

1.1 Features

The Toshiba T4500/T4600 Family is one of the lightest and most advanced portable computers available. Utilizing advanced technology and high-speed components, the T4500/T4600 Family offers excellent display legibility, battery operation and IBM PC/AT compatibility. The T4500/T4600 Family system unit consists of the following features:

- ❑ Microprocessor

The T4500 and T4500C uses an i486SX-20 microprocessor that operates at 20 MHz, 3.3 Volts. The T4600 and T4600C uses an i486SL-33 microprocessor that operates at 33 MHz, 3.3 Volts.

- ❑ Cache memory

The T4500/T4600 Family utilizes an 8 KB cache memory stored in either the i486SX or i486SL microprocessor.

- ❑ Disk storage

The T4500 and T4500C have an internal 80, 120, or 200 Megabyte (MB) Hard Disk Drive (HDD) with an average access time of 19 milliseconds. The T4600 and T4600C have an internal 120, 200, or 320 MB HDD. A 3.5-inch Floppy Disk Drive (FDD) supports 2HD floppy disks (1.44 Mbytes) and 2DD floppy disks (720 Kbytes).

- ❑ Memory

The T4500/T4600 Family comes standard with 4 MB of CMOS Random Access Memory (RAM) 3.3 Volts. This includes 640 KB of conventional memory and 3,456 KB of extended memory which can be utilized as expanded memory compatible with the Lotus/Intel/Microsoft Expanded Memory Specifications (LIM-EMS).

- ❑ Monochrome LCD (T4500/T4600)

A high-resolution, Liquid Crystal Display (LCD) displays 640 x 480 pixels with a 64-level gray scale. The T4500 and T4600 internal display controller supports Video Graphics Adapter (VGA) functions on the internal display device.

- ❑ TFT color LCD (T4500C/T4600C)

A high-resolution, Thin Film Transistor (TFT) color Liquid Crystal Display (LCD) displays 640 x 480 pixels with 512 colors for both graphics and characters. The T4500C has an 8.4-inch TFT color display, and the T4600C has a 9.5-inch TFT color display. The T4500C and T4600C internal display controller supports Video Graphics Adapter (VGA) functions on the internal display devices.

- ❑ Keyboard

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

Batteries

The T4500/T4600 Family has three different batteries: a main battery, a backup battery, and a Real Time Clock (RTC) battery.

Expansion port

The T4500/T4600 Family has a unique 150-pin expansion port which attaches to a Desk Station IV or Desk Station IV Plus.

Personal Computer Memory Card International Association (PCMCIA) card slot

The T4500 and T4500C each have one PCMCIA slot, and the T4600 and T4600C each have two PCMCIA slots which enable you to install a Toshiba MiNC card modem or other industry standard PCMCIA card.

Parallel port

The T4500/T4500C's Centronics-compatible parallel interface port serve two purposes. The port can be used to connect a Centronics-compatible printer or an external 5.25-inch floppy disk drive. T4600/T4600C's port is a parallel interface only and does not support an external floppy disk drive.

RS-232-C port

The T4500/T4600 Family has one 9-pin serial interface port.

Mouse port

The T4500/T4600 Family has one 6-pin mouse port on the back that can be connected to an IBM PS/2 mouse.

Keyboard port

The T4500/T4600 Family has one 6-pin keyboard port on the back that can be connected to an IBM PS/2 keyboard.

Microsoft Ball Point mouse with Quick Port (BPQP) connection

The T4500/T4600 Family has one BPQP port on the right.

RGB port

The T4500/T4600 Family has one 15-pin RGB port on the back that can be connected to an external video display.

Memory card slot

The T4500/T4600 Family has one Toshiba optional memory card slot which enables you to install an optional Toshiba memory card.

The T4500/T4600 Family Personal Computer is shown in Figure 1-1. The T4500/T4500C system configuration is shown in Figure 1-2, and the T4600/T4600C system configuration is shown in Figure 1-3.

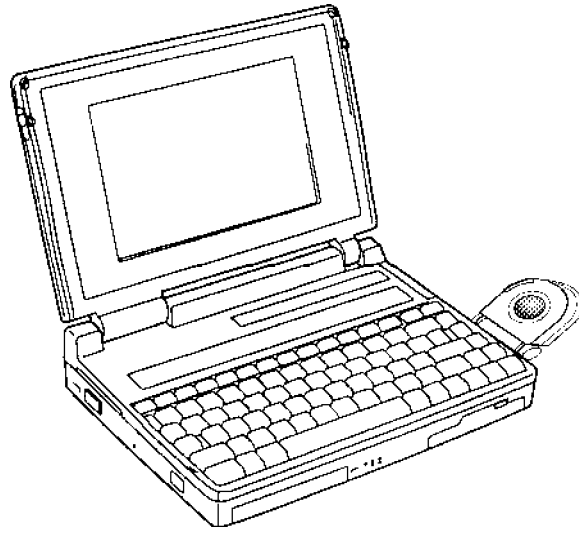


Figure 1-1 T4500/T4600 Family Personal Computer

Figure 1-2 T4500/T4500C System Unit Configuration

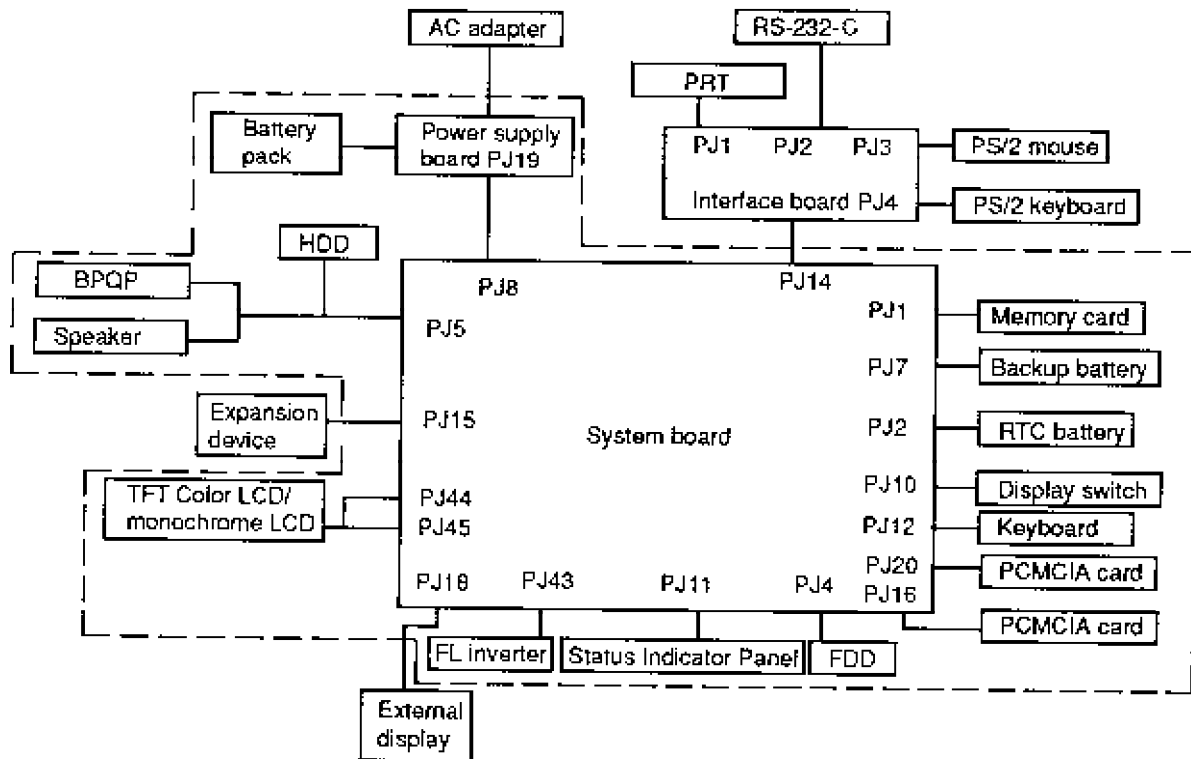


Figure 1-3 T4600/T4600C System Unit Configuration

1.2 System Unit Block Diagram

Figure 1-4 is a block diagram of the T4500/T4500C system unit.

Figure 1-4 T4500/T4500C System Board Block Diagram

The T4500 and T4500C system board shown in Figure 1-4 is composed of the following major components:

- ❑ An i486SX-20 CPU
- ❑ Super Integration (SI) T9901, which stores the following components:
 - Two Direct Memory Access Controllers (DMAC): 82C37
 - Two Programmable Interrupt Controllers (PIC): 82C59
 - One Programmable Interval Timer (PIT): 82C54
 - One Floppy Disk Controller (FDC): TC8565
 - One Serial Input/Output Controller (SIO): TC8570
 - One Variable Frequency Oscillator (VFO): TC8568
 - One I/O Controller
 - One Printer Port Controller
 - One Speaker Controller

- ❑ A Real Time Clock (RTC)

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

- ❑ A Keyboard Controller (KBC)

One M37452M4 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, and ball point quick port.

- ❑ Memory configurations

Standard RAM: 4 MB

Cache memory: 8 KB (inside CPU)

BIOS ROM: 128 KB (96 KB are used)

This Read Only Memory (ROM) contains Initial Reliability Test (IRT), Basic Input/Output System (BIOS), and video BIOS.

Video RAM: 512 KB

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

- ❑ VGA display controller: WD90C26A (144-pin) (3.3 volt operation)

This controller controls internal and external VGA compatible display. It can display the internal and external display at the same time.

❑ Clock Generator receives 14.31818 MHz (X1) and generates the following frequencies:

- 20 MHz for the CPU
- 14.7456 MHz for the COM
- 24 MHz for the FDC and VFO
- 16 MHz is used for GA
- 14.31818 MHz for WD90C26A (for VGA)

OSC (X3) generates 32.768 KHz for RTC.

❑ Gate Array

System Controller Gate Array

This gate array has the following functions:

- Memory Controller
 - DRAM Controller
 - CPU Controller
 - Compatible Bus Interface Controller
- Bus Controller
 - Compatible Bus Interface Controller
 - Compatible Access Controller
 - DMAC Controller
 - I/O Controller
- Address Latch Controller
 - 32-Bit → 16-Bit Controller
 - Address Latch
 - DMA Address Generator
 - Refresh Address Generator
- I/O Register
 - Compatible I/O Port
 - Saving the data of the Register (in resume) Controller
 - Toshiba Special Register
- 20 MHz/10 MHz Controller
 - Data Bus Change Controller
 - Data Latch

Sub LCD Controller Gate Array

This gate array has the following functions:

- Status Indicator Panel Controller
 - LCD Segment Flashing Controller
- Internal Communication Controller
 - KBC/Power Supply Micro Processor/Main CPU Communication Controller
 - KBC/Power Supply Micro Processor Interrupt Controller

IC Card Controller Gate Array

This gate array has the following functions:

- IC Card Controller
 - PCMCIA IC Card Controller
 - Toshiba Modem Card Controller
- EEPROM (for security) Controller
 - KBC-Security-EEPROM Communication Controller
- Others
 - KBC Communication Controller
 - Disable the PRT/FDD Port, HDD Access Controller
 - Suspend/Resume Controller

The block diagram of the T4600 and T4600C system board is shown in Figure 1-5.

Figure 1-5 T4600/T4600C System Board Block Diagram

The T4600 and T4600C system board shown in Figure 1-5 is composed of the following major components:

- ❑ An i486SL-33 CPU

- ❑ One Intel 82360SL

This component is super set with the i486SL microprocessor and stores the following CPU peripheral components:

- Two DMACs 8237 equivalent
- Two PICs 8259 equivalent
- Two PITs 8254 equivalent (T4600 and T4600C uses one PIT.)
- Two SIOs 16450 equivalent (T4600 and T4600C uses one SIO.)
- One RTC MC146818AF equivalent
- One EPP (Enhanced Parallel Port) controller

- ❑ One super integration (SI) T9920

The components include the following:

- One FDC TC8565 equivalent
- One VFO TC8568 equivalent
- One speaker controller

- ❑ A Keyboard Controller (KBC): M37452M4

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

- ❑ The following memories:

Standard RAM: 4 MB

Cache memory: 8 KB (inside CPU)

BIOS ROM: 128 KB (96 KB are used)

This Read Only Memory (ROM) contains Initial Reliability Test (IRT), Basic Input/Output System (BIOS), and video BIOS.

Video RAM: 512 KB

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

- ❑ VGA display controller: WD90C26A (144-pin) (3.3 volt operation)

This controller controls internal and external VGA compatible displays. It can display the internal and external displays at the same time.

- ❑ Clock Generator receives 14.31818 MHz (X1) and generates the following frequencies:
 - 66.6 MHz for the CPU
 - 14.7456 MHz for the COM
 - 24 MHz for the FDC and VFO
 - 16 MHz is used for GA
 - 14.31818 MHz for WD90C26A (for VGA)

OSC (X3) generates 32.768 KHz for RTC (inside of the 82360SL).

- ❑ A Power Supply Controller (PSC): TMP90PH48

- ❑ Gate Array

Sub LCD Controller Gate Array

This gate array has the following functions:

- Status Indicator Panel Controller
 - LCD Segment Flashing Controller
- Internal Communication Controller
 - KBC/Power Supply Micro Processor/Main CPU Communication Controller
 - KBC/Power Supply Micro Processor Interrupt Controller

IC Card Controller Gate Array

This gate array has the following functions:

- IC Card Controller
 - Two cards support PCMCIA Card Controller
 - Toshiba Modem Card Controller
- EEPROM (for security) Controller
 - KBC-Security-EEPROM Communication Controller
- Others
 - KBC Communication Controller
 - Disable the HDD/FDD/SIO Access Controller
 - Suspend/Resume Controller

1.3 3.5-inch Floppy Disk Drive

The T4500/T4600 Family 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 T4500/T4600 Family FDD is shown in Figure 1-6. The specifications for the FDD are described in Table 1-1.

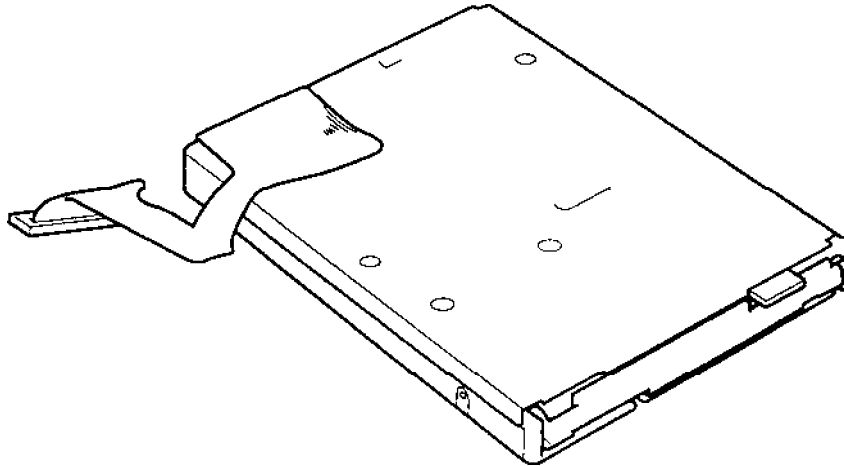


Figure 1-6 3.5-inch FDD

Table 1-1 3.5-inch FDD Specifications

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

1.4 2.5-inch Hard Disk Drive

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

T4500 and T4500C supports the 80 MB, 120 MB, and 200 MB. T4600 and T4600C supports the 120 MB, 200 MB, and 320 MB.

The T4500/T4600 Family HDD is shown in Figure 1-7. Specifications for the HDD are described in Table 1-2.

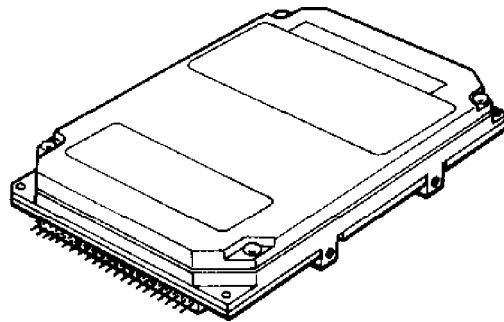


Figure 1-7 2.5-inch HDD

Table 1-2 2.5-inch HDD Specifications

	80MB		120 MB		200 MB	320 MB
	(CP2084)	(MK1422FCV)	(CP2124)	(MK2124FC)	(MK2224FC)	(MK2326FC)
Storage capacity (MB) Formatted	85.4	86.0	121.6	130.1	213.0	340.0
Number of disks	2	1	2	2	2	3
Data heads	4	2	4	4	4	6
Data surfaces	4	2	4	4	4	6
Tracks per surface	1,150	1,501	1,123	1,155	1,560	1,830
Sectors per track	38 (+1)	56 (+1)	53 (+1)	55 (+1)	-	-
Bytes per sector	512	512	512	512	512	512
Access time (ms)						
Track to track	5	3	3	5	3	3
Average	19	15	16	17	12	12
Maximum	40	25	30	36	25	25
Rotation speed (rpm)	3,486	3,600	3,743	3,200	4,000	4,200
Data transfer rate (bps) To/from media	12 M	17.6 M	18 M	15.3 M	18.9 to 31.6 M	18.7 to 29.6 M
Interleave	1:1	1:1	1:1	1:1	1:1	1:1
Recording method	2-7RLL/ 1-7 RLL	1-7 RLL	2-7 RLL/ 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 T4500/T4600 Family system unit. The keyboard is connected to the keyboard controller on the system board through a 19-pin flat cable. The keyboard is shown in Figure 1-8.

See *Appendix F* for optional keyboard configurations.

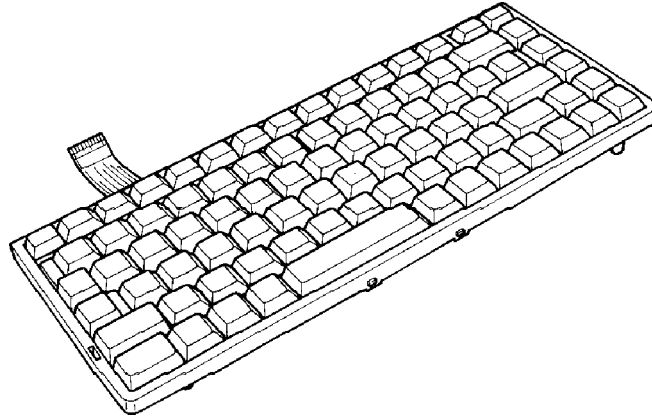


Figure 1-8 Keyboard

1.6 Sidelit Liquid Crystal Display (T4500 & T4600)

The sidelit Liquid Crystal Display (LCD) is composed of an LCD module, a Fluorescent Lamp (FL), and an FL inverter board.

1.6.1 LCD Module (T4500 & T4600)

The T4500/T4600 sidelit LCD supports 640 x 480 pixels with a High Resolution Graphics Sub-system (HRGS) and 64 levels of gray. The HRGS includes the functions of the Video Graphics Array (VGA).

The LCD receives vertical and horizontal synchronizing signals, 8-bit data signals (4-bit upper data signal and 4-bit lower data signal), and shift clock for data transmission. All signals are CMOS-level compatible.

The sidelit LCD is shown in Figure 1-9 and its specifications are described in Table 1-3.

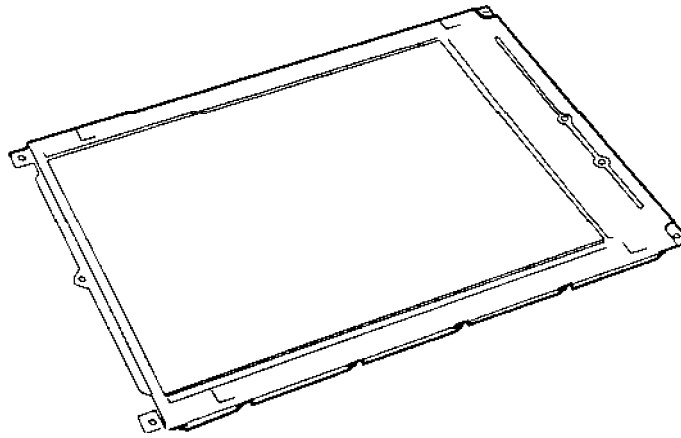


Figure 1-9 Sidelit LCD

Table 1-3 Sidelit LCD Specifications

Item	Specifications
Number of Dots (dots)	640 x 480
Dot pitch (mm)	0.30 (W) x 0.30 (H)
Display area (mm)	192 (W) x 144 (H)
Contrast	17:1 (typically)
FL current (mA)	5.0
FL frequency (KHz)	42

1.6.2 Fluorescent Lamp (FL) Inverter Board (T4500 & T4600)

The FL inverter board supplies the high frequency current needed to illuminate the FL. The specifications for the FL inverter board are described in Table 1-4.

Table 1-4 FL Inverter Board Specifications

Item		Specifications
Input	Voltage (VDC)	10
	Power (W)	2.6
Output	Voltage (VAC)	1,100
	Current (mA)	5.0
	Frequency (KHz)	42
	Current limits (mA)	2.5 ~ 5.0

1.7 TFT Color LCD Display (T4500C & T4600C)

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

1.7.1 TFT Color LCD Module (T4500C & T4600C)

The T4500C and T4600C TFT color LCD is backlit and supports 640 x 480 pixels with a High Resolution Graphics Subsystem (HRGS) and 512 colors for graphics and characters. This HRGS includes the functions of Video Graphics Array (VGA).

The T4500C's LCD receives vertical and horizontal synchronizing signals, 9-bit data signals, data enable signals, and shift clock for data transmission. The T4600C'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 1-10. The specifications for the LCD are described in Table 1-5.

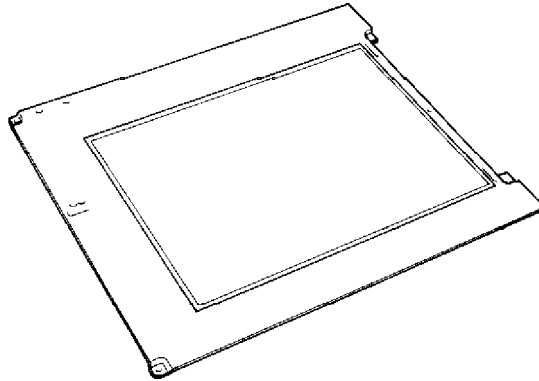


Figure 1-10 TFT Color LCD

Table 1-5 TFT Color LCD Specifications

Item	T4500C	T4600C
Number of Dots (dots)	640 x 480	640 x 480
Dot pitch (mm)	0.267 (W) x 0.27 (H)	0.3 (W) x 0.3 (H)
Display area (mm)	171 (W) x 130 (H)	192 (W) x 144 (H)
Contrast	60:1 (minimum)	60:1 (minimum)
FL current (mA)	5.0	5.0
FL frequency (KHz)	47	47

1.7.2 Fluorescent Lamp (FL) Inverter Board (T4500C & T4600C)

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 1-6.

Table 1-6 FL Inverter Board Specifications

	Item	T4500C	T4600C
Input	Voltage (VDC)	10	18
Output	Power (W)	6	6
	Voltage (VAC)	1,100	1,100
	Current (mA)	5.0	5.0
	Frequency (KHz)	47	47
	Current limits (mA)	3.0 to 5.0	3.0 to 5.0

1.8 Power Supply Board

The power supply board supplies five kinds of voltages to the T4500/T4600 Family system board. The T4500/T4600 Family power supply board has one microprocessor and it operates at 500 KHz (power off) or 20 MHz (power on).

The power supply board performs the following functions:

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

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

Table 1-7 Power Supply Board Output Rating

Use for	Name	DC voltage (V)	Regulation tolerance (%)	Maximum current (mA)	Ripple (mV)
System logic, FDD, HDD	VCC	+5	±5	2,600	100
RS-232-C, Flash ROM	12V	+12	±5	120	240
Display	DSPV	+7.5 to +23	–	7W	–
RAM, CPU	B3V	+3.3	±5	755	66
RS-232-C	M12V	–7 to –12.6	–	10	–

1.9 Batteries

The T4500/T4600 Family has three types of batteries:

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

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

		<i>Table 1-8 Battery Specifications</i>		
Main Battery	Battery name	Material	Output voltage	Capacity
	T4500	Nickel Cadmium	9.6 V	2,400 mAh
	T4500C, T4600, T4600C	Nickel Metal Hydride	9.6 V	3,000mAh
	Backup battery	Nickel Metal Hydride	1.2 V	1,100 mAh
	RTC battery	Lithium-Vanadium	3.0 V	50 mAh

1.9.1 Main Battery

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

The main battery is shown in Figure 1-11.

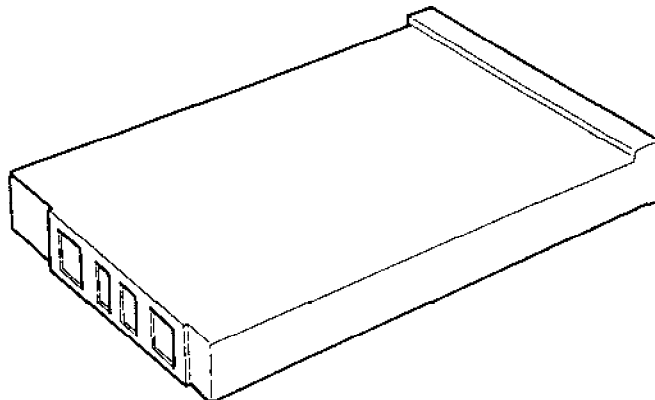


Figure 1-11 Main Battery

Battery Indicator LED

The Battery Indicator LED is located next to the battery pack slot on the front of the T4500/T4600 Family computer and is identified by a battery icon. The indicator shows the status of the removable battery pack, power supply, and AC adapter.

The status of each can be determined by color:

- Orange The battery is being charged. (AC adapter is attached.)
- Green The battery is fully charged. (AC adapter is attached.)
- No light The AC adapter is disconnected from the computer or the AC adapter is attached, 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.

Main Battery's Overload Protective Circuit

The main battery circuit is shown below:

Figure 1-12 Main Battery Circuit (Nickel Cadmium)

Figure 1-13 Main Battery Circuit (Nickel Metal Hydride)

The T4500/T4600 Family's main battery has three devices to prevent circuit overload. Table 1-9 shows the overload specifications.

Table 1-9 Circuit Overload Protection Devices for Main Battery
(Nickel Cadmium/Nickel Metal Hydride)

Protection Method	Rating/Function
❶ Thermal protector Electrical rating Maximum circuit breaker current Allowable operating temperature	12 VDC, 3 A 12 VDC/120 A 60° ~ 75°
❷ Thermal fuse Current rating Voltage rating Temperature rating	10 A 250 V 91° C
❸ Thermal sensor Load resistance Operating temperature limits	(Monitors the battery's temperature) 10 kΩ +1% (at 25° C) -50° ~ 100° C

❶ Thermal protector

When the temperature falls outside the operating range of 60° to 75° C, the thermal protector reduces the current by increasing the internal resistance.

❷ Thermal Fuses

If the temperature exceeds 91° C, the thermal fuses may blow to protect the battery and the system.

WARNING: Never try to use a battery unless its fuses are intact. Do not try to replace a battery fuse or try to bypass a fuse. Using a defective battery can permanently damage the system and can cause injury.

❸ Thermal sensor

The thermal sensor monitors the temperature of the battery.

❹ T line

The thermal sensor monitors the temperature of the battery and changes the voltage in the T line accordingly. The power supply microprocessor monitors the voltage changes in the T

line.

⑤ S line

The power supply microprocessor determines the type of battery by whether the S line is connected to the battery circuit. If the S line is connected to the negative line, the power supply microprocessor determines that a Nickel Metal Hydride Battery is installed in the computer. If the S line is not connected, the power supply microprocessor determines that a Nickel Cadmium Battery is installed in the computer.

1.9.2 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 quick charge: quick charge 1 when the system is powered off, and quick charge 2 when the system is powered on.

<i>Table 1-10 Quick Charge Times</i>		
	Kind of battery	Charging time
Quick charge 1 (power off)	Nickel Cadmium	About 1 hour, 10 minutes
	Nickel Metal Hydride	About 1 hour, 30 minutes
Quick charge 2 (power on)	Nickel Cadmium	1.5 to 4 hours (typical: 2 hours)
	Nickel Metal Hydride	1.5 to 5 hours (typical: 3 hours)

NOTES 1: *The time required for quick charge 2 is affected by the amount of power the system is consuming. Use of the fluorescent lamp and frequent disk access diverts power and lengthens the charge time.*

~~2: *Using quick charge 1, the system CPU automatically stops the charge after two hours regardless of the condition of the battery.*~~

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

1. The battery becomes fully charged
2. The AC adapter or battery is removed.

- The battery or output voltage is abnormal.

Trickle Battery Charge

When the main battery is fully charged and the AC adapter is attached, the microprocessor automatically changes quick charge 1 or 2 to trickle charge.

Detection of full charge

A full charge is detected only when the battery is charging at quick charge. A full charge is detected under any of the following conditions:

- A battery voltage fall is detected.
- The charging time exceeds the fixed limit.
- The thermal rise (+DT) exceeds the fixed limit.
- The battery's temperature is over 60°C.

1.9.3 Backup Battery

The backup battery maintains data for AutoResume and Hard RAM. The power source used to back up the AutoResume or Hard-RAM 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 1-11 shows the charging time and data preservation period of the backup battery.

<i>Table 1-11 Backup Battery Charging/Data Preservation Time</i>		
		Time
Charging Time	Power On	20 H
	Power Off	Doesn't charge

Data preservation period (full charge) 8.0 H

1.9.4 RTC battery

The RTC battery provides power to keep the current date, time and other setup information in memory while the computer is turned off. Table 1-12 shows the charging time and data preservation period of the RTC battery.

<i>Table 1-12 RTC Battery Charging/Data Preservation Time</i>		
		Time
Charging Time	Power On	24 H
	Power Off	24 H

Data preservation period (full charge) 1 month

2.1 T4500/T4600 Family Troubleshooting

Chapter 2 describes how to determine if a Field Replaceable Unit (FRU) in the T4500/T4600 Family is causing the computer to malfunction. The FRUs covered are:

- System PCB
- Floppy Disk Drive
- Hard Disk Drive
- Keyboard
- Display
- Status Indicator Panel

The Diagnostics Disk operations are described in Chapter 3, *Tests and Diagnostics* and detailed disassembly and reassembly procedures are given in Chapter 4, *Replacement Procedures*.

The following tools are necessary for implementing the troubleshooting procedures:

1. A T4500/T4500C Diagnostics Disk or T4600/T4600C Diagnostics Disk
2. A Phillips head screwdriver (2 mm)
3. A Toshiba MS-DOS system disk
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 5.25-inch floppy disk drive (only T4500 and T4500C)
11. An external CRT

2.2 Troubleshooting Flowchart

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

- Ask the user if a password is registered, and if it is, ask him or her to enter it. If the user has forgotten the password, refer to *Appendix H* for information on password deletion.
- Verify with the customer that Toshiba MS-DOS is installed on the hard disk. Non-Toshiba operating systems can cause the computer to malfunction.
- Make sure all optional equipment is disconnected from the computer.
- Make sure the floppy disk drive is empty.

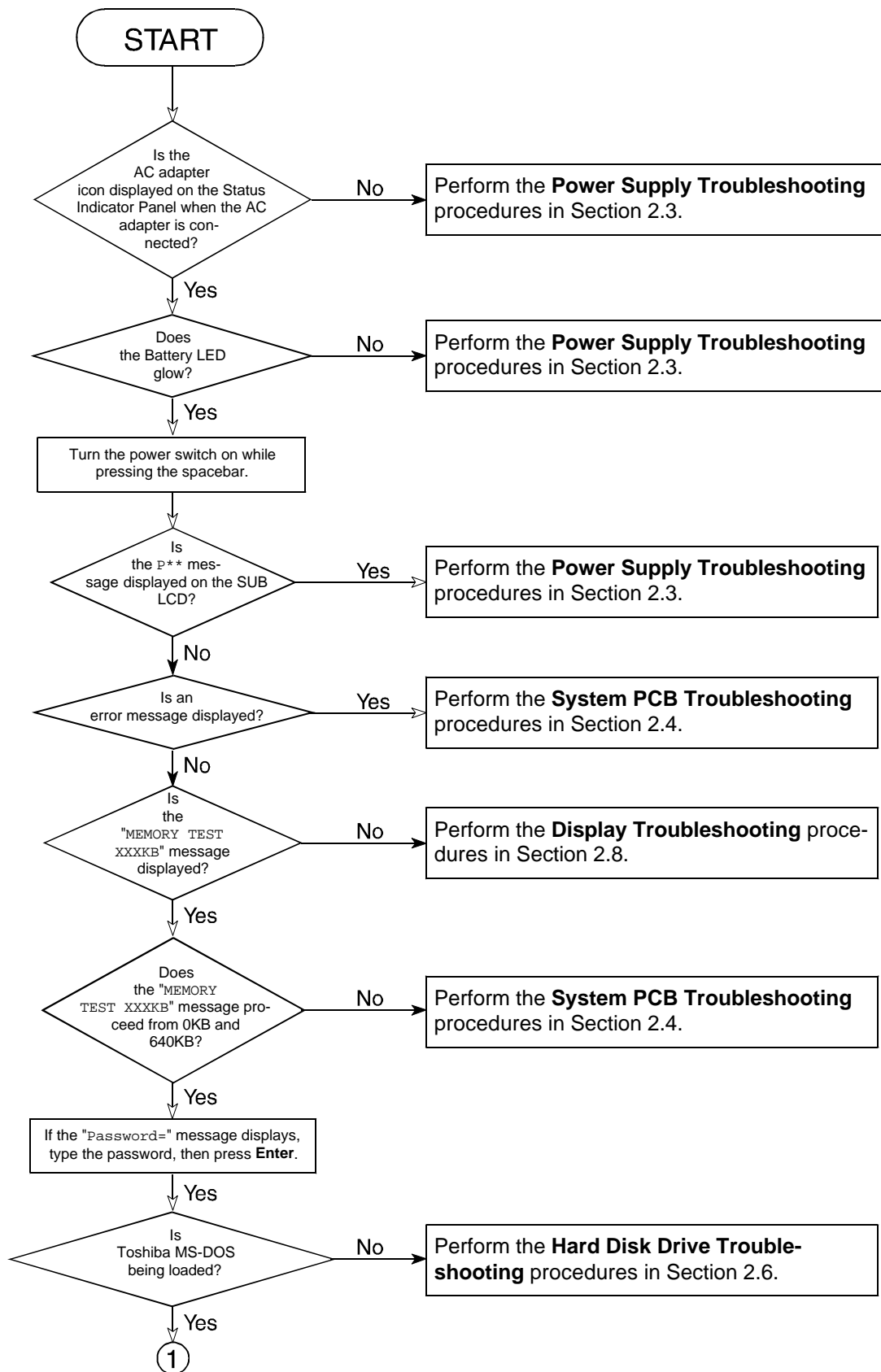


Figure 2-1 Troubleshooting Flowchart (1 of 2)

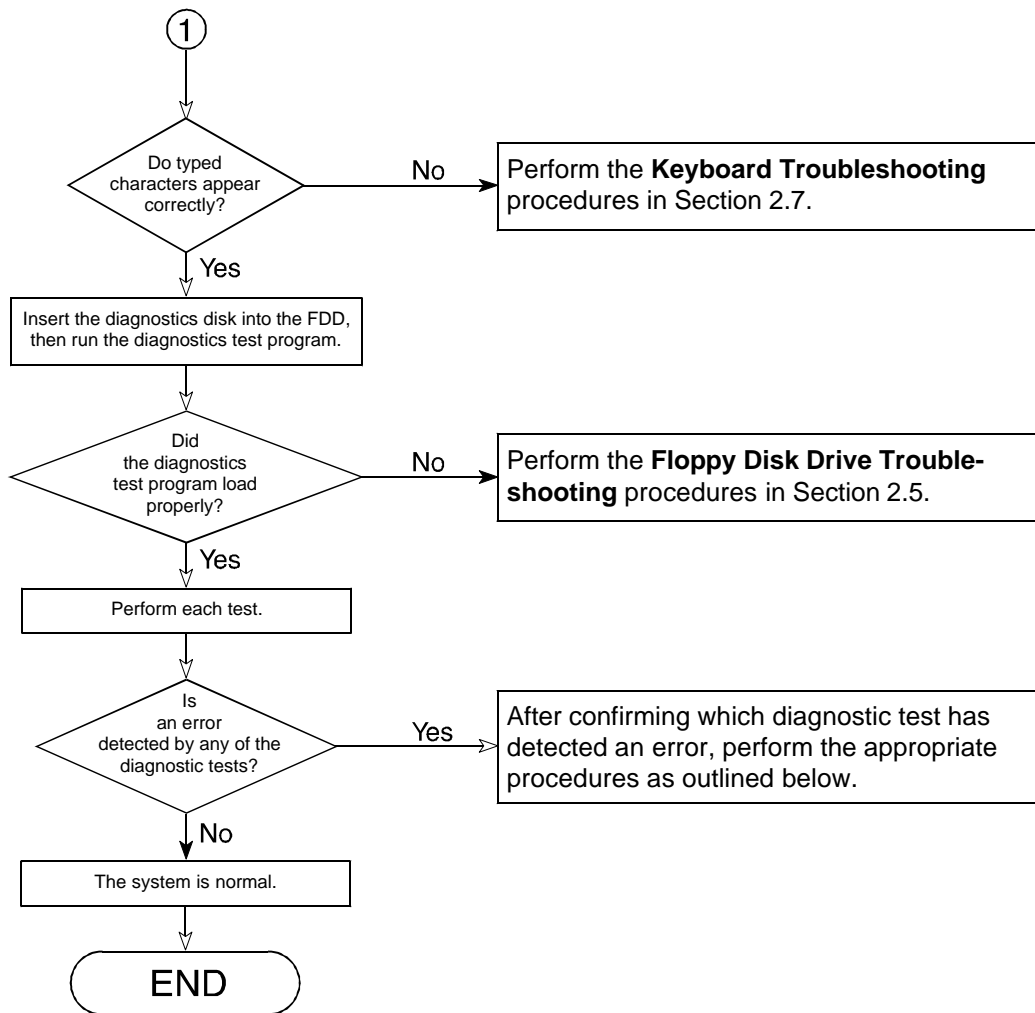


Figure 2-1 Troubleshooting Flowchart (2 of 2)

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 PCB 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 T4500/T4600 Family's power supply controls many functions and components. To determine if the power supply is functioning properly, start with Procedure 1 and continue with the other procedures as instructed. The procedures described in this section are:

Procedure 1: Power Status Check on the Status Indicator Panel

Procedure 2: Battery LED Indicator Check

Procedure 3: Battery Power Check

Procedure 4: System PCB Replacement Check

Procedure 1 Power Status Check on the Status Indicator Panel

The Status Indicator Panel displays the status of the following power-related items:

- AC adapter or Desk Station IV connection status
- System power-on status
- Remaining battery power

If an error status is displayed on the Status Indicator Panel, perform Check 1. If the Battery LED Indicator is flashing red or not glowing, go to Procedure 2. If the three icons listed above are not displayed, go to Procedure 3.

NOTE: The power supply microprocessor monitors the status of the power supply. When it detects an error, the error is displayed on the Status Indicator Panel.

Check 1: Read the error status in the battery power indicator area on the Status Indicator Panel.

Table 2-1 Outline of Power Supply Error Status

Status	Source of Error
P0*	AC Adapter or Desk Station IV error
P1*	Battery error
P2*	VCC Output error
P3*	B3V Output error
P4*	12V Output or M12V Output error
P5*	Power Supply Microcomputer error
P6*	Power On error
P8*	Environment

Adapter (AC Adapter or Desk Station)

Status	Meaning
P01	AC Adapter Voltage is over the maximum allowable limit.
P02	Desk Station Voltage is over the maximum allowable limit.

Battery

Status	Meaning
P10	Charge current is over the maximum allowable limit.

VCC Output

Status	Meaning
P20	VCC Voltage is over the maximum allowable limit.
P21	VCC Voltage is below the minimum allowable limit.
P22	VCC Voltage is output at a low level (does not fall to zero) while the power is off.

B3V Output

Status	Meaning
P30	B3V Voltage is over the maximum allowable limit.
P31	B3V Voltage is below the minimum allowable limit.
P32	B3V Voltage is not within the normal range while the system is on.
P33	B3V Voltage is not within the normal range while the system is in the resume mode or Hard-RAM is enabled.

Output Voltage (12V or M12V)

Status	Meaning
P40	12V Voltage is over the maximum allowable limit.
P41	12V Voltage is below the minimum allowable limit.
P42	M12V Voltage is not within the normal range

❑ **Power Supply Microprocessor**

Status	Meaning
P50	Firmware error.
P52	Program error.

❑ **Power Supply On/Off Sequence**

Status	Meaning
P60	VCC and B3V error.

❑ **Environment**

Status	Meaning
P80	Temperature is over 70°C or under -20°C

Check 2: When **P02** is displayed, perform the following steps:

1. Make sure the Desk Station IV is firmly connected to the computer's expansion bus port. If this port is connected correctly, proceed to step 2:
2. Replace the Desk Station IV with a new one. If the status still exists, go to Check 4.

Check 3: When **P01** is displayed, perform the following steps:

1. Make sure the AC adapter's cable and AC cord are firmly plugged into the DC IN 15 V socket and wall outlet. If these cables are connected correctly, proceed to step 2:
2. Connect a new AC adapter. If the status still exists, go to Check 4.

Check 4: When **P10** is displayed, perform the following steps:

1. Make sure the battery pack is correctly installed in the computer. If the battery pack is correctly installed, proceed to step 2:
2. Replace the battery pack with a new one. If the status still exists, go to Procedure 4.

Check 5: When **P80** is displayed, perform the following steps:

1. Move the computer to an area where the temperature is between 20°C and 70°C. If the status still exists, go to Procedure 4.

Check 6: When **P20, P21, P22, P30, P31, P32, P33, P40, P41, P42, P50** or **P60** is displayed, go to Procedure 4.

Procedure 2 Battery LED Check

The Battery LED, identified by a battery icon on the front of the T4500/T4600 Family computer, indicates the battery charging status.

- If the Battery LED indicator glows green, the AC adapter is connected and the battery is fully charged.
- If the Battery LED indicator glows amber, the AC adapter is connected and the battery is being charged.
- If the Battery LED indicator flashes red only 10 times, the sub LCD (Status Indicator Panel) controller gate array on the System PCB or Power supply microprocessor may be malfunctioning. Go to Procedure 4.
- 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 15V socket and wall outlet. If these cables are connected correctly, go to Check 2.

Check 2: Connect a new AC adapter. If the Battery LED indicator still does not glow, go to Check 3.

Check 3: Make sure the battery pack is installed in the computer correctly. If the battery pack is installed correctly, go to Check 4.

Check 4: Install a new battery pack. If the Battery LED indicator still does not glow, go to Procedure 4.

Procedure 3 Battery Power Check

The Status Indicator Panel displays the remaining battery power as shown in Table 2-2.

Table 2-2 Battery Power Status

Battery	AC adapter	Battery Power (Status Indicator Panel)
Not installed	–	Does not display
Installed	Not connected	Time or percent (selected in Setup program)
	Connected	Only percent

If the battery power is not displayed as indicated in Table 2-2, go to Check 1.

Check 1: Make sure the AC adapter's cable and AC cord are firmly plugged into the DC IN 15V socket and wall outlet. If these cables are connected correctly, go to Check 2.

Check 2: Connect a new AC adapter. If the Status Indicator Panel does not change, go to Check 3.

Check 3: Make sure the battery pack is installed in the computer correctly. If the battery pack is installed correctly, go to Check 4.

Check 4: Install a new battery pack. If the Battery Charging Status indicator still does not change, go to Section 2.9, *Status Indicator Panel Troubleshooting*.

Procedure 4 System PCB Replacement Check

The System PCB incorporates both the system board and the power supply board into one unit. Power is transferred to the power supply board through the **DC IN 15 V** plug located on the power supply board. If either the power supply board or the system board is damaged, replace the System PCB.

Refer to Chapter 4, *Replacement Procedures*, for instructions on how to disassemble the T4500/T4600 Family computer, and then perform the following check:

Check 1: Replace the System PCB with a new one and restart the system. If the problem still exists, other FRUs may be damaged.

2.4 System PCB 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

Procedure 3: Diagnostic Test Program Execution Check

Procedure 4: System PCB 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 3.

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 configuration ***
Check system. Then press [F1] key
- (e) *** Error in CMOS. Bad time function ***
Check system. Then press [F1] key

Check 2: If the following (a) or (b) error message is displayed on the screen, press any key as the message instructs.

Error message (a) appears when data stored in RAM under the resume function is lost because the battery has become discharged.

Error message (b) appears when the error is detected during a read test of the Hard RAM or the data in the Hard RAM is lost because the battery has become discharged.

If any other message appears, perform Check 3.

- (a) WARNING: RESUME FAILURE.
PRESS ANY KEY TO CONTINUE.
- (b) WARNING: DATA IN HARD-RAM WAS LOST.
YOU MUST FORMAT HARD-RAM BEFORE USE.
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 (17), (19), (20), (25) or (26) is displayed, replace the System PCB.

If error message (18) is displayed, go to the Keyboard Troubleshooting procedures in section 2.7.

If error message (21) or (22) is displayed, go to the Hard Disk Drive Troubleshooting procedures in section 2.6.

If error message (23) or (24) is displayed, go to the Floppy Disk Drive Troubleshooting procedures in section 2.5.

- (1) TIMER CH.2 OUT ERROR
- (2) PIT ERROR
- (3) MEMORY REFRESH ERROR
- (4) FIRST 64KB MEMORY ERROR
- (5) RTC ERROR
- (6) CRTC ERROR
- (7) VRAM ERROR
- (8) KBC ERROR
- (9) SYSTEM MEMORY ERROR

- (10) SYSTEM MEMORY PARITY ERROR
- (11) EXTENDED MEMORY ERROR
- (12) EXTENDED MEMORY PARITY ERROR
- (13) DMA PAGE REGISTER ERROR
- (14) DMAC #1 ERROR
- (15) DMAC #2 ERROR
- (16) PIC #1 ERROR
- (17) PIC #2 ERROR
- (18) KEYBOARD ERROR
- (19) KBC ERROR
- (20) HDC ERROR
- (21) HDD #0 ERROR
- (22) HDD #1 ERROR
- (23) NO FDD ERROR
- (24) FDD ERROR
- (25) TIMER INTERRUPT ERROR
- (26) RTC UPDATE ERROR

Procedure 2 Printer Port LED Check

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

NOTE: When you perform this check, the external FDD/PRT (T4500 and T4500C) or parallel port (T4600 and T4600C) option in the SETUP program must be set to PRT (T4500 and T4500C) or LPT1 (T4600 and T4600C).

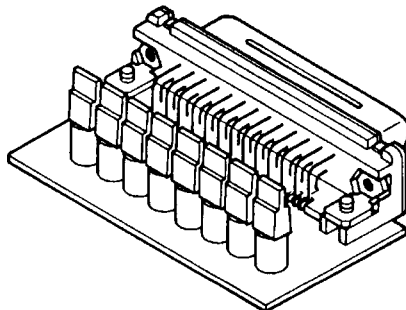


Figure 2-2 Printer Port LED

To use the printer port LED, follow these steps:

1. Turn off the computer's power.
2. Plug the printer port LED into the T4500 and T4500C's PRT/FDD connector or T4600 and T4600C's printer connector.
3. Hold down the space bar and turn on the computer's power.
4. Read the LED status from left to right as you are facing the back of the computer.
5. Convert the status from binary to hexadecimal notation.
6. If the final LED status is FFh (normal status), go to Procedure 3.
7. If the final LED status matches any of the test status values in Table 2-2, 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 22 and halts, the IRT test has already completed the KBC test. In this instance, the IRT indicates an error with the system memory test.*

Table 2-3 Printer Port LED Error Status (1 of 2)

Error status	Test item	Message
01H	Pre-init for warm start test	--
05H	PIT test	TIMER CH.2 OUT ERROR
		PIT ERROR READ DATA = XXH WRITE DATA = XXH
06H	PIT initialization	--
07H	PIT function test	MEMORY REFRESH ERROR
0AH	First 64KB memory test	FIRST 64KB MEMORY ERROR
0BH	System memory initialization	--
0DH	Interrupt vector initialization	--
15H	RTC test	RTC ERROR READ DATA = XXH WRITE DATA = XXH
16H	CMOS RAM test	****Error in CMOS. Bad battery**** ****Error in CMOS. Bad check sum**** ****Error in CMOS. Bad configuration**** ****Error in CMOS. Bad memory size**** ****Error in CMOS. Bad HDD type**** ****Error in CMOS. Bad time function**** Check system. Then press [F1] key
18H	PIC initialization	--
1FH	Display initialization	CRTC ERROR
		VRAM ERROR READ DATA = XXXXXXXXH WRITE DATA = XXXXXXXXH
22H	KBC test	KBC ERROR
25H	System memory test	SYSTEM MEMORY ERROR ADDRESS = XXXXXXXXH READ DATA = XXXXXXXXH WRITE DATA = XXXXXXXXH
		SYSTEM MEMORY PARITY ERROR ADDRESS = XXXX0000H - XXXXFFFFH
30H	Extended memory test	EXTENDED MEMORY ERROR ADDRESS = XXXXXXXXH READ DATA = XXXXXXXXH WRITE DATA = XXXXXXXXH
		EXTENDED MEMORY PARITY ERROR ADDRESS = XXXX0000H - XXXXFFFFH
40H	DMA page register test	DMA PAGE REGISTER ERROR READ DATA = XXH WRITE DATA = XXH
41H	DMAC test	DMAC #1 ERROR READ DATA = XXXXH WRITE DA = XXXXH
		DMAC #2 ERROR READ DATA = XXXXH WRITE DATA = XXXXH
42H	DMAC initialization	--

Table 2-3 Printer Port LED Error Status (2 of 2)

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

Check 1: If any of the following error codes are displayed, replace the System PCB with a new one.

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

Check 2: If Error Code **4Ah** is displayed, go to the Keyboard Troubleshooting procedures in Section 2.7.

Check 3: If Error Code **5Ah** is displayed, go to the Hard Disk Drive Troubleshooting procedures in Section 2.6.

Check 4: If Error Code **60h** is displayed, go to the Floppy Disk Drive Troubleshooting procedures in Section 2.5.

Procedure 3 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

If an error is detected during these tests, replace the System PCB with a new one.

Procedure 4 System PCB Replacement Check

The System PCB may be damaged. Disassemble the T4500/T4600 Family computer following the steps described in Chapter 4, *Replacement Procedures*, and perform the following checks:

- Check 1:** Replace the System PCB. Refer to Chapter 4 for instructions on how to remove and replace the unit.
- Check 2:** If normal operation is restored after replacing the System PCB, the original unit is probably defective.
- Check 3:** If normal operation is not restored, another FRU is probably defective. The defective unit must be isolated by performing the T4500 series (T4500/C) Diagnostics Program or the T4600 series (T4600/C) Diagnostics Program on the ASP Diagnostics Diskette.

2.5 Floppy Disk Drive Troubleshooting

This section describes how to determine if the T4500/T4600 Family's internal 3.5-inch floppy disk drive is functioning properly. Perform the steps below starting with Procedure 1 and continuing with the other procedures as required.

Procedure 1: FDD Head Cleaning Check

Procedure 2: External 5.25-inch FDD Check (T4500 or T4500C only)

Procedure 3: Diagnostic Test Program Check

Procedure 4: Connector Check and Replacement Check

Procedure 1 FDD Head Cleaning Check

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

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

If the test program cannot be executed on the T4500 series, go to Procedure 2. If the test program cannot be executed on the T4600 series, go to Procedure 4.

Procedure 2 External 5.25-inch FDD Check (T4500 or T4500C only)

NOTE: The T4600 or T4600C (T4600 series) does not support an external FDD. Therefore, all references to an external FDD (3.5-inch or 5.25-inch) relate to the T4500 or T4500C (T4500 series) computer.

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

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

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

Check 2 Replace the System PCB with a new one following the steps in Chapter 4, *Replacement Procedures*.

Procedure 3 Diagnostic Test Program Execution Check

The floppy disk drive diagnostic test program is stored on the ASP Diagnostics Diskette. After loading Toshiba MS-DOS, run the diagnostic program. Refer to Chapter 3, *Tests and Diagnostics*, for more information about the diagnostic 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 2-4 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.

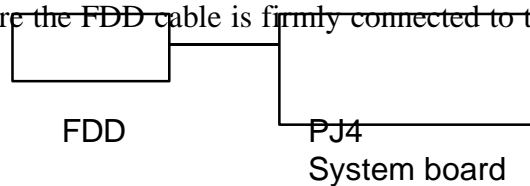
Write protected

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

Procedure 4 Connector Check and Replacement Check

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

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



If this cable is disconnected, connect it to the System PCB and repeat Procedure 3. If the FDD is still not functioning properly, perform Check 2.

Check 2: The FDD or its attached 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 System PCB with a new one following the steps in Chapter 4, *Replacement Procedures*.

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 hard disk BACKUP procedures.*

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 computer'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.

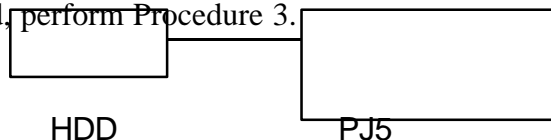
Insert system disk in drive
Press any key when ready
or
Non-System disk or disk error
Replace and press any key

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

System transferred

Check 4: The HDD is connected to the system board through an HDD flexible cable. This cable can become disconnected or damaged. Disassemble the computer as described in Chapter 4, *Replacement Procedures*. If the HDD is not connected, connect it to the system board and return to Procedure 1. If the HDD is firmly connected to the system board, perform Procedure 3.



System Board

Procedure 3 Format Check

The computer'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 T4500/T4600 Family 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 command.

Format complete

If you cannot format the HDD using the Test and Diagnostic program, go to Procedure 4.

Procedure 4 Diagnostic Test Program Execution Check

The HDD test program is stored on the ASP Diagnostics Diskette. 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 described in Table 2-4. If an error code is not generated, the HDD is operating properly.

<i>Table 2-5. Hard Disk Drive Error Code and Status</i>			
Code	Status	Code	Status
01h	Bad command	20h	HDC error
02h	Bad address mark	40h	Seek error
04h	Record not found	80h	Time-out error
05h	HDC not reset	AAh	Drive not ready
07h	Drive not initialized	BBh	Undefined error
09h	DMA boundary error	CCh	Write fault
0Ah	Bad sector error	DDh	Total time-out error
0Bh	Bad track error	E0h	Status error
10h	ECC error	FFh	Data compare error

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

Check 2: Replace the System PCB with a new one following the instructions in Chapter 4, *Replacement Procedures*.

2.7 Keyboard Troubleshooting

To determine if the computer'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

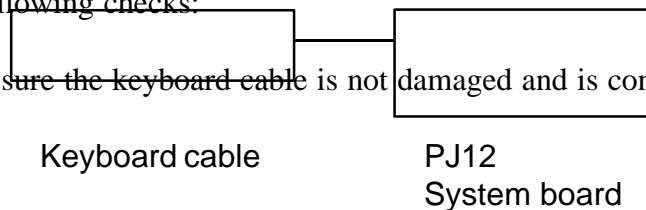
Execute the Keyboard Test in the Diagnostic Program. Refer to Chapter 3, *Tests and Diagnostics*, for more information on how to initiate the test program.

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

Procedure 2 Connector and Replacement Check

The keyboard is connected to the system board by a 19-pin flat cable. This cable may be disconnected or damaged. Disassemble the computer as described in Chapter 4, *Replacement Procedures*, and perform the following checks:

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



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

Check 2: The keyboard controller on the system board may be damaged. Replace the System PCB, which contains the system board, with a new one. Refer to Chapter 4, *Replacement Procedures* for more information about how to replace the System PCB.

2.8 Display Troubleshooting

This section describes how to determine if the T4500/T4600 Family's display is functioning properly. Start with Procedure 1 and continue with the other procedures as instructed.

Procedure 1: Brightness and Contrast Control Check

Procedure 2: External CRT Check

Procedure 3: Diagnostic Test Program Execution Check

Procedure 4: Connector Check

Procedure 5: Replacement Check

Procedure 1 Brightness and Contrast Control Check

Brightness and contrast may be changed by using Hot keys. If the display is blank, go to Check 1. If you cannot change the brightness and contrast, go to Check 3.
--

NOTE: The contrast control is effective only on the T4500 or T4600 monochrome LCD. You cannot change the contrast on the T4500C or T4600C Color LCD.

If the contrast does not change when you execute the following checks, perform Procedure 2.

Check 1: Pressing **Fn + F5** selects the active display device. Each time you press **Fn + F5**, the active display device changes in the following order: LCD; Dual Display (which activates both the LCD and CRT); and CRT.

If the display is still blank, go to Check 2.

Check 2: Pressing **Fn + F1** sets the computer in the instant security mode. Once set in this mode, the display becomes blank and the keyboard is locked to prevent others from gaining access to your computer. To restore the computer from the instant security mode, enter the instant password or turn the power off and back on.

Check 3: Pressing the **Fn + arrow** key increases or decreases the brightness of both the color and monochrome LCD panel ~~increases the brightness of the LCD panel.~~

Decreases the brightness of the LCD panel.

Increases the contrast of the LCD panel. This key is effective only on the T4500/T4600 monochrome LCD.

Decreases the contrast of the LCD panel. This key is effective only on the T4500/T4600 monochrome LCD.

Procedure 2 External CRT Check

Connect the external CRT to the computer's external monitor port, then press **Fn + F5**.

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

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

Procedure 3 Diagnostic Test Program Execution Check

The Display Test program is stored on the ASP Diagnostics Diskette. This program checks the display controller on the system board. After loading Toshiba MS-DOS, run the Diagnostics

Program. Refer to Chapter 3, *Tests and Diagnostics*, for details.

Procedure 4 Connector Check

The Display unit has an LCD module, FL unit (T4500 and T4500C), LED board, Display switch, and FL inverter board. The FL unit (T4500C) 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 information about how to

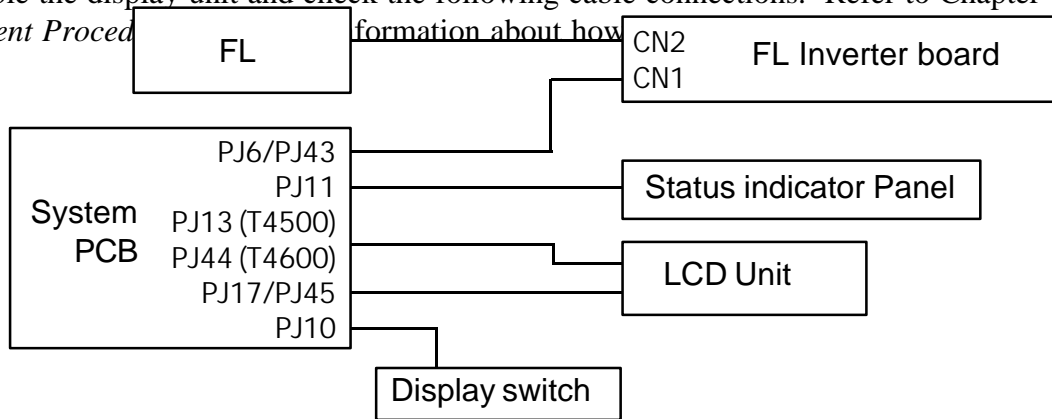


Figure 2-3 T4500/T4600 Display Connection

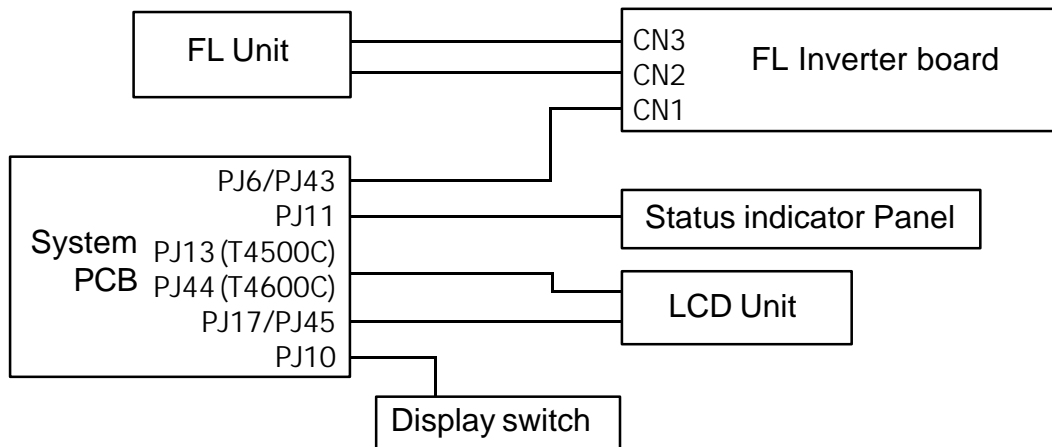


Figure 2-4 T4500C/T4600C Display Connection

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

Procedure 5 Replacement Check

The FL or FL unit, FL inverter board, LCD module, LED board, and System PCB 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 or FL unit 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 or FL unit remains lit when the display is closed, perform Check 4.

Check 1: Replace the FL (T4500 or T4600) or FL unit (T4500C or T4600C) with a new one and test the display again. If the problem still exists, perform Check 2.

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

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

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

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

Check 6: Replace the display cable with a new one and test the display again. If the problem still exists, perform Check 7.

Check 7: The system board may be damaged. Replace the System PCB with a new one and test the display again.

2.9 Status Indicator Panel Troubleshooting

To determine if the T4500/T4600 Family's Status Indicator Panel 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 Status Indicator Panel 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 status indicator panel is connected to the system board. This cable may be disconnected or damaged. Disassemble the computer as described in Chapter 4, *Replacement Procedures*, and perform the following checks:

Check 1: Make sure the keyboard cable is not damaged and is connected to the System PCB.

Status Indicator Panel Cable

PJ11 System PCB

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

Check 2: The status indicator panel controller on the system board may be damaged. Replace the System PCB with a new one. Refer to Chapter 4, *Replacement Procedures* for more information about how to replace the System PCB.

3.1 The Diagnostic Test

This chapter explains how to use the T4500/T4600 Family computer's Diagnostic Test program (TESTCE45 for T4500/T4500C, TESTCE46 for T4600/T4600C) to test the functions of the computer's hardware modules. The Diagnostics Program is stored on the ASP Diagnostics Diskettes, which are updated with every new product release. We encourage you to copy and distribute this diskette within your organization. The Diagnostic Test consists of 17 programs that are grouped into the Service Program Module (DIAGNOSTIC MENU) and the Test Program Module (DIAGNOSTIC TEST).

The DIAGNOSTIC MENU consists of the following eight functions.

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

The DIAGNOSTIC TEST option contains the following nine functional tests:

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

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

- The ASP Diagnostics Diskette (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
- 5.25-inch 2D disk for external 5.25-inch FDD (T4500/4500C only)
- A cleaning kit to clean the floppy disk drive heads (Head Cleaning)
- A printer wraparound connector for the printer wraparound test (Printer test)
- An RS-232-C wraparound connector for the RS-232-C port wraparound test (Async test)

The following sections detail the tests within the Diagnostic Test function of the DIAGNOSTIC TEST MENU. Refer to Sections 3.16 through 3.22 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 diagnostics program. To start the diagnostics program, follow these steps:

1. Turn on the computer, and allow the computer to boot. Insert the ASP Diagnostics diskette in the computer's internal floppy disk drive.
2. At the system prompt, change to drive A and type **TESTCE45** for T4500/T4500C or **TESTCE46** for T4600/T4600C, and press **Enter**.

NOTE: You cannot run the diagnostics program on a computer that has loaded an expanded memory manager such as EMM386 or Quarterdeck's QEMM into memory. If you try to run diagnostics with EMM386 loaded, you will get the following message:

Cannot execute in a virtual 8086 mode.

To run the diagnostics program, you must:

- Deactivate the line in the CONFIG.SYS file that loads the device driver for the expanded memory manager by using the DOS batch command "REM." You may also rename the CONFIG.SYS file (to keep it from executing upon bootup).
- Reboot the computer.
- Insert the ASP Diagnostics diskette into the FDD and continue with Step 2 above.

When testing is complete, don't forget to restore the CONFIG.SYS file to its original state.

TOSHIBA personal computer T4xxx DIAGNOSTICS
version X.XX (c) copyright TOSHIBA Corp. 19XX

DIAGNOSTICS MENU :

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

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

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

- To display 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 T4X00 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 (T4600/T4600C only)
 11 - EXPANSION TEST (T4600/T4600C only)
 88 - FDD & HDD ERROR RETRY COUNT SET
 99 - EXIT TO DIAGNOSTICS MENU
```

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

Refer to Sections 3.4 through 3.13 for detailed descriptions of Diagnostic Tests 1 through 10. 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.

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

```
SYSTEM TEST      XXXXXXXX
```

```
[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
99 - Exit to DIAGNOSTIC TEST MENU
```

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

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

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

```
TEST LOOP : YES
ERROR STOP: YES
```

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

Selecting **YES** for the TEST LOOP sets the test to run continuously until it is halted by the user. Selecting **NO** returns the sub-test menu to the main menu after the test is complete.

Selecting **Yes** for ERROR STOP 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 beginning.

Use the arrow keys to move the cursor to the desired option and press **Enter**. Selecting **NO** for ERROR STOP keeps the test running even if an error is found.

Table 3-1 in Section 3.3 describes the function of each test on the subtest menu, and Table 3-3 in Section 3.13 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 of 2)

No.	Test name	Subtest #	Subtest item
1	SYSTEM	01	ROM checksum
		02	H/W status
		03	Version check
2	MEMORY (T4500/T4500C only)	01	RAM constant data
		02	RAM address pattern data
		03	RAM refresh
		04	Protected mode
		05	Memory module
		06	Backup memory
		07	Hard-RAM
		08	Cache memory
		09	PCMCIA memory (1 MB SRAM)
2	MEMORY (T4600/T4600C only)	01	RAM constant data
		02	RAM address pattern data
		03	RAM refresh
		04	Protected mode
		05	Memory module
		07	Hard-RAM
		08	Cache memory
		3	KEYBOARD	01	Pressed key display (82/84)
02	Pressed key code display		
03	PS/2 Mouse connect check		
04	DCBP connect check		
4	DISPLAY	01	VRAM write/read
		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	LCD/DAC pallet
		11	TFT color display
		12	Status indicator panel

Table 3-1 Subtest Names (2 of 2)

No.	Test name	Subtest #	Subtest item
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
7	ASYNC	01	Wraparound (board)
		02	Board (#1) <=> board (#2) (T4500/4500C only)
		03	Point to point (send)
		04	Point to point (receive)
		05	Card modem loopback (2400BPS)
		06	Interrupt test
8	HDD	01	Sequential read
		02	Address uniqueness
		03	Random address/data
		04	Cross talk & peak shift
		05	Write/read/compare (CE)
		06	Write specified address
		07	Read specified address
		08	ECC circuit
		09	Sequential write
		10	W-R-C specified address
9	REAL TIMER	01	Real time
		02	Backup memory
		03	Real time carry
10	NDP (T4600/T4600C only)	01	Co-processor

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                     = xxMHz
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.

Table 3-2 Hardware Bit Status

Bit	H/W status	1	0
7	Reserved	—	—
6	CPU clock speed (T4600/T4600C) (T4500/T4500C)	17 MHz 10 MHz	33 MHz 20 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

This subtest checks the version level of the following four items:

- BIOS ROM
- BOOT ROM
- KBC version
- PS microprocessor version

This subtest compares the current data version to the reference data version which is stored in the test program. When the read information is lower than the reference data, the test program displays the following screen image. To exit this screen, press the **S** key. When the read information is higher, it indicates nothing.

```
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

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 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 (0 program end to 640 KB), then reads the new data and compares the result with the original data.

Subtest 03 RAM Refresh (Real Mode)

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

The constant data is AAAAh and 5555h.

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

Subtest 04 Protected Mode

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

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

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

Subtest 05	Memory Module
------------	---------------

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

This subtest functions the same as Subtest 04, except it is used for testing an optional memory card. Memory module capacity is 2, 4, 8, and 16 MB. After selecting Subtest 05, the following message will appear:

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

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

Subtest 06	T4500/T4500C Backup Memory
------------	----------------------------

This subtest writes constant data to memory from address C8000h to CFFFFh, then reads new data and compares the result with the original data. The constant data is 0000h, 5555h, AAAAh, and FFFFh.

T4600/T4600C: (No test item)

Subtest 07	Hard-RAM
------------	----------

This subtest writes a word unit of constant data to memory (address E0000h to E7FFFh), then reads the new data and compares the result with the original data. The constant data is 0000h, 5555h, AAAAh, and FFFFh. Also, this subtest executes the paging test for page data.

Subtest 08	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 three seconds.

Number of miss hit < Number of hit → OK

Number of miss hit ≥ Number of hit → Fail

Subtest 09	T4500/T4500C PCMCIA Memory (1 MB SPRAM)
------------	---

NOTE: To execute this test, a PCMCIA memory card must be installed in the computer.

This subtest divides the PCMCIA window (D0000h to DFFFFh) into 64 KB increments. It then executes the subtest by writing constant data to the PCMCIA memory, reads the data, then compares it with the original data.

Subtest 02 If test is OK, Press [Del] then [Enter] Key
 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 Connection Check

~~NOTE: To execute the PS/2 mouse connection check, a PS/2 mouse must be connected to the PS/2 mouse port.~~

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

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

KBD - MOUSE INTERFACE ERROR

[[HALT OPERATION]]

1: Test end

2: Continue

3: Retry

Subtest 04 — DCBP Connection Check

***NOTE:** To execute the DCBP mouse connection check, a ball-point mouse must be connected to the Ball-point Quick Port (BPQP).*

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

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

KBD-DCBP INTERFACE ERROR

[[HALT OPERATION]]

1: Test end

- 2: Continue
- 3: Retry

3.7 Display Test

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

Subtest 01 VRAM Read/Write


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.

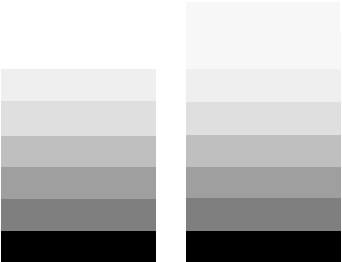
CHARACTER ATTRIBUTES

NEXT LINE SHOWS NORMAL DISPLAY.
 NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN

NEXT LINE SHOWS INTENSIFIED DISPLAY.
 IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII


NEXT LINE SHOWS REVERSE DISPLAY.

NEXT LINE SHOWS BLINKING DISPLAY
 BBBB^3BBBBBBBBBBBBBBBBBBBBBBBB



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

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

```

80*XX CHARACTER DISPLAY
0123456789012345678901234567890123456789012345678901234567890123456789012345678901234567
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnop
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnop
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnop
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnop
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqr
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrs
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrst
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstu
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuv
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvw
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwx
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxy
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~•
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~•Ç
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN0PQRSTUVWXYZ[\]^_`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	YELLOW
CYAN	MAGENTA	WHITE

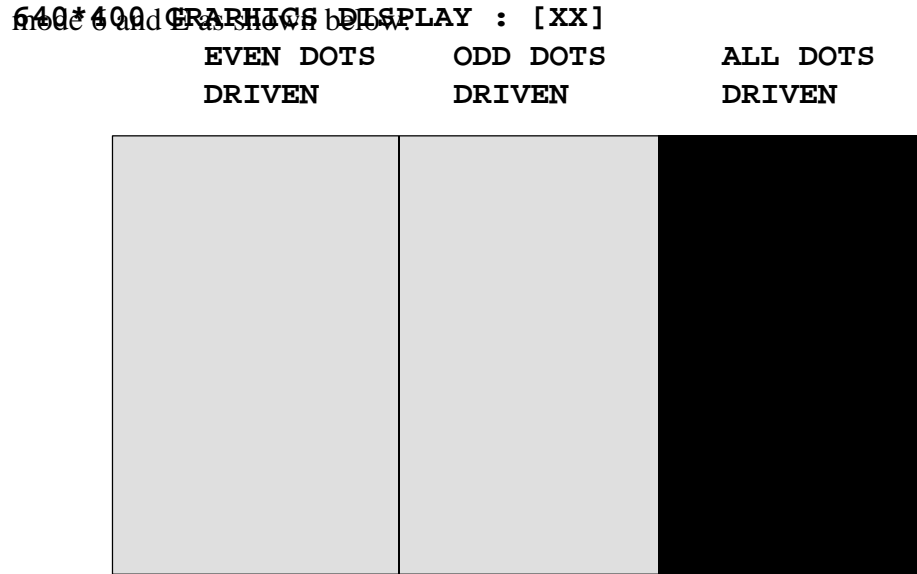


PRESS [ENTER] KEY

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

Subtest 06 PRESS [Enter] KEY
640x200 Character Display (mode 6, E)

This subtest displays even dots, odd dots, and all dots in the 640x200 dot graphics mode 6 as shown below:

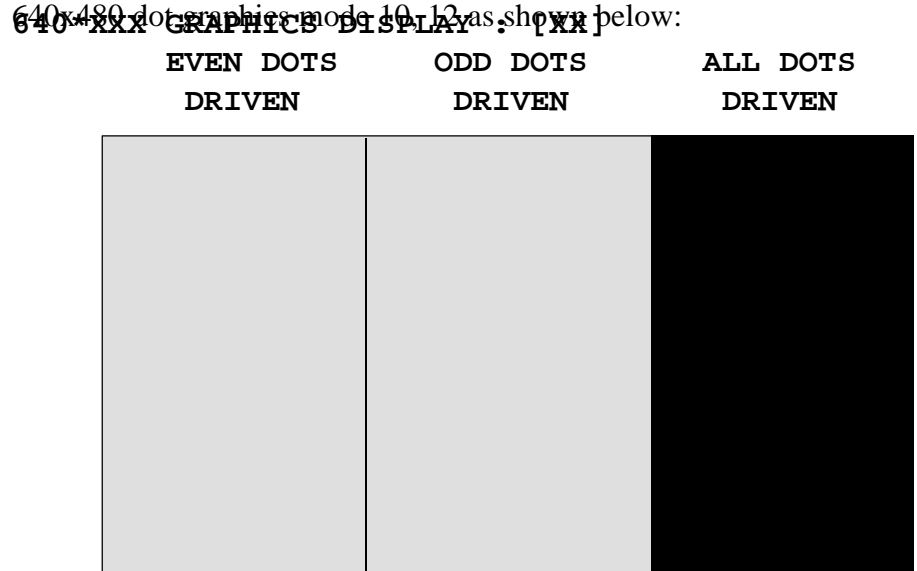


PRESS [ENTER] KEY

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

Subtest 07 640x350/400/480 Character 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, 12 as shown below:



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 Pages 0 through 7 in 40*25 character mode.

```

DISPLAY PAGE 0
00000000000000000000000000000000000000000000
0
0
0
0
0
0
0
0
0
0
0
0
00000000000000000000000000000000000000000000
    
```

Upon completion of this test, press **Ctrl + Break** to exit this subtest and return to the DISPLAY TEST menu.

Subtest 09 H Pattern Display/Border Color

This subtest displays 2000 H characters on the entire screen, as shown below.

```

HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
    
```

Pressing **Enter** displays the following message:

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

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

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

Press **Enter** to execute the border color test. To exit this subtest and return to the

DISPLAY TEST menu, press **Ctrl + Break**.

Subtest 10 LCD/DAC Pallet

This subtest checks the icon of sub LCD (Arrow, Caps Lock, Scroll Lock and Num Lock) by key operation.

```
[ Caps/Arrow/Num/Scroll LED test ]
```

```
(1) Press [ Caps Lock ] key !...Caps (on/off)
(2) Press [ Fn + F10 ] key !...Arrow (on/off)
(3) Press [ Fn + F11 ] key !...Num (on/off)
(4) Press [ Fn + F12 ] key !...Scroll (on/off)
```

PRESS [Enter] KEY

After pressing **Enter**, the subtest writes '2Ah' and '15h' data to 6 bits of 256x3 (RGB). This data is then read and compared to the original data. The following messages will be displayed.

```
[ DAC pallet W-R-CMP test ] = (about 5 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 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 256 shades of red, green and blue.

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

Subtest 12 Status Indicator Panel (Sub LCD)

This subtest turns the status indicator panel icons on and off.

```
[SUB LCD display]
```

```
SUB LCD ALL ON
```

```
PRESS [Enter]key
```

Press **Enter** to turn the status indicator panel icon on or off.

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

3.8 Floppy Disk Test

CAUTION: Before running the floppy disk test, prepare a formatted work disk. **Remove the Diagnostics Diskette and insert the 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 computer'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          XXXXXXXX
```

```
T4X00 DIAGNOSTIC TEST VX.XX  
[Ctrl]+[Break] ; test end  
[Ctrl]+[C]      ; key stop
```

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

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

The first digit in the STATUS number indicates the drive being tested and the last two

digits indicate the error status code as explained in Table 3-3 in Section 3.14.

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 computer.

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

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 computer supports three printer channels. Select the printer channel number, and press **Enter** to execute the selected subtest.

Subtest 01 Ripple Pattern

```
!#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOpqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvwxyz
This subtest prints characters for codes 20h through 7Fh line by line while shifting
one character to the left at the beginning of each new line.
!#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOpqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvwxyz
!#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOpqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvwxyz
!#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOpqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvwxyz
!#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOpqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvwxyz
!#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOpqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvwxyz
!#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOpqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvwxyz
!#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOpqrstuvwxyz[\]^_`abcdefghijklmnopqrstuvwxyz
```

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

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

Subtest 03 Wraparound

NOTE: To execute this subtest, a printer wraparound connector must be connected to the computer's printer port. The wiring diagram for the printer wraparound connector (34M741986G01) can be found in Appendix G.

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

3.10 Async Test

To execute the Async Test, select **7** from the DIAGNOSTIC TEST MENU, press **Enter** and follow the directions displayed on the screen. The async test contains six subtests that test the computer's asynchronous communication functions. Move the highlight bar to the subtest you want to execute and press **Enter**.

Subtests 01 through 04 require the following data format:

Method: Asynchronous
Speed: 9600BPS
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 - 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 wiring diagram for the RS-232-C wraparound connector can be found in Appendix G.*

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

Subtest 02 Board (#1) <=> Board (#2) (T4500/T4500C only)

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

Subtest 03	This subtest checks the data send/receive function through the RS-232-C direct cable. 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 can be found 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)

Subtest 05	This subtest, used with Subtest 03 described above, receives the data from the send side, then sends the received data. Card Modem Loopback (2400BPS)
------------	--

- NOTES:***
- 1. To execute this subtest, a 2400 bps card modem must be installed.*
 - 2. You do not have to turn on power to the modem at the Setup option. When you select this subtest, the modem is powered on automatically.*
 - 3. To execute this subtest, you need to set the “PCMCIA Slot” to “Others” in the SETUP program.*

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

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

Baud rate select (1: 300BPS, 2: 1200BPS, 3: 2400BPS) ?

Select the baud rate for the serial port and press **Enter** to execute this subtest.

Subtest 06 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 computer's hard disk drive functions. The following messages appear after selecting the hard disk test from the DIAGNOSTIC TEST MENU. Answer each of the questions with an appropriate response to execute the test:

***CAUTION:** The contents of the hard disk **will be erased** when Subtest 02 03 04 05 06 08 09, or 10 is executed. This test should **only** be executed after all other possibilities have been explored. Before running the test, transfer the contents of the hard disk to a backup system.*

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 on all DOS commands.

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 3.15. 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          XXXXXXXX

SUB-TEST   : XX
PASS COUNT : XXXXX      ERROR COUNT : XXXXX
WRITE DATA : XX        READ DATA  : XX
ADDRESS    : XXXXXXXX   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, in Section 3.14.

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: B5ADADh, 4A5252h, EB6DB6h, 149249h, 63B63Bh, 9C49C4h, 2DB6DBh, D24924h.

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 computer's real timer functions. Move the highlight bar to the subtest you want to execute and press **Enter**.

Subtest 01 Real Time

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

1. Select Subtest 01 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 FEh through 7Fh
- Writes the data pattern AAh through 55h to the RTC 50-byte memory
(address 0Eh to 3Fh)

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   :    01-01-1989
Current time   :    00:00:37
```

Pressing **Enter** displays the following:

Current date : 12-31-1988

Current time : 23:59:58

PRESS [Enter] KEY TO EXIT TEST

Press **Ctrl + Break** to exit.

3.13 Co-Processor Test

NOTE: Only the T4600 series has a built-in co-processor; therefore only the T4600 Series can execute the co-processor test.

Subtest 01 Co-Processor Test

This test checks the following functions of the co-processor:

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

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

3.14 Error Code and Error Status Names

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

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

Device name	Error code	Error status name
(COMMON) SYSTEM MEMORY	FF	Data Compare Error
	01	ROM Checksum Error
	01	Parity Error
	02	Protected Mode Not Change
	14	Memory Read/Write Error
	1B	H-RAM Mapping Error
	1C	H-RAM Read/Write Error
KEYBOARD FDD	29	No PCMCIA Card
	2A	PCMCIA Card Different
	2B	PCMCIA Mapping Error
	2C	PCMCIA Read/Write Error
	DD	Cache Memory Error
	03	Mouse Interface Error
	04	DCBP Interface Error
	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
<i>Table 3-3 Error Codes and Error Status Names (2 of 2)</i>		
Device name	Error code	Error status name
ASYNC	01	DSR On Time Out
	02	CTS On Time Out
	04	RX-READY Time Out
	08	TX-BUFFER Full Time Out
	10	Parity Error
	20	Framing Error
	40	Overrun Error
	80	Line Status Error
	88	Modem Status Error
	33	No Carrier (Card Modem)
	34	Error (Card Modem)
	36	No Dial Tone (Card Modem)
HDD	01	Bad Command Error
	02	Bad Address Mark Error
	04	Record Not Found
	05	HDC Not Reset Error
	07	Drive Not Initialized
	09	DMA Boundary Error
	0A	Bad Sector
	0B	Bad Track Error
	10	ECC Error
	11	ECC Recover Enable
	20	HDC Error
	40	Seek Error
	80	Time Out Error
	AA	Drive Not Ready
	BB	Undefined Error

	CC	Write Fault
	E0	Status Error
NDP	01	No CO-PROCESSOR
(T4600/T4600C	02	Control Word Error
only)	03	Status Word Error
	04	Bus Error
	05	Addition Error
	06	Multiplication Error

3.15 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 occurred.
4	DSC (Drive seek	"0" ---The hard disk drive heads are not settled over a track. "1" ---The hard disk drive heads are settled over a track.
3	complete) DRQ	"0" ---Drive is not ready for data transfer.

	(Data request)	"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.
<i>Table 3-5 Error Register Contents</i>		
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	"0" ---Other

- (Identification) "1" ---There was no ID field in the requested sector.
- 3 — Not used
- 2 ABRT "0" ---Other
- (Abort) "1" ---Illegal command error or a drive status error occurred.
- 1 TK00 "0" ---The hard disk found Track 0 during a recalibrate command.
- (Track 0) "1" ---The hard disk couldn't find Track 0 during a recalibrate command.
- 0 — Not used.

3.16 Hard Disk Format

The hard disk format function performs a low level (physical) format of the hard disk and executes the following track formats and check:

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

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

3.16.1 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

Items	80 MB		120 MB		200 MB	340 MB
	(CP2084)	(MK1422FCV)	(CP2124)	(MK2124FC)	(MK2224FC)	(MK2326FC)
Sector sequences	1	1	1	1	1	1
Cylinders	0~548	0~987	0~761	0~933	0~683	0~968
Heads	0~7	0~9	0~7	0~15	0~15	0~13
Sectors	1~38	1~17	1~39	1~17	1~38	1~49
Sector length (bps)	512	512	512	512	512	512

T4500/T4500C ... 80, 120, 200 MB
T4600/T4600C ... 120, 200, 320 MB

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.

3.16.2 Operations

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

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

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

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

Press [NUMBER] key

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 appear at the bottom of the screen in succession:

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

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

Interleave number (1/1 ~ 8) ?

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

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

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.*

Bad Track Register

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 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.

All Track Format

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

Track Verification

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

2. Good Track FORMAT

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

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

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

3. Bad Track FORMAT

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

***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.*

3.17 FDD Head Cleaning

3.17.1 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 function.

3.17.2 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.

3.18 Log Utilities

3.18.1 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)

3.18.2 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:

```

XXXXXXXX ERRORS
CNT TS-NAME PASS      STS ADDR          WD RD   HSTS      [ STATUS NAME ]
001  FDD 02 0000     103 00001        00 00          FDD - WRITE PROTECTED
00   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.

3.19 Running Test

NOTE: The running test executes key diagnostic tests covering the complete system. It can be used to verify reported, undetected, or intermittent problems. We recommend that the running test be allowed to run several passes during the initial diagnosis. We also recommend several passes of the test as a final check or “burn-in” to ensure no other malfunction exists.

3.19.1 Function Description

This function automatically executes the following tests in sequence:

1. System test (Subtest 01)
2. Memory test (Subtest 01, 02, 04, 06, and 07)
3. Display test (Subtest 01 to 08)
4. FDD test (Subtest 02)
5. HDD test (Subtest 01 and 05)
6. Real timer test (Subtest 02)

7. Printer test (Subtest 05)
8. Async test (Subtest 01)

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

3.19.2 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 wraparound test (Y/N) ?

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

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

Serial #A wraparound test (Y/N) ?

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

execute this test.

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

```
Mount the work disk(s) on the drive(s), then press [Enter] key.  
[Warning] : The contents of the disk(s) will be destroyed.]
```

5. This program is executed continuously. To terminate the program, press **Ctrl + Break**.

3.20 Floppy Disk Drive Utilities

3.20.1 *Function Description*

This function formats the FDD, copies the floppy disk and displays the dump list for both the FDD and HDD. Note that the T4600/T4600C does not support an external FDD. Therefore, all references to an external FDD (3.5-inch or 5.25-inch) relate to the T4500/T4500C Computer.

FORMAT

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

This program can format a external 5.25-inch (T4500/T4500C) or internal 3.5-inch floppy disk in the following formats:

- 2D: Double-sided, double-density, 48/67.5 TPI, MFM mode, 512 bytes, 9 sectors/track.
- 2DD: Double-sided, double-density, double-track, 96/135 TPI, MFM mode, 512 bytes, 9 sectors/track.
- 2HD: Double-sided, high-density, double-track, 96/135 TPI, MFM mode, 512 bytes, 18 sectors/track.

COPY

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

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.

3.20.2 Operations

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
```

❑ FORMAT Program

1. Selecting **FORMAT** displays the following message:

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

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

2. Select a drive number to display the following message:

```
Type select (0:2DD-2D,1:2D1-2D,2:2D-2HD,3:2HD-2HD) ?
```

3. 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.
```

4. Remove the Diagnostics Disk from the FDD, insert a 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) ?
```

5. Selecting **1**, displays the message from Step 3 above. Selecting **2** returns the test program to the DIAGNOSTIC MENU.

❑ COPY Program

1. 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) ?
```

2. 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.
```

3. 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 ]]
```

4. 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 2 is displayed again. After the floppy disk has been copied, the following message will appear:

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

5. To copy another disk, select **1** and the message from Step 1 will be displayed again. Entering **2** returns the test program to the DIAGNOSTIC MENU.

❑ DUMP Program

1. When DUMP is selected, the following message appears:

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

2. Select a format type number. If **2** is selected, the display will go to the step (5).

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

3. Select a drive number to display the following message:

Format type select (0:2DD, 1:2D, 2:2HD) ?

4. Select a media type number and the following message will appear:

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

5. Insert a source disk and press any key and the following message will appear:

```
*** Track = 0000 , Head = 00 , Sector = 01 ***
000 EB3C90542056342E 3030200002020100 027000A005F90300 δ<ÉT V4.00 p á .
018 0900020000000000 0000000000029E1 081A374E4F204E41 )β 7N0 NA
030 4D45202020204641 543132202020FA33 C08ED0BC007C1607 ME FAT12 3LX1
048 BB780036C5371E56 1653BF3E7CB90B00 FCF3A4061FC645FE x 6+7 V S7 > | q n ≤ñ |E■
060 0F8B0E187C884DF9 26894702226C7073E 7CFBCD13727C33C0 Y | eM·&eG & | > | V = r | 3L
078 3906137C74088B0E 137C890E207CA010 7CF726167C03061C 9 | t Y | e á | = & |
090 7C13161E7C03060E 7C83D200A3507C89 16527CA3497C8916 | | | | a T úP | e R | ú | e
0A8 4B7CB82000F72611 7C8B1E0B7C03C348 F7F30106497C8316 K | q = & | | Y | | H = ≤ I | a
0C0 4B7C00BB00058B16 527CA1507CE88700 7220B001E8A10072 K | q Y R | i P | Q r | | | | r
0D8 198BFBB90B00BEDD 7DF3A6750D8D7F20 BEE87DB90B00F3A6 Y | q | | } ≤ e u | | Q | q | ≤ a
0F0 7418BE957DE85100 32E4CD165E1F8F04 8F4402CD19585858 t | | } Q Q 2E = ^ A AD = XXX
108 EBE8BB0007B90300 A1497C8B164B7C50 5251E83A0072E6B0 δ Q q | i | | Y K | P R Q Q : r u
120 01E85400595A5872 C905010083D20003 1E0B7CE2E28A2E15 | | Y Z X r q a T | | | | e .
138 7C8A16FD7D8B1E49 7CA14B7CEA000070 00AC0AC07429B40E | e ^ } Y | I | | K | Q p | | | | |
150 BB0700CD10EBF23B 16187C7319F73618 7CFEC288164F7C33 q = δ ≥ ; | s = 6 | | T e O | 3
168 D2F7361A7C881625 7CA34D7CF8C3F9C3 B4028B164D7CB106 T = 6 | e % | ú M | | | | | Y M |
180 D2E60A364F7C8BCA 86E98A16FD7D8A36 257CCD13C30D0A4E T μ 6 O | i = a θ e ^ 2 } e 6 % | = | | N
198 6F6E2D5379737465 6D206469736B206F 72206469736B2065 on-System disk or disk e
1B0 72726F720D0A5265 706C61636520616E 6420707265737320 rror Replace and press
1C8 616E79206B657920 7768656E20726561 64790D0A0049424D any key when ready IBM
1E0 42494F2020434F4D 49424D444F532020 434F4D0000000000 BIO COMIBMDOS COM
1F8 00000000000055AA U~
```

. Press number key (1:up,2:down,3:end) ?

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

Track number ??

6. Set the track number you want to dump. The system will access the disk and dump a list, such as the following example illustrated below.

3.21 System Configuration

3.21.1 Function Description

The System Configuration program contains the following configuration information for the T4500/T4600 Family computer.

- BIOS ROM version
- Boot ROM version
- KBC version
- Base memory size
- The number of floppy disk drives
- The number of ASYNC ports
- The number of hard disk drives
- The number of printer ports
- Extended Memory Size
- PS Micom Version
- Battery

3.21.2 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  
* - 639KB MEMORY  
* - 1 FLOPPY DISK DRIVE(S)  
* - 1 ASYNC ADAPTER
```

- * - 1 HARD DISK DRIVE(S)
- * - 1 PRINTER ADAPTER
- * - XXXXXXKB EXTENDED MEMORY
- * - PS MICOM VERSION = VX.XX
- * - NI- XX BATTERY

Press Enter Key

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

3.22 SETUP

3.22.1 Function Description

The setup displays the T4500/T4500C's current system setup information as listed below. System setup information for the T4600/T4600C is listed on the next page.

1. Memory

- Total
- Base
- Extended Memory
- Hard RAM
- Shadow BIOS ROM

2. Display

- Display Adapter
- LCD Display Mode
- Display Color (T4500C only)
- LCD Gray Scale Level (T4500 only)

3. Battery

- Battery Save Mode
- Battery Display
- Manual Setting of Battery Level

4. Hard Disk

5. COM/PCMCIA/FDD/PRT

- Serial Port
- PCMCIA Slot
- External FDD/PRT

- Printer Port Type

6. Others

- Resume Mode
- CPU Cache
- Speaker Volume
- Panel Power On/Off
- Hotkeys
- External Keyboard “Fn” Key Equivalent

The setup displays the T4600/T4600C’s current system setup information as listed below:

1. Memory

- Total
- Base
- Extended Memory
- Hard RAM
- Shadow BIOS ROM

2. Display

- Display Adapter
- LCD Display Mode
- Display Colors (T4600C only)
- LCD gray Scale Level (T4600 only)
- Power On Display

3. PCMCIA/COM/PRT

- PC Card Slot 1
- PC Card Slot 2
- Serial Port
- Parallel Port
- External FDD (when connected to a Desk Station)
- Printer Port Type (when connected to a Desk Station)

4. Hard Disk

5. Battery

- Battery Save Mode
- Battery Display
- Manual Setting of Battery Level

6. Power On Password

7. Others

Power-up Mode

CPU Cache

Panel Power On/Off = 4096KB

Alarm Power On = 640KB

Hotkeys = 3328KB

Ext. Keyboard "Fn" Key Equivalent = 0KB

Ext. Keyboard "Fn" Key Equivalent = 128KB

T4500/T4500C SETUP

BIOS Version = x.xx

COM/PCMCIA/FDD/PRT

Serial Port = COM1 (IRQ4/3F8H)

PCMCIA Slot = PCMCIA

External FDD/PRT = Printer

Printer Port Type = Output

3.22.2 Accessing the SETUP Program

T4500C/T4600C only

Selecting 0 from the DIAGNOSTICS MENU and pressing Enter displays the following:

T4500/T4600 only

DISPLAY

Display Adaptor = VGA Compatible

LCD Display Mode = Color

LCD Display Colors = 16M colors

LCD Gray Scale Level = Normal 64 Levels

OTHERS

Resume Mode = Boot

Battery Save Mode = xxx

CPU Cache = Enable

Speaker Volume = High

Battery Display = Time/9

Panel Power On/Off = Disable

Hotkey = Enable

Ext. Keyboard "Fn" key equivalent = Disable

HARD DISK

Capacity = 80MB

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

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

The information you see on your screen will differ somewhat from this example, depending on the computer model, display and options selected (this is an example of the T4500/C setup screen).

The menus above show examples of setup options as they may be currently stored in memory. The options, "LCD Display Mode," and "LCD Gray Scale Level" for the T4500/T4600 or "Display Device," "LCD Display Mode" and "LCD Display Colors" for the T4500C/T4600C differ depending on the option selected for "Display Adaptor."

Note that selecting the type of hard disk drive is not an option. The T4500/T4600 Family computer automatically determines what type of internal hard disk drive is installed.

If you would like to use an external 5.25-inch floppy disk drive attached to the parallel port (T4500 or T4500C only), the "External FDD/PRT" option must be configured as either "FDD A" or "FDD B." If FDD A is selected, the computer automatically configures the external FDD as drive A and the internal 3.5-inch FDD as drive B.

Press **ESC** if the setup options displayed accurately reflect your hardware configuration and no changes are necessary.

The SETUP displays the following message:

```
Exit without saving? (Y/N)
```

Press **Y**. The system returns to the DIAGNOSTIC MENU.

3.22.3 Changing SETUP Values

You can change the setup options automatically or manually.

Automatic Reset

Follow these steps to set the values automatically:

1. At the SETUP MENU, Press **Home**. This instructs the program to reset all the options to their factory preset values.

The program calculates how much base and extended memory your computer has, based on whether or not you have an expansion memory card installed.

The SETUP menu displays the new values.

2. Confirm that the new values are correct. To change any option(s), go to the next item, *Manual Reset*.

3. If the new values are correct, press **End** to record the new values in configuration memory.

4. Go to Step 5 of the next item, *Manual Reset*.

Manual Reset

Follow these steps to change any option(s) manually:

NOTE: The cursor, which is bar-shaped, indicates which option is presently selected.

1. Use the arrow keys to move the cursor between options. You can also select each option group by pressing the character on the keyboard corresponding to the first character of the heading for each option group. For example, if you press **D**, the cursor moves to the top of the DISPLAY option group.
2. When the cursor highlights the values of an option you want to change, use the **space bar** and **backspace** keys to select the desired value.
3. When you finish making changes, press **End** to record the new values in configuration memory.

4. SETUP displays the following message:

Save Settings, perform self test and reboot? (Y/N)

Review your changes. If you need to make more alterations, press **N** and go back to Step 1 above.

5. If the new values are correct, press **Y**. The values are recorded into CMOS memory and the system restarts.

3.22.4 **SETUP Option Descriptions**

The SETUP screen is divided into functionally-related groups. This section describes each group and the options within it.

1. **Memory**

This group of options lets you configure the computer's memory.

Total

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

Base

This field displays the amount of memory installed and is automatically calculated by the computer. You cannot change this value. If you set **Hard RAM**, this value changes automatically.

Extended Memory

This field displays the amount of extended memory the computer has available. You cannot change this value.

Hard RAM

This field displays the amount of extended memory assigned to Hard RAM. When you press the **Space bar** or **Bk Sp** key, the size of memory allocated for Hard RAM increases or decreases in 64 KB increments from 128 KB to 11520 KB (T4500/T4500C) or 128 KB to 16768 KB (T4600/T4600C). The default is 0 KB.

Shadow BIOS ROM

The SETUP program displays 128 KB of RAM, which is reserved for the Shadow BIOS ROM. This field displays the amount of the extended memory used for the shadow BIOS ROM. You cannot change this value.

2. Display

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

Display Adapter

This field displays only "VGA compatible."

VGA compatible Enable the internal video controller.

Not Used Disable the internal video controller.

LCD Display Mode

Use this option to set the T4500/T4600 Family computer's display mode.

Color Selects 80x25 text or 640x480 graphics modes. This option also affects a color monitor attached to the **external display port**. (This is the default.)

Monochrome Selects monochrome mode. This is also used when you connect a VGA monochrome monitor to the **external display port**. Some software is displayed better in monochrome mode.

LCD Display Color (T4500C & T4600C only)

This option, which appears in SETUP and is available through the use of "hot keys," lets you switch among 180K colors, 24K colors, and 512K colors on the T4500C or T4600C. It does not appear on the T4500 or T4600. Refer to "Hot keys" under the *OTHERS* section later in this chapter for more information on hot key operation.

The LCD display color options are:

180K colors Displays color text with 180K colors. This is the default.

24K colors Displays color text with 24K colors.

512K colors Displays color text with 512K colors.

LCD Gray Scale Level (T4500 & T4600 only)

This option, which appears in SETUP and is available through the use of hot keys, lets you switch between normal and reverse video on the T4500 and T4600. It does not appear on the T4500C or T4600C. The options are:

Normal 64 Levels Displays black text on a white background with 64 shades of

gray.

Reverse 64 Levels Displays white text on a black background with 64 shades of gray.

3. Battery

Battery Save Mode

This option is used to select either Full Power, Economy Power, Low Power, or the User Setting of the **Battery Save Options**. You can also set this option using the hot keys.

When the AC adapter is connected to the computer, this option uses the normal life setting, even if you have selected Full Power or User's setting in the **BATTERY SAVE OPTIONS**. The default is Long life when the T4500/T4600 Family uses battery power.

```
----- BATTERY SAVE OPTIONS -----
Processing Speed/ High
CPU Sleep Mode/   Disable
Economy Power/    Disable
Display Auto Off/ 03 Min.
HDD Auto Off      03 Min.
```

```
----- BATTERY SAVE OPTIONS -----
Processing Speed/ High
CPU Sleep Mode/   Enable
Economy Power/    Disable
Display Auto Off/ 03 Min.
HDD Auto Off      03 Min.
```

Selects a preset set of battery save parameters suitable for either Full Power, Economy Power or Low Power operation. Selecting this option, displays a sub-window of the **Battery Save Options**, like the ones shown below. The options in the sub-window cannot be changed and are for informational purposes only.

```
----- BATTERY SAVE OPTIONS -----
Processing Speed      Low
CPU Sleep Mode       Enable
Display Auto Off     03 Min.
HDD Auto Off         03 Min.
```

User Setting This option allows you to set the battery save parameters in the sub-window's **Battery Save Options**. When you select this option, the automatic setting feature (Full Power, Economy Power or Low Power) is disabled and the user-preferred parameters become effective. The default setting in the sub-window depends on the **Battery Save Mode**: Full Power, Economy Power, and Low Power. User settings lets you select the following options:

- Processing Speed

This option sets the CPU operating speed to High or Low.

Processing Speed	CPU Speed
High	20 MHz
Low	10 MHz

- CPU Sleep Mode

This option is used to enable and disable the CPU sleep function.

Enable Enables sleep mode.

Disable Disables sleep mode.

- Display Auto Off

This option is used to disable or set the duration of the display automatic power off function. This function turns off the computer sidelight if you make no entry for the set period of time. Always OFF can be used only on the T4500 or T4600.

Disable Disables display automatic power off.

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

Always OFF Turns off power to the display's fluorescent lamp. This value is not displayed if the AC adapter is connected. This is used for the T4500/T4600 only.

- HDD Auto Off

This option is used to disable or set the duration of the HDD automatic power off function.

- Disable 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.

Battery Display

This option allows you to set how the Status Indicator Panel shows the remaining battery capacity: either by percentage of full charge or by remaining operating time.

- % remaining Shows the remaining battery capacity of the battery by percentage of full charge. This is the default setting.
- Time Shows the capacity of the battery by remaining operating time.

4. Hard Disk

This option enables or disables the hard disk drive.

- xxMB The T4500 Series can use an 80 or 120 MB HDD while the T4600 Series can use a 120, 200 or 320 MB HDD. The disk's capacity is automatically displayed but cannot be changed, except to No drive.
- No drive Prohibits access to the hard disk.

5. COM/PCMCIA/PRT/FDD

This option controls settings for serial and parallel ports. _____

Serial Port

This option allows you to set the COM level, COM1 or COM2, for the serial and parallel ports.

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

COM Level	Interrupt Level	I/O Address	Comment
COM1	4	3F8h	Serial Port default
COM2	3	2F8h	Card Modem default
Not Used			Disables Port

NOTE: The card modem setting is not displayed, but is automatically set to the remaining COM level when the serial port is set.

PCMCIA Slot (T4500/C) - PC Card Slot 1 or 2 (T4600/C)

This option allows you to use a PCMCIA or other optional card. If you select "Others," you can set the next window, COM Port and Power. The T4500 Series only has one PCMCIA card slot displayed on the SETUP screen as "PCMCIA Slot." The two PCMCIA slots on the T4600 Series appear as "PC Card Slot 1" and "PC Card Slot 2." The function descriptions below refer to both the T4500 and T4600 Series.

PCMCIA You can use the PCMCIA card.

Others This option allows you to set the COM port of the card modem and power on/off in the following options.

- COM Port

Two COM levels for the card modem can be selected: COM1 (IRQ4/3F8H) or COM2 (IRQ3/2F8H). If you set this level to the same as that of the serial port, the serial port setting automatically changes to Not Used.

- Power

This option allows you to turn the expansion cards on or off. However, this option does not appear if you do not install the card or set the PCMCIA Slot (or PC Card Slot 1 or 2) option to PCMCIA.

External FDD/PRT

NOTE: The T4600 Series computer will only support an external FDD when connected to a Desk Station IV or IV Plus. When connected to a Desk Station, the displayed options are "External FDD" as well as "Printer Port Type." When not connected to a Desk Station, the only available option appears as "Parallel Port."

Use this option to assign the function of the External PRT/FDD port.

Printer Configures the port for output to a printer or other parallel device. This is the default setting on the T4500/C and does not appear on the T4600/C.

FDD A Configures the port for output and input to and from an

external 5.25-inch floppy disk drive and assigns the letter A to the external drive. By default, the internal drive becomes drive B.

FDD B Configures the port for output and input to and from an external 5.25-inch floppy disk drive and assigns the letter B to the external drive. By default, the internal drive remains drive A. This is the default setting on the T4600/C when connected to a Desk Station.

Parallel Port (T4600/C only)

Use this option to assign the function of the parallel port on the T4600 or T4600C. This is the only set of parallel port settings when not connected to a Desk Station.

LPT1/ This setting configures the parallel port as LPT1, LPT2 or
LPT2/ LPT3. LPT1 is the default setting.
LPT3

Disabled Disables the parallel port.

Printer Port Type

This option sets the communication mode for the PRT/FDD port to either output-only or bi-directional. For the T4500 Series, it is effective only when the External PRT/FDD option is set to "Printer." If either FDD A or FDD B is selected, this setting is ignored and the mode is automatically set to bi-directional.

When the T4600 Series is connected to a Desk Station, the Printer Port Type setting is independent of the External FDD setting since there are two parallel ports; one for the printer (or other parallel device) and one for an external FDD.

For most printers, the port should be set to output. With some other parallel devices, the setting should be set to bi-directional.

Output Activates uni-directional operation. This is the default setting.

Bi-directional Activates bi-directional operation.

NOTE: For additional information on the Serial Port, Parallel Port, PCMCIA Slot(s), External FDD/PRT, and Printer Port Type options, see chapters 7 (Optional Devices) and 8 (System Configuration and Security) in the T4500 Series or T4600 Series Reference Manual.

6. Others

Whether or not you need to configure the T4500/T4600 Family with these options depends primarily on the kind of software or peripherals you use.

Resume Mode

This option enables and disables the AutoResume feature. You can also set this option using the hot keys. Disabling AutoResume enables Boot mode.

Boot Turns off AutoResume. This is the default setting.

Resume Turns on the AutoResume feature.

NOTE: *Resume mode works only with Toshiba's versions of MS-DOS, Windows 3.x and Toshiba MS OS/2. For more information on Resume and the installation of the proper resume drivers, refer to "Resume Mode Restrictions" in chapter 2 of the T4500 Series or T4600 Series Reference Manual.*

CPU Cache

This option enables and disables the CPU cache.

Enable Enables the CPU cache. This is the default setting.

Disable Disables the CPU cache.

Speaker Volume

This option sets software use of the system speaker. Setting this option to off disables the self-test alarm. All other system alarms are unaffected. This option also appears in the Hot Key. The default is High.

Off Disables software use of the system speaker.

High/ Enables and sets the level of the speaker. The default is High.

Medium/ When you enable the speaker, a submenu allows you to set
Low the following options: System Speaker, Low Battery Alarm, and Panel Close Alarm.

- System Speaker

This option enables or disables the system speaker.

Enable Enables the system speaker. (This is the default.)

Disable Disables the system speaker.

- Low Battery Alarm

This option enables or disables the alarm when the capacity of the battery is low.

Enable Enables the battery alarm when the capacity of the battery is low. This is the default setting.

Disable Disables the battery alarm when the capacity of the capacity of the battery is low.

- Panel Close Alarm

This option enables or disables the alarm when you close the panel.

Enable Enables the panel close alarm when you close the panel. This is the default setting.

Disable Disables the alarm when you close the panel.

Panel Power On/Off

This option enables and disables automatic panel close suspend. This option automatically turns off the computer when the display panel is closed and turns on the computer when the display panel is opened. When the system is set to Boot mode, this option is automatically disabled.

Enable Enables the system automatic power off when the display panel is closed.

Disable Disables the system automatic power off when the display panel is closed.

Hotkeys

This option enables and disables the hotkeys.

Enable Enables the hotkeys. This is the default setting.

Disable Disables the hotkeys.

NOTE: The following hotkeys are enabled only in Toshiba MS-DOS or Windows 3.x operating system/environment. If the computer is running in a system or environment other than these, set this option to “Disable.” The other hotkeys, however, will work in any operating system/environment.

- Fn + F1** Keyboard lockout security
- Fn + F2** Battery save mode
- Fn + F3** Resume mode
- Fn + F5** Display device
- Fn + F6** Reverse video display

External Keyboard “Fn” Key Equivalent

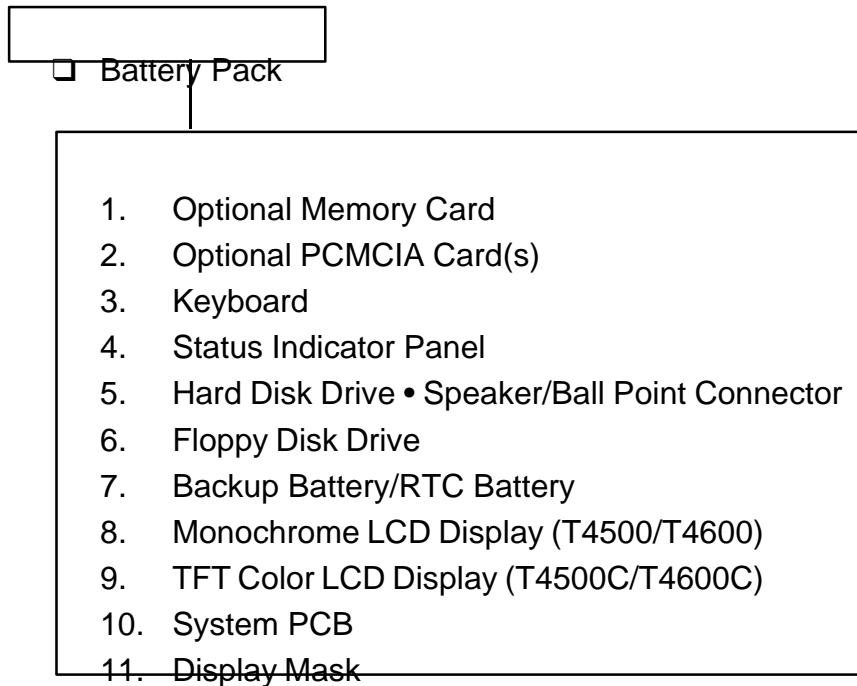
This option is used to let substitute keys on an external keyboard function as the **Fn** key.

Enable Enables the Fn key substitution

Disable Disables the Fn key substitution function. This is the default setting.

4.1 General

This section explains how to disassemble the T4500/T4600 Family computer and replace Field Replaceable Units (FRUs). It may not be necessary to remove all the FRUs in order to replace one. The chart below is a guide to which FRUs need to be removed in order to remove others. Always start by removing the battery pack, then follow the order on the chart to determine which FRU you must remove next in order to repair the one you think is causing the computer to operate improperly.



Before You Begin

Look over the procedures in this section before you begin disassembling the T4500/T4600 Family computer. Familiarize yourself with the disassembly and reassembly steps. Begin each procedure by removing the AC adapter and the battery pack as instructed in Section 4.2, *Battery Pack*.

1. Do not disassemble the T4500/T4600 Family computer unless it is operating abnormally.
2. Use only the correct and approved tools.
3. Make sure the working environment is free from the following elements whether you are using or storing the computer:
 - Dust and contaminants
 - Static electricity
 - Extreme heat, cold and humidity
4. Make sure the FRU you are replacing is causing the abnormal operation by performing the necessary diagnostics tests described in this manual.

5. Do not perform any operations that are not necessary and use only the described procedures for disassembling and installing FRUs in the computer.
6. After removing parts from the computer, place them in a safe place away from the computer so they will not be damaged and do not interfere with your work.
7. You will remove and replace many screws when you disassemble the computer. When you remove screws, make sure they are placed in a safe place and identified with the correct parts.
8. When assembling the computer make sure you use the correct screws to secure the various pieces in place. Screw sizes are listed in the corresponding figures.
9. The computer contains many sharp edges and corners, so be careful not to injure yourself.
10. After you have replaced an FRU make sure the computer is functioning properly by performing the appropriate test on the FRU you have fixed or replaced.

***NOTE:** The illustrations in this chapter are based on the appearance of the T4500C except where otherwise noted.*

Disassembly Procedures

The T4500/T4600 Family computer has two basic types of cable connectors:

- Pressure Plate Connectors
- Normal Pin Connectors

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

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

Assembly Procedures

After you have disassembled the T4500/T4600 Family and repaired the problem that was causing the computer to operate abnormally, you will need to reassemble the computer.

While assembling, remember the following general points:

- Take your time, making sure you follow the instructions closely. Most problems arise when you get in a hurry assembling the computer.
- Make sure all cables and connectors are securely fastened.
- Before securing the FRU or other parts, make sure that no cables will be pinched by screws or the FRU.
- Check that all latches are closed securely in place.
- Make sure all the correct screws are used to secure all FRUs. Using the wrong screw can 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 computer, confirm that the FRU and the computer are functioning properly.

Tools and Equipment

The use of Electrostatic Discharge (ESD) equipment is very important for your safety and the safety of those around you. Proper use of these devices will increase the success rate of your repairs and lower the cost for damaged or destroyed parts. The following equipment is necessary to disassemble and reassemble the T4500/T4600 Family computer:

- One M2 Phillips-head 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 Battery Pack

Removing the Battery Pack

To remove the T4500/T4600 Family computer's battery pack, follow the steps below and refer to Figure 4-1.

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

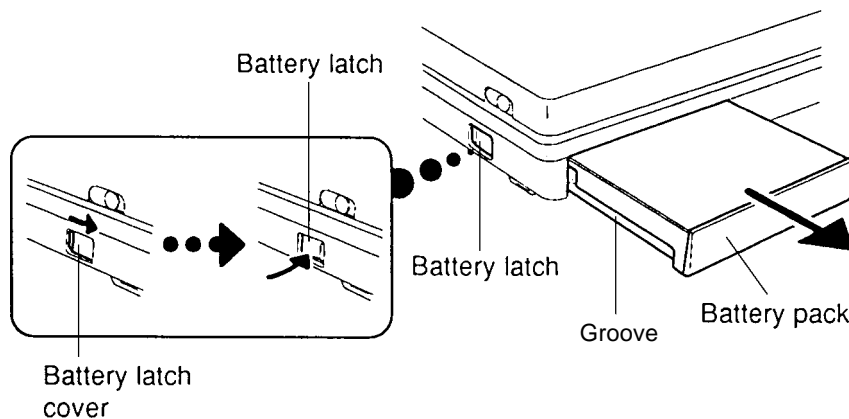


Figure 4-1 Removing the Battery Pack

Installing the Battery Pack

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

To install the T4500/T4600 Family computer battery pack, follow the steps below and refer to Figure 4-1:

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

4.3 Optional Memory Card

Removing the Optional Memory Card

To remove an optional memory card from the T4500/T4600 Family computer, follow the steps below and refer to Figures 4-2 and 4-3.

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

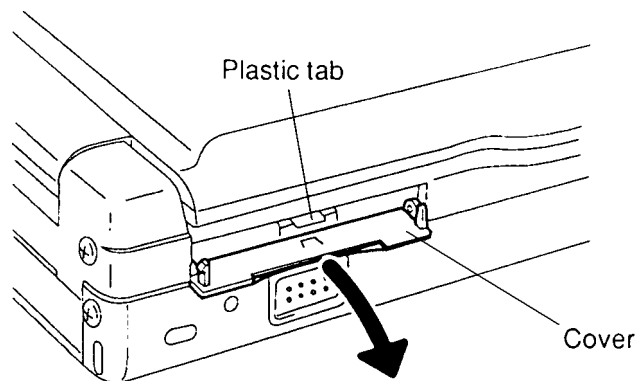


Figure 4-2 Opening the Optional Memory Card Cover

5. Grasp the **optional memory card** and pull it completely out (Figure 4-3).

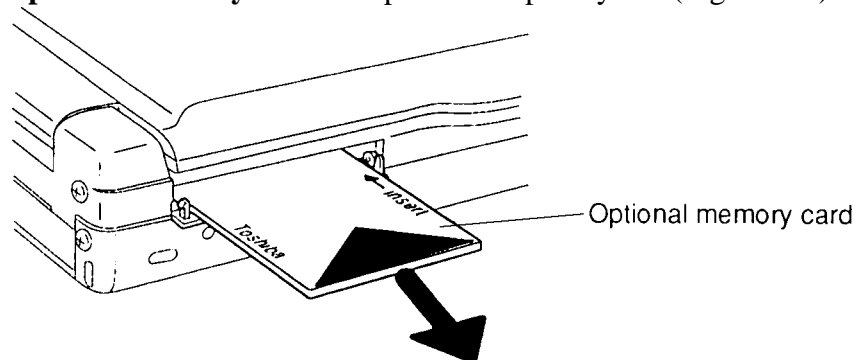


Figure 4-3 Removing the Optional Memory Card

CAUTION: DO NOT touch the connecting edge of the memory card. Debris or oil in or on

the connector may cause memory access problems.

Installing the Optional Memory Card

To install an optional memory card in the T4500/T4600 Family computer, follow the steps below and refer to Figures 4-4 and 4-2.

1. The top of the **optional memory card** is marked with the word “insert” and an arrow pointing toward the connecting edge. Turn the memory card so that it is facing up and carefully insert the connecting edge (arrow first) into the slot. *Gently* push the card until it firmly connects (Figure 4-4).

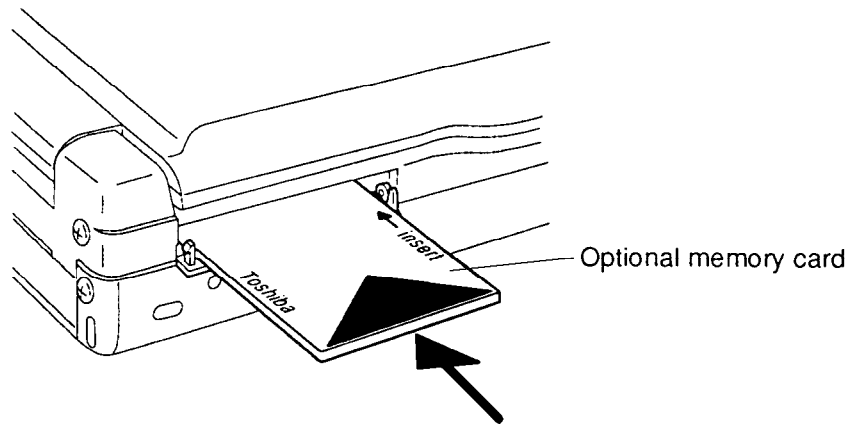


Figure 4-4 Installing the Optional Memory Card

2. Close the **expansion memory cover** (Figure 4-2).
3. Install the battery pack as described in Section 4.2.

NOTE: *The T4500/T4600 Family computer automatically configures all additional memory as extended memory.*

4.4 Optional PCMCIA Card(s)

Removing the Optional PCMCIA Card(s) & Disassembling the Slot

To remove an optional PCMCIA card from the T4500/T4600 Family computer or to disassemble the slot, follow the steps below and refer to Figures 4-5 through 4-7:

1. Turn off the power to the computer; disconnect the AC adapter, power cord and all external cables connected to it.
2. Remove the battery pack as described in Section 4.2.
3. Lift up the **outer plastic cover** on the PCMCIA card slot and carefully disengage the two latches on the sides of the cover to remove it (Figure 4-5).
4. Open the display.

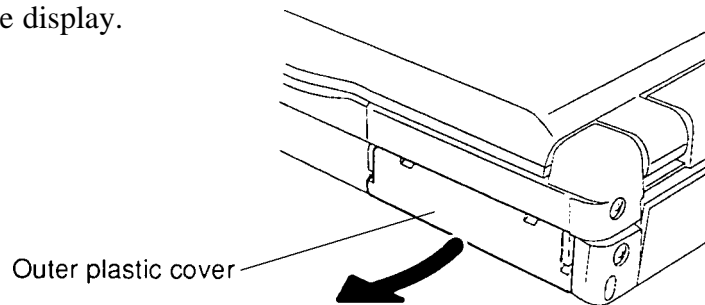


Figure 4-5 Removing the Outer Plastic PCMCIA Cover

NOTE: *If a PCMCIA card(s) is installed, go to Step 5. If a card(s) is not installed, go to Step 9. The remaining figures in this section refer specifically to the T4600/C and are slightly different from how the T4500/C will appear, which supports only one PCMCIA card.*

5. To remove a card from slot 2 (T4600/C only), unlatch the top half of the **inner plastic cover** and swivel it downward to expose the slot, PCMCIA card, and **card release button**. Press the button to release the card from its slot (Figure 4-6).

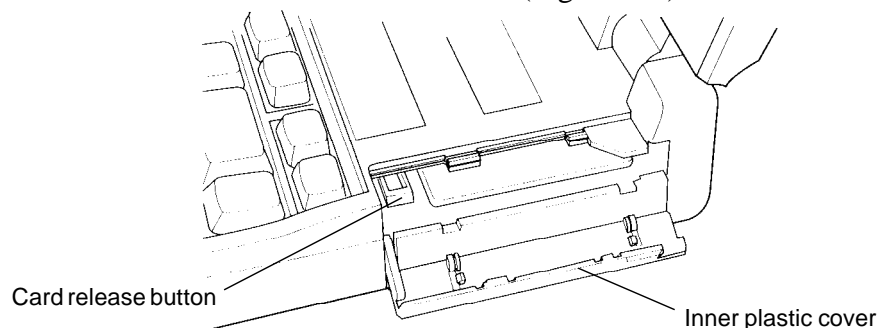


Figure 4-6 Removing the PCMCIA Card from Slot 2

6. Remove the **two M2.5x4 silver screws** on the slot's **inner plastic cover**. Grasp the bottom of the inner plastic cover and pull it in the arrow's direction to remove (Figure 4-7).
7. If optional **metal retaining brackets** are installed, remove the two **M2.5x4 silver screws** securing them to the **metal cover** (Figure 4-7).
8. Grasp the card in card slot 1, and pull it straight out (skip step 9).
9. Remove the **two M2.5x4 silver screws** on the slot's **inner plastic cover**. Grasp the bottom of the **inner plastic cover** and pull it in the arrow's direction to remove (Figure 4-7).

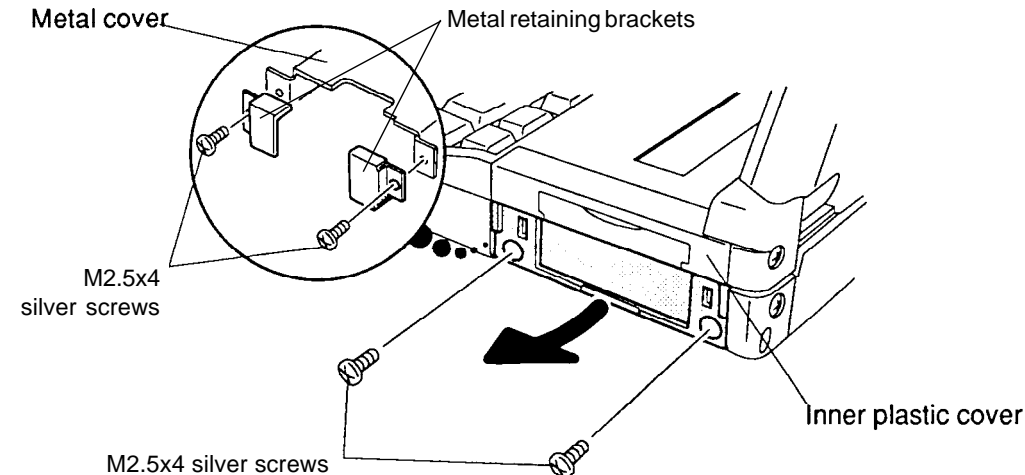


Figure 4-7 Removing the Inner Plastic PCMCIA Cover

Installing the Optional PCMCIA Card(s) & Assembling the Slot

To install optional PCMCIA card(s) in the computer or assemble the slot, follow the steps below and refer to Figures 4-5 through 4-7:

1. To access the PCMCIA card slot 1, follow Steps 1 through 7 in the above section on removing the optional PCMCIA card.
2. To install a PCMCIA card in slot 1, carefully insert the card, making sure the card is right side up and the contact surface is inserted first. If necessary, replace the optional **metal retaining brackets** and secure them with **two M2.5x4 silver screws** (Figure 4-7).
3. Snap on the **inner plastic cover** and secure it with **two M2.5x4 silver screws** (Figure 4-7).
4. To install a PCMCIA card into slot 2 (T4600/C only), unlatch the top half of the inner plastic cover and swivel it downward. Insert the card making sure the card is right side up and the contact surface is inserted first. *Gently* push the card until it firmly connects (Figure 4-6).
5. Carefully snap on the **outer plastic cover** (Figure 4-5).

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

4.5 Top Cover

Removing the Top Cover and Backup Battery

To remove the T4500/T4600 Family computer's top cover, follow the steps below and refer to Figures 4-8 and 4-9.

1. Turn off the power to the computer; disconnect the AC adapter, power cord and all external cables connected to it.
2. Remove the battery pack, optional memory card and optional PCMCIA card(s) as described in sections 4.2, 4.3, and 4.4.
3. Remove the **two M2.5x6 silver screws** securing the **top cover**, at the back corners of the computer (Figure 4-8).
4. Pull open the **port cover** on the back of the computer and take out the protective **plastic bar** seated above the ports (Figure 4-8).
5. Remove the **two M2.5x4 silver screws** that were covered by the plastic bar (Figure 4-8).
6. Carefully remove the **expansion bus cover** (Figure 4-8).

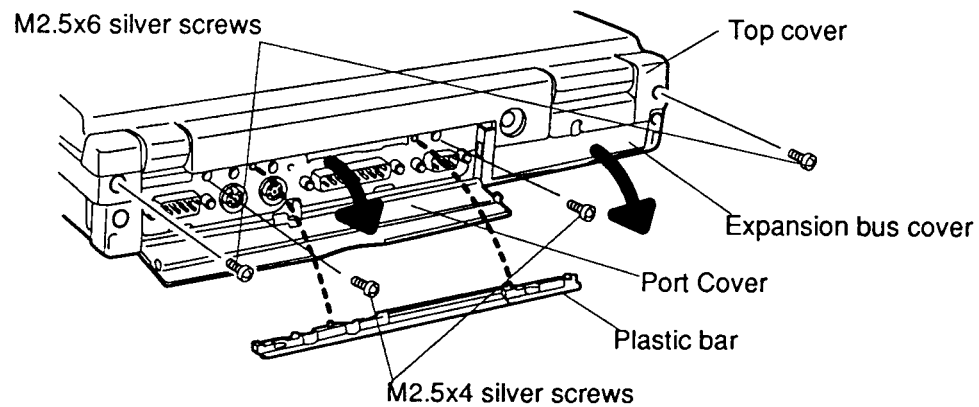


Figure 4-8 Removing the Top Cover

7. With the display closed, turn the computer over and remove the **one M2x3 black screw** at the front of the battery slot (Figure 4-9).
8. Turn the computer back over and open the display. Lay the display back fully. (Put a book or small box behind the display to support it.)
9. Remove the function key identifier strip.
10. Remove the **screw cover** and the **M2.5x6 silver screw**.
11. Unsnap the **latches** securing the **top cover** to the base assembly. Start by pressing on the front of the **top cover** just in front of the space bar and rotate the keyboard's front edge toward you to release the **front latches** (Figure 4-9).
12. Continue around the rim of the **top cover** until all latches are released, then carefully lift up the **top cover** (Figure 4-9).

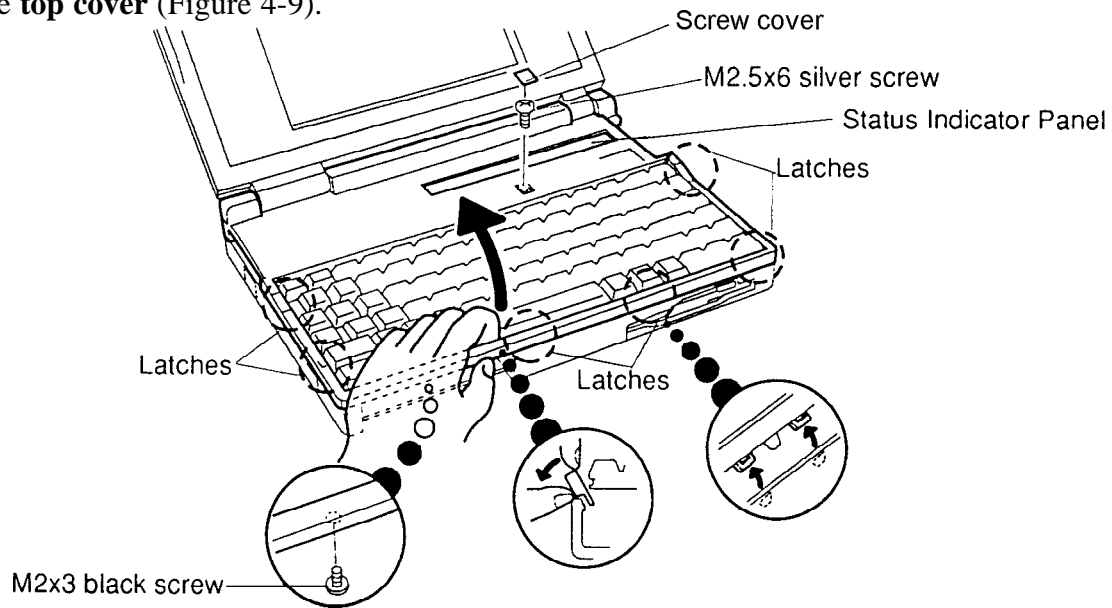


Figure 4-9 Unlatching the Top Cover

Installing the Top Cover

To install the computer's top cover, follow the steps below and refer to Figures 4-8 and 4-9.

1. Place the **top cover** on the computer making sure the **status indicator panel** is aligned with the window on the top cover.

CAUTION: *Be careful not to pinch the LCD display cables when installing the top cover.*

2. Begin at the back and snap the **top cover** in place. Continue along the sides and snap the front latches last (Figure 4-9).
3. With the display closed, turn the computer over and secure the **one M2x3 black screw** at the front of the battery slot (Figure 4-9).
4. Turn the computer back over and open the display. Lay the display back fully. (Put a book or small box behind the display to support it.)
5. Secure the **one M2.5x6 silver screw** and replace the **screw cover** below the function key identifier strip (Figure 4-9).
6. Replace the function key identifier strip.
7. Secure the **two M2.5x4 silver screws** above the PS/2 mouse and RGB ports (Figure 4-8).
8. Replace the protective **plastic bar** above the ports (Figure 4-8).
9. Secure the **two M2.5x6 silver screws** at the back corners of the computer (Figure 4-8).
10. Replace the **expansion bus cover** (Figure 4-8).
11. Install the optional PCMCIA card, optional memory card and battery pack as described in Sections 4.4, 4.3, and 4.2.

4.6 Keyboard

Removing the Keyboard

To remove the T4500/T4600 Family computer's keyboard, follow the steps below and refer to Figure 4-10.

1. Turn off the power to the computer; disconnect the AC adapter, power cord and all external cables connected to it.
2. Remove the battery pack, optional memory card, optional PCMCIA card and top cover as described in Sections 4.2 through 4.5.
3. Carefully lift up the **keyboard** to expose the keyboard connector.
4. Disconnect the **keyboard cable** from **pressure-plate connector** on the system board (Figure 4-10).

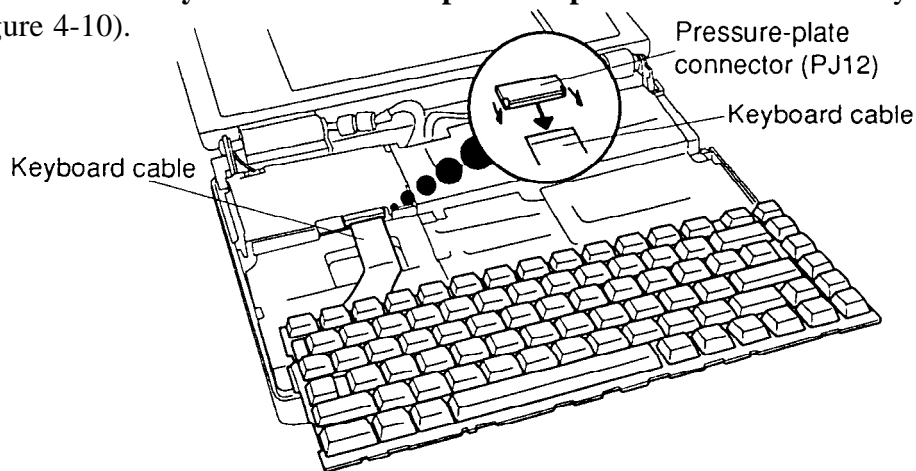


Figure 4-10 Removing the Keyboard

Installing the Keyboard

To install the computer's keyboard, follow the steps below and refer to Figures 4-10 and 4-11.

1. Connect the **keyboard cable** to the **pressure-plate connector** on the system board (Figure 4-10).
2. Seat the **keyboard** in the computer. Note that a fold is built into the **keyboard cable**. Do not try to bend the cable at any other point when you install the keyboard (Figure 4-9).

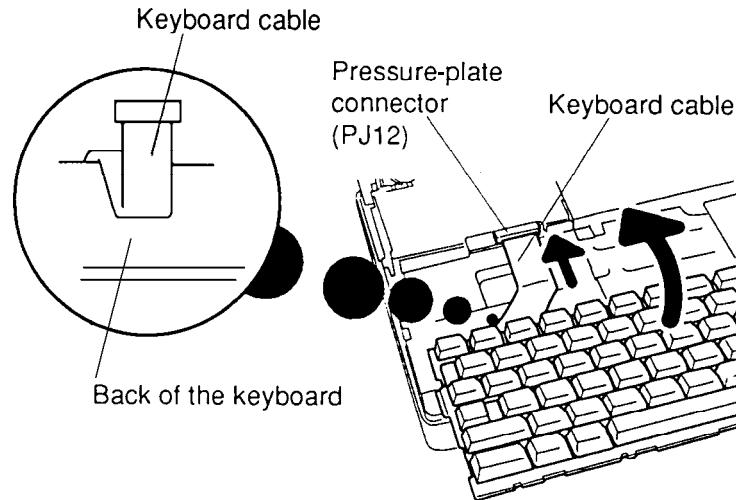


Figure 4-11 Seating the Keyboard

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

4.7 Status Indicator Panel (Sub LCD)

Removing the Status Indicator Panel

To remove the T4500/T4600 Family computer's status indicator panel, follow the steps below and refer to Figure 4-12.

1. Turn off the power to the computer; disconnect the AC adapter, power cord and all external cables connected to it.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, and keyboard as described in Sections 4.2 through 4.6.
3. Disconnect the **status indicator panel cable** from **PJ11** on the system board.

CAUTION: *The status indicator panel cable is delicate so be extremely careful not to damage it when disconnecting it.*

4. Lift out the **status indicator panel** (sub LCD).

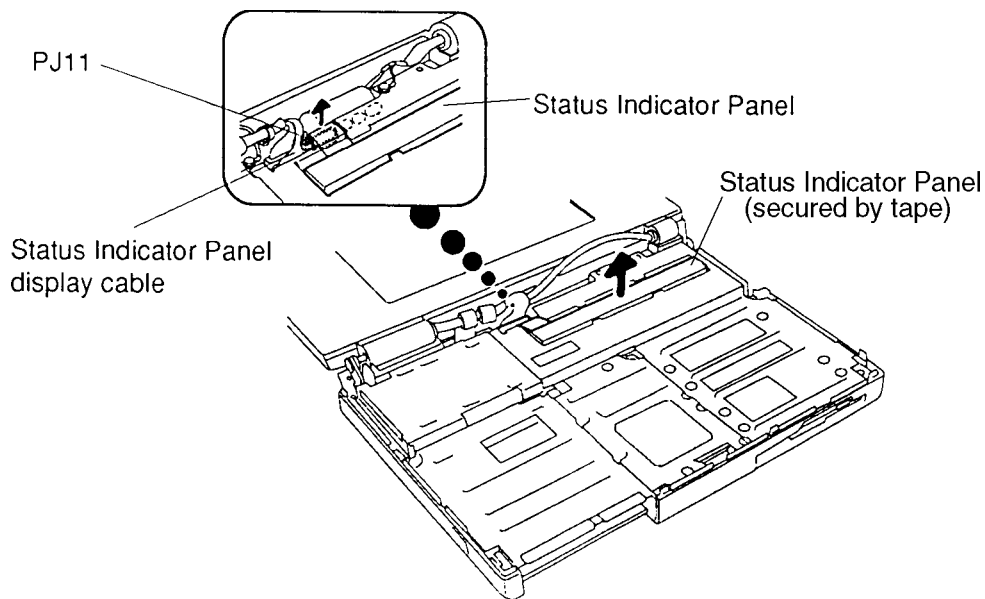


Figure 4-12 Removing the Status Indicator Panel

Installing the Status Indicator Panel

To install the computer's status indicator panel, follow the steps below and refer to Figure 4-13.

1. Connect the **status indicator panel cable** to **PJ11** on the computer and lay the panel into a recession in the **protective metal plate**.

CAUTION: The status indicator panel cable is delicate so be extremely careful not to damage it when connecting it.

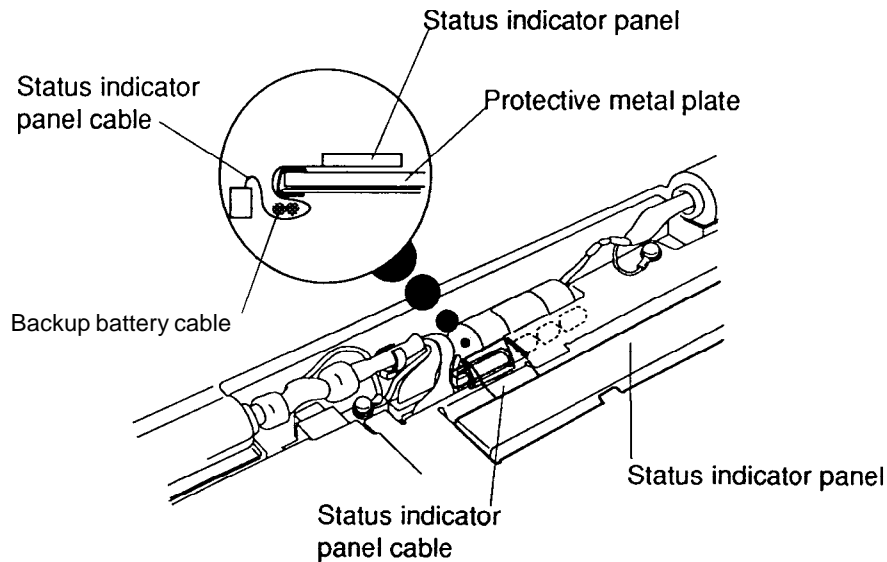


Figure 4-13 Replacing the Status Indicator Panel

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

4.8 Hard Disk Drive • Speaker/Ball-Point Mouse Connector

Removing the Hard Disk Drive • Speaker/Ball-Point Mouse Connector

To remove the T4500/T4600 Family's hard disk drive and the flexible cable connecting the speaker/ball-point mouse connector, follow the steps below and refer to Figures 4-14 through 4-16.

1. Turn off the power to the computer; disconnect the AC adapter, power cord and all external cables connected to it.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, keyboard and status indicator panel as described in Sections 4.2 through 4.7.
3. Remove the **two M2x3 black screws** securing the protective metal plate to the FDD, **two M2.5x6 screws** securing the plate to the HDD, and the **eight M2.5x6 screws** and **one M2.5x10 screw** along the plate's rim securing the plate, **left hold plate**, and ground cables to the computer (Figure 4-14).

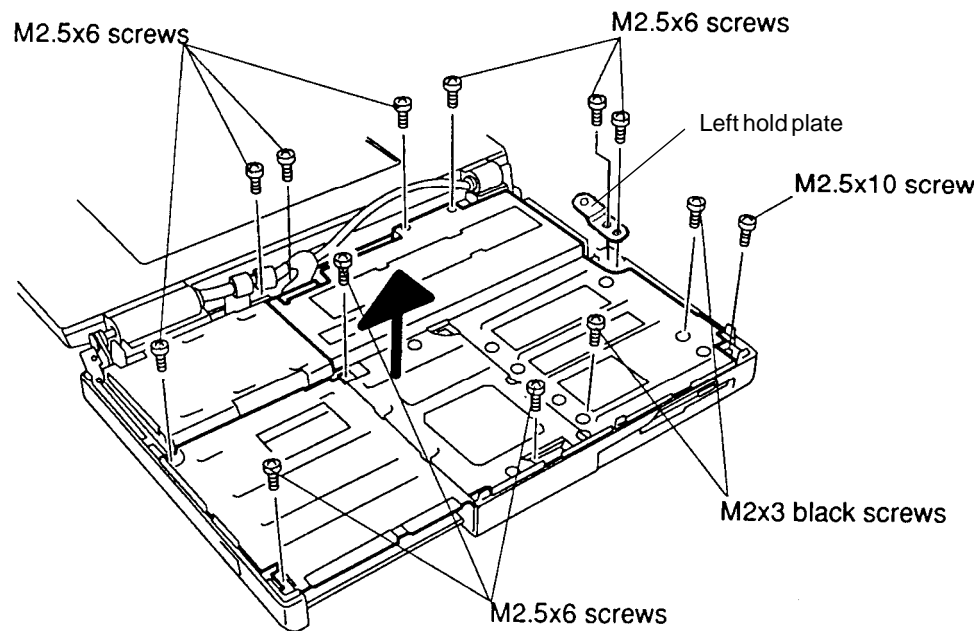


Figure 4-14 Removing the Protective Metal Plate

4. Lift off the protective metal plate.

NOTE: Use extreme caution when handling the ball-point mouse connector and the speaker as these parts are very delicate and can be damaged easily.

5. Remove the **one M2.5x6 screw** securing the **ball-point mouse connector** (Figure 4-15).
6. Lift out the **ball-point mouse connector**.
7. Lift out the **speaker**.
8. Disconnect the **FDD flexible cable** from **PJ4** on the system board (Figure 4-15).
9. Disconnect the **HDD flexible cable** from **PJ5** on the system board (Figure 4-15).

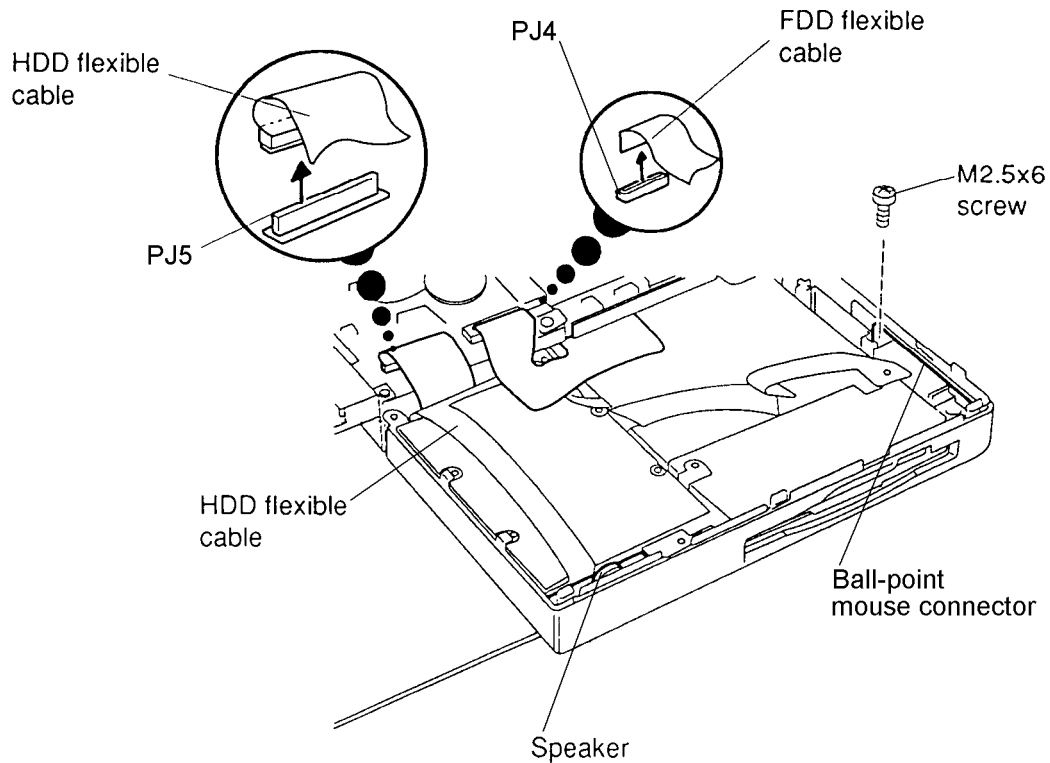


Figure 4-15 Removing the HDD

10. Lift out the **HDD** with the **ball-point mouse connector** and **speaker** attached.
11. Place your fingers behind the plastic plate on the **HDD connector** and pull to disconnect the flexible cable from the HDD.
12. Remove **four flat-head M2x4 screws** securing the **bracket** to the HDD and slip off the bracket (Figure 4-16).

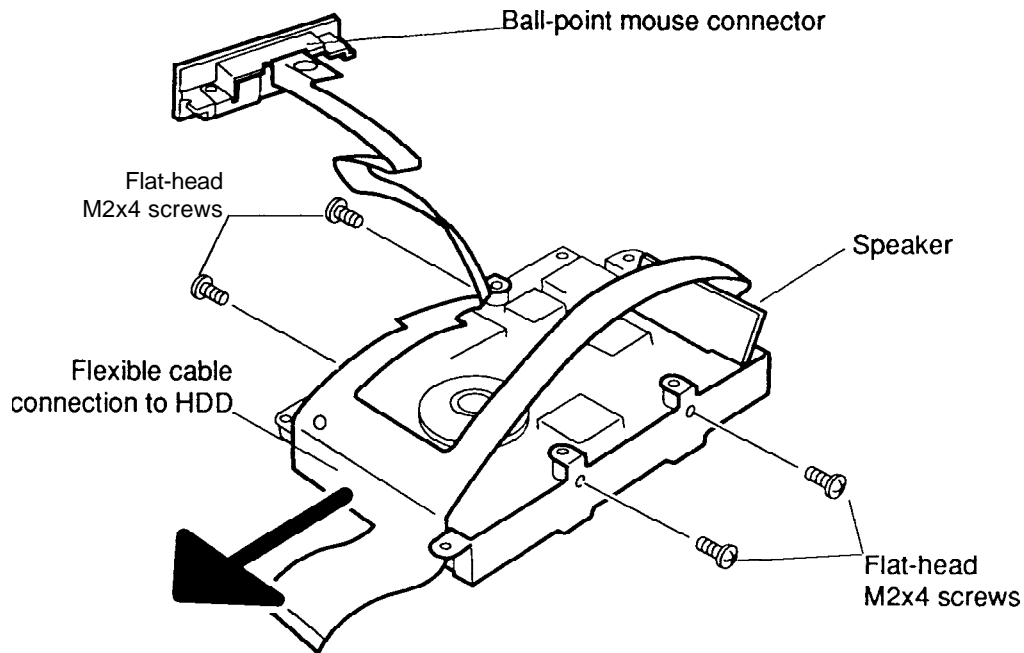


Figure 4-16 Removing the HDD Bracket and Speaker/Ball-point Connector

Installing the Hard Disk Drive

To install the computer's hard disk drive, follow the steps below and refer to Figures 4-14 through 4-17.

1. Secure the **bracket** with the **four flat-head M2x4 screws** (Figure 4-16).
2. Connect the **flexible cable** to the HDD (Figure 4-16).

CAUTION: If you replace the flexible cable with a new one, be sure to fold it and wrap tape around the cable as indicated in Figure 4-17 so that it lies flat and will not be pinched by the top cover or other component.

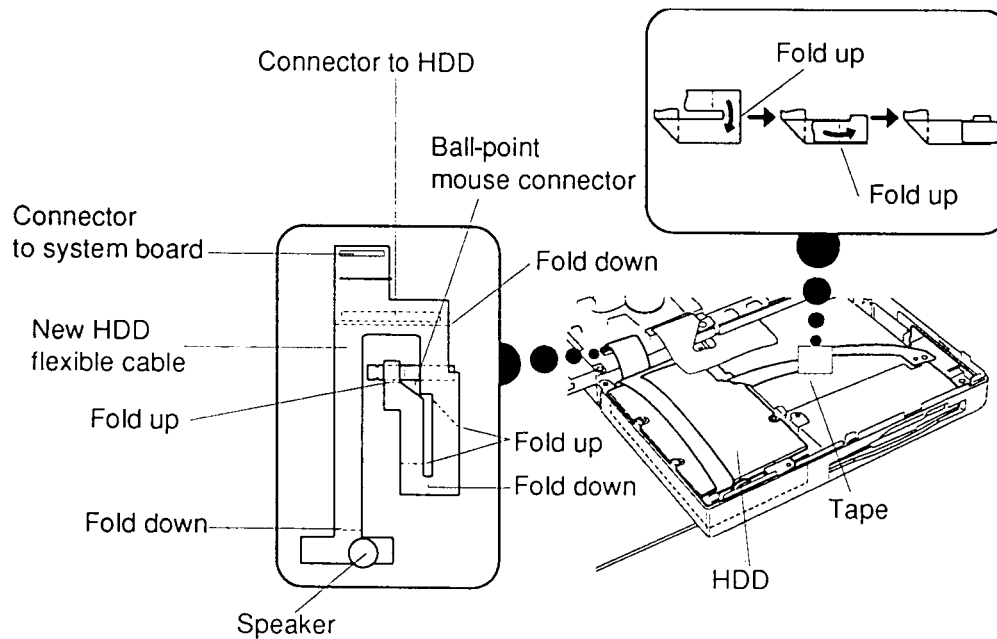


Figure 4-17 Connecting the Flexible Cable to the HDD

3. Seat the **HDD** in the frame. As you seat the HDD, a tab on the front right has two holes in it. The hole on the right should fit over a plastic guide pin on the computer. The other hole is for a screw.
4. Insert the **speaker** and **ball-point connector**. Make sure the sides of each are seated in their respective **slots** in the computer (Figure 4-15).
5. Connect the **HDD flexible cable** to **PJ5** on the system board. Connect the **FDD flexible cable** to **PJ4** on the system board (Figure 4-15).
6. Replace the **M2.5x6 screw** securing the ball-point mouse connector (Figure 4-15).
7. Reseat the **protective metal plate**, making sure the holes for screws match corresponding holes on the computer and the ground cables are routed above the plate (Figure 4-14).
8. Replace the **two M2x3 black screws** securing the protective metal plate to the FDD, **two M2.5x6 screws** securing the plate to the HDD, and the **eight M2.5x6 screws** and **one M2.5x10 screw** along the plate's rim securing the plate, **support bracket**, and ground cables to the computer (Figure 4-14).
9. Install the status indicator panel, keyboard, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.7 through 4.2.

4.9 Display Assembly

Removing the Display Assembly

To remove the T4500/T4600 Family computer's display assembly, follow the steps below and refer to Figure 4-18.

1. Turn off the power to the computer; disconnect the AC adapter, power cord and all external cables connected to it.
2. Remove the battery pack, optional memory card, optional PCMCIA card, and top cover as described in Sections 4.2 through 4.5. Also, remove the protective metal plate to disconnect the FL inverter cable as described in Section 4.8 (shown in Figure 4-14).
3. Disconnect the **two display cables** and **one FL inverter cable** (Figure 4-18).
4. Remove the tape securing the **display disable switch cable** and disconnect it from the system board (Figure 4-18).
5. Remove the **four M2.5x6 silver screws** behind the status indicator panel securing the ground cables (Figure 4-18).
6. Remove the **four M2.5x6 silver screws** on the back of the computer and on the display hinges which secures the **right hold plate** and display (Figure 4-18).
7. Lift off the display assembly (Figure 4-18).

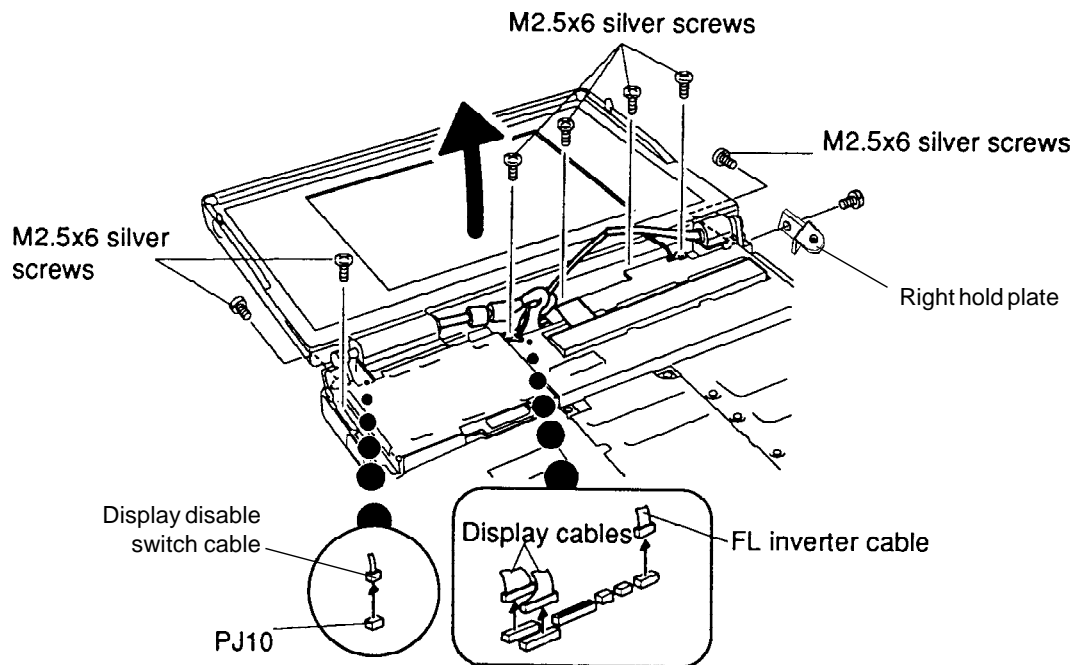


Figure 4-18 Removing the Display Assembly

Installing the Display Assembly

To install the computer's display, follow the steps below and refer to Figures 4-18 through 4-20.

1. Place the display assembly on the computer making sure the brackets on the display fit in front of the corresponding brackets on the computer.
2. Replace the **four M2.5x6 silver screws** on the back and inside hinge areas of the computer to secure the display assembly to the chassis (Figure 4-18).

CAUTION: If you replace a cable with a new one, be sure to bend and route it as indicated in the following diagrams so that it fits snugly and will not be pinched by the top cover or other components (Figures 4-19 and 4-20).

3. Connect and route the **FL inverter cable** and the **two display cables** to their respective **connectors** on the system PCB (Figure 4-19).

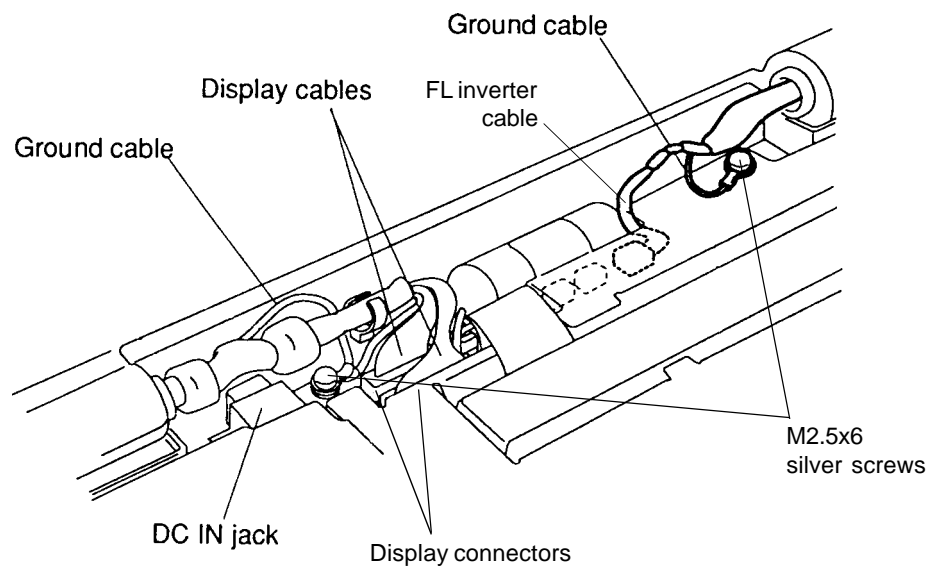


Figure 4-19 Routing the Display Cables

4. Reseat the protective metal plate, making sure the holes for screws match corresponding holes on the computer and the ground cables are routed *above* the plate (Figure 4-14).
5. Replace the **two M2x3 black screws** securing the protective metal plate to the FDD, **two M2.5x6 screws** securing the plate to the HDD, and the **eight M2.5x6 screws** and **one M2.5x10 screw** along the plate's rim securing the plate, **support bracket**, and ground cables to the computer (Figure 4-14).

6. Connect the **display disable switch cable** to its connector (**PJ10**) on the system board and secure it in place with **tape** (Figure 4-20).

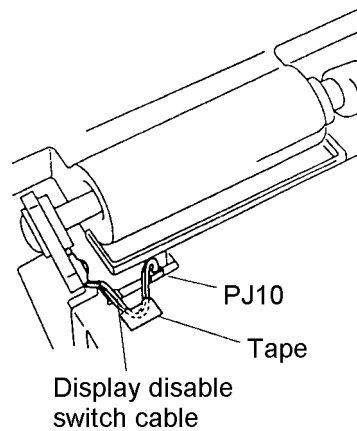


Figure 4-20 Connecting the Display Disable Switch Cable

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

4.10 System PCB

Removing the System Board

To remove the T4500/T4600 Family computer's system board, follow the steps below and refer to Figures 4-21 and 4-22.

1. Turn off the power to the computer; disconnect the AC adapter, power cord and all external cables connected to it.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, keyboard, status indicator panel, HDD, and display assembly as described in sections 4.2 through 4.9.
3. Remove **two M2.5x6 silver screws** from the bottom cover and **one M2.5x6 silver screw** securing the **system PCB** (Figure 4-21).
4. Disconnect the FDD cable at the **system PCB** (Figure 4-21).
5. Lift the **system PCB** out of the computer's case (Figure 4-21).

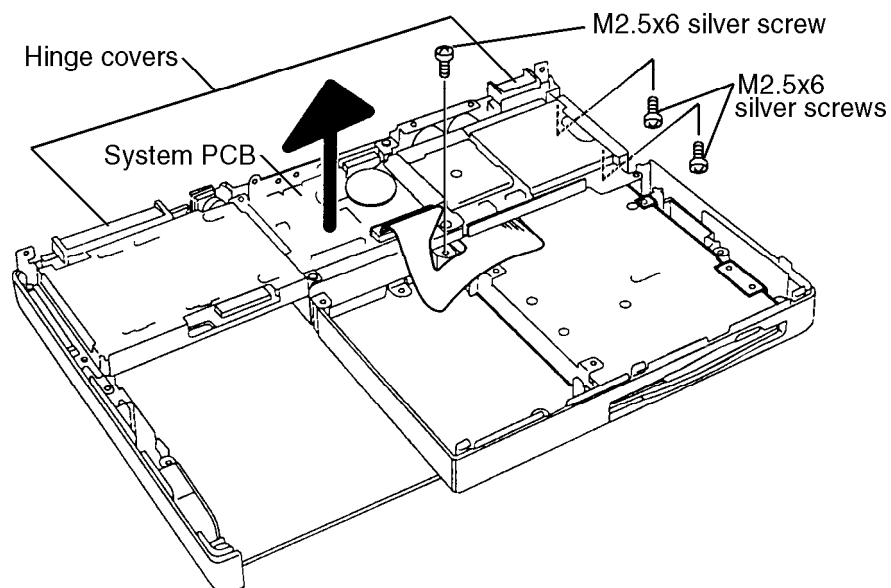


Figure 4-21 Removing the System PCB

NOTE: The **hinge covers** are not secured in any fashion to either the system board or bottom cover. Please note their locations for reassembly.

Installing the System Board

To install the computer's system board, follow the steps below and refer to Figure 4-21.

1. Seat the **system PCB** in the computer's case.
2. Replace the **hinge covers**, two **M2.5x6 silver screws** from the bottom cover, and **one M2.5x6 silver screw** securing the **system PCB**.
3. Install the Display assembly, HDD, status indicator panel, keyboard, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.9 through 4.2.

WARNING: *System PCB units must not be disassembled. Protective seals have been placed on the units to discourage users from taking them apart. If a seal is removed, the word "VOID" appears on the system PCB under the seal, and the warranty is voided (Figure 4-22).*

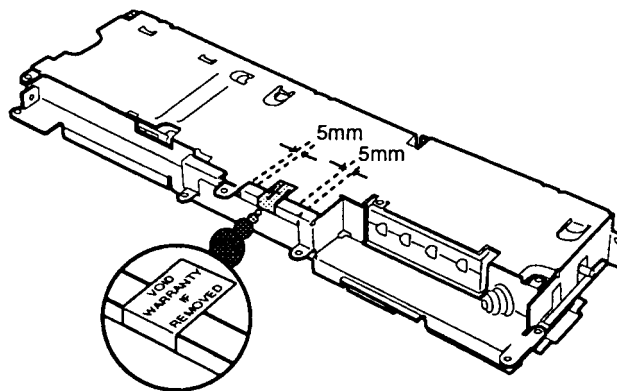


Figure 4-22 Warranty Void Seal

4.11 Floppy Disk Drive

Removing the Floppy Disk Drive

To remove the T4500/T4600 Family computer's floppy disk drive, follow the steps below and refer to Figures 4-23 and 4-24.

1. Turn off the power to the computer; disconnect the AC adapter, power cord and all external cables connected to it.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, keyboard, status indicator panel and HDD as described in sections 4.2 through 4.8.
3. Make sure the **FDD cable** is disconnected from its pressure-plate connector on the system PCB, then grasp the **FDD** on both sides and gently lift up and pull the drive toward the front of the computer (Figure 4-23).

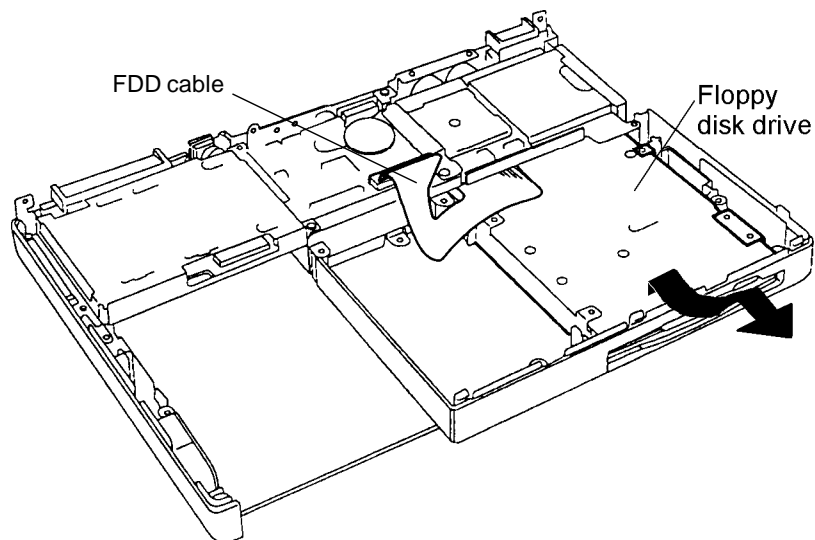


Figure 4-23 Removing the FDD

4. Remove the **two M2x3 black screws** securing the **FDD bracket** (Figure 4-24).

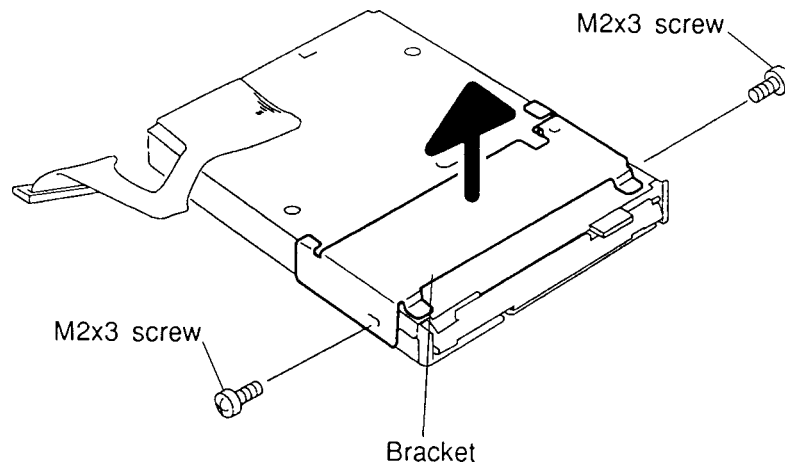


Figure 4-24 Removing the FDD Bracket

Installing the Floppy Disk Drive

To install the T4500/T4600 Family computer's floppy disk drive, follow the steps below and refer to Figures 4-23 and 4-24.

1. Place the **FDD bracket** on the FDD and secure it with the **two M2x3 black screws** (Figure 4-24).
2. Place the **FDD** in the computer (Figure 4-23).
3. Install the display assembly, HDD, status indicator panel, keyboard, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.9 through 4.2.

4.12 Backup Battery & RTC Battery

Removing the Backup Battery & RTC Battery

To remove the T4500/T4600 Family computer's backup battery and RTC battery, follow the steps below and refer to Figure 4-25.

1. Turn off the power to the computer; disconnect the AC adapter, power cord and all external cables connected to it.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, keyboard, status indicator panel, HDD and display assembly as described in sections 4.2 through 4.9.
3. Disconnect the **backup battery cable** and **RTC battery cable** from their connectors on the system PCB. Before removing the batteries, note the location of each battery and how their cables are routed. Also note the location of the tape securing the backup battery to the protective metal plate (Figure 4-25).

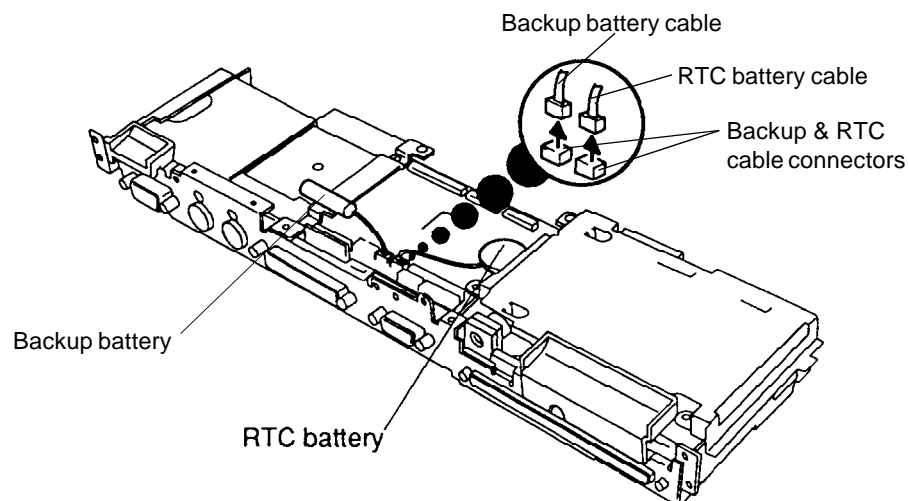


Figure 4-25 Removing the Backup Battery and RTC Battery

Installing the Backup Battery & RTC Battery

To install the computer's backup battery and RTC battery, follow the steps below and refer to Figures 4-26 and 4-27.

1. Connect the backup battery cable to its **connector**. Seat the **backup battery** so that the cable end faces away from the **connector**. Fold the cable flat along the length of the battery to prevent it from being pinched when you replace the protective metal plate. Use **tape** to secure the backup battery in its rounded cavity on the protective metal plate (Figure 4-26).

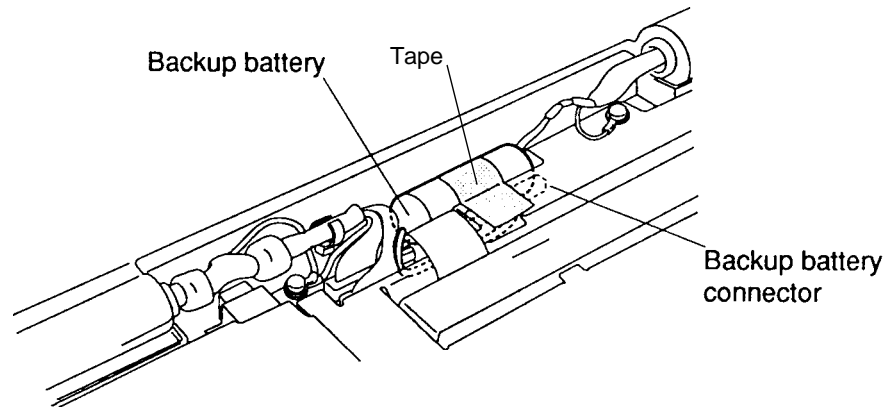


Figure 4-26 Connecting the Backup Battery

2. Connect the **RTC battery cable** to its connector, then fold the cable in a loop so it lies flat against the system board to prevent it from being pinched when you replace the protective metal plate. Double-sided adhesive tape is applied to the underside of the **RTC battery**. Stick the taped side to the system board (Figure 4-27).

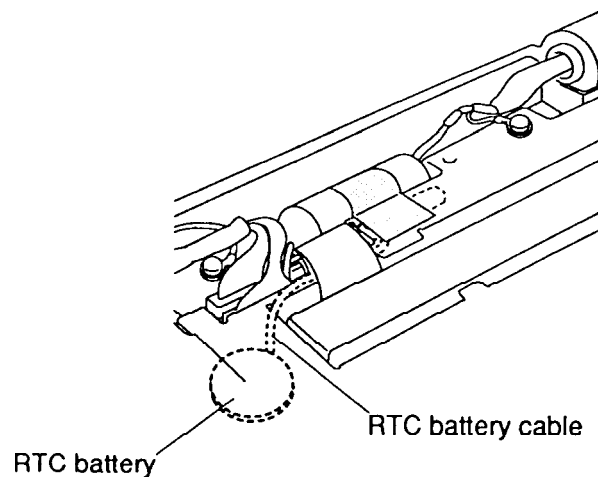


Figure 4-27 Connecting the RTC battery

3. Install the display assembly, HDD, status indicator panel, keyboard, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.9 through 4.2.

4.13 Display Mask

Removing the Display Mask

To remove the T4500/T4600 Family computer's display mask, follow the steps below and refer to Figure 4-28.

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

NOTE: *It is not necessary to remove the display assembly. However, the top cover must be removed to clear the hinge flanges.*

3. Remove **two rubber cushions** from the top corners of the display to expose **two screws** securing the **display mask** (Figure 4-28).
4. Remove the **two M2.5x4 screws** (T4500/T4600) or **two M2.5x6 screws** (T4500C/T4600C) that were covered by the cushions (Figure 4-28).
5. Carefully insert your fingers between the mask and the LCD panel and pry open the latches. Start with the **two center latches** across the bottom of the display mask. Then, unlatch the large and small display supports.
6. Continue unlatching the mask along the **sides (three latches on each side)** and top (**four latches** across the top). Be careful when pulling the mask from the display around the latch hooks so you don't break a hook.

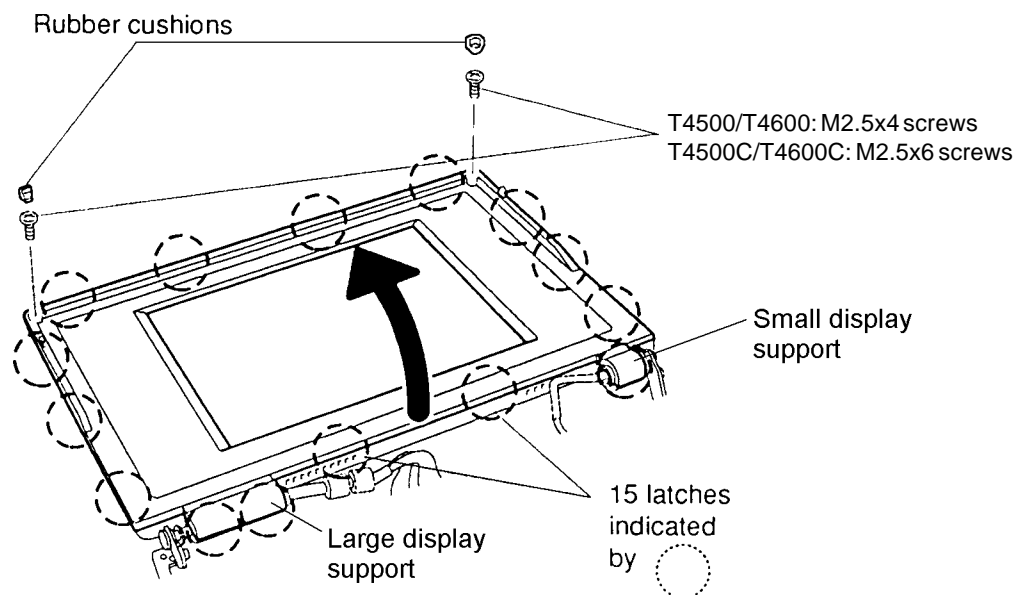


Figure 4-28 Removing the Display Mask

Installing the Display Mask

To install the computer's display mask, follow the steps below and refer to Figure 4-28.

1. Set the **display mask** in place, carefully placing the mask over the latch hooks.
2. Secure the latches beginning with the **four latches** across the top of the mask.
3. Continue along the sides of the mask (**three latches** on each side), and the bottom (two in the center, two on the larger support and one on the small support).
4. Do a quick check to be sure the mask is seated securely around the display.
5. Secure the cover with **two M2.5x4 screws** (T4500/T4600) or **two M2.5x6 screws** (T4500C/T4600C) at the top corners.
6. Attach the **two rubber cushions** at each top corner to cover the screws.
7. Install the top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.5 through 4.2.

4.14 T4500C FL Inverter Board

Removing the T4500C FL Inverter Board

To remove the T4500C's FL inverter board, follow the steps below and refer to Figure 4-29.

1. Turn off the power to the computer; disconnect the AC adapter, power cord and all external cables connected to it.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, display assembly and display mask as described in Sections 4.2, 4.3, 4.4, 4.5, 4.9, and 4.13.
3. Remove the **three M2.5x6 screws** securing the **FL inverter board**.
4. Carefully rotate the FL inverter board out from right to left and disconnect the **FL inverter cable** from **CN1** and the **four FL cables** from **CN2, CN3, CN4 and CN5** (Figure 4-29).

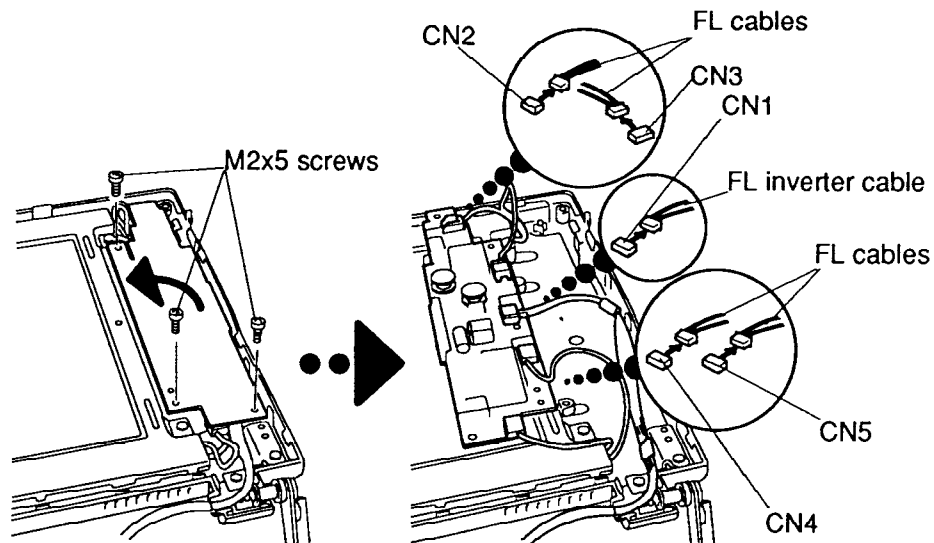


Figure 4-29 Removing the T4500C FL Inverter Board

Installing the T4500C FL Inverter Board

To install the T4500C's FL inverter board, follow the steps below and refer to Figures 4-29 and 4-30.

1. Connect the **FL inverter cable** to **CN1** on the inverter board and the **four FL cables** to **CN2, CN3, CN4 and CN5** (Figure 4-29).
2. Secure the **FL inverter cable** with **tape** (Figure 30).
3. Route the **cables** so they are not pinched by the **FL inverter board, display hinge** or other component (Figure 4-28).
4. Replace the **FL inverter board** and secure it with **three M2.5x6 screws** (Figure 4-29).

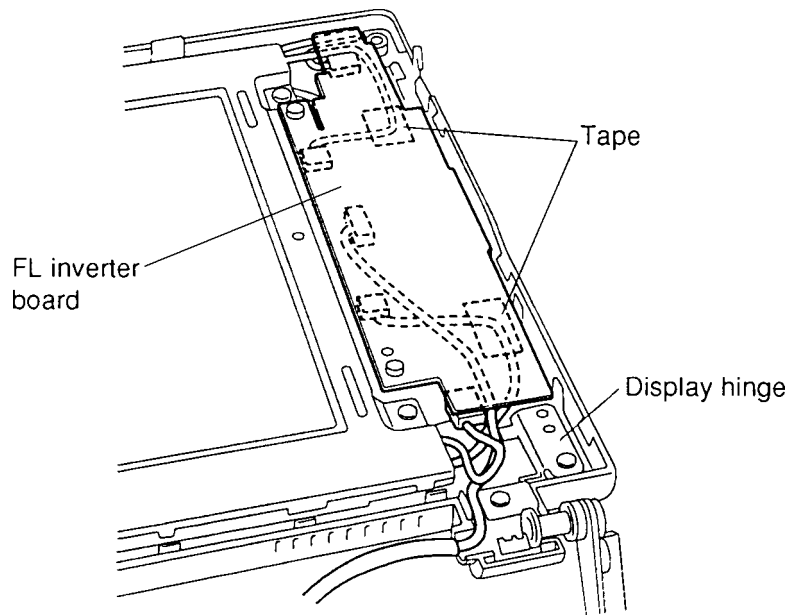


Figure 4-30 Replacing the T4500C FL Inverter Board

5. Install the display mask, display assembly, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.13, 4.9, 4.5, 4.4, 4.3 and 4.2.

4.15 T4500C 8.4-inch TFT Color LCD Module

Removing the T4500C 8.4-inch TFT Color LCD Module

To remove the T4500C's LCD module, follow the steps below and refer to Figures 4-31 and 4-32.

1. Turn off the power to the computer; disconnect the AC adapter, power cord and all external cables connected to it.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, display assembly, display mask and FL inverter board as described in Sections 4.2, 4.3, 4.4, 4.5, 4.9, 4.13, and 4.14.
3. Remove **one M2.5x6 screw** securing the **ground cable** to the LCD cover (Figure 4-31).
4. Remove **four M2.5x6 screws** securing the **TFT color LCD module** to the LCD cover (Figure 4-31).

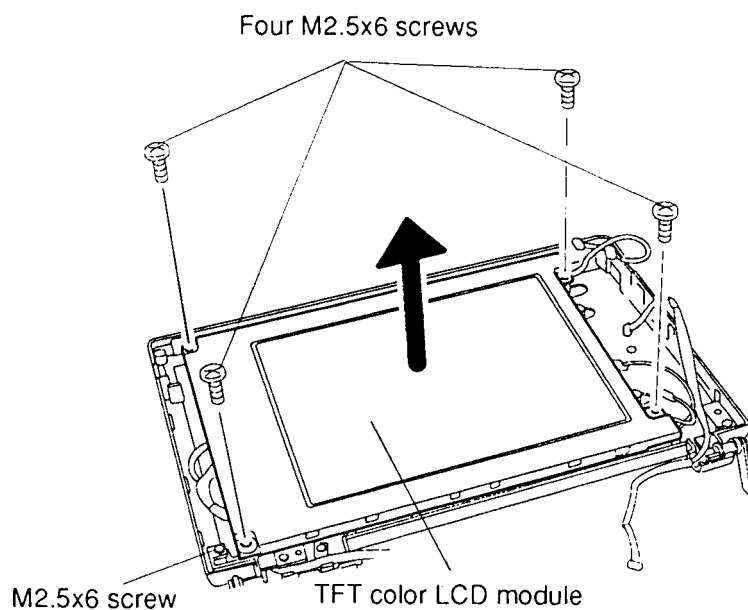


Figure 4-31 Removing the T4500C TFT Color LCD Module

5. Carefully rotate the LCD module from right to left out of the display cover and disconnect the **two display cables** from **CN1** and **CN2** on the module (Figure 4-32).

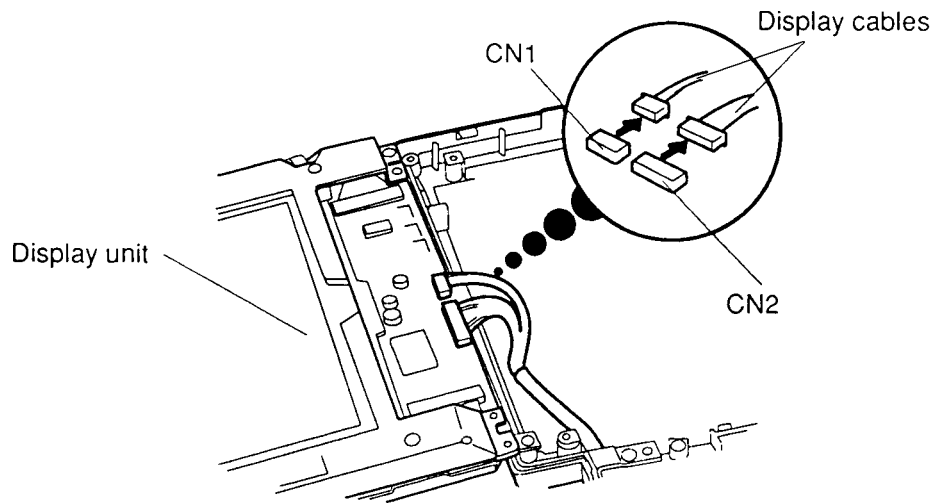


Figure 4-32 *Disconnecting the Display Cables*

Installing the T4500C 8.4-inch TFT Color LCD module

To install the T4500C's 8.4-inch TFT color LCD display, follow the steps below and refer to Figures 4-31 and 4-33:

1. Connect the **two display cables** to **CN1** and **CN2** on the **LCD module** and route the cables so they are not pinched by the FL unit or other component (Figure 4-33).
2. Secure the **ground cable** with **one M2.5x6 screw**.

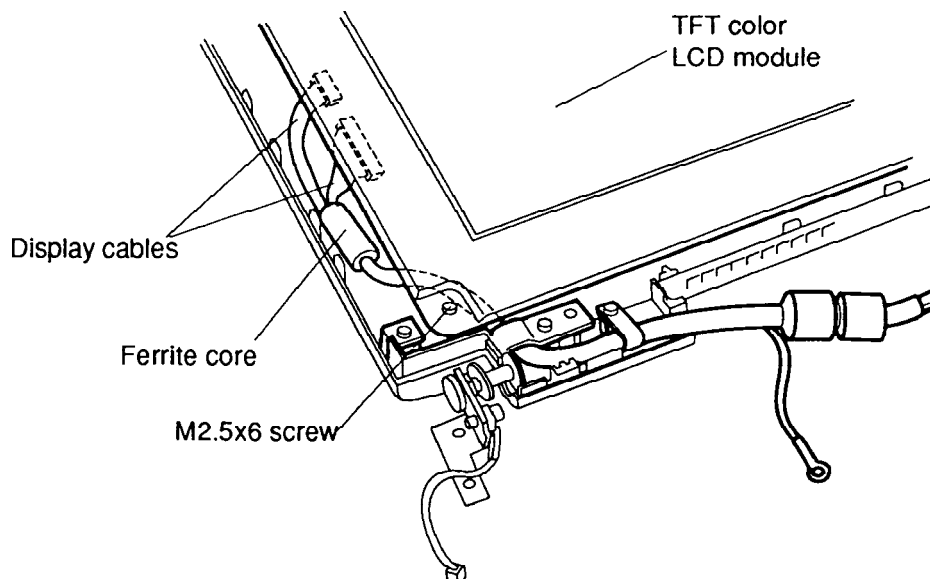


Figure 4-33 *T4500C Display Cable Routing and Connection*

3. Align the 8.4-inch **TFT color LCD display** and then secure it with **four M2.5x6 screws** (Figure 4-31).
4. Install the FL inverter board, display mask, display assembly, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.14, 4.13, 4.9, 4.5, 4.4, 4.3, 4.2.

4.16 T4500C Fluorescent Lamp Unit

CAUTION: When you remove the FL unit, be careful not to let any dust or other foreign matter enter it.

Removing the T4500C FL Unit

To remove the T4500C's FL unit, follow the steps below and refer to Figures 4-34 through 4-37.

1. Turn off the power to the computer; disconnect the AC adapter, power cord and all external cables connected to it.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, display assembly, display mask, FL inverter board, and TFT color LCD module as described in Sections 4.2, 4.3, 4.4, 4.5, 4.9, 4.13, 4.14, and 4.15.
3. Lay the **TFT color LCD module** face down and use needle-nose pliers to unbend the **five latches** holding the front and back frames together and lift the unit out of the front frame (Figure 4-34).

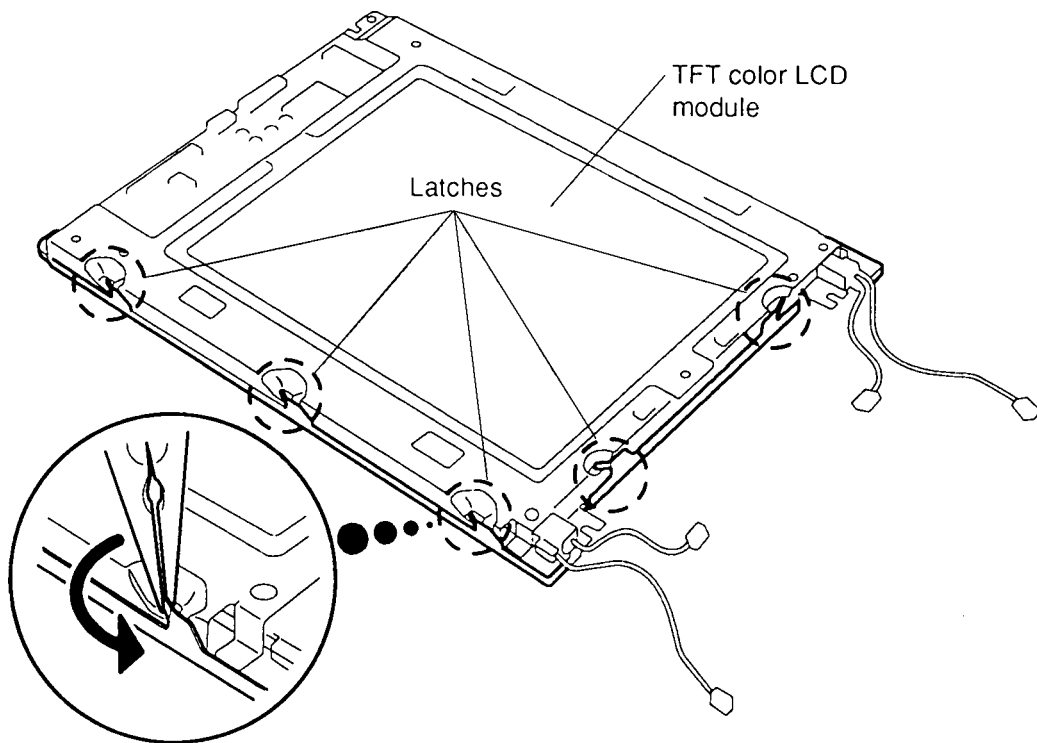


Figure 4-34 Unbending the TFT Color LCD Module Latches

4. Turn over the panel.

5. Remove the **four M2x3 silver screws** securing the **FL unit LCD panel** to the back frame (Figure 4-35).

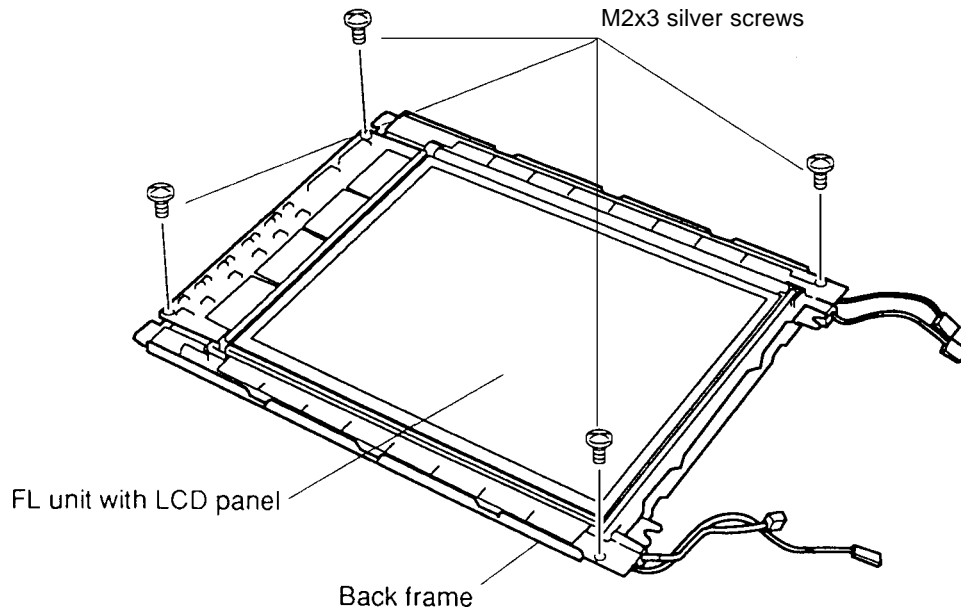


Figure 4-35 Removing the FL Unit Screws

6. Turn over the panel.
7. Use a slender object, such as tweezers, to push through the four holes on the unit and un-snap the latches to free the **LCD panel** from the back frame (Figure 4-36).
8. Lift off the back frame and turn over the **FL unit**, so it faces up (Figure 4-36).

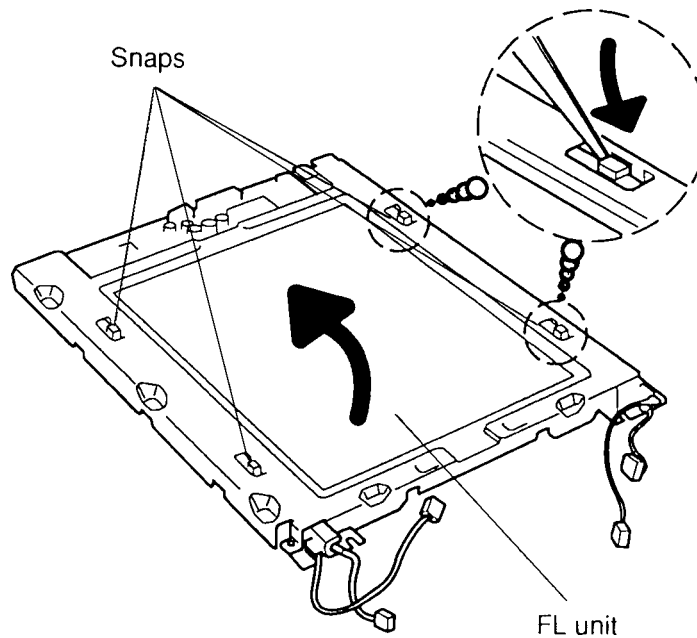


Figure 4-36 Releasing the FL Unit with the LCD Panel from the Back Frame

8. Gently unsnap the **LCD panel** at the corners from the **FL unit** and lift it off the panel (Figure 4-37).

CAUTION: *Be very careful when you unsnap the display panel. If you use too much force, you might break the panel's **tabs**.*

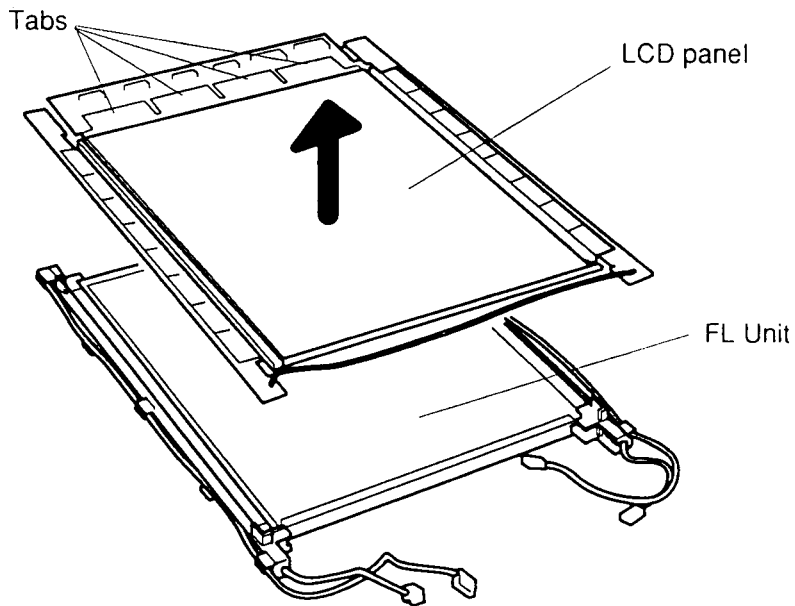


Figure 4-37 Removing the FL Unit from the Display Panel

Installing the T4500C FL Unit

To install the T4500C's FL unit, follow the steps below and refer to Figures 4-34 through 4-37.

1. Place the **FL unit** on the **LCD panel** and press down at the corners to snap it into place (Figure 4-37).
2. Put the **FL unit** with **LCD panel** in the back frame and press on the sides to secure the snaps (Figure 4-36).
3. Secure the **four M2x4 screws** (Figure 4-35).
4. Place the assembly in the front frame and carefully bend the **five latches** back into place (Figure 4-34).
5. Install the TFT color LCD module, FL inverter board, display mask, display assembly, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.15, 4.14, 4.13, 4.9, 4.5, 4.4, 4.3, and 4.2.

4.17 T4600C FL Inverter Board

Removing the T4600C FL Inverter Board

To remove the T4500C's FL inverter board, follow the steps below and refer to Figure 4-38.

1. Turn off the power to the computer; disconnect the AC adapter, power cord and all external cables connected to it.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, display assembly and display mask as described in Sections 4.2, 4.3, 4.4, 4.5, 4.9, and 4.13.
3. Disconnect the FL cables from CN2 and CN3.
4. Remove the **two M2x4 screws** securing the **FL inverter board** to the **display cover**.
5. Gently lift the FL inverter board and disconnect the FL inverter cable from CN1 and lift out the **FL inverter board**.

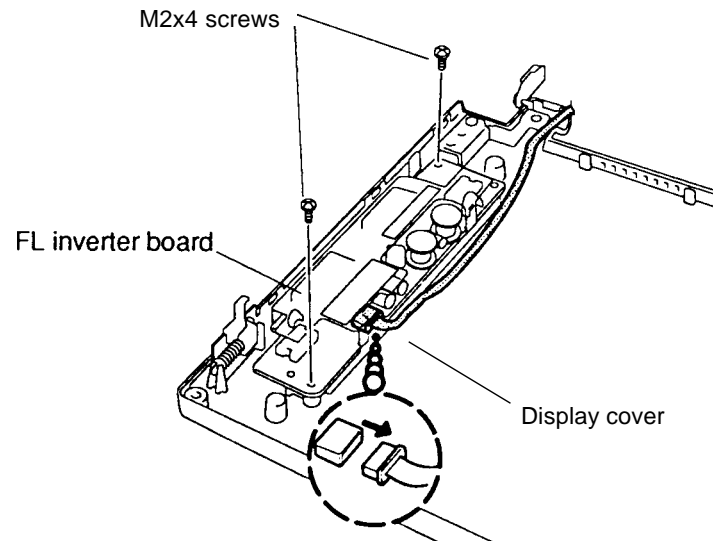


Figure 4-38 Removing the T4600C FL Inverter Board

Installing the T4600C FL Inverter Board

To install the T4600C's FL inverter board, follow the steps below and refer to Figure 4-38.

1. Connect the FL inverter cable to CN1 and the FL cables to CN2 and CN3 on the **FL inverter board**, and replace it into the **display cover**.
2. Route the cables carefully so they are not pinched by the **FL inverter board**, display hinge or other component.
3. Secure the **FL inverter board** with **two M2x4 screws**.
5. Install the display mask, display assembly, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.13, 4.9, 4.5, 4.4, 4.3 and 4.2.

4.18 T4600C 9.5-inch TFT Color LCD Module

Removing the T4600C 9.5-inch TFT Color LCD Display

To remove the T4600C's LCD module, follow these steps and refer to Figures 4-39 and 4-40.

1. Turn off the power to the computer; disconnect the AC adapter, power cord and all external cables connected to it.
2. Remove the battery pack, top cover and display mask as described in Sections 4.2, 4.5 and 4.13.
3. Remove the **four M2.5x10 screws** and **two M2.5x6 screws** securing the **LCD module** to the display cover.
4. Disconnect the FL cables from **CN2** and **CN3** and turn over the **LCD module**.

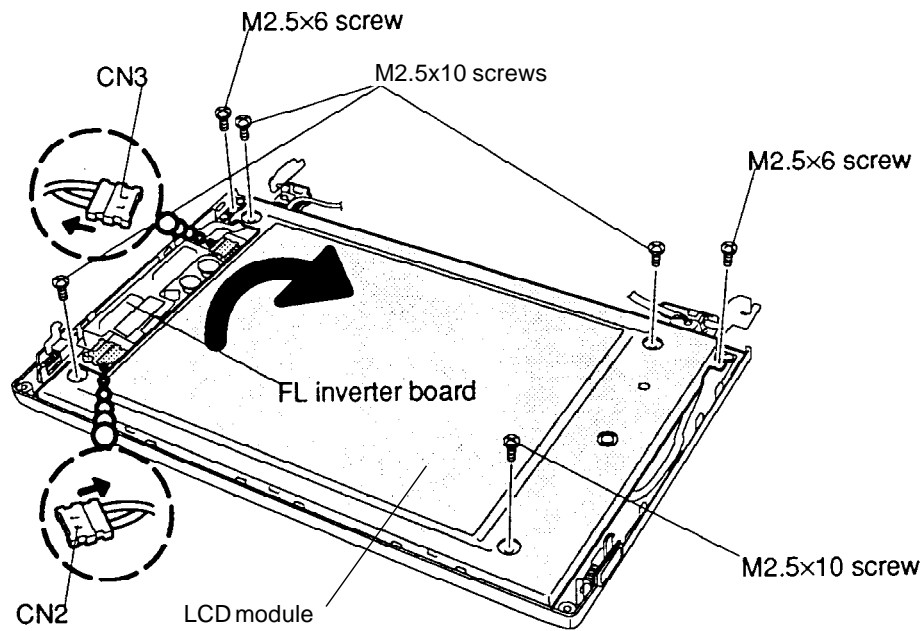


Figure 4-39 Removing the T4600C's TFT Color LCD

5. Disconnect the **display cables** from **CN11** and **CN12** on the LCD module (Figure 4-40).

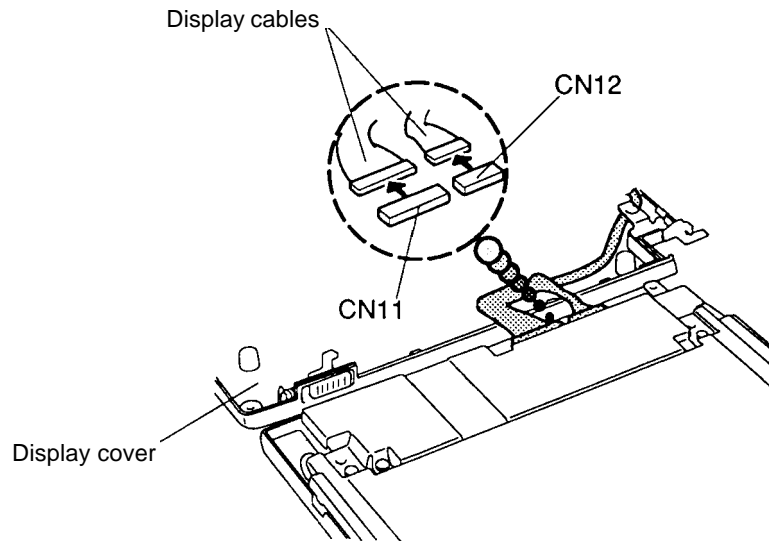


Figure 4-40 Disconnecting the Display Cables

Installing the T4600C 9.5-inch TFT Color LCD

To install the T4600C's 9.5-inch TFT color LCD, follow the steps below and refer to Figures 4-39 and 4-40.

1. Connect the **two display cables** to **CN11** and **CN12** on the TFT color LCD module and rotate the module into place (Figure 4-40).
2. Connect the two FL cables to **CN2** and **CN3** on the **FL inverter board** (Figure 4-39).
3. Align the 9.5-inch TFT color LCD and secure it with **two M2.5x6 screws**. Then secure the **four 2.5x10 screws** (Figure 4-39).

CAUTION: *If you're replacing the LCD cable or the LCD module, DO NOT forget to secure the ground cable near the left side display hinge.*

4. Replace the display mask, top cover and battery pack as described in Sections 4.13, 4.5, and 4.2.

4.19 T4600C Fluorescent Lamp Unit

Removing the T4600C's FL Unit

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

To remove the T4600C's FL unit, follow the steps below and refer to Figure 4-41.

1. Turn off the power to the computer; disconnect the AC adapter, power cord and all external cables connected to it.
2. Remove the battery pack, top cover, display mask, and TFT color LCD as described in Sections 4.2, 4.5, 4.13, and 4.18.
3. Place the **FL unit** face down and remove the four **M2.5x6 silver screws**.
4. Lift the **FL unit** out of the frame.

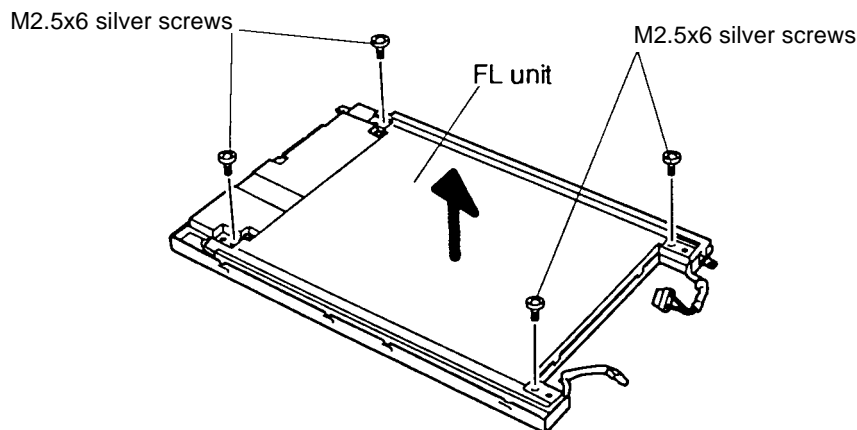


Figure 4-41 Removing the T4600C's FL Unit

Installing the T4600C's FL Unit

To install the T4600C's FL unit, follow the steps below and refer to Figure 4-41.

1. Replace the **FL unit** in the frame and secure it with the **four M2.5x6 silver screws**.
2. Replace the TFT color LCD, display mask, top cover and battery pack as described in Sections 4.18, 4.13, 4.5, and 4.2.

4.20 T4500/T4600 FL Inverter Board

Removing the Monochrome LCD FL Inverter Board

To remove the Monochrome FL inverter board, follow the steps below and refer to Figure 4-42.

1. Turn off the power to the computer; disconnect the AC adapter, power cord and all external cables connected to it.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, display assembly and display mask as described in Sections 4.2, 4.3, 4.4, 4.5, 4.9, and 4.13.
3. Remove the **two M2.5x4 screws** securing the **FL inverter board**.
4. Disconnect the **FL inverter cable** and **FL cable** from **CN1** and **CN2** on the **FL inverter board**.

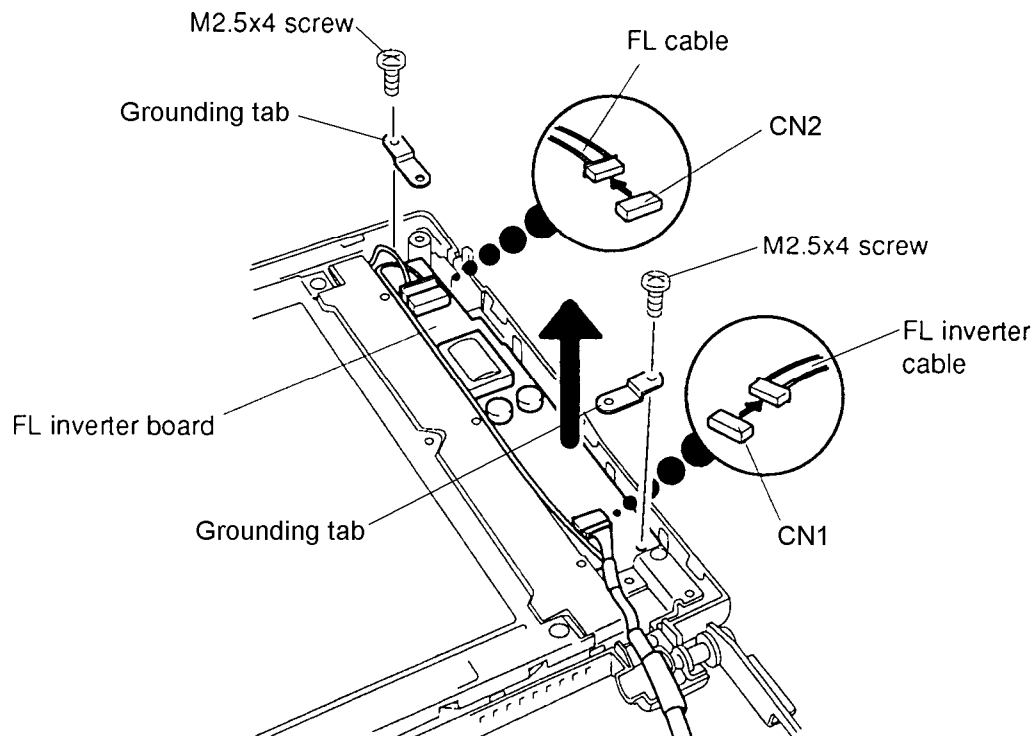


Figure 4-42 Removing the T4500/T4600 FL Inverter Board

Installing the Monochrome LCD FL Inverter Board

To install the T4500/T4600 FL inverter board, follow the steps below and refer to Figures 4-42 and 4-43.

1. Connect the **FL inverter cable** and **FL cable** to **CN1** and **CN2** on the **FL inverter board** (Figure 4-42).
2. Seat the **FL inverter board** and route the cables so they will not be pinched by the display cover or any other component (Figure 4-43).
3. Make sure the **FL cable** is secured with **tape** as indicated in Figure 4-43.

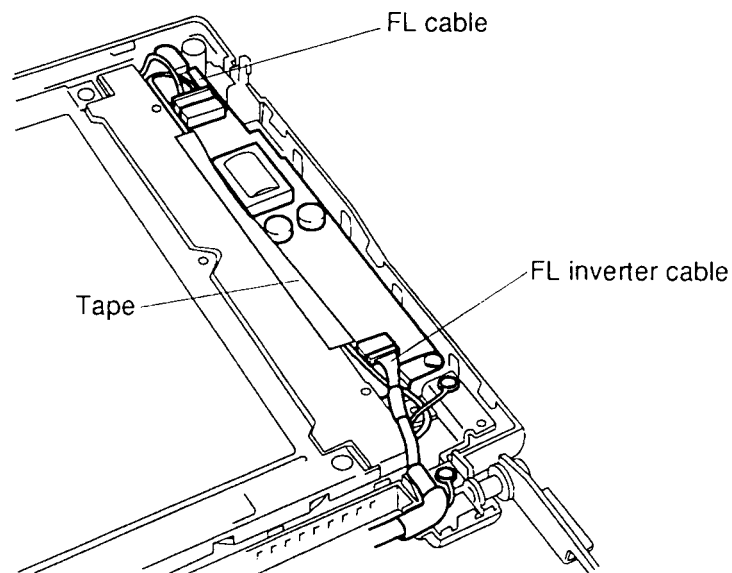


Figure 4-43 Seating the FL Inverter Board and Routing the Cables

4. Insert the grounding tabs in the **M2.5x4 screws**, then secure the **FL inverter board** to the display cover (Figure 4-43).
5. Install the display mask, display assembly, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.13, 4.9, 4.5, 4.4, 4.3 and 4.2.

4.21 T4500/T4600 LCD Module

Removing the Monochrome Liquid Crystal Display (LCD) Module

CAUTION: The T4500/T4600 LCD module is easily damaged. Before removing the module, refer to Appendix A for precautions on handling.

To remove the T4500/T4600 liquid crystal display module, follow the steps below and refer to Figures 4-44 and 4-45:

1. Turn off the power to the computer; disconnect the AC adapter, power cord and all external cables connected to it.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, display assembly and display mask as described in Sections 4.2, 4.3, 4.4, 4.5, 4.9, and 4.13.
3. Remove the **one M2.5x4 screw** securing the ground cable.
4. Remove the **four M2.5x4 screws** from each corner of the **LCD module** (Figure 4-44).
5. Rotate the **LCD module** out of the cover from right to left (Figure 4-44).

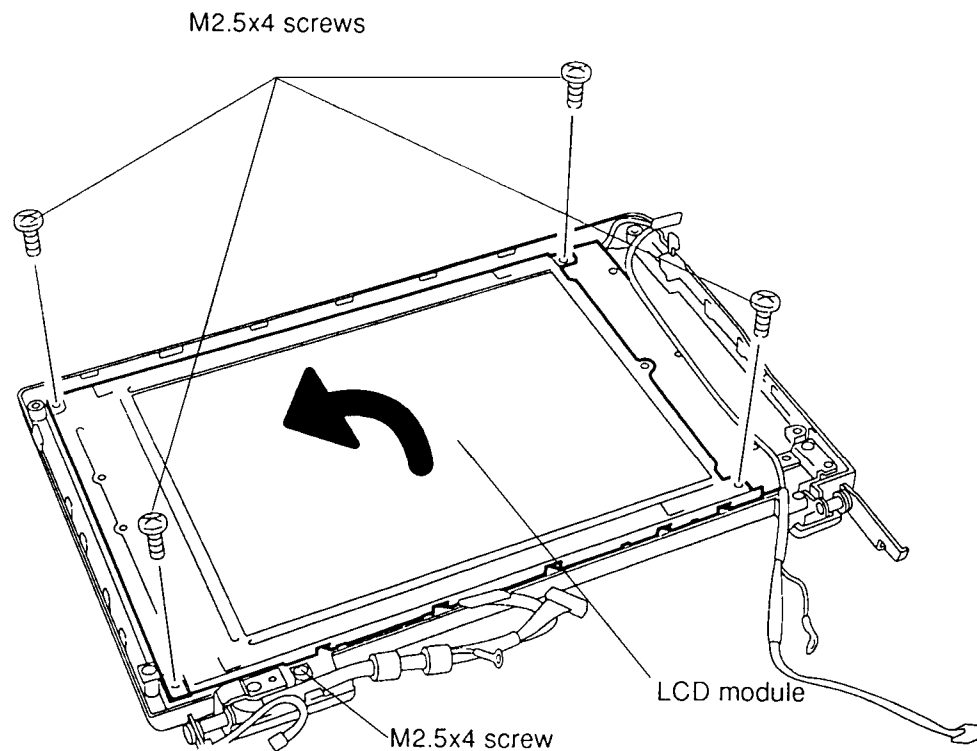


Figure 4-44 Removing the T4500/T4600 LCD Module Screws

6. Disconnect the **two display cables** from **CN1** and **CN2** on the **LCD module** (Figure 4-45).

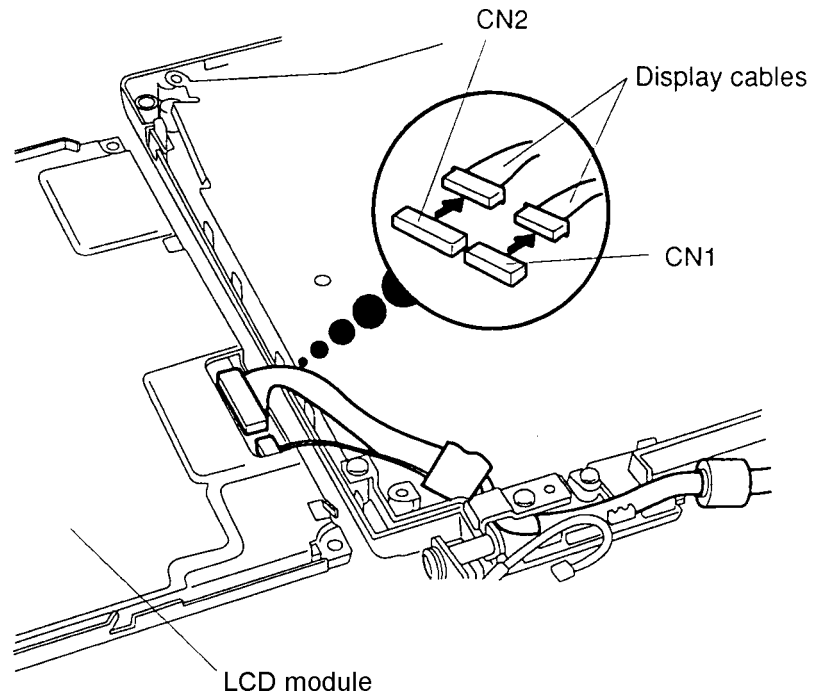


Figure 4-45 Removing the LCD Module

Installing the Monochrome Liquid Crystal Display Module

To install the T4500/T4600 liquid crystal display module, follow the steps below and refer to Figures 4-44 through 4-46.

1. Connect the two display cables to **CN1** and **CN2** on the **LCD module** (Figure 4-45).
2. Place the module in the cover and route the cables so they will not be pinched by the display panel or other component and secure them with **tape** (Figure 4-46).

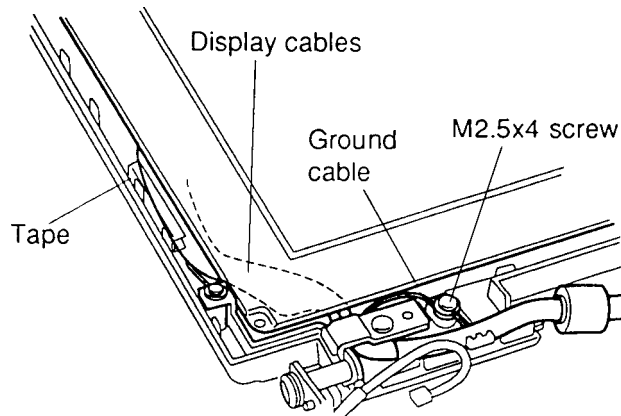


Figure 4-46 Routing the Display Cables

3. Secure the panel with **four M2.5x4 screws** (Figure 4-44).
4. Secure the **ground cable** with **one M2.5x4 screw** (Figure 4-46).
5. Install the display mask, display assembly, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.13, 4.9, 4.5, 4.4, 4.3 and 4.2.

4.22 T4500/T4600 Fluorescent Lamp

Removing the T4500/T4600 Fluorescent Lamp

To remove the T4500/T4600 fluorescent lamp, follow the steps below and refer to Figure 4-47:

1. Turn off the power to the computer; disconnect the AC adapter, power cord and all external cables connected to it.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, display assembly, display mask, FL inverter, and LCD module as described in Sections 4.2, 4.3, 4.4, 4.5, 4.9, 4.13, 4.20, and 4.21.
3. Peel off the **tape** from the lamp cover, then remove **three M1.5x3 brass flat-head screws** securing the cover and slide the cover to the right to remove it.
4. Remove the **fluorescent lamp**.

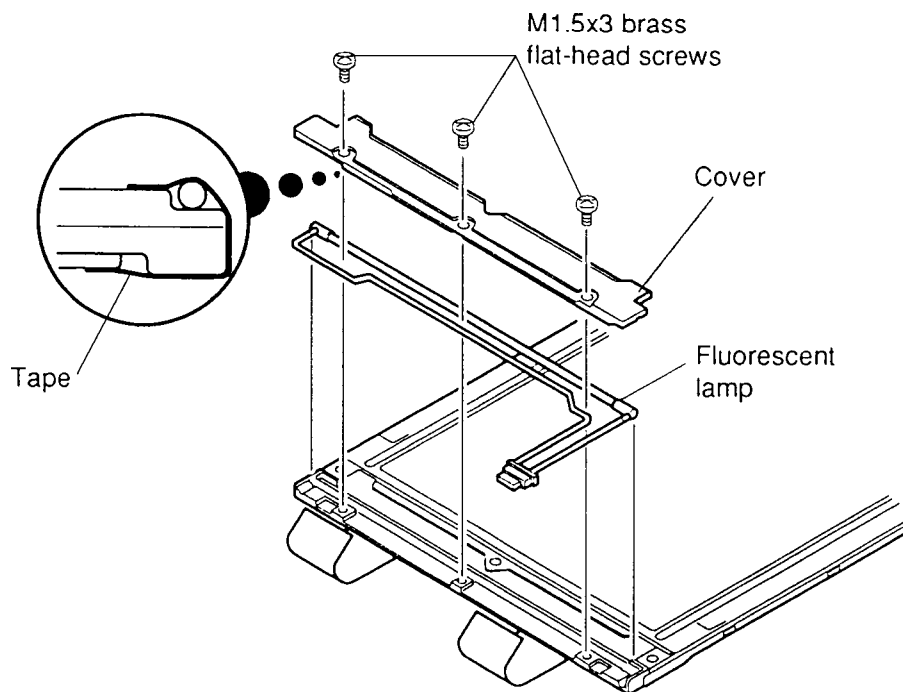


Figure 4-47 Removing the Fluorescent Lamp

Installing the Fluorescent Lamp

To install the T4500/T4600 fluorescent lamp, follow the steps below and refer to Figure 4-47.

1. Slip the edge of the plastic cover under the metal frame and align the holes in the cover with the corresponding holes in the display assembly cover.
2. Secure the plastic cover with the **three M1.5x3 brass flat-head screws**.
3. Secure the **FL cable** to the LCD module with **tape** as shown in Figure 4-47.
4. Install the LCD module, FL inverter, display mask, display assembly, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.21, 4.20, 4.13, 4.9, 4.5, 4.4, 4.3 and 4.2.

4.23 FL Inverter Cable, Display Cables & Display Sensor Switch

Removing the FL Inverter Cable, Display Cables & Display Sensor Switch

To remove the T4500/T4600 Family computer's FL inverter cable, display cables and display sensor switch, follow the steps below and refer to Figures 4-48 through 4-50.

1. Turn off the power to the computer; disconnect the AC adapter, power cord and all external cables connected to it.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, display assembly, display mask, FL inverter, and LCD or TFT module as described in Sections 4.2, 4.3, 4.4, 4.5, 4.9, 4.13; and 4.14 through 4.16 (T4500C); or 4.17 and 4.18 (T4600C); or 4.20 and 4.21 (T4500/T4600).
3. To remove the gray **FL inverter signal cable**, remove **two M2.5x4 screws** (T4500/T4600) or **two M2.5x6 screws** (T4500C/T4600C) securing the bracket holding the cable and lift out the cable (Figure 4-48).

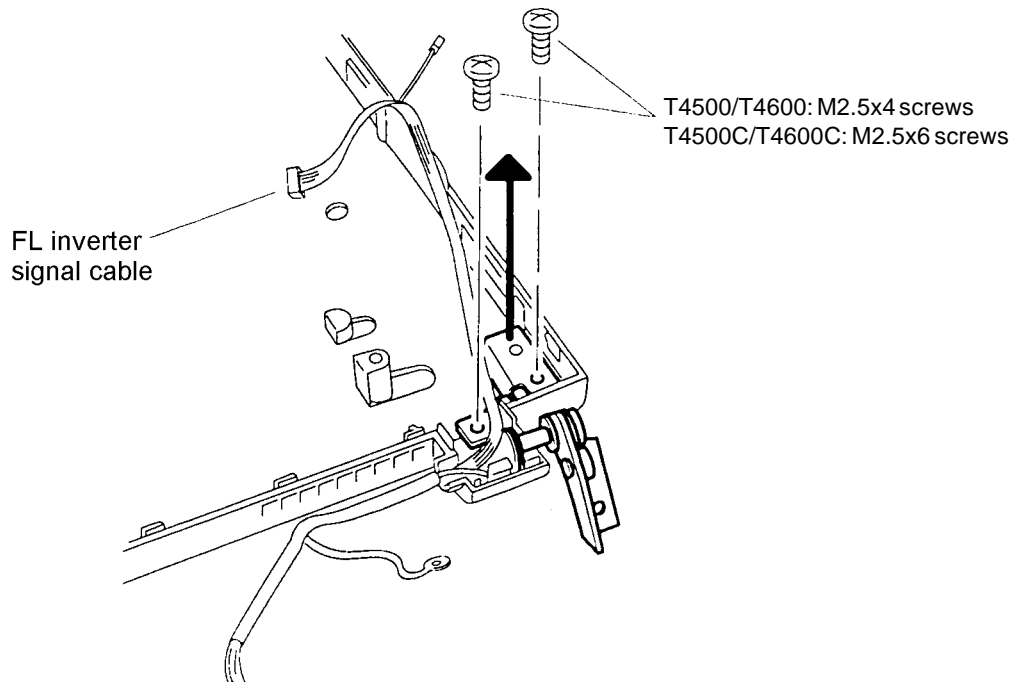


Figure 4-48 Removing the FL Inverter Signal Cable

4. To remove the pink and black **display cables**, remove the **two M2.5x6 silver screws** securing the **display hinge** (Figure 4-49).
5. Remove the **one M2.5x4 screw** (T4500/T4600) or **one M2.5x6 screw** (T4500C/T4600C) securing the ground cable (Figure 4-49).
6. Remove the **display hinge** and lift off the **display cable** (Figure 4-49).

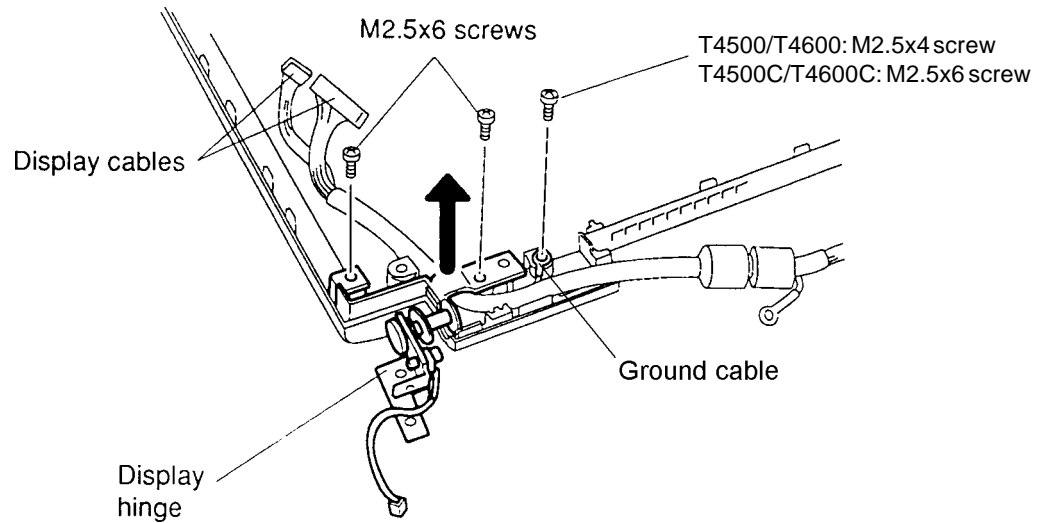


Figure 4-49 Removing the Display Cables

7. To remove the **display sensor switch**, remove the **one M2x8 silver screw** securing the cable to the hinge (Figure 4-50).

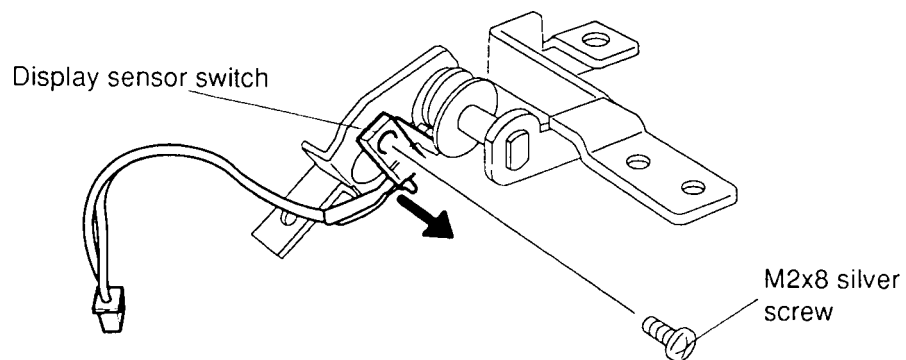


Figure 4-50 Removing the Display Sensor Switch

Installing the FL Inverter Cable, Display Cables & Display Sensor Switch

To install the computer's FL inverter cable, display cables and display sensor switch, follow the steps below and refer to Figures 4-49 through 4-51.

1. To install the **display sensor switch**, secure the cable with the **one M2x8 silver screw** (Figure 4-50).
2. To install the pink and black **display cable**, place the cable under the hump in the display hinge and secure the hinge with **two M2.5x6 screws** (Figure 4-49).

CAUTION: *Be careful to route the cables so they will not be pinched when you install the display panel (Figure 4-51).*

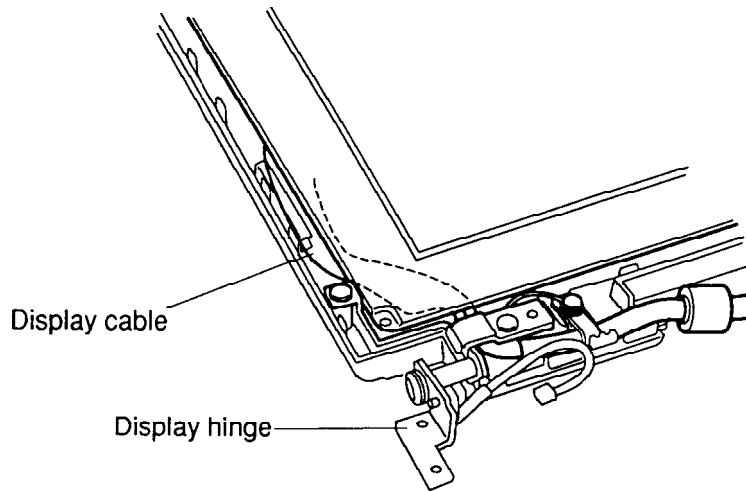


Figure 4-51 Routing the Display Cables

3. Secure the **ground cable** with **one M2.5x4 brass screw** (T4500/T4600) or **one M2.5x6 screw** (T4500C/T4600C) (Figure 4-49).
4. Install the LCD or TFT module, FL inverter, display mask, display assembly, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.20 and 4.21 (T4500/T4600); or 4.17 and 4.18 (T4600C); or 4.14 through 4.16 (T4500C); and 4.13, 4.9, 4.5, 4.4, 4.3, 4.2.

4.24 Battery Release Latch

Removing the Battery Release Latch

To remove the T4500/T4600 Family computer's battery release latch, follow the steps below and refer to Figure 4-52.

1. Turn off the power to the computer; disconnect the AC adapter, power cord and all external cables connected to it.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, keyboard, status indicator panel (sub LCD), and the protective metal sheet (HDD section) as described in Sections 4.2 through 4.8.
3. Lift out the **butterfly spring**, **round spring**, **winged latch** and **latch cover**.

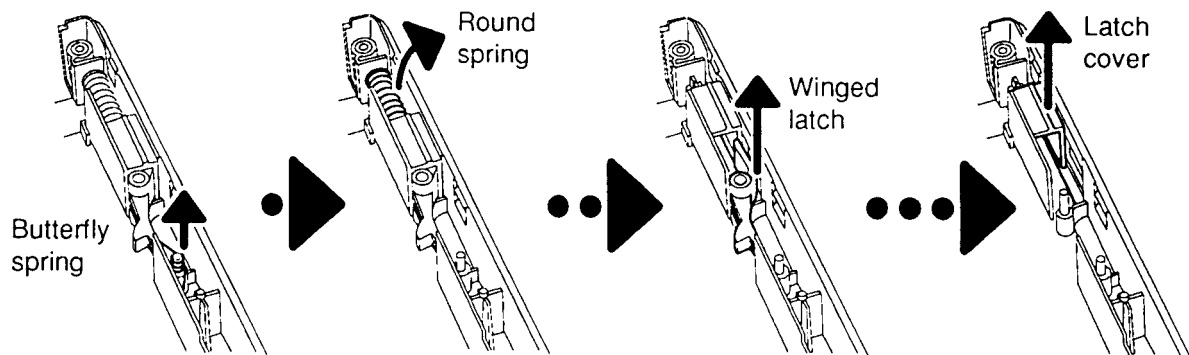


Figure 4-52 Removing the Battery Release Latch

Installing the Battery Release Latch

To install the battery release latch follow the steps below and refer to Figure 4-52.

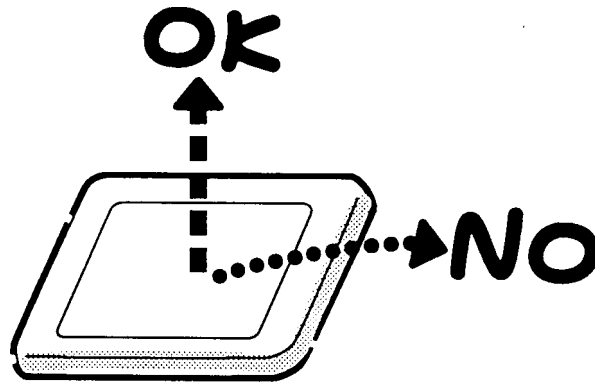
1. Install the **winged latch**.
2. Install the **butterfly spring** on the spindle, making sure one wing of the spring fits into the **winged latch** and the other fits inside the containment bar.
3. Insert the **round spring**.
4. Insert the **battery release latch** cover.
5. Install the protective metal sheet, status indicator panel, keyboard, top cover, optional PCMCIA card, optional memory card, and the battery pack as described in Sections 4.8 through 4.2.

Handling the LCD/TFT Module

Precautions for handling the T4500/T4600 Family's LCD and TFT module

The T4500/T4600 Family computer's monochrome LCD or color TFT module can be easily damaged during assembly or disassembly. Observe the following precautions when handling the module.

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



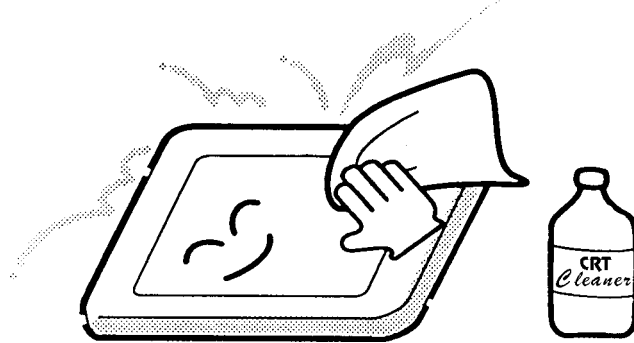
2. Be careful to align the holes at the four corners of the display module with the corresponding holes in the display cover before securing the module with screws. Do not force the module into place, because stress can affect its performance.

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

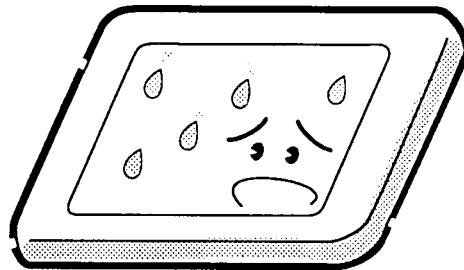


3. If the panel's surface gets dirty, wipe it with cotton or a soft cloth. If it is still dirty, try breathing on the surface to create a light condensate and wipe it again.

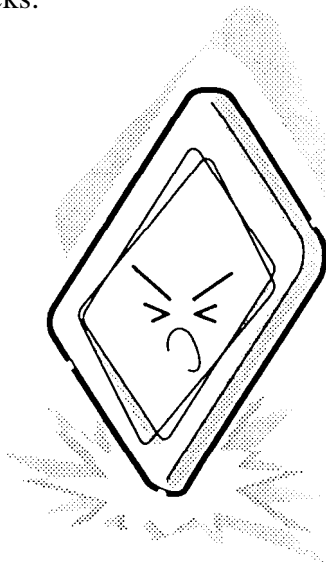
If the surface is very dirty, we recommend a CRT cleaning agent. Apply the agent to a cloth and then wipe the panel's surface. Do not apply cleaner directly to the panel.



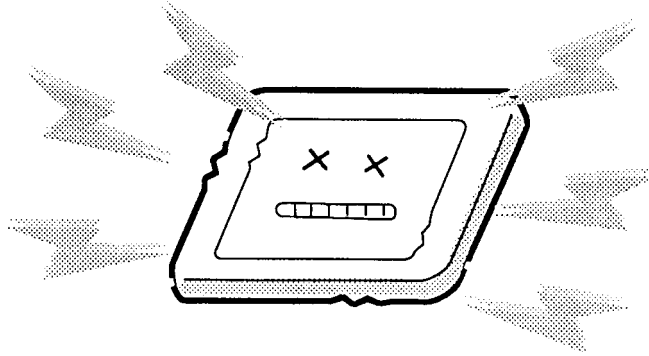
4. If water or other liquid is left on the panel's surface for a long period, it can change the screen's tint or stain it. Be sure to quickly wipe off any liquid.



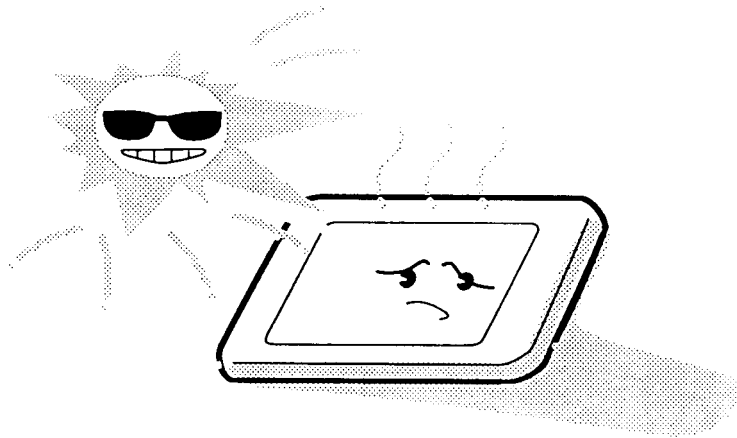
5. Glass is used in the panel, so be careful not to drop it or let it strike a hard object, which could cause breakage or cracks.



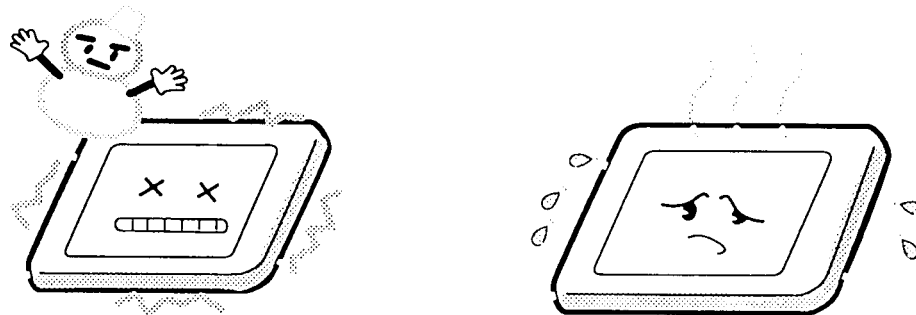
6. CMOS-LSI circuits are used in the module, so guard against damage from electrostatic discharge. Be sure to wear a wrist or ankle ground when handling the module.



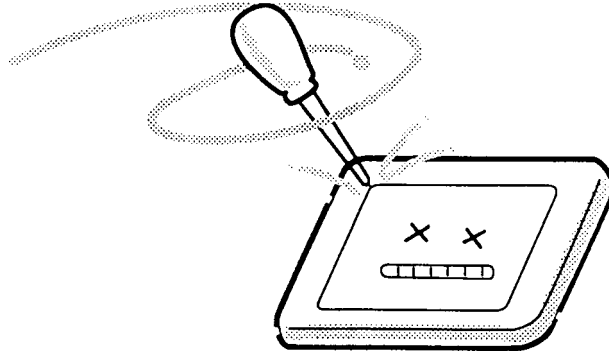
7. Do not expose the module to direct sunlight or strong ultraviolet rays for long periods.



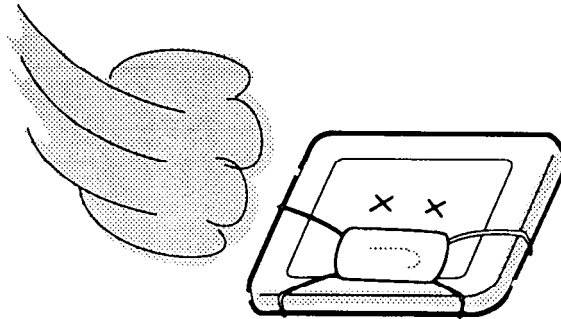
8. Do not store the module at temperatures below specifications. Cold can cause the liquid crystals to freeze, lose their elasticity or otherwise suffer damage.



9. Do not disassemble the display 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.



System PCB Layout

B.1 T4500/T4500C System Board

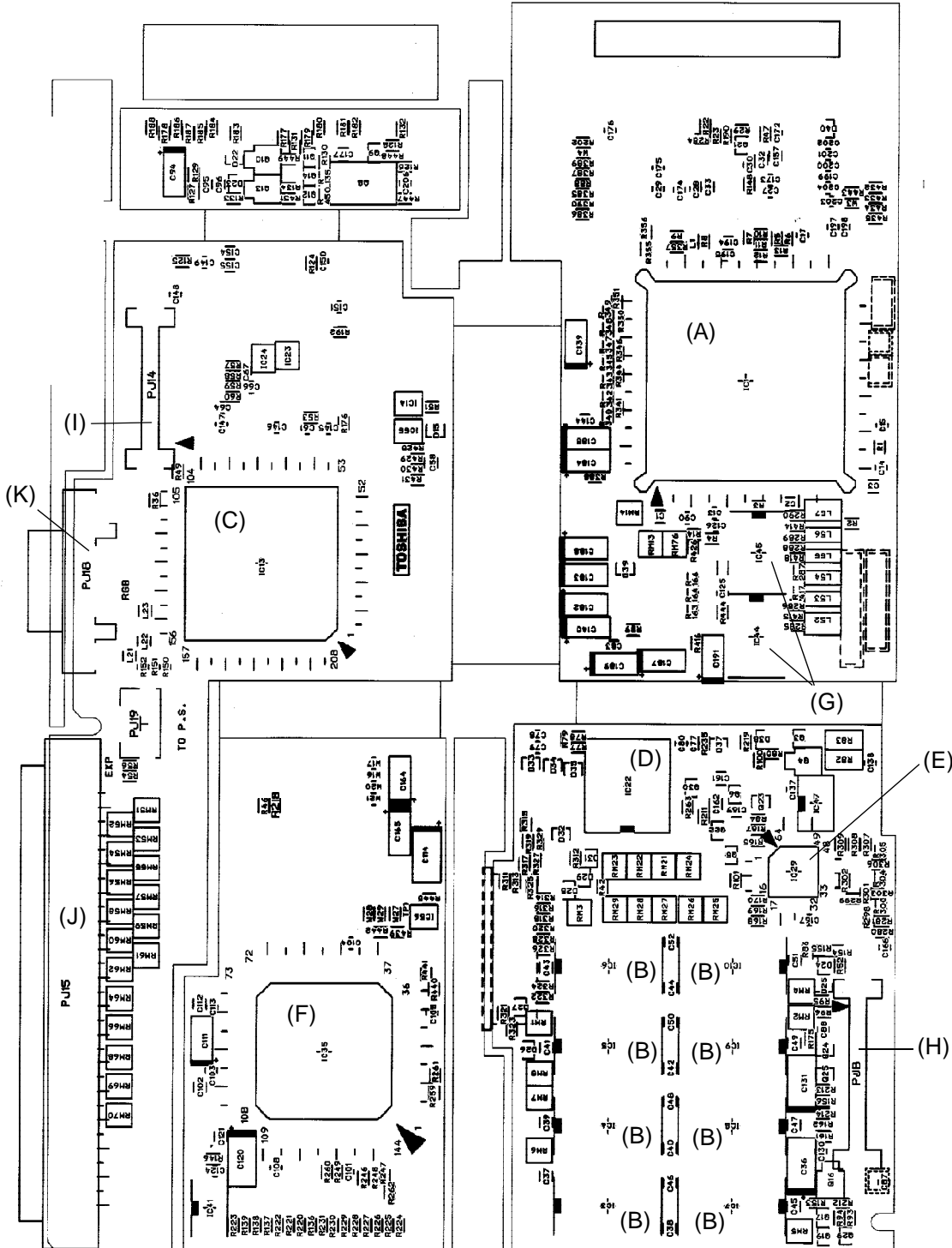


Figure B-1 T4500/T4500C System PCB (FSH4S1) - Front

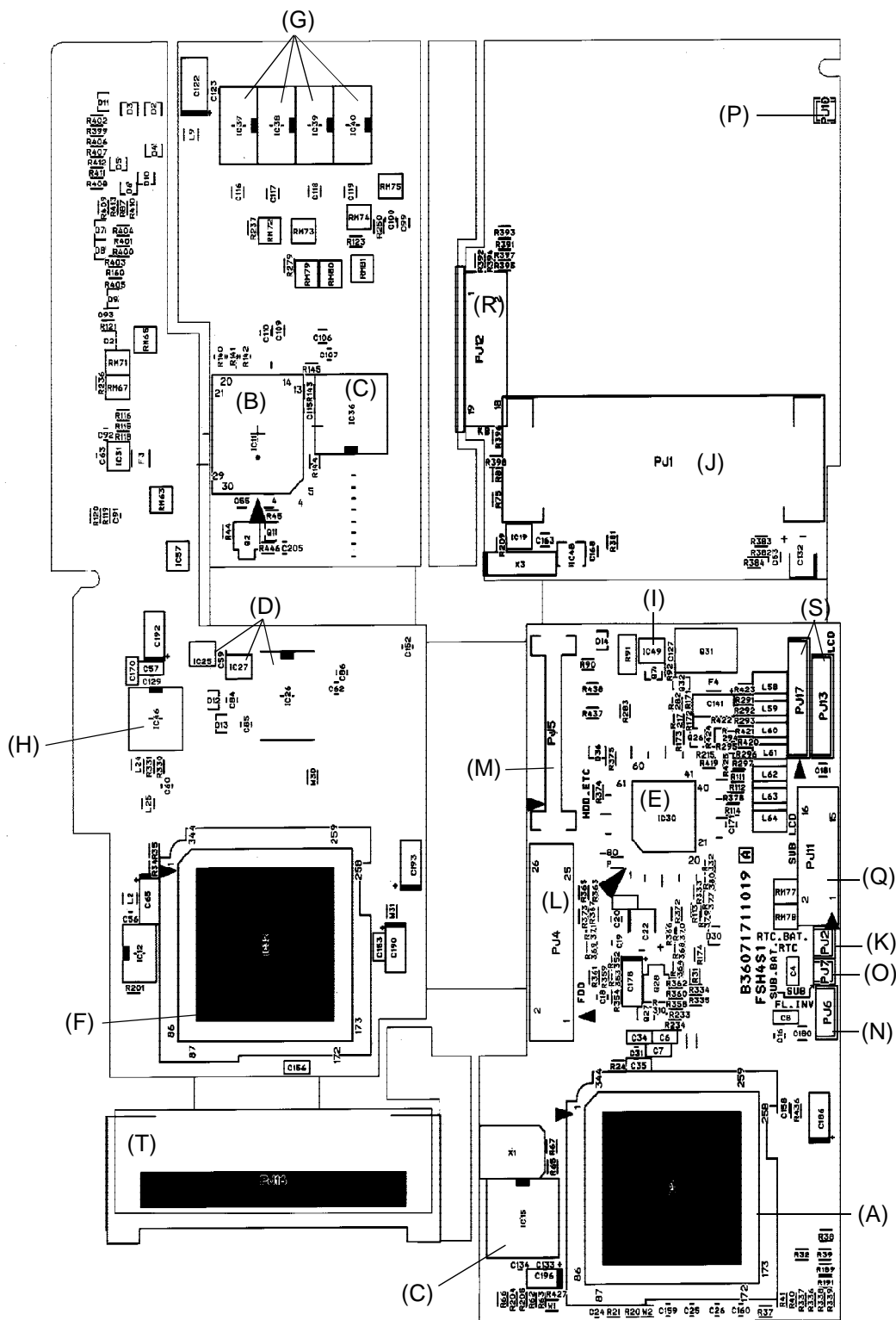


Figure B-2 T4500/T4500C System PCB (FSH4S1) - Back

Table B-1 T4500/T4500C ICs and Connectors on the System PCB - Front

Callout	Number	Description
(A)	IC 1	Central Processing Unit (CPU)
(B)	IC 3 to IC 10	System RAM
(C)	IC 13	Super Integration T9901
(D)	IC 22	Real Timer Clock (RTC)
(E)	IC 29	Sub LCD Gate Array
(F)	IC 35	VGA Controller (WD90C26A)
(G)	IC 44, IC 45	Monochrome Panel Interface Driver
(H)	PJ 8	Power Supply Board Connector
(I)	PJ 14	Back Panel Connector
(J)	PJ 15	Expansion Bus Connector
(K)	PJ 18	CRT Interface Connector

Table B-2 T4500/T4500C ICs and Connectors on the System PCB - Back

Callout	Number	Description
(A)	IC 2	System Controller Gate Array
(B)	IC 11	BIOS ROM
(C)	IC 15, IC 36	Clock Generator
(D)	IC 25 to IC 27	Serial Interface Driver
(E)	IC 30	Keyboard Controller
(F)	IC 32	ICCNT Gate Array
(G)	IC 37 to IC 40	Video RAM
(H)	IC 46	CRT Interface Controller
(I)	IC 49	Speaker Driver
(J)	PJ 1	Memory Card Connector
(K)	PJ 2	RTC Battery Connector
(L)	PJ 4	FDD Connector
(M)	PJ 5	HDD/DCBP/Speaker Connector
(N)	PJ 6	FL Inverter Connector
(O)	PJ 7	Backup Battery Connector
(P)	PJ 10	Display Sensor Switch Connector
(Q)	PJ 11	Status Indicator Panel Interface Connector
(R)	PJ 12	Keyboard Interface Connector
(S)	PJ 13, PJ 17	Display Connector
(T)	PJ 16	PCMCIA Connector

B.2 T4600/T4600C System Board

Figure B-3 T4600/T4600C System PCB (FSH1S1) - Front

Figure B-4 T4600/T4600C System PCB (FSH1S1) - Back

Table B-3 T4600/T4600C ICs and Connectors on the System PCB - Front

Callout	Number	Description
(A)	IC 1	Central Processing Unit (CPU)
(B)	IC 2 to IC 9	System RAM
(C)	IC 12	82360SL
(D)	IC 15	CLK Generator
(E)	IC 19	Sub LCD Gate Array
(F)	IC 42	VGA Controller (WD90C26A)
(G)	IC 50, IC 51	Monochrome Panel Interface Driver
(H)	PJ 8	Power Supply Board Connector
(I)	PJ 14	Back Panel Connector
(J)	PJ 15	Expansion Bus Connector
(K)	PJ 18	CRT Interface Connector

Table B-4 T4600/T4600C ICs and Connectors on the System PCB - Back

Callout	Number	Description
(A)	IC 13	Super Integration T9920
(B)	IC 10	BIOS ROM
(C)	IC 44	Clock Generator
(D)	IC 21, 22, 25	Serial Interface Driver
(E)	IC 27	Keyboard Controller
(F)	IC 29	ICCNT Gate Array
(G)	IC 45 to IC 48	Video RAM
(H)	IC 35	CRT Interface Controller
(I)	PJ 1	Memory Card Connector
(J)	PJ 2	RTC Battery Connector
(K)	PJ 4	FDD Connector
(L)	PJ 5	HDD/DCBP/Speaker Connector
(M)	PJ 43	FL Inverter Connector
(N)	PJ 7	Backup Battery Connector
(O)	PJ 10	Display Sensor Switch Connector
(P)	PJ 11	Sub LCD Connector
(Q)	PJ 12	Keyboard Interface Connector
(R)	PJ 44, 45	Display Connector
(S)	PJ 16	PCMCIA (1) Connector
(T)	PJ 20	PCMCIA

Connector Pin Assignments

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

Table C-1 T4500/T4500C Memory Slot Connector Pin Assignments (88-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	GND	—	45	GND	—
02	D00;100	I/O	46	D16;100	I/O
03	D01;100	I/O	47	D17;100	I/O
04	D02;100	I/O	48	D18;100	I/O
05	D03;100	I/O	49	D19;100	I/O
06	D04;100	I/O	50	D20;100	I/O
07	D05;100	I/O	51	D21;100	I/O
08	D06;100	I/O	52	D22;100	I/O
09	B3V	—	53	D23;100	I/O
10	D07;100	I/O	54	GND	—
11	VCC	—	55	RAS2;001	O
12	GND	—	56	GND	—
13	MA00;111	O	57	MA01;111	O
14	MA02;111	O	58	MA03;111	O
15	B3V	—	59	MA05;111	O
16	MA04;111	O	60	MA07;111	O
17	VCC	—	61	MA09;111	O
18	MA06;111	O	62	GND	—
19	MA08;111	O	63	GND	—
20	MA10;111	O	64	GND	—
21	GND	—	65	RAS1;001	O
22	RAS0;001	O	66	CAS2;011	O
23	CAS0;011	O	67	GND	—
24	CAS1;011	O	68	CAS3;011	O
25	VCC	—	69	RAS3;001	O
26	GND	—	70	MEMWE;011	O
27	B3V	—	71	DRAMST1;100	I/O
28	DRMST2;100	I/O	72	DRAMST3;100	I/O
29	DRMST4;100	I/O	73	GND	—
30	DRMST6;100	I/O	74	DRAMST5;100	I/O
31	CAS0;011	O	75	DRAMST7;100	I/O
32	CAS1;011	O	76	DRAMST8;100	I/O
33	GND	—	77	CAS2;011	O
34	D08;100	I/O	78	CAS3;011	O
35	VCC	—	79	GND	—
36	D09;100	I/O	80	D24;100	I/O
37	B3V	—	81	D25;100	I/O
38	D10;100	I/O	82	D26;100	I/O
39	D11;100	I/O	83	D27;100	I/O
40	D12;100	I/O	84	D28;100	I/O
41	D13;100	I/O	85	D29;100	I/O
42	D14;100	I/O	86	D30;100	I/O
43	D15;100	I/O	87	D31;100	I/O
44	GND	—	88	GND	—

Table C-2 T4600/T4600C Memory Slot Connector Pin Assignments (88-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	GND	—	45	GND	—
02	MD00;100	I/O	46	MD16;100	I/O
03	MD01;100	I/O	47	MD17;100	I/O
04	MD02;100	I/O	48	MD18;100	I/O
05	MD03;100	I/O	49	MD19;100	I/O
06	MD04;100	I/O	50	MD20;100	I/O
07	MD05;100	I/O	51	MD21;100	I/O
08	MD06;100	I/O	52	MD22;100	I/O
09	B3V	—	53	MD23;100	I/O
10	MD07;100	I/O	54	GND	—
11	VCC	—	55	RAS0;001	O
12	GND	—	56	GND	—
13	MA00;111	O	57	MA01;111	O
14	MA02;111	O	58	MA03;111	O
15	B3V	—	59	MA05;111	O
16	MA04;111	O	60	MA07;111	O
17	VCC	—	61	MA09;111	O
18	MA06;111	O	62	MA11;101	O
19	MA08;111	O	63	GND	—
20	MA10;101	O	64	GND	—
21	MA12;101	—	65	RAS4;001	O
22	RAS3;001	O	66	CAS32;001	O
23	CAS30;001	O	67	GND	—
24	CAS31;001	O	68	CAS33;001	O
25	VCC	—	69	RAS4;001	O
26	RAS3;001	—	70	MEMWEC;001	O
27	B3V	—	71	DRAMST1;100	I/O
28	DRAMST2;100	I/O	72	DRAMST3;100	I/O
29	DRAMST4;100	I/O	73	GND	—
30	DRAMST6;100	I/O	74	DRAMST5;100	I/O
31	CAS00;001	O	75	DRAMST7;100	I/O
32	CAS01;001	O	76	DRAMST8;100	I/O
33	GND	—	77	CAS02;001	O
34	D08;100	I/O	78	CAS03;001	O
35	VCC	—	79	GND	—
36	MD09;100	I/O	80	MD24;100	I/O
37	B3V	—	81	MD25;100	I/O
38	MD10;100	I/O	82	MD26;100	I/O
39	MD11;100	I/O	83	MD27;100	I/O
40	MD12;100	I/O	84	MD28;100	I/O
41	MD13;100	I/O	85	MD29;100	I/O
42	MD14;100	I/O	86	MD30;100	I/O
43	MD15;100	I/O	87	MD31;100	I/O
44	GND	—	88	GND	—

C.2 PJ2 RTC Connector (3-Pin)

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

Pin	Signal	I/O	Pin	Signal	I/O
01	3V	—	03	GND	—
02	N/C	—			

C.3 PJ4 FDD (Int) Connector (26-Pin)

Table C-4 FDD (Int) Connector Pin Assignments (26-pin)

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

C.4 PJ5 HDD I/F Connector (50-Pin)

Table C-5 HDD I/F Connector Pin Assignments (50-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	SD15;102	I/O	26	SD01;102	I/O
02	SD07;102	I/O	27	VCC	—
03	RESET;000	O	28	SD13;102	I/O
04	MOUSCK;100	I/O	29	VCC	—
05	MOUSDT;100	I/O	30	SD00;102	I/O
06	SD06;102	I/O	31	VCC	—
07	GND	—	32	SD14;102	I/O
08	SD08;102	I/O	33	VCC	—
09	GND	—	34	SA01;100	O
10	SD5;102	I/O	35	VCC	—
11	GND	—	36	IORD;000	O
12	SD9;102	I/O	37	HDDCS2;000	O
13	GND	—	38	IIRDY;100	I
14	SD04;102	I/O	39	SA02;100	O
15	GND	—	40	IIO16;000 (T4500/T4500C) HDIO16;000 (T4600/T4600C)	O
16	SD10;102	I/O	41	IRQ14;100	I
17	GND	—	42	SA00;100	O
18	SD03;102	I/O	43	IOWR;000	O
19	GND	—	44	HDDCS1;000	O
20	SD11;102	I/O	45	VCC	—
21	GND	—	46	DRVSL;000	O
22	SD02;102	I/O	47	BATR;100	—
23	GND	—	48	BATG;100	—
24	SD12;102	I/O	49	SPOUT1;100	—
25	VCC	—	50	SPOUT0;100	—

C.5 PJ6 (T4500/T4500C), PJ43 (T4600/T4600C) FL Inverter Connector (6-Pin)

Table C-6 FL Inverter Connector Pin Assignments (6-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	DSPV	O	04	GND	—
02	DSPV	O	05	BRTCNT	O
03	GND	—	06	GND	—

C.6 PJ7 Backup Battery Connector (2-Pin)

Table C-7 Backup Battery Connector Pin Assignments (2-pin)

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

C.7 PJ8 PS I/F Connector (50-Pin)

Table C-8 PS IF Connector Pin Assignments (50-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	PSRST;000	O	26	PSUPDT;100	I
02	PSAD0;100	I/O	27	VCC	—
03	ADPCNT;100	O	28	SUSSTA;001 (T4500/T4500C)	I
				PSSTA;000 (T4600/T4600C)	I
04	PSAD1;100	I/O	29	VCC	—
05	CPCNF;100	I	30	PSREQ;000	I
06	PSAD2;100	I/O	31	VCC	—
07	BEEP;000	O	32	BATG;100	—
08	PSAD3;100	I/O	33	VCC	—
09	PCLR;000	O	34	BATR;100	—
10	PSAD4;100	I/O	35	GND	—
11	LOBAT;100	I	36	ENB3V;000	O
12	PSAD5;100	I/O	37	GND	—
13	SUBBAT	I	38	GND	—
14	PSAD6;100	I/O	39	B3V	—
15	GND	—	40	EN3V;000	—
16	PSAD7;100	I/O	41	B3V	—
17	DSPV	O	42	ENVCC;000	—
18	PSRW0;000	O	43	M12V	—
19	DSPV	—	44	SRBTN;001	—
20	GND	—	45	12V	—
21	GND	—	46	CNTRST;100	—
22	PSTMG;000	O	47	GND	—
23	VCC	—	48	BRTCNT;100	O
24	PNLOF;000	O	49	MCV	—
25	VCC	—	50	SPKVOL;100	—

C.8 PJ10 Display Sensor Switch Connector (2-Pin)

Table C-9 Display Sensor Switch Connector Pin Assignments (2-pin)

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

C.9 PJ11 Status Indicator Panel Connector (16-Pin)

Table C-10 Status Indicator Panel I/F Pin Assignments (16-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	LCOM4;100	O	09	LSEG08;000	O
02	LCOM3;100	O	10	LSEG07;000	O
03	LCOM2;100	O	11	LSEG06;000	O
04	LCOM1;100	O	12	LSEG05;000	O
05	LSEG12;100	O	13	LSEG04;000	O
06	LSEG11;100	O	14	LSEG03;000	O
07	LSEG10;100	O	15	LSEG02;000	O
08	LSEG09;100	O	16	LSEG01;000	O

C.10 PJ12 KB I/F Connector (19-Pin)

Table C-11 KB I/F Connector Pin Assignments (19-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	KBOT00;000	O	11	KBOT03;000	O
02	KBRT6;100	I	12	KBOT04;000	O
03	KBRT0;100	I	13	KBOT05;000	O
04	KBRT2;100	I	14	KBOT06;000	O
05	KBRT3;100	I	15	KBOT08;000	O
06	KBRT1;100	I	16	KBOT02;000	O
07	KBRT7;100	I	17	KBOT07;000	O
08	KBRT5;100	I	18	KBOT09;000	O
09	KBRT4;100	I	19	KBOT10;000	O
10	KBOT01;000	O			

C.11 PJ13 (T4500/T4500C), PJ45 (T4600/T4600C) LCD Connector (13-Pin)

Table C-12 LCD Connector Pin Assignments (13-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	LCDVCC	—	11	LD2;102	O
02	LCDVCC	—	12	GND	—
03	BO;102	O	13	GND	—
04	GND	—			
05	FR;102	O			
06	GND	—			
07	UD0;102	O			
08	UD1;102	O			
09	GND	—			
10	UD2;102	O			

C.12 PJ17 (T4500/T4500C), PJ44 (T4600/T4600C) LCD Connector (15-Pin)

Table C-13 LCD Connector Pin Assignments (15-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	CNTRST;100	O	09	GND	—
02	GND	—	10	GND	—
03	UD3;102	O	11	XCLK;102	O
04	GND	I	12	LP;102	O
05	PNEL0;100	I	13	GND	—
06	LD3;102	O	14	LD0;102	O
07	GND	—	15	FP;102	O
08	LD1;102	O			

C.13 PJ14 Back Panel Connector (40-Pin)

Table C-14 Back Panel Connector Pin Assignments (40-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	GND	—	21	GND	—
02	STROB;000	I/O	22	ACK;000	I/O
03	GND	—	23	DCD1;100	O
04	PDB04;100	I/O	24	PINT;000	I/O
05	MOUSEDT;100	I/O	25	SD1;000	I
06	PDB03;100	I/O	26	BUSY;100	I/O
07	MOUSECK;100	I/O	27	RD1;000	O
08	PDB07;100	I/O	28	SLIN;000	I/O
09	EKBDAT;100	I/O	29	RI1;100	O
10	PDB02;100	I/O	30	PE;100	I/O
11	EKBCLK;100	I/O	31	RTS1;100	I
12	PDB06;100	I/O	32	ERROR;000	I/O
13	GND	—	33	VCC	—
14	PDB01;100	I/O	34	SELECT;100	I/O
15	GND	—	35	VCC	—
16	PDB05;100	I/O	36	CTS1;100	O
17	GND	—	37	VCC	—
18	PDB00;100	I/O	38	DTR1;100	I
19	GND	—	39	VCC	—
20	AUTFD;000	I/O	40	DSR1;100	O

C.14 PJ15 Expansion Connector (150-Pin)

Table C-15 T4500/T4500C Expansion Connector Pin Assignments (150-pin) (1 of 2)

Pin	Signal	I/O	Pin	Signal	I/O
01	DCIN	I	31	SA11;101	I/O
02	DCIN	I	32	SA12;101	I/O
03	DCIN	I	33	SA13;101	I/O
04	DCIN	I	34	SA14;101	I/O
05	N/C	I	35	SA15;101	I/O
06	N/C	I	36	GND	—
07	N/C	I	37	SA16;101	I/O
08	N/C	I	38	SA17;101	I/O
09	ADPCNT;100	I	39	SA18;101	I/O
10	GND	—	40	SA19;101	I/O
11	RVCC	—	41	SD00;101	I/O
12	RGND	—	42	SD01;101	I/O
13	CPCNF;100	I	43	SD02;101	I/O
14	MDMSL;001	O	44	SD03;101	I/O
15	COMCCK;101	O	45	GND	—
16	MIRQ;001	I	46	SD04;101	I/O
17	SPKTON;001	I	47	SD05;101	I/O
18	GND	—	48	SD06;101	I/O
19	SA00;101	I/O	49	SD07;101	I/O
20	SA01;101	I/O	50	SMEW;001	O
21	SA02;101	I/O	51	SMER;001	O
22	SA03;101	I/O	52	GND	—
23	SA04;101	I/O	53	IOWR;001	I/O
24	SA05;101	I/O	54	IORD;001	I/O
25	SA06;101	I/O	55	TC;101	O
26	SA07;101	I/O	56	BALE;101	O
27	GND	—	57	RESET;101	O
28	SA08;101	I/O	58	DACK1;001	O
29	SA09;101	I/O	59	IRQ9;101	I
30	SA10;101	I/O	60	GND	—

Table C-15 T4500/T4500C Expansion Connector Pin Assignments (150-pin) (2 of 2)

Pin	Signal	I/O	Pin	Signal	I/O
61	VCC	—	106	IRQ4;101	I
62	IOCLK;110	O	107	MEWR;001	I/O
63	IRQ5;101	I	108	IRQ7;101	I
64	DRQ3;101	I	109	GND	—
65	DACK3;001	O	110	RED;101	O
66	AEN;101	O	111	LGREN;101	O
67	DRQ1;101	I	112	BLUE;101	O
68	IOCRDY;101	I	113	GND	—
69	GND	—	114	PHSYNC;100	O
70	IRQ10;101	I	115	PVSYNC;100	O
71	IRQ14;101	I	116	GND	—
72	SD08;101	I/O	117	EKBDAT;100	I/O
73	SD09;101	I/O	118	EKBCLK;100	I/O
74	IRQ11;101	I	119	N/C	—
75	SD10;101	I/O	120	MOUSDT;100	I/O
76	SD11;101	I/O	121	MOUSCK;100	I/O
77	SD12;101	I/O	122	GND	—
78	IRQ12;101	I	123	STROB;010	I/O
79	GND	—	124	PDB00;110	I/O
80	SD13;101	I/O	125	PDB01;110	I/O
81	SD14;101	I/O	126	PDB02;110	I/O
82	IRQ6;101	I	127	PDB03;110	I/O
83	SD15;101	I/O	128	PDB04;110	I/O
84	LA22;101	I/O	129	PDB05;110	I/O
85	LA23;101	I/O	130	PDB06;110	I/O
86	DRQ2;101	I	131	PDB07;110	I/O
87	LA21;101	I/O	132	ACK;000	I/O
88	LA19;101	I/O	133	BUSY;100	I/O
89	LA20;101	I/O	134	PE;100	I/O
90	DACK6;001	O	135	SELCT;100	I/O
91	GND	—	136	AUTFD;000	I/O
92	REFRSH;001	I/O	137	ERROR;000	I/O
93	LA18;101	I/O	138	PINT;000	I/O
94	MASTER;001	I	139	SLIN;000	I/O
95	LA17;101	I/O	140	GND	—
96	SBHE;001	I/O	141	SD1;000	I
97	IOCHCK;001	I	142	DTR1;100	I
98	EMCS16;001	I	143	RTS1;100	I
99	GND	—	144	DCD1;100	O
100	EICS16;001	I	145	RD1;000	O
101	DACK2;001	O	146	DSR1;100	O
102	DRQ6;101	I	147	CTS1;100	O
103	DRQ5;101	I	148	RI1;100	O
104	DACK5;001	O	149	GND	—
105	MERD;001	I/O	150	GND	—

Table C-16 T4600/T4600C Expansion Connector Pin Assignments (150-pin) (1 of 2)

Pin	Signal	I/O	Pin	Signal	I/O
01	DCIN	I	31	SA11;101	I/O
02	DCIN	I	32	SA12;101	I/O
03	DCIN	I	33	SA13;101	I/O
04	DCIN	I	34	SA14;101	I/O
05	N/C	I	35	SA15;101	I/O
06	N/C	I	36	GND	—
07	N/C	I	37	SA16;101	I/O
08	N/C	I	38	SA17;101	I/O
09	ADPCNT;100	I	39	SA18;101	I/O
10	GND	—	40	SA19;101	I/O
11	RVCC	—	41	SD00;101	I/O
12	RGND	—	42	SD01;101	I/O
13	CPCNF;100	I	43	SD02;101	I/O
14	MDMSL;001	O	44	SD03;101	I/O
15	COMCCK;101	O	45	GND	—
16	MIRQ;001	I	46	SD04;101	I/O
17	SPKTON;001	I	47	SD05;101	I/O
18	GND	—	48	SD06;101	I/O
19	SA00;101	I/O	49	SD07;101	I/O
20	SA01;101	I/O	50	SMEW;001	O
21	SA02;101	I/O	51	SMER;001	O
22	SA03;101	I/O	52	GND	—
23	SA04;101	I/O	53	IOWR;001	I/O
24	SA05;101	I/O	54	IORD;001	I/O
25	SA06;101	I/O	55	TC;101	O
26	SA07;101	I/O	56	BALE;101	O
27	GND	—	57	RESET;101	O
28	SA08;101	I/O	58	DACK1;001	O
29	SA09;101	I/O	59	IRQ9;101	I
30	SA10;101	I/O	60	GND	—

Table C-16 T4600/T4600C Expansion Connector Pin Assignments (150-pin) (2 of 2)

Pin	Signal	I/O	Pin	Signal	I/O
61	VCC	—	106	IRQ4;101	I
62	IOCLK;100	O	107	MEWR;001	I/O
63	IRQ5;101	I	108	IRQ7;101	I
64	DRQ3;101	I	109	GND	—
65	DACK3;001	O	110	RED;101	O
66	AEN;101	O	111	LGREN;101	O
67	DRQ1;101	I	112	BLUE;101	O
68	EIORDY;101	I	113	GND	—
69	GND	—	114	PHSYNC;100	O
70	IRQ10;101	I	115	PVSYNC;100	O
71	IRQ14;101	I	116	GND	—
72	SD08;101	I/O	117	EKBDAT;100	I/O
73	SD09;101	I/O	118	EKBCLK;100	I/O
74	IRQ11;101	I	119	N/C	—
75	SD10;101	I/O	120	MOUSDT;100	I/O
76	SD11;101	I/O	121	MOUSCK;100	I/O
77	SD12;101	I/O	122	GND	—
78	IRQ12;101	I	123	ESTROB;000	I/O
79	GND	—	124	EPDB00;100	I/O
80	SD13;101	I/O	125	EPDB01;100	I/O
81	SD14;101	I/O	126	EPDB02;100	I/O
82	IRQ6;101	I	127	EPDB03;100	I/O
83	SD15;101	I/O	128	EPDB04;100	I/O
84	LA22;101	I/O	129	EPDB05;100	I/O
85	LA23;101	I/O	130	EPDB06;100	I/O
86	DRQ2;101	I	131	EPDB07;100	I/O
87	LA21;101	I/O	132	EACK;000	I/O
88	LA19;101	I/O	133	EBUSY;100	I/O
89	LA20;101	I/O	134	EPE;100	I/O
90	DACK6;001	O	135	ESELECT;100	I/O
91	GND	—	136	EAUTFD;000	I/O
92	REFRSH;001	I/O	137	EERROR;000	I/O
93	LA18;101	I/O	138	EPINT;000	I/O
94	MASTER;001	I	139	ESLIN;000	I/O
95	LA17;101	I/O	140	GND	—
96	SBHE;001	I/O	141	SD1;000	I
97	IOCHCK;001	I	142	DTR1;100	I
98	EMCS16;001	I	143	RTS1;100	I
99	GND	—	144	DCD1;100	O
100	EICS16;001	I	145	RD1;000	O
101	DACK2;001	O	146	DSR1;100	O
102	DRQ6;101	I	147	CTS1;100	O
103	DRQ5;101	I	148	RI1;100	O
104	DACK5;001	O	149	GND	—
105	MERD;001	I/O	150	GND	—

C.15 PJ16 PC Card Slot 1 Connector (68-Pin)

Table C-17 PC Card Slot 1 Connector Pin Assignments (68-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	GND	—	35	GND	—
02	CDA03;100	I/O	36	CD1A;000	I
03	CDA04;100	I/O	37	CDA11;100	I/O
04	CDA05;100	I/O	38	CDA12;100	I/O
05	CDA06;100	I/O	39	CDA13;100	I/O
06	CDA07;100	I/O	40	CDA14;100	I/O
07	CE1A;000	O	41	CDA15;100	I/O
08	CADA10;100	O	42	CE2A;000	O
09	OEA;000	O	43	N/C	—
10	CADA11;100	O	44	IORA;000	O
11	CADA09;100	O	45	IOWA;000	O
12	CADA08;100	O	46	CADA17;100	O
13	CADA13;100	O	47	CADA18;100	O
14	CADA14;100	O	48	CADA19;100	O
15	WEA;000	O	49	CADA20;100	O
16	BSYA;000	I	50	CADA21;100	O
17	MCVCCA	—	51	MCVCCA	—
18	MCVP1A	—	52	MCVP2A	—
19	CADA16;100	O	53	CADA22;100	O
20	CADA15;100	O	54	CADA23;100	O
21	CADA12;100	O	55	CADA24;100	O
22	CADA07;100	O	56	CADA25;100	O
23	CADA06;100	O	57	N/C	—
24	CADA05;100	O	58	CRSTA;100	O
25	CADA04;100	O	59	WAITA;000	I
26	CADA03;100	O	60	INPAKA;000	I
27	CADA02;100	O	61	REGA;000	O
28	CADA01;100	O	62	BVDA2;100	I
29	CADA00;100	O	63	BVDA1;100	I
30	CDA00;100	I/O	64	CDA08;100	I/O
31	CDA01;100	I/O	65	CDA09;100	I/O
32	CDA02;100	I/O	66	CDA10;100	I/O
33	WPA;000	I	67	CD2A;000	I
34	GND	—	68	GND	—

C.16 PJ20 PC Card Slot 2 Connector (68-Pin) (T4600/T4600C only)

Table C-18 PC Card Slot 2 Connector Pin Assignments (68-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	GND	—	35	GND	—
02	CDB03;100	I/O	36	CD1B;000	I
03	CDB04;100	I/O	37	CDB11;100	I/O
04	CDB05;100	I/O	38	CDB12;100	I/O
05	CDB06;100	I/O	39	CDB13;100	I/O
06	CDB07;100	I/O	40	CDB14;100	I/O
07	CE1B;000	O	41	CDB15;100	I/O
08	CADB10;100	O	42	CE2B;000	O
09	OEB;000	O	43	N/C	—
10	CADB11;100	O	44	IORB;000	O
11	CADB09;100	O	45	IOWB;000	O
12	CADB08;100	O	46	CADB17;100	O
13	CADB13;100	O	47	CADB18;100	O
14	CADB14;100	O	48	CADB19;100	O
15	WEB;000	O	49	CADB20;100	O
16	BSYB;000	I	50	CADB21;100	O
17	MCVCCB	—	51	MCVCCB	—
18	MCVP1B	—	52	MCVP2B	—
19	CADB16;100	O	53	CADB22;100	O
20	CADB15;100	O	54	CADB23;100	O
21	CADB12;100	O	55	CADB24;100	O
22	CADB07;100	O	56	CADB25;100	O
23	CADB06;100	O	57	N/C	—
24	CADB05;100	O	58	CRSTB;100	O
25	CADB04;100	O	59	WBITB;000	I
26	CADB03;100	O	60	INPBKB;000	I
27	CADB02;100	O	61	REGB;000	O
28	CADB01;100	O	62	BVDB2;100	I
29	CADB00;100	O	63	BVDB1;100	I
30	CDB00;100	I/O	64	CDB08;100	I/O
31	CDB01;100	I/O	65	CDB09;100	I/O
32	CDB02;100	I/O	66	CDB10;100	I/O
33	WPB;000	I	67	CD2B;000	I
34	GND	—	68	GND	—

C.17 PJ18 CRT I/F Connector (15-Pin)

Table C-19 CRT I/F Connector Pin Assignments (15-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	RED;101	O	09	N/C	—
02	LGREN;101	O	10	GND	—
03	BLUE;101	O	11	N/C	—
04	N/C	—	12	N/C	—
05	GND	—	13	PHSYNC;100	O
06	GND	—	14	PVSYNC;100	O
07	GND	—	15	N/C	—
08	GND	—			

C.18 PJ3 (FSHBP1) PS/2 Mouse Connector (6-Pin)

Table C-20 PS/2 Mouse Connector Pin Assignments (6-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	MOUSDT;101	I/O	04	VCC	—
02	N/C	—	05	MOUSCK;101	I/O
03	GND	—	06	N/C	—

C.19 PJ2 (FSHBP1) Serial I/F Connector (9-Pin)

Table C-21 Serial I/F Connector Pin Assignments (9-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	DCD1;100	I	06	DSR1;100	I
02	RD1;000	I	07	RTS1;111	O
03	SD1;011	O	08	CTS1;100	I
04	DTR1;111	O	09	RI1;100	I
05	GND	—			

C.20 PJ4 (FSHBP1) External Keyboard I/F Connector (6-Pin)

Table C-22 External Keyboard I/F Connector Pin Assignments (6-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	EKBDAT	I/O	04	VCC	—
02	N/C	—	05	EKBCLK	I/O
03	GND	—	06	N/C	—

C.21 PJ1 PRT/FDD Connector - for Printer (25-Pin)

Table C-23 PRT/FDD Connector Pin Assignments (for Printer) (25-pin)

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

C.22 PJ1 PRT/FDD Connector - for External FDD (25-Pin) (T4500/T4500C only)

Table C-24 PRT/FDD Connector Pin Assignments (for External FDD) (25-pin)

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

ASCII Character Codes

Table D-1 ASCII Character 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	Ξ
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	ƒ
5	♣	§	%	5	E	U	e	u	à	ò	Ñ	┌	└	└	σ	J
6	♠	—	&	6	F	V	f	v	å	û	ä	┌	└	└	μ	÷
7	●	↓	'	7	G	W	g	w	ç	ù	ó	┌	└	└	Υ	≈
8	●	↑	(	8	H	X	h	x	ê	ÿ	ı	┌	└	└	Φ	°
9	○	↓	)	9	I	Y	i	y	ë	Ö	┌	└	└	└	Θ	■
A	○	→	*	:	J	Z	j	z	è	Ü	┌	└	└	└	Ω	■
B	♂	←	+	;	K	[	k	{	ï	ç	½	┌	└	■	δ	√
C	♀	┌	,	<	L	\	l	|	î	£	¼	┌	└	■	φ	n
D	♪	↔	-	=	M	]	m	}	ì	¥	ı	┌	└	■	φ	2
E	♪	▲	•	>	N	^	n	~	Ä	Pt	«	┌	└	■	€	■
F	☀	▼	/	?	O	-	o	☰	Å	f	»	┌	└	■	∩	BLANK (FF)

Keyboard Scan / Character Codes

Table E-1 Scan Codes - Set 1 and Set 2 (1 of 3)

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

Table E-1 Scan Codes - Set 1 and Set 2 (2 of 3)

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

Table E-1 Scan Codes - Set 1 and Set 2 (3 of 3)

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

*** Notes:**

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

Table E-2 Scan Codes with the Left Shift Key

Cap No.	Keytop	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 shown 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.	Keytop	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 the Fn Key

Cap No.	Keytop	Code Set 1		Code Set 2	
		Make	Break	Make	Break
43	ENT	E0 1C	E0 9C	E0 5A	E0 F0 5A
58	CTRL	E0 1D	E0 9D	E0 14	E0 F0 14
60	LALT	E0 38	E0 B8	E0 11	E0 F0 11
122	NUML	45	C5	77	F0 77
123	SCRL	46	C6	7E	F0 7E

Table E-5 Scan Codes in Overlay Mode

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

Table E-6 Scan Codes with the Ctrl Key

Keytop	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 the Alt Key

Keytop	Shift	Code Set 1	Code Set 2
		Make	Make
Pause	Common	E1 ID 45 E1 SD C5	E1 14 77 E1 F0 14 F0 77
	Ctrl*	E0 46 E0 C6	E0 7E E0 F0 7E

* This key generates only Make codes.

Key Layouts

The arrow key markings for the T4500/T4600 monochrome computers and the T4500C/T4600C color computers are different. The monochrome T4500/T4600 keyboard has contrast icons on the left and right arrow keys. The color T4500C/T4600C does not have a contrast control. Also, the **F6** key has a video mode icon and is used to display normal or reverse video on the monochrome T4500/T4600 computers.

F.1 United States (USA) Keyboard

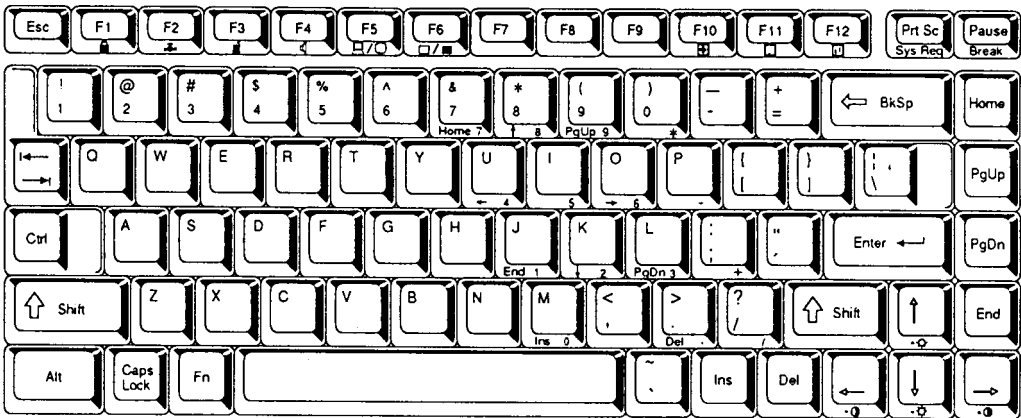


Figure F-1 USA Keyboard

F.2 United Kingdom (UK) Keyboard

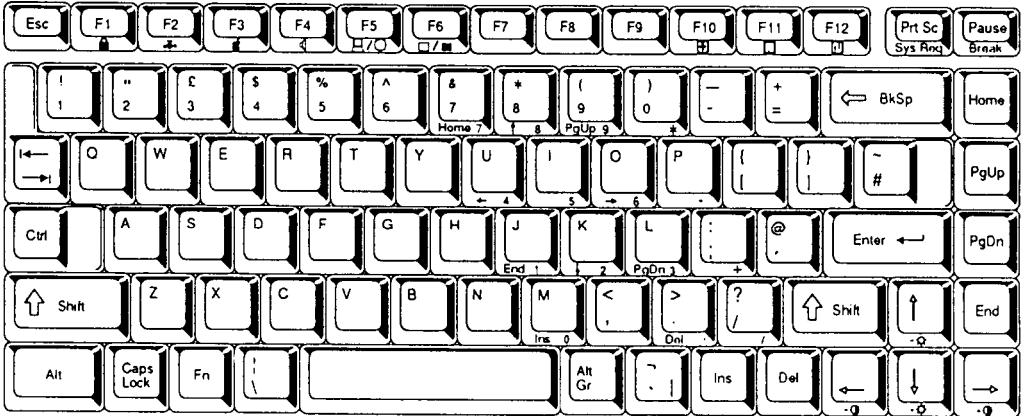


Figure F-2 UK Keyboard

F.3 German (GR) Keyboard



Figure F-3 German Keyboard

F.4 French (FR) Keyboard

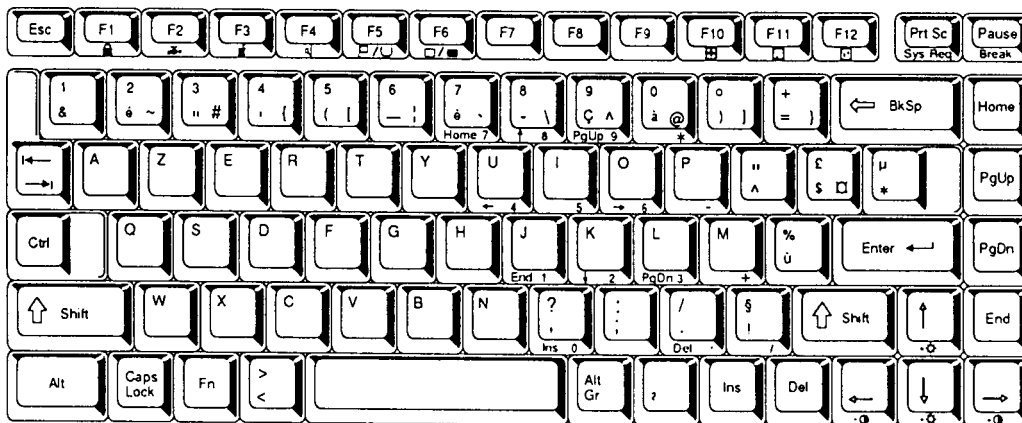


Figure F-4 French Keyboard

F.5 Spanish (SP) Keyboard

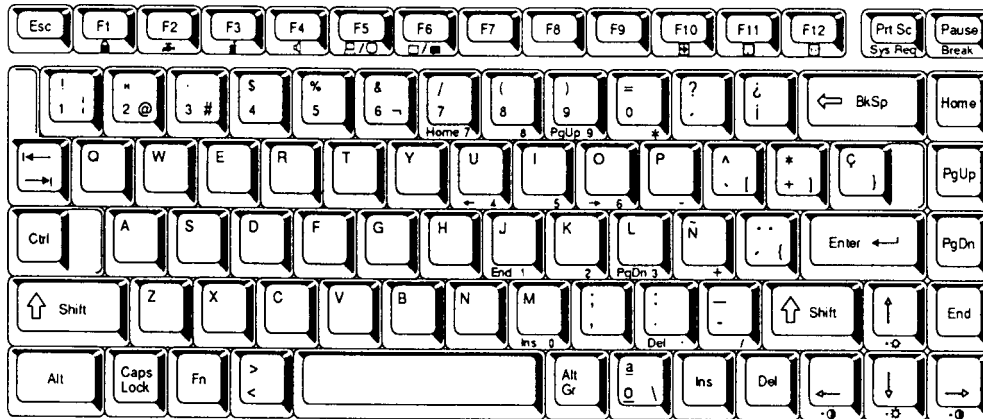


Figure F-5 Spanish Keyboard

F.6 Italian (IT) Keyboard

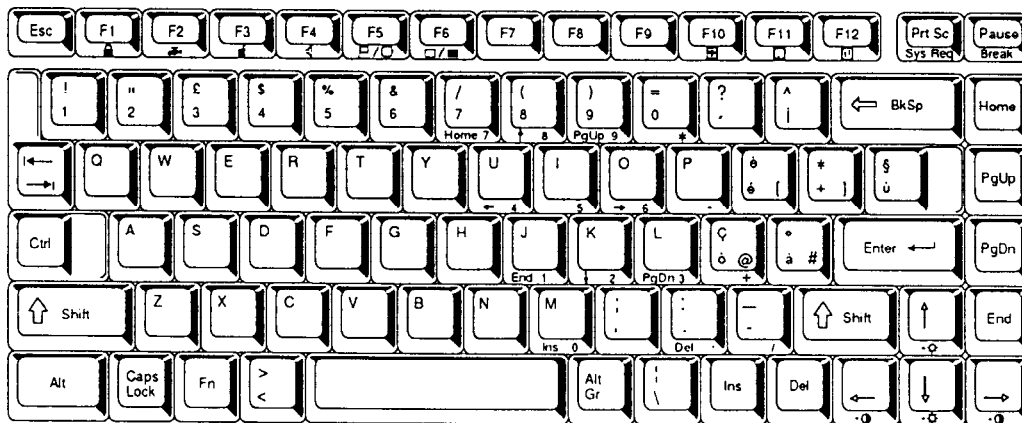


Figure F-6 Italian Keyboard

F.7 Scandinavian (SC) Keyboard

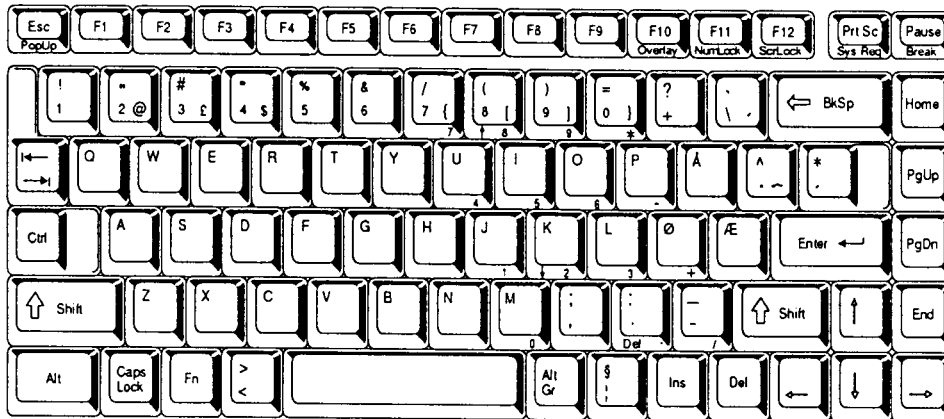


Figure F-7 Scandinavian Keyboard

F.8 Swiss-German (SL) Keyboard

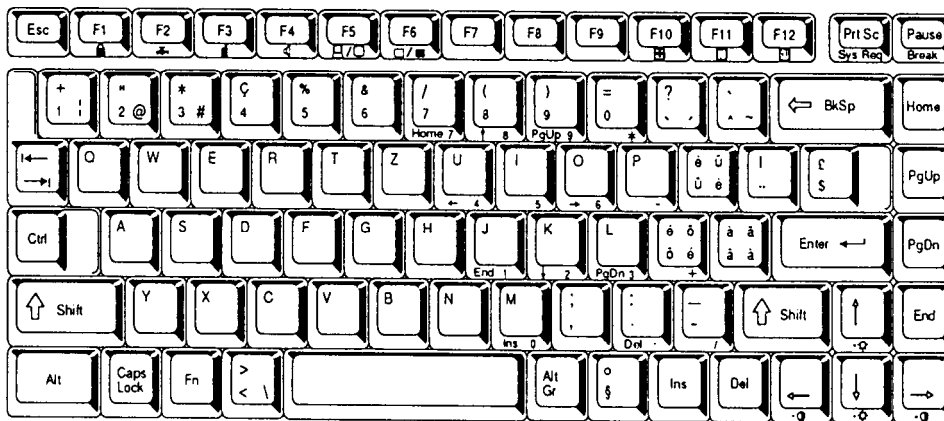


Figure F-8 Swiss-German Keyboard

F.9 Canadian (Specialized) Keyboard

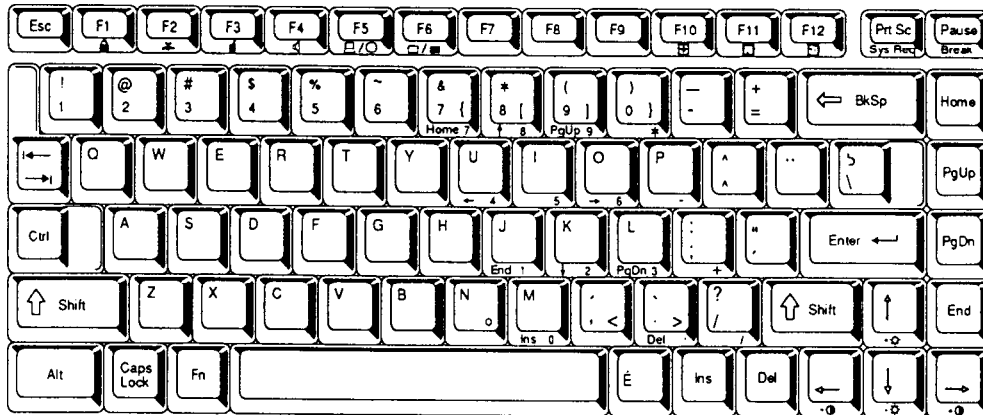


Figure F-9 Canadian Keyboard

F.10 Keycap Number Keyboard

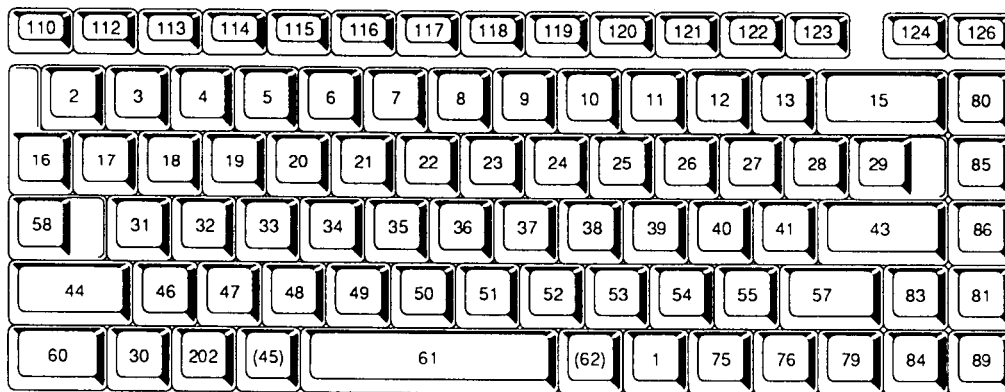


Figure F-10 Keycap Number Keyboard

Wiring Diagrams

G.1 Printer Wraparound Connector

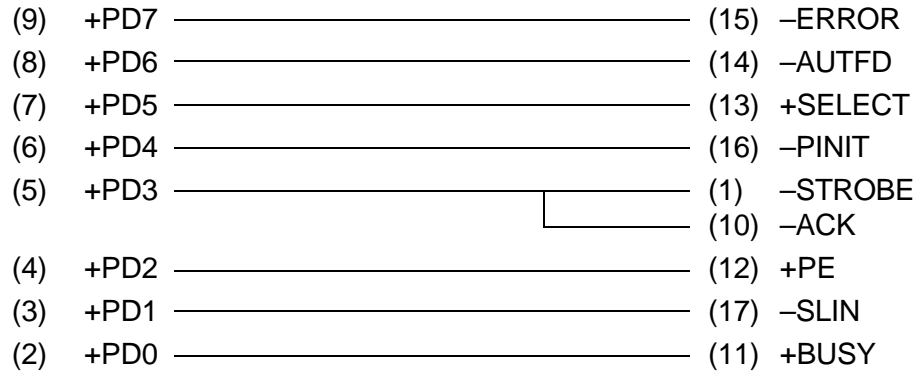


Figure G-1 Printer Wraparound Connector

G.2 RS-232-C Wraparound Connector

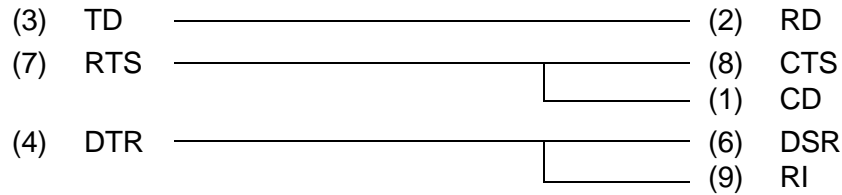


Figure G-2 RS-232-C Wraparound Connector

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

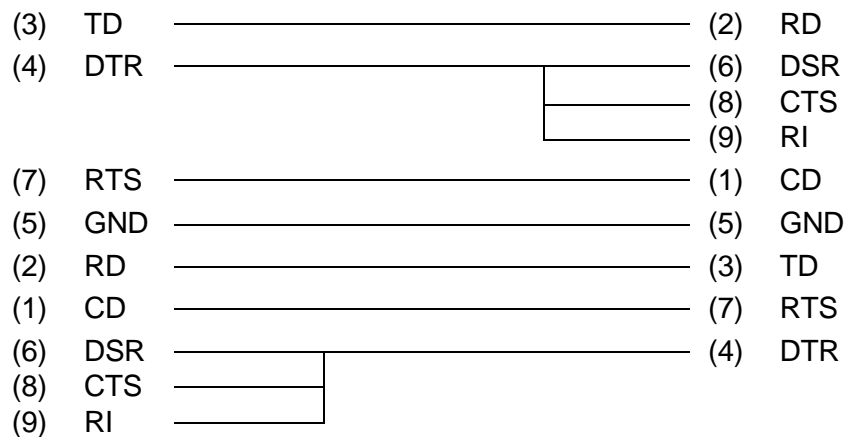


Figure G-3 RS-232-C Direct Cable (9-pin to 9-pin)

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

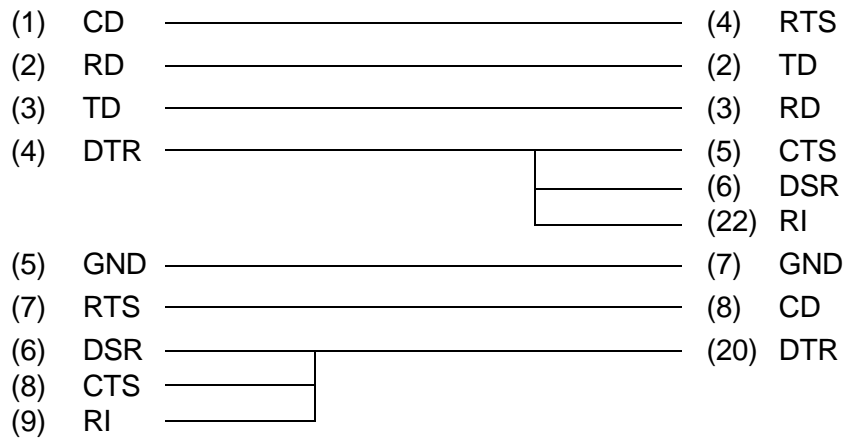


Figure G-4 RS-232-C Direct Cable (9-pin to 25-pin)

Deleting the Password

For security reasons, the Password Deletion Disk will not be distributed to Service Providers. You must obtain the current password from the computer's owner to service the machine.

If the owner forgets the password, contact your Toshiba representative for further action.

BIOS Rewrite Procedures

This appendix explains how to rewrite the system BIOS program when updating the BIOS on the T4500/T4600 Family computer.

Tools

To rewrite the BIOS, the following tool is required:

- BIOS rewrite disk for T4500/T4500C or T4600/T4600C
(May also be found on Toshiba's BBS)

Rewriting the BIOS

Follow the procedures below to start the BIOS rewrite program.

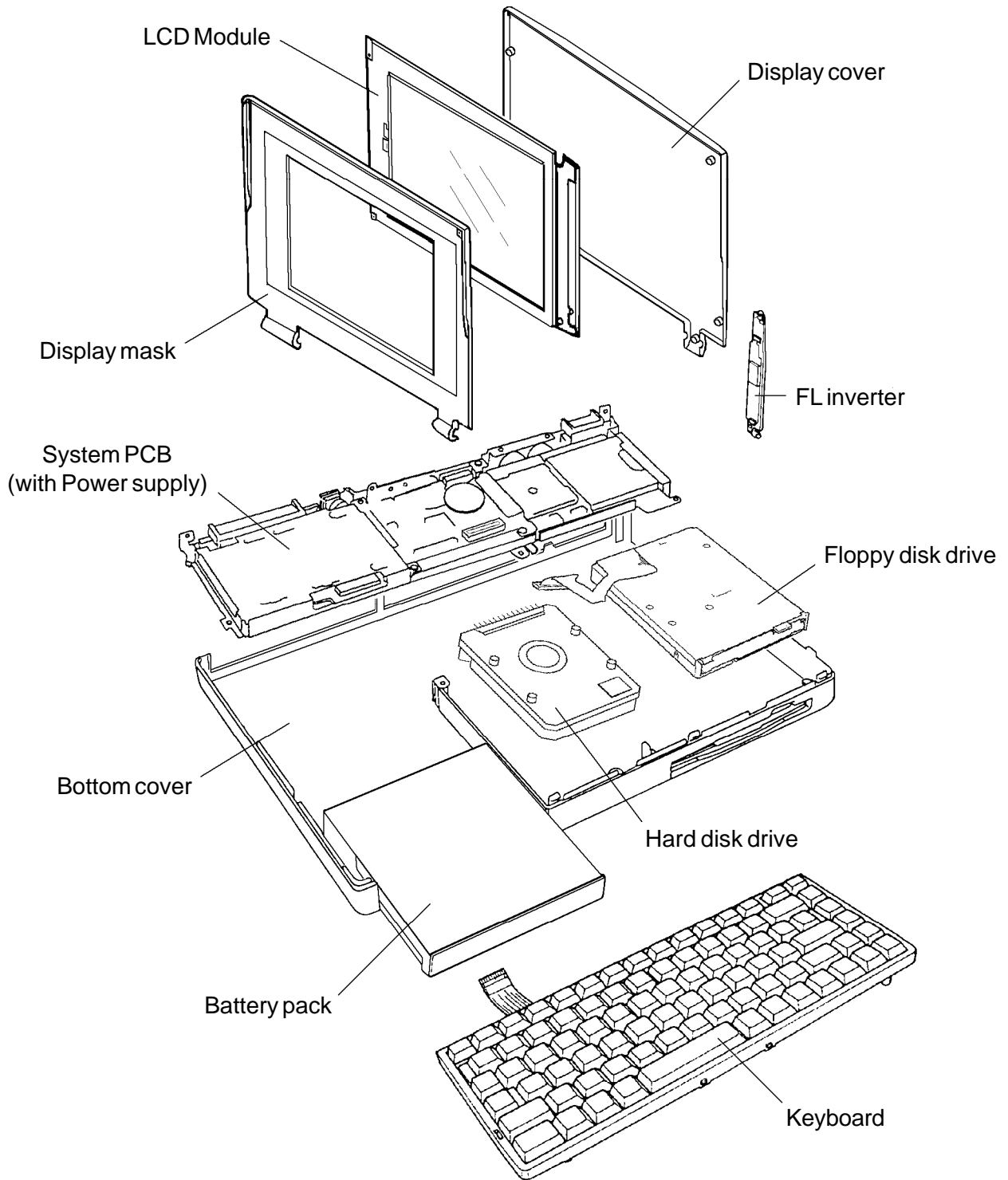
1. Set the system to Boot Mode.
2. Turn off the power to the computer.
3. Remove any PCMCIA card(s) and all external cables (except AC adapter).
4. Turn on the power while holding down the **F12** key (keep holding down the key until the system speaker sounds a beep).
5. When the BIOS update message is displayed, insert the BIOS rewrite disk into the FDD. Press the **Enter** key to start the BIOS rewrite program.
6. When the process is completed, eject the rewrite disk and press the reset switch to restart the system.

Acronyms

This is a list of some of the acronyms used in this manual.

ACRONYM	DEFINITION
BIOS	Basic Input/Output System
BPQP	Ball-point Quick Port
CPU	Central Processing Unit
DMA	Direct Memory Access
DMAC	Direct Memory Access Controller
FDC.....	Floppy Disk Controller
FDD.....	Floppy Disk Drive
FL.....	Fluorescent Light (Lamp)
FRU.....	Field Replaceable Unit
HDC	Hard Disk Controller
HDD	Hard Disk Drive
IRT	Initial Reliability Test
KBC.....	Keyboard Controller
LCD.....	Liquid Crystal Display
LED	Light Emitting Diode
PCB.....	Printed Circuit Board
PCMCIA	Personal Computer Memory Card International Association
PIC	Programmable Interrupt Controller
PIT	Programmable Interrupt Timer
PSC.....	Poser Supply Controller
ROM	Read Only Memory
RTC.....	Real Time Clock
SIO.....	One Serial Input/Output Controller
SVGA	Super Video Graphics Array
TFT	Thin Film Transistor
VFO	Variable Frequency Oscillator
VGA	Video Graphics Array

T4500/T4600 Family Computer - Exploded View



NOTE: This diagram is for reference only. Please see Chapter 4, Replacement Procedures for proper disassembly and reassembly instructions.