

1.1 GENERAL

The Toshiba T1200XE is one of the lightest portable computers available offering high technology, high speed, excellent legibility, IBM PC AT compatibility and battery machine.

The T1200XE's operating system is used with the MS-DOS version 4.0 and a powerful 80C286-12 microprocessor which has 16-bit data width on the data bus line.

The memory capacity is 1 Mbyte as standard. The system can be added one or two 2-Mbyte memory card, thus the system can be added up to 5 Mbytes of RAM.

The internal 2.5-inch HDD (hard disk drive) has capacity of 20 Mbytes. The internal 3.5-inch FDD (floppy disk drive) supports 1.44-Mbyte 2HD (double-sided, high-density, double-track) and 720-Kbyte 2DD (double-sided, double density, double-track) disks.

The keyboard is compatible with IBM enhanced keyboard which has 82 or 84 keys.

A sidelit LCD (liquid crystal display) comes with your T1200XE. The screen supports 640 by 400 pixels with CGA (color graphics adapter) compatible graphics and two color attribute combinations.

The power supply system is composed of AC adapter, batteries, and one board which has two microprocessor.

The T1200XE provides connecting ports with the optional devices at the rear panel of the system. There are one printer/external FDD port, one RGB port, one serial port, and one keypad port. Also, it provides the expansion connector for Toshiba unique option devices, and built-in modem is installed in the T1200XE as option.

The T1200XE's system unit is shown in figure 1-1 and its block diagram is shown in figure 1-2.

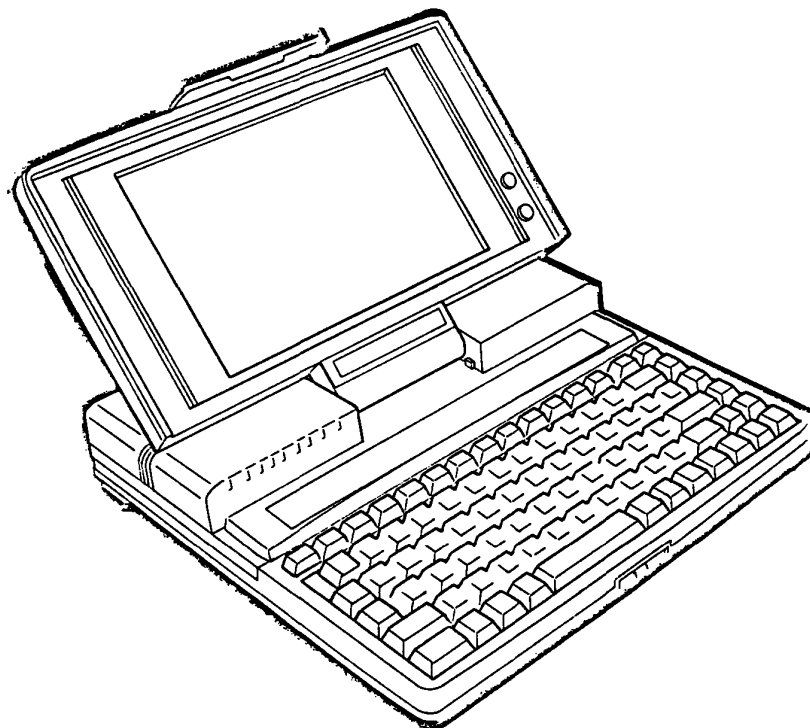


Figure 1-1 T1200XE system unit

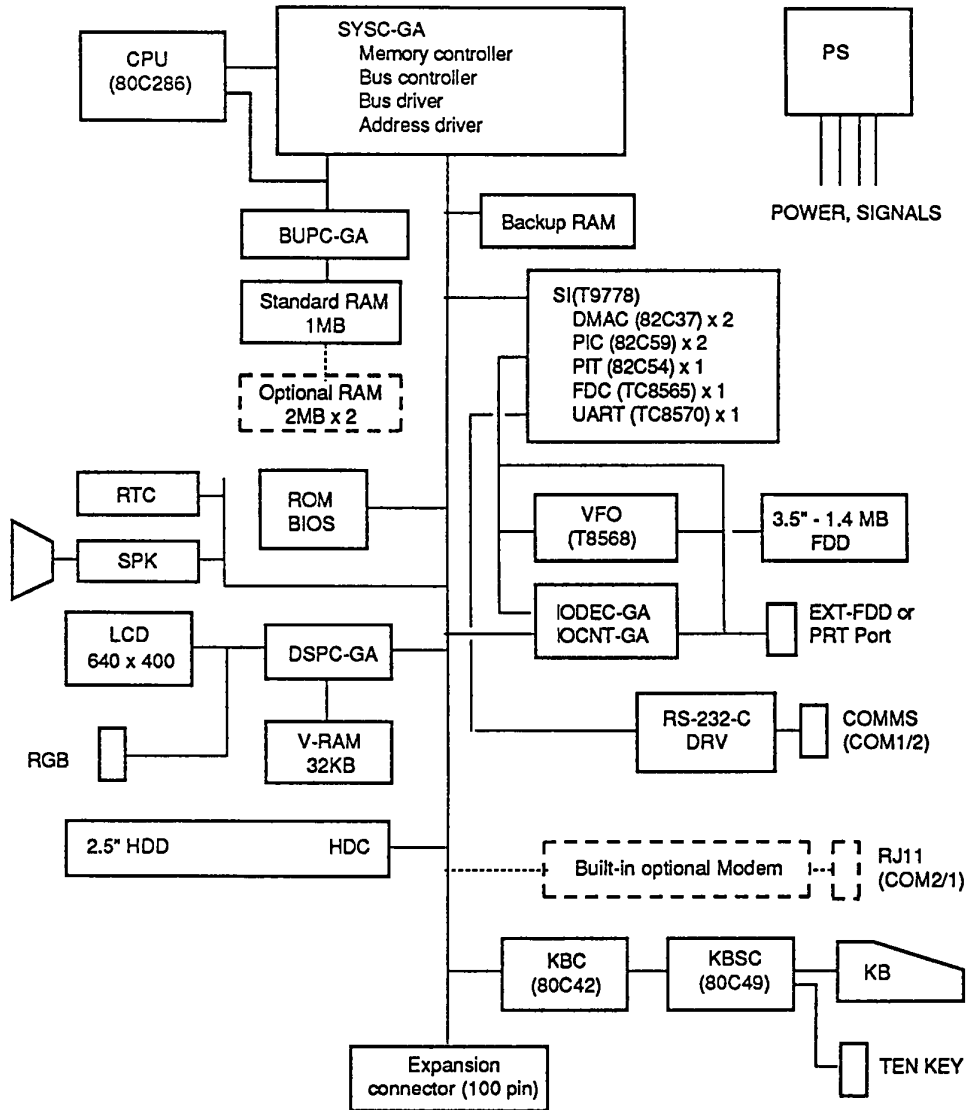


Figure 1-2 T1200XE block diagram

1.2 SYSTEM BOARD

The system board is composed of the following components:

- Central processing unit: CPU (80C286-12)
- Super integration: SI (T9778)

The SI is stored with the following functions:

Direct memory access controller*2: DMAC (82C37)

Programmable interrupt controller*2:
PIC (82C59)

Programmable interval timer*1: PIT (82C54)

Floppy disk controller*1: FDC (TC8565)

Universal asynchronous receive transmitter*1:
UART (TC8570)

- Gate arrays: GAs

The following gate arrays are mounted in the system board.

System controller gate array: SYSC-GA (208-pin)

I/O controller gate array: IOCNT-GA (100-pin)

I/O decoder gate array: IODEC-GA (100-pin)

Display controller gate array: DSPC-GA (100-pin)

Backup controller gate array: BUPC-GA (44-pin)

- Real time clock: RTC (146818A)

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

- Variable frequency oscillator: VFO (TC8568AM)
- Keyboard controller: KBC (80C42)
- Keyboard scan controller: KBSC (80C49)
- RS-232-C driver

- Memories

The following memories are mounted in the system board.

Standard RAM: 1 Mbyte

These RAMs are used such as conventional memory, hard RAM, LIM-EMS, and extended memory.

Backup RAM: 32 Kbytes

This backup RAM is stored in the data of the resumed feature.

Video RAM: 32 Kbytes

BIOS ROM: 128 Kbytes

The system BIOS uses capacity of 64 Kbytes in BIOS ROM. Other 64-Kbyte BIOS ROMs are not used.

1.3 3.5-INCH FLOPPY DISK DRIVE

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

The FDD is shown in figure 1-3 and its specifications are described in table 1-1.

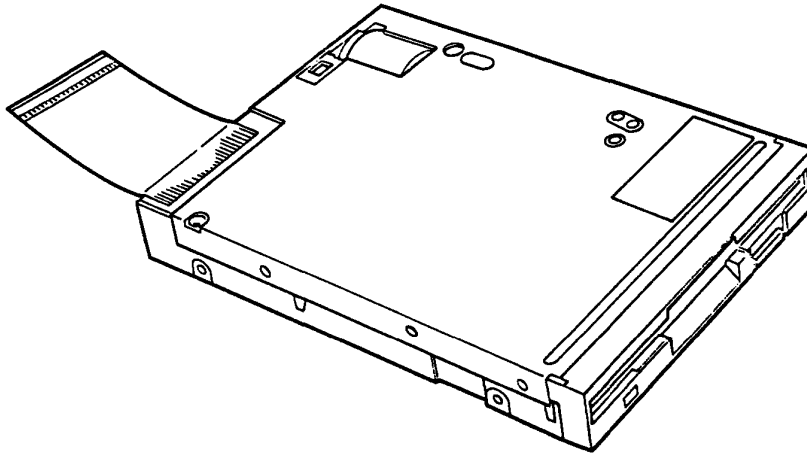


Figure 1-3 3.5-inch FDD

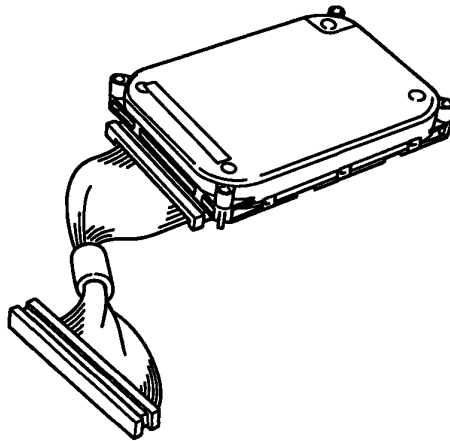
Table 1-1 3.5-inch FDD specifications

Item	2HD	2DD
Storage capacity (Kbytes)		
Unformatted	2,000	1,000
Formatted	1,440	720
Number of heads	2	2
Number of cylinders	80	80
Access time (ms)		
1 Track access	3	3
Average	181	181
Head settling time	15	15
Recording density (bit per inch)	135	135
Data transfer rate (Kbyte per second)	500	250
Rotational speed (revolutions per minute)	300	300
Recording method	MFM (Modified Frequency Modulation)	

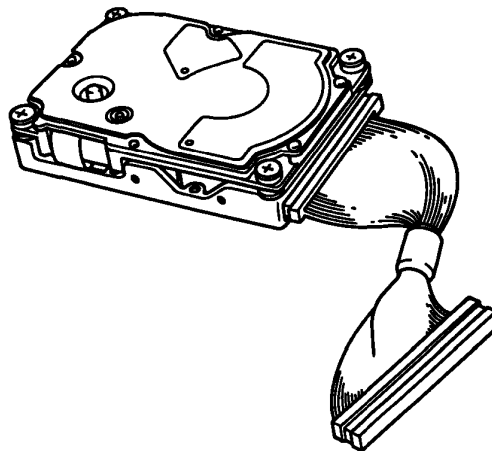
1.4 2.5-INCH HARD DISK DRIVE

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

The HDD is shown in figure 1-4 and specifications are described in table 1-2.



For Conner



For JVC

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- or 84-key keyboard is mounted on the system unit. The keyboard is a key-matrix with one of the 82 or 84 keys at each vertex.

The keyboard is connected to the keyboard controller on the system board through a 22-pin flat cable. The keyboard layout is shown in figure 1-5, and other keyboard layout is described in appendix E.

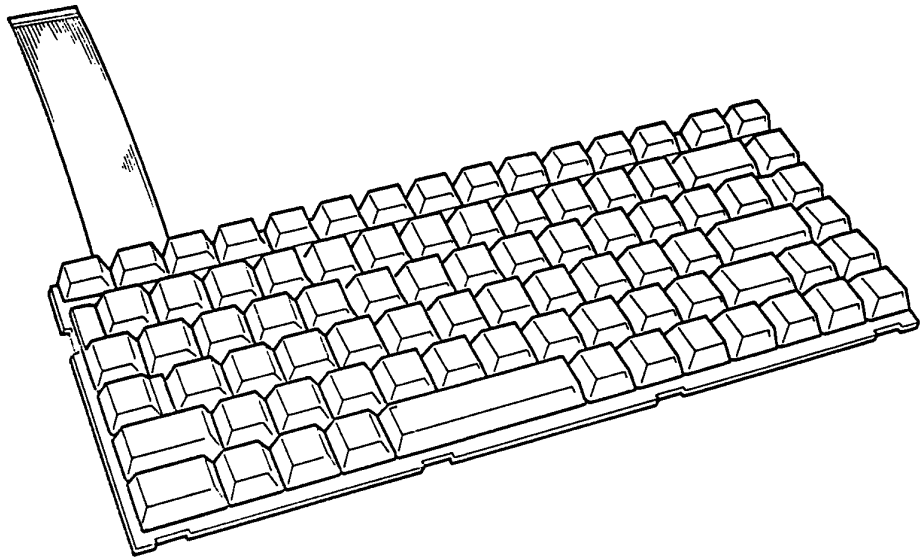


Figure 1-5 . Keyboard (UK TYPE)

1.6 SIDELIT LIQUID CRYSTAL DISPLAY

The sidelit liquid crystal display (LCD) is composed of an LCD module. The sidelit LCD is the Cold Fluorecent Lamp illuminates the display screen from the side, and you can read its clear display even in poor light condition. 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.

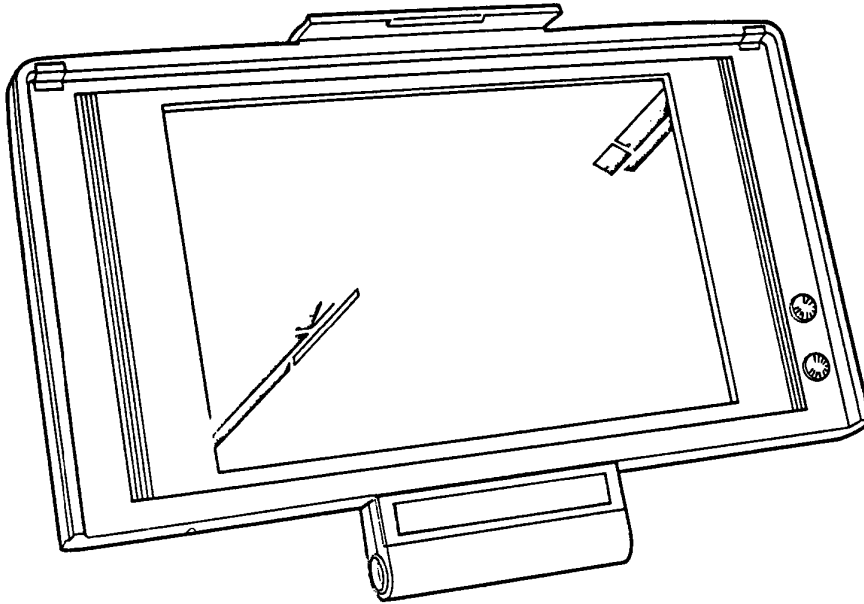


Figure 1-6 Sidelit LCD

Table 1-3 Sidelit LCD specifications

Item	Specifications
Number of dots (dots)	640×400
Dot dimension (mm)	0.28 (W)×0.28 (H)
Dot pitch (mm)	0.31 (W)×0.31 (H)
Display area (mm)	198.37 (W)×123.97 (H)
Contrast	Approx. 1:5

1.7 POWER SUPPLY BOARD

The power supply board supplies DC 5, 12, -22, and -9 volts to all the components in the system.

It is an intelligent power supply board using two microprocessors and it contains the following functions:

1. More accurate low battery detection
2. Calculations of remaining battery capacity
3. Over charge protection for battery
4. Over voltage and over current protection for DC outputs
5. Over voltage protection for DC input from AC adapter
6. Control of DC output regulation

The power supply board is shown in figure 1-7 and the output rating is specified in table 1-4.

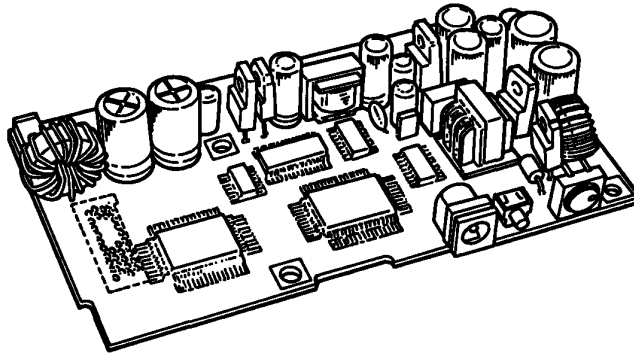


Figure 1-7 Power supply board

Table 1-4 Power supply board output rating

	DC Voltage (V)	Regulation tolerance (%)	Maximum current (mA)
System logic, FDD, HDC, HDD	+5	±5	1700
Backup RAM	+5	±10	200
LCD VEE	-22	±5	20
RS-232-C	+12	±10	50
RS-232-C modem, IO-slot	-9	±20	60
Sidelit LCD	+7.2 to 12		420

(This page is intentionally blank.)

2.1 GENERAL

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

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

Detailed replacement procedures are described in part 4 and test and test program operations are described in part 3.

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

1. T1200XE diagnostics disk
2. Two kinds of philips head screwdriver (2 mm and 3 mm)
3. Work disk (for FDD testing)
4. Cleaning disk kit (for FDD testing)
5. Printer port LED
6. RS-232-C, printer wraparound connectors

The problem isolation flowchart described in section 2.2 can be used to determine which isolation procedures are necessary to isolate a T1200XE 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 followings before performing the flowchart procedures.

1. No disk is in the FDD.
2. All optional equipments are disconnected.
3. MS-DOS has been installed in drive C before a trouble happens.

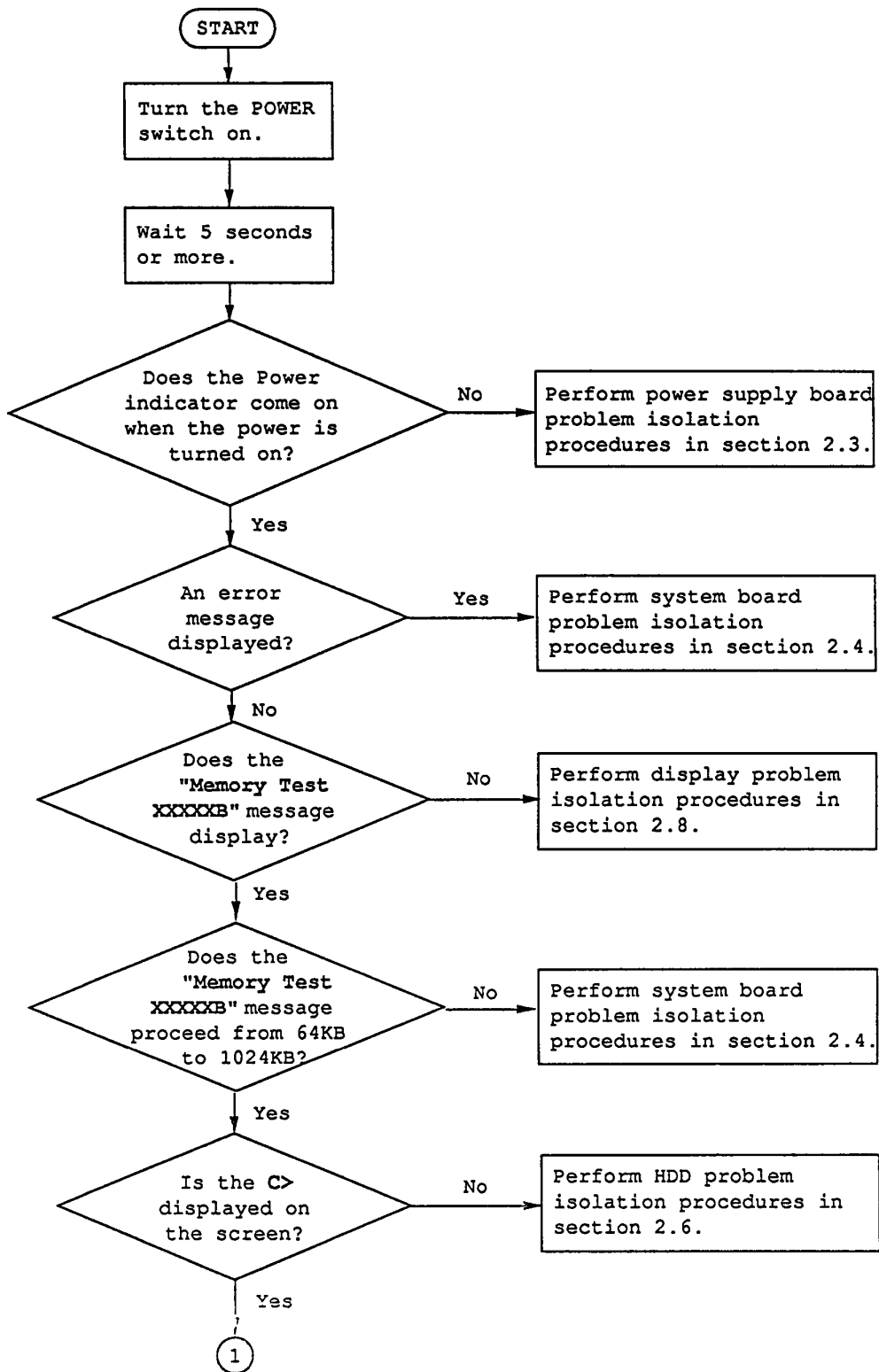


Figure 2-1 Problem isolation flowchart (1/2)

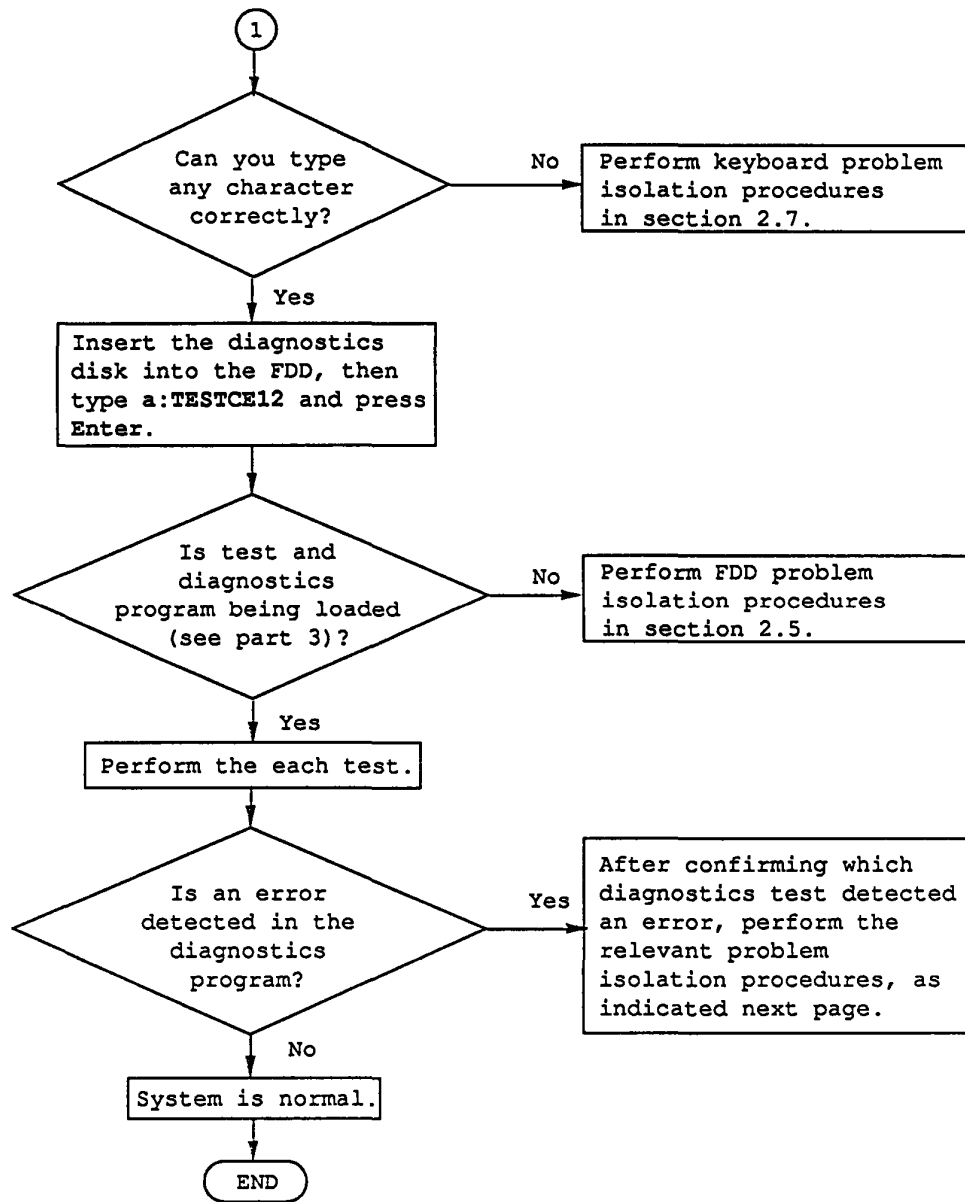


Figure 2-1 Problem isolation flowchart (2/2)

If the diagnostics program cannot detect any error, it may be an intermittent error. Running test is required to check a computer for a while.

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 problem isolation procedures in section 2.4.
2. If an error is detected on the hard disk test, perform the HDD problem isolation procedures in section 2.6.
3. If an error is detected on the keyboard test, perform the keyboard problem isolation procedures in section 2.7.
4. If an error is detected on the floppy disk test, perform the FDD problem isolation procedures in section 2.5.

2.3 POWER SUPPLY BOARD PROBLEM ISOLATION PROCEDURES

This section describes how to determine whether or not the power supply board is defective. Start with PROCEDURE 1 and continue with other procedures as instructed. The procedures described in this section are:

PROCEDURE 1: DC IN Indicator Check

PROCEDURE 2: Connector Check

PROCEDURE 1

DC IN Indicator Check

This indicator lights red if power is supplied from AC adapter to the T1200XE when you connect the AC adapters to T1200XE and a wall outlet. If the AC adapter's output voltage is abnormal or the power supply board malfunctions, the indicator labeled "DC IN" blinks red.

If the DC IN indicator blinks red or does not glow when connecting the AC adapter to the computer, check the following items.

Check 1 Unplug the AC adapter from the wall outlet and the computer, then remove the battery pack.

Plug the AC adapter into the computer, then the wall outlet and power on the computer.

If still its phenomenon remains, perform the check 2.

Check 2 The AC adapter may be damaged. Replace a new AC adapter. If still its phenomenon remains, perform the PROCEDURE 2.

PROCEDURE 2

Connector Check

The power supply board is connected to the other unit by some cables. These cables may be disconnected from the power supply board. Disassemble the T1200XE system unit for checking these cables. Disassemble procedures are described in part 4.

Check 1 Check that the following cables are connected to power supply board correctly.

- Power supply connector -----> PJ5
- Main battery connector -----> PJ4
- Sub battery connector -----> PJ2

If these cables are disconnected, connect them. Try again the normal operation. If the phenomenon remains, perform the check 2.

Check 2 The power supply board may be damaged. Replace a new power supply board. If still its phenomenon remains, the other unit may be damaged.

2.4 SYSTEM BOARD PROBLEM ISOLATION PROCEDURES

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

- PROCEDURE 1: Message Check
- PROCEDURE 2: Printer Port LED Check
- PROCEDURE 3: Test Program Check

PROCEDURE 1

Message Check

After power on, the system performs initial reliability test (IRT) which program is stored in BIOS ROM on the system board. If the error message appears, perform the check 1. If no error message displayed on the screen, perform the 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 it is 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.

*** Error in CMOS. Bad Battery ***
Check system. Then press any key

*** Error in CMOS. Bad check sum ***
Check system. Then press any key

*** Error in CMOS. Bad memory configuration ***
Check system. Then press any key

*** Error in CMOS. Bad time function ***
Check system. Then press any key

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 on the IRT program, the error message appears on the screen. If the following error message or none appears, perform PROCEDURE 3.

ERROR INTERRUPT CONTROLLER #1

ERROR INTERRUPT CONTROLLER #2

MEMORY VERIFY ERROR AT xxxx:xxxx FOUND xxxx
EXPECTED xxxx

ERROR INTERRUPTS AND STUCK NMI

ERROR PROTECT MODE

ERROR PROCESSOR EXCEPTIONAL INTERRUPT

If the following message appears on the screen,
perform the FDD problem isolation procedures.

*** FDD A is not installed ***

PROCEDURE 2

Printer Port LED Check

The printer port LED informs the IRT program status and error status as a hexadecimal value after power on the system. Connect the printer port LED to the printer port.

After power on, read the LED status from left to right.

If the final LED status is **FFH**, perform the PROCEDURE 3.

If the final LED status matches any of the error status code or normal status code value in the table 2-1, replace the system board.

Table 2-1 Normal status and error status
of the printer port LED (1/2)

Normal status	Error status	Meaning	Process
01H	81H	CPU test 1 (flag test)	Halt
02H	82H	KBIC IBF/OBF test, Video initialization	Halt
03H	83H	KBIC (KBC) IBF test (0AAH command)	Halt
04H	84H	KBIC (KBC) OBF test (55H check)	Halt
05H		Reserved	
06H		LSI initialization (DMA, PIT, PIC, RTC)	Continue
07H	87H	CPU test 2 (registers)	Halt
08H		RTC initialization (register B)	Continue
09H	89H	ROM checksum test (64KB)	Halt
0AH	8AH	Video initialization	Halt
0BH		Reserved	
0CH		Reserved	
0DH	8DH	PIT ch2 test and its initialization	Halt
0EH		CMOS time/date test	Continue
0FH	8FH	CMOS RAM test	Halt
10H	90H	DMA ch0 test	Halt
11H	91H	DMA ch1 test	Halt
12H	92H	DMA page register test	Halt
13H	93H	KBSC test and its initialization	Halt
14H	94H	Memory refresh test	Halt
15H	95H	1st 64KB RAM test	Halt
16H		Interrupt vector setup	Continue
17H	97H	Video option test	Halt
18H	98H	V-RAM test	Halt
19H	99H	PIC ch1 test	3 beeps continue
ERROR INTERRUPT CONTROLLER #1 message appears.			
1AH	9AH	PIC ch2 test	3 beeps continue
ERROR INTERRUPT CONTROLLER #2 message appears.			
1BH	9BH	CMOS battery test	1 beep key wait
*** Error in CMOS. Bad Battery *** Check system. Then press any key message appears.			
1CH		Reserved	Continue
1DH	9DH	Setup RAM size from CMOS (413H)	Continue
1EH	9EH	Size conventional RAM	Continue

Table 2-1 Normal status and error status
of the printer port LED (2/2)

Normal status	Error status	Meaning	Process
1FH	9FH	Conventional RAM test	3 beeps continue
MEMORY VERIFY ERROR AT xxxx:xxxx FOUND xxxx EXPECTED xxxx message appears.			
20H	A0H	PIC #1, #2 test	Continue
21H	A1H	NMI check	Continue
22H	A2H	Interrupt process test (INT8)	3 beeps continue
ERROR INTERRUPT AND STUCK NMI message appears.			
23H	A3H	Protect mode test	3 beeps continue
ERROR PROTECT MODE message appears.			
24H	A4H	Size extended RAM	Continue
25H	A5H	Conventional & extended RAM test	3 beeps continue
MEMORY VERIFY ERROR AT xxxx:xxxx FOUND xxxx EXPECTED xxxx message appears.			
26H	A6H	Protect mode exception	3 beeps test continue
ERROR PROCESSOR EXCEPTIONAL INTERRUPT message appears.			

NOTE: If the error occurs on the 19H to 26H normal status, printer port LED status does not halt. Error message remains on the screen, and when the IRT program is finished, these error messages are disappeared.

PROCEDURE 3

Test Program Check

The test program has several programs for testing the system board, which is stored in T1200XE diagnostics disk. Perform the following test. Detail 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 still error is detected, other units may be damaged.

2.5 FLOPPY DISK DRIVE PROBLEM ISOLATION PROCEDURES

This section describes how to determine whether or not the floppy disk drive is defective. Start with PROCEDURE 1 and continue with 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 the new floppy disk, then format it using MS-DOS FORMAT command.

If the floppy disk is not formatted, check the following items.

Check 1 Check that the FDD indicator lights. If it does not light, perform the PROCEDURE 3. If it lights, perform check 2.

Check 2 Check that the MS-DOS FORMAT command is used correctly.

When media type is 2DD, use the FORMAT/3 command.
When media type is 2HD, use the FORMAT command.

If FORMAT command is used correctly, perform the check 3.

If FORMAT command is not used correctly, try again.

If still the phenomenon remains, perform the check 3.

Check 3 Perform the head cleaning by cleaning kit of the 3.5-inch FDD. If the phenomenon still remains, perform the PROCEDURE 2.

PROCEDURE 2

Test Program Check

The FDD test program is stored in the T1200XE diagnostics disk. After running the MS-DOS using hard disk, load the diagnostics program. Detail operation is described in part 3.

Prepare the formatted floppy disk, then perform the FDD test. The error code and status is described in table 2-2. If the error occurs, perform the 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
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 by moving the write protect tab.

If the another error message appears, perform the check 2.

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

PROCEDURE 3

Connector Check

The FDD is connected to the system board by one cable. Disassemble the system unit for checking the FDD cable.

Detail procedures are described in part 4. If it is not connected, connect it to the system board. If it is connected to the system board correctly, perform check 1.

- FDD I/F connector -----> PJ7

Check 1 The FDD may be damaged. Replace the FDD to a new FDD, then check the PROCEDURES 1 and 2. If still the error occurs, the system board (floppy disk controller or other controller) may be defective. Replace the system board.

2.6 HARD DISK DRIVE PROBLEM ISOLATION PROCEDURES

This section describes how to determine whether or not the hard disk drive is defective. Start with PROCEDURE 1 and continue with 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 when perform the HDD problem isolation procedures. Before performing isolation, transfer the contents of the hard disk to floppy disks. This can be done with the MS-DOS BACKUP command. (See the MS-DOS manual for details.)*

PROCEDURE 1

Logical Format Check

Using the MS-DOS system disk, make partition of the hard disk by entering the FDISK command, then format the hard disk by entering the FORMAT command. At this time use /s switch to transfer the system program.

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

PROCEDURE 2

Test Program Check

The HDD test program is stored in T1200XE Diagnostics disk. Perform the all HDD test. Detail operation is described in part 3.

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

Table 2-3 HDD error 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
E0H	Status error
F0H	Not sense error (HW. code=FF)

PROCEDURE 3

Connector Check

The HDD is connected to the system board by HDD connector. Disassemble the system unit for checking the HDD cables.

Detail procedures are described in part 4. If it is not connected, connect them to the system board.

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

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

2.7 KEYBOARD PROBLEM ISOLATION PROCEDURES

This section describes how to determine whether or not the keyboard is defective. Start with PROCEDURE 1 and continue with 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 T1200XE diagnostics disk. Perform the test program. Detailed operation is described in part 3.

If the error occurs, perform the PROCEDURE 2. If the error does not occur, the keyboard is normal.

PROCEDURE 2

Connector Check

The keyboard is connected to the system board by one 22-pin flat cable. Disassemble the system unit for checking the keyboard cable. Detail procedures are described in part 4. If it is not connected, connect it. If it is connected correctly, perform check 1.

- Keyboard I/F connector -----> PJ18

Check 1 The keyboard may be damaged. Replace the keyboard to a new keyboard, then check the PROCEDURE 1.

If still error occurs, the keyboard controller on the system board may be damaged

2.8 DISPLAY PROBLEM ISOLATION PROCEDURES

This section describes how to determine whether or not the DISPLAY is defective. Start with PROCEDURE 1 and continue with 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 display.

Using the two dials to fine tune the display screen to your satisfaction.

If the brightness does not change, FL element may be lifetime. Perform the PROCEDURE 4.

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

If brightness and contrast of the display change, perform the PROCEDURE 2.

PROCEDURE 2

Test Program Check

Using T1200XE diagnostics disk, perform the display test. The display test checks the display controller on the system board.

If the error is detected, perform the PROCEDURE 3.

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

PROCEDURE 3

Connector Check

The display unit has LCD module, and FL power supply board. The LCD module is connected to the FL power supply board, volume board, and system board by connectors. Disassemble the display unit for checking these connectors.

Detail procedures are described in part 4.

If these connectors are not connected, connect them.

If these connectors are connected, perform the PROCEDURE 4.

PROCEDURE 4

Replacement Check

Replace the LCD module, then perform the normal operation.

If still the phenomenon remains, system board may be damaged.

(This page is intentionally blank.)

3.1 GENERAL

This part explains test and diagnostics programs. That checks the functions of all hardware modules of the T1200XE.

There are 17 programs grouped into two modules: the service program module (DIAGNOSTICS MENU) and test program module (DIAGNOSTICS TEST MENU).

The service program module is composed of six tasks:

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

The test program module is composed of 11 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. NDP TEST
11. EXPANSION TEST

The following items are necessary for carrying out the test and diagnostics programs:

1. T1200XE diagnostics disk
2. MS-DOS system disk
3. Formatted work disk (for FDD test)
4. Cleaning disk kit (for read cleaning)
5. Printer wraparound connector (for printer wraparound test)
6. 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 running the MS-DOS, insert the diagnostics disk into the floppy disk drive.
2. Type in a:TESTCE12, then press Enter.
3. The following display will appear:

```
TOSHIBA personal computer T1200XE DIAGNOSTICS
version X.XX (C) copyright TOSHIBA Corp. 1989
```

```
DIAGNOSTICS MENU :
```

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

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

Detailed explanations of the service programs and the operations are given in sections 3.17 to 3.22.

NOTE: To stop the test program:

- (1) During keyboard operation, press **Ctrl+C**.
- (2) While running the test program, press **Ctrl+Break**.

4. Type in 1, then press Enter and the following display will appear:

```
TOSHIBA personal computer T1200XE DIAGNOSTICS
version X.XX (c) copyright TOSHIBA Corp. 1989
```

```
DIAGNOSTIC TEST MENU :
```

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

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

Numbers 1 to 11 are diagnostics tests.

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

Number 99 is for returning to the DIAGNOSTIC MENU.

When selecting the floppy disk test or hard disk test, special sub-messages will appear, as described in sections 3.8 and 3.11.

5. After typing in a test number (1 to 11) of the DIAGNOSTICS TEST MENU, pressing **Enter** displays as follows:

```
TEST NAME                                XXXXXXXX
SUB TEST   : XX          ERROR COUNT : XXXXX
PASS COUNT : XXXXX      READ DATA  : XX
WRITE DATA : XX        STATUS      : XXX
ADDRESS    : XXXXXXX
SUB-TEST MENU :
01 - ROM CHECKSUM
02 - HW status
99 - Exit to DIAGNOSTIC TEST MENU

SELECT SUB-TEST NUMBER ? _
```

The screen shown above, for example, appears when you type 1 and press **Enter**.

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

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

NOTE: If you select *KEYBOARD TEST*, this message will not appear.

If you select YES (by typing in 1, 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, 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) ?
```

If you select YES (by typing in 1, then pressing **Enter**):

When an error occurs, the error status is displayed and 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, then pressing **Enter**):

When an error occurs, the error status is displayed then the error counter is incremented by one and you go to the next test.

8. Type in 1 or 2, then press **Enter** and the test program will run. Each subtest is described in section 3.3.
9. When an error occurs during the test program, the following message will appear (if you answer YES for ERROR STOP question):

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

1: Terminates the test program execution and exits to the subtest menu.

2: Continues the test.

3: Retries the test.

Error code and error status names are described in section 3.15.

3.3 SUBTEST NAMES

Table 3-1 lists the subtest of each test program.

Table 3-1 Subtest names (2/1)

No.	Test name	Subtest No.	Subtest name
1	SYSTEM	01	ROM checksum
		02	HW status
2	MEMORY	01	RAM constant data
		02	RAM address pattern data
		03	Memory refresh
		04	Protected mode
		05	Extended memory
		06	Backup memory
		07	RAM on BIOS
		08	H-RAM
		09	LIM/EMS mode
3	KEYBOARD	01	Pressed key display
		02	Pressed key code displays
4	DISPLAY	01	VRAM read/write
		02	Character attributes
		03	Character set
		04	80*25 character display
		05	Graphics display (color set 0/1)
		06	640*200 graphics display
		07	640*400 graphics display
		08	Display page
		09	"H" pattern display
		10	LED & font change
5	FDD	01	Sequential read
		02	Sequential read/write
		03	Random address/data
		04	Write specified address
		05	Read specified address
6	PRINTER	01	Ripple pattern
		02	Function
		03	Wraparound
7	ASYNC	01	Wraparound (channel #1)
		02	Wraparound (channel #2)
		03	Point to point (send)
		04	Point to point (receive)
		05	Card modem loopback
		06	Card modem on-line test
		07	Dial tester test
		08	Interrupt test (IRQ4, 3, 5)

Table 3-1 Subtest names (2/2)

No.	Test name	Subtest No.	Subtest name
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 (CE cylinder)
		09	Sequential write
		10	W-R-C specified address
9	REAL TIMER	01	Real time test
		02	Real time carry test
10	EXPANSION	01	Box wraparound test
		02	Box mono video RAM test
		03	Wraparound test (16-bit bus)

3.4 SYSTEM TEST

Subtest 01 ROM checksum

This test performs the ROM checksum test on the system board

(Test extent: F0000H - FFFFFH 64KB)

Subtest 02 H/W status

This test reads the system hardware status, then displays the status as shown below.

Press **Enter** to return to the system test's SUB-TEST MENU. Table 3-2 describes the hardware status bits. If you want to return to the SYSTEM TEST MENU, press **Enter**.

```

              76543210
H/W status = 10101100

Bit7 --- Display mode = Internal
Bit6 --- CPU clock    = 12MHZ
Bit5 --- Media type   = 2DD
Bit4 --- FDD type     = 2MB
Bit3 ---
Bit2 --- Drive A/B    = Ext.=B
Bit1 --- External FDD = OFF
Bit0 --- Internal FDD = 2MB
    
```

Table 3-2 Hardware status bit

Items	H/W status	1	0
Bit7	Display mode	Internal	External
Bit6	CPU clock	6 MHz	12 MHz
Bit5	Media type	1 MB	2 MB
Bit4	FDD type	1 MB	2 MB
Bit3	Reserved		
Bit2	Drive A/B	Ext.=B	Ext.=A
Bit1	External FDD	ON	OFF
Bit0	Internal FDD	1 MB	2 MB

3.5 MEMORY TEST

Subtest 01 RAM constant data (in real mode)

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

The constant data is FFFFH, AAAAH, 5555H, 0101H, and 0000H.

Subtest 02 RAM address pattern data (in real mode)

This subtest creates an address pattern by XORing (Exclusive-ORing) the address segment and address offset, writes the address pattern into the segment address and the offset address, then reads and compares it with the original data.

Subtest 03 RAM refresh (in real mode)

This subtest writes 256 bytes of constant data to memory, then reads and compares it with the original data. The constant data is AAAAH and 5555H. There is a delay between the write and the read operations.

Subtest 04 Protected mode

This subtest writes fixed data and address data to memory (addresses 100000H to the maximum) in protected mode, then reads and compares it with the original data.

Subtest 05 Extended memory

For the memory located at the address 100000H or more, the test program writes data, reads it back, and compares in the microprocessor's protected mode.

The data patterns used by the program are one address pattern and four constant (i.e. fixed) data patterns.

Address pattern data is a data generated by some logical operation with its memory address information. Four constant data patterns are FFFFH, AAAAH, 5555H, and 0000H.

Subtest 06 Backup memory

This subtest writes constant data (FFFFH, AAAAH, 5555H, 0000H) to memory at addresses 0E8000H to 0EFFFFH, then reads and compares it with the original data.

Subtest 07 RAM on BIOS

A register controlling the RAM on BIOS function is checked by a write/read/compare algorithm. And, the functions specified by the register are also verified. Then, the program compares the copied BIOS code in the RAM with the original code in the ROM.

Subtest 08 H-RAM

Registers controlling the Hard-RAM function is checked by a write/read/compare algorithm. And, the functions specified by the registers are also verified. Then, the program compares the copied BIOS code in the RAM with the original code in the ROM.

Finally, the memory assigned as Hard-RAM is checked by a write/read/compare algorithm using a Hard-RAM window.

Subtest 09 LIM/EMS mode (in real mode)

Registers controlling the LIM-EMS are checked. Page information is written at the beginning of each page to verify its paging function. Then, the memory assigned as LIM-EMS is checked by a write/read/compare algorithm using a LIM-EMS window.

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 screen when pressed.

The scan codes, character codes and key top names are shown in Appendix D.

KEYBOARD TEST IN PROGRESS 30200

Scan code = XX
Character code = XX
Keytop = XXXX

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

PRESS [ENTER] KEY

3.7 DISPLAY TEST

Subtest 01 VRAM read/write

This subtest writes constant data (FFFFH, AAAAH, 5555H, and 0000H) and address data to video RAM (32 Kbytes), then reads the data written and compares it with the original data.

Subtest 02 Character attributes

This subtest checks:

- Normal display
- Intensified display
- Reverse display
- Blinking display

For color displays, all seven colors used (blue, red, magenta, green, cyan, yellow, and white) are displayed. The background and foreground colors can then be checked for brightness. The display below appears on the screen when this test is run.

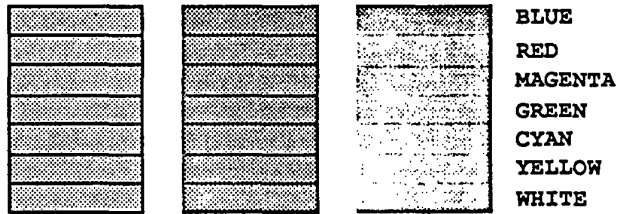
CHARACTER ATTRIBUTES

NEXT LINE SHOWS NORMNAL DISPLAY.
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNN

NEXT LINE SHOWS INTENSIFIED DISPLAY.
I I I I I I I I I I I I I I I I

NEXT LINE SHOWS REVERSE DISPLAY.
RRRRRRRRRRRRRRRRRRRRRRRRRRRRRR

NEXT LINE SHOWS BLINKING DISPLAY.
BBBBBBBBBBBBBBBBBBBBBBBBBBBBBB

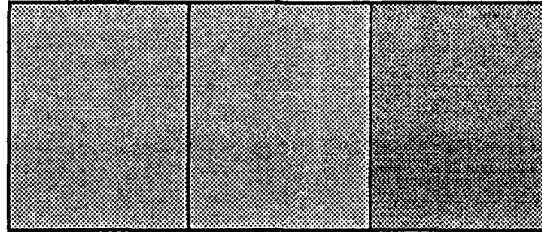


PRESS [ENTER] KEY

Subtest 05 320*200 Graphics display

This subtest displays two of color sets for the color display in the 320*200 dots graphics mode (Mode 4) as shown below:

320*200 GRAPHICS DISPLAY [X]

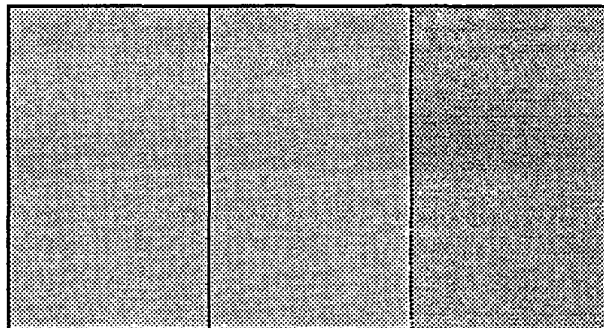


PRESS [ENTER] KEY

Subtest 06 640*200 graphics display

This subtest displays the color blocks for the black and white display in the 640*200 dots graphics mode (Mode 6) as shown below:

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



PRESS [ENTER] KEY

3.8 FLOPPY DISK TEST

CAUTION: Before running the floppy disk test, prepare a formatted work disk and remove the diagnostics disk. Then insert the work disk into the FDD, because the contents of the floppy disk will be erased.

OPERATION

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

Test drive number select (1:FDD1,2:FDD2,0:FDD1&2) ?

2. Select the test drive number, then press the **Enter**. The following message will appear:

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

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

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

4. You can select the start track number of the floppy disk test.

When pressing the **Enter** only, the start track number will be zero.

If you desire, select the start track number. Then the subtest menu of the floppy disk test will appear.

5. During the floppy disk test, the message shown below will appear. The **ADDRESS** number indicates that the first **XX** shows a cylinder number, the third **X** shows a head number, and the last **XX** shows a sector number.

The **STATUS** number indicates that the first **X** shows a drive number and the last **XX** shows an error status code.

```
FLOPPY DISK                                XXXXXXXX

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

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.

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

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

The start track can be specified at the previous stage.

Subtest 02 Sequential read/write

This subtest writes data to all tracks (as defined above) continuously, and then reads the data out and compares it with the original data. (The data pattern is B5ADADH repeated.)

Subtest 03 Random address/data

This subtest writes random data to random address on all 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 can specify the test data, track number, and head number.

Subtest 05 Read specified address

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

3.9 PRINTER TEST

CAUTION: A printer (IBM compatible) must be connected to the system in order to execute the test. Confirm that the A-B-PRT switch is set to PRT position.

CONTENTS

Subtest 01 Ripple pattern

This subtest prints characters for code 20H through 7EH line by line while shifting one character to the right at the beginning of each new line.

```
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnop
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnop
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopq
r
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqr
s
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrs
t
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrst
u
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstu
v
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstu
vw
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz[\]^_`abcdefghijklmnopqrstu
vwxy
```

Subtest 02 Function

This subtest prints out various print type as shown below.

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

Subtest 03 Wraparound

NOTE: A printer wraparound connector is necessary for executing this test. Wiring diagram of the printer wraparound connector is described in section 3.23.

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

OPERATION

Subtest 01 and 02

1. When you select the subtest 01 or 02, the following message will appear:

Select the channel number (1-3) ?

Select the printer channel number, then type in the number. The T1200XE supports three printer channels.

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

Subtest 03

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

Select the channel number (1-3) ?

Select the printer channel number, then type in the number. The T1200XE supports three printer channels.

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

3.10 ASYNC TEST

In subtest 01 to 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 Wraparound (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 3.23.

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

Subtest 02 Wraparound (channel #2)

The same test as the subtest 01 is performed for the channel #2.

Subtest 03 Point to point (send)

NOTE: This subtest must be executed in condition that two machines are connected with the RS-232-C direct cable and one side should be set as 'send' and the other set as 'receive'. The wiring diagram of the RS-232-C direct cable is described in section 3.23. The subtest 03 executed in one side and the subtest 04 executed in the other will check the communication capability as follows:

A block of data (20H to 7EH) is sent from one side to the other, and then returned back. The returned data is compared with the original one. This test is used to check whether the returned data are same as the original ones.

Subtest 04 Point to point (receive)

This subtest is used with the 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 to check whether the data to be sent from the modem card to the RS-232-C line is correct or not. This can be done with the loopback function inside the modem card.

Subtest 06 Card modem on-line test

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

In this subtest, data are sent from the 'send' side to the 'receive' side through the PBX. This subtest is used to check whether data transmission through a telephone line is done properly or not.

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 sending the pulse dial and tone dial twice automatically.

[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-#"

Subtest 08 Interrupt test (IRQ4, 3, 5)

This subtest generates the interrupt request levels 4, 3, and 5 in this order, then checks if this function works correctly.

3.11 HARD DISK TEST

CAUTION: The contents of the hard disk will be erased when subtest 02, 03, 04, 06, 08, or 09 is run. Before running the test, transfer the contents of the hard disk on the floppy disk. This can be done with the MS-DOS BACKUP 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.)

OPERATION

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

Test drive number select (1:HDD,2:HDD2,0:HDD1&2) ?
2. Select the drive number of the hard disk to be tested and press the **Enter**. The following message will appear:

HDC F/W error retry (1:yes,2:no) ?
3. This message is used to select whether to do retry operation or not when the hard disk controller detects an error. Select **yes** or **no** and press the **Enter**. The following message will appear:

Data compare error dump (1:no,2:yes) ?
4. This message is used to select whether to do dump operation or not when data compare error is detected. Select **yes** or **no** and press the **Enter**. The following message will appear:

Detail status display (1:no,2:yes) ?
5. This message is used to select whether to display the detail status on the screen or not. The detail status are described in section 3.16. Select **yes** or **no** and press the **Enter**.

6. During the hard disk test, the message shown below will appear. The ADDRESS number indicates that the first XXX shows a cylinder number, the fourth X shows a head number, and the last XX shows a sector number.

The STATUS number indicates that the first X shows a drive number and the last XX shows an error status code.

```
HARD DISK TEST                XXXXXXXX

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

CONTENTS

Subtest 01 Sequential read

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

Subtest 02 Address uniqueness

1. Selecting this subtest, the following message will appear:

```
Read Sequential select ?
```

```
1 : Forward sequential
2 : Reverse  sequential
3 : Random
```

2. Select one of the above and press the Enter.

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.

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 cylinder, then reads the data while shifting cylinder by cylinder.

```

Worst pattern data
1. B5ADAD .....
2. 4A5252 .....
3. EB6DB6 .....
4. 149249 .....
5. 63B63B .....
6. 9C49C4 .....
7. 2DB6DB .....
8. D24924 .....

```

Subtest 05 Write/read/compare (CE)

This subtest writes 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 (CE cylinder)

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

Subtest 09 Sequential write

This subtest writes specified data of the two bytes to all cylinders.

Subtest 10 W-R-C specified address

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

3.12 REAL TIMER TEST

Subtest 01 Real time

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

Operations for the test are as follows:

1. Selecting the subtest, the following message will appear:

```
REAL TIME TEST                                901000
```

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

```
Current time: XX:XX:XX
```

```
Enter new date:
```

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

2. If current date is not correct, input the current new date. Press the **Enter**, the **Enter new time:** message will appear.
3. If current time is not correct, input the current new time. Press the **Enter**, return to the subtest menu of the REAL TIME TEST.

Subtest 02 Real time carry

<p>CAUTION: When this test is executed, the current date and time is erased.</p>

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

3.13 EXPANSION TEST

NOTE: *If there is no expansion unit connected to the system, this test cannot be executed.*

Subtest 01 Box wraparound (8-bit bus)

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

Subtest 02 Box mono video RAM

NOTE: *If there is no monochrome display card in the expansion unit, this test cannot be executed.*

This subtest writes data (FF, AA, 55, and 00) into the monochrome display memory (B0000H to B0F9FH), then reads the data out and compares it with the original data.

Subtest 03 Wraparound test (16-bit bus)

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

3.14 ERROR CODE AND ERROR STATUS NAMES

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

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

Device name	Error code	Error status name
SYSTEM	01	ROM checksum error
MEMORY	01	Parity error
	02	Protected mode not change
COMMON	FF	Compare error
FDD	01	Bad command
	02	Address mark not found
	03	Write protected
	04	Record not found
	06	Media removed
	08	DMA overrun error
	09	DMA boundary error
	10	CRC error
	20	FDC error
	40	Seek error
	60	FDD not drive
	80	Time out error
EE	Write buffer error	
ASYNC	01	DSR off time out
	02	CTS off time out
	04	RX-enable time out
	08	TX-buffer full time out
	10	Parity error
	20	Framing error
	40	Overrun error
	80	Line status error
	88	Modem status error
	33	No carrier (card modem)
34	Error (card modem)	
36	No dial tone	
PRINTER	01	Time out
	08	Fault
	10	Select line
	20	Out of paper
	40	Power off
	80	Busy line

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

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)	
NDP	01	No co-processor
	02	Control word error
	03	Status word error
	04	Bus error
	05	Additional error
	06	Multiple error

3.15 HARD DISK TEST DETAIL STATUS

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

HDC status = XXXXXXXX

Detailed status of the hard disk test error is shown on the screen by eight-unit number. The first XXXX is 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 the error register of the HDC.

These contents are described in the tables 3-4 and 3-5.

Table 3-4 HDC status register contents

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

Table 3-5 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 HARD DISK FORMAT

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 run. Before running the program, transfer the contents of the hard disk onto a floppy disk. This can be done with the MS-DOS BACKUP command. (See the MS-DOS manual for details.)*

3.16.1 Program Description

1. All track FORMAT

Performs physical formatting of hard disk in the manner shown in table 3-6 below:

Table 3-6 Hard disk formatting manner

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.

3.16.2 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 pressing 2 and Enter in the DIAGNOSTICS MENU, the following display will appear:

```
DIAGNOSTIC - HARD DISK FORMAT V2.00
  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 (3/1-3) ?

- (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  
              destroyed]
```

```
Press [Bad track number (CCCH)] key ?  
      [[cylinder, head = XXX X]]
```

- (4) After pressing the 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 then appear.
- (6) Press the 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 (3/1-3) ?
```

- (3) Select an interleave number (usually select 3). 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.

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 the **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 (3/1-3) ?

- (3) Select an interleave number (usually select 3). 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 XX]]

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

3.17 HEAD CLEANING

3.17.1 Program Description

This program executes head loading and seek/read operations for head cleaning. A cleaning kit is necessary for cleaning the FDD head.

3.17.2 Operations

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

DIAGNOSTIC FLOPPY DISK HEAD CLEANING: VX.XX

Mount cleaning disk(s) on drive(s).
Press any key when ready.
2. After above message appears, remove the Diagnostics disk, insert the cleaning disk, and press any key.
3. When the **Cleaning start** message appears, FDD head cleaning will begin.
4. When cleaning is finished, the display automatically returns to the **DIAGNOSTICS MENU**.

3.18 LOG UTILITIES

3.18.1 Program Description

The program logs error information generated, while a test is in progress; the information is stored in the RAM.

However if the POWER switch is turned off the error information will be lost. The error information itself is displayed as the following:

1. Error count (CNT)
2. Test name (TS)
3. Subtest number (NAME)
4. Pass count (PASS)
5. Error status (STS)
6. Address (FDD, HDD 1 or memory; ADDR)
7. Write data (WD)
8. Read data (RD)
9. Error status name

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

3.18.2 Operations

1. After pressing 5 and Enter in the DIAGNOSTICS MENU, the error information logged in the RAM or on the floppy disk is displayed as shown below:

XXXXX ERRORS										
CNT	T-NAME	PASS	STS	ADDR	WD	RD	HSTS	[ERROR	STATUS	NAME
001	FDD	02	0000	103	00001	00	00	FDD -	WRITE	PROTECTED
001	FDD	01	0000	180	00001	00	00	FDD -	TIME	OUT ERROR

↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Error count	Test name	Subtest number	Pass count	Error status	Address	Write data	Read data	Error status name	

[[1:Next, 2:Prev, 3:Exit, 4:Clear, 5:Print, 6:FD LogRead, 7:FD LogWrite]]

2. Error information displayed on the screen can be manipulated with the following key operation:

The 1 key scrolls the display to the next page.

The 2 key scrolls the display to the previous page.

The 3 key returns the display to the DIAGNOSTICS MENU.

The 4 key erases all error log information in RAM.

The 5 key outputs error log information to a printer.

The 6 key reads log information from a floppy disk.

The 7 key writes log information to a floppy disk.

3.19 RUNNING TEST

3.19.1 Program Description

This program automatically runs the following tests in sequence.

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

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

3.19.2 Operations

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

1. Remove the diagnostics disk and insert the work disk into the floppy disk drive.
2. After pressing **6** and **Enter** in the DIAGNOSTICS MENU, the following message will appear:

Printer wrap around test (Y/N) ?
3. Select whether to execute the printer wraparound test (Yes) or not (No). Type **Y** or **N** and press **Enter**. (If **Y** is selected, a wraparound connector must be connected to the printer connector on the back of the unit.) The following message will appear:

Async#1 wrap around test (Y/N) ?
4. Select whether to execute the test (Yes) or not (No). Type **Y** or **N** and press **Enter**. (If **Y** is selected, an RS-232-C wraparound connector must be connected to the COMMS connector on the back of the unit.)
5. This program is repeated continuously. To stop the program, press **Ctrl+Break**.

3.20 FDD UTILITIES

3.20.1 Program Description

These programs format and copy floppy disks, and display dump list for both the FDD and the HDD.

1. FORMAT

CAUTION: This program is for only floppy disk drive test. The program is different from the MS-DOS FORMAT command.

This program can format 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) 2HD: Double-sided, high-density, double-track, 96/135 TPI, MFM mode, 512 bytes, 18 sectors/track.

2. COPY

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

3. DUMP

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

3.20.2 Operations

1. After pressing 7 and Enter key in the DIAGNOSTICS MENU, the following display will appear before program execution:

```
[FDD UTILITIES]
```

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

```
PRES [1] - [9] KEY
```

2. FORMAT selection

- (1) When FORMAT is selected, the following message appears:

```
DIAGNOSTICS - FLOPPY DISK FORMAT (V1.00)
Drive number select (1:A, 2:B) ?
```

- (2) Select a drive number. Type the number and the following message will then appear:

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

- (3) Select a media/drive type number. Type the number and the message similar to the 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;
formatting is then executed.
```

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

```
Format start
```

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

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

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


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

3. COPY selection

- (1) When **COPY** is selected, the following message will appear.

```
DIAGNOSTICS - COPY
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 then 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, then start the copy to memory.

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

Copy start

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

- (4) Remove the source disk from the FDD and insert the work disk (formatted); press any key. The `[[track, head = XXX XX]]` message will appear, then start the copy to target disk. When copying cannot be done with one operation, message (2) 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 (1) above. If you type 2 the display will return to the **DIAGNOSTICS MENU**.

4. DUMP selection

- (1) When DUMP is selected, the following message will appear.

```
D[HDD&FLOPPY DISK DATA DUMP]
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.

0: Displays a dump list for a floppy disk (2DD).

1: Displays a dump list for a floppy disk (2D).

2: Displays a dump list for a floppy disk (2HD).

3: Displays a dump list for a hard disk.

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

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

- (4) Select an FDD drive number; the following message will then 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 then appear. Type the track number and press **Enter**.

- (6) The **Head number ?** message will then appear. Type the head number and press **Enter**.

- (7) The **Sector number ??** message will then 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 (1) above. If you type **2** the display will return to the **DIAGNOSTICS MENU**.

3.21 SYSTEM CONFIGURATION

3.21.1 Program Description

This program displays the following system configuration.

1. BIOS ROM VERSION = VX.XX
2. Base memory size
3. Display type
4. A number of floppy disk drives
5. A number of async ports
6. A number of hard disk drives
7. A number of printer ports
8. Extended memory size
9. Co-processor presents or not

3.21.2 Operations

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

SYSTEM CONFIGURATION

```
*- BIOS ROM VERSION = VX.XX
*- 640KB MEMORY
*- COLOR/GRAPH (80 column)
*- 1 FLOPPY DISK DRIVE(S)
*- 1 ASYNC ADAPTER(S)
*- 1 HARD DISK DRIVE(S)
*- 1 PRINTER ADAPTER
*- 0 MATH CO-PROCESSOR
*- XXXXXKB EXTENDED MEMORY
```

PRESS [ENTER] KEY

Press Enter key to return to the DIAGNOSTICS MENU.

3.22 WIRING DIAGRAM

1. Printer wraparound connector

(9)	+DATA7 (4)+DATA2	_____	+SELECT	(13)
(8)	+DATA6 (3)+DATA1	_____	+P.END	(12)
(7)	+DATA5 (2)+DATA0	_____	+BUSY	(11)
(6)	+DATA (16)-INTPRT	_____	-ACKNOWLEDGE	(10)
(5)	+DATA3 (1)-STROBE	_____	-ERROR	(1)

Figure 3-1 Printer wraparound connector

2. RS-232-C wraparound connector

(3)	TRANSMIT DATA	_____	RECEIVE DATA	(2)
(7)	REQUEST TO SEND	_____	CLEAR TO SEND	(8)
		|	CARRIER DETECT	(1)
(4)	DATA TERMINAL	_____	DATA SET READY	(6)
		|	RING INDICATE	(9)

Figure 3-2 RS-232-C wraparound connector

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

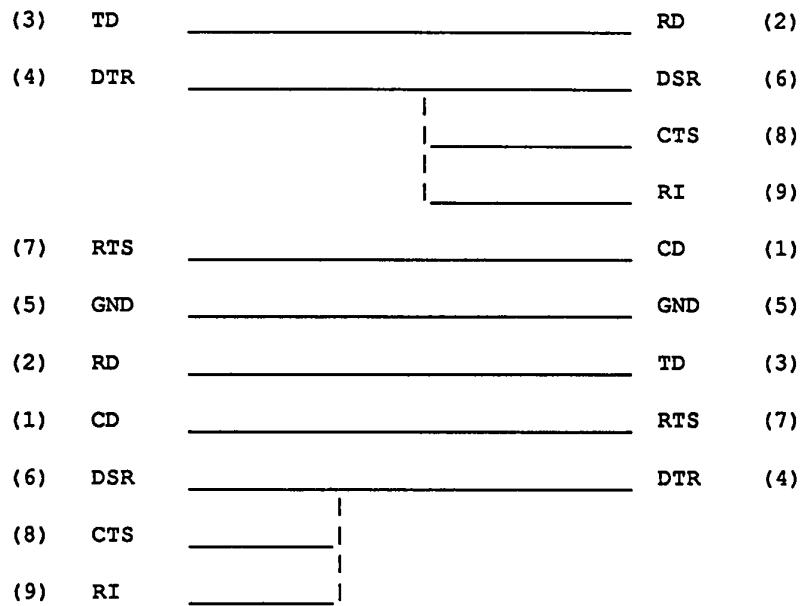


Figure 3-3 RS-232-C direct cable (9-pin to 9-pin)

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

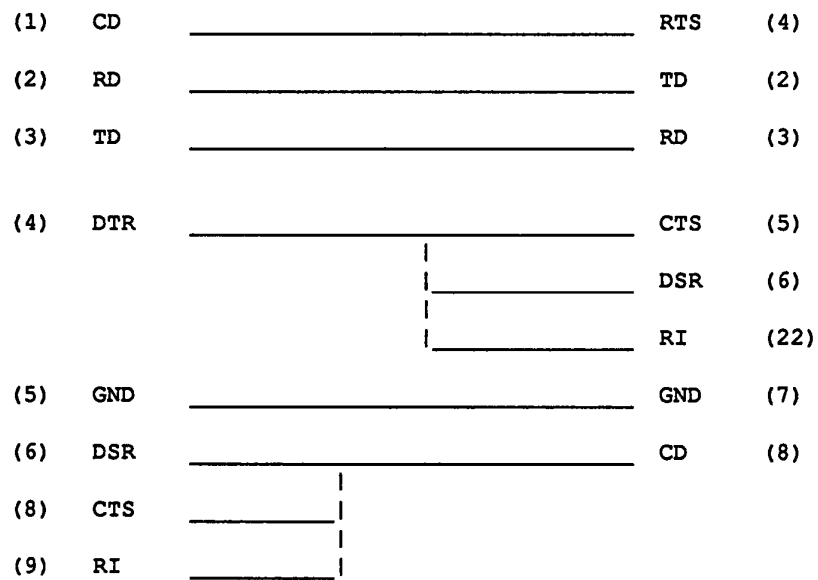


Figure 3-4 RS-232-C direct cable (9-pin to 25-pin)

4.1 GENERAL

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

FRUs are listed as follows:

1. Keyboard
2. Speaker
3. LCD
4. Contrast board
5. Top cover
6. LCD cable
7. LED board
8. Built in modem holder
9. Sub battery
10. Battery cover assembly
11. Power supply board
12. Hard disk drive (HDD)
13. Floppy disk drive (FDD)
14. Internal display disable switch board
15. System board
16. Legs
17. Handle

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 approved tools may be used.
3. After deciding the purpose of replacing the unit, and the procedures required, do not carry out any other procedures which are not absolutely necessary.
4. Be sure to turn the POWER switch off before beginning.
5. Be sure to disconnect the AC adapter and all external cables from the system.
6. Be sure to remove the main battery before beginning (refer to the reference manual).
7. Be sure to remove the sub battery after opening the top cover.
8. Follow the only fixed, standard procedures.
9. After replacing a unit, confirm that the system is operating normally.
10. Be sure not to be wounded by thin steel plate.

Tools needed for unit replacement:

1. Two kinds of phillips head screwdriver (2 mm and 3 mm)

4.2 REMOVING/REPLACING THE KEYBOARD AND SPEAKER

1. Remove the AC adapter from the system unit.
2. Turn the system unit upside down and remove the four screws (A) from the bottom cover.

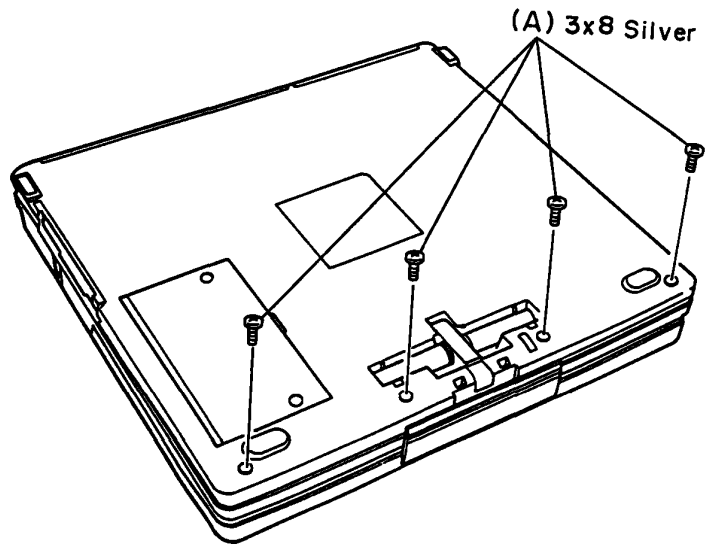


Figure 4-1 Removing the four screws

3. Turn the system unit back over, then open the display.
4. Lift up the front edge of the keyboard and remove the shield plate (B) placed underneath the keyboard. Then place the keyboard in front of the computer.
5. Release the pressure plate (C) of PJ18 (D) to disconnect the keyboard cable (E) from the system board (F).

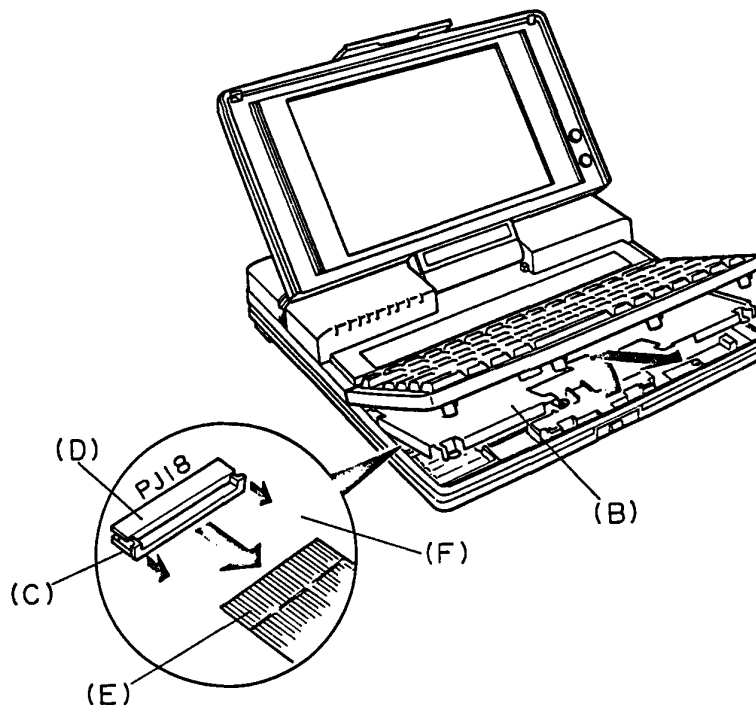


Figure 4-2 Removing the keyboard unit

6. Unlatch the four latches (F) to remove the keyboard mask (G) from the keyboard.

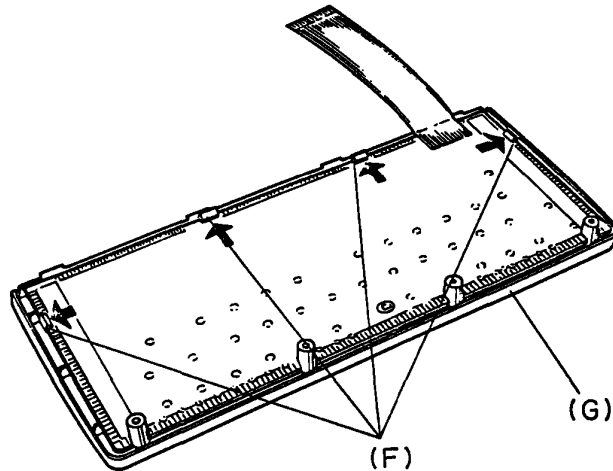


Figure 4-3 Removing the keyboard mask

7. Remove the screw (H) from the chassis (I) fixing the speaker, then disconnect the speaker cable (J) from PJ14 (K) located on the system board.

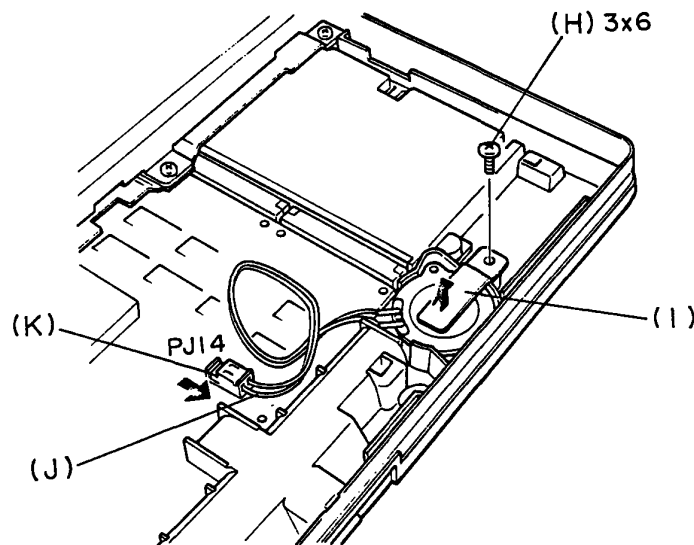


Figure 4-4 Removing the speaker

8. To install the keyboard and the speaker, follow the above procedures in reverse.

NOTE: Pay attention not to shortcircuit, because the sub battery is connected.

4.3 REMOVING/REPLACING THE LCD AND SIDELIT POWER SUPPLY BOARD

1. Remove the AC adapter from the system unit.
2. Open the display.
3. Remove the two rubbers (A). Push and hold the left side of the label (B) and slide it to the left, then remove it from the LCD mask (C). To remove the LCD mask from the LCD cover assembly, remove the four screws (D) and the nine latches (E).

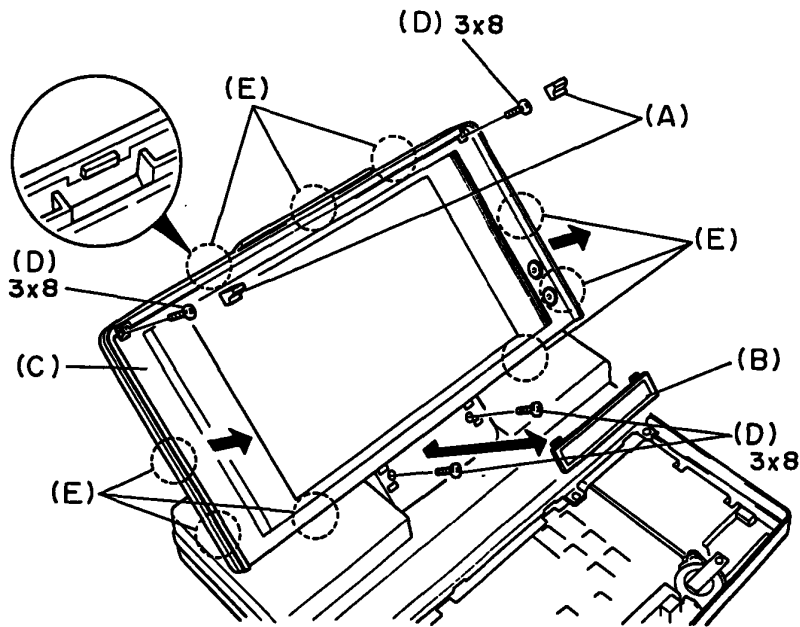


Figure 4-5 Removing the LCD mask

4. Remove the five screws (F), then disconnect the contrast cable (G) from PJ1, PJ2, PJ3, and PJ4 (H) located on the sidelit power supply board (I). Then remove the one screw (J) and disconnect the LCD cable (K).

Disconnect the LCD cable (L) from CN1 (M) on the LCD.

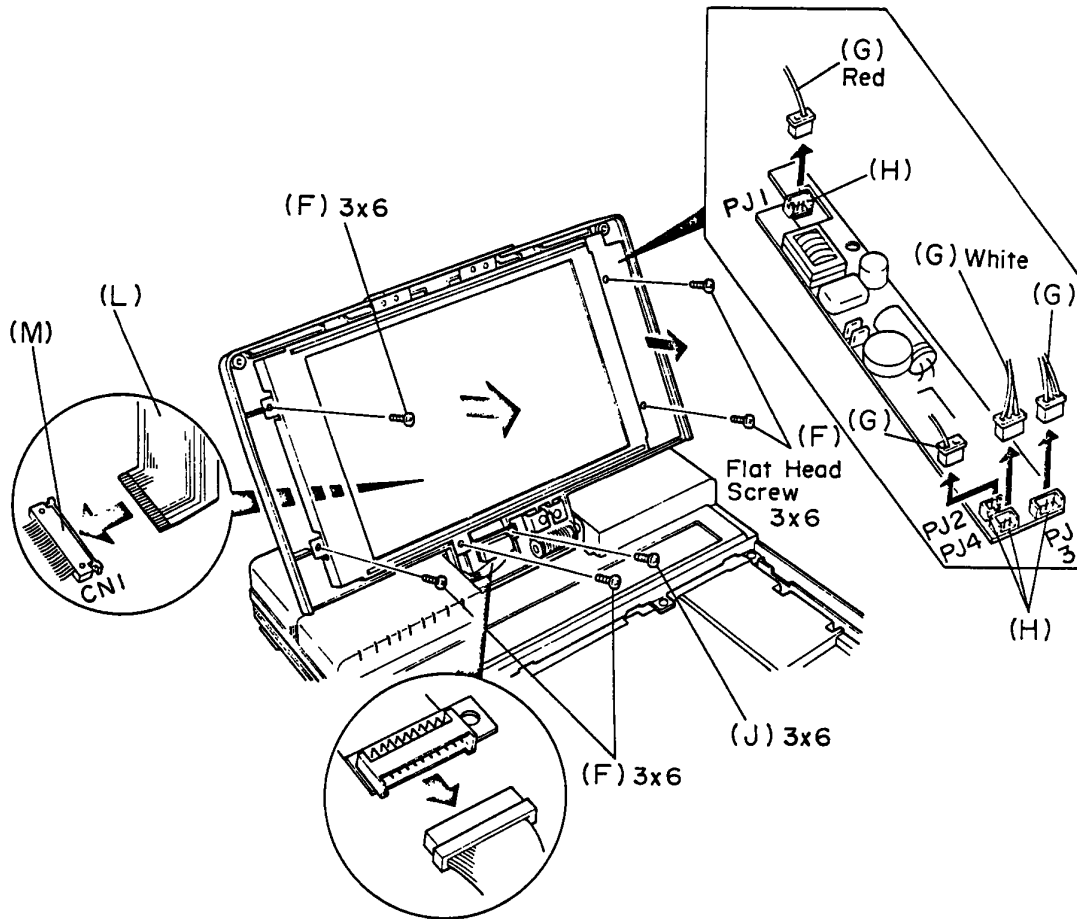


Figure 4-6 Removing the LCD

5. To install the LCD and the sidelit power supply board, follow the above procedures in reverse.

4.4 REMOVING/REPLACING THE LCD COVER ASSEMBLY

1. Remove the LCD as directed in the section 4.3.
2. Remove the one screw (A).

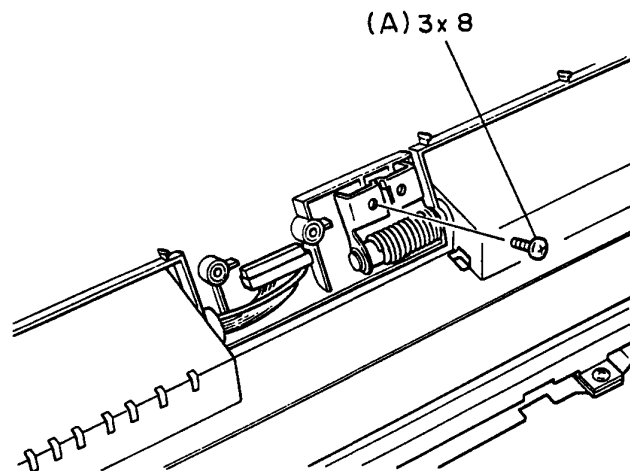


Figure 4-7 Removing the LCD cable

3. Remove the LCD cover assembly (B) bending it toward you. Remove the hinge.

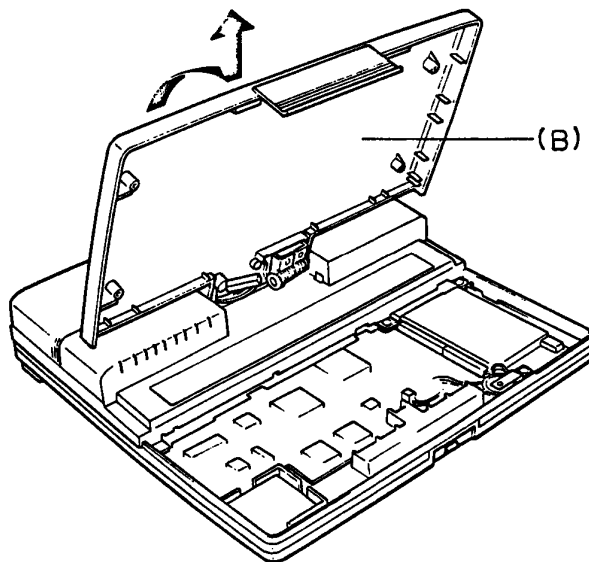


Figure 4-8 Removing the LCD cover assembly

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

4.5 REMOVING/REPLACING THE TOP COVER

1. Remove the battery and the four screws (A) from the top cover (B).

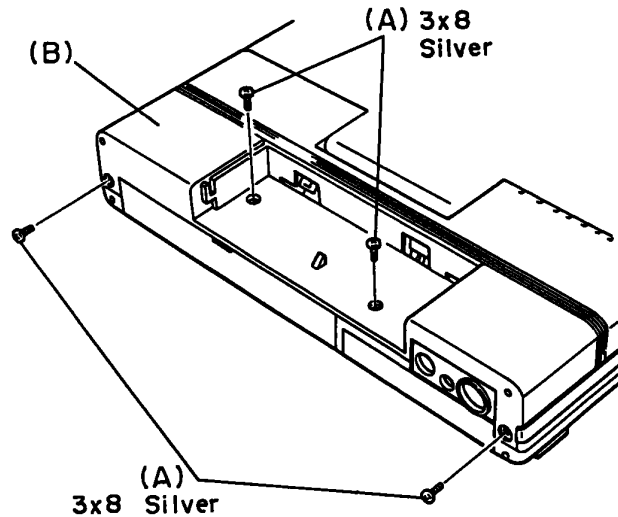


Figure 4-9 Removing the four screws

2. Remove the keyboard as directed in the section 4.2.
3. To remove the top cover, remove the three screws (C) and disconnect the LCD cable (D) from PJ6 (E) located on the system board.

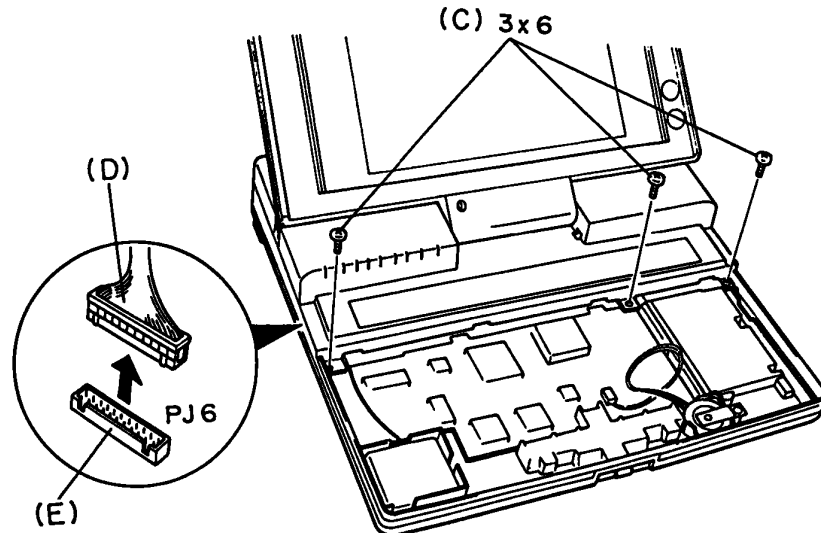


Figure 4-10 Removing the top cover

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

4.6 REMOVING/REPLACING THE LCD CABLE

1. Remove the top cover as directed in the section 4.5.
2. Remove the three screws (A) to remove the LCD cable (B) and the LCD cable holder (C).
3. And remove the LCD cable.

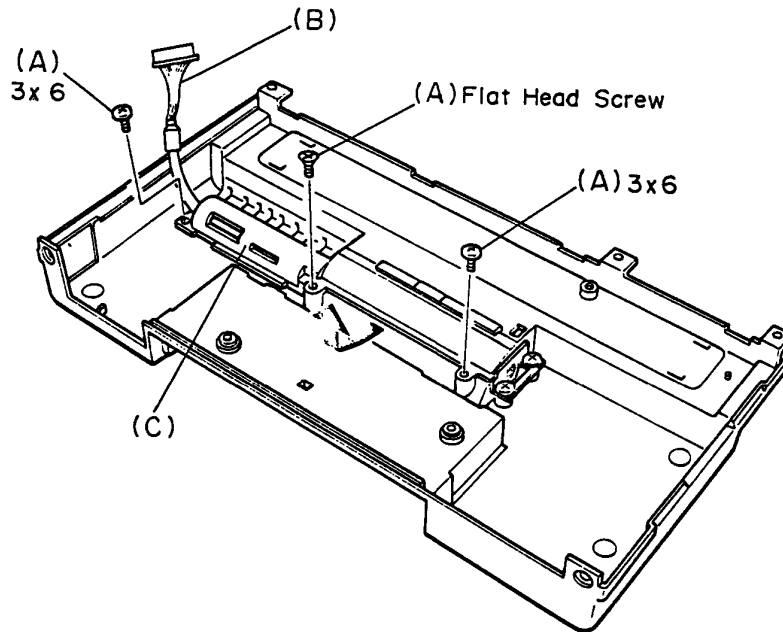


Figure 4-11 Removing the LCD cable

NOTE: Disconnect the sub battery connector first after removing the top cover.

- 4. To install the LCD cable, put the LCD cable in the cable holder (C) and install it in the top cover.

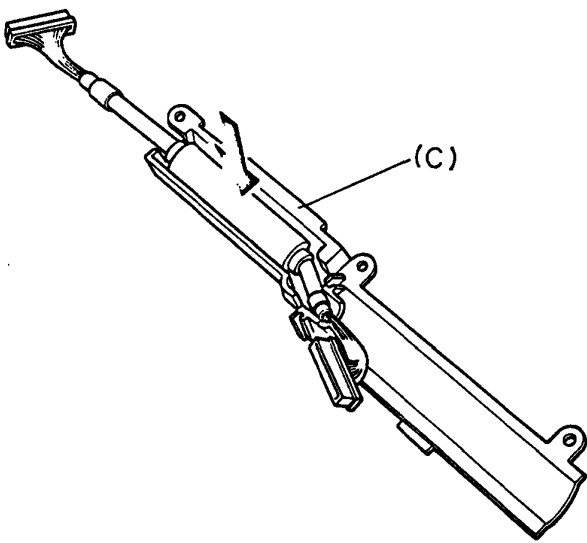


Figure 4-12 Putting the LCD cable in the cable holder

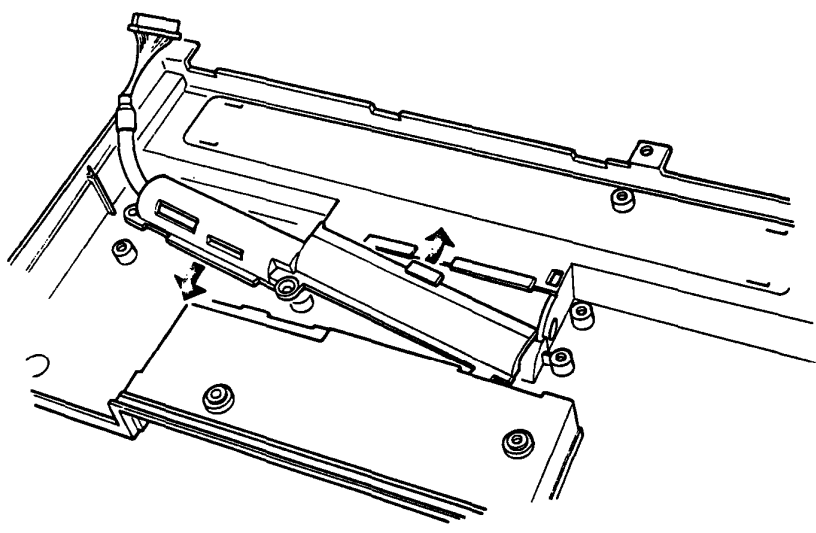


Figure 4-13 Installing the cable holder in the top cover

**4.7 REMOVING/REPLACING THE LED BOARD AND BUILT IN
MODEM HOLDER**

4.7.1 REMOVING

1. Remove the top cover as directed in section 4.5.
2. Remove the two screws (A) fixing the metal support (B).
3. To remove the metal support, pull the right side of it toward you then lift it up.

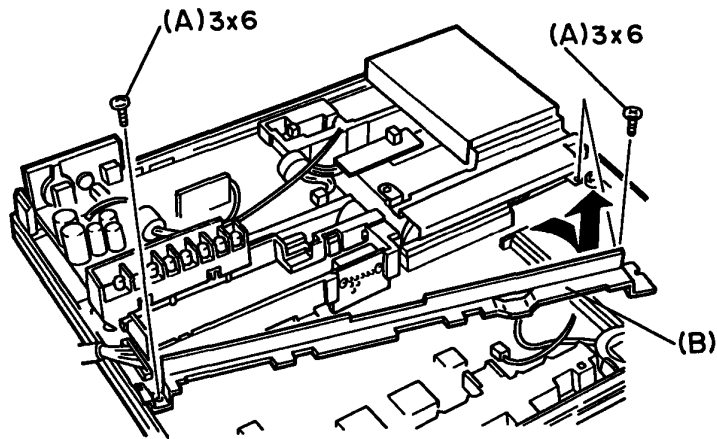


Figure 4-14 Removing the metal support

4. Remove the two latches (C) of the LED holder (D) to remove it from the built-in modem case.

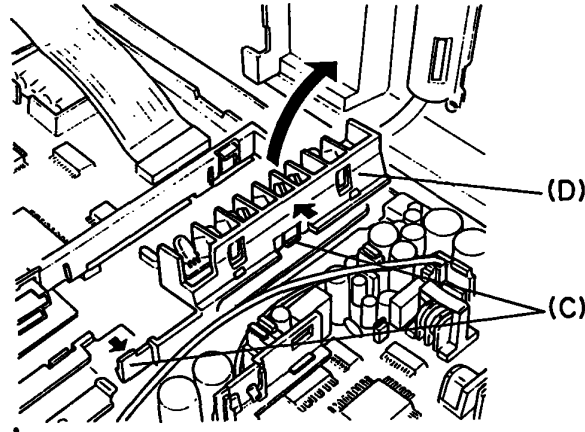


Figure 4-15 Removing the LED holder

5. Disconnect the modem connector (E) to remove the built-in modem case (F). Disconnect the LED cable (G) from the PJ8 (H) located on the system board, then remove the LED holder.

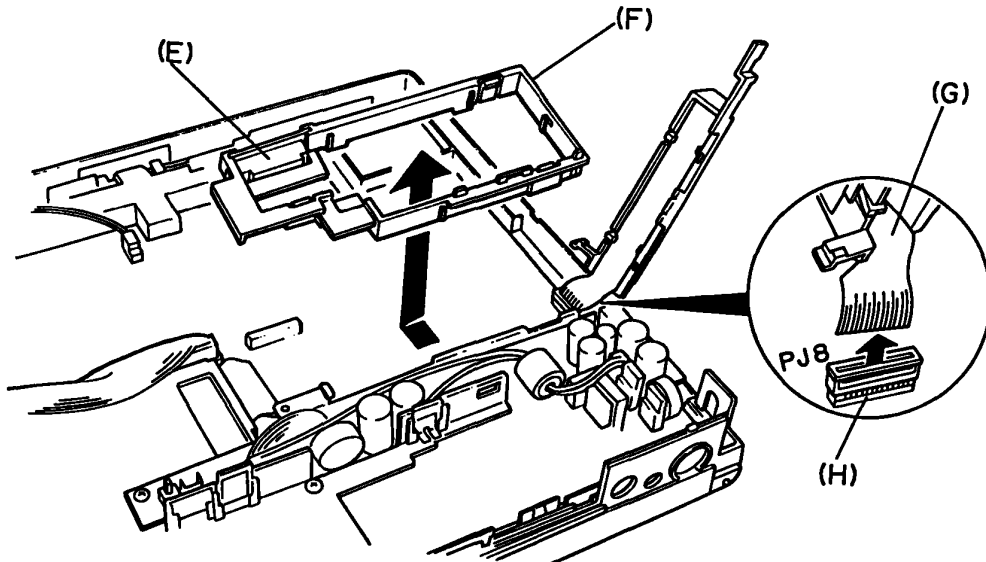


Figure 4-16 Removing the built-in modem case and modem connector

6. Remove the LED board (I) from the LED holder (J).

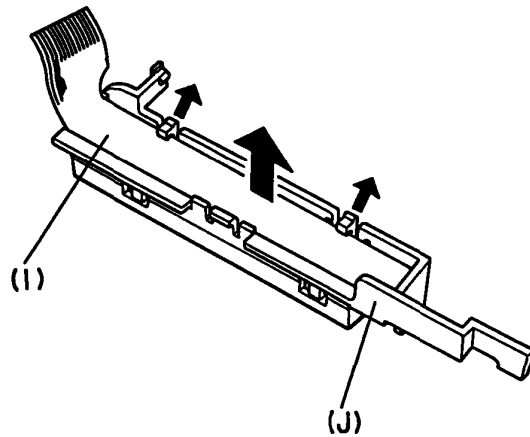


Figure 4-17 Removing the LED board

4.7.2 REPLACING

1. To install the LED board, follow the procedures of 6 in 4.7.1 in reverse.
2. To install the built-in modem case, put the convexity (A) of the built-in modem case and concavity (B) of the shield together. Put the latch (C) of the built-in modem case on the shield. Connect the modem connector (D) to the PJ19 located on the system board.

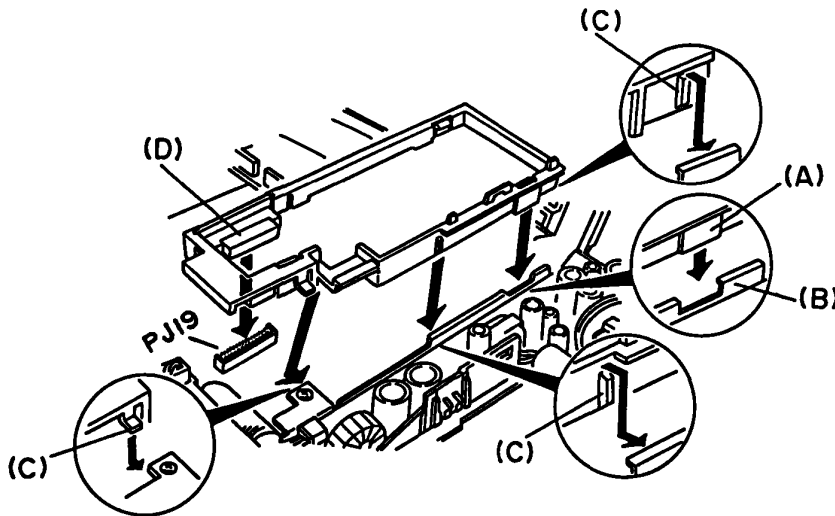


Figure 4-18 Replacing the built-in modem case

3. To install the metal support, put the concavity (E) of the metal support and the convexity (F) of the system unit together. Put the latch (G) of the built-in modem case on the concavity (H) of the metal support. Put the two screws removed at 2 in 4.7.1.

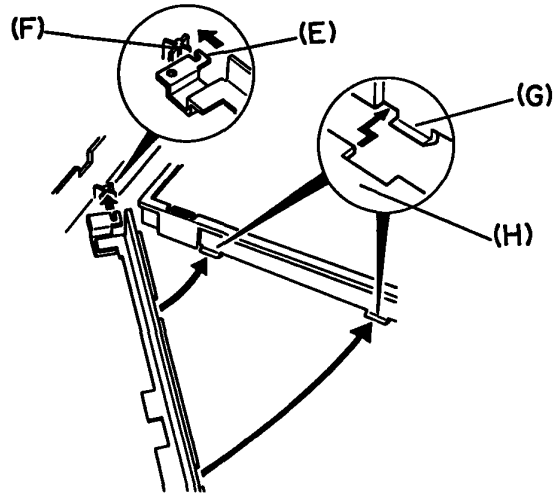


Figure 4-19 Replacing the metal support

4.8 REMOVING/REPLACING THE SUB BATTERY AND BATTERY COVER ASSEMBLY

1. Remove the LED board and the built in modem holder as directed in section 4.7.
2. To remove the sub battery, disconnect the sub battery cable (A) from PJ2 (B) located on the power supply board.

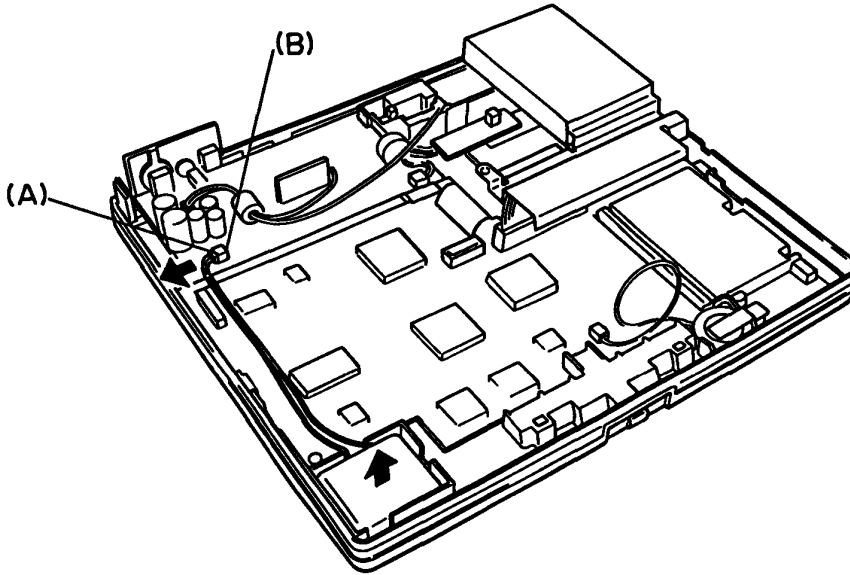


Figure 4-20 Removing the sub battery

4. Remove the two screws (E). To remove the battery cover assembly (F), disconnect the battery cable (G) from PJ4 (H) located on the power supply board (I).

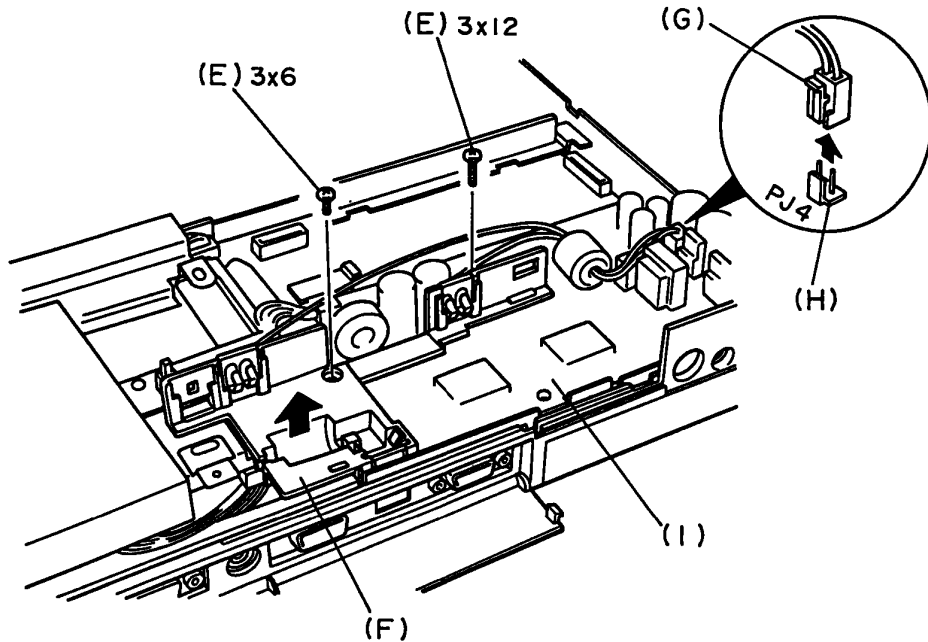


Figure 4-21 Removing the battery cover assembly

5. To install the sub battery and the battery cover assembly, follow the above procedures in reverse.

4.9 REMOVING/REPLACING THE POWER SUPPLY BOARD

1. Remove the sub battery and the battery cover assembly as directed in section 4.8.
2. Remove the two screws (A), then disconnect the internal display disable switch cable (B) from PJ3 (C) located on the power supply board (D).

Remove the power supply board from PJ5 (E) located on the system board.

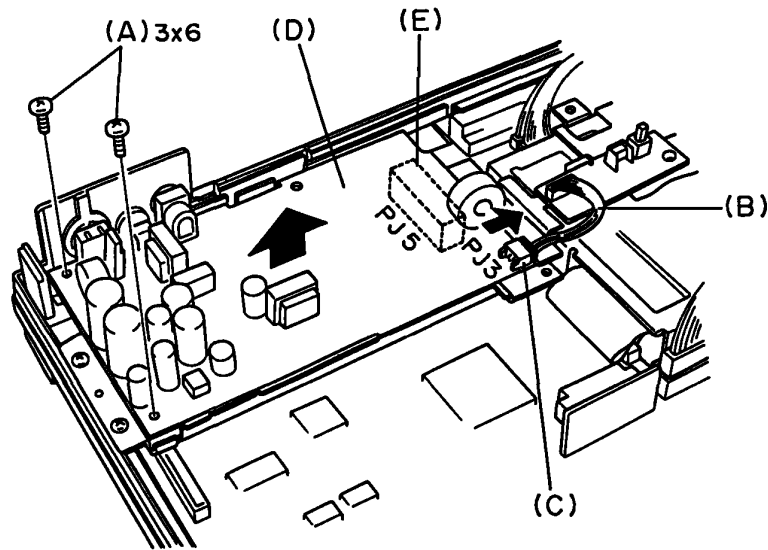


Figure 4-22 Removing the power supply board

3. Remove the four screws (F) to remove the shield (G).

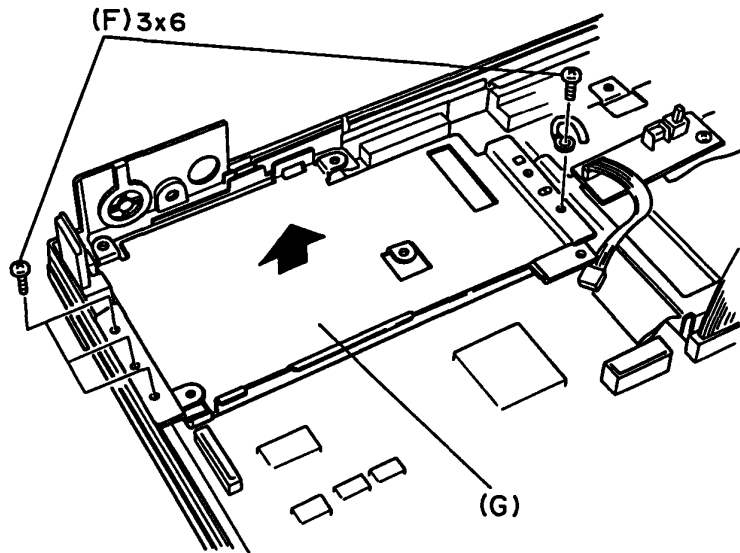


Figure 4-23 Removing the shield

4. To install the power supply board, follow the above procedures in reverse.

4.10 REMOVING/REPLACING THE HDD, FDD, AND INTERNAL DISPLAY DISABLE SWITCH BOARD

1. Remove the power supply board as directed in section 4.9.
2. Remove the HDD cable, the FDD cable, and the internal display disable switch cable (A) from PJ12, PJ7, and PJ17 (B) located on the system unit by removing the two screws (C).

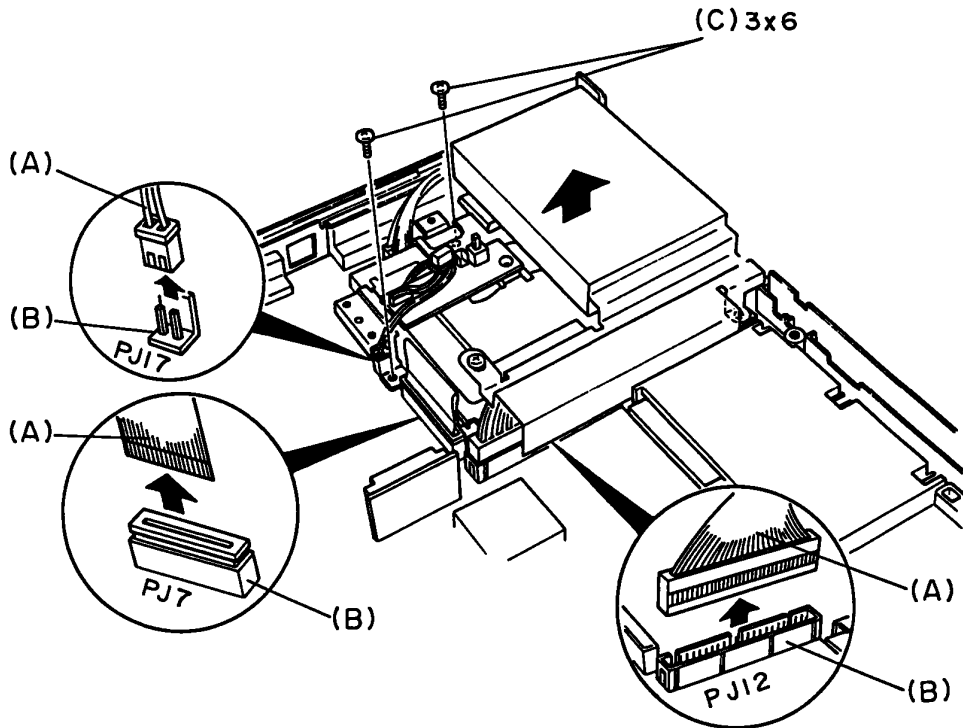


Figure 4-24 Removing the HDD cable, FDD cable and internal display disable switch cable

3. Remove the four screws (D), then remove the FDD support (E) from the FDD (F).

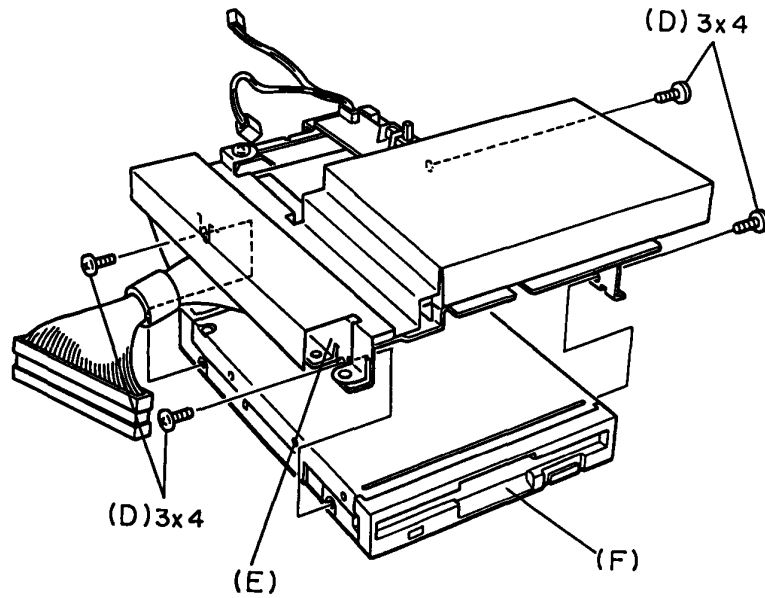


Figure 4-25 Removing the FDD support

4. Remove the five screws (G), then remove the HDD (H) from the FDD support. Remove the screw (I), then remove the internal display disable switch board from the FDD support.

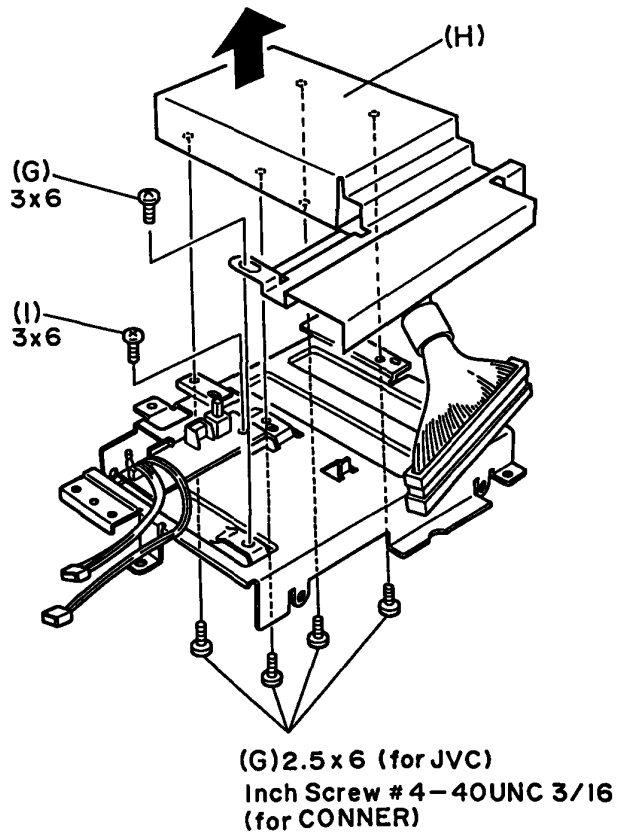
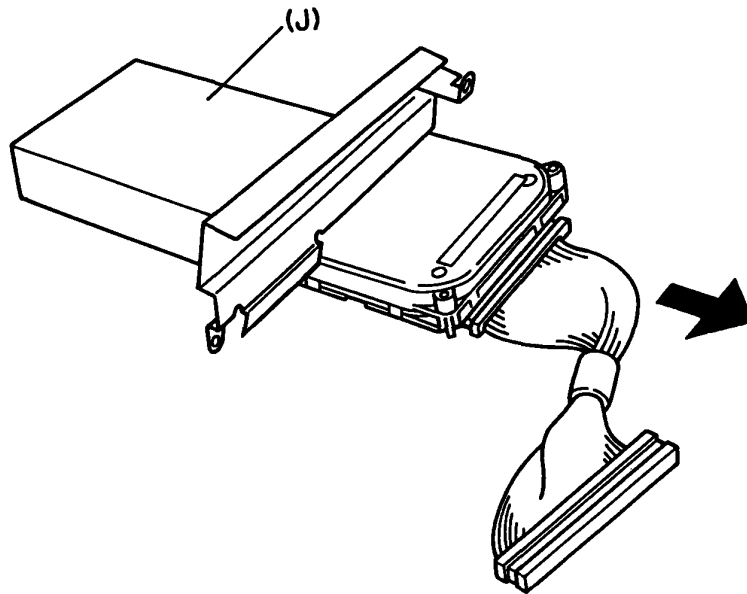
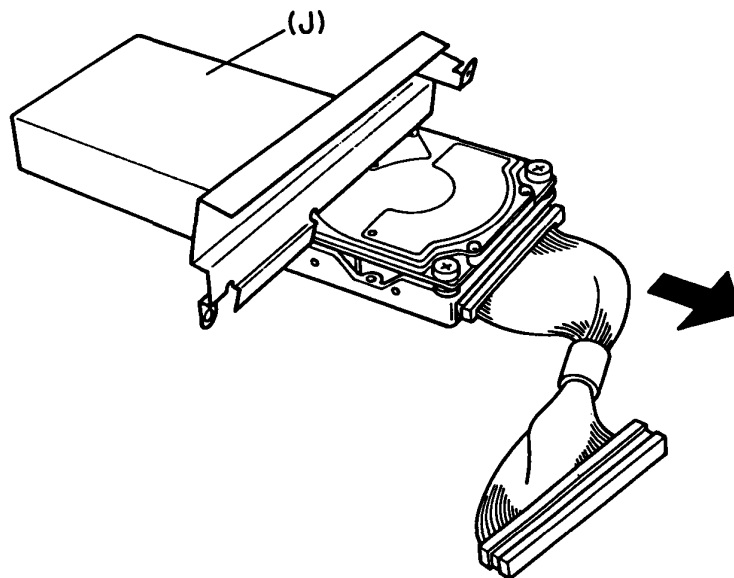


Figure 4-26 Removing the HDD and internal display disable switch board

5. Remove the HDD from the shield case (J).



For Conner



For JVC

Figure 4-27 Removing the HDD

6. To install the HDD, FDD, and internal display disable switch board, follow the above procedures in reverse.

4.11 REMOVING/REPLACING THE SYSTEM BOARD

1. Remove the HDD, FDD, and internal display disable switch board as directed in section 4.10.
2. Remove the five screws (A), then remove the system board (B) from the bottom cover (C).

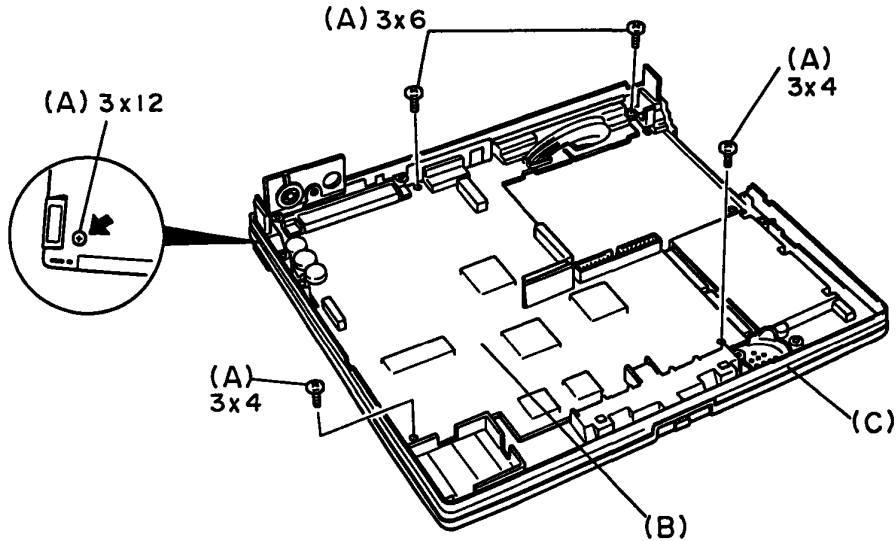


Figure 4-28 Removing the system board

3. To install the system board, follow the above procedures in reverse.

4.12 REMOVING/REPLACING THE LEGS

1. Remove the system board as directed in section 4.11.
2. Remove the two screws (A). Break off the legs at the dotted line shown in figure 4-29, and take them off from the bottom cover.
3. To install new legs to the bottom cover, put the two screws removed in 2.

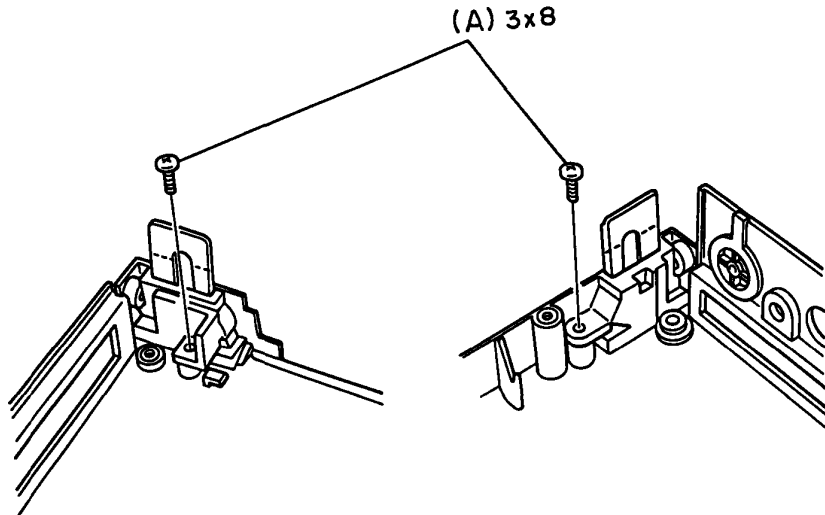


Figure 4-29 Removing the legs

4.13 REMOVING/REPLACING THE EXPANSION MEMORY CARD

NOTE: When the optional expansion memory cards are connected to the system unit, remove the expansion memory card as follows:

1. Turn the system unit upside down, and remove the two screws (A) and remove the expansion memory cover (B).

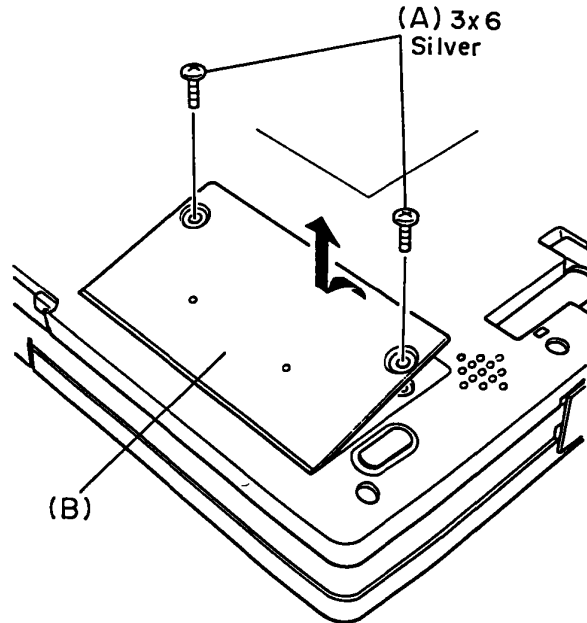


Figure 4-30 Removing the expansion memory cover

2. Remove the expansion memory card (C) from the system unit.

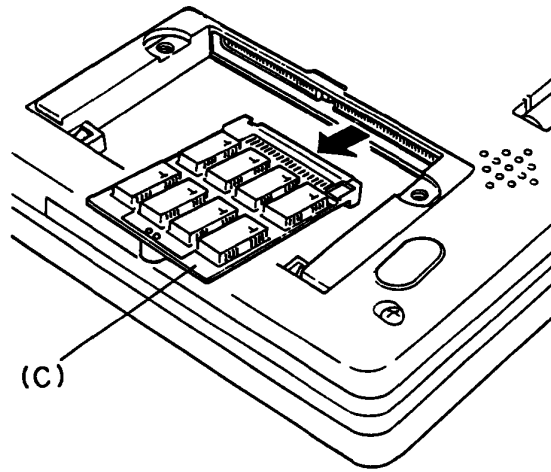


Figure 4-31 Removing the expansion memory card

3. To install the expansion memory card, follow the above procedures in reverse.

(This page is intentionally blank.)

GENERAL

The appendices include the following parts:

APPENDIX A BOARD LAYOUT

This parts shows location of the ICs and connectors on the system board and CPU board.

APPENDIX B PIN ASSIGNMENT

This part describes pin assignments of the connectors on the system board.

APPENDIX C DISPLAY CODE

This part shows the display code used in the T`200XE.

APPENDIX D KEYBOARD SCAN/CHARACTER CODE

This part shows the scan/character code of the keyboard used in the T1200XE.

APPENDIX E KEY LAYOUT

This part describes key layouts of the keyboards that are available for the T1200XE.

APPENDIX A BOARD LAYOUT

A.1 SYSTEM BOARD (ICs)

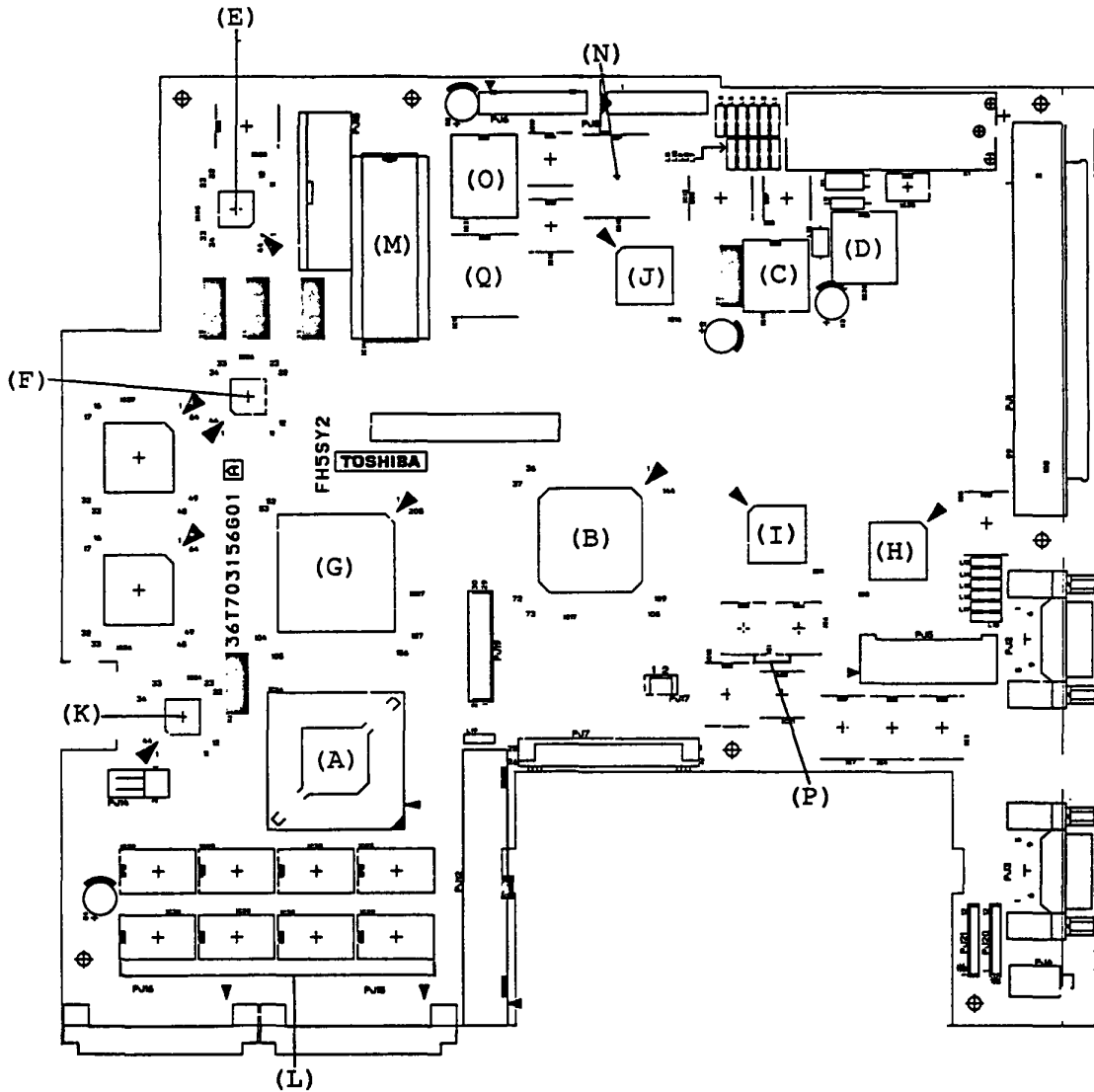


Figure A-1 System board (ICs)

- (A) CPU: Central processing unit (80C286-12)
- (B) SI: Super integration (T9778)
- (C) VFO: Variable frequency oscillator (TC8568AM)
- (D) RTC: Real time clock (HD146818A)
- (E) KBC: Keyboard scan controller (80C49)
- (F) KBC: Keyboard controller (80C42)
- (G) SYSC-GA: System controller gate array
- (H) IOCNT-GA: I/O controller gate array
- (I) IODEC-GA: I/O decoder gate array
- (J) DSPC-GA: Display controller gate array
- (K) BUPC-GA: Backup controller gate array
- (L) System RAMs
- (M) BIOS ROM
- (N) Video RAM
- (O) Backup RAM
- (P) RS-232-C DRV
- (Q) CG ROM

A.2 SYSTEM BOARD (CONNECTOR'S)

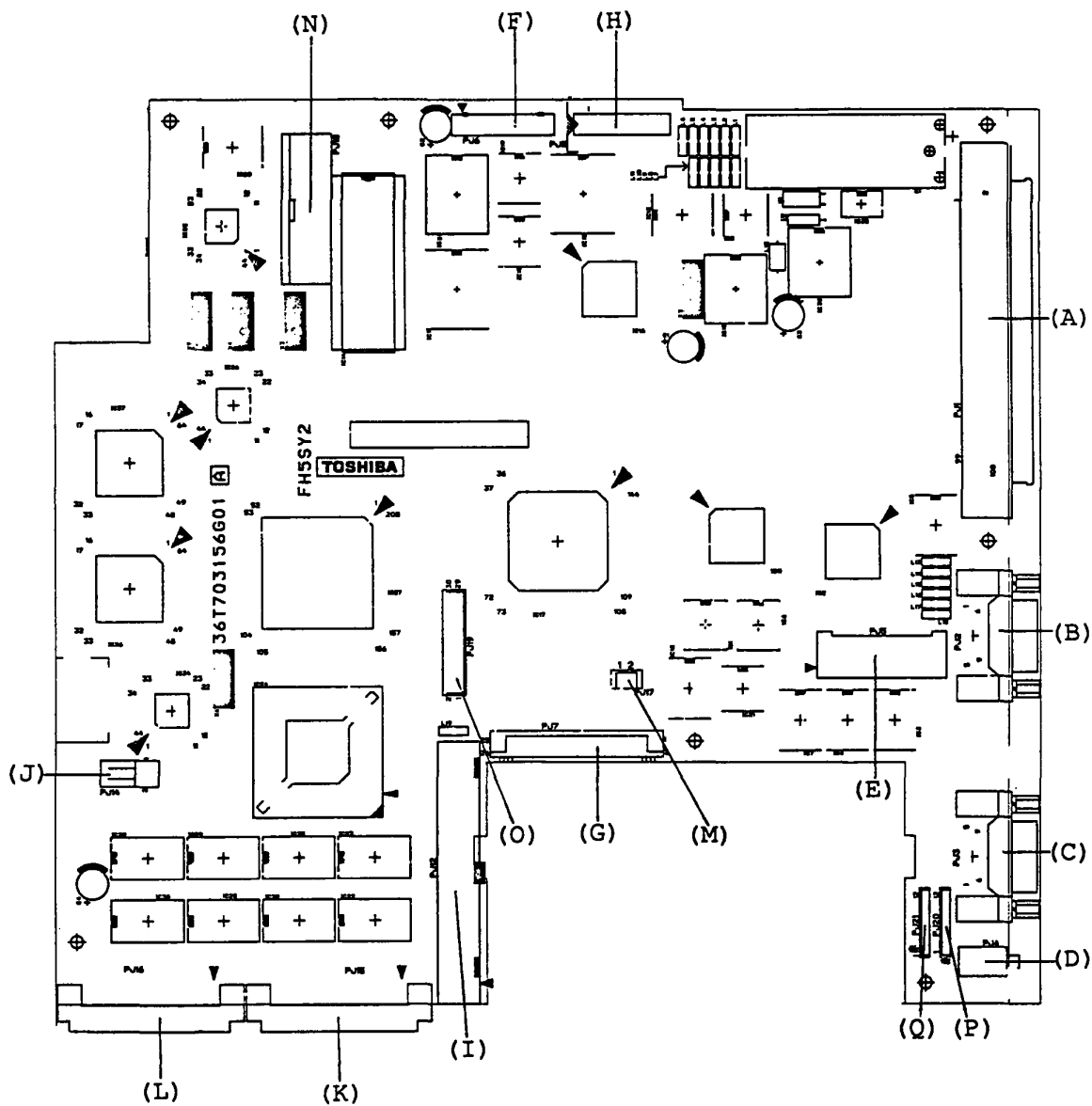


Figure A-2 System board (connector's)

- (A) PJ1: Expansion slot I/F connector
- (B) PJ2: RGB I/F connector
- (C) PJ3: Asynchronous I/F connector
- (D) PJ4: Ten keypad I/F connector
- (E) PJ5: PS I/F connector
- (F) PJ6: Flat display I/F connector
- (G) PJ7: FDD I/F connector
- (H) PJ8: LED I/F connector
- (I) PJ12: HDD I/F connector
- (J) PJ14: Speaker I/F connector
- (K) PJ15: Exp-memory 1 I/F connector
- (L) PJ16: Exp-memory 2 I/F connector
- (M) PJ17: Panel off switch I/F connector
- (N) PJ18: Keyboard I/F connector
- (O) PJ19: Built-in modem I/F connector
- (P) PJ20: PRT/FDD 1 I/F connector
- (Q) PJ21: PRT/FDD 2 I/F connector

APPENDIX B PIN ASSIGNMENT

B.1 PJ1 EXPANSION SLOT I/F CONNECTOR

Table B-1 Expansion slot I/F connector pin assignment

Pin	Signal name	I/O	Pin	Signal name	I/O
01	GND		02	RVCC	O
03	RGND	I	04	CPCNF;100	I
05	MDMSL;001	I/O	06	COMCLK;101	O
07	MIRQ;001	I	08	SPKTON;001	I
09	GND		10	SA00;101	I/O
11	SA01;101	I/O	12	SA02;101	I/O
13	SA03;101	I/O	14	SA04;101	I/O
15	SA05;101	I/O	16	SA06;101	I/O
17	SA07;101	I/O	18	GND	
19	SA08;101	I/O	20	SA09;101	I/O
21	SA10;101	I/O	22	SA11;101	I/O
23	SA12;101	I/O	24	SA13;101	I/O
25	SA14;101	I/O	26	SA15;101	I/O
27	GND		28	SA16;101	I/O
29	SA17;101	I/O	30	SA18;101	I/O
31	SA19;101	I/O	32	SD00;101	I/O
33	SD01;101	I/O	34	SD02;101	I/O
35	SD03;101	I/O	36	GND	
37	SD04;101	I/O	38	SD05;101	I/O
39	SD06;101	I/O	40	SD07;101	I/O
41	SMEW;001	O	42	SMER;001	O
43	GND		44	IOWR;001	I/O
45	IORD;001	I/O	46	TC;101	O
47	BALE;101	O	48	RESET;101	O
49	DACK1;001	O	50	IRQ9;101	I
51	GND		52	IOCLK;103	O
53	SVCC	O	54	IRQ5;101	I
55	DRQ3;101	I	56	DACK3;001	O
57	AEN;101	O	58	DRQ1;101	I
59	ORCRDY;101	I	60	GND	
61	IRQ10;101	I	62	IRQ14;101	I
63	SD08;101	I/O	64	SD09;101	I/O
65	IRQ11;101	I	66	SD10;101	I/O
67	SD11;101	I/O	68	SD12;101	I/O
69	IRQ12;101	I	70	GND	
71	SD13;101	I/O	72	SD14;101	I/O
73	IRQ6;101	I	74	SD15;101	I/O
75	LA22;101	I/O	76	LA23;101	I/O
77	DRQ2;101	I	78	LA21;101	I/O
79	LA19;101	I/O	80	LA20;101	I/O
81	DACK6;001	O	82	GND	
83	REFMD;001	I/O	84	LA18;101	I/O
85	MASTER;001	I	86	LA17;101	I/O
87	SBHE;001	I/O	88	IOCHCK;001	I
89	MMCS16;001	I/O	90	GND	
91	IOCS16;001	I	92	DACK2;001	O
93	DRQ6;101	I	94	DRQ5;101	I
95	DACK5;001	O	96	MERD;001	I/O
97	IRQ4;101	I	98	MEWR;001	I/O
99	IRQ7;101	I	100	GND	

B.2 PJ2 RGB I/F CONNECTOR

Table B-2 RGB I/F connector B pin assignment

Pin	Signal name	I/O	Pin	Signal name	I/O
01	GND		02	GND	
03	CRV;100	0	04	CGV;100	0
05	CBV;100	0	06	CIV;100	0
07	NC		08	CHSY;100	0
09	CVSY;100	0	10		

B.3 PJ3 ASYNCHRONOUS I/F CONNECTOR

Table B-3 Asynchronous I/F connector pin assignment

Pin	Signal name	I/O	Pin	Signal name	I/O
01	DCD;100	I	02	RD;000	I
03	SD;000	O	04	DTR;100	O
05	GND		06	DSR;100	I
07	RTS;100	O	08	CTS;100	I
09	RI;100	I	10		

B.4 PJ4 TEN KEYPAD I/F CONNECTOR

Table B-4 Ten Keypad I/F connector pin assignment

Pin	Signal name	I/O	Pin	Signal name	I/O
01	GND		02	TENKEY;100	I/O

B.5 PJ5 POWER SUPPLY I/F CONNECTOR

Table B-5 Power supply I/F connector pin assignment

Pin	Signal name	I/O	Pin	Signal name	I/O
01	GND		02	VCC	
03	GND		04	VCC	
05	VCC		06	VCC	
07	GND		08	VCC	
09	GND		10	VCC	
11	GND		12	RAMV	I
13	RAMV	I	14	RAMV	I
15	GND		16	BLV	I
17	GND		18	BLV	I
19	GND		20	P12V	I
21	GND		22	N9V	I
23	GND		24	N9V	I
25	CBLON;100	I	26	LCDV	I
27	GND		28	LCDV	I
29	CPCNF;100	O	30	INTDSP;000	O
31	GND		32	CHG;100	I
33	ACIN;100	I	34	LB;100	I
35	GND		36	BEEP;000	I
37	PCLR;001	I	38	PSRD;100	O
39	GND		40	PSSD;100	I

B.6 PJ6 FLAT DISPLAY I/F CONNECTOR

Table B-6 Flat display I/F connector pin assignment

Pin	Signal name	I/O	Pin	Signal name	I/O
01	GND		02	LPBHS	0
03	FPEVS	0	04	GND	
05	SCK	0	06	GND	
07	U03BE03	0	08	U02BE02	0
09	U01BE01	0	10	U00BE00	0
11	GND		12	L03BE13	0
13	L02BE12	0	14	L01BE11	0
15	L00BE10	0	16	GND	
17	M22V	0	18	L5V	0
19	BLV	0	20	CBLON;100	0
21	GND		22	GND	

B.7 PJ7 FDD I/F CONNECTOR

Table B-7 FDD I/F connector pin assignment

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

B.8 PJ8 LED I/F CONNECTOR

Table B-8 LED I/F connector pin assignment

Pin	Signal name	I/O	Pin	Signal name	I/O
01	ACIN;100	O	02	CHG;100	O
03	LB;100	O	04	CRTLED;000	O
05	ALED;000	O	06	CLED;000	O
07	NUMLED;000	O	08	CAPLED;000	O
09	OVRLED;000	O	10	LRED;100	O
11	LGREN;100	O	12	GND	
13	GND		14	VCC	

B.9 PJ12 HDD I/F CONNECTOR

Table B-9 HDD I/F connector pin assignment

Pin	Signal name	I/O	Pin	Signal name	I/O
01	RESET;000	O	02	GND	
03	SD07;101	I/O	04	SD08;101	I/O
05	SD06;101	I/O	06	SD09;101	I/O
07	SD05;101	I/O	08	SD10;101	I/O
09	SD04;101	I/O	10	SD11;101	I/O
11	SD03;101	I/O	12	SD12;101	I/O
13	SD02;101	I/O	14	SD13;101	I/O
15	SD01;101	I/O	16	SD14;101	I/O
17	SD00;101	I/O	18	SD15;101	I/O
19	GND		20	VCC	
21	NC		22	GND	
23	IOWR;000	O	24	GND	
25	IORD;000	O	26	GND	
27	IOCRDY;101	I	28	NC	
29	NC		30	GND	
31	IRQ14;100	I	32	IOCS16;000	I
33	SA01;100	O	34	NC	
35	SA00;100	O	36	SA02;100	O
37	HDC0CS;000	O	38	HDC1CS;000	O
39	DRVSL;000	I	40	GND	
41	VCC		42	VCC	
43	GND		44		

B.10 PJ14 SPEAKER I/F CONNECTOR

Table B-10 Speaker I/F connector B pin assignment

Pin	Signal name	I/O	Pin	Signal name	I/O
01	SPOUT0;100	O	02	SPOUT1;100	O

B.11 PJ15 EXP-MEMORY 1 I/F CONNECTOR

Table B-11 Exp-memory I/F connector pin assignment

Pin	Signal name	I/O	Pin	Signal name	I/O
01	D15;101	I/O	02	D14;101	I/O
03	MEWE;000	O	04	RAS6;000	O
05	GND		06	MA00;100	O
07	GND		08	MA01;100	O
09	D13;101	I/O	10	D12;101	I/O
11	D11;101	I/O	12	D10;101	I/O
13	RAS7;000	O	14	GND	
15	GND		16	MA02;100	O
17	MA03;100	O	18	MA04;100	O
19	D09;101	I/O	20	D08;101	I/O
21	D07;101	I/O	22	D06;101	I/O
23	GND		24	RAS8;000	O
25	GND		26	MA05;100	O
27	GND		28	MA06;100	O
29	MA07;100	O	30	D05;101	I/O
31	D04;101	I/O	32	D03;101	I/O
33	D02;101	I/O	34	RAS9;000	O
35	GND		36	GND	
37	MA08;100	O	38	MA09;100	O
39	GND		40	CASH1;000	O
41	GND		42	CASL1;000	O
43	GND		44	D01;101	I/O
45	GND		46	D00;101	I/O
47	RAMV	I	48	RAMV	I
49	RAMV	I	50	RAMV	I

B.12 PJ16 EXP-MEMORY 2 I/F CONNECTOR

Table B-12 Exp-memory I/F connector pin assignment

Pin	Signal name	I/O	Pin	Signal name	I/O
01	D15;101	I/O	02	D14;101	I/O
03	MEWE;000	O	04	RAS2;000	O
05	GND		06	MA00;100	O
07	GND		08	MA01;100	O
09	D13;101	I/O	10	D12;101	I/O
11	D11;101	I/O	12	D10;101	I/O
13	RAS3;000	O	14	GND	
15	GND		16	MA02;100	O
17	MA03;100	O	18	MA04;100	O
19	D09;101	I/O	20	D08;101	I/O
21	D07;101	I/O	22	D06;101	I/O
23	GND		24	RAS4;000	O
25	GND		26	MA05;100	O
27	GND		28	MA06;100	O
29	MA07;100	O	30	D05;101	I/O
31	D04;101	I/O	32	D03;101	I/O
33	D02;101	I/O	34	RAS5;000	O
35	GND		36	GND	
37	MA08;100	O	38	MA09;100	O
39	GND		40	CASH0;000	O
41	GND		42	CASL0;000	O
43	GND		44	D01;101	I/O
45	GND		46	D00;101	I/O
47	RAMV	I	48	RAMV	I
49	RAMV	I	50	RAMV	I

B.13 PJ17 PANEL OFF SWITCH I/F CONNECTOR

Table B-13 Panel off switch I/F connector pin assignment

Pin	Signal name	I/O	Pin	Signal name	I/O
01	GND		02	PNLOFF;001	O

B.14 PJ18 KEYBOARD I/F CONNECTOR

Table B-14 Keyboard I/F connector pin assignment

Pin	Signal name	I/O	Pin	Signal name	I/O
01	KBOT00;001	O	02	KBOT01;001	O
03	KBOT02;001	O	04	GND	
05	KBOT03;001	O	06	KBOT04;001	O
07	KBOT05;001	O	08	KBOT06;001	O
09	GND		10	KBOT07;001	O
11	KBOT08;001	O	12	KBOT09;001	O
13	KBOT10;001	O	14	KBRT0;001	I
15	KBRT1;001	I	16	KBRT2;001	I
17	KBRT3;001	I	18	GND	
19	KBRT4;001	I	20	KBRT5;001	I
21	KBRT6;001	I	22	KBRT7;001	I

B.15 PJ19 B-MODEM I/F CONNECTOR

Table B-15 B-modem I/F connector pin assignment

Pin	Signal name	I/O	Pin	Signal name	I/O
01	N9V	O	02	BMDMSL;000	O
03	C14R7M;101	O	04	GND	
05	SA00;100	O	06	SA01;100	O
07	SA02;100	O	08	GND	
09	SD07;100	I/O	10	SD06;100	I/O
11	GND		12	GND	
13	SD05;100	I/O	14	SD04;100	I/O
15	SD03;100	I/O	16	GND	
17	SD02;100	I/O	18	SD01;100	I/O
19	GND		20	GND	
21	SD00;100	I/O	22	IOWR;000	O
23	IORD;000	O	24	VCC	
25	RESET;100	O	26	BMPOF;100	O
27	VCC		28	VCC	
29	BMIRQ;000	I	30	BSPTON;000	I

B.16 PJ20 PRT/FDD 1 I/F CONNECTOR (INT/EXT)

Table B-16 PRT/FDD 1 I/F connector assignment

Pin	Signal name	I/O	Pin	Signal name	I/O
01	GND		02	STROB;000	O
01	GND		02	ERDY;001	I
03	PDB00;100	I/O	04	PDB01;100	I/O
03	EINDX;001	I	04	ETRD;001	I
05	PDB02;100	I/O	06	PDB03;100	I/O
05	EWPR;001	I	06	ERDAT;001	I
07	PDB04;100	I/O	08	PDB05;100	I/O
07	EDKCH;001	I	08		
09	PDB06;100	I/O	10	PDB07;100	I/O
09			10		
11	ACK;000	I	12	BUSY;100	I
11	EDSL;000	O	12	EMDN;000	O

B.17 PJ21 PRT/FDD 2 I/F CONNECTOR (INT/EXT)

Table B-17 PRT/FDD2 I/F connector pin assignment

Pin	Signal name	I/O	Pin	Signal name	I/O
01	GND		02	PE;100	I
01	GND		02	EWDAT;000	O
03	SELCT;100	I	04	AUTFD;000	O
03	EWEN;000	O	04	ELOWD;000	O
05	ERROR;000	I	06	PINT;000	O
05	ESSEL;000	O	06	EDIRC;000	O
07	SLIN;000	O	08	GND	
07	ESTEP;000	O	08	GND	
09	GND		10	GND	
09	GND		10	GND	
11	GND		12	GND	
11	GND		12	GND	

APPENDIX C DISPLAY CODE

Table C-1 Display code

HEXA DECIMAL VALUE	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	BLANK (NULL)	▶	BLANK (SPACE)	0	@	P	'	p	Ç	É	á	⋮	⌌	⌌	α	≡
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	ö	⋮	⌌	⌌	τ	≈
8	©	↑	(	8	H	X	h	x	ê	ÿ	ï	⋮	⌌	⌌	ϕ	°
9	○	↓	)	9	I	Y	i	y	ë	Ö	∟	⋮	⌌	⌌	θ	•
A	○	→	*	:	J	Z	j	z	è	Ü	∟	⋮	⌌	⌌	Ω	•
B	♂	←	+	;	K	[	k	{	ï	ç	½	⋮	⌌	⌌	δ	√
C	♀	⌌	,	<	L	\	l	!	↑	£	¼	⋮	⌌	⌌	∞	π
D	♪	↔	-	=	M	]	m	}	ì	¥	ì	⋮	⌌	⌌	φ	2
E	♪	▲	•	>	N	^	n	~	Ä	Pt	∅	⋮	⌌	⌌	€	⌌
F	☼	▼	/	?	O	—	o	Δ	Å	f	»	⋮	⌌	⌌	∩	BLANK FF

This table shows the American standard display code. This code will be changed depending on the setup option.

APPENDIX D KEYBOARD SCAN/CHARACTER CODE

Table D-1 Keyboard scan/character code (1/4)

Key No.	Key top	Base	Upper	Caps lock		Ctrl	Alt
				Base	Upper		
1	~ ,	2960	297E	2960	297E	----	*2900
2	! 1	0231	0221	0231	0221	----	7800
3	@ 2	0332	0340	0332	0340	0300	7900
4	# 3	0433	0423	0433	0423	----	7A00
5	\$ 4	0534	0524	0534	0524	----	7B00
6	% 5	0635	0625	0635	0625	----	7C00
7	^ 6	0736	075E	0736	075E	071E	7D00
8	& 7	0837	0826	0837	0826	----	7E00
9	* 8	0938	092A	0938	092A	----	7F00
10	(9	0A39	0A28	0A39	0A28	----	8000
11	) 0	0B30	0B29	0B30	0B29	----	8100
12	_	0C2D	0C5F	0C2D	0C5F	0C1F	8200
13	+ =	0D3D	0D2B	0D3D	0D2B	----	8300
15	Back space	0E08	0E08	0E08	0E08	0E7F	*0E00
16	Tab	0F09	0F00	0F09	0F00	*9400	*A500
17	Q	1071	1051	1071	1051	1011	1000
18	W	1177	1157	1177	1157	1117	1100
19	E	1265	1245	1265	1245	1205	1200
20	R	1372	1352	1372	1352	1312	1300
21	T	1474	1454	1474	1454	1414	1400
22	Y	1579 "	1559 "	1579 "	1559 "	1519 "	1500 "

Table D-1 Keyboard scan/character code (2/4)

Key No.	Key top	Base	Upper	Caps lock		Ctrl	Alt
				Base	Upper		
23	U	1675	1655	1675	1655	1615	1600
24	I	1769	1749	1769	1749	1709	1700
25	O	186F	184F	186F	184F	180F	1800
26	P	1970	1950	1970	1950	1910	1900
27	{	1A5B	1A7B	1A5B	1A7B	1A1B	*1A00
28	[	1B5D	1B7D	1B5D	1B7D	1B1D	*1B00
29	]	2B5C	2B7C	2B5C	2B7C	2B1C	*2B00
30	\	2B5C	2B7C	2B5C	2B7C	2B1C	*2B00
30	Caps Lock	----	----	----	----	----	----
31	A	1E61	1E41	1E61	1E41	1E01	1E00
32	S	1F73	1F53	1F73	1F53	1F13	1F00
33	D	2064	2044	2064	2044	2004	2000
34	F	2166	2146	2166	2146	2106	2100
35	G	2267	2247	2267	2247	2207	2200
36	H	2368	2348	2368	2348	2308	2300
37	J	246A	244A	246A	244A	240A	2400
38	K	256B	254B	256B	254B	250B	2500
39	L	266C	264C	266C	264C	260C	2600
40	:	273B	273A	273B	273A	----	*2700
41	;	2827	2822	2827	2822	----	*2800
41	"	2827	2822	2827	2822	----	*2800
41	'	2827	2822	2827	2822	----	*2800
43	Enter	1C0D	1C0D	1C0D	1C0D	1C0A	*1C00
44	Shift (L)	----	----	----	----	----	----
46	Z	2C7A	2C5A	2C7A	2C5A	2C1A	2C00
47	X	2D78	2D58	2D78	2D58	2D18	2D00
48	C	2E63	2E43	2E63	2E43	2E03	2E00
49	V	2F76	2F56	2F76	2F56	2F16	2F00

Table D-1 Keyboard scan/character code (3/4)

Key No.	Key top	Base	Upper	Caps lock		Ctrl	Alt
				Base	Upper		
50	B	3062	3042	3062	3042	3002	3000
51	N	316E	314E	316E	314E	310E	3100
52	M	326D	324D	326D	324D	320D	3200
53	<	332C	333C	332C	333C	----	*3300
54	>	342E	343E	342E	343E	----	*3400
55	? /	352F	353F	352F	353F	----	*3500
57	Shift (R)	----	----	----	----	----	----
58	Ctrl (L)	----	----	----	----	----	----
60	Alt (L)	----	----	----	----	----	----
61	Space	3920	3920	3920	3920	3920	3920
62	Alt (R)	----	----	----	----	----	----
+75	Ins	5200 52E0	5200 52E0	5200 52E0	5200 52E0	*92E0	*A200
+76	Del	5300 53E0	5300 53E0	5300 53E0	5300 53E0	*93E0	*A300
+79	<-	4B00 4BE0	4B00 4BE0	4B00 4BE0	4B00 4BE0	7300 73E0	*9B00
+80	Home	4700 47E0	4700 47E0	4700 47E0	4700 47E0	7700 77E0	*9700
+81	End	4F00 4FE0	4F00 4FE0	4F00 4FE0	4F00 4FE0	7500 75E0	*9F00
+83	↑	4800 48E0	4800 48E0	4800 48E0	4800 48E0	*8DE0	*9800
+84	↓	5000 50E0	5000 50E0	5000 50E0	5000 50E0	*91E0	*A000
+85	PgUp	4900 49E0	4900 49E0	4900 49E0	4900 49E0	8400 *84E0	*9900
+86	PgDn	5100 51E0	5100 51E0	5100 51E0	5100 51E0	7600 76E0	*A100
+89	->	4D00 4DE0	4D00 4DE0	4D00 4DE0	4D00 4DE0	7400 74E0	*9D00
110	Esc	011B	011B	011B	011B	011B	*0100
112	F1	3B00	5400	3B00	5400	5E00	6800
113	F2	3C00	5500	3C00	5500	5F00	6900
114	F3	3D00	5600	3D00	5600	6000	6A00

Table D-1 Keyboard scan/character code (4/4)

Key No.	Key top	Base	Upper	Caps lock		Ctrl	Alt
				Base	Upper		
115	F4	3E00	5700	3E00	5700	6100	6B00
116	F5	3F00	5800	3F00	5800	6200	6C00
117	F6	4000	5900	4000	5900	6300	6D00
118	F7	4100	5A00	4100	5A00	6400	6E00
119	F8	4200	5B00	4200	5B00	6500	6F00
120	F9	4300	5C00	4300	5C00	6600	7000
121	F10	4400	5D00	4400	5D00	6700	7100
122	F11	*8500	*8700	*8500	*8700	*8900	*8B00
123	F12	*8600	*8800	*8600	*8800	*8A00	*8C00
124	PrtSc	----	----	----	----	*3700	----
126	Pause	----	----	----	----	----	----
202	Fn	----	----	----	----	----	----

APPENDIX E KEY LAYOUT

E.1 USA KEYBOARD

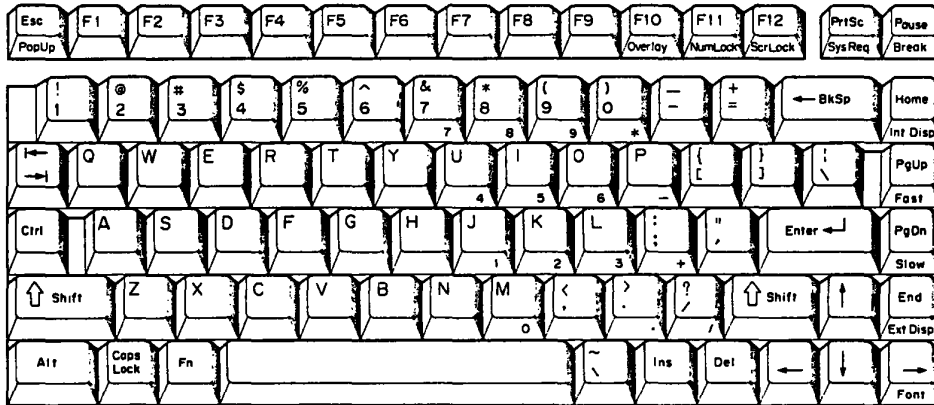


Figure E-1 USA keyboard

E.2 UK KEYBOARD

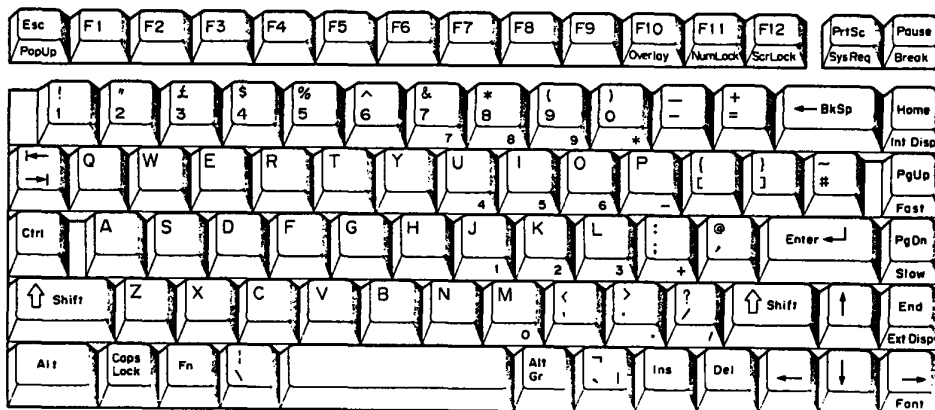


Figure E-2 UK keyboard

E.3 GERMANY KEYBOARD

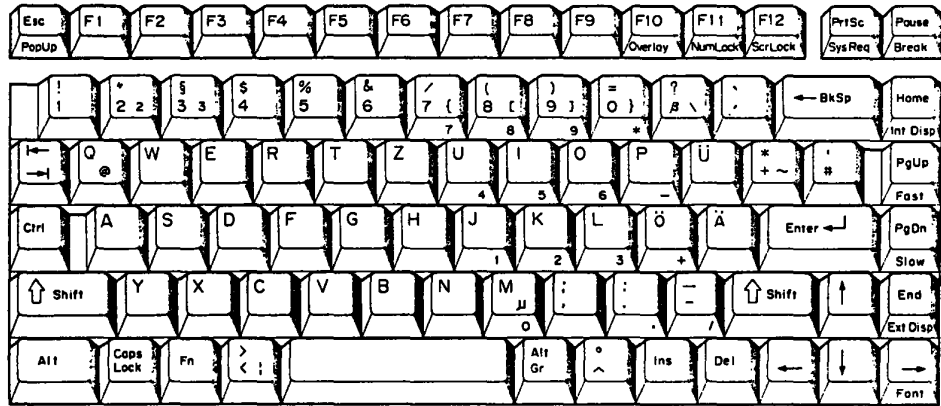


Figure E-3 Germany keyboard

E.4 FRENCH KEYBOARD

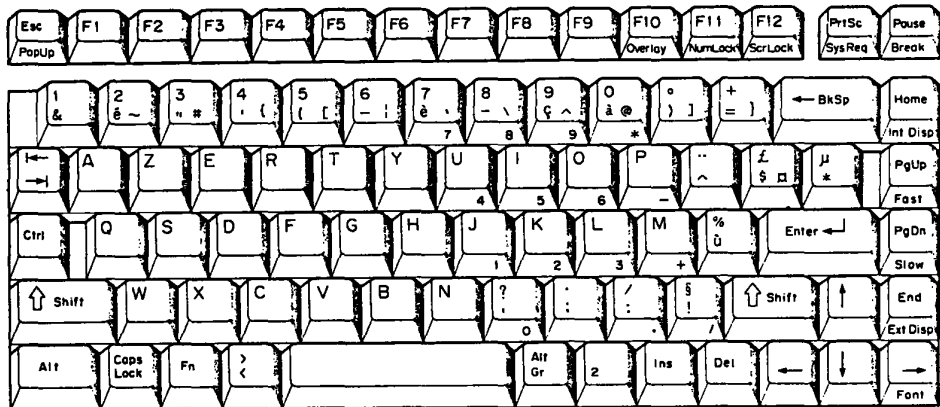


Figure E-4 French keyboard

E.5 SPANISH KEYBOARD

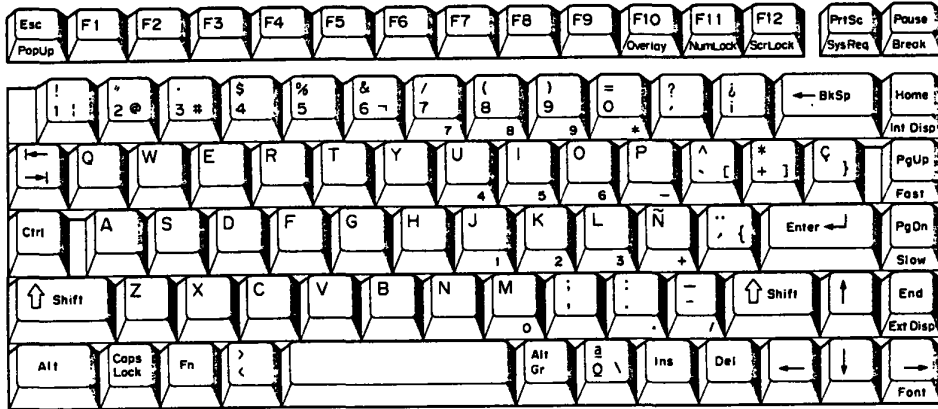


Figure E-5 Spanish keyboard

E.6 ITALIAN KEYBOARD

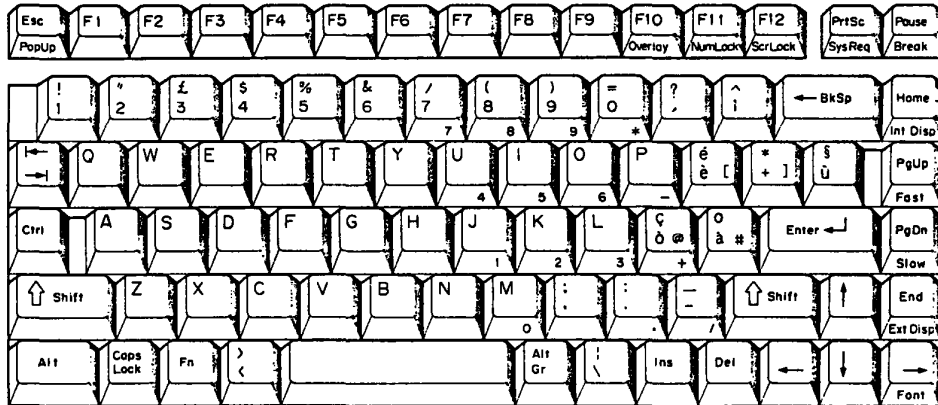


Figure E-6 Italian keyboard

E.7 SCANDINAVIAN KEYBOARD

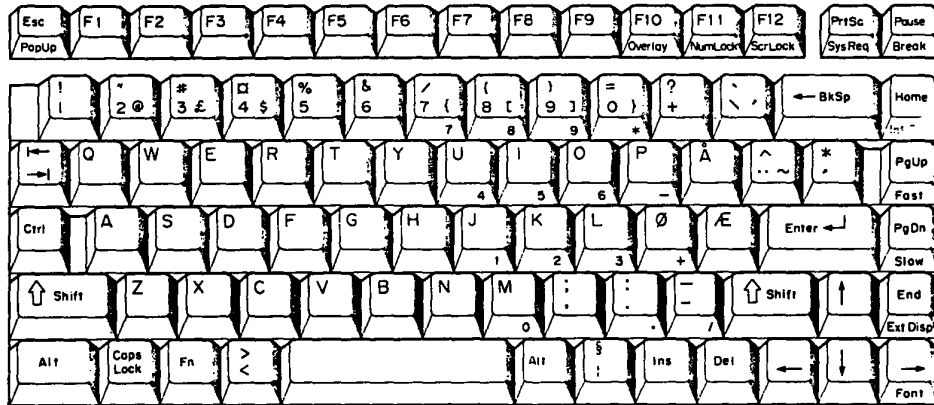


Figure E-7 Scandinavian keyboard

E.8 SWISS KEYBOARD

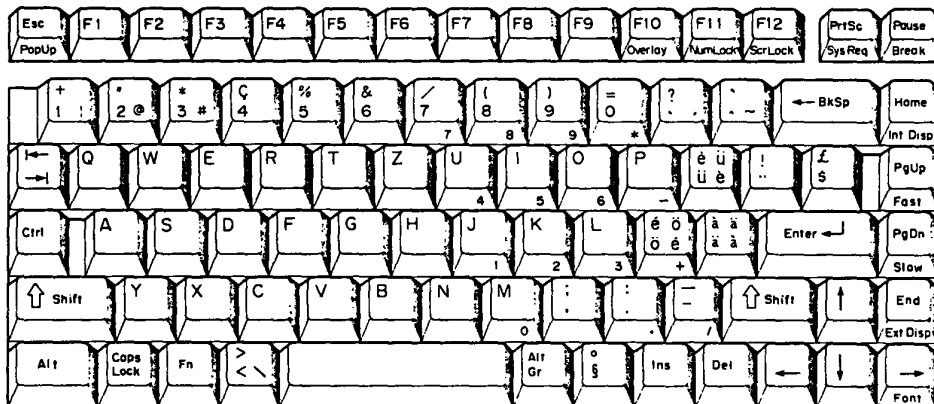


Figure E-8 Swiss keyboard

E.9 SPECIAL CANADIAN KEYBOARD

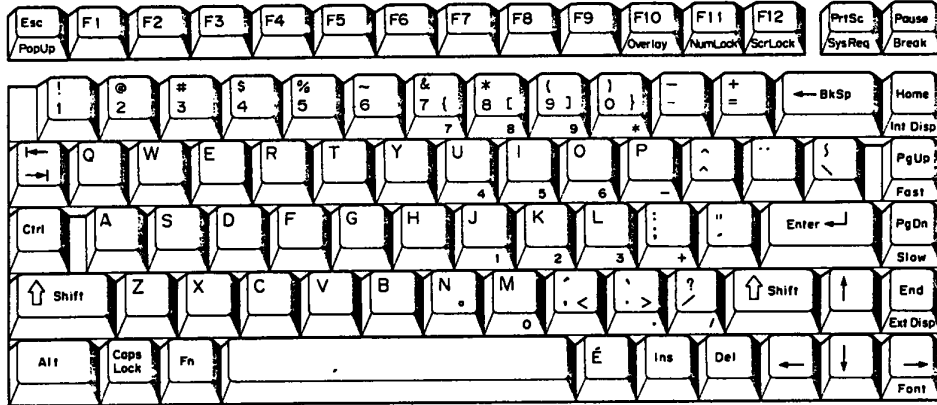


Figure E-9 Special Canadian keyboard

E.10 KEYCAP NUMBER

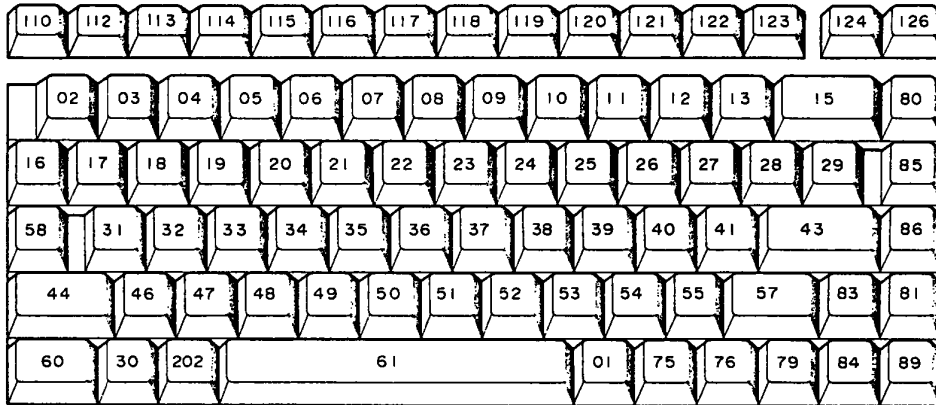


Figure E-10 Keycap number