1.1 Features

The Toshiba T2450CT is one of the lightest and most advanced portable computers available. Utilizing advanced technology and high-speed components, the T2450CT offers excellent display legibility, battery operation, and IBM PC/AT compatibility. The T2450CT system unit consists of the following features:

❑ Microprocessor

The T2450CT uses an SL Enhanced Intel DX4-75 microprocessor that operates at 75 MHz, 3.3 Volts.

❑ Math co-processor

The T2450CT has a math co-processor which is stored in the DX4 microprocessor.

❑ Cache memory

The T2450CT has a 16 KB cache memory which is stored in the DX4 microprocessor.

❑ Disk storage

The T2450CT has an internal 320 or 500 MB HDD with an average access time of 13 milliseconds for the 320 MB HDD and 12 milliseconds for the 500 MB HDD. A 3.5-inch Floppy Disk Drive (FDD) supports 2HD floppy disks (1.44 MB) and 2DD floppy disks (720 Kbytes).

❑ Memory

The T2450CT comes standard with 8 MB of CMOS Random Access Memory (RAM) 3.3 volts. This includes 640 KB of conventional memory with 7552 KB of extended memory, which can be utilized as expanded memory compatible with the Lotus/Intel/ Microsoft Expanded Memory Specifications (LIM-EMS).

❑ TFT color LCD

The T2450CT has 9.5" full-color high-resolution, Thin Film Transistor (TFT) LCD with 640x480 pixels. The T2450CT internal display controller supports VGA functions for internal display and Super SVGA for external display.

❑ Keyboard

An easy-to-use 82/84-key enhanced keyboard with full-size keys and standard spacing is compatible with IBM standard software. The computer's keyboard supports software that uses a 101- or 102-key enhanced keyboard.

❑ Batteries

The T2450CT 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 T2450CT has two PCMCIA slots, which enable you to install an industry standard PCMCIA release 2.0 card. The right side slot is 14.5 mm (Type III). The left side slot is 5.0 mm (Type II).

❑ Parallel port

The T2450CT's Centronics compatible parallel interface port can be used to connect a Centronics compatible printer. The T2450CT also supports the Enhanced Capability Port (ECP).

❑ RS-232-C port

The T2450CT has one 9-pin serial interface port.

❑ Mouse port

The T2450CT has one 6-pin mouse port on the back that can be connected to an IBM PS/2 mouse.

❑ Keyboard port

The T2450CT has one 6-pin keyboard port on the back that can be connected to an IBM PS/2 keyboard.

❑ Port replicator port

The T2450CT has a port replicator port which enables connection of a port replicator. The port replicator allows connection of a PS/2 mouse, parallel port, serial port, DC IN socket, SCSI port, Joystick, line in, line out, PS/2 keyboard, and external monitor.

❑ RGB port

The T2450CT has one 15-pin RGB port on the back that can be connected to an external video display.

❑ SCSI port

The T2450CT has one Small Computer System Interface (SCSI2) port.

❏ Memory card slot

The T2450CT has one Toshiba optional memory card slot, which enables you to install a Toshiba optional memory card.

❏ AccuPoint

The T2450CT pointer control stick, located in the center of the keyboard, provides convenient control of the cursor without requiring desk space for a mouse.

❏ Microphone

The T2450CT has an internal microphone for an optional sound card.

The T2450CT Personal Computer is shown in figure 1-1. The T2450CT system configuration is shown in figure 1-2.
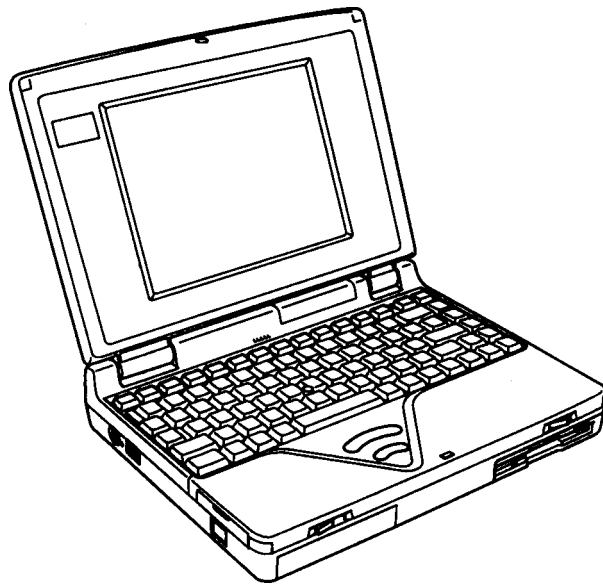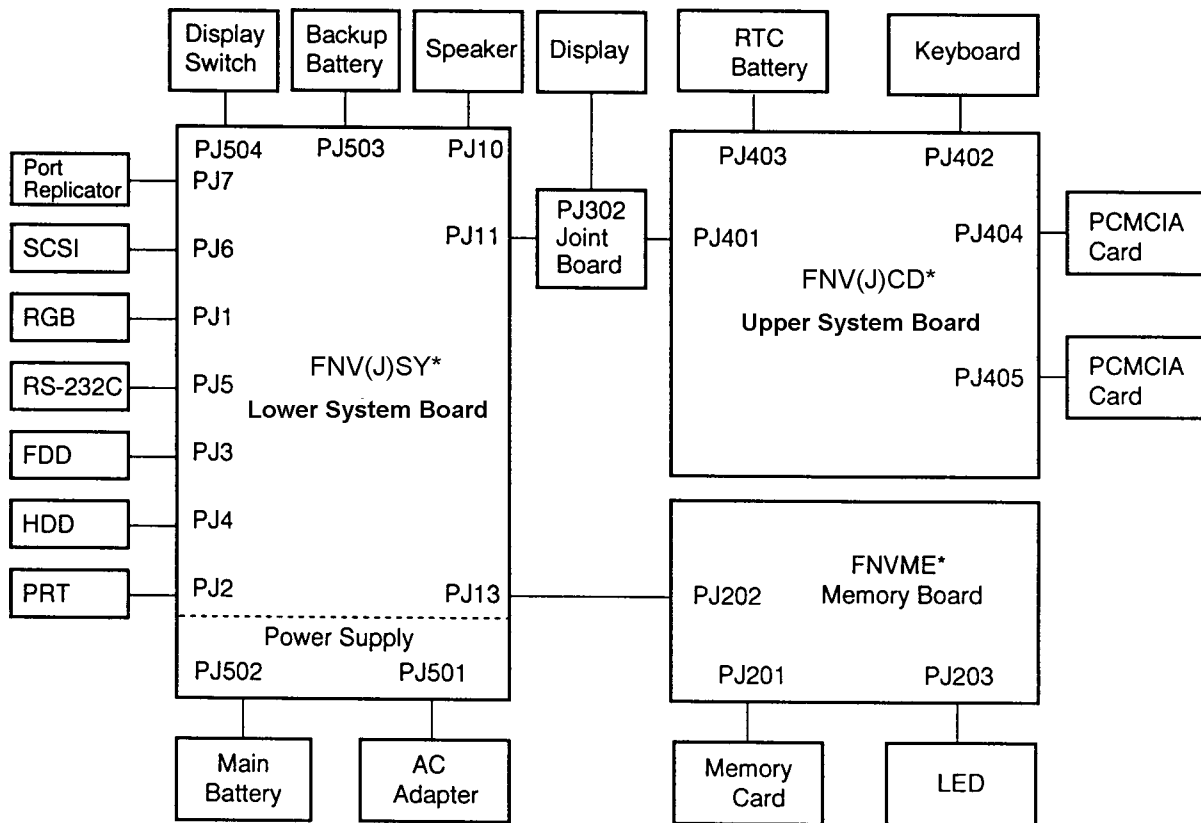

Figure 1-1 T2450CT personal computer

Figure 1-2 T2450CT system unit configuration

1.2 System Unit Block Diagram

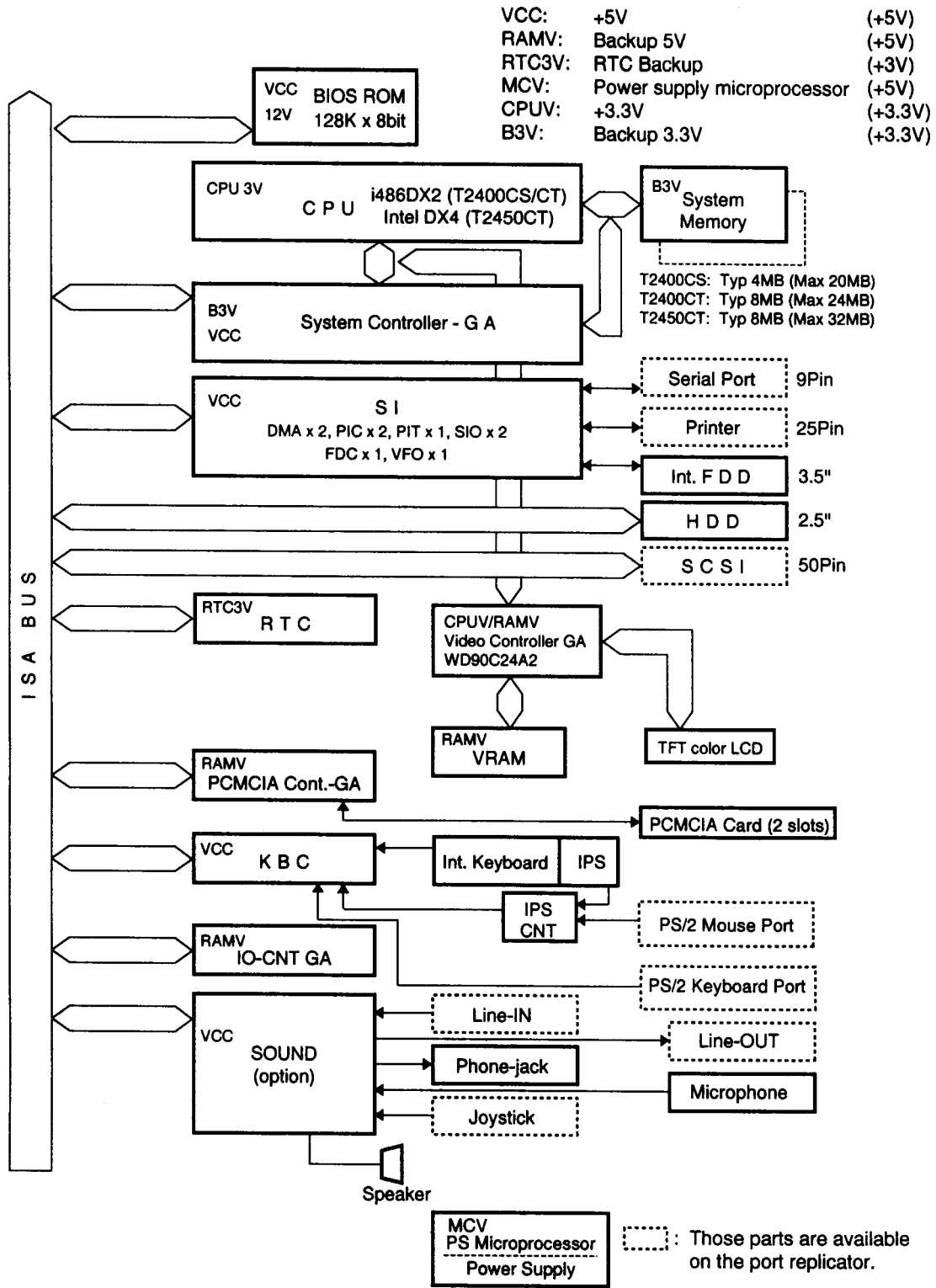Figure 1-3 is a block diagram of the T2450CT system unit.

Figure 1-3 T2450CT system board block diagram

The T2450CT system board contains the following functional components:

❑ T2450CT
One SL Enhanced Intel DX4-75 32-bit microprocessor.

DX4 operates at 75 MHz and 3.3 volts.

❑ Standard RAM
8 MB, eight 1024x4-bit chips and two 1024x16-bit chips

3.3 volt operation

No parity bit

Access time 80 ns

Data transfer is 32-bit width.

❑ Cache memory
The 16 KB of cache memory is stored inside the DX4.

❑ BIOS ROM (Flash EEPROM)
128 KB (one 128Kx8-bit chip) memory.

64 KB in the ROM are used for system BIOS.

32 KB in the ROM are used for VGA BIOS.

32 KB in the ROM are reserved.

Access time 150 ns.

Data transfer is 8-bit width.

❑ Video RAM
1 Mbytes (two 256Kx16-bit chips).

5 volt operation.

Access time 70 ns.

❑ Optional memory
One expansion memory slot is available for 4, 8, 16, and 24 MB memory modules.

Total maximum memory size is 24 MB if a 16 MB memory module

is installed. The 2450CT total maximum memory size is 32 MB if a 24 MB

memory module is installed.

3.3 volt operation

No parity bit

Access time 70 ns

❑ One super integration (SI)
  The following components:

     -Two DMACs   8237 equivalent
     - Two PICs   8259 equivalent
     - Two SIOs   16450 equivalent (One SIO is not used.)
     - One PIT   8254 equivalent
     - One FDC   TC8565 equivalent
     - One VFO   TC8568 equivalent
     - One I/O port decode
     - One SIO port control
     - One printer port control
     - One FDD control
     - One speaker control
     - One power communication control

❑ System Controller Gate Array (SYSCNT-GA)
  This gate array has the following functions:

        Memory control
           DRAM control
           CPU control
        Bus control
           Compatible bus interface control
           Compatible bus access control
           DMAC control
           I/O control
        Address latch control
           Address transfer
           Address latch
           DMA address generation
           Refresh address generation
        I/O register control
           Compatible I/O port
           Register storing at resume mode power off
           Special register
        Processing speed control
        Data bus transfer (32-bit to 16-bit) control
        Data latch

❑ PCMCIA Controller Gate Array
  PCMCIA (ToPIC) control

❑ SCSI Controller
 One AIC6360 chip is used. It controls the external SCSI ports.

❑ Video Controller Gate Array

The T2450CT internal display controller (3.3/5 volts operation) controls the internal VGA display and external SVGA compatible display. The controller is equipped with local video bus for superior performance of display. The T2450CT uses the WD90C24A.

❑ Keyboard Controller (KBC)

One M38802 chip is used.
This KBC includes the keyboard scan controller and keyboard interface controller.
The KBC controls the internal keyboard, external keyboard port, PS/2 mouse port.

❑ Real Time Clock (RTC)

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

❑ IO-CNT GA

This gate array has the following functions:
        System interface
        SCSI controller control
        Sound function control
        Hot key control (KBC interface)
        PS interface
        BIOS ROM interface
        NEXUS GA function

❑ AccuPoint Controller (U43SC11X)

This controller emulates the AccuPoint signals to PS/2 mouse signal and sends them to KBC.

1.3 3.5-inch Floppy Disk Drive

The T2450CT 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 T2450CT FDD is shown in figure 1-4. The specifications for the FDD are described in table 1-1.
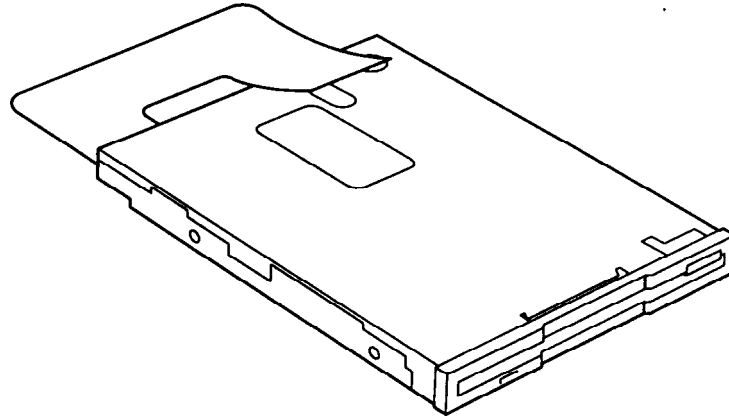
Figure 1-4 3.5-inch FDD

Table 1-1 3.5-inch FDD specifications

Item	2-MB mode	1-MB mode
Storage capacity (KB) Unformatted Formatted	2,000 1,311	1,000 737
Number of heads	2	2
Number of cylinders	80	80
Access time (ms) Track to track Average Head settling time	3 181 15	3 181 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 non-volatile storage device. It has a non-removable 2.5-inch magnetic disk and mini-winchester type magnetic heads.

T2450CT supports the 320 MB and 500MB HDD.

The T2450CT HDD is shown in figure 1-5. Specifications for the HDD are listed in table 1-2.
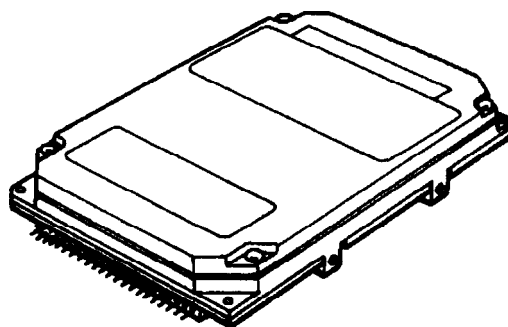
Figure 1-5 2.5-inch HDD

Table 1-2 2.5-inch HDD specifications

	320 MB		500 MB	
	MK1824FC	**IBM-DHAA2405**	**MK2526FVC**	**IBM-DHAA2540**
Storage capacity (MB) Formatted	336	328	503.5	504
Number of disks	2	2	3	2
Data heads	4	3	6	4
Cylinders	2,050	915	2,050	1,024
Sectors per track	106	49	106	64
Bytes per sector	512	512	512	512
Access time (ms) Track to track Average Maximum	3 13 25	4 14/15 (R/W) 23/24 (R/W)	3 13 25	4 14/15 (R/W) 23/24 (R/W)
Rotation speed (rpm)	4,200	3,800	4,200	3,800
Data transfer rate (bps) To/from media	25.0 to 43.75 M	24.9 to 36M	25 to 43.75M	24.9 to 36M
Interleave	1:1	1:1	1:1	1:1
Recording method	1-7 RLL	1-7 RLL	1-7 RLL	1-7 RLL

1.5   Keyboard

The 82-(USA) or 84-(European) keyboard is mounted on the T2450CT's system unit. The keyboard is connected to the keyboard controller on the PCMCIA card board through a 25-pin flat cable. The T2450CT pointer control stick, located in the center of the keyboard, provides convenient control of the cursor without requiring desk space for a mouse. The keyboard is shown in figure 1-6.

See Appendix F for optional keyboard configurations.
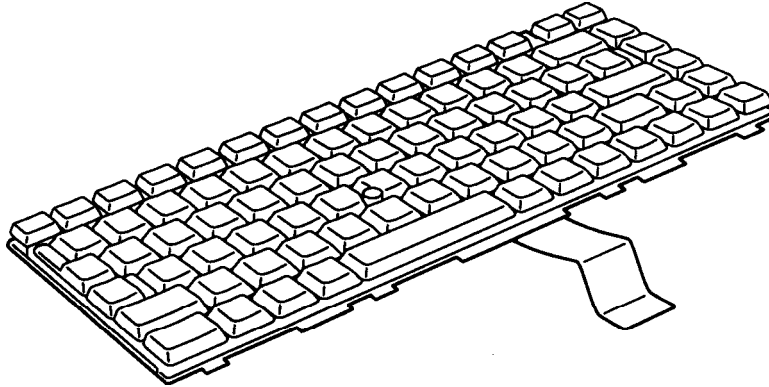
Figure 1-6 Keyboard

1.6   TFT Color LCD

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

1.6.1   TFT Color LCD Module

The T2450CT TFT color LCD supports 640x480 pixels with an internal display controller and 512 colors for graphics and characters. This controller includes the functions of Video Graphics Array (VGA) and Super VGA (SVGA) for external display.

The T2450CT's 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 1-7. The specifications for the LCD are described in table 1-3.
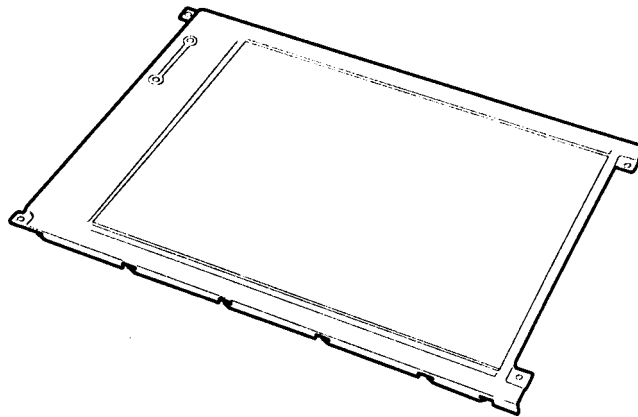
Figure 1-7 TFT color LCD

Table 1-3 TFT color LCD specifications

Item		Specifications
Number of dots	(dots)	640x480
Dot pitch	(mm)	0.3 (W)x0.3 (H)
Display area	(mm)	192 (W)x144 (H)
Contrast		60:1 (minimum)
FL current	(mA)	6.0
FL frequence	(KHz)	47

1.6.2 TFT Color Fluorescent Lamp (FL) Inverter Board

The FL inverter board supplies high frequency current to light the LCD's Fluorescent Lamp. The specifications for the FL inverter are described in table 1-4.

Table 1-4 TFT color FL inverter board specifications

Item		Specifications
Input	Voltage (VDC)	10
	Power (W)	4
Output	Voltage (VAC)	1,100
	Current (mA)	6.0
	Frequency (KHz)	47

1.7 Power Supply

The power supply supplies five kinds of voltages to the T2450CT system board. The T2450CT power supply has one microprocessor and it operates at 500 KHz. It contains 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 1-5.

Table 1-5 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	2,500	100
RS-232C, Flash ROM	P12V	+12	±5	100	240
RAM	B3V	+3.3	±5	300	66
VRAM	RAMV	+4.7	±5	300	100
CPU	CPUV	+3.3	±5	1,200	66

1.8　Batteries

The T2450CT has three types of batteries:

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

Battery specifications are listed in table 1-6.

Table 1-6　Battery specifications

Battery name	Material	Output voltage	Capacity
Main battery	Nickel Metal Hydride	12 V	2,600 mAH
Backup battery	Nickel Metal Hydride	1.2 V	1,100 mAH
RTC battery	Lithium-Vanadium	3.0 V	50 mAH

1.8.1　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 T2450CT. 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.)

Blink orange　　　The battery is low when the power is on.

No light　　　　　The AC adapter is disconnected from the computer.   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.

❍　　　AC adapter is not receiving power.

1.8.2   Battery Charging Control

Battery charging is controlled by a power supply microprocessor that is mounted on the power supply. The microprocessor controls whether the charge is on or off and detects a full charge when the AC 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 1-7 Time required for charges

	Charging time
Quick charge (power off)	About 2.3 hours
Trickle charge (power on)	About 48 hours

If the 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.

1.8.3   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 1-8 shows the charging time and data preservation period of the backup battery.

Table 1-8 Backup battery charging/data preservation time

		Time
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

1.8.4   RTC Battery

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

Table 1-9 RTC battery charging/data preservation time

		Time
Charging Time	With AC adapter or main battery	48 H
Data preservation period (full charge)		1 month

2.1　Troubleshooting

Chapter 2 describes how to determine if a Field Replaceable Unit (FRU) in the T2450CT 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

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

The following tools are necessary for implementing the troubleshooting procedures:

1. A T2450CT 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 floppy disk drive testing
5. A cleaning kit for floppy disk drive troubleshooting
6. A printer port LED
7. An RS-232-C wraparound connector
8. A printer wraparound connector
9. A multimeter
10. 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 and, if it 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.

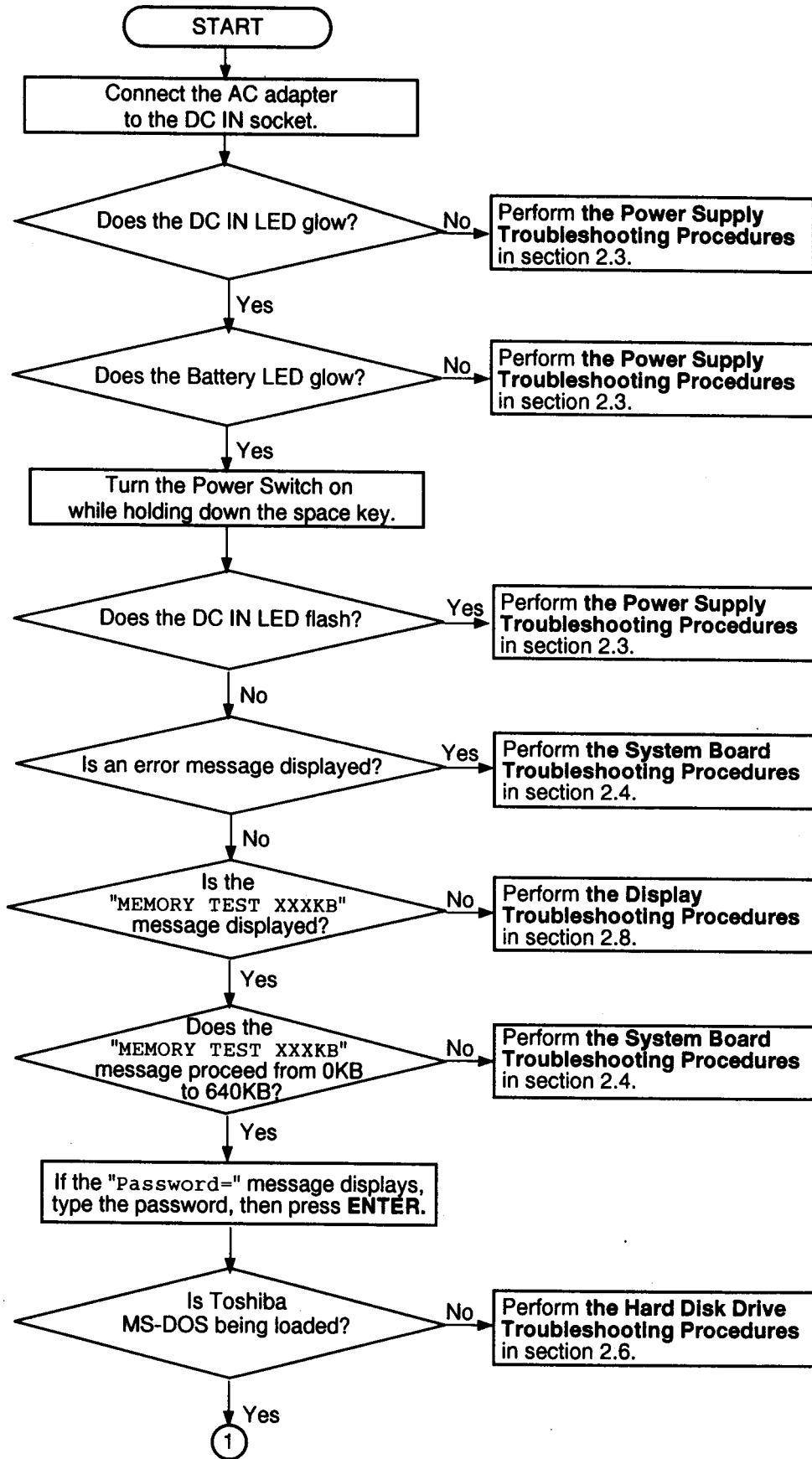❑ Make sure the floppy disk drive is empty.

```
                    ┌─────────────┐
                    │    START    │
                    └─────────────┘
                           │
                           ▼
              ┌──────────────────────────┐
              │   Connect the AC adapter  │
              │    to the DC IN socket.   │
              └──────────────────────────┘
                           │
                           ▼
```

```
  Does the DC IN LED glow?  ──No──▶  Perform the Power Supply
                                      Troubleshooting Procedures
                                      in section 2.3.
           │Yes

  Does the Battery LED glow?  ──No──▶  Perform the Power Supply
                                       Troubleshooting Procedures
                                       in section 2.3.
           │Yes

  ┌──────────────────────────────┐
  │     Turn the Power Switch on   │
  │ while holding down the space key.│
  └──────────────────────────────┘
           │

  Does the DC IN LED flash?  ──Yes──▶  Perform the Power Supply
                                        Troubleshooting Procedures
                                        in section 2.3.
           │No

  Is an error message displayed?  ──Yes──▶  Perform the System Board
                                             Troubleshooting Procedures
                                             in section 2.4.
           │No

  Is the
  "MEMORY TEST XXXKB"  ──No──▶  Perform the Display
  message displayed?             Troubleshooting Procedures
                                 in section 2.8.
           │Yes

  Does the
  "MEMORY TEST XXXKB"  ──No──▶  Perform the System Board
  message proceed from 0KB       Troubleshooting Procedures
  to 640KB?                      in section 2.4.
           │Yes

  ┌──────────────────────────────────────┐
  │ If the "Password=" message displays,   │
  │ type the password, then press ENTER.   │
  └──────────────────────────────────────┘
           │

  Is Toshiba
  MS-DOS being loaded?  ──No──▶  Perform the Hard Disk Drive
                                  Troubleshooting Procedures
                                  in section 2.6.
           │Yes
           ▼
         ( 1 )
```

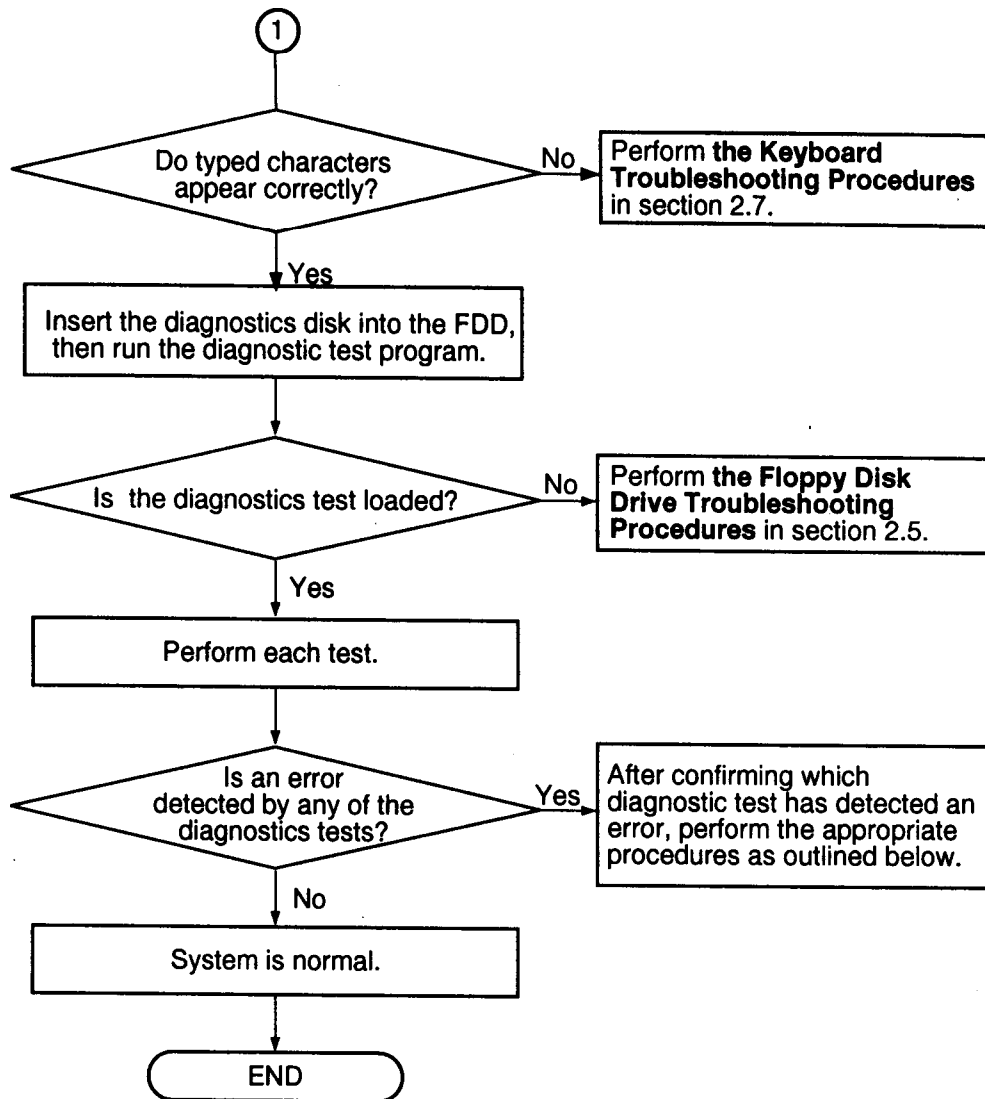*Figure 2-1 Troubleshooting flowchart (1/2)*

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 T2450CT's power supply controls many functions and components in the T2450CT. To
determine if the power supply is functioning properly, start with Procedure 1 and continue
with the other Procedures as instructed. The procedures described in this section are:

Procedure 1:   DC IN LED Indicator Check

Procedure 2:   Battery LED Indicator Check

Procedure 3:   PCB Replacement Check

Procedure 1　　DC IN LED Indicator Check

The T2450CT'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 to the computer, or the AC adapter is not attached to the T2450CT, 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 socket on the back of the computer.

> T2450CT:　　PA2430U
> DC 18 V, 1.1 A

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 T2450CT in an environment between –20°C and 70°C until the T2450CT is at the ambient temperature. Repeat the steps which caused the computer to operate abnormally. 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 Battery LED, identified by a battery icon on the front of the computer, glows orange when the AC adapter is charging the T2450CT's battery pack.

If the Battery LED indicator glows green, the AC adapter is connected and the battery is fully charged.

If the Battery LED indicator glows orange, the AC adapter is connected and the battery is being charged.

If the Battery LED 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 the battery pack is installed correctly, go to Check 3.

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

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

If the terminal looks bent or damaged, replace the 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 PCB unit incorporates the system board and the power supply board. Power is supplied to the power supply board through the DC IN 18 V plug located on the power supply board. If either the power supply board or the system board is damaged, replace the PCB unit.

Refer to chapter 4 for instructions on how to disassemble the T2450CT, and then perform the following check:

Check 1   Replace the PCB unit 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 are:

Procedure 1:　　　Message Check

Procedure 2:　　　Printer Port LED Check on Boot Mode

Procedure 3:　　　Printer Port LED Check on Resume Mode

Procedure 4:　　　Diagnostic Test Program Execution Check

Procedure 5:　　　Replacement Check

Procedure 1   Message Check

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

❑ If an error message is shown on the display, perform Check 1.

❑ If there is no error message, go to Procedure 2.

❑ If the Toshiba MS-DOS is properly loaded, go to Procedure 4.

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

If you press the **F1** key as the message instructs, the system configuration in the RTC memory configuration is set to the default setting. If error message (b) appears often when the power is turned on, replace the RTC battery. If any other error message is displayed, perform Check 2.

```
(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 ......
```

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

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

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

If one of the following error messages (1) through (20), (25), or (26) is displayed,
go to Procedure 2.

If error message (21) or (22) is displayed, go to the HDD Troubleshooting Proce-
dures in section 2.6.

If error message (23) or (24) is displayed, go to the FDD Troubleshooting Proce-
dures in section 2.5.

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

Procedure 2   Printer Port LED Check on Boot Mode

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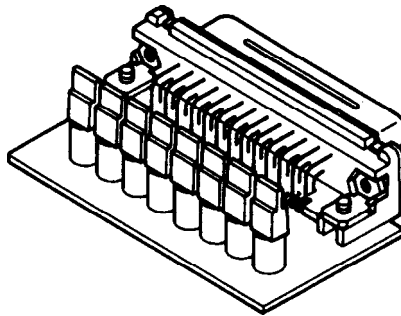
Figure 2-2 Printer port LED

To use the printer port LED follow these steps:

1.   Turn on the T2450CT's power, then set to boot mode.

2.   Turn off the T2450CT's power.

3.   Plug the printer port LED into the T2450CT's PRT connector.

4.   Hold down the space bar and turn on the T2450CT's power.

5.   Read the LED status from left to right as you are facing the back of the computer.

6.   Convert the status from binary to hexadecimal notation.

7.   If the final LED status is FFh (normal status), go to Procedure 3.

8.   If the final LED status matches any of the test status values in table 2-1, perform Check 1.

> *NOTE: If an error condition is detected by the IRT test, the printer port LED displays an error code after the IRT test ends. For example, when the printer port LED displays 42 and halts, the IRT test has already completed the DMAC initialization. In this instance, the IRT indicates an error has been detected during the PIC test.*

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

LED status	Test item	Message
01H	KBC initialization	
	ROM checksum test	BIOS is damaged! .....
02H	Special register initialization	
	PIT test	`PIT ERROR`
	PIT initialization	—
	PIT function check	`MEMORY REFRESH ERROR` `TIMER CH.2 OUT ERROR`
03H	CMOS check	`CMOS CHECKSUM ERROR` `CMOS BAD BATTERY ERROR`
	KB initialization	`KBC ERROR`
04H	Initialization of memory configuration	—
05H	SM-RAM check	—
06H	Self test check	—
	Read of Power Supply information	—
07H	ROM/RAM copy	—
08H	Initialization of internal VGA	—
0AH	First 64 KB memory test	`FIRST 64KB MEMORY ERROR` `FIRST 64KB MEMORY PARITY ERROR`
0BH	System memory initialization	—
0CH	System initialization	—
0DH	Interrupt vector initialization	—
18H	PIC initialization	—
1FH	Display initialization	`VRAM ERROR`
25H	System memory test	`SYSTEM MEMORY ERROR` `SYSTEM MEMORY PARITY ERROR`
30H	Extended memory test	`EXTENDED MEMORY ERROR` `EXTENDED MEMORY PARITY ERROR`
40H	DMA page register test	`DMA PAGE REGISTER ERROR`
41H	DMAC test	`DMAC #X ERROR`
42H	DMAC initialization	—
4AH	PIC test	`PIC #X ERROR`
50H	Mouse initialization	—
55H	KBC initialization	`KBC ERROR`
60H	HDD initialization	`HDC ERROR/HDD #0 ERROR`
65H	FDD initialization	`FDC ERROR/NO FDD ERROR`
70H	Printer initialization	—
80H	SIO initialization	—
90H	Timer initialization	`RTC UPDATE ERROR` `TIMER INTERRUPT ERROR`
A0H	NDP initialization	—

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

LED status	Test item	Message
A6H	Initialization of expansion ROM	–
C0H	Password check	–
FFH	Setup boot check	`*** Error is CMOS. xxxxxx ***` `Check system.  Then press [F1] key.`
FFH	Boot load	–

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

00h, 01h, 02h, 03h, 04h, 05h, 06h, 07h, 0Ah, 0Bh, 0Ch, 0Dh, 18h, 1Fh, 25h, 30h, 40h, 41h, 42h, 4Ah, 65h, 70h, 80h, 90h, A0h, C0h, FFh

Check 2   If error code **50h** is displayed, go to the Keyboard Troubleshooting procedures in Section 2.7.

Check 3   If error code **55h** is displayed, go to the HDD Troubleshooting Procedures in Section 2.6.

Check 4   If error code **60h** is displayed, go to the FDD Troubleshooting Procedures in Section 2.5.

Procedure 3   Printer Port LED Check on Resume Mode

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

To use the printer port LED follow these steps:

1.   Turn on the T2450CT's power, then set to resume mode.

2.   Turn off the T2450CT's power.

3.   Plug the printer port LED into the T2450CT's PRT connector.

4.   Turn on the T2450CT's power.

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 status

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

Procedure 4　　Diagnostic Test Program Execution Check

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

1. System test
2. Memory test
3. Printer test
4. ASYNC test
5. Real Timer test
6. 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 2450CT following the steps described in chapter 4, *Replacement Procedures,* and 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 exists, replace the lower system board with a new one. Refer to chapter 4, *Replacement Procedures*, 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 exists, replace the upper system board with a new one. Refer to chapter 4, *Replacement Procedures*, 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 T2450CT'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:   Diagnostic Test Program Check
>
> Procedure 3:   Connector Check and Replacement Check

Procedure 1   FDD Head Cleaning Check

FDD head cleaning is one option available in the *Diagnostic Program.* Detailed operation is listed 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 T2450CT, go to Procedure 2.

Procedure 2   Diagnostic Test Program Execution Check

The Floppy Disk Drive Diagnostic Test program is stored on the T2450CT Diagnostics Disk. After loading Toshiba MS-DOS, run the diagnostic program. Refer to Chapter 3, *Tests and Diagnostics*, for more information about the diagnostics test procedures.

Floppy disk drive test error codes and their status names are described in table 2-3. Make sure the floppy disk in the FDD is formatted correctly and that the write protect tab is disabled. If any other errors occur while executing the FDD diagnostics test, go to Check 1.

Table 2-3 Floppy disk drive error code and status

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

Check 1   If the following message is displayed, disable the write protect tab on the floppy disk. If any other message appears, perform Check 2.
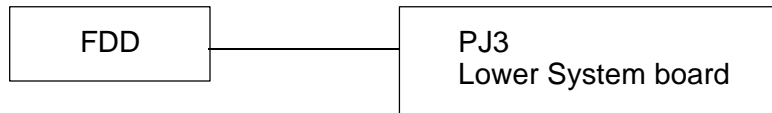
```
Write protected
```

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

Procedure 3   Connector Check and Replacement Check

The 3.5-inch Floppy Disk Drive is connected to the lower system board by the FDD cable. This cable may be disconnected from the system board or damaged. Disassemble the T2450CT 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.

```
+----------------+          +--------------------+
|                |          | PJ3                |
|      FDD       |----------| Lower System board |
|                |          |                    |
+----------------+          +--------------------+
```

If this cable is disconnected, connect it to the system unit 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, *Replacement Procedures*. 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, *Replacement Procedures*. 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 floppy disk(s) using the Toshiba MS-DOS BACKUP command. Refer to the Toshiba MS-DOS Manual for more information about how to perform the BACKUP command.

Procedure 1   Partition Check

Insert the Toshiba MS-DOS system disk and 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 T2450CT'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:

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

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

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

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

If the following message appears on the display, the system program has been transferred to the HDD. Restart the T2450CT. If the error message still appears, perform Check 4.

```
System transferred
```

Check 4   The HDD is connected to the lower system board directly. This connection can become disconnected or damaged. Disassemble the T2450CT as described in chapter 4. If the HDD is not connected, connect it to the system board and return to Procedure 1. If the HDD is firmly connected to the system board, perform Procedure 3.

```
+----------------------+        +-------+
|  Lower System Board  |--------|  HDD  |
+----------------------+        +-------+
```
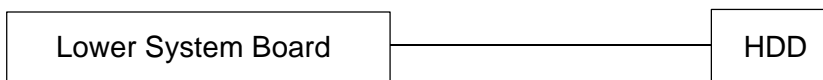
Procedure 3   Format Check

The T2450CT'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 error message appears on the display, refer to the *Toshiba MS-DOS
Manual* for more information and perform Check 2.

Check 2   Using the T2450CT Diagnostic Disk, format the HDD with a 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 com-
mand.

> Format complete

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

Procedure 4   Diagnostic Test Program Execution Check

The HDD test program is stored in the T2450CT 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 will be displayed; perform Check 1. The error codes and statuses are listed in table 2-4. If an error code is not generated, the HDD is operating properly.

Table 2-4 Hard disk drive error code and status

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

Check 1   Replace the HDD unit with a new one following the instructions in chapter 4, *Replacement Procedures*. If the HDD is still not functioning properly, perform Check 2.

Check 2   Replace the lower system board with a new one following the instructions in chapter 4, *Replacement Procedures*. If the HDD is still not functioning properly, replace the upper system board.

2.7 Keyboard Troubleshooting

To determine if the T2450CT'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 upper system board by a 25-pin flat cable. This cable may be disconnected or damaged. Disassemble the T2450CT as described in chapter 4, *Replacement Procedures*, and perform the following checks:

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

Keyboard cable	———	PJ402 Upper System board
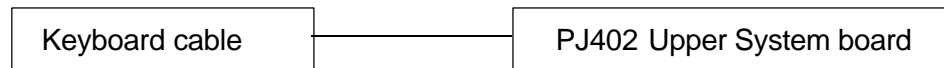
        If this cable is damaged, replace the cable with a new one. If the cable is disconnected, firmly connect it. Perform Procedure 1 again. If the keyboard is still not functioning properly, perform Check 2.

Check 2   The keyboard controller on the upper system board may be damaged. Replace the upper system board with a new one. Refer to chapter 4, *Replacement Procedures,* 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 T2450CT's display is functioning properly. Start with Procedure 1 and continue with the other procedures as instructed.

> Procedure 1: External CRT Check
>
> Procedure 2: Diagnostic Test Program Execution Check
>
> Procedure 3: Connector Check
>
> Procedure 4: Replacement Check

Procedure 1   External CRT Check

Connect the external CRT to the T2450CT'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 3.

If the external CRT appears to have the same problem as the internal LCD, the display controller may be damaged. Go to Procedure 2.

### Procedure 2   Diagnostic Test Program Execution Check

The Display Test program is stored on the T2450CT 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 3. If an error is not detected, the display is functioning properly.

Procedure 3   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.
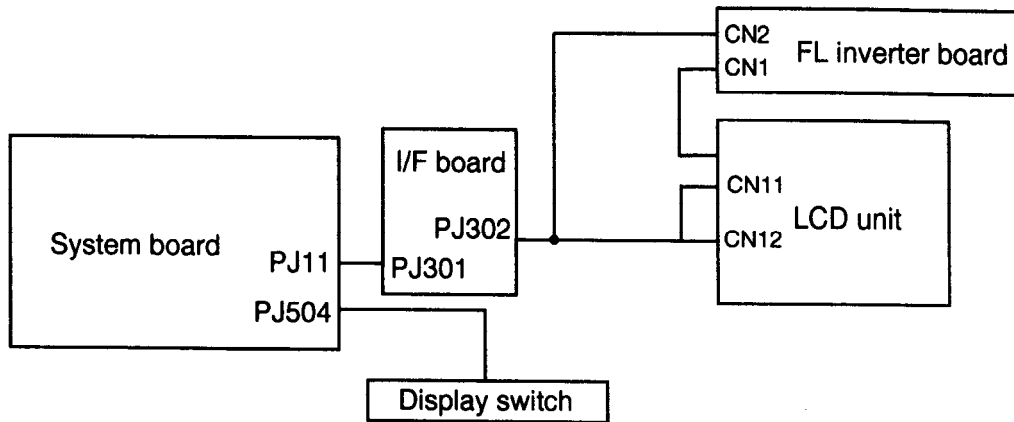
Figure 2-3 T2450CT display connection

If any of these cables is not connected, firmly reconnect it and repeat Procedure 1. If the problem still exists, perform Procedure 4.

Procedure 4   Replacement Check

The FL, FL inverter board, LCD module, and system boards 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 T2450CT's Diagnostic Test program to test the functions of the T2450CT's hardware modules. The Diagnostics Program is stored on the T2450CT Diagnostic Disk. The Diagnostic Test consists of 20 programs that are grouped into the Service Program Module (DIAGNOSTIC TEST MENU) and the Test Program Module (DIAGNOSTIC TEST).

The DIAGNOSTIC TEST MENU consists of the following eight functions. These are all located within the Diagnostic test function of the DIAGNOSTIC TEST MENU.
- ❏ DIAGNOSTIC TEST
- ❏ HARD DISK FORMAT
- ❏ HEAD CLEANING
- ❏ LOG UTILITIES
- ❏ RUNNING TEST
- ❏ FDD UTILITIES
- ❏ SYSTEM CONFIGURATION
- ❏ SETUP

The DIAGNOSTIC TEST MENU contains the following twelve functional tests:
- ❏ SYSTEM TEST
- ❏ MEMORY TEST
- ❏ KEYBOARD TEST
- ❏ DISPLAY TEST
- ❏ FLOPPY DISK TEST
- ❏ PRINTER TEST
- ❏ ASYNC TEST
- ❏ HARD DISK TEST
- ❏ REAL TIMER TEST
- ❏ NDP TEST
- ❏ EXPANSION TEST
- ❏ SOUND TEST

You will need the following equipment to perform some of the T2450CT Diagnostic test programs.
- ❏ The T2450CT Diagnostics Disk (all tests)
- ❏ A formatted working disk for the floppy disk drive test (all tests)
- ❏ 3.5-inch 2HD/2DD disk for internal 3.5-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)
- ❏ JOYSTICK wraparound

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 T2450CT DIAGNOSTICS PROGRAM. To start the DIAGNOSTIC PROGRAM follow these steps:

1. Turn on the computer, and allow the computer to boot. Insert the T2450CT Diagnostics disk in the computer's internal floppy disk drive.

2. At the system prompt, change to drive A, type **TEST2450**, and press **Enter**.

The following menu will appear:

```
TOSHIBA personal computer T24XX 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 T2450CT DIAGNOSTIC TEST MENU, press the **Esc** key. If a test program is in progress press **Ctrl** + **Break** to exit, or **Ctrl** + **C** to stop the test program.*

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

```
TOSHIBA personal computer T24XX DIAGNOSTICS
version X.XX (c) copyright TOSHIBA Corp. 19XX
DIAGNOSTIC TEST MENU :

 1 - SYSTEM TEST
 2 - MEMORY TEST
 3 - KEYBOARD TEST
 4 - DISPLAY TEST
 5 - FLOPPY DISK TEST
 6 - PRINTER TEST
 7 - ASYNC TEST
 8 - HARD DISK TEST
 9 - REAL TIMER TEST
10 - NDP TEST
11 - EXPANSION TEST
12 - SOUND TEST

88 - ERROR RETRY COUNT SET [HDD & FDD]
99 - EXIT TO DIAGNOSTICS MENU

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

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

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

```
SYSTEM TEST     XXXXXXX
                           ┌─────────────────────────────┐
                           │ T24XX 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
```

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

```
TEST LOOP  : YES
```

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

Selecting **NO** returns the subtest menu to the main menu after the test is complete.

6. The following message will appear:

```
ERROR STOP : YES
```

Then, 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
```

These 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 describes the function of each test on the subtest menu. Table 3-3 in section 3.16 describes the error codes and error status for 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	Cache memory
3	KEYBOARD	01	Pressed key display (82/84)
		02	Pressed key code display
		03	PS/2 Mouse connect check
		04	Pointing stick 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	TFT color display
		12	SVGA color graphics display
5	FDD	01	Sequential read
		02	Sequential read/write
		03	Random address/data
		04	Write specified address
		05	Read specified address
6	PRINTER	01	Ripple pattern
		02	Function
		03	Wraparound

Table 3-1 Subtest names (2/2)

No.	Test name	Subtest No.	Subtest item
7	ASYNC	01	Wraparound (board)
		02	Board (#1) <=> board (#2)
		03	Point to point (send)
		04	Point to point (receive)
		05	Interrupt test
8	HDD	01	Sequential read
		02	Address uniqueness
		03	Random address/data
		04	Cross talk & peak shift
		05	Write/read/compare (CE)
		06	Write specified address
		07	Read specified address
		08	ECC circuit
		09	Sequential write
		10	W-R-C specified address
9	REAL TIMER	01	Real time
		02	Backup memory
		03	Real time carry
10	NDP	01	NDP test
11	EXPANSION	01	PCMCIA wraparound
		02	SCSI wraparound
12	SOUND	01	CODEC (REC/PLAY)
		02	FM synthesizer
		03	SINE wave play back

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      = 50MHz (75MHz)
   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 describes the hardware bit status for each bit tested. Pressing **Enter** returns you to the Sub-Test Menu.

> *NOTE: This subtest checks bits 5 and 6, and displays their information. The other bits are not changed.*

Table 3-2 Hardware bit status

Bit	H/W status	1	0
7	Reserved	—	—
6	CPU clock speed	75 MHz	75 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

Subtest 03   Version check

This subtest checks the version of the following four items:

❑   BIOS ROM
❑   BOOT ROM
❑   KBC version
❑   PS microprocessor version

This subtest compares these four items to the reference data stored in the test
program. When the read information is lower than the reference data, the
speaker beeps, and the test program displays the following screen image. To
exit this screen, press the **S** key. When the read information is higher, the
display is unchanged.

```
ROM-BIOS          = V1.00 : OK V1.10
ROM(BOOT)         = V1.00 : OK V1.00
KBC Version       = V1.26 : NG V1.00
PS Micom Version = V1.35 : OK V1.35
```

                         Reference data
                                    Current data

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 4 MB, 8 MB, and 16 MB.

After selecting subtest 05, the following message will appear:

```
Extended memory size (1:4 MB,2:8 MB,3:16 MB,4:24MB) ?
```

Select the number that corresponds to the memory card installed in the T2450CT.

Subtest 06   Cache memory

To test the cache memory, a pass-through write-read comparison of '5A' data is run repeatedly to 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 T2450CT'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
```

Subtest 02   Pressed key code display

When a key is pressed, the scan code, character code, and keytop 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 keytop names are shown 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 this test detects an error, the following message appears:

```
 KBD - MOUSE INTERFACE ERROR

                              [[ HALT OPERATION ]]

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

Subtest 04   Pointing Stick Check

> **NOTE**: *To execute the pointing stick check, mouse driver software must be installed on the system.*

This subtest checks the functions of the pointing stick as shown below.

　　a) IPS stick pressure sensing direction and parameter.
　　b) IPS switch function check.

This test reports the IPS motion response from the IPS stick and IPS switch by displaying the location parameters. When the stick is pressed towards the upper left, the <POINTING> display changes to the following image. If an IPS switch is pressed, the <BUTTON> display alternates black and white and appears on the right side of the display. If two IPS switches are pressed, it returns to the subtest menu.

```
*****   IPS TEST PROGRAM (V1.00)   *****
    < POINTING >        < PARAMETER >
                          STATUS:0008h
                          X-RATE:0000h
                          Y-RATE:0000h


                          < BUTTON >

                          (1)        (2)
```
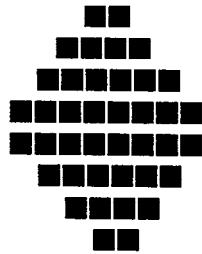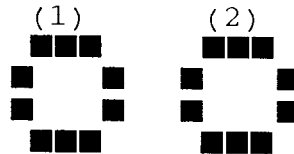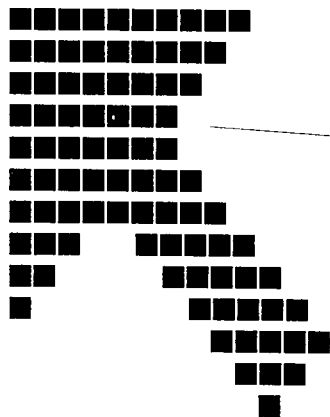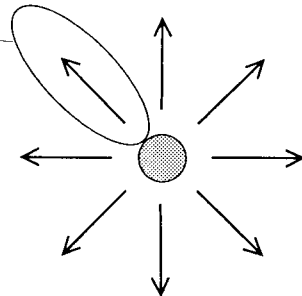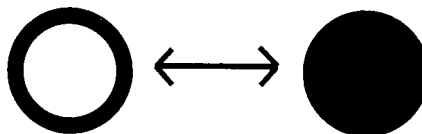
```
<< PRESS BUTTON1 + BUTTON2 THEN END >>
```

There are eight directions of arrow mark as shown below.

When the button is pressed, it alternates as shown below.

3.7　Display Test

To execute the Display Test, select **4** from the DIAGNOSTIC TEST MENU, press **Enter**, and follow the directions displayed on the screen. The Display test contains twelve subtests that test the T2450CT's display in various modes. Move the highlight bar to the subtest you want to execute and press **Enter**.

Subtest 01　　VRAM Read/Write

This subtest writes constant data FFFFh, AAAAh, 5555h, 0000h and address data to video RAM (256KB). This data is then read from the video RAM and compared to the original data.

Subtest 02　　Character Attributes (mode 1, 13h)

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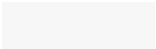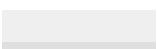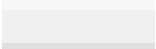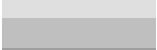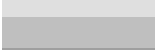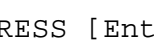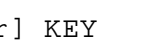
```
CHARACTER ATTRIBUTES

   NEXT LINE SHOWS NORMAL DISPLAY.
    NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN

   NEXT LINE SHOWS INTENSIFIED DISPLAY.
    IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII

   NEXT LINE SHOWS REVERSE DISPLAY.
    RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR

   NEXT LINE SHOWS BLINKING DISPLAY
    BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB


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


    PRESS [Enter] KEY
```

After pressing **Enter**, 16 colors or 16 gray scales of mode 13h appear in the 320x200 graphics mode as shown below:

BLACK
BLUE
GREEN
CYAN
RED
MAGENTA
BROWN
WHITE
GRAY
LIGHT BLUE
LIGHT GREEN
LIGHT CYAN
LIGHT RED
LIGHT MAGENTA
YELLOW
INTENSE WHITE

```
Press Enter Key
```
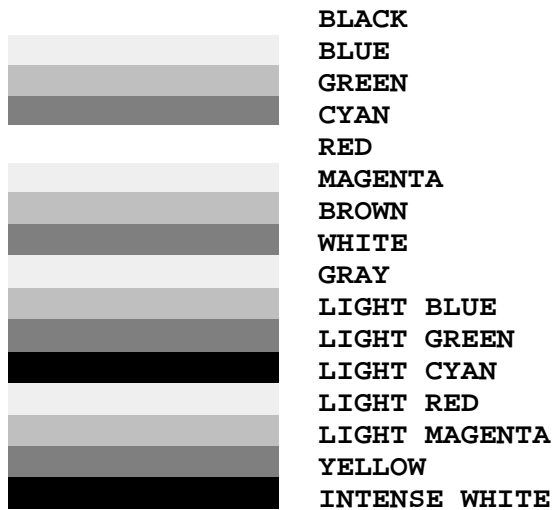
Pressing **Enter** toggles between the two tests.

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

Subtest 03   Character Set

In this subtest, the character set (addressed 00h to FFh) is displayed in the 40x25 character mode as shown below.

CHARACTER SET IN 40*25

[character set display]

```
Press [Enter] KEY
```

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

Subtest 04   80x25/30 Character Display (mode 3, 12)
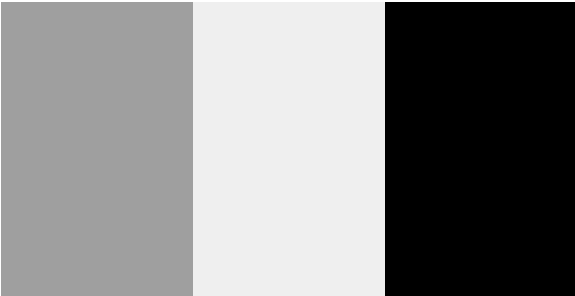
In this subtest, the character string is displayed shifting one character to the right, line by line in the 80x25 and 80x30 character modes as shown below.

```
80*XX CHARACTER DISPLAY
0123456789012345678901234567890123456789012345678901234567890123456789012345678901234567
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklm
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmn
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmno
#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnop
$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopq
%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqr
&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrs
'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrst
()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstu
)*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuv
*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvw
+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwx
,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxy
-./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 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 mode 4 and D. One example is shown below:


```
320*200 GRAPHICS DISPLAY
COLOR SET X : [X]
   GREEN        RED        BROWN
    CYAN      MAGENTA      WHITE
```

```
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 mode 6 and E as shown below:

```
640*200 GRAPHICS DISPLAY : [X]
```

```
              EVEN DOTS        ODD DOTS        ALL DOTS
               DRIVEN          DRIVEN          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 mode 10, 74, 12 as shown below:

```
640*XXX GRAPHICS DISPLAY
```

```
              EVEN DOTS        ODD DOTS        ALL DOTS
               DRIVEN          DRIVEN          DRIVEN
```

```
PRESS [Enter] KEY
```

Pressing **Enter** changes the size of the displayed image. To exit this subtest
and return to the DISPLAY TEST menu, press **Ctrl** + **Break.**

Subtest 08   Display Page

This subtest confirms that the pages can be changed in order from page 0
through page 7 in 40x25 character mode.

DISPLAY PAGE 0

```
OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
O                                      O
O                                      O
O                                      O
O                                      O
O                                      O
O                                      O
O                                      O
O                                      O
O                                      O
O                                      O
O                                      O
OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
```

Pressing **Ctrl** + **Break** exits this subtest, after completion of the test, and
returns to the DISPLAY TEST menu.

Subtest 09   H Pattern Display/Border Color

This subtest displays 2400 H characters on the entire screen, as shown below.

```
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
```

Pressing **Enter** displays the following message:

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

If an external CRT display is connected to the T2450CT, choose **1** to display
the following message:

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

Press **Enter** to execute the border color test. To exit this subtest and return to
the DISPLAY TEST menu, press **Ctrl** + **Break.**

Subtest 10   LED/DAC Pallet

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 two messages:

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

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

[ Processor latch test    ] =

Processor latch test (1:256 times, 2:endless) ?
```

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

Subtest 11   TFT color display

This subtest sets the video mode to '13,' and displays color code (0 to 63) at the same time, then displays seven screens. The first shows many colors at once, the next three display 64 shades of red, green, and blue successively and the last three display 64 shades of red, green, and blue. Also, it sets the video mode '5F,' and displays 256 colors.

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

Subtest 12   SVGA color graphics display

> *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. The color of the upper aria of the external display.

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. Remove the Diagnostics Disk and insert a work disk into the FDD. The contents of the floppy disk will be erased.

To execute the Floppy Disk Test, select **5** from the DIAGNOSTIC TEST MENU, press **Enter**, and follow the directions displayed on the screen. The Floppy Disk test contains five subtests that test the T2450CT's internal floppy disk drive. The following messages will 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**.

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

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

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

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        XXXXXXX
                              ┌─────────────────────────────┐
                              │ T24XX 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
    ```

    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.

Subtest 01   Sequential Read

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

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

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

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

Subtest 02   Sequential Read/Write

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

Subtest 03   Random Address/Data

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

Subtest 04   Write Specified Address

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

Subtest 05   Read Specified Address

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

3.9 Printer Test

To execute the Printer Test, select **6** from the DIAGNOSTIC TEST MENU, press **Enter**, and follow the directions displayed on the screen. The Printer Test contains three subtests that test the output of the printer connected to the T2450CT. The following messages will appear after selecting the Printer Test from the DIAGNOSTIC TEST MENU. Answer each of the following questions with an appropriate response to execute the test.

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

The following message will appear 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 T2450CT 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:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklm
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmn
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmno
#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnop
$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopq
%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqr
&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrs
'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrst
()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstu
)*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuv
*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvw
```

Subtest 02   Function

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

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

This subtest prints the various print types shown below:

```
 PRINTER TEST
1.      THIS LINE SHOWS NORMAL PRINT.
2.      THIS LINE SHOWS DOUBLE-WIDTH PRINT.
3.      THIS LINE SHOWS COMPRESSED PRINT.
4.      THIS LINE SHOWS EMPHASIZED PRINT.
5.      THIS LINE SHOWS DOUBLE-STRIKE PRINT.
6.      ALL CHARACTERS PRINT
!"#$%&'()*+,./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmn
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 con-nector (34M741986G01) wiring diagram is described 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 five subtests that test the T2450CT's asynchronous communication functions. Move the highlight bar to the subtest you want to execute and press **Enter**.

Subtests 01 through 04 require the following data format:

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

The following message will appear 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 described 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 described 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 described 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 is used with subtest 03 described above. This subtest receives the data from the send side, then sends the received data.

Subtest 05   Interrupt Test

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

3.11 Hard Disk Test

To execute the Hard Disk Test, select **8** from the DIAGNOSTIC TEST MENU. Press **Enter**, and follow the directions displayed on the screen. The hard disk test contains 10 subtests that test the T2450CT hard disk drive functions. The following messages will appear after selecting the hard disk test from the DIAGNOSTIC TEST MENU. Answer each of the following questions with an appropriate response to execute the test:

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 floppy disk(s). 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.

---

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

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

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

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

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

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

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

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

5. This message is used to select whether or not the HDD status is displayed on the screen. The HDD status is described in section 3.16. Select **1** or **2** and press **Enter**.

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

```
HARD DISK TEST     XXXXXXX

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. This data is then read and compared to the original data.

Subtest 04   Cross Talk & Peak Shift

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

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

Subtest 05   Write/read/compare (CE)

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

Subtest 06   Write specified address

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

Subtest 07   Read specified address

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

Subtest 08   ECC circuit

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

Subtest 09   Sequential write

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

Subtest 10   W-R-C specified address

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

3.12 Real Timer Test

To execute the Real Timer Test, select **9** from the DIAGNOSTIC TEST MENU, press **Enter** and follow the directions on the screen. The real timer test contains three subtests that test the T2450CT'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 and 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 0Eh through 80h
❑ Writes the data pattern AAh through 55h to the RTC 114-byte memory (address 0Eh to 7Fh)

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

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

Subtest 03   Real Time Carry

```
┌─────────────────────────────────────────────────────────────┐
│                                                             │
│ CAUTION:  When this subtest is executed, the current date and time are │
│ erased.                                                     │
│                                                             │
└─────────────────────────────────────────────────────────────┘
```

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

```
        Current date  : 12-31-1993
        Current time  : 23:59:58
```

Pressing **Enter** displays the following:

```
        Current date :  01-01-1994
        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 T2450CT'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 EXPANSION Test

To execute the expansion test, select **11** from the DIAGNOSTIC TEST MENU, press **Enter**, and follow the directions on the screen. The expansion test contains one subtest that tests the T2450CT's expansion port functions. The following message will appear after selecting the expansion test from the DIAGNOSTIC TEST MENU.

```
Test slot number select (1:slot1, 2:slot2, 0:slot1&2)?
```

Select the test slot number of the PCMCIA slot to be tested and press **Enter**.

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

Subtest 01   PCMCIA wraparound

This test checks the following signal line 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

Subtest 02   SCSI wraparound

This test reads the 0 cylinder of HDD.

3.15 Sound Test

To execute the sound test, select **12** from the DIAGNOSTIC TEST menu, press **Enter** and follow the directions on the screen. The sound test contains five subtests that test the T2450CT's sound functions.

Subtest 01   CODEC (REC/PLAY)

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

Test the functions of the Codec (ES688) A/D, D/A converter. At the same time, test the microphone terminals and headphone terminals. When you execute this subtest the following message is displayed:

```
[Quick REC & PLAY for ES488/688]
Press any key to *** REC ***
```

After pressing any key, start the recording and immediately play the sound. (It takes three seconds.)

Subtest 02   FM Synthesizer

Test the OPL# (YMF262) functions. Connect the headphone, and check the scale of right and left side. Also check the sound adjustment volume.

Subtest 03   SINE wave playback

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

3.16 Error Code 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)

Device name	Error code	Error status name
(COMMON)	FF	Data Compare Error
SYSTEM	01	ROM Checksum Error
Memory	01	Parity Error
	02	Protected Mode Not Changed
	14	Memory Read/Write Error
	DD	Cache Memory Error
Keyboard	01	Mouse Interface Error
	02	IPS Interface Error
	03	Interface Error
	04	Retransmit Error
	05	Mouse Handler Not Supported
	06	PS/2 Mouse & IPS Not
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

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

Device name	Error code	Error status name
ASYNC (cont.)	20	Framing Error
	40	Overrun Error
	80	Line Status Error
	88	Modem Status Error
	33	No Carrier (Card Modem)
	34	Error (Card Modem)
	36	No Dial Tone (Card Modem)
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 Enabled
	20	HDC Error
	40	Seek Error
	80	Time Out Error
	AA	Drive Not Ready
	BB	Undefined Error
	CC	Write Fault
	E0	Status Error
	EE	Access Time Out Error
NDP	01	No Co-Processor
	02	Control Word Error
	03	Status Word Error
	04	Bus Error
	05	Addition Error
	06	Multiply Error
PCMCIA	C1	Address Line Error
	C2	REG# Line Error
	C3	CE#1 Line Error
	C4	CE#2 Line Error
	C5	DATA Line Error
	C6	WAIT Line Error
	C7	BSY# Line Error
	C8	BVD1 Line Error
	CD	No PCMCIA

3.17 Hard Disk Test Detail Status

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

```
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 and the last four digits are not used.

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

The contents of the HDC status register and error register are described 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 command. "1" --- Hard disk drive is ready.
5	DWF (Drive write fault)	"0" --- DWF error is not detected. "1" --- Write fault condition occurs.
4	DSC (Drive seek complete)	"0" --- The hard disk drive heads are not settled over a track. "1" --- The hard disk drive heads are settled over a track.
3	DRQ (Data request)	"0" --- Drive is not ready for data transfer. "1" --- Drive is ready for data transfer.
2	CORR (Corrected data)	"0" --- Other "1" --- Correctable data error is corrected.
1	IDX (Index)	"0" --- Other "1" --- Index is sensed.
0	ERR (Error)	"0" --- Other "1" --- The previous command was terminated with some error.

Table 3-5 Error register contents

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

3.18 Hard Disk Format

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

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

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

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

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 floppy disk(s). This can be done with the Toshiba MS-DOS BACKUP command. See the Toshiba MS-DOS manual for details.

3.18.1   Function Description

1. All track FORMAT

    This option performs a low-level format of all the tracks on the hard disk as shown in Table 3-6 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 (1/2)

	320 MB			
	MK2326FC	H2344-A4	DHAA-2405	MK1824FCV
Sector sequences	1	1	1	1
Cylinders	0 to 968	0 to 914	0 to 914	0 to 681
Heads	0 to 13	0 to 15	0 to 14	0 to 15
Sectors	1 to 49	1 to 49	1 to 49	1 to 63
Sector length (byte/sec)	512	512	512	512

Table 3-6 Hard disk formatting sequence (2/2)

	500MB	
	DHAA-2540	**MK2526FCV**
Sector sequences	1	1
Cylinders	0 to 1046	0 to 1022
Heads	0 to 15	0 to 15
Sectors	1 to 63	1 to 63
Sector length (byte/sec)	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.

3.18.2   Operations

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

Selecting TEST 2 and pressing **Enter** in the DIAGNOSTIC MENU, displays the following messages:

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

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

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

1.   All track FORMAT

Pressing 1 selects All track FORMAT, which lets you format the entire disk.

```
[All track FORMAT]

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

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

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

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

(a)   Select a drive number and press **Enter**. The following message will appear:

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

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

```
Unlock format select (1:no/2:yes)
```

(c)   Select whether the disk has an unlock format.

NOTE: This option appears only when an HDD manufactured by JVC is installed. For JVC HDDs, which are the only disks with unlock formats, you must select 2 (yes). If 1 is selected with a JVC disk, an error will be generated. The system defaults to 1 and this message does not appear when other disks are installed.

(d)   Bad track register

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

(e)   All track format

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

(f)   Track verification

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

2.   Good track FORMAT

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

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

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

3.   Bad track FORMAT

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

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

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

4.   Bad track CHECK

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

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

Bad tracks will be displayed in the format shown below.

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

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

3.19 Head Cleaning

3.19.1   Function Description

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

3.19.2   Operations

1. Selecting test **4** from the DIAGNOSTIC MENU and pressing **Enter** displays the following messages:

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

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

    Press any key when ready.
    ```

2. Remove the Diagnostics Disk from the FDD. Then 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 DIAGNOSTIC MENU when the program is completed.

3.20 Log Utilities

3.20.1   Function Description

This function logs error information generated while a test is in progress and stores the results in RAM. This function 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. The 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)

3.20.2   Operations

1.   Selecting **5** and pressing **Enter** in the DIAGNOSTIC MENU logs error information into RAM or onto a floppy disk. The error information is displayed in the following format:

```
     XXXXX 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

                         Address
                     Error status
             Pass count                 HDC status
           Subtest number           Read data
         Test name                Write data
 Error count                                   Error status name

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

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

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

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

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

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

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

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

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

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

3.21 Running Test

3.21.1   Function Description

This function automatically executes the following tests in sequence:

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

The system automatically detects the number of floppy disk drives connected to the T2450CT for the FDD test.

3.21.2   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** from the Diagnostic Menu and press **Enter,** the following message will be displayed:

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

    Selecting **Y (yes)** executes the printer wraparound test. A printer wraparound connector must be connected to the **PRT** port on the back of the T2450CT 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 wrap-around connector must be connected to the **serial port** on the back of the T2450CT to properly execute this test.

3.22 Floppy Disk Drive Utilities

3.22.1   Function Description

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

1. FORMAT

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

    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.

3.22.2   Operations

1. Selecting **7** from the DIAGNOSTIC MENU and pressing **Enter** displays the following message:

    ```
    [ FDD UTILITIES ]

         1 - FORMAT
         2 - COPY
         3 - DUMP
         9 - EXIT TO DIAGNOSTICS MENU
    ```

2. FORMAT program

    (a)   Selecting FORMAT displays the following message:

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

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

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

```
Type select (0:2DD-2DD,1:2D-2D,2:2D-2HD,3:2HD-2HD) ?
```

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

4. DUMP program

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

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

(b) Select a format type number. If **C** or **D** is selected, the display will go to step (e).

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

(c) Select a drive number and 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 and the following message will appear:

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

    Track  number ??
```

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

3.23 System Configuration

3.23.1   Function Description

The System Configuration program contains the following configuration information for the T2450CT:

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

3.23.2   Operations

Selecting **8** from the DIAGNOSTIC MENU and pressing **Enter** displays the following system configuration:

```
SYSTEM CONFIGURATION :

   * - BIOS ROM VERSION = VX.XX
   * - BOOT ROM VERSION = VX.XX
   * - KBC VERSION      = VX.XX
   * - PS MICOM VERSION = VX.XX
   * - 639KB MEMORY
   * - 1 FLOPPY DISK DRIVE(S)
   * - 1 ASYNC ADAPTER
   * - 1 HARD DISK DRIVE(S)
   * - 1 PRINTER ADAPTER
   * - XXXXXKB EXTENDED MEMORY
   * - 1 MATH CO-PROCESSOR
   * - CPU CLOCK        = XXMHz


Press [Enter] Key
```

Press **Enter** to return to the DIAGNOSTIC MENU.

3.24 SETUP

3.24.1   Function Description

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

1. Memory
   - (a)   Total
   - (b)   Base
   - (c)   Extended Memory
   - (d)   Shadow BIOS ROM

2. Display
   - (a)   Display Adapter
   - (b)   LCD Display Mode
   - (c)   Ext. Scan Mode
   - (d)   LCD Display Colors
   - (e)   Power on display

3. Battery
   - (a)   Battery Save Modes
   - (b)   Manual set of battery level

4. Hard disk

5. COM/PRT/SCSI/SOUND
   - (a)   Serial port
   - (b)   Parallel port
   - (c)   SCSI
   - (d)   Sound system

6. Password

7. Others
   - (a)   Power-up Modes
   - (b)   CPU Cache
   - (c)   Processing Speed
   - (d)   Speaker Volume
   - (e)   Panel Power On/Off
   - (f)   Alarm Power On
   - (g)   Keyboard
   - (h)   Pointing Devices
   - (i)   Boot Priority

3.24.2   Accessing the SETUP Program

Selecting **0** from the DIAGNOSTICS MENU and pressing **Enter** displays the following
SYSTEM SETUP menu. This section lists detailed information on each item.

```
                          SYSTEM  SETUP         BIOS version = x.xx
  ┌─── MEMORY ──────────┐     ┌─── COM/PRT/SCSI/SOUND ────────┐
  │ Total         = 8192 KB │  │ Serial Port    = COM1 (IRQ4/3F8H) │
  │ Base          =  640 KB │  │ Printer Port Type = Output        │
  │ Extended      = 7360 KB │  │ SCSI           = Enabled          │
  │ Shadow BIOS ROM  =  192 KB │ Sound System   = Enabled          │
  └───────────────────────┘  └───────────────────────────────┘
  ┌─── DISPLAY ─────────────────────┐
  │ Display Adapter  = VGA compatible │  ┌─── PASSWORD ─────────────┐
  │ LCD Display Mode  = Color         │  │ Not Registered            │
  │ Ext.Scan Mode    = Interlace      │  └───────────────────────────┘
  │ LCD Display Colors= 180K colors   │  ┌─── OTHERS ────────────────┐
  │ Power On Display  = Internal/External │ Power-up Mode     = Boot   │
  └─────────────────────────────────┘  │ CPU Cache         = Enabled │
  ┌─── BATTERY ─────────────────────┐  │ Processing Speed  = High    │
  │ Battery Save Mode = Full Power    │  │ Speaker Volume    = High    │
  │ Manual Set of Battery Level       │  │                            │
  │              = E ??? F            │  │ Alarm Power On    = Disabled│
  └─────────────────────────────────┘  │ Keyboard          = Layout/Fn│
  ┌─── HARD  DISK ──────────────────┐  │ Pointing Devices  = Auto-selected │
  │ HDD Mode        = Enhanced IDE   │  │ Boot Priority     = FDD→HDD  │
  │                  (Normal)         │  └───────────────────────────┘
  └─────────────────────────────────┘

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

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

> *NOTE:*   1.   *The Panel Power On/Off item appears only when the computer is in*
> *Resume mode.*
> 2.   *The Manual Set of Battery Level option appears only when the system*
> *cannot detect the Battery charge. For example, when the battery is*
> *replaced.*
> 3.   *The Sound System item appears only when an optional sound card is*
> *installed.*

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.

Accepting Changes and Exiting the SETUP Window

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

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

```
        Are you sure? (Y/N)
```

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

```
Are you sure? (Y/N)
```

The changes you made will cause the system to reboot.

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

3. To accept the changes, press **Y**.

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

The 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**.

SETUP Options

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

1. Memory

   These options list the computer's memory allocations. The values displayed cannot be changed.

   (a) Total

   This field displays the total amount of memory installed and is automatically calculated by the computer.

   (b) Base

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

(c) Extended

This field displays the amount of extended memory the computer has available.

(d) Shadow BIOS ROM

The SETUP program displays 192 KB of RAM, which is reserved for the Shadow BIOS ROM.

2. Display

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

(a) Display Adapter

This field displays the internal adapter for the VGA internal display. Only **VGA compatible** is displayed.

(b) LCD Display Mode

Use this option to set the computer's display mode.

Color	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)
Monochrome	Selects monochrome mode. This is also used when you attach a VGA monochrome monitor to the external display port. Also, some software is displayed better 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) Ext. Scan Mode

To select interlace or non-interlace mode for the external CRT.

Interlace	Selects interlace mode. (Default)
Non-interlace	Selects non-interlace mode.

(d)   LCD Display Colors

This option is used to select the color palette of the T2450CT's internal TFT display when the LCD mode is set to "Color."

256K colors   Displays 256 colors out of 262,144 colors.

180K colors   Displays 256 colors out of 185,193 colors.

24K colors   Displays 256 colors out of 24,576 colors.

512 colors   Displays 256 colors out of 512 colors.

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

(e)   Power on display

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

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

Simultaneous   Selects both the internal LCD and the external CRT for simultaneous display.

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

---

3. Battery

These options let you set battery save functions for optimum performance or battery power conservation. You can also set the battery charge level when necessary.

(a) Battery Save Modes

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

Full Power   The following shows full power settings.

```
┌───────────── BATTERY SAVE OPTIONS ─────────────┐
│                                                 │
│   CPU Sleep Mode    =        Disabled           │
│   Display Auto Off  =        30 Min.            │
│   HDD Auto Off      =        Disabled           │
│   System Auto OFF   =        Disabled           │
│                                                 │
└─────────────────────────────────────────────────┘
```

Low Power   The following shows low power settings.

```
┌───────────── BATTERY SAVE OPTIONS ─────────────┐
│                                                 │
│   CPU Sleep Mode    =        Enabled            │
│   Display Auto Off  =        03 Min.            │
│   HDD Auto Off      =        03 Min             │
│   System Auto OFF   =        30 Min.            │
│                                                 │
└─────────────────────────────────────────────────┘
```

---

*NOTE: In boot mode, **System Auto OFF** is not displayed.*

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

(b)   User Setting Options

The following set of options can be selected in the sub menu of **User Set-ting**, which is one of the **Battery Save Mode** options.

CPU Sleep Mode

Use this option to enable or disable the CPU sleep function.

Enabled   Enables sleep mode

Disabled   Disables sleep mode

Display Auto Off

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

Disabled   Disables display automatic power off.

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

HDD Auto Off

Use this option to disable or set 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.

System auto off

Use this option to enable or disable the system automatic off function when the power up mode is set to Resume. In Boot mode, this feature is always disabled and therefore not displayed.

Disabled   Disables system automatic power off.

xx Min.   Automatically turns off power to the system if it is not used for the duration set. The duration **xx** can be set to 10, 20, 30, 40, 50, or 60 minutes.

(c) Manual set of battery level

When you use the computer for the first time or when you install a new or recharged battery, the charge level is unknown to the system. In this case the Manual Set of Battery Level options will be displayed to enable you to set the charge level to 100%, 75%, 50%, or 25% as indicated below.

```
E |              | F   100% charge

E |          |     F   75% charge

E |       |        F   50% charge

E |   |            F   25% charge

E      ???      F   Charge is unknown (Displayed in TSETUP)
```

4.   Hard Disk

This option displays the mode of the HDD for information only. It cannot be changed. To see the capacity of the hard disk, use the CHKDSK command.

Enhanced IDE (Normal)

5.   COM/PRT/SCSI/SOUND

This option controls settings for serial and printer ports and optional sound card and SCSI devices.

(a)   Serial Port

This option allows you to set the COM level, **COM1** or **COM2**, for the serial port and PCMCIA slot.

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

COM level	Interrupt level	I/O address
COM1	4	3F8h (Serial Port default)
COM2	3	2F8h
Not Used		(Disables Port)

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

(b)   Parallel Port

This option sets the address for the parallel port. The options are:

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

When you select one of the above options, except for **Not used**, a subwindow similar to the one below appears to let you set the parallel port mode. The options for this setting are **Output** (default) and **Bidirectional**.

```
┌── Option ──────────────┐
│    Mode      =     Output    │
│                              │
└──────────────────────────┘
```

(c)   SCSI

Use this option to enable or disable the SCSI port. If the port is enabled, you can also set the interrupt request level (IRQ) for an SCSI device. If the IRQ level selected is the same as that used by an optional sound card, the sound card IRQ level is automatically set to disabled when you quit this option. The options in the main menu are:

> Enabled   Enables port. (Default)
>
> Disabled   Disables port.

When **Enabled** is selected, a subwindow similar to the one below appears to let you set the interrupt level. The options for this setting are **IRQ9, IRQ10, IRQ11** (default), and **Disabled.**

```
┌── SCSI ──────────────────┐
│  SCSI interrupt level  =    IRQ11   │
│                                      │
└──────────────────────────────┘
```

(d)   Sound System

This item appears only when an optional sound card is installed. It allows you to enable or disable the sound card ports.

> Address/IRQ/DMA   Enables port. (Default)
>
> Disabled   Disables port.

When **Enabled** is selected, a subwindow similar to the one below appears to let you set the **I/O address, Interrupt level**, and **DMA channel** for the sound card.

```
┌─────── SOUND SYSTEM ───────┐
│  I/O Address      = 0220H   │
│  Interrupt Level = IRQ7     │
│  DMA   = Channel 1          │
└─────────────────────────────┘
```

The following explains each setting:

I/O address

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

```
0220h (Default), 0230h, 0240h, 0250h
```

Interrupt level

If the IRQ level selected is the same as that used by a SCSI device, the SCSI device IRQ level is automatically set to disabled when you quit this option. The available settings are:

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

DMA (direct memory access) channel

Use this option to set the DMA channel from among the following settings:

```
Channel 0, Channel 1 (default)
```

6.   Power on Password

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

        Registered   Password has been registered.

      Not registered   Password has not been registered.

For details on setting the password refer to the *Password security* section in the T2450CT reference manual.

7. Others

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

(a) Power-up Modes

This option lets you choose between AutoResume and boot mode. You can also set this option using hotkeys. AutoResume is effective with either the internal LCD or with an external monitor.

Boot   Turns on boot mode. (Default)

Resume   Turns on the AutoResume feature.

(b) CPU Cache

Use this feature to enable or disable the CPU cache.

Enabled   Enables the CPU cache. (Default)

Disabled   Disables the CPU cache.

(c) Processing Speed

This feature changes the CPU processing speed.

High   CPU operates at 75 MHz. (Default)

Low   CPU operates at half speed.

(d) Speaker Volume

This option disables or sets the volume level of the speaker. Setting this option to off disables the computer's sound function for alarms as well as for application programs. This option can also be set with hotkeys.

Off   Disables software use of the speaker.

Low   Sets the volume of the speaker to low.

Medium   Sets the volume of the speaker to medium.

High   Sets the volume of the speaker to high. (Default)

When **Low, Medium** or **High** is selected for **Speaker volume**, the subwindow below is displayed to let you enable or disable certain speaker functions.

```
┌─────── SPEAKER VOLUME OPTIONS ───────┐
│  System Speaker     =      Enabled   │
│  Low Battery Alarm  =      Enabled   │
│  Panel Close Alarm  =      Enabled   │
└──────────────────────────────────────┘
```

     Enabled   Enables the feature. (Default)

     Disabled   Disables the feature.

(e)   Panel Power On/Off

This option allows you to automatically turn your T2450CT computer on or off by opening or closing the display panel. If this feature is enabled when the computer is in Resume mode, the system is automatically powered off when the display panel is closed and powered on when the panel is opened. This option is not displayed when the computer is in boot mode.

     Enabled   Enables the feature.

     Disabled   Disables the feature. (Default)

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

(f)   Alarm Power On

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

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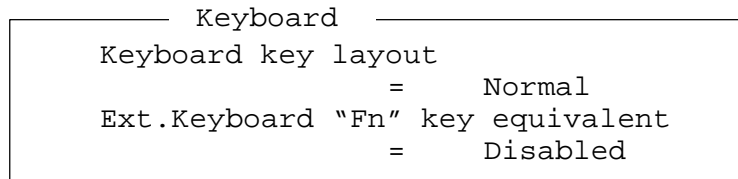   (hour:minute:seconds)

     Disabled   Disables the alarm. (Default)

> *NOTE: Do not remove the AC adapter and battery pack at the same time when you use this feature. If you do so, the time setting will be lost. You must reset this option when you restore power.*
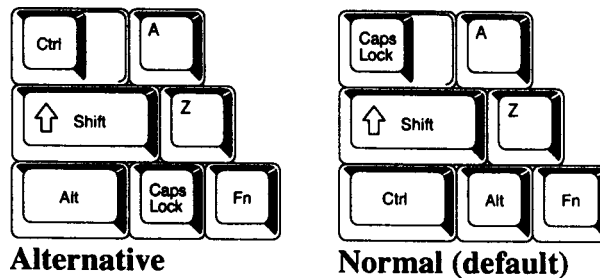
(g)   Keyboard

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

```
        ┌──────── Keyboard ────────────┐
        │   Keyboard key layout        │
        │                 =     Normal  │
        │   Ext.Keyboard "Fn" key equivalent │
        │                 =     Disabled │
        └──────────────────────────────┘
```

Keyboard key layout

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

Alternative   **Normal (default)**

Ext.Keyboard "Fn" key equivalent

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

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

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

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

(h)   Pointing Devices

Use this option to enable or disable the AccuPoint.

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

Auto-selected   The AccuPoint is disabled when a PS/2 mouse is
                   connected, otherwise the AccuPoint is enabled.
                   (Default)

(i)   Boot Priority
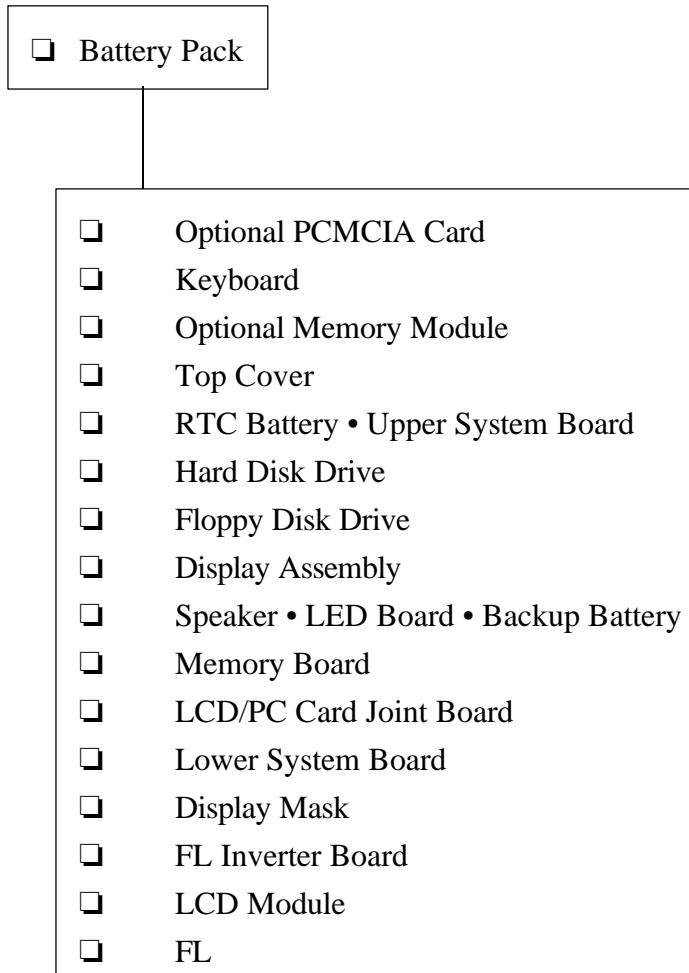
Use this option to select the disk drive priority for boot up.

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

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

You can reverse the order by holding down the **F10** key while the computer
is booting. This procedure does not affect the setting.

4.1 General

This section explains how to disassemble the T2450CT 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 the FRUs which need to be removed in order to remove others. Always start by removing the battery pack, then follow the lines on the chart to determine which FRU you must remove next in order to repair the one you think is causing the T2450CT to operate improperly.

❏ Battery Pack

❏ Optional PCMCIA Card
❏ Keyboard
❏ Optional Memory Module
❏ Top Cover
❏ RTC Battery • Upper System Board
❏ Hard Disk Drive
❏ Floppy Disk Drive
❏ Display Assembly
❏ Speaker • LED Board • Backup Battery
❏ Memory Board
❏ LCD/PC Card Joint Board
❏ Lower System Board
❏ Display Mask
❏ FL Inverter Board
❏ LCD Module
❏ FL

Before You Begin

Look over the procedures in this section before you begin disassembling the T2450CT. Familiarize yourself with the disassembly and reassembly steps. Begin each procedure by removing the AC adapter and the battery pack as instructed in section 4.2, *The Battery Pack.*

1. Do not disassemble the T2450CT 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 T2450CT:

   ❑ 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 diagnostics tests described in this manual.

5. Do not perform any operations that are not necessary and use only the described procedures for disassembling and installing FRUs in the T2450CT.

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 T2450CT. When you remove screws, make sure they are placed in a safe place and identified with the correct parts.

8. When assembling the T2450CT make sure you use the correct screws to secure the various pieces in place. Screw sizes are listed in the corresponding figures.

9. The T2450CT contains many sharp edges and corners, so be careful not to injure yourself.

10. After you have replaced an FRU make sure the T2450CT is functioning properly by performing the appropriate test on the FRU you have fixed or replaced.

> *NOTE: The illustrations in chapter 4 are based on the appearance of the T2400CS, unless otherwise noted.*

Disassembly Procedures

The T2450CT has two basic types of cable connectors:

❑ Pressure Plate Connectors
❑ Normal Pin Connectors

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

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

Assembly Procedures

After you have disassembled the 2450CT and fixed or repaired the problem that was causing the T2450CT to operate abnormally, you will need to reassemble the T2450CT.

While assembling the T2450CT, remember the following general points:

❑ Take your time, making sure you follow the instructions closely. Most problems arise when you hurry to assemble the T2450CT.

❑ Make sure all cables and connectors are securely fastened.

❑ Before securing the FRU or other parts, make sure that no cables will be pinched by screws or the FRU.

❑ Check that all latches are closed securely in place.

❑ Make sure all the correct screws are used to secure all FRUs. Using the wrong screw can either damage the threads on the screw or the head of the screw, and may prevent proper seating of an FRU.

After installing an FRU in the T2450CT confirm that the FRU and the T2450CT 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 T2450CT:

❏ One M2 Phillips screwdriver to remove and replace screws.

❏ Tweezers to lift out screws that you cannot grasp with your fingers.

❏ ESD mats for the floor and the table you are working on.

❏ An ESD wrist strap or heel grounder.

❏ Anti-static carpeting or flooring.

❏ Air ionizers in highly static sensitive areas.

4.2 The Battery Pack

Removing the Battery Pack

To remove the T2450CT battery pack, follow the steps below and refer to figure 4-1.

1. Turn off the power to the T2450CT. Disconnect the AC adapter, power cord, and all external cables connected to the T2450CT.

2. Close the display if it is open and turn the computer over.

3. Slide open the **cover** to the battery latch and press the **release button** until it clicks. The battery will pop out slightly (figure 4-1).

4. Firmly grasp the **battery pack** and pull it out (figure 4-1).
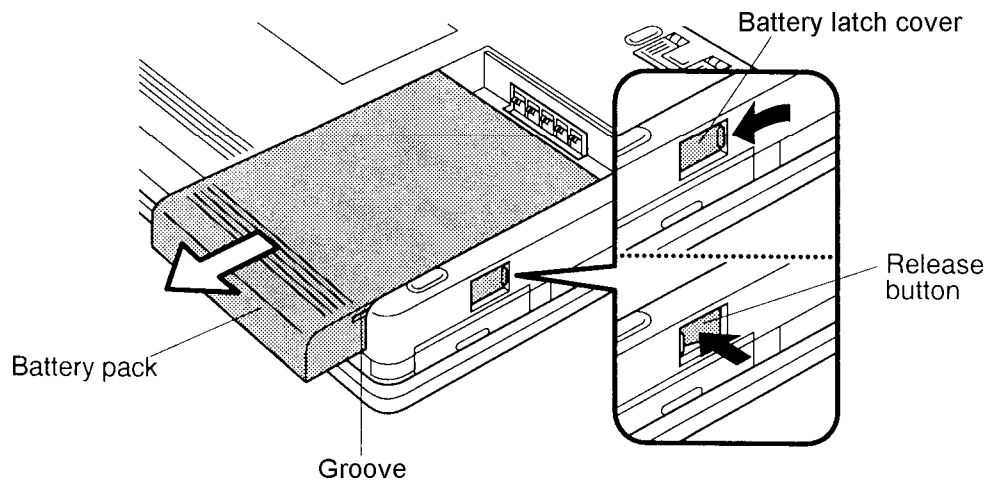
Figure 4-1 Removing the battery pack

Installing the Battery Pack

NOTE: The battery pack is designed to fit into the T2450CT in only one way.

To install the T2450CT 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 (figure 4-1).

4.3 Optional PCMCIA Card

Removing an Optional PCMCIA Card

The T2450CT has two PCMCIA slots: one for a card up to 5.0 mm (Type II), and one for a card up to 14.5 mm (Type III). Procedures for removing Type II and Type III cards are the same.

To remove optional PCMCIA cards, follow the steps below and refer to figure 4-2.

1. Turn off the power to the T2450CT. Disconnect the AC adapter, power cord, and all external cables connected to the T2450CT.

2. Remove the battery pack as described in section 4.2.

3. Open the **PCMCIA card slot cover**, then slide open the **PCMCIA card sliding stopper** (figure 4-2).

4. Slide the latch to the outside to release the card (figure 4-2).

5. Grasp the card and pull it out.
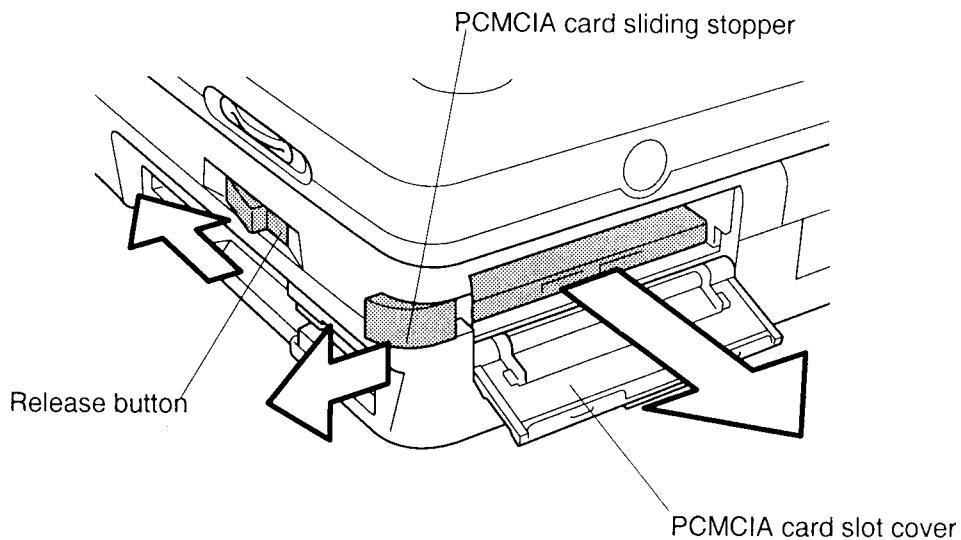
Figure 4-2 Removing the PCMCIA card outer plastic cover

Installing an Optional PCMCIA Card

To install an optional PCMCIA card in the T2450CT, follow the steps below and refer to figure 4-3:

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 4-3).
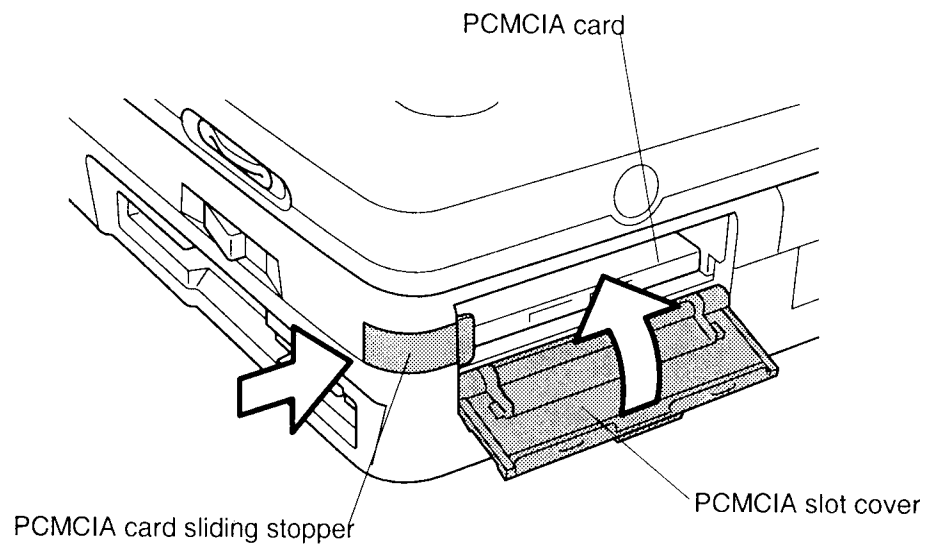
Figure 4-3 Installing the optional PCMCIA card

4. Install the battery pack as described in section 4.2.
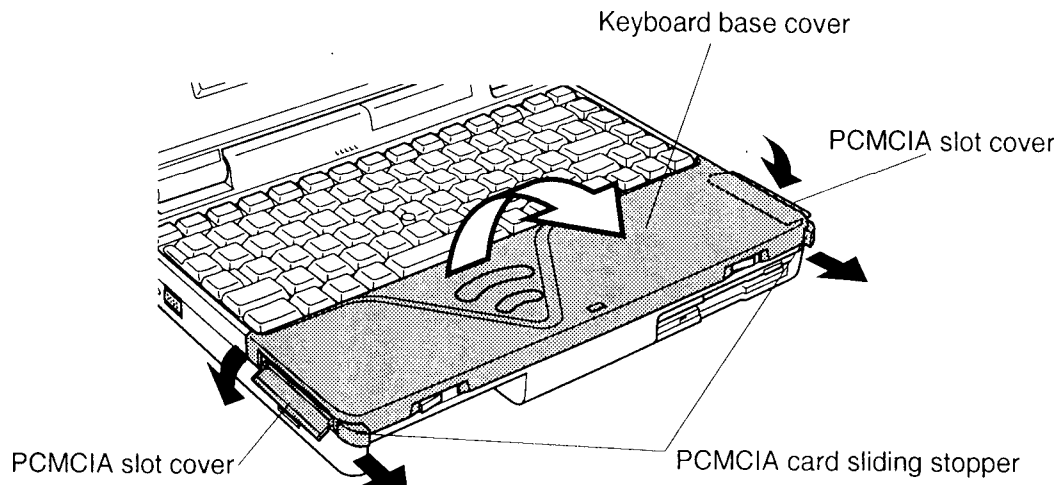
4.4 Keyboard

Removing the Keyboard

To remove the T2450CT's keyboard, follow the steps below and refer to figures 4-4 to 4-6.

1. Turn off the power to the T2450CT. Disconnect the AC adapter, power cord, and all external cables connected to the T2450CT.

2. Remove the battery pack and optional PCMCIA card as described in sections 4.2 and 4.3.

3. Turn the computer over and remove **three M2.5x8 silver screws** on the bottom.
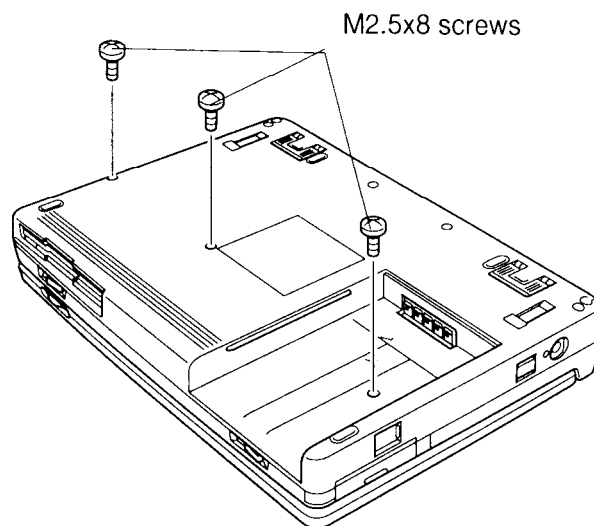

Figure 4-4 Removing three screws

4. Turn the computer back over and open the display panel and the PCMCIA card slot covers.

5. Open each side of the **PCMCIA card sliding stopper** and **PCMCIA slot cover** (figure 4-5).

6. Put your fingers just inside the PCMCIA slots and lift off the **cover** at the base of the keyboard (figure 4-5).

Figure 4-5 Removing the keyboard base cover

7. Carefully lift up the **keyboard** to expose the keyboard connector.

8. Disconnect the **keyboard cable** from the **pressure-plate connector (PJ402)** on the upper system board (figure 4-6).
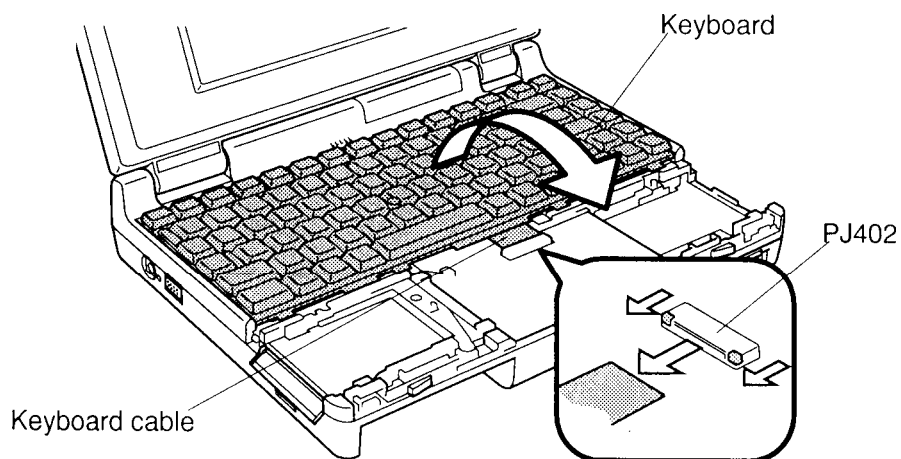
Figure 4-6 Removing the keyboard

Installing the Keyboard

To install the T2450CT's keyboard, follow the steps below and refer to figures 4-4 to 4-6.

1. Connect the **keyboard cable** to the **pressure plate connector** (PJ402) on the upper system board (figure 4-6).

2**.** Replace the **keyboard**. Fit the extensions on the back of the keyboard into corresponding holes on the computer and lay the keyboard in place.

3. Place the base of the keyboard on the T2450CT (figure 4-5).

4. Turn the computer over and secure **three M2.5x8 silver screws** on the bottom (figure 4-4).

5. Install the optional PCMCIA card and battery pack as described in sections 4.3 and 4.2.

> *CAUTION: The PCMCIA card sliding stopper comes off easily, so be careful not to lose it.*

4.5 Optional Memory Module

Removing the Optional Memory Module

To remove an optional memory module from the T2450CT, follow the steps below and refer to figures 4-4 through 4-8.

1. Turn off the power to the T2450CT. Disconnect the AC adapter, power cord, and all external cables connected to the T2450CT.

2. Remove the battery pack as described in section 4.2.

3. Turn the computer over and remove **three M2.5x8 silver screws** on the bottom (figure 4-4).

4. Turn the computer back over and open the display panel and the PCMCIA card slot covers.

5. Put your fingers just inside the PCMCIA slots and lift off the cover at the base of the keyboard (figure 4-5).

6. Put your finger under the space bar on the keyboard, lift up slightly so the extensions at the back of the keyboard clear corresponding holes on the computer. Rotate the keyboard out of the computer so that it lies face down over the AccuPoint buttons. Do not remove the keyboard cable (figure 4-7).
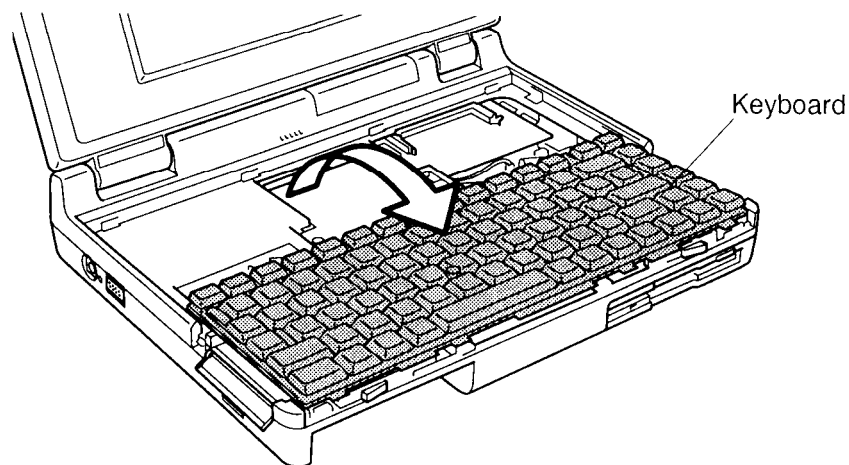
Figure 4-7 Lifting out the keyboard

7.   The memory module socket is now exposed. **Two latches** on each side of the module hold it in place. Press these to the outside to release the module. The side of the module away from the connectors will spring up (figure 4-8).

CAUTION: Do not touch the connectors on the memory module or on the computer. Debris on the connectors may cause memory access problems.
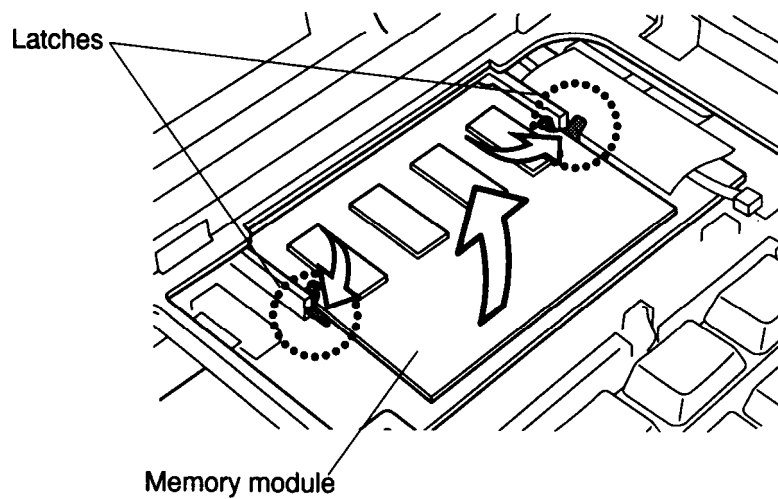
Figure 4-8 Removing the memory module

8.   Grasp the module and pull it out.

Installing the Optional Memory Module

To install an optional memory module in the T2450CT, follow the steps below and refer to figures 4-4, 4-5, and 4-9.

1. Insert the memory module at about a 45° angle, connectors first, into the computer's connectors. Note the notch at the corner of the module. This notch should be on the right as you insert the module (figure 4-9).

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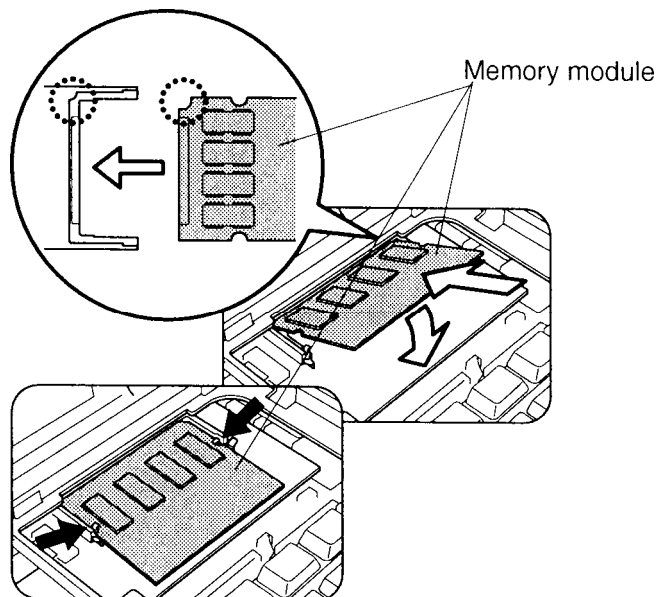

*Figure 4-9 Inserting the memory module*

2. The module is held up by springs in the computer's socket. Gently push the module into place until two latches close over each side.

3. Replace the keyboard. Fit the extensions on the back of the keyboard into corre-sponding holes on the computer and lay the keyboard in place.

4. Place the base of the keyboard on the T2450CT (figure 4-5).

5. Turn the computer over and secure **three M2.5x6 silver screws** on the bottom (figure 4-4).

6. Install the optional PCMCIA card and battery pack as described in sections 4.3 and 4.2.

4.6   Top Cover

Removing the Top Cover

To remove the T2450CT's top cover, follow the steps below and refer to figures 4-10 and 4-11.

1.   Turn off the power to the T2450CT. Disconnect the AC adapter, power cord, and all external cables connected to the T2450CT.

2.   Remove the battery pack, optional PCMCIA card, keyboard, and optional memory module as described in sections 4.2 through 4.5.

3.   Turn the computer over and remove **four M2.5x8 silver screws** on the bottom and, at the back of the T2450CT, remove **two M2.5x8 silver screws** securing the **top cover** (figure 4-10).
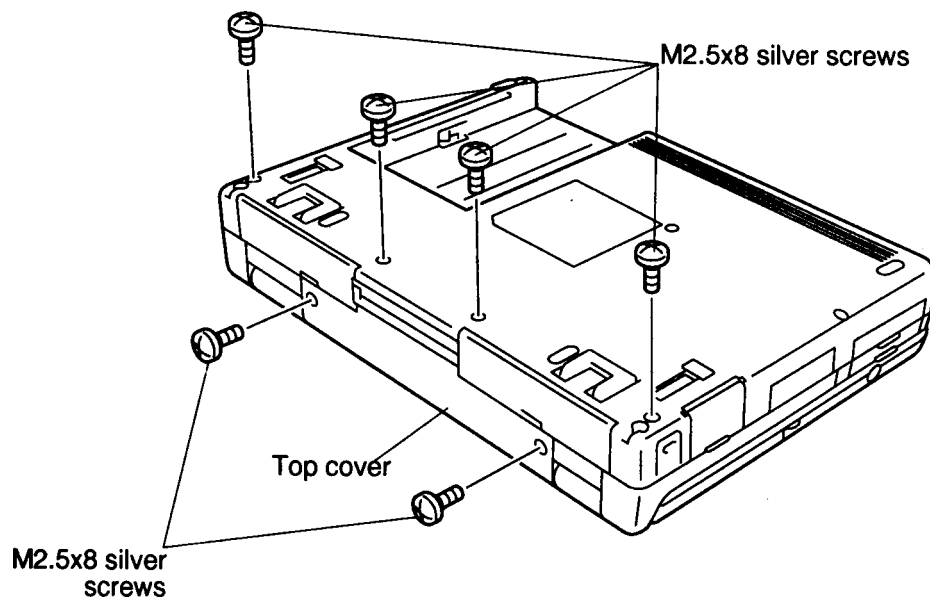
Figure 4-10 Removing top cover screws

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. Disconnect the **RTC battery cable** from **PJ403** and unthread the cables from the top cover frame. Do not remove the RTC battery at this time.

6. Unsnap the **latches** securing the **top cover** to the base assembly. Start by releasing the two **right side latches**. Rotate the keyboard to the left to release the **left side latches** and lift off the top cover (figure 4-11).
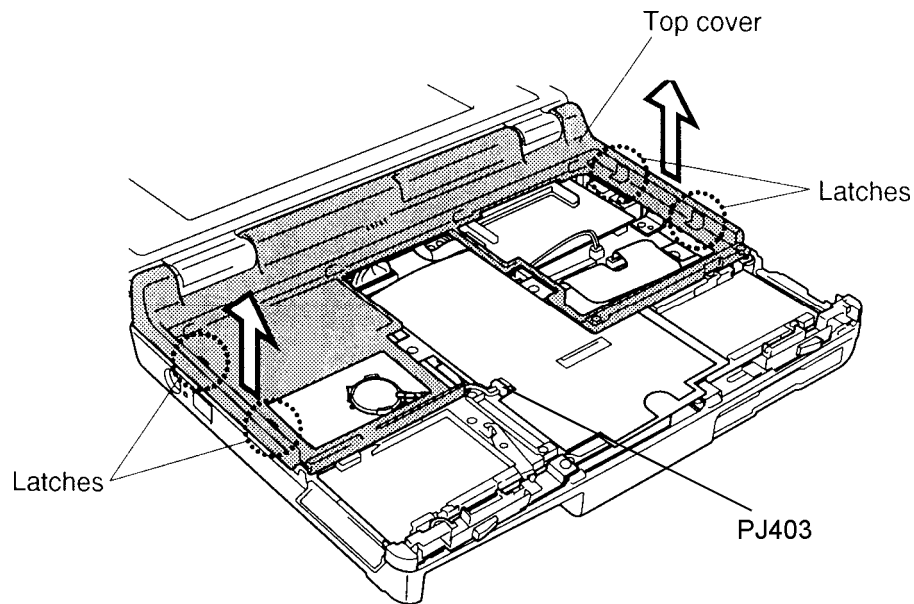
Figure 4-11 Unlatching the top cover

Installing the Top Cover

To install the T2450CT's top cover follow the steps below and refer to figures 4-10 and 4-11.

1. Place the **top cover** on the T2450CT.

2. Begin at the back and snap the **top cover** into place. Snap the side latches (figure 4-11).

3. Connect the **RTC battery cable** to **PJ403** and rethread the cables on the top cover frame.

4. Close the display so the back faces you and turn the computer over.

5. Secure **two M2.5x8 silver screws** at the back of the computer and **four M2.5x8 silver screws** on the bottom at the computer (figure 4-10).

6. Install the optional memory module, keyboard, optional PCMCIA card, and battery pack as described in sections 4.5 back through 4.2.

4.7 RTC Battery•Upper System Board

Removing the RTC Battery•Upper System Board

To remove the T2450CT's RTC battery and PCMCIA card board, follow the steps below and refer to figures 4-12 and 4-13.

1.   Turn off the power to the T2450CT. Disconnect the AC adapter, power cord, and all external cables connected to the T2450CT.

2.   Remove the battery pack, optional memory card, keyboard, optional memory module, and top cover as described in sections 4.2 through 4.6

3.   Remove **one M2.5x6 screw** and remove the right side **PCMCIA card ejector** (figure 4-12). Note the peg on the card ejector which fits into a metal loop on the release device below the card ejector.
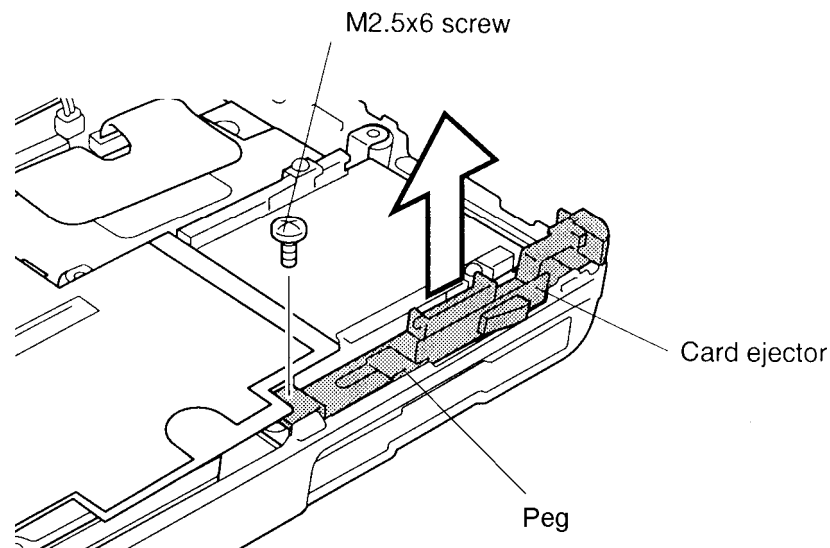
Figure 4-12 Removing the right side PCMCIA card ejector

4.   Lift out the RTC battery (figure 4-13).

5.   Remove **two M2x6 screws, two M2x8 silver screws,** and **one M2.5x6 screw** securing the **upper system board** (figure 4-13).

6.   Disconnect **PJ401** on the **upper system board** from the connector on the **LCD/ PC card board** and lift the **upper system board** out of the unit (figure 4-13). Note the metal loop on the left release device which fits over the peg on the left PCMCIA card ejector.
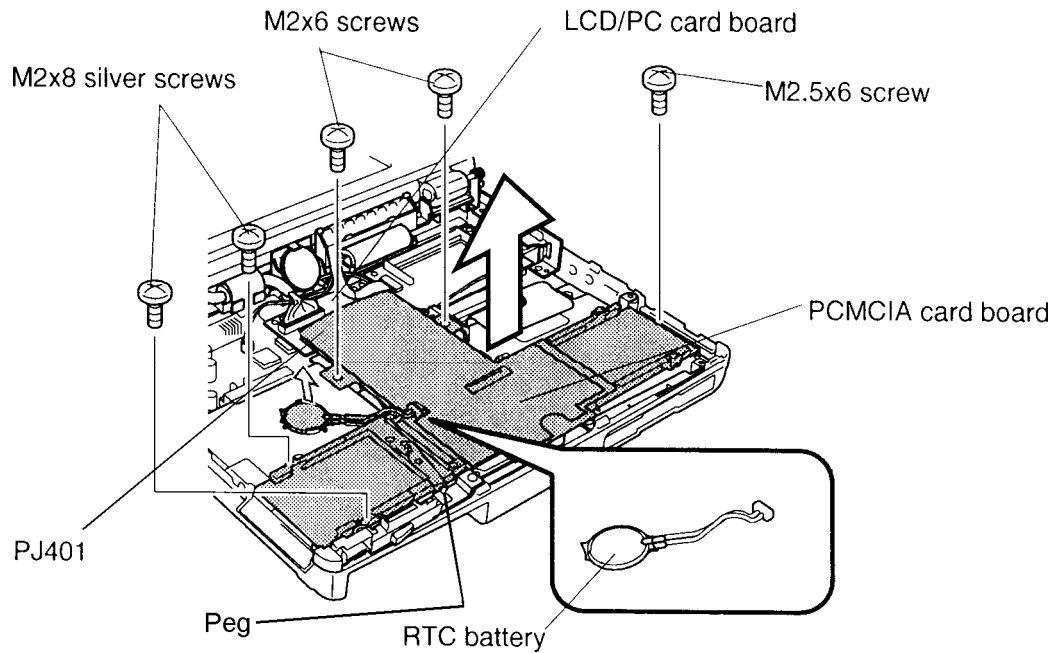
Figure 4-13 Removing the RTC battery and upper system board

Installing the RTC Battery•Upper System Board

WARNING: *If you replace the RTC battery, be sure to use only the same model battery or an equivalent battery recommended by Toshiba. Installation of the wrong battery can cause the battery to explode.*

To install the T2450CT's RTC battery•upper system board, follow the steps below and refer to figures 4-12 and 4-13.

1. Connect **PJ401** on the **upper system board** to the connector on the **LCD/PC card board** (figure 4-13).

2. Secure the **upper system board** with **two M2x6 screws**, **two M2x8 silver screws,** and **one M2.5x6 screw** (figure 4-13). Be sure to fit the metal loop on the left release device over the peg on the upper part of the PCMCIA card ejector.

3. Secure the right side **PCMCIA card ejector** with **one M2.5x6 screw** (figure 4-12). Be sure to fit the peg on the underneath part of the PCMCIA card ejector into the metal loop on the release device.

4. Set the **RTC battery** in place, but do not connect the **cable** to **PJ403** at this time (figure 4-13).

5. Install the top cover, optional memory module, keyboard, optional PCMCIA card, and battery pack as described in sections 4.6 back through 4.2.

4.8   Hard Disk Drive

Removing the Hard Disk Drive

To remove the T2450CT's hard disk drive, follow the steps below and refer to figures 4-14 and 4-15.

1. Turn off the power to the T2450CT. Disconnect the AC adapter, power cord, and all external cables connected to the T2450CT.

2. Remove the battery back, optional PCMCIA card, keyboard, optional memory module, top cover, and upper system board as described in sections 4.2 through 4.7.

3. Remove **two M2.5x4 screws** on either side of the HDD bracket, and slide the HDD unit to the front to disconnect the **HDD connector** from **PJ4** (figure 4-14).

4. Lift the **HDD** unit out of the system unit.
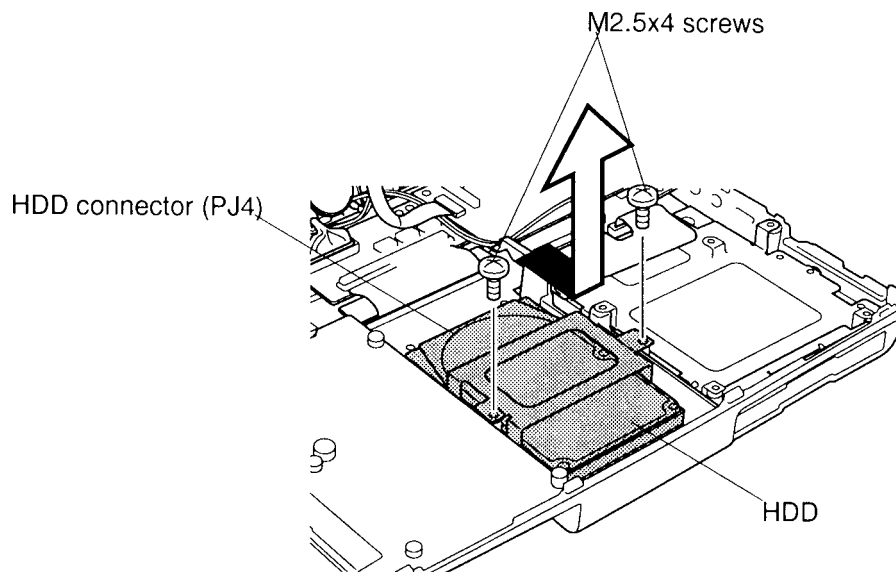
Figure 4-14 Removing the HDD unit

5. Remove **four M3x4 flat-head screws** securing the **bracket** to the **HDD** and slip off the bracket (figure 4-15).

> *NOTE: The IBM HDD has an HDD support which is held on by the bracket. If you remove the bracket, be sure to replace the support.*

Figure 4-15 Removing the HDD

Installing the Hard Disk Drive

To install the T2450CT's hard disk drive, follow the steps below and refer to figures 4-14 and 4-15.

1. Secure the **bracket** with **four M3x4 flat-head screws** (figure 4-15).

2. Place the HDD on the HDD slot and slide the HDD to the back. Make sure the **HDD connector** connects to the **system board (PJ4)** (figure 4-14).

3. Secure **two M2.5x4 screws** on either side of the HDD bracket (figure 4-14).

4. Install the upper system board, top cover, optional memory module, keyboard, optional PCMCIA card, and battery pack as described in sections 4.7 back through 4.2.

4.9 Floppy Disk Drive

Removing the Floppy Disk Drive

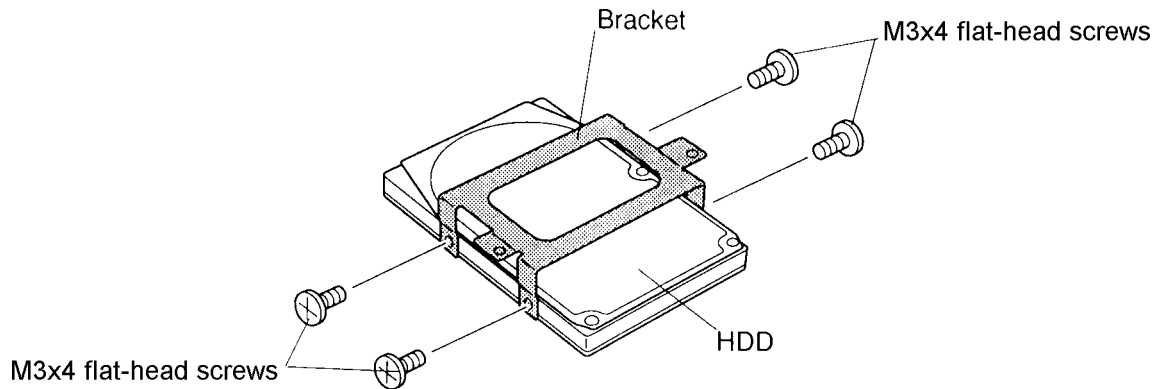To remove the T2450CT's floppy disk drive, follow the steps below and refer to figures 4-16 and 4-17.

1. Turn off the power to the T2450CT. Disconnect the AC adapter, power cord, and all external cables connected to the T2450CT.

2. Remove the battery pack, optional PCMCIA card, keyboard, optional memory module, top cover, and upper system board as described in sections 4.2 through 4.7.

3. Remove the **tape** from the FDD cable, then disconnect the **FDD cable** from **PJ3** on the lower system board and remove the **sound port cover** (figure 4-16).

4. Lift the FDD unit out of the system unit (figure 4-16).
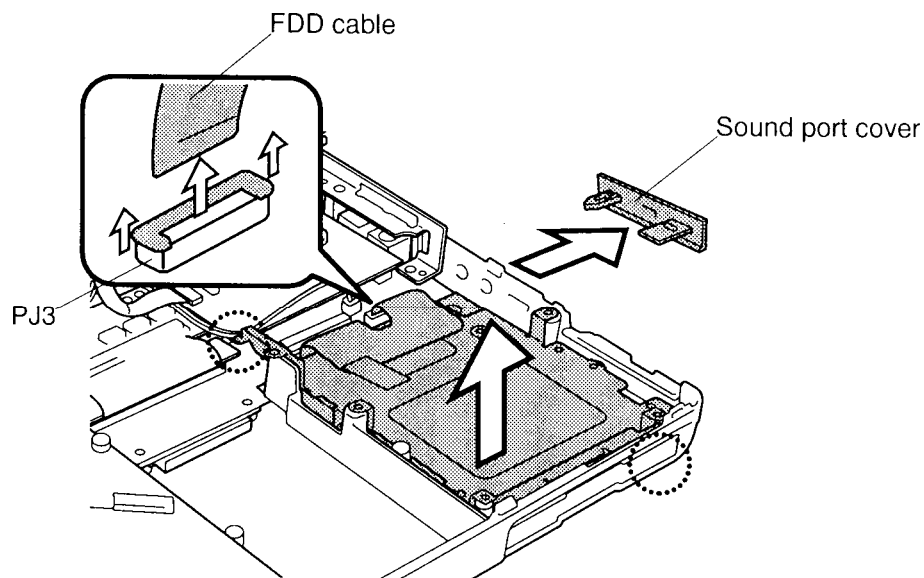
Figure 4-16 Removing the FDD unit

5. Remove **four M2.5x2.8 flat-head screws** securing the bracket to the FDD and slip off the bracket (figure 4-17).
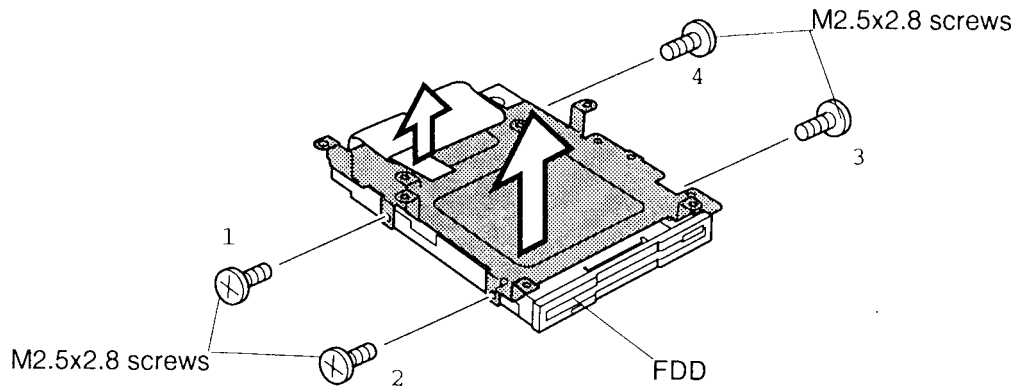
Figure 4-17 Removing the HDD

Installing the Floppy Disk Drive

To install the T2450CT's floppy disk drive, follow the steps below and refer to figures 4-16 and 4-17.

1. Secure the bracket with **four M2.5x2.8 flat-head screws** in numbered order from 1 to 4 (figure 4-17). Tighten screws 1 to 4 to a torque of less than 2.2 kgfcm.

2. Place the FDD assembly in the computer, connect the **FDD cable** to **PJ3** on the lower system board, and replace the tape on the FDD cable (figure 4-16).

3. Replace the sound port cover.

4. Install the upper system board, top cover, optional memory module, keyboard, optional PCMCIA card, and battery pack as described in sections 4.7 back through 4.2.

4.10 Microphone

Removing the Internal Microphone

To remove the internal microphone from the T2450CT, follow the steps below and refer to figures 4-18, 4-19, and 4-20.

1. Turn off the power to the T2450CT. Disconnect the AC adapter, power cord, and all external cables connected to the T2450CT.

2. Remove the battery pack, optional PCMCIA card, keyboard, optional memory module, and top cover as described in sections 4.2 through 4.6.

3. Peel off the **tape** securing the internal **microphone cable** (figure 4-18).
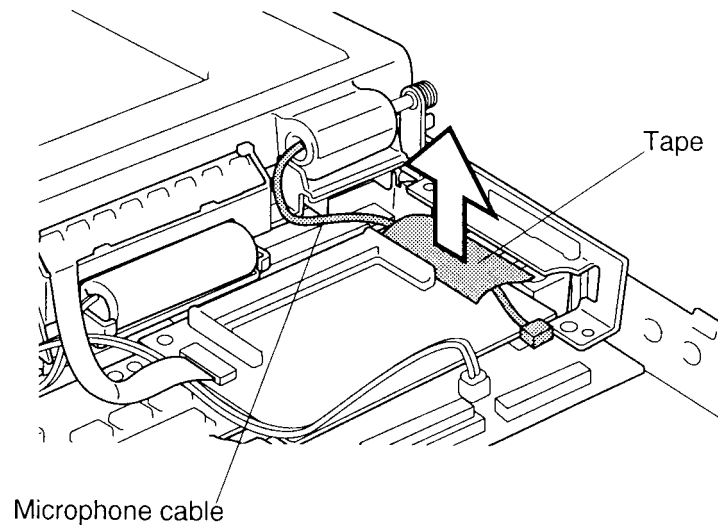
Figure 4-18 Peeling off the tape

4.   Remove **two LCD mask seals** from the display hinges and t**wo rubber pads** from the top corners of the display to expose screws securing the display mask (figure 4-19).

5.   Remove **two M2.5x6 screws** at the bottom corners of the display mask, and **two M2.5x6 screws** at the top corners (figure 4-19).

6.   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 (figure 4-19).

7.   Continue unlatching the mask along the sides (**three latches** on each side), **four latches** at the bottom, and **four latches** at the display supports (figure 4-19).

Figure 4-19 Removing the display mask

8.   Remove the internal microphone base from the cover (figure 4-20).
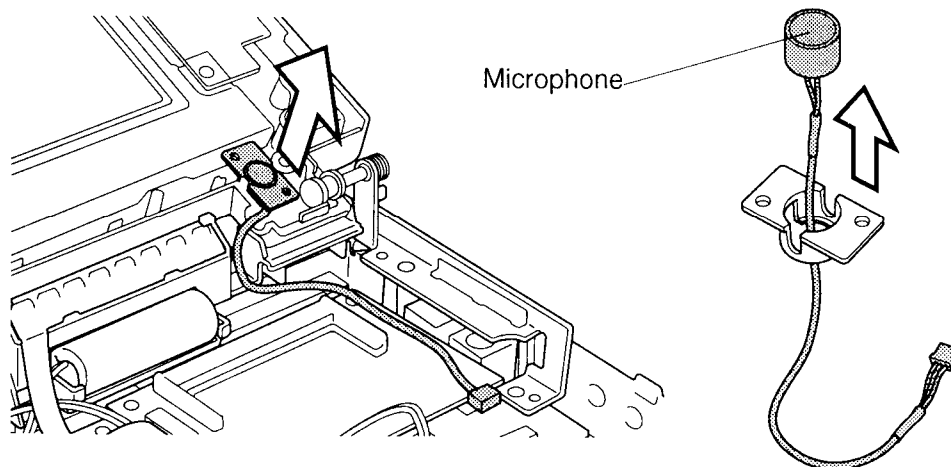
Figure 4-20 Internal microphone base

Installing the Internal Microphone

To install the T2450CT's display mask, follow the steps below and refer to figures 4-18 through 4-20.

1. Set the internal microphone base on the cover (figure 4-20).

2. Set the **display mask** in place and press firmly to secure the latches. Start at the bottom four latches and work your way around the sides (three latches on each side) and, finally, secure the four latches at the top (figure 4-19).

3. Secure **four M2.5x6 screws**, one at each corner of the display cover (figure 4-19).

4. Replace the **two rubber pads** and **two LCD mask seals** covering screws at the top two corners and hinges (figure 4-19).

5. Replace the **tape** securing the internal **microphone cable** (figure 4-18).

6. Replace the top cover, optional memory module, keyboard, optional PCMCIA card, and battery pack as described in sections 4.6 back through 4.2.

4.11 Display Assembly
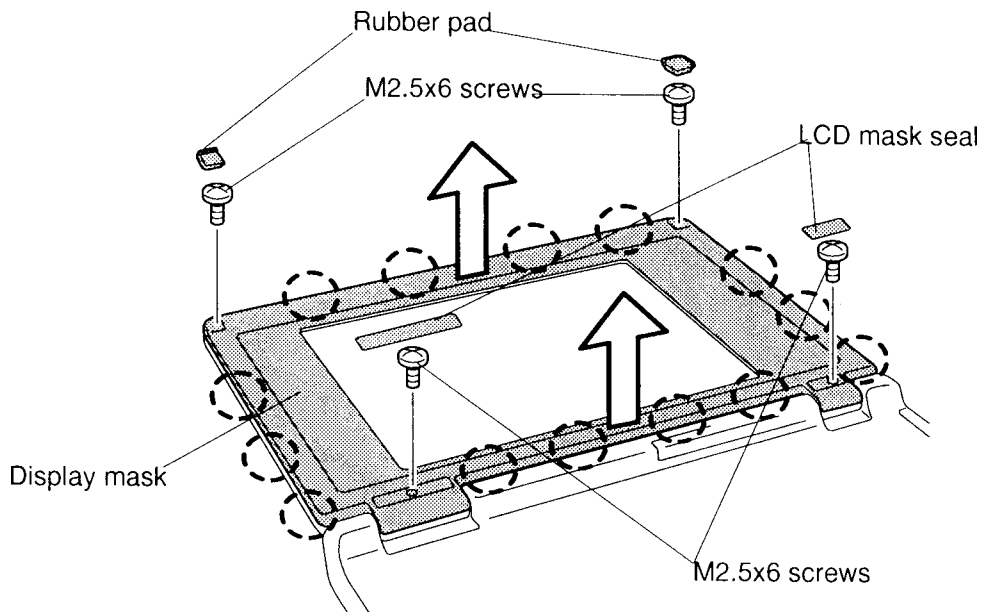
Removing the Display Assembly

To remove the T2450CT's display assembly, follow the steps below and refer to figures 4-18 and 4-21 through 4-23.

1. Turn off the power to the T2450CT. Disconnect the AC adapter, power cord, and all external cables connected to the T2450CT.

2. Remove the battery pack, optional PCMCIA card, keyboard, optional memory module, and top cover as described in sections 4.2 through 4.6.

3. Peel off the tape securing the internal **microphone cable** (figure 4-18).

4. Disconnect the **display sensor switch cable** from **PJ504** on the lower system board (figure 4-21).
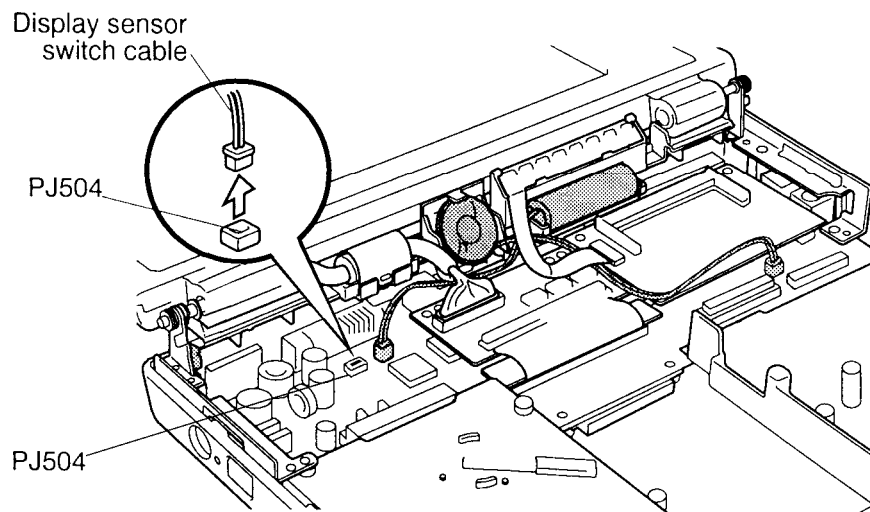
Figure 4-21 Removing the cable

5. Remove the left side **M2.5x6 screw** securing the **GND cable** on the **LCD/PC card joint board** (figure 4-22).

6. Remove the **display cable cover** and disconnect the **display cable** from the connector on the **LCD/PC card joint board** (figure 4-22).
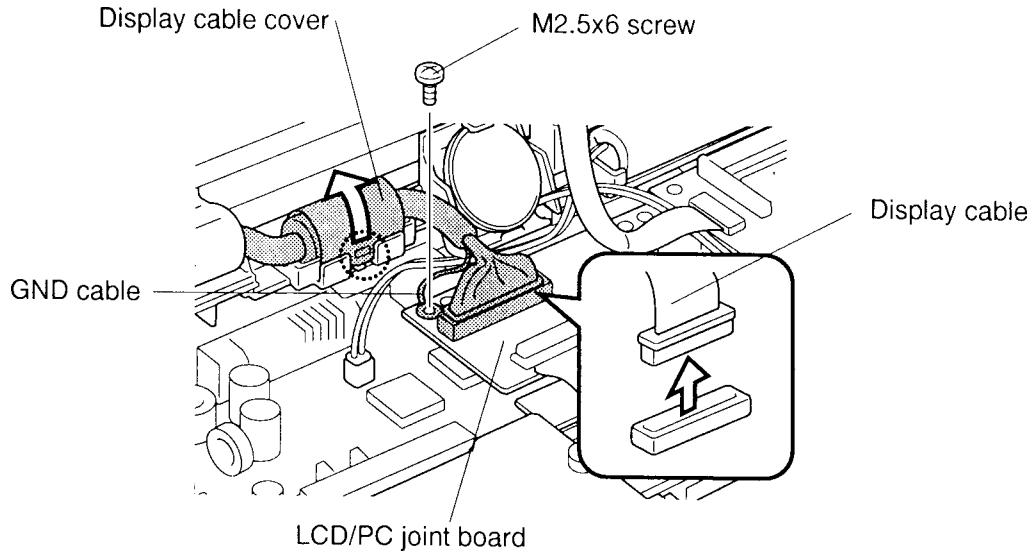
Figure 4-22 Disconnecting the display cable

7. Remove **four M2.5x6 screws** on the system unit, then lift it up to remove the **display assembly** (figure 4-23).
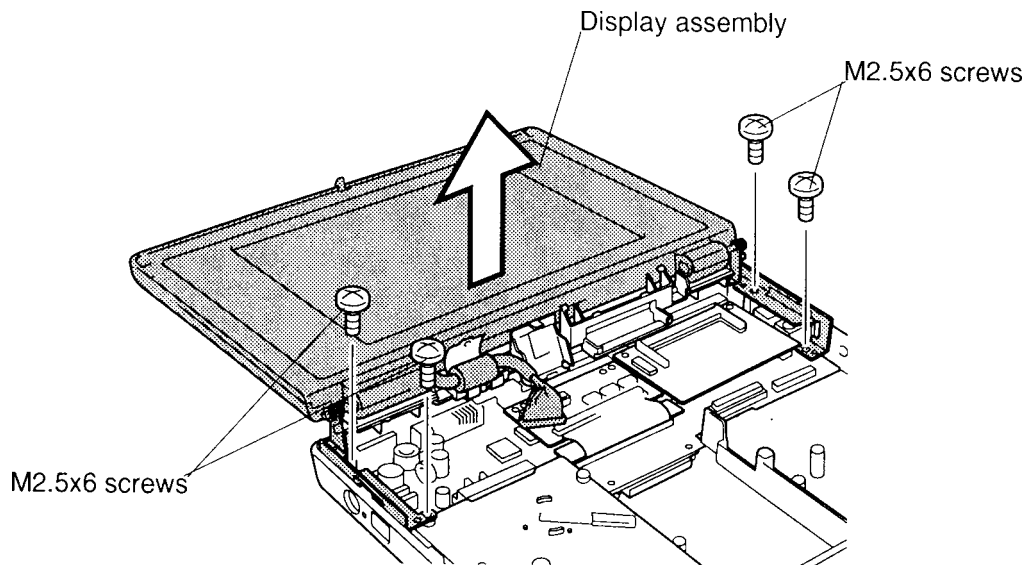
Figure 4-23 Removing the display assembly

Installing the Display Assembly

To install the T2450CT's display assembly, follow the steps below and refer to figures 4-18 and 4-21 through 4-23.

1. Secure **four M2.5x6 screws** on the display hinges to secure the **display assembly** (figure 4-23).

2. Connect the **display cable** on the **LCD/PC board** and secure it with the **display cable cover**. (figure 4-22).

3. Secure the **GND cable** from LCD on the LCD/PC board with **one M2.5x6 screw** (figure 4-22).

4. Connect the **display sensor switch cable** to **PJ504** on the lower system board (figure 4-21).

5. Place the **microphone cable** beside the memory module socket on the memory board and secure it with **tape** (figure 4-18).

6. Install the top cover, optional memory module, keyboard, optional PCMCIA card, and battery pack as described in sections 4.6 back through 4.2.

4.12 Speaker•LED Board•Backup Battery

Removing the Speaker•LED Board•Backup Battery

To remove the T2450CT's speaker, LED board and backup battery, follow the steps below and refer to figures 4-24 and 4-25.

1. Turn off the power to the T2450CT. Disconnect the AC adapter, power cord, and all external cables connected to the T2450CT.

2. Remove the battery pack, optional PCMCIA card, keyboard, optional memory module, and top cover as described in sections 4.2 through 4.6.

3. Disconnect the **speaker cable** from **PJ10** on the lower system board (figure 4-24).

4. Gently pull up the speaker latch and lift the **speaker** out of the system unit.
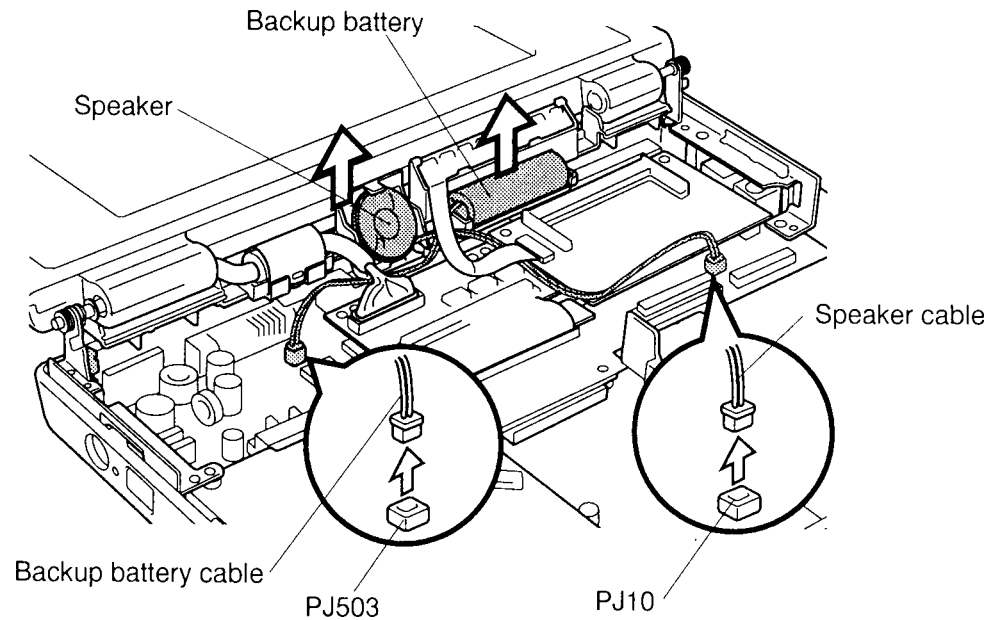
Figure 4-24 Removing the speaker and backup battery

5. Disconnect the **LED board cable** from **PJ203** on the memory board (figure 4-24).

6. Press outward on either **side latch** and lift the **LED board** from the system unit (figure 4-25).

7. Disconnect the **backup battery cable** from **PJ503** on the lower system board (figure 4-24).

8. Lift the **speaker•LED board•backup battery table frame** out of the system unit (figure 4-26). Note the routing of the backup battery cables.

9. Lift the **backup battery** out of the system unit.
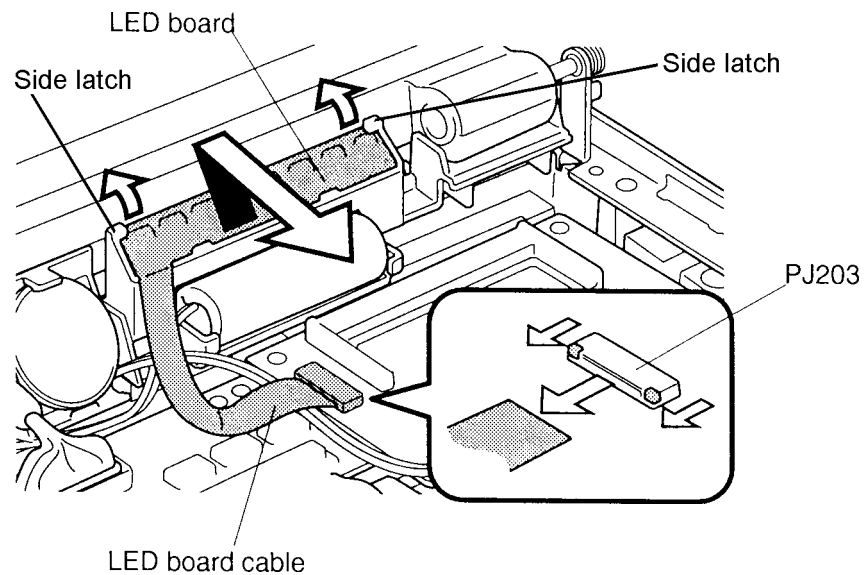
Figure 4-25 Removing the LED board
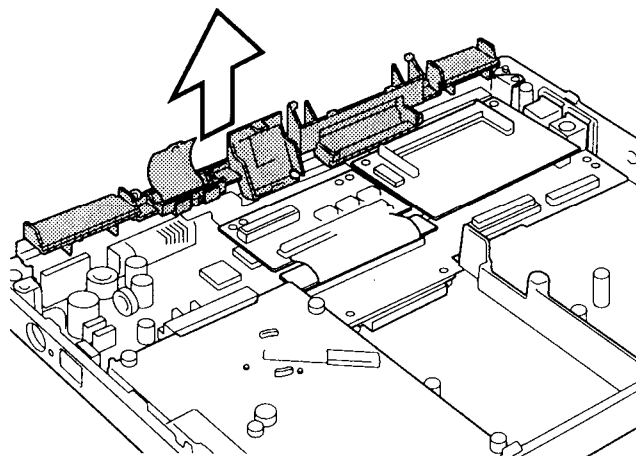
Figure 4-26 Removing the speaker•LED board•backup battery table frame

Installing the Speaker•LED Board•Backup Battery

> **WARNING:** *If you replace the backup battery, be sure to use only the same model battery or an equivalent battery recommended by Toshiba. Installation of the wrong battery can cause the battery to explode.*

To install the T2450CT's speaker, LED board, and backup battery, follow the steps below and refer to figures 4-24 through 4-26.

1. Place the **backup battery** in the **speaker•LED board•backup battery frame**, then place the frame in the bottom unit. Be sure to route the backup battery cable correctly (figure 4-26).

2. Connect the **backup battery cable** to **PJ503** on the lower system board (figure 4-24).

3. Place the **LED board** into the system unit.

4. Connect the **LED board cable** to **PJ203** on the memory board (figure 4-25).

5. Place the speaker in the backup battery table frame.

6. Connect the **speaker cable** to **PJ10** on the lower system board (figure 4-24).

7. Install the top cover, optional memory module, keyboard, optional PCMCIA card, and battery pack as described in sections 4.6 back through 4.2.

4.13 Memory Board

Removing the Memory Board

To remove the T2450CT's memory board, follow the steps below and refer to figure 4-27.

1. Turn off the power to the T2450CT. Disconnect the AC adapter, power cord, and all external cables connected to the T2450CT.

2. Remove the battery pack, optional PCMCIA card, keyboard, optional memory module, top cover, display assembly, and speaker•LED board•backup battery as described in sections 4.2 through 4.6, and 4.11 and 4.12.

3. Remove **two M2.5x6 screws** on the **memory board** (figure 4-27).

4. Disconnect the **memory board connector (PJ202)** from **PJ13** on the lower system board (figure 4-27).

5. Lift the **memory board** out of the system unit.
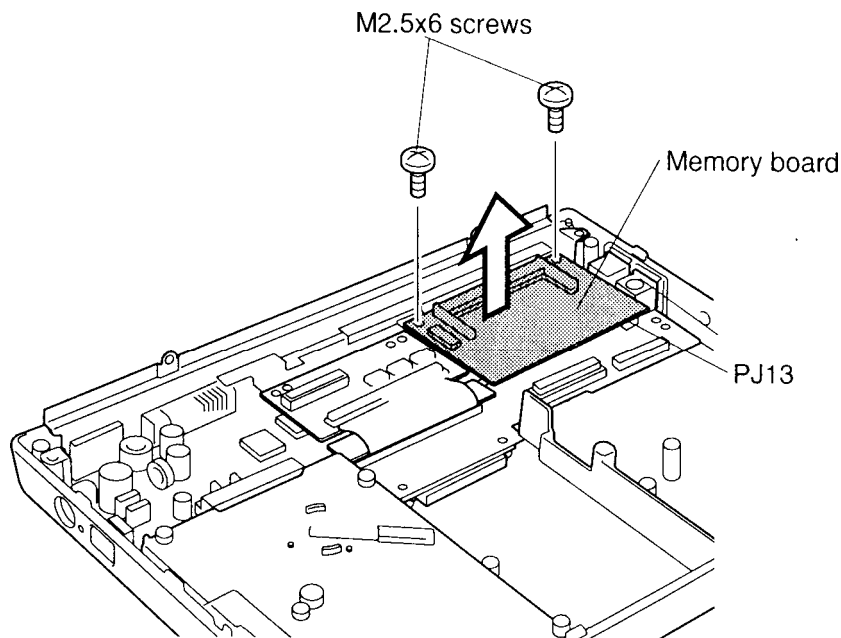
Figure 4-27 Removing the memory board

Installing the Memory Board

To install the T2450CT's memory board, follow the steps below and refer to figures 4-26 and 4-27.

1. Place the **memory board** in the computer, and connect the **memory board connector (PJ202)** to **PJ13** on the lower system board (figure 4-27).

2. Secure **two M2.5x6 screws** on the memory board (figure 4-27).

3. Install the **speaker•LED board•backuup battery table frame** on the system unit (figure 4-26).

4. Install the speaker•LED board•backup battery, display assembly, top cover, optional memory module, keyboard, optional PCMCIA card, and battery pack as described in sections 4.12, 4.11, and 4.6 back through 4.2.

4.14 LCD/PC Card Joint Board

Removing the LCD/PC Card Joint Board

To remove the T2450CT's LCD/PC card joint board, follow the steps below and refer to figures 4-26 and 4-28.

1. Turn off the power to the T2450CT. Disconnect the AC adapter, power cord, and all external cables connected to the T2450CT.

2. Remove the battery pack, optional PCMCIA card, keyboard, optional memory module, top cover, display assembly, and speaker•LED board•backup battery as described in sections 4.2 through 4.6, 4.11, and 4.12.

3. Remove the right side **M2.5x6 screw** on the **LCD/PC card joint board** (figure 4-28).

4. Lift up the LCD/PC card joint board and remove the metal support plate.

5. Disconnect the **LCD/PC card joint board connector** from **PJ11** on the lower system board (figure 4-28).

6. Lift the **LCD/PC card joint board** out of the system unit.
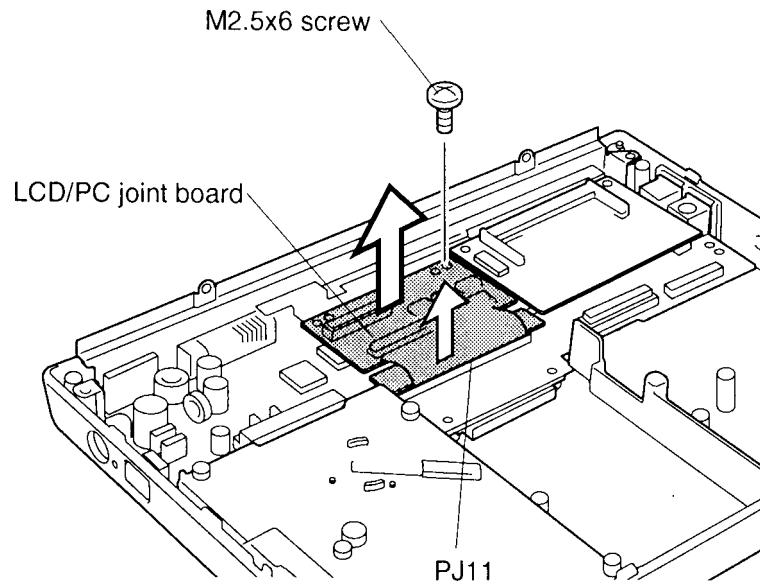
Figure 4-28 Removing the LCD/PC card joint board

Installing the LCD/PC Card Joint Board

To install the T2450CT's LCD/PC card joint board, follow the steps below and refer to figures 4-26 and 4-28.

1. Place the **LCD/PC card joint board** and metal support plate in the computer and connect the **LCD/PC card joint board connector** to **PJ11** on the lower system board (figure 4-28).

2. Secure the right side **M2.5x6 screw** on the LCD/PC card joint board (figure 4-28).

3. Install the speaker•LED board•backup battery, display assembly, top cover, optional memory module, keyboard, optional PCMCIA card, and battery pack as described in sections 4.11, 4.12, and 4.6 back through 4.2.

4.15 Lower System Board

Removing the Lower System Board

To remove the T2450CT's system board, follow the steps below and refer to figure 4-29.

1. Turn off the power to the T2450CT. Disconnect the AC adapter, power cord, and all external cables connected to the T2450CT.

2. Remove the battery pack, optional PCMCIA card, keyboard, optional memory module, top cover, RTC battery•upper system board, HDD, FDD, display assembly, speaker•LED board•backup battery, memory board, and LCD/PC card joint board as described in sections 4.2 through 4.9, and 4.11 through 4.14.

3. Remove **five M2.5x6 screws** on the system board (figure 4-29).

4. Lift the right side of the system board which will release the **DC IN jack** from the bottom cover, then lift up the system board with its cover (figure 4-27).
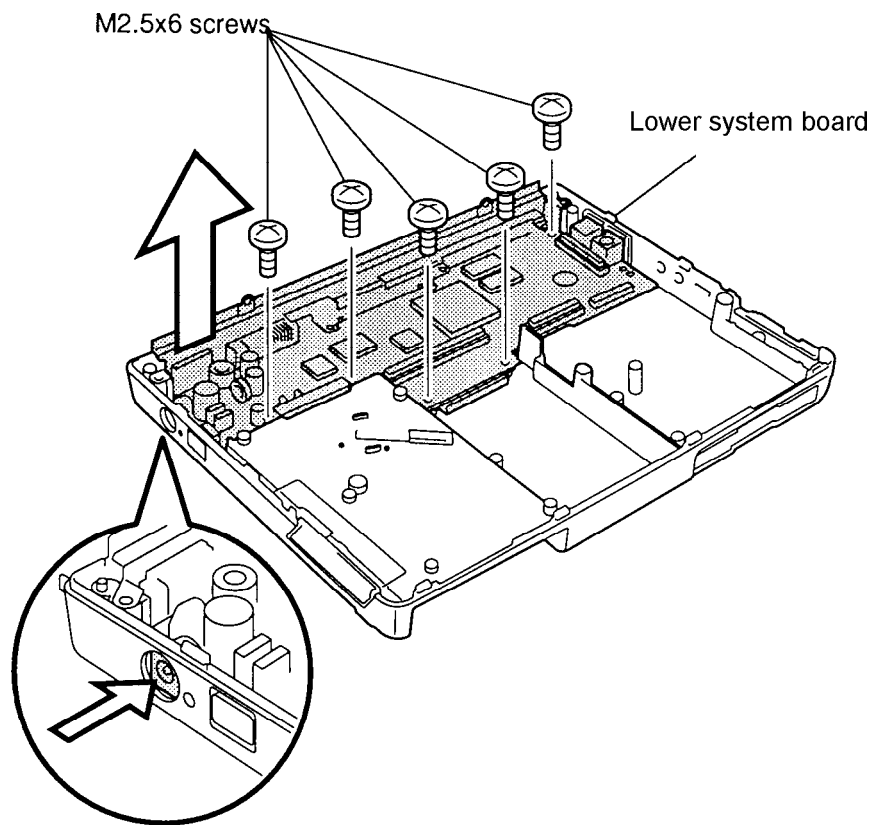
Figure 4-29 Removing the lower system board

Installing the Lower System Board

To install the T2450CT's lower system board, follow the steps below and refer to figure 4-29.

1. Place the **system board** on the bottom cover, and secure **five M2.5x6 screws** on the system board (figure 4-29).

2. Install the LCD/PC card joint card, memory board, speaker•LED board•backup battery, display assembly, FDD, HDD, RTC battery•upper system board, top cover, optional memory module, keyboard, optional PCMCIA card, and battery pack as described in sections 4.14 back through 4.11, and 4.9 back through 4.2.

4.16 Display Mask

Removing the Display Mask

To remove the T2450CT's display mask, follow the steps below and refer to figure 4-30.

1. Turn off the power to the T2450CT and disconnect the AC adapter, power cord, and all external cables connected to the T2450CT.

2. Remove the battery as described in section 4.2.

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

3. Remove **two LCD mask seals** from the display hinges and **two rubber pads** from the top corners of the display to expose screws securing the display mask (figure 4-30).

4. Remove **two M2.5x6 screws** at the bottom corners of the display mask, and **two M2.5x6 screws** at the top two corners (figure 4-30).

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 (figure 4-30).

6. Continue unlatching the mask along the **sides** (**three latches** on each side), **four latches** at the bottom, and **four latches** at the display supports (figure 4-30).
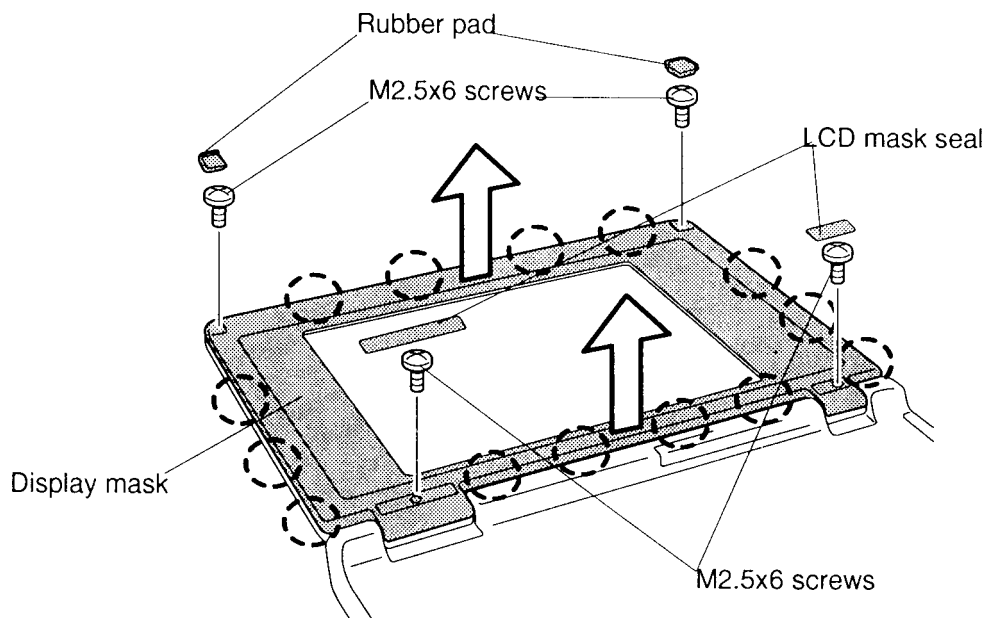
Figure 4-30 Removing the display mask

Installing the Display Mask

To install the T2450CT's display mask, follow the steps below and refer to figure 4-30.

1. Set the **display mask** in place and press firmly to secure the latches. Start at the bottom four latches and work your way around the three latches on each side and, finally, secure the four latches at the top (figure 4-30).

2. Secure **four M2.5x6 screws**, one at each corner of the display cover (figure 4-30).

3. Replace **two rubber pads** and **two LCD mask seals** covering screws at the top two corners and at the hinges (figure 4-30).

4. Replace the battery pack as described in section 4.2.

4.17 FL Inverter Board

Removing the FL Inverter Board

To remove the T2450CT's FL inverter board, follow the steps below and refer to figures 4-31 and 4-32.

1. Turn off power to the T2450CT. Disconnect the AC adapter and all external cables connected to the T2450CT.

2. Remove the battery pack and display mask as described in sections 4.2 and 4.16.

3. Remove the **tape** securing the **FL cable**.

4. Remove **two M2.5x6 screws** securing the **FL inverter board** (figure 4-31).
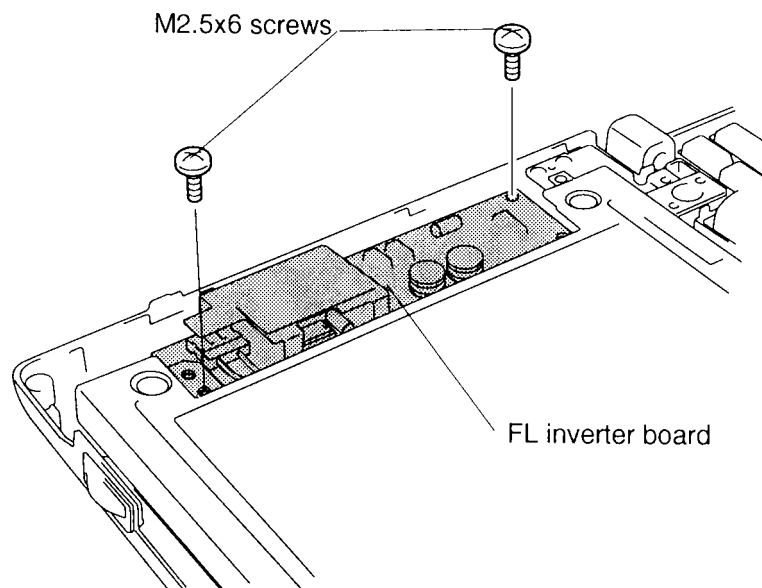
Figure 4-31 Removing the FL inverter board

5. Lift 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).
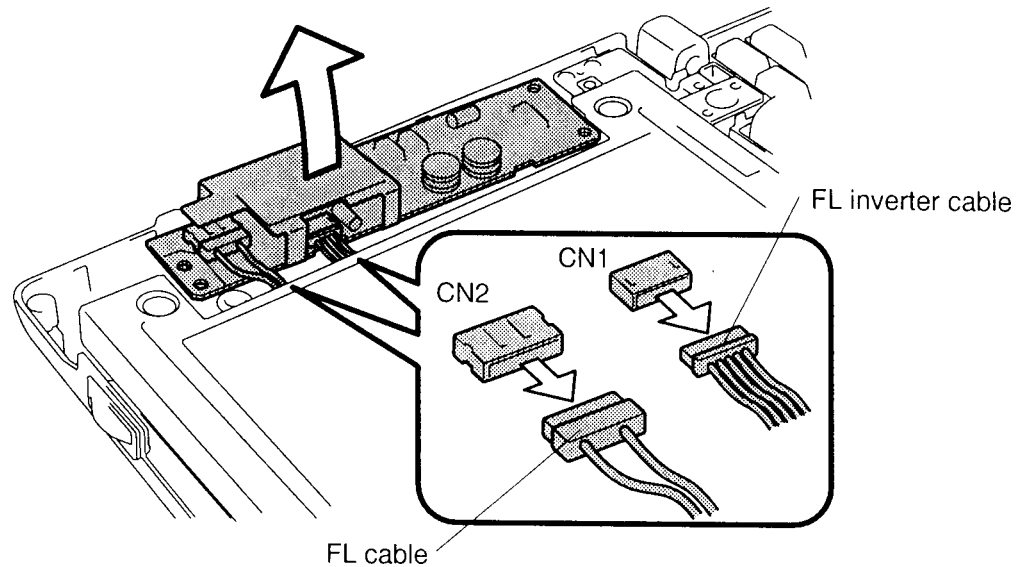
Figure 4-32 Disconnecting the FL inverter board

Installing the FL Inverter Board

To install the T2450CT's FL inverter board, follow the steps below and refer to figures 4-31 and 4-32.

1. Connect the **FL inverter cable** to **CN1** and the **FL cable** to **CN2** on the FL inverter board (figure 4-32).

2. Seat the **FL inverter board** and route the **cables** so they will not be pinched by the display cover or other component.

3. Secure the **FL inverter board** with **two M2.5x6 screws** (figure 4-31).

4. Replace the **tape** over the **FL cable**.

5. Install the display mask and battery pack as described in sections 4.16 and 4.2.

4.18 LCD Module

Removing the LCD Module

CAUTION: The T2450CT LCD module is easily damaged. Before removing the module, refer to Appendix A for precautions on handling.

To remove the T2450CT's LCD Module, follow the steps below and refer to figures 4-33 and 4-34.

1. Turn off the power to the T2450CT. Disconnect the AC adapter and all external cables connected to the T2450CT.

2. Remove the battery pack, display mask, and FL inverter board as described in sections 4.2, 4.16, and 4.17.

3. Remove **four M2.5x10 screws** securing the LCD module to the back frame of the computer (figure 4-33).

4. Remove **two M2x6 screws** securing the LCD module and **ground cable** to the hinge of the display (figure 4-33).

NOTE: Do not remove the four smaller silver screws circled on the interior portion of the panel. These screws secure the metal cover to the LCD panel.
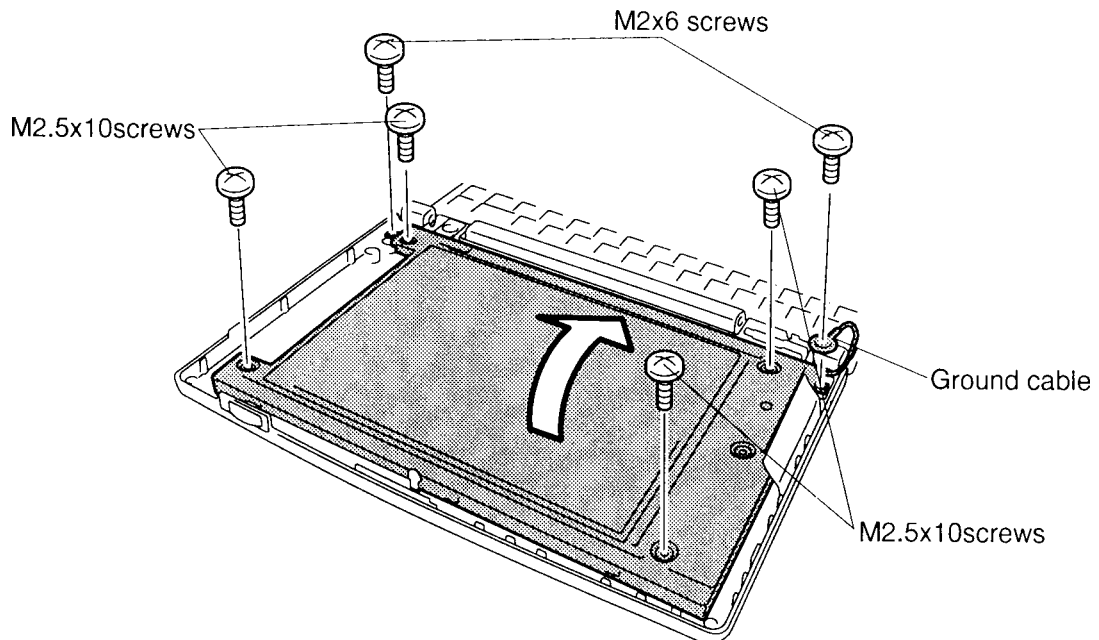
Figure 4-33 Removing the LCD screws

5.   Rotate the **LCD module** forward and place it on the keyboard (figure 4-34).

6.   Disconnect the **two display cables** from the **LCD module** (figure 4-34).

LCD module
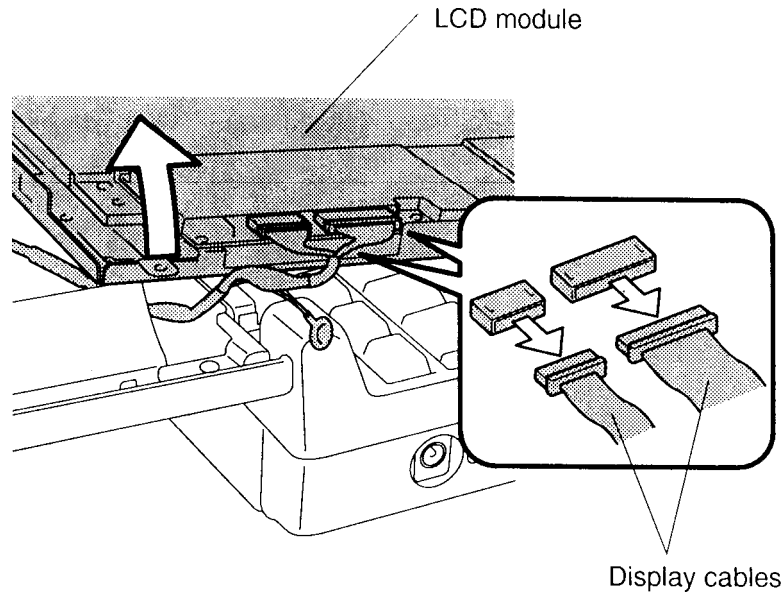
Display cables

Figure 4-34 Removing the LCD module

Installing the LCD Module

To install the T2450CT's liquid crystal display module, follow the steps below and refer to figures 4-33 to 4-34.

1.   Connect the **two display cables** to the **LCD module** (figure 4-34).

2.   Seat the LCD module in the display cover and secure it with **four M2.5x10 screws** (figure 4-33).

3.   Secure the **ground cable** and LCD module with **two M2x6 screws** (figure 4-33).

4.   Install the FL inverter board, display mask, and battery pack as described in sections 4.17, 4.16, and 4.2.

4.19 FL Unit

Removing the FL Unit

To remove the T2450CT's fluorescent lamp, follow the steps below and refer to figure 4-35.

1. Turn off the power to the T2450CT. Disconnect the AC adapter and all external cables connected to the T2450CT.

2. Remove the battery pack, display mask, FL inverter board, and LCD module as described in sections 4.2, 4.16, 4.17, and 4.18.

3. Place the **FL unit** face down and remove f**our M2x6 silver screws** (figure 4-35).

4. Lift the **FL unit** out of the frame (figure 4-35).
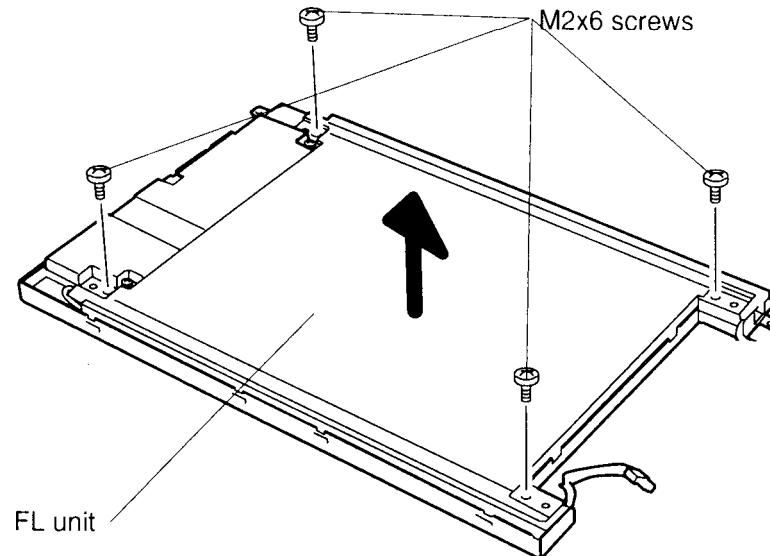
Figure 4-35 Removing the FL screws

Installing the FL Unit

To install the T2450CT's FL unit, follow the steps below and refer to figure 4-35.

1. Replace the **FL unit** in the frame and secure it with the **four M2x6 silver screws** (figure 4-35).

2. Install the LCD module, FL inverter board, display mask, and battery pack as described in sections 4.18, 4.17, 4.16, and 4.2.

Appendix A   Handling the LCD Module

Precautions for Handling the LCD Module

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

1. When installing the LCD module in the LCD cover, be sure to seat it so that it is
   properly aligned and maximum visibility of the display is maintained.
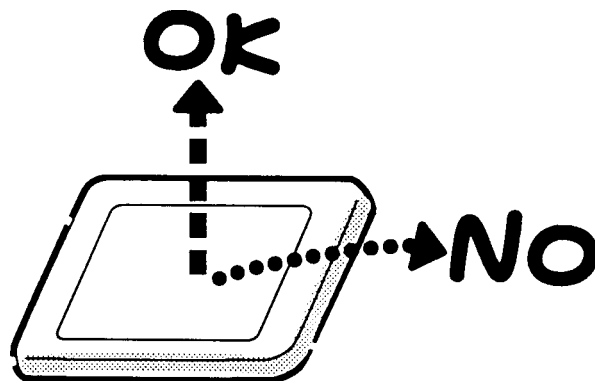
2. Be careful to align the holes at the four corners of the LCD module with the
   corresponding holes in the LCD cover before securing the module with screws. Do
   not force the module into place, because stress can affect its performance.

   Also, the panel's polarized surface is easily scarred, so be careful when handing 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.
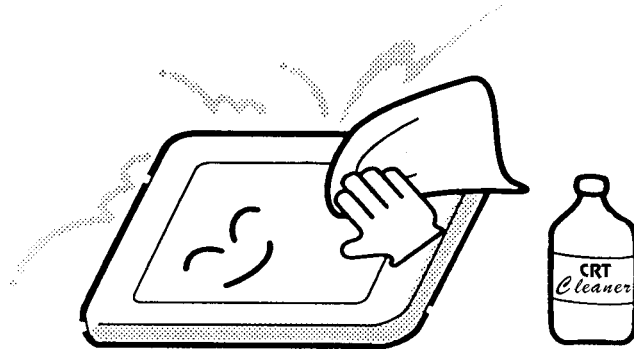
4. If water or other liquid is left on the panel's surface for a long period, it can change the screen's tint or stain it. Be sure to quickly wipe off any liquid.
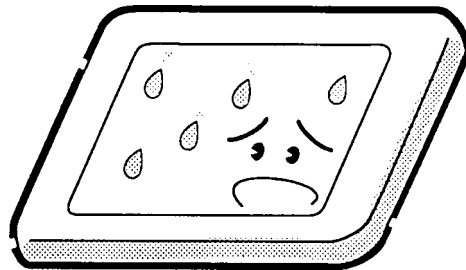
5. Glass is used in the panel, so be careful not to drop it or let it strike a hard object, which could cause breakage or cracks.
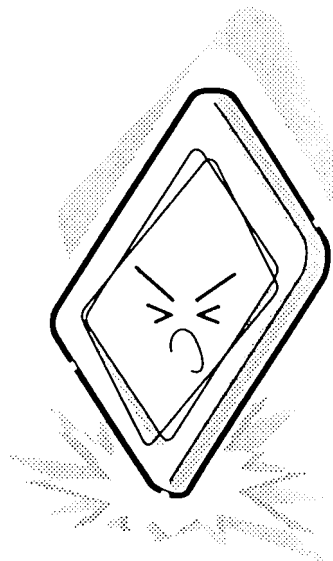
6.   CMOS-LSI circuits are used in the module, so guard against damage from electro-static discharge. Be sure to wear a wrist or ankle ground when handling the module.
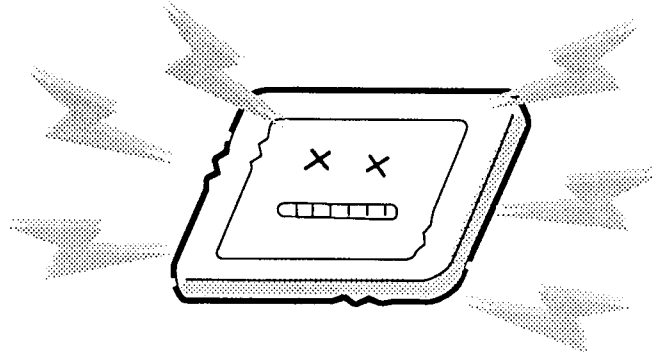
7.   Do not expose the module to direct sunlight or strong ultraviolet rays for long periods.
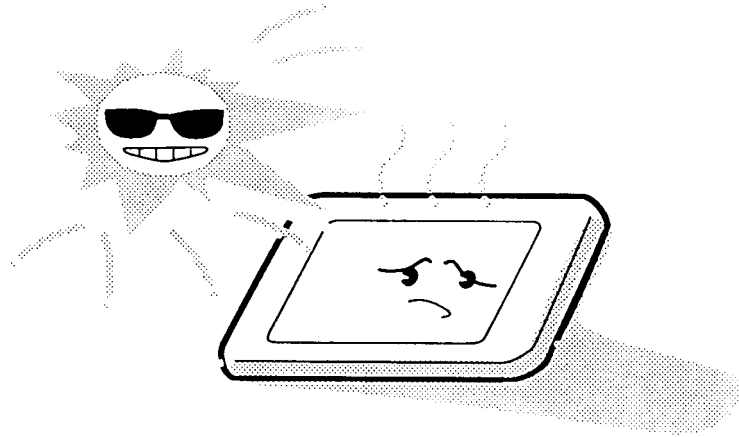
8.   Do not store the module at temperatures below specifications. Cold can cause the liquid crystals to freeze, lose their elasticity or otherwise suffer damage.
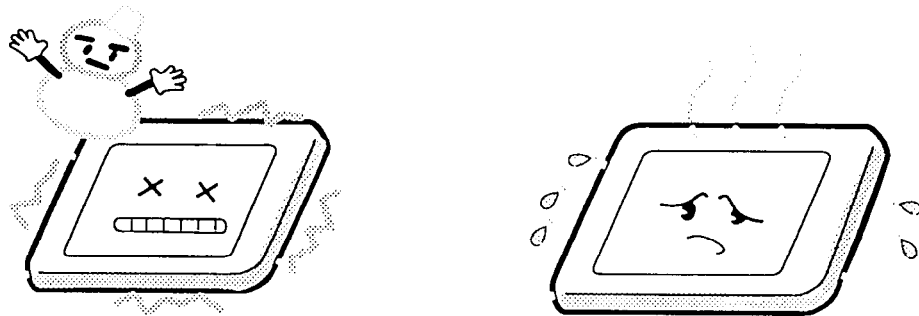
9. Do not disassemble the LCD module. Disassembly can cause malfunctions.
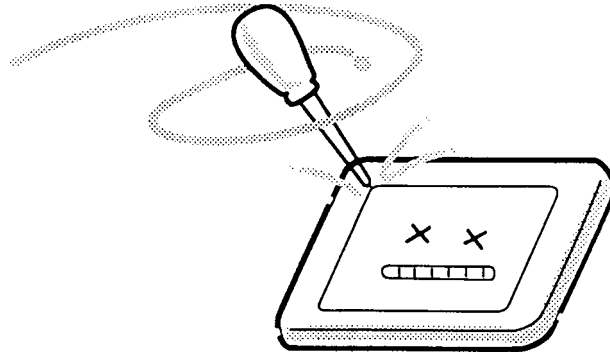
10. If you transport the module, do not use packing material that contains epoxy resin (amine) or silicon glue (alcohol or oxime). These materials can release gas that can damage the panel's polarization.
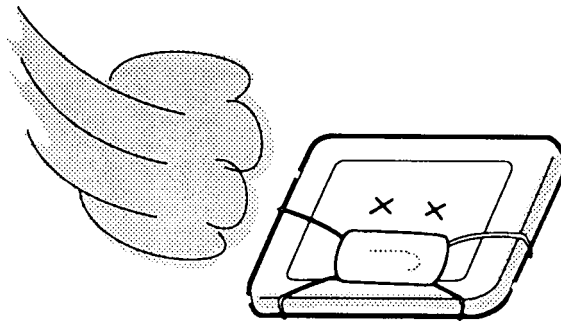
11. The TAB IC on the LCD back panel is easily damaged so be very careful when handling it.

Appendix B Board Layout

B.1   FNV(J)SY* Lower System Board
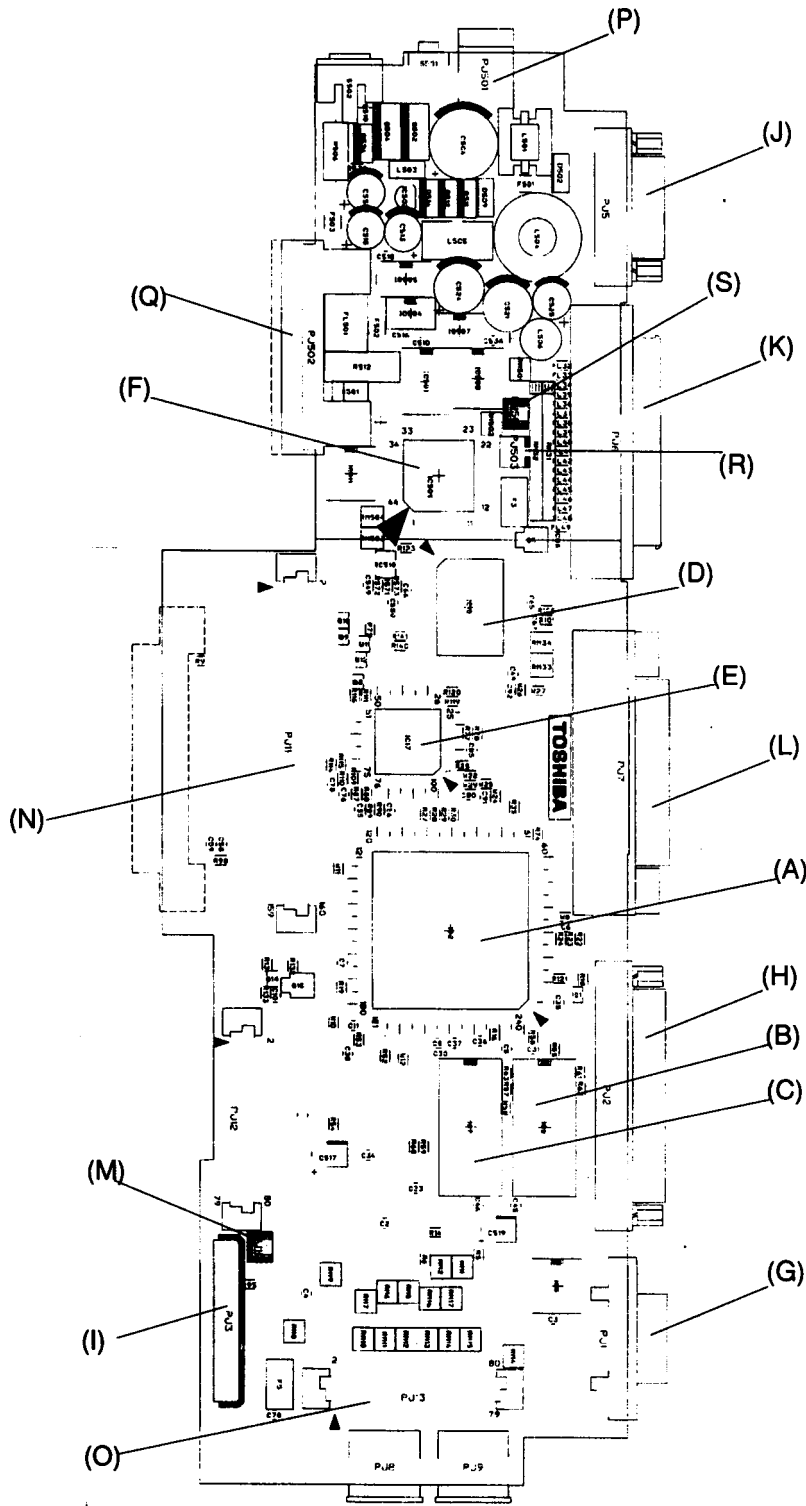
Figure B-1 FNV(J)SY lower system board (front)*
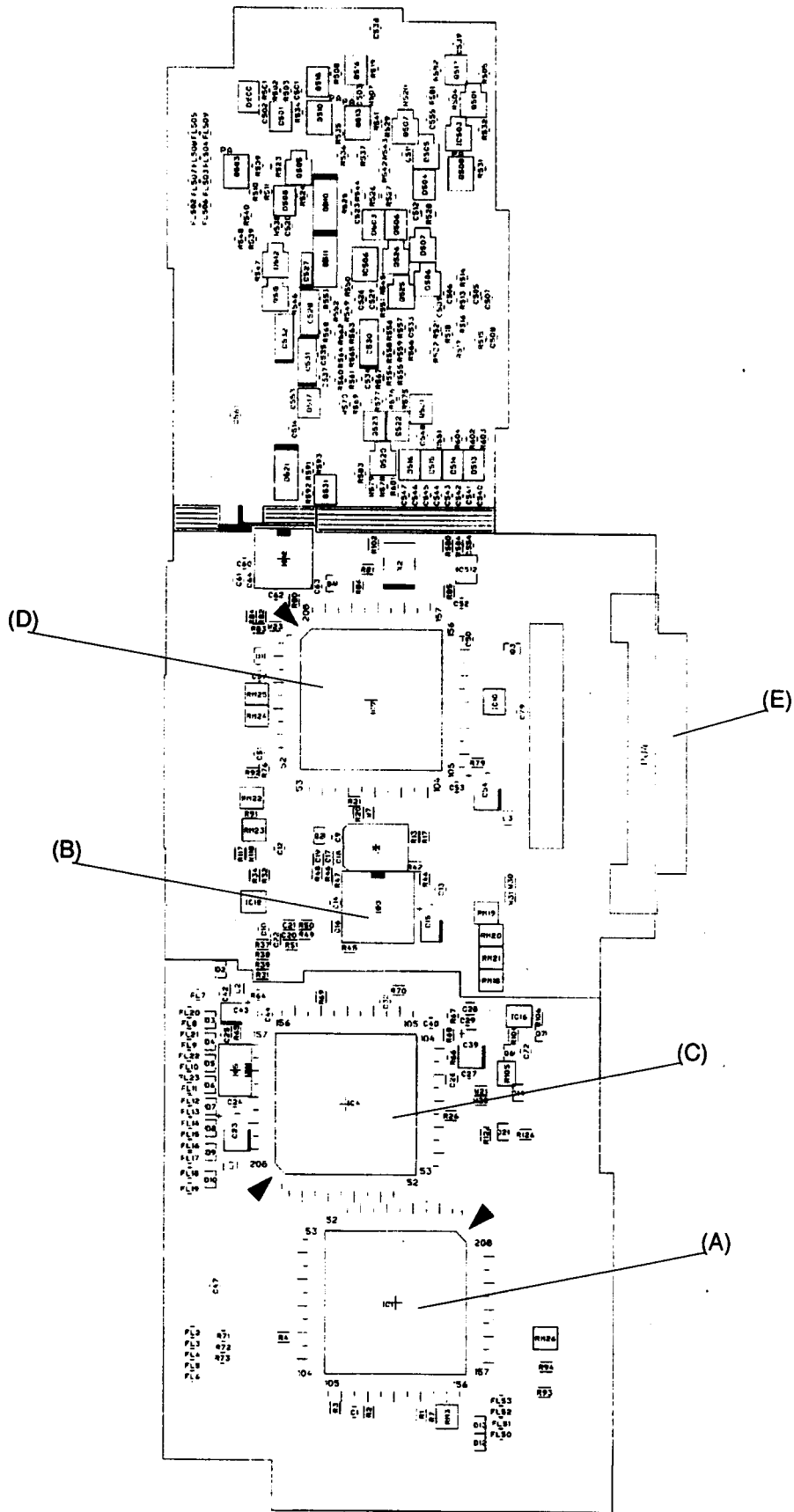
Figure B-2 FNV(J)SY* lower system board (back)

Table B-1 FNV(J)SY* lower system board ICs and connectors (front)

Mark	Number	Name
(A)	IC2	System Controller Gate Array
(B)	IC6	VRAM
(C)	IC7	VRAM
(D)	IC15	SCSI Controller
(E)	IC17	I/O Controller Gate Array
(F)	IC509	Power Supply Microprocessor
(G)	PJ1	CRT Connector
(H)	PJ2	PRT Connector
(I)	PJ3	Internal FDD Connector
(J)	PJ5	Serial Interface Connector
(K)	PJ6	SCSI Connector
(L)	PJ7	Port Replicator Connector
(M)	PJ10	Speaker Connector
(N)	PJ11	Joint Connector
(O)	PJ12	Memory Board Connector
(P)	PJ501	DC IN Connector
(Q)	PJ502	Main Battery Connector
(R)	PJ503	Backup Battery Connector
(S)	PJ504	Display Sensor Switch Connector

Table B-2 FNV(J)SY* lower system board ICs and connectors (back)

Mark	Number	Name
(A)	IC1	CPU
(B)	IC3	Clock Generator
(C)	IC4	Display Controller
(D)	IC9	Super Integration
(E)	PJ4	Internal HDD Connector

B.2 FNV(J)CD* Upper System Board
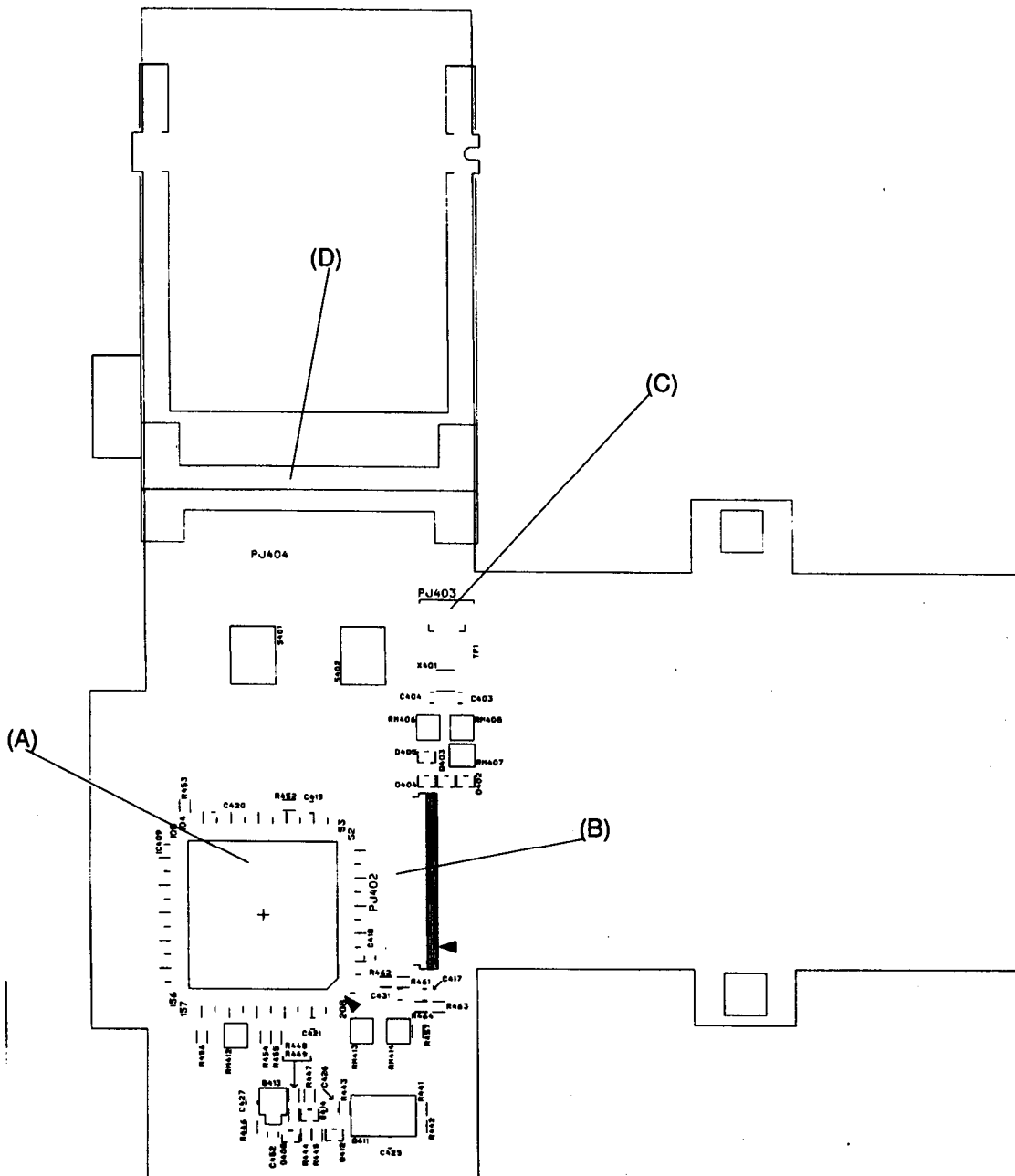
Figure B-3 FNV(J)CD upper system board (front)*
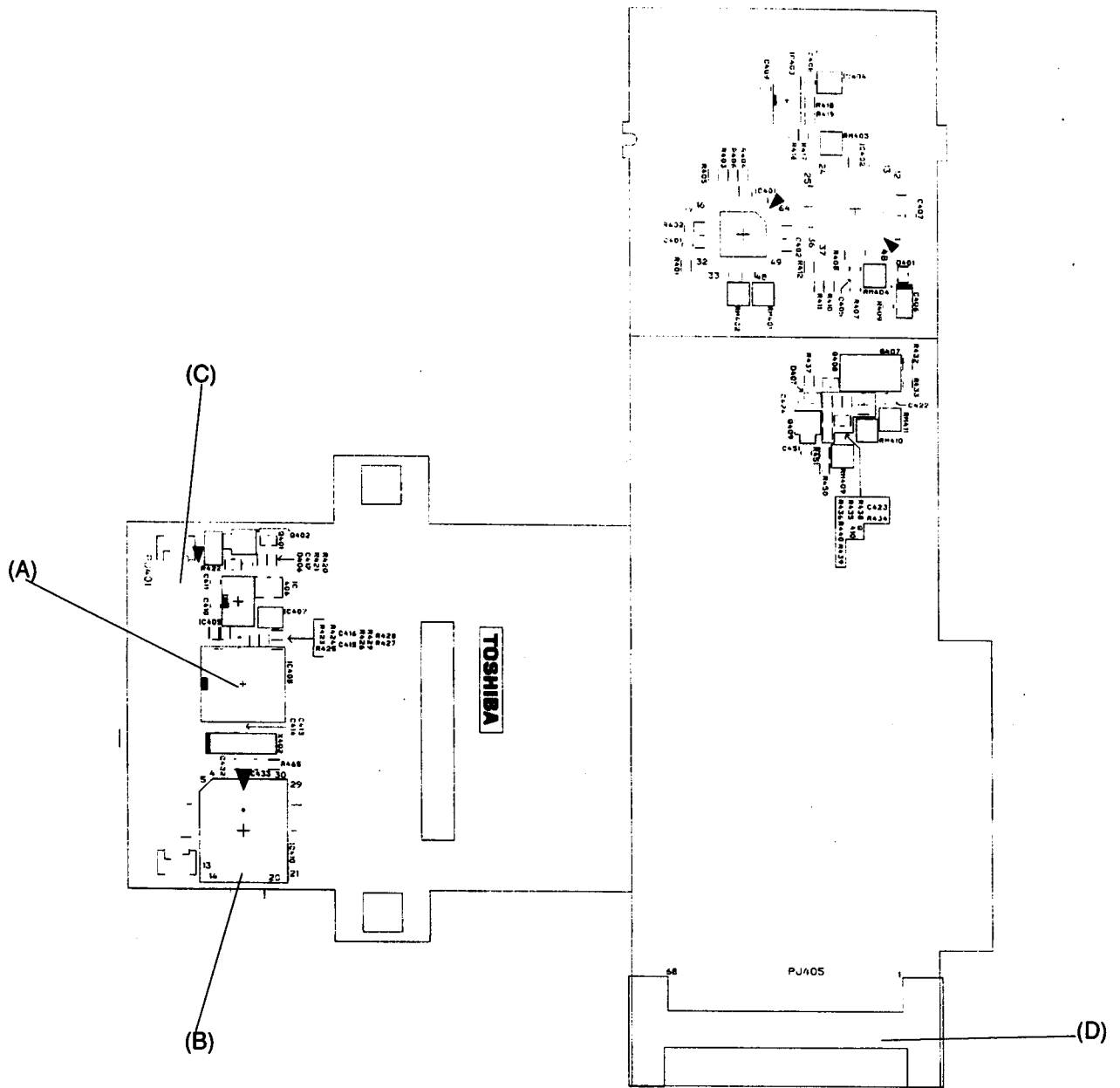
Figure B-4 FNV(J)CD* upper system board (back)

Table B-3 FNV(J)CD* upper system board ICs and connectors (front)

Mark	Number	Name
(A)	IC409	PCMCIA Controller Gate Array
(B)	PJ402	Keyboard Connector
(C)	PJ403	RTC Battery Connector
(D)	PJ404	PCMCIA Connector

Table B-4 FNV(J)CD* upper system board ICs and connectors (back)

Mark	Number	Name
(A)	IC408	Real Time Clock
(B)	IC410	BIOS ROM
(C)	PJ401	Joint Connector
(D)	PJ405	PCMCIA Connector

Appendix C   Pin Assignments

C.1   PJ1 RGB I/F Connectors (15-pin)

Table C-1 RGB I/F connector pin assignments (15-pin)

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

C.2   PJ2 PRT Connectors (25-pin)

Table C-2 PRT connector pin assignments (25-pin)

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

C.3 PJ3 Internal FDD Connectors (26-pin)

Table C-3 Internal FDD connector pin assignments (26-pin)

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

C.4 PJ4 Internal HDD Connectors (44-pin)

Table C-4   Internal HDD connector pin assignments (44-pin)

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

C.5 PJ5 Serial I/F Connectors (9-pin)

Table C-5   Serial I/F connector pin assignments (9-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	DCD1;110	I	02	RD1;010	I
03	SD1;010	O	04	DTR1;110	O
05	GND	–	06	DSR1;110	I
07	RTS1;110	O	08	CTS1;110	I
09	RI1;110	I			

C.6 PJ6 External SCSI Connectors (50-pin)

Table C-6   External SCSI connector pin assignments (50-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	GND	–	02	SCSID0;000	I/O
03	GND	–	04	SCSID1;000	I/O
05	GND	–	06	SCSID2;000	I/O
07	GND	–	08	SCSID3;000	I/O
09	GND	–	10	SCSID4;000	I/O
11	GND	–	12	SCSID5;000	I/O
13	GND	–	14	SCSID6;000	I/O
15	GND	–	16	SCSID7;000	I/O
17	GND	–	18	SCSIDP;000	I/O
19	GND	–	20	GND	–
21	GND	–	22	GND	–
23	GND	–	24	GND	–
25	N/C	–	26	VCC	–
27	GND	–	28	GND	–
29	GND	–	30	GND	–
31	GND	–	32	SCATN;000	I/O
33	GND	–	34	GND	–
35	GND	–	36	SCBSY;000	I/O
37	GND	–	38	SCACK;000	I/O
39	GND	–	40	SCRST;000	O
41	GND	–	42	SCMSG;000	I/O
43	GND	–	44	SCSEL;000	I/O
45	GND	–	46	SCSICD;000	I/O
47	GND	–	48	SCREQ;000	I/O
49	GND	–	50	SCSIIO;000	I/O

C.7   PJ7 Port Replicator Connectors (120-pin)

Table C-7   Port replicator connector pin assignments (120-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	GND	–	02	GND	–
03	SCSID0;100	I/O	04	SCSID2;100	I/O
05	SCSID4;100	I/O	06	SCSID6;100	I/O
07	SCSIDP;100	I/O	08	SCBSY;100	I/O
09	SCRST;100	I/O	10	SCSEL;100	I/O
11	SCREQ;100	I/O	12	GND	–
13	AUTFD;000	O	14	PINT;000	O
15	GND	–	16	MOUSDT;100	I/O
17	EXKBDT;100	I/O	18	GND	–
19	SD00;100	I/O	20	SD02;100	I/O
21	SD04;100	I/O	22	SD06;100	I/O
23	JOYR;000		24	GND	–
25	CVSYNC;110	O	26	GND	–
27	AGREEN;100	O	28	ABLUE;100	O
29	GND	–	30	GND	–
31	GND	–	32	GND	–
33	SCSID1;100	I/O	34	SCSID3;100	I/O
35	SCSID5;100	I/O	36	SCSID7;12200	I/O
37	SCATN;000	I/O	38	SCACK;000	I/O
39	SCMSG;000		40	SCSICD;000	
41	SCSIID;000		42	GND	–
43	ERROR;000		44	SLIN;000	
45	GND	–	46	MOUSCK;100	
47	EXKBCK;100		48	GND	–
49	SD01;100		50	SD03;100	
51	SD05;100		52	SD07;100	
53	JOYW;000		54	GND	–
55	CHSYNC;110		56	GND	–
57	ARED	O	58	GND	–
59	GND	–	60	GND	–
61	DCIN	–	62	DCIN	–
63	NC	–	64	SCVCC	–
65	NC	–	66	DSR1;110	I
67	DCD1;110	I	68	CTS1;110	I
69	RD1;010	I	70	GND	–
71	STROB;000	I/O	72	PDB00;100	I/O

Pin	Signal	I/O	Pin	Signal	I/O
73	PDB02;100	I/O	74	PDB04;100	I/O
75	PDB06;100	I/O	76	ACK;000	I/O
77	PE;100	I/O	78	GND	–
79	NC	–	80	PRDT1;000	I/O
81	NC	–	82	PRVCC	–
83	NC	–	84	MSI;100	I
85	GND	–	86	GND	–
87	LOUTRP	O	88	LOUTRM	O
89	LINRM	I	90	LINRP	I
91	DCIN	–	92	DCIN	–
93	ADCIN	I	94	SCVCC	–
95	NC	–	96	DTR1;110	O
97	RI1;110	I	98	RTS1;110	O
99	SD1;010	O	100	GND	–
101	NC	–	102	PDB01;100	I/O
103	PDB03;100	I/O	104	PDB05;100	I/O
105	PDB07;100	I/O	106	BUSY;100	I/O
107	SELCT;100	I/O	108	GND	–
109	NC	–	110	PRDT2;000	I/O
111	NC	–	112	PRVCC	–
113	NC	–	114	MSO;100	O
115	GND	–	116	GND	–
117	LOUTLP	O	118	LOUTLM	O
119	LINLM	I	120	LINLP	I

C.8 PJ11 Joint Connectors (160-pin)

Table C-8   Joint connector pin assignments (160-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	GND	–	02	GND	–
03	SD15;100	I/O	04	SD14;100	I/O
05	SD13;100	I/O	06	SD12;100	I/O
07	SD11;100	I/O	08	SD10;100	I/O
09	SD09;100	I/O	10	SD08;100	I/O
11	IRQ5;100	I	12	IRQ7;100	I
13	IRQ4;100	I	14	IRQ12;100	I
15	IRQ3;100	I	16	IRQ11;100	I
17	IRQ1;100	I	18	IRQ10;100	I
19	IRQ15;100	I	20	IRQ9;100	I
21	IRQ14;100	I	22	IRQ8;100	I
23	MCV	–	24	PCLR;000	O
25	SA00;100	I	26	SA01;100	I
27	SA02;100	I	28	SA03;100	I
29	SA04;100	I	30	SA05;100	I
31	SA06;100	I	32	SA07;100	I
33	SA08;100	I	34	SA09;100	I
35	SA10;100	I	36	SA11;100	I
37	SA12;100	I	38	SA13;100	I
39	SA14;100	I	40	SA15;100	I
41	SA16;100	I	42	SA17;100	I
43	SA18;100	I	44	SA19;100	I
45	GND	–	46	GND	–
47	CK32K;100	I	48	KBRW;000	I
49	PCSMI;000	I	50	KBTMG;100	I
51	STBY;000	I/O	52	KBUPDT;100	O
53	IPSSEL;100	O	54	KBOT00;000	I
55	BUFOFF;000	I	56	KBOT01;000	I
57	GND	–	58	KBOT02;000	I
59	ROMSL;000	O	60	KBOT03;000	I
61	ROMA16;100	O	62	KBOT04;000	I
63	ROMWE;000	O	64	KBOT05;000	I
65	ROMPRG;110	O	66	KBOT06;000	I
67	PDNROM;000	O	68	KBOT07;000	I
69	RAMV	–	70	RAMV	–
71	SD07;100	I/O	72	SD03;100	I/O
73	SD06;100	I/O	74	SD02;100	I/O
75	GND	–	76	GND	–
77	SD05;100	I/O	78	SD01;100	I/O

Table C-8   Joint connector pin assignments (160-pin) (continued)

Pin	Signal	I/O	Pin	Signal	I/O
79	SD04;100	I/O	80	SD00;100	I/O
81	VCC	–	82	VCC	–
83	VCC	–	84	VCC	–
85	KEYPRS;100	I	86	RESET;000	O
87	IORD;000	O	88	KBCS;000	O
89	IOWR;000	O	90	REFRSH;000	I/O
91	AEN;100	O	92	NC	–
93	CSPTN;000	I	94	NC	–
95	NC	–	96	IOCLK;100	O
97	MERD;000	I/O	98	MEWR;000	I/O
99	P12V	–	100	P12V	–
101	LA21;100	O	102	LA20;100	O
103	LA23;100	O	104	LA22;100	O
105	GND	–	106	GND	–
107	RESET;100	O	108	A20LOW;000	I/O
109	IIRDY;100	I	110	RSTCP;000	I
111	IIO16;000	I	112	KBWR;000	O
113	VCC	–	114	VCC	–
115	IMCS16;000	O	116	KBCLK;110	O
117	ZROW;000	O	118	RTCWR;000	O
119	SBHE;000	O	120	RTCDS;000	O
121	BALE;100	O	122	RTCAS;100	O
123	PNLD07;100	O	124	PNLD06;100	O
125	PNLD08;100	O	126	PNLD05;100	O
127	PNLD09;100	O	128	PNLD04;100	O
129	GND	–	130	GND	–
131	PNLD10;100	O	132	PNLD03;100	O
133	PNLD11;100	O	134	PNLD02;100	O
135	PNLD12;100	O	136	PNLD01;100	O
137	PNLD13;100	O	138	PNLD00;100	O
139	DSPV	–	140	DSPV	–
141	PNLD14;100	O	142	FR;100	O
143	PNLD15;100	O	144	FP;100	O
145	DSPV	–	146	LP;100	O
147	FLTEN;000	O	148	SCLK;100	O
149	VCC	–	150	LCDEN;000	O
151	MOUSDT;100	I/O	152	MOUSCK;100	I/O
153	EXKBCK;100	I/O	154	EXKBDT;100	I/O
155	ARWLED;100	I	156	NUMLED;100	I
157	CAPLED;100	I	158	IHMED;000	O
159	GND	–	160	GND	–

C.9   PJ201 Memory Slot Connectors (72-pin)

Table C-9   Memory slot connector pin assignments (72-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	GND	–	02	MD00;101	I/O
03	MD01;101	I/O	04	MD02;101	I/O
05	MD03;101	I/O	16	MD04;101	I/O
07	MD05;101	I/O	08	MD06;101	I/O
09	MD07;101	I/O	10	B3V	–
11	NC	–	12	MA00;101	O
13	MA01;101	O	14	MA02;101	O
15	MA03;101	O	16	MA04;101	O
17	MA05;101	O	18	MA06;101	O
19	MA10;101	O	20	NC	–
21	MD08;101	O	22	MD09;101	O
23	MD10;101	O	24	MD11;101	O
25	MD12;101	O	26	MD13;101	O
27	MD14;101	O	28	MA07;101	O
29	MA11;101	O	30	B3V	–
31	MA08;101	O	32	MA09;101	O
33	RAS3;001	O	34	RAS1;001	O
35	MD15;101	O	36	NC	–
37	MD16;101	O	38	MD17;101	O
39	GND	–	40	CAS0;001	O
41	CAS2;001	O	42	CAS3;001	O
43	CAS1;001	O	44	RAS0;001	O
45	RAS2;001	O	46	GND	–
47	MWE2;001	O	48	GND	–
49	MD18;101	I/O	50	MD19;101	I/O
51	MD20;101	I/O	52	MD21;101	I/O
53	MD22;101	I/O	54	MD23;101	I/O
55	NC	–	56	MD24;101	I/O
57	MD25;101	I/O	58	MD26;101	I/O
59	MD28;101	I/O	60	MD27;101	I/O
61	B3V	–	62	MD29;101	I/O
63	MD30;101	I/O	64	MD31;101	I/O
65	NC	–	66	NC	–
67	NC	–	68	NC	–
69	NC	–	70	NC	–
71	NC	–	72	GND	–

C.10   PJ302 LCD Connectors (40-pin)

Table C-10   LCD connector pin assignments (40-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	PSPV	–	02	DSPV	–
03	GND	–	04	GND	–
05	GND	–	06	RESET;000	O
07	LCDEN;000	O	08	LCDEN;000	O
09	PNLD15;110	O	10	PNLD02;110	O
11	FP;110	O	12	PNLD06;110	O
13	PNLD08;110	O	14	PNLD01;110	O
15	LP;110	O	16	GND	–
17	GND	–	18	GND	–
19	GND	–	20	GND	–
21	PNLD10;110	O	22	PNLD05;110	O
23	PNLD07;110	O	24	PNLD00;110	O
25	PNLD11;110	O	26	GND	–
27	PNLD09;110	O	28	GND	–
29	GND	–	30	GND	–
31	SCLK;110	O	32	PNLD04;110	O
33	PNLD12;110	O	34	FR;110	O
35	PNLD13;110	O	36	PNLD03;110	O
37	PNLD04;110	O	38	GND	–
39	GND	–	40	GND	–

C.11 PJ401 Joint Connectors (140-pin)

Table C-11 Joint connector pin assignments (140-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	GND	–	02	GND	–
03	SD15;100	I/O	04	SD14;100	I/O
05	SD13;100	I/O	06	SD12;100	I/O
07	SD11;100	I/O	08	SD10;100	I/O
09	SD09;100	I/O	10	SD08;100	I/O
11	IRQ5;100	O	12	IRQ7;100	I
13	IRQ4;100	O	14	IRQ12;100	O
15	IRQ3;100	O	16	IRQ11;100	O
17	IRQ1;100	O	18	IRQ10;100	O
19	IRQ15;100	O	20	IRQ9;100	O
21	IRQ14;100	O	22	IRQ8;000	O
23	MCV	–	24	PCLR;000	I
25	SA00;100	O	26	SA01;100	O
27	SA02;100	O	28	SA03;100	O
29	SA04;100	O	30	SA05;100	O
31	SA06;100	O	32	SA07;100	O
33	SA08;100	O	34	SA09;100	O
35	SA10;100	O	36	SA11;100	O
37	SA12;100	O	38	SA13;100	O
39	SA14;100	O	40	SA15;100	O
41	SA16;100	O	42	SA17;100	O
43	SA18;100	O	44	SA19;100	O
45	GND	–	46	GND	–
47	CK32K;100	O	48	KBRW;000	O
49	PCSMI;000	O	50	KBTMG;100	O
51	STBY;000	I/O	52	KBUPDT;110	I
53	IPSSEL;100	I	54	KBOT00;000	O
55	BUFOFF;000	O	56	KBOT01;000	O
57	GND	–	58	KBOT02;000	O
59	ROMCE;000	I	60	KBOT03;000	O
61	ROMA16;100	I	62	KBOT04;000	O
63	ROMWE;000	I	64	KBOT05;000	O
65	ROMPRG;110	I	66	KBOT06;000	O
67	PDNROM;100	I	68	KBOT07;000	O
69	RAMV	–	70	RAMV	–
71	SD07;100	I/O	72	SD03;100	I/O

Table C-11   Joint connector pin assignments (140-pin) (continued)

Pin	Signal	I/O	Pin	Signal	I/O
73	SD06;100	I/O	74	SD02;100	I/O
75	GND	–	76	GND	–
77	SD05;100	I/O	78	SD01;100	I/O
79	SD04;100	I/O	80	SD00;100	I/O
81	VCC	–	82	VCC	–
83	VCC	–	84	VCC	–
85	KEYPRS;100	O	86	RESET;000	I
87	IORD;000	I	88	KBCS;000	I
89	IOWR;000	I	90	REFRSH;000	I/O
91	AEN;100	I	92	BRIDGE3	–
93	CSPTN;000	O	94	BRIDGE4	–
95	BRIDGE1	–	96	IOCLK;100	I
97	MERD;000	I/O	98	MEWR;000	I/O
99	P12V	–	100	P12V	–
101	LA21;100	I	102	LA20;100	I
103	LA23;100	I	104	LA22;100	I
105	GND	–	106	GND	–
107	RESET;100	I	108	A20LOW;000	I/O
109	IIRDY;100	O	110	RSTCP;000	O
111	IIO16;000	O	112	KBWR;000	I
113	VCC	–	114	VCC	–
115	IMCS16;000	I	116	KBCLK;110	I
117	ZROW;000	I	118	RTCWR;000	I
119	SBHE;000	I	120	RTCDS;000	I
121	BALE;100	I	122	RTCAS;100	I
123	MOUSCK;100	I	124	GND	–
125	EXKBDT;100	I/O	126	GND	–
127	NUMLED;100	O	128	NC	–
129	IHMED;100	I	130	NC	–
131	VCC	–	132	VCC	–
133	MOUSDT;100	I/O	134	NC	–
135	EXKBCK;100	I/O	136	NC	–
137	ARWLED;100	O	138	GND	–
139	CAPLED;100	O	140	GND	–

C.12 PJ402 KB I/F Connectors (25-pin)

Table C-12   KB I/F connector pin assignments (25-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	KBOT10;000	O	02	KBOT09;000	O
03	KBOT08;000	O	04	KBOT07;000	O
05	KBOT06;000	O	06	KBOT05;000	O
07	KBOT04;000	O	08	KBOT03;000	O
09	KBRT7;100	I	10	KBRT6;100	I
11	KBRT5;100	I	12	KBRT4;100	I
13	KBRT3;100	I	14	KBRT2;100	I
15	KBRT1;100	I	16	KBRT0;100	I
17	KBOT02;000	O	18	KBOT01;000	O
19	KBOT00;000	O	20	IPSTK5;000	I/O
21	NC	–	22	IPSTK4;000	I/O
23	IPSTK3;000	I/O	24	VCC	–
25	IPSTK1;000	I/O			

C.13 PJ403 RTC Connectors (3-pin)

Table C-13   RTC connector pin assignments (3-pin)

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

C.14 PJ404 and PJ405 PC Card Slot Connectors (68-pin)

Table C-14   PC card slot connector pin assignments (68-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	GND	–	02	CDx03;100	I/O
03	CDx04;100	I/O	04	CDx05;100	I/O
05	CDx06;100	I/O	06	CDx07;100	I/O
07	CE1x;000	O	08	CADx10;100	O
09	OEx;000	O	10	CADx11;100	O
11	CADx09;100	O	12	CADx08;100	O
13	CADx13;100	O	14	CADx14;100	O
15	WEx;000	O	16	CBSYx;000	I
17	MCVCCx	–	18	MCVPPx	–
19	CADx16;100	O	20	CADx15;100	O
21	CADx12;100	O	22	CADx07;100	O
23	CADx06;100	O	24	CADx05;100	O
25	CADx04;100	O	26	CADx03;100	O
27	CADx02;100	O	28	CADx01;100	O
29	CADx00;100	O	30	CDx00;100	I/O
31	CDx01;100	I/O	32	CDx02;100	I/O
33	WPx;000	I	34	GND	–
35	GND	–	36	CDx1;000	I
37	CDx11;100	I/O	38	CDx12;100	I/O
39	CDx13;100	I/O	40	CDx14;100	I/O
41	CDx15;100	I/O	42	CE2x;000	O
43	NC	–	44	IORx;000	O
45	IOWx;000	O	46	CADx17;100	O
47	CADx18;100	O	48	CADx19;100	O
49	CADx20;100	O	50	CADx21;100	O
51	MCVCCx	–	52	MCVPPx	–
53	CADx22;100	O	54	CADx23;100	O
55	CADx24;100	O	56	CADx25;100	O
57	NC	–	58	CRSTx;100	O
59	WAITx;000	I	60	NC	–
61	REGx;000	O	62	BVDx2;100	I
63	BVDx1;100	I	64	CDx08;100	I/O
65	CDx09;100	I/O	66	CDx10;100	I/O
67	CDx2;000	I	68	GND	–

NOTE: The T2450CT has two PCMCIA slots: A and B. Therefore, these are two identical sets of connectors, one for each card. For signals containing an "x" designation, for example CDx04;100, read the x as "A" or "B."

C.15 PJ501 DC IN Connectors (3-pin)

Table C-15   DC IN connector pin assignments (3-pin)

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

C.16 PJ502 Main Battery Connectors (5-pin)

Table C-16 Main battery connector pin assignments (5-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	BATT	–	02	ABTH	–
03	BATSL	–	04	GND	–
05	GND	–			

C.17 PJ503 Backup Battery Connectors (2-pin)

Table C-17 Backup battery connector pin assignments (2-pin)

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

C.18 PJ504 Display Switch Connectors (2-pin)

Table C-18 Display switch connector pin assignments 2-pin)

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

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	å	û	ª	╢	╞	╓	µ	÷
7	•	↨	'	7	G	W	g	w	ç	ù	º	╖	╟	╫	τ	≈
8	◘	↑	(	8	H	X	h	x	ê	ÿ	¿	╕	╚	╪	Φ	°
9	○	↓	)	9	I	Y	i	y	ë	Ö	⌐	╣	╔	┘	Θ	·
A	◙	→	*	:	J	Z	j	z	è	Ü	¬	║	╩	┌	Ω	·
B	♂	←	+	;	K	[	k	{	ï	¢	½	╗	╦	█	δ	√
C	♀	└	,	<	L	\	l	|	î	£	¼	╝	╠	▄	∞	ⁿ
D	♪	↔	—	=	M	]	m	}	ì	¥	¡	╜	═	▌	φ	²
E	♫	▲	.	>	N	^	n	~	Ä	₧	«	╛	╬	▐	∈	∎
F	☼	▼	/	?	O	_	o	△	Å	ƒ	»	┐	▼	█	∩	BLANK FF

Appendix E   Keyboard Scan/Character Codes

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

Cap No.	Keytop	Code set 1 Make	Code set 1 Break	Code set 2 Make	Code set 2 Break		Note
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

Cap No.	Keytop	Code set 1 Make	Code set 1 Break	Code set 2 Make	Code set 2 Break	Note
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	

Cap No.	Keytop	Code set 1		Code set 2		Note
		Make	**Break**	**Make**	**Break**	**Note**
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 below:*

	With left **Shift**	With right **Shift**
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
121	ARROW	05	C5	77	F0 77
122	NUMERIC	05	C5	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 B7 E0 AA	E0 12 E0 7C	E0 F0 7C E0 F0 12
	Ctrl*	E0 37	E0 B7	E0 7C	E0 F0 7C
	Shift*	E0 37	E0 B7	E0 7C	E0 F0 7C
	Alt*	54	D4	84	F0 B4

Table E-7 Scan codes with Alt key

Key top	Shift	Code set 1 Make						Code set 2 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.

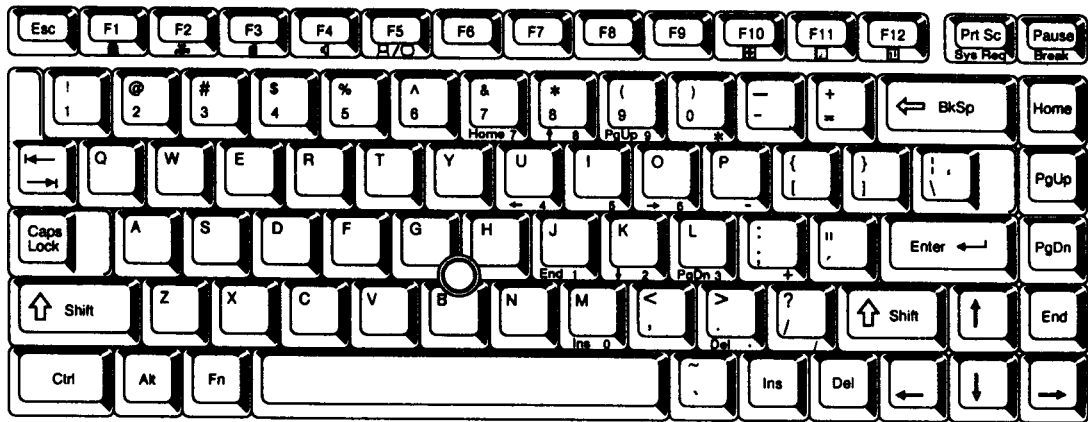# Appendix F Key Layout

F.1   United States (US) Keyboard

Figure F-1   US keyboard

F.2   United Kingdom (UK) Keyboard
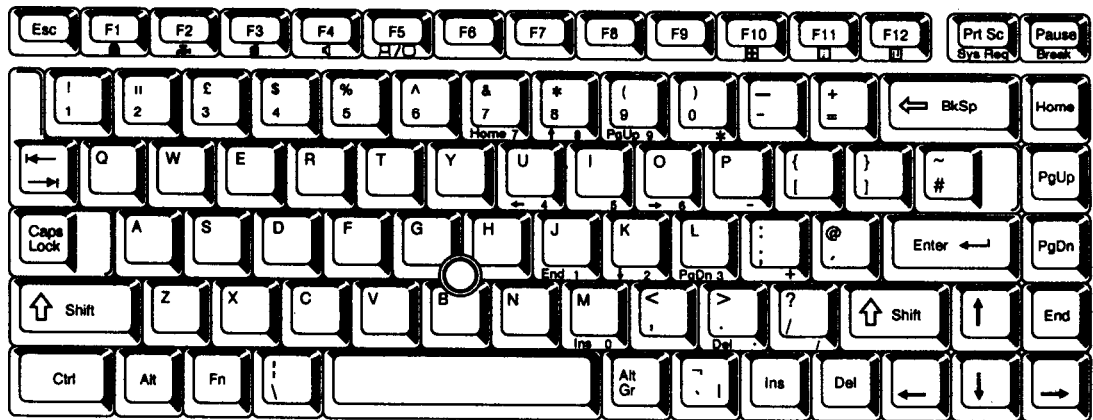
Figure F-2   UK keyboard

F.3   German (GR) Keyboard

Figure F-3 GR keyboard

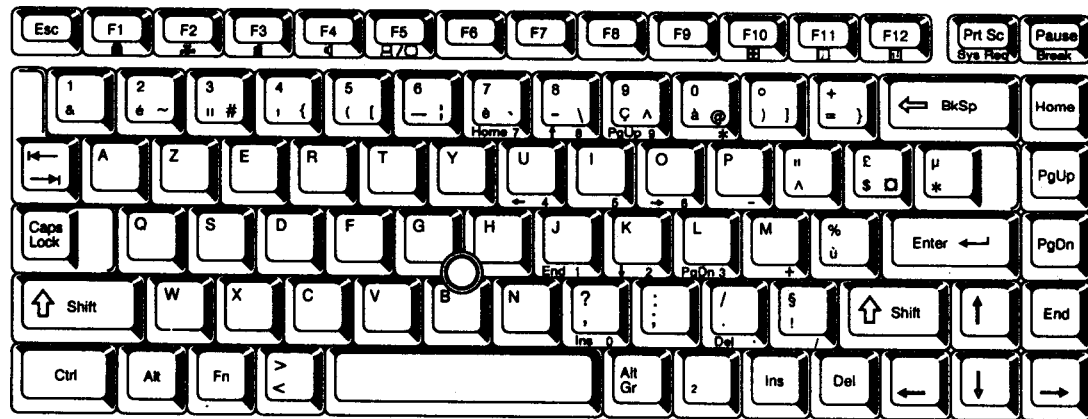## F.4   French (FR) Keyboard

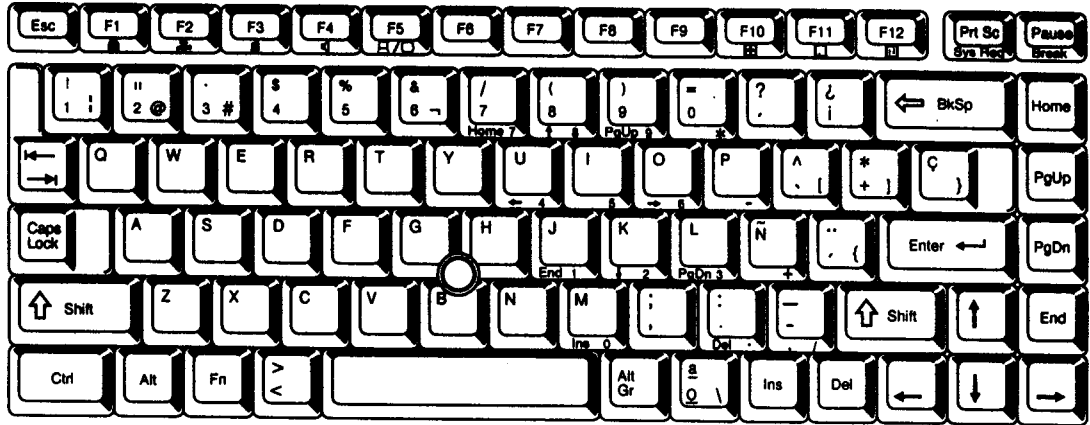*Figure F-4 FR keyboard*

F.5   Spanish (SP) Keyboard

Figure F-5 SP keyboard
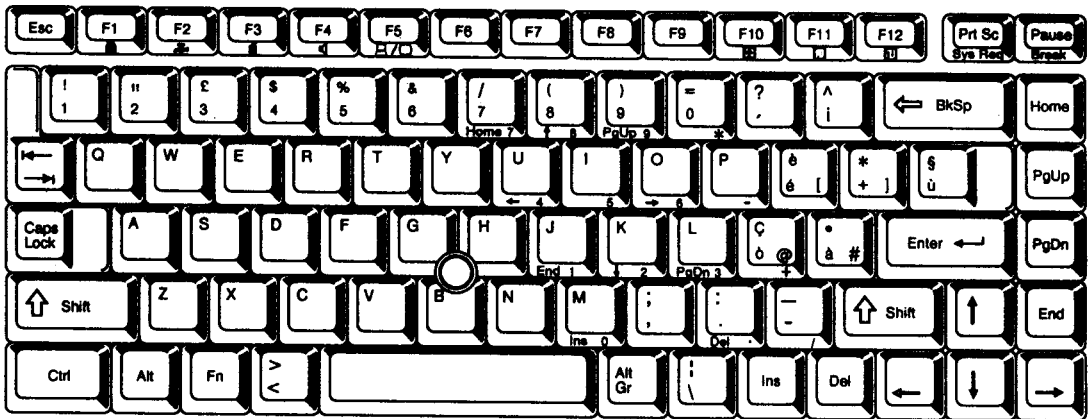
F.6   Italian (IT) Keyboard

Figure F-6 IT keyboard

F.7　Scandinavian (SC) Keyboard

Figure F-7 SC keyboard

F.8　Swiss-German (SL) Keyboard
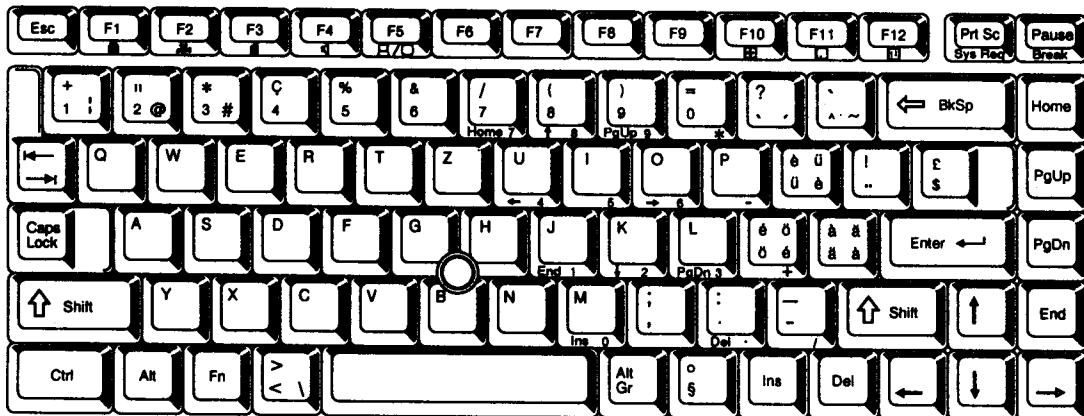

Figure F-8 SL keyboard

F.9   Canadian (Specialized) Keyboard
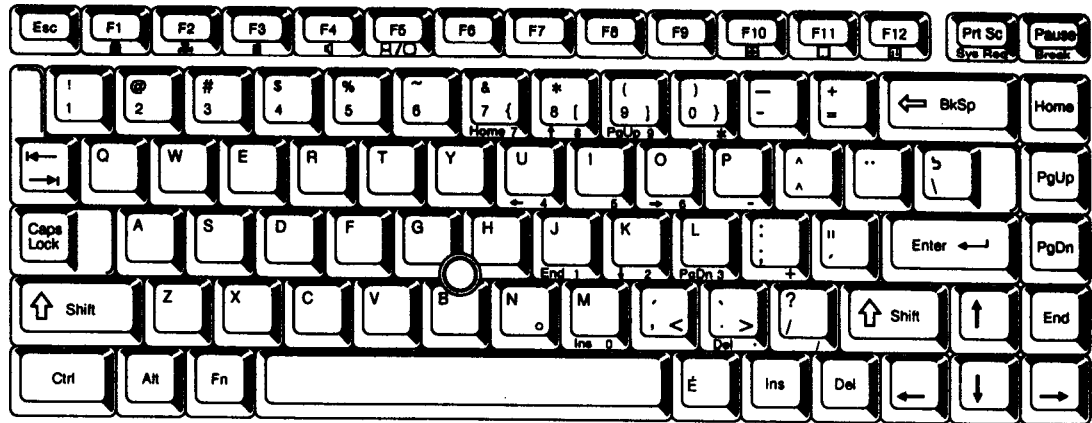

Figure F-9 Canadian keyboard
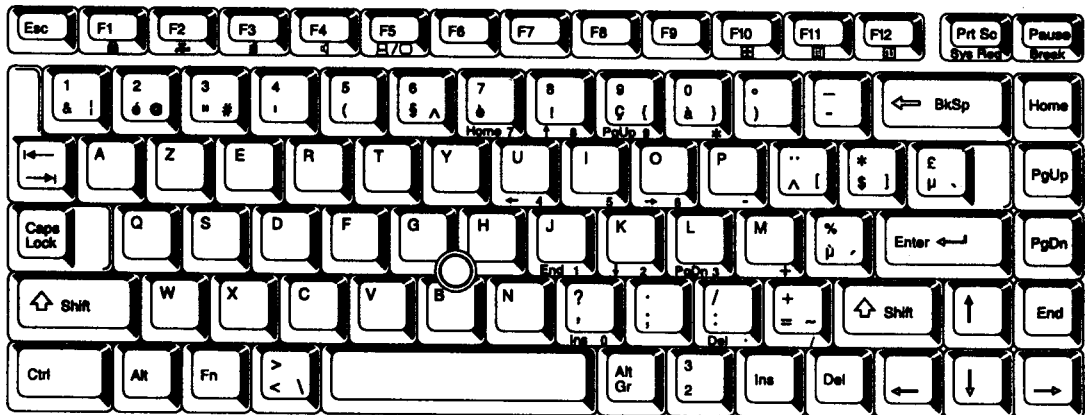
F.10   Belgian Keyboard

Figure F-10 Belgian number keyboard
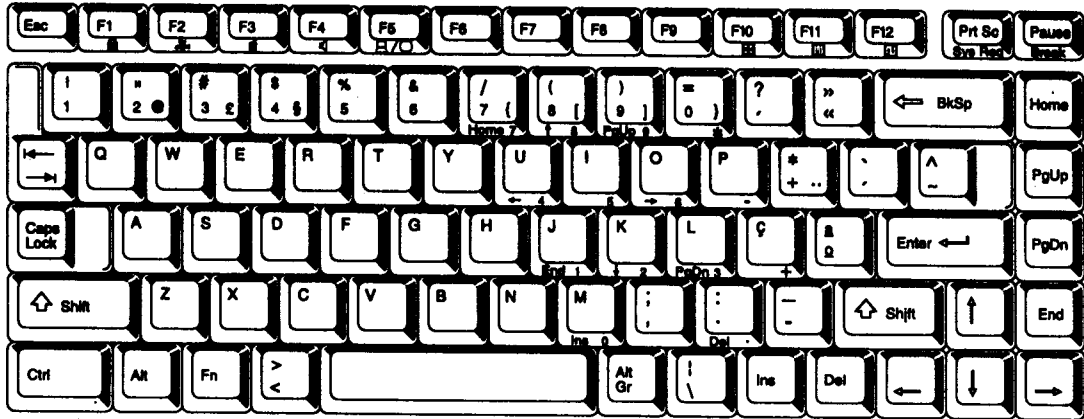
F.11 Portuguese Keyboard

Figure F-11 Portuguese keyboard
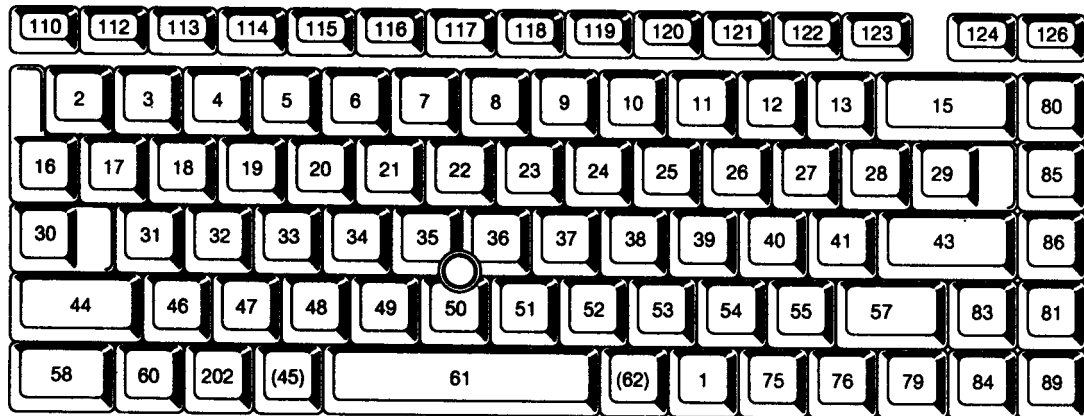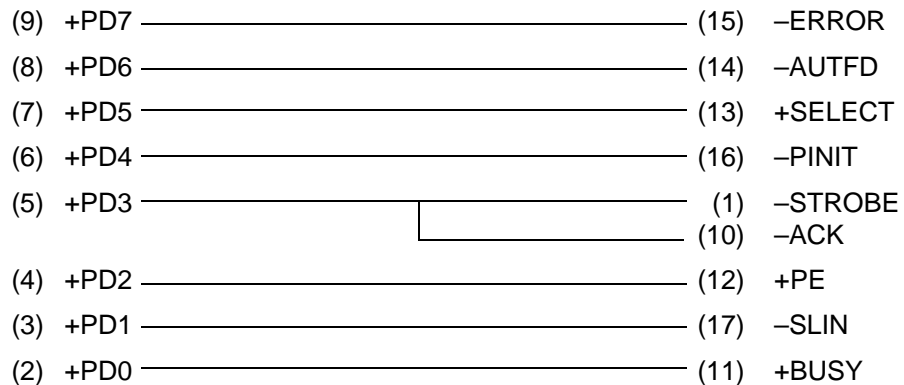
F.12 Keycap Number Keyboard

Figure F-12 Keycap number keyboard

Appendix G Wiring Diagrams

G.1   Printer Wraparound Connector

```
(9)  +PD7 ————————————————————— (15)  −ERROR
(8)  +PD6 ————————————————————— (14)  −AUTFD
(7)  +PD5 ————————————————————— (13)  +SELECT
(6)  +PD4 ————————————————————— (16)  −PINIT
(5)  +PD3 ————————————┐          (1)  −STROBE
                      └————————— (10)  −ACK
(4)  +PD2 ————————————————————— (12)  +PE
(3)  +PD1 ————————————————————— (17)  −SLIN
(2)  +PD0 ————————————————————— (11)  +BUSY
```

Figure G-1 Printer wraparound connecter

G.2   RS-232C Wraparound Connector

```
(3)  TD  ——————————————————————— (2)  RD
(7)  RTS ———————————————┐         (8)  CTS
                        └———————— (1)  CD
(4)  DTR ———————————————┐         (6)  DSR
                        └———————— (9)  RI
```
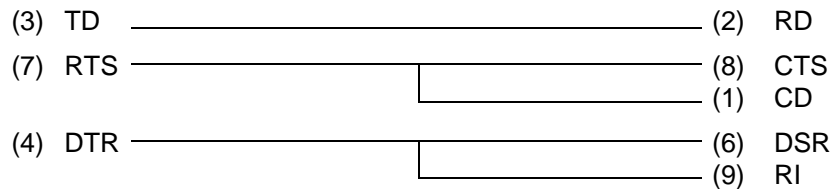
Figure G-2 RS-232-C wraparound connecter

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

```
(3)  TD  ——————————————————————— (2)  RD
(4)  DTR ———————————————┐         (6)  DSR
                        ├———————— (8)  CTS
                        └———————— (9)  RI
(7)  RTS ——————————————————————— (1)  CD
(5)  GND ——————————————————————— (5)  GND
(2)  RD  ——————————————————————— (3)  TD
(1)  CD  ——————————————————————— (7)  RTS
(6)  DSR ———————————————┐         (4)  DTR
(8)  CTS ————————————   │
(9)  RI  ———————————————┘
```
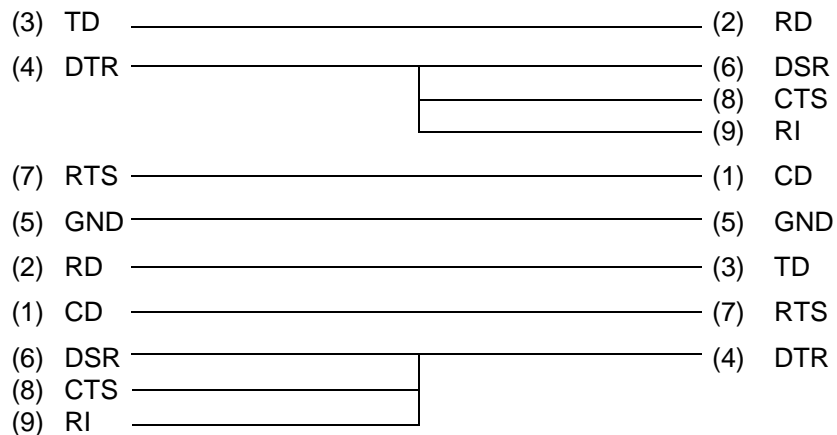
Figure G-3 RS-232-C direct cable (9-pin to 9-pin)

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

```
(1)  CD  ─────────────────────────────  (4)  RTS
(2)  RD  ─────────────────────────────  (2)  TD
(3)  TD  ─────────────────────────────  (3)  RD
(4)  DTR ───────────────┐
                        │              (5)  CTS
                        ├───────────── (6)  DSR
                        └───────────── (22) RI
(5)  GND ─────────────────────────────  (7)  GND
(7)  RTS ─────────────────────────────  (8)  CD
(6)  DSR ───────────────┐              (20) DTR
(8)  CTS ───────────────┤
(9)  RI  ───────────────┘
```
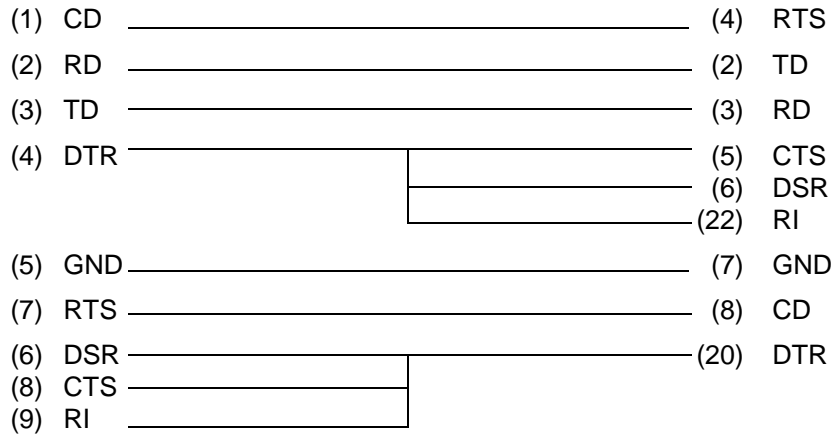
Figure G-4 RS-232-C direct cable (9-pin to 25-pin)

Appendix H   BIOS Rewrite Procedures

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

Tools

To rewrite the BIOS, you need the following tool:

❏   BIOS rewrite disk for T2450CT

Rewriting the BIOS

1.   Set the system to Boot Mode.

2.   Turn off the power to the T2450CT.

3.   Remove the external cable and PCMCIA card.

4.   Turn on the power while holding down the **F12** key. (Keep holding down the key until the system speaker sounds a beep.)

5.   When the BIOS message is displayed, insert the BIOS rewrite disk into the FDD. Press the **Enter** key to start the BIOS rewrite.

6.   When the BIOS rewrite is finished, eject the BIOS rewrite disk and press the reset switch to restart the system.