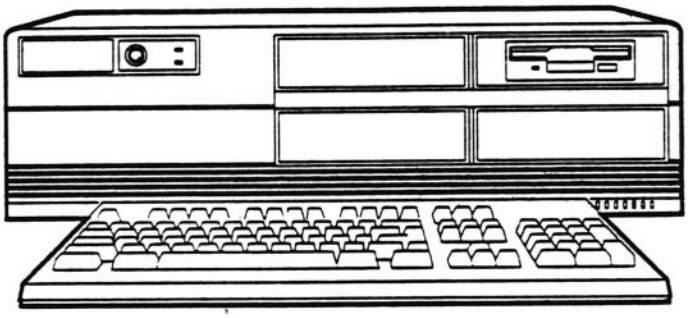
ZENITH
data systems
Groupe Bull



Z-386/20/25/33 Series Computers

Service Manual

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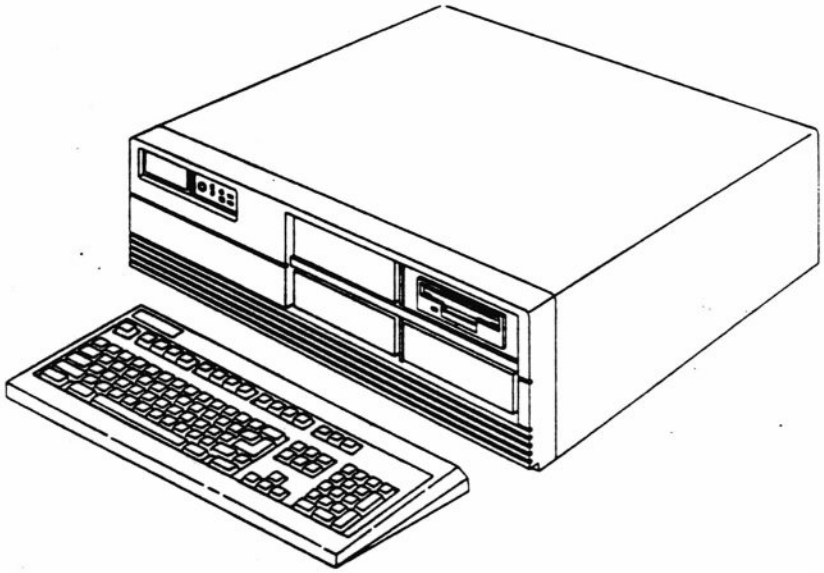
Chapter 1
Introduction

The High-Performance Workstation is an AT-compatible computer based on the 80386 32-bit central processing unit (CPU). The CPU operates at 20, 25, or 33 MHz, depending on the computer model. The computer supports from 2 to 64 megabytes of memory and uses a 32-bit proprietary bus that supports AT-compatible cards. A VGA video card provides emulation for CGA, MDA, EGA, and HGC (Hercules video) display modes. One Centronics-type parallel and two RS-232 serial ports are standard. Figure 1-1 illustrates the basic computer.

Figure 1-1. High-Performance Workstation



This manual includes operation, configuration, troubleshooting, and service procedures to the major assembly level.

Related Publications

The following manuals are also available:

- *Owner's Manual* — Part number 595-4859.
- *Technical Reference Manual* — Model TM-3600 covers hardware, BIOS, and programmable registers.

These manuals are available from Zenith Data Systems.

Tools

Use the following tools and equipment to install, repair, and maintain this computer.

- #1 Phillips screwdriver
- #2 Phillips screwdriver
- Voltmeter
- Disk-Based Diagnostics:
  Model CB-31-05 (3.5-inch version)
  — Model CB-51-05 (5.25-inch version)

The disk-based diagnostic package is available from Zenith Data Systems.

Safety Precautions

To avoid potential shock or personal injury, use the following precautions when servicing this computer.

- Verify correct line voltage selection.
- Use a grounded AC power source.
- Disconnect AC power before opening the cabinet.
- Avoid power-ground shorts.
- Disconnect the auxiliary fan when working in close proximity.

Base Computer

As shipped from the factory, the computer consists of several major assemblies including the main board, a cache card, the parallel/serial card, the serial board, a disk controller card, at least one floppy disk drive, and a power supply. Some models include a VGA video card.

Main Board — This board contains most of the computer's control circuitry including the 80386 CPU; memory; and CPU, bus, memory, and cache support circuits. The board also contains 32-bit and AT-compatible bus connectors, the keyboard and cache connectors, and numeric coprocessor socket(s).

Cache Card — The cache card installs in a connector on the main board, providing either 16K or 64K of fast access memory, increasing overall system performance.

Parallel/Serial Card — This card contains most of the peripheral interface circuitry including: the interrupt and DMA controllers, the serial/parallel I/O circuits, a real-time clock, an interval timer, and the system control processor. The MFM-300 monitor ROM, a 3-volt backup battery, and a set of diagnostic LEDs also are on this card. The card provides one RS-232C serial port and one Centronics-type parallel port.

Serial I/O Board — A second RS-232C serial port is available through the connector on this board. A short cable connects this board to the parallel/serial card.

Video Card — The video card produces analog RGB video signals. Standard output is analog VGA that also emulates the EGA, CGA, MDA, and Hercules (HGC) video display modes.

Disk Controller Card — The standard disk controller card is a Floppy/Enhanced Small Device Interface (ESDI) hard disk controller. The card provides support for up to two 3.5- or 5.25-inch floppy disk drives in any combination, and two ESDI hard disk drives. Some controllers support other hard disk interfaces, including the Small Computer System Interface (SCSI).

Memory Modules — The computer is shipped with two megabytes of system RAM installed on the main board. Memory capacity is 8 megabytes using 1-megabyte memory modules, or 20 megabytes using a combination of 1- and 4-megabyte memory modules. Optional add-on memory cards can be installed, providing up to 64 megabytes.

Bus Interface — The computer provides both AT-compatible expansion bus connectors and proprietary 32-bit expansion slots. Expansion memory cards and the parallel/serial card use the ZDS proprietary slots.

Drives — The computer comes with up to two floppy disk drives. These are usually 3.5-inch drives with a high-density storage capacity of 1.4 megabytes per high-density disk. Some computers contain up to two hard disk drives in addition to the floppy disk drives. The drives can be ESDI or SCSI devices (depending on the drive controller) of various capacities.

Power Supply — The switch-mode regulated power supply provides the following outputs:

- −5 VDC @ 21A
- −5 VDC @ 0.3A
- +12 VDC @ 7.5A
- −12 VDC @ 0.3A

These outputs are electrically isolated from the main voltage and share the cabinet as the common ground. The input voltage is switch selectable between 115 and 230 VAC.

Keyboard — The computer comes with a 101-key keyboard, configured for AT-compatible operation.

Optional Hardware

The following hardware options are available for this computer.

Coprocessors — Sockets on the main board support the following numeric coprocessors:

- Intel 80387
- Weitek WTL 3167.

Refer to the Specifications section later in this manual for specific coprocessor models. Main boards that contain two coprocessor sockets support both coprocessors installed at the same time.

Circuit Cards — The computer provides expansion slots that accept standard AT-compatible circuit cards, as well as proprietary 32-bit expansion cards.

Memory — Memory expansion options include the following:

- One-megabyte memory modules
- Two-megabyte memory modules
- Memory expansion card using two-megabyte memory modules, 8 megabytes maximum per card.

Floppy Disk Drives — The computer supports a second floppy disk drive, which can be any one of the following:

- 720K, 3.5-inch
- 1.4M, 3.5-inch
- 360K, 5.25-inch
- 1.2M, 5.25-inch.

Hard Disk Drives — The computer supports a maximum of two ESDI hard disk drives using the standard drive controller card.

NOTE: The MS-DOS operating system recognizes the primary drive controller. If you use more than one controller, you must use a different operating system, such as XENIX or OS/2, to access the secondary controller, or provide your own operating system support.

Chapter 2
Installation

This chapter provides instructions for setting up the computer, installing internal options, and connecting peripherals and power.

Unpacking the Computer

Avoid shock hazard. Do not connect power or turn on the computer until instructed to do so.

1. Unpack the user documentation and the operating system, set them aside until they are called for.

2. Choose a sturdy work location away from heat sources such as heaters or radiators. Maintain the room temperature between 60° and 80°F (16° to 27°C) with a relative humidity between 20% and 80%. Avoid lights or windows that can cause reflections on the monitor.

NOTICE Handle the computer with care to prevent damage. Do not drop or jar the hard disk drive(s).

3. Carefully unpack the computer and the keyboard.

4. Place the computer and any peripheral equipment on the work surface. Make certain there is unobstructed air space around the top, sides, and rear of the computer. These areas must be accessible during setup and options installation

5. If the computer is a videoless model, refer to the "Installation of Options" section of this chapter and install the video card now. Refer to the manufacturer's documentation for specific configuration instructions.

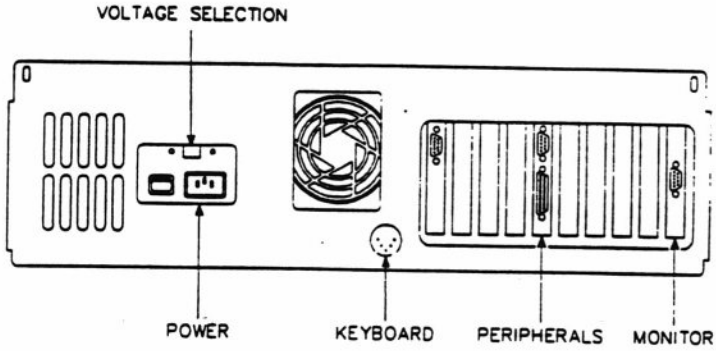
6. If other internal options are being installed, refer to the "Installation of Options" section of this chapter and install them now.

7. Give the keyboard/cover lock keys to the customer. Have the customer save all shipping cartons and inserts in case the computer must be transported.

Back Panel

All connections for power and peripherals are located on the back panel as illustrated in Figure 2-1.

Figure 2-1. Computer Back Panel



Video Connection

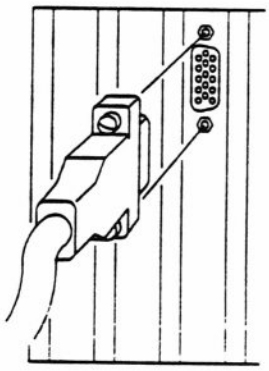
The video card installed in several computer models provides 31 kHz analog video signals through a 15-pin D-type connector.

NOTICE The video card is set for 31 kHz, VGA analog operation. Do not attempt to connect any other type of monitor to the card.

1. Position the monitor on the work surface.
2. Refer to Figure 2-2 and connect the monitor to the video card.

The specifications contain connector pinout information.

Figure 2-2. Connecting the Monitor

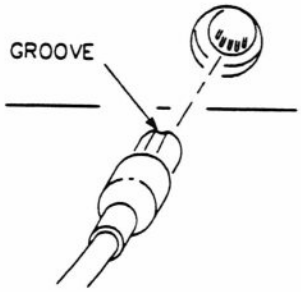


Keyboard Installation

1. Refer to Figure 2-3 and connect the keyboard to the rear of the computer.

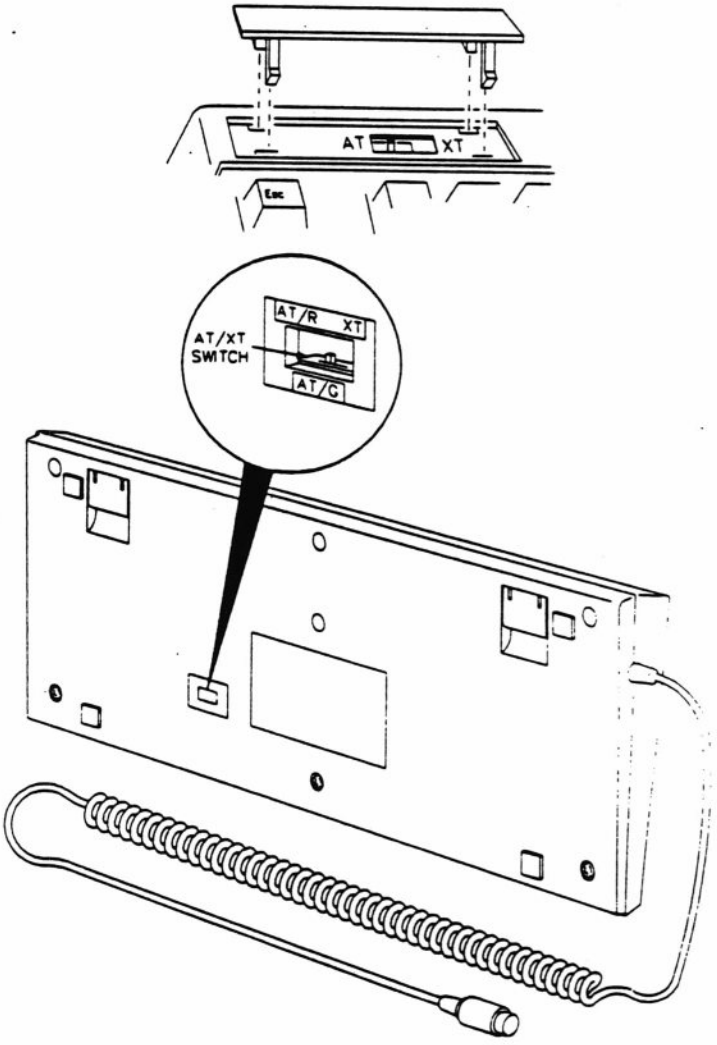
   The Specifications section contains connector pinout information.

Figure 2-3. Connecting the Keyboard Cable



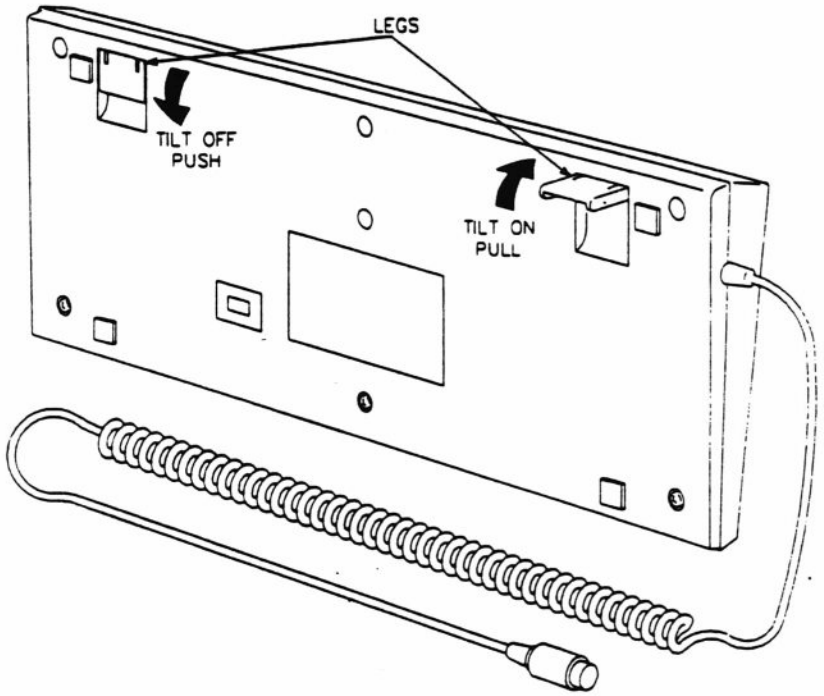
2. Refer to Figure 2-4 and check the keyboard compatibility switch. Be certain the switch is in the "AT" position.

Figure 2-4. AT/XT Compatibility Switch



3. Adjust the tilt of the keyboard by moving the legs as shown in Figure 2-5.

Figure 2-5. Keyboard Legs

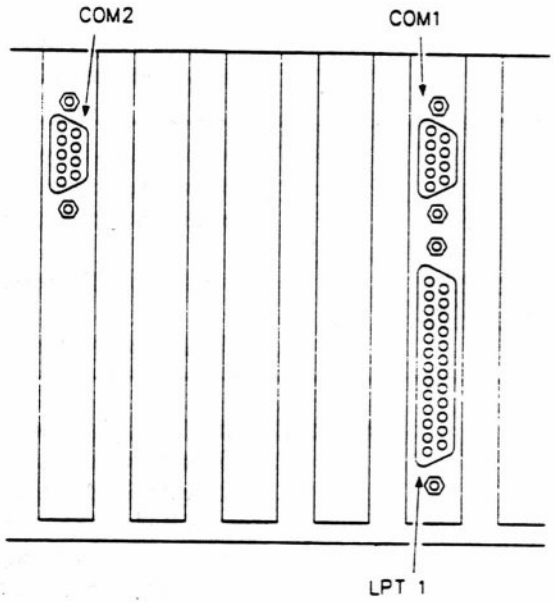


Peripheral Connections

Figure 2-6 shows the location of the Centronics-type parallel printer port and the RS-232 serial ports. Connect any peripherals and secure the cables.

The Specifications section contains connector pinout information.

Figure 2-6. Parallel and Serial Port Locations



Power Connections

Before connecting AC power to the computer or any peripheral, set all power switches to the OFF position.

1. **Refer to Figure 2-7 and check the computer's input voltage switch for the correct AC source voltage.**

If you will be operating the computer in an area serviced by a 230 VAC power source, the power cord and plug must be changed to the proper type and voltage rating.

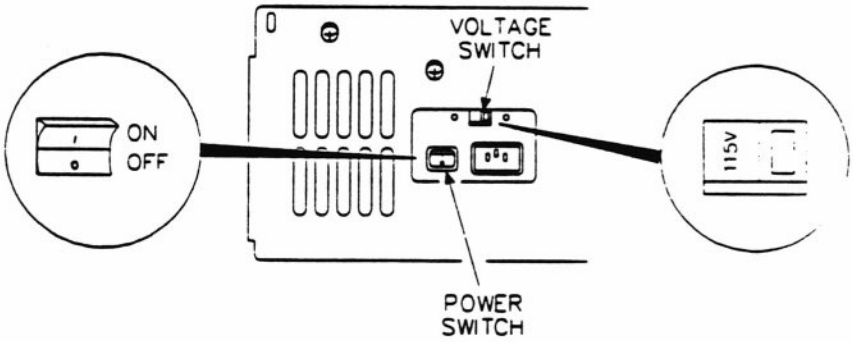
- **For 115 volt systems, a minimum of 10 amps is required.**
- **For 230 volt systems, a minimum of 5 amps is required.**

NOTICE **In the USA, the power supply cord must be UL listed, detachable, with a 3-conductor cable, type SV or SVT, #18 AWG, with a molded-on NEMA type 5-15 P plug cap at one end, and a molded-on cord connector body at the other. The cord must be rated 120 VAC, 10 amp minimum, and its length must not exceed 14.5 feet (4.5 meters). Outside the USA, the cord must be rated 250 VAC, 5 amp minimum, and must display an international agency approval marking.**

Contact your local sales representative, or the local electrical authorities if you are unsure of the type of power cord to use.

IMPORTANT **If you are unsure about the line voltage in your area, check local electrical codes.**

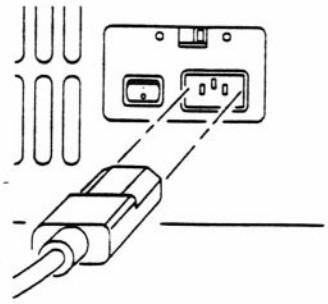
Figure 2-7. Power and Voltage Switch Locations



2. Refer to Figure 2-8 and connect the power cord to the computer and to the AC power source. You can use a properly rated switched power strip.

   - For a 115-volt AC source, a minimum of 10 amps is required.
   - For a 230-volt AC source, a minimum of 5 amps is required.

Figure 2-8. Power Connection



3. Connect the monitor and peripherals to a grounded AC power source.

Powerup

If you are unfamiliar with these procedures or require additional information, refer to Chapter 3.

1. Turn on the computer and monitor.
2. Enter the Monitor program and type SETUP.
3. Set the date and time.
4. If a hard disk drive is installed, set the computer to autoboot from the hard disk. Otherwise, set it to autoboot from the floppy disk drive.
5. Update the configuration information for any installed options.
6. Record the Setup information on the **Setup Form** at the back of the computer *Owner's Manual*.
7. Exit the Setup program and save the changes
8. Reset the computer and autoboot.

Installation of Options

Static Precautions

The following procedures describe how to install hardware options.

When handling circuit boards or integrated circuits (ICs):

- Do not remove any static-sensitive device from its protective packaging until you are ready to install it.
- Equalize the static electricity between the work surface, the device, and you by touching the work surface with one hand and then picking up the device with the other hand.
- Once you remove the device from its protective packaging, do not set it down or let go of it until it is installed in the computer or returned to its protective packaging.

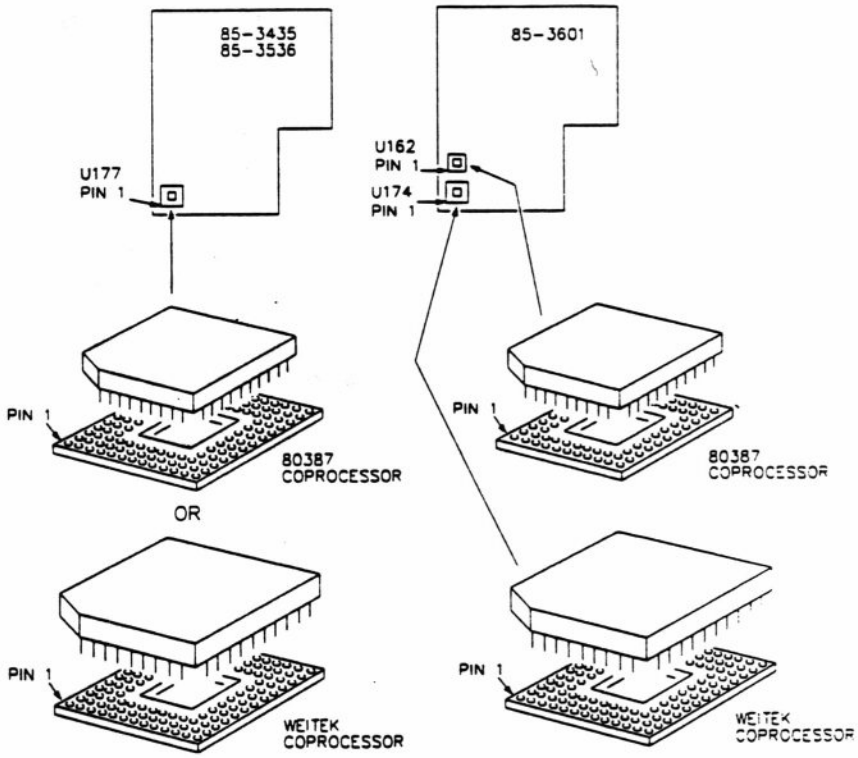
Numeric Coprocessor Installation

NOTICE Static electricity can damage the numeric coprocessor. Use static precautions.

To prevent shock, disconnect the computer from the AC power source before you remove the cover.

1. Remove the cover as described in Chapter 5.
2. Use Figure 2-9 to locate the numeric coprocessor socket.

Figure 2-9. Numeric Coprocessor Socket Location



3. Align pin 1 of the coprocessor with pin 1 of the socket. Verify that no pins are bent outside of the socket.
4. If J101 is present on the board, set it as follows:
   - If an 80387 is installed, jumper pins 1 and 2.
   - If an 80387 is not installed, jumper pins 2 and 3.
5. Replace the cover.

Circuit Card Installation

To prevent shock, disconnect the computer from the AC power source before you remove the cover.

1. Remove the cover as described in Chapter 5.

2. Refer to Table 2-1 and select the expansion slot for the new card.

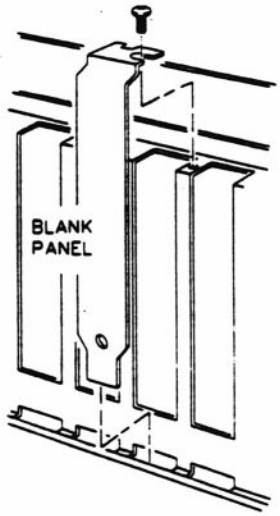
Table 2-1. Expansion Slot Assignments

SLOT	CONNECTOR	BUS	CARD
1	P101	ZDS	Optional
2	P102	ZDS	Optional
3	P103	ZDS	Optional
4	P104	ZDS	Parallel/Serial Card
5	P105	AT	Optional
6	P106	AT	Video Controller Card
7	P107	AT	Disk Drive Controller Card

NOTE: The serial I/O board does not require an expansion slot. Install this board next to the disk drive controller card on the power supply side.

3. Refer to Figure 2-10 and remove the blank panel from the slot you selected. Save the screw.

Figure 2-10. Blank Panel Removal



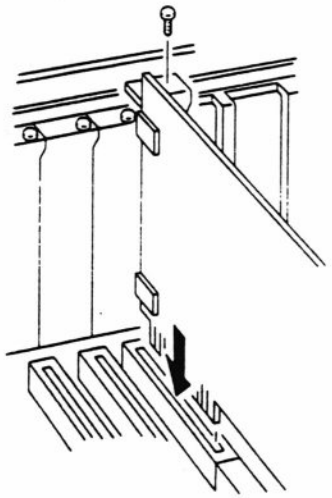
4. Refer to the card's documentation and Chapter 6, "Configuration." Set any configuration jumpers or switches.

NOTE: Retain any removed blank panels for replacements.

5. Refer to Figure 2-11 and position the new card over the slot. Seat the card by pushing down carefully until it slides into place. Secure the card with the screw you removed in step 3.

6. Replace the cover.

Figure 2-11. Circuit Card Installation



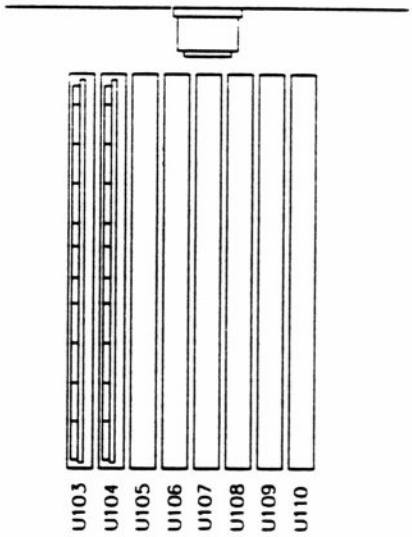
Memory Module Installation

NOTICE Static electricity can damage the memory module(s). Use static precautions.

To prevent shock, disconnect the computer from the AC power source before you remove the cover.

1. Remove the cover as described in Chapter 5.
2. Refer to Figure 2-12 and locate the memory module sockets.

Figure 2-12. Memory Module Socket Locations



IMPORTANT Presently, the motherboard supports up to 20 megabytes of memory in the following configuration:

U103	U104	U105	U106	U107	U108	U109	U110
1M	1M	1M	1M	4M	4M	4M	4M

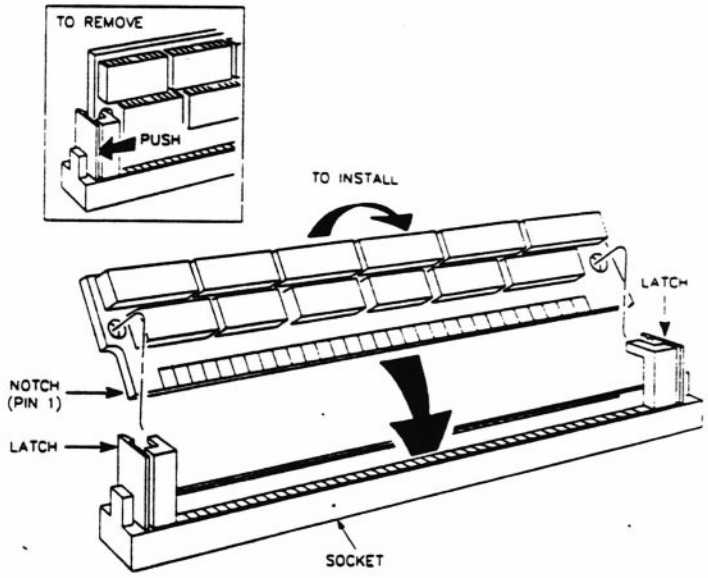
Do not place 4M memory modules in sockets U103 – U106.

NOTE: Because of the memory configurations restrictions, you will not be able to install memory in 15-, 18-, or 19-megabyte configurations.

3. To install a memory module:

   - Position the module with the component side facing away from the power-supply.
   - Tip the module slightly toward the power supply and guide it into the socket on the main board as shown in Figure 2-13.
   - Gently push the module to the left until it is upright. As the latches at each end of the socket snap over the ends of the memory module, it makes a distinct click.

Figure 2-13. Installing and Removing Memory Modules



4. To remove a memory module:

   - Use a small flat-bladed screwdriver to release the latches at each end of the module as shown in Figure 2-13.
   - Gently tip the module toward the power supply and lift it out.

5. Replace the cover.

6. Run the Setup program and update the memory information. Refer to Chapter 3 if you are unfamiliar with this procedure. Update the **Setup Form** in the back of the computer *Owner's Manual*.

7. Perform the ROM-based memory test described in "User Tests" in Chapter 3 to verify that all memory banks are functioning properly.

8. Run the disk-based memory diagnostic tests to thoroughly check the new memory. Refer to the *Diagnostics Manual* for testing instructions.

Disk Drive Installation

Use the following procedures to install any optional drives.

Drive Chassis Removal

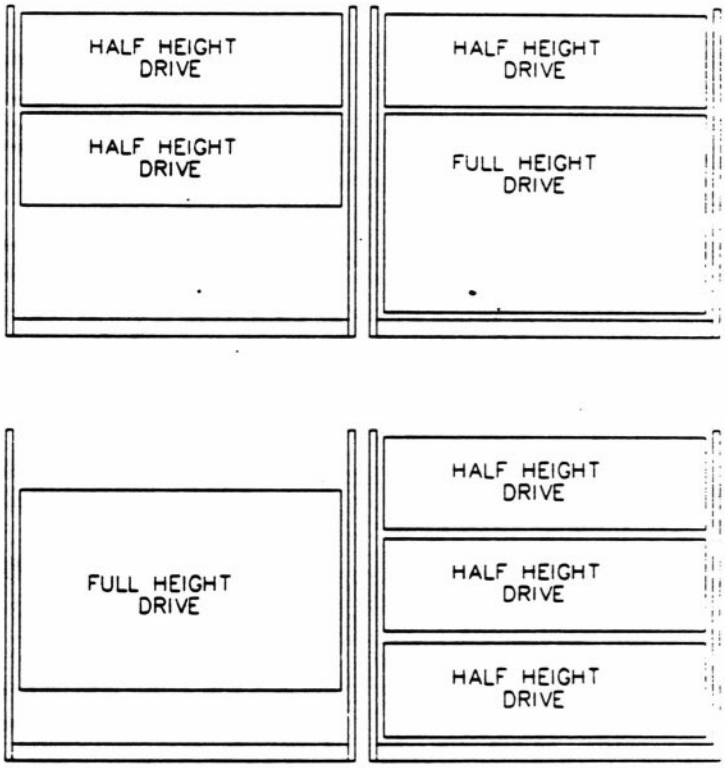
1. Place a shipping insert (or scratch disk) in the floppy disk drive(s) to protect the read/write heads during disassembly. If you have a hard disk drive in the computer, run the MS-DOS® SHIP utility (or equivalent) to park the hard disk's heads.

To prevent shock, disconnect the computer from the AC power source before you remove the cover.

2. Remove the cover as described in Chapter 5.

3. Refer to Figure 2-14 and decide where you want to install the additional disk drive.

Figure 2-14. Typical Drive Locations



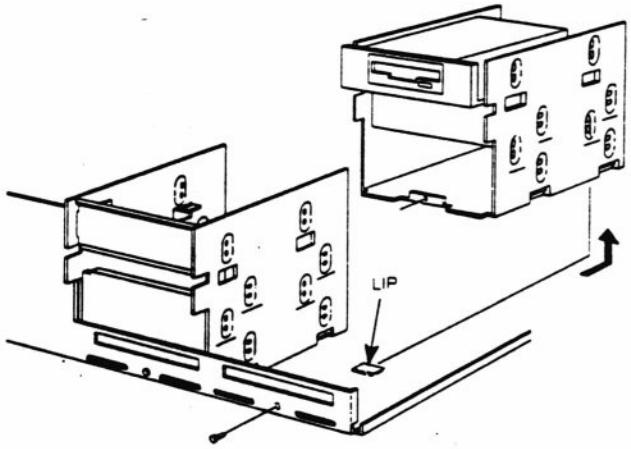
NOTICE You cannot install a full-height, 5.25-inch drive in the bottom of the left drive chassis.

4. Disconnect any cables connected to drives already installed in the chassis. Note the orientation of these cables.

5. Remove the screw that secures the drive chassis to the main chassis. Save the screw.

6. Refer to Figure 2-15 and slide the drive chassis back until it clears the lip on the computer chassis. Lift the drive chassis up and out of the computer.

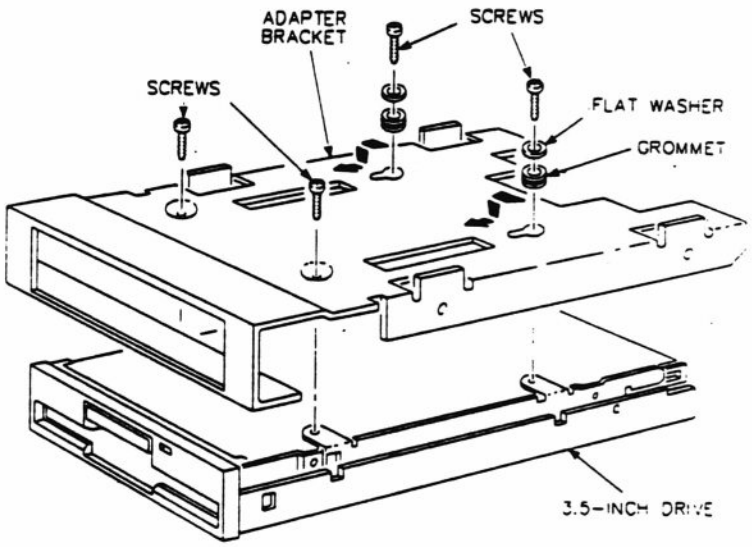
Figure 2-15. Removing a Drive Chassis



3.5-Inch Floppy Disk Drive Installation

1. Unpack the 3.5-inch floppy disk drive.
2. Refer to the configuration information packaged with the drive and to Chapter 6. Set the drive configuration switch or jumper.
3. Refer to Figure 2-16 and place the adapter upside down. Insert the two rubber grommets into the two key holes and slide them into place.
4. Turn the disk drive upside down and place the adapter bracket over the drive as shown in Figure 2-16. Line up the screw holes in the bracket with the corresponding holes in the bottom of the drive.
5. Secure the disk drive to the adapter bracket as follows:
   - Start the two longest screws through the two grommets, washers, and rear holes of the bracket into the disk drive. Do not tighten these screws.
   - Start two screws through the front holes of the bracket into the disk drive.
   - Tighten all four screws.

Figure 2-16. Mounting the Adapter Bracket to the Drive



6. Proceed to "Mounting Disk Drives."

5.25-Inch Floppy Disk Drive Installation

1. Carefully unpack the 5.25-inch floppy disk drive.
2. Refer to the configuration information packaged with the drive and to Chapter 6. Set the drive configuration jumpers or switches.
3. Proceed to "Mounting Disk Drives."

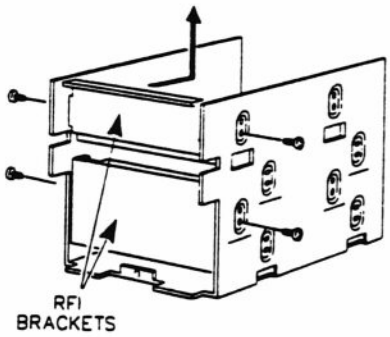
Hard Disk Drive Installation

1. Carefully unpack the hard disk drive.
2. Refer to the configuration information packaged with the drive and to Chapter 6. Set the drive configuration jumpers or switches.
3. Proceed to "Mounting Disk Drives."

Mounting Disk Drives

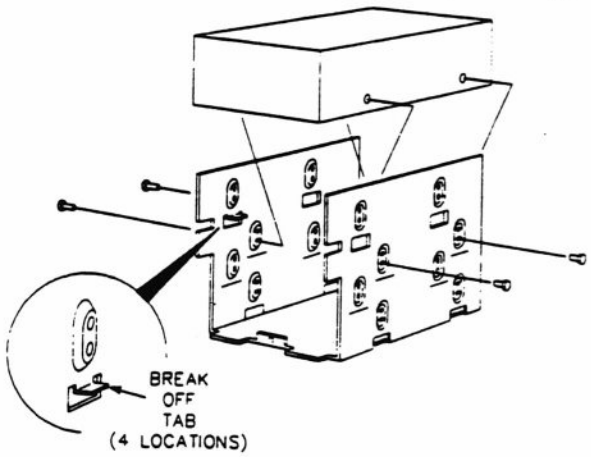
1. Remove the screws that secure the RFI bracket(s) to the drive chassis as shown in Figure 2-17.

Figure 2-17. Removing RFI Brackets



2. If you are installing a full-size hard disk drive, as shown in Figure 2-18, break off the drive support tabs shown in the inset.

Figure 2-18. Full-Height Drive Mounting (Left Chassis Only)

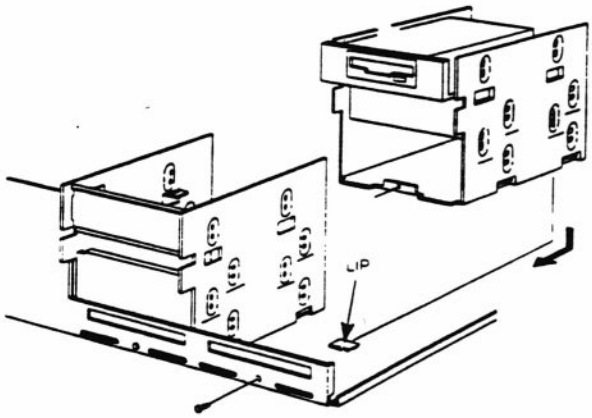


3. Secure the drive to the chassis using the four screws packed with the drive.

4. Refer to Figure 2-19 and reinstall the drive chassis as follows:

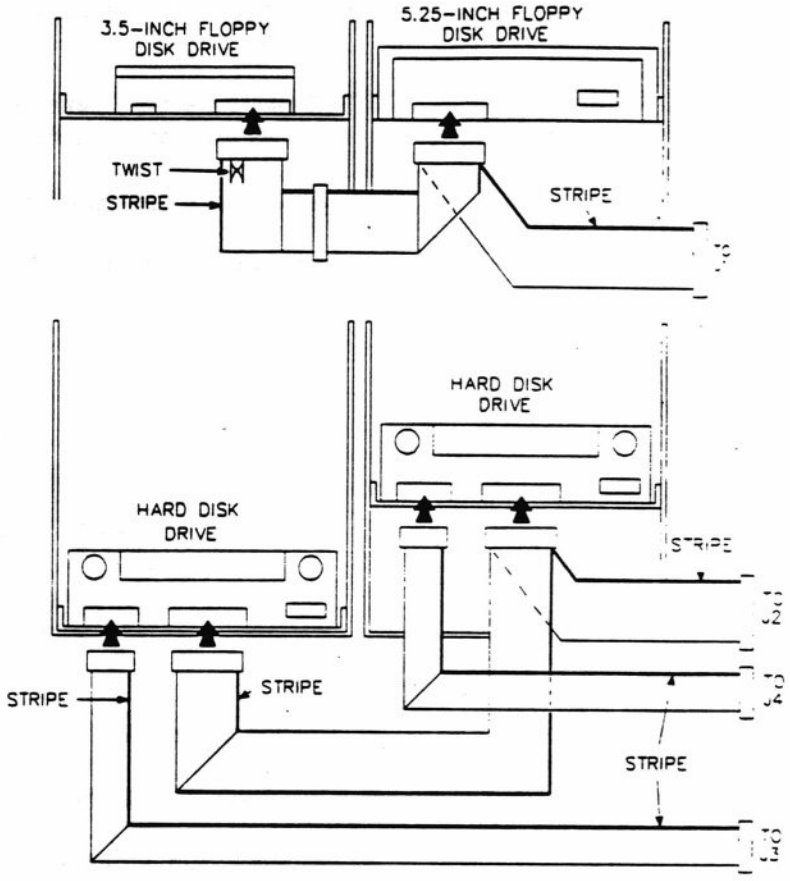
   - Place the drive chassis in the computer.
   - Slide the drive chassis forward into the lip on the base of the main chassis.
   - Use the screw you removed earlier and secure the drive chassis to the front of the computer.

Figure 2-19. Reinstalling the Drive Chassis



5. Refer to Figure 2-20 to connect the drive cables.

Figure 2-20. Disk Drive Cable Connections



6. Connect the power cable(s) to the drive(s).

NOTICE When connecting the 4-conductor power cable to most 3.5-inch disk drives, you must use an adapter cable.

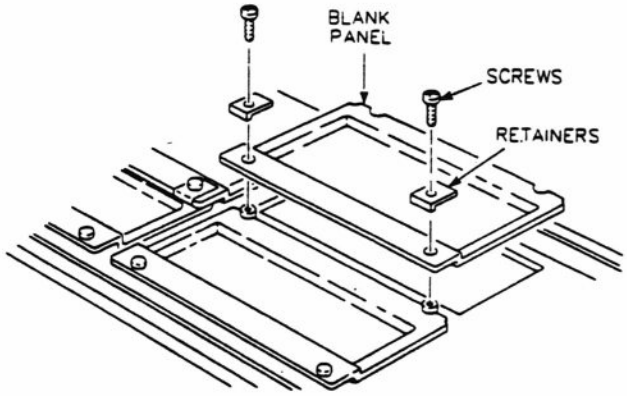
Blank Panel Removal

1. If you installed a drive that extends beyond the main chassis, remove the screws and retainers that secure the appropriate blank panel.

2. Remove the blank panel then replace the screws and retainers to secure the remaining blank panel.

3. Discard any unneeded blank panels, screws, and retainers.

Figure 2-21. Removing the Blank Panel



4. Replace the cover.

5. Reconnect the peripherals, monitor, and keyboard to the computer.

6. Run the Setup program and update drive information. Update the **Setup Form** in the computer *Owner's Manual*.

7. Refer to the operating system documentation and, if necessary, update the operating system configuration information.

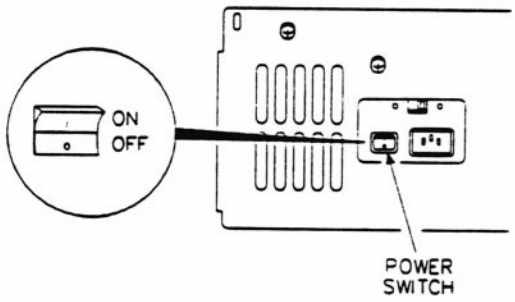
Chapter 3
Operation

This chapter covers power-up, the Monitor program, and basic operating information. Refer to the computer *Owner's Manual* for complete operating instructions.

Powerup

Refer to Figure 3-1 and turn the computer on.

Figure 3-1. Power Switch



If the voltage switch is set incorrectly, the computer could suffer damage when power is applied. If you are uncertain of the voltage in use in your area, contact your local power company.

When power is applied:

- The power supply and auxiliary fans start
- The keyboard resets (status LEDs blink), NUM LOCK remains lit
- Disk drives initialize (access indicators light, heads seek)
- Internal power-up self-tests complete
- A blinking cursor appears on the display
- The operating system loads from the hard disk drive or the floppy disk drive (autoboot option configured).

If the operating system is not installed, or it is not present on the disk, one of the following messages appears:

```
+++ DISK ERROR: Drive not ready! +++
+++ DISK ERROR: No bootable partitions! +++
No system
Not a bootable partition
```

Refer to the operating system documentation for installation instructions.

If the computer detects faults during the power-up sequence, error messages appear on the display (if the computer can drive the display). Refer to "Power-Up and Error Messages" later in this chapter.

Resetting the Computer

There are three different methods available to reset the computer:

1. Press and hold the CTRL, ALT, and DEL keys, then release them. This resets the CPU, reinitializes the computer and initiates the autoboot sequence.

2. Press and hold the CTRL, ALT, and INS keys, then release them. This resets the CPU, reinitializes the computer and enters the Monitor program.

3. Turn the computer off, wait 15 seconds, and then turn it back on. All circuits are reset to the power-on state.

The Monitor Program

The MFM-300 Monitor program contains:

- Power-up tests to detect problems that would prevent additional tests or an operating system from loading.
- The boot command to load the operating system.
- User-selectable tests to check the disk drives, keyboard, and memory.
- Video commands to display a color bar or set video and scroll modes.
- Debugging commands.
- The Setup program to store hardware configuration information.

Entering the Monitor Program

There are two methods to enter the program:

CTRL-ALT-INS — Press and hold the CTRL, ALT, and INS keys and then release them. A message similar to the following appears:

```
MFM-300 Monitor, Version x.xx
Memory size: xxxK + xxxxK + xxK Cache
Enter "?" for help
->_
```

The first line indicates the ROM version. The second line indicates how much memory is installed, including base, extended, and cache memory. The third line gives the syntax for the help command.

CTRL-ALT-ENTER — If the CTRL-ALT-INS key combination does not force the computer to enter the Monitor program, press and hold the CTRL, ALT, and ENTER keys, and then release them. The CPU register contents are displayed on the screen followed by the Monitor prompt.

If you enter the Monitor program using this method you may return to the operating system by pressing G and ENTER. Use this method to verify Setup information or to use the Monitor's debugging commands. Do not alter the Setup information while in this mode.

NOTE: In some cases the CPU locks up, preventing access by either method. If this happens, turn off the computer, wait 15 seconds, then turn it back on. This clears the CPU and allows you to use the CTRL-ALT-INS key combination.

For more information on the Monitor Program commands, refer to the *Technical Reference Manual.*

Figure 3-2. Monitor Command Summary

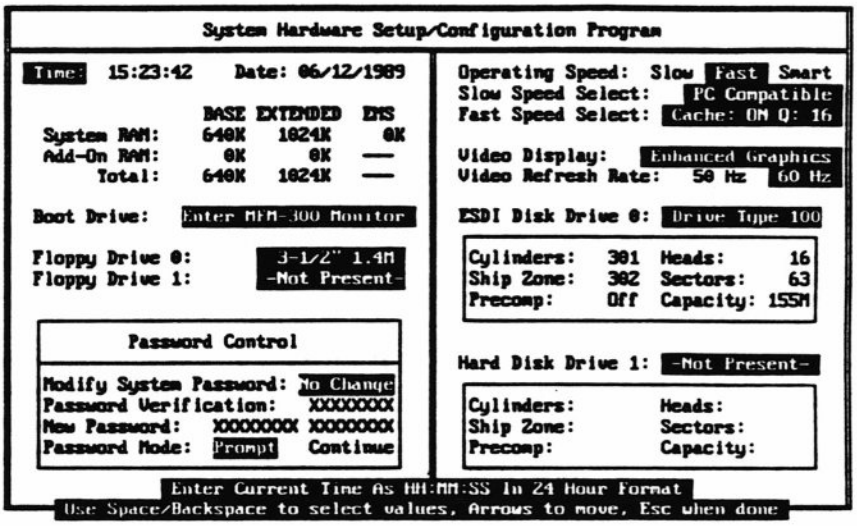
```
                    - MFM-300 Command Summary -

CMD:    Explanation             Syntax
----    -----------             ------
?:      Help                    ?
B:      Boot from disk          B [{F|W}][{0|1|2|3}][:<partition>]
C:      Color bar               C
D:      Display memory          D [<range>]
E:      Examine memory          E <addr>
F:      Fill memory             F <range>,{<byte>|"<string>"}...
G:      Execute (Go)            G [=<addr>][,<breakpoint>]...
H:      Hex math                H <number1>,<number2>
I:      Input from port         I <port>
M:      Move memory block       M <range>,<dest>
O:      Output to port          O <port>,<value>
R:      Examine Registers       R [<register>]
S:      Search memory           S <range>,{<byte>|"<string>"}...
T:      Trace program           T [<count>]
U:      Unassemble program      U [<range>]
V:      Set Video/Scroll        V [M<mode>][S<scroll>]
        Where <range> is:       <addr>{,<addr>|L<length>}
TEST:   Extended diagnostics    TEST
SETUP:  Define hardware Setup   SETUP

->
```

Setup Command

The Setup program records and stores the computer hardware configuration. This information is available each time the computer boots.

To start the program, type SETUP and press ENTER. A display similar to Figure 3-3 appears.

Figure 3-3. Setup Menu



Use the arrow keys and the TAB key to move from field to field. With the exception of the time and date fields, use the space bar and BACKSPACE keys to make selections. Current settings are displayed in reverse video.

Time

Enter the current time using the 24-hour format: *HHMMSS*. Use leading zeroes when entering single digits. The clock starts counting when the cursor leaves this field.

Example: For 6:58 A.M. enter 065800
For 6:58:30 P.M. enter 185830

If you enter an invalid time, an error message appears at the bottom of the screen. Press the ESC key and re-enter the correct time. After entering the time, press the TAB or ENTER key to move to the date field.

Date

Enter the date using the month-day-year format: *MMDDYYYY*. Use leading zeroes when entering single digits.

Example: For July 18, 1989 enter 07181989
For November 2, 1990 enter 11021990

If you enter an invalid date, an error message appears at the bottom of the screen. Press the ESC key and re-enter the correct date. Press ENTER when you are finished.

System RAM

IMPORTANT Before choosing a RAM configuration option, review the intended use of the computer with the owner. If necessary, review the software documentation for recommended memory configurations.

The term System RAM refers to memory installed on the main board. It is assigned in three areas::

- Base memory is user memory located in the first megabyte of memory. It is limited to a maximum size of 640K.
- Extended memory is typically used by "virtual disk" programs and some application software.
- EMS memory refers to memory meeting version 4.0 of the Lotus/Intel Memory Specifications. In this computer it is possible to configure a portion of the memory in the first megabyte for use as EMS memory. You may choose 256K, 384K, or 640K for this purpose. Any selection above 256K will reduce the amount of assigned base memory. All EMS memory requires a driver program for proper operation. EMS memory installed on third party cards does not appear in this field.

IMPORTANT If a third party EMS-only memory card is added to the system, and internal system memory is configured for use as EMS memory, assign the add-on card as card 2 or higher. This will prevent possible memory addressing conflicts.

Use the space bar or BACKSPACE key to select the amount and use of System RAM from the available options.

Add-On RAM

Add-On Ram refers to optional, plug-in memory cards (except EMS-only cards), including those manufactured by Zenith Data Systems. Highlight the "Add-ON RAM" field and use the space bar or BACK-SPACE key to make selections for the "BASE" and "EXTENDED" fields, as necessary.

Memory Allocation

When assigning memory for use in the computer, keep the following in mind:

- MS-DOS applications usually include the operating system when they specify a minimum memory requirement.
- MS-DOS applications specifying a minimum memory requirement of 512K or less run more efficiently with the maximum base memory – 640K.
- The MS-DOS operating system can use extended memory for "virtual disk" applications. If you set up a "virtual disk," make certain sufficient memory is allocated.

- Some MS-DOS applications use extended memory independently of the operating system. These applications typically require maximum base memory – 640K.
- Some application programs that use EMS memory do not specify a minimum memory requirement. Review the application documentation for required memory sizes.
- If OS/2 or XENIX are installed as the operating system, EMS memory cannot be used.

Boot Drive

Use the arrow keys to highlight the field, then use the space bar or BACKSPACE key to select the boot drive.

- Floppy Drive 0
- Hard Drive 0
- Floppy then Hard Disk
- Enter MFM-300 Monitor

Factory settings for this field are:

- "Floppy Drive 0" for floppy-only systems
- "Hard Disk 0" for all other systems.

Floppy Drives 0 and 1

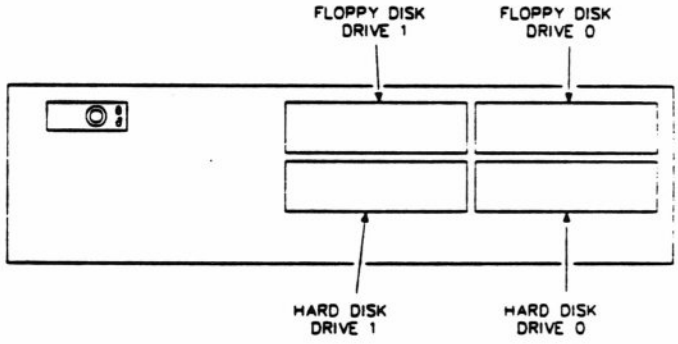
Use the space bar or BACKSPACE key to select the size and capacity of the installed floppy disk drives.

Five drive options are available:

- 360K 5.25-inch
- 1.2M 5.25-inch
- 720K 3.5-inch
- 1.4M 3.5-inch
- Not Present

Figure 3-4 shows the locations of floppy drives 0 and 1.

Figure 3-4. Floppy Disk Drives 0 and 1



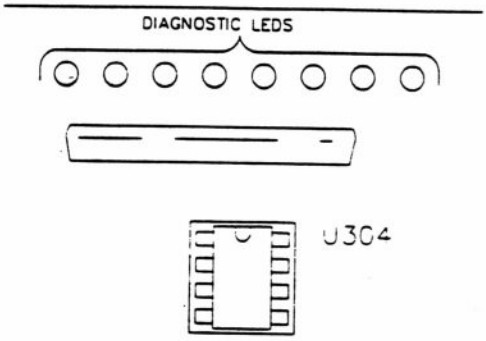
Password Control

This field sets the password. The computer is shipped without a password. If you install one for the customer, be sure to record it and provide the customer with a copy for safe keeping.

IMPORTANT If the operator forgets the password, the EEPROM that stores this information must be replaced. It is located on the parallel/serial card, as shown in Figure 3-5. The replacement part number is 444-9081.

NOTE: On some parallel/serial card models, the password EEPROM is not field-replaceable.

Figure 3-5. Password EEPROM Location



To abort a password entry, press the ESC key. To correct a mistake, use the BACKSPACE key to delete incorrect character(s).

Entering a Password for the First Time

1. Highlight the "Modify System Password" field and select "Password."

2. Press the ENTER key twice to move the cursor to the "New Password" field.

IMPORTANT Passwords are limited to eight characters or less. Alphanumeric characters including all punctuation, special characters, and the space bar are valid password characters. Do not use the SHIFT or CAPS LOCK keys when entering a password. The computer differentiates between upper- and lowercase characters, making it difficult to remember the correct password.

3. Enter the new password and press the ENTER key. The cursor position indicates the number of characters entered.

4. Verify the password by retyping it **exactly** as you entered it the first time. Press the ENTER key. The following line appears at the bottom of the display:

   ```
   Press ENTER to INSTALL new password, ESC to quit.
   ```

   Proceed to step 5.

   If the password entries do not match exactly, the display reads:

   ```
   ERROR: Incorrect password entered, ESC to continue
   ```

   or

```
ERROR: passwords do not match, ESC to continue.
```

Press the ESC key **once** to retry password verification.

Press the ESC key **twice** to start over.

5. Press the ENTER key to install the password. The highlight moves back to the "Modify System Password" field. (The password is now active.)

6. Select "Mode" and press the ENTER key. The cursor moves to the "Password Verification" field.

7. Enter the password and press the ENTER key. The cursor advances to the "Password Mode" field.

8. Use the space bar to select the mode:

   Prompt Mode — The computer will not start normal operation until the user enters the password. After five entry attempts, the computer halts and displays:

   ```
   *** Password Security Violation: System Shutdown ***
   ```

   To retry password entry, turn the computer off, wait 15 seconds, then turn it back on.

   Continue Mode — The computer can run automated applications that do not require operator intervention such as autoboot or batch programs. For normal operation, enter the password even though no prompt appears. Unlimited entry attempts are permitted in this mode.

Changing the Password

1. Highlight the "Modify System Password" field, select "Password" and press the ENTER key.

2. Enter the old password and press the ENTER key. When you finish, the cursor advances to the first "New Password" field.

3. Enter the new password. The cursor position indicates the number of characters entered. When you finish, press the ENTER key.

4. Verify the password by retyping it **exactly** as you entered it before. Press the ENTER key. The following line appears at the bottom of the display:

   Press ENTER to INSTALL new password, ESC to quit.

   Proceed to step 5.

   If the password entries do not match exactly, the display reads:

   ```
   ERROR: Incorrect password entered, ESC to continue
   ```

   or

   ```
   ERROR: passwords do not match, ESC to continue.
   ```

Press the ESC key **once** to retry password verification.

Press the ESC key **twice** to start over.

5. To install the new password, press ENTER. (The password is now active.)

Disabling the Password

1. Highlight the "Modify System Password" field, select "Password" and press the ENTER key.

2. Enter the old password and press ENTER. When you finish, the cursor advances to the first "New Password" field.

3. Press the ENTER key **three** times to disable the password.

The password is disabled when you exit and save the changes. Refer to "Exiting the Setup Menu" later in this chapter.

Operating Speed

This field sets the computer's operating speed. Three options are available:

Slow — Adds wait states to all operations. The "Slow Speed Select" field determines the number of wait states:

- PC Compatible adds 15 wait states
- AT Compatible adds 11 wait states

All cache and queue functions are automatically turned off.

This setting is useful when working with copy-protected software. Some copy-protection schemes require that the computer access the floppy drives at PC- or AT-compatible speeds.

Fast — Runs all operations at zero wait states. Cache and queue functions are automatically turned on.

IMPORTANT If no cache card is installed in the computer, select the "Cache OFF" and "Q OFF" options in the "Fast Speed Select" field.

- Cache turns the cache on or off (maximum speed = on)

- Q selects from one of three queue options:

  1. OFF disables the queue

  2. 1 sets a queue 1 word deep

  3. 16 sets a queue 16 words deep (maximum speed).

Smart — The computer automatically switches between Fast and Slow mode depending on the status of the floppy disk drive motor. If the motor is on, Slow mode is enabled; otherwise, the computer operates in Fast mode.

Video Display

This field selects the default video display routines. This selection must match the capabilities of the video card installed in the computer. The choices are:

- **Color 40 x 25** — This option selects the 40 column x 25 row display mode for CGA or EGA video cards.
- **Color 80 x 25** — This option selects the 80 column x 25 row display mode for CGA, or EGA video cards.
- **Monochrome 80 x 25** — This mode requires a monochrome video card (either MDA or Hercules video interface) and monitor.
- **Enhanced graphics** — This mode supports most EGA or VGA video cards and monitors.

Video Refresh Rate

This field determines the refresh rate used by the video card. Two options are available:

- **60 Hz** — This mode supports the 60 Hz power line frequency used in the United States.
- **50 Hz** — This mode supports the 50 Hz power line frequency used in Europe and other areas.

NOTE: If the power supply input voltage is not correct, the display may appear to flicker.

Hard Disks

The Monitor program checks the hard disk controller type. With an ESDI controller installed, the selection defaults to ESDI Disk Drive. Regardless of the controller type, if no drive is present the selection defaults to Hard Disk Drive and Drive Type to "Not Present." No entries are permitted in this situation.

NOTICE SCSI drives show Hard Disk Drive 0 or 1 "Not Present" in the Setup/Configuration program.

ESDI Disk Drive 0 or 1 — The controller is using an ESDI interface. If the drive is installed, all entries are automatic; no further input is required. The "Drive Type" field indicates "Drive Type 100."

Hard Disk Drive 0 or 1 — The controller is using a SCSI interface, or no drives are installed. In this mode, the drive type must be manually selected to match the configuration of the installed drive.

To select a drive type:

1. Move the highlight to the "Drive Type" field.
2. Use the space bar or the BACKSPACE key to make a selection.

Exiting the Setup Menu

When you finish making entries, press ESC. To save the changes, press Y followed by the ENTER key. Press N to return to the Setup program.

To exit the program without saving the changes, press ESC, then Y, and ESC again.

Boot Command

The boot process loads the operating system from a disk into computer memory. The command syntax is:

```
B[{F|W}][{0|1}][:<PARTITION>]
```

At the Monitor prompt, press B and ENTER to boot from the "default" drive indicated by the "Boot Drive" field in the Setup program. This is usually "Hard Disk Drive 0." This is also true if Setup is set for "Floppy then Hard." However, if Setup is set for "Enter MFM-300," the computer attempts to boot floppy disk drive 0.

To change default drives, manually boot from another drive. The default drive remains the same until the computer is turned off or another drive is manually booted.

Error messages appear if you attempt to boot from a non-existent drive. To correct this, access the Monitor program and enter the correct boot command. For more information about error messages, refer to "Power-Up and Error Messages" in Chapter 7.

Extend the boot command to BF (boot from floppy) or BW (Boot from Winchester, a reference to the hard disk) to boot a specific drive. If more than one drive type is installed, add the drive numbers (0 or 1) and partition numbers as required. This computer supports up to four partitions per hard disk drive. Refer to the operating system documentation for additional information.

Video Commands

The video commands are used to display a color bar pattern or set the video and scroll modes.

Color Bar Command

This command displays a series of colors in the form of a bar graph. On a monochrome monitor, the bars appear as a gray scale. This command is useful for adjusting the brightness and contrast of the video monitor.

To view the color bars:

1. Type C
2. Press ENTER.

Video Modes

The different video modes determine the number of dots to produce on the screen. The dot resolution determines the sharpness, character definition, number of lines, and number of colors in the display.

Application programs can change resolutions to provide different display characteristics. Table 3-1 lists the typical VGA video modes.

Table 3-1. Video Modes

MODE NUMBER	DISPLAYABLE COLORS	RESOLUTION
0 (color)	16	40 × 25 text
1 (color)	16	40 × 25 text
2 (color)	16	80 × 25 text
3 (color)	16	80 × 25 text
4 (color)	4	40 × 25 text, 320 × 200 graphics
5 (color)	4	40 × 25 text, 320 × 200 graphics
6 (color)	2	80 × 25 text, 640 × 200 graphics
7 (monochrome)	4	80 × 25 text, 720 × 350 graphics
D (color)	16	40 × 25 text, 320 × 200 graphics
E (color)	16	80 × 25 text, 640 × 200 graphics
F (monochrome)	4	80 × 25 text, 640 × 350 graphics
10 (color)	4 or 16	80 × 25 text, 640 × 350 graphics
11 (monochrome)	2	640 × 480 VGA
12 (color)	256	640 × 480 VGA
13 (color)	256	320 × 200 VGA

Scroll Modes

Scroll modes determine how information scrolls on the screen. Three modes are available:

- S0 (Software Scroll Mode) is used by PC-compatible software. This mode is available in all video modes. The display scrolls in single-line increments.
- S1 (Hardware Jump Scroll Mode) is not compatible with all applications software. Mode S1 is used with video modes 3 through 6 to provide a faster scroll rate than mode S0. The display scrolls in single-line increments.
- S2 (Smooth Scroll Mode) is only used with video mode 6. The display scrolls in smaller increments to provide a smoother appearance.

User Tests

The Monitor program contains five user-selectable tests. To access the test menu, type TEST at the Monitor prompt and press ENTER. The following menu appears:

```
CHOOSE ONE OF THE FOLLOWING:
1. DISK READ TEST
2. KEYBOARD TEST
3. BASE MEMORY TEST
4. EXTENDED MEMORY TEST
5. POWER-UP TEST
6. EXIT
ENTER YOUR CHOICE:
```

To run a test, type the number that corresponds to the test. With the exception of the keyboard test, each test continues to run until an error is detected or the test is halted.

To stop a test, press the ESC key once. Press the ESC key a second time to return to the test menu. There you can select another test or select EXIT to return to the Monitor prompt.

All tests, except for the keyboard test, display a test count similar to the following:

```
SAMPLE TEST

                        TEST COUNT = x

TYPE <ESC> TO ABORT
```

If an error is detected during the test, information about the error appears on the display.

Disk Read Test — This test continuously reads the first sector of track 0 on the test drive. To change the test drive, manually boot from the drive you want to test. (It is not necessary for the boot operation to actually load the operating system.) To run the test you must have a formatted disk in the drive.

Successful completion of this test only indicates that the drive can read from the disk. If the computer still fails to boot, problems could exist with memory or related control circuits.

Keyboard Test — This test checks the operation of most keys on the keyboard. Valid entries display an ASCII character or symbol and a key scan code each time a key is pressed. The following keys cannot be tested:

ALT
CAPS LOCK
CTRL
ESC
NUM LOCK
PAUSE
PRINT SCREEN
SCROLL LOCK
— SHIFT

The TM-3600 *Technical Reference Manual* contains a detailed listing of scan codes for the computer.

Base Memory Test — This test performs a fast march algorithm on all memory in the first megabyte of the system memory map, including video memory.

While the test is running, an audible clicking sound can be heard. When the test reaches the video memory area, a series of moving patterns are displayed on the screen.

Extended Memory Test — This test performs the same fast march algorithm on all installed memory above the 1 megabyte base memory area. Since no video memory exists in this area, no patterns appear.

Power-Up Test — This test continuously repeats the power-up tests used during startup. This test checks the following circuits:

- Crystal frequencies
- Interrupt controllers
- DMA controllers
- Disk drive controller
- Timer 1 interrupt
- CPU
- ROM
- RAM

Disk Drives

The computer supports up to two floppy disk drives in any combination of the following:

- 720K, 3.5-inch
- 1.4M, 3.5-inch
- 360K, 5.25-inch
- 1.2M, 5.25-inch.

The computer also supports up to two hard disk drives. The disk controller provided with the computer supports ESDI drives. Two models are available:

- 150M
- 320M

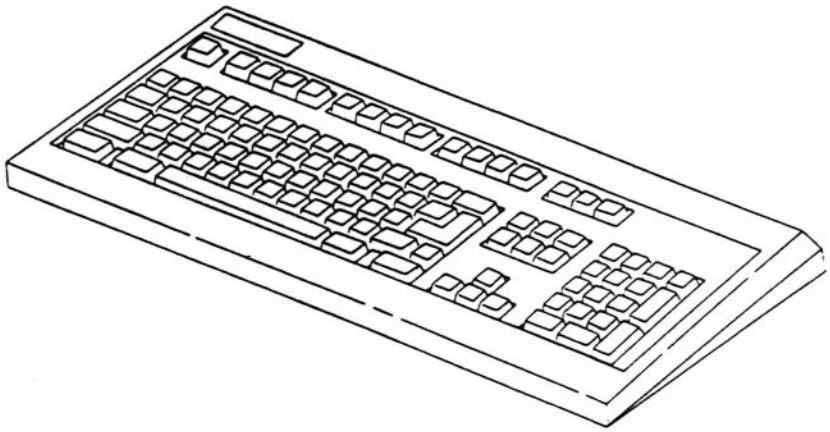
IMPORTANT MS-DOS only recognizes the primary controller in the computer. If you need to use another controller type, obtain a different operating system such as XENIX.

The *Owner's Manual* contains more information concerning operation and care of both floppy and hard disk drives.

Keyboard

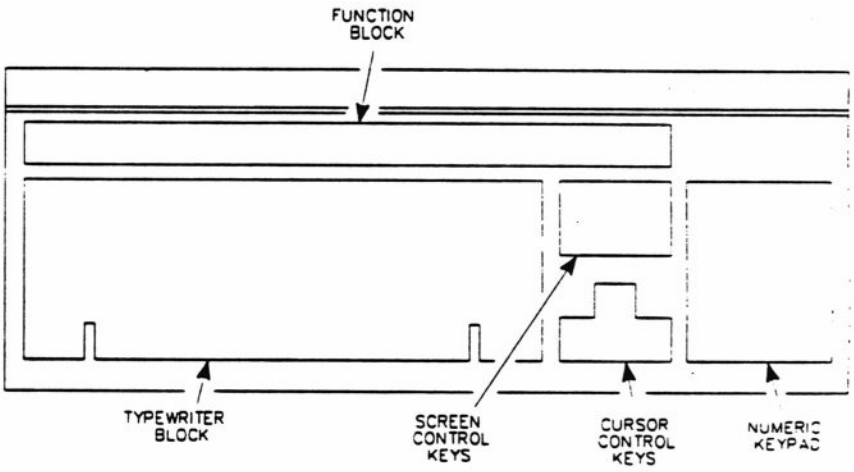
The computer comes with a 101-key keyboard, as illustrated in Figure 3-6. The keyboard features auto-repeat, audible feedback, and software programmability. The keyboard is configurable for XT- or AT-compatible operation (refer to Chapter 6).

Figure 3-6. 101-Key Keyboard



The keyboard contains five key groups. These groups are described briefly in the following paragraphs. Figure 3-7 locates these groups on the keyboard. Detailed information on the keyboard is in the *Owner's Manual*.

Figure 3-7. Key Groups



NOTE: The keyboard functions described in this section apply to Monitor program functions only. Operating systems and application programs can redefine the operation of individual keys.

Typewriter Block — These are the primary alphanumeric keys. The keys are arranged in a standard QWERTY layout. There are two groups in this block:

- Alphanumeric keys include letter, numeric, punctuation, and space keys.

- Control keys include control (CTRL), alternate (ALT), tab, shift, backspace, caps lock, and the enter/return keys.

Numeric Keypad — These keys provide a numeric entry keypad. Activating the NUM LOCK key turns the keypad on. When NUM LOCK is off, these keys perform cursor and screen movement functions.

The SHIFT key affects the operation of the NUM LOCK key. If the SHIFT key is active when NUM LOCK is active, it reverses the NUM LOCK key operation.

Screen Control Keys — These key functions are defined by the operating system or application program. Older software packages may not recognize these keys, but use the functions on the numeric keypad instead.

Cursor Control Keys — These keys control cursor movement. Older software packages may not recognize these keys, but use the functions on the numeric keypad instead.

Function Block — These key functions are defined by the operating system or application program. Older software may not recognize the F11 or F12 keys. The Monitor program recognizes the PRINT SCREEN and SCROLL LOCK keys from this group.

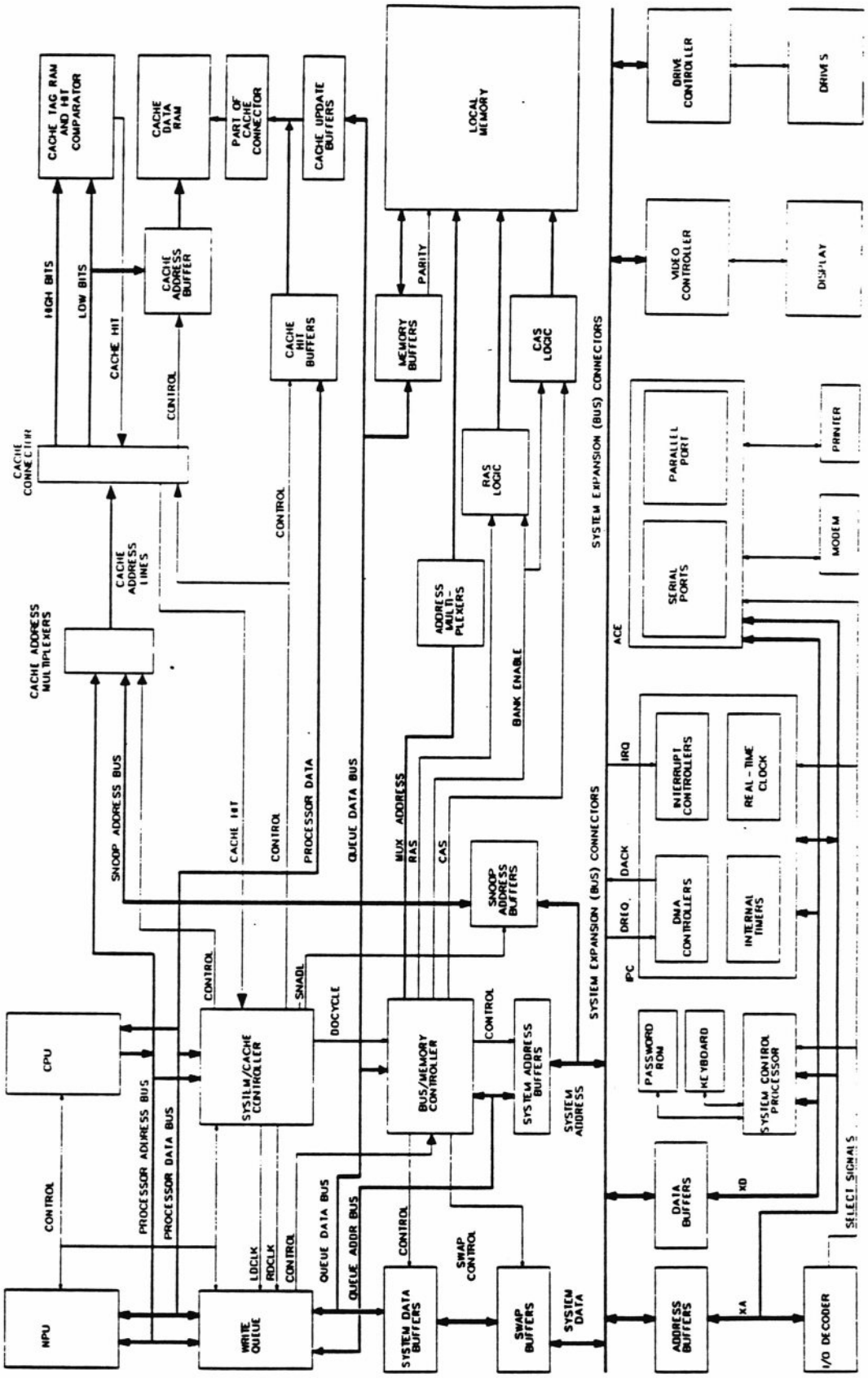
Chapter 4
Functional Theory

This chapter explains the operation of major circuits in the computer.

Architecture

The Z-386/xx computers are 80386-based computers using 32-bit address and data busses. It supports expansion using the 16-bit AT bus and a proprietary 32-bit bus. The computer uses several internal busses to separate functional circuit blocks. Custom gate arrays and logic devices control system operations and the bus interfaces. Figure 4-1 (shown on page 4-2) is a diagram of the computer, illustrating the major functional blocks, and busses.

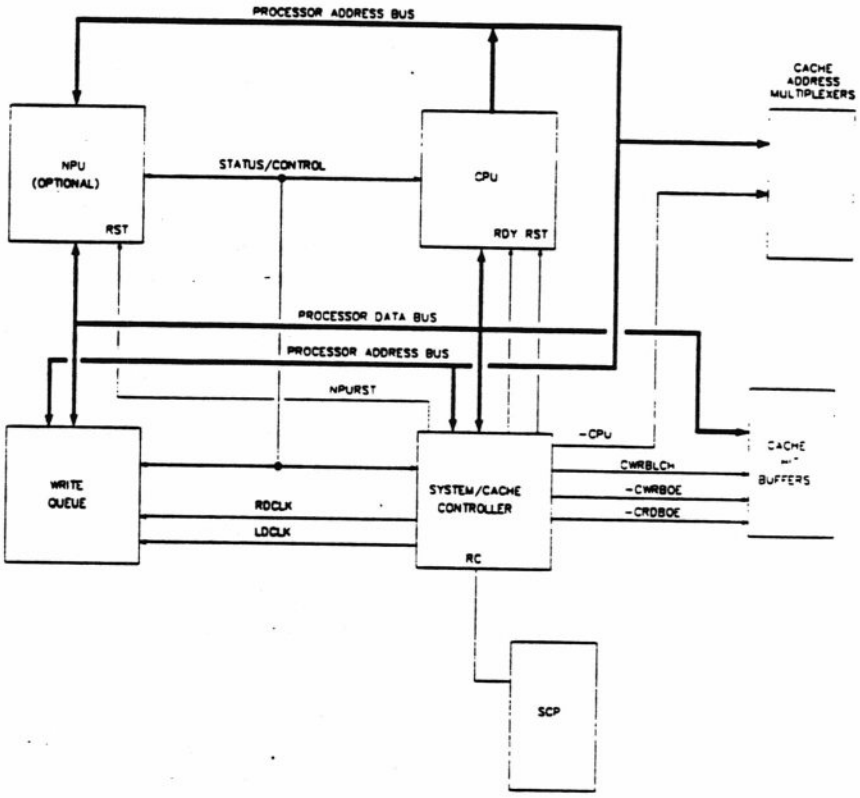
Figure 4-1. Z-386/xx Functional Diagram



CPU Circuits

The CPU circuits control the operation of the CPU on the processor bus and the interface to other bus devices. These circuits are located on the main board.

Figure 4-2. CPU Circuits



CPU — The CPU executes program instructions, sends instructions to the write queue, controls or directs NPU operations, and interfaces with the cache memory.

NPU — The optional numeric coprocessor supports math intensive calculations the would slow down normal CPU operations.

The 80387 NPU operates under control of the CPU. The Weitek WTL 3167 operates independently. Refer to the *Technical Reference Manual* for additional information.

Write Queue — The queue is a custom logic device that stores up to 16 instructions from the CPU for execution later. Queue operation is controlled by the system/cache controller. If the queue is disabled, processor instructions are passed directly to the queue bus.

System/Cache Controller — This custom gate array controls write queue operations, bus/memory controller operations, and the interface to the cache. It also generates the CPU and NPU reset signals. This controller and the write queue form what appears as the CPU interface for the rest of the system. If cache memory is not installed, or is disabled, the controller will not perform normal cache operations.

System Control Processor (SCP) — The SCP generates the warm reset signal the system/cache controller uses to generate CPU reset. It also generates the A20GATE signal.

Memory Circuits

The memory circuits allow the computer to read from and store data in memory. They develop read and write control signals, generate RAS and CAS signals, and check for and report parity errors. These circuits are located on the main board.

System/Cache Controller — This custom gate array starts and ends cycles and controls the operation of the bus/memory controller.

Bus/Memory Controller — This custom gate array performs most memory control functions. It generates memory read, write, RAS and CAS signals, and provides the memory addresses. It also controls the memory data latches and the system address and data latches.

Data Latch — The data latch buffers the data passing between the queue and memory data busses, performs parity checks, and reports parity errors.

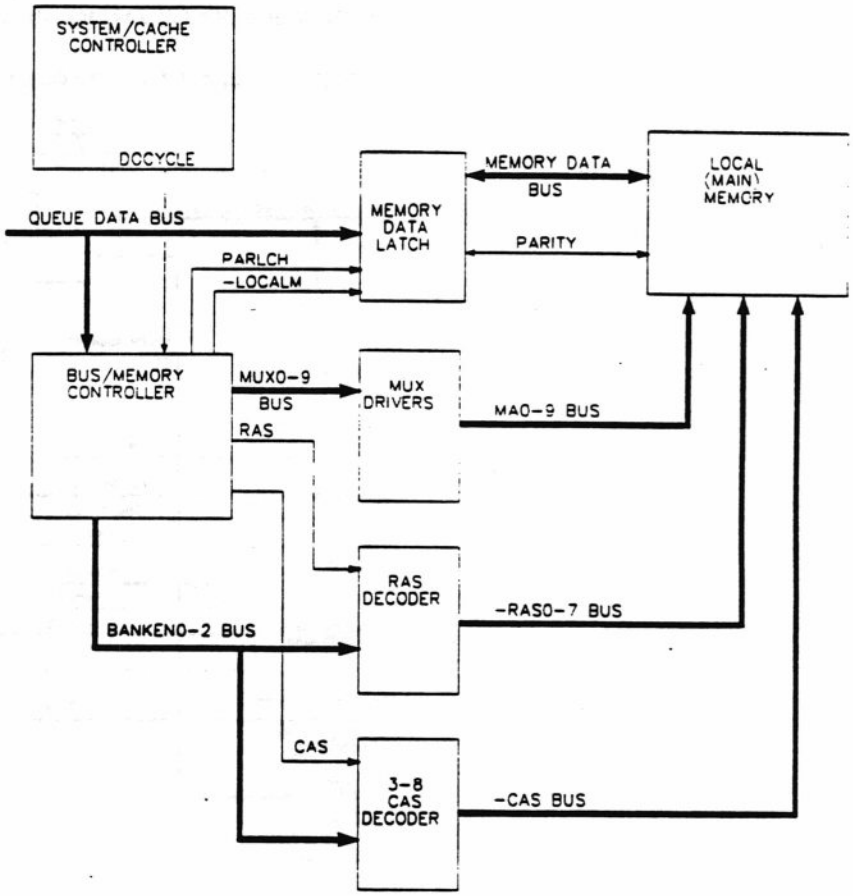
Multiplexers — Use the MUX signals from the bus/memory controller to develop the memory address lines. They also develop the write enable signals.

RAS Decoder — This is a custom PAL that develops individual RAS signals from bank enable and RAS signals from the bus/memory controller.

CAS Decoders — These are 3 to 8 decoders that develop the individual CAS signals using CAS and bank enable signals from the bus/memory controller.

Local Memory — On the main board, 8 sockets are available for memory modules. The sockets are connected to the memory data latches, the address multiplexers, and the decoders.

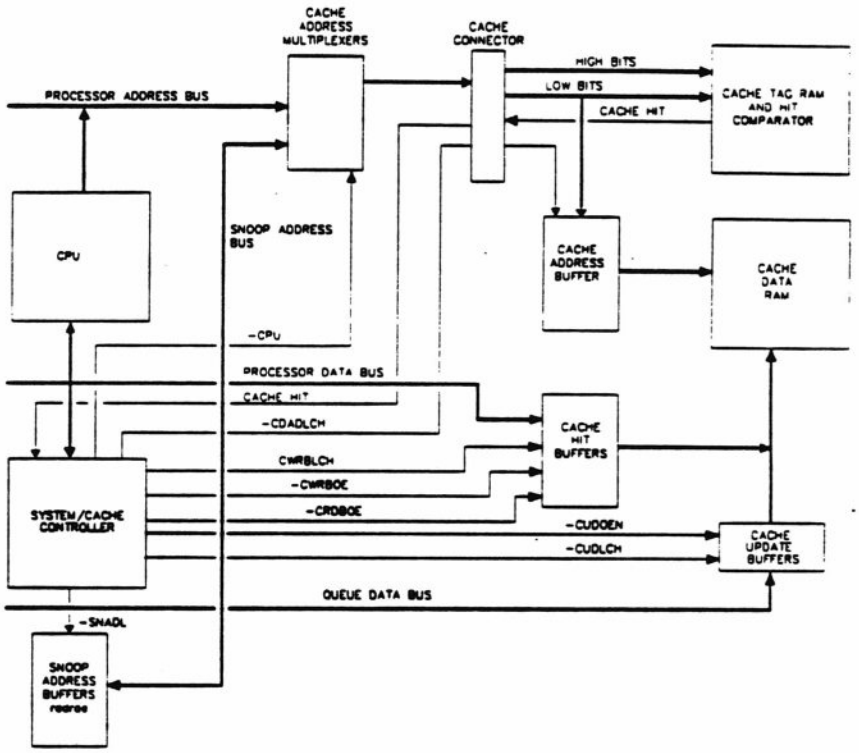
Figure 4-3. Main Memory Circuits



Cache Memory Circuits

These circuits control access to cache memory, if it is installed. They allow data to move in and out of cache memory, make data comparisons, and report cache hit and miss status. The control circuits are located on the main board, the cache itself is a plug-in card. Cache memory is a small amount of high-speed memory between main memory and the CPU which stores frequently used data for the CPU.

Figure 4-4. Cache Memory Circuits



CPU — The CPU provides local address information for cache reads and comparisons.

System/Cache Controller — This controls the operation of the cache data and update buffers, and the cache address buffers. It also controls cache operations including reads, writes, hits, and misses.

Cache Tag RAM — This memory stores data tags to identify the actual values stored in the cache data RAM.

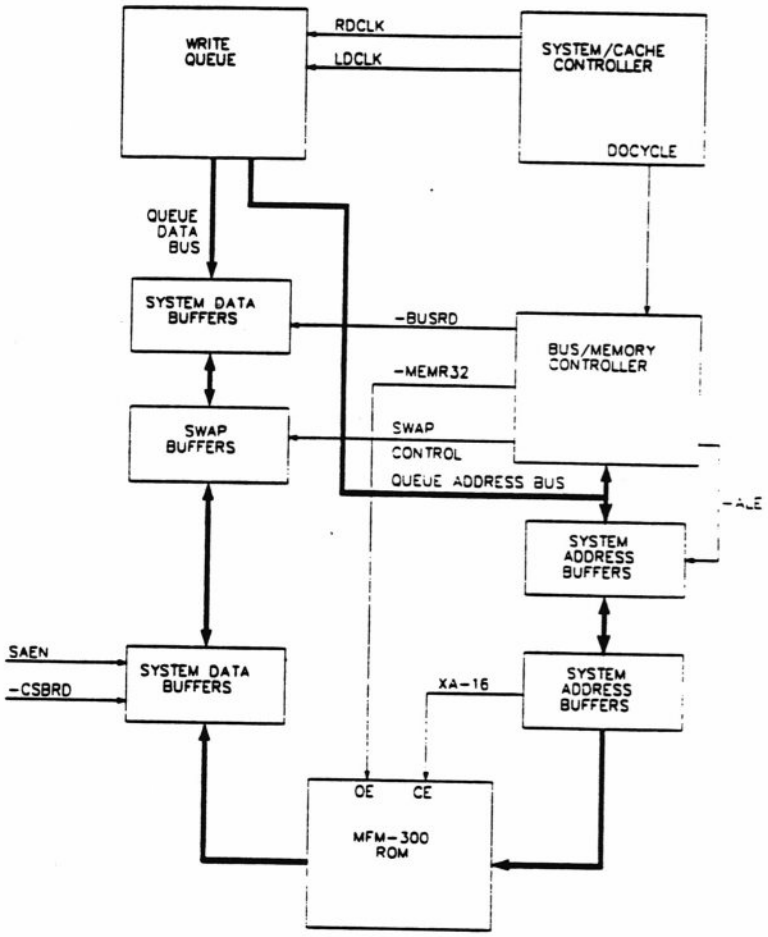
Cache Data RAM — This RAM stores the actual data values used by the CPU.

Cache Comparator — The comparator performs cache comparisons and notifies the system/cache controller if a cache hit occurs.

ROM

The MFM-300 Monitor ROM, located on the parallel/serial card, contains the start-up instructions for the computer. The ROM is accessed by control signals generated by the bus/memory controller.

Figure 4-5. ROM Memory Circuits



Write Queue — Under the control of the system/cache controller, the write queue makes address information available to the system address bus.

System/Cache Controller — This controls the operation of the write queue and the bus/memory controller

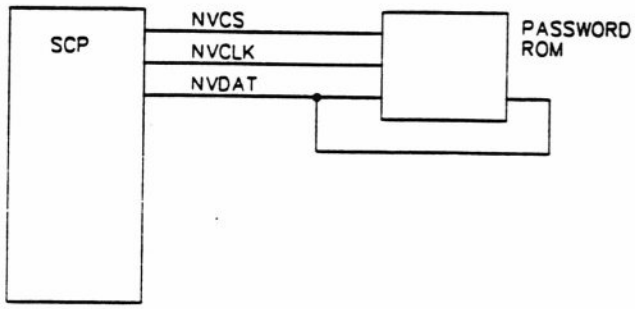
Bus/Memory Controller — This controls the operation of the system data and address buffers. It also generates the memory read signal that enables the ROM.

Swap Buffers — Under control of the bus/memory controller, these buffers build larger data words for system cycles.

Password ROM

The password ROM stores the system password, if one is used. This circuit is located on the parallel/serial card.

Figure 4-6. Password ROM Circuit

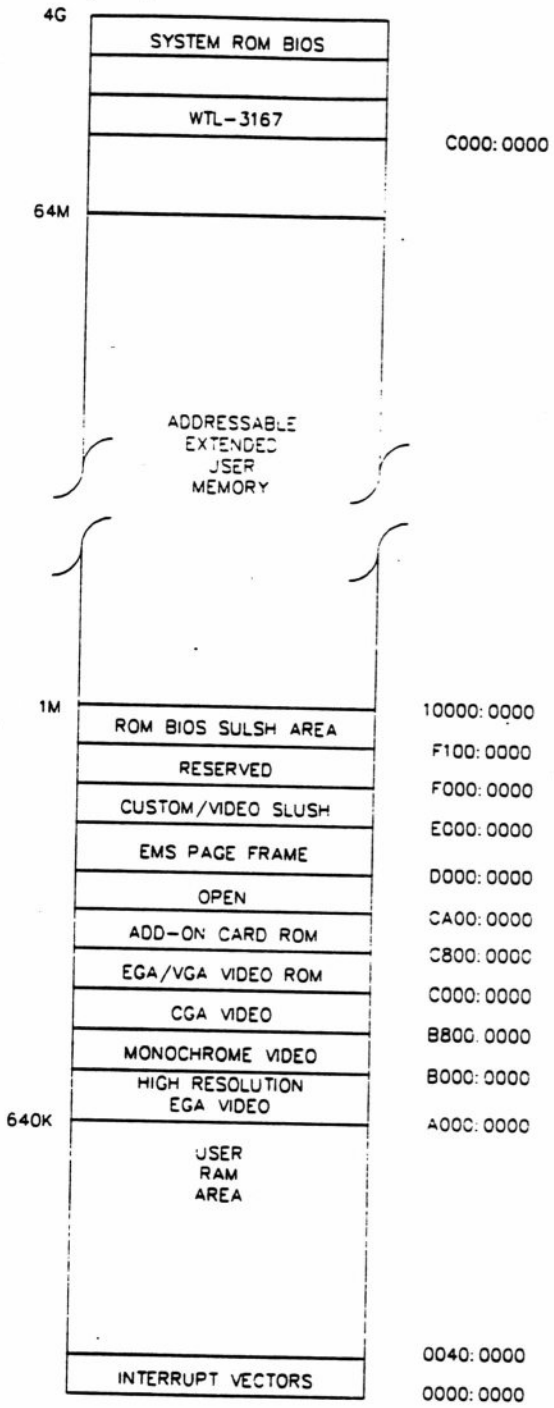


Password ROM — The 1024-bit serial ROM stores the system password.

System Control Processor (SCP) — The SCP controls the operation of the password ROM. The SCP provides clock signals, and read and write lines for the ROM. It sends serial data to the ROM and reads serial data from the ROM.

The system memory map provides a broad overview of memory resources in the computer.

Figure 4-7. Memory Map



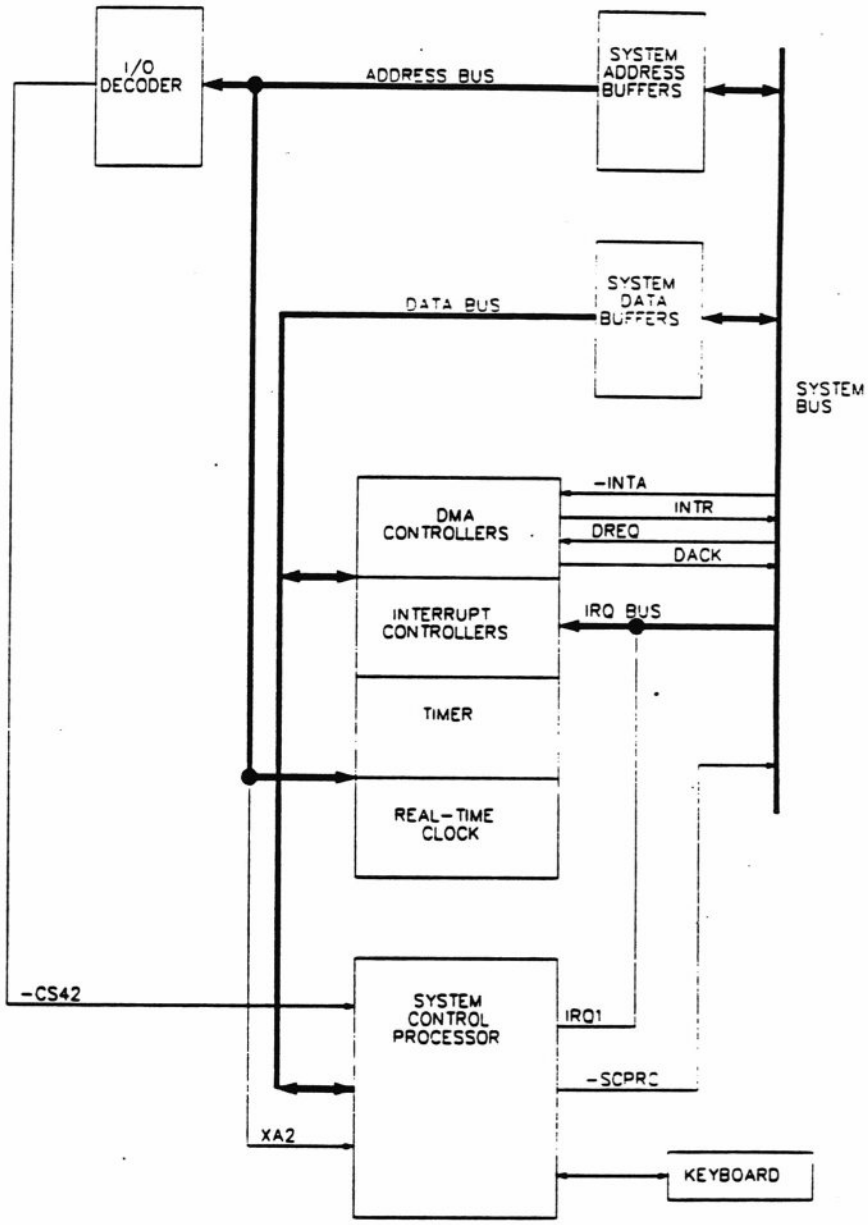
Peripheral Circuits

These circuits, located on the parallel/serial card, allow the computer to communicate with devices such as the keyboard, disk drives, or the serial and parallel ports. They are also used for functions such as DMA, interrupt and timer functions.

I/O Operations

This group of circuits handles the DMA, interrupt, real-time clock, timer functions, and communicates with the keyboard.

Figure 4-8. I/O Operation Circuits



Integrated Peripherals Controller (IPC) — The IPC contains two DMA controllers, two interrupt controllers, the interval timer, and the real-time clock. It connects directly to the following signals:

- Interrupt request (IRQ)
- DMA request (DREQ)
- DMA acknowledge (DACK)
- Interrupt request (INTR)
- Interrupt acknowledge ($\overline{\text{INTA}}$).

System Control Processor (SCP) — The SCP processes keyboard information, develops the keyboard interrupt, and generates the CPU warm reset signal.

I/O Decoder — The decoder is a custom logic device that decodes the system address lines (SA0 – SA9) and develops SCP select, $\overline{\text{CS42}}$.

Communications

These circuits control communications with two serial ports and one parallel port in the computer. They provide control, timing, and parallel/serial or serial/parallel conversion for serial communications. They also provide control signals for parallel communication.

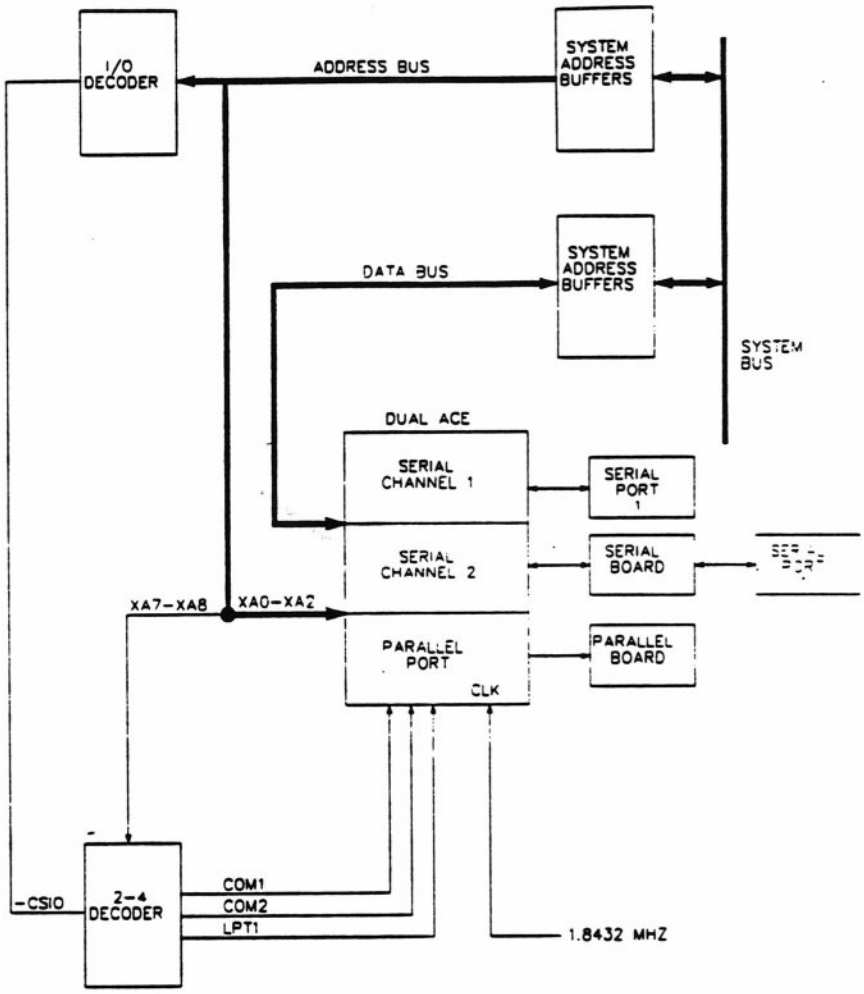
Dual Asynchronous Communications Element — This element contains all control circuitry (except drivers) to support two serial ports and one parallel port.

I/O Decoder — This decoder is a custom logic device that decodes the system address lines (SA0 – SA9) and develops a select signal for the dual ACE.

2-4 Decoder — This decoder develops the individual select signals for the communications channels from XA7, XA8, and $\overline{\text{CSIO}}$.

Serial Board — This external board connects to the parallel/serial card and provides the second serial port connector.

Figure 4-9. Communications Circuits



Video Controller Card

The video card supports a maximum resolution of 640 x 480 pixels in VGA display mode. It provides 256K of display memory, and emulates CGA, EGA, MDA, and HGC (Hercules) display modes. The video card operates over the AT bus.

There is a single 15-pin 31KHz analog RGB connector. Some cards use a four-position dip switch to set the default display mode, others do not.

Some models of this computer are shipped without any installed video option. Refer to the manufacturers instructions and Chapters 2 and 6 in this manual for installation and configuration information.

Disk Controller Card

The controller card provided with the computer supports up to two ESDI hard disk drives and two floppy disk drives. Both hard disk ports implement the standard ESDI interface with a 1:1 interleave. The maximum data transfer rate is 10 Mbits/sec. The floppy ports address two floppy drives in any combination of the following:

- 360K 5.25 inch
- 1.2M 5.25 inch
- 720K 3.5 inch
- 1.44M 3.5 inch

The disk controller card operates over the AT bus.

Custom Logic

A custom logic device is usually an array of AND gates, OR gates, and flip-flops. Programming combines these elements to perform specific tasks in the computer. Most custom logic devices in this computer perform decoding or control functions:

- Coprocessor control
- Memory control and decoding (read/write/RAS)
- I/O decoding
- DMA control

Power Supply

Do not attempt to service the power supply. It contains high-energy level hazards even when disconnected.

The internal 200-watt switching power supply provides the following outputs:

- +5 VDC @ 21A
- −5 VDC @ 0.3A
- +12 VDC @ 7.5A
- −12 VDC @ 0.3A

The power supply develops the sACOK and sDCOK signals used to generate the main reset signal. (Refer to "Reset" later in this chapter.)

Bus Descriptions

The following sections describe the major address and data busses used in the computer.

Processor Bus

The bi-directional processor bus provides address, data, and control connections for the CPU. It is isolated from the main bus by the write queue. The bus resides on the main board.

Address Bus — The processor address bus connects the CPU to the numeric coprocessor, the write queue, the system/cache controller, and the cache address buffers. It includes address lines pA2 – pA31. A0 and A1 are generated by the bus/memory controller.

Data Bus — The processor data bus connects the CPU to the numeric coprocessor, the write queue, the system/cache controller, and the cache data buffers. It consists of pD0 – pD31.

Control — The control lines direct the flow of information to and from the CPU. The control signals consist of:

- pWR — Processor write/read cycle
- pDC — Processor data/code cycle
- pMIO — Processor memory/IO cycle
- pRDY — Processor cycle complete
- pLOCK — Processor cycle lock control
- pADS — Valid address information
- RDYWTK — Weitek coprocessor ready
- RDY387 — 80387 coprocessor ready.

Queue Bus

The bi-directional queue bus, located on the main board, connects the two posted-write arrays with the rest of the system.

Address Bus — The queue address bus connects the queue to the memory/bus controller and the system address buffers. It consists of QA2 – QA31

Data Bus — The queue data bus connects the queue to the memory/bus controller, the system data buffers, the cache update buffers, and the memory data buffers. It consists of QD0 – QD31.

Control — The control lines direct the writing and reading of data to and from the queue. They also control the latching of address and data lines into and out of the queue and the system bus. Control signals consist of:

- QW/R — Queue write/read cycle
- QD/C — Queue data/code cycle
- QM/IO — Queue memory/IO cycle
- RDCLK — Queue read control
- LDCLK — Queue load control
- ADL — Latches address information through the queue
- QACOE — Queue address output control
- QDOEB — Queue data buffer output control
- QDOEC — Queue data buffer output control.

Cache Bus

This bi-directional bus, located on the main board, connects the system/cache controller to the cache buffers and the cache connector.

Address Bus — The cache address bus connects the cache address buffers to the cache connector. It consists of CA0 – CA25.

Data Bus — The cache data bus connects the cache hit buffers and the cache update buffers to the cache connector. It consists of CD0 – CD31.

Control — The system/cache controller develops all required signals for this bus. These signals control the operation of the cache address and data buffers and the cache update buffers. They include the following:

- $\overline{\text{CPU}}$ — Cache address latch control
- $\overline{\text{CUDOEN}}$ — Cache update data latch enable
- $\overline{\text{CUDLCH}}$ — Cache update latch direction control
- CWRBLCH — Cache write/read buffer latch control
- $\overline{\text{CWRBOE}}$ — Cache write buffer output enable
- $\overline{\text{CRDBOE}}$ — Cache read buffer output enable.

System Bus

This is a bi-directional bus, located on the main board, that connects the system address and data buffers to the expansion bus slots.

Address Bus — The system address bus connects the system address buffers to the expansion bus connectors and the snoop address buffers. It consists of sA0 – sA16, and sLA17 – sLA25 and sLA31.

Data Bus — The system data bus connects the system data buffers to the crossover buffers and the expansion bus. It consists of sD0 – sD31.

Control — The system/cache controller and the bus/memory controller develop the signals that control the bus. These signals include:

- $\overline{\text{ALE}}$ — System address latch enable
- HOLDA — System hold acknowledge
- $\overline{\text{sHOLDA}}$ — Bus hold acknowledge
- $\overline{\text{BUSRD}}$ — Bus data buffer control
- $\overline{\text{BWDOEL}}$ — Bus data write low byte enable
- $\overline{\text{BWDOEH}}$ — Bus data write high byte enable
- $\overline{\text{BWDOE}}$ — Bus data write output enable
- BRDL0 – BRDL3 — Bus read byte latch control.

Extended Bus

This bi-directional bus, located on the parallel/serial card, extends the system bus to the major devices on the I/O card.

Address Bus — The extended address bus connects the system address buffers to the IPC, the Monitor ROM, and the asynchronous communications element. It consists of XA0 – XA23.

Data Bus — The extended data bus connects the system data buffer, the IPC, the SCP, the Monitor ROM, and the asynchronous communications element. It consists of XD0 – XD7.

Control — The extended address bus uses three primary control signals to control the movement of bus information:

- $\overline{\text{DMAAEN}}$ — System address buffer direction control
- SAEN — System data bus enable
- $\overline{\text{RDXD8}}$ — System data buffer direction control.

DMA Bus

The DMA bus, located on the parallel/serial card, consists of two parts: the DMA request bus, and the DMA acknowledge bus. Neither bus is bi-directional.

DMA Request Bus — This is an input bus to the IPC, connecting directly to the system expansion bus. Devices requesting DMA services use this bus to initiate a DMA cycle. It consists of DREQ0 – DREQ3 and DREQ5 – DREQ7.

DMA Acknowledge Bus — When the system/cache controller grants a DMA cycle, the IPC uses this output bus to notify the requesting device that the DMA operation can begin. This bus connects the IPC to the system expansion bus through a buffer. It consists of DACK0 – DACK7.

Control — The hold request and hold acknowledge signals control the operations on this bus.

Interrupt Request Bus

This is a one-way input bus to the IPC. It connects the system expansion bus to the IPC and resides on the parallel/serial card. It consists of IRQ1, IRQ3 – IRQ7, and IRQ9 – IRQ15.

Latched Address Bus

The latched address bus, located on the parallel/serial card, carries the extended 7 bits of the AT address bus. This bi-directional bus connects the system expansion bus to the system address buffers and the DMA page register. It consists of LA17 – LA23 and is controlled by $\overline{\text{LREF}}$ and $\overline{\text{XREF}}$.

Unique Characteristics

The Z-386/xx computer uses several innovative design concepts that increase its performance and capabilities.

Slushware — Slushware is a reserved area of system memory (0E000H – 0FFFFFH) is used to store the BIOS ROM information and BIOS information for installed video cards. This information is copied during system powerup and write-protected. Storing the BIOS information in slushware reduces data access time.

Cache — The cache is a small amount of high-speed Static Random Access Memory (SRAM) residing between the CPU and system memory. It provides fast local storage for frequently-accessed code and data.

The system/cache controller checks cache memory on each CPU data request cycle. If the data is in the cache, a "cache hit" has occurred. The cache supplies this data to the CPU and the cycle is stopped. If the data is not in the cache, then a "cache miss" occurs and the cycle is allowed to continue. The requested data is retrieved for the CPU and the cache is updated. The cache always reads 32-bits, regardless of the data size requested by the CPU. The cache is a one-way set associative, or direct-mapped, design using a posted write-through architecture.

Write Queue — Two posted-write gate arrays provide storage space for up to 16 write instructions. The queue is a 66-bit wide, 16-location deep, transparent FIFO latch/buffer.

The CPU operates on a local bus, separate from the system bus. The write queue is positioned between the two busses. The write queue stores instructions issued by the CPU. The bus/memory controller, controlled by the system/cache controller, fetches instructions from the write queue, then completes the operation on the system bus. This frees the CPU to continue with other operations without waiting for the system bus. This allows the computer to pipeline bus cycles in the queue. Thus, the 80386 pipeline mode is not used in this computer.

Bus Snooping — This function is performed by the system/cache controller. Bus snooping is used to maintain the accuracy of data in the cache.

On each system write cycle, the system/cache controller routes address information to the cache where a comparison takes place. If the address is in the cache, the controller interrupts the cycle and executes cycles to update the information in the cache. If the address is not in the cache, the cycle continues without interruption.

Power-Up Sequence

Figure 4-10 shows the Monitor ROM power-up sequence. The ROM goes through this procedure each time power is applied to the computer or a warm reset (CTRL-ALT-DEL or CTRL-ALT-INS) sequence occurs. At this time, the CPU performs an unconditional jump to F000:FFF0, where the power-up reset vector is located that starts this sequence.

Figure 4-10. Start-Up Sequence

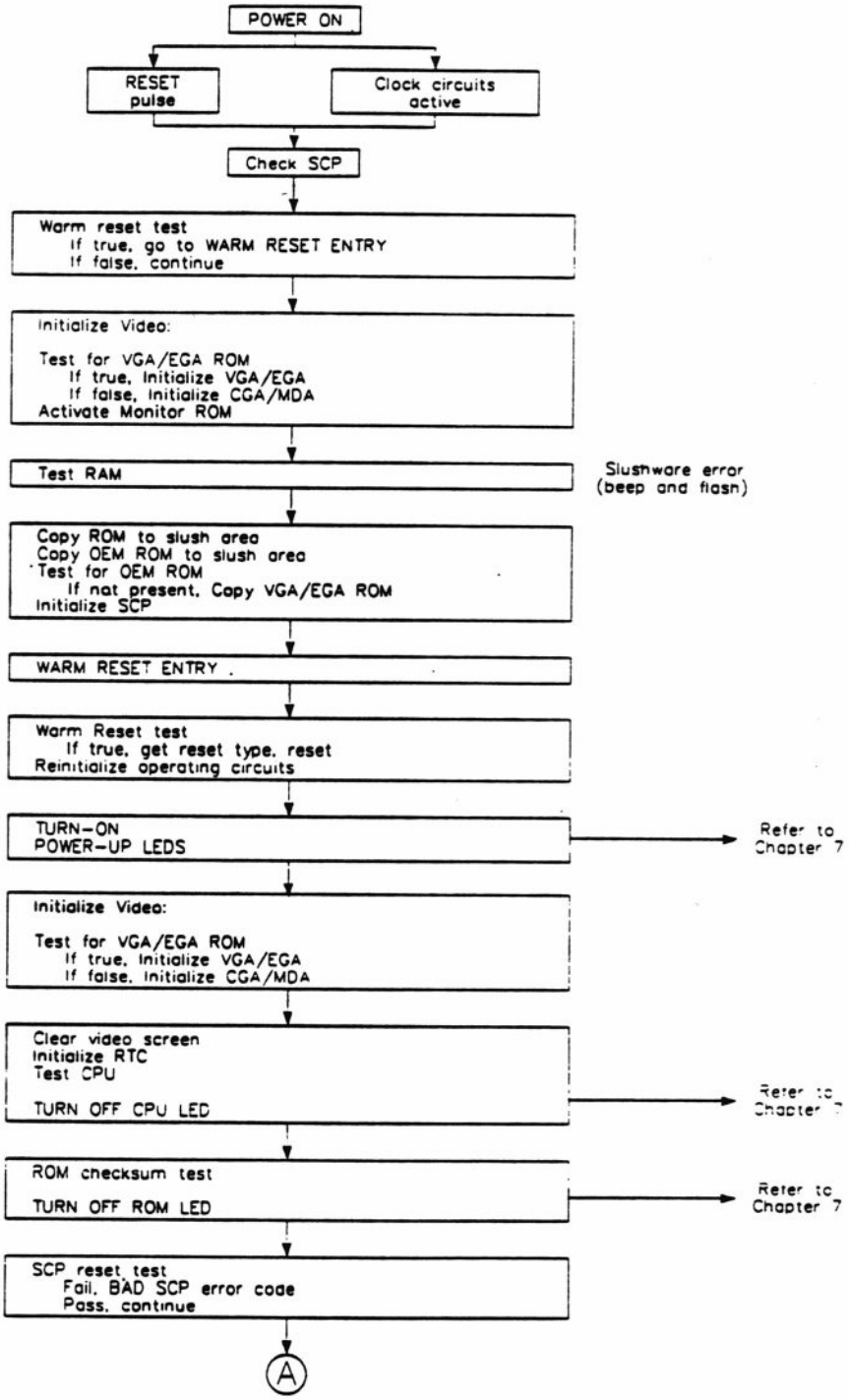
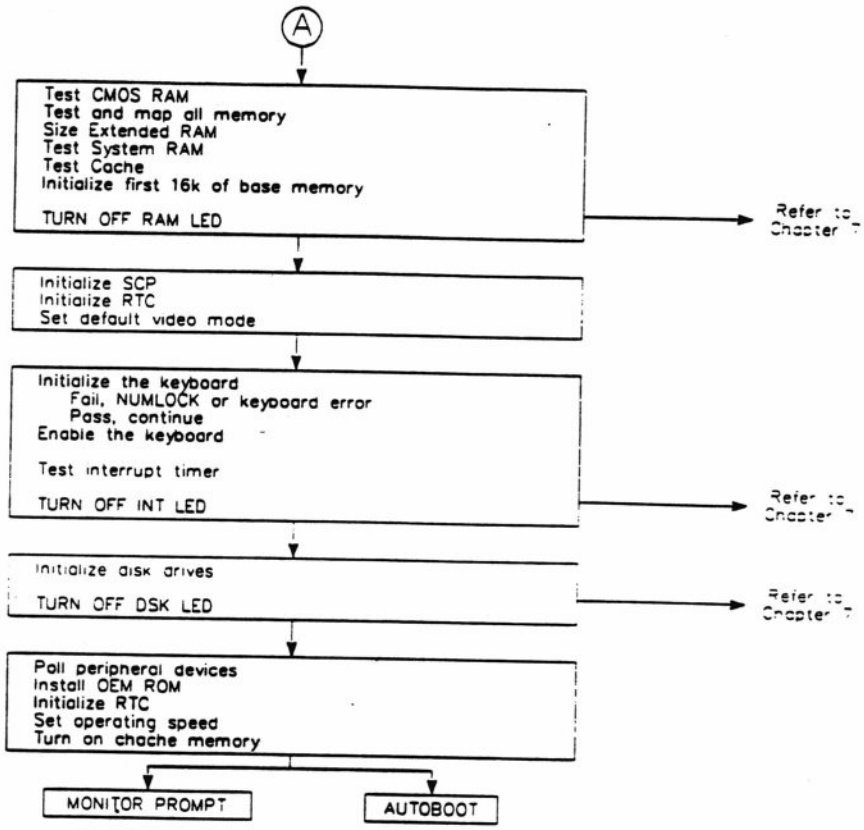


Figure 4-10 (continued). Start-Up Sequence



Reset

The computer's reset circuitry returns the computer to a known state to start operation. Two methods are available: a hardware (hard) reset or a software (soft) reset.

Hardware Reset

A hardware reset completely resets the system. It initializes major circuit groups and starts operation from a known condition. This happens whenever the computer is turned on or when it recovers from a power failure.

When power is applied to the computer, the power supply develops a DCOK signal (sDCOK) and an ACOK signal (sACOK). The ACOK signal goes active first, causing the control buf 2 PAL on the main board to generate the main reset signal, $\overline{\text{RESET}}$.

The $\overline{\text{RESET}}$ signal resets the write queue, the bus/memory controller, and the system/cache controller. The system/cache controller develops the CPU reset signal, RSTCPU and the numeric coprocessor reset signal, RSTNPU. The $\overline{\text{RESET}}$ signal is buffered and inverted, then sent to the system bus as sRESET. This signal provides the reset pulse for cards plugged into the bus.

When sDCOK goes active, it terminates the reset pulse.

Software Reset

A software reset only resets the CPU; all other circuits and memory are left alone. The CTRL-ALT-DEL or CTRL-ALT-INS key combinations start this process.

When the SCP receives the key combination, it generates SCP reset ($\overline{SCPRC}$). A software reset is also generated if a program writes to I/O port FE. The I/O port generates fast reset ($\overline{FRC}$). If either signal is active, the reset CPU signal ($\overline{RC}$)is placed on the system bus. The system/cache controller receives this signal and generates the required reset for the CPU.

Bus Arbitration

Bus arbitration is the orderly management of internal and external busses so essential system elements can gain access to the system bus without disrupting normal operation.

The following sections briefly discuss bus arbitration under typical operating conditions.

Bus Masters

A bus master obtains control of the bus by activating a DMA request line (DREQx). The IPC places a hold request ($\overline{HOLD}$) on the system bus. The system/cache controller receives the hold request and returns hold acknowledge (HOLDA). The IPC then places DMA acknowledge (DACKx) on the system bus. This happens while the system/cache controller and the bus/memory controller stop bus activity and tristate the system bus.

When the requesting master sees the DMA acknowledge signal, it asserts the bus master line (MASTER) so the bus/memory controller knows what bus cycle size to use. The requesting master has 10 – 15 microseconds to access the bus. (This time period is necessary to avoid conflicts with refresh cycles.)

When the bus master completes operation, it releases the master line. This clears the DMA acknowledge, hold and hold acknowledge clear, and the system bus is again under control of the system/cache controller.

CPU

In most computers, the CPU gains access to the bus using the hold request (HOLD) and hold acknowledge (HOLDA) lines. In this computer, all bus arbitration is handled by the system/cache controller. The CPU generally confines operations to the write queue, the cache, and the numeric coprocessor, using the local bus. There are two exceptions to this condition:

- If a posted-write occurs when the queue is full, the CPU waits for an open spot in the queue. Access to the system bus is required for this operation to move information from the system bus to memory.
- If an interrupt acknowledge cycle occurs, the CPU waits for access to the system bus before processing the interrupt request.

I/O

An I/O cycle begins when the CPU places address and control signals on the local bus. The write queue loads these values for execution. When the queue reaches the I/O instruction, it places the address information on the bus and identifies the cycle for the bus/memory controller. The system/cache controller issues the DOCYCLE command to start the cycle. The bus/memory controller places the address on the system bus and drives the I/O lines. The address lines are decoded to identify the device and the I/O lines (IOR, IOW) indicate the operation.

Refresh

The refresh cycle begins when the IPC on the parallel/serial card generates a refresh request. The signal is decoded, activating the hold line on the system bus. The system/cache controller responds by arbitrating the bus and returning hold acknowledge. Hold acknowledge is then decoded, placing the refresh signal on the bus. When the bus/memory controller sees refresh, it executes one memory read cycle.

Memory Cycles

Normal memory cycles involve writing data to, or reading data from memory. Several different cycles are involved in these operations.

ROM Read

This operation is performed when the computer first powers up. To speed access, the Monitor ROM is copied to the slush area. Once the ROM is copied, it is write-protected. The computer then makes ROM accesses from the slush area using normal memory read cycles.

On powerup the CPU starts the read cycle by placing address and control information on the processor bus. This information passes to the system bus through the write queue. Control signals go to the write queue, the system/cache controller, and the bus/memory controller to identify the cycle. The system/cache controller starts the cycle by executing DOCYCLE and the bus/memory controller drives $\overline{\text{MEMR32}}$ on the bus. The extended address latches are enabled by a pull down resistor, placing the system address information on extended address bus lines XA0 – XA16. $\overline{\text{MEMR32}}$ is combined with LA31 to produce $\overline{\text{ROMOE}}$, enabling the ROM for output. The ROM is selected whenever XA16 is active. SAEN is driven by a buffer to latch extended data lines XD0 – XD7 onto the secondary data bus. $\overline{\text{CSBRD}}$, developed by the I/O decoder, determines the data direction. At the end of the cycle, the bus/memory controller issues $\overline{\text{RDYBUS}}$ to the system/cache controller. The system/cache controller sends $\overline{\text{pRDY}}$ to the CPU, ending the cycle.

If cache is installed, the system/cache controller activates control lines ($\overline{\text{CUDOEN}}$ and $\overline{\text{CUDLCH}}$) to move the data into the cache data RAM. Once the cache has data, the system/cache controller fetches data from there.

Memory Read

The CPU initiates a memory read cycle by placing the memory address and cycle control information on the processor bus. It then indicates the cycle start by activating pADS. The control and address information is loaded into the write queue. Table 4-1 lists the decoding for the cycle control signals.

Table 4-1. Cycle Control Signal Decoding

pMIO	pDC	pWR	CYCLE TYPE
0	0	0	Interrupt acknowledge
0	0	1	Invalid
0	1	0	I/O data read
0	1	1	I/O data write
1	0	0	Memory code read
1	0	1	Shutdown/Halt
1	1	0	Memory data read
1	1	1	Memory data write

The bus/memory controller and the system/cache controller use the control signals to identify the cycle. The system/cache controller clocks the write queue using $\overline{\text{RDCLK}}$ to place the address on the bus, then starts the cycle by generating DOCYCLE. The bus/memory controller activates the memory read line (if the read is to ZDS proprietary memory, $\overline{\text{MEMR32}}$ is activated, otherwise $\overline{\text{MEMR}}$ is used). It then determines what size cycle (16- or 32-bit) is occurring and provides the control signals, RAS and CAS signals, and the memory addresses ($\overline{\text{MUX0}}$ – $\overline{\text{MUX9}}$) for the cycle. The memory multiplexers develop the memory address from these signals. The RAS and CAS decoders develop individual RAS and CAS signals.When data is available on the memory data bus, LOCALM and PARLCH from the bus/memory controller latch the data onto the queue data bus. At the end of the cycle, $\overline{\text{RDYBUS}}$ and $\overline{\text{pRDY}}$ are issued.

If cache is installed, the system/cache controller forces a comparison between the cache tag RAM and the address requested by the CPU. If the address is already in the cache, the cache comparator activates a hit line (CHIT1 – CHIT3) notifying the system/cache controller. The controller stops the current read cycle, activates the control lines (CRDBOE and CWRBLCH), and reads the data from the cache. It completes the cycle by returning a ready signal $\overline{\text{pRDY}}$ to the CPU.

If the data is not in the cache, the read cycle continues normally. When the data is read from main memory, the system/cache controller activates $\overline{\text{CUDOEN}}$ and $\overline{\text{CUDLCH}}$ to write the data into the cache.

Memory Write

The CPU initiates the memory write cycle by placing address information on the processor bus, activating CPU cycle start (pADS), and activating the cycle control signals.

The bus/memory controller and the system/cache controller use the control signals to identify the cycle. The system cache controller clocks the write queue using RDCLK to place the address on the bus, then starts the cycle by generating DOCYCLE. The bus/memory controller activates the memory write line (if the read is to ZDS proprietary memory, MEMW32 is activated, otherwise MEMW is used) and determines what size cycle (16- or 32-bit) is occurring. It then provides the control signals, RAS and CAS, and the memory addresses (MUX0 – MUX9) for the cycle. The memory multiplexers develop the memory address from these signals. MEMW is inverted and used to develop the memory write enable signals. When data is available on the queue data bus, LOCALM and PARLCH from the bus/memory controller latch the data into local memory. At the end of the cycle, RDYBUS and pRDY are issued.

If cache is installed, the system/cache controller forces a comparison between the address and those already in the cache. If the address is in the cache, the system/cache controller activates CRDBOE and CWRBLCH to latch the data into the cache data RAM. CDADLCH latches the address information. If the data is not in the cache, the write cycle continues normally.

Refresh

Every 15 microseconds the IPC generates the TMROUT 1 signal which starts the refresh cycle. TMROUT 1 clocks a flip-flop to generate refresh request (REFREQ). The DMA control PAL decodes this signal generating IPC hold request (IPCHRQ) and places HOLD on the system bus. The system/cache controller receives the request, arbitrates the bus, and places hold acknowledge (HLDA) on the system bus. The DMA Control PAL decodes hold acknowledge and places the refresh signal (REFRESH) on the system bus. This signal also latches the refresh counter and the refresh page register, placing the refresh values on the bus. When the bus/memory controller sees the refresh signal, it provides the refresh addresses and starts a single memory read cycle.

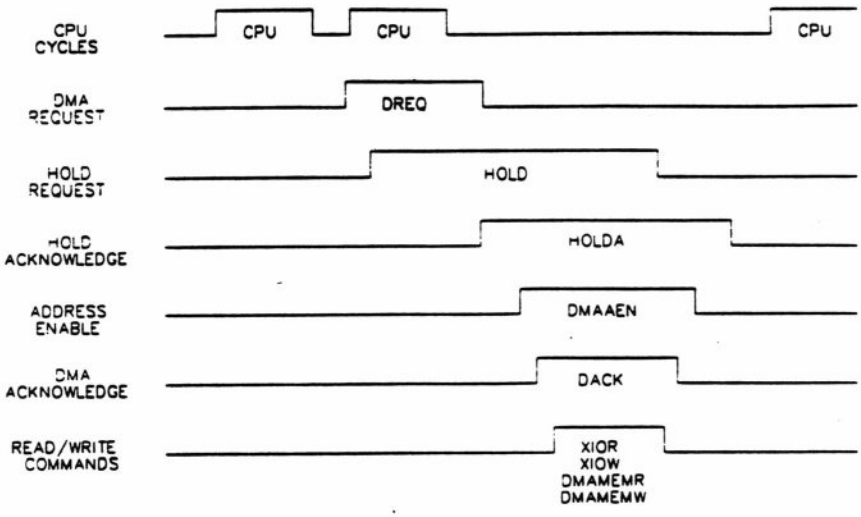
DMA Cycles

DMA operations allow large blocks of data, up to 64k bytes, to move quickly between memory and peripheral devices. The design of this computer permits DMA operations anywhere in the 64-megabyte memory address space.

The requesting master starts the cycle by activating one of the system bus DMA request lines. The IPC receives the request, then generates IPC hold request (IPCHRQ). This signal is decoded, buffered, and sent to the system bus (HOLD). The system/cache controller on the main board processes the hold signal and places hold acknowledge (HOLDA) on the system bus. HOLDA is buffered, decoded, and goes to the IPC (IPCHLDA). The IPC responds by placing a DMA acknowledge (DACK) on the system bus. When the requesting master sees this signal, it asserts the MASTER or MSTER32 line connected to the bus/memory controller. This lets the controller know whether a 16-bit or a 32-bit master is driving the bus. The master has bus access for the next 10 to 15 microseconds. This timing avoids conflicts with refresh cycles.

The IPC handles 8- or 16-bit DMA operations. In order to distinguish between the two cycle types, the IPC generates a different signal for each type of access $\overline{AEN1}$ or $\overline{AEN2}$. Figure 4-11 illustrates the general sequence of events for a DMA cycle.

Figure 4-11. Typical DMA Cycle



Input/Output Cycles

I/O cycles consist of read and write operations that allow the computer to communicate with the keyboard, DMA and interrupt controllers, the real-time clock, the timer, and various peripherals.

I/O Read

When access is required for an I/O read cycle, the CPU places the I/O address on the processor bus. It then uses the status lines to identify the cycle and activates pADS. The address information passes through the write queue to the system address bus, the control information identifies the cycle to the system/cache and bus/memory controllers. The system/cache controller sends DOCYCLE to start the cycle. The bus/memory controller then sends out the I/O read signal, $\overline{IOR}$. $\overline{IOR}$ is buffered on the parallel/serial card to develop $\overline{XIOR}$, and address information is decoded by the I/O decode PAL. The PAL generates select signals for different I/O devices. Data is latched back to the system bus by enabling SAEN.

When the cycle is completed, the bus/memory controller issues a bus ready signal to the system/cache controller. The system/cache controller issues a ready signal ($\overline{pRDY}$) to the CPU to indicate that the cycle is complete. I/O cycles are not cached.

I/O Write

The I/O write cycle is essentially identical to the I/O read cycle with the use of the I/O write signals, $\overline{IOW}$ and $\overline{XIOW}$. Note that although all information must pass through the write queue from the CPU; I/O write cycles are not posted in the queue. Like I/O read cycles, I/O write cycles are not cached.

Interrupt Cycles

An interrupt cycle starts when a device activates one of the interrupt request lines (IRQ) connected to the IPC on the parallel/serial card. The IPC then activates an interrupt request and sends it to the main board. When the CPU receives the request, it notifies the bus/memory controller that an interrupt acknowledge has been granted. The bus/memory controller sends an interrupt acknowledge signal back to the IPC.

When the IPC receives the interrupt acknowledge, it places the 8-bit vector address of the service routine on the system bus. The CPU reads the vector and services the routine. (If the CPU was operating on the processor bus when the interrupt occurred, it halts local operation and accesses the system bus to process the interrupt routine.) When the CPU completes the service routine, it resumes normal operation.

Halt and Shutdown Cycles

The 80386 CPU enters a halt state whenever it executes a software HALT instruction. The CPU indicates this condition to the system/cache controller using the processor control lines pMIO, pDC, and pWR. The CPU then enters an idle state. The system/cache controller notifies the bus/memory controller. The bus/memory controller completes the current process, then also idles. Once halted, the CPU can only resume operation if a non-maskable interrupt or an interrupt request occur, or the CPU is reset.

The CPU shuts down if it encounters a processor double fault condition. This type of condition occurs if the processor attempts to access an invalid memory location. The same sequence of events occurs as with a halt condition. In the case of a shutdown the CPU can only resume operation if a non-maskable interrupt occurs or the CPU is reset.

I/O Operations

The parallel/serial card contains circuitry to perform I/O operations for the computer. The following sections briefly introduce these functions.

Real-Time Clock

The real-time clock (RTC) is part of the IPC. Besides containing internal RAM to store current date and time information, the RTC contains additional RAM to store SETUP configuration information. If power fails, or is turned off, the RTC is backed up by a battery source on the card.

A crystal oscillator on the parallel/serial card generates a 32.768 MHz clock signal that drives the IPC OSC1 input. This signal is divided internally by the RTC for clock timing.

The computer accesses the RTC by placing an address on the extended address bus, bits XA0 – XA9. When the IPC ACK line goes active, the IPC decodes XA0 – XA7 to determine which subsystem the computer wants to access. The computer then places data on the extended data bus, bits XD0 – XD6. The parallel/serial card decodes extended address bits XA0, XA4, and the OR'ed output of XA6 and XA7. The decoded line is inverted and becomes real-time clock address strobe (RTCAS). This strobes the RTC which uses the data on the bus as an index pointer to the desired location in the RTC. Information is then accessed using normal I/O read or write cycles.

The RTC interfaces with the rest of the computer through an 8-bit data latch on the parallel/serial card that connects to the lower 8 bits of the secondary data bus. Secondary address enable (SAEN) controls the output of this latch which buffers the address signals onto the lower 8 bits of the secondary address bus.

If Vcc falls below 4.25 VDC, the $\overline{PF}$ (POWER FAIL) output on the backup battery source goes active. This forces the IPC PWRGD (POWER GOOD) signal low, disconnecting the RTC from the rest of the computer. If Vcc falls below 3.0 VDC, the battery source switches on and supplies power to the RTC.

Programmable Interval Timer

The interval timer is a part of the IPC on the parallel/serial card. It generates the IRQ0 signal for timekeeping and floppy motor timeout, system refresh timing, and provides timing signals for speaker operation.

A crystal oscillator on the parallel/serial card generates a 14.318 MHz clock (OSC 14) signal that is divided by three before going to the IPC TMRCLK input. This is the input timing signal for the timer. OSC 14 also goes to the system bus and becomes the bus OSC signal.

The computer accesses the timer by placing an address on the extended address bus, bits XA0 – XA9. When the IPC ACK line goes active, the IPC decodes XA0 – XA7 to determine which subsystem the computer wants to access. I/O read and write cycles are used for writing and reading the timer. On powerup, control words are written to initialize timer values and start the counters.

The timer provides different timing signals for the system. Every 15 microseconds TMROUT 1 goes active, initiating a refresh cycle. TMROUT 2 drives the speaker, using LPBQ0 as a gate input for tone generation. TMROUT1 and 2 both go to port B in the computer. The timer also generates a signal that is connected internally to IRQ0 on the interrupt controller.

System Control Processor

The system control processor (SCP) is an 8-bit slave microprocessor. It interfaces with the keyboard and the password ROM, generates the warm reset signal, gate A20, and keyboard interrupt signals.

The SCP is clocked from the OSC14 signal. The signal is sent through a flip-flop to the SCP as CLK42.

The computer accesses the SCP by activating the $\overline{CS42}$ line. The I/O decoder activates $\overline{CS42}$ when SA0 and SAEN are low, and SA0 – SA9 contain an address in the range of 60H – 6FH. The computer uses XA2 to indicate whether the byte transferred on XD0 – XD7 is command or data. When $\overline{CS42}$ is active, the SCP responds to I/O read and write requests.

The SCP sends and receives data from the keyboard over the KBDAT line. Each time a key or a combination of keys is pressed, the SCP generates IRQ1. This allows the keyboard data to be placed on the bus. The SCP provides the keyboard clock signal, KBCLK. If the keyboard sends a CTRL-ALT-INS, or a CTRL-ALT-ENTER key sequence, the SCP generates SCP reset ($\overline{SCPRC}$). This signal becomes $\overline{RC}$ on the bus and goes to the system/cache controller on the main board. The controller then generates a CPU reset.

The SCP also interfaces to the password ROM. The SCP clocks the ROM over the NVCLK line, selects the chip using NVCS, and sends and receives information over the NVDAT line.

Serial Port

The computer provides two serial I/O channels. The circuitry is contained in the dual asynchronous communications element (ACE). This bi-directional IC permits communications with other serial devices through an RS-232 connection.

The ACE is clocked by a 1.8432 MHz crystal oscillator located on the parallel/serial card. This clock is used internally to develop the different baud rates for serial communications.

To access the ACE, the I/O decoder develops $\overline{CSIO}$ when SAEN is low and an address in one of the serial port ranges (3F8H – 3FFH or 2F8H – 2FFH) is present on the bus. $\overline{CSIO}$ enables a 2-to-4 decoder that uses XA7 and XA8 to develop the actual chip select (CS0 or CS1). When selected, the device responds to I/O requests. It uses XA0 – XA2 to select specific registers and passes data over the XD0 – XD7 lines.

The ACE obtains serial data from the 232 connector and sends it to the receiver over the RXD line. The receiver converts it into parallel form before placing it on the XD0-XD7 data lines. The transmitter converts parallel data from the XD0-XD7 data lines into serial form and then sends it over the TXD line to the 232 connector. The ACE generates IRQ3 or IRQ4 to signal the CPU, through the interrupt controllers, whenever it requires servicing. When the ACE receives data, it activates IOOUT to move the data onto the system bus.

Four handshaking signals, receive line signal detect ($\overline{DCD}$), data set ready ($\overline{DSR}$), clear to send ($\overline{CTS}$), and ring indicator ($\overline{RI}$), are used to control serial communications. These lines are available for each serial channel. The $\overline{DCD}$ line is active when a data carrier is detected by the modem. $\overline{DSR}$ is asserted when a modem is ready to establish communications with the computer. $\overline{CTS}$ is asserted when the modem is ready to receive data and $\overline{RI}$ indicates the modem has detected a telephone ring. All signals are inverted by an inverter/receiver between the serial port and the ACE.

Data terminal ready ($\overline{DTR}$) and request to send ($\overline{RTS}$) are output handshaking lines. The $\overline{DTR}$ line is asserted when the ACE is ready to receive data. The $\overline{RTS}$ line goes active when the ACE has data to send. These two lines are buffered by drivers between the ACE and the serial port.

Parallel Port

The 25-pin parallel port on the parallel/serial card provides a Centronics type interface for transfer of parallel data between the computer and a peripheral device. The circuitry that runs the port is contained in the dual asynchronous communications element (ACE).

To access the parallel communications channel, the I/O decoder develops $\overline{CSIO}$ when SAEN is low and an address in one of the parallel port ranges (378H – 37FH or 278H – 27FH) is present on the bus. $\overline{CSIO}$ enables a 2-to-4 decoder that uses XA7 and XA8 to develop the actual chip select. When selected, the I/O commands ($\overline{XIOW}$ and $\overline{XIOR}$) determine whether a write or a read takes place. It uses XA0 – XA1 to select specific registers and passes data over the XD0 – XD7 lines. When $\overline{LSETUP}$ is active, the parallel printer is enabled.

Chapter 5
Disassembly

This chapter contains step-by-step instructions for computer disassembly. For reassembly, perform the steps in the reverse order unless instructed otherwise. Read each section completely before disassembling the computer.

Static Precautions

To prevent component damage from static discharges, use the following precautions:

- Do not remove any static-sensitive device from its protective packaging until you are ready to install it.
- Equalize the static electricity between the work surface, the device, and you by touching the work surface with one hand and then picking up the device with the other hand.
- Once you remove the device from its protective packaging, do not set it down or let go of it until it is either installed in the computer or returned to its protective packaging.

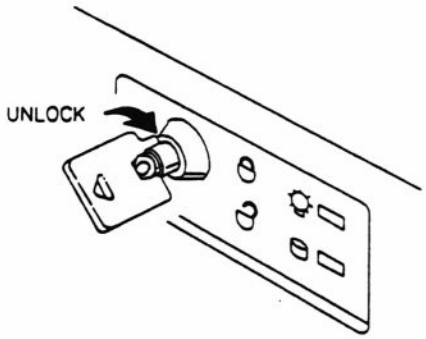
Cover Removal

1. Turn on the computer and run the MS-DOS SHIP utility or it's equivalent before beginning disassembly. Place a shipping insert (or a scratch disk) in the floppy drive(s).

Avoid shock hazard. Unplug the computer and disconnect the line cord before beginning disassembly.

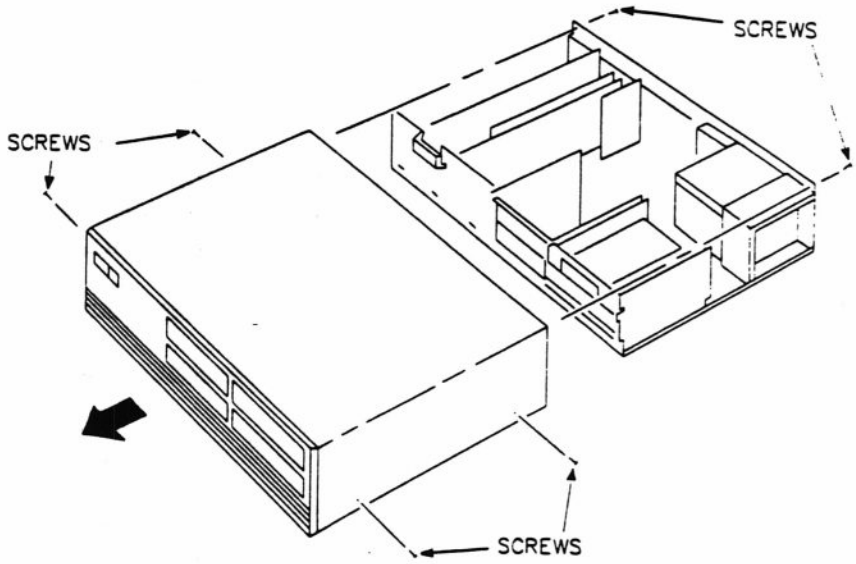
2. Turn off the computer and unplug it.
3. Disconnect the keyboard, video monitor, and all other peripherals from the computer.
4. Refer to Figure 5-1 and unlock the cover.

Figure 5-1. Unlocking the Cover



5. Refer to Figure 5-2 and remove the screws that secure the cover to the computer. Save the screws.

Figure 5-2. Cover Removal



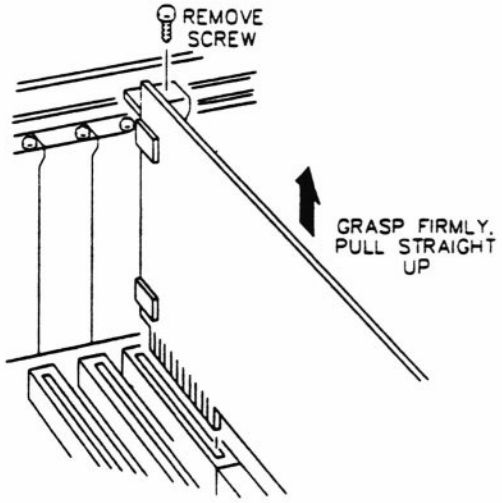
6. Remove the cover by sliding it toward the front of the computer. Support the cover as you slide it off to avoid contact with circuit cards or cables.

Circuit Card Removal

NOTICE Static can damage some circuit cards. Use static precautions.

1. Remove the cover as described earlier.
2. Remove any cables attached to the card. Note their location and orientation.
3. Refer to Figure 5-3 and remove the screw that secures the circuit card to the computer chassis. Save the screw. Grasp the card and lift it until it is free of the connector.
4. Place the card in protective packaging.

Figure 5-3. Circuit Card Removal



NOTE: If the card is not replaced, reinstall the blank panel to reduce stray electromagnetic emissions.

SmartBattery Removal

IMPORTANT This procedure deletes all configuration information stored in the CMOS RAM. Note the current setup information before removing the battery so you can reenter the correct information after reassembly.

CAUTION

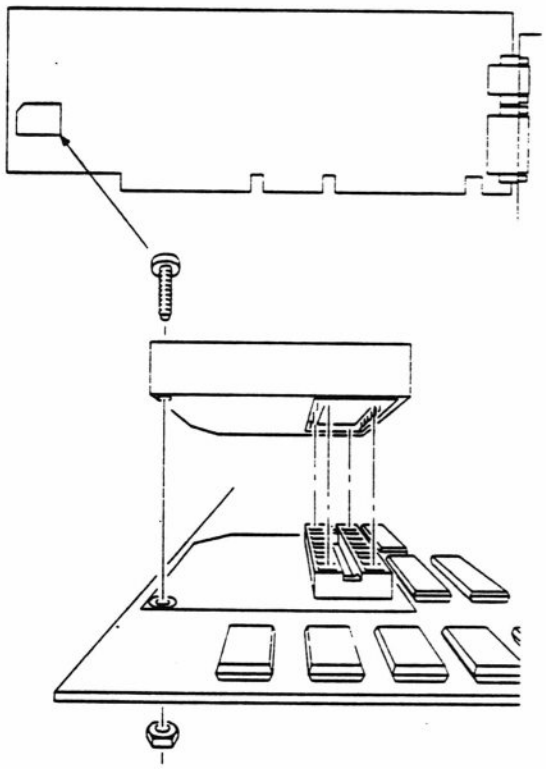
The SmartBattery contains a lithium battery. It is safety sealed; do not open it. To prevent explosion hazards, avoid shorting the battery; do not attempt to recharge it. Use the disposal procedure described later in this chapter.

The SmartBattery package is mounted in an IC socket on the parallel/serial card, as show in Figure 5-4.

NOTICE Static electricity can damage the parallel/serial card. Use static precautions.

1. Remove the cover as described earlier.
2. Disconnect the LED/speaker/keylock cable from the parallel/serial card.
3. Remove the parallel/serial card.
4. Refer to Figure 5-4. Remove the screw that holds the battery to the card.
5. Carefully pry the battery out of the socket.

Figure 5-4. Battery Removal



NOTE: When you install the replacement battery, remove the protective socket from the SmartBattery before installation.

SmartBattery Disposal

The SmartBattery contains a lithium battery. It is safety sealed; do not open it. To prevent explosion hazards, avoid shorting the battery; do not attempt to recharge it, and do not incinerate the SmartBattery.

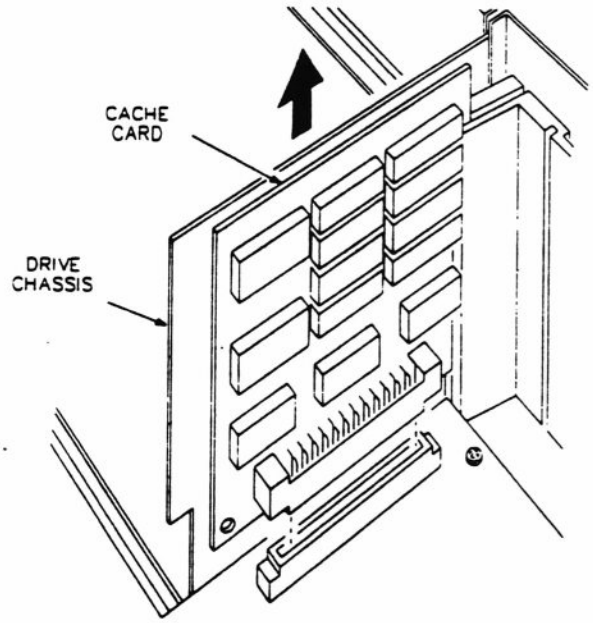
1. Clip all exposed battery leads. Do not short the battery!
2. Wrap the battery in insulating tape to prevent accidental shorting.
3. Pack the battery so it cannot be crushed.
4. Dispose of the battery in the trash.

Cache Card Removal

NOTICE Static electricity can damage the cache card. Use static precautions.

1. Remove the cover as described earlier.
2. Refer to Figure 5-5 and remove the cache card by grasping it and lifting it straight up and out of the connector.
3. Place the card in protective packaging.

Figure 5-5. Cache Card Removal

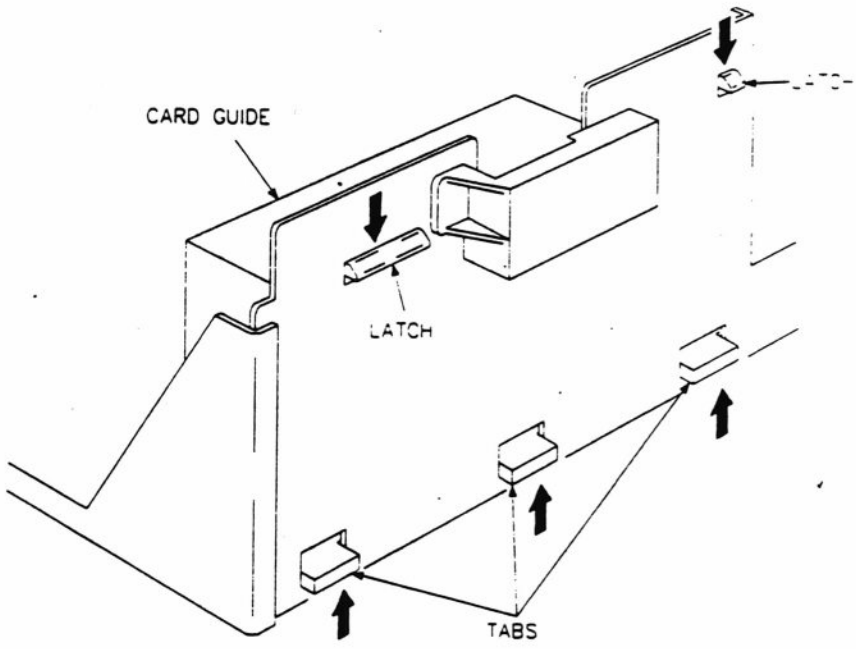


Keylock, Card Guide, and Speaker Removal

NOTICE Static electricity can damage circuit cards. Use static precautions.

1. Remove the cover as described earlier.
2. Disconnect the LED/speaker/keylock cable from the parallel/serial card.
3. Note the orientation of the power/disk access LED cable. Remove it from the disk controller card.
4. Remove all circuit cards as described earlier.
5. Refer to Figure 5-6. Release the top tabs on the card guide by pushing them down and inward.

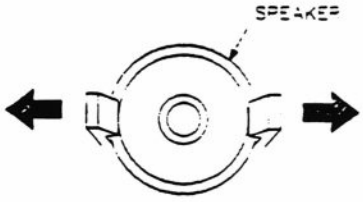
Figure 5-6. Card Guide Removal



6. Lift the card guide so the bottom tabs align with the holes in the front of the chassis. Push the tabs through the chassis and remove the card guide.

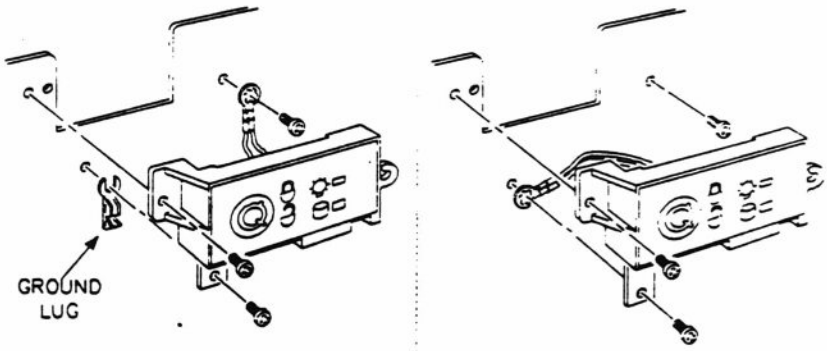
7. Refer to Figure 5-7 and remove the speaker from the card guide.

Figure 5-7. Speaker Removal



8. Refer to Figure 5-8 and remove the two screws that secure the LED/speaker/keylock assembly to the chassis. Note the location of the ground lug for reassembly.

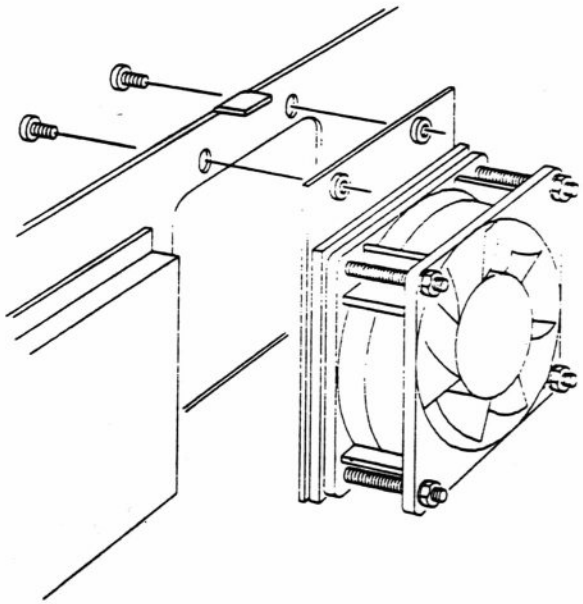
Figure 5-8. LED/Speaker/Keylock Removal



Auxiliary Fan Removal

1. Remove the cover as described earlier.
2. Disconnect the fan cable from the main board.
3. Refer to Figure 5-9 and remove the two screws that secure the fan assembly to the computer chassis.
4. Lift the fan assembly out of the computer.

Figure 5-9. Auxiliary Fan Removal



Memory Module Removal

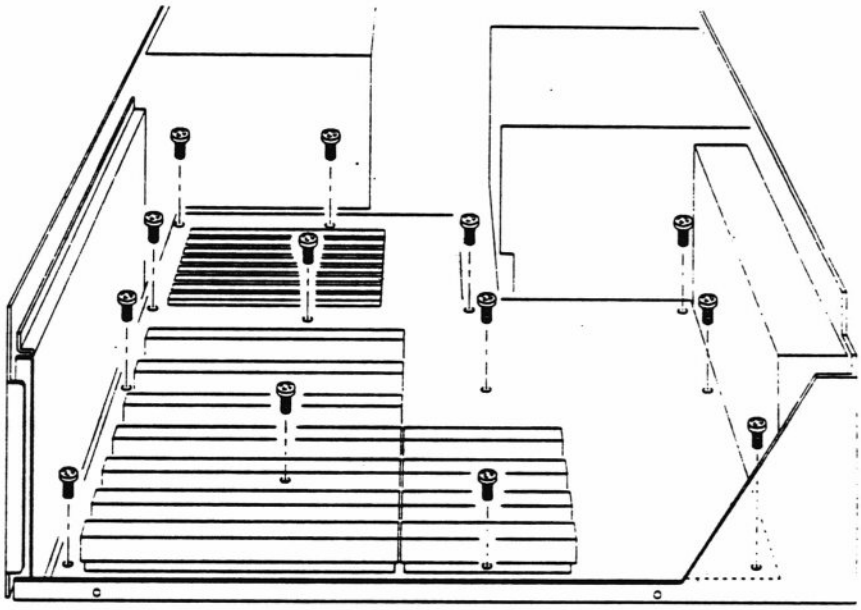
Chapter 2, "Installation," contains instructions for removing memory modules.

Main Board Removal

NOTICE Static electricity can damage the main board and other circuit cards. Use static precautions.

1. Remove the cover as described earlier.
2. Remove all circuit cards as described earlier.
3. Remove the auxiliary fan assembly as described earlier.
4. Disconnect the power supply connector from the main board.
5. Refer to Figure 5-10 and remove the screws that secure the main board to the chassis.
6. Lift the main board out of the computer.

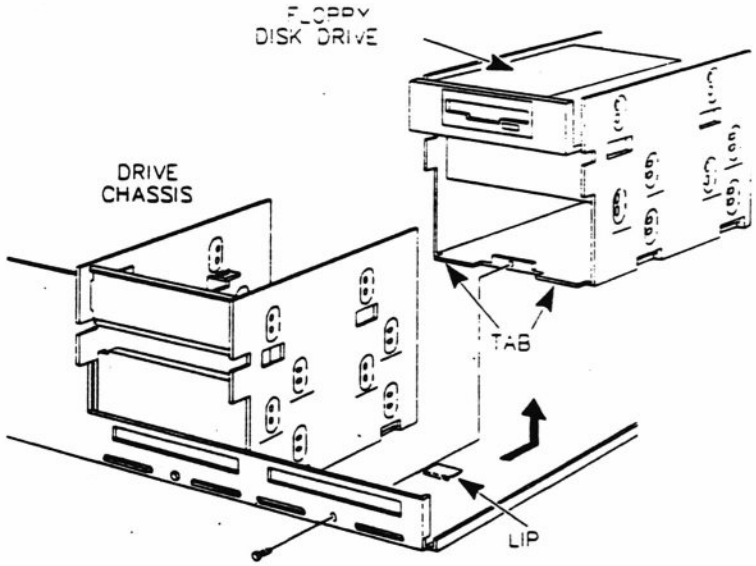
Figure 5-10. Removing the Main Board



Disk Drive and Chassis Removal

1. Remove the cover as described earlier.
2. Disconnect all cables from each drive to be removed.
3. Remove the screw that secures the drive chassis to the main chassis, as shown in Figure 5-11.
4. Slide the drive chassis about one-half inch toward the back of the computer.
5. Lift the drive chassis up and out of the computer chassis.
6. Remove the four screws that secure the disk drive to the drive chassis.
7. Carefully slide the drive out of the drive chassis.

Figure 5-11. Disk Drive Removal



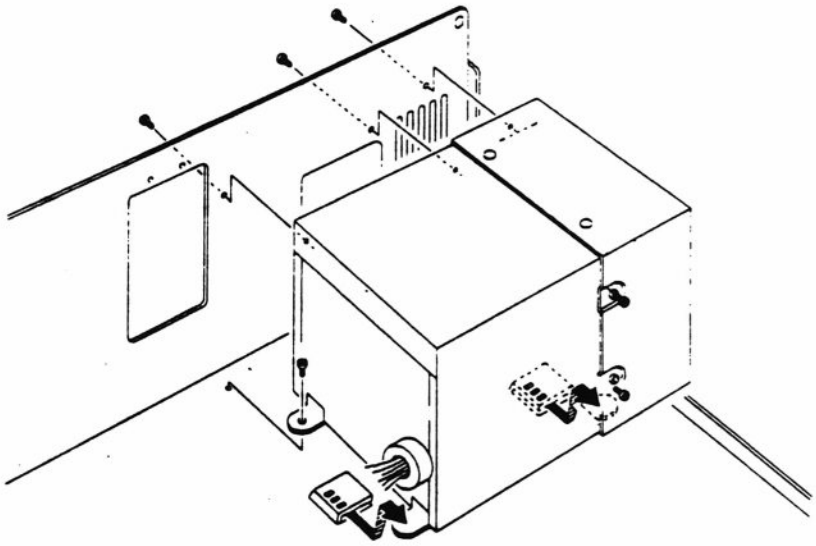
Power Supply Removal

1. Remove the cover as described earlier.
2. Remove the auxiliary fan as described earlier.
3. Disconnect the power supply from the main board.
4. Disconnect power cables from the disk drives.
5. Remove the screws that secure the power supply to the chassis.
6. Slide the power supply forward about one-half inch until it clears the retaining tab on the chassis bottom.

   NOTE: It may be necessary to remove the drive control cables or the drive chassis to allow enough room to slide the power supply forward.

7. Lift the power supply out of the computer chassis.

Figure 5-12. Power Supply Removal



Chapter 6
Configuration

This chapter describes hardware jumper and switch settings for the computer. For information about connector pinouts, refer to "Specifications" later in this manual.

Main Board (Part Numbers 85-3435, 85-3536, and 85-3601)

Depending on the model, the main board contains up to 3 configurable jumpers. Figure 6-1 illustrates their locations and Table 6-1 describes the settings.

Figure 6-1. Main Board Jumper Locations

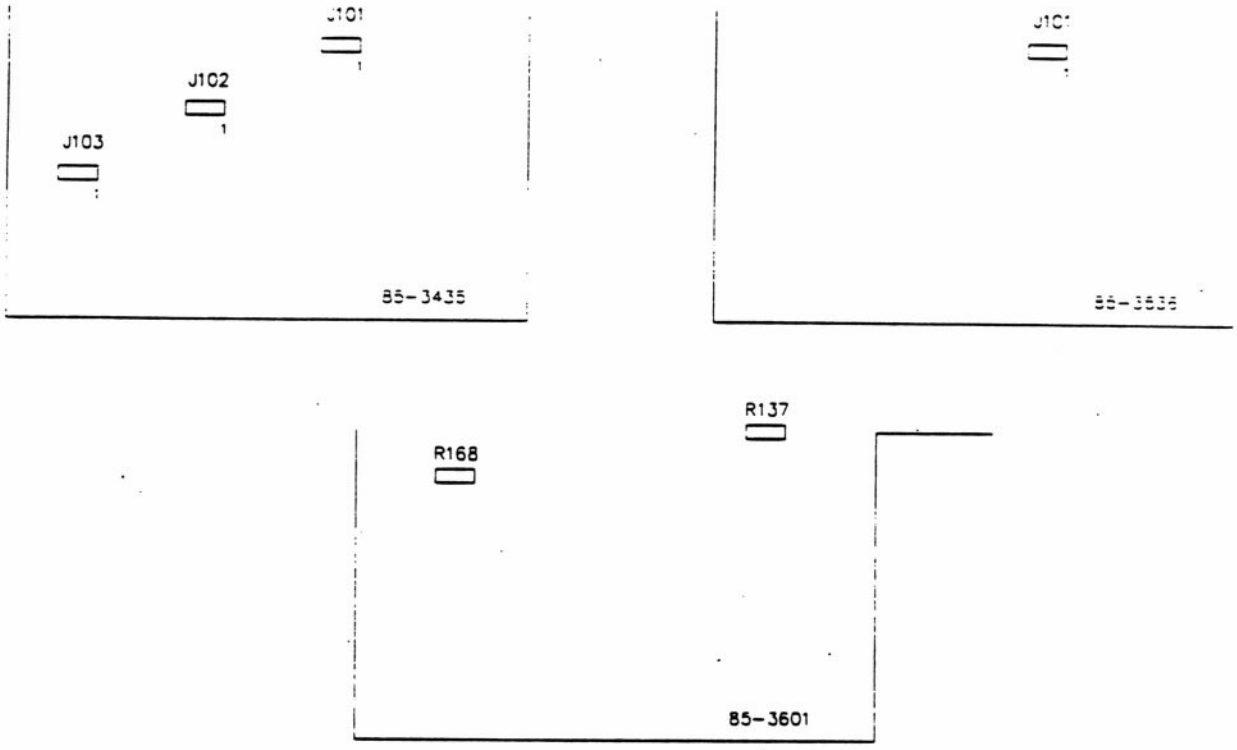


Table 6-1. Main Board Jumper Settings

JUMPER	SETTING	DESCRIPTION
J101[2]		Numeric coprocessor option
	1-2	80387 numeric coprocessor installed.
	2-3[1]	Weitek WTL 3167 coprocessor installed **or** no coprocessor installed.
J102		CPU clock speed
	1-2	20 MHz CPU clock speed.
	2-3[1]	25 MHz CPU clock speed.
J103		Synchronous/asynchronous coprocessor clock
	1-2[1]	The coprocessor clock runs synchronously with the CPU clock (25 MHz CPU clock and 20 MHz NPU clock, or 20 MHz CPU clock and 16 MHz NPU clock).
	2-3	The coprocessor clock will run asynchronously with the CPU clock.
R137[3]		CPU clock speed
	On	33 MHz CPU clock speed.
	Off	25 MHz CPU clock speed.
R168[3]		CPU clock speed
	On	25 MHz CPU clock speed.
	Off	33 MHz CPU clock speed.

NOTES

1. Factory setting.
2. J101 only is used on boards containing the base number 85-3536-1 and 85-3601-01.
3. R137 and R168 are populated with jumpers only on boards containing the base number 85-3601-01.

Parallel/Serial Card (Part Numbers 85-3426 and 85-3548)

This card contains 14 configurable jumpers. Figure 6-2 illustrates the card and the jumper locations. Table 6-2 describes the settings.

Figure 6-2. Parallel/Serial Card Jumper Locations

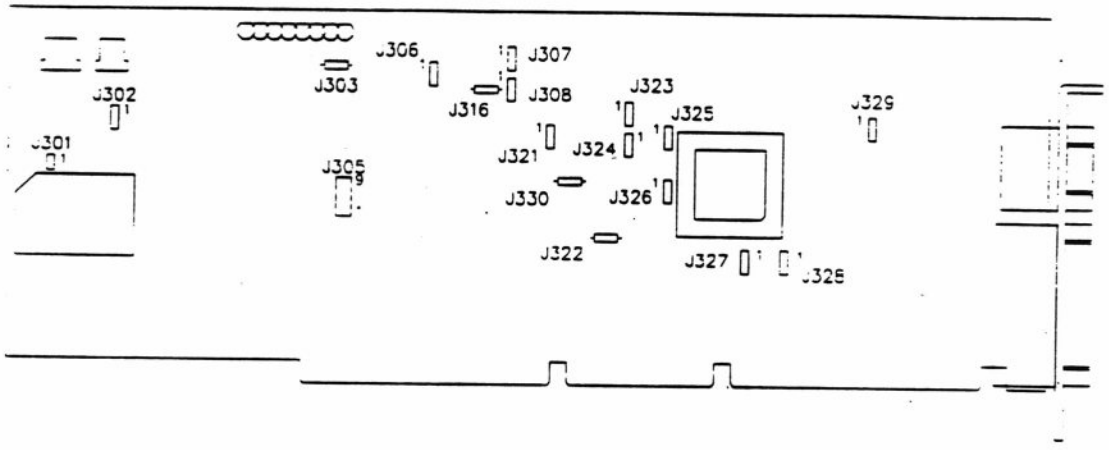


Table 6-2. Parallel/Serial Card Hardware Jumper Descriptions

JUMPER	SETTING	DESCRIPTION
J301		Battery backup source
	1-2[1]	Parallel/serial card SmartBattery.
	2-3	External AT-compatible battery.
J302		I/O card SmartBattery reset option
	On[1]	Software reset enabled
	Off	Software reset disabled.
J303[3, 5]		Secondary disable parity generator signal
	Open[2]	Normal disable parity signal generation.
	Closed	Secondary signal source (do not use).
J305		Video/keyboard options
	1-2	Not assigned (reserved).
	3-4	Not assigned (reserved).
	5-6	Not assigned (reserved).
	7-8[1]	On - color.
		Off - monochrome.
	9-10[2]	AT-compatible keyboard.

continued...

Table 6-2. Parallel/Serial Card Hardware Jumper Descriptions

JUMPER	SETTING	DESCRIPTION
J306		Power failure interrupt disable/enable
	1-2	Enable interrupt on power failure.
	2-3[1]	Disable interrupt on power failure.
J307		Power indicator status
	1-2	The power-on LED is always on.
	2-3[1]	The power-on LED is controlled by bit 7 of the diagnostic LED port.
J308	2-3[1]	Reserved — do not change.
J316[3]		Reserved.
J321		Diagnostic indicator definition
	1-2[1]	Diagnostic LED definitions.
	2-3	Power-on self-test binary LEDs.
J322[4]		Slushware protection select (reserved)
	Open	Disable SCP slushware protection.
	Closed[1]	Enable SCP slushware protection.
J323		Serial port 1 address assignment (use same setting as J324)
	1-2[1]	COM1 (03FxH).
	2-3	COM2 (02FxH).
	Off	Disabled.
J324		Serial port 2 address assignment (use same setting as J323)
	1-2[1]	COM2 (02FxH).
	2-3	COM1 (03FxH).
	Off	Disabled.
J325		Parallel port address
	1-2[1]	LPT1 (037xH).
	2-3	LPT2 (027xH).
	Off	Disabled.
J326		Power-good signal source
	1-2[1]	SmartBattery.
	2-3	Power supply.
J327		Serial port 2 interrupt assignment (use same setting as J328)
	1-2[1]	COM2 (IRQ3).
	2-3	COM1 (IRQ4).
	Off	Disabled.

continued...

Table 6-2. Parallel/Serial Card Hardware Jumper Descriptions

JUMPER	SETTING	DESCRIPTION
J328		Serial port 1 interrupt assignment (use same setting as J327)
	1-2[1]	COM1 (IRQ4).
	2-3	COM2 (IRQ3).
	Off	Disabled.
J329		Parallel port interrupt (use same setting as J325)
	1-2[1]	LPT1 (IRQ7).
	2-3	LPT2(IRQ5).
	Off	Disabled.
J330[3]		Hardwire diagnostic LED port (reserved)
	Open[2]	LED port selectable as diagnostic or test port.
	Closed	Hardwire the LED port for diagnostic status reporting.

NOTES

1. Factory setting. Indicates a jumper is installed on these pins.
2. Factory setting. Indicates no jumper.
3. No jumper block installed in this location.
4. No jumper block installed in this location. A wire jumper is installed.
5. This jumper is used only if J330 is jumpered.

Parallel/Serial Card (Part Number 85-3629)

This card contains several configurable jumpers. Figure 6-3 illustrates the card and the jumper locations. Table 6-3 describes the settings.

Figure 6-3. Parallel/Serial Card Jumper Locations

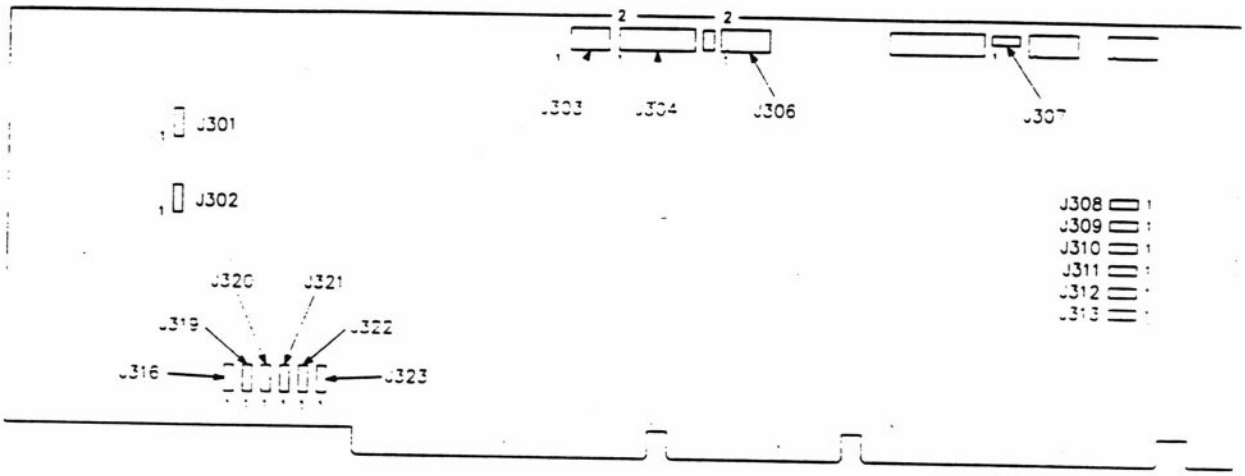


Table 6-3. Parallel/Serial Card Hardware Jumper Descriptions

JUMPER	SETTING	DESCRIPTION
J301		Battery backup source
	1-2[1]	Parallel/serial card battery.
	2-3	System battery.
J302		Power-good signal source
	1-2	Parallel/serial card battery.
	2-3[1]	Power supply.
J303		Parallel port 2 address[4]
	1-2	LPT2 (027xH).
	3-4	LPT3 (020xH).
	5-6	LPT4 (021xH).
	7-8	LPT5 (022xH).
	None[2]	Port disabled.
J304		Serial port 3 address[7]
	1-2[2]	COM4 (024xH).
	3-4[2]	COM5 (124xH).
	5-6[2]	COM6 (224xH).
	7-8[2]	COM7 (324xH).
	9-10[2]	COM8 (424xH).
	11-12[2]	COM9 (524xH).
	13-14[2]	COM10 (624xH).
	15-16[2]	COM11 (724xH).
	None[1]	Port disabled.

continued...

Table 6-3. Parallel/Serial Card Hardware Jumper Descriptions

JUMPER	SETTING	DESCRIPTION
J305		Parallel/serial card reset option
	On[1]	Reset enabled.
	Off	Reset disabled.
J306		Video/keyboard options
	1-2[2]	Not assigned (reserved).
	3-4[2]	Not assigned (reserved).
	5-6[2]	Not assigned (reserved).
	7-8[1]	Jumper on — color video.
		Jumper off — monochrome.
	9-10[2]	AT-compatible keyboard.
J307		Interrupt IRQ5 enable
	1-2[1]	Enable.
	3-4	Disable.
J308		Parallel port 1 interrupt[3] (use same setting as J312)
	1-2[1]	LPT1 (IRQ7).
	2-3	LPT2 (IRQ5).
	No jumper	Disabled.
J309		Serial port 2 [6] (use same setting as J311)
	1-2[1]	COM2 (IRQ3).
	2-3	COM1 (IRQ4).
	No jumper	Disabled.
J310		Serial port 1 interrupt[5] (use same setting as J313)
	1-2[1]	COM1 (IRQ4).
	2-3	COM2 (IRQ3).
	No jumper	Disabled.
J311		Serial port 2 address[6] (use same setting as J309)
	1-2[1]	COM2 (02FxH).
	2-3	COM1 (03FxH).
	No jumper	Disabled.
J312		Parallel port 1 address[3] (use same setting as J308)
	1-2[1]	LPT1 (037xH).
	2-3	LPT2 (027xH).
	No jumper	Disabled.
J313		Serial port 1 address[5] (use same setting as J310)
	1-2[1]	COM1 (03FxH).
	2-3	COM2 (02FxH).
	No jumper	Disabled.
J314		Reserved for RAM/ROM write-protect test
	Off	Slushware permanently write-protected.
	On[1]	Slushware write-protect enabled by RRWRENB.

continued...

Table 6-3. Parallel/Serial Card Hardware Jumper Descriptions

JUMPER	SETTING	DESCRIPTION
J315		Reserved
	Off[2]	(Former Z-100 video support[8]).
J316		Reserved
	Off[2]	(Former Z-100 video support[8]).
J317		Reserved
	Off[2]	(If J319 is not populated, install wire jumper)
J318		Reserved (Z-100 video support)[8]
	1-2	Z-100 mode supported.
	2-3[1]	Z-100 mode not supported. **Do not** change.
J319		Diagnostic indicator definition
	1-2[1]	Normal usage.
	2-3	Power-up test binary codes.
J320		Power indicator status (front bezel)
	1-2	Indicator always on.
	2-3[1]	Indicator controlled by diagnostic port.
J321		Serial port 3 interrupt[7]
	1-2	IRQ15.
	3-4[1]	IRQ10.
J322		Non-maskable interrupt options
	1-2	Interrupt on power failure or $\overline{\text{IOCHCK}}$.
	2-3[1]	Interrupt only on $\overline{\text{IOCHCK}}$.
J323		Interrupt REARM trigger
	1-2[1]	IRQ10.
	3-4	IRQ15.
	No jumper	Disabled.

NOTES

1. Factory setting. Indicates installed jumper.
2. Factory setting. Indicates no jumper.
3. Parallel port 1 is located on the parallel/serial card.
4. Parallet port 2 is located on the optional serial/parallel board. Parallel port 2 **is not** available if the dual serial card is installed.
5. Serial port 1 is located on the parallel/serial card.
6. If the optional serial/parallel board is installed, serial port 2 is the 9-pin, D-type connector above the 25-pin, D-type connector. Serial port 2 is the 9-pin, D-type connector on the dual serial board.
7. Serial port 3 is the 25-pin, D-type connector on the dual serial board. Serial port 3 is not available if the optional serial/parallel board is installed.
8. Z-100 mode video support is not available with this computer.

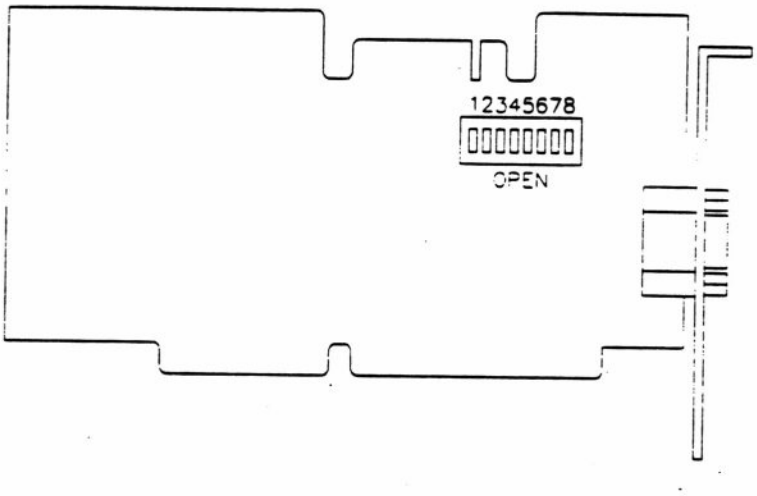
Video Cards

Some models of this computer are equipped with a 31 kHz video driver card. Several different video configurations are available. The following sections provide a brief introduction, and configuration information where required.

NOTICE To avoid damage to the video card and monitor, configure the video card for the monitor being installed.

Z-549 Video Card

Figure 6-4. Z-549 Video Card Switch Locations



The Z-549 video card, shown in Figure 6-4, can be used alone or in combination with another video card. However, only one card and monitor combination can be active at any given time.

Tables 6-4 through 6-7 list the video card's various SW1 DIP switch settings for possible hardware configurations. The primary video card supplies initial video information at powerup.

Table 6-4. Z-549 (Only) Card Switch Settings.

DISPLAY TYPE	SWITCH SECTION 1	2	3	4
VGA[1]	ON	ON	OFF	OFF
CGA (40 column)	ON	OFF	OFF	ON
CGA (80 column)	OFF	OFF	OFF	ON
EGA (200 line)	ON	ON	ON	OFF
EGA (350 line)	OFF	ON	ON	OFF
MDA	ON	ON	OFF	ON

NOTE:
1. Factory setting

Table 6-5. Z-549 (Primary) and MDA (Secondary) Switch Settings

DISPLAY TYPE	SWITCH SECTION 1	2	3	4
VGA[1]	ON	ON	OFF	OFF
CGA (40 column)	ON	OFF	OFF	ON
CGA (80 column)	OFF	OFF	OFF	ON
EGA (200 line)	ON	ON	ON	OFF
EGA (350 line)	OFF	ON	ON	OFF

NOTE:
1. Factory setting

Table 6-6. MDA (Primary) and Z-549 (Secondary) Switch Settings

DISPLAY TYPE	SWITCH SECTION 1	2	3	4
VGA	OFF	OFF	OFF	OFF
CGA (40 column)	ON	ON	ON	ON
CGA (80 column)	OFF	ON	ON	ON
EGA (200 line)	ON	OFF	ON	ON
EGA (350 line)	OFF	OFF	ON	ON

Table 6-7. CGA (Primary) and Z-549 (Secondary) Switch Settings

DISPLAY TYPE	SWITCH SECTION 1	2	3	4
MDA	OFF	OFF	ON	OFF
VGA (monochrome)	OFF	OFF	ON	OFF

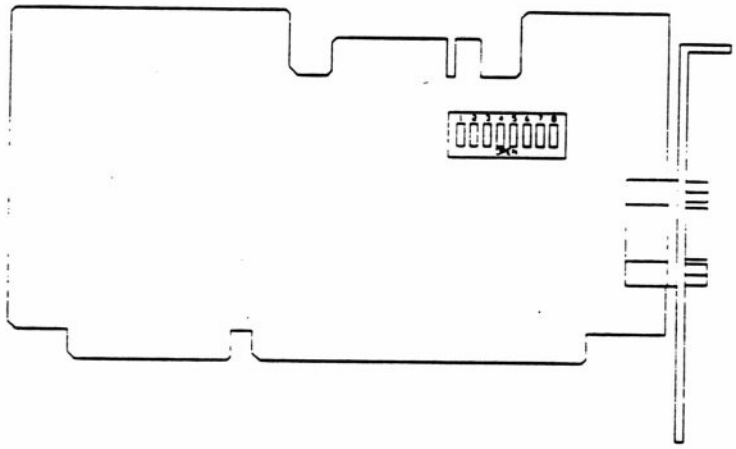
High-Performance VGA Cards

Some computer models contain a high-performance 16-bit VGA video display card. These cards provide 31 kHz analog video signals from the same style connector used on the Z-549 card. Each card provides a default VGA display mode and can also produce EGA, CGA, and MDA display modes.

(152-19-J1)

This card includes an eight-segment switch for testing. The switch has no impact on the configuration of the card. Figure 6-5 illustrates this card.

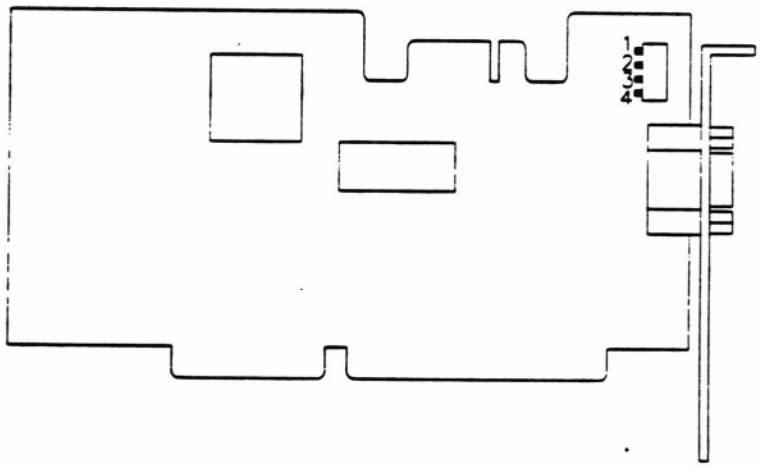
Figure 6-5. VGA Display Card (152-19-J1)



(152-0010-C2)

This card contains one 4-segment switch, SW1, that sets the power-up display mode for the card. This switch is configured in the same manner as described in Tables 6-4 through 6-7. Figure 6-6 illustrates the card.

Figure 6-6. VGA Display Card (152-0010-C2)



(152-37-J1)

This card contains two configurable jumpers (refer to Table 6-8). If an eight-segment switch is installed, it is disabled by the ROM. The card provides VGA video by default and can also produce EGA, CGA, and MDA display modes. Figure 6-7 illustrates the card and jumper locations, while Table 6-8 describes the jumper settings.

Figure 6-7. VGA Display Card (152-37-J1)

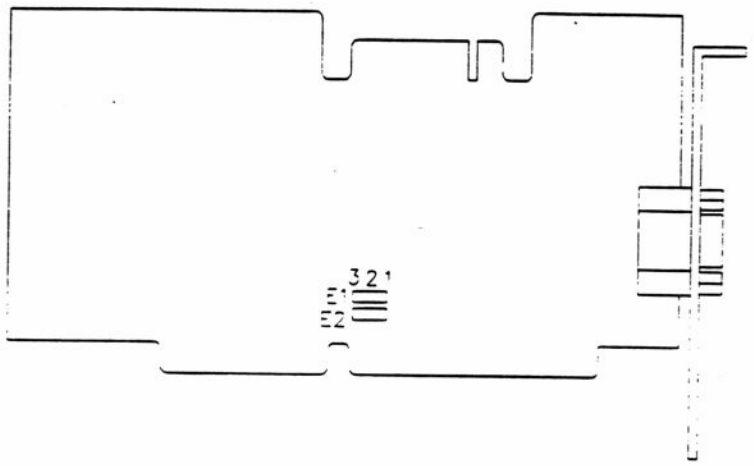


Table 6-8. Video Jumper Descriptions

JUMPER	SETTING	DESCRIPTION
E1		IRQ2 Enable
	1-2	Enable.
	2-3[1]	Disable.
E2		16-bit ROM decode address
	1-2[1]	Decode range: C000-C7FF.
	2-3	Decode range: C000-DFFF.

NOTE
1. Factory setting.

ESDI Drive Controller (Part# 152-1-A1)

The ESDI drive controller card has one jumper and one four-segment switch. Jumpers W2 and W3 are reserved for testing purposes. W2 is set ON and W3 is set OFF. **Do not** alter the configuration of these jumpers. Refer to Table 6-9 for a description of the switch settings. Figure 6-8 illustrates the location of the switch.

Figure 6-8. Disk Controller Card Switch Location

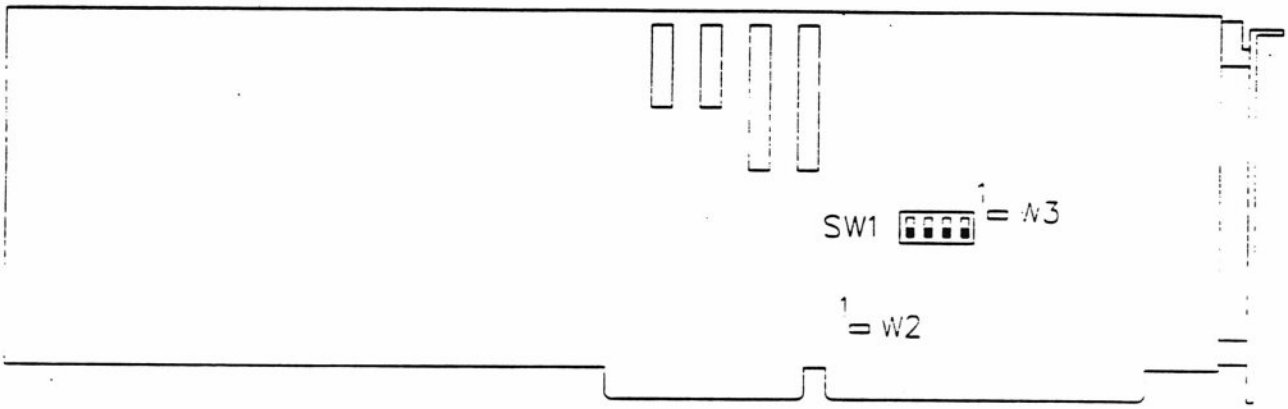


Table 6-9. ESDI Drive Controller Board Switch Settings

SWITCH SECTION	SETTING	DESCRIPTION
1 and 2		Primary/Secondary port address selection
	Open[1]	Primary port address selected.
	Closed	Secondary port address selected.

Port Address	Hard Disk	Floppy Disk
Primary	1F0-1F7	3F2-3F7
Secondary	170-177	372-377

3		Memory address
	Open[1]	ROM addressed at C800:0000.
	Closed	ROM addressed at D800:0000.
4		Memory enable
	Open[1]	On-board BIOS ROM is disabled.
	Closed	On-board BIOS ROM is enabled.

NOTE:
1. Factory setting.

Hard Disk Drives

This computer uses a specially configured drive interface cable. Because of this, all drives are configured for the same drive selection — drive unit #1. This is the factory setting; no additional configuration is necessary.

If more that one drive is installed, the resistor terminating pack must be removed from one of the drives. Be certain that the drive connected to the last connector on the cable is the one with the terminating resistor.

Floppy Disk Drives

Floppy drives are configured much like hard disk drives. Most drives use either a jumper block or a switch for configuration. Because of the special data cable, all drives share the same address. Make certain all drives are set as drive unit #1.

Newer 3.5" drives do not require terminating resistors. Older 5.25" disk drives do require proper termination. As with hard disk drives, the last drive on the cable is terminated using the installed resistor pack. The terminating resistor must be removed from any other drive on the cable.

Keyboard

The 101-key keyboard can be set for either PC- or AT-compatible operation. A switch is located beneath the logo nameplate. To access the switch, use a small screwdriver to gently pry up the nameplate. The switch positions are labeled AT and XT. Position the switch in the AT position for use with this computer.

Chapter 7
Troubleshooting

This chapter provides information on troubleshooting the computer. This information is included to assist in diagnosing problems to the major assembly level.

Preliminary Checks

Remove the cover and look for the following:

- Damage to the circuit cards or chassis parts including:
  - — Dented or bent metal parts
  - — Frayed, nicked, or cut cables
  - — Visible cracks on circuit cards
  - — Heat damage — (discoloration or melting)
  - — Connector pins that are bent or touching
  - — Broken socket connectors
- Configuration — make certain that switches and jumpers on each card are properly configured (refer to Chapter 6).
- Placement — check that all cards are properly seated in the bus connectors.
- Connections — check all cable connections. Make certain each cable is positioned and connected properly. Make sure power and external connections are secure.
- Optional cards — remove any optional card(s) that is not part of the base computer configuration.

Powerup

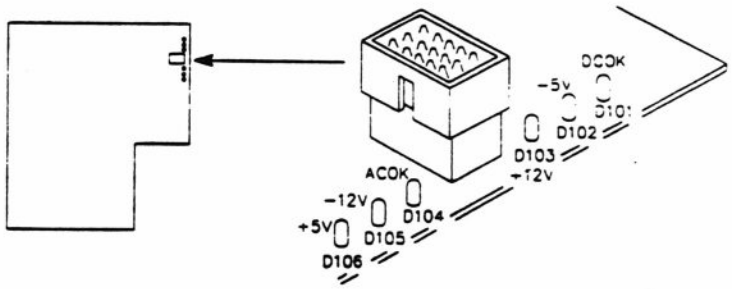
At powerup, the computer begins an initialization process to check internal circuits and components. (Refer to Chapter 4 for a detailed start-up chart.) If the computer encounters a problem during this process, an error message appears on the monitor screen. (Refer to "Power Up and Error Messages.") Some initialization actions produce a visual or audible signal. The following events should occur when power is applied to the computer:

1. The power supply and auxiliary fans start.
2. The keyboard resets, status LEDs blink, and the NUM LOCK LED remains lit.
3. Disk drives initialize (access indicators light, heads seek).
4. Prompt appears on the monitor display.
5. Internal power-up self-tests complete.
6. Computer attempts to autoboot.

Status LEDs

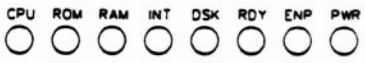
There are two sets of status LEDs in the computer. The power status group is located on the main board near the power connector. As the computer powers up, all of these LEDs turn on. The last two to light are the ACOK and DCOK indicators. Figure 7-1 illustrates the LEDs and the associated signals.

Figure 7-1. Power Status LEDs



The second set of LEDs is located on the I/O card, near the front of the computer. Figure 7-2 illustrate this group of LEDs.

Figure 7-2. I/O Card Status LEDs



As the computer powers up, the entire row of LEDs lights and then, one by one, go out. As each LED goes out, it indicates that the computer has passed a portion of the internal power-up tests. If the computer is configured to autoboot, only the PWR LED will remain lit. If a Monitor prompt appears on the display, the RDY and PWR LEDs remain lit. The status LEDs are used in the troubleshooting charts that follow to assist in repairing the computer.

Troubleshooting Charts

The following charts are organized to simplify your troubleshooting efforts. Start with the General System Troubleshooting Chart, Figure 7-3. This chart provides immediate repair recommendations or directs you to other, more detailed charts. These charts identify the faulty assembly or recommend further tests to isolate the problem. Follow the sequence through until you locate and repair the problem.

Each block in the chart represents a step in troubleshooting the computer. Some blocks contain a smaller numbered block. The smaller block is a reference to the notes that appear on the troubleshooting charts.

Figure 7-3. General System Troubleshooting Chart

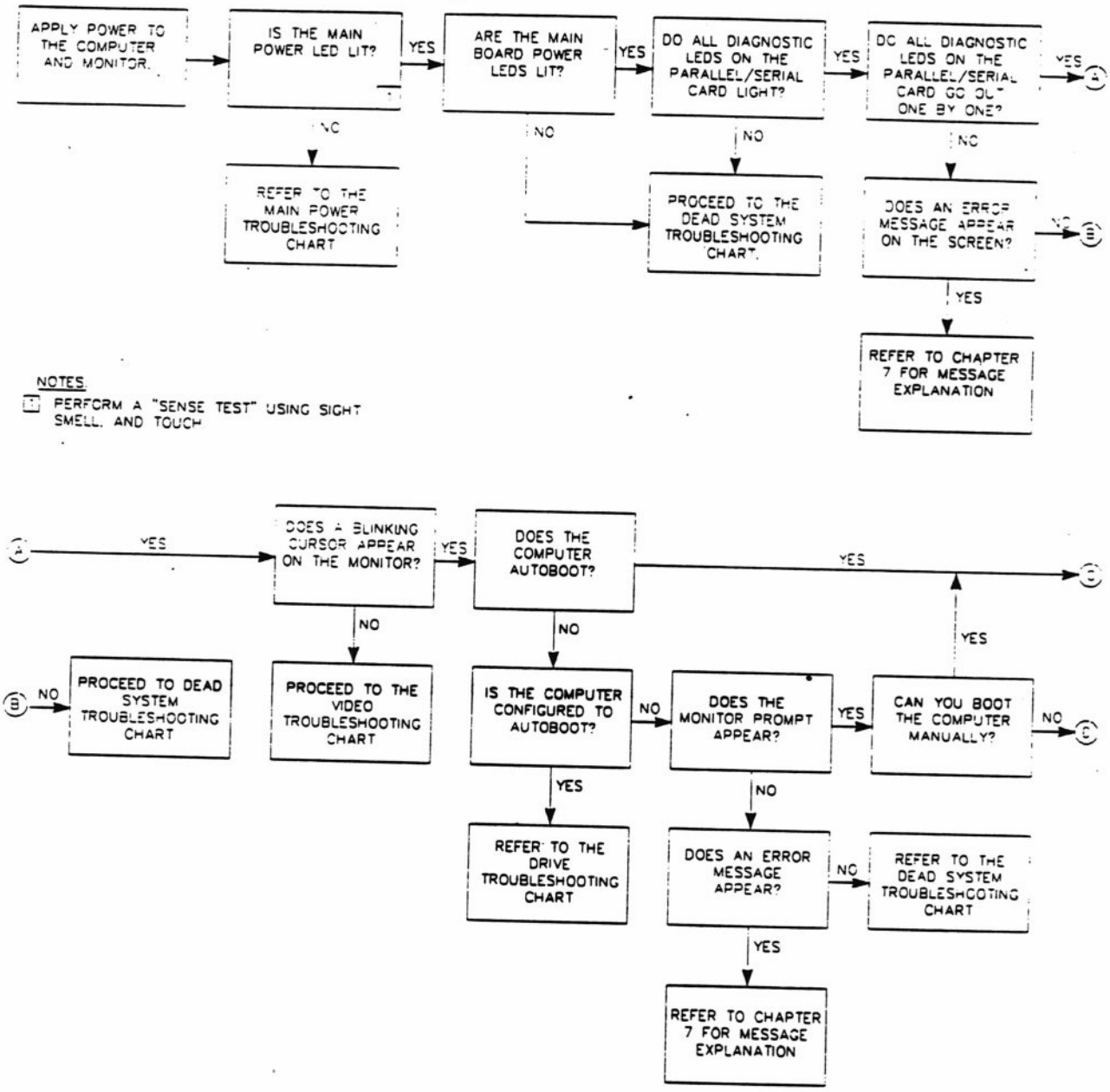


Figure 7-3 (continued). ***General System Troubleshooting Chart***

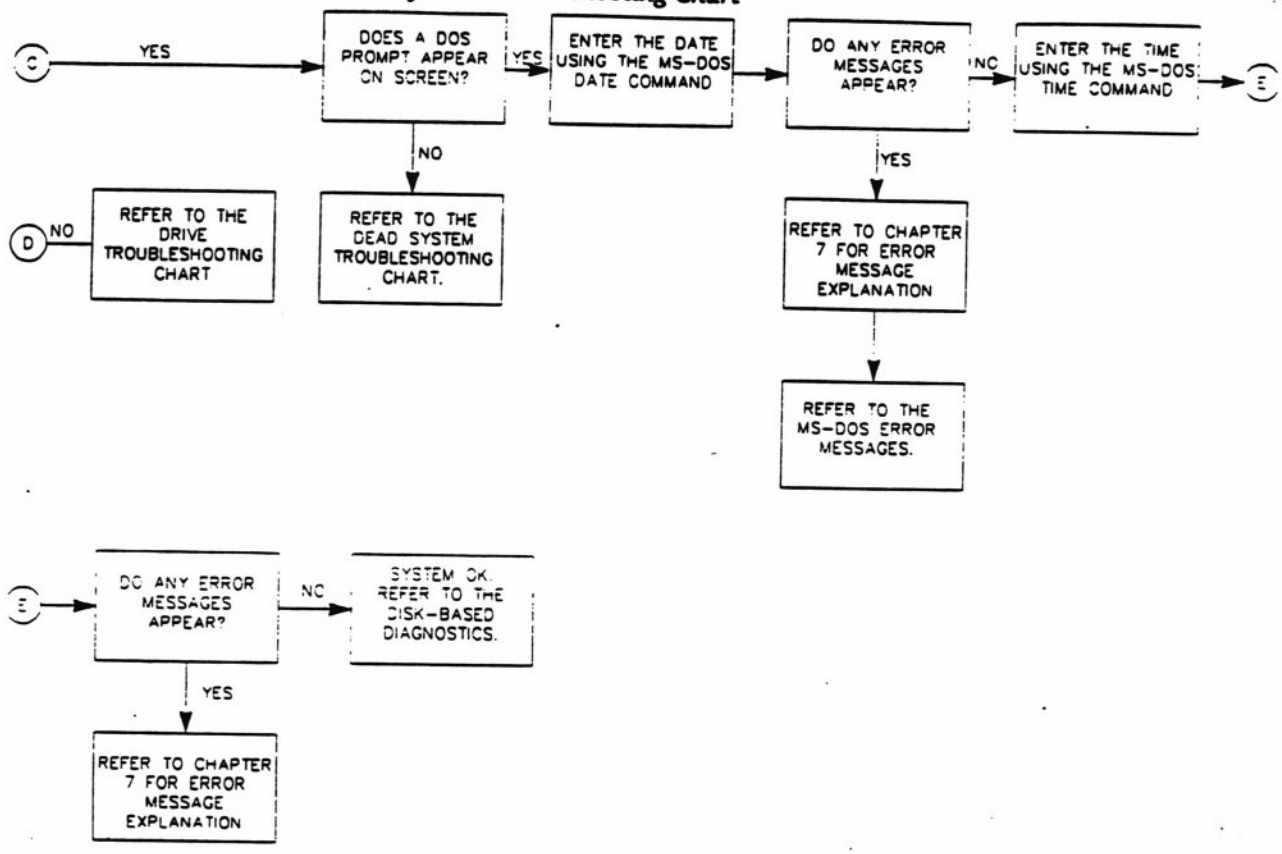
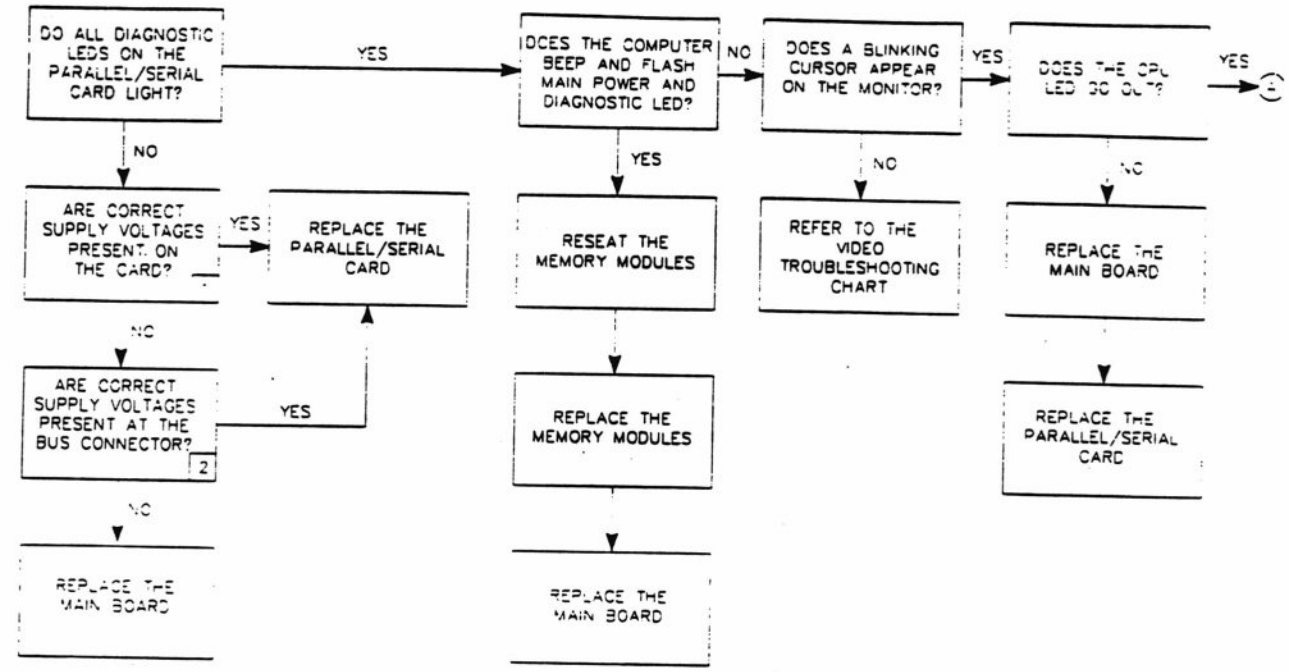


Figure 7-4. Dead System Troubleshooting Chart



NOTES:

1 +5VDC IS AVAILABLE AS INPUT POWER TO MOST IC'S
+12VDC IS ON PIN 14 OF U318 (MC1489)
−12VDC IS ON PIN 1 OF U318 (MC1489)

2 REFER TO THE "SPECIFICATIONS" CHAPTER FOR CONNECTOR PRINTOUTS

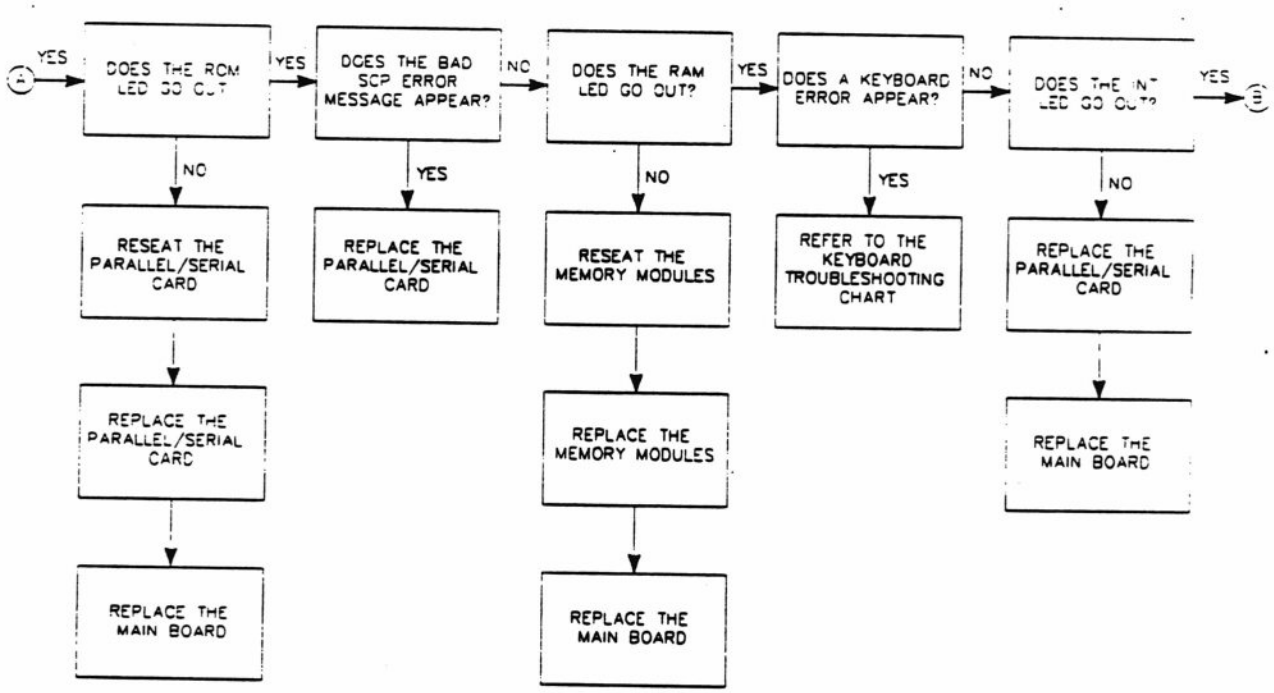


Figure 7-4 (continued). ***Dead System Troubleshooting Chart***

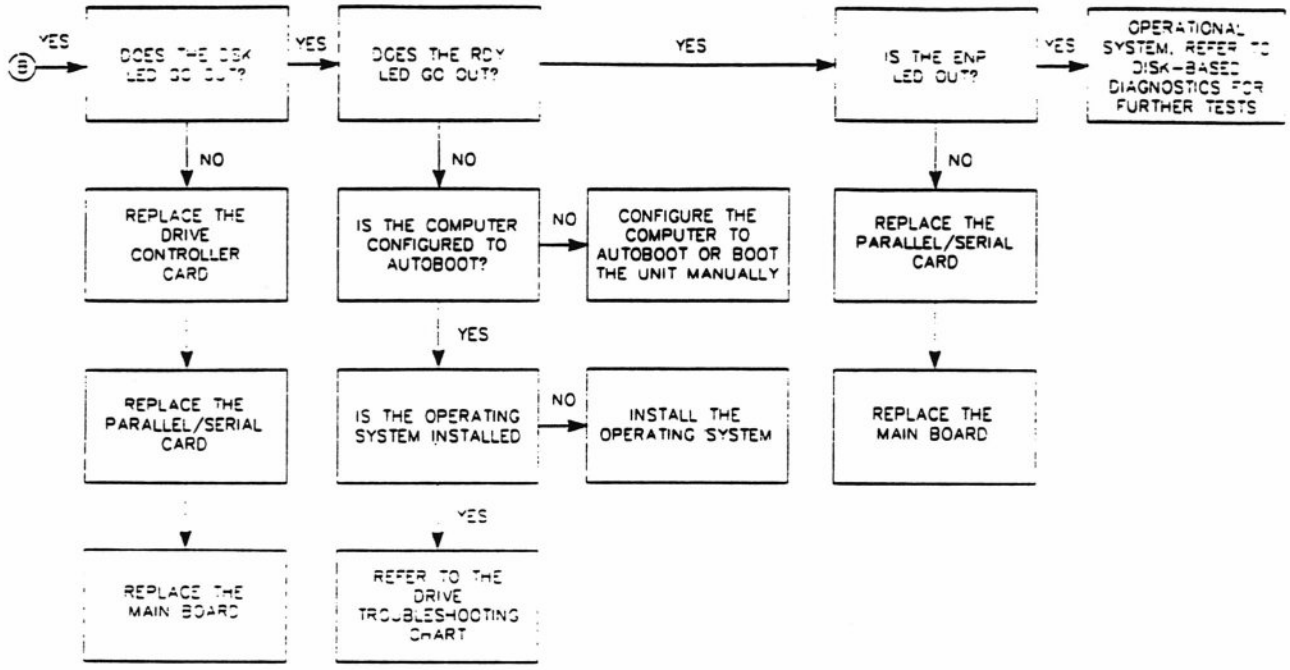
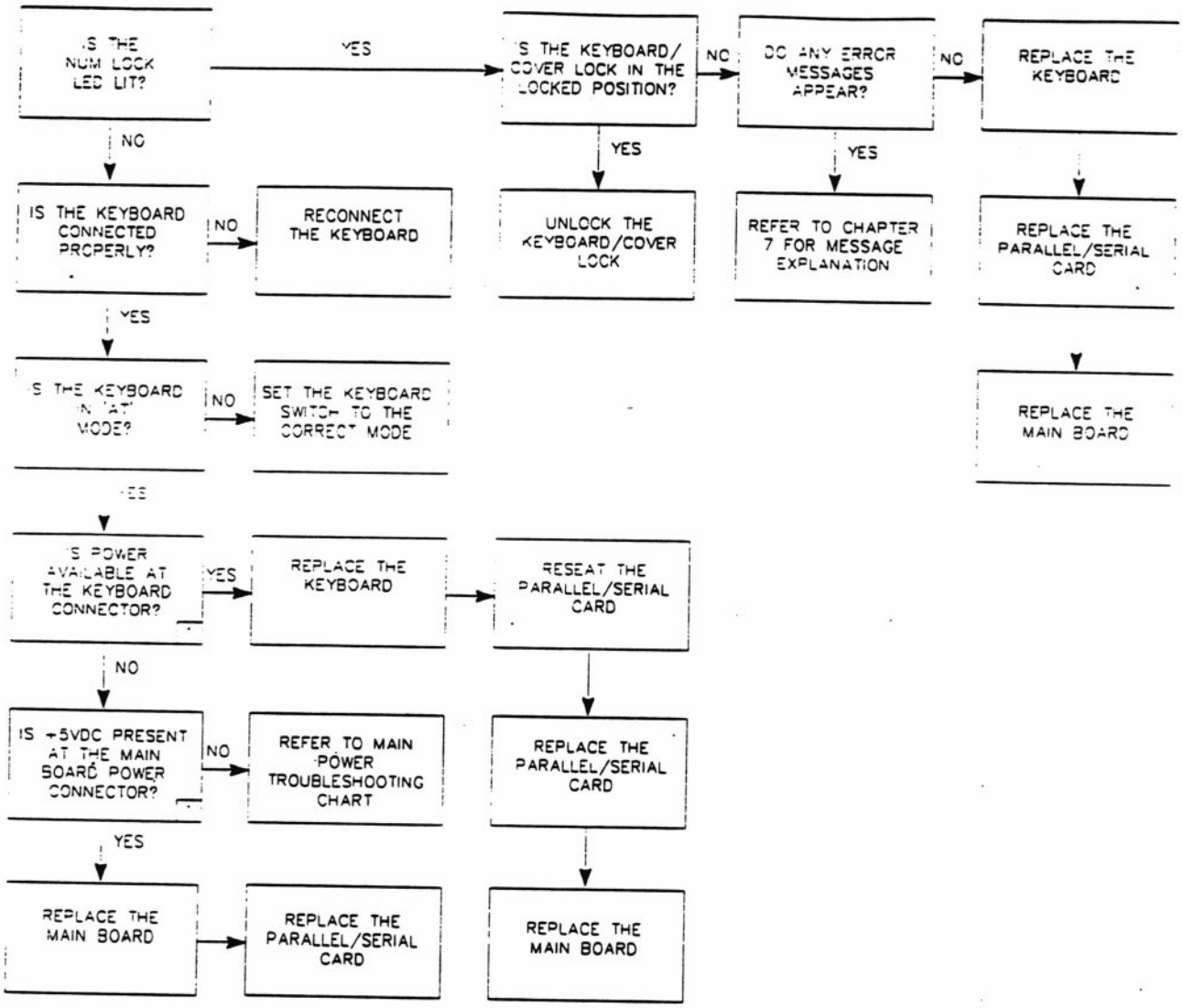
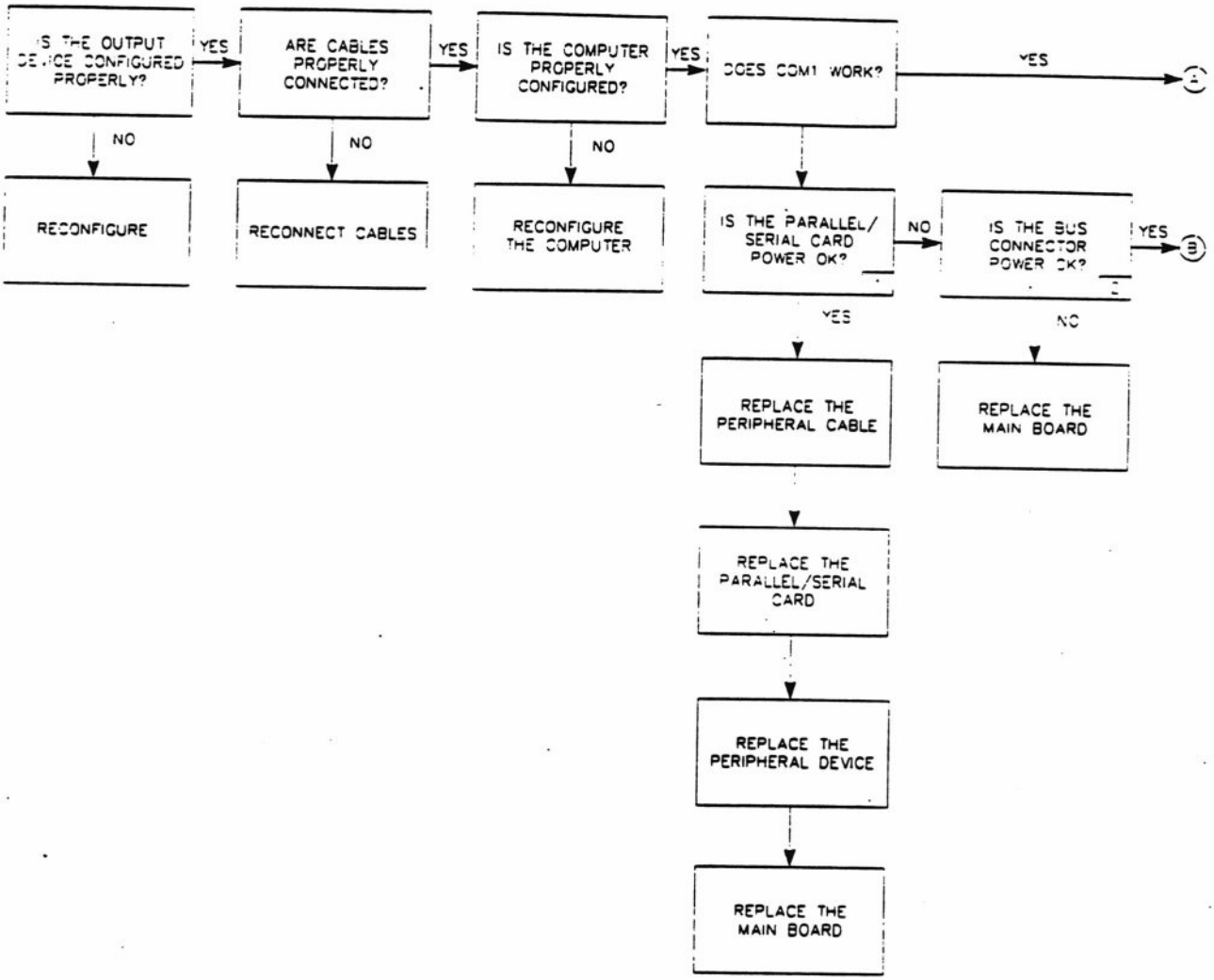


Figure 7-5. Keyboard Troubleshooting Chart



NOTES:
1. REFER TO "SPECIFICATIONS" CHAPTER FOR CONNECTOR PINOUTS.

Figure 7-6. Parallel/Serial Port Troubleshooting



NOTES

1. +5VDC IS AVAILABLE AS INPUT POWER TO MOST IC'S
   +12VDC IS ON PIN 14 OF U318 (MC1489)
   −12VDC IS ON PIN 1 OF U318 (MC1489)
2. REFER TO THE "SPECIFICATIONS" CHAPTER FOR CONNECTOR PINOUTS
3. DISK−BASED DIAGNOSTIC TESTS REQUIRE THE SERIAL LOOPBACK CONNECTOR (438−67) AND THE PARALLEL PORT INTERRUPT CONNECTOR (438−64).

Figure 7-6 (continued). Parallel/Serial Port Troubleshooting

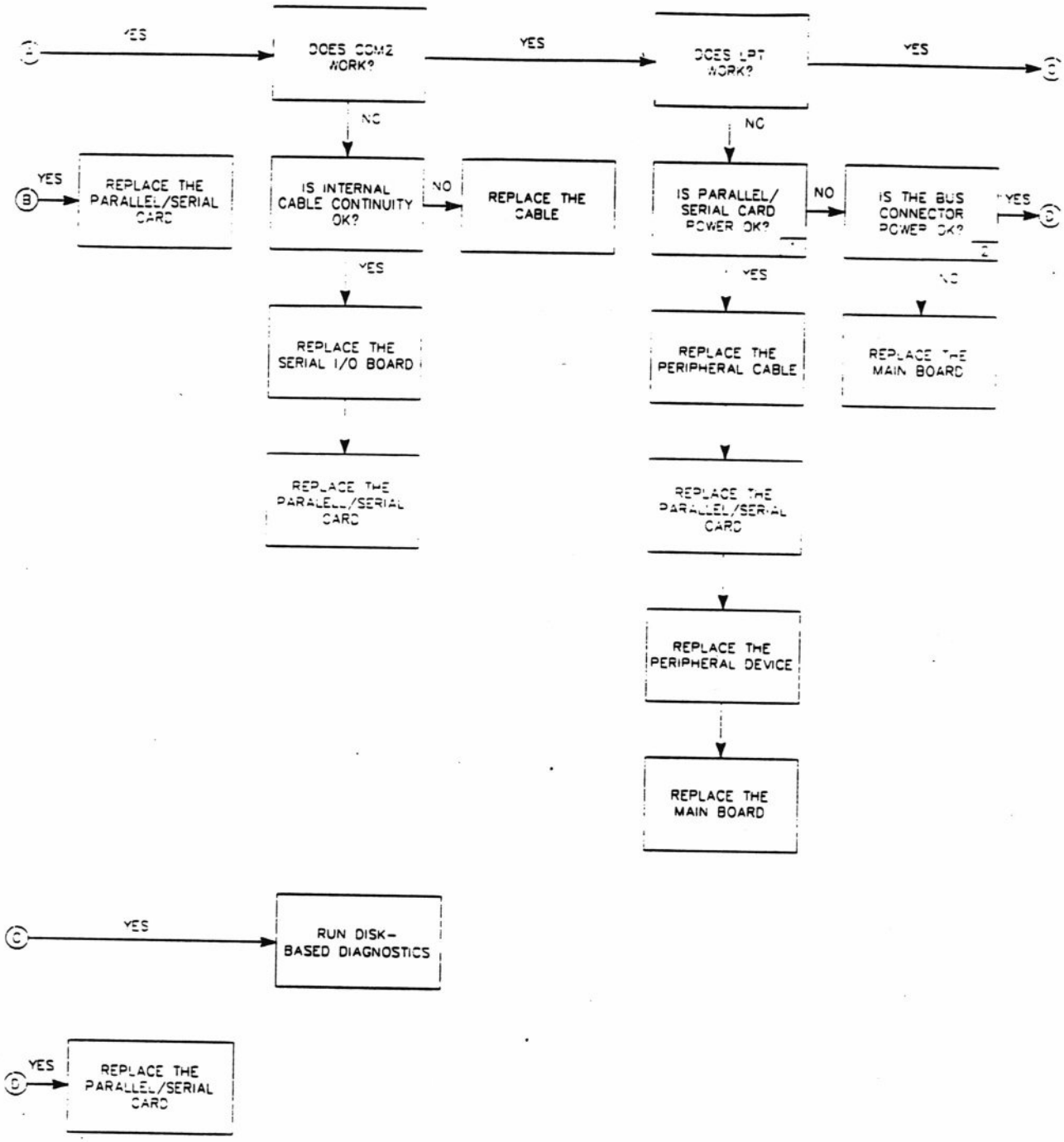
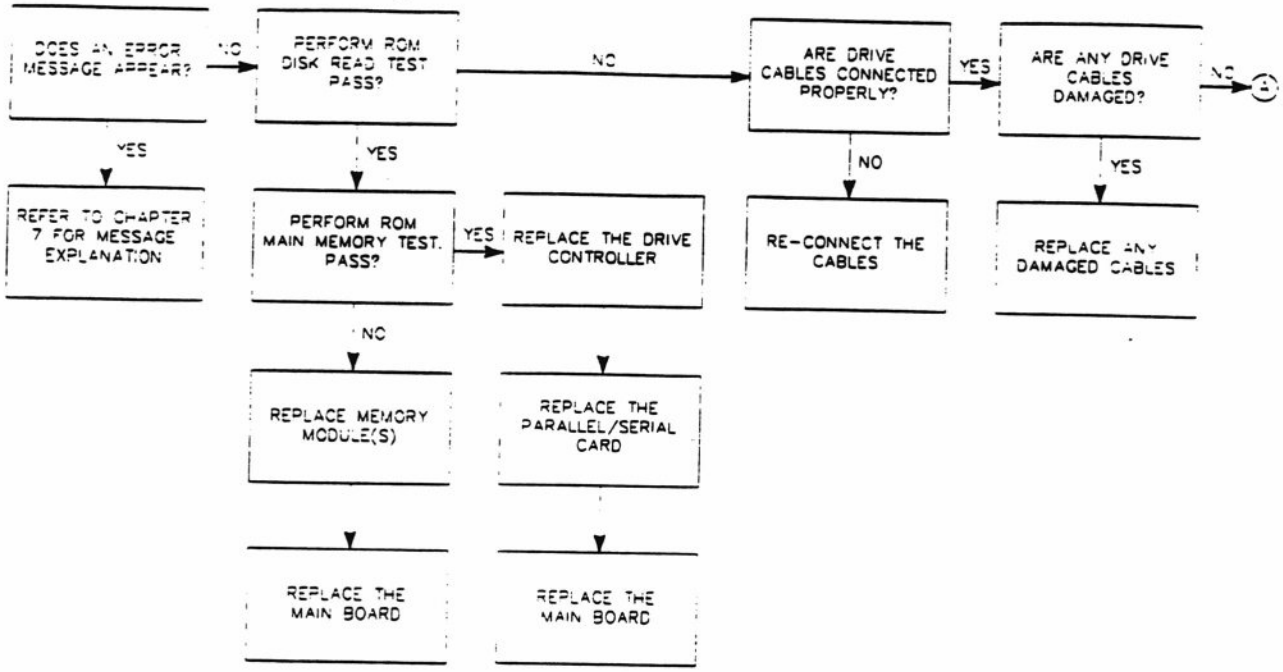


Figure 7-7. Drive Troubleshooting Chart



NOTES:

1. REFER TO THE "SPECIFICATIONS" CHAPTER FOR CONNECTOR PINOUTS.
2. ADAPTER CABLE IS ONLY USED WITH 3.5" DISK DRIVES.

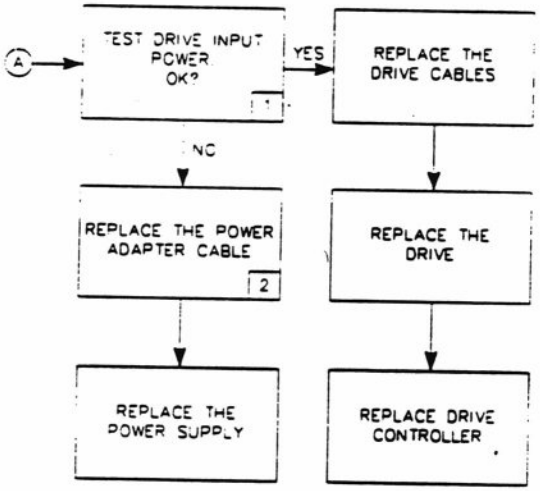
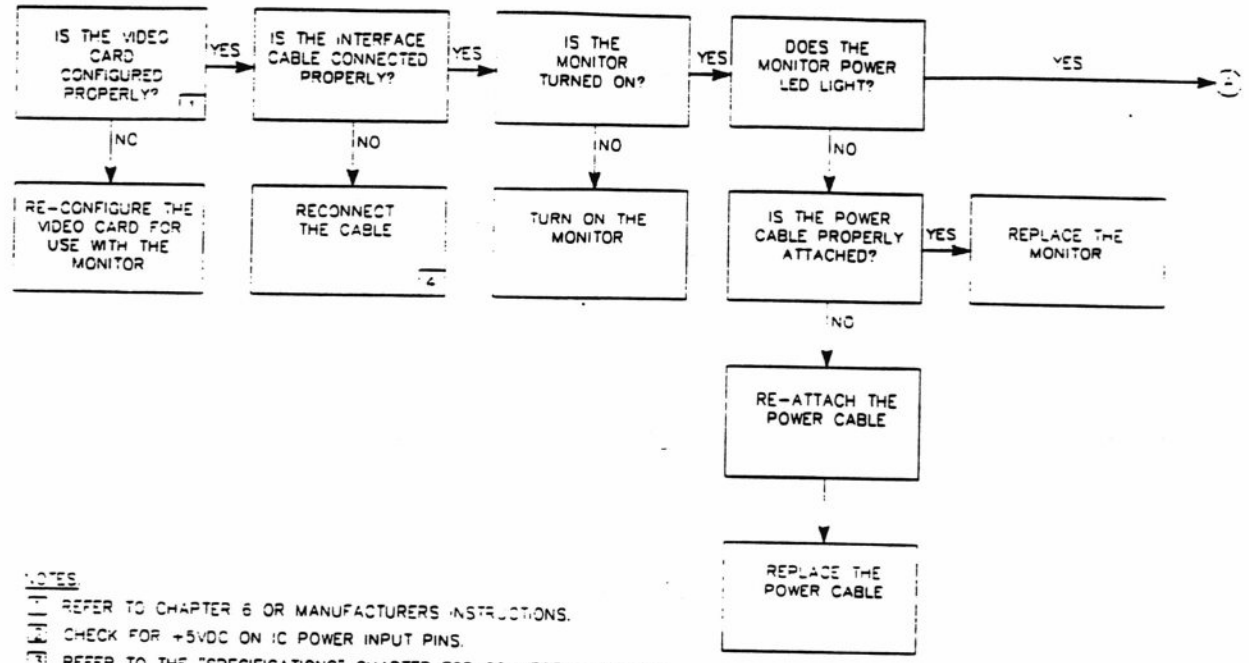


Figure 7-8. Video Troubleshooting Chart



NOTES:

1. REFER TO CHAPTER 6 OR MANUFACTURERS INSTRUCTIONS.
2. CHECK FOR +5VDC ON IC POWER INPUT PINS.
3. REFER TO THE "SPECIFICATIONS" CHAPTER FOR CONNECTOR PINOUTS.
4. ON SOME MONITORS THE CABLE CANNOT BE REMOVED. REPLACE THE MONITOR INSTEAD.

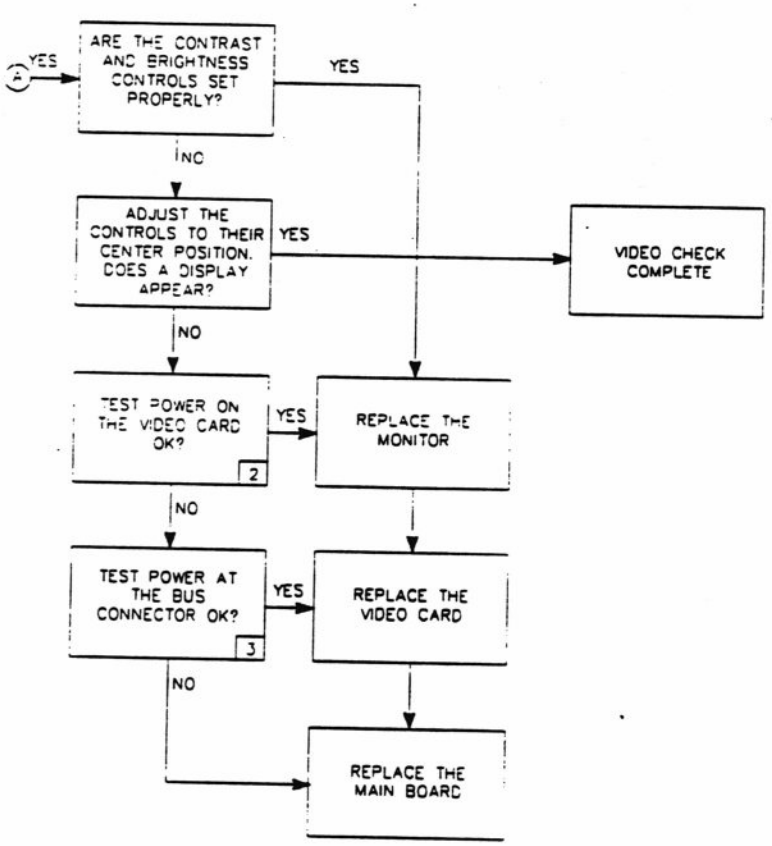


Figure 7-9. Power Troubleshooting Chart

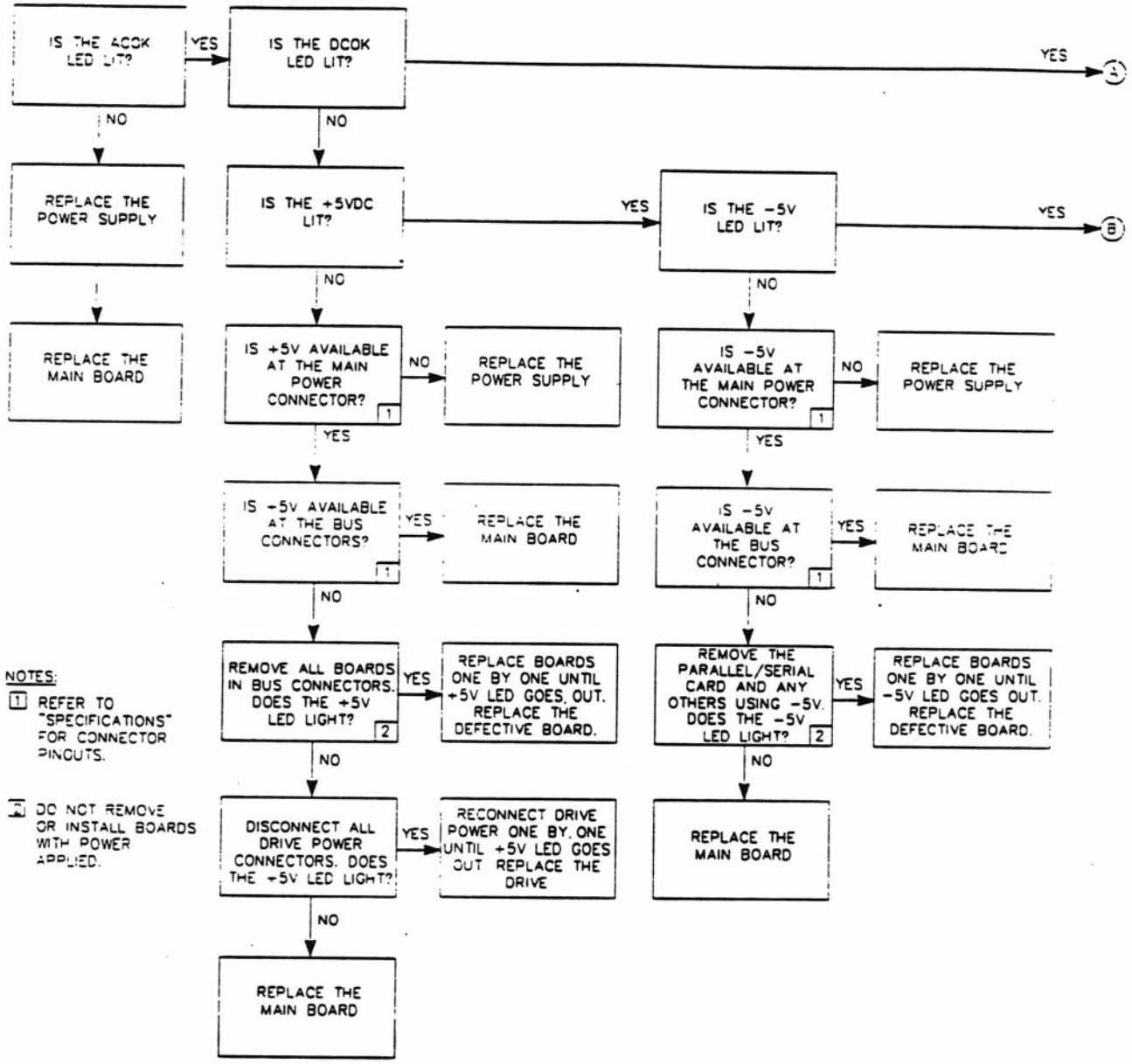


Figure 7-9 (continued). Power Troubleshooting Chart

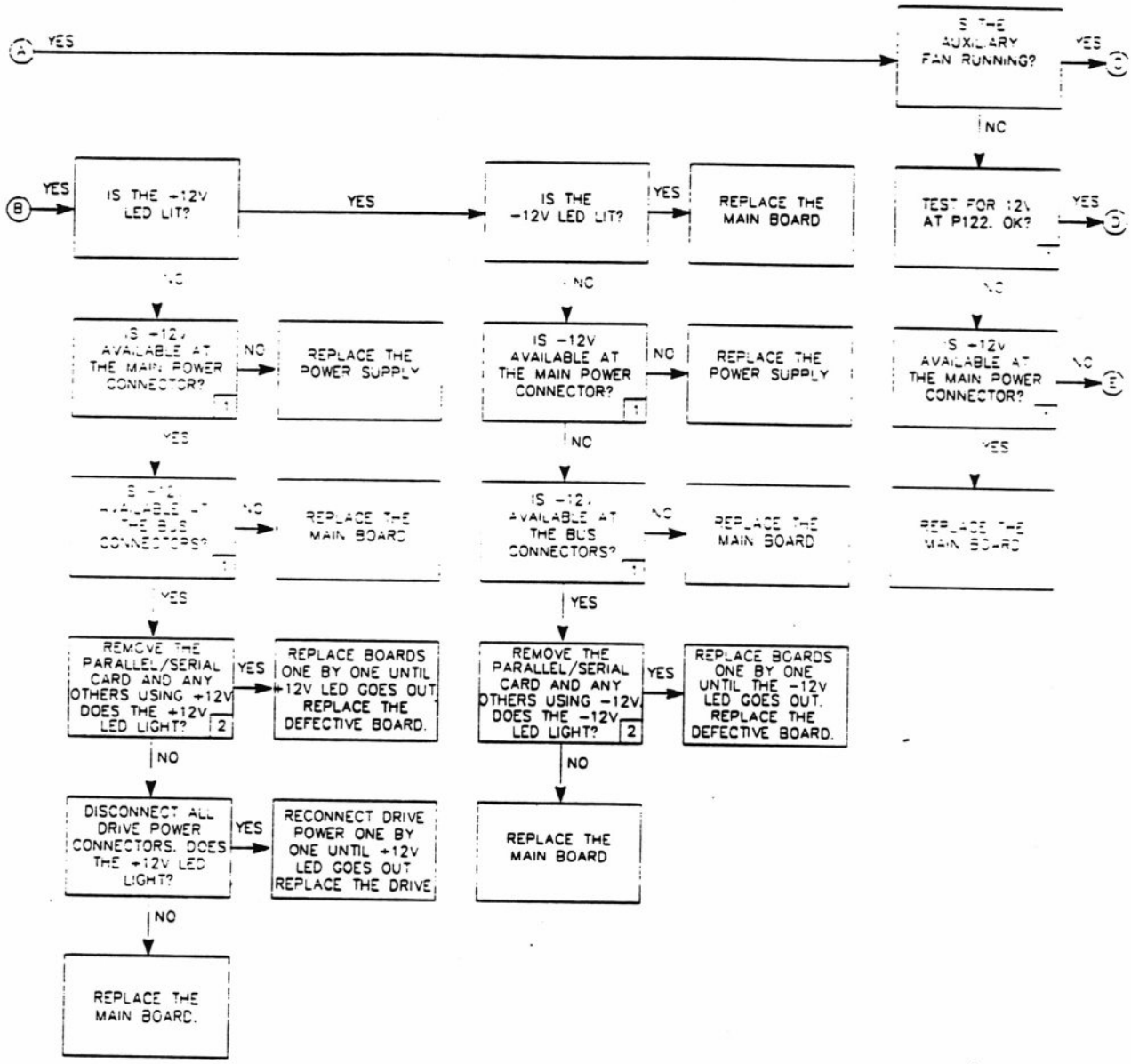
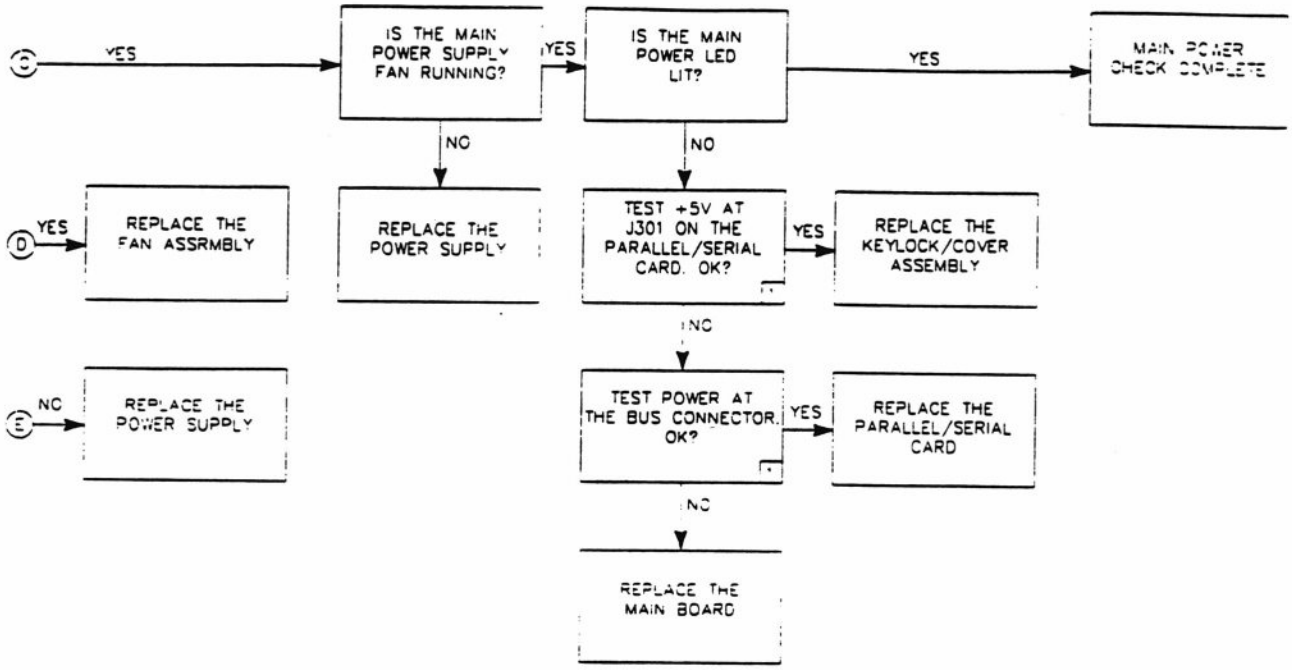


Figure 7-9 (continued). Power Troubleshooting Chart



Disk-Based Diagnostics

An optional disk-based diagnostics package is available for this computer. The disk-based diagnostics provide a more extensive and detailed series of tests for the computer. Refer to the beginning of this manual for product model numbers.

Power-Up and Error Messages

If the computer encounters any problems during self-tests or power-up, it displays a message on the monitor. The error messages are listed in alphabetical order, with descriptions of the probable cause(s), and corrective action.

Bad configuration information found in CMOS!

This message normally appears after backup battery replacement. At other times it may indicate a backup battery failure. The message "Errors found! Please press <Esc> to continue" also appears at the bottom of the screen.

Corrective steps:

- Use the Setup program to re-enter the configuration information.
- Refer to "SmartBattery Removal" in Chapter 5 and replace the backup battery.

Bad disk controller!

This message occurs if a disk drive cable is damaged or not securely connected, if the controller card is not seated properly, or if a hardware failure occurs.

Corrective steps:

- Inspect the disk drive power and data cables for nicks or damage.
- Make certain all cables are properly connected.
- Reseat the drive controller card.
- Use the Disk Read Test to determine whether the drive or the controller card is at fault. Replace the failing unit.

Base memory size error: SETUP: XXXK ACTUAL: XXXK

The amount of base memory specified in the Setup program does not agree with the amount of base memory identified during powerup. The message can also indicate a faulty or improperly installed memory module.

Corrective steps:

- Use the Setup program to verify the correct base memory size.
- Inspect the memory modules for proper installation.
- Use the Base Memory Test to check base memory. If the message is repeated, use the disk-based diagnostics for more extensive tests. If the computer does not boot, replace the first memory module and try again. (This problem could also be caused by a problem on the parallel/serial card.) If the tests identify a memory module, replace it. If the tests identify a CMOS RAM failure, or a problem with the Monitor ROM, replace the parallel/serial card. If the tests are inconclusive, replace the main board.

Cache circuit card Tag RAM failure! Chip: U7XX!

The power-up tests detected a failure in the cache Tag RAM.

Corrective steps:

- Verify that the cache card is properly seated.
- Replace the cache card.
- Replace the main board.

Cache circuit card Data RAM failure! Chip: U7XX!

The power-up tests detected a failure in the cache Data RAM.

Corrective steps:

- Verify that the cache card is properly seated.
- Replace the cache card.
- Replace the main board.

Cache circuit card failure!

The power-up test detected a general cache failure.

Corrective steps:

- Verify that the cache card is properly seated.
- Replace the cache card.
- Replace the main board.

Cannot reset drive!

The disk is not properly installed in the drive, the drive door/latch is not closed, or a hardware failure has occurred.

Corrective steps:

- Check the floppy disk for proper installation.
- Make sure the drive door is fully closed.
- Replace the drive or the disk controller.

CMOS memory failure!

The internal CMOS memory failed the power-up test.

Corrective steps:

- Use the Setup program and verify the configuration information.
- Replace the parallel/serial card.

CPU failure!

Either the CPU or supporting circuitry suffered a hardware failure.

Corrective steps:

- Replace the main board in the computer.
- Replace the parallel/serial card.

CRC error!

This message indicates a faulty disk, a hardware failure, or a loose or faulty drive cable. The problem could also be with the drive controller card.

Corrective steps:

- Try another disk. If the problem disappears, the disk is bad. Copy any readable files to a good disk and reformat the faulty disk. If bad sectors are reported, discard the disk.
- If more than one disk drive is installed in the computer, try the other disk drive. If the second disk drive works, replace the first drive.
- Inspect all power and signal cables for nicks or damage.
- Inspect all cables for proper installation.
- Replace the disk controller card using the same model as the original.

Data Corrected!

The computer detected an error, but was able to correct the data.

Corrective steps:

- If this message occurs on a regular basis, refer to "CRC error."
- Use disk-based diagnostics to test the drive.

Disk not bootable!

The computer attempted to boot an unformatted or non-system disk, or the disk is not usable.

Corrective steps:

- Make certain that the disk is bootable. If not, reformat the disk and install the operating system.
- For a hard disk drive, first try to reinstall the operating system. If necessary, back up the drive and use PREP to reinitialize the disk. Reformat the drive and install the operating system. As a last resort, replace the drive.

Divide by zero!

The power-up self-tests failed or a software failure occurred. This message can also appear if you quickly turn the computer off and then back on.

Corrective steps:

- Try another copy of the software, or contact the software manufacturer or dealer to report the problem. Unless this message occurs during the power-up sequence, the problem is likely to be in the software.

- Turn the computer off, wait 15 seconds, and turn it back on again. If the message reappears, replace the main board.

DMA overrun!

The problem is caused by a DMA hardware failure.

Corrective steps:

- Replace the parallel/serial card.

- If the problem remains, replace the main board.

Drive not ready!

There is no disk in the floppy drive, the disk is not fully inserted, or a drive hardware failure occurred. This message also appears if the computer attempts to access a non-existent disk drive.

Corrective steps:

- Verify that the correct drive was specified.

- Make certain the disk is fully inserted in the drive, and the door is closed and latched.

- Replace the drive.

Errors found. Please unlock keyboard and press ESC to continue.

The computer was powered up with the keyboard locked (mechanically or by software).

Corrective steps:

- Unlock the keyboard/cover lock.

- Enter the required password.

Extended memory size error! SETUP: XXXK ACTUAL: XXXXK

The amount of extended memory specified in the Setup program does not agree with the amount of extended memory identified during powerup. A faulty or improperly installed memory module can also create this problem.

Corrective steps:

- Use the Setup program to verify the memory size entry.
- Inspect all memory modules for proper installation.
- Use the Extended Memory Test to check extended memory.
- Use the disk-based diagnostics to test extended memory. If you cannot boot the computer, replace the first memory module and try again. If the tests identify a faulty memory module, replace it. If the problem is on a memory card, replace the indicated memory module, or the card.

Fatal Error; cannot continue.

This message only appears immediately following another error message. The first message indicates what error halted operation.

Corrective steps:

- Refer to the first error message and follow the instructions to resolve that problem.

Incorrect video configuration. Please run SETUP.

The video card configuration does not match the video configuration information in the Setup program. This message also occurs if jumper J305 on the parallel/serial card is not set correctly.

Corrective steps:

- Use the Setup program to verify the video display information.
- Refer to Chapter 6 and verify the placement of jumper J305 on the parallel/serial card.

Invalid address mark!

This message appears if the floppy disk is damaged or has not been properly formatted.

Corrective steps:

- Copy any readable files to a good disk and reformat the faulty disk. If bad sectors are reported, discard the disk.
- If the problem occurs on a hard disk, three options are available:

  — Reformat the hard disk.

  — Run PREP, then reformat the hard disk.

  — Replace the hard disk drive.

  NOTE: FORMAT and PREP will destroy all data on the drive. Copy any readable files to floppy disks before proceeding.

Invalid command!

Some internal process (usually math related) created an illegal processor state. Otherwise, a hardware failure occurred. This error also occurs when an illegal command is entered.

Corrective steps:

- Re-enter the command.
- Try another copy of the software or contact the software manufacturer or dealer to report the problem.
- Replace the main board.

Invalid data read!

The floppy disk is damaged or was not properly formatted.

Corrective steps:

- Copy any readable files to a good disk and format the faulty disk. If bad sectors are reported, discard the disk.

Invalid date.

The date was entered incorrectly, or the real-time clock failed.

Corrective steps:

- Use the Setup program to re-enter the date information. If the message reappears replace the parallel/serial card.

Invalid time.

The time was entered incorrectly, or the real-time clock failed.

Corrective steps:

- Use the Setup program to re-enter the date information. If the message reappears replace the parallel/serial card.

Keyboard not responding or not connected!

The keyboard is not properly connected, or the cable is damaged.

Corrective steps:

- Verify the keyboard is properly connected (refer to Chapter 2).
- Replace the keyboard.
- Replace the parallel/serial card.
- Replace the main board.

Memory parity failure!

The power-up tests detected a memory parity failure.

Corrective steps:

- Inspect all memory modules for proper installation.
- Use the Base Memory Test to check memory.
- Use the Extended Memory Test to check memory. If these tests reveal the same message, use the disk-based diagnostics to run more extensive tests. If the computer does not boot, replace the first memory module and try again. If the tests identify a faulty memory module, replace it. If not, replace the main board.

Must run SETUP to boot from Winchester!

The Setup program contains the wrong hard disk drive configuration information.

Corrective steps:

- Use the Setup program to specify the correct hard disk drive type for the boot drive. (Refer to Chapter 3.)

No bootable partitions

The computer attempted to boot from an unformatted partition on the hard disk drive. This message is normal the first time a hard disk system is powered up.

Corrective steps:

- Make certain a valid partition is selected to boot from.
- Format the partition and install the operating system. Refer to the operating system documentation for instructions.

No system

The computer attempted to boot from a formatted disk or partition without an operating system.

Corrective steps:

- Make certain a valid drive is selected for the boot operation.
- Install the operating system. Refer to the operating system documentation for instructions.

Non-maskable interrupt received!

This message warns of an impending power failure. Either the AC power supply has failed (blown fuse or circuit breaker), or the supply has dropped below acceptable operating levels (brownout). The message also appears if a software program issues an undefined interrupt. Certain machine language commands entered from the Monitor program can also cause this error.

Corrective steps:

- Turn the computer off. If the power supply is at fault, replace it. If the AC supply is at fault, do not restore power to the computer until the problem is resolved.
- If a software problem is suspected, either correct the problem or have the customer contact the software manufacturer for assistance.

Not a bootable partition

The computer attempted to boot an unformatted partition on the hard disk drive.

Corrective steps:

- Make certain a valid partition is selected for the boot operation.
- Format the partition and install the operating system. Refer to the operating system documentation for instructions.

Overflow!

This message appears if a power-up self-test failed or if the computer is turned off, then back on very quickly. This problem can also be software-related.

Corrective steps:

- Try another copy of the program or contact the software manufacturer or dealer to report the problem.
- Unless this message occurs during the power-up sequence, the problem is probably software-related. Turn the computer off, wait for 15 seconds, and turn it back on. If the message reappears, replace the main board.

Parity hardware failure! Address: XXXXX:YYYY, Chip: UXXX

This message indicates that the power-up tests detected a parity failure.

Corrective steps:

- Use the Base Memory Test to check memory. If the test reveals the same message, use the disk-based diagnostics to run more extensive tests. If the computer does not boot, replace the first memory module and try again. If the tests identify a faulty memory module, replace it. If not, replace the main board.

Please replace the back-up battery!

This message is normal after replacing the backup battery. It can also mean the backup battery has reached the end of its useful life.

Corrective steps:

- If the battery was recently replaced, use the Setup program to enter the proper hardware configuration settings for the computer.
- Refer to Chapter 5 and replace the backup battery.

RAM failure! SIMM module: XXXX

NOTE: SIMM is a mnemonic for Single In-line Memory Module.

The power-up tests detected a memory failure.

Corrective steps:

- Inspect all memory modules for proper installation.
- Swap the installed memory modules. If the problem disappears, the module was not installed correctly. If the problem moves, the module is defective.
- Use the Base Memory Test to check memory. If the tests reveal the same message, replace the module indicated in the failure report. ALTERNATIVE: Replace the main board. If you cannot enter the user tests, replace the memory modules.

ROM checksum failure!

The Monitor ROM failed the power-up self-test. This message may also appear if the computer is turned off, then back on very quickly.

Corrective steps:

- Turn the computer off, wait for 15 seconds, and turn it back on.
- If the message reappears, replace the parallel/serial card.

Sector not found!

The computer attempted to access an unformatted or damaged floppy disk.

Corrective steps:

- Copy any readable files to a good disk and reformat the faulty disk. If bad sectors are reported, discard the disk.

Seek failure!

The computer attempted to access an unformatted or damaged floppy disk.

Corrective steps:

- Copy any readable files to another disk and format the disk. If bad sectors are reported, discard the disk.

System control processor failure!

The system control processor failed the power-up self-test. This message may also appear if you turn the computer off and then back on again very quickly.

Corrective steps:

- Turn the computer off, wait for 15 seconds, and turn it back on. If the message reappears, replace the parallel/serial card.

Timer interrupt failure!

The interrupt controller or timing logic failed the power-up self-test. This message may also appear if you turn the computer off, then back on very quickly.

Corrective steps:

- Turn the computer off, wait for 15 seconds, and turn it back on again. If the message reappears, replace the parallel/serial card.

Wild hardware interrupt!

An unexpected error or memory failure occurred while running a program.

Corrective steps:

- Turn the computer off, wait 15 seconds, and turn it back on. Rerun the program.
- If the message occurs at the same place during the operation of a program, it may be software related. Contact the software manufacturer or dealer and report the problem.
- If the message occurs randomly, use the disk-based diagnostics to test the computer. Replace any faulty assemblies.

Wild interrupt!

An unexpected error or memory failure occurred while running a program.

Corrective steps:

- Turn the computer off, wait 15 seconds, and turn it back on. Rerun the program.
- If the message occurs at the same place during the operation of a program, it may be software related. Contact the software manufacturer or dealer and report the problem.
- If the message occurs randomly, use the disk-based diagnostic tests to test the computer. Replace any faulty assemblies.

Chapter 8
Parts List

Table 8-1 lists only field-replaceable parts. All part numbers are cross-referenced to the exploded view in Figure 8-1. All parts are common to 20MHz, 25MHz, and 33MHz systems unless otherwise noted.

Figure 8-1. Exploded View

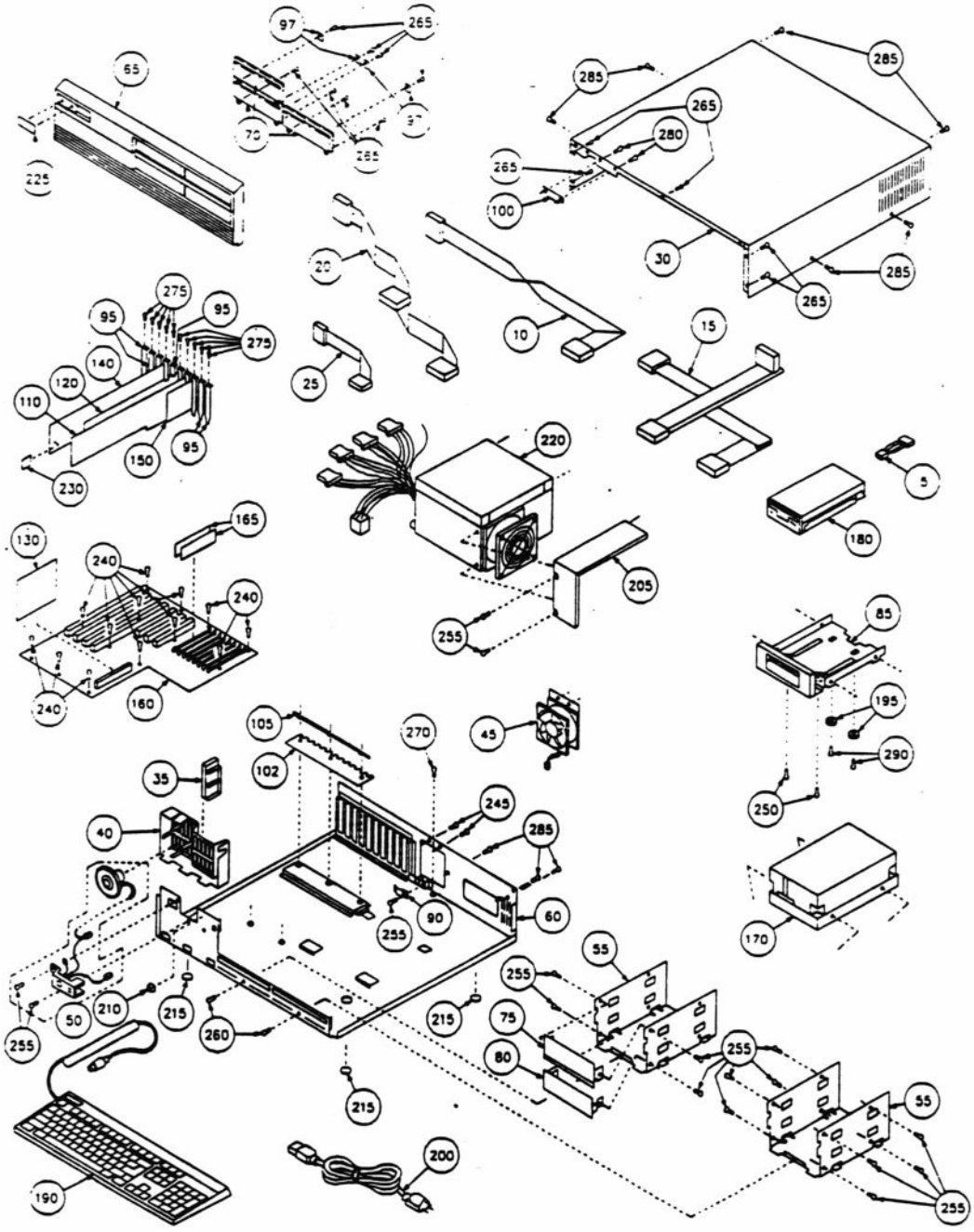


Table 8-1. Field-Replaceable Parts List

REF NUMBER	PART NUMBER	DESCRIPTION
Cables:		
5	134-1884	4-pin power adapter cable assembly for 3.5-inch floppy disk drives
10	134-1984	20-pin data cable, hard drive
15	134-1990	34-pin floppy disk/tape drive cable assembly
20	134-2086	34-pin hard drive control cable
25	134-2100	10-pin serial port extension cable assembly
Chassis Parts:		
30	90-1368-3	Cabinet (top cover), office tan
35	94-654	PCB guide adapter (single section)
40	94-682	Card guide (10 section)
45	100-1938	Auxiliary fan assembly
50	181-7597	Keyboard lock/speaker/LED assembly
55	200-1568	Disk drive chassis
60	200-1569-2	Chassis (main), office tan
65	203-2332-1	Front panel (plastic)
70	203-2333-1	Drive panel (plastic)
75	203-2441	Panel, metal, disk drive bracket (internal, top) for half height drive
76	204-2968	Panel, metal, disk drive bracket (internal, top)
80	204-3107	Panel, metal, disk drive bracket (internal, bottom)
85	204-3121-2	Bracket, 3.5-inch drive in 5.25-inch housing
90	204-3166	Keyboard ground bracket
	204-3402	(Replacement)
95	204-3205	Blank back panel bracket
97	258-730	Spring, clip
100	258-775	Spring, flat
102	258-782	Spring, contact
105	266-1243	Spring retainer
Circuit Boards:		
110	152-1-A1	ESDI disk drive controller
	152-1-A2	ESDI disk drive controller
120	152-4	31kHz (VGA) video controller card
	152-4-E2	31kHz (VGA) video controller card 16-bit w/GS
	152-10-C2	31kHz (VGA) video controller card
	152-19-J1	31khz (VGA) video controller card (high performance)
	152-37-J1	High performance VGA video card
130	181-7642-10	Cache card, 16K (20MHz and 25MHz)
	181-7771-10	Cache card, 16K (20MHz and 25MHz)
	181-7788-10	Cache card, 16K (20MHz and 25MHz)
	181-7660-10	64K cache card
	181-7741-10	Cache card, 16K (33MHz)

continued...

Table 8-1. Field-Replaceable Parts List

REF NUMBER	PART NUMBER	DESCRIPTION
140	181-7643-1C	Par/Ser card (25MHz and 33MHz)
	181-7765-10	Par/Ser card (20MHz and 25MHz)
	181-7770-10	Par/Ser card (20MHz and 25MHz)
	181-7789-10	Par/Ser card (20MHz and 25MHz)
	240-8001-10	Par/Ser card (25MHz and 33MHz)
150	181-7662-10	Serial I/O board
160	240-7639-1C	Main board (25MHz)
	240-7768-10	Main board (20MHz and 25MHz)
	240-7740-10	Main board (33MHz)
165	443-1587	Memory module, 100ns (20MHz and 25MHz)
	443-1661	Memory module, 80ns (33MHz)
Disk Drives:		
170	151-1045	Hard disk drive (ESDI), 150M, 18 ms
	151-1051	Hard disk drive (ESDI), 320M
	151-1096-K1	Hard disk drive (ESDI), 150M, 18 ms
	151-1110-U1	Hard disk drive (ESDI), 40M, 28ms
	151-1111-U1	Hard disk drive (ESDI), 320M
180	151-1088-E2	3.5-inch, 1.44M, floppy disk drive
	151-1047	3.5-inch, 1.44M, floppy disk drive
Keyboard:		
190	163-40-4	101-key keyboard (green LEDs)
	163-73	101-key keyboard (red/green LEDs)
Miscellaneous:		
195	73-59	Grommet, neoprene, drive mtg
200	89-62	Line cord, shielded, Europe
	89-65	Line cord, shielded, US
	89-69	Line cord, shielded, England
205	204-2886	Bracket, power supply shroud
210	261-49	Foot, square (black rubber)
215	261-64	Foot, round (cork rubber)
220	234-890	Power supply
225	391-695	Nameplate, ZDS
230	418-53	3.0V Lithium battery

continued...

Table 8-1. Field-Replaceable Parts List

REF NUMBER	PART NUMBER	DESCRIPTION
Hardware:		
240	250-1150	6-32 x .500 Screw, pan phillips
245	250-1325	6-32 x .250 Screw, pan phillips
250	250-1411	4-40 x .250 Screw, pan phillips
255	250-1538	6-32 x .250 Screw, pan phillips
260	250-1549	6-CA x .500 Screw, pan phillips
265	250-1556	6-BT x .375 Screw, pan phillips
270	250-1557	6-32 x .187 Screw, pan phillips
275	250-1586	6-32 x .312 Screw, pan phillips
280	250-1593	6AB x .375 Screw, hex washer
285	250-1594	6-32 x .375 Screw, pan phillips
290	250-1595	4-40 x .375 Screw, truss phillips

Table 8-2. Optional Parts

PART NUMBER	DESCRIPTION
Expansion:	
181-7640-10	Memory Expansion Card
443-1635	100ns Memory Modules for Expansion Card
360 KB, 5.25-Inch Floppy Disk Drives:	
151-1010	
151-1010-R1	
151-1014	
1.2 MB, 5.25-Inch Floppy Disk Drives:	
151-1012	
151-1012-R1	
151-1029	

Specifications

CPU:

Host Processor: Intel 80386, 32-bit processor.

Clock Speed:
Z-386/20 — 20 MHz, 0 wait states.
Z-386/25 — 25 MHz, 0 wait states.
Z-386/33 — 33 MHz, 0 wait states.

Coprocessor:
Optional Intel 32-bit 80387:
ZA-3500-CI — 20 MHz
ZA-3600-CI — 25 MHz
ZA-3800-CI — 33 MHz

or Weitek 32-bit WTL 3167:
ZA-3500-CW — 20 MHz
ZA-3600-CW — 25 MHz
ZA-3800-CW — 33 MHz

Memory:

System: 2 megabytes minimum, up to 20 megabytes.

Expansion: Up to three self-configuring memory cards with up to four 2-megabyte memory modules. Maximum add-on memory: 32 megabytes.

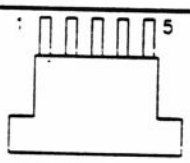
Cache: 8K or 16K standard depending on model. 16-word write buffer.

Configuration: 256K, 512K, or 640K base memory; 256K EMS memory; and extended memory (up to limit of installed memory).

Sound:

Single channel, PC-compatible using an 8Ω 2" speaker.

P301 LED/Speaker/Keylock Connector



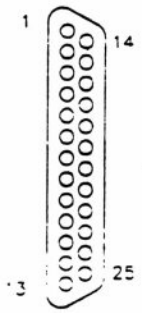
PIN	SIGNAL
1	LED power
2	Audio out
3	+5 VDC
4	Keyboard inhibit
5	Ground

Input/Output:

Parallel Port:

One 25-pin Centronics-type parallel port (DB-25 connector).Configurable as LPT1, LPT2, or disabled.

External 25-Pin Parallel Connector

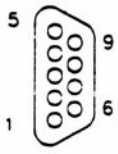


PIN	SIGNAL
1	$\overline{\text{Strobe}}$
2	Data bit 0
3	Data bit 1
4	Data bit 2
5	Data bit 3
6	Data bit 4
7	Data bit 5
8	Data bit 6
9	Data bit 7
10	$\overline{\text{Acknowledge}}$
11	Busy
12	Paper end (out)
13	Select (from printer)
14	$\overline{\text{Auto feed}}$
15	$\overline{\text{Error}}$
16	$\overline{\text{Initialize printer}}$
17	$\overline{\text{Select}}$ (to printer)
18-25	Ground

Serial Port:

Two RS-232C asynchronous serial ports (DB-9 connectors):
One start bit; 7- or 8-bit word length; one or two stop bits.
Selectable baud rates: 110, 150, 300, 600, 1200, 2400, 4800, or 9600 baud (MS-DOS options).
RD, CTS, DSR, CD signals recognized; TD, RTS, DTR control signals generated.
Half- or full-duplex operation.

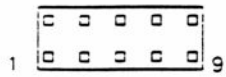
External 9-Pin Serial Connector



PIN	SIGNAL
1	CD — carrier detect
2	Receive data
3	Transmit data
4	DTR — data terminal ready
5	Signal ground
6	DSR — data set ready
7	RTS — request to send
8	CTS — clear to send
9	RI — ring indicate
Case	Chassis ground

NOTE: Some serial devices require a special cable to connect the 9-pin D-type connector (DB-9) used on this computer to a 25-pin D-type connector (DB-25).

Internal 10-Pin Serial Connector (P303)



PIN	SIGNAL
1	CD — carrier detect
2	DSR — data set ready
3	Receive data
4	RTS — request to send
5	Transmit data
6	CTS — clear to send
7	DTR — data terminal ready
8	RI — ring indicate
9	Signal ground
10	Not used

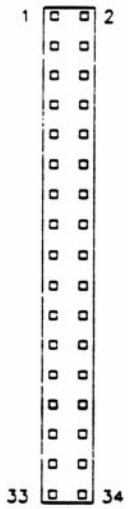
Disk Drives:

Floppy:

One 3.5-inch, 1.4M floppy disk drive standard.
Support for one additional floppy disk drive:
- 720K, 3.5-inch
- 1.4M, 3.5-inch
- 360K, 5.25-inch
- 1.2M, 5.25-inch

Write-protection recognized.

Floppy Disk Connector (J1)



PIN	SIGNAL
2	Write current control
4	Reserved
6	Drive select 3
8	Index
10	Motor enable 1
12	Drive select 2
14	Drive select 1
16	Motor enable 2
18	Direction select
20	Step pulse
22	Write data
24	Write gate
26	Track 0
28	Write protect
30	Read data
32	Select head 1
34	Diskette changes

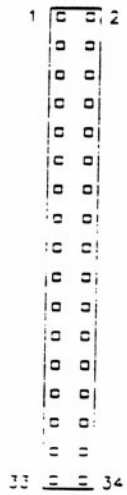
All odd numbered pins are ground

Hard:

Maximum of two drives per controller card, 5.25-inch full height or half height.
150M or larger ESDI drives

NOTE: MS-DOS recognizes only one primary controller card. A second controller requires a different operating system such as XENIX® or OS/2®.

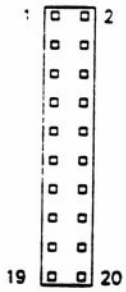
ESDI Control Connector (J2)



PIN	SIGNAL
2	Head select 3
4	Head select 2
6	Write gate
8	Drive status
10	Transfer acknowledge
12	Attention
14	Head select 0
16	Sector/AM found
18	Head select 1
20	Index
22	Ready
24	Transfer request
26	Drive select 1
28	Drive select 2
30	Reserved
32	Read gate
34	Command data

All odd numbered pins are ground

ESDI Data Connector (J3/J4)



PIN	SIGNAL
1	Drive selected
2	Reserved
3	Command complete
4	Address mark enable
5	Ground
6	Ground
7	Write clock
8	Write clock
9	Ground
10	Read/reference clock
11	Read/reference clock
12	Ground
13	Write data
14	Write data
15	Ground
16	Ground
17	Read data
18	Read data
19	Ground
20	Reserved

8-Bit Video (152-4-E3):

Video signal: Analog RGB, 75Ω, 0 – 0.714 V; zero volts represents black.

Horizontal sync: 31.49 kHz.

Vertical sync: 40 – 70 Hz, depending on video mode and monitor.

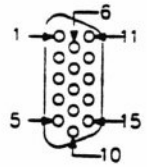
Video display: VGA at 31.49 kHz scan frequency and EGA, CGA, and MDA display modes.

Video memory: 256K.

Bus interface: 8-bit PC type interface; 8MHz, zero wait states.

Monitor interface: 15-pin D-type connector.

External 15-Pin Analog Video Connector



PIN	31.49 kHz ANALOG RGB
1	Red video
2	Green video
3	Blue video
4	NC[1]
5	Ground
6	Red ground
7	Green ground
8	Blue ground
9	NC[1]
10	Sync ground
11	Monitor sense – color
12	Monitor sense – monochrome
13	Horizontal sync
14	Vertical sync
15	NC[1]

NOTE

1. No connection.

16-bit Video (152-10-C2):

Video signal: Analog RGB, 75Ω, 0 – 0.714 V; zero volts represents black.

Horizontal sync: 31.49 kHz.

Vertical sync: 50 – 70 Hz, depending on video mode and monitor.

Video display: VGA, at a constant 31.49 kHz scan.

Video memory: 256K.

Bus interface: 16-bit PC/AT type interface; 8MHz, zero wait states.

Monitor interface: 15-pin D-type connector.

NOTE: The video connector is the same as used for 8-bit analog video.

16-bit Video (152-19-J1):

Video signal:	Analog RGB, 75Ω, 0 – 0.714 V; zero volts represents black.
Horizontal sync:	31.49 kHz.
Vertical sync:	50 – 70 Hz, depending on video mode and monitor.
Video display:	VGA, at a constant 31.49 kHz scan.
Video memory:	256K.
Bus interface:	16-bit PC/AT type interface; 8MHz, zero wait states.
Monitor interface:	15-pin D-type connector.

NOTE: The video connector is the same as used for 8-bit analog video.

16-bit Video (152-37-J1):

Video signal:	Analog RGB, 75Ω, 0 – 0.714 V; zero volts represents black.
Horizontal sync:	31, 31.5, 35, 35.5 kHz.
Vertical sync:	43 – 70 Hz, depending on video mode and monitor.
Video display:	VGA, at a constant 31.49 kHz scan.
Video memory:	256K, expandable to 512K.
Bus interface:	16-bit PC/AT type interface; 8MHz, zero wait states.
Monitor interface:	15-pin D-type connector.

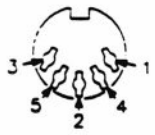
NOTE: The video connector is the same as used for 8-bit analog video.

Keyboard:

101-key enhanced keyboard with 17-key numeric keypad, 4-key cursor control pad, 6-key editing pad, 3-key function pad, and twelve programmable function keys.

XT- or AT-compatible, switch selectable.

Keyboard Connector



PIN	SIGNAL
1	Keyboard clock (Output)
2	Keyboard data (Input)
3	Keyboard reset (Output)
4	Ground
5	+5 VDC (Output)

Expansion Connectors:

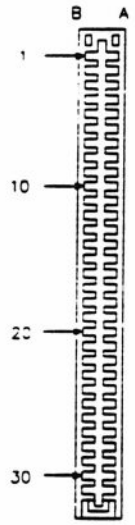
Four 32-bit (Zenith Data Systems) proprietary card slots (three available), and three 16-bit PC/AT slots (one available).

AT Bus

PC CONNECTOR	PIN	SIGNAL
	A1	$\overline{\text{IOCHCHK}}$
	A2	SD7
	A3	SD6
	A4	SD5
	A5	SD4
	A6	SD3
	A7	SD2
	A8	SD1
	A9	SD0
	A10	IOCHRDY
	A11	AEN
	A12	SA19
	A13	SA18
	A14	SA17
	A15	SA16
	A16	SA15
	A17	SA14
	A18	SA13
	A19	SA12
	A20	SA11
	A21	SA10
	A22	SA9
	A23	SA8
	A24	SA7
	A25	SA6
	A26	SA5
	A27	SA4
	A28	SA3
	A29	SA2
	A30	SA1
	A31	SA0

continued...

AT Bus

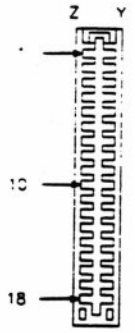


PIN	SIGNAL
B1	GND
B2	RESET DRV
B3	+5 VDC
B4	IRQ9
B5	-5 VDC
B6	DRQ2
B7	-12 VDC
B8	0WS
B9	+12 VDC
B10	GND
B11	$\overline{\text{SMEMW}}$
B12	$\overline{\text{SMEMR}}$
B13	$\overline{\text{IOW}}$
B14	$\overline{\text{IOR}}$
B15	$\overline{\text{DACK}}$
B16	DRQ3
B17	$\overline{\text{DACK1}}$
B18	DRQ1
B19	$\overline{\text{REFRESH}}$
B20	CLOCK
B21	IRQ7
B22	IRQ6
B23	IRQ5
B24	IRQ4
B25	IRQ3
B26	$\overline{\text{DACK2}}$
B27	T/C
B28	ALE
B29	+5 VDC
B30	OSC
B31	GND

continued...

AT Bus

	PIN	SIGNAL
AT EXTENSION		
	Y1	BHE
	Y2	LA23
	Y3	LA22
	Y4	LA21
	Y5	LA20
	Y6	LA19
	Y7	LA18
	Y8	LA17
	Y9	$\overline{\text{MEMR}}$
	Y10	$\overline{\text{MEMW}}$
	Y11	SD8
	Y12	SD9
	Y13	SD10
	Y14	SD11
	Y15	SD12
	Y16	SD13
	Y17	SD14
	Y18	SD15
	Z1	$\overline{\text{M16}}$
	Z2	$\overline{\text{I16}}$
	Z3	IRQ10
	Z4	IRQ11
	Z5	IRQ12
	Z6	IRQ15
	Z7	IRQ14
	Z8	$\overline{\text{DACK0}}$
	Z9	DRQ0
	Z10	$\overline{\text{DACK5}}$
	Z11	DRQ5
	Z12	$\overline{\text{DACK6}}$
	Z13	DRQ6
	Z14	$\overline{\text{DACK7}}$
	Z15	DRQ7
	Z16	+5 VDC
	Z17	$\overline{\text{sMASTER}}$
	Z18	GND



Zenith Bus Extensions

PIN	SIGNAL
W1	SD16
W2	SD17
W3	SD18
W4	SD19
W5	SD20
W6	SD21
W7	SD22
W8	SD23
W9	GND
W10	SD24
W11	SD25
W12	SD26
W13	SD27
W14	SD28
W15	SD29
W16	SD30
W17	SD31
W18	GND
W19	GND
W20	LA24
W21	LA25
W22	LA26
W23	LA27
W24	LA28
W25	$\overline{\text{MASTER32}}$
W26	LA31
W27	FASTRDY
W28	GND
W29	$\overline{\text{MEMPAGE}}$
W30	$\overline{\text{MEMCYCLE}}$
W31	Vcc

continued...

Zenith Bus Extensions

PIN	SIGNAL
X1	$\overline{M32}$
X2	KBCLOCK
X3	KBDATA
X4	DCOK
X5	GND
X6	ACOK
X7	$\overline{IRQ8}$
X8	$\overline{IRQ13}$
X9	Vcc
X10	$\overline{BEN0}$
X11	$\overline{BEN1}$
X12	$\overline{BEN2}$
X13	$\overline{BEN3}$
X14	GND
X15	$\overline{MEMR32}$
X16	$\overline{MEMW32}$
X17	$\overline{HOLD}$
X18	$\overline{HOLDACK}$
X19	PCLK
X20	$\overline{INTA}$
X21	$\overline{INTR}$
X22	$\overline{NMI}$
X23	$\overline{RC}$
X24	GND
X25	A20GATE
X26	$\overline{DISPG}$
X27	WRT
X28	ROMRAMEN
X29	SPRAMEN
X30	WRDIS
X31	Vcc

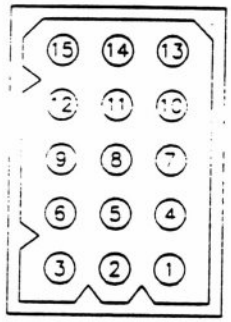
Power:

Input: 100 – 130 VAC at 60 Hz, or 200 – 230 VAC at 50 Hz, switch selectable, 200W rating.

Output: +5 VDC at 21A, +12 VDC at 7.5A, −12 VDC at 0.3A and −5 VDC at 0.3A.

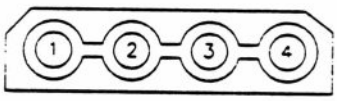
Battery: 3.0 V lithium battery provides backup power to real-time clock and CMOS memory.

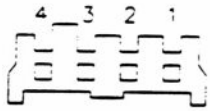
Main Power Connector



PIN	SIGNAL	WIRE COLOR
1	+12 VDC	Orange
2	+12 VDC	Orange
3	Ground	Black
4	−12 VDC	White
5	Ground	Black
6	Ground	Black
7	ACOK	Blue
8	+5 VDC	Red
9	Ground	Black
10	DCOK	Yellow
11	+5 VDC	Red
12	Ground	Black
13	−5 VDC	Violet
14	+5 VDC	Red
15	Ground	Black

Drive Power Connectors





PIN	SIGNAL	WIRE COLOR
1	+12 VDC	Orange
2	Ground	Black
3	Ground	Black
4	+5 VDC	Red

Auxiliary Fan Power Connector

PIN	SIGNAL
1	+12 VDC
2	Ground

Environment:

Operating:	60° – 80°F (16° – 27°C) at 20% – 80% relative humidity (non-condensing).
Storage:	−40° – +125°F (−40° – +52°C) at 20% – 80% relative humidity (non-condensing).

Size:

Computer:	21 x 17 x 6 inches (53 cm x 43 cm x 16 cm)
Keyboard:	18.5 x 8 x 1.5 inches (47 cm x 20 cm x 9 cm)
Weight:	≈54 lbs (24.3 kg) in carton with keyboard and manual.

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