick
4	DISPLAY	01	VRAM read/write
		02	Character attributes
		03	Character set
		04	80 x 25/30 Character display
		05	320 x 200 Graphics display
		06	640 x 200 Graphics display
		07	640 x 350/480 Graphics display
		08	Display page
		09	"H" pattern display/border color
		10	LED/DAC pallet
		11	Color 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 Diagnostic Test Menu's subtest names (2/2)

Test no.	Test name	Subtest no.	Subtest item
7	ASYNC	01	Wraparound (board)
		02	Board (#1) <=> board (#2) (Not used)
		03	Point to point (send)
		04	Point to point (receive)
		05	Interrupt test
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 (Internal)
		02	PCMCIA wraparound (External)

## 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. Move the highlight bar to the subtest you want to execute and press **Enter**.

Subtest 01    ROM Checksum

Tests the system board from address F0000h to FFFFFh (64 KB).

Subtest 02    Not used

Subtest 03    Not used

Subtest 04    Not used

Subtest 05    Thermistor Check

Checks the thermistor that controls CPU temperature. The thermistor cable connects to PJ1 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. Move the highlight bar to the subtest you want to execute and press **Enter**.

### Subtest 01 RAM Constant Data (Real Mode)

Writes a 256-byte unit of constant data to conventional memory (0 to 640 KB), then reads the data and compares the result with the original data. The constant data is FFFFh, AAAAh, 5555h, and 0000h.

### Subtest 02 RAM Address Pattern Data (Real Mode)

Writes address pattern data created by the exclusive-ORing (XORing) to the address segment and address offset in conventional memory (program end to 640 KB). The new data is then read and compared with the original data.

### Subtest 03 RAM Refresh (Real Mode)

Writes a 256-byte unit of constant data to conventional memory (0 to 640 KB), then reads the 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.*

### Subtest 04 Protected Mode

**NOTE:** *The CONFIG.SYS file must be configured without expanded memory manager programs such as EMM386.EXE, EMM386.SYS, or QEMM386.SYS. Also, the HIMEM.SYS must be deleted from the CONFIG.SYS file.*

Writes constant data and address data to extended memory (memory area beyond 1 MB), then reads new data and compares the result with the original data.

The constant data is FFh, AAh, 55h, and 00h.

Subtest 05 Memory Module

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

Functions the same as Subtest 04, except it is used for testing an optional memory card. Memory module capacity is 8 MB, 16 MB, and 32 MB.

After selecting Subtest 05, the following message appears:

Extended memory size (1:8 MB,2:16 MB,3:32 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). One test takes 3 seconds.

Number of misses < Number of hits → OK

Number of misses ≥ Number of hits → Fail



## 3.6 Keyboard Test

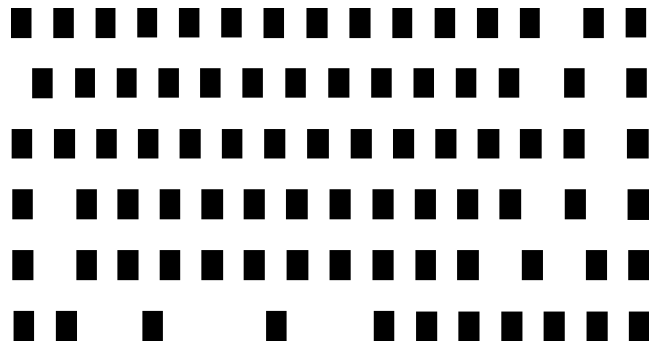
To execute the Keyboard Test, select **3** from the Diagnostic Test Menu, press **Enter**, and follow the directions on the screen. The Keyboard Test contains four subtests that test the computer's keyboard actions. Move the highlight bar to the subtest you want to execute and press **Enter**.

Subtest 01    Pressed Key Display (82/84)

***NOTE:** The **Num Lock** and the **Overlay** mode must be off to execute this subtest.*

When you execute this subtest, the keyboard layout is drawn on the display as shown below. When any key is pressed, the corresponding key on the screen changes to an "\*" character. Holding a key down enables the auto-repeat function which causes the key's display character to blink.

[[[    Press Key Display    ]]]



If test OK, Press [Del] [Enter] Key

## Subtest 02    Pressed Key Code Display

When a key is pressed, the scan code, character code, and keytop name display on the screen in the format shown below. The **Ins**, **Caps Lock**, **Num Lock**, **Scroll Lock**, **Alt**, **Ctrl**, **Left Shift**, and **Right Shift** keys display in Reverse Screen mode when pressed. The scan codes, character codes, and keytop names are shown in Appendix D.

```
KEYBOARD TEST  IN PROGRESS  302000

                          Scan code      =
                          Character code =
                          Keytop         =

Ins Lock Caps Lock Num Lock  Scroll Lock
Alt  Ctrl  Left Shift Right Shift

PRESS [Enter] KEY
```

## Subtest 03    PS/2 Mouse Connect Check

***NOTE:** To execute the PS/2 mouse connect check, a PS/2 mouse must be connected to the PS/2 mouse/keyboard port on the computer or the enhanced port replicator.*

Checks whether a PS/2 mouse is connected.

If this test does not detect an error, it returns to the subtest menu.

If this test detects an error, the following message appears:

```
DATA COMPARE ERROR

[[ HALT OPERATION ]]

1: Test end
2: Continue
3: Retry
```



### 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 eleven subtests that test the computer's display in various modes. Move the highlight bar to the subtest you want to execute and press **Enter**.


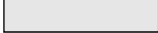



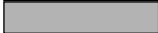


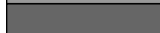
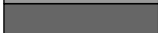
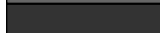
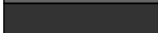




Subtest 01    VRAM Read/Write

Writes constant data FFFFh, AAAAh, 5555h, 0000h, and address data to video RAM (1 MB). This data is then read from the video RAM and compared to the original data.

Subtest 02    Character Attributes (Mode 1, 13h)

Displays the following character attribute modes: normal, intensified, reverse, and blinking as shown in the display below. The character attribute modes display the foreground color and intensified color (16 colors or 16-level gray scale) using black, blue, red, magenta, green, cyan, yellow, and white from the color display. The display below appears on the screen when this subtest is executed.

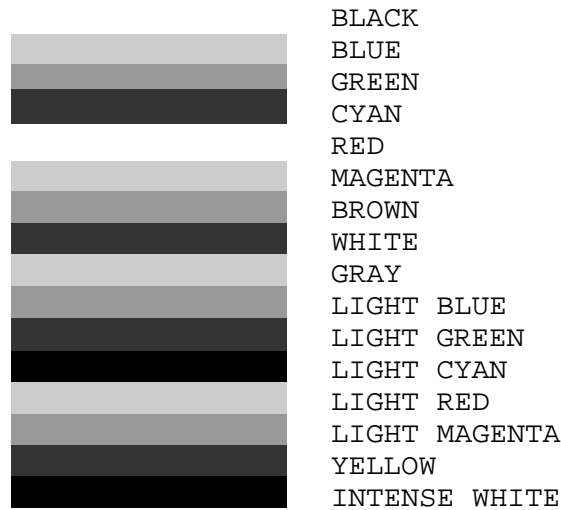
```
CHARACTER ATTRIBUTES  
  
NEXT LINE SHOWS NORMAL DISPLAY.  
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN  
  
NEXT LINE SHOWS INTENSIFIED DISPLAY.  
IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII  
  
NEXT LINE SHOWS REVERSE DISPLAY.  
RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR  
  
NEXT LINE SHOWS BLINKING DISPLAY  
BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB
```

		00 08 ; BLACK
		01 09 ; BLUE
		04 0C ; RED
		05 0D ; MAGENTA
		02 0A ; GREEN
		03 0B ; CYAN
		06 0E ; YELLOW
		07 0F ; WHITE

PRESS [ENTER] KEY

After pressing **Enter**, 16 colors or 16 levels of gray of mode 13h appear in the 320 x 200 graphics mode, as shown below:

320\*200 GRAPHICS DISPLAY [ 13 ]



PRESS [ENTER] KEY

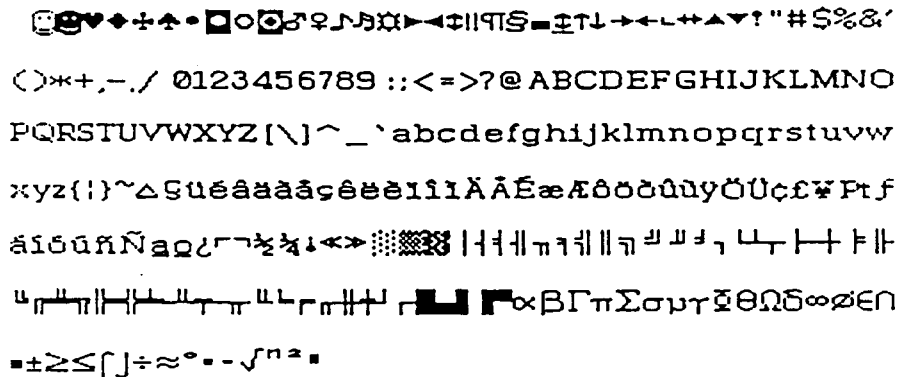
Pressing **Enter** toggles between the two tests.

To exit this subtest and return to the Display Test Menu, press **Ctrl + Break**.

Subtest 03 Character Set

Displays the character set (addressed 00h to FFh) in the 40 x 25 character mode, as shown below.

CHARACTER SET IN 40\*25



Press [Enter] KEY

To exit this subtest and return to the Display Test Menu, press **Ctrl + Break**.



Subtest 06 640 x 200 Graphics Display (Mode 6, E)

Displays even dots, odd dots, and all dots in the 640 x 200 dot graphics mode 6 and E, as shown below:

640\*200 GRAPHICS DISPLAY : [X]

EVEN DOTS  
DRIVEN

ODD DOTS  
DRIVEN

ALL DOTS  
DRIVEN



PRESS [Enter] KEY

To exit this subtest and return to the Display Test Menu, press **Ctrl + Break**.

Subtest 07 640 x 350/480 Graphics Display (Mode 10, 12)

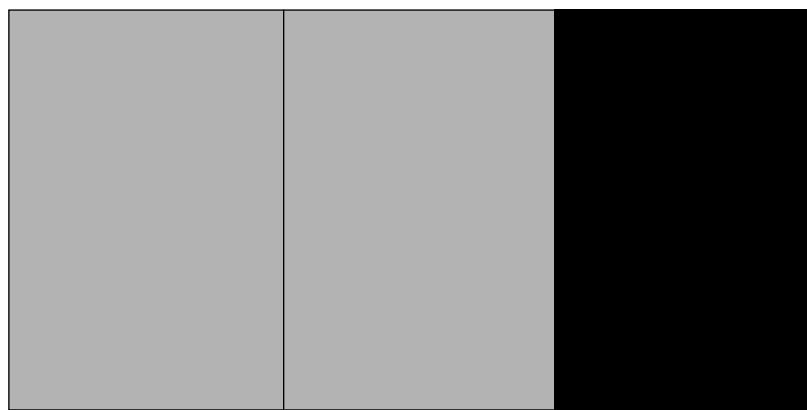
Displays even dots, odd dots, and all dots in the 640 x 350 and 640 x 480 dot graphics mode 10, 12 as shown below:

640\*XXX GRAPHICS DISPLAY

EVEN DOTS  
DRIVEN

ODD DOTS  
DRIVEN

ALL DOTS  
DRIVEN



PRESS [Enter] KEY

Pressing **Enter** changes the size of the displayed image. To exit this subtest and return to the Display Test Menu, press **Ctrl + Break**.

Subtest 08    Display Page

Confirms that the pages can be changed in order from page 0 through page 7 in 40 x 25 character mode.

```

DISPLAY PAGE 0

0000000000000000000000000000000000000000000000000000000000000000
0                               0
0                               0
0                               0
0                               0
0                               0
0                               0
0                               0
0                               0
0                               0
0                               0
0                               0
0                               0
0                               0
0000000000000000000000000000000000000000000000000000000000000000

```

Pressing **Ctrl + Break** exits this subtest, after completion of the test, and returns to the Display Test Menu.

Subtest 09    H Pattern Display/Border Color

Displays H characters on the entire screen, as shown below.

```

HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
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HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH

```

**NOTE:** In the bottom row, only the top half of the letter H appears.

Pressing **Enter** displays the following message:

```
Setting the color CRT (1:yes/2:no) ?
```



If an external CRT display is connected to the computer, choose **1** to display the following message:

```
[Border color test (7 times press [Enter] key)]
```

Press **Enter** to execute the border color test. To exit this subtest and return to the Display Test Menu, press **Ctrl + Break**.

#### Subtest 10 LED/DAC Pallet

Checks the LED indicator (Caps Lock, Allow and Num Lock) by key operation.

```
[ Caps/Num/Overlay LED test ]  
  
(1) Press [ Caps Lock      ] key !...Caps  (on/off)  
(2) Press [ Fn + F10 Lock ] key !...Allow (on/off)  
(3) Press [ Fn + F11      ] key !...Num   (on/off)  
  
PRESS [Enter] KEY
```

Press **Enter** to display the following message:

```
[ DAC pallet W-R-CMP test]      = (about 1 second)
```

After pressing enter, this subtest writes the "2A" and "15" data to 6 bit of 256 x 3 (RGB), then reads data and compares the result with the original data.

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

#### Subtest 11 Color Display

Sets the video mode to "13," displays color code (0 to 63) at the same time, then displays seven screens. The first shows many colors at once; the next three display 64 shades of red, green, and blue successively; and the last three display 64 shades of red, green and blue. Also, it sets the video mode to "79" and displays 256 colors.

Press **Enter** to change the display. Press **Ctrl + Break** to exit.

## 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.

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 internal floppy disk drive. The following messages appear after selecting the Floppy Disk Test from the Diagnostic Test Menu. To execute the test, answer each question with an appropriate response.

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) ?
```

**NOTE:** The computer supports one FDD, so select FDD#1. The other options cause an error in the test program.

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) ?
```

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 appears after you select the start track number. Select the number of the subtest you want to execute and press **Enter**. The following message appears during the Floppy Disk Test.

```
FLOPPY DISK      XXXXXXXX
```

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

Subtest 01 Sequential Read

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

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

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

Writes specified data to a specified track, head, and address. Before you start the test, you must enter data to be written, a track number, and a head number.

Subtest 05 Read Specified Address

Reads data from a specified track, head, and address. Before you start the test, you must enter a track and head number.

### 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. Move the highlight bar to the subtest you want to execute and press **Enter**.

The following messages appear after selecting the subtest from the subtest menu. Answer each of the following questions with an appropriate response to execute the test.

```
channel#1 = XXXXh
channel#2 = XXXXh
channel#3 = XXXXh
Select the channel number (1-3) ?
```

The printer I/O port address is specified by the XXXXh number. The computer supports three printer channels. Select the printer channel number and press **Enter** to execute the selected subtest.

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

#### Subtest 01 Ripple Pattern

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

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

Subtest 02      Function

For IBM compatible printers, tests the following functions:

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

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[\]^_`abcdefghijklmnop
   qrstuvwxyz{|}~
```

Subtest 03      Wraparound

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

Checks the output and bidirectional modes of the data control and status 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 on the screen. The Async Test contains five subtests that test the computer's asynchronous communication functions. Move the highlight bar to the subtest you want to execute and press **Enter**.

Subtests 01 through 04 require the following data format:

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

The following message appears at the bottom of the screen when Subtests 01, 03, 04, or 05 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. Press **Enter** to start the subtest.

Subtest 01    Wraparound (Board)

***NOTE:** To execute this subtest, an RS-232-C wraparound connector (34M741621G01) must be connected to the RS-232-C port. The RS-232-C wraparound connector wiring diagram is described in Appendix F.*

Checks the data send/receive function through the wraparound connector.

Subtest 02    Board (#1) <=> board (#2)

Not used.

Subtest 03 Point to Point (Send)

**NOTE:** *To execute this subtest, two machines must be connected with an RS-232-C direct cable. One machine should be set as "send" (Subtest 03) and the other set as "receive" (Subtest 04). The wiring diagram for the RS-232-C direct cable is described in Appendix F.*

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

Subtest 04 Point to Point (Receive)

Used with Subtest 03 described above. Receives the data from the send side, then sends the received data.

Subtest 05 Interrupt Test

Checks the Interrupt Request Level of IRQ 4, 3, and 5 from the send side.

### 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 10 subtests that test the computer hard disk drive functions. The following messages appear after selecting the Hard Disk Test from the Diagnostic Test Menu. To execute the test, answer each of the following questions with an appropriate response:

***NOTE:** The contents of the hard disk drive 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 drive to floppy disks. This should be done with the BACKUP command in the Toshiba Companion Utility. Do not use the MS-DOS BACKUP command.*

*After the Hard Disk Test is completed, execute the Toshiba MS-DOS FDISK command, which will set the partition. Then execute the Toshiba MS-DOS FORMAT command. Refer to the Toshiba MS-DOS manual for details.*

1. When you select the Hard Disk Test from the Diagnostic Test Menu, the following message appears:

Test drive number select (1:HDD#1,2:HDD#2,0:HDD1&2) ?

2. Select the hard disk drive number to be tested and press **Enter**. The following message appears:

HDC F/W error retry (1:yes,2:no) ?

3. This message is used to select the retry operation when the hard disk controller detects an error. Select **1** or **2** and press **Enter**. The following message appears:

Data compare error dump (1:no,2:yes) ?

4. This message is used to select the error dump operation when a data compare error is detected. Select **1** or **2** and press **Enter**. The following message appears:

Detail status display (1:no,2:yes) ?

5. This message is used to select whether the HDD status displays on the screen. The HDD status is described in Section 3.16. Select **1** or **2** and press **Enter**.



6. The Hard Disk Test message appears after you respond to the Detail Status prompt. Select the number of the subtest you want to execute and press **Enter**. The following message appears 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
```

The first three digits of the ADDRESS indicate which cylinder is being tested, the fourth digit indicates the head, and the last two digits indicate the sector.

The first digit of the STATUS number indicates the drive being tested. The last two digits indicate the error status code as explained in Table 3-3.

Subtest 01 Sequential Read

Reads all the tracks on the HDD sequentially, starting at track 0. When all the tracks on the HDD have been read, the test starts at the maximum track and reads the tracks on the HDD sequentially back to track 0.

Subtest 02 Address Uniqueness

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

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

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)

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

Writes specified data to a specified cylinder and head on the HDD.

Subtest 07 Read Specified Address

Reads data which has been written to a specified cylinder and head on the HDD.

Subtest 08 ECC Circuit

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

Subtest 09 Sequential Write

Writes specified 2-byte data to all of the cylinders on the HDD.

Subtest 10 W-R-C Specified Address

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 computer's 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. The following message appears:

```
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 appears:

```
Enter new time :
```

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

Pressing **Enter** toggles between the time and the date. To exit, press **Ctrl + Break**.

### Subtest 02 Backup Memory

Performs the following backup memory check:

- Writes 1-bit of "on" data to address 01h through 80h
- Writes 1-bit of "off" data to address FEh through 7Fh
- Writes the data pattern AAh through 55h to the RTC 114-byte memory (address 0Eh to 7Fh)

Then reads and compares this data with the original data.

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

Subtest 03 Real Time Carry

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

Checks the real time clock increments, making sure the date and time display in the following format:

```
Current date   : 12-31-1994
Current time   : 23:59:58
```

Pressing **Enter** displays the following:

```
Current date   : 01-01-1995
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 Diagnostic Test Menu, press **Enter**, and follow the directions on the screen. The NDP Test contains one subtest that tests the NDP (Numeric Data Processor) functions.

#### Subtest 01 NDP

Checks the following functions of the math co-processor:

- 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 Diagnostic Test Menu, press **Enter**, and follow the directions on the screen. The Expansion Test contains two subtests.

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

#### Subtest 01 PCMCIA Wraparound (Internal)

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

Executes 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

#### Subtest 02 PCMCIA Wraparound (External)

Checks the signal lines of the enhanced port replicator's PC card slots.

Procedures for conducting this test are the same as for Subtest 01 PCMCIA Wraparound (Internal) described above.

### 3.15 Diagnostic Test Error Codes and Status Names

Table 3-2 lists the error codes and status names for the Diagnostic Test.

*Table 3-2 Diagnostic Test error codes and status names (1/2)*

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 connected
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 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
	08	TX-BUFFER Full Time Out
	10	Parity Error

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

Device name	Error code	Error status name
ASYNC (cont.)	20	Framing Error
	40	Overrun Error
	80	Line Status Error
	88	Modem Status Error
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 Recovery 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
EXPANSION	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



### 3.16 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; 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; the second byte displays the HDC error register.

The contents of the HDC status register and error register are described 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" --- Other. "1" --- Correctable data error is corrected.
1	IDX (Index)	"0" --- Other. "1" --- Index is sensed.
0	ERR (Error)	"0" --- Other. "1" --- The previous command was terminated with some error.

*Table 3-4 Hard disk controller error register contents*

<b>Bit</b>	<b>Name</b>	<b>Description</b>
7	BBK1 (Bad block mark)	"0" Other. "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" Other. "1" There was no ID field in the requested sector.
3	—	Not used.
2	ABRT (Abort)	"0" Other. "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.

## 3.17 Hard Disk Format

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

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

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

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

**CAUTION:** *The contents of the hard disk drive will be erased when this program is executed. Before executing the function, transfer the contents of the hard disk drive to floppy disks. Use BACKUP in the Toshiba Companion Utility. Do not use the MS-DOS BACKUP Command. See the Toshiba MS-DOS manual for details.*

### 3.17.1 Function Description

1. All Track FORMAT

Performs a low-level format of all the tracks on the hard disk drive, 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 drive formatting sequence

Item	Toshiba MK1926FCV	IBM DBOA-20810
Formatted capacity (byte)	814,915,584	812,851,200
Disks	3	2
Logical heads	16	16
Logical cylinders	1,579	1,575
Bytes per sector	512	512
Rotation speed (rpm)	4200	4009

## 2. Good Track FORMAT

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

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

Searches the hard disk drive for bad tracks by reading data to all the tracks on the hard disk drive. A list of bad tracks displays when the program is complete. If an error other than a bad track is detected, the program automatically terminates.

### 3.17.2 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.*

Selecting Test **2** and pressing **Enter** in the Diagnostics Menu displays 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

Pressing **1** selects 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 appear at the bottom of the screen in succession:

(a) Drive number

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

Select a drive number and press **Enter**.

(b) Interleave number

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

Select an interleave number (1 ~ 8) and press **Enter**. Pressing only **Enter** selects 1.

(c) Bad track register

The Bad Track register prompt appears 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 in 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

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 display in the format shown below.

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

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

## 3.18 Head Cleaning

### 3.18.1 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.

### 3.18.2 Operations

1. Selecting Test **4** from the Diagnostics Menu and pressing **Enter** displays 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 appears, the FDD head cleaning has begun.
4. The display automatically returns to the Diagnostics Menu when the program is completed.





2. The error information on the screen can be manipulated using 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 Diagnostics 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.

## 3.20 Running Test

### 3.20.1 Function Description

This function automatically executes the following tests in sequence:

1. System Test (Subtest 01)
2. Memory Test (Subtests 01, 02, 04, 06)
3. Display Test (Subtests 01 through 08)
4. FDD Test (Subtest 02)
5. HDD Test (Subtests 01, 05)
6. Real Timer Test (Subtest 02)
7. Printer Test (Subtest 03)
8. Async Test (Subtest 01)

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

### 3.20.2 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 FDD testing.*

1. Remove the Diagnostics Disk from the floppy disk drive and insert the work disk.
2. Select **6** from the Diagnostics Menu and press **Enter**. The following message displays:

```
Printer wrap around test (Y/N) ?
```

Selecting **Y (yes)** executes the Printer Wraparound Test. A printer wraparound connector must be connected to the **parallel** port on the back of the computer to properly execute this test.

3. Select **Y** or **N** and press **Enter**. The following message appears:

```
Serial #A wrap around test (Y/N) ?
```

Selecting **Y (yes)** executes the Async Wraparound Test. An RS-232-C wrap-around connector must be connected to the **serial port** on the back of the computer to properly execute this test.

4. Select **Y** or **N** and press **Enter**. The following message appears :

```
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**.

## 3.21 Floppy Disk Drive Utilities

### 3.21.1 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.*

Formats a 5.25-inch or 3.5-inch floppy disk in the following formats:

- (a) 2D: Double-sided, double-density, 48/67.5 TPI, MFM mode, 512 bytes, 9 sectors/track.
  - (b) 2DD: Double-sided, double-density, double-track, 96/135 TPI, MFM mode, 512 bytes, 9 sectors/track.
  - (c) 2HD: Double-sided, high-density, double-track, 96/135 TPI, MFM mode, 512 bytes, 18 sectors/track.
- #### 2. COPY

Copies data from a source floppy disk to a target floppy disk.

#### 3. DUMP

Displays the contents of the floppy disk and the designated sectors of the hard disk drive on the display.

### 3.21.2 Operations

1. Selecting **7** from the Diagnostics Menu and pressing **Enter** displays the following message:

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

## 2. FORMAT Program

- (a) Selecting FORMAT displays 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-2DD,1:2D-2D,2:2D-2HD,3:2HD-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 appears:

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

- (e) Typing **1** displays the message from Step (c) above. Typing **2** returns the test to the Diagnostics Menu.

## 3. COPY Program

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

```
FLOPPY DISK FORMAT & COPY : VX.XX  
Type select (0:2DD-2DD,1:2D-2D,2:2D-2HD,3:2HD-2HD)?
```

- (b) Selecting a media/drive type number displays 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 appears, 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 appears and the data starts copying to the target disk. When the amount of data is too large to be copied in one operation, the message from Step (b) displays again. After the floppy disk has been copied, the following message appears:

```
Copy complete
Another copy (1:Yes/2:No) ?
```

- (e) To copy another disk, type **1** and the message from Step (a) displays again. Entering **2** returns the test program to the Diagnostics Menu.

#### 4. DUMP Program

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

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

- (b) Select a format type number. If **C** or **D** is selected, the display goes to Step (e).

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

- (c) Select a drive number and the following message displays:

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

- (d) Select a media type number and the following message appears:

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

- (e) Insert a source disk and press any key. The following message appears:

```
— Max. address —  
  [Track ] = 0079  
  [ Head ] = 01  
  [Sector] = 09
```

```
Track number ??
```

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

## 3.22 System Configuration

### 3.22.1 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 Micom Version
5. Base 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
13. PC card slot

### 3.22.2 Operations

Selecting **8** from the Diagnostics Menu and pressing **Enter** displays 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  
* - 639KB MEMORY  
* - 1 FLOPPY DISK DRIVE(S)  
* - 1 ASYNC ADAPTER  
* - 1 HARD DISK DRIVE(S)  
* - 1 PRINTER ADAPTER  
* - XX MB + XXXXB EXTENDED MEMORY  
* - 1 MATH CO-PROCESSOR  
* - CPU CLOCK        = 100MHz  
* - 2 PCMCIA slot
```

Press [Enter] Key

**NOTE:** When the enhanced port replicator is attached, "4 PCMCIA slot" displays.

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



## 3.23 SETUP

### 3.23.1 Function Description

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

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

### 3.23.2 Accessing the SETUP Program

Selecting **0** from the Diagnostics Menu and pressing **Enter** displays the following:

```

                                SYSTEM SETUP                                BIOS version = x.xx
----- MEMORY -----
Total           = 8192 KB
Base           = 640 KB
Extended       = 7360 KB
Shadow BIOS ROM = 192 KB

----- DISPLAY -----
Display Adapter = VGA compatible
LCD Display Mode = Color
VGA Segment Address = E000H
LCD Display Colors = 222K Colors
Power On Display = Internal/External
Text Mode Stretch = Enabled

----- HARD DISK -----
HDD Mode = Enhanced IDE (Normal)

----- POWER ON PASSWORD -----
Not Registered

----- I/O PORTS -----
Serial Port      = COM1 (IRQ4/3F8H)
Parallel Port    = LPT1 (378H)

----- OTHERS -----
Power-up Mode    = Resume
CPU Cache        = Enabled
Battery Save Mode = Full Power
Battery Level     = E      F
Alarm Volume      = High
System Beep      = Enabled
Panel Power On/Off = Disabled
Alarm Power On   = Disabled
Keyboard         = Layout/Fn
Pointing Devices = Auto-selected
Boot Priority     = FDD → HDD
```

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

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

**NOTES:** 1. The Panel Power On/Off item appears only when the computer is in Resume mode.  
2. The 110CS LCD Display Colors options are 222K and 4096 colors.

### 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.

### 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 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.

## 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*  
*Write Policy*

## SETUP Options

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

1. Memory

Lists the computer's memory allocations. You cannot change these values.

- (a) Total

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

- (b) Base

Displays the amount of base (conventional) memory, **640 KB**, and is automatically calculated by the computer.

- (c) Extended

Displays the amount of extended memory the computer has available.

- (d) Shadow BIOS ROM

Displays 192 KB of RAM, which is reserved for the Shadow BIOS ROM.

## 2. Display

This group of options helps you configure the computer's display.

- (a) Display Adapter

Displays the internal controller for the VGA internal display. Only **VGA compatible** displays. You cannot change it.

- (b) LCD Display Mode

The LCD displays text in 80 characters x 25 lines and graphics in 800 x 600 pixels for either **Color** or **Monochrome** mode. Use this option to set the computer's display mode to **Color** or **Monochrome**.

*Color* Selects color mode. (Default)

*Monochrome* Selects monochrome mode. Some software displays better in monochrome mode.

- (c) VGA Segment Address

Use this option to set the VGA segment address from the following option:

C000H, E000H (Default), E400H

**NOTE:** In the DOS environment, if you choose either E400H or C000H, the pop-up window does not display when you press **Fn+F2** or **Fn+F3** hotkeys. However, the corresponding key functions work.

- (d) LCD Display Colors

This option is used to select the color palette of the internal display when the LCD mode is set to **Color**.

TFT Display (110CT)

*256K colors* Displays 256 out of 262,144 colors. (This value cannot be changed.)

## DSTN Display (110CS)

*222K colors* Displays 256 out of 226,981 colors.

*4096 colors* Displays 256 out of 4096 colors.

**NOTE:** If DSTN screen flickers with an **LCD Display Colors** setting of **222K Colors**, select **4096 Colors**.

### (e) Power On Display

This option is used to select the display when booting up.

*Internal/External* Selects an external CRT if one is connected, otherwise it selects the internal LCD. (Default)

*Simultaneous* 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 in the following order: internal LCD to simultaneous to external CRT.

### (f) Text Mode Stretch

Text mode stretch enables a larger display area of 800 x 600 pixels in text mode. Disabling this function reduces the display area to the standard 800 x 600 pixels.

*Enabled* Enables the text mode stretch feature. (Default)

*Disabled* Disables the text mode stretch feature.

## 3. Hard Disk

Displays the mode of the HDD for information only. It cannot be changed.

*Enhanced IDE (Normal)* Select this mode when using MS-DOS, Windows, or OS/2. (Default)

*Standard IDE* Select this mode when using Novell NetWare or UNIX. When this mode is selected, up to 504 MB is logically available even though the hard disk drive's capacity is larger than 504 MB.

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

**NOTE:** *Formats for Enhanced IDE and Standard IDE are different. Therefore, if you change the setting, you will need to reformat the hard disk drive for the appropriate setting.*

#### 4. Password

Allows you to set or reset the user password for power on and instant security.

*Registered*    The user password has been registered.

*Not registered*    The user password has not been registered.

For details on setting the user password, refer to your computer's User's Manual.

#### 5. I/O ports

Controls settings for serial and parallel ports and the sound system.

##### (a) Serial Port

This option allows you to set the COM level (**COM1** or **COM2**) for the serial port and PC card slot. The serial port interrupt request level (IRQ) and I/O port base address for each COM level is shown below:

COM level	Interrupt level	I/O address
COM1	4	3F8h (Serial port default)
COM2	3	2F8h
COM3	4	3E8h
COM4	3	2E8h
Not used		(Disables port)

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

##### (b) Parallel Port

Sets the address for the parallel port. The options are:

*LPT1 (378H)*    Sets the address to 378H. (Default)  
*LPT2 (278H)*    Sets the address to 278H.  
*LPT3 (3BCH)*    Sets the address to 3BCH.  
*Not used*        Disables the port.

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

Option
Mode = ECP

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

## 6. Others

Whether 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. AutoResume is effective with either the internal LCD or with an external monitor.

*Boot* Turns on Boot mode. (Default)

*Resume* Turns on the AutoResume 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 enable 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**.

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 the processor handles data.

(c) Battery Save Mode

This option is used to select **Full Power**, **Low Power**, or **User Setting** of the **BATTERY SAVE OPTION**.

*Full Power* The following shows full power settings.

BATTERY SAVE OPTIONS	
Processing Speed	= High
CPU Sleep Mode	= Disabled
Display Auto Off	= 30 Min. (110CT) Disabled (110CS)
HDD Auto Off	= 30 Min.
System Auto Off	= Disabled
LCD Brightness	= Bright

*Low Power* The following shows low power settings.

BATTERY SAVE OPTIONS	
Processing Speed	= Low
CPU Sleep Mode	= Enabled
Display Auto Off	= 03 Min.
HDD Auto Off	= 03 Min.
System Auto Off	= 30 Min.
LCD Brightness	= Semi-bright

**NOTE:** *In Boot mode, the System Auto Off message does not appear.*

*User Setting* Allows you to set the battery save parameters on the subwindow, **BATTERY SAVE OPTIONS**. When you select this option, the automatic setting feature (Full Power or Low Power) is disabled and the user-preferred parameters become effective. The default setting in the subwindows depends on the **Battery Save Mode: Low Power (Long Life) or Full Power (Normal Life)**. For LCD Brightness details, see Item (d) *Battery Save Options* below.



(d) Battery Save Options

The following set of options can be selected in the submenu of **User Setting**, which is one of the **Battery Save Mode** options.

Processing Speed

Changes the CPU processing speed.

*High* CPU operates at 100 MHz. (Default)

*Low* CPU operates at low speed.

CPU Sleep Mode

Enables or disables the CPU sleep function.

*Enabled* Enables sleep mode.

*Disabled* Disables sleep mode.

Display Auto Off

Disables or sets the duration of the display automatic power off function. This function causes the computer to turn the LCD panel's illumination off if you make no entry for the set period of time.

*Disabled* Disables display automatic power off.

*xx Min.* Automatically turns off power to the LCD panel's illumination if the panel is not used for the duration set. The duration **xx** can be set to 1, 3, 5, 10, 15, 20, or 30 minutes.

HDD Auto Off

Disables or sets the duration of the HDD automatic power off function.

*xx Min.* Automatically turns off power to the hard disk drive if it is not used for the duration set. The duration **xx** can be set to 1, 3, 5, 10, 15, 20, or 30 minutes.

## System Auto Off

Use this option to enable or disable the system automatic off function in Resume mode when you are working in DOS. In Boot mode, it is disabled and does not display.

*Disabled* Disables system automatic power off.

*xx Min.* 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.

## LCD Brightness





Sets the level of LCD brightness.

*Bright* Full brightness for maximum visibility.

*Semi-Bright* Less than full brightness for saving power.

### (e) Battery Level

When you use the computer for the first time or when you install a new or recharged battery, the charge level is unknown to the system. In this case, the Battery Level options display to enable you to set the charge level to 100%, 75%, 50%, or 25%.

E		F	100% charge
E		F	75% charge
E		F	50% charge
E		F	25% charge
E	???	F	Charge is unknown (Displays in SETUP)

### (f) Alarm Volume

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.

*Off* Disables the alarm.

*Low* Sets the alarm volume to low.

*Medium* Sets the alarm volume to medium.

*High* Sets the alarm volume to high. (Default)

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

ALARM VOLUME OPTIONS		
LOW BATTERY Alarm	=	Enable
Panel Close Alarm	=	Enable

*Enabled* Enables the feature. (Default)

*Disabled* Disables the feature.

(g) System Beep

Enables or disables the system beep.

*Enabled* Enables the feature. (Default)

*Disabled* Disables the feature.

(h) Panel Power On/Off

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.

*Disabled* Disables the feature. (Default)

**NOTE:** When this feature is enabled, do not remove the AC cable and battery pack at the same time. If you do so, data saved by AutoResume will be lost. You must also reset this option.

(i) Alarm Power On

Sets the time for the system to turn on automatically. For example, if you are expecting to receive a modem transmission at a time when you are away or asleep, you can set this option to the time of the transmission. This option does not automatically turn off the system. This feature operates in either Resume or Boot mode.

00:00:00 Sets the power on time (24-hour clock).

*Disabled* Disables the alarm.

**NOTE:** When using this feature, do not remove the AC cable and battery pack at the same time. If you do so, the setting will be lost. You must reset this option when you restore power.

(j) Keyboard

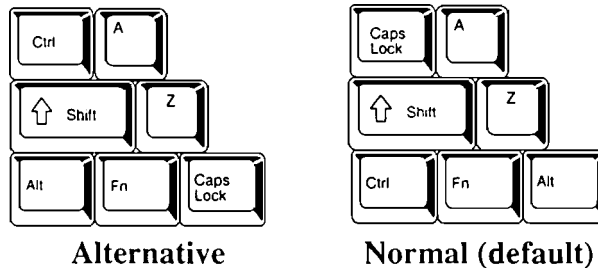
This option lets you change the keyboard layout and set the **Fn** key equivalent when you are using an external keyboard. Selecting this option displays the following subwindow.

**Keyboard**

Int. Keyboard key layout	=	Normal
Ext. Keyboard "Fn" key equivalent	=	Disabled

Int. Keyboard Layout

This option lets you select the arrangement of the **Caps Lock**, **Ctrl**, and **Alt** keys according to the following illustrations:



Ext. Keyboard **Fn** Key Equivalent

Sets a key combination on an external keyboard to emulate the **Fn** key on the computer's internal keyboard. Setting an **Fn** key equivalent enables you to use "Hotkeys" by pressing the set combination in place of the **Fn** key.

*Disabled* No **Fn** key equivalent. (Default)

*Fn Equivalent* Left Ctrl + Left Alt\*  
Right Ctrl + Right Alt\*  
Left Alt + Left Shift  
Right Alt + Right Shift  
Left Alt + Caps Lock

\* If these selections are made, you cannot warm boot the system by pressing **Ctrl + Alt + Del**.

(k) Pointing Devices

Enables or disables the AccuPoint.

*Auto selected* The AccuPoint is disabled when a PS/2 mouse or serial mouse is connected; otherwise the AccuPoint is enabled. (Default)

*Simultaneous* If a PS/2 mouse or serial mouse is connected to an optional port replicator, both the AccuPoint and the external mouse are enabled.

(l) Boot Priority

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

*FDD→HDD* The computer looks for bootable files first on the FDD and next on the HDD. (Default)

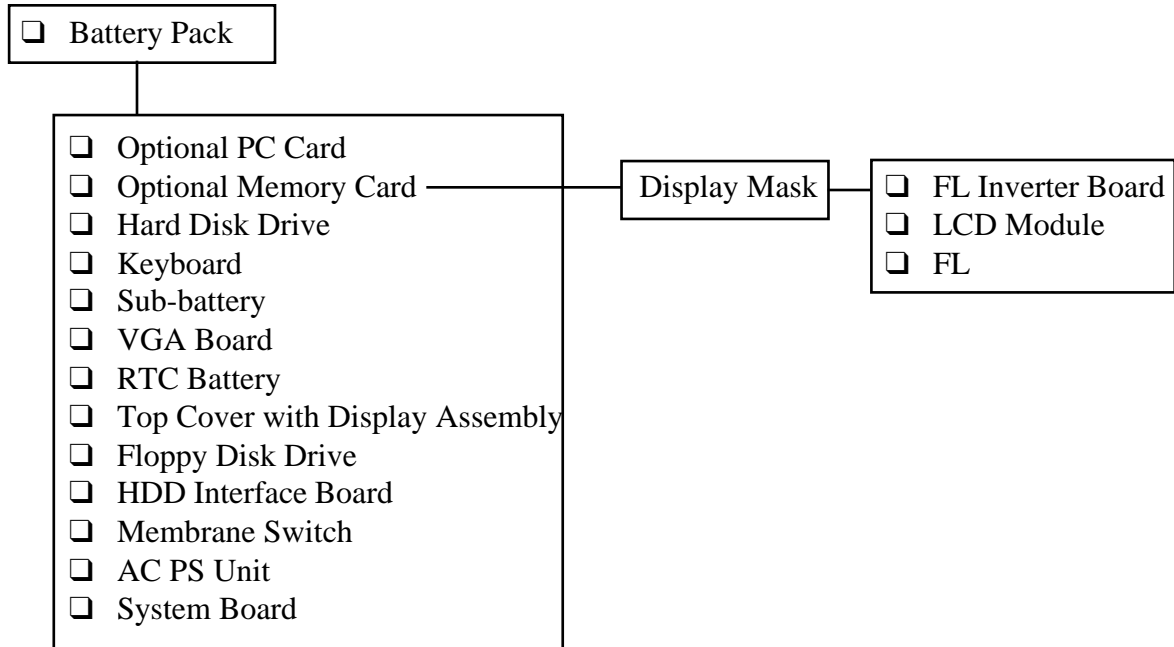
*HDD→FDD* The computer looks for bootable files first on the HDD and next on the FDD.

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



## 4.1 General

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

### **DANGER:**

1. *Always use the nickel metal hydride (NiMH) 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 very careful not to touch connectors or components. Also, do not disassemble individual components in 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. Never use foreign parts.*
2. *Make sure that metal objects such as screws or paper clips do not fall into the unit. They 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 figures. 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 disconnected.*
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, *Battery Pack*.

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 disassembling 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 you place them in a safe place and identify them with the correct parts.
8. 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 figures.
9. The computer contains many sharp edges and corners, so be careful not to injure yourself.
10. After you have replaced an FRU, make sure the computer is functioning properly by performing the appropriate test on the FRU you have fixed or replaced.

## Disassembly Procedures

The computer has two basic types of cable connectors:

- Pressure Plate Connectors
- Normal Pin Connectors

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 you pull out the connector, connect it again making sure the connector's pressure plate is fully lifted when you insert the cable.

Standard pin connectors are used with all other cables. These connectors can be connected and disconnected by simply pulling them apart or pushing them together.

## Assembly 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.
- Make sure all cables and connectors are securely fastened.
- Before securing the FRU or other parts, make sure that no cables will be pinched by screws or the FRU.
- Check that all latches are closed securely in place.
- Make sure all 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.
- One M3 Phillips screwdriver to remove and replace screws for the HDD.
- 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.
- Anti-static carpeting or flooring.
- Air ionizers in highly static sensitive areas.

## Screw Tightening Torque

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

- M2            0.22 Nm (2.2 kgfcm)
- M2.5        0.36 Nm (3.5 kgfcm)
- FDD         0.22 Nm (2.2 kgfcm)
- HDD         0.3 Nm (3.1 kgfcm) or less

## 4.2 Battery Pack

### Removing the Battery Pack

To remove the battery pack, follow the steps below and refer to Figures 4-1 and 4-2.

1. Turn the computer off. Disconnect the AC power cord and all external cables connected to the computer.
2. Turn the computer over.
3. Push the **battery cover lock** to release the **battery cover**.
4. Push the cover forward until it stops (about one centimeter or half an inch).

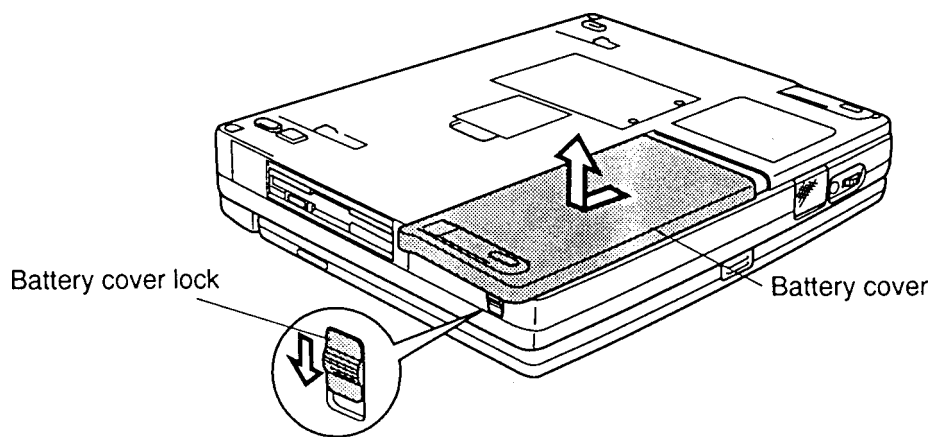


Figure 4-1 Removing the battery pack cover

5. Lift off the cover.
6. Pull back the battery latch and lift out the **battery pack**.

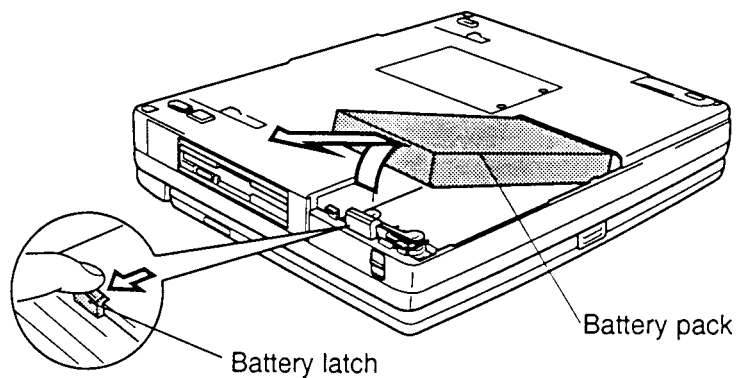


Figure 4-2 Removing the battery pack

**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 Figures 4-1 to 4-3.

**WARNING:** *The battery is a nickel metal hydride battery and should be replaced only by your dealer or by a Toshiba service representative. The battery can explode if not properly replaced, used, handled, or disposed of. Dispose of the battery as required by local ordinances or regulations. Use only batteries recommended by Toshiba as replacements.*

1. Turn the computer off. Disconnect the AC power cord and all external cables connected to the computer.
2. Carefully insert the new or recharged **battery pack**.
3. Replace the **battery cover** and slide it closed. Be sure the **battery cover latches** fit into the corresponding holes on the computer.

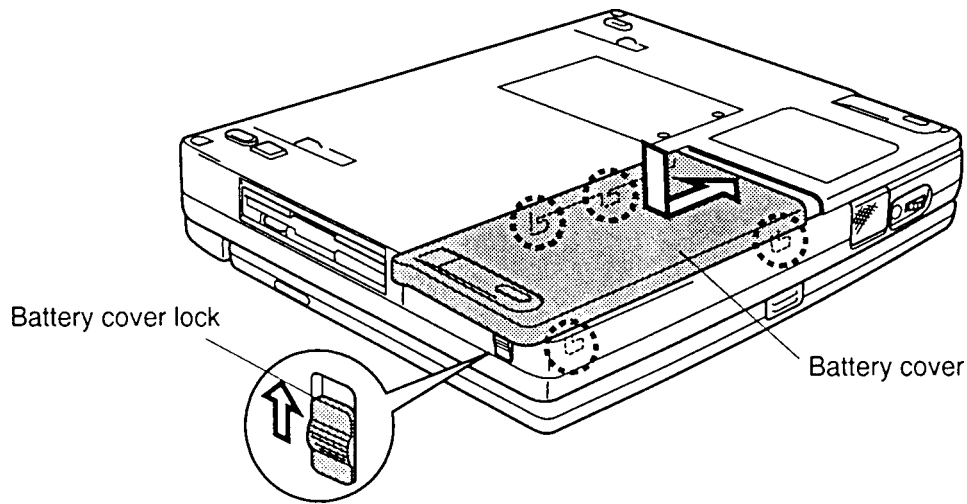


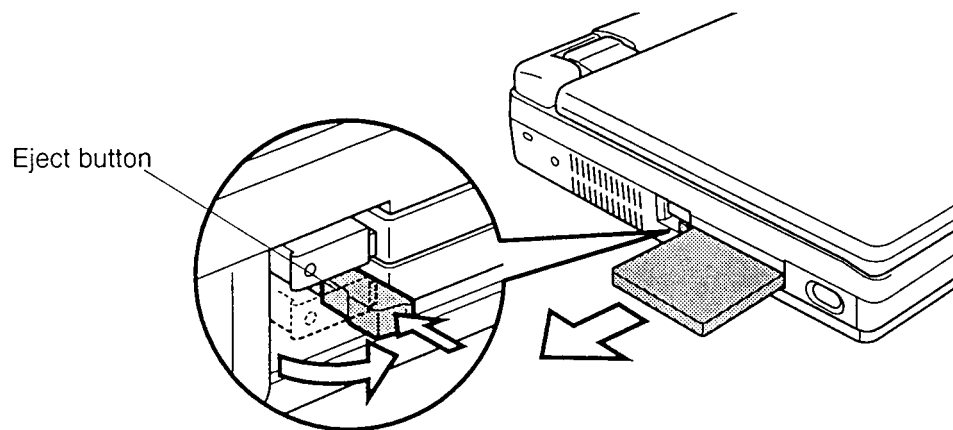
Figure 4-3 Installing the battery pack

## 4.3 Optional PC Card

### Removing an Optional PC Card

To remove an optional PC card, make sure the computer is in Boot mode. Then follow the steps below and refer to Figure 4-4.

1. Turn the computer off. Disconnect the AC power cord and all external cables connected to the computer.
2. Remove the battery pack as described in Section 4.2.
3. Pull out the **eject button**; then press it (the top button for the top card and the bottom button for the bottom card). The card will pop out slightly for removal.



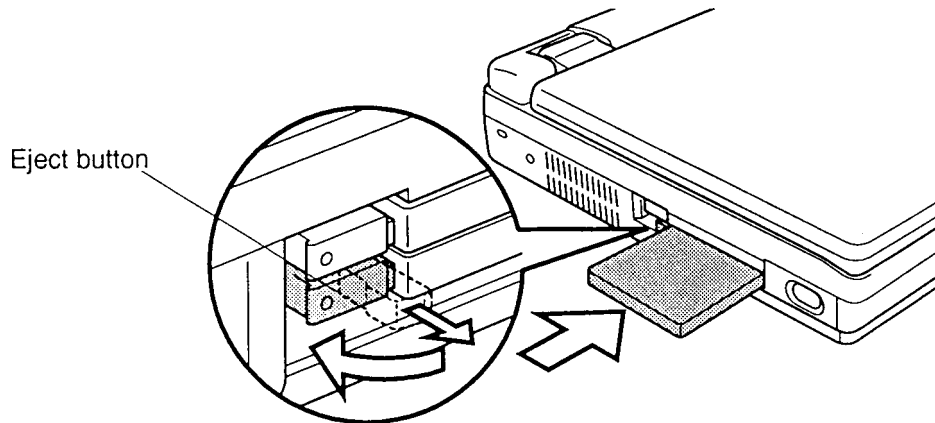
*Figure 4-4 Removing the PC card*

## Installing an Optional PC Card

To install an optional PC card, follow the steps below and refer to Figure 4-5.

**NOTE:** Before you install the PC card, make sure the computer is in Boot mode.

1. Turn the computer off. Disconnect the AC power cord and all external cables connected to the computer.
2. Insert the PC card as shown in Figure 4-5.



*Figure 4-5 Inserting the PC card*

3. When the card is almost fully seated, you will feel some resistance. Press gently to assure a firm connection, but do not force the card into position.
4. When the card is fully seated, an eject button will pop out: the top button for the top connector and the bottom button for the bottom connector.
5. Pull the eject button out slightly and turn it to lock the card.
6. Install the battery pack as described in Section 4.2.

## 4.4 Optional Memory Module

### Removing an Optional Memory Module

To remove an optional memory module, make sure the computer is in Boot mode then follow the steps below and refer to Figures 4-6 and 4-7.

1. Turn the computer off. Disconnect the AC power cord and all external cables connected to the computer.
2. Remove the battery pack and optional PC card as described in Sections 4.2 and 4.3.
3. Turn the computer upside down.
4. Remove **two M2x4 silver screws** securing the **memory module socket cover**.
5. Slide your fingernail or a thin object under the screw end of the cover and remove it.

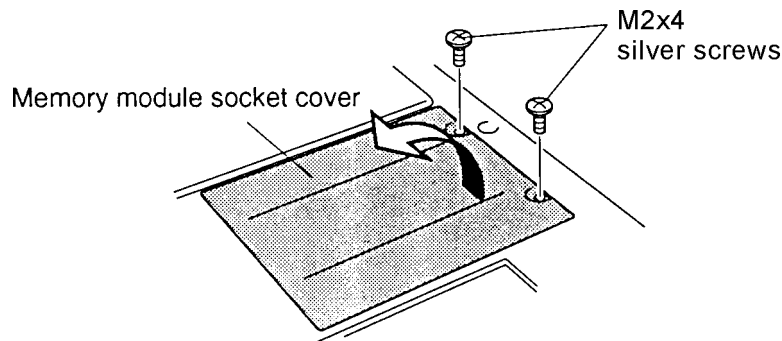


Figure 4-6 Removing the memory module socket cover

6. Remove **two M2x4 silver screws** securing the module to a brace at the center of the module.

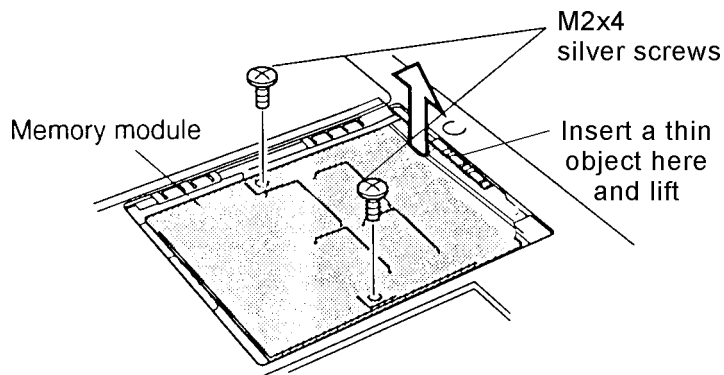


Figure 4-7 Removing the memory module

7. Use a thin object to lift up the edge to disengage the connectors, then grasp the module by the edges and remove it.



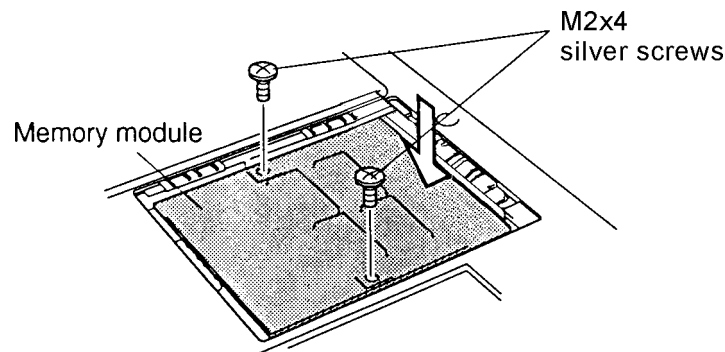
## Installing an Optional Memory Module

To install an optional memory module, make sure the computer is in Boot mode. Then follow the steps below and refer to Figures 4-6 to 4-8.

1. Position the connector on the bottom of the **module** over the corresponding connector on the computer (align the holes on the side of the module over the screw holes on the brace).

**NOTE:** Do not touch the connectors on the memory module or on the computer. Debris on the connectors may cause memory access problems.

2. Place your fingers above the connector and press firmly but gently to assure a solid connection. The module should be seated level.
3. Secure the module to the brace with **two M2x4 silver screws**.



*Figure 4-8 Inserting the memory module*

4. Lay the cover in place and secure it with **two M2x4 silver screws** (Figure 4-6).
5. Install the battery pack and optional PC card as described in Sections 4.2 and 4.3.

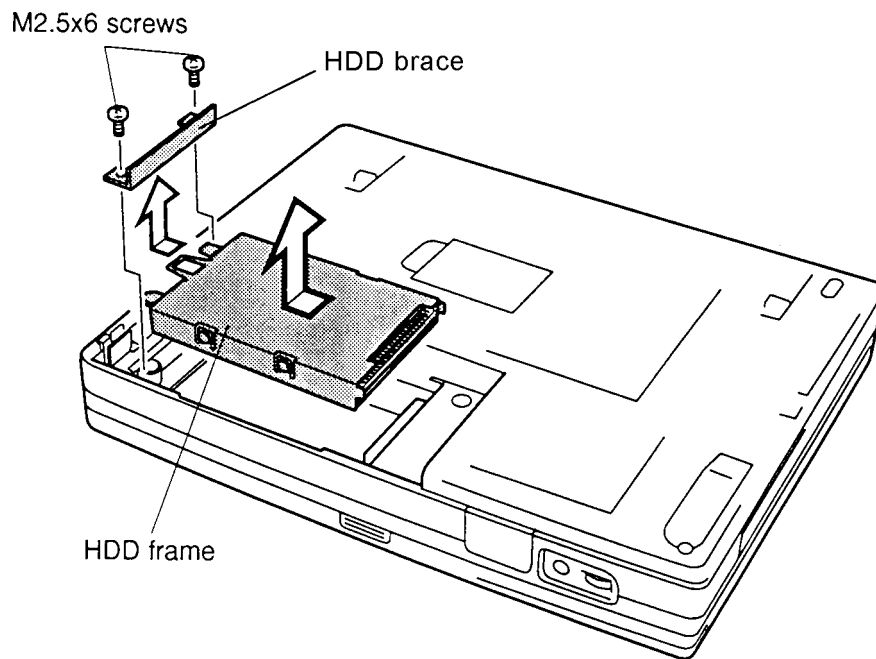
## 4.5 Hard Disk Drive (HDD)

### Removing the HDD

To remove the HDD, follow the steps below and refer to Figures 4-9 and 4-10.

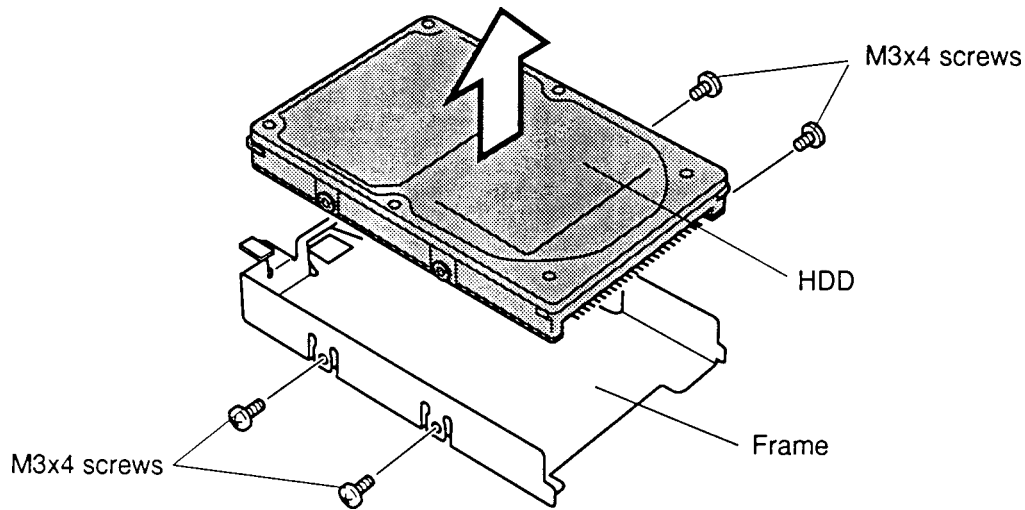
1. Turn the computer off. Disconnect the AC power cord and all external cables connected to the computer.
2. Remove the battery pack, optional PC card and optional memory module as described in Sections 4.2, 4.3, and 4.4.
3. Remove **two M2.5x6 screws** securing the **HDD frame** and **brace** to the computer.
4. Pull the frame forward by its handle to disconnect the **HDD**.
5. Remove the frame and brace with the HDD.

**NOTE:** *Keep the brace with the frame.*



*Figure 4-9 Removing the frame and brace with the HDD*

6. Remove **four M3x4 flat-head screws** securing the frame to the HDD and separate the HDD from the frame.



*Figure 4-10 Removing the HDD from the frame*

## **Installing the HDD**

To install the HDD, follow the steps below and refer to Figures 4-9 and 4-10.

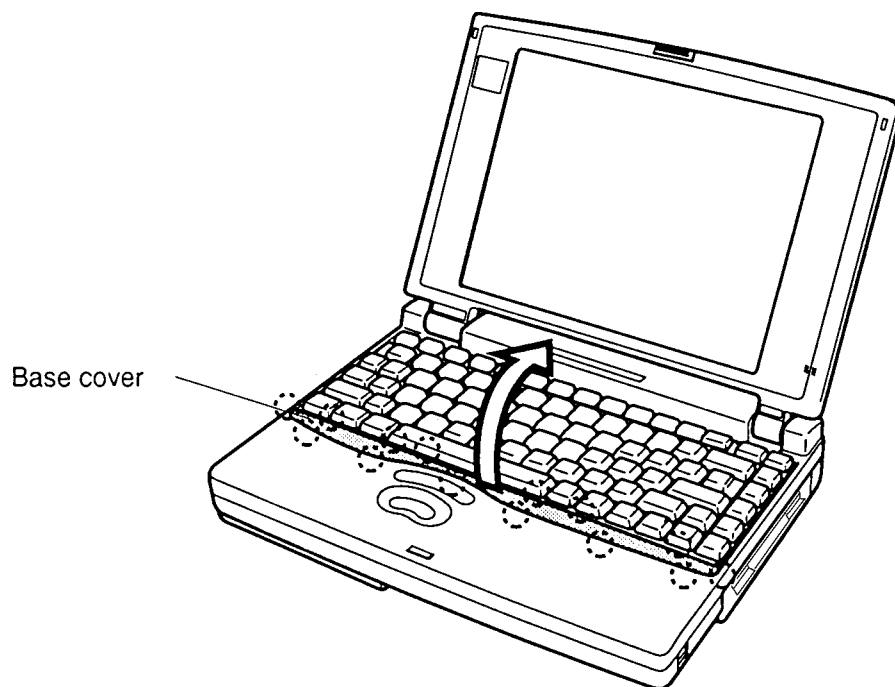
1. Secure the **HDD frame** to the **HDD** with **four M3x4 flat-head screws**.
2. Attach the **HDD brace** to the **HDD frame**.
3. Seat the HDD in the computer and press to secure the connection. Carefully insert the pins to start the connection. Then lower the HDD and press to push all the way in.
4. Secure the HDD frame to the computer with **two M2.5x6 screws**.
5. Install the optional memory module, optional PC card, and battery pack as described in Sections 4.4, 4.3, and 4.2.

## 4.6 Keyboard

### Removing the Keyboard

To remove the keyboard, follow the steps below and refer to Figures 4-11 to 4-13.

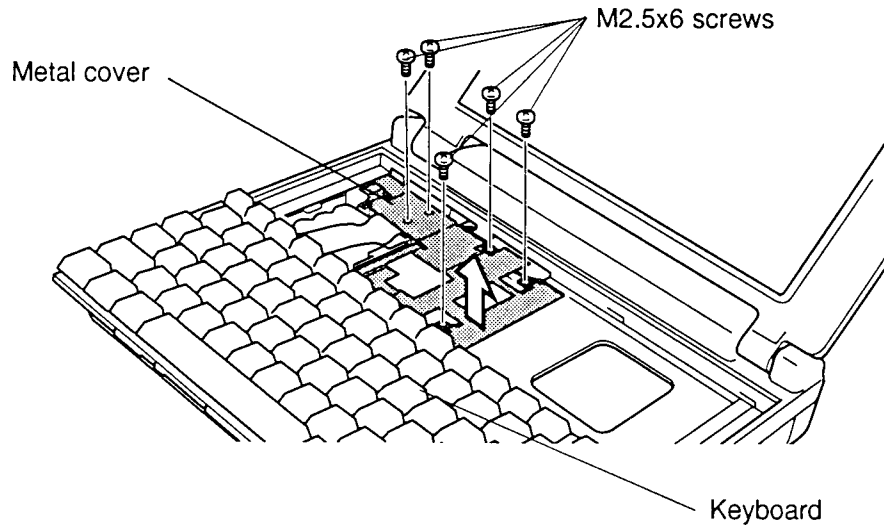
1. Turn the computer off. Disconnect the AC power cord and all external cables connected to the computer.
2. Remove the battery pack, optional PC card, optional memory module, and HDD as described in Sections 4.2 through 4.5.
3. Release **14 latches** on the **base cover** and remove it. Begin along the front side.



*Figure 4-11 Removing the keyboard base*

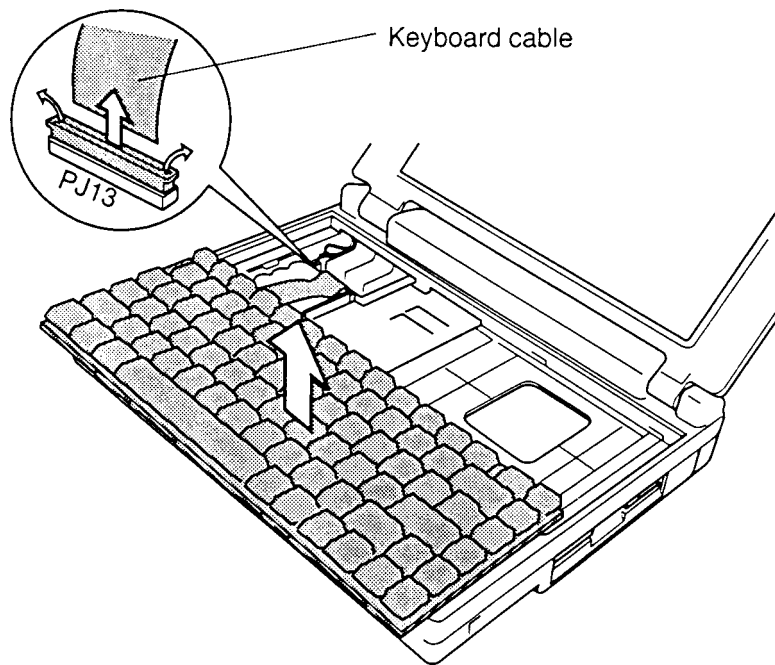
4. Lift out the **keyboard** and set it on the wrist rest.

5. Remove **five M2.5x6 screws** securing the **metal cover** and lift out the cover.



*Figure 4-12 Removing the metal cover*

6. Disconnect the **keyboard cable** from **PJ13** on the system board and lift out the keyboard.



*Figure 4-13 Removing the keyboard*

## Installing the Keyboard

To install the keyboard, follow the steps below and refer to Figures 4-11 to 4-14.

1. Connect the **keyboard cable** to **PJ13** on the system board. Make sure the cable connection is secure in the pressure plate.
2. Fit the two tabs of the metal cover into the top cover and backup battery base (Figure 4-14). Then seat the **metal cover** and secure it with **five M2.5x6 screws**. Make sure the plastic tab on the LED connector is under the metal cover. Be sure to replace the ground cable.

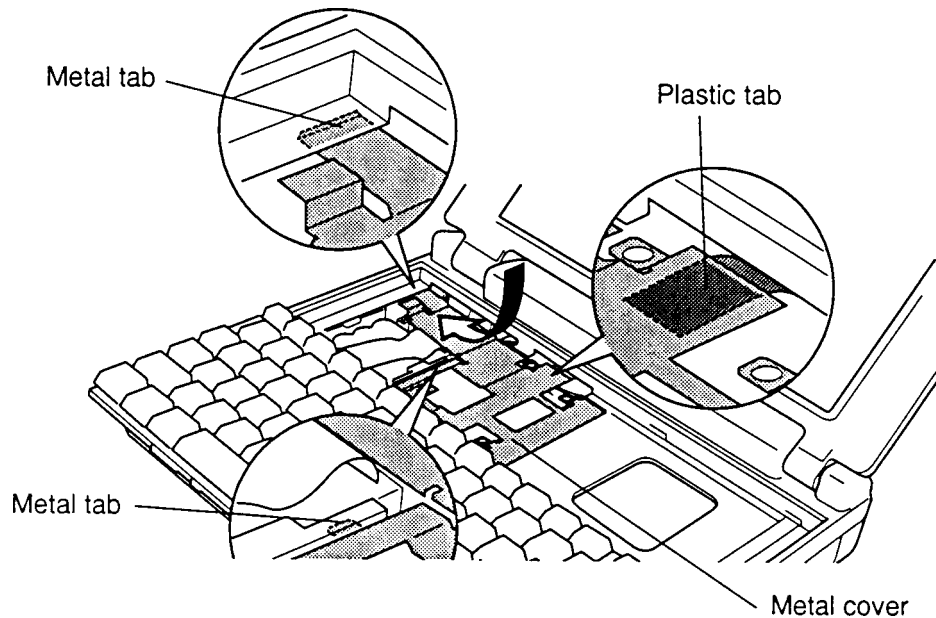


Figure 4-14 Seating the metal cover

3. Fit tabs on the back of the keyboard into corresponding holes on the computer and lay the keyboard in place.
4. Secure **six latches** on the back of the **keyboard base**. Then secure **two latches** at the ends and **six latches** along the front.
5. Install the HDD, optional memory module, optional PC card, and battery pack as described in Sections 4.5, 4.4, 4.3, and 4.2.

## 4.7 Sub-battery and VGA Board

### Removing the Sub-battery and VGA Board

To remove the sub-battery and VGA board, follow the steps below and refer to Figures 4-15 to 4-17.

1. Turn the computer off. Disconnect the AC power cord and all external cables connected to the computer.
2. Remove the battery pack, optional PC card, optional memory module, HDD, and keyboard as described in Sections 4.2 through 4.6.
3. Disconnect the **sub-battery** from **PJ503** and remove it.

**WARNING:** If you replace the sub-battery, be sure to use only batteries recommended by Toshiba. Installation of the wrong battery can cause the battery to explode or otherwise cause damage.

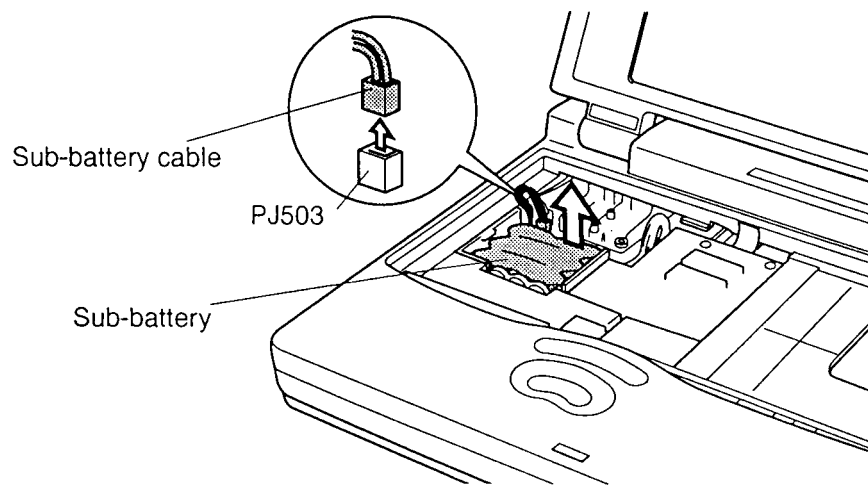
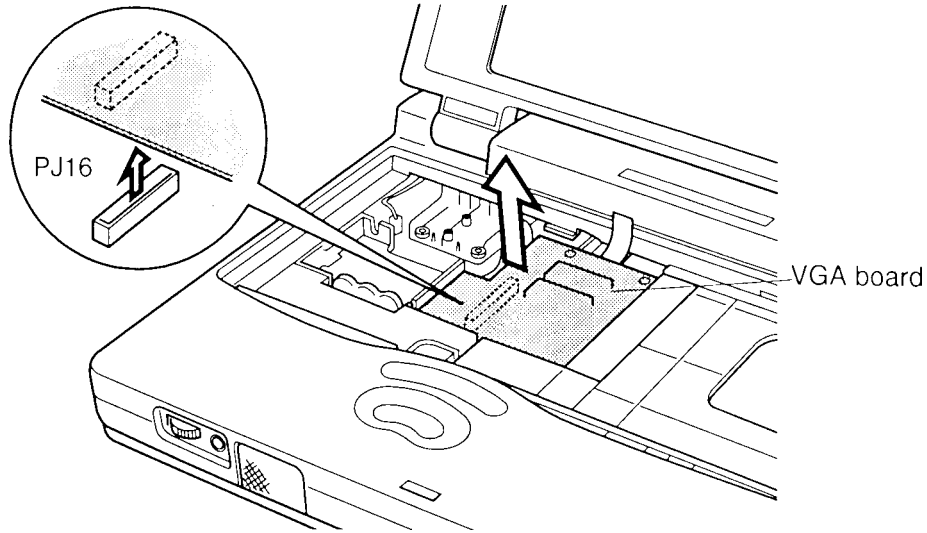


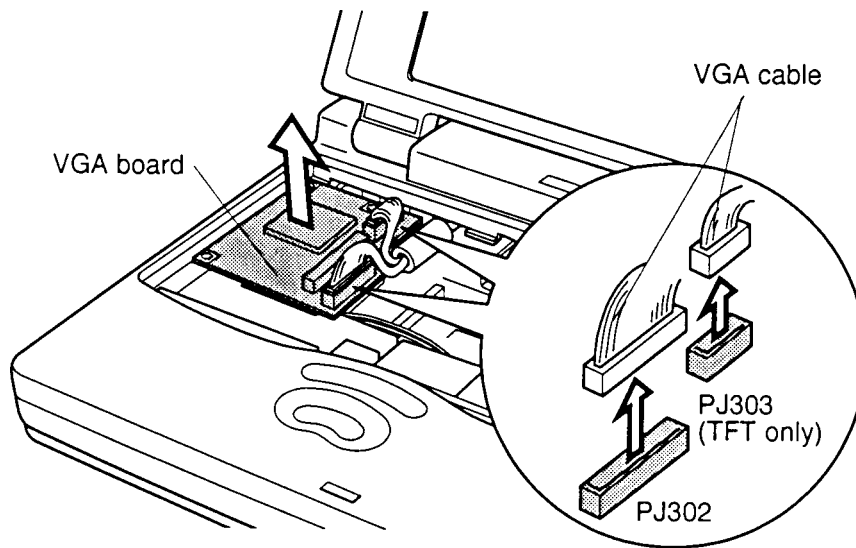
Figure 4-15 Removing the sub-battery

4. Disconnect the **VGA board** from system board connector **PJ16**.



*Figure 4-16 Disconnecting the VGA board*

5. Rotate the board out and disconnect the **VGA cable** from **PJ302** on the VGA board. For the **110CT** with TFT, also disconnect it from **PJ303** (the 110CS with DSTN does not use PJ303).



*Figure 4-17 Disconnecting the cables from the VGA board*



## Installing the Sub-battery and VGA Board

To install the sub-battery and VGA board, follow the steps below and refer to Figures 4-15 to 4-18.

1. Connect the **VGA cable** to **PJ302** on the **VGA board**. For the **110CT** with TFT, also connect it to **PJ303** (the 110CS with DSTN does not use PJ303). Make sure the **ferrite core** is seated properly.

**NOTE:** Make sure the **PJ301** on the VGA board and **PJ16** on the system board connector are not dirty; if they are dirty, clean them. If a connector is broken, replace the VGA board or system board with a new one.

2. Rotate the board into place and press evenly to connect the **VGA board connector** to **PJ16** on the system board.
3. Seat the **sub-battery** and connect the cable to **PJ503** on the system board.

**CAUTION:** Be sure to connect the sub-battery connector to the white socket, not the orange one. The orange socket, **PJ10**, is for the panel close sensor cable. If these connectors are switched, the system will be damaged.

4. Use a multimeter to measure the **TP2 (+)** and ground voltage according to the following value.

TP2 6.0 V to 8.0 V

If the voltage is too low, replace the sub-battery with a new one.

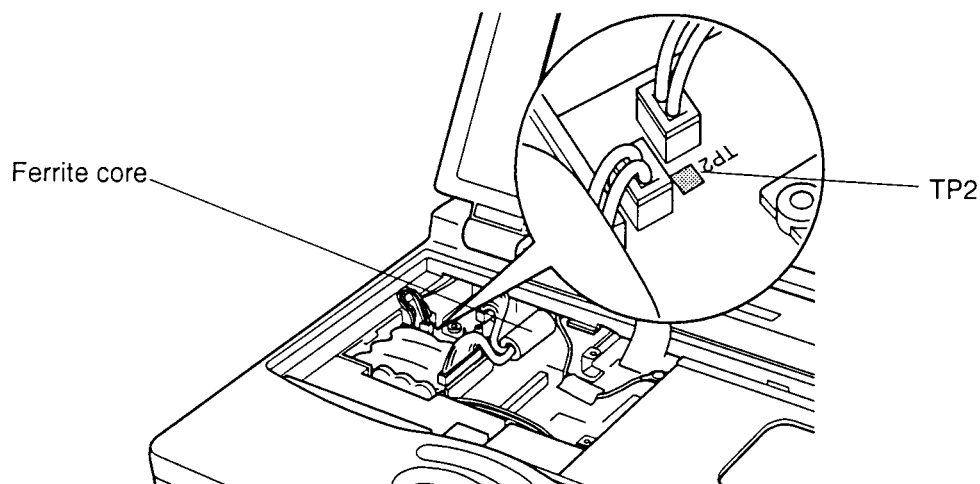


Figure 4-18 Measuring the voltage at TP2

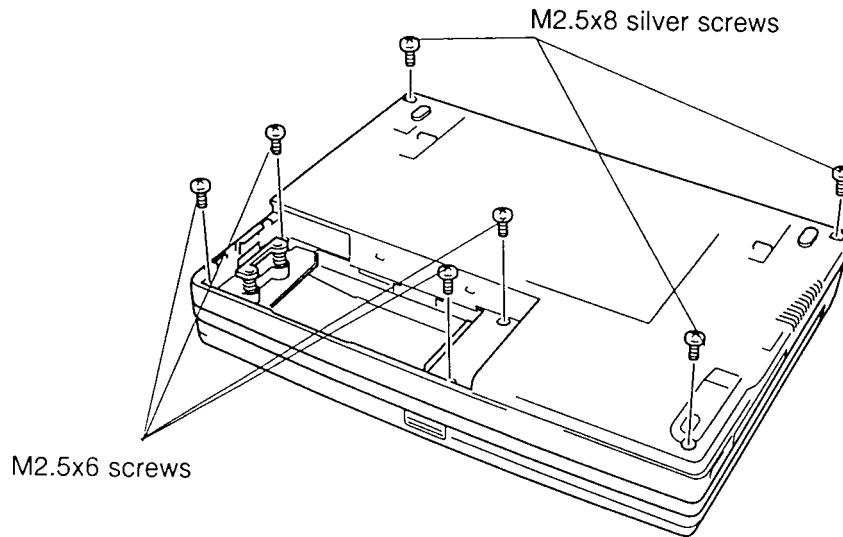
5. Install the keyboard, HDD, optional memory module, optional PC card, and battery pack as described in Sections 4.6 back through 4.2.

## 4.8 RTC Battery and Top Cover with Display Assembly

### Removing the RTC Battery and Top Cover with Display Assembly

To remove the RTC battery and top cover with display assembly, follow the steps below and refer to Figures 4-19 to 4-21.

1. Turn the computer off. Disconnect the AC power cord and all external cables connected to the computer.
2. Remove the battery pack, optional PC card, optional memory module, HDD, keyboard, sub-battery, and VGA board as described in Sections 4.2 through 4.7.
3. Turn the computer upside down and remove **three M2.5x8 silver screws** from three corners of the bottom cover.
4. Remove **four M2.5x6 screws** from the battery slot.

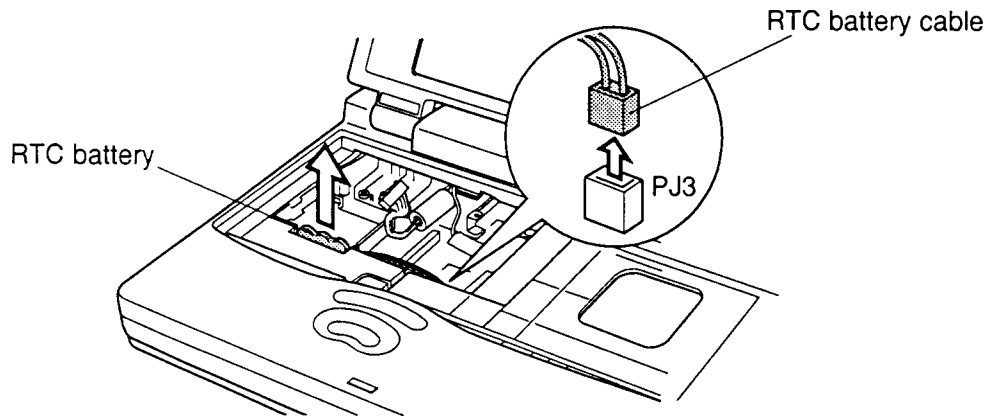


*Figure 4-19 Removing the top cover screws*

5. Turn the computer over and lift back the **top cover with display assembly** so you can disconnect cables.

6. Disconnect the **Real Time Clock battery cable** from **PJ3** on the system board and remove the battery.

**WARNING:** *If you replace the RTC battery, be sure to use only batteries recommended by Toshiba. Installation of the wrong battery can cause the battery to explode or otherwise cause damage.*



*Figure 4-20 Removing the RTC battery*

7. Disconnect the **panel sensor close cable** from **PJ10**.
8. Carefully lift the LED pressure connector. Then remove the **LED cable** from **PJ14** on the system board.
9. Remove **one M2.5x8 screw** from the sub-battery base. Remove **one M2.5x6 screw** securing the ground wire from the system board. Remove the **tape** securing the display **ground cable**.

10. Release **two latches** at the back of the computer and lift up the top cover with display assembly. Start above the ports on the left side and work to the right.

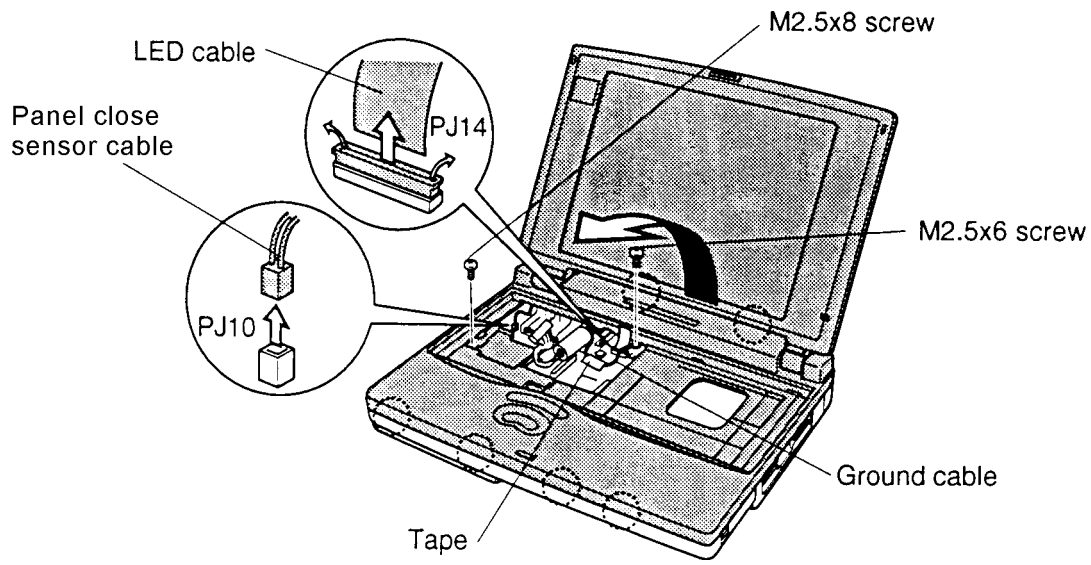


Figure 4-21 Removing the top cover with display assembly

### Installing the RTC Battery and Top Cover with Display Assembly

To install the RTC battery and top cover with display assembly, follow the steps below and refer to Figures 4-19 to 4-22.

1. Seat the **top cover** with display assembly from the front. Slowly rotate it to the back, then secure the latches to the top cover.
2. Connect the **LED panel cable** to **PJ14**. Make sure the cable connection is secured with the pressure plate.
3. Connect the **panel close sensor cable** to **PJ10** (orange) on the system board.

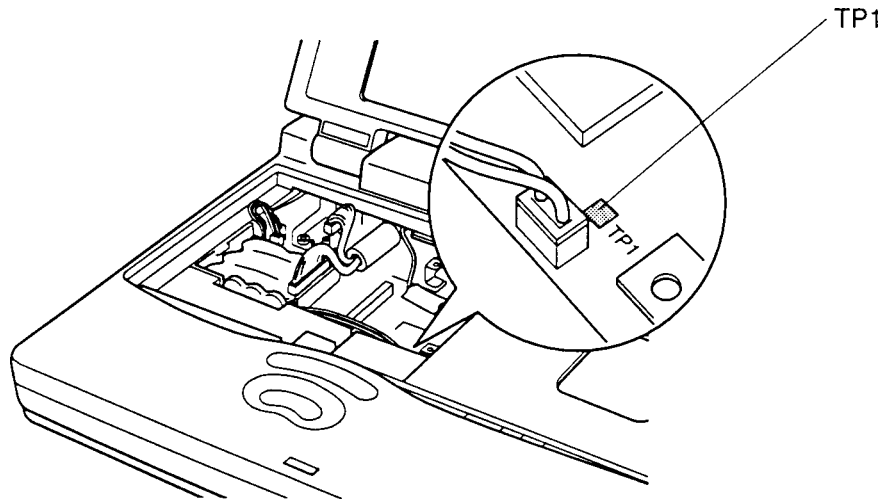
**CAUTION:** Be sure to connect the panel close sensor cable to the orange socket, not the white one. The white socket, PJ503, is for the sub-battery cable. If these connectors are switched, the system will be damaged.

4. Secure the sub-battery base with **one M2.5x8 screw**.
5. Secure **one M2.5x6 screw** with **ground cable** and replace the tape.

6. Connect the **Real Time Clock battery cable** to **PJ3** on the system board. Use a multimeter to measure the **TP1 (+)** and ground voltage according to the following value.

+2V to 4V

If the voltage is too low, replace the RTC battery with a new one.



*Figure 4-22 Measuring the voltage at TP1*

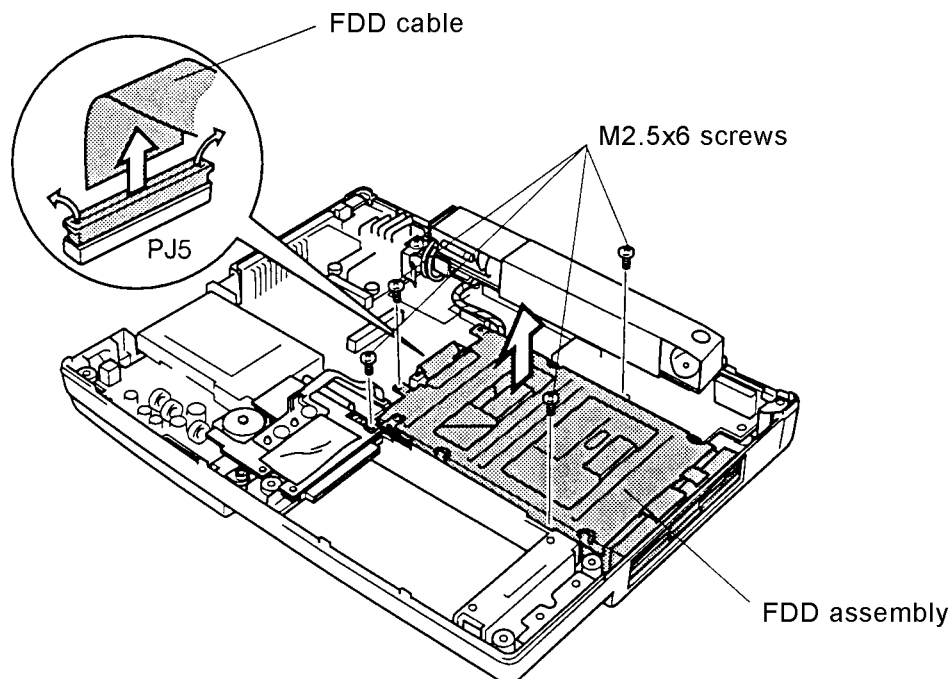
7. Turn the computer upside down and secure **three M2.5x8 silver screws** and **four M2.5x6 screws** (Figure 4-19).
8. Install the sub-battery, VGA board, keyboard, HDD, optional memory module, optional PC card, and battery pack as described in Sections 4.7 back through 4.2.

## 4.9 Floppy Disk Drive (FDD)

### Removing the FDD

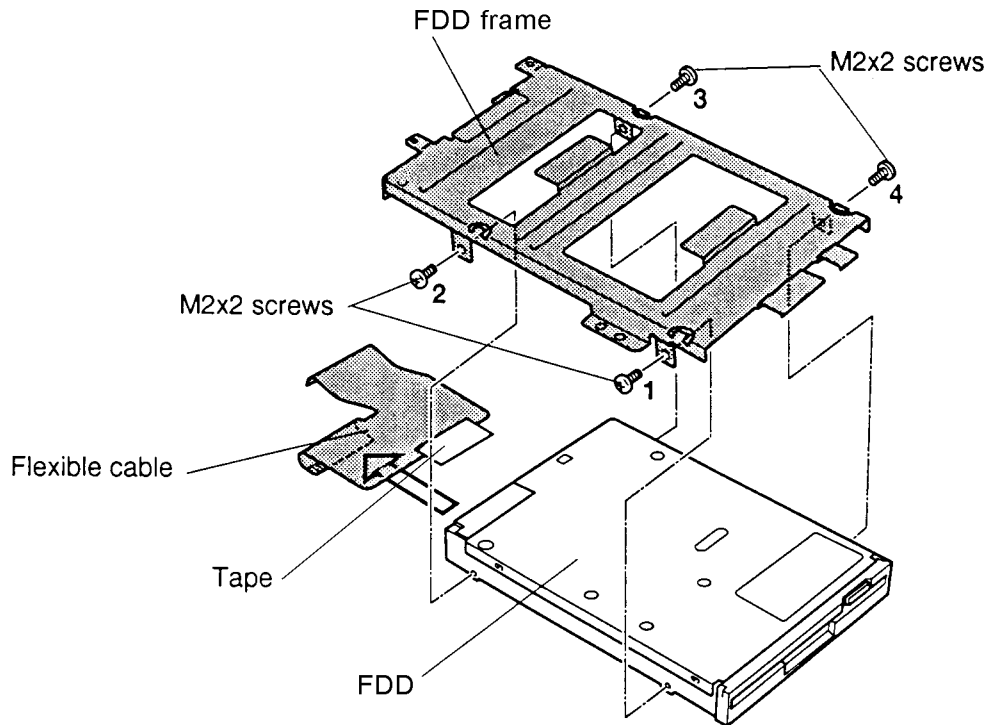
To remove the FDD, follow the steps below and refer to Figures 4-23 and 4-24.

1. Turn the computer off. Disconnect the AC power cord and all external cables connected to the computer.
2. Remove the battery pack, optional PC card, optional memory module, HDD, keyboard, sub-battery, VGA board, RTC battery, and top cover with display assembly as described in Sections 4.2 through 4.8.
3. Remove **four M2.5x6 screws** from the FDD assembly.
4. Disconnect the **FDD cable** from **PJ5** on the **system board** and lift out the drive.



*Figure 4-23 Removing the FDD assembly*

5. Remove **four M2x2 screws** securing the **frame** to the FDD and lift off the frame.
6. Remove the **tape** and disconnect the **flexible cable** from the drive.



*Figure 4-24 Removing the FDD frame*

## Installing the FDD

To install the FDD, follow the steps below and refer to Figures 4-23 and 4-24.

1. Connect the **flexible cable** to the FDD and secure it with **tape**.
2. Secure the **frame** to the **FDD** with **four M2x2 screws** in the numbered order: 1 to 4 (Figure 4-24). Tighten screws 1 to 4 to a torque of less than 2.2 kgfcm.
3. Insert the FDD under the ground plate. Then engage the **latches** on the frame with corresponding **notches** on the computer and seat the **FDD assembly**.
4. Connect the **FDD cable** to **PJ5** on the system board.
5. Secure the FDD assembly with **four M2.5x6 screws**.
7. Install the top cover with display assembly, RTC battery, sub-battery, VGA assembly, keyboard, HDD, optional memory module, optional PC card, and battery pack as described in Sections 4.8 back through 4.2.

## 4.10 HDD Interface Board and Membrane Switch

### Removing the HDD Interface Board and Membrane Switch

To remove the HDD interface board and membrane switch, follow the steps below and refer to Figures 4-25 and 4-26.

1. Turn the computer off. Disconnect the AC power cord and all external cables connected to the computer.
2. Remove the battery pack, optional PC card, optional memory module, HDD, keyboard, sub-battery and VGA board, top cover with display assembly, and FDD as described in Sections 4.2 through 4.9.
3. Disconnect the **membrane switch cable** from **PJ7** on the system board. Note how the cable is bent.
4. Disconnect the **HDD interface board flexible cable** from **PJ6** on the system board.
5. Remove **three M2.5x6 screws** securing the **HDD interface board**. Note that one screw also secures the **ground plate**.
6. Lift out the HDD interface board.

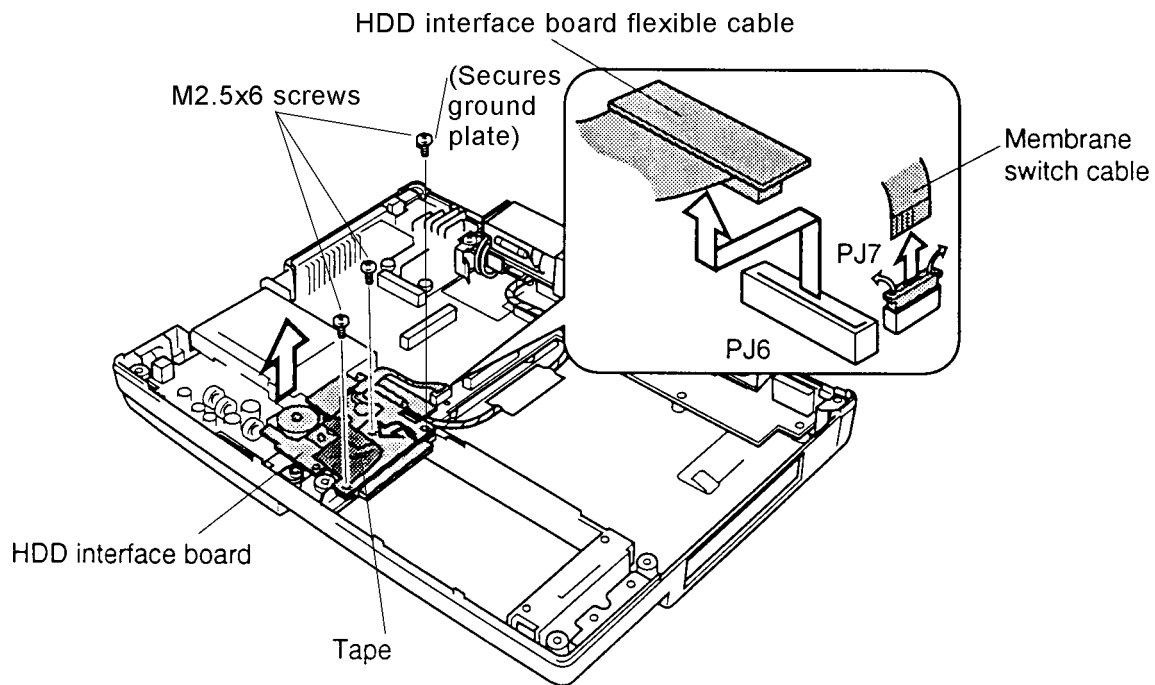
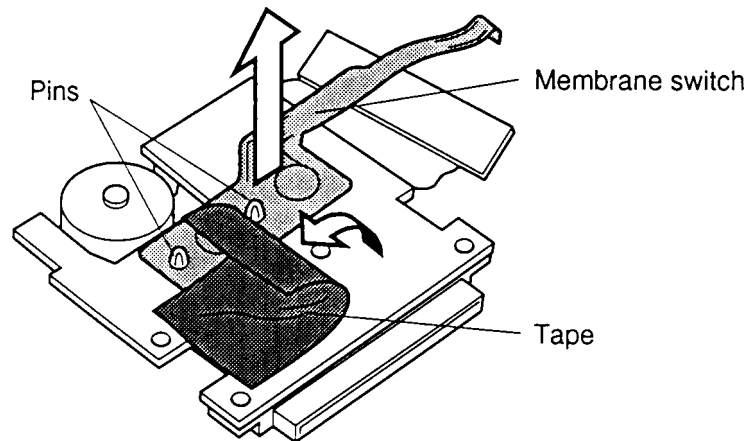


Figure 4-25 Removing the HDD interface board



8. Pull off the **tape** securing the **membrane switch**.
9. The membrane switch is held in place by plastic **pins**. Carefully lift the membrane switch clear of pins to remove it.



*Figure 4-26 Removing the membrane switch*

### **Installing the HDD Interface Board and Membrane Switch**

To install the HDD interface board and membrane switch, follow the steps below and refer to Figures 4-25 and 4-26.

1. Seat the **membrane switch** in the HDD interface board and secure it partially with **tape**.
2. Place and press evenly to connect the **HDD interface board flexible cable** to **PJ6** on the system board.
3. Seat the HDD interface board and secure it with **three M2.5x6 screws**. Make sure the **ground plate** is secured.
4. Connect the **membrane switch cable** to **PJ7** on the system board. Insert with the blue side of the cable facing up. Make sure the cable connection is secured with the pressure plate.
5. Install the FDD, top cover with display assembly, RTC battery, sub-battery, VGA board, keyboard, HDD, optional memory module, optional PC card, and battery pack as described in Sections 4.9 back through 4.2.

## 4.11 AC Power Supply Unit

### Removing the AC PS Unit

To remove the AC PS unit, follow the steps below and refer to Figures 4-27 and 4-28.

1. Turn the computer off. Disconnect the AC power cord and all external cables connected to the computer.
2. Remove the battery pack, optional PC card, optional memory module, HDD, keyboard, sub-battery, VGA board, RTC battery, top cover with display assembly, FDD, and HDD interface board as described in Sections 4.2 through 4.10.
3. Remove the **tape** securing the **AC PS unit cable** and disconnect the AC PS unit cable from **PJ502** on the system board.
4. Remove the **tape** securing the **AC PS unit** and remove **one M2.5x10 screw** securing the **AC PS unit**.
5. Turn the **AC PS unit** out of its seating and lay it on its side.

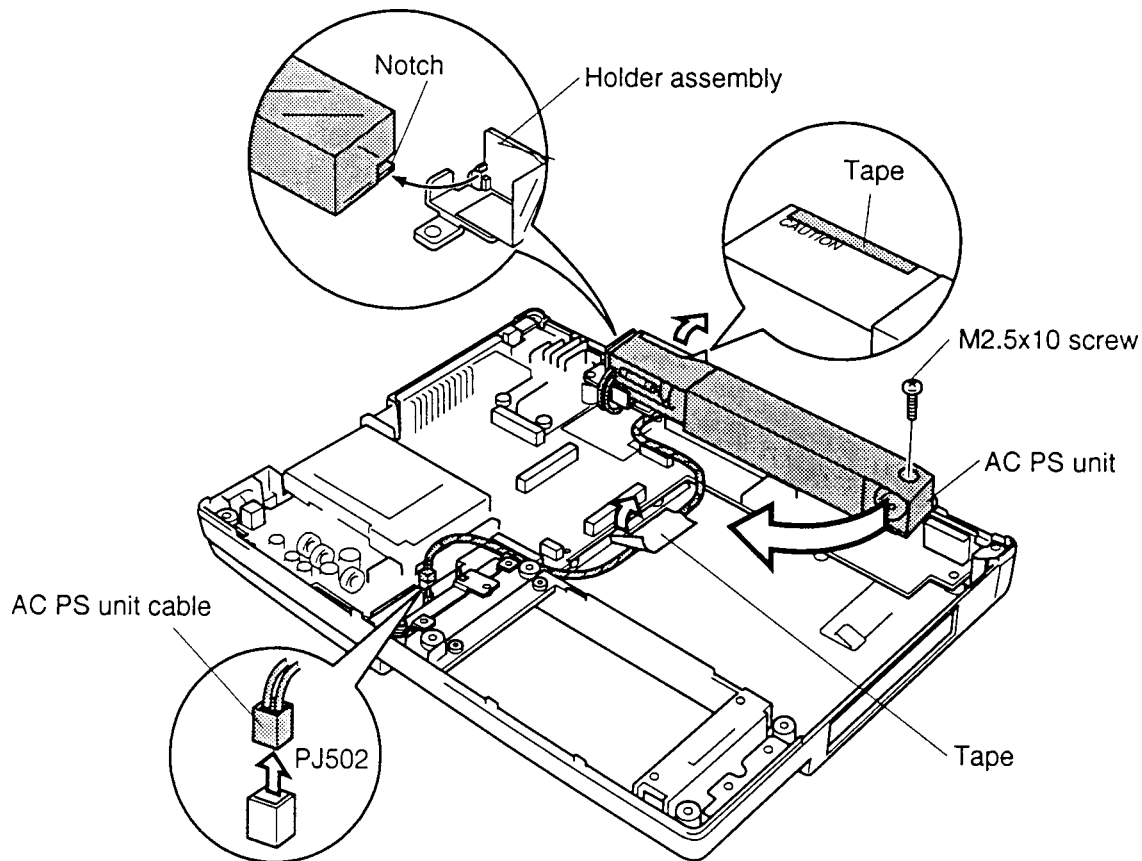
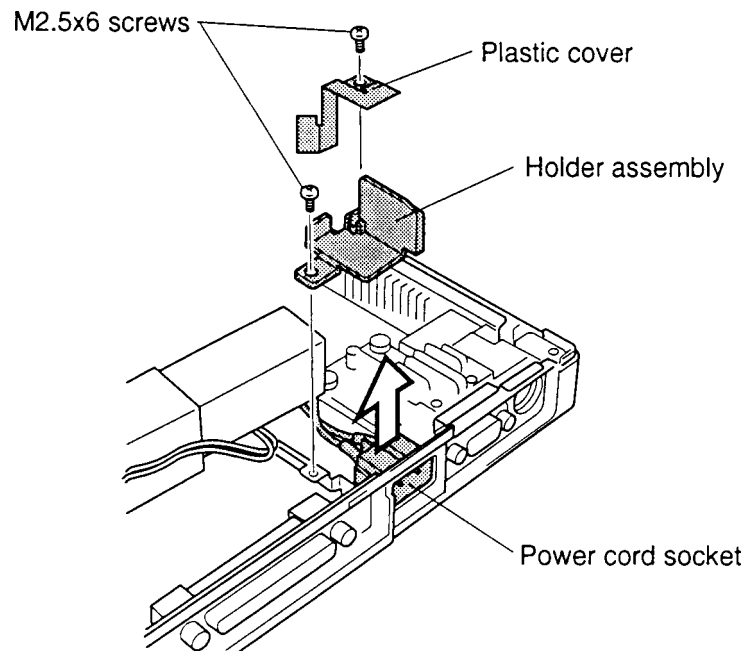


Figure 4-27 Removing the AC PS unit

6. Remove **two M2.5x6 screws** securing the **holder assembly** and **plastic cover** and lift out the assembly.

7. Lift the **power cord socket** straight up until it clears its slots and remove the **AC PS unit**.



*Figure 4-28 Removing the holder assembly and power cord socket*

### **Installing the AC PS Unit**

To install the AC PS unit, follow the steps below and refer to Figures 4-27 and 4-28.

1. Seat the **power cord socket** with the side with markings facing up. Press gently to secure its position.
2. Seat the **holder assembly** and **plastic cover**, then secure it with **two M2.5x6 screws**.
3. Seat the **AC PS unit**. Be sure to fit the AC PS unit's plastic cover into the notch on the holder assembly (Figure 4-27).
4. Secure the **tape** to the **plastic plate** and the **AC PS unit**. Make sure the **tape** is placed just above the word "CAUTION" (Figure 4-27).
5. Secure the **AC PS unit** with **one M2.5x10 screw**.
6. Connect the **AC PS unit cable** to **PJ502** and thread the cable between PJ6 and the battery terminal. Secure the cable with **tape**.
7. Install the HDD interface board, top cover with display assembly, RTC battery, sub-battery, VGA assembly, keyboard, HDD, optional memory module, optional PC card, and battery pack as described in Sections 4.9 back through 4.2.

## 4.12 System Board

### Removing the System Board

To remove the system board, follow the steps below and refer to Figure 4-29.

1. Turn the computer off. Disconnect the AC power cord and all external cables connected to the computer.
2. Remove the battery pack, optional PC card, optional memory module, HDD, keyboard, sub-battery, VGA board, top cover with display assembly, RTC battery, FDD, HDD interface board, and AC PS unit as described in Sections 4.2 through 4.11.
3. Remove **one M2.5x6 screw** securing the **battery terminal cover** and remove it.
4. Remove **seven M2.5x6 screws** and the **AC PS unit support**.
5. Lift out the **system board**. Lift the system board from the side away from the ports; then pull out to disengage ports.

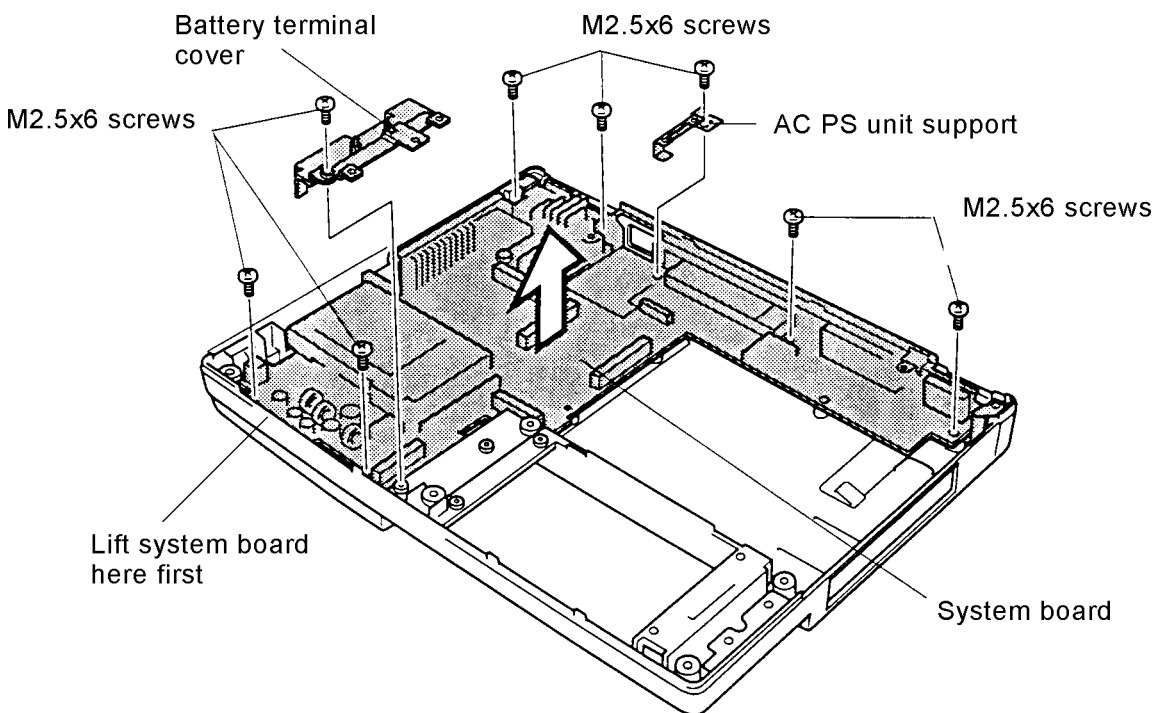


Figure 4-29 Removing the system board

## Installing the System Board

To install the system board, follow the steps below and refer to Figure 4-29.

1. Seat the **system board**. First set the edge along the computer port side, then lay the board into place.
2. Seat the **AC PS unit support** and secure **seven M2.5x6 screws**.
3. Seat the **battery terminal cover** and secure it with **one M2.5x6 screw**.
4. Install the AC PS unit, HDD interface board, FDD, top cover with display assembly, RTC battery, sub-battery, VGA assembly, keyboard, HDD, optional memory module, optional PC card, and battery pack as described in Sections 4.1.1 back through 4.2.

## 4.13 Display Mask

### Removing the Display Mask

To remove the display mask, follow the steps below and refer to Figures 4-30 and 4-31.

1. Turn the computer off. Disconnect the AC power cord and all external cables connected to the computer.
2. Remove the battery pack, optional PC card and optional memory module as described in Sections 4.2, 4.3, and 4.4.

**NOTE:** *It is not necessary to remove the top cover with the display assembly.*

3. Remove **two rubber seals** from the display hinges and **two rubber cushions** from the top corners to expose screws securing the **display mask**.

**NOTE:** *Support the back of the display with your hand when you remove the screws.*

4. Remove **four M2.5x6 screws** that were covered by the rubber seals and cushions.

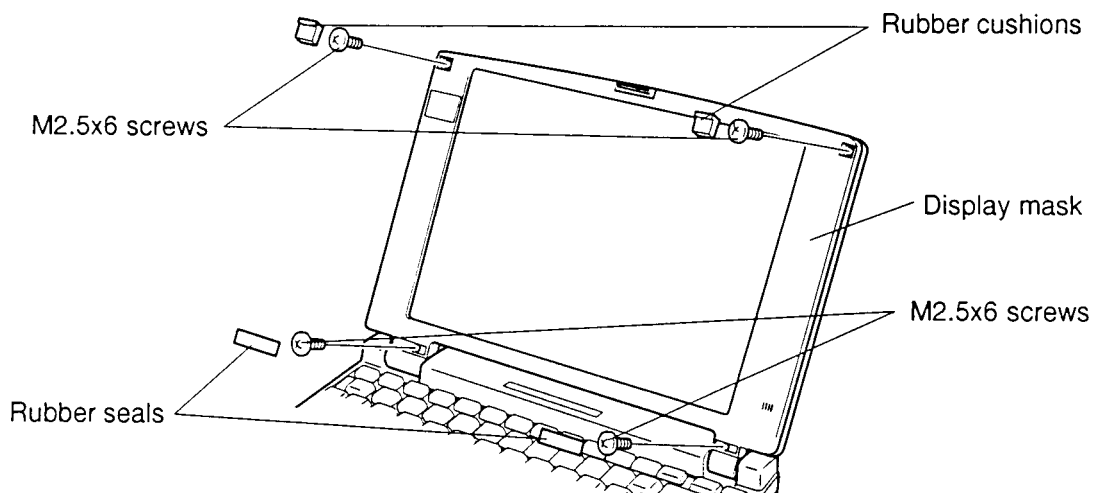


Figure 4-30 Removing the rubber seals, cushions, and screws

5. Carefully insert your fingers between the mask and the LCD panel and pry open the latches. Start with the **four latches** across the bottom of the display mask.
6. Continue unlatching the mask along the **sides (four latches on each side)** and at the top (**four latches**).

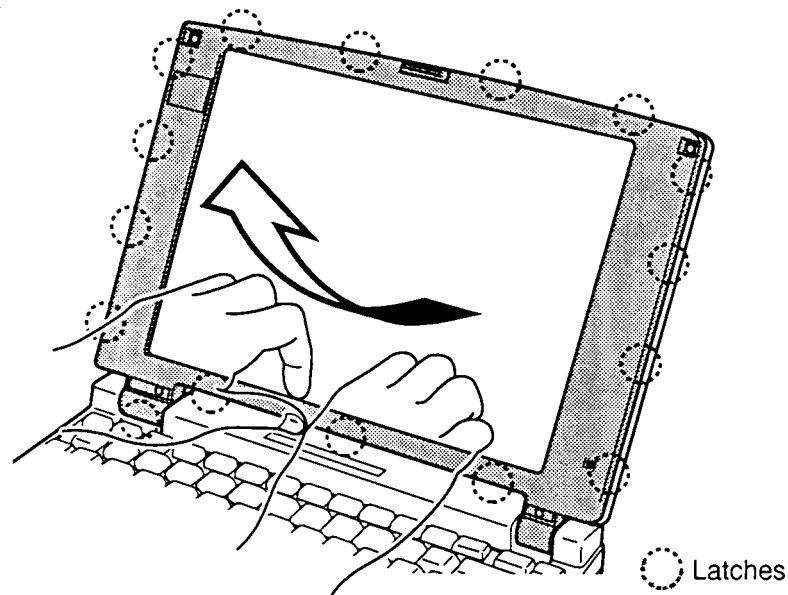


Figure 4-31 Removing the display mask

## Installing the Display Mask

To install the display mask, follow the steps below and refer to figures 4-30 and 4-31.

1. Set the **display mask** in place and secure the latches beginning with **four latches** at the top of the display mask.
2. Continue along the sides (**four latches**) and bottom of the display (**four latches**).

**NOTE:** Support the back of the display with your hand when you secure the screws.

3. Secure the display mask with **four M2.5x6 screws**.
4. Attach **two rubber seals** and **two rubber cushions** to cover the screws.
5. Install the optional PC card, optional memory card, and battery pack as described in Sections 4.4, 4.3, and 4.2.

## 4.14 Fluorescent Lamp (FL) Inverter Board (110CT with TFT)

### Removing the FL Inverter Board

To remove the FL inverter board, follow the steps below and refer to Figure 4-32.

1. Turn the computer off. Disconnect the AC power cable and all external cables connected to the computer.
2. Remove the battery pack, optional PC card, optional memory module, and display mask as described in Sections 4.2, 4.3, 4.4, and 4.13.

**NOTE:** Support the back of the display with your hand when you remove the screws.

3. Remove **two M2.5x6 screws** securing the **FL inverter board**. Note the ground screw.
4. Disconnect the **FL inverter cable** from **CN1** and the **FL cable** from **CN2** on the **FL inverter board**.
5. Lift out the FL inverter board.

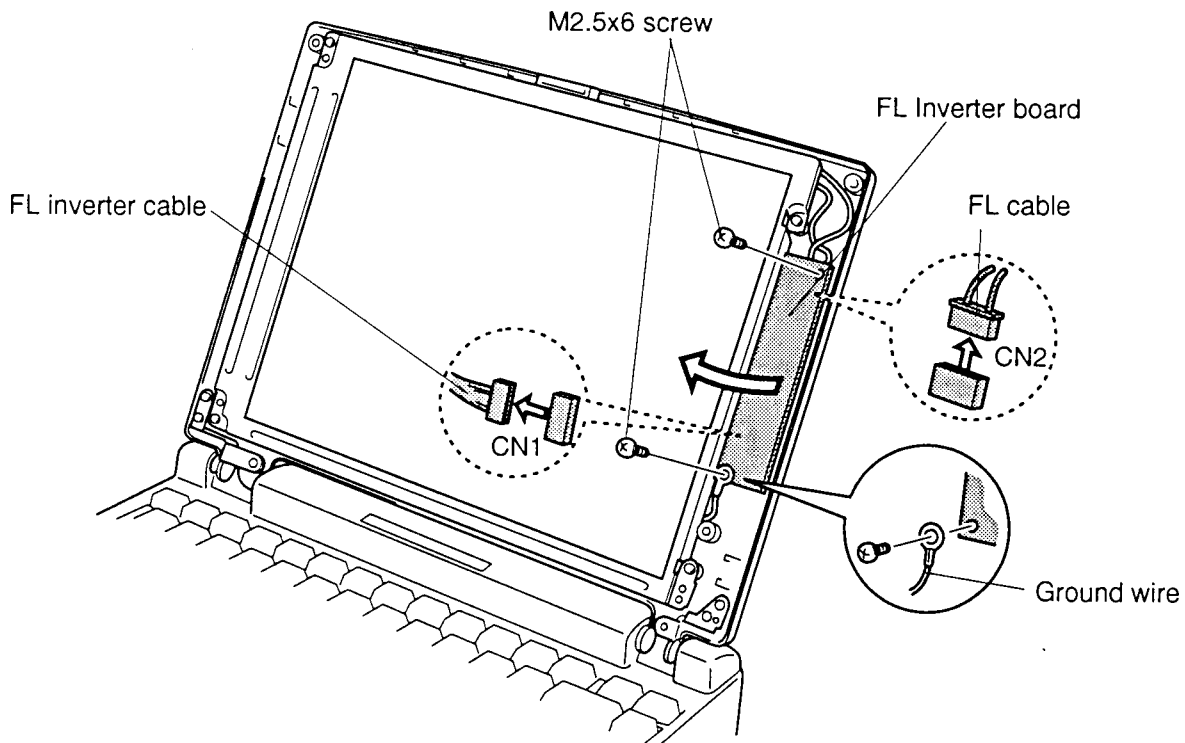


Figure 4-32 Removing the FL inverter board (110CT with TFT)



## Installing the FL Inverter Board

To install the FL inverter board, follow the steps below and refer to Figure 4-32.

1. Seat the **FL inverter board**.
2. Connect the **FL inverter cable** to **CN1** and the **FL cable** to **CN2** on the **FL inverter board**.

***NOTE:** Support the back of the display with your hand when you secure the screws.*

3. Secure the **FL inverter board** with **two M2.5x6 screws**.
4. Install the display mask, optional memory card, optional PC card, and battery pack as described in Sections 4.13, 4.4, 4.3, and 4.2.

## 4.15 Fluorescent Lamp (FL) Inverter Board (110CS with DSTN)

### Removing the FL Inverter Board

To remove the FL inverter board, follow the steps below and refer to Figure 4-33.

1. Turn the computer off. Disconnect the AC power cable and all external cables connected to the computer.
2. Remove the battery pack, optional PC card, optional memory module, and display mask as described in Sections 4.2, 4.3, 4.4, and 4.13.

**NOTE:** Support the back of the display with your hand when you remove the screws.

3. Remove **two M2.5x6 screws** securing the **FL inverter board**. Note the ground screw.
4. Remove **one M2.5x6 screw** securing the **contrast control board**.
5. Remove the **tape** from the **FL cable**.
6. Disconnect the **FL inverter cable** from **CN1** and the **FL cable** from **CN2** on the **FL inverter board**.
7. Lift out the **FL inverter board**.
8. Disconnect the **contrast control cable** from **PJ1** on the **contrast control board**. Lift out the contrast control board.

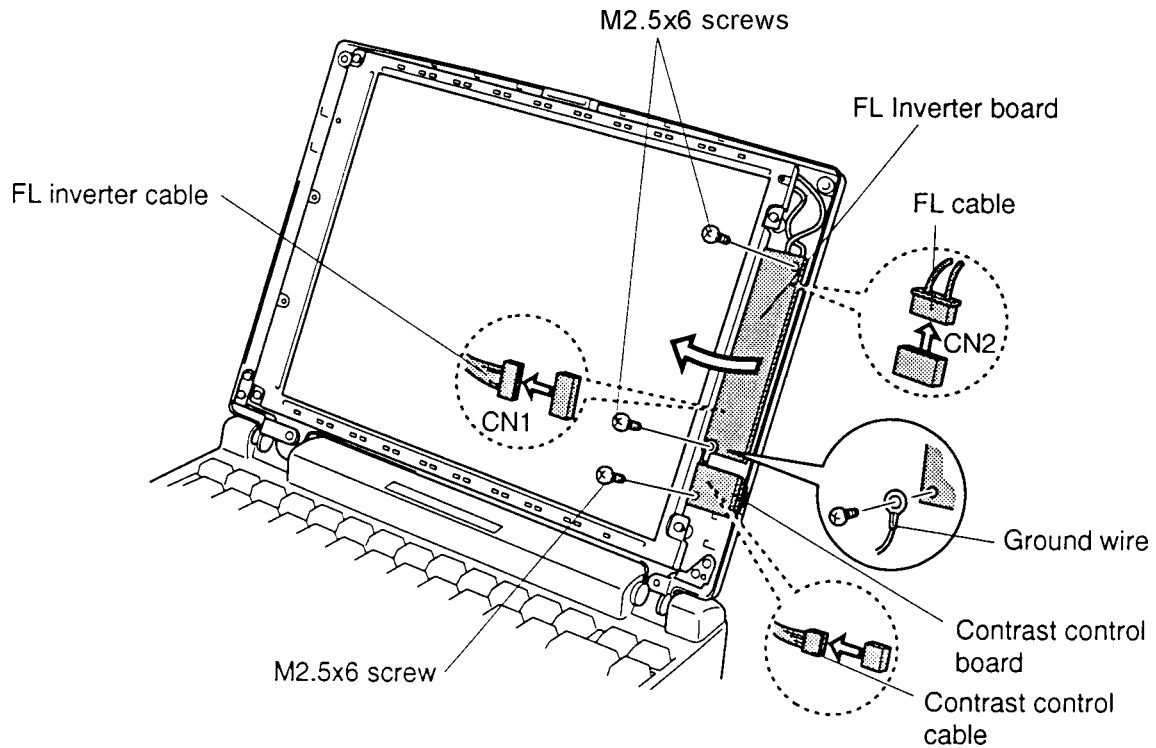


Figure 4-33 Removing the FL inverter board (110CS with DSTN)

## Installing the FL Inverter Board

To install the FL inverter board, follow the steps below and refer to Figure 4-33.

1. Connect the **contrast control cable** to **PJ1** on the **contrast control board**.
2. Seat the **contrast control board**. Be sure the wheel fits through the port.
3. Secure the **contrast control board** with **one M2.5x6 screw**.

**NOTE:** Support the back of the display with your hand when you secure the screws.

4. Connect the **FL inverter cable** to **CN1** and the **FL cable** to **CN2** on the FL inverter board.
5. Seat the **FL inverter board**.
6. Secure the **FL inverter board** with **two M2.5x6 screws**. Note the ground wire.
7. **Tape** the **FL cable** down.
8. Install the display mask, optional memory card, optional PC card, and battery pack as described in 4.13, 4.4, 4.3, and 4.2.

## 4.16 Liquid Crystal Display (LCD) Module (110CT with TFT)

### Removing the LCD Module

To remove the LCD module, follow the steps below and refer to Figures 4-34 and 4-35.

1. Turn the computer off. Disconnect the AC power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory module, optional PC card, display mask, and FL inverter board as described in Sections 4.2, 4.3, 4.4, 4.13, and 4.14.

**NOTE:** Support the back of the display with your hand when you remove the screws.

3. Remove **four M2.5x6 screws** securing the **LCD module** to the LCD cover. The screw at the lower left corner also secures the **ground cable**.

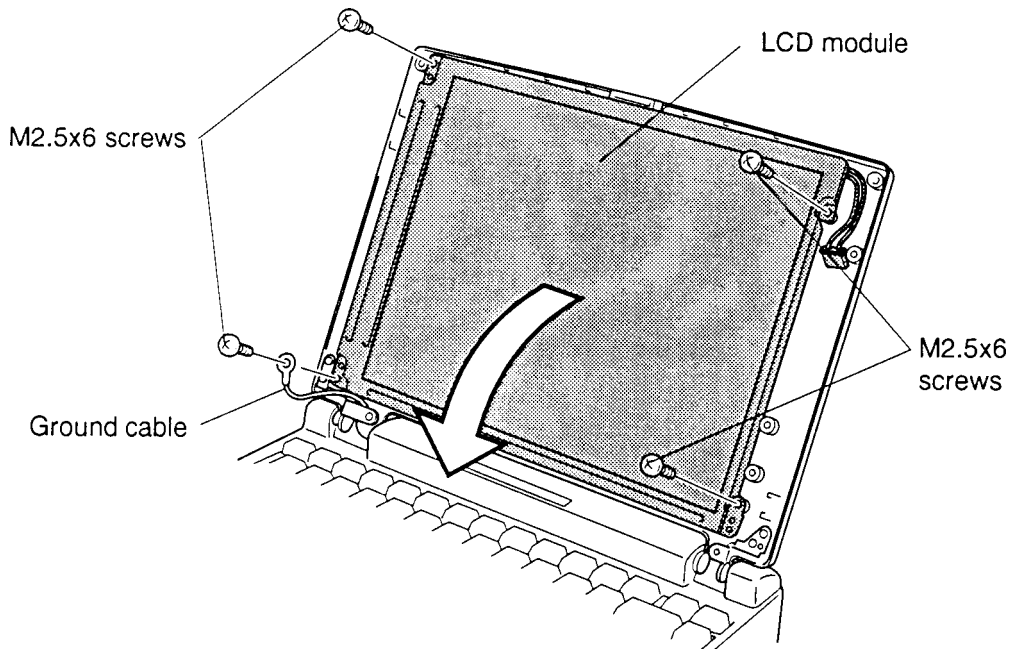


Figure 4-34 Removing the LCD module screws (110CT with TFT)

**NOTE:** Metal edges on the LCD module are sharp; be careful not to cut yourself.

4. Carefully rotate the **LCD module** out of the LCD cover and lay it on the keyboard.

5. Disconnect the display flexible cable from the display unit and disconnect **four display cables** from **PJ2, PJ3, PJ4, and PJ5** on the **flexible cable**.
6. Remove the **shielded tape** securing the display cables to the LCD cover.

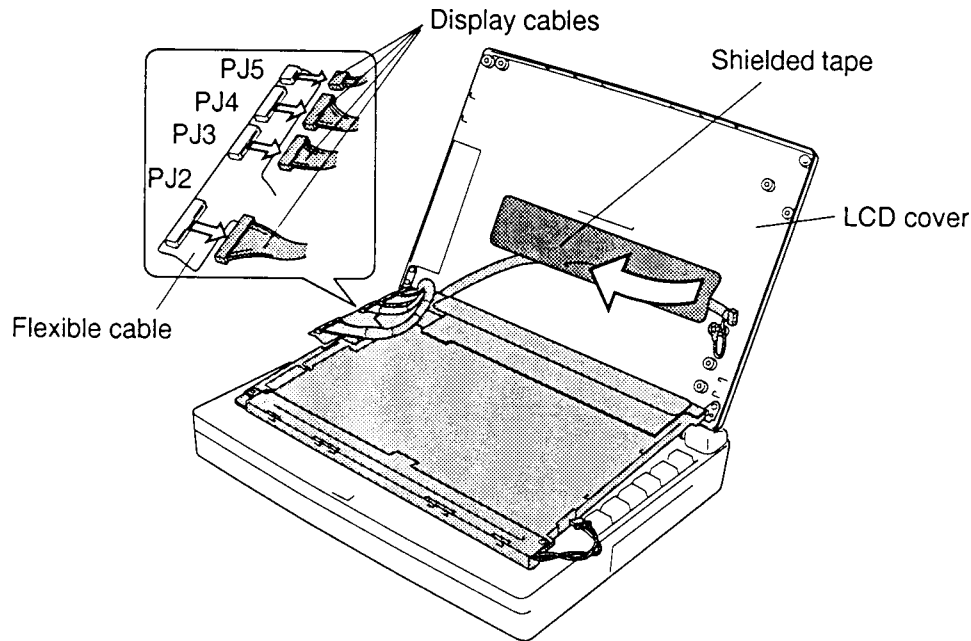


Figure 4-35 Removing the LCD module (110CT with TFT)

### Installing the LCD Module

To install the LCD module, follow the steps below and refer to Figures 4-34 and 4-35.

1. Secure the **display cable** to the **LCD cover** with **shielded tape**.
2. Connect the **display cables** to **PJ2, PJ3, PJ4, and PJ5** on the **flexible cable** and connect the flexible cable to the display module.
3. Carefully rotate the **LCD module** into the **LCD cover**.

**NOTE:** Support the back of the display with your hand when you secure the screws.

4. Secure **four M2.5x6 screws** on the **LCD module**. Make sure the ground cable is secured at the lower left corner.
5. Install the FL inverter board, display mask, optional memory module, optional PC card, and battery pack as described in Sections 4.14, 4.13, 4.4, 4.3, and 4.2.

## 4.17 Liquid Crystal Display (LCD) Module (110CS with DSTN)

### Removing the LCD Module

To remove the LCD module, follow the steps below and refer to Figures 4-36 and 4-37.

1. Turn the computer off. Disconnect the AC power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory module, optional PC card, display mask, and FL inverter board as described in Sections 4.2, 4.3, 4.4, 4.13, and 4.15.

**NOTE:** Support the back of the display with your hand when you remove the screws.

3. Remove **four M2.5x6 screws** securing the **LCD module** to the LCD cover. The screw at the lower left corner also secures the **ground cable**.

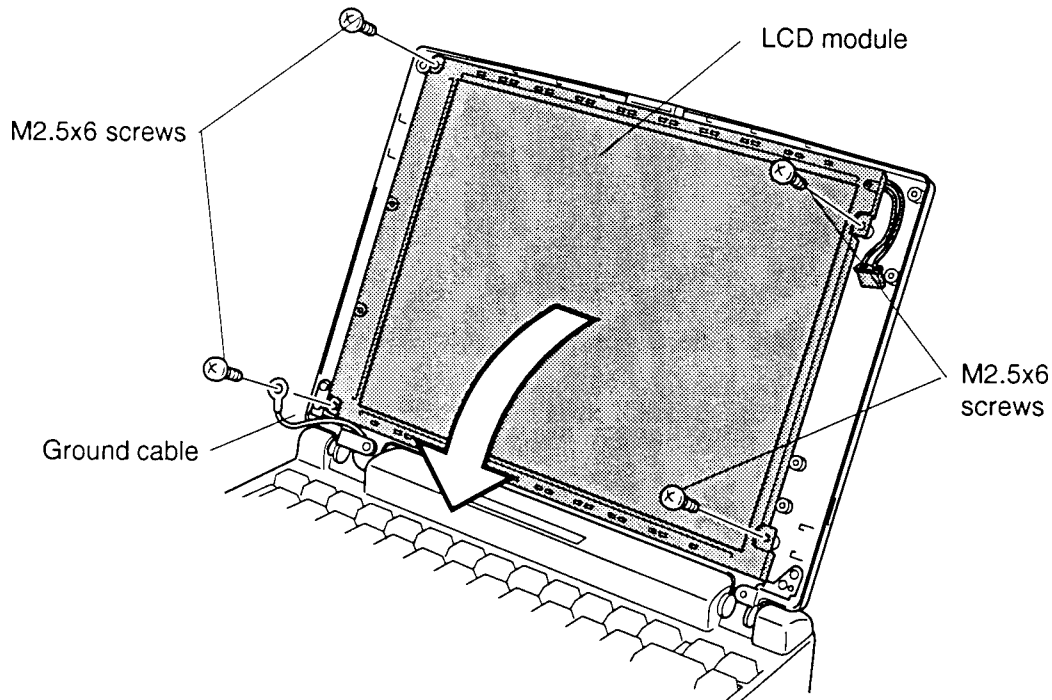


Figure 4-36 Removing the LCD module screws (110CS with DSTN)

**NOTE:** Metal edges on the LCD module are sharp; be careful not to cut yourself.

4. Carefully rotate the **LCD module** out of the LCD cover and lay it on the keyboard.
5. Disconnect the **display flexible cable** from the display unit. Disconnect **three display cables** from **PJ2, PJ3, and PJ4** on the **flexible cable**.

6. Remove the **shielded tape** securing the display cables to the LCD cover.

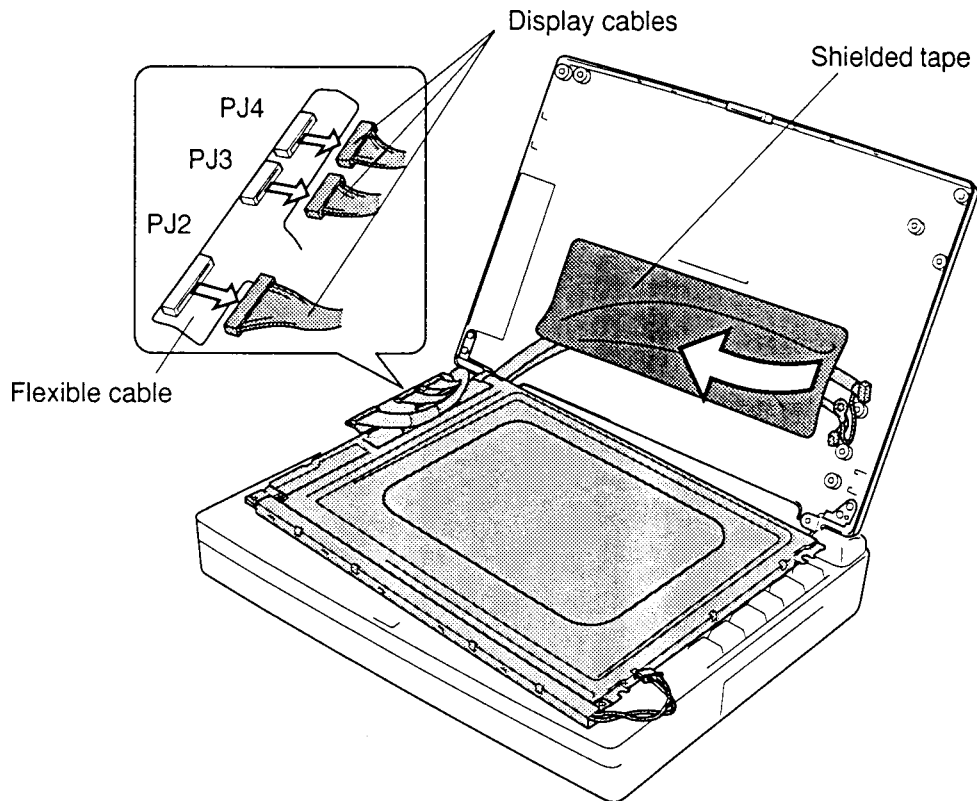


Figure 4-37 Removing the LCD module (110CS with DSTN)

## Installing the LCD Module

To install the LCD module, follow the steps below and refer to Figures 4-36 and 4-37.

1. Secure the **display cable** to **LCD cover** with **shielded tape**.
2. Connect the **display cables** to **PJ2**, **PJ3**, and **PJ4** on the **flexible cable** and connect the **flexible cable** to the display module. Be sure to fit the flexible cable under the plastic guide before seating the LCD module.
3. Carefully rotate the **LCD module** into the **LCD cover**.

**NOTE:** Support the back of the display with your hand when you secure the screws.

4. Secure **four M2.5x6 screws** on the **LCD module**. Make sure the ground cable is secured at the left bottom corner.
5. Install the FL inverter board, display mask, optional memory module, optional PC card, and battery pack as described in Sections 4.15, 4.13, 4.4, 4.3, and 4.2.

## 4.18 Fluorescent Lamp (FL) (110CT with TFT)

**CAUTION:** When you remove the **FL**, be careful not to let any dust or other foreign matter contaminate the **LCD panel**. Any contamination can affect the performance of the unit.

### Removing the FL

To remove the FL, follow the steps below and refer to Figure 4-38.

1. Turn the computer off. Disconnect the AC power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory module, optional PC card, display mask, FL inverter board, and LCD module as described in Sections 4.2, 4.3, 4.4, 4.13, 4.14, and 4.16.
3. Place the **FL** face down and remove **two M2x6 silver screws** and an **inch screw** securing the **metal FL cover**.
4. Lift off the **metal FL cover**.
5. Lift the **FL** out of the frame.

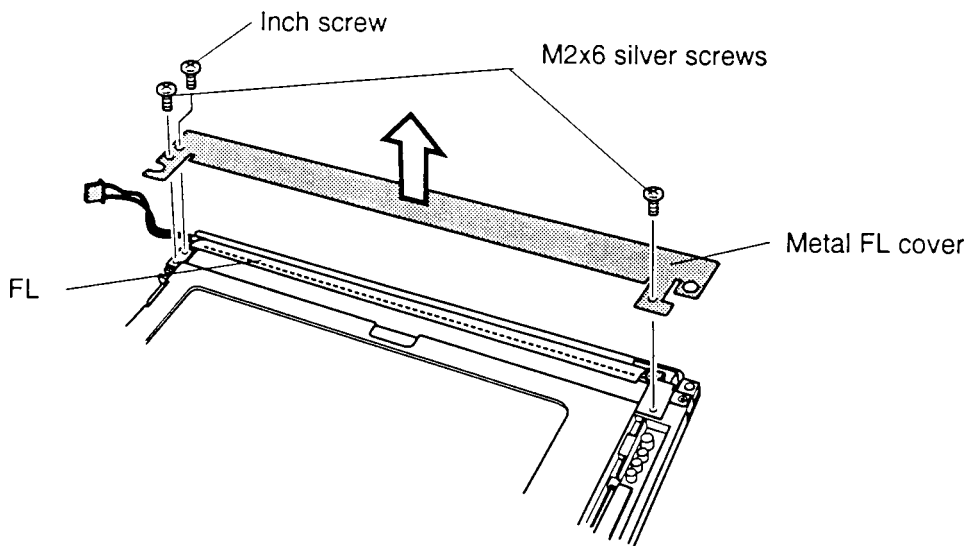


Figure 4-38 Removing the FL (110CT with TFT)



## Installing the FL

To install the FL, follow the steps below and refer to Figure 4-38.

1. Place the **FL** in the frame. Lift up the plastic film to route the FL cable.
2. Seat the **metal FL cover**.
3. Secure the **metal FL cover** with **two M2x6 silver screws** and an **inch screw**.
4. Install the LCD module, FL inverter board, display mask, optional PC card, optional memory module, and the battery pack as described in Sections 4.16, 4.14, 4.13, 4.4, 4.3, and 4.2.

## 4.19 Fluorescent Lamp (FL) (110CS with DSTN)

**CAUTION:** When you remove the FL, be careful not to let any dust or other foreign matter enter the LCD panel components. Any contamination can affect the performance of the unit.

### Removing the FL

To remove the FL, follow the steps below. Refer to Figures 4-39 and 4-40.

1. Turn the computer off. Disconnect the AC power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory module, optional PC card, display mask, FL inverter board, and LCD module as described in Sections 4.2, 4.3, 4.4, 4.13, 4.15, and 4.17.
3. Turn the **LCD module** over and release **four latches** securing the **FL module** to its frame.
4. Remove **two M2x6 screws**.

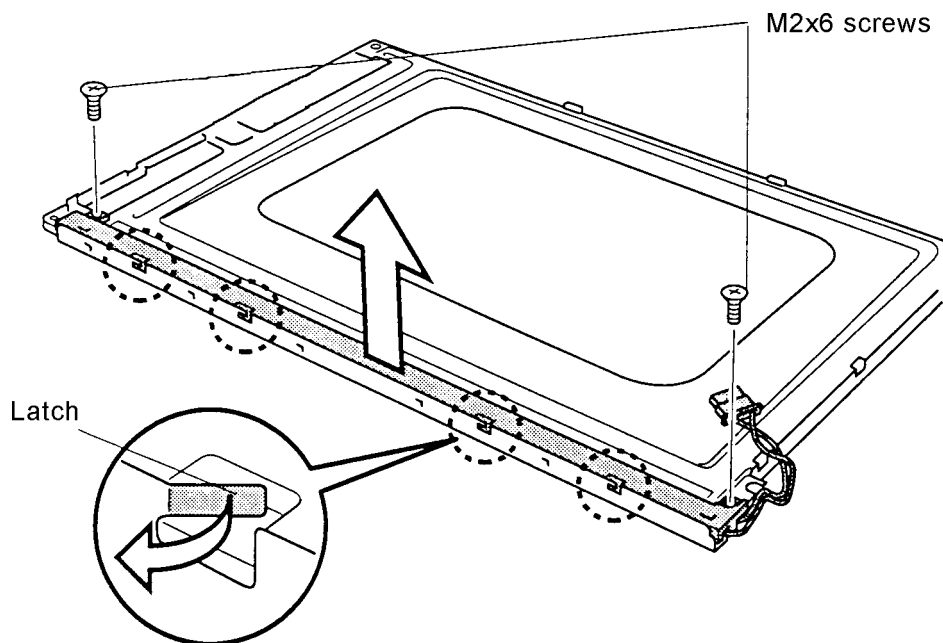
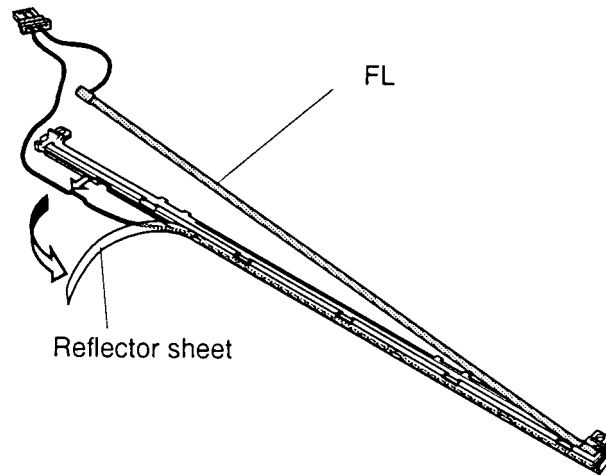


Figure 4-39 Removing the FL assembly (110CS with DSTN)

5. Lift the FL module out of the frame.

6. Lift the end of the **reflector sheet** covering the **FL** and lift out the FL. Be careful not to pull or apply tension to the reflector sheet.



*Figure 4-40 Removing the FL (110CS with DSTN)*

### **Installing the FL**

To install the FL, follow the steps below and refer to Figures 4-39 and 4-40.

1. Seat the **FL**, gently press it securely in place and cover it with the end of the reflector sheet. Be careful not to pull or apply tension to the reflector sheet.
2. Secure **two M2x6 screws**.
3. Secure **four latches**.
4. Install the LCD module, FL inverter board, display mask, optional PC card, optional memory module, and the battery pack as described in Sections 4.17, 4.15, 4.13, 4.4, 4.3, and 4.2.

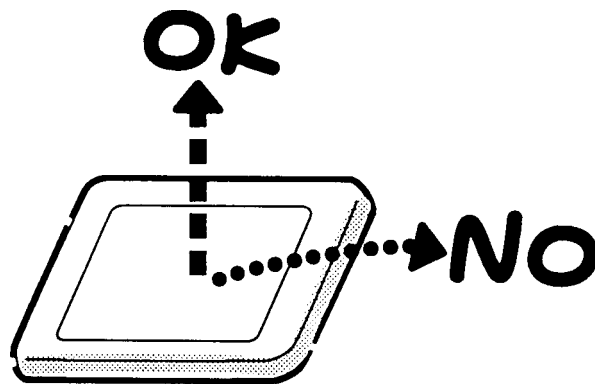


## Appendix A Handling the LCD Module

### Precautions for Handling the LCD Module

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

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



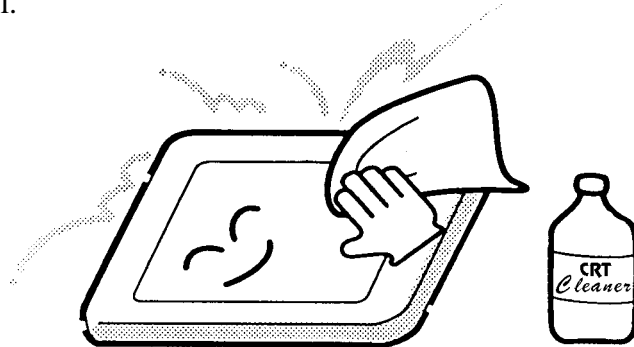
2. Be careful to align the holes at the four corners of the LCD module with the corresponding holes in the LCD cover before securing the module with screws. Do not force the module into place, because stress can affect its performance.

Also, the panel's polarized surface is easily scarred, so be careful when handling it.

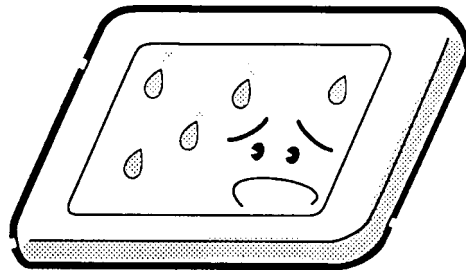


3. If the panel's surface gets dirty, wipe it with cotton or a soft cloth. If it is still dirty, try breathing on the surface to create a light condensate and wipe it again.

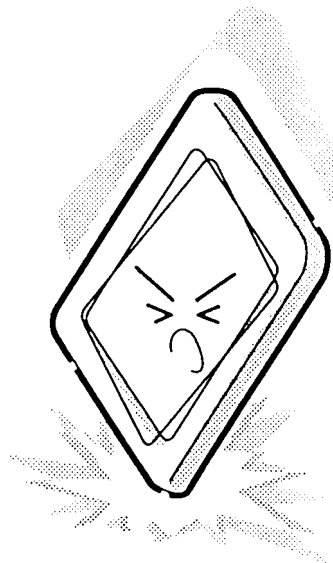
If the surface is very dirty, we recommend a CRT cleaning agent. Apply the agent to a cloth and then wipe the panel's surface. Do not apply cleanser directly to the panel.



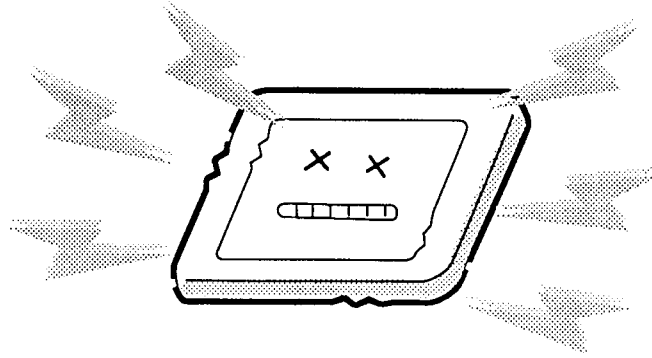
4. If water or other liquid is left on the panel's surface for a long period, it can change the screen's tint or stain it. Be sure to quickly wipe off any liquid.



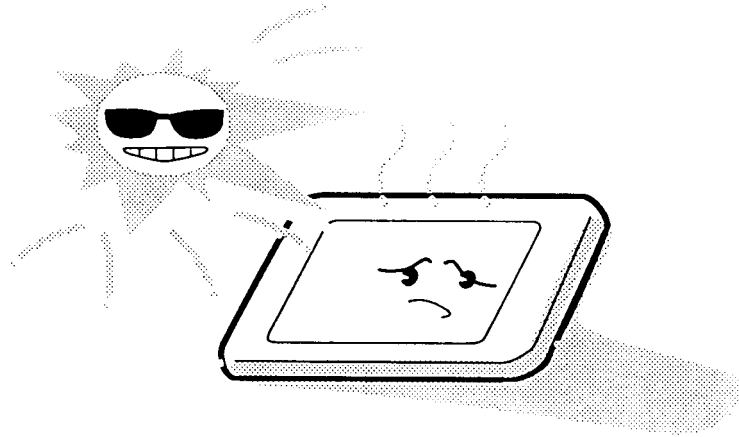
5. Glass is used in the panel, so be careful not to drop it or let it strike a hard object, which could cause breakage or cracks.



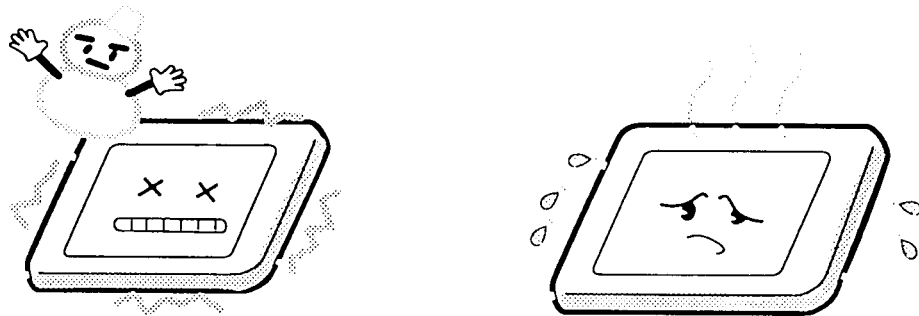
6. CMOS-LSI circuits are used in the module, so guard against damage from electrostatic discharge. Be sure to wear a wrist or ankle ground when handling the module.



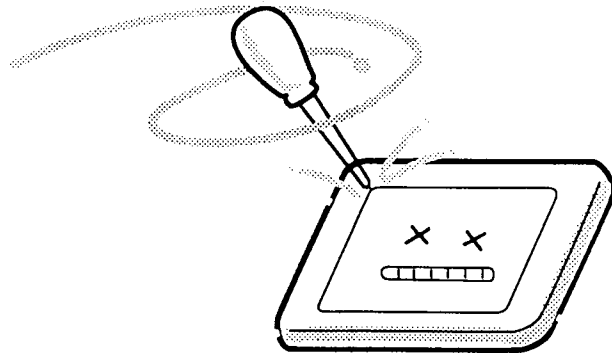
7. Do not expose the module to direct sunlight or strong ultraviolet rays for long periods.



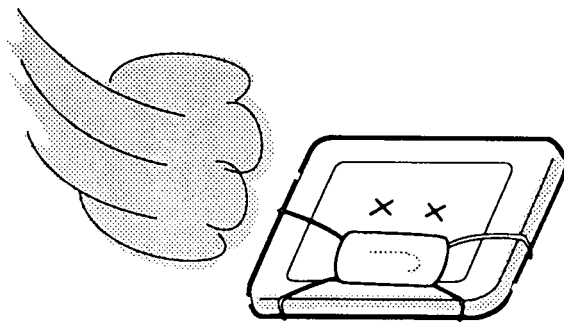
8. Do not store the module at temperatures below specifications. Cold can cause the liquid crystals to freeze, lose their elasticity, or otherwise suffer damage.



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.





## Appendix B Board Layouts

### B.1 System Board Front View

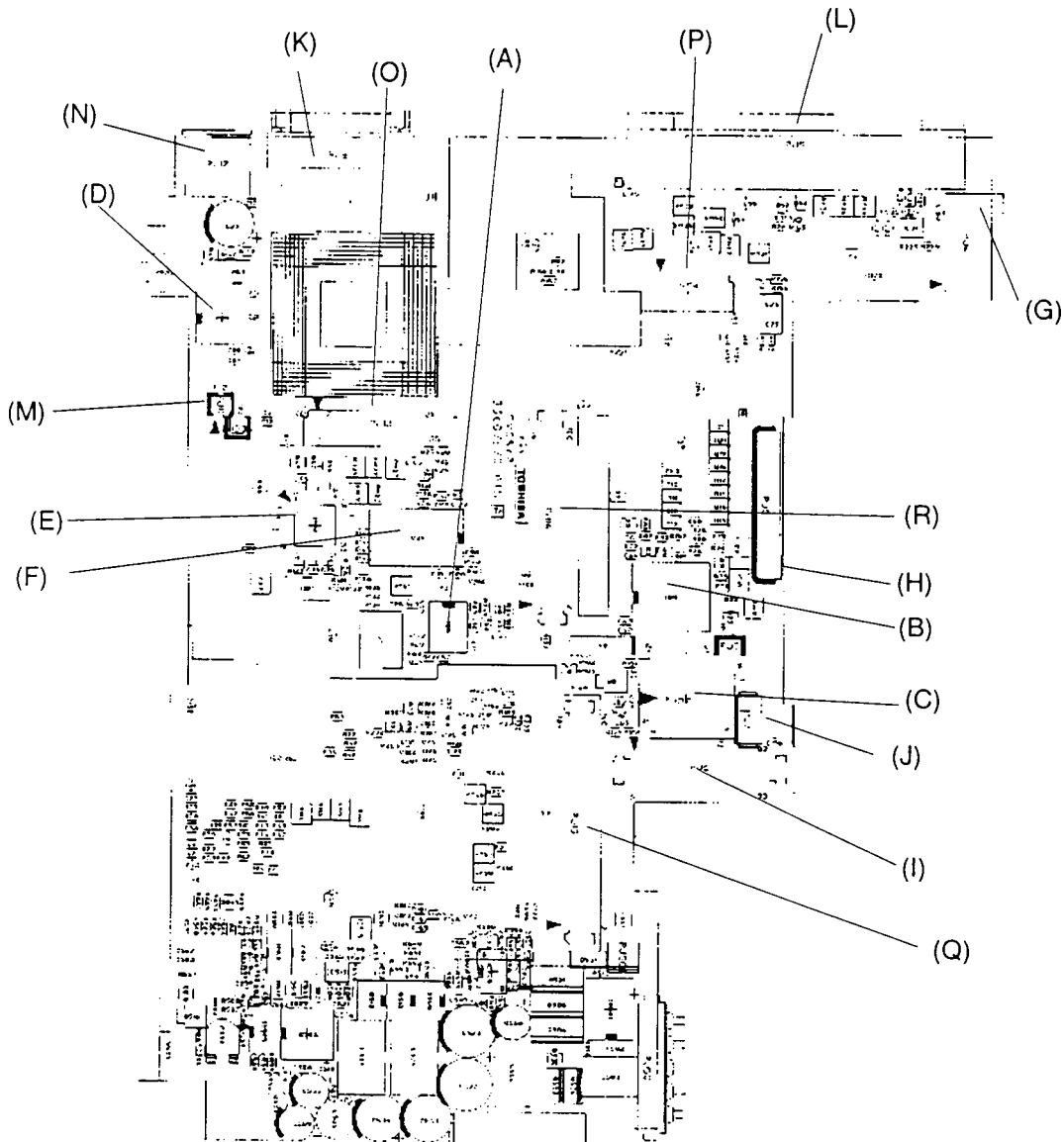


Figure B-1 System board layout (front)

## B.2 System Board Back View

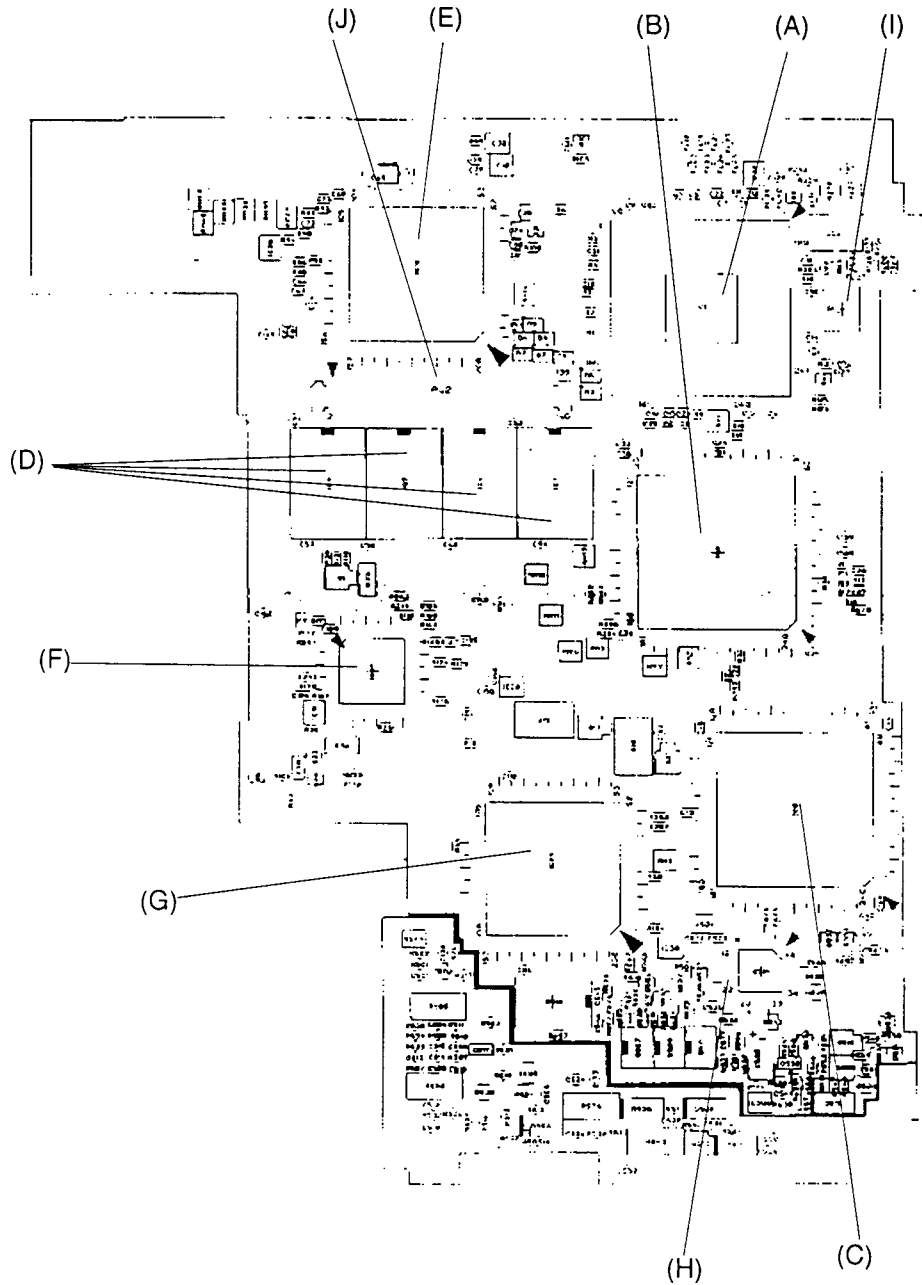


Figure B-2 System board layout (back)

*Table B-1 System board ICs and connectors (front)*

<b>Mark</b>	<b>Number</b>	<b>Name</b>
(A)	IC8	System Clock
(B)	IC11	RTC Controller
(C)	IC14	BIOS ROM
(D)	IC19	Async Controller
(E)	IC20	Keyboard Controller
(F)	IC24	IPS Controller
(G)	PJ4	PRT/RGB I/F Connector
(H)	PJ5	FDD Connector
(I)	PJ6	HDD I/F Connector
(J)	PJ7	IPS Connector
(K)	PJ8	Async I/F Connector
(L)	PJ9	P-REP Connector
(M)	PJ10	Panel Sensor Connector
(N)	PJ12	Ext. Keyboard Connector
(O)	PJ13	Keyboard Connector
(P)	PJ14	LED Connector
(Q)	PJ15	PC Card Slot Connector
(R)	PJ16	VGA Connector

*Table B-2 System board ICs and connectors (back)*

<b>Mark</b>	<b>Number</b>	<b>Name</b>
(A)	IC1	CPU
(B)	IC2	SCPCNT GA
(C)	IC3	SISCNT GA
(D)	IC4 to IC7	System Memory
(E)	IC12	SI
(F)	IC27	I/O GA
(G)	IC29	PC Card Controller
(H)	IC514	PS Micon
(I)	PJ1	Thermistor Connector
(J)	PJ2	Exp. Memory Connector



## Appendix C Pin Assignments

### C.1 PJ1 Thermistor Connector (3-pin)

Table C-1 Thermistor connector pin assignments (3-pin)

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

### C.2 PJ2 Expansion Memory Connector (140-pin)

Table C-2 Expansion memory connector pin assignments (140-pin) (1/3)

Pin No.	Signal name	I/O	Pin No.	Signal Name	I/O
01	B3V	-	02	B3V	-
03	GND	-	04	HD36;100	I/O
05	HD30;100	I/O	06	HD37;100	I/O
07	HD34;100	I/O	08	HD38;100	I/O
09	HD33;100	I/O	10	GND	-
11	B3V	-	12	HD39;100	I/O
13	HD32;100	I/O	14	HD40;100	I/O
15	HD44;100	I/O	16	HD41;100	I/O
17	HD45;100	I/O	18	B3V	-
19	GND	-	20	HD42;100	I/O
21	HD46;100	I/O	22	HD43;100	I/O
23	HD47;100	I/O	24	HD16;100	I/O
25	HD20;100	I/O	26	GND	-
27	B3V	-	28	HD17;100	I/O
29	HD21;100	I/O	30	HD18;100	I/O
31	HD22;100	I/O	32	HD19;100	I/O
33	HD23;100	I/O	34	B3V	-
35	GND	-	36	HD24;100	I/O
37	HD28;100	I/O	38	HD25;100	I/O
39	HD29;100	I/O	40	HD26;100	I/O
41	HD30;100	I/O	42	GND	-
43	B3V	-	44	HD27;100	I/O
45	HD31;100	I/O	46	HD00;100	I/O
47	HD04;100	I/O	48	HD01;100	I/O
49	HD05;100	I/O	50	B3V	-

Table C-2 Expansion memory connector pin assignments (140-pin) (2/3)

Pin No.	Signal name	I/O	Pin No.	Signal Name	I/O
51	GND	-	52	HD02;100	I/O
53	HD06;100	I/O	54	HD03;100	I/O
49	HD05;100	I/O	50	B3V	-
51	GND	-	52	HD02;100	I/O
53	HD06;100	I/O	54	HD03;100	I/O
55	HD07;100	I/O	56	HD08;100	I/O
57	HD12;100	I/O	58	GND	-
59	B3V	-	60	HD09;100	I/O
61	HD13;100	I/O	62	HD10;100	I/O
63	HD14;100	I/O	64	HD11;100	I/O
65	HD15;100	I/O	66	B3V	-
67	GND	-	68	HD48;100	I/O
69	HD52;100	I/O	70	HD49;100	I/O
71	HD53;100	I/O	72	HD50;100	I/O
73	HD54;100	I/O	74	GND	-
75	B3V	-	76	HD51;100	I/O
77	HD55;100	I/O	78	HD56;100	I/O
79	HD60;100	I/O	80	HD57;100	I/O
81	HD61;100	I/O	82	HD58;100	I/O
83	HD62;100	I/O	84	HD59;100	I/O
85	HD63;100	I/O	86	GND	-
87	CAS1;001	O	88	CAS0;001	O
89	CAS3;001	O	90	CAS2;001	O
91	CAS5;001	O	92	CAS4;001	O
93	CAS7;001	O	94	CAS6;001	O
95	NC	-	96	NC	-
97	NC	-	98	NC	-
99	MWE0;001	O	100	GND	-
101	NC	-	102	NC	-
103	GND	-	104	NC	-
105	ERAS0;001	O	106	ERAS2;001	O
107	ERAS1;001	O	108	ERAS3;001	O
109	NC	-	110	NC	-
111	NC	-	112	NC	-
113	NC	-	114	NC	-
115	NC	-	116	NC	-
117	GND	-	118	GND	-

Table C-2 Expansion memory connector pin assignments (140-pin) (3/3)

Pin No.	Signal name	I/O	Pin No.	Signal Name	I/O
119	NC	-	120	NC	-
121	GND	-	122	GND	-
123	NC	-	124	NC	-
125	GND	-	126	GND	-
127	MA00;101	O	128	MA01;101	O
129	MA02;101	O	130	MA03;101	O
131	MA04;101	O	132	MA05;101	O
133	GND	-	134	MA07;101	O
135	MA06;101	O	136	MA09;101	O
137	MA08;101	O	138	MA11;101	O
139	MA10;101	O	140	GND	-

### C.3 PJ3 NiMH RTC Battery Connector (3-pin)

Table C-3 NiMH RTC battery connector pin assignments (3-pin)

Pin No.	Signal name	I/O	Pin No.	Signal Name	I/O
01	(BATTERY+)	-	02	NC	-
03	GND	-			

#### C.4 PJ4 PRT/RGB I/F Connector (30-pin)

Table C-4 PRT/RGB I/F connector pin assignments (30-pin)

Pin No.	Signal name	I/O	Pin No.	Signal Name	I/O
01	AGREEN;100	O	02	ARED;100	O
03	ABLUE;100	O	04	GND	-
05	GND	-	06	GND	-
07	GND	-	08	CRTEN;000	O
09	CHSYNC;110	O	10	CVSYNC;110	O
11	CVSYNC;100	I	12	CHSYNC;100	I
13	ERROR;000	I	14	PD3;100	I/O
15	SELCT;100	O	16	PD2;100	I/O
17	PE;100	I	18	PD1;100	I/O
19	BUSY;100	I	20	PD0;100	I/O
21	ACK;000	I	22	STROB;000	O
23	SLIN;000	I/O	24	PD4;100	I/O
25	PINT;000	O	26	PD5;100	I/O
27	AUTFD;000	O	28	PD6;100	I/O
29	VCC	-	30	PD7;100	I/O

#### C.5 PJ5 FDD Connector (26-pin)

Table C-5 FDD connector pin assignments (26-pin)

Pin No.	Signal name	I/O	Pin No.	Signal Name	I/O
01	IFSSEL;000	O	02	GND	-
03	IFRDAT;000	I	04	GND	-
05	IFWPRO;000	O	06	GND	-
07	IFTRK0;000	I	08	GND	-
09	IFWEN;000	O	10	GND	-
11	IFWEN;000	O	12	GND	-
13	IFWDAT;000	O	14	NC	-
15	IFDIRC;000	O	16	GND	-
17	IFAMON;000	O	18	IFHMED;000	I
19	IFRADY;000	I	20	VCC	-
21	DISKCHG;000	I	22	VCC	-
23	IFDASL;000	O	24	VCC	-
25	IFINDEX;000	I	26	VCC	-



## C.6 PJ7 HDD Connector (90-pin)

Table C-6 HDD connector pin assignments (90-pin) (1/2)

Pin No.	Signal name	I/O	Pin No.	Signal Name	I/O
01	NC	-	02	GND	-
03	NC	-	04	IRQ14;100	I
05	NC	-	06	SA02;100	O
07	NC	-	08	SA01;100	O
09	GND	-	10	IRQ7;100	I
11	GND	-	12	IRQ5;100	I
13	GND	-	14	CSPTON;000	O
15	GND	-	16	FIORD;000	O
17	GND	-	18	FIOWR;000	O
19	GND	-	20	GND	-
21	GND	-	22	IOCS16;000	O
23	GND	-	24	IOCRDY;100	I
25	GND	-	26	HDCS0;000	O
27	GND	-	28	HDCS1;000	O
29	GND	-	30	PSPNBP;100	O
31	GND	-	32	HDDLED;000	I
33	GND	-	34	GND	-
35	GND	-	36	SD00;100	I/O
37	GND	-	38	SD01;100	I/O
39	GND	-	40	SD02;100	I/O
41	GND	-	42	SD03;100	I/O
43	GND	-	44	SD04;100	I/O
45	GND	-	46	SD05;100	I/O
47	GND	-	48	SD06;100	I/O
49	GND	-	50	SD07;100	I/O
51	GND	-	52	GND	-
53	GND	-	54	SD15;100	I/O
55	GND	-	56	SD14;100	I/O
57	GND	-	58	SD13;100	I/O
59	GND	-	60	SD12;100	I/O
61	GND	-	62	SD11;100	I/O
63	GND	-	64	SD10;100	I/O
65	GND	-	66	SD09;100	I/O
67	GND	-	68	SD08;100	I/O
69	GND	-	70	GND	-
71	GND	-	72	RESET;000	O

*Table C-6 HDD connector pin assignments (90-pin) (2/2)*

Pin No.	Signal name	I/O	Pin No.	Signal Name	I/O
73	GND	-	74	RVCC	-
75	GND	-	76	VCC	-
77	GND	-	78	VCC	-
79	GND	-	80	VCC	-
81	GND	-	82	VCC	-
83	GND	-	84	VCC	-
85	GND	-	86	VCC	-
87	GND	-	88	VCC	-
89	GND	-	90	VCC	-

### **C.7 PJ8 Asynchronous Connector (9-pin)**

*Table C-7 Asynchronous connector pin assignments (9-pin)*

Pin No.	Signal name	I/O	Pin No.	Signal Name	I/O
001	DCD1;101	I	002	RXD1;001	I
003	TXD1;011	O	004	DTR1;111	O
005	GND	—	006	DSR1;101	I
007	RTS1;101	O	008	CTS1;101	I
009	RI1;101	I			

## C.8 PJ9 P-REP Connector (176-pin)

Table C-8 P-REP connector pin assignments (176-pin) (1/3)

Pin No.	Signal name	I/O	Pin No.	Signal Name	I/O
01	GND	-	02	GND	-
03	LA23;110	O	04	LA20;110	O
05	FRESET;010	O	06	SBHE;010	O
07	MERD;010	O	08	ZEROWS;010	I
09	IOCRDY;110	O	10	BUFOFF;020	O
11	PSPTON;010	I	12	NC	-
13	GND	-	14	DTR1;110	O
15	TXD1;010	O	16	DCD1;100	I
17	CTS1;100	I	18	PVT	O
19	PVT	O	20	SYSCLK;100	O
21	IORD;010	O	22	VCC	-
23	VCC	O	24	VCC	-
25	NC	-	26	NC	-
27	NC	-	28	IRQ7;110	I
29	IRQ9;110	I	30	IRQ12;110	I
31	ERROR;000	I	32	PE;100	I
33	ACK;000	I	34	PINT;000	O
35	STROB;000	O	36	PD1;100	I/O
37	PD3;100	O	38	PD5;100	I/O
39	GND	-	40	ARED;120	O
41	AGREEN;120	O	42	ABLUE;120	O
43	GND	-	44	GND	-
45	GND	-	46	GND	-
47	LA21;110	O	48	LA22;110	O
49	AEN;110	O	50	BALE;110	O
51	MEWR;010	O	52	IOCS16;010	O
53	MECS16;010	O	54	REFRSH;010	O
55	PCSMB;010	I	56	PCMB;110	O
57	GND	-	58	RTS1;110	O
59	DSR1;100	I	60	RI1;100	I
61	RXD1;000	I	62	PVT	O
63	PVT	O	64	PVT	O
65	IOWR;010	O	66	VCC	-
67	VCC	-	68	IRQ4;110	I
69	IRQ3;110	I	70	IRQ11;110	I
71	IRQ5;110	I	72	IRQ15;110	I

Table C-8 P-REP connector pin assignments (176-pin) (2/3)

Pin No.	Signal name	I/O	Pin No.	Signal Name	I/O
73	IRQ10;110	I	74	IRQ14;110	I
75	SELCT;100	I	76	BUSY;100	I
77	SLIN;000	O	78	AUTFD;000	O
79	PD0;100	I/O	80	PD2;100	I/O
81	PD4;100	I/O	82	PD6;100	I/O
83	PD7;100	I/O	84	GND	-
85	CHSYNC;120	O	86	CVSYNC;120	O
87	GND	-	88	GND	-
89	P12V	-	90	SA00;110	O
91	SA08;110	O	92	SA02;110	O
93	GND	-	94	SA04;110	O
95	SA10;110	O	96	SA06;110	O
97	GND	-	98	SA15;110	O
99	SA18;110	O	100	SA13;110	O
101	GND	-	102	SD07;110	I/O
103	SA16;110	O	104	SD05;110	I/O
105	GND	-	106	SD03;110	I/O
107	SA09;110	O	108	SD11;110	I/O
109	GND	-	110	SD00;110	I/O
111	SD13;110	I/O	112	SD15;110	I/O
113	GND	-	114	NC	-
115	NC	-	116	NC	-
117	NC	-	118	NC	-
119	NC	-	120	NC	-
121	GND	-	122	PRDT2;000	I
123	MOUSCK;100	O	124	MOUSDY;100	I
125	NC	-	126	NC	-
127	GND	-	128	LOUTRM	O
129	LOUTRP	O	130	NC	-
131	NC	-	132	NC	-
133	P12V	-	134	SA01;110	O
135	SA09;110	O	136	SA03;110	O
137	GND	-	138	SA05;110	O
139	SA11;110	O	140	SA07;110	O
141	GND	-	142	SA14;110	O
143	SA19;110	O	144	SA12;110	O
145	GND	-	146	SD06;110	I/O
147	SA17;110	O	148	SD04;110	I/O

Table C-8 P-REP connector pin assignments (176-pin) (3/3)

Pin No.	Signal name	I/O	Pin No.	Signal Name	I/O
149	GND	-	150	SD02;110	I/O
151	SD08;110	I/O	152	SD10;110	I/O
153	GND	-	154	SD01;110	I/O
155	SD12;110	I/O	156	SD14;110	I/O
157	GND	-	158	NC	-
159	NC	-	160	NC	-
161	NC	-	162	NC	-
163	NC	-	164	NC	-
165	GND	-	166	PRDT1;000	I
167	EXKBDT;100	I/O	168	EXKBCK;100	O
169	JOYR;000	I	170	NC	-
171	GND	-	172	NC	-
173	LOUTLM	O	174	LOURLP	O
175	NC	-	176	NC	-

### C.9 PJ10 Panel Sensor Connector (2-pin)

Table C-9 Panel sensor connector pin assignments (2-pin)

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

### C.10 PJ12 Ext. Keyboard Connector (6-pin)

Table C-10 Ext. Keyboard connector pin assignments (6-pin)

Pin No.	Signal name	I/O	Pin No.	Signal Name	I/O
01	MOUSE/KB_DATA	I/O	02	EXKBDT;100	I/O
03	GND	-	04	VCC	-
05	MOUSE/KB _CLOCKO	O	06	EXKBCK;100	O

## C.11 PJ13 Keyboard Connector (25-pin)

Table C-11 Keyboard connector pin assignments (25-pin)

Pin No.	Signal name	I/O	Pin No.	Signal Name	I/O
01	KBRT6;100	I	02	KBRT2;100	I
03	KBRT5;100	I	04	KBRT0;100	I
05	KBRT1;100	I	06	KBRT3;100	I
07	KBRT7;100	I	08	KBRT4;100	I
09	KBOT02;000	O	10	KBOT09;000	O
11	KBOT11;000	O	12	KBOT03;000	O
13	KBOT04;000	O	14	KBOT05;000	O
15	KBOT06;000	O	16	KBOT07;000	O
17	KBOT08;000	O	18	KBOT01;000	O
19	KBOT00;000	O	20	IPSY;100	I
21	GND	-	22	IPSX;100	I
23	IPSY;100	I	24	VCC	-
25	IPSX;100	I			

## C.12 PJ14 LED Connector (12-pin)

Table C-12 LED connector pin assignments (12-pin)

Pin No.	Signal name	I/O	Pin No.	Signal Name	I/O
01	GND	-	02	PONGRN;110	O
03	PONORG;110	O	04	DRVLED;110	O
05	CAPLED;110	O	06	ARWLED;110	O
07	NUMLED;110	O	08	CHGGRN;100	O
09	CHGORG;100	O	10	DCGRN;100	O
11	DCORG;100	O	12	PLED	O

### C.13 PJ15 PC Card Connector (140-pin)

Table C-13 PC card connector pin assignments (140-pin) (1/2)

Pin No.	Signal name	I/O	Pin No.	Signal Name	I/O
001	GND	—	002	GND	—
003	GND	—	004	GND	—
005	GND	—	006	GND	—
007	CDA2;000	I	008	SDB2;000	I
009	WPA;100	I	010	WPB;100	I
011	CDA10;100	I/O	012	CDB10;100	I/O
013	CDA02;100	I/O	014	CDB02;100	I/O
015	CDA09;100	I/O	016	CDB09;100	I/O
017	CDA01;100	I/O	018	CDB01;100	I/O
019	CDA08;100	I/O	020	CDB08;100	I/O
021	CDA00;100	I/O	022	CDB00;100	I/O
023	BVDA1;100	I	024	BVDB1;100	I
025	CADA00;100	O	026	CADB00;100	O
027	BVDA2;100	I	028	BVDB2;100	I
029	CADA01;100	O	030	CADB01;100	O
031	REGA;000	O	032	REGB;000	O
033	CADA02;100	O	034	CADB02;100	O
035	NC	—	036	NC	—
037	CADA03;100	O	038	CADB03;100	O
039	WAITA;000	I	040	WAITB;000	I
041	CADA04;100	O	042	CADB04;100	O
043	CRESTA;100	O	044	CRESTB;100	O
045	CADA05;100	O	046	CADB05;100	O
047	NC	—	048	NC	—
049	CADA06;100	O	050	CADB06;100	O
051	CADA25;100	O	052	CADB25;100	O
053	CADA07;100	O	054	CADB07;100	O
055	CADA24;100	O	056	CADB24;100	O
057	CADA12;100	O	058	CADB12;100	O
059	CADA23;100	O	060	CADB23;100	O
061	CADA15;100	O	062	CADB15;100	O
063	CADA22;100	O	064	CADB22;100	O
065	CADA16;100	O	066	CADB16;100	O
067	MCVPPA	O	068	MCVPPB	O
069	MCVPPA	O	070	MCVPPB	O
071	MCVCCA	O	072	MCVCCB	O

Table C-13 PC card connector pin assignments (140-pin) (2/2)

Pin No.	Signal name	I/O	Pin No.	Signal Name	I/O
073	MCVCCA	O	074	MCVCCB	O
075	CADA21;100	O	076	CADB21;100	O
077	BSYA;000	I	078	BSYB;000	I
079	CADA20;100	O	080	CADB20;100	O
081	WEA;000	O	082	WEB;000	O
083	CADA19;100	O	084	CADB19;100	O
085	CADA14;100	O	086	CADB14;100	O
087	CADA18;100	O	088	CADB15;100	O
089	CADA13;100	O	090	CADB13;100	O
091	CADA17;100	O	092	CADB17;100	O
093	CADA08;100	O	094	CADB08;100	O
095	IOWA;000	O	096	CADB09;100	O
097	CADA09;100	O	098	CADB09;100	O
099	IORA;000	O	100	IORB;000	O
101	CADA11;100	O	102	DADB11;000	O
103	NC	—	104	NC	—
105	OEA;000	O	106	OEB;000	O
107	CE2A;000	I/O	108	CE2B;000	I/O
109	CADA10;100	I/O	110	CADB10;100	I/O
111	CDA15;100	I/O	112	CDB15;100	I/O
113	CE1A;000	O	114	CE1B;000	O
115	CDA14;100	I/O	116	CDB14;100	I/O
117	CDA07;100	I/O	118	CDB07;100	I/O
119	CDA13;100	I/O	120	CDB13;100	I/O
121	CDA06;100	I/O	122	CDB06;100	I/O
123	CDA12;100	I/O	124	CDB12;100	I/O
125	CDA05;100	I/O	126	CDB05;100	I/O
127	CDA11;100	I/O	128	CDB11;100	I/O
129	CDA04;100	I/O	130	CDB04;100	I/O
131	CDA1;000	I/O	132	CDB1;000	I/O
133	CDA03;100	I/O	134	CDB03;100	I/O
135	GND	—	136	GND	—
137	GND	—	138	GND	—
139	GND	—	140	GND	—



## C.14 PJ16 VGA Connector (120-pin)

Table C-14 VGA connector pin assignments (120-pin) (1/2)

Pin No.	Signal name	I/O	Pin No.	Signal Name	I/O
01	P12V	O	02	BE3;000	O
03	B5V	O	04	BE2;000	O
05	B5V	O	06	ADS;000	O
07	B5V	O	08	RDYVLI;000	O
09	FLHIGH	O	10	VCC	-
11	CFLPWR	O	12	VCC	-
13	GND	-	14	VCC	-
15	VCC	-	16	FLV0	O
17	VCC	-	18	RDYVLO;000	I
19	VCC	-	20	CSVLBI;000	I
21	GND	-	22	CLKVLO;100	O
23	FLV1	O	24	WR;000	O
25	RSTVGA;000	O	26	GND	-
27	PDNVGA;000	O	28	D23;100	I/O
29	CLKVGA;100	O	30	D22;100	I/O
31	GND	-	32	D21;100	I/O
33	RESET;000	O	34	D20;100	I/O
35	PANEL1;100	I	36	GND	-
37	PANEL0;100	I	38	D19;100	I/O
39	FLTEN;000	O	40	D18;100	I/O
41	GND	-	42	D17;100	I/O
43	BE0;000	O	44	D16;100	I/O
45	BE1;000	O	46	GND	-
47	MIO;000	O	48	D24;100	I/O
49	A06;100	I	50	D25;100	I/O
51	GND	-	52	D26;100	I/O
53	A06;100	I	54	D27;100	I/O
55	A07;100	I	56	GND	-
57	A08;100	I	58	D28;100	I/O
59	A09;100	I	60	D29;100	I/O
61	GND	-	62	D30;100	I/O
63	A10;100	I	64	D31;100	I/O
65	A11;100	I	66	GND	-
67	A02;100	I	68	D08;100	I/O
69	A16;100	I	70	D09;100	I/O
71	GND	-	72	D10;100	I/O
73	A17;100	I	74	D11;100	I/O

Table C-14 VGA connector pin assignments (120-pin) (2/2)

Pin No.	Signal name	I/O	Pin No.	Signal Name	I/O
75	A18;100	I	76	GND	-
77	A19;100	I	78	D12;100	I/O
79	A20;100	I	80	D13;100	I/O
81	GND	-	82	D14;100	I/O
83	A03;100	I	84	D15;100	I/O
85	A04;100	I	86	GND	-
87	A05;100	I	88	D04;100	I/O
89	A12;100	I	90	D03;100	I/O
91	GND	-	92	D02;100	I/O
93	A13;100	I	94	D01;100	I/O
95	A14;100	I	96	GND	-
97	A15;100	I	98	D00;100	I/O
99	A23;100	I	100	D07;100	I/O
101	GND	-	102	D06;100	I/O
103	A24;100	I	104	D05;100	I/O
105	A25;100	I	106	GND	-
107	A22;100	I	108	CHSYNC;100	I
109	A21;100	I	110	CVSYNC;100	I
111	GND	-	112	GND	-
113	B3V	-	114	ARED;100	I
115	B3V	-	116	AGREEN;100	I
117	B3V	-	118	ABLUE;100	I
119	GND	-	120	GND	-

## Appendix D Keyboard Scan/Character Codes

Table D-1 Scan codes (set 1 and set 2) (1/3)

Cap No.	Keytop	Code set 1		Code set 2		Note
		Make	Break	Make	Break	
01	' ~	29	A9	0E	F0 0E	
02	1 !	02	82	16	F0 16	
03	2 @	03	83	1E	F0 1E	
04	3 #	04	84	26	F0 26	
05	4 \$	05	85	25	F0 25	
06	5 %	06	86	2E	F0 2E	
07	6 ^	07	87	36	F0 36	
08	7 &	08	88	3D	F0 3D	*2
09	8 *	09	89	3E	F0 3E	*2
10	9 (	0A	8A	46	F0 46	*2
11	0 )	0B	8B	45	F0 45	
12	- _	0C	8C	4E	F0 4E	
13	= +	0D	8D	55	F0 55	
15	BkSp	0E	8E	66	F0 66	
16	Tab	0F	8F	0D	F0 0D	
17	Q	10	90	15	F0 15	
18	W	11	91	1D	F0 1D	
19	E	12	92	24	F0 24	
20	R	13	93	2D	F0 2D	
21	T	14	94	2C	F0 2C	
22	Y	15	95	35	F0 35	
23	U	16	96	3C	F0 3C	*2
24	I	17	97	43	F0 43	*2
25	O	13	98	44	F0 44	*2
26	P	19	99	4D	F0 4D	*2
27	[ {	1A	9A	54	F0 54	
28	] }	1B	9B	5B	F0 5B	
29 (42)	\	2B	AB	5D	F0 5D	*5
30	Caps Lock	3A	BA	58	F0 58	
31	A	1E	9E	1C	F0 1C	
32	S	1F	9F	1B	F0 1B	
33	D	20	A0	23	F0 23	
34	F	21	A1	2B	F0 2B	
35	G	22	A2	34	F0 34	
36	H	23	A3	33	F0 33	
37	J	24	A4	3B	F0 3B	*2
38	K	25	A5	42	F0 42	*2
39	L	26	A6	4B	F0 4B	*2
40	; :	27	A7	4C	F0 4C	*2

Table D-1 Scan codes (set 1 and set 2) (2/3)

Cap No.	Keytop	Code set 1		Code set 2		Note
		Make	Break	Make	Break	
41	' "	28	A8	52	F0 52	
43	Enter	1C	9C	5A	F0 5A	
44	Shift (L)	2A	AA	12	F0 12	
45	No.102 key	56	D6	61	F0 61	
46	Z	2C	AC	1A	F0 1A	
47	X	2D	AD	22	F0 22	
48	C	2E	AE	21	F0 21	
49	V	2F	AF	2A	F0 2A	
50	B	30	B0	32	F0 32	
51	N	31	B1	31	F0 31	
52	M	32	B2	3A	F0 3A	*2
53	, <	33	B3	41	F0 41	*2
54	. >	34	B4	49	F0 49	*2
55	/ ?	35	B5	4A	F0 4A	*2
57	Shift (R)	36	B6	59	F0 59	
58	Ctrl	1D	9D	14	F0 14	*3
60	Alt (L)	38	B8	11	F0 11	*3
61	Space	39	B9	29	F0 29	
62	ALT (R)	E0 38	E0 B8	E0 11	E0 F0 11	
75	Ins	E0 52	E0 D2	E0 70	E0 F0 70	*1
76	Del	E0 53	E0 D3	E0 71	E0 F0 71	*1
79	←	E0 4B	E0 CB	E0 6B	E0 F0 6B	*1
80	Home	E0 47	E0 C7	E0 6C	E0 F0 6C	*1
81	End	E0 4F	E0 CF	E0 69	E0 F0 69	*1
83	↑	E0 48	E0 C8	E0 75	E0 F0 75	*1
84	↓	E0 50	E0 D0	E0 72	E0 F0 72	*1
85	PgUp	E0 49	E0 C9	E0 7D	E0 F0 7D	*1
86	PgDn	E0 51	E0 D1	E0 7A	E0 F0 7A	*1
89	→	E0 4D	E0 CD	E0 74	E0 F0 74	*1
110	Esc	01	81	76	F0 76	

Table D-1 Scan codes (set 1 and set 2) (3/3)

Cap No.	Keytop	Code set 1		Code set 2		Note
		Make	Break	Make	Break	
112	F1	3B	3B	05	F0 05	
113	F2	3C	BC	06	F0 06	
114	F3	3D	BD	04	F0 04	
115	F4	3E	BE	0C	F0 0C	
116	F5	3F	BF	03	F0 03	
117	F6	40	C0	0B	F0 0B	
118	F7	41	C1	83	F0 83	
119	F8	42	C2	0A	F0 0A	
120	F9	43	C3	01	F0 01	
121	F10	44	C4	09	F0 09	
122	F11	57	D7	78	F0 78	*3
123	F12	58	D8	07	F0 07	*3
124	PrintSc	*6	*6	*6	*6	*6
126	Pause	*7	*7	*7	*7	*7
202	Fn	—	—	—	—	*4

**Notes:**

- \*1: Scan codes differ by mode.
- \*2: Scan codes differ by overlay function.
- \*3 Combination with **Fn** key makes different codes.
- \*4: **Fn** key does not generate a code by itself.
- \*5: This key corresponds to key No. 42 in 102-key model.
- \*6: Refer to Table D-6, scan codes with **Ctrl** key.
- \*7: Refer to Table D-7, scan codes with **Alt** key.

Table D-2 Scan codes with left Shift key

Cap No.	Key top	Code set 1		Code set 2	
		Make	Break	Make	Break
75	INS	E0 AA E0 52	E0 D2 E0 2A	E0 F0 12 E0 70	E0 F0 70 E0 12
76	DEL	E0 AA E0 53	E0 D3 E0 2A	E0 F0 12 E0 71	E0 F0 71 E0 12
79	←	E0 AA E0 4B	E0 CB E0 2A	E0 F0 12 E0 6B	E0 F0 6B E0 12
80	Home	E0 A E0 47	E0 C7 E0 2A	E0 F0 12 E0 6C	E0 F0 6C E0 12
81	End	E0 AA E0 4F	E0 CF E0 2A	E0 F0 12 E0 69	E0 F0 69 E0 12
83	↑	E0 AA E0 48	E0 C8 E0 2A	E0 F0 12 E0 75	E0 F0 75 E0 12
84	↓	E0 AA E0 50	E0 D0 E0 2A	E0 F0 12 E0 72	E0 F0 72 E0 12
85	PgUp	E0 AA E0 49	E0 C9 E0 2A	E0 F0 12 E0 7D	E0 F0 7D E0 12
86	PgDn	E0 AA E0 51	E0 D1 E0 2A	E0 F0 12 E0 7A	E0 F0 7A E0 12
89	→	E0 AA E0 4D	E0 CD E0 2A	E0 F0 12 E0 74	E0 F0 74 E0 12

*Note: The table above shows scan codes with the left **Shift** key. In combination with the right **Shift** key, scan codes are changed as below:*

	<i>With left Shift</i>	<i>With right Shift</i>
Set 1	E0 AA	E0 B6
	E0 2A	E0 36
Set 2	E0 F0 12	E0 F0 59
	E0 12	E0 59

Table D-3 Scan codes in Numlock mode

Cap No.	Key top	Code set 1		Code set 2	
		Make	Break	Make	Break
75	INS	E0 2A E0 52	E0 02 E0 AA	E0 12 E0 70	E0 F0 70 E0 F0 12
76	DEL	E0 2A E0 53	E0 D3 E0 AA	E0 12 E0 71	E0 F0 71 E0 F0 12
79	←	E0 2A E0 4B	E0 CB E0 AA	E0 12 E0 6B	E0 F0 6B E0 F0 12
80	Home	E0 2A E0 47	E0 C7 E0 AA	E0 12 E0 6C	E0 F0 6C E0 F0 12
81	End	E0 2A E0 4F	E0 CF E0 AA	E0 12 E0 69	E0 F0 69 E0 F0 12
83	↑	E0 2A E0 48	E0 C8 E0 AA	E0 12 E0 75	E0 F0 75 E0 F0 12
84	↓	E0 2A E0 50	E0 D0 E0 AA	E0 12 E0 72	E0 F0 72 E0 F0 12
85	PgUp	E0 2A E0 49	E0 C9 E0 AA	E0 12 E0 7D	E0 F0 7D E0 F0 12
86	PgDn	E0 2A E0 51	E0 D1 E0 AA	E0 12 E0 7A	E0 F0 7A E0 F0 12
89	→	E0 2A E0 4D	E0 CD E0 AA	E0 12 E0 74	E0 F0 74 E0 F0 12

Table D-4 Scan codes with Fn key

Cap No.	Keypop	Code set 1		Code set 2		
		Make	Break	Make	Break	
43	ENT	E0 1C	E0 9C	E0 5A	E0 F0 5A	
58	CTRL	E0 1D	E0 9D	E0 14	E0 F0 14	
60	LALT	E0 38	E0 B8	E0 11	E0 F0 11	
121	ARROW	05	C5	77	F0 77	
122	NUMERIC	05	C5	7E	F0 7E	

Table D-5 Scan codes in Overlay mode

Cap No.	Keypop	Code set 1		Code set 2		
		Make	Break	Make	Break	
08	7 (7)	47	C7	6C	F0 6C	
09	8 (8)	48	C8	75	F0 75	
10	9 (9)	49	C9	7D	F0 7D	
11	0 (*)	37	B7	7C	F0 7C	
23	U (4)	4B	CB	6B	F0 6B	
24	I (5)	4C	CC	73	F0 73	
25	O (6)	4D	CD	74	F0 74	
26	P (-)	4A	CA	7B	F0 7B	
37	J (1)	4F	CF	69	F0 69	
38	K (2)	50	D0	72	F0 72	
39	L (3)	51	D1	7A	F0 7A	
40	; (+)	4E	CE	79	F0 79	
52	M (0)	52	D2	70	F0 70	
53	, (.)	33	B3	41	F0 41	
54	/ (/)	53	D3	71	F0 71	
55	/ (/)	E0 35	E0 B5	40 4A	E0 F0 4A	

Table D-6 Scan codes with Ctrl key

Key top	Shift	Code set 1		Code set 2			
		Make	Break	Make	Break		
Prt Sc	Common	E0 2A E0 37	E0 B7 E0 AA	E0 12 E0 7C	E0 F0 7C	E0 F0 12	E0 F0 12
	Ctrl*	E0 37	E0 B7	E0 7C	E0 F0 7C		
	Shift*	E0 37	E0 B7	E0 7C	E0 F0 7C		
	Alt*	54	D4	84	F0 B4		

\*: This key generates only make codes.

Table D-7 Scan codes with Alt key

Key top	Shift	Code set 1			Code set 2			
		Make	Break		Make	Break		
Pause	Common	E1 ID 45	E1 SD C5	E1 14 77	E1 F0 14	F0 77		
	Ctrl*	E0 46	E0 C6	E0 7E	E0 F0 7E			

\*: This key generates only make codes.





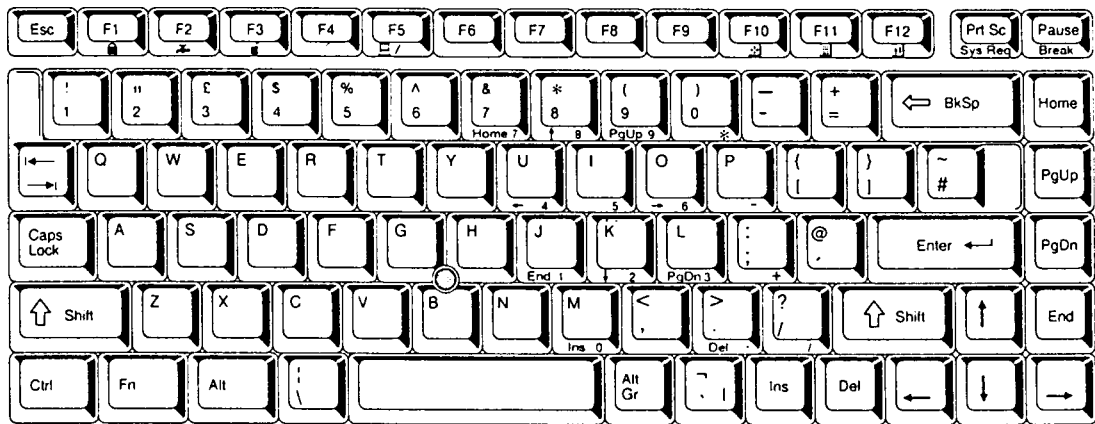
## Appendix E Key Layouts

### E.1 United States (US) Keyboard



*Figure E-1 US keyboard*

### E.2 United Kingdom (UK) Keyboard



*Figure E-2 UK keyboard*

### E.3 German (GR) Keyboard

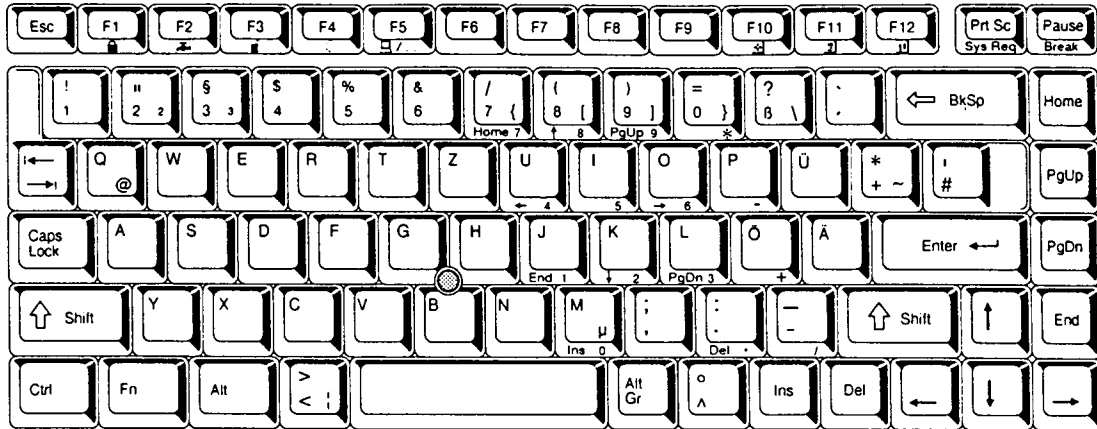


Figure E-3 GR keyboard

### E.4 French (FR) Keyboard

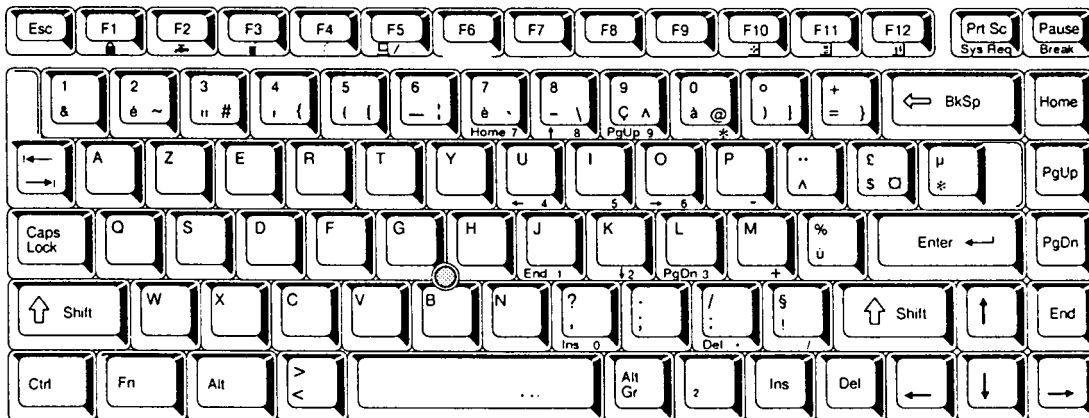


Figure E-4 FR keyboard

## E.5 Spanish (SP) Keyboard

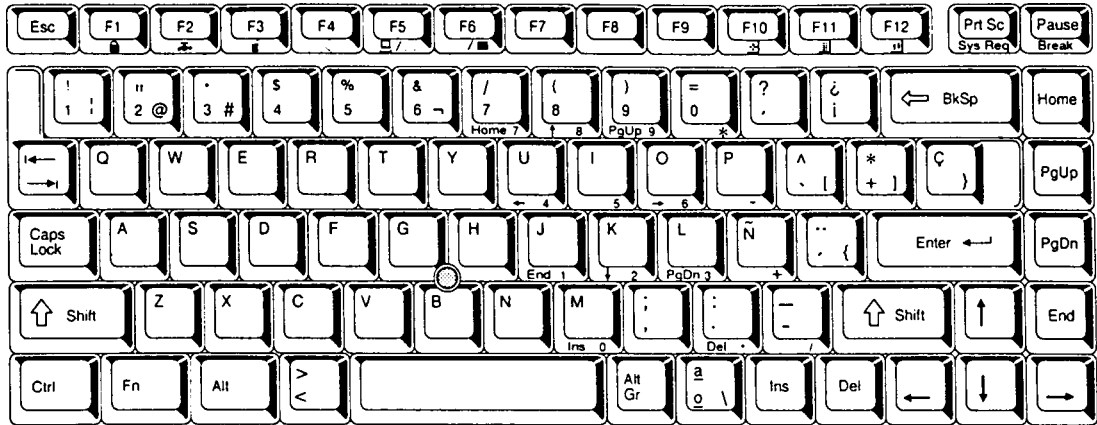


Figure E-5 SP keyboard

## E.6 Italian (IT) Keyboard

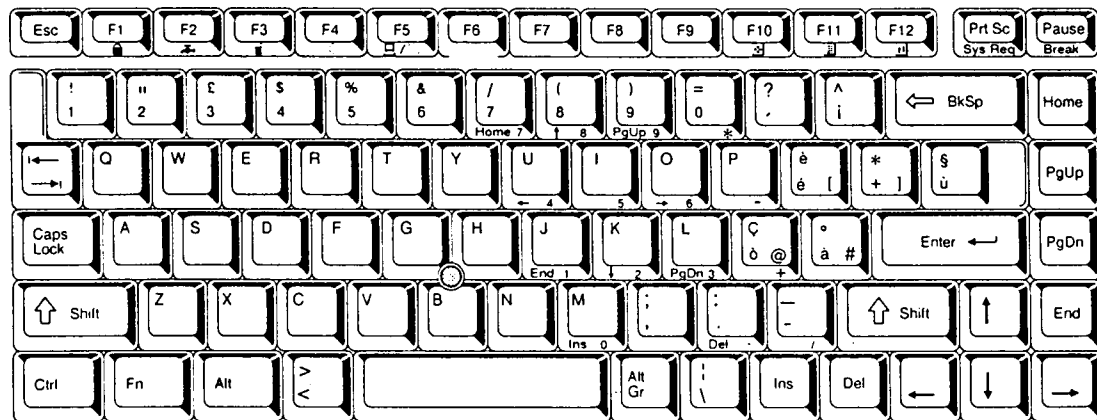


Figure E-6 IT keyboard

## E.7 Scandinavian (SC) Keyboard

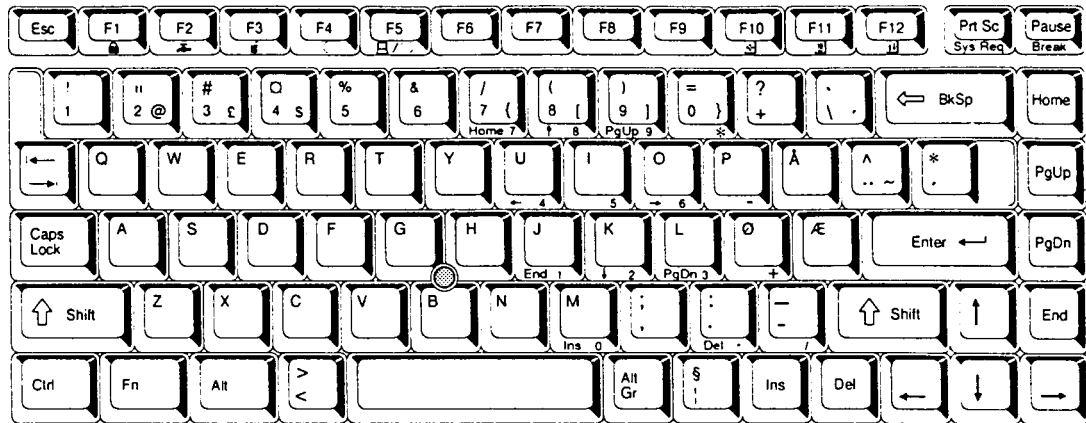


Figure E-7 SC keyboard

## E.8 Swiss-German (SL) Keyboard

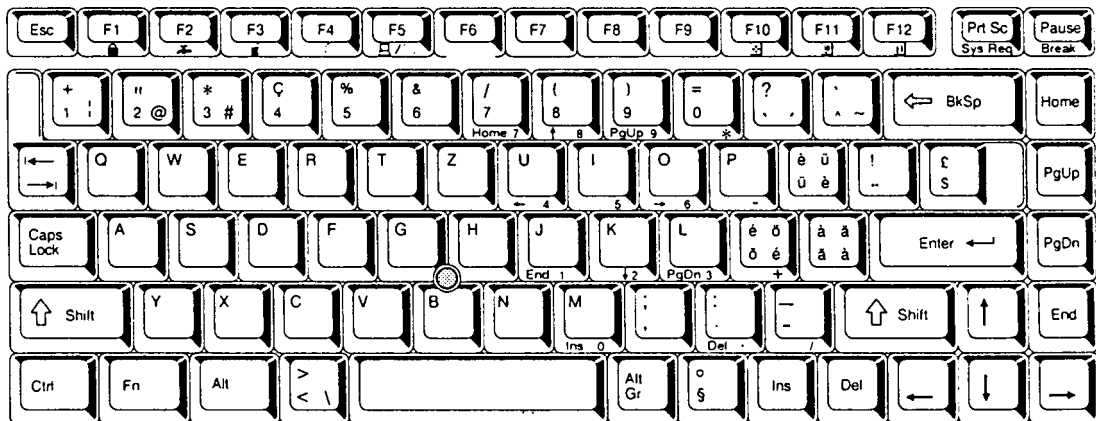


Figure E-8 SL keyboard

## Appendix F Wiring Diagrams

### F.1 Printer Wraparound Connector

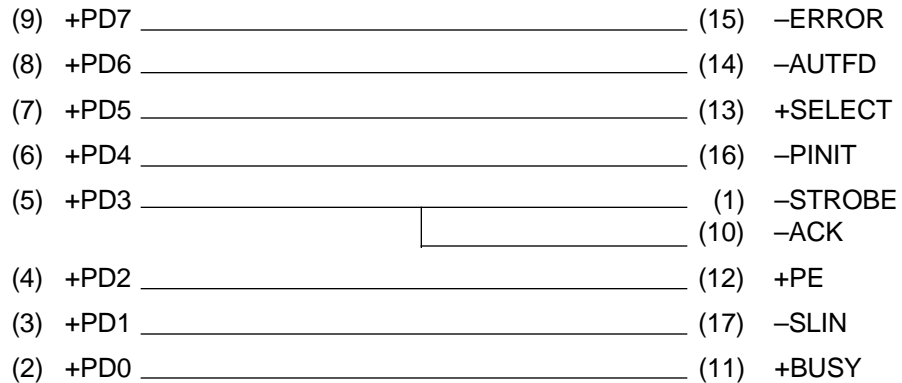


Figure F-1 Printer wraparound connector

### F.2 RS-232-C Wraparound Connector

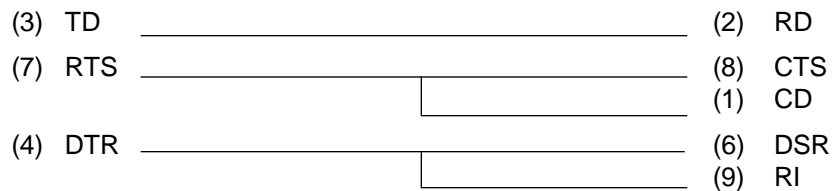


Figure F-2 RS-232-C wraparound connector

### F.3 RS-232-C Direct Cable (9-Pin to 9-Pin)

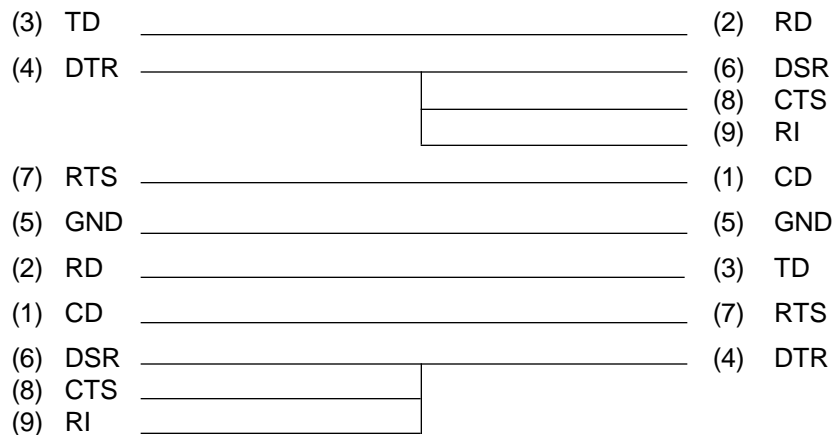
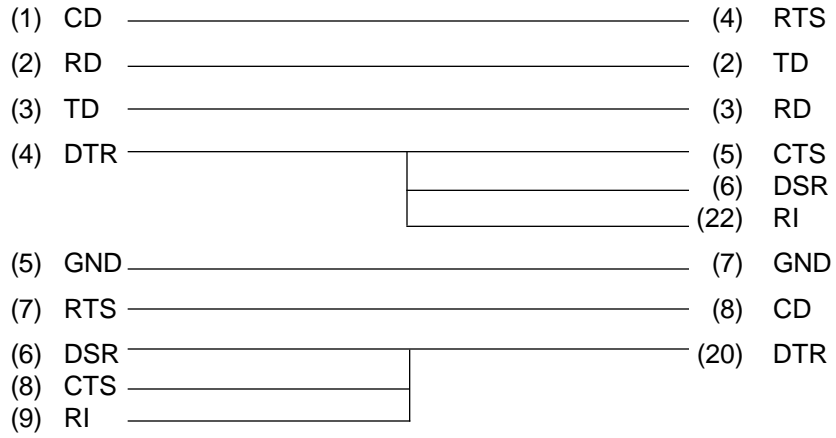


Figure F-3 RS-232-C direct cable (9-pin to 9-pin)

#### F.4 RS-232-C Direct Cable (9-Pin to 25-Pin)



*Figure F-4 RS-232-C direct cable (9-pin to 25-pin)*

## Appendix G BIOS Rewrite Procedures

This appendix explains how to rewrite the system BIOS program when you update the system BIOS.

### Tools

To rewrite the BIOS, you need the following tool:

- The Diagnostics Disk for the 110 series.

### Rewriting the BIOS

1. Set the system to Boot mode.
2. Turn the computer off.
3. Remove the external cable and PC card.
4. While holding down the **F12** key, turn the computer on. Continue to hold down the key until the system speaker beeps.
5. When prompted, insert the Diagnostics Disk into the FDD. Press **Enter** to start BIOS rewriting.
6. When BIOS rewriting is finished, eject the Diagnostics Disk. Press the reset switch to restart the system.

