
1.1 GENERAL

The Toshiba T1000LE is one of the lightest portable computers available offering high technology, high speed, excellent legibility, IBMPC/XT compatibility, and battery operation.

The T1000LE is so small it defines a new class of portables called notebook computers.

The T1000LE uses the MS-DOS version 3.30 operating system and contains a powerful 80C86-2 microprocessor with a 16-bit data width on the data bus line. The standard random access memory (RAM) capacity is 1-Mbyte with the ability to insert 1-, 2-, 4- or 8-Mbyte memory cards; thus, the system can have up to 9 Mbytes of RAM.

The T1000LE system unit consists of the following features:

- System board/memory board
- 3.5-inch floppy disk drive (FDD) that supports two memory formats:
 - 1.44-Mbyte double-sided, high-density, double-track (2HD)
 - 720-Kbyte double-sided, double-density, double-track (2DD)
- 2.5-inch hard disk drive (HDD) with 20-Mbyte capacity
- IBM enhanced keyboard compatibility
- Sidelit liquid crystal display (LCD)
- Power supply system consisting of an AC adapter and batteries

The LCD supports 640 x 400 pixels with color/graphics adapter (CGA) compatibility and two color attribute combinations.

Connecting ports for optional equipment are provided on the rear panel of the system. A parallel port, serial port, and expansion bus connector are all provided for.

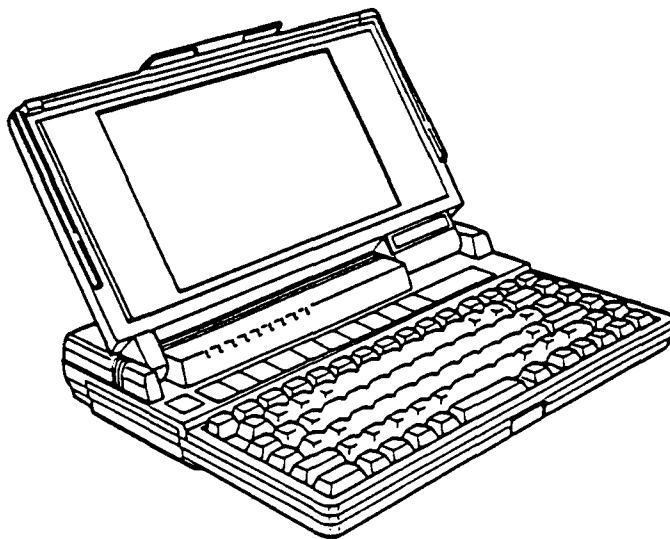


Figure 1-1 T1000LE system unit

1.2 SYSTEM UNIT

Figure 1-2 shows the T1000LE's system block diagram.

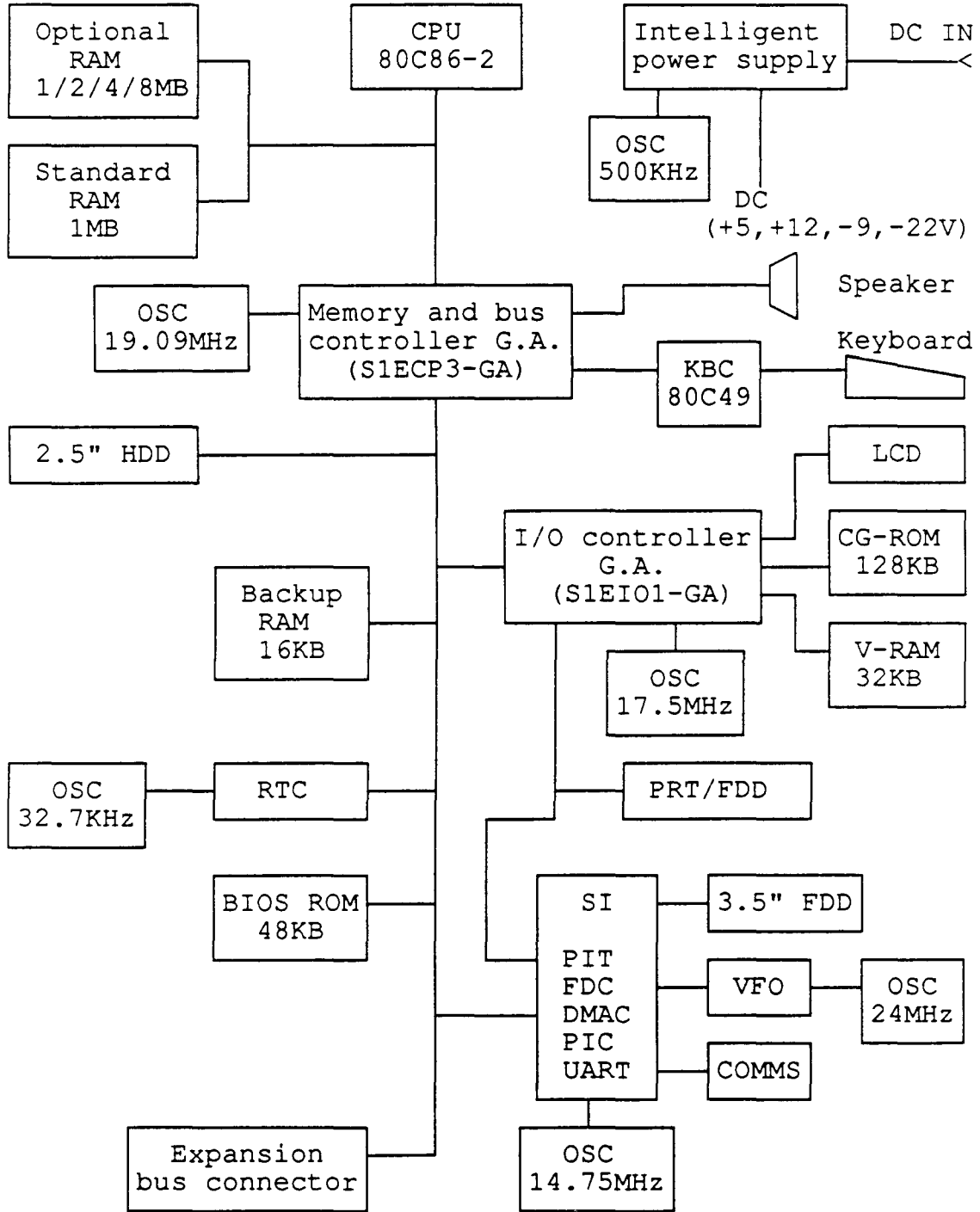


Figure 1-2 Block Diagram

The system board in the T1000LE is composed of the following major components:

- Central processing unit: CPU (80C86-2)

The CPU is a 16-bit microprocessor operating at 9.54MHz or 4.77MHz clock speed.

- Super integration: SI (T9776)

The SI stores the following components:

Direct Memory Access controller:	DMAC (TMP82C37A)
Programmable interrupt controller:	PIC (TMP82C59A)
Programmable interval timer:	PIT (TMP82C53)
Floppy disk controller:	FDC (TC8565)
Universal asynchronous receiver and transmitter:	SIO (TC8570)

- Variable frequency oscillator: VFO (TC8568)

The VFO chip is used for FDD control logic.

- Real time clock: RTC (TC8521)

The RTC has memory in the chip which keeps the date, time, and system configuration with an RTC battery.

- Keyboard controller: KBC (TMP80C49)

- Memories:

Standard RAM:	1 Mbyte
Backup RAM:	16 Kbytes
BIOS ROM:	48 Kbytes
Video RAM:	32 Kbytes
CG ROM:	128 Kbytes

- Gate arrays:

Memory and bus controller gate array:	S1ECP3-GA (184-pin)
I/O controller gate array:	S1EIO1-GA (184-pin)

- Oscillators: OSC

32.768KHz OSC (X1) is used for the RTC.

19.09091MHz OSC (X2) is used for the CPU.

14.7456MHz OSC (X3) is used for the SIO.

24MHz OSC (X4) is used for the VFO.

17.5MHz OSC (X5) is used for the LCD.

500KHz OSC (X501) is used for the CPU of the intelligent power supply.

The location of these OSCs are shown in Appendix A.

1.3 3.5-INCH FLOPPY DISK DRIVE

The 3.5-inch floppy disk drive (FDD) is a high performance, reliable, and thin drive that supports 720-Kbyte (formatted) 2DD and 1.44-Mbyte (formatted) 3.5-inch floppy diskettes.

The FDD is shown in Figure 1-3 and its specifications are described in Table 1-1.

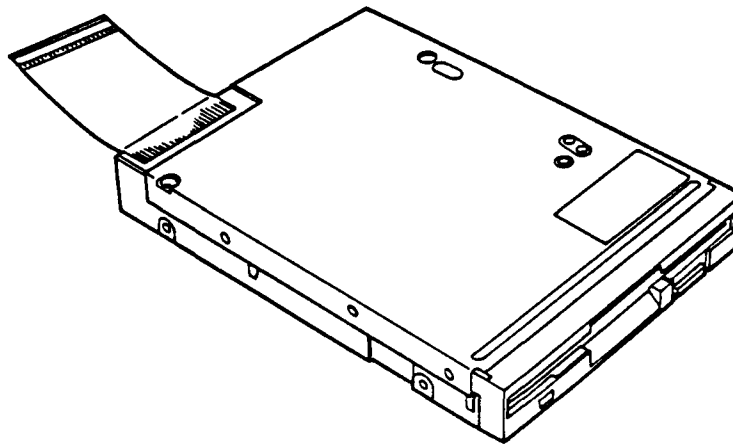


Figure 1-3 3.5-inch FDD

Table 1-1 3.5-inch FDD specifications

Item	Specifications	
	2-Mbyte mode	1-Mbyte mode
Storage capacity (Kbyte)		
Unformatted	2,000	1,000
Formatted	1,440	720
Number of heads	2	2
Number of cylinders	80	80
Access time (ms)		
Track to track	3	3
Average	181	181
Head settling time	15	15
Rotation speed (rpm)	360	360
Data transfer rate (Kbps)	500	300
Recording method	MFM (modified frequency modulation)	
Recording track density (bpi)	135	135
Recording density (bpi)	17,430	8720

1.4 2.5-INCH HARD DISK DRIVE

The 20-Mbyte (formatted) hard disk drive (HDD) is a random access storage device. It is equipped with a non-removal 2.5-inch magnetic disk and mini-Winchester type magnetic heads.

The HDD is shown in Figure 1-4 and its specifications are described in Table 1-2.

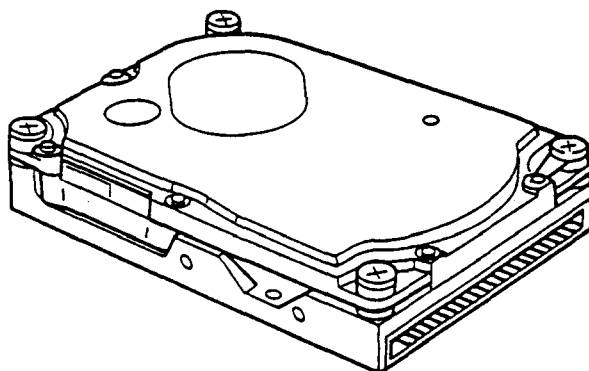


Figure 1-4 2.5-inch HDD

Table 1-2 2.5-inch HDD specifications

Item	JDE2825P	CP2024
Storage capacity (Mbytes) Formatted	21.4	21.4
Number of disks	1	1
Data surfaces	2	2
Data heads	2	2
Track per surface	581	653
Track density (tpi)	1,465	1,700
Sectors per track	36	33
Access time (ms)		
Track to track	8	5
Average	25	25
Maximum	45	40
Rotation speed (rpm)	3,109	3,433
Data transfer rate (bps) To/from media	10 M	10 M
Interleave	1:1	1:1
Recording method	2-7 RLL code (Run length limited)	
Recording density (ID) (bpi)	39,665	34,816

1.5 KEYBOARD

The 82- (USA) or 84- (European) keyboard is mounted on the system unit. The keyboard is connected to the keyboard controller on the system board through a 20-pin flat cable. The keyboard is shown in Figure 1-5.

Optional keyboard configurations are illustrated in Appendix E.

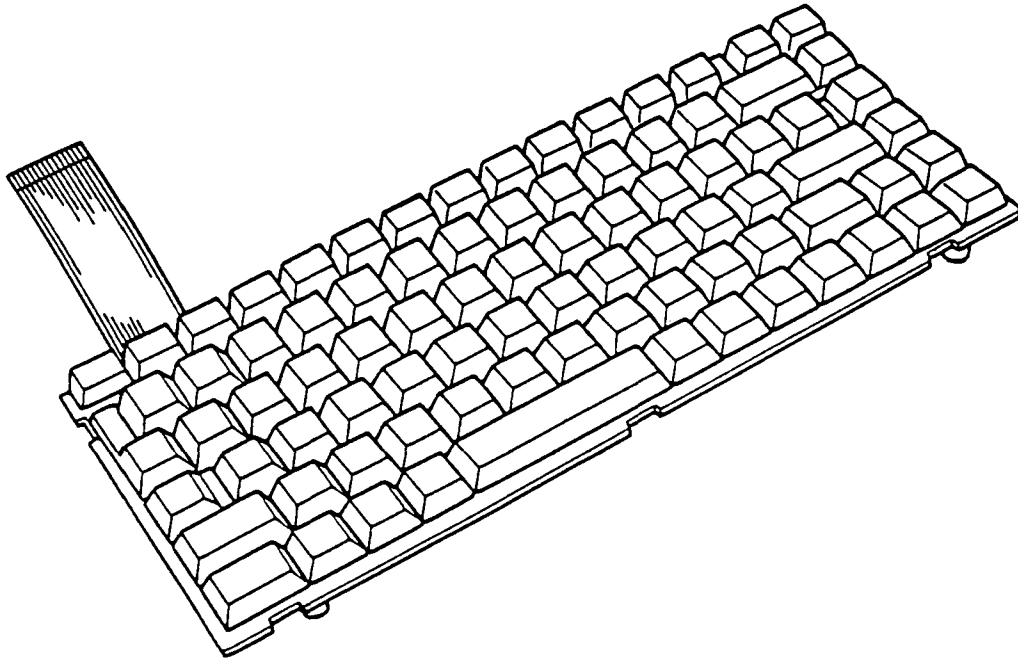


Figure 1-5 Keyboard

1.6 SIDELIT LIQUID CRYSTAL DISPLAY

The sidelit liquid crystal display (LCD) is composed of an LCD module, fluorescent lamp (FL), and FL inverter. The sidelit LCD is illuminated from the side. Thus, you can read its clear display even in poorly lit conditions. It 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 TTL-level compatible. The specifications are described in Table 1-3.

The sidelit LCD has two color attribute combinations and the display quality can be adjusted by the contrast and brightness controls.

A high frequency current is supplied by the FL inverter to illuminate the FL.

The sidelit LCD is shown in Figure 1-6.

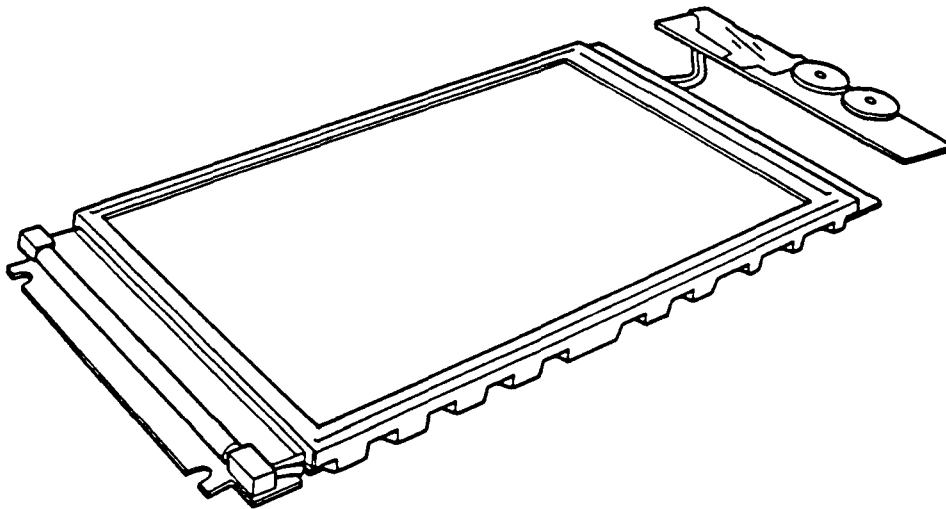


Figure 1-6 Sidelit LCD

Table 1-3 Sidelit LCD specifications

Item		Specifications
Number of dots	(dots)	640 x 400
Dot dimension	(mm)	0.27 (W) x 0.27 (H)
Dot pitch	(mm)	0.30 (W) x 0.30 (H)
Display area	(mm)	202.0 (W) x 128.0 (H)
Contrast		1 : 4 (Min.)
FL current	(mA)	7.0 - 7.8
FL frequency	(KHz)	25 - 45

2.1 GENERAL

The problem isolation procedures described in Part 2 are used to isolate defective field replaceable units (FRUs). The FRUs covered are:

1. Power supply unit
2. System board
3. FDD
4. HDD
5. Keyboard
6. Display

Test program operations are described in Part 3 and detailed replacement procedures are described in Part 4.

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

1. T1000LE Diagnostics Disk
2. Phillips head screwdriver
3. Work disk (for FDD testing)
4. Cleaning disk kit (for FDD testing)
5. Printer port LED
6. RS-232-C, printer wraparound connectors
7. Multimeter

The problem isolation flowchart described in Section 2.2 can be used to determine which isolation procedures are necessary to isolate a T1000LE problem.

2.2 PROBLEM ISOLATION FLOWCHART

The flowchart in Figure 2-1 is used as a guide for determining which FRU is defective. Please confirm the following before performing the flowchart procedures.

1. Disconnect all optional equipment.
2. Remove any disk in the FDD.

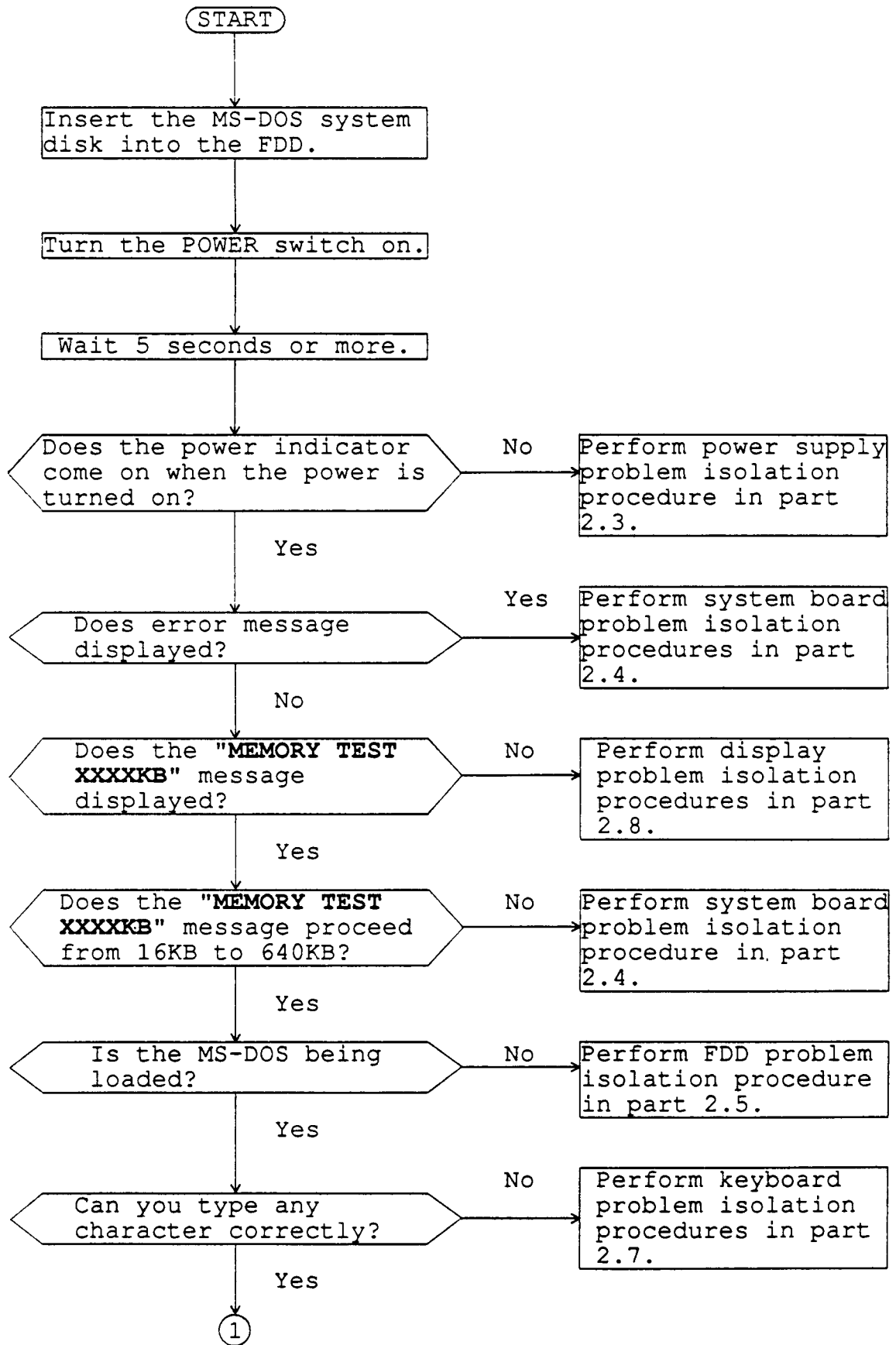


Figure 2-1 Problem isolation flowchart

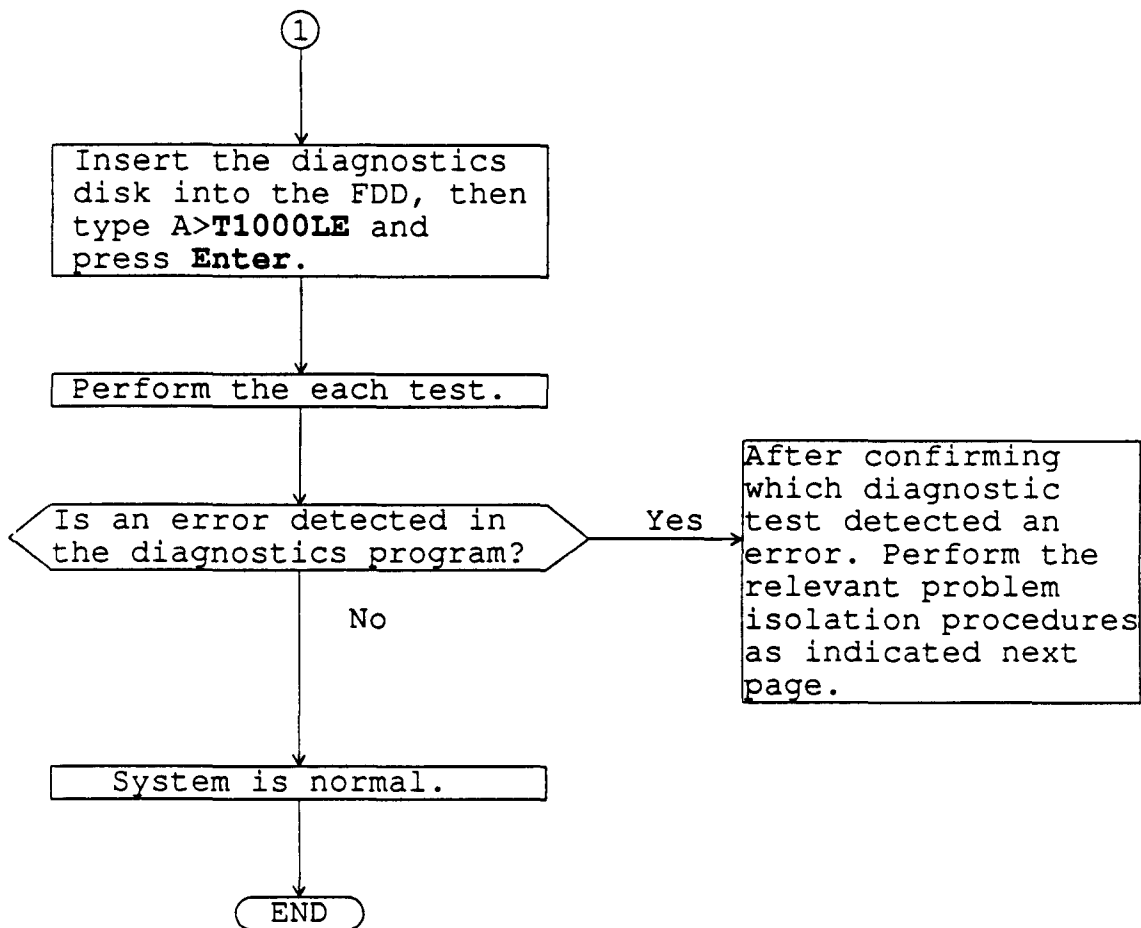


Figure 2-1 Problem isolation flowchart (continued)

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

After confirming which diagnostic test detected an error, perform the relevant problem isolation procedures as indicated on the following pages.

1. If an error is detected on the system test, memory test, display test, ASYNC test, printer test, or real timer test, perform the system board isolation procedures in Section 2.4.
2. If an error is detected on the keyboard test, perform the keyboard problem isolation procedures in Section 2.7.
3. If an error is detected on the floppy disk test, perform the FDD problem isolation procedures in Section 2.5.
4. If an error is detected on the hard disk test, perform the HDD problemisolation procedures in Section 2.6.

2.3 POWER SUPPLY PROBLEM ISOLATION PROCEDURES

This section describes how to determine if the power supply is defective. Start with PROCEDURE 1 and continue with the other procedures as instructed. The procedures described in this section are:

PROCEDURE 1: Indicator Check

PROCEDURE 2: Connector, Cable, and Power Switch Check

PROCEDURE 3: Replacement Check

PROCEDURE 1

Indicator Check

The indicator labeled “DC IN” lights red if power is supplied from the AC adapter when you connect the AC adapter to the T1000LE and a wall outlet. If the AC adapter’s output voltage is abnormal, this indicator blinks red or does not glow.

- (1) If the DC IN indicator blinks red or does not glow before the power is turned on to the system, see Check 1.
- (2) If the DC IN indicator blinks red or does not glow after the power is turned on to the system, see Check 2. Also, check the power output circuits to the system.

Check 1 Unplug the AC adapter from the wall outlet and system. Reconnect the AC adapter to the system and wall outlet, then restart the system. If the problem still exists, perform Check 2.

Check 2 Check the AC adapter voltage supplied to the system using the multimeter. If it is not normal (DC +12V), the AC adapter may be damaged. Replace it with a new AC adapter. If the problem still exists, perform PROCEDURE 2. Also, check the battery charge circuits.

The indicator labeled “Battery” lights orange (while the AC adapter is charging the battery) or lights green (when the battery pack is fully charged) if power is supplied from the AC adapter when you connect the battery pack to the system. If only the battery pack is connected to the system, this indicator lights green (the battery pack is in use) or lights red (the battery is low), and if this indicator blinks red, the battery pack is completely discharged.

- (1) If the battery indicator blinks or does not glow when you connect the AC adapter to the system, see Check 3.
- (2) If the battery indicator blinks or does not glow when you disconnect the AC adapter to the system, see Check 6. Also, check the power output circuits to the system.

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

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

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

- Check 6 Check that the battery pack is correctly connected to the system. If the problem still exists, perform Check 7.
- Check 7 Replace the battery pack with a known good one. If the problem still exists, perform PROCEDURE 2.

PROCEDURE 2

Connector, Cable, and Power Switch Check

The battery pack is connected directly to the power supply board and an optional battery cable is connected to the system board through the power supply board on the back of the top cover. The sub battery and power switch cable are connected directly to the system board. Any of these cables may be disconnected or damaged. Disassemble the system unit to checking the cables. Disassembly procedures are described in Part 4.

Check 1 Check that the following cables are correctly connected to the system board, power supply board, and LED board.

LED board	PJ601 <----->	System board	PJ503
	PJ602 <----->	PS board	PJ803
	PJ603 <----->	System board	PJ505
PS board	PJ802 <----->	System board	PJ502
	PJ805 <----->	DC jack	PJ702
Power switch	----->	System board	PJ501

If any of these cables are disconnected, connect them and restart the system. If the problem still exists, perform Check 2.

Check 2 Recheck the above cables using the multimeter. If any of the cables look damaged, replace them and restart the system. If the problem still exists, perform Check 3.

Check 3 Check the power switch contact using the multimeter. If the power switch contact is bad, replace the power switch with a new one and restart the system. If the problem still exists, perform PROCEDURE 3.

PROCEDURE 3

Replacement Check

In this system unit, the power board, DC-IN board, LED board, and system board are connected with the power supply circuits, and the LED board is connected with the indicator circuits. Any of these boards may be damaged. Perform Checks 1 through 4 to check the voltages and/or replace them. Replacement procedures are described in Part 4.

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

- Check 2 Replace the power board with a new one and restart the system. If the problem still exists, perform Check 3.

- Check 3 Replace the LED board with a new one and- restart the system. If the problem still exists, perform Check 4.

- Check 4 Replace the system board with a new one. If the problem still exists, other units may be damaged. Continue troubleshooting the system unit.

2.4 SYSTEM BOARD PROBLEM ISOLATION PROCEDURES

This section describes how to determine if the system board is defective. Start with PROCEDURE 1 and continue with the other procedures as instructed. The procedures described in this section are:

PROCEDURE 1: Message and Beep Sound Check

PROCEDURE 2: Printer Port LED Check

PROCEDURE 3: Test Program Check

PROCEDURE 1

Message and Beep Sound Check

After the power is turned on, the system performs the initial reliability test (IRT) which is a program stored in BIOS ROM on the system board. The IRT tests and initializes each IC on the system board.

If an error message appears on the screen, perform Check 1, and if nothing is displayed on the screen, perform PROCEDURE 2.

Check 1 If the following error message appears on the screen, press any key. This program confirms the current system configuration and the configuration stored to RTC memory. If they are different, the following message will appear. You can easily set the current configuration in the RTC memory by pressing any key. If another error message appears, perform Check 2.

*****SYSTEM CONFIGURATION ERROR*****

**A checksum error occurred in the configuration RAM.
Press any key for default set....**

Check 2 If the following message appears, press any key. At this time the resumed data will be erased. If another error message appears, perform Check 3.

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

Check 3

The IRT program tests the system board. If an error occurs in the IRT program, the error message appears on the screen and beep sounds are generated. If the following error messages do not appear and the beep sounds are not heard, perform PROCEDURE 3. (The boldface messages shown below are visible on the screen. The normal messages do not appear on the screen and only beep sounds are generated.)

V-RAM TEST ERROR BEEP (1 LONG and 2 SHORT)

KEYBOARD ERROR

RESUME ERROR BEEP (1 SHORT)

If an error for storing data occurs in the resume mode, the following message will appear.

**WARNING RESUME FAILURE
PRESS ANY KEY TO CONTINUE**

**XXXX MEMORY ERROR
DISK CONTROLLER FAILURE
DISK 0 FAILURE
FDD ERROR**

HARD RAM TEST BEEP (1 SHORT)

If an error occurs during the read test, the following message will appear.

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

PROCEDURE 2

Printer Port LED Check

The printer port LED displays the IRT program status and error status as a hexadecimal value after turning on the system.

1. Connect the printer port LED to the printer port.
2. After turning the system on, read the LED status from left to right.
3. If the final LED status is **FEh**, perform PROCEDURE 3. If the final LED status matches one of the error status codes in Table 2-1, replace the system board.

Table 2-1 Error status of the printer port LED

Error status	Meaning	Process
01h	BIOS ROM checksum test	HALT
06h	First 16KB RAM test	HALT

If the status changes from **AAh** to **FEh**, the IRT program is normal.

PROCEDURE 3

Test Program Check

The test program which is stored in the T1000LE Diagnostics Disk has several programs for testing the system board. Perform the following tests. Detailed operation is described in Part 3.

- System test
- Memory test
- Display test
- Printer test
- ASYNC test
- Real timer test

If an error is detected during the above tests, replace the system board. If the problem still exists, another unit may be defective. Continue troubleshooting the system unit.

2.5 FLOPPY DISK DRIVE PROBLEM ISOLATION 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: Format Check

PROCEDURE 2: Test Program Check

PROCEDURE 3: Connector Check

PROCEDURE 1

Format Check

Prepare a new floppy disk by formatting it using the MS-DOS FORMAT command. If the floppy disk does not format correctly, check the following items.

- Check 1 Check that the FDD indicator lights. If it does not light, perform PROCEDURE 3. If it lights, perform Check 2.
- Check 2 Check that the MS-DOS FORMAT command was used correctly.
- When the media type is 2DD, use the FORMAT/3 command.
- When the media type is 2HD, use the FORMAT command.
- If the FORMAT command was used correctly, perform Check 3.
- If the FORMAT command was not used correctly, try again. If the problem still exists, perform Check 3.
- Check 3 Clean the read/write head using the 3.5-inch FDD cleaning kit. If the problem still exists, perform PROCEDURE 2.

PROCEDURE 2

Test Program Check

The FDD test program is stored in the T1000LE Diagnostics Disk. After loading MS-DOS, run the diagnostic program. Detailed operation is described in Part 3.

Prepare the formatted floppy disk, then perform the FDD test. The error code and status are described in Table 2-2.

If error occurs, perform Check 1.

Table 2-2 FDD error code and status

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

Check 1 If the **Write protected** message appears, remove the write protect tab. If any other error message appears, perform Check 2.

Check 2 Check that the floppy disk is formatted correctly. If it is correct, perform PROCEDURE 3.

PROCEDURE 3

Connector Check

The FDD is connected to the system unit by the FDD cable. This cable may be disconnected from the system unit. Disassemble the system unit and check the FDD cable. Disassembly procedures are described in Part 4.

Check 1 Check that the following cable is correctly connected to the system board.

FDD 1 cable -----> System board PJ5

If this cable is disconnected, connect it to the system unit and perform PROCEDURE 1 and 2. If the problem still exists, perform Check 2.

Check 2 The FDD may be defective. Replace it with a new FDD, then perform PROCEDURE 1 and 2. If the problem still exists, perform Check 3.

Check 3 The system board may be defective. Replace it with a new system board.

2.6 HARD DISK DRIVE PROBLEM ISOLATION PROCEDURES

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

PROCEDURE 1: Logical Format Check

PROCEDURE 2: Test Program Check

PROCEDURE 3: Connector Check

CAUTION: *The contents of the hard disk will be erased by performing the HDD problem isolation procedures. Before continuing, transfer the contents of the hard disk to floppy disks. This can be done with the MS-DOS BACK-UP command. (See the MS-DOS manual for details.)*

PROCEDURE 1

Logical Format Check

Using the MS-DOS system disk, make a partition of the hard disk by using the FDISK command. Then format the hard disk by using the FORMAT command. At this time enter /s after FORMAT to transfer the system program.

If normal operation is restored, the HDD is normal. If normal operation is not restored, perform PROCEDURE 2.

PROCEDURE 2

Test Program Check

The HDD test program is stored in the T1000LE Diagnostics Disk. Perform all HDD tests. Detailed operation is described in Part 3.

If an error is detected during the HDD test, an error code and status will be displayed; perform PROCEDURE 3. The error code and status are described in Table 2-3. If no error is generated, the HDD is normal.

Table 2-3 HDD error code and status

Code	Status
01h	Bad command error
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
ECh	Access time out error
E0h	Status error
F0h	Not sense error (HW. code=FF)

PROCEDURE 3

Connector Check

The packed HDD is connected to the system board by the HDD connector. Disassemble the system unit and check the HDD . Detailed procedures are described in Part 4. If this cable is disconnected, connect it to the system board and perform PROCEDURES 1 and 2. If the problem still exists, perform Check 1.

Check 1 The HDD may be damaged. Replace the HDD unit with a new one. If the error still occurs, perform Check 2.

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

2.7 KEYBOARD PROBLEM ISOLATION 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 Check

PROCEDURE 1

Test Program Check

The keyboard test program is stored in the T1000LE Diagnostics Disk. Perform the test program. Detailed operation is described in Part 3. If an error occurs, perform PROCEDURE 2.

If an error does not occur, the keyboard is normal.

PROCEDURE 2

Connector Check

The keyboard is connected to the system board by a 20-pin flat cable. Disassemble the system unit and check the keyboard cable. Detailed procedures are described in Part 4.

Check 1 Check that the following cable is not disconnected from the system board.

Keyboard cable -----> System board PJ8

If this cable is not connected, connect it and perform PROCEDURE 1. If the problem still exists, perform Check 2.

Check 2 The keyboard or keyboard cable may be damaged. Replace the keyboard with a new one, then perform PROCEDURE 1. If the problem still exists, the keyboard controller on the system board may be damaged. Replace the system board.

2.8 DISPLAY PROBLEM ISOLATION 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

PROCEDURE 2: Test Program Check

PROCEDURE 3: Connector Check

PROCEDURE 4: Replacement Check

PROCEDURE 1

Brightness and Contrast Volume Check

The system has brightness and contrast dials on the right side of the display unit. Use the two dials to tune up the display screen to your satisfaction. If the brightness does not change, the FL (fluorescent light) element may be run down. Perform PROCEDURE 4.

If the character contrast does not change, perform PROCEDURE 2.

If brightness and contrast of the display does not change, perform PROCEDURE 2.

PROCEDURE 2

Test Program Check

Using the T1000LE Diagnostics Disk, perform the display test. The display test checks the display controller on the system board.

If an error is detected, perform PROCEDURE 3.

If an error is not detected, the display is normal.

PROCEDURE 3

Connector Check

The display unit has an LCD module, FL element, and FL inverter. The LCD module and FL inverter are connected to the system board with the LCD cable. The FL element is connected by a cable to the FL inverter. Either or both of these cables may be disconnected from the system board.

Disassemble the display unit and check these connectors. Detailed procedures are described in Part 4.

If these connectors are not connected, connect them and perform PROCEDURE 1 and 2. If the problem still exists, perform PROCEDURE 4.

PROCEDURE 4

Replacement Check

In this system unit, the FL inverter, LCD module, and system board are connected with the display circuits. Any of these may be damaged. Perform Checks 1 through 3. Detailed procedures are described in Part 4.

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

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

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

3.1 GENERAL

This part explains the test and diagnostics programs which check the functions of all the hardware modules of the T1000LE.

The T1000LE ASP diagnostics are composed of 15 programs grouped into two modules: the service program module (DIAGNOSTICS MENU) and test program module (DIAGNOSTIC TEST MENU).

The service program module is composed of 5 tasks:

1. DIAGNOSTIC TEST
2. RUNNING TEST
3. LOG UTILITIES
4. HEAD CLEANING
5. SYSTEM CONFIGURATION

The test program module is composed of 10 tests:

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. EXPANSION TEST

In addition to T1000LE diagnostics, the HDFAT, FDFMT, FDCPY, and FDDMP commands are on the Diagnostic Diskette.

The following items are necessary for carrying out the test and diagnostic programs.

1. T1000LE Diagnostics Disk
2. Formatted work disk (For FDD test)
3. Cleaning disk kit (For head cleaning)
4. Printer wraparound connector (For printer wraparound test)
5. RS-232-C wraparound connector (For ASYNC wraparound test)

Service personnel can use these programs to isolate problems by selecting the appropriate program and operation procedures described in Section 3.2.

3.2 OPERATIONS

1. After loading the MS-DOS, insert the Diagnostics Disk in the floppy disk drive.
2. Type in A:TESTCEIL and press **Enter**.
3. The following display will appear:

```
TOSHIBA personal computer T1000LE DIAGNOSTICS
Version x.xx (c) copyright TOSHIBA Corp. 1990
```

```
DIAGNOSTICS MENU
```

```
1 - DIAGNOSTIC TEST
2 - RUNNING TEST
3 - LOG UTILITIES
4 - HEAD CLEANING
5 -
6 -
7 -
8 - SYSTEM CONFIGURATION
9 - EXIT TO MS-DOS
```

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

The service program tasks are explained in Sections 3.16 through 3.19. The test program module tests are explained here and in Sections 3.3 through 3.15.

NOTE: <i>To stop execution of any test program, press Ctrl + Break.</i>

4. Type in 1 and press **Enter**. The following display will appear:

**TOSHIBA personal computer T1000LE DIAGNOSTICS
version x.xx (c) copyright TOSHIBA Corp. 1990**

DIAGNOSTICS 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 -**
- 11 - EXPANSION TEST**

- 88 - FDD & HDD ERROR RETRY COUNT SET**
- 99 - EXIT TO DIAGNOSTICS MENU**

PRESS [1] - [9] KEY ??

Numbers 1 through 11 are diagnostic tests. These tests are explained in Sections 3.4 through 3.13.

Number 88 is for setting the floppy disk drive and hard disk drive error retry count.

Number 99 is for returning to the DIAGNOSTICS MENU.

When selecting the floppy disk test, special sub-messages will appear as described in Section 3.8.

5. After typing in a test number (1 through 11) from the DIAGNOSTIC TEST MENU, press **Enter**. A test-specific display will appear. For example, the following screen shows the system test, which appears when you type **1** and press **Enter**.

```
ROM-TEST V x.xx SUB-NO..??  
  
PASS..0000 ERRCNT..000 CMD..xx  
  
STATUS xxx ADR xxxxx WD xx RD xx  
  
01 - BIOS ROM CHECKSUM  
  
99 - EXIT TO DIAGNOSTICS MENU
```

6. Select a subtest. See Table 3-1 for a list of the valid subtests. Type in the subtest number, then press **Enter**. The following message will appear:

```
TEST LOOP (1:Yes/2:No) 1
```

If you select Yes (by typing in **1** and then pressing **Enter**): Each time a test cycle ends, it increments the pass counter by one and repeats the test cycle.

If you select No (by typing in **2** and pressing **Enter**): At the end of a test cycle, the test execution is terminated and you exit to the subtest menu.

7. Type in **1** or **2**, then press **Enter**. The following message will appear:

```
ERROR STOP (1:Yes/2:No) 1
```

If you select Yes (by typing in **1** and pressing **Enter**): When an error occurs, the error status is displayed. Execution of the test program stops and the operation guide is displayed on the right side of the display screen.

If you select No (by typing in **2** and pressing **Enter**): When an error occurs, the error status is displayed. The error counter increases by one and you go to the next pass of the subtest.

8. Type in **1** or **2**, then press **Enter** and the test program will run. Each subtest is described in Table 3-1 of Section 3.3.

9. When an error occurs during a test program, the following message (operation guide) will appear (if you answered Yes for the ERROR STOP question):

```
ERROR STATUS NAME    [[HALT OPERATION]]
1 : Test End
2 : Continue
3 : Retry
PRESS [1]-[3] KEY
```

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

The error code and error status names are described in Table 3-2 of Section 3.14.

3.3 SUBTEST NAMES

Table 3-1 lists the subtests for each test program.

Table 3-1 Subtest names

No.	Test name	Subtest No.	Subtest item
1	SYSTEM	01	BIOS ROM CHECKSUM
2	MEMORY	01	Constant data
		02	Random data
		03	Sequential data
		04	Addresspack
		05	Memory refresh
		06	Backup memory
		07	EMS mode
3	KEYBOARD	01	Pressed Key display
		02	Pressed Key code display
4	DISPLAY	01	VRAM read/write
		02	Character attributes
		03	Character set
		04	80 * 25 Character display
		05	320*200 Graphics display
		06	640*200 Graphics display
		07	640*400 Graphics display
		08	Display page
		09	H pattern display
		10	LED display
5	FDD	01	Sequential read
		02	Sequential read/write
		03	Random address/data read/write
		04	Write specified address
		05	Read specified address
6	PRINTER	01	Ripple pattern
		02	Function pattern
		03	Wraparound
7	ASYNC	01	Wrap around (channel#1)
		02	Wrap around (channel#2)
		03	Point to Point (send)
		04	Point to Point (receive)
		05	Card modem loopback
		06	Card modem on-line
		07	Dial tester test
8	HDD	01	Sequential read
		02	Address uniqueness
		03	Random address/data
		04	Cross talk & peak shift
		05	Write/read/compare(CE)
		06	Write specified address
		07	Read specified address
		08	ECC circuit
9	REAL TIMER	01	REAL TIMER TEST
		02	REAL TIMER CARRY TEST
11	EXPANSION	01	Box wrap around test
		02	Box mono video-ram test

3.4 SYSTEM TEST

Subtest 01 BIOS ROM CHECKSUM

This test performs the IPL ROM checksum test on the system board.
(Test extent: F0000h - FFFFFh 64KB)

3.5 MEMORY TEST

Subtest 01 Constant data

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

Subtest 02 Random data

This subtest writes random data to conventional memory (640KB), then reads and compares it with the original data.

Subtest 03 Sequential data

This subtest writes sequential data to conventional memory (640KB), then reads and compares it with the original data repeatedly. The sequential data is 00h to FFh.

Subtest 04 Addresspack

This subtest packs the test address and writes data to conventional memory (640KB), then reads and compare it with the original data.

Subtest 05 Memory refresh

This subtest writes data to conventional memory (640KB), then reads and compares it with the original data. The data is 00h, 55h, AAh, and FFh. There is a delay between the write and the read operations.

Subtest 06 Backup memory

This subtest writes data (FFh, AAh, 55h, and 00h) and address pattern data created by XORing (Exclusive-ORing) high/low of the offset address to memory (addressed F0000h to F07FFh), then reads and compares it with the original data. Before and after the test data is preserved.

Subtest 07 EMS mode

This subtest tests EMS memory (page frame address D0000h) and block select register (03h) every 64KB in the same way as subtest 06.

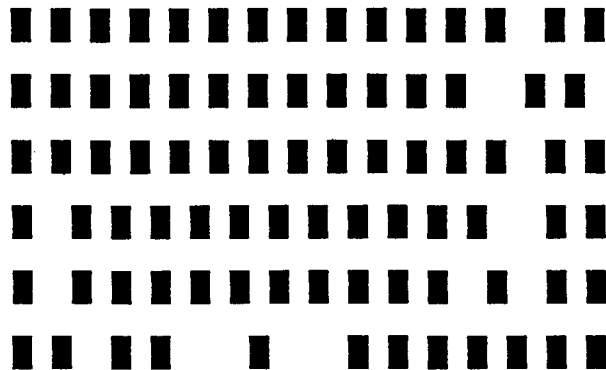
3.6 KEYBOARD TEST

Subtest 01 Pressed Key display

When the keyboard layout (as shown below) is drawn on the display, press any key and check that the corresponding key on the screen is changed to the character “*”.

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

KEYBOARD TEST



```
[Prt Sc] -----> [Alt] + [Prt Sc]
[Pause]  -----> [Ctrl] + [Pause]
[FN]     -----> [FN] + [/]
```

IF TEST OK, PRESS [Del] THEN [Enter] Key

Subtest 02 Pressed Key Code display

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

The **Ins Lock**, **Caps Lock**, **Num Lock**, **Scroll Lock**, **Alt**, **Ctrl**, **Left Shift**, and **Right Shift** keys are displayed in reverse video when pressed. To use the **Num Lock** and **Scroll Lock** keys, press FN + the key. The scan codes, character codes, and key top names are described in Appendix D.

KEYBOARD TEST

Scan code =
Character code =
Keytop =

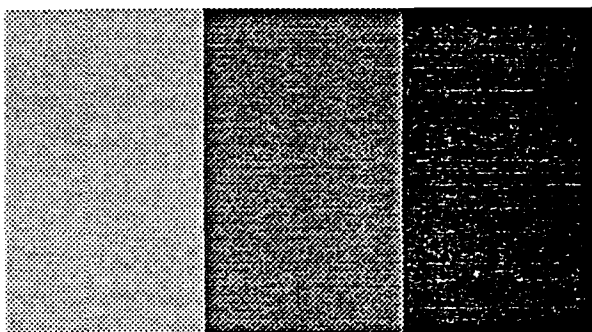
Ins Lock	Caps Lock	Num Lock	Scroll Lock
Alt	Ctrl	Left Shift	Right Shift

Press [Enter] Key

Subtest 05 320x200 Graphics display

This subtest displays three of the color sets for the color display in the 320x200 dots graphics mode as shown below.

320*200 GRAPHICS DISPLAY



Press [Enter] Key

Subtest 06 640x200 Graphics display

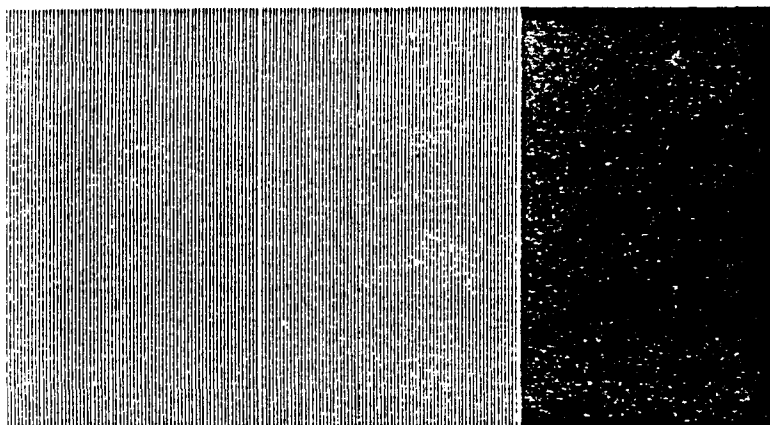
This subtest displays the color blocks for the black and white display in the 640x200 dots graphics mode as shown below.

640*200 GRAPHICS DISPLAY

**EVEN DOTS
DRIVEN**

**ODD DOTS
DRIVEN**

**ALL DOTS
DRIVEN**



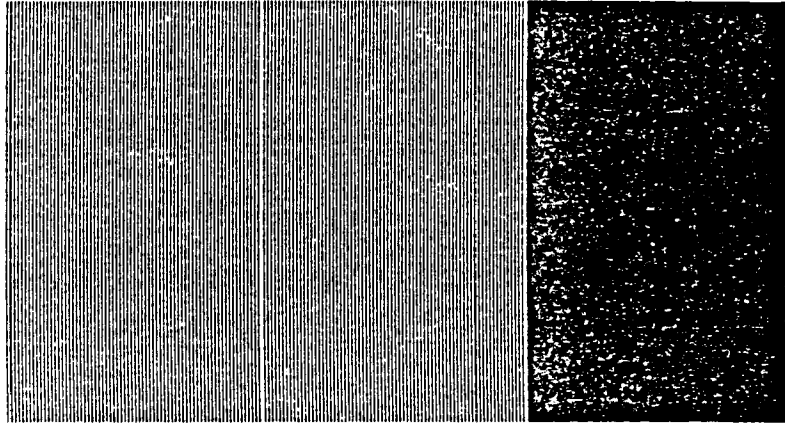
Press [Enter] Key

Subtest 07 640x400 Graphics display

This subtest displays the color blocks for the black and white display in the 640x400 pixels graphics mode as shown below.

640*400 GRAPHICS DISPLAY

EVEN DOTS ODD DOTS ALL DOTS
DRIVEN DRIVEN DRIVEN



Press [Enter] Key

Subtest 08 Display page

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

DISPLAY PAGE 0

```
0000000000000000000000000000000000000000000000000000000000000000
0                                  0
0                                  0
0                                  0
0                                  0
0                                  0
0                                  0
0                                  0
0                                  0
0                                  0
0                                  0
0                                  0
0                                  0
0                                  0
0                                  0
0000000000000000000000000000000000000000000000000000000000000000
```

Subtest 09 H pattern display

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

```

HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
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HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH

```

Subtest 10 LED display

This subtest displays as follows:

[Speed/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 + Numlock] key ! ... Num (on/off)
- (5) Press [Fn] key ! ... Overlay
- (6) Press [Fn + ->] key ! ... FONT change test

Press [Enter] Key

When the Enter key is pressed, the display changes as shown below.
 Double and single fonts, and reverse display are changed by pressing the Enter key.

[Attribute special test]

- (1) FG(non-zero) , BG(zero) , R18(bit1,0) ... Double
- (2) FG(non-zero) NE BG(non-zero) , R18(bit3,2) ...

Press [Enter] Key

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.*

OPERATIONS

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

*** TEST CONTROL MENU ***

TEST DRIVE MENU

1 - UNIT 1
2 - UNIT 2
0 - UNIT 1 & 2
9 - Exit To DIAGNOSTICS MENU

PRESS [1]-[2] or [9] KEY ?

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

TEST MODE MENU

1 - 2HD <Internal or External>
2 - 2DD <Internal>
3 - 2D <External Drive 2HD>
4 - 2D <External Drive 2D >
9 - Exit To DIAGNOSTICS MENU

PRESS [1]-[4] or [9] KEY ?

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

```
FDD-TEST V x.xx SUB-NO..??  
  
PASS..0000   ERRCNT..000   CMD..xx  
  
STATUS xxx ADR xxxxx WD xx RD xx  
  
01 - Sequential read  
02 - Sequential read/write  
03 - Random address/data read/write  
04 - Write specified address  
05 - Read specified address  
  
99 - Exit to DIAGNOSTICS MENU
```

4. Select the subtest number, then press **Enter**. The following message will appear.

```
TEST LOOP (1:Yes/2:No) 1
```

If you select Yes (by typing in **1** and pressing **Enter**): Each time a test cycle ends, it increments the pass counter by one and repeats the test cycle.

If you select No (by typing in **2** and pressing **Enter**): At the end of a test cycle, the test execution is terminated and you exit to the subtest menu.

5. Type in **1** or **2**, then press **Enter**. The following message will appear:

```
ERROR STOP (1:Yes/2:No) 1
```

If you select Yes (by typing in **1** and pressing **Enter**): When an error occurs, the error status is displayed. Execution of the test program stops and the operation guide is displayed on the right side of the display screen.

If you select No (by typing in **2** and pressing **Enter**): When an error occurs, the error status is displayed. The error counter increases by one and you go to the next subtest.

6. Type in **1** or **2**, then press **Enter**. The following message will appear.

```
Max. Track      = 79  
Max. Head       = 1  
Max. Sector     = xx  
  
Test Start Track ??
```

7. If you perform subtests 01 or 02, only the Track Number is specified.

If you perform subtest 03, the Track Number, Head Number, Sector Number, and Number of Sectors are not specified.

If you perform subtest 04, the Track Number, Head Number, Sector Number, Number of Sectors, and Data Pattern must all be specified.

If you perform subtest 05, the Track Number, Sector Number, and Number of Sectors must be specified.

8. Type in the start track number, then press **Enter**. If you perform subtests 01 or 05, the following message will appear.

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

If you perform subtests 02 through 04, the following message will appear.

**[Warning: The content of the disk(s),
will be destroyed]
Mount the Work disk(s) on the drive(s),
then press [Enter] key.**

9. If the inserted floppy disk is your work disk, press **Enter**. The FDD test will now run.

Contents

Subtest 01 Sequential read

This subtest performs the CRC (cyclic redundancy check) with a continuous read operation of all tracks on a floppy disk.

The tracks available for floppy disk formats are:

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

2DD (Double-sided, double-density, double-track)

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

The start track can be specified at the next stage.

Subtest 02 Sequential read/write

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

Subtest 03 Random address/data read/write

This subtest writes random data to random addresses on all the tracks (as 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 on the specified address that you enter from the keyboard. You must specify the test data, track number, and head number.

Subtest 05 Read specified address

This subtest performs a read operation on the specified address that you enter from the keyboard. You must specify the track number and head number.

3.9 PRINTER TEST

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

Operations

Subtest 01, 02, and 03

1. When you select a subtest, the following message will appear.

Select the channel number (1-3) ?

Select the printer channel number, then type in the number. The T1000LE supports three printer channels.

2. After pressing **Enter**, the subtest is executed.

Contents

Subtest 01 Ripple pattern

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

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

Subtest 02 Function Pattern

This subtest prints out various print type as elite, condense, and double, etc.

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

Subtest 03 Wraparound

The data, control, and status lines will be checked with the printer wraparound connector.

NOTE: A printer wraparound connector is necessary for executing this test. The wiring diagram for the printer wraparound connector is described in Section 3.24.

3.10 ASYNC TEST

In subtest 01 through subtest 05, data transmission is done with the following format:

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

Subtest 01 Wrap around (Channel #1)

NOTE: *The RS-232-C wraparound connector must be connected to Channel 1 to execute this test. The wiring diagram of the RS-232-C wraparound connector is described in Section 3.4.*

A data send/receive test is performed with the wraparound connector for Channel 1.

Subtest 02 Wrap around (Channel #2)

The same test as subtest 01 is performed for Channel 2.

Subtest 03 Point to Point (Send)

NOTE: *To execute this subtest, two machines must be connected with the RS-232-C direct cable. One machine should be set as 'send' and the other set as 'receive'. The wiring diagram for the RS-232-C direct cable is described in Section 3.24. By executing subtest 03 in one machine and subtest 04 in the other machine, the communication capability will be checked as follows.*

A block of data (20h to 7Eh) is sent from one machine to the other, and is then returned. The returned data is compared with the original data.

This test is used for checking whether the returned data is the same as the original data.

Subtest 04 Point to Point (Receive)

This subtest is used with subtest 03 as described above.

Subtest 05 Card modem loopback

NOTE: *If there is no modem card in the system, this test cannot be executed.*

This subtest is used for checking if the data sent from the modem card to the RS-232-C line is correct. This can be done with the loopback function inside the modem card.

Subtest 06 Card modem on-line

NOTE: *This test requires two machines which are connected to the PBX (Private Branch Exchange). One machine is set as 'send' and the other as 'receive'. When both machines are ready, you can start the test.*

In this subtest, data is sent from the 'send' machine to the 'receive' machine through the PBX. This subtest is used for checking whether data transmission through a telephone line is done properly.

Subtest 07 Dial tester test

NOTE: *To execute this subtest, a dial tester must be connected to the system.*

This subtest is carried out by automatically sending the pulse dial and tone dial twice.

[Pulse dial] "1-2-3-4-5-6-7-8-9-0-1-2"

[Tone dial] "1-2-3-4-5-6-7-8-9-*0-#"

3.11 HARD DISK TEST

CAUTION: *The contents of the hard disk will be erased when subtest 02, 03, 04, 06, or 08 is run. Before running the test, transfer the contents of the hard disk to the floppy disk. This can be done with the MS-DOS BACK-UP command. After the test, enter the MS-DOS FDISK command, which will set the partition. Then enter the MS-DOS FORMAT command. (See the MS-DOS manual for details.)*

OPERATIONS

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

TEST CONTROL MENU

TEST DRIVE MENU

1 - UNIT 1
2 - UNIT 2
9 - Exit to DIAGNOSTICS MENU

PRESS [1]-[2] or [9] KEY ?

2. Select the drive number of the hard disk 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 for selecting to retry the operation when the hard disk controller detects an error. Select 1 or 2 and press Enter. The following message will appear:

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

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

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

5. This message is used for selecting to display the detail status on the screen or not. The detail status is described in Section 3.15. Select **1** or **2** and press **Enter**. The following message will appear:

```
HDD-TEST V x.xx SUB-NO..??  
  
PASS..0000   ERRCNT..000   CMD..xx  
  
STATUS xxx ADR xxxxx WD xx RD xx  
  
01 - Sequential read  
02 - Address uniqueness  
03 - Random address/data  
04 - Cross talk & peak shift  
05 - Write/read/compare(CE)  
06 - Write specified address  
07 - Read specified address  
08 - ECC circuit  
99 - Exit to DIAGNOSTIC TEST MENU
```

6. Select the subtest number, then press **Enter**. The following message will appear.

```
TEST LOOP (1:Yes/2:No) 1
```

If you select Yes (by typing in **1** and then pressing **Enter**): Each time a test cycle ends, it increments the pass counter by one and repeats the test cycle.

If you select No (by typing in **2** and then pressing **Enter**): At the end of a test cycle, the test execution is terminated and you exit to the subtest menu.

7. Type in **1** or **2**, then press **Enter**. The following message will appear:

```
ERROR STOP (1:Yes/2:No) 1
```

If you select Yes (by typing in **1** and pressing **Enter**): When an error occurs, the error status is displayed. Execution of the test program stops and the operation guide is displayed on the right side of the display screen.

If you select No (by typing in **2** and pressing **Enter**): When an error occurs, the error status is displayed. The error counter increases by one and you go to the next subtest.

8. Type in **1** or **2**, then press **Enter**. The following message will appear.

Max. Cylinder = 614

Max. Head = 03

Max. Sector = 17

9. If you perform subtests 02 through 06, or 08, the following message will appear.

[Warning : The content of the disk(s)

Will be destroyed]

then press [Enter] Key.

10. If you perform subtest 06, the Cylinder Number, Head Number, Sector Number, Number of Sectors, and Data Pattern must be specified. If you perform subtest 07, all of these except the Data Pattern are specified. And if you perform subtest 08, only the Cylinder Number and Head Number must be specified.

CONTENTS

Subtest 01 Sequential read

This subtest performs forward reading of contents from track 0 to the maximum track and then performs reverse reading of the contents from the maximum track to track 0.

Subtest 02 Address uniqueness

This subtest writes the address data that is different sector by sector at each track, then reads and compares it to the original data. This test is done for all tracks.

There are three types of reads as listed below.

- Forward sequential
- Reverse sequential
- Random

Subtest 03 Random address/data

This subtest writes random data to random addresses (cylinder, head, and sector), and then reads the data out and compares it to the original data.

Subtest 04 Cross talk & peak shift

This subtest writes the eight types of worst Pattern data (shown below) to a cylinder, then reads the data while shifting cylinder by cylinder.

Worst pattern data:

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

Subtest 05 Write/read/compare(CE)

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

Subtest 06 Write specified address

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

Subtest 07 Read specified address

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

Subtest 08 ECC circuit

This subtest checks the ECC (error check and correction) circuit functions of a specified cylinder and head.

3.12 REAL TIMER TEST

Subtest 01 Real timer

A new date and time can be inputted during this subtest when the current date and time are displayed.

Operations for the test are as follows.

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

Current date: xx-xx-xxxx

Current time: xx:xx:xx

Enter new date:

2. If the current date is not correct, input the correct date and press **Enter**.
3. If the current time is not correct, input the correct time and press **Enter**. This will return you to the subtest menu of the Real timer test.

Subtest 02 Real timer 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 EXPANSION TEST

NOTE: *If the Toshiba Desk Station II is not connected to the system, this test cannot be executed.*

Subtest 01 Box wrap around test

NOTE: *As this subtest required a special tool to be executed, it cannot be carried out here.*

Subtest 02 Box mono video-ram test

NOTE: *If there is no monochrome display card in the Toshiba Desk Station, this test cannot be executed.*

This subtest writes data (FFh, AAh, 55h, 00h) into the monochrome display memory (B000h to B0F9Fh), then reads the data out and compares it with the original data.

3.14 ERROR CODE AND ERROR STATUS NAMES

Table 3-2 lists the error code and error status names.

Table 3-2 Error code and error status names

Device name	Error code	Error status name
(COMMON)	FF	Data Compare Error
SYSTEM	01	ROM Checksum 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
PRINTER	80	Time Out Error
	EE	Write Buffer Error
	01	Time Out
	08	Fault
	10	Select Line
	20	Out Of Paper
ASYNC	40	Power Off
	80	Busy Line
	01	[DSR ON] Time Out
	02	[CTS ON] 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)	

Table 3-2 Error code and error status names (continued)

Device name	Error code	Error status name
HDD	01	Bad Command Error
	02	Bad Address Mark
	04	Record Not Found
	05	HDC Not Reset
	07	Drive Not Initialize
	09	DMA Boundary Error
	0A	Bad Sector Error
	0B	Bad Track Error
	10	ECC Error
	11	ECC Recover Enable
	20	HDC Error
	40	Seek Error
	80	Time Out Error
	AA	Drive Not Ready
	BB	Undefined
	CC	Write Fault
E0	Status Error	
F0	Not Sense Error (FF)	

3.15 HARD DISK TEST DETAIL STATUS

When an error occurs in the hard disk test, the following message will appear:

HDC status = xxxx

Detailed status of the hard disk test error is shown on the screen by an eight-unit number. The first xxxx is the error status and the last xxxx is not used.

Error status is composed of 2 bytes; the first byte shows the contents of the HDC status register in hexadecimal form and the other shows the error register of the HDC.

These contents are described in the Tables 3-3 and 3-4.

Table 3-3 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 command was terminated with some error.

Table 3-4 Error register contents

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

3.16 RUNNING TEST

3.16.1 Program Description

This program automatically runs the following tests in sequence.

1. FDD test (subtest number 02)
2. HDD test (subtest number 01, 05)
3. System test (subtest number 01)
4. Memory test (subtest number 04, 06, 07)
5. Display test (subtest number 01 to 08)
6. Printer test (subtest number 03)
7. ASYNC test (subtest number 01)

When running an FDD test, this system automatically decides if there is one or two FDDs.

3.16.2 Operations

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

1. Remove the Diagnostics Disk and insert the work disk into the floppy disk drive.
2. After pressing **2** and **Enter** in the DIAGNOSTICS MENU, the following message will appear:

```
* RUNNING TEST CONTROL MENU *  
Printer wrap around test (1:Yes/2:No) ?
```

If you select Yes (by typing in **1** and pressing **Enter**): The printer wraparound test will be executed. A printer wraparound connector must be connected to the printer connector on the back of the unit to properly execute this test.

If you select No (by typing in **2** and pressing **Enter**): The printer wraparound test will not be executed.

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

```
ASYNC wrap around test (1:Yes/2:No) ?
```

If you select Yes (by typing in **1** and pressing **Enter**): The ASYNC wraparound test will be executed. An RS-232-C wraparound connector must be connected to the COMMS connector on the back of the unit to properly execute this test.

If you select No (by typing in 2 and pressing **Enter**): The ASYNC wraparound test will not be executed.

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

LIM-EMS Memory test (1:Yes/2:No)

If you select Yes (By typing in 1 and pressing **Enter**): The following message will appear:

```
Select memory block!  [[Int = xxxxKB  Ext = xxxxKB]]
(1) Internal (2) 0-2MB (3) 2-4MB (4) 4-6MB (5) 6-8MB (0) All (2/4/8MB)
```

Enter the values for the internal and external memory. The following warning message will appear:

```
[Warning:  The content of the EMS Memory,
will be destroyed]
Press [Enter] Key.
```

If you select No (By typing in 2 and pressing **Enter**): The LIM-EMS memory test will not be executed.

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

FDD w/r/c test (1:Yes/2:No) ?

If you select Yes (by typing in 1 and pressing **Enter**): The sequential read/write test for the FDD will be executed. The following message will appear:

TEST DRIVE MENU

```
1 - UNIT 1
2 - UNIT 2
0 - UNIT 1&2
9 - Exit To DIAGNOSTICS MENU
```

PRESS [1]-[2] or [9] KEY ?

Select the drive number of the floppy disk drive to be tested and then press **Enter**. The following message will appear:

FDD MEDIA TYPE MENU

- 1 - 2HD <Internal or External>
- 2 - 2DD <Internal>
- 3 - 2D <External Drive 2HD>
- 4 - 2D <External Drive 2D >
- 9 - Exit To DIAGNOSTICS MENU

PRESS [1]-[4] or [9] KEY ?

Select the media type of the floppy disk to be tested, then press **Enter**. The following message will appear:

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

If you select No (by typing in 2 and pressing **Enter**): The FDD write/read/compare test will not be executed.

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

HDD w/r/c test (1:Yes/2:No) ?

If you select Yes (By typing in 1 and pressing **Enter**): The following message will appear:

TEST DRIVE MENU

- 1 - UNIT 1
- 2 - UNIT 2
- 9 - Exit To DIAGNOSTICS MENU

PRESS [1]-[2] or [9] KEY ?

Select the test drive number and press **Enter**.

If you select No (By typing in 2 and pressing **Enter**): The HDD read/write/compare test will not be executed.

7. Type in 1 or 2 and press **Enter**. The running test will begin for the tests you have selected.
8. This program is repeated continuously. To stop the program, press **Ctrl + Break**.

3.17 LOG UTILITIES

3.17.1 Program Description

This program logs error information generated while a test is in progress; the information is stored in RAM. However, if the POWER switch is turned off, the error information will be lost. The error information itself is displayed as follows.

1. Error count (ERR)
2. Test name (TST)
3. Subtest number (SB)
4. Pass count (PASS)
5. Error status (STS)
6. FDD/HDD or memory address (ADDRESS)
7. Write data (WD)
8. Read data (RD)
9. HDC status (HSTS)
10. Error status name (NAME)

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

3.17.2 Operations

1. After pressing **3** and **Enter** in the DIAGNOSTICS MENU, the error information logged in RAM or on the floppy disk is displayed as shown below.

```
ERROR LOG UTILITIES  PAGE 01  TOTAL ERROR=[xxxx]
ERR TST SB PASS STS ADDRESS WD RD HSTS NAME
(CCCHSS)
```

2. If error information is displayed on the screen, the following will appear.

```
(1)Next (2)Prev (3)Exit (4)Clear (5)FD Write (6)FD Read (7)Print
```

3. Error information displayed on the screen can be manipulated with the following key operations.
 - (1) Scrolls the display to the next page.
 - (2) Scrolls the display to the previous page.
 - (3) Returns the display to the DIAGNOSTICS MENU.
 - (4) Erases all error log information in RAM.
 - (5) Writes log information to a floppy disk.
 - (6) Reads log information from a floppy disk.
 - (7) Outputs error log information to a printer.

4. In the case of “error retry OK”, the capital “R” will be placed at the beginning of error status. However, this is not added to the error count.

3.18 HEAD CLEANING

3.18.1 Program Description

This program executes head load/seek and read operations for head cleaning. A cleaning disk kit is necessary for cleaning the 3.5-inch FDD head.

3.18.2 Operations

1. After pressing **4** and **Enter** in the **DIAGNOSTICS MENU**, the following message will appear.

1-UNIT 1
2-UNIT 2
3-UNIT 1 & 2

9-EXIT TO DIAGNOSTICS MENU

PRESS [1]-[3]or[9] Key ?
2. After the above message appears, remove the Diagnostics Disk, and insert the cleaning disk. Select the drive number for the cleaning disk, then press **Enter**.
3. When the **FDD Cleaning Execution** message appears, FDD head cleaning will begin.
4. When cleaning is finished, the display automatically returns to the **DIAGNOSTICS MENU**.

3.19 SYSTEM CONFIGURATION

3.19.1 Program Description

This program displays the following system configuration.

1. BIOS ROM version
2. Conventional memory size
3. Display type
4. Number of floppy disk drives
5. Number of ASYNC ports
6. Number of hard disk drives
7. Number of printer ports
8. Expanded memory size

3.19.2 Operations

After pressing **8** and **Enter** to select from the DIAGNOSTICS MENU, the following display will appear.

```
SYSTEM CONFIGURATION  Vx.xx

* - 640KB Conventional Memory

* - LCD

* - 1 Floppy Disk Drive

* - 1 ASYNC Adapter

* - 1 Hard Disk

* - 1 Printer Adapter

* - xxxxKB EMS Memory Size

PRESS [Enter] Key ?
```

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

3.20 HARD DISK FORMAT

This command executes hard disk formatting.

There are two types of hard disk formatting:

1. Physical formatting
2. Logical formatting

This program is for physical formatting of the hard disk. It can execute the following items:

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 a floppy disk. This can be done with the MS-DOS BACK-UP command. (See the MS-DOS manual for details.)*

3.20.1 Program Description

1. All track FORMAT

Performs physical formatting of the hard disk as shown in Table 3-5 below:

Table 3-5 Hard disk formatting sequence

Items	Description
Sector sequences	1
Cylinders	0 to 614
Heads	0 to 2
Sectors	1 to 16
Sector length (bps)	512
Bad track (maximum)	20

2. Good track FORMAT

Executes the formatting of a specified cylinder and track as a good track.

3. Bad track FORMAT

Executes the formatting of a specified cylinder and track as a bad track.

4. Bad track CHECK

Checks for bad tracks by performing a read operation for all tracks on the hard disk; a list of bad tracks is then displayed.

3.20.2 Operations

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

1. After loading the MS-DOS, insert the Diagnostics Disk in the floppy disk drive. Type in **A:HDFAT**, then press **Enter**. The following display will appear:

```
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 selection

- (1) When all track FORMAT (1) is selected, the following message will appear:

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

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

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

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

```
[ HDD TYPE ] : CYLINDER = xxx
[ HDD TYPE ] : HEAD     = x
[ HDD TYPE ] : SECTOR   = xx
```

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

Press [Bad track number (CCCH)] key ?

- (4) After pressing **Enter**, the **[[cylinder, head = xxx x]]** message will appear, then all cylinders of the hard disk are formatted and checked.
- (5) After formatting the hard disk the Format complete message will appear.
- (6) Press **Enter** to return to the HARD DISK FORMAT MENU.

3. Good track FORMAT or bad track FORMAT selection

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

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

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

Interleave number (1/1-3) ?

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

```
[ HDD TYPE ] : CYLINDER = xxx
[ HDD TYPE ] : HEAD     = x
[ HDD TYPE ] : SECTOR   = xx
```

Press [Track number (CCCH)] key ?

- (4) Type a track number (four digits) and press **Enter**. (The first three digits are the cylinder number and the last digit is the head number.) This executes the formatting of good tracks or bad tracks as indicated.

***NOTE:** This program can format only one track per operation. If it is desired to format several good tracks or bad tracks, repeat the operation as many times as necessary.*

- (5) After formatting the track of the hard disk, the **Format complete** message will appear.

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

4. Bad track CHECK selection

- (1) When bad track CHECK is selected, the following message will appear:

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

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

Interleave number (1/1-3) ?

- (3) Select an interleave number (usually select 1). Type the number and press **Enter**. Then the following message appears, and bad tracks of the hard disk are checked.

```
[ HDD TYPE ] : CYLINDER = xxx
[ HDD TYPE ] : HEAD      = x
[ HDD TYPE ] : SECTOR    = xx
```

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

- (4) After checking the bad tracks of the hard disk, the **Format complete** message will appear.
- (5) Press **Enter** to return to the HARD DISK FORMAT MENU.

3.21 FLOPPY DISK FORMAT

This command executes FDD formatting.

3.21.1 Program Description

<p><i>CAUTION: This program is only for testing a floppy disk drive. The program is different from the MS-DOS FORMAT command.</i></p>

This program can format a floppy disk (5.25-inch/3.5-inch) as follows:

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

3.21.2 Operations

1. After running MS-DOS, insert the Diagnostics Disk in the floppy disk drive. Type in **A:FDFMT** and press **Enter**. The following message will appear:

DIAGNOSTICS - FLOPPY DISK FORMAT : Vx.xx

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

2. Select a drive number. Type the number and the following message will appear:

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

3. Select a media/drive type number. Type the number and a message similar to the one below will appear:

Warning : Disk data will be destroyed.

Insert work disk into drive A:

Press any key when ready.

4. Remove the Diagnostics Disk from the FDD and insert the work disk; press any key.

The following message will appear and formatting 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**, the display will return to the message in step 3 above. If you type **2**, the display will return to the DIAGNOSTICS MENU.

3.22 FLOPPY DISK COPY

This command copies floppy disks.

3.22.1 Program Description

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

3.22.2 Operations

1. After running MS-DOS, insert the Diagnostics Disk in the floppy disk drive. Type in **A:FDCPY** and press **Enter**. 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. Type the number. The following message will appear:

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

3. Remove the Diagnostics Disk from the FDD and insert the source disk; press any key. The following message will appear and the copying to memory begins.

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

Copy start

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

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

4. Remove the source disk from the FDD and insert the formatted work disk; press any key. The [[**track, head = xxx x**]] message will appear and start the copying to a target disk. When copying cannot be done with one operation, the message in step 2 above is displayed again. Repeat the operation.

After the floppy disk has been copied, the following message will appear:

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

5. If you type **1** the display will return to the message in step 1 above. If you type **2** the display will return to the DIAGNOSTICS MENU.

3.23 FDD AND HDD DUMP

This command displays the dump list for both the FDD and HDD.

3.23.1 Program Description

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

3.23.2 Operations

1. After running MS-DOS, insert the Diagnostics Disk in the floppy disk drive. Type in **A:FDDMP** and press **Enter**. The following message appears:

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

2. Select a format type number. Type the number. If **3** is selected, the dump lists for the hard disk are displayed automatically (see step 8 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 (HDD).

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

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

4. Select an FDD drive number by typing in **1** or **2**. The following message will 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. The **Track number ??** message will appear. Type the track number and press **Enter**.
6. The **Head number ?** message will appear. Type the head number and press **Enter**.
7. The **Sector number ??** message will appear. Type the sector number and press **Enter**. The dump list for the floppy disk will be displayed.

8. After a dump list appears on the screen, the **Press number key (1: up, 2: down, 3: end) ?** message will appear.

1: Displays the next sector dump.

2: Displays a previous sector dump.

3: Displays the following message:

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

9. If you type **1**, the display will return to the message shown after step 1 above. If you type **2**, the display will return to the **C:** prompt.

3.24 WIRING DIAGRAMS

1. Printer wraparound connector

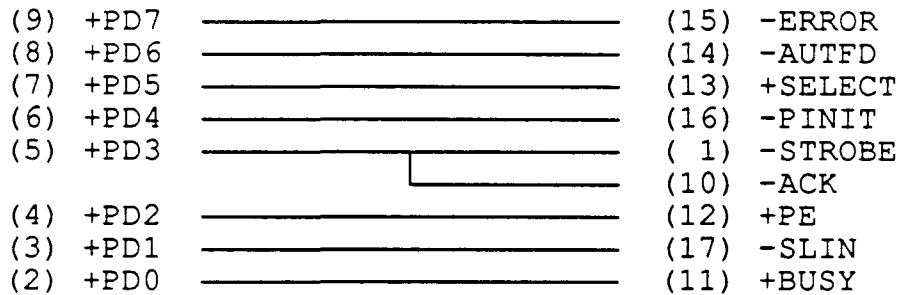


Figure 3-1 Printer wraparound connector

2. RS-232-C wraparound connector

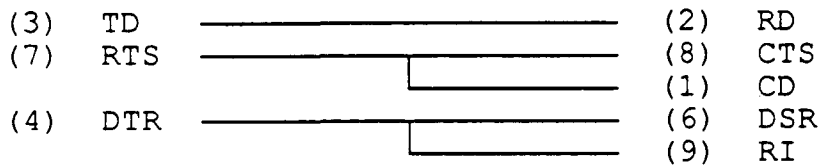


Figure 3-2 RS-232-C wraparound connector

3. RS-232-C direct cable (9-pin to 9-pin)

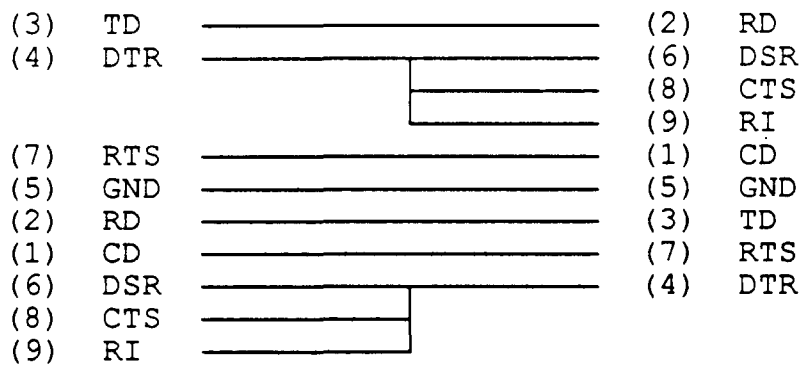


Figure 3-3 RS-232-C direct cable (9-pin to 9-pin)

4. RS-232-C direct cable (9-pin to 25-pin)

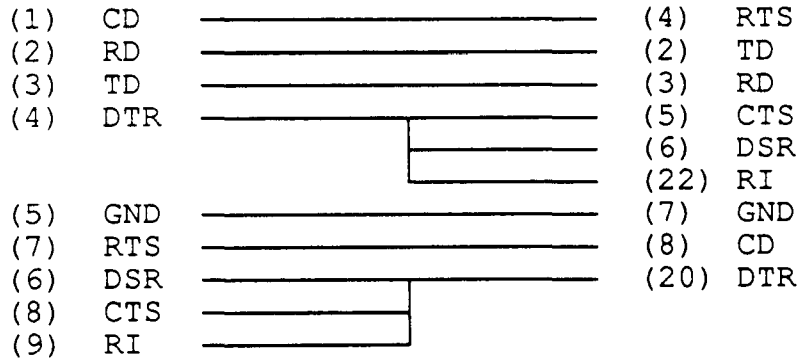


Figure 3-4 RS-232-C direct cable (9-pin to 25-pin)

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4.1 GENERAL

This section gives detailed procedures for removing and replacing field replaceable units (FRUs).

FRUs are listed as follows:

1. FDD
2. FL Inverter
3. HDD
4. I/F unit
5. Keyboard
6. LCD cable
7. LCD cover assembly
8. LCD module
9. LED board
10. Modem adapter
11. Modem cover
12. RTC battery
13. Sub battery
14. System board
15. Top cover

The following points must be kept in mind:

1. The system should never be disassembled unless there is a problem (abnormal operation, etc.).
2. Only quality tools should be used.
3. Keep the system free of dust and moisture.
4. The system is made of delicate electric components that are extremely sensitive to static electricity.
5. Whether using the system or storing it, the environment should be free of extreme heat, cold, or humidity.
6. After deciding the purpose of replacing the unit and the procedures required, do not perform any other procedures which are not absolutely necessary.
7. Be sure to turn the POWER switch off before beginning, and disconnect the AC adapter and all external cables from the system.

8. Only perform those steps given in each procedure.
9. After replacing an FRU, confirm that the system is operating normally.
10. There are many pins on the PCBs and sharp edges on both the PCBs and shielding. Be careful when working with these components.
11. The numerous screws securing the system are not interchangeable. When reassembling the system, follow the appropriate procedures and figures because the various screw dimensions are given.
12. If the part description is different between the Maintenance Manual and the Parts Catalog, the Parts Catalog description will be listed in parenthesis for the first reference.

Tools needed for FRU replacement:

1. Phillips head screwdriver
2. Tweezers

4.2 REMOVING/REPLACING THE HDD

NOTE: *If the HDD is not installed, the system unit will power up, and then immediately power down.*

1. Turn off the power to the system unit and remove the AC adapter from the system unit.
2. Turn the system unit upside down and remove the two screws (M3x6 silver) (A).
3. Pull the HDD pack handle (cover HDD pack) (B) out, and firmly pull and remove the HDD pack (C) from the system unit.

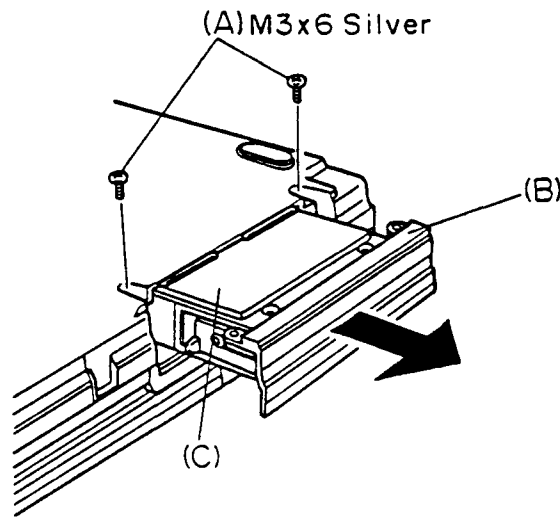


Figure 4-1 Removing the HDD pack

4. Remove the four screws (tap screws) (D) from the HDD pack and remove the pack cover (E) while sliding it toward the HDD pack handle.

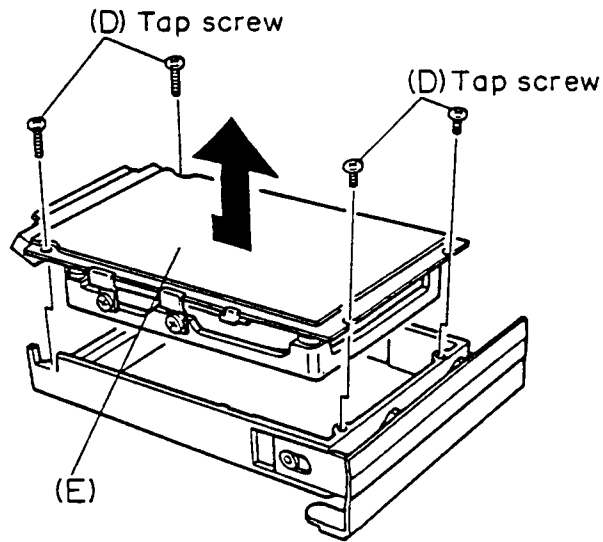


Figure 4-2 Removing the HDD pack cover

5. Remove the four screws (inch screws) (F) and remove the HDD pack cover from the HDD unit (G).

NOTE: *If the HDD unit is a Conner CP2024, the HDD is secured to the HDD pack cover from the bottom, and not the side, with four screws.*

6. Remove the HDD flexible cable (FPC FHDCO2) (H) from the HDD unit.

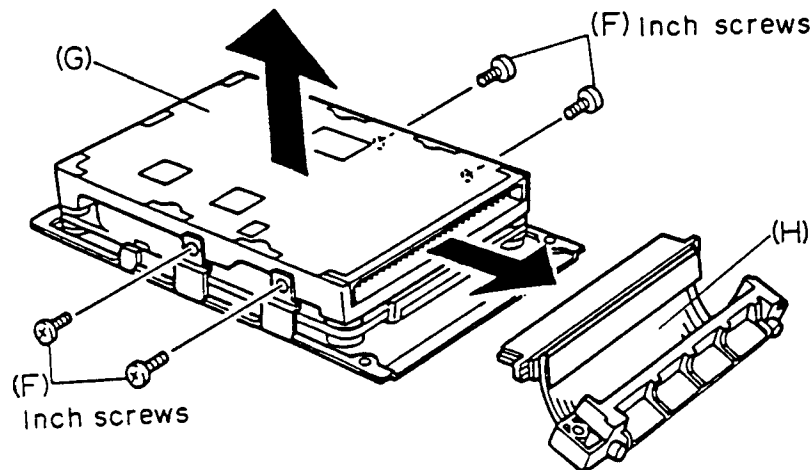


Figure 4-3 Removing the HDD unit

7. To install the HDD unit, follow the above procedure in reverse.

4.3 REMOVING/REPLACING THE KEYBOARD & SUB BATTERY

1. Turn off the power to the system unit and remove the AC adapter from the system unit.
2. Turn the system unit upside down and remove the three screws (M3x8 silver) (A) that attach the keyboard to the system unit.

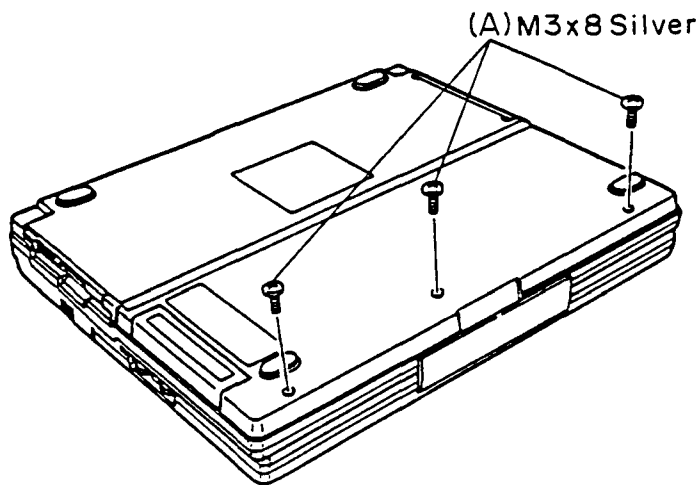


Figure 4-4 Removing the three screws

3. Carefully turn the system unit back over and open the display.
4. Lift up the front edge of the keyboard unit (B) and place it in front of the computer. At this time, you cannot disconnect the keyboard cable.

5. Release the pressure plate (C) of PJ8 (D) and disconnect the keyboard cable (E) from the system board.

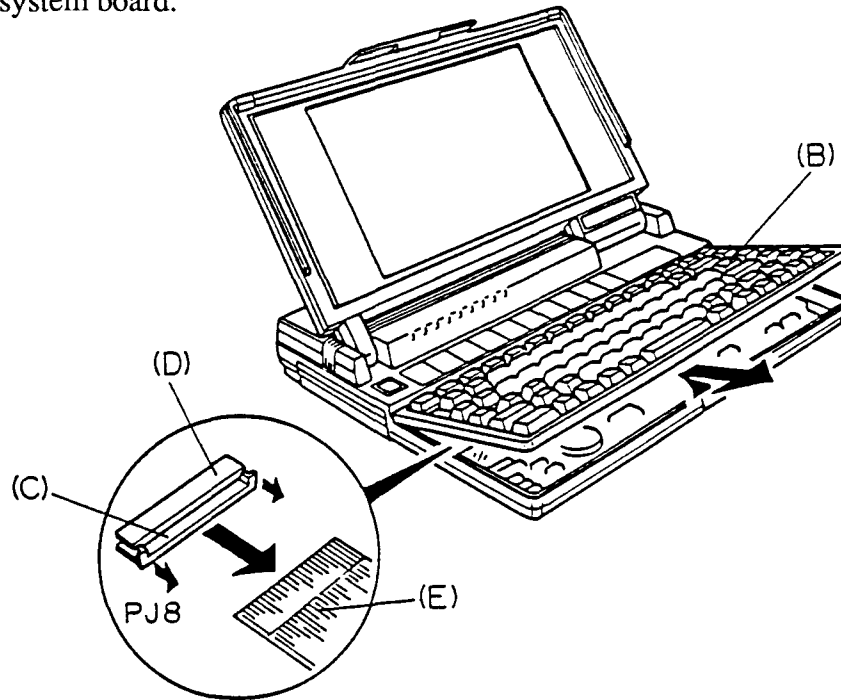


Figure 4-5 Removing the keyboard unit

6. Release the seven latches (F) on the keyboard cover (KB Cover) (G) and pull out the keyboard (H).

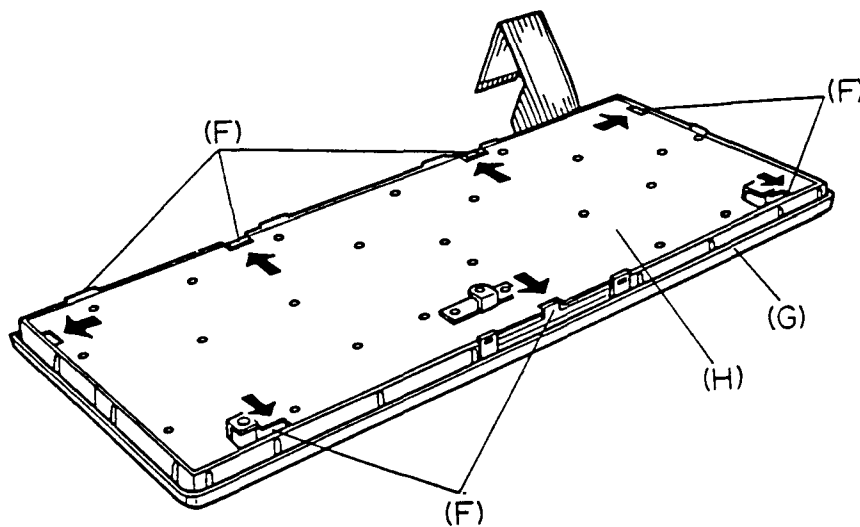


Figure 4-6 Removing the keyboard

7. Remove the sub battery cable (I) from PJ504 (J) located on the system board. Then remove the sub battery (K).

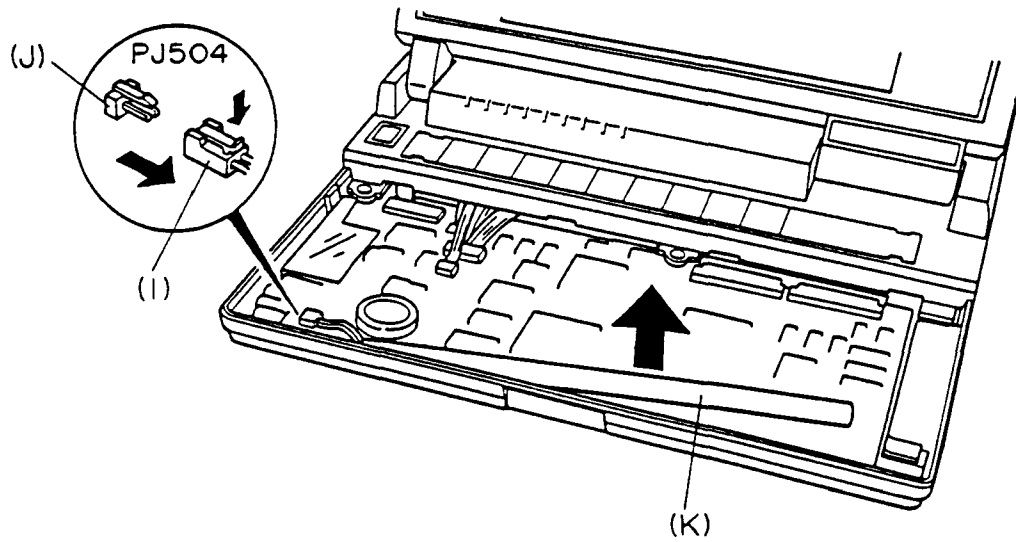


Figure 4-7 Removing the sub battery

8. To install the keyboard and the sub battery, follow the above procedure in reverse.

4.4 REMOVING/REPLACING THE LCD MODULE AND FL INVERTER BOARD

1. Turn off the power to the system unit and remove the AC adapter from the system unit.
2. Open the display, and then remove the two rubber feet (cushions) (A) and name plate (B) from the LCD mask (C).
3. Remove the four screws (M3x6) (D) and release the ten latches (E) on the LCD mask.

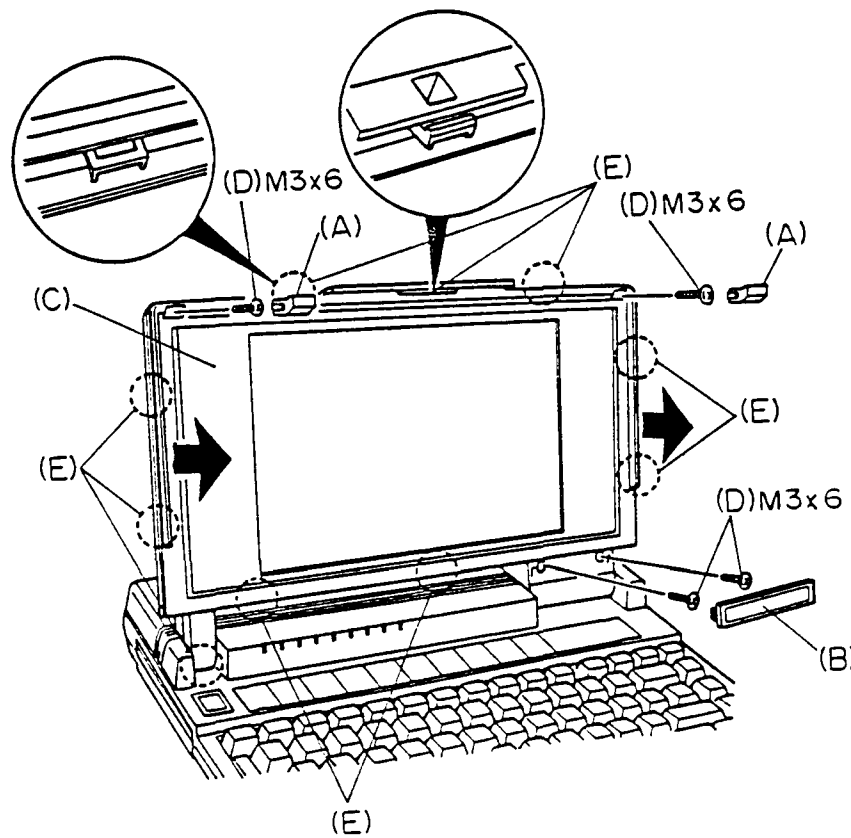


Figure 4-8 Removing the LCD mask

4. Remove the two screws (M3x6) (F) from the FL inverter board (G) and lift its right edge toward you. Remove the FL inverter board by sliding it to the right side of the system.

5. Disconnect the two cables (H) from PJ1 and PJ2 (I) located on the FL inverter board.

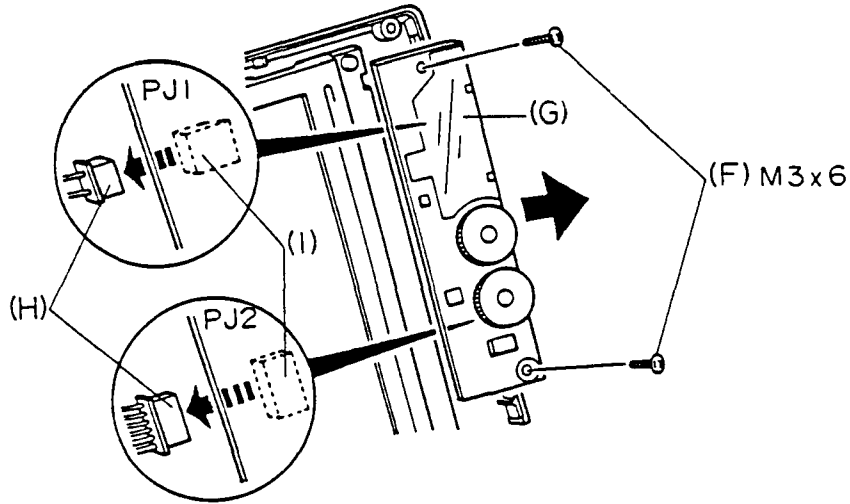


Figure 4-9 Removing the FL inverter board

6. Disconnect the LCD cable (J) from the LCD cable connector (K), Then remove the four screws (M3x6) (L) and remove the LCD module (M) from the LCD cover.
7. Release the pressure plate of CN3 (N) on back of the LCD module to disconnect the LCD cable (FPC F1ELF22) (O).

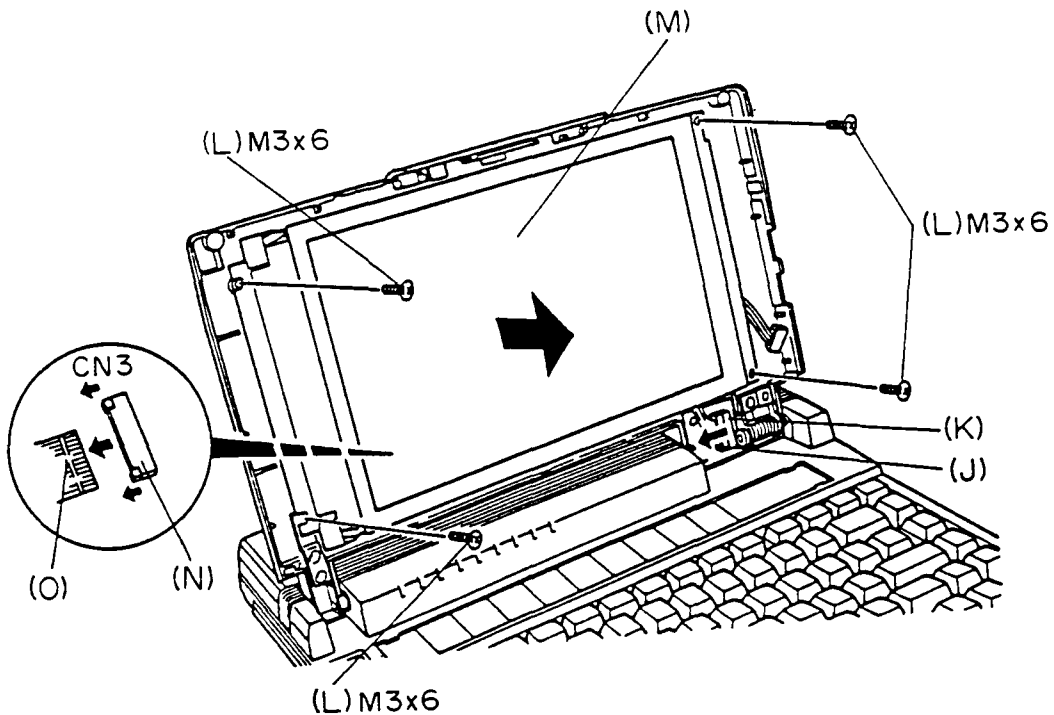


Figure 4-10 Removing the LCD module

8. To install the LCD module and FL inverter board, follow the above procedure in reverse.

NOTE: *The surplus cable between the LCD module and PJ1 connector on the FL inverter board should be stored behind the LCD module.*

4.5 REMOVING/REPLACING THE LCD COVER ASSEMBLY

1. Remove the LCD module and FL inverter board from the system unit as directed in Section 4.4.
2. Remove the three screws (M3x6) (A) to release the hinges (B) from the system unit.

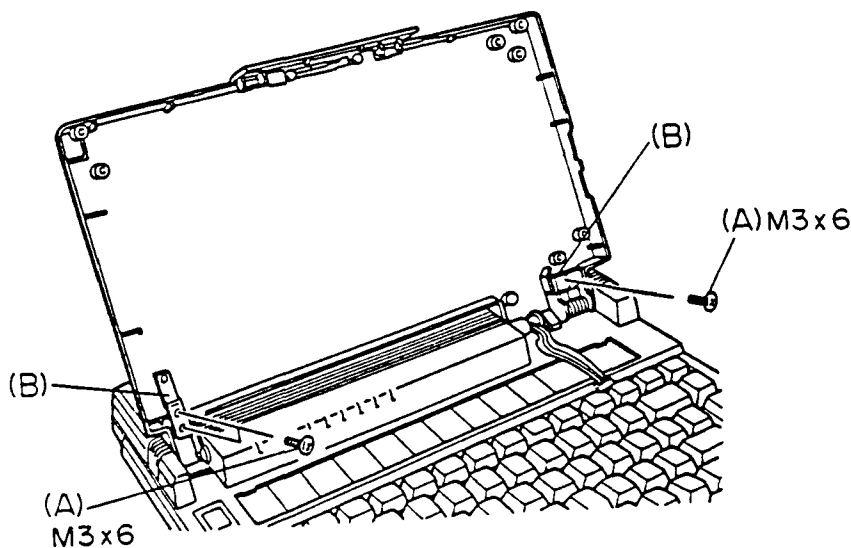


Figure 4-11 Removing the hinges

3. Bend the LCD cover (C) toward you, and remove the LCD cover by lifting it up.

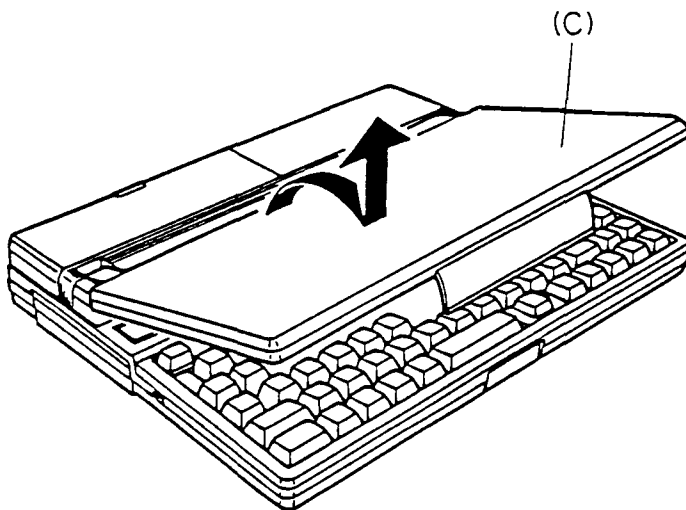


Figure 4-12 Removing the LCD cover

4. To install the LCD cover assembly, follow the above procedure in reverse.

4.6 REMOVING/REPLACING THE TOP COVER, MODEM COVER, AND MODEM ADAPTER

1. Remove the keyboard unit and LCD cover assembly from the system unit as directed in Sections 4.3 and 4.5.
2. Remove the battery pack (Main battery) (A) from the system unit.
3. Remove the two screws (M3x8 silver) (B) and remove the modem case (C) from the system unit.

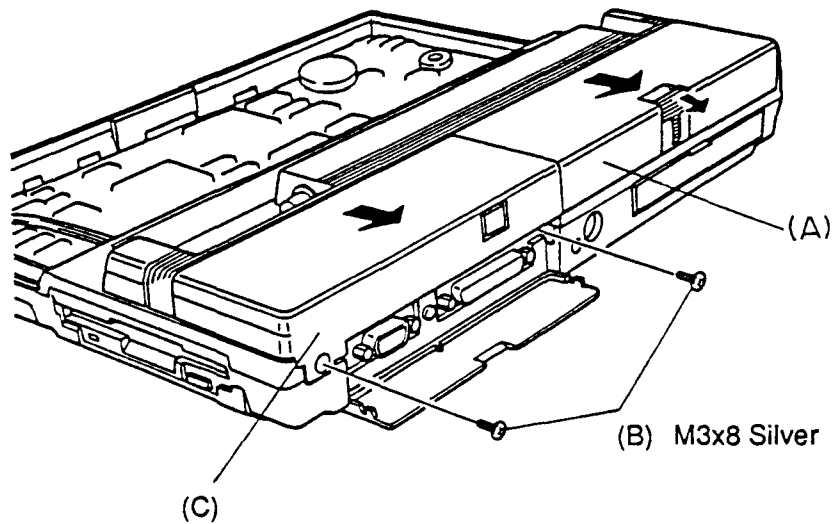


Figure 4-13 Removing the battery pack and modem case

4. Disconnect the modem adapter (PCB F1EMAD) (D).
5. Remove the seven screws (M3x8 silver) (E) to remove the top cover (Cover sub assembly) (F) from the system unit.

6. Disconnect the power supply cables, LED cable, and LCD cable from PJ501, PJ502, PJ503, PJ505, and PJ7 (G).

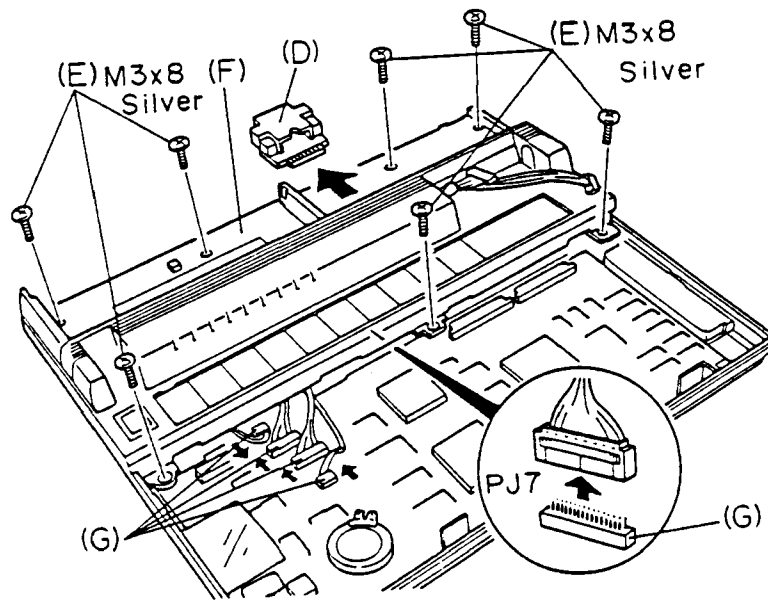


Figure 4-14 Removing the modem adapter and top cover

7. To install the top cover, modem case, and modem adapter, follow the above procedure in reverse.

4.7 REMOVING/REPLACING THE POWER SUPPLY BOARDS, POWER SWITCH, & LCD CABLE

1. Remove the top cover (Cover sub assembly) from the system unit as directed in Section 4.6.
2. Remove the one screw (M3x6) (A), lift up the power supply board (F1EC22) (B) and pull it out from PJ602 located on the LED board (PCB F1EL11).
3. Disconnect the cables from PJ801, PJ804, and PJ805 (C).
4. Remove the two screws (M3x6) (D) and remove the battery terminal (E) from the top cover.
5. Remove the two screws (M3x6) (F) to remove the power switch unit (Plate SW) (G) from the top cover.

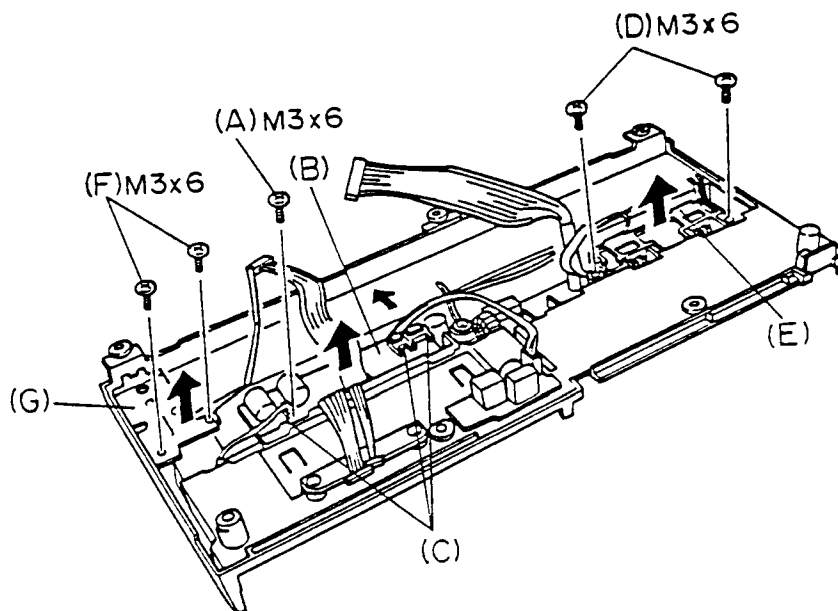


Figure 4-15 Removing the power supply board

6. Remove the two screws (M3x4 silver) (H) to remove the DC-IN board (SW bracket assembly, PCB F1EJC3) (I) from the top cover.
7. Remove the one screw (M3x4) (J). After remove the spacer (K) and wire clip (L), remove the LED board (PCB F1EL11) (M) from the top cover.

8. Loosen the other wire clip (N) and release the LCD cable (LCD harness) (O). Then remove the one screw (tap screw) (P) to remove wire clip from the top cover.
9. After removing the hinge holder (Q), remove the LCD cable from the top cover.
10. Remove the two screws (M3x4 silver) (R) and remove the earth spring (S) and LCD cover shaft (T) from the top cover.

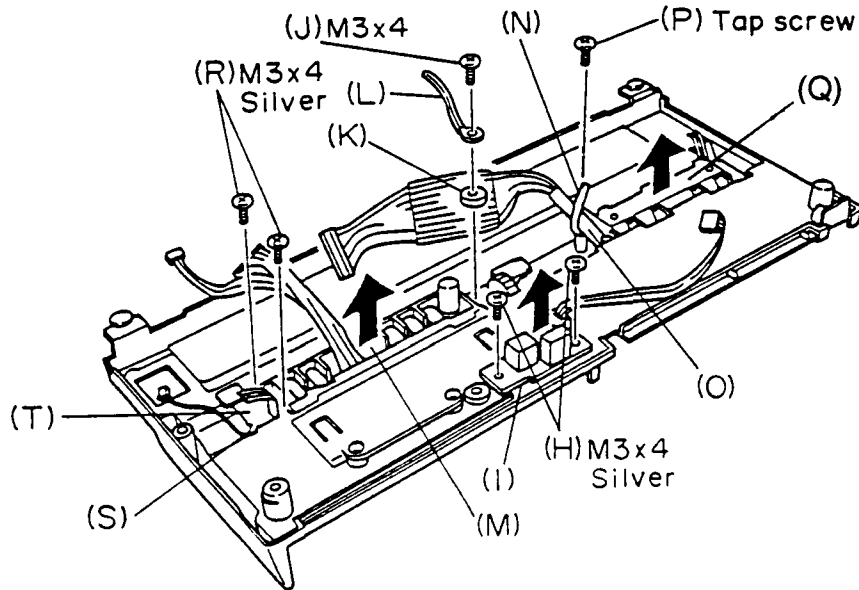


Figure 4-16 Removing the LED board and LCD cable

11. Remove the one screw (M3x4) (U) to remove the panel switch (V) from the switch plate (Plate SW) (W).

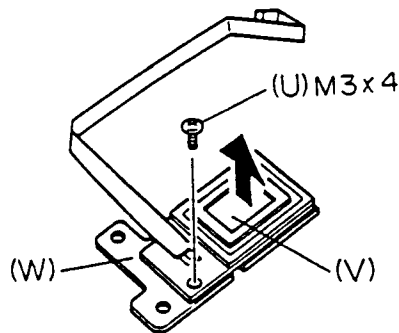


Figure 4-17 Removing the panel switch

12. To install the power supply boards, power switch, and LCD cable, follow the above procedure in reverse.

4.8 REMOVING/REPLACING THE RTC BATTERY AND FDD UNIT

1. Remove the top cover from the system unit as directed in the Section 4.6.
2. Disconnect the RTC battery cable (A) from PJ9 (B) located on the system board, then remove the RTC battery (Ni-Cd battery) (C) from the system unit.
3. Remove the I/F unit (FCP F1EFC4) (D) from the connector guide (E). Then remove the one screw (M3x6) (F) to carefully remove the connector guide from the FDD bracket.
4. Remove the two screws (M3x6) (G) and release the pressure plate of PJ5 (H) to disconnect the FDD cable (I).

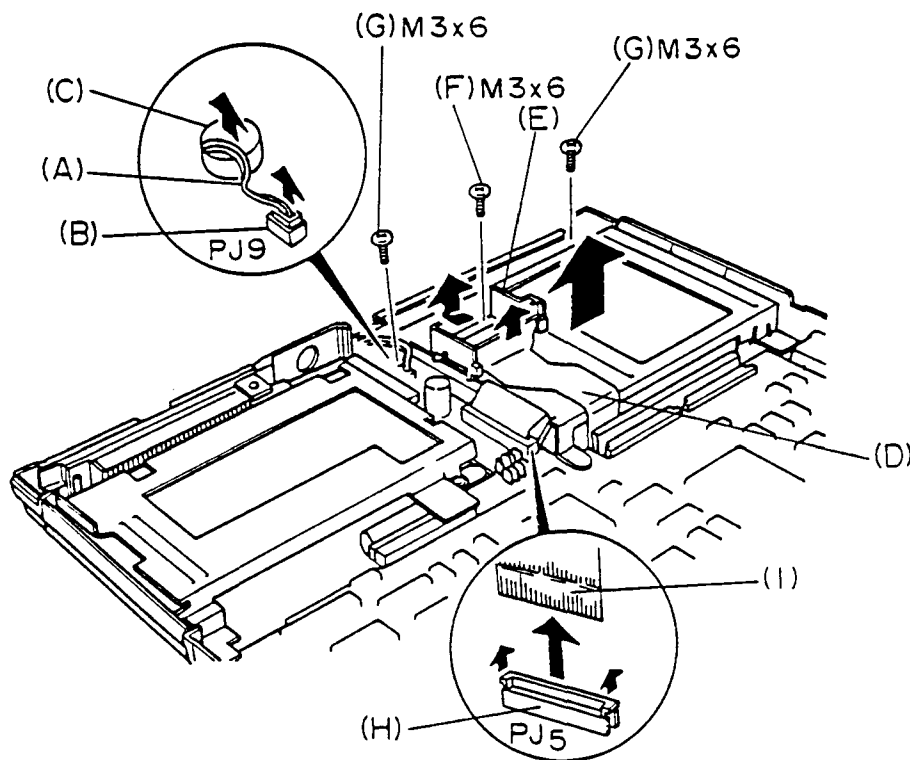


Figure 4-18 Removing the RTC battery and FDD unit

6. Remove the three screws (M3x4 silver) (K) and remove the FDD (L) from the FDD bracket (M).

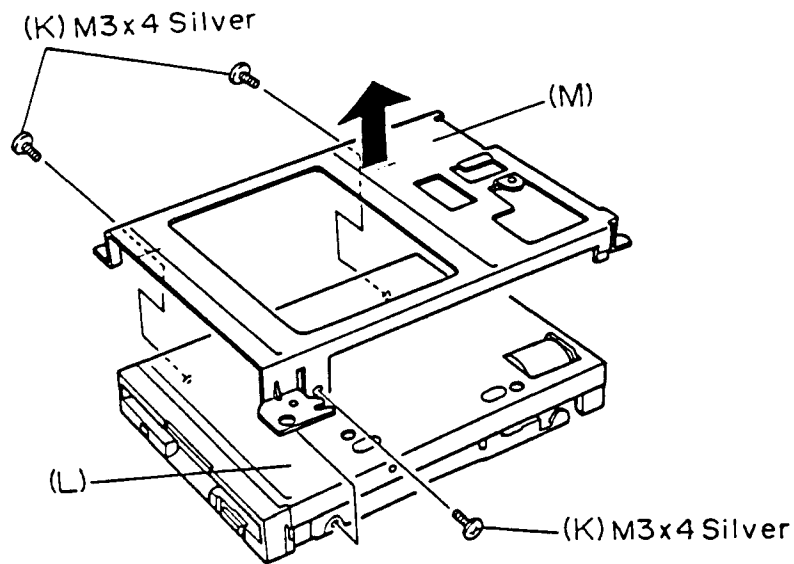


Figure 4-19 Removing the FDD unit

7. To install the RTC battery and FDD unit, follow the above procedure in reverse.

4.9 REMOVING/REPLACING THE I/F UNIT AND SYSTEM BOARD

1. Remove the RTC battery, FDD unit, and HDD pack from the system unit as directed in Sections 4.2 and 4.8.
2. Remove the two screws (M3x6) (A) and remove the HDD bracket (B) from the system unit.
3. Release the I/F unit (FPC F1EFC4) (C) from PJ1 and PJ2 (D) located on the system board.
4. Remove the two screws (M3x6 silver) (E) and remove the I/F unit from the system unit.

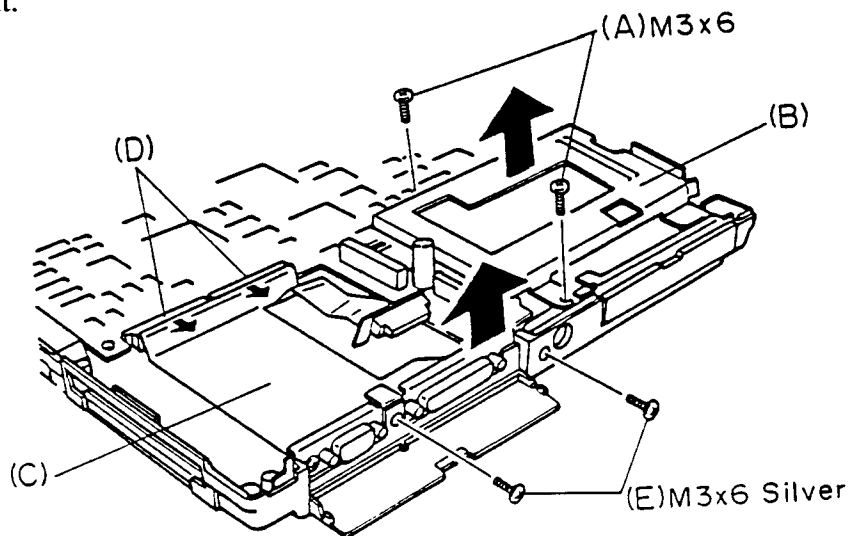


Figure 4-20 Removing the HDD bracket and I/F unit

5. After removing the one screw (M3x6 silver) (F), disconnect the HDD I/F cable (PCB F1EHF1) (G) from PJ12 (H) located on the system board.

- 6. Remove the two screws (M3x12) (I) and disconnect the HDD I/F cable from the system unit.

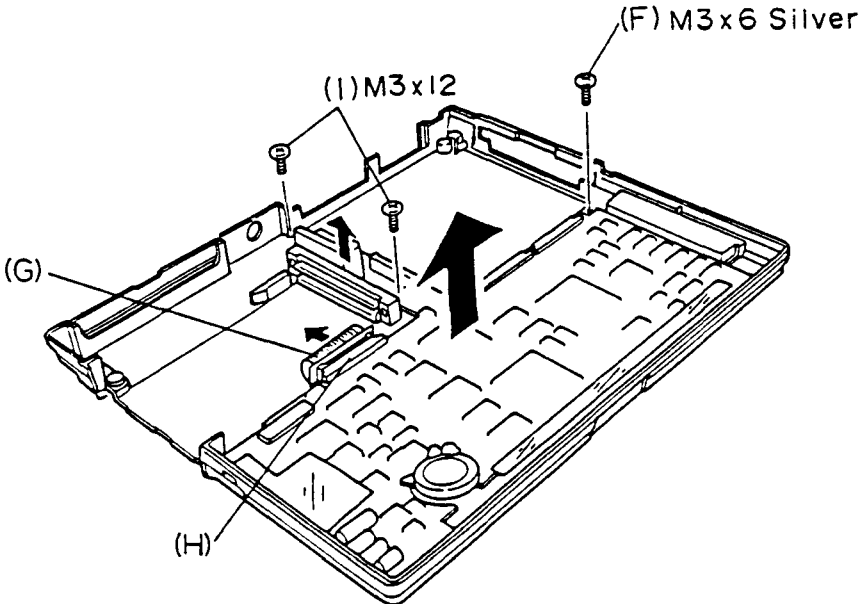


Figure 4-21 Removing the system board

- 7. To install the I/F cable, system board, and HDD I/F cable, follow the above procedure in reverse.

4.10 REMOVING/REPLACING THE BIOS ROM

1. Remove the keyboard unit from the system unit as directed in Section 4.3.
2. Slide the plate (A) toward the notch of the BIOS ROM (B) until it clicks, and remove it from the socket (C).

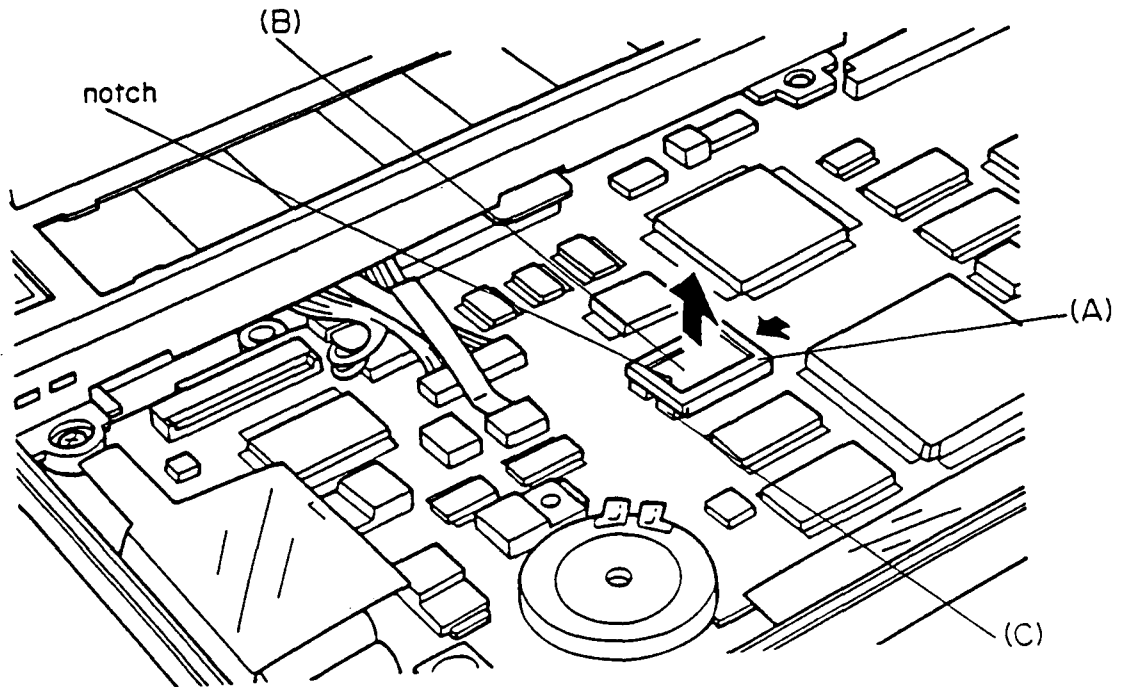


Figure 4-22 Removing the plate

3. Remove the BIOS ROM from the socket.

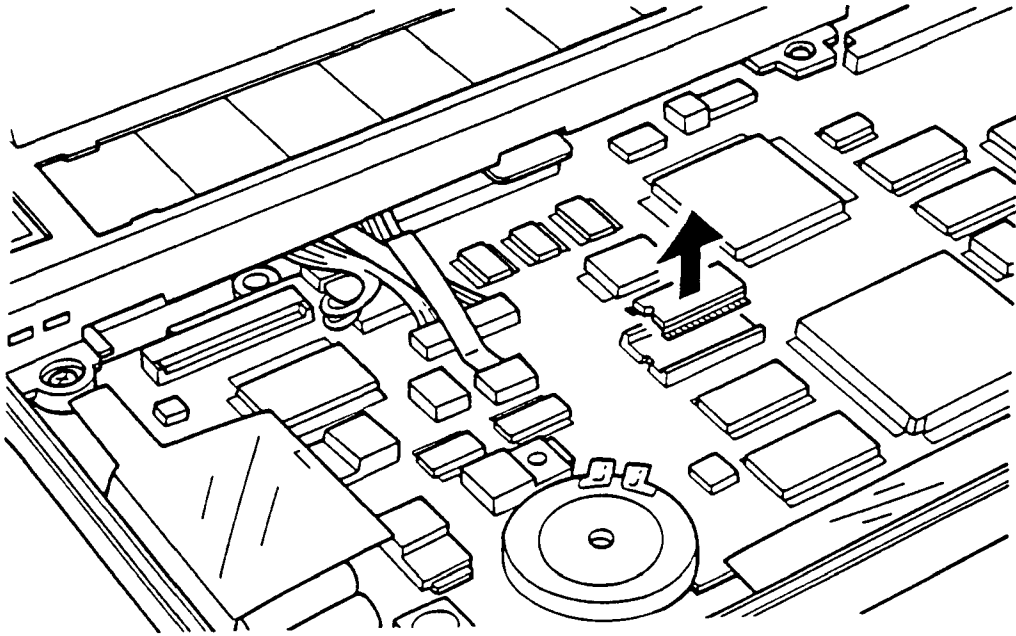


Figure 4-23 Removing the BIOS ROM

4. Place the new BIOS ROM in the socket.

NOTE: *The notch should point to the left.*

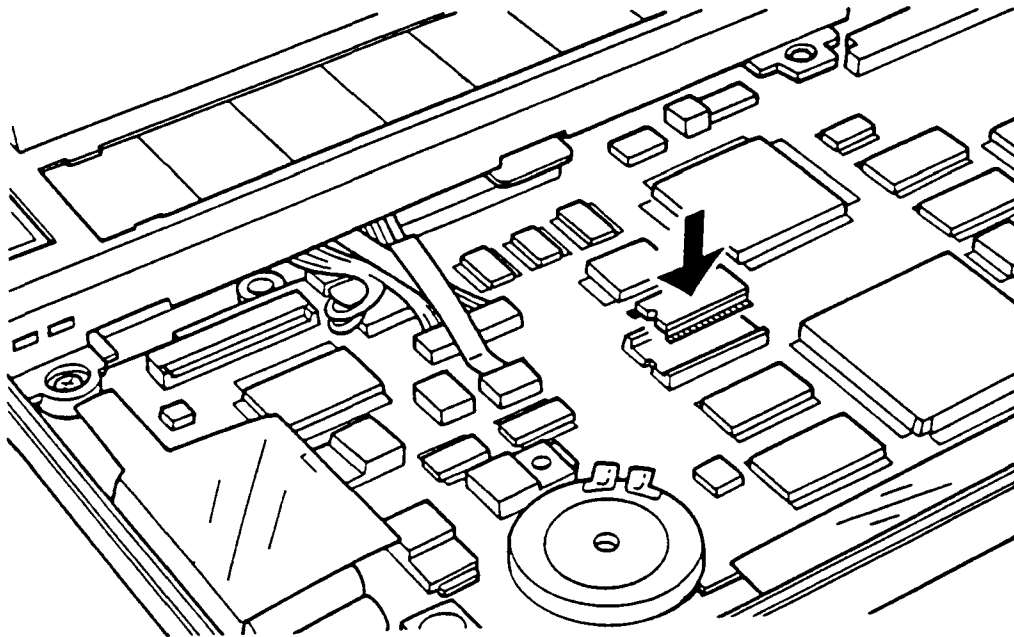


Figure 4-24 Placing the BIOS ROM

5. Correctly align the left edge of the plate and socket, and firmly press down on the plate until it is seated.

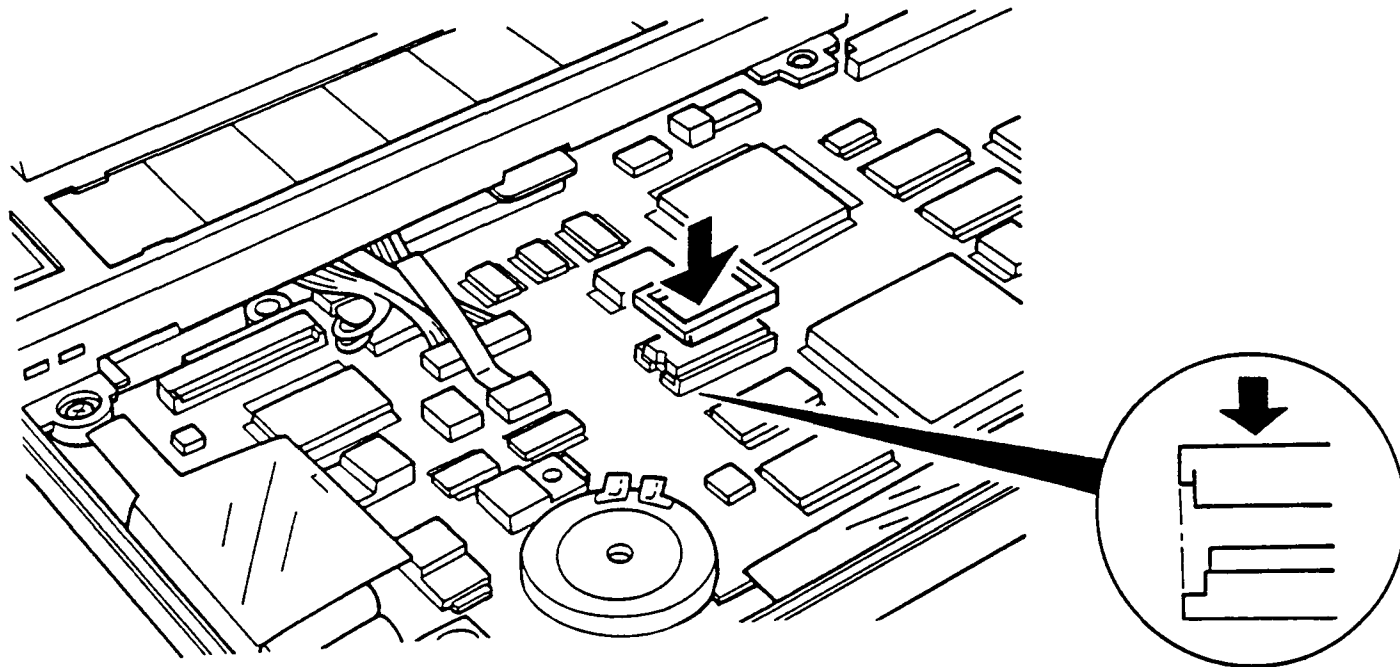


Figure 4-25 Seating the plate

6. To reassemble the system unit, follow the procedure in Section 4.3 in reverse.

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APPENDIX A BOARD LAYOUTS

1. System board F1ECP4 (ICs and OSCs)

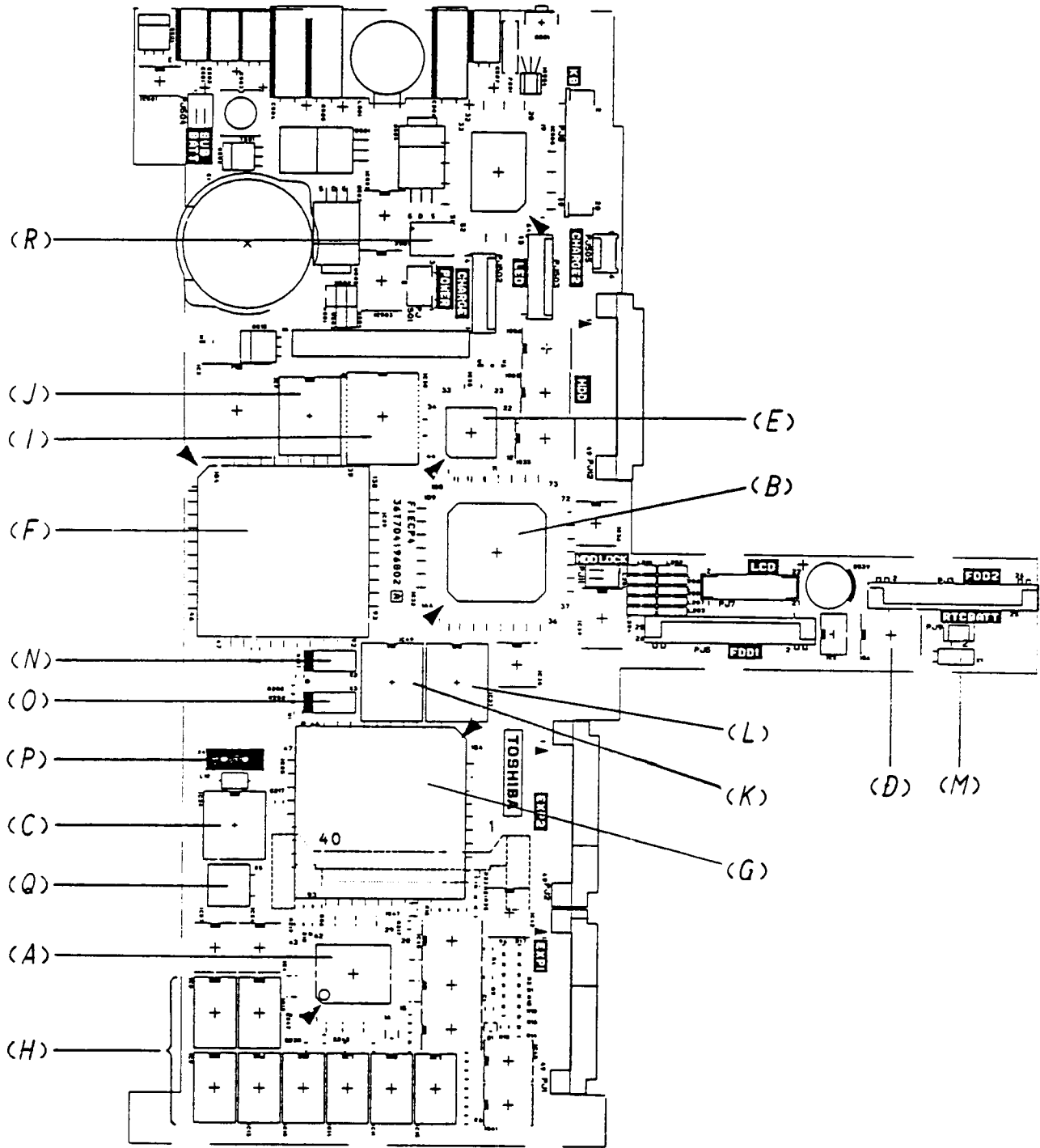


Figure A-1 System Board F1ECP4 (ICs and OSCs)

- (A) CPU: Central processing unit (80C86-2)
- (B) SI: Super integration (T9776)
- (C) VFO: Variable frequency oscillator (TC8568AM)
- (D) RTC: Real time clock (TC8521P)
- (E) KBC: Keyboard controller (80C49)
- (F) S1ECP3-GA: Memory and bus controller gate array
- (G) S1EIO1-GA: I/O controller gate array
- (H) SYSTEM RAM ICs
- (I) BIOS ROM
- (J) BACKUP RAM
- (K) VIDEO RAM
- (L) CG ROM
- (M) X1 32.768KHz OSC
- (N) X2 19.09091MHz OSC
- (O) X3 14.7456MHz OSC
- (P) X4 24MHz OSC
- (Q) X5 17.5MHz OSC
- (R) X501 500KHz OSC

APPENDIX A

2. System board F1ECP4 (connectors)

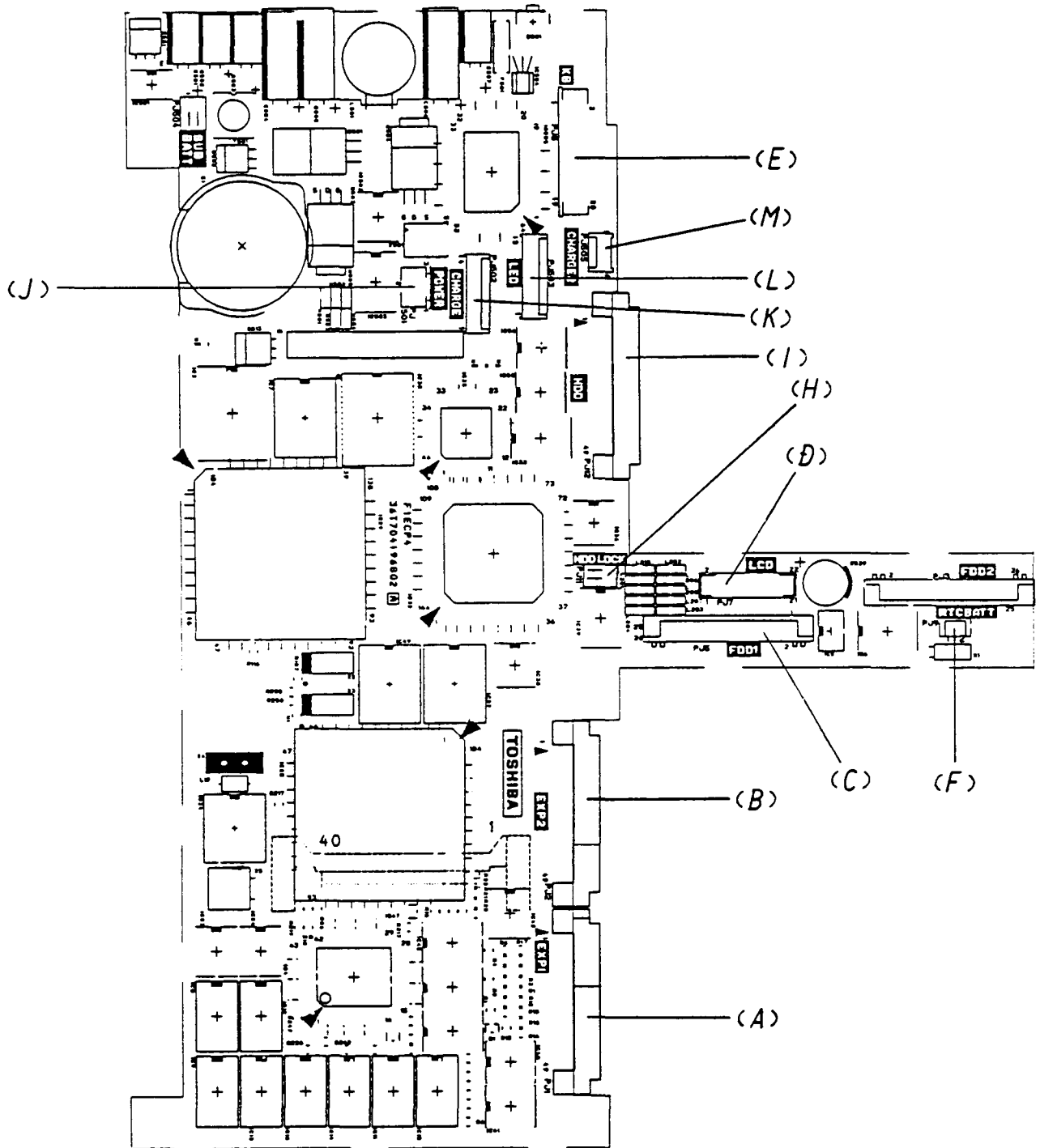


Figure A-2 System board F1ECP4 (connectors) (Front)

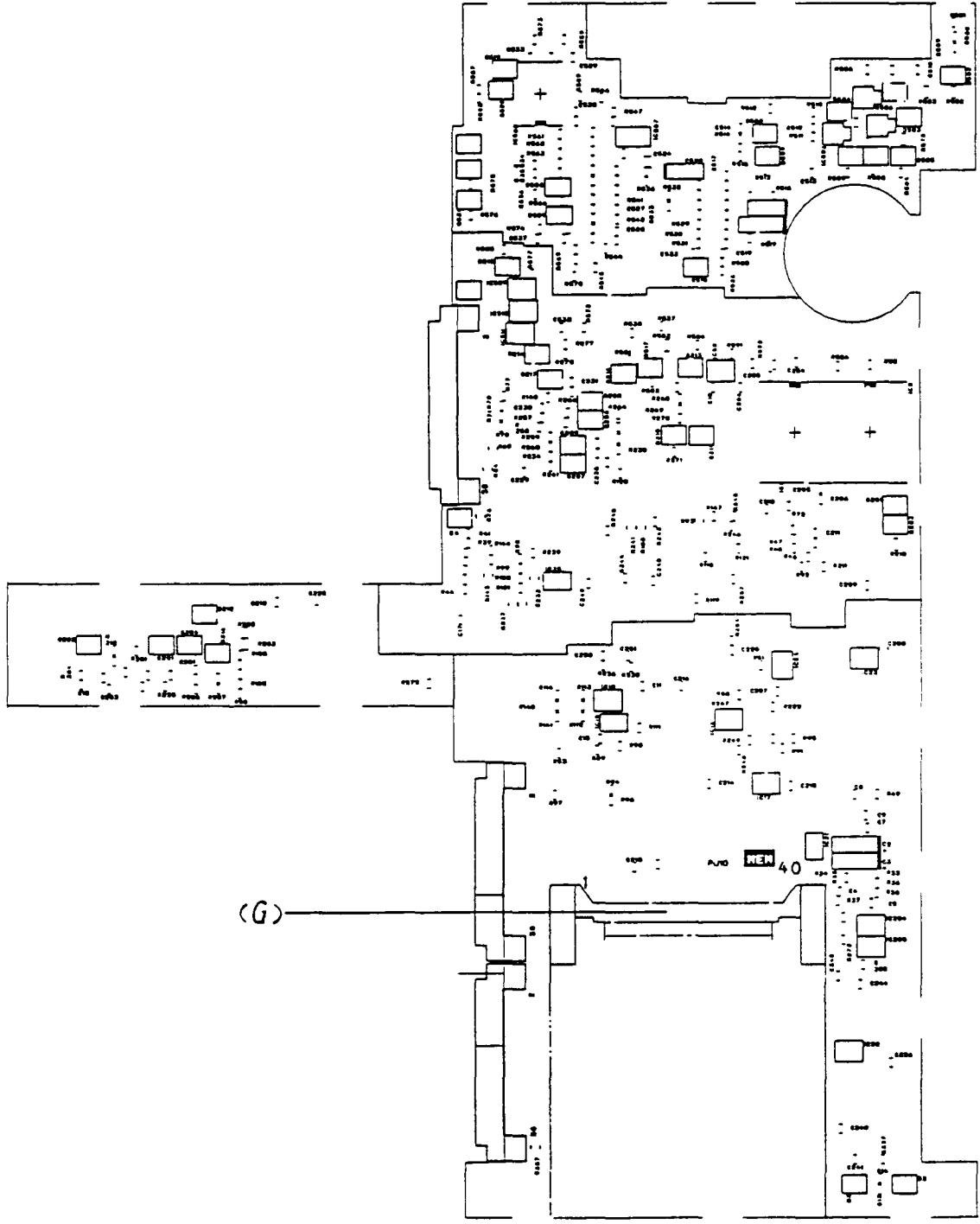


Figure A-3 System board F1ECP4 (connectors) (Back)

APPENDIX A

(A)	PJ1	Expansion 1 connector
(B)	PJ2	Expansion 2 connector
(C)	PJ5	FDD 1 I/F connector
(D)	PJ7	LCD I/F connector
(E)	PJ8	Keyboard I/F connector
(F)	PJ9	RTC battery connector
(G)	PJ10	Expansion memory I/F connector
(H)	PJ 11	HDD lock connector
(I)	PJ12	HDD I/F connector
(J)	PJ501	Power switch connector
(K)	PJ502	Charge connector
(L)	PJ503	LED connector
(M)	PJ505	Charge 2 connector

APPENDIX B PIN ASSIGNMENT

1. PJ1 Expansion 1 Connector

Table B-1 Expansion 1 connector pin assignment (50-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	VCC		26	PD1:100	I/O
2	VCC		27	PD2:100	I/O
3	BMIRO:000	I	28	PD3:100	I/O
4	BMSPK:000	I	29	PD4:100	I/O
5	DACK1:000	O	30	PD5:100	I/O
6	IRO2:100	I	31	PD6:100	I/O
7	VCC		32	PD7:100	I/O
8	CPCKB:100	O	33	ACK:100	I
9	IRO5:100	I	34	BUSY:100	I
10	DRO3:100	I	35	GND	
11	DACK3:000	O	36	PE:100	I
12	HLDA:100	O	37	SELECT:100	I
13	DRO1:100	I	38	AUTFD:000	O
14	IORDY:100	I	39	ERROR:000	I
15	GND		40	PINIT:000	O
16	IRO6:100	I	41	SLIN:000	O
17	DRO2:100	I	42	DCD:100	I
18	DACK0:000	O	43	RD:000	I
19	IOERR:000	I	44	SD:000	O
20	DACK2:000	O	45	DTR:100	O
21	IRO4:100	I	46	DSR:100	I
22	IRO7:100	I	47	RTS:100	O
23	STROBE:000	O	48	CTS:100	I
24	GND		49	RI:100	I
25	PD0:100	I/O	50	GND	

APPENDIX B

2. PJ2 Expansion 2 Connector

Table B-2 Expansion 2 connector pin assignment (50-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	MVEE:000	O	26	A13:100	O
2	BMDSL:000	O	27	A14:100	O
3	COMCLK:000	O	28	A15:100	O
4	GND		29	A16:100	O
5	KVCC:100	O	30	A17:100	O
6	KGND:000	O	31	A18:100	O
7	CPCNF:100	I	32	A19:100	O
8	MDSL:000	I/O	33	GND	
9	CMCK:100	O	34	SYD0:100	I/O
10	MIRO:000	I	35	SYD1:100	I/O
11	SPTON:000	I	36	SYD2:100	I/O
12	A0BB:100	O	37	SYD3:100	I/O
13	A01:100	O	38	SYD4:100	I/O
14	A02:100	O	39	SYD5:100	I/O
15	GND		40	SYD6:100	I/O
16	A03:100	O	41	SYD7:100	I/O
17	A04:100	O	42	MEWR:000	O
18	A05:100	O	43	XMERD:000	O
19	A06:100	O	44	IOWR:000	I/O
20	A07:100	O	45	IORD:000	I/O
21	A08:100	O	46	TC:100	O
22	A09:100	O	47	CALE:100	O
23	A10:100	O	48	RESET:100	O
24	A11:000	O	49	BMPOF:100	O
25	A12:100	O	50	GND	

3. PJ5 FDD 1 I/F Connector

Table B-3 FDD 1 I/F connector pin assignment (26-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	VCC		14	STEP:000	
2	INDEX:000		15	GND	
3	VCC		16	WDATA:000	
4	FDSELA:000		17	GND	
5	VCC		18	WGATE:000	
6	DSKCHG:000		19	GND	
7	VCC		20	TRACK0:000	
8	READY:000		21	GND	
9	MEDIA:000		22	WPROTC:000	
10	MONA:000		23	GND	
11	LOWDNS:000		24	RDDA:000	
12	FDCDRC:000		25	GND:000	
13	GND		26	SIDE:000	

4. PJ7 LCD I/F Connector

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

Pin	Signal	I/O	Pin	Signal	I/O
1	PVBL:100	O	12	UD1:100	O
2	GND		13	UD2:100	O
3	CBLON:000	O	14	UD3:100	O
4	CBLHI:000	O	15	LCD5V:100	O
5	(N/C)		16	LCDVEE:000	O
6	GND:		17	GND	
7	FP:100	O	18	LD0:110	O
8	LP:100	O	19	LD1:110	O
9	SCP:100	O	20	LD2:110	O
10	GND		21	LD3:110	O
11	UD0:100	O	22	GND	

APPENDIX B

5. PJ8 Keyboard I/F Connector

Table B-5 Keyboard I/F connector pin assignment (20-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	KBSC0:000	O	11	KBSC10:000	O
2	KBSC1:000	O	12	KBRTN0:000	I
3	KBSC2:000	O	13	KBRTN1:000	I
4	KBSC3:000	O	14	KBRTN2:000	I
5	KBSC4:000	O	15	KBRTN3:000	I
6	KBSC5:000	O	16	KBRTN4:000	I
7	KBSC6:000	O	17	KBRTN5:000	I
8	KBSC7:000	O	18	KBRTN6:000	I
9	KBSC8:000	O	19	KBRTN7:000	I
10	KBSC9:000	O	20	(N/C)	

6. PJ9 RTC Battery Connector

Table B-6 RTC battery connector pin assignment (2-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	GND	O	2	RTV:100	I

7. PJ10 Expansion Memory I/F Connector

Table B-7 Expansion memory I/F connector pin assignment (40-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	GND		21	MVRAM:100	O
2	AD03:100	I/O	22	DRA7:110	O
3	AD04:100	I/O	23	DRA6:100	O
4	AD05:100	I/O	24	DRA5:110	O
5	AD06:100	I/O	25	DRA4:110	O
6	AD07:100	I/O	26	DRA3:110	O
7	AD08:100	I/O	27	DRA2:110	O
8	AD09:100	I/O	28	DRA1:110	O
9	AD10:100	I/O	29	DRAEN:100	I
10	DRA8:110	O	30	GND	
11	GND		31	DRA0:110	O
12	CASH:000	O	32	AD00:100	I/O
13	RASB2:000	O	33	AD01:100	I/O
14	RASB1:000	O	34	AD02:100	I/O
15	XMEWR:010	O	35	AD11:100	I/O
16	CASL:000	O	36	AD12:100	I/O
17	RASB3:000	O	37	AD13:100	I/O
18	RASB0:000	O	38	AD14:100	I/O
19	DRA9:100	O	39	AD15:100	I/O
20	MVRAM:100	O	40	GND	

8. PJ11 HDD Lock Connector

Table B-8 HDD lock connector pin assignment (2-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	HLOCK:000		2	GND	

APPENDIX B

9. PJ12 HDD I/F Connector

Table B-9 HDD I/F connector pin assignment (50-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	GND		26	IOWR:000	O
2	GND		27	IORD:000	O
3	GND		28	IORDY:100	I
4	GND		29	HDIN:010	I
5	RESET:000	O	30	GND	
6	GND		31	AD08:100	I/O
7	SYD7:100	I/O	32	HIRO5:100	I
8	VCC		33	AD09:100	I/O
9	SYD6:100	I/O	34	HIO16:010	I
10	VCC		35	AD10:100	I/O
11	SYD5:100	I/O	36	A01:100	O
12	VCC		37	AD11:100	I/O
13	SYD4:100	I/O	38	A0BB:100	O
14	VCC		39	AD12:100	I/O
15	SYD3:100	I/O	40	A02:100	O
16	VCC		41	AD13:100	I/O
17	SYD2:100	I/O	42	HDDCS0:000	O
18	VCC		43	AD14:100	I/O
19	SYD1:100	I/O	44	HDDCS1:000	O
20	VCC		45	AD15:100	I/O
21	SYD0:100	I/O	46	HDDLED:000	I
22	GND		47	GND	
23	GND		48	GND	
24	GND		49	GND	
25	GND		50	GND	

10. PJ501 Power Switch Connector

Table B-10 Power switch connector pin assignment (3-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	GND		3	POWRSW:000	
2	GND				

11. PJ502 Charge Connector

Table B-11 Charge connector pin assignment (14-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	PVT:100		8	CB2ON1:000	
2	PVT:100		9	PVMC:100	
3	PVT:100		10	CB2ON0:000	
4	STORI:100		11	PVIN:100	
5	PLNOF:000		12	CVIN:100	
6	CVBAT2:100		13	CPECL0:000	
7	CB2ON2:000		14	CHGON:000	

12. PJ503 LED Connector

Table B-12 LED connector pin assignment (15-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	GND		9	BDLED:010	O
2	GND		10	ADLED:010	O
3	GND		11	CBTON1:000	O
4	CIBATT:100	O	12	CBTON0:000	O
5	HBATSW:000	O	13	CCHGC:100	O
6	SCRL:010	O	14	FASTL:100	O
7	NUML:110	O	15	SLOWL:110	O
8	CAPL:010	O			

13. PJ505 Charge 2 Connector

Table B-13 Charge 2 connector pin assignment (6-pin)

Pin	Signal	I/O	Pin	Signal	I/O
1	CVBATT:100	O	4	LBATLE:100	O
2	DSPL:000	O	5	DCHG2:100	O
3	DCHG:100	O	6	LBATL2:100	O

APPENDIX C ASCII CHARACTER CODES

Table C-1 ASCII Character Code Table

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

APPENDIX D KEYBOARD SCAN/ CHARACTER CODES

Table D-1 Scan code, character code, and key top names

Cap No.	Key Top	Lower Case	Upper Case	Num Lock		With (Ctrl)	With (Alt)
				Lower	Upper		
1	~ ,	29 60	29 7E	29 60	29 7E	-	*29 00
2	! 1	02 31	02 21	02 31	02 21	-	78 00
3	@ 2	03 32	03 40	03 32	03 40	03 00	79 00
4	# 3	04 33	04 23	04 33	04 23	-	7A 00
5	\$ 4	05 34	05 24	05 34	05 24	-	7B 00
6	% 5	06 35	06 25	06 35	06 25	-	7C 00
7	^ 6	07 36	07 5E	07 36	07 5E	07 1E	7D 00
8	& 7	08 37	08 26	08 37	08 26	-	7E 00
9	* 8	09 38	09 2A	09 38	09 2A	-	7F 00
10	(9	0A 39	0A 28	0A 39	0A 28	-	80 00
11	) 0	0B 30	0B 29	0B 30	0B 29	-	81 00
12	=	0C 2D	0C 5F	0C 2D	0C 5F	0C 1F	82 00
13	+ =	0D 3D	0D 2B	0D 3D	0D 2B	-	83 00
15	Back space	0E 08	0E 08	0E 08	0E 08	0E 7F	*0E 00

NOTE: * Only extended code.
** Only normal code.

APPENDIX D

Table D-1 Scan Code, character code, and key names (continued)

Cap No.	Key Top	Lower Case	Upper Case	Num Lock		With (Ctrl)	With (Alt)
				Lower	Upper		
16	Tab	0F 09	0F 00	0F 09	0F 00	*94 00	*A5 00
17	Q	10 71	10 51	10 51	10 71	10 11	10 00
18	W	11 77	11 57	11 57	11 77	11 17	11 00
19	E	12 65	12 45	12 45	12 65	12 05	12 00
20	R	13 72	13 52	13 52	13 72	13 12	13 00
21	T	14 74	14 54	14 54	14 74	14 14	14 00
22	Y	15 79	15 59	15 59	15 79	15 19	15 00
23	U	16 75	16 55	16 55	16 75	16 15	16 00
24	I	17 69	17 49	17 49	17 69	17 09	17 00
25	O	18 6F	18 4F	18 4F	18 6F	18 0F	18 00
26	P	19 70	19 50	19 50	19 70	19 10	19 00
27	{ [	1A 5B	1A 7B	1A 5B	1A 7B	1A 1B	*1A 00
28	}]	1B 5D	1B 7D	1B 5D	1B 7D	1B 1D	*1B 00
29	| \	2B 5C	2B 7C	2B 5C	2B 7C	2B 1C	*2B 00
30	Caps Lock	-	-	-	-	-	-
31	A	1E 61	1E 41	1E 41	1E 61	1E 01	1E 00
32	S	1F 73	1F 53	1F 53	1F 73	1F 13	1F 00
33	D	20 64	20 44	20 44	20 64	20 04	20 00
34	F	21 66	21 46	21 46	21 66	21 06	21 00
35	G	22 67	22 47	22 47	22 67	22 07	22 00
36	H	23 68	23 48	23 48	23 68	23 08	23 00

NOTE: * Only extended code.
 ** Only normal code.

KEYBOARD SCAN/CHARACTER CODES

Table D-1 Scan Code, character code, and key names (continued)

Cap No.	Key Top	Lower Case	Upper Case	Num Lock		With (Ctrl)	With (Alt)
				Lower	Upper		
37	J	24 6A	24 4A	24 4A	24 6A	24 0A	24 00
38	K	25 6B	25 4B	25 4B	25 6B	25 0B	25 00
39	L	26 6C	26 4C	26 4C	26 6C	26 0C	26 00
40	: ;	27 3B	27 3A	27 3B	27 3A	-	*27 00
41	" ,	28 27	28 22	28 27	28 22	-	*28 00
43	Enter	1C 0D	1C 0D	1C 0D	1C 0D	1C 0A	*1C 00
44	Shift (L)	-	-	-	-	-	-
45	\ |	56 5C	56 7C	56 5C	56 7C	-	-
46	Z	2C 7A	2C 5A	2C 5A	2C 7A	2C 1A	2C 00
47	X	2D 78	2D 58	2D 58	2D 78	2D 18	2D 00
48	C	2E 63	2E 43	2E 43	2E 63	2E 03	2E 00
49	V	2F 76	2F 56	2F 56	2F 76	2F 16	2F 00
50	B	30 62	30 42	30 42	30 62	30 02	30 00
51	N	31 6E	31 4E	31 4E	31 6E	31 0E	31 00
52	M	32 6D	32 4D	32 4D	32 6D	32 0D	32 00
53	< ,	33 2C	33 3C	33 2C	33 3C	-	*33 00
54	> .	34 2E	34 3E	34 2E	34 3E	-	*34 00
55	? /	35 2F	35 3F	35 2F	35 3F	-	*35 00
57	Shift (R)	-	-	-	-	-	-

NOTE: * Only extended code.
 ** Only normal code.

APPENDIX D

Table D-1 Scan Code, character code, and key names (continued)

Cap No.	Key Top	Lower Case	Upper Case	Num Lock		With (Ctrl)	With (Alt)
				Lower	Upper		
58	Ctrl (L)	-	-	-	-	-	-
60	Alt (L)	-	-	-	-	-	-
61	Space	39 20	39 20	39 20	39 20	39 20	39 20
62	AltGr	-	-	-	-	-	-
75	Ins	52 00 52 E0	52 00 52 E0	52 00 52 E0	52 00 52 E0	*92 E0	*A2 00
76	Del	53 00 53 E0	53 00 53 E0	53 00 53 E0	53 00 53 E0	*93 E0	*A3 00
79	←	4B 00 4B E0	4B 00 4B E0	4B 00 4B E0	4B 00 4B E0	73 00 73 E0	*9B 00
80	Home	47 00 47 E0	47 00 47 E0	47 00 47 E0	47 00 47 E0	77 00 77 E0	*97 00
81	End	4F 00 4F E0	4F 00 4F E0	4F 00 4F E0	4F 00 4F E0	75 00 75 E0	*9F 00
83	↑	48 00 48 E0	48 00 48 E0	48 00 48 E0	48 00 48 E0	*8D E0	*98 00
84	↓	50 00 50 E0	50 00 50 E0	50 00 50 E0	50 00 50 E0	*91 E0	*A0 00
85	PgUp	49 00 49 E0	49 00 49 E0	49 00 49 E0	49 00 49 E0	84 00 84 E0	*99 00
86	PgDn	51 00 51 E0	51 00 51 E0	51 00 51 E0	51 00 51 E0	76 00 76 E0	*A1 00
89	→	4D 00 4D E0	4D 00 4D E0	4D 00 4D E0	4D 00 4D E0	74 00 74 E0	*9D 00
110	Esc	01 1B	01 1B	01 1B	01 1B	01 1B	*01 00
112	F1	3B 00	54 00	3B 00	54 00	5E 00	68 00
113	F2	3C 00	55 00	3C 00	55 00	5F 00	69 00

NOTE: * Only extended code.
 ** Only normal code.

KEYBOARD SCAN/CHARACTER CODES

Table D-1 Scan Code, character code, and key names (continued)

Cap No.	Key Top	Lower Case	Upper Case	Num Lock		With (Ctrl)	With (Alt)
				Lower	Upper		
114	F3	3D 00	56 00	3D 00	56 00	60 00	6A 00
115	F4	3E 00	57 00	3E 00	57 00	61 00	6B 00
116	F5	3F 00	58 00	3F 00	58 00	62 00	6C 00
117	F6	40 00	59 00	40 00	59 00	63 00	6D 00
118	F7	41 00	5A 00	41 00	5A 00	64 00	6E 00
119	F8	42 00	5B 00	42 00	5B 00	65 00	6F 00
120	F9	43 00	5C 00	43 00	5C 00	66 00	70 00
121	F10	44 00	5D 00	44 00	5D 00	67 00	71 00
122	F11	*85 00	*87 00	*85 00	*87 00	*89 00	*8B 00
123	F12	*86 00	*88 00	*86 00	*88 00	*8A 00	*8C 00
124	PrtSc	-	-	-	-	**72 00	-
126	Pause	-	-	-	-	00 00	-
202	Fn	-	-	-	-	-	-

NOTE: * Only extended code.
 ** Only normal code.

APPENDIX E KEYBOARD LAYOUTS

1. USA keyboard

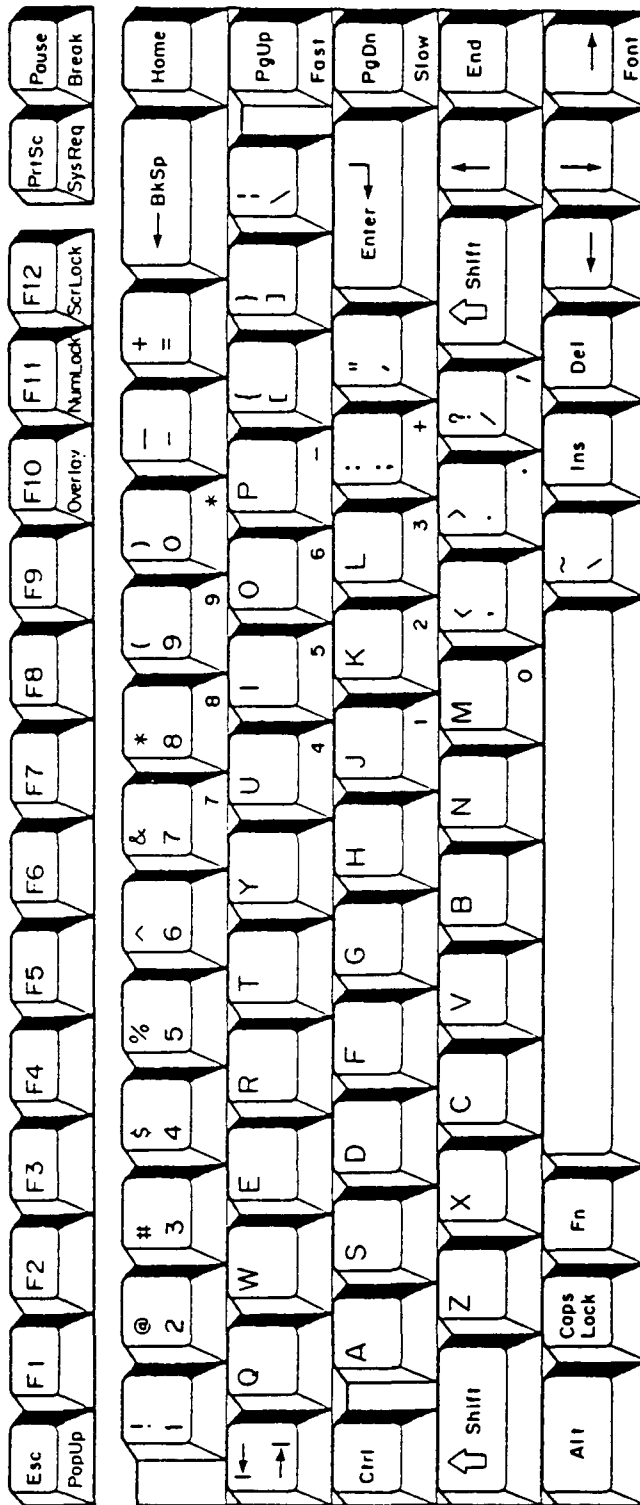


Figure E-1 USA keyboard

2. UK keyboard

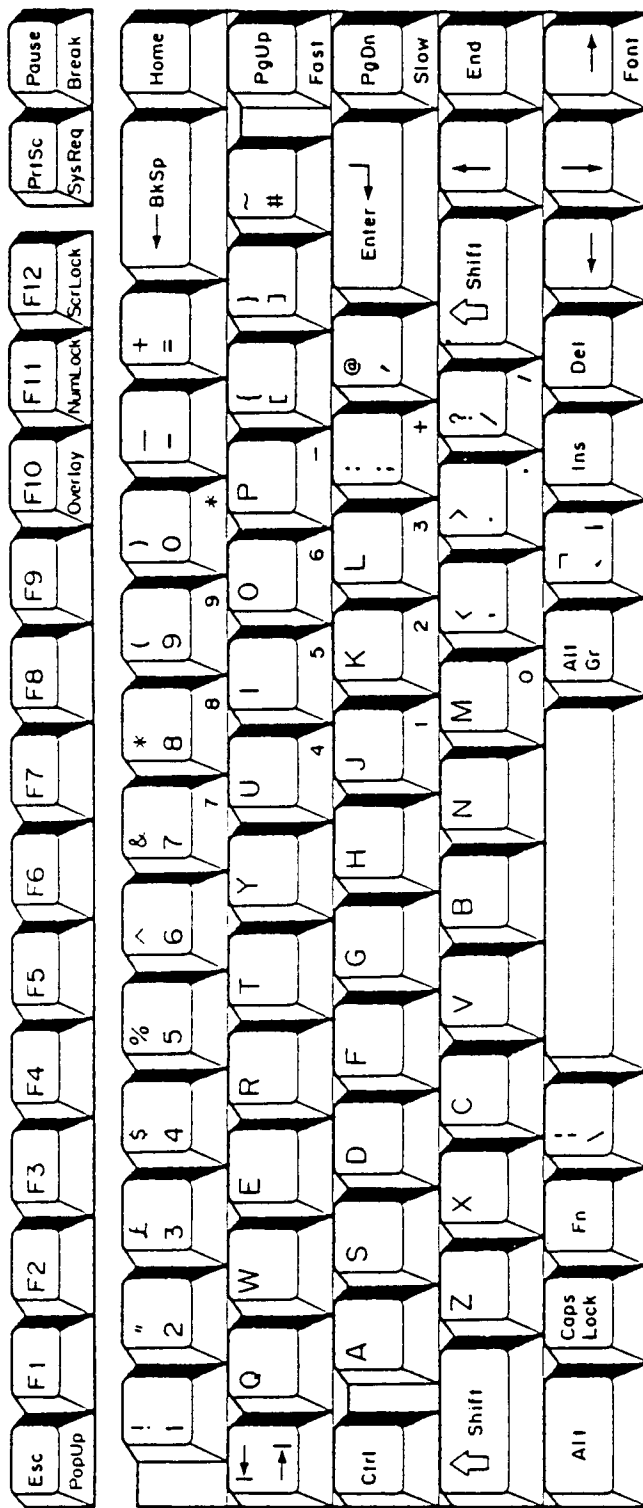


Figure E-2 UK keyboard

3. German keyboard

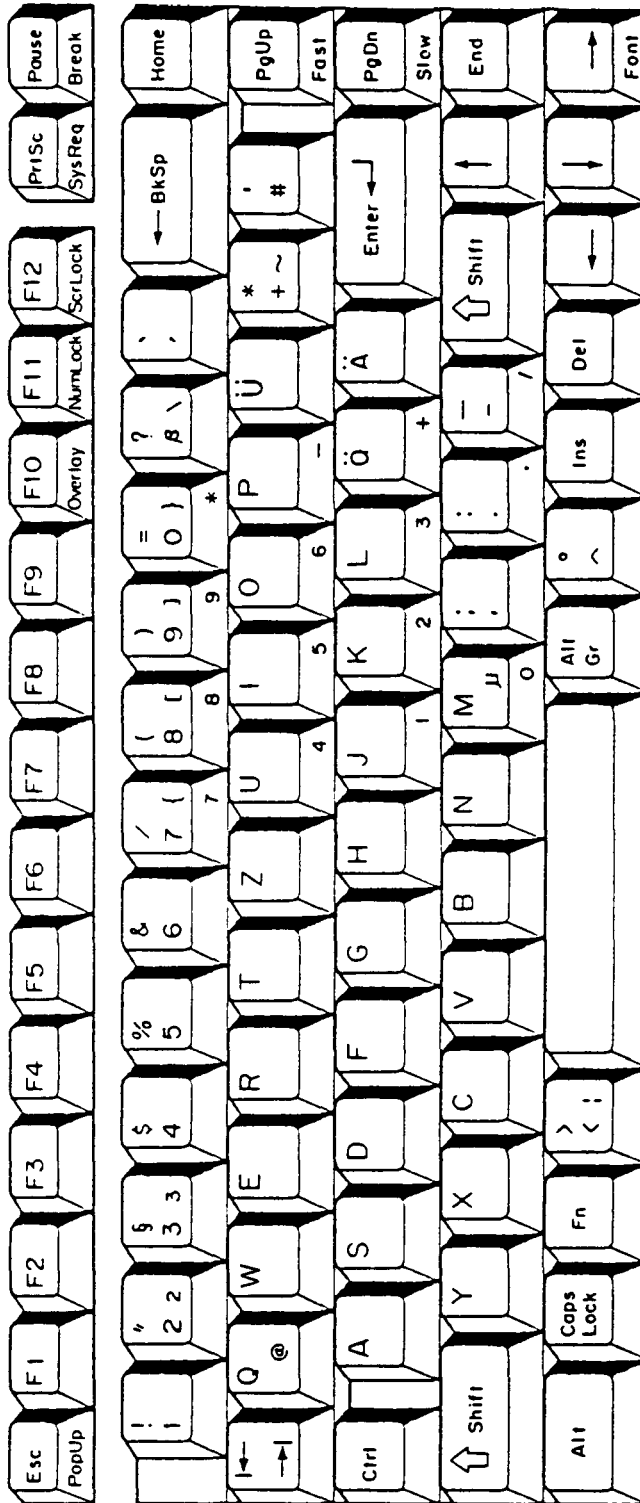


Figure E-3 German keyboard

4. French keyboard

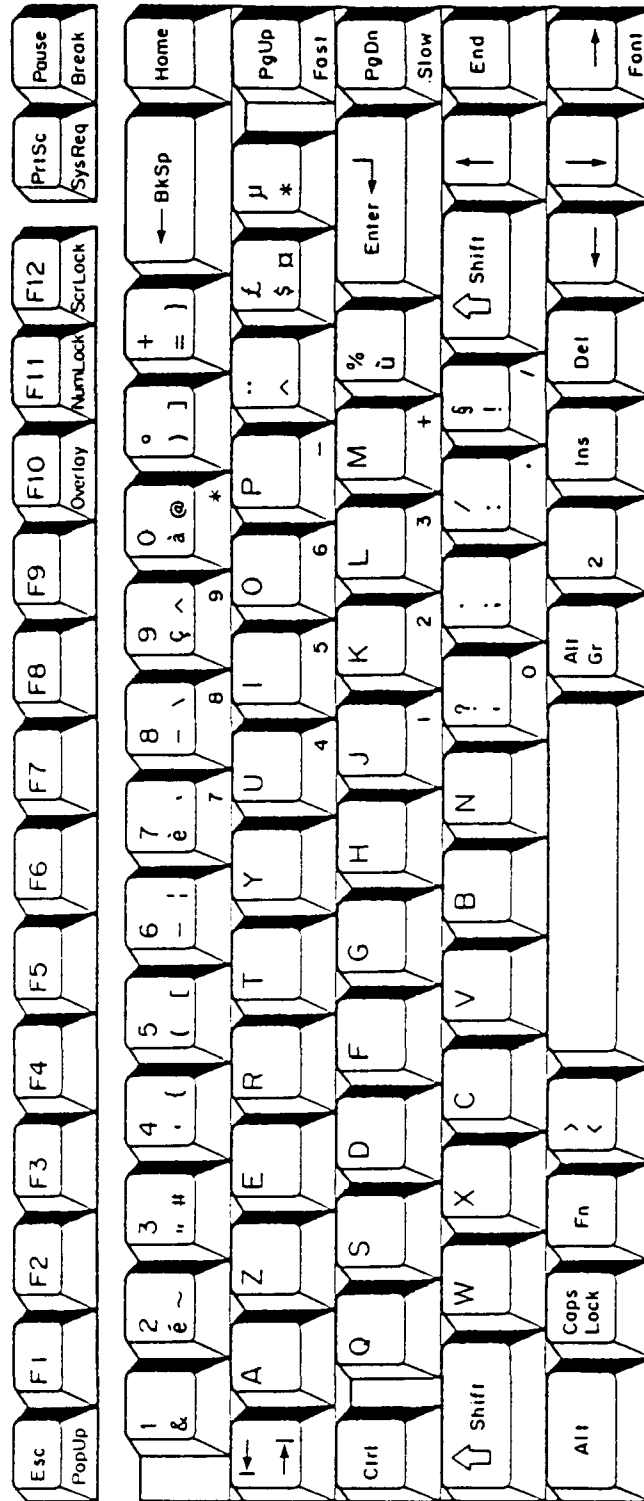


Figure E-4 French keyboard

5. Spanish keyboard

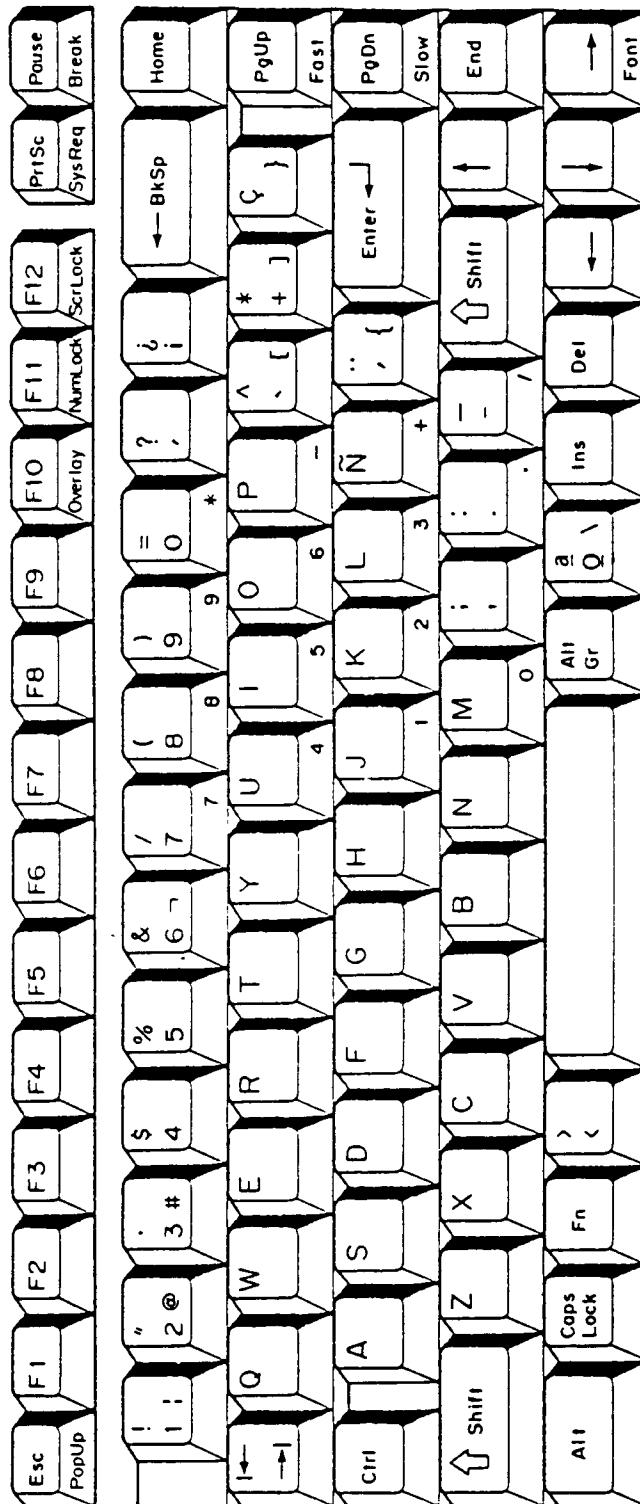


Figure E-5 Spanish keyboard

6. Italian keyboard

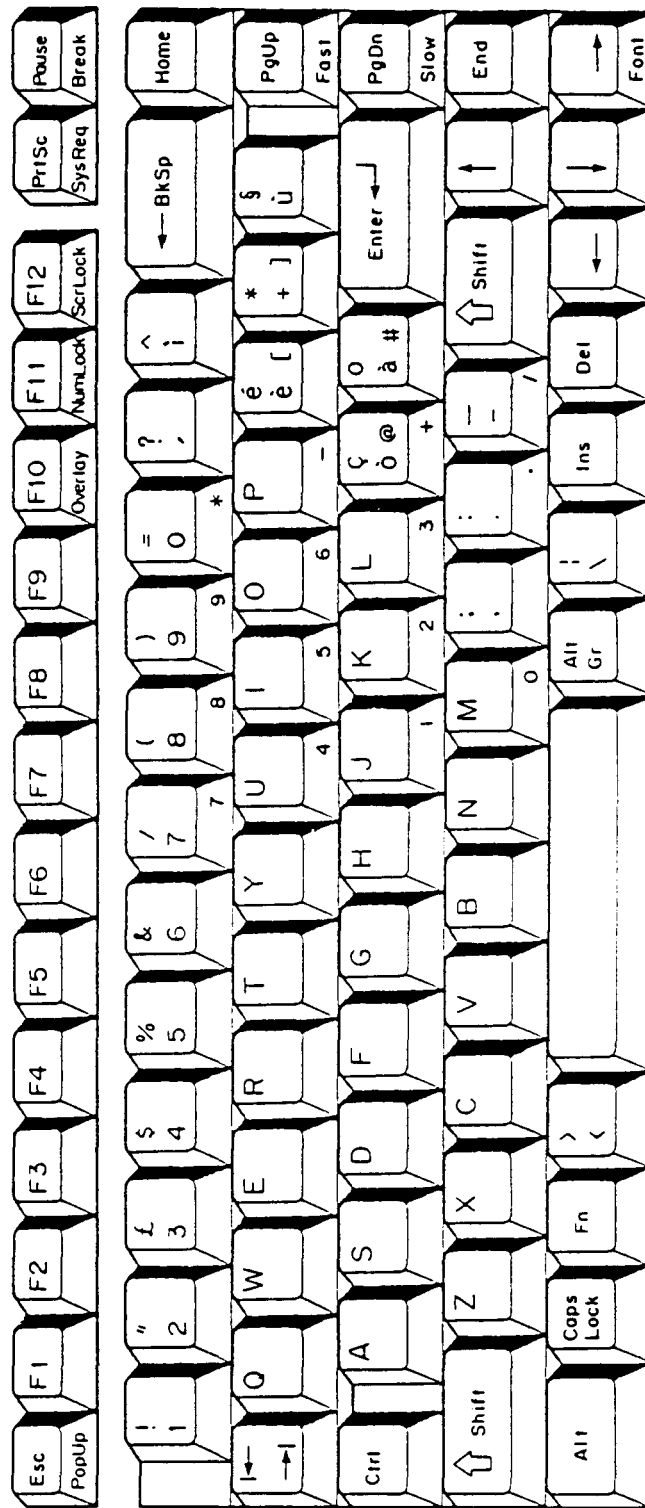


Figure E-6 Italian keyboard

7. Scandinavian keyboard

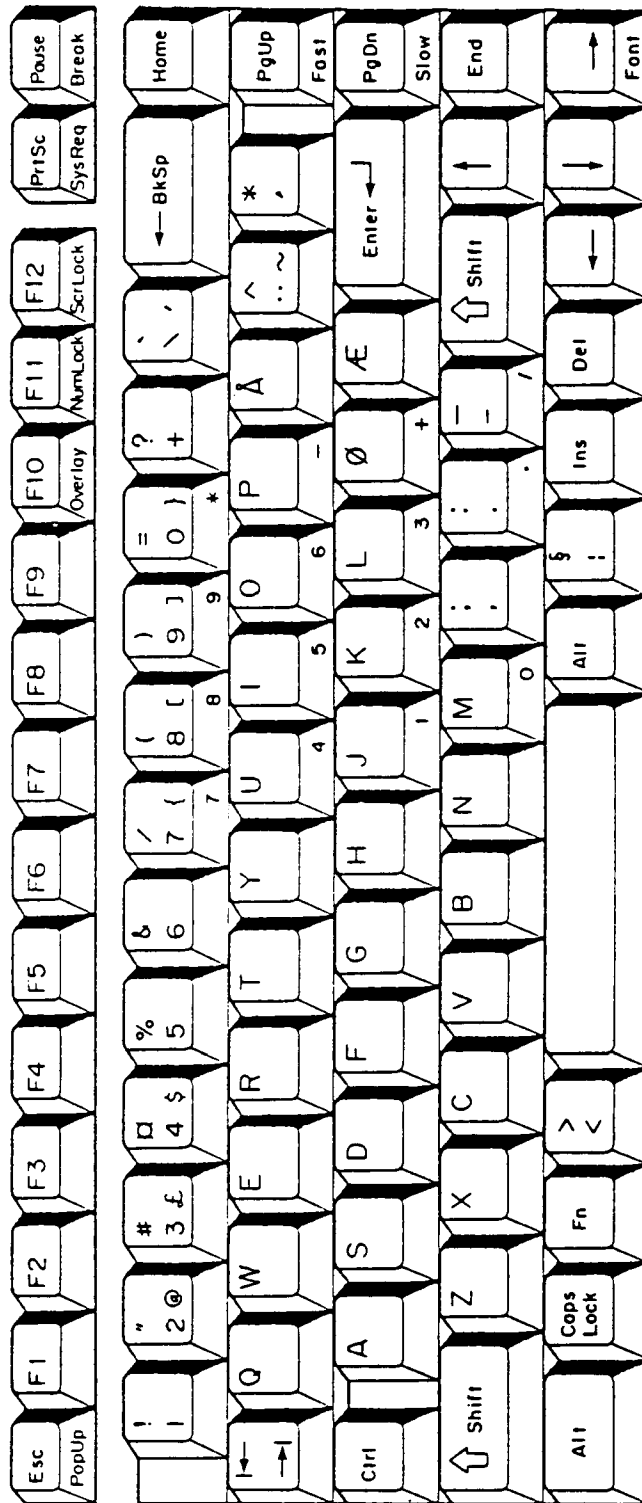


Figure E-7 Scandinavian keyboard

8. Swiss keyboard

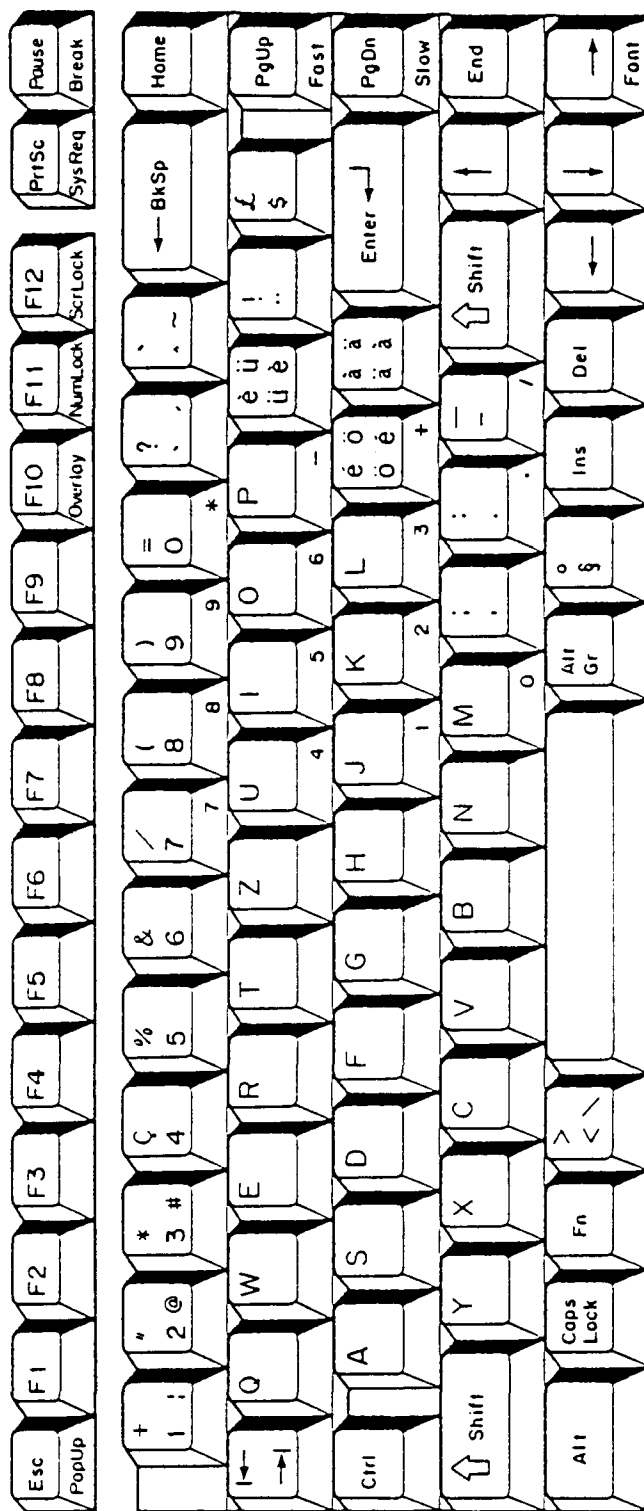


Figure E-8 Swiss keyboard

9. Special Canadian keyboard

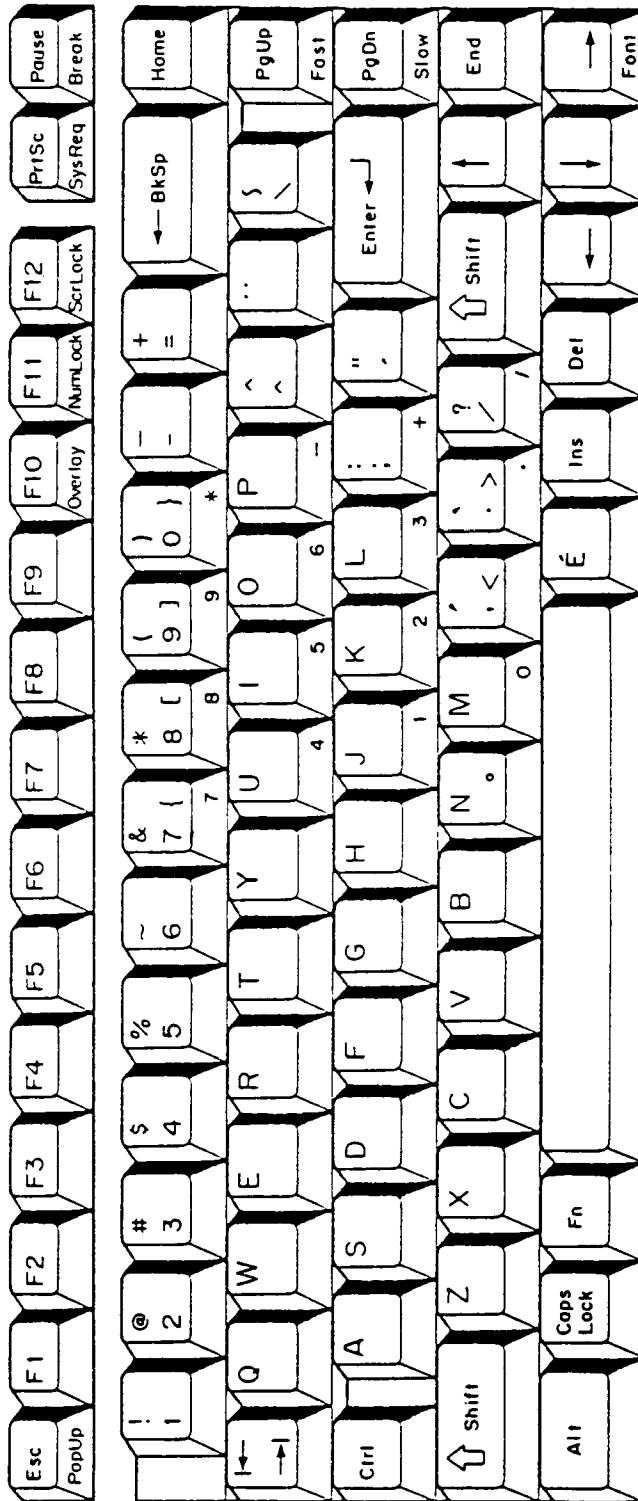


Figure E-9 Special Canadian keyboard

10. Keycap number

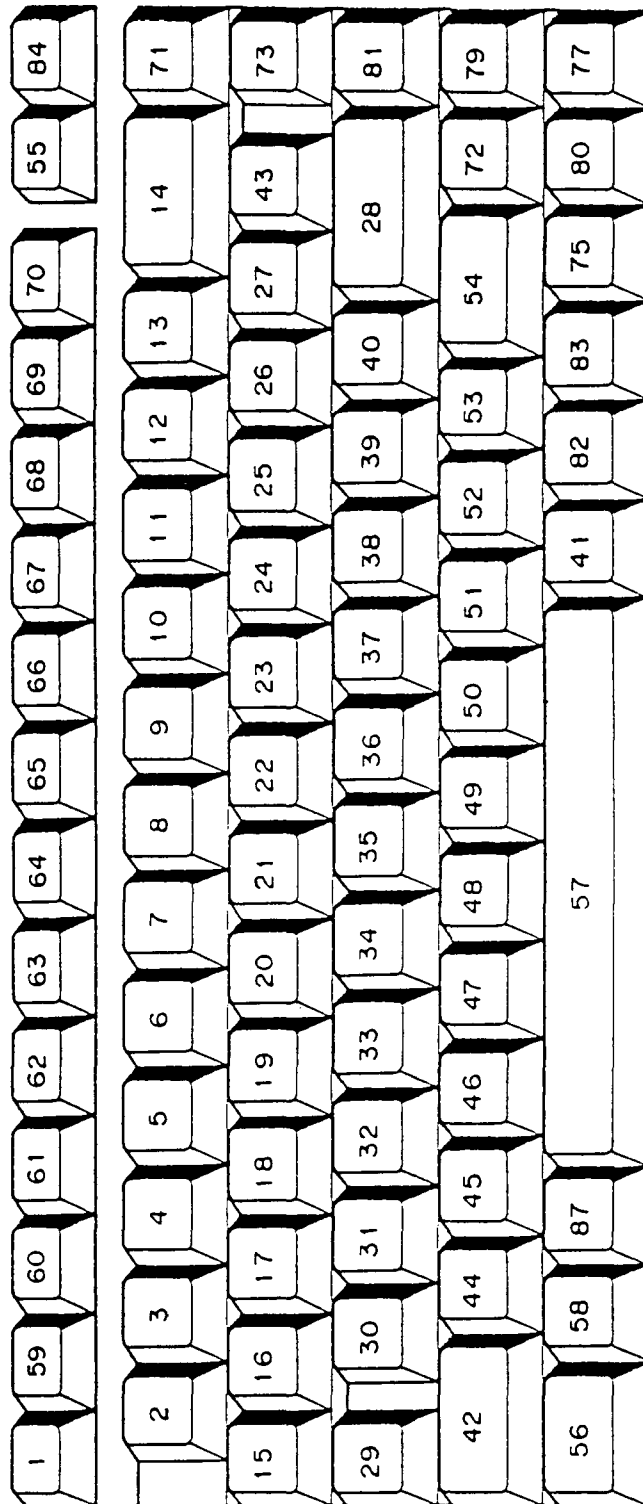


Figure E-10 Keycap number