
1.1 GENERAL

The Toshiba T3200SXC is one of the most advanced portable personal computers available offering high technology, high speed, and IBM PC/AT compatibility.

The main features of the T3200SXC are as follows:

- The central processing unit (CPU) is the Intel 80386SX-20 32-bit microprocessor, operated at 20 MHz.
- The standard memory has 1 Mbyte of random access memory (RAM) with a 16-bit data bus width, expandable up to a maximum of 13 Mbytes.
- The Intel 80387SX-20 math co-processor is connected as an option.
- The display supports a high resolution thin film transistor (TFT) color liquid crystal display (LCD) with 640x480 pixels (dots) with video graphics array (VGA) and 512 color capability.
- The display controller of the T3200SXC is the color panel display subsystem (CPDS) that supports the VGA-compatible display function on the color LCD and an external CRT. The external CRT should be of a VGA-compatible analog input type. The CPDS supports the following features:
 - Maximum of 185193 colors on the TFT color LCD (256 colors can be displayed at one time).
 - Maximum of 262144 colors on the external color CRT display (256 colors can be displayed at one time).
 - EGA modes, CGA modes, and T3100 graphics modes (mode 74h) are supported through the BIOS (not at the hardware level).
- The hard disk drive (HDD) has a capacity of 40 Mbytes with a 25-millisecond (ms) average access time or a capacity of 120 Mbytes with a 19-ms average access time.
- The floppy disk drive (FDD) can support 2DD (720 Kbytes) and 2HD (1.44 Mbytes) floppy disks.
- The keyboard has 91/92-key keyboard with the keys of a subset of the industry standard 101/102-key keyboard.
- The universal auto-sensing power supply is used for world-wide usage.
- The lithium battery backs up the real time clock.
- The T3200SXC can support one 8-bit half size industry standard card or one 16-bit Toshiba card, and one 16-bit full size industry standard card.

- The interface connector has one PRT/EXT.FDD connector (25-pin), two serial connectors (9-pin), one VGA connector (15-pin), and one external keyboard connector (5-pin).
- The built-in modem slot support a T1200 style modem.

The T3200SXC is shown in Figure 1-1 and the configuration of the T3200SXC's system unit is shown in Figure 1-2.



Figure 1-1 T3200SXC personal computer

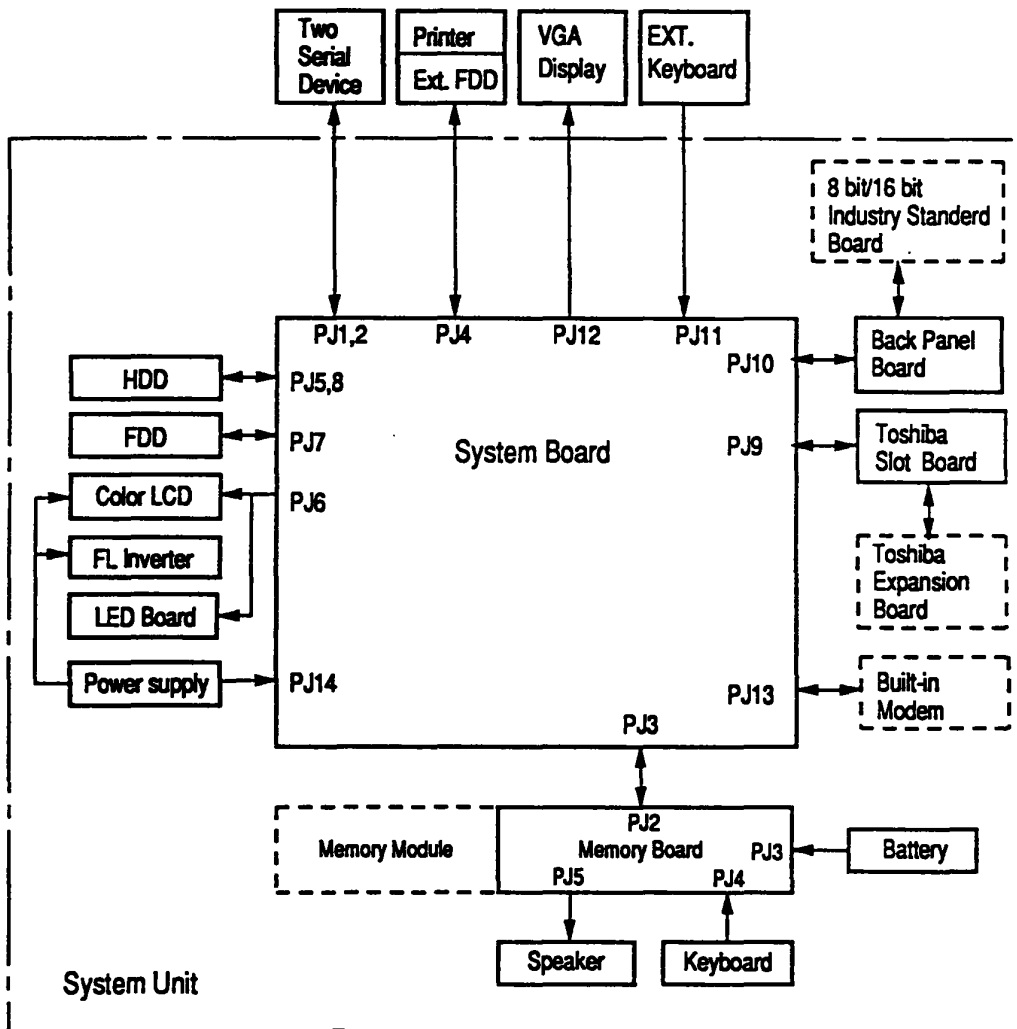


Figure 1-2 System unit configuration

The system board is composed of the following components:

- Central processing unit (CPU): 80386SX-20
- Numeric data processor socket for the 80387SX-20 (Optional)
- Serial input output (SIO): NS16450
- Variable frequency oscillator (VFO): MB4108
- Super integration (SI): T9778A
SI includes:
 - two DMACs (equivalent to TMP82C37A)
 - two PICs (equivalent to TMP82C59A)
 - one PIT (equivalent to TMP82C54)
 - one FDC (equivalent to TC8565)
 - one SIO (equivalent to TC8570)
- Gate arrays
 - Gate array memory controller (GA-MCNT4B)
 - Gate array bus controller (GA-BCNT4B)
 - Gate array FDD/printer controller (GA-FDC)
- Color panel display subsystem (CPDS)
 - WD90C21 display controller (VGA compatible)
 - Gate array color gray-scale controller (GA-CGSC)
 - DAC
 - Video RAM: 256 Kbytes

The system board is shown in Figure 1-4.

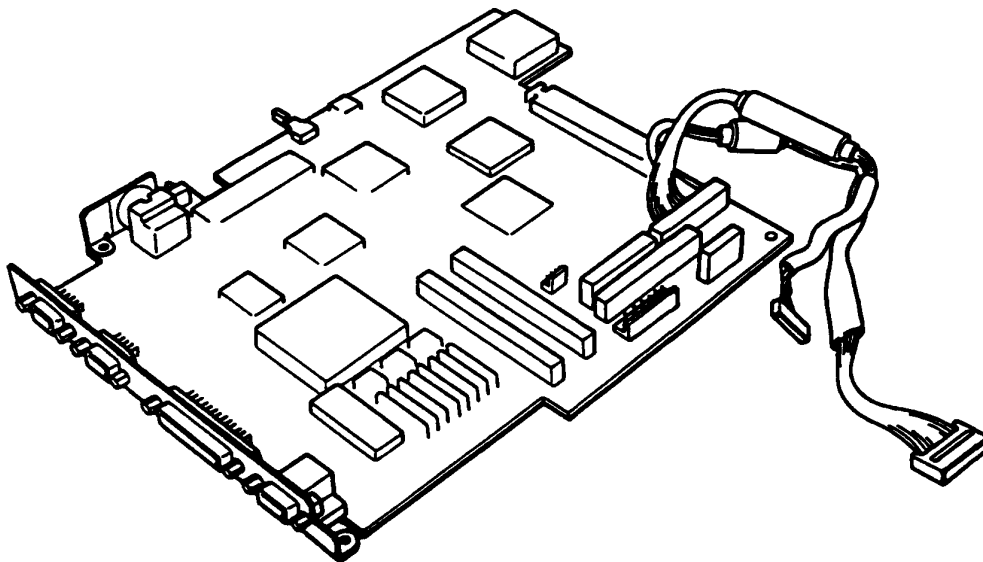


Figure 1-4 System board

The memory board is composed of the following components:

- Real time clock (RTC): MC146818A or equivalent
- Keyboard controller (KBC): 8742 or equivalent
- Keyboard scan controller (SCC): 8749 or equivalent
- Initial program loader (IPL) ROM: 128 Kbytes (96 Kbytes are used)
This ROM contains the initial reliability test (IRT), system basic input output system (system BIOS), and video BIOS.
- System RAM: 1 Mbyte
- Memory module socket
The memory is expandable up to a maximum of 13 Mbytes.

The memory board is shown in Figure 1-5.

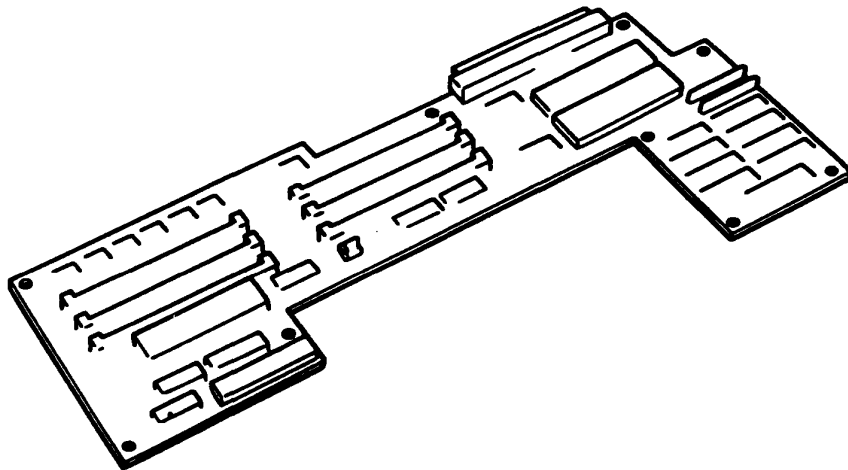


Figure 1-5 Memory board

1.3 3.5-INCH FLOPPY DISK DRIVE

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

The FDD is shown in Figure 1-6 and its specifications are described in Table 1-1.

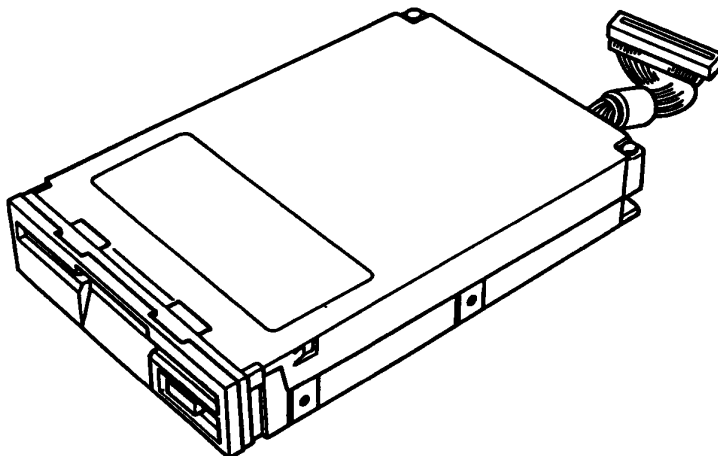


Figure 1-6 3.5-inch FDD

Table 1-1 3.5-inch FDD specifications

Item	2-Mbyte Mode	1-Mbyte Mode
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	94	94
Head settling time	15	15
Recording density (bpi)	135	135
Data transfer rate (Kbps)	500	250
Rotation speed (rpm)	300	300
Recording method	MFM (Modified Frequency Modulation)	

1.4 3.5-INCH HARD DISK DRIVE

The 40-Mbyte and 120-Mbyte hard disk drives (HDD) are random access type storage devices. They are equipped with non-removal 3.5-inch magnetic disks and mini-Winchester type magnetic heads.

The HDD is shown in Figure 1-7 and its specifications are described in Table 1-2.

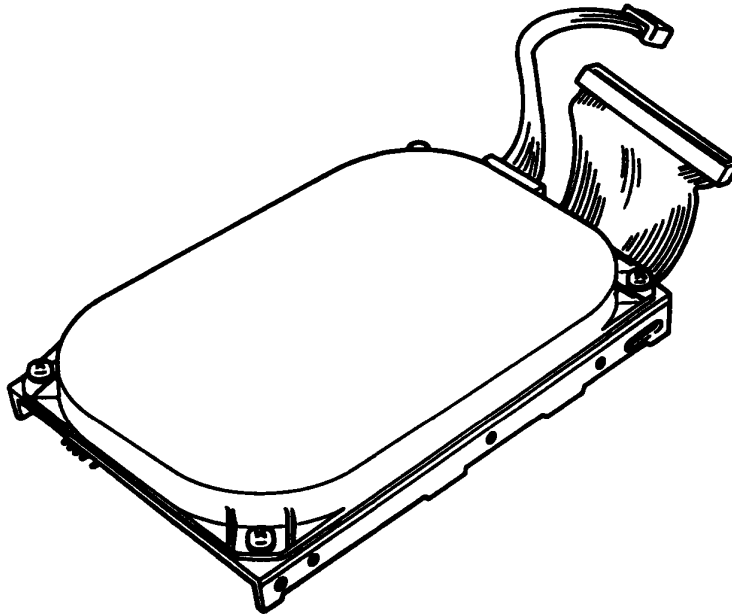


Figure 1-7 3.5-inch HDD

Table 1-2 3.5-inch HDD specifications

ITEM	Specifications	
	40-Mbyte	120-Mbyte
Storage capacity (Mbytes) Formatted	40.6	115.9
Number of heads	5	15
Tracks per surface	980	931
Sector per track	17	17
Bytes per sector	512	512
Access time (ms)		
Track to track	8	5
Average	25	19
Maximum	50	40
Interleave	1:1	1:1
Rotation speed (rpm)	3,557	3,409
Buffer (Kbytes)	8	64
Programmed I/O operation (bits)	16	16
Recording method	2-7 RLL code	

Item	Power (40MB)	
Voltage (VDC)	+12 V	+5 V
Current (A)	230 mA (R/W)	275 mA (R/W)
	140 mA (Seeking)	180 mA (Seeking)
	100 mA (Idle)	160 mA (Idle)

Item	Power (120MB)	
Voltage (VDC)	+12 V	+5 V
Current (A)	200 mA (R/W)	280 mA (R/W)
	260 mA (Seeking)	140 mA (Seeking)
	175 mA (Idle)	140 mA (Idle)

1.5 HDD JUMPER STRAPS

The HDD has three or four jumper straps located on the hard disk controller board as shown in Figure 1-8, and their configuration is listed in Table 1-3.

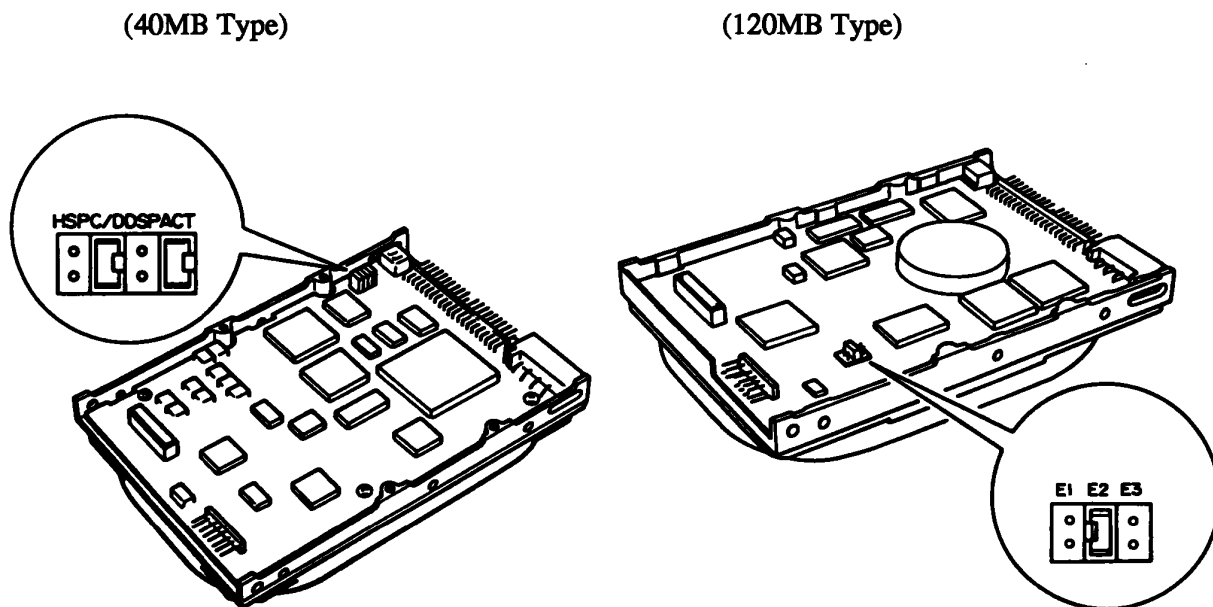


Figure 1-8 HDD jumper straps

Table 1-3 HDD jumper strap configuration

40MB Type		120MB Type	
Signal	Status	Signal	Status
HSP	Open	E1	Open
C/D	Short	E2	Short
DSP	Open	E3	Open
ACT	Short		

1.6 KEYBOARD

The 91/92-key keyboard, with full size keys and standard spacing, provides full compatibility with standard IBM software. The keyboard is connected to the keyboard controller on the system board through a 27-pin flat cable. The keyboard is shown in Figure 1-9.

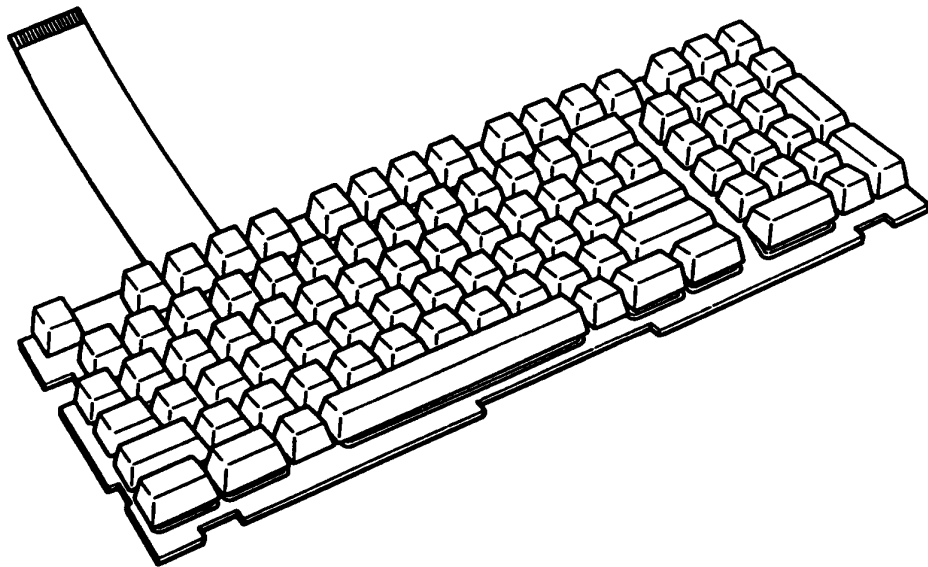


Figure 1-9 Keyboard

1.7 LIQUID CRYSTAL DISPLAY

The liquid crystal display (LCD) is composed of an LCD module, fluorescent lamps (FLs), and an inverter. The thin film transistor (TFT) LCD is illuminated from the back. Thus, you can read its clear display even in poorly lit conditions. It receives vertical and horizontal synchronizing signals, 9-bit data signals, and shift clock for data transmission. All signals are TTL-level compatible. The LCD specifications are described in Table 1-4.

The LCD can display up to 512 colors.

The inverter supplies the high frequency current needed to illuminate the FLs.

The LCD is shown in Figure 1-10 and its specifications are described in Table 1-4.

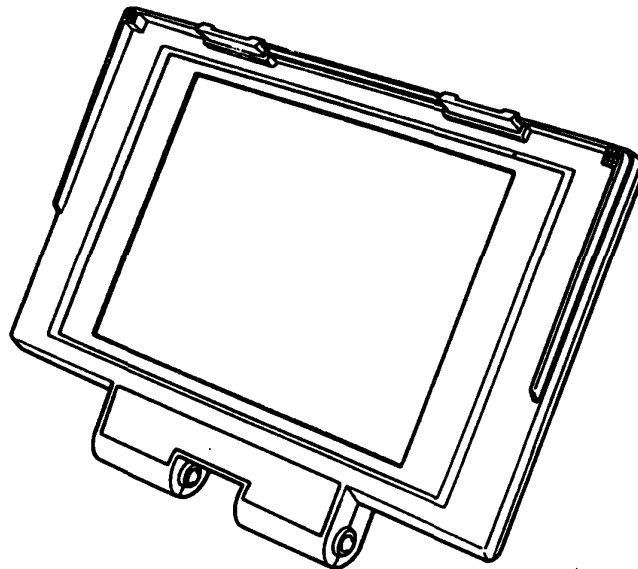


Figure 1-10 LCD

Table 1-4 LCD specifications

Item	Specifications
Number of dots (dots)	640(H)x480(V)
Dot pitch (mm)	0.33 (W)x0.33 (H)
Display area (mm)	211.2(H)x158.4(V)
Color	512 colors
Contrast ratio	60:1
Gray scale	8 levels for each gun (RGB)
Power (max.)	19 watts

1.8 POWER SUPPLY UNIT

The universal auto-sensing power supply can be used world-wide and supplies +5, -5, +12, and -12 VDC to the computer.

The power supply unit is housed in the computer and it supplies the regulated power to the:

- 1) System board
- 2) Memory board
- 3) 3.5-inch floppy disk drive (FDD)
- 4) 3.5-inch hard disk drive (HDD)
- 5) External keyboard
- 6) Liquid crystal display (LCD)
- 7) Option boards
- 8) Cooling fans

The power supply unit includes an input line filter, line fuse, cooling fan, power conversion circuitry, and connectors.

Input ratings are: 115 VAC, 1.5 A or 230 VAC, 1.0 A.

The power supply unit is shown in Figure 1-11 and the output ratings are specified in Table 1-5.

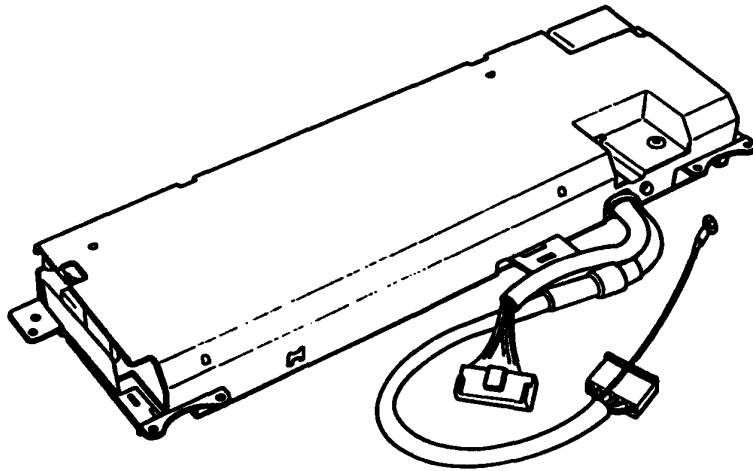


Figure 1-11 Power supply unit

Table 1-5 Power supply unit output rating

	DC Voltage (V)	Maximum Current (A)
For system	+5	6.0
	+12	1.7
	-5	0.25
	-12	0.3
For LCD	+12	1.4

2.1 GENERAL

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

1. Power supply unit
2. System board
3. Memory board
4. FDD
5. HDD
6. Keyboard
7. LCD

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

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

1. T3200SXC Diagnostics Disk
2. Phillips head screwdriver
3. Blade head screwdriver
4. Tweezers
5. 2DD and 2HD formatted work disks (for FDD testing)
6. Cleaning disk kit (for FDD testing)
7. Multimeter
8. Printer port LED
9. RS-232-C wraparound connector (for ASYNC testing)
10. Printer wraparound connector (for printer testing)
11. Wraparound board (for expansion testing)

The problem isolation flowchart described in Section 2.2 may be used to determine which isolation procedures are necessary to isolate a problem with the T3200SXC.

2.2 PROBLEM ISOLATION FLOWCHART

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

1. No floppy disk is in the FDD.
2. All optional equipment is disconnected.
3. MS-DOS was installed in drive C before a problem occurred.

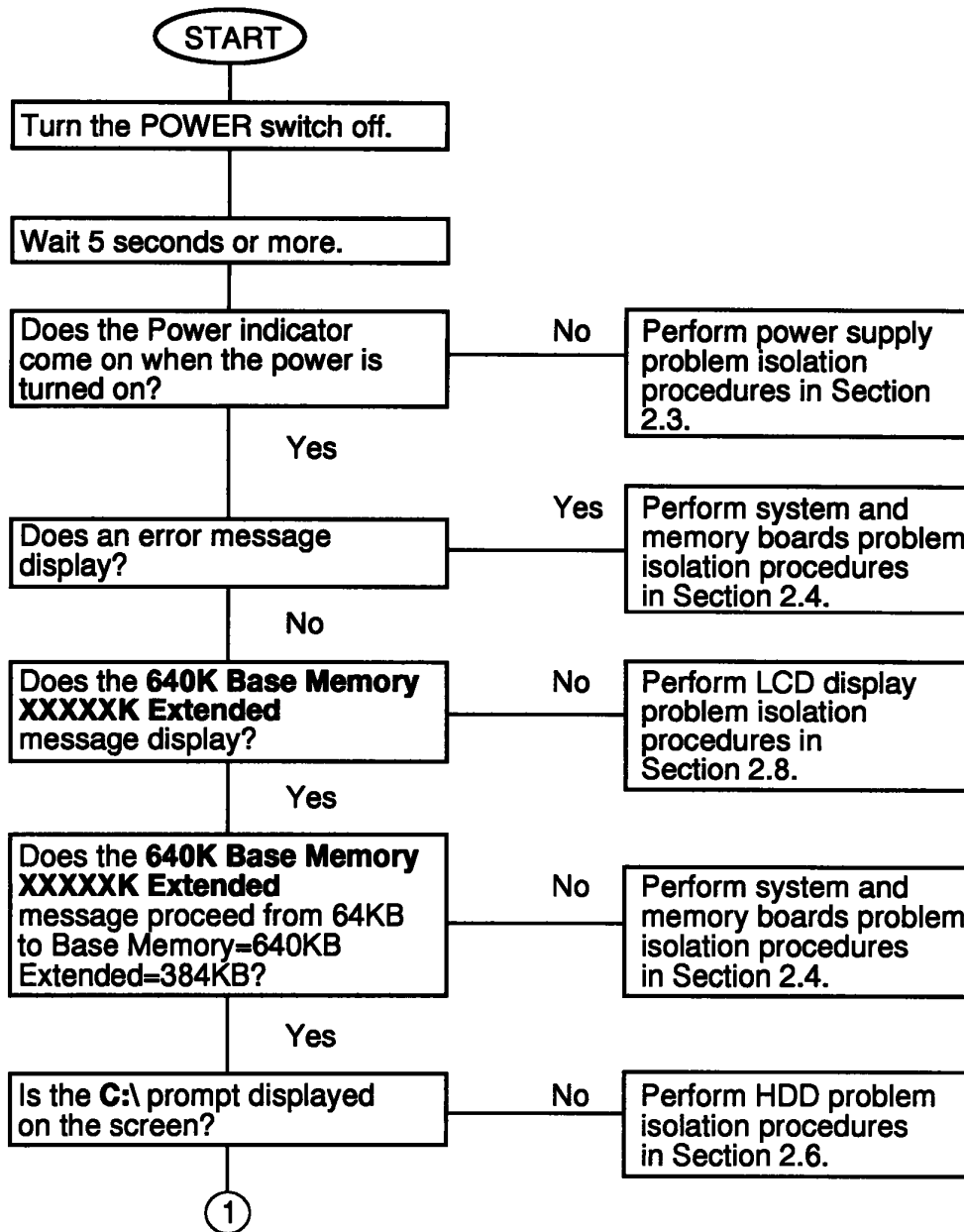


Figure 2-1 Problem isolation flowchart

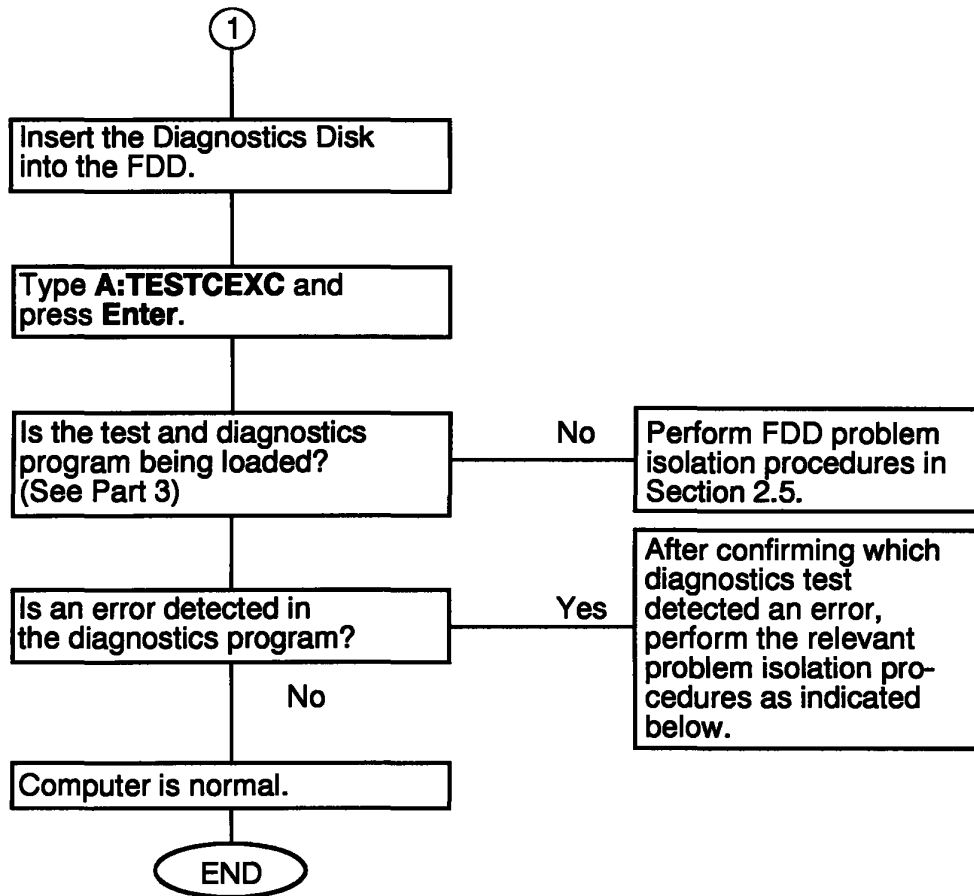


Figure 2-1 Problem isolation flowchart (continued)

1. If an error is detected on the system test, memory test, display test, or real timer test, perform the system and memory boards 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 UNIT PROBLEM ISOLATION PROCEDURES

WARNING: *Dangerously high voltage is supplied to the power supply unit. Exercise extreme caution with working with this component. After turning the computer off, wait a few minutes to allow the electricity to discharge.*

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

- PROCEDURE 1: Power indicator check
- PROCEDURE 2: Connector check
- PROCEDURE 3: Output voltage check
- PROCEDURE 4: Power supply unit replacement

PROCEDURE 1

Power indicator check

1. Turn on the power.
2. If the power indicator lights, go to **PROCEDURE 3**. If the indicator does not light, check the AC power cord connection. One end of the AC power cord should be inserted the standard AC wall outlet and the other end should be connected to the AC IN jack on the back of the computer.

If OK, replace the AC power cord with a new one.

After replacing the AC power cord, if the indicator lights, the original cord was probably defective. If the indicator still does not light, go to **PROCEDURE 2**.

PROCEDURE 2

Connector check

1. Turn off the power and then unplug the AC power cord.
2. Remove the top cover. (Refer to Section 4.6.)
3. Remove the power supply unit. (Refer to Section 4.9.)
4. If the power supply connector (PJ14) on the system board is connected properly, go to PROCEDURE 3. If it is not connected properly, reconnect it.

After reconnecting the power supply connector, if the indicator lights still do not light, go to PROCEDURE 3.

PROCEDURE 3

Output voltage check

1. Plug the AC power cord into the power supply unit, then turn on the power.
2. Use a multimeter to confirm that the output voltages of the two power supply connectors match the values in Table 2-1.
3. If the voltages are within the range of values given in Table 2-1, the power supply unit is normal, but the system board is probably defective. Go to the system and memory boards problem isolation procedures in Section 2.4.
4. If the voltages are still not within the range of values given in Table 2-1, go to PROCEDURE 4.

Table 2-1 Power supply unit output voltages

Connector	Pin Number		Voltage (VDC)		
	+lead	-lead	Normal	Min	Max
For system board	5	4, 6, 7	12	11.4	12.6
	8, 9	4, 6, 7	5	4.75	5.25
	2	4, 6, 7	-12	-13.2	-10.8
	3	4, 6, 7	-5	-5.25	-4.75
For LCD	1	4	12	10.8	13.2

PROCEDURE 4

Power supply unit replacement

1. Turn off the power and then unplug the AC power cord.
2. Replace the power supply unit. (Refer to Section 4.9.)
3. If normal operation is restored after replacing the power supply unit, the original power supply unit was probably defective.
4. If normal operation is not restored, another FRU is probably defective. The defective unit must be isolated and replaced.

2.4 SYSTEM AND MEMORY BOARDS

PROBLEM ISOLATION PROCEDURES

CAUTION: *Before carrying out any of these procedures, make sure that the FDD does not contain a diskette. Performing these procedures with a floppy disk in the FDD may result in loss of data.*

This section describes how to determine if the system or memory 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 execution
- PROCEDURE 4: Memory board replacement
- PROCEDURE 5: System board replacement

PROCEDURE 1

Message check

1. Turn on the power.
2. If the computer boots up normally, go to PROCEDURE 3.
3. If the following error message is displayed on the screen, press the F1 key and execute the setup operation.

Refer to the T3200SXC REFERENCE MANUAL for detailed setup operation.

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

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

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

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

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

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

4. If the following message is displayed on the screen, turn off the power. Wait 5 seconds or more, then turn on the power. If the following message is displayed again, go to the HDD problem isolation procedures in Section 2.6.

HDC ERROR

HDD #0 ERROR

HDD #1 ERROR

5. If the following message is displayed on the screen, turn off the power. Wait 5 seconds or more, then turn on the power. If the following message is displayed again, go to the FDD problem isolation procedures in Section 2.5.

NO FDD ERROR

FDC ERROR

6. If the following message is displayed on the screen, turn off the power. Wait 5 seconds or more, then turn on the power. If the following message is displayed again, go to the keyboard problem isolation procedures in Section 2.7.

KEYBOARD ERROR

7. If the following message is displayed on the screen, go to PROCEDURE 4.

**CPU ERROR
SYSTEM ROM CHECK SUM ERROR
TIMER CH.2 OUT ERROR
PIT ERROR
MEMORY REFRESH ERROR
FIRST 64KB MEMORY ERROR
RTC ERROR
CRTIC ERROR
VRAM ERROR
KBC ERROR
SYSTEM MEMORY ERROR
SYSTEM MEMORY PARITY ERROR
PROTECTED MODE ERROR
CPU EXCEPTION ERROR
EMS PAGE REGISTER ERROR
DMA PAGE REGISTER ERROR
DMAC #1 ERROR
DMAC #2 ERROR
PIC #1 ERROR
PIC #2 ERROR
TIMER INTERRUPT ERROR
RTC UPDATE ERROR**

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

PROCEDURE 2

Printer port LED check

1. Turn off the power.
2. Plug the printer port LED into the PRT/FDD connector on the back of the computer and set the A-B-PRT switch to the PRT position.
3. While watching the printer port LED, turn on the power. The printer port LED will light when the power switch is turned on.
4. Read the final LED status from left to right as a hexadecimal value.
5. If the final LED status matches any of the error status values in Table 2-2, go to PROCEDURE 4.
6. If the final LED status is **FFH**, go to PROCEDURE 3.

Table 2-2 Printer port LED error status

Error Status	Test item	Message
00H	CPU test	CPU ERROR
00H	ROM check sum test	SYSTEM ROM CHECK SUM ERROR
05H	PIT test	TIMER CH.2 OUT ERROR PIT ERROR READ DATA = XXH WRITE DATA = XXH
06H	PIT initialization	
07H	Refresh test	MEMORY REFRESH ERROR
0AH	First 64KB memory test	FIRST 64KB MEMORY ERROR
0DH	Interrupt vector initialization	
15H	RTC test	RTC ERROR READ DATA = XXH WRITE DATA = XXH
16H	RTC initialization	
18H	PIC initialization	
50H	Peculiar HW initialization	
1FH	Display initialization	CRTC ERROR VRAM ERROR READ DATA = XXXXXXXXH WRITE DATA = XXXXXXXXH
22H	KBC test	KBC ERROR
25H	System memory test	SYSTEM MEMORY ERROR ADDRESS = XXXXXXXXH READ DATA = XXXXXXXXH WRITE DATA = XXXXXXXXH SYSTEM MEMORY PARITY ERROR ADDRESS = XXXX0000H - XXXXFFFFH
31H	Protected mode test	PROTECTED MODE ERROR
31H	CPU exceptional interrupt test	CPU EXCEPTION ERROR
30H	Extended memory test	EXTENDED MEMORY ERROR ADDRESS = XXXXXXXXH READ DATA = XXXXXXXXH WRITE DATA = XXXXXXXXH EXTENDED MEMORY PARITY ERROR ADDRESS = XXXX0000H - XXXXFFFFH
41H	DMA page register	DMA PAGE REGISTER ERROR READ DATA = XXH WRITE DATA = XXH
40H	DMAC test	DMAC #1 ERROR READ DATA = XXXXH WRITE DATA = XXXXH DMAC #2 ERROR READ DATA = XXXXH WRITE DATA = XXXXH
42H	DMAC initialization	

Table 2-2 Printer port LED error status (continued)

Error Status	Test item	Message
4AH	PIC test	PIC #1 ERROR READ DATA = XXH WRITE DATA = XXH PIC #2 ERROR READ DATA = XXH WRITE DATA = XXH
54H	Keyboard test	KEYBOARD ERROR
55H	KBC initialization	KBC ERROR
60H	HDD initialization	HDC ERROR HDD #0 ERROR HDD #1 ERROR
65H	FDD initialization	NO FDD ERROR FDC ERROR
70H	Printer test	
80H	SIO test	
90H	Timer initialization	TIMER INTERRUPT ERROR RTC UPDATE ERROR
A0H	NDP initialization	
A6H	Extended I/O ROM	
FFH	Option ROM test	
FFH	CMOS RAM test1	*** Error in CMOS. Bad battery *** Bad check sum *** Bad configuration *** Bad memory size *** Bad HDD type *** Bad time function *** Check system. Then press [F1] key..

PROCEDURE 3

Test program execution

1. Execute the following tests on the Diagnostic Test Menu. (Refer to Part 3 Test and Diagnostics.)
 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
2. If an error is detected during the memory test, go to PROCEDURE 4.
3. If an error is detected during the system test, ASYNC test, or real timer test, go to PROCEDURE 5.
4. If an error is detected during the floppy disk test, go to the FDD problem isolation procedures in Section 2.5.
5. If an error is detected during the hard disk test, go to the HDD problem isolation procedures in Section 2.6.
6. If an error is detected during the keyboard test, go to the keyboard problem isolation procedures in Section 2.7.
7. If an error is detected during the display test, go to the LCD problem isolation procedures in Section 2.8.

PROCEDURE 4

Memory board replacement

1. **Replace the memory board. (Refer to Section 4.14.)**
2. **If normal operation is restored after replacing the memory board, the original memory board is probably defective.**
3. **If normal operation is not restored, the system board is probably defective. Go to PROCEDURE 5.**

PROCEDURE 5

System board replacement

1. **Replace the system board. (Refer to Section 4.14.)**
2. **If normal operation is restored after replacing the system board, the original system board is probably defective.**
3. **If normal operation is not restored, another FRU is probably defective. The defective unit must be isolated by the test and diagnostics program and then replaced.**

2.5 FLOPPY DISK DRIVE PROBLEM ISOLATION PROCEDURES

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

- PROCEDURE 1:** Test and diagnostics program loading check
- PROCEDURE 2:** Message check
- PROCEDURE 3:** Head cleaning
- PROCEDURE 4:** FDD test execution
- PROCEDURE 5:** FDD connector check
- PROCEDURE 6:** FDD replacement

PROCEDURE 1

Test and diagnostics program loading check

1. Turn off the power.
2. Insert the Diagnostics Disk into the FDD.
3. Turn on the power.
4. If loading starts normally, go to **PROCEDURE 3**. (See Section 3.2 to determine if loading has started normally.)
5. If loading has not started normally, go to **PROCEDURE 2**.

PROCEDURE 2

Message check

1. When the power switch is turned on after the MS-DOS system disk is inserted into the FDD, message (a), (b), or (c) shown below may appear.
 - (a) ***** FDD A is not installed *****
 - (b) **Non-System disk or disk error
Replace and press any key when ready**
 - (c) **Place system disk in drive.
Press any key when ready.**
2. If message (a) is displayed, check that the A-B-PRT switch is set to PRT. If it is not set to PRT, set it to PRT. If it is set to PRT, go to PROCEDURE 5.
3. If message (b) or (c) is displayed, the contents of the floppy disk is damaged, or a disk other than the MS-DOS system disk has been inserted into the FDD. Insert a new MS-DOS system disk into the FDD. If loading completes, go to PROCEDURE 4. If loading does not complete, go to PROCEDURE 3.
4. If the following message is displayed, go to PROCEDURE 5.

NO FDD ERROR
5. If the following message is displayed, go to PROCEDURE 6.

FDC ERROR
6. If none of the above messages appears, go to PROCEDURE 5.

PROCEDURE 3

Head cleaning

1. Turn off the power.
2. Insert the cleaning disk into the FDD.
3. Turn on the power.
4. If normal operation is restored after cleaning the head, go to **PROCEDURE 4**.
5. If normal operation is not restored, go to **PROCEDURE 5**.

PROCEDURE 4

FDD test execution

1. Insert the Diagnostics Disk into the FDD. Then type **A:TESTCEXC** and press **Enter**.
2. Remove the diagnostics disk from the FDD, then insert a formatted work disk.
3. Run the floppy disk test as indicated on the diagnostic test menu.
4. If an error is generated during the floppy disk test, an error code and status will be displayed. The error codes are described in Table 2-3. Go to PROCEDURE 6.
5. If no error is generated, the FDD is normal.

Table 2-3 FDD error code

Code	Status
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

PROCEDURE 5

FDD connector check

1. Turn off the power and then unplug the AC power cord.
2. Remove the top cover. (Refer to Section 4.6.)
3. Check that the FDD connection (PJ7) is secure.
4. If the FDD cable is securely connected to the system board, go to **PROCEDURE 6**.
5. If the FDD cable is not securely connected to the system board, secure the connection.

PROCEDURE 6

FDD replacement

1. Turn off the power.
2. Remove the FDD. (Refer to Section 4.11.)
3. Connect a new FDD to the FDD connector without installing the new FDD. Then connect all of the FRUs removed during FDD removal to their corresponding connectors without installing the FRUs.
4. Turn on the power.
5. If normal operation is restored, the original FDD is probably defective. Install the new FDD and reassemble the computer.
6. If normal operation is not restored, the system board is probably defective. Disconnect the new FDD. Refer to Section 2.4.

2.6 HARD DISK DRIVE PROBLEM ISOLATION PROCEDURES

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

- PROCEDURE 1: HDD indicator check
- PROCEDURE 2: Message check
- PROCEDURE 3: Format execution
- PROCEDURE 4: Hard disk test execution
- PROCEDURE 5: Connector check
- PROCEDURE 6: HDD jumper straps check
- PROCEDURE 7: HDD replacement

PROCEDURE 1

HDD indicator check

1. Turn off the power.
2. If there is a floppy disk in the FDD, remove it.
3. Wait 5 seconds or more after turning off the power, then turn on the power.
4. If the HDD indicator lights, go to PROCEDURE 2.
5. If the HDD indicator does not light, go to PROCEDURE 5.

PROCEDURE 2

Message check

1. If the operating system is loaded normally, go to PROCEDURE 4.
2. If the following message is displayed on the screen, go to PROCEDURE 3.

**Insert system disk in drive.
Press any key when ready....**

3. If one of the following messages is displayed on the screen, go to PROCEDURE 7.

HDC ERROR

HDD #0 ERROR

HDD #1 ERROR

PROCEDURE 3

Format execution

CAUTION: *The contents of the hard disk will be erased when the **FORMAT** command is run. Before running this test, 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.)*

1. Insert the MS-DOS system disk into the FDD. Reboot the computer or turn the computer on.
2. Partition the hard disk. (See the MS-DOS Manual for details.)
3. Format the hard disk. (See the MS-DOS Manual for details.) At this time type **FORMAT C:/S** to transfer the system program.
4. If normal operation is restored, the HDD is normal.
5. If normal operation is not restored, go to PROCEDURE 6.

PROCEDURE 4

Hard disk test execution

CAUTION: *The contents of the hard disk will be erased when the test program is run. Before running this test, 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.)*

1. Insert the Diagnostics Disk into the FDD. Then type **A:TESTCEXC** and press **Enter**. Run the hard disk test as indicated on the diagnostic test menu.
2. If an error is detected during the hard disk test, an error code and status will be displayed; go to **PROCEDURE 6**. The error codes and statuses are described in Table 2-4.
3. If no error is generated, the HDD is normal. Enter the MS-DOS **FDISK** command to partition the hard disk. Then enter the MS-DOS **FORMAT** command. (See the MS-DOS Manual for details.)

Table 2-4 HDD error code

Code	Status
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 (HW.code=FF)

PROCEDURE 5

Connector check

1. Turn off the power and then unplug the AC power cord.
2. Remove the top cover. (Refer to Section 4.6.)
3. Check that the HDC signal cable (PJ8) and HDD power cable (PJ5) are secure.
4. If these cables are securely connected to the system board, go to PROCEDURE 6.
5. If the cables are not securely connected, secure them.

PROCEDURE 6

HDD jumper straps check

1. Remove the HDD. (Refer to Section 4.7.)
2. Check that the jumper straps are set correctly as shown in Figure 2-2 and described in Table 2-5.
3. If the jumper straps are set correctly, go to PROCEDURE 7.
4. If the jumper straps are not set correctly, set them correctly.

Table 2-5 HDD jumper strap configuration

40MB Type		120MB Type	
Signal	Status	Signal	Status
HSP	Open	E1	Open
C/D	Short	E2	Short
DSP	Open	E3	Open
ACT	Short		

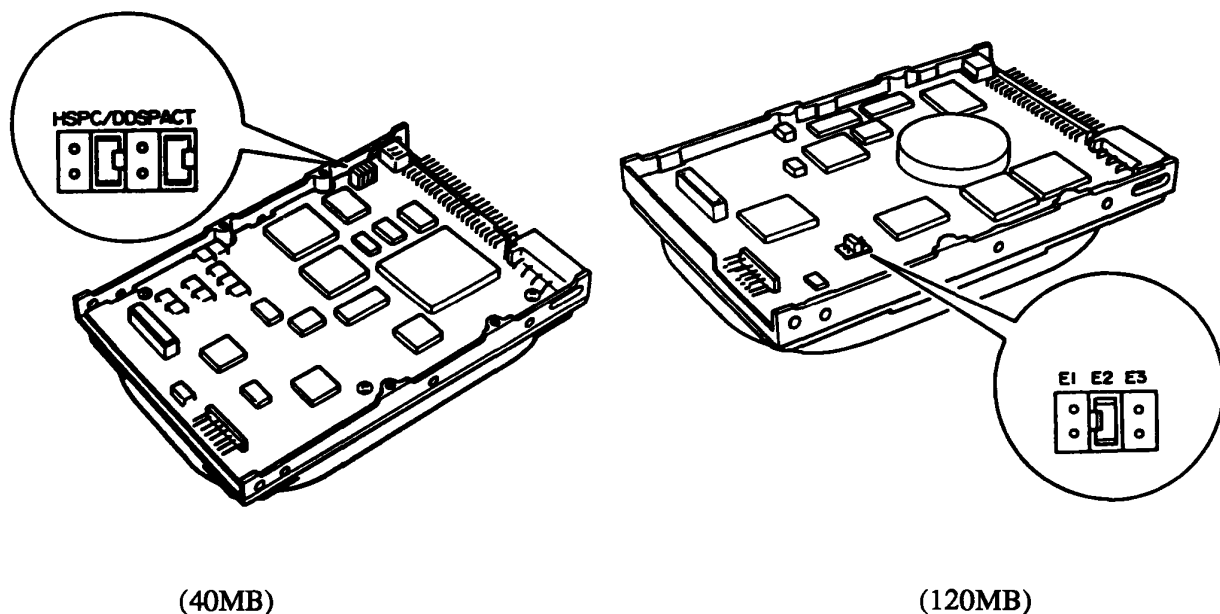


Figure 2-2 HDD jumper straps

PROCEDURE 7

HDD replacement

1. Turn off the power.
2. Remove the HDD. (Refer to Section 4.7.)
3. Connect a new HDD to the system board without installing the HDD. Then connect all the FRUs removed during HDD removal without installing the FRUs.
4. If normal operation is restored, the original HDD is probably defective. Install the new HDD and reassemble the computer.
5. If normal operation is not restored, the system board is probably defective. Disconnect the new HDD. Refer to Section 2.4.

2.7 KEYBOARD PROBLEM ISOLATION PROCEDURES

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

- PROCEDURE 1: Input check
- PROCEDURE 2: Keyboard test execution
- PROCEDURE 3: Connector check
- PROCEDURE 4: Keyboard replacement

PROCEDURE 1

Input check

1. Insert an MS-DOS system disk into the FDD.
2. Turn on the power.
3. If the following message is displayed on the screen, go to PROCEDURE 3.

KEYBOARD ERROR

4. When the A:\ prompt appears on the screen, press any of the white keys on the keyboard (any character key).

CAUTION: Do not type an MS-DOS acceptable command such as *DEL* or *FORMAT*. Such operation may erase your important program or data.

If the character you pressed appears on the screen, press **Enter**. Go to PROCEDURE 2.

Toshiba Personal Computer MS-DOS Version x.xx /Rxx

(C) Copyright Toshiba Corporation 1983,1989
(C) Copyright Microsoft Corporation 1981,1986

Current date is xxx xx-xx-19xx
Enter new date (mm-dd-yy) : _
Current time is xx:xx:xx.xx
Enter new time : _

COMMAND Version x.xx
A> abcdefghijklmnopqrst.....

5. If the character does not appear on the screen, go to PROCEDURE 3.

PROCEDURE 2

Keyboard test execution

1. Insert the Diagnostics Disk into the FDD. Then type **A:TESTCEXC** and press **Enter**. Run the keyboard test as indicated on the diagnostic test menu.
2. If an error is detected during the test, go to **PROCEDURE 3**.
3. If no error is detected during the test, the keyboard is normal.

PROCEDURE 3

Connector check

1. Turn off the power and then disconnect the AC power cord.
2. Lift up the keyboard (refer to Section 4.2) and check that the keyboard cable (PJ4) is securely connected to the system board. If it is securely connected, go to PROCEDURE 4.
3. If it is not securely connected, secure it.

PROCEDURE 4

Keyboard replacement

1. Turn off the power and then unplug the AC power cord.
2. Remove the keyboard. (Refer to Section 4.2.)
3. Connect a new keyboard to the system board without installing it.
4. If normal operation is restored after connecting the new keyboard, the original keyboard is probably defective. Install the new keyboard and reassemble the computer.
5. If normal operation is not restored, the system board is probably defective. Disconnect the new keyboard. Refer to Section 2.4.

2.8 LIQUID CRYSTAL DISPLAY PROBLEM ISOLATION PROCEDURES

This section describes how to determine if the liquid crystal display (LCD) is defective. Start with PROCEDURE 1 and continue with other procedures as instructed. The procedures described in this section are:

- PROCEDURE 1: Display and FLs check
- PROCEDURE 2: Display test execution
- PROCEDURE 3: Connector and cable check
- PROCEDURE 4: Replacement check

PROCEDURE 1

Display and FLs check

1. Turn off the power.
2. Wait 5 seconds or more and then turn on the power. After turning on the power, the following message should be displayed in the upper left corner of the screen:

xxxK Base Memory, xxxxxK Extended

3. If the above message appears, go to PROCEDURE 2.
4. When the FLs light, the light can be seen through the ventilator of the top cover. Confirm that the FLs light.

If the FLs light, go to PROCEDURE 2.

If the FLs do not light, go to PROCEDURE 4.

PROCEDURE 2

Display test execution

1. Insert the Diagnostics Disk into the FDD. Then type **A:TESTCEXC** and press **Enter**. Run the display test as indicated on the diagnostic test menu.
2. If an error is detected during the display test, the system board is probably defective. Replace the system board with a new one. Detailed procedures described in Section 4.14.
3. If no error is generated, the LCD is normal.

PROCEDURE 3

Connectors and cable check

The display unit has an LCD module, FLs, and an FL inverter. The LCD module is connected to the system board with the LCD cable. The FL inverter is connected to the system board with the FL inverter cable.

CAUTION: *To check the connectors, turn off the power and remove the AC power cord from the computer.*

1. Disassemble the computer and check the following connectors. Detailed disassembly procedures are described in Sections 4.3 and 4.4.

LCD module	<—	System board (PJ6)
FL inverter (PJ1)	<—	System board (PJ6)
FL inverter (PJ2,3)	<—>	FLs (2 connectors)

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

2. Check the continuity of the following cables using the multimeter. Detailed disassembly procedures are described in Sections 4.3 and 4.4.

FL inverter (PJ2,3)	<—>	FLs (2 connectors)
---------------------	-----	--------------------

If either of these cables looks damaged, replace them and restart the computer. If the problem still exists, go to PROCEDURE 4.

PROCEDURE 4

Replacement check

In this computer, the FL inverter, LCD module, two FLs, and system board are connected with the display circuits. Some of them may be damaged. Perform the following checks. Detailed disassembly procedures are described in Part 4.

- Check 1 Replace the FLs with new ones and recheck the display. If the problem still exists, perform Check 2.

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

- Check 3 Replace the FL inverter with a new one and recheck the display. If the problem still exists, perform Check 4.

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

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3.1 GENERAL

This section explains the test and diagnostics programs which check the functions of all the hardware modules of the T3200SXC. The T3200SXC ASP diagnostics are composed of 18 programs grouped into two modules: the service program module (DIAGNOSTICS MENU) and the test program module (DIAGNOSTIC TEST MENU).

The service program module is composed of 7 tasks:

1. HARD DISK FORMAT
2. SEEK TO LANDING ZONE (HDD)
3. HEAD CLEANING
4. LOG UTILITIES
5. RUNNING TEST
6. FDD UTILITIES
7. 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. T3200SXC Diagnostics Disk
2. MS-DOS system disk
3. 2HD and 2DD formatted work disks (for FDD test)
4. Cleaning disk kit (for head cleaning)
5. Printer wraparound connector (for printer wraparound test)
6. RS-232-C wraparound connector (for ASYNC wraparound test)
7. Wraparound board (for expansion test)

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

3.2 OPERATIONS

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

**TOSHIBA personal computer T3200SXC DIAGNOSTICS
version x.xx (c) copyright TOSHIBA Corp. 1990**

DIAGNOSTICS MENU :

- 1 - DIAGNOSTIC TEST**
- 2 - HARD DISK FORMAT**
- 3 - SEEK TO LANDING ZONE (HDD)**
- 4 - HEAD CLEANING**
- 5 - LOG UTILITIES**
- 6 - RUNNING TEST**
- 7 - FDD UTILITIES**
- 8 - SYSTEM CONFIGURATION**
- 9 - EXIT TO MS-DOS**
- 0 - SETUP**

PRESS [0] - [9] KEY

Detailed explanations of the service program tasks and their operations are given in Sections 3.17 through 3.23.

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 and press Enter. The following display will appear:

TOSHIBA personal computer T3200SXC DIAGNOSTICS
version x.xx (c) copyright TOSHIBA Corp. 1990

DIAGNOSTIC TEST MENU :

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

PRESS [1] - [9] KEY

Numbers 1 to 11 are diagnostic tests. These tests are explained in Sections 3.4 through 3.14.

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

Number 99 is for returning to the DIAGNOSTICS MENU.

When selecting the floppy disk test 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 through 11) from the DIAGNOSTIC TEST MENU, press **Enter**. A test-specific display will appear. For example, the following screen shows the system test, which appears when you type 1 and press **Enter**:

SYSTEM TEST

XXXXXXX

```
T3200SXC DIAGNOSTIC TEST x.xx
[Ctrl]+[Break] : test end
[Ctrl]+[C]      : key stop
```

SUB-TEST : XX

PASS COUNT: XXXXX

WRITE DATA: XX

ADDRESS : XXXXXX

ERROR COUNT: XXXXX

READ DATA : XX

STATUS : XXX

SUB-TEST MENU :

01 - ROM checksum

02 - HW status

99 - Exit to DIAGNOSTIC TEST MENU

SELECT SUB-TEST NUMBER? _

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

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

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

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

Each time a test cycle ends, it increases the pass counter by one and repeats the test cycle.

If you select NO (by typing in 2 and pressing **Enter**):

At the end of a test cycle, the test execution is terminated and you exit to the subtest menu.

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

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

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

When an error occurs, the error status is displayed. Execution of the test program stops and an operation guide is displayed on the right side of the display screen.

If you select **NO** (by typing in **2** and pressing **Enter**):

When an error occurs, the error status is displayed. The error counter is increased by one and the subtest continues.

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

9. When an error occurs during the test program, the following message will appear (if you answer **YES** for the **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.

The error code and error status names are described in Table 3-3 of Section 3.15.

3.3 SUBTEST NAMES

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

Table 3-1 Subtest names

No.	Test name	Sub No.	Subtest item
1	SYSTEM	01 02	ROM checksum HW status
2	MEMORY	01 02 03 04 05	RAM constant data RAM address pattern data RAM refresh Protected mode Memory module
3	KEYBOARD	01 02 03	Pressed key display (91/92) Pressed key code display Pressed key display (101/102)
4	DISPLAY	01 02 03 04 05 06 07 08 09 10 11	VRAM read/write Character attributes Character set 80*25 Character display Graphics display (color set 0/1) 640*200 Graphics display 640*400 Graphics display Display page "H" pattern display LED/DAC pallet TFT 57 color display
5	FDD	01 02 03 04 05	Sequential read Sequential read/write Random address/data Write specified address Read specified address
6	PRINTER	01 02 03	Ripple pattern Function Wraparound
7	ASYNC	01 02 03 04 05 06	Wraparound (board) Board (#1) <=> Board (#2) Point to point (send) Point to point (receive) Card modem loopback (1200 bps) Interrupt test (IRQ4,3,5)

Table 3-1 Subtest names (continued)

No.	Test name	Sub No.	Subtest item
8	HDD	01 02 03 04 05 06 07 08 09 10	Sequential read Address uniqueness Random address/data Cross talk & peak shift Write/read/compare (CE) Write specified address Read specified address ECC circuit Sequential write W-R-C specified address
9	REAL TIMER	01 02 03	Real time Backup memory Real time carry
10	NDP	01	NDP test
11	EXPANSION UNIT	01 02 03 04	Box wraparound Box mono video-RAM Wraparound (51-bus) Wraparound (32-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**.

```
H/W status =    76543210
                10001101

Bit7 -          =
Bit6 -          =
Bit5 - Notch signal = 2HD
Bit4 - FDD type   = 2HD
Bit3 -          =
Bit2 - Drive A/B   = Normal
Bit1 - External FDD = OFF
Bit0 -          =
```

Table 3-2 Hardware status bit

Items	H/W status	1	0
Bit7	Reserved		
Bit6	Reserved		
Bit5	Media type	2DD	2HD
Bit4	FDD type	2DD	2HD
Bit3	Reserved		
Bit2	Drive A/B	Normal	Change
Bit1	External FDD	ON	OFF
Bit0	Reserved		

3.5 MEMORY TEST

Subtest 01 RAM constant data

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

Subtest 02 RAM address pattern data

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

This subtest writes 256 bytes of constant data to conventional 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 (address 100000H to the max.) in protected mode, then reads and compares it with the original data.

Subtest 05 Memory module

The same test as described for subtest 04 is done for the optional memory module.

Memory module capacity is 2MB, 4MB and 8MB. After selecting the subtest, the following message will appear:

Memory module size (1:2MB, 2:4MB, 3:8MB)?

When the memory module is 2 Mbytes, select option 1.

When the memory module is 4 Mbytes, select option 2.

When the memory module is 8 Mbytes, select option 3.

3.6 KEYBOARD TEST

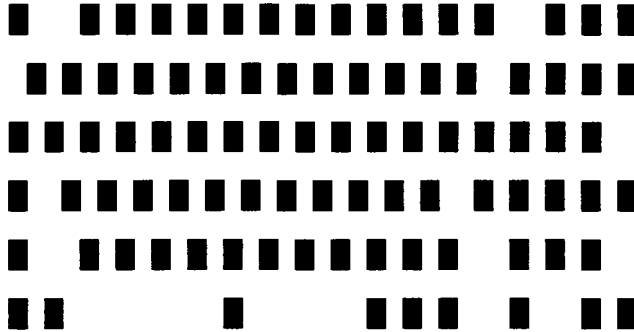
Subtest 01 Pressed key display (91/92)

NOTE: Make sure the Num-lock key is off. If this key is on, the test cannot be executed.

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

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

KEYBOARD TEST IN PROGRESS 301000



[SCC Version = Vx.xxxx : xx Key]
[Print : Alt+SysReq , Pause : Ctrl+Break]
IF TEST OK, PRESS [DEL] THEN [ENTER] KEY

Subtest 02 Pressed key code display

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

The **Ins**, **Caps lock**, **Num lock**, **Scroll lock**, **Alt**, **Ctrl**, **Left Shift**, and **Right Shift** keys are displayed in reverse screen when pressed.

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

```
KEYBOARD TEST    IN PROGRESS        302000
```

```
     Scan code        =  
     Character code =  
     Keytop           =
```

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

```
PRESS [Enter] KEY
```

Subtest 03 Pressed key display (101/102)

NOTE: Make sure the Num-lock key is off. If this key is on, the test cannot be executed.

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

When a key is held depressed, the display will blink designating the auto-repeat function.

```
KEYBOARD TEST                    IN PROGRESS        303000  
  
  ■ ■ ■ ■ ■    ■ ■ ■ ■ ■    ■ ■ ■ ■ ■    ■ ■ ■  
  ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■    ■ ■ ■    ■ ■ ■ ■ ■  
  ■    ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■    ■ ■ ■    ■ ■ ■ ■ ■  
  ■    ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■    ■    ■ ■ ■ ■ ■  
  ■    ■            ■            ■    ■    ■ ■ ■    ■ ■ ■ ■ ■
```

```
[SCC Version = Vx.xxxx : xx Key]  
Print : Alt+SysReq , Pause : Ctrl+Break  
IF TEST OK, PRESS [DEL] THEN [ENTER] KEY
```

3.7 DISPLAY TEST

NOTE: The contents of this test differ with the display modes (VGA-color and VGA-monochrome). This mode is changed with the SETUP program.

Subtest 01 VRAM read/write

This subtest writes constant data (FFFFH, AAAAH, 5555H, and 0000H) and address data to video RAM (256 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.

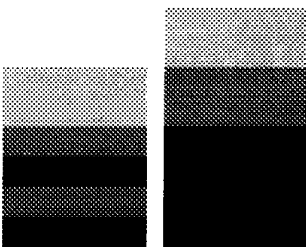
The display below appears on the screen when this test is executed:

CHARACTER ATTRIBUTES

```

NEXT LINE SHOWS NORMAL DISPLAY
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
NEXT LINE SHOWS INTENSIFIED DISPLAY
IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII
NEXT LINE SHOWS REVERSE DISPLAY
RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR
NEXT LINE SHOWS BLINKING DISPLAY
BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB

```

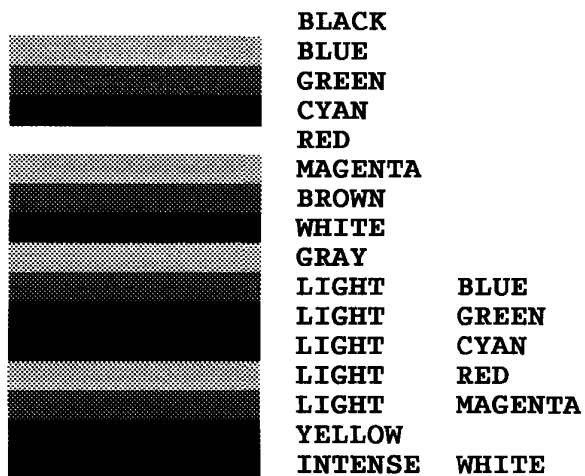


00	08	; BLACK
01	09	; BLUE
04	0C	; RED
05	0D	; MAGENTA
02	0A	; GREEN
03	0B	; CYAN
06	0E	; YELLOW
07	0F	; WHITE

PRESS [ENTER] KEY

After pressing **Enter**, all sixteen background and foreground colors will be displayed in mode 13H, and the brightness of the colors can be checked.

320*200 GRAPHICS DISPLAY [13]

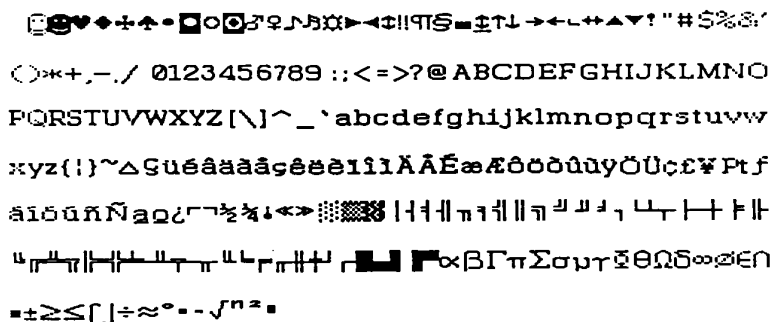


PRESS [ENTER] KEY

Subtest 03 Character set

In this subtest the character set (00H to FFH) is displayed in the 40x25 character mode as shown below:

CHARACTER SET IN 40X25



PRESS [ENTER] KEY

Subtest 04 80x25 Character display

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

```

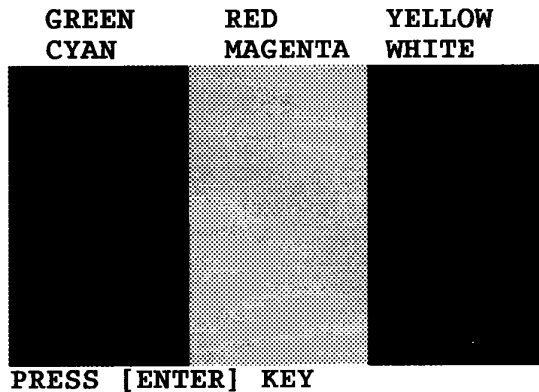
80*xx CHARACTER DISPLAY
012345678901234567890123456789012345678901234567890123456789012345678901234567
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNQRSTUvwxyz[\]^_`abcdefghijklm
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNQRSTUvwxyz[\]^_`abcdefghijklmn
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNQRSTUvwxyz[\]^_`abcdefghijklmno
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNQRSTUvwxyz[\]^_`abcdefghijklmnop
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNQRSTUvwxyz[\]^_`abcdefghijklmopq
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNQRSTUvwxyz[\]^_`abcdefghijklmopqr
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNQRSTUvwxyz[\]^_`abcdefghijklmopqrs
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNQRSTUvwxyz[\]^_`abcdefghijklmopqrst
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNQRSTUvwxyz[\]^_`abcdefghijklmopqrstu
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNQRSTUvwxyz[\]^_`abcdefghijklmopqrstuv
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNQRSTUvwxyz[\]^_`abcdefghijklmopqrstuvw
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNQRSTUvwxyz[\]^_`abcdefghijklmopqrstuvwx
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNQRSTUvwxyz[\]^_`abcdefghijklmopqrstuvwxy
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNQRSTUvwxyz[\]^_`abcdefghijklmopqrstuvwxyz
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNQRSTUvwxyz[\]^_`abcdefghijklmopqrstuvwxyz{
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNQRSTUvwxyz[\]^_`abcdefghijklmopqrstuvwxyz{|
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNQRSTUvwxyz[\]^_`abcdefghijklmopqrstuvwxyz{|}
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNQRSTUvwxyz[\]^_`abcdefghijklmopqrstuvwxyz{|}-
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNQRSTUvwxyz[\]^_`abcdefghijklmopqrstuvwxyz{|}-Ç
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNQRSTUvwxyz[\]^_`abcdefghijklmopqrstuvwxyz{|}-•Çü
PRESS [ENTER] KEY

```

Subtest 05 Graphics display (color set 0/1)

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

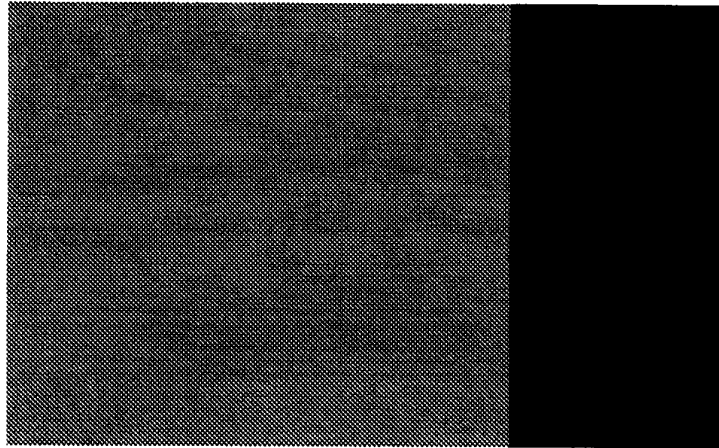
320*200 GRAPHICS DISPLAY
COLOR SET X : [x]



Subtest 06 640x200 Graphics display

This subtest displays EVEN DOTS, ODD DOTS and ALL DOTS in the 640x200 dots graphics mode (modes 6 and E) as shown below:

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

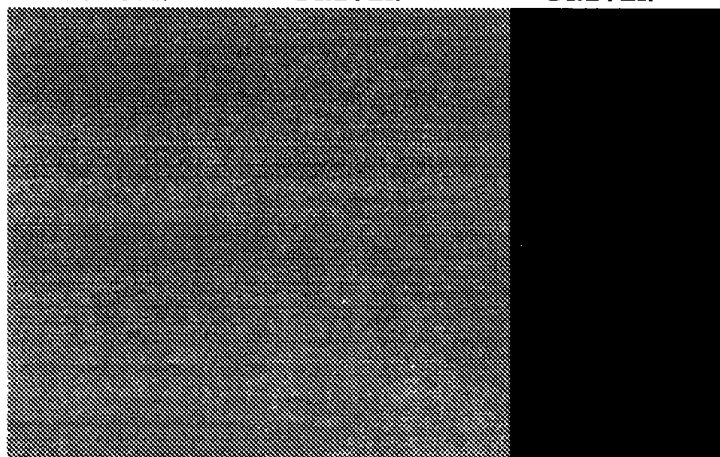


PRESS [ENTER] KEY

Subtest 07 640x400 Graphics display

This subtest displays EVEN DOTS, ODD DOTS, ALL DOTS in the 640x350 and 640x480 dots graphics mode (modes 10 and 12) as shown below:

640*xxx GRAPHICS DISPLAY : [xx]
EVEN DOTS ODD DOTS ALL DOTS
DRIVEN DRIVEN DRIVEN



PRESS [ENTER] KEY

Subtest 08 Display page

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

DISPLAY PAGE 0

```
000000000000000000000000000000000000000000000000000000000000000000
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
000000000000000000000000000000000000000000000000000000000000000000
```

Subtest 09 “H” pattern display

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

```
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
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HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
```

After the H characters are displayed, press **Enter** and the following message is displayed:

Setting the color CRT (1:yes / 2:no)

If you select yes (by typing in **1** and pressing **Enter**):
When the color CRT is connected to the computer, the seven border colors are displayed on the screen.

If you select no (by typing in **2** and pressing **Enter**):
The display will return to the subtest menu.

Subtest 10 LED/DAC pallet

This subtest displays as follows:

DISPLAY TEST IN PROGRESS 410000

```
T3200SXC DIAGNOSTIC TEST x.xx
[Ctrl]+[Break]: test end
[Ctrl]+[C] : key stop
```

SUB-TEST : 10
PASS COUNT: 00000 ERROR COUNT: 00000
WRITE DATA: 00 READ DATA : 00
ADDRESS : 00000 STATUS : 000

[Speed/CRT/Caps/Num/Scroll LED test]

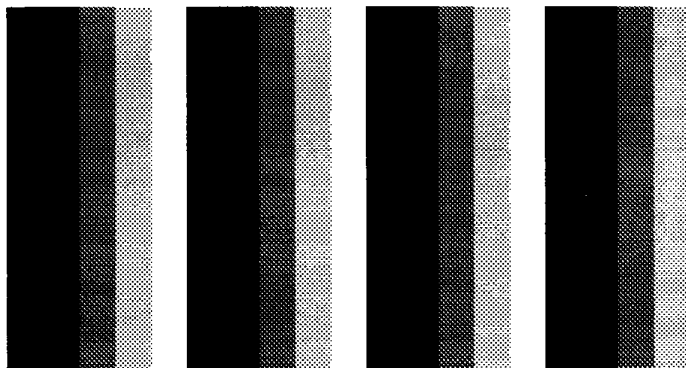
- (1) Press [Caps Lock] key !...Caps (on/off)
- (2) Press [Num lock] key !...Num (on/off)
- (3) Press [Scroll lock] key !...Scroll (on/off)

PRESS [ENTER] KEY

Check the Caps Lock LED, Num Lock LED and Scroll Lock LED lights by pressing the **Caps Lock** key, **Num Lock** key, and **Scroll Lock** key. Then press **Enter** and this subtest writes constant data (2AH/15H) to the DAC registers.

Subtest 11 TFT 57 color display

This subtest displays 57 red, green, and blue color scales on the screen.



3.8 FLOPPY DISK TEST

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

OPERATION

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

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

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

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

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

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

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

If you do not specify a start track number and press **Enter**, the start track number will default to zero.

If you desire, select the start track number and press **Enter**. Then the subtest menu for the floppy disk test will appear.

5. During the floppy disk test, the message shown below will appear:

```
FLOPPY DISK      IN PROGRESS          XXXXXXXX

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

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.

CONTENTS

Subtest 01 Sequential read

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

The tracks available for the floppy disk formats are:

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

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

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

The start track can be specified when you select the floppy disk diagnostics.

Subtest 02 Sequential read/write

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

The data pattern is B5ADADH repeated.

Subtest 03 Random address/data

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

Subtest 04 Write specified address

This subtest writes the specified data to 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 a read operation from the specified address that you enter from the keyboard. You can specify the track number and head number.

Subtest 02 Function

This subtest prints out various print types as shown below:

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

Subtest 03 Wraparound

NOTE: A printer wraparound connector is necessary for executing this subtest. The wiring diagram for the printer wraparound connector is described in Section 3.25.

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

3.10 ASYNC TEST

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

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

Subtest 01 Wraparound (board)

NOTE: *The RS-232-C wraparound connector must be connected to the SERIAL A CONNECTOR to execute this subtest. The wiring diagram of the RS-232-C wraparound connector is described in Section 3.25.*

A data send/receive test is performed with the wraparound connector for the channel number you selected.

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

NOTE: *The RS-232-C direct cable (9-pin to 9-pin) must be connected to channels 1 and 2 to execute this test. The wiring diagram of the RS-232-C direct cable is described in Section 3.25.*

The same test as described for subtest 01 is performed for the channel #1 <=> #2.

Subtest 03 Point to point (send)

NOTE: *To execute this subtest, two computers must be connected with the RS-232-C direct cable. One computer should be set as 'send' and the other set as 'receive'. The wiring diagram for the RS-232-C direct cable is described in Section 3.25. By executing subtest 03 in one computer and subtest 04 in the other computer, the communication capability is checked as follows.*

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

Subtest 04 Point to point (receive)

This subtest is used with subtest 03 as described above.

Subtest 05 Card modem loopback (1200 bps)

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

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

Subtest 06 Interrupt test (IRQ4, 3, 5)

This subtest generates the interrupt request levels (IRQs) 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, 05, 06, 08, 09 or 10 is executed. Before running the test, transfer the contents of the hard disk to a 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 DIAGNOSTIC 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 **Enter**. The following message will appear:

`HDC F/W error retry (1:yes,2:no) ?`
3. This message is used for selecting to retry the operation when the hard disk controller detects an error. Type in **1** or **2** and press **Enter**. The following message will appear:

`Data compare error dump (1:no,2:yes) ?`
4. This message is used for selecting to perform a dump operation when a data compare error is detected. Type in **1** or **2** and press **Enter**. The following message will appear:

`Detail status display (1:no,2:yes) ?`
5. This message is used for selecting to display the detail status on the screen. The detail statuses are described in Table 3-4 of Section 3.16. Type in **1** or **2** and press **Enter**.

6. During the hard disk test, the message shown below will appear:

```
HARD DISK TEST                XXXXXXXX

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

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.

CONTENTS

Subtest 01 Sequential read

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

Subtest 02 Address uniqueness

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

1. By 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 **Enter**.

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) that is shifted cylinder by cylinder then reads the data out and compares it to the original data.

Worst pattern data is B5ADAD, B5A5252, EB5DB6, 149249, 63B63B, 9C49C4, 2DB6DB and 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

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

Subtest 09 Sequential write

This subtest writes 2 bytes of specified data 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 it with the original data.

3.12 REAL TIMER TEST

Subtest 01 Real time

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

Operations for the subtest are as follows:

1. By selecting this 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 the current date is not correct, input the correct date and press **Enter**. Then the following message will appear:

Enter new time:

3. If the current time is not correct, input the correct time and press **Enter**. This returns you to the subtest menu of the Real Time Test.

Subtest 02 Backup memory

This subtest writes data (01H, 02H, 04H,..., 80H, FEH, FBH, FDH,...7FH, AAH, 55H) to 50 bytes of the backup memory (addresses 0EH to 3FH), and then reads and compares it with the original data.

Subtest 03 Real time carry

<p><i>NOTE: When this subtest is executed, the current date and time are erased.</i></p>
--

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

3.13 NDP TEST

NOTE: This test cannot be executed if a numeric data processor (NDP) is not mounted on the system board.

Subtest 01 NDP test

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

3.14 EXPANSION UNIT TEST

NOTE: *If an expansion unit is not connected to the computer, this test cannot be executed.*

Subtest 01 Box wraparound

NOTE: *To execute this subtest, a wraparound board must be installed in the expansion unit.*

The following tests are executed:

- Clock test (OSC, CLK, ALE)
- Interrupt test (IRQ3,5)
- DMA test (channel #1,3 or TC status)
- Data bus test (00H-FFH)
- Address bus test (A0000H-A0000H)
- Wait CNT test

Subtest 02 Box mono video-RAM

NOTE: *To execute this subtest, a monochrome display card must be installed in the expansion unit.*

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

Subtest 03 Wraparound test (51 bus)

NOTE: *To execute this subtest, a wraparound board must be installed in the expansion unit.*

The following tests are executed:

Clock test (OSC, CLK, ALE, DACK0)
Interrupt test (IRQ7-3, IRQ14, IRQ12-9)
DMA#1 test (channel 1...3, or TC status)
Data bus test (00H-FFH)
Address bus test (C0000H-CFFFFH)
Memory W/R test
IO16 test
MASTER test
DMA#2 test (channel 5, 6)
CCMCS test
MDSPK test (buzzer)
A17-23 test (B80000H, B40000H)

Subtest 04 Wraparound test (32 bus)

NOTE: *To execute this subtest, a wraparound board must be installed in the expansion unit.*

The following tests are executed:

Clock test (OSC, CLK, ALE, DACK0)
Interrupt test (IRQ7-3, IRQ14, IRQ12-9)
DMA#1 test (channel 1...3, or TC status)
Data bus test (00H-FFH)
Address bus test (C0000H-CFFFFH)
Memory W/R test
IO16 test
MASTER test
DMA#2 test (channel 5, 6)
-12, +12, -5V test
A17-23 test (680000H, 640000H)

3.15 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

Device name	Error code	Error status name
COMMON	FF	Data Compare Error
SYSTEM	01	ROM Checksum Error
MEMORY	01 02	Parity Error Protected Mode Not Change Error
FDD	01 02 03 04 06 08 09 10 20 40 60 80 EE	Bad Command Address Mark Not Found Write Protected Record Not Found Media Removed DMA Overrun Error DMA Boundary Error CRC Error FDC Error Seek Error FDD Not Drive Time Out Error Write Buffer Error
ASYNC	01 02 04 08 10 20 40 80 88 33 34 36	DSR Off Time Out CTS Off Time Out RX-Enable Time Out TX-Buffer Full Time Out Parity Error Framing Error Overrun Error Line Status Error Modem Status Error No Carrier (CARD MODEM) Error (CARD MODEM) No Dial Tone (CARD MODEM)
PRINTER	01 08 10 20 40 80	Time Out Fault Select Line Out Of Paper Power Off Busy Line

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

Device name	Error code	Error status name
HDD	01	Bad Command Error
	02	Bad Address Mark
	04	Record Not Found
	05	HDC Not Reset
	07	Drive Not Initialize
	09	DMA Boundary Error
	0A	Bad Sector Error
	0B	Bad Track Error
	10	ECC Error
	11	ECC Recover Enable
	20	HDC Error
	40	Seek Error
	80	Time Out Error
	AA	Drive Not Ready
	BB	Undefined
	CC	Write Fault
	E0	Status Error
F0	Not Sense Error (HW.code=FF)	
NDP	01	No Co-processor
	02	Control Word Error
	03	Status Word Error
	04	Bus Error
	05	Addition Error
	06	Multiply Error

3.16 HARD DISK TEST DETAIL STATUS

When an error occurs in 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 an eight-unit number. The first XXXX is the error status and the last XXXX is not used.

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

These contents are described in 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" ... Hard disk drive heads are settled over a track. "1" ... 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 (Uncorrectable)	"0" ... There is no uncorrectable data error. "1" ... Uncorrectable data error has been detected.
5		Not used.
4	IDNF (Identification)	"0" ... Otherwise. "1" ... There was no ID field in the requested sector.
3		Not used.
2	ABRT (Abort)	"0" ... Otherwise. "1" ... Illegal command error or a drive status error occurs.
1	TK0 (Track 0)	"0" ... Hard disk has found track 0 during a recalibrate command. "1" ... Hard disk could not find track 0 during a recalibrate command.
0		Not used.

3.17 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:

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

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

3.17.1 Program Description

1. All track FORMAT

Performs physical formatting of the hard disk as shown in Table 3-6 below:

Table 3-6 Hard disk formatting sequence

Items	40MB	120MB
Sector sequences	1	1
Cylinders	0 to 979	0 to 930
Heads	0 to 4	0 to 14
Sectors	1 to 17	1 to 17
Sector length	512 bytes per sector	512 bytes per sector
Bad track (max.)	40 tracks	39 tracks

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.

3.17.2 Operations

CAUTION: After physical formatting is finished, enter the MS-DOS FDISK command, which will partition the hard disk. 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 Vx.xx

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

Press [NUMBER] key ?

2. All track FORMAT selection

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

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

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

Interleave number (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 completely destroyed]

Press [Bad track number (CCCH) key ?

- (4) After pressing **Enter**, the following message will appear and all cylinders of the hard disk are formatted and checked.

[[cylinder, head = xxx x]]

- (5) After formatting the hard disk, the following message will appear:

Format complete

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

3. Good track FORMAT or bad track FORMAT selection

- (1) When 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 1). Type the number and press **Enter**. The following message will appear:

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

Press [Bad 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.) The following message is displayed and the good tracks or bad tracks are formatted as selected.

[[cylinder, head = xxx x]]

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 specified hard disk track, the following message will appear:

Format complete

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

4. **Bad track CHECK selection**

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

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

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

Interleave number (3/1-3) ?

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

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

```
[WARNING : Current DISK data will be completely destroyed]  
[[cylinder, head = xxx x]]
```

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

Format complete

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

3.18 SEEK TO LANDING ZONE (HDD)

3.18.1 Program Description

When transporting the computer, the HDD heads can hit a surface on the HDD containing data. This can damage the surface, thus causing a permanent loss of data. To protect the HDD and its data, the SEEK TO LANDING ZONE program moves the HDD heads to areas called the “landing zone.”

NOTE: The built-in hard disk drive automatically moves the heads to the landing zone at power down.

3.18.2 Operations

1. After pressing **3** and **Enter** in the DIAGNOSTICS MENU, this program is automatically executed and the following message will appear:

Landing seek completed. (HDD#1)
Press [Enter] key.

2. After pressing **Enter**, the DIAGNOSTICS MENU appears.

3.19 HEAD CLEANING

3.19.1 Program Description

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

3.19.2 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 following message appears, FDD head cleaning will begin:

Cleaning start

4. When cleaning is finished, the display automatically returns to the DIAGNOSTICS MENU.

2. Error information displayed on the screen can be manipulated with the following number keys:

Number

Key

Function

1	Scrolls the display to the next page.
2	Scrolls the display to the previous page.
3	Returns the display to the DIAGNOSTICS MENU.
4	Erases all error log information in RAM.
5	Outputs error log information to a printer.
6	Reads log information from a floppy disk.
7	Writes log information to a floppy disk.

3.21 RUNNING TEST

3.21.1 Program Description

This program automatically executes the following tests in sequence:

1. System test (subtest number 01)
2. Memory test (subtest number 01, 02, 03, 04)
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 (subtest number 02)

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

3.21.2 Operations

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

1. Remove the Diagnostics Disk and insert the work disk into the floppy disk drive.
2. After pressing **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 computer.) The following message will appear:

```
Async#1 wrap around test (Y/N) ?  
Async#2 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 SER. A or SER. B connector on the back of the unit.)
5. This program is repeated continuously. To stop the program, press **Ctrl+Break**.

3.22 FDD UTILITIES

3.22.1 Program Description

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

1. FORMAT

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

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

- (1) 2D: Double-sided, double-density, 48/67.5 TPI, MFM mode, 512 bytes, 9 sectors/track.
- (2) 2DD: Double-sided, double-density, double-track, 96/135 TPI, MFM mode, 512 bytes, 9 sectors/track.
- (3) 2HD: Double-sided, high-density, double-track, 96/135 TPI, MFM mode, 512 bytes, 18 sectors/track.

2. COPY

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

3. DUMP

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

3.22.2 Operations

1. After pressing **7** and **Enter** 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

PRESS [1] - [9] KEY

2. **FORMAT** selection

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

DIAGNOSTICS - FLOPPY DISK FORMAT : Vx.xx
Drive number select (1 = A:, 2 = B:) ?

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

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

- (3) Select a media/drive type number. Type the number and press **Enter**. A message similar to the one below will appear:

Warning : Disk data will be destroyed.

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

- (4) Remove the Diagnostics Disk from the FDD and insert the work disk; press any key. The following message will appear; 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 step (3) above. If you type **2** and press **Enter**, the display will return to the **DIAGNOSTICS MENU**.

3. COPY selection

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

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

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

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

- (3) Remove the Diagnostics Disk from the FDD and insert the source disk; press any key. The following message appears, and the command starts the copying to memory:

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

Copy start

- (4) Remove the source disk from the FDD and insert the target disk (formatted); press any key. The following message will appear and start the copying to the target disk. When copying cannot be done with one operation, the message in step (2) is displayed again. Repeat the operation.

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

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

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

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

4. DUMP selection

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

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

- (2) Select a format type number. Type the number and press **Enter**. If 3 is selected, the dump lists for the hard disk are displayed automatically and the display will go to the message in step (5) below.

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

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

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

- (4) Select an FDD drive number by typing 1 or 2 and pressing **Enter**. The following message will appear:

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

- (5) Remove the Diagnostics Disk from the FDD and insert a source disk; press any key. The **Track number ??** message will appear. Type the track number and press **Enter**.

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

- (7) The **Sector number ??** message will appear. Type the sector number and press **Enter**. The specified dump list will be displayed.

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

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

If you type 1, the next sector dump will be displayed. If you type 2, the previous sector dump will be displayed. If you type 3, the following message appears:

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

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

3.23 SYSTEM CONFIGURATION

3.23.1 Program Description

This program displays the following system configuration information:

1. BIOS ROM version
2. Base memory size
3. Display type
4. Number of floppy disk drives
5. Number of async ports
6. Number of hard disk drives
7. Number of printer ports
8. Co-processor presence
9. Extended memory size

3.23.2 Operations

After pressing **8** and **Enter** in the DIAGNOSTICS MENU, a display similar to the following will appear:

SYSTEM CONFIGURATION

```
*- BIOS ROM VERSION = Vx.xx
*- xxxKB MEMORY
*- COLOR/GRAPH (80-column)
*- 1 FLOPPY DISK DRIVE(S)
*- 2 ASYNC ADAPTER(S)
*- 1 HARD DISK DRIVE(S)
*- 1 PRINTER ADAPTER(S)
*- 0 MATH CO-PROCESSOR
*- xxxxxKB EXTENDED MEMORY
```

PRESS [ENTER] KEY

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

3.24 SETUP

Refer to Chapter 7 (System Configuration) in the T3200SXC Reference Manual for details on this program.

3.25 WIRING DIAGRAMS

1. Printer wraparound connector

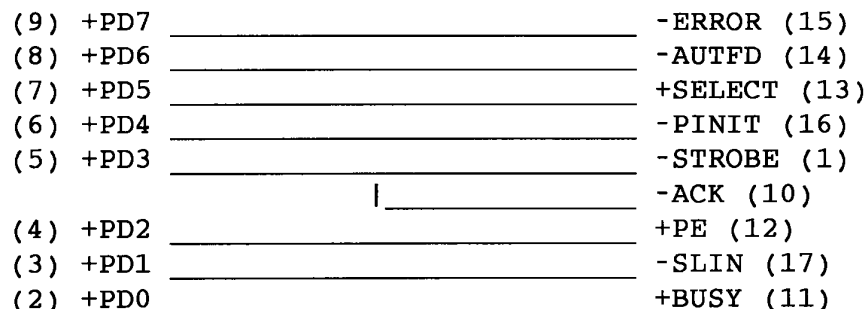


Figure 3-1 Printer wraparound connector

2. RS-232-C wraparound connector

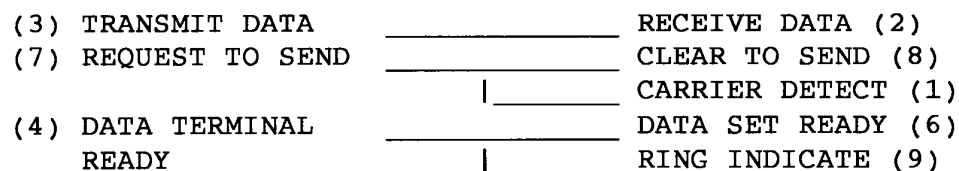


Figure 3-2 RS-232-C wraparound connector

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

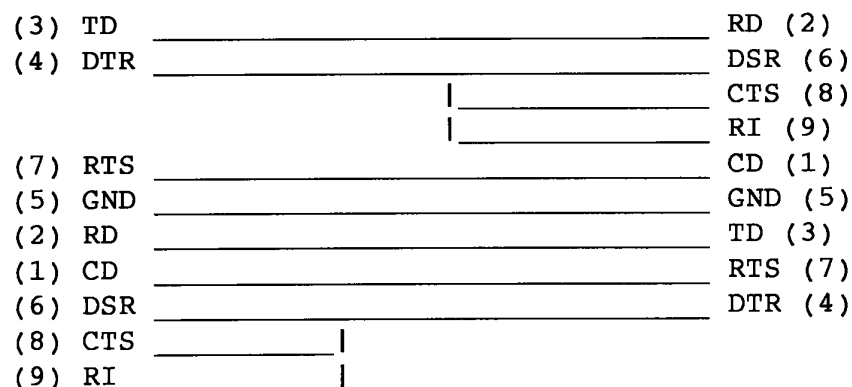


Figure 3-3 RS-232-C direct cable (9-pin to 9-pin)

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

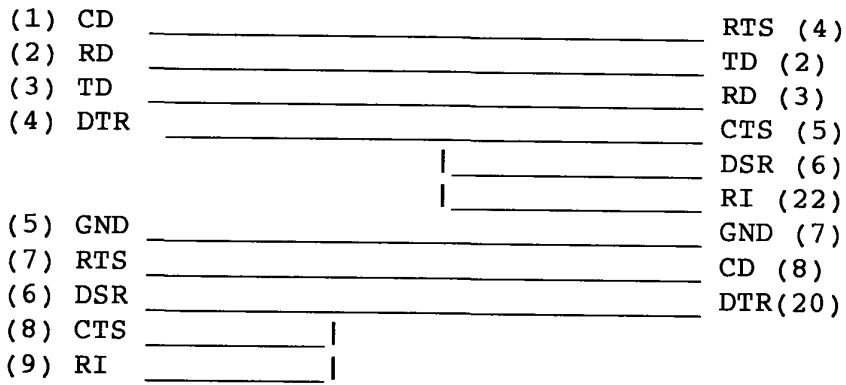


Figure 3-4 RS-232-C direct cable (9-pin to 25-pin)

4.1 GENERAL

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

FRUs are listed as follows:

1. Keyboard
2. Speaker
3. LCD module
4. FL inverter
5. LED board
6. LCD cover assembly
7. Top cover
8. Fan
9. LCD sensor
10. Power supply
11. HDD
12. Lithium battery
13. FDD
14. Back panel board
15. Modem connector cable
16. System board
17. Memory board

The following points must be kept in mind:

1. The computer should never be disassembled unless there is a problem (abnormal operation, etc.).
2. Use only the tools specified below.
3. Keep the computer free of dust and moisture.
4. Exercise electrostatic discharge prevention measures to avoid damaging the computer.
5. After deciding the purpose of replacing an FRU and the procedures required, do not perform any other procedures which are not absolutely necessary.
6. Be sure to turn the POWER switch off before beginning.
7. Be sure to disconnect the AC power cord and all external cables from the computer.
8. Perform only those steps given in each procedure.
9. After replacing an FRU, confirm that the computer is operating normally.
10. The numerous screws securing the computer are not interchangeable. When reassembling the computer, follow the appropriate procedures and figures which provide the various screw dimensions.
11. If an FRU/part description is different between this Maintenance Manual and the Parts Catalog, the Parts Catalog description will be given in parentheses.

Tools needed for FRU replacement:

1. Phillips head screwdriver
2. Tweezers

4.2 REMOVING/REPLACING THE KEYBOARD AND SPEAKER

1. Disconnect the AC power cord from the computer.
2. Turn the computer upside down and remove the four 3x8 black screws (A) from the bottom cover.

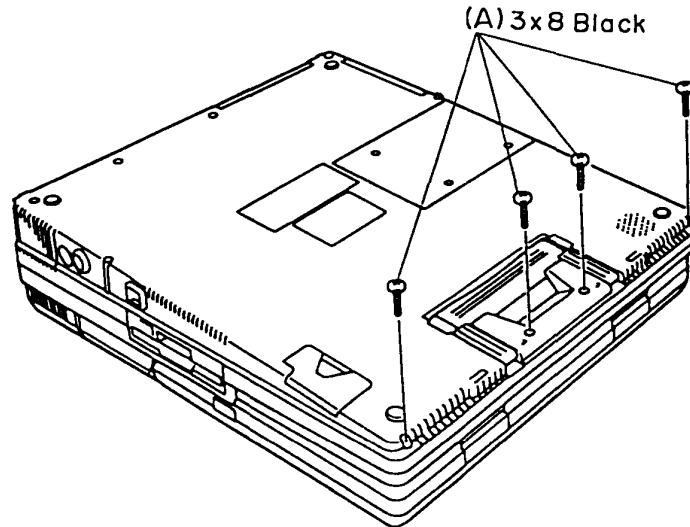


Figure 4-1 Removing the four screws

3. Turn the computer back over and open the display.
4. Lift up the front edge of the keyboard unit (B) and gently place it in front of the computer.

CAUTION: The keyboard unit is still connected to the system board with the keyboard cable. Be careful not to pull on the keyboard unit, or you could damage the system board and/or the keyboard unit.

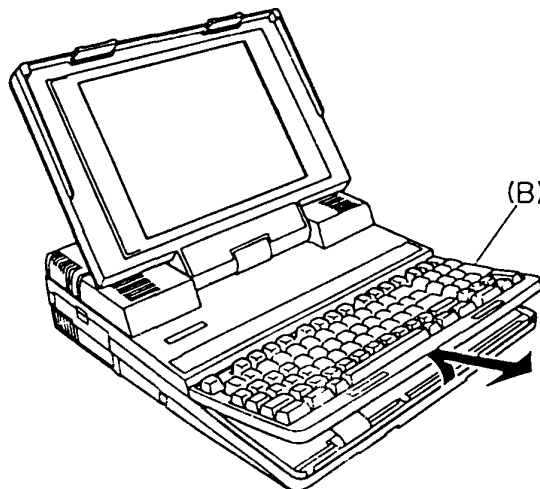


Figure 4-2 Removing the keyboard unit

5. Remove the two 3x8 screws (C) from the shield plate (D). Lift up the front edge of the shield plate to pull it out.
6. Release the pressure plate (E) of the PJ4 keyboard connector (F) to disconnect the keyboard cable (G) from the system board (H).

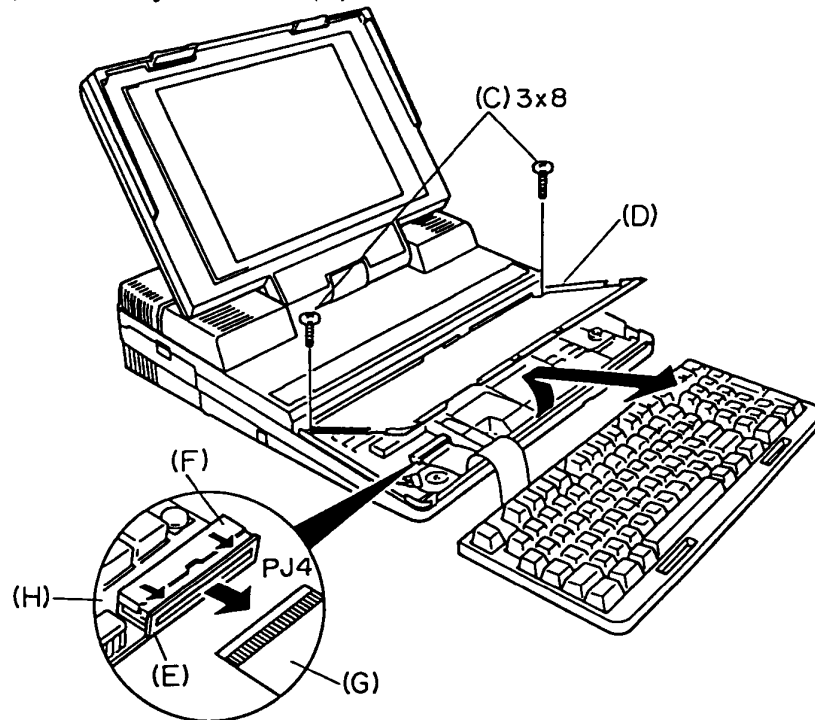


Figure 4-3 Removing the shield plate and disconnecting the keyboard cable

7. Release the four latches (I) and then pull the keyboard mask (J) off of the keyboard (K).

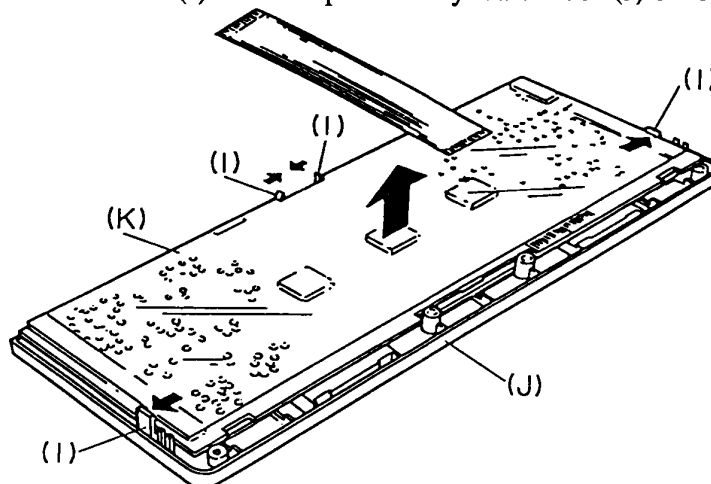


Figure 4-4 Removing the keyboard

8. Disconnect the speaker cable (L) from connector PJ5 on the system board.
9. Remove the two 3x4 silver screws (M) and then remove the speaker.

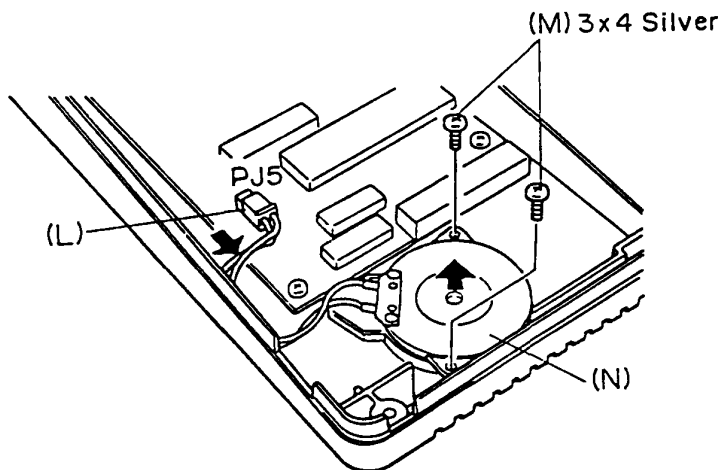


Figure 4-5 Removing the speaker

10. To install the keyboard and the speaker, follow the above procedure in reverse.

4.3 REMOVING/REPLACING THE LCD AND FLs

1. Disconnect the AC power cord from the computer.
2. Using tweezers, peel off the label (A) from the LCD mask (B). Then remove the two rubber cushions (C).
3. Remove the four 3x6 screws (D) and then remove the LCD mask by pulling it up.

NOTE: For reassembly make sure that the LCD mask is secured with the six latches (E).

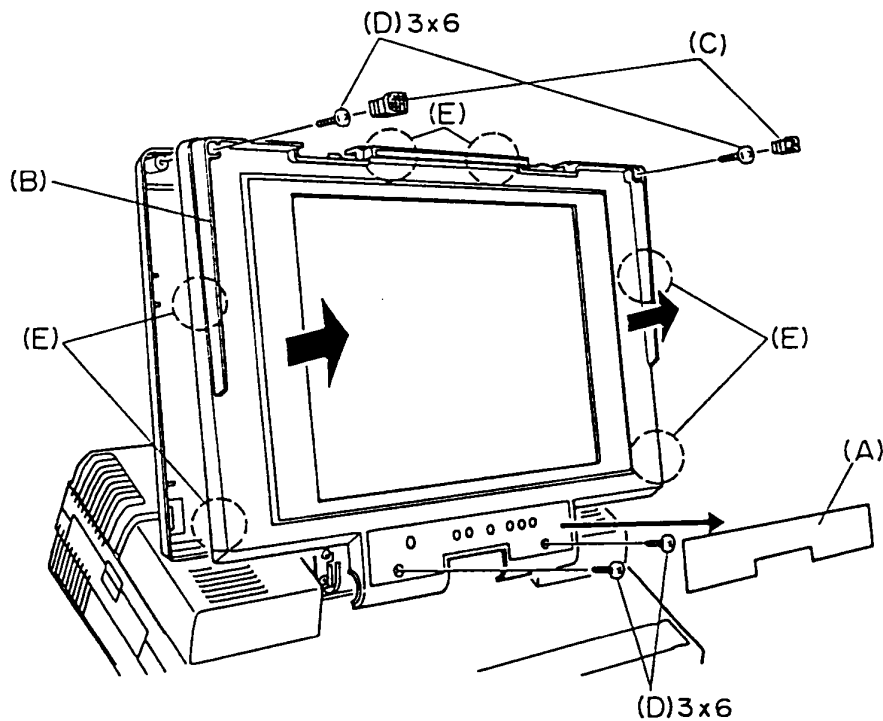


Figure 4-6 Removing the LCD mask

4. Remove the four 3x6 screws (F) from the LCD cover (G). To remove the LCD (H), disconnect the three cables (I) from each connector (J) in the back of the LCD.

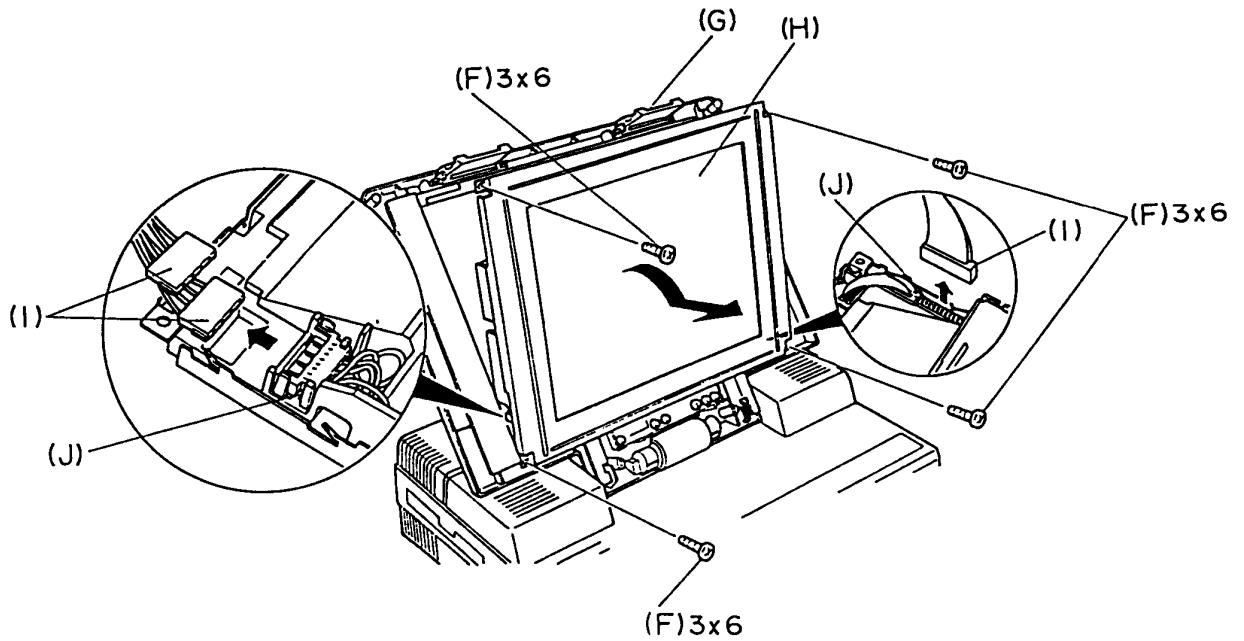


Figure 4-7 Removing the LCD unit

5. Turn the LCD module face down and release the right or left latches (K). Slide the two FL shield plates (L) out and away from the LCD module.

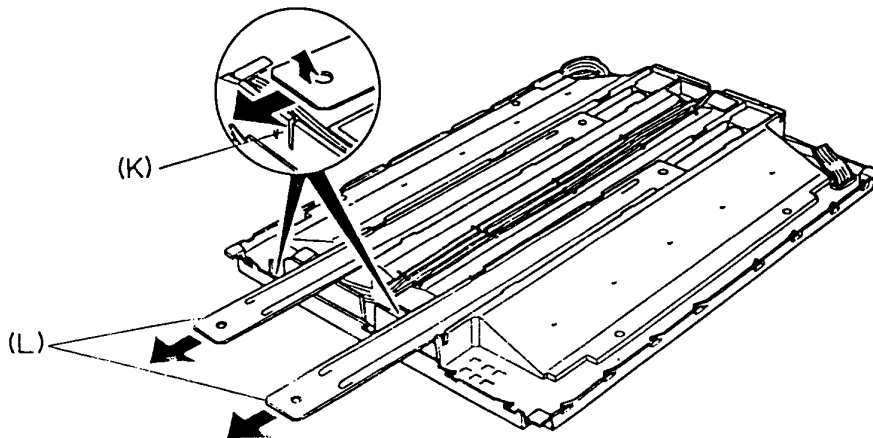


Figure 4-8 Removing the two FL shield plates

6. Remove the four rubber cushions (M).

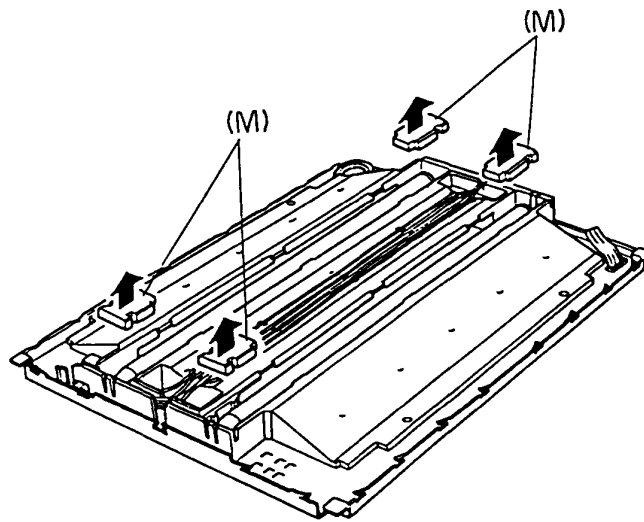


Figure 4-9 Removing the four rubber cushions

7. Remove the cable (N). Release the four latches (O) to remove the two connectors (P) and then remove the two FLs (Q).

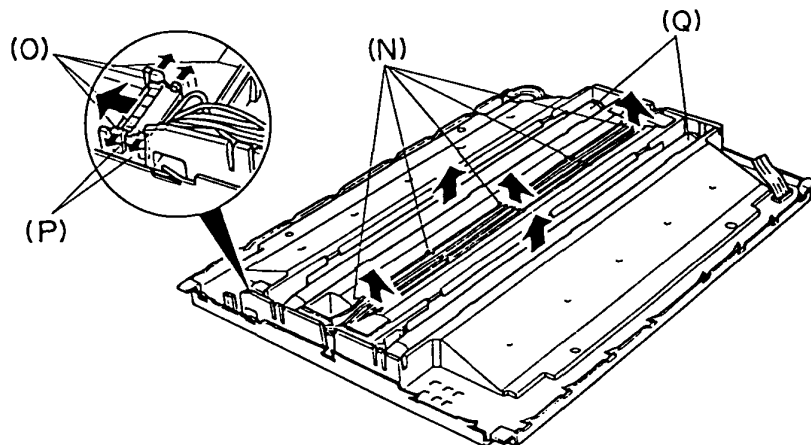


Figure 4-10 Removing the two FLs

8. To install the LCD and FLs, follow the above procedure in reverse.

4.4 REMOVING/REPLACING THE FL INVERTER AND LED BOARD

1. Remove the LCD as instructed in Section 4.3.
2. To remove the FL inverter (A), remove the three 3x6 screws (B) and disconnect the FL inverter cable (C) from connector PJ1 (D).
3. Disconnect the two FL cables (E) from connectors PJ2 and PJ3 (F) on the FL inverter.

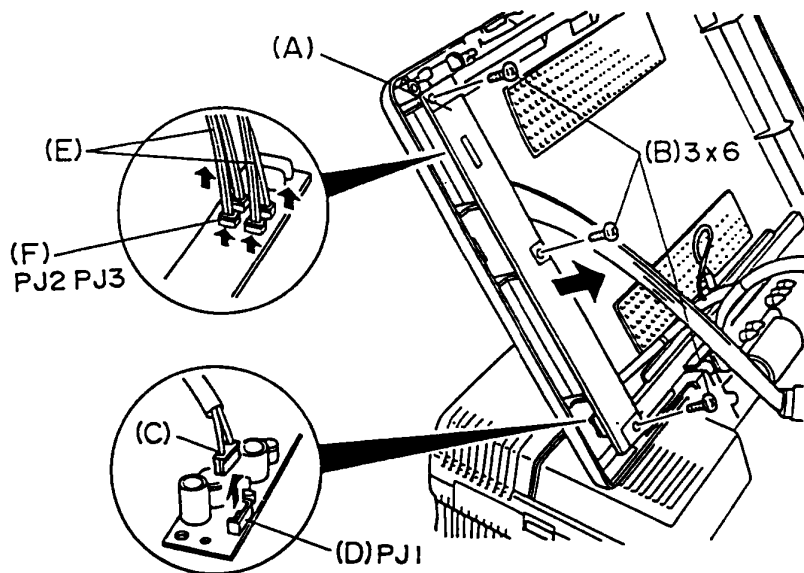


Figure 4-11 Removing the FL inverter

4. Release the latch (G) that secures the LED board (H) and then remove the LED board from the LCD cover (I).
5. Remove the LED signal cable (J) from connector PJ201 (K) on the LED board.

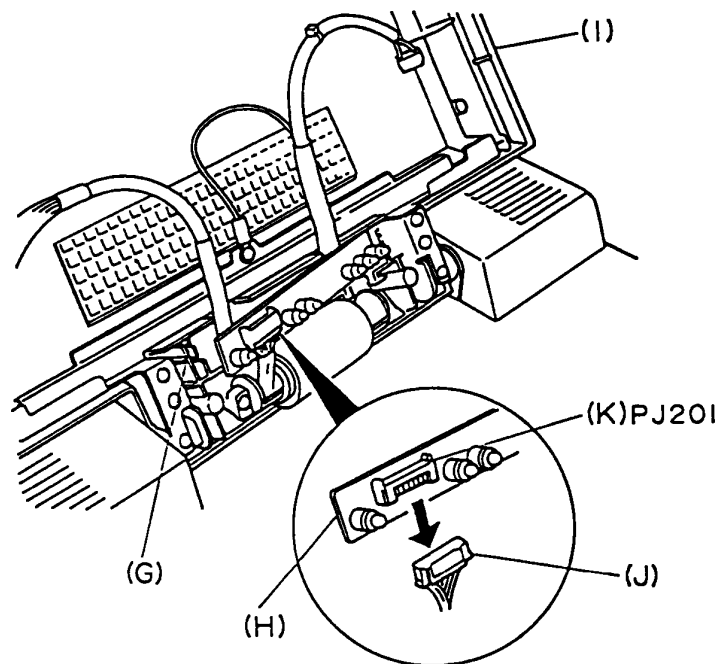


Figure 4-12 Removing the LED board

6. To install the FL inverter board and the LED board, follow the above procedure in reverse.

CAUTION: When installing the LED board, make sure that the power cable and the signal cable for the LCD are properly routed through the hollows in the LCD cover. If the power cable or the signal cable is pinched between the ribs of the LCD cover and the LED board, the computer will be damaged.

4.5 REMOVING/REPLACING THE LCD COVER ASSEMBLY

1. Remove the LCD and the LED board as instructed in Sections 4.3 and 4.4.
2. Remove the two 3x4 silver screw (A) and then remove the ground cable (B).
3. Remove the six 3x8 screws (C). Then remove the two shaft holders (D) and reinforce plate (E), shown in Figure 4-13.
4. Remove the LCD cover assembly (F) from the computer while rotating the LCD cover assembly forward.

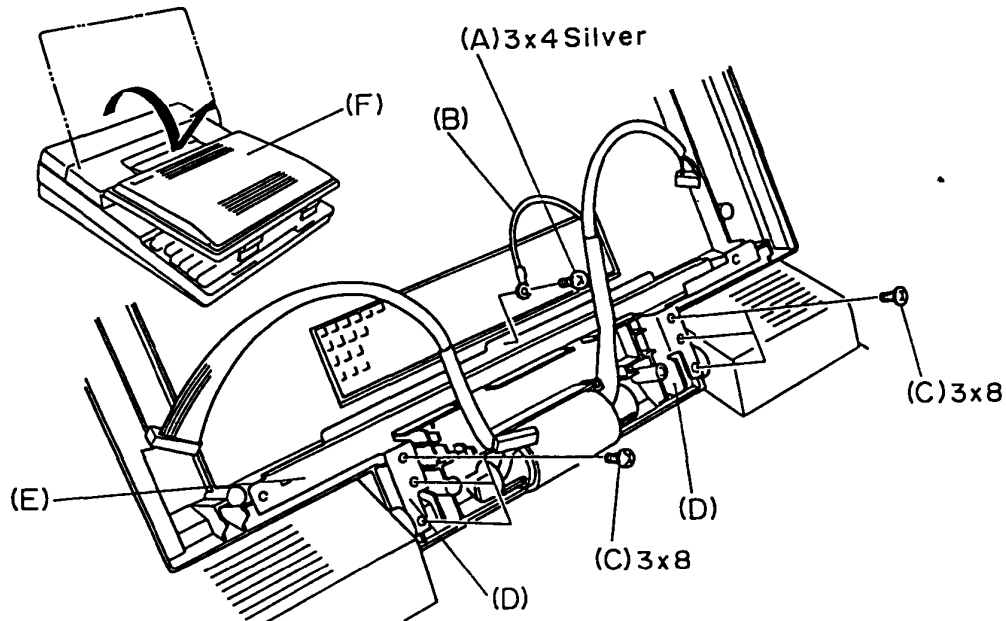


Figure 4-13 Removing the LCD cover assembly

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

4.6 REMOVING/REPLACING THE TOP COVER

1. Turn the computer upside down and remove the six 3x8 black screws (A).

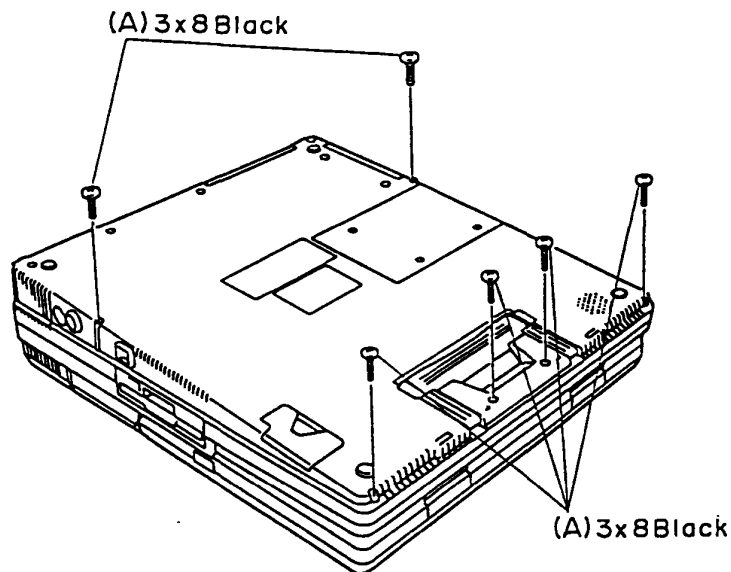


Figure 4-14 Removing the six screws

2. Turn the computer back over. Then remove the keyboard and LCD cover assembly as instructed in Sections 4.2 and 4.5.
3. Remove the two 3x6 screws (B) from the cable guide. Then remove the front cable guide (C).

NOTE: Support the cable guide from behind as you remove the two screws.

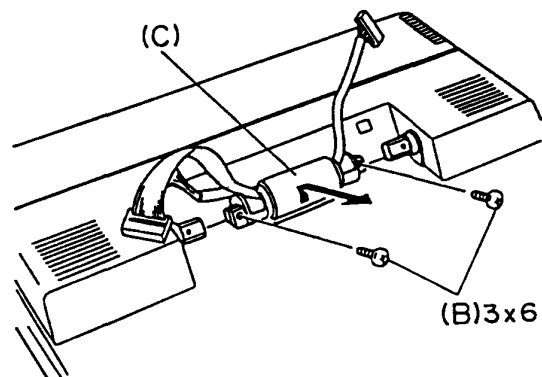


Figure 4-15 Removing the front cable guide

4. Remove the two 3x6 black screws (D) and then remove the rear panel (E). Remove the remaining three 3x6 black screws (F).

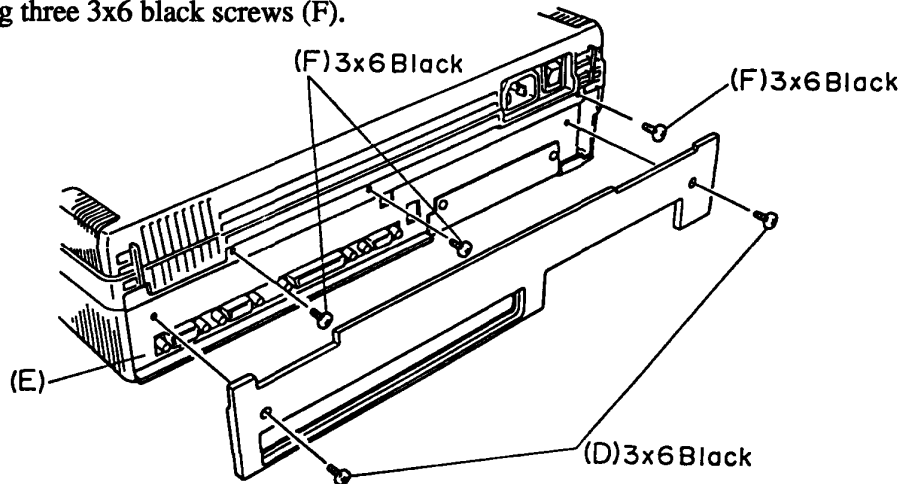


Figure 4-16 Removing the rear panel and five screws

5. Remove the two mask top covers (H) from the top cover (I) by sliding them outward. Remove the two 3x6 screws (J) under the mask top covers and the one 3x6 screw (K) in front of the top cover. Gently lift up the top cover and set it aside.

CAUTION: As you lift the top cover, gently guide the two cables through the opening in the top cover.

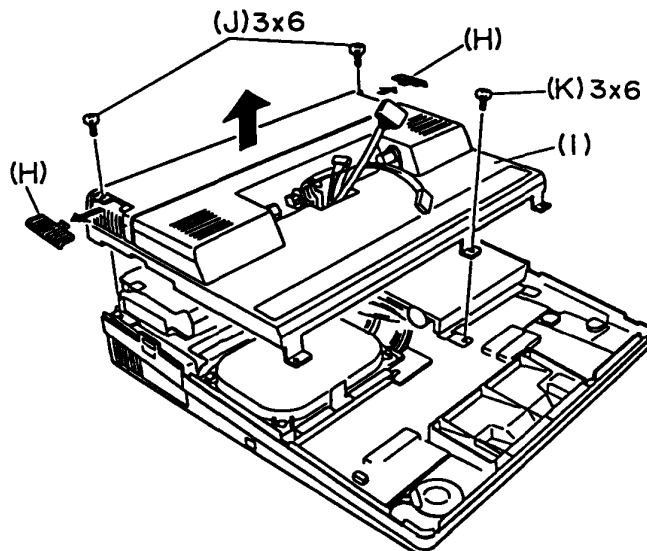


Figure 4-17 Removing the top cover

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

CAUTION: For reassembly, gently guide the two cables through the opening in the top cover, making sure the cables are not twisted or pinched once the top cover is in place.

4.7 REMOVING/REPLACING THE HDD

1. Remove the top cover as instructed in Section 4.6.
2. Disconnect the HDD power supply cable (E) from the HDD.
3. Remove the three 3x6 screws (A) securing the HDD unit (B).
4. Disconnect the HDD signal cable (C) from connector PJ8 (D) and the HDD power supply cable (E) from connector PJ5 (F) on the system board.

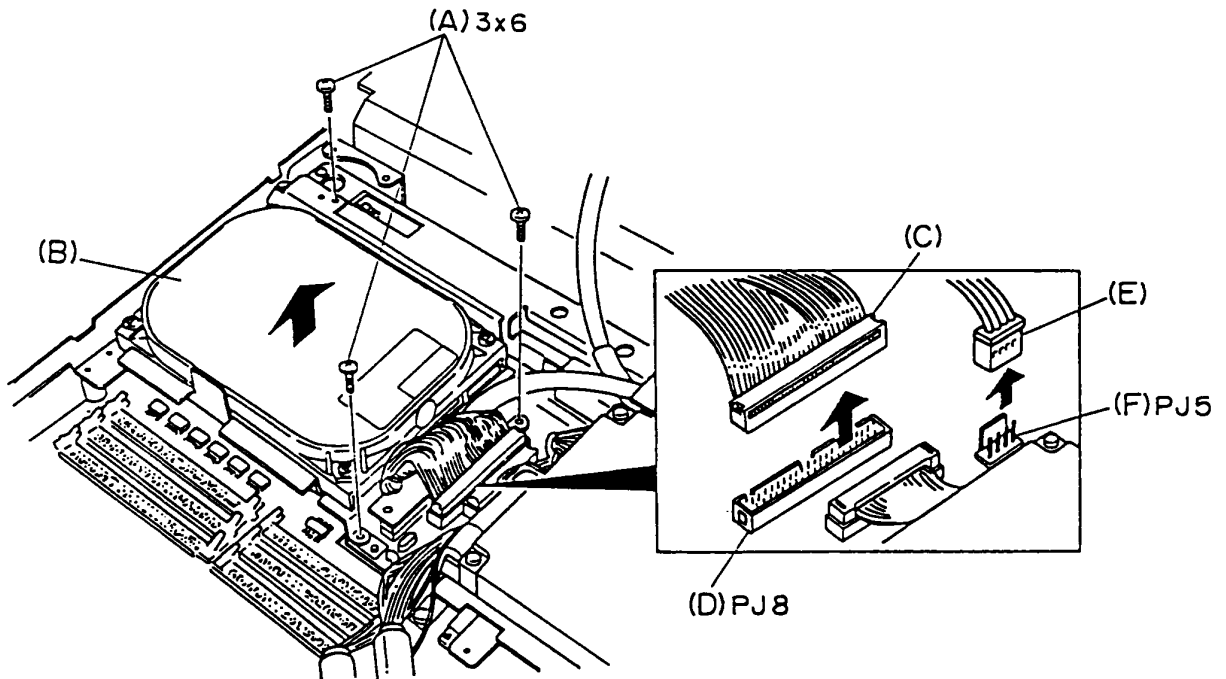


Figure 4-18 Removing the HDD unit

5. Remove the four inch screws (G) and then remove the HDD (H) from the HDD support (I).

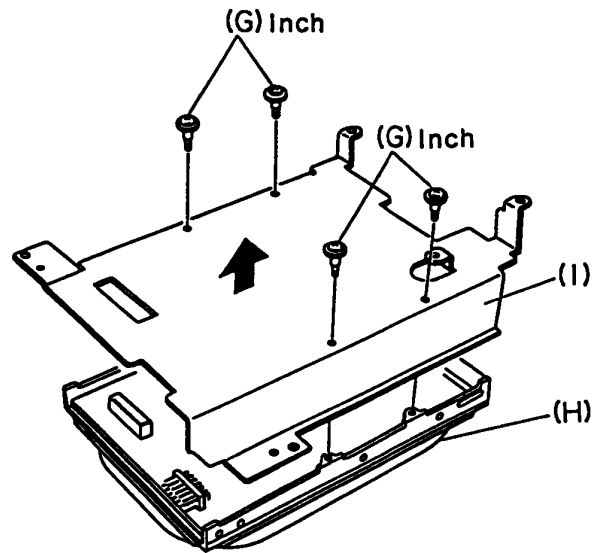


Figure 4-19 Removing the HDD

6. To install the HDD, follow the above procedure in reverse.

4.8 REMOVING/REPLACING THE FAN AND LCD SENSOR

1. Remove the top cover as instructed in Section 4.6.
2. To remove the fan (A), disconnect the fan cable (B) from the fan connector PJ6 (C). Remove the two 3x25 screws (D) from the fan (A).
3. To remove the LCD sensor (E), disconnect the LCD sensor cable (F) from connector PJ5 (G) on the back panel board. Then remove the flat head screw (H) from the LCD sensor.

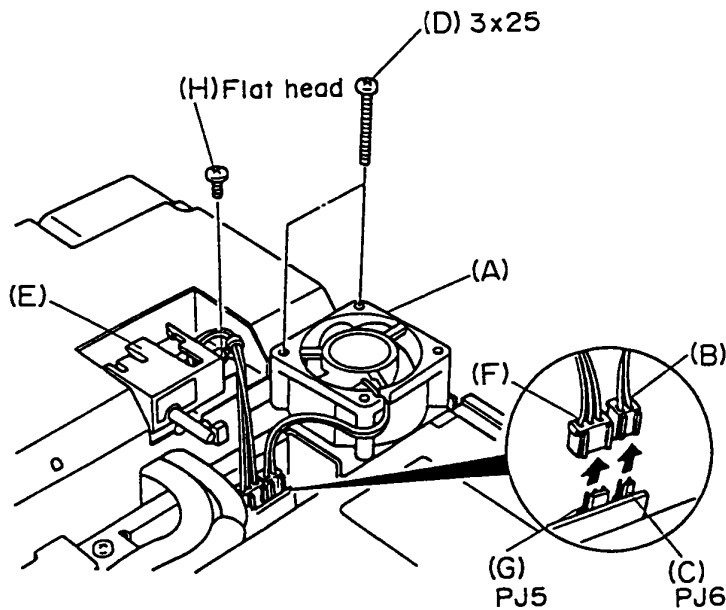


Figure 4-20 Removing the fan and the LCD sensor

4. To install the fan and the LCD sensor, follow the above procedure in reverse.

4.9 REMOVING/REPLACING THE POWER SUPPLY

1. Remove the top cover, fan, LCD sensor, and HDD as instructed in Sections 4.6, 4.7, and 4.8.
2. Disconnect the power supply cable (A) from connector PJ14 (B) on the system board. Then remove the four 3x4 silver screws (C) and one 3x6 screw (D) from the power supply cable bracket (E) to remove the power supply unit (F).

NOTE: When reinserting the power supply cable into connector PJ14, make sure the latch (G) on the cable clicks firmly into place.

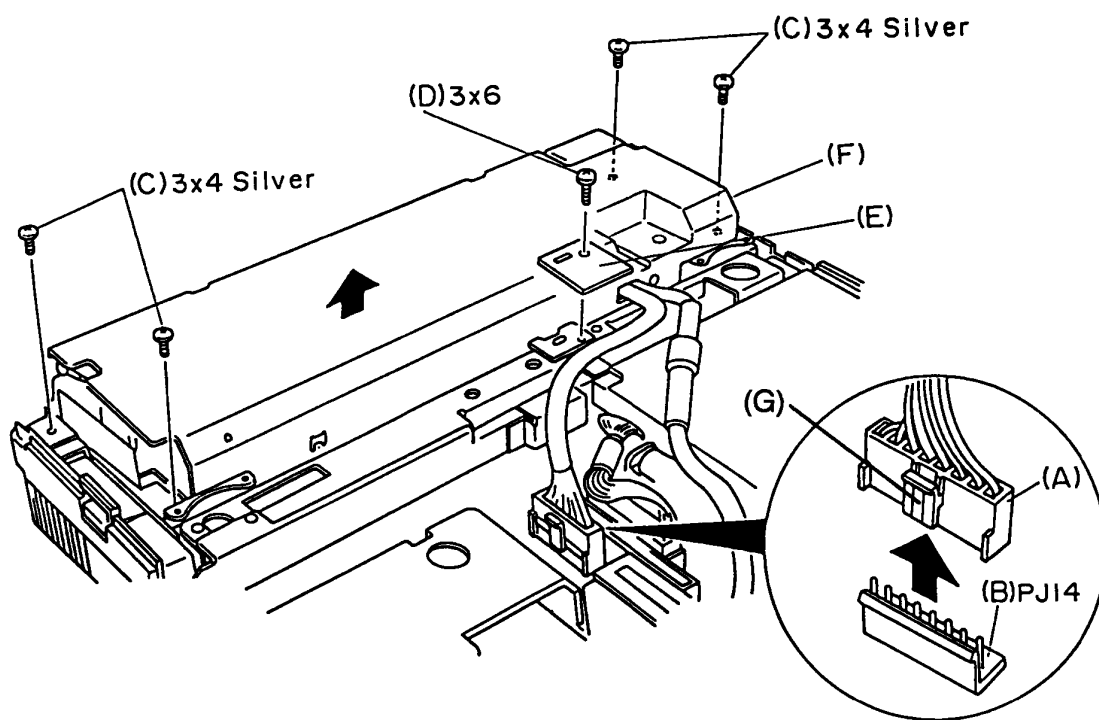


Figure 4-21 Removing the power supply unit

3. Remove the one 3x8 screw (H) from the power supply cover (I). Then remove the power supply cover by sliding it to the right.

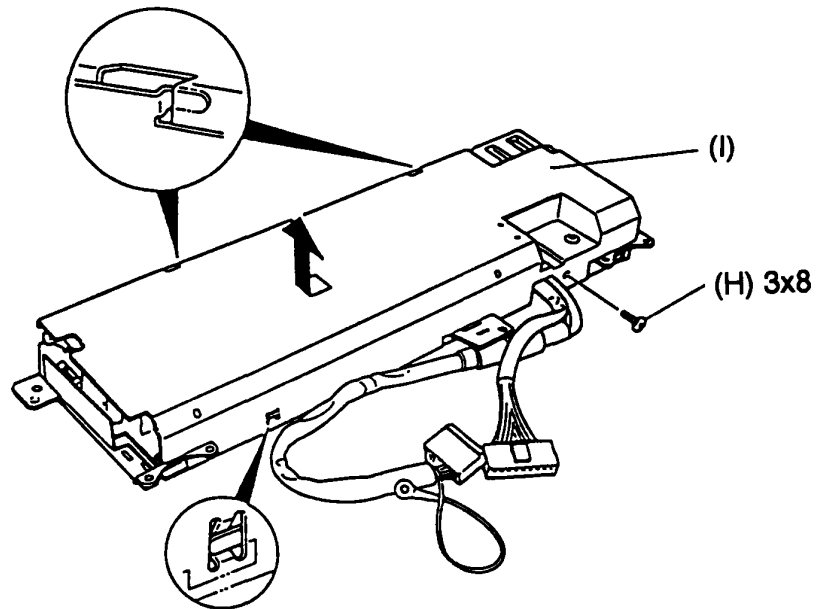


Figure 4-22 Removing the power supply cover

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

4.10 REMOVING/REPLACING THE LITHIUM BATTERY

WARNING: *If the lithium battery is incorrectly replaced, there is a danger of the battery exploding. For replacement, use the same or equivalent type of battery recommended by the equipment manufacturer. Discard used batteries according to the manufacturer's instructions.*

1. Remove the top cover as instructed in Section 4.6.
2. Disconnect the lithium battery cable (A) from connector PJ3 (B) on the memory board. Then remove the lithium battery (C).

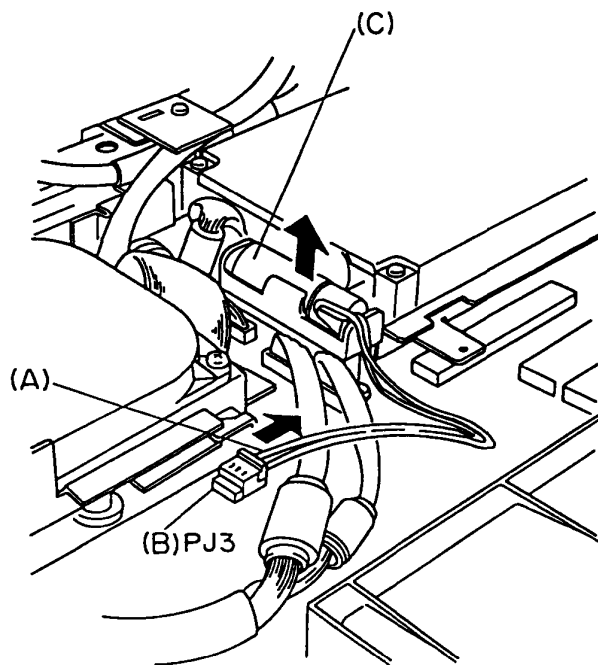


Figure 4-23 Removing the lithium battery

3. To install the lithium battery, follow the above procedure in reverse.

4.11 REMOVING/REPLACING THE FDD

1. Remove the top cover as instructed in Section 4.6.
2. Remove the one 3x6 screw (A). Then remove the power supply cable bracket (B) from the power supply and remove the three 3x6 screws (C) securing the FDD support. Then disconnect the FDD cable (D) from connector PJ7 (E) and remove the FDD unit (F).

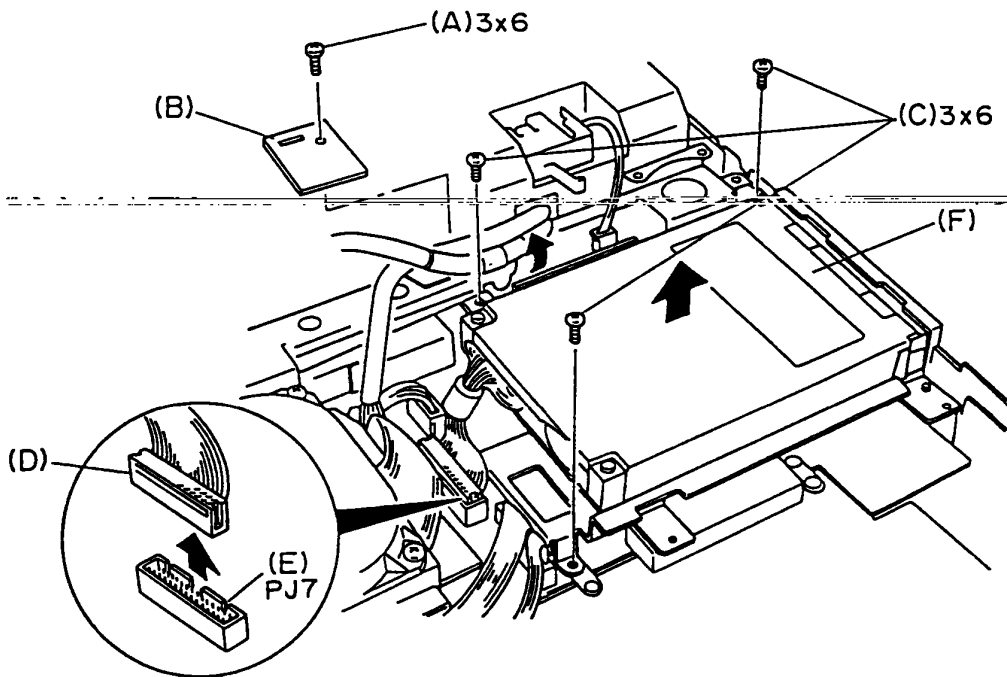


Figure 4-24 Removing the FDD unit

3. Remove the two 3x4 special screws (E) and one 3x6 screw (F) from the FDD support (G). Then remove the FDD (H) from the FDD support.

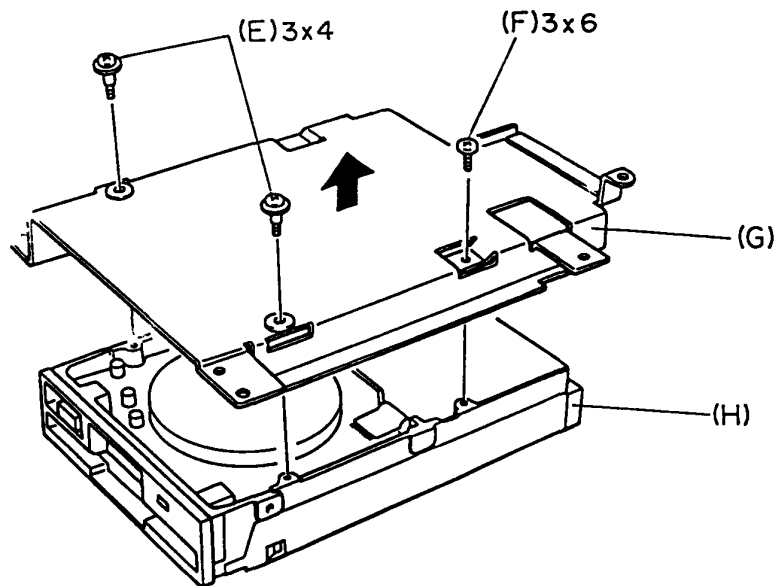


Figure 4-25 Removing the FDD

4. To install the FDD, follow the above procedure in reverse.

4.12 REMOVING/REPLACING THE BACK PANEL BOARD UNIT

1. Remove the HDD, power supply, and FDD as instructed in Sections 4.7, 4.9, and 4.11.
2. Remove the back panel board unit (A) from the system board (B) by removing the three 3x6 screws (C).

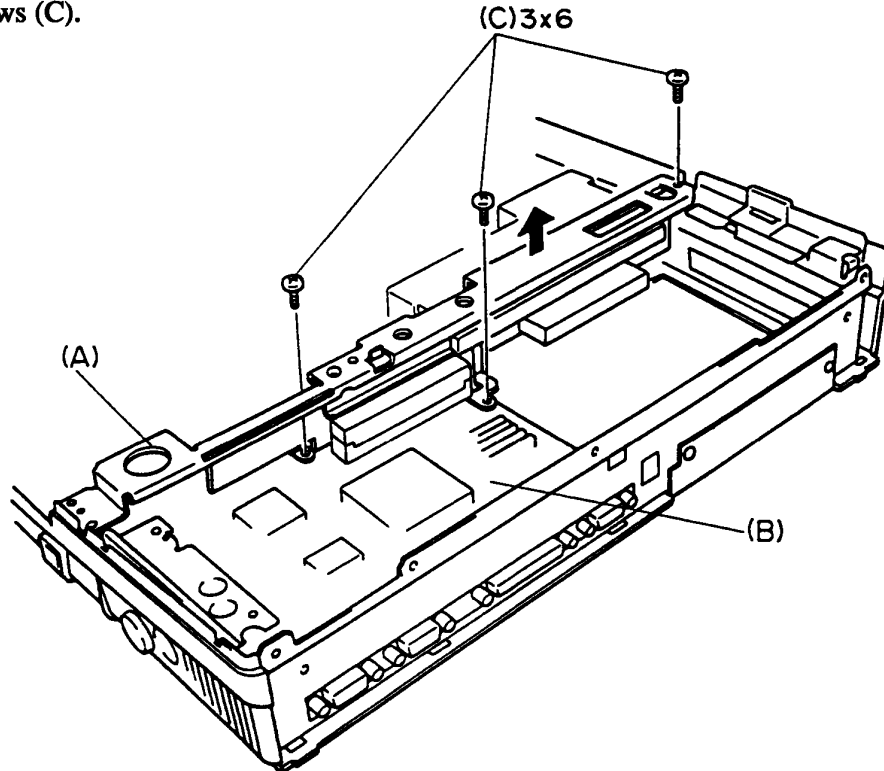


Figure 4-26 Removing the back panel board unit

3. Remove the back panel board 1 (D) by removing the two 3x4 screws (E).

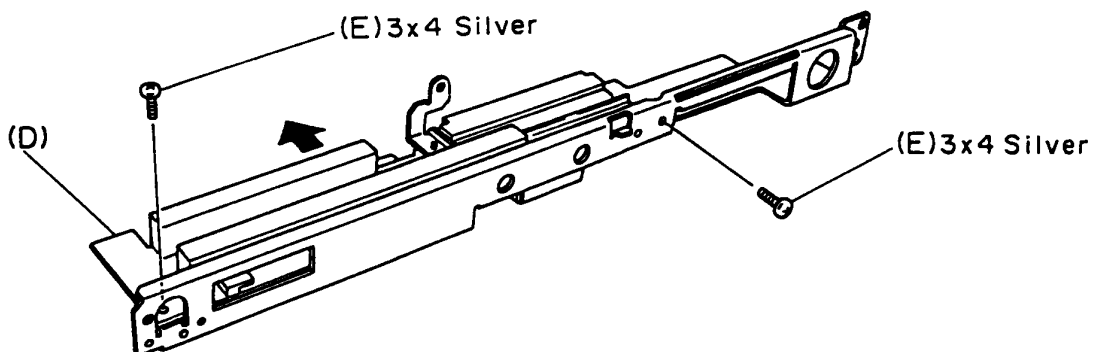


Figure 4-27 Removing the back panel board 1

4. Remove the two 3x4 screws (F) from the back panel board 1 to remove the back panel board bracket (G).

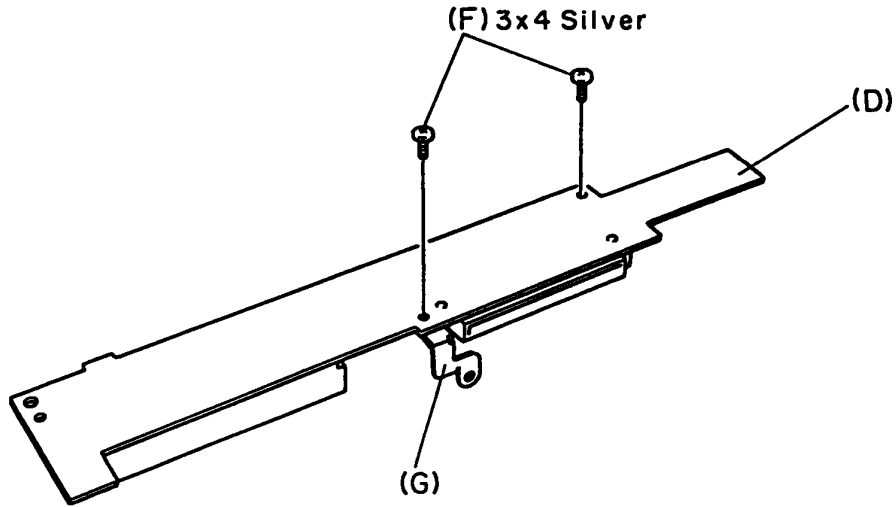


Figure 4-28 Removing the back panel board bracket

5. Remove the back panel board 2 (H) by removing the two 3x4 silver screws (I).

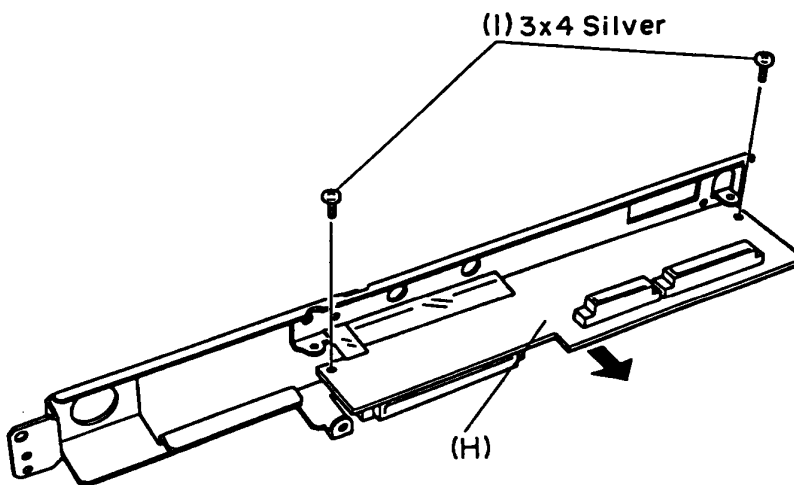


Figure 4-29 Removing the back panel board 2

6. To install the back panel board unit, follow the above procedure in reverse.

4.13 REMOVING/REPLACING THE MODEM CONNECTOR CABLE

1. Turn the computer upside down. Then remove the three 3x6 black screws (A) and remove the modem connector cover (B) from the underside of the computer (C).

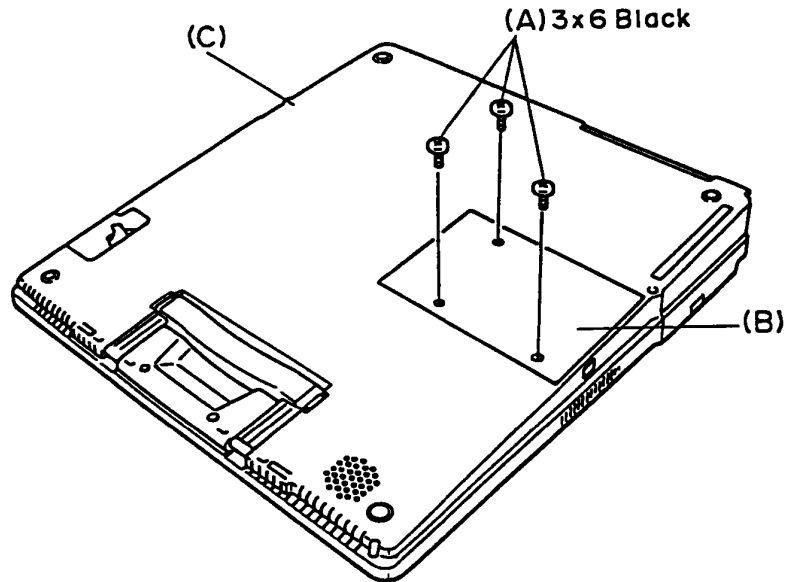


Figure 4-30 Removing the modem connector cover

2. Remove the HDD as instructed in Section 4.9. Remove the modem cable (D) from connector PJ13 (E) by removing the one 3x6 screw (F) securing the modem cable (D).

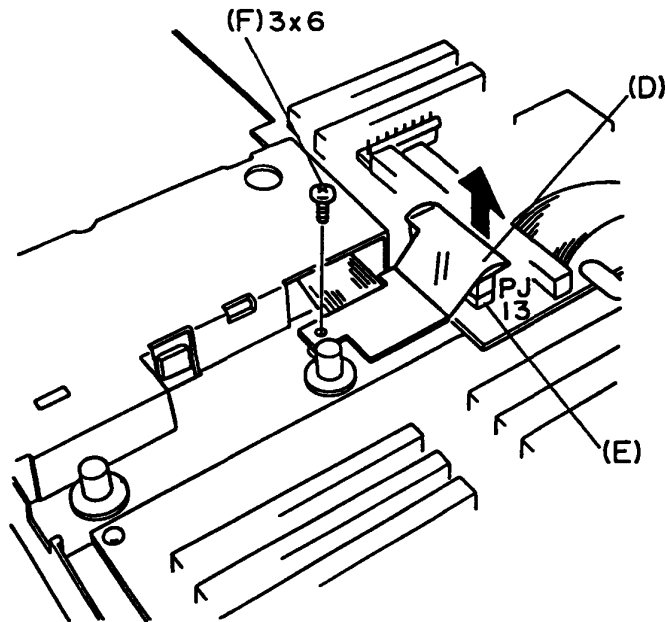


Figure 4-31 Removing the modem cable

3. To install the modem connector cable, follow the above procedure in reverse.

4.14 REMOVING/REPLACING THE SYSTEM BOARD AND THE MEMORY BOARD

1. Remove the back panel board unit and modem connector cable as instructed in Sections 4.12 and 4.13.
2. Remove the two 3x6 black screws (A) at the rear of the computer, and then remove the mask panel (B).

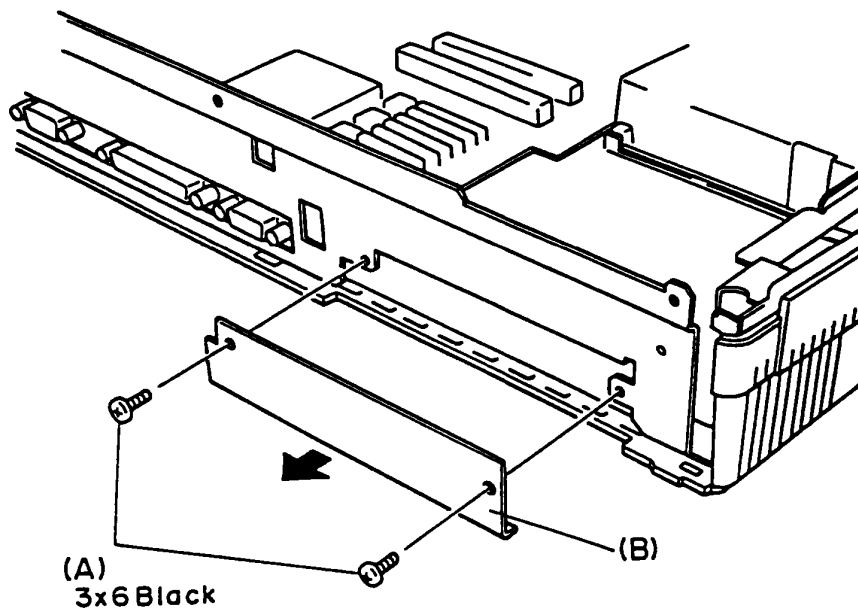


Figure 4-32 Removing the mask panel

3. Turn the computer upside down and remove the four 3x8 black screws (C) from the bottom cover. Remove the rear support (D) from the computer.

NOTE: For reassembly, it is recommended that you reinstall the top cover prior to reinstalling the rear support.

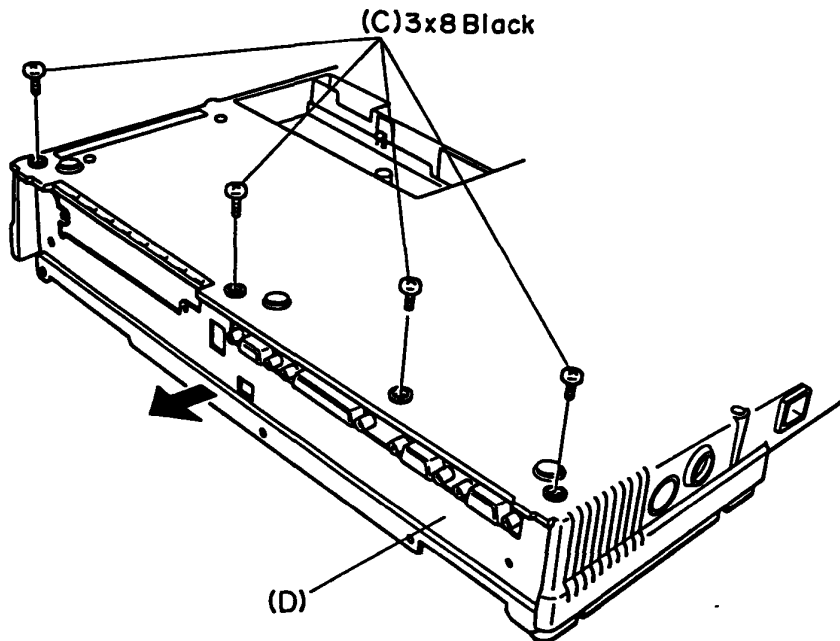


Figure 4-33 Removing the rear support

4. Turn the computer right side up.

5. Remove the speaker cable from connector PJ5 on the memory board.
6. Remove the thirteen 3x4 silver screws (E) and one 3x6 screw (F). Then remove the system board (G) and the memory board (H) as one unit from the bottom cover (I).

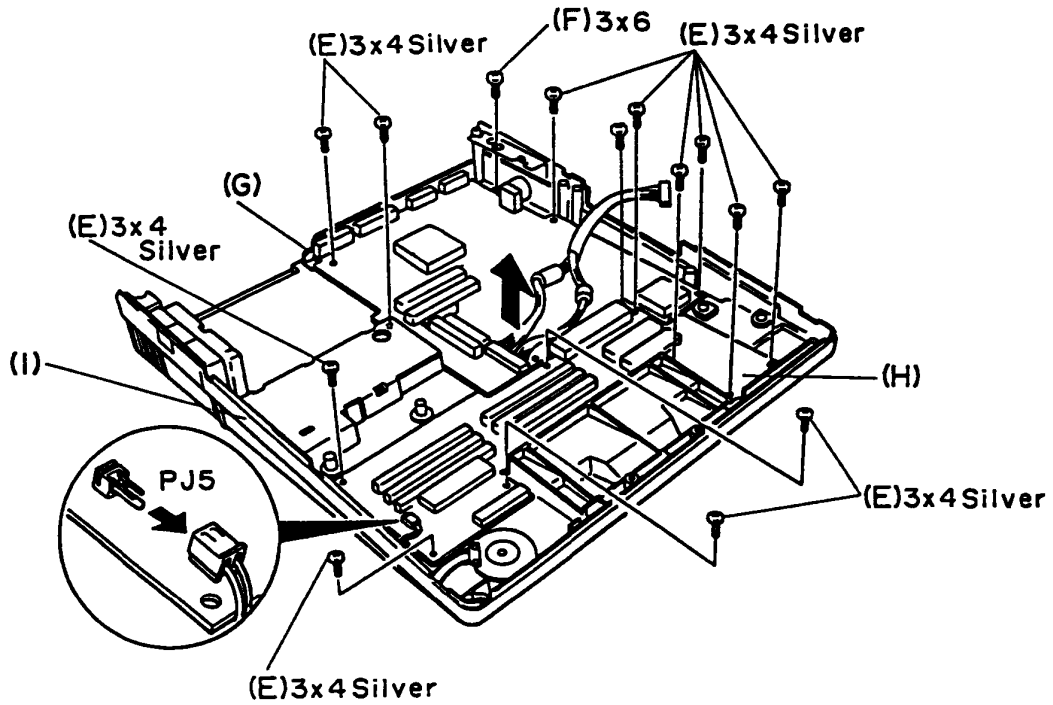


Figure 4-34 Removing the system board and the memory board

7. Disconnect the memory board (I) from the system board (J).

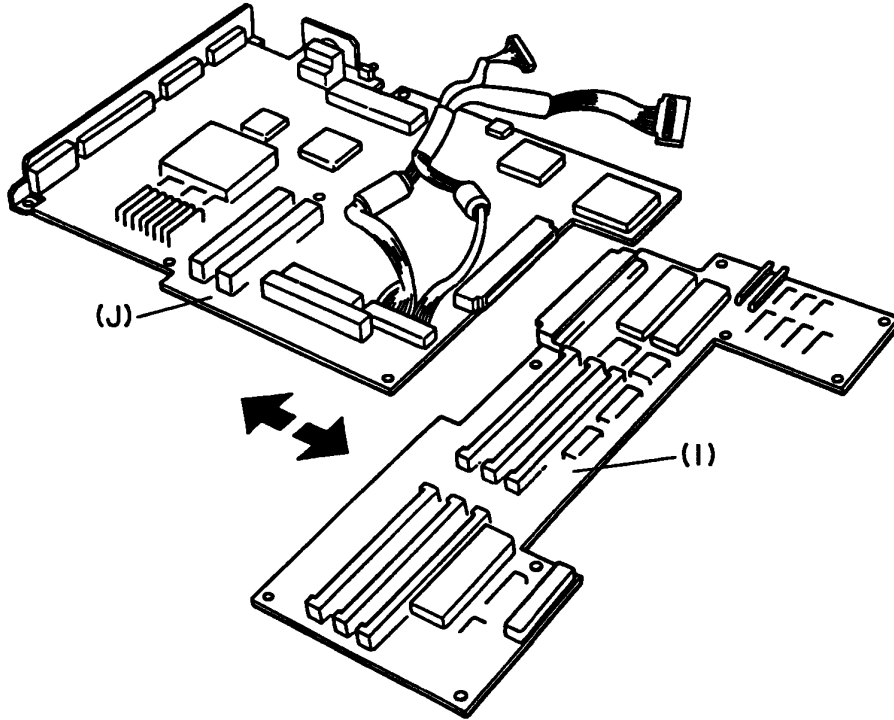


Figure 4-35 Removing the system board

8. To install the system board and memory board, follow the above procedure in reverse.

APPENDIX A BOARD LAYOUTS

A.1 SYSTEM BOARD (ICs)

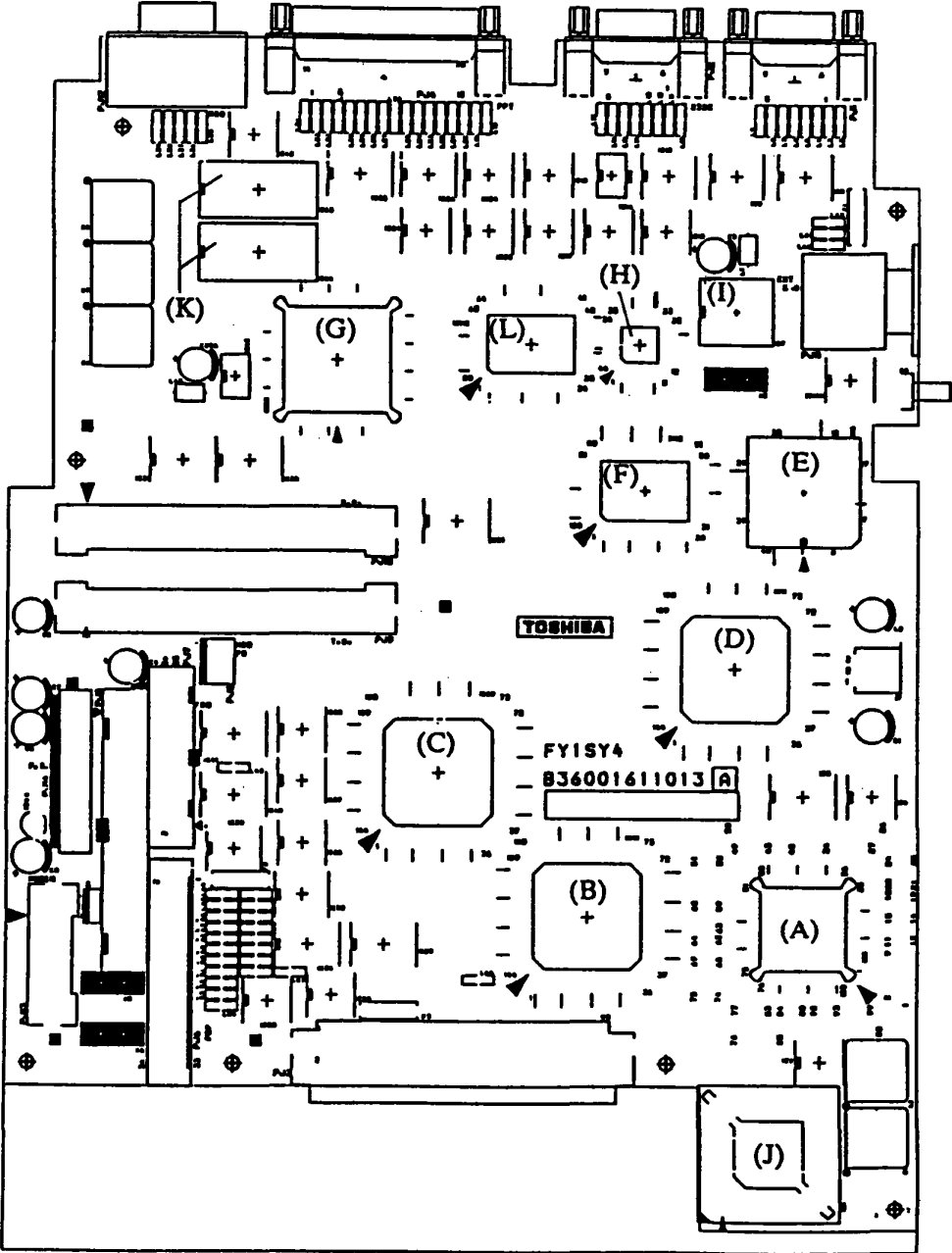


Figure A-1 System board (ICs)

- (A) CPU: Central processing unit (80386SX-20)
- (B) GA-MCNT4: Memory controller gate array
- (C) GA-BCNT4: Bus controller gate array
- (D) SI: Super integration (T9778A)
- (E) SIO: Serial I/O controller (NS16450)
- (F) GA-FDC: FDD/printer controller gate array
- (G) WD90C21: Paradise video graphics array
- (H) CGSC: Color gray scale controller gate array
- (I) VFO: Variable frequency oscillator (MB4108)
- (J) NDP Socket: Numeric data processing socket (80387SX-20)
- (K) Video RAMs
- (L) DAC

A.2 MEMORY BOARD (ICs)

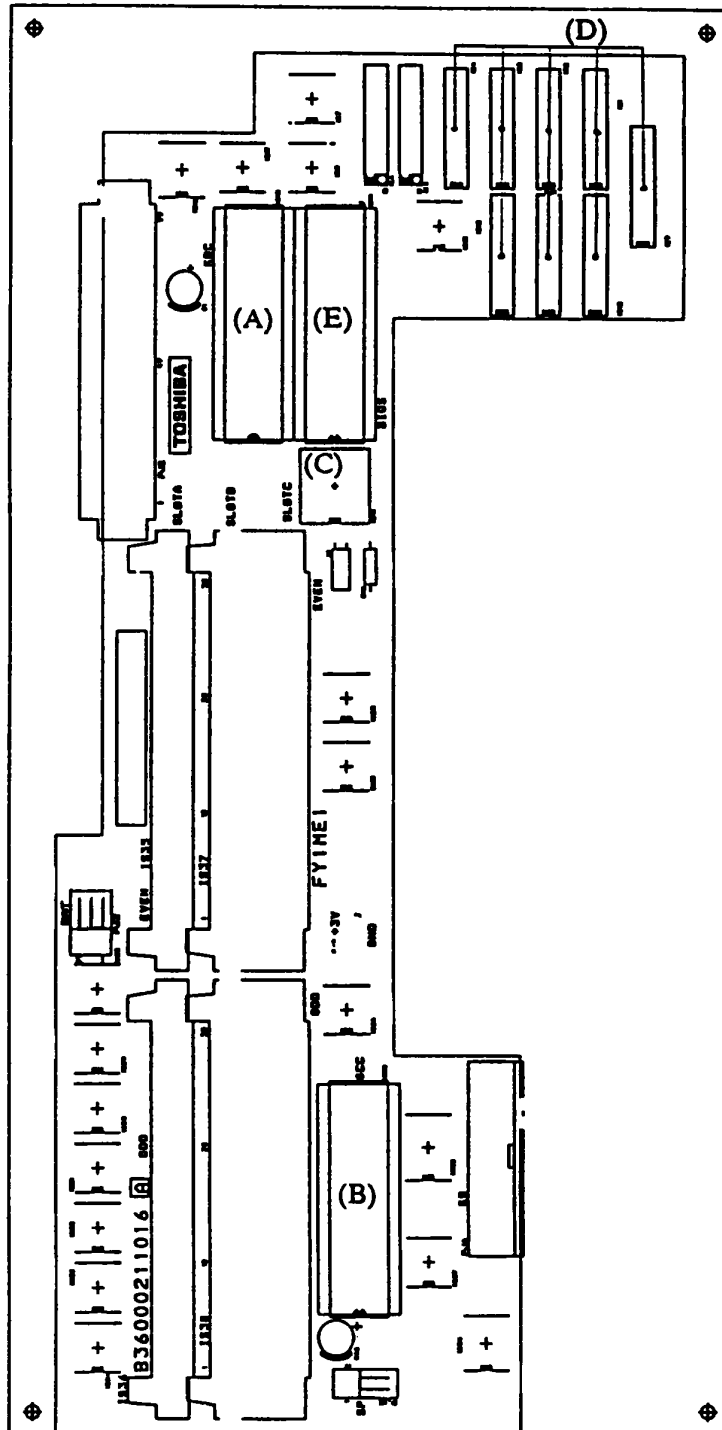


Figure A-2 Memory board (ICs)

- (A) **KBC:** **Keyboard controller**
- (B) **SCC:** **Keyboard scan controller**
- (C) **RTC:** **Real time clock (MC146818A)**
- (D) **System memories**
- (E) **BIOS ROM**

A.3 SYSTEM BOARD (CONNECTORS)

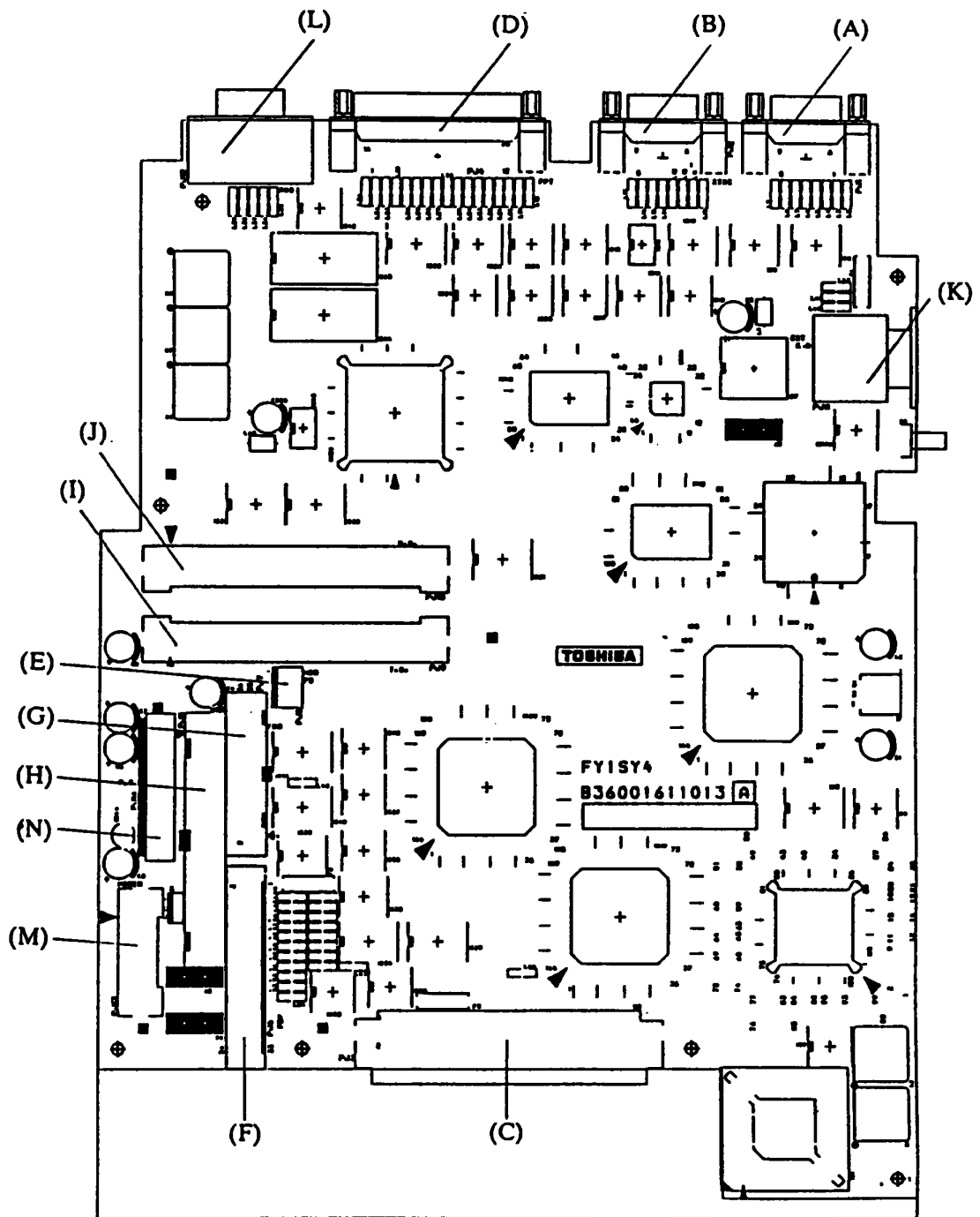


Figure A-3 System board (connectors)

- (A) PJ1: SIO I/F connector B
- (B) PJ2: SIO I/F connector A
- (C) PJ3: Memory board I/F connector
- (D) PJ4: PRT/EXT.FDD I/F connector
- (E) PJ5: HDD power supply connector
- (F) PJ6: LCD I/F connector
- (G) PJ7: 3.5" FDD I/F connector
- (H) PJ8: HDC I/F connector
- (I) PJ9: TOSHIBA slot board I/F connector
- (J) PJ10: Back panel I/F connector
- (K) PJ11: EXT KB I/F connector
- (L) PJ12: CRT I/F connector
- (M) PJ13: Built-in modem I/F connector
- (N) PJ14: Power supply connector

A.4 MEMORY BOARD (CONNECTORS)

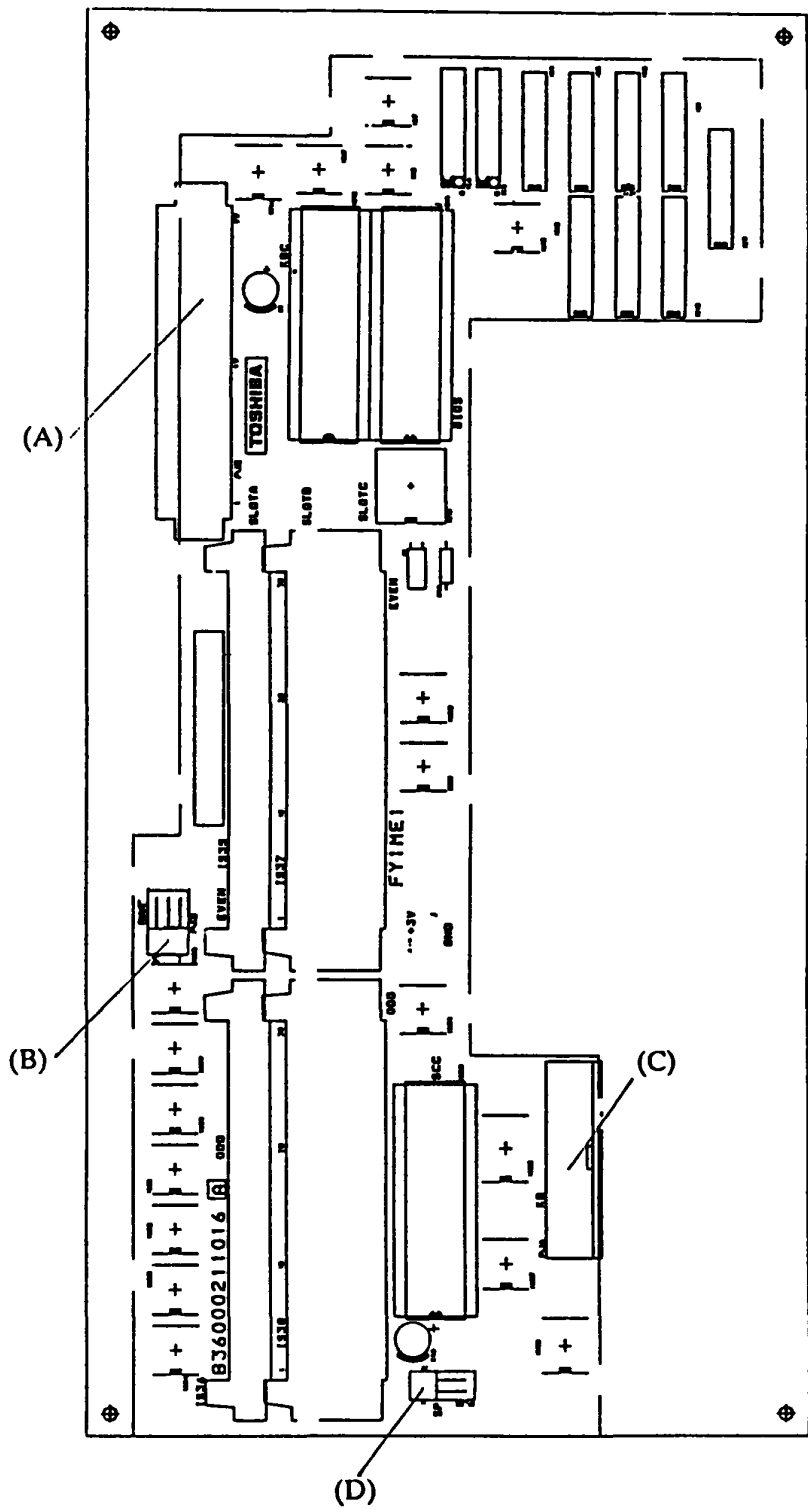


Figure A-4 Memory board (connectors)

- (A) PJ2: System board I/F connector
- (B) PJ3: Lithium battery connector
- (C) PJ4: Keyboard connector
- (D) PJ5: Speaker connector

APPENDIX B PIN ASSIGNMENTS

B.1 SYSTEM BOARD

B.1.1 PJ1 SIO I/F Connector B (9-pin)

Table B-1 SIO I/F connector B pin assignment

Pin	Signal	I/O	Pin	Signal	I/O
1	MDCD2;110	I	6	MDDSR2;110	I
2	MDRD2;110	I	7	MDRTS2;110	O
3	MDTD2;110	O	8	MDCTS2;110	I
4	MDDTR2;110	O	9	MDRI2;110	I
5	GND				

B.1.2 PJ2 SIO I/F Connector A (9-pin)

Table B-2 SIO I/F connector A pin assignment

Pin	Signal	I/O	Pin	Signal	I/O
1	MDCD1;110	I	6	MDDSR1;110	I
2	MDRD1;110	I	7	MDRTS1;110	O
3	MDTD1;110	O	8	MDCTS1;110	I
4	MDDTR1;110	O	9	MDRI1;110	I
5	GND				

B.1.3 PJ3 Memory Board I/F Connector (100-pin)

Table B-3 Memory board I/F connector pin assignment

Pin	Signal	I/O	Pin	Signal	I/O
1	GND		51	MA10;110	O
2	VCC		52	MA9;110	O
3	SPK;000	O	53	MA8;110	O
4	LEDCAP;100	I	54	MA7;110	O
5	LEDNUM;100	I	55	GND	
6	LEDSCR;100	I	56	MA6;110	O
7	PUCLR;000	I	57	MA5;110	O
8	POWOFF;000	O	58	MA4;110	O
9	KBDATO;010	I	59	MA3;110	O
10	IRQ8;100	I	60	MA2;110	O
11	GND		61	MA1;110	O
12	DSTRB;000	O	62	MA0;110	O
13	RETIMW;000	O	63	RAS6;110	O
14	AS18;000	O	64	RAS5;110	O
15	SD0;100	I/O	65	RAS4;110	O
16	SD1;100	I/O	66	GND	
17	SD2;100	I/O	67	VCC	
18	SD3;100	I/O	68	RAS3;110	O
19	SD4;100	I/O	69	RAS2;110	O
20	SD5;100	I/O	70	RAS1;110	O
21	SD6;100	I/O	71	RASOH;110	O
22	GND		72	RASOL;110	O
23	SD7;100	I/O	73	RASOP;110	O
24	ROMCS;010	O	74	CAS1;110	O
25	A16;100	O	75	CAS0;110	O
26	A15;100	O	76	WE;110	O
27	A14;100	O	77	GND	
28	A13;100	O	78	MPD1;100	I/O
29	A12;100	O	79	MPD0;100	I/O
30	A11;100	O	80	N/C	
31	A10;100	O	81	MD15;100	I/O
32	KBCCS;000	O	82	MD14;100	I/O
33	GND		83	MD13;100	I/O
34	VCC		84	MD12;100	I/O
35	IOR;020	O	85	MD11;100	I/O
36	A2;100 O		86	MD10;100	I/O
37	IOW;020	O	87	MD9;100	I/O
38	KBCLK0;000	I	88	GND	
39	IRQ1;100	I	89	MD8;100	I/O
40	FSELSW;000	O	90	MD7;100	I/O
41	EXTFDD;100	O	91	MD6;100	I/O
42	NOTCH;000	O	92	MD5;100	I/O
43	EKBDAT;010	O	93	MD4;100	I/O
44	GND		94	MD3;100	I/O
45	EKCLK;010	O	95	MD2;100	I/O
46	REAL;000	I/O	96	MD1;100	I/O
47	RTCD;000	I	97	MD0;100	I/O
48	RESET;101	O	98	KBSEL;100	O
49	CK8M;110	O	99	VCC	
50	N/C		100	GND	

B.1.4 PJ4 PRT/EXT.FDD I/F Connector (25-pin)

Table B-4 PRT/EXT.FDD I/F connector pin assignment

Pin	For PRT		For EXT.FDD	
	Signal	I/O	Signal	I/O
1	STROBE;020	I/O	READY;000	I
2	PD0;120	I/O	INDEX;000	I
3	PD1;120	I/O	TRACK0;000	I
4	PD2;120	I/O	WPROTC;000	I
5	PD3;120	I/O	RDDA;000	I
6	PD4;120	I/O	DSKCHG;000	I
7	PD5;120	I/O	N/C	
8	PD6;120	I/O	N/C	
9	PD7;120	I/O	N/C	
10	ACK;010	I/O	SWFDB;100	O
11	BUSY;110	I/O	SWMONB;000	O
12	PE;110	I/O	WRDATA;100	O
13	SELECT;110	I/O	EXFDWE;100	O
14	AUTFD;010	I/O	XRATE0;100	O
15	ERROR;010	I/O	SIDE;100	O
16	PRINT;010	I/O	FDCDRC;100	O
17	SLIN;010	I/O	STEP;100	O
18-25	GND		GND	

B.1.5 PJ5 HDD Power Supply Connector (4-pin)

Table B-5 HDD power supply connector pin assignment

Pin	Signal	I/O	Pin	Signal	I/O
1	P+12V		3	GND	
2	GND		4	VCC	

B.1.6 PJ6 LCD I/F Connector (34-pin)

Table B-6 LCD I/F connector pin assignment

Pin	Signal	I/O	Pin	Signal	I/O
1	VCC		18	GND	
2	GND		19	PLTB0;120	O
3	CP+12V		20	GND	
4	GND		21	PLTB1;120	O
5	FLTCLK;120	O	22	GND	
6	GND		23	PLTB2;120	O
7	PLTR0;120	O	24	GND	
8	GND		25	FLTLP;120	O
9	PLTR1;120	O	26	FLTFP;120	O
10	GND		27	DENAB;120	O
11	PLTR2;120	O	28	DRVALD;000	O
12	GND		29	DRVBLD;000	O
13	PLTG0;120	O	30	GND	
14	GND		31	VCC	
15	PLTG1;120	O	32	LED CAP;010	O
16	GND		33	LED NUM;010	O
17	PLTG2;120	O	34	LED SCR;010	O

B.1.7 PJ7 3.5-inch FDD I/F Connector (26-pin)

Table B-7 3.5-inch FDD I/F connector pin assignment

Pin	Signal	I/O	Pin	Signal	I/O
1	VCC		14	STEP;000	O
2	INDEX;000	I	15	GND	
3	VCC		16	WDATA;000	O
4	FDSELA;000	O	17	GND	
5	VCC		18	WGATE;000	O
6	DSKCHG;000	I	19	GND	
7	VCC		20	TRACK0;000	I
8	READY;000	I	21	GND	
9	NOTCH;010	I	22	WPROTC;000	I
10	MONA;000	O	23	GND	
11	LOWDN0;000	O	24	RDDA;000	I
12	FDCDRC;010	O	25	GND	
13	GND		26	SIDE;010	O

B.1.8 PJ8 HDC I/F Connector (44-pin)**Table B-8 HDC I/F connector pin assignment**

Pin	Signal	I/O	Pin	Signal	I/O
1	HRESET;010	O	23	HIOW;001	O
2	GND		24	GND	
3	HSD7;100	I/O	25	HIOR;001	O
4	HSD8;100	I/O	26	GND	
5	HSD6;100	I/O	27	HRDY;100	I
6	HSD9;100	I/O	28	HALE;110	O
7	HSD5;100	I/O	29	N/C	
8	HSD10;100	I/O	30	GND	
9	HSD4;100	I/O	31	IRQ14;100	I
10	HSD11;100	I/O	32	HIO16;000	I
11	HSD3;100	I/O	33	HSA1;101	O
12	HSD12;100	I/O	34	N/C	
13	HSD2;100	I/O	35	HSA0;101	O
14	HSD13;100	I/O	36	HSA2;101	O
15	HSD1;100	I/O	37	HDDCS0;010	O
16	HSD14;100	I/O	38	HDDCS1;010	O
17	HSD0;100	I/O	39	HACT;000	I
18	HSD15;100	I/O	40	GND	
19	GND		41	VCC	
20	VCC		42	VCC	
21	N/C		43	GND	
22	GND		44	GND	

B.1.9 PJ9 Toshiba Slot Board I/F Connector (100-pin)

Table B-9 Toshiba slot board I/F connector pin assignment

Pin	Signal	I/O	Pin	Signal	I/O
1	GND		51	VCC	
2	VCC		52	DRQ2;100	I
3	SA1;100	I/O	53	SA9;100	I/O
4	SA0;100	I/O	54	SA10;100	I/O
5	SD7;100	I/O	55	RESET;100	O
6	BIOCHK;000	I	56	IRQ9;100	I
7	SA3;100	I/O	57	SA8;100	I/O
8	SA2;100	I/O	58	SD14;100	I/O
9	SD6;100	I/O	59	SD15;100	I/O
10	GND		60	GND	
11	COMCLK;012	O	61	SA6;100	I/O
12	SA4;100	I/O	62	SA7;100	I/O
13	SD4;100	I/O	63	SD12;100	I/O
14	SD5;100	I/O	64	SD13;100	I/O
15	TC;100	O	65	SD10;100	I/O
16	BALE;110	I	66	SA5;100	I/O
17	SD2;100	I/O	67	MASTER;000	I
18	SD3;100	I/O	68	SD11;100	I/O
19	DACK2;000	O	69	SD9;100	I/O
20	GND		70	GND	
21	SD1;100	I/O	71	MEMW;010	I/O
22	IRQ5;100	I	72	SD8;100	I/O
23	IRQ4;100	I	73	DACK6;000	O
24	TIORDY;100		74	DRQ6;100	I
25	SD0;100	I/O	75	LA17;100	I/O
26	IRQ7;100	I	76	MEMR;010	I/O
27	IRQ6;100	I	77	DACK5;000	O
28	SA19;100	I/O	78	DRQ5;100	I
29	DMACK;100	O	79	LA18;100	I/O
30	GND		80	GND	
31	REFRSH;000	I/O	81	LA20;100	I/O
32	SYSCLK;121	O	82	LA19;100	I/O
33	SA18;100	I/O	83	IRQ14;100	I
34	DACK1;000	O	84	LA22;100	I/O
35	DRQ1;100	I	85	LA21;100	I/O
36	SA16;100	I/O	86	IRQ11;100	I
37	SA17;100	I/O	87	IRQ12;100	I
38	DACK3;000	O	88	LA23;100	I/O
39	DRQ3;000	I	89	IRQ10;100	I
40	GND		90	GND	
41	SA14;100	I/O	91	TIO16;000	I
42	SA15;100	I/O	92	SBHE;000	I/O
43	IOW;010	I/O	93	TMEM16;000	I
44	IOR;010	I/O	94	TMSPK;000	I
45	SA13;100	I/O	95	TMIRQ;000	I
46	SMEMW;010	O	96	TMDMCS;000	O
47	SMEMR;010	O	97	P+12	
48	SA11;100	I/O	98	VCC	
49	SA12;100	I/O	99	M-9V	
50	GND		100	GND	

B.1.10 PJ10 Back Panel I/F Connector (100-pin)

Table B-10 Back panel I/F connector pin assignment

Pin	Signal	I/O	Pin	Signal	I/O
1	SA1;100	I/O	51	SA9;100	I/O
2	SA0;100	I/O	52	SA10;100	I/O
3	SD7;100	I/O	53	RESET;100	O
4	BIOCHK;000	I	54	IRQ9;100	I
5	SA3;100	I/O	55	SA8;100	I/O
6	SA2;100	I/O	56	VCC	
7	SD6;100	I/O	57	SD14;100	I/O
8	GND		58	SD15;100	I/O
9	CK14M;031	O	59	SA6;100	I/O
10	SA4;100	I/O	60	SA7;100	I/O
11	SD4;100	I/O	61	SD12;100	I/O
12	SD5;100	I/O	62	SD13;100	I/O
13	TC;100	O	63	SD10;100	I/O
14	BALE;110	O	64	SA5;100	I/O
15	SD2;100	I/O	65	MASTER;000	I
16	SD3;100	I/O	66	SD11;100	I/O
17	IRQ3;100	I	67	SD9;100	I/O
18	DACK2;000	O	68	GND	
19	SD1;100	I/O	69	DACK7;000	O
20	GND		70	DRQ7;100	I
21	IRQ5;100	I	71	MEMW;010	I/O
22	IRQ4;100	I	72	SD8;100	I/O
23	BIORDY;100	I	73	DACK6;000	O
24	SD0;100	I/O	74	DRQ6;100	I
25	IRQ7;100	I	75	LA17;100	I/O
26	IRQ6;100	I	76	MEMR;010	I/O
27	SA19;100	I/O	77	DACK5;000	O
28	DMACK;100	O	78	DRQ5;100	I
29	REFRSH;000	I/O	79	LA18;100	I/O
30	SYSCLK;120	O	80	GND	
31	SA18;100	I/O	81	DACK0;000	O
32	VCC		82	DRQ0;100	I
33	DACK1;100	O	83	LA20;100	I/O
34	DRQ1;100	I	84	LA19;100	I/O
35	SA16;100	I/O	85	IRQ15;100	I
36	SA17;100	I/O	86	IRQ14;100	I
37	DACK3;000	O	87	LA22;100	I/O
38	DRQ3;100	I	88	LA21;100	I/O
39	SA14;100	I/O	89	IRQ11;100	I
40	SA15;100	I/O	90	IRQ12;100	I
41	IOW;010	I/O	91	LA23;100	I/O
42	IOR;010	I/O	92	VCC	
43	SA13;100	I/O	93	P+12	
44	GND		94	IRQ10;100	I
45	SMEMW;010	O	95	BIO16;000	I
46	SMEMR;010	O	96	SBHE;000	I/O
47	SA11;100	I/O	97	M-12	
48	SA12;100	I/O	98	BMEM16;000	I
49	DRQ2;100	I	99	M-5V	
50	COVER;100	O	100	GND	

B.1.11 PJ11 EXT Keyboard I/F Connector (5-pin)

Table B-11 EXT keyboard I/F connector pin assignment

Pin	Signal	I/O	Pin	Signal	I/O
1	EKBCLK;110	I/O	4	GND	
2	EKBDAT;110	I/O	5	EKB5V;100	
3	N/C				

B.1.12 PJ12 CRT I/F Connector (15-pin)

Table B-12 CRT I/F connector pin assignment

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

B.1.13 PJ13 Built-in Modem I/F Connector (30-pin)

Table B-13 Built-in modem I/F connector pin assignment

Pin	Signal	I/O	Pin	Signal	I/O
1	M-9V		16	GND	
2	BMDMCS;000	O	17	SD2;100	I/O
3	COMCLK;130	O	18	SD1;100	I/O
4	GND		19	GND	
5	SA0;100	O	20	GND	
6	SA1;100	O	21	SD0;100	I/O
7	SA2;100	O	22	IOW;020	O
8	GND		23	IOR;020	O
9	SD7;100	I/O	24	VCC	
10	SD6;100	I/O	25	RESET;101	O
11	GND		26	GND(MPWROF;100)	
12	GND		27	VCC	
13	SD5;100	I/O	28	VCC	
14	SD4;100	I/O	29	BMIRQ;000	I
15	SD3;100	I/O	30	BMSPK;000	I

B.1.14 PJ14 Power Supply Connector (9-pin)

Table B-14 Power supply connector pin assignment

Pin	Signal	I/O	Pin	Signal	I/O
1	COVER;101	0	6	GND	
2	M-12V		7	GND	
3	M-5		8	VCC	
4	GND		9	VCC	
5	P+12				

B.2 MEMORY BOARD

B.2.1 PJ2 System Board I/F Connector (100-pin)

Table B-15 System board I/F connector pin assignment

Pin	Signal	I/O	Pin	Signal	I/O
1	GND		51	MA10;100	O
2	VCC		52	MA9;100	O
3	SPK;000	I	53	MA8;100	O
4	LED CAP;100	O	54	MA7;100	O
5	LEDNUM;100	O	55	GND	
6	LEDSCR;100	O	56	MA6;110	O
7	PUCLR;000	O	57	MA5;110	O
8	POW OFF;000	I	58	MA4;110	O
9	KBDAT0;010	O	59	MA3;110	O
10	IRQ8;100	O	60	MA2;110	O
11	GND		61	MA1;110	O
12	DSTRB;000	I	62	MA0;110	O
13	RETIMW;000	I	63	RAS6;110	O
14	AS18;000	I	64	RAS5;110	O
15	SD0;100	I/O	65	RAS4;110	O
16	SD1;100	I/O	66	GND	
17	SD2;100	I/O	67	VCC	
18	SD3;100	I/O	68	RAS3;110	O
19	SD4;100	I/O	69	RAS2;110	O
20	SD5;100	I/O	70	RAS1;110	O
21	SD6;100	I/O	71	RAS0H;110	O
22	GND		72	RAS0L;110	O
23	SD7;100	I/O	73	RAS0P;110	O
24	ROMCS;010	O	74	CAS1;110	O
25	A16;100	O	75	CAS0;110	O
26	A15;100	O	76	WE;110	O
27	A14;100	O	77	GND	
28	A13;100	O	78	MPD1;100	I/O
29	A12;100	O	79	MPD0;100	I/O
30	A11;100	O	80	N/C	
31	A10;100	O	81	MD15;1001	I/O
32	KBCCS;000	O	82	MD14;100	I/O
33	GND		83	MD13;100	I/O
34	VCC		84	MD12;100	I/O
35	IOR;020	O	85	MD11;100	I/O
36	A2;100	O	86	MD10;100	I/O
37	IOW;020	O	87	MD9;100	I/O
38	KBCLK0;000	I	88	GND	
39	IRQ1;100	I	89	MD8;100	I/O
40	FSELSW	O	90	MD7;100	I/O
41	EXTFDD;100	O	91	MD6;100	I/O
42	NOTCH;000	O	92	MD5;100	I/O
43	EKBDAT;010	O	93	MD4;100	I/O
44	GND		97	MD0;100	I/O
45	EKCLK;010	O	94	MD3;100	I/O
46	REAL;000	I/O	95	MD2;100	I/O
47	RTCD;000	I	96	MD1;100	I/O
48	RESET;101	O	98	KBSEL;100	I
49	CK8M;110	O	99	VCC	
50	N/C		100	GND	

B.2.2 PJ3 Lithium Battery Connector (3-pin)

Table B-16 Lithium battery connector pin assignment

Pin	Signal	I/O	Pin	Signal	I/O
1	GND		3	BAT36V;100	I
2	N/C				

B.2.3 PJ4 Keyboard Connector (27-pin)

Table B-17 Keyboard connector pin assignment

Pin	Signal	I/O	Pin	Signal	I/O
1	GND		15	KBRN0;000	I
2	KBCS0;010	O	16	KBRN1;000	I
3	KBSC1;010	O	17	KBRN2;000	I
4	KBSC2;010	O	18	KBRN3;000	I
5	GND		19	GND	
6	KBCS3;010	O	20	KBRN4;000	I
7	KBSC4;010	O	21	KBRN5;000	I
8	KBSC5;010	O	22	KBRN6;000	I
9	KBSC6;010	O	23	KBRN7;000	I
10	GND		24	KBSC11;010	O
11	KBSC7;010	O	25	KBSC12;010	O
12	KBSC8;010	O	26	N/C	
13	KBSC9;010	O	27	GND	
14	KBSC10;010	O			

B.2.4 PJ5 Speaker Connector (2-pin)

Table B-18 Speaker connector pin assignment

Pin	Signal	I/O	Pin	Signal	I/O
1	SPKON;000	O	2	SPKVCC;100	O

APPENDIX C ASCII CHARACTER CODES

Table C-1 ASCII character codes

HEXA DECIMAL VALUE	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣
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	N	▒	▒	▒	σ	∫
6	♠	▬	&	6	F	V	f	v	â	û	ä	▒	▒	▒	μ	÷
7	•	↕	'	7	G	W	g	w	ç	ù	o	▒	▒	▒	τ	≈
8	•	↑	(	8	H	X	h	x	ê	ÿ	ï	▒	▒	▒	ø	°
9	○	↓	)	9	I	Y	i	y	ë	ö	ü	▒	▒	▒	θ	•
A	●	→	*	:	J	Z	j	z	è	Ü	ü	▒	▒	▒	Ω	•
B	♂	←	+	;	K	[	k	{	ï	ç	½	▒	▒	▒	δ	√
C	♀	└	,	<	L	\	l	|	î	£	¼	▒	▒	▒	∞	∞
D	♪	↔	-	=	M	]	m	}	î	¥	ï	▒	▒	▒	φ	2
E	♪	▲	.	>	N	^	n	~	Ä	Þ	ø	▒	▒	▒	€	■
F	⚙	▼	/	?	O	_	o	Δ	Å	f	»	▒	▒	▒	∩	BLANK PF

APPENDIX D KEYBOARD SCAN/ CHARACTER CODES

Table D-1 Keyboard scan/character codes

Key No.	Key top	Base	Upper	Caps lock		Ctrl	Alt
				Base	Upper		
1	ESC "	011B "	011B "	011B "	011B "	011B "	--- "
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 "	---- ----	7A00 "
6	% 5	0635 "	0625 "	0635 "	0625 "	---- ----	7C00 "
7	^ 6	0736 "	075E "	0736 "	075E "	071E "	7D00 "
8	& 7	0837 "	0826 "	0837 "	0826 "	---- ----	7300 "
9	* 8	0938 "	092A "	0938 "	092A "	---- ----	7F00 "
10	(9	0B30 "	0B29 "	0B30 "	0B29 "	---- ----	8000 "
11	) 0	0B30 "	0B29 "	0B30 "	0B29 "	---- ----	8100 "
12	- _	0C2D "	0C5F "	0C2D "	0C5F "	0C1F "	8200 "
13	+ =	0D3D "	0D2B "	0D3D "	0D2B "	---- ----	8300 "
14	BS "	0E08 "	0E08 "	0E08 "	0E08 "	0E7F ----	--- "
15	TAB "	0F09 "	0F00 "	0F09 "	0F00 "	---- 9400	---- A500
16	Q "	1071 "	1051 "	1051 "	1071 "	1011 "	1000 "

Table D-1 Keyboard scan/character codes (continued)

Key No.	Key top	Base	Upper	Caps lock		Ctrl	Alt
				Base	Upper		
17	W	1177 "	1157 "	1157 "	1177 "	1117 "	1100 "
18	E	1265 "	1245 "	1245 "	1265 "	1205 "	1200 "
19	R	1372 "	1352 "	1352 "	1372 "	1312 "	1300 "
20	T	1474 "	1454 "	1454 "	1474 "	1414 "	1400 "
21	Y	1579 "	1559 "	1559 "	1579 "	1519 "	1500 "
22	U	1675 "	1655 "	1655 "	1675 "	1615 "	1600 "
23	I	1769 "	1749 "	1749 "	1769 "	1709 "	1700 "
24	O	186F "	184F "	184F "	186F "	180F "	1800 "
25	P	1970 "	1950 "	1950 "	1970 "	1910 "	1900 "
26	{ [	1A5B "	1A7B "	1A5B "	1A7B "	1A1B "	---- 1A00
27	}]	1B5D "	1B7D "	1B5D "	1B7D "	1B1D "	---- 1B00
28	L-E	1C0D "	1C0D "	1C0D "	1C0D "	1C0A "	---- 1C00
29	L-C	---- ----	---- ----	---- ----	---- ----	---- ----	---- ----
30	A	1E61 "	1E41 "	1E41 "	1E61 "	1E01 "	1E00 "
31	S	1F73 "	1F53 "	1F53 "	1F73 "	1F13 "	1F00 "
32	D	2064 "	2044 "	2044 "	2064 "	2004 "	2000 "
33	F	2166 "	2146 "	2146 "	2166 "	2106 "	2100 "

Table D-1 Keyboard scan/character codes (continued)

Key No.	Key top	Base	Upper	Caps lock		Ctrl	Alt
				Base	Upper		
34	G	2267 "	2247 "	2247 "	2267 "	2207 "	2200 "
35	H	2368 "	2348 "	2348 "	2368 "	2308 "	2300 "
36	J	246A "	244A "	244A "	246A "	240A "	2400 "
37	K	256B "	254B "	254B "	256B "	250B "	2500 "
38	L	266C "	264C "	264C "	266C "	260C "	2600 "
39	: ;	273B "	273A "	273B "	273A "	---- ----	---- 2700
40	" '	2827 "	2822 "	2827 "	2822 "	---- ----	---- 2800
41	*2	2960 "	297E "	2960 "	2973 "	---- ----	---- 2900
42	L-S	---- ----	---- ----	---- ----	---- ----	---- ----	---- ----
43	*1	2B5C "	287C "	2B5C "	2B7C "	2B1C "	---- 2B00
44	Z	2C7A "	2C5A "	2C5A "	2C7A "	2C1A "	2C00 "
45	X	2D78 "	2D58 "	2D58 "	2D78 "	2D18 "	2D00 "
46	C	2E63 "	2E43 "	2E43 "	2E63 "	2E03 "	2E00 "
47	V	2F76 "	2F56 "	256 "	2F76 "	2F16 "	2F00 "
48	B	3062 "	3042 "	3042 "	3062 "	3002 "	3000 "
49	N	316E "	314E "	314E "	316E "	310E "	3100 "
50	M	326D "	324D "	324D "	326D "	320D "	3200 "

Table D-1 Keyboard scan/character codes (continued)

Key No.	Key top	Base	Upper	Caps lock		Ctrl	Alt
				Base	Upper		
51	< ,	332C "	333C "	332C "	333C "	---- ----	---- 3300
52	> .	342E "	343E "	342E "	343E "	---- ----	---- 3400
53	? /	352F "	353F "	352F "	353F "	---- ----	---- 3500
54	R-S	---- ----	---- ----	---- ----	---- ----	---- ----	---- ----
55	* "	372A "	372A "	372A "	372A "	---- 9600	---- 3700
56	L-A	---- ----	---- ----	---- ----	---- ----	---- ----	---- ----
57	SPC	3920 "	3920 "	3920 "	3920 "	3920 "	3920 "
58	CAP	---- ----	---- ----	---- ----	---- ----	---- ----	---- ----
59	F1	3B00 "	5400 "	3B00 "	5400 "	5E00 "	6800 "
60	F2	3C00 "	5500 "	3C00 "	5500 "	5F00 "	6900 "
61	F3	3D00 "	5600 "	3D00 "	5600 "	6000 "	6A00 "
62	F4	3E00 "	5700 "	3E00 "	5700 "	6100 "	6B00 "
63	F5	3F00 "	5800 "	3F00 "	5800 "	6200 "	6C00 "
64	F6	4000 "	5900 "	4000 "	5900 "	6300 "	6D00 "
65	F7	4100 "	5A00 "	4100 "	5A00 "	6400 "	6E00 "
66	F8	4200 "	5B00 "	4200 "	5B00 "	6500 "	6F00 "
67	F9	4300 "	5C00 "	4300 "	5C00 "	6600 "	7000 "

Table D-1 Keyboard scan/character codes (continued)

Key No.	Key top	Base	Upper	Caps lock		Ctrl	Alt
				Base	Upper		
68	F10	4400 "	5D00 "	4400 "	5D00 "	6700 "	7100 "
69	NUM	----	----	----	----	----	----
70	SCR	----	----	----	----	----	----
71	7 HOM	4700 "	4737 "	4737 "	4700 "	7700 "	* *
72	8 UC	4800 "	4838 "	4838 "	4800 "	----	* *
73	9 PUP	4900 "	4939 "	4939 "	4900 "	8400 "	* *
74	-	4A2D "	4A2D "	4A2D "	4A2D "	----	----
						8E00	4A00
75	4 LC	4B00 "	4B34 "	4B34 "	4B00 "	7300 "	* *
76	5	----	4C35 "	4C35 "	----	8F00	* *
77	6 RC	4D00 "	4D36 "	4D36 "	4D00 "	7400 "	* *
78	+	4E2B "	4E2B "	4E2B "	4E2B "	----	----
						9000	4E00
79	1 END	4F00 "	4F31 "	4F31 "	4F00 "	7500 "	* *
80	2 DC	5000 "	5032 "	5032 "	5000 "	----	* *
						9100	
81	3 PDN	5100 "	5133 "	5133 "	5100 "	7600 "	* *
82	O INS	5200 "	5230 "	5230 "	5200 "	----	* *
						9200	
83	. DEL	5300 "	532E "	532E "	5300 "	----	----
						9300	----
84	R-A	----	----	----	----	----	----

Table D-1 Keyboard scan/character codes (continued)

Key No.	Key top	Base	Upper	Caps lock		Ctrl	Alt
				Base	Upper		
85	R-C	----	----	----	----	----	----
87	F11	8500	8700	8500	8700	8900	8B00
88	F12	8600	8800	8600	8800	8A00	8C00
89	R-S S-R	----	----	----	----	7200 "	----
90	PUS BRK	----	----	----	----	0000 "	----
91	/	352F E02F	352F E02F	352F E02F	352F E02F	9500	A400
92	R-E	1C0D E00D	1C0D E00D	1C0D 300D	1C0D 300D	1C0A 300A	A600

NOTES:

BS:	Back Space	NUM:	Num Lock	R-A:	Right Alt
L-E:	Left Enter	SCR:	Scroll Lock	R-C:	Right Ctrl
L-C:	Left Ctrl	HOM:	Home	R-S:	Right Screen
L-S:	Left Shift	UC:	Up Cursor	S-R:	Sys Req
R-S:	Right Shift	PUP:	PgUp	PUS:	Pursue
L-A:	Left Alt	RC:	Right Cursor	BRK:	Break
SPC:	Space	DC:	Down Cursor	R-E:	Right Enter
CAP:	Caps Lock	PDN:	PgDn		

APPENDIX E KEYBOARD LAYOUTS

E.1 USA VERSION

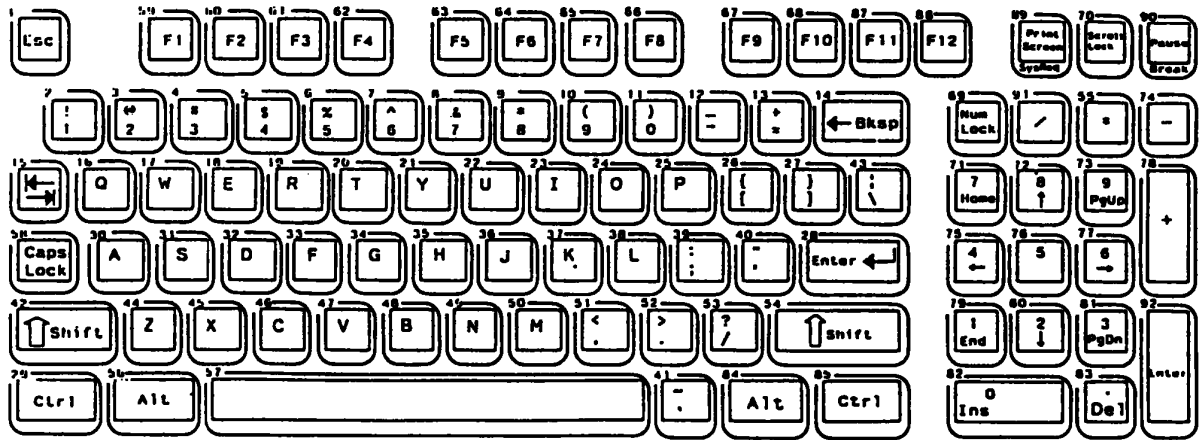


Figure E-1 USA version

E.2 UK VERSION

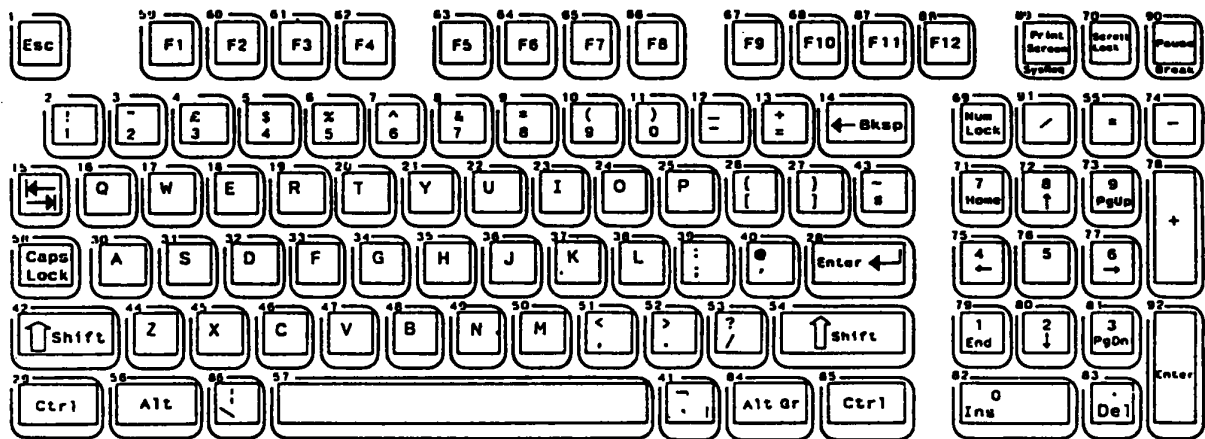


Figure E-2 UK version

E.3 GERMANY VERSION

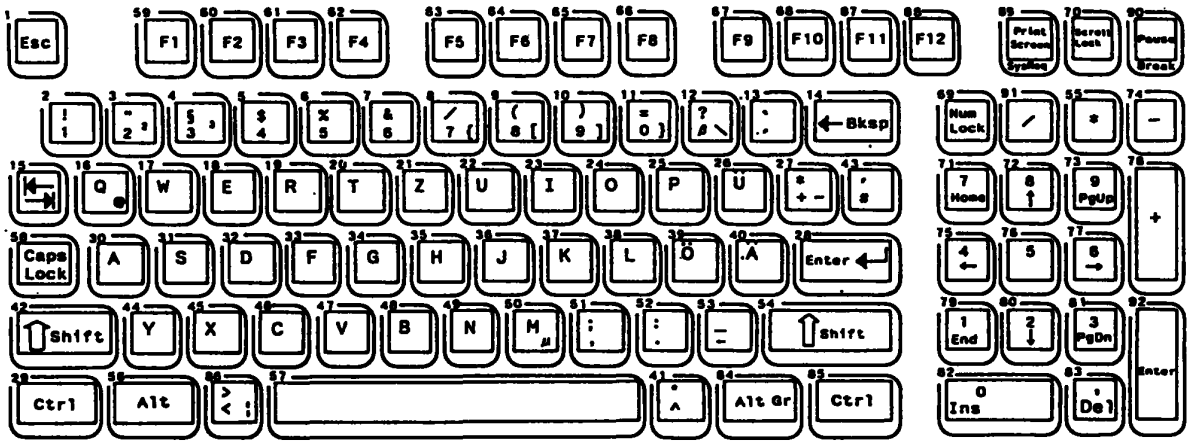


Figure E-3 Germany version

E.4 FRANCE VERSION

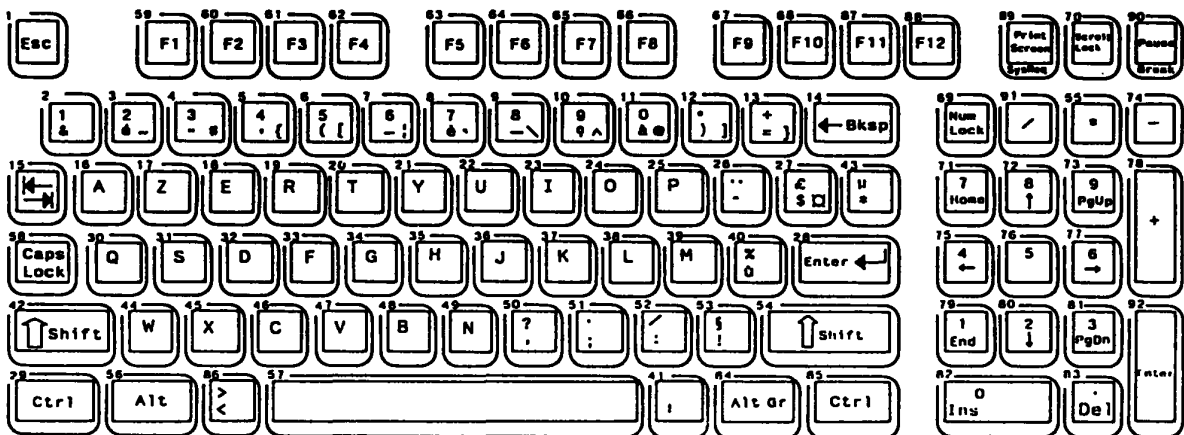


Figure E-4 France version

E.5 SPAIN VERSION

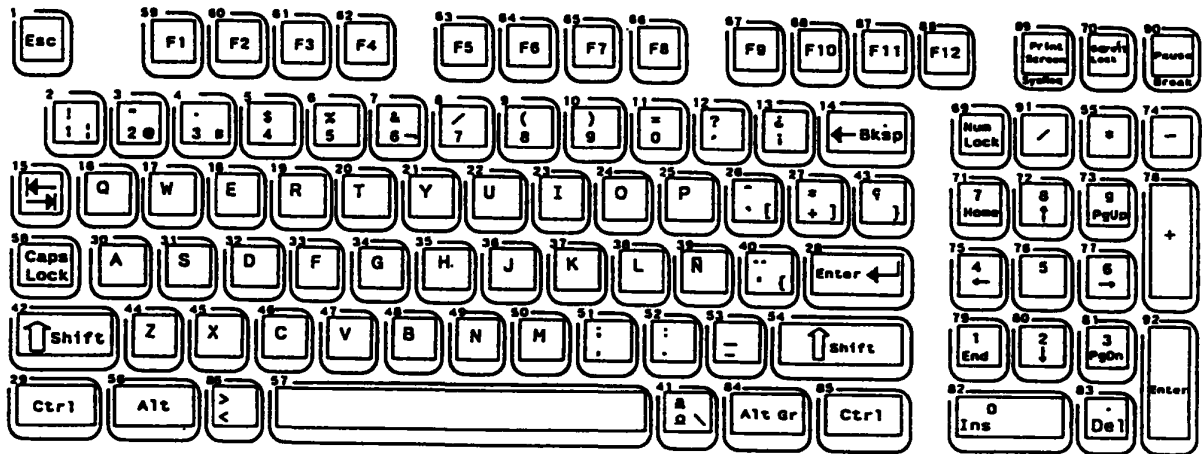


Figure E-5 Spain version

E.6 ITALY VERSION

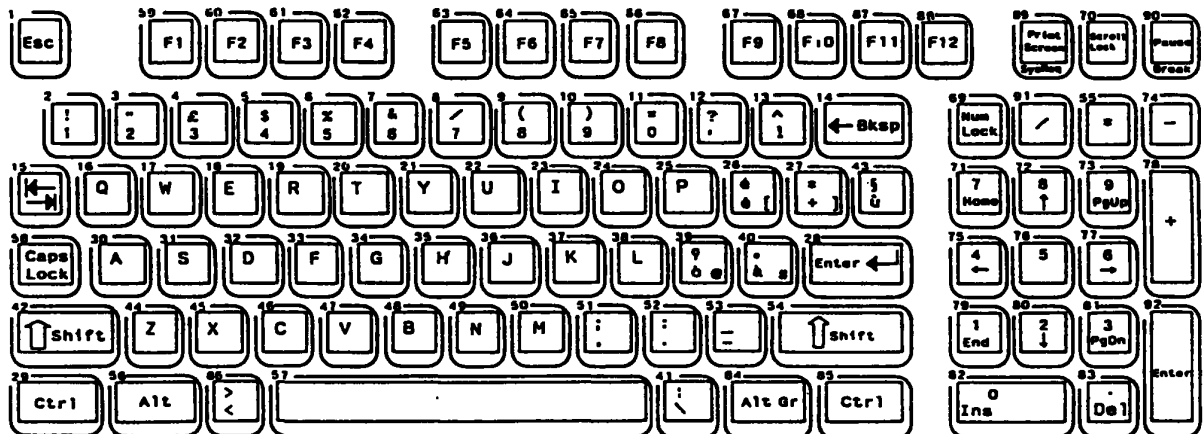


Figure E-6 Italy version

E.7 SWITZERLAND VERSION

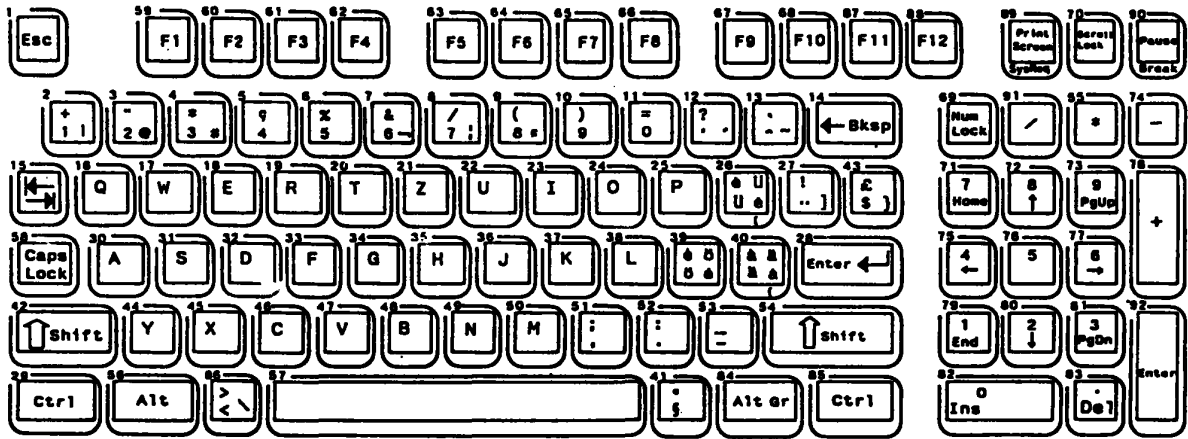


Figure E-7 Switzerland version

E.8 CANADA VERSION

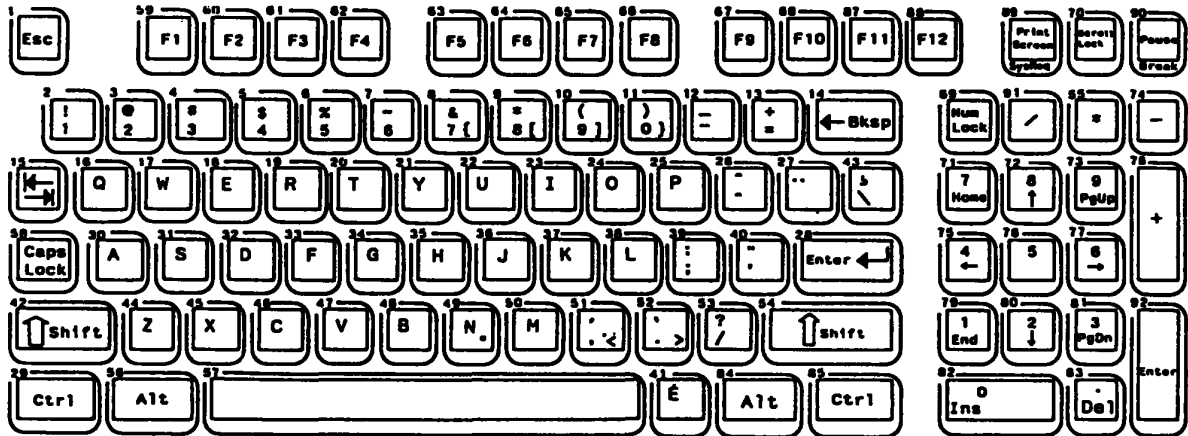


Figure E-8 Canada version

E.9 SWEDEN VERSION

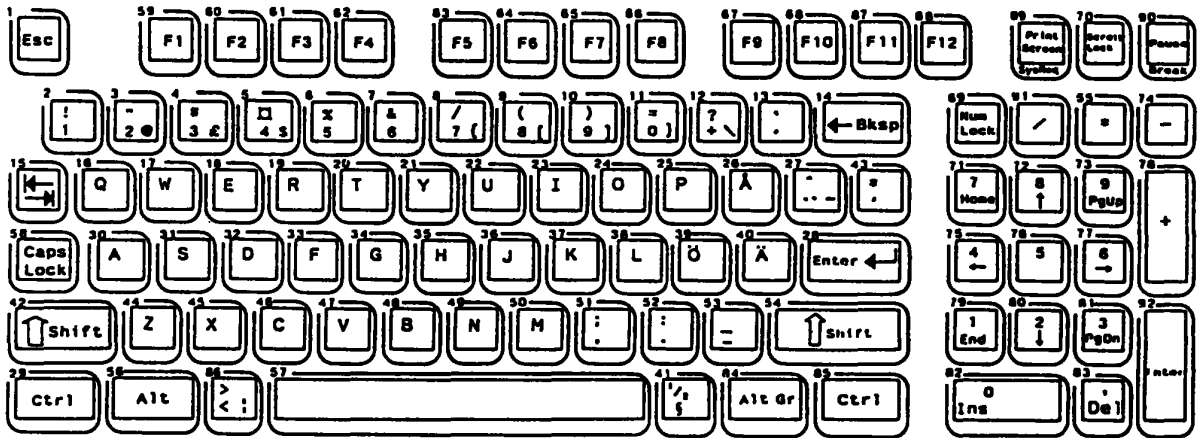


Figure E-9 Sweden version

E.10 DENMARK VERSION

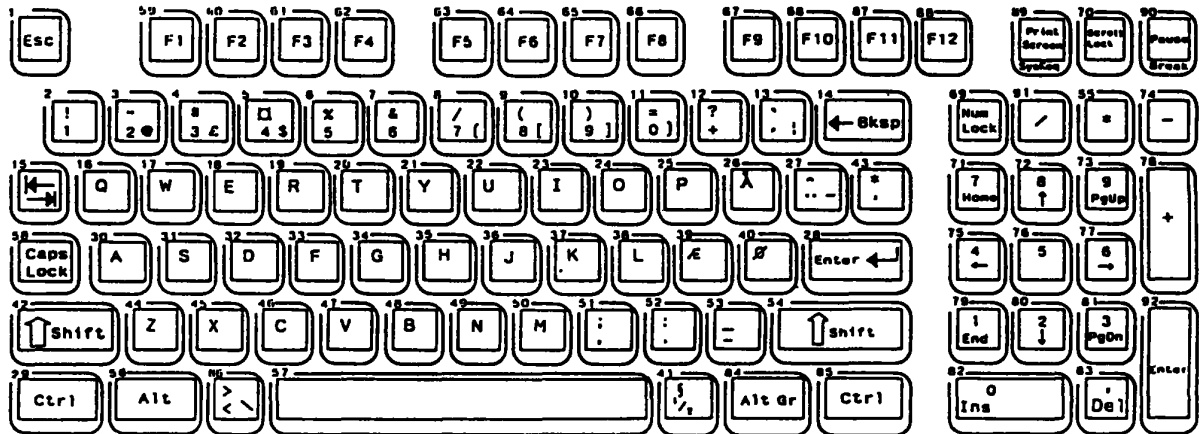


Figure E-10 Denmark version

E.11 NORWAY VERSION

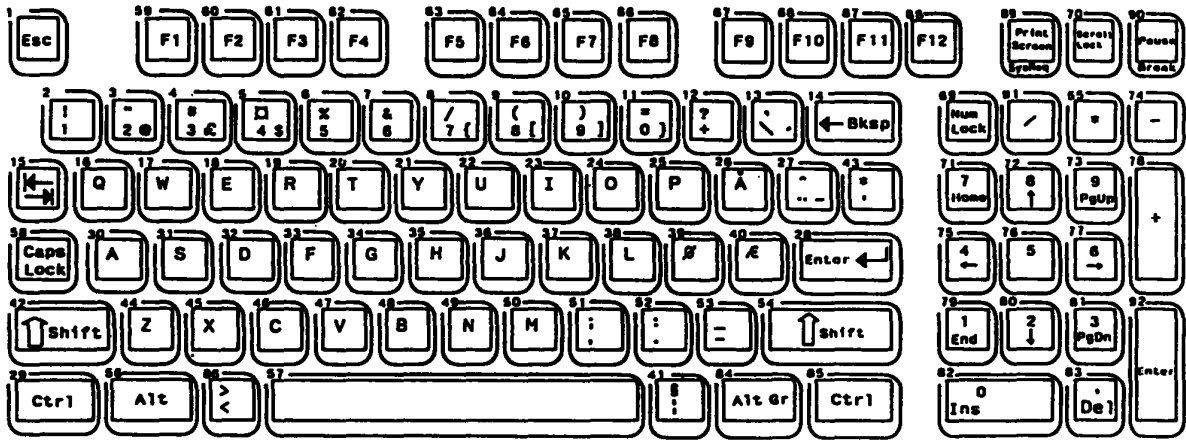


Figure E-11 Norway version