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# **Chapter 1**

## **Hardware Overview**

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# Contents

1.1	T1800 Features .....	1-5
1.2	The System Unit Block Diagram .....	1-7
1.3	The 3.5-inch Floppy Disk Drive .....	1-9
1.4	The 2.5-inch Hard Disk Drive .....	1-10
1.5	The Keyboard .....	1-11
1.6	The Sidelit Liquid Crystal Display .....	1-12
1.6.1	LCD Module .....	1-12
1.6.2	FL Inverter Board .....	1-13
1.7	Power Supply Board .....	1-14

## Tables

Table 1-1	3.5-inch FDD specifications .....	1-9
Table 1-2	2.5-inch HDD specifications .....	1-10
Table 1-3	Sidelit LCD specifications .....	1-12
Table 1-4	FL Inverter specifications .....	1-13
Table 1-5	Power Supply Board output rating .....	1-14

## Figures

Figure 1-1	T1800 personal computer .....	1-6
Figure 1-2	System unit configuration .....	1-6
Figure 1-3	Block diagram .....	1-7
Figure 1-4	3.5-inch FDD .....	1-9
Figure 1-5	2.5-inch HDD .....	1-10
Figure 1-6	Keyboard .....	1-11
Figure 1-7	Sidelit LCD .....	1-12
Figure 1-8	FL Inverter Board .....	1-13
Figure 1-9	Power Supply Board .....	1-14



## 1.1 T1800 Features

The Toshiba T1800 is one of the lightest and most advanced portable computers available. Utilizing advanced technology and high speed components, the T1800 offers excellent display legibility, battery operation and IBM PC/AT compatibility.

The T1800 system unit consists of the following features:

- ❑ An 80386SX-20 32-bit microprocessor, operating at 20 MHz or 10 MHz.
- ❑ Standard Random Access Memory (RAM) capacity is 2MB. Optional 2, 4 or 8 MB expansion cards can be installed, thus expanding RAM memory to a maximum of 10 MB.
- ❑ An optional 80387SX-20 Numeric Data Processor (NDP) can be installed in the built-in socket located on the bottom of the T1800.
- ❑ A high resolution, fully adjustable Liquid Crystal Display (LCD) is composed of 640 horizontal and 480 vertical pixels and displays 25 lines of standard text 80 characters wide. The LCD displays 64 levels of gray (at a resolution of 320x200) and supports the VGA functions.
- ❑ The 3.5-inch internal Floppy Disk Drive (FDD) supports both 1.44 MB Double-sided, High-density, Double-track (2HD) and 720 KB Double-sided, Double-density, Double-track (2DD) floppy disk.
- ❑ The integrated 2.5-inch 40 or 60 MB Hard Disk Drive (HDD) provides nonvolatile storage for software and data.
- ❑ An 82/84-key keyboard has full-sized keys, a numeric key pad overlay, cursor and page control. The keyboard supports software that uses the industry standard 101/102-key keyboard.
- ❑ The universal auto-sensing AC adapter supplies power to operate the T1800 and recharges its batteries. It can operate from a range of 100 to 240 volts. Optional power cords support various countries' AC outlet configurations.
- ❑ A PS/2 mouse connector is located on the right side of the T1800.
- ❑ Serial devices can be connected to the T1800's standard 9-pin, RS-232-C serial port.
- ❑ One selectable Centronics-compatible parallel port connects the T1800 to optional parallel devices.
- ❑ The Toshiba AutoResume feature stores the T1800's data in backup RAM and configuration when the power is turned off.
- ❑ The Real Time Clock (RTC) IC chip and battery continuously update the data and time and keep the system configuration even when the T1800 power is off.
- ❑ The T1800 has a ten key pad interface connector that can be connected to an external ten key pad.

The T1800 Personal Computer is shown in Figure 1-1. The system configuration is shown in Figure 1-2.

*Figure 1-1 T1800 personal computer*

*Figure 1-2 System unit configuration*

## 1.2 The System Unit Block Diagram

Figure 1-3 is a block diagram of T1800 system unit.

*Figure 1-3 Block diagram*

The T1800 system board diagrammed in Figure 1-3 is composed of the following major components:

- ❑ 80386SX-20 CPU
- ❑ Socket for an optional 80387SX-20 Numeric Data Processor (NDP)
- ❑ Memories
  - Standard RAM: 2 MB
  - BIOS ROM: 128 KB (96 KB are used)  
This ROM contains the Initial Reliability Test (IRT), the Basic Input/Output System (BIOS), and video BIOS.
  - Backup RAM: 32 KB
  - Video RAM: 256 KB
  - Optional memory cards expand memory to a maximum of 10 MB.
- ❑ Super integration (SI) T9901 chip contains the following components:
  - Two Direct Memory Access Controllers (DMACs): 82C37A
  - Two Programmable Interrupt Controllers (PICs): 82C59A
  - One Programmable Interval Timer (PIT): 82C54
  - One Serial Input/Output controller (SIO): TC8570
  - One Floppy Disk Controller (FDC): TC8565
  - One Variable Frequency Oscillator (VFO): TC8568
  - One Input/Output Controller
  - One Input/Output Driver
- ❑ System Controller Gate Array
  - This gate array has following circuits:
    - Memory controller
    - Bus controller
    - Bus driver
    - Address decoder
- ❑ The following Oscillators (OSC):
  - 40.0 MHz OSC (X1) is used for the CPU.
  - 14.7456 MHz OSC (X5) is used for the COM.
  - 14.31818 MHz OSC (X2) is used for the KBC.
  - 24 MHz OSC (X6) is used for the FDC and VFO.
  - 32.768 KHz OSC (X7) is used for the RTC.
  - 28.322 MHz OSC (X3), and 25.175 MHz OSC (X4) are used for the video.
- ❑ One keyboard Controller (KBC): M37452M4
- ❑ One Real Time Clock (RTC): MC146818AF
- ❑ VGA controller

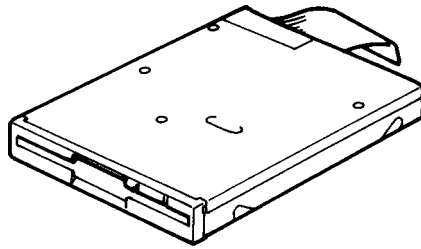
This VGA controller includes the Digital Analog Controller (DAC).



### 1.3 The 3.5-inch Floppy Disk Drive

The T1800 3.5-inch Floppy Disk Drive (FDD) is a thin, high performance, reliable drive that supports 720KB (formatted ) 2DD and 1.44 MB (formatted) 3.5 inch floppy disk.

The T1800 FDD is shown in Figure 1-4. Specifications for the FDD are described in Table 1-1.



*Figure 1-4 3.5-inch FDD*

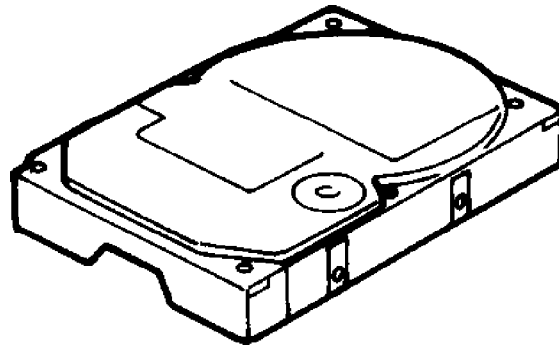
*Table 1-1 3.5-inch FDD specifications*

<b>Item</b>	<b>2-MB mode</b>	<b>1-MB mode</b>
Storage capacity (KB)		
Unformatted	2,000	1,000
Formatted	1,474	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 The 2.5-inch Hard Disk Drive

The T1800's 40MB or 60MB (formatted) Hard Disk Drive (HDD) are a random access nonvolatile storage device. They have a non-removal 2.5-inch magnetic disk and mini-winchester type magnetic heads.

The T1800 HDD is shown in Figure 1-5. Specifications for the HDD are described in Table 1-2.



*Figure 1-5 2.5-inch HDD*

*Table 1-2 2.5-inch HDD specifications*

Item	40 MB	60MB
	MK1122FC	CP-2064
Storage Capacity (MB) Formatted	43.0	64.0
Number of disks	1	2
Data heads	2	4
Data surfaces	2	4
Track per surface	615	823
Sectors per track	43 (+1)	38 (+1)
Bytes per sector	512	512
Access time (ms)		
Track to track	5	5
Average	23	19
Maximum	40	40
Rotation speed (rpm)	3,200	3,486
Data transfer rate (bps) To/from buffer	5.0 M	4.5 M
Interleave	1:1	1:1
Recording method	1-7 RLL	2-7 RLL/1-7 RLL

## 1.5 The Keyboard

The 82-Key (USA) or 84-Key (European) keyboard is mounted on the T1800's system unit. The keyboard is connected to the keyboard controller on the system board through 19-pin flat cables. The keyboard is shown in Figure 1-6.

See Appendix E for optional keyboard configurations.

*Figure 1-6 Keyboard*

## 1.6 The Sidelit Liquid Crystal Display

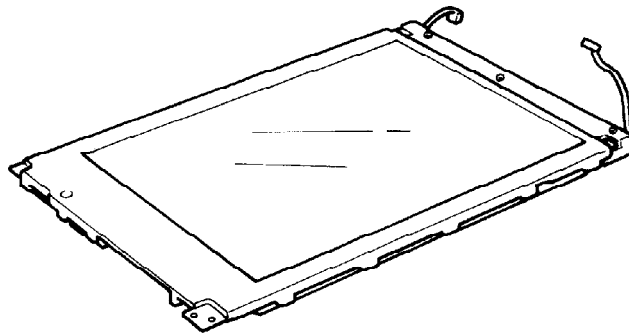
The Sidelit Liquid Crystal Display (LCD) contains a LCD module, a Fluorescent Lamp (FL), and a FL inverter board.

### 1.6.1 LCD Module

The T1800 Sidelit LCD supports 640x480 pixels with Video Graphics Array (VGA) and a 64-level gray (at a resolution of 320x200).

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

The sidelit LCD is shown in Figure 1-7. Specifications for the LCD are described in Table 1-3.



*Figure 1-7 Sidelit LCD*

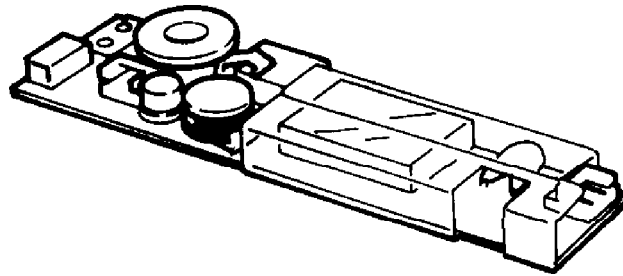
*Table 1-3 Sidelit LCD specifications*

Item		Specifications
Number of dots	(dots)	640 x 480
Dot dimension	(mm)	0.27(W) x 0.27(H)
Dot pitch	(mm)	0.30(W) x 0.30(H)
Display area	(mm)	196.0(W) x 147.6(H)
Contrast		17:1
FL current	(mA)	5.0 (Fix)
FL frequency	(KHz)	40

## 1.6.2 FL Inverter Board

The Fluorescent Lamp (FL) Inverter Board supplies high frequency current needed to illuminate the LCD's fluorescent lamp.

The FL inverter board is shown in Figure 1-8 and the specifications for FL Inverter are described in Table 1-4.



*Figure 1-8 FL Inverter board*

*Table 1-4 FL inverter specifications*

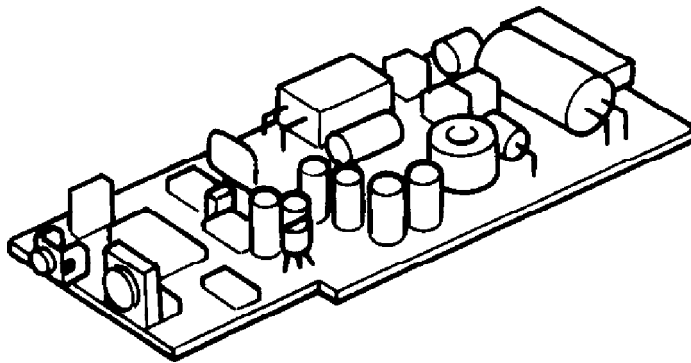
Item			Specifications
Input	Voltage	(V)	5 (DC)
	Power	(W)	1.7
Output	Voltage	(V)	950 (rms)
	Current	(mA)	5.0 (rms)
	Frequency	(KHz)	40 kHz

## 1.7 Power Supply Board

The power supply board supplies four voltages to the T1800 system board. The T1800 power supply board has one microprocessor and it operates at 500 KHz.

The power supply board 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 panel 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.



*Figure 1-9 Power supply board*

*Table 1-5 Power supply board output rating*

Items		DC voltage (V)	Regulation tolerance (%)	Maximum current (mA)
System logic, HDC, HDD FDD, Sidelit LCD	(VCC)	+5	±5	2,700
Backup RAM	(RAMV)	+4.7	±5	400
RS-232-C	(VDD)	+12	±5	25
RS-232-C	(VEE)	-9	±15	60

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# **Chapter 2**

## **Troubleshooting Procedures**

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# Contents

2.1	T1800 Troubleshooting .....	2-5
2.2	Troubleshooting Flowchart .....	2-6
2.3	Power Supply Board Troubleshooting Procedures .....	2-8
2.4	System Board Troubleshooting Procedures .....	2-10
2.5	Floppy Disk Drive Troubleshooting Procedures .....	2-16
2.6	Hard Disk Drive Troubleshooting Procedures .....	2-19
2.7	Keyboard Troubleshooting Procedures .....	2-23
2.8	Display Troubleshooting Procedures .....	2-24

## Tables

Table 2-1	Printer port LED error status .....	2-13
Table 2-2	Floppy disk drive error code and status .....	2-17
Table 2-3	Hard disk drive error code and status .....	2-22

## Figures

Figure 2-1	Troubleshooting flowchart .....	2-6
Figure 2-2	Printer port LED .....	2-12



## 2.1 T1800 Troubleshooting

This chapter describes how to determine if a Field Replaceable Unit (FRU) in the T1800 is causing the computer to malfunction. The FRUs covered are:

- Power supply board
- System board
- Floppy Disk Drive
- Hard Disk Drive
- Keyboard
- Display

The following tools are required to perform the T1800 troubleshooting procedures.

1. T1800 Diagnostics Disk
2. Phillips head screwdriver (2 mm)
3. Toshiba MS-DOS system disk
4. 2DD or 2HD formatted work disk for floppy disk drive testing
5. Cleaning disk kit for the 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 to determine which FRU testing procedures to execute. Before performing the flowchart steps, verify the following:

- Verify with the customer that Toshiba MS-DOS is located on the computer. Other non-Toshiba operating systems will cause the computer to malfunction.
- Make sure all optional equipment is disconnected from the computer.
- Make sure the floppy disk is empty.

***NOTE:*** *If you forget the password and cannot start up the computer, connect the printer port wraparound board (F31PRT), then turn the POWER switch on. The computer will override the password function by erasing the current password.*

*Figure 2-1 Troubleshooting flowchart (continued)*

If the diagnostics program does not detect any errors, the problem may be an intermittent one. Execute the running test program several times to isolate the problem.

After confirming which diagnostic test detected an error by checking the Log Utilities function, 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 Board Troubleshooting Procedures

The T1800's power supply board controls many functions and components in the T1800. To determine if the power supply board is functioning properly, Start with the other procedures as instructed.

Procedures 1: **Battery** and **DC IN** Indicator Function Check

Procedures 2: Power Supply Board Connection Check

### Procedure 1: **Battery** and **DC IN** Indicator Function Check

The T1800's AC adapter converts AC power to DC Power and contains a charging circuit which charges T1800's batteries. The adapter connects to the DC IN socket connector on the back of the computer. When the AC adapter is connected to the T1800 and the power is turned off, the AC adapter charges the batteries.

The **Battery** indicator displays the charge status of the battery pack. The **DC IN** indicator displays whether or not the AC adapter is connected and supplying power. The Battery indicator glows orange when the AC adapter is charging the battery pack.

If the **DC IN** indicator does not light, the AC adapter is not supplying power to the T1800 or the AC adapter is not attached to the T1800.

When the **DC IN** indicator is orange, the AC adapter is connected and supplying power to the T1800.

If the **DC IN** indicator is flashing orange, the AC adapter's voltage supply is abnormal or the power supply is not functioning properly.

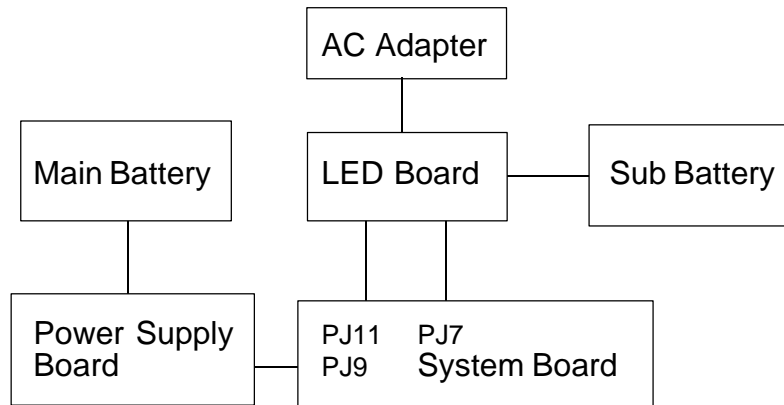
If any of the above indicator conditions are abnormal, make sure the LED indicator lights are not burned out before performing the following check.

- Check 1 Make sure the AC adapter's cable is firmly plugged into the DC IN socket on the back of the computer.
- Check 2 If the **DC IN** indicator is still flashing orange when connects the AC adapter currently, its voltage output is abnormal. Connect a new AC adapter and turn the T1800 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 T1800 in an environment between -20°C and 70°C until the T1800 is at the ambient temperature. Repeat the steps which caused the T1800 to operate abnormally. If the same problem still appears, perform Procedure 2.

## Procedure 2: Power Supply Board Connection Check

The power supply board is connected to other components by various cables. These cable connectors can become disconnected from the power supply board, thus causing the T1800 to malfunction. To check these connections, it is necessary to disassemble the T1800. Refer to Chapter 4, *Replacement Procedures*, for more information about how to disassemble the T1800. Then perform Check 1.

- Check 1 The following cable connect the power supply board to other components. Make sure these connections are secure and that none of the cable are pinched or damaged.



If any of these connections are loose, firmly secure them. Replace any broken or damaged cables. Execute the procedures that were causing the T1800 to malfunction. If the computer still does not function properly, perform Check 2.

- Check 2 Replace the power supply board with a new one and restart the system. If the problem still exists, perform Check 3.
- Check 3 Replace the system board with a new one. If the problem still exists, other units may be damaged.

## 2.4 System Board Troubleshooting Procedures

To determine if the system board is defective or not functioning properly, perform the following procedures beginning with Procedure 1 and continue with the other procedures as instructed.

Procedure 1: Message Check

Procedure 2: Printer Port LED Check

Procedure 3: Diagnostic Test Program Execution Check

### Procedure 1: Message Check

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

**NOTE:** To run the T1800's IRT test, press the space bar and turn on the computer.

If an error message is displayed, perform Check 1. If not, go to Procedure 2. If MS-DOS is properly loaded, go to Procedure 3.

Check 1 If the following error message is displayed on the screen for one second, the external FDD is not connected, even though the external FDD/PRT option in the SETUP program is set to FDD A. Set the external FDD/PRT option to FDD B or PRT, or connect the external FDD and restart the system. If any other error message appears, execute Check 2.

\*\*\* FDD A is not installed \*\*\*

Check 2 If one of the following error messages is displayed on the screen, press any key as the message instructs. These error occurs when the system configuration preserved in the RTC memory (CMOS type memory) is not the same as the actual one or the data is lost.

If you press any 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 3.

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



Check 3 If the following (a) or (b) error message is displayed on the screen, press any key as the message instructs.

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

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

If any other message appears, perform Check 4.

(a) WARNING: RESUME FAILURE.  
PRESS ANY KEY TO CONTINUE.

(b) WARNING: DATA IN HARD-RAM WAS LOST.  
YOU MUST FORMAT HARD-RAM BEFORE USE.  
PRESS ANY KEY TO CONTINUE.

Check 4 The IRT tests the system board when the IRT detects the error, the system stops or the error message appears.

If one of the following (1) through (17), (19), (20), (25) or (26) error message is displayed, replace the system board.

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

If the (21) or (22) error message 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.

If none of these error message appears, go to Procedure 2.

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

## Procedure 2: Printer Port LED Check

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

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

*Figure 2-2 Printer port LED*

To use the printer port LED follow these steps:

**NOTE:** To run the T1800's IRT Test, press the space bar and turn on the computer.

1. Turn off the T1800's power.
2. Plug the printer port LED into the T1800's printer/FDD connector.
3. Press the space bar, then turn on the T1800's power.
4. Read the LED status from left to right as you are facing the back of the computer.
5. Convert the status from binary to hexadecimal notation.
6. If the final LED status is FFh (normal status), go to Procedure 3.
7. If the final LED status matches any of the test status values in table 2-1, perform Check 1.

**NOTE:** ~~If an error condition is detected by the IRT test, the printer port LED displays an error code after the IRT test finishes. For example, when the printer port LED displays 22 and halts, the IRT test has already completed the KBC test. In this instance, the IRT indicates an error with the system memory test.~~

Table 2-1 Printer port LED 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
15H	CMOS RAM test	****Error in CMOS. Bad battery**** ****Error in CMOS. Bad check sum**** ****Error in CMOS. Bad configuration**** ****Error in CMOS. Bad memory size**** ****Error in CMOS. Bad HDD type**** ****Error in CMOS. Bad time function**** Check system. Then press [F1] key
18H	PIC initialization	—
1FH	Display initialization	CRTC ERROR
		VRAM ERROR READ DATA = XXXXXXXXXH WRITE DATA = XXXXXXXXXH
22H	KBC test	KBC ERROR
25H	System memory test	SYSTEM MEMORY ERROR ADDRESS = XXXXXXXXXH READ DATA = XXXXXXXXXH WRITE DATA = XXXXXXXXXH
		SYSTEM MEMORY PARITY ERROR ADDRESS = XXXX0000H - XXXXFFFFH
30H	Extended memory test	EXTENDED MEMORY ERROR ADDRESS = XXXXXXXXXH READ DATA = XXXXXXXXXH WRITE DATA = XXXXXXXXXH
		EXTENDED MEMORY PARITY ERROR ADDRESS = XXXX0000H - XXXXFFFFH
40H	DMA page register test	DMA PAGE REGISTER ERROR READ DATA = XXH WRITE DATA = XXH
41H	DMAC test READ DATA = XXXXH	DMAC #1 ERROR
	WRITE DA = XXXXH	DMAC #2 ERROR READ DATA = XXXXH WRITE DATA = XXXXH

Table 2-1 Printer port LED error status (2/2)

Error status	Test item	Message
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	-
90H	Timer initialization	TIMER INTERRUPT ERROR RTC UPDATE ERROR
A0H	NDP initialization	-
A6H	Expnsion I/O ROM	-
FFH	Expansion system ROM	-

Check 1 If the following error codes are displayed, replace the system board with a new one.

**01h, 05h, 06h, 0Ah, 0bh, 15h, 16h, 18h, 1Fh, 22h, 25h, 30h, 40h, 41h, 42h, 54h, 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, make sure the mouse cable is connected to the system board. If it is replace the system board with a new one.

Check 4 If error code **60h** is displayed, go to the HDD Troubleshooting Procedures in Section 2.6.

Check 5 If error code **65h** is displayed, go to the FDD Troubleshooting Procedures in Section 2.5.

### **Procedure 3: Diagnostic Test Execution Check**

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

1. System test
2. Memory test
3. Printer test
4. ASYNC test
5. Real timer test
6. NDP test (if the NDP is installed.)

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

## 2.5 Floppy Disk Drive Troubleshooting Procedures

This section describes how to determine if the T1800's internal 3.5" floppy disk drive is functioning properly. Perform the procedures below starting with procedure 1 and continuing with the other procedures as instructed.

Procedure 1: FDD Head Cleaning Check

Procedure 2: External 5-1/4" FDD Check

Procedure 3: Diagnostic Test Program Execution Check

Procedure 4: Connector Check and Replacement Check

### Procedure 1: FDD Head Cleaning Check

The FDD head cleaning is one of the option available in the *Diagnostic Program*. Detailed operation is given in *Chapter 3, Test and Diagnostics*.

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

If the test program cannot be executed, go to Procedure 2.

### Procedure 2: External 5-1/4" Check

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

Check 1 Connect the external 5-1/4" FDD to the printer/FDD port and make sure it functions properly. If it does, perform Check 2. If it doesn't, perform Check 4.

**NOTE:** To use the external 5-1/4" FDD, set the external FDD/PRT option in the *SETUP* program to FDD A or FDD B.

Check 2 Disassemble the system unit and make sure the internal FDD cable is properly connected to PJ4 on the system board. If it is, perform Check 3.

Check 3 Replace the FDD with a new one. If the problem still exists, perform Check 4.

Check 4 Replace the system board with new one.

### Procedure 3: Diagnostic Test Program Execution Check

The Floppy Disk Drive Diagnostic Test program is stored on the T1800 Diagnostics Disk. After loading Toshiba MS-DOS, run the diagnostic program (TESTCE18). Refer to Chapter 3, *Test and Diagnostics*, for more information about the diagnostics test procedures.

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

Table 2-2 Floppy disk drive error code and status

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

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

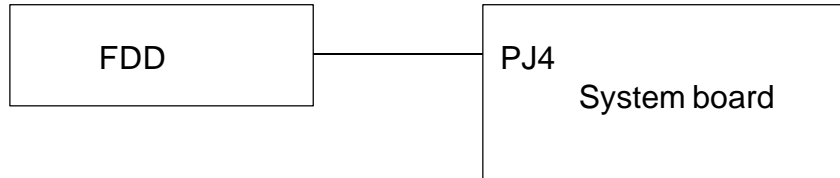
Write protected

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

#### Procedure 4: Connector Check and Replacement Check

The 3.5-inch Floppy Disk Drive is connected to the system unit by the FDD cable. This cable may be disconnected from the system board or damaged. Disassemble the T1800 following the steps described in Chapter 4, *Replacement Procedures* and perform the following checks.

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



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

Check 3      Replace the system board with a new one following the steps in Chapter 4, *Replacement Procedures*.



## 2.6 Hard Disk Drive Troubleshooting Procedures

To determine if the hard disk drive is functioning properly, perform the procedures below starting with Procedure 1. Continue with the other procedures as instructed.

Procedure 1: Partition Check

Procedure 2: Message Check

Procedure 3: Format Check

Procedure 4: Diagnostic Test Program Execution Check

**CAUTION:** *The contents of the hard disk will be erased when the HDD troubleshooting procedures are executed. Transfer the contents of the hard disk to a floppy disk(s) using the Toshiba MS-DOS BACKUP command. Refer to the Toshiba MS-DOS manual for more information about how to perform the BACKUP command.*

### Procedure 1: Partition Check

Insert the Toshiba MS-DOS system disk and turn on the computer. Then perform the following checks.

- Check 1 Type **C:** and press **Enter**. If you cannot change to drive C, go to Check 2. If you can change to drive C, go to Procedure 2.
- Check 2 Type **FDISK** and press **Enter**. Choose Display Partition Information from the FDISK menu. If drive C is listed, go to Check 3. If drive C is not listed, return to the FDISK menu and choose to create a DOS partition on drive C. Then re-check 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 to set the active partition for drive C. Then re-check the system. If the problem still exists, go to Procedure 2.

## Procedure 2: Message Check

When the T1800's HDD is not function properly, some of the following error messages may appear on the display. Start with Check 1 below and perform the other checks as instructed.

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

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

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

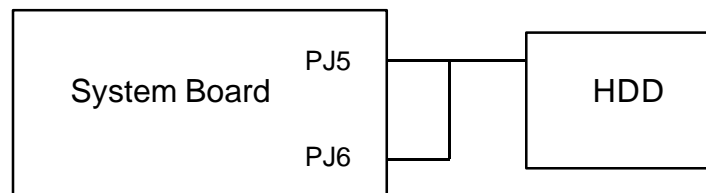
Insert system disk in drive  
Press any key when ready . . . . .  
or  
Non-System disk or disk error  
Replace and press any key when ready.

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 T1800. If the error message still appears, perform Check 4.

System transferred

Check 4 The HDD is connected to the system board through an HDD flexible cable. This cable can become disconnected or damaged. Disassemble the T1800 as described in *Chapter 4, Replacement Procedures*. If the HDD is not connected, connect it to the system board and return to Procedure 1. If the HDD is firmly connected to the system board, perform Procedure 3.



### Procedure 3: Format Check

The T1800'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 the **FORMAT C:/S** 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 messages appear on the display, refer to the *Toshiba MS-DOS Manual* for more information about the error message and perform Check 2.

- Check 2 Using the T1800 Diagnostic Disk, format the HDD with a low level format option. Refer to Chapter 3, *Tests and Diagnostics* for more information about the diagnostic program.

If the following message appears on the display, the HDD low level format is complete. Partition and format the HDD using the MS-DOS FORMAT command.

Format complete

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

## Procedure 4: Diagnostic Test Program Execution Check

The HDD test program is stored in the T1800 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 2-3. If an error code is not generated, the HDD is operating properly.

Table 2-3 Hard disk drive error code and status

Code	Status
01h	Bad command
02h	Bad address mark
04h	Record not found
05h	HDC not reset
07h	Drive not initialize
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
CCh	Write fault
E0h	Status error
F0h	Not sense error (HW. code=FF)

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

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

## 2.7 Keyboard Troubleshooting Procedures

To determine if the T1800's keyboard is functioning properly, perform the following procedures. Start with Procedure 1 and continue with the other procedures as instructed.

Procedure 1: Diagnostic Test Program Execution Check

Procedure 2: Connector and Replacement Check

### Procedure 1: Diagnostic Test Program Execution Check

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

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

### Procedure 2: Connector and Replacement Check

The keyboard is connected to the system board by a 19-pin flat cable and modem interface board. This cable may be disconnected or damaged. Disassemble the T1800 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 modem interface board and system board.



If this cable is damaged, replace keyboard with a new one, or firmly connected them if there are disconnected. Perform Procedure 1 again. If the keyboard is still not functioning properly, perform Check 2.

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

## 2.8 Display Troubleshooting Procedure

This section describes how to determine if the T1800's display is functioning properly. Start with Procedure 1 and continue with the other Procedures as instructed.

Procedure 1: Contrast Volume Check

Procedure 2: External CRT Check

Procedure 3: Diagnostic Test Program Execution Check

Procedure 4: Connector Check

Procedure 5: Replacement Check

### **Procedure 1: Contrast Volume Check**

The contrast dial is on the right side of the display unit. Use this dial to adjust the display screen.

If the contrast does not change when you adjust it, perform Procedure 2.

### **Procedure 2: External CRT Check**

Connect the external CRT to T1800's External monitor port, then boot the computer. The computer automatically detects the external CRT even if Resume mode is enabled.

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

If 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**

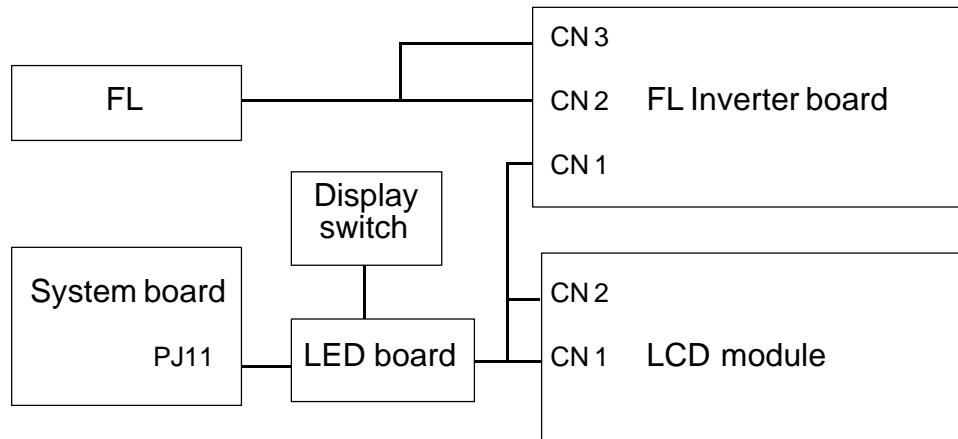
The Display Test program is stored on the T1800 Diagnostic Disk. This program checks the display controller on the system board. After loading Toshiba MS-DOS, run the Diagnostic Program (TESTCE18). Refer to Chapter 3, *Tests and Diagnostics*, for detailed instructions about this test

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

#### Procedure 4: Connector Check

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

Disassemble the display unit and check the following cable connections. Refer to Chapter 4, *Replacement Procedures*, for more information about how to disassemble the T1800.



If any of these cable are not connected, firmly re-connect them and perform Procedure 1 and 2 again. If the problem still exists, perform Procedure 5.

## Procedure 5: Replacement Check

The FL inverter board, LCD module, LED board, and System board are connected to the display circuits. Any of these components may be damaged. Refer to Chapter 4, *Replacement Procedures*, for instructions on how to disassemble the T1800 and then perform the following checks.

If the FL does not light, perform Check 1.

If the display screen something wrong, perform Check 3.

If the display does not function completely, perform Check 3.

If the display FL does not light when display is closed, perform Check 4.

- Check 1    Replace the FL with a new one and test the display again. If the problem still exists, perform Check 2.
- Check 2    Replace the FL inverter board with a new one and test the display again. If the problem still exists, perform Check 3.
- Check 3    Replace the LCD module with a new one and test the display again. If the problem still exists, perform Check 6.
- Check 4    Replace the display switch with a new one and test the display again. If the problem still exists, perform Check 5.
- Check 5    Replace the LED board with a new one and test the display again. If the problem still exist, perform Check 6.
- Check 6    Replace the display cable with a new one and test the display again. If the problem still exists, perform Check 7.
- Check 7    Replace the display switch with a new one and test the display again. If the problem still exist, perform Check 8.
- Check 8    The system board may be damaged. Replace the system board with a new one and test the display again.



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# **Chapter 3**

## **Tests and Diagnostics**

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# Contents

3.1	The Diagnostic Test .....	3-5
3.2	Executing the T1800 Diagnostic Test .....	3-6
3.3	Subtest Names .....	3-9
3.4	System Test .....	3-11
3.5	Memory Test .....	3-12
3.6	Keyboard Test .....	3-14
3.7	Display Test .....	3-16
3.8	Floppy Disk Test .....	3-22
3.9	Printer Test .....	3-24
3.10	Async Test .....	3-26
3.11	Hard Disk Test .....	3-28
3.12	Real Timer Test .....	3-31
3.13	Numeric Data Processor Test .....	3-32
3.14	Error Code and Error Status Names .....	3-33
3.15	Hard Disk Test Detail Status .....	3-35
3.16	Hard Disk Format .....	3-37
	3.16.1 Function Description .....	3-37
	3.16.2 Operations .....	3-38
3.17	Head Cleaning .....	3-41
	3.17.1 Function Description .....	3-41
	3.17.2 Operations .....	3-41
3.18	Log Utilities .....	3-42
	3.18.1 Function Description .....	3-42
	3.18.2 Operations .....	3-42
3.19	Running Test .....	3-44
	3.19.1 Function Description .....	3-44
	3.19.2 Operations .....	3-44
3.20	Floppy Disk Drive Utilities .....	3-45
	3.20.1 Function Description .....	3-45
	3.20.2 Operations .....	3-45
3.21	System Configuration .....	3-49
	3.21.1 Function Description .....	3-49
	3.21.2 Operations .....	3-49
3.22	SETUP .....	3-50
	3.22.1 Function Description .....	3-50
	3.22.2 Accessing the SETUP .....	3-51
	3.22.3 Changing SETUP Values .....	3-52
	3.22.4 SETUP Option Descriptions .....	3-53

**Tables**

Table 3-1 Subtest names ..... 3-9  
Table 3-2 T1800 hardware bit status ..... 3-11  
Table 3-3 Error codes and error status names ..... 3-33  
Table 3-4 Hard disk controller status register contents ..... 3-35  
Table 3-5 Error register contents ..... 3-36  
Table 3-6 Hard disk formatting sequence ..... 3-37

## 3.1 The Diagnostic Test

This chapter explains how to use the T1800's Diagnostic Test program (TESTCE18) to test the functions of the T1800's hardware modules. The Diagnostics Program is stored on the T1800 Diagnostic Disk. The Diagnostics programs consists of 18 programs that are divided into the Service Program Module (DIAGNOSTIC MENU) and the Test Program Module (DIAGNOSTIC TEST).

The DIAGNOSTIC MENU consists of the following eight functions. These are all located within the Diagnostic test function of the DIAGNOSTIC MENU.

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

The DIAGNOSTIC MENU 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
- NDP TEST

To execute the T1800 Diagnostic test programs you will need the following equipment to perform some of the tests:

- The T1800 Diagnostics Disk (all tests)
- A formatted working disk for the floppy disk drive test (all tests)
- A cleaning disk kit to clean the floppy disk drive heads (Head Cleaning)
- A printer wraparound connector for the printer wraparound test (Printer test)
- An RS-232-C wraparound connector for the RS-232-C port wraparound test (ASYNC test)

The following sections detail the tests within the Diagnostic Test function of the DIAGNOSTIC MENU. Refer to Sections 3.16 through 3.22 for detailed information on the remaining seven Service Program Module functions.

## 3.2 Executing the T1800 Diagnostic Test

Toshiba MS-DOS is required to run the T1800 DIAGNOSTIC PROGRAM. To start the DIAGNOSTIC PROGRAM follow these steps:

**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 CONFIG.SYS file.

1. Turn on the T1800, and allow the computer to boot. Insert the T1800 Diagnostics disk in the T1800's internal floppy disk drive.
2. At the system prompt change to drive A and type **TESTCE18** and press **Enter**.

The following menu will appear:

```
TOSHIBA personal computer T1800 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
```

**NOTE:** To exit the T1800 DIAGNOSTIC TEST MENU, press **Esc** key. If a test program is in progress, press **Ctrl+Break** to exit the test program.

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

```
TOSHIBA personal computer T1800 DIAGNOSTICS
version X.XX (c) copyright TOSHIBA Corp. 19XX
DIAGNOSTIC TEST MENU :
```

```
1 - SYSTEM TEST
2 - MEMORY TEST
3 - KEYBOARD TEST
4 - DISPLAY TEST
5 - FLOPPY DISK TEST
6 - PRINTER TEST
7 - ASYNC TEST
8 - HARD DISK TEST
9 - REAL TIMER TEST
10 - NDP TEST
88 - FDD & HDD ERROR RETRY COUNT SET
99 - EXIT TO DIAGNOSTICS MENU
```

Refer to sections 3.4 through 3.13 for detailed descriptions of each Diagnostic Test 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.

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

```
SYSTEM TEST          XXXXXXXX
                    T1800
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 - BIOS check  
99 - Exit to DIAGNOSTIC TEST MENU

```
DIAGNOSTIC TEST MENU
[Ctrl]+[Break] ; test and
[Ctrl]+[C] ; key stop
```

**NOTE:** The menu displayed by your T1800 may be slightly different from the one shown above.

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

```
TEST LOOP   : YES
```

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

Selecting **NO**, returns the sub-test menu to the main menu after the test is complete.

6. The following message will appear:

```
ERROR STOP  : YES
```

Then, use arrow and **Enter** keys to move the cursor on the options to choose. Selecting **YES**, stops the test program when an error is found and displays the operation guide on the right side of the display screen as shown below:

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

These three selection has following meaning.

- 1: Terminates the test program execution and exits to the subtest menu.
- 2: Continues the test.
- 3: Restarts the test from the beginning.

7. Use arrow and **Enter** keys to move the cursor to the options execute the subtest chosen from the subtest menu.

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 MENU.

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

| No. | Test name | Subtest No. | Subtest item                     |
|-----|-----------|-------------|----------------------------------|
| 1   | SYSTEM    | 01          | ROM checksum                     |
|     |           | 02          | HW status                        |
|     |           | 03          | BIOS 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                         |
| 3   | KEYBOARD  | 01          | Pressed key display (82/84)      |
|     |           | 02          | Pressed key code display         |
|     |           | 03          | PS/2 Mouse 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                   |
| 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          | Wrap around                      |
| 7   | ASYNC     | 01          | Wrap around (board)              |
|     |           | 02          | Board (#1) <=> board (#2)        |
|     |           | 03          | Point to point (send)            |
|     |           | 04          | Point to point (receive)         |
|     |           | 05          | Card modem loopback (1200 BPS)   |
|     |           | 06          | Interrupt test                   |

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

| <b>No.</b> | <b>Test name</b> | <b>Subtest No.</b> | <b>Subtest item</b>     |
|------------|------------------|--------------------|-------------------------|
| 8          | HDD              | 01                 | Sequential read         |
|            |                  | 02                 | Address uniqueness      |
|            |                  | 03                 | Random address/data     |
|            |                  | 04                 | Cross talk & peak shift |
|            |                  | 05                 | Write/read/compare (CE) |
|            |                  | 06                 | Write specified address |
|            |                  | 07                 | Read specified address  |
|            |                  | 08                 | ECC circuit             |
|            |                  | 09                 | Sequential write        |
|            |                  | 10                 | W-R-C specified address |
| 9          | REAL TIMER       | 01                 | Real time               |
|            |                  | 02                 | Backup memory           |
|            |                  | 03                 | Real time carry         |
| 10         | NDP              | 01                 | NDP test                |

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

#### Subtest 01 ROM checksum

The ROM checksum tests the T1800's system board from address F0000h - FFFFFh (64KB).

#### Subtest 02 H/W status

This test reads and displays the T1800's 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 Sub-Test Menu.

*Table 3-2 T1800 hardware bit status*

| Bit | H/W status      | 1      | 0      |
|-----|-----------------|--------|--------|
| 7   | Reserved        | —      | —      |
| 6   | CPU clock speed | 10 MHz | 20 MHz |
| 5   | Media type      | 2DD    | 2HD    |
| 4   | FDD type        | 1 MB   | 2 MB   |
| 3   | Reserved        | —      | —      |
| 2   | Drive A/B       | A      | B      |
| 1   | External FDD    | ON     | OFF    |
| 0   | Internal FDD    | 2DD    | 2HD    |

## 3.5 Memory Test

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

### Subtest 01 RAM Constant Data

This subtest writes constant data to conventional memory (0 to 640KB). Then reads and compares with the original data.  
The constant data is FFFFh, AAAAh, 5555h, 0101h, and 0000h.

### Subtest 02 RAM Address Pattern Data

This subtest writes address pattern data created by the eXclusive-ORing (XORing), to the address segment and address offset in conventional memory (0 to 640KB), then read from conventional memory and compared with the original data.

### Subtest 03 RAM Refresh (real mode)

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

The constant data is AAAAh and 5555h.

**NOTE:** *The size of the data being read and written to conventional memory causes a short delay between write and read operations.*

### Subtest 04 Protected Mode

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

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

Subtest 05 Memory Module

**NOTE:** *To execute the this subtest, an optional memory card must be installed in the T1800.*

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

After select subtest 05, the following message will be appears:

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

Select the number that corresponds to the memory card installed in the T1800.

Subtest 06 Backup Memory

This subtest writes constant data to memory from address E8000h to EFFFFh, then reads and compares with the original data.

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

Subtest 07 Hard-RAM

The Hard-RAM subtest writes a word unit of constant data to memory (address E8000h to EFFFFh), then reads and compares with the original data.

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

Also, this subtest executes the paging test for page data.



Subtest 03 PS/2 Mouse Connect Check

***NOTE:*** To execute the PS/2 mouse connect check, the PS/2 mouse must be connected to T1800.

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

If this test does not detect the error, return to subtest menu.

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

MOUSE INTERFACE ERROR

### 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 ten subtests that test the T1800's display in various modes. Move the bar corresponding to the subtest you want execute and press **Enter**.

#### Subtest 01 VRAM Read/Write

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

#### Subtest 02 Character Attributes

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.

NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN

NEXT LINE SHOWS INTENSIFIED DISPLAY.

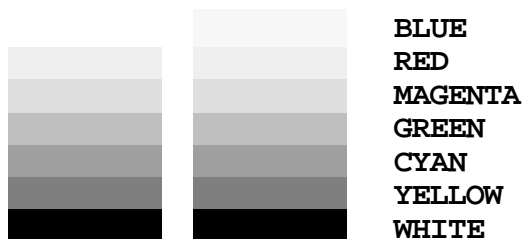
IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII

NEXT LINE SHOWS REVERSE DISPLAY.

RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR

NEXT LINE SHOWS BLINKING DISPLAY.

BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB



PRESS [ENTER] KEY





## Subtest 04 80x25/30 Character Display

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

```
80*25 CHARACTER DISPLAY
0123456789012345678901234567890123456789012345678901234567890123456789012345678901234567
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnop
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnop
"$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnop
#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnop
$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnopq
%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnopqr
&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrs
'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrst
`()+,-./0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstu
*)+,-./0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuv
*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvw
+, -./0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwx
, -./0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxy
-./0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz
./0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{
/0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|
0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}
123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
23456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~•
3456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~•Ç
456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~•Çü

PRESS [ENTER] KEY
```

To exit this subtest and return to the DISPLAY TEST menu, press **Enter**.

Subtest 05 320x200 Graphics Display

This subtest displays the following two color sets for the color display in 320x200 dots graphics mode 4 and D as shown below:

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



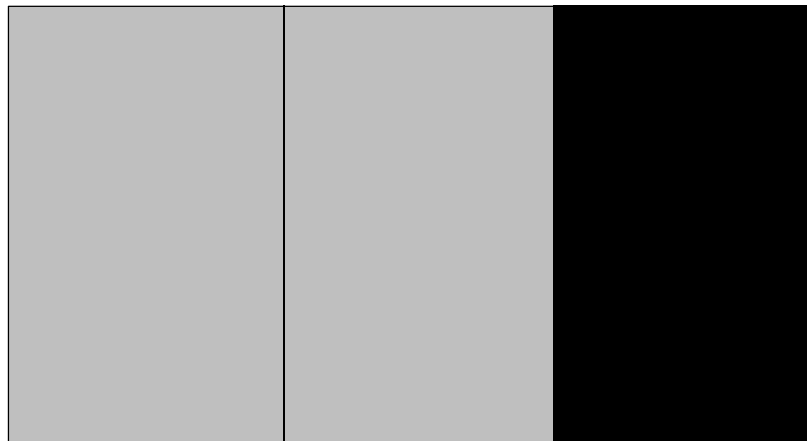
PRESS [ENTER] KEY

To exit this subtest and return to the DISPLAY TEST menu, press **Enter**.

Subtest 06 640x200 Graphics Display

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

640\*200 GRAPHICS DISPLAY : [X]  
EVEN DOTS      ODD DOTS      ALL DOTS  
DRIVEN      DRIVEN      DRIVEN



PRESS [ENTER] KEY

To exit this subtest and return to the DISPLAY TEST menu, press **Enter**.





## 3.8 Floppy Disk Test

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

To execute the Floppy Disk Test, select **5** from the DIAGNOSTIC TEST MENU, press **Enter** and follow the directions displayed on the screen. The Floppy Disk test contains five subtests that test the T1800's internal floppy disk drive. The following messages will appear after selecting the Floppy Disk Test from the DIAGNOSTIC TEST MENU. Answer each of the following questions 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 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
```

```
T1800 DIAGNOSTIC TEST IV  XX
```

```
[Ctrl]+[Break] ; test and  
[Ctrl]+[C]    ; key stop
```

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

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

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

Subtest 01 Sequential Read

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

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

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

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

Subtest 02 Sequential Read/Write

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

Subtest 03 Random Address/Data

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

Subtest 04 Write Specified Address

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

Subtest 05 Read Specified Address

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

## 3.9 Printer Test

To execute the Printer Test, select **6** from the DIAGNOSTIC TEST MENU, press **Enter** and follow the directions displayed on the screen. The Printer test contains three subtests that test the printer output connected to the T1800. The following messages will appear after selecting the Printer Test from the DIAGNOSTIC TEST MENU. Answer each of the following questions with an appropriate response to execute the test.

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

The following message will appear when the printer test is selected:

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

The printer I/O port address is specified by the XXXXh number. The T1800 supports three printer channels. Select the printer channel number, and press **Enter** to execute the selected subtest.

### Subtest 01 Ripple Pattern

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

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

### Subtest 02 Function

This subtest prints the various print types shown below.

```
PRINTER TEST
1. THIS LINES 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[\]^_`abcdefghijklmn
opqrstuvwxyz{|}~
```



Subtest 03    Wraparound

***NOTE:*** *To execute this subtest a printer wraparound connector must be connected to the T1800's printer port. The printer wrap around connector (34M741986G01) wiring diagram is described in Appendix F.*

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 T1800's asynchronous communication functions. Move the bar corresponding to the subtest you want to execute and press **Enter**.

Subtests 01 through 04 require the following data format:

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

The following message will appear 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 subtest.

Subtest 01    Wraparound (board)

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

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

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

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

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

Subtest 03    Point to point (Send)

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

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

Subtest 04 Point to point (Receive)

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

Subtest 05 Card Modem Loopback (1200BPS)

**NOTE:** *To execute this subtest, a 1200BPS type built-in modem must be installed. An 1200BPS type modem can work correctly with this machine.*

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

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

Baud rate select (1: 110BPS, 2: 300BPS, 3: 1200BPS) ?

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

Subtest 06 Interrupt Test IRQ4, 3 and 5

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

### 3.11 Hard Disk Test

To execute the Hard Disk Test, select **8** from the DIAGNOSTIC TEST MENU, press **Enter**, and follow the directions displayed on the screen. The hard disk test contains ten subtests that test the T1800 hard disk drive functions. The following messages will appear after selecting the hard disk test from the DIAGNOSTIC TEST MENU. Answer each of the following questions with an appropriate response to execute the test.

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

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

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

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

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

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

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

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

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

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

5. This message is used to select whether or not the HDD status is displayed on the screen. The HDD status is described in section 3.15. Select **1** or **2** and press **Enter**.

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

```
HARD DISK TEST                XXXXXXXX

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

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

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

Subtest 01 Sequential Read

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

Subtest 02 Address Uniqueness (Uniqueness)

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

- Forward sequential
- Reverse sequential
- Random

Subtest 03 Random Address/Data

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

Subtest 04 Cross Talk & Peak Shift

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

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

- Subtest 05    Write/read/compare (CE)
- This subtest writes B5ADADh worst pattern data to the CE cylinder on the HDD, then reads the data from the CE cylinder and compares it with the original data.
- Subtest 06    Write specified address
- This subtest writes specified data to a specified cylinder and head on the HDD.
- Subtest 07    Read specified address
- This subtest reads data which has been written to a specified cylinder and head on the HDD.
- Subtest 08    ECC circuit
- This subtest checks the Error Check and Correction (ECC) circuit functions of the specified cylinder and head on the HDD.
- Subtest 09    Sequential write
- This subtest writes specified 2-byte data to all of the cylinders on the HDD.
- Subtest 10    W-R-C specified address
- This subtest writes data to a specified cylinder and head on the HDD, then reads the data and compares it to the original data.

## 3.12 Real Timer Test

To execute the Real time 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 T1800's real timer functions. Move the bar corresponding to the subtest you want to execute and press **Enter**.

### Subtest 01 Real Time

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

1. Select subtest 01 and the following message will appear:

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

```
Enter new date:
```

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

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

```
Enter new time :
```

3. If the current time is not correct, input the correct time in military format. After pressing **Enter** the display returns to the Real Time Test menu.

### Subtest 02 Backup Memory

This subtest performs the following backup memory check:

Writes 1-bit of "on" data to address 01h through 80h

Writes 1-bit of "off" data to address FEh through 70h

Writes the data pattern AAh through 55h to the RTC 50 bytes memory (address 0Eh to 3Fh)

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

### Subtest 03 Real Time Carry

**CAUTION:** When this subtest is executed, the current data 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 : XX-XX-XXXX
Current time : XX:XX:XX
```

### 3.13 Numeric Data Processor Test

*NOTE: To execute this test, a math co-processor (NDP) must be mounted in the T1800.*

Subtest 01    NDP test

This test checks the following functions of the numeric data processor:

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



### 3.14 Error Code and Error Status Names

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

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

| <b>Device name</b> | <b>Error code</b> | <b>Error status name</b>  |
|--------------------|-------------------|---------------------------|
| (COMMON)           | FF                | Data Compare Error        |
| SYSTEM             | 01                | ROM Checksum Error        |
| Memory             | 01                | Parity Error              |
|                    | 02                | Protected Mode Not Change |
|                    | 14                | Memory Read/Write Error   |
|                    | 1B                | H-RAM Mapping Error       |
|                    | 1C                | H-RAM Read/Write 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             |
|                    | 80                | Time Out Error            |
|                    | EE                | Write Buffer Error        |
| PRINTER            | 01                | Time Out                  |
|                    | 08                | Fault                     |
|                    | 10                | Select Line               |
|                    | 20                | Out Of Paper              |
|                    | 40                | Power Off                 |
|                    | 80                | Busy Line                 |
| ASYNC              | 01                | DSR Off Time Out          |
|                    | 02                | CTS Off Time Out          |
|                    | 04                | RX-ENABLE Time Out        |
|                    | 08                | TX-BUFFER Full Time Out   |
|                    | 10                | Parity Error              |

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

| Device name | Error code           | Error status name         |
|-------------|----------------------|---------------------------|
| ASYNC       | 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             |
|             | 07                   | Drive Not Initialized     |
|             | 09                   | DMA Boundary Error        |
|             | 0A                   | Bad Sector Error          |
|             | 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                 |
| CC          | Write Fault          |                           |
| E0          | Status Error         |                           |
| F0          | Not Sense Error (FF) |                           |
| NDP         | 01                   | No CO-PROCESSOR           |
|             | 02                   | Control Word Error        |
|             | 03                   | Status Word Error         |
|             | 04                   | Bus Error                 |
|             | 05                   | Additional Error          |
|             | 06                   | Multiple Error            |

### 3.15 Hard Disk Test Detail Status

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

```
HDC status = XXXXXXXX
```

Detailed information about the hard disk test error is displayed on the screen by an eight-digit number. The first four digits represent the hard disk controller (HDC) error status number and the last four digits are not used.

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

The contents of the HDC status register and error register are described in Tables 3-4 and 3-5.

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

| Bit | Name                         | Description                                                                                                                    |
|-----|------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| 7   | BSY<br>(Busy)                | "0"---- HDC is busy.<br>"1"---- HDC is ready                                                                                   |
| 6   | DRDY<br>(Drive ready)        | "0"---- Hard disk drive is not ready to accept any command.<br>"1"---- Hard disk drive is ready.                               |
| 5   | DWF<br>(Drive write fault)   | "0"---- DWF error is not detected.<br>"1"---- Write fault condition occurs.                                                    |
| 4   | DSC<br>(Drive seek complete) | "0"---- The hard disk drive heads are not settled over a track.<br>"1"---- The hard disk drive heads are settled over a track. |
| 3   | DRQ<br>(Data request)        | "0"---- Drive is not ready to transfer data.<br>"1"---- Drive is ready for data transfer.                                      |
| 2   | CORR<br>(Corrected data)     | "0"---- Other<br>"1"---- Correctable data error is corrected.                                                                  |
| 1   | IDX<br>(Index)               | "0"---- Other<br>"1"---- Index is sensed.                                                                                      |
| 0   | ERR<br>(Error)               | "0"---- Other<br>"1"---- The previous command was terminated with some error.                                                  |

*Table 3-5 Error register contents*

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

### 3.16 Hard Disk Format

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

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

This hard disk format function performs a low level format of the hard disk and executes the following hard disk format and checks:

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 execute the Bad track CHECK option to displays a list of bad tracks level on HDD.*

Table 3-6 Hard disk formatting sequence

| Items               | Description |          |
|---------------------|-------------|----------|
|                     | 40 MB       | 60MB     |
| Sector sequences    | 1 : 1       | 1 : 1    |
| Cylinders           | 0 to 976    | 0 to 822 |
| Heads               | 0 to 1      | 0 to 3   |
| Sectors             | 1 to 44     | 1 to 39  |
| Sector length (bps) | 512         | 512      |

## 2. Good track FORMAT

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

## 3. Bad track FORMAT

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

## 4. Bad track CHECK

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

### 3.16.2 Operations

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

1. Selecting test **2** and pressing **Enter** in the DIAGNOSTIC MENU, displays the following messages:

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

```
1 - All track FORMAT
2 - Good track FORMAT
3 - Bad track FORMAT
4 - Bad track CHECK
9 - Exit to DIAGNOSTICS MENU
```

## 2. All track format option

- (1) Selecting the all track format option displays the following message:

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

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

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

- (3) Select an interleave number (usually **1**) and press **Enter**. The following display will appear:

```
Unlock Format select (1:no,2:yes) ?
```

- (4) Select whether or not the HDD has an unlock format and press **Enter**.

***NOTE:** HDDs which manufactured by JVC has unlock format function and must be selected **2:yes**. On the other hand, other HDDs does not have unlock format function, therefore **1:no** must be selected.*

The following message will appear:

```
[ HDD TYPE ] : CYLINDER = XXXX  
[ HDD TYPE ] : HEAD      = XX  
[ HDD TYPE ] : SECTOR   = XX
```

```
[ WARNING : Current DISK data will be  
              completely destroyed ]
```

```
Press [Bad track number (CCCCHH)] key ?
```

- (5) Enter the cylinder and head number of the bad tracks on the HDD and press **Enter**. The cylinder number is represented by CCCC and HH is the head number. If the HDD does not have any bad tracks, press **Enter**. The [[cylinder, head = XXXX XX]] message will appear and all the cylinders in the hard disk will be formatted and checked.
- (6) After formatting the hard disk, execute the verify check program. When the verify check program is complete, the following message will appear:  
  
Format complete
- (6) Press **Enter** to return to the Hard Disk Format menu.

### 3. Good track format or bad track format selection

- (1) When the good track format or bad track format is selected, the following message will appear.

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

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

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

- (3) Select an interleave number (usually **1**) and press **Enter**. The following message will appear.

```
[ HDD TYPE ] : CYLINDER = XXXX  
[ HDD TYPE ] : HEAD      = XX  
[ HDD TYPE ] : SECTOR   = XX
```

```
Press [Track number (CCCCHH)] key ?
```

- (4) Type the four digit track number and press **Enter**. The first three digits indicate the cylinder and the last digit indicates the head. This formats either good tracks or bad tracks as selected.

***NOTE:** This program can format only one track per operation. Repeat the operation as many times as necessary to format several good tracks or bad tracks.*

- (5) After a track on the hard disk has been formatted the following message will be displayed:

Format complete

- (6) Press **Enter** to return to the Hard Disk Format menu.

#### 4. Bad track check option

- (1) When this option is selected, the following message will appear:

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

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

Interleave number (1/1-8) ?

- (3) Select an interleave number (usually **1**) and press **Enter**. The following message is displayed, and the bad tracks on the hard disk are checked:

```
[ HDD TYPE ] : CYLINDER = XXXX
[ HDD TYPE ] : HEAD     = XX
[ HDD TYPE ] : SECTOR   = XX

[[cylinder, head = XXXX XX]]
```

- (4) After checking the bad tracks on the hard disk the following message will appear:

Format complete

- (5) Press **Enter** to return to the Hard Disk Format menu.



## 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 operation.

### 3.17.2 Operations

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

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

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

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

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



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

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

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

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

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

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

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

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

3. In the case of “error retry OK,” a capital “R” will be placed at the beginning of 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 number 01)
2. Memory test (subtest number 01, 02, 04, 06, 07)
3. Display test (subtest number 01 to 08)
4. FDD test (subtest number 02)
5. Printer test (subtest number 03)
6. Async test (subtest number 01)
7. HDD test (subtest number 01, 05)
8. Real timer test (subtest number 02)

The system automatically detects the number of floppy disk drives connected to the T1800 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 working disk.
2. Select **6** from the Diagnostic Menu and press **Enter**, the following message will be displayed:

Printer wrap around test (Y/N) ?

Selecting **Yes** executes the printer wraparound test. A printer wraparound connector must be connected to the **printer/FDD** port on the back of the T1800 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 **Yes** executes the ASYNC wraparound test. An RS-232-C wraparound connector must be connected to the **serial port** on the back of the T1800 to properly execute this test.

4. Select **Y** or **N** and press **Enter** to start the test.
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

**CAUTION:** *This program is only for testing a floppy disk drive. The option is different than 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 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. Selecting **7** from the DIAGNOSTIC MENU and pressing **Enter** displays the following message:

```
[ FDD UTILITIES ]
```

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

## 2. FORMAT program

- (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, and insert the work disk and press any key.

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

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

```
Format start
```

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

After the floppy disk is formatted, the following message will appear:

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

- (5) Typing **1**, displays the message from step (3) above. Typing **2** returns the test 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 will appear, indicating the program has started.

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

Copy start

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

- (4) Remove the source disk from the FDD, insert a formatted working 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
Format type select (0:2DD,1:2D,2:2HD,3:HDD)?
```

- (2) Select a format type number. Type the number. If **3** is selected, the display will go to the step (5).

```
0: Displays a dump list for a floppy disk (2DD).
1: Displays a dump list for a floppy disk (2D).
2: Displays a dump list for a floppy disk (2HD).
3: Displays a dump list for a hard disk.
```

- (3) If **0**, **1**, or **2** is selected, the following message will appear.

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

If **3** is selected, go to step (5).

- (4) Select an FDD drive number and the following message will appear:

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

- (5) Remove the Diagnostics Disk from the FDD and insert a source disk. Press any key and the following message will appear:

```
— Max. address —  
  [Track ] = XXXX  
  [ Head ] = XX  
  [Sector] = XX  
  Track number ??
```

- (6) Type the track number and press **Enter**. The following message will appear:

```
Head number ?
```

- (7) Type the head number and press **Enter**. The following message will appear:

```
Sector number ??
```

- (8) Type the sector number and press **Enter**. The specified dump list will be displayed.

- (9) After a dump list appears on the screen, the following message will appear:

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

- 1: Displays the next sector dump.
- 2: Displays a previous sector dump.
- 3: Displays the following message.

```
Another dump ( 1 : Yes / 2 : No ) ?
```

- (10) If you type **1**, the display will return to the message shown in step (1) above. If you type **2**, the display will return to the DIAGNOSTIC MENU.



## 3.21 System Configuration

### 3.21.1 Function Description

The System Configuration program contains the following configuration information for the T1800:

1. SKBC version
2. BIOS ROM version
3. Base memory size
4. Display mode
5. A number of floppy disk drives
6. A number of ASYNC ports
7. A number of hard disk drives
8. A number of printer ports
9. Co-processor
10. Extended memory size

### 3.21.2 Operations

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

```
SYSTEM CONFIGURATION :  
  
* - SKBC VERSION = VX.XX  
* - BIOS ROM VERSION = VX.XX  
* - 640KB MEMORY  
* - COLOR/GRAPH( 80 Column )  
* - 1 FLOPPY DISK DRIVE(S)  
* - 1 ASYNC ADAPTER  
* - 1 HARD DISK DRIVE(S)  
* - 1 PRINTER ADAPTER  
* - 0 MATH CO-PROCESSOR  
* - XXXXXKB EXTENDED MEMORY  
  
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. Hard disk
  - (1) Capacity
4. Time & date
5. COM/PRT/FDD
  - (1) Serial port
  - (2) Built-in modem
  - (3) Built-in modem Power
  - (4) External FDD/PRT
  - (5) Printer port type
6. Power on password
7. Others
  - (1) Resume mode
  - (2) Battery save mode
  - (3) Pop-up
  - (4) Speaker
  - (5) Battery alarm
8. Battery save option
  - (1) Processing speed
  - (2) CPU sleep mode
  - (3) HDD auto off
  - (4) Display auto off

### 3.22.2 Accessing the SETUP

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

#### T1800 SETUP

|                                                                                                                        |                                                                                                                                                                                 |
|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>MEMORY</p> Total = 2048KB<br>Base = 640KB<br>Extended = 1280KB<br>Hard RAM = 0KB<br>Shadow BIOS ROM = Enable(128KB) | <p>COM/PRT/FDD</p> Serial Port = COM1 (IRQ4/3F8H)<br>Built-in Modem = COM2 (IRQ3/2F8H)<br>Built-in Modem Power = On<br>External FDD/PRT = Printer<br>Printer Port Type = Output |
| <p>DISPLAY</p> Display Adaptor = VGA Compatible<br>LCD Display Mode = Color<br>LCD Gray Scale Level = Normal 64 Levels | <p>POWER ON PASSWORD</p> Not Registered                                                                                                                                         |
| <p>HARD DISK</p> Capacity = 40MB                                                                                       | <p>OTHERS</p> Resume Mode = Boot<br>Battery Save Mode = Automatic<br>(Long Life)<br>Pop-up = Enable<br>Speaker = On<br>Battery Alarm = On                                       |
| <p>TIME &amp; DATE</p> 00:00:00, Tue Jan 01, 1992                                                                      |                                                                                                                                                                                 |

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

The menus above show examples of setup options as they currently may be stored in memory. Since the options shown reflect the previously set options, the display you see may be different from the one above. The options, "LCD Display Mode," "LCD Gray Scale," and "LCD Gray Scale Level" differ depending on the option selected for "Display Adaptor."

Notice that selecting the type of diskette drive is not an option. The T1800 automatically determines what type of internal diskette drive is installed. Also, you don't have to run the SETUP to use an external 5.25-inch diskette drive.

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

The SETUP displays the following message:

Exit without saving? (Y/N)

Press **Y**. The system returns to the diagnostic menu.

### 3.22.3 Changing SETUP Values

You can change the setup options automatically or manually.

#### Automatic Reset

Follow these steps to set the values automatically:

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

The program calculates how much base and extended memory your T1800 has, based on whether or not you have an expansion memory card installed.

The T1800 SETUP menu displays the new values.

2. Confirm that the new values are correct. To change any option(s), go to the next item, **Manual Reset**.
3. If the new values are correct, press **End** to record the new values in configuration memory.
4. Go to step **5** of the next item, **Manual Reset**.

#### Manual Reset

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

***NOTE:** The cursor, shown as a video bar, indicates which option is presently selected.*

1. Use the arrow keys to move the cursor between options. You can also select each option group by pressing the character on the keyboard corresponding to the first character of the heading for each option group. For example, if you press **D**, the cursor moves to the top of the **DISPLAY** option group.
2. When the cursor highlights the values of an option you want to change, use the **space bar** and **backspace** keys to select the desired value.
3. When you finish making changes, press **End** to record the new values in configuration memory.
4. **SETUP** displays the following message:  
  
Save Settings , perform self test and reboot? (Y/N)  
  
Review your changes. If you need to make more alterations, press **N** and go back to step 1 above.
5. If the new values are correct, press **Y**. They are recorded into CMOS memory and the system restarts.

### 3.22.4 SETUP Option Descriptions

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

#### 1. Memory

This group of options lets you configure the T1800's memory.

##### (1) Total

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

##### (2) Base

This field displays the amount of memory installed and is automatically calculated by the computer. You cannot change this value.

##### (3) Extended Memory

This field displays the amount of extended memory the T1800 has available. You cannot change this value.

##### (4) Hard RAM

This field displays the amount of extended memory assigned to Hard RAM. When you press the **space bar** or **backspace** key, the size of memory allocated for Hard RAM increases or decreases in 64KB step from 128KB to 8192KB. The default is 0KB.

##### (5) Shadow BIOS ROM

The SETUP program displays 128KB of RAM, which is reserved for the Shadow BIOS ROM. This field displays the amount of the extended memory used for the shadow BIOS ROM. If you set this option to **Enable**, extended memory will be reduced by 128KB.

|                |                                                                  |
|----------------|------------------------------------------------------------------|
| Enable (128KB) | You can use the shadow BIOS ROM.<br>(This is the default value). |
| Disable        | You cannot use the shadow BIOS ROM.                              |

#### 2. Display

This group of options helps you configure the T1800's display.

##### (1) Display adapter

This displays only **VGA compatible**. You cannot change it.

VGA compatible    Chooses the internal adapter for the VGA display.

(2) LCD display mode

Use this option to set the T1800'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**. (This is the default.)
- Monochrome                Selects monochrome mode. This also used when you attach a VGA monochrome monitor to the **external display port**. Also some software is displayed better in monochrome mode.

(3) LCD gray scale level

This option lets you switch between uses normal and reverse video. This option also appears in the Pop-up Window. 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 shade of gray.

3. Hard disk

This option enables or disables the hard disk drive.

- xxMB                        The 40-MB and 60-MB type HDD can be used for this machine. The disk's capacity is automatically displayed but, cannot be changed except No drive.
- No drive                    You cannot access the hard disk.

4. Time & Date

5. COM/PRT/FDD

This option controls setting for serial and parallel ports.

(1) Serial Port/Built-in Modem

This option allows you to set the COM level, COM1 or COM2, for the serial and parallel ports. This 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 (Built-in Modem default) |
| Not Used  |                 | (Disables Port)               |

(2) Built-in Modem Power

Use the option to turn the built-in modem's power on or off. This appears only when the built-in modem is installed.

- ON Built-in Modem power is on.
- OFF Built-in Modem power is off.

(3) External FDD/PRT

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

- Printer Configures the port for output to a printer or other parallel device. This is the default setting.
- FDD A Configures the port for output and input to and from the external 5.25-inch floppy disk drive and assigns the letter A to the external drive. By default the internal drive becomes drive B.
- FDD B Configures the port for output and input to and from the external 5.25-inch floppy disk drive and assigns the letter B to the external drive. By default the internal drive remains drive A.

(4) Printer Port Type

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

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

## 6. 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
```

### How to set the Password

To set the power on password, following these steps.

|                                                                                                           |
|-----------------------------------------------------------------------------------------------------------|
| <b>NOTE:</b> <i>When typing the password option, you can use either capital letters or small letters.</i> |
|-----------------------------------------------------------------------------------------------------------|

1. Press the Space or **BkSp** key to display the following prompt:

Use this section to set the system date and time.

```
Password =
```

2. Enter a password of up to 10 characters. The characters 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 =    ****
```

|                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------|
| <b>NOTE:</b> <i>If you press <b>Enter</b> before entering the password, Not Registered will appear on the display.</i> |
|------------------------------------------------------------------------------------------------------------------------|

3. Press **Enter** . The following message appears allowing you to verify the password.

```
Verify Password =
```

4. Re-enter the character string you just types and press Enter.  
If the two character strings match, the password is registered and the display changes to:

```
Registered
```

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

```
Entry Error !!
```

### How to Reset the Password

To reset the power on password, follow these steps:

1. Press the **Spacebar** or **BkSp** to display the following prompt:

```
Password =
```



2. Enter the currently registered password. The character string you enter is displayed as a string of asterisks.

Password = \*\*\*\*

**NOTE:** *If you press **ENTER** before entering the password, Registered will appear on the display.*

3. Press **ENTER**. 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 2.

Entry Error!!

4. Following the same procedures as the ones described in the previous section, **How to Set the Password**, to set a new password.

### **Making a Password Service Disk**

If you happen to forget your password, how will you start up your computer? The T1800 provides you a special feature of the password service disk which unlocks the password. To make the password service disk, prepare a formatted 3.5-inch 2DD floppy disk (any data will be erased) and follow the steps below.

1. Set the password as described in previous section.
2. Insert a 3.5-inch 2DD floppy disk into drive A.
3. Press **End** and the following message appears:

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

## 7. Others

Whether or not you need to configure the T1800 with these options depends primarily on the kind of software or peripherals you use.

### (1) Resume mode

This option enables and disables the AutoResume feature. You can also set this option using the Pop-up Window. Disabling AutoResume enables boot mode.

|        |                                                    |
|--------|----------------------------------------------------|
| Boot   | Turns off AutoResume. This is the default setting. |
| Resume | Turns on the AutoResume feature.                   |

### (2) Battery save mode

This option is used to select either the automatic setting (Normal Life) or (Long Life) or the User Setting of the **BATTERY SAVE OPTIONS**. You can also set this option using the Pop-up Window.

When the AC adapter is connected to the T1800, this option uses the normal life setting even if you have set it to **Long life** or **User's setting** in the SETUP window. The default is **Long life** when the T1800 uses battery power.

|                           |                                                                                                                                                                                                                                                                                                             |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Long life/<br>Normal life | Selects a preset set of battery save parameters suitable for either Long or Normal battery life operation. Selecting this option, displays a sub-window of, <b>BATTERY SAVE OPTIONS</b> , like the one shown here. The options in the sub-window cannot be changed and are for informational purposes only. |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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

*Long Life setting*

| BATTERY SAVE OPTIONS |         |
|----------------------|---------|
| Processing Speed     | High    |
| CPU Sleep Mode       | Disable |
| HDD Auto Off         | Disable |
| Display Auto Off     | Disable |

*Normal Life setting*

### User setting

This option, allows you to set the battery save parameters on the sub-windows, **BATTERY SAVE OPTIONS**. When you select this, 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 the next section, *Battery Save Options*.

**(3) Pop-up**

Use this option to enable or disable the Pop-up window.

Enable Enables you to access to the Pop-up Window.  
This is the default setting.

Disable Disables the Pop-up Window.

**(4) 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.

On Enables software use of the system speaker.  
This is the default setting.

Off Disables software use of the system speaker.

**(5) Battery Alarm**

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

On Enables the alarm. This is the default setting.

Off Disables the alarm.

## 8. BATTERY SAVE OPTIONS

### (1) PROCESSING SPEED

Use this option to set the CPU operating speed high or low.

| <b>Processing speed</b> | <b>CPU speed</b> |
|-------------------------|------------------|
| High                    | 20 MHz.          |
| Low                     | 10 MHz.          |

### (2) CPU Sleep Mode

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

|         |                      |
|---------|----------------------|
| Enable  | Enables sleep mode.  |
| Disable | Disables sleep mode. |

### (3) HDD auto off

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

|         |                                                                                                                                                                   |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Disable | Disables HDD automatic power off.                                                                                                                                 |
| xx Min. | Automatically turns off power to the hard disk drive if it is not used for the duration set. The duration <b>xx</b> can be set to 3, 5, 10, 15, 20 or 30 minutes. |

### (4) Display auto off

Use this option to disable or set the duration of the display automatic power off function. This function causes the T1800 to turn off the side-light if you do not make an entry for the set period of time.

|            |                                                                                                                                                                        |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Disable    | Disables display automatic power off.                                                                                                                                  |
| xx Min.    | Automatically turns off power to the sidelit LCD panel if it is not used for the duration set. The duration <b>xx</b> can be set to 1, 3, 5, 10, 15, 20 or 30 minutes. |
| Always OFF | Turns off power to the sidelit LCD display's florescent lamp. This value is not displayed if the AC adapter is connected.                                              |

---

# **Chapter 4**

## **Replacement Procedures**

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# Contents

|      |                                                         |      |
|------|---------------------------------------------------------|------|
| 4.1  | General .....                                           | 4-5  |
| 4.2  | The Battery Pack .....                                  | 4-8  |
| 4.3  | The Optional Memory Card .....                          | 4-10 |
| 4.4  | The Keyboard .....                                      | 4-12 |
| 4.5  | The Built-in Modem Case and Modem Interface Board ..... | 4-15 |
| 4.6  | The Top Cover .....                                     | 4-17 |
| 4.7  | The Hard Disk Drive .....                               | 4-19 |
| 4.8  | The Floppy Disk Drive .....                             | 4-21 |
| 4.9  | The Battery Terminal .....                              | 4-23 |
| 4.10 | The Power Supply Board.....                             | 4-24 |
| 4.11 | The System Board .....                                  | 4-25 |
| 4.12 | The Battery Release Latch and Battery Lock.....         | 4-26 |
| 4.13 | The Display Mask .....                                  | 4-27 |
| 4.14 | The FL Inverter Board .....                             | 4-29 |
| 4.15 | The Liquid Crystal Display (LCD).....                   | 4-30 |
| 4.16 | The Fluorescent Lamp (FL) .....                         | 4-31 |
| 4.17 | The Display Back Cover .....                            | 4-32 |
| 4.18 | The LED Board and Sub Battery .....                     | 4-34 |
| 4.19 | The Display Cable and Display Switch .....              | 4-36 |
| 4.20 | The Math Co-Processor .....                             | 4-38 |

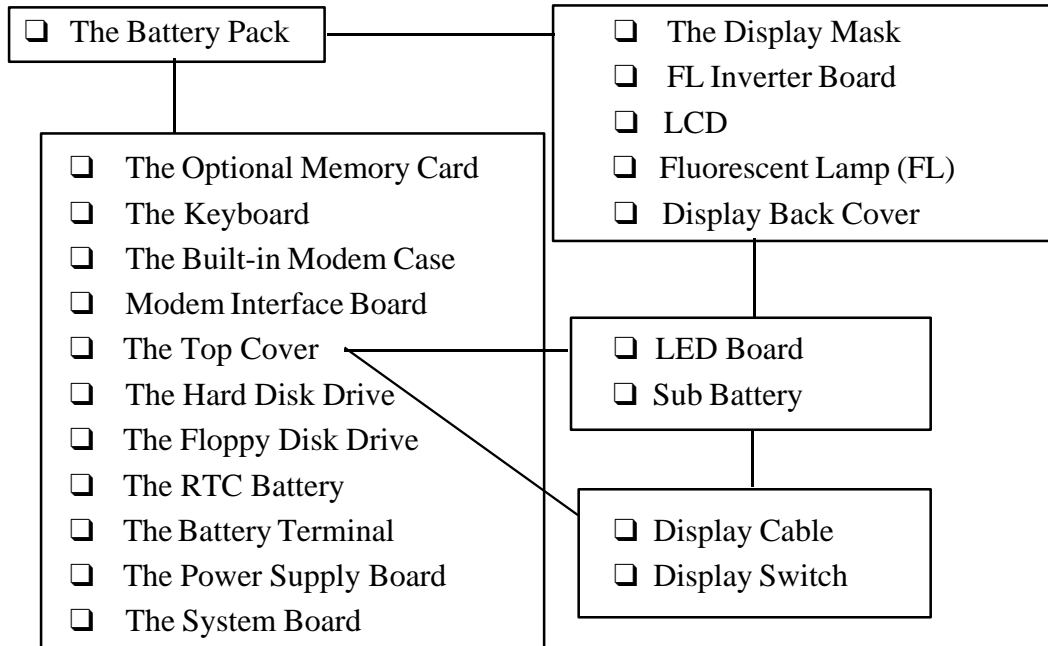
## Figures

|             |                                                               |      |
|-------------|---------------------------------------------------------------|------|
| Figure 4-1  | Operating the battery release latch .....                     | 4-8  |
| Figure 4-2  | Removing the battery pack .....                               | 4-8  |
| Figure 4-3  | Removing the optional memory card cover .....                 | 4-10 |
| Figure 4-4  | Removing the memory card .....                                | 4-10 |
| Figure 4-5  | Removing the screws securing the keyboard and top cover ..... | 4-12 |
| Figure 4-6  | Unsnapping the keyboard and keyboard cable .....              | 4-13 |
| Figure 4-7  | Removing the built-in modem case .....                        | 4-15 |
| Figure 4-8  | Removing the modem interface board .....                      | 4-15 |
| Figure 4-9  | Removing the three screws and two cables .....                | 4-17 |
| Figure 4-10 | Removing the metal plate .....                                | 4-19 |
| Figure 4-11 | Removing the hard disk drive .....                            | 4-19 |
| Figure 4-12 | Removing the hard disk drive bracket .....                    | 4-20 |
| Figure 4-13 | Removing the RTC battery .....                                | 4-21 |
| Figure 4-14 | Removing the floppy disk drive .....                          | 4-21 |
| Figure 4-15 | Removing the FDD bracket .....                                | 4-22 |
| Figure 4-16 | Removing the battery terminal .....                           | 4-23 |
| Figure 4-17 | Removing the power supply board .....                         | 4-24 |
| Figure 4-18 | Removing the system board .....                               | 4-25 |
| Figure 4-19 | Removing the battery release latch and battery lock .....     | 4-26 |
| Figure 4-20 | Removing the display mask screws .....                        | 4-27 |
| Figure 4-21 | Removing the FL inverter board .....                          | 4-29 |
| Figure 4-22 | Removing the LCD .....                                        | 4-30 |
| Figure 4-23 | Removing the FL cover and FL .....                            | 4-31 |
| Figure 4-24 | Removing the display cable cover .....                        | 4-32 |
| Figure 4-25 | Removing the display back cover .....                         | 4-32 |
| Figure 4-26 | Removing the screws .....                                     | 4-34 |
| Figure 4-27 | Disconnecting the cables from the LED board .....             | 4-34 |
| Figure 4-28 | Removing the display cable .....                              | 4-36 |
| Figure 4-29 | Removing the display switch .....                             | 4-36 |
| Figure 4-30 | Removing the math co-processor cover .....                    | 4-38 |
| Figure 4-31 | Removing the math co-processor .....                          | 4-38 |
| Figure 4-32 | Aligning the math co-processor .....                          | 4-39 |



## 4.1 General

This section explains how to disassemble the T1800 and replace Field Replaceable Units (FRUs) in the T1800. It may not be necessary to remove all the FRUs in order to replace one. The chart below is a guide to which FRUs need to be removed in order to remove another. Always start by removing the battery pack, then follow the lines on the chart to find out which FRU you must remove next in order to repair the one you think is causing the T1800 to operate abnormally.



### Before You Begin

Look over the procedures in this section before you begin disassembling the T1800. Familiarize yourself with the steps required to disassemble the T1800 in order to fix the FRU you determined is causing the computer to operate abnormally. Begin each procedure by removing the AC adapter and the battery pack as instructed in section 4.2, Removing the T1800 Battery Pack:

1. Do not disassemble the T1800 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 T1800:
  - ❑ 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 test 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 T1800.

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 disassembling the T1800. When removing screws, make sure they are put in a safe place and identified with the correct parts.
8. When assembling the T1800 make sure you use the correct screws to secure the various pieces in place. Screw sizes are listed in the corresponding figures.
9. The T1800 contains many sharp edges and corners, so be careful not to injure yourself.

## **Disassembly Procedures**

The T1800 has two basic types of cable connectors:

- Pressure Plate Connectors
- Normal Pin Connectors

To disconnect a Pressure Plate connector, lift up the tabs on either side of the plastic connector and slide the cable out of the connector. To connect the cable to a Pressure Plate connector, make sure the sides of the Pressure Plate connector are fully extended and slide the cable into the connector. Secure the cable in place by pushing the sides of the down so it 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 sides of the connector are fully extended when you insert the cable.

The normal pin connectors connect the remaining cables, which can be connected and disconnected by simply pulling them apart or pushing them together.

## **Assembly Procedures**

After you have disassembled the T1800 and fixed or repaired the problem that was causing the T1800 to operate abnormally you will need to reassemble the T1800. While assembling the T1800, remember the following general points:

- Take your time making sure you follow the instructions closely. Most problems arise when you get in a hurry while assembling the T1800.
- Make sure all cables and connectors are securely fastened.
- Before securing the FRU or other parts, make sure that any cables in the area will not be pinched by the screws or the FRU.
- Check that all latches are latched securely in place.
- Make sure all the screws are replaced with the correct screws. Using the wrong screw can either damage the screw's threads or head.

After installing an FRU in the T1800 confirm that the FRU and the T1800 are functioning properly.

## **Tools and Equipment**

The use of ElectroStatic Discharge (ESD) equipment is very important for the integrity of the sensitive electronic components. Proper use of these devices will increase the success rate of your repairs and lower the cost of damaged or destroyed parts. The following equipment is necessary to disassemble and reassemble the T1800:

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

## 4.2 The Battery Pack

The battery pack is always the first FRU you should remove when you disassemble the T1800. This is done as a safety precaution so you do not get an electric shock as you disassemble or reassemble the computer.

### Removing the Battery Pack

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

1. Turn off the power to the T1800. Disconnect the AC adapter and all external cables connected to the T1800.
2. Close the display if it is open.
3. Turn the computer upside down, push the battery lock to free the **release latch**, as shown in the figure below, then slide the **battery release latch** forward.

*Figure 4-1 Operating the battery release latch*

4. Push the **battery pack** out slightly with your thumb and lift out the battery pack, as shown in Figure 4-2.

*Figure 4-2 Removing the battery pack*

## Installing the Battery Pack

**CAUTION:** *Be careful not to short-circuit a battery pack's positive (+) and negative (-) terminals. Do not try to disassemble the battery pack.*

To install the battery pack, place the battery pack in place and secure its latch.

## 4.3 The Optional Memory Card

### Removing the Memory Card

To remove the memory card or memory card cover, follow the steps below and refer to Figures 4-3 and 4-4.

1. Turn off the power to the T1800. Disconnect the AC adapter and all external cables connected to the T1800.
2. Turn the computer upside down and place it on a flat surface.
3. Remove the battery pack as instructed in section 4.2.
4. Remove the one **M2.5x4 silver screw** securing the **optional memory card cover** and push the cover off as shown below.

*Figure 4-3 Removing the optional memory card cover*

5. Grasp the outside edge of the **memory card** to pull it out as shown in the Figure 4-4. You may have to jiggle the card slightly from side to side as shown below.

**CAUTION:** Do not touch the connecting edge of the memory card. Debris or grease in the connector may cause memory access problems.

*Figure 4-4 Removing the memory card*

## Installing the Memory Card

To install the memory card, follow the steps below:

1. The top of the **memory card** is marked with the word "insert" and an arrow pointing toward the connecting edge. Hold the memory card face down, with its connecting edge facing the computer. Carefully insert the card into the slot. Make sure the card is firmly connected.
2. Replace the **optional memory card cover** over the memory card slot with **one M2.5x4 screw**.
3. Install the battery pack as instructed in section 4.2.

## 4.4 The Keyboard

### Removing the Keyboard

To remove the keyboard, follow the steps below and refer to Figures 4-5 and 4-6:

1. Turn off the power to the T1800. Disconnect the AC adapter and all external cables connected to the T1800.
2. Remove the battery pack and optional memory card cover as instructed in sections 4.2 and 4.3.
3. Turn the T1800 over so that its front faces you.
4. Remove the **three front M2x6 silver screws** on the **bottom cover** if you are removing only the keyboard. Refer to Figure 4-5.
5. If you are removing the top cover, remove **three front M2x6 silver screws, two M2.5x6 silver screws, three M2.5x4 silver screws**, then remove the **one M3x6 silver screw** located on the back of the computer. Refer to Figure 4-5.

*Figure 4-5 Removing the screws securing the keyboard and top cover*



6. Turn the T1800 over so that its front faces you.
7. Open the display panel.
8. Unsnap the **two latches** securing the keyboard to the **base assembly**. Press on the bottom of the **keyboard mask** and pull the keyboard's front edge toward you to release the latches. Refer to Figure 4-6.

***NOTE:** After unsnapping the keyboard latches, lift the front of the keyboard up and lean it against the display panel. The keyboard cable is short and can be damaged if you try to move the keyboard in any other direction before disconnecting it.*

9. Disconnect the **keyboard cable** from pressure plate connector **PJ702** on the **modem interface board** and place the keyboard aside. Refer to Figure 4-6.

*Figure 4-6 Unsnapping the keyboard and keyboard cable*

## Installing the Keyboard

To install the keyboard and the associated parts around it, follow these steps:

1. Place the keyboard so that the bottom is facing you and lean it against the display panel. Refer to Figure 4-6. Connect the **keyboard cable** to **pressure plate connector PJ702** on the **modem interface board**.
2. Check to make sure you have connected the **keyboard cable** to the correct places on the modem interface board.
3. Lower the keyboard onto **base assembly** making sure the edges of the keyboard align with the base assembly all the way around the keyboard. Secure the **two latches** on the front of the keyboard and re-check the alignment of the keyboard and the bottom cover. Refer to Figure 4-6.
4. Close the display panel and turn the T1800 over and install either the front **three M2x6 silver screws** or **nine M2x6 silver, M2.5x6 silver, M2.5x4 silver and M3x6 silver screws** removed in step 4 or 5. Refer to Figure 4-5.
5. Install the optional memory card and cover, and then replace the battery pack as instructed in sections 4.2 and 4.3.

## 4.5 The Built-in Modem Case and Modem Interface Board

### Removing the Built-in Modem Case and Modem Interface Board

To remove the built-in modem case and modem interface board follow these steps and refer to Figures 4-7 and 4-8:

1. Turn off the power to the T1800. Disconnect the AC adapter and all external cables connected to the T1800.
2. Remove the battery pack, optional memory card, and keyboard as instructed in sections 4.2, 4.3 and 4.4.
3. Remove the two **M2.5x6 silver screws** holding the **built-in modem case** in place and lift out the built-in modem case. Refer to Figure 4-7.

*Figure 4-7 Removing the built-in modem case*

4. Take off the **modem interface board** from the built-in modem case. Refer to Figure 4-8.

*Figure 4-8 Removing the modem interface board*

## Installing the Built-in Modem Case and Modem Interface Board

To install the built-in modem case and modem interface board follow these steps.

1. Attach the **modem interface board** to the **built-in modem case**. Refer to Figure 4-8.
2. Fit the **built-in modem case** into the **latch** on the **base assembly** and connect the **modem interface board's PJ703** to the **system board's PJ10**.
3. Install the keyboard, memory card, and battery pack as instructed in sections 4.2, 4.3, and 4.4.

## 4.6 The Top Cover

### Removing the Top Cover

To remove the T1800's top cover follow these steps and refer to Figure 4-8:

1. Turn off the power to the T1800. Disconnect the AC adapter and all external cables connected to the T1800.
2. Remove the battery pack, optional memory card and keyboard as described in sections 4.2, 4.3, 4.4 and 4.5.

**NOTE:** If the ground screw is mounted, remove the ground screw from the back of the computer.

3. Remove the **three M2.5x8 silver screws** securing the front of the **top cover** and disconnect the **DC-IN cable** from **PJ7** on the system board as shown in Figure 4-9.
4. Remove the **one M2.5x6 silver screw** securing the **display connector cover**, then disconnect the **display cable** from **PJ11** on the system board.

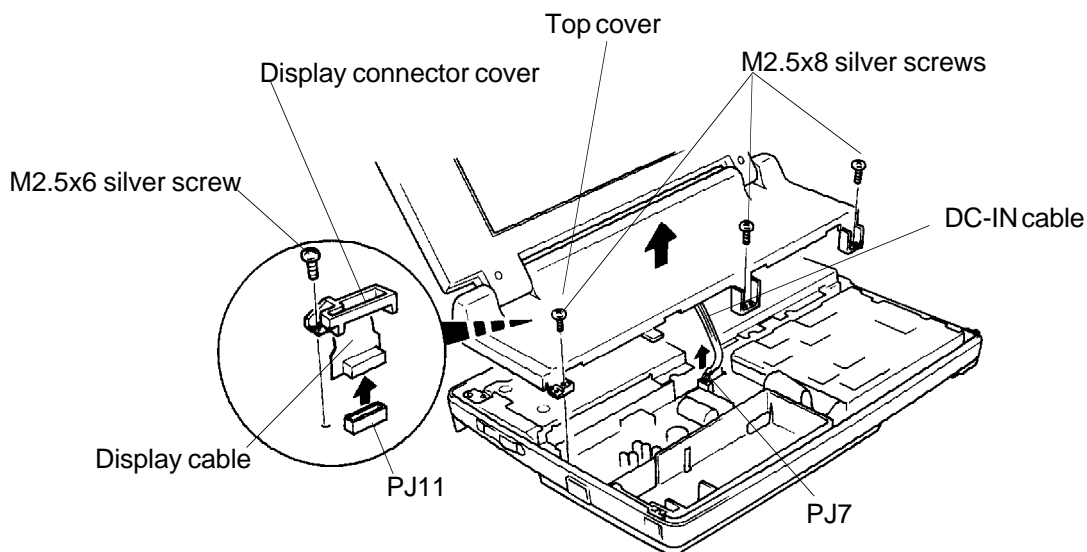


Figure 4-9 Removing the three screws and two cables

5. Lift the top cover off the chassis and place it aside.

## Installing the Top Cover

To install the top cover follow these steps:

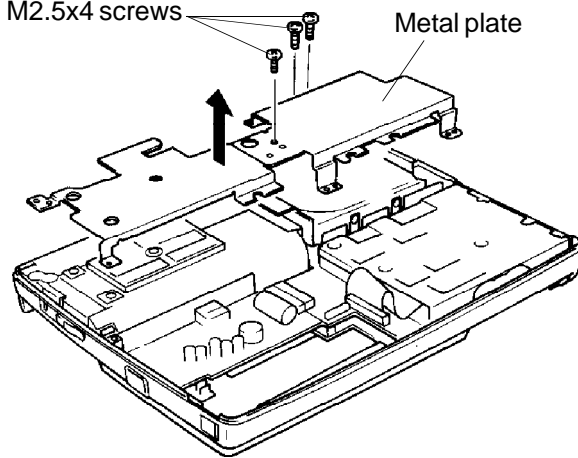
1. Align the **ground plate** with the **notch** located on the back of the top cover. Then connect the **display cable** to **PJ11** on the system board.
2. Secure the **display connector cover** with **one M2.5x8 silver screw**. Connect the **DC-IN cable** to **PJ7** on the system board. Then place the top cover on the base assembly.
3. Secure the **top cover** with the **three front M2.5x8 silver screws**.
4. Install the keyboard, optional memory card, and battery pack as instructed in sections 4.2, 4.3, and 4.5.

## 4.7 The Hard Disk Drive

### Removing the Hard Disk Drive

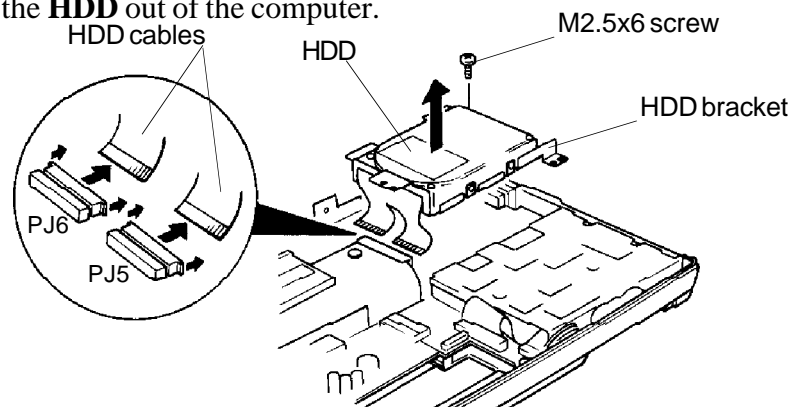
To remove the hard disk drive (HDD) follow these steps and refer to Figures 4-10 through 4-12:

1. Turn off the power to the T1800. Disconnect the AC adapter, and all external cables connected to the T1800.
2. Remove the battery pack, optional memory card, keyboard and top cover as instructed in sections 4.2, 4.3, 4.4, 4.5 and 4.6.
3. Remove the **three M2.5x4 screws** securing the **metal plate**. Refer to Figure 4-10.



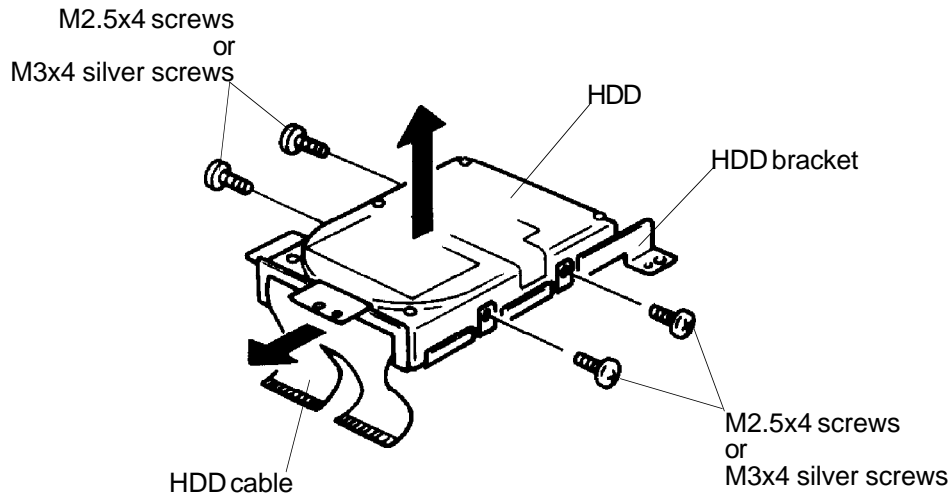
*Figure 4-10 Removing the metal plate*

4. Remove the **one M2.5x6 screw** securing the **HDD bracket** to the bottom cover. Refer to Figure 4-11.
5. Disconnect the **HDD cable** from the **pressure plate connectors PJ6 and PJ5** on the system board. Refer to Figure 4-11.
6. Lift the **HDD** out of the computer.



*Figure 4-11 Removing the hard disk drive*

7. Remove the **HDD cable** from the **HDD**. Refer to Figure 4-12.
8. To remove the **HDD bracket** from the **HDD**, remove the four **M3x4 silver screws (60MB HDD)** or **M2.5x4 screws (40MB HDD)** securing the **HDD** to the **HDD bracket** as shown in Figure 4-12.



*Figure 4-12 Removing the hard disk drive bracket*

9. Separate the bracket from the drive.

### **Installing the Hard Disk Drive**

To install the hard disk drive in the T1800 follow these steps:

1. Align the **HDD bracket** with the four holes on the side of the **HDD**. Refer to Figure 4-12.
2. Install the **four M3x4 silver screws (60MB HDD)** or **four M2.5x4 screws (40MB HDD)** removed in step 8 to secure the **HDD bracket** to the **HDD**.
3. Connect the **HDD cable** to **PJ5** and **PJ6** on the system board.
4. Connect the **HDD cable** to the **HDD**.
5. Place the **HDD** and its bracket in the T1800.
6. Secure the **HDD** in place with the **one M2.5x4 screw** removed in step 4. Refer to Figure 4-11.
7. Secure the metal plate with **three M2.5x4 screws** removed in step 3. Refer to Figure 4-10.
8. Install the top cover, keyboard, optional memory card, and battery pack as instructed in sections 4.2, 4.3, 4.4, 4.5 and 4.6.



## 4.8 The Floppy Disk Drive

### Removing the Floppy Disk Drive

To remove the floppy disk drive follow the steps below and refer to Figures 4-13 through 4-15:

1. Turn off the power to the T1800. Disconnect the AC adapter and all external cables connected to the T1800.
2. Remove the battery pack, optional memory card, keyboard, top cover, and hard disk drive as described in sections 4.2, 4.3, 4.4, 4.6 and 4.7.
3. Remove the **tape** securing the **RTC battery** and **Real Time Clock (RTC) battery cable** from **PJ2** on the system board and place it aside. Refer to Figure 4-13.

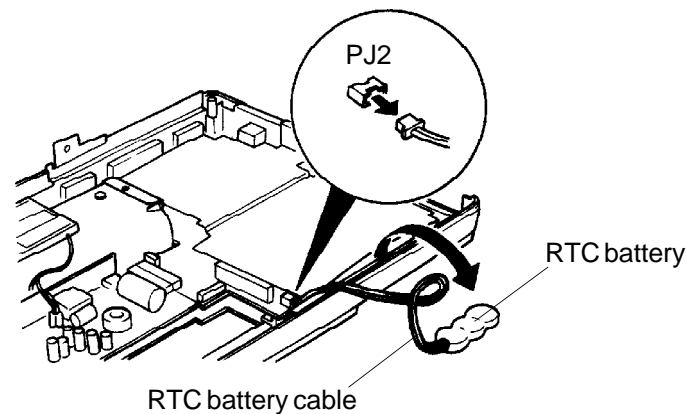


Figure 4-13 Removing the RTC battery

4. Remove the **two M2.5x4 screws** securing the **FDD bracket** to the bottom cover as shown in Figure 4-14.
5. Disconnect the **FDD cable** from **pressure plate connector PJ4** on the system board. Refer to Figure 4-14.

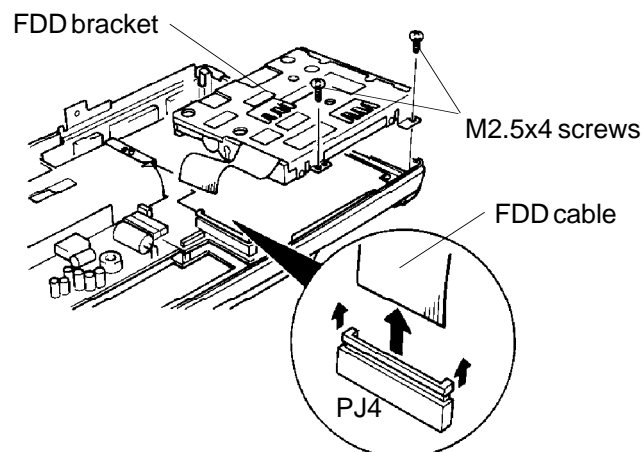
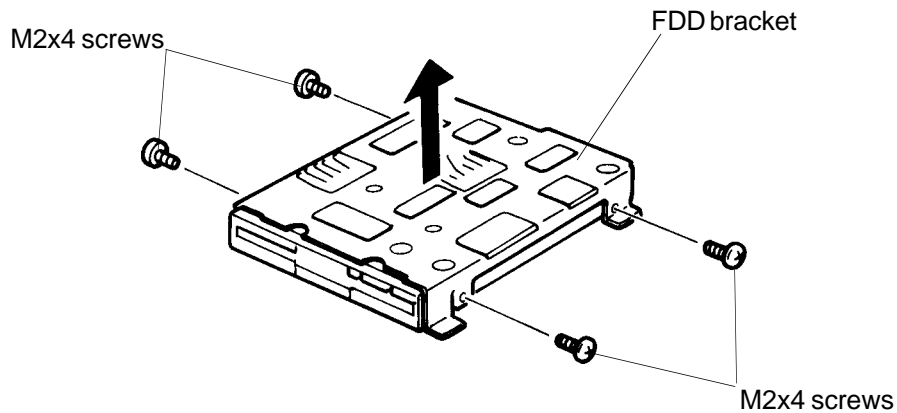


Figure 4-14 Removing the floppy disk drive

6. Lift the FDD out of the computer and place it aside.
7. Disconnect the RTC battery connector from PJ2. Refer to Figure 4-13.

8. To remove the **FDD bracket** from the **FDD**, remove the **four M2x4 screws** securing the **FDD** to the **bracket** as shown in Figure 4-15.



*Figure 4-15 Removing the FDD bracket*

9. Separate the bracket from the drive.

### **Installing the Floppy Disk Drive**

To install the floppy disk drive in the T1800 follow these steps:

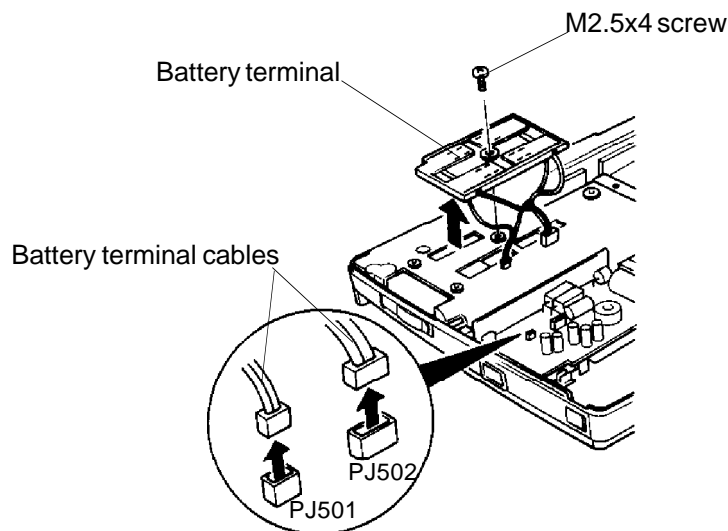
1. Align the **FDD bracket** with the four holes on the side of the **FDD**. Refer to Figure 4-15.
2. Install the **four M2x4 screws** removed in step 7 to secure the **FDD bracket** to the **FDD**.
3. Connect the **RTC battery cable** to **PJ2** on the system board. Make sure to lay **RTC battery cable** across the **FDD cable**, so that it is not pinched between hard objects.
4. Place the **FDD** and its **FDD bracket** in the T1800. Connect the **FDD cable** to **pressure plate connector PJ4** on the system board.
5. Secure the **FDD** in place with the **two M2.5x4 screws** removed in step 4.
6. Place the **RTC battery** in front of the FDD as shown in Figure 4-13 and replace the tape (50 mm ) on the RTC battery.
7. Install the top cover, keyboard, optional memory card, battery pack and HDD as instructed in sections 4.2, 4.3, 4.4, 4.6 and 4.7.

## 4.9 The Battery Terminal

### Removing the Battery Terminal

To remove the T1800's battery terminal follow these steps and refer to Figure 4-16:

1. Turn off the power to the T1800. Disconnect the AC adapter and all external cables connected to the T1800.
2. Remove the battery pack, optional memory card, keyboard, metal plate, and top cover as described in sections 4.2, 4.3, 4.4, 4.6, and 4.7.
3. Remove the **battery terminal cables** from **PJ501** and **PJ502** on the **power supply board**.
4. Remove the **one M2.5x4 screw**, and lift the **battery terminal** out.



*Figure 4-16 Removing the battery terminal*

### Installing the Battery Terminal

To install the battery terminal follow these steps:

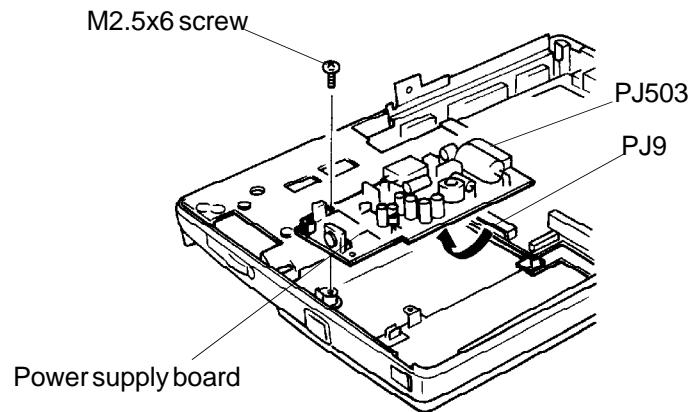
1. Place the **battery terminal** into position as shown in Figure 4-16.
2. Connect the **battery terminal cable** to **PJ501** and **PJ502** on the **power supply board**.
3. Secure the **one M2.5x4 screw** removed in step 4.
4. Install the battery pack, optional memory card, keyboard, metal plate, and top cover as instructed in sections 4.2, 4.3, 4.4, 4.6, and 4.7.

## 4.10 The Power Supply Board

### Removing the Power Supply Board

To remove the power supply board follow these steps and refer to Figure 4-17:

1. Turn off the power to the T1800. Disconnect the AC adapter, and all external cables connected to the T1800.
2. Remove the battery pack, optional memory card, keyboard, hard disk drive, built-in modem, battery terminal, and top cover as described in sections 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, and 4.9.
3. Remove **one M2.5x6 screw** at the rear left corner of the **power supply board** that secures the board to the chassis. Refer to Figure 4-17.
4. Disconnect the **power supply board connector PJ503** from **PJ9** on the system board. Refer to Figure 4-17.



*Figure 4-17 Removing the power supply board*

5. Lift out the power supply board.

### Installing the Power Supply Board

To install the power supply board follow these steps:

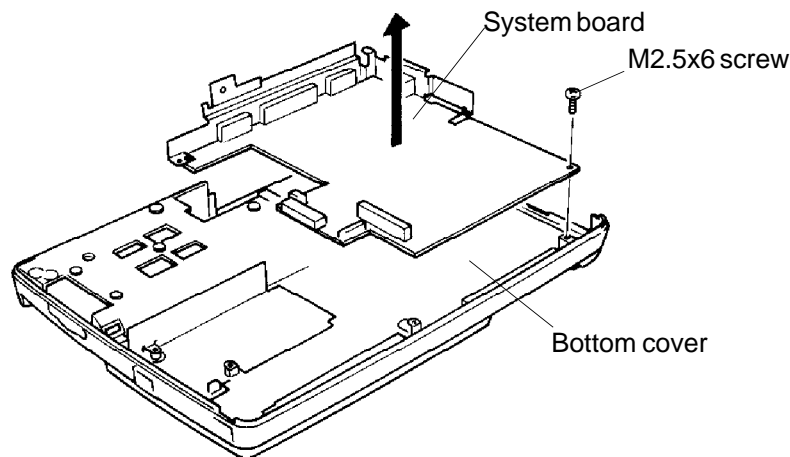
1. Place the **power supply board** into position as shown in Figure 4-17. Then connect **PJ503** on the power supply to **PJ9** on the system board.
2. Secure the power supply board with the **one M2.5x4 screw** removed in step 3. Refer to Figure 4-17.
3. Install the battery pack, optional memory card, keyboard, hard disk drive, built-in modem, battery terminal, and top cover as described in sections 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, and 4.9.

## 4.11 The System Board

### Removing the System Board

To remove the system board follow these steps and refer to Figures 4-18:

1. Turn off the power to the T1800, disconnect the AC adapter and external cables connected to the T1800.
2. Remove the battery pack, optional memory card, keyboard, built-in modem, top cover, power supply board, battery terminal, floppy disk drive and hard disk drive as described in sections 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9 and 4.10.
3. Remove **one M2.5x6 screw** securing the system board to the bottom cover. Refer to Figure 4-18.
4. Gently lift the **system board** out of the computer. Refer to Figure 4-18.



*Figure 4-18 Removing the system board*

### Installing the System Board

To install the system board follow these steps:

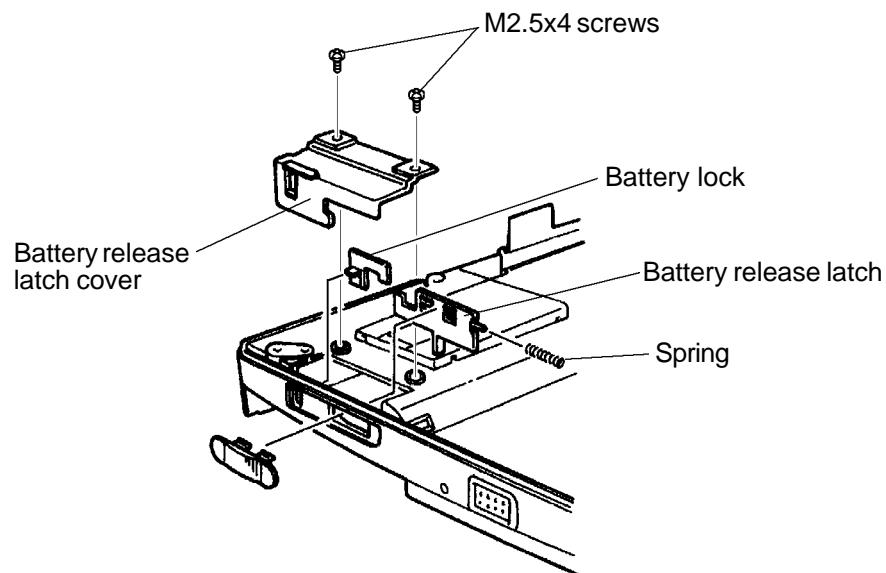
1. Connect the power supply board **PJ503** to system board **PJ9**, then place the system board into position as shown in Figure 4-18.
2. Secure the system board and power supply board with **one M2.5x4 screw** each.
3. Install the battery pack, optional memory card, keyboard, built-in modem, top cover, power supply board, battery terminal, floppy disk drive and hard disk drive as instructed in sections 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9 and 4.10.

## 4.12 The Battery Release Latch and Battery Lock

### Removing the Battery Release Latch and Battery Lock

To remove the battery release latch and battery lock follow these steps and refer to Figure 4-19:

1. Turn off the power to the T1800. Disconnect the AC adapter and all external cables connected to the T1800.
2. Remove the battery pack, optional memory card, keyboard, hard disk drive, built-in modem, battery terminal and top cover as described in sections 4.2, 4.3, 4.4, 4.6, 4.7, and 4.9.
3. Remove the **two M2.5x4 screws** on the **battery release latch cover**. Refer to Figure 4-19.
4. Remove the **battery release latch cover, battery release latch, battery lock, and spring** from the bottom cover. Refer to Figure 4-19.



*Figure 4-19 Removing the battery release latch and battery lock*

### Installing the Battery Release Latch and Battery Lock

To install the battery release latch and battery lock follow these steps:

1. Place the **battery release latch** and **battery lock** into position as shown in Figure 4-19.
2. Secure the **battery release latch cover** with **two M2.5x4 screws**.
3. Install the battery pack, optional memory card, keyboard, hard disk drive, battery terminal and top cover as described in sections 4.2, 4.3, 4.5, 4.6, 4.7, and 4.9.

## 4.13 The Display Mask

### Removing the Display Mask

To remove the display mask, follow these steps and refer to Figure 4-20:

1. Turn off the power to the T1800. Disconnect the AC adapter, and all external cables connected to the T1800.
2. Remove the battery pack as instructed in section 4.2.
3. Open the display panel.
4. Remove the **two plastic seals** from the display supports and the **two rubber cushions** from the top corners of the display panel.
5. Remove the **four M2x6 silver screws** securing the **display mask**. Refer to Figure 4-20.
6. **Twelve plastic latches** secure the **display mask** to the **back cover** of the LCD module. To release these latches, while holding the **cover latches** up, start with the **top three latches** first and work your way around the mask until all latches are released.
7. Gently separate the display mask from the back cover.

**CAUTION:** Before removing the display mask from the T1800, make sure the display panel is opened to angle of more than 90 degrees to prevent breakage of the display hinge supports on the mask.

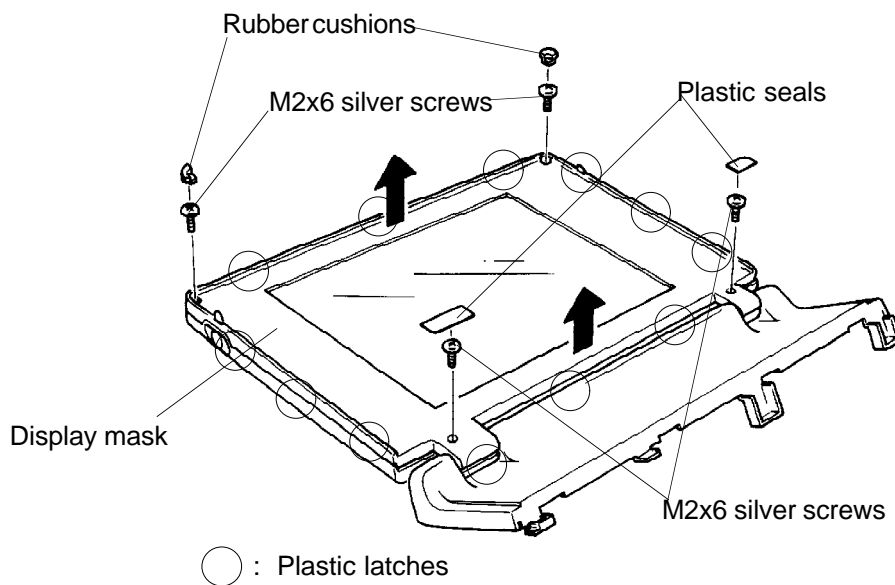


Figure 4-20 Removing the display mask screws

## Installing the Display Mask

To install the display mask, follow these steps:

1. Align the **display mask** over the display panel. Be careful not to damage the lower portion of the display mask that covers the hinges.
2. Snap the **twelve latches** on the display mask into place. Check to make sure the seam between the display mask and back cover is evenly seated around the display.
3. Secure the mask in place with the **four M2x6 silver screws** removed in step 5 and cover the screws with the **rubber cushions** on the top of the display and the **plastic seals** on the bottom of the display.

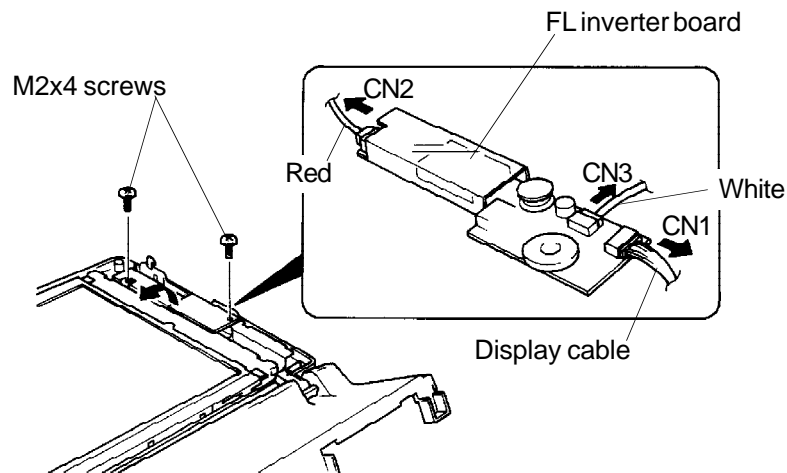


## 4.14 The FL Inverter Board

### Removing the FL Inverter Board

To remove the FL inverter board, follow these steps and refer to Figure 4-21:

1. Turn off the power to the T1800. Disconnect the AC adapter, and all external cables connected to the T1800.
2. Remove the battery pack and display mask as instructed in sections 4.2 and 4.13.
3. Remove the **two M2x4 screws** securing the **FL inverter board**. Refer to Figure 4-21.
4. Gently turn the **FL inverter board** toward the LCD to expose the **three cables** connecting the FL inverter board to the LCD panel.
5. Disconnect the display cable from **CN1**, FL **white** connector from **CN3**, **red** connector from **CN2** on the **FL inverter board**. Refer to Figure 4-21.



*Figure 4-21 Removing the FL inverter board*

### Installing the FL Inverter Board

To install the FL inverter board, follow these steps:

1. Connect the **display cable** to **CN1** on the **FL inverter board**, then connect the two **FL cables** to **CN3 (white connector)** and **CN2 (red connector)**.
2. Secure the **FL inverter board** to the **back cover** of the LCD module with two **M2x4 screws**.
3. Install the display mask and battery pack as instructed in sections 4.2 and 4.13.

## 4.15 The Liquid Crystal Display (LCD)

### Removing the Liquid Crystal Display

To remove the LCD, follow these steps and refer to Figure 4-22:

1. Turn off the power to the T1800. Disconnect the AC adapter, and all external cables connected to the T1800.
2. Remove the battery pack, display mask, and FL inverter board as instructed in sections 4.2, 4.13, and 4.14.
3. Remove the **three M2x4 screws** securing the **LCD module** to the LCD cover. Refer to Figure 4-22.
4. Lift the LCD module up, rotate it back and disconnect the **two display cables** from **CN1** and **CN2** on the left side of the LCD. Refer to Figure 4-22.

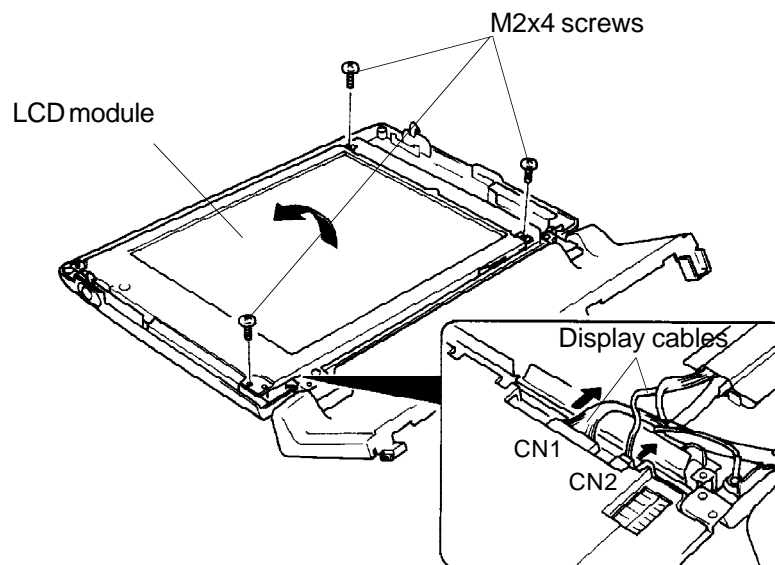


Figure 4-22 Removing the LCD

### Installing the Liquid Crystal Display

To install the LCD, follow these steps:

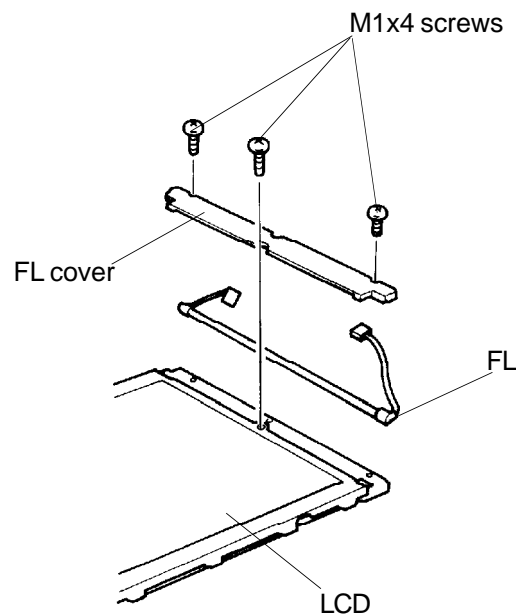
1. Connect the **two display cables** on the left side of the **LCD module** to **CN1** and **CN2** on the LCD.
2. Gently rotate the **LCD module**, until it touches the back cover.
3. Secure the **LCD module** with **three M2x4 screws**.
4. Install the FL inverter board, display mask, and battery pack as instructed in sections 4.2, 4.13, and 4.14.

## 4.16 The Fluorescent Lamp (FL)

### Removing the FL

To remove the FL, follow these steps and refer to Figure 4-23:

1. Turn off the power to the T1800. Disconnect the AC adapter, and all external cables connected to the T1800.
2. Remove the battery pack, display mask, FL inverter board, and LCD as described in sections 4.2, 4.13, 4.14, and 4.15.
3. Remove the **three M1x4 screws** securing the **FL cover**. Refer to Figure 4-23.
4. Remove the **FL cover**, then lift the **FL** out of the **LCD module** and place it aside. Refer to Figure 4-23.



*Figure 4-23 Removing the FL cover and FL*

### Installing the FL

To install the FL, follow these steps:

1. Align the **FL** with the right side of the LCD gently.
2. Replace the **FL cover** and secure it with **three M1x4 screws** removed in step 3.

## 4.17 The Display Back Cover

### Removing the Display Back Cover

To remove the Display back cover, follow these steps and refer to Figures 4-24 and 4-25:

1. Turn off the power to the T1800. Disconnect the AC adapter, and all cables connected to the T1800.
2. Remove the battery pack, the optional memory card, the keyboard, the top cover, display mask, FL inverter board, and LCD as instructed in sections 4.2, 4.3, 4.4, 4.6, 4.13, 4.14 and 4.15.
3. Remove the **display cable cover** securing the **display cable** to the back cover. Refer to Figure 4-24.

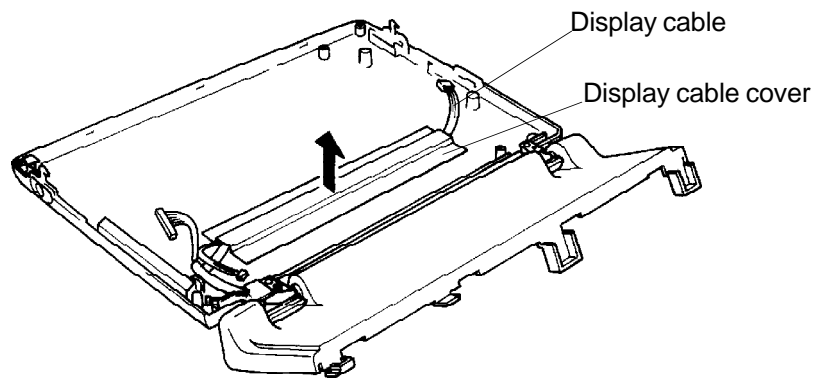


Figure 4-24 Removing the display cable cover

4. Remove the **three M2.5x6 screws** securing the display cover and **one M2.5x4 screw** securing the GND. Refer to Figure 4-25.

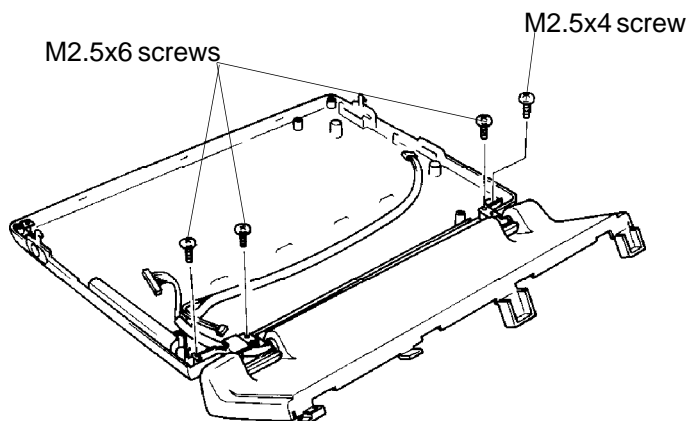


Figure 4-25 Removing the display back cover

**CAUTION:** Use care in removing the back cover! It may be necessary to rotate the cover slightly so that you do not damage the bottom portion of the cover over the hinges.

## Installing the Display Back Cover

To install the display back cover, follow these steps:

1. Position the **display back cover**, then secure the back cover with **three M2.5x6 screws** and **one M2.5x4 screw**.
2. Replace the **display cable cover** with the display cable. Refer to Figure 4-24.
3. Install the LCD, FL inverter board, display mask, top cover, keyboard, memory card, and battery pack as instructed in sections 4.2, 4.3, 4.6, 4.13, 4.14, and 4.15.

## 4.18 The LED Board and Sub Battery

### Removing the LED Board and Sub Battery

To remove the LED board and sub battery, follow these steps and refer to Figures 4-26 and 4-27.

1. Turn off the power to the T1800. Disconnect the AC adapter, and all cables connected to the T1800.
2. Remove the battery pack, the optional memory card, the keyboard, and the top cover as instructed in sections 4.2, 4.3, 4.4, and 4.6.
3. Remove the **three M2.5x4 screws** securing the **sub battery cover** and **LED board** and the **metal plate**. Refer to Figure 4-26.

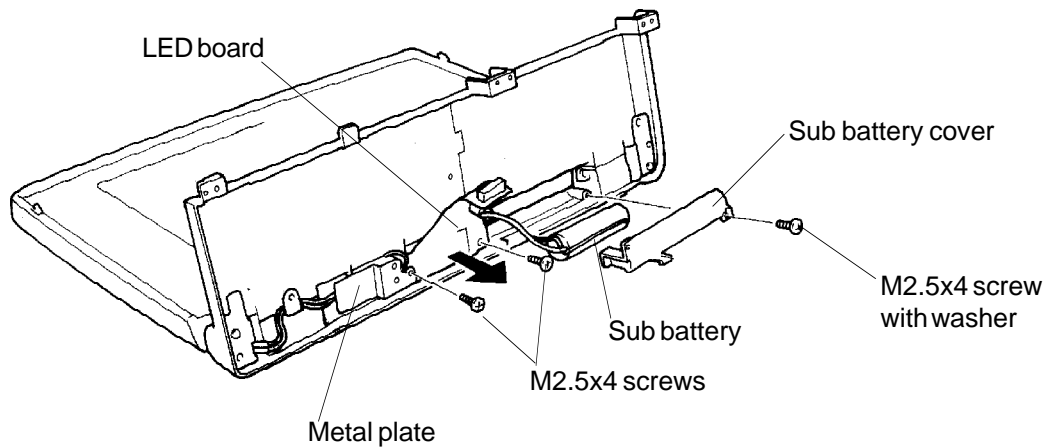


Figure 4-26 Removing the screws

4. Rotate the **LED board** toward you, then disconnect the **two display cables**, **display switch cable**, and **sub battery cable** from the **LED board**.

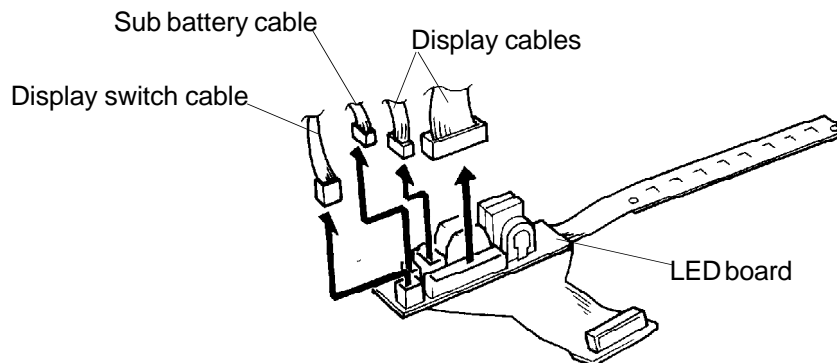


Figure 4-27 Disconnecting the cables from the LED board

## Installing the LED Board and Sub Battery

To install the LED board and sub battery, follow these steps:

1. Connect the **two display cables, display switch cable, and sub battery cable** to the **LED board**. Refer to Figure 4-27.
2. Secure the **LED board** and the **metal plate** with **two M2.5x4 screws**.
3. Place the **sub battery** on the **sub battery case**, then secure the sub battery cover with **two M2.5x4 screws**.
4. Install the top cover, keyboard, optional memory card, and battery pack as instructed in sections 4.2, 4.3, 4.4, and 4.6.

## 4.19 The Display Cable and Display Switch

### Removing the Display Cable and Display Switch

To remove the display cable and display switch, follow these steps and refer to Figures 4-28 and 4-29:

1. Turn off the power to the T1800. Disconnect the AC adapter, and all external cables connected to the T1800.
2. Remove the battery pack, keyboard, top cover, display mask, FL inverter board, LCD, back cover, and LED board as instructed in sections 4.2, 4.3, 4.4, 4.13, 4.14, 4.16, 4.17 and 4.18.
3. Remove the **one M2.5x6 screw** and **one M2.5x4 silver screw** securing the **display cable cover** and **hinges** over the **display switch**. Refer to Figure 4-28.
4. Remove the **display cable** cover from the **top cover**, then slide the display cable out of the top cover.

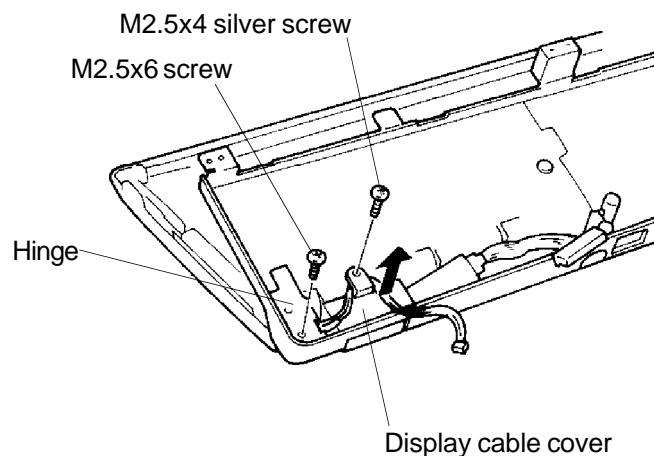


Figure 4-28 Removing the display cable

5. Remove the **display switch hinge** from the top cover, then remove the **one M2x8 screw** securing the **display switch**. Refer to Figure 4-29.

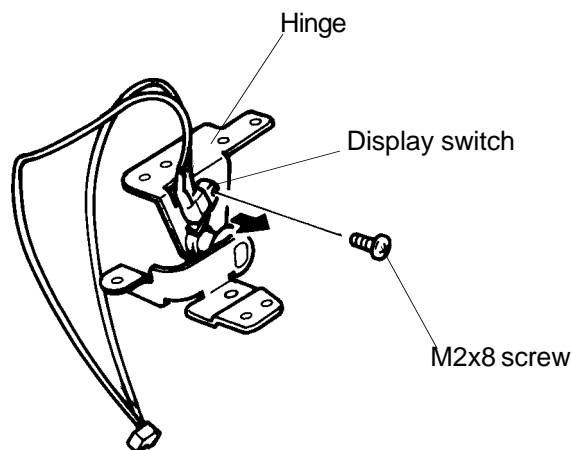


Figure 4-29 Removing the display switch



## Installing the Display Cable and Display Switch

To install the display cable and display switch, follow these steps:

1. Slide the **display cable** in through the **top cover** of the T1800. Refer to Figure 4-28.
2. Secure the **display switch** to the display **hinge** with **one M2x8 screw**. Refer to Figure 4-29.
3. Install the hinge and display cable cover to the top cover with **one M2.5x6 screw** and **one M2.5x4 silver screws**. Refer to Figure 4-28.
4. Install the battery pack, keyboard, top cover, display mask, FL inverter board, LCD, back cover, and LED board as instructed in sections 4.2, 4.3, 4.4, 4.13, 4.14, 4.16, 4.17 and 4.18.

## 4.20 The Math Co-Processor

### Removing the Math Co-Processor

To remove the math co-processor, follow these steps and refer to Figures 4-30 and 4-31:

1. Turn off the power to the T1800. Disconnect the AC adapter, and all cables connected to the T1800.
2. Turn the T1800 over. Make sure the display is closed.
3. Remove the **one M2x6 silver screw** to remove the **math co-processor cover** . Refer to Figure 4-30.

*Figure 4-30 Removing the math co-processor cover*

4. Insert the **tweezers** or **small flat-blade screwdriver** into the slots at the **diagonal corners** of the socket and pry the math co-processor out gently. Refer to Figure 4-31.

**CAUTION:** Be careful not to damage the socket and Math co-processor.

*Figure 4-31 Removing the math co-processor*

## Installing the math co-processor

To install the math co-processor, follow these steps:

1. Align **math co-processor** with the **math co-processor socket**. Note the **notch** on the right side of the **math co-processor**, and the **notch** on the **math co-processor socket**. These notches indicate the correct position of the math co-processor. Refer to Figure 4-32.

*Figure 4-32 Aligning the math co-processor*

2. Replace the **math co-processor cover** and secure the **one M2x6 silver screw**.



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# Appendices

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# Contents

|                   |                                                    |               |
|-------------------|----------------------------------------------------|---------------|
| <b>Appendix A</b> | <b>System Board Layout .....</b>                   | <b>App-5</b>  |
| A.1               | System Board (Front) .....                         | App-5         |
| A.2               | System Board (Back) .....                          | App-6         |
| <b>Appendix B</b> | <b>Pin Assignment .....</b>                        | <b>App-7</b>  |
| B.1               | PJ1 EXP MEM Connector .....                        | App-7         |
| B.2               | PJ2 Real Time Clock Connector .....                | App-7         |
| B.3               | PJ3 External PRT/FDD Port Connector .....          | App-8         |
| B.4               | PJ4 Internal Floppy Disk Drive Pin Connector ..... | App-8         |
| B.5               | PJ5 HDD I/F Connector .....                        | App-9         |
| B.6               | PJ6 HDD I/F Connector .....                        | App-9         |
| B.7               | PJ7 DC Jack.....                                   | App-9         |
| B.8               | PJ8 Asynchronous I/F Connector.....                | App-10        |
| B.9               | PJ9 Power Supply I/F Connector .....               | App-10        |
| B.10              | PJ10 Keyboard Modem I/F Connector .....            | App-11        |
| B.11              | PJ11 LED FPC Connector .....                       | App-12        |
| B.12              | PJ16 Ten-Key Connector .....                       | App-12        |
| B.13              | PJ17 CRT I/F Connector .....                       | App-12        |
| B.14              | PJ19 PS/2 Mouse Connector .....                    | App-13        |
| <b>Appendix C</b> | <b>ASCII Character Codes .....</b>                 | <b>App-15</b> |
| <b>Appendix D</b> | <b>Keyboard Scan/Character Codes .....</b>         | <b>App-17</b> |
| <b>Appendix E</b> | <b>Keyboard Layouts .....</b>                      | <b>App-23</b> |
| E.1               | USA Keyboard .....                                 | App-23        |
| E.2               | UK Keyboard .....                                  | App-23        |
| E.3               | German Keyboard .....                              | App-24        |
| E.4               | French Keyboard .....                              | App-24        |
| E.5               | Spanish Keyboard .....                             | App-25        |
| E.6               | Italian Keyboard .....                             | App-25        |
| E.7               | Scandinavian (DK, NO, SW) Keyboard .....           | App-26        |
| E.8               | Swiss (French/German) Keyboard .....               | App-26        |
| E.9               | Canadian Keyboard .....                            | App-27        |
| E.10              | Keycap Number Keyboard .....                       | App-27        |
| <b>Appendix F</b> | <b>Wiring Diagrams .....</b>                       | <b>App-29</b> |
| F.1               | Printer Wraparound Connector .....                 | App-29        |
| F.2               | RS-232-C Wraparound Connector .....                | App-29        |
| F.3               | RS-232-C Direct Cable (9 Pin to 9 Pin) .....       | App-29        |
| F.4               | RS-232-C Direct Cable (9 Pin to 25 Pin) .....      | App-30        |

## Tables

|            |                                                            |        |
|------------|------------------------------------------------------------|--------|
| Table B-1  | EXP MEM connector pin assignment (40-pin) .....            | App-7  |
| Table B-2  | RTC connector pin assignment (2-pin) .....                 | App-7  |
| Table B-3  | External PRT/FDD connector pin assignment (25-pin) .....   | App-8  |
| Table B-4  | Internal FDD connector pin assignment (25-pin) .....       | App-8  |
| Table B-5  | HDD I/F connector pin assignment (22-pin) .....            | App-9  |
| Table B-6  | HDD I/F connector pin assignment (22-pin) .....            | App-9  |
| Table B-7  | DC Jack connector pin assignment (3-pin) .....             | App-9  |
| Table B-8  | Asynchronous I/F connector pin assignment (9-pin) .....    | App-10 |
| Table B-9  | Power supply I/F connector pin assignment (30-pin) .....   | App-10 |
| Table B-10 | Keyboard modem I/F connector pin assignment (48-pin) ..... | App-11 |
| Table B-11 | LED FPC connector pin assignment (36-pin) .....            | App-12 |
| Table B-12 | Ten-Key pin assignment (3-pin) .....                       | App-12 |
| Table B-13 | CRT I/F connector pin assignment (15-pin) .....            | App-12 |
| Table B-14 | PS/2 mouse connector pin assignment (6-pin) .....          | App-13 |
|            |                                                            |        |
| Table C-1  | ASCII Character Codes .....                                | App-15 |
|            |                                                            |        |
| Table D-1  | Scan codes (set 1 and set 2) .....                         | App-17 |
| Table D-2  | Scan codes with Shift key .....                            | App-20 |
| Table D-3  | Scan codes in Numlock mode .....                           | App-20 |
| Table D-4  | Scan codes with Fn key .....                               | App-21 |
| Table D-5  | Scan codes in overlay mode .....                           | App-21 |
| Table D-6  | Scan codes with Ctrl key .....                             | App-21 |
| Table D-7  | Scan codes with Alt key .....                              | App-21 |

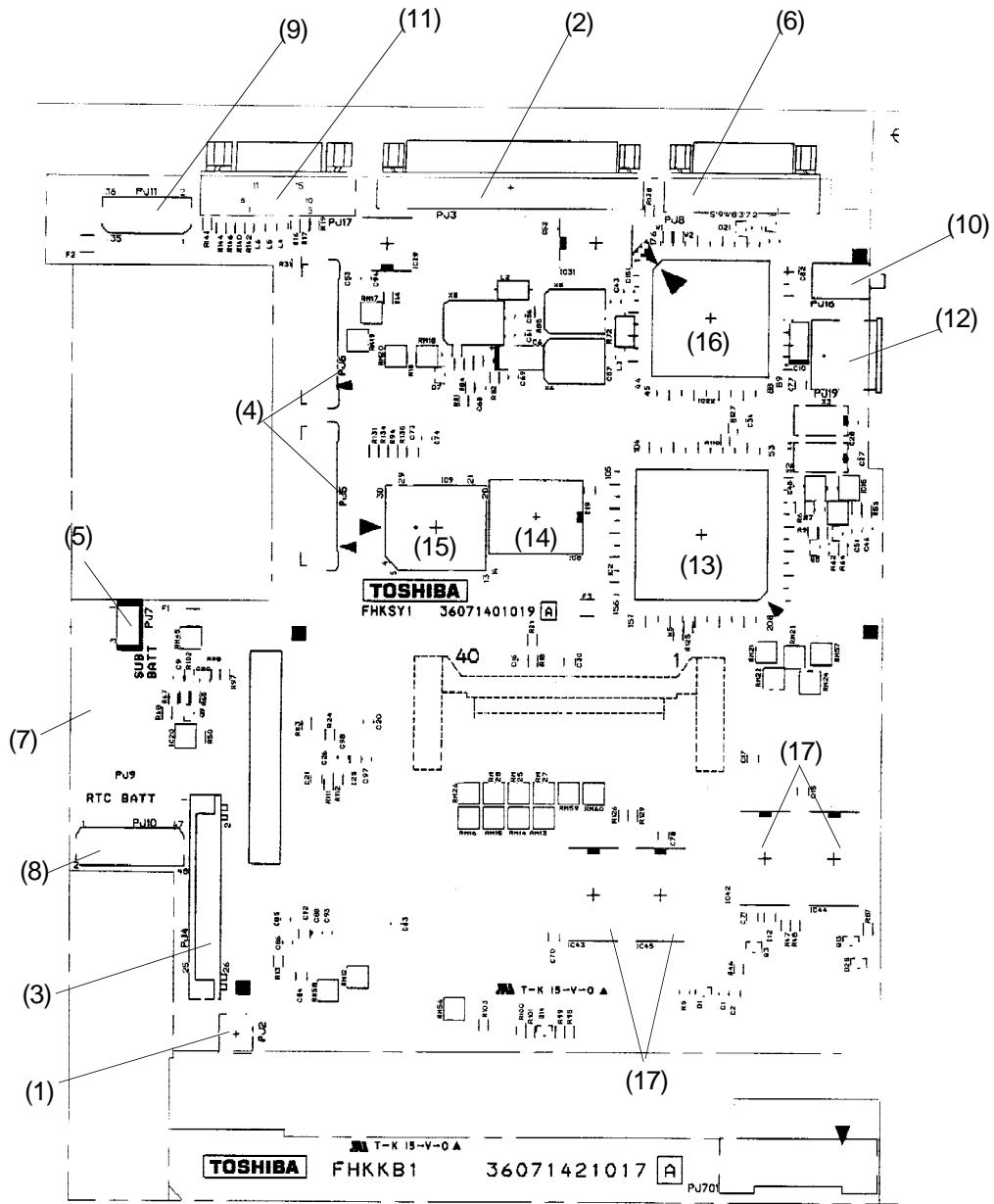
## Figures

|             |                                               |        |
|-------------|-----------------------------------------------|--------|
| Figure A-1  | System board (Front) .....                    | App-5  |
| Figure A-2  | System board (Back) .....                     | App-6  |
|             |                                               |        |
| Figure E-1  | USA keyboard .....                            | App-23 |
| Figure E-2  | UK keyboard .....                             | App-23 |
| Figure E-3  | German keyboard .....                         | App-24 |
| Figure E-4  | French keyboard .....                         | App-24 |
| Figure E-5  | Spanish Keyboard .....                        | App-25 |
| Figure E-6  | Italian keyboard.....                         | App-25 |
| Figure E-7  | Scandinavian (DK, NO, SW) keyboard .....      | App-26 |
| Figure E-8  | Swiss (French/German) keyboard .....          | App-26 |
| Figure E-9  | Canadian keyboard .....                       | App-27 |
| Figure E-10 | Keycap number keyboard .....                  | App-27 |
|             |                                               |        |
| Figure F-1  | Printer wraparound connector .....            | App-29 |
| Figure F-2  | RS-232-C wraparound connector .....           | App-29 |
| Figure F-3  | RS-232-C direct cable (9 pin to 9 pin) .....  | App-29 |
| Figure F-4  | RS-232-C direct cable (9 pin to 25 pin) ..... | App-30 |



# Appendix A System Board Layout

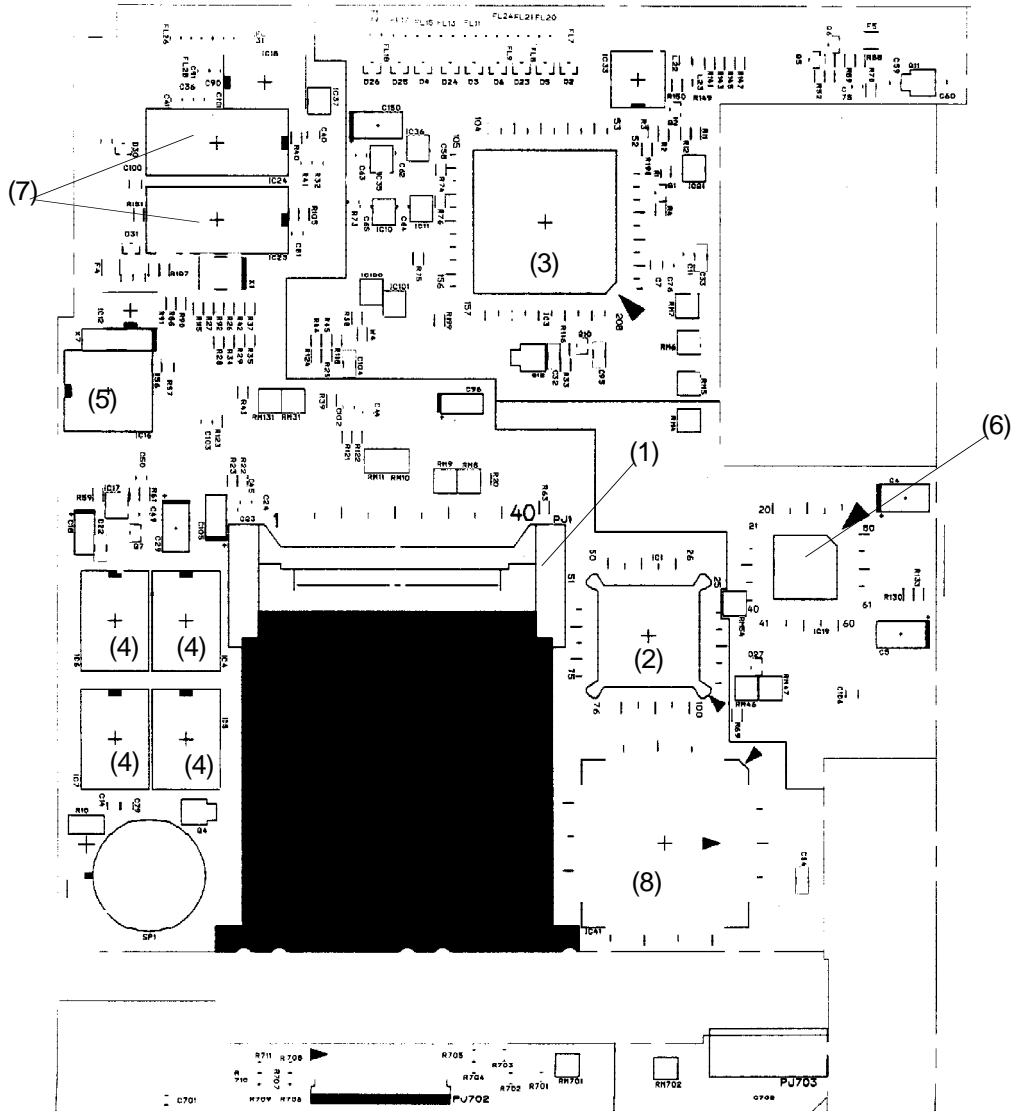
## A.1 System Board (Front)



| Mark | Number   | Name                     | Mark | Number       | Name                         |
|------|----------|--------------------------|------|--------------|------------------------------|
| (1)  | PJ2      | RTC battery connector    | (10) | PJ16         | Ten-key port                 |
| (2)  | PJ3      | Printer/FDD port         | (11) | PJ17         | CRT port                     |
| (3)  | PJ4      | Internal FDD connector   | (12) | PJ19         | PS/2 mouse port              |
| (4)  | PJ5, PJ6 | HDD connector            | (13) | IC2          | System controller gate array |
| (5)  | PJ7      | Sub battery connector    | (14) | IC8          | Backup RAM                   |
| (6)  | PJ8      | RS-232-C port            | (15) | IC9          | BIOS ROM                     |
| (7)  | PJ9      | Power supply connector   | (16) | IC22         | VGA controller gate array    |
| (8)  | PJ10     | Built-in modem connector | (17) | IC42 to IC45 | System memory                |
| (9)  | PJ11     | LCD connector            |      |              |                              |

Figure A-1 System board (front)

## A.2 System Board (Back)



| Mark | Number        | Name                                  |
|------|---------------|---------------------------------------|
| (1)  | PJ1           | Expansion memory port                 |
| (2)  | IC2           | Central Processing Unit (CPU) 80386SX |
| (3)  | IC3           | Super Integration T9901               |
| (4)  | IC4 to IC7    | System memory                         |
| (5)  | IC16          | Real Timer Clock (RTC)                |
| (6)  | IC19          | Keyboard controller                   |
| (7)  | IC23 and IC24 | Video RAM                             |
| (8)  | IC41          | 80367SX socket                        |

Figure A-2 System board (back)

## Appendix B Pin Assignment

### B.1 PJ1 EXP MEM Connector

*Table B-1 EXP MEM connector pin assignment (40-pin)*

| Pin | Signal    | I/O | Pin | Signal   | I/O |
|-----|-----------|-----|-----|----------|-----|
| 01  | GND       |     | 02  | D03;100  | I/O |
| 03  | D04;100   | I/O | 04  | D05;100  | I/O |
| 05  | D06;100   | I/O | 06  | D07;100  | I/O |
| 07  | D08;100   | I/O | 08  | D09;100  | I/O |
| 09  | D10;100   | I/O | 10  | MA08;100 | O   |
| 11  | GND       |     | 12  | CASH;000 | O   |
| 13  | RAS4;000  | O   | 14  | RAS3;000 | O   |
| 15  | MEMWE;000 | O   | 16  | CASL;000 | O   |
| 17  | RAS5;000  | O   | 18  | RAS2;000 | O   |
| 19  | EMA09;100 | O   | 20  | RAMV     |     |
| 21  | RAMV      |     | 22  | MA07;100 | O   |
| 23  | MA06;100  | O   | 24  | MA05;100 | O   |
| 25  | MA03;100  | O   | 26  | MA03;100 | O   |
| 27  | MA02;100  | O   | 28  | MA01;100 | O   |
| 29  | DRMEN;100 | I   | 30  | GND      |     |
| 31  | MA00;100  | O   | 32  | D00;100  | I/O |
| 33  | D01;100   | I/O | 34  | D02;100  | I/O |
| 35  | D11;100   | I/O | 36  | D12;100  | I/O |
| 37  | D13;100   | I/O | 38  | D14;100  | I/O |
| 39  | D15;100   | I/O | 40  | GND      |     |

### B.2 PJ2 Real Time Clock Connector

*Table B-2 RTC connector pin assignment (2-pin)*

| Pin | Signal | I/O | Pin | Signal | I/O |
|-----|--------|-----|-----|--------|-----|
| 01  | 3.6V   | I   | 02  | GND    |     |

### B.3 PJ3 External PRT/FDD Port Connector

Table B-3 External PRT/FDD connector pin assignments (25-pin)

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

### B.4 PJ4 Internal Floppy Disk Drive Pin Connector

Table B-4 Internal FDD connector pin assignments (25-pin)

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

## B.5 PJ5 HDD I/F Connector

Table B-5 HDD I/F connector pin assignment (22-pin)

| Pin | Signal    | I/O | Pin | Signal   | I/O |
|-----|-----------|-----|-----|----------|-----|
| 01  | RESET;000 | O   | 02  | GND      |     |
| 03  | SD07;102  | I/O | 04  | SD08;102 | I/O |
| 05  | SD06;102  | I/O | 06  | GND      |     |
| 07  | SD09;102  | I/O | 08  | SD05;102 | I/O |
| 09  | SD10;102  | I/O | 10  | SD04;102 | I/O |
| 11  | GND       |     | 12  | SD11;102 | I/O |
| 13  | SD03;102  | I/O | 14  | SD12;102 | I/O |
| 15  | SD02;102  | I/O | 16  | GND      |     |
| 17  | SD13;102  | I/O | 18  | SD01;102 | I/O |
| 19  | SD14;102  | I/O | 20  | SD00;102 | I/O |
| 21  | GND       |     | 22  | GND      |     |

## B.6 PJ6 HDD I/F Connector

Table B-6 HDD I/F connector pin assignment (22-pin)

| Pin | Signal     | I/O | Pin | Signal     | I/O |
|-----|------------|-----|-----|------------|-----|
| 01  | GND        |     | 02  | SD15;102   | I/O |
| 03  | VCC        |     | 04  | IOWR;000   | O   |
| 05  | GND        |     | 06  | IORD;000   | O   |
| 07  | IIRDY;100  | I   | 08  | IRQ14;100  | I   |
| 09  | GND        |     | 10  | IIO16;000  | I   |
| 11  | SA01;100   | O   | 12  | SA00;100   | O   |
| 13  | GND        |     | 14  | SA02;100   | O   |
| 15  | HDC0CS;000 | O   | 16  | HDC1CS;000 | O   |
| 17  | GND        |     | 18  | DRVSL;000  | I   |
| 19  | VCC        |     | 20  | VCC        |     |
| 21  | VCC        |     | 22  | GND        |     |

## B.7 PJ7 DC Jack

Table B-7 DC jack connector pin assignment (3-pin)

| Pin | Signal | I/O | Pin | Signal | I/O |
|-----|--------|-----|-----|--------|-----|
| 01  | GND    |     | 02  | DCIN   |     |
| 03  | START  |     |     |        |     |

## B.8 PJ8 Asynchronous I/F Connector

Table B-8 Asynchronous I/F connector pin assignment (9-pin)

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

## B.9 PJ9 Power Supply I/F Connector

Table B-9 Power supply I/F connector pin assignment (30-pin)

| Pin | Signal     | I/O | Pin | Signal     | I/O |
|-----|------------|-----|-----|------------|-----|
| 01  | DCIN       |     | 02  | DCIN       |     |
| 03  | DCIN       |     | 04  | DCIN       |     |
| 05  | GND        |     | 06  | DCIN       |     |
| 07  | DCIN       |     | 08  | DCIN       |     |
| 09  | SBATT      |     | 10  | DSPV       |     |
| 11  | DSPV       |     | 12  | DSPV       |     |
| 13  | PSSD;100   | O   | 14  | PSRD;100   | I   |
| 15  | PNLOFF;000 | I   | 16  | GND        |     |
| 17  | BEEP;000   | I   | 18  | PCLR;001   | I   |
| 19  | GND        |     | 20  | BTFULL;100 | I   |
| 21  | CHG;100    | I   | 22  | DCLED;100  | I   |
| 23  | P12V       |     | 24  | N9V        |     |
| 25  | GND        |     | 26  | VCC        |     |
| 27  | CBLON;000  | I   | 28  | RAMV       |     |
| 29  | RAMV       |     | 30  | GND        |     |

## B.10 PJ10 Keyboard Modem I/F Connector

Table B-10 Keyboard modem I/F connector pin assignment (48-pin)

| Pin | Signal      | I/O | Pin | Signal     | I/O |
|-----|-------------|-----|-----|------------|-----|
| 01  | KBOT10;00   | O   | 02  | KBRT7;100  | I   |
| 03  | KBOT09;001  | O   | 04  | KBRT1;100  | I   |
| 05  | KBOT07;001  | O   | 06  | KBRT3;100  | I   |
| 07  | KBOT02;001  | O   | 08  | KBRT2;100  | I   |
| 09  | KBOT08;001  | O   | 10  | KBRT0;100  | I   |
| 11  | BSPTON;000  | I   | 12  | KBRT6;100  | I   |
| 13  | BMIRQ;000   | I   | 14  | KBOT00;001 | O   |
| 15  | RESET;100   | O   | 16  | KBOT06;001 | O   |
| 07  | BMPOF;100   | O   | 18  | KBOT05;001 | O   |
| 19  | IORD;000    | O   | 20  | KBOT04;001 | O   |
| 21  | SD00;100    | I/O | 22  | KBOT03;001 | O   |
| 23  | SD05;100    | I/O | 24  | KBOT01;001 | O   |
| 25  | SD04;100    | I/O | 26  | KBRT4;100  | I   |
| 27  | SD03;100    | I/O | 28  | KBRT5;100  | I   |
| 29  | VCC         |     | 30  | VCC        |     |
| 31  | VCC         |     | 32  | VCC        |     |
| 33  | GND         |     | 34  | GND        |     |
| 35  | GND         |     | 36  | GND        |     |
| 37  | IOWR;000    | O   | 38  | GND        |     |
| 39  | SD02;100    | I/O | 40  | SD01;100   | I/O |
| 41  | SD07;100    | I/O | 42  | SD06;100   | I/O |
| 43  | SA00;100    | O   | 44  | SA02;100   | O   |
| 45  | \$14R7M;100 | I   | 46  | SA01;100   | O   |
| 47  | N9V         |     | 48  | BMDMSL;000 | O   |

## B.11 PJ11 LED FPC Connector

Table B-11 LED FPC connector pin assignment (36-pin)

| Pin | Signal     | I/O | Pin | Signal     | I/O |
|-----|------------|-----|-----|------------|-----|
| 01  | SPEED;000  | O   | 02  | POWER;100  | O   |
| 03  | CAPLED;101 | O   | 04  | OVRLED;101 | O   |
| 05  | NUMLED;101 | O   | 06  | DRVSL;101  | O   |
| 07  | ALED;101   | O   | 08  | BTFULL;100 | O   |
| 09  | CHG;100    | O   | 10  | DCLED;100  | O   |
| 11  | LCVCC      |     | 12  | LCVCC      |     |
| 13  | LCVCC      |     | 14  | GND        |     |
| 15  | GND        |     | 16  | PNLOFF;001 | I   |
| 17  |            |     | 18  | CBLON;000  | O   |
| 19  | FDSPV      |     | 20  | FDSPV      |     |
| 21  | FDSPV      |     | 22  | SCKU;120   | O   |
| 23  | FLCDV      |     | 24  | TSLD3;120  | O   |
| 25  | TSLD2;120  | O   | 26  | TSLD1;120  | O   |
| 27  | TSLD0;120  | O   | 28  | TSUD3;120  | O   |
| 29  | TSUD2;120  | O   | 30  | TSUD1;120  | O   |
| 31  | TSUD0;120  | O   | 32  | GND        |     |
| 33  | GND        |     | 34  | TSCLK;110  | O   |
| 35  | FPF;120    | O   | 36  | LPF;120    | O   |

## B.12 PJ16 Ten-Key Connector

Table B-12 Ten-key pin assignment (3-pin)

| Pin | Signal | I/O | Pin | Signal     | I/O |
|-----|--------|-----|-----|------------|-----|
| 01  | GND    |     | 02  | TENKEY;100 | I   |
| 03  |        |     |     |            |     |

## B.13 PJ17 CRT I/F Connector

Table B-13 CRT I/F connector pin assignment (15-pin)

| Pin | Signal     | I/O | Pin | Signal     | I/O |
|-----|------------|-----|-----|------------|-----|
| 01  | TRED;101   | O   | 02  | TGREN;101  | O   |
| 03  | TBLUE;101  | O   | 04  |            |     |
| 05  | GND        |     | 06  | GND        |     |
| 07  | GND        |     | 08  | GND        |     |
| 09  |            |     | 10  | GND        |     |
| 11  |            |     | 12  |            |     |
| 13  | THSYNC;100 | O   | 14  | TVSYNC;100 | O   |
| 15  |            |     |     |            |     |



**B.14 PJ19 PS/2 Mouse Connector**

*Table B-14 PS/2 mouse connector pin assignment (6-pin)*

| <b>Pin</b> | <b>Signal</b> | <b>I/O</b> | <b>Pin</b> | <b>Signal</b> | <b>I/O</b> |
|------------|---------------|------------|------------|---------------|------------|
| 01         | MOUSED;100    | I          | 02         |               |            |
| 03         | GND           |            | 04         | VCC           |            |
| 05         | MUSECK;100    | I          | 06         |               |            |



# Appendix C ASCII Character Codes

Table C-1 ASCII Character Codes

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



## Appendix D Keyboard Scan/Character Codes

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

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

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

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

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

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

\* Notes:

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

Table D-2 Scan codes with 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 case of combination with a right shift key, scan codes are changed as below:*

|       | <u>With left shift</u> | <u>With right shift</u> |
|-------|------------------------|-------------------------|
| Set 1 | E0 AA —————            | E0 B6                   |
|       | E0 2A —————            | E0 36                   |
| Set 2 | E0 F0 12 —————         | E0 F0 59                |
|       | E0 12 —————            | E0 59                   |

Table D-3 Scan codes in Numlock mode

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



Table D-4 Scan codes with Fn key

| Cap No. | 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 D-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 D-6 Scan codes with Ctrl key

| Key top | Shift  | Code set 1  |             | Code set 2  |                   |
|---------|--------|-------------|-------------|-------------|-------------------|
|         |        | Make        | Break       | Make        | Break             |
| Prt Sc  | Common | E0 2A E0 37 | E0 B7 E0 AA | E0 12 E0 7C | E0 F0 7C E0 F0 12 |
|         | 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 D-7 Scan codes with Alt key

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

\* This key generates only make codes.



## **Appendix E Keyboard Layout**

### **E.1 USA Keyboard**

*Figure E-1 USA keyboard*

### **E.2 UK Keyboard**

*Figure E-2 UK keyboard*

### **E.3 German Keyboard**

*Figure E-3 German keyboard*

### **E.4 French Keyboard**

*Figure E-4 French keyboard*

## **E.5 Spanish Keyboard**

*Figure E-5 Spanish keyboard*

## **E.6 Italian Keyboard**

*Figure E-6 Italian keyboard*

## **E.7 Scandinavian (DK, NO, SW) Keyboard**

*Figure E-7 Scandinavian (DK, NO, SW) keyboard*

## **E.8 Swiss (French/German) Keyboard**

*Figure E-8 Swiss (French/German) keyboard*

## **E.9 Canadian Keyboard**

*Figure E-9 Canadian keyboard*

## **E.10 Keycap Number Keyboard**

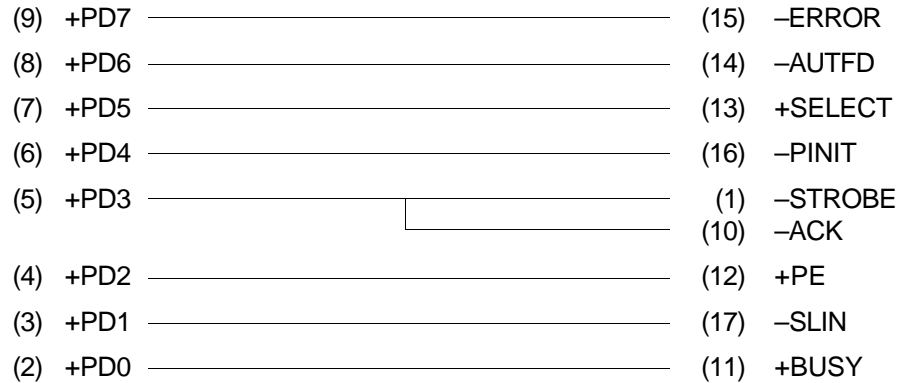
*Figure E-10 Keycap number keyboard*





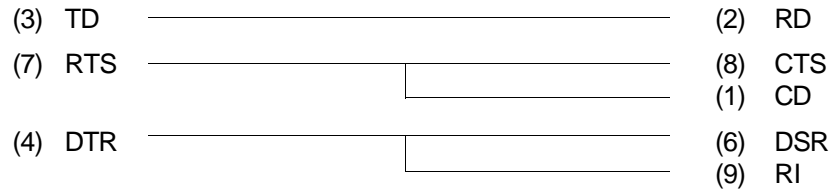
## Appendix F Wiring Diagrams

### F.1 Printer Wraparound Connector



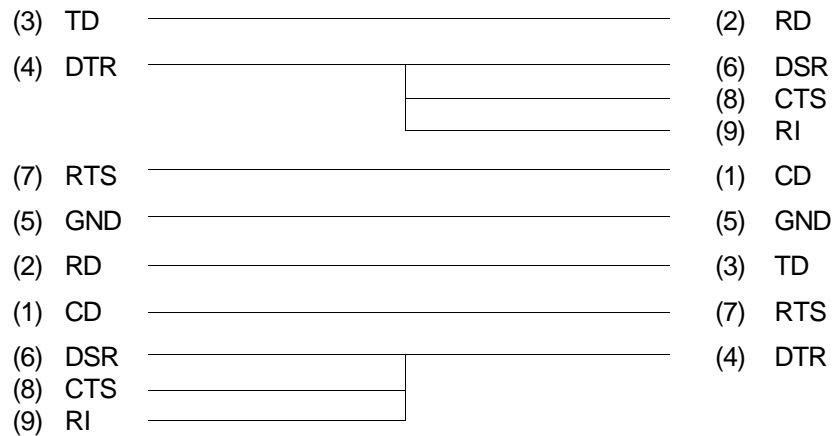
*Figure F-1 Printer wraparound connector*

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



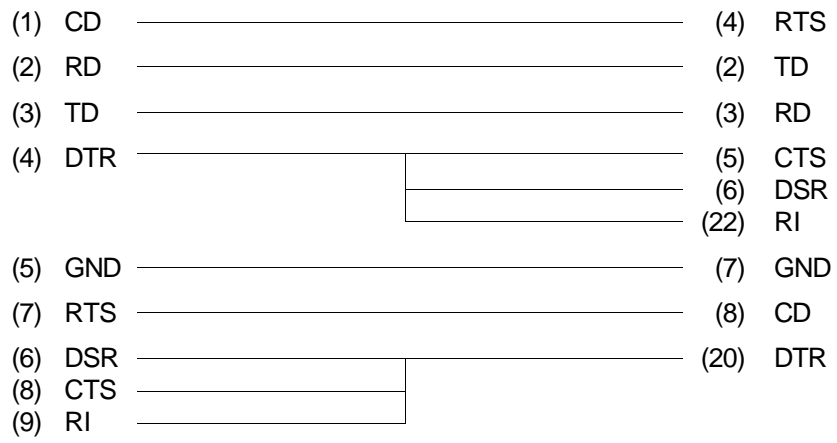
*Figure F-2 RS-232-C wraparound connector*

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



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

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



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

Printer Instruction:

Please leave the inside back cover

**BLANK**