1.1 T4400SX Features

The Toshiba T4400SX uses extensive Large Scale Integration (LSI) and Complementary Metal-Oxide Semiconductor (CMOS) technology to provide minimum size and weight, low power usage, and high reliability. The T4400SX incorporates the following features and benefits.

❑ An 80486SX-25 32-bit microprocessor, operating at 25MHz. The CPU has 8KB of internal cache memory.

❑ Standard Random Access Memory (RAM) capacity is 2MB. An optional 2, 4, or 8MB expansion card can be installed, thus expanding RAM memory to a maximum of 10MB.

❑ The T4400SX comes standard with 2MB of CMOS RAM. This includes 640KB of conventional memory, 128KB of Shadow BIOS, and 1280KB of extended memory which can be utilized as expanded memory compatible with the Lotus/Intel/Microsoft Expanded Memory Specifications (LIM-EMS).

❑ A high resolution, fully adjustable Liquid Crystal Display (LCD) or Plasma Display Panel (PDP) is composed of 640 horizontal and 480 vertical pixels in text mode and displays 25 lines of standard text, 80 characters wide. The LCD displays 16 or 64 levels of gray and the PDP displays 16 levels of gray. Both displays support the High Resolution Graphics Subsystem (HRGS), including VGA functions.

❑ The 3.5-inch internal 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 integrated 2.5" 60MB or 80MB Hard disk Drive (HDD) provides nonvolatile storage for software and data.

❑ An 82/84-keyboard has full-sized keys, a numeric keypad overlay, cursor and page control. The keyboard supports software that uses the industry standard 101/102-key keyboard.

❑ A ten-key keypad connector is located on the left side of the T4400SX.

❑ The universal auto-sensing AC adapter supplies power to operate the T4400SX and recharge its batteries. It can operate from a range of 100 to 240 volts. Optional power cords support various countries' AC outlet configurations.

❑ A PS/2 mouse connector is located on the back side of the T4400SX.

❑ An original Toshiba built-in card modem slot supports asynchronous communication.

❑ Serial devices can be connected to the standard 9-pin RS-232C serial port.

❏   One selectable Centronics-compatible parallel port allows the T4400SX to interface with optional parallel equipment.

❏   The Toshiba AutoResume feature stores the T4400SX's data in backup RAM when the power is turned off.

❏   The Real Time Clock (RTC) IC chip and battery continuously update the date and time and keep the system configuration even when the power is turned off.

The T4400SX Personal Computer is shown in Figure 1-1 and the T4400SX system configuration is shown in Figure 1-2.
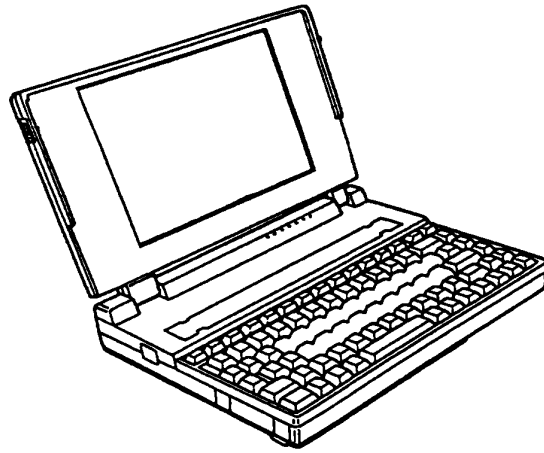

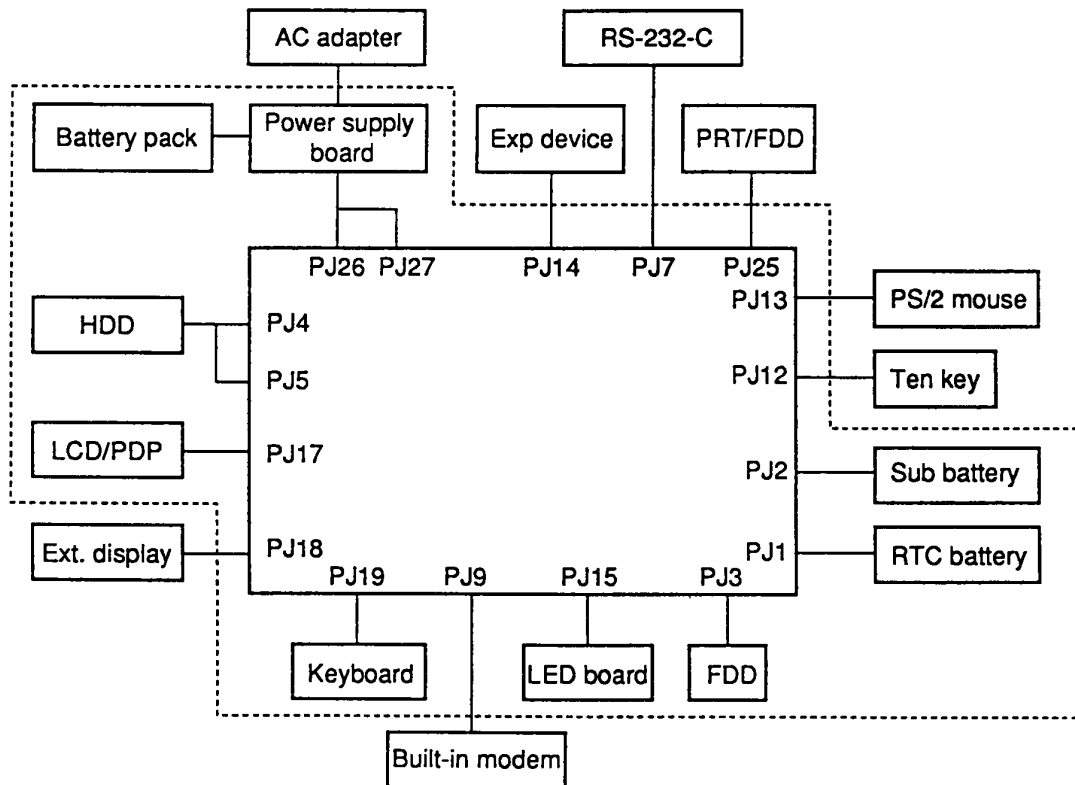*Figure 1-1   T4400SX personal computer*

Figure 1-2   T4400SX system unit configuration

1.2 System Unit Block Diagram

Figure 1-3 is a block diagram of the T4400SX system unit.

Figure 1-3 T4400SX block diagram

The system board in the T4400SX is composed of the following major components:

❑	Central Processing Unit (CPU): 80486SX-25
	The CPU is a 32-bit microprocessor operating at 25MHz.

❑	Super Integration (SI): T9901

	The SI stores the following components:
	· Two Direct Memory Access Controllers (DMACs): 82C37
	· Two Programmable Interrupt Controllers (PICs):	82C59
	· One Programmable Interval Timer (PIT):	82C54
	· One Floppy Disk Controller (FDC):	TC8565
	· One Serial Input/Output Controller (SIO):	TC8570
	· One Variable Frequency Oscillator (VFO):	TC8568
	· One I/O Controller

❑	Real Time Clock (RTC): 146818AF

	The RTC chip stores the date, time, and system configuration with power supplied from the RTC battery.

❑	Keyboard Controller (KBC): M37452M4

❑	Power Supply Controller (PSC): 47C1660

❑	Memory:

	Standard RAM:	2MB (8KB Cache Memory inside CPU)
	Backup RAM:	32KB
	BIOS ROM:	128KB (96KB are used)
		BIOS ROM contains the Initial Reliability Test (IRT), the system's Basic Input/
		Output System (BIOS), and the video BIOS.
	Video RAM:	256KB
	Optional memory cards:
		The system can have up to 10MB of RAM by installing an optional memory card.

❑	System control gate array:	SYS-CNT-GA (344-pin)

❑	VGA display controller:	PVGA1F:WD90C23 (132-pin)

❏   Oscillators (OSC):

24MHz OSC (X1) is used for the FDC and VFO.
25.0MHz OSC (X2) is used for the CPU.
44.9MHz OSC (X3), 28.322MHz OSC (X4), and 25.175MHz OSC (X5) are used for the video.
14.7456MHz OSC (X6) is used for the COM.
14.31818MHz OSC (X7) is used for the KBC.
32.768KHz OSC (X8) is used for the RTC.

See Appendix A for the location of the oscillators.

1.3   3.5-inch Floppy Disk Drive

The T4400SX 3.5-inch Floppy Disk Drive (FDD) is a thin, high performance, reliable drive that supports 720KB (formatted) 2DD and 1.44MB (formatted) 2HD 3.5-inch floppy disks.

The T4400SX FDD is shown in Figure 1-4 and its specifications are described in Table 1-1.
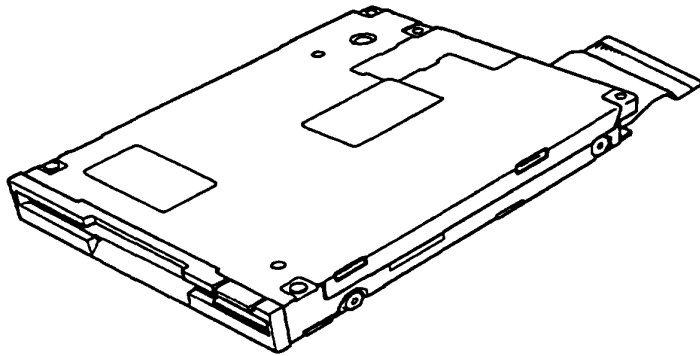
Figure 1-4   3.5-inch FDD

Table 1-1   3.5-inch FDD specifications

Item	2-Mbyte mode	1-Mbyte mode
Storage capacity (Kbyte)		
Unformatted	2,000	1,000
Formatted	1,475	737
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	Modified Frequency Modulation (MFM)	

1.4 2.5-inch Hard Disk Drive

The 60MB or 80MB (formatted) Hard Disk Drive (HDD) is a random access, nonvolatile storage device. It is equipped with a non-removal 2.5-inch magnetic disk and mini-Winchester type magnetic heads.

The T4400SX HDD is shown in Figure 1-5. The HDD specifications are described in Table 1-2.
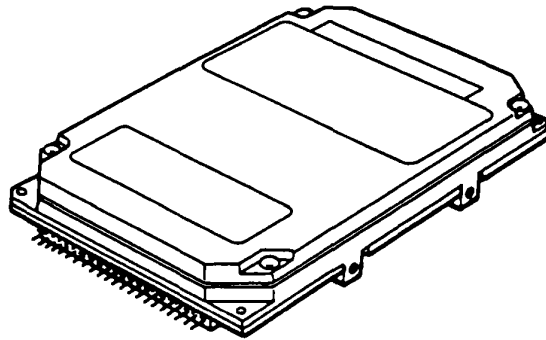
Figure 1-5 2.5-inch HDD

Table 1-2 2.5-inch HDD specifications

Item	60MB (CP-2064)	80MB (CP2084)
Storage capacity Formatted (Mbytes)	64.0	85.4
Number of disks	2	2
Data heads	4	4
Data surfaces	4	4
Tracks per surface	823	1,097
Sectors per track	38 (+1)	38 (+1)
Bytes per sector	512	512

Access time (ms)
  Track to track
  Average
  Maximum
	5
	19
	40
		5
		19
		40

Rotation speed (rpm)	3,486	3,486
Data transfer rate (bps) To/from media	1.5M	1.5M
Interleave	1:1	1:1
Recording method	2-7 RLL/ 1-7 RLL	2-7 RLL/ 1-7 RLL

1.5 Keyboard

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

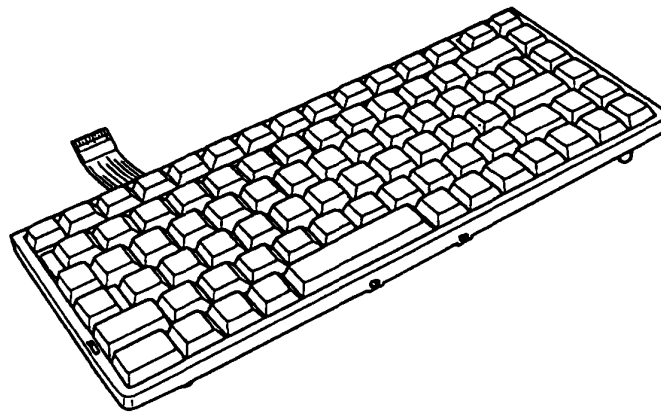See Appendix E for optional keyboard configurations.

Figure 1-6 Keyboard

1.6 Sidelit Liquid Crystal Display

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

1.6.1   LCD Module

The T4400SX 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.
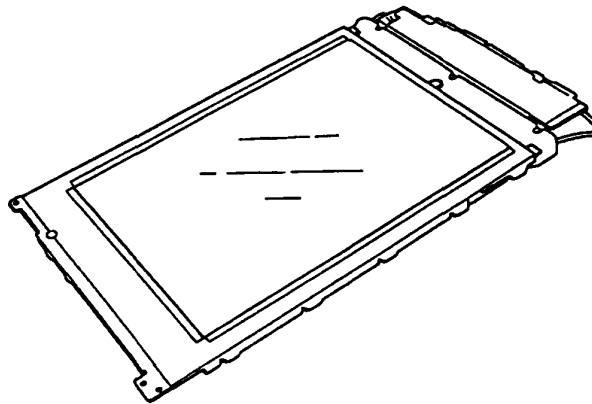
Figure 1-7 Sidelit LCD

Table 1-3 Sidelit LCD specifications

Item		Specifications
Number of dots	(dots)	640 x 480
Dot dimension	(mm)	0.24 (W) x 0.24 (H)
Dot pitch	(mm)	0.27 (W) x 0.27 (H)
Display area	(mm)	196 (W) x 147.06 (H)
Contrast		15:1 (typ.)
FL current	(mA)	4.0 - 6.0
FL frequency	(KHz)	35 - 43

1.6.2   FL Inverter Board

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

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

Table 1-4 FL inverter specifications

Item			Specifications
Input	Voltage	(VDC)	13 - 28
	Power	(W)	3.6 (Max.)
Output	Voltage	(VAC)	1100 (Min.)
	Current	(mA)	5.5
	Frequency	(KHz)	44
	Bounds of current	(mA)	3.25 - 5.5

1.7   Plasma Display

The plasma display is composed of a display panel and driver circuits. It receives vertical and horizontal synchronizing signals, four-bit data signals, and shift clock for data transmission. All signals are TTL-level compatible. The plasma display has 16 levels of gray and the display quality can be adjusted with the contrast control.

The plasma display is shown in Figure 1-8 and its specifications are described in Table 1-5.
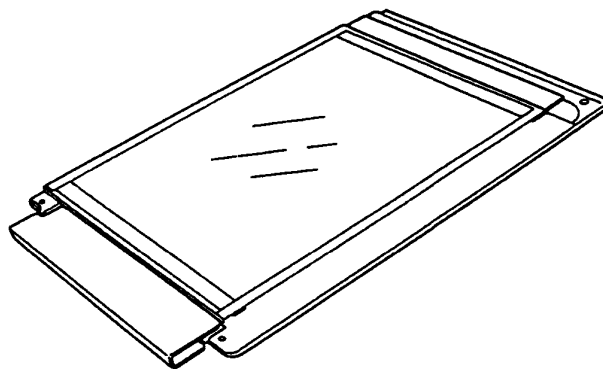
Figure 1-8 Plasma Display

Table 1-5 Plasma display specifications

Item		Specifications
Number of dots	(dots)	640 x 480
Dot dimension	(mm)	0.2 (W) x 0.24 (H)
Dot pitch	(mm)	0.30 (W) x 0.30 (H)
Display area	(mm)	144.0 (W) x 192.0 (H)
Color		Neon-Orange
Contrast ratio		100:1
Gray scale		16 levels
Power (maximum)		44 watts
Mean time between failure (MTBF)	(hours)	20,000

2.1 T4400SX Troubleshooting

The troubleshooting procedures described in this chapter are used to isolate defective Field Replaceable Units (FRUs). The FRUs covered are:

❑ Power supply board (PCB FY4PSx) (x = PCB revision number)

❑ System board (PCB FY4SYx)   (x = PCB revision number)

❑ FDD

❑ HDD

❑ Keyboard

❑ Display

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

The following items are necessary for implementing the troubleshooting procedures.

❑ T4400SX Diagnostics Disk

❑ Phillips head screwdriver (2mm)

❑ Toshiba MS-DOS system disk

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

❑ Cleaning disk kit (for FDD testing)

❑ Printer port LED

❑ RS-232C wraparound connector

❑ Printer wraparound connector

❑ Multimeter

2.2 Troubleshooting Flowchart

The flowchart in Figure 2-1 is used as a guide for determining which troubleshooting procedures to execute. Before performing the flowchart steps, perform the following:

❑   Disconnect all optional equipment from the T4400SX.
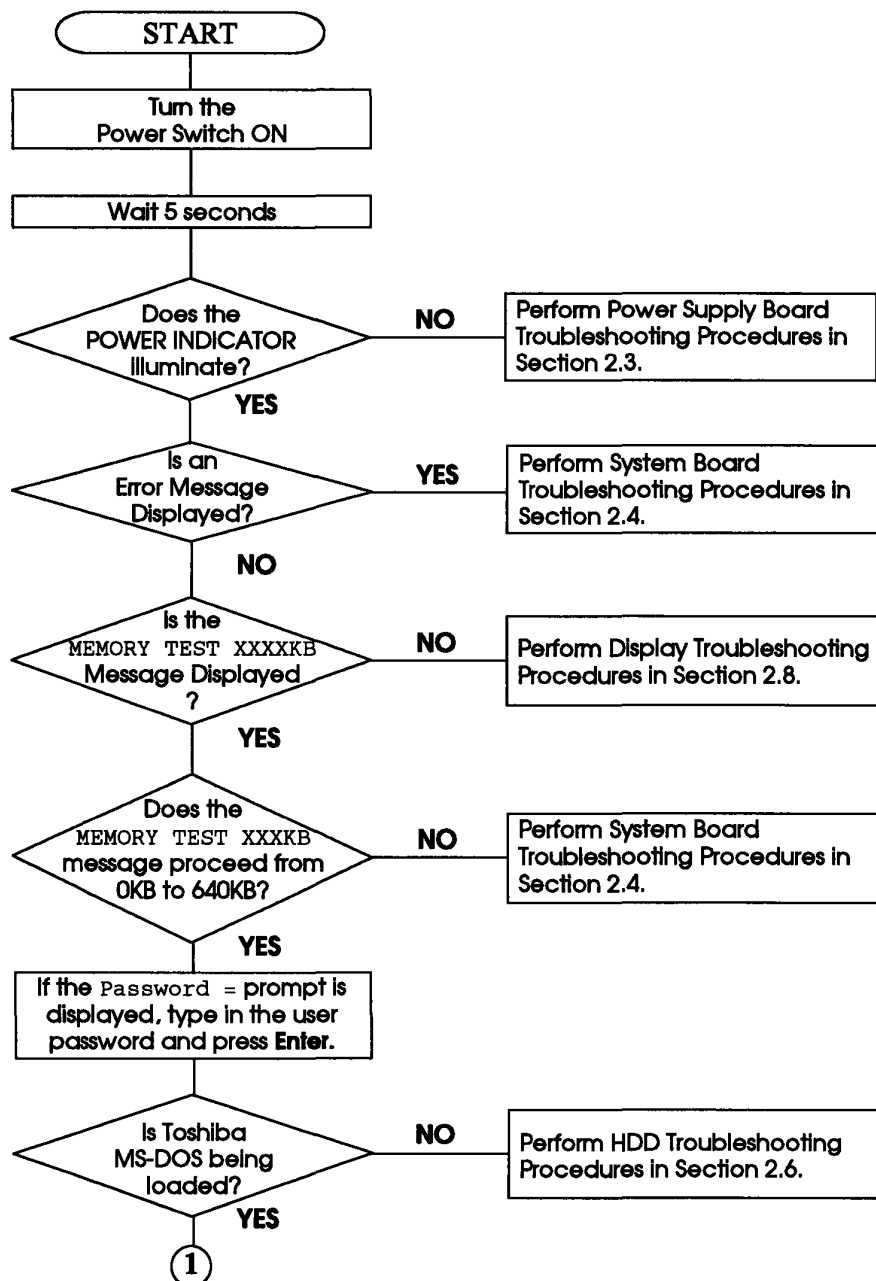
❑   Remove any diskette in the FDD.

Figure 2-1 Troubleshooting flowchart

①

```
        ┌──────────────────┐
        │     Do typed     │  NO   ┌────────────────────────────┐
        < characters appear >─────▶│ Perform Keyboard           │
        │     correctly?   │       │ Troubleshooting Procedures in│
        └──────────────────┘       │ Section 2.7.               │
              │ YES                 └────────────────────────────┘
        ┌──────────────────────────┐
        │ Connect wraparound connec-│
        │ tors. Insert ASP Diagnostics│
        │ diskette into FDD, type   │
        │ TESTCE44, and press ENTER.│
        └──────────────────────────┘
              │
        ┌──────────────────┐
        │      Is the      │  NO   ┌────────────────────────────┐
        < Diagnostics Test loaded >─▶│ Perform FDD Troubleshooting│
        │        ?         │       │ Procedures in Section 2.5. │
        └──────────────────┘       └────────────────────────────┘
              │ YES
        ┌──────────────────┐
        │ Perform each test.│
        └──────────────────┘
              │
        ┌──────────────────┐
        │    Is an error   │  YES  ┌────────────────────────────┐
        < detected by any of the >─▶│ After confirming which test has│
        │  Diagnostic Tests │       │ detected an error, perform the│
        │        ?         │       │ appropriate troubleshooting │
        └──────────────────┘       │ procedures.                │
              │ NO                  └────────────────────────────┘
        ┌──────────────────┐
        │ System is normal. │
        └──────────────────┘
              │
         (  END  )
```
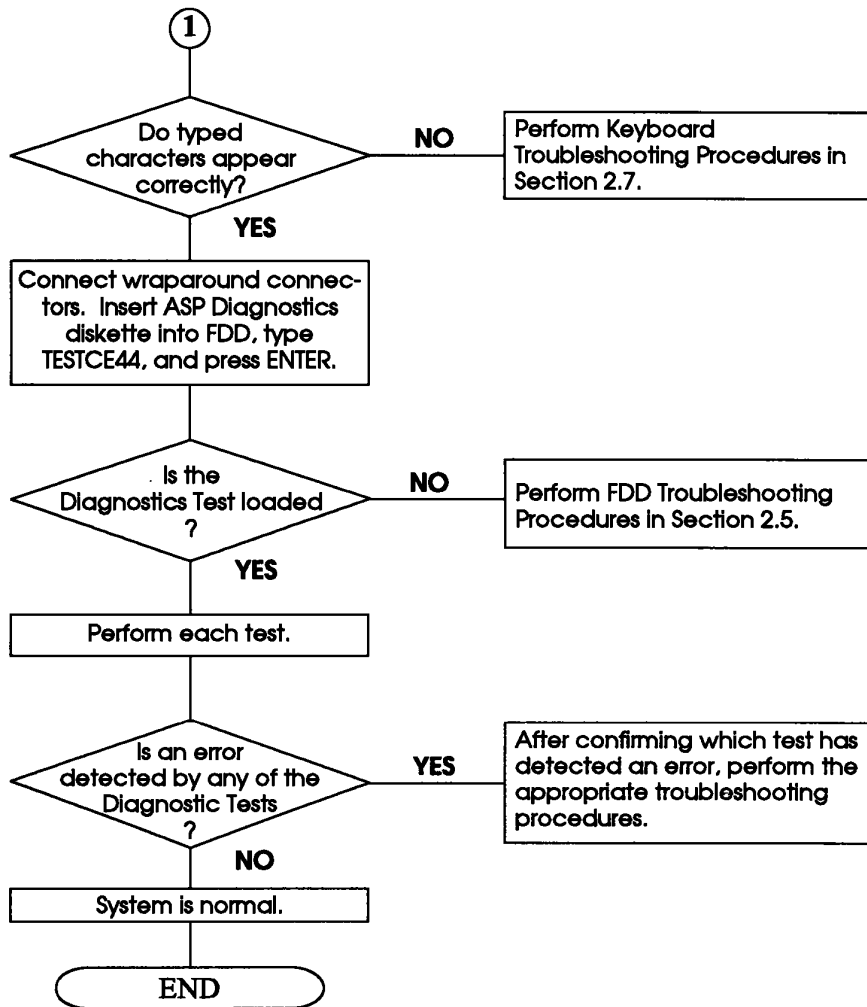
Figure 2-1 Troubleshooting flowchart (continued)

If the diagnostic program cannot 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 troubleshooting procedures 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 troubleshooting procedures in Section 2.4.

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

❑   If an error is detected on the floppy disk test, perform the floppy disk drive troubleshooting procedures in Section 2.5.

❑   If an error is detected on the hard disk test, perform the hard disk drive troubleshooting procedures in Section 2.6.

2.3 Power Supply Board Troubleshooting Procedures

The T4400SX's power supply board controls many functions and components in the T4400SX. To determine if the power supply board is functioning properly, start with Procedure 1 and continue with the other procedures as instructed. The procedures described in this section are:

Procedure 1: AC Adapter and Battery Indicator Function Check

Procedure 2: Power Supply Board Connector Check

Procedure 3: System Board and Power Supply Board Replacement Check

Procedure 1

AC Adapter and Battery Indicator Function Check

The T4400SX's AC adapter converts AC power to DC current and contains a charging circuit that charges the batteries. The adapter connects to the **DC IN 21V** connector on the back of the computer. When the AC adapter is connected and the power is off, the AC adapter charges the batteries.

The LED indicator panel informs you of the charge status of the battery pack and also whether or not an AC adapter is connected and supplying power. The LED indicator labeled **Battery** glows amber when the AC adapter is charging the battery pack.

If the **Battery** indicator is red, the AC adapter is connected and supplying power to the T4400SX.

If the indicator is flashing red, the AC adapter's voltage supply is abnormal or the power supply is not functioning properly.

If the Battery LED indicator does not light when it should, make sure the LED indicator lights are not burned out before performing the following checks.

Check 1   Check that the AC adapter cable is firmly plugged into the **DC IN 21V** connector on the back of the computer.

Check 2   If the **Battery** indicator is flashing red, it's voltage is abnormal. Connect a new AC adapter and turn the computer on again to verify the **Battery** indicator.
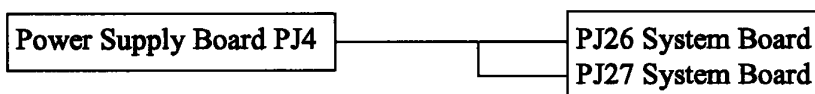
Check 3   The battery pack may be malfunctioning. Replace it with a new one and turn the computer on again. If the problem still exists, perform Procedure 2.

Procedure 2

Power Supply Board Connector Check

The power supply board is connected to the system board by one flexible cable. This cable may be disconnected from the power supply board or system board, thus causing the computer to malfunction. Refer to Chapter 4 for instructions on how to disassemble the T4400SX and then perform the following check.

Check 1   Make sure that the following connections are secure and that the cable is not pinched or broken.

```
┌─────────────────────────┐                ┌──────────────────────┐
│ Power Supply Board PJ4   │────────────┬───│ PJ26 System Board    │
└─────────────────────────┘            └───│ PJ27 System Board    │
                                           └──────────────────────┘
```

If any of these connections are loose, secure them. Replace the flex cable if it is broken or damaged. Execute those procedures that were causing the T4400SX to malfunction. If the problem still exists, refer to Procedure 3.

Procedure 3

System Board and Power Supply Board Replacement Check

The power supply board is connected to the system board. Power is supplied to the power supply board from the **DC IN 21V** plug located on the power supply board. The power supply board or the system board may be damaged. Refer to Chapter 4 for instructions on how to disassemble the T4400SX, and then perform the following checks.

Check 1   Replace the power supply 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. Perform the T4400SX Diagnostic Test to locate the malfunctioning FRU(s).

2.4 System Board Troubleshooting Procedures

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

Procedure 1:   Message Check

Procedure 2:   Printer Port LED Check

Procedure 3:   Diagnostic Test Program Execution Check

Procedure 4:   LED Board and RTC Battery Check

Procedure 5:   System Board Replacement Check

Procedure 1

Message Check

1.   Turn on the power.

2.   If the system is loaded normally, refer to Procedure 3.

3.   If any of the following messages are displayed on the screen, press the **F1** key to execute the SETUP program. Detailed SETUP program procedures are described in Chapter 3.

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

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

**** Error in CMOS.  Bad HDD type ****
Check system. Then press [F1] key.

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

4.   If the following message is displayed on the screen, turn off the power. Wait five seconds or more, then turn on the power again. If the following message is displayed again, go to the Hard Disk Drive Troubleshooting Procedures in Section 2.6.

```
Insert system disk in drive

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

5.   If any of the following messages are displayed on the screen, refer to Procedure 4.

CPU ERROR
SYSTEM ROM CHECK SUM ERROR
TIMER CH.2 OUT ERROR
PIT ERROR
MEMORY REFRESH ERROR
FIRST 64KB MEMORY ERROR
RTC ERROR
CRTC ERROR
VRAM ERROR
KBC ERROR
SYSTEM MEMORY ERROR
SYSTEM MEMORY PARITY ERROR
PROTECTED MODE ERROR
CPU EXCEPTION ERROR
EXTENDED MEMORY ERROR
EXTENDED MEMORY PARITY ERROR
EMS PAGE REGISTER ERROR
EXPANDED MEMORY ERROR
EXPANDED MEMORY PARITY ERROR
DMA PAGE REGISTER ERROR
DMAC #1 ERROR
DMAC #2 ERROR
PIC #1 ERROR
PIC #2 ERROR
KEYBOARD ERROR
KBC ERROR
HDC ERROR
HDD #0 ERROR
HDD #1 ERROR
NO FDD ERROR
FDC ERROR
TIMER INTERRUPT ERROR
RTC UPDATE ERROR

6.   If none of the above messages are displayed and you have a printer port LED, go to Procedure 2.

Procedure 2

Printer Port LED Check

1.   Turn off the power.

2.   Plug the printer port LED into the **PRT/FDD** connector on the back of the unit and use the SETUP function to set the **External A-B-PRT** option to the **PRT** value.

3.   While watching the printer port LED, turn on the power. The printer port LED will light when the power switch is turned on.

4.   Read the final test status from left to right as you are facing the back of the computer. Convert the status from binary to hexadecimal notation.

5.   If the final test status matches any of the test status values in Table 2-1, refer to Procedure 4.

6.   If the final test status is **FFH**, go to Procedure 3.

NOTE: The T4400SX uses the printer port LED a bit differently than other Toshiba computers. The final status on the LED indicates the last test successfully completed before an error was detected. The error message displayed on the screen will be for the test status in Table 2-1 following the test status given on the printer port LED.

Table 2-1 Printer port LED test statuses

Printer Port LED Indication		Test Status	Test Item	Message
A	B			
○○○○	○○○●	01H	Pre-init for warm start test	–
○○○○	○●○●	05H	PIT test	TIMER CH. 2 OUT ERROR PIT ERROR READ DATA = XXH WRITE DATA = XXH
○○○○	○●●○	06H	PIT initialization	–
○○○○	○●●●	07H	PIT function test	MEMORY REFRESH ERROR
○○○○	●○●○	0AH	First 64KB memory test	FIRST 64KB MEMORY ERROR
○○○○	●○●●	0BH	System memory initialization	–
○○○○	●●○●	0DH	Interrupt vector initialization	–
○○○●	○●○●	15H	RTC test	RTC ERROR READ DATA = XXH WRITE DATA = XXH
○○○●	○●○●	15H	CMOS RAM test	****Error in CMOS. Bad battery**** ****Error in CMOS. Bad check sum**** ****Error in CMOS. Bad configuration**** ****Error in CMOS. Bad memory size**** ****Error in CMOS. Bad HDD type**** ****Error in CMOS. Bad time function**** Check system. Then press [F1] key..
○○○●	○●●○	16H	RTC initialization	–
○○○●	●○○○	18H	PIC initialization	–
○○○●	●●●●	1FH	Display initialization	CRTC ERROR VRAM ERROR READ DATA = XXXXXXXXH WRITE DATA = XXXXXXXXH
○○●○	○○●○	22H	KBC test	KBC ERROR
○○●○	○●○●	25H	System memory test	SYSTEM MEMORY ERROR ADDRESS = XXXXXXXXH READ DATA = XXXXXXXXH WRITE DATA = XXXXXXXXH SYSTEM MEMORY PARITY ERROR ADDRESS = XXXX0000H - XXXXFFFFH
○○●●	○○○○	30H	Extended memory test	EXTENDED MEMORY ERROR ADDRESS = XXXXXXXXH READ DATA = XXXXXXXXH WRITE DATA = XXXXXXXXH EXTENDED MEMORY PARITY ERROR ADDRESS = XXXX0000H - XXXXFFFFH

● = On
○ = Off

Table 2-1 Printer port LED test statuses (continued)

Printer Port LED Indication A	Printer Port LED Indication B	Test Status	Test Item	Message
○●○○	○○○○	40H	DMA page register test	DMA PAGE REGISTER ERROR READ DATA = XXXXXXXXH WRITE DATA = XXXXXXXXH
○●○○	○○○●	41H	DMAC test	DMAC #1 ERROR READ DATA = XXXXH WRITE DATA = XXXXH
				DMAC #2 ERROR READ DATA = XXXXH WRITE DATA = XXXXH
○●○○	○○●○	42H	DMAC initialization	–
○●○○	●○●○	4AH	PIC test	PIC #1 ERROR READ DATA = XXH WRITE DATA = XXH
				PIC #2 ERROR READ DATA = XXH WRITE DATA = XXH
○●○●	○●○○	54H	Keyboard test	KEYBOARD ERROR
○●○●	○●○●	55H	KBC initialization	KBC ERROR
○●○●	●○●○	5AH	Mouse initialization	–
○●●○	○○○○	60H	HDD initialization	HDC ERROR
				HDD #0 ERROR
				HDD #1 ERROR
○●●○	○●○●	65H	FDD initialization	NO FDD ERROR
				FDD ERROR
○●●●	○○○○	70H	Printer test	–
●○○○	○○○○	80H	RS-232C	–
●○○●	○○○○	90H	Timer initialization	TIMER INTERRUPT ERROR
				RTC UPDATE ERROR
●○●○	○○○○	A0H	NDP initialization	–
●○●○	○●●○	A6H	Expansion I/O ROM	–
●●●●	●●●●	FFH	Expansion system ROM	–

● = On
○ = Off

Procedure 3

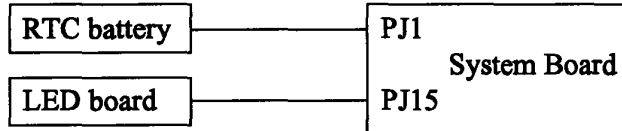## Diagnostic Test Program Execution

The Diagnostic Program located on the Diagnostics Diskette has several tests for testing the T4400SX.

1. Execute the following tests from the Diagnostic Test Menu. Refer to Chapter 3 for detailed instructions on how to perform these tests.

    ❑   System test

    ❑   Memory test

    ❑   Keyboard test

    ❑   Display test

    ❑   Floppy disk test

    ❑   Printer test

    ❑   ASYNC test

    ❑   Hard disk test

    ❑   Real timer test

2. If an error is detected during the memory test, ASYNC test, or printer test, refer to Procedure 5.

3. If an error is detected during the floppy disk test, refer to the Floppy Disk Drive Troubleshooting Procedures in Section 2.5.

4. If an error is detected during the hard disk test, refer to the Hard Disk Drive Troubleshooting Procedures in Section 2.6.

5. If an error is detected during the keyboard test, refer to the Keyboard Troubleshooting Procedures in Section 2.7.

6. If an error is detected during the display test, refer to the Display Troubleshooting Procedures in Section 2.8.

7. If an error is detected during the system test or real timer test, refer to Procedure 4.

Procedure 4

LED Board and RTC Battery Check

The LED board and the RTC battery are both connected to the system board. Either of these cables may be disconnected from the system board. Refer to Chapter 4 for instructions on how to disassemble the system unit and check the following cable connections.

```
┌─────────────┐              ┌──────────────────┐
│ RTC battery ├──────────────┤ PJ1              │
└─────────────┘              │      System Board│
┌─────────────┐              │                  │
│ LED board   ├──────────────┤ PJ15             │
└─────────────┘              └──────────────────┘
```

If these cables are disconnected or damaged, connect or replace them as required and restart the system. If the problem still exists, refer to Procedure 5.

Procedure 5

System Board Replacement

1. Replace the system board. Refer to Chapter 4 for instructions on how to remove and replace the system board.

2. If normal operation is restored after replacing the system board, the original system board is probably defective.

3. If normal operation is not restored, another FRU is probably defective. The defective unit must be isolated by performing the T4400SX Diagnostic Program.

2.5 Floppy Disk Drive Troubleshooting Procedures

This section describes how to determine if the floppy 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:   Format Check

Procedure 3:   Test Program Check

Procedure 4:   Connector and Replacement Check

Procedure 1

Message Check

Prepare a Toshiba MS-DOS system disk and insert it into the floppy disk drive. Turn on the power. If Toshiba MS-DOS loading starts normally, refer to Procedure 2.

If the loading starts abnormally, make sure you are using a bootable diskette. If the diskette is bootable and one of the following messages appears 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

Prepare a new floppy disk by using the Toshiba MS-DOS FORMAT command from the hard disk drive.

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

Check 1   Make sure the **FDD** indicator lights when you execute the FORMAT command. If it does not light, refer to Procedure 4. If it lights, refer to Check 2 below.

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

If the FORMAT command was executed correctly, refer to Check 3. If the FORMAT command was not executed correctly, format the floppy disk using the correct FORMAT command. If the problem still exists, refer to Check 3.

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

Procedure 3

Test Program Check

The Floppy Disk Drive Test program is stored on the T4400SX Diagnostics Disk. After loading Toshiba MS-DOS, run the Diagnostic Program (TESTCE44). Refer to Chapter 3 for detailed instructions about the diagnostic test procedures.

Correctly format a floppy disk and make sure the write protected tab is disabled. Then perform the FDD Diagnostic Test. The error codes and statuses are described in Table 2-2.

If an error occurs, refer to Check 1.

Table 2-2 FDD error codes and statuses

Code	Status
01h	Bad command
02h	Address mark no found
03h	Write protected
04h	Record not found
06h	Media removed on dual attach card
08h	DMA overrun error
09h	DMA boundary error
10h	CRC error
20h	FDC error
40h	Seek error
60h	FDD not drive
80h	Time out error (Not ready)
EEh	Write buffer error

Check 1   If the **Write protected** message appears, disable 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 and Replacement Check

The floppy disk drive is connected to the system unit by the FDD cable. Disassemble the system unit and check the FDD. Refer to Chapter 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 PJ3.

| FDD Cable | ———————————— | PJ3 System Board |
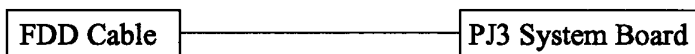
If this cable is disconnected, connect it to the system unit and refer back to Procedures 2 and 3. If the problem still exists, refer to Check 2.

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. Refer to Chapter 4 for instructions on how to replace the system board.

2.6 Hard Disk Drive Troubleshooting 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:   System Transfer and Logical Format Check

    Procedure 3:   Physical Format Check

    Procedure 4:   Test Program Check

    Procedure 5:   Connector and Replacement Check

> *CAUTION: The contents of the hard disk will be erased when the HDD Troubleshooting 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 hard disk drive is not functioning properly, error messages may appear on the screen as follows:

Check 1   If one of the following messages appears, proceed to Check 2. Otherwise, proceed to Procedure 3.

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

After five seconds the displayed message is erased from the screen.

Check 2   If the following message appears, proceed to Procedure 2. Otherwise, proceed to Procedure 3.

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

Procedure 2

System Transfer and Logical Format Check

The hard disk drive may have lost the Toshiba MS-DOS system program or could have a format problem. Perform Check 1 and proceed as instructed.

Check 1   Using the Toshiba MS-DOS disk, install a system program on the hard disk using the SYS command.

If the following message appears on the display, the system program has been loaded on the hard disk drive. Restart the T4400SX. If normal operation is not restored, proceed to Check 2.

System transferred

If an error message appears on the display, refer to the *Toshiba MS-DOS Manual* for more information about the error message. Proceed to Check 2.

Check 2   Using the Toshiba MS-DOS system disk, partition the hard disk by using the Toshiba FDISK command. Then format the hard disk using the Toshiba FORMAT C:/S command to transfer the system program onto the hard disk.

If the following message appears on the display, the hard disk is formatted.

Format complete

If any other message appears on the display, refer to the *Toshiba MS-DOS Manual* for more information about the message.

Procedure 3

Low Level Format Check

The T4400SX's hard disk drive is formatted by using the low level (physical) format program located on the T4400SX Diagnostics Diskette. The HDD may have a low level format problem.

Using the T4400SX Diagnostics Diskette, format the HDD with a low level format. Refer to Chapter 3, Tests and Diagnostics, for more information about this diagnostic program.

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

    Format complete

If you cannot do a low level format of the HDD, go to Procedure 4.

Procedure 4

Test Program Check

The HDD test program is stored on the T4400SX Diagnostics Disk. After loading Toshiba MS-DOS, run the Diagnostic Program (TESTCE44) and perform all the HDD subtests in the Diagnostics Hard Disk Drive Test. Refer to Chapter 3 for detailed instructions about the HDD test.

If an error is detected during the HDD testing, an error code and status will be displayed; refer to Procedure 5. The HDD error codes and statuses are described in Table 2-3. If an error code is not generated, the HDD is OK.

Table 2-3 HDD error codes and statuses

Code	Status
01h	Bad command
02h	Bad address mark
04h	Record not found
05h	HDC not reset
07h	Drive not initialize
09h	DMA boundary error
0Ah	Bad sector error
0Bh	Bad track error
10h	ECC error
11h	ECC recover enable
20h	HDC error
40h	Seek error
80h	Time out error
AAh	Drive not ready
BBh	Undefined
CCh	Write fault
E0h	Status error
F0h	Not sense error (HW. code = FF)

Procedure 5

Connector and Replacement Check

The HDD is connected to the system board by the HDD flexible cable. Disassemble the system unit and check the HDD. Refer to Chapter 4 for instructions on how to disassemble the computer and then perform the following checks.

Check 1   Make sure the HDD flexible cable is firmly connected to the HDD.

```
┌─────┐      ┌───────────────────┐      ┌──────────────────┐
│ HDD │──────│ HDD flexible cable │──┬───│ PJ4 System Board │
└─────┘      └───────────────────┘  └───│ PJ5 System Board │
                                         └──────────────────┘
```
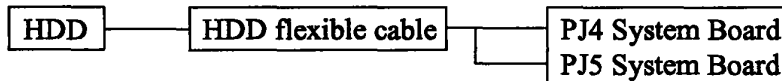
If the cable is disconnected, firmly reconnect it and refer back to Procedures 2, 3, and 4. If the cable is firmly connected to the system board and is not damaged, proceed to Check 3. If the cable is damaged, proceed to Check 2.

Check 2   Replace the HDD flexible cable with a new one. If the HDD still does not function properly, proceed to Check 3.

Check 3   The HDD may be damaged. Replace the HDD unit with a new one. If the HDD still does not function properly, proceed to Check 4.

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

2.7 Keyboard Troubleshooting Procedures

This section describes how to determine if the keyboard is defective. 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 and Replacement Check

Procedure 1

Test Program Check

The keyboard test program is stored on the T4400SX Diagnostics Disk. After loading Toshiba MS-DOS, run the Diagnostic Program (TESTCE44) and perform the keyboard test. Refer to Chapter 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 operating properly.

Procedure 2

Connector and Replacement Check

The keyboard is connected to the system board by a 19-pin flat cable. Disassemble the system unit and check the keyboard. Refer to Chapter 4 for instructions on how to disassemble the system unit and then perform the following checks.

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

| Keyboard cable |————————| System board PJ14 |
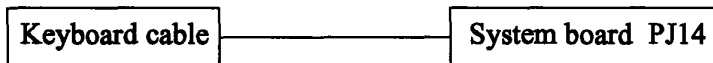
If this cable is not connected, firmly reconnect it. If the cable is damaged, replace the keyboard unit and refer back to Procedure 1. If the keyboard still does not function properly, refer to Check 2.

Check 2   The keyboard controller on the system board may be damaged. Replace the system board with a new one.

2.8   Display Troubleshooting Procedures

This section describes how to determine if the display is defective. 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 (for LCD type only)

  Procedure 2:   External CRT Check

  Procedure 3:   Test Program Check

  Procedure 4:   Connector Check

  Procedure 5:   Replacement Check

Procedure 1

Brightness and Contrast Volume Check (for LCD model only)

This check is for LCD units only. If the unit has a plasma display, go to Procedure 2.

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 the brightness or contrast does not change when adjusted, go to Procedure 2.

Procedure 2

External CRT Check

> *NOTE: For an LCD type machine, the system only recognizes the external monitor when the monitor is connected to the CRT (RGB) port before you power on the computer. When the display signal is transmitted to the external monitor, the internal LCD is disabled.*
>
> *For a PDP type machine, the system will recognize both the external monitor and internal PDP when an external monitor is connected to the CRT (RGB) port.*

Connect the external monitor to the T4400SX's CRT (RGB) port and then cold boot the computer. The computer automatically detects the external CRT.

If the external monitor is working correctly, the internal LCD or PDP may be damaged. Perform Procedure 4.

If the external monitor is also not working correctly, the display controller may be damaged. Perform Procedure 3.

Procedure 3

Test Program Check

The display test program is stored on the T4400SX Diagnostics Disk. This program checks the display controller on the system board. After loading Toshiba MS-DOS, run the Diagnostic Program (TESTCE44). Refer to Chapter 3 for detailed instructions about the display test.

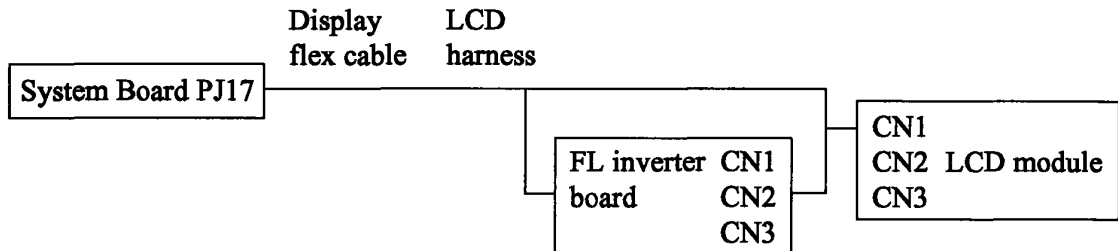If an error is detected, refer to Procedure 4.

If an error is not detected, the display is operating properly.

Procedure 4

Connector Check - LCD

The LCD display components are connected to the system board by two cables, the display flex cable and the LCD harness. Either of these cables may be disconnected from the system board.

Disassemble the display unit and check the following cable connections. Refer to Chapter 4 for instruction on how to disassemble the system unit.

```
                        Display      LCD
                        flex cable   harness
 ┌──────────────────┐
 │ System Board PJ17 ├──────────────────────┐                     ┌──────────────────┐
 └──────────────────┘                       │                  ┌──┤ CN1              │
                                      ┌──────┴──────────┐    ┌──┤ CN2  LCD module  │
                                      │ FL inverter CN1 ├────┘  │ CN3              │
                                      │ board       CN2 ├──────┐└──────────────────┘
                                      │             CN3 │      │
                                      └─────────────────┘      │
```

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

Connector Check - Plasma Display

The plasma display components are connected to the system board by two cables, the display flex cable and the PDP harness. Either of these cables may be disconnected from the system board.

Disassemble the display unit and check the following cable connections. Refer to Chapter 4 for instruction on how to disassemble the system unit.

```
                        Display      PDP
                        flex cable   harness
 ┌──────────────────┐
 │ System Board PJ17 ├──────────────────────────┐              ┌──────────────────┐
 └──────────────────┘                           │              │ J1A              │
                                         ┌───────┴───┐       ┌──┤ J2B  PDP module  │
                                         │ DC-DC     ├───────┘  │ J21              │
                                         │ converter │          └──────────────────┘
                                         └───────────┘
```
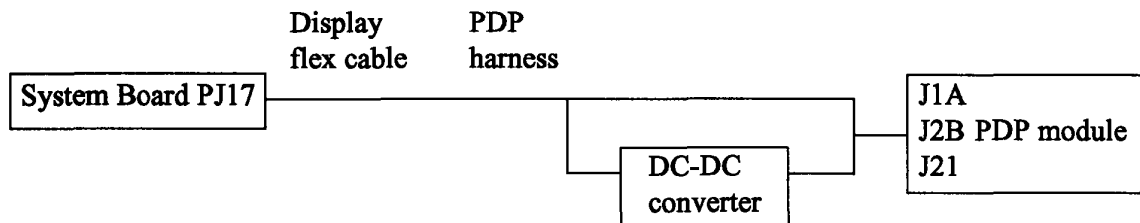
If any of these cables are not connected, firmly reconnect them and refer back to Procedures 1 and 2. If the problem still exists, refer to Procedure 5.

Procedure 5

Replacement Check - LCD

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

Check 1   Replace the FL inverter board 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   Replace the display cable with a new one and recheck the display. If the problem still exists, refer to Check 4.

Check 4   The system board may be damaged. Replace the system board with a new one and recheck the display.

Replacement Check - Plasma Display

Refer to Chapter 4 for instructions on how to disassemble the system unit and then perform the following checks.

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

Check 2   Replace the display cable 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.

3.1   Introduction

This chapter explains how to use the T4400SX Diagnostic Program (TESTCE44) to test the functions of all the T4400SX hardware modules. This program is located on the T4400SX Diagnostics 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 T4400SX Diagnostic Program you will need the following:

❏   T4400SX Diagnostics Diskette

❏   Formatted work disk for the Floppy Disk Test

❏   Cleaning disk kit to clean the FDD heads during the Floppy Disk Test

❏   Printer wraparound connector for the printer wraparound test during the Printer Test

❏   RS-232C wraparound connector for the RS-232C wraparound test during the ASYNC 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 T4400SX Diagnostic Program

To start the T4400SX Diagnostic Program, follow these steps:

1. Make sure the computer is loaded with Toshiba MS-DOS. Turn on the T4400SX and allow the computer to boot. Then insert the T4400SX Diagnostics Diskette in the floppy disk drive.

2. Change to the A drive. Then type **TESTCE44** and press **Enter**.

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

```
TOSHIBA personal computer T4400SX 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 Program Menu and return to MS-DOS, type **9** and press **Enter**. To exit any Subtest Menu, type **99** and press **Enter**. If a test is in progress, press **Ctrl + Break** to exit the test. If a test has not been executed, press **Ctrl + C** to return to the Subtest Menu.*

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 T4400SX 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**. A test-specific display will appear. For example, the following display shows the System Test, which appears when you type **1** and press **Enter**.

```
SYSTEM TEST                    XXXXXXX

                               T4400SX DIAGNOSTIC TEST Vx.xx
                               [Ctrl]+[Break] ; test end
                               [Ctrl]+[C]     ; key stop

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

SUB-TEST MENU :

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

SELECT SUB-TEST NUMBER  ?
```

NOTE: The menu displayed by your T4400SX 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 potential 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	Cache memory
3	KEYBOARD	01	Pressed key display (82/84)
		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
		11	TFT 64 color display
5	FDD	01	Sequential read
		02	Sequential read/write
		03	Random address/data
		04	Write specified address
		05	Read specified address
6	PRINTER	01	Ripple pattern
		02	Function
		03	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

To execute the System Test, type **1** from the DIAGNOSTIC TEST MENU and press **Enter**. The following subtests can now be executed from the SYSTEM TEST Menu.

Subtest 01˙   ROM checksum

This test performs a ROM checksum test on the T4400SX's system board from address F0000h - FFFFFh (64KB).

Subtest 02   HW status

This test reads and displays the T4400SX's hardware status as shown below.

```
                  76543210
H/W status = 10001000

    Bit7 --                =
    Bit6 -- CPU clock      = 25MHZ
    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.

Table 3-2 describes the hardware bit status for each bit tested.

Table 3-2 Hardware bit status

Bit	H/W status	1	0
7	Reserved		-
6	CPU clock speed	12.5 MHz	25 MHz
5	Media type	2DD	2HD
4	FDD type	1 MB	2 MB
3	Reserved		-
2	Drive A/B	A	B
1	External FDD	ON	OFF
0	Internal FDD	2DD	2HD

3.5 Memory Test

To execute the Memory Test, type **2** from the DIAGNOSTIC TEST MENU and press **Enter**. The following subtests can now be executed from the Memory Test menu.

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) to the address segment and address offset in conventional memory (0 to 640KB), then reads and compares it with the original data.

Subtest 03   RAM refresh (real mode)

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

The constant data is AAAAh and 5555h.

There is a short 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 T4400SX.

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

Memory module capacity is 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 T4400SX.

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 a word unit 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 for page data.

Subtest 8   Cache memory

This subtest writes constant data to the T4400SX's cache memory, then reads and compares it with the original data.

The constant data is AAAAh and 5555h.

3.6 Keyboard Test

To execute the Keyboard Test, type 3 from the DIAGNOSTIC TEST MENU and press **Enter**. The following subtests can now be executed from the Keyboard Test menu.
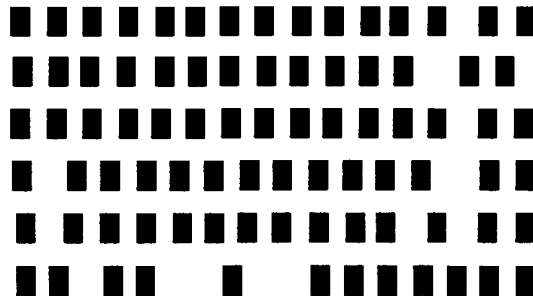
Subtest 01   Pressed key display (82/84)

> *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.

Holding a key down enables the auto-repeat function which causes the key's display character to blink.

```
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

To execute the Display Test, type 4 from the DIAGNOSTIC TEST MENU and press **Enter**. The following subtests can now be executed from the Display Test menu.

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.

Display Modes: Normal
                   Intensified
                   Reverse
                   Blinking

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

CHARACTER ATTRIBUTES

NEXT LINE SHOWS NORMAL DISPLAY.
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN

NEXT LINE SHOWS INTENSIFIED DISPLAY.
IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII

NEXT LINE SHOWS REVERSE DISPLAY.
███████████████████████████████████

NEXT LINE SHOWS BLINKING DISPLAY
BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB

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

PRESS [ENTER] KEY

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

320*200 GRAPHICS DISPLAY [13]

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

PRESS [ENTER] KEY

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

Subtest 03   Character set

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

CHARACTER SET IN 40*25

PRESS [ENTER] KEY

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

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

In this subtest, the character string is displayed shifting one character to the left line by line in the 80x25 and 80x30 character modes 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
```
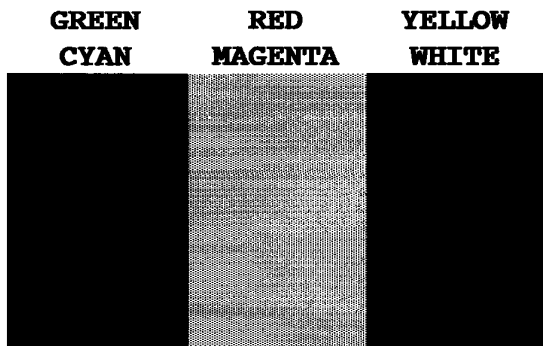
To exit this subtest and return to the DISPLAY TEST menu, press **Enter**.

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

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

Color set 0:   Green, Red, Yellow
Color set 1:   Cyan, Magenta, White

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

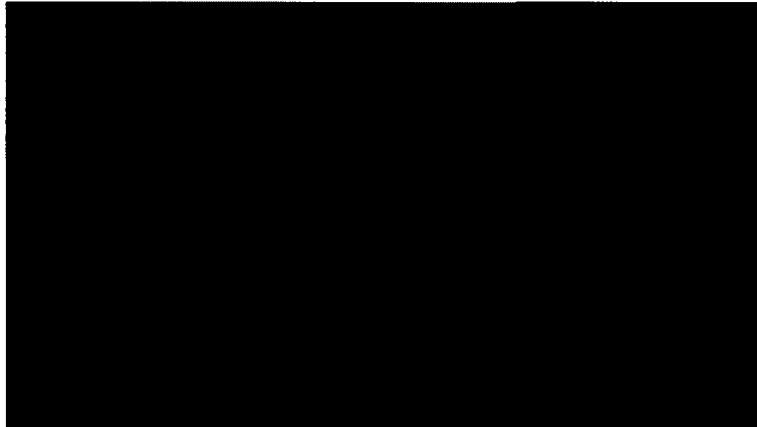| **GREEN** | **RED** | **YELLOW** |
| **CYAN** | **MAGENTA** | **WHITE** |

PRESS [ENTER] KEY

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

Subtest 06   640x200 Graphics display (mode 6 and 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 and 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
OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
```

Subtest 09   ''H'' pattern display/border color

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

```
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
```

Press **Enter** and the following message is displayed.

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

If an external monitor is connected, type **1** to display the following message.

            Border Color Test (7 times press [Enter] key)

Press **Enter** to execute the border color test.

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

Subtest 10   LED / DAC pallet

This subtest checks the LED Speed, Caps Lock, and Num Lock operations by writing 2Ah/15h data to 6 bits of 256x3 (RGB). This data is then read and compared 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 [ Fn + Num lock ] key ! ... Num     (on/off)

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

PRESS [ENTER] KEY

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

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

Subtest 11   TFT 64 color display (for color screen only)

This subtest displays 64 levels of gray scale or red, green, and blue on the T4400SX's display or external color monitor.

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. Execute the Floppy Disk Test by typing 5 from the DIAGNOSTIC TEST MENU and pressing **Enter**. 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 code as explained in Table 3-3 on page 3-33.

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 following tracks are read according to the media type of the floppy disk drive.
   Double-sided, double-density (2D): Tracks 0 to 39.
   Double-sided, double-density, double-track (2DD) and Double-sided, high-density, double-track (2HD): Tracks 0 to 79.

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

Subtest 02   Sequential read/write

This subtest writes the bad data pattern B5ADADh to all tracks (as specified in Subtest 01) continuously, and then reads the data out and compares it with the original data.

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 Subtest 01 or 02. Make sure the setup option **External FDD/PRT** is set to **Printer**.

OPERATION

1. Execute the Printer Test by typing **6** from the DIAGNOSTIC TEST MENU and pressing **Enter**. After selecting a subtest and answering the Test Loop and Error Stop messages, 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 specifies the printer I/O port address.

   The T4400SX supports three printer channels. Select the printer channel number and press **Enter** to execute the selected subtest.

CONTENTS

Subtest 01   Ripple pattern

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

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

Subtest 02   Function

This subtest prints out the various print types shown below.

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

Subtest 03   Wraparound

NOTE: *To execute this subtest, a printer wraparound connector (C*D-4890004-A00) must be connected to the printer port. The printer wraparound connector wiring diagram is given in Appendix F.*

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

3.10 ASYNC Test

To execute the ASYNC Test, type **7** from the DIAGNOSTIC TEST MENU and press **Enter**. The following subtests can now be executed from the ASYNC Test menu.

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

The following message will appear after you select Subtest 01, 03, 04, or 05 and have answered the Test Loop and Error Stop messages.

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

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

The **XXXXh** data in the above message specifies the serial I/O port address.

The T4400SX supports three serial port channels. Select the serial port channel number and press **Enter** to execute the selected subtest.

Subtest 01   Wrap around (board)

> *NOTE: To execute this subtest, an RS-232C wraparound connector (C*D-4890005-A00) must be connected to the RS-232C port. The RS-232C 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-232C direct cable (9-pin to 9-pin) must be connected to channels 1 and 2. The RS-232C direct cable wiring diagram is given in Appendix F.*

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

Subtest 03   Point to point (send)

```
NOTE:  To execute this subtest, two machines must be connected with an RS-232C 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-232C 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-232C port to the built-in modem. The same data is then sent from the modem to the RS-232C port and compared to the original data.

After you select the channel number for the serial port and press **Enter**, the following message appears.

Baud rate select (0:110BPS, 1:300BPS, 2:1200BPS) ?

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

Subtest 06   Interrupt test (IRQ 4, 3, and 5)

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, execute the Toshiba MS-DOS FDISK command, which will partition the hard disk drive. Then execute the Toshiba MS-DOS FORMAT command. Refer to the Toshiba MS-DOS manual for details.*

OPERATION

1. Execute the Hard Disk Test by typing **8** from the DIAGNOSTIC TEST MENU and pressing **Enter**. 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 on 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 as explained in Table 3-3 on page 3-33.

CONTENTS

Subtest 01   Sequential read

The sequential read test is a sequential reading of all the tracks on the HDD starting at track 0. When all the tracks on the hard disk have been read, the test starts at the maximum track and reads the tracks on the hard disk 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 hard disk. The data written to each sector is then read and compared with the original data. There are three ways in which the hard disk can be read:

- Forward sequential
- Reverse sequential
- Random

Subtest 03   Random address/data

This subtest writes random data to random addresses (cylinder, head, and sector) on the hard disk 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 on the hard
                  disk, 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 on the hard disk.

Subtest 07   Read specified address

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

Subtest 08   ECC circuit

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

Subtest 09   Sequential write

                  This subtest writes specified 2-byte data to all cylinders on the hard disk.

Subtest 10   W-R-C specified address

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

3.12 Real Timer Test

To execute the Real Timer Test, type **9** from the DIAGNOSTIC TEST MENU and press **Enter**. The following subtests can now be executed from the Real Timer Test menu.

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 following 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 perform the following checks of the backup memory.

- ❏   One bit of "on" data to addresses 01h through 80h.
- ❏   One bit of "off" data to addresses FEh through 7Fh.
- ❏   The data pattern AAh through 55h to 50 bytes of the RTC backup memory (addressed 0Eh through 3Fh).

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

Subtest 01   NDP test

This subtest checks the following functions of the numeric data processor (math co-processor).

- ❏ control word

- ❏ status word

- ❏ bus

- ❏ addition

- ❏ multiplication

This subtest determines if the CPU contains the NDP functions by sending one bit of "on" data to the CPU. If the subtest determines that the NDP functions are present, the test execution continues.

3.14 Error Codes and Error Status Names

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

Table 3-3 Error codes and error status names

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
	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 Error codes and error status names (continued)

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 Mark Error
	04	Record Not Found
	05	HDC Not Reset
	07	Drive Not Initialize
	09	DMA Boundary Error
	0A	Bad Sector
	0B	Bad Track Error
	10	ECC Error
	11	ECC Recover Enable
	20	HDC Error
	40	Seek Error
	80	Time Out Error
	AA	Drive Not Ready
	BB	Undefined
	CC	Write Fault
	E0	Status Error
NDP	01	No CO-PROCESSOR
	02	Control Word Error
	03	Status Word Error
	04	Bus Error
	05	Addition Error
	06	Multiple Error

3.15 Hard Disk Test Detail Status

When an error occurs in the Hard Disk Test, the following message is displayed.

HDC status = XXXXXXXX

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

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

The values and meanings of the HDC status register are described in Tables 3-4. Table 3-5 displays the values and meanings of the HDC error register.

Table 3-4 HDC status register contents

Bit	Name	Description
7	BSY (Busy)	"0"--HDC is busy. "1"--HDC is ready.
6	DRDY (Drive ready)	"0"--Hard disk drive is not ready to accept any command. "1"--Hard disk drive is ready.
5	DWF (Drive write fault)	"0"--DWF error is not detected. "1"--Write fault condition occurs.
4	DSC (Drive seek complete)	"0"--The hard disk drive heads are not settled over a track. "1"--The hard disk drive heads are settled over a track.
3	DRQ (Data request)	"0"--Drive is not ready 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.

Table 3-5 HDC Error register contents

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	TK09 (Track 0)	"0"--The hard disk has found track 0 during a recalibrate command. "1"--The hard disk could not find track 0 during a recalibrate command.
0	----	Not used.

3.16 Hard Disk Format

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

      ❏   Low level (physical) formatting

      ❏   MS-DOS (logical) formatting

This Hard Disk Format function performs a low level format of the hard disk and executes the following hard disk 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 Function Description

1.   All track FORMAT

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

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

Table 3-6 Hard disk formatting sequence

Item	Description	
	60MB	80MB
Sector sequences	1	1
Cylinders	0 to 822	0 to 1096
Heads	0 to 3	0 to 3
Sectors	1 to 38	1 to 39
Sector length (bps)	512	512

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 of 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 to partition the hard disk. 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 menu 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

(1)   Selecting the All track FORMAT program 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 message will be displayed.

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

(4)   Select whether or not the hard disk 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 all the bad tracks on the hard disk and press **Enter**. The cylinder number is represented by **CCCC** and **HH** is the head number. If the hard disk 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
```

(7)   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 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 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 Function Description

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

3.17.2 Operations

1.   Select the HEAD CLEANING function from the DIAGNOSTICS MENU and press **Enter**. The following message 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 Function Description

This function logs error information generated while a test is in progress and stores the results in RAM. The error information can then be stored onto a floppy disk or outputted to a printer. If the POWER switch is turned off, the error information will be lost. The error information is displayed in the following order:

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

3.18.2 Operations

1.   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      |   |   HDC status                   |
           |   |  Pass count            |   Read data                        |
           |   Subtest number           Write data                           |
           Test name                                                         |
      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
Key	Function
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 error log information from a floppy disk.
7	Writes the error 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 Function 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)
8. Real timer test (Subtest number 02)

The system automatically detects the number of floppy disk drives connected to the T4400SX for the Floppy Disk Drive Test.

3.19.2 Operations

> *CAUTION: Do not forget to load a work disk into the FDD. If a work disk is not loaded, an error will be generated during the Floppy Disk Drive 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 **PRT/FDD** connector on the back of the T4400SX to properly execute this test.

3. Type in **Y** or **N** and press **Enter**. The following message will appear.

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

   Selecting **Yes** executes the ASYNC wraparound test. An RS-232C wraparound connector must be connected to the **COMMS** connector on the back of the T4400SX to properly execute this test.

4. Type in **Y** or **N** and press **Enter**. The following message will appear.

     Mount the work disk(s) on the drive(s),
     then press [Enter] key.

     [Warning: The contents of the disk(s)
           will be destroyed]

5. Press **Enter** and the Running Test is executed continuously. To terminate the program, press **Ctrl + Break**.

3.20 Floppy Disk Drive Utilities

3.20.1 Function Description

The Floppy Disk Drive Utilities function formats a floppy disk, copies floppy disks, and displays the dump list for both a floppy disk and the hard disk.

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:

    ❑   2D: Double-sided, double-density, 48/67.5 TPI, MFM mode, 512 bytes, 9 sectors/ track.

    ❑   2DD: Double-sided, double-density, double-track, 96/135 TPI, MFM mode, 512 bytes, 9 sectors/track.

    ❑   2HD: Double-sided, high-density, double-track, 96/135 TPI, MFM mode, 512 bytes, 18 sectors/track.

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 on the display.

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**. The following message will be displayed.

```
Warning : Disk data will be destroyed.

Insert work disk into drive x:
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.

```
FLOPPY DISK FORMAT & COPY : Vx.xx
Type select (0:2DD-2DD,1:2D-2D,2:2D-2HD,3:2HD-2HD) ?
```

(2)   Select a media drive type number. The following message will be displayed.

```
Insert source disk into drive x:
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)   Once the copying of the source disk is completed, the following message appears.

```
Insert target disk into drive x:
Press any key when ready.

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

(5)   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.

```
DIAGNOSTICS - HARD DISK & FLOPPY DISK DUMP : Vx.xx
Format type select (0:2DD,1:2D,2:2HD,3:HDD) ?
```

(2)   Select a format type number. Type in 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 a floppy disk drive number by typing in **1** or **2**. The following message will
      appear.

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

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

        -- Max. address ---
          [Track] = xxxx
          [Head] = xx
          [Sector] = xx

        Track   number ??

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

        Head number   ?

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

        Sector number ??

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

(9)   After a dump list 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.
        3:   Displays the following message.

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

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

3.21 System Configuration

3.21.1 Function Description

The System Configuration function contains the following configuration information for the T4400SX.

- ❑ 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.** A system configuration screen similar to the one below will be displayed.

```
SYSTEM CONFIGURATION :

        *  -  BIOS ROM VERSION = Vx.xx
        *  -  639KB 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 Function Description

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

MEMORY
      Total memory size
      Base memory size
      Extended memory size
      Hard RAM size
      Shadow BIOS ROM

DISPLAY (LCD UNIT)
      Display Adapter
      LCD Display Mode
      LCD gray scale level

DISPLAY (PDP UNIT)
      Display Adapter
      Disply Device
      Plasma Display mode

HARD DISK
      Capacity

TIME & DATE

COM/PRT/FDD
      Serial Port
      Built-in Modem
      External FDD/PRT
      Printer Port Type

POWER ON PASSWORD

OTHERS
      Resume Mode
      Battery Save Mode with submenu of Battery Save Options
            Processing speed
            CPU sleep mode
            HDD auto off
            Display auto off
            LCD/PDP brightness
      Cache
      Pop-up
      Speaker
      Battery Alarm

3.22.2 Accessing the SETUP

Select the SETUP function from the DIAGNOSTICS MENU and press **Enter**. A display similar to one of the following will appear depending on the display type (LCD or PDP).

LCD Display

```
                              T4400SX SETUP
┌─────────── MEMORY ───────────┐  ┌─────────── COM/PRT/FDD ───────────┐
│ Total          =    2048KB   │  │ Serial Port      = COM1 (IRQ4/3f8H)│
│ Base           =     640KB   │  │ Built-in Modem   = COM2 (IRQ3/2F8H)│
│ Extended       =    1280KB   │  │                                    │
│ Hard RAM       =       0KB   │  │ External FDD/PRT = Printer         │
│ Shadow BIOS ROM = Enable (128KB)│ │ Printer Port Type = Output        │
└──────────────────────────────┘  └────────────────────────────────────┘

┌─────────── DISPLAY ──────────┐  ┌───────── POWER ON PASSWORD ────────┐
│ Display Adaptor   =VGA Compatible│ Not Registered                    │
│                               │  └────────────────────────────────────┘
│ LCD Display Mode    =Color    │  ┌─────────── OTHERS ─────────────────┐
│ LCD Gray Scale Level = Normal 16 Levels│ Resume Mode        = Boot   │
└──────────────────────────────┘  │ Battery Save Mode  = User Setting  │
┌─────────── HARD DISK ────────┐  │ Cache              = Enable        │
│ Capacity          = 80MB     │  │ Popup              = Enable        │
└──────────────────────────────┘  │ Speaker            = On            │
┌─────────── TIME & DATE ──────┐  │ Battery Alarm      = On            │
│ 14:19:54, Fri Jan 10, 1992   │  └────────────────────────────────────┘
└──────────────────────────────┘
```

PDP Display

```
                              T4400SX SETUP
┌─────────── MEMORY ───────────┐  ┌─────────── COM/PRT/FDD ───────────┐
│ Total          =    2048KB   │  │ Serial Port      = COM1 (IRQ4/3f8H)│
│ Base           =     640KB   │  │ Built-in Modem   = COM2 (IRQ3/2F8H)│
│ Extended       =    1280KB   │  │                                    │
│ Hard RAM       =       0KB   │  │ External FDD/PRT = Printer         │
│ Shadow BIOS ROM = Enable (128KB)│ │ Printer Port Type = Output        │
└──────────────────────────────┘  └────────────────────────────────────┘

┌─────────── DISPLAY ──────────┐  ┌───────── POWER ON PASSWORD ────────┐
│ Display Adaptor   =VGA Compatible│ Not Registered                    │
│ Display Device    =Plasma     │  └────────────────────────────────────┘
│ Plasma Display Mode =Color    │  ┌─────────── OTHERS ─────────────────┐
│                               │  │ Resume Mode        = Boot          │
└──────────────────────────────┘  │ Battery Save Mode  = User Setting  │
┌─────────── HARD DISK ────────┐  │ Cache              = Enable        │
│ Capacity          = 80MB     │  │ Popup              = Enable        │
└──────────────────────────────┘  │ Speaker            = On            │
┌─────────── TIME & DATE ──────┐  │ Battery Alarm      = On            │
│ 14:19:54, Fri Jan 10, 1992   │  └────────────────────────────────────┘
└──────────────────────────────┘
```

These displays are examples of the setup options as they are currently stored in memory for the T4400SX. The available setup options for the display are dependent on the value selected for the Display Adapter option.

Notice that selecting the type of floppy disk drive is not an option. The T4400SX automatically determines what type of internal floppy disk drive is installed.

Press **Esc** if the setup options displayed accurately reflect your hardware configuration. The following message will be displayed.

      Exit Without Saving? (Y/N)

If you press **Y**, the display returns to the DIAGNOSTICS MENU.

3.22.3 Changing SETUP Values

The SETUP values for the T4400SX can be changed automatically to their default settings or manually to user-defined settings.

Automatic Reset

Follow these steps to set all of 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 base and extended memory your T4400SX 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 default values for the other options.

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

3. If the new values are correct, proceed to step 4 in the **Manual Reset** section.

Manual Reset

Follow these steps to change 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. You can also select each option group by pressing the character on the keyboard corresponding to the first letter of the heading for each group. For example, if you press **D** the cursor moves to the top of the DISPLAY option group.

2. When the option you want to change is highlighted, press either the **space bar** or **backspace** 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 the following 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**. The new values are recorded into CMOS memory and the system reboots.

3.22.4 SETUP Descriptions

This section explains the alternate values for each SETUP option.

1. MEMORY

    This group of options lets you configure the memory you install in the T4400SX.

    (1) Total
         This field displays the total amount of memory that is in the computer. This amount is automatically calculated by the computer and cannot be changed on the screen.

    (2) Base
         This field displays the amount of base (conventional) memory, which is 640KB. This is automatically calculated by the computer and cannot be changed on the screen.

    (3) Extended
         This field displays the amount of extended memory the T4400SX has available. The amount of memory allocated to extended memory depends on the size of the Hard RAM. This amount is automatically calculated by the computer and cannot be changed on the screen.

    (4) Hard RAM
         Use this option to create a Hard RAM disk in the T4400SX's memory. When you press the **space bar** or **backspace** key, the size of memory allocated for Hard RAM increases and decreases in 64KB increments from 129KB to 9472KB. The amount of memory you can allocate for Hard RAM depends on the size of extended memory.

    (5) Shadow BIOS ROM
         As shown on the screen, 128KB of RAM is reserved for the Shadow BIOS. This configuration cannot be changed in the SETUP program. To change the Shadow BIOS, you need to include the Expanded Memory Manager (EMM386.EXE) in the CONFIG.SYS file which will then emulate expanded memory in extended memory.

2. Display

    This group of options helps you configure the T4400SX's display depending on the computer's display technology: LCD or PDP.

    <u>LCD Unit</u>
    (1) Display Adapter
         Use this option to choose the display adapter.

         VGA compatible Chooses the internal adapter for the VGA display. This is the default setting.

Not used   Internal display adapter is disables. You can install any exter-
                      nal display controller card in the Desk Station IV. Remaining
                      display setup options are not available..

(2)   LCD Display Mode
       Use this option to select whether the display will use the color or monochrome mode.

       Color   Displays in color mode. 262144 colors are converted to 64
                          levels of gray for the LCD display. This is the default setting.

       Monochrome   Selects the monochrome mode and simulates 64 levels of gray
                          with the LCD's 16-level gray scale. This mode is also used
                          when you attach a VGA monochrome monitor to the RGB
                          port.

(3)   LCD Gray Scale Level
       This option lets you switch between 16 and 64 levels of gray and normal and reverse
       video for screen text. This option also appears in the Pop-up Window.

       Normal 16 Levels   Displays black text on a white background with 16
                                levels of gray.
                                This is the default setting.

       Reverse 16 Levels   Displays white text on a black background with 16
                                levels of gray.

       Normal 64 Levels   Displays black text on a white background with 64
                                levels of gray.

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

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

<u>PDP Unit</u>
(1)   Display Adapter
       Use this option to choose the display adapter.

       VGA compatible Chooses the internal adapter for the VGA display. This is the
                          default setting.

       Not used   Internal display adapter is disables. You can install any exter-
                          nal display controller card in the expansion slots. Remaining
                          display setup options are not available.

(2) Display Device
Use this option to select whether the screen will display on the T4400SX's plasma display and/or on an external monitor via the RGB port on the back of the computer.

Plasma   Specifies the dual display mode. This is the default setting.

CRT   Specifies an external monitor.

(3) Plasma display mode
Use this option to select whether the plasma display will use the color or monochrome mode.

Color   Displays in color mode. 256 colors are converted to 16 levels of gray (orange) for the plasma display. This is the default setting.

Monochrome   Selects the monochrome mode and simulates 64 levels of gray with the PDP's 16-level gray (orange) scale. This mode is also used when you attach a VGA monochrome monitor to the RGB port.

3. HARD DISK

This section displays the size and type of hard disk installed in the T4400SX. Use either the **space bar** or **backspace** key to choose one of the two hard disk options.

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

No Drive   Disables the hard disk. The T4400SX functions as if a hard disk is not installed.

4. TIME & DATE

Use either the **space bar** or **backspace** key to change the system date and time.

5. COMM/PRT/FDD

This option allows you to set the serial and parallel ports and the built-in modem.

(1) Serial Port
Use this option to assign a communications port name to the serial port (**COMMS**).

COM1 (IRQ4/3F8H)   Assigns COM1 to the serial port. This is the default setting.

COM2 (IRQ3/2F8H)   Assigns COM2 to the serial port.

Not Used   Disables the serial (**COMMS**) port. You can now install an optional card into the expansion chassis without any conflict with the COM level of the serial port.

(2)   Built-in Modem
       This option lets you assign a communications port name to the card modem slot.

       COM1 (IRQ4/3F8H)   Assigns COM1 to the built-in modem slot.

       COM2 (IRQ3/2F8H)   Assigns COM2 to the built-in modem slot.
                                This is the default.

       Not Used   Disables the built-in modem. You can now install an optional card into the expansion chassis without any conflict with the COM level of 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**. *If both are assigned to* **COM1** *or* **COM2**, *the computer will automatically select* **Not Used** *for one of the two options.*

---

(3)   Built-in Modem Power
       This option only displays if a built-in modem is installed. The option is used to turn the power on and off to the modem.

(4)   External FDD/PRT
       Use this option to assign the function of the parallel **PRT/FDD** port.

       Printer   Configures the port for output to a parallel printer. By default the internal drive becomes drive A.
                      This is the default setting.

       FDD A   Configures the port for output and input with an external floppy disk drive and assigns the external drive as A. By default the internal drive becomes drive B.

       FDD B   Configures the port for output and input with an external floppy disk drive and assigns the external drive as B. By default the internal drive remains drive A.

(5)   Printer Port Type
       When the **PRT/FDD** port is set for output to the Printer as opposed to the external floppy disk drive, this option lets you change the Printer port from output only (the default) to receive input as well as output. Do not change this setting if you're

connecting the T4400SX to a printer. You would change this option only if you're connecting the computer to a device that requires a bi-directional parallel signal.

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

Bi-Directional Activates bi-directional operation.

6.   Power on Password
     This option allows you to enable or disable the password required for the T4400SX to power on and allow access to the C prompt.

On   Enables the Power on Password mode. The computer will require the correct password before allowing the power on sequence to continue.

Off   Disables the Power on Password mode. By disabling the password, the computer erases the previous password from memory. The SETUP program displays Not Registered on the SETUP menu.

When servicing a customer's computer that has the Power on Password mode enabled, you need the password from the customer before you can power on the machine. However, you can attach a printer wraparound connector to the PRT/FDD port before turning the T4400SX on. This will automatically reset the Power on Password option to Off and the SETUP program will save the change when you turn the computer off.

> *NOTE: If you use the printer wraparound connector to reset the Power on Password option, make sure you inform the customer of the change when returning the computer.*

Setting the Power On Password Option

To set the power on password option, follow these steps.

1. Press the **Space** or **Backspace** key and the following prompt message appears.

    Password =

2. Enter a password consisting of up to ten characters. The character string you enter is displayed as a string of asterisks. For example, if you enter a password consisting of four characters, the display shows:

    Password = *

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

    Verify Password =

4. Re-enter the same character string you entered in step 2 and press **Enter**. If the two character strings match, the password is registered and the display changes to:

Registered

If they do not match, the following message appears along with a beep indicating you must repeat steps 3 and 4.

Once the power on password option is set, the SETUP program displays **Registered**.

Resetting the Power On Password Option

To reset the power on password option, follow these steps.

1. Press the **Space** or **Backspace** key and the following prompt message appears.

Password =

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

Password = ****

3. Press **Enter**. If the character string you entered matches the registered password, the password option is reset and the display changes to:

Not Registered.

If they do not match, the following message appears along with a beep and the display returns to **Registered**.

> *NOTE: Be sure not to forget the password. If you need to bypass the power on password verification, you can attach a printer wraparound connector to the PRT/FDD port before turning the T4400SX on. This will automatically reset the Power on Password option to Off and the SETUP program will save the change when you turn the computer off.*

7. OTHERS

Whether or not you need to configure the T4400SX with these options depends primarily on the type of software or peripherals you use.

(1) Resume Mode
This option enables and disables the AutoResume feature. You can also set this option using the Pop-up Window.

Boot	Enables the boot mode by turning off the AutoResume feature. This is the default setting.
Resume	Enables the AutoResume feature.

(2)   Battery Save Mode
       This option allows you select parameters that can extend the life of the main battery
       within the T4400SX.

       Long Life This value can only be selected when the computer is powered on
       without using the AC adapter. When selected, the Battery Save Options window is
       displayed and informs of the preset values for the following options.

               Processing Speed = **Low**
               CPU Sleep Mode = **Enable**
               HDD Auto Off = **03Min.**
               Display Auto Off = **03Min.**
               PDP/LCD Brightness = **Semi-Bright**

       Normal Life   This value can be selected when the computer is powered on
       using the AC adapter. When selected, the Battery Save Options window is displayed
       and informs of the preset values for the following options.

               Processing Speed = **High**
               CPU Sleep Mode = **Disable**
               HDD Auto Off = **Disable**
               Display Auto Off = **Disable**
               PDP/LCD Brightness = **Bright**

       User Settings   This value allows you to choose the values for the options
       displayed in the Battery Save Options window as follows.

               Processing Speed = **High** or **Low**
               CPU Sleep Mode = **Disable** or **Enable**
               HDD Auto Off = **Disable, 03Min., 05Min., 10Min., 15Min.,**
                              20Min., or **30Min.**
               Display Auto Off = **Disable, 01Min., 03Min., 05Min., 10Min.,**
                              15Min., 20Min., or **30Min.**
               PDP/LCD Brightness = **Bright** or **Semi-Bright**

(3)   Cache
       This option is used to enable or disable the cache memory established on the
       T4400SX.

       Enable   Enables the cache memory.

       Disable   Disables the cache memory.

(4)   Popup
       Use this option to enable or disable the Pop-up window.

       Enable   Allows you to access the Pop-up window by pressing **Fn** + **Esc**.
                     This is the default setting.

       Disable   Disables the Pop-up window.

(5)   Speaker
       This option enables and disables the software usage of the system speaker. Setting
       this option to **Off** also disables the self-test alarm. All other system alarms are
       unaffected. This option appears in the Pop-up Window.

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

       Off   Disables software usage of the system speaker.

(6)   Battery Alarm
       This option enables and disables the battery alarm. The battery alarm sounds when
       the battery pack is low. This option also appears in the Pop-up Window.

       On   Enables the alarm.
                     This is the default.

       Off   Disables the alarm.

8.   BATTERY SAVE OPTIONS

Use these options to increase the amount of time you can operate the T4400SX with battery
power.

(1)   Processing Speed
       Use this option to select the CPU and system bus speeds. Some optional boards are
       dependent on the system bus speed.

       High   Selects the maximum CPU and system bus speeds.

       Low   Selects the low CPU and system bus speeds. This setting makes the
                     T4400SX system bus and CPU speeds compatible with the IBM PC/
                     AT.

(2) CPU Sleep Mode
Use this option to enable or disable the CPU sleep mode. This option also appears in the Pop-up Window. If you use a non-Toshiba MS-DOS operating system, you must disable this option.

Enable   Enables the CPU sleep mode.
              This is the default setting.

Disable   Disables the CPU sleep mode.

(3) HDD Auto Off
Use this option to disable or set the duration of the HDD automatic power off function. This option also appears in the Pop-up Window. If you use a non-Toshiba MS-DOS operating system, you must disable this option.

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 duration **(xx)** can be set to 3, 5, 10, 15, 20, or 30 minutes.

(4) Display Auto Off
Use this option to disable or set the duration of the display automatic power off function. Setting this option conserves battery power because it causes the T4400SX to turn the sidelight off if you don't use the computer for the specified period of time. This option also appears in the Pop-up Window. If you use a non-Toshiba MS-DOS operating system, you must disable this option.

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

xxMin.   Automatically turns off power to the sidelit LCD panel if the computer is not used for the specified duration. Enabling this option will conserve battery power. The duration **(xx)** can be set to 1, 3, 5, 10, 15, 20, or 30 minutes.

Always OFF Disables this option when an AC adapter is connected. However, the original setting is unchanged.

(5) LCD/PDP Brightness
This option appears only then the display adapter option is set to **VGA compatible**. It allows you to select a brightness level for the LCD/PDP.

Bright   The maximum brightness level will be used.

Semi-Bright   A slightly lower brightness level will be used.

4.1   General

This section explains how to disassemble the T4400SX and replace Field Replaceable Units (FRUs) in the T4400SX. It may not be necessary to remove all the FRUs in order to replace just one. The chart below is a guide to which FRUs need to be removed in order to remove others. Always start by removing the battery pack, then follow the lines on the chart to determine which FRU you must remove next in order to access the one you think is causing the T4400SX to operate abnormally.

```
┌──────────────┐                    ┌─────────────────────────┐
│ Battery Pack │────────────────────│ Plasma Display          │
└──────┬───────┘                    │ Liquid Crystal Display  │
┌──────┴────────────────────────┐   └────────────┬────────────┘
│ Optional Modem Card            │                │
│ Keyboard                       │                │
│ Built-in Modem Assembly        │                │
│ RTC Battery                    │                │
│ Top Cover         ─────────────┼──┐  ┌──────────┴──────┐
│ Power Supply Board          ───┼──┼──│ Display Cables  │
│ Sub Battery                    │  │  └─────────────────┘
│ Battery Pack Assembly          │  └──┌─────────────────┐
│ Floppy Disk Drive Unit         │     │ LED Board       │
│ Hard Disk Drive Unit           │     └─────────────────┘
│ System Board                   │
└────────────────────────────────┘
```
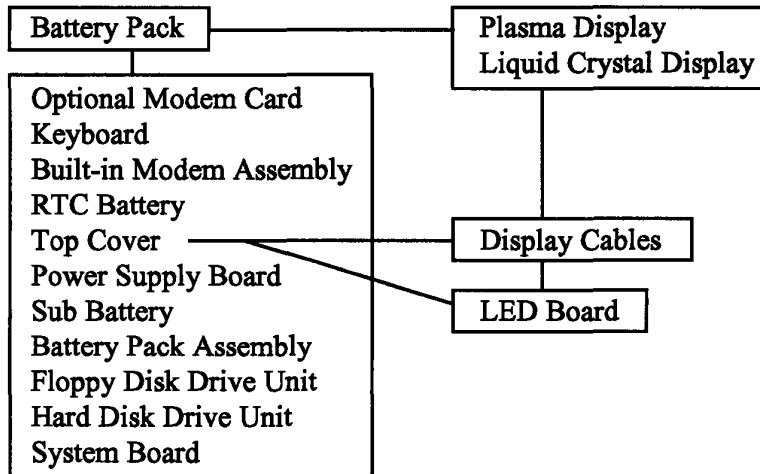
Before You Begin

Review the procedures in this section before you begin disassembling the T4400SX. Familiarize yourself with the disassembly and reassembly steps. Always begin each procedure by removing the AC adapter and battery pack as instructed in Section 4.2.

1.   Do not disassemble the T4400SX 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 T4400SX.

      ❑   Dust and contaminates
      ❑   Static electricity
      ❑   Extreme heat, cold, or humidity

4.   Make sure the FRU you are replacing is causing the abnormal operation by performing the necessary diagnostic tests described in Chapter 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 T4400SX.

7. After removing parts from the computer, place them in a safe place away from the computer so they cannot be damaged and will not interfere with your work.

8. You will remove and replace many screws when you disassemble the T4400SX. When you remove screws, make sure they are placed in a safe place and identified with the correct parts.

9. When assembling the T4400SX, make sure you use the correct screws to secure the various pieces in place. Screw sizes are listed in the corresponding Figures.

10. The T4400SX contains many sharp edges and corners. Be careful not to injure yourself.

11. After you have replaced an FRU, make sure the T4400SX is functioning properly by performing the appropriate diagnostic test on the FRU you have fixed or replaced.

Disassembly Procedures

The T4400SX has two basic types of cable connectors:

- Pressure Plate Connectors
- Pin Connectors

To disconnect a Pressure Plate Connector, release the tabs on both sides of the plastic connector and slide the cable out of the connector. To connect a cable to a Pressure Plate Connector, make sure the tabs of the Pressure Plate connector are fully extended and then slide the cable into the connector. Secure the cable in place by pressing down on the tabs so that they are flush with the sides of the connector. Gently pull on the cable to make sure the cable is firmly inserted. If the cable comes out of the connector, connect it again making sure the tabs of the connector are fully extended when you insert the cable.

Installation (Reassembly) Procedures

When you have disassembled the T4400SX and fixed or repaired the problem that was causing the T4400SX to operate abnormally, you will need to reassemble the T4400SX. Keep the following items in mind while you are reassembling the T4400SX.

1. Take your time and make sure you carefully follow the instructions. Most problems arise when you are in a hurry to reassemble the T4400SX.

2. Make sure all cables and connectors are securely fastened.

3. Before securing the FRU or other part, make sure there are no cables in the area that will be pinched by the screws or the FRU.

4.   Check that all latches and pressure plates are locked into place.

5.   Be sure to use the correct screws to secure the various parts. Screw sizes are listed in the corresponding Figures.

6.   Make sure you replace all the screws that were removed during disassembly.

Tools and Equipment

The use of ElectroStatic Discharge (ESD) equipment is very important to your safety and the safety of those around you. Proper use of the following ESD devices will increase the success rate of your repairs and lower the cost of damaged or destroyed parts. The following equipment is necessary to disassemble and reassemble the T4400SX:

- One M2 Phillips-head screwdriver to remove and replace screws.

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

- ESD mats for the work table and the floor.

- ESD wrist strap or heel grounder.

- Anti-static carpeting or flooring.

- Air ionizers in highly static-sensitive areas.

4.2 Battery Pack

Removing the Battery Pack

1. Turn off the power to the T4400SX and disconnect the AC adapter, power cord, and all external cables connected to the T4400SX.

2. Facing the right side of the computer, push the battery cover release lever (A) up, and then slide the battery pack cover (B) toward the back of the T4400SX. Remove the battery pack cover to expose the battery and its pull tab (Figure 4-1).
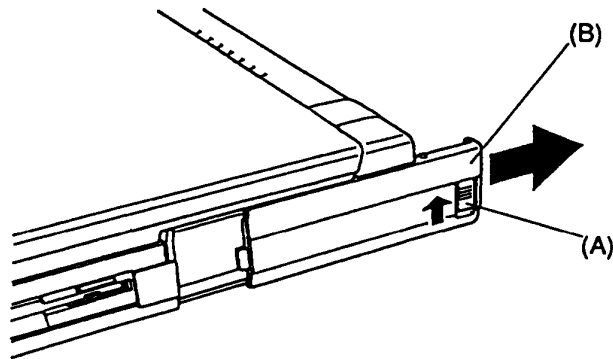
Figure 4-1 Removing the battery pack cover

3. Firmly grasp the battery pack pull tab (D) and pull the battery (C) out of the computer (Figure 4-2).
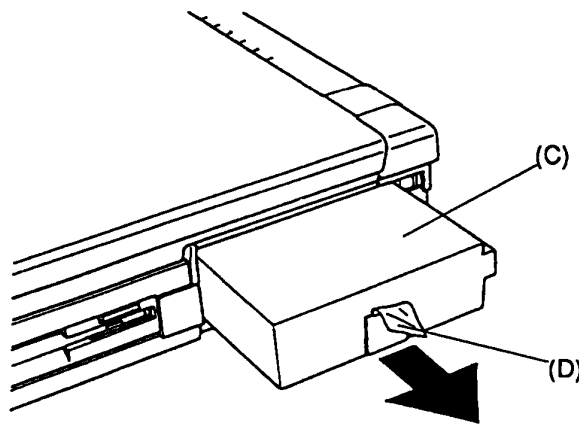
Figure 4-2 Removing the battery pack

Installing the Battery Pack

NOTE: The battery pack is designed to fit into the T4400SX in only one way.

---

1.   Gently slide the battery pack into the battery slot making sure the battery's alignment tab is aligned with the computer's cutout on the back portion of the battery slot.

2.   Push the battery in until it locks into place.

3.   Position the battery pack cover onto the guides and slide it into place; its latch should lock into place (Figure 4-1).

4.3 Optional Memory Card

Removing the Optional Memory Card

1. Turn off the power to the T4400SX and disconnect the AC adapter, power cord, and all external cables connected to the T4400SX.

2. Turn the T4400SX upside down with the front facing you.

3. Remove the **EXP. MEMORY** cover (A) (Figure 4-3).
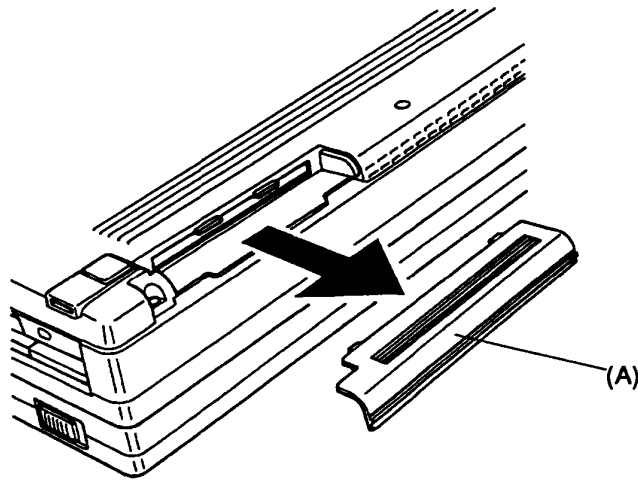
Figure 4-3 Removing the EXP. MEMORY cover

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

NOTE: Do not touch the connecting edge of the memory card. Debris or grease in or on the connector may cause memory access problems.
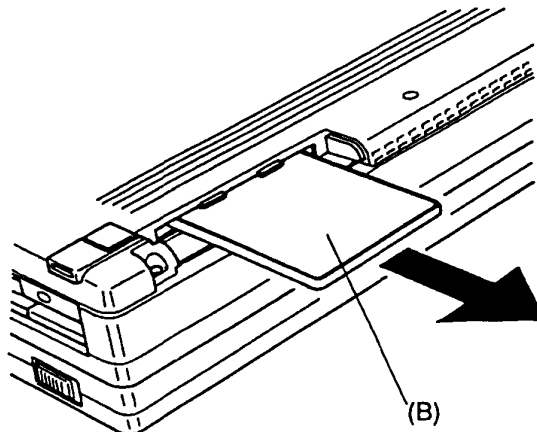
Figure 4-4 Removing the optional memory card

Installing the Optional Memory Card

1.   The top of the memory card is marked with the word ''insert'' and an arrow pointing toward the connecting edge. Turn the memory card face down, with its connecting edge facing the computer. Carefully insert the card into the narrow slot and push gently to ensure a firm connection.

2.   Replace the **EXP. MEMORY** cover; its latch should snap into place (Figure 4-3).

The T4400SX automatically configures all additional memory as extended memory. Use the SETUP program to reconfigure the additional memory.

4.4 Keyboard

Removing the Keyboard

1.   Turn off the power to the T4400SX and disconnect the AC adapter, power cord, and all external cables connected to the T4400SX.

2.   Remove the battery pack and optional memory card as described in Sections 4.2 and 4.3.

3.   Turn the T4400SX upside down with its front facing you.

4.   Remove the three front (M2x16 silver) screws (A) on the bottom cover. If you are planning to remove the top cover, also remove the three (M2x8) screws (B) (Figure 4-5).
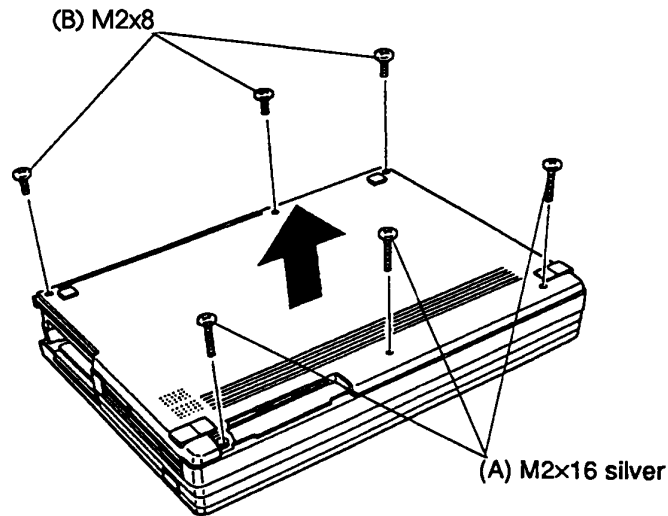
Figure 4-5 Removing the six screws securing the keyboard and top cover

5.   Turn the T4400SX right side up with its front facing you.

6.   Open the display panel (C).

7.   Unsnap the latches (D) securing the keyboard mask (E) to the base assembly. Press on the bottom of the keyboard mask and rotate the keyboard's front edge toward you to release the latches (Figure 4-6).
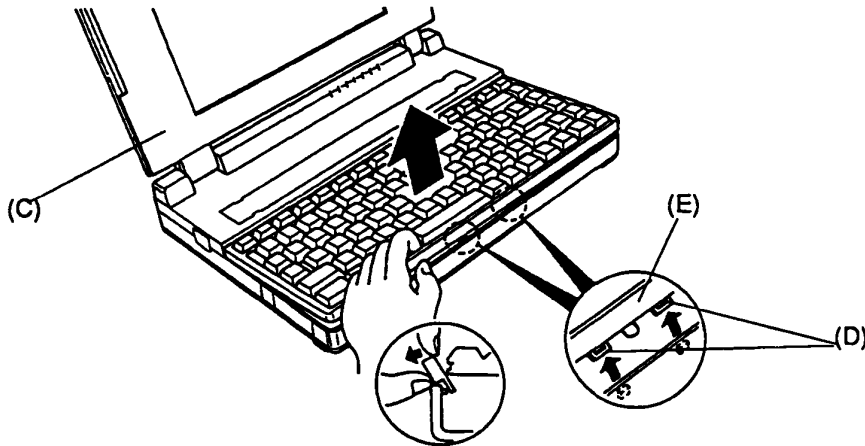
Figure 4-6 Releasing the keyboard mask from the base assembly

8.   Carefully lift the keyboard (F) and rest it against the display panel.

NOTE: The keyboard is still connected to the system board with a short keyboard cable. This cable can be damaged if you try to move the keyboard further than the cable will allow. The cable will be released in Step 11 of this procedure.

9.   Remove the two (M2x5 silver) screws (H) securing the metal plate and then place the metal plate aside (Figure 4-7).
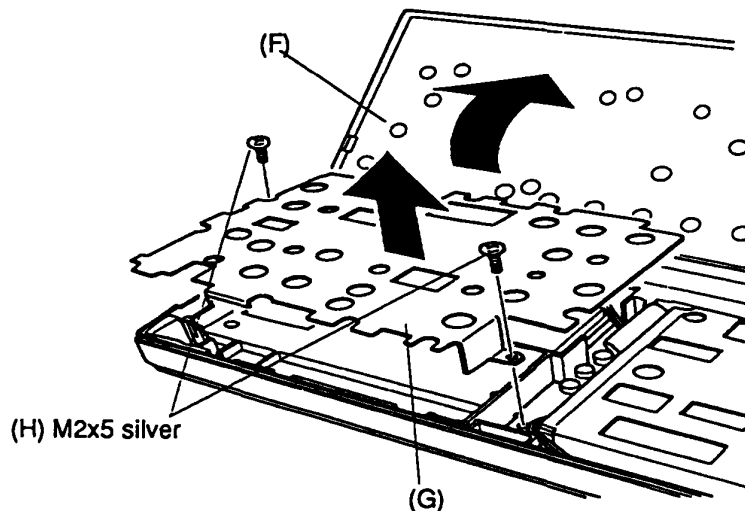
Figure 4-7 Removing the metal plate screws and metal plate

10. Remove the two (M2x5 silver) screws (I) securing the built-in modem case (J). Then remove the case from the computer and place it aside (Figure 4-8).
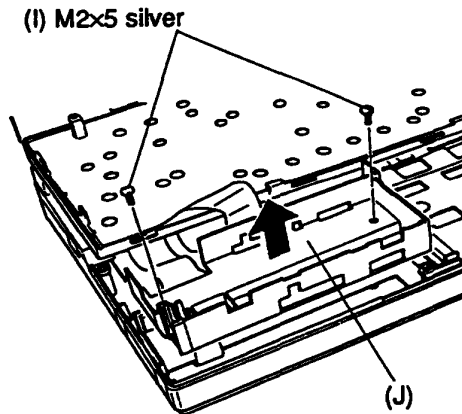
Figure 4-8 Removing the built-in modem case

11. Disconnect the keyboard cable (K) from the pressure plate connector PJ19 (L) on the system board (M) and then place the keyboard aside (Figure 4-9).
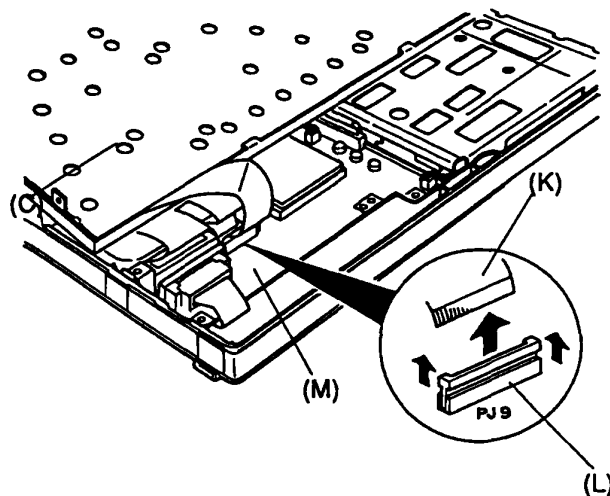
Figure 4-9 Disconnecting the keyboard cable

Installing the Keyboard

1.   Place the keyboard so that the bottom is facing you and lean it against the display panel. Connect the keyboard cable to pressure plate connector PJ19 on the system board (Figure 4-9).

2.   Install the built-in modem case and secure the two (M2x5 silver) screws (Figure 4-8).

3.   Check to make sure you have connected the keyboard cable to the correct connector (PJ19) on the system board.

4.   Install the metal plate and secure the two (M2x5 silver) screws (Figure 4-7).

5.   Lower the keyboard onto the base assembly making sure the edges of the keyboard mask align with the base assembly all the way around the keyboard mask. Secure the latches on the front of the keyboard and recheck the alignment of the keyboard and the base assembly (Figure 4-6).

6.   Close the display panel and turn the T4400SX upside down. Install either the front three (M2x16 silver) or six (M2x16 silver and M2x8) screws (Figure 4-5).

4.5 Central Processing Unit

Removing the Central Processing Unit

1. Turn off the power to the T4400SX and disconnect the AC adapter, power cord, and all external cables connected to the T4400SX.

2. Remove the battery pack, optional memory card, and keyboard as described in Sections 4.2, 4.3, and 4.4.

3. Lift the lever (A) on the left side of the CPU socket (B) to release the CPU (C) from its socket. Lift the lever up until you hear a click indicating the lever is fully extended (Figure 4-10).
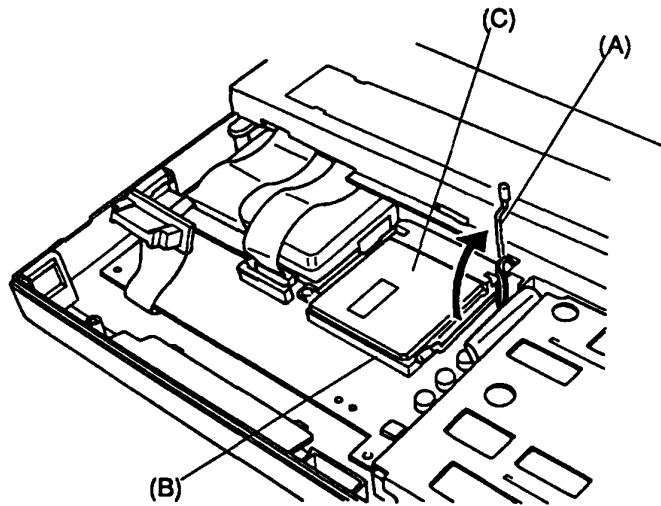
Figure 4-10 Releasing the CPU lever

CAUTION: If the T4400SX has been in operation recently, the CPU's surface may be hot. Allow the CPU to cool to the touch before attempting to remove it.

4. Grasp the CPU and lift it out of the CPU socket.

Installing the Central Processing Unit

1. Make sure the lever on the CPU socket is fully extended (Figure 4-10).

2. Correctly align the CPU with the CPU socket. The small circle (D) on the right front corner of the CPU and the small yellow circle (E) on the system board should face in the same direction. These circles indicate the correct positioning of Pin 1 on the CPU (Figure 4-11).

CAUTION: Misalignment of Pin 1 on the CPU will cause the system to fail and may permanently damage the CPU.
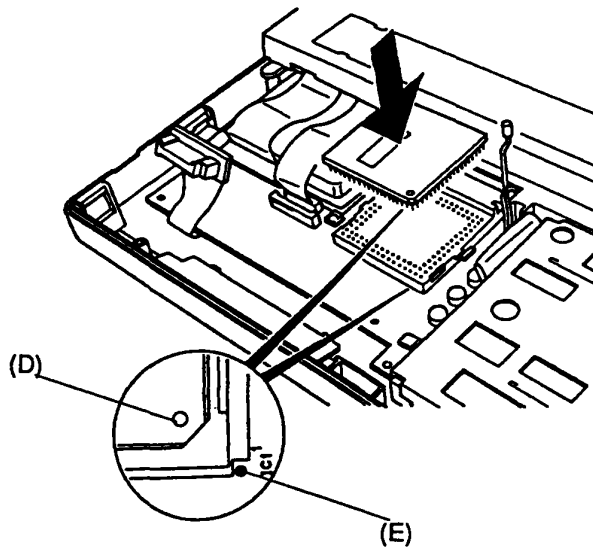
Figure 4-11   Installing the central processor unit

3. Press down on the CPU to firmly connect it with the system board.

4. Lower the lever on the CPU socket and latch it under the clip on the side of the socket.

4.6 Top Cover

Removing the Top Cover

1. Turn off the power to the T4400SX and disconnect the AC adapter, power cord, and all external cables connected to the T4400SX.

2. Remove the battery pack, optional memory card, and keyboard as described in Sections 4.2, 4.3, and 4.4.

3. If a ground cable is connected to the ground screw (A), remove the ground screw and disconnect the ground cable from the computer.

4. Disconnect the LED cable (D) from pressure plate connector PJ15 (E) and the display flex cable (F) from PJ17 (G) on the system board (Figure 4-12).

5. Support the back of the display panel as you remove the three (M2x8) screws (B) securing the front of the display panel (C) to the base assembly (Figure 4-12).

> *CAUTION: Once you have removed the three (M2x8 silver) screws from the front of the display panel, the panel will be free to fall backward. Therefore, you must support the panel as you remove the three (M2x8 screws).*

6. Unsnap the **GND** plate cover (H) on the back of the bottom cover.
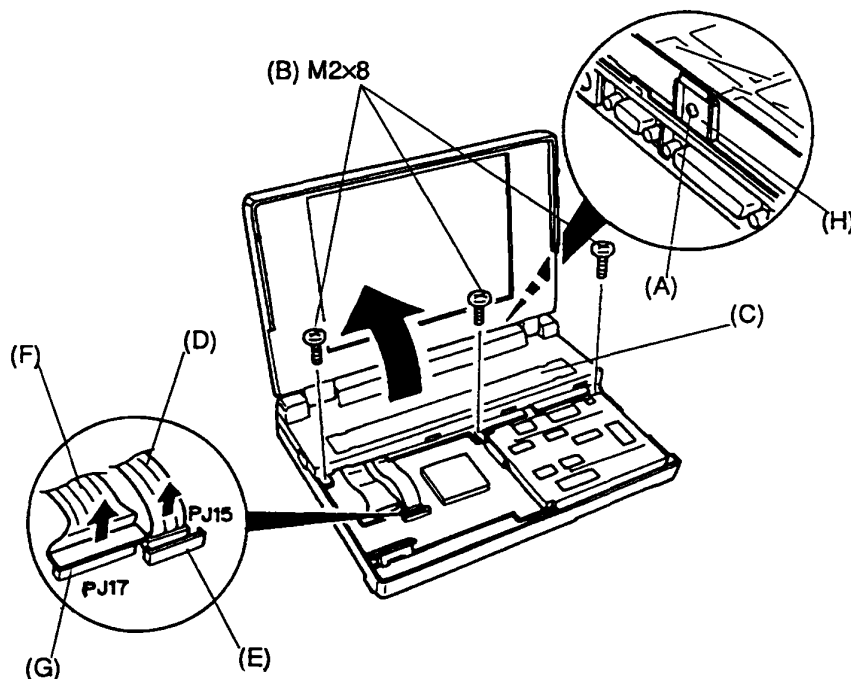
Figure 4-12 Removing the three top cover screws

7. Lift the top cover away from the base assembly and set it aside.

Installing the Top Cover

1.	Align the ground plate (A) with the notch located on the back of the top cover. Then position the top cover onto the base assembly (Figure 4-13).
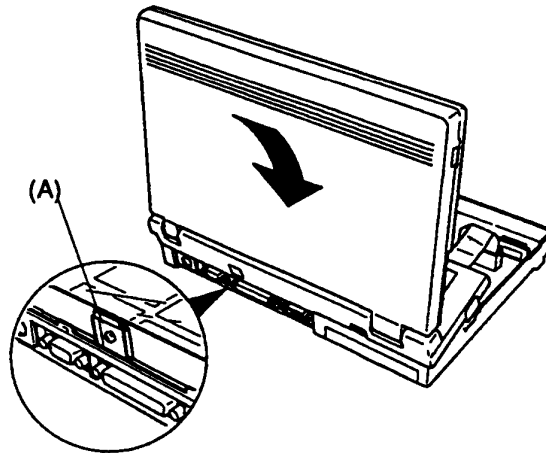
Figure 4-13 Attaching the top cover

2.	Install the three (M2x8 silver) top cover screws (Figure 4-12).

3.	Connect the display flex cable to PJ17 and the LED cable to PJ15 on the system board (Figure 4-12).

> *CAUTION: Make sure to connect the display flex cable to PJ17. DO NOT attempt to connect the display cable to PJ19. Damage to the display flex cable and/or the system board may result by connecting the display flex cable incorrectly.*

4.7 LED Board and Display Flex Cable

Removing the LED Board and Display Flex Cable

1. Remove the top cover as instructed in Section 4.6.

2. Turn the top cover over so its bottom is facing you.

3. Remove the single (M2x5 silver) screw (A) securing the support bridge (B) to the top cover.

4. Carefully peel the plastic cover (C) back just enough to expose the LED holder (D). Separate each flexible cable from the plastic cover (Figure 4-14).
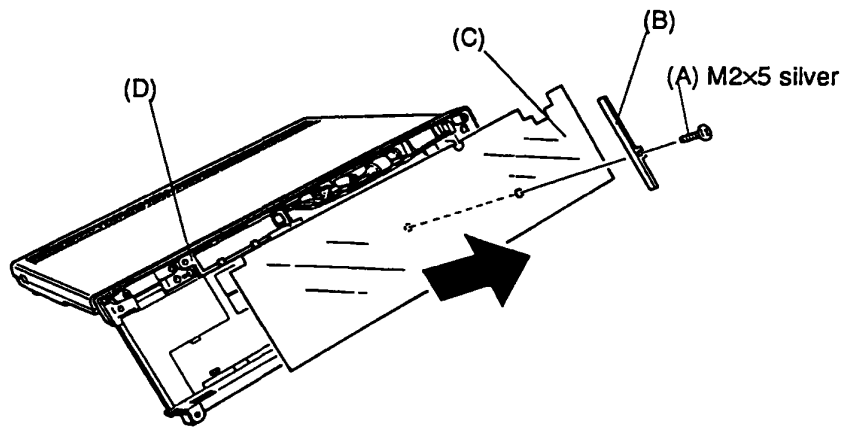
Figure 4-14 Removing the support bridge and plastic cover

5. Remove the one (M2x4) screw (E) and one (M2.5x6 brass) screw (F) securing the LED holder to the top cover (Figure 4-15).
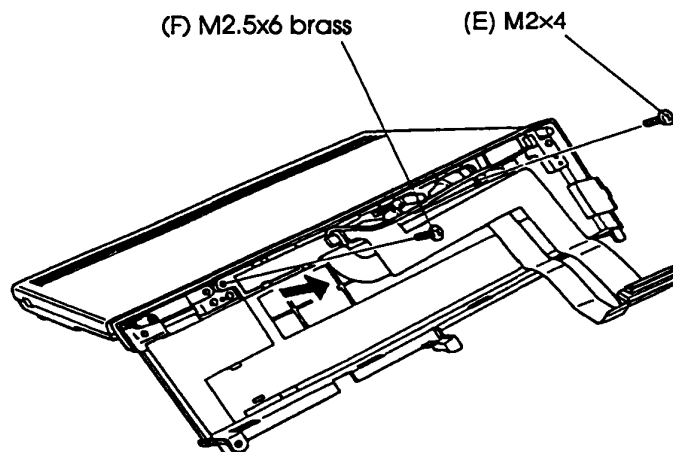
Figure 4-15 Removing the LED holder screws

6. Gently lift the LED holder (G) up and out. Then carefully disconnect the three display cables (H) and the display disable switch cable (I) (Figure 4-16).
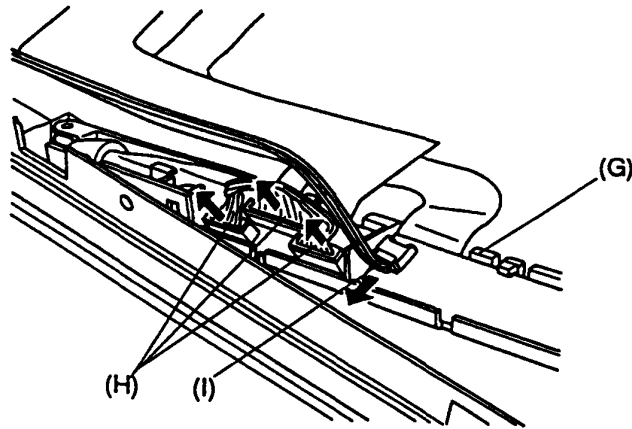
Figure 4-16 Disconnecting the display cables and the display disable switch cable

7. Unsnap the latches (K) securing the LED board (J) to the LED holder. Then unsnap the latch (L) securing the display flex cable (M) to the LED holder. Remove the LED board and display flex cable from the LED holder (Figure 4-17).
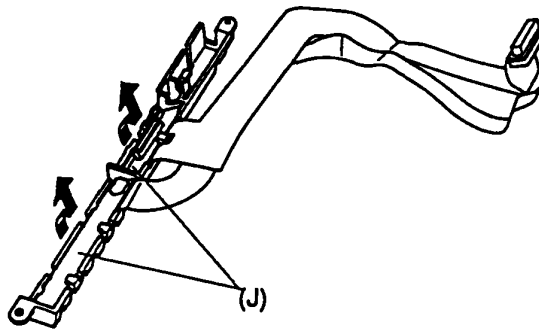
Figure 4-17 Removing the LED board and display flex cable

Installing the LED Board and Display Flex Cable

1. Place the display flex cable in the LED holder and make sure the latch secures it in place (Figure 4-17).

2. Place the LED board in the LED holder and make sure the latches secure it in place (Figure 4-17).

3. Place the LED holder in the top cover, leaving the holder slightly elevated so you can connect the three display cables and the display disable switch cable (Figure 4-16).

4. Set the LED holder in place and insert the two (M2x4 and M2.5x6 brass) screws (Figure 4-15).

5. Route the display cables so that the ferrite core rests in the recess on the top cover.

6. Reposition the plastic cover over the cables on the top cover and secure the support bridge with the single (M2x5 silver) screw (Figure 4-14).

4.8 Power Supply Board

Removing the Power Supply Board

1. Turn off the power to the T4400SX and disconnect the AC adapter, power cord, and all external cables connected to the T4400SX.

2. Remove the battery pack, optional memory card, keyboard, and top cover as described in Sections 4.2, 4.3, 4.4, and 4.6.

3. Disconnect the power supply cable (A) from PJ4 (B) on the power supply board (C).

4. Remove the single (M2x5 silver) screw (D) in the front left corner of power supply board that secures it to the base assembly (Figure 4-18).
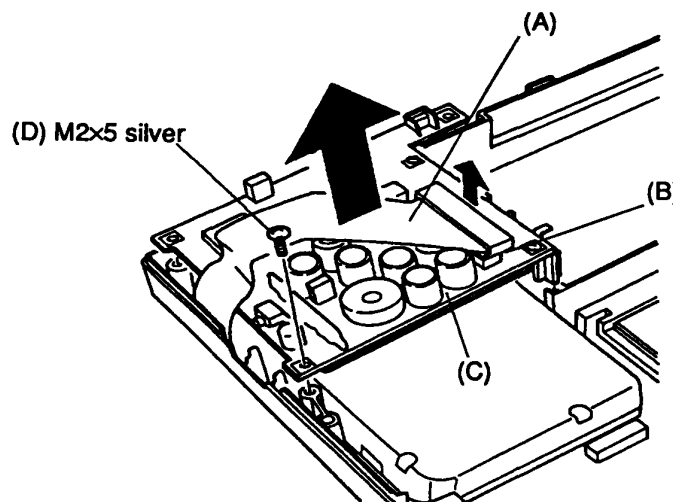
Figure 4-18 Removing the power supply

5. Lift the power supply board's front edge out first then rotate it slightly until it clears the EXP port chassis of the system board. Then place the power supply board aside.

Installing the Power Supply Board

1. Insert the back edge of the power supply board beneath the EXP port chassis on the system board. Then place the power supply board into position. Make sure the battery terminal connections are properly inserted into the battery case (Figure 4-18).

2. Connect the power supply cable to PJ4 on the power supply board.

3. Secure the single (M2x5 silver) screw.

4.9 Battery Pack Case

Removing the Battery Pack Case

1. Turn off the power to the T4400SX and disconnect the AC adapter, power cord, and all external cables connected to the T4400SX.

2. Remove the battery pack, optional memory card, keyboard, top cover, and power supply board as described in Sections 4.2, 4.3, 4.4, 4.6, and 4.8.

3. Disconnect the sub battery (A) from PJ2 (B) on the system board (Figure 4-19).
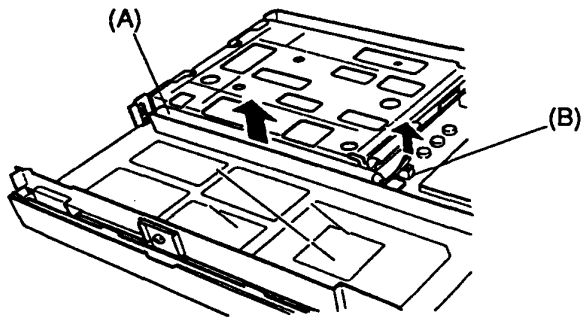
Figure 4-19 Disconnecting the sub battery

4.   Remove the two (M2x5 silver) screws (C) securing the battery pack case (D) to the base assembly.

> **CAUTION:** *Before you remove the battery pack case, locate the Quad Tape Carrier Package (QTCP) gate array, IC2 (E), below the case. DO NOT touch this gate array; doing so may damage the gate array, thus causing the system to fail.*

5.   A locator notch (F) under the left end of the assembly secures the case to the base assembly. Gently squeeze the assembly to release the locator notch.

6.   Lift the battery pack case out of the computer and set it aside (Figure 4-20).
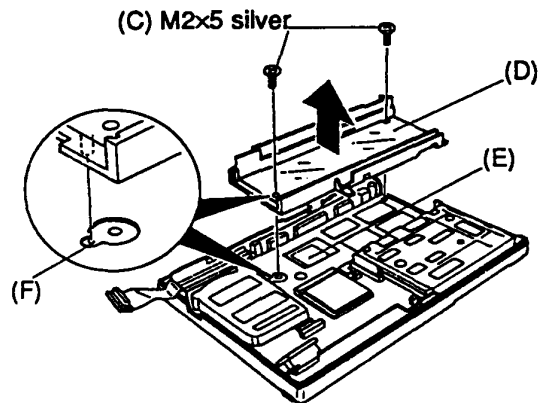
Figure 4-20 Removing the battery pack case

Installing the Battery Pack Case

1.   Align the battery pack case with the base assembly. Set the locator tab into the locator notch on the base assembly and press it into place (Figure 4-20).

2.   Secure the battery pack case in place with the two (M2x5 silver) screws (Figure 4-20).

3.   Connect the sub battery to PJ2 on the system board and place it into position at the front of the battery pack case (Figure 4-19).

4.10 Floppy Disk Drive

Removing the Floppy Disk Drive

1. Turn off the power to the T4400SX and disconnect the AC adapter, power cord, and all external cables connected to the T4400SX.

2. Remove the battery pack, optional memory card, keyboard, top cover, power supply board, and battery pack case as described in Sections 4.2, 4.3, 4.4, 4.6, 4.8, and 4.9.

3. Disconnect the Real Time Clock (RTC) battery (A) from PJ1 and remove it from the computer.

4. Remove the two (M2x5 silver) screws (B) securing the floppy disk drive (C) to the base assembly (Figure 4-21).

5. Disconnect the FDD cable (D) from pressure plate connector PJ3 (E) on the system board (Figure 4-21).
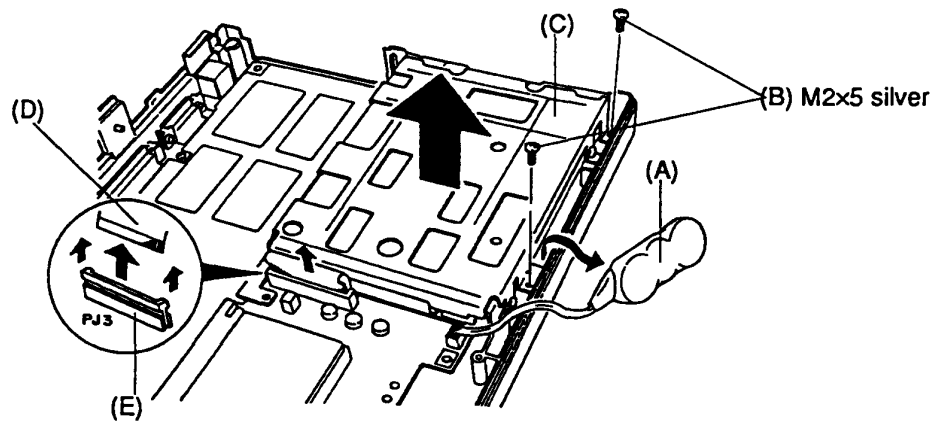
Figure 4-21   Removing the floppy disk drive

6. Lift the FDD out of the computer and set it aside.

7.   To remove the FDD bracket (F) from the FDD, remove the four (M2.5x4 brass) screws (G) securing the FDD to the bracket (Figure 4-22).
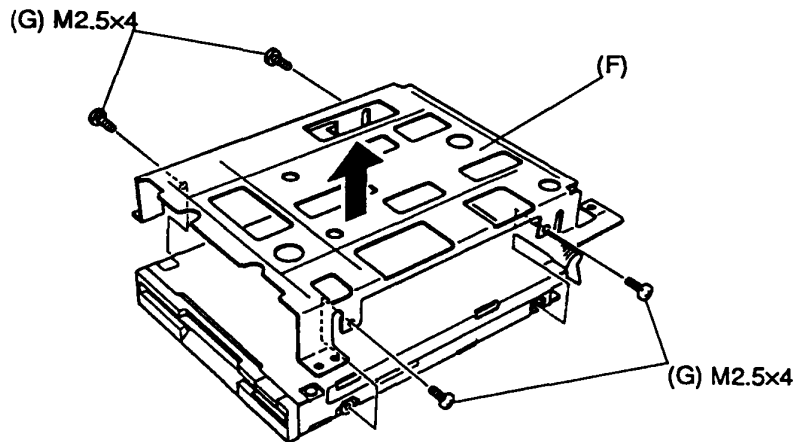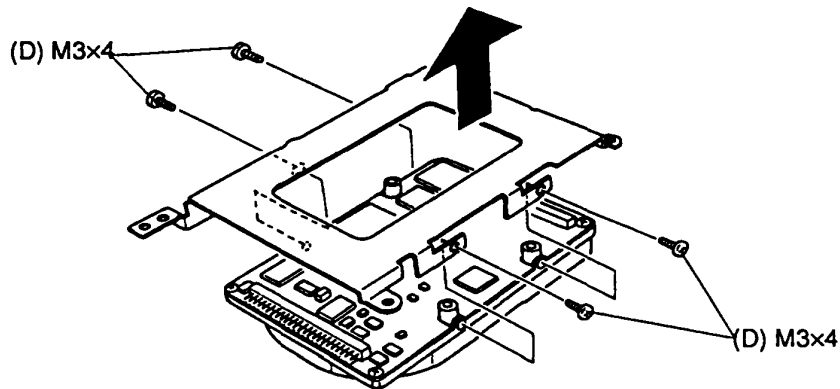

Figure 4-22 Removing the floppy disk drive bracket

8.   Separate the bracket from the drive.

Installing the Floppy Disk Drive

1.   To install the FDD bracket, align the FDD bracket with the four holes on the sides of the FDD (Figure 4-22).

2.   Install the four (M2.5x4 brass) screws to secure the FDD bracket to the FDD.

3.   Place the FDD and its bracket in the T4400SX. Connect the FDD cable to pressure plate connector PJ3 on the system board (Figure 4-21).

4.   Secure the FDD in place with the two (M2x5 silver) screws.

5.   Connect the RTC battery to PJ1 on the system board. Then place the RTC battery in front of the FDD.

4.11 Hard Disk Drive

Removing the Hard Disk Drive

1.   Turn off the power to the T4400SX and disconnect the AC adapter, power cord, and all external cables connected to the T4400SX.

2.   Remove the battery pack, optional memory card, keyboard, top cover, power supply board, and battery pack case as described in Sections 4.2, 4.3, 4.4, 4.6, 4.8, and 4.9.

3.   Remove the four (M2x5 silver) screws (A) securing the HDD bracket (B) to the bottom cover (Figure 4-23).

4.   Carefully lift the HDD and disconnect the HDD cable (C) from the HDD (Figure 4-23).

5.   Lift the HDD out of the computer.
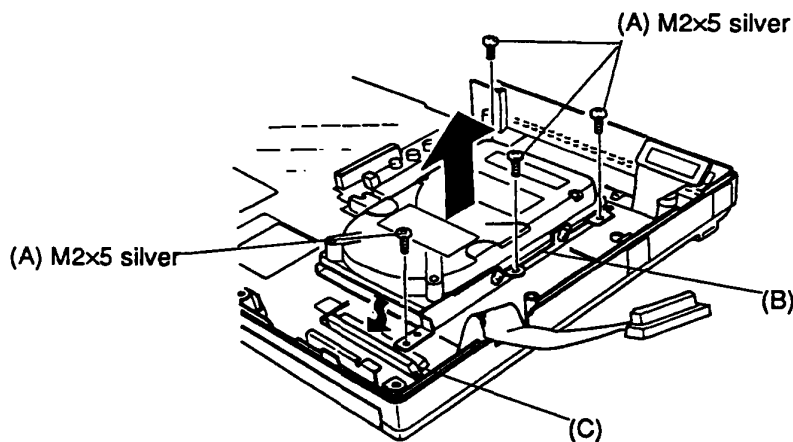
Figure 4-23 Removing the hard disk drive

6.   To remove the HDD bracket from the HDD, remove the four (M3x4) screws (D) securing the HDD to the bracket (Figure 4-24).

Figure 4-24 Removing the hard disk drive bracket

7.   Separate the bracket from the drive.

Installing the Hard Disk Drive

1.   To install the HDD bracket, align the bracket with the four holes on the sides of the HDD (Figure 4-24).

2.   Install the four (M3x4) screws to secure the HDD bracket to the HDD.

3.   Connect the HDD cable to the HDD. Then place the HDD and its bracket in the T4400SX (Figure 4-23).

4.   Secure the HDD in place with the four (M2x5 silver) screws.

4.12 System Board

Removing the System Board

1.   Turn off the power to the T4400SX and disconnect the AC adapter, power cord, and all external cables connected to the T4400SX.

2.   Remove the battery pack, optional memory card, keyboard, top cover, power supply board, battery pack case, floppy disk drive, and hard disk drive as described in Sections 4.2, 4.3, 4.4, 4.6, 4.7 4.9, 4.10, and 4.11.

3.   Remove the three (M2x5 silver) screws (A) securing the system board to the bottom cover (Figure 4-25).

4.   Gently lift the I/O connector panel to dislodge the system board from the three guide pins on the base assembly (Figure 4-25).

5.   Gently lift the system board (B) up and slide it toward the front of the computer to release the ports from the base assembly and lift the system board out of the computer.
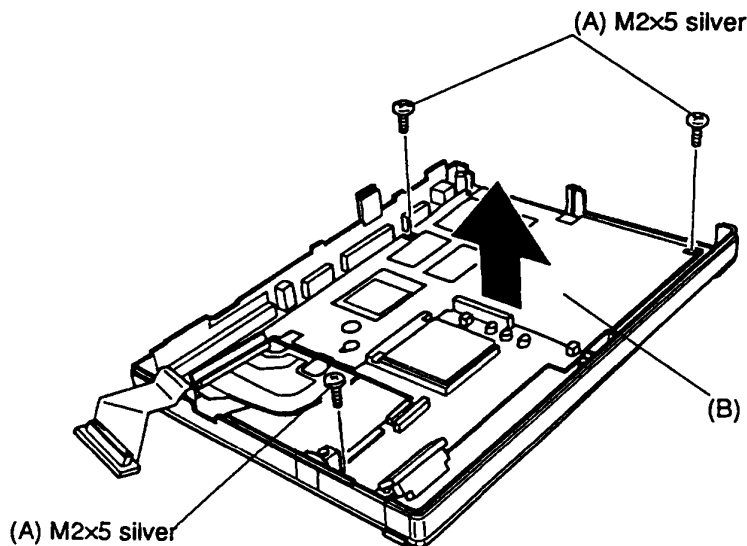

Figure 4-25 Removing the system board

6. Turn the system board over and disconnect the power supply board cable (C) from pressure plate connectors PJ26 (D) and PJ27 (E) and the hard disk cable (F) from pressure plate connectors PJ4 (G) and PJ5 (H) (Figure 4-26).
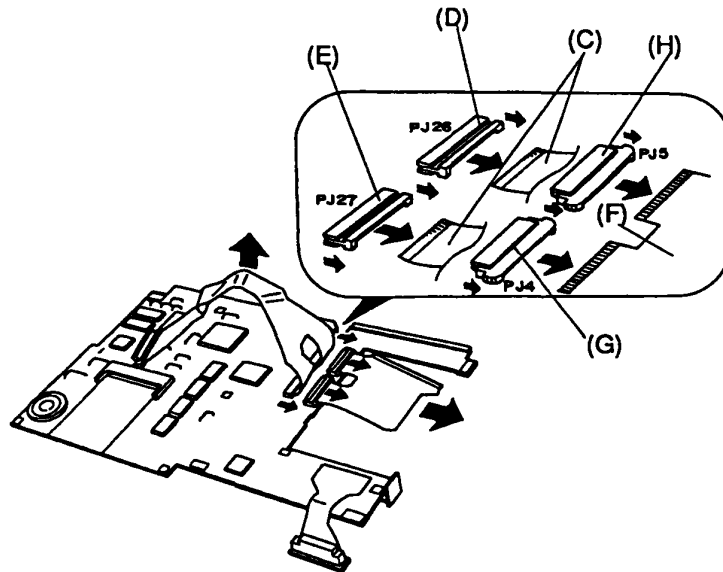

Figure 4-26 Disconnecting the power supply cable and HDD cable

Installing the System Board

1. Connect the hard disk drive cable to PJ4 and PJ5 on the bottom of the system board (Figure 4-26).

2. Connect the power supply cable to PJ26 and PJ27 on the bottom of the system board (Figure 4-26).

> *NOTE: Make sure the HDD and power supply cables are securely connected before proceeding. If they should become disconnected, the T4400SX would have to be completely disassembled to reconnect them.*

3. Place the system board in the T4400SX, making sure the power supply cable and HDD cable are not pinched. Align the system board with the three guide pins on the base assembly.

4. Secure the system board in place with the three (M2x5) screws (Figure 4-25).

4.13 Display Mask

Removing the Display Mask

1.   Turn off the power to the T4400SX and disconnect the AC adapter, power cord, and all external cables connected to the T4400SX.

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

3.   Open the display panel.

4.   Remove the two stick-on labels (A) from the display hinges and the two rubber cushions (B) from the top corners of the display panel to expose the four screws (C) securing the display mask (D) (Figure 4-27).

5.   Remove the four (M2x5 silver) screws (C) securing the display mask to the display cover.

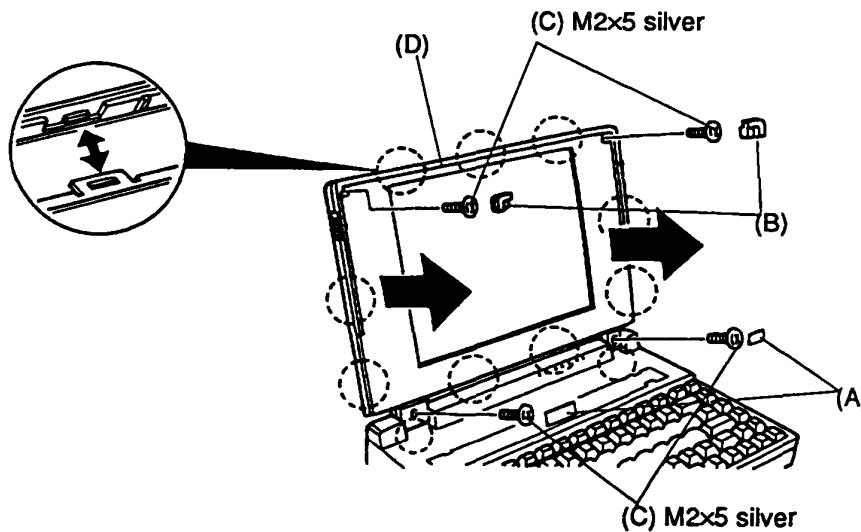6.   Unsnap the nine latches securing the display cover (Figure 4-27).

Figure 4-27 Removing the display mask screws

Installing the Display Mask

> *CAUTION: Route the cables in the lower right corner away from the hinge assembly before you install the display mask.*

1. Align the mask on the display panel, being careful not to damage the portion of the mask that covers the hinges.

2. Snap the nine latches on the mask in place. Check to make sure the seam between the front and the back of the display is evenly seated around the display (Figure 4-27).

3. Secure the mask in place with the four (M2x5 silver) screws and cover the screws with the rubber cushions at the top of the display and the stick-on labels at the bottom of the display.

4.14 Plasma Display

Removing the Plasma Display

1.   Turn off the power to the T4400SX and disconnect the AC adapter, power cord, and all external cables connected to the T4400SX.

2.   Remove the battery pack and display mask as described in Sections 4.2 and 4.12.

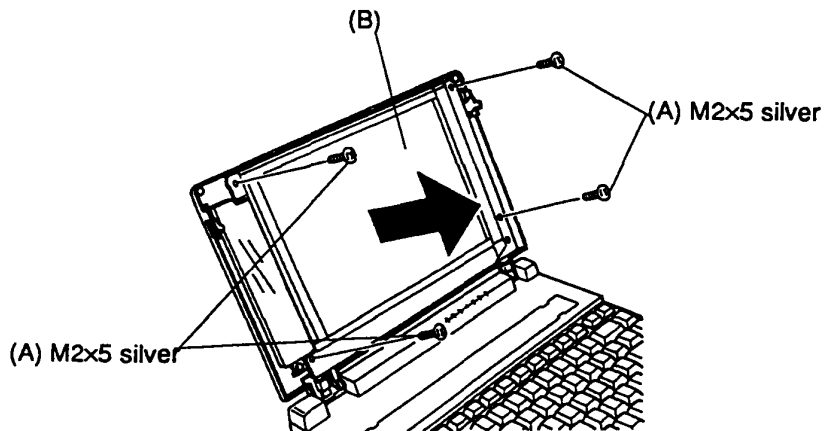3.   Remove the four (M2x5 silver) screws (A) securing the plasma display (B) (Figure 4-28).

Figure 4-28   Removing the plasma display screws

4.   Lay the plasma display panel on the keyboard and disconnect the three display cables (C) from J1A (D), J1B (E) and J21 (F) on the plasma display (Figure 4-29).
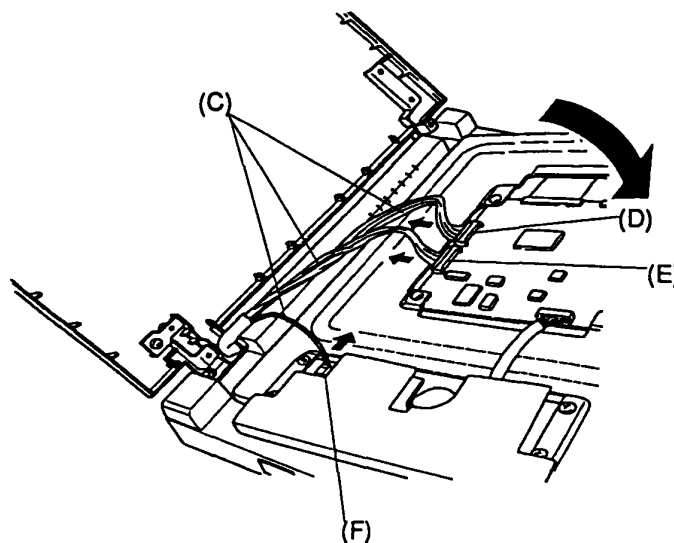
Figure 4-29   Disconnecting the display cables from the display panel

5.   To remove the rear display cover (G), remove the two (M2.5x6) screws (H) from the display support (I) (Figure 4-30).

Figure 4-30 Removing the display cover and screw
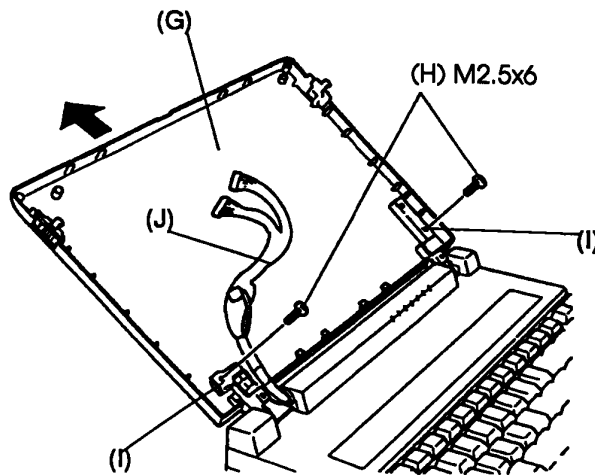
6.   To remove the display cables (J), the top cover and LED holder must also be removed. If you need to remove the display cables, remove the top cover and LED holder as instructed in Sections 4.6 and 4.7.

7.   Turn the top cover over and remove the (M2x4 silver) screw (K) securing the display cable cover (L) (Figure 4-31).
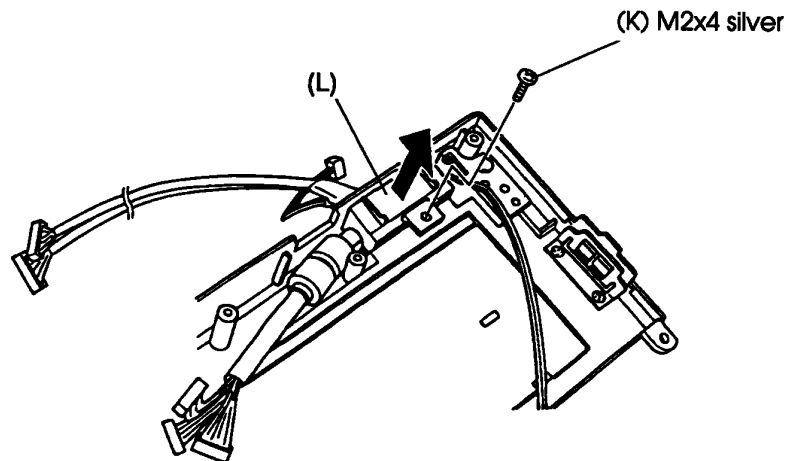
Figure 4-31 Removing the display cable cover

8. Slide the display cables (M) out of the top cover to remove them from the top cover (Figure 4-32).

Figure 4-32 Removing the display cables

9. To remove the display disable switch, remove the two (M2.5x4) screws (N) securing the switch to the top cover (O) (Figure 4-33).

Figure 4-33 Removing the left hinge cover screws

10. Remove the one (M2x8) screw (P) securing the display disable switch (Q) (Figure 4-34).
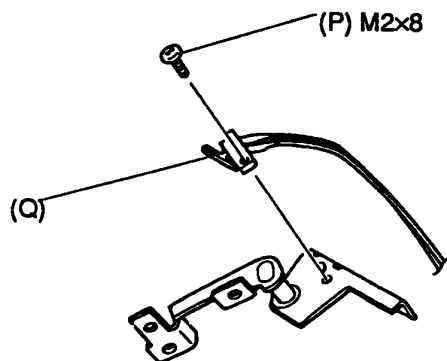
Figure 4-34 Removing the display disable switch

Installing the Plasma Display

1.   Place the display disable switch on the top cover and secure it with the one (M2x8) screw (Figure 4-34).

2.   Position the display disable switch in the top cover and secure it with the two (M2.5x4) screws (Figure 4-33).
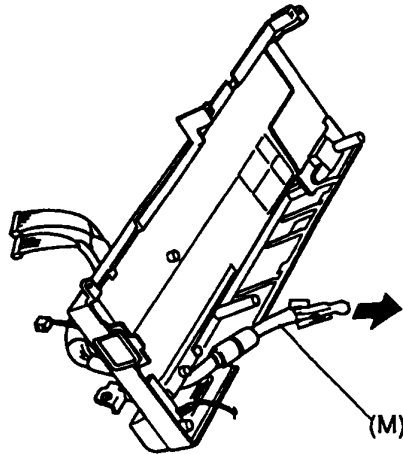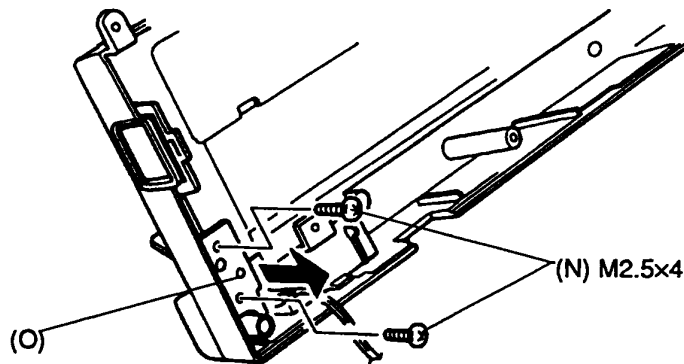
3.   Route the display cables through the top cover (Figure 4-32).

4.   Confirm that the display cable (A) is routed correctly in the top cover before securing the display cable cover in place with the (M2x4 silver) screw. The display cable should fit securely under the cover (Figures 4-35 and 4-31).
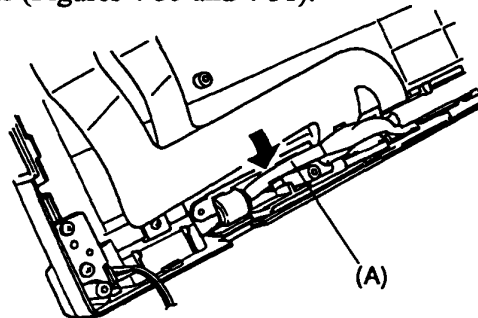
Figure 4-35 Routing the display cable in the top cover

5.   Install the LED holder as described in Section 4.6.

6.   Install the rear display cover of the plasma display. Secure it with the two (M2.5x6) screws to the display support (Figure 4-30).

7.   Make sure the display cable (B) is routed correctly between the hinge (C) and the display case (D) (Figure 4-36).
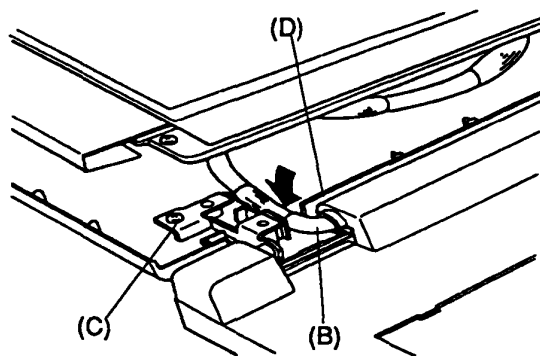
Figure 4-36 Routing the display cable

8.   Lay the plasma display face down on the keyboard and connect the three display cables to the plasma display (Figure 4-29).

9.   Align the plasma display and the display cables on the display cover of the plasma display and secure the display with the four (M2x5 silver) screws (Figure 4-28).

4.15 Liquid Crystal Display

Removing the Liquid Crystal Display

1. Turn off the power to the T4400SX and disconnect the AC adapter, power cord, and all external cables connected to the T4400SX.

2. Remove the battery pack and display mask as described in Sections 4.2 and 4.12.

3. Remove the two (M2x5 silver) screws (A) securing the FL inverter board (B).

4. Rotate the FL inverter board toward the LCD module and disconnect the cable (C) from CN2 (D) and disconnect the two cables (E) from CN1 (F) and CN3 (G) (Figure 4-37).
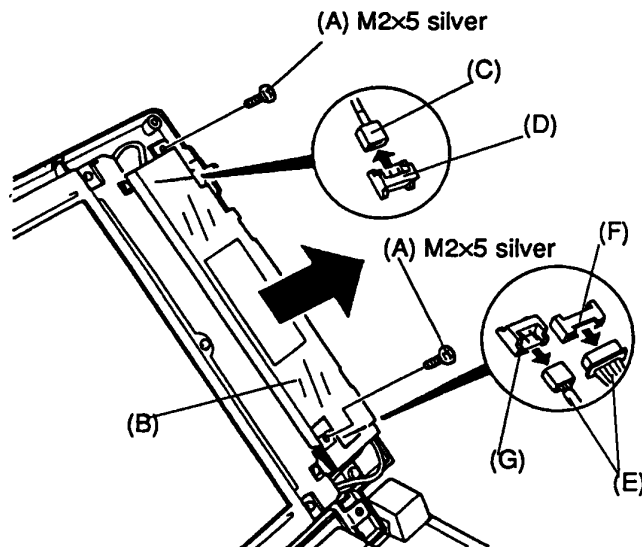
Figure 4-37 Removing the FL inverter board and disconnecting the display cables

5.   Remove the four (M2x5 silver) screws (H) securing the LCD module (I) to the LCD cover (Figure 4-38).
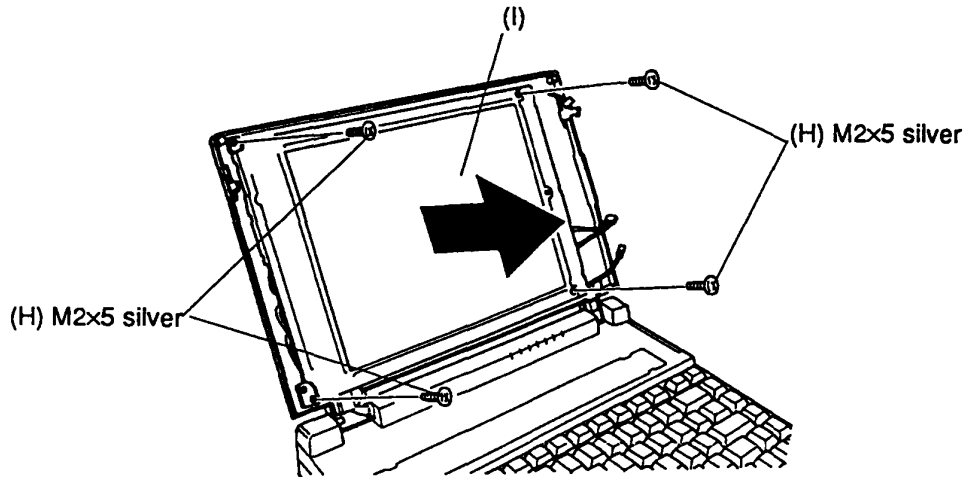
Figure 4-38   Removing the LCD from the back panel cover

6.   Rotate the LCD module out of the LCD cover (J) and disconnect the LCD cables (K) from CN1 (L), CN2 (M), and CN3 (N) (Figure 4-39).
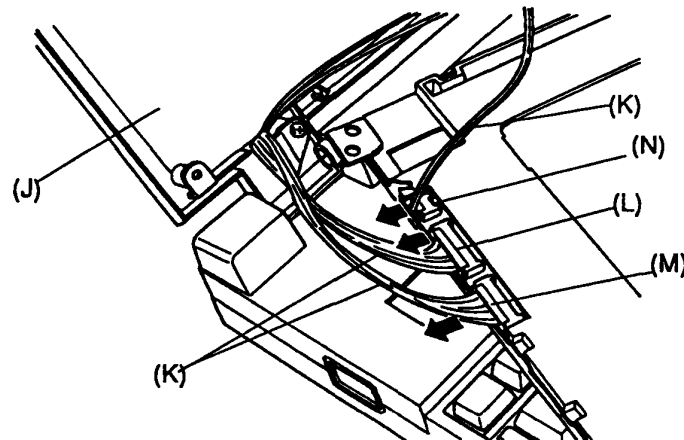
Figure 4-39   Disconnecting the LCD cables

Installing the Liquid Crystal Display

1.   Connect the LCD cables to CN1, CN2, and CN3 on the LCD module (Figure 4-39).

2.   Route the FL inverter board power cable along the bottom of the LCD module and between the two lower right screw posts.

3.   Place the LCD module in the LCD cover.

4.   Install the four (M2x5 silver) screws to secure the LCD module to the LCD cover (Figure 4-38).

5.   Turn the FL inverter board so that the back is facing you and then connect the three FL inverter cables to CN1, CN2, and CN3 on the FL inverter board (Figure 4-39).

6.   Rotate the FL inverter board to the right and place it into the LCD cover. Make sure the volume knobs pass through the openings in the LCD cover. Then align the bottom of the FL inverter board with the guide pin on the LCD cover.

7.   Install the two (M2x5 silver) screws to secure the FL inverter board to the LCD cover (Figure 4-37).

CAUTION: *Route the cables in the lower right corner away from the hinge assembly before you install the display mask.*

4.16 BIOS ROM

Removing the BIOS ROM

1. Make sure the display is closed and then turn the T4400SX upside down.

2. Remove the single (M2x4 silver) screw (A) (Figure 4-40).

3. Remove the BIOS ROM cover (B) to expose the BIOS ROM (Figure 4-40).
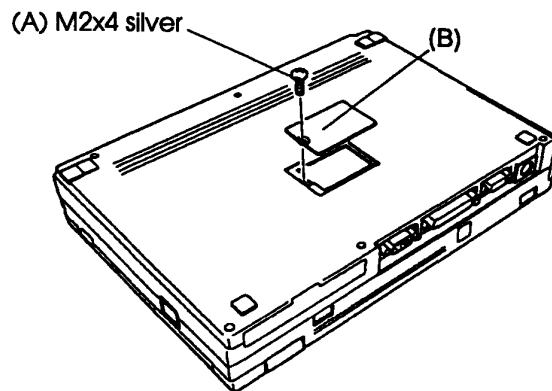
Figure 4-40 Removing the BIOS ROM cover

4. Slide the BIOS ROM plate (C) toward the notch on the BIOS ROM (D) until it clicks. Then lift the plate up from the system board (Figure 4-41).
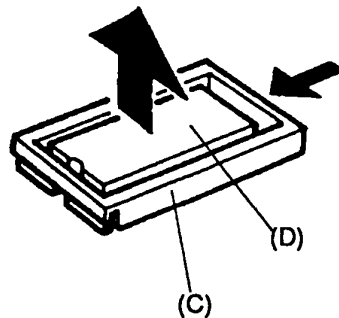
Figure 4-41 Removing the BIOS ROM plate

5.   Remove the BIOS ROM from the BIOS ROM socket (Figure 4-42).
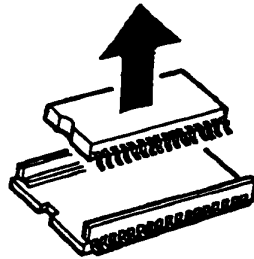
Figure 4-42 Removing the BIOS ROM

Installing the BIOS ROM

1.   Align the BIOS ROM (A) with the BIOS ROM socket (B).

NOTE: The notch (C) on the left side of the BIOS ROM and the notch (D) on the BIOS ROM socket should face in the same direction. These notches indicate the correct position of the BIOS ROM.
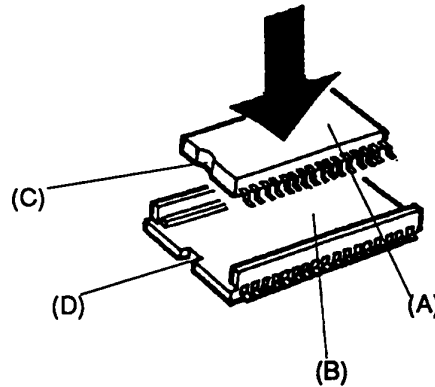
Figure 4-43 Aligning the BIOS ROM

2.   Align the left edge of the plate and socket. Firmly press down on the plate until it is seated (Figure 4-44).
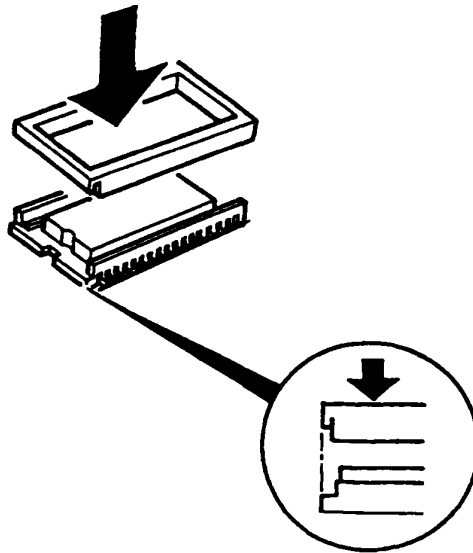
Figure 4-44 Aligning the plate

3.   Place the BIOS ROM cover onto the bottom cover and secure it with the single (M2x4 silver) screw (Figure 4-40).

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Appendix A System Board Layout

A.1   System Board FY4SYx (ICs)
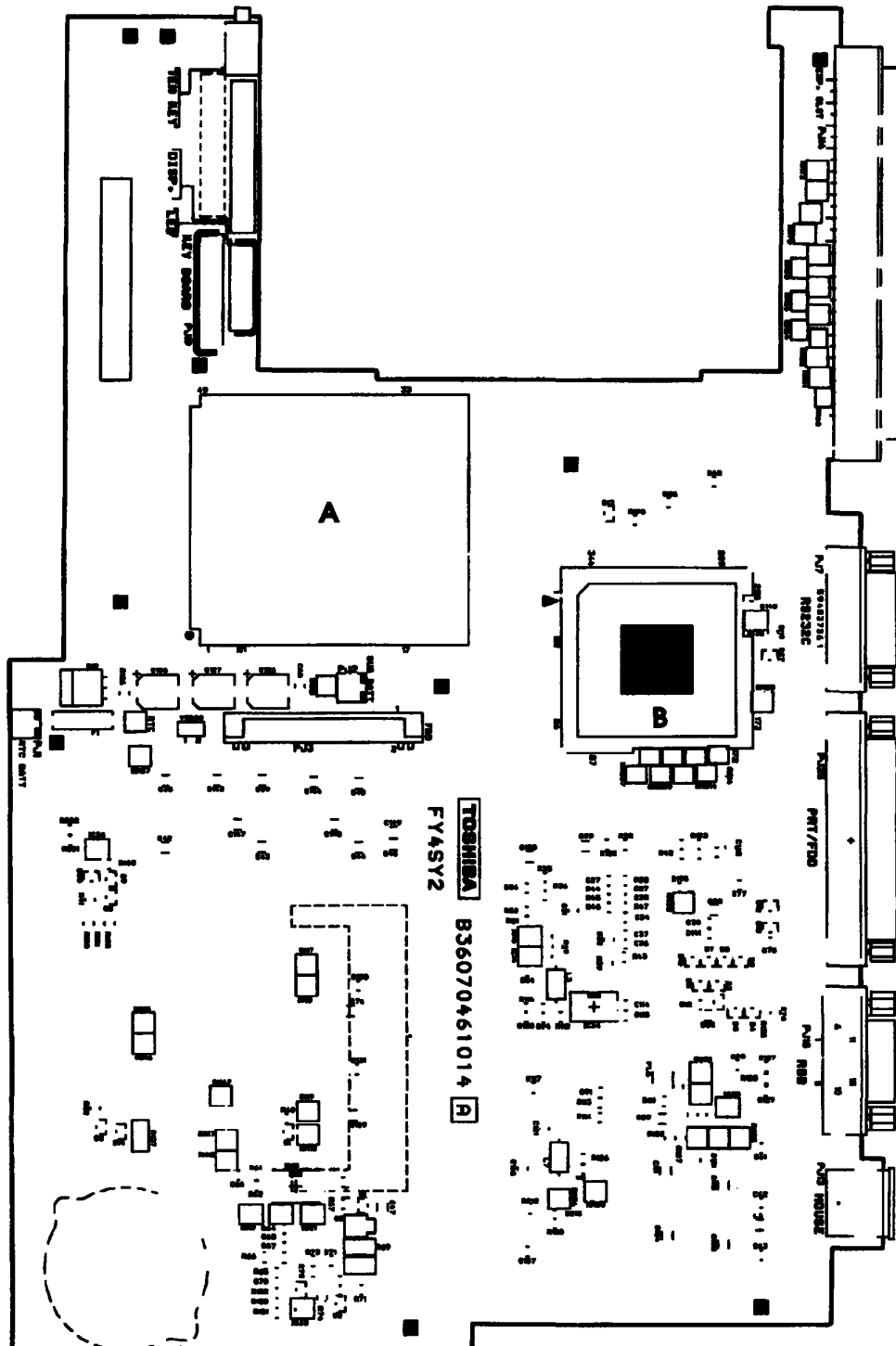
Figure A-1 System board FY4SYx (ICs) (front)
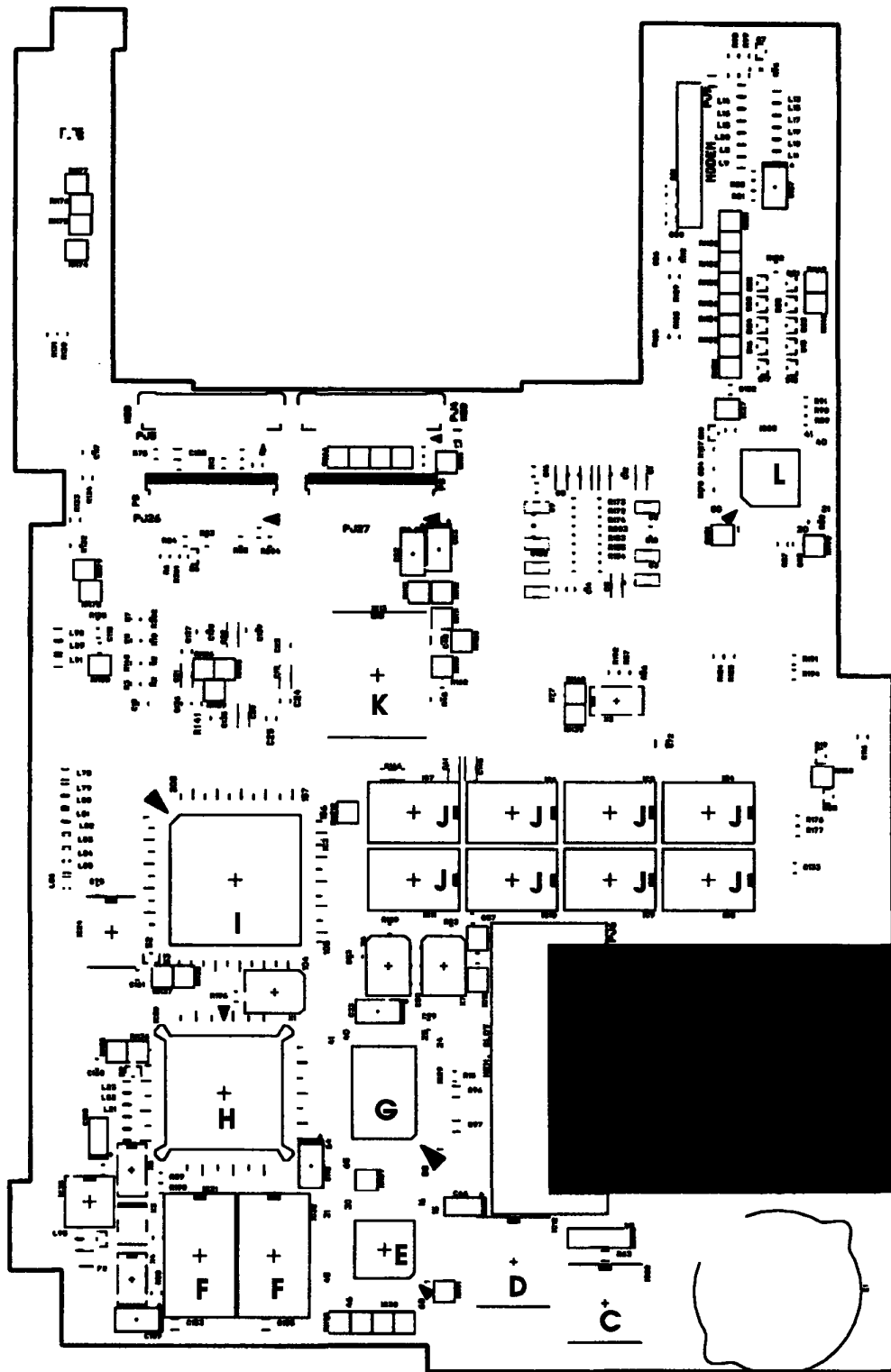
Figure A-2 System board FY4SYx (ICs) (back)

Table A-1 ICs on the system board FY4SYx

Callout	Number	Name
(A)	IC1	CPU 80486SX
(B)	IC2	System Controller Gate Array
(C)	IC22	RTC
(D)	IC12	Backup RAM
(E)	IC30	Color Gray Scale Controller
(F)	IC31, IC32	Video RAM
(G)	IC29	Digital Analog Converter
(H)	IC28	PVGA1F
(I)	IC3	Super Integration T9901
(J)	IC4, IC5, IC6, IC7 IC8, IC9, IC10, IC11	System Memory
(K)	IC31	BIOS ROM
(L)	IC25	Keyboard Controller

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A.2 System Board FY4SYx (Connectors)
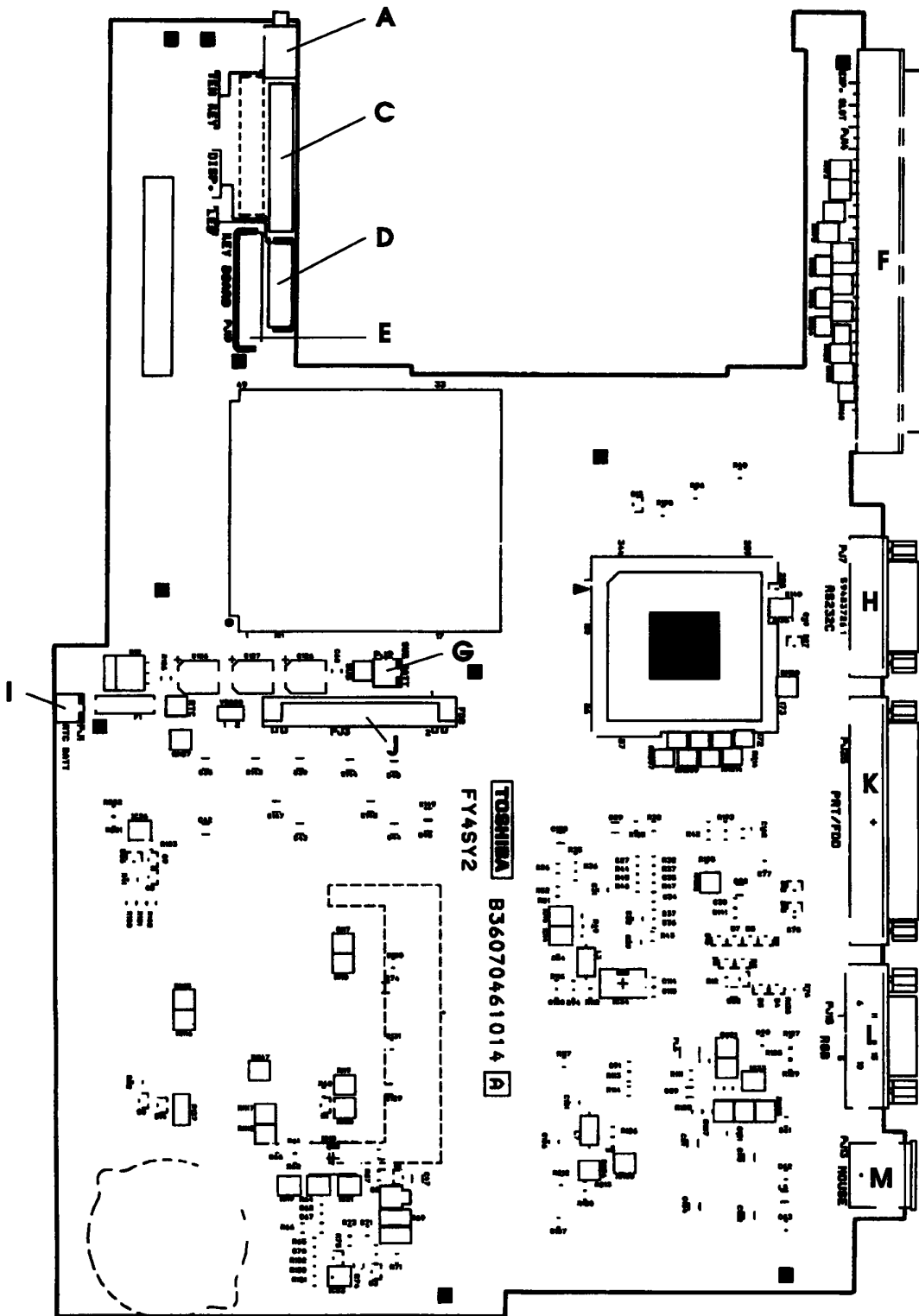
Figure A-3 System board FY4SYx (connectors) (front)
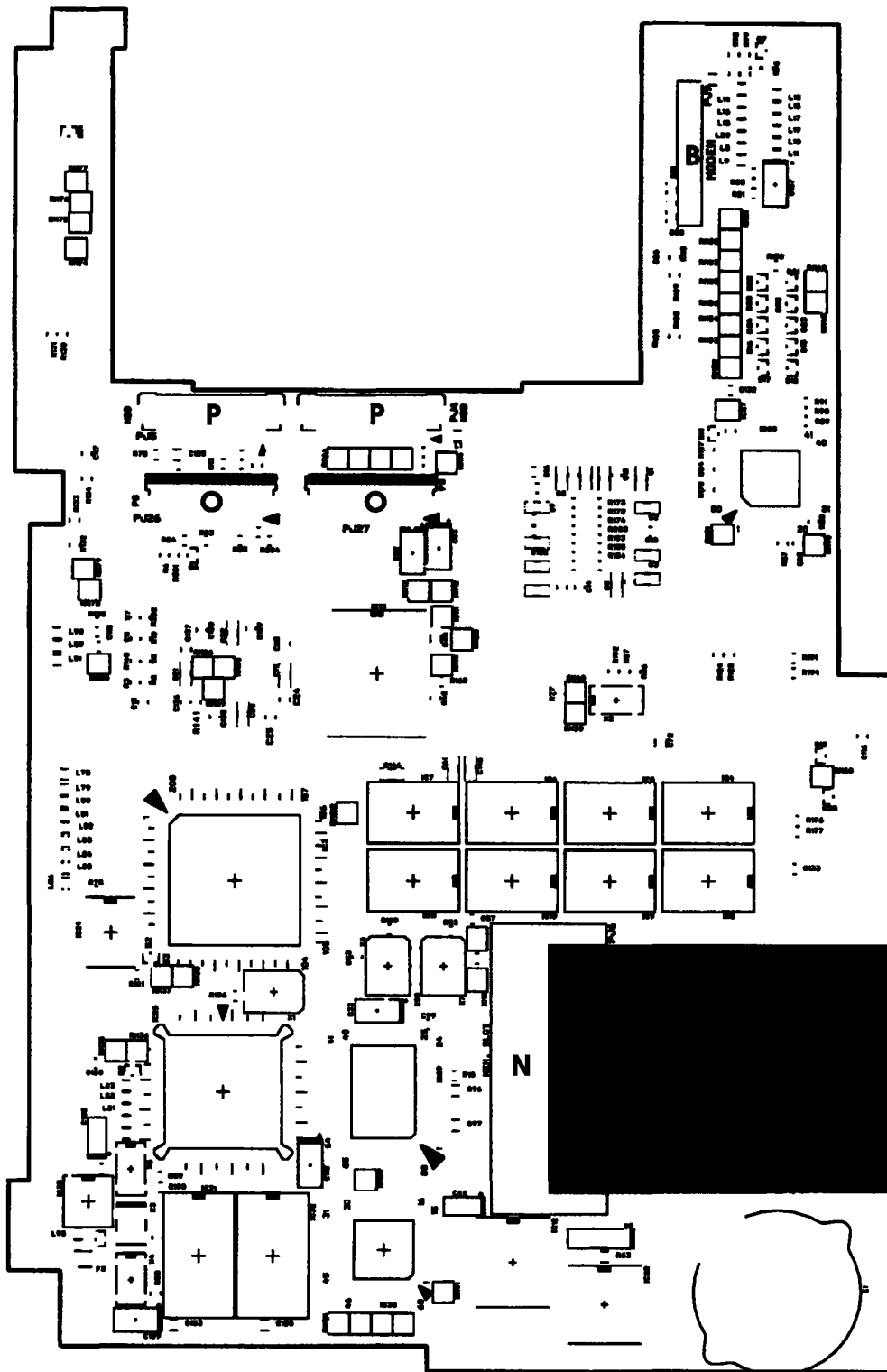
Figure A-4 System board FY4SYx (connectors) (back)

Table A-2 Connectors on the system board FY4SYx

Callout	Number	Name
(A)	PJ12	Tenkey Pad Connector
(B)	PJ9	Built-in Modem Connector
(C)	PJ17	Display Connector
(D)	PJ15	LED Connector
(E)	PJ19	Keyboard Connector
(F)	PJ14	Expansion Connector
(G)	PJ2	Sub Battery Connector
(H)	PJ7	RS-232C Connector
(I)	PJ1	RTC Battery Connector
(J)	PJ3	FDD Connector
(K)	PJ25	PRT/FDD Connector
(L)	PJ18	CRT I/F (RGB) Connector
(M)	PJ13	PS/2 Mouse Connector
(N)	PJ6	Expansion Memory Connector
(O)	PJ26, PJ27	Power Supply Connectors
(P)	PJ4, PJ5	HDD Connectors

Figure A-5 System board FY4SYx (OSCs) (back)

Appendix B Pin Assignments

B.1   PJ1 RTC Connector

Table B-1 RTC connector pin assignment (2-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	S10.1		02	GND	

B.2   PJ2 PS I/F Connector

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

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

B.3   PJ3 FDD (Int) Connector

Table B-3 FDD (Int) connector pin assignment (26-pin)

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

B.4   PJ4 HDD I/F Connector

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

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

B.5   PJ5 HDD I/F Connector

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

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

B.6 PJ6 Memory Slot Connector

Table B-6 Memory slot connector pin assignment (88-pin)

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

B.7 PJ7 Serial I/F Connector

Table B-7 Serial I/F connector pin assignment (9-pin)

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

B.8 PJ9 B-Modem I/F Connector

Table B-8 B-modem I/F connector pin assignment (30-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	N9V	O	16	GND	
02	BMDMSL;000	O	17	SD02;103	I/O
03	$14R7M;120	O	18	SD01;103	I/O
04	GND		19	GND	
05	SA00;103	O	20	GND	
06	SA01;103	O	21	SD00;103	I/O
07	SA02;103	O	22	IOWR;003	O
08	GND		23	IORD;103	O
09	SD07;103	I/O	24	VCC	
10	SD06;103	I/O	25	RESET;110	O
11	GND		26	BMPOF;100	O
12	GND		27	VCC	
13	SD05;103	I/O	28	VCC	
14	SD04;103	I/O	29	BMIRQ;000	I
15	SD03;103	I/O	30	BSPTON;000	I

B.9 PJ12 Numeric Keypad Connector

Table B-9 Numeric keypad connector pin assignment (3-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	GND		03	N/C	—
02	TENKEY;100	I/O	—	—	—

B.10 PJ13 PS/2 Mouse Connector

Table B-10 PS/2 mouse connector pin assignment (6-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	MOUSED;110	I/O	04	MUSED;100	I/O
02	N/C		05	MUSECK;110	I/O
03	GND		06	N/C	

B.11 PJ14 Expansion Connector

Table B-11 Expansion connector pin assignment (150-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	DCIN	O	49	SD07;101	I/O
02	DCIN	O	50	SMEW;001	O
03	DCIN	O	51	SMER;001	O
04	DCIN	O	52	GND	
05	CURENT	O	53	IOWR;001	I/O
06	CURENT	O	54	IORD;001	I/O
07	CURENT	O	55	TC;101	O
08	CURENT	O	56	BALE;101	O
09	ADPCN;100	O	57	RESET;101	O
10	GND		58	DACK1;001	O
11	RVCC		59	IRQ9;101	I
12	RGND		60	GND	
13	CPCNF;100	I	61	N/C	
14	MDMSL;001	O	62	IOCLK;110	O
15	COMCCK;101	O	63	IRQ5;101	I
16	MIRQ;001	I	64	DRQ3;101	I
17	SPKTON;001	I	65	DACK3;001	O
18	GND		66	AEN;101	O
19	SA00;101	I/O	67	DRQ1;101	I
20	SA01;101	I/O	68	IOCRDY;101	I
21	SA02;101	I/O	69	GND	
22	SA03;101	I/O	70	IRQ10;101	I
23	SA04;101	I/O	71	IRQ14;101	I
24	SA05;101	I/O	72	SD08;101	I/O
25	SA06;101	I/O	73	SD09;101	I/O
26	SA07;101	I/O	74	IRQ11;101	I
27	GND		75	SD10;101	I/O
28	SA08;101	I/O	76	SD11;101	I/O
29	SA09;101	I/O	77	SD12;101	I/O
30	SA10;101	I/O	78	IRQ12;101	I
31	SA11;101	I/O	79	GND	
32	SA12;101	I/O	80	SD13;101	I/O
33	SA13;101	I/O	81	SD14;101	I/O
34	SA14;101	I/O	82	IRQ6;101	I
35	SA15;101	I/O	83	SD15;101	I/O
36	GND		84	LA22;101	I/O
37	SA16;101	I/O	85	LA23;101	I/O
38	SA17;101	O	86	DRQ2;101	I
39	SA18;101	O	87	LA21;101	I/O
40	SA19;101	O	88	LA19;101	I/O
41	SD00;101	I/O	89	LA20;101	I/O
42	SD01;101	I/O	90	DACK6;001	O
43	SD02;101	I/O	91	GND	
44	SD03;101	I/O	92	REFMD;001	I/O
45	GND		93	LA18;101	I/O
46	SD04;101	I/O	94	MASTER;001	I
47	SD05;101	I/O	95	LA17;101	I/O
48	SD06;101	O	96	SBHE;001	I/O

Table B-11 Expansion connector pin assignment (150-pin) (continued)

Pin	Signal	I/O	Pin	Signal	I/O
97	IOCHCK;001	I	124	PDB00;110	I/O
98	MMCS16;001	I	125	PDB01;110	I/O
99	GND		126	PDB02;110	I/O
100	IOCS16;001	I	127	PDB03;110	I/O
101	DACK2;001	O	128	PDB04;110	I/O
102	DRQ6;101	I	129	PDB05;110	I/O
103	DRQ5;101	I	130	PDB06;110	I/O
104	DACK5;001	O	131	PDB07;110	I/O
105	MERD;001	I/O	132	ACK;000	I/O
106	IRQ4;101	I	133	BUSY;100	I/O
107	MEWR;001	I/O	134	PE;100	I/O
108	IRQ7;101	I	135	SELCT;100	I/O
109	GND		136	AUTFD;000	I/O
110	RED;101	O	137	ERROR;000	I/O
111	LGREN;101	O	138	PINT;000	I/O
112	BLUE;101	O	139	SLIN;000	I/O
113	GND		140	GND	
114	PHYSYNC;100	O	141	SD1;000	O
115	PVSYNC;100	O	142	DTR1;100	O
116	GND		143	RTS1;100	O
117	EKBDAT;100	I/O	144	DCD1;100	I
118	EKBCLK;100	O	145	RD1;000	I
119	TENKEY;100	I/O	146	DSR1;100	I
120	MUSED;100	I/O	147	CTS1;100	I
121	MSECK;100	I/O	148	RI1;100	I
122	GND		149	GND	
123	STROB;000	I/O	150	GND	

B.12 PJ15 LED Connector

Table B-12 LED connector pin assignment (12-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	CHG;110	O	07	CAPLED;110	O
02	LB;110	O	08	POWER;100	O
03	HDDLED;100	O	09	SPEED;100	O
04	ALED;100	O	10	PNLOFF;000	I
05	OVERLED;110	O	11	GND	—
06	NUMLED;110	O	12	GND	—

B.13 PJ17 LCD Connector

Table B-13   LCD connector pin assignment (32-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	GND		17	GND	
02	PLTR0;101	O	18	PLTB2;101	O
03	GND		19	GND	
04	PLTR1;101	O	20	DFLTCK;101	O
05	GND		21	DFP;101	O
06	PLTR1;101	O	22	DLP;101	O
07	GND		23	BANCNT;100	O
08	PLTG0;101	O	24	DENAB;101	O
09	GND		25	PNEL1;100	I
10	PLTG1;101	O	26	PNEL0;100	I
11	GND		27	FLTEN;110	O
12	PLTG2;101	O	28	FLTEN;110	O
13	GND		29	CBLON;000	O
14	PLTB0;101	O	30	FLTEN;110	O
15	GND		31	GND	
16	PLTB1;101	O	32	DSPV	O

B.14 PJ18 CRT I/F Connector

Table B-14   CRT I/F connector pin assignment (15-pin)

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

B.15 PJ19 KB I/F Connector

Table B-15   KB I/F connector pin assignment (19-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	KBOT00;010	O	11	KBOT03;010	O
02	KBRT6;100	I	12	KBOT04;010	O
03	KBRT0;100	I	13	KBOT05;010	O
04	KBRT2;100	I	14	KBOT06;010	O
05	KBRT3;100	I	15	KBOT08;010	O
06	KBRT5;100	I	16	KBOT02;010	O
07	KBRT1;100	I	17	KBOT07;010	O
08	KBRT5;100	I	18	KBOT09;010	O
09	KBRT4;100	I	19	KBOT10;010	O
10	KBOT01;010	O	—	—	—

B.16 PJ25 PRT/FDD (Ext) Connector

Table B-16 PRT/FDD (Ext) connector pin assignment (25-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	STROB;000	I/O	14	AUTFD;000	I/O
02	PDB00;100	I/O	15	ERROR;000	I/O
03	PD01;100	I/O	16	PINT;000	I/O
04	PD02;100	I/O	17	SLIN;000	I/O
05	PD03;100	I/O	18	GND	
06	PD04;100	I/O	19	GND	
07	PD05;100	I/O	20	GND	
08	PD06;100	I/O	21	GND	
09	PD07;100	I/O	22	GND	
10	ACK;000	I/O	23	GND	
11	BUSY;100	I/O	24	GND	
12	PE;100	I/O	25	GND	
13	SELCT;100	I/O	—	—	—

B.17 PJ26 PS I/F Connector

Table B-17 PS I/F connector pin assignment (20-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	N/C		11	CBLON;000	I
02	PAATA;000	O	12	THERM	
03	SRBTN;000	I	13	GND	
04	PCLR;000	I	14	SUBBAT	I
05	BEEP;000	I	15	GND	
06	CPCNF;100	O	16	DCIN	O
07	PNLOFF;011	O	17	DCIN	O
08	PSRD;100	O	18	GND	
09	PSSD;100	I	19	CURENT	O
10	ADPCNT;100	I	20	CURENT	O

B.18 PJ27 PS I/F Connector

Table B-18 PS I/F connector pin assignment (20-pin)

Pin	Signal	I/O	Pin	Signal	I/O
01	GND		11	P12V	I
02	RAMV		12	DSPV	I
03	RAMV		13	DSPV	I
04	GND		14	GND	
05	VCC		15	BRNCNT;100	I
06	VCC		16	CHG;100	I
07	VCC		17	LB;100	I
08	VCC		18	GND	
09	GND		19	N/C	
10	N9V		20	N/C	

Appendix C ASCII Character Codes

Table C-1 ASCII character codes

HEXA-DECIMAL VALUE	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	BLANK (NULL)	▶	BLANK (SPACE)	0	@	P	`	p	Ç	É	á	‖‖‖	└	┴	α	Ξ
1	☺	◄	↕	!	1	A	Q	a	q	ü	æ	í	‖‖‖	┬	┬	β	±
2	☻	↕	"	2	B	R	b	r	é	Æ	ó	▓			Γ	≥
3	♥	‼	#	3	C	S	c	s	â	ô	ú		├	┴	π	≤
4	♦	¶	$	4	D	T	d	t	ä	ö	ñ	┤		┘	Σ	⌠
5	♣	§	%	5	E	U	e	u	à	ò	Ñ	╡	┼	┌	σ	⌡
6	♠	▬	&	6	F	V	f	v	å	û	ª	╢		┌	µ	÷
7	●	↨	'	7	G	W	g	w	ç	ù	º	┐	┼		ϒ	≈
8	◘	↑	(	8	H	X	h	x	ê	ÿ	¿	╕	└		Φ	°
9	○	↓	)	9	I	Y	i	y	ë	Ö	⌐	┐	├	┌	Θ	∙
A	◎	→	*	:	J	Z	j	z	è	Ü	¬	┐	┴	┐	Ω	▬
B	♂	←	+	;	K	[	k	{	ï	¢	½			■	δ	√
C	♀	└	,	<	L	\	l	|	î	£	¼	╛	┬	■	φ	ⁿ
D	♪	↔	-	=	M	]	m	}	ì	¥	¡	┘		■	φ	²
E	♫	▲	.	>	N	^	n	~	Ä	₧	«	╣	┼	■	∈	■
F	☼	▼	/	?	O	_	o	⌂	Å	ƒ	»	┐		■	∩	BLANK FF

App-22

Appendix D Keyboard Scan/Character Codes

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

Cap No.	Keytop	Code set 1		Code set 2		Note
		Make	Break	Make	Break	
01	` ~	29	A9	0E	F0 0E	
02	1 !	02	82	16	F0 16	
03	2 @	03	83	1E	F0 1E	
04	3 #	04	84	26	F0 26	
05	4 $	05	85	25	F0 25	
06	5 %	06	86	2E	F0 2E	
07	6 ^	07	87	36	F0 36	
08	7 &	08	88	3D	F0 3D	*2
09	8 *	09	89	3E	F0 3E	*2
10	9 (	0A	8A	46	F0 46	*2
11	0)	0B	8B	45	F0 45	
12	- _	0C	8C	4E	F0 4E	
13	= +	0D	8D	55	F0 55	
15	BkSp	0E	8E	66	F0 66	
16	Tab	0F	8F	0D	F0 0D	
17	Q	10	90	15	F0 15	
18	W	11	91	1D	F0 1D	
19	E	12	92	24	F0 24	
20	R	13	93	2D	F0 2D	
21	T	14	94	2C	F0 2C	
22	Y	15	95	35	F0 35	
23	U	16	96	3C	F0 3C	*2
24	I	17	97	43	F0 43	*2
25	O	18	98	44	F0 44	*2
26	P	19	99	4D	F0 4D	*2
27	[{	1A	9A	54	F0 54	
28	] }	1B	9B	5B	F0 5B	
29 (42)	\		2B	AB	5D	F0 5D	*5
30	Caps Lock	3A	BA	58	F0 58	
31	A	1E	9E	1C	F0 1C	
32	S	1F	9F	1B	F0 1B	
33	D	20	A0	23	F0 23	
34	F	21	A1	2B	F0 2B	
35	G	22	A2	34	F0 34	
36	H	23	A3	33	F0 33	
37	J	24	A4	3B	F0 3B	*2
38	K	25	A5	42	F0 42	*2
39	L	26	A6	4B	F0 4B	*2
40	; :	27	A7	4C	F0 4C	*2
41	' "	28	A8	52	F0 52	
43	Enter	1C	9C	5A	F0 5A	

Table D-1 Scan codes (set 1 and 2) (continued)

Cap No.	Keytop	Code set 1 Make	Code set 1 Break	Code set 2 Make	Code set 2 Break	Note
44	Shift (L)	2A	AA	12	F0 12	
45	No. 102 key	56	D6	61	F0 61	
46	Z	2C	AC	1A	F0 1A	
47	X	2D	AD	22	F0 22	
48	C	2E	AE	21	F0 21	
49	V	2F	AF	2A	F0 2A	
50	B	30	B0	32	F0 32	
51	N	31	B1	31	F0 31	
52	M	32	B2	3A	F0 3A	*2
53	, <	33	B3	41	F0 41	*2
54	. >	34	B4	49	F0 49	*2
55	/ ?	35	B5	4A	F0 4A	*2
57	Shift (R)	36	B6	59	F0 59	
58	Ctrl	1D	9D	14	F0 14	*3
60	Alt (L)	38	B8	11	F0 11	*3
61	Space	39	B9	29	F0 29	
62	Alt (R)	E0 38	E0 B8	E0 11	E0 F0 11	
75	Ins	E0 52	E0 D2	E0 70	E0 F0 70	*1
76	Del	E0 53	E0 D3	E0 71	E0 F0 71	*1
79		E0 4B	E0 CB	E0 6B	E0 F0 6B	*1
80	Home	E0 47	E0 C7	E0 6C	E0 F0 6C	*1
81	End	E0 4F	E0 CF	E0 69	E0 F0 69	*1
83		E0 48	E0 C8	E0 75	E0 F0 75	*1
84		E0 50	E0 D0	E0 72	E0 F0 72	*1
85	PgUp	E0 49	E0 C9	E0 7D	E0 F0 7D	*1
86	PgDn	E0 51	E0 D1	E0 7A	E0 F0 7A	*1
89		E0 4D	E0 CD	E0 74	E0 F0 74	*1
110	Esc	01	81	76	F0 76	
112	F1	3B	3B	05	F0 05	

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

NOTES:

*1   Scan codes differ by mode.

*2   Scan codes differ by overlay function.

*3   Combination with **Fn** key makes different codes.

*4   **Fn** key does not generate a code by itself.

*5   This key corresponds to key No. 42 in the 102-key mode.

*6   Refer to Table D-6 Scan codes with **Ctrl** key.

*7   Refer to Table D-7 Scan codes with **Alt** key.

Table D-2 Scan codes with **Shift** key

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

NOTE: The table above shows the scan codes using the left **Shift** key. In case of a combination with the right **Shift** key, the scan codes will change as indicated below:

	With left **Shift**	With right **Shift**
Set 1	E0 AA	E0 B6
	E0 2A	E0 36
Set 2	E0 F0 12	E0 F0 59
	E0 12	E0 59

Table D-3 Scan codes in NumLock mode

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

Table D-4 Scan codes with Fn key

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

Table D-5 Scan codes with overlay mode

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

Table D-6 Scan codes with Ctrl key

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

Table D-7 Scan codes with Alt key

Key Top	Shift	Code set 1	Code set 2
		Make	Make
Pause	Common	E1 1D 45 E1 SD C5	E1 14 77 E1 F0 14 F0 77
	Ctrl*	E0 46 E0 C6	E0 7E E0 F0 7E

* This key generates only make codes.

Appendix E Keyboard Layouts

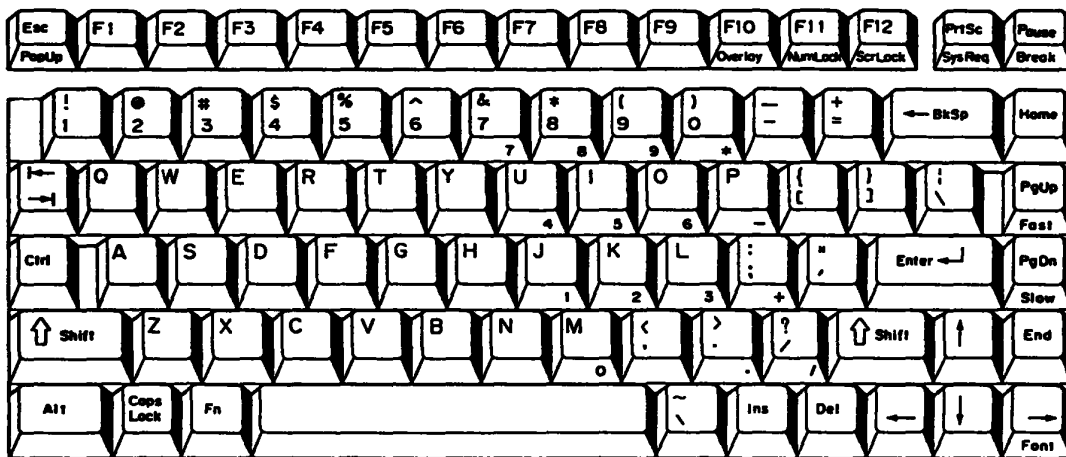## E.1   U.S.A. Keyboard

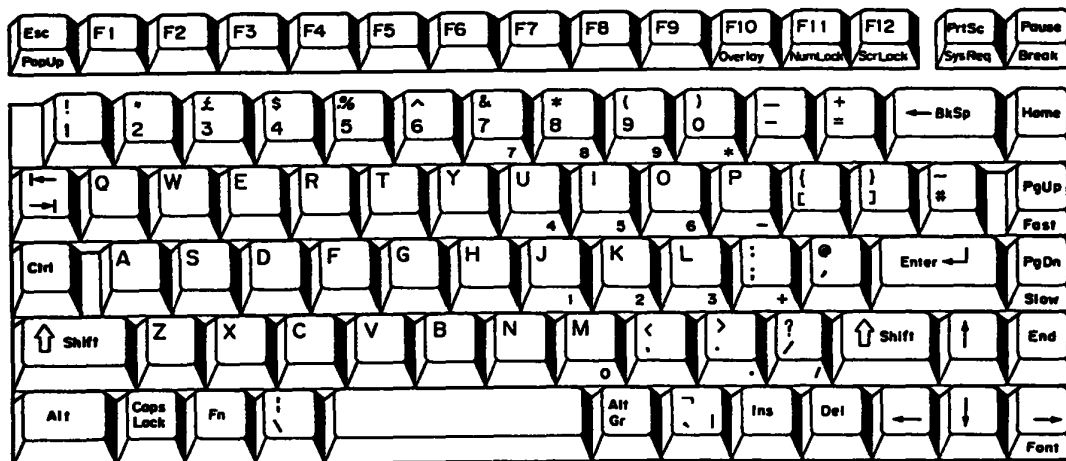*Figure E-1   U.S.A. keyboard*

E.2   U.K. Keyboard

Figure E-2   U.K. keyboard

E.3   German Keyboard
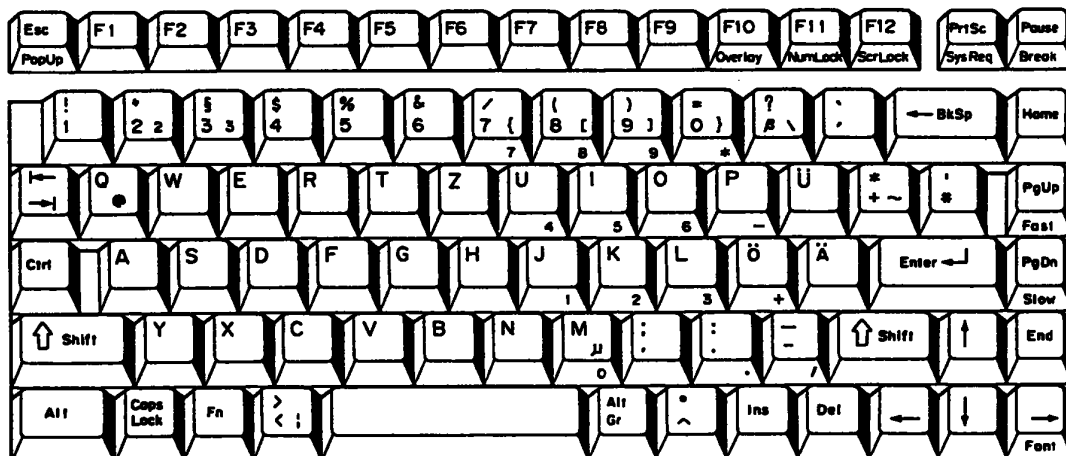

Figure E-3   German keyboard

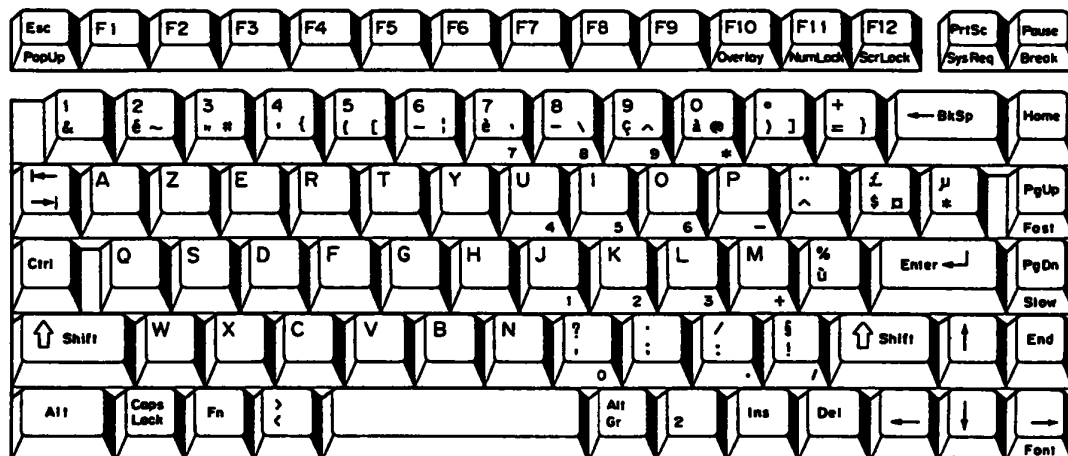## E.4   French Keyboard

Figure E-4   French keyboard

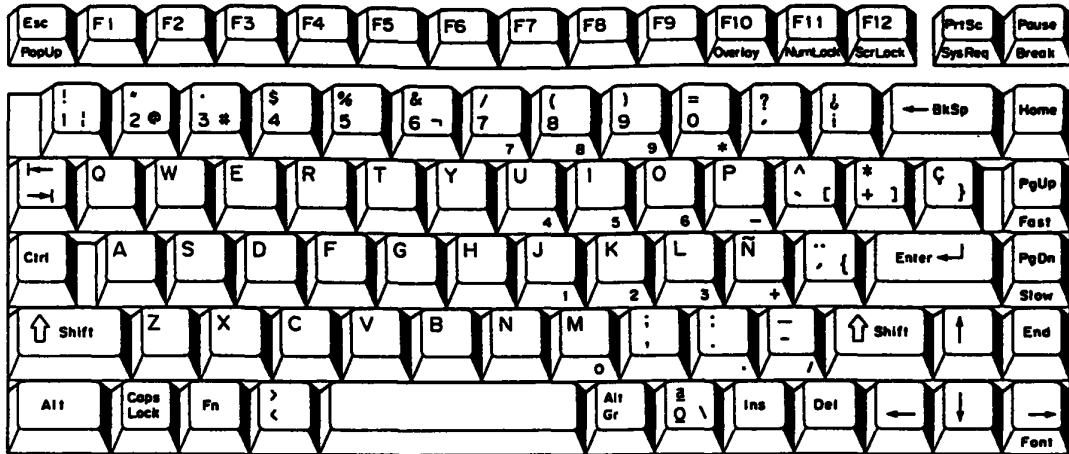**E.5   Spanish and Latin Keyboard**

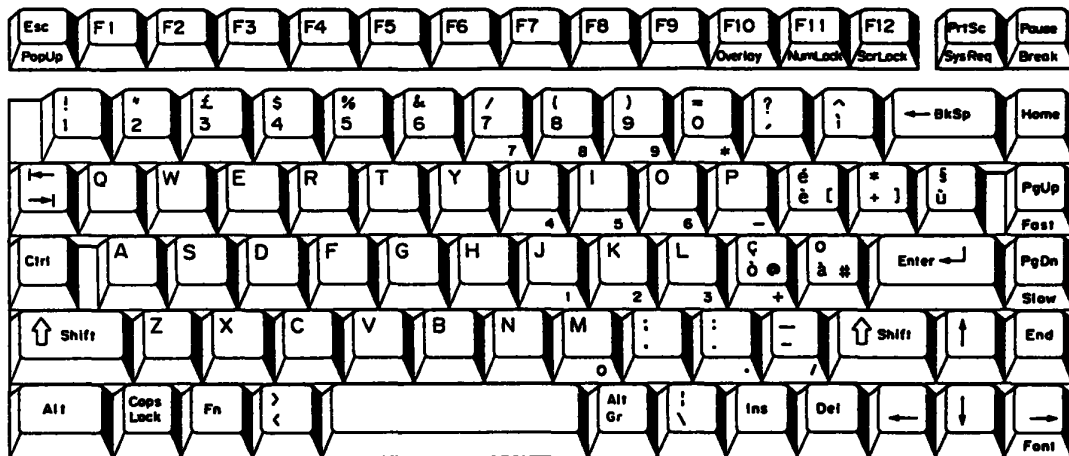*Figure E-5 Spanish and Latin keyboard*

E.6   Italian Keyboard

Figure E-6 Italian keyboard
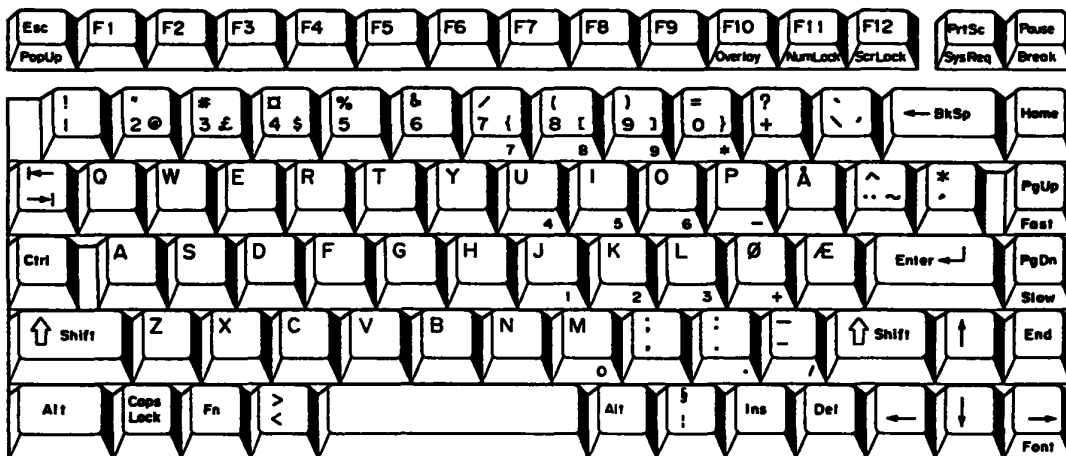
E.7   Scandinavian (DK, NO, SW) Keyboard

Figure E-7 Scandinavian (DK, NO, SW) keyboard
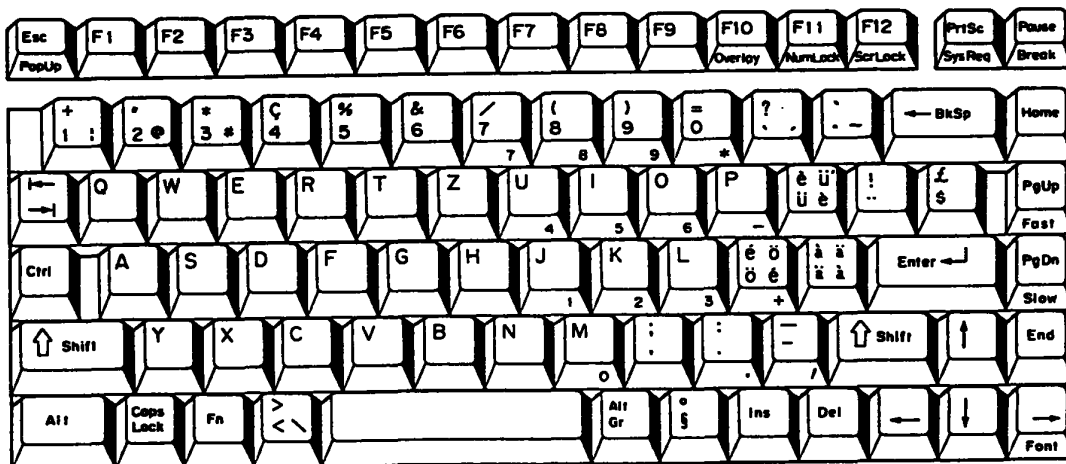
E.8   Swiss (French/German) Keyboard

Figure E-8 Swiss (French/German) keyboard
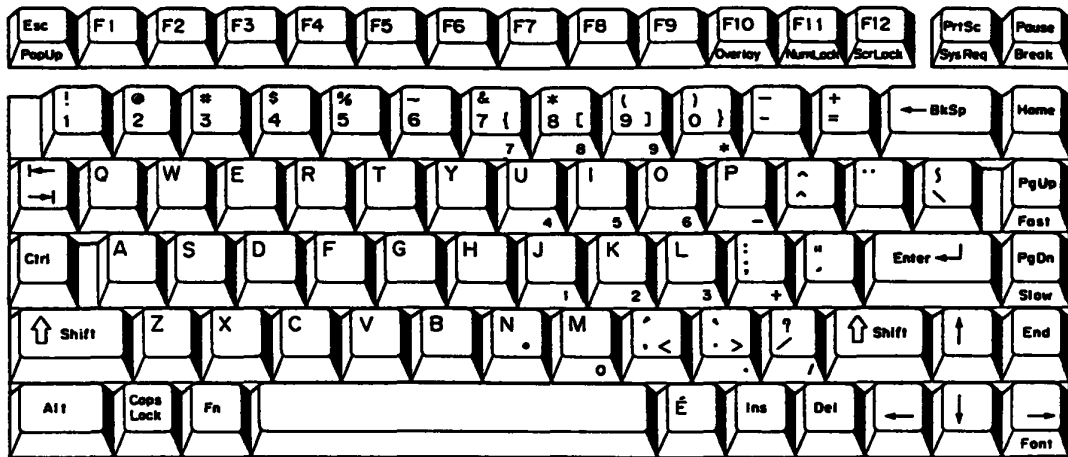
E.9   Canadian Keyboard

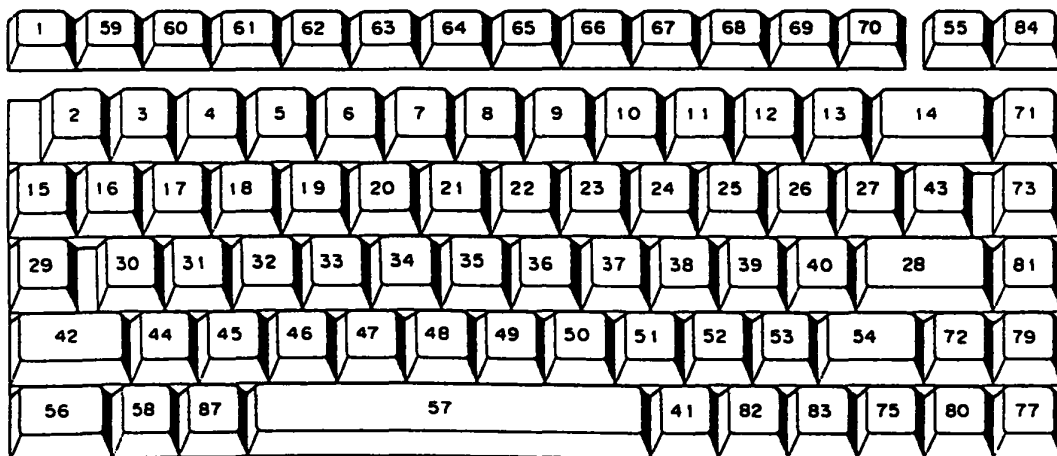*Figure E-9 Canadian keyboard*

E.10   Keycap Number Keyboard

Figure E-10 Keycap number keyboard

Appendix F Wiring Diagrams
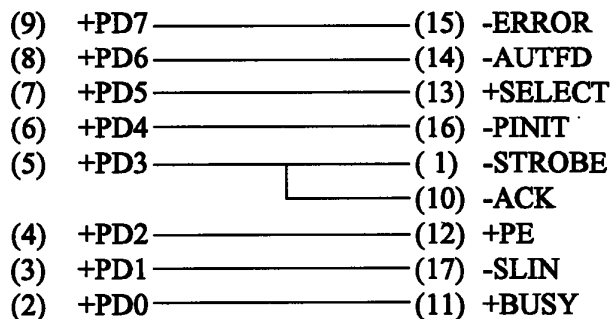
F.1 Printer Wraparound Connector

```
(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-232C Wraparound Connector

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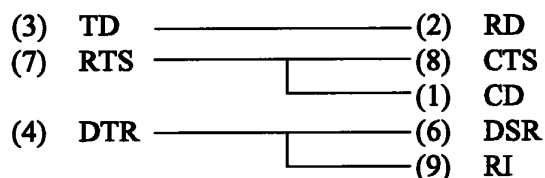
Figure F-2 RS-232C wraparound connector

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

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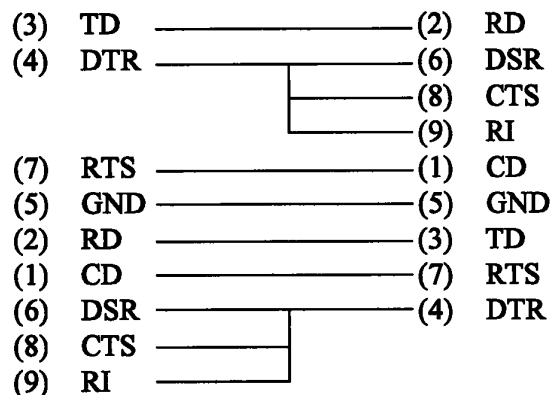
Figure F-3 RS-232C direct cable (9-pin to 9-pin)

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

```
(1)  CD  ─────────────  (4)  RTS
(2)  RD  ─────────────  (2)  TD
(3)  TD  ─────────────  (3)  RD
(4)  DTR ──────────┐    (5)  CTS
                   ├──  (6)  DSR
                   └──  (22) RI
(5)  GND ─────────────  (7)  GND
(7)  RTS ─────────────  (8)  CD
(6)  DSR ──────────┐    (20) DTR
(8)  CTS ──────────┤
(9)  RI  ──────────┘
```
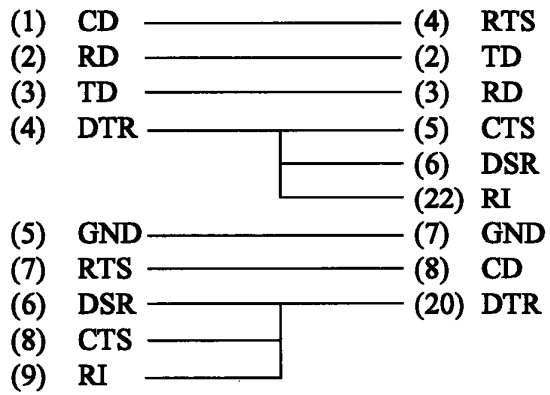
Figure F-4 RS-232C direct cable (9-pin to 25-pin)