Part 1
Hardware Overview

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1.1   General

The Toshiba T2000 is one of the lightest and most advanced portable computers available offering advanced computer technology, high speed, excellent legibility, IBM PC/AT compatibility, and battery operation.

The T2000 is one of a new class of portables called notebook computers, the lightest portable computers available.

The T2000 system unit has the following features:

❑   The Central Processing Unit (CPU) is an 80C286-12 16-bit microprocessor, operating at 12MHz (fast mode) and 6MHz (slow mode).

❑   The standard Random Access Memory (RAM) capacity is 1MB. With 1MB, 2MB, 4MB, or 8MB expansion memory cards, the T2000 system can have a maximum of 9MB of RAM.

❑   An 80C287-12 Numeric Data Processor (NDP) can be installed.

❑   The Liquid Crystal Display (LCD) supports 640x480 pixels with Video Graphics Array (VGA) compatibility and 16 levels of gray.

❑   The display controller supports VGA functions through the High Resolution Graphics Subsystem (HRGS).

❑   The 3.5-inch Floppy Disk Drive (FDD) supports two memory formats:
   •   1.44MB double-sided, high-density, double-track (2HD)
   •   720KB double-sided, double-density, double-track (2DD)

❑   The 2.5-inch Hard Disk Drive (HDD) has either a 20MB or 40MB capacity.

❑   The keyboard is an 86/88-key keyboard that is fully compatible with the IBM standard 101/ 102-key keyboard.

❑   The universal auto-sensing AC adapter can be used in a range from 100 to 240 volts AC.

❑   A built-in modem slot is available for an optional built-in modem.

❑   A parallel port, serial port, RGB port, numeric keypad port, and expansion bus connector allow the T2000 to interface with a variety of optional equipment.

❑   The T2000 supports the Toshiba AutoResume feature, storing the data and configuration information when the power is turned off.

❑   The Real Time Clock (RTC) continuously stores the date and time even when the power is turned off.

The T2000 Personal Computer is shown in Figure 1-1 and the T2000 system configuration is shown in Figure 1-2.

Figure 1-1 T2000 personal computer

Figure 1-2 T2000 system unit configuration

1.2 System Unit

Figure 1-3 shows the block diagram of the T2000's system unit.

Figure 1-3 T2000 block diagram

The system board in the T2000 is composed of the following major components:

❑   Central Processing Unit (CPU): 80C286-12

❑   Numeric Data Processor (NDP) socket for the 80C287-12 (optional)

❑   Super Integration (SI): T9778A

        The SI stores the following components:
        · Two Direct Memory Access Controllers (DMACs): 82C37A
        · Two Programmable Interrupt Controllers (PICs):   82C59A
        · One Programmable Interval Timer (PIT):   82C54
        · One Floppy Disk Controller (FDC):   TC8565
        · One Serial Input/Output Controller (SIO):   TC8570

❑   Variable Frequency Oscillator (VFO): TC8568AM

        The VFO chip is used for Floppy Disk Drive control logic.

❑   Real Time Clock (RTC): 146818AF

        The RTC (146818AF) stores the date, time, and system configuration.

❑   Keyboard Interface Controller (KBIC): 80C42

❑   Keyboard Scan Controller (KBSC): 80C50

❑   Power Supply Controller (PSC): U47C440

❑   Memory:

        Standard RAM: 1MB
        Optional RAM: 1MB, 2MB, 4MB, or 8MB
        Backup RAM: 32KB
        BIOS ROM: 128KB (96KB are used)
            BIOS ROM also contains the Initial Reliability Test (IRT), the T2000's system
            Basic Input/Output System (BIOS), and the video BIOS.
        Video RAM: 256KB

❑   Gate arrays:

        System control gate array: GA-SYS CNT (208-pin)
        I/O control gate array: GA-IO CNT (100-pin)
        I/O decoder gate array: GA-IO DEC (100-pin)
        Refresh control gate array: GA-RFE (44-pin)
        VGA display controller: PVGA1F (132-pin)

❑   Oscillators (OSC):

14.7456MHz OSC (X1) is used for the SIO.
14.31818MHz OSC (X2) is used for the KBC.
44.9MHz OSC (X3), 28.322MHz OSC (X5), and 25.175MHz OSC (X6) are used for the video.
24.0MHz OSC (X4) is used for the CPU.
24MHz OSC (X7) is used for the VFO.
32.768KHz OSC (X8) is used for the RTC.
500KHz OSC (X701) is used for the PSC.

See Appendix A for the location of the OSCs.

1.3   3.5-inch Floppy Disk Drive

The T2000 3.5-inch Floppy Disk Drive (FDD) supports 720KB (formatted) 2DD and 1.44MB (formatted) 2HD 3.5-inch floppy disks.

The T2000 FDD is shown in Figure 1-4 and its specifications are described in Table 1-1.

Figure 1-4 T2000 3.5-inch FDD

Table 1-1 T2000 3.5-inch FDD specifications

Item	2-Mbyte mode	1-Mbyte mode
Storage capacity (Kbyte)		
Unformatted	2,000	1,000
Formatted	1,440	720
Number of heads	2	2
Number of cylinders	80	80
Access time (ms)		
Track to track	3	3
Average	94	94
Head settling time	15	15
Recording track density (tpi)	135	135
Data transfer rate (Kbps)	500	250
Rotation speed (rpm)	300	300
Recording method	MFM (modified frequency modulation)	

1.4   2.5-inch Hard Disk Drive

The 20MB or 40MB (formatted) Hard Disk Drive (HDD) is a random access storage device. It is equipped with a non-removal 2.5-inch magnetic disk and mini-Winchester type magnetic heads.

The two HDDs manufactured for the T2000 are shown in Figure 1-5. Their specifications are described in Table 1-2.

JVC   Conner

Figure 1-5 T2000 2.5-inch HDD

Table 1-2 T2000 2.5-inch HDD specifications

Item	20-Mbyte		40-Mbyte	
	JD-E2825P	CP-2024	CP-2044	JD-E2850P
Storage capacity Formatted (Mbytes)	20.4	21.4	42.5	42.52
Number of disks	1	1	2	2
Data heads	2	2	4	3
Data surfaces	2	2	4	3
Tracks per surface	581	653	552	791(+2)
Tracks per drive	1,162	1,306	2,208	2,373(+6)
Sectors per track	36	32(+1)	38(+1)	35(+1)
Bytes per sector	512	512	512	512
Access time (ms) Track to track Average Maximum	9 25 47	5 23 40	5 19 40	9 25 47
Rotation speed (rpm)	3,109	3,444	3,486	3,109
Data transfer rate To/from media (bps)	10 M	10 M	12 M	10 M
Interleave	1:1	1:1	1:1	1:1
Recording method	2-7 RLL	2-7 RLL	2-7 RLL/ 1-7 RLL	2-7 RLL

1.5   Keyboard

The 86-key (USA) or 88-key (European) keyboard is mounted on the T2000 system unit. The keyboard is connected to the keyboard controller on the system board through 8-pin and 12-pin flat cables. The keyboard is shown in Figure 1-6.

See Appendix E for optional keyboard configurations.

Figure 1-6 T2000 keyboard

1.6 Sidelit Liquid Crystal Display

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

(1)   LCD module

The T2000 sidelit LCD is illuminated from the side and supports 640x480 pixels with a High Resolution Graphics Subsystem (HRGS) and 16 levels of gray. The HRGS includes the functions of the Video Graphics Array (VGA).

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

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

Figure 1-7 Sidelit LCD

Table 1-3 Sidelit LCD specifications

Item	Specifications
Number of dots (dots)	640x480
Dot dimension (mm)	0.24(W)x0.24(H)
Dot pitch (mm)	0.27(W)x0.27(H)
Display area (mm)	183.0(W)x136.0(H)
Contrast	15:1 (typ.)
FL current (mA)	4.0-6.0
FL frequency (KHz)	35-43

(2)   Fluorescent Lamp inverter board

The FL inverter board supplies the high frequency current needed to illuminate the FL.

The specifications for the FL inverter are described in Table 1-4.

Table 1-4 FL inverter specifications

Item		Specifications
Input	Voltage (V)	12-24
	Power (W)	3.6 (Max.)
Output	Voltage (V)	800 (min.)
	Current (mA)	5.5
	Frequency (KHz)	39
	Bounds of current (mA)	3.25-5.5

Part 2
Problem Isolation Procedures

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2.1   General

This part describes how to determine which Field Replaceable Unit (FRU) is causing the T2000 to operate abnormally.

The FRUs covered are:

- ❑   Power supply unit

- ❑   System board (PCB FA2SYx)

- ❑   FDD

- ❑   HDD

- ❑   Keyboard

- ❑   Display

The following items are necessary for implementing the problem isolation procedures.

- ❑   T2000 Diagnostics Disk

- ❑   Phillips head screwdrivers (2mm, 3mm)

- ❑   Toshiba MS-DOS system disk

- ❑   2DD or 2HD formatted work disk (for FDD testing)

- ❑   Cleaning disk kit (for FDD testing)

- ❑   Printer port LED

- ❑   RS-232-C wraparound connector

- ❑   Printer wraparound connector

- ❑   Multimeter

2.2 Problem Isolation Flowchart

The flowchart in Figure 2-1 is used as a guide for determining which FRU is causing the T2000 to operate abnormally. Before performing the procedures described in the flowchart, please confirm the following:

❑ Disconnect all optional equipment from the T2000.
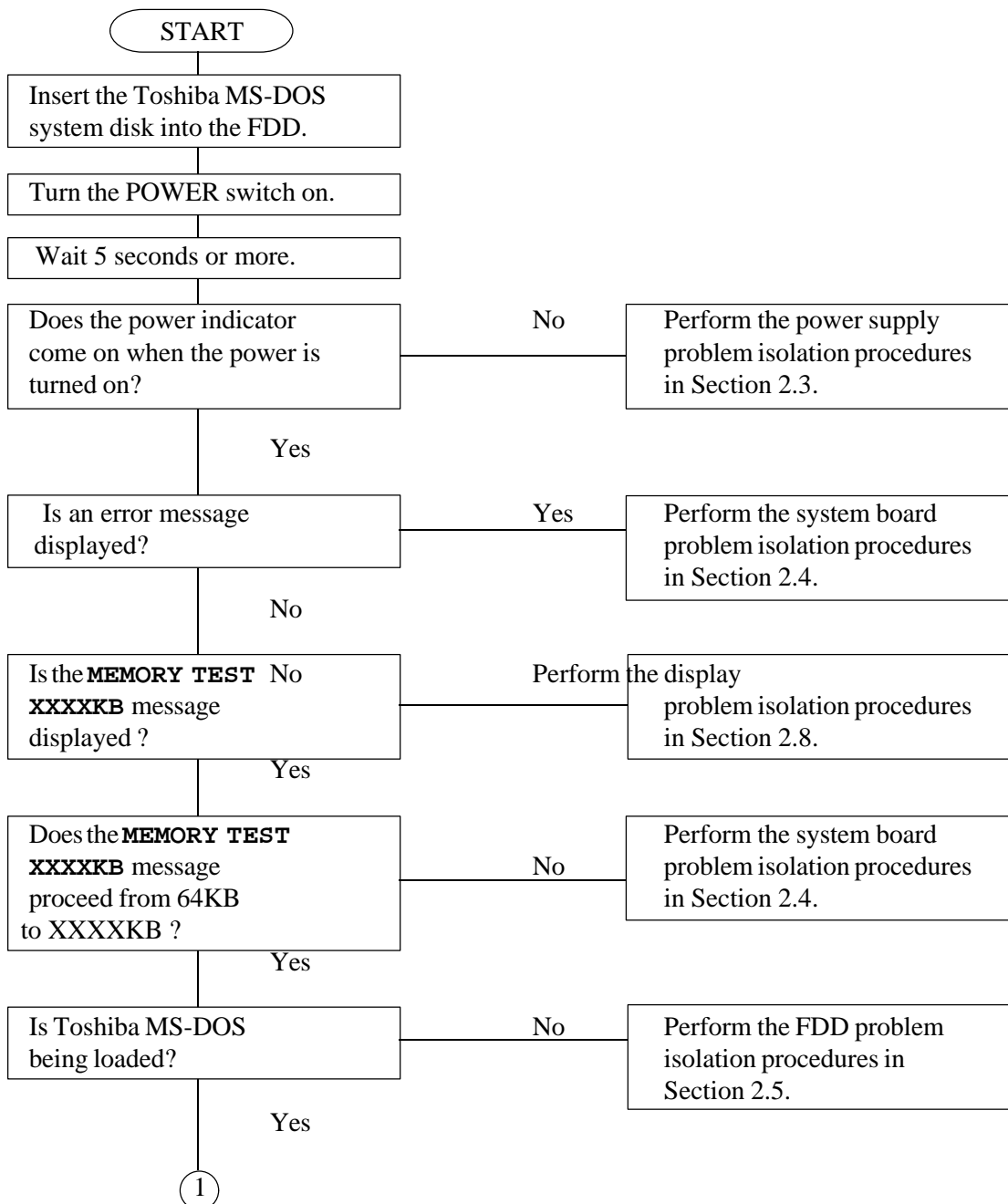
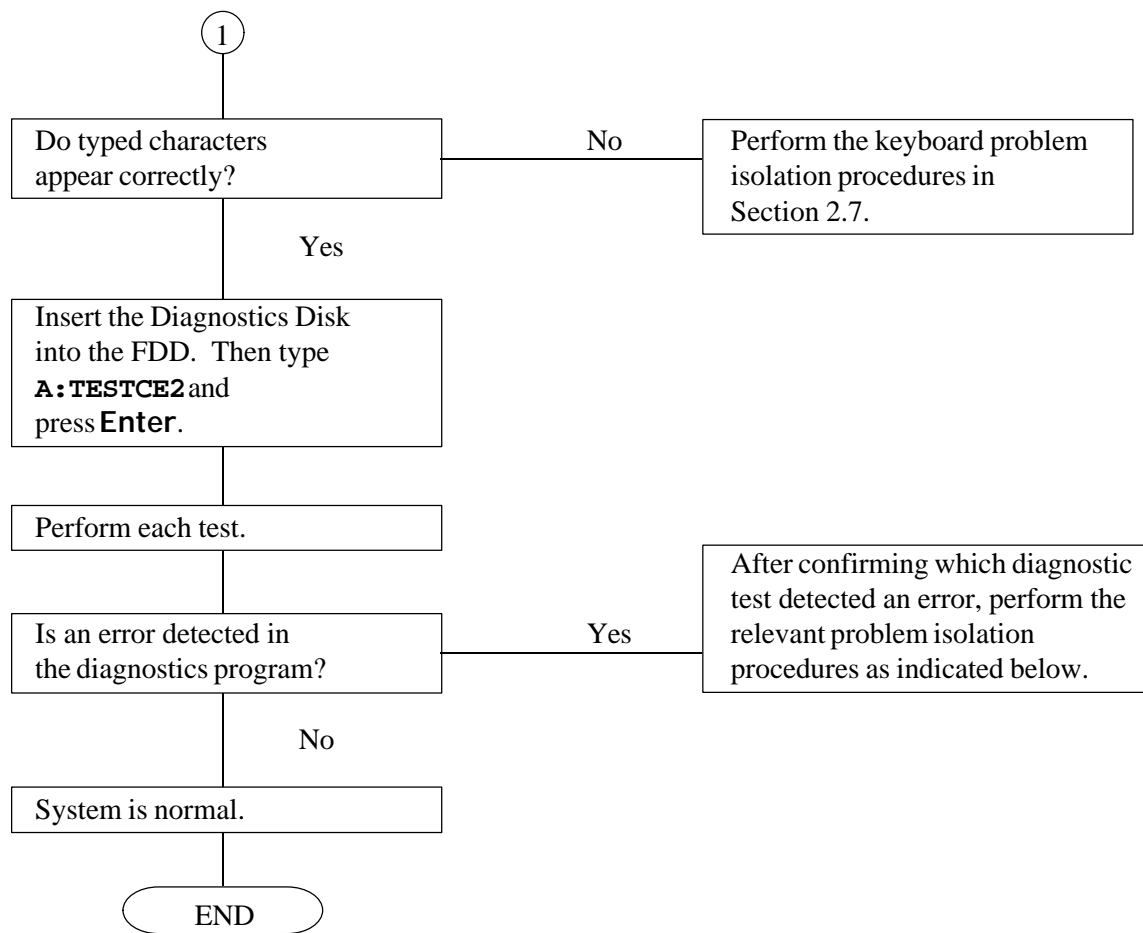❑ Remove any diskette in the FDD.

```
                    ( START )
          ┌────────────────────────────┐
          │ Insert the Toshiba MS-DOS   │
          │ system disk into the FDD.   │
          └────────────────────────────┘
          ┌────────────────────────────┐
          │ Turn the POWER switch on.   │
          └────────────────────────────┘
          ┌────────────────────────────┐
          │  Wait 5 seconds or more.    │
          └────────────────────────────┘
  ┌──────────────────────┐   No    ┌──────────────────────────┐
  │ Does the power indicator├──────►│ Perform the power supply │
  │ come on when the power is│       │ problem isolation procedures│
  │ turned on?            │         │ in Section 2.3.          │
  └──────────────────────┘         └──────────────────────────┘
              │ Yes
  ┌──────────────────────┐   Yes   ┌──────────────────────────┐
  │  Is an error message  ├───────►│ Perform the system board │
  │ displayed?           │         │ problem isolation procedures│
  └──────────────────────┘         │ in Section 2.4.          │
              │ No                 └──────────────────────────┘
  ┌──────────────────────┐   No    ┌──────────────────────────┐
  │ Is the MEMORY TEST    ├───────►│ Perform the display      │
  │ XXXXKB message        │         │ problem isolation procedures│
  │ displayed ?          │         │ in Section 2.8.          │
  └──────────────────────┘         └──────────────────────────┘
              │ Yes
  ┌──────────────────────┐   No    ┌──────────────────────────┐
  │ Does the MEMORY TEST  ├───────►│ Perform the system board │
  │ XXXXKB message        │         │ problem isolation procedures│
  │ proceed from 64KB     │         │ in Section 2.4.          │
  │ to XXXXKB ?          │         └──────────────────────────┘
  └──────────────────────┘
              │ Yes
  ┌──────────────────────┐   No    ┌──────────────────────────┐
  │ Is Toshiba MS-DOS     ├───────►│ Perform the FDD problem  │
  │ being loaded?        │         │ isolation procedures in  │
  └──────────────────────┘         │ Section 2.5.             │
              │ Yes               └──────────────────────────┘
              ( 1 )
```

Figure 2-1 Problem isolation flowchart

```
                    ①
                    │
┌─────────────────────┐                    ┌─────────────────────┐
│ Do typed characters │       No           │ Perform the keyboard problem │
│ appear correctly?   │────────────────────│ isolation procedures in │
└─────────────────────┘                    │ Section 2.7.        │
           │                               └─────────────────────┘
           │ Yes
┌─────────────────────┐
│ Insert the Diagnostics Disk │
│ into the FDD.  Then type    │
│ A:TESTCE2 and               │
│ press Enter.                │
└─────────────────────┘
           │
┌─────────────────────┐
│ Perform each test.  │
└─────────────────────┘
           │                               ┌─────────────────────┐
           │                               │ After confirming which diagnostic │
┌─────────────────────┐                    │ test detected an error, perform the │
│ Is an error detected in │   Yes          │ relevant problem isolation │
│ the diagnostics program? │──────────────│ procedures as indicated below. │
└─────────────────────┘                    └─────────────────────┘
           │
           │ No
┌─────────────────────┐
│ System is normal.   │
└─────────────────────┘
           │
       ( END )
```

Figure 2-1 Problem isolation flowchart (continued)

If the diagnostics program does not detect any errors, the problem may be intermittent. The running test should be executed several times to isolate the problem.

After confirming which diagnostic test detected an error(s), refer to the appropriate section as follows:

❑ 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 problem isolation procedures in Section 2.4.

❑ If an error is detected on the keyboard test, perform the keyboard problem isolation procedures in Section 2.7.

❑ If an error is detected on the floppy disk test, perform the FDD problem isolation procedures in Section 2.5.

❑ If an error is detected on the hard disk test, perform the HDD problem isolation procedures

2.3 Power Supply Problem Isolation Procedures

This section describes how to determine if the power supply is causing the T2000 to operate abnormally. Start with Procedure 1 and continue with the other procedures as instructed. The procedures described in this section are:

Procedure 1: **DC IN** Indicator Check

Procedure 2: Connector and Cable Check

Procedure 1

DC IN Indicator Check

1.   When the T2000 AC adapter is connected to a live wall outlet and the T2000, the **DC IN** indicator will light red. If the AC adapter or the power supply is malfunctioning, the **DC IN** indicator will flash red or does not light at all.

      (1)   If the **DC IN** indicator flashes red, refer to Check 1.

      (2)   If the **DC IN** indicator does not light, refer to Check 2.

Check 1   When a power supply problem occurs, the **DC IN** indicator will flash repeatedly with a 4-bit status that varies depending on the problem.

The **DC IN** indicator is off for two seconds and then it lights for either ½ second (indicating a binary 0) or one full second (indicating a binary 1). There is a one-second interval between bits, with bit 0 (zero) or the least significant bit first and ending with bit 3 (three) or the most significant bit.

For example, the following timing chart shows a status of 5h (0101). The timing chart below is read from right to left.

(Paste timing sequence)

The status and its meaning are described in Table 2-1.

However, when the **DC IN** indicator blinks at random, the AC adapter or charging circuit may be damaged. In this case, replace the AC adapter with a new one. If the

problem still exists, perform Procedure 3.

Table 2-1 Power supply error status

Status	Meaning
1h	Over voltage of AC adapter output voltage. (More than +18V±5%)
2h	Abnormal temperature in the system. (Less than -20°C or more than 70°C.)
3h	Abnormal charging. (The system cannot stop charging.)
4h	Over current of charging current.
5h	Abnormal charging voltage.
6h	Abnormal battery voltage.
7h	Abnormal VCC (+5) voltage.
8h	Abnormal RAMV (+5V for DRAM) voltage.
9h	VEE (-9V) is shorted.
Ah	VDD (+12V) is shorted.
Bh	VDSP (+12V to +18V for FL) is shorted.
Ch	Turned off the Desk Station II before turning off the T2000.
Dh	Battery terminal is shorted.
Eh	Under voltage of AC adapter output voltage. (Less than +18V±5%)
Fh	Under current of charging current.

Check 2   When the **DC IN** indicator does not light, one or all of the following could be the cause:

1.   The AC adapter is damaged. Replace the AC adapter.
2.   Fuse (F701) on the system board is bad. Replace the fuse.
3.   The charge/+18V switching signal is not sent correctly.
4.   The AC adapter detecting circuit is damaged. Replace the AC adapter.

If the **DC IN** indicator problem still exists, perform Procedure 3.

2.   The indicator labeled **Battery** lights yellow (while the system is charging the battery) or lights green (when the battery pack is fully charged) if power is supplied from the AC adapter when you connect the battery pack to the system and the system is off.

NOTE: The system automatically stops charging the battery when the battery pack overheats.

If only the battery pack is connected to the system, this indicator does not light (indicating the battery pack is in use, or the battery pack is not in use when the AC adapter is connected) or blinks red (indicating the battery is low). If the battery pack is completely discharged, this indicator does not light.

(1)   If the battery indicator blinks or does not glow when you connect the AC adapter to the system and the system is off, see Check 3.

(2)   If the battery indicator blinks when you disconnect the AC adapter from the system, see Check 6.

NOTE: If both (1) and (2) above occur, check the power output circuits to the system.

Check 3   Make sure the battery pack is correctly connected to the system. If the problem still exists, perform Check 4.

Check 4   Connect the AC adapter to the system and wait 30 minutes or so. If the problem still exists, perform Check 5.

Check 5   Replace the battery pack with a recharged battery pack. If the problem still exists, perform Procedure 2. Also, check the battery charge circuits.

Check 6   Make sure the battery pack is correctly connected to the system. If the problem still exists, perform Check 7.

Check 7   Replace the battery pack with a known good one. If the problem still exists, perform

Procedure 2.

Procedure 2

Connector and Cable Check

The battery pack is connected to the system board with the battery cable. The cable may be discon-
nected or damaged. Refer to Part 4 for instructions on how to disassemble the T2000 and then
perform the following checks.

Check 1   Make sure the battery terminal cable is connected to the system board at PJ702.

               If this cable is disconnected, connect it and restart the system. If the problem still
               exists, refer to Check 2.

Check 2   Recheck the cable using a multimeter. If the cable looks damaged, replace the
               terminal assembly and restart the system. If the problem still exists, refer to Proce-

dure 3.

Procedure 3

Replacement Check

In the T2000, the power supply circuits are located on the system board. There is a connector from PJ704 to PJ705 for the intelligent power supply (IPS). The LED board (PCB FT2LEx) connects to PJ9 on the system board. Either of these boards may be damaged. Refer to Part 4 for instructions on how to disassemble the T2000, and then perform the following checks.

Check 1   Replace the LED board with a new one and restart the system. If the problem still exists, perform Check 2.

Check 2   Replace the system board with a new one. If the problem still exists, other units

may be damaged.

2.4   System Board Problem Isolation Procedures

This section describes how to determine if the system board is causing the T2000 to operate abnormally. Start with Procedure 1 and continue with the other procedures as instructed. The procedures described in this section are:

Procedure 1:   Message and Beep Sound Check

Procedure 2:   Printer Port LED Check

Procedure 1

Message and Beep Sound Check

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

If an error message appears on the screen, refer to Check 1. If nothing is displayed on the screen, refer to Procedure 2.

Check 1　　　　If the following error message appears on the screen briefly, the **PRT/FDD** port is assigned as **FDD-A** and an external FDD is not attached to the **PRT/FDD** port. Assign the **PRT/FDD** port as **FDD-B** or **Printer** using the Setup program, or attach an external FDD. Then reboot the system.

*** FDD A is not installed ***

If another error message appears, perform Check 2.

Check 2　　　　If the following error message appears on the screen, press the **F1** key. Then execute the setup operation. Detailed setup operation procedures are described in Part 3.

This program confirms the current T2000 system configuration and the configuration stored in RTC memory. If they are different, the following message will appear.

```
*** Error in CMOS.  Bad battery ***
Check system. Then press [F1] key.

*** Error in CMOS.  Bad check sum ***
Check system. Then press [F1] key.

*** Error in CMOS.  Bad memory configuration ***
Check system. Then press [F1] key.

*** Error in CMOS.  Bad time function ***
```

```
                  Check system. Then press [F1] key.
```

           If another error message appears, refer to Check 3.
Check 3   If the following message appears, and the status of the printer port LED is **F4h** to
           F6h, replace the system board. Otherwise, press any key. At this time the resumed
           data will be erased.

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


           WARNING:  DATA IN HARD RAM WAS LOST
           YOU MUST FORMAT HARD RAM BEFORE USE
           PRESS ANY KEY TO CONTINUE
```

           If another error message appears, refer to Check 4.

Check 4   The IRT program tests the system board. If an error occurs in the IRT program, the
           error message appears on the screen and beep sounds are generated.

           If the following message appears, replace the system board. Otherwise, refer to
           Check 5.

```
           ERROR INTERRUPT CONTROLLER #1


           ERROR INTERRUPT CONTROLLER #2


           MEMORY VERIFY ERROR AT xxxx:xxxx FOUND xxxx
           EXPECTED xxxx


           ERROR INTERRUPTS AND STUCK NMI


           ERROR PROTECT MODE


           ERROR PROCESSOR EXCEPTIONAL INTERRUPTS
```

Check 5   If the following message is displayed on the screen, refer to the Hard Disk Drive
           Problem Isolation Procedures in Section 2.6.

           If the following error message does not appear and the beep sounds do not occur,
           refer to Procedure 2.

Procedure 2

Printer Port LED Check

The printer port LED displays the IRT program status and error status as a hexadecimal value after the T2000 is turned on.

1.   Connect the printer port LED to the printer port.
2.   After turning the system on, read the LED status from left to right as you are facing the back of the computer.
3.   If the final LED status is **FFh**, refer to Procedure 3. If the final LED status matches

Normal Status	Error Status	Meaning	Process
02h	82h	KBIC IBF/OBF test, video initialization	Halt
03h	83h	KBIC IBF test (0AAh command)	Halt
04h	84h	KBIC OBF test (55h check)	Halt
05h		Reserved	
06h		LSI initialization (DMA, PIT, PIC, RTC)	Continue
07h	87h	CPU test 2 (registers)	Halt
08h		RTC initialization (register B)	Continue
09h	89h	ROM checksum test (64KB)	Halt
0Ah	8Ah	Video initialization	Halt
0Bh		Reserved	
0Ch		Reserved	
0Dh	8Dh	PIT channel 2 test and its initialization	Halt
0Eh		Reserved	
0Fh	8Fh	CMOS RAM test	Halt
10h	90h	DMA channel 0 test	Halt
11h	91h	DMA channel 1 test	Halt
12h	92h	DMA page register test	Halt
13h	93h	KBSC test and its initialization	Halt
14h	94h	Memory refresh test	Halt
	A7h	Backup RAM test	Halt
	14h	Protect mode test	Halt
15h	95h	First 64KB RAM test	Halt
16h		Interrupt vector setup	Continue
17h	97h	Video option test	Halt
18h	98h	V-RAM test	Halt
19h	99h	PIC channel 1 test	3 beeps continue
1Ah	9Ah	PIC channel 2 test	3 beeps continue

one of the error status codes in Table 2-2, replace the system board.

Table 2-2 Normal status and error status of the printer port LED (continued)

Normal Status	Error Status	Meaning	Process
1Bh	9Bh	CMOS battery test	1 beep key wait
1Ch		Reserved	Continue
1Dh	9Dh	Setup RAM size from CMOS (413h)	Continue
1Eh	9Eh	Size conventional RAM	Continue
1Fh	9Fh	Conventional RAM test	3 beeps continue
20h	A0h	PIC ch1/ch2 test	Continue
21h	A1h	NMI check	Continue
22h	A2h	Interrupt process test (INT8)	3 beeps continue
23h	A3h	Protect mode test	3 beeps continue
24h	A4h	Size extended RAM	Continue
25h	A5h	Conventional and extended RAM test	3 beeps continue
26h	A6h	Protect mode exception test	3 beeps continue

NOTE: If the error occurs on the 19h to 24h normal status, the system does not halt. The error message remains on the screen and when the IRT program is finished, these error messages are erased.

Status	Explanation
F1h	An FDD was running when the power was turned off. Power was turned off while the IRT was running. The hardware reset switch was pressed. An external display card was attached when the power was turned off. An external expansion memory card was attached when the power was turned off.
F2h	An external display card was attached while the power was turned off.
F3h	An internal display card was changed while the power was turned off.
F4h	Backup RAM has been corrupted. The backup RAM checksum, system RAM checksum, V-RAM checksum, or expansion memory checksum in backup RAM has been corrupted.
F5h	System RAM has been corrupted.
F6h	V-RAM has been corrupted.
F7h	Internal expansion memory has been corrupted.

The table below lists the resume errors and the associated error status codes.

Procedure 3

Test Program Check

The Diagnostic Test function in the T2000 Diagnostic Program has several tests for testing the T2000 system board. Perform the following tests.

❑ System test

❑ Memory test

❑ Display test

❑ Printer test

❑ ASYNC test

❑ Real timer test

Refer to Part 3 for detailed instructions about these tests.

If an error is detected during the T2000 Diagnostic Program, replace the system board. If the problem still exists, check the other FRUs in the T2000.

2.5 Floppy Disk Drive Problem Isolation Procedures

This section describes how to determine if the floppy disk drive is causing the T2000 to operate abnormally. Start with Procedure 1 and continue with the other procedures as instructed. The procedures described in this section are:

Procedure 1: Message Check

Procedure 2: Format Check

Procedure 3:   Test Program Check

Procedure 4:   Connector Check

Procedure 1

Message Check

Insert the Toshiba MS-DOS system disk in the FDD and turn on the power. If the T2000 loads Toshiba MS-DOS normally, refer to Procedure 2.

If Toshiba MS-DOS does not load normally, the following message or a similar message will appear on the screen. Refer to Procedure 4.

```
Place system disk in drive.
Press any key when ready.
```

```
        Non-System disk or disk error
        Replace and press any key when ready
```

Procedure 2

Format Check

Format a floppy disk using the Toshiba MS-DOS FORMAT command.

If the floppy disk does not format correctly, perform the following checks.

Check 1   Make sure the **FDD** indicator lights. If it does not light, refer to Procedure 4. If it
           lights, refer to Check 2.

Check 2   Make sure the Toshiba MS-DOS FORMAT command was used correctly.
           When the media type is 2DD, use the FORMAT/3 command.
           When the media type is 2HD, use the FORMAT command.

           If the FORMAT command was used correctly, refer to Check 3.
           If the FORMAT command was not used correctly, try again. If the problem still
           exists, refer to Check 3.

Check 3   Clean the read/write head using the 3.5-inch FDD cleaning kit. If the problem still
                exists, refer to Procedure 3.

Procedure 3

Test Program Check

The FDD test program is stored on the T2000 Diagnostics Disk. After loading Toshiba MS-DOS,
run the Diagnostic Program (TESTCE2). Refer to Part 3 for detailed instructions about the FDD
test.

Insert a formatted floppy disk and then start the FDD test. The error code and status are described
in Table 2-3.

If an error occurs, refer to Check 1.

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

Table 2-3 FDD error code and status

Check 1   If the **Write protected** message appears, remove the write protect tab on the

floppy disk. If any other error message appears, refer to Check 2.

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

Procedure 4

Connector Check

The FDD is connected to the system unit by the FDD cable. Disassemble the system unit and check the FDD. Refer to Part 4 for instructions on how to disassemble the system unit and then perform the following checks.

Check 1   Make sure the FDD cable is firmly connected to the system board at PJ16.

If this cable is disconnected, connect it to the system unit and refer back to Procedures 2 and 3. If the problem still exists, refer to Check 2.

Check 2   The FDD may be defective. Replace the FDD with a new one and refer back to
               Procedures 2 and 3. If the problem still exists, refer to Check 3.

Check 3   The system board may be causing the problem. Replace it with a new system board.

2.6   Hard Disk Drive Problem Isolation Procedures

This section describes how to determine if the hard disk drive is defective. Start with Procedure 1
and continue with the other procedures as instructed. The procedures described in this section are:

Procedure 1:   Message Check

Procedure 2:   Logical Format Check

Procedure 3:   Test Program Check

Procedure 4:   Connector Check

CAUTION: The contents of the hard disk will be erased when the HDD Problem Isolation Procedures are executed. Before continuing, transfer the contents of the hard disk to floppy disks. This can be done with the Toshiba MS-DOS BACKUP command. Refer to the Toshiba MS-DOS manual for details.

Procedure 1

Message Check

When the power switch is turned on, the following message may appear on the screen.

If the following message appears, refer to Procedure 4.

```
ERROR ENCOUNTERED INITIALIZING HARD DISK DRIVE
```

ERROR INITIALIZING HARD DISK CONTROLLER

If the above message does not appear, refer to Procedure 2.

Procedure 2

Logical Format Check

Using the Toshiba MS-DOS system disk, partition the hard disk using the FDISK command. Then format the hard disk using the /s switch after the FORMAT command to transfer the system program.

If normal operation is restored, the HDD is OK. If normal operation is not restored, refer to Procedure 3.

Procedure 3

Test Program Check

The HDD test program is stored on the T2000 Diagnostics Disk. After loading Toshiba MS-DOS, run the Diagnostic Program (TESTCE2) and perform the HDD test. Refer to Part 3 for detailed instructions about the HDD test.

If an error occurs during the HDD testing, an error code and status will be displayed; refer to Procedure 4. The HDD error code and descriptions are described in Table 2-4. If an error code is not generated, the HDD is OK.

Code	Descriptions
01h	Bad command error
02h	Bad address error
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

Table 2-4 HDD error code and descriptions

Procedure 4

Connector Check

The HDD is connected to the system board by the HDD board (PCB FT2HDx). Disassemble the system unit and check the HDD. Refer to Part 4 for instructions on how to disassemble the computer and then perform the following checks.

Check 1   Make sure the HDD board (orange flat cable) is firmly connected to the system board and HDD.

 If the board is disconnected, firmly reconnect it and refer back to Procedures 2 and 3. If the problem still exists, refer to Check 2.

Check 2   The HDD may be defective. Replace the HDD unit with a new one. If the error still occurs, refer to Check 3.

Check 3   The system board may be damaged. Replace the system board with a new one. If

the error still occurs, refer to Check 4.

Check 4   The HDD board may be damaged. Replace the HDD board with a new one.

2.7   Keyboard Problem Isolation Procedures

This section describes how to determine if the keyboard is causing the T2000 to operate abnormally. Start with Procedure 1 and continue with the other procedures as instructed. The procedures described in this section are:

Procedure 1:   Test Program Check

Procedure 2:   Connector Check

Procedure 1

Test Program Check

The keyboard test program is stored on the T2000 Diagnostics Disk. After loading Toshiba MS-DOS, run the Diagnostic Program (TESTCE2) and perform the keyboard test. Refer to Part 3 for detailed instructions about the keyboard test.

If an error occurs, refer to Procedure 2.
If an error does not occur, the keyboard is OK.

Procedure 2

Connector Check

The keyboard is connected to the system board by 8-pin and 12-pin flat cables. Disassemble the system unit and check the keyboard cables. Refer to Part 4 for instruction on how to disassemble the system unit and then perform the following checks.

Check 1   Make sure the following cables are firmly connected to the system board.

Keyboard cable   System board PJ7
                                        System board PJ8

If these cables are not connected, connect them and refer back to Procedure 1. If the problem still exists, refer to Check 2.

Check 2   The keyboard or keyboard cables may be damaged. Replace the keyboard with a new one, and refer back to Procedure 1. If the problem still exists, refer to Check 3.

Check 3   The keyboard controller on the system board may be damaged. Replace the system
                board with a new one.

2.8   Display Problem Isolation Procedures

This section describes how to determine if the display is causing the T2000 to operate abnormally.
Start with Procedure 1 and continue with the other procedures as instructed. The procedures
described in this section are:

Procedure 1:   Brightness and Contrast Volume Check

Procedure 2:   Test Program Check

Procedure 3:   Connector Check

Procedure 1

Brightness and Contrast Volume Check

The brightness and contrast dials are on the right side of the display unit. Use these dials to adjust the display screen to your satisfaction.

If only the brightness does not change, refer to Procedure 3.

If only the contrast does not change, refer to Procedure 3.
If both the brightness and contrast do not change, refer to Procedure 2.

Procedure 2

Test Program Check

The display test program is stored on the T2000 Diagnostics Disk. This program checks the display controller on the system board. After loading Toshiba MS-DOS, run the Diagnostic Program (TESTCE2). Refer to Part 3 for detailed instructions about the display test.

If an error is detected, refer to Procedure 3.
If an error is not detected, the display is OK.

Procedure 3

Connector Check

The display unit has an LCD module, FL (Fluorescent Lamp), and FL inverter. The LCD module and FL inverter are connected to the system board with the LCD cable. The LED board (PCB FT2LEx) is connected directly to the system board. Either or both of these cables may be disconnected from the system board.

Disassemble the display unit and check these connectors. Refer to Part 4 for instruction on how to disassemble the system unit.

    System board PJ12───────────── LCD module CN1
                                     LCD module CN2
    System board PJ9   LED board
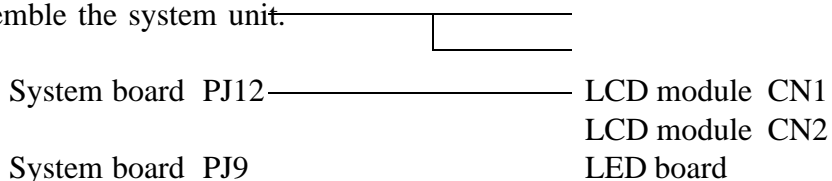
If these connectors are not connected, connect them and refer back to Procedures 1 and 2. If the problem still exists, refer to Procedure 4.

Procedure 4

Replacement Check

In the T2000, the FL inverter, LCD module, and system board are connected with the display circuits. Any of these units may be damaged. Refer to Part 4 for instructions on how to disassemble the system unit and then perform the following checks.

Check 1 Replace the FL inverter with a new one and recheck the display. If the problem still exists, refer to Check 2.

Check 2 Replace the LCD module with a new one and recheck the display. If the problem still exists, refer to Check 3.

Check 3 The system board may be damaged. Replace the system board with a new one and recheck the display. If the problem still exists, refer to Check 4.

Check 4 The LED board may be damaged. Replace the LED board with a new one.

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Part 3
Tests and Diagnostics

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Contents

Tables

3.1   General

This part explains how to use the T2000 Diagnostic Program (TESTCE2) which tests the functions of all the T2000 hardware modules. This program is located on the T2000 Diagnostic Diskette. The Diagnostic Program is composed of 18 programs divided into the Service Program Module (DIAGNOSTICS MENU) and the Test Program Module (DIAGNOSTIC TEST MENU).

The Service Program Module provides the following eight functions:

1.   DIAGNOSTIC TEST
2.   HARD DISK FORMAT
3.   HEAD CLEANING
4.   LOG UTILITIES
5.   RUNNING TEST
6.   FDD UTILITIES
7.   SYSTEM CONFIGURATION
8.   SETUP

The Test Program Module contains the following ten tests. These are all located within the Diagnostic Test function of the Service Program Module.

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

To execute the T2000 Diagnostic Program you will need the following:

❏   T2000 Diagnostics Diskette

❏   Formatted work disk for the FDD test

❏   Cleaning disk kit to clean the FDD heads

❏   Printer wraparound connector for the printer wraparound test

❏   RS-232-C wraparound connector for the ASYNC wraparound test

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

3.2   Using the T2000 Diagnostic Program

To start the T2000 Diagnostic Program, follow these steps:

1.   Make sure the computer is loaded with Toshiba MS-DOS version 3.3 or 4.0. Turn on the T2000 and insert the T2000 Diagnostics Diskette in the floppy disk drive.

2.   Change to the A drive. Then type **A:TESTCE2** and press **Enter**.

3.   The DIAGNOSTICS MENU will be displayed as shown below.

```
TOSHIBA personal computer T2000 DIAGNOSTICS
version x.xx (c) copyright TOSHIBA Corp. 1991

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


PRESS [0] - [9] KEY
```

NOTE: To exit the Diagnostic Test function, press **Ctrl** + **C**. *If a test is in progress, press* **Ctrl** + **Break** *to exit the test.*

4.   To execute the Diagnostic Test function from the DIAGNOSTICS MENU, type **1** and press **Enter**. The following DIAGNOSTIC TEST MENU will be displayed, listing the ten tests.

```
TOSHIBA personal computer T2000 DIAGNOSTICS
version x.xx (c) copyright TOSHIBA Corp. 1991

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

PRESS [1] - [99] KEY
```

Diagnostic Tests 1 through 10 are discussed in Sections 3.4 through 3.13. Test menu option 88 sets the floppy disk drive and hard disk drive error retry count. Option 99 exits the DIAGNOSTIC TEST MENU and returns you to the DIAGNOSTICS MENU.

5.   Enter the desired test number from the DIAGNOSTIC TEST MENU and press **Enter**. The following message will be displayed.

```
SYSTEM TEST                      XXXXXXX

                                  T2000 DIAGNOSTIC TEST Vx.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   : XXXXXX    STATUS     : XXX

SUB-TEST MENU :

01 - ROM checksum
02 - HW status
99 - Exit to DIAGNOSTIC TEST MENU

SELECT SUB-TEST NUMBER  ?
```

NOTE: The message displayed by your T2000 may be slightly different than the one shown above.

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

        TEST LOOP (1:YES/2:NO) ?

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

Selecting **NO** returns you to the subtest menu after the test is completed.

7. Type in **1** or **2** for the Test Loop and press **Enter**. The following message will appear.

        ERROR STOP (1:YES/2:NO) ?

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

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

Selecting **NO** displays the error status, increases the error counter by one, and resumes the test.

8. Type in **1** or **2** for the Error stop and press **Enter** to execute the subtest chosen from the subtest menu. Table 3-1 in Section 3.3 lists the subtests available for each test on the DIAGNOSTIC TEST 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 describes the subtest for each test program in the Test Program Module.

Table 3-1   Subtest names

Test No.	Test name	Subtest No.	Subtest name
1	SYSTEM	01	ROM checksum
		02	HW status
2	MEMORY	01	RAM constant data
		02	RAM address pattern data
		03	RAM refresh
		04	Protected mode
		05	Memory module
		06	Backup memory
		07	Hard-RAM
		08	LIM-EMS
3	KEYBOARD	01	Pressed key display (86/88)
		02	Pressed key code display
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 (1200BPS)
		06	Interrupt test

Table 3-1 Subtest names (continued)

Test No.	Test name	Subtest No.	Subtest name
8	HDD	01	Sequential read
		02	Address uniquence (uniqueness)
		03	Random address/data
		04	Cross talk & peek (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

Subtest 01   ROM checksum

This test performs a ROM checksum test on the T2000's system board from address F0000h - FFFFFh (64KB).

Subtest 02   HW status

This test reads and displays the T2000's hardware status as shown below.

```
              76543210
H/W status = 10001000

   Bit7 —                =
   Bit6 — CPU clock    = 12MHZ
   Bit5 — Notch signal = 2HD
   Bit4 — FDD type     = 2MB
   Bit3 —                =
   Bit2 — Drive A/B    = Ext. = B
   Bit1 — External FDD = OFF
   Bit0 — Internal FDD = 2HD
```

Once this information is displayed, press **Ctrl** + **Break** to return to the SYSTEM TEST menu. There is a slight delay of about 15 seconds before the **Ctrl** + **Break** keys can be pressed.

Table 3-2 describes the hardware bit status.

Table 3-2 Hardware bit status

Bit	H/W status	1	0
7	Reserved		
6	CPU clock speed	6 MHz	12 MHz
5	Media type	2DD	2HD
4	FDD type	1 MB	2 MB
3	Reserved		
2	Drive A/B	B	A
1	External FDD	ON	OFF
0	Internal FDD	2DD	2HD

3.5   Memory Test

Subtest 01   RAM constant data

This subtest writes constant data to conventional memory (0 to 640KB), then reads and compares it 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 eXclusive-ORing (XORing) the address segment and address offset to conventional memory (0 to 640KB), then reads and compares it with the original data.

Subtest 03   RAM refresh (real mode)

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

The constant data is AAAAh and 5555h.

There is a delay between the write and the 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 it 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 T2000.

This subtest is the same as subtest 04; it is used for testing an optional memory card.

Memory module capacity is 1MB, 2MB, 4MB, and 8MB.

After selecting subtest 05, the following message will be displayed.

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

Select the number that corresponds to the memory card installed in the T2000.

Subtest 06   Backup memory

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

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

Subtest 07   Hard-RAM

NOTE: To execute this subtest, Hard-RAM must be set up on the system.

This subtest writes word units of constant data to memory (address E0000h to E7FFFh), then reads and compares it with the original data.

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

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

Subtest 08   LIM-EMS

This subtest writes the 0000h, 5555h, AAAAh, and FFFFh data to 64KB unit EMS memory, then reads and compares it with the original data.

3.6   Keyboard Test

Subtest 01   Pressed key display (86/88)

> *NOTE:* *Make sure the* **Num Lock** *key is off. If the* **Num Lock** *key is on, this subtest cannot be executed.*

The keyboard layout, as shown below, is drawn on the display. When any key is pressed, the corresponding key on the screen is changed to the "*" (asterisk) character.

When a key is held down, the display will blink indicating that the auto-repeat function is enabled.

```
KEYBOARD TEST      IN PROGRESS      301000
```

```
[Print:Alt+SysReq , Pause:Ctrl+Break]
IF TEST OK, PRESS [DEL] THEN [ENTER] KEY
```

Subtest 02   Pressed key code display

When a key is pressed, the scan code, character code, and key top name are displayed on the screen in the format shown below.

The **Ins**, **Caps Lock**, **Num Lock**, **Scroll Lock**, **Alt**, **Ctrl**, **Left Shift**, and **Right Shift** keys are displayed in reverse video when pressed. The scan codes, character codes, and key top names are listed in Appendix D.

```
KEYBOARD TEST      IN PROGRESS      302000

          Scan code       =
          Character code  =
          Keytop          =
Ins Lock    Caps Lock    Num Lock    Scroll Lock
Alt         Ctrl         Left Shift  Right Shift
PRESS [ENTER] KEY
```

3.7 Display Test

Subtest 01   VRAM read/write

This subtest writes constant data and address data to video RAM (256KB), then reads the data written and compares it with the original data.

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

Subtest 02   Character attributes (mode 1, 13h)

This subtest shows the following display modes and displays the foreground colors and intensified colors (16 colors or 16 levels of gray) using black, blue, red, magenta, green, cyan, yellow, and white from the color display.

    Normal
    Intensified
    Reverse
    Blinking

The display below appears on the screen when this subtest is selected.

CHARACTER ATTRIBUTES

  NEXT LINE SHOWS NORMAL DISPLAY.
    NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN

  NEXT LINE SHOWS INTENSIFIED DISPLAY.
    IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII

  NEXT LINE SHOWS REVERSE DISPLAY.
    RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR

  NEXT LINE SHOWS BLINKING DISPLAY
    BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB

After pressing **Enter**, 16 colors or 16 levels of gray for mode 13h are displayed as shown below.

320*200 GRAPHICS DISPLAY [13]

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

Subtest 03   Character set

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

CHARACTER SET IN 40*25

PRESS [ENTER] KEY

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

Subtest 04   80x25 and 80x30 Character display (mode 12)

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

```
80*XX CHARACTER DISPLAY
01234567890123456789012345678901234567890123456789012345678901234567
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklm
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmn
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmno
#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnop
$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopq
%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqr
&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrs
'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrst
()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstu
)*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuv
*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvw
+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwx
,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxy
-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz
./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{
/0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}
123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
23456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~•
3456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~•Ç
456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~•Çü
PRESS [ENTER] KEY
```

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

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

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

Color set 1:   Green, Red, Yellow
Color set 2:   Cyan, Magenta, White

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

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

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

This subtest displays the even dots, odd dots, and all dots blocks 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 **Ctrl** + **Break**.

Subtest 07   640x350/400/480 Graphics display (mode 10, 74, 12)

This subtest displays the even dots, odd dots, and all dots blocks in the 640x350 and
640x480 dots graphics mode 10 and 12 as shown below.

```
640*XXX GRAPHICS DISPLAY : [XX]
          EVEN DOTS      ODD DOTS      ALL DOTS
          DRIVEN         DRIVEN        DRIVEN
```

```
PRESS [ENTER] KEY
```

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

Subtest 08   Display page

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

DISPLAY PAGE 0

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

To exit this subtest and return to the DISPLAY TEST menu, press **Ctrl** + **Break**. Once the subtest has displayed all seven pages, you will return to the DISPLAY TEST menu.

Subtest 09   "H" pattern display

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

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

If an external CRT display is attached, seven border colors and the following message will appear for selecting the CRT.

Setting the CRT (1:Yes/2:No)

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

Subtest 10   LED / DAC pallet

This subtest checks the LED Speed, Caps Lock, and Num Lock using key operations.

It also writes the 2Ah/15h data to 6 bits of 256x3 (RGB), then reads the written data and compares it with original data.

```
[ Speed/CRT/Caps/Num/Overlay LED test ]

  (1) Press [ Fn + Pgdn ] key !   ... Speed   (red)

  (2) Press [ Fn + Pgup ] key !   ... Speed   (green)

  (3) Press [ Caps Lock  ] key ! ... Caps    (on/off)

  (4) Press [ Num lock   ] key ! ... Num     (on/off)

  (5) Press [ Fn         ] key ! ... Overlay (on/off)

PRESS [ENTER] KEY
```

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

3.8   Floppy Disk Test

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

OPERATION

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

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

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

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

3.   Select the media type of the floppy disk to be tested and press **Enter**. The following message will appear.

    Test start track   (Enter:0/dd:00-79) ?

4.   Select the start track number and press **Enter**. Simply pressing **Enter** sets the start track at zero. The FLOPPY DISK TEST menu will appear after you select the start track number.

5.   The following message appears above the FLOPPY DISK TEST menu and during each subtest.

    ```
    FLOPPY DISK                                    XXXXXXX

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

    The first three digits of the **ADDRESS** number are the cylinder number being tested, the fourth digit is the head number and the last two digits are the sector number.

    The first digit of the **STATUS** number is the drive number being tested and the last two digits are the error status number.

CONTENTS

Subtest 01   Sequential read

This subtest performs the Cyclic Redundancy Check (CRC) with a continuous read operation of all the tracks on a floppy disk.

The tracks available for the floppy disk formats are:
Double-sided, double-density (2D): Tracks 0 to 39.
Double-sided, double-density, double-track (2DD) and Double-sided, high-density, double-track (2HD): Tracks 0 to 79.

The start track was specified when you selected the Floppy Disk Test from the DIAGNOSTIC TEST MENU.

Subtest 02   Sequential read/write

This subtest writes data to all tracks (as defined above) continuously, and then reads the data out and compares it with the original data.
(The data pattern B5ADADh is repeated.)

Subtest 03   Random address/data

This subtest writes random data to random addresses on all tracks defined in subtest 01 and then reads the data out and compares it with the original data.

Subtest 04   Write specified address

This subtest writes the specified data to the specified track, head, and address. You can specify the test data, track number, and head number.

Subtest 05   Read specified address

This subtest reads the data from the specified track, head, and address. You can specify the track number and head number.

3.9   Printer Test

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

OPERATION

1.   When you select this test, the following message will appear.

```
channel#1 = XXXXh
channel#2 = XXXXh
channel#3 = XXXXh

Select the channel number (1-3) ?
```

The **XXXXh** data in the above message shows the printer I/O port address.

The T2000 supports three printer channels. Select the printer channel number and press

Enter to display the PRINTER TEST menu.
CONTENTS

Subtest 01   Ripple pattern

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

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

Subtest 02   Function

This subtest prints out the various print types shown below.

Subtest 03   Wrap around

NOTE: To execute this subtest, a printer wraparound connector must be connected to printer port. The printer wraparound connector (34M741986G01) wiring diagram is given in Appendix F.

This subtest checks the data control and status lines through the printer wraparound connector.

Both the output mode and bi-directional mode are tested.

3.10 ASYNC Test

Subtests 01 through 04 requires the following data format:

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

Subtest 01   Wrap around (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 given 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 direct cable (9-pin to 9-pin) must be connected to channels 1 and 2. The RS-232-C direct cable wiring diagram is given in Appendix F.

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

Subtest 03   Point to point (send)

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

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

Subtest 04   Point to point (receive)

This subtest is used with subtest 03 as described above.

This subtest receives the data from the send side, then returns the data.

Subtest 05   Card modem loopback (1200BPS)

NOTE: To execute this subtest, a built-in modem must be installed.

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

Subtest 06   Interrupt test

This subtest checks the Interrupt Request Levels (IRQ) 4, 3, and 5 from the send side.

3.11 Hard Disk 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 floppy disks. This can be done with the Toshiba MS-DOS BACKUP command. After the test, enter the Toshiba MS-DOS FDISK command, which will set the partition. Then enter the Toshiba MS-DOS FORMAT command. Refer to the Toshiba MS-DOS manual for details.*

OPERATION

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. Type in **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. Type in **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 the screen. The HDD status is described in Section 3.15. Type in **1** or **2** and press **Enter**. The HARD DISK TEST menu will appear.
6. During the hard disk test, the following message will appear.

```
HARD DISK TEST                        XXXXXXX

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

The first three digits of the **ADDRESS** number are the cylinder number being tested, the

fourth digit is the head number and the last two digits are the sector number.

The first digit of the **STATUS** number is the drive number being tested and the last two digits are the error status code.

CONTENTS

Subtest 01   Sequential read

The sequential read test is a sequential reading of the 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 uniquence (uniqueness)

The address uniqueness test writes unique address data to each sector, track by track, on the HDD. The data written to each sector is then read and compared with the original data. There are three ways in which the HDD can be read:

- Forward sequential

- Reverse sequential

- Random

Subtest 03   Random address/data

This subtest writes random data to random addresses to the cylinder, head, and sector on the HDD and then reads the written data back and compares it to the original data.

Subtest 04   Cross talk & peek (peak) shift

This subtest writes the 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 the worst pattern data (B5ADADh) to the CE cylinder, and then reads the data out and compares it with the original data.

Subtest 06   Write specified address

This subtest writes specified data to a specified cylinder and head.

Subtest 07   Read specified address

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

Subtest 08   ECC circuit

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

Subtest 09   Sequential write

This subtest writes specified 2-byte data to all cylinders.

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

3.12 Real Timer Test

Subtest 01   Real time

A new date and time can be inputted during the Real Time subtest.

To execute the Real Time subtest, follow these steps:

1.   After the REAL TIMER TEST menu appears, select subtest 01. The follow-
        ing message will appear displaying the current date and time.

                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 prompt and
        press **Enter**. The following prompt will appear.

                Enter new time :

3.   If the current time is not correct, input the correct time (in military format)
        and press **Enter**. Press **Ctrl** + **Break** to return to the REAL TIMER TEST
        menu.

Subtest 02   Backup memory

This subtest writes to 50 bytes of the RTC backup memory (addressed 0Eh through 3Fh) as follows:

        One bit of "on" data to addresses 01h through 80h.
        One bit of "off" data to addresses FEh through 7Fh and to addresses AAh
        through 55h.
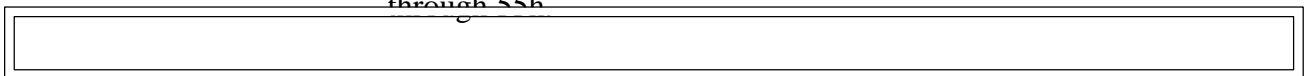
Then the subtest reads and compares this data with the original data.

Subtest 03   Real time carry

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

This subtest checks if the real time clock correctly increments the date and time displayed (month, day, year, hour, minute, and second).

3.13 NDP Test

NOTE: *To execute this test, a Numeric Data Processor (NDP) must be mounted on the system board.*

Subtest 01   NDP test

This test checks the control word, status word, bus, and addition and multiplication functions.

3.14 Error Codes and Error Status Names

Device name	Error code	Error status name
(COMMON)	FF	Data Compare Error
SYSTEM	01	ROM Checksum Error
MEMORY	01	Parity Error
	02	Protected Mode Not Change
	14	Memory Read/Write Error
	15	RAM_ON_BIOS Unestablish
	16	Register Error
	19	BIOS Copy Error (System)
	1A	BIOS Copy Error (VGA)
	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

Table 3-3 lists the error codes and error status names

Device name	Error code	Error status name
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
	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 Error
	04	Record Not Found
	05	HDC Not Reset
	07	Drive Not Initialize
	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	Multipul Error

Table 3-3 Error codes and error status names

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 HDC error status and the last four digits are not used.

The HDC 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.

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

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

Bit	Name	Description
7	BBK (Bad block mark)	"0"--Otherwise. "1"--A bad block mark is detected.
6	UNC (Uncorrectable)	"0"--There is no uncorrectable data error. "1"--Uncorrectable data error has been detected.
5		Not used.
4	IDNF (Identification)	"0"--Otherwise. "1"--There was no ID field in the requested sector.
3		Not used.
2	ABRT (Abort)	"0"--Otherwise. "1"--Illegal command error or a drive status error occurs.
1	TK0 (Track 0)	"0"--The hard disk has found track 0 during a recalibrate command. "1"--The hard disk could not find track 0 during a recalibrate command.
0		Not used.

Table 3-4 HDC status register contents

Table 3-5 Error register contents

3.16 Hard Disk Format

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

❑   Physical formatting

❑   Logical formatting

This Hard Disk Format function physically formats the hard disk and executes the following Hard Disk formats and check:

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

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

3.16.1 Program Description

1.   All track FORMAT

Physically formats all the tracks on the hard disk as shown in Table 3-6 below.

Items	Description	
	20MB	**40MB**
Sector sequences	1	1
Cylinders	0 to 614	0 to 979
Heads	0 to 3	0 to 4
Sectors	1 to 17	1 to 17
Sector length (bps)	512	512
Bad track (maximum)	20	20

NOTE: Before executing the All track FORMAT, execute the Bad track CHECK to display a list of bad tracks on the HDD.

Table 3-6 Hard disk formatting sequence

2.   Good track FORMAT

The Good track FORMAT program formats a specified cylinder and track as a good track. If the good track has been formatted as a bad track, use this program to change the track to a good track.

3.   Bad track FORMAT

The Bad track FORMAT program formats a specified cylinder and track as a bad track. If a bad track has been detected, use this program to label it as a bad track.

4.   Bad track CHECK

The Bad track CHECK program 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 completed. If an error other than a bad track is detected, the program is automatically terminated.

3.16.2 Operations

CAUTION: After physical formatting is finished, enter the Toshiba MS-DOS FDISK command which will set the partition. Then execute the Toshiba MS-DOS FORMAT command. See the Toshiba MS-DOS manual for details.

1.   Select the HARD DISK FORMAT function from the DIAGNOSTICS MENU. The following prompt appears.

```
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

Press [NUMBER] key ?
```

2.   All track FORMAT program

NOTE: Before executing the All track FORMAT, execute the Bad track CHECK to display a list of bad tracks on the HDD. This information is required in step (5) below.

(1)   Selecting the All track FORMAT 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
        be displayed.

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

(4)   Select whether or not the HDD has an unlock format and press **Enter**. If the system
        unit contains a JVC HDD, select **yes**. If the system unit contains a Conner HDD,
        select **no**.

        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 following message will appear
        and all the cylinders in the hard disk will be formatted and checked.

```
            [[cylinder, head = xxxx xx]]
```

(6)   After formatting the hard disk, execute the verify check program by pressing **Enter**.
        When the verify check program is completed, the following message will appear.

```
            Format complete
```

(6)   Press **Enter** to return to the HARD DISK FORMAT menu.

3.   Good track FORMAT and Bad track FORMAT programs

(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 are the cylinder number and the last digit is the head number. 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 program

(1)   When the Bad track CHECK program 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 Program 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 for cleaning the FDD heads.

3.17.2 Operations

1.   Select the HEAD CLEANING function from the DIAGNOSTICS MENU and press **Enter**. The following prompt is displayed.

```
        DIAGNOSTICS - FLOPPY DISK HEAD CLEANING : Vx.xx

        Mount cleaning disk(s) on drive(s).
        Press any key when ready.
```

2.   Remove the Diagnostics Disk from the FDD. Insert the cleaning disk into the FDD and

press **Enter**.

3. When the **Cleaning start** message appears, the FDD head cleaning has started.

4. The display automatically returns to the DIAGNOSTICS MENU when the function is completed.

3.18 Log Utilities

3.18.1 Program Description

This program logs error information generated while a test is in progress and stores the results in RAM. If the POWER switch is turned off, the error information will be lost. The error information is displayed in the following order:

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

This program can store data on a floppy disk or output the data to a printer.

3.18.2 Operations

1. Select the LOG UTILITIES function from the DIAGNOSTICS MENU and press **Enter**. The error information logged in RAM or on the floppy disk is displayed as shown below.

```
      XXXXX ERRORS
CNT TS-NAME PASS   STS   ADDR   WD RD HSTS [ERROR STATUS NAME ]

001 FDD 02 0000  103 00001   00 00        FDD - WRITE PROTECTED
001 FDD 01 0000  180 00001   00 00        FDD - TIME OUT ERROR
```

Address

Error status

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

        [[1:Next,2:Prev,3:Exit,4:Clear,5:Print,6:FD Log Read,7:FD Log Write]]
2.   The error information displayed on the screen can be manipulated with the following
      number keys.

      Number
      <u>Key</u>   <u>Function</u>
       1   Scrolls the display to the next page.
       2   Scrolls the display to the previous page.
       3   Returns to the DIAGNOSTICS MENU.
       4   Erases all error log information in RAM.

5	Outputs the error log information to a printer.
6	Reads the log information from a floppy disk.
7	Writes the log information to a floppy disk.

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

3.19 Running Test

3.19.1 Program Description

The Running Test function automatically executes the following tests in sequence.

    1.   System test (subtest number 01)
    2.   Memory test (subtest numbers 01, 02, 03, 04, 06, 07)
    3.   Display test (subtest numbers 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 numbers 01, 05)

The system automatically detects the number of floppy disk drives connected to the T2000.

3.19.2 Operations

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

1. Remove the Diagnostics Disk from the floppy disk drive and insert the work disk.

2. Select the RUNNING TEST function from the DIAGNOSTICS 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 connector on the back of the T2000 to properly execute this test.

3. Type in **1** or **2** and press **Enter**. The following message will appear.

        Async#1 wrap around test (Y/N) ?

Selecting **Yes** executes the ASYNC wraparound test. An RS-232-C wraparound connector

4.   Type in **1** or **2** and press **Enter** to start the test.

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

3.20 FDD Utilities

3.20.1 Program Description

The FDD Utilities function formats the FDD, copies floppy disks, and displays the dump list for both the FDD and HDD.

1.   FORMAT

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

   This program can format a floppy disk (5.25-inch/3.5-inch) 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 a floppy disk (both 3.5-inch and 5.25-inch) and the designated sectors of the hard disk.

3.20.2 Operations

1. Select the FDD UTILITIES function from the DIAGNOSTICS MENU and press **Enter**. The following message will be displayed.

```
[ FDD UTILITIES ]

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

PRESS [1] - [9] KEY
```

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 and press **Enter** to display the following message.

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

(3) Select a media/drive type number and press **Enter**. A message similar to the one below will be displayed.

```
Warning : Disk data will be destroyed.

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

(4) Remove the Diagnostics Disk from the FDD, insert the work disk, and press any key.

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

```
[ FDD TYPE ] : TRACK  = xxx
[ FDD TYPE ] : HEAD   = x
[ FDD TYPE ] : SECTOR = xx

        Format start
```

```
                            [[track, head = xxx x]]
```

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

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

(5)   If you type **1** and press **Enter**, the display will repeat the message in step (3) above. If you type **2**, the display returns to the DIAGNOSTICS MENU.

3.   COPY program

(1)   When COPY is selected, the following message appears.

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

(2)   Select a media/drive type number and press **Enter**. A message similar to the one below will be displayed.

```
        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 and start the copying to memory.

```
        [ 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 and insert the formatted work disk; press any key. The **[[track,head = xxx x]]** message will appear and start the copying to the target disk. When the amount of data is too large to be copied in one operation, the message in 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 in step (1) will be displayed again. If
        you type **2**, the display returns to the DIAGNOSTICS MENU.

4.   DUMP program

(1)   When DUMP is selected, the following message appears.

```
        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 message in step (5) below.

        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) ?
```

(4)   Select an FDD drive number by typing in **1** or **2**. The following message will ap-
        pear.

```
        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 is displayed 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.

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

If you type **1**, the display will return to the message shown after step (1) above. If you type **2**, the display will return to the DIAGNOSTICS MENU.

3.21 System Configuration

3.21.1 Program Description

The System Configuration function contains the following configuration information for the T2000.

❑   BIOS ROM version

❑   Base memory size

❑   Display mode

❑   Number of floppy disk drives

❑   Number of ASYNC ports

❑   Number of hard disk drives

❑   Number of printer ports

❑   Co-processor

❑   Extended memory size

3.21.2 Operations

Select the SYSTEM CONFIGURATION function from the DIAGNOSTICS MENU and press **Enter**. The following system configuration will be displayed.

```
SYSTEM CONFIGURATION :

    * - 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 DIAGNOSTICS MENU.

3.22 SETUP

3.22.1 Program Description

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

1.   MEMORY
      (1)   Total memory size
      (2)   Base memory size
      (3)   Hard RAM size
      (4)   EMS memory size
      (5)   Extended memory size
      (6)   Shadow BIOS ROM

2.   DISPLAY
      (1)   Display Adapter
      (2)   LCD display mode
      (3)   LCD gray scale
      (4)   LCD gray scale level

3.   COMMUNICATION
      (1)   Serial port COM level
      (2)   Built-in modem COM level

4.   HARD DISK
      (1)   Capacity

5.   POWER SAVE OPTIONS
      (1)   Resume mode
      (2)   CPU sleep mode
      (3)   HDD auto off
      (4)   Display auto off
      (5)   Battery alarm
      (6)   Speaker
      (7)   Built-in modem power

6.   OTHERS
        (1)   Popup
        (2)   Processing speed
        (3)   External FDD/PRT
        (4)   Printer port type

7.   TIME & DATE

3.22.2 Accessing the SETUP

Select the SETUP function from the DIAGNOSTICS MENU and press **Enter**. The following display will appear.

This display is an example of the setup options available for the T2000. Notice that selecting the type of floppy disk drive is not an option.

Press **Esc** if the setup options displayed accurately reflect your hardware configuration.

3.22.3 Changing SETUP Values

The SETUP values for the T2000 can be changed automatically to their default settings or manually to user-defined settings.

Automatic Reset

Follow these steps to set all the SETUP values to their default settings.

1. Press **Home** to reset all the SETUP values to their factory preset (default) values. The SETUP program calculates how much conventional and extended memory your T2000 has, based on whether or not you have a memory expansion module (optional memory card) installed. SETUP stores the memory value it calculates in configuration memory along with the factory preset (default) values for the other options.

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

3. If the new values are correct, press **End** and the system will reboot.

← ↑ ↓

Manual Reset

Follow these steps to change any of the SETUP option(s) manually.

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

1. Use the , →, , and keys (or **Enter**) to move the cursor between the options.

2. When the option you want to change is highlighted, press either the **space bar** or **back-space** key to display the alternate values.

3. When you are finished making changes, press **End** to record the new values in the configuration memory.

4.   The SETUP menu displays this message.

        Save Settings And Reboot? (Y/N)

Review your changes. If you need to make more alternations, press **N** and return to step 1
above.

5.   If the new values are correct, press **Y** and the system will reboot.

3.22.4 SETUP Descriptions

This section explains the alternate values for each SETUP option.

1.   MEMORY

        Configuration memory involves selecting how much RAM the system uses for each of the
        three types of memory: Base memory, Hard RAM, and Extended memory.

        (1)   Total
                This option displays the amount of standard RAM (1024KB) plus the amount of an
                optional memory card (1024KB, 2048KB, 4096KB, or 8192KB).

        (2)   Base
                This option displays the amount of base memory, which is 640KB. This is for your
                information only and cannot be changed. Base memory is also called conventional
                memory.

        (3)   Hard RAM
                This option configures part of extended memory as Hard RAM. You can add 128KB
                to a maximum 8576KB in 64KB increments. The preset value is 0KB.

        (4)   EMS
                Use this option to configure RAM as expanded memory. The setting you choose for
                EMS reduces extended memory. If no extended memory is available, you cannot
                increase EMS. You can increase the size of extended memory by decreasing the
                size of EMS or setting BIOS to ROM.

                xxxxKB is the number of KB (from 64KB to 7808KB in 64KB increments) of
                internal RAM configured as expanded memory. The preset value is 0KB.

        (5)   Extended
                This option displays the amount of internal RAM configured as extended memory.
                You can reduce this amount by assigning LIM-EMS and Hard RAM and copying
                BIOS ROM to RAM.

                xxxxKB is the number of KB (in 64KB increments) of RAM configured as extended
                memory.

        (6)   Shadow BIOS ROM

Use this special feature of the T2000 to copy BIOS functions from ROM to RAM for faster access while you're using the T2000. You must have at least 128KB of extended memory to select **Enable**. Since the BIOS subroutines are accessed often, enabling this option significantly improves the T2000's operating speed.

Enable   Copies BIOS from BIOS ROM to RAM.

Disable   Accesses BIOS from BIOS ROM.

2.   DISPLAY

(1)   LCD Display Mode
If an external monitor is not attached to the T2000, this option determines whether the LCD uses the monochrome mode or color mode. If there is a monitor attached to the T2000, the T2000's LCD display mode is determined by the mode of the monitor (either monochrome or color), and the setting for this option has no effect.

Color   Displays in color mode. The T2000 converts 262,144 colors to 16 intensity levels of gray for the LCD. This is the default setting.

Monochrome   Displays in monochrome mode. The T2000 converts 64 intensity levels of gray to 16 intensity levels of gray for the LCD.

(2)   LCD Gray Scale
This specifies the relationship between the brightness levels for characters displayed in normal and intense display modes. A setting of **Bright** causes the T2000 to use the maximum brightness level (gray scale level 15) to display characters. A setting of **Semi-Bright** causes the T2000 to use a slightly lower brightness level (gray scale level 11).

The options are:
        Normal:Semi-Bright,Intense:Bright (default)
        Normal:Bright,Intense:Semi-Bright

If you're primarily using text-based programs as opposed to graphics software, you may find that choosing **Normal:Bright,Intense:Semi-Bright** makes the text easier to read.

(3)   LCD Gray Scale Level
This specifies the levels of gray and reverses how characters are displayed on the LCD screen.

Normal 16 Levels	Displays black characters and graphics on a white background with 16 levels of gray. This is the default setting.
Reverse 16 Levels	Displays white characters and graphics on a black background with 16 levels of gray.
Normal 8 Levels	Displays black characters and graphics on a white

background with 8 levels of gray.

Reverse 8 Levels   Displays white characters and graphics on a black background with 8 levels of gray.

When you select a new LCD Gray Scale Level, any previous changes you made using VCHAD (VGA Change Display program) are no longer valid.

3.   COMMUNICATION

This option allows you to change the I/O address and interrupt request (IRQ) levels of the serial ports. The T2000 supports one serial port and one built-in modem port.

Since the I/O address and IRQ level of a serial port are automatically established according to the COM level, the SETUP program only prompts you to specify the COM level.

(1)   Serial Port
This option lets you assign the communications port name to the serial port (labeled **COMMS**).

    COM1   Assigns COM1 to the serial port.
                     This is the default setting.

    COM2   Assigns COM2 to the serial port.

    Not Used   Disables the serial (**COMMS**) port.

(2)   Built-in Modem
This option lets you assign the communications port name to the built-in modem port. If a built-in modem is not installed, this setting has no effect.

    COM1   Assigns COM1 to the built-in modem port.

COM2   Assigns COM2 to the built-in modem port.
                  This is the default setting.

Not Used   Disables the built-in modem port.

NOTE: You can assign a COM level only once. For example, the **Serial Port** *and* **Built-in Modem** *cannot both be assigned to* **COM1**.

4.   HARD DISK

Use either the **space bar** or **backspace** key to choose one of two hard disk options.

Capacity = xxMB   Sets the hard disk to its standard setting.
                       This is the default setting.

No Drive   Disables the hard disk. The T2000 functions as if a hard disk
                       is not installed.

5.   POWER SAVE OPTIONS

This option enables, disables, and sets the T2000 power saving features.

(1)   Resume Mode
       This option enables and disables the AutoResume feature.

       Boot   Disables the AutoResume feature.
                          This is the default setting.

       Resume   Enables the AutoResume feature.

(2)   CPU Sleep Mode
       This option enables and disables the CPU sleep mode.

       Enable   Enables the CPU sleep mode. The computer will automatically shift
                     to an operating speed of 2MHz when the processor is idle.
                     This is the default setting.

       Disable   Disables the CPU sleep mode.

(3)   HDD Auto Off
       This option enables and disables the HDD automatic power off. When the AC
       adapter is attached, this function is disabled but the setting is unchanged.

Disable   Disables HDD automatic power off.
This is the default setting.

xxMin.   Automatically turns off power to the HDD if it is not used for the specified duration. The minutes of duration **xx** can be set to:

03 05 10 15 20 30

(4)   Display Auto Off

This option enables and disables the display automatic power off. When the AC adapter is attached, this function is disabled but the setting is unchanged.

Disable   Disables the display automatic power off.
This is the default setting.

xxMin.   Automatically turns off power to the FL of the sidelit LCD if the computer is not used for the specified duration. Enabling this option will conserve battery power. The minutes of duration **xx** can be set to:

01 03 05 10 15 20 30

(5)   Battery Alarm

This option enables and disables the battery alarm. The battery alarm sounds when the battery pack is low.

On   Enables the alarm.
This is the default setting.

Off   Disables the alarm.

(6)   Speaker

This option enables and disables the software use of the system speaker. Setting this option to **Off** also disables all system alarms, except the battery alarm.

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

Off   Disables software use of the system speaker.

(7)   Built-in Modem Power

Use this option to supply power to the built-in modem. To conserve battery power, this option should be set to **Off** when a built-in modem is not in use.

      On   Turns on power to the built-in modem.
                      This is the default setting.

      Off   Turns off power to the built-in modem.

6.   OTHERS

(1)   Popup

This option enables and disables the Pop-up window.

      Enable   Allows you to access the Pop-up window.
                      This is the default setting.

      Disable   Disables the Pop-up window.

(2)   Processing Speed

This option selects the CPU and system bus speeds. Some option cards are dependent on the system bus speed.

      High   Selects the high CPU speed.
                      This is the default setting.

      Low   Selects the low CPU speed. This setting makes the T2000 CPU speeds compatible with IBM PC/AT.

(3)   External FDD/PRT

This option assigns the function of the **PRT/FDD** port.

      Printer   Assigns the port as a printer port. An FDD connected to the **PRT/FDD** port cannot be accessed. An internal FDD is assigned as A. This is the default setting.

      FDD A   Assigns the external FDD as A and the internal FDD as B.

      FDD B   Assigns the external FDD as B and the internal FDD as B.

(4)   Printer Port Type

This option sets the printing capabilities of the **PRT/FDD** port.

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

      Bi-Directional   Selects bi-directional operation.

7.   TIME & DATE

Part 4
Replacement Procedures

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Contents

Figures

4.1   General

This section provides detailed procedures for disassembling the T2000 and replacing Field Replaceable Units (FRU).

The following FRUs are covered in this section:

1. System board (PCB FA2SYx)
2. LED board (PCB FT2LEx)
3. HDD board (PCB FT2HDx)
4. FL inverter board
5. Keyboard unit
6. Sub battery
7. RTC battery
8. Modem assembly
9. Cover assembly
10. Base assembly
11. LED holder assembly
12. Battery terminal assembly
13. LCD mask
14. LCD module
15. LCD cable
16. Speaker bracket
17. Speaker
18. HDD chassis
19. HDD unit
20. FDD chassis
21. FDD unit

x = Board revision number

Before You Begin

Review the procedures in this section before you begin disassembling the T2000. Familiarize yourself with the steps and remember the following points:

1.   Do not disassemble the T2000 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 T2000:
 ❑   dust and contaminates
 ❑   static electricity
 ❑   extreme heat, cold, and/or humidity
4.   Make sure the FRU you are replacing is causing the abnormal operation by performing the necessary tests described in Part 3 of this manual.
5.   Do not perform any operations that are not necessary.
6.   Follow the described procedures for disassembling and installing FRUs in the T2000.
7.   After removing parts from the computer, place them in a safe place away from the computer so they are not damaged and do not interfere with your work.
8.   You will remove and replace many screws when you disassemble the T2000. When you remove screws, make sure they are placed in a safe place and identified with the correct parts.
9.   The T2000 contains many sharp edges and corners. Be careful not to injury yourself.
10.   After you have replaced an FRU, make sure the T2000 is functioning properly by performing the appropriate test on the FRU you have fixed or replaced.

While assembling the T2000, remember the following general points:

1.   Make sure all cables and connectors are securely fastened.
2.   Before securing parts, make sure there are no cables that will be pinched or otherwise damaged.
3.   Check to be sure all latches and pressure plates are locked into place.
4.   Be sure to use the correct screws to secure the various parts. Screw sizes are listed in the corresponding figures.
5.   Make sure you replace all the screws that were removed during disassembly.

After installing an FRU in the T2000, confirm that the FRU and the T2000 are functioning properly before returning the unit.

Tools

You will need the following equipment to disassemble and reassemble the T2000:

❑   (1) M 2.5 Phillips-head screwdriver to remove and replace screws.

❑   (1) M 3 Phillips-head screwdriver to remove and replace the HDD screws.

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

4.2 Removing/Replacing the Battery Pack

To remove the T2000 Battery Pack:

1.   Turn off the power to the T2000 and disconnect the AC adapter, power cord, and all external cables connected to the T2000.

2.   Facing the back of the computer, pull back the battery release levers (A) and slowly slide the battery pack (B) toward you until the battery pack stops (Figure 4-1).

Figure 4-1 Removing the battery pack

3.   Firmly grasp the battery pack and lift it straight up and out of the computer.

To install the battery pack:

1.   Align the battery pack with the battery pack slot on the T2000.

2.   Slide the battery pack toward the computer until the battery pack snaps into place.

4.3 Removing/Replacing the Modem Assembly

To remove the T2000 Modem Assembly:

1.   Turn off the power to the T2000 and disconnect the AC adapter, power cord, and all external cables connected to the T2000.

2.   Close the T2000 display panel if it is open.

3   Turn the computer upside down so that the front of the computer is facing you.

4.   Remove the two silver 2.5 x 6 mm screws (A) securing the modem cover (B) (Figure 4-2).

5.   Lift the modem cover away from the T2000.

Figure 4-2 Removing the modem cover

6. Remove the two silver 2.5 x 6 mm screws (C) securing the modem assembly (D). If an optional modem is installed, disconnect the modem connector.

7. Lift the modem assembly out of the T2000 (Figure 4-3).

Figure 4-3 Removing the modem assembly

To reassemble the computer, follow steps 1 through 7 in reverse order.

4.4 Removing/Replacing the Optional Memory Card

To remove the T2000 Optional Memory Card:

1.   Turn off the power to the T2000 and disconnect the AC adapter, power cord, and all external cables connected to the T2000.

2.   Close the T2000 display panel if it is open.

3   Turn the computer upside down so that the front of the computer is facing you.

4.   Firmly press the **EXP. MEMORY** slot cover (A) to unlatch it. Maintaining pressure, pull the cover away from the computer (Figure 4-4).

Figure 4-4 Removing the memory card slot cover

5.   Remove the optional memory card (B) from the system unit (Figure 4-5).

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

Figure 4-5 Removing the optional memory card

To install the T2000 Optional Memory Card:

1.   Turn the memory card upside down so that the word "insert" and an arrow pointing toward the connecting edge are facing up.

2.   Carefully slide the memory card into the narrow slot and push gently to ensure a firm connection. **DO NOT** force the memory card into place.

3.   Replace the cover; its latches should snap into place.

4.   Turn the computer right side up.

5.   Reconnect the AC adapter, open the display, and turn on the computer.

The T2000 automatically configures all additional memory as expanded memory. Use the SETUP program to configure your additional memory as expanded memory. You can also use your additional memory as VDISK.

4.5   Removing/Replacing the Keyboard

To remove the T2000 Keyboard:

1.   The battery pack must be removed first. Refer to Section 4.2 for instructions on how to remove this item before proceeding.

2.   Close the T2000 display panel if it is open.

3   Turn the computer upside down so that the front of the computer is facing you.

4.   Remove the three silver 2.5 x 8 mm screws (A) from the bottom of the T2000 (Figure 4-6).

Figure 4-6 Removing the three screws

5. Carefully turn the T2000 right side up with the front facing you and open the display panel.

6. Press firmly on the front edge of the keyboard cover to release the two tabs. Then gently lift the keyboard (B) out and set it in front of the T2000.

7. Release the pressure plates and disconnect the keyboard cables (C) from PJ7 (12-pin connector) (D) and PJ8 (8-pin connector) (E) on the system board (Figure 4-7).

Figure 4-7 Removing the keyboard

8. Turn the keyboard over and release the eleven latches (F) holding the keyboard assembly together (Figure 4-8).

Figure 4-8 Removing the keyboard cover

To reassemble the computer, follow steps 1 through 8 in reverse order.

4.6   Removing/Replacing the Sub Battery

To remove the sub battery:

1.   The battery pack and keyboard must be removed first. Refer to Sections 4.2 and 4.5 for instructions on how to remove these items before proceeding.

2.   Move the plastic cover (A) aside and disconnect the sub battery cable (B) from PJ703 (C) on the system board.

3.   Lift the sub battery (D) out of the T2000.

Figure 4-9 Removing the sub battery

To reassemble the T2000, follow steps 1 through 3 in reverse order.

4.7   Removing/Replacing the Speaker

To remove the speaker:

1.   The battery pack and keyboard must be removed first. Refer to Sections 4.2 and 4.5 for instructions on how to remove these items before proceeding.

2.   Remove the seven 2.5 x 4 mm screws (A) securing the shield plate (B) (Figure 4-10).

Figure 4-10 Removing the seven screws

3.   Remove the shield plate and set it aside.

4.   Slightly lift and slide the speaker assembly (C) toward you and disconnect the speaker cable (D) from PJ11 (E) on the system board (Figure 4-11).

Figure 4-11 Removing the speaker bracket

5.   Lift the speaker assembly out of the T2000.

6.   Remove the two 2.5 x 4 mm screws (F) securing the speaker (G) to the speaker holder (Figure 4-12).

Figure 4-12 Removing the speaker

7.   Separate the speaker from the speaker holder. At reassembly, make sure to route the speaker cable beneath the speaker holder. (Refer to Figure 4-12 above.)

To reassemble the computer, follow steps 1 through 7 in reverse order.

4.8 Removing/Replacing the FL Inverter Board and LCD Module

To remove the T2000 FL Inverter Board and LCD Module:

1.   The battery pack must be removed first. Refer to Section 4.2 for instructions on how to remove this item before proceeding.

2.   Open the display and remove the two rubber cushions (cushion LCD) (A) and name plate assembly (B) from the LCD mask (C) (Figure 4-13).

3.   Remove the four 2.5 x 6 mm screws (D) and release the ten latches (E) on the LCD mask (Figure 4-13).

> *CAUTION:* *Be careful not to damage the two top cover latches, protruding through the LCD mask, as you remove the LCD mask.*

Figure 4-13 Removing the LCD mask

4.	Remove the two 2.5 x 4 mm screws (F). Rotate the FL inverter board toward the LCD module and disconnect the three cables (G) from CN1 (black connector) (H), CN2 (white connector) (I), and CN3 (J) located on the FL inverter board (Figure 4-14).

Figure 4-14 Removing the FL inverter board

5.	To remove the LCD module, disconnect the LCD cable (K) from CN1 (L) and CN2 (M) located on the LCD module (N) while moving the insulator (O) aside. Remove the four 2.5 x 4 mm screws (P) and remove the ground cable (Q) and LCD module from the T2000 (Figure 4-15).

Figure 4-15 Removing the LCD module

To reassemble the computer, follow steps 1 through 5 in reverse order.

4.9　Removing/Replacing the Top Cover Assembly

To remove the top cover assembly:

1.　The battery pack, keyboard, and speaker bracket must be removed first. Refer to Sections 4.2, 4.5, and 4.7 for instructions on how to remove these items before proceeding.

2.　Disconnect the LED cable (A) and LCD cable (B) from PJ9 (C) and PJ12 (D) on the system board (Figure 4-16).

3.　Remove the three silver 2.5 x 6 mm screws (E) from the front of the top cover (Figure 4-16).

Figure 4-16 Removing the front top cover screws

4.   Remove the four silver 2.5 x 6 mm screws (F) from the T2000's battery pack slot (G) (Figure 4-17).

Figure 4-17 Removing the four screws

To reassemble the computer, follow steps 1 through 4 in reverse order.

4.10 Removing/Replacing the RTC Battery and LED Board

To remove the RTC Battery and LED board:

1.   The battery pack, keyboard, speaker bracket, and top cover assembly must be removed first. Refer to Sections 4.2, 4.5, 4.7, and 4.9 for instructions on how to remove these items before proceeding.

2.   Remove the 2.5 x 4 mm screw (A) and the LCD cable plate (plate harness) (B) (Figure 4-18).

   NOTE: The ground cable is not shown in Figure 4-18 below. When reassembling the computer, be sure to use the 2.5 x 4 mm screw (A) to resecure the ground cable.

3.   Remove the two tap screws (C) and the hinge holder (D). Then carefully remove the LCD cable from the cover assembly (Figure 4-18).

   CAUTION: Be careful not to damage the LCD cable as you remove the hinge holder.

Figure 4-18 Removing the LCD cable

4.   To remove the sensor cable from the LED holder assembly, disconnect the sensor cable (E) and release the two clamps (F) (Figure 4-19).

5.   Remove the two 2.5 x 4 mm screws (G) and then remove the LED holder assembly (H)
     from the cover assembly (Figure 4-19).

     CAUTION: *The thermistor contacts should be clear of the cover assembly when lifting
     the LED holder assembly from the cover assembly.*

Figure 4-19 Removing the LED holder assembly

6.   To remove the RTC battery (I), disconnect it from PJ1 on the LED board (PCB FT2LEx) (J)
     and lift it out of the LED holder assembly.

7.   To remove the LED board, disconnect the thermistor cable (K) from PJ2 on the LED board.
     Then release the four latches (L) on the LED holder assembly and remove the LED board
     from the LED holder assembly (Figure 4-20).

Figure 4-20 Removing RTC battery and LED board

To reassemble the computer, follow steps 1 through 7 in reverse order.

4.11 Removing/Replacing the Battery Terminal Assembly and HDD

To remove the battery terminal assembly and HDD:

1.   The battery pack, keyboard, speaker bracket, and top cover must be removed first. Refer to Sections 4.2, 4.5, 4.7, and 4.9 for instructions on how to remove these items before proceeding.

2.   Disconnect the battery terminal assembly cable (A) from PJ702 (B) on the system board and set the battery terminal assembly (C) aside (Figure 4-21).

Figure 4-21 Removing the battery terminal assembly

3.   Remove the two 2.5 x 4 mm screws (D) securing the HDD to the system board (Figure 4-22).

Figure 4-22 Removing the HDD assembly

4.   Grasping the top of the HDD, gently lift the HDD and the HDD chassis (E) out of the bottom cover as one unit (Figure 4-22).

5.   Disconnect the flexible hard disk cable (F) from the HDD (G). Set the HDD assembly aside (Figure 4-22).

6.   Disconnect the HDD flexible cable (H) from the system board at PJ3 (I) and PJ4 (J) (Figure 4-23).

Figure 4-23 Disconnecting the HDD flexible cables

7.   Remove the four 3 x 4 mm screws (K) that secure the HDD to the HDD chassis (Figure 4-24).

Figure 4-24 Separating the HDD chassis from the HDD

8.   Separate the HDD from the HDD chassis and set the HDD aside.

To reassemble the computer, follow steps 1 through 8 in reverse order.

4.12 Removing/Replacing the FDD

To remove the FDD:

1.   The battery pack, keyboard, speaker bracket, and top cover assembly must be removed first. Refer to Sections 4.2, 4.5, 4.7, and 4.9 for instructions on how to remove these items before proceeding.

2.   Disconnect the FDD cable (A) from PJ16 (B) located on the system board and remove the two 2.5 x 4 mm screws (C). Lift the FDD chassis (D) and FDD out of the T2000 as one unit (Figure 4-25).

Figure 4-25 Removing the FDD chassis

3.   Remove the three 2.5 x 4 mm (special) screws (E) and then remove the FDD (F) from the FDD chassis (Figure 4-26).

Figure 4-26 Removing the FDD

To reassemble the computer, follow steps 1 through 3 in reverse order.

4.13 Removing/Replacing the System Board

To remove the system board:

1.   The battery pack, optional modem (if installed), keyboard, speaker bracket, top cover assembly, and HDD must be removed first. Refer to Sections 4.2, 4.3, 4.5, 4.7, 4.9, and 4.11 for instructions on how to remove these items before proceeding.

2.   Disconnect the sub battery cable (A) from PJ703 (B) on the system board. Leave the sub battery in the computer (Figure 4-27).

3.   Disconnect the floppy disk drive cable (C) from PJ16 (D) on the system board (Figure 4-27).

4.   Gently slide the modem connector (E) through the modem assembly housing (Figure 4-27).

5.   Remove the four 2.5 x 4 mm screws (F) securing the system board to the bottom cover (Figure 4-27).

Figure 4-27 Removing the system board screws

6.   Remove the **EXP** cover (G) on the back of the computer (Figure 4-28).

7.   Flip down the **PRT/FDD** cover (H) and remove the silver 2.5 x 6 mm screw (I) from between the **PRT/FDD** and **COMMS** ports on the back of the computer (Figure 4-28).

Figure 4-28 Removing the system board

8.   Gently remove the system board from the bottom cover and set the bottom cover aside.

To reassemble the computer, follow steps 1 through 8 in reverse order.

Appendices

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Contents

Appendix E   Keyboard Layouts

Appendix F   Wiring Diagrams

Appendix A   System Board Layout

A.1   System Board FA2SYx (ICs)
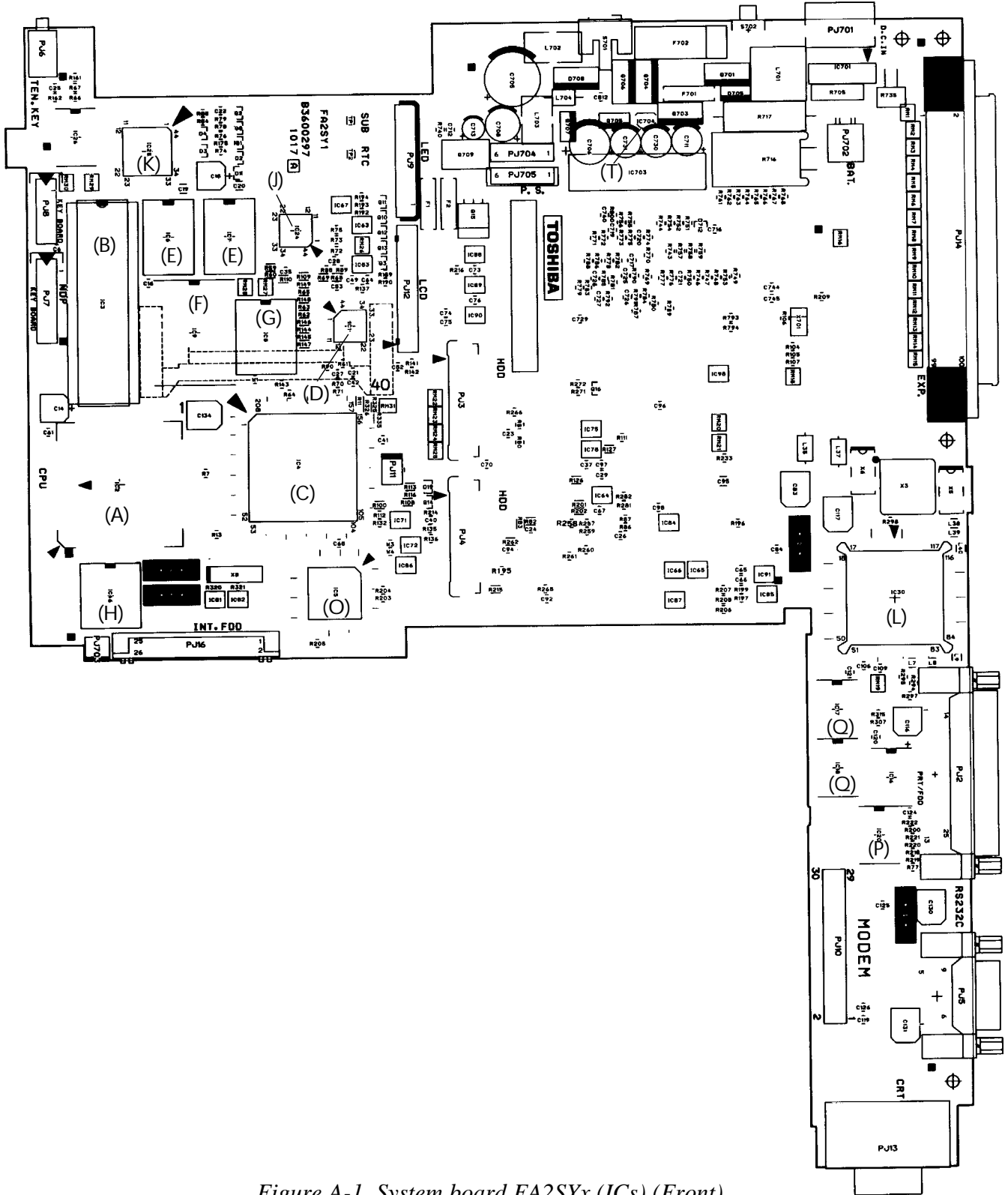
Figure A-1 System board FA2SYx (ICs) (Front)
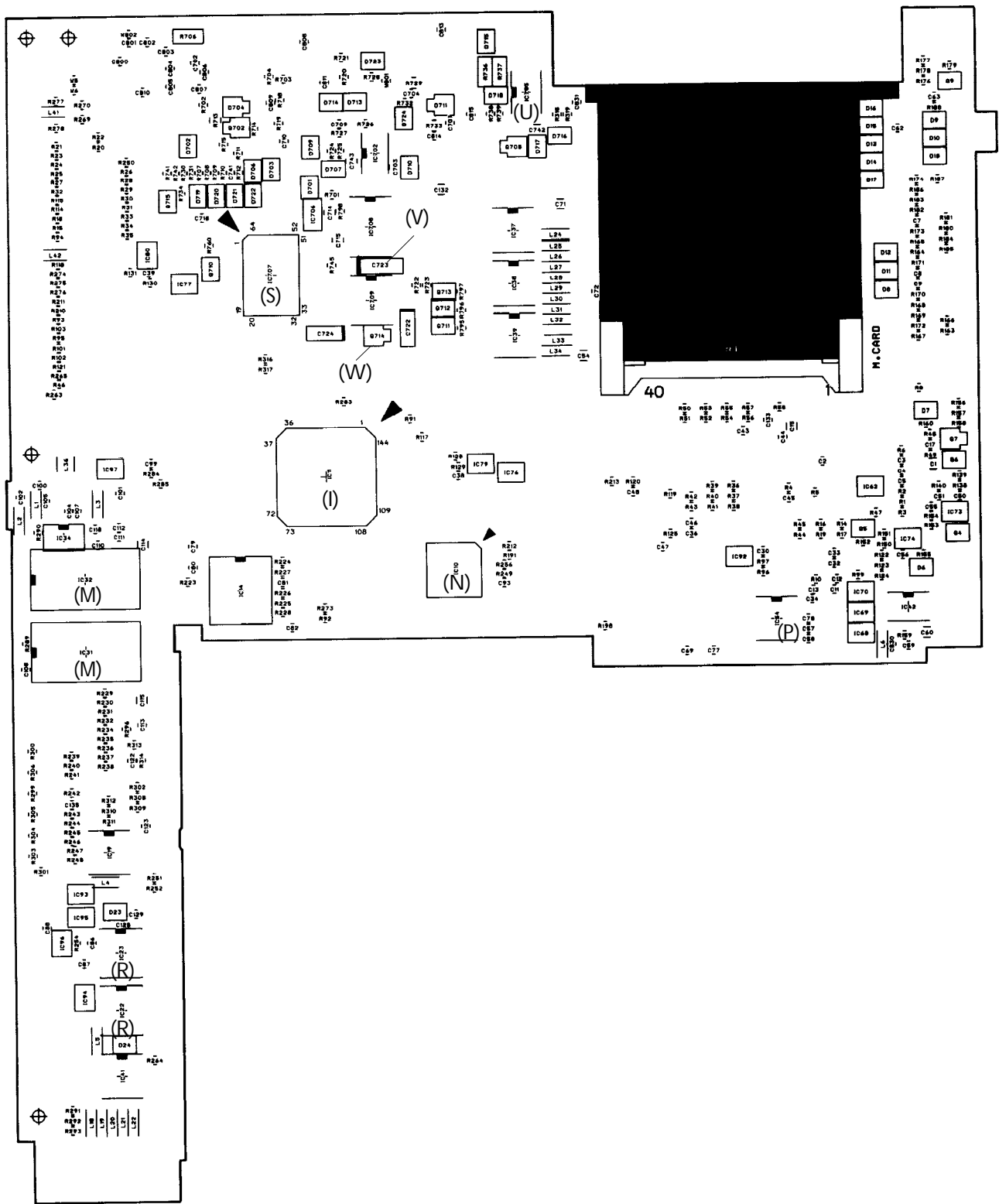
Figure A-1 System board FA2SYx (ICs) (Back)

Table A-1 ICs on the system board FA2SYx

Callout	Number	Name
(A)	IC2	CPU: Central Processing Unit (80C286-12)
(B)	IC3	NDP: Numeric Data Processor (80C287-12)
(C)	IC4	GA-SYS CNT: System Control Gate Array
(D)	IC1	GA-REF CNT: Refresh Control Gate Array
(E)	IC6, 7	System RAM
(F)	IC9	BIOS ROM
(G)	IC8	Backup RAM
(H)	IC46	RTC: Real Time Clock
(I)	IC11	SI: Super Integration T9778A
(J)	IC24	KBIC: Keyboard Interface Controller 80C42
(K)	IC25	KBSC: Keyboard Scan Controller 80C50
(L)	IC30	PVGA1F
(M)	IC31, 32	Video RAM
(N)	IC10	GA-I/O CNT: I/O Controller Gate Array
(O)	IC5	GA-I/O DEC: I/O Decoder Gate Array
(P)	IC16, 54	FDD Interface Driver
(Q)	IC17, 18	PRT Interface Driver
(R)	IC22, 23	RS-232-C Interface Driver
(S)	IC707	Power Supply Microprocessor (U47C660S)
(T)	IC704	Regulator
(U)	IC705	Backup Power Controller (L1025)
(V)	IC708	Power Supply Driver (L1600)
(W)	IC709	Switching Regulator (L1451)

A.2   System Board FA2SYx (OSCs)
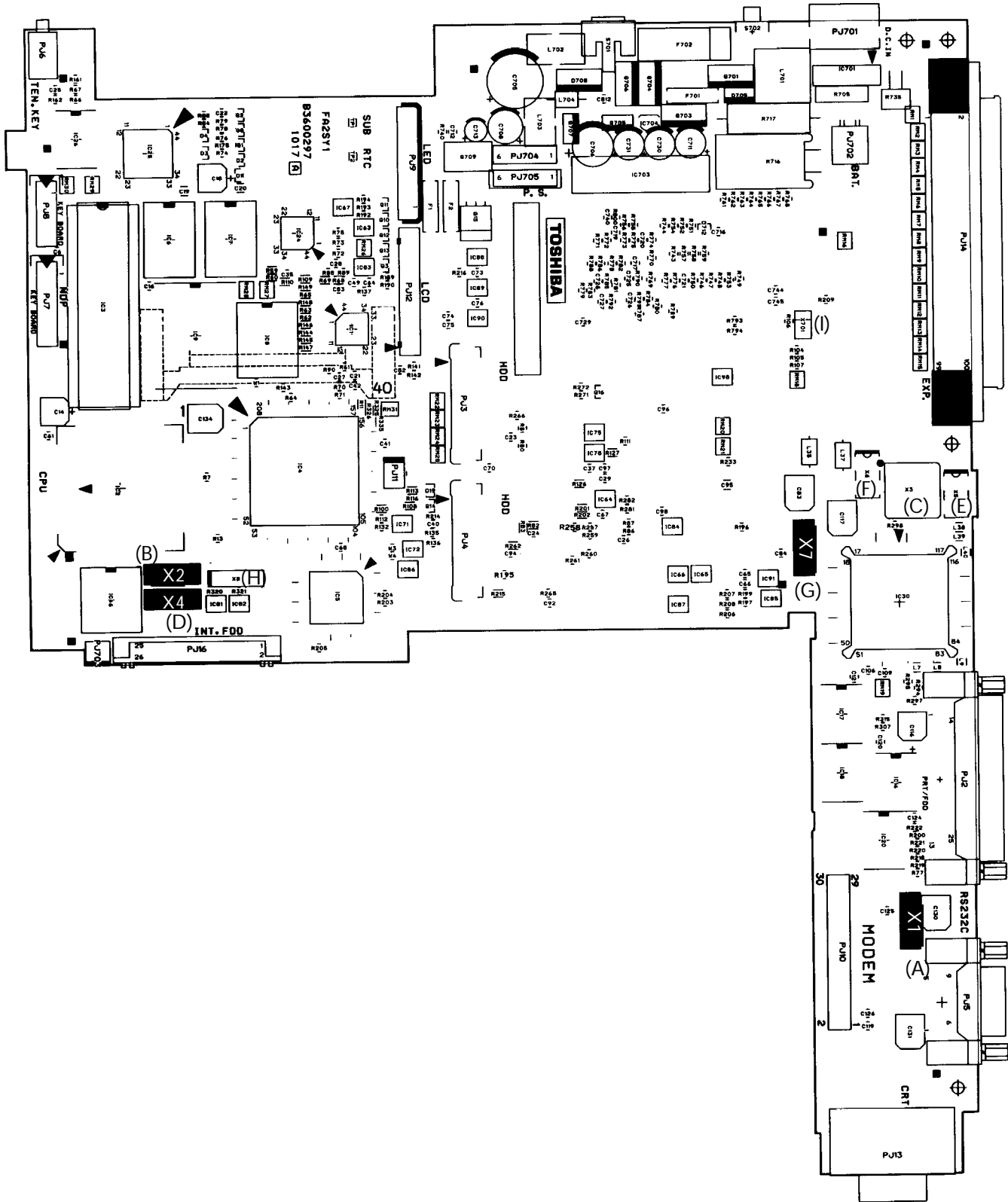
Figure A-2 System board FA2SYx (OSCs)

Table A-2 OSCs on the system board FA2SYx

Callout	Number	Name
(A)	X1	14.7456MHz Oscillator
(B)	X2	14.31818MHz Oscillator
(C)	X3	44.9MHz Oscillator
(D)	X4	24.0MHz Oscillator
(E)	X5	28.322MHz Oscillator
(F)	X6	25.175MHz Oscillator
(G)	X7	24MHz Oscillator
(H)	X8	32.768KHz Oscillator
(I)	X701	500KHz Oscillator

A.3   System Board FA2SYx (Connectors)
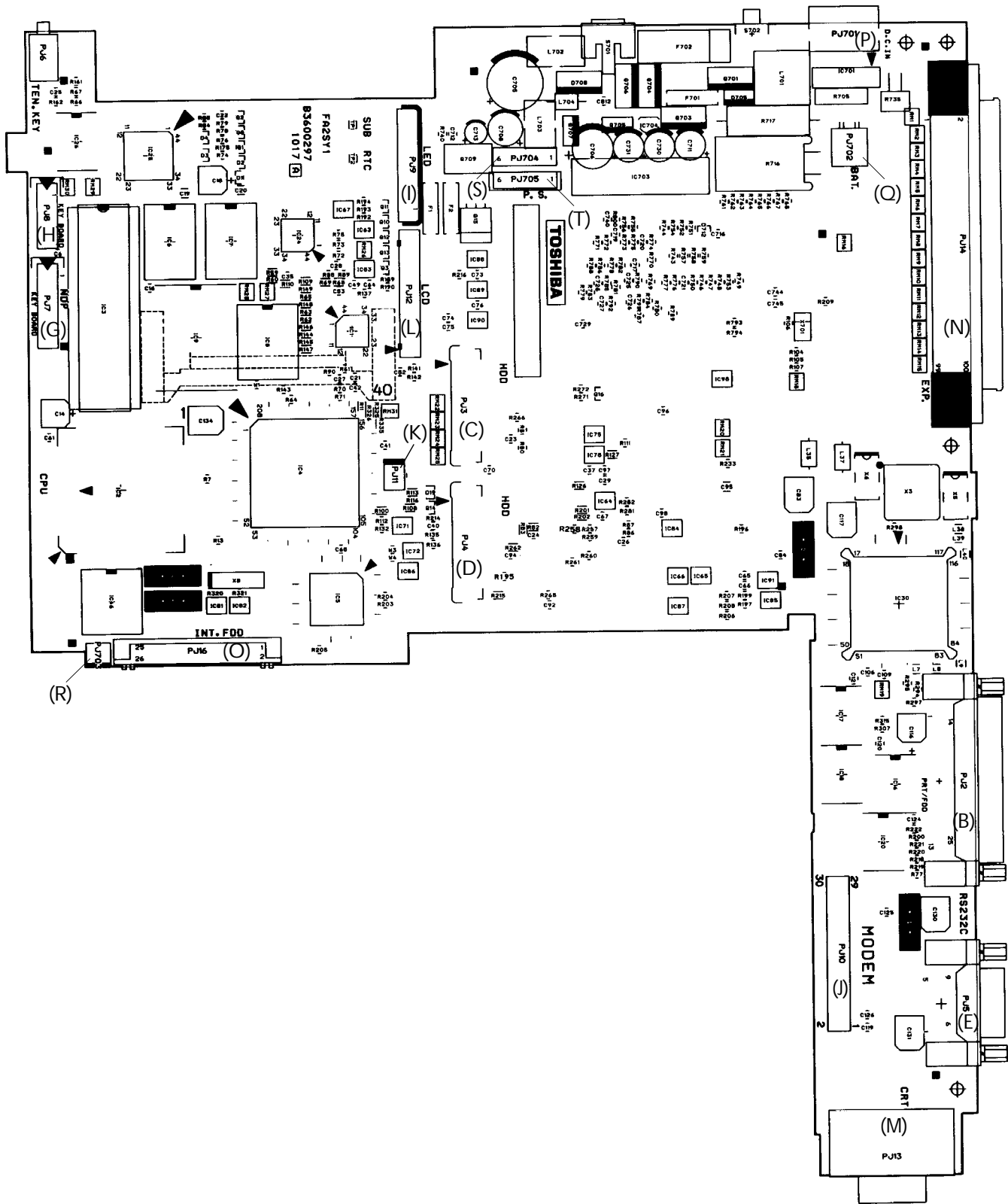
Figure A-3 System board FA2SYx (connectors) (Front)
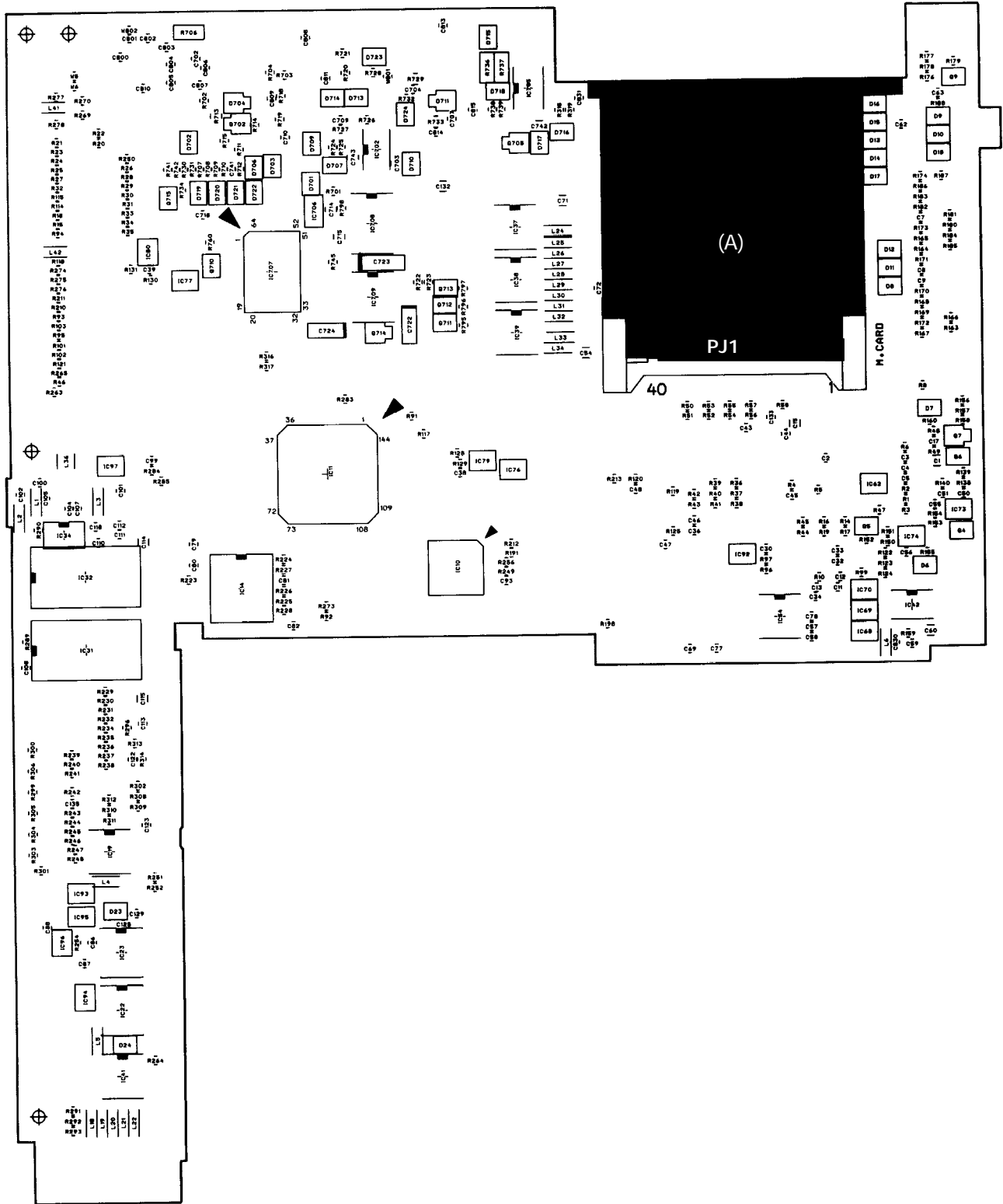
Figure A-3 System board FA2SYx (connectors) (Back)

Table A-3 Connectors on the system board FA2SYx

Callout	Number	Name	Number of pins
(A)	PJ1	Expansion Memory I/F Connector	40
(B)	PJ2	Printer/FDD I/F Connector	25
(C)	PJ3	HDD I/F Connector (Left)	22
(D)	PJ4	HDD I/F Connector (Right)	22
(E)	PJ5	RS-232-C I/F Connector	9
(F)	PJ6	Numeric Keypad I/F Connector	3
(G)	PJ7	Keyboard I/F Connector (Right)	12
(H)	PJ8	Keyboard I/F Connector (Left)	8
(I)	PJ9	LED Board I/F Connector	22
(J)	PJ10	Built-in Modem I/F Connector	30
(K)	PJ11	Speaker I/F Connector	2
(L)	PJ12	LCD I/F Connector	30
(M)	PJ13	CRT I/F Connector	15
(N)	PJ14	Expansion Bus Connector	100
(O)	PJ16	FDD I/F Connector	26
(P)	PJ701	AC Adapter I/F Connector	6
(Q)	PJ702	Battery Pack I/F Connector	2
(R)	PJ703	Sub Battery I/F Connector	2
(S)	PJ704	System I/F Connector	6
(T)	PJ705	Power Supply I/F Connector	6

Appendix B   Pin Assignments

B.1   PJ1 Expansion Memory I/F Connector

Table B-1 Expansion memory I/F connector pin assignment (40-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	GND		21	RAMV	O
2	D03;100	I/O	22	MA07;101	O
3	D04;100	I/O	23	MA06;101	O
4	D05;100	I/O	24	MA05;101	O
5	D06;100	I/O	25	MA04;101	O
6	D07;100	I/O	26	MA03;101	O
7	D08;100	I/O	27	MA02;101	O
8	D09;100	I/O	28	MA01;101	O
9	D10;100	I/O	29	DRMEM;100	I
10	MA08;101	O	30	GND	
11	GND		31	MA00;101	O
12	CASH;002	O	32	D00;100	I/O
13	RAS4;000	O	33	D01;100	I/O
14	RAS3;000	O	34	D02;100	I/O
15	MEMWE;002	O	35	D11;100	I/O
16	CASL;002	O	36	D12;100	I/O
17	RAS5;000	O	37	D13;100	I/O
18	RAS2;000	O	38	D14;100	I/O
19	EMA09;101	O	39	D15;100	I/O
20	RAMV		40	GND	

B.2   PJ2 PRT/FDD I/F Connector

Table B-2 PRT/FDD I/F connector pin assignment (25-pin)

[For Printer]

Pin	Signal	I/O	Pin	Signal	I/O
1	STROB;000	O	14	AUTOFD;000	O
2	PDB00;100	I/O	15	ERROR;000	I
3	PDB01;100	I/O	16	PINT;000	O
4	PDB02;100	I/O	17	SLIN;000	O
5	PDB03;100	I/O	18	GND	
6	PDB04;100	I/O	19	GND	
7	PDB05;100	I/O	20	GND	
8	PDB06;100	I/O	21	GND	
9	PDB07;100	I/O	22	GND	
10	ACK;000	I	23	GND	
11	BUSY;100	I	24	GND	
12	PE;100	I	25	GND	
13	SELECT;100	I	---	---	---

[For FDD]

Pin	Signal	I/O	Pin	Signal	I/O
1	ERDY;001	I	14	ELOWD;000	O
2	EINDX;001	I	15	ESSEL;000	O
3	ETR0;001	I	16	EDIRC;000	O
4	EWPR;001	I	17	ESTEP;000	O
5	ERDAT;001	I	18	GND	
6	EDKCH;001	I	19	GND	
7	(N/C)		20	GND	
8	(N/C)		21	GND	
9	(N/C)		22	GND	
10	EDSL;000	O	23	GND	
11	EMON;000	O	24	GND	
12	EWDAT;000	O	25	GND	
13	EWEN;000	O	---	---	---

B.3 PJ3 HDD I/F Connector (Left)

Table B-3 HDD I/F connector (L) pin assignment (22-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	RESET;020	O	12	HSD11;100	I/O
2	GND		13	HSD03;100	I/O
3	HSD07;100	I/O	14	HSD12;100	I/O
4	HSD08;100	I/O	15	HSD02;100	I/O
5	HSD06;100	I/O	16	GND	
6	GND		17	HSD13;100	I/O
7	HSD09;100	I/O	18	HSD01;100	I/O
8	HSD05;100	I/O	19	HSD14;100	I/O
9	HSD10;100	I/O	20	HSD00;100	I/O
10	HSD04;100	I/O	21	GND	
11	GND		22	GND	

B.4 PJ4 HDD I/F Connector (Right)

Table B-4 HDD I/F connector (R) pin assignment (22-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	GND		12	SA00;120	O
2	HSD15;100	I/O	13	GND	
3	VCC		14	SA02;120	O
4	IOWR;020	O	15	HDC0CS;020	O
5	GND		16	HDC1CS;020	O
6	IORD;020	O	17	GND	
7	IIRDY;100	I	18	DRVSL;000	I
8	IRQ14;100	I	19	VCC	
9	GND		20	VCC	
10	II016;000	I	21	ATSEL;100	I
11	SA01;120	O	22	GND	

B.5　PJ5　RS-232-C I/F Connector

Table B-5　RS-232-C I/F connector pin assignment (9-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	DCD;100	I	6	DSR;100	I
2	RD;000	I	7	RTS;100	O
3	SD;000	O	8	CTS;100	I
4	DTR;100	O	9	RI;100	I
5	GND		---	---	---

B.6　PJ6　Numeric Keypad I/F Connector

Table B-6　Numeric keypad I/F connector pin assignment (3-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	GND		3	(N/C)	
2	TENKEY;100	O	---	---	---

B.7　PJ7　Keyboard I/F Connector (Right)

Table B-7　Keyboard I/F connector (R) pin assignment (12-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	(N/C)		7	KBOT03;000	O
2	KBOT01;000	O	8	KBOT10;000	O
3	KBOT09;000	O	9	KBOT05;000	O
4	KBOT07;000	O	10	KBOT02;000	O
5	KBOT06;000	O	11	KBOT08;000	O
6	KBOT04;000	O	12	KBOT00;000	O

B.8　PJ8　Keyboard I/F Connector (Left)

Table B-8　Keyboard I/F connector (L) pin assignment (8-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	KBRT7;100	I	5	KBRT3;100	I
2	KBRT6;100	I	6	KBRT2;100	I
3	KBRT5;100	I	7	KBRT1;100	I
4	KBRT4;100	I	8	KBRT0;100	I

B.9   PJ9 LED Board I/F Connector

Table B-9 LED board I/F connector pin assignment (22-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	GND		12	CAPLED;000	O
2	BUV	O	13	GND	
3	BAT;100	O	14	OVRLED;000	O
4	GND		15	NUMLED;000	O
5	PNLOFF;001	O	16	CLED;000	O
6	VCC		17	GND	
7	VCC		18	ALED;000	O
8	DCIN;000	O	19	CRTLED;000	O
9	GND		20	LB;000	O
10	CKHRQ;000	O	21	CHG;000	O
11	POWER;000	O	22	GND	

B.10   PJ10 Built-in Modem I/F Connector

Table B-10 Built-in modem I/F connector pin assignment (30-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	N9V		16	GND	
2	BMDSL;000	O	17	SD02;100	I/O
3	$14R7M;120	O	18	SD01;100	I/O
4	GND		19	GND	
5	SA00;100	O	20	GND	
6	SA01;100	O	21	SD00;100	I/O
7	SA02;100	O	22	IOWR;000	O
8	GND		23	IORD;000	O
9	SD07;100	I/O	24	VCC	
10	SD06;100	I/O	25	RESET;100	O
11	GND		26	BMPOF;100	O
12	GND		27	VCC	
13	SD05;100	I/O	28	VCC	
14	SD04;100	I/O	29	BMIRQ;000	I
15	SD03;100	I/O	30	BSPTON;000	O

B.11   PJ11 Speaker I/F Connector

Table B-11   Speaker I/F connector pin assignment (2-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	SPOUT0;100	I	2	SPOUT1;100	O

B.12   PJ12 LCD I/F Connector

Table B-12   LCD I/F connector pin assignment (30-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	GND		16	(N/C)	
2	LP;020	O	17	GND	
3	GND		18	SLD3;120	O
4	FP;020	O	19	GND	
5	GND		20	SLD2;120	O
6	SCLK;110	O	21	GND	
7	GND		22	SLD1;120	O
8	SUD3;120	O	23	GND	
9	GND		24	SLD0;120	O
10	SUD2;120	O	25	LCDV	
11	GND		26	GND	
12	SUD1;120	O	27	DSPV	
13	GND		28	GND	
14	SUD0;120	O	29	DSPV	
15	LCDV		30	GND	

B.13   PJ13 CRT I/F Connector

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

Pin	Signal	I/O	Pin	Signal	I/O
1	RED;100	O	9	(N/C)	
2	GREEN;100	O	10	GND	
3	BLUE;100	O	11	(N/C)	
4	(N/C)		12	(N/C)	
5	GND		13	PHSYNC;100	O
6	GND		14	PVSYNC;100	O
7	GND		15	(N/C)	
8	GND		---	---	---

B.14 PJ14 Expansion Bus I/F Connector

Table B-14 Expansion bus I/F connector pin assignment (100-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	GND		51	GND	
2	RVCC		52	SVCC	
3	RGND		53	IOCLK;101	O
4	CPCNF;100	I	54	IRQ5;101	I
5	MDMSL;001	I/O	55	DRQ3;101	I
6	COMCLK;101	O	56	DACK3;001	O
7	MIRQ;001	I	57	AEN;101	O
8	SPKTON;001	I	58	DRQ1;101	I
9	GND		59	IOCRDY;101	I
10	SA00;101	O	60	GND	
11	SA01;101	O	61	IRQ10;101	I
12	SA02;101	O	62	IRQ14;101	I
13	SA03;101	O	63	SD08;101	I/O
14	SA04;101	O	64	SD09;101	I/O
15	SA05;101	O	65	IRQ11;101	I/O
16	SA06;101	O	66	SD10;101	I/O
17	SA07;101	O	67	SD11;101	I/O
18	GND		68	SD12;101	I/O
19	SA08;101	O	69	IRQ12;101	I
20	SA09;101	O	70	GND	
21	SA10;101	O	71	SD13;101	I/O
22	SA11;101	O	72	SD14;101	I/O
23	SA12;101	O	73	IRQ6;101	I
24	SA13;101	O	74	SD15;101	I/O
25	SA14;101	O	75	LA22;101	O
26	SA15;101	O	76	LA23;101	O
27	GND		77	DRQ2;101	I
28	SA16;101	O	78	LA21;101	O
29	SA17;101	O	79	LA19;101	O
30	SA18;101	O	80	LA20;101	O
31	SA19;101	O	81	DACK6;001	O
32	SD00;101	I/O	82	GND	
33	SD01;101	I/O	83	REFMD;001	O
34	SD02;101	I/O	84	LA18;101	O
35	SD03;101	I/O	85	MASTER;001	I
36	GND		86	LA17;101	O
37	SD04;101	I/O	87	SBHE;001	O
38	SD05;101	I/O	88	IOCHCK;001	I
39	SD06;101	I/O	89	MMCS16;001	I
40	SD07;101	I/O	90	GND	
41	SMEW;001	O	91	IOCS16;001	I
42	SMER;001	O	92	DACK2;001	O
43	GND		93	DRQ6;101	I
44	IOWR;001	I/O	94	DRQ5;101	I
45	IORD;001	I/O	95	DACK5;001	O
46	TC;101	O	96	MERD;001	I/O
47	BALE;101	O	97	IRQ4;101	I
48	RESET;101	O	98	MEWR;001	I/O
49	DACK1;001	O	99	IRQ7;101	I
50	IRQ9;101	I	100	GND	

B.15 PJ16 FDD I/F Connector

Table B-15 FDD I/F connector pin assignment (26-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	VCC	O	14	ISTEP;000	O
2	IINDX;000	I	15	GND	
3	VCC		16	IWDAT;000	O
4	IDSL;000	O	17	GND	
5	VCC		18	IWEN;000	O
6	DSKCHG;000	I	19	GND	
7	VCC		20	ITR0;000	I
8	IRDY;000	I	21	GND	
9	IHMED;000	I	22	IWPR;000	I
10	IMON;000	O	23	GND	
11	ILOWD;000	O	24	IRDAT;000	O
12	IDIRC;000	O	25	GND	
13	GND		26	ISSEL;000	O

B.16 PJ701 AC Adapter I/F Connector

Table B-16 AC adapter I/F connector pin assignment (6-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	INPUT1		4	ACHGON0	
2	INPUT2		5	GND	
3	GND		6	GND	

B.17 PJ702 Battery Pack I/F Connector

Table B-17 Battery pack I/F connector pin assignment (2-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	+14.4V		2	GND	

B.18 PJ703 Sub Battery I/F Connector

Table B-18 Sub battery pack I/F connector pin assignment (2-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	+6V		2	GND	

B.19   PJ704 System I/F Connector

Table B-19 System I/F connector pin assignment (6-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	PSVEE		4	PSVCC	
2	PSVDD		5	PSRAMV	
3	PSVCC		6	PSVDSP	

B.20   PJ705 Power Supply I/F Connector

Table B-20 Power supply I/F connector pin assignment (6-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	N9V		4	VCC	
2	P12V		5	RAMV	
3	VCC		6	DSPV	

Appendix C   ASCII Character Codes

Table C-1 ASCII character codes

Appendix D   Keyboard Scan/Character Codes

Table D-1 Keyboard scan/character code

Cap No.	Key Top	Lower Case	Upper Case	Caps Lock		With (Ctrl)	With (Alt)
				Lower	Upper		
1	~ `	29 60	29 7E	29 60	29 7E	-	*29 00
2	! 1	02 31	02 21	02 31	02 21	-	78 00
3	@ 2	03 32	03 40	03 32	03 40	03 00	79 00
4	# 3	04 33	04 23	04 33	04 23	-	7A 00
5	$ 4	05 34	05 24	05 34	05 24	-	7B 00
6	% 5	06 35	06 25	06 35	06 25	-	7C 00
7	^ 6	07 36	07 5E	07 36	07 5E	07 1E	7D 00
8	& 7	08 37	08 26	08 37	08 26	-	7E 00
9	* 8	09 38	09 2A	09 38	09 2A	-	7F 00
10	(9	0A 39	0A 28	0A 39	0A 28	-	80 00
11	) 0	0B 30	0B 29	0B 30	0B 29	-	81 00
12	_ -	0C 2D	0C 5F	0C 2D	0C 5F	0C 1F	82 00
13	+ =	0D 3D	0D 2B	0D 3D	0D 2B	-	83 00
15	Back space	0E 08	0E 08	0E 08	0E 08	0E 7F	*0E 00
16	Tab	0F 09	0F 00	0F 09	0F 00	*94 00	*A5 00
17	Q	10 71	10 51	10 71	10 51	10 11	10 00
18	W	11 77	11 57	11 77	11 57	11 17	11 00
19	E	12 65	12 45	12 65	12 45	12 05	12 00
20	R	13 72	13 52	13 72	13 52	13 12	13 00
21	T	14 74	14 54	14 74	14 54	14 14	14 00
22	Y	15 79	15 59	15 79	15 59	15 19	15 00
23	U	16 75	16 55	16 75	16 55	16 15	16 00
24	I	17 69	17 49	17 69	17 49	17 09	17 00

NOTE: * = Only extended code.

Cap No.	Key Top	Lower Case	Upper Case	Caps Lock		With (Ctrl)	With (Alt)
				Lower	Upper		
25	O	18 6F	18 4F	18 6F	18 4F	18 0F	18 00
26	P	19 70	19 50	19 70	19 50	19 10	19 00
27	{ [	1A 5B	1A 7B	1A 5B	1A 7B	1A 1B	*1A 00
28	}]	1B 5D	1B 7D	1B 5D	1B 7D	1B 1D	*1B 00
29	| \	2B 5C	2B 7C	2B 5C	2B 7C	2B 1C	*2B 00
30	Caps Lock	-	-	-	-	-	-
31	A	1E 61	1E 41	1E 61	1E 41	1E 01	1E 00
32	S	1F 73	1F 53	1F 73	1F 53	1F 13	1F 00
33	D	20 64	20 44	20 64	20 44	20 04	20 00
34	F	21 66	21 46	21 66	21 46	21 06	21 00
35	G	22 67	22 47	22 67	22 47	22 07	22 00
36	H	23 68	23 48	23 68	23 48	23 08	23 00
37	J	24 6A	24 4A	24 6A	24 4A	24 0A	24 00
38	K	25 6B	25 4B	25 6B	25 4B	25 0B	25 00
39	L	26 6C	26 4C	26 6C	26 4C	26 0C	26 00
40	: ;	27 3B	27 3A	27 3B	27 3A	-	*27 00
41	" '	28 27	28 22	28 27	28 22	-	*28 00
43	Enter	1C 0D	1C 0D	1C 0D	1C 0D	1C 0A	*1C 00
44	Shift (L)	-	-	-	-	-	-
46	Z	2C 7A	2C 5A	2C 7A	2C 5A	2C 1A	2C 00
47	X	2D 78	2D 58	2D 78	2D 58	2D 18	2D 00
48	C	2E 63	2E 43	2E 63	2E 43	2E 03	2E 00
49	V	2F 76	2F 56	2F 76	2F 56	2F 16	2F 00
50	B	30 62	30 42	30 62	30 42	30 02	30 00
51	N	31 6E	31 4E	31 6E	31 4E	31 0E	31 00

NOTE:　　　* = Only extended code.

Cap No.	Key Top	Lower Case	Upper Case	Caps Lock Lower	Caps Lock Upper	With (Ctrl)	With (Alt)
52	M	32 6D	32 4D	32 6D	32 4D	32 0D	32 00
53	<　,	33 2C	33 3C	33 2C	33 3C	-	*33 00
54	>　.	34 2E	34 3E	34 2E	34 3E	-	*34 00
55	?　/	35 2F	35 3F	35 2F	35 3F	-	*35 00
57	Shift (R)	-	-	-	-	-	-
58	Ctrl (L)	-	-	-	-	-	-
60	Alt (L)	-	-	-	-	-	-
61	Space	39 20	39 20	39 20	39 20	39 20	39 20
62	AltGr	-	-	-	-	-	-
75	Ins	52 00 52 E0	52 00 52 E0	52 00 52 E0	52 00 52 E0	*92 E0	*A2 00
76	Del	53 00 53 E0	53 00 53 E0	53 00 53 E0	53 00 53 E0	*93 E0	*A3 00
79	¼	4B 00 4B E0	4B 00 4B E0	4B 00 4B E0	4B 00 4B E0	73 00 73 E0	*9B 00
80	Home	47 00 47 E0	47 00 47 E0	47 00 47 E0	47 00 47 E0	77 00 77 E0	*97 00
81	End	4F 00 4F E0	4F 00 4F E0	4F 00 4F E0	4F 00 4F E0	75 00 75 E0	*9F 00
83	¡	48 00 48 E0	48 00 48 E0	48 00 48 E0	48 00 48 E0	*8D E0	*98 00
84	»	50 00 50 E0	50 00 50 E0	50 00 50 E0	50 00 50 E0	*91 E0	*A0 00
85	PgUp	49 00 49 E0	49 00 49 E0	49 00 49 E0	49 00 49 E0	84 00 *84 E0	*99 00
86	PgDn	51 00 51 E0	51 00 51 E0	51 00 51 E0	51 00 51 E0	76 00 76 E0	*A1 00
89	«	4D 00 4D E0	4D 00 4D E0	4D 00 4D E0	4D 00 4D E0	74 00 74 E0	*9D 00
90	Num Lock	-	-	-	-	-	-
105	+	4A 2D	4A 2D	4A 2D	4A 2D	*8E 00	*4A 00
106	-	4E 2B	4E 2B	4E 2B	4E 2B	*90 00	*4E 00
110	Esc	01 1B	01 1B	01 1B	01 1B	01 1B	*01 00
112	F1	3B 00	54 00	3B 00	54 00	5E 00	68 00
113	F2	3C 00	55 00	3C 00	55 00	5F 00	69 00

NOTE:　　　* = Only extended code.

Cap No.	Key Top	Lower Case	Upper Case	Caps Lock		With (Ctrl)	With (Alt)
				Lower	Upper		
114	F3	3D 00	56 00	3D 00	56 00	60 00	6A 00
115	F4	3E 00	57 00	3E 00	57 00	61 00	6B 00
116	F5	3F 00	58 00	3F 00	58 00	62 00	6C 00
117	F6	40 00	59 00	40 00	59 00	63 00	6D 00
118	F7	41 00	5A 00	41 00	5A 00	64 00	6E 00
119	F8	42 00	5B 00	42 00	5B 00	65 00	6F 00
120	F9	43 00	5C 00	43 00	5C 00	66 00	70 00
121	F10	44 00	5D 00	44 00	5D 00	67 00	71 00
122	F11	*85 00	*87 00	*85 00	*87 00	*89 00	*8B 00
123	F12	*86 00	*88 00	*86 00	*88 00	*8A 00	*8C 00
125	Scroll Lock	-	-	-	-	-	-
200	Pause Break	-	-	-	-	-	-
201	PrtSc SysRq	-	-	-	-	*37 00	-
202	Fn	-	-	-	-	-	-

NOTE: * = Only extended code.

Appendix E Keyboard Layouts

E.1   U.S.A. Keyboard

Figure E-1 U.S.A. keyboard

E.2   U.K. Keyboard

Figure E-2 U.K. 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   Swedish/Finnish Keyboard

Figure E-7 Swedish/Finnish keyboard

E.8   Danish Keyboard

Figure E-8 Danish keyboard

E.9   Norwegian Keyboard

Figure E-9 Norwegian keyboard

E.10   Swiss (French/German) Keyboard

Figure E-10 Swiss (French/German) keyboard

E.11   Canadian Keyboard

Figure E-11 Canadian keyboard

E.12   Keycap Number

Figure E-12 Keycap number

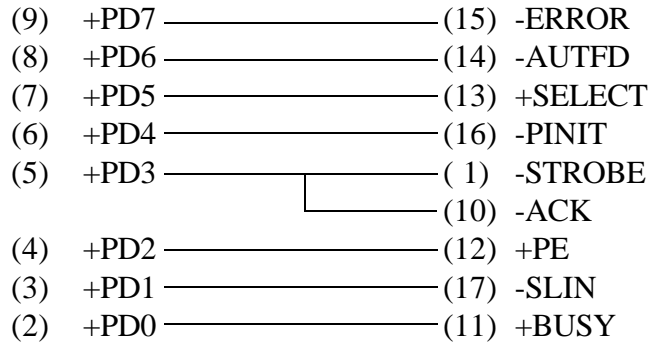# Appendix F   Wiring Diagrams

F.1   Printer Wraparound Connector

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

Figure F-1 Printer wraparound connector

F.2   RS-232-C Wraparound Connector

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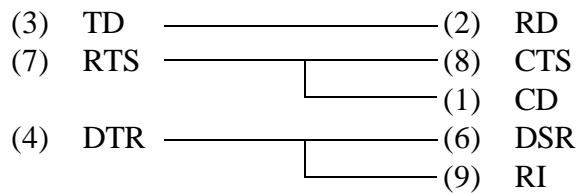
Figure F-2 RS-232-C wraparound connector

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

```
(3)   TD   ———————————— (2)   RD
(4)   DTR  ——————————┐  (6)   DSR
                     ├— (8)   CTS
                     └— (9)   RI
(7)   RTS  ———————————— (1)   CD
(5)   GND  ———————————— (5)   GND
(2)   RD   ———————————— (3)   TD
(1)   CD   ———————————— (7)   RTS
(6)   DSR  ——————————┐  (4)   DTR
(8)   CTS  ——————————┤
(9)   RI   ——————————┘
```
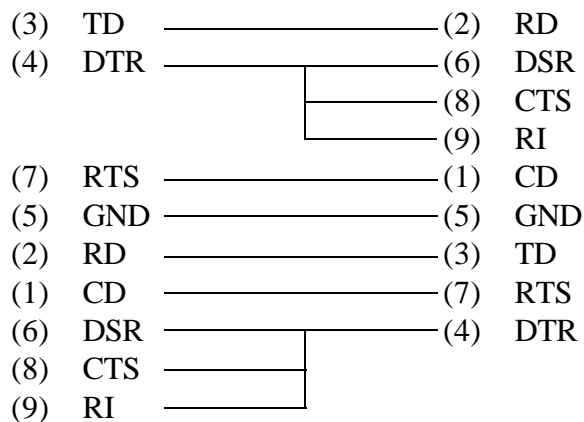
Figure F-3 RS-232-C direct cable (9-pin to 9-pin)

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

```
(1)   CD    ─────────────────   (4)   RTS
(2)   RD    ─────────────────   (2)   TD
(3)   TD    ─────────────────   (3)   RD
(4)   DTR   ──────────┐          (5)   CTS
                      ├─────────  (6)   DSR
                      └─────────  (22)  RI

(5)   GND   ─────────────────   (7)   GND
(7)   RTS   ─────────────────   (8)   CD
(6)   DSR   ──────────┐          (20)  DTR
(8)   CTS   ──────────┤
(9)   RI    ──────────┘
```
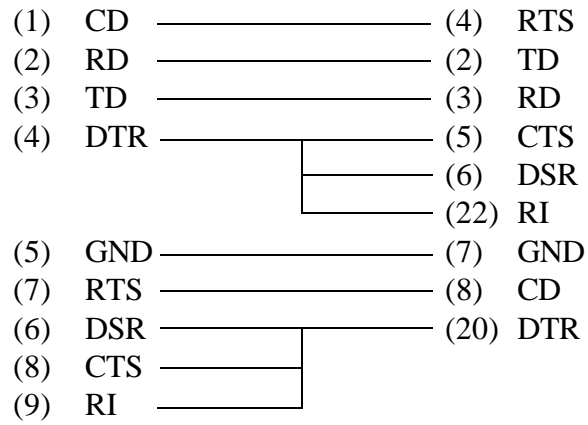
Figure F-4 RS-232-C direct cable (9-pin to 25-pin)

T2000 Notes