



**AT&T**

254-450-105IS  
Issue 2

Service Manual

**AT&T** Personal  
Computer 6300

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**\*\*\* WARNING \*\*\***

This equipment has been certified to comply with the limits for a Class B computing device, pursuant to Subpart J of Part 15 of FCC Rules. Only peripherals (computer input/output devices, terminals, printers, etc.) certified to comply with the Class B limits may be attached to this computer. Operation with noncertified peripherals is likely to result in interference to radio and TV reception.

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# CONTENTS

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## 1

### INTRODUCTION

<b>GENERAL</b> .....	1-3
<b>ORGANIZATION</b> .....	1-4
<b>TOOLS AND ACCESSORIES</b> .....	1-5

---

## 2

### SYSTEM OVERVIEW

<b>INTRODUCTION</b> .....	2-3
<b>SYSTEM MODULE</b> .....	2-5
Motherboard .....	2-9
CPU and DMA Circuitry .....	2-15
Memory .....	2-16
Input/Output Peripheral Interfaces .....	2-18
Input/Output Connectors .....	2-22
Motherboard Component Layout .....	2-25
Display Controllers .....	2-27
Bus Converter .....	2-31
Input/Output (I/O) Expansion Bus Characteristics .....	2-33
Mini-Floppy Disk Unit(s) .....	2-35
Slim Hard Disk Units (Optional) .....	2-37
Hard Disk Unit Controllers (Optional) .....	2-39

---

Memory Expansion Board (Optional) ..... 2-42  
Power Supply ..... 2-44

**DISPLAY ENHANCEMENT BOARD  
(OPTIONAL)** ..... 2-49

**SMALL EXPANSION BOX  
(OPTIONAL)** ..... 2-51

**DISPLAY** ..... 2-52

Monochrome Display ..... 2-52

Color Display (Optional) ..... 2-54

**KEYBOARD** ..... 2-56

**DISPLAY AND KEYBOARD EXTENSION  
CABLES** ..... 2-58

**MINIMUM SYSTEM  
CONFIGURATION** ..... 2-59

**EXPANDED SYSTEM  
CONFIGURATION** ..... 2-60

---

# 3

## INSTALLATIONS

**SITE PREPARATION** ..... 3-3

<b>ENVIRONMENTAL REQUIREMENTS</b> .....	3-5
<b>PHYSICAL CHARACTERISTICS</b> .....	3-6
<b>UNPACKING</b> .....	3-7
<b>OPTION INSTALLATION</b> .....	3-8
Removing System Module Covers .....	3-9
Removing Upper Cover .....	3-10
Removing Lower Cover .....	3-11
Upgrading Motherboard Memory to 256KB or 640KB .....	3-12
Installing Memory Expansion Board .....	3-21
Upgrading Memory Expansion Board Memory to 384KB .....	3-27
Installing 8087 Numeric Data Processor .....	3-36
Replacing Mini-Floppy Disk Unit With Hard Disk Unit .....	3-42
Removing Upper MFD Unit .....	3-42
Installing 10- or 20-MB Hard Disk Units .....	3-46
Installing Hard Disk Controller Board .....	3-48
Setting DIP Switches and Jumpers .....	3-52
Installing Small Expansion Box .....	3-63
Installing the Display Enhancement Board .....	3-77
Installing DEB Software .....	3-90
Floppy Disk Systems .....	3-91
Hard Disk Systems .....	3-94
Troubleshooting the DEB Installation .....	3-97
Installing the Mouse .....	3-100
Installing the Ball in the Mouse .....	3-100
Connecting the Mouse to the Computer .....	3-102

Installing the Keyboard ROM .....	3-104
Opening the Keyboard .....	3-104
Removing Existing ROM Chip .....	3-105
Installing New ROM Chip .....	3-105
Installing the Mouse Software .....	3-107
Installing the Mouse Software With the Dual Diskette Computer .....	3-107
Installing Mouse Software With the Hard Disk Computer .....	3-109

<b>SYSTEM INSTALLATION .....</b>	<b>3-110</b>
----------------------------------	--------------

<b>APPLYING POWER TO THE SYSTEM .....</b>	<b>3-115</b>
---	--------------

---

# 4      **DIAGNOSTICS**

<b>INTRODUCTION .....</b>	<b>4-5</b>
---------------------------	------------

<b>RESIDENT DIAGNOSTICS .....</b>	<b>4-7</b>
-----------------------------------	------------

Operating Procedures .....	4-8
----------------------------	-----

Test Descriptions .....	4-10
-------------------------	------

Error Messages .....	4-15
----------------------	------

<b>CUSTOMER TEST DIAGNOSTICS .....</b>	<b>4-20</b>
--	-------------

Loading Customer Test .....	4-21
-----------------------------	------

Operating Procedures .....	4-22
----------------------------	------

Automatic Mode .....	4-23
----------------------	------

Manual Mode .....	4-25
-------------------	------

Test Descriptions . . . . .	4-32
Motherboard Test . . . . .	4-32
Memory Test . . . . .	4-33
Keyboard Test . . . . .	4-34
Video System Test . . . . .	4-35
Parallel Port Test . . . . .	4-36
Serial Port(s) Test . . . . .	4-37
48 TPI Floppy Disk Test . . . . .	4-37
HDU Drive and Controller Test . . . . .	4-38
Parallel Printer Test . . . . .	4-39
8087 Math Co-Processor . . . . .	4-41
Mouse Test . . . . .	4-41
8530 Test . . . . .	4-42
Video Option Board Test (DEB [Display Enhancement Board]) . . . . .	4-42
2nd HDU Drive and Controller Test . . . . .	4-45
<b>SYSTEM TEST DIAGNOSTICS . . . . .</b>	<b>4-47</b>
Loading System Test . . . . .	4-47
Operating Procedures . . . . .	4-48
Test Descriptions . . . . .	4-58
Motherboard Test . . . . .	4-58
Memory Test . . . . .	4-60
Keyboard Test . . . . .	4-62
Video System Test . . . . .	4-63
Parallel Port Test . . . . .	4-67
Serial Port(s) Test (Using 8250) . . . . .	4-69
48 TPI Floppy Disk Test . . . . .	4-71
MB HDU Drive and Controller Test . . . . .	4-74
8087 Math Co-Processor . . . . .	4-77
Parallel Printer Test . . . . .	4-77
Mouse Test . . . . .	4-79
8530 Test . . . . .	4-80
Video Option Board Test [Display Enhancement Board (DEB)] . . . . .	4-80
2nd HDU Drive and Controller Test . . . . .	4-83

<b>SYSTEM TEST DIAGNOSTICS (OVERLAY VERSION)</b> .....	4-87
Loading System Test (Overlay Version) .....	4-87
<b>STAND-ALONE MOTHERBOARD DMA TEST DIAGNOSTICS</b> .....	4-89
DMA Test .....	4-89
<b>STAND-ALONE LOW-LEVEL FORMAT UTILITY TEST</b> .....	4-92
General Characteristics .....	4-93
The Bad Track Table .....	4-95
List of Operations .....	4-96
Help .....	4-101
HDU Configuration .....	4-102
Low-Level Format .....	4-105
Display and Edit Bad Track Table .....	4-110
Format Bad Tracks .....	4-119
Verify Surface Test .....	4-121
Ship the Unit .....	4-124
Exit Low-Level Format (LLF) Utility .....	4-125
<b>CUSTOMER AND SYSTEM TEST ERROR MESSAGES</b> .....	4-127
100—Motherboard Tests .....	4-127
300—Memory Tests .....	4-129
400—Keyboard Tests .....	4-133
500—Video Tests .....	4-137
600—Parallel Port Tests .....	4-144
700—8250 Serial Port Tests .....	4-145
800—MFD Unit Tests .....	4-147
900—HDU Tests .....	4-149

10XX—Parallel Printer Tests .....	4-152
18XX—8087-2 Numeric Co-Processor Tests .....	4-152
20XX—Mouse Tests .....	4-153
21XX—8530 Serial Port Tests .....	4-154
23XX—Video Option Board (DEB) Tests .....	4-155
24XX—HDU Drive No. 2 Tests .....	4-167

---

# 5 MAINTENANCE

<b>GENERAL</b> .....	5-5
Troubleshooting .....	5-5
Replacing Faulty Modules .....	5-5
Reminders .....	5-6

<b>TROUBLESHOOTING WITHOUT SYSTEM TEST</b> .....	5-7
System Will Not Power Up Normally .....	5-7
System Load Check on Power Supply .....	5-9
Short Isolation Procedure .....	5-19
Display Check .....	5-26
Mini-Floppy Disk Unit Check .....	5-28
Two Mini-Floppy Disk Units .....	5-28
One MFD Unit and One HDU .....	5-33
System Will Not Access Hard Disk .....	5-36
Hard Disk Problems .....	5-38

Problems That May Occur in a One/Two Hard Disk Configuration . . . . .	5-39
Placing Low-Level Format and Bad Track Mapping on the Hard Disk . . . . .	5-41
Partition Hard Disk for MS-DOS . . . . .	5-45
Formatting the Hard Disk . . . . .	5-47
Hard Disk Unit "Not Ready" on Cold Start . . . . .	5-50
Resident Diagnostic Error Messages . . . . .	5-51

**TROUBLESHOOTING WITH SYSTEM**

<b>TEST</b> . . . . .	5-54
Motherboard . . . . .	5-55
Random Access Memory (RAM) . . . . .	5-59
Determining Faulty RAM Chips . . . . .	5-65
Keyboard . . . . .	5-69
Video System . . . . .	5-73
Parallel Port . . . . .	5-88
Serial Port Test (Using 8250) . . . . .	5-91
Mini-Floppy Disk Drive . . . . .	5-94
Hard Disk Unit . . . . .	5-99
Parallel Printer Test . . . . .	5-105
8087-2 Math Co-Processor . . . . .	5-109
Mouse . . . . .	5-112
Mouse Test . . . . .	5-114
8530 Serial Port Test . . . . .	5-118
Video Option Board (Display Enhancement Board) . . . . .	5-121
Video Option Board Test . . . . .	5-125
Second Hard Disk Unit . . . . .	5-135

<b>STAND-ALONE MOTHERBOARD DMA TEST DIAGNOSTICS</b> .....	5-142
Test Description .....	5-142
Loading DMA Test .....	5-142
Operating Procedures .....	5-143
<b>POWER SUPPLY ADJUSTMENT</b> .....	5-145
<b>REPLACING FAULTY MODULES</b> .....	5-148
Removing Upper System Module Cover .....	5-149
Removing Lower System Module Cover .....	5-150
Replacing Power Supply Unit .....	5-151
Replacing Fan .....	5-156
Replacing Motherboard .....	5-157
Replacing Bus Converter .....	5-161
Replacing Display Controller .....	5-162
Replacing Lower Mini-Floppy Disk Unit .....	5-168
Replacing Upper Mini-Floppy Disk Unit .....	5-175
Replacing Slim HDU .....	5-180
Replacing Memory Expansion Board .....	5-186
Replacing HDU Controller .....	5-187
Replacing Small Expansion Box (External HDU) .....	5-189
Replacing Memory Chips .....	5-193
Mouse Care and Cleaning .....	5-198
Cleaning Keyboard Contacts .....	5-201

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# A

## APPENDIX A: SWITCHES AND JUMPERS

<b>INTRODUCTION</b> .....	A-3
Switches .....	A-3
Jumpers .....	A-6
<b>MOTHERBOARD</b> .....	A-7
Jumpers .....	A-7
DIP Switch Setting .....	A-9
DIPSW-0 Settings .....	A-10
DIPSW-1 Settings .....	A-13
<b>HARD DISK CONTROLLERS</b> .....	A-16
HDUs Supported .....	A-29
<b>DISPLAY CONTROLLER BOARD</b> .....	A-30
Display Controller Jumpers .....	A-30
Video Disable Option .....	A-32
P4 Display Controller Board .....	A-32
P8 Display Controller Board .....	A-34
Display Enhancement Board Jumpers .....	A-35
<b>Mini-Floppy Disk Units</b> .....	A-38
Jumpers .....	A-38

Resistor Pack or Terminating Resistor .....	A-39
Toshiba Mini-Floppy Disk Unit .....	A-39
OPE Mini-Floppy Disk Unit .....	A-41
Matsushita Mini-Floppy Disk Unit .....	A-43
<b>HARD DISK UNIT .....</b>	<b>A-45</b>
Jumper and Switch Setting .....	A-45
<b>AT&amp;T PC 6300 ACCEPTANCE PROCEDURE .....</b>	<b>A-54</b>

---

# **B** APPENDIX B: FIELD REPLACEABLE MODULES

<b>FIELD REPLACEABLE MODULES .....</b>	<b>B-3</b>
--	------------

---

## **INDEX**

<b>GENERAL .....</b>	<b>1-3</b>
<b>ORGANIZATION .....</b>	<b>1-4</b>
<b>TOOLS AND ACCESSORIES.....</b>	<b>1-5</b>

## GENERAL

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The purpose of this Service Manual is to support service personnel in the installation and maintenance of the AT&T Personal Computer 6300 (PC 6300) and its options. Since there is a minimum number of moving parts in the system, there is virtually no preventive maintenance. Therefore, the maintenance of the system is limited to signal adjustments and troubleshooting. The only signal adjustment is on the power supply.

All Diagnostic Tests and Maintenance Procedures are designed for AT&T Products only.

## **ORGANIZATION**

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The information in this manual is organized as follows:

- Chapter 2, “SYSTEM OVERVIEW,” contains an overview of the PC 6300 and its main units. It also contains some detailed information on the operation and functions of the system modules.
- Chapter 3, “INSTALLATIONS,” discusses site preparation, environmental requirements, and installation of the PC 6300 and its supported options.
- Chapter 4, “DIAGNOSTICS,” contains procedures for performing all three levels of diagnostics on the PC 6300. It also contains a description of the test performed during the diagnostics and error messages.
- Chapter 5, “MAINTENANCE,” discusses troubleshooting procedures for the PC 6300 and contains procedures for the replacement of faulty modules.
- Appendix A, “DIP SWITCHES AND JUMPERS,” discusses the location and purpose of the Dual In-Line Package (DIP) Switches and Jumpers that are contained in the PC 6300.
- Appendix B, “FIELD REPLACEABLE MODULES,” contains a list of the field replaceable modules and the information required for ordering these modules.

## TOOLS AND ACCESSORIES

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The following tools and accessories should be readily available when performing maintenance on the PC 6300:

- Volt/Ohm Meter (VOM)
- Medium-Sized Standard Screwdriver
- Chip Insertion Tool
- Chip Extraction Tool
- Wrist Strap (Static Discharge Strap)
- 2 Blank Formatted (Scratch) Diskettes (Double-sided, double-density, soft-sectored, 5-1/4 inch floppy diskettes)
- Serial Loopback Connector (for testing Serial Port)

## INTRODUCTION

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- Parallel Loopback Connector (for testing Parallel Port)
- 1/4 inch Nutdriver
- 7/32 inch Nutdriver
- 3/16 inch Nutdriver
- 5/32 inch Nutdriver
- Phillips Screwdriver.

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<b>INTRODUCTION</b> .....	2-3
<b>SYSTEM MODULE</b> .....	2-5
Motherboard .....	2-9
CPU and DMA Circuitry .....	2-15
Memory .....	2-16
Input/Output Peripheral Interfaces .....	2-18
Input/Output Connectors .....	2-22
Motherboard Component Layout .....	2-25
Display Controllers .....	2-27
Bus Converter .....	2-31
Input/Output (I/O) Expansion Bus Characteristics .....	2-33
Mini-Floppy Disk Unit(s) .....	2-35
Slim Hard Disk Units (Optional) .....	2-37
Hard Disk Unit Controllers (Optional) .....	2-39
Memory Expansion Board (Optional) .....	2-42
Power Supply .....	2-44
<b>DISPLAY ENHANCEMENT BOARD (OPTIONAL)</b> .....	2-49
<b>SMALL EXPANSION BOX (OPTIONAL)</b> .....	2-51
<b>DISPLAY</b> .....	2-52
Monochrome Display .....	2-52
Color Display (Optional) .....	2-54

**KEYBOARD** ..... 2-56

**DISPLAY AND KEYBOARD EXTENSION  
CABLES** ..... 2-58

**MINIMUM SYSTEM  
CONFIGURATION** ..... 2-59

**EXPANDED SYSTEM  
CONFIGURATION** ..... 2-60

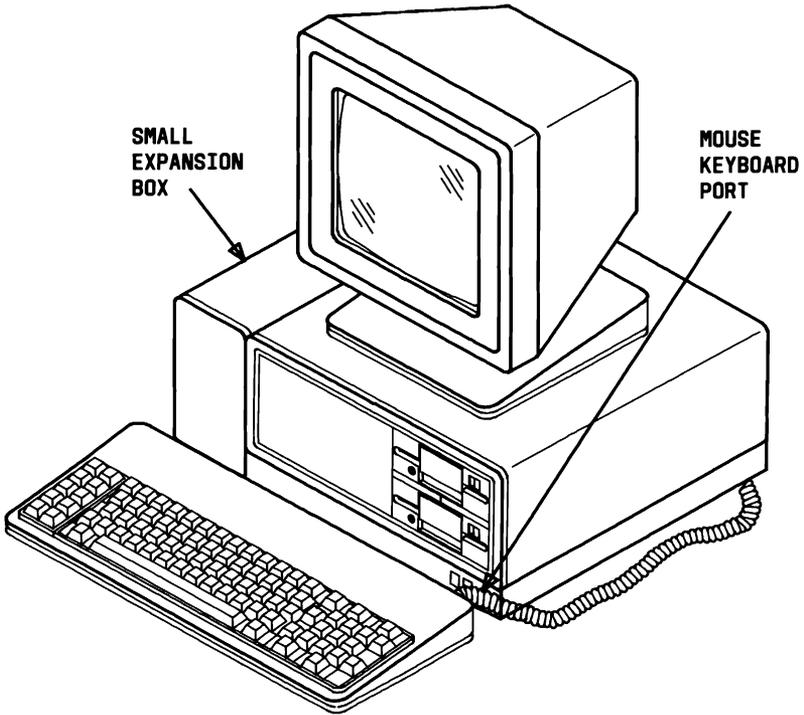
## INTRODUCTION

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The AT&T Personal Computer 6300 (Figure 2-1) is a desktop unit; and in its standard configuration, contains three units:

- System Module
- Display (Monochrome or Color)
- Keyboard.

An optional fourth unit, the Small Expansion Box, may also be present. The Small Expansion Box houses a Hard Disk Unit (HDU).



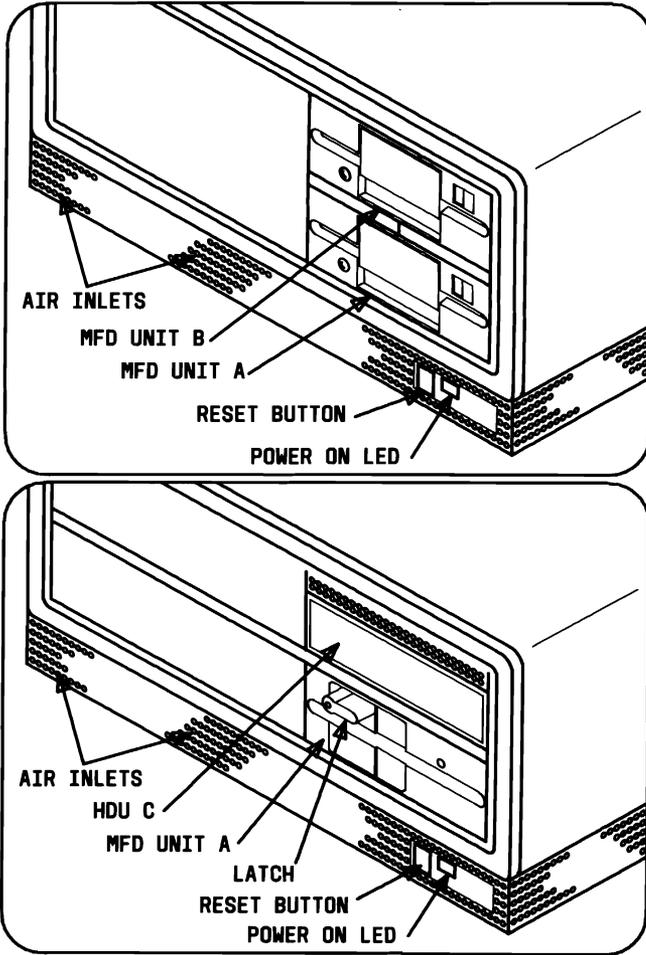
**Figure 2-1. AT&T Personal Computer 6300 With Small Expansion Box (Optional)**

## SYSTEM MODULE

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The System Module houses the Motherboard, Display Controller, Bus Converter Board, one or two slim (low profile) 5.25-inch Floppy Disk Units, and a Power Supply. Some System Modules may contain one Mini-Floppy Disk (MFD) Unit and a 10-MB or 20-MB slim HDU. If the Small Expansion Box or Slim HDU is present, the System Module will also contain a HDU Controller Board. All system modules are equipped with a fan.

Each front panel of the two System Modules (Figure 2-2) has a green Power-On LED and RESET button. The front panel also provides access to the MFD Unit(s). The base of the System Module contains air inlets to cool the system.



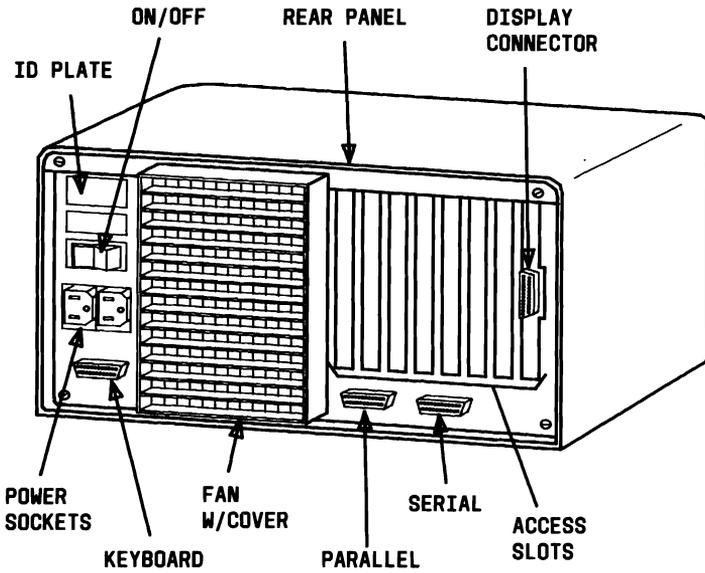
**Figure 2-2. Two Types of System Module Front Panels**

The rear panel of the System Module (Figure 2-3) consists of the following:

- Keyboard Connector
- Serial Port Connector
- Parallel Port Connector
- Power Inlet Connector
- Power Outlet Connector
- Display Connector
- On/Off Switch
- Access Slots for Expansion Boards
- Fan with Cover
- I/D Plate (Serial and Central Processor Unit numbers).

# SYSTEM OVERVIEW

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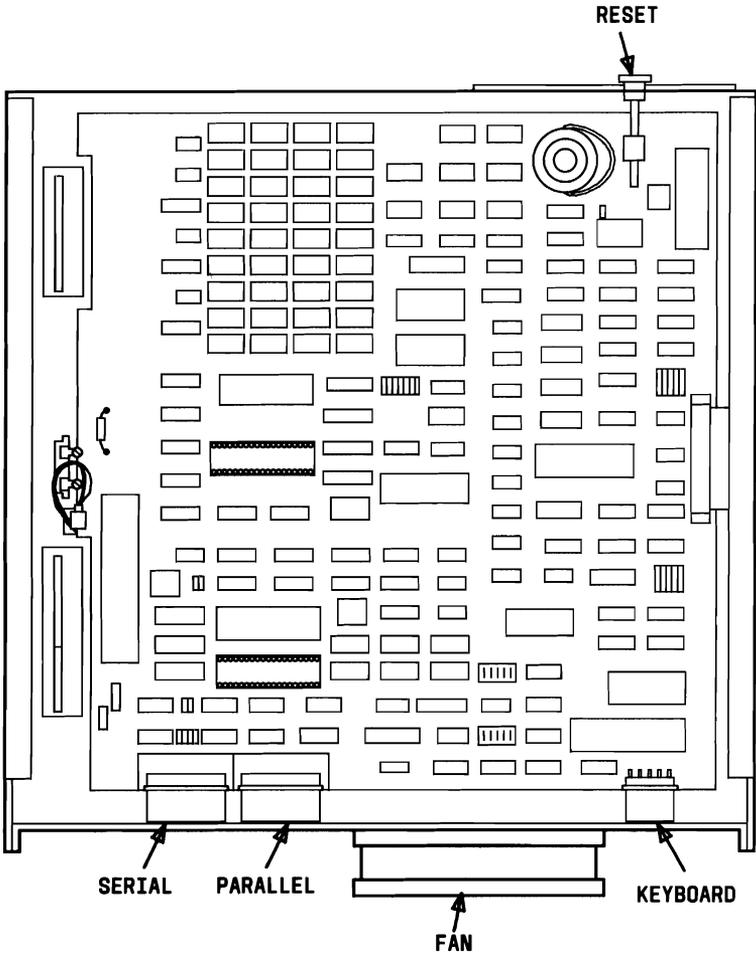
**Figure 2-3. System Module Rear Panel**

## **Motherboard**

The Motherboard is the large printed circuit board at the bottom of the System Module chassis. The Motherboard is placed in the System Module with its component side facing downward. This means that if the lower cover of the System Module were removed, the components (chips, transistors, resistors, DIP switches, etc.) of the Motherboard would be exposed (Figure 2-4).

**SYSTEM OVERVIEW**

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**Figure 2-4. Motherboard in System Module**

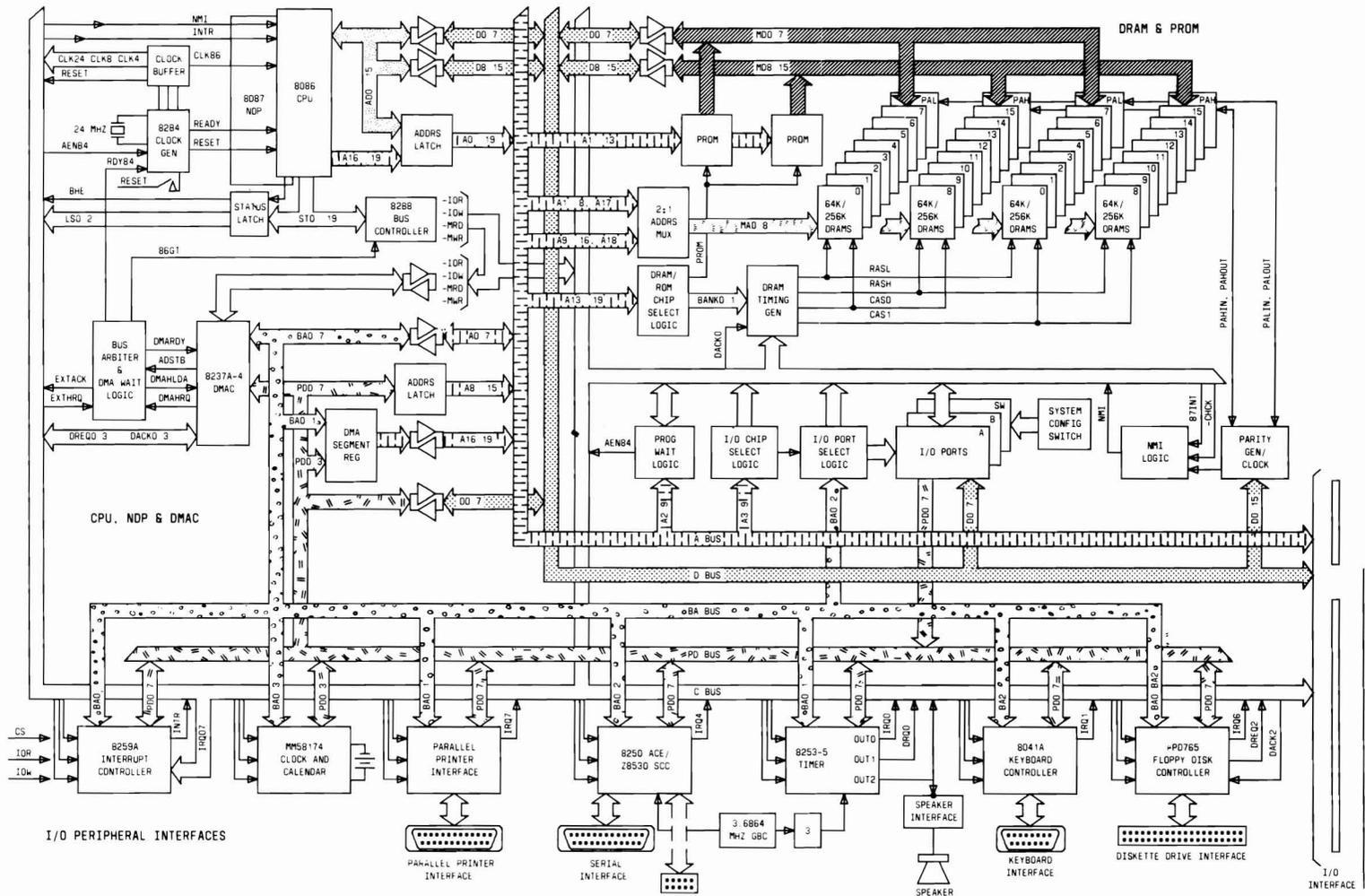


Figure 2-5. Functional Block Diagram of Motherboard

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The Motherboard can be divided into four different sections with each section providing specific functions:

- Central Processing Unit (CPU) and Direct Memory Access (DMA)
- Memory — Random Access Memory (RAM) and Programmable Read-Only Memory (PROM)
- Input/Output (I/O) Peripheral Interfaces
- Input/Output Connectors.

These sections are connected by three system buses:

**A Bus** Carries address information generated by the CPU or DMA controller.

**D Bus** Carries data information between the CPU, DMA controller, memory, and the I/O peripheral interfaces.

**C Bus** Carries all the control signals.

The Motherboard uses an Intel 8288 (or equivalent) Bus Controller to manage the various buses. It decodes the status output of the CPU to generate the bus command and control signals at the appropriate times. Figure 2-5 is a functional block diagram of the Motherboard.

---

## *CPU and DMA Circuitry*

The CPU used with the PC 6300 is the 16-bit Intel 8086-2 (or equivalent). This microprocessor contains the arithmetic and logic circuitry to extract program instructions from memory and execute them one at a time. The 8086-2 operates at a frequency of 8 MHz.

There is a socket on the Motherboard for an optional Numeric Data Processor (NDP). The NDP is a 16-bit Intel 8087-2 NDP (or equivalent) that serves as a co-processor attached to the 8086 CPU. The NDP monitors the 8086 instruction stream and extracts only the commands intended for the 8087. The 8087 NDP instructions include a full set of arithmetic functions as well as powerful exponential, logarithmic, and trigonometric functions.

The DMA circuitry on the Motherboard is constructed of:

- DMA Controller
- DMA Segment Register
- DMA Control Buffer
- DMA Data Buffer
- DMA Address Latches.

The main component of the DMA circuitry is the Intel 8237 DMA (or equivalent) Controller. The DMA Controller is the device that generates requests to take over the system bus and transfer information directly from the I/O peripherals to the system memory and vice versa. This is necessary when moving blocks of data rapidly from memory to I/O peripherals.

## *Memory*

The Motherboard RAM is organized in such a way that it can be addressed as bytes (8 bits) as well as words (2 bytes/16 bits). It is divided into two banks: bank 0 and bank 1. Both banks have two groups of nine 64-K or 256-K bit chips. One group is the lower byte (even address) and the other is the higher byte (odd address). Eight chips of each group are used for memory storage and the ninth chip is used for parity checking. All RAMs are dynamic and require periodic refresh. Memory refresh is provided by the DMA circuitry.

The Motherboard has four standard memory configurations: 128 KB, 256 KB, 512 KB (CPU 3X), and 640 KB. In the 128-KB configuration, the RAM resides in bank 0. Initially, bank 1 does not contain any memory chips, but sockets are present for the easy expansion of the Motherboard memory. With the insertion of 64-K bit memory chips into bank 1, the Motherboard memory is expanded to 256 KB. With the insertion of 256-K bit memory chips into bank 1, the Motherboard memory is expanded to 640 KB. In the 256-KB configuration, both banks 0 and 1 may be soldered to the Motherboard. The 64-K bit chips in one of the banks can be replaced with 256-K bit chips that will provide 640 KB of RAM on the Motherboard.

The Motherboard ROM contains the Resident Diagnostics and Bootstrap Loader programs. Two EPROM chips provide a total of 16 KB of Programmable Read-Only Memory. The ROMs physically occupy addresses F0000 to FFFFF. Following power-up or reset, the 8086 CPU always begins execution at location FFFFF0 that contains a jump instruction. This jump instruction directs the system to the initial Resident Diagnostic routine and then to the Bootstrap Loader. The ROMs also contain drivers for the Keyboard, Mini-Floppy Disk, Hard Disk, and other peripherals along with initialization programs for Large Scale Integration (LSI) chips.

## ***Input/Output Peripheral Interfaces***

The I/O Peripheral Interfaces of the Motherboard are listed below:

- Keyboard Interface
- Mini-Floppy Disk Interface
- Parallel Printer Interface
- Serial Communications Channel (SCC) Interface
- I/O Chip Select Logic
- Interrupt Controller
- Timer
- Real-Time Clock and Calendar.

### ***Keyboard Interface***

The Keyboard Interface provides the interface between the system and the Keyboard. It converts the system's parallel data to serial data for the Keyboard and vice versa. The main component of this interface is the 8041/8741 Keyboard Controller.

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### *Mini-Floppy Disk Interface*

The MFD Interface has two major functions:

- It manages the logic and control circuitry required in recording data onto and reading data from the MFD Units.
- It initially formats new disks.

The MFD Interface is physically located on the Motherboard. Its chief component is the NEC  $\mu$ PD765 Floppy Disk Controller (or equivalent). This controller contains the circuitry and control functions for interfacing the 8086 CPU to the MFD Units. The controller operates in a DMA mode during data transfers. In this way, the 8086 CPU need only load the command required into the controller and all data transfers occur under the control of the  $\mu$ PD765 and the DMA controller. The  $\mu$ PD765 supports 15 separate commands.

### *Parallel Printer Interface*

The Parallel Printer Interface provides one Centronics-like parallel interface for the connection of a printer. It is physically located on the Motherboard and access is made through the rear panel of the System Module. A printer may be one of the following:

- Daisy Wheel Letter-Quality Printer
- Dot-Matrix Printer.

### *Serial Communication Interface*

The PC 6300 has a standard serial channel to support serial communications. The LSI serial communication chip used is the NEC 8250 (or equivalent). It provides one asynchronous RS-232 channel. The RS-232 connector is located on the Motherboard and access is made through the rear panel of the System Module.

### *Input/Output Chip Select Logic*

The I/O Chip Select Logic is an address decoder used to generate chip select signals from address bits A4 to A9. This circuitry uses the PAL12L10 as the Motherboard I/O address decoder.

---

### *Interrupt Controller*

Hardware Interrupts are asynchronous events requiring CPU attention and are generally started by peripheral devices requiring service. The CPU is normally allowed to execute its main program until an interrupt request occurs. On receipt of an interrupt request, the CPU completes the instruction being executed, saves its current state (instruction pointer, code segment, and flags), and fetches a new routine to service the interrupting device. Once the interrupting device has been serviced, the CPU resumes its main program at the point where it was interrupted.

The system has nine interrupts in all: eight maskable interrupts and one nonmaskable interrupt. The nonmaskable interrupt has priority over the maskable interrupts. The maskable interrupts have a specific priority level assigned to each of them. It is the job of the interrupt controller to handle the priority of the maskable interrupts. It functions as an overall manager in the interrupt-driven system environment to choose which interrupt gets service first according to their priority levels. The interrupt controller used is the Intel 8259 (or equivalent).

### *Timer*

The Timer is a programmable device that has three independent channels. Channel 0 is used as the input for the real-time clock. Channel 1 is used to time and request refresh cycles from the DMA channel. Channel 2 is used to support the tone generator for the audio speaker. The timer used is the Intel 8253 (or equivalent) programmable interval timer.

### *Real-Time Clock and Calendar*

A Clock-Calendar Chip is used to provide real time such as seconds, minutes, hours, days, day of week, months, etc., for the system. A 3-volt, low-power standby rechargeable battery is connected to it to ensure that the real time is kept even when the system is turned off. The chip used is the MM58174AN.

### ***Input/Output Connectors***

There are five I/O Connectors on the Motherboard. Two of the connectors (J1 and J2) are used to connect the Motherboard to the Display Controller. The other three connectors are for the Keyboard, parallel interface (printer), and the asynchronous RS-232 channel. The connectors, along with the signal (pin) names, are shown in Figure 2-6 as they appear on the Motherboard. Refer to the "AT&T Personal Computer 6300 Reference Manual" for detailed pin information.

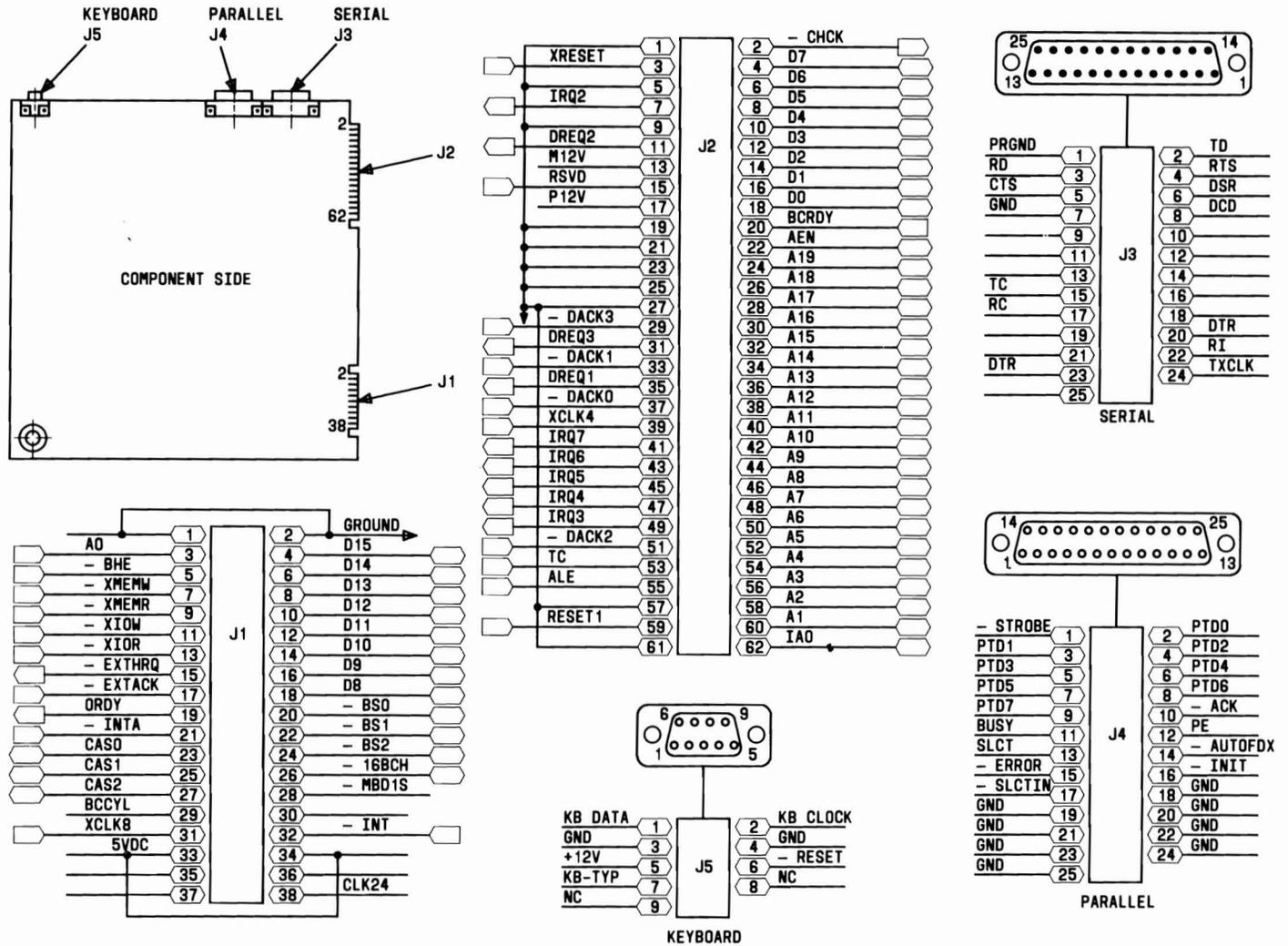


Figure 2-6. Motherboard Connectors

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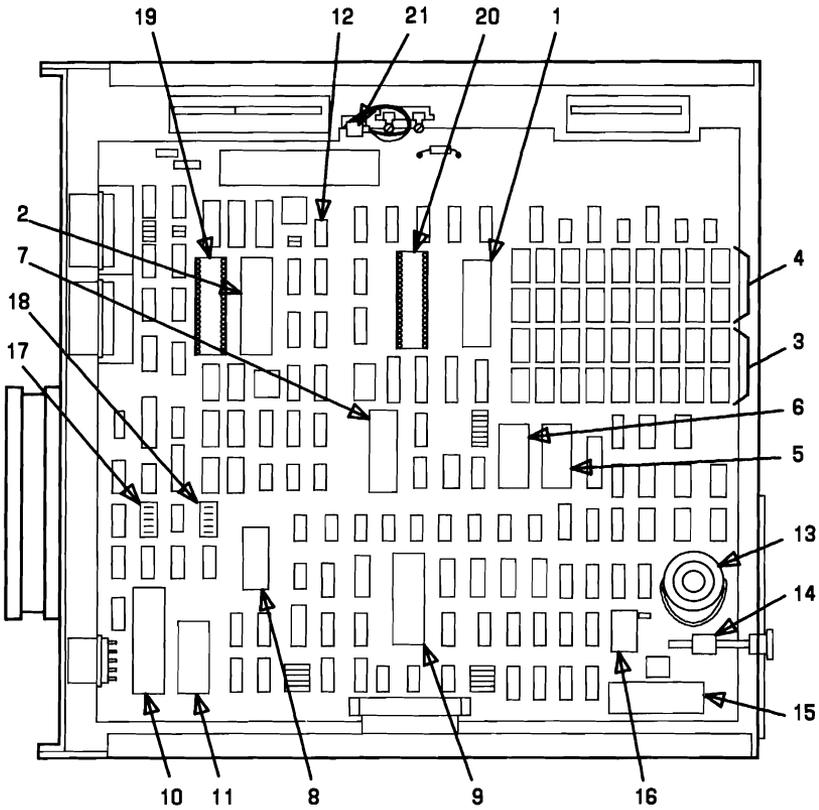
## ***Motherboard Component Layout***

Figure 2-7 shows the physical location of the following principal Motherboard integrated circuits and other components:

1. 8086-2 CPU
2. 8250 UART
3. Bank 0 RAM
4. Bank 1 RAM
5. High-Byte EPROM
6. Low-Byte EPROM
7. 8237 DMA Controller
8. 8259A Interrupt Controller
9. NEC  $\mu$ PD765 MFD  
Controller (or equivalent)
10. 8041 or 8741 Keyboard  
Controller
11. 8253 Timer
12. 8288 Bus Controller
13. Speaker
14. RESET Button
15. Battery
16. Clock-Calendar Chip
17. DIP Switch Bank 1
18. DIP Switch Bank 0
19. Z-8530 Socket
20. 8087-2 Socket
21.  $\pm$ 12V Connector.

# SYSTEM OVERVIEW

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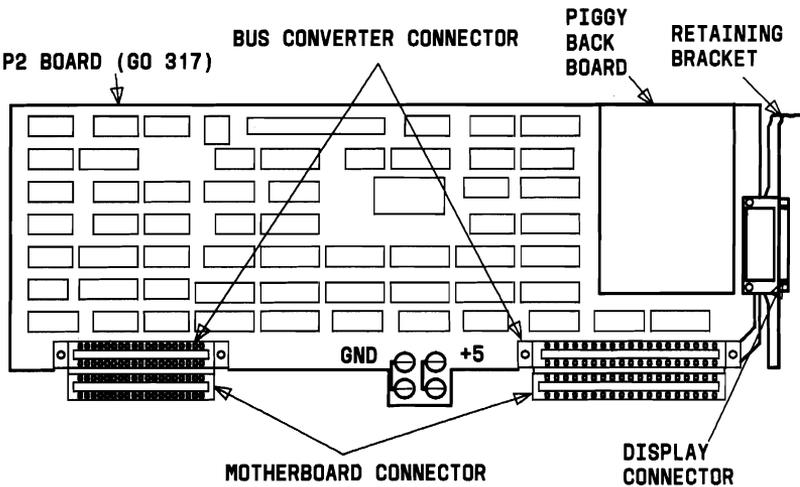


**Figure 2-7. Motherboard Integrated Circuit (IC) Chip Locations**

---

## Display Controllers

The Three Display Controllers (Figures 2-8, 2-9, and 2-10) are designed to interface between the Motherboard and the Display. They attach in a perpendicular fashion to the Motherboard by the two lower connectors. The upper connectors are used for connection of the Bus Converter Board.



**Figure 2-8. Display Controller (P2 Board)**

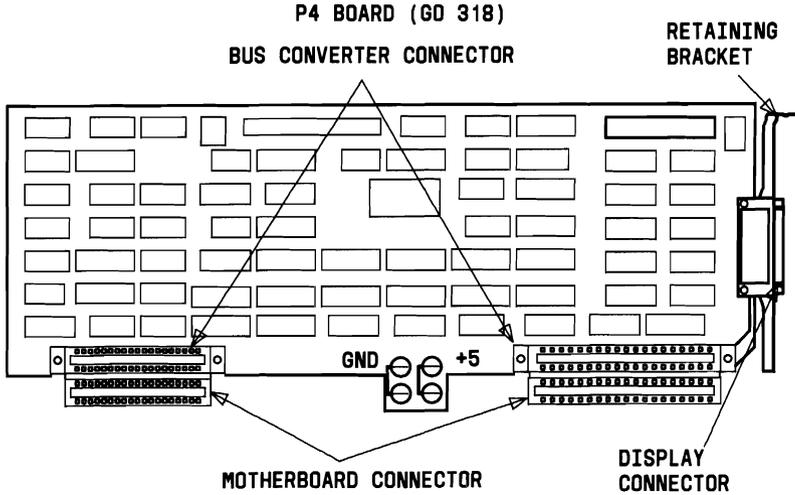


Figure 2-9. Display Controller (P4 Board)

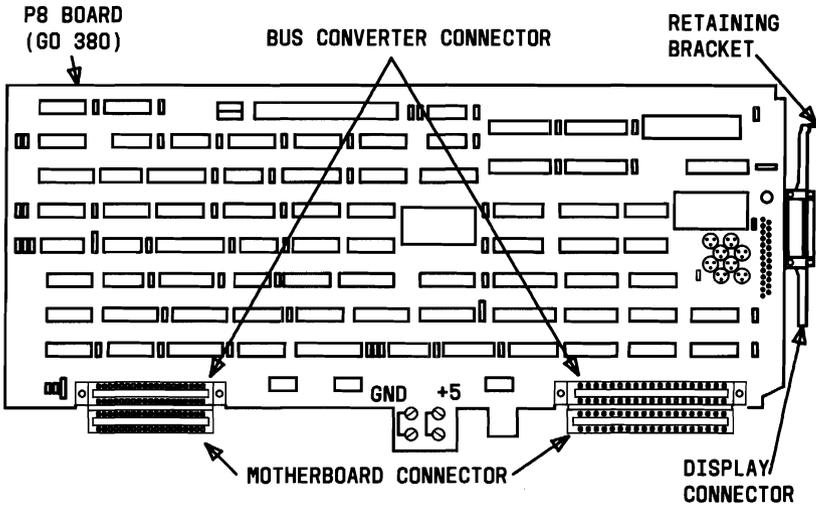


Figure 2-10. Display Controller (P8 Board)

The controllers have two basic modes of operation: alphanumeric and all points addressable graphics (with additional modes available within each of these). In the alphanumeric mode, the display can be operated either in a 40-column by 25-row mode or in an 80-column by 25-row mode. In both modes, character cell size is 8 dots (pixels) by 16 dots (pixels).

In the graphics mode, three resolutions are available:

- 640 by 400 pixels monochrome graphics
- 640 by 200 pixels monochrome graphics (IBM PC compatible)
- 320 by 200 pixels color graphics (IBM PC compatible).

**Note:** The AT&T Monochrome Display has a green foreground on a black background.

## SYSTEM OVERVIEW

---

The character attributes of reverse video, blinking, highlight, hide, and underline are available in the alphanumeric modes. In the color mode, 4 colors chosen from a palette of 16 can be displayed simultaneously. For a monochrome monitor, various shades of green are displayed to simulate a color display.

The display controllers contain 32 KB of arbitrated RAM for use as video refresh memory. The Display Controllers use a 6845 CRT controller. The 6845 controller operates at either 25 MHz, 19 MHz, or 12 MHz depending on the mode and resolution selected.

The P4 (Revision 5 or Higher) and P8 Display Controllers have **VIDEO DISABLE** capability. Refer to Appendix A for disable instructions.

---

## Bus Converter

The Bus Converter Boards (Figure 2-11) provides 16-bit and 8-bit expansion slots. This permits simultaneous use of 16-bit expansion boards and 8-bit IBM compatible expansion boards.

The Bus Converter Boards have two sets of connectors:

- Two or three 38-pin connectors to handle signals used by the 16-bit expansion boards.
- Seven 62-pin connectors to handle signals used by both 16-bit boards and 8-bit IBM compatible boards.

Figure 2-11 shows that the connectors are arranged in seven rows. Two or three of the rows have both a 38-pin and a 62-pin connector in the row. These rows are used to connect the 16-bit expansion boards to the system and are referred to as dual-connector expansion slots. One dual-connector expansion slot is reserved for a Video Enhancement Board (DEB [Display Enhancement Board]). The other is used for the insertion of a Memory Expansion Board that is discussed later in this chapter.

Figure 2-11 also shows that there are five remaining rows with one 62-pin connector. These five expansion slots are used to install 8-bit IBM compatible boards. They are referred to as single-connector expansion slots. This manual now discusses only one 8-bit board: the HDU Controller board.

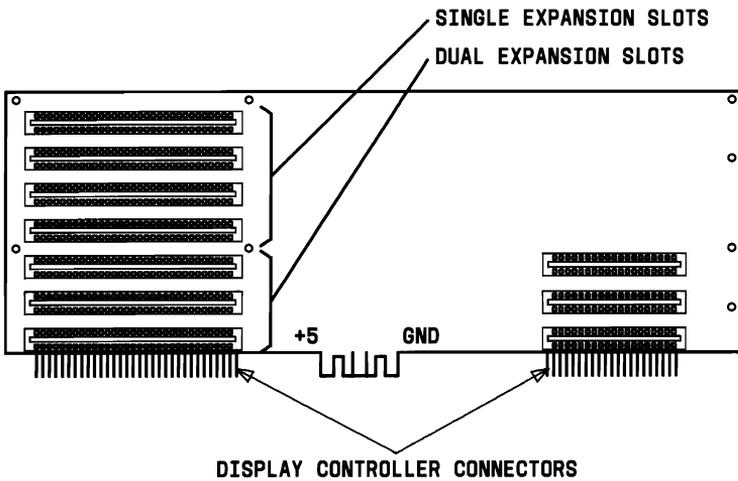
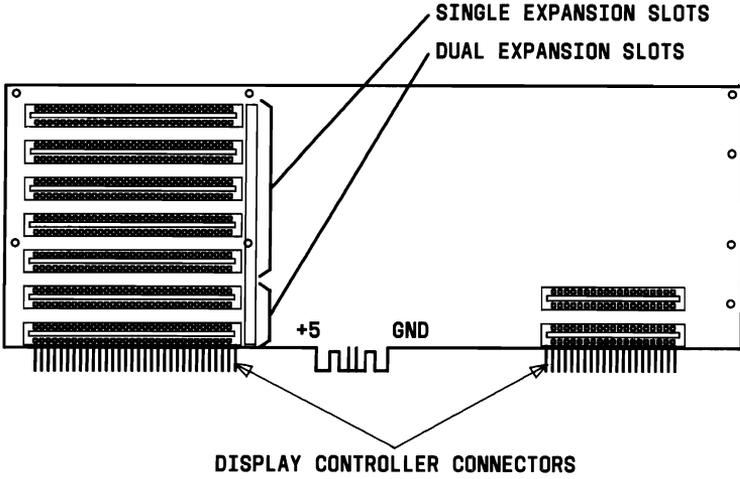


Figure 2-11. Bus Converter Boards

---

## **Input/Output (I/O) Expansion Bus Characteristics**

All I/O expansion bus signals are at standard TTL levels and all expansion bus outputs provide enough drive to power all seven system expansion slots—assuming two low power Schottky (LS) loads per slot. Figure 2-12 illustrates the two types of connector slots and their respective names.

SYSTEM OVERVIEW

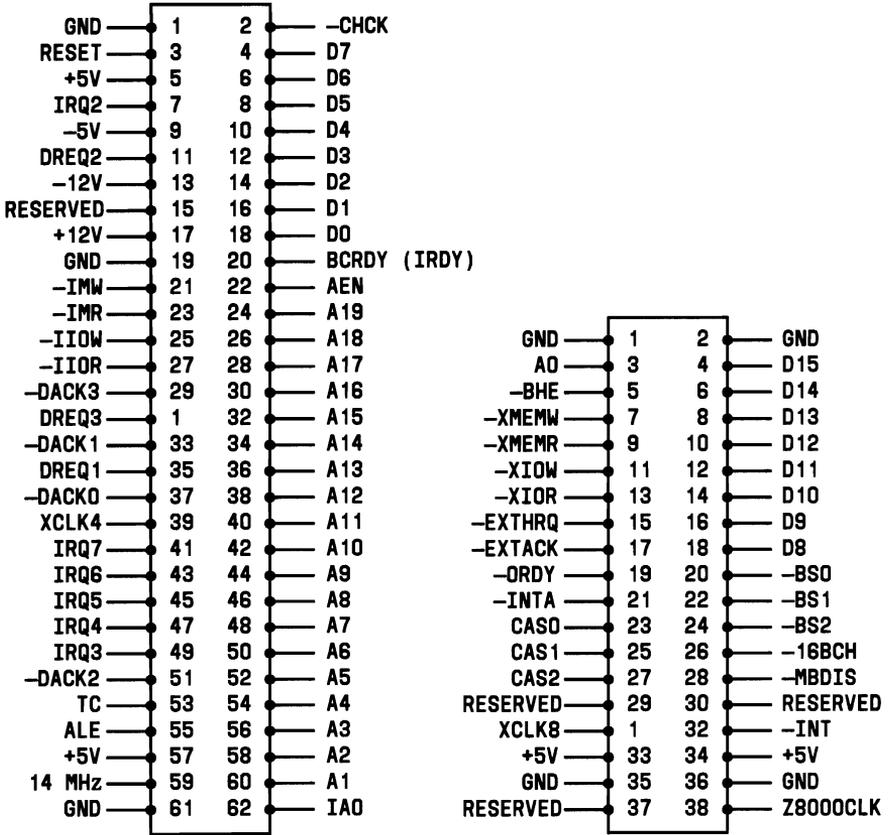
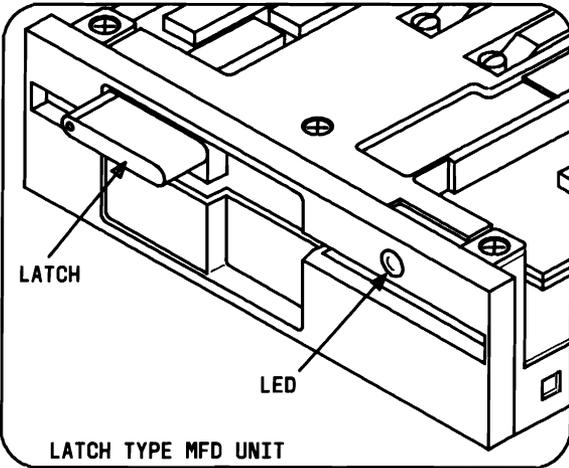
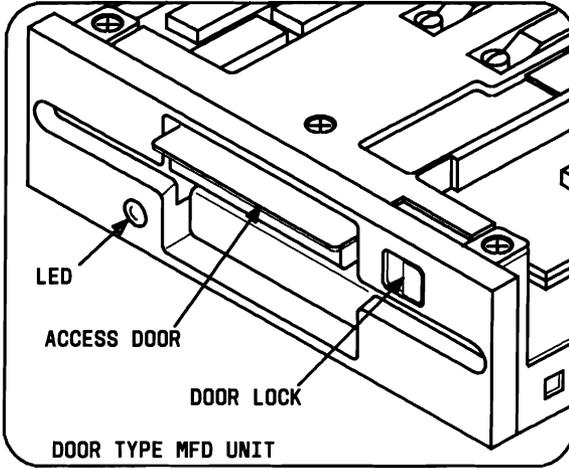


Figure 2-12. I/O Expansion Bus Connectors

---

## **Mini-Floppy Disk Unit(s)**

The AT&T Personal Computer 6300 uses 5.25-inch MFD Units (Figure 2-13) that have a formatted capacity of 360 KB. Refer to the "AT&T Personal Computer 6300 Reference Manual" for detailed pin information. The MFD Units have an Indicator (LED) that is illuminated when that particular disk is being accessed. The MFD Units also have a door or latch that permits access to the MFD drive. The MFD Units with doors have a locking mechanism to lock the door after a diskette has been inserted.



**Figure 2-13. Mini-Floppy Disk Units**

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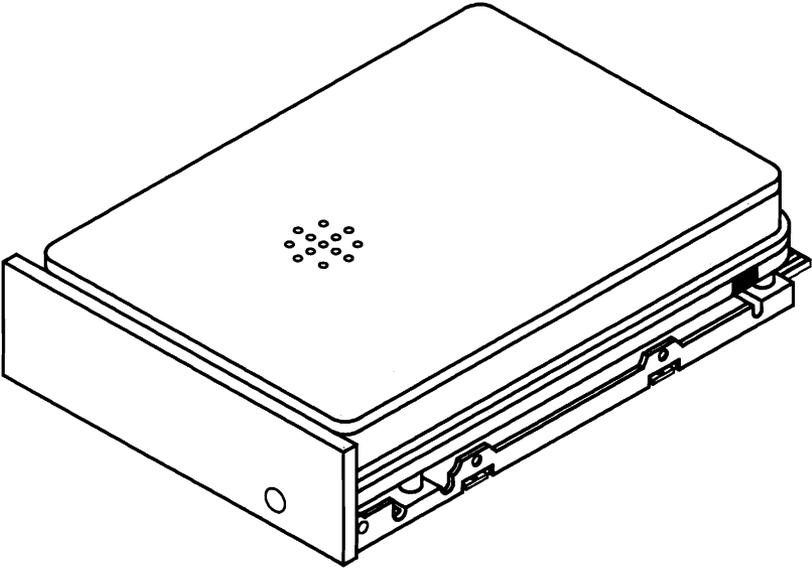
## **Slim Hard Disk Units (Optional)**

### **10-MB Hard Disk Unit**

One of the MFD Units may be replaced with a 10-MB (formatted) Hard Disk Unit (HDU). The HDU (Figure 2-14) is a random access 5.25-inch slim (half-height) Winchester storage device with two nonremovable disks as storage media. Each disk surface has one movable head to service 306 data tracks. This Slim HDU is the same physical size and mounts the same as the MFD Unit. It also uses the same dc voltages as the MFD Unit. The installation of this HDU requires a minimum of 256-KB RAM.

### **20-MB Hard Disk Unit**

One of the MFD Units may be replaced with a 20-MB (formatted) Hard Disk Unit (HDU). The HDU (Figure 2-14) is a random access 5.25-inch slim (half-height) storage device with two nonremovable disks as storage media. Each disk surface has one movable head to service 612 data tracks. This Slim HDU is the same physical size and mounts the same as the MFD Unit. It also uses the same dc voltages as the MFD Unit. The installation of this HDU requires a minimum of 256-KB RAM.



**Figure 2-14. 10- or 20-MB Slim Hard Disk Unit**

---

## Hard Disk Unit Controllers (Optional)

If a HDU is added to the system (internally or externally), the HDU Controller (Figure 2-15) or (Figure 2-16) must be installed to interface the HDU with the 8086 CPU. The HDU Controller is a circuit board that plugs into one of the 8-bit expansion slots on the Bus Converter. It is attached to the HDU with two ribbon cables. Refer to "Appendix A" for information on how to configure the HDU controller.

There are two types of HDU Controllers, the DTC (Data Technology Corporation) and the WD (Western Digital). The physical differences between the Controllers are:

1. The DTC Controller is a full-size modular circuit card. The WD Controller is a half-size modular circuit card.
2. Each HDU Controller must be configured for the type of drive used (see Appendix A). The DTC Controller is configured by setting the DIP Switches on the card. The WD Controller has jumpers that must be placed.

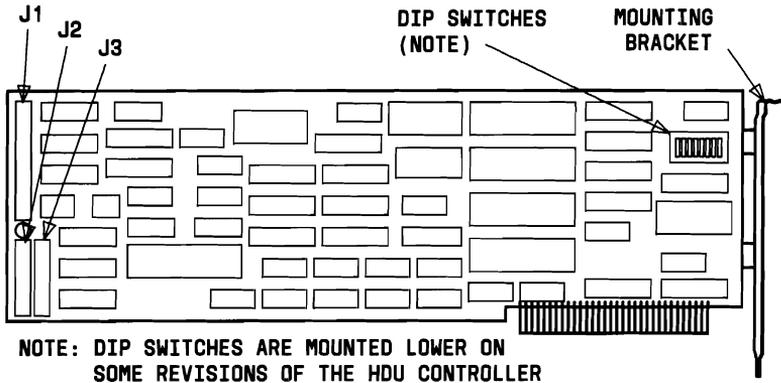
Each Controller formats the hard disk drives differently; therefore, they cannot be interchanged without performing the following:

- Make a backup copy of all data if possible
- Low-Level Format the drive using the System Test
- Partition the drive using the MS-DOS FDISK
- Restore the backup data.

## SYSTEM OVERVIEW

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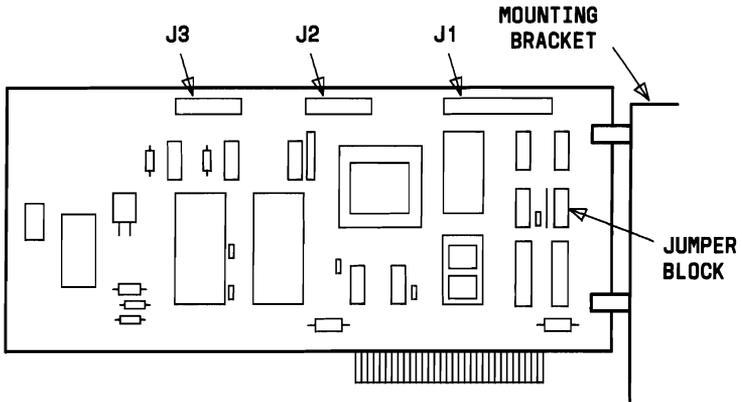
The WD Controller is not supported by ROM BIOS 1.21 and earlier versions. Both the DTC and the WD Controller are supported by ROM BIOS 1.43 and later versions.



**Figure 2-15. DTC Hard Disk Unit Controller**

The J1, J2, and J3 connectors on the DTC Controller provide the following:

- The J1 connector is the control connector. This connector transfers the control signals to and from the HDUs. Two HDUs can be installed using a Daisy Chain Connection.
- The J2 and J3 connectors are data connectors. These connectors transfer data to and from the HDUs. The drive selection is determined by the settings on the HDU, not by the choice of connectors.



**Figure 2-16. Western Digital Hard Disk Unit Controller  
(Requires a ROM BIOS 1.43 or Higher)**

The J1, J2, and J3 connectors on the WD Controller provide the following:

- The J1 connector is the control connector. This connector transfers the control signals to and from the HDUs. Two HDUs can be installed using a Daisy Chain Connection.
- The J2 and J3 connectors are data connectors. These connectors transfer data to and from the HDUs. The J2 connector must be used in a 1-HDU configuration. The J3 connector is used for the second HDU in a 2-drive configuration.

## Memory Expansion Board (Optional)

The Memory Expansion Board (Figure 2-17) is organized in three banks of 128 KB each. The three banks (0, 1, and 2) are each made up of two groups of nine 64-K bit RAM chips. One group is the lower byte (even address) and the other is the higher byte (odd address). Eight chips are used for memory and the ninth chip is used for parity checking.

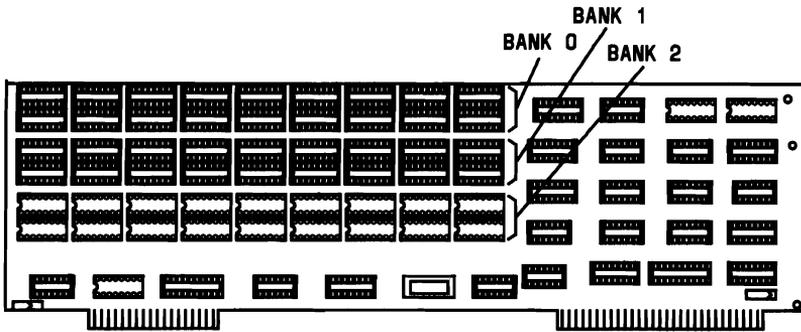


Figure 2-17. Memory Expansion Board

The Memory Expansion board is inserted in a 16-bit expansion slot on the Bus Converter Board. The minimum amount of memory on the Memory Expansion Board is 256 KB (128 KB in bank 0 and 128 KB in bank 1). This can be expanded up to 384 KB by inserting chips into bank 2. The Motherboard must have 256-KB RAM before the Memory Expansion Board can be used.

**Note:** If the Display Enhancement Board (DEB) is to be installed, the recommended installation location is the first 16-bit expansion slot with the Memory Board in the second 16-bit expansion slot.

## *Power Supply*

The Power Supply is the metal box found at the rear of the System Module between the disk drives and the fan. The PC 6300 uses a switching-type LA16 or LA16/B power supply with the following electrical input characteristics:

- Single-phase alternating current for the two ranges 100 to 120 V and 200 to 240 V. This is done using a main voltage changeover jumper mounted on the printed circuit board, a different line cord, and fan assembly. The total power output is 163 Watts (LA16) or 182 Watts (LA16/B).
- Permanent driftings of the nominal voltage  $\pm 10\%$ , that allows two ranges of correct operation: 90 to 132 V and 180 to 264 V. The transient driftings are shown in Figures 2-18 and 2-19.
- Nominal operating frequency of 50 and 60 Hz with acceptable variations of  $\pm 5\%$ .
- A current surge is acceptable in the power up transient as long as it does not exceed 15 amperes. Both the LA16 and the LA16/B power supplies have 4 amp slow blow fuses.

The only voltage calibration potentiometer present on the power supply is for the +5 V dc. Any variation of the +5 V dc will also affect the +12, -12, and +15 V dc. Figure 2-20 shows the power supply output voltages and the potentiometer location.

A special filter inserted on the Power Supply has the function of limiting interference to the mains. The acoustic noise is less than or equal to 33 dBA.

**LA16/B POWER SUPPLY**

The general output specifications for the LA16/B power supply is shown in the following table (Figure 2-18). It shows the minimum and maximum values of current generated per the output voltages. The power supply unit is able to provide a stationary power of 182 watts.

Nominal Voltage	Tolerance	Minimum Current	Maximum Current	Maximum Ripple
+5 V	± 5%	6.2 A	20.8 A	50 mVp-p
+12 V (Note)	± 5%	0.9 A	4.2 A	100 mVp-p
+15 V	± 10%	1.0 A	1.8 A	250 mVp-p
-12 V	± 5%	0	0.25 A	100 mVp-p

**Figure 2-18. Power Supply Output Characteristics**

**Note:** An impulsive repetitive load with maximum 1/5 duty cycle and behavior is allowed on the +12 V. An impulsive load is allowed on the +12 V to be added to the static load in the power-on transition where a deviation from the rated tolerances of the output voltages is allowed.

The worst load crossings allowed with no power take-off on +15 V are as follows:

$$\begin{aligned}
 I (+12 \text{ V}) \quad 0.9 \text{ A (min)} &\rightarrow I (+5) \quad 14.3 \text{ A (max)} \\
 I (+5 \text{ V}) \quad 6.2 \text{ A (min)} &\rightarrow I (+12) \quad 4.5 \text{ A (max)}.
 \end{aligned}$$

---

## LA16 POWER SUPPLY

The general output specifications for the LA16 power supply is shown in the following table (Figure 2-19). It shows the minimum and maximum values of current generated per the output voltages. The power supply unit is able to provide a stationary power of 163 watts.

Nominal Voltage	Tolerance	Minimum Current	Maximum Current	Maximum Ripple
+5 V	±5%	6.2 A	16.8 A	50 mVp-p
+12 V (Note)	±5%	0.9 A	4.5 A	100 mVp-p
+15 V	±10%	1.0 A	2.4 A	250 mVp-p
-12 V	±5%	0	0.25 A	100 mVp-p

**Figure 2-19. Power Supply Output Characteristics**

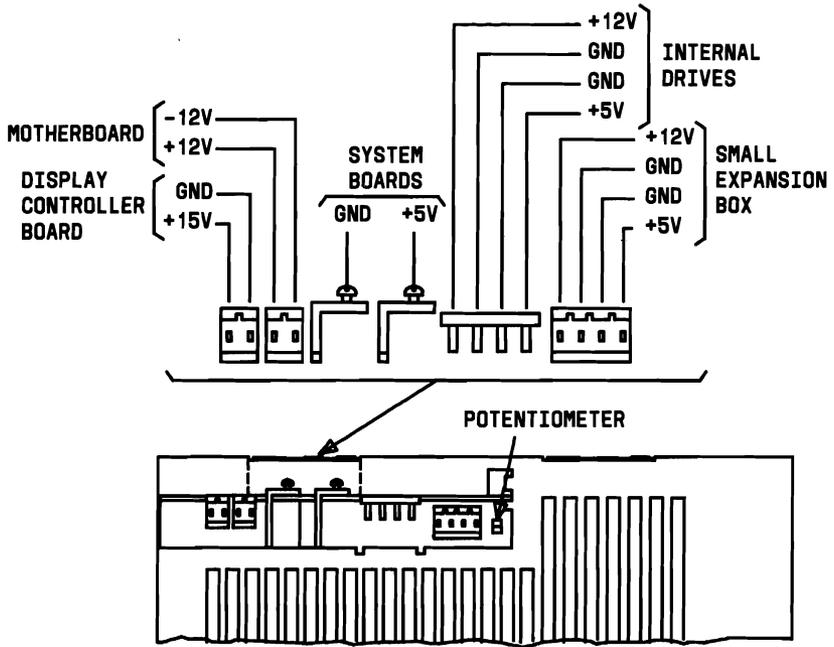
**Note:** An impulsive repetitive load with maximum 1/5 duty cycle and behavior is allowed on the +12 V. An impulsive load is allowed on the +12 V to be added to the static load in the power-on transition where a deviation from the rated tolerances of the output voltages is allowed.

The worst load crossings allowed with no power take-off on +15 V are as follows:

I (+12 V) 0.9 (min) → I (+5) 14.3A (max)  
 I (+5 V) 6.2A (min) → I (+12) 4.5A (max).

# SYSTEM OVERVIEW

---



**Figure 2-20. Power Supply Outputs and Potentiometer**

## DISPLAY ENHANCEMENT BOARD (OPTIONAL)

---

The optional Display Enhancement Board provides additional operating modes when used with the Display Controller Board. The main features provided by the Display Enhancement Board are:

1. Three additional 640 x 400 pixel bit planes—higher resolution with 16 colors.
2. Two new graphic modes that support up to 16,536 colors/patterns:
  - 640 x 400 pixels color graphics—16 colors on screen (16 shades of green on monochrome display)
  - 640 x 200 pixels color graphics—16 colors on screen (16 shades of green on monochrome display).
3. Software-controlled color look-up table:
  - Maps bit planes to 16-color palettes—allowing color cycling
  - Supports 4 blink rates in hardware
  - Supports dithering in hardware
  - Supports pattern and texture fills for adding dimension to mechanical drawings.

## SYSTEM OVERVIEW

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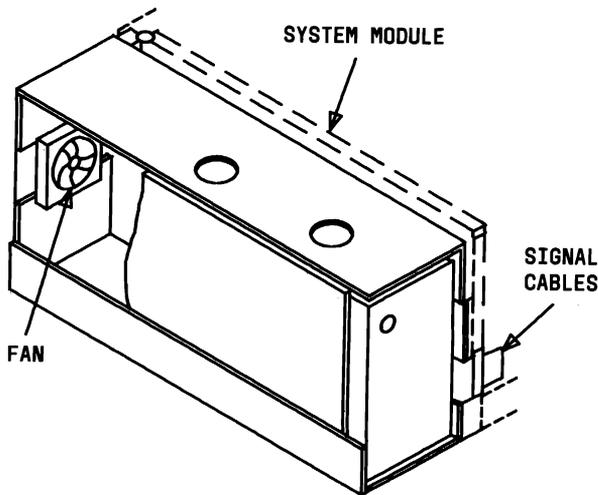
4. Simultaneous display of characters and graphics.
5. Simultaneous use of either a Monochrome and Color Display or two Color Displays. (The System Module Power Supply will not support the simultaneous use of two Monochrome Displays.)
6. Compatibility between the Display Enhancement Board (in the transparent mode) and the IBM PC graphics software.

The Display Enhancement Board plugs into one of the dual-row expansion slots on the Bus Expansion Board. It is connected to the Display Controller Board by a ribbon cable.

## SMALL EXPANSION BOX (OPTIONAL)

---

A Small Expansion Box (Figure 2-21) can be connected to the PC 6300 to provide the PC 6300 with additional disk storage. The Small Expansion Box contains a 10-MB (formatted) HDU. The HDU Controller is housed in the System Module on the Bus Converter Board. This external HDU is connected to the HDU Controller by two ribbon cables. The Small Expansion Box also contains a fan to cool the HDU. The Small Expansion Box can be used with either one or two MFD Units and requires a minimum of 256-KB RAM.



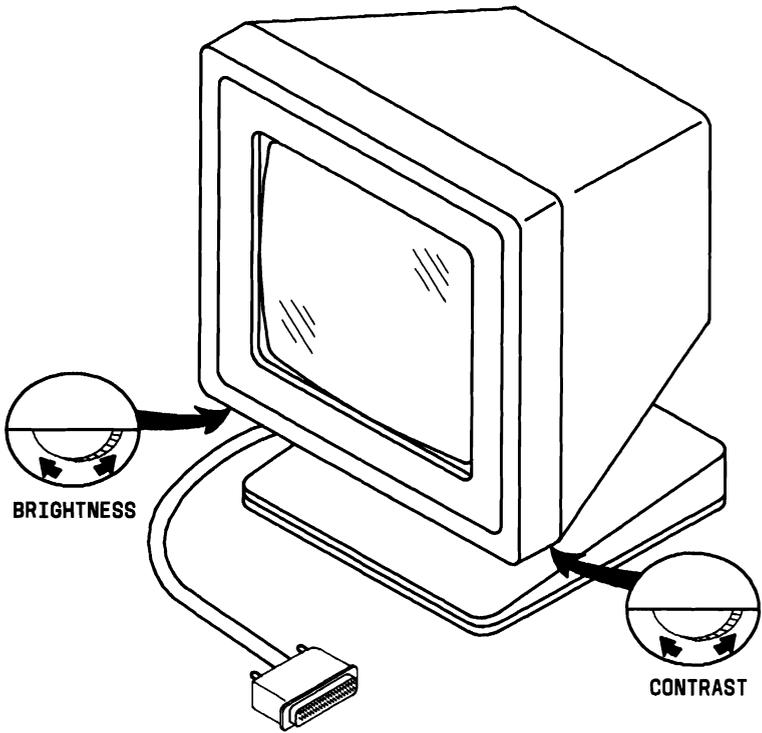
**Figure 2-21. HDU 340 Small Expansion Box**

## DISPLAY

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### **Monochrome Display**

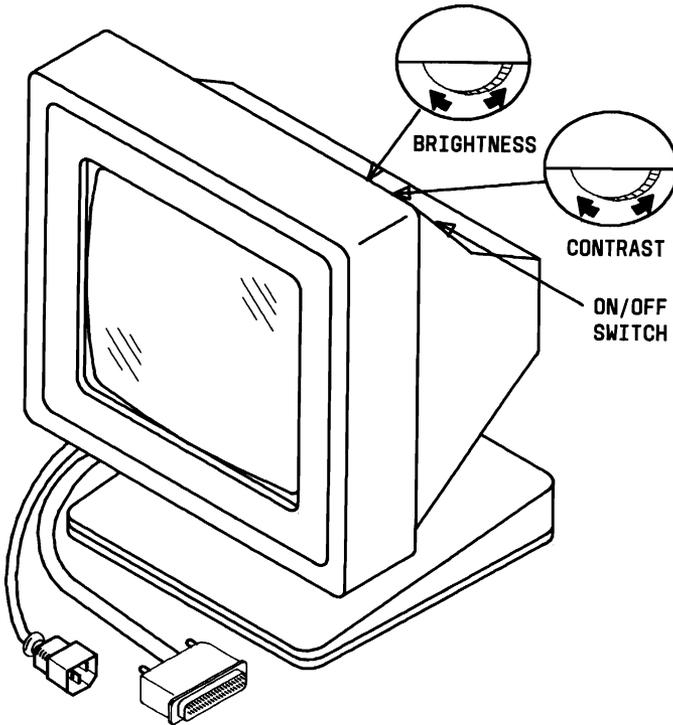
The Monochrome Display (Figure 2-22) is a display with a green foreground on a black background. The Monochrome Display is attached to the System Module with a cable that serves as a signal and power cable. The Display may either sit on top of the System Module or on top of a nearby table top or desk. The Display has both brightness and contrast adjustment controls that are easily accessible to the operator.



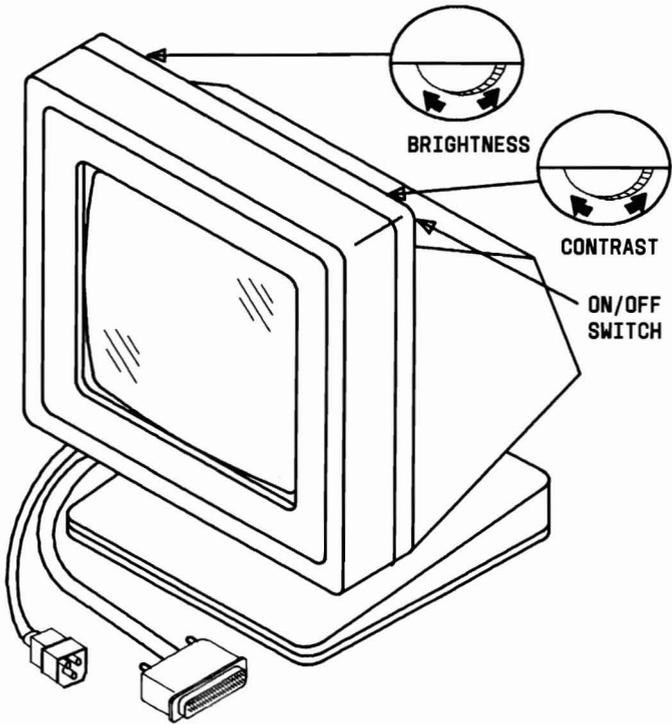
**Figure 2-22. Monochrome Display**

## Color Display (Optional)

Either of the two Color Displays (Figures 2-23 and 2-24) attach to the System Module with two cables: a signal cable and a power cable. The Display may sit on top of the System Module or on a nearby table or desk. The Color Displays can display up to 16 different colors with the red, green, and blue video signals (and intensity) independent of each other.



**Figure 2-23. A 318H Color Display**

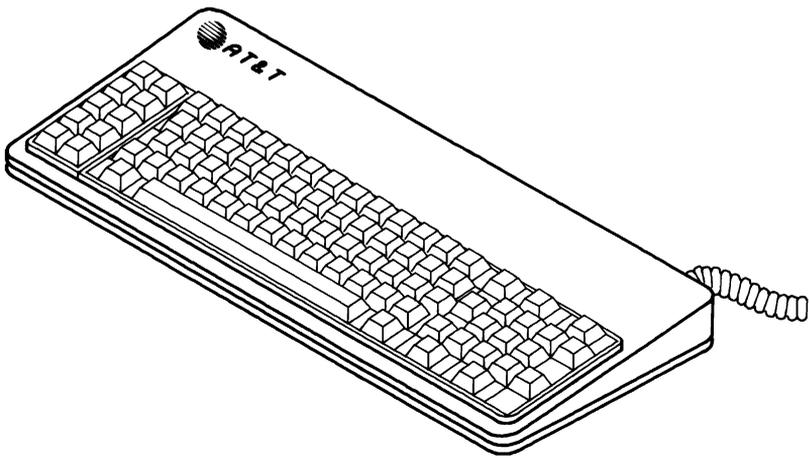


**Figure 2-24. A 318 Color Display**

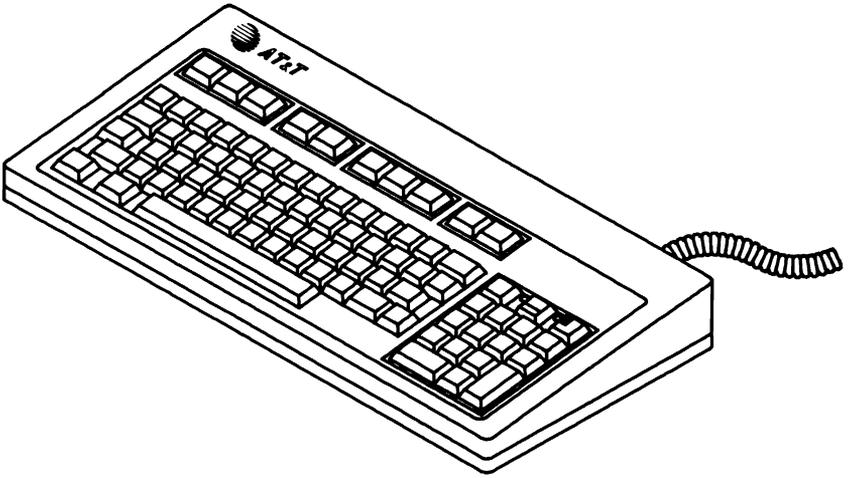
## KEYBOARD

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There are two types of Keyboards that can be used with the AT&T Personal Computer 6300. They are the Model 301 Keyboard (Figure 2-25) and the Model 302 Keyboard (Figure 2-26). Both Keyboards have two different positions that can be adjusted to suit the operator; each Keyboard can be tilted 4 or 8 degrees. The Keyboards have a permanently attached cable that connects to a connector at the rear of the System Module. This shielded cable has 5 wires: +12 V dc, 2 Grounds, and 2 bidirectional signal lines. The cable is approximately 6-feet long and is coiled like that of a telephone handset. The central (alphanumeric) part of the Keyboard is standard. There are 10 function keys on the left of the Model 301 Keyboard. The function keys on the 302 Keyboard are located in a row on top of the Keyboard. Both Keyboards have 15 numeric keys on the right-hand side that have legend for their numeric functions, cursor control, numeric calculations, and display editing. Both Keyboards support the AT&T Mouse 6300.



**Figure 2-25. Model 301 Keyboard**



**Figure 2-26. Model 302 Keyboard**

## DISPLAY AND KEYBOARD EXTENSION CABLES

---

Extension cables are available for the Display and Keyboard. These cables allow the Display and Keyboard to be located up to 15 feet away from the System Module. When extension cables are installed, the connectors may be placed inside the base of the Display so that the coiled Keyboard cable looks like it is connected to the Display. Both cables then exit through the other side of the base and connect to the rear of the System Module. The extension cables for Color Displays also include a power cable.

## MINIMUM SYSTEM CONFIGURATION

---

The PC 6300 contains the following in its minimum configuration:

- a. Monochrome Display
- b. Keyboard
- c. System Module
  1. Motherboard
    - 16-KB EPROM
    - 128-KB RAM
    - 8-MHz 8086-2 CPU
    - DMA Controller
    - Floppy Disk Interface
    - Timer
    - Interrupt Controller
    - Serial Communication Controller (one channel—asynchronous)
    - Parallel Interface
    - Battery Back-Up Calendar Chip
    - Keyboard Controller
  2. Display Controller
  3. Bus Converter
  4. One 5.25-inch (360-KB) MFD Unit
  5. Power Supply
  6. Fan.

## EXPANDED SYSTEM CONFIGURATION

---

The PC 6300 can be expanded with the insertion of option boards in the System Module or installing external options. In its expanded configuration, the PC 6300 may contain the following:

- a. Color Display
- b. Keyboard with Mouse
- c. System Module
  1. Motherboard
    - 8087 Math Co-Processor
    - 16-KB EPROM
    - 640-KB RAM
    - 8-MHz 8086-2 CPU
    - DMA Controller
    - Floppy Disk Interface
    - Timer
    - Interrupt Controller
    - Serial Communication Controller (one channel—asynchronous)
    - Parallel Interface
    - Battery Back-Up Calendar Chip
    - Keyboard Controller
  2. Display Controller
  3. Bus Converter Board
    - Memory Expansion Board
    - HDU Controller
  4. Display Enhancement Board (DEB)
  5. Two 5.25-inch (360-KB) MFD Units or One MFD Unit and One Slim HDU
  6. Power Supply
  7. Fan

- d. Small Expansion Box (Full-Size 10-MB HDU)
- e. Display and Keyboard Extension Cables.

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<b>SITE PREPARATION</b> .....	3-3
<b>ENVIRONMENTAL REQUIREMENTS</b> .....	3-5
<b>PHYSICAL CHARACTERISTICS</b> .....	3-6
<b>UNPACKING</b> .....	3-7
<b>OPTION INSTALLATION</b> .....	3-8
Removing System Module Covers .....	3-9
Removing Upper Cover .....	3-10
Removing Lower Cover .....	3-11
Upgrading Motherboard Memory to 256KB or 640KB .....	3-12
Installing Memory Expansion Board .....	3-21
Upgrading Memory Expansion Board Memory to 384KB .....	3-27
Installing 8087 Numeric Data Processor .....	3-36
Replacing Mini-Floppy Disk Unit With Hard Disk Unit .....	3-42
Removing Upper MFD Unit .....	3-42
Installing 10- or 20-MB Hard Disk Units .....	3-46
Installing Hard Disk Controller Board .....	3-48
Setting DIP Switches and Jumpers .....	3-52
Installing Small Expansion Box .....	3-63
Installing the Display Enhancement Board .....	3-77
Installing DEB Software .....	3-90
Floppy Disk Systems .....	3-91
Hard Disk Systems .....	3-94
Troubleshooting the DEB Installation .....	3-97

---

## INSTALLATIONS

---

Installing the Mouse .....	3-100
Installing the Ball in the Mouse .....	3-100
Connecting the Mouse to the Computer.....	3-102
Installing the Keyboard ROM .....	3-104
Opening the Keyboard .....	3-104
Removing Existing ROM Chip .....	3-105
Installing New ROM Chip.....	3-105
Installing the Mouse Software .....	3-107
Installing the Mouse Software With the Dual Diskette Computer .....	3-107
Installing Mouse Software With the Hard Disk Computer .....	3-109
<b>SYSTEM INSTALLATION .....</b>	<b>3-110</b>
<b>APPLYING POWER TO THE SYSTEM .....</b>	<b>3-115</b>

## SITE PREPARATION

---

The AT&T Personal Computer 6300 operates reliably in a typical office environment, but it is important to adhere to the following when choosing a suitable site:

1. ***The PC 6300 should be plugged into a grounded outlet.***  
Ungrounded machines do not work properly and can be a safety hazard. If the PC 6300 is not plugged into a grounded outlet, one can experience:

- Improper program operation
- Unreadable disks
- Extensive machine damage.

The PC 6300 should, when possible, be isolated from sources of electrical noise and from devices that can cause excessive voltage level variations. Some common sources of electrical noise are:

- Air conditioners, fans, refrigerators, washing machines, and large blowers
- Transformers and alternators
- Large brush-type or induction motors (such as those used on elevators)
- Radio and TV transmitters, microwaves, signal generators, and high-frequency security devices.

**Note:** Some of the normal small office machines (typewriters, small copiers, calculators, etc.) are allowed on the same line if they do not cause excessive interference on the line.

2. ***The PC 6300 should be placed in a dust-free environment.*** Airborne dust, dirt, and smoke can cause excessive wear on moving surfaces, short open circuits (especially in the presence of high humidity), and read/write errors on the disk.
3. ***The PC 6300 should be placed away from heat and direct sunlight.*** Unusually high temperatures coupled with low humidity can cause static problems.
4. ***The front and rear panels of the PC 6300 should not be obstructed.*** The PC 6300 is cooled by a fan located on the rear panel. This fan pulls air in through air inlets on the base of the System Module. The base of the System Module should be free from papers or other materials that would obstruct air flow.
5. ***The System Module should not be placed in a small enclosed area.*** The heat dissipation of the system is 140 watts (477.7 BTU/hour); this may be enough to raise the temperature beyond the maximum allowed if enclosed in a small area. This will also decrease the air flow around the module.

# ENVIRONMENTAL REQUIREMENTS

---

The environment in which the PC 6300 **operates** should meet the following requirements:

## Electrical

100-120 (standard); 200-240 volts maximum (selectable by an internal power supply jumper)

50-60 Hertz

Power usage - 162 watts

## Ambient Temperature

Operating: +10 to +40 degrees Centigrade  
(+50 to +104 degrees Fahrenheit)

Storage: -40 to +60 degrees Centigrade  
(-40 to +140 degrees Fahrenheit)

## Relative Humidity

Operating: 10% to 95% RH, noncondensing

Storage: 5% to 95% RH, noncondensing

## Altitude

Operating: Sea Level to 10,000 feet

Storage: Sea Level to 30,000 feet

## Standards

UL 478 and 114

CSA 154 and 143

FCC Part 15, Subpart J, Class B

## Acoustic Noise Level

48 DBA maximum

## PHYSICAL CHARACTERISTICS

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The System Module [with two Mini-Floppy Disk (MFD) Units] weighs 30.8 lbs. (14 Kg), the Display weighs 19.8 lbs. (9 Kg), and the Keyboard weighs 4.5 lbs (2 Kg).

Figure 3-1 lists the approximate physical dimensions and weight of the System Module, the Monochrome and Color Displays, and Model 301 and Model 302 Keyboards.

<b>APPROXIMATE PHYSICAL CHARACTERISTICS</b>		
<b>UNIT</b>	<b>SIZE</b>	<b>WEIGHT</b>
System Module	15" x 14½" x 6" 38.1 cm x 36.8 cm x 15.2 cm	30.8 lbs. 13.8 kg
Monochrome Display	13" x 12½" x 10½" 33.0 cm x 31.3 cm x 26.3 cm	19.8 lbs. 9.0 kg
Color Display	14" x 14" x 14½" 35.6 cm x 35.6 cm x 36.8 cm	27 lbs. 12. kg
Model 301 Keyboard	17½" x 7½" x 1" 40.6 cm x 19.1 cm x 2.5 cm	4½ lbs. 2. kg
Model 302 Keyboard	16" x 8½" x 1¼" 44.5 cm x 19.1 cm x 2.5 cm	4½ lbs. 2. kg

**Figure 3-1. Approximate Dimensions and Weight of the AT&T Personal Computer 6300 Units**

## UNPACKING

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<b>PROTECT YOUR HARD DISK</b>
To prevent damage to CPU's with hard disks, <b>always</b> park the HDU by using the " <b>SHIP</b> " command which is found on the enclosed System Test Diagnostics Diskette before moving. See additional information on the following page.

The three main units of the system are the System Module, the Display, and the Keyboard. These units are packed in protective packaging before being placed in a shipping carton. The packaging protects the modules against damage during transit. The shipping carton should also contain the ac Power Cable that is used to connect the system to the grounded wall outlet.

Save the shipping carton and packing material in case you ever need to repack and move your PC 6300.

## OPTION INSTALLATION

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This section gives the installation procedures for various options supported by the PC 6300. If no options are to be installed, go to the section titled "System Installation." If options are to be installed, it is much easier to install them before connecting the major units for system operation. Please keep in mind that the procedures for installing options are presented as though the PC 6300 is operational and that only one option is being installed at a time.

During the installation of many options, the System Module must be shifted into various positions to allow access to certain parts of the module. When handling the System Module, care should be taken not to damage its components in any way. If the System Module contains a HDU, extra care should be taken because the HDU is sensitive to sudden shocks. Before moving the unit, the HDU heads should be parked, using the "SHIP" command. If power is present on the HDU, the System Module must never be lifted for any reason.

***Caution: To avoid possible internal damage to the systems circuitry by static electricity, be sure to wear a wrist strap (static discharge strap) that is connected to ground or touch the metal chassis of the system just before you start to handle any circuit boards or chips. Also, avoid touching solder lands and components as much as possible.***

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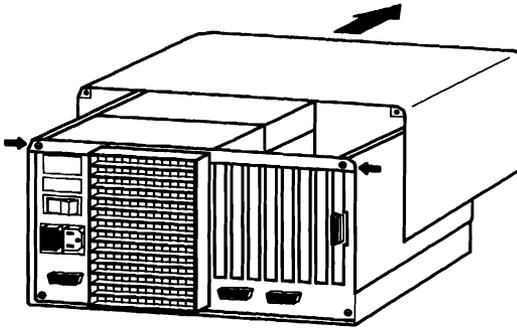
Before attempting to install any of the options, one should become familiar with the Dual In-Line Package (DIP) switches and jumpers associated with most options. Appendix A provides information on the location of the system's DIP switches and jumpers and how they should be set for the various system configurations. At this point, it may be helpful to remove the System Module covers to view the DIP switches and jumpers while reviewing Appendix A.

## **Removing System Module Covers**

The removal of the upper System Module cover will expose the MFD Unit(s), HDU and Controller, Display Controller Board, Bus Converter Board, Memory Expansion Board, and Power Supply. The removal of the lower System Module cover will expose the Motherboard and its components (chips, DIP switches, jumpers, etc.).

### ***Removing Upper Cover***

1. Loosen the two screws that secure the upper cover (Figure 3-2).



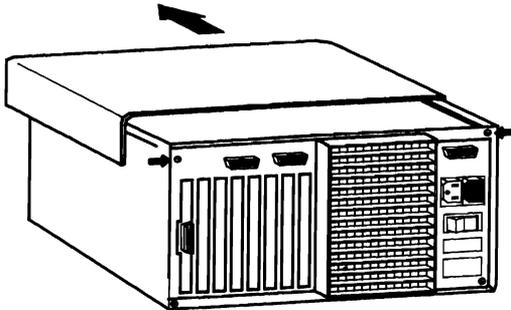
**Figure 3-2. Removal of the Upper System Module Cover**

2. Slide the Upper Cover forward approximately 0.5 inch and lift it from the System Module (Figure 3-2).

---

## ***Removing Lower Cover***

1. Turn the System Module upside down so that the lower cover is on top.
2. Loosen the two screws that secure the lower cover (Figure 3-3).



**Figure 3-3. Removal of the Lower System Module Cover**

3. Slide the lower cover forward approximately 0.5 inch and lift it from the System Module.

## Upgrading Motherboard Memory to 256 KB or 640 KB

The materials required for upgrading the Motherboard memory are:

- Eighteen 64-K bit or 256-K bit RAM chips (see the following table)
- Medium-sized standard screwdriver.

VARIOUS CONFIGURATIONS		NEW UPGRADED CONFIGURATION	
18 RAM Chips in Bank 0 (Each)	Total Memory	Add 18 RAM Chips to Bank 1 (Each)	Total New Memory
64 KB	128 KB	64 KB	256 KB
64 KB	128 KB	256 KB	640 KB
256 KB	512 KB	64 KB	640 KB

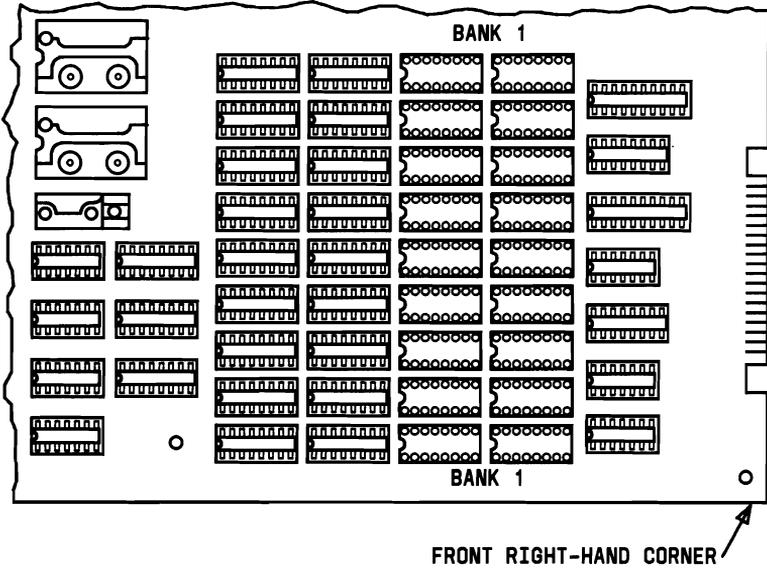
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***Caution: To prevent any damage to the system circuitry by static electricity, be sure to wear a wrist static strap or touch the metal chassis of the system just before you handle any IC chips or system boards.***

To upgrade the Motherboard memory, proceed as follows:

1. Turn the System Module and all external devices OFF.
2. Unplug the ac power cable from the rear panel.
3. Disconnect all cables (Display, Keyboard, Printer, etc.) from the rear panel of the System Module.
4. Turn the System Module upside down so that the lower cover is on top.
5. Loosen the two screws that secure the lower cover (located on the rear panel).
6. Slide the lower cover forward approximately 0.5 inch and lift it from the System Module.

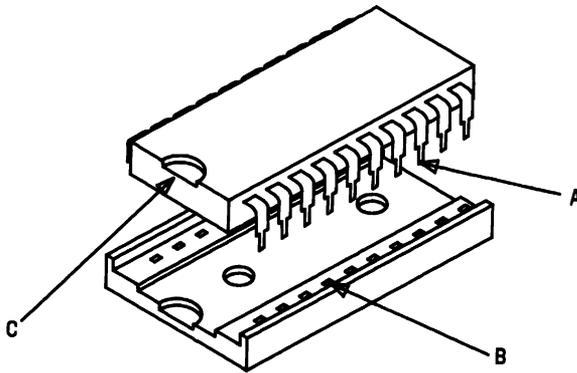
7. Locate Bank 1 on the Motherboard (Figure 3-4).



**Figure 3-4. Locating Bank 1 on the Motherboard**

8. Put on the wrist strap and connect to ground (if available), or touch the metal chassis before picking up the RAM chip to release the static electricity from your hand.

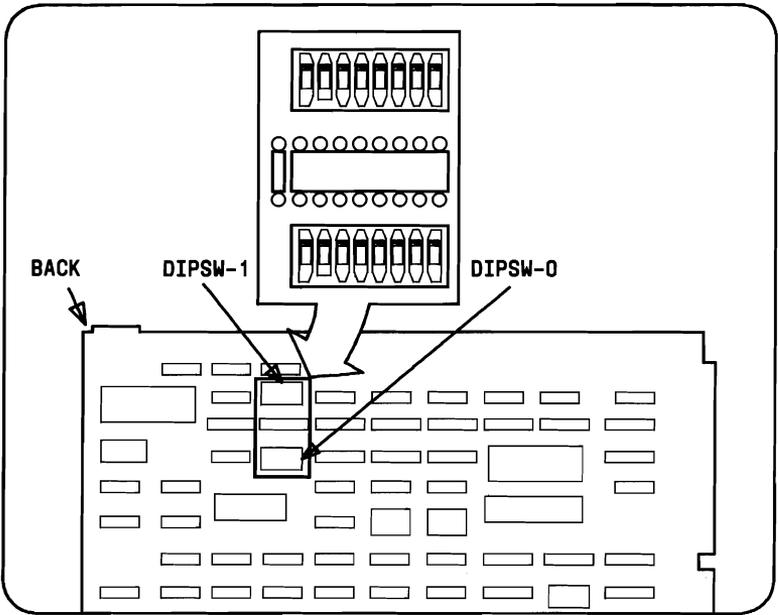
- 
- Align the RAM chip pins (A) with a socket (B) as in Figure 3-5. Make sure that the notch in the chip (C) is facing the same direction as the other chips on the board. To insert, push the chip down firmly.



**Figure 3-5. Inserting RAM Chip into the Socket**

- Repeat Step 8 for the remaining 17 sockets in Bank 1 of the Motherboard memory.
- Remove the wrist strap (if a wrist strap was used).

- 12. Locate DIPSW-0 on the Motherboard (Figure 3-6).

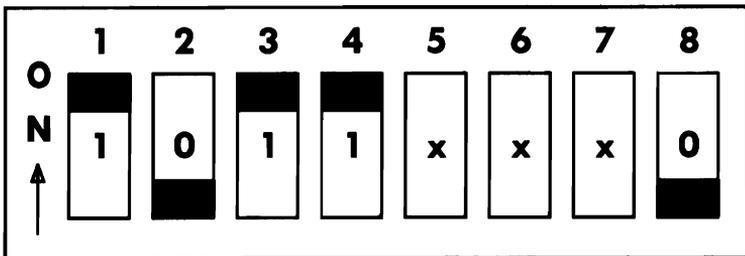


**Figure 3-6. Locating DIPSW-0 on the Motherboard**

**Note:** Refer to “Appendix A” for other DIPSW-0 settings.

13. On DIPSW-0, set switches 1, 2, 3, and 4 for 256-KB total memory (Figure 3-7).

- Switch 1 ON
- Switch 2 OFF
- Switch 3 ON
- Switch 4 ON
- Switches 5 to 7 (Do not require setting for memory)
- Switch 8 OFF.



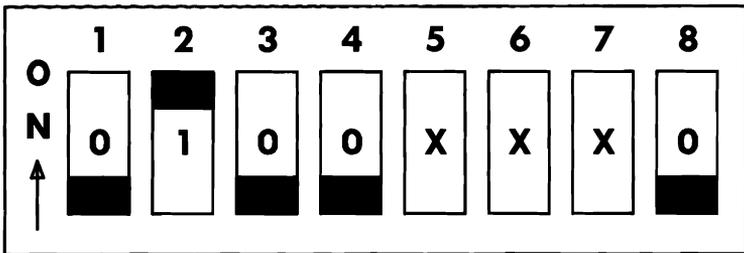
**Figure 3-7. DIPSW-0 Setting for 256-KB Total Memory**

**Note:** Some switches are rocker type; others are slide type. Some DIP switches have the ON designation at the top of the switch; others have it on the bottom.

**ON=CLOSED=1**  
**OFF=OPEN=0**

14. On DIPSW-0, set switches 1, 2, 3, and 4 for 640-KB total memory adding 256-K bit chips (Figure 3-8).

- Switch 1 **OFF**
- Switch 2 **ON**
- Switch 3 **OFF**
- Switch 4 **OFF**
- Switches 5 to 7 (Do not require setting for memory)
- Switch 8 **OFF**.



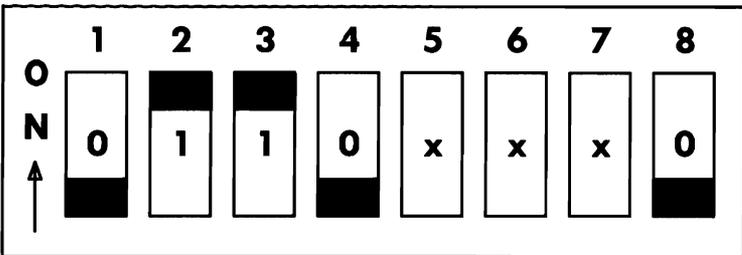
**Figure 3-8. DIPSW-0 Setting for 640-KB Total Memory on Motherboard Using 256-K Bit Chips in Bank 1**

**Note:** Some switches are rocker type; others are slide type. Some DIP switches have the **ON** designation at the top of the switch; others have it on the bottom.

**ON=CLOSED=1**  
**OFF=OPEN=0**

15. On DIPSW-0, set switches 1, 2, 3, and 4 for 640-KB total memory adding 64-K bit chips (Figure 3-9).

- Switch 1 **OFF**
- Switch 2 **ON**
- Switch 3 **ON**
- Switch 4 **OFF**
- Switches 5 to 7 (Do not require setting for memory)
- Switch 8 **OFF**.



**Figure 3-9. DIPSW-0 Setting for 640-KB Total Memory on Motherboard Using 64-K Bit Chips in Bank 1**

**Note:** Some switches are rocker type; others are slide type. Some DIP switches have the **ON** designation at the top of the switch; others have it on the bottom.

**ON=CLOSED=1**  
**OFF=OPEN=0**

## INSTALLATIONS

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16. Replace the lower System Module cover and tighten the two cover screws.
17. Place the System Module back to its upright position.
18. Connect the cables that were disconnected (Keyboard, Display, Printer, etc.) back to the rear panel of the System Module.
19. Plug the ac power cable into the rear panel.
20. Verify that the RAM passes Resident Diagnostics and then run the Customer Test Diagnostics in the Automatic Mode. (Refer to Chapter 4.)

---

## Installing Memory Expansion Board

The Motherboard memory must be fully populated (256 KB) before installing the Memory Expansion Board. The Memory Expansion Board is equipped with a minimum of 256-KB RAM and can be expanded to 384 KB maximum. This will supply the system with a **total** of 512-KB or 640-KB RAM, respectively. If the Memory Expansion Board is to be expanded to 384 KB, refer to the section titled “Upgrading Memory Expansion Board to 384 KB” before installation.

The materials required for the installation of the Memory Expansion Board are:

- Medium-sized standard screwdriver
- Memory Expansion Board.

***Caution: To prevent any damage to the system circuitry by static electricity, be sure to touch the metal chassis of the system just before you handle any IC chips or system boards.***

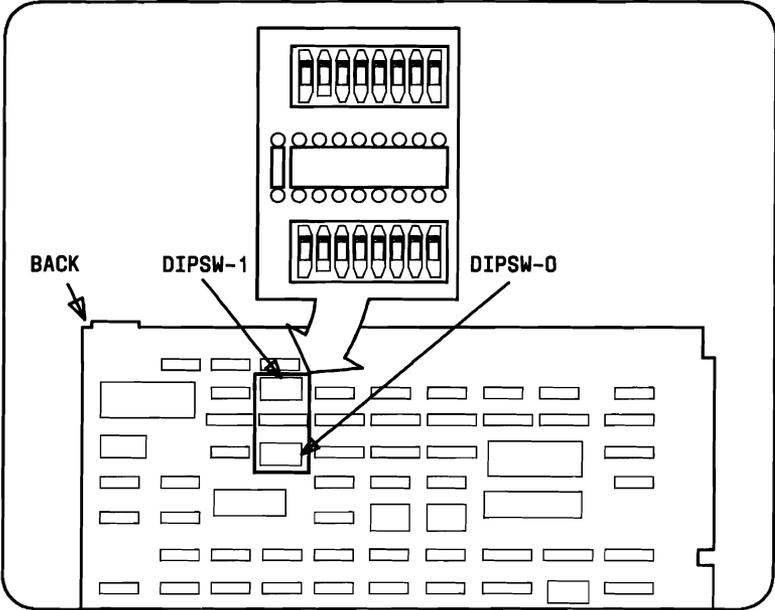
To install the Memory Expansion Board, proceed as follows:

1. Turn the System Module and all external devices OFF.
2. Unplug the ac power cable from the rear panel.
3. Disconnect all cables ( Display, Keyboard, Printer, etc.) from the rear panel of the System Module.

**INSTALLATIONS**

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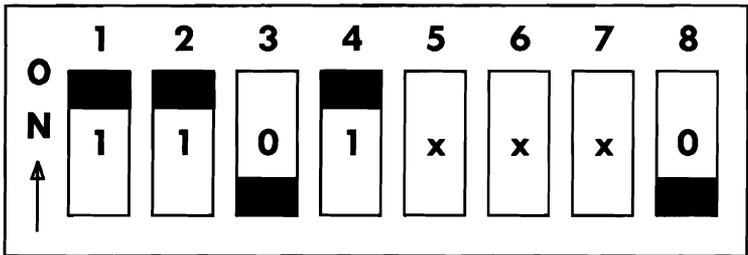
- 4. Turn the System Module upside down so that the lower cover is on top.
- 5. Loosen the four screws that secure the upper and lower covers (located on the rear panel).
- 6. Slide the lower cover forward approximately 0.5 inch and lift it from the System Module.
- 7. Locate DIPSW-0 on the Motherboard (Figure 3-10).



**Figure 3-10. Locating DIPSW-0 on the Motherboard**

- 
8. On DIPSW-0, set switches 1, 2, 3, and 4 for 512-KB Total RAM (Figure 3-11).

- Switch 1 **ON**
- Switch 2 **ON**
- Switch 3 **OFF**
- Switch 4 **ON**
- Switches 5 to 7 (Do not require setting for memory)
- Switch 8 **OFF**.



**Figure 3-11. DIPSW-0 Setting for 512-KB Total RAM in System (256 KB on Motherboard, 256-KB Memory Expansion Board)**

**Note:** Some switches are rocker type; others are slide type. Some DIP switches have the **ON** designation at the top of the switch; others have it on the bottom.

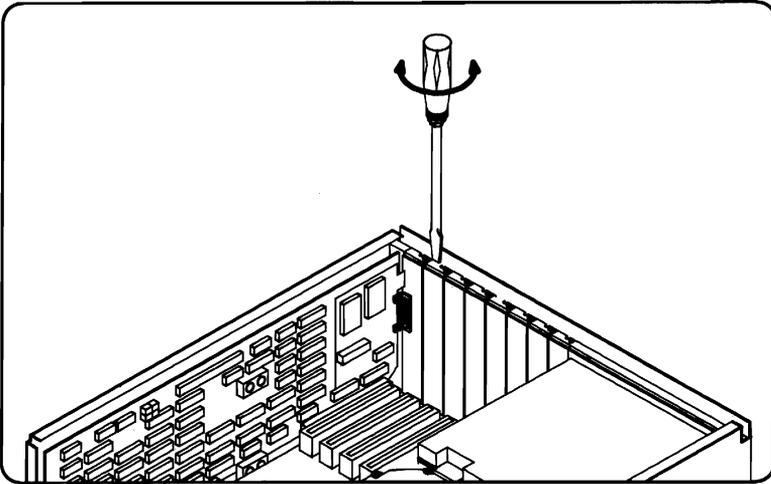
**ON=CLOSED=1**

**OFF=OPEN=0**

## INSTALLATIONS

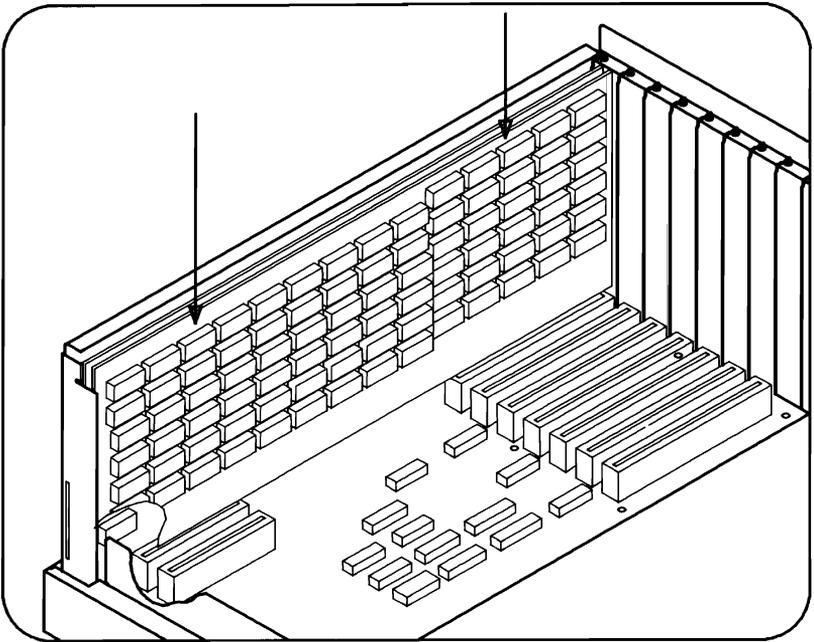
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9. Replace the lower System Module cover and tighten the two screws that secure the cover.
10. Place the System Module back to its upright position.
11. Slide the upper cover forward approximately 0.5 inch and lift it from the System Module.
12. Using a screwdriver, remove the Expansion Slot Cover of the second dual connector expansion slot (Figure 3-12).



**Figure 3-12. Removing the Expansion Slot Cover**

13. Put on the wrist strap and connect to ground (if available), or touch the metal chassis before picking up the Memory Expansion Board to release the static electricity from your hand.
14. Gently insert the Memory Expansion Board into the first dual connector expansion slot on the Bus Converter Board (Figure 3-13).



**Figure 3-13. Inserting the Memory Expansion Board**

## INSTALLATIONS

---

15. Remove the wrist strap (if wrist strap was used).
16. Using a screw and screwdriver, secure the Memory Expansion Board by fastening the retaining bracket to the rear panel.
17. Replace the upper System Module cover and tighten the two cover screws.
18. Connect the cables that were disconnected (Keyboard, Display, Printer, etc.) back to the rear panel of the System Module.
19. Plug the ac power cable into the rear panel.
20. Verify that the RAM passes the Resident Diagnostics and then run Customer Test Diagnostics in the Automatic Mode. (Refer to Chapter 4.)

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## Upgrading Memory Expansion Board Memory to 384 KB

The materials required for the upgrade of the Memory Expansion Board memory to 384 KB are:

- Eighteen 64-K bit RAM chips
- Medium-sized standard screwdriver.

***Caution: To prevent any damage to the system circuitry by static electricity, be sure to touch the metal chassis of the system just before you handle any IC chips or system boards.***

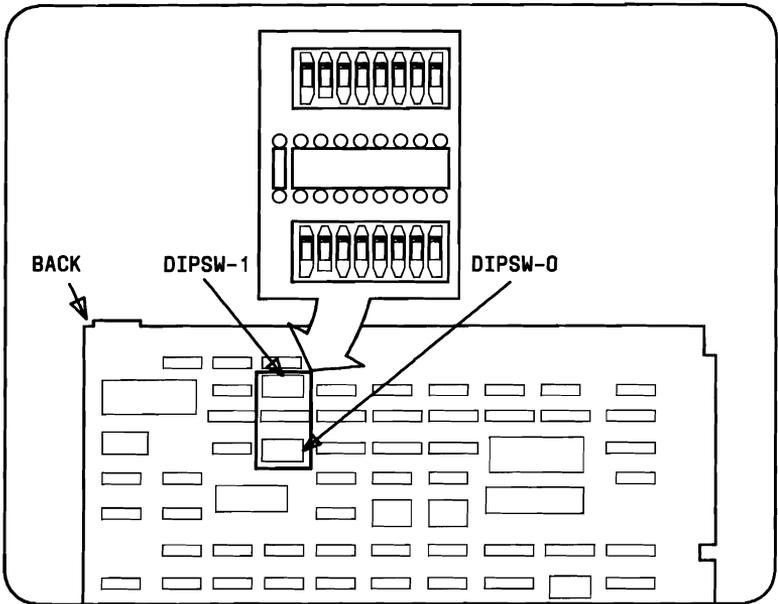
To upgrade the Memory Board, proceed as follows:

1. Turn the System Module and all external devices OFF.
2. Unplug the ac power cable from the rear panel.
3. Disconnect all cables (Display, Keyboard, Printer, etc.) from the rear panel of the System Module.
4. Loosen the four screws that secure the upper and lower covers (located on the rear panel).
5. Slide the upper cover forward approximately 0.5 inch and lift it from the System Module.

## INSTALLATIONS

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6. Turn the System Module upside down so that the lower cover is on top.
7. Slide the lower cover forward approximately 0.5 inch and lift it from the System Module.
8. Locate DIPSW-0 on the Motherboard (Figure 3-14).

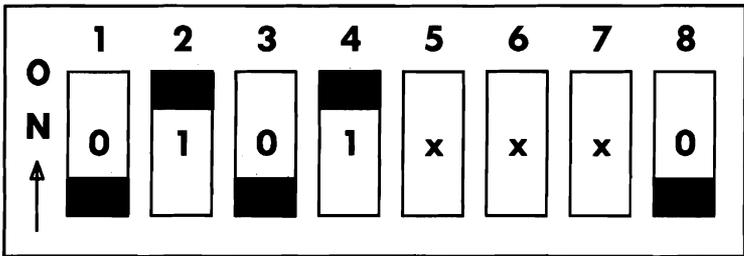


**Figure 3-14. Locating DIPSW-0 on the Motherboard**

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9. On DIPSW-0, set switches 1, 2, 3, and 4 (Figure 3-15).

- Switch 1 **OFF**
- Switch 2 **ON**
- Switch 3 **OFF**
- Switch 4 **ON**
- Switches 5 to 7 (Do not require setting for memory)
- Switch 8 **OFF**.



**Figure 3-15. DIPSW-0 Setting for 640-KB Total Memory in System (256 KB on Motherboard, 384 KB on Memory Expansion Board)**

**Note:** Some switches are rocker type; others are slide type. Some DIP switches have the **ON** designation at the top of the switch; others have it on the bottom.

**ON=CLOSED=1**

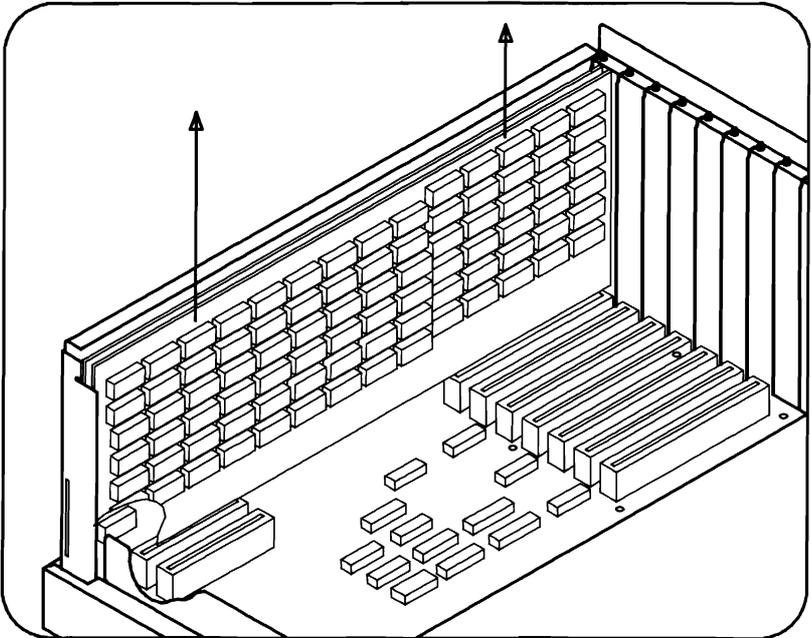
**OFF=OPEN=0**

## INSTALLATIONS

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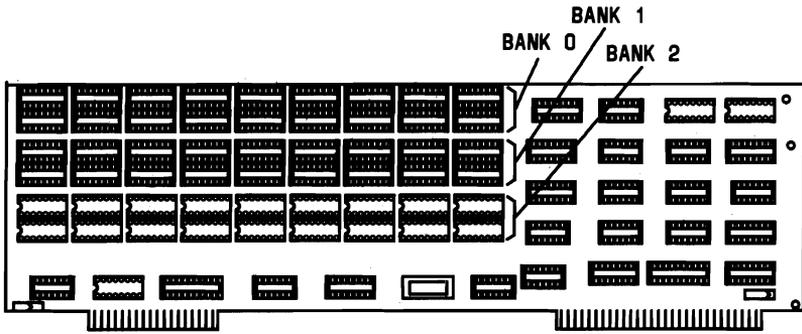
10. Replace the lower System Module cover and tighten the two screws that secure the cover.
11. Place the System Module back in its upright position.
12. Remove the screw that secures the Memory Expansion Board retaining bracket to the rear panel.
13. Put on the wrist strap and connect to ground (if available), or touch the metal chassis before picking up the RAM chip to release the static electricity from your hand.

- 
14. Remove the Memory Expansion Board from the Bus Converter (Figure 3-16).



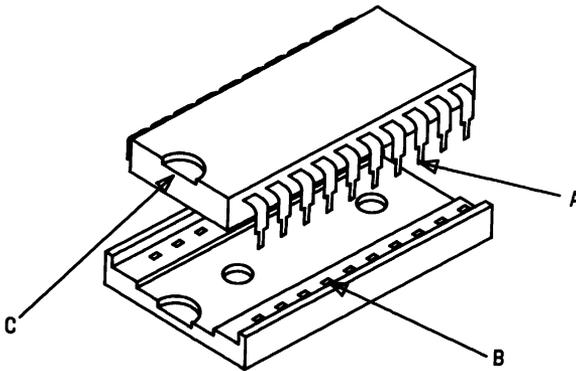
**Figure 3-16. Removal of the Memory Expansion Board**

- 15. Locate Bank 2 on the Memory Expansion Board (Figure 3-17).



**Figure 3-17. Locating Bank 2 on the Memory Expansion Board**

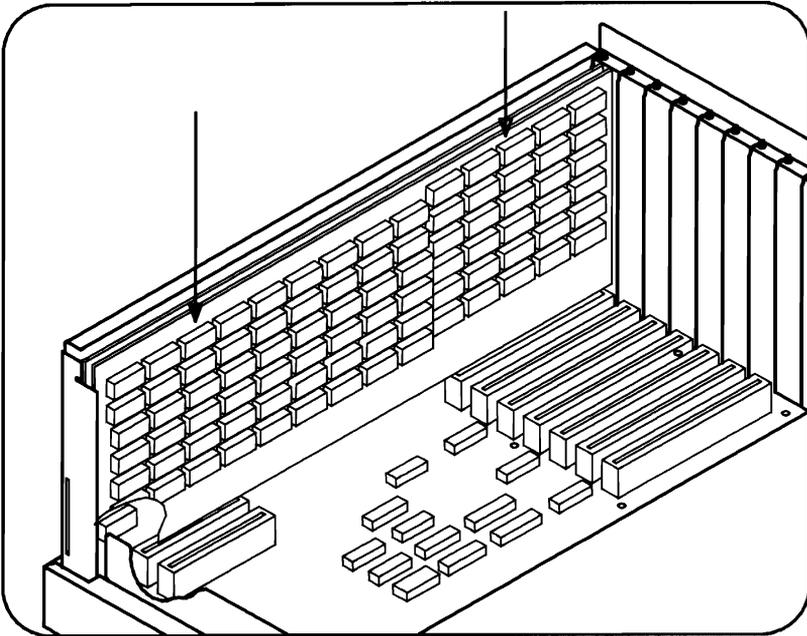
- 
16. Align the RAM chip (A) with a socket (B) as shown in Figure 3-18. Make sure that the notch in the chip (C) is facing the same direction as the other chips on the board. Push the chip down firmly to insert.



**Figure 3-18. Inserting the RAM Chip into the Socket**

17. Repeat Step 16 for the remaining 17 sockets in Bank 2 of the Memory Expansion Board.

18. Gently insert the Memory Expansion Board into the first dual connector expansion slot on the Bus Converter Board (Figure 3-19).



**Figure 3-19. Inserting the Memory Expansion Board**

19. Remove the wrist strap (if wrist strap was used).
20. Secure the Memory Expansion Board by fastening the retaining bracket to the rear panel.
21. Replace the upper System Module cover and tighten the two cover screws.
22. Connect the cables that were disconnected (Keyboard, Display, Printer, etc.) back to the rear panel.
23. Connect the ac power cable to the rear panel.
24. Verify that the RAM passes the Resident Diagnostics and then run the Customer Test Diagnostics in the Automatic Mode. (Refer to Chapter 4.)

## Installing 8087 Numeric Data Processor

The 8087 Numeric Data Processor (NDP) is a fast arithmetic processor that serves as a co-processor to the 8086 CPU. The 8087 NDP is installed into a socket on the Motherboard next to the 8086. The materials required for installing the 8087 NDP are:

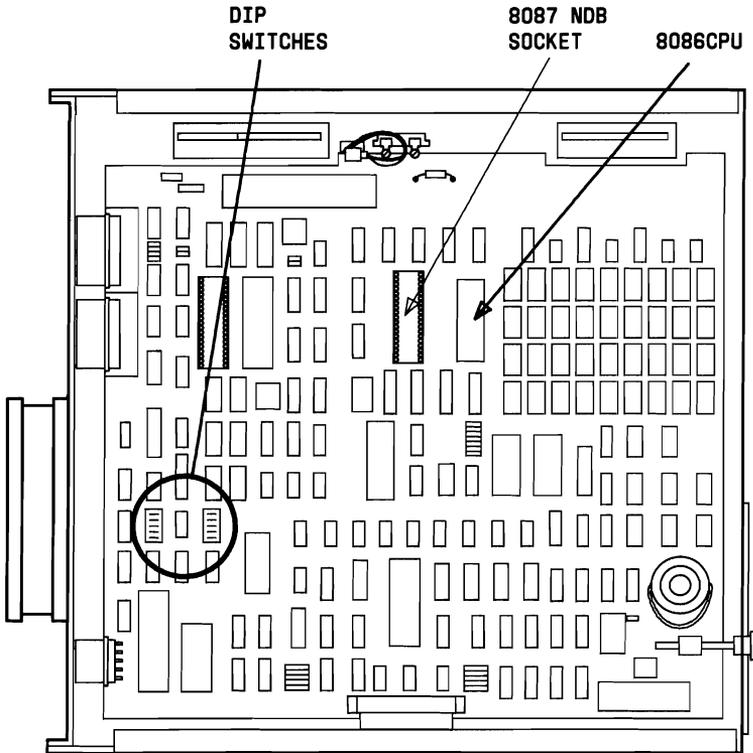
- Medium-sized standard screwdriver
- 8087 NDP.

***Caution: To prevent any damages to the system circuitry by static electricity, be sure to touch the metal chassis of the system just before you handle any IC chips or system boards.***

To install the 8087 Numeric Data Processor, proceed as follows:

1. Turn the System Module and all external devices OFF.
2. Unplug the Module's power cable from the ac wall outlet.
3. Disconnect all cables (Display, Keyboard, Printer, etc.) from the rear panel of the System Module.

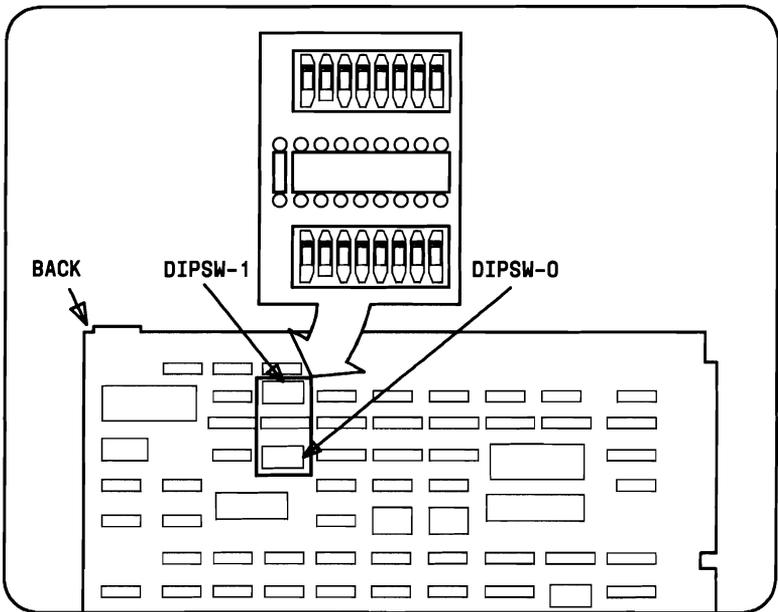
4. Turn the System Module upside down so that the lower cover is on top.
5. Loosen the two screws that secure the lower cover (located on the rear panel).
6. Slide the lower cover forward approximately 0.5 inch and lift it from the System Module.
7. Locate the socket provided for insertion of the 8087 NDP on the Motherboard (Figure 3-20).



**Figure 3-20. Locating the 8087 NDP Socket**

8. Put on the wrist strap and connect to ground (if available), or touch the metal chassis before picking up the 8087 chip to release the static electricity from your hand.

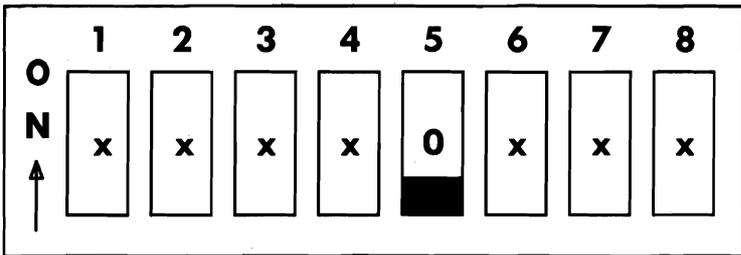
9. Align the 8087 NDP pins with the socket. Make sure that the notch in the chip is pointing in the same direction as other chips on the Motherboard. Then gently insert the 8087 NDP into the socket.
10. Remove wrist strap (if wrist strap was used).
11. Locate DIPSW-0 on the Motherboard (Figure 3-21).



**Figure 3-21. Locating DIPSW-0 on the Motherboard**

12. Set DIP switch 5 as shown in Figure 3-22.

- Switches 1 to 4 (Do not require setting)
- Switch 5 **OFF**
- Switches 6 to 8 (Do not require setting).



**Figure 3-22. Setting DIPSW-0 for Presence of 8087 NDP**

**Note:** Some switches are rocker type; others are slide type. Some DIP switches have the **ON** designation at the top of the switch; others have it on the bottom.

**ON=CLOSED=1**  
**OFF=OPEN=0**

- 
13. Replace the lower System Module cover and tighten the two cover screws.
  14. Place the System Module back to its upright position.
  15. Connect the cables that were disconnected (Keyboard, Display, Printer, etc.) back to the rear panel of the System Module.
  16. Connect the system power cable to the System Module and then to the ac wall outlet.
  17. Verify that the Motherboard passes Power-Up Diagnostics and then run the Customer Test Diagnostics in the Automatic Mode. (Refer to Chapter 4.)

## **Replacing Mini-Floppy Disk Unit With Hard Disk Unit**

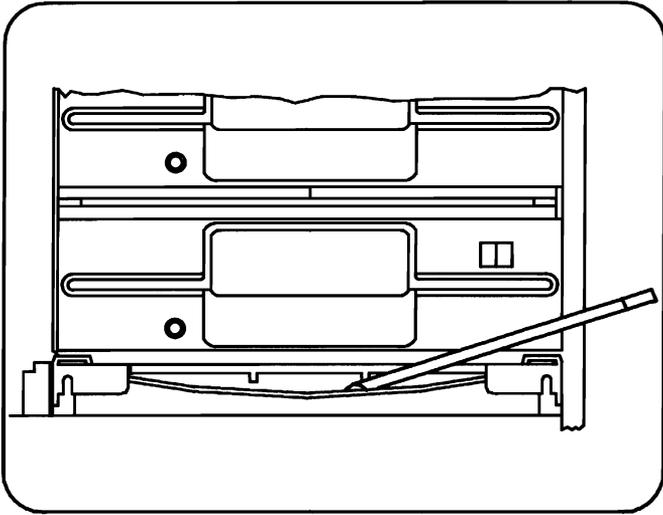
The replacement of the Upper MFD Unit with a Slim 10-MB HDU is performed in four parts:

- Removing Upper MFD Unit
- Installing Slim 10-MB HDU
- Installing HDU Controller
- Setting DIP switches and jumpers.

### ***Removing Upper MFD Unit***

1. Turn the System Module and all external devices OFF.
2. Unplug the ac power cable from the rear panel.
3. Disconnect all cables (Keyboard, Display, Printer, etc.) from the System Module rear panel.
4. Loosen the four screws that secure the upper and lower covers (located on the rear panel).
5. Slide the upper cover forward approximately 0.5 inch and lift it from the System Module.

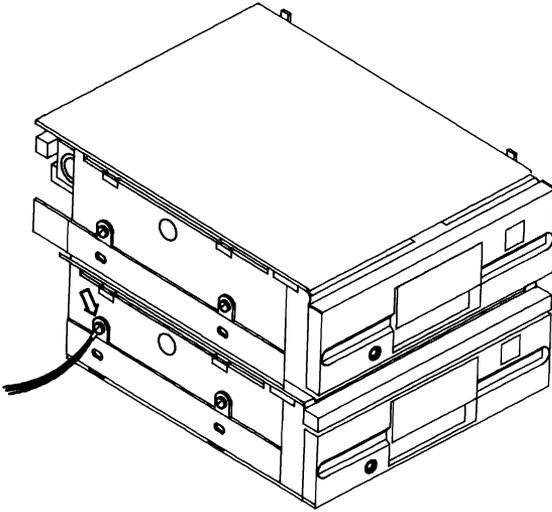
- 
- Using a screwdriver, push down the metal bar below the drive assembly (Figure 3-23) and slide the assembly forward to permit access to the signal and power cables.



**Figure 3-23. Unlocking Drive Assembly**

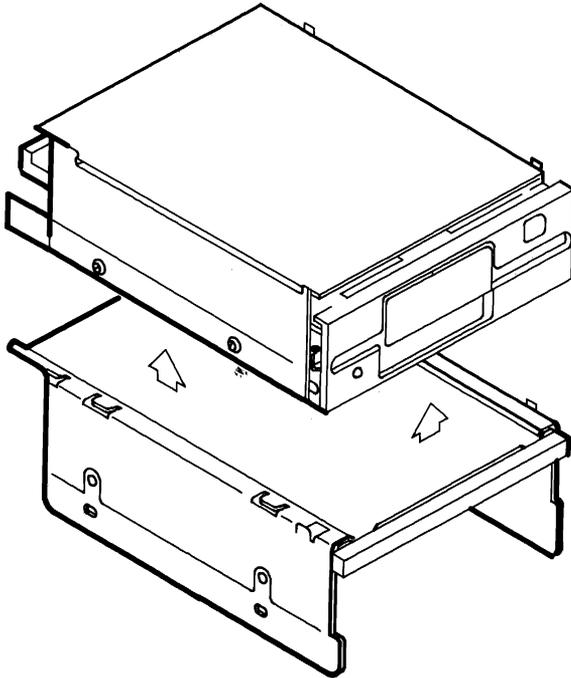
- Carefully remove the ribbon cables, power cables, and the ground connectors from the rear of both MFD Units. Mark the connector that was connected to MFD Unit A (lower MFD).

- Using a standard screwdriver, carefully remove the screw from the side of the assembly that secures the ground strap (Figure 3-24) and remove the assembly from the cabinet.



**Figure 3-24. Removing Drive Assembly Ground Strap**

- 
9. Remove the three remaining screws that hold the metal cover of the lower MFD Unit in place and lift the cover and the upper MFD Unit from the assembly.
  10. Remove the four screws that attach the upper MFD Unit to the cover and remove the MFD Unit from the cover (Figure 3-25).

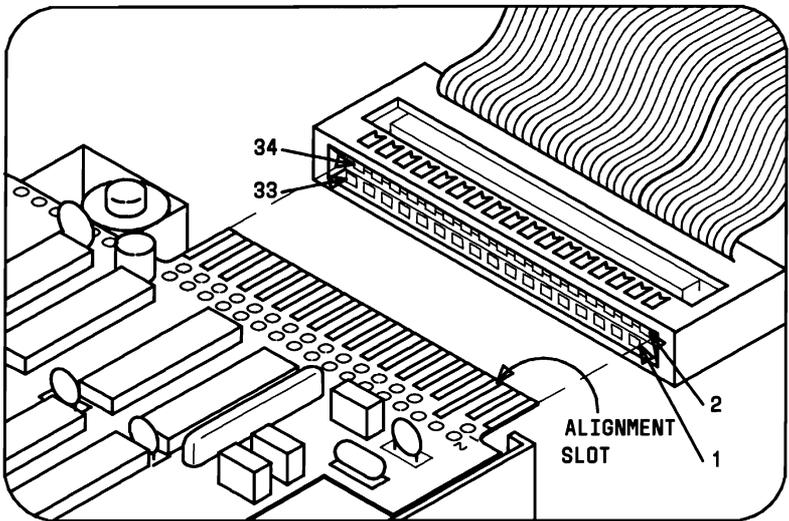


**Figure 3-25. Removal of Upper Mini-Floppy Disk Unit From Cover**

### ***Installing 10- or 20-MB Hard Disk Units***

1. Attach the HDU to the cover of the bottom MFD unit using the same holes and screws that attached the upper MFD Unit.
2. Attach the HDU and cover to the drive assembly using the same screws that were removed. *Do not* fasten the screw used by the ground strap until the ground strap is in place.
3. Slide the assembly into the cabinet slots, but ***do not*** push the assembly all the way to the locked position.

4. Connect the ground, power, and signal cables to the MFD Unit. Make sure that the signal cable connector for MFD Unit A is the same one that was used previously. Verify that the numbers on the signal cable connector correspond to the numbers on the MFD Unit (Figure 3-26).



**Figure 3-26. Connecting the Signal Cable to the MFD Unit**

### ***Installing Hard Disk Controller Board***

There are two types of HDU Controllers: the DTC (Data Technology Corporation) and the WD (Western Digital). The physical differences between the Controllers are:

1. The DTC Controller is a full-size modular circuit card. The WD Controller is a half-size modular circuit card.
2. Each HDU Controller must be configured for the type of drive used (see Appendix A). The DTC Controller is configured by setting the DIP Switches on the card. The WD Controller has jumpers that must be placed.

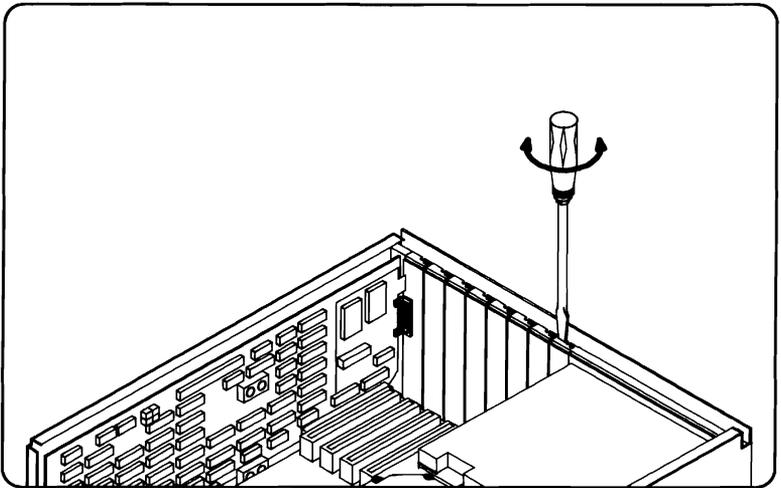
Each Controller formats the hard disk drives differently; therefore, they cannot be interchanged without performing the following:

- Make a backup copy of all data if possible.
- Using the System Test, Low-Level Format the drive.
- Using the MS-DOS FDISK, partition the drive.
- Restore the backup data.

---

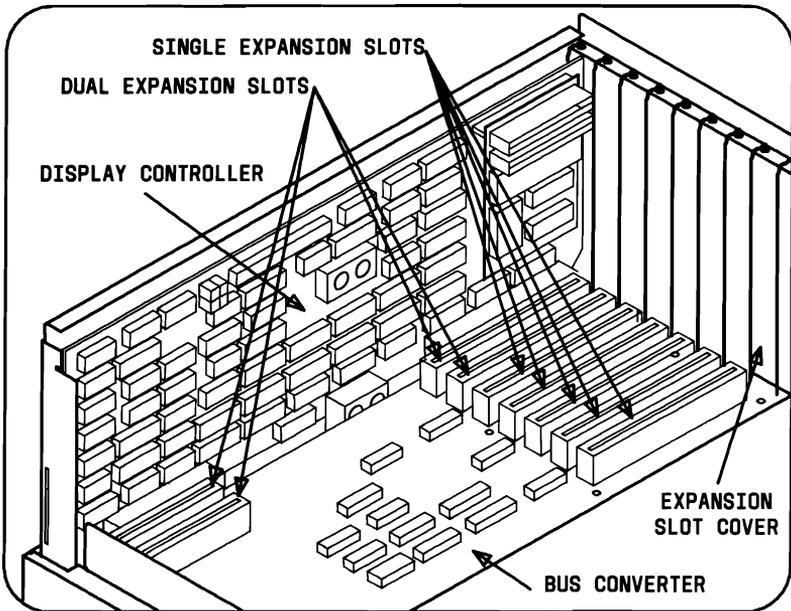
The WD Controller is not supported by ROM BIOS 1.21 and earlier versions. Both the DTC and the WD Controller are supported by ROM BIOS 1.43 and later versions.

1. Using a screwdriver, remove the Expansion Slot Cover closest to the HDU (Figure 3-27) on the rear panel.



**Figure 3-27. Removing Expansion Slot Cover**

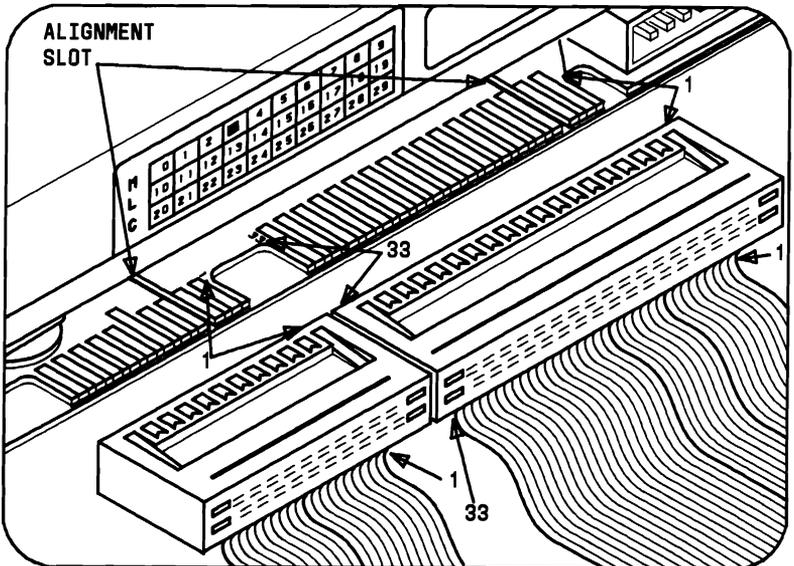
2. Insert the HDU Controller Board into the connector expansion slot just opened (Figure 3-28).



**Figure 3-28. Single Connector Expansion Slots**

3. Using a screw and screwdriver, secure the HDU Controller Board retainer bracket to the rear panel.

4. Connect the smaller ribbon cable to the 20-pin connector marked "J2" on the HDU Controller Board, ensuring that the colored stripe on the ribbon cable is on the bottom (DTC) or on the left for Western Digital.
  
5. Connect the other end of the small ribbon cable to the 20-pin connector on the rear of the HDU, ensuring that the numbers on the cable connector correspond with those on the HDU connector (Figure 3-29).



**Figure 3-29. Connecting Ribbon Cables to HDU**

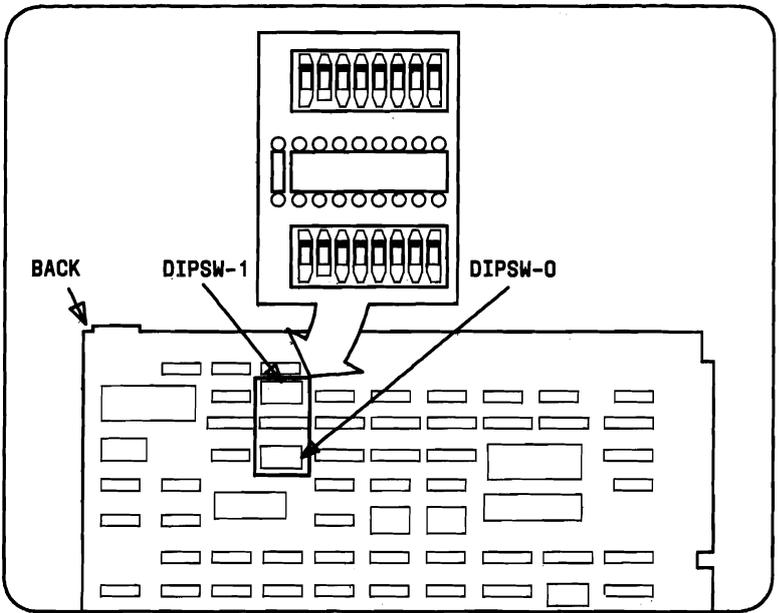
6. Connect the larger ribbon cable to the 34-pin connector on the rear of the HDU, ensuring that the numbers on the cable connector correspond with those on the HDU connector (Figure 3-29).
7. Connect the other end of the large ribbon cable to the 34-pin connector marked "J1" on the HDU Controller Board, ensuring that the colored stripe is on the bottom (DTC) or on the left for Western Digital.
8. Connect the power cable to the rear of the HDU.
9. Push the Drive Assembly all the way into the slot until the assembly is locked into place.

### ***Setting DIP Switches and Jumpers***

There are several DIP switches and jumpers that must be set with the removal of the MFD Unit B and the installation of the HDU. One switch is located on the Motherboard and the remainder of the switches and jumpers are on the HDU Controller.

1. Turn the System Module upside down so that the lower cover is on top.
2. Slide the lower cover forward approximately 0.5 inch and lift it from the System Module.

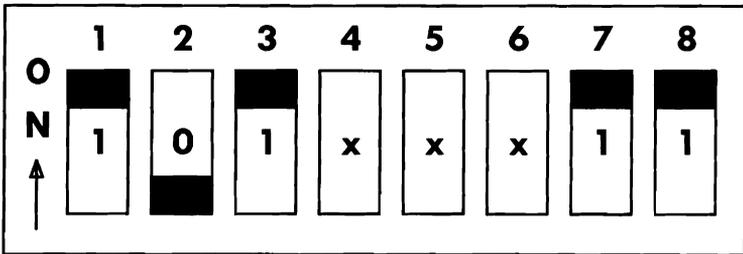
- 
3. Locate DIPSW-1 on the Motherboard (Figure 3-30).



**Figure 3-30. Locating DIPSW-1 on the Motherboard**

4. Set switches 3, 4, 7, and 8 of DIPSW-1 to reflect the presence of one MFD Unit and HDU (Figure 3-31).

- Switch 1 **ON**
- Switch 2 **OFF**
- Switch 3 **ON**
- Switches 4, 5, and 6 (Do not require setting for disks)
- Switch 7 **ON**
- Switch 8 **ON**.



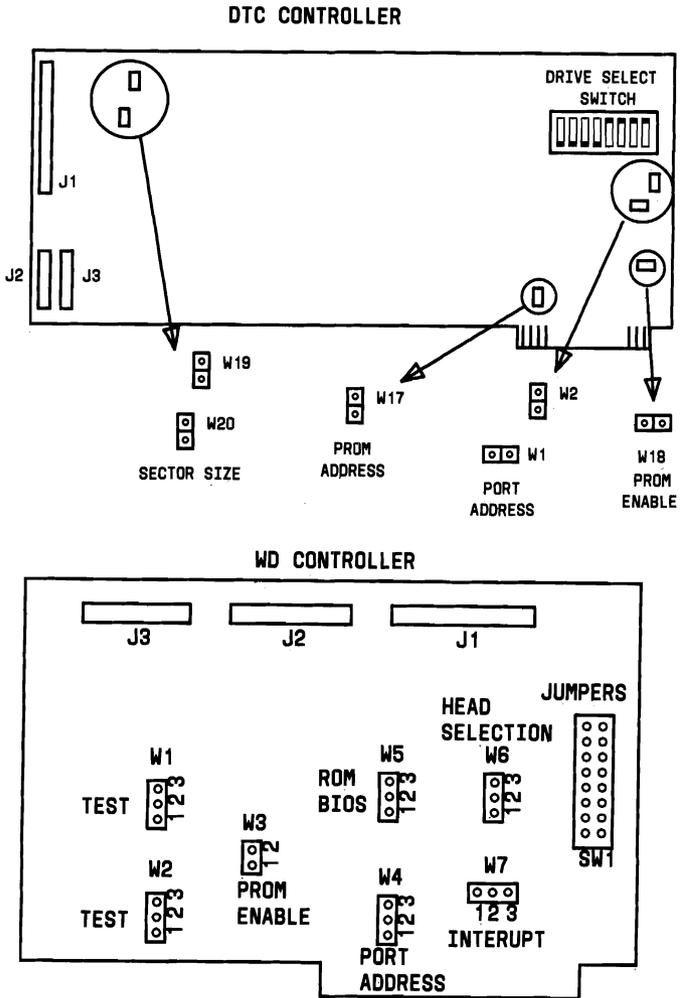
**Figure 3-31. DIPSW-1 Setting for One Mini-Floppy Disk Unit and Hard Disk Unit(s)**

**Note:** Refer to Appendix A for additional switch settings. Some switches are rocker type; others are slide type. Some DIP switches have the **ON** designation at the top of the switch; others have it on the bottom.

**ON=CLOSED=1**  
**OFF=OPEN=0**

5. Replace the lower System Module cover and tighten the two cover screws.
6. Place the System Module back to its upright position.
7. Determine the type (DTC or WD) Controller and locate the jumpers on the HDU Controller Board (Figure 3-32).

**Note:** On later versions of the DTC Controller, some jumpers have been eliminated.



**Figure 3-32. Two Types of Hard Disk Controller Boards With DIP Switch and Jumpers**

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The J1, J2, and J3 connectors on the *DTC Controller* provide the following:

- The J1 connector is the control connector. This connector transfers the control signals to and from the HDUs. Two HDUs can be installed using a Daisy Chain Connection.
- The J2 and J3 connectors are data connectors. These connectors transfer data to and from the HDUs. The drive selection is determined by the settings on the HDU, not by the choice of connectors.

The J1, J2, and J3 connectors on the *WD Controller* provide the following:

- The J1 connector is the control connector. This connector transfers the control signals to and from the HDUs. Two HDUs can be installed using a Daisy Chain Connection.
  - The J2 and J3 connectors are data connectors. These connectors transfer data to and from the HDUs. The J2 connector must be used in a 1-HDU configuration. The J3 connector is used for the second HDU in a 2-drive configuration.
8. For the WD Controller, go to Step 15. For the DTC Controller, proceed with Step 9.
  9. Verify jumpers are present on W1 and W2 (Figure 3-32). This defines the HDU Controller port address as 320.

## INSTALLATIONS

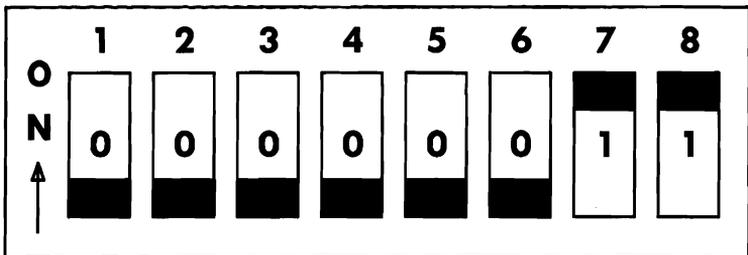
---

10. Verify a jumper is present on W17 and is not present on W18 (Figure 3-32). A jumper on W17 defines the starting address for the HDU Controller EPROM at C800:0000 and a jumper on W18 enables the HDU Controller EPROM. The HDU Controller EPROM must not be present.
11. Verify a jumper is present on W20 and not present on W19 (Figure 3-32). This sets the HDU sector size at 512 KB.
12. Locate the Drive Select Switch on the HDU Controller (Figure 3-32).

13. The switch settings for a 10-MB disk are shown in Figure 3-33.

- Switches 1 to 6 **OFF**
- Switches 7 to 8 **ON**.

**Note:** Some switches are rocker type; others are slide type. Some DIP switches have the **ON** designation at the top of the switch; others have it on the bottom. Refer to Appendix A for other hard disk switch configurations.



**Figure 3-33. DTC Hard Disk Controller DIP Switch Settings for 10-MB Hard Disk**

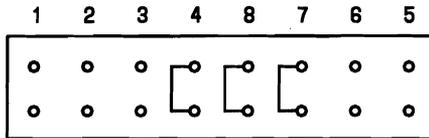
**ON=CLOSED=1**  
**OFF=OPEN=0**

14. Proceed to Step 19.
15. Verify that jumpers are present on W1, W2, W4, and W6 on the WD Controller (Figure 3-32). **ROM BIOS 1.43 or higher are required for WD controller.**
16. Verify the jumper's location: W2 connects pins 1 and 2, W4 connects pins 2 and 3, and W6 connects pins 2 and 3. Location W3 does not have a jumper.

**Note:** The physical locations of the jumpers may vary.

17. The jumper settings (SW1) for the 20-MB Seagate ST-225 HDU with WD Controller are shown in Figure 3-34.

- Jumpers 4, 7, and 8 are **PRESENT**
- Jumpers 1, 2, 3, 5, and 6 are **NOT PRESENT**



**Figure 3-34. Seagate ST-225 20-MB Hard Disk With WD Controller, DIP Switch (Jumper) Settings**

**Note:** Refer to Appendix A for additional HDU switch settings.

## INSTALLATIONS

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18. This sets up the controller for the 20-MB HDU.
19. Replace the upper System Module cover making sure that all signal cables are out of the way and tighten the two screws that secure the cover.
20. Connect the cables that were disconnected (Keyboard, Display, Printer, etc.) back to the rear panel of the System Module.
21. Plug the ac power cable into the rear panel.
22. Turn the Power Switch ON and verify that the system recognizes the presence of the HDU and then run the Customer Test Diagnostics in the Automatic Mode. (Refer to Chapter 4.)

---

## Installing Small Expansion Box

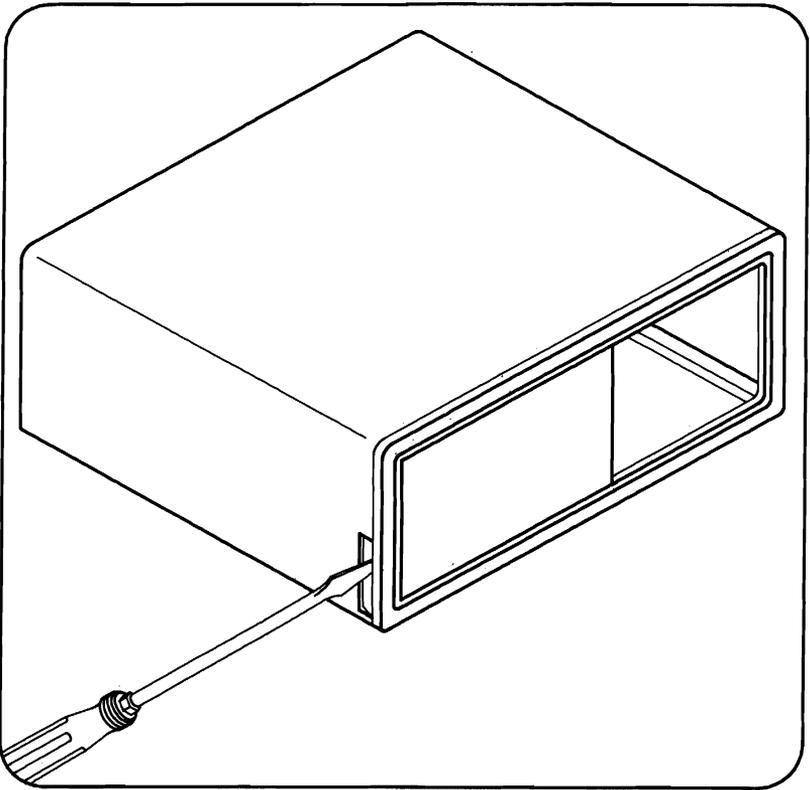
The materials required for the installation of the Small Expansion Box are:

- Small Expansion Box with two signal cables and one power cable
- Hard Disk Unit Controller
- Medium-sized standard screwdriver
- Clamp for connecting Small Expansion Box to System Module.

To install the Small Expansion Box:

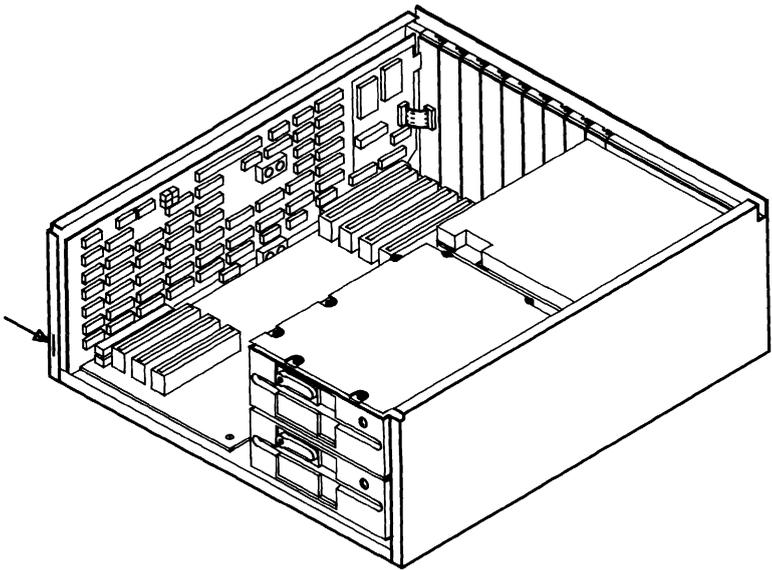
1. Turn the System Module and all external devices OFF.
2. Unplug the ac power cable from the rear panel.
3. Disconnect all the cables (Display, Keyboard, Printer, etc.) from the rear panel of the System Module.
4. Loosen the two screws that secure the upper cover.
5. Slide the upper cover forward approximately 0.5 inch and lift it from the System Module.

6. Remove the plastic cut-out panel on the left side of the upper System Module cover by applying pressure on it with a screwdriver (Figure 3-35).



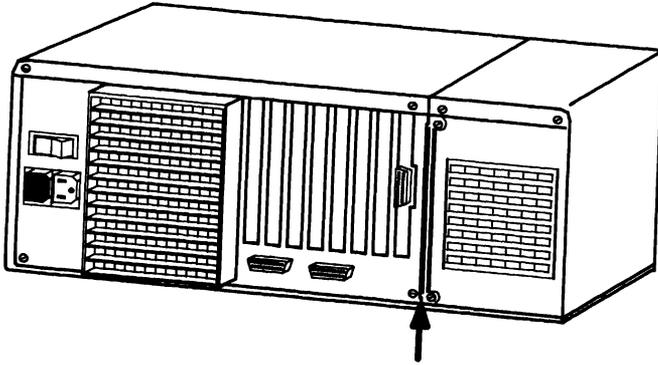
**Figure 3-35. Removing a Plastic Panel From the System Module**

- 
7. Insert the tab on the Small Expansion Box into the slot on the left front of the System Module (Figure 3-36). Make sure that the signal cables are placed into the System Module so they are not pinched.



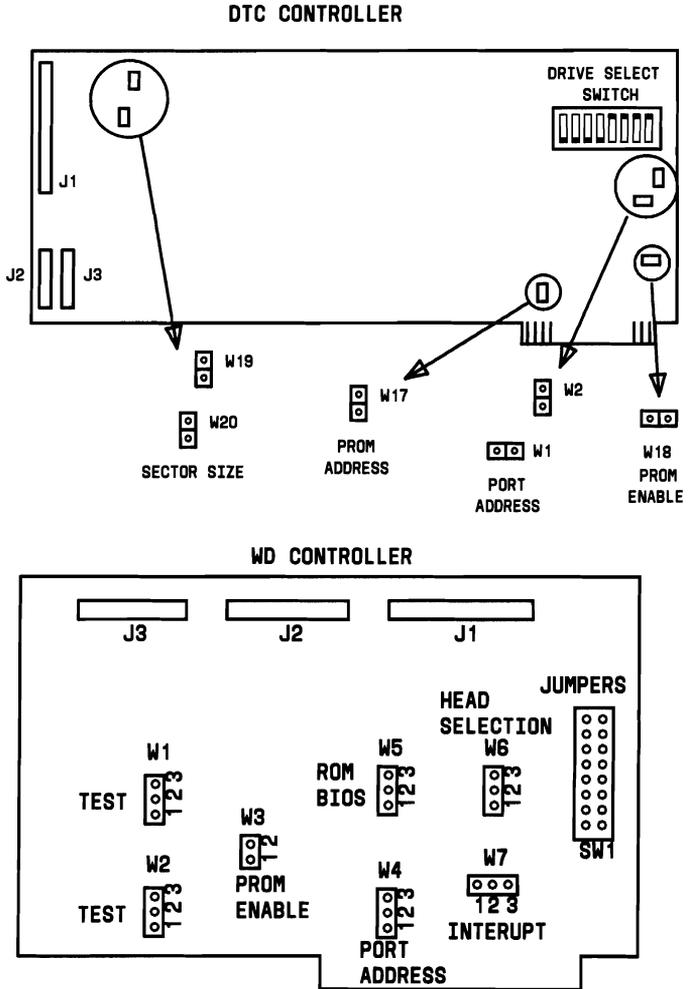
**Figure 3-36. Fitting a Small Expansion Box to the System Module**

8. Fasten the Small Expansion Box to the System Module by attaching the clamp to the rear of the System Module (Figure 3-37).



**Figure 3-37. Attaching the Small Expansion Box to the System Module**

9. For the WD Controller, go to Step 16. For the DTC Controller, proceed with Step 10.
10. Verify jumpers are present on W1 and W2 (Figure 3-38). This defines the HDU Controller port address as 320.
11. Verify a jumper is present on W17 and is not present on W18 (Figure 3-38). A jumper on W17 defines the starting address for the HDU Controller EPROM at C800:0000, and a jumper on W18 enables the HDU Controller EPROM. The HDU Controller EPROM must not be present.



**Figure 3-38. Two Types of Hard Disk Controller Boards With DIP Switch and Jumpers**

The J1, J2, and J3 connectors on the *DTC Controller* provide the following:

- The J1 connector is the control connector. This connector transfers the control signals to and from the HDUs. Two HDUs can be installed using a Daisy Chain Connection.
- The J2 and J3 connectors are data connectors. These connectors transfer data to and from the HDUs. The drive selection is determined by the settings on the HDU, not by the choice of connectors.

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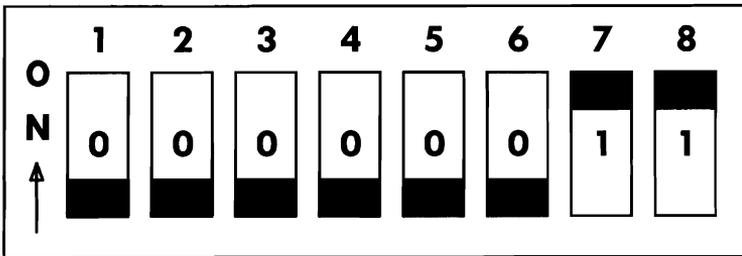
The J1, J2, and J3 connectors on the *WD Controller* provide the following:

- The J1 connector is the control connector. This connector transfers the control signals to and from the HDUs. Two HDUs can be installed using a Daisy Chain Connection.
  - The J2 and J3 connectors are data connectors. These connectors transfer data to and from the HDUs. The J2 connector must be used in a 1-HDU configuration. The J3 connector is used for the second HDU in a 2-drive configuration.
12. Verify that jumper W20 has a jumper present and W19 does not (Figure 3-38). This sets the HDU sector size at 512 KB.
  13. Locate the Drive Select Switch on the HDU Controller (Figure 3-38).

14. The switch settings for a 10-MB disk are shown in Figure 3-39.

- Switches 1 to 6 **OFF**
- Switches 7 to 8 **ON**.

**Note:** Some switches are rocker type; others are slide type. Some DIP switches have the **ON** designation at the top of the switch; others have it on the bottom. Refer to Appendix A for other hard disk switch configurations.



**Figure 3-39. DTC Hard Disk Controller DIP Switch Settings for 10-MB Disk**

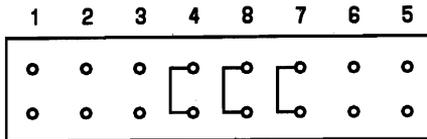
**ON=CLOSED=1**  
**OFF=OPEN=0**

- 
15. Go to Step 20.
  16. Verify that jumpers are present on W1, W2, W4, and W6 on the WD Controller (Figure 3-38). **ROM BIOS 1.43 or higher are required for the WD controller.**
  17. Verify the jumper's location: W2 connects pins 1 and 2, W4 connects pins 2 and 3, and W6 connects pins 2 and 3; Location W3 does not have a jumper.

**Note:** The physical locations of the jumpers may vary.

18. The jumper settings (SW1) for the 20-MB Seagate ST-225 HDU with WD Controller are shown in Figure 3-40.

- Jumpers 4, 7, and 8 are **PRESENT**
- Jumpers 1, 2, 3, 5, and 6 are **NOT PRESENT**

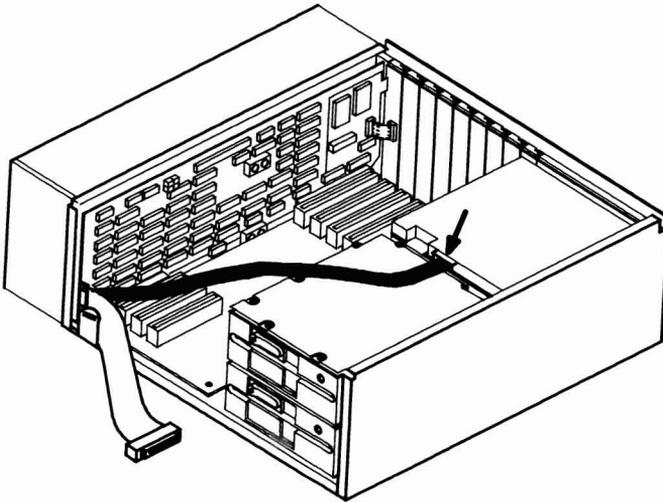


**Figure 3-40. Seagate ST-225 20-MB Hard Disk With WD Controller, DIP Switch Settings**

**Note:** Refer to Appendix A for additional HDU switch settings.

19. This sets up the controller for the 20-MB HDU.

- 
20. Connect the power cable from the Small Expansion Box to the connector on the power supply (Figure 3-41).

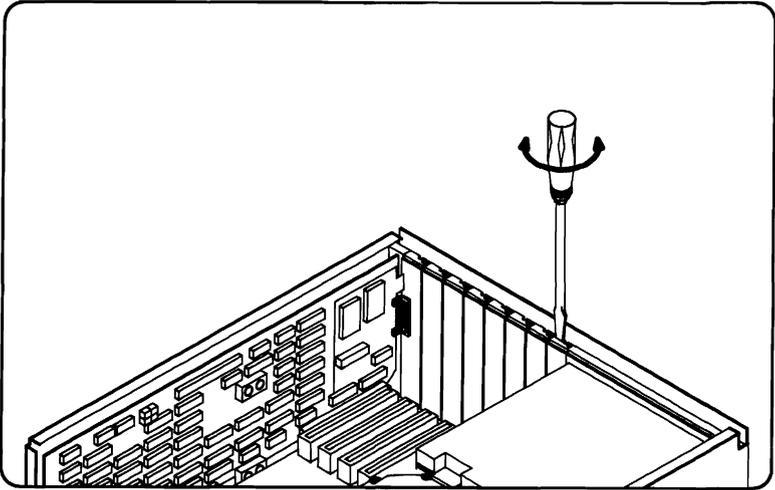


**Figure 3-41. Connecting Small Expansion Box Power Cable**

## INSTALLATIONS

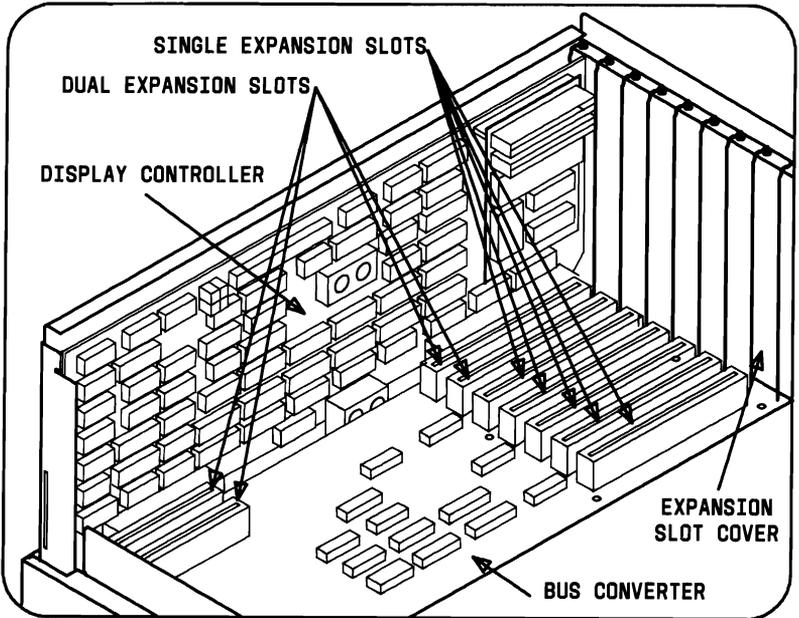
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21. Using a screwdriver, remove the Expansion Slot Cover closest to the HDU (Figure 3-42) on the rear panel.



**Figure 3-42. Removing the Expansion Slot Cover**

22. Insert the HDU Controller Board into a single connector expansion slot (Figure 3-43).



**Figure 3-43. Single Connector Expansion Slots**

23. Secure the HDU Controller Board by fastening the retaining bracket to the rear panel with a screw and screwdriver.

24. Connect the smaller ribbon cable to the 20-pin connector marked "J2" on the HDU Controller Board, ensuring that the colored stripe on the ribbon cable is on the bottom (DTC) or on the left for Western Digital.
25. Connect the other end of the large ribbon cable to the 34-pin connector marked "J1" on the HDU Controller Board, ensuring that the colored stripe is on the bottom (DTC) or on the left for Western Digital.
26. Replace the upper System Module cover making sure that all cables are out of the way and tighten the two screws that secure the cover.
27. Reconnect the cables that were disconnected from the rear panel (Keyboard, Display, Printer, etc.).
28. Plug the ac power cable into the rear panel.
29. Turn the Power Switch ON and verify that the system recognizes the presence of the HDU and then run the Customer Test Diagnostics in the Automatic Mode. (Refer to Chapter 4.)

**Note:** If on boot-up diagnostics FIXED DISK does not show "1 Ready" or "Present," then check for the stripe direction on the HDU signal cables at the HDU end (Figure 3-29).

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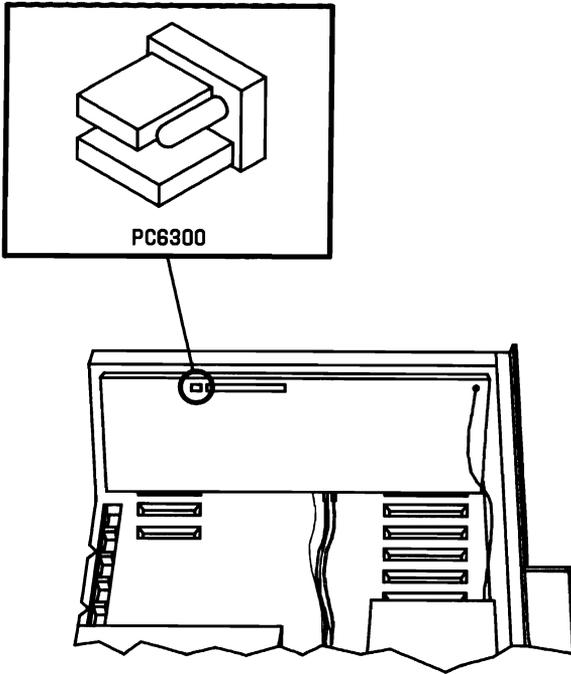
## Installing the Display Enhancement Board

The materials required to install the Display Enhancement Board (DEB) are:

- Display Enhancement Board
- Medium-sized standard screwdriver.

To install the DEB:

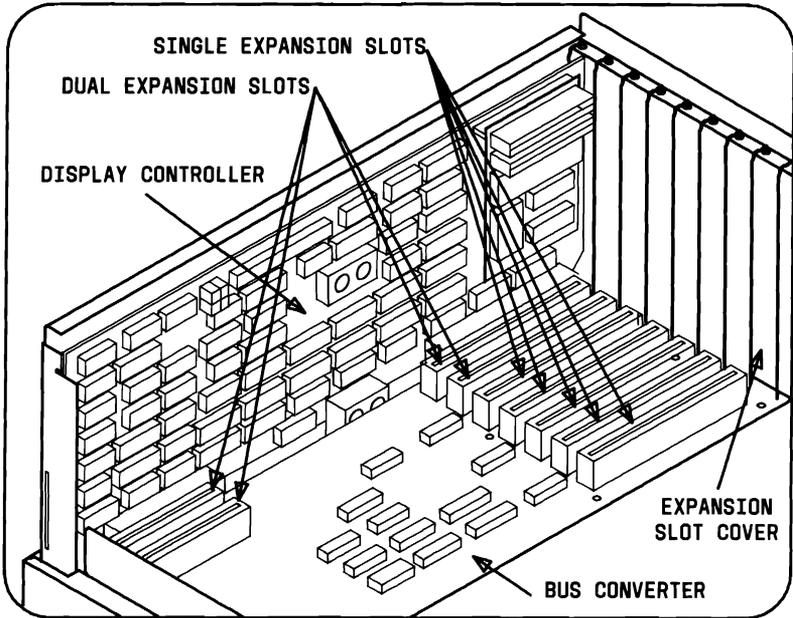
1. Turn the System Module and all external devices OFF.
2. Unplug the ac power cable from the rear panel.
3. Disconnect all the display cables from the rear panel of the System Module.
4. Loosen the two screws that secure the upper cover.
5. Slide the upper cover forward approximately 0.5 inch and lift it from the System Module.
6. If you have a memory board installed, remove it temporarily to provide some working space.
7. Locate jumper block A on the Video Display Controller (VDC) (Figure 3-44).



**Figure 3-44. Jumper Block A on the VDC**

8. Remove the lower jumper that connects pins 5 and 6 at jumper block A, and replace it with the 3-pin jumper supplied with the DEB.
9. Using a screwdriver, remove the Expansion Slot Cover of an unused dual expansion slot (Figure 3-45) near the VDC.

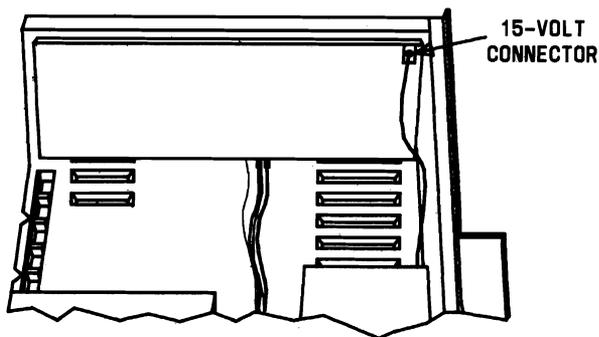
**Note:** Although the DEB can be placed in any dual expansion slot, the 50-pin cable which connects the VDC to the DEB is short requiring the DEB to be located near the VDC.



**Figure 3-45. Dual Expansion Slots in the System Module**

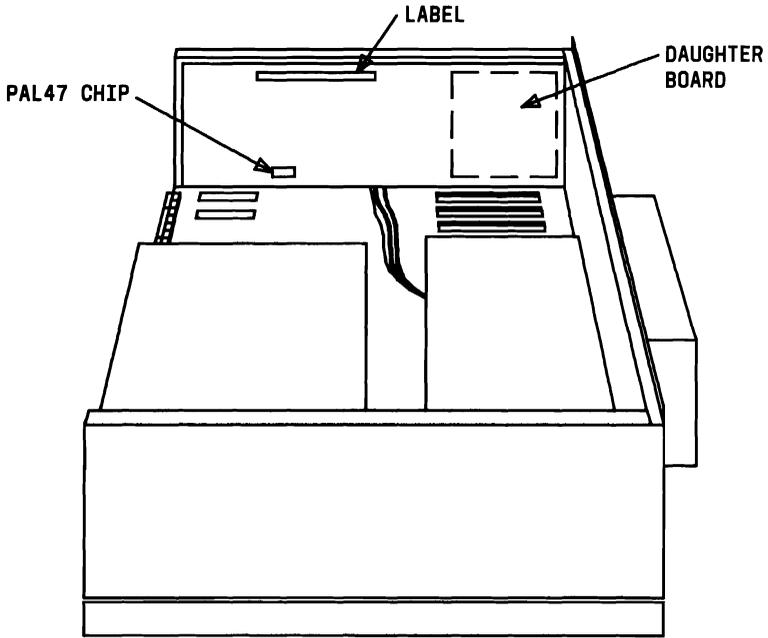
10. If a color monitor is to be connected to the DEB, go to Step 13. If a Monochrome Monitor is to be connected to the DEB, locate the 15-volt connector (Figure 3-46) at the top right of the VDC and temporarily disconnect it.

**Note:** The enhanced display features are available only to the monitor connected to the DEB.



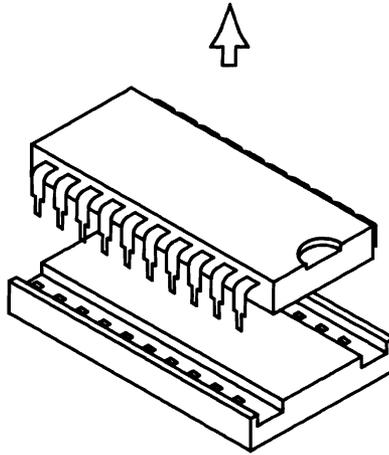
**Figure 3-46. The 15-Volt Connector on the VDC**

11. Determine if the level number of your built-in Video Display Controller is G0318 or higher. This is the board that ordinarily controls display; the DEB enhances the capabilities of this standard board. The two ways of determining your level number are:
  - a. Look for a small label (usually yellow) located in the center top section on the VDC (Figure 3-47). The label has the level number on it.
  - b. If the VDC has a daughter board (a small board attached on the far right of the VDC), the level number is G0317, and you will need to replace the PAL47 chip. If the level number is G0318 or higher, skip the next steps and go to Step 15.



**Figure 3-47. VDC PAL47 Chip, Label, and Daughter Board Locations**

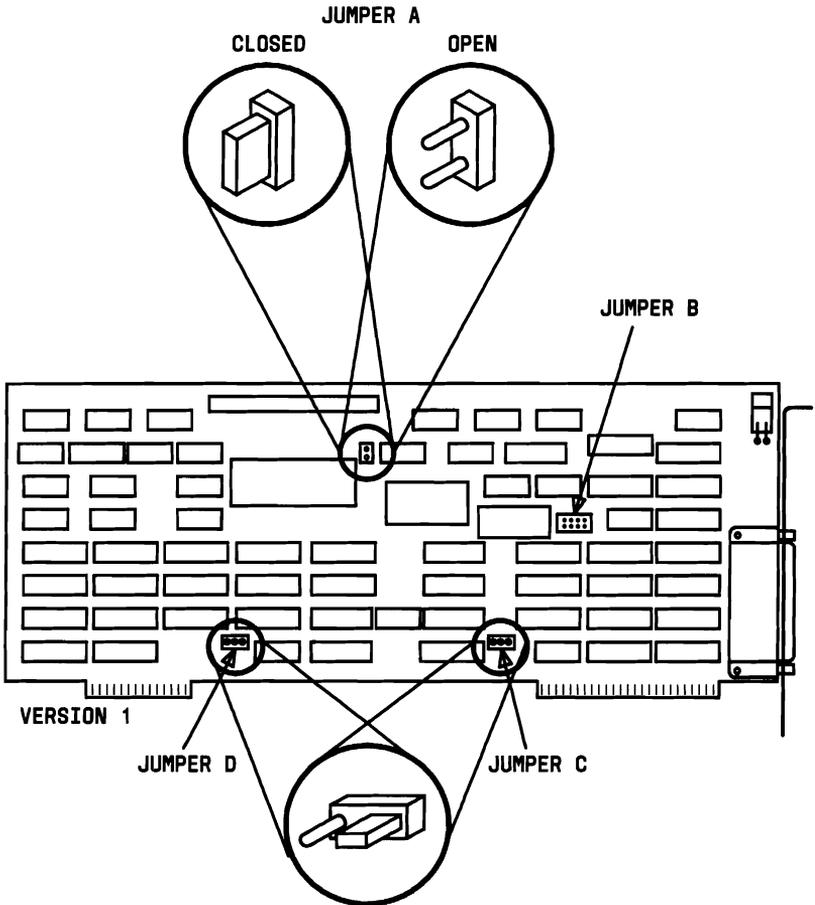
12. Locate the PAL47 chip (Figure 3-48). It is on the bottom row, fifth column from the left, at coordinates 5G. Gently remove the chip using a screwdriver or extraction tool.



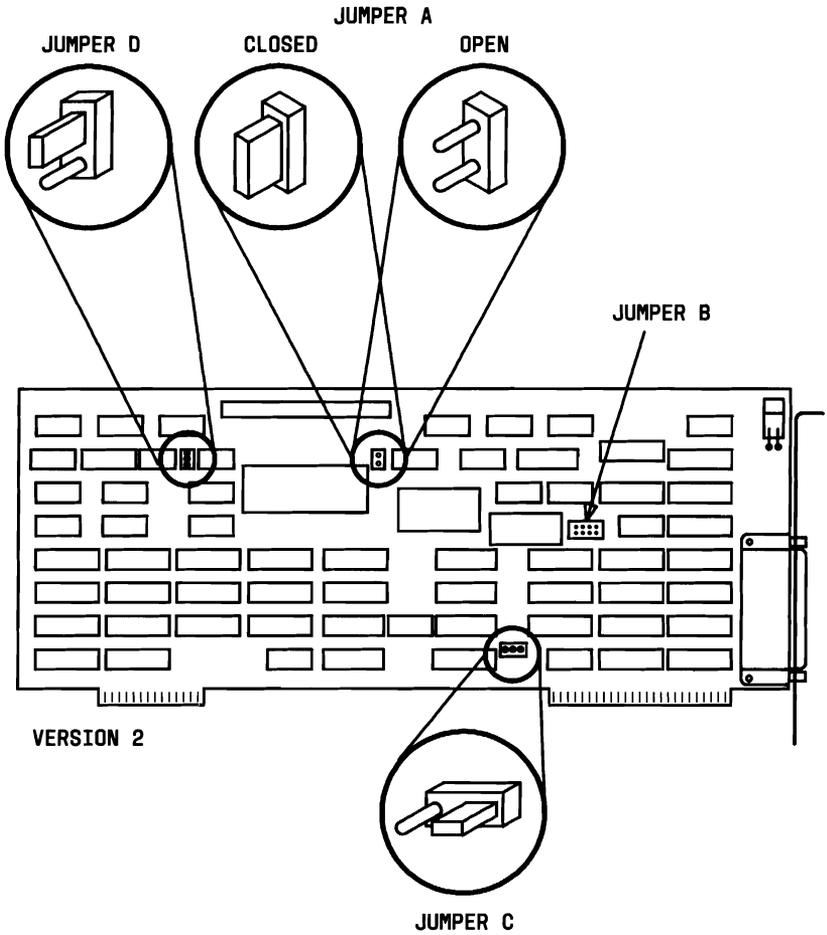
**Figure 3-48. PAL47 Chip**

13. Gently remove the replacement PAL chip stored in the spare socket of the DEB.
14. Align the pins of the replacement PAL chip with the socket (check that the notch or dot on the chip is facing the same direction as the other chips already present on the board) and insert.

15. When connecting more than one monitor, remove the jumper cap from jumper location A (Figure 3-49) on the DEB.



**Figure 3-49. Jumper Locations for Version One of the DEB (Sheet 1 of 2)**

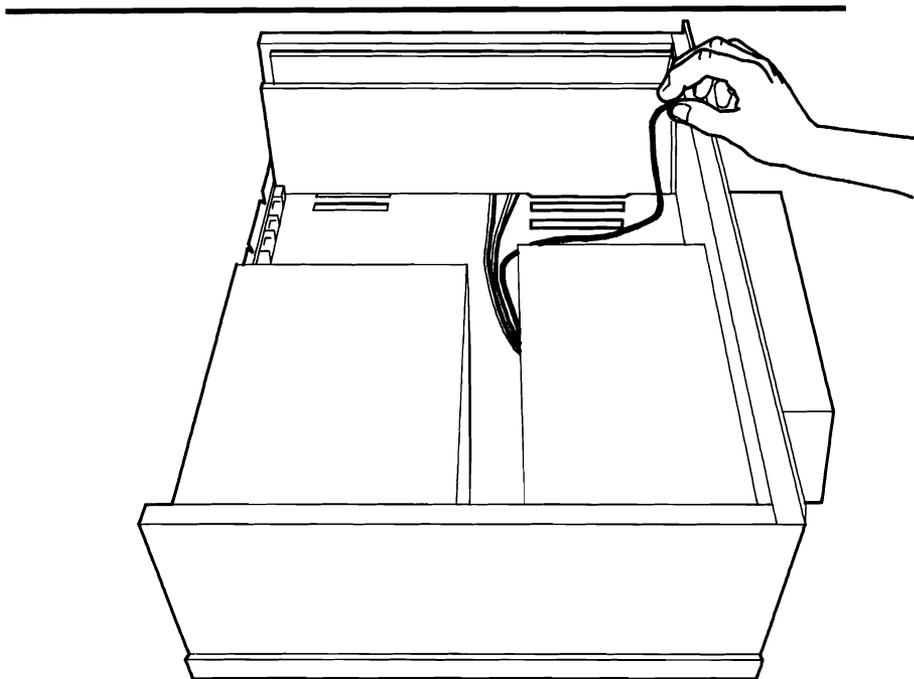


**Figure 3-49. Jumper Locations for Version Two of the DEB (Sheet 2 of 2)**

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### **Installing Monitors**

- a. If a color monitor is to be connected to the DEB, connect the monitor to the connector on the DEB and secure the connection with the two screws on the mounting bracket.
  
- b. If a monochrome monitor is to be connected to the DEB, connect the monitor to the connector on the DEB and secure the connection with the two screws on the mounting bracket. Reconnect the 15-volt connector (disconnected from the VDC) to the connector at the top right of the DEB (Figure 3-50).



**Figure 3-50. Connecting the 15-Volt Connector to the DEB**

If two monitors are to be installed, connect one monitor to the VDC and the other monitor to the DEB. If one is a monochrome monitor, the 15-volt connector must be connected to the same board (VDC or DEB) as the monochrome monitor.

**Note:** The enhanced display features are available only to the monitor connected to the DEB.

16. The four jumper locations on the DEB and their functions are shown for information purposes only in Figure 3-51. Except for jumper location A (Step 15), the remaining jumpers are already at their default setting and do not require resetting.

<b>JUMPER LOCATION</b>	<b>JUMPER SETTING</b>	<b>JUMPER FUNCTION</b>
A	*Closed Open	No monitor connected to VDC Monitor connected to VDC
B	*Open Closed	Indicates displacement of internal addressing For future use
C	*1 to 2 2 to 3	PC 6300 For future use
D	*1 to 2	Provides signal synchronization

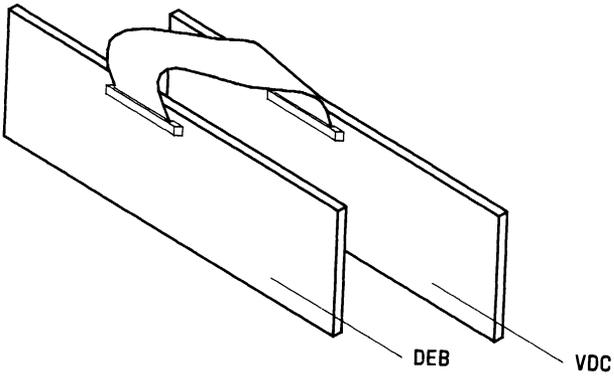
\* Default Settings

**Figure 3-51. DEB Jumper Settings and Functions**

## INSTALLATIONS

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17. Align and insert the 50-pin connector cable to the VDC (Figure 3-52).



**Figure 3-52. Connecting the 50-Pin Cable**

18. Insert the DEB in the open expansion slot. Insure that the board is firmly seated in the connectors.
19. Connect the other end of the 50-pin connector cable to the DEB (Figure 3-52). The cable should contain no twists. Secure the DEB with the screw removed from the slot cover.
20. If a memory board was removed to provide work space, replace it at this time.
21. Replace the system Module cover and tighten the two screws that secure the cover.
22. Reconnect any cables that were disconnected.
23. Plug in the ac power cords for the PC and, if applicable, the color monitor.
24. Turn on the PC; you should see a display of internal boot diagnostic messages. If you don't, turn to the section titled "Trouble Shooting the DEB Installation" and correct the problem before installing the DEB software.

## Installing DEB Software

The four steps required to install the DEB device driver are:

1. Replace the old version of **GW BASIC** with the enhanced version that comes with the DEB.
2. Copy the file **DEDRIVER.DEV** onto the system disk.
3. Edit a special file called **CONFIG.SYS** to tell the system where to find the DEB driver.
4. Reboot the system.

The file **CONFIG.SYS** is processed automatically by the PC each time the system is started. **CONFIG.SYS** defines the specific system to DOS. When a nonstandard device such as the DEB is used, DOS needs to know where to find the driver for that device. Then DOS automatically loads the special device as an extension of itself.

---

## ***Floppy Disk Systems***

The following procedures apply for systems with either one or two floppy disk drives.

1. Copy the system diskette (MS-DOS) using the “diskcopy” command as follows:
  - a. Insert the system diskette MS-DOS (that came with the system) in drive A and boot up.
  - b. Insert a blank diskette in drive B. If the system has only a single drive, MS-DOS treats it as both drive A and drive B.

**Note:** The “diskcopy” command will automatically format the target (blank) diskette.

- c. Type the following:

**diskcopy a: b:**

**Note:** If the system has only one drive, follow the prompts and insert the appropriate diskettes as required.

When the MS-DOS prompt ( A> ) appears, the copy process is complete.

- d. Remove the original system diskette and insert the new system diskette into drive A.
2. Copy the new version of **GW BASIC** and the **DEDRIVER.DEV** file on the new system diskette as follows:
- a. Insert the diskette containing the new version of **GW BASIC** into drive B.

**Note:** If the system has only one drive, follow the prompts and insert the appropriate diskettes as required. The new version of **GW BASIC** will replace the older version.

- 
- b. Type the following:

```
copy b:gwbasic.exe a:
```

When the copy has been made, the message **1 file(s) copied** will appear. Type the following:

```
copy b:dedriver.dev a:
```

When the copy has been made, the message **1 file(s) copied** will appear.

3. To edit the **CONFIG.SYS** file, use **EDLIN** or any other text editor that you prefer as follows:
- a. Type the following line at the end of the **CONFIG.SYS** file:

```
DEVICE=dedriver.dev
```

**Note:** If you don't have a **CONFIG.SYS** file (and you won't if you copied your original MS-DOS system diskette), a new file will be created.

- b. Now reboot the system. (Press the RESET button at the front of the computer or press the **CTRL**, **ALT**, and **DEL** keys simultaneously.)
- c. A display of internal boot diagnostic messages will appear. If these messages do not appear, refer to the section titled "Troubleshooting DEB Installation" before adjusting your monitor.

### ***Hard Disk Systems***

The following instructions are for systems that include a hard disk.

1. To replace the **GW BASIC** on the system disk (hard disk) with the new version of **GW BASIC** that comes with the DEB, proceed as follows:
  - a. Go to the directory where your original **GW BASIC** resides (or specify the appropriate pathnames).
  - b. Insert the diskette containing the new version of **GW BASIC** into drive A.

- 
- c. Type the following:

**copy a:gwbasic.exe c:**

- d. When the copy has been made, the following message will appear:

**1 file(s) copied**

- e. Type the following:

**copy a:dedriver.dev c:**

When the copy has been completed, the following message will appear: **1 file(s) copied.**

2. To edit the **CONFIG.SYS** file, use **EDLIN** or any other text editor that you prefer as follows:
  - a. Type the following line at the end of the **CONFIG.SYS** file:

```
DEVICE=[d:] [path] dedriver.dev
```

where [d:] is the drive. In this case, drive C (which need not be specified) and [path] is the name of the directory where the **DEDRIVER.DEV** file resides. The system will automatically create a **CONFIG.SYS** file if one does not already exist.

- b. Now reboot the system. (Press the **RESET** button at the front of the computer or press the **CTRL**, **ALT**, and **DEL** keys simultaneously.)
  - c. A display of internal boot diagnostic messages will appear. If they do not, turn to the section titled "Troubleshooting the DEB Installation" before adjusting the monitor.

---

## Troubleshooting the DEB Installation

If a problem exists after installing the DEB, check the following:

If no display (blank video screen):

- Make sure the video monitor is plugged in—either to the Display Enhancement Board or to the Video Display Controller.
- Check to see if the 50-pin connector cable is correctly connected at both ends. It is possible to connect the cable so that some of the pins are beyond the end of the connector. (See “Installing the DEB.”)
- Make sure both connectors are firmly seated in their respective slots.
- If a Monochrome Monitor is connected, make sure the 15-volt connector is attached to the correct board. (See “Installing Monitors.”)
- If a Color Monitor is connected, make sure the ac power cord on the monitor is plugged in.

If jagged lines appear on the display:

- Make sure jumper A on the VDC is correctly installed.
- Make sure jumper C is set correctly. The correct setting depends on the type of personal computer (Figure 3-51). For the PC 6300, the jumper should be from 1 to 2.

If garbled display:

- Make sure jumper A on the VDC is correctly installed.

If application software indicates a wrong monitor is connected (monochrome instead of color or vice versa):

- Make sure jumper A on the DEB is set correctly. Run the “Customer” diagnostic, and it will show whether the system is identifying the monitor as color or monochrome. If “Customer” shows a monochrome system when a color monitor is attached, then the monitor may be at fault.

If color bar pattern is not correct:

- Adjust the contrast and/or brightness controls on the monitor. As on a color TV, these controls can seriously affect the color displayed.

---

If monochrome shades are not correct:

- Adjust the contrast and/or brightness controls on the monitor.

If monitor does not display all colors or all monochrome shades:

- Make sure the monitor is plugged into the DEB. The enhanced features are available only through the DEB connector.

If an error message appears when SETUP.BAS is run:

- Reboot the system and try again. If the error persists, the problem is one of the following:
  - a. The wrong version of GWBASIC is being used, reinstall the new version. See “DEB Software Installation.”
  - b. The DEDRIVER.DEV has not been loaded correctly. See “DEB Software Installation.”
  - c. The CONFIG.SYS file has not been edited; or with disk system, the wrong pathname in the CONFIG.SYS file has been specified. See “DEB Software Installation.”

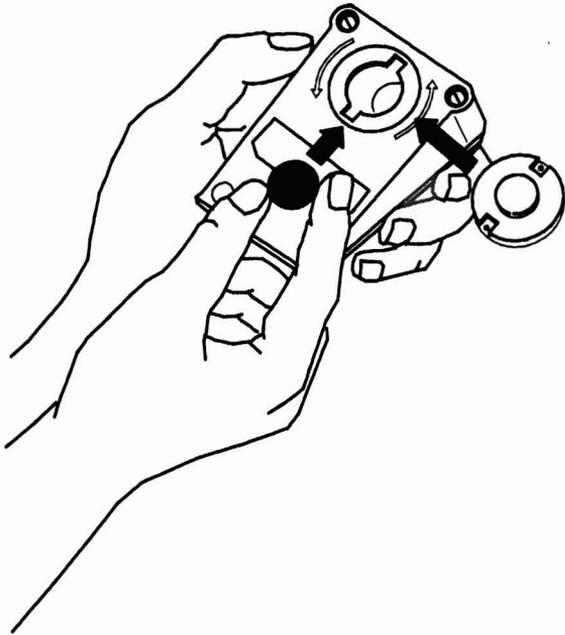
If the problem persists, there is a toll-free hotline to call (1-800-922-0354).

## Installing the Mouse

### *Installing the Ball in the Mouse*

1. Turn the mouse upside down to locate the ball housing cover. Remove the cover by turning it counterclockwise (Figure 3-53).
2. Insert the ball into its housing.
3. Replace the cover and secure it by turning it clockwise.

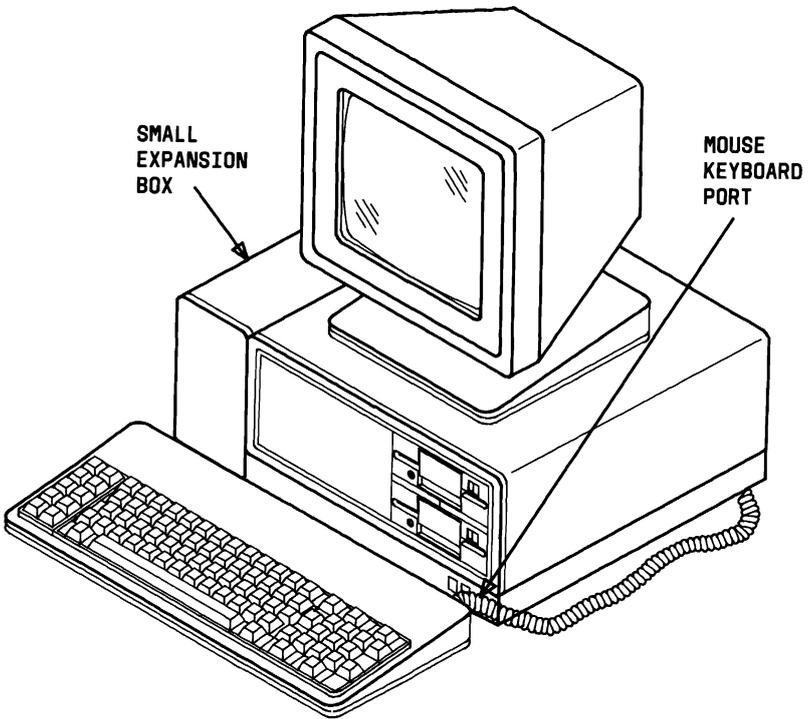
**Note:** The ball is designed to roll easily within its housing.



**Figure 3-53. Mouse Housing**

### ***Connecting the Mouse to the Computer***

1. Turn off the power (if the power is not off already).
2. Locate the Keyboard Mouse Connector (mouse port) on the back edge of the Keyboard (Figure 3-54).
3. Press the plug at the end of the mouse cable into the mouse port.
4. Tighten the screws on the sides of the mouse plug.

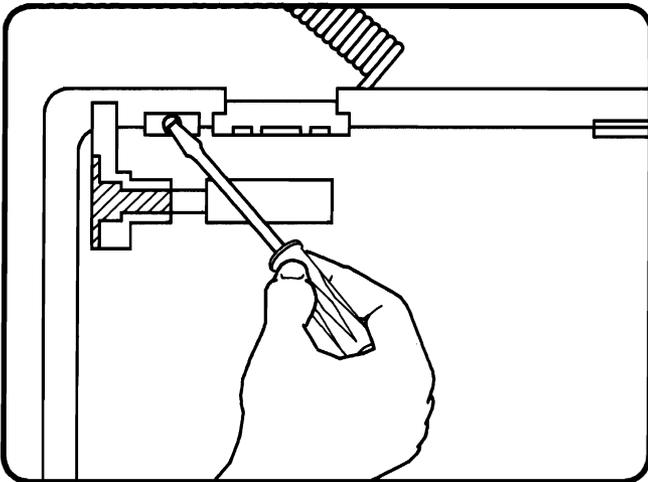


**Figure 3-54. Locating the Mouse Port**

## Installing the Keyboard ROM

### *Opening the Keyboard*

1. Turn off the power.
2. Turn the Keyboard upside down.
3. Release the latch nearest the Keyboard cable with a small screwdriver while spreading apart the top and bottom halves of the Keyboard. Proceed clockwise until all the latches have been released (Figure 3-55).



**Figure 3-55. Unlocking Latches on the Keyboard**

4. Remove the half of the Keyboard housing that is facing up.

---

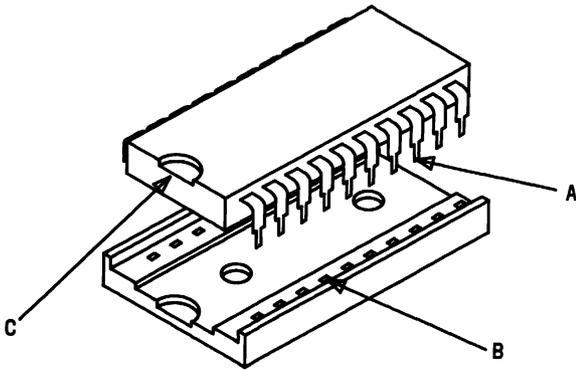
## ***Removing Existing ROM Chip***

**Note:** Remove existing ROM only if ROM present on Keyboard is version 1.0 or below. ROMs 1.1 and above are compatible with mouse.

1. Locate the existing 24-pin ROM chip to be replaced.
2. Carefully remove the chip by prying it up from its socket.

## ***Installing New ROM Chip***

1. Put on the wrist strap and connect to ground or touch the metal chassis before picking up the ROM chip to release the static electricity from your hand.
2. Align the ROM chip pins (A) with a socket (B) (Figure 3-56). Make sure that the notch in the chip (C) is facing the same direction as the other chips on the board. Push chip down firmly to insert.



**Figure 3-56. Inserting ROM Chip into the Socket**

3. Remove wrist strap (if wrist strap was used).
4. Replace Keyboard covers.

---

## Installing the Mouse Software

Before using the mouse for the first time, you must install the mouse software. The procedure you follow depends on whether you are using the Dual Diskette or the Hard Disk PC 6300.

Turn to the section of this documentation that explains how to install the mouse software with the computer you are using.

### *Installing the Mouse Software With the Dual Diskette Computer*

You need to copy your DOS system diskette and the mouse driver diskette onto one new diskette for a bootable mouse/system diskette.

**Note:** If you already have a working copy of the DOS system, place it in drive B and skip down to Step 6.

1. To begin, format the new diskette.
2. Copy the DOS files onto it with Steps 3 and 4.
3. Insert the DOS diskette into drive A and a new diskette into drive B.

4. When you see the (A>), type the command:

```
format b: /s
```

Then press the **RETURN** key.

5. Remove your original DOS diskette from drive A.
6. Insert the Mouse Diskette into drive A.
7. When you see the (A>), type the command:

```
copy a:*. * b:
```

Then press the **RETURN** key.

This gives you a bootable mouse/system diskette that activates the mouse every time you use it.

8. Remove the Mouse Diskette from drive A and store it as you did your DOS diskette. The diskette in drive B is now a bootable mouse/system diskette.

---

## *Installing Mouse Software With the Hard Disk Computer*

You need to copy the Mouse Diskette onto the hard disk of the computer. To do this, follow the procedures below.

1. Put the Mouse Diskette into drive A.
2. When you see the (A>), type the command:

```
copy a:*. * c:
```

3. Or if you see (C>), type the command:

```
copy a:*. * c:
```

Then press the **RETURN** key.

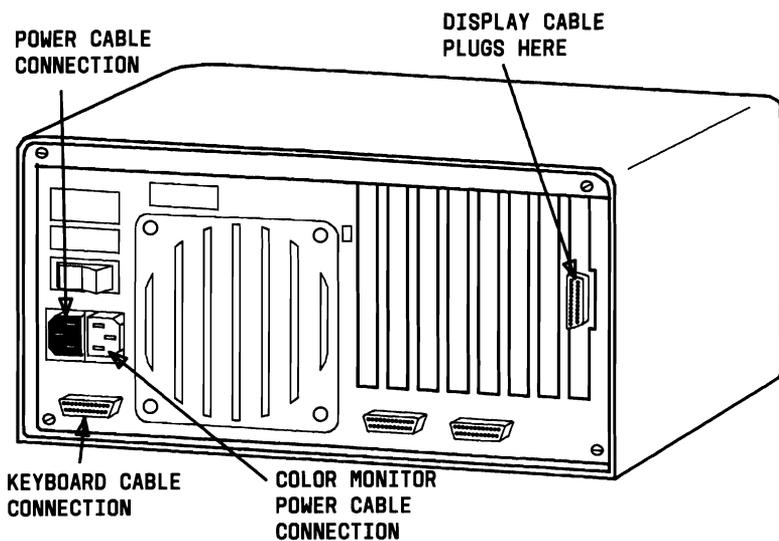
4. Remove the Mouse Diskette from drive A and store it as you did your DOS diskette.

## SYSTEM INSTALLATION

---

The installation of the PC 6300 consists of connecting the Keyboard and Display to the System Module. Before installing the system, make sure that the site chosen meets all the requirements listed at the beginning of this chapter.

1. Carefully set the System Module into place at the chosen site.
2. Set the Display on the System Module or next to it.
3. Secure the Display cable to the Display Connector on the rear panel (Figure 3-57).



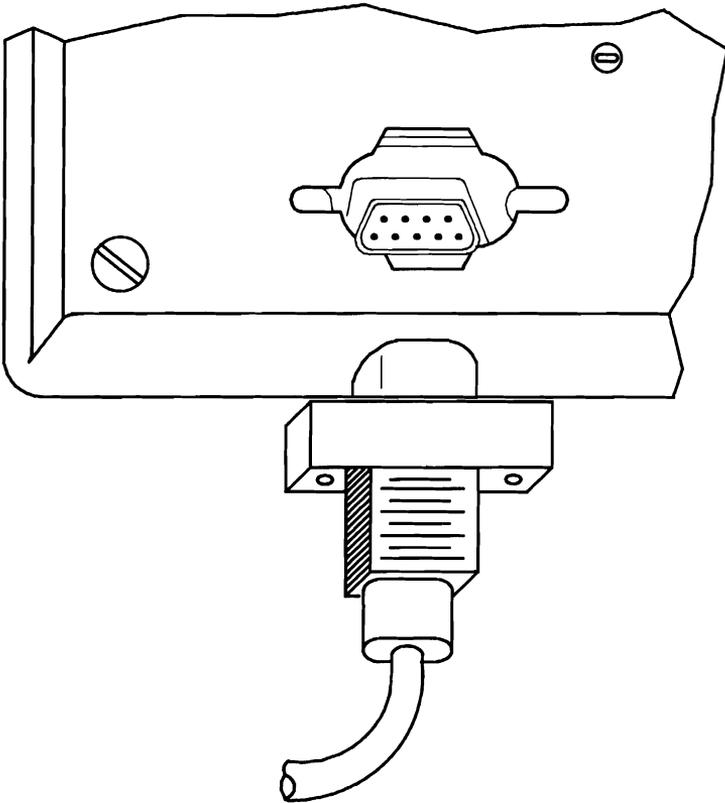
**Figure 3-57. Connecting Display to the Rear Panel**

4. Place the Keyboard next to the System Module.

## INSTALLATIONS

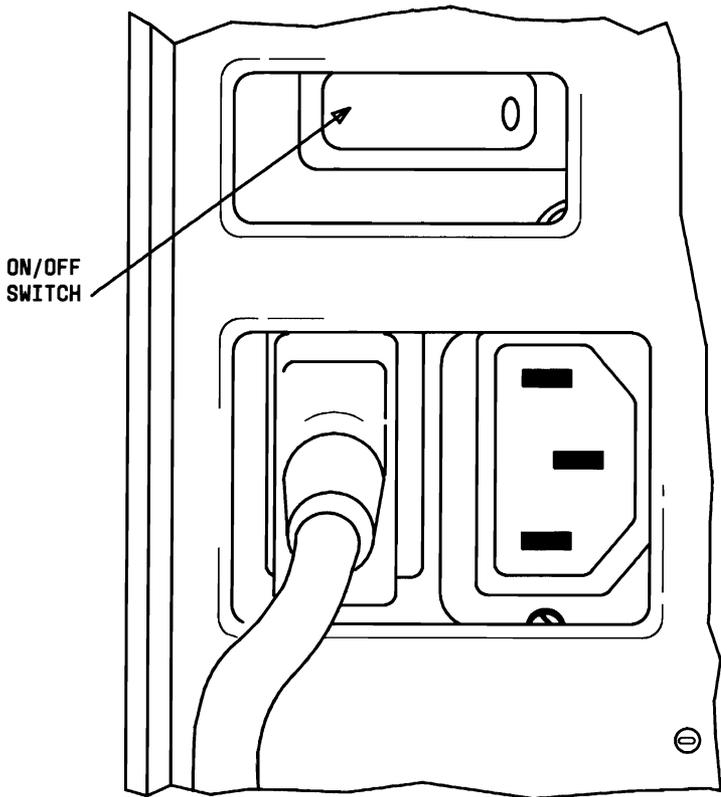
---

5. Secure the Keyboard cable to the Keyboard Connector on the rear panel (Figure 3-58).



**Figure 3-58. Connecting the Keyboard to the Rear Panel**

- 
6. Verify that the ON/OFF switch is in the OFF position.
  7. Insert the female plug of the ac power cable into the power inlet on the back panel of the System Module (Figure 3-59).



**Figure 3-59. Power Inlet on the Rear Panel**

8. Connect the male plug of the ac power cable into the ac wall outlet.

## INSTALLATIONS

---

Before turning the Power Switch ON, refer to Chapter 4 and review the section “Resident Diagnostics.” After a good understanding of the Resident Diagnostics has been obtained, refer to the section “Applying Power to System.” If the Resident Diagnostics pass, run the Customer Test Diagnostics in the Automatic Mode to fully test the operation of the system. If the system does not pass Resident Diagnostics, refer to Chapter 5 for troubleshooting information.

## APPLYING POWER TO THE SYSTEM

---

When power is applied to the PC 6300, the 8086 CPU starts program execution at EPROM address FFFF0. This address contains a jump instruction to the initial program loading routine. After the Power-On Bootstrap routine has completed, the Resident Diagnostics are performed.

After the Resident Diagnostics have successfully completed, the system makes an attempt to load the Operating System. The Operating System can reside on either a Diskette or on a hard disk. If the Operating System resides on a diskette, the diskette must be inserted into MFD Unit A. If the Operating System Diskette is inserted into MFD Unit A, the Operating System is loaded automatically. If no diskette is present in MFD Unit A, the system looks for a bootable Operating System on the HDU. If the Operating System resides on the HDU, then the Operating System Boot is automatic.

The following steps should be followed when powering up the system for operation:

1. Turn the Display's brightness control fully clockwise.
2. Turn the Power Switch ON.

3. Messages similar to the following should be displayed:

```
Resident Diagnostics
Rev X.XX
CPU(i8086)   Pass
ROM Module  Pass
DMA Timer   Pass
DMA Control Pass
Interrupts  Pass
XXX kb RAM  Pass
RT Clock    Pass
Fixed Disk: Not Present
Floppy A:   Ready
```

4. At the end of the Resident Diagnostics, a short beep is heard.
5. At this point, the system checks your disk drives. If a hard disk is present, you receive a **Ready** message. If not, you receive a **Not Present** message.
6. The system now checks floppy disk drive A. If a diskette is in the drive, you receive a **Ready** message. If a diskette is *not* in drive A, you receive a **Not Ready** message.

If the computer finds a diskette in drive A that it cannot boot from, you will receive a **Ready** message and the error message:

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

- 
7. If the following message is displayed:

```
Primary Boot-Strap...
Primary Boot-Strap DISK READ ERROR.
Primary Boot-Strap...
```

check floppy disk drive A to insure that a diskette has been installed and the latch is closed.

8. The Operating System is loaded as discussed in the previous paragraphs, and the following is a sample of a typical display.

```
AT&T Personal Computer 6300
Copyright (c) 1984 by AT&T, all rights reserved

Compatibility Software
Copyright (c) 1984 by Phoenix Software Associates Ltd.

Microsoft MS-DOS Version 2.11
Copyright 1981,82,83 Microsoft Corp.

Command v. 2.11

A>
```

9. At this point, you should have received the MS-DOS prompt (A>) or (C>). You can now verify that the Operating System is loaded by entering the **DIR** command and listing the contents of the diskette or HDU.

---

<b>INTRODUCTION</b> .....	4-5
<b>RESIDENT DIAGNOSTICS</b> .....	4-7
Operating Procedures .....	4-8
Test Descriptions .....	4-10
Error Messages .....	4-15
<b>CUSTOMER TEST</b>	
<b>DIAGNOSTICS</b> .....	4-20
Loading Customer Test .....	4-21
Operating Procedures .....	4-22
Automatic Mode .....	4-23
Manual Mode .....	4-25
Test Descriptions .....	4-32
Motherboard Test .....	4-32
Memory Test .....	4-33
Keyboard Test .....	4-34
Video System Test .....	4-35
Parallel Port Test .....	4-36
Serial Port(s) Test .....	4-37
48 TPI Floppy Disk Test .....	4-37
HDU Drive and Controller Test .....	4-38
Parallel Printer Test .....	4-39
8087 Math Co-Processor .....	4-41
Mouse Test .....	4-41
8530 Test .....	4-42
Video Option Board Test (DEB [Display Enhancement Board]) .....	4-42
2nd HDU Drive and Controller Test .....	4-45
<b>SYSTEM TEST DIAGNOSTICS</b> .....	4-47
Loading System Test .....	4-47
Operating Procedures .....	4-48

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# DIAGNOSTICS

---

Test Descriptions .....	4-58
Motherboard Test .....	4-58
Memory Test .....	4-60
Keyboard Test .....	4-62
Video System Test .....	4-63
Parallel Port Test .....	4-67
Serial Port(s) Test (Using 8250) .....	4-69
48 TPI Floppy Disk Test .....	4-71
MB HDU Drive and Controller Test .....	4-74
8087 Math Co-Processor .....	4-77
Parallel Printer Test .....	4-77
Mouse Test .....	4-79
8530 Test .....	4-80
Video Option Board Test [Display Enhancement Board (DEB)] .....	4-80
2nd HDU Drive and Controller Test .....	4-83

## **SYSTEM TEST DIAGNOSTICS (OVERLAY VERSION) .....**

4-87

Loading System Test (Overlay Version) .....	4-87
---	------

## **STAND-ALONE MOTHERBOARD DMA TEST DIAGNOSTICS .....**

4-89

DMA Test .....	4-89
----------------	------

## **STAND-ALONE LOW-LEVEL FORMAT UTILITY TEST .....**

4-92

General Characteristics .....	4-93
The Bad Track Table .....	4-95
List of Operations .....	4-96
Help .....	4-101
HDU Configuration .....	4-102
Low-Level Format .....	4-105
Display and Edit Bad Track Table .....	4-110
Format Bad Tracks .....	4-119
Verify Surface Test .....	4-121

---

Ship the Unit .....	4-124
Exit Low-Level Format (LLF) Utility .....	4-125

**CUSTOMER AND SYSTEM TEST ERROR  
MESSAGES .....**

100—Motherboard Tests .....	4-127
300—Memory Tests .....	4-129
400—Keyboard Tests .....	4-133
500—Video Tests .....	4-137
600—Parallel Port Tests .....	4-144
700—8250 Serial Port Tests .....	4-145
800—MFD Unit Tests .....	4-147
900—HDU Tests .....	4-149
10XX—Parallel Printer Tests .....	4-152
18XX—8087-2 Numeric Co-Processor Tests .....	4-152
20XX—Mouse Tests .....	4-153
21XX—8530 Serial Port Tests .....	4-154
23XX—Video Option Board (DEB) Tests .....	4-155
24XX—HDU Drive No. 2 Tests .....	4-167

# INTRODUCTION

---

The AT&T Personal Computer 6300 has three different levels of diagnostic testing:

- Motherboard
- Memory
- Keyboard.

The Resident Diagnostics are the lowest level of tests that are performed on the AT&T Personal Computer 6300. The tests are automatically executed when power is applied to the system. The purpose of the Resident Diagnostics is to assure a minimum working level of the main modules in the system.

The next level of diagnostic testing is the Customer Test Diagnostics. The Customer Test Diagnostics are stored on a diagnostic diskette that is provided to the customer. The purpose of these tests is to provide the customer with a set of comprehensive tests to verify the correct operation of each module in the AT&T Personal Computer 6300. These tests should be run:

- On initial installation
- After any maintenance work
- After adding any options.

## DIAGNOSTICS

---

The highest level of diagnostic testing is the System Test Diagnostics. The System Test Diagnostics are also stored on a diagnostic diskette. The purpose of the System Test Diagnostics is to provide service personnel with a flexible means of testing failing/marginal modules and to verify that repaired modules are operating correctly.

**Note:** The Menus driven by the diagnostics will use the term Main Board instead of Motherboard.

Although all versions of the System and Customer Test work with all versions of the ROM BIOS and MS-DOS, the following recommendations are made:

1. When testing a machine with ROM BIOS 1.21 (and earlier), and MS-DOS 2.11 use System and Customer Test versions 2.05 and (earlier).
2. When testing a machine with ROM BIOS 1.43 (and later), use System and Customer Test versions 3.18 (and later).
3. When testing a machine with a WD (Western Digital) HDU Controller, use System and Customer Test versions 3.18 (and later).
4. Use all System (Overlay Versions) Tests with MS-DOS 2.11 on a 128-K machine.

## RESIDENT DIAGNOSTICS

---

The Resident Diagnostics are executed automatically each time the AT&T Personal Computer 6300 is powered up or reset. These programs reside in the Motherboard ROMs and test the basic functionality of the main modules within the AT&T Personal Computer 6300. In order to execute these programs, the 8284 8-MHz clock generator, the LS244 clock driver, the 8288 bus controller, and a minimal subset of the CPUs (8086) instruction set must be working. The two ROMs, as well as the data address and control buses to the ROMs, must be functioning. The Display must also be working for error reporting purposes.

It is recommended that service personnel go through the Resident Diagnostics and then the Customer Test Diagnostics each time the AT&T Personal Computer 6300 is serviced or an option is added to it. The Resident Diagnostics perform short checks on the following modules:

- Motherboard
- Mini-Floppy Disk (MFD) Unit
- Hard Disk Unit (HDU)
- Small Expansion Box HDU.

### Operating Procedures

The Resident Diagnostics are executed as follows:

1. Turn the Display's brightness and contrast knobs fully clockwise.
2. Turn the power switch ON.
3. Keyboard lights (NUM LOCK and CAP LOCK) will blink during the Boot-up Procedure.
4. The Floppy Resident Diagnostic Screen should look similar to this:

```
Resident Diagnostics
Rev X.XX
CPU(i8086)   Pass
ROM Module   Pass
DMA Timer    Pass
DMA Control  Pass
Interrupts   Pass
XXX kb RAM   Pass
RT Clock     Pass
Fixed Disk:  Not Present
Floppy A:    Ready
```

- 
5. The HDU Diagnostic Screen should look similar to this:

```
Resident Diagnostics
Rev X.XX
CPU(i8086) Pass
ROM Module Pass
DMA Timer Pass
DMA Control Pass
Interrupts Pass
XXX kb RAM Pass
RT Clock Pass
Fixed Disk: 1 Disk(s) Ready
Floppy A: Ready
```

6. A short beep is heard at the end of these tests.
7. If the Operating System resides on a diskette and the diskette has not been inserted in the MFD Unit or the MFD Unit cannot read the diskette, the following message is displayed:

```
Primary Boot-Strap...
Primary Boot-Strap DISK READ ERROR.
Primary Boot-Strap...
```

You must insert the MS-DOS System Diskette and close the drive door before the Operating System is loaded by the bootstrap loader.

8. If the system has a HDU that contains a bootable Operating System, the Operating System is booted from the HDU if the system cannot boot from MFD Unit A.

### Test Descriptions

The following sequence is executed when the power switch is turned ON or when the hardware RESET button is pressed.

1. The system reset vector at FFFF0 executes an unconditional direct intersegment jump instruction to the 8086 CPU test.
2. The 8086 CPU test is performed. Interrupts are disabled. First, the CPU's status flags are tested using the accumulator and the processor control and conditional control transfer instruction classes. Second, the CPU's general and segment registers are tested with a test pattern. Third, a typical instruction from each of the CPU's data transfer, arithmetic, logical, and string manipulation instruction classes are tested. Fourth, a set of the CPU's addressing modes are tested on ROM. Fifth, the stack segment and pointer registers are initialized to address the ROM stack, and the call/return instructions are tested. Testing the CPU's software-interrupt instruction capability is postponed until after the ROM and RAM modules have been tested. The CPU's hardware-interrupt diagnostics are postponed until after the 8253 real-time clock channel, the 8041 Keyboard peripheral interface, and the 8259 interrupt controller have been initialized and tested, because all three are involved in the testing.
3. The Keyboard peripheral interface chip (8041 or 8741) is programmed and initialized, the lights go off, and a beep is heard.

- 
4. The Display Controller Board is programmed for monochrome 80 by 25 text mode.
  5. The parallel printer port and the display are used to report the successful completion of each diagnostic test. The check point bytes are not strobed to the parallel port, so that an attached printer will not confuse the check point information with actual printable data.
  6. The parallel printer port and the display are sent confirmation that the CPU test has been successful. If the CPU test fails, an attempt is made to send a "CPU (i8086) Fail" error message to the display, and the CPU is halted.
  7. The ROM test is performed by calculating a checksum. The checksum, defined to be a byte addition of all the bytes in the high and low ROM modules, is summed and compared to zero.
  8. The parallel printer port and the display are sent confirmation that the ROM module test has passed. If the ROM test fails, a "ROM Module Fail" error message is sent to the display, indicating that the system diagnostic/bootstrap ROM is faulty and the CPU is halted.

9. The DMA counter of the 8253 Timer is tested. The DMA controller is disabled while the 8253 Timer is initialized. The timer counter associated with the DMA controller has its registers and counting ability tested in the polled mode. The DMA controller counter is left programmed with a zero (maximal) count to prevent the timer interfering with the 8237 DMA controller test.
10. The parallel printer port and the display are sent confirmation that the DMA counter of the 8253 Timer is functional. If the DMA counter test fails, a "DMA Timer Fail" error message is sent to the display, and the CPU is halted.
11. The 8237 DMA controller is tested. The DMA controller is cleared and its registers, as well as the 4-bit segment latch, are tested with fixed test patterns. The 8253 timer for the DMA controller is programmed with the proper count in order to refresh the dynamic RAM. All three DMA channels are programmed with the proper mode. In order to test the functionality of the DMA controller, the status of the memory refresh channel is checked for a request from the timer, and the lowest bank of RAM is tested.
12. The parallel printer port and the display are sent confirmation that the 8237 DMA Controller and the memory refresh are functional. If the DMA Controller test fails, a "DMA Control Fail" error message is sent to the display, and the CPU is halted.

- 
13. Initialize RAM stack at top of lowest RAM bank.
  14. Initialize dummy interrupt vectors in lowest RAM bank.
  15. Determine the system configuration from the switch settings.
  16. The 8259 Programmable Interrupt Controller and 8086 CPU interrupt test is performed. Software interrupts are generated by executing an INT H0 directly and performing a divide-by-zero operation. Also, the single-step, nonmaskable, and breakpoint interrupts are tested. The 8086 CPU's software interrupt service procedure is thus tested. The 8259 Interrupt Controller is initialized. A test pattern interrupt mask is written to and read back from the 8259. The 8259 is programmed with all interrupts masked off. The 8086 CPU's interrupts are enabled.
  17. The parallel printer port and the display are sent confirmation that the 8259 Interrupt Controller and the software interrupts are functional. If the interrupt test fails, an "Interrupts Fail" error message is sent to the display identifying the software/hardware interrupt failure, and the CPU is halted.
  18. The MM58174 Real-Time Clock test is performed. It is assumed, at first, that the battery-powered Real-Time Clock/Calendar chip is correctly programmed with a valid user-selected time. The Real-Time clock is read, the valid state saved, the chip's time and data registers verified by writing and reading, and then the valid time written back to the chip. Next, the remaining two 8253 counters are programmed and tested as in the 8253 DMA timer test

above. Additionally, the 8259 Interrupt Controller's interrupt mask is enabled to allow a timer interrupt, so that the 8086 CPU and the 8259 Interrupt Controller interrupt service procedure is thus tested.

19. The parallel printer port and the display are sent confirmation that the MM58174 Real-Time Clock/Calendar chip is functional. If the 8253 clock fails to interrupt within the acceptable time interval, an "RT Clock Fail" error message specifying the reason for failure is sent to the display, and the CPU is halted.
20. The interrupt vectors (including the nonmaskable interrupts due to parity errors during the RAM module test) are initialized for normal operation.
21. The RAM test is performed bank-by-bank based on the system configuration. An address and fixed pattern test is done. A nonmaskable interrupt occurring during this test indicates that the memory parity circuitry has detected a parity error.
22. The parallel printer port and the display are sent confirmation that the RAM module is functional. The display reports the successful completion of each bank test, as it is tested. If a failure is detected, a "xxx kb RAM Fail:cc:y000:zzzz:www:rrrr" error message is sent to the display indicating the faulty location, and the CPU is halted.

- 
23. The Fixed Drive and NEC765 Floppy Tests are performed sequentially. The disk drive is initialized, and the disk drive test is performed. Track zero, side zero is read on all ready disk drives in the particular hardware disk drive configuration.
  24. If a failure is detected on a ready drive, a "Floppy(A:) Not Ready," "Floppy(B:) Not Ready," or "Fixed Disk Not Ready" message is sent to the Display. Otherwise, you are informed that the appropriate drive is Ready. This informs you that the software recognizes that the drive is present from the system configuration switches.
  25. Control is transferred to the boot-strap loader that loads an operating system from the ready floppy drive (A:) or from a valid bootable partition on the fixed disk.

### ***Error Messages***

The Display is used to report Pass/Fail messages regarding each test. The Resident Diagnostic error messages are listed in Figure 4-1 along with a brief explanation of the message. For a list of the action(s) to be taken when one of these messages is received, refer to Chapter 5, "MAINTENANCE."

<b>DIAGNOSTIC MESSAGE</b>	<b>MEANING</b>
<b>CPU(i8086) Fail</b>	Faulty CPU
<b>ROM Module Fail</b>	ROM failure
<b>DMA Timer Fail</b>	Timer Channel 1 failure
<b>DMA Control Fail</b>	Faulty DMA Controller
<b>Interrupts Fail</b>	Failure in software interrupts
<b>Interrupt Fail H0</b>	INT REQ0 from Timer Channel 0 not functioning
<b>Interrupt Fail H1</b>	INT REQ1 from Keyboard Controller not functioning
<b>Interrupt Fail H2</b>	INT REQ2 from I/O Board not functioning
<b>Interrupt Fail H3</b>	INT REQ3 from I/O Board not functioning
<b>Interrupt Fail H4</b>	INT REQ4 from Serial Interface not functioning
<b>Interrupt Fail H5</b>	INT REQ5 from I/O Board not functioning (or HDU Controller)
<b>Interrupt Fail H6</b>	INT REQ6 from Floppy Disk Unit Controller not functioning
<b>Interrupt Fail H7</b>	INT REQ7 from Parallel port not functioning

**Figure 4-1. Resident Diagnostic Messages (Sheet 1 of 5)**

DIAGNOSTIC MESSAGE	MEANING
<b>RT Clock Fail</b>	MM58174 registers not functioning
<b>RT Clock Fail:NR</b>	8253 interrupt did not respond
<b>RT Clock Fail:LO</b>	8253 interrupt is out of specification on the low end
<b>RT Clock Fail:HI</b>	8253 interrupt is out of specification on the high end

**Figure 4-1. Resident Diagnostic Messages (Sheet 2 of 5)**

DIAGNOSTIC MESSAGE	MEANING
<b>Floppy (A:) Not Ready</b>	Diskette not present or faulty MFD Unit A
<b>Fixed Disk Not Present</b>	Faulty HDU

**Figure 4-1. Resident Diagnostic Messages (Sheet 3 of 5)**

DIAGNOSTIC MESSAGE	MEANING
<b>nnn kb RAM Fail:cc:y000:zzz:www:rrrr</b>	RAM not Functional

nnn = last RAM bank tested (in decimal)

cc = RAM configuration

01 = 128-KB Total RAM

02 = 256-KB Total RAM

03 = 512-KB Total RAM

04 = 640-KB Total RAM

y = 128-KB bank with failure

1 = Bank 0 on Motherboard

2 = Bank 1 on Motherboard

3 = Bank 0 on Exp. Board

4 = Bank 1 on Exp. Board

5 = Bank 2 on Exp. Board

Bank 0 = 512 KB

Bank 1 = 128 KB

1 = Bank 0 on Motherboard

2 = Bank 0 on Motherboard

3 = Bank 0 on Motherboard

4 = Bank 0 on Motherboard

5 = Bank 1 on Motherboard

000 = segment of failure

zzzz = offset of failure

www = data that was written

rrrr = data that was read

**Figure 4-1. Resident Diagnostic Messages (Sheet 4 of 5)**

---

DIAGNOSTIC MESSAGE	MEANING
<b>nnn kb RAM Fail:cc:y000:zzzz:www:r</b>	RAM not Functional

nnn = last RAM bank tested (in decimal)  
 cc = RAM configuration  
     01 = 128-KB Total RAM  
     02 = 256-KB Total RAM  
     03 = 512-KB Total RAM  
     04 = 640-KB Total RAM  
 y = 128-KB bank with failure  
     1 = Bank 0 on Motherboard  
     2 = Bank 1 on Motherboard  
     3 = Bank 0 on Exp. Board  
     4 = Bank 1 on Exp. Board  
     5 = Bank 2 on Exp. Board  
 Bank 0 = 128 KB  
 Bank 1 = 512 KB  
     1 = Bank 0 on Motherboard  
     2 = Bank 1 on Motherboard  
     3 = Bank 1 on Motherboard  
     4 = Bank 1 on Motherboard  
     5 = Bank 1 on Motherboard  
 000 = segment of failure  
 zzzz = offset of failure  
 www = data that was written  
 rrrr = data that was read

**Figure 4-1. Resident Diagnostic Messages (Sheet 5 of 5)**

## CUSTOMER TEST DIAGNOSTICS

---

The Customer Test is loaded from the diagnostic diskette that is supplied to the customer. The purpose of the Customer Test Diagnostics is to provide you with a set of tests to verify the functionality of the AT&T Personal Computer 6300 modules. Each test can be selected individually as needed. These tests include:

- Motherboard
- Memory
- Keyboard
- Color/Monochrome Video System
- Parallel Interface
- Serial Interface
- MFD
- HDU and Controller
- Parallel Printer
- 8087 Math Co-Processor
- Video Option Board (DEB)
- Second HDU and Controller.

These tests allow customers to gain a degree of confidence in the correct operation of the system and discriminate between hardware and software problems. In many cases, it will be necessary for Service Personnel to perform the System Test Diagnostics in order to confirm the customer's diagnosis. An explanation of error messages are provided at the end of this chapter. For troubleshooting information associated with the error messages, refer to Chapter 5, "MAINTENANCE."

**Note:** It is recommended that you make a copy of your Customer Test Diagnostic Diskette. Save the original as a backup master. Use the copy as the working Customer Test Diagnostic Diskette.

---

## Loading Customer Test

To run the Customer Test Diagnostics Diskette properly, the system must be loaded as follows:

1. Insert the MS-DOS System Diskette into MFD Unit A and close the drive door.
2. Turn the System Module power switch ON.
3. After the Resident Diagnostics have successfully been completed, verify that the Operating System has been loaded.
4. Remove the MS-DOS System Diskette from MFD Unit A.
5. Insert the Customer Test Diskette into MFD Unit A and close the drive door.

**Note:** When doing printer testing, make sure the printer has paper loaded and the printer "READY" indicator is on.

6. Load the Customer Test Diagnostics by entering:

```
A>customer<CR>
```

7. When the diagnostics have been loaded, your screen should look like this:

```
*** CUSTOMER TEST PROGRAM ***
VERSION X.XX

==> TO EXIT CUSTOMER TEST PROGRAM DURING TEST, PRESS
      'ctrl break' KEYS TO EXIT TEST PROGRAM

DO YOU WISH TO RUN THE TESTS IN AUTOMATIC MODE?
(y = YES, n = NO)
-
```

## Operating Procedures

You have the option of running the Customer Test in either the Automatic Mode or the Manual Mode. In the Automatic Mode, you are required only to insert scratch diskette(s). In the Manual Mode, you are required to interface with the system throughout the test by selecting options from various menus. In either mode, the "ctrl break" keys are used if you want to exit the TEST PROGRAM.

---

## *Automatic Mode*

Pressing **y** followed by the **ENTER** key places the test in the Automatic Mode. A list of the systems hardware is displayed and you are asked if the list is correct:

```
THE INSTALLED HARDWARE IS:
```

- 1 - MAIN BOARD
- 3 - XXX KB MEMORY (XXX = Total system RAM)
- 4 - 83 KEY KEYBOARD
- 5 - XXXX VIDEO SYSTEM (XXXX = COLOR or MONOCHROME)
- 6 - 1 PARALLEL PORT(S)
- 7 - 1 SERIAL PORT(S) (USING 8250)
- 8 - X 48 TPI FLOPPY DISK DRIVE(S) (X=1 or 2)
- 9 - X HDU DRIVE AND CONTROLLER (X=10 or 20 MB)

```
IS THE LIST OF HARDWARE CORRECT? (y = YES, n = NO)
```

```
- _
```

After pressing **y** followed by the **ENTER** key (correct list), the following message is displayed.

```
--> ATTENTION: SCRATCH DISKETTES MUST BE RE-FORMATTED BEFORE  
USE BY YOUR OPERATING SYSTEM, USING YOUR OPERATING SYSTEM  
FORMAT COMMAND.
```

```
PRESS 'ENTER' KEY TO CONTINUE - _
```

The previous message is to remind the user that scratch diskettes formatted by the System or Customer Test using the Manual Mode option 1 of MENU A are not actually MS-DOS formatted and are to be used only for the execution of floppy disk tests.

**Note:** The MS-DOS formatted diskettes can be used for testing. After testing, all test scratch diskettes must be reformatted under MS-DOS to operate.

Insert a formatted diskette in the MFD Unit(s). After you have inserted the formatted diskette(s) and pressed the **ENTER** key, the tests start running in the automatic mode.

If you discover that the system hardware does not match the hardware list, press the **n** key followed by the **ENTER** key. The following message will be displayed:

```
ERROR - HARDWARE DOES NOT AGREE WITH CONFIGURATION TESTS
=> Record any difference(s) between the list of the Hardware
on the screen and the hardware that should be listed.
PROGRAM TERMINATED!!!
```

```
A>_
```

If the customer test does not list the correct hardware configuration, proceed as follows:

1. Check DIP switches on Motherboard (see Appendix A).
2. Use system test to add a module to the configuration and then test the module.
3. Call "Hot-Line" at 1-800-922-0354.

---

## *Manual Mode*

If you pressed the **n** key followed by the **ENTER** key, the Customer Test is placed into the Manual Mode and MENU A is displayed.

### *MENU A*

The purpose of MENU A is to provide you access to the various Testing Options.

```
TESTING OPTIONS
0 - EXECUTE TESTS ONCE
1 - FORMAT SCRATCH DISKETTE
2 - EXIT DIAGNOSTICS PROGRAM
ENTER DESIRED ACTION - _
```

Pressing the **0** key followed by the **ENTER** key takes you to MENU B where the list of installed hardware is displayed. You must verify that the list of installed hardware is correct. If you indicate that the list is correct, you are taken to MENU C where either all tests or specific tests are run once.

Pressing the **1** key followed by the **ENTER** key takes you to MENU D which is the format scratch diskette menu.

## DIAGNOSTICS

---

Pressing the **2** key followed by the **ENTER** key takes you back to the Operating System and the MS-DOS prompt is displayed. To reenter the diagnostic routines, you have to input **customer** followed by the **ENTER** key.

### *MENU B*

The purpose of MENU B is to verify that the system has the correct system configuration prior to performing any tests. A menu similar to the one shown below is displayed after you have pressed the key, **0** followed by the **ENTER** key at the end of MENU A:

```
THE INSTALLED HARDWARE IS:
 1 - MAIN BOARD
 3 - XXX KB MEMORY (XXX = Total System RAM)
 4 - 83 KEY KEYBOARD
 5 - XXXX VIDEO SYSTEM (XXXX = COLOR or MONOCHROME)
 6 - 1 PARALLEL PORT(S)
 7 - 1 SERIAL PORT(S)
 8 - X 48 TPI FLOPPY DISK DRIVE(S) (X=1 or 2)
 9 - X HDU DRIVE AND CONTROLLER (X=10 or 20 MB)

IS THE LIST OF HARDWARE CORRECT? (y = YES, n = NO)
- -
```

If you press the **y** key followed by the **ENTER** key, MENU C is displayed. In MENU C, you must indicate if *all* hardware is to be tested or if specific hardware is to be tested.

---

If you press the **0** key followed by the **ENTER** key, the following is displayed:

```
INSERT DISKETTE DRIVE  A:  
PRESS 'ENTER' KEY TO CONTINUE - _
```

After you press the **ENTER** key, the following will appear:

```
FORMATTING.... FORMAT COMPLETE  
PRESS 'ENTER' KEY TO CONTINUE - _
```

If you press the **1** key followed by the **ENTER** key, the following is displayed:

```
INSERT DISKETTE DRIVE  B:  
PRESS 'ENTER' KEY TO CONTINUE - _
```

After you press the **ENTER** key, the following will appear:

```
FORMATTING.... FORMAT COMPLETE  
PRESS 'ENTER' KEY TO CONTINUE - _
```

## DIAGNOSTICS

---

If you press the **n** key followed by the **ENTER** key, the following will be displayed:

```
ERROR - HARDWARE DOES NOT AGREE WITH CONFIGURATION TESTS
-> Record any difference(s) between the list of the Hardware
on the screen and the hardware that should be present.
PROGRAM TERMINATED!!!
```

```
A>_
```

If the above error message is displayed, the System Test Diagnostics can be used to add hardware to the list.

### *MENU C*

The purpose of MENU C is to give you the option of testing all of the installed hardware or specific modules.

MENU C looks like this:

```
1 - MAIN BOARD
3 - XXX KB MEMORY (XXX = Total System RAM)
4 - 83 KEY KEYBOARD
5 - XXXX VIDED SYSTEM (XXXX = COLOR or MONOCHROME)
6 - 1 PARALLEL PORT(S)
7 - 1 SERIAL PORT(S) (USING 8250)
8 - X 48 TPI FLOPPY DISK DRIVE(S) (X=1 or 2)
9 - X HDU DRIVE AND CONTROLLER (X=10 or 20 MB)
To test all listed hardware, press the ENTER key only.
To test individual hardware functions, enter the desired test
number(s), with spaces between the numbers, and then press
the ENTER key.
```

```
-
```

---

You can select the hardware to be tested by entering the corresponding numbers, separated by spaces. To select all the hardware, press just the **ENTER** key.

The following message is displayed prior to performing the tests:

```
PAUSE ON ERROR?   (y = YES, n = NO)
- -
```

It is recommended that you press the **y** key so that the test will not continue if an error occurs.

### *MENU D*

After pressing the **1** key followed by the **ENTER** key at the end of MENU A, the following will be displayed:

```
==> ATTENTION: SCRATCH DISKETTES MUST BE RE-FORMATTED BEFORE
      USE BY YOUR OPERATING SYSTEM, USING YOUR OPERATING SYSTEM
      FORMAT COMMAND.
PRESS 'ENTER' KEY TO CONTINUE - _
```

The previous message is to remind the user that scratch diskettes formatted by the System or Customer Test using the Manual Mode option 1 of MENU A are not actually MS-DOS formatted, and are to be used only for the execution of floppy disk tests.

## DIAGNOSTICS

---

**Note:** The MS-DOS formatted diskettes can be used for testing. After testing, all test scratch diskettes must be reformatted under MS-DOS to operate.

When the **ENTER** key is pressed to continue, the following is displayed:

```
SELECT DISKETTE DRIVE:  
  0 - drive 'A'  
  1 - drive 'B'  
ENTER DESIRED ACTION - _
```

If you press the **0** key followed by the **ENTER** key, the following is displayed:

```
INSERT DISKETTE DRIVE  A:  
PRESS 'ENTER' KEY TO CONTINUE - _
```

After you press the **ENTER** key, the following will appear:

```
FORMATTING.... FORMAT COMPLETE  
PRESS 'ENTER' KEY TO CONTINUE - _
```

---

If you press the **1** key followed by the **ENTER** key, the following is displayed:

```
INSERT DISKETTE DRIVE  B:  
PRESS 'ENTER' KEY TO CONTINUE - _
```

After you press the **ENTER** key, the following will appear:

```
FORMATTING.... FORMAT COMPLETE  
PRESS 'ENTER' KEY TO CONTINUE - _
```

## **Test Descriptions**

The following paragraphs briefly describe the tests performed during Customer Test Diagnostics.

### ***Motherboard Test***

The Motherboard test checks the following:

- CPU
- Large Scale Integration (LSI) Chips
- ROM
- Speaker Test.

In the CPU test, all of the addressing modes and instruction classes performed in the Power-Up Diagnostics are tested again in a more complete manner. A test of the CPU registers is also performed. This test checks each register for storage ability and pattern sensitivity. This is accomplished by testing with many different fixed patterns, using shifts and rotates, loads and exchanges.

---

The LSI test checks the functionality of the following integrated circuits:

- 8250 Communication Chip
- 8253 Timer
- 8237 DMA Controller
- 8259 Interrupt Controller
- 58174 Real-Time Clock
- 8041 Keyboard Controller
- 765 Floppy Disk Controller.

The ROM Test is performed by calculating a checksum. The checksum, defined to be a byte addition of all the bytes in the high and low ROM modules, is summed and compared to zero.

The speaker test puts out tones of 50, 100, 200, 400, 800, 1600, 3200, and 6400 hertz.

## ***Memory Test***

The Memory test performs the following tests consecutively:

- Addressing Test
- Fixed Pattern Test.

**Addressing Test:** This test writes into each memory location its address. The memory is then checked to verify the addresses. This test is then repeated, writing the complement of the address into each memory location.

**Fixed Pattern Test:** This test checks one memory block at a time (16 KB) by writing to each memory location the current test pattern and immediately verifying the pattern. The test cycles through all of the memory 24 times, using a different pattern each time. The 24 patterns in hexadecimal format are: AAAA, FFFF, 0000, 5555, 0101, 0202, 0404, 0808, 1010, 2020, 4040, 8080, FEFE, FDFD, FBFB, F7F7, EFEF, DFDF, BFBF, 7F7F, FF00, 00FF, AA55, 55AA.

### *Keyboard Test*

The Keyboard internal hardware is first tested, and then a graphic representation of the Keyboard layout is displayed. This layout is used to manually test the individual keys. The LEDs on the keyboard should blink while the keyboard hardware is being tested. During this phase, the test is capable of detecting and locating stuck keys. A stuck key is located by means of the scan code displayed in the error messages (see error messages for Keyboard test 400). The next phase of the test consists of manually testing each key on the keyboard. The proper operation is indicated on the displayed keyboard layout. If any key does not function properly, you are asked to press **ctrl** and **0** (numeric key pad **0**) and the error message is then displayed. If the test was successful, you are asked to press **ctrl** and **1** (numeric key pad **1**) to proceed with other tests.

---

## ***Video System Test***

The Video System Test performs the following tests:

- Hardware Test
- Monitor Test Patterns
- Character Set
- Color Bars / Grey Scale
- 80 by 25 Alphanumerics, Character Attributes
- 80 by 25 Alphanumerics, Paging
- 40 by 25 Alphanumerics, Paging
- 640 by 400 Graphics, 2 Colors
- 640 by 200 Graphics, 2 Colors
- 320 by 200 Graphics, 4 Colors.

**Hardware:** Tests the hardware of the Display Unit and Display Controller.

**Monitor Test Patterns:** Displays the test patterns on the screen so that proper alignment of the screen can be checked. The test patterns include an alignment grid and a screen display full of "H's".

**Character Set:** Checks the Display Controllers ROM by writing all available characters to the screen.

**Color Bars / Gray Scale:** Checks the different colors or shades of grey or green phosphorous Displays, as the case may be. The various colors are: Black, Blue, Red, Magenta, Green, Cyan, Brown, White, Dark Grey, Light Blue, Light Red, Light Magenta, Light Green, Light Cyan, Yellow, and Intense White.

**80 by 25 Alphanumerics, Character Attributes:** Checks the Display Controllers logic for normal intensity, reverse, underline, blinking, reverse-blinking, underline-blinking, high-intensity, underline high-intensity, and blinking high-intensity modes.

**80 by 25 Alphanumerics, Paging:** Exercises the addressing circuitry from the display controller chip to display controller memory using the 80 by 25 mode.

**40 by 25 Alphanumerics, Paging:** Exercises the addressing circuitry from the display controller chip to display controller memory using the 40 by 25 mode.

**640 by 400 Graphics, 2 Color:** Exercises the 640 by 400 graphics mode using two colors.

**640 by 200 Graphics, 2 Color:** Exercises the 640 by 200 graphics mode using two colors.

**320 by 200 Graphics, 4 Color:** Exercises the 320 by 200 graphics mode using four colors.

### ***Parallel Port Test***

This test checks the path to the Parallel interface.

---

## ***Serial Port(s) Test***

The Serial Port(s) test checks the Serial interface.

## ***48 TPI Floppy Disk Test***

The user is asked to insert a formatted MS-DOS scratch diskette in the drive(s). The diskette(s) must be formatted in an MS-DOS environment using the format utility (**format a:** or **format b:**). The following tests are then carried out:

- Sequential Write
- Sequential Read and Data Check.

**Sequential Write:** This test writes a test pattern to the diskette starting with the outermost track and continuing to the innermost track.

**Sequential Read and Data Check:** This test reads the diskette starting with the outermost track and continuing to the innermost track.

## ***HDU Drive and Controller Test***

The HDU Drive and Controller test checks the following:

- Drive Ready Test
- Testing HDU Controller
- Testing HDU Drive
- Seek Test on HDU
- Verifying HDU Surface
- Write to HDU Test Cylinder
- Read and Check Data on HDU Test Cylinder.

**Drive Ready Test:** The drive ready test assures that the hard disk drive is ready. If the drive is not ready in 15 to 17 seconds, an error message is displayed.

**Testing HDU Controller:** This test checks the HDU Controller board. This test writes, reads, and verifies all possible data to the ports that allow both writes and reads.

**Testing HDU Drive:** This test checks the hardware of the HDU itself.

**Seek Test:** The first seek is to the last cylinder, the second seek is to the first cylinder, the third seek is to the last cylinder - 1, the fourth seek is to the first cylinder + 1, and so on.

---

**Verifying HDU Surface:** This test verifies each track of the HDU and searches for bad tracks.

**Write to HDU Test Cylinder:** This test writes information to the HDU test cylinder.

**Read and Check Data on HDU Test Cylinder:** This test reads information off the test cylinder. The test then checks to see if the information read to the HDU was the same information that was written in the previous test.

### ***Parallel Printer Test***

This option tests the printer connected to the parallel port of the system. The tests initializes the printer which prints out a complete character set. You must compare the printout to the following display.



---

## ***8087 Math Co-Processor***

If the system configuration switches indicate that the 8087 Numeric Data Processor is present, then the 8087 test is performed. The 8087 test involves doing initializations to the 8087 and making sure they all pass.

## ***Mouse Test***

If you choose the Mouse Test, the following menu is displayed:

```
MOUSE TESTS:  
  
  0 - RETURN TO MAIN MENU  
  1 - GRAPHIC MODE  
  2 - TEXT MODE  
  
 10 - RUN ALL OF THE ABOVE TESTS  
  
ENTER SELECTION(S):_
```

You may run a specific test by pressing the appropriate key followed by the **ENTER** key. Or, you may run all the tests by typing **10**, followed by the **ENTER** key.

**0 - RETURN TO MAIN MENU:** Returns to the Main Menu (Menu A).

**1 - GRAPHIC MODE:** The graphic mode test asks you to position the cursor in certain boxes located on the screen. This checks to see if the Mouse is working correctly.

**2 - TEXT MODE:** The text mode test asks you to position the cursor over four different numbers that are located on the screen, and then press the appropriate button.

### ***8530 Test***

This test checks channels A and B of the Z8530 serial interface. The same serial loopback used for the 8250 may be used for complete testing of this port.

### ***Video Option Board Test (DEB [Display Enhancement Board])***

The Video Option Board can be tested with the System Test by using option "23" from the "MENU C." This option appears in "MENU C" only when the Video Option Board is present.

**Note:** Option 23 will NOT be displayed if the Video Option Board is not present or is improperly installed.

---

After giving the choice for the “PAUSE ON ERROR?” question, the System Test displays the following menu listing all tests available for the Video Option Board:

```
0 - RETURN TO MAIN MENU
1 - MEMORY TEST
2 - TRANSPARENT MODE
3 - TEXT WITH 400 LINE GRAPHICS
4 - TEXT WITH 200 LINE GRAPHICS
5 - 400 LINE GRAPHICS, 4 BIT PLANES, FULL LUT
6 - REDUCED LUT TEST (LITTLEBIT)

10 - RUN ALL OF THE ABOVE TESTS
```

Specific tests can be run by entering the option number followed by the **ENTER** key, or all tests may be run by entering the value “10” followed by the **ENTER** key.

**Note:** Tests 3 and 4 must be run with the contrast control set to approximately midrange. This is necessary in order to distinguish between lines that are blinking from low light to high light.

A detailed description with specific screens can be found in the “MAINTENANCE” Section (Chapter 5). The following is a brief description of the test performed by each of the MENU options.

**1 - MEMORY TEST:** No error should occur during this test. If any error does occur, reject the DEB.

*Note:* The “Diagnostic Utility” will write data to the default drive. MFD default drives must have a formatted (write unprotected) diskette installed.

**2 - OPTION BOARD TRANSPARENT MODE:** This test displays a framed full screen with three lines. If any additional random character and/or blocks are displayed, reject the board.

**3 - TEXT WITH 400-LINE GRAPHICS:** This test produces a screen with 8 lines, each exercising a different video feature. The monitor contrast control must be set to midrange. Each line describes its appearance. If the description and the actual appearance do not agree, reject the board.

**4 - TEXT WITH 200-LINE GRAPHICS:** This test is similar to the 400-line graphics test and displays the same self-explanatory messages. The monitor contrast control must be set to midrange.

**5 - 400-LINE GRAPHICS, 4-BIT PLANES, FULL LUT:** This test verifies the proper performance of several screen capabilities. Several lines containing self-explanatory messages are displayed on the screen, each testing a different feature.

**6 - REDUCED LUT TEST (LITTLEBIT):** Three self-explanatory messages are displayed for this test.

Approval of the question asked on the screen redisplayes the main screen options. Selection “0” then summarizes the results on the screen in a set of messages.

---

## ***2nd HDU Drive and Controller Test***

The HDU Drive and Controller test checks the following:

- Drive Ready Test
- Test HDU Controller
- Test HDU Drive
- Seek Test on HDU
- Verify HDU Surface
- Write to HDU Test Cylinder
- Read and Check Data on HDU Test Cylinder.

**Drive Ready Test:** The drive ready test assures that the hard disk drive is ready. If the drive is not ready in 15 to 17 seconds, an error message is displayed.

**HDU Controller Test:** This test checks the HDU Controller board. This test writes, reads, and verifies all possible data to the ports that allow both writes and reads.

**HDU Drive Test:** This test checks the hardware of the HDU itself.

**Seek Test:** The first seek is to the last cylinder, the second seek is to the first cylinder, the third seek is to the last cylinder - 1, the fourth seek is to the first cylinder + 1, and so on.

**Verifying HDU Surface:** This test verifies each track of the HDU and searches for bad tracks.

**Write to HDU Test Cylinder:** This test writes information to the HDU test cylinder.

**Read and Check Data on HDU Test Cylinder:** This test reads information off the test cylinder. The test then checks to see if the information read to the HDU was the same information that was written in the previous test.

# SYSTEM TEST DIAGNOSTICS

---

The System Test Diagnostics are loaded from a diagnostic diskette. These tests are designed to enable Service Personnel to identify failing/marginal modules and verify the modules correct operation after repairs have been made. Service personnel can select specific tests to run, depending on the nature of the errors that are reported. A list of the error messages that may be received is located at the end of this chapter. For troubleshooting information associated with the error messages, refer to Chapter 5, "MAINTENANCE."

**Note:** It is recommended that you make a copy of your System Test Diagnostic Diskette. Save the original as a backup master. Use the copy as the working System Test Diagnostic Diskette. Make sure the copy is **not write protected**.

## Loading System Test

The System Test Diagnostics is loaded as follows:

1. Insert the MS-DOS System Diskette into MFD Unit A and close the drive door.
2. Turn the System Module power switch ON.
3. After the Resident Diagnostics have successfully been completed, verify that the Operating System has been loaded.
4. Remove the MS-DOS System Diskette from MFD Unit A.

## DIAGNOSTICS

---

5. Insert the System Test Diskette into MFD Unit A and close the drive door.
6. Load the System Test Diagnostics by entering:

```
A>system<CR>
```

7. When the diagnostics have been loaded, MENU A will appear on the screen.

## Operating Procedures

### *MENU A*

When the System Diagnostics are loaded, MENU A appears and your screen should look like this:

```
*** SYSTEM TEST PROGRAM ***  
VERSION X.XX  
TESTING OPTIONS  
  
0 - EXECUTE TESTS ONCE  
1 - EXECUTE TESTS MULTIPLE TIMES  
2 - ERROR LOGGING UTILITIES  
3 - FORMAT SCRATCH DISKETTE  
4 - EXIT DIAGNOSTICS PROGRAM  
ENTER DESIRED ACTION - _
```

Pressing the **0** key, followed by the **ENTER** key, takes you to MENU B where the list of installed hardware is displayed. You must verify that the list of installed hardware is correct.

Pressing the **1** key, followed by the **ENTER** key, takes you to MENU B where the list of installed hardware is displayed. Then you must verify that the list of installed hardware is correct.

Pressing the **2** key, followed by the **ENTER** key, takes you to MENU E where the Error Logging Utilities are displayed.

Pressing the **3** key, followed by the **ENTER** key, takes you to MENU F where you will be able to format a diskette without exiting the diagnostics.

Pressing the **4** key, followed by the **ENTER** key, takes you back to the Operating System.

*MENU B*

After indicating if the tests were to be run one or more times, MENU B appears and your screen should look similar to the following typical example. The actual screen display is determined by the machine configuration.

```
1 - MAIN BOARD
3 - XXX KB MEMORY (XXX = total system RAM)
4 - 83 KEY KEYBOARD
5 - XXXX VIDEO SYSTEM (XXXX = COLOR or MONOCHROME)
6 - PARALLEL PORT(S)
7 - SERIAL PORT(S) (USING 8250)
8 - X 48TPI FLOPPY DISK DRIVE(S) (X=1 or 2)
9 - X MB HDU DRIVE AND CONTROLLER (X=10 or 20 MB)

IS THE LIST OF HARDWARE CORRECT? ('y' = YES, 'n' = NO)
- -
```

If you press the **y** key, followed by the **ENTER** key, you are taken to MENU D. In MENU D, you must indicate if **all** hardware is to be tested or if specific modules are to be tested.

If you press the **n** key, followed by the **ENTER** key, the following message is displayed:

```
ERROR - HARDWARE DOES NOT AGREE WITH CONFIGURATION TESTS
DO YOU WANT TO ADD ANY HARDWARE TO THE LIST ? ('y' = YES, 'n' = NO)
```

If you press the **n** key, followed by the **ENTER** key, MENU D is displayed. If the **y** key is pressed, followed by the **ENTER** key, you are taken to MENU C.

---

---

### *MENU C*

The purpose of MENU C is to provide Service Personnel with the ability to add hardware to the list shown in MENU B. MENU C looks like this:

HARDWARE OPTIONS THAT CAN BE ADDED TO LIST:

- 9 - 10 MB HDU DRIVE AND CONTROLLER
- 10 - PARALLEL PRINTER (LPT1:)
- 18 - 8087 MATH COPROCESSOR
- 21 - 1 SERIAL PORT (USING 8530)
- 23 - VIDEO OPTION BOARD
- 24 - XX HARD DISK AND CONTROLLER

To add all of the listed hardware, press the ENTER key only.

To add individual hardware function(s), enter the desired number(s), with spaces between the numbers, and then press the ENTER key.

-

You can, thus, add items from the Hardware Options List. After having done this, MENU B (plus added hardware) is again displayed, and you are asked if the list of hardware is correct.

### *MENU D*

The purpose of MENU D is to allow you the option of testing all of the installed hardware or specific modules. If you choose to test the hardware multiple times, MENU D prompts you to indicate the number of times (loops) the hardware is to be tested. This is helpful if the customer is experiencing intermittent faults.

After you indicate if the tests are to be performed once or multiple times, MENU D is displayed:

```
1 - MAIN BOARD
3 - XXX KB MEMORY (XXX = total system RAM)
4 - 83 KEY KEYBOARD
5 - XXXX VIDEO SYSTEM (XXXX = COLOR or MONOCHROME)
6 - 1 PARALLEL PORT(S)
7 - 1 SERIAL PORT(S) (USING 8250)
8 - X 48TPI FLOPPY DISK DRIVE(S) (X=1 or 2)
9 - X MB HDU DRIVE AND CONTROLLER (X=10 or 20 MB)
To test all listed hardware, press the ENTER key only.
To test individual hardware functions, enter the desired test
number(s), with spaces between the numbers, and then press
the ENTER key.
```

-

The hardware to be tested is selected by entering the corresponding numbers, separated by spaces. To select all the hardware, press just the **ENTER** key.

---

If you pressed the **1** key (EXECUTE TESTS MULTIPLE TIMES) at the end of MENU A, the following is displayed after MENU D is displayed:

```
ENTER THE NUMBER OF TEST LOOPS TO RUN -  
(PRESS JUST THE 'ENTER' KEY FOR INFINITE LOOPS)  
-
```

Regardless of which option you selected at the end of MENU A, the following message is displayed prior to performing the tests:

```
PAUSE ON ERROR?   ('y' = YES, 'n' = NO)  
- -
```

It is recommended that you press the **y** key so that the test will not continue if an error occurs.

Depending on the test(s) selected, additional menus may be displayed. These menus are discussed in the section *Test Descriptions*.

## DIAGNOSTICS

---

### *MENU E*

The purpose of MENU E, Error Logging Utilities, is to provide you with a means of recording diagnostic errors. MENU E appears when the **2** key is pressed followed by the **ENTER** key at the end of MENU A. MENU E looks like this:

```
ERROR LOGGING UTILITIES
  0 - INITIALIZE ERROR LOG
  1 - DISPLAY ERROR LOG
  2 - STOP ERROR LOG
  3 - SET TIME TO 00:00:00
  4 - DISPLAY TIME
  5 - EXIT [TO TEST OPTIONS MENU]
ENTER DESIRED ACTION - _
```

If you press the **0** key, followed by the **ENTER** key, an error log is initialized that records the failures detected by diagnostic tests. You must choose which device will be used in recording errors from the following menu:

```
CURRENT LOGGING DEVICE = nul:
CHOOSE ERROR OUTPUT DEVICE:
  0 - DISK
  1 - PARALLEL PRINTER (PRN:)
  2 - SERIAL PORT (AUX:)
  3 - NO CHANGE
ENTER DESIRED ACTION - _
```

---

If you press the **0** key followed by the **ENTER** key, the following menu is displayed for the selection of the specific disk:

```
SELECT ERROR LOG DRIVE:
  0 - drive 'A'
  1 - drive 'B'
  2 - drive 'C'
ENTER DESIRED ACTION - _
```

When you select a drive to be used as the logging device, the system attempts to create a file called **error.log**. If an MFD Unit is specified, the write-protect tab must not be present on the diskette used. However, care must be taken if the floppy disk tests are to be run because the contents of the diskette may be erased.

If you press the **1** key, followed by the **ENTER** key, the list of logged failures is displayed from the diskette or hard disk.

If you press the **2** key, followed by the **ENTER** key, error logging is stopped.

If you press the **3** key, followed by the **ENTER** key, a 24-hour timer is initialized at 00:00:00.

If you press the **4** key, followed by the **ENTER** key, the current value of the 24-hour timer is displayed.

If you press the **5** key, followed by the **ENTER** key, you are taken to the Test Options Menu, MENU A.

## DIAGNOSTICS

---

### *MENU F*

The purpose of MENU F is to provide you with a means of recording diagnostic error information. The following is displayed when the **3** key and the **ENTER** key are pressed at the end of MENU A.

```
--> ATTENTION: SCRATCH DISKETTES MUST BE RE-FORMATTED BEFORE  
      USE BY YOUR OPERATING SYSTEM, USING YOUR OPERATING SYSTEM  
      FORMAT COMMAND.
```

```
PRESS 'ENTER' KEY TO CONTINUE - _
```

The previous message is to remind the user that scratch diskettes formatted by the System or Customer Test using option 1 of MENU A are not actually MS-DOS formatted and are to be used only for the execution of floppy disk tests.

**Note:** The MS-DOS formatted Diskettes can be used for testing. After testing, all test scratch diskettes must be reformatted under MS-DOS to operate.

---

When the **ENTER** key is pressed to continue, the following display MENU F appears:

```
SELECT DISKETTE DRIVE:  
  0 - drive 'A'  
  1 - drive 'B'  
ENTER DESIRED ACTION - _
```

If you press the **0** key, followed by the **ENTER** key, the following is displayed:

```
INSERT DISKETTE DRIVE  A:
```

After you press the **ENTER** key, the following will appear:

```
FORMATTING.... FORMAT COMPLETE  
PRESS 'ENTER' KEY TO CONTINUE - _
```

## DIAGNOSTICS

---

If you press the **1** key, followed by the **ENTER** key, the following is displayed:

```
INSERT DISKETTE DRIVE B:  
PRESS 'ENTER' KEY TO CONTINUE - _
```

After you press the **ENTER** key, the following will appear:

```
FORMATTING.... FORMAT COMPLETE  
PRESS 'ENTER' KEY TO CONTINUE - _
```

## Test Descriptions

The following paragraphs briefly describe the tests performed during the System Test Diagnostics.

### *Motherboard Test*

The Motherboard test checks the following:

- CPU
- Large Scale Integration (LSI) Chips
- ROM
- Speaker.

In the CPU test, all of the addressing modes and instruction classes performed in the Resident Diagnostics are tested again in a more complete manner. A test of the CPU registers is also performed. This test checks each register for storage ability and pattern sensitivity, by testing with many different fixed patterns, using shifts and rotates, loads and exchanges.

In the LSI test, the diagnostics check the functionality of the following integrated circuits:

- 8250 Communication Chip
- 8253 Timer
- 8237 DMA Controller
- 8259 Interrupt Controller
- 58174 Real-Time Clock
- 8041 Keyboard Controller
- 765 Floppy Disk Controller.

When the Timer is being tested, audible tones are generated that can be heard coming from the speaker on the Motherboard.

The ROM test is performed by calculating a checksum. The checksum, defined to be a byte addition of all the bytes in the high and low ROM modules, is summed and compared to zero.

The speaker test puts out tones of 50, 100, 200, 400, 800, 1600, 3200, and 6400 hertz.

## *Memory Test*

If you chose to run the Memory Test, the following menu is displayed:

```
MEMORY TEST SELECTIONS:  
 0 - RETURN TO MAIN MENU  
 1 - ADDRESSING TEST  
 2 - FIXED PATTERN TEST  
 3 - MARCHING PATTERN TEST  
 4 - MOVING INVERSION TEST  
 5 - BUS NOISE TEST  
 6 - REFRESH TEST  
  
 7 - RUN ALL OF THE ABOVE TESTS  
  
ENTER SELECTION(S):_
```

You may choose to run specific tests by pressing the appropriate key(s) (separated by spaces) followed by the **ENTER** key. You may run all of the tests by pressing the **7** key, followed by the **ENTER** key. Tests 2, 3, and 4 take a few minutes to complete.

---

**Addressing Test:** This test writes into each memory location its address. The memory is then checked to verify the addresses. This test is then repeated, writing the complement of the address into each memory location.

**Fixed Pattern Test:** This test writes to each memory location the current test pattern and immediately verifies the pattern. The test cycles through all of the memory 24 times, using a different pattern each time. The 24 patterns in hexadecimal format are: AAAA, FFFF, 0000, 5555, 0101, 0202, 0404, 0808, 1010, 2020, 4040, 8080, FEFE, FDFD, FBFB, F7F7, EFEF, DFDF, BFBF, 7F7F, FF00, 00FF, AA55, and 55AA.

**Marching Pattern Test:** The same 24 patterns used in the fixed pattern test are used in this test. The memory is first filled with the first pattern. Starting at the beginning of memory, the pattern is read and verified, and then the complement of the pattern is written into the cell and verified. The test then goes to the next cell and repeats the same process until the end-of-memory is reached. When the end-of-memory is reached, the test starts backwards verifying the pattern, complementing it, storing it, and verifying it. This is repeated for each cell until the beginning location is reached. This process is repeated for all 24 patterns. All of the memory is written and read 96 times in this test.

**Moving Inversion Test:** This test uses a complex algorithm in that a field of zero bits is inverted and then reinverted again with each pass. This process is repeated using address steps, which with each pass are multiplied by two. This test is run first with a forward sequence and then a backward sequence. The main characteristics of this algorithm are that each write is written between two read actions, and that the addresses are generated in different increments and directions.

**Bus Noise Test:** This test exercises the memory address and data buses. This test fills the memory with a pattern and then checks it. This is repeated using all 24 fixed patterns. This entire sequence is then repeated 8 times.

**Refresh Test:** This test first writes a zero pattern to all banks under test. The test then delays 10 seconds and verifies that all memory locations still contain the zero pattern. This is repeated using an FFFF pattern. This test verifies that the RAM memory is being correctly refreshed by the display circuitry.

**Parity Circuit Test:** This test checks the parity generation and checking circuitry. It has not yet been included in the System Test Diagnostics.

### ***Keyboard Test***

The Keyboard internal hardware is first tested and then a graphic representation of the Keyboard layout is displayed. This layout display is used to manually test the individual keys. The LEDs on the keyboard will blink while the keyboard is being tested. During this phase, the test is capable of detecting and locating stuck keys. A stuck key is located by means of the scan code displayed in the error messages (see error messages for Keyboard test 400). The next phase of the test consists of manually testing each key on the keyboard. Proper operation is indicated on the displayed keyboard. If any key does not function properly, you are asked to press **CTRL** and **0** (numeric key pad **0**), and the error message is then displayed. If the test was successful, you are asked to press **CTRL** and **1** (numeric key pad **1**) to proceed with other tests. The keyboard display test is only run if you choose to execute each test only once in MENU A.

---

## *Video System Test*

If you choose to perform the Video System Test, the following menu is displayed:

```
MONOCHROME VIDEO TEST SELECTIONS ARE:
```

- 0 - RETURN TO MAIN MENU
- 1 - HARDWARE
- 2 - MONITOR TEST PATTERNS
- 3 - CHARACTER SET
- 4 - GREY SCALE
- 5 - CHARACTER ATTRIBUTES, 80 BY 25 ALPHANUMERICS
- 6 - PAGING, 80 BY 25 ALPHANUMERICS, 8 PAGES
- 7 - PAGING, 40 BY 25 ALPHANUMERICS, 16 PAGES
- 8 - 640 BY 400 GRAPHICS, 2 COLOR
- 9 - 640 BY 200 GRAPHICS, 2 COLOR
- 10 - 320 BY 200 GRAPHICS, 4 COLOR
- 12 - Z8001 MODE MONITOR TEST (Note)
- 20 - RUN ALL OF THE ABOVE TESTS

```
ENTER SELECTION(S):_
```

**Note:** Option 12 is removed for System Test 3.18 or higher.

You may run specific tests by pressing the appropriate key, followed by the **ENTER** key. You may run all tests by typing **20**, followed by the **ENTER** key.

**1 - HARDWARE:** Tests the hardware of the Display and Display Controller.

## DIAGNOSTICS

---

**Memory Disk Transfer** is also performed during this phase. This particular routine creates a file on drive A. ***Because of this, a formatted nonwrite-protected disk must be present in drive A. This may be a nonwrite-protected copy of the system test or the scratch diskette used for the floppy tests.***

If this test is used with a write-protected diskette in drive A, either of the following messages appear.

WRITE PROTECT ERROR WRITING DRIVE A:

ABORT, RETRY, IGNORE?

**Note:** On ABORT, you will return to the operating system.

---

The DMA Memory Transfer Test takes data from the video controller's memory and transfers it to a file that is created on drive A. The size of this file depends on the available disk memory space. The maximum size is 16 KB and the minimum size is 1 KB. If less than 1 KB of disk space is available, the following error message is displayed:

```
--- NO ERRORS IN VIDEO HARDWARE TEST ---  
EXECUTION OF MEMORY/DISK TRANSFER TEST NOT POSSIBLE,  
THE DISK IS FULL.  
PRESS 'ENTER' KEY TO CONTINUE -
```

A floppy disk file is created from data in the Video Controller Memory by DMA transfer. The contents of the disk file is then compared to the Video Controller Memory, see Customer and System Test Error Messages.

**2 - Monitor Test Patterns:** Test patterns are displayed on the screen so that proper alignment of the screen can be checked. The test patterns include an alignment grid and a screen display full of "H's".

**3 - Character Set:** Checks the Display Controllers ROM by writing all available characters to the screen.

**4 - Gray Scale:** Checks the different colors or shades of grey or green phosphorous displays, as the case may be. The various colors are: Black, Blue, Red, Magenta, Green, Cyan, Brown, White, Dark Grey, Light Blue, Light Red, Light Magenta, Light Green, Light Cyan, Yellow, and Intense White.

**5 - Character Attributes, 80 by 25 Alphanumerics:** Checks the Display Controllers logic for normal intensity, reverse, underline, blinking, reverse blinking, underline blinking, high-intensity, underline high-intensity, and blinking high-intensity modes.

**6 - Paging, 80 by 25 Alphanumerics, 8 Pages:** Exercises the addressing circuitry from the Display Controller chip to Display Controller memory using the 80 by 25 mode.

**7 - Paging, 40 by 25 Alphanumerics, 16 Pages:** Exercises the addressing circuitry from the Display Controller chip to Display Controller memory using the 40 by 25 mode.

**8 - 640 by 400 Graphics, 2 Color:** Exercises the 640 by 400 graphics mode using two colors.

**9 - 640 by 200 Graphics, 2 Color:** Exercises the 640 by 200 graphics mode using two colors.

**10 - 320 by 200 Graphics, 4 Color:** Exercises the 320 by 200 graphics mode using four colors.

---

## *Parallel Port Test*

If you select the Parallel Port Test, you are asked if a printer is connected to the parallel port. This test will check up to four ports.

```
IS A PRINTER CONNECTED TO THE PARALLEL PORT? ('y'= YES, 'n'= NO)
- -
```

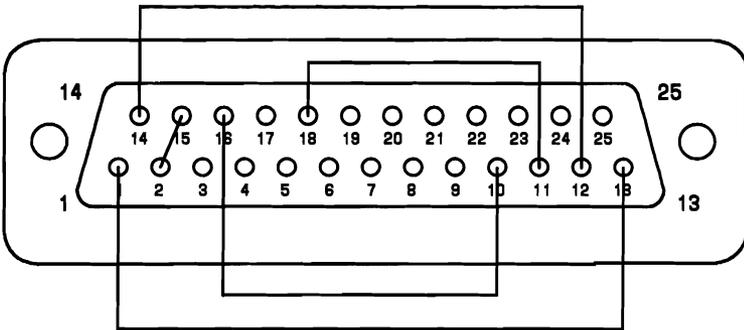
If you pressed key **y**, followed by the **ENTER** key, the test is performed as if a printer was connected to the port. If you press key **n**, followed by the **ENTER** key, you are asked if the **loopback** jumper is installed:

```
IS THE PARALLEL PORT LOOPBACK JUMPER INSTALLED? ('y'=YES, 'n'=NO)
- -
```

The loopback jumper connects the outputs of the printer port to the inputs and connects the various handshake signals. This test writes all 256 binary patterns to the output port and reads the input port after each output to verify the correct operation. The handshake signals are implicitly tested.

The parallel loopback jumper is a male 25-pin connector that fits into the parallel port on the rear panel of the System Module. The loopback jumper is wired as follows (Figure 4-2):

- Pin 1 (-STROBE) to Pin 13 (SELECT)
- Pin 2 (PTD0) to Pin 15 (-ERROR)
- Pin 10 (-ACK) to Pin 16 (-INIT)
- Pin 11 (BUSY) to Pin 18 (GND)
- Pin 12 (PE) to Pin 14 (-AUTOFDX)



**Figure 4-2. Parallel Loopback Jumper**

---

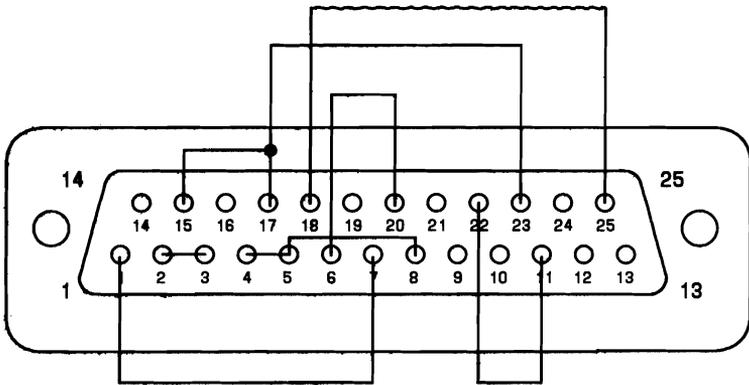
## ***Serial Port(s) Test (Using 8250)***

The serial port(s) test may be carried out with or without a loopback jumper. This test will check up to two serial ports (using 8250). You are asked if a loopback jumper is connected:

IS THE SERIAL PORT LOOPBACK JUMPER INSTALLED? ('y' = YES, 'n' = NO)  
 - -

The loopback jumper connects the following pins (Figure 4-3):

Pin <b>1</b> (PRGND)	to	Pin <b>7</b> (GND)	
Pin <b>2</b> (TXD)	to	Pin <b>3</b> (RXD)	
Pin <b>4</b> (RTS)	to	Pin <b>5</b> (CTS)	to Pin <b>8</b> (DCD)
Pin <b>6</b> (DSR)	to	Pin <b>20</b> (DTR)	
Pin <b>11</b> (-TCLD)	to	Pin <b>22</b> (RI)	
Pin <b>15</b> (TC)	to	Pin <b>17</b> (RC)	to Pin <b>23</b> (DTR)
Pin <b>18</b> (RCLD)	to	Pin <b>25</b> (-RCLD)	



**Figure 4-3. Serial Loopback Jumper**

---

## *48 TPI Floppy Disk Test*

If you choose to perform the Floppy Disk Test, the following is displayed:

```
TEST 800 - 48TPI FLOPPY DISK DRIVE(S)
NUMBER OF RETRIES ON DISKETTE ERROR? (0 to 5)
ENTER DESIRED ACTION - _
```

Since many errors that occur on floppy disk drives are intermittent, you may specify the number of retries by pressing the appropriate key (0 to 5), followed by the **ENTER** key. The next menu is then displayed:

```
CHOOSE DRIVE(S) TO TEST:
0 - drive 'A'
1 - drive 'B'
2 - drive 'A' and 'B'
ENTER DESIRED ACTION - _
```

After you press the appropriate key followed by the **ENTER** key, the floppy disk option menu is displayed:

```
MFD UNIT TEST SELECTION:
0 - RETURN TO MAIN MENU
1 - SEQUENTIAL WRITE
2 - SEQUENTIAL READ
3 - FUNNEL READ AND DATA COMPARE
4 - VERIFY DISKETTE
5 - RANDOM READ
6 - ALL OF THE ABOVE TESTS

7 - WRITE PROTECT TEST
8 - HEAD ALIGNMENT
-
```

After selecting the options, you are asked to insert a formatted scratch diskette. The diskette must be formatted in an MS-DOS environment, using the format utility (**format a:** or **format b:**).

The following is a description of the tests performed by each MENU option.

**1 - SEQUENTIAL WRITE:** This test writes to all sectors of a formatted diskette (previously formatted by the option "FORMAT SCRATCH DISKETTE"). The first byte of each sector contains the track number, the second byte contains the sector number, the third byte contains the head number. The remainder of each record is filled with a sample pattern. The sample pattern used is 00h, FFh, B6h, D9h. From D9h on, the remainder of each sector is filled with repeated byte patterns.

---

**2 - SEQUENTIAL READ:** This test reads all the tracks on the diskette, sector by sector. The tracks are read incrementally with an interleaving factor of 3.

**3 - FUNNEL READ AND DATA COMPARE:** This test reads all the tracks sector-by-sector, and compares each track with the WRITE SEQUENTIAL sample pattern.

**4 - VERIFY DISKETTE:** This test is the same as the sequential read test except it does not transfer data to the memory and no data comparisons take place.

**5 - RANDOM READ:** In this test, sector 1, head 0 of a random track, is read and the data checked. This is repeated for 200 tracks.

**7 - WRITE PROTECT:** This test operates the write-protect mechanism on the disk drive. In this test, sector 1, head 0 on track 39, will be read into the buffer first. An attempt is made to write over the same sector. Any error except a write-protect error is counted as a soft error and will be retried for the specified number of times. It is considered a write-protect error (hard error) if no error is found. If there is a write-protect error, the sector is read for a second time and the data is checked for any possible change. Any change is considered a hard error.

**8 - HEAD ALIGNMENT:** The purpose of the head alignment test is to position the heads over prerecorded alignment tracks on an alignment diskette. To allow operator flexibility, the program will ask for the desired track number, then verify the track.

### *MB HDU Drive and Controller Test*

If you test the HDU and Controller, the following menu appears:

```
TEST 900 - X MB HDU DRIVE AND CONTROLLER (X=10 or 20 MB)
NUMBER OF RETRIES ON HDU ERROR? (0 to 5)
ENTER DESIRED ACTION - _
```

Since many errors that occur on HDUs are intermittent, you may specify the number of retries by pressing the appropriate key (0 to 5), followed by the **ENTER** key. The HDU option menu is then displayed. The HDU menu looks similar to:

```
HDU TEST SELECTIONS:
0 - RETURN TO MAIN MENU
1 - DRIVE READY TEST
2 - CONTROLLER HARDWARE
3 - DRIVE HARDWARE
4 - SEEK TEST
5 - VERIFY SURFACE
6 - TEST CYLINDER READ/WRITE
7 - DATA PATTERN TEST
8 - FUNNEL TEST
9 - AGING TEST
10 - FULL EXERCISER
11 - WRITE & VERIFY SURFACE
12 - LOW LEVEL FORMAT
13 - SHIP THE UNIT
14 - DISPLAY BAD TRACK TABLE
15 - FORMAT BAD TRACKS

16 - RUN ALL OF THE ABOVE TESTS

ENTER SELECTION(S):_
```

---

**0 - RETURN TO MAIN MENU:** Returns to the Main Menu—MENU A.

**1 - DRIVE READY TEST:** The drive ready test checks the drive ready circuitry of the HDU. If the drive is not ready in 15 to 17 seconds, a Time Out error message is displayed.

**2 - CONTROLLER HARDWARE:** This test checks the hard disk controller board. This test writes, reads, and verifies all possible data to the ports that allow both writes and reads.

**3 - DRIVE HARDWARE:** This test checks the hardware of the hard disk drive itself.

**4 - SEEK TEST:** The first seek is to the last cylinder, the second seek is to the first cylinder, the third seek is to the last cylinder -1, the fourth seek is to the first cylinder +1, and so on.

**5 - VERIFY SURFACE:** This test verifies the surface of the HDU, taking into account the contents of the bad block list.

**6 - TEST CYLINDER READ/WRITE:** This test writes data to track 305 of the HDU, then reads and verifies the data.

**7 - DATA PATTERN TEST: This Test Will Erase All Files on the Disk.** The pattern test writes all cylinders with a data pattern, and then verifies that pattern. The disk is written from the first cylinder to the last cylinder. This sequence is then repeated from the last cylinder to the first.

**8 - FUNNEL TEST: This Test Will Erase All Files on the Disk.** The funnel test writes an incrementing pattern (first three bytes are usually the cylinder, head, and sector) to the disk. The pattern of the write, read, and verify is, however, different. Each cylinder/surface is written one sector at a time. The sectors are written in the following manner: start sector, last sector, start sector +1, last sector -1, and so on down to the center sector. The surface pointer is then incremented and the process repeated until all cylinders have been tested in this manner.

**9 - AGING TEST: This Test Will Erase All Files on the Disk.** The aging test is a very long test. The sectors are written and verified individually. Then all sectors previously written are read and verified.

**10 - FULL EXERCISER: This Test Will Erase All Files on the Disk.** The full exerciser test performs tests 1 through 7 repeatedly.

**11 - WRITE & VERIFY SURFACE: This Test Will Erase All Files on the Disk.** This test writes once as per the data pattern test and then performs the read/verify function of the data pattern test. It also produces the bad block list.

**12 - LOW LEVEL FORMAT: This Test Will Erase All Files on the Disk.** This test sets up the sectors and their addresses to provide the hard disk controller with information about the drive during the initial setup.

---

**13 - SHIP THE UNIT:** This is actually not a test for the HDU. It is a software routine that sets the heads of the HDU in an unused track at the end of the disk. This reduces the possibility of the disk being damaged when the unit is transported from one location to another. This subroutine can also be found on the MS-DOS disk.

**14 - DISPLAY BAD TRACK TABLE:** This test checks to see if there are any bad tracks on the HDU and puts them in a table.

**15 - FORMAT BAD TRACKS: This Test Will Erase All Files on the Disk.** This test finds bad tracks and marks them as bad tracks in the BTT.

**16 - RUN ALL OF THE ABOVE TESTS: This Test Will Erase All Files on the Disk.** This test runs tests 1 to 13, inclusively.

### ***8087 Math Co-Processor***

If the system configuration switches indicate that the 8087 Numeric Data Processor is present, then the 8087 test is performed. The 8087 test involves doing initializations to the processor and making sure they all pass.

### ***Parallel Printer Test***

This option tests the printer connected to the parallel port of the system. The test initializes the printer which prints out a complete character set. Compare your printout to the following.



---

## *Mouse Test*

If you choose the Mouse Test, the following menu is displayed:

```
MOUSE TESTS:
  0 - RETURN TO MAIN MENU
  1 - GRAPHIC MODE
  2 - TEXT MODE

 10 - RUN ALL OF THE ABOVE TESTS
ENTER SELECTION(S):_
```

You may run a specific test by pressing the appropriate key followed by the **ENTER** key. Or, you may run all the tests by typing **10**, followed by the **ENTER** key.

**0 - RETURN TO MAIN MENU:** Returns to the Main Menu—MENU A.

**1 - GRAPHIC MODE:** The graphic mode test asks you to position the cursor in certain boxes located on the screen. This checks to see if the Mouse is working correctly.

**2 - TEXT MODE:** The text mode test asks you to position the cursor over four different numbers that are located on the screen, and then press the appropriate button.

### ***8530 Test***

This test checks channels A and B of the Z8530 serial interface. The same serial loopback used for the 8250 may be used for complete testing of this port.

### ***Video Option Board Test [Display Enhancement Board (DEB)]***

The Video Option Board can be tested with the System Test by using option “23” from the “MENU C” options. This option appears in “MENU C” only when the Video Option Board is present.

**Note:** Option 23 will NOT be displayed if the Video Option Board is not present or is improperly installed.

After giving the choice for the “PAUSE ON ERROR?” question, the System Test displays the following menu listing all tests available for the Video Option Board:

- 0 - RETURN TO MAIN MENU
  - 1 - MEMORY TEST
  - 2 - TRANSPARENT MODE
  - 3 - TEXT WITH 400 LINE GRAPHICS
  - 4 - TEXT WITH 200 LINE GRAPHICS
  - 5 - 400 LINE GRAPHICS, 4 BIT PLANES, FULL LUT
  - 6 - REDUCED LUT TEST (LITTLEBIT)
  
  - 10 - RUN ALL OF THE ABOVE TESTS

---

Specific tests can be run by entering the option number, followed by the **ENTER** key, or all tests may be run by entering the value "10", followed by the **ENTER** key.

**Note:** Tests 3 and 4 must be run with the contrast control set to approximately midrange. This is necessary to distinguish between lines that are blinking from low light to high light.

A detailed description with specific screens can be found in the "MAINTENANCE" Section of Chapter 5. The following is a brief description of the test performed by each of the MENU options.

**1 - MEMORY TEST:** No error should occur during this test. If any error does occur, reject the DEB.

**Note:** The "Diagnostic Utility" will write data on the default drive. MFD default drives must have a formatted (write unprotected) diskette installed.

**2 - TRANSPARENT MODE:** This test displays a framed full screen with three lines. If any additional random character and/or blocks are displayed, reject the board.

**3 - TEXT WITH 400 LINE GRAPHICS:** This test produces a screen with 8 lines, each exercising a different video feature. (The monitor contrast control must be set to midrange.) Each line describes its appearance. If the description and the actual appearance do not agree, reject the board.

**4 - TEXT WITH 200 LINE GRAPHICS:** This test is similar to the 400 Line Graphics test and displays the same self-explanatory messages. (The monitor contrast control must be set to midrange.)

**5 - 400 LINE GRAPHICS, 4 BIT PLANES, FULL LUT:** This option verifies the proper performance of several screen capabilities. Several lines containing self-explanatory messages are displayed on the screen, each testing a different feature.

**6 - REDUCED LUT TEST (LITTLEBIT):** Three self-explanatory messages are displayed for this test.

Approval of the question asked on the screen redisplay the main screen options. Selection "0" then summarizes the results on the screen in a set of messages.

---

## *2nd HDU Drive and Controller Test*

If you test the HDU and Controller, the following menu appears:

```
TEST 2400 - X MB HDU DRIVE AND CONTROLLER (X=10 or 20 MB)
NUMBER OF RETRIES ON HDU ERROR? (0 to 5)
ENTER DESIRED ACTION - _
```

Since many errors that occur on HDUs are intermittent, you may specify the number of retries by pressing the appropriate key (0 to 5), followed by the **ENTER** key. The HDU option menu is then displayed. The HDU menu looks similar to:

```
HDU TEST SELECTIONS:
0 - RETURN TO MAIN MENU
1 - DRIVE READY TEST
2 - CONTROLLER HARDWARE
3 - DRIVE HARDWARE
4 - SEEK TEST
5 - VERIFY SURFACE
6 - TEST CYLINDER READ/WRITE
7 - DATA PATTERN TEST
8 - FUNNEL TEST
9 - AGING TEST
10 - FULL EXERCISER
11 - WRITE & VERIFY SURFACE
12 - LOW LEVEL FORMAT
13 - SHIP THE UNIT
14 - DISPLAY BAD TRACK TABLE
15 - FORMAT BAD TRACKS

16 - RUN ALL OF THE ABOVE TESTS

ENTER SELECTION(S):_
```

**0 - RETURN TO MAIN MENU:** Returns to the Main Menu—MENU A.

**1 - DRIVE READY TEST:** The drive ready test checks the drive ready circuitry of the HDU. If the drive is not ready in 15 to 17 seconds, a Time Out error message is displayed.

**2 - CONTROLLER HARDWARE:** This test checks the hard disk controller board. This test writes, reads, and verifies all possible data to the ports that allow both writes and reads.

**3 - DRIVE HARDWARE:** This test checks the hardware of the hard disk drive itself.

**4 - SEEK TEST:** The first seek is to the last cylinder, the second seek is to the first cylinder, the third seek is to the last cylinder -1, the fourth seek is to the first cylinder +1, and so on.

**5 - VERIFY SURFACE:** This test verifies the surface of the HDU, taking into account the contents of the bad block list.

**6 - TEST CYLINDER READ/WRITE:** This test writes data to track 305 of the HDU, then reads and verifies the data.

**7 - DATA PATTERN TEST: This Test Will Erase All Files on the Disk.** The pattern test writes all cylinders with a data pattern, and then verifies that pattern. The disk is written from the first cylinder to the last cylinder. This sequence is then repeated from the last cylinder to the first.

---

**8 - FUNNEL TEST: This Test Will Erase All Files on the Disk.** The funnel test writes an incrementing pattern (first three bytes are usually the cylinder, head, and sector) to the disk. The pattern of the write, read, and verify is, however, different. Each cylinder/surface is written one sector at a time. The sectors are written in the following manner: start sector, last sector, start sector + 1, last sector - 1, and so on down to the center sector. The surface pointer is then incremented and the process repeated until all cylinders have been tested in this manner.

**9 - AGING TEST: This Test Will Erase All Files on the Disk.** The aging test is a very long test. The sectors are written and verified individually. Then all sectors previously written are read and verified.

**10 - FULL EXERCISER: This Test Will Erase All Files on the Disk.** The full exerciser test performs tests 1 through 7 repeatedly.

**11 - WRITE & VERIFY SURFACE: This Test Will Erase All Files on the Disk.** This test writes once as per the data pattern test and then performs the read/verify function of the data pattern test. It also produces the bad block list.

**12 - LOW LEVEL FORMAT: This Test Will Erase All Files on the Disk.** This test sets up the sectors and their addresses to provide the hard disk controller with information about the drive during the initial setup.

**13 - SHIP THE UNIT:** This is actually not a test for the HDU. It is a software routine that sets the heads of the HDU in an unused track at the end of the disk. This reduces the possibility of the disk being damaged when the unit is transported from one location to another. This subroutine can also be found on the MS-DOS disk.

**14 - DISPLAY BAD TRACK TABLE:** This test checks to see if there are any bad tracks on the HDU and puts them in a table.

**15 - FORMAT BAD TRACKS: This Test Will Erase All Files on the Disk.** This test finds bad tracks and marks them as bad tracks in the BTT.

**16 - RUN ALL OF THE ABOVE TESTS: This Test Will Erase All Files on the Disk.** This test runs tests 1 to 13, inclusively.

## SYSTEM TEST DIAGNOSTICS (OVERLAY VERSION)

---

The Overlay Version of the System Test X.XX must be used in systems with 128-KB memory. Other versions of the System Test which run with 128 KB will display the following message:

Program too big to fit into memory

**Note:** The overlay version of the system test will function correctly only with the 2.11 version of MS-DOS. MS-DOS 3.1 and further releases take up more memory space than 2.11 and will display an error message.

### Loading System Test (Overlay Version)

The System Test Diagnostics (Overlay Version) is loaded as follows:

1. Insert the MS-DOS 2.11 System Diskette into MFD Unit A and close the drive door.
2. Turn the System Module power switch ON.
3. After the Resident Diagnostics have successfully been completed, verify that the Operating System has been loaded.
4. Remove the MS-DOS 2.11 System Diskette from MFD Unit A.

## DIAGNOSTICS

---

5. Insert the System Test Diskette into MFD Unit A and close the drive door.
6. Load the System Test Diagnostics (Overlay Version) by entering:

```
A>system<CR>
```

7. When the diagnostics have been loaded, MENU A will appear on the screen.

The overlay version of the System Test is not placed in memory as in the standard version. Various tests and subtests are accessed directly from the diskette program as needed.

8. If the system is looking for the program or the diskette is not in the proper drive, the following display appears:

```
-> SYSTEM TEST DISKETTE MUST BE IN DRIVE (X)  
MAKE SURE DISKETTE IS INSTALLED  
PRESS ANY KEY
```

**Note:** Do not rename this program because it will not run under any name other than "System."

# STAND-ALONE MOTHERBOARD DMA TEST DIAGNOSTICS

---

## DMA Test

The Motherboard DMA Test is a stand-alone program which tests the Motherboard direct memory access chip for multichannel operation. The DMA Test Diagnostics is loaded as follows:

1. Insert the MS-DOS System Diskette into drive A and close the drive door.
2. Turn the System Module power switch ON.
3. After the Resident Diagnostics have successfully been completed, verify that the Operating System has been loaded.
4. Remove the MS-DOS System Diskette from drive A.
5. Insert the stand-alone DMA Test Diskette into drive A and close the drive door.

## DIAGNOSTICS

---

**Note:** If the DMA Test Diskette is loaded from a drive other than drive A, the following message will appear:

Please reboot the system with distribution diskette in Drive A

6. Load the DMA Test Diagnostics by entering:

A>DMA—Test<CR>

7. When the diagnostics have been loaded, MENU A will appear on the screen.

When the DMA controller test is executed, the following message is displayed:

Motherboard DMA Controller Test — Version X.X  
This program tests the DMA controller for multichannel operation.  
If the DMA chip has a bug the program may hang.  
If this happens for more than 120 seconds, restart the computer and run the test again. If the computer hangs a second time, or a fail message is reported, a new PAL, PLS2B, is available from the Hot-Line, 1-800-922-0354, to correct the problem.

Press <return> to execute test -

---

When the return is pressed, the screen will clear and a message is displayed.

If you have a good DMA chip, the following message appears:

```
##### DMA TEST PASSED
```

If you have a bad DMA chip, the following message appears:

```
##### DMA TEST ERROR !!!  
  
The DMA controller chip 8237 failed.  
The bug occurs when 2 or more channels  
of DMA are used at the same time. Most  
high speed tape drives and some network  
interface cards will be affected.  
This is the only diagnostic that will  
find the problem, since other diagnostics  
test one channel at a time.  
  
Press <return> to exit -
```

**Note:** The DMA test will try to write to a floppy in drive A. The floppy must not be write protected.

At the end of the test, press “return” to exit the program.

## **STAND-ALONE LOW-LEVEL FORMAT UTILITY TEST**

---

The Stand-Alone Low-Level Format (LLF) Utility Test is similar to the Hard Disk Test portion of the PC 6300 System Test, but has a professional presentation for a better user interface.

The utility is compatible with either the Western Digital Controller (WD) or the Data Technology Controller (DTC). It will detect which hard disk controller is installed (WD or DTC). This information is displayed on the screen.

The utility will allow the user to Low-Level Format a hard disk, enter bad tracks in a table, verify surface, and mark them on HDU.

The basic operations performed are to:

1. Low-Level Format a HDU and determine the "Optimal Interleave Factor."
2. Get bad track information from the user.
3. Execute the "VERIFY SURFACE" test.
4. Find additional bad tracks during the "VERIFY SURFACE" test.
5. Mark every bad sector in a track.

---

## ***General Characteristics***

The following are the general characteristics of the Low-Level Format utility:

1. The program is a stand-alone utility delivered on a nonbootable diskette.
2. The program shows the “BANNER” *informing the user about the NUMBER and DATA RELEASE.*
3. The utility will be aborted if the PC hasn’t recognized the Hard Disk Controller.
4. The “HELP” option provides information on how to operate the utility.
5. The program can operate with a DTC or WD controller, and will display the type of controller.
6. The program displays the HDC configuration and prompts the user for verification with the following screen:

```
----> kind of CPU (I8086 or I80286)
----> number of HDU present
----> kind of HD controller installed (WD or DTC)
----> number of heads and cylinders for each HDU
----> DIP-SWITCHES setting on HD controller
```

7. The program can operate with two Hard Disk Units.
8. The program protects the user from unintended destructive operations as follows:
  - a. A verification input is required from the user before starting any destructive operation of data stored on the HDU.
  - b. There are no default limitations for the destructive operations or for selecting the HDU. The user selects the drive and the operations during the start session.
  - c. A quit prompt appears before starting a data destructive operation.
  - d. A quit selection doesn't cause the utility to be exited.
  - e. Only one HDU at a time can be selected for operations. The HDU drive selected for operations is displayed.
9. The program is able to Low-Level Format a HDU that has previously been low-level formatted.
10. The Verify Surface Test has a multiple loop option capability. The test will inquire as to the number of test passes to run.
11. The default number of retries is set at 2 in the Verify Surface Test. If after two retries a sector cannot be read without error, the sector is considered bad.

---

## ***The Bad Track Table***

The Bad Track Table (BTT) is a table in memory that stores information on bad tracks, obtained from the Verify Surface Test and from information manually inserted by the user.

If the “FORMAT BAD TRACKS” option or option 1 of “DISPLAY AND EDIT BAD TRACK TABLE” is selected, (the following sections describe these functions) all the tracks stored in the BTT will be physically reformatted with the “bad track flag” bit set in the ID field of each sector. The reformat of each bad track is verified and retried once, if all the sectors in the track fail to return codes. If the verification fails after the second reformat, a failure message is printed.

- This BTT is cleared when the utility is loaded and is never cleared while the utility is running.
- Bad tracks will not generate error messages unless the number of bad tracks exceeds the maximum permissible number. The maximum permissible number is:
  - a. Either 64 bad tracks total, or 2 bad tracks per megabyte of formatted storage, whichever is larger. In other words, the magic number is 64 for storage up to 32 MB and 2N megabyte/megabyte for higher storage.
  - b. Cylinders 0, 1, 2, and 3 must be error free.

The BTT has room for 256 bad tracks. The following information is stored in the table for each record.

- Cylinder number of the bad track (0 is the first cylinder)
- Head number of the bad track (0 is the first head)
- The number of the first sector found bad on this track
- The BIOS error code that indicates why the sector was bad.

### ***List of Operations***

This section describes the function performed by the Low-Level Format utility.

#### *Banner*

The utility presents a Banner, which provides the user with the RELEASE NUMBER and date of delivery for about 10 seconds, and then displays the Main Menu.

---

The Banner message is as follows:

```
AT&T
PERSONAL COMPUTER
HARD DISK UTILITY
RELEASE NUMBER X.X
Month Day, Year
```

The first activity of the utility is to check for the presence of the Hard Disk Controller. If the HDC is not installed, the following message is displayed and the program is aborted:

```
AT&T
PERSONAL COMPUTER
HARD DISK UTILITY
RELEASE NUMBER X.X
Month Day, Year

WARNING - NO HARD DISK DETECTED DURING
CHECK CONFIGURATION PROGRAM ABORTED
PRESS 'ENTER' KEY TO CONTINUE -
```

## DIAGNOSTICS

---

### *Main Menu*

```
- HDU UTILITY SELECTIONS : -  
  1 - HELP  
  2 - HDU CONFIGURATION  
  3 - LOW LEVEL FORMAT  
  4 - DISPLAY AND EDIT BAD TRACK TABLE  
  5 - FORMAT BAD TRACKS  
  6 - VERIFY SURFACE TEST  
  7 - SHIP THE UNIT  
  8 - EXIT TO L.L.F. UTILITY  
  
ENTER SELECTION : _
```

Some of the above selections require verification of the following conditions before execution.

The HDU must be selected previously using the "HDU CONFIGURATION/SELECT DRIVE" option. If not, the following message will appear:

```
WARNING - The HDU drive is not yet selected.  
          You have to select the unit by ``SELECT DRIVE`` function  
  
PRESS 'ENTER' KEY TO CONTINUE -
```

---

For the functions: "FORMAT BAD TRACKS, VERIFY SURFACE, and SHIP THE UNIT," the disk has to be already formatted; if not, the following message will be displayed:

```
WARNING - DISK # 1 OR 2 IS NOT LOW LEVEL FORMATTED
          ABORT OPERATION
PRESS 'ENTER' KEY TO CONTINUE -
```

The program returns to the Main Menu.

The HDU menu selections and their functions are as follows:

- 1 - HELP:** Displays a help message for the user regarding the utility.
- 2 - HDU CONFIGURATION:** This selects the target drive and informs the user of the configuration.
- 3 - LOW LEVEL FORMAT:** Formats the selected HDU.
- 4 - DISPLAY AND EDIT THE BAD TRACK TABLE:** Displays and edits the bad track table and also marks the bad sectors on HDU by a specific subitem.
- 5 - FORMAT BAD TRACKS:** Formats the bad tracks saved on the bad track table.

**6 - VERIFY SURFACE TEST:** Verifies the surface of the disk, taking into account the contents of the bad track table.

**7 - SHIP THE UNIT:** This is a security precaution for the HDU, which must be used before moving the PC 6300.

**8 - EXIT TO L.L.F. UTILITY:** Pressing key "8", followed by the **ENTER** key, takes the user back to the operating system command level.

---

A more detailed explanation of each option on the Main Menu follows:

### ***Help***

The Help display is started by pressing the key “1” followed by the **ENTER** key on the Main Menu.

***Caution: Care should be observed when using the following factory format program, as it is possible to destroy all data on the HDU.***

The Low-Level Format utility performs a factory format on the hard disks supported by the PC 6300. This factory format must be performed before FDISK is run to create a partition on the HDU. Before running the program, the user must select the HDU to be tested by means of the “Select Drive” option found under the “Check Configuration” option. Upon completion of the Low-Level Format, a verify test should be performed to catch bad blocks on the surface of the HDU. The bad blocks should be formatted after the Verify Surface Test.

## *HDU Configuration*

The HDU Configuration is started by pressing key “2” followed by the **ENTER** key on the Main Menu. This provides information about the HDU configuration and selecting the drive with the following menu:

```
-HDU CONFIGURATION MENU : -  
  
  1 - CHECK CONFIGURATION  
  2 - SELECT DRIVE  
  3 - RETURN TO MAIN MENU  
  
ENTER SELECTION : _
```

**1 - CHECK CONFIGURATION:** Displays the CPU, i8086 for the PC 6300, the type of HD controller installed WD or DTC, and the characteristics of the unit drive installed in terms of number of "Heads, Cylinders, and Setting DIP Switches." The following is a sample screen.

```

- CHECK CONFIGURATION -
+ CPU Type                = i8086
+ Controller Type         = W.D. (Western Digital) or
                          D.T.C. (Data Technology Corporation)
+ Number of HDU installed = 1 or 2
+ HDU #1 : Number of heads   = n
              Number of cylinders = nnn
              DIP switches    = : x : x : x : x : x : x : x : x :
              -----
                1  2  3  4  5  6  7  8
+ HDU #2 : Number of heads   = n
              Number of cylinders = nnn
              DIP switches    = : x : x : x : x : x : x : x : x :
              -----
                1  2  3  4  5  6  7  8
NOTE:  0 corresponds to ON and 1 corresponds to OFF
PRESS 'ENTER' KEY TO CONTINUE - _

```

**Note:** If the HDU Controller switch (or jumper) settings or the HDU drive select switches are not properly set, the following message is also displayed:

```

WARNING - Switch setting on HDU Controller not correct.

```

## DIAGNOSTICS

---

**2 - SELECT DRIVE:** Press key “2”, followed by **ENTER** key on the HDU Configuration Menu, the following menu appears:

### With 1 Hard Disk Installed

```
- SELECT DRIVE -  
1 - DRIVE #1  
  
3 - RETURN TO PREVIOUS MENU  
  
ENTER SELECTION : _
```

### With 2 Hard Disks Installed

```
-SELECT DRIVE-  
  
1 - DRIVE #1  
2 - DRIVE #2  
3 - RETURN TO PREVIOUS MENU  
  
ENTER SELECTION : _
```

**1 - DRIVE #1:** Pressing key “1” selects HDU drive # 1.

**2 - DRIVE #2** Pressing key “2” selects HDU drive # 2.

**3 - RETURN TO PREVIOUS MENU:** Pressing key “3”, followed by the **ENTER** key, returns the program to the previous menu (HDU Configuration Menu).

---

## ***Low-Level Format***

The Low-Level Format operation is started by pressing key "3", followed by the **ENTER** key on the "Main Menu."

If the HDU has been selected, the following steps are performed:

**Note:** If the HDU appears to have a low-level format, the following warning message will appear:

```
      - LOW LEVEL FORMAT -  
      DRIVE SELECTED # 1 OR 2  
WARNING THIS DISK APPEARS TO BE LOW LEVEL FORMATTED.  
        DO YOU WISH TO CONTINUE ( Y or N ) ?
```

If the user responds "N" or "n", followed by the **ENTER** key, the program will return to the Main Menu.

## DIAGNOSTICS

---

If the user responds “Y” or “y”, followed by the **ENTER** key, the program will continue, and the following message will request the operator’s confirmation:

```
WARNING - THIS OPERATION ERASES ALL FILES.
```

```
----> TYPE '1234' TO CONFIRM SELECTION  
----> TYPE '0'    TO ABORT THE OPERATION
```

With a DTC or WD controller, the “Interleave Factor” will always be by definition six (6) and the following message will be generated:

```
HARDWARE TESTS SUGGESTS BEST INTERLEAVE FACTOR IS ``1:6``  
DO YOU WISH TO SPECIFY A DIFFERENT INTERLEAVE FACTOR (Y or N)
```

- a. If the user responds “N” or “n”, followed by the **ENTER** key, the established value for “X” by the “Optimal Interleave Factor” procedure will be used as the interleave factor.
- b. If the user responds “Y” or “y”, followed by the **ENTER** key, the following message is displayed:

```
ENTER AN INTERLEAVE FACTOR (6, 5, 4 )?
```

---

The operator response is checked, and if it is out of range (6, 5, 4,) the following error message will be displayed:

```
WARNING - ILLEGAL ENTRY
PRESS 'ENTER' KEY TO CONTINUE -
( error interleave factor entry message )
```

and the program returns to the Main Menu.

If the Interleave Factor is in range, all preparatory actions to execute the HDU formatting are performed and the format process is activated. The following message appears on the screen:

```
WAIT: LOW LEVEL FORMAT IS IN PROGRESS ON DRIVE # 1 or 2
ESTIMATED TIME IS : XX min.
```

If there is an error during the ROM BIOS format operation, the following error message is displayed :

```
LOW LEVEL FORMAT FAILED
PRESS ``ENTER`` KEY TO CONTINUE
```

## DIAGNOSTICS

---

At the end of the drive format, the program verifies the first sector of the last three cylinders of the drive. If any of the three sectors is verified without an error, the format is assumed to be successful and the following message is displayed:

```
END LOW LEVEL FORMAT
DO YOU WANT TO EDIT THE BAD TRACK TABLE (Y or N)?
```

If any of the sectors contain an error, the drive format is repeated and the verification check is redone. If the verification check still fails, the following message is displayed:

```
LOW LEVEL FORMAT FAILED
PRESS ``ENTER`` KEY TO CONTINUE
```

and the program returns to the main menu.

If the Low-Level Format is successful, the following message appears:

```
END LOW LEVEL FORMAT
DO YOU WANT TO EDIT THE BAD TRACK TABLE (Y or N)?
```

---

The user can edit the bad track table or enter any defect information provided by the drive manufacturer at this time.

- a. If the operator responds "N" or "n", followed by the **ENTER** key, the program returns to the main menu.
- b. If the operator responds "Y" or "y", followed by the **ENTER** key, the "DISPLAY AND EDIT THE BAD TRACK TABLE" function is called and the following menu is displayed.

```
- DISPLAY AND EDIT BAD TRACK TABLE -  
  HDU-DRIVE SELECTED IS # 1 or 2  
  
  BAD TRACK TABLE EDIT OPTIONS:  
  
  1 - FINISHED EDITING (PROCEED WITH FORMATTING)  
  2 - ADD BAD TRACK(S) TO TABLE  
  3 - DELETE BAD TRACK(S) FROM TABLE  
  4 - DISPLAY BAD TRACK TABLE  
  5 - ABORT FORMAT OPERATION  
ENTER DESIRED ACTION -_
```

**Note:** It is advantageous to edit the Bad Track Table for optimal disk operation.

### ***Display and Edit Bad Track Table***

The bad track table editor allows the user to:

1. Format the bad track
2. Add bad tracks to the table
3. Delete bad tracks from the table
4. Display the bad track table
5. Abort the display and edit bad track.

This can be done by:

1. Pressing key “4” when the Main Menu is displayed on the screen.
2. In the Low-Level Format after the entire disk is formatted, the user is prompted to enter the editor before the bad tracks are marked. This is usually when the bad track information provided by the drive manufacturer would be entered.
3. In the Format Bad Tracks operation, the user is prompted to enter the editor before the bad track information in the table is used to reformat the bad tracks. Except for looking over the table before the reformat operation, the editor functions should not be needed.

---

The "DISPLAY AND EDIT BAD TRACK TABLE" selection has the following menu:

```
- DISPLAY AND EDIT BAD TRACK TABLE -  
  HDU-DRIVE SELECTED IS # 1 or 2  
  
  BAD TRACK TABLE EDIT OPTIONS:  
  
  1 - FINISHED EDITING (PROCEED WITH FORMATTING)  
  2 - ADD BAD TRACK(S) TO TABLE  
  3 - DELETE BAD TRACK(S) FROM TABLE  
  4 - DISPLAY BAD TRACK TABLE  
  5 - ABORT FORMAT OPERATION  
ENTER DESIRED ACTION -_
```

A description of each command follows:

**1 - FINISHED EDITING (PROCEED WITH FORMATTING):** Causes the editor to be exited and the bad tracks in the bad track table are physically formatted with the bad track bit set in the ID field for all the sectors.

Before formatting the bad tracks saved on the BTT, a check is made to see if the HDU has been selected and if it is LL formatted. The following procedure is followed:

1. If the HDU has been selected and is LL formatted, the following message appears:

```
WARNING - THIS OPERATION ERASES ALL FILES  
  
----> TYPE '1234' TO CONFIRM THE OPERATION SELECTED  
----> TYPE '0'   TO ABORT THE OPERATION SELECTED
```

## DIAGNOSTICS

---

2. If the interleave factor is not defined (by previous LLF option), “the best interleave procedure” is started.

In the case of PC 6300, with a DTC or WD controller, the Interleave Factor called will always be by definition six (6) and the following message will be generated:

```
HARDWARE TESTS SUGGESTS BEST INTERLEAVE FACTOR IS ``1:6``  
DO YOU WISH TO SPECIFY A DIFFERENT INTERLEAVE FACTOR (Y or N)
```

- a. If the user responds “N” or “n”, followed by the **ENTER** key, the established value of “6” will be used as Interleave Factor.
- b. If the user responds “Y” or “y”, followed by the **ENTER** key, the following message is displayed:

```
ENTER AN INTERLEAVE FACTOR (6, 5, or 4) ?
```

---

The user response is checked; and if it is out of range (6, 5, or 4), the following error message will be displayed:

```
WARNING - ILLEGAL ENTRY
PRESS 'ENTER' KEY TO CONTINUE -
```

and the program returns to the Main Menu.

3. If the Interleave Factor is in range, the following message is displayed:

```
- FORMAT BAD TRACK -
DRIVE SELECTED # 1 OR 2
```

4. If no bad tracks have been saved on the BTT, the following message will be displayed:

```
- NO BAD TRACK(S) PRESENT ON TABLE -
- PRESS ENTER KEY TO CONTINUE -
```

and the program returns to the Main Menu.

## DIAGNOSTICS

---

5. If bad tracks have been saved on the BTT, the following message will be displayed:

```
WAIT : FORMAT BAD TRACK IN PROGRESS ON H.D.U # 1 OR 2
      FORMATTING CYLINDER # xx : HEAD # YY
```

6. If the formatting has been successful, the following message is displayed:

```
END FORMAT BAD TRACK(S)
PRESS ENTER KEY TO CONTINUE -
```

If the formatting has not been successful, the following message will appear:

```
FORMAT BAD TRACK(S) FAILED
PRESS 'ENTER' KEY TO CONTINUE
```

In both cases, the program returns to the Main Menu.

---

**2 - ADD BAD TRACK(S) TO TABLE:** This option allows the user to manually add tracks to the bad track table. Only the cylinder number and the head number of each bad track is requested. The values entered are checked to insure they are in range. If the values are out of the range, the following message is displayed:

```
WARNING - ILLEGAL ENTRY
PRESS 'ENTER' KEY TO CONTINUE
```

If the user inputs a bad track that causes the drive to exceed the bad drive limits, the track will be added to the BTT, and the following message is displayed:

```
BAD DISK DRIVE - CONSULT THE SERVICE MANUAL
```

If the user requests a bad track already stored on the BTT, the following message is displayed:

```
WARNING: THE ENTERED BAD TRACK IS ALREADY ON THE BAD TRACK TABLE
```

## DIAGNOSTICS

---

If a bad track causes a “bad drive” parameter to be exceeded, a warning message is displayed and the editor returns to the main menu. The bad track is then added to the bad track table. The following information is used with the bad track table.

- a. The cylinder/head numbers must be entered in decimal. If a track is added by mistake, it can be deleted from the table using option 3 [DELETE BAD TRACK(S) FROM TABLE].
- b. To return to the editor menu, enter a carriage return in response to either the cylinder # or head # prompt.
- c. The keys PG UP and PG DN are used to scroll the Bad Track Table.
- d. The ESC key is used to exit from the add bad track option, and the INS key inserts the bad track.

---

**3 - DELETE BAD TRACK(S) FROM TABLE:** This option allows the user to manually delete tracks from the bad track table. Its main function is to delete tracks that were previously added by mistake. If the BTT is empty, the following message is displayed:

- NO BAD TRACK(S) PRESENT ON TABLE -  
- PRESS ENTER KEY TO CONTINUE -

and the program returns to Main Menu.

If the bad track is not found, the cylinder # and head # of the track to be removed are limit checked. If they are not within limits, the following message is displayed:

WARNING: THE ENTERED BAD TRACK IS ALREADY ON THE BAD TRACK TABLE

The following information is used with the “Delete Bad Track(s) From Table” option:

- a. To return to the editor menu, enter a carriage return in response to either the cylinder # or head # prompt.
- b. The keys PG UP and PG DN scroll the BTT screen.
- c. The ESC key is used to exit from the add bad track option, and the DEL key deletes the selected bad track.

**4 - DISPLAY BAD TRACK TABLE:** This option displays the contents of the bad track table in a formatted manner. The displayed information is:

1. The cylinder number of the bad track (cylinder 0 is the first cylinder)
2. The head number of the bad track (head 0 is the first head)
3. The number of the first sector in the track that was found to be bad during the testing. For manually entered bad tracks, the sector is always 1 (sector 1 is the first sector of a track).
4. The error code returned by the BIOS indicates why the sector was bad. For manually entered bad tracks, the code will not be displayed.

If there are no bad tracks in the table, the following message will be displayed:

```
- NO BAD TRACK(S) PRESENT ON TABLE -  
- PRESS ENTER KEY TO CONTINUE -
```

and the program returns to Main Menu.

---

The following information is used with the "DISPLAY BAD TRACK TABLE."

- a. The bad tracks in the table are recorded in the same order as found.
- b. The keys PG UP and PG DN are used to scroll the Bad Track Table.
- c. The ESC key is used to exit the option "add bad track."

**5 - ABORT FORMAT OPERATION:** This option allows the user to exit without reformatting the tracks contained in the Bad Track Table.

### ***Format Bad Tracks***

This option physically reformats the bad tracks in the bad track table with the track bit set in the ID field of all the sectors. The Format Bad Tracks operation is started by pressing the key "5" followed by the **ENTER** key on the Main Menu.

If the target HDU has been selected and the disk already LL Formatted, the following message is displayed:

- FORMAT BAD TRACK(S) -  
DO YOU WANT TO EDIT THE BAD TRACK TABLE (Y OR N) ?

## DIAGNOSTICS

---

- a. If the user responds "Y" or "y" followed by the **ENTER** key, the same actions performed by "DISPLAY AND EDIT BAD TRACK" function are performed.
- b. If the user's answer is "N" or "n", followed by the **ENTER** key, the reformat operation is started and the same actions performed by "FINISHED EDITING (PROCEED WITH FORMATTING)" function are performed.

---

## *Verify Surface Test*

The Verify Surface operation is started by pressing key "6" followed by the **ENTER** key on the Main Menu. This function checks the surface of a formatted disk, detecting any defective tracks. The test will update the BTT when it finds a bad sector. Once a bad sector of a track is found, any additional bad sectors found on the same track are ignored as all the sectors on the track will be marked bad.

The test has a multiple loop capability option, which will request from the user the number of passes to run. The default number of retries is set at 2 in the Verify Surface Test. Therefore, after two retries, the sector is considered bad.

Finding a bad sector (then track) during the VERIFY SURFACE TEST doesn't cause an error to be displayed unless:

1. When the total number of bad tracks found on the HDU exceeds the maximum permissible number, the following message is displayed:

```
TOO MANY ERRORS ON DRIVE
VERIFY SURFACE TEST FAILED
PRESS 'ENTER' KEY TO CONTINUE - _
```

This maximum number is dependent on the size of the HDU and the algorithm is: either 64 bad tracks total, or 2 bad tracks per megabyte of formatted storage, whichever is larger (64 for storage up to 32 MB and for higher storage 2N megabyte/megabyte).

## DIAGNOSTICS

---

2. If a bad track is found on the first four cylinders, the following error message is displayed:

```
BAD DISK DRIVE - CONSULT THE SERVICE MANUAL
VERIFY SURFACE TEST FAILED
PRESS 'ENTER' KEY TO CONTINUE - _
```

3. If the bad track found exceeds the entries of the BTT, the following error message is displayed:

```
BAD TRACK TABLE OVERFLOW
VERIFY SURFACE TEST FAILED
PRESS 'ENTER' KEY TO CONTINUE - _
```

Then the program returns to Main Menu.

If the Verify Surface Test has been selected and the disk is LL Formatted, the following message will be displayed:

```
- VERIFY SURFACE TEST -
HOW MANY LOOPS DO YOU WANT TO RUN ?
```

- a. When the user enters the number of test loops to be run, the following message is displayed:

```
WAIT: VERIFY SURFACE TEST IN PROGRESS ON DRIVE #1 OR 2
      ESTIMATED TIME :XX
      VERIFYING CYLINDER # YY
```

- b. If the test is successfully completed, the following end message will be displayed:

```
END VERIFY SURFACE TEST
PRESS ENTER KEY TO CONTINUE -
```

and the program returns to the Main Menu.

### *Ship the Unit*

This command is a security precaution for the HDU, and it must be used before moving the PC 6300 System. To use the command, go to the Main Menu and press key "7". The following is displayed:

```
- SHIP THE UNIT -  
WAIT : SHIP IN PROGRESS ON DRIVE # 1 OR 2  
END SHIP FUNCTION
```

If the HDU has been selected, the utility will set the HDU heads in the last track of the disk.

---

### ***Exit Low-Level Format (LLF) Utility***

To exit, press key “8” followed by **ENTER**. This takes the user back to the operating system command level.

The **ERROR MESSAGES** table summarizes the Hexadecimal display code and mnemonic message printed by the PC 6300 during format operations (LOW-LEVEL FORMAT and FORMAT BAD TRACKS). Either of the two displays, depending on the option used, will appear:

```
LOW LEVEL FORMAT FAILED  
PRESS 'ENTER' KEY TO CONTINUE - _
```

or

```
FORMAT BAD TRACK FAILED  
PRESS 'ENTER' KEY TO CONTINUE - _
```

<b>LOW-LEVEL FORMAT ERROR MESSAGE TABLE</b>	
<b>Messages / Explain</b>	<b>Hexadecimal Code</b>
BAD COMMAND	0x01
ADDR MARK NOT FOUND	0x02
SECTOR NOT FOUND	0x04
RESET FAILED	0x05
OPERATION FAILED	0x07
DMA BOUNDARY	0x09
BAD TRACK FLAG	0x0b
BAD ECC ON READ	0x10
ECC CORRECTED DATA	0x11
HDU CONTROLLER FAILURE	0x20
BAD SEEK	0x40
TIME OUT	0x80
UNKNOWN ERROR	0xbb or other
SENSE FAIL	0xff

Some of these error messages (hexadecimal code) are error codes from the Bad Track Table. The message explains the error code.

## CUSTOMER AND SYSTEM TEST ERROR MESSAGES

---

When an error is encountered in either the Customer Test or the System Test, an error message is displayed. Each error message has a 3-digit number associated with it and is interpreted as follows:

**YXX**

Where:

**Y** is the test number as it appears on MENU D. For example: 1 = Motherboard Test.

**XX** is any number from 1 to 99 giving information on the type of error encountered.

Additional information such as status, byte written, byte read, etc., may also be displayed to aid in fault isolation.

### **100—Motherboard Tests**

The 100 series tests are the Motherboard Tests. The error messages for this series of tests are listed below.

**101** CPU Test fail.

**102** Motherboard ROM checksum error.

**103** Data path to LSI chip bad—the error message indicates which LSI chip failed the test.

## DIAGNOSTICS

---

- 104** Calendar chip failed.
- 105** 8259 Interrupt Controller failed functional check.
- 106** 6845 Display Controller failed functional check.
- 107** 8237 DMA Controller failed functional check.
- 108** 765 Floppy Disk Controller failed functional check.
- 109** 8253 Timer failed functional check.
- 110** 8250 Serial Communications Controller failed functional check.
- 111** 8530 Serial Communications Controller failed functional check.
- 112** 8041 Keyboard Controller failed functional check.
- 113** Oscillator compare fail—system oscillator is compared to calendar chip circuit oscillator and the result indicates that one or both of the oscillators are out of specification.
- 114** Speaker circuit failed.
- 115** 8087 Numeric Data Processor failed simple functional check.

- 
- 116** Switches that indicate the present hardware do not agree with the hardware that is present in the system.
  - 117** Keyboard I/O register failed data path check.
  - 118** External ROM checksum error.
  - 119** External ROM self-test fail—the self-test that an external ROM performs on its dependent hardware failed.
  - 120** Nonmaskable interrupt failed.

### **300—Memory Tests**

The 300 series tests are the Memory Tests. The error messages for this series of tests are listed below:

- 301** Addressing test failed.
- 302** Fixed Pattern test failed or hardware parity error.  
(Only detected by the System Test.)
- 303** Marching Pattern test failed or hardware parity error.  
(Only detected by the System Test.)
- 304** Moving Inversion test failed or hardware parity error.  
(Only detected by the System Test.)

- 305** Bus Noise test failed or hardware parity error. (Only detected by the System Test.)
  
- 306** Refresh Circuit Test or hardware parity error. (Only detected by the System Test.)
  
- 310** When a 16-KB block of main memory was copied to the 16-KB buffer memory in the Display Controller RAM, the check on the contents of the Display Controller RAM after the copy indicated that the Display Controller RAM did not contain the same data. The segment of the 16-KB block of main memory that was copied is displayed in the error message. This usually indicates that the Display Controller RAM is bad.
  
- 311** When the 16-KB Display Controller memory buffer was copied back to a 16-KB block of main memory that was just checked, the contents of the two 16-KB blocks were not the same.
  
- 320** When reading a 16-KB block of memory either before or after the block was checked during a memory test, a parity error occurred.
  
- 330** Memory size switches do not agree with the actual memory size that is determined during the memory tests.

---

Additional information such as segment failure, data written (in HEX), and data read (in HEX) may also be displayed. The segment indicates the bank in which the failure occurred. The segment codes for bank locations are listed in Figure 4-4.

<b>SEGMENT CODE</b>	<b>BANK LOCATION</b>
<b>%0000</b>	Motherboard Bank 0
<b>%2000</b>	Motherboard Bank 1
<b>%4000</b>	Expansion Board Bank 0
<b>%6000</b>	Expansion Board Bank 1
<b>%8000</b>	Expansion Board Bank 2

**Figure 4-4. Memory Bank Error Codes**



---

## 400—Keyboard Tests

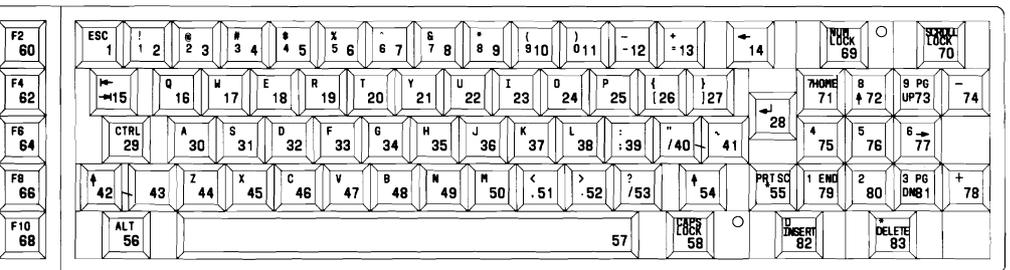
The 400 series tests are the Keyboard Tests. The error messages for this series of tests are listed below:

- 401** Bad 8041 Controller on Motherboard.
- 402** Bad 8039, 8049, or 8749 in the Keyboard, or no Keyboard connected.
- 403** 8039, 8049, or 8749 in the Keyboard indicates a stuck key error. The scan code listed in the error message provides the location of a stuck key.

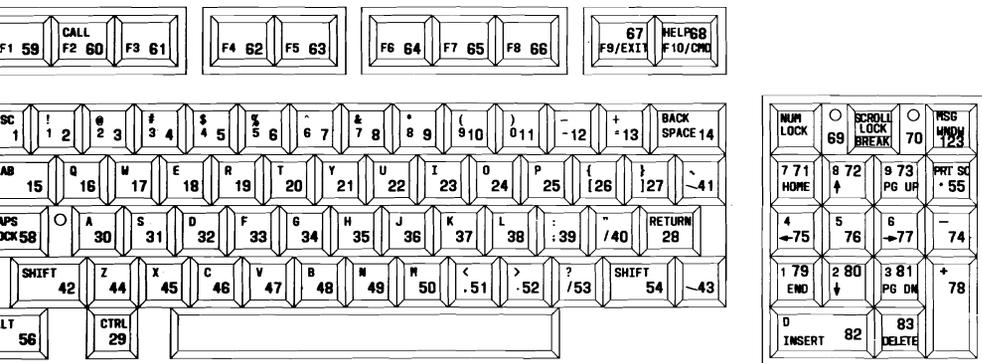
An example of the 83 Key—Keyboard Self-Test Error is as follows:

%001C (faulty scan code)

Transform message from hexadecimal to decimal to locate a stuck key (Figures 4-5 and 4-6).



**Figure 4-5. Model 301 Keyboard Scan Codes**



**Figure 4-6. Model 302 Keyboard Scan Codes**

## DIAGNOSTICS

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- 405** Operator indicated that the test using the Keyboard template on the screen failed. The error applies to the keys on the Keyboard that are not functioning correctly.
- 406** Operator indicated that the LEDs on the Keyboard are not functioning correctly.
- 407** Operator indicated that the Keyboard beep circuit was not functioning correctly.
- 408** Interrupt on keyboard not working (only on System Test).

---

## 500—Video Tests

The 500 series tests are the Video Tests. The error messages for this series of tests are listed below:

### 501 Video Memory failed.

The following message is displayed when an error occurs during the Memory/Word Test (16-bit transfer).

501 - MONOCHROME/COLOR VIDEO SYSTEM					
MEMORY WORD WRITE / READ ERROR					
1	16384	#B800	#7FFE	#5A5A	#FEFE
PASS#	#BAD	SEGMENT	OFFSET	WRITTEN	READ

An explanation of the displayed information follows:

- PASS# = Number of test cycle.
- #BAD = Number of memory words under test.
- SEGMENT = Segment of memory under test.
- OFFSET = Last address of tested memory.
- WRITTEN = Data words written in memory.
- READ = Data read from memory.

## DIAGNOSTICS

---

### 502 Video Controller failed (6845).

The following message is displayed when an error occurs during CRTC Test.

```
502 - MONOCHROME/COLOR VIDEO SYSTEM
      6845 CRTC WRITE / READ ERROR
#0000 #00F4
OUT   IN
```

An explanation of the displayed information follows:

- OUT = Data written to CRTC 6845.
- IN = Data read from CRTC 6845.

### 503 Video Memory failed (byte check mode).

The following message is displayed when an error occurs during the Memory/Byte Test (8-bit transfer).

```
503 - MONOCHROME/COLOR VIDEO SYSTEM
      MEMORY BYTE WRITE / READ ERROR
1     32768 #B800 #7FFF #005A #00FE
PASS# #BAD  SEGMENT OFFSET WRITTEN READ
```

---

An explanation of the displayed information follows:

- PASS# = Number of test cycle.
- #BAD = Number of memory bytes under test.
- SEGMENT = Segment of memory under test.
- OFFSET = Last address of tested memory.
- WRITTEN = Data bytes written in memory.
- READ = Data bytes read from memory.

#### 504 Memory Disk Transfer Test through DMA Operations (only on System Test).

The following message is displayed when an error occurs during the Memory/Disk Transfer Test (data block transfer). This error is detected only for the System Test package.

```

504 - MONOCHROME/COLOR VIDEO SYSTEM
MEMORY/DISK TRANSFER TEST THROUGH DMA OPERATIONS ERROR
1      #4000    #B800    #0      #5555    #FE00
PASS#  #BAD     SEGMENT  OFFSET  WRITTEN  READ

```

An explanation of the displayed information follows:

- PASS# = Number of test cycle.
- #BAD = Number of data bytes to transfer.
- SEGMENT = Segment of memory under test.
- OFFSET = Initial address of memory.
- WRITTEN = Data pattern written in memory.
- READ = Data pattern read from memory.

**Note:** The DMA feature is tested using a diskette to transfer data between the video RAM and the FDU. The following message is displayed when the “Memory/Disk Transfer Test through DMA operation” is running and there is no memory space available on the diskette.

EXECUTION OF MEMORY/DISK TRANSFER TEST NOT POSSIBLE, THE  
DISK IS FULL

The size of the data transfer between video RAM and FDU, using the DMA feature in burst, depends on the space available on the diskette as follows:

- a. Transfer of 1-K bytes if memory space available on diskette is less than 4-K bytes but greater than or equal to 1-K bytes.
- b. Transfer of 4-K bytes if memory space available on diskette is less than 8-K bytes but greater than or equal to 4-K bytes.
- c. Transfer of 8-K bytes if memory space available on diskette is less than 16-K bytes but greater than or equal to 8-K bytes.
- d. Transfer of 16-K bytes if memory space available on diskette is greater than or equal to 16-K bytes.

The subtest is skipped when there is no space available on the diskette. The diskette used with the DMA feature must not be write protected.

---

**510** The ROM character set displayed on the screen was not correct.

The following message appears when the display of characters generated by ROM fails.

```
510 - MONOCHROME/COLOR VIDEO SYSTEM  
      CHARACTER SET ERROR
```

**520** The Grey Scale Test failed.

The following message appears when the display of 16 color/shades of gray bars fails.

```
520 - MONOCHROME/COLOR VIDEO SYSTEM  
      COLOR/GRAY BARS ERROR
```

**530** The Screen Attributes Test failed.

The following message is displayed when the Character Attributes Test fails.

```
530 - MONOCHROME/COLOR VIDEO SYSTEM  
      CHARACTER ATTRIBUTES ERROR
```

## DIAGNOSTICS

---

**540** The 80 by 25 Mode Paging Test failed.

The following message appears when the page display in 80 by 25 alphanumeric mode fails. The “X” in the display identifies the bad page.

```
540 - MONOCHROME/COLOR VIDEO SYSTEM
      80 BY 25 PAGING ERROR
X
BAD PAGE
```

**541** The 40 by 25 Mode Paging Test failed.

The following message appears when the page display in 40 x 25 alphanumeric mode fails. The “Y” in the display identifies the bad page.

```
541 - MONOCHROME/COLOR VIDEO SYSTEM
      40 BY 25 PAGING ERROR
Y
BAD PAGE
```

---

**550** The 640 by 400 Graphics Mode Test failed.

The following message appears when the image display in 640 by 400 graphics mode fails.

```
550 - MONOCHROME/COLOR VIDEO SYSTEM
      640 BY 400 GRAPHICS ERROR
```

**551** The 640 by 200 Graphics Mode Test failed.

The following message appears when the image display in 640 by 200 graphics mode fails.

```
551 - MONOCHROME/COLOR VIDEO SYSTEM
      640 BY 200 GRAPHICS ERROR
```

**552** The 320 by 200 Graphics Mode Test failed.

The following message appears when the image display in 640 by 200 graphics mode fails.

```
552 - MONOCHROME/COLOR VIDEO SYSTEM
      320 BY 200 GRAPHICS ERROR
```

**560** The Color Monitor Degauss Circuit Test failed.

## 600—Parallel Port Tests

The 600 series tests are the Parallel Port Tests. The error messages for this series of tests are listed below:

- 6x1** The data path check to the Parallel Port failed.
- 6x2** The command port test failed (only on System Test).
- 6x3** The status port test failed (only on System Test).
- 6x4** The Parallel Port interrupt circuit failed (only on System Test).

**Note:** x = 0, 1, 2, and 3 for the four possible ports.

A Hexadecimal status byte may also be displayed to aid in fault isolation. The meanings of the status bits are shown below.

PRINTER STATUS BYTE	
Bit 7 = 1	Not Busy
Bit 6 = 1	Not Busy
Bit 5 = 1	Out of Paper
Bit 4 = 1	Selected
Bit 3 = 1	I/O Error
Bit 2 = 1	Not Used
Bit 1 = 1	Not Used
Bit 0 = 1	Time Out

---

## 700—8250 Serial Port Tests

The 700 series tests are the 8250 Serial Port Tests. The error messages for this series of tests are listed below:

- 7x1** Data path check to the 8250 failed.
- 7x2** Transmit/receive failed using the 8250 Internal Loopback Mode.
- 7x3** Transmit/receive failed using the loopback jumper (only on System Test).
- 7x4** 8250 Interrupt Circuit Check failed.
- 7x5** Control lines are not correct using external loopback jumper.

**Note:** x = 0 or 1 for two possible ports.

Status bytes may also be displayed to aid in fault isolation. There are two different interpretations of the bits, depending on the device that is connected to the port.

<b>LINE STATUS BYTE</b>	
Bit 7 = 1	Time Out
Bit 6 = 1	Trans Shift Register Empty
Bit 5 = 1	Trans Holding Register Empty
Bit 4 = 1	Break Detect
Bit 3 = 1	Framing Error
Bit 2 = 1	Parity Error
Bit 1 = 1	Overrun Error
Bit 0 = 1	Data Ready

<b>MODEM STATUS BYTE</b>	
Bit 7 = 1	Received Line Signal Detect
Bit 6 = 1	Ring Indicator
Bit 5 = 1	Data Set Ready
Bit 4 = 1	Clear to Send
Bit 3 = 1	Delta Receive Line Signal Detect
Bit 2 = 1	Trailing Edge Ring Detector
Bit 1 = 1	Delta Data Set Ready
Bit 0 = 1	Delta Clear to Send

---

## 800—MFD Unit Tests

The 800 series tests are the MFD Unit Tests. The error messages for this series of tests are listed below:

- 801** Error during Sequential Write Test.
- 802** Error during Sequential Read Test.
- 803** Error during Funnel-Read and Data Compare Test (only on System Test).
- 804** Error during Verify Diskette (only on System Test).
- 805** Error during Random-Read Test (only on System Test).
- 806** Error during Write-Protect Test (only on System Test).
- 807** Error during Write-Protect Test (only on System Test).
- 808** Error during Head Alignment Test (only on System Test).

## DIAGNOSTICS

---

Status words may also be displayed to aid in fault isolation. The status words for the MFD Unit (800 series) tests are listed in Figure 4-7.

<b>STATUS WORD</b>	<b>MEANING</b>
<b>%0080</b>	Time Out (Drive failed to respond)
<b>%0040</b>	Bad Seek (Seek operation failed)
<b>%0020</b>	Bad 765 (765 Controller has failed)
<b>%0010</b>	Bad CRC (Bad CRC on diskette read)
<b>%0009</b>	DMA Boundary (Attempt to DMA across 64-KB boundary)
<b>%0008</b>	Bad DMA (DMA overrun on operation)
<b>%0004</b>	Record not fnd (Requested sector not found)
<b>%0003</b>	Write Protect (Write attempted on write-protect disk)
<b>%0002</b>	Bad Addr Mark (Address Mark not found)
<b>%0001</b>	Bad Cmd (Bad command passed to diskette I/O)

**Figure 4-7. Floppy Disk Status Word Meanings**

---

## 900—HDU Tests

The 900 series tests are the HDU Tests. The error messages for this series of tests are listed below:

- 901 Drive Ready Test fail.
- 902 Controller Self-Diagnostics fail.
- 903 Controller RAM Test failed.
- 904 Drive Self-Diagnostics failed.
- 905 Surface Verify Test failed.
- 906 Test Cylinder Write/Read Tests failed.
- 907 Seek Test failed.
- 908 Data Pattern Test failed (only on System Test).
- 909 Funnel Test failed (only on System Test).
- 910 Aging Test failed (only on System Test).

## DIAGNOSTICS

---

- 911** Low-Level Format Test failed (only on System Test).
- 912** Write and Verify Surface failed (determines bad block list) (only on System Test).
- 930** Too many bad blocks. (If the HDUs available disk space is less than the nominal value, the drive must be replaced.)
- 931** Bad Block Determination Test failed.
- 932** Track 00 or 01 or 02 or 03 Bad (only on System Test).  
[All of the first four cylinders of the drive (cylinders 0 to 3) must be good.]

Status words may also be displayed to aid in fault isolation. The status words for HDU (900 series) tests are listed in Figure 4-8.

---

<b>STATUS WORD</b>	<b>MEANING</b>
<b>%00FF</b>	Sense Fail (Sense operation failed)
<b>%00BB</b>	Undef Err (Undefined Error occurred)
<b>%0080</b>	Time Out (Device failed to respond)
<b>%0040</b>	Bad Seek (Seek operation failed)
<b>%0020</b>	Bad Cntrl (Controller has failed)
<b>%0011</b>	Data Corrected (ECC Corrected Data Error)
<b>%0010</b>	Bad ECC (Bad ECC on disk read)
<b>%000B</b>	Bad Track (Bad Track Flag Detected)
<b>%0009</b>	DMA Boundary (Attempt to DMA across 64-KB boundary)
<b>%0007</b>	Init Fail (Drive Parameter Activity Fail)
<b>%0005</b>	Bad Reset (Reset Failed)
<b>%0004</b>	Record not fnd (Requested sector not found)
<b>%0002</b>	Bad Addr Mark (Address Mark not found)
<b>%0001</b>	Bad Cmd (Bad command passed to disk I/O error)

**Figure 4-8. HDU Status Word Meanings**

## **10XX—Parallel Printer Tests**

The 10XX series tests are the Parallel Printer Tests. The error messages for this series of tests are as follows:

<b>ERROR</b>	<b>DESCRIPTION</b>
--------------	--------------------

1001	Operator indicated error.
------	---------------------------

1002	Error while printing character.
------	---------------------------------

## **18XX—8087-2 Numeric Co-Processor Tests**

The 18XX series tests are the 8087-2 Numeric Co-Processor Tests.

<b>ERROR</b>	<b>DESCRIPTION</b>
--------------	--------------------

1801	Functional test failed.
------	-------------------------

1802	Mathematical function test failed.
------	------------------------------------

1803	Interrupt test failed.
------	------------------------

---

## **20XX—Mouse Tests**

The 20XX series tests are the Mouse Tests. The error message for this series of tests are as follows:

<b>ERROR</b>	<b>DESCRIPTION</b>
--------------	--------------------

<b>2010</b>	Graphics operation error (operator entered). THIS ERROR IS DETECTED ONLY FOR SYSTEM TEST PACKAGE.
-------------	---

<b>2020</b>	Text operation error (operator entered). THIS ERROR IS DETECTED ONLY FOR SYSTEM TEST PACKAGE.
-------------	---

## **21XX—8530 Serial Port Tests**

The 21XX series tests are the 8530 Serial Port Tests. The error message for this series of tests are as follows:

<b>ERROR</b>	<b>DESCRIPTION</b>
<b>2101</b>	Data path check to the 8530 failed.
<b>2102</b>	Transmit/receive failed using the 8530 internal loopback mode.
<b>2103</b>	Transmit/receive failed using the loopback jumper. <b>THIS ERROR IS DETECTED ONLY FOR SYSTEM TEST PACKAGE.</b>

---

## 23XX—Video Option Board (DEB) Tests

The 23XX series tests are the Video Option Tests. The error message for this series of tests are as follows:

**2301** Plane 0 word memory error.

The following display appears when an error occurs during the Memory/Word Test (16-bit transfer) plane 0.

2301	-	VIDEO	OPTION	BOARD		PLANE	0	MEMORY	WORD	ERROR
1		16384	#A0000			#7FFE		#5ASA		#FFFF
PASS#		#BAD	SEGMENT			OFFSET		WRITTEN		READ

An explanation of the displayed information follows:

- PASS# = Number of test cycle.
- #BAD = Number of memory words under test.
- SEGMENT = Segment of memory under test.
- OFFSET = Last address of tested memory.
- WRITTEN = Data words written in memory.
- READ = Data read from memory.

**DIAGNOSTICS**

---

**2302** Plane 1 word memory error.

The following display appears when an error occurs during the Memory/Word Test (16-bit transfer) plane 1.

```
2302 - VIDEO OPTION BOARD      PLANE 1 MEMORY WORD ERROR
1      16384    #A800    #7FFE    #5A5A    #FFFF
PASS#  #BAD    SEGMENT  OFFSET   WRITTEN  READ
```

An explanation of the displayed information follows:

- **PASS#** = Number of test cycle.
- **#BAD** = Number of memory words under test.
- **SEGMENT** = Segment of memory under test.
- **OFFSET** = Last address of tested memory.
- **WRITTEN** = Data words written in memory.
- **READ** = Data read from memory.

---

**2303** Plane 2 word memory error.

The following display appears when an error occurs during the Memory/Word Test (16-bit transfer) plane 2.

2303 - VIDEO OPTION BOARD	PLANE 2 MEMORY WORD ERROR
1 16384 #B000 #7FFE #5A5A #FFFF	
PASS# #BAD SEGMENT OFFSET WRITTEN READ	

An explanation of the displayed information follows:

- PASS# = Number of test cycle.
- #BAD = Number of memory words under test.
- SEGMENT = Segment of memory under test.
- OFFSET = Last address of tested memory.
- WRITTEN = Data words written in memory.
- READ = Data read from memory.

## DIAGNOSTICS

---

### 2304 Plane 0 word memory error.

The following display appears when an error occurs during the Memory/Word Test (8-bit transfer) plane 0.

2304 - VIDEO OPTION BOARD	PLANE 0 MEMORY BYTE ERROR
1 32768 #A000 #7FFE #005A #00FF	
PASS# #BAD SEGMENT OFFSET WRITTEN READ	

An explanation of the displayed information follows:

- PASS# = Number of test cycle.
- #BAD = Number of memory words under test.
- SEGMENT = Segment of memory under test.
- OFFSET = Last address of tested memory.
- WRITTEN = Data words written in memory.
- READ = Data read from memory.

---

**2305** Plane 1 word memory error.

The following display appears when an error occurs during the Memory/Word Test (8-bit transfer) plane 1.

2305 - VIDE	OPTION BOARD	PLANE 0	MEMORY	BYTE	ERROR
1	32768	#A800	#7FFF	#005A	#00FF
PASS#	#BAD	SEGMENT	OFFSET	WRITTEN	READ

An explanation of the displayed information follows:

- PASS# = Number of test cycle.
- #BAD = Number of memory words under test.
- SEGMENT = Segment of memory under test.
- OFFSET = Last address of tested memory.
- WRITTEN = Data words written in memory.
- READ = Data read from memory.

## DIAGNOSTICS

---

### 2306 Plane 2 word memory error.

The following display appears when an error occurs during the Memory/Word Test (8-bit transfer) plane 2.

2306	-	VIDEO	OPTION	BOARD	PLANE	2	MEMORY	BYTE	ERROR
1		32768	#B000	#7FFF	#005A	#00FF			
PASS#	#BAD	SEGMENT	OFFSET	WRITTEN	READ				

An explanation of the displayed information follows:

- PASS# = Number of test cycle.
- #BAD = Number of memory words under test.
- SEGMENT = Segment of memory under test.
- OFFSET = Last address of tested memory.
- WRITTEN = Data words written in memory.
- READ = Data read from memory.

---

**2307** Plane 0 memory/disk transfer test through DMA operation error. THIS ERROR IS DETECTED ONLY FOR SYSTEM TEST PACKAGE.

The following display appears when an error occurs during the Memory/Disk Transfer Test (data block transfer) plane 0. These errors are only detected for the System Test Package.

```
2307 - VIDEO OPTION BOARD
PLANE 0 - MEMORY/DISK TRANSFER TEST THROUGH DMA
OPERATIONS ERROR
1      1000      #A000      #0      #5555      #FFFF
PASS#  #BAD     SEGMENT   OFFSET   WRITTEN   READ
```

An explanation of the displayed information follows:

- PASS# = Number of test cycle.
- #BAD = Number of data bytes to transfer.
- SEGMENT = Segment of memory under test.
- OFFSET = Initial address of tested memory.
- WRITTEN = Data words written in memory.
- READ = Data pattern read from memory.

**2308** Plane 1 memory/disk transfer test through DMA operation error. THIS ERROR IS DETECTED ONLY FOR SYSTEM TEST PACKAGE.

The following display appears when an error occurs during the Memory/Disk Transfer Test (data block transfer) plane 1. These errors are only detected for the System Test Package.

```
2308 - VIDE0 OPTION BOARD
PLANE 1 - MEMORY/DISK TRANSFER TEST THROUGH DMA
OPERATIONS ERROR
1 #1000 #A800 #0 #5555 #FFFF
PASS# #BAD SEGMENT OFFSET WRITTEN READ
```

An explanation of the displayed information follows:

- PASS# = Number of test cycle.
- #BAD = Number of data bytes to transfer.
- SEGMENT = Segment of memory under test.
- OFFSET = Initial address of memory.
- WRITTEN = Data pattern written in memory.
- READ = Data pattern read from memory.

---

**2309** Plane 2 memory/disk transfer test through  
DMA operation error. THIS ERROR IS  
DETECTED ONLY FOR SYSTEM TEST PACKAGE.

The following display appears when an error occurs during the Memory/Disk Transfer Test (data block transfer) plane 2. These errors are only detected for the System Test Package.

```
2309 - VIDED OPTION BOARD
Plane 2 - MEMORY/DISK TRANSFER TEST THROUGH DMA
OPERATIONS ERROR
1      1000      #B000      #0      #5555      #FFFF
PASS#  #BAD    SEGMENT  OFFSET  WRITTEN  READ
```

An explanation of the displayed information follows:

- PASS# = Number of test cycle.
- #BAD = Number of data bytes to transfer.
- SEGMENT = Segment of memory under test.
- OFFSET = Initial address of tested memory.
- WRITTEN = Data pattern written in memory.
- READ = Data pattern read from memory.

**Note:** The DMA feature is tested using a diskette to transfer data between the video RAM and the FDU. The following message is displayed when the “Memory/Disk Transfer Test through DMA operation” is running and there is no memory space available on the diskette.

EXECUTION OF MEMORY/DISK TRANSFER TEST NOT POSSIBLE, THE  
DISK IS FULL

The size of the data transfer between video RAM and FDU, using the DMA feature in burst, depends on the space available on the diskette as follows:

- a. Transfer of 1-K bytes if memory space available on diskette is less than 4-K bytes but greater than or equal to 1-K bytes.
- b. Transfer of 4-K bytes if memory space available on diskette is less than 8-K bytes but greater than or equal to 4-K bytes.
- c. Transfer of 8-K bytes if memory space available on diskette is less than 16-K bytes but greater than or equal to 8-K bytes.
- d. Transfer of 16-K bytes if memory space available on diskette is greater than or equal to 16-K bytes.

---

**2310** Transparent mode test failure.

The following error message appears when the display of image in "transparent" mode fails:

```
2310 - VIDE0 OPTION BOARD  
TRANSPARENT MODE ERROR
```

**2320** Text/graphics error (640 by 400).

The following error message appears when the display of image in "overlay" mode (DEB 640 by 400 graphics, IND 80 by 25 alphanumeric) fails:

```
2320 - VIDE0 OPTION BOARD  
TEXT / 400 LINE GRAPHICS ERROR
```

## DIAGNOSTICS

---

### **2330** Text/graphics error (640 by 200).

The following error message appears when the display of image in “overlay” mode (DEB 640 by 200 graphics, IND 80 by 25 alphanumeric) fails:

```
2330 - VIDEO OPTION BOARD
      TEXT / 200 LINE GRAPHICS ERROR
```

### **2340** Full graphics display error (640 by 400, 4 planes).

The following error message appears when the display of image in “full graphics” mode (both DEB and IND in 640 by 400 graphics) fails:

```
2320 - VIDEO OPTION BOARD
      FULL GRAPHICS ERROR
```

---

**2350** Partial LUT test error (“littlebit” test).

The following error message appears when the display of image in “reduced LUT” mode fails:

2350 - VIDEO OPTION BOARD  
REDUCED LUT (LITTLEBIT) ERROR

## **24XX—HDU Drive No. 2 Tests**

The 24XX series tests are the HDU Drive No. 2 Tests. The error message for this series of tests are as follows:

<b>ERROR</b>	<b>DESCRIPTION</b>
<b>2401</b>	Drive Ready Test failed.
<b>2402</b>	Controller Self-Diagnostics failed.
<b>2403</b>	Controller RAM Test failed.
<b>2404</b>	Drive Self-Diagnostics failed.
<b>2405</b>	Surface Verify Test failed.

## DIAGNOSTICS

---

- 2406** Test cylinder Write/Read tests failed.
- 2407** Seek Test failed.
- 2408** Data Pattern Test failed.  
THIS ERROR IS DETECTED ONLY FOR  
SYSTEM TEST PACKAGE.
- 2409** Funnel Test Failed.  
THIS ERROR IS DETECTED ONLY FOR  
SYSTEM TEST PACKAGE.
- 2411** Low-Level Format Test failed.  
THIS ERROR IS DETECTED ONLY FOR  
SYSTEM TEST PACKAGE.
- 2412** Write and verify surface failed (this routine  
determines the bad block list).  
THIS ERROR IS DETECTED ONLY FOR  
SYSTEM TEST PACKAGE.
- 2430** Too many bad blocks. (If the HDUs available  
disk space is less than the normal value, the  
drive must be replaced.)
- 2431** Bad Block Determinator Test failed.
- 2432** Track 00 or 01 or 02 or 03 bad. [All of the four  
cylinders of the drive (cylinders 0 to 3) must  
be good.]

Status words may also be displayed to aid in fault isolation. The status words for HDU (2400 series) tests are listed in Figure 4-9.

---

<b>STATUS WORD</b>	<b>MEANING</b>
<b>%00FF</b>	Sense Fail (Sense operation failed)
<b>%00BB</b>	Undef Err (Undefined Error occurred)
<b>%0080</b>	Time Out (Device failed to respond)
<b>%0040</b>	Bad Seek (Seek operation failed)
<b>%0020</b>	Bad Cntrl (Controller has failed)
<b>%0011</b>	Data Corrected (ECC Corrected Data Error)
<b>%0010</b>	Bad ECC (Bad ECC on disk read)
<b>%000B</b>	Bad Track (Bad Track Flag Detected)
<b>%0009</b>	DMA Boundary (Attempt to DMA across 64-KB boundary)
<b>%0007</b>	Init Fail (Drive Parameter Activity Fail)
<b>%0005</b>	Bad Reset (Reset Failed)
<b>%0004</b>	Record not fnd (Requested sector not found)
<b>%0002</b>	Bad Addr Mark (Address Mark not found)
<b>%0001</b>	Bad Cmd (Bad command passed to disk I/O error)

**Figure 4-9. HDU Status Word Meanings**

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<b>GENERAL</b> .....	5-5
Troubleshooting .....	5-5
Replacing Faulty Modules .....	5-5
Reminders .....	5-6
<b>TROUBLESHOOTING WITHOUT SYSTEM TEST</b> .....	5-7
System Will Not Power Up Normally .....	5-7
System Load Check on Power Supply .....	5-9
Short Isolation Procedure .....	5-19
Display Check .....	5-26
Mini-Floppy Disk Unit Check .....	5-28
Two Mini-Floppy Disk Units .....	5-28
One MFD Unit and One HDU .....	5-33
System Will Not Access Hard Disk .....	5-36
Hard Disk Problems .....	5-38
Problems That May Occur in a One/Two Hard Disk Configuration .....	5-39
Placing Low-Level Format and Bad Track Mapping on the Hard Disk .....	5-41
Partition Hard Disk for MS-DOS .....	5-45
Formatting the Hard Disk .....	5-47
Hard Disk Unit "Not Ready" on Cold Start .....	5-50
Resident Diagnostic Error Messages .....	5-51
<b>TROUBLESHOOTING WITH SYSTEM TEST</b> .....	5-54
Motherboard .....	5-55
Random Access Memory (RAM) .....	5-59
Determining Faulty RAM Chips .....	5-65

---

## MAINTENANCE

---

Keyboard .....	5-69
Video System .....	5-73
Parallel Port .....	5-88
Serial Port Test (Using 8250) .....	5-91
Mini-Floppy Disk Drive .....	5-94
Hard Disk Unit .....	5-99
Parallel Printer Test .....	5-105
8087-2 Math Co-Processor .....	5-109
Mouse .....	5-112
Mouse Test .....	5-114
8530 Serial Port Test .....	5-118
Video Option Board (Display Enhancement Board) .....	5-121
Video Option Board Test .....	5-125
Second Hard Disk Unit .....	5-135
<b>STAND-ALONE MOTHERBOARD DMA TEST DIAGNOSTICS .....</b>	<b>5-142</b>
Test Description .....	5-142
Loading DMA Test .....	5-142
Operating Procedures .....	5-143
<b>POWER SUPPLY ADJUSTMENT .....</b>	<b>5-145</b>

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**REPLACING FAULTY**

**MODULES** ..... 5-148

    Removing Upper System Module Cover ..... 5-149

    Removing Lower System Module Cover ..... 5-150

    Replacing Power Supply Unit..... 5-151

    Replacing Fan ..... 5-156

    Replacing Motherboard ..... 5-157

    Replacing Bus Converter ..... 5-161

    Replacing Display Controller ..... 5-162

    Replacing Lower Mini-Floppy Disk Unit ..... 5-168

    Replacing Upper Mini-Floppy Disk Unit ..... 5-175

    Replacing Slim HDU ..... 5-180

    Replacing Memory Expansion Board ..... 5-186

    Replacing HDU Controller ..... 5-187

    Replacing Small Expansion Box (External  
 HDU)..... 5-189

    Replacing Memory Chips ..... 5-193

    Mouse Care and Cleaning ..... 5-198

    Cleaning Keyboard Contacts ..... 5-201

## GENERAL

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This chapter contains procedures to be used in isolating system troubles. Once the faulty module has been determined, procedures are provided for replacing the faulty modules. Procedures are also provided for adjusting power supply output voltage. This is the only module of the AT&T Personal Computer 6300 that may require periodic adjustment.

### Troubleshooting

The method used in troubleshooting the PC 6300 depends on the condition of the system when the power switch is turned ON. If the system is not capable of performing the System Test Diagnostics, the section entitled "Troubleshooting Without System Test" should be used.

If the system is capable of performing the System Test Diagnostics, the section entitled "Troubleshooting With System Test" should be used. These procedures consist of performing specific portions of the System Test Diagnostics, depending on the nature of the trouble. It is assumed that error messages are generated when these tests are performed.

### Replacing Faulty Modules

After the source of trouble has been isolated to a specific module, procedures are provided for the replacement of the faulty module. Appendix B contains a list of the replaceable modules along with ordering information.

## Reminders

During attempts to isolate and resolve system troubles, the System Module must be shifted into various positions to allow access to certain areas. When handling the System Module, care should be taken not to damage its components in any way. If the System Module contains a Hard Disk Unit (HDU), extra care should be taken because the HDU is very sensitive to sudden shocks. The HDU heads should be parked with the "SHIP" command before moving the unit. You must **never** lift the System Module for any reason if power is present on the HDU.

To avoid possible internal damage to the system's circuitry by static electricity, be sure to wear a wrist strap (static discharge strap) that is connected to ground or touch the metal chassis of the system just before you start to handle any circuit boards or chips. Also, avoid touching solder lands and components as much as possible.

When replacing circuit boards, do not remove the new board from its packaging material until it is ready to be installed. After the new board has been installed, the faulty board should be placed in the packaging material as soon as possible.

## **TROUBLESHOOTING WITHOUT SYSTEM TEST**

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This section contains checks that are performed when normal system responses are not received after the power switch is turned ON. If the Resident Diagnostics are performed during power up, a beep is heard to indicate the completion of these tests. If the results of the Resident Diagnostics are displayed and errors are indicated, refer to the "Resident Diagnostic Error Messages" for a list of the error messages and the corrective action to be taken.

If a unit, such as the power supply, display, MFD unit, or HDU is suspected of being faulty, individual checks are provided for these units.

### **System Will Not Power Up Normally**

If the system does not respond normally after the power switch is turned ON, the following indicators and Figure 5-1 may be used to determine the source of the trouble and the action to be taken:

- Display
- Power ON LED
- Fan
- Beep at end of Resident Diagnostics.

<b>INDICATORS</b>	<b>SUGGESTED ACTION</b>
No Display No LED No Fan No Beep	<ol style="list-style-type: none"> <li>1. Verify that power switch is ON.</li> <li>2. Verify that power cord is plugged in at wall outlet and rear panel.</li> <li>3. Verify that 110 V ac is present at wall outlet.</li> <li>4. Check ac cord continuity.</li> <li>5. Remove fan cover. Check leads for 110 V ac. If YES, replace fan.</li> <li>6. Refer to "System Load check on on PS."</li> </ol>
No Display No LED Fan Okay No Beep	Refer to "Power Supply Check."
No Display No LED Fan Okay Beep Okay	<ol style="list-style-type: none"> <li>1. Verify that +2 and 0 volts are present on the LED leads. If the leads have +5 and 0 volts present, the LED is bad and the Motherboard must be replaced.</li> <li>2. Refer to "Display Check."</li> </ol>
No Display LED Okay Fan Okay Beep Okay	Refer to "Display Check."
Display Okay LED Okay Fan Okay No Beep	<ol style="list-style-type: none"> <li>1. Verify the setting of DIPSW-0, switch 8, agrees with the type of ROM installed (2732 or 2764).</li> <li>2. Replace Bus Converter Board.</li> <li>3. Replace Display Controller Board.</li> <li>4. Replace Motherboard.</li> </ol>
No Display LED Okay Fan Okay No Beep	Replace the Motherboard.

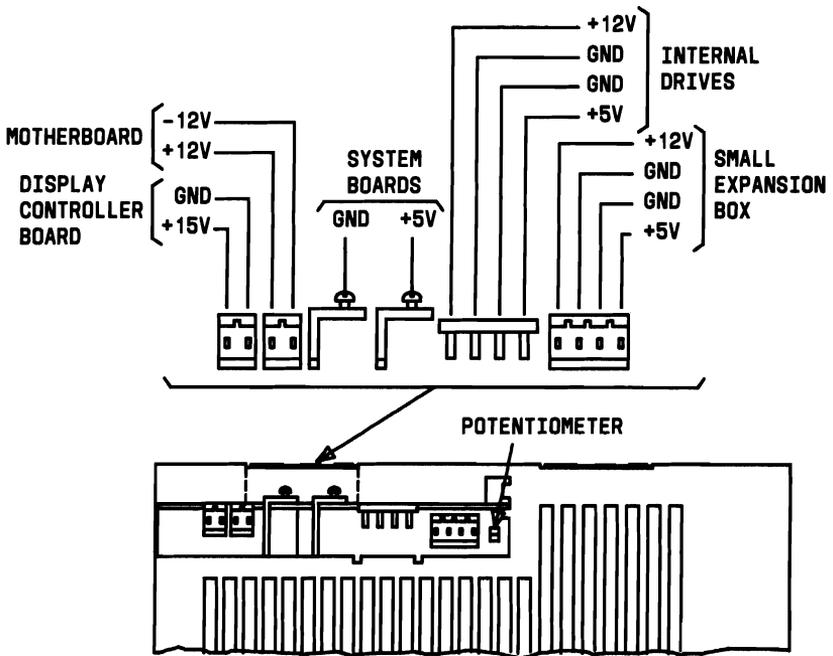
**Figure 5-1. Troubleshooting Without System Test**

## **System Load Check on Power Supply**

This procedure contains both procedural steps and questions. Where questions are asked, responses for both YES and NO answers are provided.

1. Turn the power switch OFF.
2. Loosen the two screws that secure the upper cover.
3. Slide the upper cover forward approximately 0.5 inch and lift it from the System Module.
4. Note where and how the power cables are connected to the power supply, then disconnect each power cable from the power supply.

5. Place the volt-ohmmeter (VOM) leads on +5 and GND screw terminals of the power supply (10 volts or greater scale—observe polarity) (Figure 5-2).



**Figure 5-2. Power Supply Connectors**

---

6. Turn the power switch ON and verify that the fan is running. If the fan is not running, the ac voltage is not present on the power supply.

7. Does VOM indicate +5 volts (+4.75—+5.25 volts)?

**YES** Reconnect all of the power cables to the power supply. Proceed to Step 8 and continue the procedure to determine if the power supply is being loaded down.

**NO** If the voltage was not within tolerance, refer to "Power Supply Adjustment." If there was **NO** voltage present on the terminals, replace the power supply.

8. Turn the power switch OFF.

**Note:** During the remainder of this procedure, the power switch is turned ON and OFF many times. It is very important that it remain OFF at *least* 30 seconds before turning it back ON.

9. Place the VOM leads across +5 and GND screw terminals of power supply (10 V dc or greater scale—observe polarity).

10. Turn the power switch ON. (Wait 30 seconds before power up.)

## MAINTENANCE

---

11. Does the VOM indicate +5 volts (+4.75—+5.25 volts)?

**YES** Power supply okay. Exit power supply check.

**NO** Continue.

12. Turn the power switch OFF.

13. Loosen the screws securing the +5 (red) and GND (black) cables to the power supply and remove the cables.

14. Place the VOM leads across +5 and GND screw terminals of the power supply (10-volts dc or greater scale—observe polarity).

15. Turn the power switch ON. (Wait 30 seconds before power up.)

16. Does the VOM indicate +5 volts (+4.75—+5.25 volts)?

**YES** Refer to “Short Isolation Procedure.”

**NO** Continue.

17. Turn the power switch OFF.

18. Reconnect all the power cables to the power supply.

19. Unplug the keyboard from the rear panel.
20. Turn the power switch ON. (Wait 30 seconds before power up.)
21. Does the VOM indicate +5 volts (+4.75—+5.25 volts)?  
  
    **YES**    Replace keyboard.  
  
    **NO**     Continue.
22. Turn the power switch OFF.
23. Unplug display from the rear panel.
24. Turn the power switch ON. (Wait 30 seconds before power up.)
25. Does the VOM indicate +5 volts (+4.75—+5.25 volts)?  
  
    **YES**    Replace display.  
  
    **NO**     Continue.
26. Turn the power switch OFF.

27. Unplug +15 V dc Display Controller power cable from the power supply (Figure 5-3).

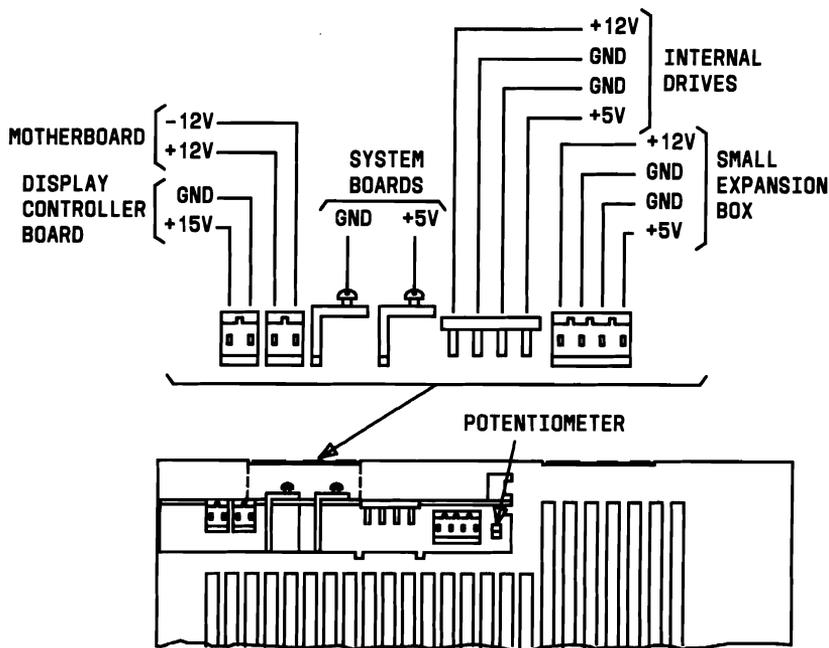


Figure 5-3. Power Supply Connectors

28. Turn the power switch ON. (Wait 30 seconds before power up.)

29. Does the VOM indicate +5 volts (+4.75—+5.25 volts)?

**YES** Check the Display Controller power cable for continuity. If continuity is okay, replace the Display Controller Board.

**NO** Continue.

30. Turn the power switch OFF.

31. Plug +15 V dc Display Controller power cable into the power supply.

32. Unplug +12, -12 V dc Motherboard power cable from the power supply.

33. Turn the power switch ON. (Wait 30 seconds before power up.)

34. Does the VOM indicate +5 volts (+4.75—+5.25 volts)?

**YES** Check the Motherboard power cable for continuity. If continuity is okay, replace the Motherboard.

**NO** Continue.

35. Turn the power switch OFF.

---

## MAINTENANCE

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36. Plug +12, -12 V dc Motherboard power cable back into the power supply.
37. Is Small Expansion Box (External HDU) present?
- YES** Continue.
- NO** Go to Step 41.
38. Unplug Small Expansion Box (External HDU) power cable from the power supply.
39. Turn the power switch ON. (Wait 30 seconds before power up.)
40. Does the VOM indicate +5 volts (+4.75—+5.25 volts)?
- YES** Replace Small Expansion Box.
- NO** Continue.
41. Turn the power switch OFF.
42. Plug Small Expansion Box (External HDU) power cable back into the power supply.
43. Use a screwdriver to unlock the drive assembly and slide it forward enough to gain access to the power cables.

44. Unplug the power cable from the rear of the MFD Unit A (lower MFD Unit).

45. Turn the power switch ON. (Wait 30 seconds before power up.)

46. Does the VOM indicate +5 volts (+4.75—+5.25 volts)?

**YES** Check the continuity of the MFD Unit A power cable. If continuity is okay, replace the MFD Unit A.

**NO** Continue.

47. Turn the power switch OFF.

48. Plug the power cable back into the rear of the MFD Unit A.

49. Is the MFD Unit B present?

**YES** Continue.

**NO** Go to Step 53.

50. Unplug the power cable from the rear of the MFD Unit B.

51. Turn the power switch ON.

---

## MAINTENANCE

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52. Does the VOM indicate +5 volts (+4.75—+5.25 volts)?

**YES** Check the MFD Unit B power cable for continuity. If continuity is okay, replace the MFD Unit B.

**NO** Continue.

53. Turn the power switch OFF.

54. Plug the power cable back into the rear of the MFD Unit B.

55. Is Slim HDU present?

**YES** Continue.

**NO** Replace the power supply.

56. Unplug the power cable from the rear of the Slim HDU.

57. Turn the power switch ON.

58. Does the VOM indicate +5 volts (+4.75—+5.25 volts)?

**YES** Check Slim HDU power cable for continuity. If continuity is okay, replace Slim HDU.

**NO** Replace the power supply.

### ***Short Isolation Procedure***

This procedure contains both procedural steps and questions. Where questions are asked, responses are provided for both YES and NO answers.

1. Turn the power switch OFF.
2. Loosen the screws securing the +5 and GND cables to the power supply and remove the cables.
3. Attach the VOM to the +5 and GND cables. (Use ohms R x 1 scale.)
4. Does the meter read 0 ohms?

**YES** Continue.

**NO** Return to "Power Supply Check."

5. Remove an option board from the Bus Converter Board.
6. Does the VOM indicate 7 ohms or more after the option board has been removed?

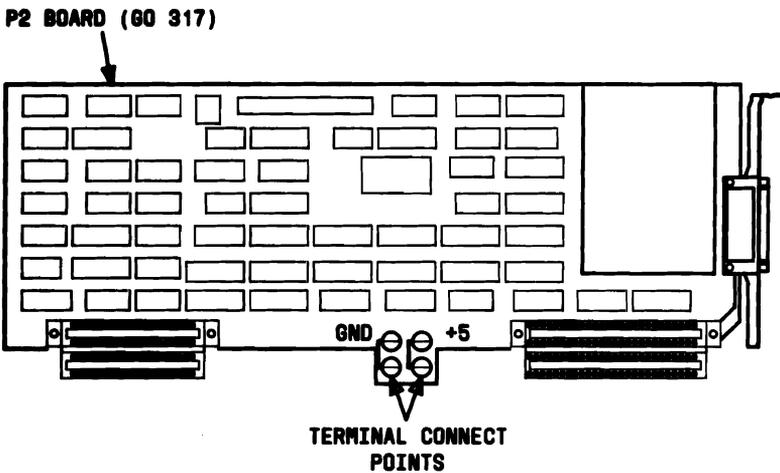
**YES** Replace the option board just removed and continue.

**NO** Continue.

## MAINTENANCE

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7. Repeat Steps 5 and 6 until all optional boards have been removed from the Bus Converter Board.
8. Remove Display Controller Board.
9. Place the VOM across +5 and GND terminal connect points on Display Controller Board (Figure 5-4).



**Figure 5-4. Display Controller Boards (Sheet 1 of 2)**

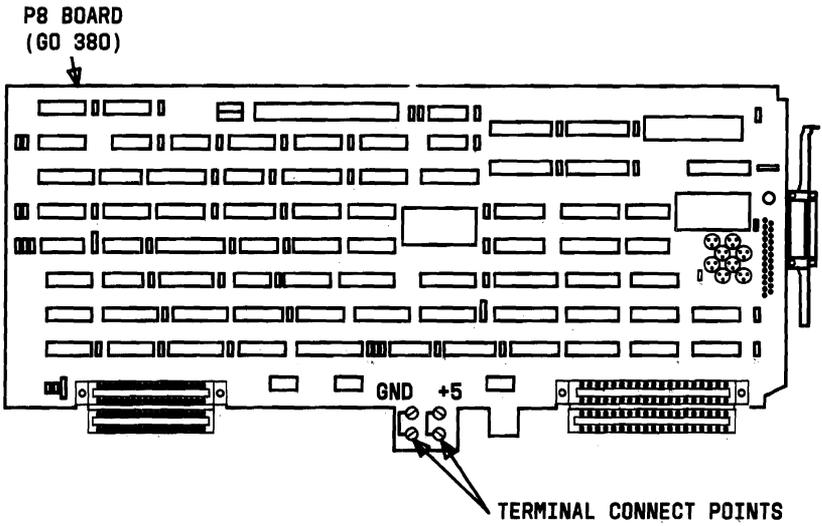
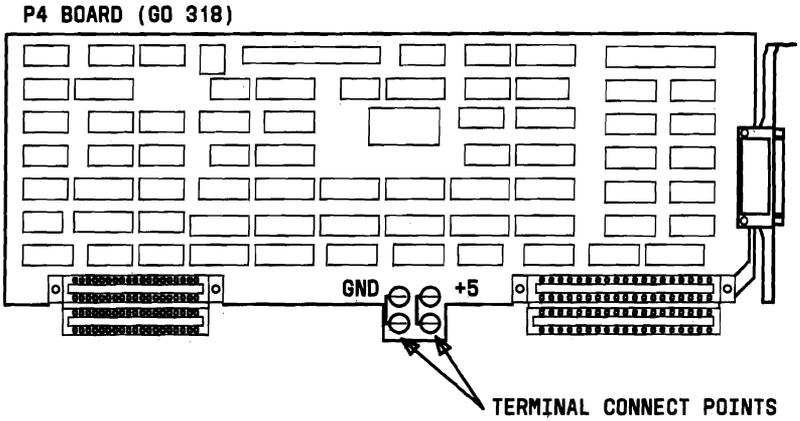


Figure 5-4. Display Controller Boards (Sheet 2 of 2)

## MAINTENANCE

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10. Does the VOM indicate 7 ohms or more?

**YES** Continue.

**NO** Replace the Display Controller Board.

11. Place the VOM across +5 and GND terminal connect points on Bus Converter Board (Figure 5-5).

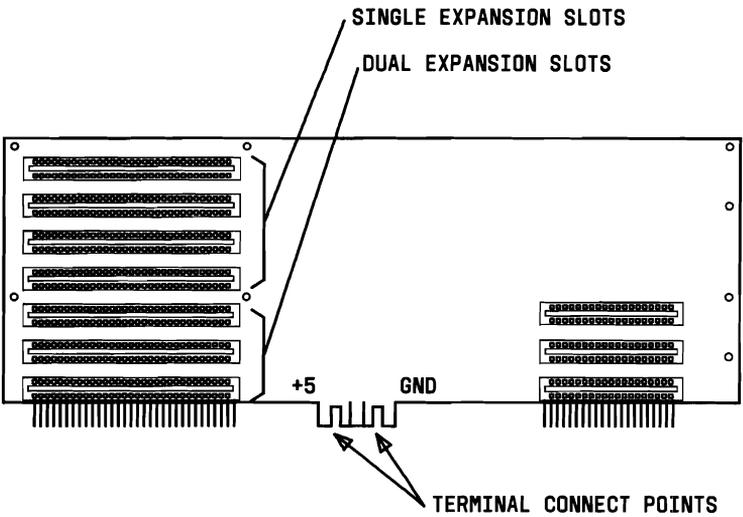
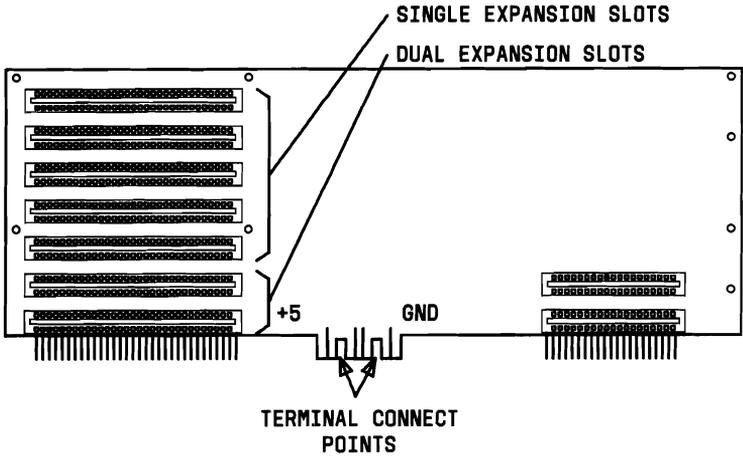


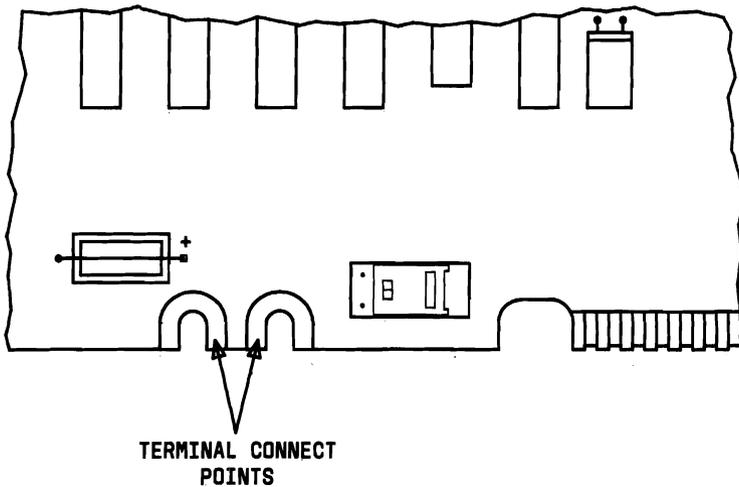
Figure 5-5. Bus Converter Boards

12. Does the VOM indicate 7 ohms or more?

**YES** Continue.

**NO** Replace the Bus Converter Board and continue.

13. Place the VOM across +5 and GND terminal connect points on the Motherboard (Figure 5-6).



**Figure 5-6. Motherboard +5 and GND Connect Points**

14. Does the VOM indicate 7 ohms or more?

**YES** No short found on the boards. Return to the  
"Power Supply Check."

**NO** Replace the Motherboard.

## Display Check

1. Verify that the Contrast and Brightness controls on the display are rotated fully clockwise.
2. Verify that the display cord is securely plugged into the connector on the rear panel.
3. Verify that +15 V dc is present on the power supply connector for the Display Controller (Figure 5-7).

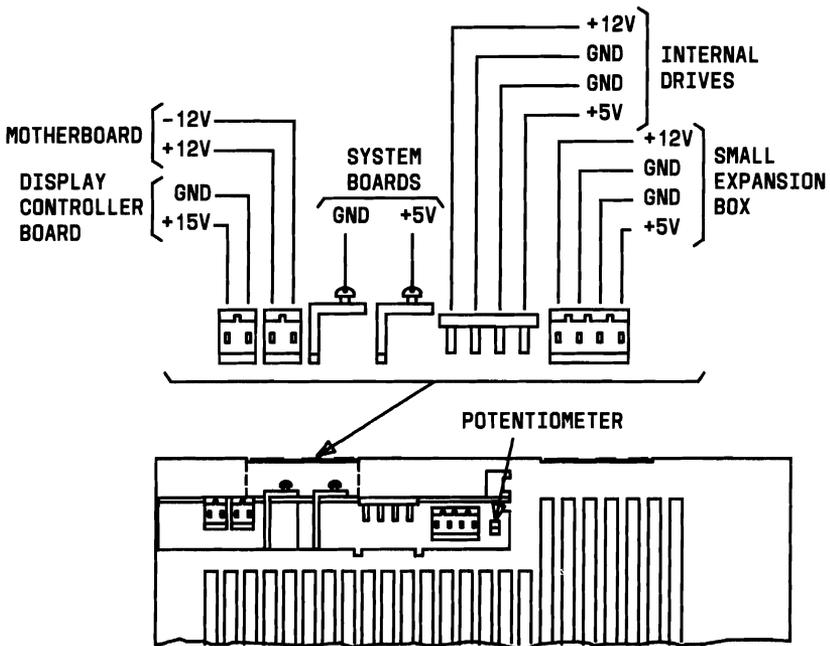


Figure 5-7. Power Supply Connectors

4. If +15 V dc is not present, refer to "Power Supply Check."
5. If +15 V dc is present, replace:
  - a. Display
  - b. Display Controller Board
  - c. Motherboard.

## **Mini-Floppy Disk Unit Check**

Often the Mini-Floppy Disk Units are suspected to be faulty because there are problems in loading the Operating System or an application program from a diskette. The process of troubleshooting this problem depends on the drive configuration: two MFD Units or one MFD Unit and one HDU.

### ***Two Mini-Floppy Disk Units***

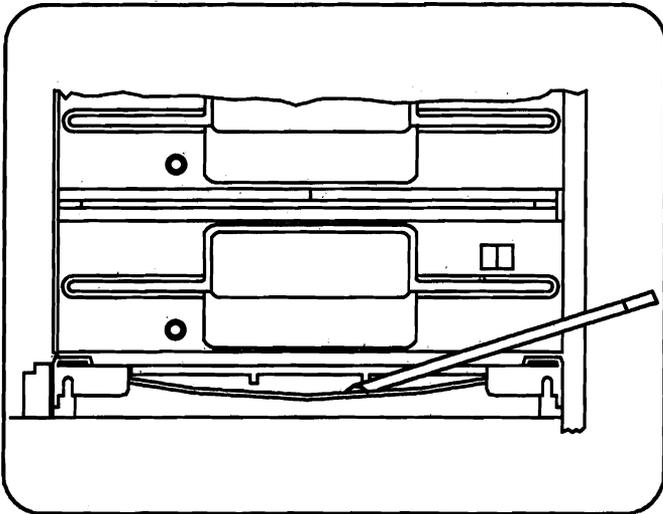
This procedure contains both procedural steps and questions. Where Questions are asked, responses are provided for both YES and NO answers.

1. Turn the power switch OFF.
2. Insert a new Operating System Diskette into the MFD Unit A.
3. Turn the power switch ON.
4. Did the Operating System Boot from the new Diskette?

**YES** Original Operating System Diskette was faulty.  
Replace with new one.

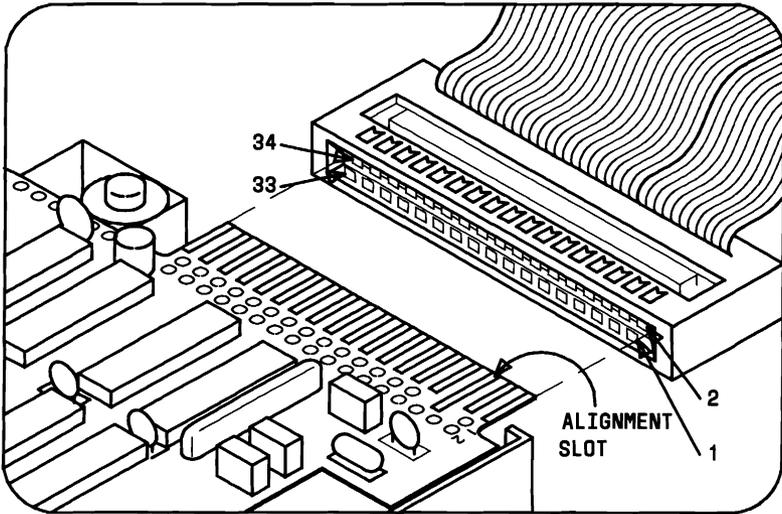
**NO** Continue.

- 
5. Turn the power switch OFF.
  6. Loosen the two screws that secure the upper cover.
  7. Slide the upper cover forward approximately 0.5 inch and lift it from the System Module.
  8. Unlock the drive assembly using a screwdriver and slide it forward enough to gain access to the cables (Figure 5-8).



**Figure 5-8. Unlocking Drive Assembly**

9. Unplug the signal cables from both MFD Units and note how the cable for the MFD Unit A (lower MFD Unit) is twisted before connecting to the MFD Unit. The MFD Unit into which this connector is plugged is defined as MFD Unit A.
10. Plug the twisted (MFD Unit A) connector into the MFD Unit B. The MFD Unit B becomes MFD Unit A (Figure 5-9).



**Figure 5-9. Connecting Signal Cable to MFD Unit**

11. Remove the new Operating System Diskette from the MFD Unit A and place it into MFD Unit B.
12. Turn the power switch ON.
13. Did the Operating System Boot from the MFD Unit B?  
  
    **YES** MFD Unit A is faulty. Replace the MFD Unit A.  
  
    **NO** Continue.
14. Turn the power switch OFF.
15. Remove the power cable from the MFD Units and the power supply and check it for continuity.
16. Is continuity okay?  
  
    **YES** Continue.  
  
    **NO** Replace the power cable.
17. Inspect the Signal Cable from the Motherboard. (It may be necessary to remove the Lower System Module Cover to unplug the cable from the Motherboard.)

18. Does the Signal Cable appear to be in good condition?

**YES** Continue.

**NO** Replace the MFD Unit Signal Cable with a new one and attempt to boot the Operating System.

19. Replace the cables back to their original position.

20. Slide drive assembly back until it is locked into place.

21. Refer to "Power Supply Check."

22. If the power supply is operating properly, replace the Motherboard.

***One MFD Unit and One HDU***

This procedure contains both procedural steps and questions. Where questions are asked, responses are provided for both YES and NO answers.

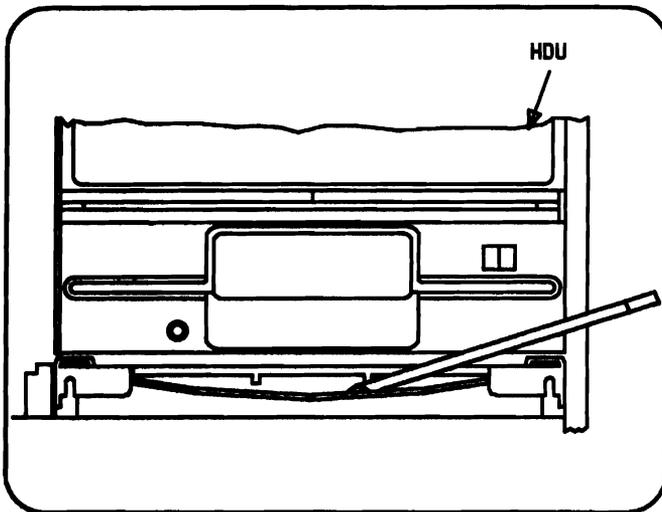
1. Turn the power switch OFF.
2. Insert a new Operating System Diskette into the MFD Unit A (lower MFU Unit).
3. Turn the power switch ON.
4. Did the Operating System boot from the new Diskette?

**YES** Original Operating System Diskette was faulty.  
Replace with a new one.

**NO** Continue.

5. Turn the power switch OFF.
6. Loosen the two screws that secure the upper cover.
7. Slide the upper cover forward approximately 0.5 inch and lift it from the System Module.

8. Unlock the drive assembly and slide the assembly forward enough to gain access to the cables (Figure 5-10).



**Figure 5-10. Unlocking Drive Assembly**

9. Remove the power cable from the MFD Unit and power supply and check it for continuity.

10. Is continuity okay?

**YES** Continue.

**NO** Replace the power cable with a new one and attempt to boot the Operating System.

11. Inspect the MFD Unit signal cable. (It may be necessary to remove the Lower System Module Cover to unplug the cable from the Motherboard.)

12. Does the signal cable appear to be in good condition?

**YES** Continue.

**NO** Replace the signal cable with a new one and attempt to boot the Operating System.

13. Replace the cables back to their original position.

14. Slide the drive assembly back to the locked position.

15. Refer to "Power Supply Check."

16. If the power supply is operating properly, replace the MFD Unit.

17. If the Operating System does not boot after replacing the MFD Unit, replace the Motherboard.

---

## ***System Will Not Access Hard Disk***

***Caution: This will destroy ALL data stored on the HDU.***

A unit that has just been received, transported to a new location, or equipped with a new HDU may experience trouble accessing the HDU (drive C). This becomes apparent when the system will not boot from drive C or recognizes it as being a non-DOS partitioned disk. This is probably the result of rough handling during shipment or transporting of the unit and is an indication that the HDU heads may be misaligned. Even though the HDU cannot be read from or written to, the Resident Diagnostics will show the HDU (Fixed Disk) status as Ready. The first fix attempt in the case of a previously bootable Hard Disk, which is no longer accessible, is to try to retransfer the Operating System to the Hard Disk Unit by means of the SYS command present in your MS-DOS system diskette. This may recover any lost data from one of the first tracks on the Hard Disk. If this fails, then try reformatting the HDU to clear the problem.

If the HDU problem is the result of the heads becoming misaligned, the following message may be received when trying to read or write to the Hard Disk:

```
Non-DOS disk error reading drive C
Abort, Retry, Ignore? _
```

There are three basic steps that can be taken in an attempt to clear this HDU problem:

- a. Place low-level format on HDU (System Test Diagnostics).
- b. Build MS-DOS partitions on the HDU (**fdisk** command).
- c. Reformat the HDU (**format** command with **\s** option).

If these steps do not produce a usable HDU, the HDU must be replaced.

The following sections contain step-by-step procedures to resolve the above HDU problem.

## Hard Disk Problems

If you are experiencing Hard Disk Problems, these may be solved using the following procedures. If the problem still exists, the Hard Disk will have to be replaced.

**Note:** Hard Disks with a bad track among the first four-tracks of the drive (0-3 tracks) cannot be used by MS-DOS 3.1. The HDU must be replaced.

### Problems During Power-Up Diagnostics:

1. FIXED DISK: NOT PRESENT or NOT READY
  - a. Check all cables, power, data, and control to make sure they are properly connected.
  - b. Do the "Cold Start" procedure: toggle the ON/OFF switch quickly to make sure the drive spins up fast enough to be recognized.
  - c. Replace the HDU.
2. FIXED DISK: PRESENT or READY but cannot access
  - a. Check data cable connection on the HDU.
  - b. Run the **fdisk** procedure to check the disk partitions.

- c. Reformat the Hard Disk.
- d. **LOW-LEVEL FORMAT:** Refer to section “Placing Low-Level Format and Bad Track Mapping on Hard Disk.”
- e. If these procedures do not work—change out the Hard Disk.

### **Problems That May Occur in a One/Two Hard Disk Configuration**

The following is a list of problems and symptoms that may occur in a one or two Hard Disk Configuration:

1. If a PC 6300, with two Hard Disks when booted, only gets one disk ready, check the following:
  - a. The drive select switch on the second HDU is set to drive 1.
  - b. The cables are connected properly.
  - c. The terminating resistor on drive 1 was not removed. (The last drive on the chain should be the only one with a terminating resistor.)

2. If when running **fdisk** the user gets two drives of the same cylinder size, even though the drives are of different capacities, check the following:
  - a. The switch settings on the controller are not set properly for drive 2.
  - b. The version of DOS you are using is before Release 1.1 (Version 2.11).
3. When running the low-level utility under the system diagnostics test, the configuration should show test series 900.
4. If the configuration shows test 2400, check that the drive select switch on the first HDU is set to drive 2.
5. When formatting a drive larger than 32 MB, a 9 MB formatted DOS partition is produced due to the way MS-DOS handles drives larger than 32 MB. In releases of MS-DOS before 3.2, the maximum drive size is 32 MB. This is to be fixed in DOS 3.2 and higher.
6. When two drives are connected to the PC 6300 (ROM BIOS 1.21 or earlier), the second disk is not recognized on startup unless the reset switch is pressed. To remedy this, install ROM BIOS 1.43 and check the switch (or jumper) settings on the controller.
7. If the Hard Disks installed are not being recognized during execution of resident diagnostics (ROM BIOS version 1.21 and later), check the DIPSW-1 Switch 3.

---

## Placing Low-Level Format and Bad Track Mapping on the Hard Disk

***Caution: It must be understood that this procedure will destroy ALL data stored on the HDU.***

1. Before running System Diagnostics, you must get the bad track table listing located on top of the HDU.
2. Turn off the System Module and all external devices.
3. Unplug the ac power cable from the rear panel.
4. Loosen the two screws that secure the upper cover.
5. Slide the upper cover forward approximately 1/2 inch and lift it from the System Module.
6. Look at the top of your HDU for a piece of paper with data. This is the HDU error map which designates the cylinder number and head number for each bad track found by the HDU manufacturer.
7. Write down each cylinder number and head number pair on a piece of paper.
8. Replace the upper System Module cover and tighten the two screws on the rear panel. Connect the ac power cable to the ac wall outlet.

## MAINTENANCE

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9. Insert the MS-DOS System diskette into drive A.
10. Turn the power switch ON and verify that the Operating System is booted.
11. Insert the System Diagnostics diskette into drive A.
12. Type SYSTEM and press Return.
13. From the System Diagnostic Menu, type 0 and Execute Test Once and press Return.
14. The list of installed hardware along with IS LIST OF HARDWARE CORRECT? is displayed.
15. Verify by typing y and press Return. The verified list of the hardware is displayed along with information on performing all tests or individual tests.
16. Select the HDU DRIVE AND CONTROLLER Test by typing 9 followed by pressing Return. PAUSE ON ERROR? is displayed.
17. Type y and press Return. NUMBER OF RETRIES ON HDU ERROR? (0 TO 5) along with ENTER DESIRED ACTION is displayed.
18. Type 5 and press Return. The list of HDU TEST SELECTIONS is displayed along with ENTER SELECTIONS(S).

- 
19. Select the Low-Level Format routine by typing **12** followed by pressing Return. A message is displayed warning that **TEST #12 ERASES ALL FILES** and asks, "DO YOU WANT TO DO TEST #12?"
  20. Type **1234** and press Return. The format routine will take about 5 minutes. When the routine is complete, "DO YOU WANT TO EDIT THE BAD TRACK TABLE?" is displayed. (This procedure must be done.)
  21. Type **y** and press Return. Select the option **ADD BAD TRACK(S) TO TABLE** by typing **1** followed by pressing Return. **ENTER CYLINDER #** is displayed.
  22. Enter the cylinder # of one of the bad tracks that you jotted down in Step 7 and press Return. **ENTER HEAD #** is displayed.
  23. Enter the head # associated with the cylinder # of the bad track and press Return.
  24. Continue Steps 22 and 23 until you have entered all the bad tracks you jotted down in Step 7. When done, press Return when prompted for the cylinder #.
  25. Select the option **DISPLAY BAD TRACK TABLE** by typing **3** followed by pressing Return.

**Note:** A message will be displayed to consult the service manual when attempting to recuperate Hard Disks with one of its first four bad tracks. The tracks (0-3) are essential to permit MS-DOS operations. Any HDU which reports a bad track among its first four tracks may not be recuperated and, therefore, must be replaced. The error message displayed is as follows:

BAD DISK DRIVE—CONSULT SERVICE MANUAL

26. Verify that you have entered all data correctly. Correct any mistakes by deleting and adding the changed data.
27. Select the FINISHING EDITING (PROCEED WITH FORMATTING) option by typing **0** followed by pressing Return. Wait for the HDU test menu to be redisplayed. This will occur when all bad tracks are marked. Any additional bad tracks present on HDU, but not noted on the HDU error map, will now be looked for and entered in the bad track table.
28. Select the VERIFY SURFACE option by typing **5** followed by pressing Return. This test will take about 12 minutes.
29. Select the FORMAT BAD TRACKS option by typing **15** followed by pressing Return. This will mark any bad tracks found by the VERIFY SURFACE test.

- 
30. Type **1234** and press Return. The message, "DO YOU WANT TO EDIT THE BAD TRACK TABLE?" is displayed. Type **n** and press Return.
  31. Select the option RETURN TO THE MAIN MENU by typing **0**, followed by pressing Return. The message "DO YOU WISH TO DISPLAY BAD TRACK TABLE?" is displayed. Type **n** and press Return.
  32. From the TESTING OPTION MENU, type **4 EXIT DIAGNOSTIC PROGRAM**.
  33. Remove System Test diskette from drive A. Insert the MS-DOS System Diskette and reboot the system.

### ***Partition Hard Disk for MS-DOS***

1. Insert the MS-DOS System Diskette into drive A.
2. Enter the **fdisk** command.
3. The **fdisk** options are then displayed. Select option 1 (default) by pressing the **ENTER** key.

4. The screen should look like this for the 10-MB Hard Disk:

```
Create MS-DOS Partition

No partition defined

Total disk space is 305 cylinders.

Do you wish to use the entire fixed
disk for MS-DOS (Y/N).....?[Y]
```

**Note:** The line in the previous screen (Total disk space is 305 cylinders) will read 612 cylinders when a 20-MB Hard Disk is used.

5. Press the **ENTER** key to indicate YES (default) that the entire fixed disk is to be used by MS-DOS.
6. The screen should now look like this for the 10-MB Hard Disk:

```
Create MS-DOS Partition

Partition Status  Type Start End Size
      1           A   DOS     0 304 305

Total disk space is 305 cylinders.
The current active partition is 1

Press Esc to return to FDISK Options.[_]
```

- 
7. The screen should now look like this for the 20-MB Hard Disk:

```
Create MS-DOS Partition

Partition Status  Type Start End Size
      1          A   DOS      0 611 612

Total disk space is 612 cylinders.
The current active partition is 1

Press Esc to return to FDISK Options.[_]
```

8. The HDU is now partitioned for use by MS-DOS. Press the ESC key twice to return to MS-DOS.

### ***Formatting the Hard Disk***

1. When the A> prompt is received, enter:

```
A> format c: /s
Press any key to begin formatting C: _
```

and press any key to begin formatting the HDU (drive C).

2. While the HDU is being formatted, the message "Formatting..." is displayed. When formatting is completed, the screen should look like this for the 10-MB Hard Disk:

```
Formatting...Format Complete
System transferred

10592256 bytes total disk space
  49152 bytes used by system
10543104 bytes available on disk

A>_
```

**Note:** The numbers shown above and what you actually see on the screen may differ slightly.

When formatting is completed, the screen should look like this for the 20-MB Hard Disk:

```
Formatting...Format Complete
System transferred

21217280 bytes total disk space
  40960 bytes used by system
21176320 bytes available on disk

A>_
```

3. Remove the MS-DOS System Diskette from drive A.

At this point, you should be able to boot MS-DOS from the HDU. If the system will not boot from the HDU, enter the command **dir c:** in an attempt to read the contents of the HDU. If this is successful, reformat the HDU (**format c: /s**) and try booting the Operating System again. If this is unsuccessful (cannot read drive C), replace the HDU.

## **Hard Disk Unit “Not Ready” on Cold Start**

If the Resident Diagnostics indicate that the HDU (Fixed Disk) is not ready after the power switch is turned ON, this HDU may be the victim of a design problem. This design problem has been resolved and the replacement units have the fix incorporated. This problem is present only on cold starts (when the computer has been OFF for a little while and the power switch is turned ON). This can be verified as follows:

1. After the computer has been OFF for a few minutes, turn the power switch ON.
2. If the Resident Diagnostics indicates the Fixed Disk is “Not Ready,” turn the power switch OFF and then immediately turn it back ON.
3. If the Resident Diagnostics now indicates the Fixed Disk is “Ready,” it is a good possibility the HDU is defective and should be replaced.

---

## Resident Diagnostic Error Messages

Figure 5-11 lists the Resident Diagnostic error messages, the probable cause of the error, and the suggested action to be taken.

<b>ERROR MESSAGE</b>	<b>PROBABLE CAUSE</b>	<b>SUGGESTED ACTION</b>
CPU (i8086) Fail	Defective 8086 CPU	Replace Motherboard
ROM Fail	ROM Failure	Replace Motherboard
DMA Timer Fail	Timer Channel 1 Failure	Replace Motherboard
DMA Control	DMA Controller Failure	Replace Motherboard
Interrupt Fail	Software Interrupt Failure	Replace Motherboard
Interrupt Fail H0	Timer Channel 0 Failure	Replace Motherboard
Interrupt Fail H1	Keyboard Controller Failure	Replace Motherboard
Interrupt Fail H2	I/O Board Failure	Replace Motherboard
Interrupt Fail H3	I/O Board Failure	Replace Motherboard
Interrupt Fail H4	Serial Interface Failure	Replace Motherboard
Interrupt Fail H5	I/O Board Failure	Replace Motherboard

**Figure 5-11. Resident Diagnostic Error Messages  
(Sheet 1 of 2)**

**MAINTENANCE**

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<b>ERROR MESSAGE</b>	<b>PROBABLE CAUSE</b>	<b>SUGGESTED ACTION</b>
Interrupt Fail H6	Floppy Controller Failure	Replace Motherboard
Interrupt Fail H7	Parallel Port Failure	Replace Motherboard
RT Clock Fail	Clock/Calendar Chip Failure	Replace Motherboard
RT Clock Fail: NR	8253 Interrupt Failure	Replace Motherboard
RT Clock Fail: LO	8253 low-end Failure	Replace Motherboard
RT Clock Fail: HI	8253 high-end Failure	Replace Motherboard
XXX RAM Fail	RAM Failure	Perform System Test Diagnostics Memory Tests
Floppy (A:) Not Ready	See Note 1.	See Note 1.
Fixed Disk Not Present	See Note 2.	See Note 2.

See notes on the following page.

**Figure 5-11. Resident Diagnostic Error Messages  
(Sheet 2 of 2)**

---

**Note 1:** This error message will be displayed if a diskette is not present in the MFD Unit. If diskette is present, check the MFD Unit power and signal cables and verify that they are connected properly and then check to see if the cables are in good condition. If cables are okay, replace MFD Unit. If an error message is still received, the MFD Controller is faulty; replace the Motherboard.

**Note 2:** This error message will be displayed if the control cable is not connected properly. Check control cable for proper connections. Refer to procedures for replacing HDU for information on the connection of the cables. If cables are okay, the problem resides in either the HDU Controller, Bus Converter, or HDU, respectively.

# TROUBLESHOOTING WITH SYSTEM TEST

---

This section is to be used when the Resident Diagnostics complete successfully and the System Test Diagnostics can be loaded from a diskette. The troubleshooting procedures in this section are arranged according to the tests performed in the System Test Diagnostics:

Series 100	MOTHERBOARD
Series 300	RAM
Series 400	KEYBOARD
Series 500	VIDEO
Series 600	PARALLEL PORT
Series 700	SERIAL PORT
Series 800	MINI-FLOPPY DISK DRIVE(S)
Series 900	HARD DISK DRIVE(S)
Series 1000	PARALLEL PRINTER
Series 1800	8087 COPROCESSOR
Series 2000	MOUSE
Series 2100	SERIAL PORT (USING 8530)
Series 2300	VIDEO OPTION BOARD
Series 2400	SECOND HARD DISK UNIT.

The following items are supplied for each of the above tests series:

- List of possible defective hardware
- Procedures for performing specific test(s)
- List of error messages and the module(s) that caused the error.

For a detailed description of the tests that are performed during the System Test Diagnostics, refer to Chapter 4, "DIAGNOSTICS."

---

## Motherboard

Possible defective hardware:

- Motherboard
  - Display Controller Board.
1. Turn the power switch OFF.
  2. Insert the MS-DOS System Diskette into drive A.
  3. Turn the power switch ON and verify that the Operating System is booted.
  4. Remove the MS-DOS System Diskette from drive A.
  5. Insert the System Test Diskette into drive A.
  6. Enter:

```
A> system<CR>
```

and wait for TESTING OPTIONS to be displayed along with ENTER DESIRED ACTION. Press the **O** key followed by the **ENTER** key.

7. IS THERE A MOUSE CONNECTED? is displayed. Press the **n** key if your system does not have a mouse. If your system does have a mouse, press the **y** key (3.18 or later version of Diagnostics).
8. The list of installed hardware is displayed along with "IS THE LIST OF HARDWARE CORRECT?" Press the **y** key followed by the **ENTER** key.
9. Verified list of hardware is displayed along with information on performing all tests or individual tests. Select the Motherboard Test by pressing the **1** key followed by the **ENTER** key.
10. PAUSE ON ERROR? is displayed. Press the **y** key followed by the **ENTER** key.
11. The Motherboard test is performed and an error message similar to the one shown below is displayed if an error occurs.

```
TEST 100 - MAIN BOARD
00:00:00 PASS #1
104 - MAIN BOARD    BAD CALENDAR CIRCUIT
```

12. Record the error message and turn the power switch OFF.

13. Using the recorded error message and the table shown in Figure 5-12, determine the module that generated the failure and replace that module.

ERROR NO.	PROBABLE CAUSE	MODULE
101	Faulty 8086-2 CPU	Motherboard
102	ROM Checksum Error	Motherboard
103	Data Path to LSI Chip Bad	Motherboard
104	Calendar Chip Failed	Motherboard (See Note 1.)
105	8259 Interrupt Controller Failed	Motherboard
106	6845 Display Controller Failed	Display Controller
107	8237 DMA Controller Failed	Motherboard
108	765 MFD Controller Failed	Motherboard
109	8253 Timer Failed	Motherboard
110	8250 SCC Chip Failed	Motherboard
111	8530 SCC Chip Failed	Motherboard

See note at the end of table.

**Figure 5-12. Motherboard Troubleshooting Chart  
(Sheet 1 of 2)**

<b>ERROR NO.</b>	<b>PROBABLE CAUSE</b>	<b>MODULE</b>
112	8041 Keyboard Controller Failed	Motherboard
113	Oscillator Circuit Failed	Motherboard
114	Speaker Circuit Failed	Motherboard
115	8087 NDP Failed	Motherboard (See Note 2.)
116	Switches do not agree with the installed hardware	(See Note 3.)
117	Keyboard I/O Register Failed	Motherboard
120	Nonmaskable Interrupt Failed	Motherboard

**Note 1:** Verify that a cap is present on jumper **C** prior to replacing the Motherboard.

**Note 2:** Verify that DIPSW-0, switch 5, is set to OFF (or "0") prior to replacing the 8087 NDP.

**Note 3:** Refer to Appendix A and check the setting of switches DIPSW-0 and DIPSW-1.

**Figure 5-12. Motherboard Troubleshooting Chart  
(Sheet 2 of 2)**

---

## Random Access Memory (RAM)

Possible defective hardware:

- Motherboard
  - Memory Expansion Board
  - RAM Chip
  - Display Controller.
1. Turn the power switch OFF.
  2. Insert the MS-DOS System Diskette into drive A.
  3. Turn the power switch ON and verify that the Operating System is booted.
  4. Remove the MS-DOS System Diskette from drive A.
  5. Insert the System Test Diskette into drive A.

6. Enter:

```
A> system<CR>
```

- and wait for TESTING OPTIONS to be displayed along with ENTER DESIRED ACTION. Press the **0** key followed by the **ENTER** key.
7. IS THERE A MOUSE CONNECTED? is displayed. Press the **n** key if your system does not have a mouse. If your system does have a mouse, press the **y** key (3.18 or later versions of Diagnostics).
8. The list of installed hardware is displayed along with “IS LIST OF HARDWARE CORRECT?” Press the **y** key followed by the **ENTER** key.
9. Verified list of hardware is displayed along with information on performing all tests or individual tests. Select the RAM Test by pressing the **3** key followed by the **ENTER** key.
10. PAUSE ON ERROR? is displayed. Press the **y** key followed by the **ENTER** key.

11. List of MEMORY TEST SELECTIONS is displayed along with ENTER SELECTION(S). Press keys **1** and **2** (separated by spaces) followed by the **ENTER** key.
12. The Addressing Test and the Fixed Pattern Test will run and an error message similar to the following is displayed if an error occurs:

```

00:01:04 PASS #1
302 - XXX KB MEMORY
FIXED PATTERN
%2000      %0000      %AAAA      %ABAA
SEGMENT   OFFSET    WRITTEN    READ
    
```

13. If the Addressing Test and the Fixed Pattern Test pass, and faulty RAM is still suspected, perform the Moving Inversion Test. [Press the **4** key followed by the **ENTER** key when ENTER SELECTIONS is displayed after the MEMORY TEST SELECTION(S) is displayed.]

14. The Memory Moving Inversion Test will run and an error message similar to the one shown below is displayed if an error occurs:

```
00:01:44  PASS #1
304 - xxx KB MEMORY
MOVING INVERSION
%2000    %0000    %AAAA    %ABAA
SEGMENT  OFFSET    WRITTEN  READ
```

15. Record the error message and turn the power switch OFF.
16. Using the recorded error message and tables shown in Figures 5-13 and 5-14, determine the module that generated the failure and replace the faulty module.

<b>ERROR NO.</b>	<b>PROBABLE CAUSE</b>	<b>MODULE</b>
301	Addressing Test Failed	See Note 1.
302	Fixed Pattern Test Failed	See Note 1.
303	Marching Pattern Test Failed	See Note 1.
304	Moving Inversion Test Failed	See Note 1.
305	Bus Noise Test Failed	See Note 1.
306	Refresh Circuit Test Failed	See Note 1.
307	Parity Circuit Test Failed	See Note 1.
310	Data copied to the Video RAM from System RAM does not match.	Display Controller
311	Data copied back to System RAM from Video RAM does not match.	Display Controller
320	Parity error occurred when reading a 64-KB block of data.	See Note 2.
330	DIPSW-0, switches 1-4, does not agree with the actual memory size determined during the memory test.	Check DIPSW-0. Refer to Appendix A.

See notes on next page.

**Figure 5-13. RAM Troubleshooting Chart**

**Note 1:** Refer to Figure 5-14 to determine the board that contained the failure. If the faulty RAM chip is not socketed (soldered to the board), the board must be replaced. If the error occurred in a socketed bank, the faulty RAM chip can be replaced. Refer to “Determining Faulty RAM Chips” to isolate the RAM chip that is faulty.

**Note 2:** Refer to Figure 5-14 to determine the bank in which the parity error is located. If the bank is not socketed, the board must be replaced. If the bank is socketed, replace the parity chips in the bank. If replacing the board or parity chips does not clear the error, replace the Motherboard.

SEGMENT CODE	BANK LOCATION
% 0000	Motherboard Bank 0
% 2000	Motherboard Bank 1
% 4000	Expansion Board Bank 0
% 6000	Expansion Board Bank 1
% 8000	Expansion Board Bank 2

**Figure 5-14. Faulty RAM Bank Locating Chart**

---

Information such as segment failure, data written (in HEX), and data read (in HEX) may also be displayed. The segment indicates the bank in which the failure occurred. The segment codes for bank locations are shown below.

### ***Determining Faulty RAM Chips***

First, the data written and read in HEX must be converted to binary. The table shown in Figure 5-15 provides a HEX to binary conversion chart.

HEX	BINARY	HEX	BINARY	HEX	BINARY	HEX	BINARY
0	0000	1	0001	2	0010	3	0011
4	0100	5	0101	6	0110	7	0111
8	1000	9	1001	A	1010	B	1011
C	1100	D	1101	E	1110	F	1111

**Figure 5-15. Hexadecimal to Binary Conversion Chart**

## MAINTENANCE

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Faulty RAM chips are determined by comparing the binary data written to the binary data read. By knowing which data bit is faulty, you can locate the faulty RAM chip as shown below:

Example:

Data Written in HEX - AAAA

Data Read in HEX - ABAA

<u>Bit Position</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>10</u>	<u>9</u>	<u>8</u>	<u>7</u>	<u>6</u>	<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>0</u>
Binary Data Written	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
Binary Data Read	-1	0	1	0	1	0	1	1	1	0	1	0	1	0	1	0
	<hr/>															
	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0

In the above example, the faulty data bit is bit 8. Therefore, the bad chip is the eighth chip in the bank. Figures 5-16 and 5-17 show the RAM chip locations in each bank.

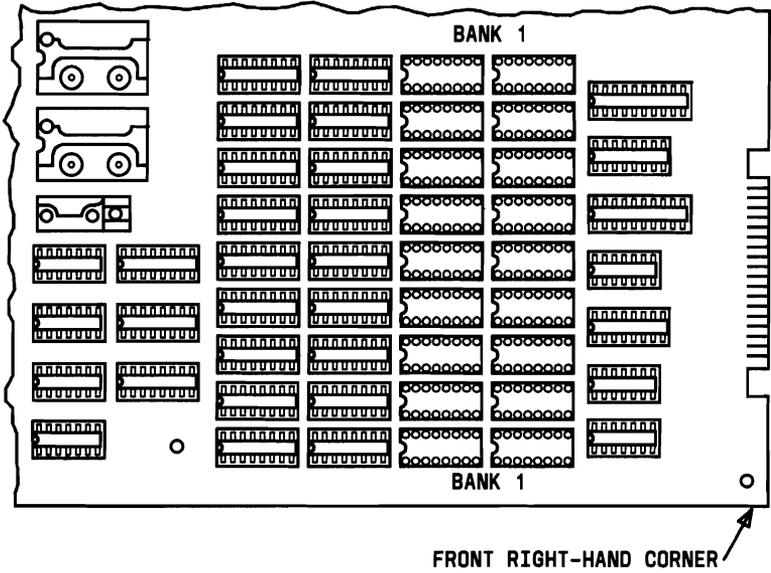
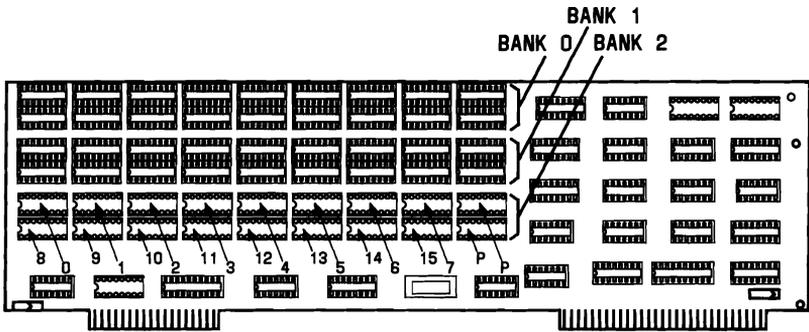


Figure 5-16. Motherboard RAM Chip Positions



P = PARITY

NOTE: ALL THREE BANKS ARE ORDERED THE SAME.

**Figure 5-17. Expansion Board RAM Chip Positions**

---

## Keyboard

Possible defective hardware:

- Keyboard
  - Motherboard.
1. Turn the power switch OFF.
  2. Insert the MS-DOS System Diskette into drive A.
  3. Turn the power switch ON and verify that the Operating System is booted.
  4. Remove the MS-DOS System Diskette from drive A.
  5. Insert the System Test Diskette into drive A.
  6. Enter:

```
A> system<CR>
```

and wait for TESTING OPTIONS to be displayed along with ENTER DESIRED ACTION. Press the **O** key followed by the **ENTER** key.

7. IS THERE A MOUSE CONNECTED? is displayed. Press the **n** key if your system does not have a mouse. If your system does have a mouse, press the **y** key (3.18 or later versions of Diagnostics).
8. The list of installed hardware is displayed along with IS LIST OF HARDWARE CORRECT? Press the **y** key followed by the **ENTER** key.
9. Verified list of hardware is displayed along with information on performing all tests or individual tests. Select the Keyboard Test by pressing the **4** key followed by the **ENTER** key.
10. PAUSE ON ERROR? is displayed. Press the **y** key followed by the **ENTER** key.
11. The hardware associated with the keyboard is tested. As the tests are running, verify that the LEDs on the Keyboard blink. This is to verify that the LEDs are working properly. If an error is found, a message similar to the following is displayed:

```
TEST 400 - 83 KEYBOARD TEST
00:02:04 PASS #1
402 - 83 KEY KEYBOARD KEYBOARD SELFTEST ERROR
```

- 
12. If no error is found in the hardware tests, a graphic representation of the keyboard is displayed. Follow the instructions shown at the bottom of the display to test the operation of the keys.
  13. If you indicated that an error occurred while testing the keys, a message similar to the following is displayed:

```
00:03:30      PASS #1  
405 - 83 KEY KEYBOARD  OPERATOR DETECTED KEYBOARD ERROR
```

14. Record the error message and turn the power switch OFF.

15. Using the recorded error message and the table shown in Figure 5-18, determine the module that generated the failure and replace that module.

ERROR NO.	PROBABLE CAUSE	MODULE
401	Bad 8041 or 8741 Controller on Motherboard.	Motherboard
402	Bad 8039, 8049, or 8749 in Keyboard or Keyboard not connected.	Keyboard
403	8039 in Keyboard indicated a stuck key error.*	Keyboard
405	Operator indicated that keys on Keyboard are not working properly.	Keyboard
406	Operator indicated that LEDs on Keyboard are not working properly.	Keyboard
408	Interruption Keyboard not functioning.	Motherboard

\* See Customer and System Test ERROR messages on how to locate a stuck key.

**Figure 5-18. Keyboard Troubleshooting Chart**

---

## Video System

Possible defective hardware:

- Display
  - Display Controller Board.
1. Turn the power switch OFF.
  2. Insert the MS-DOS System Diskette into drive A.
  3. Turn the power switch ON and verify that the Operating System is booted.
  4. Remove the MS-DOS System Diskette from drive A.
  5. Insert the System Test Diskette into drive A.
  6. Enter:

```
A> system<CR>
```

and wait for TESTING OPTIONS to be displayed along with ENTER DESIRED ACTION. Press the **O** key followed by the **ENTER** key.

7. IS THERE A MOUSE CONNECTED? is displayed. Press the **n** key if your system does not have a mouse. If your system does have a mouse, press the **y** key.
  
8. The list of installed hardware is displayed along with IS LIST OF HARDWARE CORRECT? Press the **y** key followed by the **ENTER** key (3.18 or later versions of Diagnostics).
  
9. Verified list of hardware is displayed along with information on performing all tests or individual tests. Select the Video Test by pressing the **5** key followed by the **ENTER** key.
  
10. PAUSE ON ERROR? is displayed. Press the **y** key followed by the **ENTER** key.
  
11. The VIDEO TEST SELECTIONS is displayed along with ENTER SELECTION(S). Select **20** (Perform all tests) followed by the **ENTER** key.

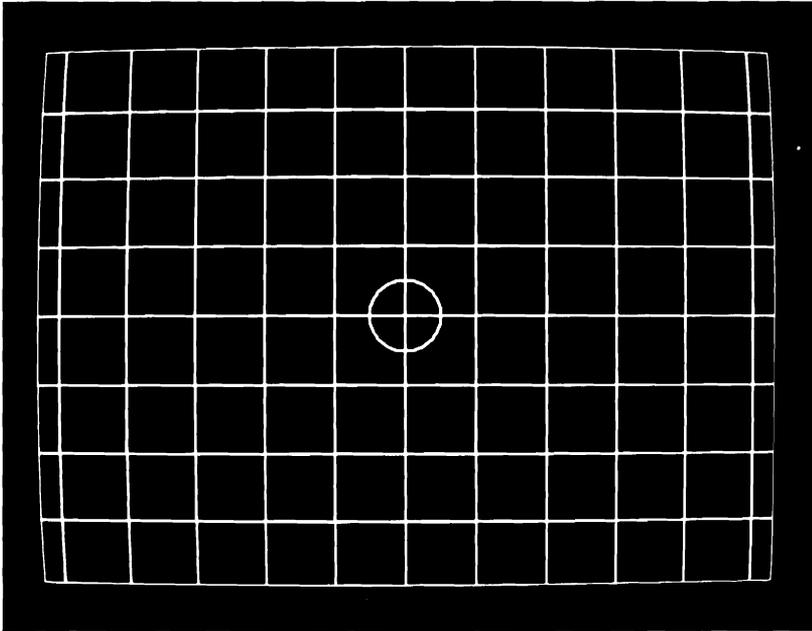
- 
12. The hardware portion of the Video System is tested and a message similar to the following is displayed if an error occurs:

```
S01 - VIDEO SYSTEM  VIDEO MEMORY WORD WRITE/READ ERROR
1      2049  %B800    %7FFA    %5A5A    %5AFF
PASS#  #BAD  SEGMENT  OFFSET   WRITTEN   READ
(HIT THE ENTER KEY TO CONTINUE)
```

If an error occurs, record the error message and continue.

**Note:** A blank formatted floppy is required in drive A: when running the hardware video test. (Refer to System Diagnostics in Chapter 4.)

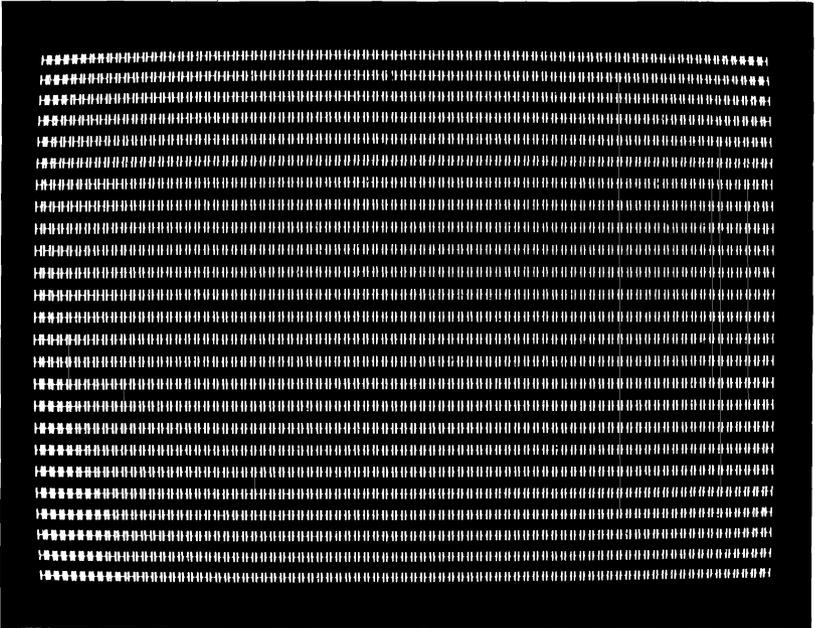
13. After the hardware test is performed and the **ENTER** key is pressed, the Monitor Test Patterns are produced on the display.
  - a. The first test pattern produced is shown in Figure 5-19. When comparing the pattern, pay particular attention to the linearity of the lines and that the pattern is centered on the display.



**Figure 5-19. First Monitor Test Pattern**

To display the next pattern, press the **ENTER** key.

- 
- b. The second test pattern produced is shown in Figure 5-20. When comparing the patterns, pay particular attention to the linearity of each **H** row to verify the alignment of the raster.



**Figure 5-20. Second Monitor Test Pattern**

If the tests in Steps A or B above indicate a distorted or misaligned display, the display must be replaced. Press the **ENTER** key to continue with the video tests.



15. The Gray Scale test pattern should be displayed on the screen as shown in Figure 5-22.

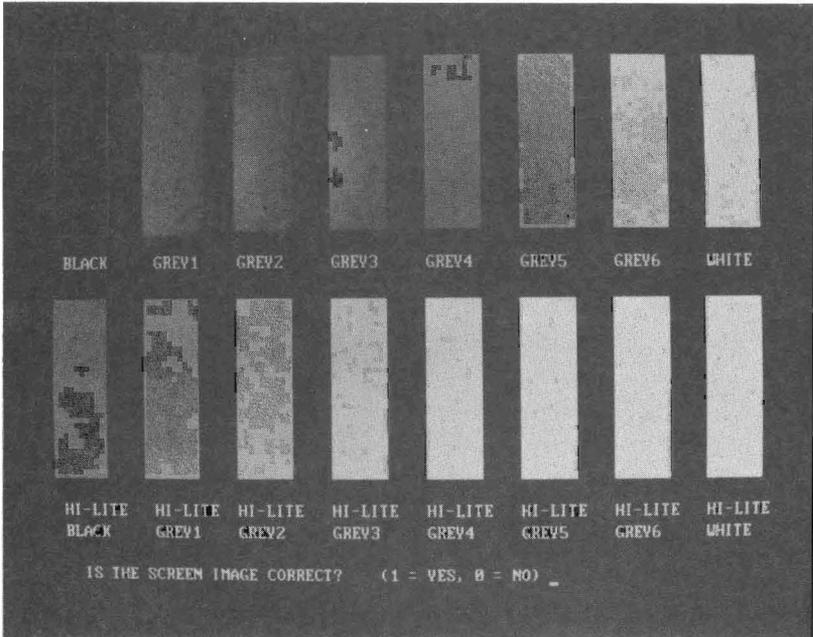
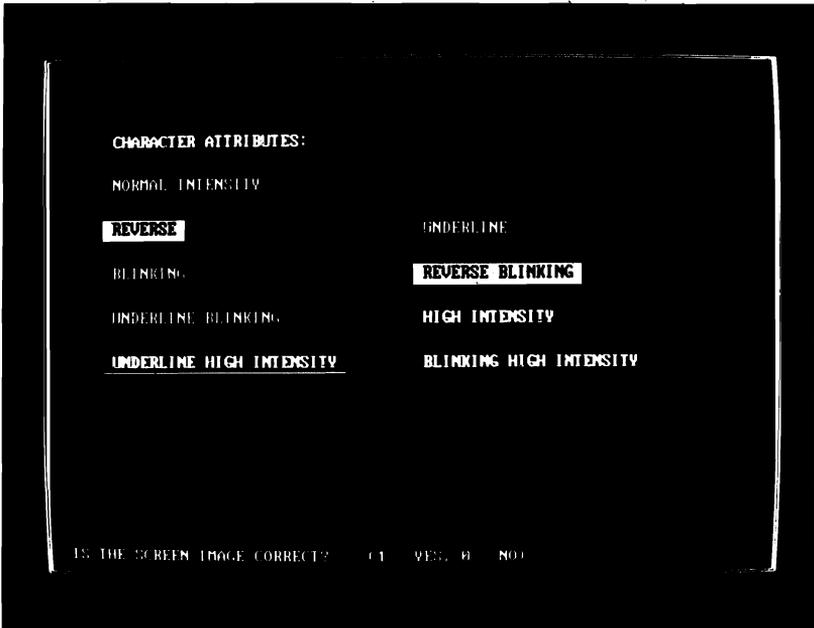


Figure 5-22. Gray Scale Test Pattern

If the pattern shown on the display is the same as Figure 5-22, press the **y** key. If it is not the same as Figure 5-21, press the **n** key followed by the **ENTER** key to continue with (abort) the video tests.

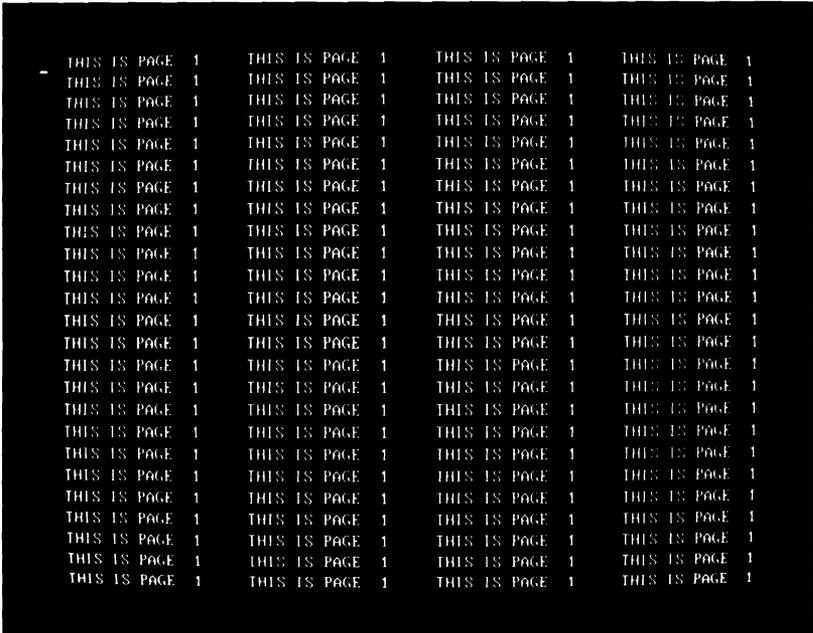
16. The Character Attributes should be displayed on the screen as shown in Figure 5-23.



**Figure 5-23. Character Attributes Test Pattern**

If the attributes (Figure 5-24) shown on the screen are all performing satisfactorily, press the **y** key. If they are not the same as Figure 5-24, press the **n** key followed by the **ENTER** key to continue with (abort) the video tests.

- 
17. The next test is the Paging Test (80 by 25 mode) that exercises the 32 KB of RAM on the Display Controller Board. The 32 KB of RAM will provide eight (0 through 7) pages of text in the 80 by 25 mode. To step through the pages, press the **ENTER** key. If the next page is not displayed after the **ENTER** key is pressed, press the **0** key followed by the **ENTER** key to indicate a failure. The patterns shown on the display should look like Figure 5-24.



**Figure 5-24. Paging Test Pattern—80 by 25 Mode**

- 
18. After the seventh page, the test will automatically go to the 40 by 25 mode paging test. In this mode, there are sixteen (0 through 15) pages instead of eight. To step through the pages, press the **ENTER** key. If the next page is not displayed after the **ENTER** key is pressed, press the **0** key followed by the **ENTER** key to indicate a failure. The patterns shown on the display should be similar to Figure 5-25.

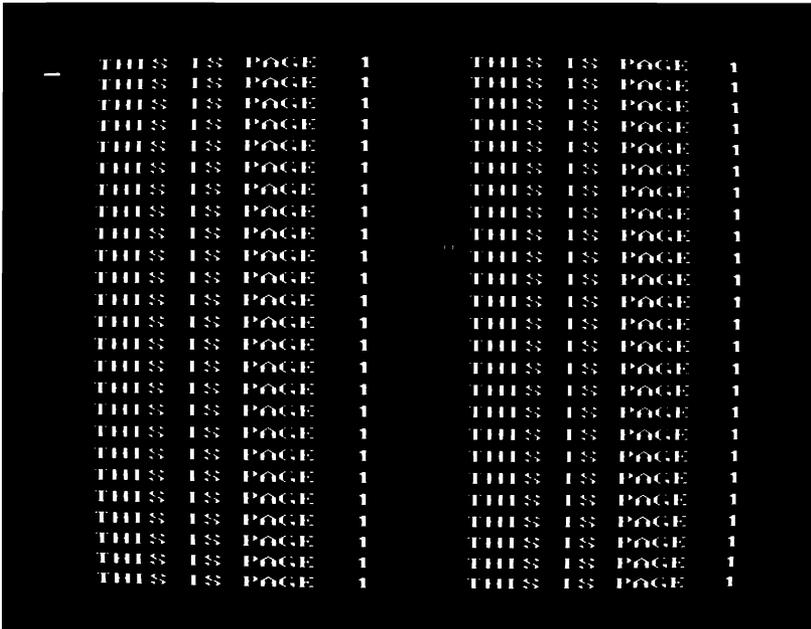
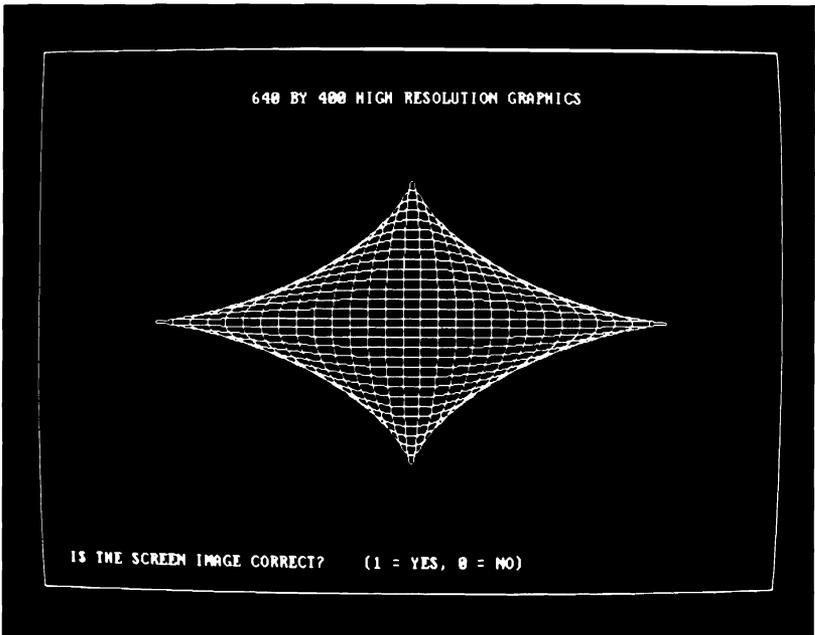


Figure 5-25. Paging Test Pattern—40 by 25 Mode

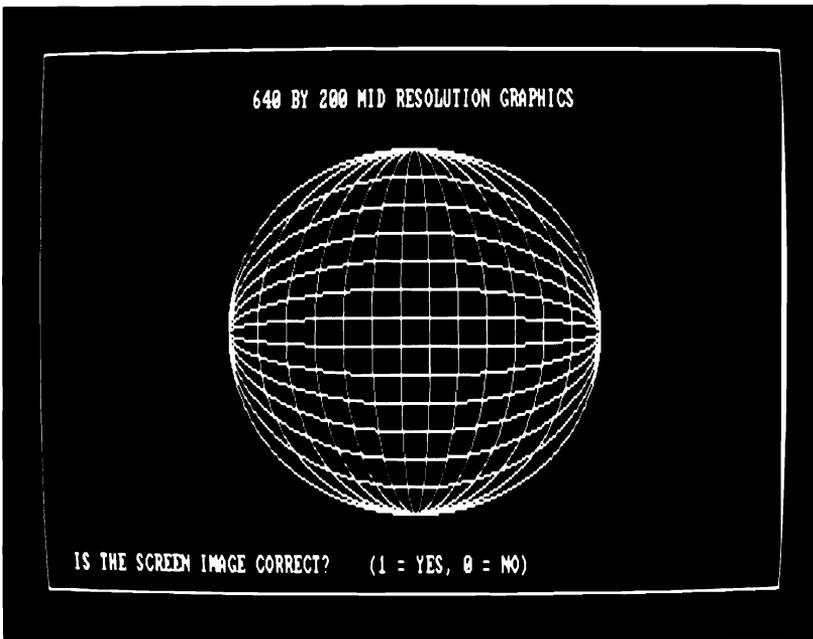
19. After the fifteenth page, the 640 by 400 High Resolution Graphics pattern is displayed (Figure 5-26).



**Figure 5-26. 640 by 400 High Resolution Graphics Pattern**

If the pattern shown on the screen is the same as Figure 5-26, press the **y** key. If it is not the same as Figure 5-26, press the **n** key followed by the **ENTER** key to continue with (abort) the video tests.

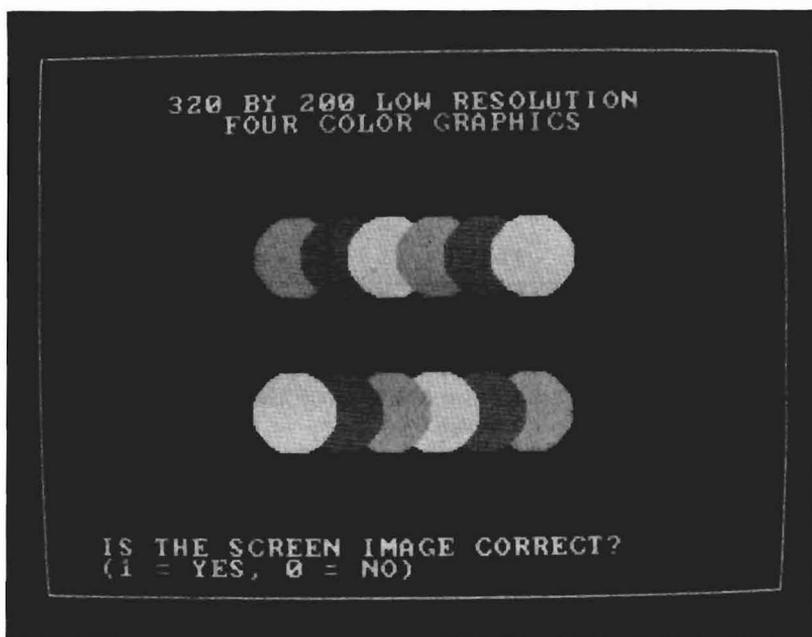
20. The 640 by 200 Mid Resolution Graphics pattern should be displayed (Figure 5-27).



**Figure 5-27. 640 by 200 Mid Resolution Graphics Pattern**

If the pattern shown on the screen is the same as Figure 5-27, press the **y** key. If it is not the same as Figure 5-27, press the **n** key followed by the **ENTER** key to continue with (abort) the video tests.

21. The 320 by 200 Low Resolution Four Color Graphics Pattern should be displayed (Figure 5-28).



**Figure 5-28. 320 by 200 Low Resolution Graphics Pattern**

If the pattern shown on the screen is the same as Figure 5-28, press the **y** key. If it is not the same as Figure 5-28, press the **n** key followed by the **ENTER** key.

22. If an error message was received as the result of performing these tests, use the recorded error message and the table shown in Figure 5-29 to determine the module that generated the failure and replace that module.

ERROR NO.	PROBABLE CAUSE	MODULE
501	Video Memory RAM Failure	Display Controller
502	Video Controller (6845) Failed	Display Controller
503	Video Memory Failure (Byte Check Mode)	Display Controller
504	Memory Disk Transfer Test Through DMA Operation	Display Controller
510	Character Set displayed on screen not correct	Display Controller
520	Grey Scale/Color Bars Test Failed	1. Display 2. Display Controller
530	Screen Attributes Test failed	Display Controller

**Figure 5-29. Video System Troubleshooting Chart (Sheet 1 of 2)**

<b>ERROR NO.</b>	<b>PROBABLE CAUSE</b>	<b>MODULE</b>
540	80 by 25 Mode Paging Test failed	Display Controller
541	40 by 25 Mode Paging Test Failed	Display Controller
550	640 by 400 Graphics Mode Test Failed	Display Controller
551	640 by 200 Graphics Mode Test Failed	Display Controller
552	320 by 200 Graphics Mode Test Failed	Display Controller
560	Color Monitor Degauss Circuit Test Failed	Display

**Figure 5-29. Video System Troubleshooting Chart (Sheet 2 of 2)**

## Parallel Port

Possible defective hardware—Motherboard.

1. Turn the power switch OFF.
2. Unplug the printer from the Parallel Port.
3. Connect the Parallel Port Loopback Jumper to the parallel port.
4. Insert the MS-DOS System Diskette into drive A.
5. Turn the power switch ON and verify that the Operating System is booted.
6. Remove the MS-DOS System Diskette from drive A.
7. Insert the Systems Test Diskette into drive A.
8. Enter:

```
A>system<CR>
```

and wait for TESTING OPTIONS to be displayed along with ENTER DESIRED ACTION. Press the **O** key followed by the **ENTER** key.

- 
9. IS THERE A MOUSE CONNECTED? is displayed. Press the **n** key if your system does not have a mouse. If your system does have a mouse, press the **y** key (3.18 or later versions of Diagnostics).
  10. The list of installed hardware is displayed along with IS LIST OF HARDWARE CORRECT? Press the **y** key followed by the **ENTER** key.
  11. Verified list of hardware is displayed along with information on performing all tests or individual tests. Select the Parallel Port Test by pressing the **6** key followed by the **ENTER** key.
  12. PAUSE ON ERROR? is displayed. Press the **y** key followed by the **ENTER** key.
  13. The diagnostics ask if a printer is connected to the parallel port. Press the **0** key followed by the **ENTER** key for a NO response.
  14. The diagnostics then ask if the loopback jumper is installed. Press the **y** key followed by the **ENTER** key for a YES response.

**Note:** Refer to loopback jumper pinouts under Parallel Port Test in DIAGNOSTICS, Chapter 4.

15. The Parallel Port test will run and an error message similar to the one shown below will be displayed if an error is found:

```
00:05:35  PASS #1
603 - PARALLEL PORT          STATUS LINE
%0030      %0078      1      0
EXPECT     READ      JUMPER?  PRINTER CONNECTED?
```

16. Record the error message and turn the power switch OFF.
17. Using the recorded error message and the table shown in Figure 5-30, determine the module that generated the failure and replace that module.

ERROR NO.	PROBABLE CAUSE	MODULE
601	Data Path Check to Parallel Port Failed	Motherboard
602	Command Port Test Failed	Motherboard
603	Status Port Test Failed	Motherboard
604	Parallel Port Interrupt Circuit Failed	Motherboard

**Figure 5-30. Parallel Port Troubleshooting Chart**

---

## Serial Port Test (Using 8250)

Possible defective hardware—Motherboard.

1. Turn the power switch OFF.
2. Insert the MS-DOS System Diskette into drive A.
3. Turn the power switch ON and verify that the Operating System is booted.
4. Remove the MS-DOS System Diskette from drive A.
5. Insert the System Test Diskette into drive A.
6. Enter:

```
A>system<CR>
```

and wait for TESTING OPTIONS to be displayed along with ENTER DESIRED ACTION. Press the **O** key followed by the **ENTER** key (3.18 or later versions of Diagnostics).

7. IS THERE A MOUSE CONNECTED? is displayed. Press the **n** key if your system does not have a mouse. If your system does have a mouse, press the **y** key.
8. The list of installed hardware is displayed along with IS LIST OF HARDWARE CORRECT? Press the **y** key followed by the **ENTER** key.
9. Verified list of hardware is displayed along with information on performing all tests or individual tests. Select the Serial Port (Using 8250) Test by pressing the **7** key followed by the **ENTER** key.
10. PAUSE ON ERROR? is displayed. Press the **y** key followed by the **ENTER** key.
11. The diagnostics ask if the serial loopback jumper is installed. Press key **y**, followed by the **ENTER** key for a YES response.
12. The Serial Port Test will run and an error message similar to the one shown below is displayed if an error is found:

```
00:07:12  PASS #1
702 - SERIAL PORT (USING 8250)  TRANSMIT/RECEIVE
%0001      %0000      %0000
XMIT       REC       STATUS
```

13. Record the error message and turn the power switch OFF.
14. Using the recorded error message and the table shown in Figure 5-31, determine the module that generated the failure and replace that module.

ERROR NO.	PROBABLE CAUSE	MODULE
701	Data Path to 8250 Failed	Motherboard
702	Transmit/Receive Failed Using 8250 Internal Loopback Mode	Motherboard
703	Transmit/Receive Failed Using Loopback Jumper	Motherboard
704	8250 Interrupt Circuit Failed	Motherboard
705	Control Lines are not Correct on the Loopback Jumper	See Note.

**Note:** Refer to Chapter 4, "DIAGNOSTICS," and verify that the Serial Loopback Jumper is wired properly. If the Jumper is wired properly, replace the Motherboard.

**Figure 5-31. Serial Port Troubleshooting Chart**

## Mini-Floppy Disk Drive

Possible defective hardware:

- MS-DOS System Diskette
  - MFD Unit Cable
  - Motherboard
  - MFD Unit.
1. Turn the power switch OFF.
  2. Insert the MS-DOS System Diskette into drive A.
  3. Turn the power switch ON and verify that the Operating System is booted.
  4. Remove the MS-DOS System Diskette from drive A.
  5. Insert the System Test Diskette into drive A.

- 
6. Enter:

```
A>system<CR>
```

and wait for TESTING OPTIONS to be displayed along with ENTER DESIRED ACTION. Press the **0** key followed by the **ENTER** key.

7. IS THERE A MOUSE CONNECTED? is displayed. Press the **n** key if your system does not have a mouse. If your system does have a mouse, press the **y** key (3.18 or later versions of Diagnostics).
8. The list of installed hardware is displayed along with "IS LIST OF HARDWARE CORRECT?" Press the **y** key followed by the **ENTER** key.
9. Verified list of hardware is displayed along with information on performing all tests or individual tests. Select the Mini-Floppy Disk Test by pressing the **8** key followed by the **ENTER** key.
10. PAUSE ON ERROR? is displayed. Press the **y** key followed by the **ENTER** key.
11. NUMBER OF RETRIES ON DISKETTE ERROR? (0 TO 5) is displayed along with ENTER DESIRED ACTION. Press the **0** key followed by the **ENTER** key.

12. The diagnostics then asks which MFD Unit is to be tested. Select drive A, drive B, or both drives by pressing the appropriate key followed by the **ENTER** key.
13. List of MFD Unit Test Selections is displayed along with **ENTER SELECTION(S)**. Press keys **4, 1, and 2** (separated by spaces) followed by the **ENTER** key.

**Note:** Floppy Test 1 must be executed prior to running Floppy Tests 2, 3, and/or 5.

14. Mini-Floppy Disk Unit tests 4, 1, and 2 will run and an error message similar to the following is displayed if an error occurs:

```
00:00:00  PASS #1
801 - 48  TPI FLOPPY DISK DRIVES      TIME OUT
0         0         0         1         %0080
DRIVE     TRACK    HEAD     SECTOR   CODE
```

15. Record the error message and turn the power switch OFF.
16. Using the recorded error message and the tables shown in Figures 5-32 and 5-33, determine the module that generated the failure and replace that module.

ERROR NO.	PROBABLE CAUSE	MODULE
801	Error Occurred During Sequential Write Test.	MFD Unit
802	Error Occurred During Sequential Read Test.	MFD Unit
803	Error During Funnel Read and Data Compare Test.	MFD Unit
804	Error During Verify Diskette.	MFD Unit
805	Error During Random Read Test.	MFD Unit
806	Error During Write Protect Test.	See Note.
808	Error During Head Alignment Test.	MFD Unit

**Note:** Verify that the diskette has a write-protect tab present. If write-protect tab is present, replace the MFD Unit.

**Figure 5-32. MFD Unit Troubleshooting Chart**

Status words may also be displayed to aid in fault isolation. The status words for the MFD Unit tests are in Figure 5-33, along with the probable cause of the failure and the module in which the failure occurred.

<b>STATUS WORD</b>	<b>PROBABLE CAUSE</b>	<b>MODULE</b>
% 0080	Time Out (Drive failed to respond)	1. MFD Unit 2. Motherboard
% 0040	Bad Seek (Seek operation failed)	1. MFD Unit 2. Motherboard
% 0020	Bad 765 (765 MFD Controller Chip failed)	1. MFD Unit 2. Motherboard
% 0010	Bad CRC (Bad CRC on diskette read)	1. MFD Unit 2. Motherboard
% 0009	DMA Boundary (DMA attempted to cross 64-KB boundary)	Motherboard
% 0008	Bad DMA (DMA overrun on operation)	Motherboard
% 0004	Record not found (Requested sector not found)	1. Diskette 2. MFD Unit
% 0003	Write Protect (Write attempt on write-protect diskette)	1. Diskette 2. MFD Unit
% 0002	Bad Addr Mark (Address Mark not found)	1. Diskette 2. MFD Unit
% 0001	Bad Cmd (Bad command passed to diskette I/O)	1. MFD Unit 2. Motherboard

**Figure 5-33. MFD Unit Status Words**

---

## Hard Disk Unit

Possible defective hardware:

- HDU Cable
  - HDU Controller
  - HDU.
1. Turn the power switch OFF.
  2. Insert the MS-DOS System Diskette into drive A.
  3. Turn the power switch ON and verify that the Operating System is booted.
  4. Remove the MS-DOS System Diskette from drive A.
  5. Insert the System Test Diskette into drive A.
  6. Enter:

```
A> system<CR>
```

and wait for **TESTING OPTIONS** to be displayed along with **ENTER DESIRED ACTION**. Press the **0** key followed by the **ENTER** key.

7. IS THERE A MOUSE CONNECTED? is displayed. Press the **n** key if your system does not have a mouse. If your system does have a mouse, press the **y** key (3.18 or later versions of Diagnostics).
8. The list of installed hardware is displayed along with "IS LIST OF HARDWARE CORRECT?" Press the **y** key followed by the **ENTER** key.
9. Verified list of hardware is displayed along with information on performing all tests or individual tests. Select the XX MB HDU Test by pressing the **9** key followed by the **ENTER** key.
10. PAUSE ON ERROR? is displayed. Press the **y** key followed by the **ENTER** key.
11. Number of retries on HDU error (0 to 5) is displayed. Enter the desired action.
12. HDU tests 1 through 7 will run and the name of the test being run is displayed. An error message similar to the following is displayed if an error occurs:

```
00:00:00  PASS #1
901 - 10 MB HARD DISK DRIVE          TIME OUT
0        0        0        1        X0080
DRIVE    TRACK    HEAD     SECTOR    CODE
```

13. Record the error message and turn the power switch OFF.
14. Using the recorded error message and the tables shown in Figures 5-34 and 5-35, determine the module that generated the failure and replace that module.

ERROR NO.	PROBABLE CAUSE	MODULE
901	Drive Ready Test Failed	1. HDU Cables 2. HDU Controller 3. HDU*
902	Controller Self-Diagnostic Failed	HDU Controller
903	Controller RAM Test Failed	HDU Controller
904	Drive Self-Diagnostics Failed	HDU*
905	Surface Verify Test Failed	HDU*
906	Test Cylinder Write/Read Tests Failed	1. HDU Controller 2. HDU*
907	Seek Test Failed	1. HDU Controller 2. HDU*

\* If the HDUs available disk space is less than the nominal value (10 MBs for 10 Meg HDUs and 20 MBs for 20 Meg HDUs), it should be replaced.

**Figure 5-34. HDU Troubleshooting Chart (Sheet 1 of 2)**

ERROR NO.	PROBABLE CAUSE	MODULE
908	Data Pattern Test Failed	1. HDU Controller 2. HDU*
909	Funnel Test Failed	1. HDU Controller 2. HDU*
910	Aging Test Failed	1. HDU Controller 2. HDU*
911	Low-Level Format Test Failed	1. HDU Controller 2. HDU*
912	Write and Verify Surface Failed (This routine determines the bad block list.) THIS ERROR IS DETECTED ONLY FOR SYSTEM TEST PACKAGE.	1. HDU Controller 2. HDU*
930	Too Many Bad Blocks	1. HDU Controller 2. HDU*
931	Bad Block Determination Test Failed	1. HDU Controller 2. HDU*
932	Track 00, 01, 02, or 03 bad	1. HDU*

\* If the HDUs available disk space is less than the nominal value (10 MBs for 10 Meg HDUs and 20 MBs for 20 Meg HDUs), it should be replaced.

**Figure 5-34. HDU Troubleshooting Chart (Sheet 2 of 2)**

STATUS WORD	PROBABLE CAUSE	MODULE
%00FF	Sense Fail (Sense operation failed)	1. HDU Controller 2. HDU
%0080	Time Out (HDU failed to respond)	HDU
%0040	Bad Seek (Seek operation failed)	HDU
%0020	Bad Controller (Controller failed)	HDU Controller
%0011	Data Corrected (ECC corrected data error)	See Note.
%0010	Bad ECC (Bad ECC on disk read)	HDU Controller
%0009	Attempt to DMA across 64-KB boundary	1. HDU Controller 2. Motherboard
%0007	Init Fail (Drive parameter activity fail)	Check DIP Switch on HDU Controller.

**Note:** This status word indicates that an error was found and corrected on your HDU by the controller. If this is a recurring error, you may have a problem with the surface of your HDU.

**Figure 5-35. HDU Status Words (Sheet 1 of 2)**

<b>STATUS WORD</b>	<b>PROBABLE CAUSE</b>	<b>MODULE</b>
% 0005	Bad Reset (Reset failed)	HDU
% 0004	Record not found (Requested sector not found)	HDU
% 0002	Bad Address Mark (Address Mark not found)	HDU
% 0001	Bad Command (Bad command passed to disk—I/O error)	1. Check DIP Switch on Controller. 2. Check HDU Cables. 3. HDU Controller 4. HDU

**Figure 5-35. HDU Status Words (Sheet 2 of 2)**

---

## Parallel Printer Test

Possible defective hardware:

- Printer
- Motherboard.

To use the Parallel Printer Test, proceed as follows:

1. Turn the power switch OFF.
2. Insert the MS-DOS System Diskette into drive A.
3. Turn the power switch ON and verify that the Operating System is booted.
4. Remove the MS-DOS System Diskette from drive A.
5. Insert the Systems Test Diskette into drive A.
6. Enter:

```
A> system<CR>
```

and wait for TESTING OPTIONS to be displayed along with ENTER DESIRED ACTION. Press the **0** key followed by the **ENTER** key.

7. IS THERE A MOUSE CONNECTED? is displayed. Press the **n** key if your system does not have a mouse. If your system does have a mouse, press the **y** key (3.18 or later version of Diagnostics).
8. The list of installed hardware is displayed along with "IS LIST OF HARDWARE CORRECT?" Press the **y** key followed by the **ENTER** key.
9. Verified list of hardware is displayed along with information on performing all tests or individual tests. Select the Parallel Printer Test by pressing the **1** key followed by the **ENTER** key.
10. PAUSE ON ERROR? is displayed. Press the **y** key followed by the **ENTER** key.
11. When the Parallel Printer Test is performed, you will be prompted to check the printout for errors. You must answer **y** if the printout is correct or **n** if the printout is incorrect. The printout should correspond to the character set which the printer has been set for (see next page).

!"#\$%&'()\*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[-]^\_`abcdefghijklmnopqrstuvwxyz  
!"#\$%&'()\*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ[-]^\_`abcdefghijklmnopqrstuvwxyz

TEST 1000 - PARALLEL PRINTER (LPT1:)

IS THE PRINTOUT CORRECT? (y = YES, n = NO) :

If an error is found, an error message similar to the one shown below is displayed:

```
TEST 1000 - PARALLEL PRINTER (LPT1:)  
IS THE PRINTOUT CORRECT? ( y = YES, n = NO ) : N  
11:29:38 PASS #1  
1001 - PARALLEL PRINTER (LPT1:) BAD PRINTOUT
```

- 12. Record the error message and turn the power switch OFF.
- 13. Using the recorded error message and the table shown in Figure 5-36, determine the module that generated the failure and replace that module.

ERROR NO.	PROBABLE CAUSE	MODULE
1001	OPERATOR INDICATED ERROR	1. Printer Check Switch Setting 2. Printer
1002	ERROR WHILE PRINTING CHARACTER	Motherboard

**Figure 5-36. Parallel Printer Test Troubleshooting Chart**

---

## 8087-2 Math Co-Processor

Possible defective hardware:

- 8087-2 Math Co-Processor
- Motherboard.

To test the 8087-2 Math Co-Processor, proceed as follows:

1. Turn the power switch OFF.
2. Insert the MS-DOS System Diskette into drive A.
3. Verify when the PC boots during the Resident Diagnostics that the screen displays NPU i8087 PASS ROM BIOS 1.43 or greater.
4. Turn the power switch ON and verify that the Operating System is booted.
5. Remove the MS-DOS System Diskette from drive A.
6. Insert the System Test Diskette into drive A.

7. Enter:

```
A> system<CR>
```

and wait for TESTING OPTIONS to be displayed along with ENTER DESIRED ACTION. Press the **0** key followed by the **ENTER** key.

8. IS THERE A MOUSE CONNECTED? is displayed. Press the **n** key if your system does not have a mouse. If your system does have a mouse, press the **y** key (3.18 or later version of Diagnostics).
9. The list of installed hardware is displayed along with "IS THE LIST OF HARDWARE CORRECT?" Press the **y** key followed by the **ENTER** key.
10. The verified list of hardware is displayed along with the information on performing all tests or individual tests. Select the 8087 Test by typing **18** followed by the **ENTER** key.
11. PAUSE ON ERROR? is displayed. Press the **y** key followed by the **ENTER** key.

12. The 8087 Test is performed and an error message similar to the one shown below is displayed if an error occurs:

```

TEST 1800 - 8087 MATH COPROCESSOR
07:20:33 PASS #1
1803 - 8087 MATH COPROCESSOR INTERRUPT ERROR
    
```

13. Record the error message and turn the power switch OFF. Compare the error message with the following error messages (Figure 5-37):

ERROR NO.	PROBABLE CAUSE	MODULE
1801	Functional Test Failed.	Check Motherboard Check 8087
1802	Mathematical Function Test Failed.	Check Motherboard Check 8087
1803	Interrupt Test Failed.	Check Switch Settings Check Motherboard Check 8087

**Figure 5-37. 8087 Troubleshooting Chart**

## Mouse

Possible defective hardware:

- Mouse
- Keyboard.

1. Turn the power switch OFF.
2. Insert the MS-DOS System Diskette into drive A.
3. Turn the power switch ON and verify that the Operating System is booted.
4. Remove the MS-DOS System Diskette from drive A.
5. Insert the System Test Diskette into drive A (3.18 or later versions of Diagnostics).
6. Enter:

```
A> system<CR>
```

and wait for TESTING OPTIONS to be displayed, along with ENTER DESIRED ACTION. Press the **O** key followed by the **ENTER** key.

7. IS THERE A MOUSE CONNECTED? is displayed. Press the **y** key followed by the **ENTER**.
8. The list of installed hardware is displayed along with "IS LIST OF HARDWARE CORRECT?" Press the **y** key followed by the **ENTER** key.
9. Verified list of hardware is displayed along with information on performing all tests or individual tests. Select the "MOUSE TESTS" by typing **20** followed by the **ENTER** key.
10. PAUSE ON ERROR? is displayed. Press the **y** key followed by the **ENTER** key.
11. The mouse test options are displayed.

## *Mouse Test*

If you select the "MOUSE TESTS", the following menu is displayed:

```
MOUSE TESTS:  
  
 0 - RETURN TO MAIN MENU  
 1 - GRAPHIC MODE  
 2 - TEXT MODE  
  
10 - RUN ALL OF THE ABOVE TESTS  
  
ENTER SELECTION(S):_
```

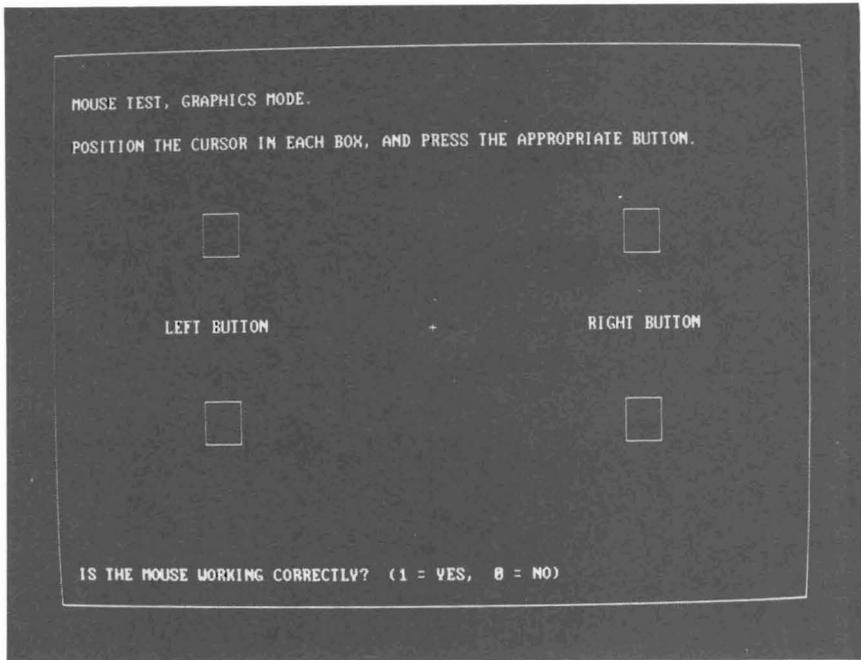
You may run a specific test by pressing the appropriate key followed by the **ENTER** key. Or, you may run all the tests by typing **10** followed by the **ENTER** key.

**Return to Main Menu:** Returns to the Main Menu (MENU A).

**Graphic Mode:** The graphic mode test asks you to position the cursor in certain boxes located on the screen. This checks to see if the mouse is working correctly.

**Text Mode:** The text mode test asks you to position the cursor over four different numbers that are located on the screen and then press the appropriate button.

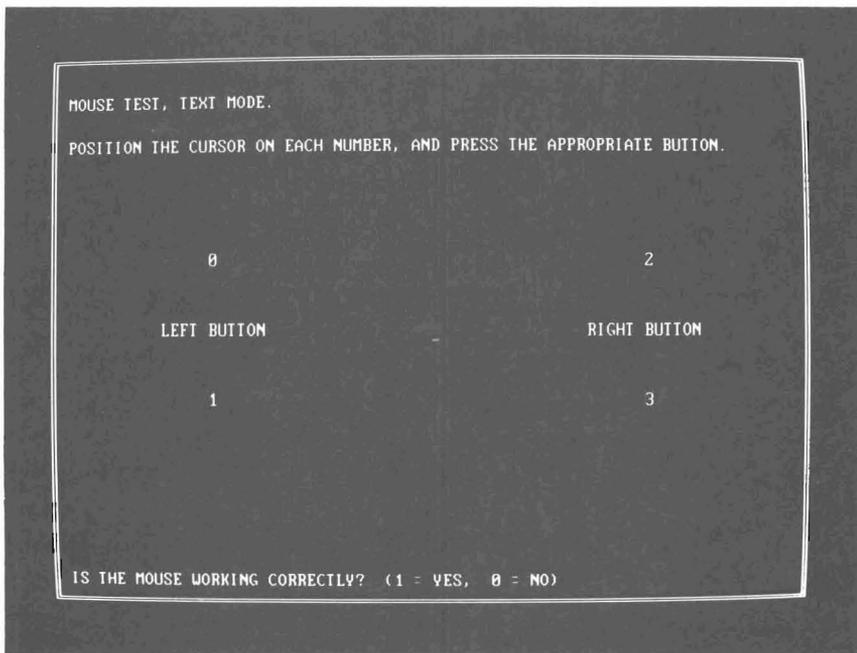
- a. The first test pattern produced is shown in Figure 5-38.



**Figure 5-38. Graphic Mode Test Pattern**

If the mouse is working correctly, press the **y** key; otherwise, press the **n** key. After you have chosen **y** or **n**, press the **ENTER** key to display the next pattern.

b. The second test pattern produced is shown in Figure 5-39.



**Figure 5-39. Text Mode Test Pattern**

If the mouse is working correctly, press the **y** key; otherwise, press the **n** key. After you have chosen **y** or **n**, press the **ENTER** key four times to display the main menu.

---

If the mouse is not working correctly, see Figure 5-40 (Mouse Troubleshooting Chart).

<b>ERROR NO.</b>	<b>PROBABLE CAUSE</b>	<b>MODULE</b>
2010	Graphic Operation Error	Mouse
2020	Text Operation Error	Mouse

**Figure 5-40. Mouse Troubleshooting Chart**

## **8530 Serial Port Test**

Possible defective hardware:

- 8530 Serial Port
- Motherboard.

To use the 8530 Serial Port Test, proceed as follows:

1. Turn the power switch OFF.
2. Insert the MS-DOS System Diskette into drive A.
3. Turn the power switch ON and verify that the Operating System is booted.
4. Remove the MS-DOS System Diskette from drive A.
5. Insert the System Test Diskette into drive A.

- 
6. Enter:

```
A> system<CR>
```

and wait for TESTING OPTIONS to be displayed along with ENTER DESIRED ACTION. Press the **0** key followed by the **ENTER** key.

7. IS THERE A MOUSE CONNECTED? is displayed. Press the **n** key if your system does not have a mouse. If your system does have a mouse, press the **y** key (3.18 or later version of Diagnostics).
8. The list of installed hardware is displayed along with "IS THE LIST OF HARDWARE CORRECT?" Press the **y** key followed by the **ENTER** key.
9. The list of hardware is displayed along with the information on performing all tests or individual tests by typing **21** followed by the **ENTER** key.
10. PAUSE ON ERROR? is displayed. Press the **y** key followed by the **ENTER** key. "IS THE SERIAL PORT LOOPBACK JUMPER INSTALLED?" is displayed. Press the **n** key followed by the **ENTER** key.

11. The system diagnostics test displays:

Serial Data Transfer — INTERNAL loopback — Side A

The 8530 Test is performed and a message similar to the one shown below is displayed.

```
TEST 2100 - Serial Port Test
07:20:33          PASS #1
2101 - 8530 Serial Port          DATA PATH ERROR
```

12. Record the error message and turn the power switch OFF. Compare the error message with the following error messages (Figure 5-41).

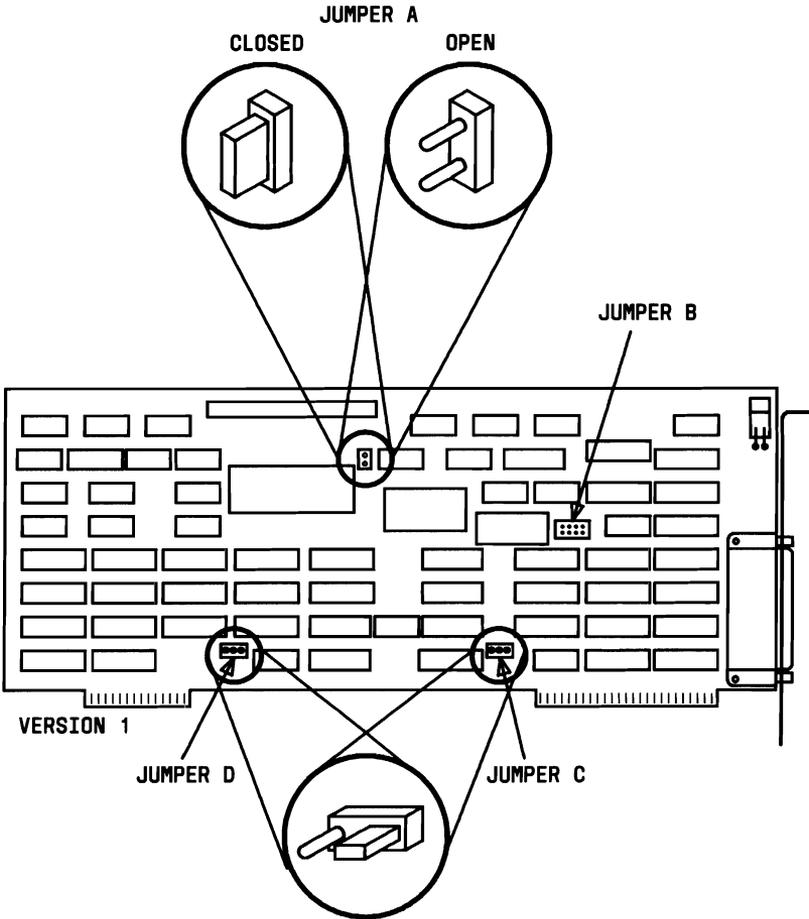
ERROR CODE	MESSAGE
2101	Data Path Check to the 8530 Failed.
2102	Transmit/Receive Failed Using the 8530 Internal Loopback Mode.
2103	Transmit/Receive Failed Using the Loopback Jumper.

**Figure 5-41. 8530 Troubleshooting Chart**

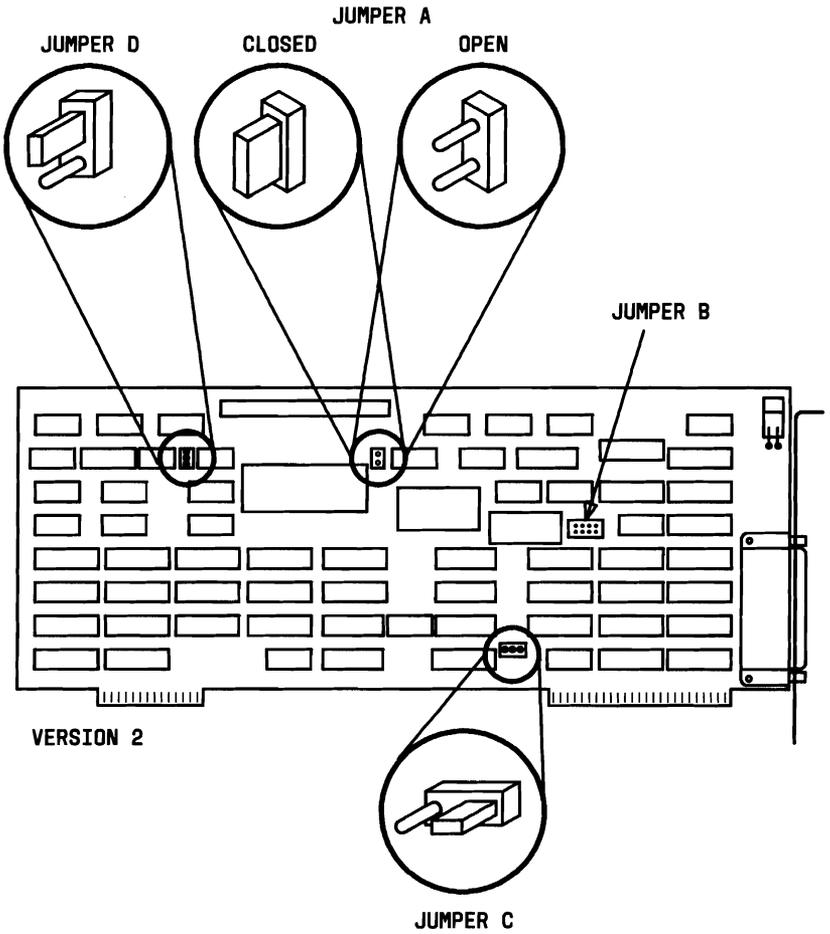
## **Video Option Board (Display Enhancement Board)**

Possible defective hardware:

- Display
  - Video Option Board.
1. Verify that jumper location A has a jumper block installed and jumper location B does not (Figures 5-42 and 5-43).



**Figure 5-42. Jumper Locations for Version One of the DEB**



**Figure 5-43. Jumper Locations for Version Two of the DEB**

## MAINTENANCE

---

2. Turn the power switch OFF.
3. Insert the MS-DOS System Diskette into drive A.
4. Turn the power switch ON and verify that the Operating System is booted.
5. Remove the MS-DOS System Diskette from drive A.
6. Insert the System Test Diskette into drive A (3.18 or later versions of Diagnostics).
7. Enter:

```
A> system<CR>
```

and wait for **TESTING OPTIONS** to be displayed, along with **ENTER DESIRED ACTION**. Press the **0** key followed by the **ENTER** key.

---

## Video Option Board Test

The Video Option Board, also called Display Enhancement Board (DEB), can be tested with the System Test (or Customer Test) by first invoking Selection “0” from “MENU A” which displays the properly installed hardware components. Specifically, if the Video Option Board is present, the hardware list in “MENU B” will include the following additional line:

```
      |  
      |  
23—VIDEO OPTION BOARD.
```

**Note:** This line is NOT displayed if the optional video board is not present in the system or is improperly installed.

Answering “Y” (plus the **ENTER** key) to the request for hardware verification will step the system test to “MENU D.”

Enter selection number “**23**” to activate the Video Option Board Tests and answer the following request displayed on the screen:

PAUSE ON ERROR? (y=Yes, n=NO)

After the choice is made, the System Test displays the following menu which lists all tests available for the Video Option Board:

VIDEO OPTION BOARD TEST SECTION ARE:

- 0 - RETURN TO MAIN MENU
- 1 - MEMORY TEST
- 2 - TRANSPARENT MODE
- 3 - TEXT WITH 400 LINE GRAPHICS
- 4 - TEXT WITH 200 LINE GRAPHICS
- 5 - 400 LINE GRAPHICS, 4 BIT PLANES, FULL LUT
- 6 - REDUCED LUT TEST (LITTLEBIT)
  
- 10 - RUN ALL OF THE ABOVE TESTS

Run specific tests by entering the appropriate value followed by **ENTER** key or run all tests by entering the value **10** followed by the **ENTER** key.

**Note:** Tests 3 and 4 must be run with the contrast control set to midrange. This is necessary in order to distinguish between lines that are blinking from low light to high light.

---

**1—MEMORY TEST:** This option tests the memory and transfers data from memory to disk through DMA operations. During the test, the screen will be blank for about 10 seconds and then several colored screens with a striped background will appear briefly. Each has the following text on the first line:

“MEMORY/DISK TRANSFER TEST THROUGH DMA OPERATION”

No error should occur during this test. If any error does occur, reject the DEB. *Please note* that the “Diagnostic Utility” will write some data on floppy drive A; therefore, a formatted floppy should be ready (**not** write protected) in drive A.

The test results are displayed with the following screen:

```
--- NO ERRORS IN MEMORY TEST ---  
--- NO ERRORS IN MEMORY/DISK TRANSFER TEST  
      THROUGH DMA OPERATIONS ---  
  
PRESS ``ENTER`` KEY TO CONTINUE.
```

**2—OPTION BOARD TRANSPARENT MODE:** This selection displays a full screen with the following three lines:

OPTION BOARD TRANSPARENT MODE

(SCREEN SHOULD BE BASICALLY BLANK)

IS THE SCREEN IMAGE CORRECT? ( y = YES, n = NO ) :

If any additional random character and/or blocks are displayed, reject the board.

---

**3—TEXT WITH 400-LINE GRAPHICS:** This test produces a screen with 8 lines, each exercising a different video feature. Set Contrast Control to Midrange on monitor. Each line gives a description of its appearance and is self-explanatory as follows:

TEXT WITH 400 LINE GRAPHICS

THIS LINE, BORDER, AND TITLE ARE ON STRIPED BACKGROUND.

TEXT ON BACKGROUND OF MOVING STRIPES.

THIS IS PLAIN TEXT ON BLACK BACKGROUND.

THIS IS STRIPED TEXT ON A BLACK BACKGROUND.

TEXT BLINKING FROM LO-LITE TO HI-LITE, ON BLACK BACKGROUND

THE BACKGROUND STRIPES AT THIS LINE ARE BROKEN

IS THE SCREEN IMAGE CORRECT? ( y = YES, n = NO ) :

If the following description and the actual appearance do not agree, reject the board.

**Line 2:** The background consists of vertical, narrow stripes. The color combination is gray, blue, gray, black. On a monochrome monitor, this shows as gray and black stripes.

**Line 3:** The moving stripes are green and black with a horizontal back and forth movement.

**Line 5:** The striped text has a color combination of blue, purple, green, and yellow background. Two shades of gray on a black background are displayed on a monochrome monitor.

**Line 6:** The text is flashing quickly in a light blue color (bright gray for monochrome).

The message on the last line asks the user to approve or reject the results of the test, and must be answered in order to continue. If the description of the actual appearance does not agree, reject the board.

**4—TEXT WITH 200 LINE GRAPHICS:** This selection is similar to the option 3 selection and displays the same self-explanatory messages. Set the Contrast Control to midrange on the monitor.

TEXT WITH 200 LINE GRAPHICS

THIS LINE, BORDER, AND TITLE ARE ON STRIPED BACKGROUND.

TEXT ON BACKGROUND OF MOVING STRIPES.

THIS IS PLAIN TEXT ON BLACK BACKGROUND.

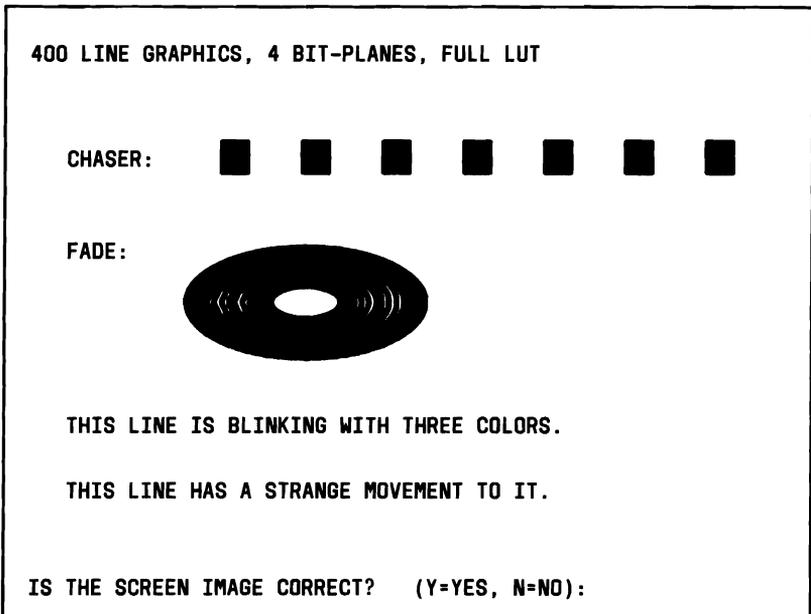
THIS IS STRIPED TEXT ON A BLACK BACKGROUND.

TEXT BLINKING FROM LO-LITE TO HI-LITE, ON BLACK BACKGROUND

IS THE SCREEN IMAGE CORRECT? ( y = YES, n = NO ) :

**5—400 LINE GRAPHICS, 4 BIT-PLANES, FULL LUT:**

Special screen capabilities are displayed, each with a self-explanatory message of the feature tested. This test starts with an ellipse being drawn in the center of the screen. The ellipse then goes through several color changes and will fill in concentric ellipses. After six color changes, it will stop in a solid color display. The final colors are (from the center outward) green, light green, blue, white, and yellow. On a monochrome monitor, the final picture is made up of different shades of gray, with the center being the darkest and getting lighter toward the edges. The final screen will contain the following six lines:



**Line 2:** This line is composed of three colors: green, white, and blue. It has a horizontal movement in both directions with the center located in the upper right-hand corner of the monitor.

**Line 4:** The three colors are green, red, and white.

**Line 5:** This line has some vertical movement combined with some pixel movement through the character (from left-to-right and back).

The results must be approved or rejected by the user to continue testing.

**6—REDUCED LUT TEST (LITTLEBIT):** Three self-explanatory messages are displayed for this test:

```
REDUCED LUT TEST (LITTLEBIT)

THIS LINE OF TEXT IS NOT BLINKING

THIS IS A PLAIN HI-LITE WHITE LINE OF TEXT

IS THE SCREEN IMAGE CORRECT?  ( y = YES, n = NO ) :
```

The user must approve or reject the results.

---

Upon completing these tests, the following summary is produced.

```

Tests completed.
Number of test loops runs = 1
Total error during testing = X (actual number)
PRESS ``ENTER`` KEY TO CONTINUE
    
```

Pressing the “**ENTER**” key will produce the following data:

```

TESTING RESULTS:
TEST # | ERRORS | PASSES | TEST TITLE
-----|-----|-----|-----
2300   | 0*     | 1*     | VIDE0 OPTION BOARD
PRESS ``ENTER`` KEY TO CONTINUE
    
```

Pressing the “**ENTER**” key returns the user to “MENU A.”

Error codes and explanations are shown in Figure 5-44.

<b>ERROR MESSAGES FOR THE VIDEO OPTION BOARD (DEB)</b>		
<b>ERROR</b>	<b>PROBABLE CAUSE</b>	<b>MODULE</b>
2301	Plane 0 word memory error	DEB
2302	Plane 1 word memory error	DEB
2303	Plane 2 word memory error	DEB
2304	Plane 0 byte memory error	DEB
2305	Plane 1 byte memory error	DEB
2306	Plane 2 byte memory error	DEB
2307	Plane 0 memory/disk transfer test through DMA operation error	DEB
2308	Plane 1 memory/disk transfer test through DMA operation error	DEB
2309	Plane 2 memory/disk transfer test through DMA operation error	DEB
2310	Transfer mode test failure	DEB
2320	Text/graphics error (640x400)	DEB
2330	Text/graphics error (640x300)	DEB
2340	Full graphics display error (640x400, 4 planes)	DEB
2350	Partial LUT test error ("littlebit" test)	DEB

**Figure 5-44. Video Option Board Troubleshooting Chart**

---

## Second Hard Disk Unit

Possible defective hardware:

- HDU Cable
- HDU Controller
- HDU.

To test the second hard disk, proceed as follows:

1. Turn the power switch OFF.
2. Insert the MS-DOS System Diskette into drive A.
3. Turn the power switch ON and verify that the Operating System is booted.
4. Remove the MS-DOS System Diskette from drive A.
5. Insert the System Test Diskette into drive A.

6. Enter:

```
A> system<CR>
```

and wait for TESTING OPTIONS to be displayed, along with ENTER DESIRED ACTION. Press the **0** key followed by the **ENTER** key.

7. IS THERE A MOUSE CONNECTED? is displayed. Press the **n** key if your system does not have a mouse. If your system does have a mouse, press the **y** key (3.18 or later versions of Diagnostics).
8. The list of installed hardware is displayed along with "IS LIST OF HARDWARE CORRECT?" Press the **y** key followed by the **ENTER** key.
9. Verify the list of hardware is correctly displayed with the corresponding tests or individual tests. Select the XX MB HDU Test by typing **24** followed by the **ENTER** key.
10. PAUSE ON ERROR? is displayed. Press the **y** key followed by the **ENTER** key.

Number of retries on HDU error (0 to 5) is displayed. Enter the desired action.

11. HDU Tests 1 through 7 will run and the name of the test being run is displayed. An error message similar to the following is displayed if an error occurs:

00:00:00	PASS #1				
2401	- 10 MB	HARD	DISK	DRIVE	TIME OUT
0	0	0	1		%0080
DRIVE	TRACK	HEAD	SECTOR		CODE

12. Record the error message and turn the power switch OFF.

13. Using the recorded error message and the tables shown in Figures 5-45 and 5-46, determine the module that generated the failure and replace that module.

<b>ERROR NO.</b>	<b>PROBABLE CAUSE*</b>	<b>MODULE</b>
2401	Drive Ready Test Failed	1. HDU Cables 2. HDU Controller 3. HDU
2402	Controller Self-Diagnostic Failed	HDU Controller
2403	Controller RAM Test Failed	HDU Controller
2404	Drive Self-Diagnostics Failed	HDU
2405	Surface Verify Test Failed	HDU
2406	Test Cylinder Write/Read Tests Failed	1. HDU Controller 2. HDU
2407	Seek Test Failed	1. HDU Controller 2. HDU

\* If the HDUs available disk space is less than the nominal value (10 MBs for 10 Meg HDUs and 20 MBs for 20 Meg HDUs), it should be replaced.

**Figure 5-45. HDU Troubleshooting Chart (Sheet 1 of 2)**

ERROR NO.	PROBABLE CAUSE*	MODULE
2408	Data Pattern Test Failed	1. HDU Controller 2. HDU
2409	Funnel Test Failed	1. HDU Controller 2. HDU
2410	Aging Test Failed	1. HDU Controller 2. HDU
2411	Low-Level Format Test Failed	1. HDU Controller 2. HDU
2412	Write and Verify Surface Failed (determine Bad Block List)	1. HDU Controller 2. HDU
2430	Too Many Bad Blocks	1. HDU Controller 2. HDU
2431	Bad Block Determination Test Failed	1. HDU Controller 2. HDU
2432	Track 00, 01, 02, or 03 Bad	1. HDU

\* If the HDUs available disk space is less than the nominal value (10 MBs for 10 Meg HDUs and 20 MBs for 20 Meg HDUs), it should be replaced.

**Figure 5-45. HDU Troubleshooting Chart (Sheet 2 of 2)**

<b>STATUS WORD</b>	<b>PROBABLE CAUSE</b>	<b>MODULE</b>
%00FF	Sense Fail (sense operation failed)	1. HDU Controller 2. HDU
%0080	Time Out (HDU failed to respond)	HDU
%0040	Bad Seek (seek operation failed)	HDU
%0020	Bad Controller (controller failed)	HDU Controller
%0011	Data Corrected (ECC corrected data error)	See Note.
%0010	Bad ECC (Bad ECC on disk read)	HDU Controller
%0009	(Attempt to DMA across 64-KB boundary)	1. HDU Controller 2. Motherboard
%0007	Init Fail (Drive parameter activity fail)	Check DIP Switch on HDU Controller

**Note:** This status word indicates that an error was found and corrected on your HDU by the controller. If this is a recurring error, you may have a problem with the surface of your HDU.

**Figure 5-46. HDU Status Words (Sheet 1 of 2)**

STATUS WORD	PROBABLE CAUSE	MODULE
%0005	Bad Reset (reset failed)	HDU
%0004	Record not found (requested sector not found)	HDU
%0002	Bad Address Mark (address mark not found)	HDU
%0001	Bad Command (bad command passed to disk—I/O error)	<ol style="list-style-type: none"> <li>1. Check Switch (or jumpers) on HDU Controller</li> <li>2. Check HDU Cables</li> <li>3. HDU Controller</li> <li>4. HDU</li> </ol>

**Figure 5-46. HDU Status Words (Sheet 2 of 2)**

# STAND-ALONE MOTHERBOARD DMA TEST DIAGNOSTICS

---

## Test Description

Motherboard DMA Controller Test — Version X.X

The DMA Test is a stand-alone program that tests the DMA chip on the Motherboard. The DMA controller test checks the Motherboard DMA chip for multichannel operation. If the DMA chip is faulty, the program will detect this problem.

## Loading DMA Test

The DMA Test Diagnostics is loaded as follows:

1. Insert the MS-DOS System Diskette into the MFD Unit A and close the drive door.
2. Turn the System Module power switch ON.
3. After the Resident Diagnostics have successfully been completed, verify that the Operating System has been loaded.
4. Remove the MS-DOS System Diskette from the MFD Unit A.
5. Insert the DMA Stand-Alone Diskette into the MFD Unit A and close the drive door.

6. Load the DMA Test Diagnostics by entering:

```
A> DMA-TEST<CR>
```

7. When the diagnostics have been loaded, MENU A will appear on the screen.

### *Operating Procedures*

When the DMA controller test is started, the following message is displayed:

```
Motherboard DMA Controller Test — Version X.X
This program tests the DMA controller for multichannel
operation.
If the DMA has a bug the program may hang.
If this happens for more than 120 seconds, re-start the
computer and run the test again.
If the computer hangs a second time, or a fail message is
reported, a new PAL, PL52B, is available from the Hot-Line,
1-800-922-0354, to correct the problem.

Press <return> to execute test -
```

When the return key is pressed, the following message appears:

```
***** DMA TEST
```

- If you have a good DMA chip, the word PASSED is displayed next to the previous message.
- If you have a bad DMA chip, the word FAILED is displayed next to the following message.

```
#### DMA TEST ERROR !!!
```

```
The DMA controller chip 8237 failed.  
The bug occurs when 2 or more channels  
of DMA are used at the same time. Most  
high speed tape drives and some network  
interface cards will be affected.  
This is the only diagnostic that will find  
the problem, since other diagnostics  
test one channel at a time.
```

```
Press <return> to exit -
```

**Note:** The DMA test will try to write to a floppy in drive A. The floppy must not be write protected.

At the end of the test, press the "Return" key to exit the program.

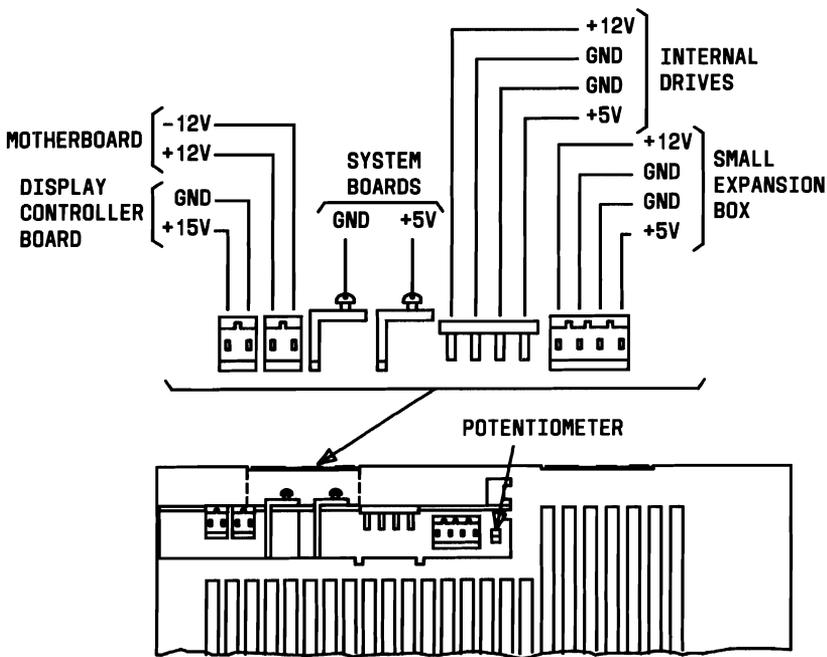
## POWER SUPPLY ADJUSTMENT

---

The only adjustment performed of the power supply is on the +5 V dc circuitry. Any changes in this voltage directly affects the +12, -12, and +15 V dc. The adjustment is performed by means of the potentiometer found on the power supply next to the MFD Unit connector.

1. Turn the power switch OFF.
2. Loosen the two screws that secure the upper cover.
3. Slide the upper cover forward approximately 0.5 inch and lift it from the System Module.

- Place the VOM leads across the +5 V dc and GND terminals of the power supply (10 V dc or greater scale—observe polarity) (Figure 5-47).



**Figure 5-47. Power Supply Connectors and Potentiometer**

5. Turn the power switch ON.
6. Rotate the potentiometer (Figure 5-47) with a screwdriver until the VOM indicates exactly +5 V dc.
7. Turn the power switch OFF.
8. If no further maintenance is required, replace the upper cover.

## REPLACING FAULTY MODULES

---

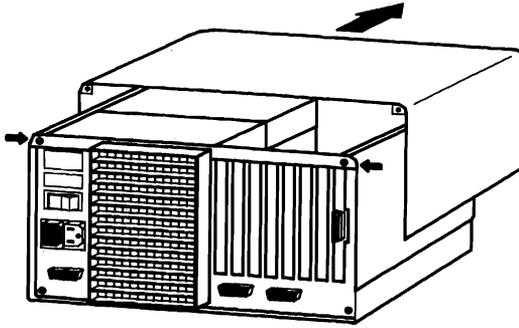
This section contains procedures for the replacement of the following modules:

- Power Supply
- Fan
- Motherboard
- Display Controller Board
- Bus Converter Board
- Mini-Floppy Disk Unit
- XX-MB Slim HDU
- HDU Controller Board
- Small Expansion Box (External 10-MB HDU)
- Memory Expansion Board
- 64-K Bit or 256-K Bit RAM Chip.

---

## Removing Upper System Module Cover

1. Loosen the two screws that secure the upper cover to the System Module (Figure 5-48).

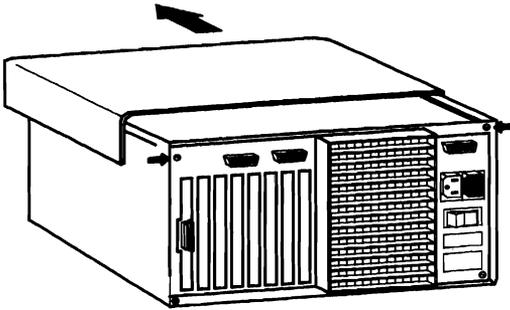


**Figure 5-48. Removing the Upper System Module Cover**

2. Slide the upper cover forward approximately 0.5 inch and lift it from the System Module.

## Removing Lower System Module Cover

1. Turn the System Module upside down so the lower cover is on top.
2. Loosen the two screws from the lower section of the rear panel (Figure 5-49).



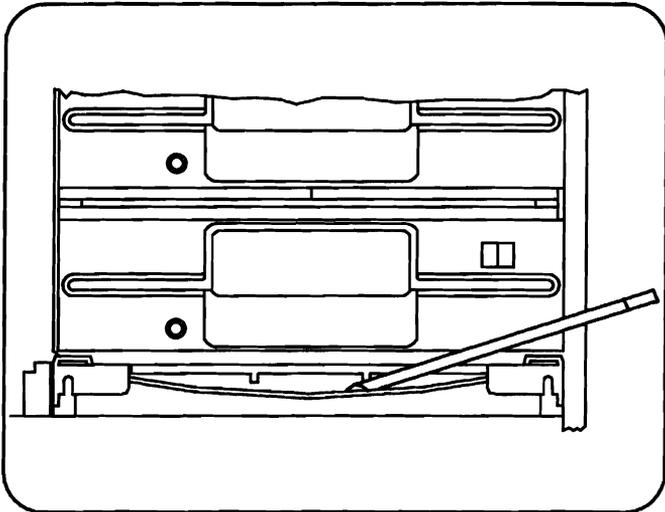
**Figure 5-49. Removing the Lower System Module Cover**

3. Slide the lower cover forward approximately 0.5 inch and lift it from the System Module.

---

## Replacing Power Supply Unit

1. Turn the System Module and all external devices OFF.
2. Unplug the System Module power cable from the rear panel.
3. Remove the upper System Module cover.
4. Using a screwdriver, push down the metal bar below the MFD Units assembly and slide the assembly forward to gain access to the signal and power cables (Figure 5-50).

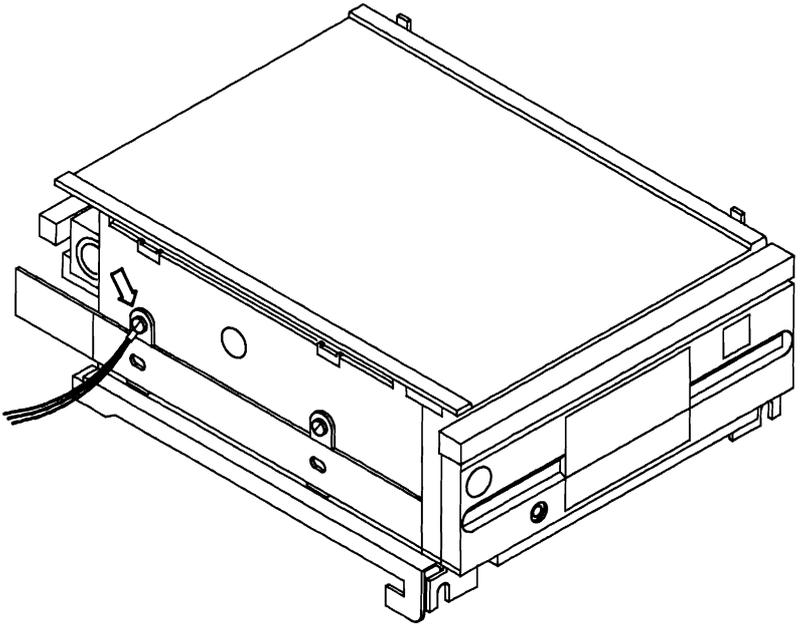


**Figure 5-50. Unlocking the Drive Assembly**

5. Disconnect all ribbon cables, power cables, and ground connectors from the rear of the drive.

**Note:** Notice how the numbers on the ribbon cable connectors correspond with the numbers on the connectors at the rear of the MFD Unit or HDU.

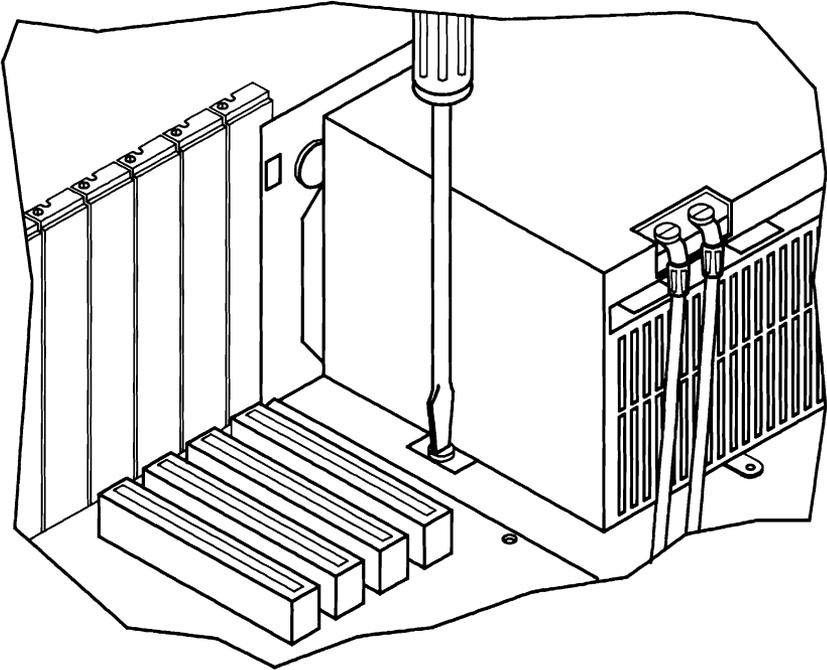
- 
6. Remove the screw that secures the ground strap to the side of the drive assembly (Figure 5-51).



**Figure 5-51. Removing the Drive Assembly Ground Strap**

7. Remove the drive assembly from the System Module and place it in a safe place.

8. Remove the power cables for the Display, Motherboard, HDU, and MFD Unit from the power supply.
9. Remove the +5 and GND cables from the power supply.
10. Remove the screw that secures the power supply to the chassis (Figure 5-52).



**Figure 5-52. Removing the Power Supply**

11. Gently slide the power supply toward the Bus Converter board until it can be raised from the chassis.
12. Remove the screw that secures the ground strap of the fan to the outside of the power supply.
13. Remove the two screws that secure the fan cover and remove the cover.
14. Disconnect the power cables from the fan and slide the cables and connectors through the hole in the rear panel.
15. Lift the power supply out of the System Module chassis.
16. Remove the screws that secure the ground cables to the side of the power supply.

To reinstall the power supply, perform the removal operation in reverse order.

## **Replacing Fan**

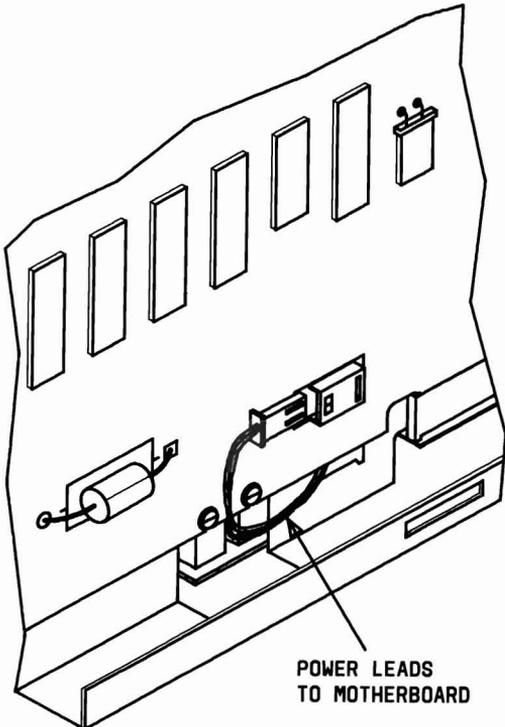
1. Perform the procedures for removing the power supply.
2. After the power supply has been removed, use a pair of side cutters to cut the rubber inserts securing the fan to the rear panel.
3. Remove the fan.
4. Slide the new rubber inserts through the holes in the rear panel and carefully pull them through (from the outside) until they are flush with the inside of rear panel.
5. Align the replacement fan with the inserts making sure the power connectors for the fan are at the top.
6. Slide new rubber inserts through the holes in the fan until they are protruding out of the rear of the fan.
7. Carefully pull the inserts through the fan until they are holding the fan in place.

Perform procedures for removing the power supply in reverse order to reinstall the power supply.

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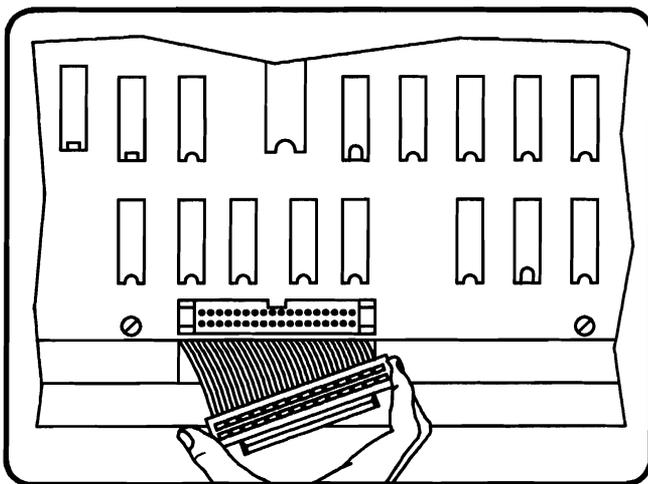
## Replacing Motherboard

1. Turn the System Module and all external devices OFF.
2. Unplug the ac power cable from the rear panel.
3. Disconnect all cables (Display, Keyboard, Printer, etc.) from the rear panel of the System Module.
4. Loosen the two screws that secure the lower cover.
5. Invert the System Module and slide the lower cover forward approximately 0.5 inch and lift it from the System Module.
6. Unplug the +12 and -12 power cable from the Motherboard (Figure 5-53).



**Figure 5-53. Motherboard Power Cable and +5 V dc—GND Connectors**

7. Loosen the screws that secure the +5 V dc and GND connectors on the Motherboard to the Display Controller.
8. Unplug the MFD Unit signal cable connector from the Motherboard (Figure 5-54).



**Figure 5-54. Removing MFD Unit Signal Cable From Motherboard**

## MAINTENANCE

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9. Remove the four mounting screws that secure the Motherboard to the chassis.
  
10. Carefully remove the Motherboard from the System Module.

Prior to installing the new Motherboard, ensure that the switches and jumpers are configured the same on the new board. Refer to Appendix A for information on the location and setting of the switches and jumpers.

To reinstall the Motherboard, perform the removal procedures in reverse order.

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## Replacing Bus Converter

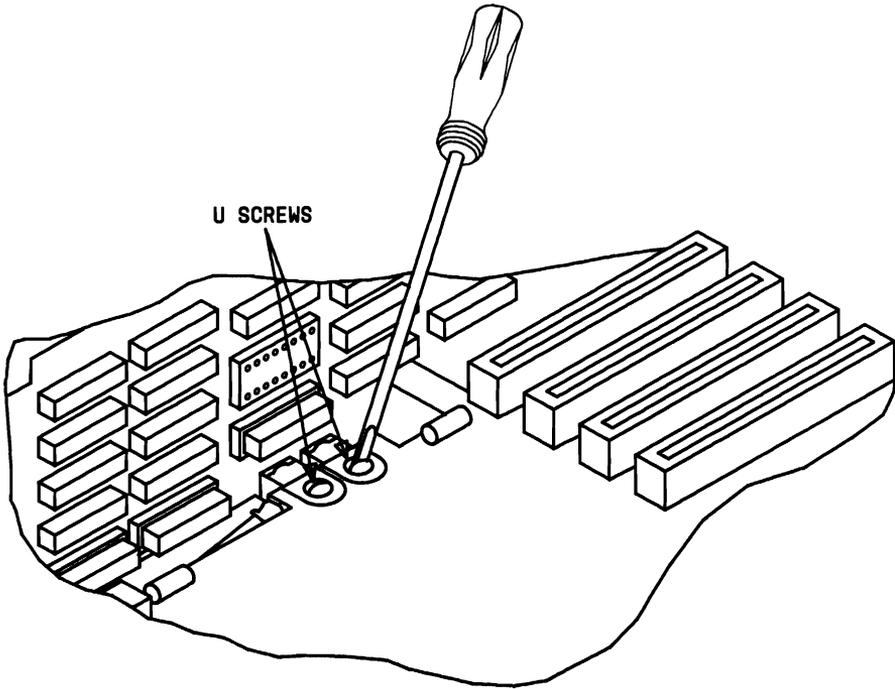
1. Turn the System Module and all external devices OFF.
2. Unplug the ac power cable from the rear panel.
3. Loosen the two screws that secure the upper cover.
4. Slide the upper cover forward approximately 0.5 inch and lift it from the System Module.
5. Remove all expansion boards from the Bus Converter.
6. Loosen the screws that secure the +5 V dc and GND terminals of the Bus Converter to the Display Controller.
7. Remove the +5 V dc and GND power cables from the connect points.
8. Remove the four mounting screws that secure the Bus Converter to the chassis.
9. Gently slide the Bus Converter toward the power supply until the connectors have cleared the Display Controller.
10. Carefully lift the Bus Converter from the System.

To reinstall the Bus Converter, perform the removal procedures in reverse order.

## **Replacing Display Controller**

1. Turn the System Module and all external devices OFF.
2. Unplug the ac power cable from the rear panel.
3. Loosen the four screws that secure the upper and lower covers.
4. Slide the upper cover forward approximately 0.5 inch and lift it from the System Module.
5. Remove all expansion boards from the Bus Converter.
6. Unplug the +15 V dc power cable from rear of the Display Controller.

- 
7. Loosen the two screws that secure the +5 and GND terminals of the Bus Converter to the Display Controller (Figure 5-55).



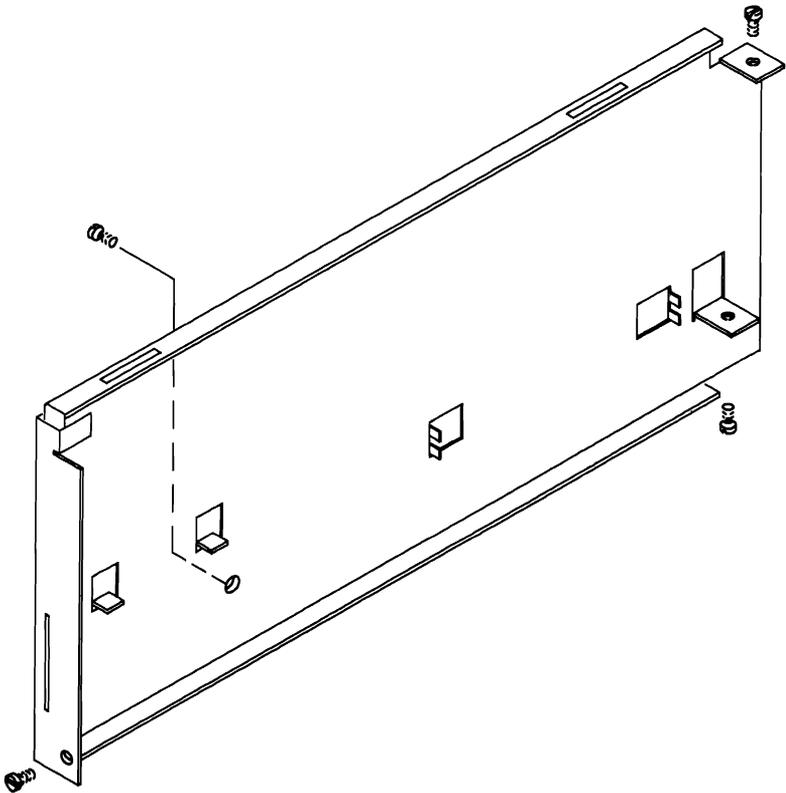
**Figure 5-55. Bus Converter +5 V dc and GND Terminal Connectors**

## MAINTENANCE

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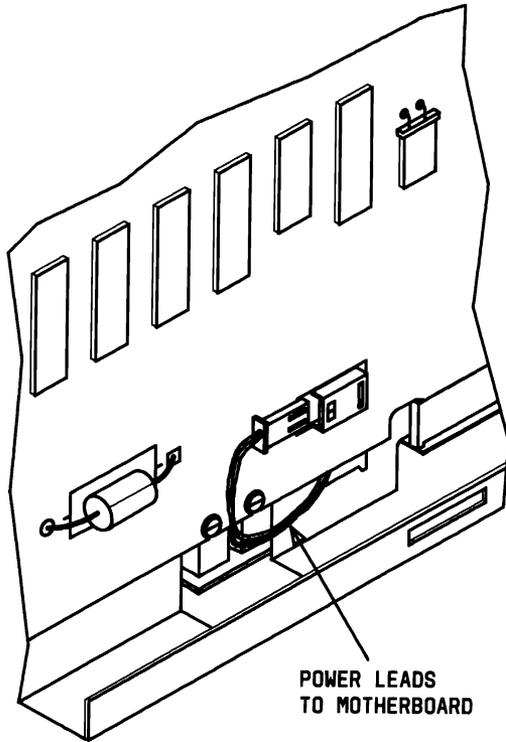
8. Remove the +5 and GND power cables from the connect points.
9. Remove the two screws that secure the Display Controller retaining bracket to the rear panel. One of the screws is at the top of the retaining bracket, and the other is on the rear panel under the Display connector.
10. Invert the System Module and slide the lower cover forward approximately 0.5 inch and lift it from the System Module.

11. Remove the four screws that secure the left panel to the chassis. One of the screws is on the front, one at the top of the rear panel, one on the left panel, and one at the rear of the chassis on the Motherboard side (Figure 5-56).



**Figure 5-56. Removing the Left Side Panel**

12. Invert the System Module and loosen the two screws that secure the +5 and GND terminals of the Motherboard to the Display Controller (Figure 5-57).



**Figure 5-57. Motherboard +5 and GND Terminal Connectors**

13. Place the System Module on its side and gently push upwards on the Display Controller connectors until the connectors are separated from the Bus Converter and Motherboard. Then, carefully lift the Display Controller from the System Module.

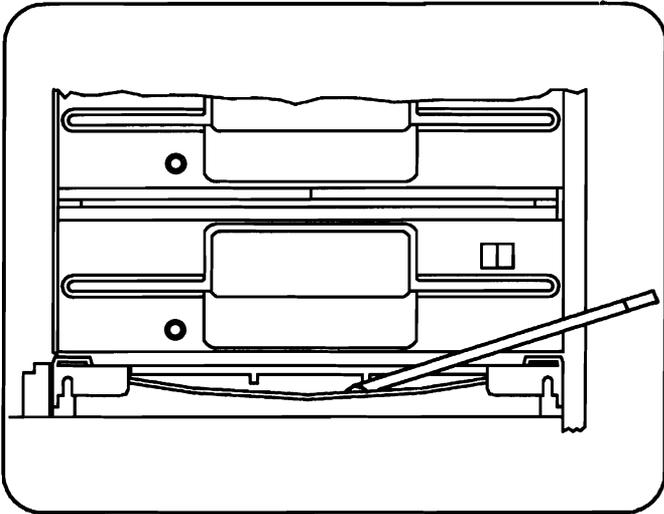
If installing a new Display Controller, verify that the jumpers on the new controller are set the same as the one just removed. Refer to Appendix A for the location and default settings of the jumpers.

To reinstall the Display Controller, perform the removal procedures in reverse order.

## **Replacing Lower Mini-Floppy Disk Unit**

1. Turn the System Module and all external devices OFF.
2. Unplug the ac power cable from the rear panel.
3. Loosen the two screws that secure the upper cover.
4. Slide the upper cover forward approximately 0.5 inch and lift it from the System Module.

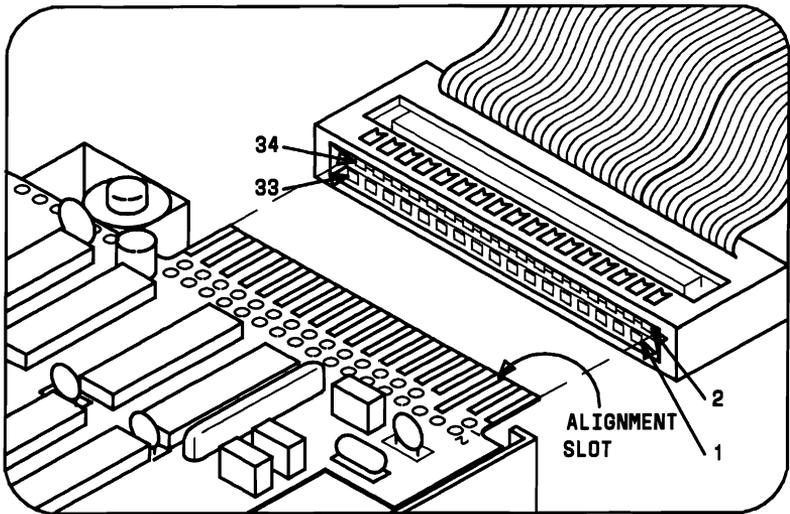
- 
5. Using a screwdriver, push down the metal bar below the drive assembly and slide the assembly forward to permit access to the signal and power cables (Figure 5-58).



**Figure 5-58. Unlocking Drive Assembly**

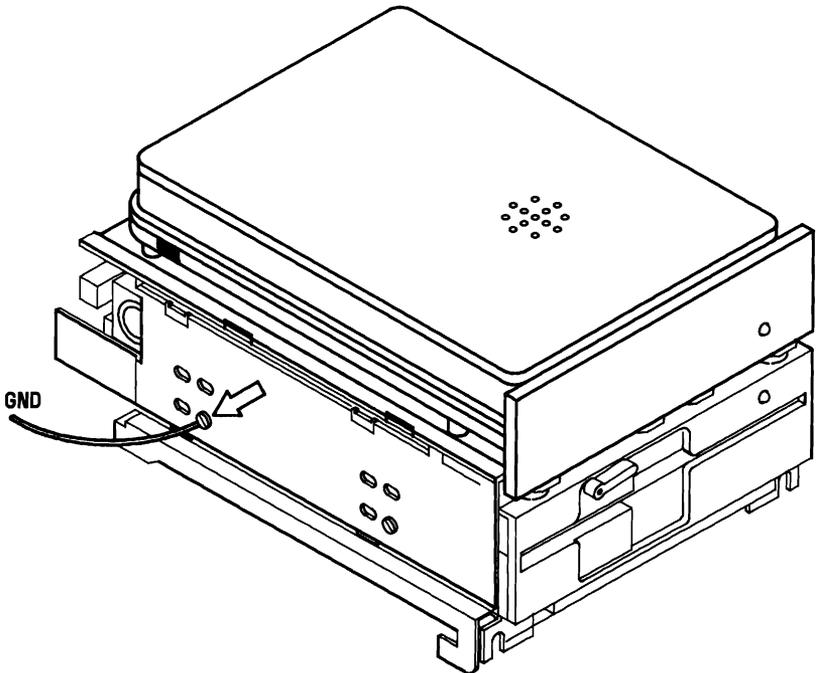
6. Remove the ribbon cables, power cables, and the ground connector(s) from the rear of the MFD Unit(s) and/or HDU (Figure 5-59).

**Note:** Notice how the numbers on the ribbon cable connectors correspond with the numbers on the connectors at the rear of the MFD Unit(s) or HDU.



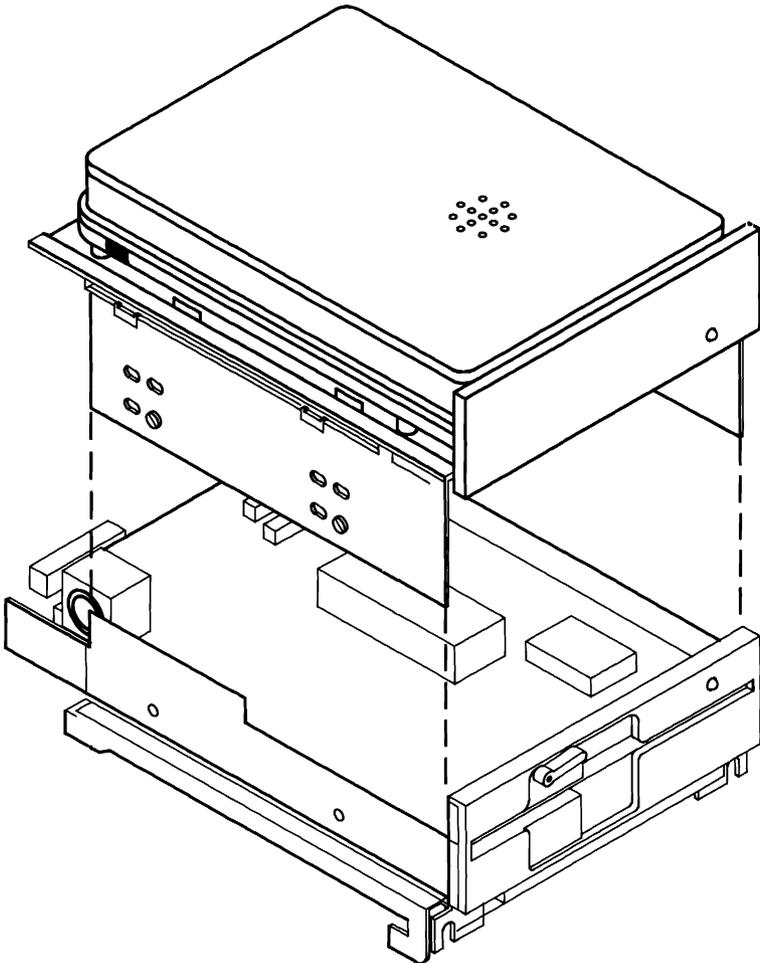
**Figure 5-59. MFD Unit Signal Cable Connections**

- 
7. Using a standard screwdriver, carefully remove the screw(s) from the side of the assembly that secures the ground strap(s) and remove the assembly from the System Module (Figure 5-60).



**Figure 5-60. Removing the Drive Assembly Ground Strap**

8. Remove the remaining screws that hold the metal cover of the lower MFD Unit in place and lift the cover and the upper MFD Unit or HDU from the assembly (Figure 5-61).

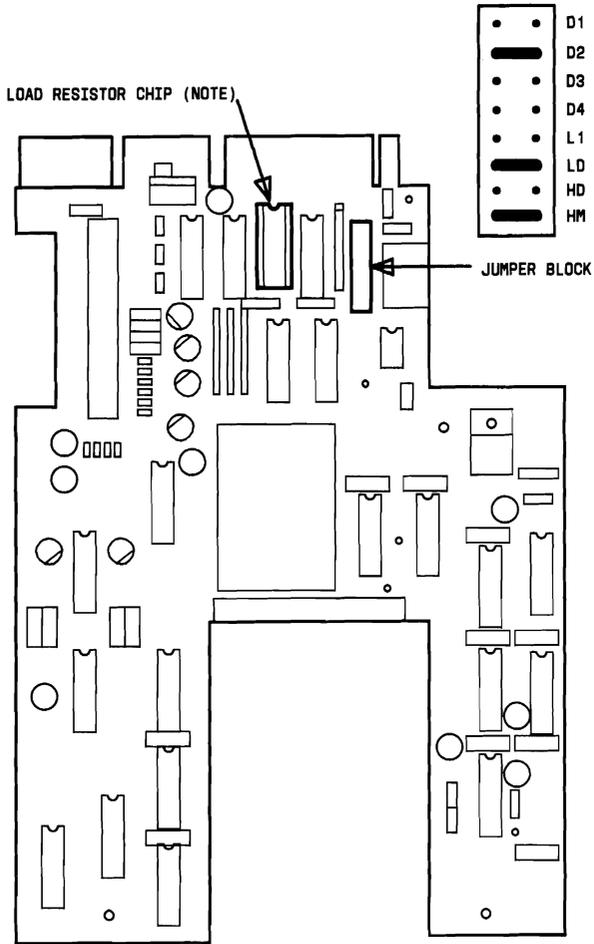


**Figure 5-61. Removal of Metal Cover**

9. Remove the four screws that secure the lower MFD Unit to the base of the drive assembly and remove the MFD Unit from the base.

Prior to installing the new MFD Unit, refer to Appendix A to verify the jumper settings. Also, MFD Unit A must have a Load Resistor Chip present (Figure 5-62).

To reinstall MFD Unit A, perform the removal procedures in reverse order.



NOTE:  
SOME VERSIONS MAYBE SOLDERED AND  
HAVE TWO JUMPER BLOCKS

**Figure 5-62. MFD Unit Load Resistor and Jumper Block**

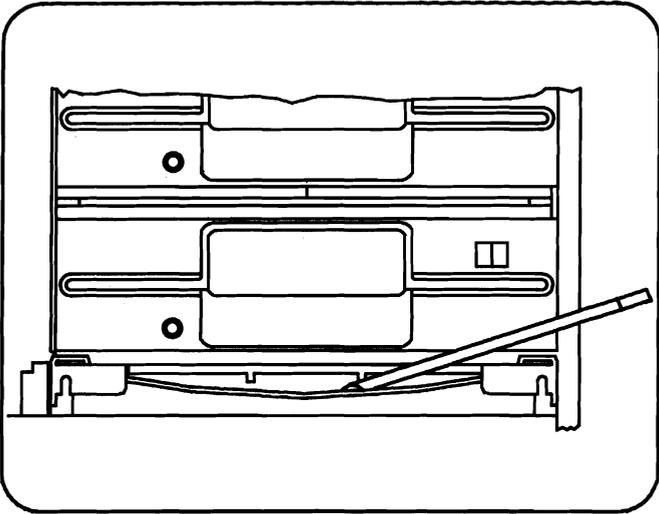
## **Replacing Upper Mini-Floppy Disk Unit**

1. Turn the System Module and all external devices OFF.
2. Unplug the ac power cable from the rear panel.
3. Loosen the two screws that secure the upper cover.
4. Slide the upper cover forward approximately 0.5 inch and lift it from the System Module.

## MAINTENANCE

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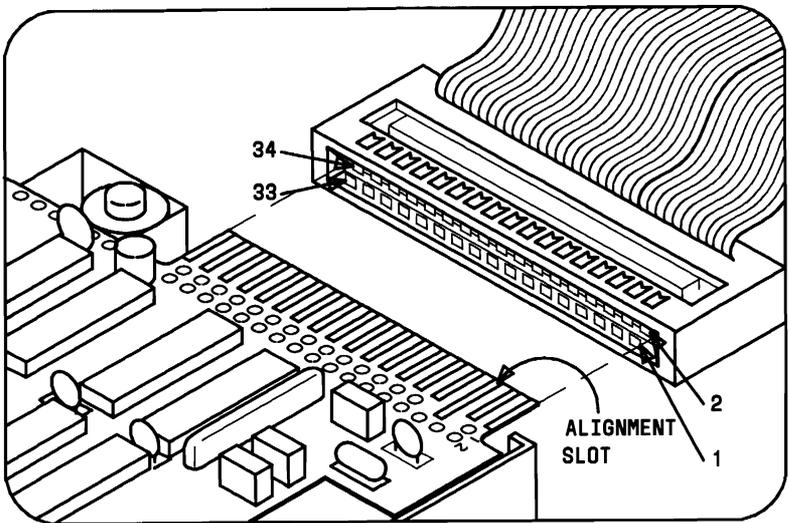
5. Using a screwdriver, push down the metal bar below the drive assembly and slide the assembly forward to permit access to the signal and power cables. (Figure 5-63).



**Figure 5-63. Unlocking the Drive Assembly**

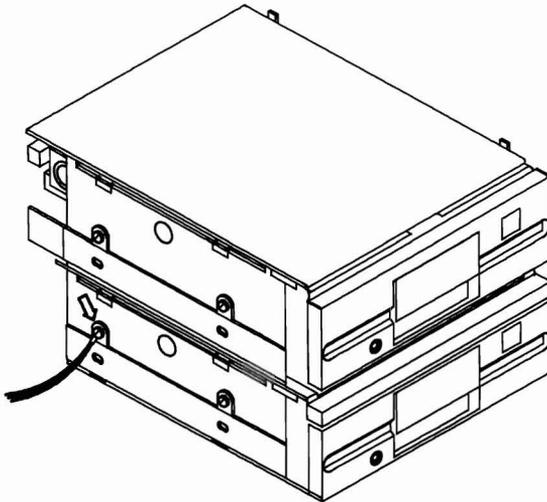
6. Remove the ribbon cables, power cables, and the ground connectors from the rear of both MFD Units (Figure 5-64).

**Note:** Notice how the numbers on the ribbon cable connectors correspond with the numbers on the connectors at the rear of the MFD Units.



**Figure 5-64. MFD Unit Signal Cable Connection**

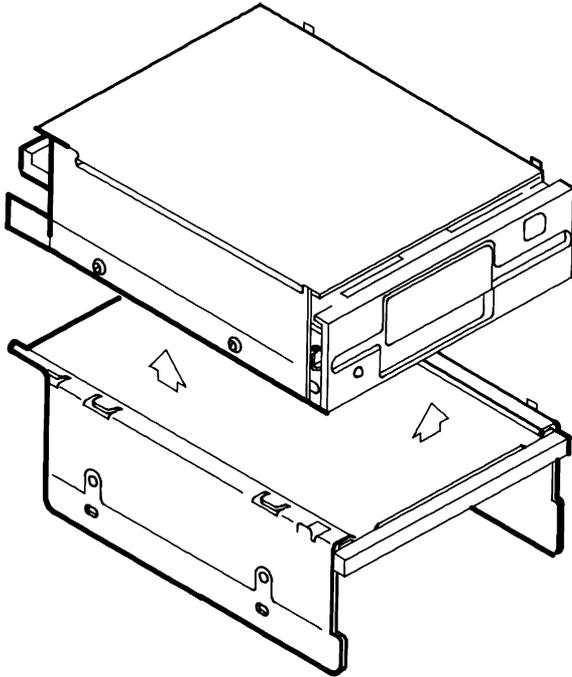
7. Remove the screw(s) from the side of the assembly that secures the ground strap(s) and remove the drive assembly from the System Module (Figure 5-65).



**Figure 5-65. Removing the Drive Assembly Ground Strap**

8. Remove the remaining screws that hold the metal cover of the lower MFD Unit in place and lift the cover and the upper MFD Unit from the assembly.

- 
9. Remove the four screws that attach the upper MFD Unit to the cover and remove the MFD Unit from the cover (Figure 5-66).



**Figure 5-66. Removing the Metal Cover and Upper MFD Unit**

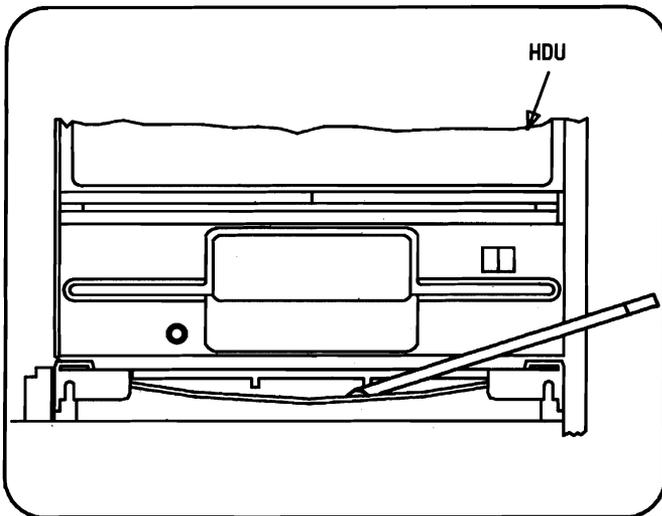
Prior to installing the new MFD Unit, verify that the jumpers are set the same as the drive just removed. Refer to Appendix A for the location and default setting of the jumpers. Remove the terminating load resistor chip or jumpers as required.

To reinstall MFD Unit B, perform the removal procedures in reverse order.

## **Replacing Slim HDU**

1. Turn the System Module and all external devices OFF.
2. Unplug the ac power cable from the rear panel.
3. Loosen the two screws that secure the upper cover.
4. Slide the upper cover forward approximately 0.5 inch and lift it from the System Module.

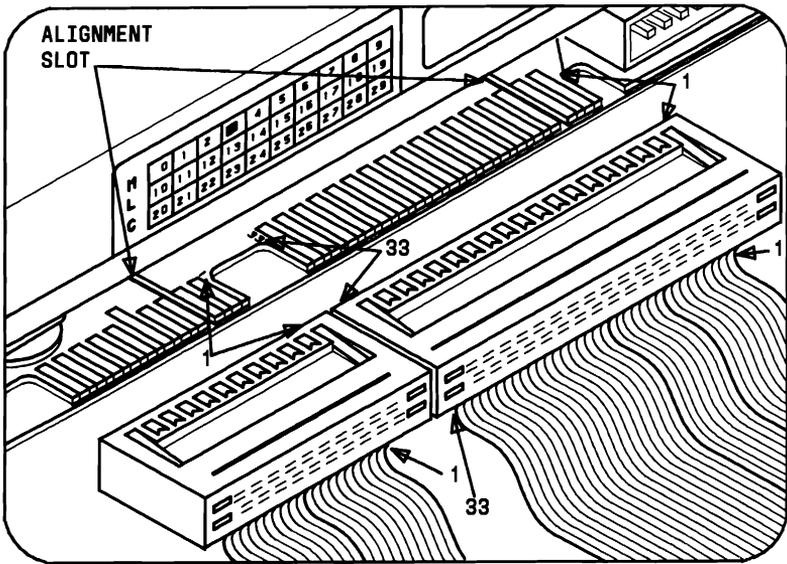
- 
- Using a screwdriver, push down the metal bar below the drive assembly and slide the assembly forward to gain access to the signal and power cables (Figure 5-67).



**Figure 5-67. Unlocking the Drive Assembly**

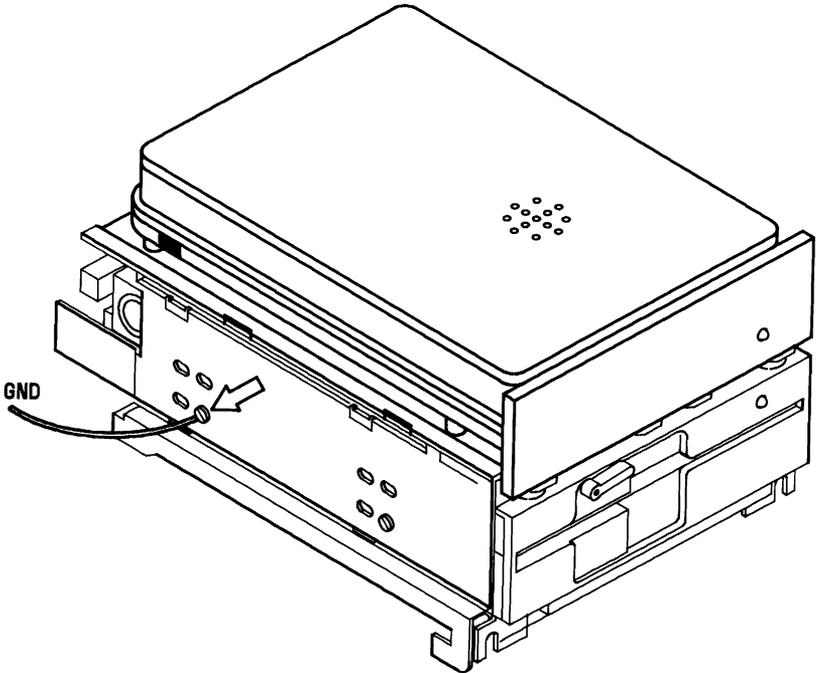
- Carefully remove the ribbon cables, power cables, and the ground connector from the rear of the drives (Figure 5-68).

**Note:** Notice how the numbers on the ribbon cable connectors correspond with the numbers on the connectors at the rear of the MFD Unit and HDU.



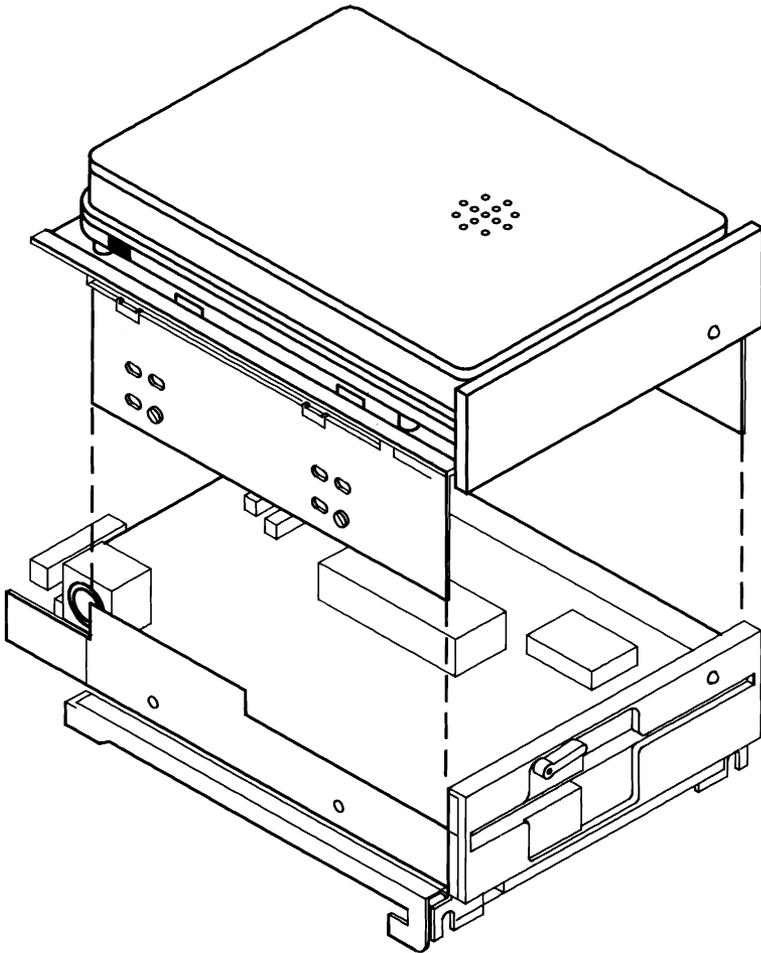
**Figure 5-68. Slim HDU Cable Connections**

- 
- Using a standard screwdriver, remove the screw from the side of the drive assembly that secures the ground strap and remove the assembly from the cabinet (Figure 5-69).



**Figure 5-69. Removing the Drive Assembly Ground Strap**

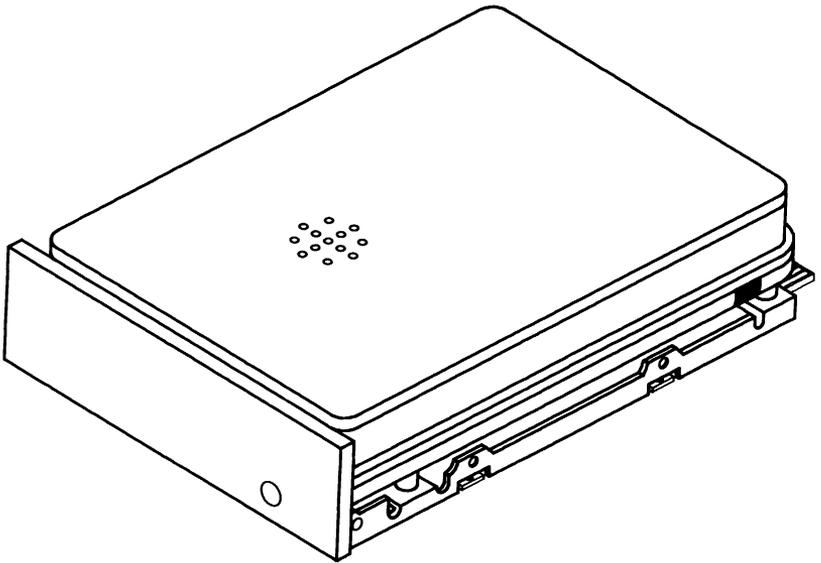
8. Remove the remaining screws that hold the metal cover of the MFD Unit in place, and lift the cover and the HDU from the assembly (Figure 5-70).



**Figure 5-70. Removing the Metal Cover**

- 
9. Remove the four screws that attach the HDU to the cover and remove the HDU from the cover.

To reinstall the Slim HDU (Figure 5-71), perform the removal procedure in reverse order.



**Figure 5-71. Slim Hard Disk Unit**

## **Replacing Memory Expansion Board**

1. Turn the System Module and all external devices OFF.
2. Unplug the ac power cable from the rear panel.
3. Loosen the two screws that secure the upper cover.
4. Slide the upper cover forward approximately 0.5 inch and lift it from the System Module.
5. Remove the screw that secures the Memory Expansion Board retaining bracket to the rear panel.
6. Carefully remove the Memory Expansion Board from the Bus Converter.

If Bank 2 has been populated with memory chips to expand the system memory to 640 KB, remove the chips from the faulty expansion board and insert them into the replacement board.

To reinstall the Memory Expansion Board, perform the removal procedures in reverse order.

---

## Replacing HDU Controller

1. Turn the System Module and all external devices OFF.
2. Unplug the ac power cable from the rear panel.
3. Loosen the two screws that secure the upper cover.
4. Slide the upper cover forward approximately 0.5 inch and lift it from the System Module.
5. Disconnect the ribbon cables from the HDU Controller.

**Note:** Notice how the ribbon cables are connected to the controller with the blue stripe of the cable at the bottom.

6. Remove the screw that secures the HDU Controller Board retaining bracket to the rear panel.
7. Carefully remove the HDU Controller Board from the Bus Converter.

## MAINTENANCE

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Prior to installing the new HDU Controller Board, verify that the DIP Switches and Jumpers are set the same as the old Controller. Refer to Appendix A for information on the setting and location of the switches and jumpers.

To reinstall the new HDU Controller, perform the removal procedure in reverse order.

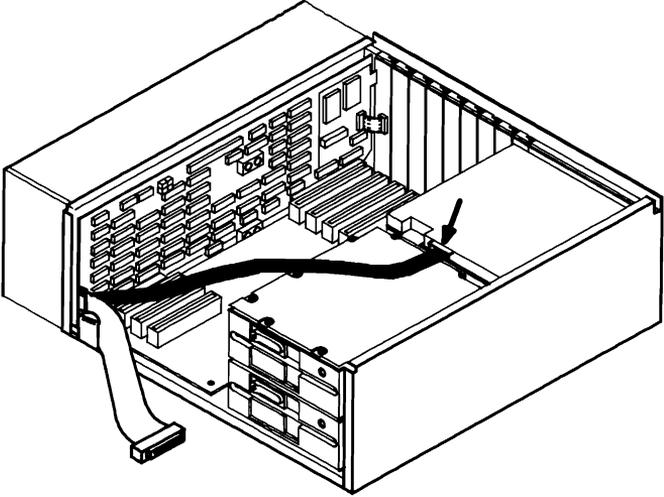
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## Replacing Small Expansion Box (External HDU)

1. Turn the System Module and all external devices OFF.
2. Unplug the ac power cable from the rear panel.
3. Loosen the two screws that secure the upper cover.
4. Slide the upper cover forward approximately 0.5 inch and lift it from the System Module.
5. Disconnect the ribbon cables from the HDU Controller

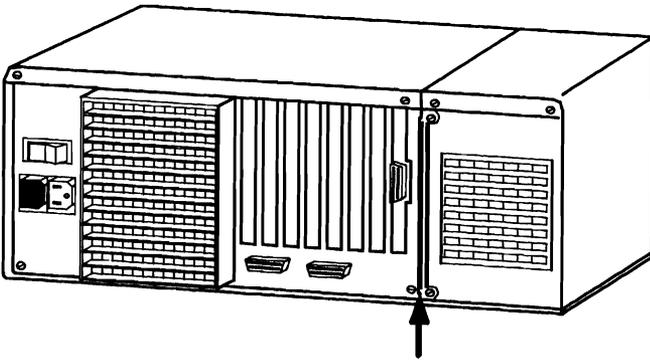
**Note:** Notice how the ribbon cables are connected to the controller with the blue strip of the cable at the bottom.

- 6. Disconnect the Small Expansion Box power cable from the power supply (Figure 5-72).



**Figure 5-72. Small Expansion Box Power Cable Connection**

- 
7. Remove the screws that secure the bracket to the Small Expansion Box and remove the bracket (Figure 5-73).



**Figure 5-73. Small Expansion Box Bracket**

8. Slide the Small Expansion Box forward until the tab in the front is free from the slot on the front of the chassis, and remove the Small Expansion Box from the System Module.
9. Loosen the two screws that secure the cover of the Small Expansion Box.

10. Slide the upper cover of the Small Expansion Box forward approximately 0.5 inch and lift the cover from the box.
11. Remove the screws that secure the HDU to the Small Expansion Box chassis.
12. Carefully remove the HDU and cables from the Small Expansion Box.

Prior to installing the new HDU, verify that it is the same size as the one just removed.

To reinstall the Small Expansion Box, perform the removal procedure in reverse order.

---

## Replacing Memory Chips

1. Turn the System Module and all external devices OFF.
2. Unplug the ac power cable from the rear panel.
3. If necessary, disconnect all cables (Display, Keyboard, Printer, etc.) from the rear panel of the System Module.
4. After you have determined which board (Motherboard or Memory Expansion Board) the faulty RAM chip resides on, remove the appropriate System Module cover.
5. Determine the location of the faulty chip as discussed in the section "TROUBLESHOOTING WITH SYSTEM TEST - Random Access Memory (RAM)."
6. Locate the faulty RAM chip (Figures 5-74 and 5-75).

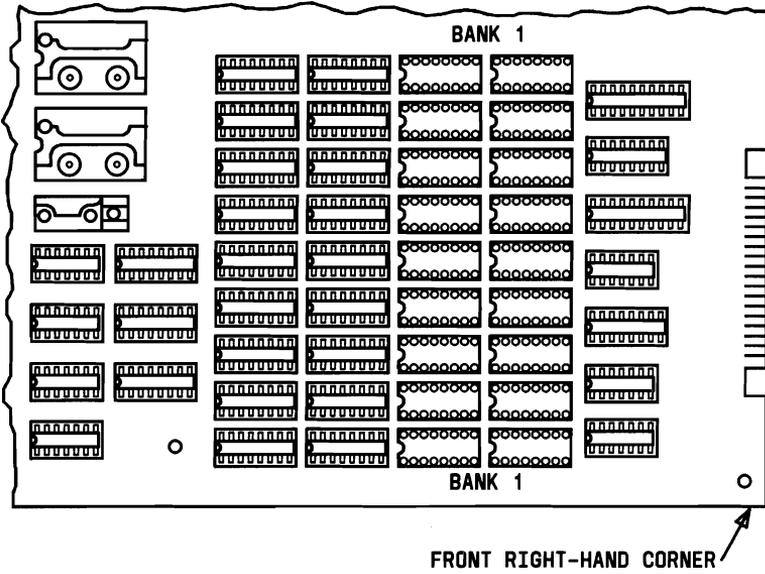
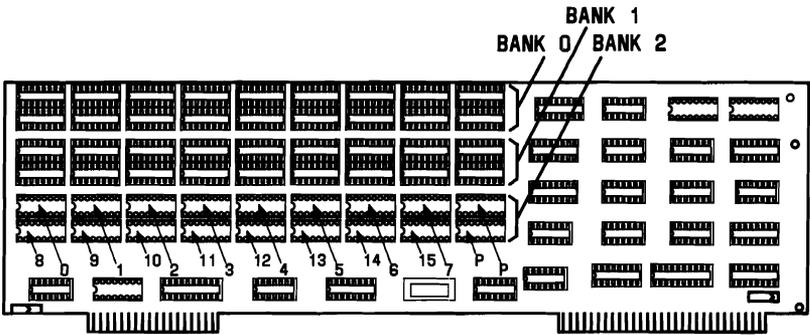


Figure 5-74. Motherboard RAM Chip Positions

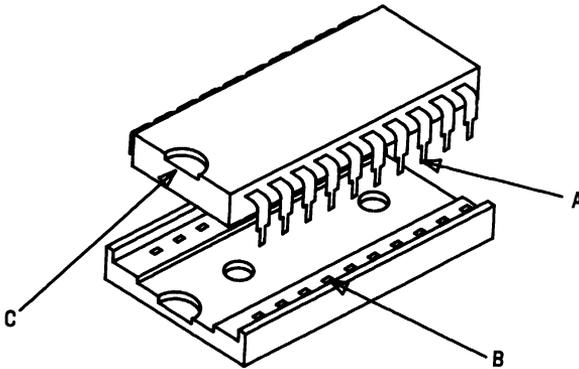


P = PARITY

NOTE: ALL THREE BANKS ARE ORDERED THE SAME.

**Figure 5-75. Expansion Board RAM Chip Positions**

7. Put on the wrist strap and connect it to ground (if available), or touch the metal chassis before picking up the RAM chip to release static electricity from your hand.
8. Carefully remove the faulty RAM chip using the chip extraction tool.
9. Align the new RAM chip pins (A) with the socket (B). Make sure that the notch in the chip (C) is facing the same direction as the other chips on the board (Figure 5-76).



**Figure 5-76. Inserting New RAM Chip into Socket**

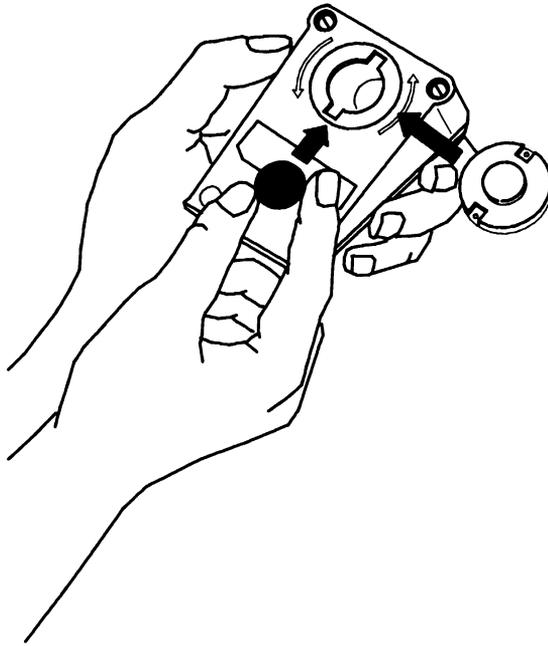
10. Repeat Steps 8 and 9 for each faulty RAM chip.
11. Remove wrist strap (if wrist strap was used).
12. Replace the System Module cover.
13. Connect the cables that were disconnected (Keyboard, Display, Printer, etc.) back to the rear panel of the System Module.
14. Plug the ac power cable into the rear panel.

## **Mouse Care and Cleaning**

The mouse is housed in a rugged plastic case that protects it under normal conditions. No special care is necessary except for occasional cleaning of the ball.

If dirt or lint builds up on the ball and prevents it from tracking properly, use the following procedure for cleaning it:

1. Locate the ball housing cover (Figure 5-77).



**Figure 5-77. Mouse Housing**

## MAINTENANCE

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2. Open it by turning the housing cover counterclockwise.
3. Remove the ball from the housing.
4. **Clean the ball using tap water only.** The rubber material on the ball washes clean easily.
5. Dry the ball and return it to the housing.
6. Replace the ball housing cover and secure it by turning it clockwise.

---

## **Cleaning Keyboard Contacts**

Some keyboards have shown the symptom of not registering a pressed key or keys. In many cases, this problem is caused by dust, cigarette ashes, or dirt getting under the key mechanism. This prevents the key mechanism from making proper contact with the Printed Circuit Board located under the keyboard.

1. Turn power switch OFF.
2. Locate the troubled key.
3. Place a small flathead screwdriver beneath each side of the key cap.
4. Gently pry off the key cap using the two screwdrivers.
5. Locate the two clips on the key mechanism that connects the key mechanism with the keyboard.
6. Using two screwdrivers, gently press the clips on the key mechanism towards its center with a lifting motion. The mechanism should easily come out of its mounting hole.

7. Using a cotton swab, clean the bottom of the key mechanism and the Printed Circuit Board with contact cleaner solution or light alcohol.

***Caution: Be sure that there is no cotton threads or lint left on the key mechanism or Printed Circuit Board after you have finished cleaning the contacts.***

8. Replace the key mechanism.
9. Replace the key cap.

# A

## APPENDIX A: SWITCHES AND JUMPERS

---

<b>INTRODUCTION</b> .....	A-3
Switches .....	A-3
Jumpers .....	A-6
<b>MOTHERBOARD</b> .....	A-7
Jumpers .....	A-7
DIP Switch Setting .....	A-9
DIPSW-0 Settings .....	A-10
DIPSW-1 Settings .....	A-13
<b>HARD DISK CONTROLLERS</b> .....	A-16
HDUs Supported .....	A-29
<b>DISPLAY CONTROLLER BOARD</b> .....	A-30
Display Controller Jumpers .....	A-30
Video Disable Option .....	A-32
P4 Display Controller Board .....	A-32
P8 Display Controller Board .....	A-34
Display Enhancement Board Jumpers.....	A-35
<b>Mini-Floppy Disk Units</b> .....	A-38
Jumpers .....	A-38
Resistor Pack or Terminating Resistor .....	A-39
Toshiba Mini-Floppy Disk Unit .....	A-39
OPE Mini-Floppy Disk Unit.....	A-41
Matsushita Mini-Floppy Disk Unit.....	A-43

**APPENDIX A: SWITCHES AND JUMPERS**

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**HARD DISK UNIT** ..... A-45  
    Jumper and Switch Setting ..... A-45

**AT&T PC 6300 ACCEPTANCE  
PROCEDURE** ..... A-54

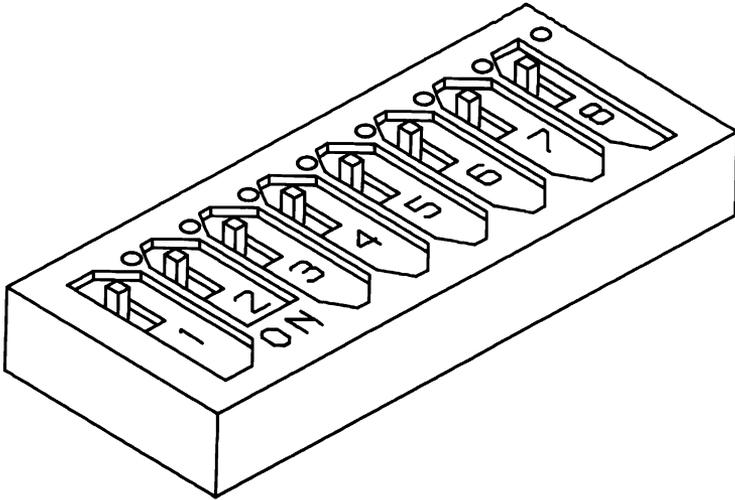
## INTRODUCTION

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This appendix provides information on the Switches and Jumpers associated with the AT&T Personal Computer 6300. The Switches and Jumpers are used to define the system's configuration. Any time an option is added to the system, the Switches and/or Jumpers reflect the addition of this option.

### Switches

The Switches used are Dual In-Line Package (DIP) Switches that can easily be set with a ball-point pen. There are two types of DIP Switches used in the AT&T Personal Computer 6300. The first type is a Slide Switch (Figure A-1).

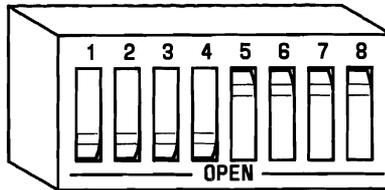


**Figure A-1. Slide DIP Switch**

The Slide Switches have eight switches (SW1 - SW8) each. The individual switches are OFF ("0") when pushed toward the zero ("0") and ON ("1") when pushed toward the switch number (1, 2, 3, ...) or "ON" labeled side of the switch. In Figure A-1, all switches (SW1 - SW8) are shown in the OFF ("0") position.

**Note:** Some DIP Switches may have the switch numbers on the OFF side of the switch.

The second type of DIP Switch used is a Rocker Switch (Figure A-2).



**Figure A-2. Rocker DIP Switch**

The Rocker DIP Switch also has eight switches (SW1 - SW8). There is only one rocker switch in the AT&T Personal Computer 6300, and it may be located on the Hard Disk Controller Board. This switch is referred to as the Drive Select Switch. The individual switches are OFF ("0") when the switch is pushed toward the "OPEN" marking and ON ("1") when pushed toward the number (1, 2, 3, ...) or "ON" labeled side of the DIP switch. In Figure A-2, SW1 - SW4 are shown in the OFF ("0") position and SW5 - SW8 are shown in the ON ("1") position.

**ON=CLOSED=1**

**OFF=OPEN=0**

**NO SETTING REQUIRED=X**

Figures A-5 to A-8 contain the various settings for the Motherboard DIP Switches.

## Jumpers

The Jumpers used in the AT&T Personal Computer 6300 are composed of jumper pins that protrude out of the circuit board and the jumper cap. The individual Jumpers assume an OFF ("0") state if a jumper cap *is not* present on the pins and an ON ("1") state if a jumper cap *is* present on the pins. There may be more than two jumper pins grouped together for defining more than one setting.

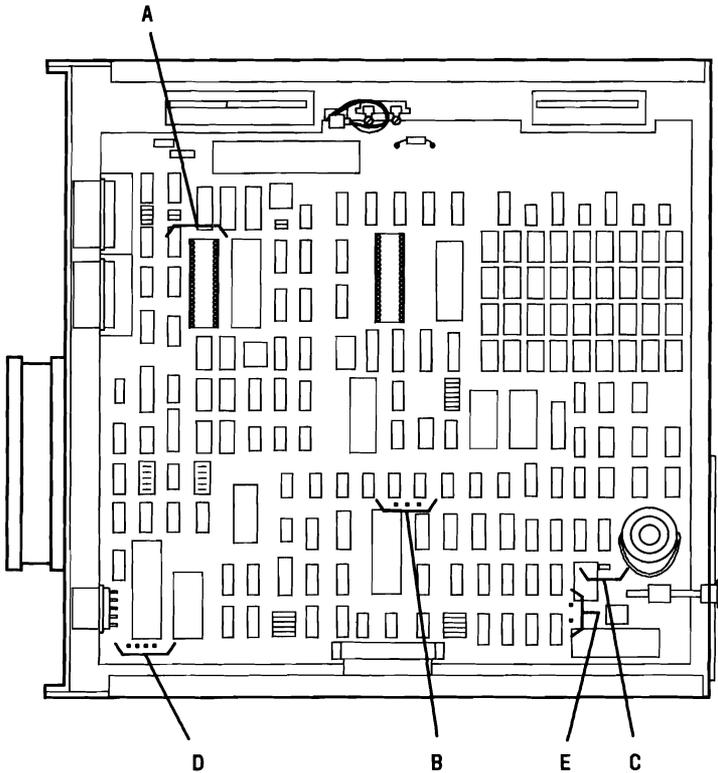
# MOTHERBOARD

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This section contains information on the Jumpers and Switches located on the Motherboard.

## Jumpers

There are five jumpers (A - E) located on the Motherboard. Figure A-3 shows the physical location of the jumper pins.



**Figure A-3. Motherboard Jumper Locations**

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## APPENDIX A: SWITCHES AND JUMPERS

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The jumper **A** is physically located near the socket reserved for the insertion of the Z8530 SCC. This jumper defines the clock to be used with the Z8530 SCC. The jumper is not currently used.

The jumper **B** is physically located near the Floppy Disk Controller. This jumper is used only for production testing and should not have a jumper cap present.

The jumper **C** is physically located close to the speaker. This jumper is not used but is present.

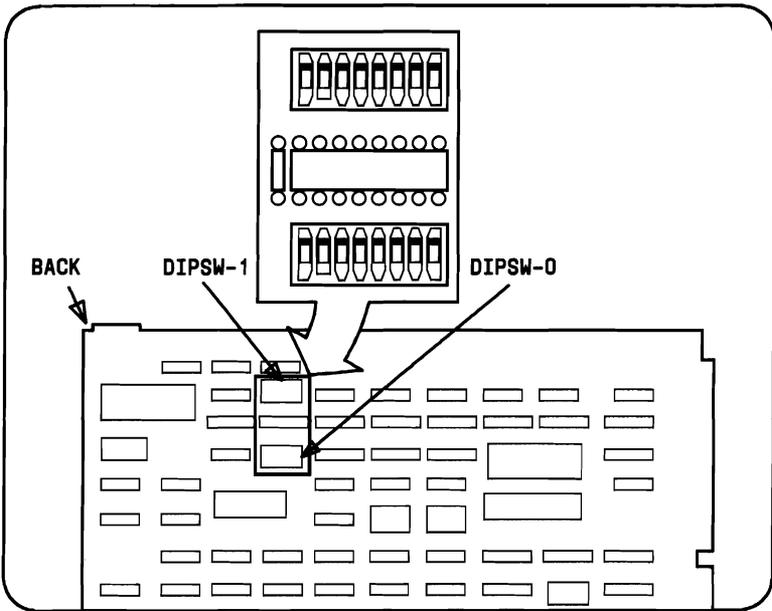
The jumper **D** is physically located close to the Keyboard connector. This jumper is not used.

The jumper **E** is used to enable or disable the battery of the Clock Calendar Chip. Jumper cap is normally present.

---

## DIP Switch Setting

The AT&T Personal Computer 6300 will always have at least two DIP Switches: DIPSW-0 and DIPSW-1. These switches are located on the Motherboard (Figure A-4).



**Figure A-4. Location of Motherboard DIP Switches**

## DIPSW-0 Settings

- **SW1-SW4** — Define the total amount of RAM present in the system and the type of memory chips used.
- **SW5** — Reflects presence of 8087 Numeric Data Processor.
- **SW6** — Defines type of Serial Interface Controller (8250 or Z-8530).
- **SW7** — Not used.
- **SW8** — Defines type of EPROM chip (2732 or 2764) for ROM 1.21 or below.
- **SW8** — Reflects presence or absence of memory chips in Bank 1 for ROM 1.43 or higher.

The various settings for DIPSW-0 are shown in Figures A-5 and A-6.

**APPENDIX A: SWITCHES AND JUMPERS**

MOTHERBOARD (ROM 1.21 OR BELOW)								FUNCTION
SW1	SW2	SW3	SW4 *	SW5	SW6	SW7	SW8	
0	1	1	1	X	X	X	X	128-KB Total RAM on Motherboard
1	0	1	1	X	X	X	X	256-KB Total RAM on Motherboard
1	1	0	1	X	X	X	X	512-KB Total RAM (256 on Motherboard 256 on Exp. Board)
1	1	1	0	X	X	X	X	512-KB Total RAM on Motherboard 512-KB Bank 0 0-KB Bank 1
0	1	0	1	X	X	X	X	640-KB Total RAM (256 on Motherboard 384 on Exp. Board)
0	1	0	0	X	X	X	X	640-KB Total RAM on Motherboard 128-KB Bank 0 512-KB Bank 1
0	1	1	0	X	X	X	X	640-KB Total RAM on Motherboard 512-KB Bank 0 128-KB Bank 1
X	X	X	X	1	X	X	X	8087 NDP not present
X	X	X	X	0	X	X	X	8087 NDP present
X	X	X	X	X	1	X	X	8250 ACE (Async. Comm. Element) present
X	X	X	X	X	0	X	X	Z8530 SCC present Motherboard
X	X	X	X	X	X	X	1	2732 PROM present
X	X	X	X	X	X	X	0	2764 PROM present

\*SW4 1 — 256-K bit RAM chips not used  
 0 — 256-K bit RAM chips used

**ON=CLOSED=1**  
**OFF=OPEN=0**  
**NO SETTING REQUIRED=X**

**Figure A-5. Switch Settings for DIPSW-0 (ROM 1.21 or Below)**

**APPENDIX A: SWITCHES AND JUMPERS**

<b>MOTHERBOARD (ROM 1.43) OR HIGHER</b>								
<b>SW1</b>	<b>SW2</b>	<b>SW3</b>	<b>SW4 *</b>	<b>SW5</b>	<b>SW6</b>	<b>SW7</b>	<b>SW8 †</b>	<b>FUNCTION</b>
0	1	1	1	X	X	X	1	128-KB Total RAM on Motherboard
1	0	1	1	X	X	X	0	256-KB Total RAM on Motherboard
1	1	0	1	X	X	X	0	512-KB Total RAM (256 on Motherboard 256 on Exp. Board)
1	1	1	0	X	X	X	1	512-KB Total RAM on Motherboard 512-KB Bank 0 0-KB Bank 1
0	1	0	1	X	X	X	0	640-KB Total RAM (256 on Motherboard 384 on Exp. Board)
0	1	0	0	X	X	X	0	640-KB Total RAM on Motherboard 128-KB Bank 0 512-KB Bank 1
0	1	1	0	X	X	X	0	640-KB Total RAM on Motherboard 512-KB Bank 0 128-KB Bank 1
X	X	X	X	1	X	X	X	8087 NDP not present
X	X	X	X	0	X	X	X	8087 NDP present
X	X	X	X	X	1	X	X	8250 ACE (Async. Comm. Element) present
X	X	X	X	X	0	X	X	Z8530 SCC present

\*SW4 1 — 256-K bit RAM chips not used  
 0 — 256-K bit RAM chips used

†SW8 1 — Motherboard Bank 1 Empty  
 0 — Motherboard Bank 1 Full

**ON=CLOSED=1**  
**OFF=OPEN=0**  
**NO SETTING REQUIRED=X**

**Figure A-6. Switch Settings for DIPSW-0 (ROM 1.43)**

## DIPSW-1 Settings

The switches SW1 - SW8 are used to reflect options associated with the MFD Units, HDU, and Display. Figures A-7 and A-8 show the various switch settings for DIPSW-1.

- **SW1** – Floppy Type
- **SW2** – Fast or Slow Startup (Floppy Speed)
- **SW3** – HDU Indigenous or External
- **SW4** – Not used with (ROM 1.21 or below) or Scroll Speed (ROM 1.43)
- **SW5** – Display Type
- **SW6** – Display Type
- **SW7** – Number of Floppies
- **SW8** – Number of Floppies

**APPENDIX A: SWITCHES AND JUMPERS**

<b>MOTHERBOARD (ROM 1.21 OR BELOW)</b>								
<b>SW1</b>	<b>SW2</b>	<b>SW3</b>	<b>SW4</b>	<b>SW5</b>	<b>SW6</b>	<b>SW7</b>	<b>SW8</b>	<b>FUNCTION</b>
1	X	X	X	X	X	X	X	48 TPI Floppy(s) (360 KB)
0	X	X	X	X	X	X	X	96 TPI Floppy(s) (720 KB)
X	1	X	X	X	X	X	X	Slow start-up speed for Floppy Drive
X	0	X	X	X	X	X	X	Fast start-up speed for Floppy Drive
X	X	1	X	X	X	X	X	Indigenous HDU ROM
X	X	0	X	X	X	X	X	External HDU ROM * -
X	X	X	1	X	X	X	X	Reserved for Future Use
X	X	X	X	1	1	X	X	Reserved for Future Use
X	X	X	X	0	1	X	X	40 x 25 Color
X	X	X	X	1	0	X	X	80 x 25 Color
X	X	X	X	0	0	X	X	80 x 25 Monochrome
X	X	X	X	X	X	1	1	1 Floppy Drive
X	X	X	X	X	X	0	1	2 Floppy Drives
X	X	X	X	X	X	1	0	3 Floppy Drives (2 Maximum)
X	X	X	X	X	X	0	0	4 Floppy Drives (2 Maximum)

\* If external ROM is not present, HDU will not be recognized.

**ON=CLOSED=1**  
**OFF=OPEN=0**  
**NO SETTING REQUIRED=X**

**Figure A-7. Switch Settings for DIPSW-1 (ROM 1.21 or Below)**

## APPENDIX A: SWITCHES AND JUMPERS

<b>MOTHERBOARD (ROM 1.43) OR HIGHER</b>								
<b>SW1</b>	<b>SW2</b>	<b>SW3</b>	<b>SW4</b>	<b>SW5</b>	<b>SW6</b>	<b>SW7</b>	<b>SW8</b>	<b>FUNCTION</b>
1	X	X	X	X	X	X	X	48 TPI Floppy(s) (360 KB)
0	X	X	X	X	X	X	X	96 TPI Floppy(s) (720 KB)
X	1	X	X	X	X	X	X	Slow start-up speed for Floppy Drive
X	0	X	X	X	X	X	X	Fast start-up speed for Floppy Drive
X	X	1	X	X	X	X	X	Indigenous HDU ROM
X	X	0	X	X	X	X	X	External HDU ROM *
X	X	X	1	X	X	X	X	Fast Scroll Rate
X	X	X	0	X	X	X	X	Slow Scroll Rate
X	X	X	X	1	1	X	X	EGA or Video Controller Disabled
X	X	X	X	0	1	X	X	40 x 25 Color
X	X	X	X	1	0	X	X	80 x 25 Color
X	X	X	X	0	0	X	X	80 x 25 Monochrome
X	X	X	X	X	X	1	1	1 Floppy Drive
X	X	X	X	X	X	0	1	2 Floppy Drives
X	X	X	X	X	X	1	0	3 Floppy Drives (2 Maximum)
X	X	X	X	X	X	0	0	4 Floppy Drives (2 Maximum)

\* If external ROM is not present, HDU will not be recognized.

**ON=CLOSED=1**

**OFF=OPEN=0**

**NO SETTING REQUIRED=X**

**Figure A-8. Switch Settings for DIPSW-1 (ROM 1.43)**

## HARD DISK CONTROLLERS

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There are two types of HDU Controllers: the DTC (Data Technology Corporation) and the WD (Western Digital). The physical differences between the Controllers are:

- The DTC Controller is a full-size modular circuit card. The WD Controller is a half-size modular circuit card.
- Each HDU Controller must be configured for the type of drive used (see Appendix A). The DTC Controller is configured by setting the DIP Switches on the card. The WD Controller has jumpers that must be placed.

Each Controller formats the hard disk drives differently; therefore, they cannot be interchanged without performing the following:

- Make a backup copy of all data if possible
- Low-Level Format the drive using the System Test
- Partition the drive using the MS-DOS FDISK
- Restore the backup data.

The WD Controller is not supported by ROM BIOS 1.21 and earlier versions. Both the DTC and the WD Controller are supported by ROM BIOS 1.43 and later versions.



The jumpers **W1** and **W2** define the port address of the DTC Controller (Figure A-10).

<b>W1</b>	<b>W2</b>	<b>ADDRESS</b>
1	1	320 (default value)
1	0	324
0	1	328
0	0	32C

0 = jumper cap not present  
1 = jumper cap present

**Figure A-10. Hard Disk Controller DTC Jumpers W1 and W2 Settings**

Jumper **W17** defines the starting address of the Hard Disk Controller PROM. If the jumper cap is present, the starting address is C800:0000 which is the default address. If the jumper cap is removed, the PROM is relocated at D800:0000.

Jumper **W18** is the PROM enable jumper. If the jumper cap is present, the PROM is enabled. The PROM is disabled when the jumper cap is removed (cap is normally not present).

Jumpers **W19** and **W20** define the sector size of the HDUs (Figure A-11).

<b>W19</b>	<b>W20</b>	<b>SECTOR SIZE</b>
0	0	256
0	1	512 (Default)
1	0	1024

0 = jumper cap not present  
 1 = jumper cap present

**Figure A-11. Hard Disk Controller DTC Jumpers W19 and W20 Settings**

The WD controller has eight jumper blocks and three connectors (Figure A-12).

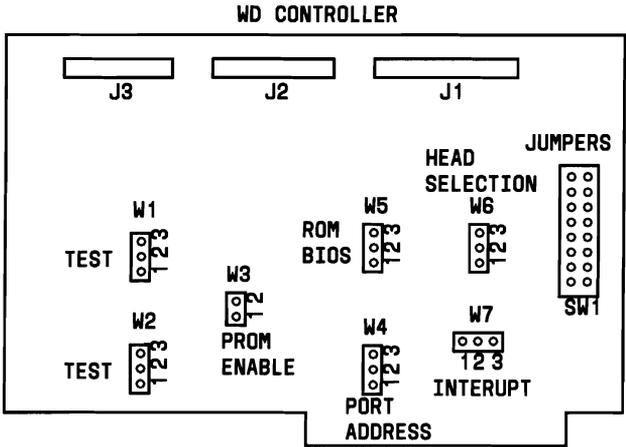
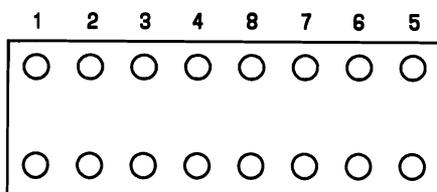


Figure A-12. Jumper Locations on WD Controller

The J1, J2, and J3 connectors on the WD Controller provide the following:

- The J1 connector is the control connector. This connector transfers the control signals to and from the HDUs. Two HDUs can be installed using a Daisy Chain Connection.
- The J2 and J3 connectors are data connectors. These connectors transfer data to and from the HDUs. The J2 connector must be used in a one HDU configuration. The J3 connector is used for the second HDU in a 2-drive configuration.

The WD Drive Selection Switch SW1 is shown in Figure A-13.



POSITION	FUNCTION
1, 2, 5, 6	DRIVE 1
3, 4, 7, 8	DRIVE 0

**Note:** SW1 is not actually a switch but a set of jumpers.  
See HDU Configuration Parameter Tables (Figures A-15 to A-20)  
for the actual setting.

**Figure A-13. Drive Selection Switch SW1 on WD Controller**

## APPENDIX A: SWITCHES AND JUMPERS

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Figure A-14 shows the WD controller jumper positions and functions.

Jumper	Position	Function
W1	2 to 1	Normal - Default
W1	2 to 3	Drive 0 Select enable (test)
W2	2 to 1	Normal - Default
W2	2 to 3	READ GATE enabled (test)
W3	in	BIOS on Controller Board enabled
W3	out	BIOS on Motherboard enabled - Default
W4	2 to 3	I/O address 320H - Default
W4	2 to 1	I/O address 324H
W5	2 to 3	BIOS ROM size 16 K
W5	2 to 1	BIOS ROM size 32 K or 64 K - Default
W6	2 to 3	Reduced write current (8 heads)
W6	2 to 1	Head select 3 (16 heads) - Default
W7	2 to 3	IREQ2 on I/O expansion bus interface
W7	2 to 1	IREQ5 on I/O expansion bus interface - Default

**Note:** Jumper W7-2 to W7-1 is formed by the board's printed circuit tracking. If IREQ2 is required, then the tracking between W7-2 and W7-1 must be opened (cut).

### Figure A-14. WD Controller Jumper Positions and Functions

Figures A-15, A-16, and A-17 show switch settings for the DTC Controller with ROM BIOS 1.21 and earlier.

1-HDU CONFIGURATION									
POS	DRIVE TYPE = (DRIVE #0)	SWITCH SETTING							
		1	2	3	4	5	6	7	8
0	5 MB	0	0	1	1	0	0	1	1
1	24 MB	0	0	0	1	0	0	1	1
2	15 MB	0	0	1	0	0	0	1	1
3	10-MB Default	0	0	0	0	0	0	1	1
4	5-MB Syquest - 3Q306	0	0	1	1	0	0	0	1
5	30-MB CDC WREN I	0	0	0	1	0	0	0	1
*6	20-MB Seagate ST-225, CMI 4426	0	0	1	0	0	0	0	1
*7	20-MB MiniScribe MS-3425, OPE XM-5220	0	0	0	0	0	0	0	1
*8	20-MB CMI 4426	0	0	1	1	0	0	1	0
9	Not Specified	0	0	0	1	0	0	1	0
10	Not Specified	0	0	1	0	0	0	1	0
11	Not Specified	0	0	0	0	0	0	1	0
12	Not Specified	0	0	1	1	0	0	0	0
13	Not Specified	0	0	0	1	0	0	0	0
14	Not Specified	0	0	1	0	0	0	0	0
15	Not Specified	X	X	X	X	X	X	X	X

\* Not supported by BIOS 1.1 and earlier (use 1.21 and later version for 20 MB drives).

**1 = ON = CLOSED**

**0 = OFF = OPEN**

**X = DOES NOT REQUIRE SETTING**

**Figure A-15. HDU Configuration Parameter Table for ROM BIOS 1.21 and Earlier (One HDU Only)**

**APPENDIX A: SWITCHES AND JUMPERS**

DRIVE #0 FOR TWO HDUs									
POS	DRIVE TYPE = (DRIVE #0)	SWITCH SETTING							
		1	2	3	4	5	6	7	8
0	5 MB	*	*	1	1	*	*	1	1
1	24 MB	*	*	0	1	*	*	1	1
2	15 MB	*	*	1	0	*	*	1	1
3	10-MB Default	*	*	0	0	*	*	1	1
4	5-MB Syquest - 3Q306	*	*	1	1	*	*	0	1
5	30-MB CDC WREN I	*	*	0	1	*	*	0	1
†6	20-MB Seagate ST-225, CMI 4426	*	*	1	0	*	*	0	1
†7	20-MB MiniScribe MS-3425, OPE XM-5220	*	*	0	0	*	*	0	1
†8	20-MB CMI 4426	*	*	1	1	*	*	1	0
9	Not Specified	*	*	0	1	*	*	1	0
10	Not Specified	*	*	1	0	*	*	1	0
11	Not Specified	*	*	0	0	*	*	1	0
12	Not Specified	*	*	1	1	*	*	0	0
13	Not Specified	*	*	0	1	*	*	0	0
14	Not Specified	*	*	1	0	*	*	0	0
15	Not Specified	X	X	X	X	X	X	X	X

\* See Figure A-17 for Drive #1 settings.

† Not supported by BIOS 1.1 and earlier (use 1.21 and later version for 20-MB drives).

**1 = ON = CLOSED**

**0 = OFF = OPEN**

**X = DOES NOT REQUIRE SETTING**

**Figure A-16. HDU Configuration Parameter Table for ROM BIOS 1.21 and Earlier (Two HDUs Only—Drive #0)**

<b>DRIVE #1 FOR TWO HDUs</b>									
<b>POS</b>	<b>DRIVE TYPE = (DRIVE #1)</b>	<b>SWITCH SETTING</b>							
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
0	5 MB	1	1	*	*	1	1	*	*
1	24 MB	0	1	*	*	1	1	*	*
2	15 MB	1	0	*	*	1	1	*	*
3	10-MB Default	0	0	*	*	1	1	*	*
4	5-MB Syquest - 3Q306	1	1	*	*	0	1	*	*
5	30-MB CDC WREN I	0	1	*	*	0	1	*	*
†6	20-MB Seagate ST-225, CMI 4426	1	0	*	*	0	1	*	*
†7	20-MB MiniScribe MS-3425, OPE XM-5220	0	0	*	*	0	1	*	*
†8	20-MB CMI 4426	1	1	*	*	1	0	*	*
9	Not Specified	0	1	*	*	1	0	*	*
10	Not Specified	1	0	*	*	1	0	*	*
11	Not Specified	0	0	*	*	1	0	*	*
12	Not Specified	1	1	*	*	0	0	*	*
13	Not Specified	0	1	*	*	0	0	*	*
14	Not Specified	1	0	*	*	0	0	*	*
15	Not Specified	X	X	X	X	X	X	X	X

\* See Figure A-16 for Drive #0 settings.

† Not supported by BIOS 1.1 and earlier versions (use 1.21 and later versions for 20-MB Drives)

**1 = ON = CLOSED**

**0 = OFF = OPEN**

**X = DOES NOT REQUIRE SETTING**

**Figure A-17. HDU Configuration Parameter Table for ROM BIOS 1.21 and Earlier (Two HDUs Only—Drive #1)**

Figures A-18, A-19, and A-20 show Jumper/Switch Settings for WD and DTC Controllers with ROM BIOS 1.43 and later versions.

1-HDU CONFIGURATION									
POS	DRIVE TYPE = (DRIVE #0)	SWITCH SETTING (NOTE)							
		1	2	3	4	5	6	7	8
0	28-MB CDC WREN I	0	0	1	1	0	0	1	1
1	20-MB Seagate ST-225, CMI 4426	0	0	0	1	0	0	1	1
2	20-MB Tandon TM-262	0	0	1	0	0	0	1	1
3	10-MB Default	0	0	0	0	0	0	1	1
4	20-MB MiniScribe MS-3425, OPE XM-5220	0	0	1	1	0	0	0	1
5	28-MB CDC WREN I	0	0	0	1	0	0	0	1
6	20-MB Seagate ST-225, CMI 4426	0	0	1	0	0	0	0	1
7	20-MB MiniScribe MS-3425, OPE XM-5220	0	0	0	0	0	0	0	1
8	21-MB CMI 6426	0	0	1	1	0	0	1	0
9	42-MB MiniScribe 6053	0	0	0	1	0	0	1	0
10	40-MB Tandon TM-755	0	0	1	0	0	0	1	0
11	40-MB CDC WREN II Slim	0	0	0	0	0	0	1	0
12	53-MB CDC WREN II	0	0	1	1	0	0	0	0
13	68-MB Micropolis 1325, MiniScribe 6085, Seagate 4085	0	0	0	1	0	0	0	0
14	46-MB Seagate ST-251	0	0	1	0	0	0	0	0
15	Drive #0 Only	X	X	X	X	X	X	X	X

**Note:** For WD Controllers, jumper positions are arranged 1 2 3 4 8 7 6 5 on the board. For DTC Controllers, switch positions are arranged 1 2 3 4 5 6 7 8 on the board. See Hard Disk Installation in Chapter 3 for examples.

- 1 = JUMPER PRESENT (WD) = SWITCH CLOSED (DTC)
- 0 = JUMPER NOT PRESENT (WD) = SWITCH OPEN (DTC)
- X = DOES NOT REQUIRE SETTING

**Figure A-18. HDU Configuration Parameter Table for ROM 1.43 and Higher (One HDU Only)**

DRIVE #0 OR TWO HDU'S									
POS	DRIVE TYPE = (DRIVE #0)	SWITCH SETTING (NOTE)							
		1	2	3	4	5	6	7	8
0	28-MB CDC WREN I	*	*	1	1	*	*	1	1
1	20-MB Seagate ST-225, CMI 4426	*	*	0	1	*	*	1	1
2	20-MB Tandon TM-262	*	*	1	0	*	*	1	1
3	10-MB Default	*	*	0	0	*	*	1	1
4	20-MB MiniScribe MS-3425, OPE XM-5220	*	*	1	1	*	*	0	1
5	28-MB CDC WREN I	*	*	0	1	*	*	0	1
6	20-MB Seagate ST-225, CMI 4426	*	*	1	0	*	*	0	1
7	20-MB MiniScribe MS-3425, OPE XM-5220	*	*	0	0	*	*	0	1
8	21-MB CMI 6426	*	*	1	1	*	*	1	0
9	42-MB MiniScribe 6053	*	*	0	1	*	*	1	0
10	40-MB Tandon TM-755	*	*	1	0	*	*	1	0
11	40-MB CDC WREN II Slim	*	*	0	0	*	*	1	0
12	53-MB CDC WREN II	*	*	1	1	*	*	0	0
13	68-MB Micropolis 1325, MiniScribe 6085, Seagate 4085	*	*	0	1	*	*	0	0
14	46-MB Seagate ST-251	*	*	1	0	*	*	0	0
15	Drive #0 Only	X	X	X	X	X	X	X	X

**Note:** For WD Controllers, jumper positions are arranged 1 2 3 4 8 7 6 5 on the board.  
 For DTC Controllers, switch positions are arranged 1 2 3 4 5 6 7 8 on the board.  
 See Hard Disk Installation in Chapter 3 for examples.

**1 = JUMPER PRESENT (WD) = SWITCH CLOSED (DTC)**  
**0 = JUMPER NOT PRESENT (WD) = SWITCH OPEN (DTC)**  
**X = DOES NOT REQUIRE SETTING**

\*See Figure A-20 for Drive #1 settings.

**Figure A-19. HDU Configuration Parameter Table for ROM 1.43 and Higher (Two HDUs Only—Drive #0)**

**APPENDIX A: SWITCHES AND JUMPERS**

<b>DRIVE #1 FOR TWO HDUs</b>									
<b>POS</b>	<b>DRIVE TYPE = (DRIVE #1)</b>	<b>SWITCH SETTING (NOTE)</b>							
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
0	28-MB CDC WREN I	1	1	*	*	1	1	*	*
1	20-MB Seagate ST-225, CMI 4426	0	1	*	*	1	1	*	*
2	20-MB Tandon TM-262	1	0	*	*	1	1	*	*
3	10-MB Default	0	0	*	*	1	1	*	*
4	20-MB MiniScribe MS-3425, OPE XM-5220	1	1	*	*	0	1	*	*
5	28-MB CDC WREN I	0	1	*	*	0	1	*	*
6	20-MB Seagate ST-225, CMI 4426	1	0	*	*	0	1	*	*
7	20-MB MiniScribe MS-3425, OPE XM-5220	0	0	*	*	0	1	*	*
8	21-MB CMI 6426	1	1	*	*	1	0	*	*
9	42-MB MiniScribe 6053	0	1	*	*	1	0	*	*
10	40-MB Tandon TM-755	1	0	*	*	1	0	*	*
11	40-MB CDC WREN II Slim	0	0	*	*	1	0	*	*
12	53-MB CDC WREN II	1	1	*	*	0	0	*	*
13	68-MB Micropolis 1325, MiniScribe 6085, Seagate 4085	0	1	*	*	0	0	*	*
14	46-MB Seagate ST-251	1	0	*	*	0	0	*	*
15	Drive #0 Only	X	X	X	X	X	X	X	X

**Note:** For WD Controllers, jumper positions are arranged 1 2 3 4 8 7 6 5 on the board.  
 For DTC Controllers, switch positions are arranged 1 2 3 4 5 6 7 8 on the board.  
 See Hard Disk Installation in Chapter 3 for examples.

- 1 = JUMPER PRESENT (WD) = SWITCH CLOSED (DTC)**
- 0 = JUMPER NOT PRESENT (WD) = SWITCH OPEN (DTC)**
- X = DOES NOT REQUIRE SETTING**

\* See Figure A-19 for Drive #0 settings.

**Figure A-20. HDU Configuration Parameter Table for ROM 1.43 and Higher (Two HDUs Only—Drive #1)**

More detailed information on the HDU Parameter Tables may be found in the PC 6300 Reference Manual.

## **HDUs Supported**

The following HDUs are supported by the AT&T PC 6300:

### **10-MB DRIVES**

- OPE XM-5210
- Shugart SA-712
- Seagate ST-212
- Tandon TM-252

### **20-MB DRIVES**

- Seagate ST-225
- OPE XM-5220
- MiniScribe MS-3425

### **28-MB DRIVES**

- CDC WREN I.

# DISPLAY CONTROLLER BOARD

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## Display Controller Jumpers

There is one jumper block located on the Display Controller Board (Figure A-21). This jumper block has six pins (1 - 6).

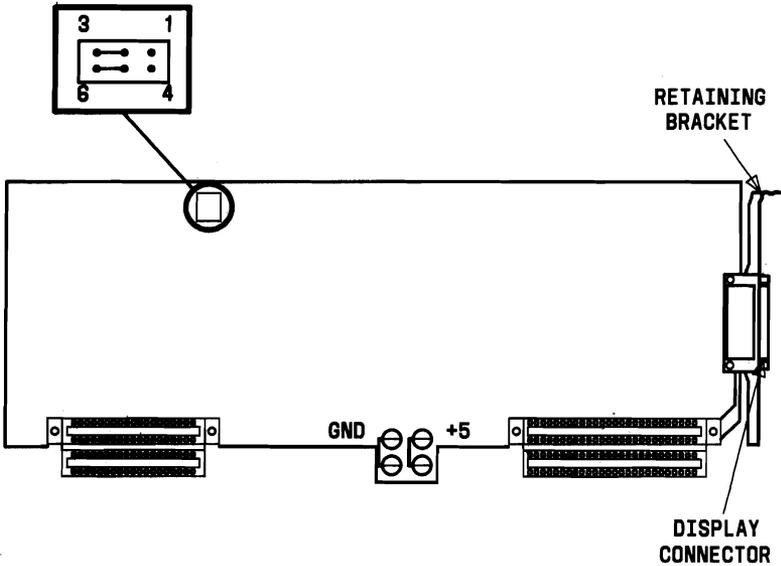


Figure A-21. Display Controller Board Jumper

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Figure A-22 shows the jumper block configurations for the Display Controller Board jumper block.

<b>POSITION</b>	<b>FUNCTION</b>
<b>1-2</b>	24-MHz On-board Oscillator
<b>2-3</b>	Motherboard Oscillator (Normal Position)
<b>4-5</b>	High-Resolution Board Oscillator
<b>5-6</b>	Clock Selection Circuitry (Normal Position)

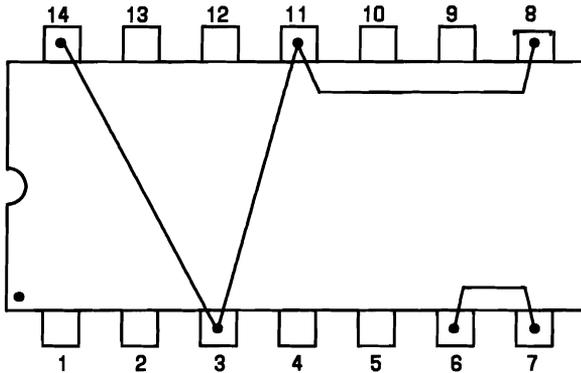
**Figure A-22. Display Controller Board Jumper Settings**

## Video Disable Option

Both the P4 and the P8 Display Controller Boards contain video disable options. The procedure required for each board is explained in the following information.

### *P4 Display Controller Board*

To disable the P4 board, a plug must be substituted for the chip in position 6H (74LS00). The plug with pin strap connections is shown in Figure A-23. The chip position 6H is shown in Figure A-24.



**Figure A-23. P4 Board Video Disable Plug**

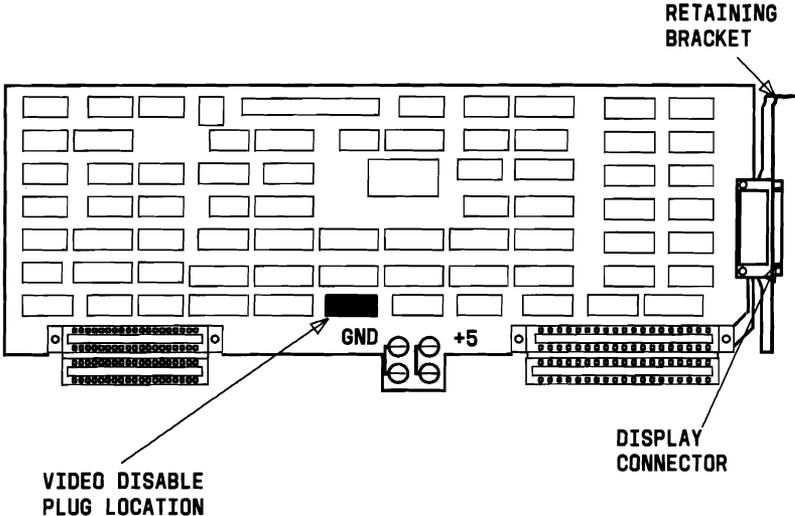
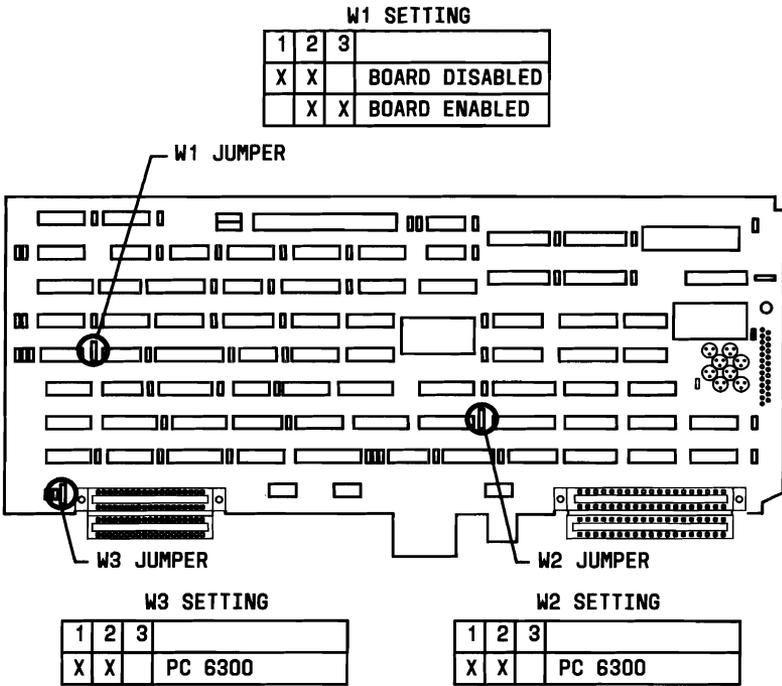


Figure A-24. P4 Board Video Enable/Disable Location

### *P8 Display Controller Board*

To disable the P8 board, jumpers must be placed at W1, W2, and W3 (Figure A-25).



**Figure A-25. P8 Board Video Enable/Disable Locations**

## Display Enhancement Board Jumpers

The jumper locations for the two versions of the DEB are shown in Figures A-26 and A-27.

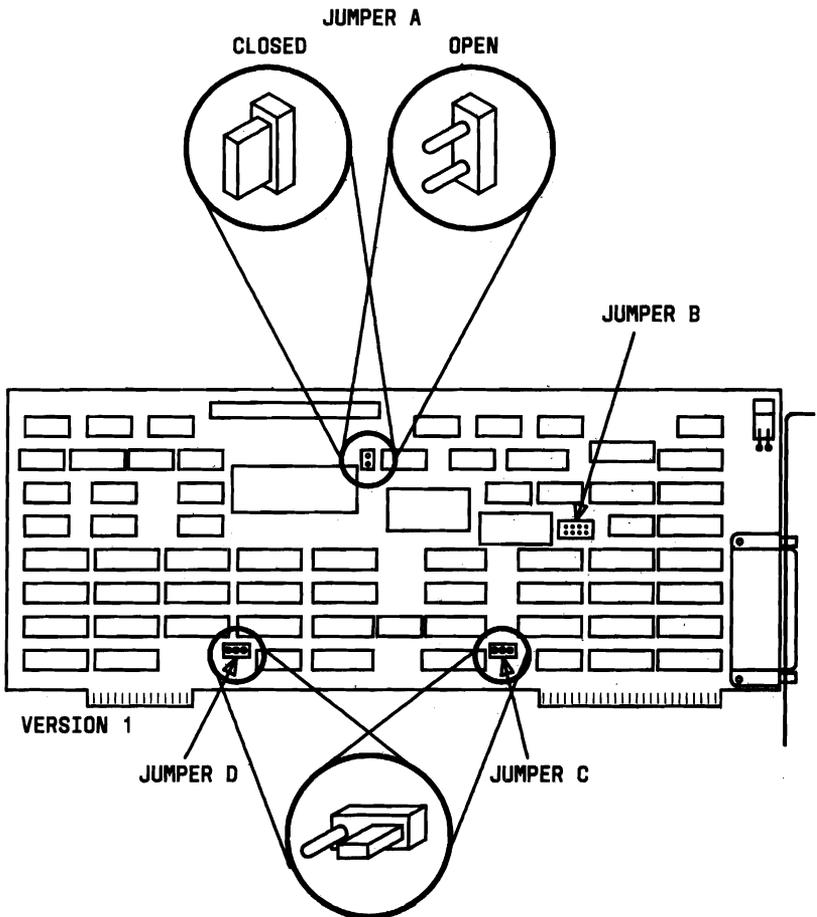


Figure A-26. Jumper Locations for Version 1 of the DEB

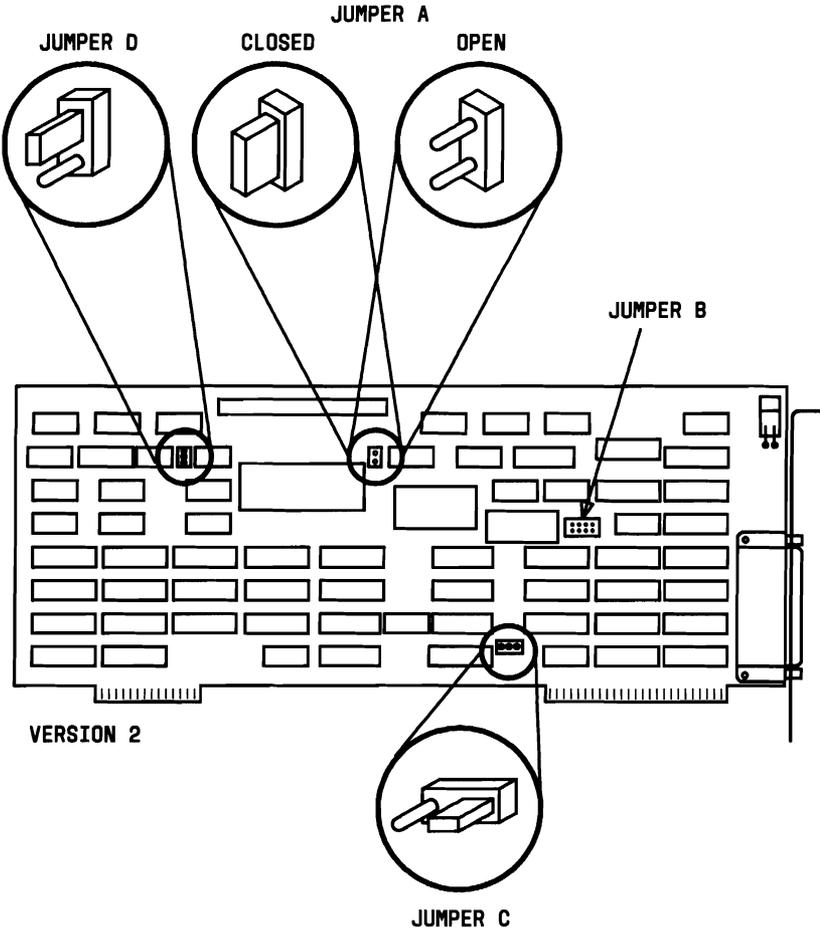


Figure A-27. Jumper Locations for Version 2 of the DEB

The jumper setting for the DEB are shown in Figure A-28.

<b>JUMPER LOCATION</b>	<b>JUMPER SETTING</b>	<b>JUMPER FUNCTION</b>
A	*Closed Open	No monitor connected to VDC Monitor connected to VDC
B	*Open  Closed	Indicates displacement of internal addressing For future use
C	*1 to 2 2 to 3	PC 6300 For future use
D	*1 to 2	Provides signal synchronization

\* Default Settings

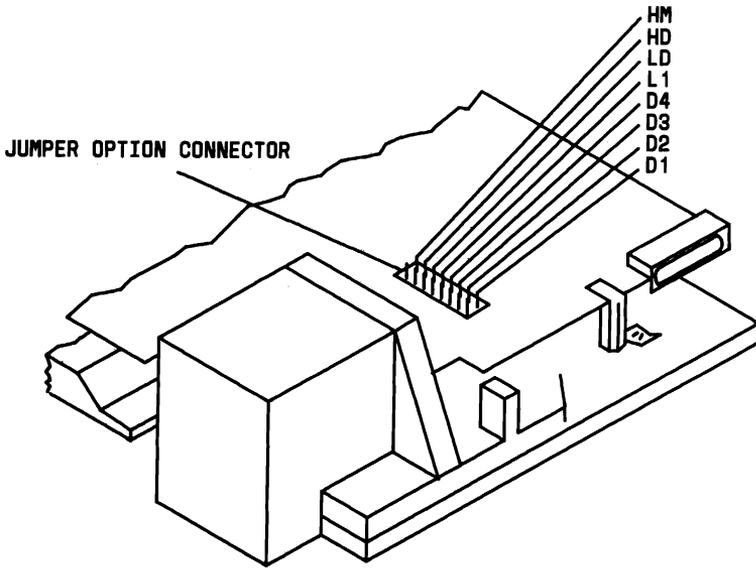
**Figure A-28. DEB Jumper Settings and Functions**

## Mini-Floppy Disk Units

---

### Jumpers

The MFD units have jumper settings that are used to show the electrical signals and drive selection on the system. Figure A-29 is an example of the jumper option connector.



**Figure A-29. Mini-Floppy Disk Unit Jumpers**

## Resistor Pack or Terminating Resistor

Resistor Pack installation information is as follows:

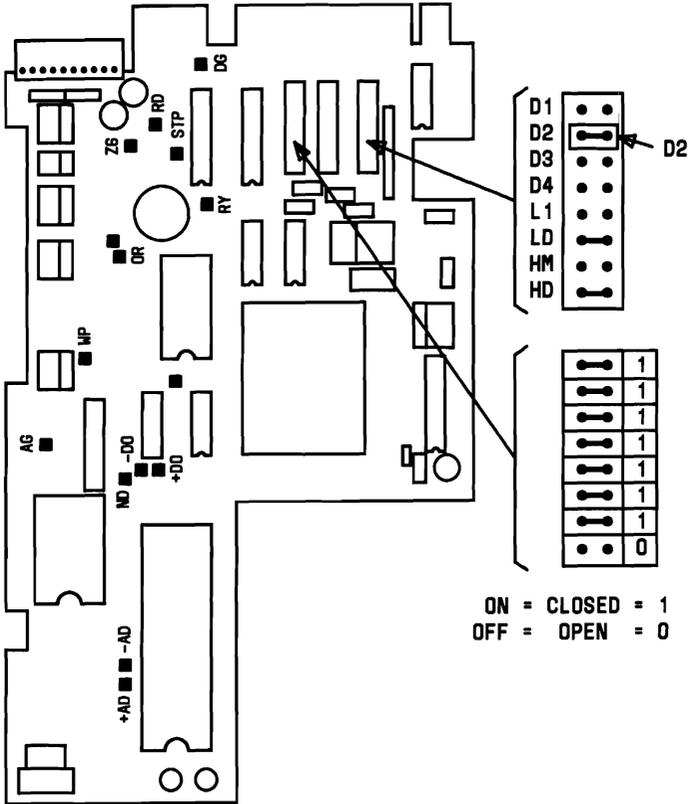
- **Drive A:** The resistor pack should not be installed in drive A when installing a dual floppy drive system (CPU-2).
- **Drive B:** The resistor pack should be installed in drive B in a dual floppy drive system (CPU 12).

*Note:* All MFDs come configured for drive B.

## Toshiba Mini-Floppy Disk Unit

The standard jumper and DIP switch default settings for the Toshiba Mini-Floppy Disk Unit are shown in Figure A-30. The locations with jumpers (jumper caps) are represented by the darkened areas.

**APPENDIX A: SWITCHES AND JUMPERS**



**Figure A-30. Toshiba Mini-Floppy Disk Unit**

## OPE Mini-Floppy Disk Unit

The following information contains the jumper requirements and switch settings for the OPE Mini-Floppy Disk Units (Figure A-31). All DIP Switches on the OPE MFD should be set to the “ON” position. Locations (51 and 52) with jumper caps are represented by the darkened areas.

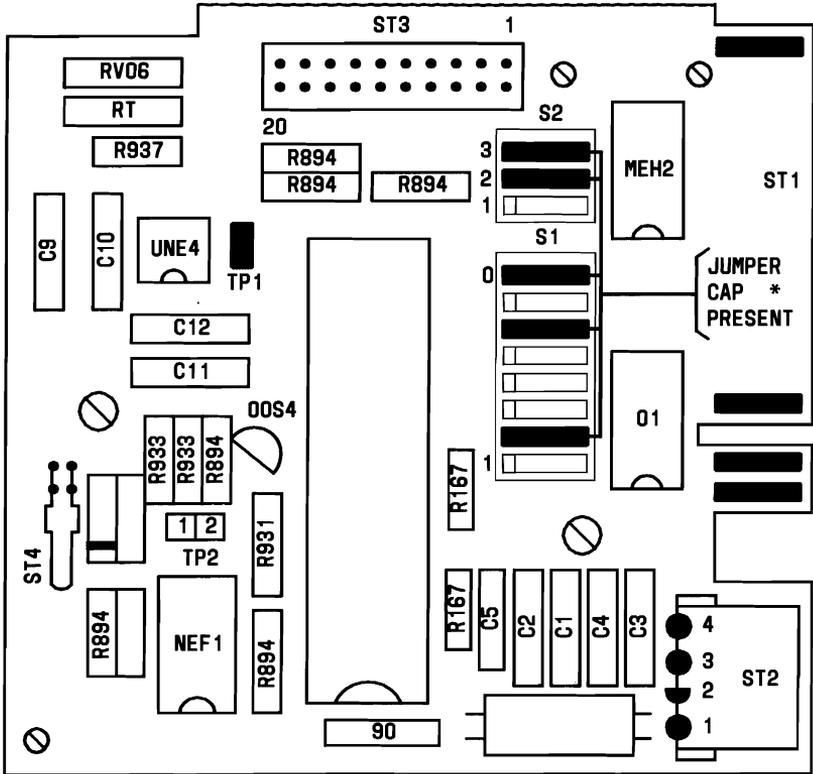
SPINDLE MOTOR START	TP2 JUMPER
WITH MOTOR ON SIGNAL	0
WITH DRIVE SELECT SIGNAL	1

SW1 DEFAULT SETTINGS							
1	2	3	4	5	6	7	8
0	1	0	0	0	1	X	X

SW2 DEFAULT SETTINGS		
1	2	3
X	1	1

**1 = ON = CLOSED = JUMPER PRESENT**  
**0 = OFF = OPEN = JUMPER NOT PRESENT**  
**X = DOES NOT REQUIRE SETTING**

APPENDIX A: SWITCHES AND JUMPERS



\* DEFAULT

Figure A-31. OPE Mini-Floppy Disk Unit Jumpers

## Matsushita Mini-Floppy Disk Unit

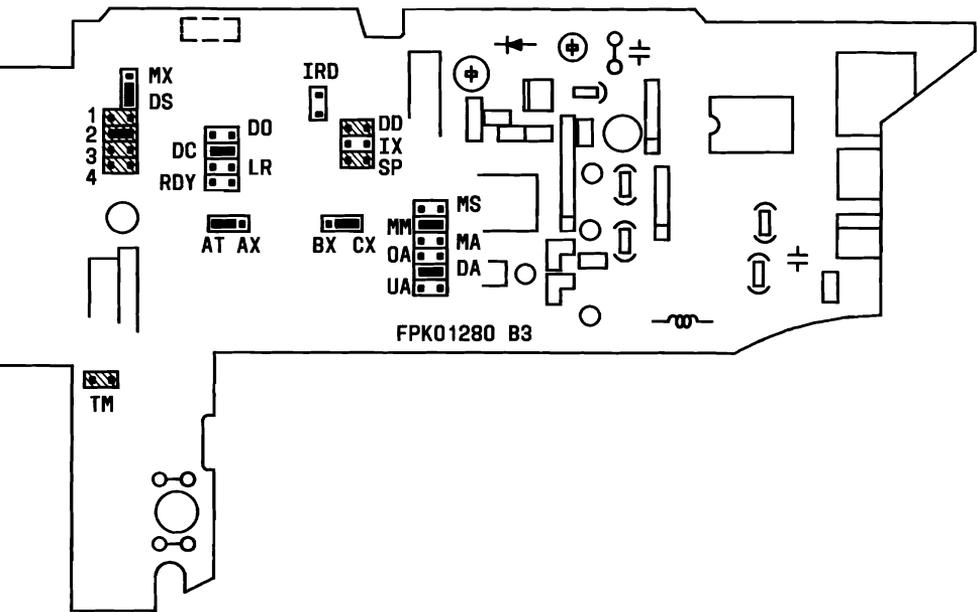
The following information contains the jumper requirements and switch settings for the Matsushita Mini-Floppy Disk Units (Figure A-32). The locations with jumpers (jumper caps) are represented by the darkened areas.

### JUMPERS

ALWAYS OFF	UA	OA	HA	MS	IRD	RDX	LR	DO	IX	MX	AX	BX
ALWAYS ON	DC	DS	AT	CX	DA	MM						

### SYSTEM

FUNCTION	JUMPERS	L1				P.C.
DISK CHANGE	SP	—				ON
	DD	ON				—
DRIVE SELECT	1	ON	—	—	—	—
	2	—	ON	—	—	ON
	3	—	—	ON	—	—
	4	—	—	—	ON	—
TERMINATING RESISTOR	TM	ON THE LAST DRIVE				ON THE LAST DRIVE



**Figure A-32. Matsushita Mini-Floppy Disk Drive**

## HARD DISK UNIT

---

### **Jumper and Switch Setting**

The HDU jumper or switch locations will vary with different disk drives. The following figures show the default setting, drive selection, and terminating resistor locations for the drives now supported by AT&T.

Before connecting the HDU to the system, it is necessary to adjust the ohmic charge of the signal cable with the terminator resistors. These resistors, present on the basic board, can be included or excluded by inserting or not inserting the jumpers marked with an asterisk (\*).

**Note:** If only one drive is connected to the system, the jumper must be present. If more than one drive is connected, only the last drive of the chain must be jumper-connected, the jumpers for the intermediate drivers must be removed.

## **DRIVE SELECT 1-4 (JUMPER PRESET)**

Drive select, when logically true, connects the drive to the control lines. Only one drive select line may be active at a time.

Jumper options DS1, DS2, DS3, and DS4 determine the drive select line that will activate the interface for that drive.

Seven HDUs that can be used with the AT&T PC 6300 are shown in Figures A-33 to A-39.

## **DRIVE SELECTION**

### **Terminator Pack**

In a daisy chain configuration, the terminator pack must be removed from all drives except the last unit.

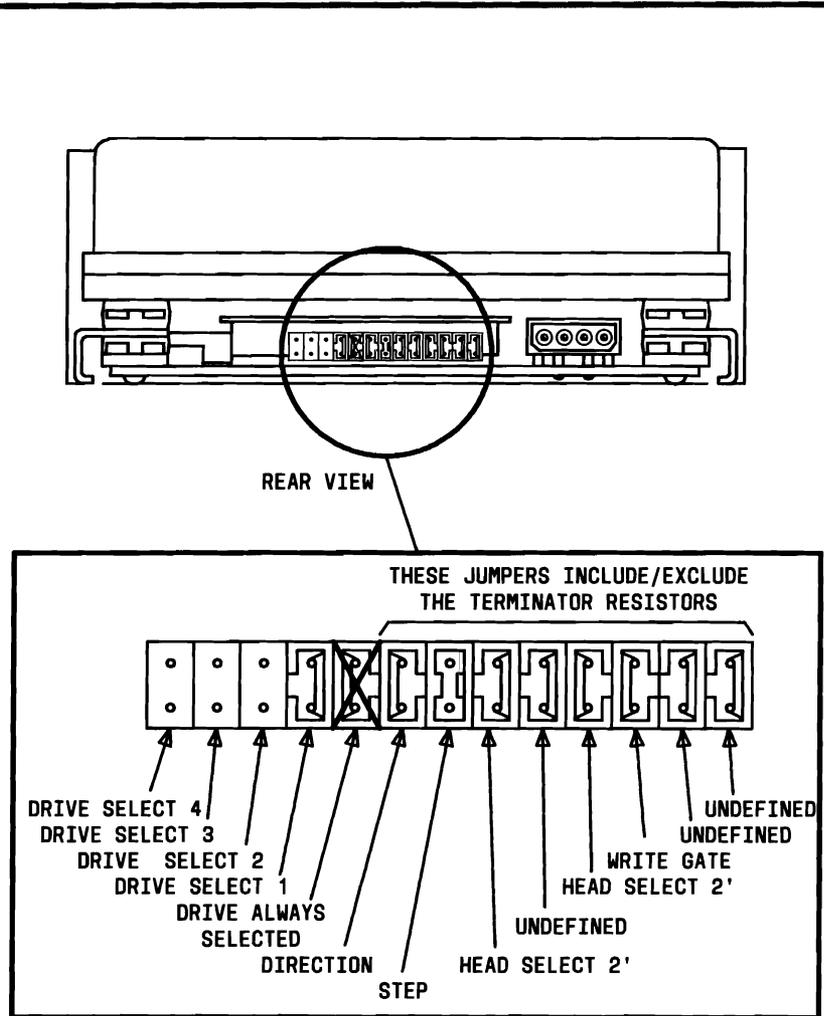


Figure A-33. Shugart SA-712 (10 MB) HDU

APPENDIX A: SWITCHES AND JUMPERS

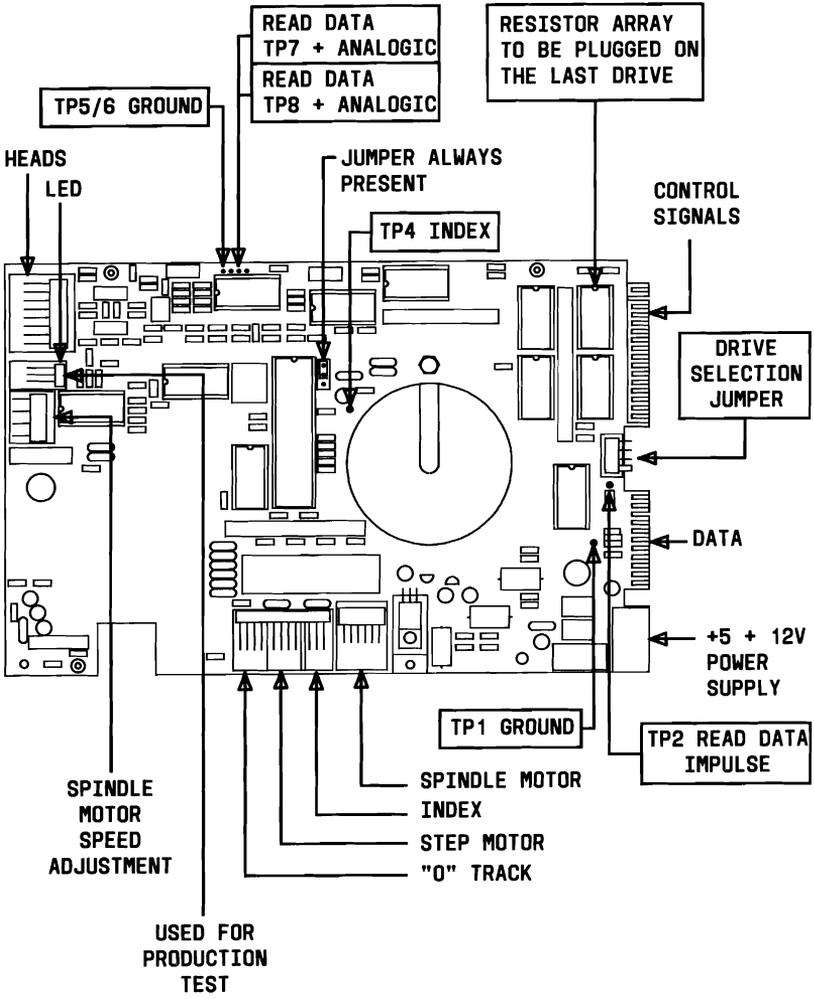
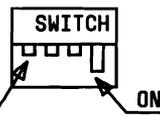


Figure A-34. Tandon TM-252 (10 MB) HDU

JUMPER				
FUNCTION	1	2	3	4
RADIAL	1	X	X	X
CHAIN	0	X	X	X
AT134	X	1	0	1
AT151	X	1	0	0

SWITCH				
SELECTION	1	2	3	4
DRIVE 1	1	0	0	0
DRIVE 2	0	1	0	0
DRIVE 3	0	0	1	0
DRIVE 4	0	0	0	1



OFF      ON

↑
↑  
 ALWAYS PRESENT      ALWAYS ABSENT  
 (SEE DIAGNOSTIC TEST)

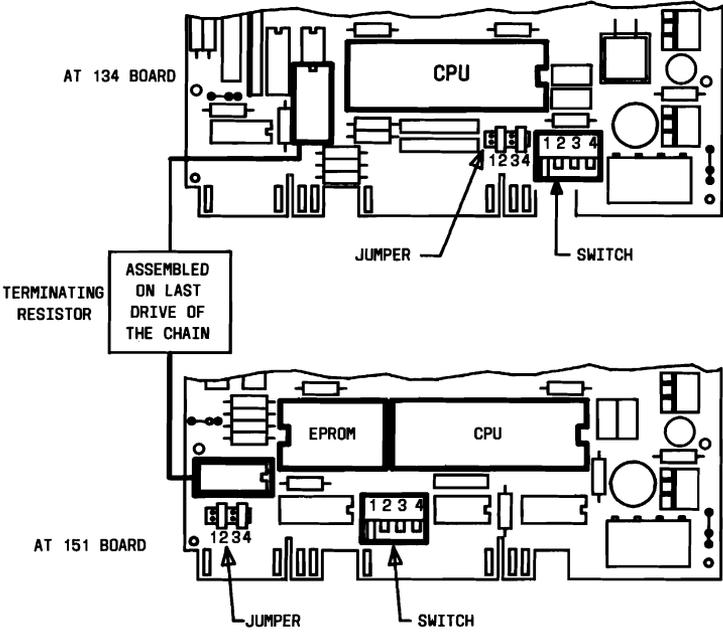


Figure A-35. OPE XM-5210 (10 MB) HDU

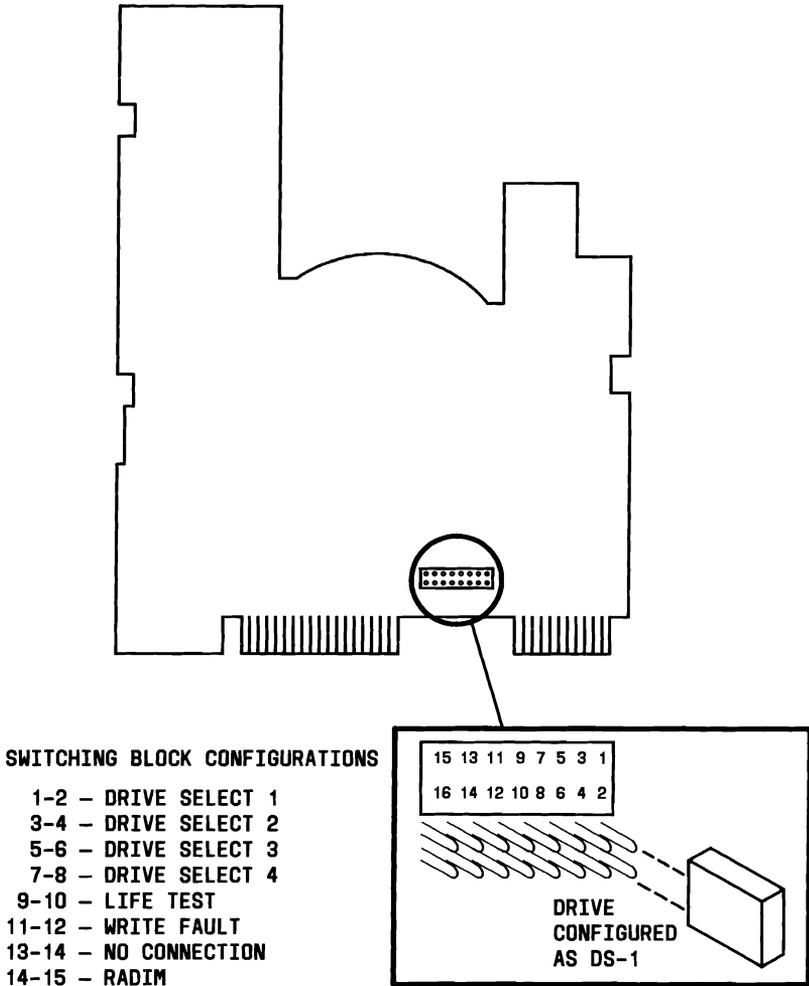
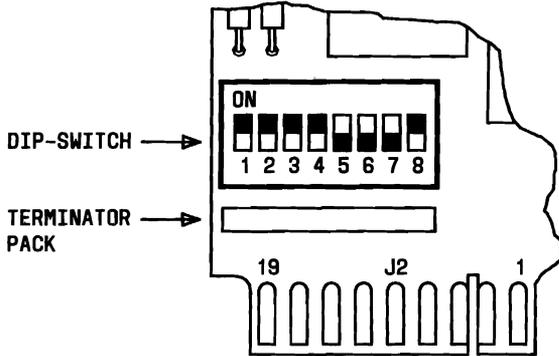


Figure A-36. Seagate Model ST-212 (10 MB) HDU

DRIVE SELECTION



		<u>DIP SWITCH</u>							<u>NOT CONNECTED</u>
		8	7	6	5	4	3	2	1
<b>NORMAL OPERATION</b>	DRIVE SELECT 1	1	0	0	0	X	1	1	
	DRIVE SELECT 2	0	1	0	0	X	1	1	
	DRIVE SELECT 3	0	0	1	0	X	1	1	
	DRIVE SELECT 4	0	0	0	1	X	1	1	
<b>DIAGNOSTIC AND EXERCISE ROUTINE</b>	FACTORY USE ONLY	X	X	X	X	X	0	1	
	RANDOM SEEK (BURN-IN MODE)	X	X	X	X	0	1	0	
	RANDOM SEEK	X	X	X	X	1	1	0	
	CRESCENDO SEEK (BURN-IN MODE)	X	X	X	X	0	0	0	
	CRESCENDO SEEK	X	X	X	X	1	0	0	

**Figure A-37. MiniScribe MS-3425 (20 MB) HDU**

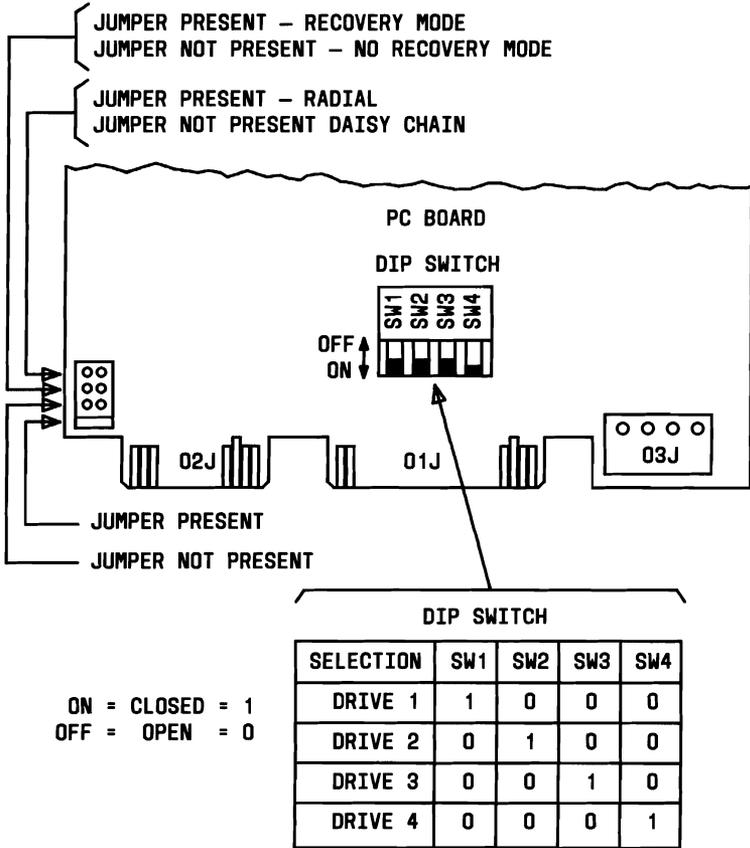


Figure A-38. OPE XM-5220 (20 MB) HDU

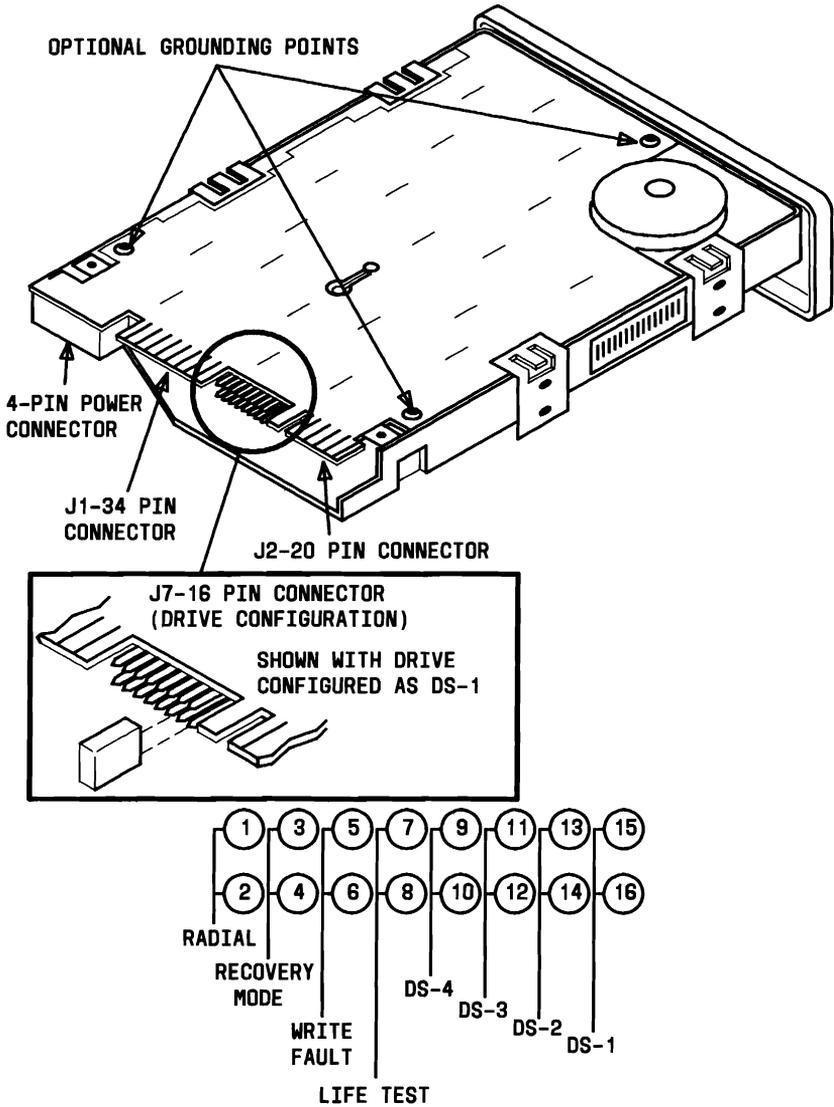


Figure A-39. Seagate Model ST-225 (20 MB) HDU

## AT&T PC 6300 ACCEPTANCE PROCEDURE

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The Standard Acceptance Procedure of the PC 6300 is the Customer Test Diagnostics. This procedure provides a set of tests to verify the functionality of the PC 6300 modules. These tests should be run:

- On initial installation
- After any maintenance work
- After adding any options.

# B

## APPENDIX B: FIELD REPLACEABLE MODULES

---

<b>FIELD REPLACEABLE MODULES .....</b>	<b>B-3</b>
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## **FIELD REPLACEABLE MODULES**

---

This appendix contains a list of field replaceable modules along with the COMCODE for each.

**APPENDIX B: FIELD REPLACEABLE MODULES**

---

<b>AT&amp;T-IS PART DESCRIPTION</b>	<b>AT&amp;T-IS COMCODE</b>
Motherboard 128 KB	405055161
Motherboard 128 KB	405018557
Motherboard 256 KB	405018581
Motherboard 256 KB	405055195
Motherboard 512 KB	405055229
Motherboard 640 KB	405203019
ROM BIOS (H & L) 1.21	845654029
ROM BIOS (H & L) 1.43	105203780
8087 NDP Co-Processor	403768690
Keyboard ROM	405018599
I/O Proc—Keyboard	405018607
CRT Controller (P-2)	405055237
CRT Controller (P-4)	405018631
CRT Controller (P-8)	405203027
Bus Converter (2-16 bit slots)	403350986
Bus Converter (3-16 bit slots)	405018664
HDU Controller (DTC)	403350952
HDU Controller (WD WX1)	405214669
HDU Controller (WD WX2)	405022301

**APPENDIX B: FIELD REPLACEABLE MODULES**

<b>AT&amp;T-IS PART DESCRIPTION</b>	<b>AT&amp;T-IS COMCODE</b>
Memory Exp 256 KB 128-KB Chip Set 512-KB Chip Set	403351299 403351273 405023052
Power Supply LA16 Power Supply LA16B	403351240 405204900
Keyboard 301 Keyboard 302	405162579 405007683
Monitor 313 Monitor 313	403351349 405004755
Monitor 318 Monitor 318 Monitor 318/H	403351356 405004763 405004748
Video Disable Chip Video Bridge Adapter	405098625 405067281
10-MB HDU Slim (Seagate) 10-MB HDU Slim (Tandon) 10-MB HDU Slim (OPE-1) 10-MB HDU Slim (OPE-2)	405018805 405018730 405018763 405018789

**APPENDIX B: FIELD REPLACEABLE MODULES**

<b>AT&amp;T-IS PART DESCRIPTION</b>	<b>AT&amp;T-IS COMCODE</b>
20-MB HDU Slim (MiniScribe)	405018847
20-MB HDU Slim (Seagate)	405018839
20-MB HDU Slim (OPE)	405117722
360-KB Floppy Disk (OPE)*	403319080
360-KB Floppy Disk (Toshiba-1)†	403351430
360-KB Floppy Disk (Toshiba-2)*	405055278
360-KB Floppy Disk (Matsushita)	TBA
Mouse	403768666
Display Enhanc. Board	403350945
Security Lock	405078585
CRT Bridge	405055245
2-MB Expansion Board	405120858
HDS 349 Exp Box	403351448
10-MB HDU Full	403350960
HDU Faceplate	403908130
Blank MFD/HDU Insert	405144809
MFD "A" Insert	405055294
MFD "B" Insert	405055302
HDU "C" Insert	405018714
MFD "NEUTRAL" Insert	405055328

\*Latch Type

†Door Type

**APPENDIX B: FIELD REPLACEABLE MODULES**

---

<b>AT&amp;T-IS PART DESCRIPTION</b>	<b>AT&amp;T-IS COMCODE</b>
AC Power Cord	403816739
MFD/HDU Power Cable	403816762
HDS 340 Power Cable	403846959
CPU Power Cable Kit	405055369
- CRT Cont +15 V Cbl	N/A
- Mthr Brd +12 V Cbl	N/A
- Bus Conv +5 V/GND	N/A
CPU2 MFD Ribbon Cbl	405055391
CPU1/3 MFD Ribbon Cbl	403846918
HDU Data Cable	403846892
HDU Control Cable	403846900
CPU Fan & Grommets	403351257
CPU Fan Grommets	405055468
HDB 340 Fan & Grommets	405018870
Keyboard Data Cbl	405055666
Keycap Kit	405055393

**APPENDIX B: FIELD REPLACEABLE MODULES**

---

<b>AT&amp;T-IS PART DESCRIPTION</b>	<b>AT&amp;T-IS COMCODE</b>
CPU Hardware Kit - RESET Button - RESET Button Spring - PWR LED Lens CVR - EXP Board Guide	405055310 N/A N/A N/A N/A
CPU Fan Cover	405055344
Motherboard Speaker Motherboard Battery	405086159 405055427
CPU Upper Cover CPU Lower Cover	405055625 405055641
Keyboard Upper Cover Keyboard Lower Cover	405055484 405055500
PC 6300 - Upgrade Kit - Mthr Brd Gen 4.5 - Bus Exp Board - CRT Controller - PC6300UG Label	405023037 405022955 405022997 405022971 405023037

**APPENDIX B: FIELD REPLACEABLE MODULES**

---

<b>AT&amp;T-IS PART DESCRIPTION</b>	<b>AT&amp;T-IS COMCODE</b>
Spacebar Kit - Spacebar - Spacebar Spring - Spacebar Clip	405055419 N/A N/A N/A
Key Plunger Kit	405055443
20 MB Upgrade Kit	405249996

100—Motherboard Tests, 4-127  
10XX—Parallel Printer Tests, 4-152  
18XX—80807-2 Numeric Co-Processor Tests, 4-152  
20XX—Mouse Tests, 4-153  
21XX—8530 Serial Port Tests, 4-154  
23XX—Video Option Board (DEB) Tests, 4-155  
24XX—HDU Drive No. 2 Tests, 4-167  
2nd HDU Drive and Controller Test, 4-45, 4-83  
300—Memory Tests, 4-129  
400—Keyboard Tests, 4-133  
48 TPI Floppy Disk Test, 4-37, 4-71  
500—Video Tests, 4-137  
600—Parallel Port Tests, 4-144  
700—8250 Serial Port Tests, 4-145  
800—MFD Unit Tests, 4-147  
80807-2 Math Co-Processor, 5-109  
8087 Math Co-Processor, 4-41, 4-77  
8530 Serial Port Test, 5-118  
8530 Test, 4-42, 4-80  
900—HDU Tests, 4-149

## A

air flow, 3-4  
APPLYING POWER TO THE SYSTEM, 3-115  
AT&T PC 6300 ACCEPTANCE PROCEDURE, A-54  
Automatic Mode, 4-23  
Automatic Mode; Customer Test, 4-22

## B

Banner, 4-96  
block diagram; Motherboard, 2-13  
Bus Controller, 2-11  
Bus Converter, 2-31

## C

Central Processing Unit, 2-15  
character attributes; Display Controller, 2-30  
Cleaning Keyboard Contacts, 5-201  
Color Display (Optional), 2-54  
Connecting the Mouse to the Computer, 3-102  
CPU and DMA Circuitry, 2-15  
CPU test, 4-10  
CUSTOMER AND SYSTEM TEST  
ERROR MESSAGES, 4-127  
100—Motherboard Tests, 4-127  
10XX—Parallel Printer Tests, 4-152  
18XX—80807-2 Numeric Co-Processor Tests, 4-152  
20XX—Mouse Tests, 4-153  
21XX—8530 Serial Port Tests, 4-154  
23XX—Video Option Board (DEB) Tests, 4-155  
24XX—HDU Drive No. 2 Tests, 4-167  
300—Memory Tests, 4-129  
400—Keyboard Tests, 4-133  
500—Video Tests, 4-137  
600—Parallel Port Tests, 4-144  
700—8250 Serial Port Tests, 4-145  
800—MFD Unit Tests, 4-147  
900—HDU Tests, 4-149  
CUSTOMER TEST  
DIAGNOSTICS, 4-20  
Loading Customer Test, 4-21  
Operating Procedures, 4-22  
Test Descriptions, 4-32

## D

Determining Faulty RAM Chips, 5-65

DIAGNOSTICS, 4-1

CUSTOMER AND SYSTEM TEST

ERROR MESSAGES, 4-127

CUSTOMER TEST

DIAGNOSTICS, 4-20

INTRODUCTION, 4-5

RESIDENT DIAGNOSTICS, 4-7

STAND-ALONE LOW-LEVEL

FORMAT UTILITY TEST, 4-92

STAND-ALONE MOTHERBOARD

DMA TEST DIAGNOSTICS, 4-89

SYSTEM TEST DIAGNOSTICS, 4-47

SYSTEM TEST DIAGNOSTICS

(OVERLAY VERSION), 4-87

DIP Switch Setting, A-9

DIP Switch; Rocker, A-5

DIP Switch; Slide, A-3

DIPSW-0, A-10

DIPSW-0 Settings, A-10

DIPSW-1, A-13

DIPSW-1 Settings, A-13

DISPLAY, 2-52

Color Display (Optional), 2-54

Monochrome Display, 2-52

DISPLAY AND KEYBOARD

EXTENSION CABLES, 2-58

DISPLAY CONTROLLER

BOARD, A-30

Display Controller Jumpers, A-30

P8 Display Controller Board, A-34

Video Disable Option, A-32

DISPLAY ENHANCEMENT BOARD

(OPTIONAL), 2-49

Display Check, 5-26

Display Controller Jumpers, A-30

Display Controllers, 2-27

Display Enhancement Board

Jumpers, A-35

Display and Edit Bad Track

Table, 4-110

DMA Controller, 2-15

DMA Test, 4-89

Display and Edit Bad Track

Table, 4-110

Exit Low-Level Format (LLF)

Utility, 4-125

Format Bad Tracks, 4-119

General Characteristics, 4-93

HDU Configuration, 4-102

Help, 4-101

List of Operations, 4-96

Low-Level Format, 4-105

Ship the Unit, 4-124

The Bad Track Table, 4-95

Verify Surface Test, 4-121

DMA circuitry, 2-15

DMA controller (test), 4-12

DMA counter (test), 4-12

Drive test, 4-15

## E

electrical noise, 3-3

environment; operating, 3-5

ENVIRONMENTAL

REQUIREMENTS, 3-5

Error Logging Utilities, 4-54

Error Messages, 4-15

Exit Low-Level Format (LLF)

Utility, 4-125

EXPANDED SYSTEM

CONFIGURATION, 2-60

Extension cables, 2-58

---

## F

Faulty RAM Chip; Determining, 5-65  
FIELD REPLACEABLE  
MODULES, B-1, B-3  
FIELD REPLACEABLE  
MODULES, B-3  
Floppy Disk Controller, 2-19  
Floppy Disk Systems, 3-91  
Format Bad Tracks, 4-119  
Formatting the Hard Disk, 5-47  
front panel; System Module, 2-5

## G

GENERAL, 1-3, 5-5  
Reminders, 5-6  
Replacing Faulty Modules, 5-5  
Troubleshooting, 5-5  
General Characteristics, 4-93

## H

HARD DISK CONTROLLERS, A-16  
HDUs Supported, A-29  
HARD DISK UNIT, A-45  
Jumper and Switch Setting, A-45  
Hard Disk Problems, 5-38  
Hard Disk Systems, 3-94  
Hard Disk Unit, 5-99  
Hard Disk Unit Controllers  
(Optional), 2-39

Hard Disk Unit "Not Ready" on Cold  
Start, 5-50  
Hard Disk Unit—Slim, 2-37  
HDU Configuration, 4-102  
HDU Controller, 2-39  
HDU Drive and Controller Test, 4-38  
HDUs Supported, A-29  
heat dissipation, 3-4  
Help, 4-101

## I

Input/Output (I/O) Expansion Bus  
Characteristics, 2-33  
Input/Output Chip Select Logic, 2-20  
Input/Output Connectors, 2-22  
Input/Output Peripheral  
Interfaces, 2-18  
Inserting ROM Chip; Keyboard, 3-105  
INSTALLATIONS, 3-1  
APPLYING POWER TO THE  
SYSTEM, 3-115  
ENVIRONMENTAL  
REQUIREMENTS, 3-5  
OPTION INSTALLATION, 3-8  
PHYSICAL  
CHARACTERISTICS, 3-6  
SITE PREPARATION, 3-3  
SYSTEM INSTALLATION, 3-110  
UNPACKING, 3-7  
Installing 10- or 20-MB Hard Disk  
Units, 3-46  
Installing 8087 Numeric Data  
Processor, 3-36  
Installing DEB Software, 3-90  
Floppy Disk Systems, 3-91  
Hard Disk Systems, 3-94

## INDEX

---

Installing Hard Disk Controller Board, 3-48  
Installing Memory Expansion Board, 3-21  
Installing Mouse Software With the Hard Disk Computer, 3-109  
Installing New ROM Chip, 3-105  
Installing Small Expansion Box, 3-63  
Installing the Ball in the Mouse, 3-100  
Installing the Display Enhancement Board, 3-77  
Installing the Keyboard ROM, 3-104  
    Installing New ROM Chip, 3-105  
    Opening the Keyboard, 3-104  
    Removing Existing ROM Chip, 3-105  
Installing the Mouse, 3-100  
    Connecting the Mouse to the Computer, 3-102  
    Installing the Ball in the Mouse, 3-100  
Installing the Mouse Software, 3-107  
    Installing Mouse Software With the Hard Disk Computer, 3-109  
    Installing the Mouse Software With the Dual Diskette Computer, 3-107  
Installing the Mouse Software With the Dual Diskette Computer, 3-107  
Interrupt Controller, 2-21  
interrupt test, 4-13  
interrupts, 2-21  
INTRODUCTION, 1-1, 2-3, 4-5, A-3  
    GENERAL, 1-3  
    Jumpers, A-6  
    ORGANIZATION, 1-4  
    Switches, A-3  
    TOOLS AND ACCESSORIES, 1-5  
(I/O) Expansion Bus  
Characteristics, 2-33

I/O Chip Select Logic, 2-20  
I/O Connectors—Motherboard, 2-22  
I/O Peripheral Interfaces, 2-18

## J

Jumper and Switch Setting, A-45  
Jumpers, A-6, A-7, A-38

## K

KEYBOARD, 2-56  
Keyboard, 5-69  
Keyboard Interface, 2-18  
Keyboard Latches, 3-104  
Keyboard ROM Installation, 3-104  
Keyboard Test, 4-34, 4-62

## L

levels of diagnostics, 4-5  
List of Operations, 4-96  
Loading Customer Test, 4-21  
Loading DMA Test, 5-142  
    Operating Procedures, 5-143  
Loading System Test, 4-47  
Loading System Test (Overlay Version), 4-87  
Low-Level Format, 4-105

---

## M

- Main Menu, 4-98
- MAINTENANCE, 5-1
  - GENERAL, 5-5
  - POWER SUPPLY ADJUSTMENT, 5-145
  - REPLACING FAULTY MODULES, 5-148
  - STAND-ALONE MOTHERBOARD DMA TEST DIAGNOSTICS, 5-142
  - TROUBLESHOOTING WITH SYSTEM TEST, 5-54
  - TROUBLESHOOTING WITHOUT SYSTEM TEST, 5-7
- Manual Mode, 4-25
- Manual Mode; Customer Test, 4-25
- Matsushita Mini-Floppy Disk Unit, A-43
- MB HDU Drive and Controller Test, 4-74
- Memory, 2-16
- Memory Expansion Board, 2-42
- Memory Expansion Board (Optional), 2-42
  - Power Supply, 2-44
- Memory Test, 4-33, 4-60
- Memory refresh, 2-16
- memory configurations;
- Motherboard, 2-16
- MENU A, 4-25, 4-48
- MENU B, 4-26, 4-50
- MENU C, 4-28, 4-51
- MENU D, 4-29, 4-52
- MENU E, 4-54
- MENU F, 4-56
- MFD Interface, 2-19
- Mini-Floppy Disk Drive, 5-94
- Mini-Floppy Disk Interface, 2-19
- Mini-Floppy Disk Unit Check, 5-28
  - One MFD Unit and One HDU, 5-33
  - System Will Not Access Hard Disk, 5-36
  - Two Mini-Floppy Disk Units, 5-28
- Mini-Floppy Disk Unit(s), 2-35
- Mini-Floppy Disk Units, A-38
  - Jumpers, A-38
  - Matsushita Mini-Floppy Disk Unit, A-43
  - OPE Mini-Floppy Disk Unit, A-41
  - Resistor Pack or Terminating Resistor, A-39
  - Toshiba Mini-Floppy Disk Unit, A-39
- MINIMUM SYSTEM CONFIGURATION, 2-59
- Monochrome Display, 2-52
- MOTHERBOARD, A-7
  - DIP Switch Setting, A-9
  - DIPSW- Settings, A-10
  - DIPSW-1 Settings, A-13
  - Jumpers, A-7
- Motherboard, 2-9, 5-55
  - CPU and DMA Circuitry, 2-15
  - Input/Output Connectors, 2-22
  - Input/Output Peripheral Interfaces, 2-18
  - Memory, 2-16
  - Motherboard Component Layout, 2-25
- Motherboard Component Layout, 2-25
- Motherboard RAM, 2-16
- Motherboard ROM, 2-17
- Motherboard Test, 4-32, 4-58
- Motherboard Test; Customer Test Diagnostics, 4-32
- Mouse, 5-112
  - Mouse Test, 5-114

## INDEX

---

Mouse Care and Cleaning, 5-198  
Mouse Housing, 3-100  
Mouse Keyboard Port, 3-102  
Mouse Software; Installing, 3-107  
Mouse Test, 4-41, 4-79, 5-114

## N

Numeric Data Processor, 2-15

## O

One MFD Unit and One HDU, 5-33  
OPE Mini-Floppy Disk Unit, A-41  
Opening the Keyboard, 3-104  
Operating Procedures, 4-8, 4-22, 4-48, 5-143  
    Automatic Mode, 4-23  
    Manual Mode, 4-25  
OPTION INSTALLATION, 3-8  
    Installing 8087 Numeric Data Processor, 3-36  
    Installing DEB Software, 3-90  
    Installing Memory Expansion Board, 3-21  
    Installing Small Expansion Box, 3-63  
    Installing the Display Enhancement Board, 3-77  
    Installing the Keyboard ROM, 3-104  
    Installing the Mouse, 3-100  
    Installing the Mouse Software, 3-107  
    Removing System Module Covers, 3-9

OPTION INSTALLATION (Contd)  
    Replacing Mini-Floppy Disk Unit With Hard Disk Unit, 3-42  
    Troubleshooting the DEB Installation, 3-97  
    Upgrading Memory Expansion Board Memory to 384KB, 3-27  
    Upgrading Motherboard Memory to 256KB or 640KB, 3-12  
ORGANIZATION, 1-4

## P

P4 Display Controller Board, A-32  
P8 Display Controller Board, A-34  
    Display Enhancement Board Jumpers, A-35  
Parallel Loopback Jumper, 4-68  
Parallel Port, 5-88  
Parallel Port Test, 4-36, 4-67  
Parallel Printer Interface, 2-20  
Parallel Printer Test, 4-39, 4-77, 5-105  
Partition Hard Disk for MS-DOS, 5-45  
PHYSICAL CHARACTERISTICS, 3-6  
Placing Low-Level Format and Bad Track Mapping on the Hard Disk, 5-41  
    Formatting the Hard Disk, 5-47  
    Partition Hard Disk for MS-DOS, 5-45  
POWER SUPPLY ADJUSTMENT, 5-145  
Power Supply, 2-44  
Problems That May Occur in a One/Two Hard Disk Configuration, 5-39

---

## R

- RAM chip locations, 5-66
  - RAM test, 4-14
  - RAM—display controllers, 2-30
  - Random Access Memory (RAM), 5-59
    - Determining Faulty RAM Chips, 5-65
  - real time clock—input, 2-22
  - Real-Time Clock and Calendar, 2-22
  - Real-Time Clock test, 4-13
  - rear panel; System Module, 2-7
  - Reminders, 5-6
  - Removing Existing ROM Chip, 3-105
  - Removing Lower Cover, 3-11
  - Removing Lower System Module Cover, 5-150
  - Removing System Module Covers, 3-9
    - Removing Lower Cover, 3-11
    - Removing Upper Cover, 3-10
  - Removing Upper Cover, 3-10
  - Removing Upper MFD Unit, 3-42
  - Removing Upper System Module Cover, 5-149
  - REPLACING FAULTY MODULES, 5-148
    - Cleaning Keyboard Contacts, 5-201
    - Mouse Care and Cleaning, 5-198
    - Removing Lower System Module Cover, 5-150
    - Removing Upper System Module Cover, 5-149
    - Replacing Bus Converter, 5-161
    - Replacing Display Controller, 5-162
    - Replacing Fan, 5-156
    - Replacing HDU Controller, 5-187
    - Replacing Lower Mini-Floppy Disk Unit, 5-168
    - Replacing Memory Chips, 5-193
    - Replacing Memory Expansion Board, 5-186
    - Replacing Motherboard, 5-157
  - REPLACING FAULTY MODULES (Contd)
    - Replacing Power Supply Unit, 5-151
    - Replacing Slim HDU, 5-180
    - Replacing Small Expansion Box (External HDU), 5-189
    - Replacing Upper Mini-Floppy Disk Unit, 5-175
  - Replacing Bus Converter, 5-161
  - Replacing Display Controller, 5-162
  - Replacing Fan, 5-156
  - Replacing Faulty Modules, 5-5
  - Replacing HDU Controller, 5-187
  - Replacing Lower Mini-Floppy Disk Unit, 5-168
  - Replacing Memory Chips, 5-193
  - Replacing Memory Expansion Board, 5-186
  - Replacing Mini-Floppy Disk Unit With Hard Disk Unit, 3-42
    - Installing 10- or 20-MB Hard Disk Units, 3-46
    - Installing Hard Disk Controller Board, 3-48
    - Removing Upper MFD Unit, 3-42
    - Setting DIP Switches and Jumpers, 3-52
  - Replacing Motherboard, 5-157
  - Replacing Power Supply Unit, 5-151
  - Replacing Slim HDU, 5-180
  - Replacing Small Expansion Box (External HDU), 5-189
  - Replacing Upper Mini-Floppy Disk Unit, 5-175
- RESIDENT DIAGNOSTICS, 4-7
  - Operating Procedures, 4-8
  - Test Descriptions, 4-10
- Resident Diagnostic Error Messages, 5-51
- Resistor Pack or Terminating Resistor, A-39
- resolutions, 2-29
- ROM test, 4-11

**S**

- Second Hard Disk Unit, 5-135
  - segment codes; memory failure, 4-132
  - Serial Communication Interface, 2-20
  - Serial Loopback Jumper, 4-70
  - Serial Port Test (Using 8250), 5-91
  - Serial Port(s) Test, 4-37
  - Serial Port(s) Test (Using 8250), 4-69
  - Setting DIP Switches and Jumpers, 3-52
  - Ship the Unit, 4-124
  - Short Isolation Procedure, 5-19
  - SITE PREPARATION, 3-3
  - Slim Hard Disk Units (Optional), 2-37
  - SMALL EXPANSION BOX (OPTIONAL), 2-51
  - Small Expansion Box—External HDU, 2-51
  - STAND-ALONE LOW-LEVEL FORMAT UTILITY TEST, 4-92
  - STAND-ALONE MOTHERBOARD DMA TEST DIAGNOSTICS, 4-89, 5-142
    - DMA Test, 4-89
    - Loading DMA Test, 5-142
    - Test Description, 5-142
  - Status bytes; serial port(s), 4-146
  - status byte; parallel port, 4-144
    - AT&T PC 6300 ACCEPTANCE PROCEDURE, A-54
  - SWITCHES AND JUMPERS, A-1
    - DISPLAY CONTROLLER BOARD, A-30
    - HARD DISK CONTROLLERS, A-16
    - HARD DISK UNIT, A-45
    - INTRODUCTION, A-3
    - MOTHERBOARD, A-7
    - Mini-Floppy Disk Units, A-38
  - SWITCHES AND JUMPERS (Contd)
    - Switches, A-3
  - SYSTEM INSTALLATION, 3-110
  - SYSTEM MODULE, 2-5
    - Bus Converter, 2-31
    - Display Controllers, 2-27
    - Hard Disk Unit Controllers (Optional), 2-39
    - Input/Output (I/O) Expansion Bus Characteristics, 2-33
    - Memory Expansion Board (Optional), 2-42
    - Mini-Floppy Disk Unit(s), 2-35
    - Motherboard, 2-9
    - Slim Hard Disk Units (Optional), 2-37
  - SYSTEM OVERVIEW, 2-1
  - DISPLAY, 2-52
  - DISPLAY AND KEYBOARD EXTENSION CABLES, 2-58
  - DISPLAY ENHANCEMENT BOARD (OPTIONAL), 2-49
  - EXPANDED SYSTEM CONFIGURATION, 2-60
  - INTRODUCTION, 2-3
  - KEYBOARD, 2-56
  - MINIMUM SYSTEM CONFIGURATION, 2-59
  - SMALL EXPANSION BOX (OPTIONAL), 2-51
  - SYSTEM MODULE, 2-5
- SYSTEM TEST DIAGNOSTICS, 4-47
    - Loading System Test, 4-47
    - Operating Procedures, 4-48
    - Test Descriptions, 4-58
  - SYSTEM TEST DIAGNOSTICS (OVERLAY VERSION), 4-87
    - Loading System Test (Overlay Version), 4-87

---

System Load Check on Power Supply, 5-9  
  Short Isolation Procedure, 5-19  
System Module; handling, 3-8  
System Will Not Access Hard Disk, 5-36  
System Will Not Power Up Normally, 5-7  
system busses, 2-11

## T

Test Description, 5-142  
  2nd HDU Drive and Controller Test, 4-45, 4-83  
  48 TPI Floppy Disk Test, 4-37, 4-71  
Test Descriptions, 4-10, 4-32, 4-58  
  8087 Math Co-Processor, 4-41, 4-77  
  8530 Test, 4-42, 4-80  
  Error Messages, 4-15  
  HDU Drive and Controller Test, 4-38  
  Keyboard Test, 4-34, 4-62  
  MB HDU Drive and Controller Test, 4-74  
  Memory Test, 4-33, 4-60  
  Motherboard Test, 4-32, 4-58  
  Mouse Test, 4-41, 4-79  
  Parallel Port Test, 4-36, 4-67  
  Parallel Printer Test, 4-39, 4-77  
  Serial Port(s) Test, 4-37  
  Serial Port(s) Test (Using 8250), 4-69  
  Video Option Board Test (DEB [Display Enhancement Board]), 4-42  
  Video Option Board Test [Display Enhancement Board (DEB)], 4-80  
  Video System Test, 4-35, 4-63  
  Testing HDU Drive and Controller, 4-83  
  The Bad Track Table, 4-95  
  Timer, 2-22  
TOOLS AND ACCESSORIES, 1-5  
Toshiba Mini-Floppy Disk Unit, A-39  
TROUBLESHOOTING WITH SYSTEM TEST, 5-54  
  80807-2 Math Co-Processor, 5-109  
  8530 Serial Port Test, 5-118  
  Hard Disk Unit, 5-99  
  Keyboard, 5-69  
  Mini-Floppy Disk Drive, 5-94  
  Motherboard, 5-55  
  Mouse, 5-112  
  Parallel Port, 5-88  
  Parallel Printer Test, 5-105  
  Random Access Memory (RAM), 5-59  
  Second Hard Disk Unit, 5-135  
  Serial Port Test (Using 8250), 5-91  
  Video Option Board (Display Enhancement Board), 5-121  
  Video Option Board Test, 5-125  
  Video System, 5-73  
TROUBLESHOOTING WITHOUT SYSTEM TEST, 5-7  
  Display Check, 5-26  
  Hard Disk Problems, 5-38  
  Hard Disk Unit "Not Ready" on Cold Start, 5-50  
  Mini-Floppy Disk Unit Check, 5-28  
  Placing Low-Level Format and Bad Track Mapping on the Hard Disk, 5-41  
  Problems That May Occur in a One/Two Hard Disk Configuration, 5-39  
  Resident Diagnostic Error Messages, 5-51  
  System Load Check on Power Supply, 5-9

## INDEX

---

### TROUBLESHOOTING WITHOUT SYSTEM TEST (Contd)

- System Will Not Power Up
  - Normally, 5-7
- Troubleshooting, 5-5
- Troubleshooting the DEB Installation, 3-97
- Two Mini-Floppy Disk Units, 5-28

## W

- wrist strap, 3-8, 5-6

## U

- UNPACKING, 3-7
- Upgrading Memory Expansion Board Memory to 384KB, 3-27
- Upgrading Motherboard Memory to 256KB or 640KB, 3-12

## V

- Verify Surface Test, 4-121
- Video Disable Option, A-32
  - P4 Display Controller Board, A-32
- Video Option Board (Display Enhancement Board), 5-121
- Video Option Board Test, 5-125
- Video Option Board Test (DEB [Display Enhancement Board]), 4-42
- Video Option Board Test [Display Enhancement Board (DEB)], 4-80
- Video System, 5-73
- Video System Test, 4-35, 4-63