

1.1 Features

The T1950, T1950CS and T1950CT units consist of the following features.

Processor Processor Type BIOS RAM	Intel SL-Enhanced 486DX2/40Mhz. (P24S chip) DX2: (3.3v w/8KB internal cache) <i>Co-processor embedded.</i> 128KB flash EPROM (150ns) 4MB Expandable to 20MB (80ns)
Display Ext. Display	T1950: Fluorescent Sidelit Monochrome LCD T1950CS: Dynamic-STN Dual Scan Color LCD T1950CT: TFT Active Matrix Color LCD T1950 & T1950CS: VGA 640 x 480 (16 colors of 4096) T1950CT: 800 x 600/256 colors;1024 x 768/256 colors (<i>using Toshiba supplied drivers</i>)
FDD HDD	3 1/2" 1.44MB T1950 & T1950CS: 120MB/200MB T1950CT: 200MB/320MB
Optional Peripherals	101-key Keyboard (PS/2)
Ports	1 - 14.5mm PCMCIA Type III (2.0) 1 9-PIN Serial (16450 UART) 1 Parallel/FDD: BI-DIR 1 15-PIN RGB 1 Mouse Quick Port (DCBM) 1 PS/2 Mouse Port (<i>not usable if DCBM connected</i>)
Keyboard	1 101-key Keyboard Port (PS/2) 82-Keys, 3mm Travel
Battery Battery Life Recharge Time	NIMH (12V 2400mAH) PART# PA2420UXRA 2-3 HRS. 1.4-2.3 HRS (Computer off only)
AC Adapter	<u>T1950 & T1950CS</u> : Input: 100-240VAC , Input Frequency: 50-60Hz, Input Power: .5A - .28A (50/60Hz) Output Voltage: 18 VDC, 1.1A <u>T1950CT</u> : Input: 100-240VAC, Input Frequency: 50-60Hz, Input Power: .7A - .4A (50/60Hz) Output Voltage: 18 VDC, 1.7 A
Bundled Software	Toshiba DOS 6.0; Windows 3.1; MaxTime; Ultrafont.
Dimensions	T1950: 11.7"W x 8.4"D x 2.0"H, 6.4 lbs. T1950CS & T1950CT: 11.7"W x 8.4"D x 2.1"H, 7 lbs.

The T1950 Series Personal Computer is shown in Figure 1-1, and its system configuration is shown in Figure 1-2.

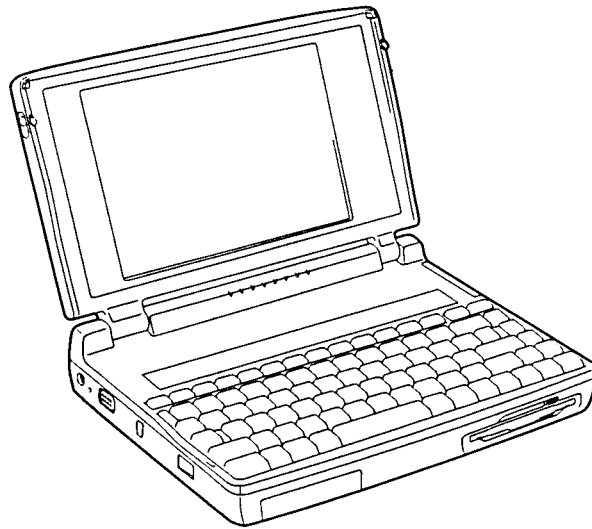


Figure 1-1 T1950 Series Personal Computer

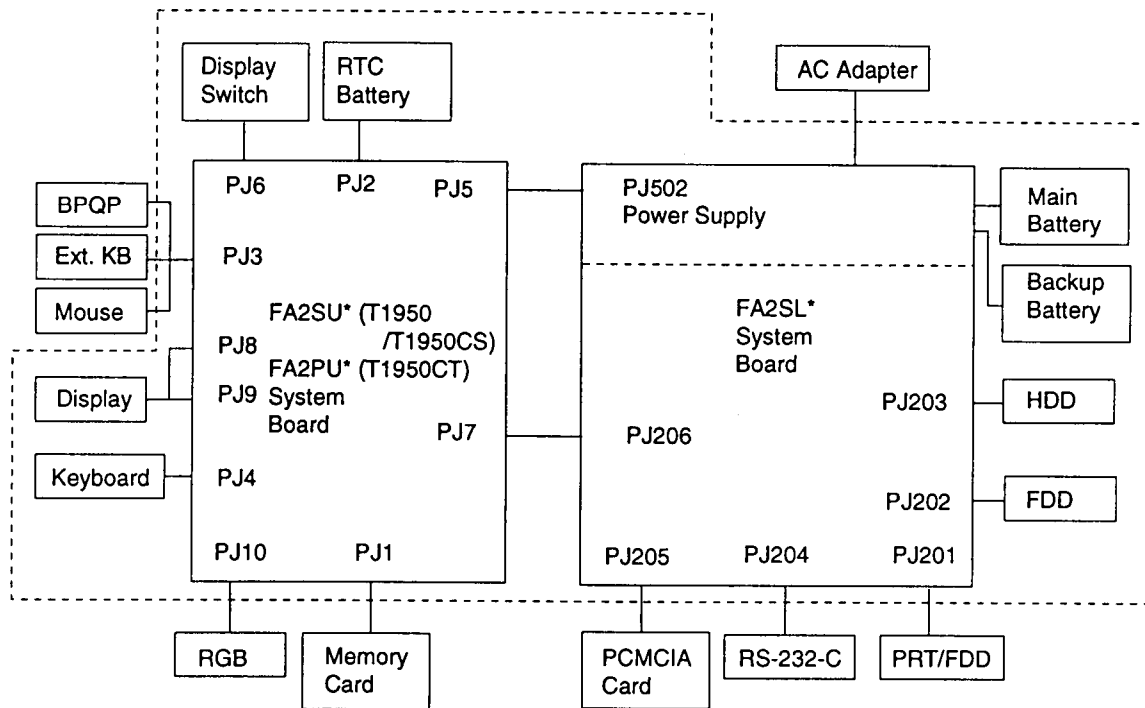


Figure 1-2 T1950 Series System Unit Configuration

1.2 System Unit Block Diagram

Figure 1-3 is a block diagram of the T1950 Series system unit.

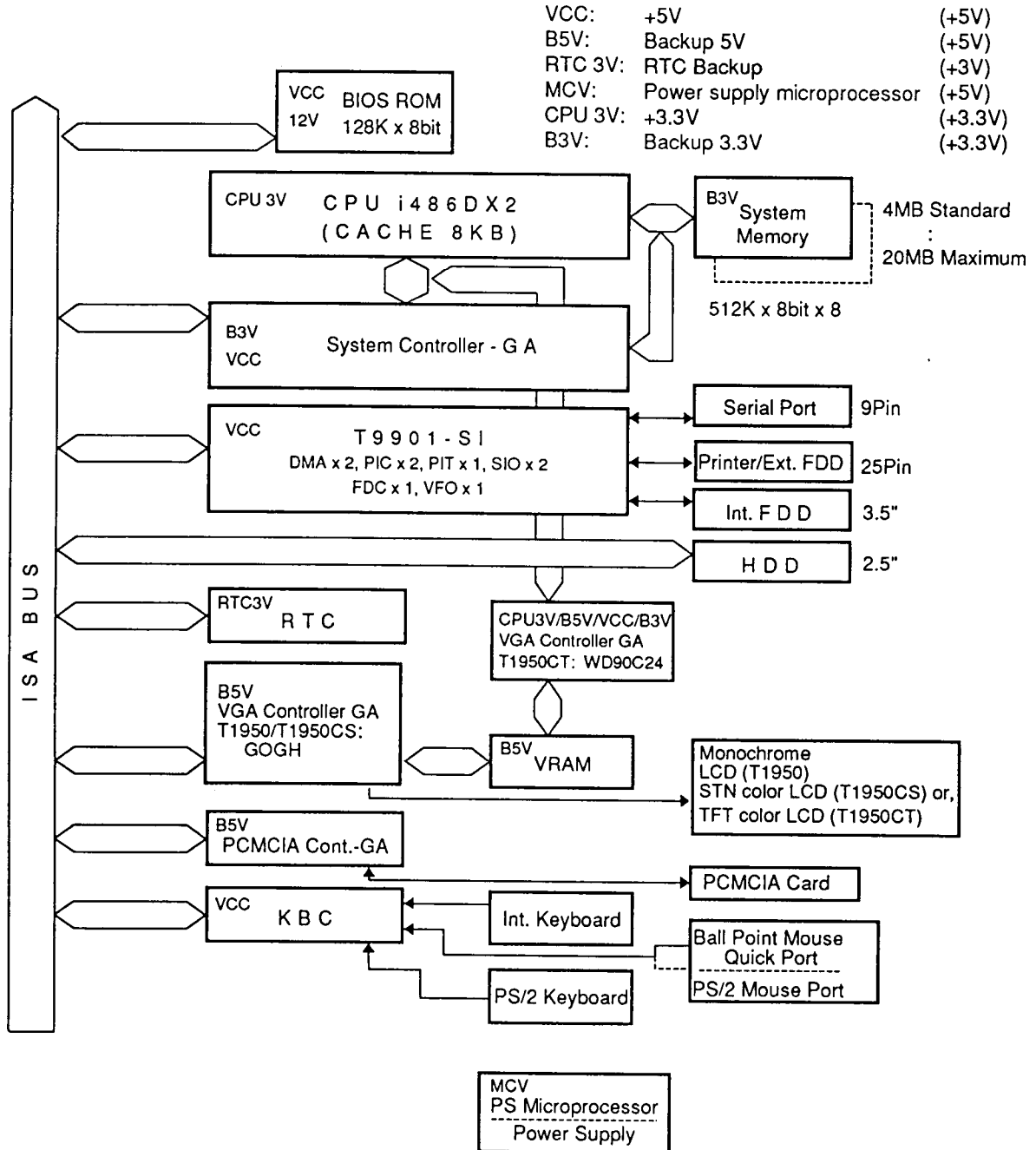


Figure 1-3 T1950 Series System Board Block Diagram

The T1950 Series system board is composed of the following major components:

- ❑ An i486DX2-40 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 of bytes memory. Fourteen bytes of memory are used for the calendar and clock. The remaining 114 bytes are used for the system configuration data.

OSC (X3) generates 32.768 KHz for RTC.

- ❑ 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.

- ❑ The following memories:

Standard RAM: 4 MB
Cache memory: 8 KB (inside CPU)
BIOS ROM: 128 KB (96 KB are used)
This ROM contains Initial Reliability Test (IRT), Basic Input/Output System (BIOS), and video BIOS.
Video RAM: 256 KB
Optional memory cards expand memory to a maximum of 20 MB.

- ❑ VGA display controller

T1950/T1950CS (GOGH): This controller controls internal and external VGA compatible display.

T1950CT (WD90C24): This controller controls internal VGA display and external SVGA compatible display.

- ❑ Clock Generator receives 14.31818 MHz (X2) and generates the following frequencies:
 - 20 MHz for the CPU (CPU operates at 40MHz.)
 - 14.7456 MHz for the COM
 - 24 MHz for the FDC and VFO
 - 16 MHz is used for GA
 - 14.31818 MHz is used for T9901 (SI)

- ❑ Gate Array

System Controller Gate Array

This gate array has the following functions:

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

PCMCIA Controller Gate Array

This gate array has the following functions:

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

1.3 3.5-inch Floppy Disk Drive

The T1950 Series 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 T1950 Series FDD is shown in Figure 1-4, and specifications are listed in Table 1-1.

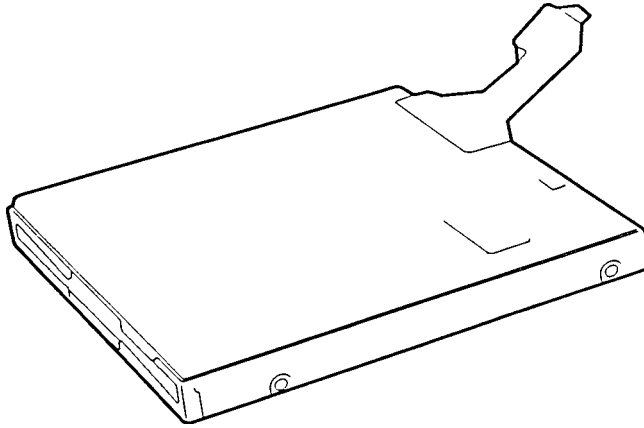


Figure 1-4 3.5-inch FDD

Table 1-1 3.5-inch FDD Specifications

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

1.4 2.5-inch Hard Disk Drive

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

The T1950/T1950CS supports a 120 or 200 MB HDD. The T1950CT supports a 200 or 320 MB HDD.

A T1950 Series HDD is shown in Figure 1-5, and specifications are listed in Table 1-2.

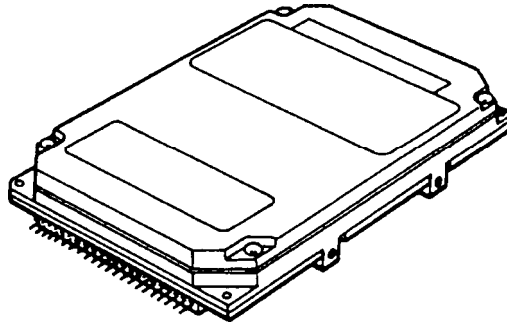


Figure 1-5 2.5-inch HDD

Table 1-2 2.5-inch HDD Specifications

	120 MB		200 MB	320 MB
	(CP2124)	(MK2124FC)	(MK2224FC)	(MK2326FC)
Storage capacity (MB) Formatted	121.6	130.1	213.0	340.0
Number of disks	2	2	2	3
Data heads	4	4	4	6
Data surfaces	4	4	4	6
Tracks per surface	1,123	1,155	1,560	1,830
Sectors per track	53 (+1)	55 (+1)	–	–
Bytes per sector	512	512	512	512
Access time (ms)				
Track to track	3	5	3	3
Average	16	17	12	12
Maximum	30	36	25	25
Rotation speed (rpm)	3,743	3,200	4,000	4,200
Data transfer rate (bps) To/from media	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
Recording method	2-7 RLL	1-7 RLL	1-7 RLL	1-7 RLL

1.5 Keyboard

The 82-(USA) or 84-(European) keyboard is mounted on the T1950 Series system unit, and is connected to the keyboard controller on the system board through a 19-pin flat cable. The keyboard is shown in Figure 1-6.

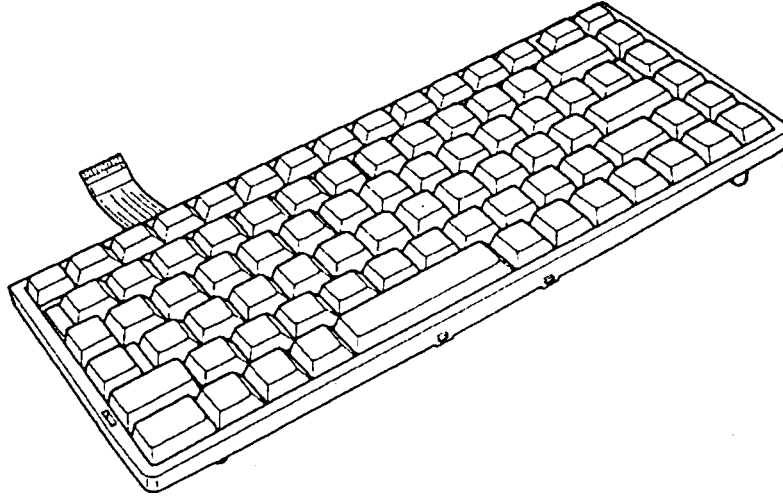


Figure 1-6 Keyboard

1.6 Monochrome LCD (T1950)

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

1.6.1 Monochrome LCD Module

The T1950 monochrome LCD supports 640x480 pixels with a Video controller and 64 levels of gray. The video controller includes the functions of the Video Graphics Array (VGA).

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

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

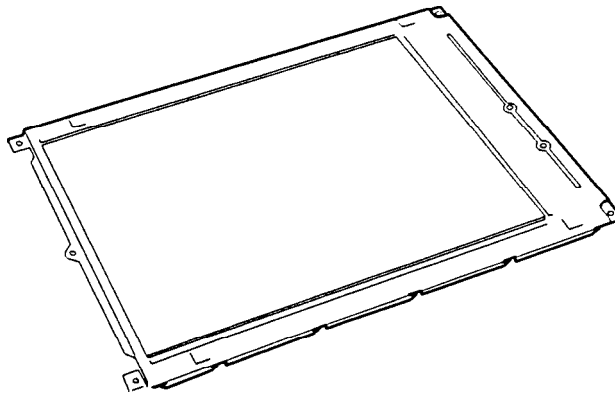


Figure 1-7 Monochrome LCD

Table 1-3 Monochrome LCD Specifications

Item		Specifications
Number of Dots	(dots)	640 x 480
Dot pitch	(mm)	0.30 (W) x 0.30 (H)
Display area	(mm)	198 (W) x 150 (H)
Contrast		17:1 (typically)
FL current	(mA)	5.0
FL frequency	(KHz)	42

1.6.2 Monochrome Fluorescent Lamp (FL) Inverter Board

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

Table 1-4 Monochrome FL Inverter Board Specifications

Item		Specifications
Input	Voltage (VDC)	5
	Power (W)	2.2
Output	Voltage (VAC)	950
	Current (mA)	4.2
	Frequency (KHz)	38.5

1.7 STN Color LCD (T1950CS)

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

1.7.1 STN Color LCD Module

The T1950CS STN color LCD is backlit and supports 640x480 pixels with a Video controller. This video controller includes the functions of Video Graphics Array (VGA).

The T1950CS's LCD receives vertical and horizontal synchronizing signals, 16-bit data signal (8-bit upper block data signal and 8-bit lower block data signal) and shift clock for data transmission. All signals are CMOS-level compatible.

The STN LCD is shown in Figure 1-8, and specifications for the LCD are listed in Table 1-5.

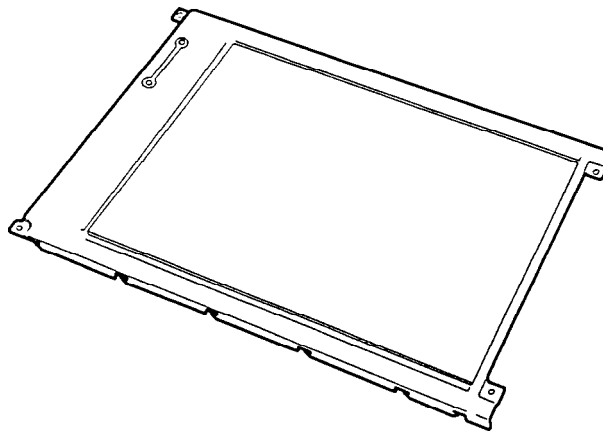


Figure 1-8 STN Color LCD

Table 1-5 STN Color LCD Specifications

Item	Specifications
Number of Dots (dots)	640x480
Dot pitch (mm)	0.3 (W)x0.3 (H)
Display area (mm)	195 (W)x147 (H)
Contrast	18:1 (Typically)
FL current (mA)	5.0
FL frequency (KHz)	47

1.7.2 STN Color Fluorescent Lamp (FL) Inverter Board

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

Table 1-6 STN Color FL Inverter Board Specifications

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

1.8 TFT Color LCD (T1950CT)

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

1.8.1 TFT Color LCD Module

The T1950CT TFT color LCD supports 640x480 pixels with an internal display controller and 512 colors for graphics and characters. This controller includes the functions of Video Graphics Array (VGA) and Super VGA (SVGA) for external display.

The T1950CT'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 1-9, and specifications are listed in Table 1-7.

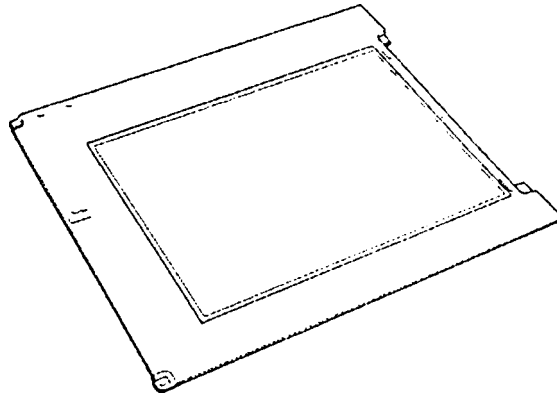


Figure 1-9 TFT Color LCD

Table 1-7 TFT Color LCD Specifications

Item		Specifications
Number of dots	(dots)	640x480
Dot pitch	(mm)	0.27 (W)x0.27 (H)
Display area	(mm)	171 (W)x130 (H)
Contrast		60:1 (minimum)
FL current	(mA)	5.0
FL frequency	(KHz)	47

1.8.2 TFT Color Fluorescent Lamp (FL) Inverter Board

The FL inverter board supplies high frequency current to light the LCD's Fluorescent Lamp. The specifications for the FL inverter are listed in Table 1-8.

Table 1-8 FL Inverter Board Specifications

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

1.9 Power Supply

The power supply uses a microprocessor to monitor and regulate the voltages used within the T1950 Series computers. The power supply contains the following functions:

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

The power supply output rating is specified in Table 1-9.

Table 1-9 Power Supply Output Rating

Use for	Name	DC voltage (V)	Regulation tolerance (%)	Maximum current (mA)	Ripple (mV)
System logic, FDD, HDD, Display	VCC	+5	±5	3,500	100
RS-232C, Flash ROM	12V	+12	±5	120	240
RAM, CPU	B3V	+3.3	±5	755	66
RS-232C	M12V	-7 to -12.6	-	10	-

1.10 Batteries

The T1950 Series has three types of batteries:

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

Specifications for these batteries are listed in Table 1-10.

Table 1-10 Battery Specifications

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

1.10.1 Battery Indicator

The battery indicator is located on the top cover, and shows the status of the removable battery pack, power supply and AC adapter.

The status of each can be determined by color:

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

1.10.2 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.

1.10.2.1 Battery Charging Control

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

When the AC adapter is attached, there are two types of charge: quick charge when the system is powered off, and trickle charge when the system is powered on. Table 1-11 shows the charging time period of the main battery.

Table 1-11 Time Required for Battery Charges

	Charging time
Quick charge (power off)	About 2.3 hours (T1950) About 1.4 hours (T1950CS/T1950CT)
Trickle charge (power on)	About 48 hours

Quick Battery Charge

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

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

Trickle Battery Charge

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

1.10.3 Backup Battery

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

AC adapter > Main battery > Backup battery

The backup battery is charged by the main battery or AC adapter when the system is powered on. Table 1-12 shows the charging time and data preservation period of the backup battery.

Table 1-12 Backup Battery Charging/Data Preservation Time

		Time
Charging Time	Power On	16 H
	Power Off (with AC Adapter)	60 H
	Power Off (Without AC Adapter)	Doesn't charge
Data preservation period (full charge)		8 H

1.10.4 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 1-13 shows the charging time and data preservation period of the RTC battery.

Table 1-13 RTC Battery Charging/Data Preservation Time

		Time
Charging Time	Power On	48 H
	Power Off	Doesn't charge
Data preservation period (full charge)		1 month

2.1 Troubleshooting

Chapter 2 describes how to determine if a Field Replaceable Unit (FRU) in the T1900/T1900C is causing the computer to malfunction. FRUs covered include the:

1. Upper and Lower System Boards
2. Floppy Disk Drive
3. Hard Disk Drive
4. Keyboard
5. Display

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

The following tools are necessary for implementing the troubleshooting procedures:

1. T1900/T1900C Diagnostics Disk
2. Phillips head screwdriver (2 mm)
3. Toshiba MS-DOS system disk(s)
4. 2DD or 2HD formatted work disk for floppy disk drive testing
5. Cleaning kit for floppy disk drive troubleshooting
6. Printer port LED
7. RS-232-C wraparound connector
8. Printer wraparound connector
9. Multimeter
10. External 5.25-inch floppy disk drive
11. External CRT

2.2 Troubleshooting Flowchart

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

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

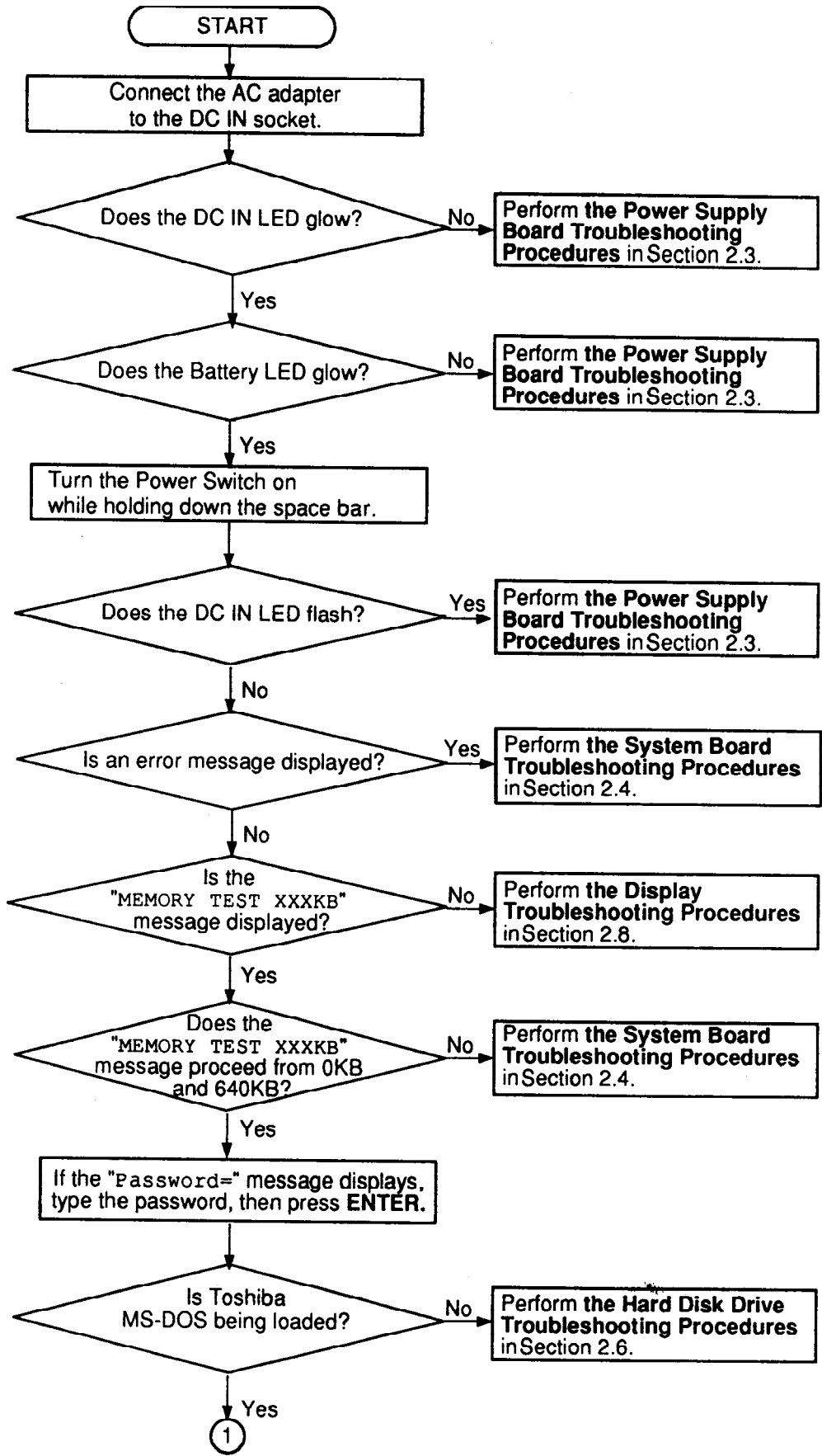


Figure 2-1 Troubleshooting Flowchart (1/2)

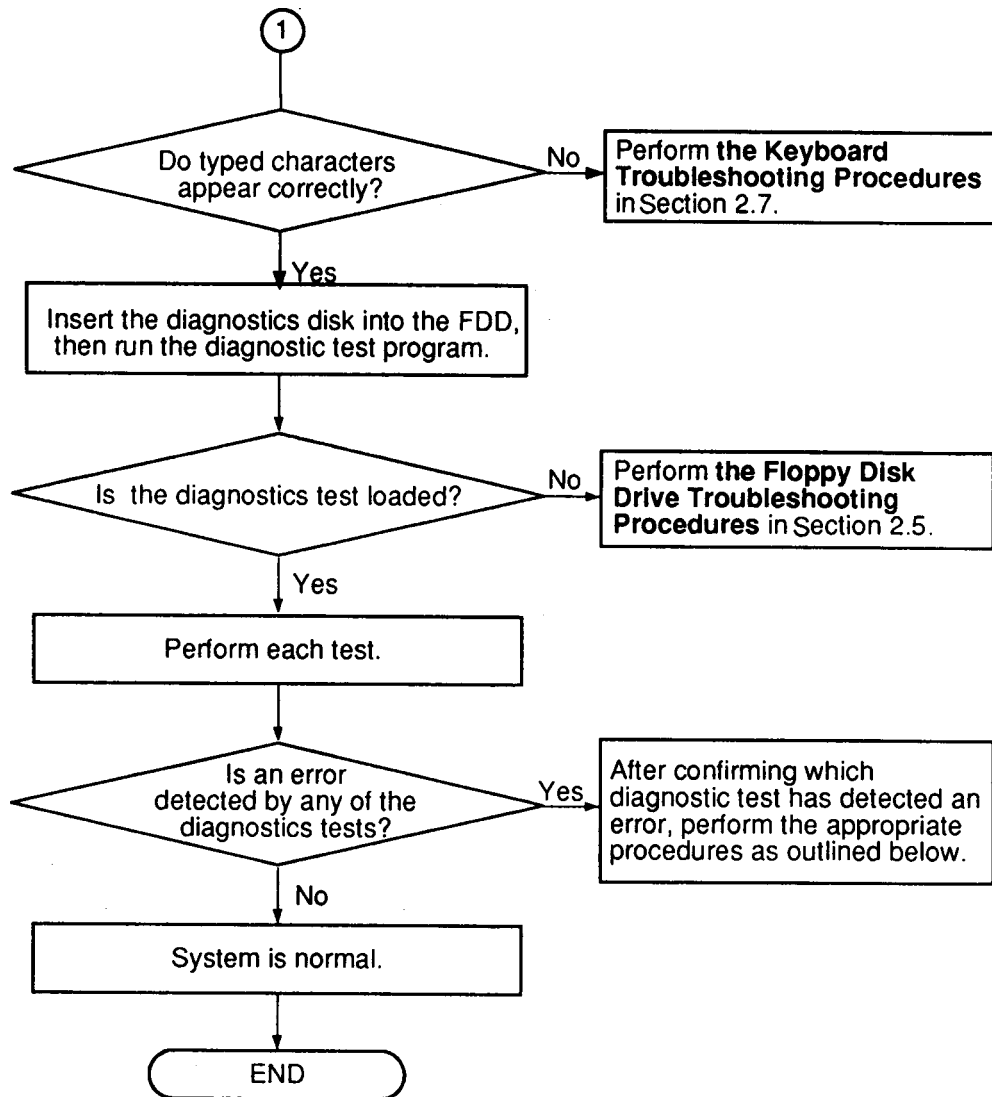


Figure 2-1 Troubleshooting Flowchart (2/2)

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

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

2.3 Power Supply Troubleshooting

The T1900/T1900C's power supply controls many functions and components in the computer. To determine if the power supply is functioning properly, start with Procedure 1 and continue with the other procedures as instructed. Procedures described in this section are:

Procedure 1: DC IN LED Indicator Check

Procedure 2: Battery LED Indicator Check

Procedure 3: System PCB Replacement Check

Procedure 1 DC IN LED Indicator Check

The T1900/T1900C's AC adapter converts AC power to DC power and contains a charging circuit which charges the computer's batteries. The adapter connects to the DC IN socket connector on the left side of the computer. When it is connected and the power is turned off, the AC adapter charges the batteries.

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

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

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

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

T1900 (PA2417U), 1.1 A

T1900C (PA2478U), 1.7 A

Check 2 If the DC IN indicator flashes orange when the AC adapter is connected, its voltage output is abnormal. Connect a new AC adapter and turn the computer on again to verify the indicator condition.

- Check 3 The battery pack may be malfunctioning. Replace the battery pack with a new one and turn the computer on again. If the problem still exists, perform Check 4.
- Check 4 Place the computer in an environment between -20°C and 70°C until the unit is at the ambient temperature. Repeat the steps which caused the computer to operate abnormally. If the same problem still appears, perform Procedure 3.

Procedure 2 Battery LED Indicator Check

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

- If the Battery LED indicator glows green, the AC adapter is connected and the battery is fully charged.
 - If the Battery LED indicator glows amber, the AC adapter is connected and the battery is being charged.
 - If the Battery LED indicator does not glow, go to Check 1.
- Check 1 Make sure the AC adapter's cable and AC cord are firmly plugged into the DC IN socket and wall outlet. If these cables are connected correctly, go to Check 2.
- Check 2 Make sure the battery pack is installed in the computer correctly. If the battery pack is installed correctly, go to Check 3.
- Check 3 Remove the battery pack and check that the battery terminal is clean and not bent.
- If the terminal appears dirty, clean it gently with a cotton swab dipped in alcohol.
 - If the terminal looks bent or damaged, replace the lower system board.
 - If the battery terminal is clean and not bent, go to Check 4.
- Check 4 Connect a new AC adapter. If the battery LED indicator still does not glow, go to Check 5.
- Check 5 Install a new battery pack. If the battery LED indicator still does not glow, go to Procedure 3.

Procedure 3 Power Supply Replacement Check

The power supply is built into the lower system board. If the power supply is damaged, the lower system board must be replaced.

Refer to Chapter 4 for instructions on how to disassemble the T1900/T1900C, then perform the following check:

- Check 1 Replace the lower system board with a new one and restart the system. If the problem still exists, go to Check 2.

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

2.4 System Board Troubleshooting

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

- Procedure 1: Message Check
- Procedure 2: Printer Port LED Check in Boot Mode
- Procedure 3: Printer Port LED Check in Resume Mode
- Procedure 4: Diagnostic Test Program Execution Check
- Procedure 5: System Board Replacement Check

Procedure 1 Message Check

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

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

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

These errors occur when the system configuration preserved in the RTC memory (CMOS-type memory) is not the same as the actual configuration or when the data is lost.

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

Check 2 If either of the following error messages [(a) or (b)] is displayed on the screen, press any key as the message instructs.

- (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.

Error Message (a) appears when data stored in RAM under the resume function is lost because the battery has become discharged or the system PCB is damaged. Go to Procedure 3.

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

If any other message appears, perform Check 3.

Check 3 The IRT checks the system boards. When the IRT detects an error, the system stops or an error message appears. Refer to Table 2-1 for a list of error messages.

Table 2-1 IRT Error Messages (1/2)

No.	Error Message
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

Table 2-1 IRT Error Messages (2/2)

No.	Error Message
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

- If any of the following error messages is displayed, go to Procedure 5:
1 through 17, 19, 20, 25 or 26
- 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 HDD Troubleshooting Procedures in Section 2.6.
- If Error Message 23 or 24 is displayed, go to the FDD Troubleshooting Procedures in Section 2.5.

Procedure 2 Printer Port LED Check in Boot Mode

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

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

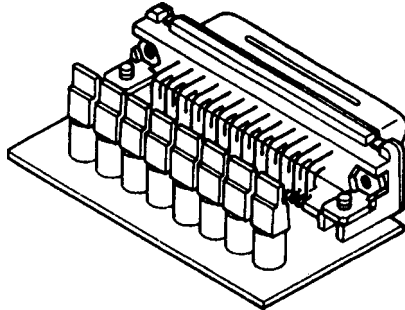


Figure 2-2 Printer Port LED

To use the printer port LED, follow these steps:

1. Turn on the T1900/T1900C's power, then set it to boot mode.
2. Turn off the computer.
3. Plug the printer port LED into the computer's PRT/FDD connector.
4. Hold down the space bar and turn on the T1900/T1900C's power.
5. Read the LED status from left to right as you are facing the back of the computer.
6. Convert the status from binary to hexadecimal notation.
7. If the final LED status is FFh (normal status), go to Procedure 3.
8. If the final LED status matches any of the test status values in Table 2-2, go to 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 has been detected during the system memory test.

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

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

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

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

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

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

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

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

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

Procedure 3 Printer Port LED Check in Resume Mode

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

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

To use the printer port LED, follow these steps:

1. Turn on the T1900/T1900C's power, then set it to resume mode.
2. Turn off the computer.
3. Plug the printer port LED into the computer's PRT/FDD connector.
4. Turn on the computer.
5. Read the LED status from left to right as you face the back of the computer.
6. Convert the status from binary to hexadecimal notation.
7. If the final LED status is FFh (normal status), go to Procedure 4.
8. If the final LED status matches any of the test status values listed in Table 2-3, go to Procedure 5.

Table 2-3 Printer Port LED Resume Mode Error Status

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

Procedure 4 Diagnostic Test Program Execution Check

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

1. System Test
2. Memory Test
3. Printer Test
4. ASYNC Test

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

Procedure 5 System Board Replacement Check

The upper (FATSU*) or lower (FATSL*) system board may be damaged. (Note that the power supply is mounted on the FATSL*.) Refer to the T1900/T1900C parts catalog for a breakdown of the computer's system boards.

Disassemble the T1900/T1900C following the steps described in Chapter 4, *Replacement Procedures*, then perform the following checks.

NOTE: To determine whether to first replace the FATSU* or the FATSL* during the troubleshooting procedures:

1. Check the error status on the printer port LED and locate the status in Table 2-2 or 2-3.
2. Compare the error status with the tables in Appendix B.
 - If the error is related to an IC or connector listed in Table B-1 or B-2, replace the FATSU* (upper system board) first.
 - If the error is related to an IC or connector listed in Table B-3 or B-4, replace the FATSL* (lower system board) first.

As an example, if the error status indicates a keyboard (KBC) problem, replace the FATSU* since the keyboard controller (IC15) is located on the upper system board, then continue with the troubleshooting procedures. However, if the error indicates a PCMCIA problem, replace the FATSL* first since the PCMCIA Gate Array (IC203) is located on the lower system board.

- Check 1 Replace the upper or lower system board.
- Check 2 If normal operation is restored after replacing the upper (or lower) system board, the original board is probably defective.
- Check 3 If normal operation is not restored, replace the original system board, then swap out the remaining system board with a new one.
- Check 4 If normal operation is still not restored, either both system boards or another FRU is probably defective. The defective unit must be isolated by performing the T1900/T1900C Diagnostics Program.

2.5 Floppy Disk Drive Troubleshooting

This section describes how to determine if the T1900/T1900C's internal 3.5-inch floppy disk drive is functioning properly. Perform the steps below starting with Procedure 1 and continuing with the other procedures as required.

- Procedure 1: FDD Head Cleaning Check
- Procedure 2: External 5.25-inch FDD Check
- Procedure 3: Diagnostic Test Program Check
- Procedure 4: Connector Check and Replacement Check

Procedure 1 FDD Head Cleaning Check

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

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

If the test program cannot be executed on the T1900/T1900C, go to Procedure 2.

Procedure 2 External 5.25-inch FDD Check

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

- Check 1 Connect an 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 an external 5.25-inch FDD, set the external FDD/PRT option in the SETUP program to FDD A or FDD B.

- Check 2 Replace the lower system board with a new one following the steps in Chapter 4, *Replacement Procedures*.

Procedure 3 Diagnostic Test Program Execution Check

The Floppy Disk Drive Diagnostic Test program is stored on the T1900/T1900C Diagnostics Disk. After loading Toshiba MS-DOS, run the diagnostics program. Refer to Chapter 3, *Tests and Diagnostics*, for more information about the diagnostic test procedures.

NOTE: As noted in Chapter 3, be sure to remove the Diagnostics Disk and replace it with a formatted work disk before continuing with the Diagnostic Test Program.

Floppy disk drive test error codes and their status names are listed in Table 2-4.

Table 2-4 Floppy Disk Drive Error Codes and Statuses

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

If any errors other than those listed in Table 2-4 occur while executing the FDD diagnostics test, go to Check 1.

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.

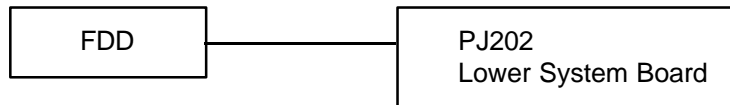
Write protected

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 lower system board by the FDD cable. This cable may become disconnected from the system board or damaged. Disassemble the T1900/T1900C 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 lower system board.



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

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

Check 3 Replace the lower system board with a new one following the steps in Chapter 4.

2.6 Hard Disk Drive Troubleshooting

To determine if the Hard Disk Drive (HDD) 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. Before beginning, 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 this command.*

Procedure 1 Partition Check

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

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

Procedure 2 Message Check

When the T1900/T1900C's HDD does not function properly, some of the following error messages may appear on the display. Start with Check 1 below and perform the other checks as instructed.

- Check 1 If any of the following messages appear, perform Check 2. If the following messages do not appear, perform Check 4.

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

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

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

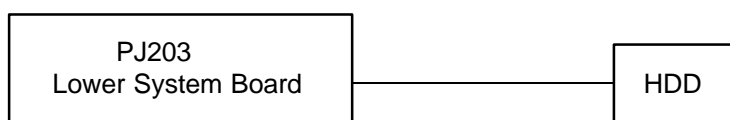
```
Insert system disk in drive
Press any key when ready .....
      or
Non-System disk or disk error
Replace and press any key
```

- 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 T1900/T1900C. If the error message still appears, perform Check 4.

```
System transferred
```

- Check 4 The HDD is connected to the lower system board through an HDD flexible cable. This cable can become disconnected or damaged. Disassemble the T1900/T1900C as described in Chapter 4, *Replacement Procedures*. If the HDD is not connected, reconnect it to the system board and return to Procedure 1. If the HDD is firmly connected to the system board, perform Procedure 3.



Procedure 3 Format Check

The T1900/T1900C'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 T1900/T1900C Diagnostic Disk, format the HDD with a low level format option. Refer to Chapter 3, *Test and Diagnostics* for more information about the diagnostic program.

If the following message appears on the display, the HDD low level format is complete.

Format complete

Partition and format the HDD using the MS-DOS FORMAT command.

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

Procedure 4 Diagnostic Test Program Execution Check

The HDD test program is stored in the T1900/T1900C Diagnostics Disk. Perform all of the HDD tests in the Hard Disk Drive Test. Refer to Chapter 3, *Tests and Diagnostics*, for more information about the HDD test program.

If an error is detected during the HDD test, an error code and status will be displayed; perform Check 1. The error codes and statuses are described in Table 2-5. If an error code is not generated, the HDD is operating properly.

Table 2-5 Hard Disk Drive Error Codes and Statuses

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

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

2.7 Keyboard Troubleshooting

To determine if the T1900/T1900C's keyboard is functioning properly, perform the following procedures. Start with Procedure 1 and continue with the other procedures as instructed.

Procedure 1: Diagnostic Test Program Execution Check

Procedure 2: Connector and Replacement Check

Procedure 1 Diagnostic Test Program Execution Check

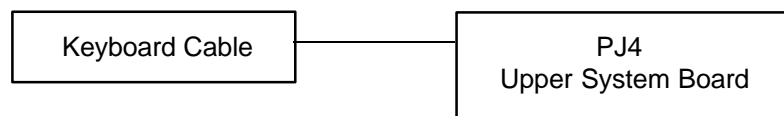
Execute the Keyboard Test in the Diagnostic Program. Refer to Chapter 3, *Tests and Diagnostics*, for more information on how to perform the test program.

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

Procedure 2 Connector and Replacement Check

The keyboard is connected to the upper system board by a 19-pin flat cable. This cable may be disconnected or damaged. Disassemble the T1900/T1900C 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 reconnect it, then 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 upper system board. Refer to Chapter 4, *Replacement Procedures* for more information about how to replace the upper system board.

2.8 Display Troubleshooting

This section describes how to determine if the T1900/T1900C's display is functioning properly. Start with Procedure 1 and continue with the other procedures as instructed.

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

Procedure 1 Contrast Control Check

Contrast is changed by the contrast dial. If the display is blank, go to Check 1. If you cannot change the brightness and contrast, go to Check 3.

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

Procedure 2 External CRT Check

Connect the external CRT to the T1900/T1900C's external monitor port, then boot the computer. The computer automatically detects the external CRT even if Resume mode is enabled.

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

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

Procedure 3 Diagnostic Test Program Execution Check

The Display Test program is stored on the T1900/T1900C Diagnostic Disk. This program checks the display controller on the upper system board (FATSU*). After loading Toshiba MS-DOS, run the Diagnostic Program. Refer to Chapter 3, *Tests and Diagnostics*, for details.

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

Procedure 4 Connector Check

The Display unit has an LCD module, Fluorescent Lamp (FL), display switch, and FL inverter board. The FL and FL inverter board are connected by two cables. The LCD module and upper 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 for more information about how to disassemble the computer.

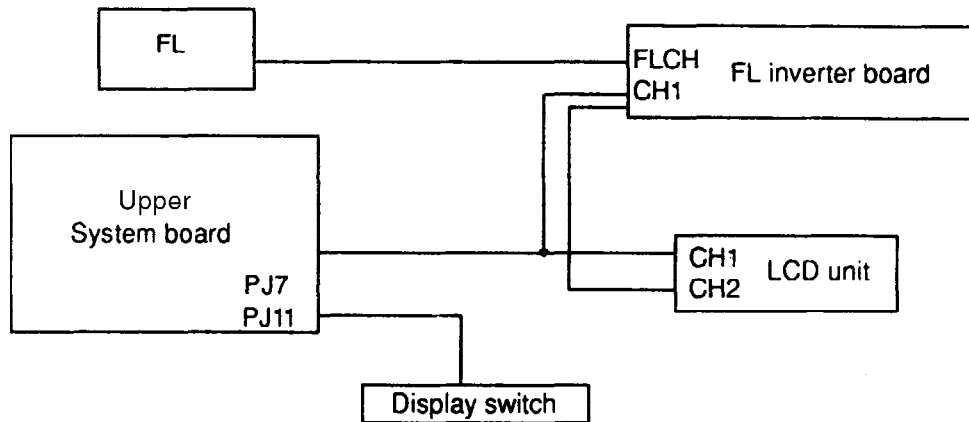


Figure 2-3 T1900 Display Connections

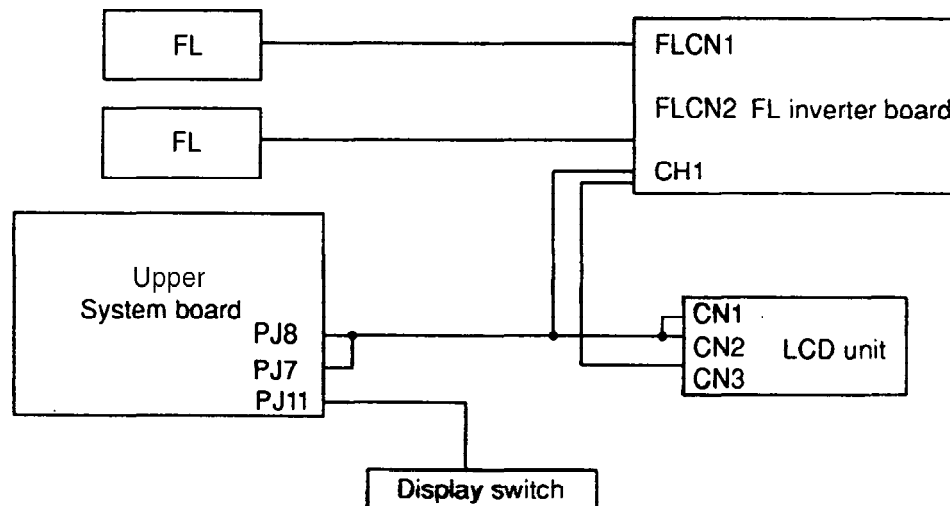


Figure 2-4 T1900C Display Connections

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

Procedure 5 Replacement Check

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

- If the FL does not light, perform Check 1.
- If characters are not displayed clearly, perform Check 3.
- If some screen functions do not operate properly, perform Check 3.
- If the FL remains lit when the display is closed, perform Check 4.

- Check 1 Replace the FL with a new one and test the display again. If the problem still exists, perform Check 2.
- Check 2 Replace the FL inverter board with a new one and test the display again. If the problem still exists, perform Check 3.
- Check 3 Replace the LCD module with a new one and test the display again. If the problem still exists, perform Check 4.
- Check 4 Replace the display switch with a new one and test the display again. If the problem still exists, perform Check 5.
- Check 5 Replace the display cable with a new one and test the display again. If the problem still exists, perform Check 6.
- Check 6 The upper system board may be damaged. Replace the system board with a new one and test the display again.

3.1 The Diagnostic Test

This chapter explains how to use the T1900/T1900C's Diagnostic Test program (TESTCE19) to test the functions of the T1900/T1900C's hardware modules. The Diagnostics Program is stored on the T1900/T1900C Diagnostic Disk and consists of 18 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
- LOG UTILITIES
- RUNNING TEST
- FDD UTILITIES
- SYSTEM CONFIGURATION
- SETUP

The DIAGNOSTIC TEST option contains the following ten functional tests:

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

The following equipment is needed to perform some of the T1900/T1900C Diagnostic test programs.

- The T1900/T1900C Diagnostics Disk (all tests)
- A formatted working disk for the Floppy Disk Drive test (all tests)
- 3.5-inch 2HD/2DD disk for internal 3.5-inch FDD
- 5.25-inch 2D disk for external 5.25-inch FDD

- A cleaning kit to clean the floppy disk drive heads (Head Cleaning)
- A PCMCIA wraparound connector for the I/O card test (PCMCIA test)
- A printer wraparound connector for the printer wraparound test (Printer test)
- An RS-232-C wraparound connector for the RS-232-C port wraparound test (ASYNC test)

The following sections detail the tests within the Diagnostic Test function of the DIAGNOSTIC TEST option 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 T1900/T1900C diagnostics program. To start the program, follow these steps:

1. Turn on the computer and allow it to **boot from the A: drive**.
2. Insert the T1900/T1900C Diagnostics disk in the computer's internal floppy disk drive.
3. At the system prompt (A:), type **TESTCE19**, and press **Enter**.

The following menu will appear:

```
TOSHIBA personal computer T1900 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 T1900/T1900C DIAGNOSTIC TEST menu, press the **Esc** key. If a test program is in progress, press **Ctrl + Break** to exit the test program, or press **Ctrl + C** to stop the program.

4. To select the DIAGNOSTIC TEST menu from the DIAGNOSTICS MENU, set the highlight bar to **1**, and press **Enter**. The following menu appears:

```
TOSHIBA personal computer T1900 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 - PCMCIA TEST
```

```
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.

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

```
SYSTEM TEST      XXXXXXXX
```

```
T1900 DIAGNOSTIC TEST VX.XX
[Ctrl]+[Break]; test end
[Ctrl]+[C]    ; key stop
```

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

```
SUB-TEST MENU :
```

```
01 - ROM checksum
02 - HW status
03 - Version check
99 - Exit to DIAGNOSTIC TEST MENU
```

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

NOTE: The menu displayed by your T1900/T1900C may be slightly different from the one shown above.

6. Select the desired subtest from the subtest menu and press **Enter**. The following messages appear:

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

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

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

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 error.

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. Table 3-3 in Section 3.14 describes the error codes and error status for each error.

3.3 Subtest Names

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

Table 3-1 Subtest Names (1/2)

No.	Test Name	Subtest No.	Subtest Item
1	SYSTEM	01	ROM checksum
		02	H/W status
		03	Version check
2	MEMORY	01	RAM constant data
		02	RAM address pattern data
		03	RAM refresh
		04	Protected mode
		05	Memory module
		06	Backup memory
		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 read/write
		02	Character attributes
		03	Character set
		04	80*25/30 Character display
		05	320*200 Graphics display
		06	640*200 Graphics display
		07	640*350/400/480 Graphics display
		08	Display page
		09	"H" pattern display/Border color
		10	LED/DAC pallet
		11	64 color display
5	FDD	01	Sequential read
		02	Sequential read/write
		03	Random address/data
		04	Write specified address
		05	Read specified address
6	PRINTER	01	Ripple pattern
		02	Function
		03	Wraparound

Table 3-1 Subtest Names (2/2)

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

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**.

Subtest01 ROMchecksum

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

Subtest02 H/W status

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

```

              76543210
H/W status = 10001000

Bit7 -      =
Bit6 - CPU clock = 20MHz
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 subtest menu.

Table 3-2 Hardware Bit Status

Bit	H/W Status	1	0
7	Reserved	—	—
6	CPU clock speed	20 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
0	Internal FDD	2DD	2HD

Subtest03 Version check

This subtest checks the version of the following items:

- BIOS ROM
- BOOTROM
- KBC Version
- PS Microprocessor Version

The subtest compares these items to the reference data 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, the display is unchanged.

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

Reference data Current data

3.5 Memory Test

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

Subtest01 RAM constant data (real mode)

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

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

Subtest02 RAM address pattern data (real mode)

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

Subtest03 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 results 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.*

Subtest04 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 results with the original data.

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

Subtest05 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 MBs.

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 T1900/T1900C.

Subtest06 Backup Memory

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

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

Subtest07 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 results with the original data.

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

This subtest also executes the paging test for page data.

Subtest08 Cache memory

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

Number of miss hit < Number of hit → OK

Number of miss hit ≥ Number of hit → Fail

3.6 Keyboard Test

To execute the Keyboard Test, select **3** from the DIAGNOSTIC TEST MENU, press **Enter** and follow the directions displayed on the screen. The Keyboard Test contains subtests that test the T1900/T1900C's keyboard actions and mouse connections. Move the highlight bar to the subtest you want to execute and press **Enter**.

Subtest01 Pressed key display (82/84)

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

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

KEYBOARD TEST IN PROGRESS 301000

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

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

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

Subtest02 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
```

Subtest03 PS/2 mouse connect check

***NOTE:** To execute the PS/2 mouse connect check, a PS/2 mouse must be connected to the computer.*

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

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

If it detects an error, the following message appears:

```
KBD - MOUSE INTERFACE ERROR
```

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

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

Subtest 04 DCBP Connect Check

***NOTE:** To execute the DCBP connect check, a ball-point mouse must be connected to the computer.*

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 eleven subtests that test the T1900/T1900C's display in various modes. Move the highlight bar to the subtest you want to execute and press **Enter**.

Subtest01 VRAM Read/Write

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

Subtest02 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.

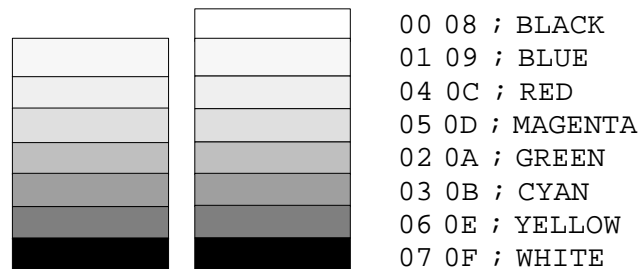
CHARACTER ATTRIBUTES

NEXT LINE SHOWS NORMAL DISPLAY .
NN

NEXT LINE SHOWS INTENSIFIED DISPLAY .
II

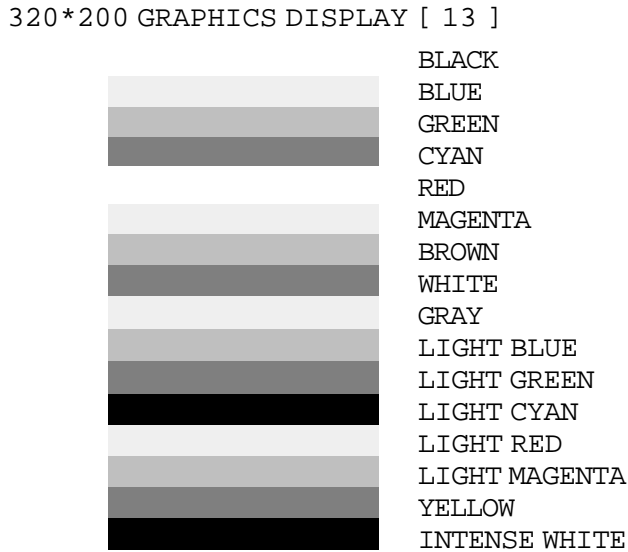
NEXT LINE SHOWS REVERSE DISPLAY .
RRR

NEXT LINE SHOWS BLINKING DISPLAY
BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB



PRESS [Enter] KEY

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



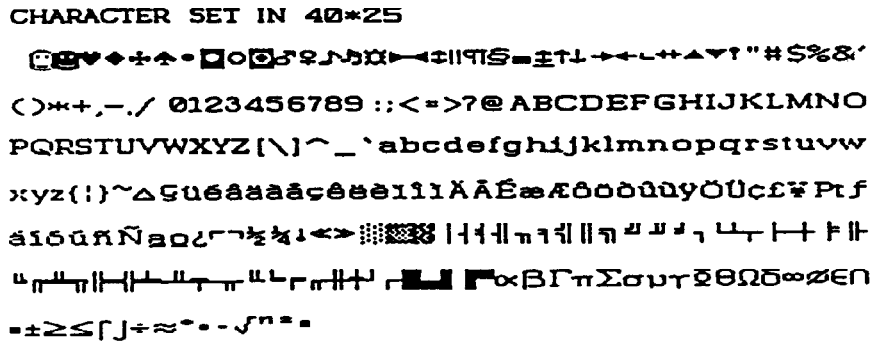
PRESS [ENTER] KEY

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

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

Subtest03 Character Set

In this subtest, the character set (addressed 00h to FFh) is displayed in the 40*25 character mode as shown below.



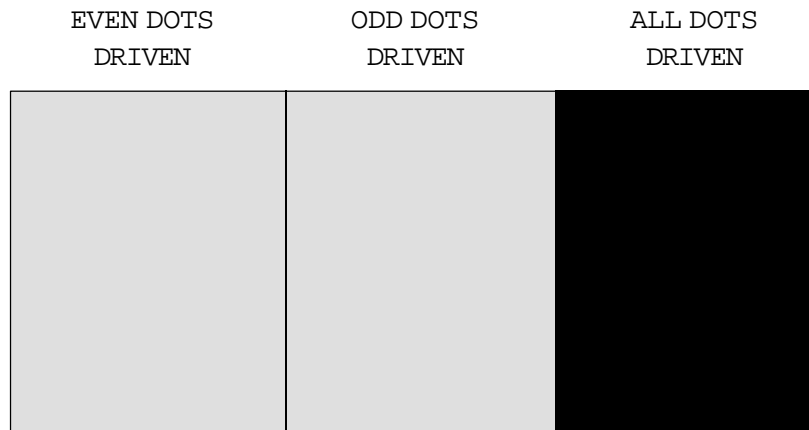
Press [Enter] KEY

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

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

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

640*200 GRAPHICS DISPLAY : [X]



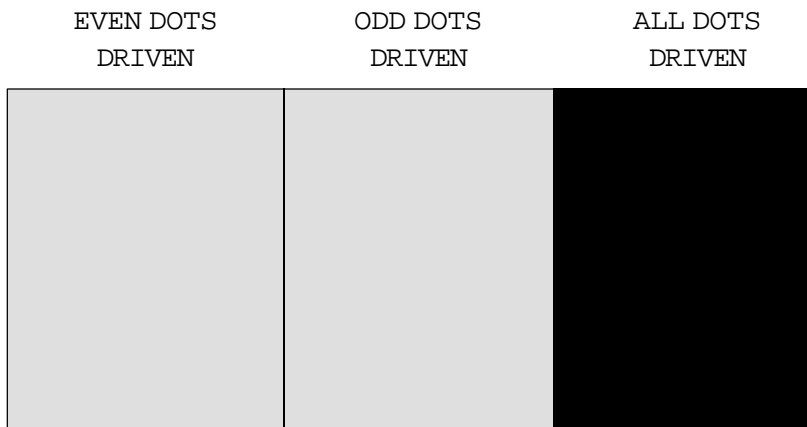
PRESS [Enter] KEY

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, 74, 12 as shown below:

640*XXX GRAPHICS DISPLAY



PRESS [Enter] KEY

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

Subtest 10 LED/DAC Pallet

This subtest checks the Caps Lock, Num Lock, and Overlay LEDs by key operation.

[Caps/Num/Overlay LED test]

(1) Press [Caps Lock] key !...Caps (on/off)
(2) Press [Fn + NumLock] key !...Num (on/off)
(3) Press [Fn] key !...Overlay (on/off)

PRESS [Enter] KEY

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

[DAC pallet W-R-CMP test] = (about 5 seconds)

[Processor latch test] =

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

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

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

Subtest 11 64 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 64 shades of red, green and blue.

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

3.8 Floppy Disk Test

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

To execute the Floppy Disk Test, select **5** from the DIAGNOSTIC TEST menu, press **Enter** and follow the directions displayed on the screen. The Floppy Disk test contains five subtests that test the T1900/T1900C's internal floppy disk drive.

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

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

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

```
T1900 DIAGNOSTIC TEST VX.XX
[Ctrl]+[Break] ; test end
[Ctrl]+[C] ; key stop
```

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

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

The first digit in the STATUS number indicates the drive being tested, and the last two digits indicate the error status code as explained in Table 3-3 in Section 3-14.

Subtest01 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.

Subtest02 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.

Subtest03 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.

Subtest04 Write Specified Address

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

Subtest05 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 T1900/T1900C.

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

The following message appears when the printer test is selected:

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

The printer I/O port address is specified by the XXXXh number. The T1900/T1900C supports three printer channels. Select the printer channel number, and press **Enter** to execute the selected subtest.

Subtest01 Ripple Pattern

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

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

Subtest02 Function

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

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

The subtest prints the various print types shown below:

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

Subtest03 Wraparound

***NOTE:** To execute this subtest, a printer wraparound connector must be connected to the computer's printer port. The printer wraparound connector (34M741986G01) wiring diagram is described in Appendix 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 T1900/T1900C'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 appears at the bottom of the screen when Subtests 01, 03, 04, and 05 are selected:

```
Channel#1 = XXXXh
Channel#2 = XXXXh
Channel#3 = XXXXh
Select the Channel number (1 - 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.

Subtest01 Wraparound (board)

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

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

Subtest02 Board (#1) <=> board (#2)

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

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

Subtest 03 Point to point (Send)

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

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

Subtest 04 Point to point (Receive)

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

Subtest 05 Card Modem Loopback (2400BPS)

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

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

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

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

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

Subtest 06 Interrupt Test

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

3.11 Hard Disk Test

To execute the Hard Disk Test, select **8** from the DIAGNOSTIC TEST menu, press **Enter** and follow the directions displayed on the screen. The Hard Disk Test contains 10 subtests that test the T1900/T1900C hard disk drive functions.

CAUTION: *The contents of the hard disk will be erased when Subtest 02, 03, 04, 05, 06, 08, 09, or 10 is executed. Before running the test, transfer the contents of the hard disk to a floppy disk(s). This can be done with the Toshiba MS-DOS BACKUP command.*

After the hard disk test is completed, execute the Toshiba MS-DOS FDISK command, which will set the partition. Then execute the Toshiba MS-DOS FORMAT command.

Refer to the Toshiba MS-DOS manual for details.

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

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 appears after you respond to the Detail Status prompt. Select the number of the subtest you want to execute and press **Enter**. The following message displays during each subtest.

```
HARD DISK TEST    XXXXXXXX

SUB-TEST : XX
PASS COUNT: XXXXX ERROR COUNT: XXXXX
WRITE DATA: XX  READ DATA : XX
ADDRESS : XXXXXXX 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.

Subtest01 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.

Subtest02 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

Subtest03 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.

Subtest04 Cross Talk & Peak Shift

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

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

Subtest05 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.

Subtest06 Write specified address

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

Subtest07 Read specified address

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

Subtest08 ECC circuit

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

Subtest09 Sequential write

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

Subtest10 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 T1900/T1900C's real timer functions. Move the highlight bar to the subtest you want to execute and press **Enter**.

Subtest01 Real Time

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

1. Select Subtest 01; the following message appears:

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

```
Enter new date:
```

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

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

Subtest02 Backup Memory

This subtest performs the following backup memory check:

- Writes 1 bit of "on" data to addresses 01h through 80h
- Writes 1 bit of "off" data to addresses FEh through 7Fh
- Writes the data pattern AAh through 55h to the RTC 50-byte memory (address 0Eh to 3Fh)

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

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

Subtest03 Real Time Carry

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

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

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

After two seconds, the following displays:

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

PRESS [Enter] KEY TO EXIT TEST

Press **Ctrl + Break** to exit.

3.13 PCMCIA Test

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

Subtest01 I/O Card Test (PCMCIA)

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

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

This subtest is executed in the following order:

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

3.14 Error Codes 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 (1/2)

Device Name	Error Code	Error Status Name
(COMMON)	FF	Data Compare Error
SYSTEM	01	ROM Checksum Error
MEMORY	01	Parity Error
	02	Protected Mode Not Changed
	14	Memory Read/Write Error
	1B	H-RAM Mapping Error
	1C	H-RAM Read/Write Error
	DD	Cache Memory Error
KEYBOARD	03	Mouse Interface Error
	04	DCBP Interface Error
FDD	01	Bad Command
	02	Address Mark Not Found
	03	Write Protected
	04	Record Not Found
	06	Media Removed
	08	DMA Overrun Error
	09	DMA Boundary Error
	10	CRC Error
	20	FDC Error
	40	Seek Error
	60	FDD Not Drive Error
	80	Time-out Error
EE	Write Buffer Error	
PRINTER	01	Time-out
	08	Fault
	10	Select Line
	20	Out Of Paper
	40	Power Off
	80	Busy Line

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

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
	08	HDC Overrun (DRQ)
	09	DMA Boundary Error
	0A	Bad Sector
	0B	Bad Track Error
	10	ECC Error
	11	ECC Recover Enable
	20	HDC Error
	40	Seek Error
	80	Time-out Error
	AA	Drive Not Ready
	BB	Undefined Error
	CC	Write Fault
	E0	Status Error
EE	Access Time-out Error	
PCMCIA	C1	Address Line Error
	C2	REG# Line Error
	C3	CE#1 Line Error
	C4	CE#2 Line Error
	C5	DATA Line Error
	C6	WAIT Line Error
	C7	BSY# Line Error
	C8	BVD1 Line Error
	CD	No PCMCIA

3.15 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 two bytes; the first byte displays the contents of the HDC status register in hexadecimal form, and the second byte displays the HDC error register.

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 complete)	"0" --- The hard disk drive heads are not settled over a track. "1" --- The hard disk drive heads are settled over a track.
3	DRQ (Data request)	"0" --- Drive is not ready for data transfer. "1" --- Drive is ready for data transfer.
2	CORR (Corrected data)	"0" --- Other "1" --- Correctable data error is corrected.
1	IDX (Index)	"0" --- Other "1" --- Index is sensed.
0	ERR (Error)	"0" --- Other "1" --- The previous command was terminated with an error.

Table 3-5 Error Register Contents

Bit	Name	Description
7	BBK1 (Bad block mark)	"0" --- Other "1" --- A bad block mark is detected.
6	UNC (Uncorrectable)	"0" --- There is no uncorrectable data error. "1" --- Uncorrectable data error has been detected.
5	—	Not used
4	IDNF (Identification)	"0" --- Other "1" --- There was no ID field in the requested sector.
3	—	Not used
2	ABRT (Abort)	"0" --- Other "1" --- Illegal command error or a drive status error occurred.
1	TK00 (Track 0)	"0" --- The hard disk found Track 0 during a recalibrate command. "1" --- The hard disk could not 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 floppy disk(s). This can be done with the Toshiba MS-DOS BACKUP command. See the Toshiba MS-DOS manual for details.*

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

Item	80 MB	120 MB		200 MB
	(MK1422FCV)	(CP2124)	(MK2124FC)	(MK2224FC)
Sector Sequences	1	1	1	1
Cylinders	0~987	0~761	0~933	0~683
Heads	0~9	0~7	0~15	0~15
Sectors	1~17	1~39	1~17	1~38
Sector Length (bps)	512	512	512	512

2. Good track FORMAT

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

3. Bad track FORMAT

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

4. Bad track CHECK

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

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

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

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

1. All track FORMAT

Pressing **1** selects "All track FORMAT," which formats the entire disk.

```
[All track FORMAT]
```

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

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

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

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

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

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

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

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

- (3) 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.*

- (4) Bad track register

Next, the Bad Track register prompt will appear as shown below. Enter the cylinder and head numbers of bad tracks and press **Enter**. Note that if there are no bad tracks, pressing **Enter** alone is the same as executing All Track Format described in Item (5) 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.

(5) All track format

All tracks are formatted as good tracks except those registered as bad tracks in Item (4) above or those identified as bad tracks in track verification described in Item (6) below.

(6) 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 sub test 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 prompt shown below.

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

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

3. Bad track FORMAT

To format a track as a bad track, enter the number for 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.

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

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

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

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

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

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

2. Error information displayed on the screen can be manipulated using the following number keys:

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

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

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

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

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

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

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

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

3.19 Running Test

3.19.1 Function Description

This function automatically executes the following tests in sequence:

1. System Test (Subtest 01)
2. Memory Test (Subtests 01, 02, 04, 06, and 07)
3. Display Test (Subtests 01 to 08)
4. FDD Test (Subtest 02)
5. HDD Test (Subtests 01 and 05)
6. Real timer Test (Subtest 02)
7. Printer Test (Subtest 03)
8. Async Test (Subtest 01)

The system automatically detects the number of floppy disk drives connected to the T1900/T1900C 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** (Running Test) 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. Note that a printer wraparound connector must be connected to the **PRT/FDD** port on the back of the T1900/T1900C to properly execute this test.

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

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

Selecting **Y (yes)** executes the ASYNC wraparound test. An RS-232-C wraparound connector must be connected to the **serial port** on the back of the T1900/T1900C to properly execute this test.

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

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

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

3.20 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.

1. FORMAT

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

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

- (1) 2D: Double-sided, double-density, 48/67.5 TPI, MFM mode, 512 bytes, 9 sectors/track.
- (2) 2DD: Double-sided, double-density, double-track, 96/135 TPI, MFM mode, 512 bytes, 9 sectors/track.
- (3) 2HD: Double-sided, high-density, double-track, 96/135 TPI, MFM mode, 512 bytes, 18 sectors/track.

2. COPY

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

3. DUMP

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

3.20.2 Operations

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

[FDD UTILITIES]

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

2. 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-2DD, 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 the work disk, and press any key.

The following message will be displayed when the FDD format is executed:

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

```
Format start
```

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

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

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

- (5) Typing **1** displays the message from Step (3) above; typing **2** returns the display screen to the DIAGNOSTIC MENU.

3. 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 appears, 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, type **1** and the message from Step 1 will be displayed again. Entering **2** returns the test program to the DIAGNOSTIC MENU.

4. 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 Step (5).

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

- (3) Select a drive number and the following message will be displayed:

```
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. The following message appears:

```
— 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.

3.21 System Configuration

3.21.1 Function Description

The System Configuration program contains the following configuration information for the T1900/T1900C:

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

3.21.2 Operations

Select **8** (System Configuration) from the DIAGNOSTIC MENU and press **Enter**. The following system configuration displays:

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
* - XXXXXKB EXTENDED MEMORY
* - PS MICOM VERSION = VX.XX
```

Press [Enter] Key

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

3.22 SETUP

3.22.1 Function Description

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

1. Memory
 - (1) Total
 - (2) Base
 - (3) Extended Memory
 - (4) Hard RAM
 - (5) Shadow BIOS ROM

2. Display
 - (1) Display Adapter
 - (2) LCD Display Mode
 - (3) LCD Gray Scale Level

3. COM/PCMCIA/FDD/PRT
 - (1) Serial Port
 - (2) PC Card Slot
 - (3) External FDD/PRT
 - (4) Printer Port Type

4. Hard Disk

5. Power on Password

6. Others
 - (1) Power-up Mode
 - (2) CPU Cache
 - (3) Processing Speed
 - (4) Battery Save Mode
 - (5) Popup
 - (6) Speaker
 - (7) Battery Alarm

7. Battery Save Options
 - (1) CPU Sleep Mode
 - (2) HDD Auto Off
 - (3) Display Auto Off

3.22.2 Accessing the SETUP Program

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

T1900 SETUP		BIOS version = x.xx
MEMORY		
Total	=	4096 KB
Base	=	640 KB
Extended	=	3328 KB
Hard RAM	=	0 KB
Shadow BIOS ROM	=	128 KB
HARD DISK		
Capacity = **MB		
POWER ON PASSWORD		
Not Registered		
DISPLAY		
Display Adaptor	=	VGA Compatible
LCD Display Mode	=	Color
LCD Gray Scale Level	=	Normal 64 Levels
COM/PCMCIA/FDD/PRT		
Serial Port	=	COM1 (IRQ4/3F8H)
PC Card Slot	=	PCMCIA
External FDD/PRT	=	Printer
Printer Port Type	=	Output
OTHERS		
Power-up Mode	=	Boot
CPU Cache	=	Enabled
Processing Speed	=	High
Battery Save Mode	=	Automatic (Normal Life)
Popup	=	Enabled
Speaker	=	Enabled
Battery Alarm	=	Enabled

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

NOTE: The LCD gray scale level does not appear on the T1900C screen.

3.22.3 Moving Within the SETUP Menu and Changing Values

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

3.22.4 Accepting Changes and Exiting the SETUP Window

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

Are you sure? (Y/N)

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

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

3.22.5 The Factory Preset Configuration

When you access SETUP, the current configuration is displayed.

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

3.22.6 SETUP Options

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

1. Memory

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

- (1) Total

This field displays the total amount of memory installed and is automatically calculated by the computer. This value cannot be changed.

- (2) Base

This field displays the amount of base (conventional) memory—640 KB—and is automatically calculated by the computer. This value cannot be changed.

- (3) Extended Memory

This field displays the amount of extended memory the computer has available. This value is calculated automatically when modifications are made to the Hard Ram value.

- (4) Hard RAM

This field displays the amount of extended memory assigned to Hard RAM. You can set the size of Hard RAM from 128 KB to 19,712 KB in 64 KB increments. The default is 0 KB.

- (5) Shadow BIOS ROM

The SETUP program displays 128 KB of RAM, which is reserved for the Shadow BIOS ROM. **This value cannot be changed.**

2. Display

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

(1) Display Adapter

This field displays the internal adapter for the VGA internal display: VGA compatible. This value cannot be changed.

(2) LCD Display Mode

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

Color Selects 80 x 25 text or 640 x 480 graphics modes. This option also affects a color monitor attached to the external display port. (Default)

Monochrome Selects monochrome mode. This is also used when you attach a VGA monochrome monitor to the external display port. Note that some software is displayed best in monochrome mode.

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

(3) LCD Gray Scale Level (T1900 only)

This option, which appears in SETUP and in the Pop-up Window, lets you switch between normal and reverse video on the T1900. It does not appear on the T1900C. 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. COM/PCMCIA/FDD/PRT

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

(1) Serial Port

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

COM Level	Interrupt Level	I/O Address
COM1	4	3F8h (Serial port default)
COM2	3	2F8h (PCMCIA default)
Not used	-	- (Disables port)

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

(2) PC Card Slot

This option enables you to select how the PC Card slot is used.

PCMCIA Identifies an installed PCMCIA card. (Default)

Others Identifies an installed Toshiba card modem (model: PC-22-T24M, or PC-T24SL).

When you choose *Others*, the sub-window below appears allowing you to control the modem's COM Port and power.

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

Use the *COM Port* option to select the interrupt (IRQ)/COM level for the Toshiba card modem: COM 1 or COM2 (Default).

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

When the *COM Port* option is set to *Others*, the *Power* option is displayed in the sub-window. The *Power* option indicates the setting in CMOS.

(3) External FDD/PRT

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

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

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

(4) Printer Port Type

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

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

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

4. Hard Disk

This option enables or disables the hard disk drive.

<i>80, 120, or 200 MB</i>	Provides access to the hard disk. The disk's capacity is automatically displayed and cannot be changed.
<i>No Drive</i>	Prevents access to the hard disk.

5. Power-on Password

This option allows you to set or reset the power-on password. If the power-on password has not been set, the SETUP program displays the following message:

Not registered

If the password has been set, the following displays:

Registered

(1) How to set the Password

To set the power-on password, follow the steps listed below.

NOTE: When typing the password option, you can use either capital letters or small letters.

- (a) When *Not registered* displays, press the space bar or **BkSp** key. The following prompt appears:

Password =

- (b) Enter a password of up to 10 characters. The character string you enter is displayed as a string of asterisks. For example, if you enter a password consisting of four characters, the display is shown as:

Password = ****

NOTE: If you press **Enter** before entering the password, "Not Registered" reappears on the display.

- (c) Press **Enter**. The following message appears allowing you to verify the password.

Verify Password =

- (d) Re-enter the character string you just typed and press **Enter**. If the two character strings match, the password is registered and the display changes to:

Registered

If the two character strings do not match, the password is not registered and the display changes to:

Entry Error !!

Repeat Steps (a) through (d) to set the password.

Before exiting Setup, follow the instructions in the *Making A Password Service Disk* section to make a password service disk. If the customer forgets his/her password, he/she can use the Password Service Disk to unlock password protection.

(2) How to Reset/Disable the Password

To reset or disable the password, follow these steps:

- (a) Press the space bar or **BkSp** key at the *Registered* prompt to display the following:

Password =

- (b) Enter the currently registered password and press **Enter**. The character string you enter is displayed as a string of asterisks.

Password = ****

- (c) If the character string you enter matches the registered password, the password option is reset and the display change to:

Not Registered

If they do not match, the following message appears along with a beep indicating you must repeat Step (b).

Entry Error !!

(3) Making a Password Service Disk

You must generate a new Password Service Disk each time you set a new password, even if you register a password that you have previously saved to a Password Service Disk. To make the Password Service Disk, prepare a formatted 3.5-inch 2DD floppy disk and follow the steps below. Note that any data on the disk **will be erased**.

- (a) Set the password as described in the previous section.
- (b) Insert a 3.5-inch 2DD floppy disk into Drive A.

(c) Press **End**. The system displays the following messages:

Save settings , perform self test and reboot? (Y/N)
Insert Password Service Disk if necessary .

(d) Press **Y**. The computer writes the password data to the diskette and displays:

Remove the Password Service Disk , then press any key .

(e) Remove the diskette and press any key. The computer reboots.

6. Others

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

(1) Power-up Mode

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

Boot Turns on boot mode. (Default)

Resume Turns on the AutoResume feature.

NOTE: *AutoResume does not work with the enhanced mode of Microsoft Windows unless the WRESUME driver is loaded. (See Chapter 7 in the Microsoft Windows Reference Manual, Power and Power-up Modes.)*

(2) CPU Cache

This feature enables or disables the CPU cache.

Enabled Enables the CPU cache. (Default)

Disabled Disables the CPU cache.

(3) Processing Speed

This feature changes the CPU processing speed. It is also available in the Pop-up Window.

High Fast processing speed (Default)

Low Slow processing speed

The *Low* setting puts the CPU clock speed at half the regular speed.

(4) Battery Save Mode

This option selects *Automatic Long Life*, *Automatic Normal Life*, or *User Setting* of the *BATTERY SAVE OPTION*. You can also set this option using the Pop-up Window.

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

BATTERYSAVE OPTIONS

CPU Sleep Mode = Enabled

HDD Auto Off = 03 Min.

Display Auto Off = 03 Min.

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

BATTERYSAVE OPTIONS

CPU Sleep Mode = Disabled

HDD Auto Off = Disabled

Display Auto Off = Disabled

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

(5) Popup

This option enables or disables the Pop-up Window.

Enabled Allows access to the Pop-up Window. (Default)

Disabled Denys access to the Pop-up Window.

(6) Speaker

This option enables and disables 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 Pop-up Window.

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

Disabled Disables software use of the system speaker.

(7) Battery Alarm

This option enables and disables the low battery alarm. The option also appears in the Pop-up Window.

Enabled Enables the alarm. (Default)

Disabled Disables the alarm.

7. Battery Save Options

(1) CPU Sleep Mode

This option enables or disables the CPU sleep function.

Enabled Enables sleep mode.

Disabled Disables sleep mode.

(2) HDD Auto Off

Use this option to disable or set the duration of the HDD automatic power-off function.

Disabled Disables HDD automatic power off.

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

(3) Display Auto Off

Use this option to disable or set the duration of the display automatic power-off function. This function causes the computer to turn the side-light off if you make no entry for the set period of time.

Disabled Disables display automatic power off.

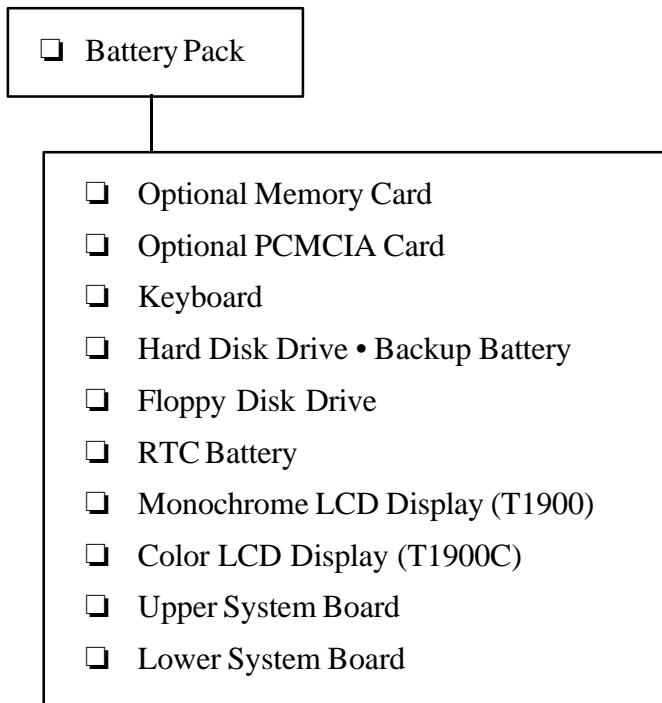
xx Min. Automatically turns off power to the sidelit LCD panel if it is not used for the duration set. The duration **xx** can be set to 1, 3, 5, 10, 15, 20 or 30 minutes.

Always OFF Turns off the power to the display's fluorescent lamp. If the AC adapter is connected, this option is not displayed. This option appears only on monochrome LCDs.

CAUTION: Do not use *Always OFF* with the Pop-up Window disabled.

4.1 General

This section explains how to disassemble the T1900/T1900C 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 must 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 must be removed in order to repair the one you think is causing the T1900/T1900C to operate improperly.



Before You Begin

Look over the procedures in this section before you begin disassembling the T1900/T1900C. Familiarize yourself with the disassembly and reassembly steps, then begin each procedure by removing the AC adapter and the battery pack as instructed in Section 4.2, **The Battery Pack**.

1. Do not disassemble the T1900/T1900C 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 T1900/T1900C:
 - 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 T1900/T1900C.
6. After removing parts from the computer, place them in a safe place away from the computer so they will not be damaged and will not interfere with your work.
7. You will remove many screws when you disassemble the T1900/T1900C. When you remove screws, make sure they are placed in a safe place and identified with the correct parts.
8. When reassembling the T1900/T1900C, make sure you use the correct screws to secure the various pieces in place. Screw sizes are listed in the corresponding figures in the manual.
9. The T1900/T1900C contains many sharp edges and corners, so be careful not to injure yourself.
10. After you have replaced an FRU, make sure the T1900/T1900C is functioning properly by performing the appropriate test on the FRU you have fixed or replaced.

NOTE: The illustrations in Chapter 4 are based on the appearance of the T1900C, unless otherwise noted.

Disassembly Procedures

The T1900/T1900C has two basic types of cable connectors:

- Pressure Plate Connectors
- Normal Pin Connectors

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

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

Assembly Procedures

After you have disassembled the T1900/T1900C and fixed or repaired the problem that was causing the computer to operate abnormally, you will need to reassemble it.

While assembling the computer, remember the following general points:

- Take your time and make sure you follow the instructions closely. Most problems arise when you get in a hurry.
- Make sure all cables and connectors are securely fastened.
- Before securing 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.
- Make sure the correct screws are used to secure all FRUs. Using the wrong screw can damage the threads or the head of the screw, and may prevent proper seating of an FRU.

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

Tools and Equipment

The use of ElectroStatic Discharge (ESD) equipment is very important for your safety and the safety of those around you. Proper use of these devices will increase the success rate of your repairs and lower the cost for damaged or destroyed parts. The following equipment is necessary to disassemble and reassemble the T1900/T1900C:

- One M2 Phillips-head screwdriver.
- A jeweler's screwdriver to remove screw masks.
- 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 LCD support block composed of anti-static foam.
- An ESD wrist strap or heel grounder.
- Anti-static carpeting or flooring.
- Air ionizers in highly static-sensitive areas.

4.2 The Battery Pack

Removing the Battery Pack

To remove the T1900/T1900C battery pack, follow the steps below and refer to Figure 4-1.

1. Turn off the power to the T1900/T1900C, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Slide open the **cover** to the **battery latch** (located on the left, front of the computer) and press the **release button** until it clicks. The battery will pop out slightly (Figure 4-1).
3. Firmly grasp the **battery pack** and pull it out.

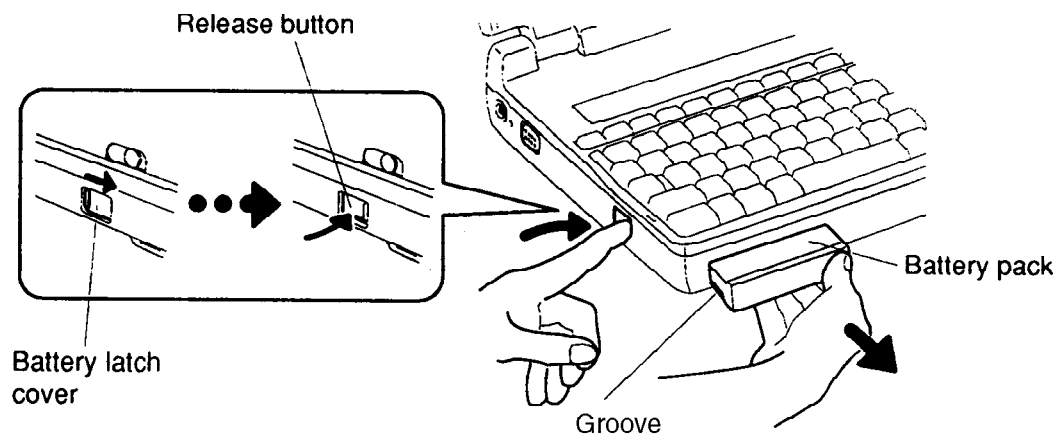


Figure 4-1 Removing the Battery Pack

Installing the Battery Pack

NOTE: The battery pack is designed to fit into the T1900/T1900C in only one way.

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

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

4.3 Optional Memory Card

Removing an Optional Memory Card

To remove an optional memory card from the T1900/T1900C, follow the steps below and refer to Figure 4-2.

1. Turn off the power to the T1900/T1900C, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack as described in Section 4.2.
3. Open the **cover** to the expansion memory slot.
4. Grasp the plastic tab and pull it so the card comes partially out of the computer.
5. Grasp the **optional memory card** and pull it completely out.

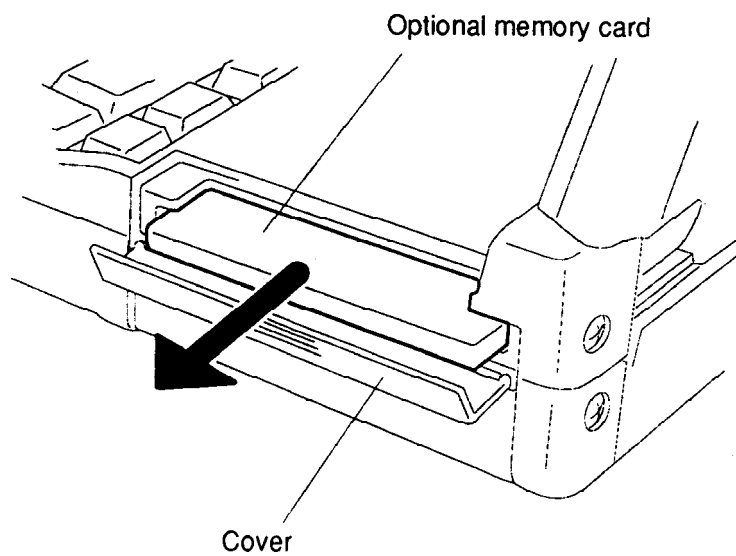


Figure 4-2 Removing the Optional Memory Card

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

Installing an Optional Memory Card

To install an optional memory card in the T1900/T1900C, follow the steps below and refer to Figure 4-2.

1. The top of an **optional memory card** is marked with the word “insert” and an arrow pointing toward the connecting edge. Turn the memory card so that it is facing up and carefully insert the connecting edge (arrow first) into the slot. Push gently to ensure a firm connection.
2. Close the expansion memory **cover**.
3. Install the battery pack as described in Section 4.2.
4. The T1900/T1900C automatically configures all additional memory as extended memory.

4.4 Optional PCMCIA Card

Removing an Optional PCMCIA Card

To remove an optional PCMCIA card from the T1900/T1900C, follow the steps below and refer to Figure 4-3.

1. Turn off the power to the T1900/T1900C, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack as described in Section 4.2.
3. Open the **PCMCIA card slot cover** (located below the memory card slot), then slide the **PCMCIA card sliding stopper** to the left.
4. Use a coin or similar object to slide the PCMCIA card **release button** on the bottom of the computer to pop the card slightly out.
5. Grasp the card and pull it out.

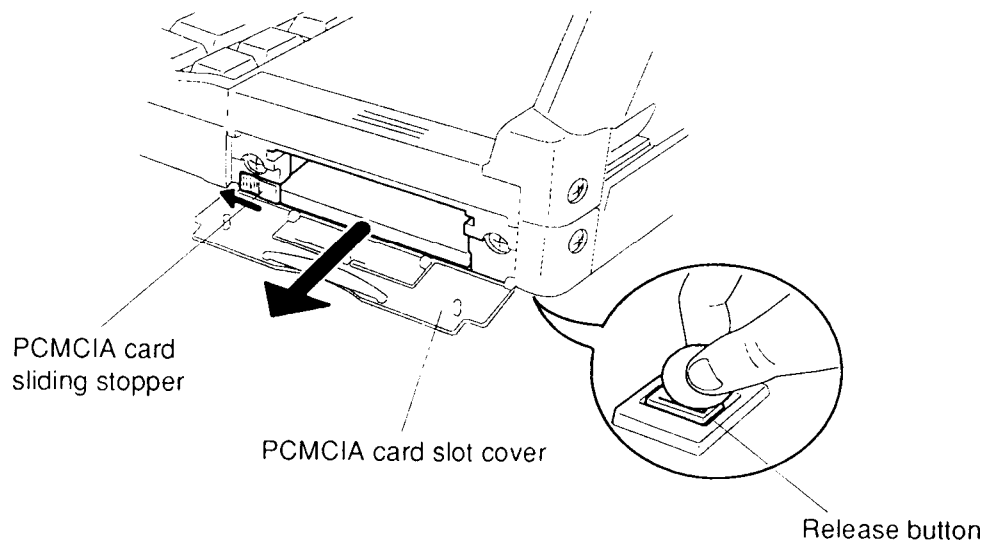


Figure 4-3 Removing the PCMCIA Card

Installing an Optional PCMCIA Card

To install an optional PCMCIA card in the T1900/T1900C, follow the steps below and refer to Figure 4-4.

1. To install a **PCMCIA card**, carefully insert the card, making sure the card is right side up and the contact surface is inserted first.
2. When the card is almost fully seated, you will feel some resistance. Press gently to assure a firm connection, but do not force the card into position.
3. Push the **PCMCIA card sliding stopper** into place, then close the **PCMCIA slot cover**.

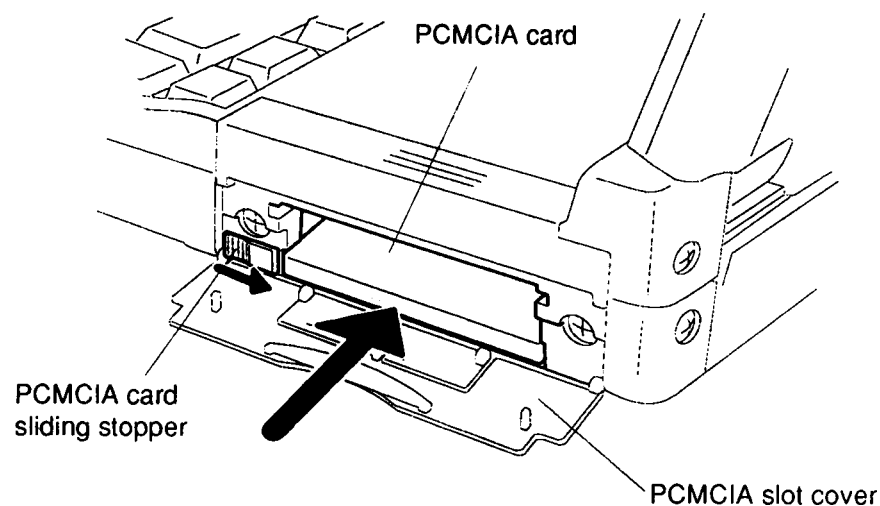


Figure 4-4 Installing the Optional PCMCIA Card

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

4.5 Top Cover

Removing the Top Cover

To remove the T1900/T1900C's top cover, follow the steps below and refer to Figures 4-5 and 4-6.

1. Turn off the power to the T1900/T1900C, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card and optional PCMCIA card as described in Sections 4.2, 4.3, and 4.4.
3. At the back of the computer, remove the **four M2.5x6 silver screws** securing the **top cover** (Figure 4-5).

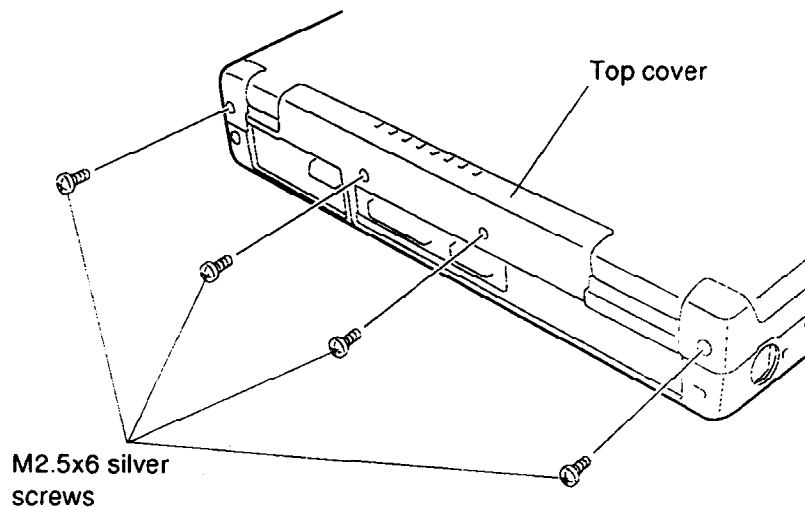


Figure 4-5 Removing Top Cover Screws

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

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

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

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

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

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

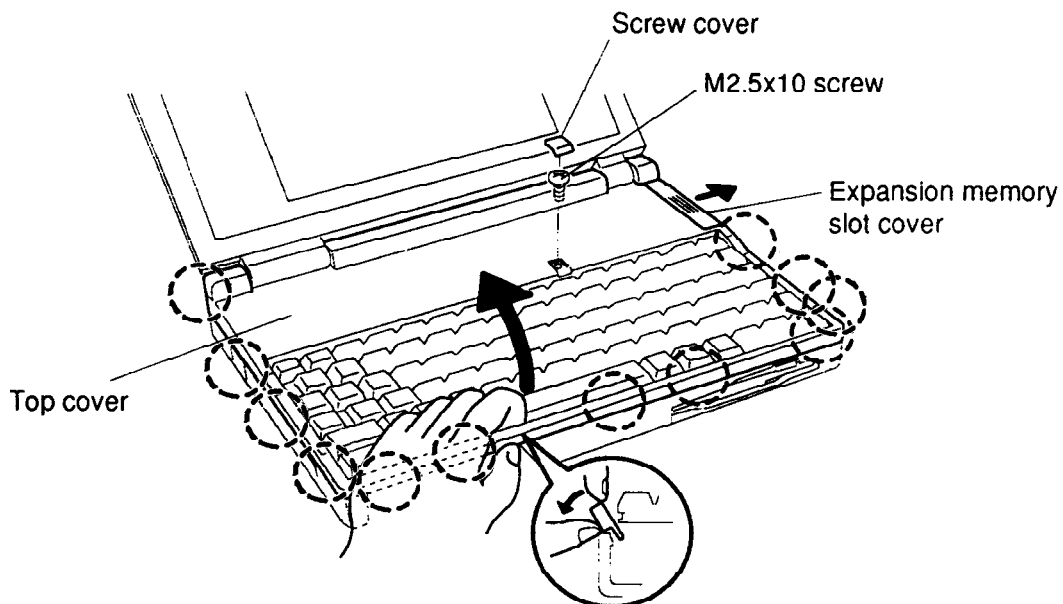


Figure 4-6 Unlatching the Top Cover

Installing the Top Cover

To install the T1900/T1900C's top cover follow the steps below and refer to Figures 4-5 and 4-6.

1. Place the **top cover** on the T1900/T1900C.
2. Begin at the back and snap the **top cover** into place. Continue along the sides and snap the front latches last (Figure 4-6).
3. Secure the **M2.5x10 screw** above the keyboard and replace the **screw cover** (Figure 4-6).
4. Close the display and set the RGB and PRT port protective covers in place.
5. Secure the **four M2.5x6 silver screws** at the back of the unit (Figure 4-5).
6. Install the optional PCMCIA card, optional memory card and battery pack as described in Sections 4.4, 4.3, and 4.2.

4.6 Keyboard

Removing the Keyboard

To remove the T1900/T1900C's keyboard, follow the steps below and refer to Figure 4-7.

1. Turn off the power to the T1900/T1900C, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card and top cover as described in Sections 4.2 through 4.5.
3. Carefully lift up the **keyboard** to expose the keyboard connector.
4. Disconnect the **keyboard cable** from **pressure-plate connector PJ4** on the upper system board and set the keyboard aside.

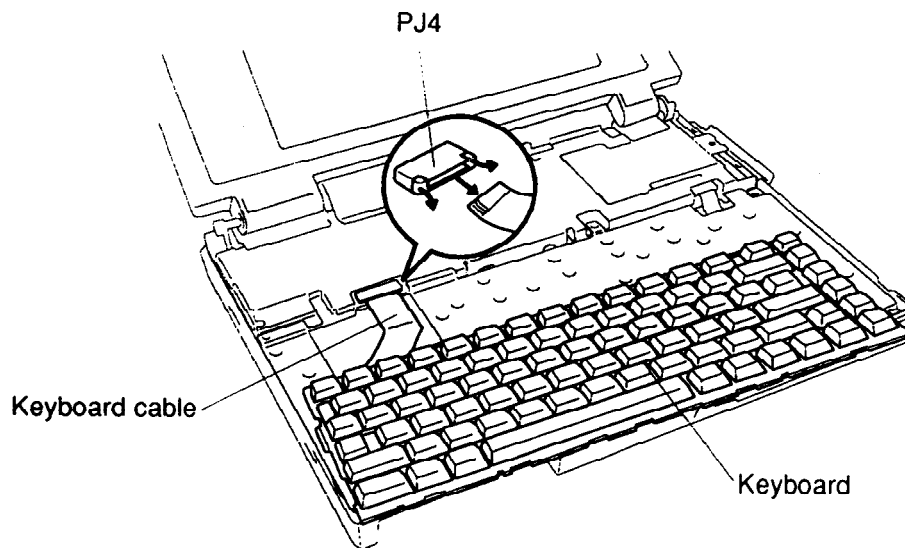


Figure 4-7 Removing the Keyboard

Installing the Keyboard

To install the T1900/T1900C's keyboard, follow the steps below and refer to Figures 4-7 and 4-8.

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

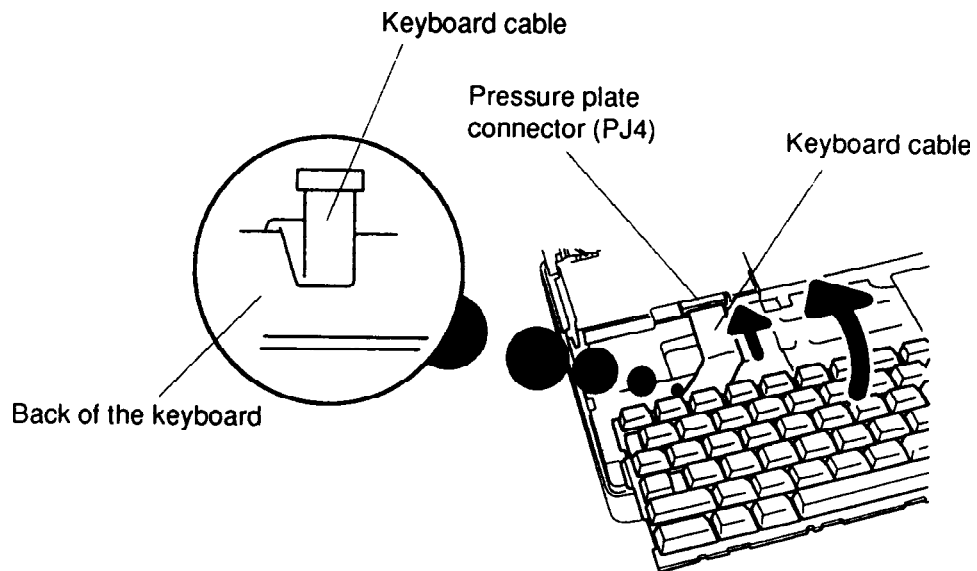


Figure 4-8 Seating the Keyboard

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

4.7 Hard Disk Drive • Backup Battery

Removing the Hard Disk Drive • Backup Battery

To remove the T1900/T1900C's hard disk drive and backup battery, follow the steps below and refer to Figures 4-9 through 4-12.

1. Turn off the power to the T1900/T1900C, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, and keyboard as described in Sections 4.2 through 4.6.
3. Remove the tape next to the keyboard connector (PJ4).
4. Remove the **five M2.5x6 screws** securing the **keyboard base plate** to the bottom cover and lift off the plate (Figure 4-9).

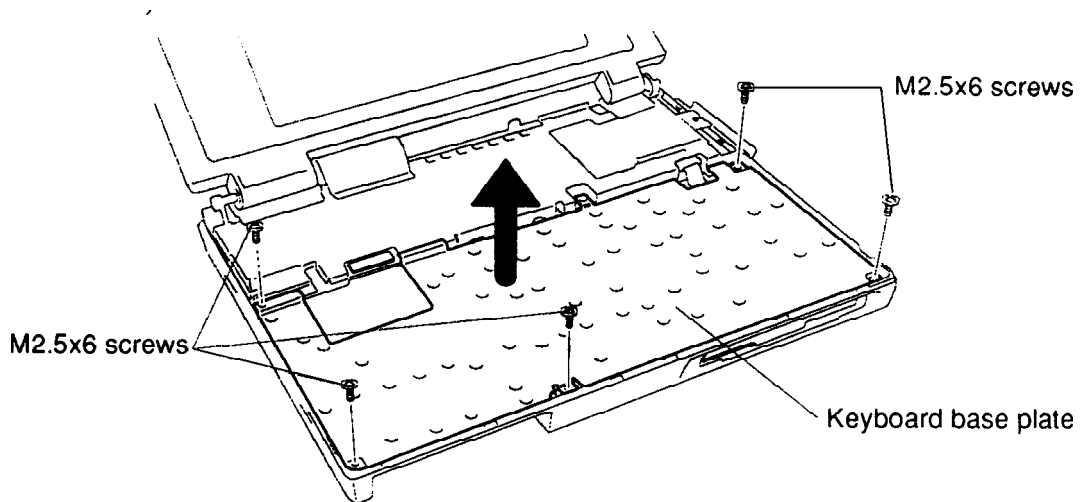


Figure 4-9 Removing the Keyboard Base Plate

5. Remove the tape over the **backup battery cable** and lift out the **backup battery** (Figure 4-10).

NOTE: The connector (**PJ503**) for the backup battery cable is easily accessible upon removal of the HDD, therefore remove the HDD before attempting to disconnect the cable.

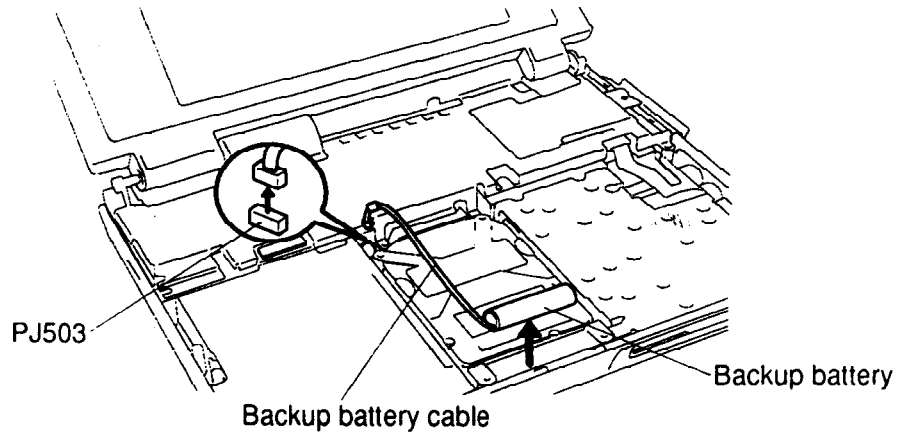


Figure 4-10 Removing the Backup Battery

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

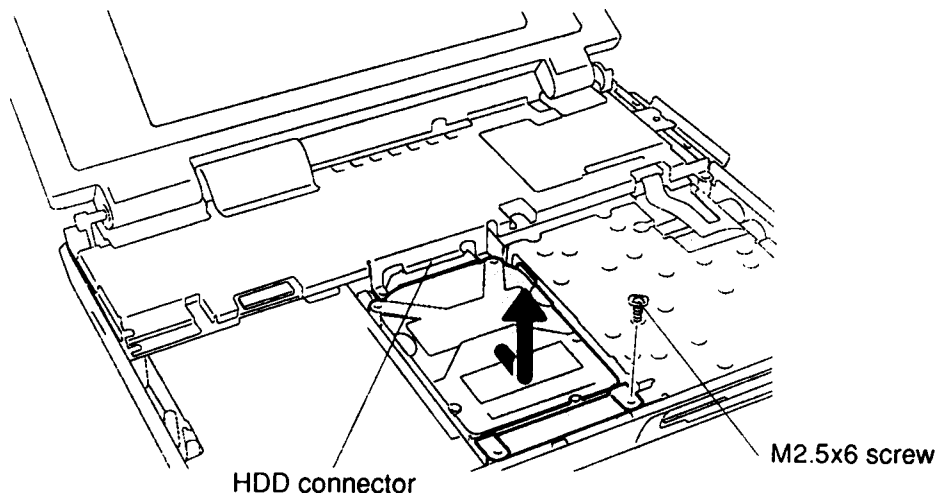


Figure 4-11 Removing the HDD

8. Disconnect the **backup battery cable** from **PJ503** (Figure 4-10).

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

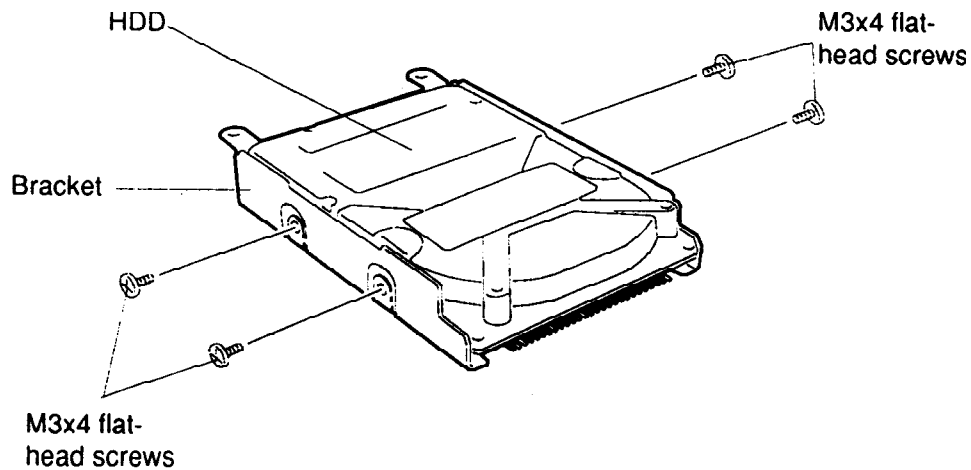


Figure 4-12 Removing the Bracket from the HDD

Installing the Hard Disk Drive and Backup Battery

To install the T1900/T1900C's hard disk drive and backup battery, follow the steps below and refer to Figures 4-9 through 4-13.

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

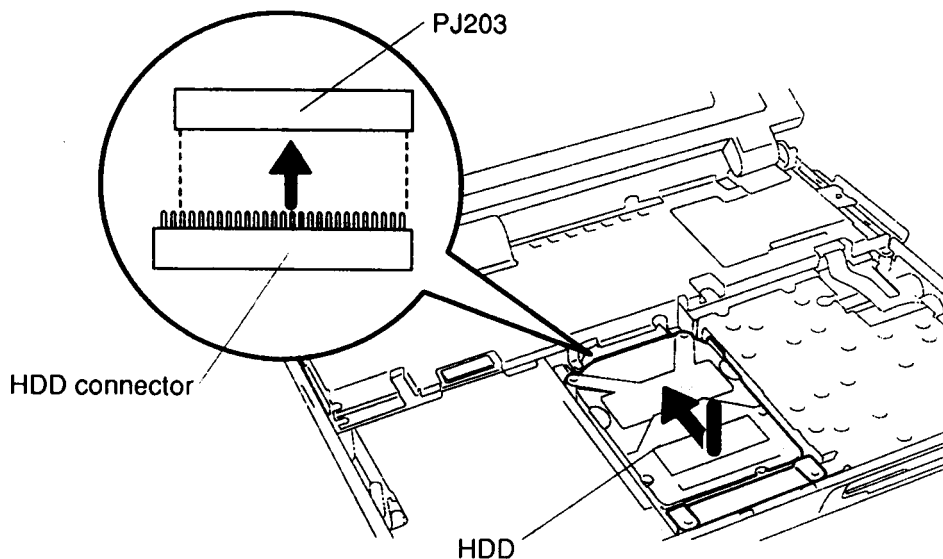


Figure 4-13 Connecting the HDD to the System Board

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

4.8 Display Mask

Removing the Display Mask

To remove the T1900/T1900C's display mask, follow the steps below and refer to Figure 4-14.

1. Turn off the power to the T1900/T1900C, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.

***NOTE:** It is not necessary to remove the display assembly from the computer to remove its components*

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

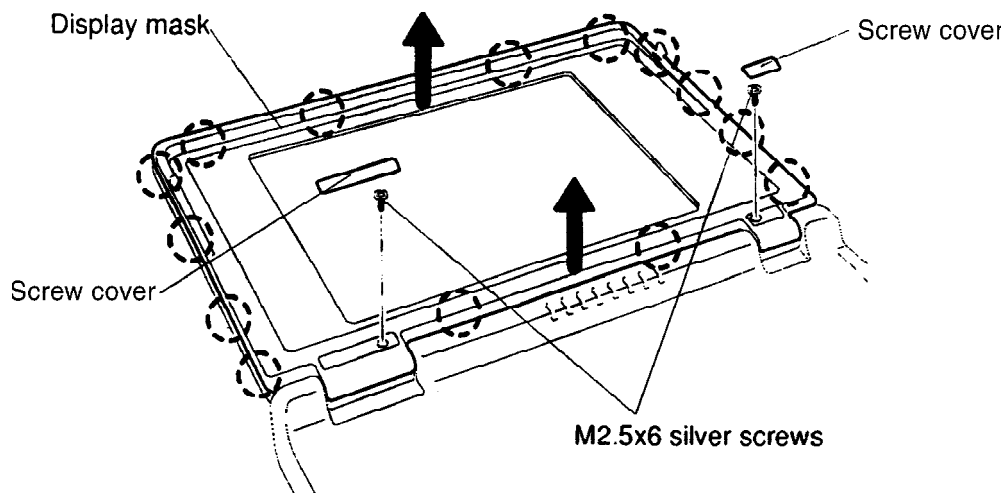


Figure 4-14 Removing the Display Mask

Installing the Display Mask

To install the T1900/T1900C's display mask, follow the steps below and refer to Figure 4-14.

1. Set the **display mask** in place and secure the snaps beginning with the **four snaps** in the display supports, **three snaps** in the larger support and **one snap** in the small support.
2. Continue along the bottom of the display (**two snaps**), along the sides (**four snaps**) and across the top (**four snaps**).
3. Secure the cover with **two M2.5x6 silver screws** at the display hinges.
4. Attach the **two screw covers** at each display hinge to cover the screws.

4.9 Display Assembly

Removing the Display Assembly

To remove the T1900/T1900C's display assembly, follow the steps below and refer to Figures 4-15 through 4-17.

1. Turn off the power to the T1900/T1900C, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, keyboard, keyboard base plate, and display mask as described in Sections 4.2 through 4.8.
3. Set the **display unit** at a 90° angle to the base and remove the **two hinge covers** from the left and right hinges (Figure 4-15).

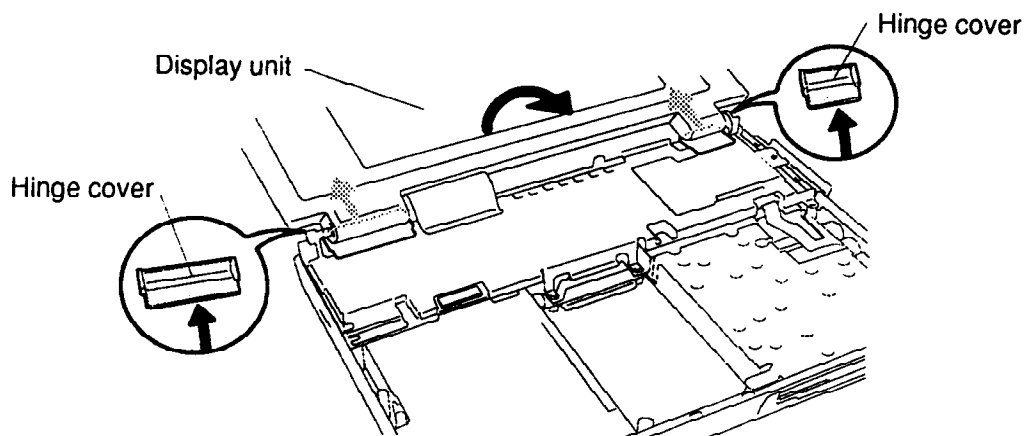


Figure 4-15 Removing the Hinge Covers

4. Remove the four **M2.5x8 silver screws** and two **M2.5x10 screws** on the **system board cover** (Figure 4-16). Note that the M2.5x8 screw under the hinge secures the ground wire.
5. Peel back the clear **plastic insulator** covering the display cable and lift out the **system board cover**. As you lift the cover, place your fingers under the right side to keep the **memory card housing** intact.

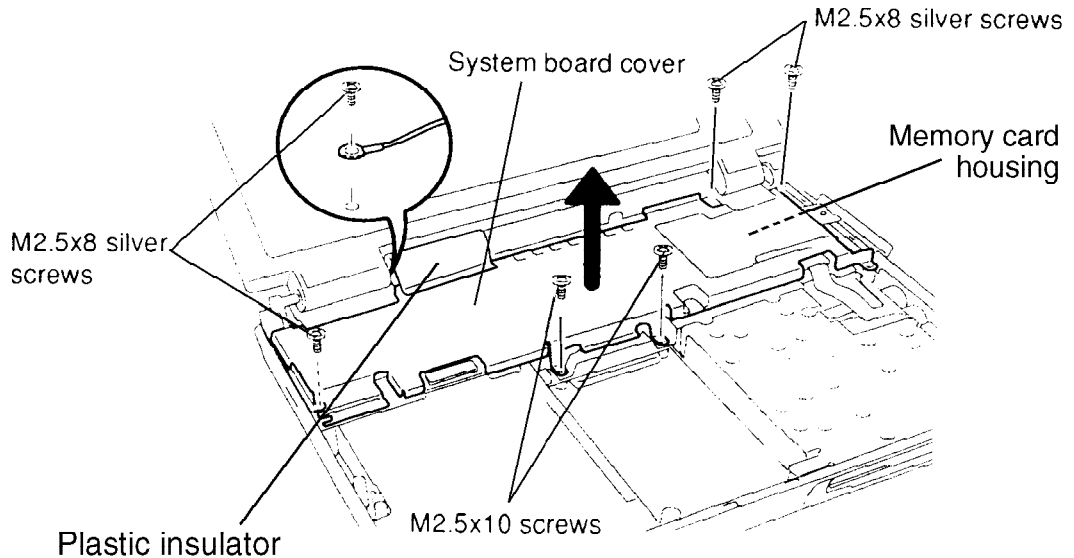


Figure 4-16 Removing the System Board Cover

6. Disconnect the **two display cables** from **PJ7** and **PJ8** on the system board (Figure 4-17).

NOTE: The T1900 has only one *display cable: PJ7*.

7. Carefully disconnect the **display sensor switch cable** from **PJ11** on the system board.
8. Remove the **M2.5x6 silver screw** at the back right corner of the computer.
9. Lay the display back fully (put a book or small box behind the display to support it) and remove the **two M2.5x8 silver screws** on the display hinges securing the display, then lift off the display assembly.

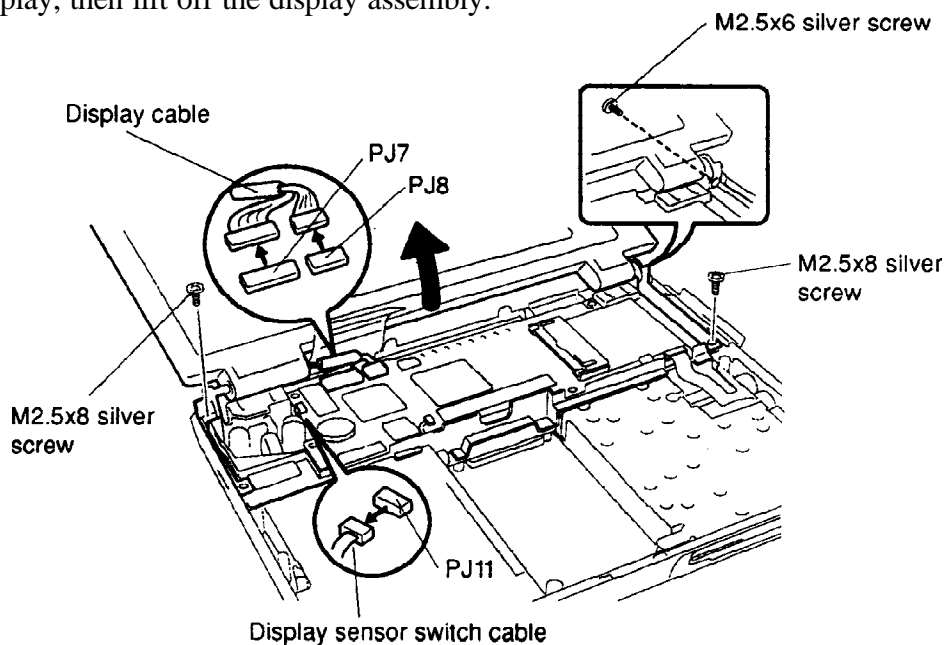


Figure 4-17 Removing the Display Assembly

Installing the Display Assembly

To install the T1900/T1900C's display assembly, follow the steps below and refer to Figures 4-15 through 4-17.

1. Place the **display assembly** on the computer aligning the brackets with the screw holes on the middle-frame assembly. Be sure to route the clear **plastic insulator** between the display assembly and the bottom chassis (Figure 4-17).
2. Replace the **two M2.5x8 silver screws** on the display hinges to secure the display assembly.

CAUTION: *If you replace a cable with a new one, be sure to bend and route it as indicated in Figures 4-15 through 4-17 so that it fits snugly and will not be pinched by the top cover or other components.*

3. Connect the **display sensor switch cable** to **PJ11** on the system board (Figure 4-17).
4. Connect the **two display cables** to **PJ7** and **PJ8** on the system board (Figure 4-17).
5. Secure the **M2.5x6 silver screw** on the back of the computer (Figure 4-17).
6. Set the **system board cover** in place and secure the display **ground wire** with an **M2.5x8** silver screw (Figure 4-16).
7. Secure the **system board cover** with **three M2.5x8 silver screws** and **two M2.5x10 screws** (Figure 4-16).
8. Place the clear **plastic insulator** over the display cables and press it so that it adheres to the **system board cover** (Figure 4-16).
9. Set the display unit at a 90° angle to the base and insert the two **hinge covers** under the left and right hinges (Figure 4-15).
10. Install the display mask, keyboard base plate, keyboard, top cover, optional PCMCIA card, optional memory card, and battery pack as described in Sections 4.8 through 4.2.

4.10 Upper System Board

Removing the Upper System Board (FATSU*)

To remove the T1900/T1900C's upper system board, follow the steps below and refer to Figure 4-18.

1. Turn off the power to the T1900/T1900C, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, keyboard, HDD, display mask, and display assembly as described in Sections 4.2 through 4.9.
3. Disconnect the **mouse/KB cable** from **PJ3**, and **RTC battery cable** from **PJ2** on the **upper system board**.
4. Remove the **M2.5x6 silver screw** on the left side of the **upper system board** and **M2x8 screw** on the **optional memory card connector**.
5. Pull up the upper system board to disconnect **PJ5** and **PJ10** and separate it from the lower system board.

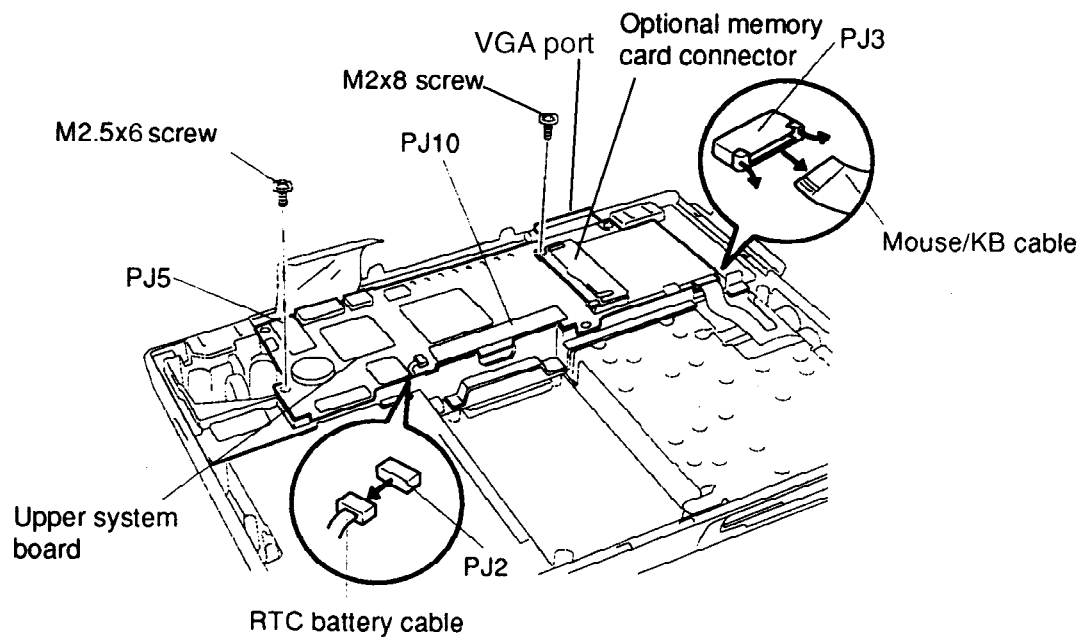


Figure 4-18 Removing the Upper System Board

Installing the Upper System Board

To install the T1900/T1900C's upper system board, follow the steps below and refer to Figure 4-18.

1. Place the **upper system board** on the lower system board aligning connectors **PJ5** and **PJ10**. Press the **VGA port** area to seat the upper right corner of the system board, then press the PJ5 and PJ10 connectors to connect the upper system board to the lower system board.

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

2. Secure the **M2.5x6 screw** on the left side of the upper system board, and the **M2x8 screw** on the **optional memory card connector**.
3. Connect the **RTC battery cable** to **PJ2**, and **mouse/KB cable** to **PJ3**.
4. Install the display assembly, display mask, HDD, keyboard, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.9 through 4.2.

4.11 Lower System Board - RTC Battery

Removing the Lower System Board - RTC Battery

To remove the T1900/T1900C's lower system board and RTC battery, follow the steps below and refer to Figures 4-19 through 4-22.

1. Turn off the power to the T1900/T1900C, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, keyboard, HDD, display mask, display assembly, and upper system board as described in Sections 4.2 through 4.10.
3. Remove the tape and **RTC battery** from the middle frame assembly (Figure 4-19).
4. Disconnect the **FDD cable** from **PJ202** on the lower system board (Figure 4-19).

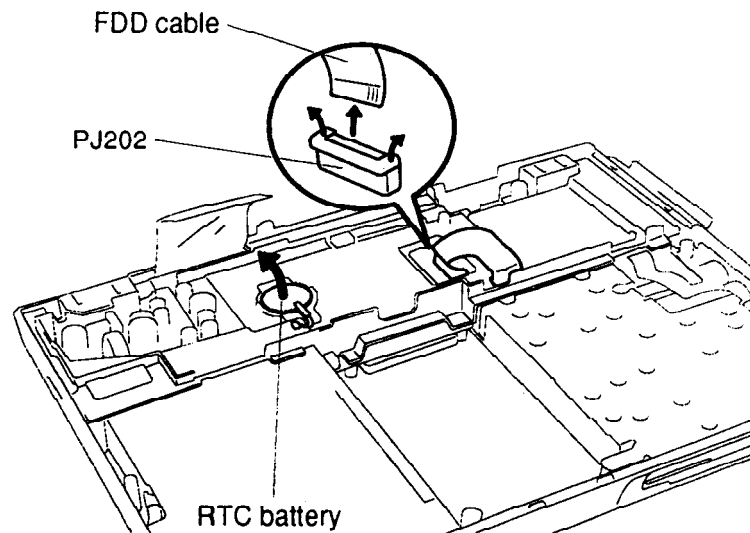


Figure 4-19 Removing the RTC Battery and FDD Cable

5. Remove the **M2.5x6 silver screw** from the bottom of the computer (Figure 4-20).
6. Remove the **two M2.5x10 screws** located next to the power supply circuits of the **lower system board** (Figure 4-20).
7. Open the PCMCIA expansion slot cover on the right side of the computer, remove the two M2.5x6 screws securing the cover, then remove the cover.

- Lift up the right side of the **lower system board** assembly and slide the assembly to the right to release the **DC IN jack** on the left side of the board.

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

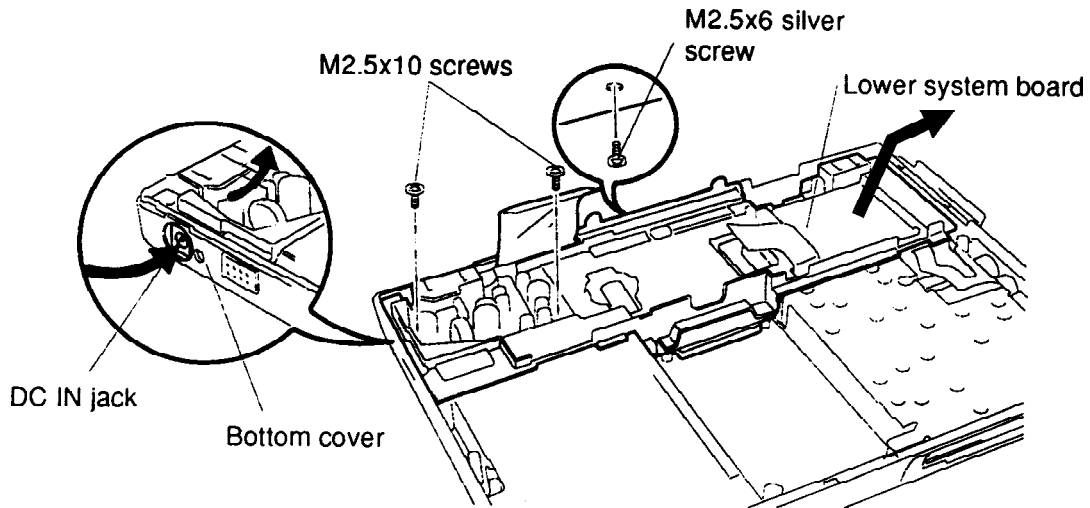


Figure 4-20 Removing the Lower System Board Assembly

- Turn the lower system board assembly over, remove the **two M2.5x6 screws**, then lift off the **lower metal plate** and PCMCIA **ejector button** (Figure 4-21).

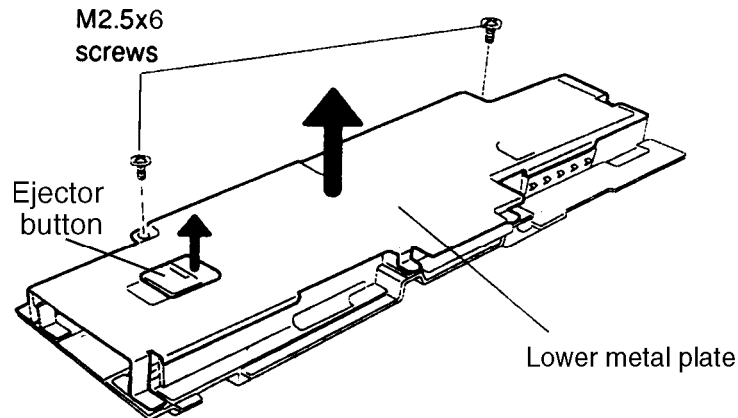


Figure 4-21 Removing the Lower Metal Plate

10. Remove the **two M2x8 screws** on the **PCMCIA connector**, and **two M2.5x6 screws** on the lower system board (Figure 4-22).
11. Lift off the **PCMCIA card ejector**.
12. Separate the **lower system board** from the middle frame assembly.
13. Lift out the **PCMCIA frame assembly**.

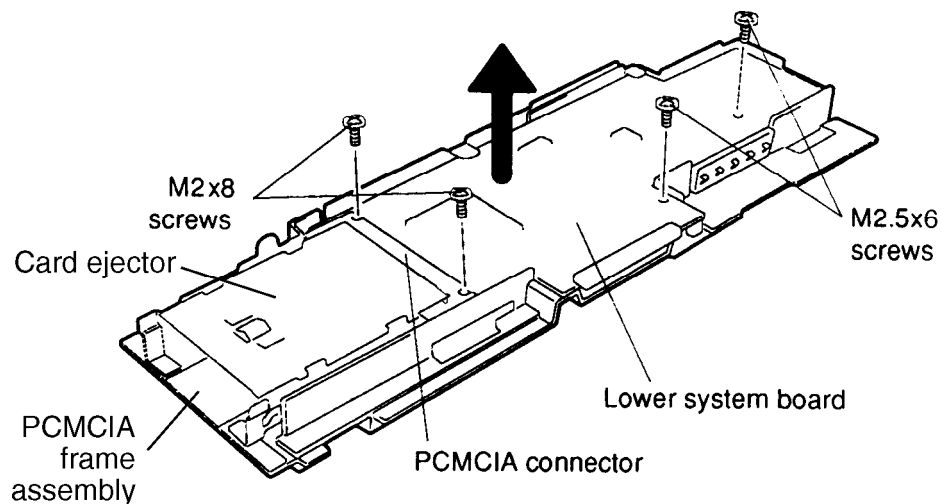


Figure 4-22 Removing the Lower System Board

Installing the Lower System Board and RTC Battery

To install the T1900/T1900C's lower system board and RTC battery, follow the steps below and refer to Figures 4-19 through 4-22.

1. Insert the **PCMCIA frame assembly**.
2. Slide the **lower system board** into the middle frame assembly from left to right, making certain that the DC IN jack fits into the hole on the right side of the middle frame assembly.
3. Place the **PCMCIA card ejector** on the **PCMCIA frame assembly**. The card ejector fits inside the walls of the PCMCIA frame assembly and hooks into the holes on the **PCMCIA connector**.
4. Secure the **two M2x8 screws** on the **PCMCIA connector** and **two M2.5x6 screws** on the lower system board (Figure 4-22).
5. Holding the **PCMCIA ejector button** over the opening in the **lower metal plate**, place the metal plate onto the lower system board. Work the ejector button so that it moves the card ejector plate back and forth (Figure 4-21).
6. Secure the **lower metal plate** with **two M2.5x6 screws** (Figure 4-21).

7. Turn the assembly over, and place the lower system board assembly into the computer's chassis, inserting the **DC IN jack** into the opening on the left side of the chassis (Figure 4-20).

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

8. Secure the **two M2.5x10 screws** by the power supply circuits, and connect the **FDD cable** to **PJ202** (Figures 4-19 and 4-20).
9. Secure the **M2.5x6 screw** on the bottom of the unit (Figure 4-20).
10. Set the **RTC battery** in the RTC battery holder on the middle frame assembly and place the tape over the battery (Figure 4-19).
11. Set the PCMCIA expansion slot cover in place and secure it with two M2.5x6 screws.
12. Install the upper system board, display assembly, display mask, HDD, keyboard, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.10 through 4.2.

4.12 Floppy Disk Drive and Mouse/KB Board

Removing the Floppy Disk Drive and Mouse/KB Board

To remove the T1900/T1900C's floppy disk drive and mouse/KB board, follow the steps below and refer to Figures 4-23 through 4-25.

1. Turn off the power to the T1900/T1900C, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, keyboard, HDD, display mask, display assembly, upper system board, and lower system board as described in Sections 4.2 through 4.11.
3. Remove the **two M2.5x6 screws** on the **mouse/KB board assembly** (Figure 4-23).
4. Lift the left side of the **FDD unit** with **mouse/KB board assembly** and slowly pull it to the left to remove the assembly from the chassis (Figure 4-23).

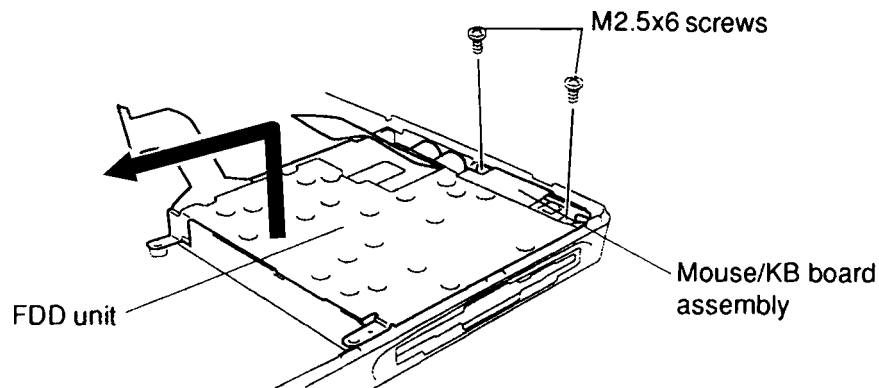


Figure 4-23 Removing the FDD and Mouse/KB Board

5. To separate the **mouse/KB board** and **FDD unit**, remove the **two M2.5x4 screws** (Figure 4-24).

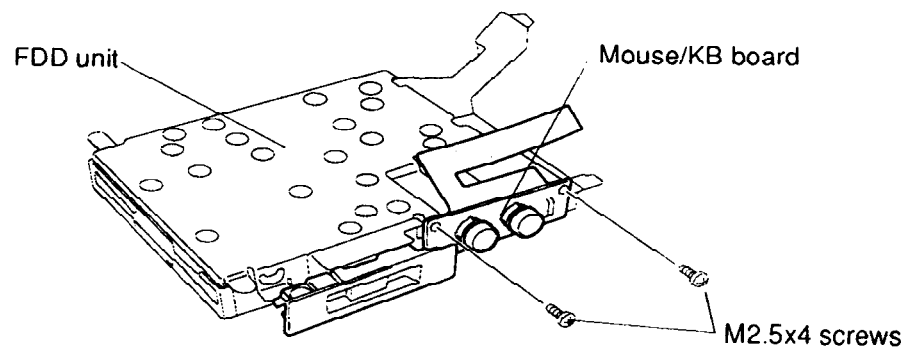


Figure 4-24 Separating the FDD and Mouse/KB Board

6. Remove the **three M2x3 black screws** securing the **FDD bracket** and remove the bracket (Figure 4-25).

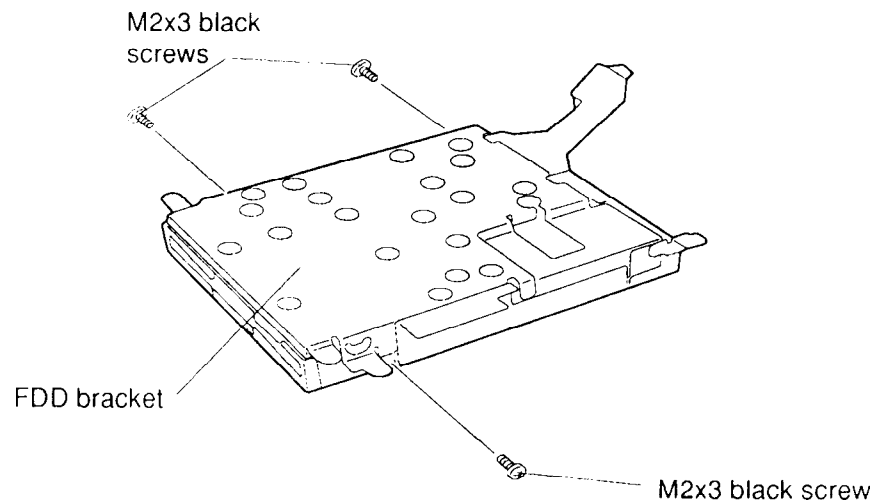


Figure 4-25 Removing the FDD Bracket

Installing the Floppy Disk Drive and Mouse/KB Board

To install the T1900/T1900C's floppy disk drive and mouse/KB board, follow the steps below and refer to Figures 4-23 through 4-25.

1. Place the **FDD bracket** on the FDD and secure it with the **three M2x3 black screws** (Figure 4-25).
2. Secure the **mouse/KB board** with **two M2.5x4 screws** to the FDD bracket (Figure 4-24).
3. Place the **FDD assembly** in the computer, right side first, and secure the **mouse/KB board** with **two M2.5x6 screws** (Figure 4-23).
4. Install the lower system board, upper system board, display assembly, display mask, HDD, status indicator panel, keyboard, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.11 through 4.2.

4.13 T1900C FL Inverter Board

Removing the T1900C FL Inverter Board

To remove the T1900C's FL inverter board, follow the steps below and refer to Figures 4-26 and 4-27.

1. Turn off the power to the T1900/T1900C, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, and display mask as described in Sections 4.2, 4.3, 4.4, 4.5, and 4.8.
3. Remove the four **M2.5x6 screws** securing the **display support plate** (Figure 4-26).

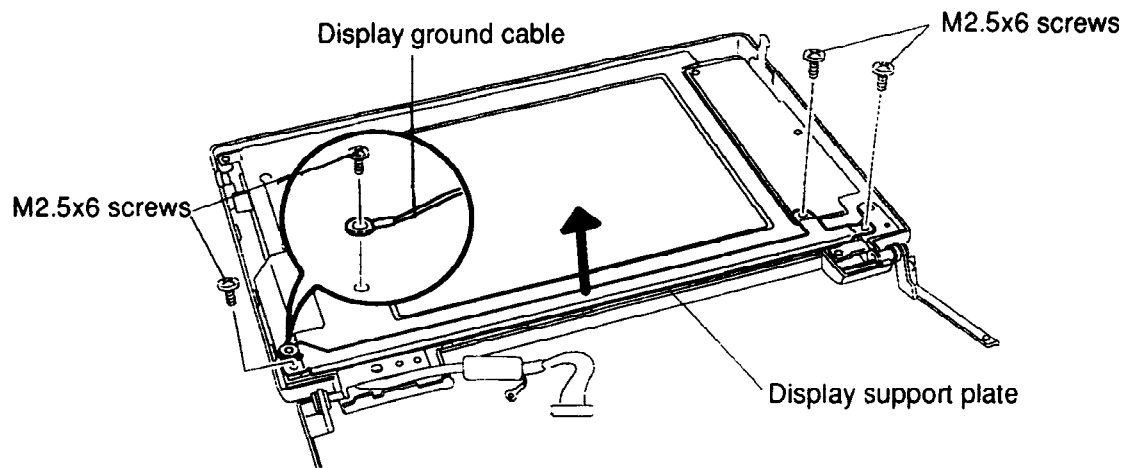


Figure 4-26 Removing the Display Support Plate

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

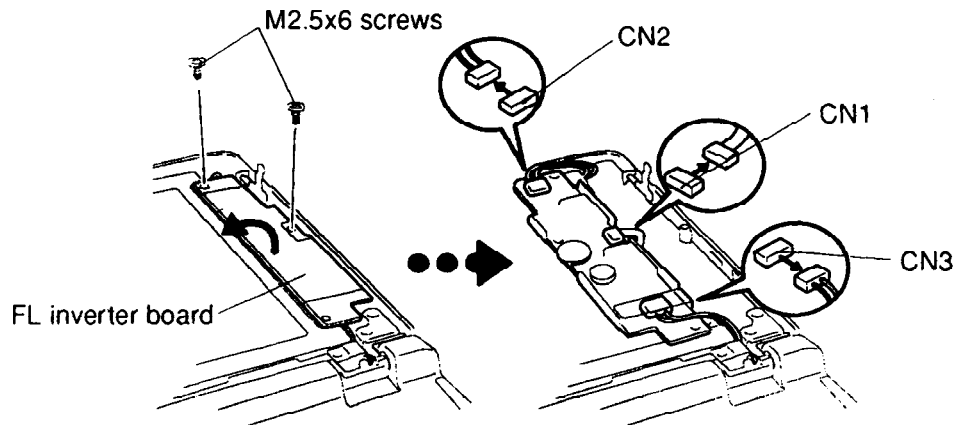


Figure 4-27 Removing the FL Inverter Board

Installing the T1900C FL Inverter Board

To install the T1900C's FL inverter board, follow the steps below and refer to Figures 4-26 and 4-27.

1. Connect the **FL inverter cable** to **CN1** on the **inverter board** and the **two FL cables** to **CN2** and **CN3** (Figure 4-27).
2. Route the **cables** so they are not pinched by the **FL inverter board**, **display hinge** or other component.
3. Replace the **FL inverter board** and secure it with the **two M2.5x6 screws** (Figure 4-27).
4. Set the **display support plate** in place and secure it with **four M2.5x6 screws**. One screw also secures the **display ground cable** (Figure 4-26).
5. Install the display mask, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.8, 4.5, 4.4, 4.3 and 4.2.

4.14 T1900C LCD Module

Removing the Color LCD Module

To remove the T1900C's color LCD module, follow the steps below and refer to Figure 4-28.

1. Turn off the power to the T1900/T1900C, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, display mask, display assembly and inverter board as described in Sections 4.2, 4.3, 4.4, 4.5, 4.8, 4.9 and 4.13.
3. Remove the **M2.5x6 screw** securing the **LCD module** to the LCD cover.
4. Carefully rotate the **LCD module** from right to left out of the display cover and disconnect the **three display cables** from the LCD module.

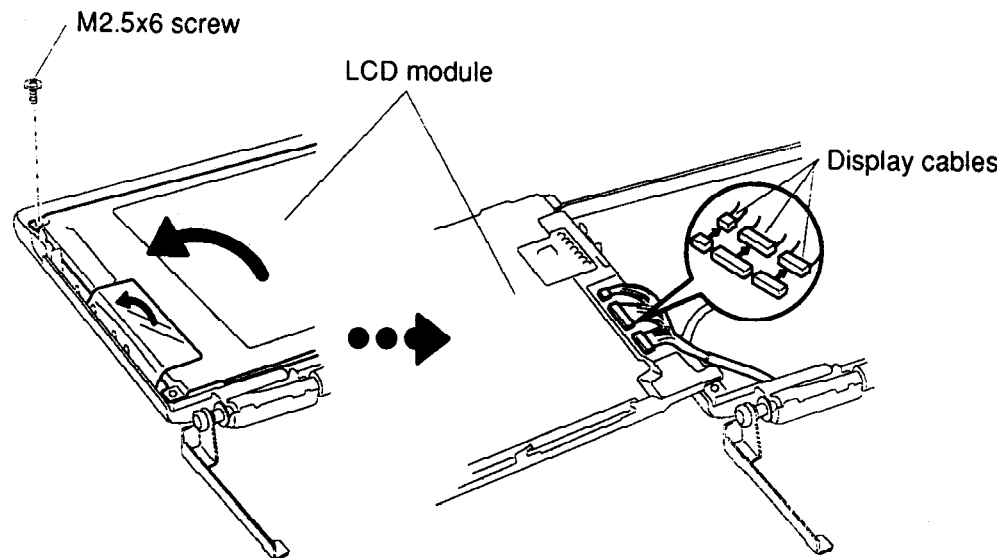


Figure 4-28 Removing the LCD Module

Installing the T1900C LCD Module

To install the T1900C's LCD module, follow the steps below and refer to Figure 4-28.

1. Connect the **three display cables** to the LCD module, and carefully rotate the LCD module into the LCD cover.
2. Secure the **M2.5x6 screw** on the LCD module.
3. Install the FL inverter board, display assembly, display mask, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.13, 4.9, 4.8, 4.5, 4.4, 4.3 and 4.2.

4.15 T1900C Fluorescent Lamp (FL)

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

Removing the T1900C FL

To remove the T1900C's FL, follow the steps below and refer to Figures 4-29 through 4-31.

1. Turn off the power to the T1900/T1900C, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, display mask, display assembly, FL inverter board, and LCD module as described in Sections 4.2, 4.3, 4.4, 4.5, 4.8, 4.9, 4.13 and 4.14.
3. Lay the **color LCD module** face down and use needle-nose pliers to unbend the **16 latches** holding the front and back frames together. Then lift the unit out of the front frame (Figure 4-29).

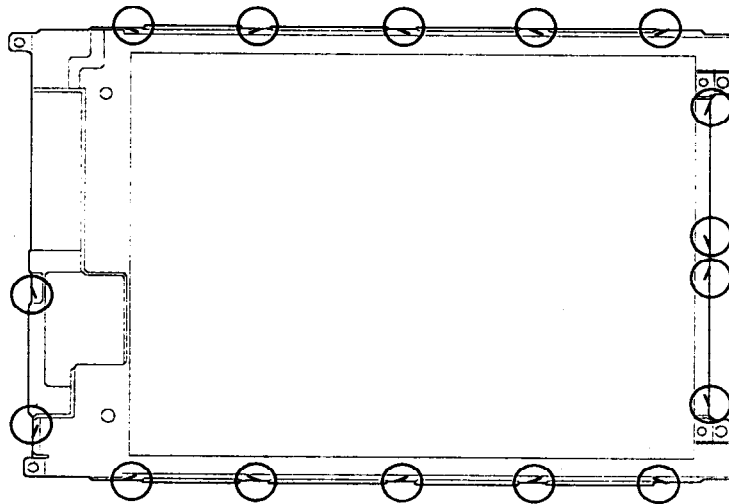


Figure 4-29 Unbending the Color LCD Module Latches

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

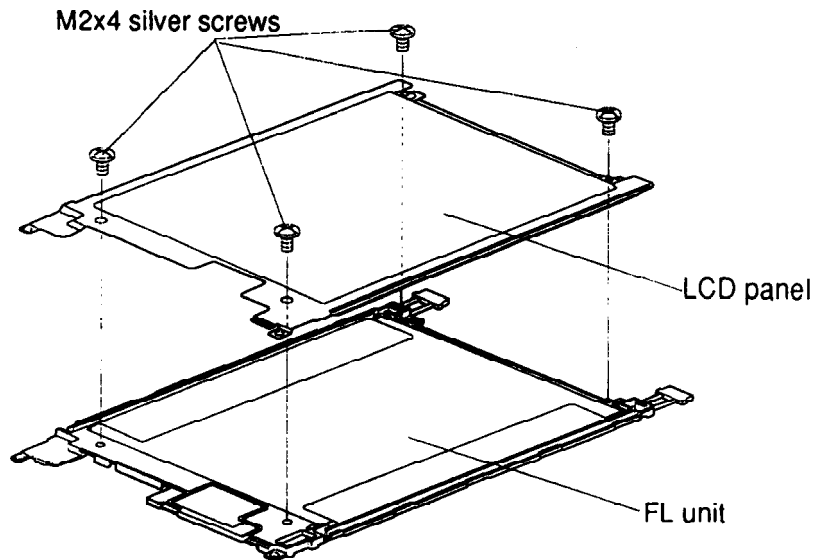


Figure 4-30 Removing the FL Screws

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

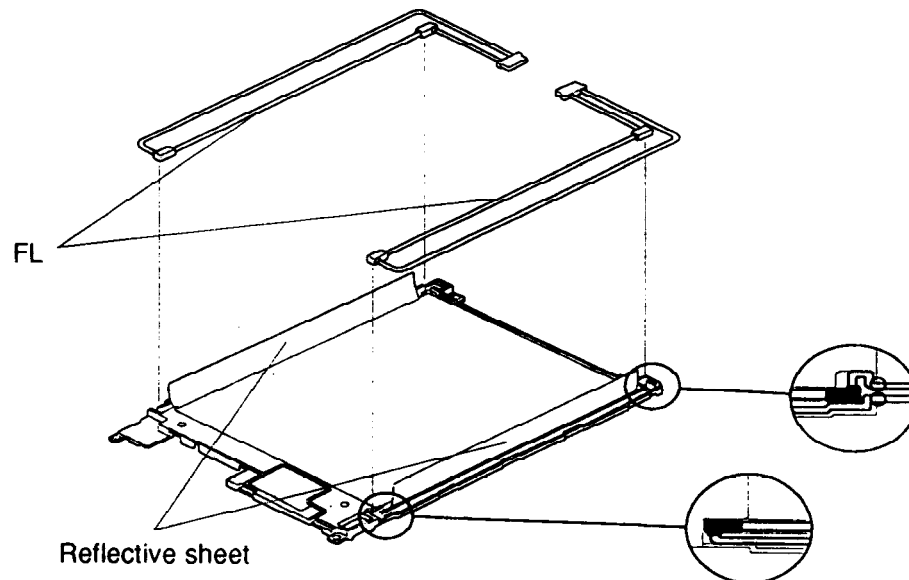


Figure 4-31 Removing the FL

Installing the T1900C FL Unit

To install the T1900C's FL unit, follow the steps below and refer to Figures 4-29 through 4-31.

1. Place the **FL** on the **FL unit** and cover the FL using the reflective sheet (Figure 4-31).
2. Secure the **LCD panel** with **four M2x4 screws** (Figure 4-30).
3. Carefully bend the **16 latches** back into place (Figure 4-29).
4. Install the color LCD module, FL inverter board, display assembly, display mask, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.14, 4.13, 4.9, 4.8, 4.5, 4.4, 4.3, and 4.2.

4.16 T1900 FL Inverter Board

Removing the T1900 FL Inverter Board

To remove the T1900's FL inverter board, follow the steps below and refer to Figures 4-32 and 4-33.

1. Turn off the power to the T1900/T1900C, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, display mask and display assembly as described in Sections 4.2 through 4.5, 4.8 and 4.9.
3. Remove the **five M2.5x6 screws** securing the **display support plate** (Figure 4-32).

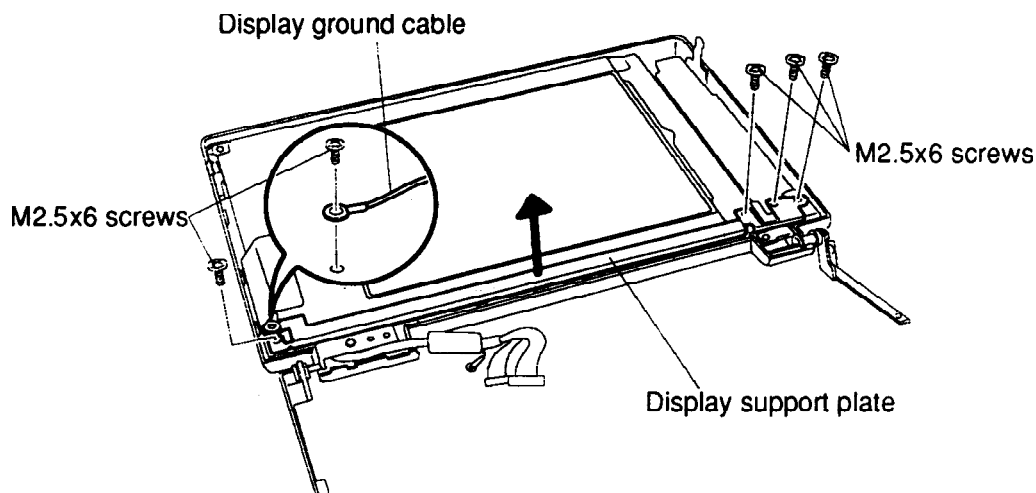


Figure 4-32 Removing the Display Support Plate

4. Remove the **M2.5x6 screw** securing the **FL inverter board** (Figure 4-33).
5. Turn the FL inverter board over and disconnect the **FL cables** and **FL inverter cable** from **CN1** and **CN2** (Figure 4-33).

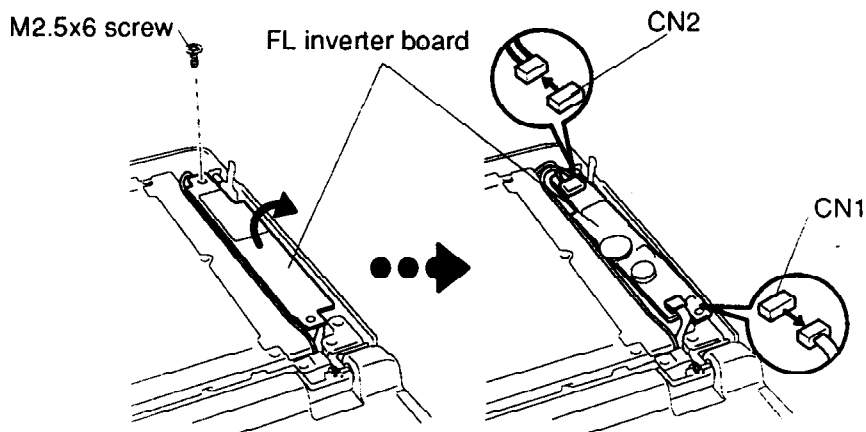


Figure 4-33 Removing the FL Inverter Board

Installing the FL Inverter Board

To install the T1900's FL inverter board, follow the steps below and refer to Figures 4-32 and 4-33.

1. Connect the **FL inverter cable** and **FL cables** to **CN1** and **CN2** on the FL inverter board (Figure 4-33).
2. Seat the **FL inverter board** and route the **cables** so they will not be pinched by the display cover or other component.
3. Secure the **FL inverter board** with one **M2.5x6 screw** (Figure 4-33).
4. Set the **display support plate** in place and secure it with **five M2.5x6 screws**. One screw also secures the **display ground cable** (Figure 4-32).
5. Install the display assembly, display mask, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.9, 4.8, 4.5, 4.4, 4.3 and 4.2.

4.17 T1900 LCD Module

Removing the T1900 Liquid Crystal Display (LCD) Module

CAUTION: The T1900 LCD module is easily damaged. Before removing the module, refer to Appendix A for precautions on handling.

To remove the T1900's Liquid Crystal Display Module, follow the steps below and refer to Figure 4-34.

1. Turn off the power to the T1900/T1900C, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, display mask, display assembly, and FL inverter board as described in Sections 4.2, 4.3, 4.4, 4.5, 4.8, 4.9 and 4.16.
3. Remove the **two M2.5x6 screws**.
4. Rotate the **LCD module** out of the cover from right to left.
5. Disconnect the **two display cables** from **CN1** and **CN2** on the **LCD module**.

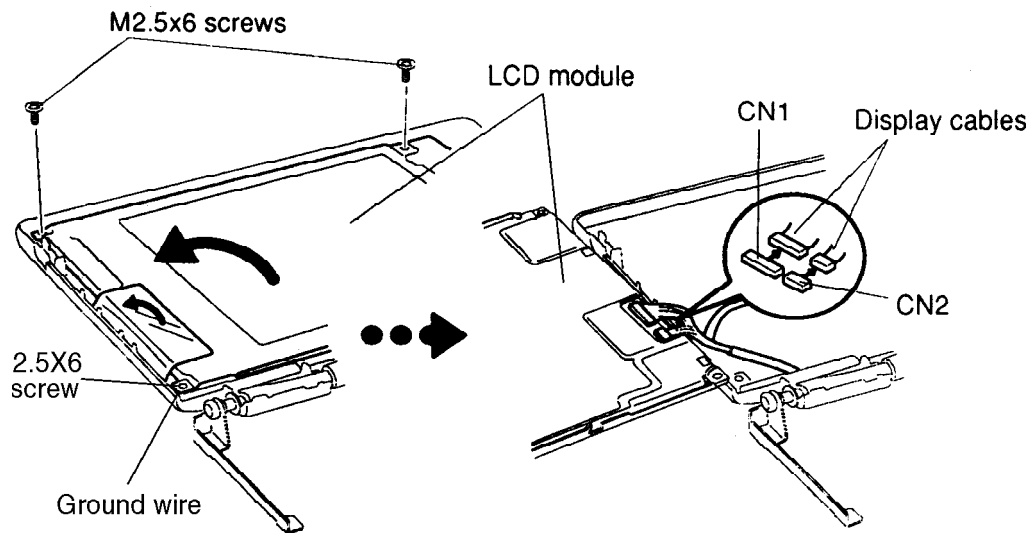


Figure 4-34 Removing the LCD Module

Installing the Liquid Crystal Display Module

To install the T1900's liquid crystal display module, follow the steps below and refer to Figure 4-34.

1. Connect the **two display cables** to **CN1** and **CN2** on the LCD module.
2. Place the **module** in the cover and route the **cables** so they will not be pinched by the display panel or other components.
3. Secure the panel with **two M2.5x6 screws**.
4. Install the FL inverter board, display assembly, display mask, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.16, 4.9, 4.8, 4.5, 4.4, 4.3 and 4.2.

4.18 T1900 Fluorescent Lamp (FL)

Removing the T1900 Fluorescent Lamp

To remove the T1900's Fluorescent Lamp, follow the steps below and refer to Figure 4-35.

1. Turn off the power to the T1900/T1900C, and, if attached, disconnect the AC adapter, power cord and all external cables connected to the computer.
2. Remove the battery pack, optional memory card, optional PCMCIA card, top cover, display mask, FL inverter, and LCD module as described in Sections 4.2, 4.3, 4.4, 4.5, 4.8, 4.9, 4.16, and 4.17.
3. Peel off the tape from the lamp cover, then remove **three M1.5x3 brass flat-head screws** securing the cover and take off the **cover**.
4. Remove the **fluorescent lamp**.

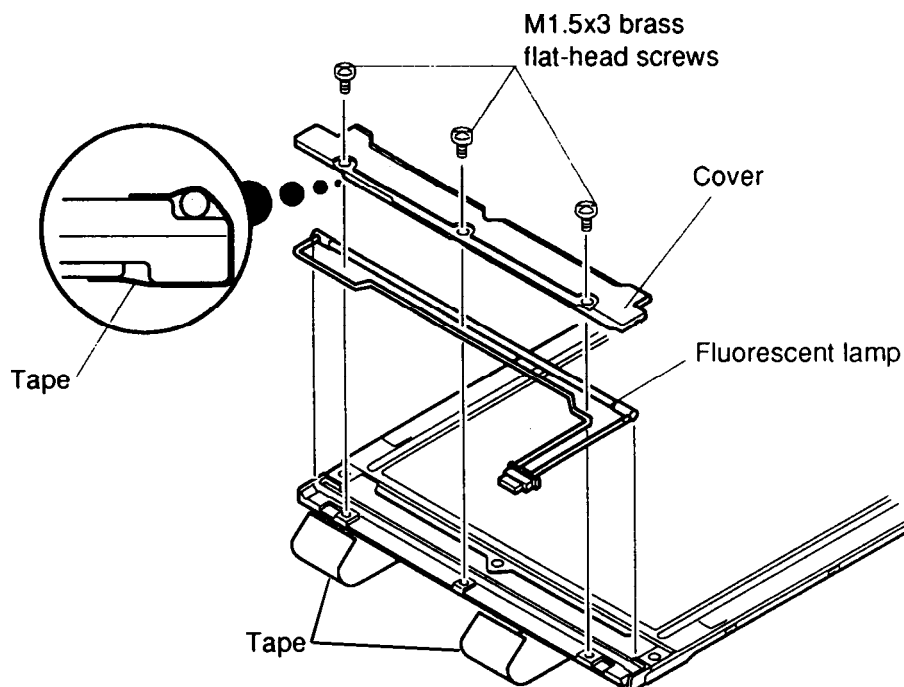


Figure 4-35 Removing the Fluorescent Lamp

Installing the Fluorescent Lamp

To install the T1900's fluorescent lamp, follow the steps below and refer to Figure 4-35.

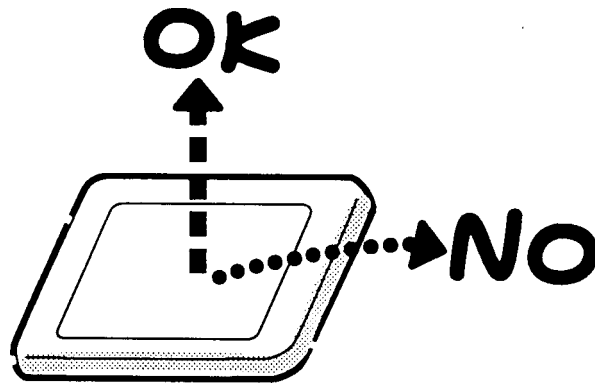
1. Place the fluorescent lamp in position in the LCD module.
2. Slip the edge of the **plastic cover** under the metal frame and align the holes in the cover with the corresponding holes in the display assembly cover.
3. Secure the plastic cover with the **three flat-head M1.5x3 brass screws**.
4. Secure the **FL cable** to the **LCD panel** with tape as indicated in Figure 4-35.
5. Install the LCD panel, FL inverter, display assembly, display mask, top cover, optional PCMCIA card, optional memory card and battery pack as described in Sections 4.17, 4.16, 4.9, 4.8, 4.5, 4.4, 4.3 and 4.2.

Appendix A Handling the LCD Module

Precautions for Handling the T1900/T1900C LCD Module

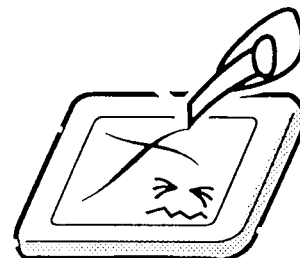
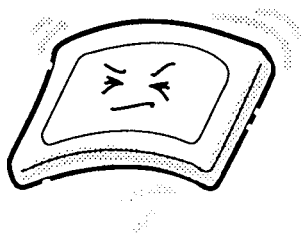
The T1900/T1900C's LCD module can be easily damaged during assembly or disassembly. Therefore, please observe the following precautions when handling the LCD module.

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



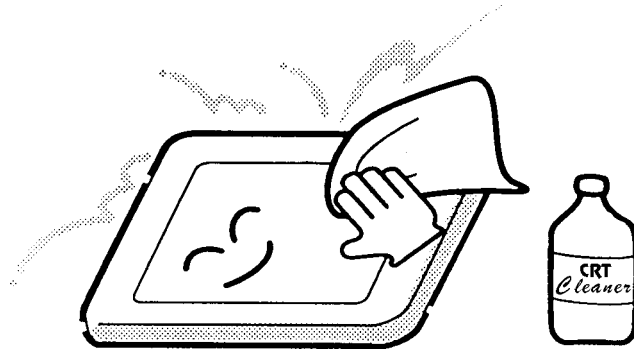
2. Be careful to align the holes at the four corners of the LCD module with the corresponding holes in the LCD cover before securing the module with screws. Do not force the module into place, because stress can affect its performance.

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

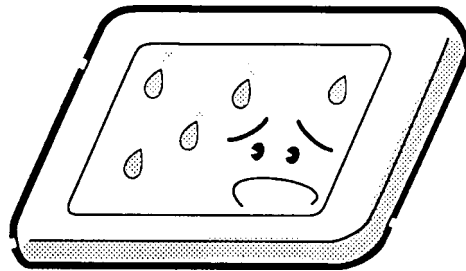


3. If the panel's surface gets dirty, wipe it with cotton or a soft cloth. If it is still dirty, try breathing on the surface to create a light condensate and wipe it again.

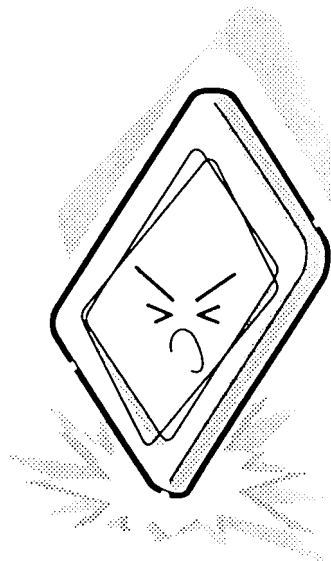
If the surface is very dirty, we recommend a CRT cleaning agent. Apply the agent to a cloth and then wipe the panel's surface. Do not apply cleanser directly to the panel.



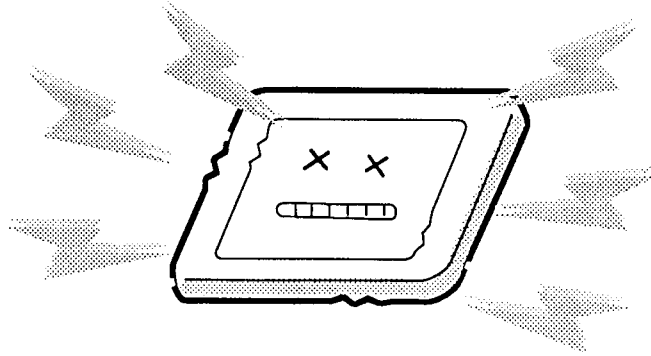
4. If water or other liquid is left on the panel's surface for a long period, it can change the screen's tint or stain it. Be sure to quickly wipe off any liquid.



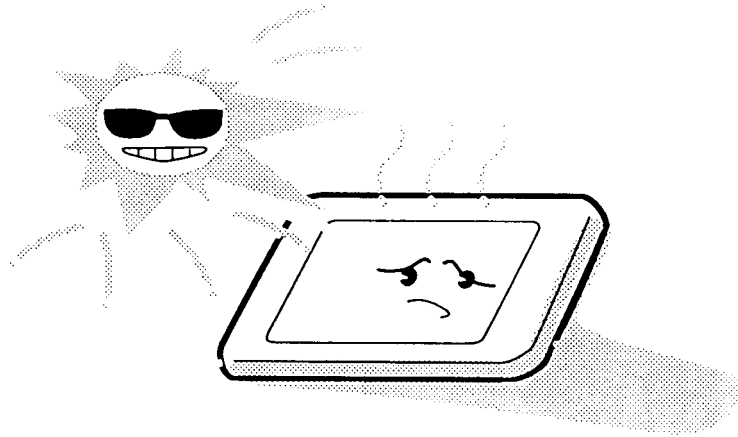
5. Glass is used in the panel, so be careful not to drop it or let it strike a hard object, which could cause breakage or cracks.



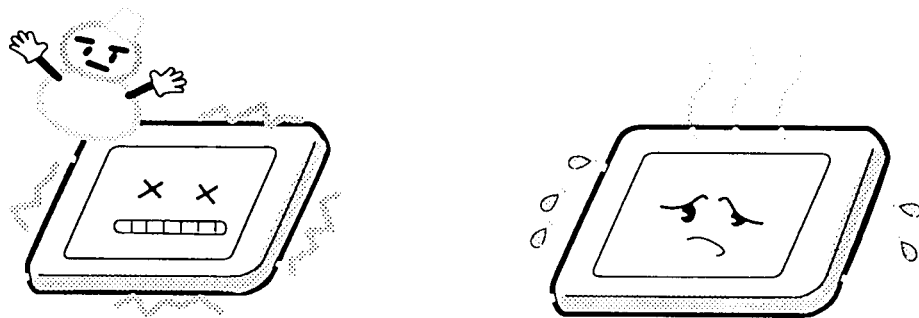
6. CMOS-LSI circuits are used in the module, so guard against damage from electrostatic discharge. Be sure to wear a wrist or ankle ground when handling the module.



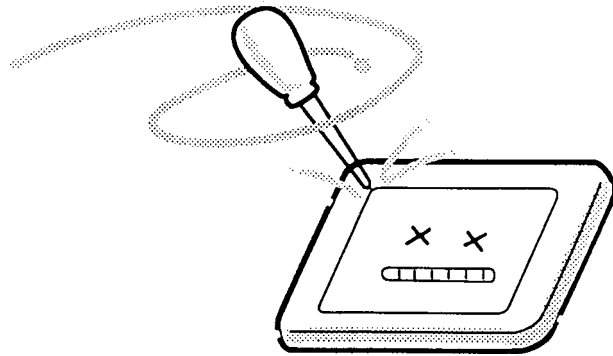
7. Do not expose the module to direct sunlight or strong ultraviolet rays for long periods.



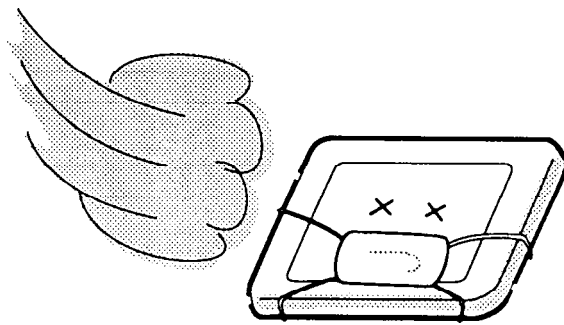
8. Do not store the module at temperatures below specifications. Cold can cause the liquid crystals to freeze, lose their elasticity or otherwise suffer damage.



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



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



Appendix B Board Layout

B.1 FATSU* Upper System Board

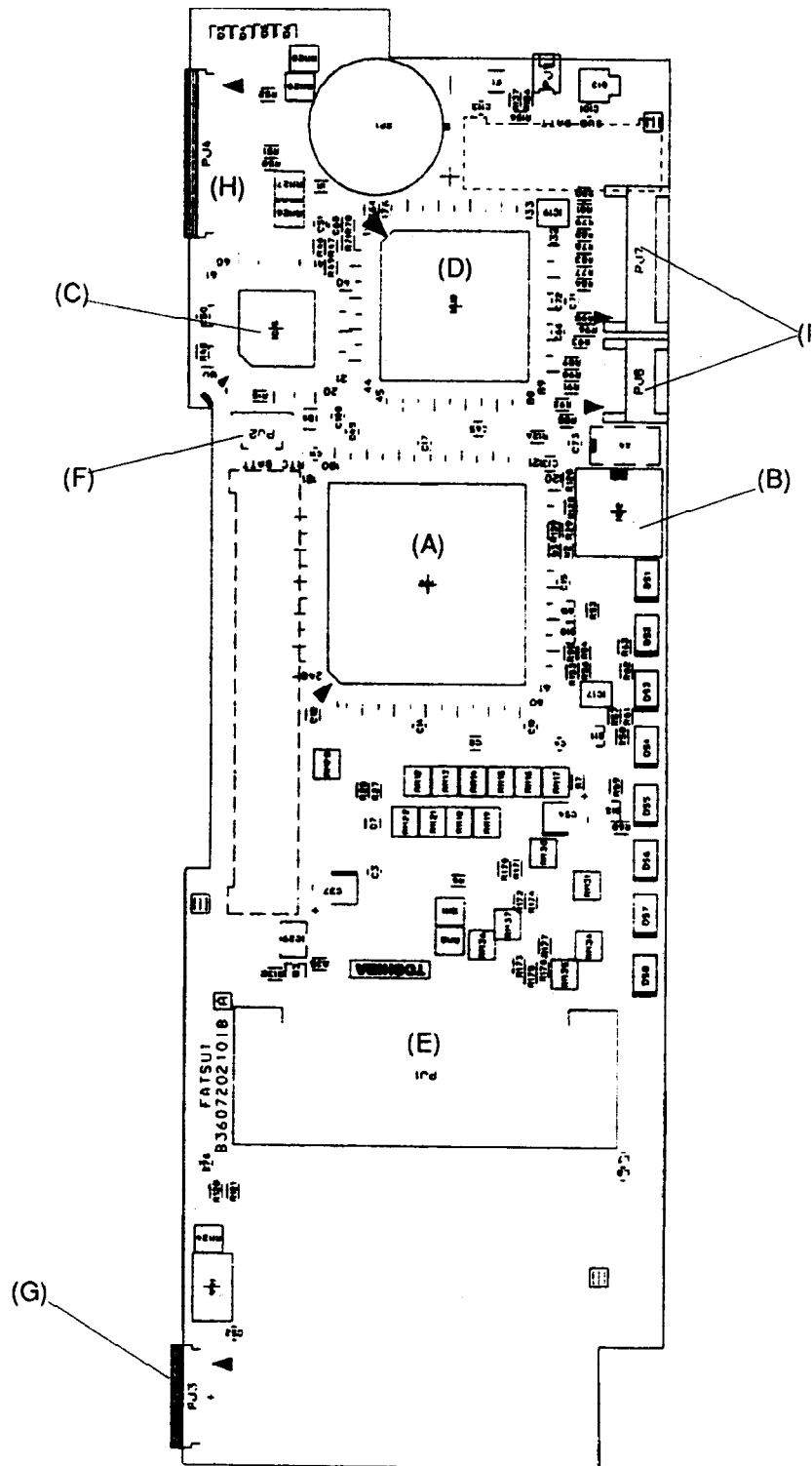


Figure B-1 FATSU* Upper System Board (front)

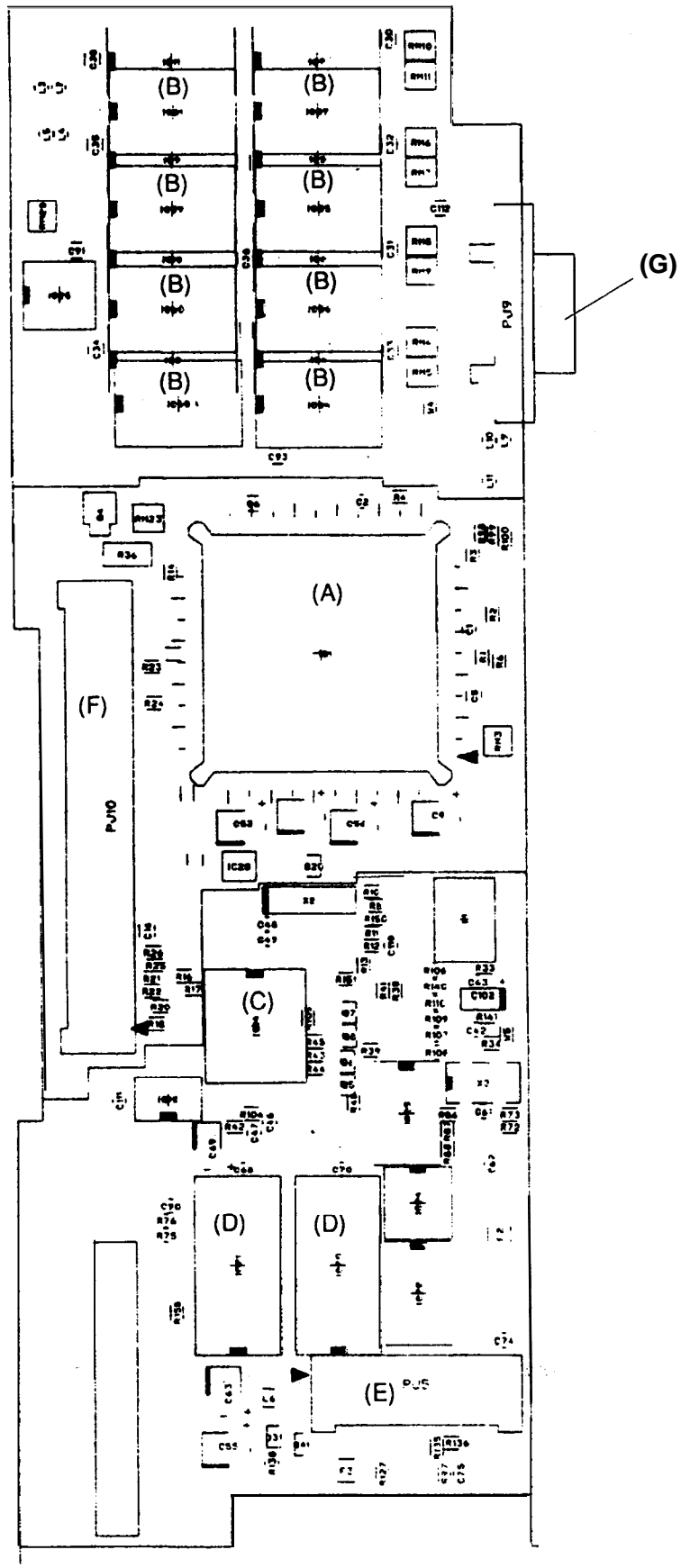


Figure B-2 FATSU* Upper System Board (back)

Table B-1 FATSU Upper System Board ICs and Connectors (front)*

Mark	Number	Name
(A)	IC2	System Controller Gate Array
(B)	IC12	Clock Generator
(C)	IC15	Keyboard Controller
(D)	IC18	Display Controller
(E)	PJ1	Optional Memory Card Connector
(F)	PJ2	RTC Battery Connector
(G)	PJ3	Mouse/KB Connector
(H)	PJ4	Keyboard Connector
(I)	PJ7, 8	LCD Connector

Table B-2 FATSU Upper System Board ICs and Connectors (back)*

Mark	Number	Name
(A)	IC1	CPU 80486SX
(B)	IC4 to 7, IC8 to 11, IC54 to 61	System Memory
(C)	IC14	Real Time Clock
(D)	IC20, 21	Video Memory
(E)	PJ5	Power Supply Interface Connector
(F)	PJ10	Joint Connector
(G)	PJ9	CRT Connector

B.2 FATSL* Lower System Board

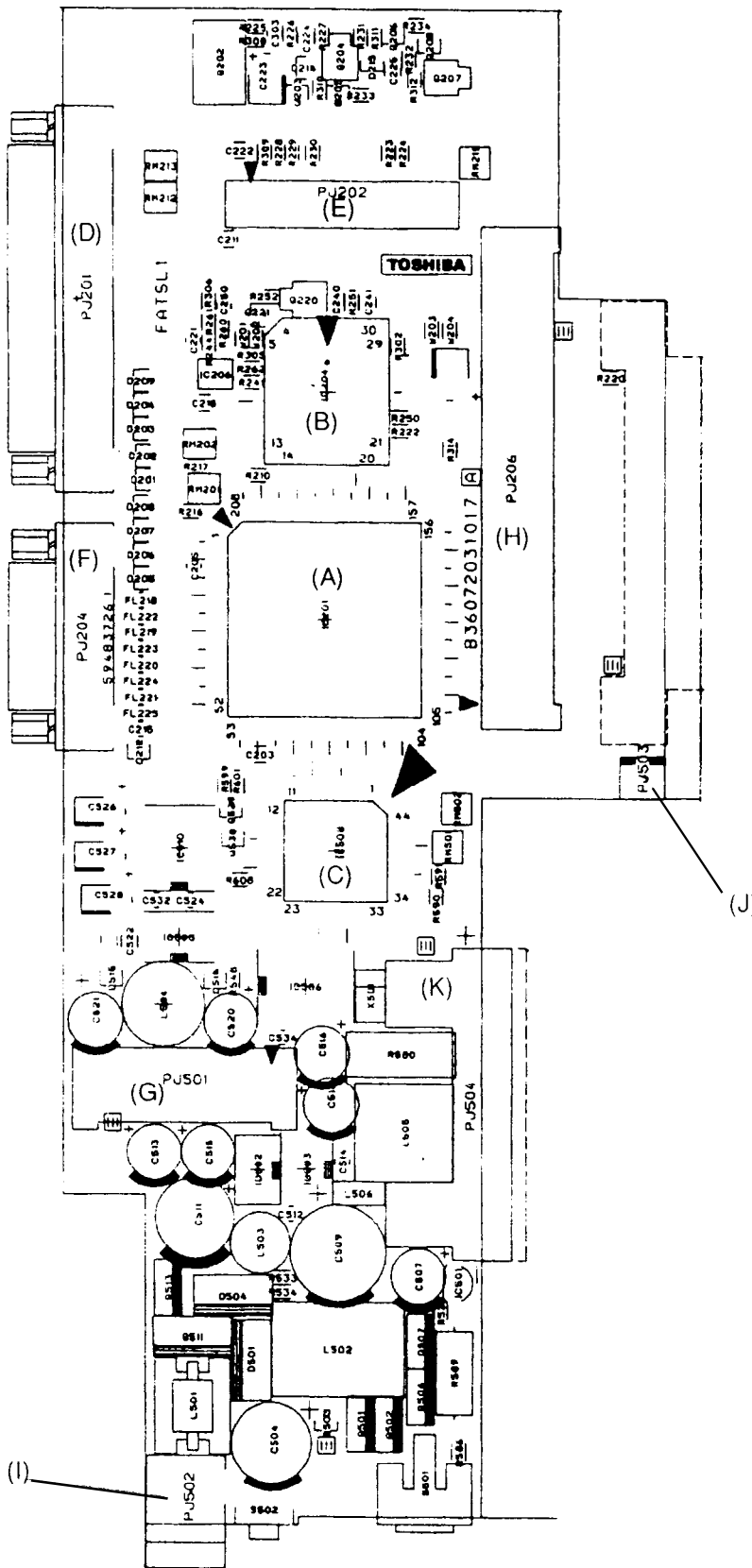


Figure B-3 FATSL* Lower System Board (front)

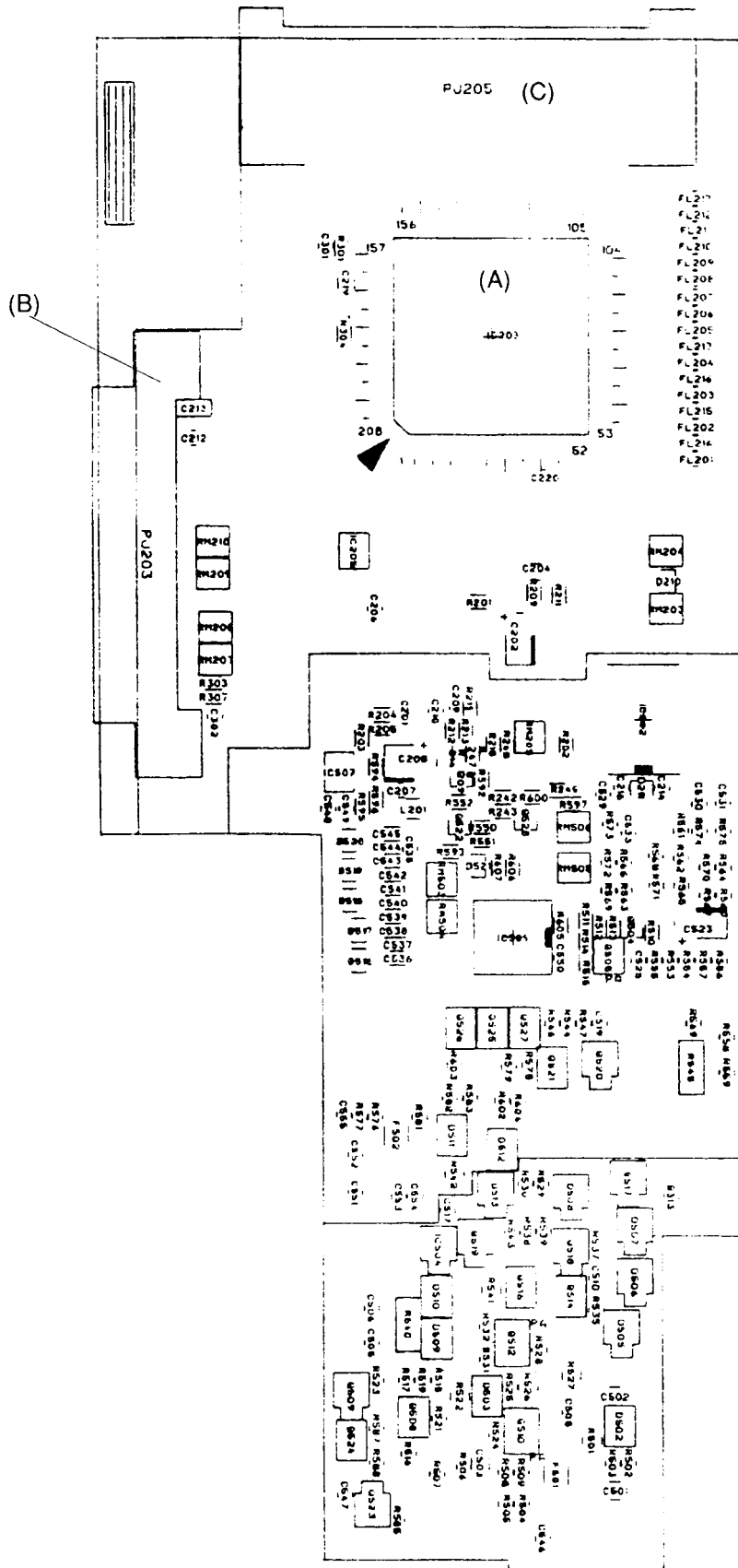


Figure B-4 FATSL* Lower System Board (back)

Table B-3 FATSL Lower System Board ICs and Connectors (front)*

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

Table B-4 FATSL Lower System Board ICs and Connectors (back)*

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

Appendix C Pin Assignments

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

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

Pin	Signal	I/O	Pin	Signal	I/O
01	GND	–	45	GND	–
02	D00;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	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	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	–

C.2 PJ2 RTC Connector (3-Pin)

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

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

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

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

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

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

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

Pin	Signal	I/O	Pin	Signal	I/O
01	KBOT00;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.5 PJ5 (PJ501) Power Supply Interface Connector (40-Pin)

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

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

C.6 PJ7 LCD Connector 1 (20-Pin)

Table C-6 LCD Connector 1 Pin Assignments (20-pin)

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

C.7 PJ8 LCD Connector 2 (10-Pin)

Table C-7 LCD Connector 2 Pin Assignments (10-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	SCLD09;100	O	06	SCLD10;110	O
02	SCLD11;110	O	07	SCLD13;110	O
03	SCLD15;110	O	08	SCLD14;110	O
04	SCLD08;110	O	09	GND	–
05	SCLD12;110	O	10	GND	–

C.8 PJ9 CRT I/F Connector (15-Pin)

Table C-8 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.9 PJ10 (PJ206) Joint Connector (100-Pin)

Table C-9 CRT I/F Connector Pin Assignments (100-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	GND	–	51	SA11;100	I/O
02	\$24MHZ;100	O (I)	52	SA10;100	I/O
03	GND	–	53	SA09;100	I/O
04	GND	–	54	SA08;100	I/O
05	SD00;100	I/O	55	SA07;100	I/O
06	SD01;100	I/O	56	SA00;100	I/O
07	SD02;100	I/O	57	SA01;100	I/O
08	SD03;100	I/O	58	SA02;100	I/O
09	SD04;100	I/O	59	SA03;100	I/O
10	SD10;100	I/O	60	SA04;100	I/O
11	SD11;100	I/O	61	SA05;100	I/O
12	SD12;100	I/O	62	SA06;100	I/O
13	REFRSH;000	I/O	63	GND	–
14	\$14R7M;100	O (I)	64	GND	–
15	\$14R3M;100	O (I)	65	GND	–
16	IOCLK;100	O	66	GND	–
17	RESET;000	O (I)	67	SD08;100	I/O
18	SPKDRV;000	O (I)	68	SD09;100	I/O
19	HLDACK;101	O (I)	69	SD10;100	I/O
20	HREQ;100	I (O)	70	SD11;100	I/O
21	IOWR;000	I/O	71	SD12;100	I/O
22	IORD;000	I/O	72	SD13;100	I/O
23	DMACLK;100	O (I)	73	SD14;100	I/O
24	DMARDY;100	O (I)	74	SD15;100	I/O
25	SMER;000	O (I)	75	LA20;100	I/O
26	SMEW;000	O (I)	76	LA21;100	I/O
27	DMAWR;000	I (O)	77	LA22;100	I/O
28	DMARD;000	I (O)	78	LA23;100	I/O
29	AEN;100	I (O)	79	MEWR;000	I/O
30	DACK2;000	I (O)	80	MERD;000	I/O
31	DMAEN8;100	I (O)	81	BALE;100	O (I)
32	ENPNBP;000	I/O	82	SBHE;000	I/O
33	IRQ8;100	O (I)	83	BPRFS;100	I (O)
34	TMOUT1;100	I (O)	84	CK32K;100	O (I)
35	TIMGT2;100	O (I)	85	ROMCS;000	O (I)
36	TMOUT2;100	O (I)	86	IMCS16;100	I (O)
37	IRQ1;100	O (I)	87	IIO16;000	I (O)
38	INTR;100	I (O)	88	IIRDY;100	I (O)
39	INTA;000	O (I)	89	ZROW;000	I (O)
40	DRVSL;000	I (O)	90	SMI;000	I (O)
41	IRQ12;100	O (I)	91	SUSST;000	O (I)
42	CPHLDA;100	O (I)	92	STBY;000	I (O)
43	SA19;100	I (O)	93	RSTVCP;100	O (I)
44	SA18;100	I (O)	94	PWRON;100	I (O)
45	SA17;100	I (O)	95	RSTVGA;000	I (O)
46	SA16;100	I/O	96	GND	–
47	SA15;100	I/O	97	GND	–
48	SA14;100	I/O	98	GND	–
49	SA13;100	I/O	99	GND	–
50	SA12;100	I/O	100	GND	–

C.10 PJ11 Display Sensor Switch Connector (2-Pin)

Table C-10 Display Sensor Switch Connector Pin Assignments (2-pin)

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

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

Table C-11 PRT/FDD Connector (for printer) Pin Assignments (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.12 PJ201 PRT/FDD (Ext) Connector (for FDD) (25-Pin)

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

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

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

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

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

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

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

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

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

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

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

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

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

Pin	Signal	I/O	Pin	Signal	I/O
01	GND	–	35	GND	–
02	CDA03;100	I/O	36	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.17 PJ502 DC IN Connector (3-Pin)*Table C-17 DC IN Connector Pin Assignments (3-pin)*

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

C.18 PJ503 Backup Battery Connector (2-Pin)*Table C-18 Backup Battery Connector Pin Assignments (2-pin)*

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

C.19 PJ504 Main Battery Connector (5-Pin)*Table C-19 Main Battery Pin Assignments (5-pin)*

Pin	Signal	I/O	Pin	Signal	I/O
01	BATT	–	04	GND	–
02	CBTH	–	05	GND	–
03	N.C.	–			

Appendix D USA Display Codes

Table D-1 USA Display Codes

HEXA-DECIMAL VALUE	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	BLANK (NULL)	▶	BLANK (SPACE)	0	@	P	•	p	Ç	É	á	||||	L	⊥	α	ε
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	f
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	ö	⊥	⊥	⊥	γ	≈
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

Appendix E Keyboard Scan/Character Codes

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

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

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

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

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

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

Notes:

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

Table E-2 Scan Codes with Left Shift Key

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

NOTE: The table above shows scan codes with the **Left Shift** key. In combination with the **Right Shift** key, scan codes are changed as listed below.

	With Left Shift	With Right Shift
Set 1	E0 AA -----	E0 B6
	E0 2A -----	E0 36
Set 2	E0 F0 12-----	E0 F0 59
	E0 12-----	E0 59

Table E-3 Scan Codes in Numlock Mode

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

Table E-4 Scan Codes with Fn Key

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

Table E-5 Scan Codes in Overlay Mode

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

Table E-6 Scan Codes with Ctrl Key

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

Table E-7 Scan Codes with Alt Key

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

* This key generates only Make codes.

Appendix F Keyboard Layouts

F.1 United States (US) Keyboard

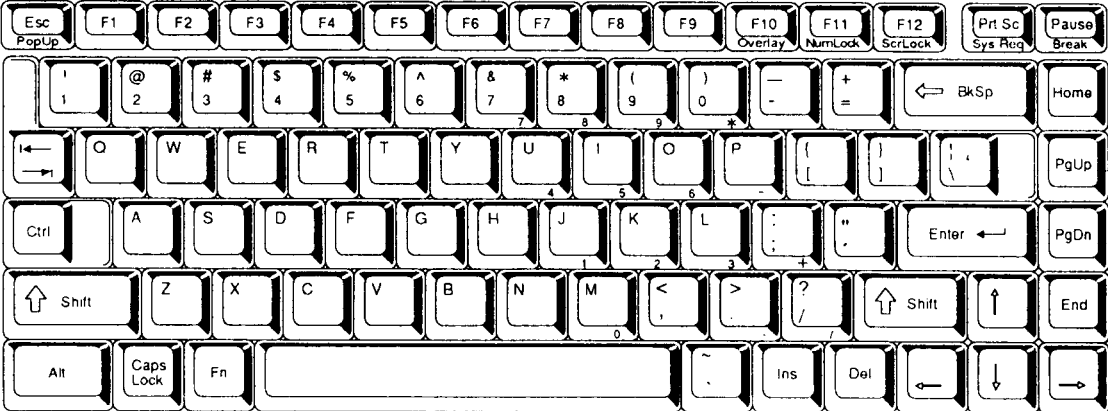


Figure F-1 US Keyboard

F.2 United Kingdom (UK) Keyboard

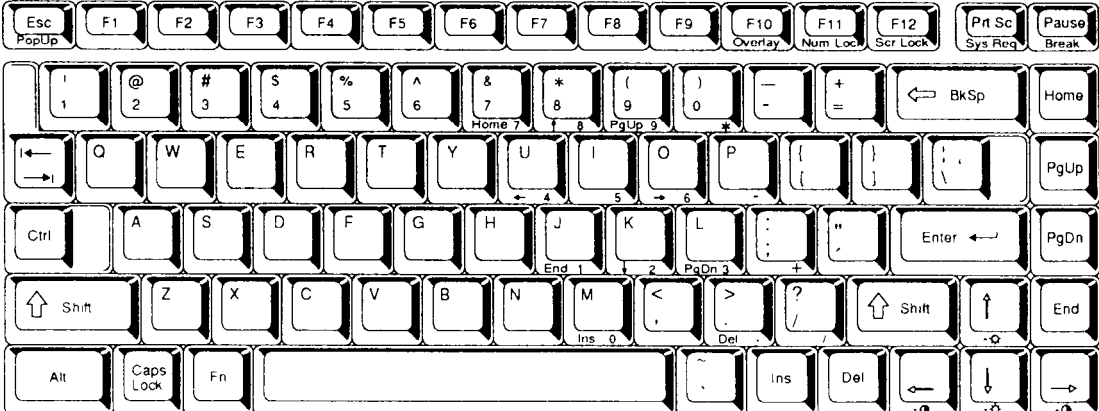


Figure F-2 UK Keyboard

F.3 German (GR) Keyboard

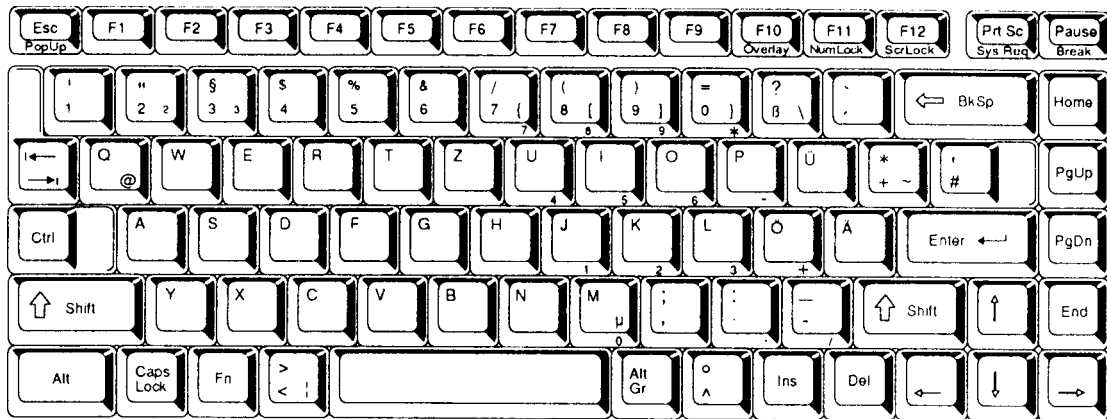


Figure F-3 GR Keyboard

F.4 French (FR) Keyboard

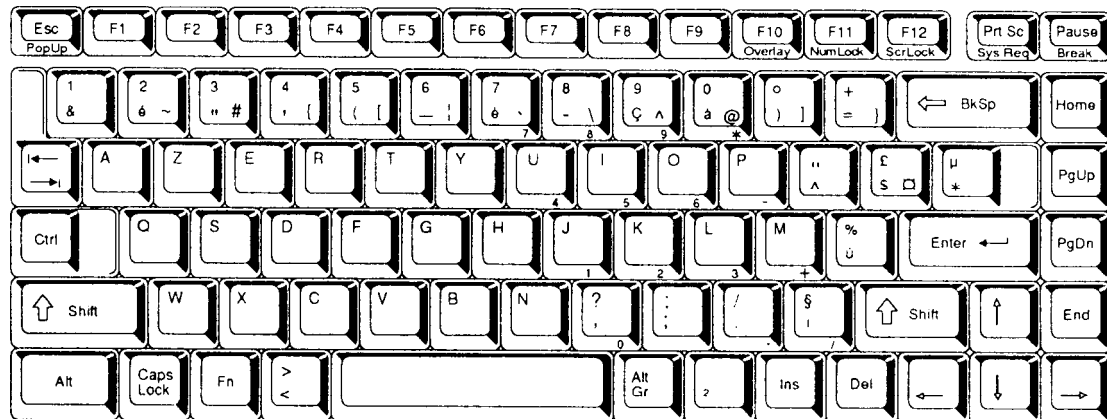


Figure F-4 FR Keyboard

F.5 Spanish (SP) Keyboard

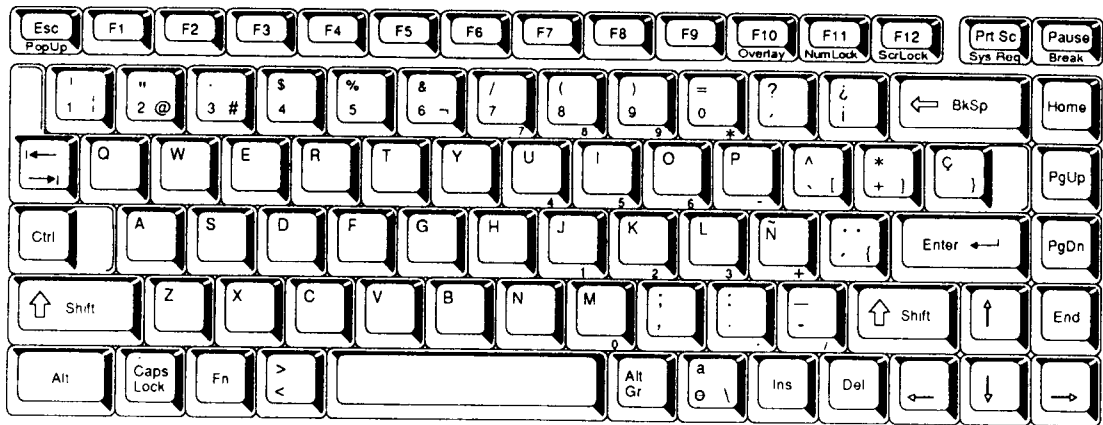


Figure F-5 SP Keyboard

F.6 Italian (IT) Keyboard

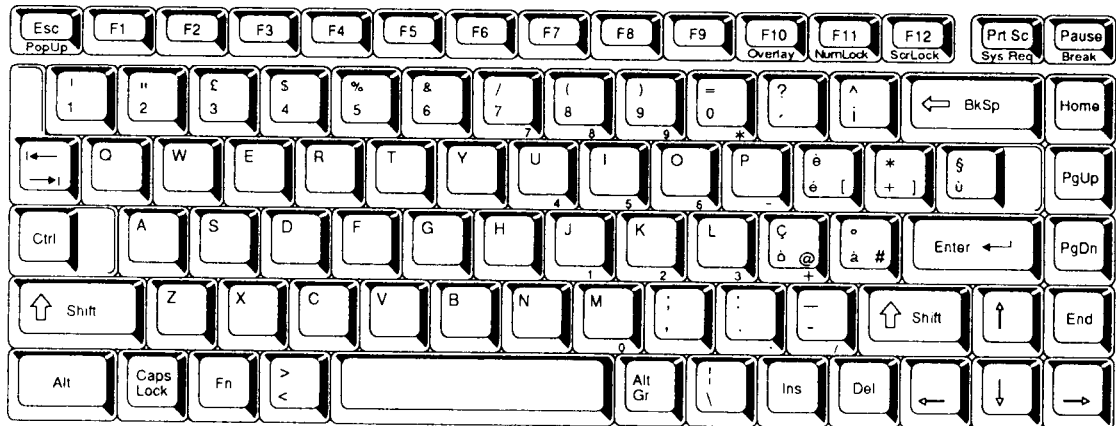


Figure F-6 IT Keyboard

F.7 Scandinavian (SC) Keyboard

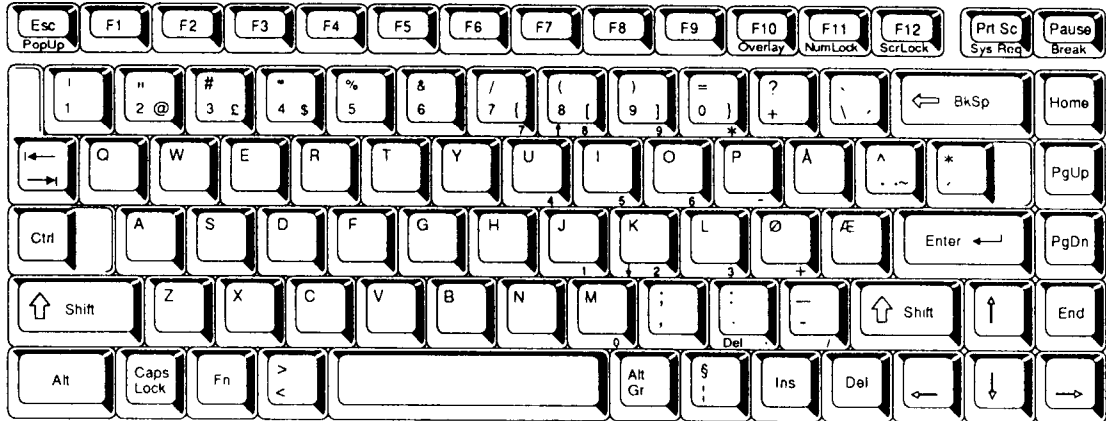


Figure F-7 SC Keyboard

F.8 Swiss-German (SL) Keyboard

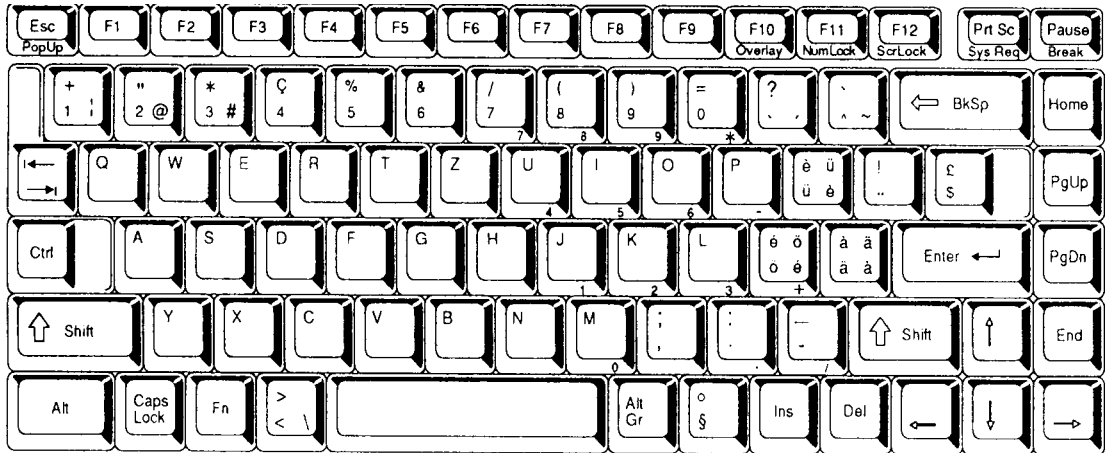


Figure F-8 SL Keyboard

F.9 Canadian (Specialized) Keyboard

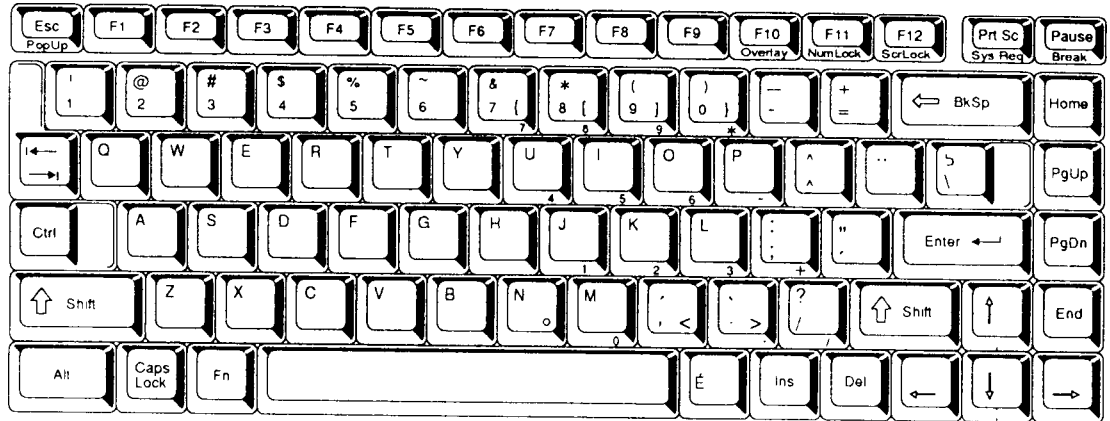


Figure F-9 Canadian Keyboard

F.10 Keycap Number Keyboard

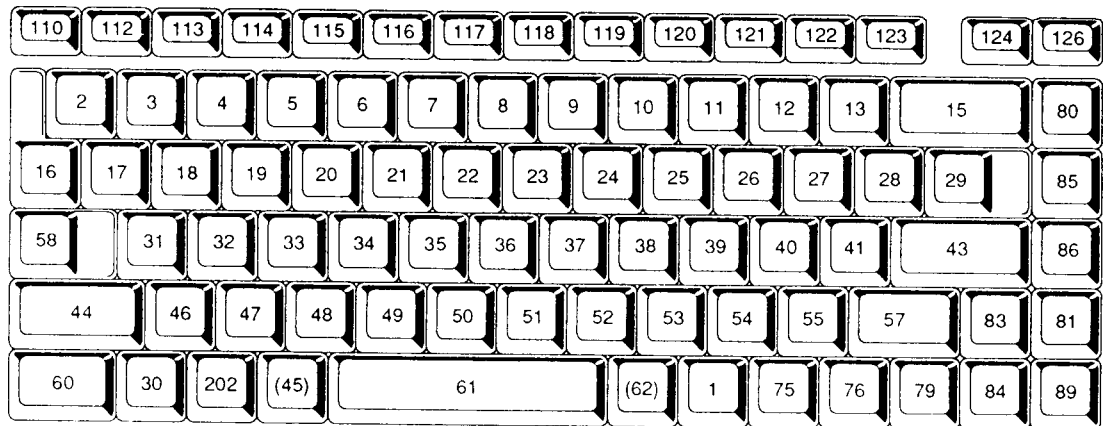


Figure F-10 Keycap Number Keyboard

Appendix G Wiring Diagrams

G.1 Printer Wraparound Connector

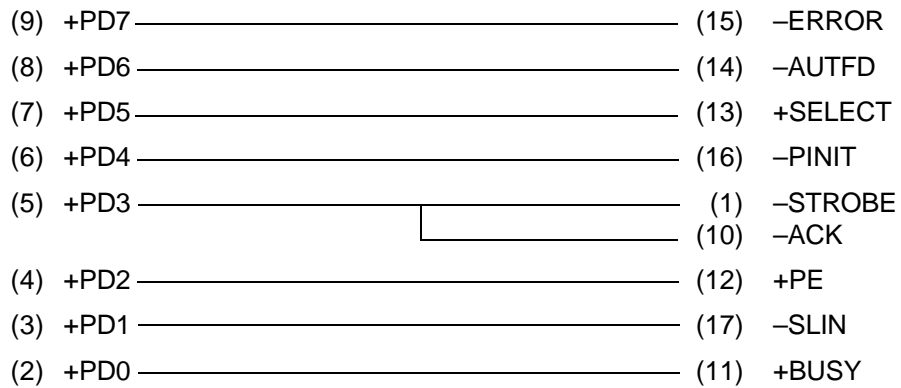


Figure G-1 Printer Wraparound Connector

G.2 RS-232-C Wraparound Connector

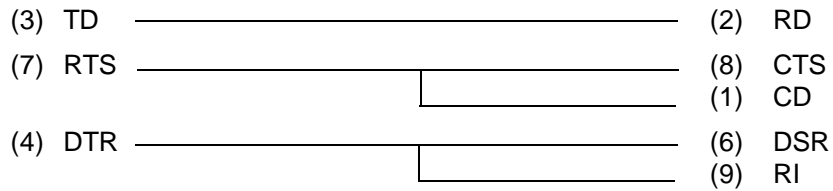


Figure G-2 RS-232-C Wraparound Connector

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

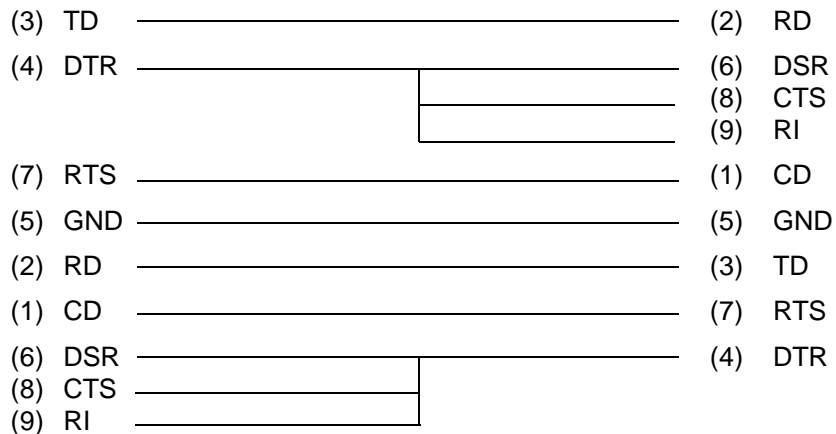


Figure G-3 RS-232-C Direct Cable (9-pin to 9-pin)

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

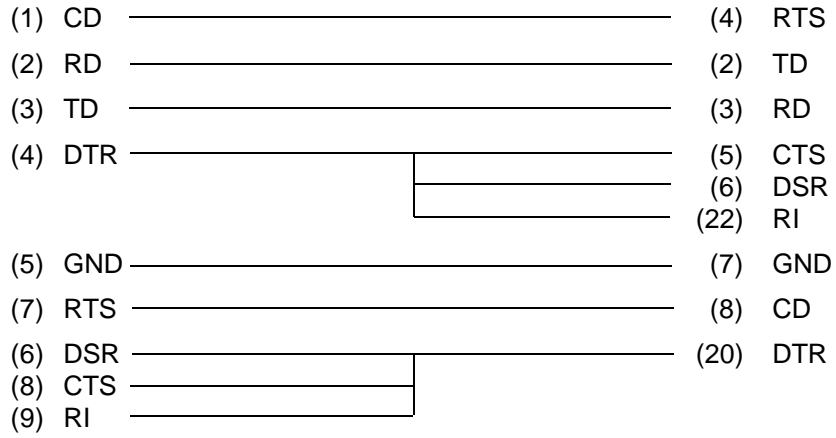


Figure G-4 RS-232-C Direct Cable (9-pin to 25-pin)