

## 1.1 Features

The Toshiba T1960CS and T1960CT are two of the lightest and most advanced portable computers available. Utilizing advanced technology and high-speed components, the T1960CS/T1960CT offer excellent display legibility, battery operation and IBM PC/AT compatibility. The T1960 Series of computers consist of the following features:

- ❑ Microprocessor

The SL Enhanced Intel 486DX2-50 microprocessor operates at 50 MHz, 3.3 Volts.

- ❑ Math co-processor

A math co-processor is stored in the i486DX2 microprocessor.

- ❑ Cache memory

8 KB of cache memory is stored in the i486DX2 microprocessor.

- ❑ Disk storage

The internal 200 Megabyte (MB) Hard Disk Drive (HDD) has an average access time of 13 milliseconds, while the 320 MB HDD has an average of 12 milliseconds. The 3.5-inch Floppy Disk Drive (FDD) supports 2HD floppy disks (1.44 MB) and 2DD floppy disks (720 Kbytes).

- ❑ Memory

The T1960CS/T1960CT comes standard with 4 MB of CMOS Random Access Memory (RAM) 3.3 Volts. This includes 640 KB of conventional memory and 3,456 KB of extended memory which can be utilized as expanded memory compatible with the Lotus/Intel/Microsoft Expanded Memory Specifications (LIM-EMS).

- ❑ STN color LCD (T1960CS)

The high-resolution, Supertwist Nematic (STN) color Liquid Crystal Display (LCD) displays 640x480 pixels with 226,981 colors for both graphics and characters. The T1960CS internal display controller supports Video Graphics Array (VGA) functions on the internal display devices.

- ❑ TFT color LCD (T1960CT)

The high-resolution, Thin Film Transistor (TFT) color LCD displays 640x480 pixels with 262,144 colors for both graphics and characters. The T1960CT internal display controller supports VGA functions for internal display and Super VGA (SVGA) for external display.

Keyboard

The easy-to-use 82/84-key enhanced keyboard with full-size keys and standard spacing is compatible with IBM standard software.

Batteries

The T1960CS/T1960CT has three different batteries: a main battery, a backup battery, and a Real Time Clock (RTC) battery.

Personal Computer Memory Card International Association (PCMCIA) card slot

The PCMCIA slot enables you to install a MiNC Toshiba card modem or other industry-standard PCMCIA release 2.0 card.

Parallel port

The Centronics-compatible parallel interface port serves two purposes: the port can be used to connect a Centronics-compatible printer or an external 5 1/4" floppy disk drive.

RS-232-C port

The RS-232-C port is a 9-pin serial interface port.

Mouse port

The 6-pin mouse port on the back supports an IBM PS/2 mouse.

Keyboard port

The 6-pin keyboard port on the back supports an IBM PS/2 keyboard.

Microsoft BallPoint Mouse V2.0 with Quick Port (BPQP) connection

The BPQP2 port is located on the right side of the computer.

RGB port

The 15-pin RGB port on the back supports an external video display.

Memory card slot

The memory card slot enables you to install an optional Toshiba memory card.

The T1960CS/T1960CT Personal Computer is shown in Figure 1-1, and its system configuration is illustrated in Figure 1-2.

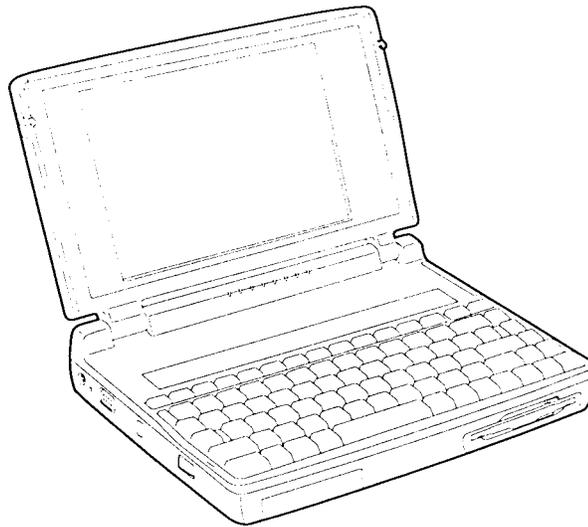


Figure 1-1 T1960CS/T1960CT Personal Computer

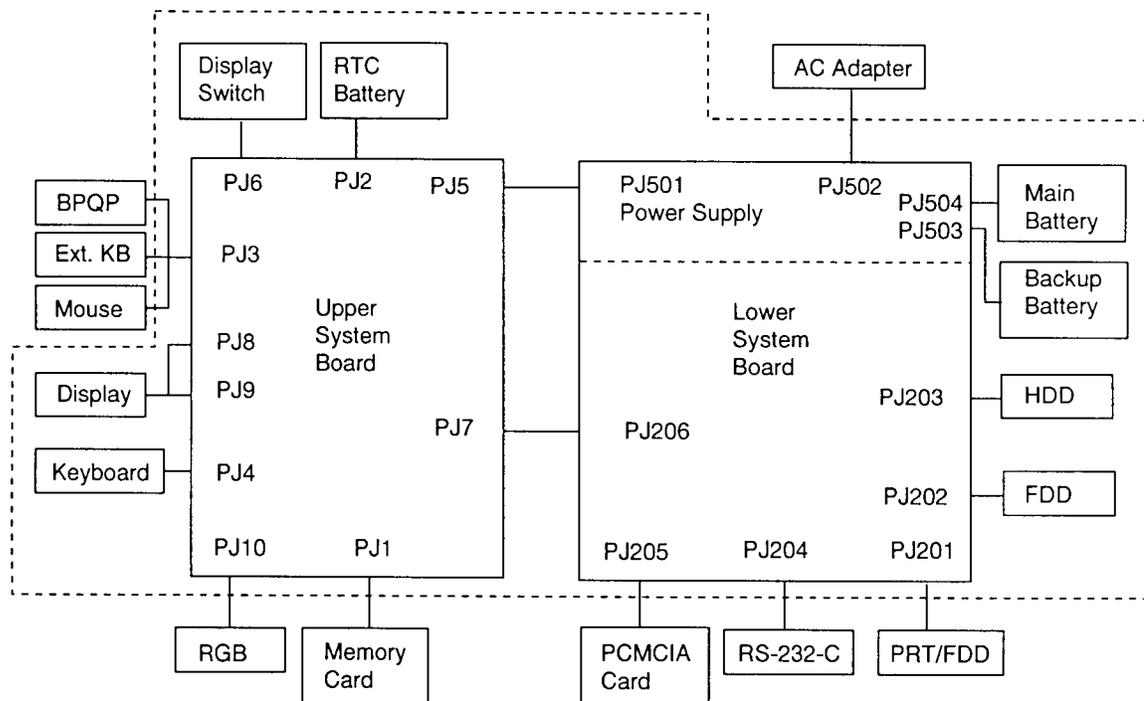


Figure 1-2 T1960CS/T1960CT System Unit Configuration

## 1.2 System Unit Block Diagram

Figure 1-3 is a block diagram of the T1960CS/T1960CT system unit.

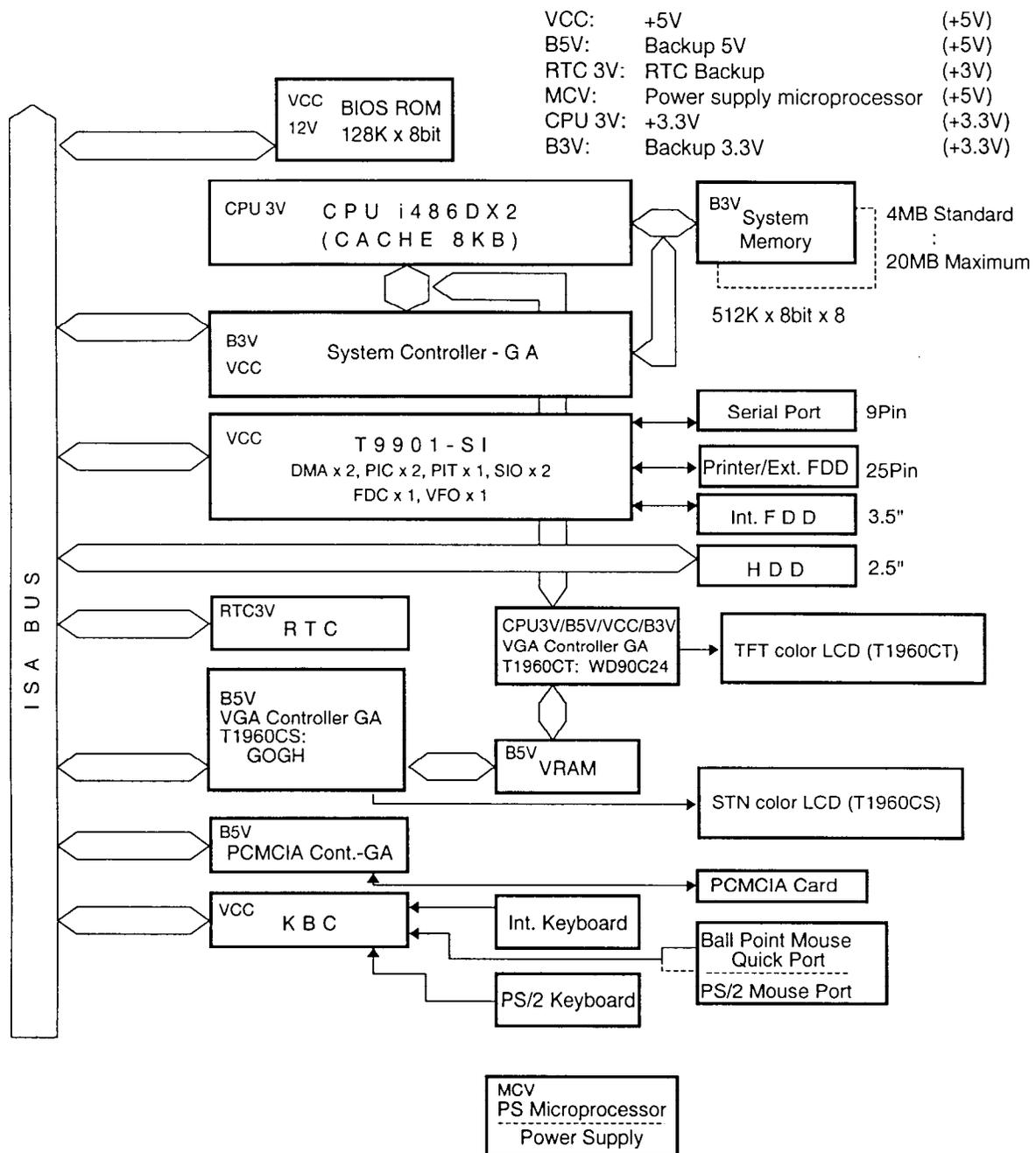


Figure 1-3 T1960CS/T1960CT System Board Block Diagram

The T1960CS/T1960CT system board is composed of the following major components:

- ❑ An i486DX2-50 CPU
- ❑ Super Integration (SI) T9901, which stores the following components:
  - Two Direct Memory Access Controllers (DMAC): 82C37
  - Two Programmable Interrupt Controllers (PIC): 82C59
  - One Programmable Interval Timer (PIT): 82C54
  - One Floppy Disk Controller (FDC): TC8565
  - One Serial Input/Output Controller (SIO): TC8570
  - One Variable Frequency Oscillator (VFO): TC8568
  - One I/O Controller
  - One Printer Port Controller
  - One Speaker Controller

- ❑ A Real Time Clock (RTC)

A T9934 chip with 128 bytes of memory is used. Fourteen bytes are used for the calendar and clock, while the remaining 114 bytes are used for the system configuration data.

OSC (X3) generates 32.768 KHz for RTC.

- ❑ A Keyboard Controller (KBC)

An M37452M4 chip is used.

The KBC, which includes the keyboard scan controller and keyboard interface controller, controls the internal keyboard, external keyboard port, PS/2 mouse port, and Ball Point Quick Port.

- ❑ Memory

Standard RAM: 4 MB

Cache memory: 8 KB (inside CPU)

BIOS ROM: 128 KB (96 KB are used)

The ROM contains the Initial Reliability Test (IRT), Basic Input/Output System (BIOS), and video BIOS.

Video RAM: 256 KB

Optional memory cards expand memory to a maximum of 20 MB.

- ❑ VGA display controller

T1960CS (GOGH): This controller controls the internal and external VGA compatible display.

T1960CT (WD90C24): This controller controls the internal VGA display and external SVGA compatible display.

- ❑ The Clock Generator receives 14.31818 MHz (X2) and generates the following frequencies:
  - 25 MHz for the CPU (CPU operates at 50MHz.)
  - 14.7456 MHz for the COM
  - 24 MHz for the FDC and VFO
  - 16 MHz is used for GA
  - 14.31818 MHz is used for T9901 (SI)

- ❑ Gate Array

System Controller Gate Array

This gate array has the following functions:

- CPU Controller
- Memory Controller
  - DRAM Controller
  - Compatible Bus Interface Controller
- SMI Controller
- VL Bus Controller
- Bus Controller
  - Compatible Bus Interface Controller
  - Compatible Access Controller
  - DMAC Controller
  - I/O Controller
- Address Latch Controller
  - 32-Bit to 16-Bit Controller
  - Address Latch
  - DMA Address Generator
  - Refresh Address Generator
- I/O Register
  - Compatible I/O Port
  - Saving the data of the Register (in Resume Mode) Controller
  - Toshiba Special Register
- 50 MHz/25 MHz Controller
- Data Bus Change Controller
- Data Latch

PCMCIA Controller Gate Array

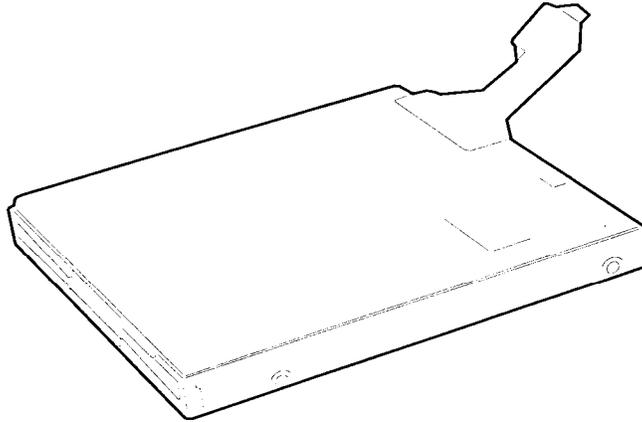
This gate array has the following functions:

- Memory Card Controller
  - PCMCIA IC Card Controller
  - Toshiba Modem Card Controller

### 1.3 3.5-inch Floppy Disk Drive

The T1960CS/T1960CT 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, and its specifications are listed in Table 1-1.



*Figure 1-4 3.5-inch FDD*

*Table 1-1 3.5-inch FDD Specifications*

Item	2 MB mode	1 MB mode
Storage capacity (KB)		
Unformatted	2,000	1,000
Formatted	1,311	737
Number of heads	2	2
Number of cylinders	80	80
Access time (ms)		
Track to track	3	3
Average	181	181
Head settling time	15	15
Recording track density (tpi)	135	135
Data transfer rate (Kbps)	500	250
Rotation speed (rpm)	300	300
Recording method	Modified Frequency Modulation (MFM)	

## 1.4 2.5-inch 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 T1960CS/T1960CT supports a 200 and a 320 MB HDD.

The HDD is shown in Figure 1-5, and its specifications are listed in Table 1-2.

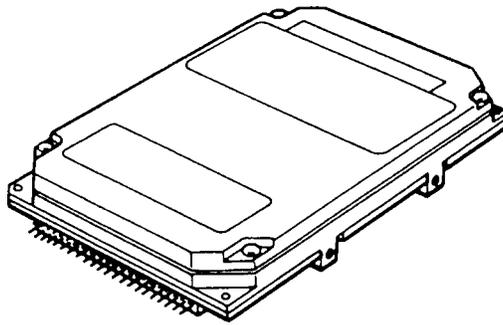


Figure 1-5 2.5-inch HDD

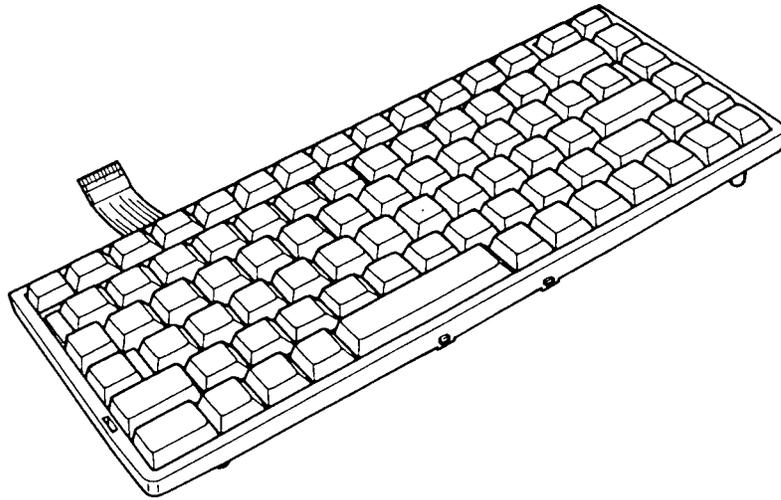
Table 1-2 2.5-inch HDD Specifications

Item	200MB	320MB
	(MK1624FCV)	(MK2326FC)
Storage capacity (MB) Formatted	213.0	340.0
Number of disks	2	3
Data heads	4	6
Data surfaces	4	6
Tracks per surface	1,560	1,830
Sectors per track	–	–
Bytes per sector	512	512
Access time (ms)		
Track to track	3	3
Average	13	12
Maximum	25	25
Rotation speed (rpm)	4,000	4,200
Data transfer rate (bps) To/from media	18.9 to 31.6 M	18.7 to 29.6 M
Interleave	1:1	1:1
Recording method	1-7 RLL	1-7 RLL

## 1.5 Keyboard

The 82-(USA) or 84-(European) keyboard is mounted on the T1960CS/T1960CT's system unit. The keyboard is connected to the keyboard controller on the system board through a 19-pin flat cable. The keyboard is shown in Figure 1-6.

See Appendix F for optional keyboard configurations.



*Figure 1-6 Keyboard*

## 1.6 STN Color LCD (T1960CS)

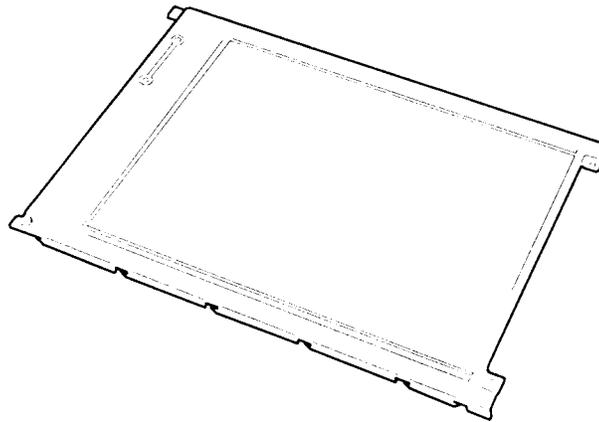
The STN Color Liquid Crystal Display (LCD) contains an LCD module, a Fluorescent Lamp (FL), and an FL inverter board.

### 1.6.1 STN Color LCD Module

The T1960CS STN color LCD is backlit and supports 640x480 pixels with a Video controller. The controller includes the functions of Video Graphics Array (VGA).

The LCD receives vertical and horizontal synchronizing signals, 16-bit data signal, 8-bit upper block data signal, 8-bit lower block data signal, and shift clock for data transmission. All signals are CMOS-level compatible.

The STN LCD is shown in Figure 1-7, and its specifications are listed in Table 1-3.



*Figure 1-7 STN Color LCD*

*Table 1-3 STN Color LCD Specifications*

Item		Specifications
Number of Dots	(dots)	640 x 480
Dot pitch	(mm)	0.3 (W) x 0.3 (H)
Display area	(mm)	195 (W) x 147 (H)
Contrast		18:1 (Typically)
FL current	(mA)	5.0 x 2
FL frequency	(KHz)	47

## 1.6.2 STN Color Fluorescent Lamp (FL) Inverter Board

The FL inverter board supplies high frequency current to light the LCD's Fluorescent Lamp. Specifications for the FL inverter are listed in Table 1-4.

*Table 1-4 STN Color FL Inverter Board Specifications*

Item		Specifications
Input	Voltage (VDC)	5
	Power (W)	6
Output	Voltage (VAC)	1,000
	Current (mA)	5.0 x 2
	Frequency (KHz)	42

## 1.7 TFT Color LCD (T1960CT)

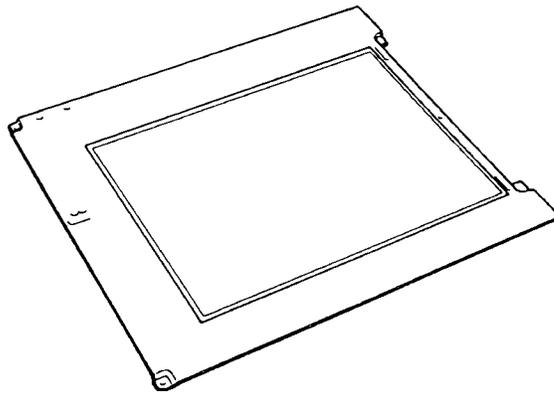
The TFT Color Liquid Crystal Display (LCD) contains an LCD module, a Fluorescent Lamp (FL), and an FL inverter board.

### 1.7.1 TFT Color LCD Module

The T1960CT TFT color LCD supports 640x480 pixels with an internal display controller and 512 colors for graphics and characters. The controller includes the functions of Video Graphics Array (VGA) and Super VGA (SVGA) for external display.

The LCD receives 9-bit data signals, data enable signals, and shift clock for data transmission. All signals are CMOS-level compatible.

The TFT LCD is shown in Figure 1-8, and its specifications are listed in Table 1-5.



*Figure 1-8 TFT Color LCD*

*Table 1-5 TFT Color LCD Specifications*

Item		Specifications
Number of dots	(dots)	640 x 480
Dot pitch	(mm)	0.27 (W) x 0.27 (H)
Display area	(mm)	171 (W) x 130 (H)
Contrast		60:1 (minimum)
FL current	(mA)	5.0
FL frequency	(KHz)	47

### 1.7.2 TFT Color Fluorescent Lamp (FL) Inverter Board

The FL inverter board supplies high frequency current to light the LCD's Fluorescent Lamp. Specifications for the FL inverter are listed in Table 1-6.

*Table 1-6 FL Inverter Board Specifications*

Item		Specifications
Input	Voltage (VDC)	5
	Power (W)	3
Output	Voltage (VAC)	1,100
	Current (mA)	5.0
	Frequency (KHz)	47

## 1.8 Power Supply

The power supply supplies five kinds of voltages to the T1960CS/T1960CT system board. The T1960CS/T1960CT power supply board has one microprocessor and operates at 500 KHz. The board performs the following functions:

1. Determines if the AC adapter or battery is connected to the computer.
2. Detects DC output and circuit malfunctions.
3. Controls the LED indicator 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*

Use for	Name	DC Voltage (V)	Regulation Tolerance (%)	Maximum Current (mA)	Ripple (mV)
System logic, FDD, HDD, Display	VCC	+5	±5	3,500	100
RS-232-C Flash ROM	12V	+12	±5	120	240
RAM, CPU	B3V	+3.3	±5	755	66
RS-232-C	N9V	-7 to -12.6	-	10	-

## 1.9 Batteries

The T1960CS/T1960CT has three types of batteries:

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

Specifications for these batteries are listed in Table 1-8.

*Table 1-8 Battery Specifications*

Battery	Material	Output Voltage	Capacity
Main battery	Nickel Metal Hydride	12 V	2,400 mAH
Backup battery	Nickel Metal Hydride	1.2 V	1,100 mAH
RTC battery	Lithium-Vanadium	3.0 V	50 mAH

### 1.9.1 Main Battery

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

#### Battery Indicator

The Battery indicator is located on the top cover of the T1960CS/T1960CT. The indicator shows the status of the removable battery pack, power supply and AC adapter. The status of each can be determined by color:

- Orange    The battery is being charged. (AC adapter is attached.)
- Green     The battery is fully charged. (AC adapter is attached.)
- No light    The AC adapter is disconnected from the computer, or the AC adapter is connected, but it cannot charge the battery for one of the following reasons:
  - The battery is extremely hot. Allow the computer and the battery to reach room temperature before attempting to charge the battery.
  - The battery is almost fully discharged. The battery will not begin charging immediately in this state, it will begin charging a few minutes after the AC adapter is connected.
  - The AC adapter is not receiving power.

## 1.9.2 Battery Charging Control

Battery charging is controlled by a 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 adapter and battery are attached to the computer. The system charges the battery using quick charge or trickle charge.

### ❑ Quick Battery Charge

When the AC adapter 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 Charges of the Main Battery*

Charge	Charging Time
Quick charge (power off)	About 1.4 hours
Trickle charge (power on)	About 48 hours

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

1. The battery becomes fully charged
2. The AC adapter or battery is removed.
3. The battery or AC adapter output voltage is abnormal.
4. The charge current is abnormal.

### ❑ Trickle Battery Charge

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

### 1.9.3 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 adapter > Main battery > Backup battery

The backup battery is charged by the main battery or AC adapter when the system is powered on. Table 1-10 shows the charging time and data preservation period of the backup battery.

*Table 1-10 Backup Battery Charging/Data Preservation Time*

<b>Backup Battery</b>		<b>Time</b>
Charging Time	Power On	16 H
	Power Off (with AC Adapter)	60 H
	Power Off (Without AC Adapter)	Doesn't charge
Data preservation period (full charge)		8 H

### 1.9.4 RTC Battery

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

*Table 1-11 RTC Battery Charging/Data Preservation Time*

<b>RTC Battery</b>		<b>Time</b>
Charging Time	Power On	48 H
	Power Off	Doesn't charge
Data preservation period (full charge)		1 month

## 2.1 Troubleshooting

Chapter 2 describes how to determine if a Field Replaceable Unit (FRU) in the T1960CS/T1960CT is causing the computer to malfunction. The FRUs covered are:

1. System Board(s)
2. Floppy Disk Drive
3. Hard Disk Drive
4. Keyboard
5. Display

Diagnostic disk operations are described in Chapter 3, and detailed replacement procedures are given in Chapter 4.

The following tools are necessary for implementing the troubleshooting procedures:

1. A T1960CS/T1960CT Diagnostics Disk
2. A Phillips-head screwdriver (2 mm)
3. A Toshiba MS-DOS system disk(s)
4. A 2DD or 2HD formatted work disk for testing the floppy disk drive
5. A cleaning kit for troubleshooting the floppy disk drive
6. A printer port LED
7. An RS-232-C wraparound connector
8. A printer wraparound connector
9. A multimeter
10. An external 5.25-inch floppy disk drive
11. An external CRT

## 2.2 Troubleshooting Flowchart

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

- Ask the user if a password is registered. If one is, ask him or her 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. 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.

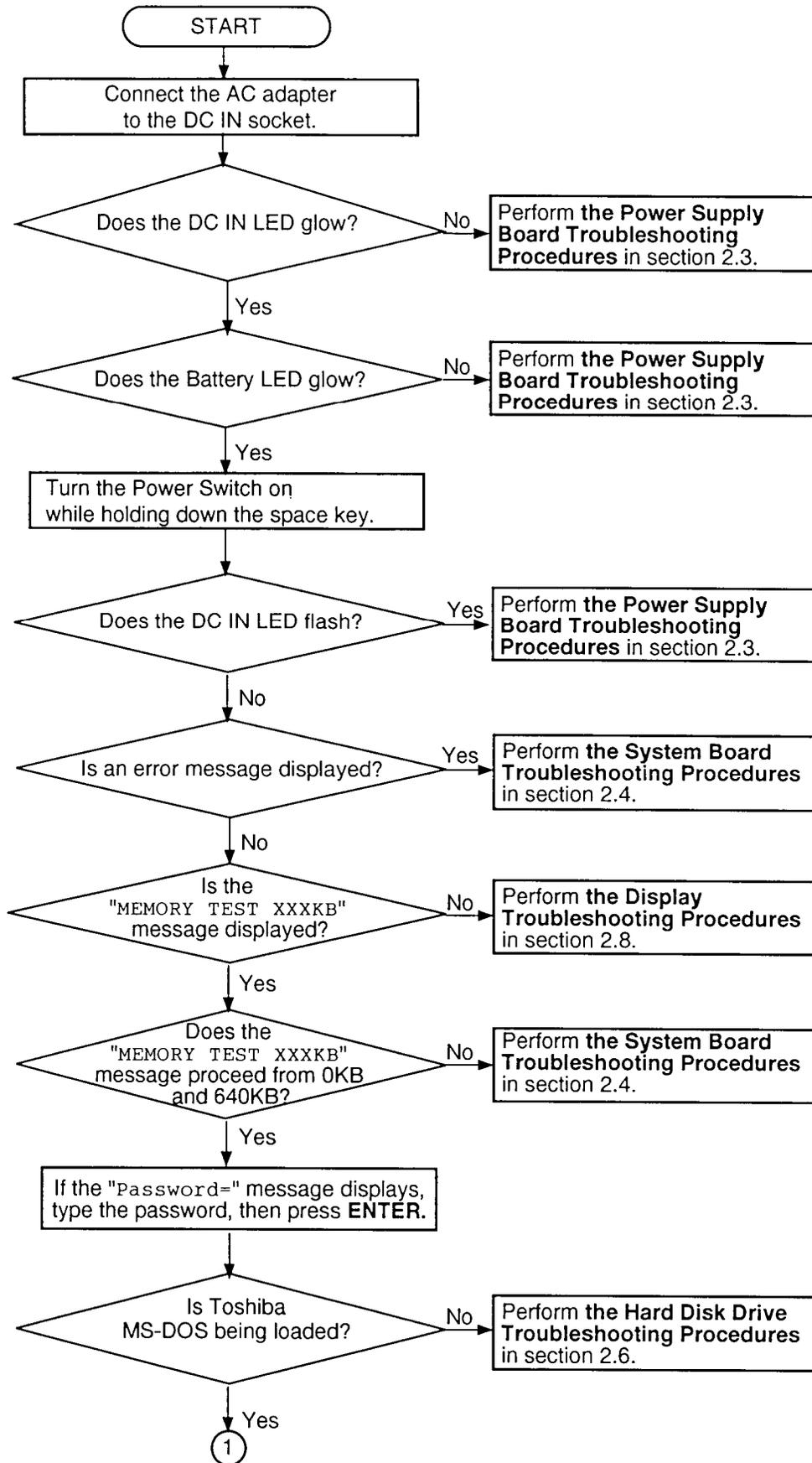


Figure 2-1 Troubleshooting Flowchart (1/2)

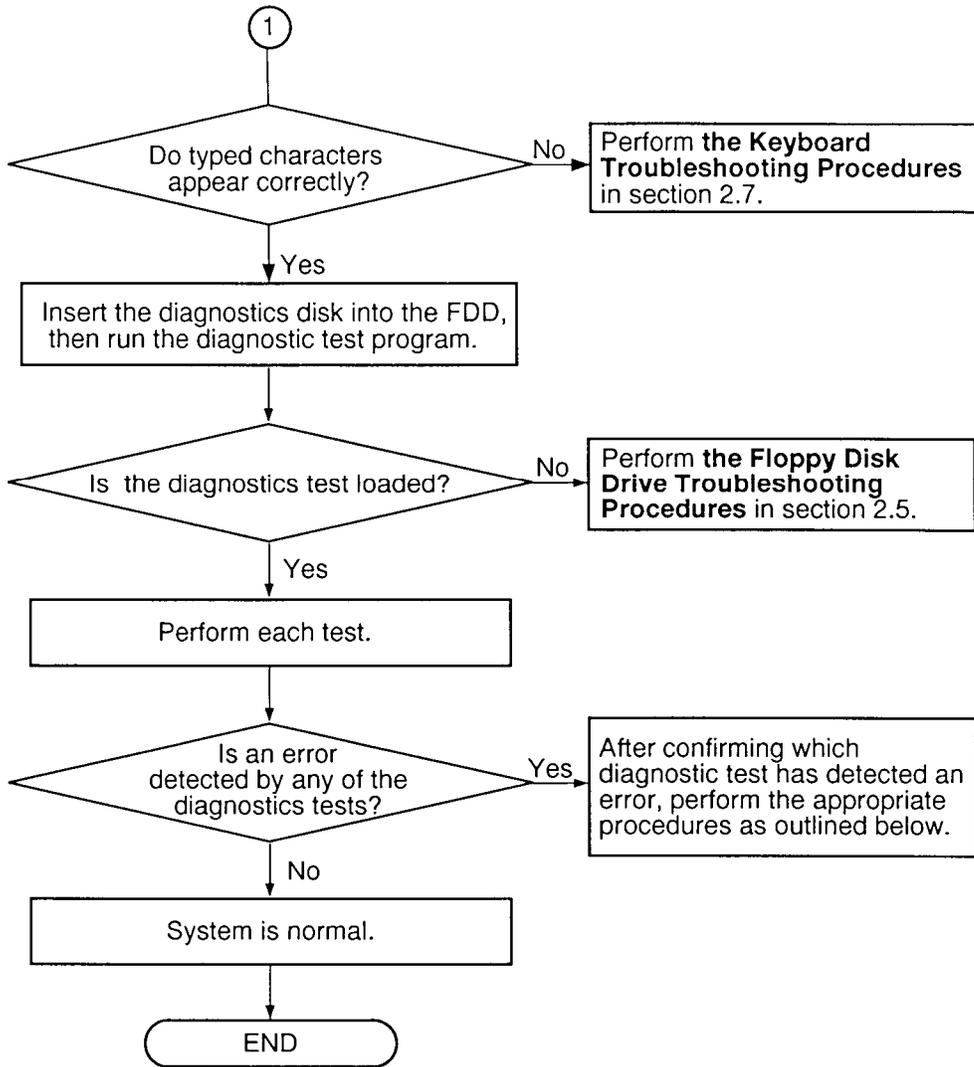


Figure 2-1 Troubleshooting Flowchart (2/2)

If the diagnostics program cannot detect an error, the problem may be intermittent. The Running Test program should be executed several times to isolate the problem. Check the Log Utilities function to confirm which diagnostic test detected an error(s), then perform the appropriate troubleshooting procedures as follows:

1. If an error is detected on the System Test, Memory Test, Display Test, ASYNC Test, Printer Test, or Real Timer Test, perform the System Board Troubleshooting Procedures in Section 2.4.
2. If an error is detected on the Keyboard Test, perform the Keyboard Troubleshooting Procedures in Section 2.7.
3. If an error is detected on the Floppy Disk Test, perform the Floppy Disk Drive Troubleshooting Procedures in Section 2.5.
4. If an error is detected on the Hard Disk Test, perform the Hard Disk Drive Troubleshooting Procedures in Section 2.6.

## 2.3 Power Supply Troubleshooting

The T1960CS/T1960CT's 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 include:

Procedure 1: DC IN LED Indicator Check

Procedure 2: Battery LED Indicator Check

Procedure 3: PCB Replacement Check

### Procedure 1 DC IN LED Indicator Check

The T1960CS/T1960CT's AC adapter converts AC power to DC power and contains a charging circuit which charges the computer's batteries. The adapter connects to the DC IN socket connector on the left side of the computer. When the AC adapter is connected to the computer and the power is turned off, the AC adapter charges the batteries.

The DC IN indicator displays whether or not the AC adapter is connected and supplying power.

- When the DC IN indicator is green, the AC adapter is connected and supplying power to the computer.
- If the DC IN indicator does not light, the AC adapter is not supplying power, or the AC adapter is not attached to the computer, go to Check 1.
- If the DC IN indicator is flashing green, the AC adapter's voltage supply is abnormal or the power supply is not functioning properly, go to Check 1.

If any of the above indicator conditions are abnormal, make sure the LED indicator lights are not burned out before performing the following Checks.

**Check 1** Make sure the correct AC adapter's cable is firmly plugged into the DC IN 1.7 A socket on the back of the computer.

**Check 2** If the DC IN indicator flashes green when the AC adapter is connected, its voltage output is abnormal. Connect a new AC adapter 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, perform Check 4.

- Check 4 Place the computer in an environment between  $-20^{\circ}\text{C}$  and  $70^{\circ}\text{C}$  until it reaches ambient temperature. Repeat the steps which caused the computer to malfunction. If the same problem still appears, perform Procedure 3.

## **Procedure 2 Battery LED Indicator Check**

The Battery LED indicator shows the battery charging status. The LED, identified by a battery icon on the front of the computer, glows orange when the AC adapter is charging the computer's battery pack.

- If the Battery LED indicator glows green, the AC adapter is connected and the battery is fully charged.
- If the indicator glows orange, the AC adapter is connected and the battery is being charged.
- If the indicator does not glow, go to Check 1.

Check 1 Make sure the AC adapter's cable and AC cord are firmly plugged into the DC IN socket and wall outlet. If these cables are connected correctly, go to Check 2.

Check 2 Make sure the battery pack is installed in the computer correctly. If it is, 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 lower system board.
- If the battery terminal is clean and not bent, go to Check 4.

Check 4 Connect a new AC adapter. If the Battery LED indicator still does not glow, go to Check 5.

Check 5 Install a new battery pack. If the Battery LED indicator still does not glow, go to Procedure 3.

### **Procedure 3    PCB Replacement Check**

The power supply is mounted on the lower system board (FA2SL\*). If either the power supply or the system board is damaged, refer to Chapter 4 for instructions on how to disassemble the T1960CS/T1960CT, then perform the following checks.

- Check 1    Replace the lower system board with a new one and restart the system. If the problem still exists, go to Check 2.
  
- Check 2    Replace the upper system board with a new one and restart the system. If the problem still exists, other FRUs may be damaged.

## 2.4 System Board Troubleshooting

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

- 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 each IC on the system board and initializes it.

- If an error message displays, 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.

- (a) `*** Error in CMOS. Bad HDD type ***  
Check system. Then press [F1] key .....`
- (b) `*** Error in CMOS. Bad battery ***  
Check system. Then press [F1] key .....`
- (c) `*** Error in CMOS. Bad check sum ***  
Check system. Then press [F1] key .....`
- (d) `*** Error in CMOS. Bad memory size ***  
Check system. Then press [F1] key .....`
- (e) `*** Error in CMOS. Bad time function ***  
Check system. Then press [F1] key .....`

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 system configuration in the RTC memory configuration is set to the default setting. If error message (b) appears often when power is turned on, replace the RTC battery. If any other error message displays, perform Check 2.

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

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

This message appears when data stored in RAM under the resume function is lost because the battery has become discharged or the system board is damaged. Go to Procedure 3.

If any other message appears, perform Check 3.

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

- If any of the following error messages display, replace the system board: (1) through (17), (19), (20), (25) or (26).
- If error message (18) displays, go to the Keyboard Troubleshooting Procedures in Section 2.7.
- If error message (21) or (22) displays, go to the HDD Troubleshooting Procedures in Section 2.6.
- If error message (23) or (24) displays, go to the FDD Troubleshooting Procedures in Section 2.5.

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

**NOTE:** When you perform this check, the external FDD/PRT option in the SETUP program must be set to PRT and set to boot mode.

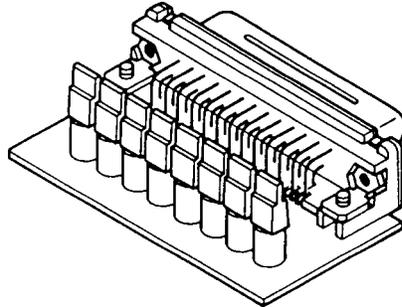


Figure 2-2 Printer Port LED

To use the printer port LED follow these steps:

1. Turn on the T1960CS/T1960CT's power, then set it to boot mode.
2. Turn off the computer.
3. Plug the printer port LED into the computer's PRT/FDD connector.
4. Hold down the space bar and turn on the power to the computer.
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, if the printer port LED displays 22 and halts, the IRT test has already completed the KBC test. In this instance, the IRT indicates an error has been detected during the system memory test.

Table 2-1 Printer Port LED Boot Mode Error Statuses (1/2)

Error Status	Test Item	Message
01H	Pre-init for warm start test	—
05H	PIT test	TIMER CH.2 OUT ERROR
		PIT ERROR READ DATA = XXH WRITE DATA = XXH
06H	PIT initialization	—
07H	PIT function test	MEMORY REFRESH ERROR
0AH	First 64KB memory test	FIRST 64KB MEMORY ERROR
0BH	System memory initialization	—
0DH	Interrupt vector initialization	—
15H	RTC test	RTC ERROR READ DATA = XXH WRITE DATA = XXH
16H	CMOS RAM test	****Error in CMOS. Bad battery**** ****Error in CMOS. Bad check sum**** ****Error in CMOS. Bad configuration**** ****Error in CMOS. Bad memory size**** ****Error in CMOS. Bad HDD type**** ****Error in CMOS. Bad time function**** Check system. Then press [F1] key
18H	PIC initialization	—
1FH	Display initialization	CRTC ERROR
		VRAM ERROR READ DATA = XXXXXXXXXH WRITE DATA = XXXXXXXXXH
22H	KBC test	KBC ERROR
25H	System memory test	SYSTEM MEMORY ERROR
		ADDRESS = XXXXXXXXXH READ DATA = XXXXXXXXXH WRITE DATA = XXXXXXXXXH
		SYSTEM MEMORY PARITY ERROR ADDRESS = XXXX0000H - XXXXFFFFH
30H	Extended memory test	EXTENDED MEMORY ERROR
		ADDRESS = XXXXXXXXXH READ DATA = XXXXXXXXXH WRITE DATA = XXXXXXXXXH
		EXTENDED MEMORY PARITY ERROR ADDRESS = XXXX0000H - XXXXFFFFH
40H	DMA page register test	DMA PAGE REGISTER ERROR READ DATA = XXH WRITE DATA = XXH

Table 2-1 Printer Port LED Boot Mode Error Statuses (2/2)

Error Status	Test Item	Message
41H	DMAC test	DMAC #1 ERROR READ DATA = XXXXH WRITE DATA = XXXXH
		DMAC #2 ERROR READ DATA = XXXXH WRITE DATA = XXXXH
42H	DMAC initialization	-
4AH	PIC test	PIC #1 ERROR READ DATA = XXH WRITE DATA = XXH
		PIC #2 ERROR READ DATA = XXH WRITE DATA = XXH
54H	Keyboard test	KEYBOARD ERROR
55H	KBC initialization	KBC ERROR
5AH	Mouse initialization	-
60H	HDD initialization	HDC ERROR HDC #0 ERROR HDC #1 ERROR
65H	FDD initialization	NO FDD ERROR
		FDD ERROR
70H	Printer test	-
80H	RS-232-C test	-
90H	Timer initialization	TIMER INTERRUPT ERROR
		RTC UPDATE ERROR
A0H	NDP initialization	-
A6H	Expansion I/O ROM	-
FFH	Expansion system ROM	-

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

01h, 05h, 06h, 07h, 0Ah, 0Bh, 0Dh, 15h, 16h, 18h, 1Fh, 22h, 25h, 30h, 40h,  
41h, 42h, 54h, 55h, 65h, 70h, 80h, 90h, A0h, A6h

Check 2 If error code **4Ah** displays, go to the Keyboard Troubleshooting Procedures in Section 2.7.

Check 3 If error code **5Ah** 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.

***NOTE:** When you perform this check, the external FDD/PRT option in the SETUP program must be set to PRT and set to resume mode.*

To use the printer port LED follow these steps:

1. Turn on the T1960CS/T1960CT's power, then set it to resume mode.
2. Turn off the computer.
3. Plug the printer port LED into the PRT/FDD connector.
4. Turn on the computer.
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 Statuses*

<b>Error Status</b>	<b>Meaning of Status</b>
00H	RAM BIOS error
F0H	Press the reset switch.
F1H	Suspend process error (The system will suspend while FDD is accessed, etc.)
F2H	The system has optional ROM, or optional card (CGA, MDA).
F4H	Backup RAM checksum error
F5H	Main memory checksum error
F6H	Video RAM checksum error
F7H	Extended memory checksum error
F8H	Backup RAM checksum error
F9H	Main memory checksum error
FAH	Video RAM checksum error
FBH	Extended memory checksum error
FDH	Card modem error (The card modem will be removed while the system is in resume, etc.)
FEH	Password error (The password will be erased before it is suspended.)

## 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. PCMCIA Test

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

## Procedure 5 Replacement Check

The system board(s) may be damaged. Disassemble the T1960CS/T1960CT following the steps described in Chapter 4, *Replacement Procedures*, then perform the following checks.

- If the IRT test detects any of the following codes, go to Check 1.

06H, 07H, 0AH, 0BH, 0DH, 15H, 18H, 1FH, 22H, 25H, 54H, 55H, 90H

- If the IRT test detects any of the following codes, go to Check 2.

01H, 05H, 16H, 30H, 40H, 41H, 42H, 65H, 70H, 80H, A0H, A6H

- If any of the following diagnostic tests detect an error, go to Check 1.

System Test  
Memory Test  
Real Timer Test

- If any of the following diagnostic tests detect an error, go to Check 2.

Printer Test  
ASYNC Test  
PCMCIA Test

**Check 1** Replace the upper system board with a new one. If the problem still exist, replace the lower system board. Refer to Chapter 4 for instructions on how to remove and replace the upper and lower system boards.

**Check 2** Replace the lower system board with a new one. If the problem still exist, replace the upper system board. Refer to Chapter 4 for instructions on how to remove and replace the upper and lower system boards.

## 2.5 Floppy Disk Drive Troubleshooting

This section describes how to determine if the T1960CS/T1960CT's internal 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: External 5.25-inch FDD Check
- Procedure 3: Diagnostic Test Program Check
- Procedure 4: Connector Check and Replacement Check

### Procedure 1 FDD Head Cleaning Check

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

After loading Toshiba MS-DOS, run the Diagnostic Program and then clean the FDD heads using the cleaning kit. If the FDD still does not function properly after cleaning, go to Procedure 3.

If the test program cannot be executed on the T1960CS/T1960CT, go to Procedure 2.

### Procedure 2 External 5.25-inch FDD Check

The floppy disk controller on the computer's system board controls the internal and external FDD. To determine if either the system board or the internal FDD is defective, check the following items.

- Check 1 Connect the external 5.25-inch FDD to the PRT/FDD port and make sure it functions properly. If it does, perform Procedure 4. If it doesn't, perform Check 2.

**NOTE:** To use the external 5.25-inch FDD, set the external FDD/PRT option in the *SETUP* program to FDD A or FDD B.

- Check 2 Replace the lower system board with a new one following the steps in Chapter 4, *Replacement Procedures*. If the FDD is still not functioning properly, replace the upper system board.

### Procedure 3 Diagnostic Test Program Execution Check

The Floppy Disk Drive Diagnostic Test program is stored on the T1960CS/T1960CT Diagnostics Disk. After loading Toshiba MS-DOS, run the diagnostic program. Refer to Chapter 3, *Tests and Diagnostics*, for more information about diagnostic test procedures.

Floppy disk drive test error codes and their status names are listed 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 Codes and Statuses*

<b>Code</b>	<b>Status</b>
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.

Write protected

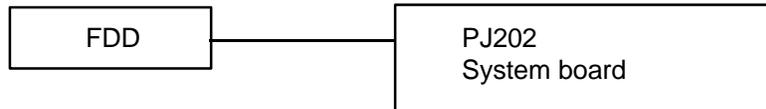
If any other message appears, perform Check 2.

Check 2 Make sure the floppy disk is formatted correctly. If it is, go to Procedure 4.

## Procedure 4 Connector Check and Replacement Check

The 3.5-inch Floppy Disk Drive is connected to the system board by the FDD cable. This cable may be disconnected from the system board or it may be damaged. Disassemble the T1960CS/T1960CT following the steps described in Chapter 4, *Replacement Procedures*, and perform the following checks.

Check 1 Make sure the FDD cable is firmly connected to the system board.



If the cable is disconnected, reconnect it and repeat Procedure 3. If the FDD is still not functioning properly, perform Check 2.

Check 2 The FDD or its cable may be defective or damaged. Replace the FDD with a new one following the steps in Chapter 4. If the FDD is still not functioning properly, perform Check 3.

Check 3 Replace the upper system board with a new one following the steps in Chapter 4. If the FDD is still not functioning properly, replace the lower system board.

## 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 will be erased when the HDD troubleshooting procedures are executed. Transfer the contents of the hard disk to a backup system using the Toshiba MS-DOS BACKUP command. Refer to the Toshiba MS-DOS Manual for more information about how to perform this command.*

### Procedure 1 Partition Check

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

- Check 1 Type **C:** and press **Enter**. If you cannot change to Drive C, go to Check 2. If you can 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, then 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, then 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 T1960CS/T1960CT's 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.

Note that the error messages appear on the display for five (5) seconds, then disappear.

```
HDC ERROR
      or
HDD #0 ERROR
      or
HDD #1 ERROR
```

- Check 2 If either of the following messages appear, 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
```

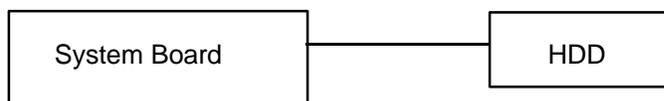
- Check 3 Using the Toshiba MS-DOS system disk, install a system program on the hard disk using the SYS command.

If the following message appears on the display, the system program has been transferred to the HDD.

```
System transferred
```

Restart the computer. If the error message still appears, perform Check 4.

- Check 4 The HDD is connected to the system board directly. This connection can become disconnected or damaged. Disassemble the computer as described in Chapter 4, *Replacement Procedures*. If the HDD is not connected, reconnect it and return to Procedure 1. If the HDD is firmly connected to the system board, perform Procedure 3.



### Procedure 3    Format Check

The T1960CS/T1960CT's 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 using the FDISK command. Format the hard disk 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 message appears on the display, refer to the *Toshiba MS-DOS Manual* for more information and perform Check 2.

- Check 2    Using the T1960CS/T1960CT Diagnostic Disk, format the HDD with the low level format option. Refer to Chapter 3, *Tests and Diagnostics* for more information about the diagnostic 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 Test and Diagnostic program, go to Procedure 4.

## Procedure 4 Diagnostic Test Program Execution Check

The HDD test program is stored in the T1960CS/T1960CT Diagnostics Disk. Perform all of the HDD tests in the Hard Disk Drive Test. Refer to Chapter 3, *Tests and Diagnostics*, for more information about the HDD test program.

If an error is detected during the HDD test, an error code and status displays; perform Check 1. 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 Codes and Statuses*

<b>Code</b>	<b>Status</b>
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 recover enable
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 lower system board with a new one following the instructions in Chapter 4. If the FDD is still not functioning properly, replace the upper system board.

## 2.7 Keyboard Troubleshooting

To determine if the T1960CS/T1960CT's keyboard is functioning properly, perform the following procedures. Start with Procedure 1 and continue with the other procedures as instructed.

Procedure 1: Diagnostic Test Program Execution Check

Procedure 2: Connector and Replacement Check

### Procedure 1 Diagnostic Test Program Execution Check

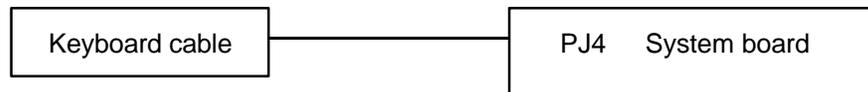
Execute the Keyboard Test in the Diagnostic Program. Refer to Chapter 3, *Tests and Diagnostics*, for more information on how to perform the test program.

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

### Procedure 2 Connector and Replacement Check

The keyboard is connected to the system board by a 19-pin flat cable. This cable may be disconnected or damaged. Disassemble the T1960CS/T1960CT as described in Chapter 4 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, reconnect it. Perform Procedure 1 again. If the keyboard is still not functioning properly, perform Check 2.

Check 2 The keyboard controller on the upper system board may be damaged. Replace the upper system board with a new one. Refer to Chapter 4 for more information. If the keyboard is still not functioning properly, replace the lower system board.

## 2.8 Display Troubleshooting

This section describes how to determine if the T1960CS/T1960CT's display is functioning properly. Start with Procedure 1 and continue with the other procedures as instructed.

- Procedure 1: Contrast Control Check (T1960CS only)
- 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 (T1960CS only)

Contrast is changed with the contrast dial. If the contrast does not change when you turn the dial, perform Procedure 2.

### Procedure 2 External CRT Check

Connect the external CRT to the T1960CS/T1960CT's 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 T1960CS/T1960CT Diagnostic Disk. This program checks the display controller on the system board. After loading Toshiba MS-DOS, run the Diagnostic 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.

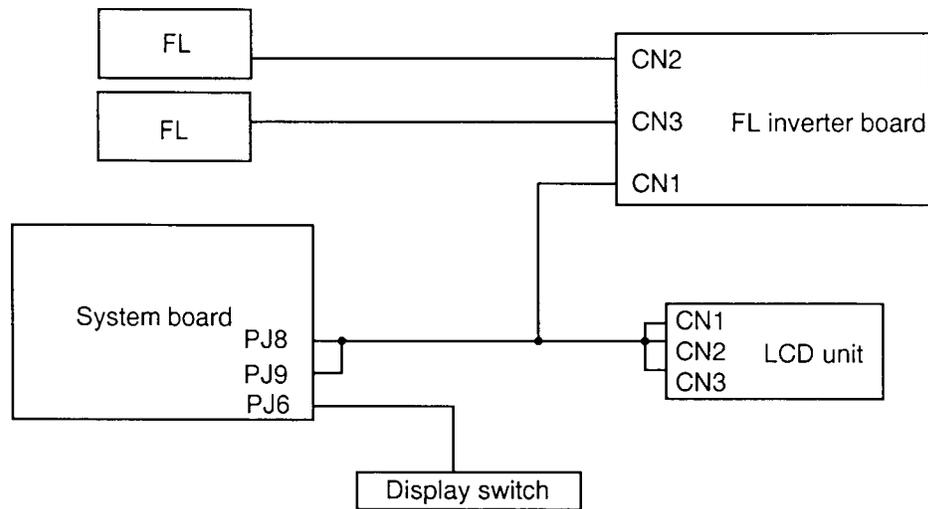


Figure 2-3 T1960CS Display Connection

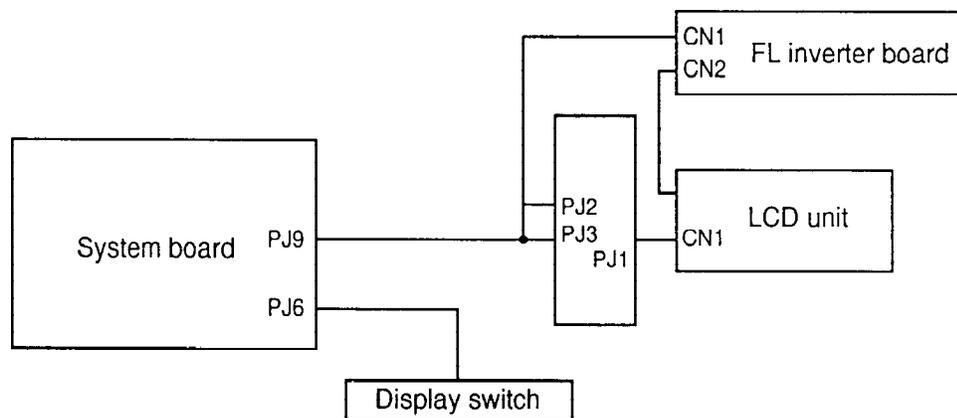


Figure 2-4 T1960CT Display Connection

If any of these cables are not connected, firmly reconnect them 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 and then perform the following checks.

- If the FL does not light, perform Check 1.
- If characters are not displayed 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 4.

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 upper system board may be damaged. Replace the upper system board with a new one and test the display again. If the problem still exists, perform Check 7.

Check 7 The lower system board may be damaged. Replace the lower system board with a new one.

### 3.1 The Diagnostic Test

This chapter explains how to use the T1960CS/T1960CT's Diagnostic Test Program (TEST195S [T1960CS] or TEST195T [T1960CT]) to test the functions of the T1960CS/T1960CT's hardware modules. The Diagnostic Program is stored on the T1960CS/T1960CT Diagnostic Disk, and consists of 19 programs that are grouped into the Service Program Module (DIAGNOSTICS MENU) and the Test Program Module (DIAGNOSTIC TEST Menu).

The DIAGNOSTICS MENU consists of the following functions:

- DIAGNOSTIC TEST
- HARD DISK FORMAT
- HEAD CLEANING
- LOG UTILITIES
- RUNNING TEST
- FDD UTILITIES
- SYSTEM CONFIGURATION
- SETUP

The DIAGNOSTIC TEST option contains the following functional tests:

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

The following equipment is needed to perform some of the T1960CS/T1960CT Diagnostic test programs:

- The T1960CS/T1960CT Diagnostics Disk (all tests)
- A formatted working disk for the floppy disk drive test (all tests)
- 3.5-inch 2HD/2DD disk for the internal 3.5-inch FDD
- 5.25-inch 2D disk for the external 5.25-inch FDD
- A cleaning kit to clean the floppy disk drive heads (Head Cleaning)
- A PCMCIA wraparound connector for the I/O card test (PCMCIA test)
- A printer wraparound connector for the printer wraparound test (Printer test)
- An RS-232-C wraparound connector for the RS-232-C port wraparound test (ASYNC test)

The following sections detail the tests within the Diagnostic Test function of the DIAGNOSTIC TEST Menu. Refer to Sections 3.17 through 3.23 for detailed information on the remaining seven Service Program Module functions.

## 3.2 Executing the Diagnostic Test

Toshiba MS-DOS is required to run the T1960CS/T1960CT Diagnostic Test Program. To start the program, follow the steps listed below:

1. Turn on the computer, and allow the computer to boot. Insert the T1960CS/T1960CT Diagnostics Disk in the computer's internal floppy disk drive.
2. At the system prompt, change to drive A and type **TEST195S** (T1960CS) or **TEST195T** (T1960CT), and press **Enter**.

The following menu will appear:

```
TOSHIBA personal computer T19XXXX 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 T1960CS/T1960CT DIAGNOSTIC TEST Menu, press the **Esc** key. If a test program is in progress, press **Ctrl + Break** to exit the test program, or press **Ctrl + C** to stop the program.

3. To select the **DIAGNOSTIC TEST** option from the **DIAGNOSTICS MENU**, set the highlight bar to **1**, and press **Enter**. The following menu will appear:

```
TOSHIBA personal computer T1960 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 - PCMCIA 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.

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

```
SYSTEM TEST      XXXXXXXX
```

```
T1960 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 - HW status
03 - Version check
99 - Exit to DIAGNOSTIC TEST MENU
```

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

**NOTE:** The menu displayed by your T1960CS/T1960CT may be slightly different from the one shown above.

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

```
TEST LOOP : YES
```

Selecting **YES** sets the test to run continuously until it is halted by the user. Selecting **NO** returns the screen to the main menu after the test is complete.

6. The following message appears:

```
ERROR STOP : YES
```

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

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

```
ERROR STATUS NAME    [[ HALT OPERATION ]]  
  
1: Test end  
2: Continue  
3: Retry
```

The three selections have the following functions:

- 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.

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

Table 3-1 in Section 3.3 lists the function of each test on the subtest menu. Table 3-3 in Section 3.15 lists error codes and the status of each error.

### 3.3 Subtest Names

Table 3-1 lists the subtest names for each test program in the DIAGNOSTIC TEST menu.

*Table 3-1 Subtest Names (1/2)*

No.	Test Name	Subtest No.	Subtest Item
1	SYSTEM	01	ROM checksum
		02	H/W status
		03	Version check
2	MEMORY	01	RAM constant data
		02	RAM address pattern data
		03	RAM refresh
		04	Protected mode
		05	Memory module
		06	Backup memory
		07	
		08	Cache memory
3	KEYBOARD	01	Pressed key display (82/84)
		02	Pressed key code display
		03	PS/2 Mouse connect check
		04	DCBP connect check
4	DISPLAY	01	VRAM read/write
		02	Character attributes
		03	Character set
		04	80*25/30 Character display
		05	320*200 Graphics display
		06	640*200 Graphics display
		07	640*350/400/480 Graphics display
		08	Display page
		09	"H" pattern display/Border color
		10	LED/DAC pallet
		11	T1960CS: 64 color display T1960CT: TFT color display
		12	SVGA color graphics display (T1960CT)
5	FDD	01	Sequential read
		02	Sequential read/write
		03	Random address/data
		04	Write specified address
		05	Read specified address
6	PRINTER	01	Ripple pattern
		02	Function
		03	Wraparound

Table 3-1 Subtest Names (2/2)

No.	Test Name	Subtest No.	Subtest Item
7	ASYNC	01	Wraparound (board)
		02	Board (#1) <=> board (#2)
		03	Point to point (send)
		04	Point to point (receive)
		05	Card modem loopback (2400BPS)
		06	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	PCMCIA	01	I/O card test (PCMCIA)

### 3.4 System Test

To execute the System Test select **1** from the DIAGNOSTIC TEST Menu, press **Enter** and follow the directions displayed on the screen. Move the highlight bar to the subtest you want to execute and press **Enter**.

#### Subtest 01 ROM checksum

The ROM checksum tests the system board from address F0000h to FFFFFh (64KB).

#### Subtest 02 H/W status

This test reads and displays the hardware status as shown below.

```

                                76543210
H/W status = 10001000

Bit7 -                          =
Bit6 - CPU clock                 = 25MHz
Bit5 - Notch signal              = 2HD
Bit4 - FDD type                  = 2MB
Bit3 -                          =
Bit2 - Drive A/B                 = Ext. = B
Bit1 - External FDD              = OFF
Bit0 - Internal FDD              = 2HD
```

Table 3-2 lists the hardware bit status for each bit tested. Pressing **Enter** returns you to the Sub-Test Menu.

*Table 3-2 Hardware Bit Status*

Bit	H/W status	1	0
7	Reserved	—	—
6	CPU clock speed	25 MHz	25 MHz
5	Media type	2DD	2HD
4	FDD type	1.6 MB	2 MB
3	Reserved	—	—
2	Drive A/B	Ext. = A	Ext. = B
1	External FDD	ON	OFF
0	Internal FDD	2DD	2HD



## 3.5 Memory Test

To execute the Memory Test, select **2** from the DIAGNOSTIC TEST Menu, press **Enter** and follow the directions displayed on the screen. Move the highlight bar to the subtest you want to execute and press **Enter**.

### Subtest 01 RAM constant data (real mode)

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

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

### Subtest 02 RAM address pattern data (real mode)

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

### Subtest 03 RAM refresh (real mode)

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

The constant data is AAAAh and 5555h.

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

### Subtest 04 Protected mode

**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.*

This subtest writes constant data and address data to extended memory (maximum address 100000h), 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.*

This subtest functions the same as Subtest 04, except it is used for testing an optional memory card. Memory module capacity is 2, 4, 8, and 16 MB.

After selecting Subtest 05, the following message appears:

```
Extended memory size (1:2 MB,2:4 MB,3:8 MB,4:16 MB) ?
```

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

Subtest 06 Backup memory

This subtest writes constant data to memory from address C8000h to CFFFFh, then reads new data and compares the result with the original data.

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

Subtest 08 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 miss hit < Number of hit → OK  
Number of miss hit ≥ Number of hit → Fail

## 3.6 Keyboard Test

To execute the Keyboard Test, select **3** from the DIAGNOSTIC TEST Menu, press **Enter** and follow the directions displayed on the screen. The Keyboard test contains two subtests that test the T1960CS/T1960CT'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.

KEYBOARD TEST    IN PROGRESS    301000

```

■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■
  ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■
■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■
■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■
■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■
■ ■           ■ ■ ■ ■ ■ ■ ■ ■ ■ ■
```

PrtSc        :    [Alt] + [SysReq]  
Pause        :    [Ctrl]+[Break] to test end

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

To exit this test, press **Del** and **Enter**.

Subtest 02    Pressed key code display

When a key is pressed, the scan code, character code, and key top name are displayed on the screen in the format shown below. The **Ins**, **Caps Lock**, **Num Lock**, **Scroll Lock**, **Alt**, **Ctrl**, **Left Shift**, and **Right Shift** keys are displayed in reverse screen mode when pressed. The scan codes, character codes, and key top names are listed in Appendix E.

```
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 computer.*

This subtest checks whether a PS/2 mouse is connected or not.

If this test does not detect an error, it returns to the subtest menu. If it detects an error, the following message appears:

```
KBD - MOUSE INTERFACE ERROR
```

```
[[ HALT OPERATION ]]
```

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

Subtest 04    DCBP Connect Check

**NOTE:** *Before performing the DCBP mouse connect check:*

- 1) *Connect a ball-point mouse to the computer.*
- 2) *Remove the DCBP driver software.*
- 3) *Disconnect the PS/2 mouse.*

This subtest checks whether a ball-point mouse is connected or not.

If the test does not detect an error, the program returns to the subtest menu. If it detects an error, the following message appears:

KBD-DCBP INTERFACE ERROR

[ [ HALT OPERATION ] ]

1: Test end  
2: Continue  
3: Retry





Subtest 04 80x25/30 Character Display (mode 3, 12)

In this subtest, the character string is displayed shifting one character to the right, line by line in the 80x25 and 80x30 character modes as shown below.

```
80*XX CHARACTER DISPLAY
01234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567
! "#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopq
! "#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopq
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopq
#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopq
$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopq
%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqr
&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrs
'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrst
()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstu
()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstuv
*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvw
+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvwx
,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvwxy
-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvwxyz
./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvwxyz{
/0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvwxyz{|
0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvwxyz{|}
123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
23456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvwxyz{|}~•
3456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvwxyz{|}~•Ç
456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvwxyz{|}~•Çü
PRESS [ENTER] KEY
```

Pressing **Enter** toggles between the tests. To exit this subtest and return to the DISPLAY TEST menu, press **Ctrl + Break**.

Subtest 05 320x200 Graphics Display (mode 4,D)

This subtest displays two color sets for the color display in 320x200 dot graphics modes 4 and D. One example is shown below.

```
320*200 GRAPHICS DISPLAY
COLOR SET X : [X]
```



PRESS [ENTER] KEY

Pressing **Enter** toggles between tests. To exit this subtest and return to the DISPLAY TEST menu, press **Ctrl + Break**.

Subtest 06 640x200 Graphics Display (mode 6, E)

This subtest displays even dots, odd dots, and all dots in the 640x200 dot graphics modes 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 640x350/400/480 Graphics Display (mode 10, 74, 12)

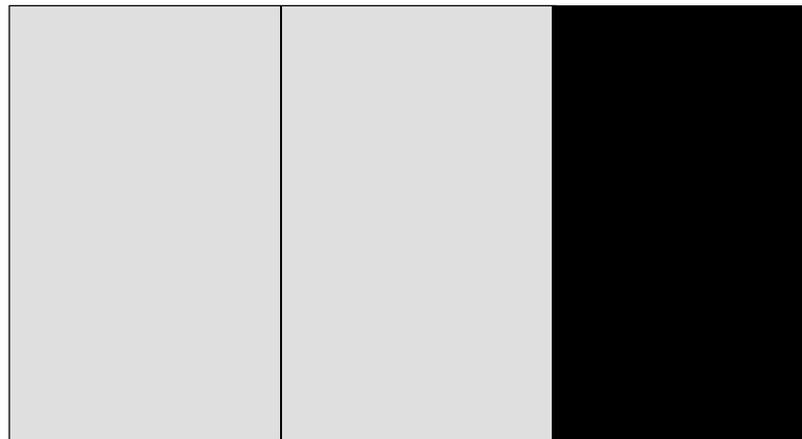
This subtest displays even dots, odd dots, and all dots in the 640x350, 640x400, and 640x480 dot graphics modes 10, 74, 12 as shown below.

640\*XXX GRAPHICS DISPLAY : [XX]

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 10 LED/DAC Pallet

This subtest checks the LED indicator (Caps Lock, Overlay and Num Lock) by key operation.

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

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

```
[ DAC pallet W-R-CMP test ] = (about 1 second)  
  
[ Processor latch test    ] =  
  
Processor latch test (1:256 times, 2:endless) ?
```

After pressing **Enter**, the subtest writes '2A' and '15' data to 6 bits of 256x3 (RGB), then reads the new data and compares the result with original data.

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

Subtest 11 64 color graphics display (T1960CS), TFT color graphics display (T1960CT)

This subtest 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.

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

Subtest 12 SVGA color graphics display (T1960CT)

***NOTE:** To execute this subtest, the external SVGA display must be connected and the power-on display option of SETUP program must be set to Internal/External.*

This subtest displays seven screens.

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

## 3.8 Floppy Disk Test

**CAUTION:** Before running the floppy disk test, prepare a formatted work disk since the contents of the floppy disk in the FDD will be erased. Remove the Diagnostics Disk and insert the work disk into the FDD.

To execute the Floppy Disk Test, select **5** from the DIAGNOSTIC TEST Menu, press **Enter** and follow the directions displayed on the screen. The Floppy Disk test contains five subtests that test the T1960CS/T1960CT's internal floppy disk drive.

The following messages appear after selecting the Floppy Disk Test from the DIAGNOSTIC TEST menu. Answer each question with an appropriate response to execute the test.

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

**T1960CS:**

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

**T1960CT:**

Test drive number select : FDD#1 (Select the drive using the arrow keys.)

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

**T1960CS:**

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

**T1960CT:**

Media in drive #X mode : 2DD (Select the media type using the arrow keys.)

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

FLOPPY DISK            XXXXXXXX

```
T1960 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 : XXXXXXXX    STATUS : XXX

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

The first digit in the STATUS number indicates the drive being tested, and the last two digits indicate the error status code as explained in Table 3-3 in Section 3-15.

#### Subtest 01 Sequential Read

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

- Double-sided, double-density (2D): Tracks 0 to 39.
- Double-sided, double-density, double-track (2DD) and double-sided, high-density, double-track (2HD): Tracks 0 to 79.

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

#### Subtest 02 Sequential Read/Write

This subtest continuously writes data pattern B5ADADh to all the specified tracks selected in Step 3 above. The data is then read and compared to the original data.

#### Subtest 03 Random Address/Data

This subtest writes random data to random addresses on all tracks defined in Step 3 above. The data is then read and compared to the original data.

#### Subtest 04 Write Specified Address

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

#### Subtest 05 Read Specified Address

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

### 3.9 Printer Test

To execute the Printer Test, select **6** from the DIAGNOSTIC TEST menu, press **Enter** and follow the directions displayed on the screen. The Printer Test contains three subtests that test the output of the printer connected to the T1960CS/T1960CT.

***NOTE:** An IBM-compatible printer must be connected to the system to execute this test. Make sure setup option "External FDD/PRT" is set to **Printer**.*

The following message appears when the printer test is selected:

```
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 T1960CS/T1960CT supports three printer channels. Select the printer channel number, and press **Enter** to execute the selected subtest.

#### Subtest 01 Ripple Pattern

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

```
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnop
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnop
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopq
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqr
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrs
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrs
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstu
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstu
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuv
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvw
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwx
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxy
```

## Subtest 02    Function

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

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

The subtest prints the various print types as illustrated 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
opqrstuvwxyz{|}~
```

## 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 shown in Appendix G.

This subtest 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 displayed on the screen. The Async Test contains six subtests that test the T1960CS/T1960CT'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:	9600 BPS
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, and 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, and 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 shown in Appendix G.

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

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

**NOTE:** To execute this subtest, an RS-232-C cable (9-pin to 9-pin) must be connected to Boards 1 and 2. The RS-232-C direct cable wiring diagram is shown in Appendix G.

This subtest checks the data send/receive function through the RS-232-C direct cable.

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 shown in Appendix G.*

This subtest 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)

This subtest, used with Subtest 03 above, receives the data from the send side, then sends the received data.

Subtest 05 Card Modem Loopback (2400BPS)

***NOTES:** (1) To execute this subtest, a 2400 bps type card modem must be installed.  
(2) It is not necessary to turn on power to the modem at the Setup option. When you select this subtest, the modem is powered on automatically.  
(3) To execute this subtest, set the PCMCIA Slot to Others in the Setup program.*

This subtest sends data from the RS-232-C port to the built-in modem. The same data is then sent from the modem to the RS-232-C port and compared to the original data.

When you select the channel number of the serial port and press **Enter**, the following messages appear:

```
Baud rate select (2: 300BPS, 4: 1200BPS, 5: 2400BPS) ?  
Mode select (1: BELL, 2: CCITT) ?
```

Select the baud rate and mode for the card modem and press **Enter** to execute the subtest.

Subtest 06 Interrupt Test

This subtest checks the Interrupt Request Level of IRQs 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 displayed on the screen. The hard disk test contains 10 subtests that test the T1960CS/T1960CT hard disk drive functions.

**CAUTION:** *The contents of the hard disk will be erased when Subtest 02, 03, 04, 05, 06, 08, 09, or 10 is executed. Before running the test, transfer the contents of the hard disk to a backup system. This can be done with the Toshiba 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.*

The following messages will appear after selecting the hard disk test from the DIAGNOSTIC TEST menu. Answer each of the questions with an appropriate response to execute the test.

1. When you select the hard disk test from the DIAGNOSTIC TEST menu, the following message will appear:

**T1960CS:**

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

**T1960CT:**

Test drive number select : HDD#1 (Select the drive using the arrow keys.)

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

**T1960CS:**

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

**T1960CT:**

HDC F/W error retry : YES (Make your selection using the arrow keys.)

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 will appear:

**T1960CS:**

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

**T1960CT:**

Data compare error dump : NO (Make your selection using the arrow keys.)

- 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 will appear:

**T1960CS:**

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

**T1960CT:**

Detail status display : NO (Make your selection using the arrow keys.)

- This message is used to select whether or not the HDD status is displayed on the screen. The HDD status is described in Section 3.15. Select **1** or **2** and press **Enter**.
- The Hard Disk Test message will appear. Select the number of the subtest you want to execute and press **Enter**. The following message will appear 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, and the last two digits indicate the error status code as explained in Table 3-3.

**Subtest 01**    Sequential Read

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

**Subtest 02**    Address Uniqueness

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

- Forward sequential
- Reverse sequential
- Random

**Subtest 03**    Random Address/Data

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

Subtest 04 Cross Talk & Peak Shift

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

<b>Worst Pattern Data</b>	<b>Cylinder</b>
'B5ADAD'	0 cylinder
'4A5252'	1 cylinder
'EB6DB6'	2 cylinder
'149249'	3 cylinder
'63B63B'	4 cylinder
'9C49C4'	5 cylinder
'2DB6DB'	6 cylinder
'D24924'	7 cylinder

Subtest 05 Write/read/compare (CE)

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

Subtest 06 Write specified address

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

Subtest 07 Read specified address

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

Subtest 08 ECC circuit

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

Subtest 09 Sequential write

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

Subtest 10 W-R-C specified address

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

## 3.12 Real Timer Test

To execute the Real Timer Test, select **9** from the DIAGNOSTIC TEST Menu, press **Enter** and follow the directions on the screen. The Real Timer Test contains three subtests that test the T1960CS/T1960CT'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 will appear:

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

```
Enter new date:
```

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

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

```
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

This subtest 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 50-byte memory (address 0Eh to 3Fh)

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

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

Subtest 03 Real Time Carry

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

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

```
Current date : 12-31-1992
Current time : 23:59:58
```

Pressing **Enter** displays the following:

```
Current date : 01-01-1993
Current time : 00:00:00
```

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

Press **Ctrl + Break** to exit.

### 3.13 NDP Test

To execute the NDP test, select **10** from the DIAGNOSTICS TEST Menu, press **Enter** and follow the directions on the screen. The NDP Test contains one subtest that tests the T1960CS/T1960CT's NDP functions.

Subtest 01    NDP

This test checks the following functions of NDP:

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

Press **Ctrl + Break** to exit.

### 3.14 PCMCIA Test

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

#### Subtest 01 I/O Card Test (PCMCIA)

This test checks the following signal lines of the PCMCIA slot:

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

This subtest is executed in the following order:

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

### 3.15 Error Codes and Error Status Names

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

*Table 3-3 Error Codes and Error Status Names (1/2)*

<b>Device Name</b>	<b>Error Code</b>	<b>Error Status Name</b>
(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	03	Mouse Interface Error
	04	DCBP Interface Error
FDD	01	Bad Command
	02	Address Mark Not Found
	03	Write Protected
	04	Record Not Found
	06	Media Removed
	08	DMA Overrun Error
	09	DMA Boundary Error
	10	CRC Error
	20	FDC Error
	40	Seek Error
	60	FDD Not 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
	20	Framing Error
	40	Overrun Error
	80	Line Status Error
	88	Modem Status Error
	33	No Carrier (Card Modem)
	34	Error (Card Modem)
	36	No Dial Tone (Card Modem)

Table 3-3 Error Codes and Error Status Names (2/2)

Device Name	Error Code	Error Status Name
HDD	01	Bad Command Error
	02	Bad Address Mark Error
	04	Record Not Found
	05	HDC Not Reset Error
	07	Drive Not Initialized
	08	HDC Overrun (DRQ)
	09	DMA Boundary Error
	0A	Bad Sector
	0B	Bad Track Error
	10	ECC Error
	11	ECC Recover Enable
	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
PCMCIA	C1	Address Line Error
	C2	REG# Line Error
	C3	CE#1 Line Error
	C4	CE#2 Line Error
	C5	DATA Line Error
	C6	WAIT Line Error
	C7	BSY# Line Error
	C8	BVD1 Line Error
	CD	No PCMCIA

### 3.16 Hard Disk Test Detail Status

If an error occurs in the Hard Disk Test, the following message displays:

```
HDC status = XXXXXXXX
```

Detailed information about the hard disk test error is displayed 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 two bytes; the first byte displays the contents of the HDC status register in hexadecimal form, and the second byte displays the HDC error register.

Contents of the HDC status register and error register are listed in Tables 3-4 and 3-5.

*Table 3-4 Hard Disk Controller Status Register Contents*

Bit	Name	Description
7	BSY (Busy)	"0" --- HDC is busy. "1" --- HDC is ready.
6	DRDY (Drive ready)	"0" --- Hard disk drive is not ready to accept any commands. "1" --- Hard disk drive is ready.
5	DWF (Drive write fault)	"0" --- DWF error is not detected. "1" --- Write fault condition occurred.
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 was corrected.
1	IDX (Index)	"0" --- Other "1" --- Index is sensed.
0	ERR (Error)	"0" --- Other "1" --- The previous command was terminated with an error.

*Table 3-5 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 occurred.
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

Of the two types of hard-disk formatting—low-level (physical) and MS-DOS (logical)—this function performs a low-level format of the hard disk and executes the following hard disk formats and check:

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

**CAUTION:** *The contents of the hard disk will be erased when this program is executed. Before executing the function, transfer the contents of the hard disk onto a backup system. This can be done with the Toshiba MS-DOS BACKUP command. See the Toshiba MS-DOS manual for details.*

### 3.17.1 Function Description

1. All track FORMAT

This option performs a low-level format of all the tracks on the hard disk as listed in Table 3-6 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 3-6 Hard Disk Formatting Sequence

Item	200 MB	320 MB
	(MK1624FCV)	(MK2326FC)
Sector sequences	1	1
Cylinders	0 to 683	0 to 968
Heads	0 to 15	0 to 13
Sectors	1 to 38	1 to 49
Sector length (bps)	512	512

## 2. Good track FORMAT

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

## 3. Bad track FORMAT

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

## 4. Bad track CHECK

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

### 3.17.2 Operations

**CAUTION:** *The contents of the hard disk will be erased when this program is executed. Before executing the function, transfer the contents of the hard disk onto a backup system. This can be done with the Toshiba MS-DOS BACKUP command. See the Toshiba MS-DOS manual for details.*

Select TEST 2 (Hard Disk Format) from the DIAGNOSTIC MENU and press **Enter**. The following selections display:

```
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 formats the entire disk.

```
[All track FORMAT]

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

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

The following prompts appear at the bottom of the screen in succession:

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

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

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

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

- (c) Bad track register

The Bad Track register prompt will appear as shown below. Enter the cylinder and head numbers of the 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 the track verification process 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 formatted as a bad track automatically.

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 the drive, interleave, cylinder and head as indicated in the screen prompts 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 the drive, interleave, cylinder and head as indicated in the screen prompts shown below.

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

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

4. Bad track CHECK

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

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

Bad tracks will be displayed in the format shown below.

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

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

**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.

## 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 required to perform this function.

### 3.18.2 Operations

1. Select **4** (Head Cleaning) from the DIAGNOSTICS MENU and press **Enter** to display the following messages:

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

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

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

2. Remove the Diagnostics Disk from the FDD, insert the cleaning disk, and press **Enter**.
3. When the "cleaning start" message appears, the FDD head cleaning has begun.
4. The display automatically returns to the DIAGNOSTICS MENU when the program is completed.

## 3.19 Log Utilities

### 3.19.1 Function Description

This function logs error information generated while a test is in progress and stores the results in RAM. The Log Utilities can store data on a floppy disk or output the data to a printer. If the power switch is turned off, the error information will be lost. Error information is displayed in the following order:

1. Error count (CNT)
2. Test name (TS-NAME)
3. Subtest number (TS-NAME)
4. Pass count (PASS)
5. Error status (STS)
6. FDD/HDD or memory address (ADDR)
7. Write data (WD)
8. Read data (RD)
9. HDC status (HSTS)
10. Error status name ( ERROR STATUS NAME)

### 3.19.2 Operations

1. Select **5** (Log Utilities) from the DIAGNOSTICS MENU and press **Enter**. Error information is logged into RAM or onto a floppy disk. This information is displayed in the following format:

```
XXXXXX ERRORS
CNT TS-NAME PASS STS ADDR      WD RD HSTS [STATUS NAME]
001 FDD 02 0000 103 00001    00 00      FDD - WRITE PROTECTED
001 FDD 01 0000 180 00001    00 00      FDD - TIME OUT ERROR
```

Labels for the output format:

- CNT: Error count
- TS-NAME: Test name
- PASS: Subtest number
- STS: Pass count
- ADDR: Error status
- WD: Write data
- RD: Read data
- HSTS: HDC status
- [STATUS NAME]: Error status name

[[1:Next, 2:Prev, 3:Exit, 4:Clear, 5:Print, 6:FD Log Read, 7:FD Log Write]]

2. Error information displayed 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 Diagnostic Menu.

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

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

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

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

3. If an “error retry OK” condition occurs, 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, and 06)
3. Display Test (Subtests 01 to 08)
4. FDD Test (Subtest 02)
5. HDD Test (Subtests 01 and 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 T1960CS/T1960CT for the FDD test.

### 3.20.2 Operations

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

1. Remove the diagnostics disk from the floppy disk drive and insert the work disk.
2. Select **6** (Running Test) from the DIAGNOSTICS MENU and press **Enter**, the following message will be displayed:

Printer wraparound test (Y/N) ?

Selecting **Y (Yes)** executes the printer wraparound test. A printer wrap-around connector must be connected to the **PRT/FDD** port on the back of the T1960CS/T1960CT to properly execute this test.

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

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

Selecting **Y (Yes)** executes the ASYNC wraparound test. An RS-232-C wraparound connector must be connected to the **serial port** on the back of the T1960CS/T1960CT to properly execute this test.

4. Select **Yes** or **No** and press **Enter**. The following message will appear :

```
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 the 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.*

This program can format 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

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

#### 3. DUMP

This program displays the contents of the floppy disk (both 3.5-inch and 5.25-inch) and the designated sectors of the hard disk on the display.

### 3.21.2 Operations

1. Select **7** (FDD Utilities) from the DIAGNOSTICS MENU and press **Enter**. The following message displays:

```
[ 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 will be displayed:

```
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 will be displayed 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 will appear:

```
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 will display a message similar to the one below:

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

- (c) Remove the Diagnostics Disk from the FDD, insert the source disk, and press any key. The following message will appear, 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 will appear and start copying to the target disk. When the amount of data is too large to be copied in one operation, the message from Step (b) is displayed again. After the floppy disk has been copied, the following message will appear:

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

- (e) To copy another disk, type **1** and the message from Step (a) will be displayed 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. The following message appears:

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

- (c) Select a drive number. If **C** or **D** is selected, the display will go to Step (e), otherwise the following message will be displayed:

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

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

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

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

```
— 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 T1960CS/T1960CT:

1. BIOS ROM version
2. Boot ROM version
3. The number of math co-processors
4. Base memory size
5. The number of floppy disk drives
6. The number of ASYNC ports
7. The number of hard disk drives
8. The number of printer ports
9. Extended Memory Size
10. KBC version
11. PS Micom Version

### 3.22.2 Operations

Select **8** (System Configuration) from the DIAGNOSTICS MENU and press **Enter** to display the system configuration:

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

Press [Enter] Key

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
  - (d) Shadow BIOS ROM
2. Display
  - (a) Display Adapter
  - (b) LCD Display Mode
  - (c) LCD Display Colors (T1960CT only)
  - (d) Power On Display (T1960CT only)
3. COM/PCMCIA/FDD/PRT
  - (a) Serial Port
  - (b) PC Card Slot
  - (c) External FDD/PRT
  - (d) Printer Port Type
4. Hard Disk
5. Power on Password
6. Others
  - (a) Power-up Mode
  - (b) CPU Cache
  - (c) Processing Speed
  - (d) Battery Save Mode
  - (e) Popup
  - (f) Speaker
  - (g) Battery Alarm
  - (h) Panel Power On/Off
  - (i) Boot Priority
7. Battery Save Options
  - (a) CPU Sleep Mode
  - (b) HDD Auto Off
  - (c) Display Auto Off
  - (d) System Auto Off

### 3.23.2 Accessing the SETUP Program

Select **0** (Setup) from the DIAGNOSTICS MENU and press **Enter**. The following screen displays:

SYSTEM SETUP		BIOS version = x.xx
<b>MEMORY</b>		
Total	=	4096 KB
Base	=	640 KB
Extended	=	3328 KB
Shadow BIOS ROM	=	128 KB
<b>HARD DISK</b>		
Capacity	=	***MB
<b>POWER ON PASSWORD</b>		
Not Registered		
<b>DISPLAY</b>		
Display Adapter	=	VGA compatible
LCD Display Mode	=	Color
LCD Display Colors	=	256K colors
Power On Display	=	Internal/External
<b>COM/PCMCIA/FDD/PRT</b>		
Serial Port	=	COM1 (IRQ4/3F8H)
PC Card Slot	=	PCMCIA
External FDD/PRT	=	Printer
Printer Port Type	=	Output
<b>OTHERS</b>		
Power-up Mode	=	Boot
CPU Cache	=	Enabled
Processing Speed	=	High
Battery Save Mode	=	Automatic (Normal Life)
Popup	=	Enabled
Speaker	=	Enabled
Battery Alarm	=	Enabled
Boot Priority	=	FDD→HDD

↑ ↓ ← → : Select items, Space, BkSp : Change values  
Esc: Exit without saving, Home: Set default values, End: Save changes and Exit

**NOTE:** The LCD display colors and power on display do not appear on the T1960CS screen.

### 3.23.3 Moving Within the SETUP Menu and Changing Values

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

### 3.23.4 Accepting Changes and Exiting the SETUP Window

1. Press **End** to accept the changes you made. The following message displays:

Are you sure? (Y/N)

- (a) To make other changes, press **N**, then repeat the steps above.
- (b) To accept the changes, press **Y**. The system will reboot automatically.

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

### 3.23.5 Factory Preset Configuration

When you access SETUP, the current configuration is displayed.

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

### 3.23.6 SETUP Options

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

#### 1. Memory

This option lists the computer's memory allocations. Values are automatically calculated by the computer.

##### (a) Total

Displays the total amount of memory installed.

##### (b) Base

Displays the amount of base (conventional) memory (**640 KB**).

##### (c) Extended Memory

Displays the amount of extended memory the computer has available.

##### (d) Shadow BIOS ROM

Displays 128 KB of RAM, which is reserved for the Shadow BIOS ROM.

#### 2. Display

These options help you configure the computer's display.

##### (a) Display Adapter

Displays the internal adapter for the VGA internal display. Only **VGA compatible** is displayed. You cannot change it.

##### (b) LCD Display Mode

Sets the computer's display mode.

<i>Color</i>	Selects 80 x 25 text or 640 x 480 graphics modes. This option also affects a color monitor attached to the external display port. (Default)
<i>Monochrome</i>	Selects monochrome mode. This is also used when you attach a VGA monochrome monitor to the external display port. Note that some software displays best in monochrome mode.

**NOTE:** When you connect a CRT to the computer, you cannot change the display mode. The LCD Display Mode is automatically set to conform to the CRT being used.

(c) LCD Display Colors (T1960CT only)

Selects the color palette of the T1960CT's internal TFT display when the "LCD Display Mode" is set to *Color*.

<i>256K colors</i>	Displays 256 colors out of 262,144.
<i>180K colors</i>	Displays 256 colors out of 185,193.
<i>24K colors</i>	Displays 256 colors out of 24,576.
<i>512 colors</i>	Displays 256 colors out of 512.

**NOTE:** If the screen flickers with a certain LCD Display Colors setting, select a setting that has a lower number of colors.

(d) Power On Display (T1960CT only)

Selects the display when booting up or starting the computer from resume mode.

<i>Internal/External</i>	Uses the internal LCD if an external CRT is not connected, and uses the external CRT if one is connected.
<i>Simultaneous</i>	Uses both the internal LCD and the external CRT if one is connected.

### 3. COM/PCMCIA/FDD/PRT

This option controls settings for the serial and parallel ports and the PC card slot.

#### (a) Serial Port

Allows you to set the COM level— COM1 or COM2—for the serial port and PC Card slot.

The serial port interrupt 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 (PCMCIA default)
Not used		(Disables port)

If the COM level for the serial port is set to the same level as the Toshiba card modem, the card modem's COM level is automatically reset to *Not Used*.

#### (b) PC Card Slot

Enables you to select how the PC Card slot is used.

*PCMCIA* Choose this selection when you have installed a PCMCIA card. (Default)

*Others* Choose this selection when you have installed a Toshiba card modem (model: PC-22-T24M, or PC-T24SL).

When you choose *Others*, the subwindow below appears to let you control the modem's COM Port and power.

COM Port = COM2 (IRQ3/2F8H)  
Power = On

Use the *COM Port* option to select the interrupt (IRQ)/COM level for the Toshiba card modem: COM1 or COM2. (Default)

Use the *Power* option to turn the power to the modem on or off.

When the "COM Port" option is set to *Others*, the "Power" option is displayed in the subwindow. The "Power" option indicates the setting in CMOS.

(c) External FDD/PRT

Assigns the function of the printer/FDD port.

<i>Printer</i>	Configures the port for output to a printer or other parallel device. (Default)
<i>FDD A</i>	Configures the port for output and input to and from the external 5 1/4" diskette drive and assigns the letter A to the external drive. By default the internal drive becomes Drive B.
<i>FDD B</i>	Configures the port for output and input to and from the external 5 1/4" diskette drive and assigns the letter B to the external drive. By default the internal drive remains Drive A.

The following table is a quick reference to the "External FDD/PRT" setting.

Option Setting	External FDD ID	Internal FDD ID
Printer (default)	None	A
FDD A	A	B
FDD B	B	A

(d) Printer Port Type

Sets the communication mode for the printer/FDD port to either output-only or bi-directional. It is effective only when the "External FDD/PRT" option is set to *Printer*. If *FDD A or B* is selected, this setting is ignored and the mode is automatically set to bi-directional. For most printers, the port should be set to *Output*. With some other parallel devices, the setting should be *Bi-directional*.

<i>Output</i>	Activates uni-directional operation. (Default)
<i>Bi-directional</i>	Activates bi-directional operation.

4. Hard Disk

This option enables or disables the hard disk drive.

<i>200 or 320 MB</i>	You can access the hard disk. The disk's capacity is automatically displayed and cannot be changed.
<i>No Drive</i>	You cannot access the hard disk.

## 5. Power On Password

This option allows you to set or reset the power-on password.

*Registered*      The password has been registered.

*Not registered*      The password has not been registered.

For details on setting the power-on password, refer to your T1960CS/T1960CT User's Manual.

## 6. Others

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

### (a) Power-up Mode

Lets you choose between AutoResume and boot mode. You can also set this option using the Pop-up Window.

*Boot*      Turns on boot mode. (Default)

*Resume*      Turns on the AutoResume feature.

***NOTE:*** *AutoResume does not work with the enhanced mode of Microsoft Windows unless the WRESUME driver is loaded.*

### (b) CPU Cache

Enables or disables the CPU cache.

*Enabled*      Enables the CPU cache. (Default)

*Disabled*      Disables the CPU cache.

### (c) Processing Speed

Changes the CPU processing speed.

*High*      The CPU operates at 50 MHz. (Default)

*Low*      The CPU operates at half speed.

(d) Battery Save Mode

Selects *Automatic (Normal Life)*, *Automatic (Long Life)* or *User Setting* of the "Battery Save Option." You can also set this option using the Pop-up Window.

*Automatic (Long life)* Default when the computer is booted without the AC adapter connected.

Battery Save Options  
CPU Sleep Mode = Enabled  
HDD Auto Off = 03 Min.  
Display Auto Off = 03 Min.  
System Auto Off = 30 Min.

*Automatic (Normal life)* Default when the computer is booted with the AC adapter connected.

Battery Save Options  
CPU Sleep Mode = Disabled  
HDD Auto Off = Disabled  
Display Auto Off = Disabled  
System Auto Off = Disabled

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

*User Setting* This option allows you to set the battery save parameters on the subwindow, **Battery Save Options**. When you select *User Setting*, the automatic setting feature (Long Life or Normal Life) is disabled and the user-preferred parameters become effective. The default setting in the sub-windows depends on the **Battery Save Mode: Automatic (Long Life) or Automatic (Normal Life)**. For details, see "Battery Save Options" later in this section.

(e) Popup

Enables or disables the Pop-up Window.

*Enabled* You can access the Pop-up Window. (Default)

*Disabled* You cannot access the Pop-up Window.

(f) Speaker

Enables or disables software use of the system speaker. Setting this option to *Disabled* disables the self-test alarm. All other system alarms are unaffected. This option also appears in the Pop-up Window.

*Enabled* Enables software use of the system speaker.  
(Default)

*Disabled* Disables software use of the system speaker.

(g) Battery Alarm

Enables or disables the low battery alarm. This option also appears in the Pop-up Window.

*Enabled* Enables the alarm. (Default)

*Disabled* Disables the alarm.

(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 automatically powers off when the display panel is closed and powers 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)

(i) Boot Priority

Selects 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 does not affect the setting.

## 7. Battery Save Options

### (a) CPU Sleep Mode

Enables or disables the CPU sleep function.

*Enabled*                      Enables sleep mode.

*Disabled*                     Disables sleep mode.

### (b) HDD Auto Off

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

*Disabled*                     Disables HDD automatic power off.

*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 3, 5, 10, 15, 20 or 30 minutes.

### (c) Display Auto Off

Disables or sets the duration of the display automatic power-off function. This function causes the computer to turn the display 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 display illumination LCD panel 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.

### (d) System Auto Off

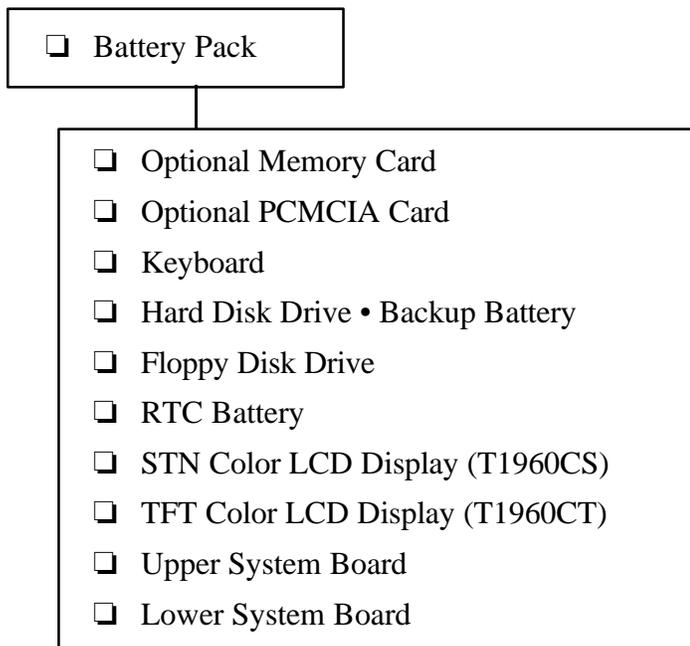
Enables or disables the system automatic off function when the power-up mode is set to Resume. In boot mode, this feature is always disabled.

*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 3, 5, 10, 15, 20 or 30 minutes.

## 4.1 General

This section explains how to disassemble the T1960CS/T1960CT 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 chart to determine which FRU you must remove next in order to repair the one you think is causing the T1960CS/T1960CT to operate improperly.



### Before You Begin

Look over the procedures in this section before you begin disassembling the T1960CS/T1960CT. Familiarize yourself with the disassembly and reassembly steps, then begin each procedure by removing the AC adapter and the battery pack as instructed in Section 4.2, *The Battery Pack*.

1. Do not disassemble the T1960CS/T1960CT 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 T1960CS/T1960CT:
  - ❑ Dust and contaminates
  - ❑ Static electricity
  - ❑ Extreme heat, cold and humidity
4. Make sure the FRU you are replacing is causing the abnormal operation by performing the necessary diagnostic 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 T1960CS/T1960CT.
6. After removing parts from the computer, place them in a safe place away from the computer so they will not be damaged and will not interfere with your work.
7. You will remove and replace many screws when you disassemble the computer. When you remove screws, make sure they are placed in a safe place and identified 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.

**NOTE:** *The illustrations in this chapter are based on the appearance of the T1960CS, unless otherwise noted.*

## Disassembly Procedures

The T1960CS/T1960CT has two basic types of cable connectors:

- Pressure Plate Connectors
- Normal Pin Connectors

To disconnect a Pressure Plate connector, pull the pressure plate's side tabs straight out (toward the cable) and slide the cable out of the connector. To connect a cable to a Pressure Plate connector, make sure the pressure plate is open by fully extending the side tabs, then slide the cable into the connector. Secure the cable in place by pushing the side tabs of the pressure plate in so the plate is flush with the sides of the connector. *Gently* pull on the cable to make sure it is secure. If you pull out the connector, connect it again making sure the pressure plate's side tabs are fully extended 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 it to operate abnormally, you will need to reassemble it.

While assembling the T1960CS/T1960CT, remember the following general points:

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

After installing an FRU, confirm that it 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 T1960CS/T1960CT:

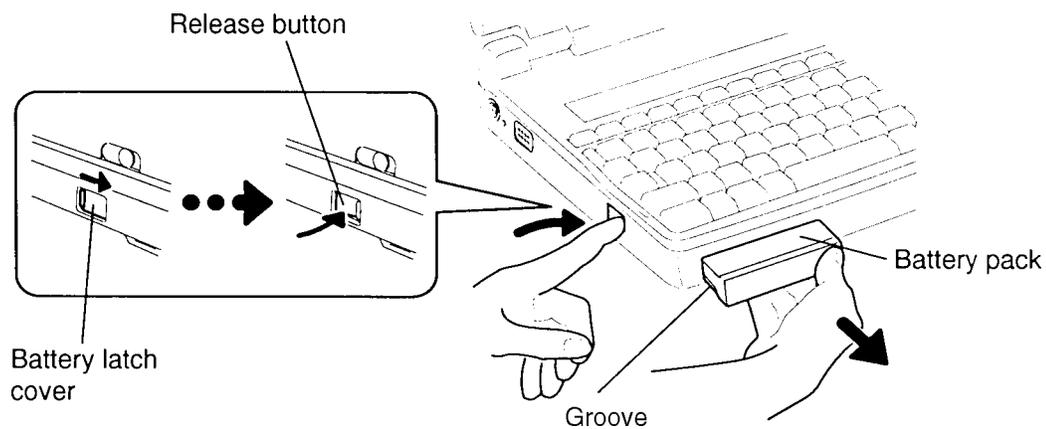
- One M2 Phillips screwdriver to remove and replace screws.
- A Jeweler's screwdriver to remove screw covers.
- Tweezers to lift out screws that you cannot grasp with your fingers.
- ESD mats for the floor and the table you are working on.
- An ESD wrist strap or heel grounder.
- Antistatic carpeting or flooring.
- Air ionizers in highly static-sensitive areas.

## 4.2 The Battery Pack

### Removing the Battery Pack

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

1. Turn off the power to the computer, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Close the display if it is open.
3. Slide open the **cover** to the battery latch and press the **release button** until it clicks. The battery will pop out slightly.
4. Firmly grasp the **battery pack** and pull it out.



*Figure 4-1 Removing the Battery Pack*

### Installing the Battery Pack

**NOTE:** The battery pack is designed to fit into the T1960CS/T1960CT in only one way.

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

1. Gently slide the **battery pack** into the battery slot making sure the **groove** on the side of the battery faces left and the smooth side faces right.
2. Push the **battery pack** in until it locks into place.

## 4.3 Optional Memory Card

### Removing an Optional Memory Card

To remove an optional memory card from the computer, follow the steps below and refer to Figure 4-2.

1. Turn off the power to the computer, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack as described in Section 4.2.
3. Open the **cover** to the expansion memory slot.
4. Grasp the plastic tab and pull it so the card comes partially out of the computer.
5. Grasp the **optional memory card** and pull it completely out.

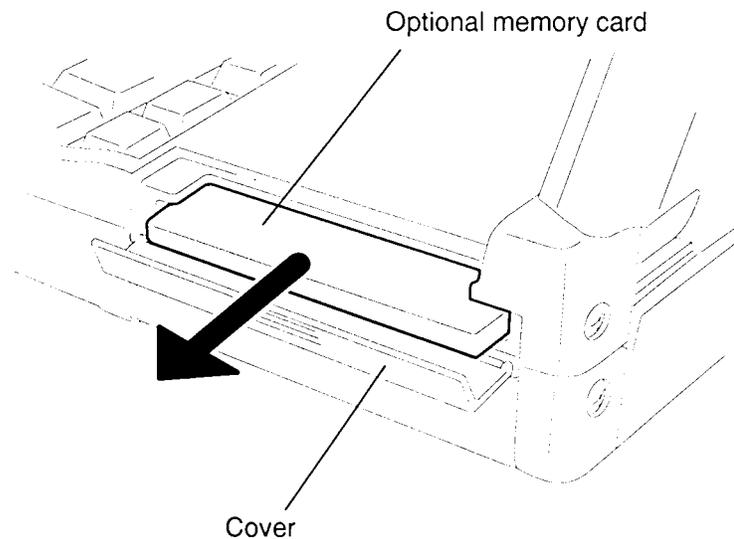


Figure 4-2 Removing the Optional Memory Card

**CAUTION:** DO NOT touch the connecting edge of the memory card. Debris or oil in or on the connector may cause memory access problems.

## Installing an Optional Memory Card

To install an optional memory card in the T1960CS/T1960CT, follow the steps below and refer to Figure 4-2.

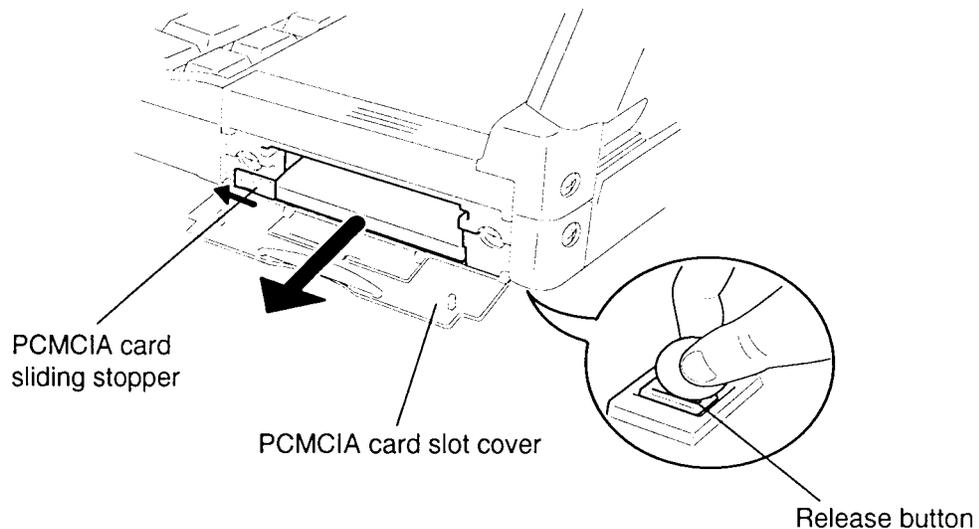
1. The top of the **optional memory card** is marked with the word “insert” and an arrow pointing toward the connecting edge. Turn the memory card so that it is facing up and carefully insert the connecting edge (arrow first) into the slot. Push gently to ensure a firm connection.
2. Close the **expansion memory cover**.
3. Install the battery pack as described in Section 4.2.
4. The T1960CS/T1960CT automatically configures all additional memory as extended memory.

## 4.4 Optional PCMCIA Card

### Removing an Optional PCMCIA Card

To remove an optional PCMCIA card from the T1960CS/T1960CT, follow the steps below and refer to Figure 4-3.

1. Turn off the power to the computer, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack as described in Section 4.2.
3. Open the **PCMCIA card slot cover** (located below the memory card slot), then slide the **PCMCIA card sliding stopper** to the left.
4. Use a coin or similar object to slide the PCMCIA card **release button** on the bottom of the computer to pop the card slightly out.
5. Grasp the card and pull it out.

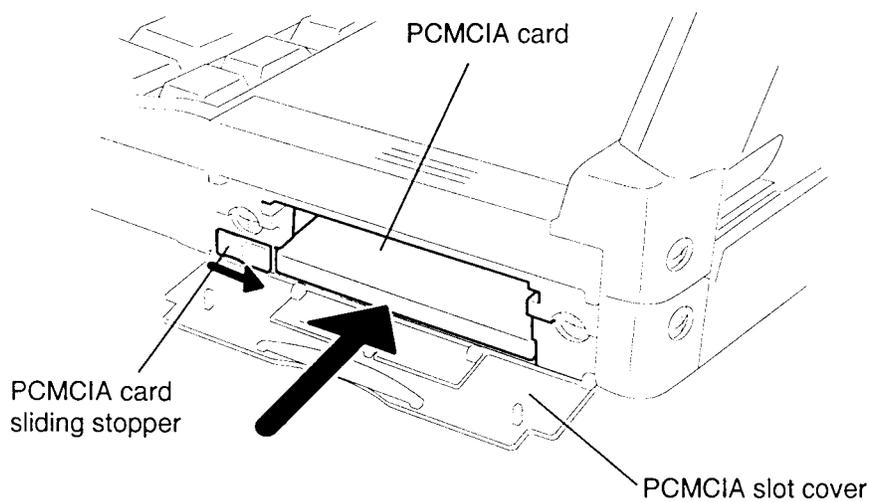


*Figure 4-3 Removing the PCMCIA Card*

## Installing an Optional PCMCIA Card

To install an optional PCMCIA card in the T1960CS/T1960CT, follow the steps below and refer to Figure 4-4.

1. To install a **PCMCIA card**, carefully insert the card, making sure the card is right side up and the contact surface is inserted first.
2. 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.
3. Push the **PCMCIA card sliding stopper** into place, then close the **PCMCIA slot cover**.



*Figure 4-4 Installing the Optional PCMCIA Card*

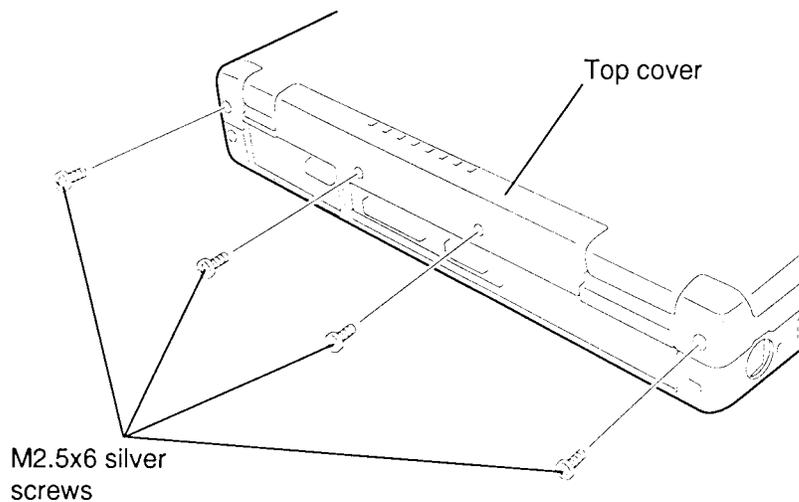
4. Install the battery pack as described in Section 4.2.

## 4.5 Top Cover

### Removing the Top Cover

To remove the T1960CS/T1960CT's top cover, follow the steps below and refer to Figures 4-5 and 4-6.

1. Turn off the power to the computer, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, and optional PCMCIA card as described in Sections 4.2, 4.3, and 4.4.
3. At the back of the computer, remove the **four M2.5x6 silver screws** securing the **top cover** (Figure 4-5).



*Figure 4-5 Removing Top Cover Screws*

4. Turn the computer so the front faces you and open the display. Lay the display back fully. (Put a book or small box behind the display to support it.)

5. Open the **expansion memory slot cover** on the right side of the unit (Figure 4-6).
6. Using a jeweler's screwdriver, remove the **screw cover** located above the function keys, then remove the **M2.5x10 screw** (Figure 4-6).

**NOTE:** *Be sure to use the correct screws when reassembling the top cover.*

7. Unsnap the **latches** securing the **top cover** to the base assembly. Start by pressing on the front of the **top cover** just in front of the space bar and rotate the keyboard's front edge toward you to release the **front latches** (Figure 4-6).
8. Continue around the rim of the **top cover** until all latches are released, then carefully lift up the **top cover** (Figure 4-6).

**NOTES:** (1) *The latch on the back left corner may catch. To release this latch, gently move the cover back and forth to free it from the chassis.*

(2) *As you remove the top cover, the RGB and PRT port protective covers will fall away from the back of the unit.*

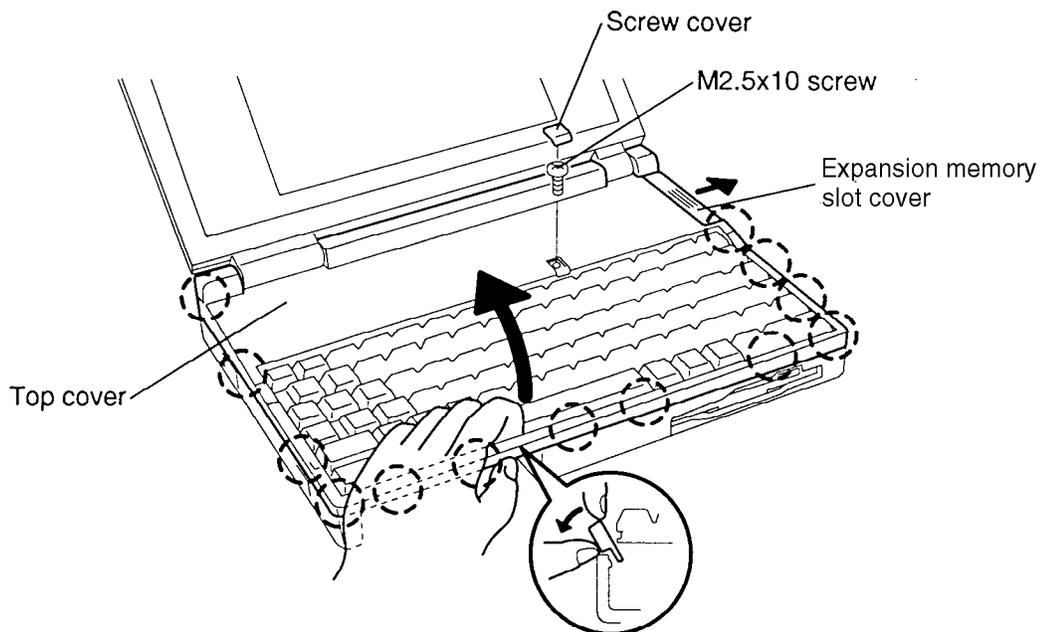


Figure 4-6 Unlatching the Top Cover

## Installing the Top Cover

To install the top cover follow the steps below and refer to Figures 4-5 and 4-6.

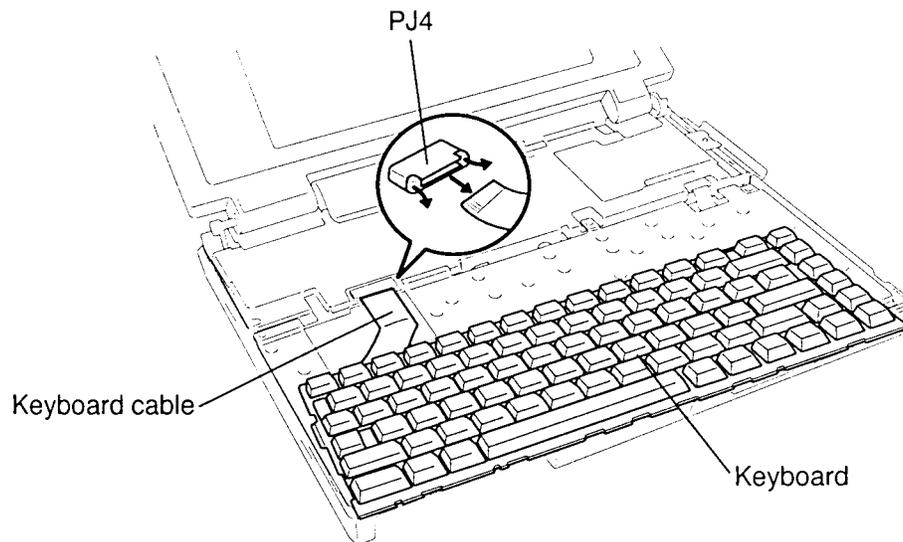
1. Place the **top cover** on the computer.
2. Begin at the back and snap the **top cover** into place. Continue along the sides and snap the front latches last (Figure 4-6).
3. Secure the **M2.5x10 screw** above the function keys and replace the **screw cover** (Figure 4-6).
4. Close the display and set the RGB and PRT port protective covers in place.
5. Secure the **four M2.5x6 silver screws** at the back of the unit (Figure 4-5).
6. Install the optional PCMCIA card, optional memory 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 Figure 4-7.

1. Turn off the power to the computer, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card and top cover as described in Sections 4.2 through 4.5.
3. Carefully lift up the **keyboard** to expose the keyboard connector.
4. Disconnect the **keyboard cable** from **pressure-plate connector PJ4** on the upper system board and set the keyboard aside.

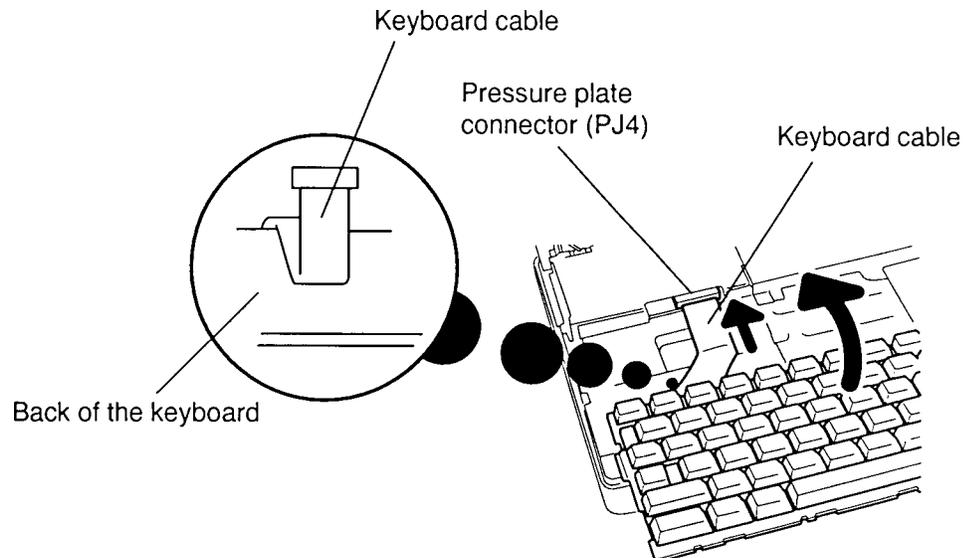


*Figure 4-7 Removing the Keyboard*

## Installing the Keyboard

To install the keyboard, follow the steps below and refer to Figures 4-7 and 4-8.

1. Connect the **keyboard cable** to **pressure plate connector PJ4** on the upper system board (Figure 4-7).
2. Seat the **keyboard** in the computer. Note that a fold is built into the **keyboard cable**. Do not try to bend the cable at any other point when you install the keyboard (Figure 4-8).



*Figure 4-8 Seating the Keyboard*

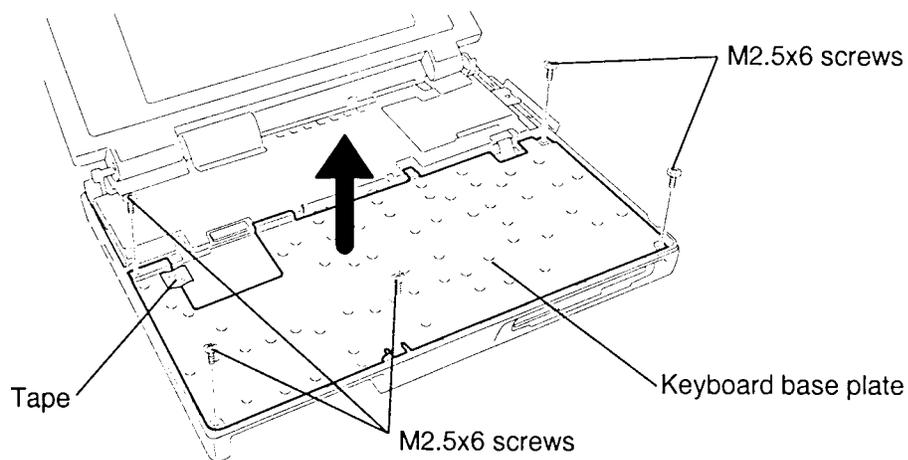
3. Install the top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.5 through 4.2.

## 4.7 Hard Disk Drive • Backup Battery

### Removing the Hard Disk Drive • Backup Battery

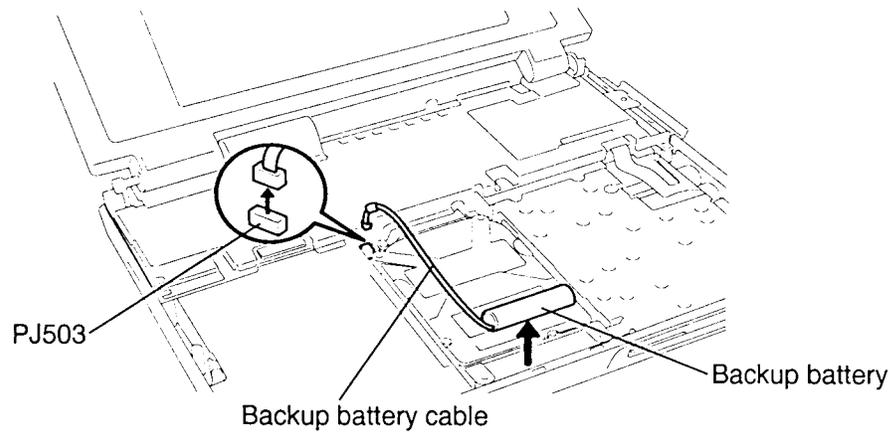
To remove the hard disk drive and backup battery, follow the steps below and refer to Figures 4-9 through 4-12.

1. Turn off the power to the computer, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, and keyboard as described in Sections 4.2 through 4.6.
3. Remove the **tape** next to the keyboard connector (PJ4).
4. Remove the **five M2.5x6 screws** securing the **keyboard base plate** to the bottom cover and lift off the plate (Figure 4-9).



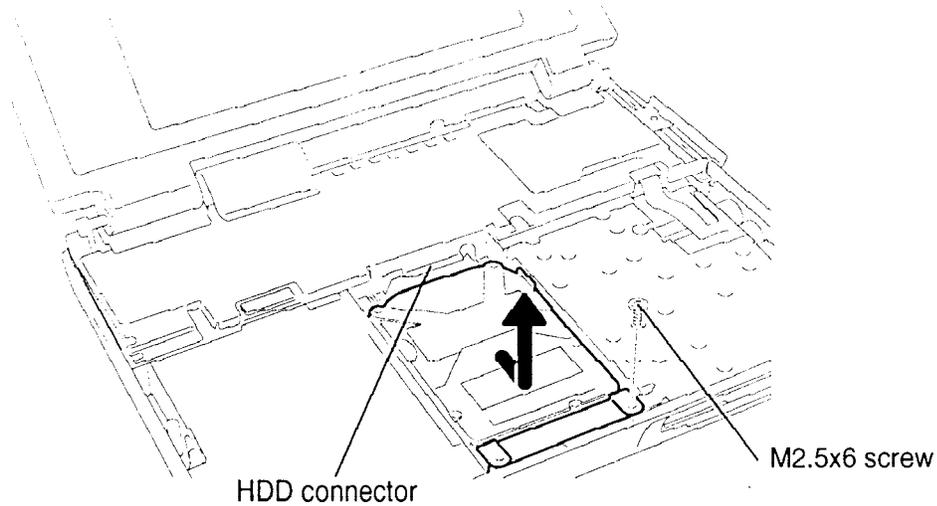
*Figure 4-9 Removing the Keyboard Base Plate*

5. Disconnect the **backup battery cable** from **PJ503**, and lift out the **backup battery** (Figure 4-10).



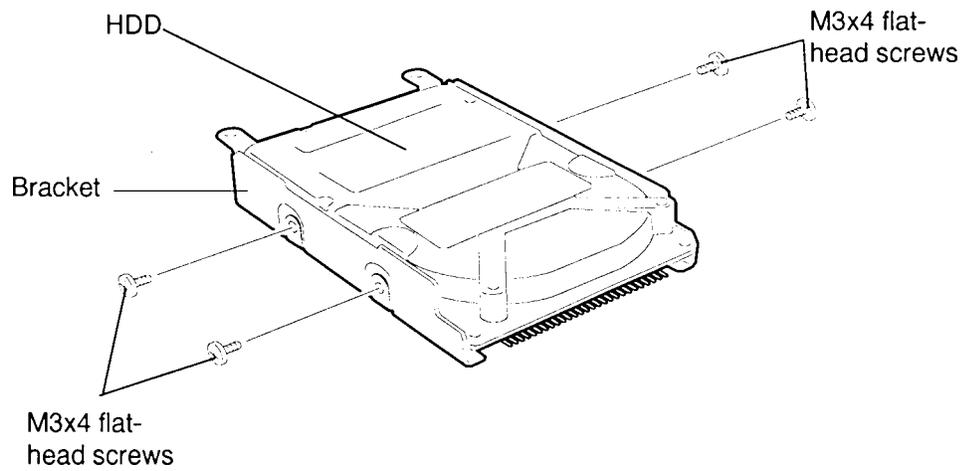
*Figure 4-10 Removing the Backup Battery*

6. Remove the **M2.5x6 screw** from the front of the HDD, and slide the HDD to the front to disconnect the **HDD connector** (Figure 4-11).
7. Lift out the HDD from the system unit.



*Figure 4-11 Removing the HDD*

- Remove the **four flat-head M3x4 screws** securing the **bracket** to the HDD and slip off the bracket (Figure 4-12).

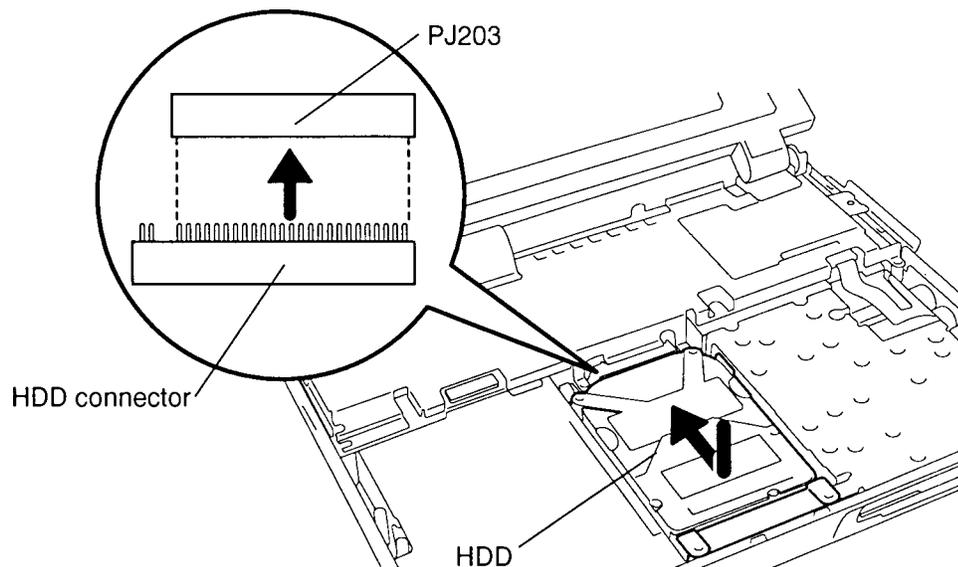


*Figure 4-12 Removing the Bracket from the HDD*

## Installing the Hard Disk Drive and Backup Battery

To install the hard disk drive and backup battery, follow the steps below and refer to Figures 4-9 through 4-13.

1. Secure the **bracket** with the **four flat-head M3x4 screws** (Figure 4-12).
2. Connect the **backup battery cable** to **PJ503** (Figure 4-10).
3. Place the **HDD** into the HDD slot, and slide the drive to the back. Make sure the **HDD connector** connects to **PJ203** on the lower system board correctly as shown in Figure 4-13.



*Figure 4-13 Connecting the HDD to the System Board*

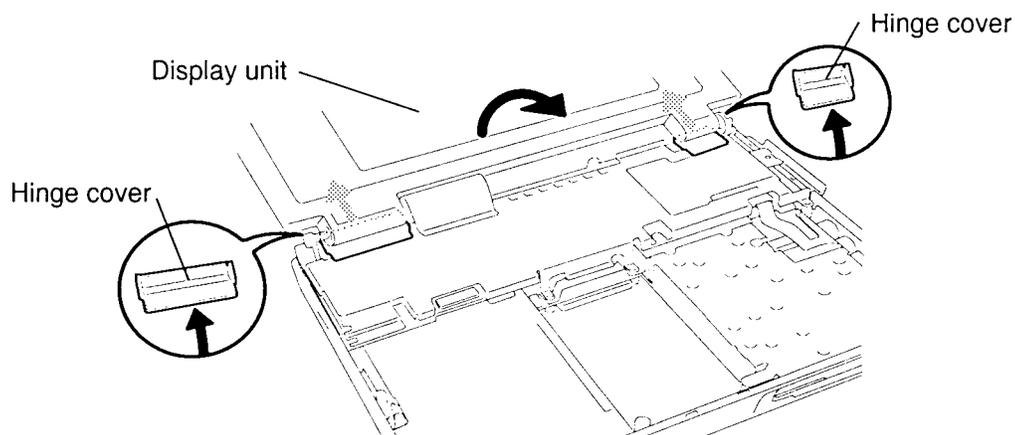
4. Route the **backup battery cable** in the space between the HDD and the battery cable insulator, then place the backup battery in the backup battery slot (Figure 4-10).
5. Secure the **M2.5x6 screw** at the front of the HDD (Figure 4-11).
6. Set the **keyboard base plate** in place and secure it with the **five M2.5x6 screws** (Figure 4-9).
7. Replace the **tape** next to the keyboard connector (PJ4) (Figure 4-9).
8. Install the keyboard, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.6 through 4.2.

## 4.8 Display Assembly

### Removing the Display Assembly

To remove the T1960CS/T1960CT's display assembly, follow the steps below and refer to Figures 4-14 through 4-16.

1. Turn off the power to the computer, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, keyboard, and keyboard base plate as described in Sections 4.2 through 4.7.
3. Set the **display unit** at a 90° angle to the base and remove the **two hinge covers** from the left and right hinges (Figure 4-14).



*Figure 4-14 Removing the Hinge Covers*

4. Remove the display mask as described in Section 4.12.
5. Remove the **four M2.5x8 silver screws** and **two M2.5x10 screws** on the **system board cover** (Figure 4-15). Note that the M2.5x8 screw under the left hinge secures the ground wire.
6. Peel back the clear **plastic insulator** covering the display cable and lift out the **system board cover**. As you lift the cover, place your fingers under the right side to keep the **memory card housing** intact.

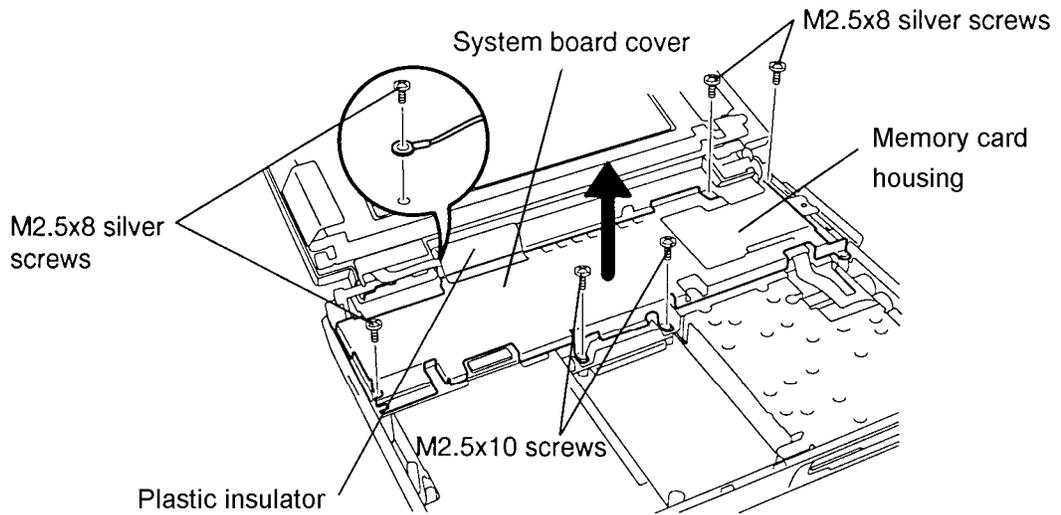


Figure 4-15 Removing the System Board Cover

7. Disconnect the **two display cables** from **PJ8** and **PJ9** on the system board (Figure 4-16).
8. Disconnect the **display sensor switch cable** from **PJ6** on the system board.
9. Remove the **M2.5x6 silver screw** at the back right corner of the computer.
10. Lay the display back fully, (put a book or small box behind the display to support it) and remove the **two M2.5x8 silver screws** on the display hinges securing the display (Figure 4-16).
11. Lift off the display assembly (Figure 4-16).

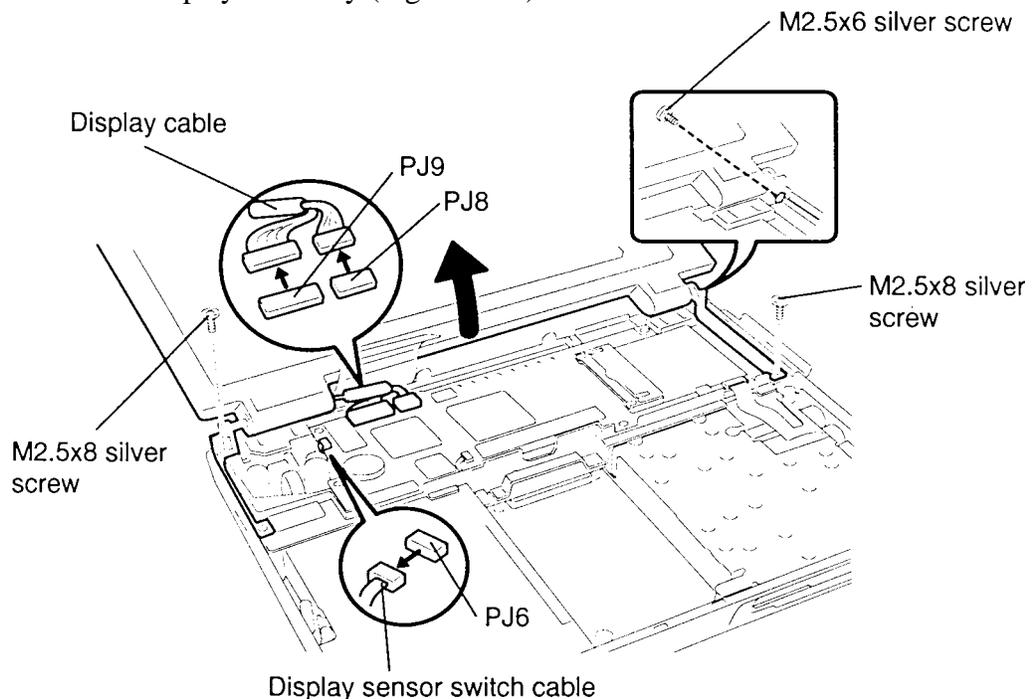


Figure 4-16 Removing the Display Assembly

## Installing the Display Assembly

To install the T1960CS/T1960CT's display assembly, follow the steps below and refer to Figures 4-14 and 4-16.

1. Place the **display assembly** on the computer aligning the brackets with the screw holes on the middle-frame assembly. Be sure to route the clear **plastic insulator** between the display assembly and the bottom chassis (Figure 4-16.)
2. Replace the **two M2.5x8 silver screws** on the display hinges to secure the display assembly (Figure 4-16).

**CAUTION:** *If you replace a cable with a new one, be sure to bend and route it as indicated in Figures 4-14 through 4-16 so that it fits snugly and will not be pinched by the top cover or other components.*

3. Connect the **display sensor switch cable** to **PJ6** on the system board (Figure 4-16) .
4. Connect the **two display cables** to **PJ8** and **PJ9** on the system board (Figure 4-16).
5. Secure the **M2.5x6 silver screw** on the back of the computer (Figure 4-16).
6. Set the **system board cover** in place and secure the **display ground cable** with an **M2.5x8 silver screw** (Figure 4-15).
7. Secure the **system board cover** with **three M2.5x8 silver screws** and **two M2.5x10 screws** (Figure 4-15).
8. Place the clear **plastic insulator** over the display cables and press the insulator so that it adheres to the **system board cover** (Figure 4-15).
9. Set the display unit at a 90° angle to the base and insert the two **hinge covers** under the left and right hinges (Figure 4-14).
10. Install the display mask, keyboard base plate, keyboard, top cover, optional PCMCIA card, optional memory card, and battery pack as described in Sections 4.12, and 4.7 through 4.2.

## 4.9 Upper System Board

### Removing the Upper System Board

To remove the T1960CS/T1960CT's upper system board, follow the steps below and refer to Figure 4-17.

1. Turn off the power to the computer, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, keyboard, HDD, display mask, and display assembly as described in Sections 4.2 through 4.7, 4.12, and 4.8.
3. Disconnect the **mouse/KB cable** from **PJ3**, and **RTC battery cable** from **PJ2** on the **upper system board**.
4. Remove the **M2.5x8 silver screw** on the left side of the **upper system board** and **M2x8 screw** on the **optional memory card connector**.
5. Pull up the upper system board to disconnect **PJ5** and **PJ7** and separate it from the lower system board.

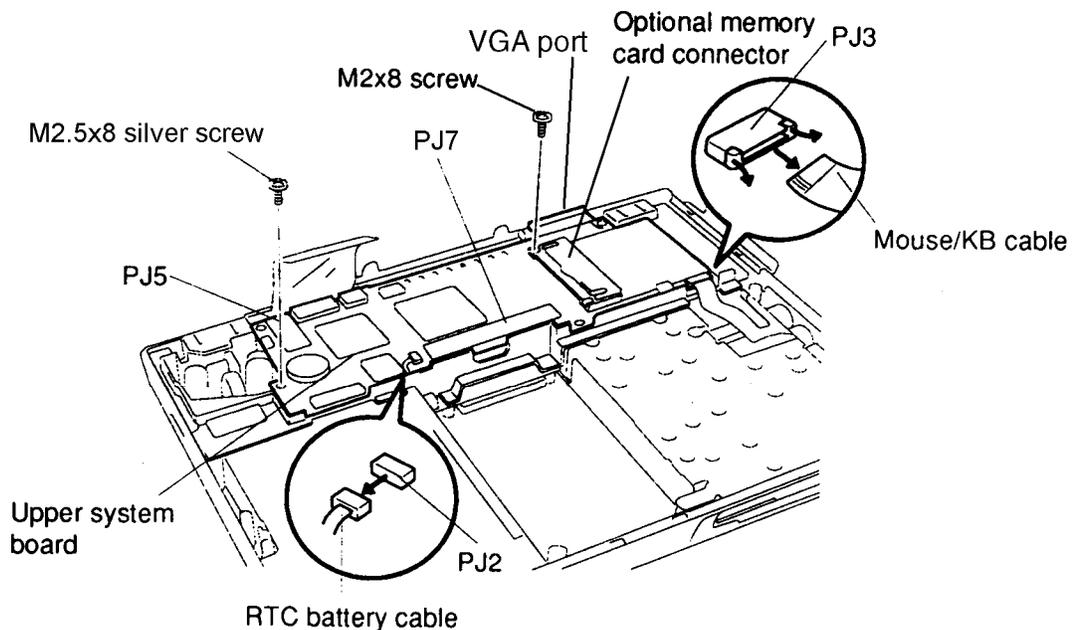


Figure 4-17 Removing the Upper System Board

## Installing the Upper System Board

To install the T1960CS/T1960CT's upper system board, follow the steps below and refer to Figure 4-17.

1. Place the **upper system board** on the lower system board aligning connectors **PJ5** and **PJ7**. Press the **VGA port** area to seat the upper right corner of the system board, then press the PJ5 and PJ7 connectors to connect the upper system board to the lower system board.

*CAUTION: When you install the upper system board, be careful not to cover the RTC battery cable and mouse/KB cable. These cables must be connected to the PJ2 and PJ3 connectors on the top of the upper system board.*

*Be careful when you align power connector PJ5 on the upper system board and PJ501 on the lower system board. If the connectors are not squarely aligned, a short may occur causing damage to the system boards.*

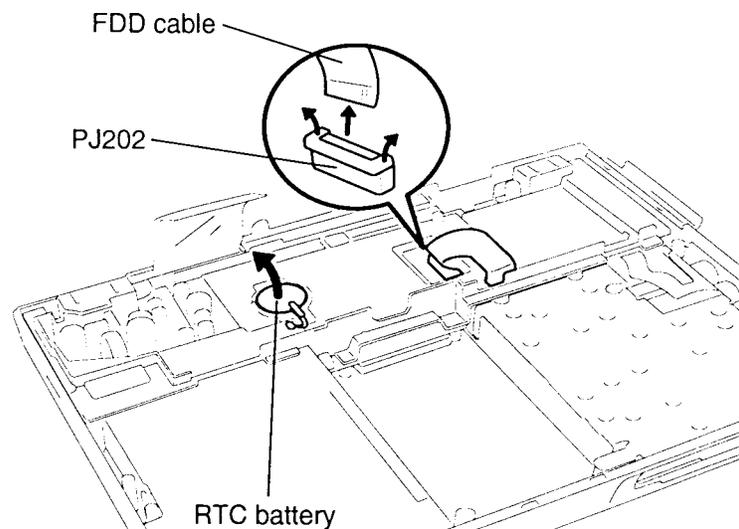
2. Secure the **M2.5x8 silver screw** on the left side of the upper system board, and the **M2x8 screw** on the **optional memory card connector**.
3. Connect the **RTC battery cable** to **PJ2**, and **mouse/KB cable** to **PJ3**.
4. Install the display assembly, display mask, HDD, keyboard, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.8, 4.12, and 4.7 through 4.2.

## 4.10 Lower System Board/RTC Battery

### Removing the Lower System Board/RTC Battery

To remove the T1960CS/T1960CT's lower system board and RTC battery, follow the steps below and refer to Figures 4-18 through 4-21.

1. Turn off the power to the computer, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, keyboard, HDD, display mask, display assembly, and upper system board as described in Sections 4.2 through 4.7, 4.12, 4.8, and 4.9.
3. Remove the **RTC battery** from the lower system board cover (Figure 4-18).
4. Disconnect the **FDD cable** from **PJ202** on the lower system board (Figure 4-18).



*Figure 4-18 Removing the RTC Battery and FDD Cable*

5. Remove the **M2.5x6 silver screw** from the bottom of the computer (Figure 4-19).
6. Remove the **two 2.5x10 screws** located next to the power supply circuits on the **lower system board** (Figure 4-19).
7. Open the PCMCIA expansion slot cover on the right side of the computer, remove the two M2.5x6 screws securing the cover, then remove the cover.
8. Lift up the right side of the **lower system board** assembly and slide the assembly to the right to release the **DC IN jack** on the left side of the board, then lift out the assembly.

**CAUTION:** When you remove the lower system board assembly, carefully slide the FDD cable out of the hole on the middle frame assembly.

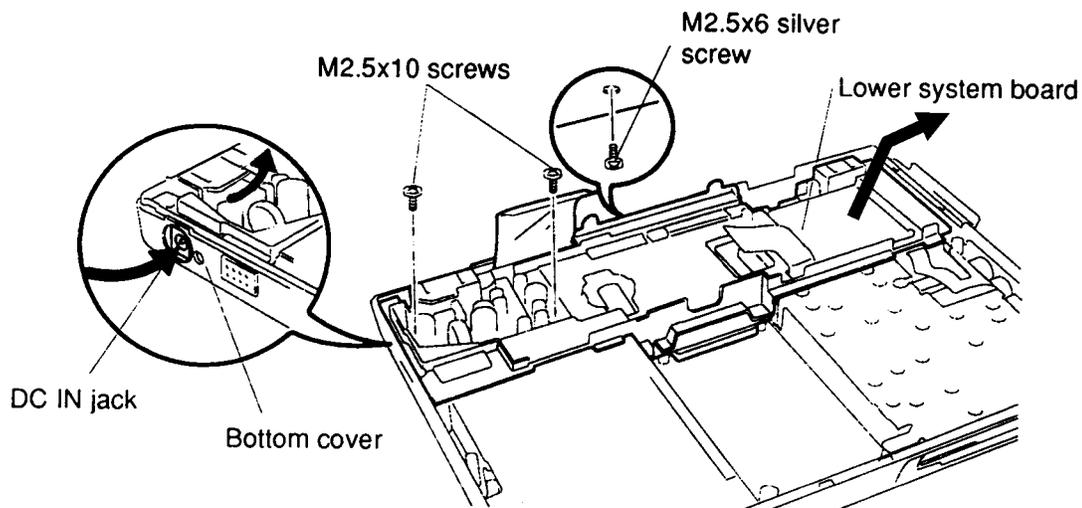


Figure 4-19 Removing the Lower System Board Assembly

9. Turn the lower system board assembly over, remove the **two M2.5x8 silver screws**, then lift off the **lower metal plate** and PCMCIA **ejector button** (Figure 4-20).

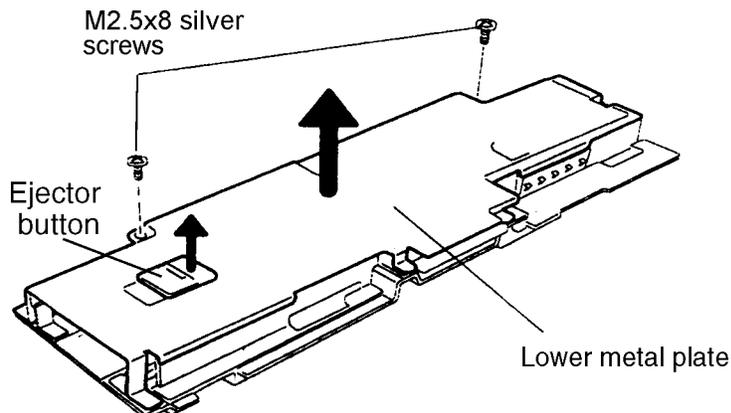
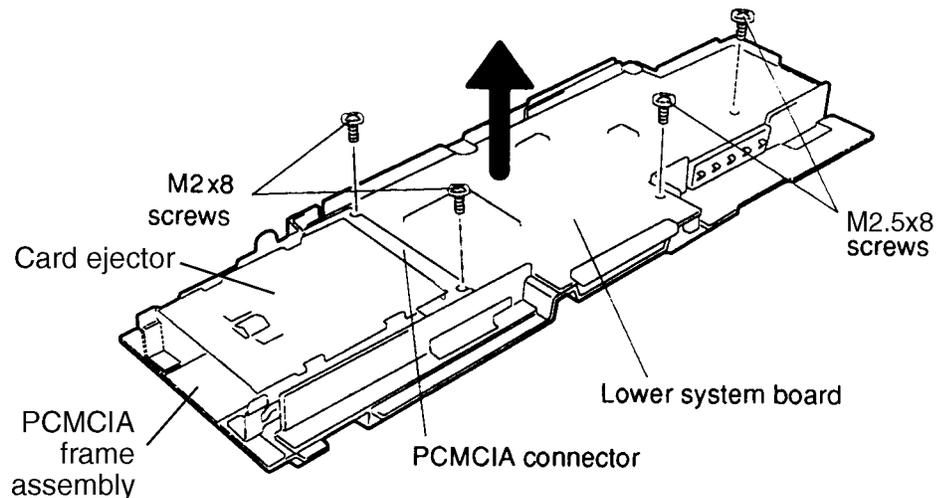


Figure 4-20 Removing the Lower Metal Plate

10. Remove the **two M2x8 screws** on the **PCMCIA connector**, and **two M2.5x8 silver screws** on the lower system board (Figure 4-21).
11. Lift off the **PCMCIA card ejector**.
12. Separate the **lower system board** from the middle frame assembly.
13. Lift out the **PCMCIA frame assembly**.



*Figure 4-21 Removing the Lower System Board*

### **Installing the Lower System Board and RTC Battery**

To install the T1960CS/T1960CT's lower system board and RTC battery, follow the steps below and refer to Figures 4-18 through 4-21.

1. Insert the **PCMCIA frame assembly** into the middle frame assembly.
2. Slide the **lower system board** into the middle frame assembly from left to right, making certain that the DC IN jack fits into the hole on the right side of the middle frame assembly.
3. Place the **PCMCIA card ejector** on the **PCMCIA frame assembly**. The card ejector fits inside the walls of the PCMCIA frame assembly and hooks into the holes on the **PCMCIA connector**.
4. Secure the **two M2x8 screws** on the **PCMCIA connector** and **two M2.5x8 silver screws** on the lower system board (Figure 21).
5. Holding the **PCMCIA ejector button** over the opening in the **lower metal plate**, place the metal plate onto the lower system board. Work the ejector button so that it moves the card ejector plate back and forth (Figure 4-20).

6. Secure the **lower metal plate** with **two M2.5x8 screws** (Figure 4-20).
7. Turn the assembly over, and place the lower system board assembly into the computer's chassis, inserting the **DC IN jack** into the opening on the left side of the chassis (Figure 4-19).

***CAUTION:** When you install the lower system board assembly, be careful to thread the FDD cable through the FDD cable hole.*

8. Secure the **two M2.5x10 screws** by the power supply circuits, and connect the **FDD cable** to **PJ202** (Figures 4-18 and 4-19).
9. Secure the **M2.5x6 screw** on the bottom of the unit (Figure 4-19).
10. Set the **RTC battery** in the RTC battery holder on the middle frame assembly (Figure 4-18).
11. Set the PCMCIA expansion slot cover in place and secure it with two M2.5x6 screws.
12. Install the upper system board, display assembly, display mask, HDD, keyboard, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.9, 4.8, 4.12, and 4.7 through 4.2.

## 4.11 Floppy Disk Drive and Mouse/KB Board

### Removing the Floppy Disk Drive and Mouse/KB Board

To remove the T1960CS/T1960CT's floppy disk drive and mouse/KB board, follow the steps below and refer to Figures 4-22 through 4-24.

1. Turn off the power to the computer, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, keyboard, HDD, display mask, display assembly, upper system board, and lower system board as described in Sections 4.2 through 4.7, 4.12, 4.8, 4.9, and 4.10.
3. Remove the **two M2.5x6 silver screws** on the **mouse/KB board assembly** (Figure 4-22).
4. Lift the left side of the **FDD unit** with **mouse/KB board assembly** and slowly pull it to the left to remove the assembly from the chassis (Figure 4-22).

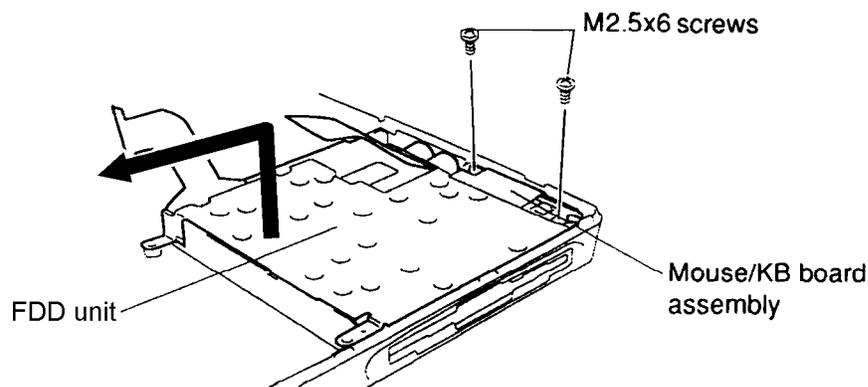


Figure 4-22 Removing the FDD and Mouse/KB Board

5. To separate the **mouse/KB board** and **FDD unit**, remove the **two M2.5x4 screws** (Figure 4-23).

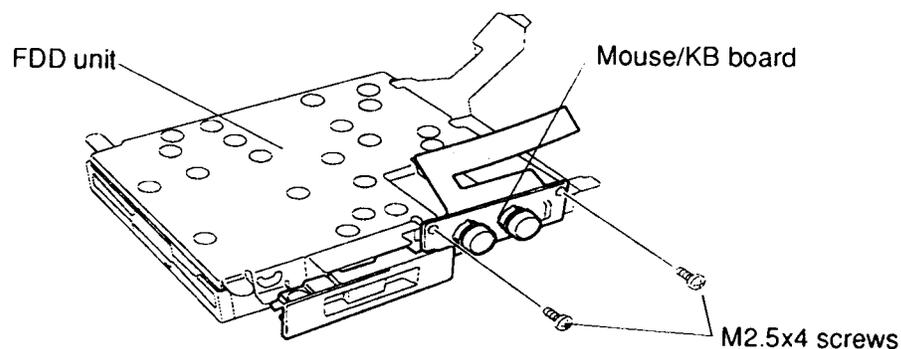
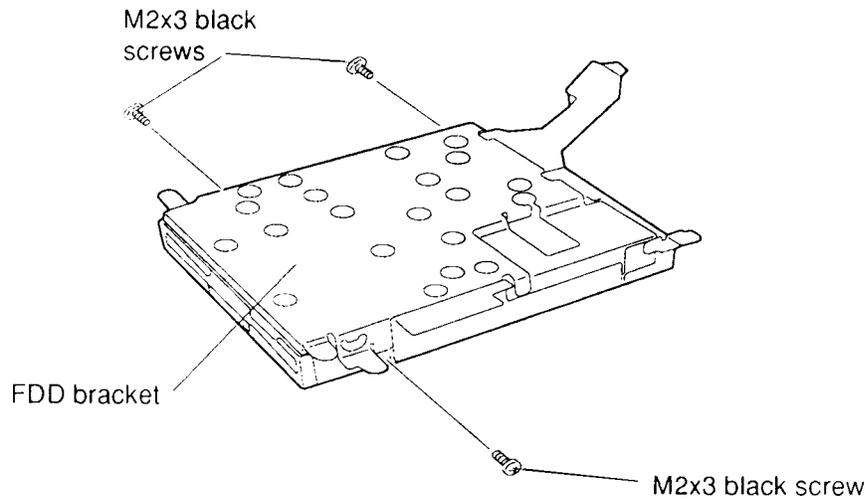


Figure 4-23 Separating the FDD and Mouse/KB Board

6. Remove the **three M2x3 black screws** securing the **FDD bracket** and remove the bracket (Figure 4-24).



*Figure 4-24 Removing the FDD Bracket*

### **Installing the Floppy Disk Drive and Mouse/KB Board**

To install the T1960CS/T1960CT's floppy disk drive and mouse/KB board, follow the steps below and refer to Figures 4-22 through 4-24.

1. Place the **FDD bracket** on the FDD and secure it with the **three M2x3 black screws** (Figure 4-24).
2. Secure the **mouse/KB board** with **two M2.5x4 screws** to the FDD bracket (Figure 4-23).
3. Place the **FDD assembly** in the computer, right side first, and secure the **mouse/KB board** with **two 2.5x6 silver screws** (Figure 4-22).
4. Install the lower system board, upper system board, display assembly, display mask, HDD, status indicator panel, keyboard, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.10, 4.9, 4.8, 4.12, and 4.7 through 4.2.

## 4.12 Display Mask

### Removing the Display Mask

To remove the T1960CS/T1960CT's display mask, follow the steps below and refer to Figure 4-25.

1. Turn off the power to the computer, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card and top cover as described in Sections 4.2, 4.3, 4.4 and 4.5.

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

3. Remove the **two screw covers** from the display hinges to expose **two screws** securing the **display mask**.
4. Remove the **two M2.5x6 silver screws** that were covered by the **screw covers**.
5. Carefully insert your fingers between the mask and the LCD panel and pry open the latches. Start with the **four latches** across the top of the display mask.
6. Continue unlatching the mask along the **sides (four latches on each side)**, at the bottom (**two latches**), and display supports. There is also a latch at the small support and three latches at the large support not indicated in the illustration.

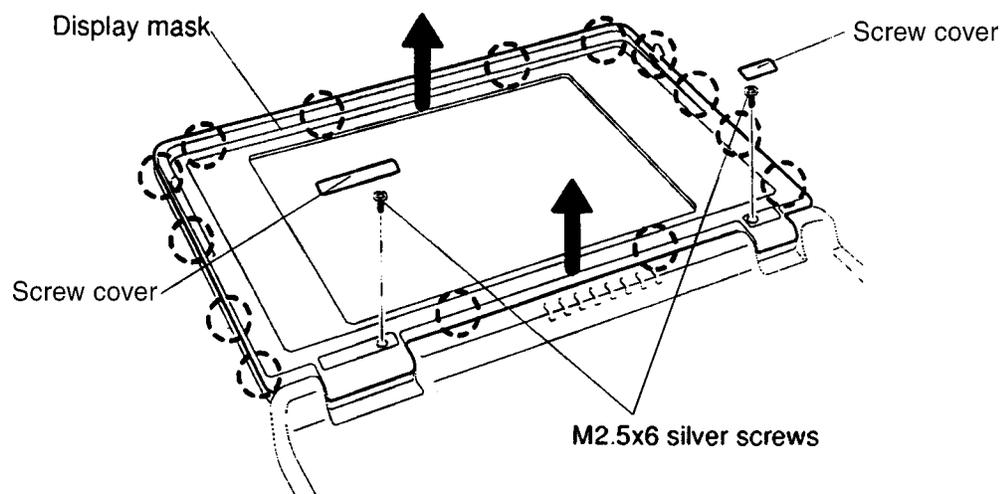


Figure 4-25 Removing the Display Mask

## Installing the Display Mask

To install the T1960CS/T1960CT's display mask, follow the steps below and refer to Figure 4-25.

1. Set the **display mask** in place and secure the snaps beginning with the **four snaps** in the display supports, **three snaps** in the large support and **one snap** in the small support.
2. Continue along the bottom of the display (**two snaps**), along the sides (**four snaps** on each side) and across the top (**four snaps**).
3. Secure the cover with **two M2.5x6 silver screws** at the display hinges.
4. Attach the **two screw covers** at each display hinge to cover the screws.
5. Install the top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.5, 4.4, 4.3 and 4.2.

## 4.13 T1960CS FL Inverter Board

### Removing the T1960CS FL Inverter Board

To remove the T1960CS's FL inverter board, follow the steps below and refer to Figures 4-26 and 4-27.

1. Turn off the power to the computer, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, and display mask as described in 4.2, 4.3, 4.4, 4.5, and 4.12.
3. Remove the **four M2.5x6 screws** securing the **display support plate** (Figure 4-26).

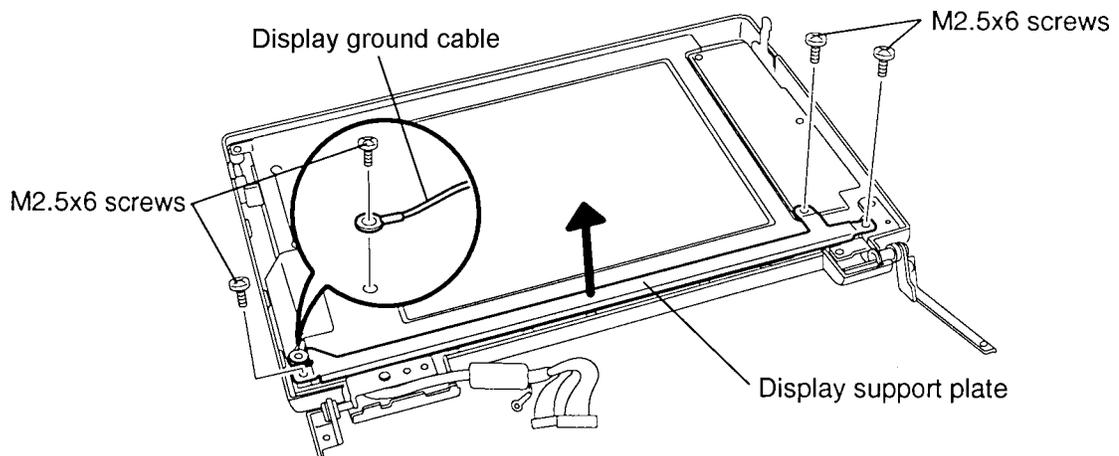


Figure 4-26 Removing the Display Support Plate

4. Remove the **two M2.5x6 screws** securing the **FL inverter board** (Figure 4-27).
5. Carefully rotate the **FL inverter board** out from right to left and disconnect the **FL inverter cable** from **CN1** and the **two FL cables** from **CN2** and **CN3**.

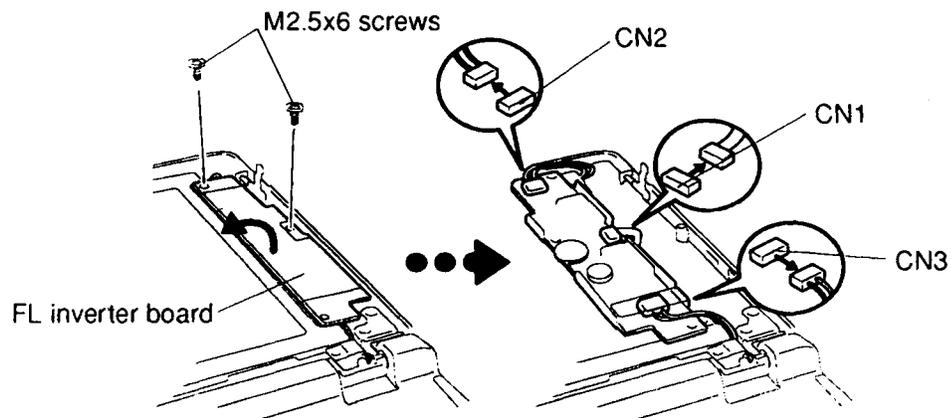


Figure 4-27 Removing the FL Inverter Board

## Installing the T1960CS FL Inverter Board

To install the T1960CS's FL inverter board, follow the steps below and refer to Figures 4-26 and 4-27.

1. Connect the **FL inverter cable** to **CN1** on the **inverter board** and the **two FL cables** to **CN2** and **CN3** (Figure 4-27).
2. Route the **cables** so they are not pinched by the **FL inverter board**, **display hinge** or other component.
3. Replace the **FL inverter board** and secure it with the **two M2.5x6 screws** (Figure 4-27).
4. Set the **display support plate** in place and secure it with **four M2.5x6 screws**. One screw also secures the **display ground cable** (Figure 4-26).
5. Install the display mask, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.12, 4.5, 4.4, 4.3 and 4.2.

## 4.14 T1960CS LCD Module

### Removing the Color LCD Module

To remove the T1960CS's color LCD module, follow the steps below and refer to Figure 4-28.

1. Turn off the power to the computer, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, display mask, display assembly and inverter board as described in Sections 4.2, 4.3, 4.4, 4.5, 4.12, 4.8, and 4.13.
3. Remove the **M2.5x6 screw** securing the **LCD module** to the LCD cover.
4. Carefully rotate the **LCD module** from right to left out of the display cover and disconnect the **three display cables** from the LCD module.

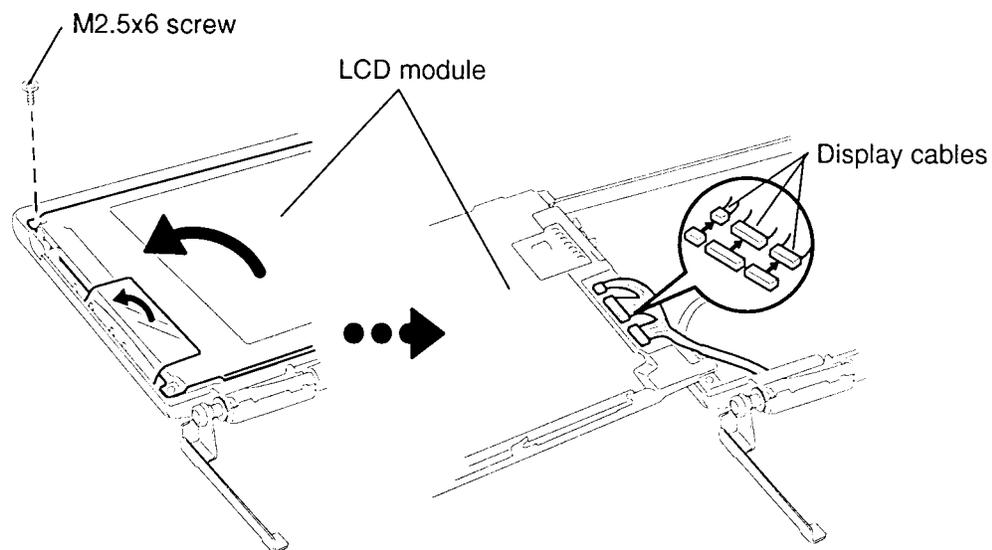


Figure 4-28 Removing the T1960CS's LCD Module

### Installing the T1960CS LCD Module

To install the T1960CS's LCD module, follow the steps below and refer to Figure 4-28.

1. Connect the **three display cables** to the LCD module, and carefully rotate the LCD module into the LCD cover.
2. Secure the **M2.5x6 screw** on the LCD module.
3. Install the FL inverter board, display assembly, display mask, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.13, 4.8, 4.12, 4.5, 4.4, 4.3 and 4.2.

## 4.15 T1960CS Fluorescent Lamp (FL)

**CAUTION:** When you remove the **FL**, be careful not to let any dust or other foreign matter enter the display panel components.

### Removing the T1960CS FL

To remove the T1960CS's FL, follow the steps below and refer to Figures 4-29 through 4-31.

1. Turn off the power to the computer, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, display mask, display assembly, FL inverter board, and LCD module as described in Sections 4.2, 4.3, 4.4, 4.5, 4.12, 4.8, 4.13, and 4.14.
3. Lay the **color LCD module** face down and use needle-nose pliers to unbend the **16 latches** holding the front and back frames together. Then lift the unit out of the front frame (Figure 4-29).

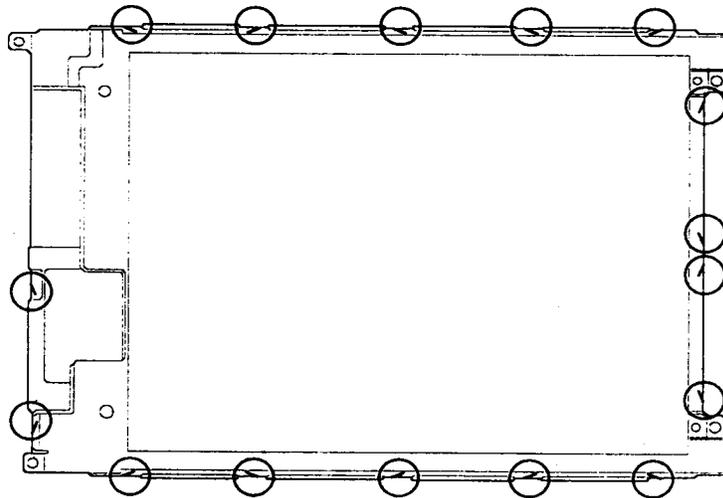
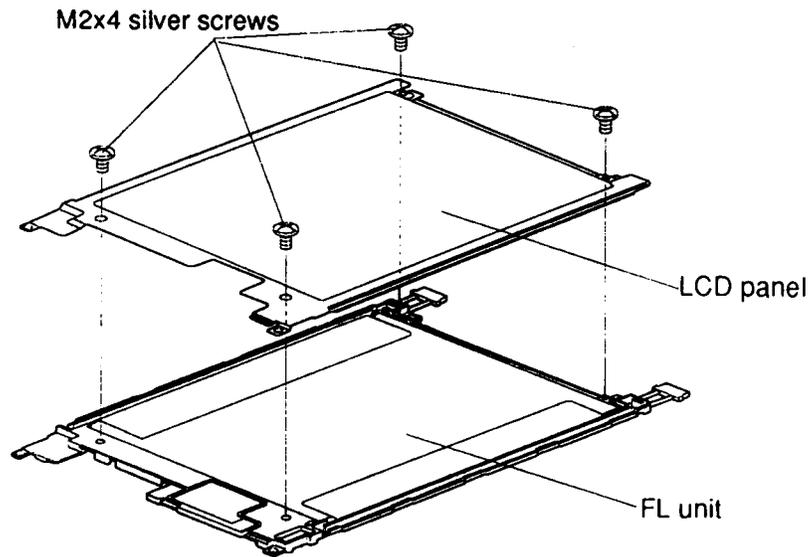


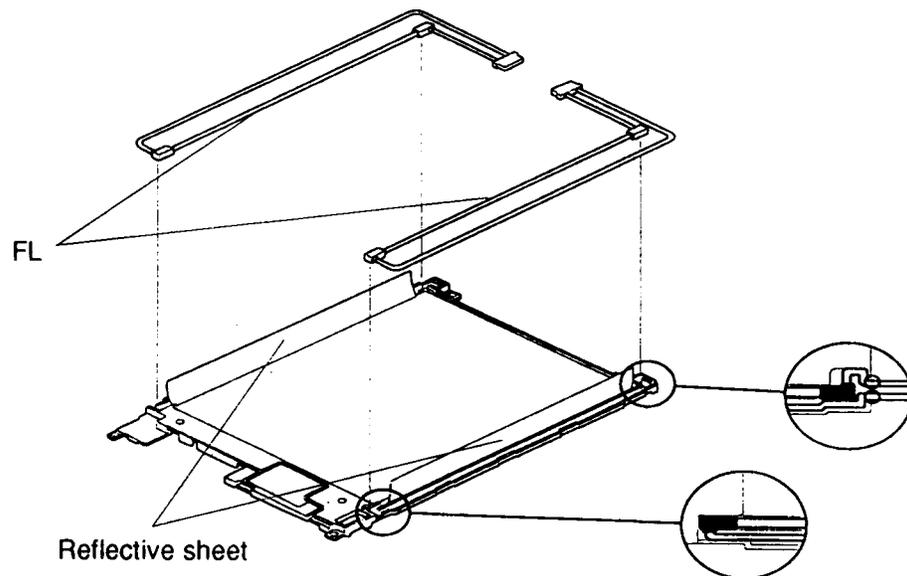
Figure 4-29 Unbending the Color LCD Module Latches

4. Remove the **four M2x4 silver screws** securing the **FL unit** and **LCD panel** to the back frame (Figure 4-30).



*Figure 4-30 Removing the FL Screws*

5. Pull out the **reflective sheet** from the LCD module.
6. Lift out the **FL** (Figure 4-31).



*Figure 4-31 Removing the FL*

## Installing the T1960CS FL Unit

To install the T1960CS's FL unit, follow the steps below and refer to Figures 4-29 through 4-31.

1. Place the **FL** on the **FL unit** and cover the FL with the reflective sheet (Figure 4-31).
2. Secure the **LCD panel** with **four M2x4 screws**. (Figure 4-30).
3. Carefully bend the **16 latches** back into place (Figure 4-29).
4. Install the color LCD module, FL inverter board, display assembly, display mask, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.14, 4.13, 4.8, 4.12, 4.5, 4.4, 4.3, and 4.2.

## 4.16 T1960CT FL Inverter Board

### Removing the T1960CT FL Inverter Board

To remove the T1960CT's FL inverter board, follow the steps below and refer to Figure 4-32.

1. Turn off the power to the computer, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, and display mask as described in Sections 4.2, 4.3, 4.4, 4.5, and 4.12.
3. Remove the **two M2.5x6 screws** securing the **FL inverter board**.
4. Rotate the FL inverter board out of its seating and disconnect the **FL inverter cable** from **CN1** and the **FL cable** from **CN2** on the FL inverter board.

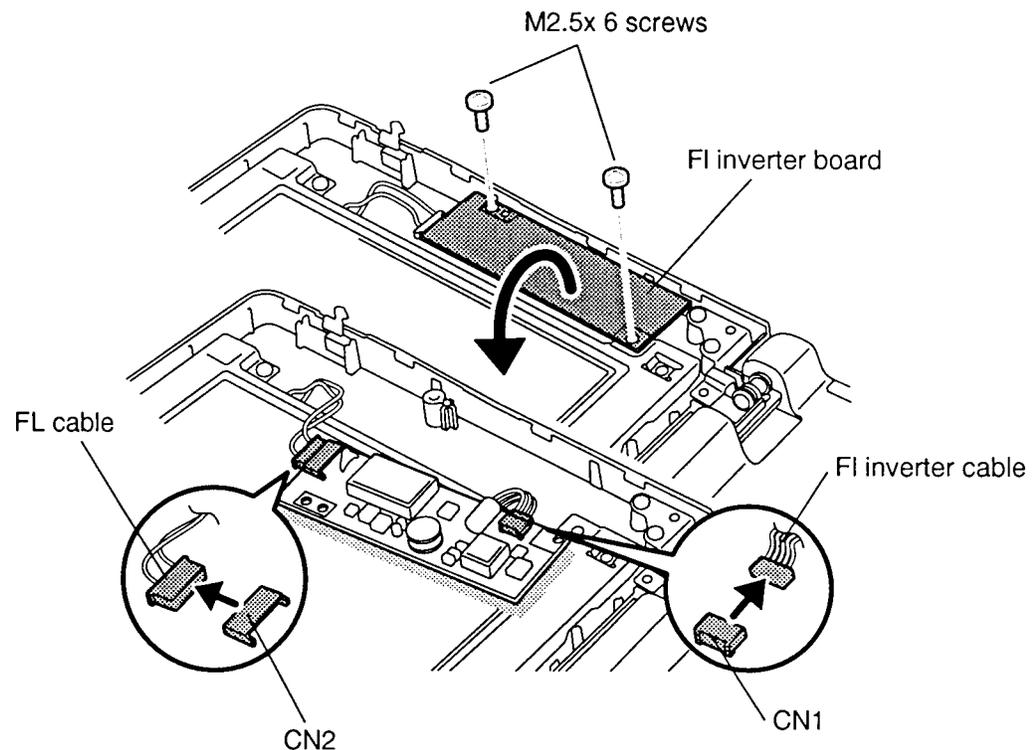


Figure 4-32 Removing the FL Inverter Board

## Installing the FL Inverter Board

To install the T1960CT's FL inverter board, follow the steps below and refer to Figure 4-32.

1. Connect the **FL inverter cable** to **CN1** and the **FL cable** to **CN2** on the FL inverter board.
2. Seat the **FL inverter board** and route the **cables** so they will not be pinched by the display cover or other components.
3. Secure the **FL inverter board** with the **two M2.5x6 screws**.
4. Install the display mask, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.12, 4.5, 4.4, 4.3 and 4.2.

## 4.17 T1960CT LCD Module

### Removing the T1960CT Liquid Crystal Display (LCD) Module

**CAUTION:** The T1960CT LCD module is easily damaged. Before removing the module, refer to Appendix A for precautions on handling.

To remove the T1960CT's Liquid Crystal Display Module, follow the steps below and refer to Figures 4-33 to 4-35.

1. Turn off the power to the computer, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, display mask and FL inverter board as described in Sections 4.2, 4.3, 4.4, 4.5, 4.12 and 4.16.
3. Remove the **three M2.5x6 screws** securing the LCD module to the back frame of the computer (Figure 4-33).

**NOTE:** Do not remove the screws circled in Figure 4-33. These screws secure the metal cover to the LCD panel.

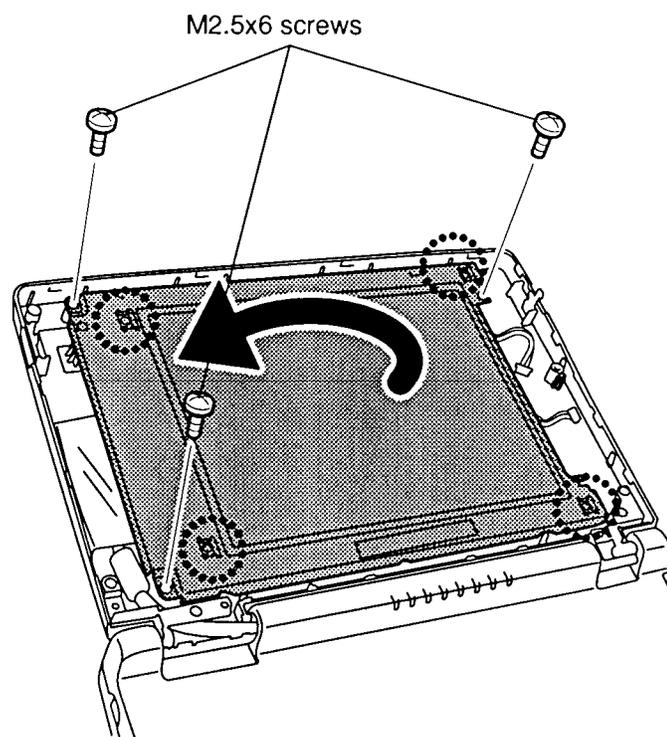
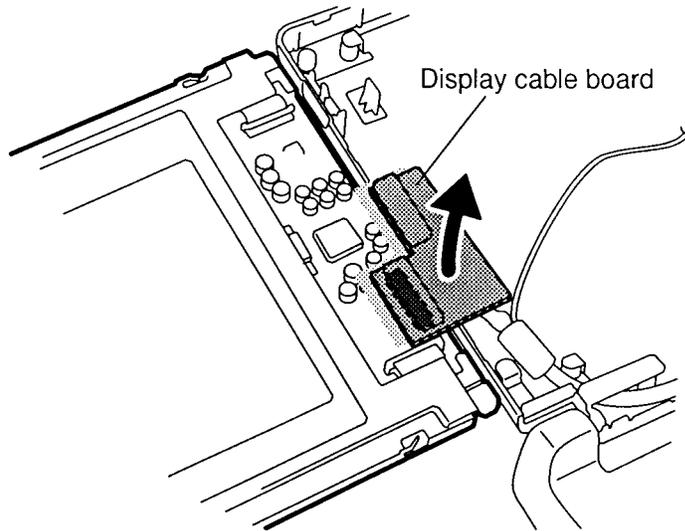


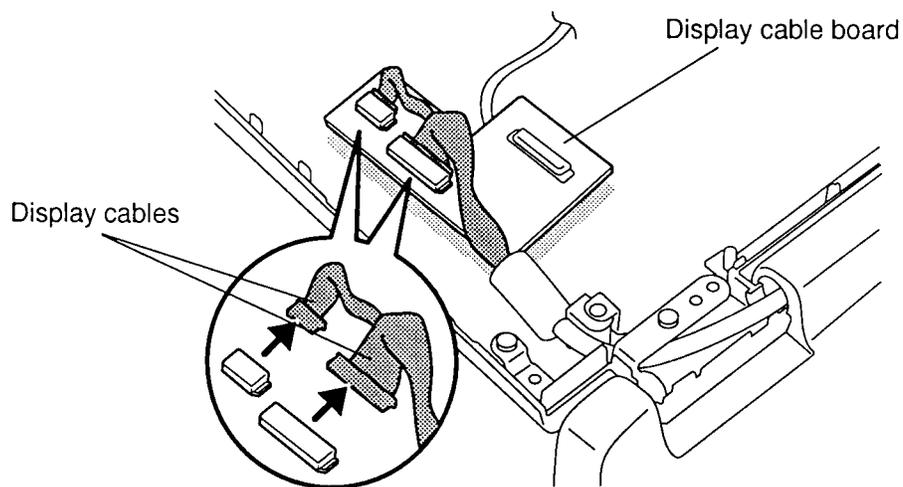
Figure 4-33 Removing the LCD Screws

4. Rotate the **LCD module** out of the cover from right to left (Figure 4-34).
5. Disconnect the **display cable board** from the **LCD module** (Figure 4-34).



*Figure 4-34 Removing the LCD Module*

6. Pull off the insulator attached by double-sided tape.
7. Disconnect the **display cables** from the **display cable board** to remove the board (Figure 4-35).



*Figure 4-35 Removing the Display Cable Board*

## Installing the Liquid Crystal Display Module

To install the T1960CT's liquid crystal display module, follow the steps below and refer to Figures 4-33 to 4-35.

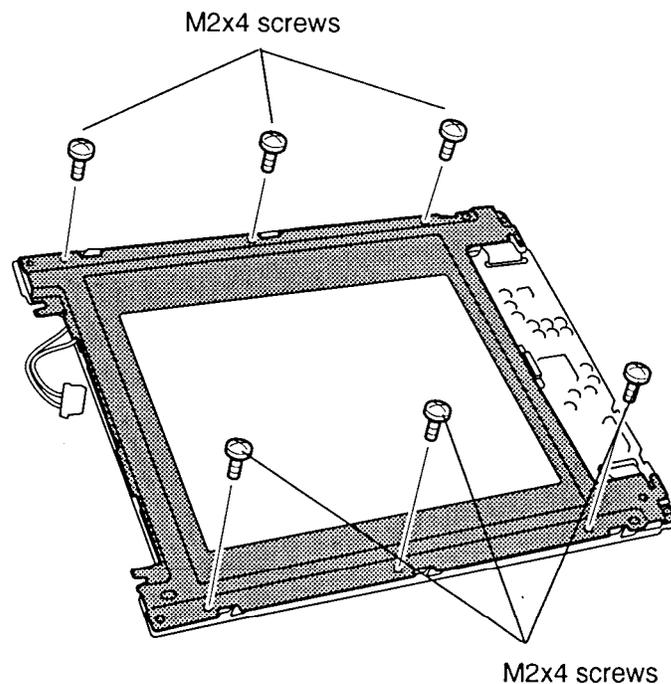
1. Connect the **display cables** to the **display cable board** (Figure 4-35).
2. Connect the **display cable board** to the LCD module (Figure 4-34).
3. Fix the insulator to the board pressing gently to secure the tape.
4. Place the **module** in the cover and route the **cables** so they will not be pinched by the display panel or other components.
5. Secure the panel with **three M2.5x6 screws** (Figure 4-33).
6. Install the FL inverter board, display mask, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.16, 4.12, 4.5, 4.4, 4.3 and 4.2.

## 4.18 T1960CT Fluorescent Lamp

### Removing the T1960CT Fluorescent Lamp

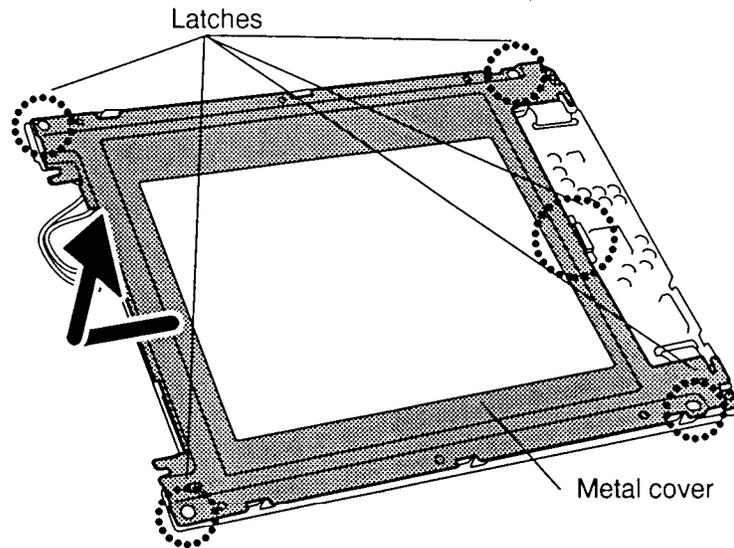
To remove the T1960CT's fluorescent lamp, follow the steps below and refer to Figures 4-36 to 4-38.

1. Turn off the power to the computer, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, display mask, FL inverter board, and LCD module as described in Sections 4.2, 4.3, 4.4, 4.5, 4.12, 4.16 and 4.17.
3. Turn the LCD module upside down and remove the **six M2x4 silver screws** (Figure 4-36).



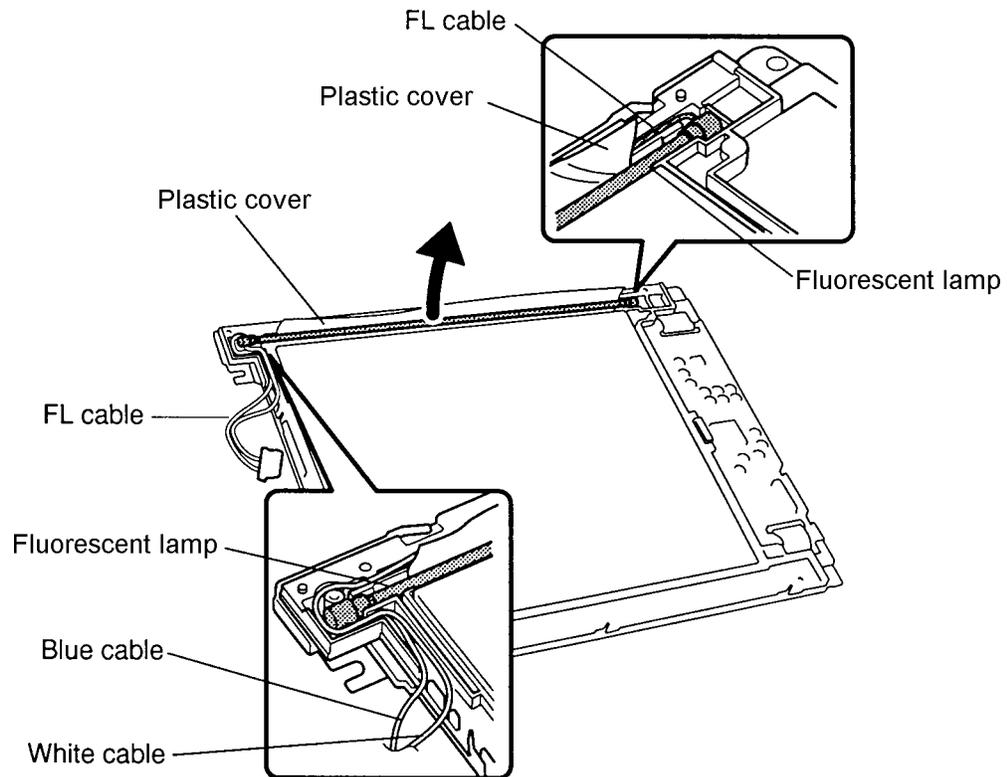
*Figure 4-36 Removing the FL Screws*

- Slide the **metal cover** out slightly to free it of the **latches** marked by circles in Figure 4-37, and lift off the cover.



*Figure 4-37 Removing the Metal Cover*

- Hold up the **plastic cover** shielding the **fluorescent lamp** and lift the **FL cable** to remove the **lamp** (Figure 4-38). The cable is held secure in its groove by small tongues, so pry it out gently.



*Figure 4-38 Removing the Fluorescent Lamp*

## Installing the T1960CT Fluorescent Lamp

To install the T1960CT's fluorescent lamp, follow the steps below and refer to Figures 4-36 to 4-38. Note that there are separate grooves for the lamp and its white cable.

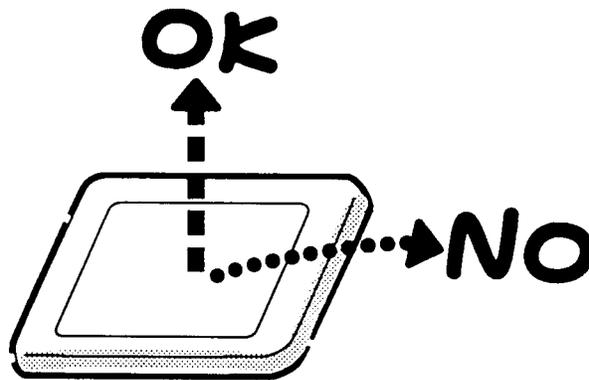
1. Slip the lamp's **plastic shield** between the lamp and its **white cable** and lay the lamp into its groove.
2. Lay the cable into its groove, pressing down gently so that it is held in place by the small tongues in the groove.
3. Route the **white** and **blue cables** as shown in Figure 4-38. Make sure the cables are pressed down snugly so they will not be pinched by other components.
4. Lay the **metal cover** on the LCD panel making sure the latches marked by circles in Figure 4-37 fit into their corresponding **notches** on the LCD panel. First, fit the **larger latch** at the center of the edge facing the inverter board into its **notch**, which should guide the other fittings into position.
5. Slide the **metal cover** back into place to secure the latches.
6. Secure the metal cover with **six M2x4 screws** (Figure 4-36).
7. Install the LCD module, FL inverter board, display mask, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.17, 4.16, 4.12, 4.5, 4.4, 4.3 and 4.2.

## Appendix A Handling the LCD Module

### Precautions for Handling the T1960CS/T1960CT 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.



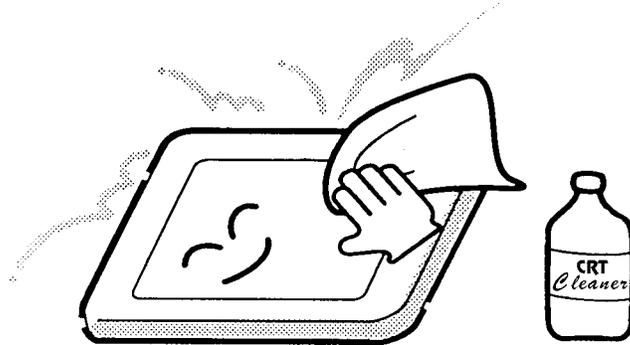
2. Be careful to align the holes at the four corners of the LCD module with the corresponding holes in the LCD cover before securing the module with screws. Do not force the module into place, because stress can affect its performance.

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

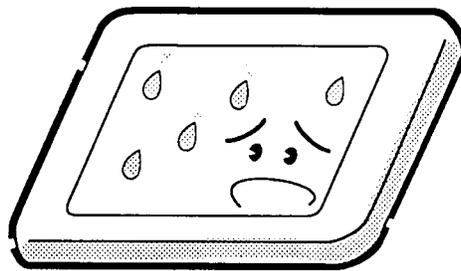


3. If the panel's surface gets dirty, wipe it with cotton or a soft cloth. If it is still dirty, try breathing on the surface to create a light condensate and wipe it again.

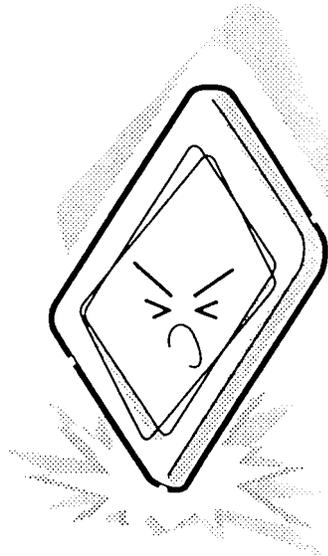
If the surface is very dirty, we recommend a CRT cleaning agent. Apply the agent to a cloth and then wipe the panel's surface. Do not apply cleanser directly to the panel.



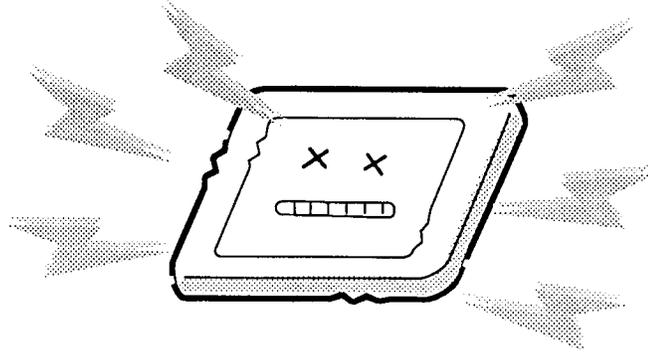
4. If water or other liquid is left on the panel's surface for a long period, it can change the screen's tint or stain it. Be sure to quickly wipe off any liquid.



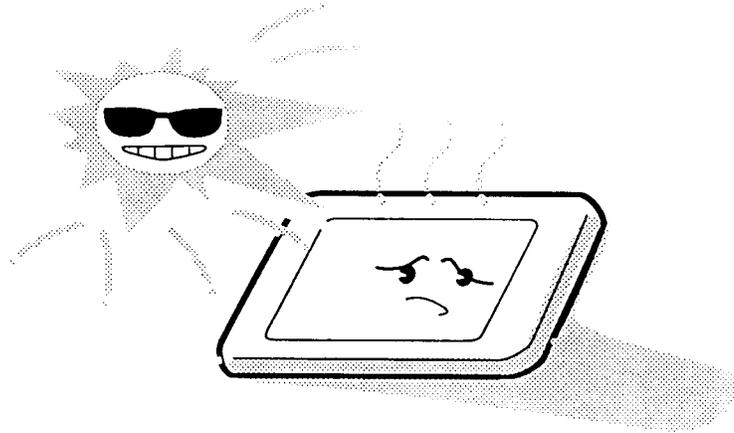
5. Glass is used in the panel, so be careful not to drop it or let it strike a hard object, which could cause breakage or cracks.



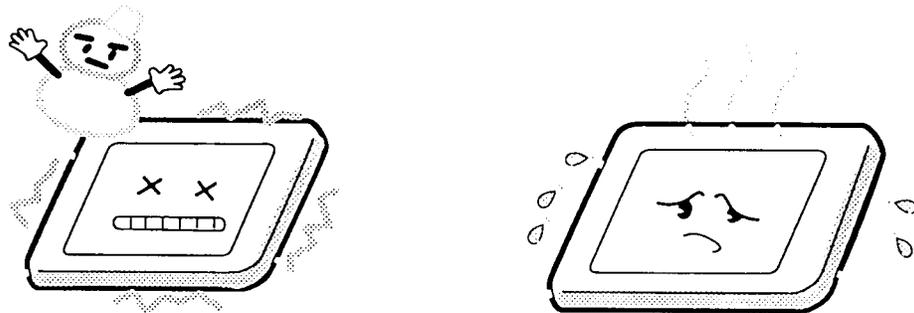
6. CMOS-LSI circuits are used in the module, so guard against damage from electrostatic discharge. Be sure to wear a wrist or ankle ground when handling the module.



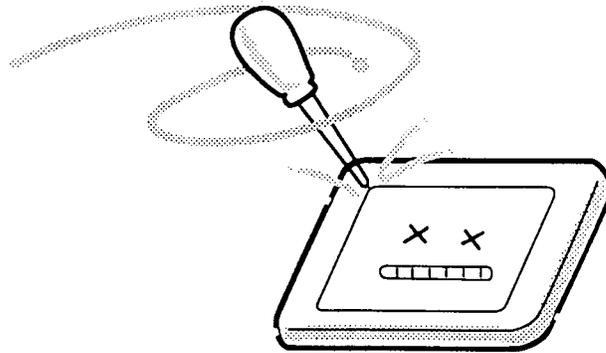
7. Do not expose the module to direct sunlight or strong ultraviolet rays for long periods.



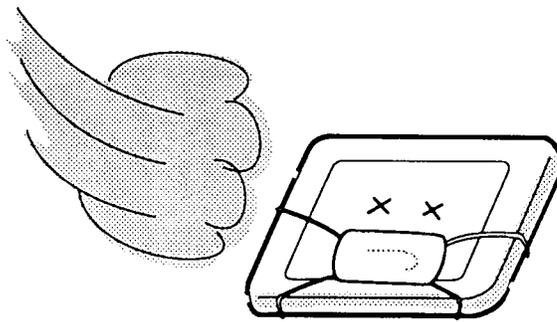
8. Do not store the module at temperatures below specifications. Cold can cause the liquid crystals to freeze, lose their elasticity or otherwise suffer damage.



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 panels' polarization.



# Appendix B Board Layout

## B.1 FA2SU\* (T1960CS), FA2PU\* (T1960CT) System Board

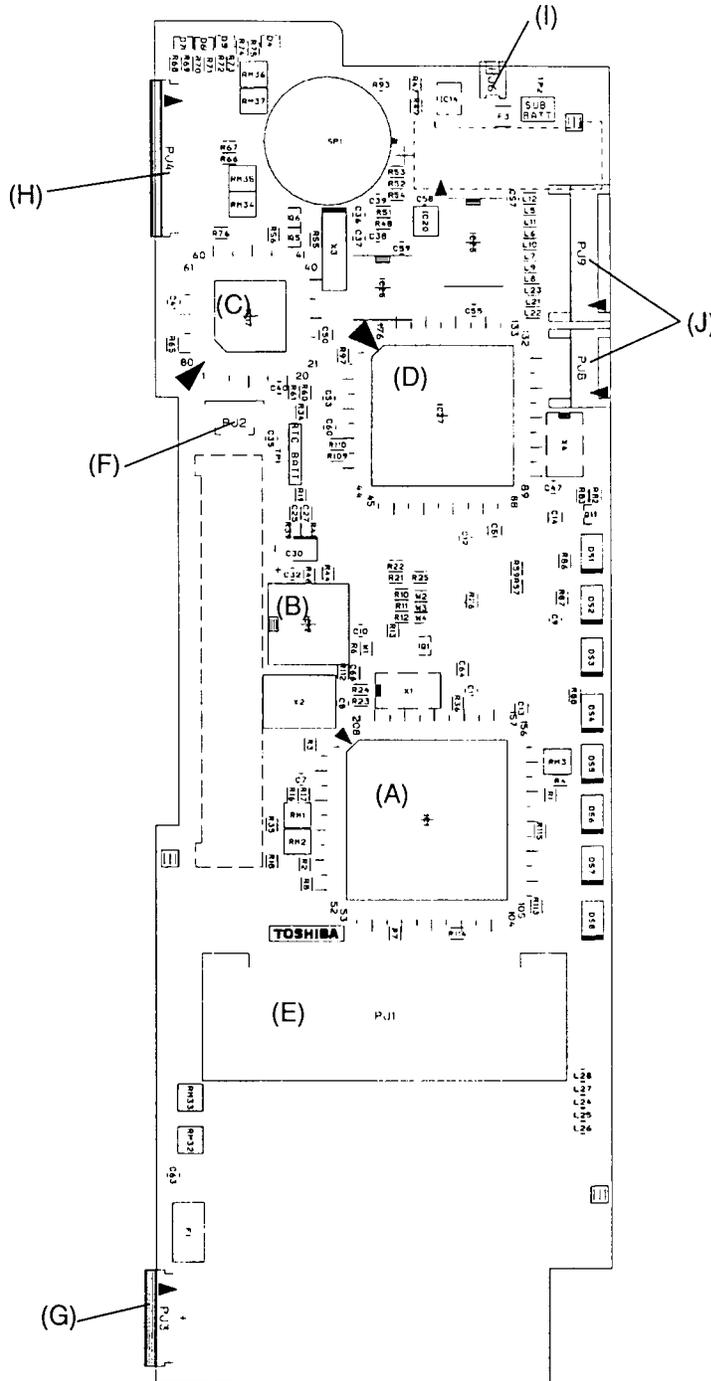
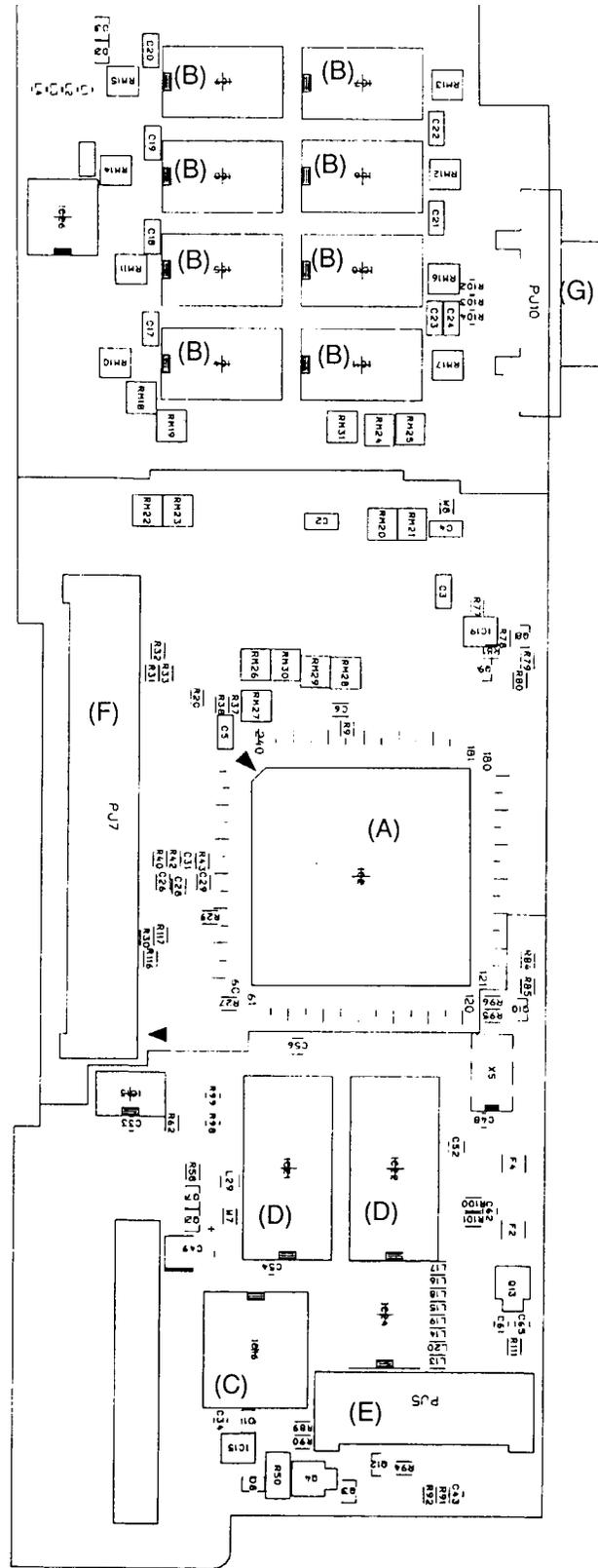


Figure B-1 FA2SU\*/FA2PU\* System Board (front)



*Table B-1 FA2SU\*/FA2PU\* System Board ICs and Connectors (front)*

<b>Mark</b>	<b>Number</b>	<b>Name</b>
(A)	IC1	CPU 80486DX2
(B)	IC12	Clock Generator
(C)	IC17	Keyboard Controller
(D)	IC27 IC20	Display Controller (FA2SU* only) Display controller (FA2PU* only)
(E)	PJ1	Optional Memory Card Connector
(F)	PJ2	RTC Battery Connector
(G)	PJ3	Mouse/KB Connector
(H)	PJ4	Keyboard Connector
(I)	PJ6	Display Sensor Switch Connector
(J)	PJ8, 9	LCD Connector

*Table B-2 FA2SU\*/FA2PU\* System Board ICs and Connectors (back)*

<b>Mark</b>	<b>Number</b>	<b>Name</b>
(A)	IC2	System Controller Gate Array
(B)	IC4 to11 (IC101 to IC108) (IC104 to IC111)	System Memory (FA2SU* only) (FA2PU* only)
(C)	IC16	Real Time Clock
(D)	IC21, 22	Video Memory
(E)	PJ5	Power Supply Interface Connector
(F)	PJ7	Joint Connector
(G)	PJ10	CRT Connector

## B.2 FA2SL\* System Board

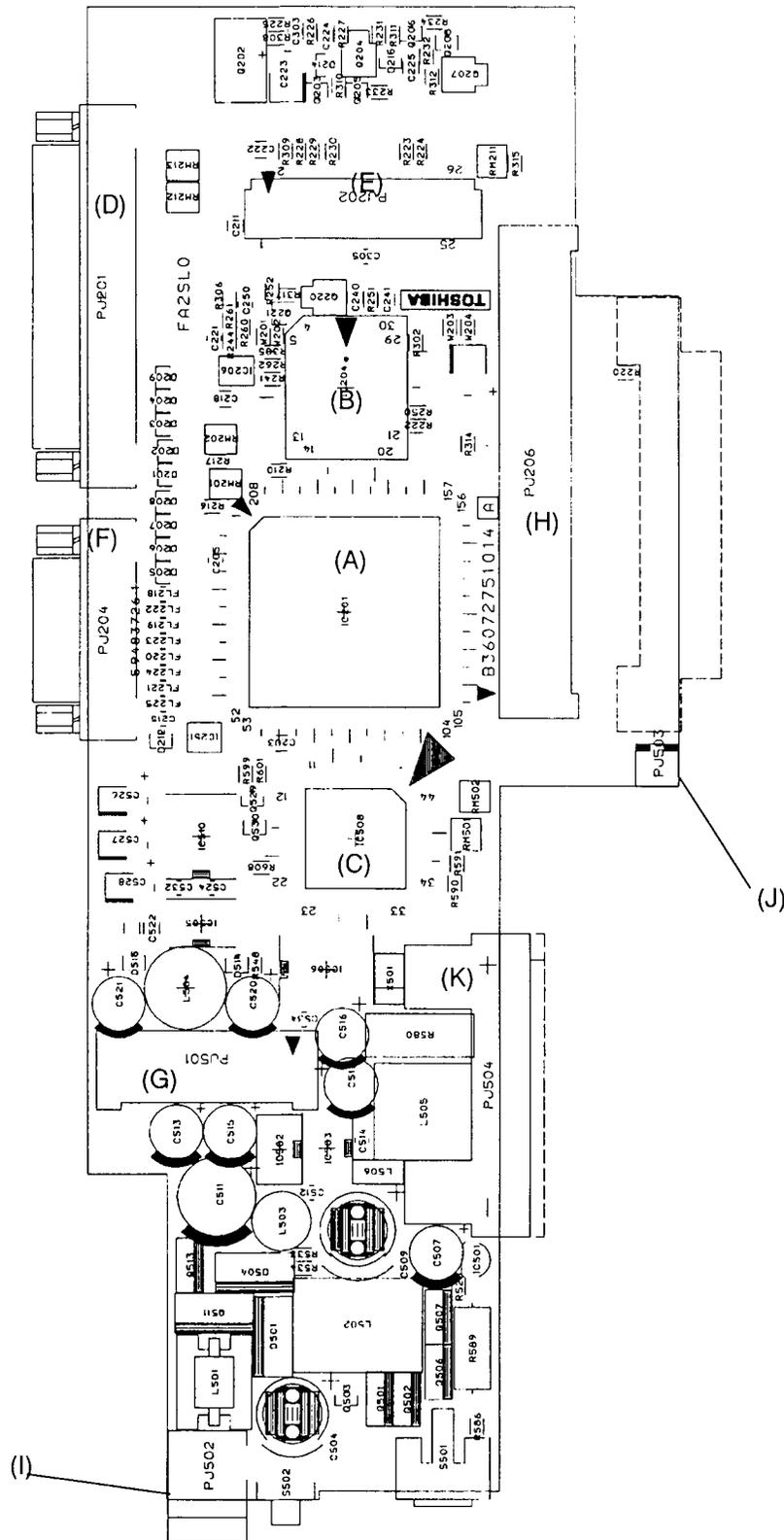


Figure B-3 FA2SL\* System Board (front)

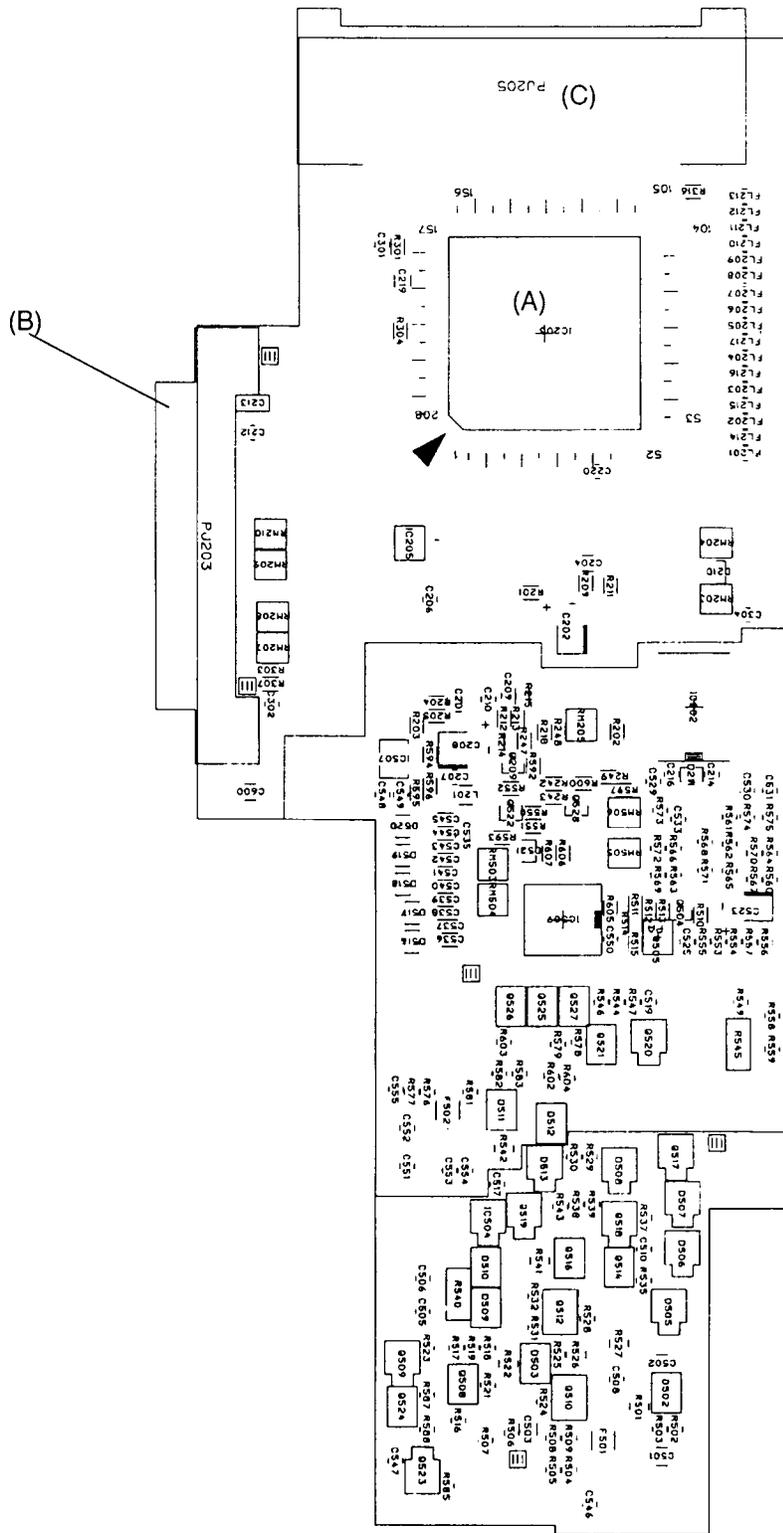


Figure B-4 FA2SL\* System Board (back)

*Table B-3 FA2SL\* System Board ICs and Connectors (front)*

<b>Mark</b>	<b>Number</b>	<b>Name</b>
(A)	IC201	Super Integration
(B)	IC204	BIOS ROM
(C)	IC508	Power Supply Microprocessor
(D)	PJ201	PRT/FDD Connector
(E)	PJ202	Internal FDD Connector
(F)	PJ204	Serial Interface Connector
(G)	PJ501	Power Supply Connector
(H)	PJ206	Joint Connector
(I)	PJ502	DC IN Connector
(J)	PJ503	Backup Battery Connector
(K)	PJ504	Main Battery Connector

*Table B-4 FA2SL\* System Board ICs and Connectors (back)*

<b>Mark</b>	<b>Number</b>	<b>Name</b>
(A)	IC203	PCMCIA Controller Gate Array
(B)	PJ203	Internal HDD Connector
(C)	PJ205	PCMCIA Connector

## Appendix C Pin Assignments

### C.1 PJ1 Memory Slot Connector (88-Pin)

Table C-1 Memory Slot Connector Pin Assignments (88-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	GND	–	45	GND	–
02	D00;101	I/O	46	D16;101	I/O
03	D01;101	I/O	47	D17;101	I/O
04	D02;101	I/O	48	D18;101	I/O
05	D03;101	I/O	49	D19;101	I/O
06	D04;101	I/O	50	D20;101	I/O
07	D05;101	I/O	51	D21;101	I/O
08	D06;101	I/O	52	D22;101	I/O
09	B3V	–	53	D23;101	I/O
10	D07;101	I/O	54	GND	–
11	VCC	–	55	RAS2;001	O
12	GND	–	56	GND	–
13	MA00;101	O	57	MA01;101	O
14	MA02;101	O	58	MA03;101	O
15	B3V	–	59	MA05;101	O
16	MA04;101	O	60	MA07;101	O
17	VCC	–	61	MA09;101	O
18	MA06;101	O	62	GND	–
19	MA08;101	O	63	GND	–
20	MA10;101	O	64	GND	–
21	GND	–	65	RAS1;001	O
22	RAS0;001	O	66	CAS2;001	O
23	CAS0;001	O	67	GND	–
24	CAS1;001	O	68	CAS3;001	O
25	VCC	–	69	RAS3;001	O
26	RAS0;001	O	70	MEMWE2;001	O
27	B3V	–	71	NC	–
28	NC	–	72	NC	–
29	NC	–	73	GND	–
30	NC	–	74	NC	–
31	CAS0;001	O	75	NC	–
32	CAS1;001	O	76	NC	–
33	GND	–	77	CAS2;001	O
34	D08;101	I/O	78	CAS3;001	O
35	VCC	–	79	GND	–
36	D09;101	I/O	80	D24;100	I/O
37	B3V	–	81	D25;100	I/O
38	D10;101	I/O	82	D26;100	I/O
39	D11;101	I/O	83	D27;100	I/O
40	D12;101	I/O	84	D28;100	I/O
41	D13;101	I/O	85	D29;100	I/O
42	D14;101	I/O	86	D30;100	I/O
43	D15;101	I/O	87	D31;100	I/O
44	GND	–	88	GND	–

## C.2 PJ2 RTC Connector (3-Pin)

Table C-2 RTC Connector Pin Assignments (3-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	S10.1	–	03	GND	–
02	NC	–			

## C.3 PJ3 Mouse/KB Connector (10-Pin)

Table C-3 Mouse/KB Connector Pin Assignments (10-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	VCC	–	06	EKBDAT;100	I/O
02	VCC	–	07	EKBCLK;100	I/O
03	VCC	–	08	GND	–
04	MOUSED;100	I/O	09	GND	–
05	MUSECK;100	I/O	10	GND	–

## C.4 PJ4 KB I/F Connector (19-Pin)

Table C-4 KB I/F Connector Pin Assignments (19-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	KBOT00;001	O	11	KBOT03;001	O
02	KBRT6;100	I	12	KBOT04;001	O
03	KBRT0;100	I	13	KBOT05;001	O
04	KBRT2;100	I	14	KBOT06;001	O
05	KBRT3;100	I	15	KBOT08;001	O
06	KBRT1;100	I	16	KBOT02;001	O
07	KBRT7;100	I	17	KBOT07;001	O
08	KBRT5;100	I	18	KBOT09;001	O
09	KBRT4;100	I	19	KBOT10;001	O
10	KBOT01;001	O			

## C.5 PJ5 (PJ501) Power Supply Interface Connector (40-Pin)

Table C-5 Power Supply Interface Connector Pin Assignments (40-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	MCV	–	21	GND	–
02	GND	–	22	GND	–
03	DCLED;100	I (O)	23	RAMV	–
04	BTFULL;100	I (O)	24	RAMV	–
05	CHG;100	I (O)	25	B3V	–
06	GND	–	26	B3V	–
07	SUSST;100	O (I)	27	CPUV	–
08	SRBTN;000	I (O)	28	CPUV	–
09	BFOFF;000	I (O)	29	GND	–
10	CBLON;000	I (O)	30	ALED;100	I (O)
11	NC	–	31	KEYPRS;100	O (I)
12	PNLOFF;000	O (I)	32	POPUP;100	O (I)
13	GND	–	33	KBCS;000	I (O)
14	GND	–	34	SPEAK;100	I (O)
15	VCC	–	35	IHMED;000	I (O)
16	VCC	–	36	SUBBAT;100	I (O)
17	VCC	–	37	TMOUT0;100	I (O)
18	VCC	–	38	IRQ13;100	O (I)
19	VCC	–	39	GND	–
20	VCC	–	40	GND	–

## C.6 PJ6 Display Switch Connector (2-Pin)

Table C-6 Display Switch Connector Pin Assignments (2-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	PNLOFF;000	I	02	GND	–

## C.7 PJ7 (PJ206) Joint Connector (100-Pin)

Table C-7 Joint Connector Pin Assignments (100-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	GND	–	51	SA11;100	I/O
02	\$24MHZ;100	O (I)	52	SA10;100	I/O
03	GND	–	53	SA09;100	I/O
04	GND	–	54	SA08;100	I/O
05	SD00;100	I/O	55	SA07;100	I/O
06	SD01;100	I/O	56	SA00;100	I/O
07	SD02;100	I/O	57	SA01;100	I/O
08	SD03;100	I/O	58	SA02;100	I/O
09	SD04;100	I/O	59	SA03;100	I/O
10	SD05;100	I/O	60	SA04;100	I/O
11	SD06;100	I/O	61	SA05;100	I/O
12	SD07;100	I/O	62	SA06;100	I/O
13	REFRSH;000	I/O	63	GND	–
14	C14R7M;100	O (I)	64	GND	–
15	C14R3M;100	O (I)	65	GND	–
16	IOCLK;100	O	66	GND	–
17	RESET;000	O (I)	67	SD08;100	I/O
18	SPKDRV;000	O (I)	68	SD09;100	I/O
19	HACK;100	O (I)	69	SD10;100	I/O
20	HREQ;100	I (O)	70	SD11;100	I/O
21	IOWR;000	I/O	71	SD12;100	I/O
22	IORD;000	I/O	72	SD13;100	I/O
23	DMACLK;100	O (I)	73	SD14;100	I/O
24	DMARDY;100	O (I)	74	SD15;100	I/O
25	SMER;000	O (I)	75	LA20;100	I/O
26	SMEW;000	O (I)	76	LA21;100	I/O
27	DMAWR;000	I (O)	77	LA22;100	I/O
28	DMARD;000	I (O)	78	LA23;100	I/O
29	AEN;100	I (O)	79	MEWR;000	I/O
30	DACK2;000	I (O)	80	MERD;000	I/O
31	AEN1;100	I (O)	81	BALE;100	O (I)
32	ENPNBP;000	I/O	82	SBHE;000	I/O
33	IRQ8;100	O (I)	83	BPRFS;100	I (O)
34	TMOUT1;100	I (O)	84	CK32K;100	O (I)
35	TIMGT2;100	O (I)	85	ROMCS;000	O (I)
36	TMOUT2;100	O (I)	86	IMCS16;000	I (O)
37	IRQ1;100	O (I)	87	IIO16;000	I (O)
38	INTR;100	I (O)	88	IIRDY;100	I (O)
39	INTA;000	O (I)	89	ZROW;000	I (O)
40	DRVSL;000	I (O)	90	EXTSMI;000	I (O)
41	IRQ12;100	O (I)	91	SUSST;000	O (I)
42	CPHLDA;100	O (I)	92	STBY;000	I (O)
43	SA19;100	I (O)	93	RSTVCP;100	O (I)
44	SA18;100	I (O)	94	PWRON;100	I (O)
45	SA17;100	I (O)	95	RSTVGA;000	I (O)
46	SA16;100	I/O	96	GND	–
47	SA15;100	I/O	97	GND	–
48	SA14;100	I/O	98	GND	–
49	SA13;100	I/O	99	GND	–
50	SA12;100	I/O	100	GND	–

## C.8 PJ8 LCD Connector 2 (10-Pin)

Table C-8 LCD Connector 2 Pin Assignments (10-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	SCLD09;110	O	06	SCLD10;110	O
02	SCLD11;110	O	07	SCLD13;110	O
03	SCLD15;110	O	08	SCLD14;110	O
04	SCLD08;110	O	09	GND	–
05	SCLD12;110	O	10	GND	–

## C.9 PJ9 LCD Connector 1 (20-Pin)

Table C-9 LCD Connector 1 Pin Assignments (20-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	LPF;110	O	11	SUD0;110	O
02	LCLK;110	O	12	SLD3;110	O
03	FPF;110	O	13	SLD0;110	O
04	GND	–	14	GND	–
05	SUD1;110	O	15	GND	–
06	CBLON;000	O	16	RESET;000	O
07	SUD3;110	O	17	LCVCC	–
08	SLD2;110	O	18	LCVCC	–
09	SUD2;110	O	19	FLCDV	–
10	SLD1;110	O	20	FLCDV	–

## C.10 PJ10 CRT I/F Connector (15-Pin)

Table C-10 CRT I/F Connector Pin Assignments (15-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	RED;101	O	09	NC	–
02	TGREN;101	O	10	GND	–
03	BLUE;101	O	11	NC	–
04	NC	–	12	NC	–
05	GND	–	13	HSYNC;100	O
06	GND	–	14	TVSYNC;100	O
07	GND	–	15	NC	–
08	GND	–			

## C.11 PJ201 PRT/FDD Connector (for Printer) (25-Pin)

*Table C-11 PRT/FDD Connector (for printer) Pin Assignments (25-pin)*

<b>Pin</b>	<b>Signal</b>	<b>I/O</b>	<b>Pin</b>	<b>Signal</b>	<b>I/O</b>
01	STROB;000	I/O	14	AUTFD;000	I/O
02	PDB00;100	I/O	15	ERROR;000	I/O
03	PDB01;100	I/O	16	PINT;000	I/O
04	PDB02;100	I/O	17	SLIN;000	I/O
05	PDB03;100	I/O	18	GND	–
06	PDB04;100	I/O	19	GND	–
07	PDB05;100	I/O	20	GND	–
08	PDB06;100	I/O	21	GND	–
09	PDB07;100	I/O	22	GND	–
10	ACK;000	I/O	23	GND	–
11	BUSY;100	I/O	24	GND	–
12	PE;100	I/O	25	GND	–
13	SELCT;100	I/O			

## C.12 PJ201 PRT/FDD (Ext) Connector (for FDD) (25-Pin)

Table C-12 PRT/FDD (Ext) Connector (for FDD) Pin Assignments (25-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	RDY	I	14	LOWD	O
02	INDX	I	15	SSEL	O
03	TRO	I	16	DIRC	O
04	WPR	I	17	STEP	O
05	RDAT	I	18	GND	–
06	DKCH	I	19	GND	–
07	N/C	–	20	GND	–
08	N/C	–	21	GND	–
09	N/C	–	22	GND	–
10	DSL	O	23	GND	–
11	MON	O	24	GND	–
12	WDAT	O	25	GND	–
13	WEN	O			

## C.13 PJ202 Internal FDD Connector (26-Pin)

Table C-13 Internal FDD Connector Pin Assignments (26-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	VCC	–	14	ISTEP;000	O
02	IINDEX;000	I	15	GND	–
03	VCC	–	16	IWDAT;000	O
04	IDSL;000	O	17	GND	–
05	VCC	–	18	IWEN;000	O
06	DSKCHG;000	I	19	GND	–
07	VCC	–	20	ITR0;000	I
08	IRDY;000	I	21	GND	–
09	IHMED;000	I	22	IWPR;000	I
10	IMON;000	O	23	GND	–
11	ILOWD;000	O	24	IRDAT;000	I
12	IDIRC;000	O	25	GND	–
13	GND	–	26	ISSEL;000	O

## C.14 PJ203 Internal HDD Connector (44-Pin)

Table C-14 Internal HDD Connector Pin Assignments (44-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	RESET;000	I	23	IOWR;000	I/O
02	GND	–	24	GND	–
03	SD07;100	I/O	25	IORD;000	I/O
04	SD08;100	I/O	26	GND	–
05	SD06;100	I/O	27	NC	–
06	SD09;100	I/O	28	NC	–
07	SD05;100	I/O	29	IIRDY;100	I
08	SD10;100	I/O	30	GND	–
09	SD04;100	I/O	31	IRQ14;100	I
10	SD11;100	I/O	32	IIO16;000	I
11	SD03;100	I/O	33	SA01;100	I/O
12	SD12;100	I/O	34	NC	–
13	SD02;100	I/O	35	SA00;100	I/O
14	SD13;100	I/O	36	SA02;100	I/O
15	SD01;100	I/O	37	HDC0CS;000	O
16	SD14;100	I/O	38	HDC1CS;000	O
17	SD00;100	I/O	39	DRVSL;000	I
18	SD15;100	I/O	40	GND	–
19	GND	–	41	VCC	–
20	NC	–	42	VCC	–
21	NC	–	43	GND	–
22	GND	–	44	RVCC	–

## C.15 PJ204 Serial I/F Connector (9-Pin)

Table C-15 Serial I/F Connector Pin Assignments (9-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	DCD1;100	I	06	DSR1;100	I
02	RD1;000	I	07	RTS1;100	O
03	SD1;000	O	08	CTS1;100	I
04	DTR1;100	O	09	RI1;100	I
05	GND	–			

## C.16 PJ205 PC Card Slot Connector (68-Pin)

Table C-16 PC Card Slot Connector Pin Assignments (68-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	GND	–	35	GND	–
02	CDA03;100	I/O	36	CD1;000	I
03	CDA04;100	I/O	37	CD11;100	I/O
04	CDA05;100	I/O	38	CD12;100	I/O
05	CDA06;100	I/O	39	CD13;100	I/O
06	CDA07;100	I/O	40	CD14;100	I/O
07	CE1;000	O	41	CD15;100	I/O
08	CAD10;100	O	42	CE2;000	O
09	COE;000	O	43	NC	–
10	CAD11;100	O	44	IOR;000	O
11	CAD09;100	O	45	IOW;000	O
12	CAD08;100	O	46	CAD17;100	O
13	CAD13;100	O	47	CAD18;100	O
14	CAD14;100	O	48	CAD19;100	O
15	CWE;000	O	49	CAD20;100	O
16	CBSY;000	I	50	CAD21;100	O
17	MCVCC	–	51	MCVCC	–
18	MCVP1	–	52	MCVP2	–
19	CAD16;100	O	53	CAD22;100	O
20	CAD15;100	O	54	CAD23;100	O
21	CAD12;100	O	55	CAD24;100	O
22	CAD07;100	O	56	CAD25;100	O
23	CAD06;100	O	57	NC	–
24	CAD05;100	O	58	CRST;100	O
25	CAD04;100	O	59	WAIT;000	I
26	CAD03;100	O	60	INPAK;000	I
27	CAD02;100	O	61	REGA;000	O
28	CAD01;100	O	62	BVD2;100	I
29	CAD00;100	O	63	BVD1;100	I
30	CD00;100	I/O	64	CD08;100	I/O
31	CD01;100	I/O	65	CD09;100	I/O
32	CD02;100	I/O	66	CD10;100	I/O
33	WP;000	I	67	CD2;000	I
34	GND	–	68	GND	–

### C.17 PJ502 DC IN Connector (3-Pin)

*Table C-17 DC IN Connector Pin Assignments (3-pin)*

Pin	Signal	I/O	Pin	Signal	I/O
01	DCIN	–	03	GND	–
02	GND	–			

### C.18 PJ503 Backup Battery Connector (2-Pin)

*Table C-18 Backup Battery Connector Pin Assignments (2-pin)*

Pin	Signal	I/O	Pin	Signal	I/O
01	SUBBAT	–	02	GND	–

### C.19 PJ504 Main Battery Connector (5-Pin)

*Table C-19 Main Battery Pin Assignments (5-pin)*

Pin	Signal	I/O	Pin	Signal	I/O
01	BATT	–	04	GND	–
02	CBTH	–	05	GND	–
03	NC	–			

# Appendix D USA Display Codes

Table D-1 USA Display Codes

HEXA DECIMAL VALUE	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	BLANK (NULL)	▶	BLANK (SPACE)	0	@	P	'	p	Ç	É	á	☐	☐	☐	α	≡
1	☺	◀	!	1	A	Q	a	q	ü	æ	í	☐	☐	☐	β	±
2	☹	↑	"	2	B	R	b	r	é	Æ	ó	☐	☐	☐	Γ	≥
3	♥	!!	#	3	C	S	c	s	â	ô	ú	☐	☐	☐	π	≤
4	♠	¶	\$	4	D	T	d	t	ä	ö	ñ	☐	☐	☐	Σ	∫
5	♣	§	%	5	E	U	e	u	à	ò	Ñ	☐	☐	☐	σ	∫
6	♠	—	&	6	F	V	f	v	ð	û	ä	☐	☐	☐	μ	÷
7	•	↓	'	7	G	W	g	w	ç	ù	ü	☐	☐	☐	τ	≈
8	●	↑	(	8	H	X	h	x	ê	ÿ	ï	☐	☐	☐	ϕ	°
9	○	↓	)	9	I	Y	i	y	ë	Ö	Γ	☐	☐	☐	θ	•
A	●	→	*	:	J	Z	j	z	è	Ü	Γ	☐	☐	☐	Ω	•
B	♂	←	+	;	K	[	k	{	ï	ç	½	☐	☐	☐	δ	√
C	♀	└	,	<	L	\	l	!	↑	£	¼	☐	☐	☐	∞	∞
D	♪	↔	—	=	M	]	m	}	î	¥	¡	☐	☐	☐	φ	2
E	♪	▲	.	>	N	^	n	~	Ä	¶	«	☐	☐	☐	€	■
F	⚙	▼	/	?	O	_	o	Δ	Å	f	»	☐	☐	☐	∩	BLANK FF

## Appendix E Keyboard Scan/Character Codes

Table E-1 Scan Codes (Sets 1 and 2) (1/3)

Cap No.	Keypop	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 E-1 Scan Codes (Sets 1 and 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 E-1 Scan Codes (Sets 1 and 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 E-6, scan codes with **Ctrl** key.
- 7\* Refer to Table E-7, scan codes with **Alt** key.

Table E-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 listed below.

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

Table E-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 E-4 Scan Codes with Fn Key

Cap No.	Keytop	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	
122	NUML	45	C5	77	F0 77	
123	SCRL	46	C6	7E	F0 7E	

Table E-5 Scan Codes in Overlay Mode

Cap No.	Keytop	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 E-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 12	E0 7C	E0 F0 7C	E0 F0 12
	Ctrl*	E0 37		E0 7C		E0 F0 7C	
	Shift*	E0 37		E0 7C		E0 F0 7C	
	Alt*	54		84		F0 B4	

*Table E-7 Scan Codes with Alt Key*

Key top	Shift	Code Set 1						Code Set 2							
		Make						Make							
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 F Key Layout

## F.1 United States (US) Keyboard

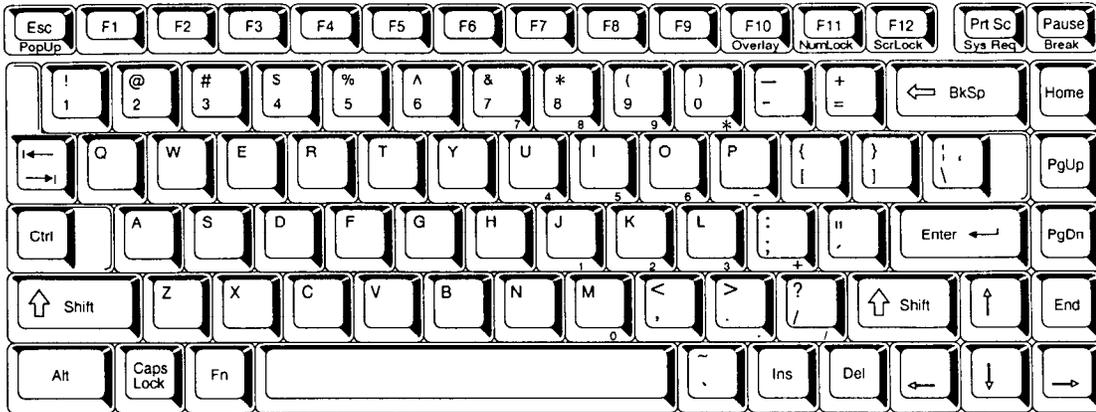


Figure F-1 US Keyboard

## F.2 United Kingdom (UK) Keyboard

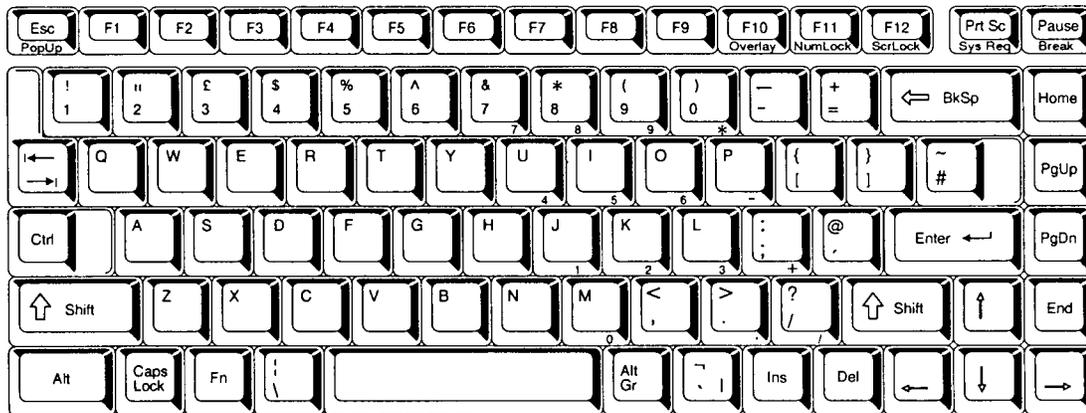


Figure F-2 UK Keyboard

### F.3 German (GR) Keyboard

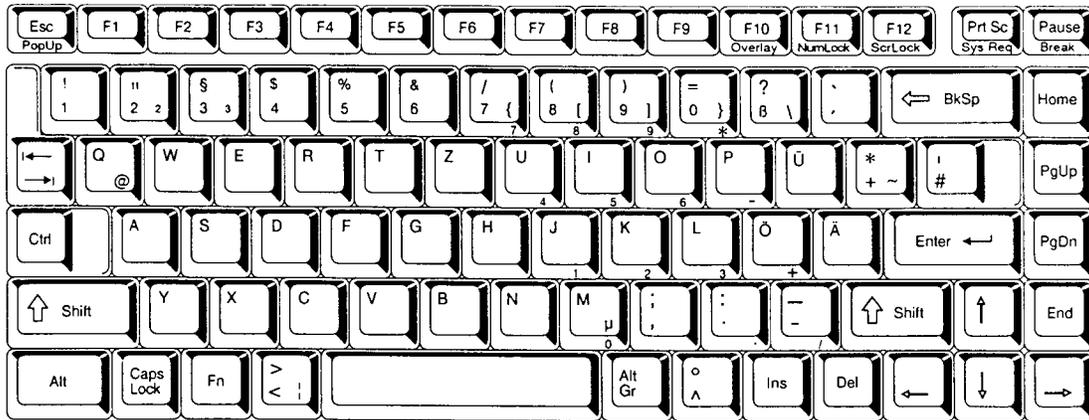


Figure F-3 GR Keyboard

### F.4 French (FR) Keyboard

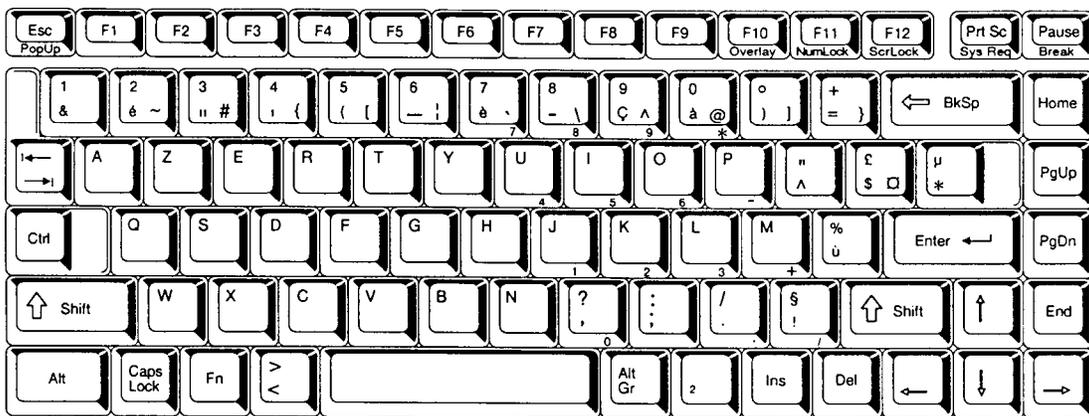


Figure F-4 FR Keyboard

## F.5 Spanish (SP) Keyboard

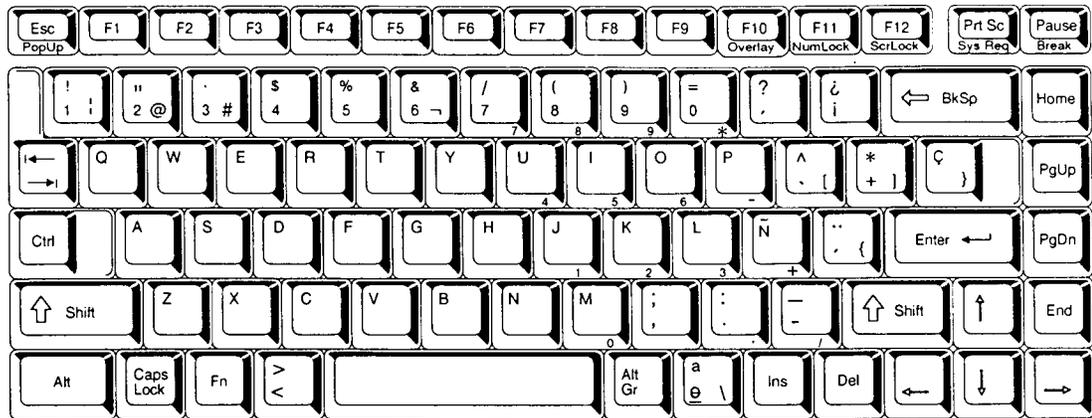


Figure F-5 SP Keyboard

## F.6 Italian (IT) Keyboard

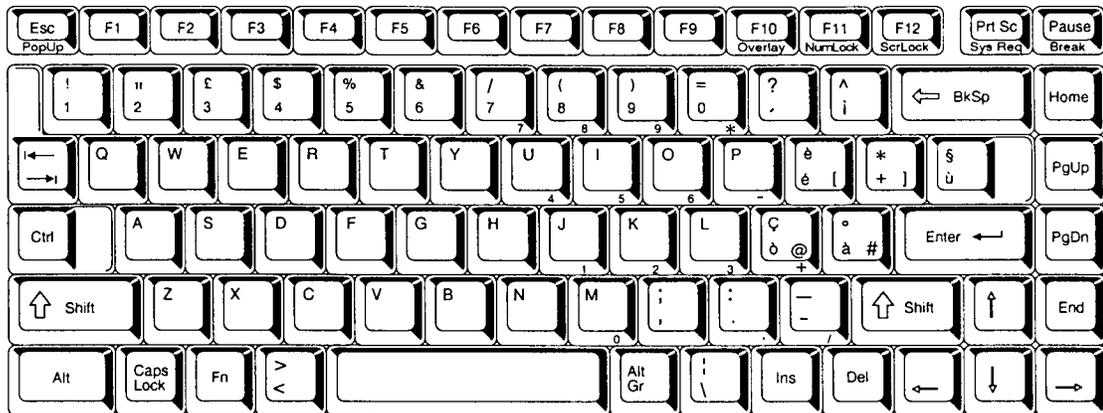


Figure F-6 IT Keyboard

## F.7 Scandinavian (SC) Keyboard

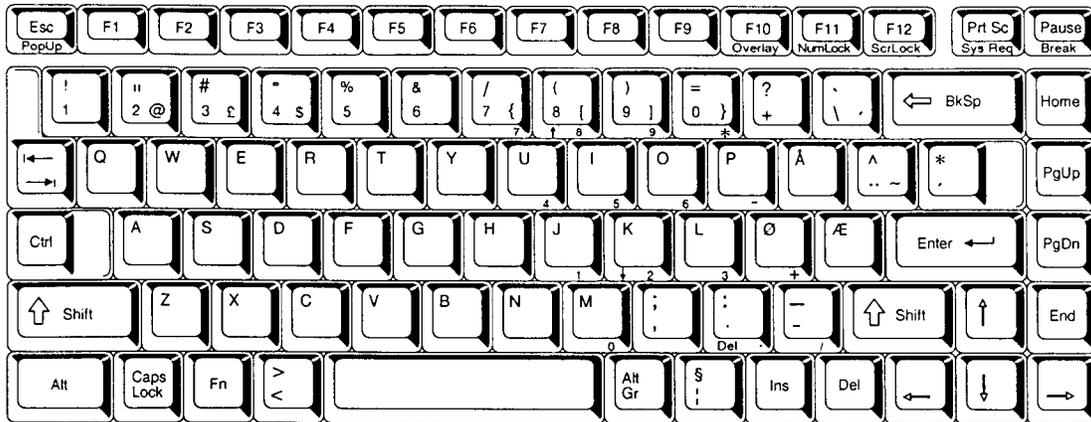


Figure F-7 SC Keyboard

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

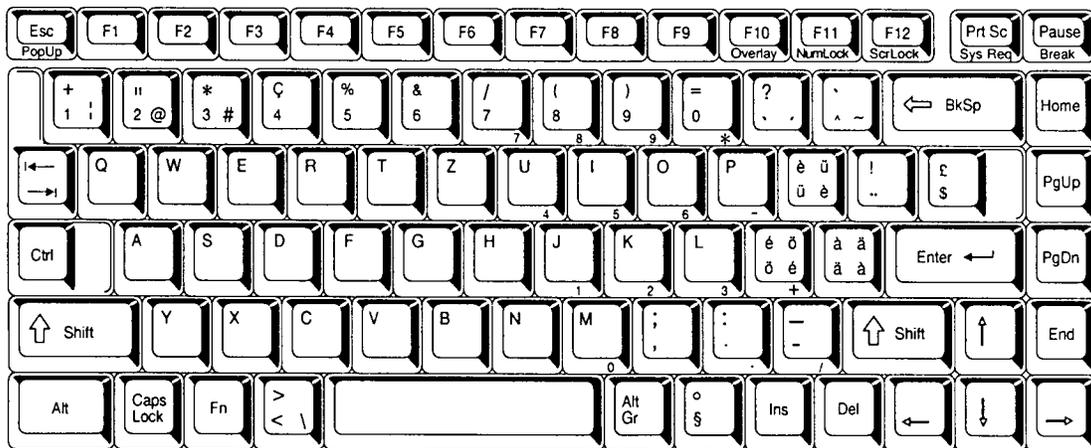


Figure F-8 SL Keyboard

## F.9 Canadian (Specialized) Keyboard

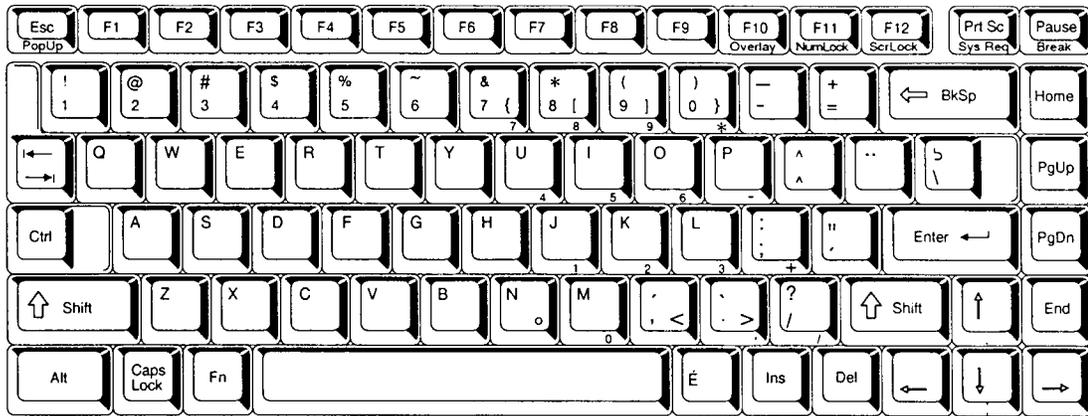


Figure F-9 Canadian Keyboard

## F.10 Keycap Number Keyboard

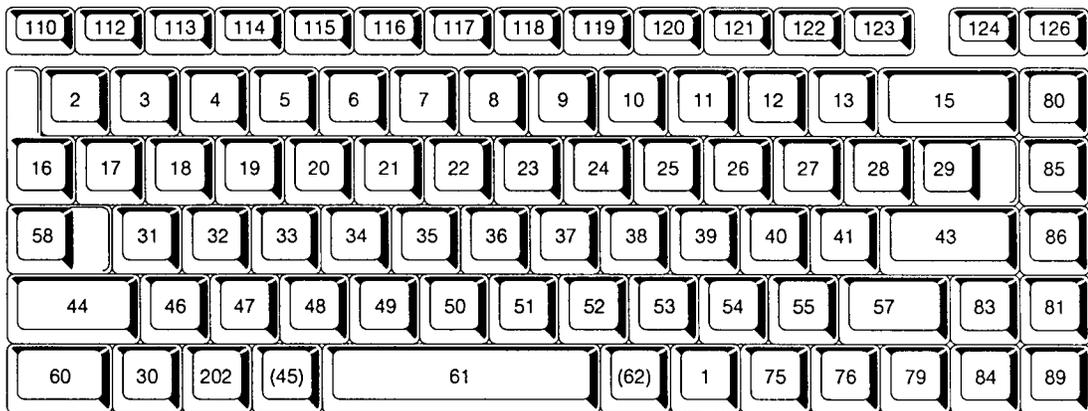


Figure F-10 Keycap Number Keyboard

## Appendix G Wiring Diagrams

### G.1 Printer Wraparound Connector

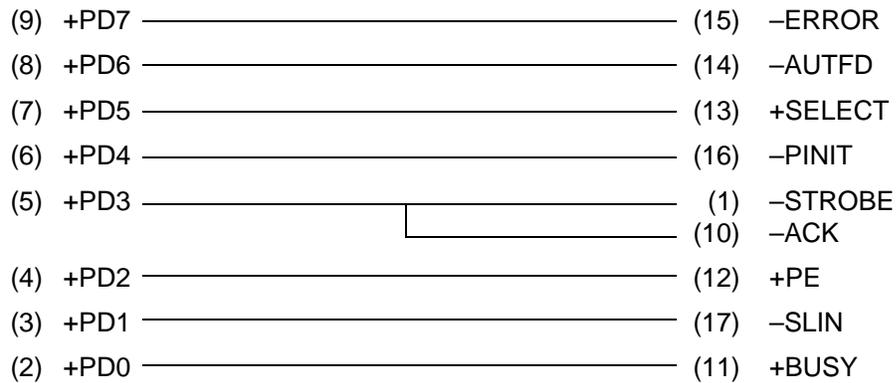


Figure G-1 Printer Wraparound Connector

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

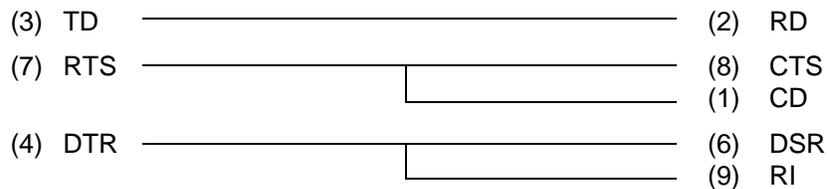


Figure G-2 RS-232-C Wraparound Connector

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

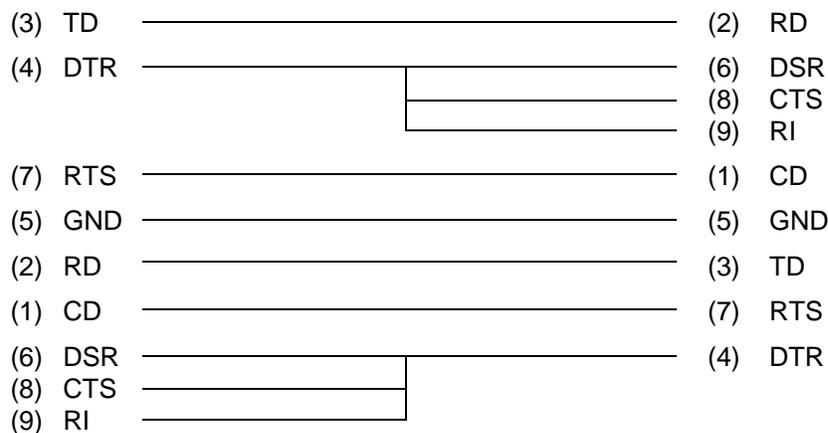
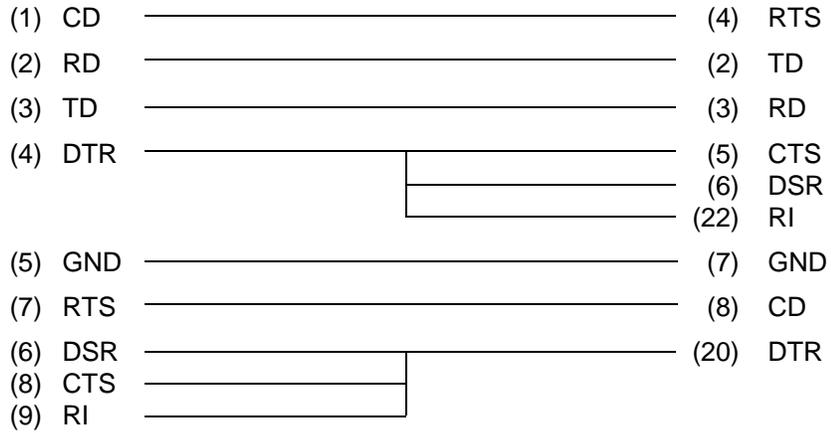


Figure G-3 RS-232-C Direct Cable (9-pin to 9-pin)

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



*Figure G-4 RS-232-C Direct Cable (9-pin to 25-pin)*