

Silicon Graphics® Zx10 Visual Workstation Owner's Guide

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Contributors

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FCC/DOC Compliance

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential installation. This equipment generates, uses, and can radiate radio frequency energy. If the equipment is not installed and used in accordance with the instructions, it may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, try to correct the interference as follows: reorient or relocate the affected device; increase the separation between this equipment and the affected device; connect this equipment to an outlet on a circuit different from the circuit to which the affected device is connected; consult a dealer or an experienced radio/television technician for help.

For additional regulatory information, see the label attached to the back of the equipment.

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations. Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Safety Notices

This is a user-serviceable system. However, there are no user-serviceable parts in the power supply. Please return the power supply to the manufacturer for repair.

Service and upgrade tasks should be performed by users who can follow instructions in a manual to service equipment, and can do so without harm to themselves or damage to the equipment.

The AC power cord for this unit is the service disconnect. Ensure the AC power outlet to which the system's power cord connects is close to the system and is easily accessible. For protection against electrical shock and energy hazards, unplug the system's power cord from its AC power outlet before opening or servicing the system.

If the AC voltage selection switch on the power supply is not set correctly, serious equipment damage may occur when power to the system is turned on.

To reduce the risk of electrical shock and energy hazards, do not attempt to open the equipment unless instructed, and do not use a tool for purposes other than instructed.

Internal components may be at high temperatures. Allow time for them to cool before handling them.

Internal components can be damaged by static electricity. Use an antistatic wrist strap connected to the bare metal of the system's chassis to protect against electrostatic discharge.

If a modem card used in the system receives ground from the system, ensure the system is connected to an earth-grounded AC power outlet.

Notes

Changes or modifications made to the system that are not approved by the party responsible for compliance could void the user's authority to operate the equipment.

Procedures in this document assume familiarity with the general terminology associated with personal computers, and with the safety practices and regulatory compliance required for using and modifying electronic equipment.

Read all operating instructions before using this device. Keep these instructions for future reference. Follow all warnings on the device or in the operating instructions.

To comply with the limits for an FCC Class B computing device, always use shielded cables and the power cord supplied with the system.

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002	September 2000 Initial Rev

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About This Guide

This *Owner's Guide* describes how to set up and configure your SGI Zx10 visual workstation. The *Owner's Guide* also provides information on operating, servicing, and upgrading your Zx10 system.

This *Owner's Guide* is organized as follows:

- Chapter 1, “Setting Up the Hardware” describes how to set up the system hardware.
- Chapter 2, “Setting Up the Software” describes how to set up the operating system and associated system software.
- Chapter 3, “Configuring the System” describes how to configure the system for use.
- Chapter 4, “Operating the System” describes how to use essential features and provides other basic information on operating the system.
- Chapter 5, “Troubleshooting Operational Problems” describes how to resolve basic problems you may encounter when using the system.
- Chapter 6, “Reinstalling the Operating System” describes how to reinstall the operating system and associated system software, if required.
- Chapter 7, “Gaining Access to System Components” describes how to open the system and gain access to major internal components.
- Chapter 8, “Upgrading the System” provides information on adding and upgrading major system components.
- Chapter 9, “Servicing the System” describes how to remove and replace major system components.
- Chapter 10, “System Hardware and Specifications” provides technical reference information and system specifications.
- Appendix A, “Ergonomics Guide” contains valuable information on ways to minimize repetitive stress injuries when working with a computer.

More Information

For additions or changes to information in this document, see the *Release Notes* (if delivered with the system).

For more detailed information on the operating system, see the printed and online Microsoft documentation delivered with the system.

For detailed information on the system board, system board components, and basic input/output system (BIOS), see the *System Board Guide* delivered with the workstation.

Getting Support

When you need software support or hardware maintenance:

- Visit Supportfolio Online on the World Wide Web at <http://support.sgi.com>.
- Visit SGI Global Services on the World Wide Web at <http://www.sgi.com/support>.
- Contact an SGI Customer Support Center (listed on the SGI Global Services Web pages).

For more information, see the *Support Guide* delivered with your system.

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Setting Up the Hardware

This chapter describes how to set up the hardware for your system.

Unpacking the System



Figure 1-1 Rear Lip of Base Unit

Caution: Remove and move items carefully. Do not drop items on a hard surface, or damage to internal components may result. You may need help to move heavy items.

Caution: Do not use the lip at the top rear of the base unit as a handhold when removing the base unit from packaging or when moving the base unit.

Remove everything from the shipping cartons and verify you have (at a minimum) these items:

- System base unit and power cord
- Keyboard and mouse
- Operating system software CD, diskettes, and documentation
- Driver software CD
- Monitor, power cord, and video cable (if purchased)
- System documentation, including a quick-setup poster, an *Owner's Guide*, a *System Board Guide*, and *Release Notes* (if provided)

Save the packaging materials. If you need to return equipment for repair, it must be in its original packaging for you to get warranty service.

If you have already set up the system hardware using the quick-setup poster, review the rest of this chapter and then go to Chapter 2, "Setting Up the Software."

Placing System Components

When placing system components, keep these guidelines in mind:

- Place the base unit in an area where air can circulate freely around it.
- Do not expose the system to high levels of dust, smoke, or moisture.
- Maintain a temperature range of 50 °F to 90 °F (10 °C to 32 °C); the optimum operating temperature is 70 °F (21 °C).
- Maintain a humidity range of 20 percent to 80 percent non-condensing; the optimum humidity is 50 percent non-condensing.

Connecting System Components

Caution: If you do not use the cables delivered with the system, use shielded cables to prevent excessive electromagnetic interference (EMI). The cables delivered with the system reduce the amount of EMI produced by the system.

After placing the system components, connect them together using the included cables. The base unit and other system components have keyed and labeled ports, to make it easier to connect them together with the right cables. If you cannot connect a cable easily, ensure that you are aligning the cable connector correctly with the port.

The following figures illustrate the back of the base unit. Most ports on the back of the base unit are colored and labeled with icons for easy reference. Locations of expansion cards and their ports may differ from those shown.

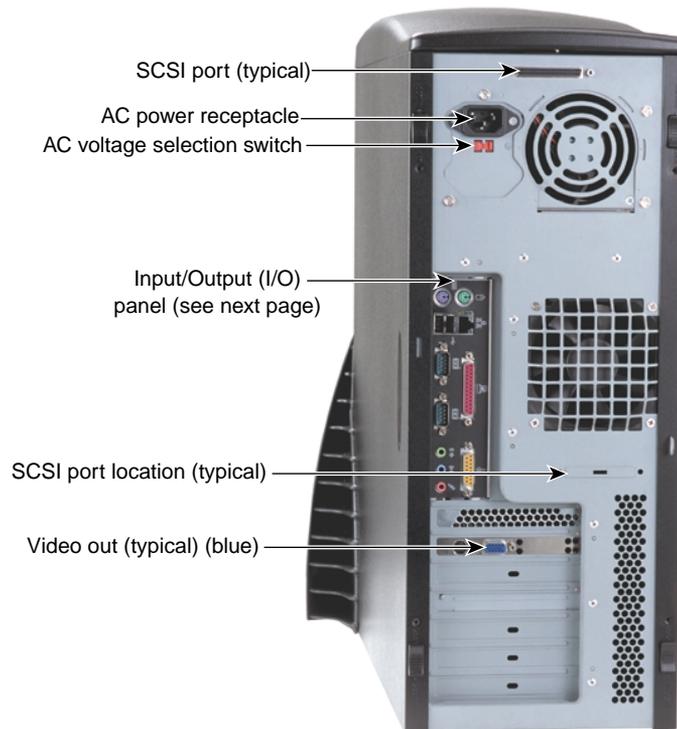


Figure 1-2 Back of the Base Unit

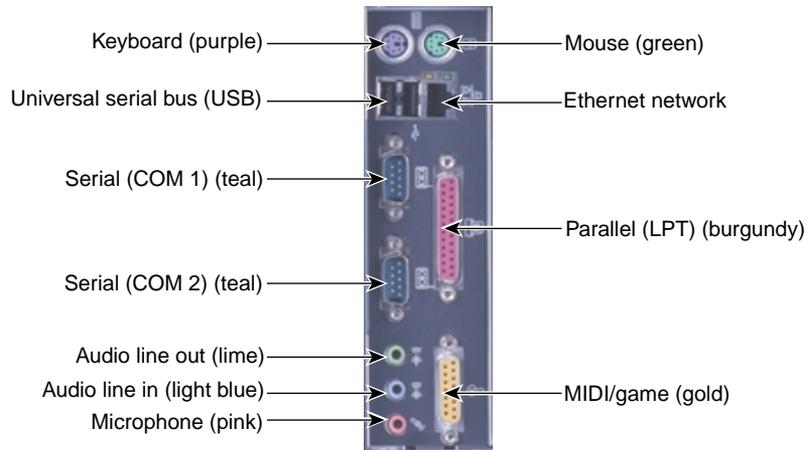


Figure 1-3 Input/Output (I/O) Panel

To connect the system components:

1. Connect a video cable from the monitor to the video out port on the graphics controller card. See the graphics controller documentation for more information.
2. Connect cables from the keyboard and the mouse to their ports.
3. If you have speakers and a microphone, connect their cables to their ports. See the speaker and microphone documentation for more information.
4. Connect a cable from your site's Ethernet network to the Ethernet port.
5. Connect a cable from a parallel peripheral device to the parallel port.
6. Connect cables from any serial peripheral devices to the serial ports.
7. Connect cables from any USB peripheral devices to the USB ports.
8. Connect the cable from any external SCSI peripheral devices, or a SCSI terminator module, to the SCSI port. See "Connecting External SCSI Devices" in this chapter.

Caution: On a server system, if you do not connect an external SCSI peripheral device to the SCSI port, connect a terminator module to the port.

9. Connect cables to ports on any other installed expansion cards as required. See the expansion card documentation for more information.

Caution: Do not connect the system power cord to the base unit or to an AC power outlet at this time. See “Connecting to AC Power” later in this chapter for more information.

Locating Expansion Cards

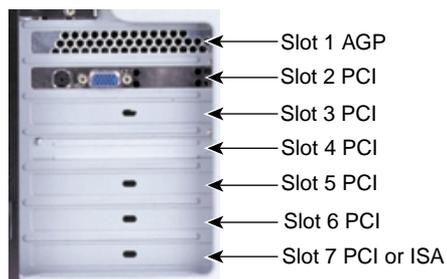


Figure 1-4 Expansion Slots

The following table describes the expansion slots and any typically installed expansion cards. Note that Slot 7 is a shared PCI/ISA slot; you can install a PCI expansion card or an ISA expansion card in this slot, but not both.

Table 1-1 Expansion Slots and Cards

Slot	Type	Typical Expansion Cards Installed
1 (Top)	AGP	Graphics controller
2	PCI (64-bit/33MHz)	Varies by system
3	PCI (64-bit/33MHz)	Varies by system
4	PCI (64-bit/33MHz)	Varies by system
5	PCI (64-bit/33MHz)	Varies by system
6	PCI (64-bit/33MHz)	Varies by system
7	PCI (64-bit/33MHz)	Varies by system
7 (Bottom)	ISA	Varies by system

Caution: If a modem card used in the system receives ground from the system, ensure the system is connected to an earth-grounded AC power outlet.

For information on installing or connecting to expansion cards, see Chapter 8, “Upgrading the System” and the expansion card documentation delivered with the system.

Connecting External SCSI Devices

The system has a dual-channel low-voltage differential (LVD) SCSI controller integrated on the system board. You can connect external Ultra, Ultra2, or Ultra3 SCSI devices to this controller through the SCSI port on the back of the base unit.



Figure 1-5 SCSI Ports on the Back of the Base Unit

Caution: On a server system, if you do not connect an external SCSI peripheral device to the SCSI port, connect a terminator module to the port.

Note: The figure below shows the possible locations for the SCSI port on the back of the base unit. Only one SCSI port is available on your system.

To ensure data integrity and promote optimum performance:

- Use the shortest cables possible to connect SCSI peripheral devices.
- Use high-quality SCSI cables to ensure adequate shielding (impedance of 110 to 135 ohms).

To connect external SCSI devices:

1. If the system is connected to AC power and operating, shut down the system and unplug the system power cord from its AC power outlet.
2. If a terminator module is connected to the SCSI port on the system, remove it.
3. Connect one end of a SCSI cable to the SCSI port on the system.
4. Connect the other end of the SCSI cable to a SCSI peripheral device.
5. Connect a SCSI cable between SCSI ports on any additional SCSI peripheral devices.
6. Set the SCSI ID of **each** peripheral device to a **unique** SCSI ID number. Do not use any SCSI ID numbers already used by the system.
7. For each SCSI peripheral device connected to the port, if the device is:
 - The last or only device on the SCSI chain, **install** or **enable** SCSI termination
 - **Not** the last or only device on the SCSI chain, **disable** or **remove** SCSI termination
8. Ensure that the power switch on each peripheral device is in the off position; then connect the power cord from each peripheral device to an AC power outlet.
9. Turn on power to all connected SCSI peripheral devices and then start the system.
10. If necessary, install software drivers and configure the peripheral devices according to the vendor's instructions.

See Chapter 8, “Upgrading the System” for additional details on installing external SCSI peripheral devices.

Connecting to AC Power

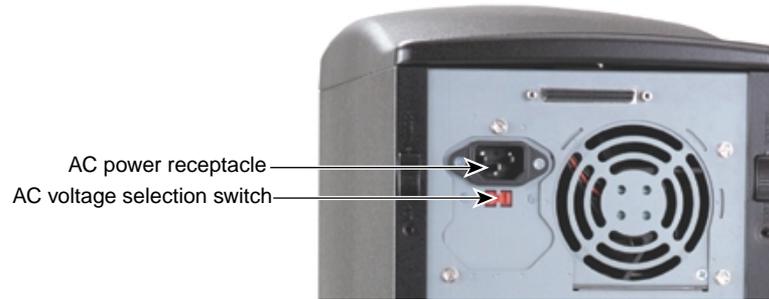


Figure 1-6 AC Power

Caution: The AC power cord for this unit is the service disconnect. To remove AC power from the system, you must unplug the system power cord from its AC power outlet.

Caution: Ensure the AC power outlet to which the system’s power cord connects is close to the system and is easily accessible.

When you connect the system’s base unit to AC power, auxiliary power is applied to the system. Auxiliary power ensures that system components power up quickly when needed. See Chapter 4, “Operating the System” for more information on controlling system power.

To connect the system to AC power:

1. Make sure the AC voltage selection switch on the power supply (on the back of the base unit) is set to the proper line voltage for your location.
 - If your location uses 90 to 135 volts, the number **115** must be visible.
 - If your location uses 180 to 264 volts, the number **230** must be visible.

Warning: If you do not set the AC voltage selection switch on the power supply correctly, equipment damage may occur when you connect the system to AC power.

2. Connect the system's power cord to the AC power receptacle on the base unit.
3. Connect the power cords from the monitor, base unit, and any external peripheral devices to properly grounded three-prong AC power outlets.

Starting the System

Caution: If you start the system, and then turn it off before completing the instructions in Chapter 2, "Setting Up the Software" you will have to reinstall the operating system and associated system software. See "What's Next?" on page 30 for more information.

Caution: Before starting the system for the first time, you may want to learn more about system power, startup, and shutdown. See Chapter 4, "Operating the System" for more information.

To start (apply full power to) the system, open the door on the front of the base unit and press the Power button.

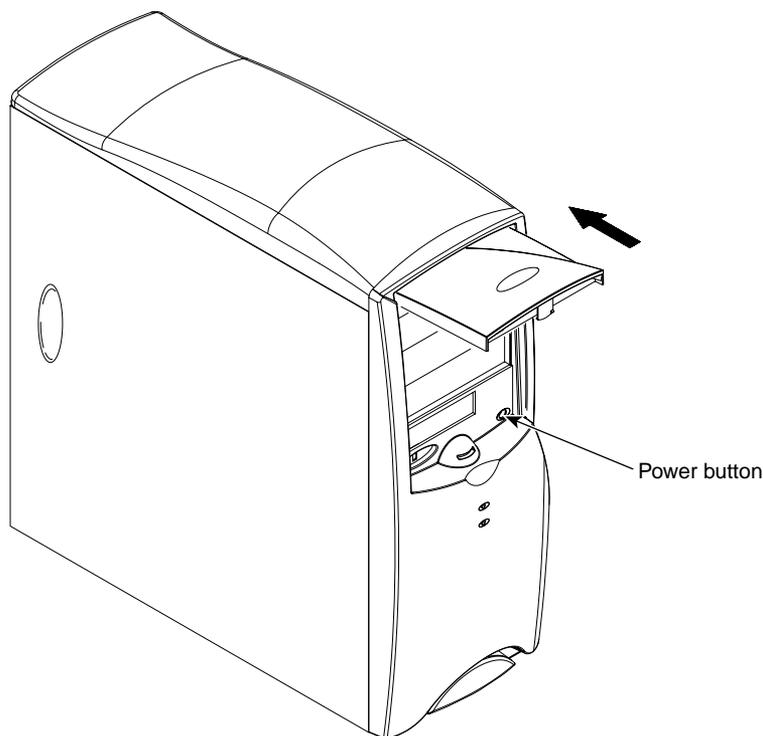


Figure 1-7 System Power Button

What's Next?

You can do the following to prepare your system for use:

- If you want to get going with the default setup, go to Chapter 2, “Setting Up the Software” to start the system and go through operating system Setup. **If you start the system and then turn it off before completing operating system Setup, you will have to reinstall the operating system and associated system software.**
- The operating system is already installed through the first phase of the Setup process. If you want to reinstall the operating system and associated system software instead of completing Setup, see Chapter 6, “Reinstalling the Operating System”.

Setting Up the Software

This chapter describes how to set up the operating system and associated system software for your system.

Preparing for Setup

Your workstation's primary hard disk drive was formatted and partitioned before shipment. In Explorer or My Computer, you can right-click a disk drive and click Properties to display the drive's partition size and file system format. If you purchased other disk drives, you may have to format and partition them for use. See the operating system documentation and Help for more information on formatting, partitioning, and administering disk drives.

The operating system and associated system software is installed on the system's primary hard disk drive. Installed system software includes:

- Driver software for the SCSI controller, graphics controller, audio controller, and mouse
- Driver software for peripheral devices and expansion cards installed at the factory
- Core networking software
- The latest certified operating system Service Pack software, if needed
- Quick-Fix Engineering (QFE) software, if needed
- System management software

The operating system is installed through the first phase of the Setup process. You must follow the Setup process to prepare the operating system for use.

Before you go through operating system Setup, have the following documents available:

- Microsoft's operating system documentation

- Documentation for the system's graphics controller and any other installed expansion cards

Get and record the following information:

Your name, and the name of your company or organization:

The Product Identification Number from Microsoft's documentation, Certificate of Authenticity, or registration card:

A user name for a user account:

If the system is connected to a network, get and record the following information for your system from your network administrator:

Computer name:

Workgroup name (if the system will be part of a workgroup):

Domain name (if the system will be part of a domain):

If the system will be a server, get and record the following information for your system from your network administrator:

Security role for your server in the domain: primary domain controller, backup domain controller, or stand-alone server:

If your server will be acting as a backup domain controller or a stand-alone server, user name and password of an authorized domain administrator account:

Note: Determine the security role for your server before beginning system configuration. You cannot change a stand-alone server to a domain controller without reinstalling the operating system. A domain controller maintains security policy and performs user

authentication for a domain. Stand-alone servers may be part of a domain, but they do not have to participate in the domain. See the operating system documentation for more information.

If the system is connected to a network that uses the Transmission Control Protocol/Internet Protocol (TCP/IP), get and record the appropriate TCP/IP information for your system from your network administrator:

Internet Protocol (IP) address: _____

IP subnet mask: _____

IP domain name for your network: _____

IP address for your network's default gateway: _____

IP addresses for Domain Name System (DNS) servers, if any: _____

IP addresses for Windows Internet Name Service (WINS) servers, if any: _____

The operating system delivery media contain software and drivers for both Reduced Instruction Set Computing (RISC)- and Intel-based systems. When installing operating system software, make sure you install it from the \i386 directory on the delivery media.

Going Through Setup

Caution: If you start the system and then turn it off before completing operating system Setup, you will have to reinstall the operating system and associated system software.

Caution: Before starting the system for the first time, you may want to learn more about system power, startup, and shutdown. See Chapter 4, "Operating the System" for this information.

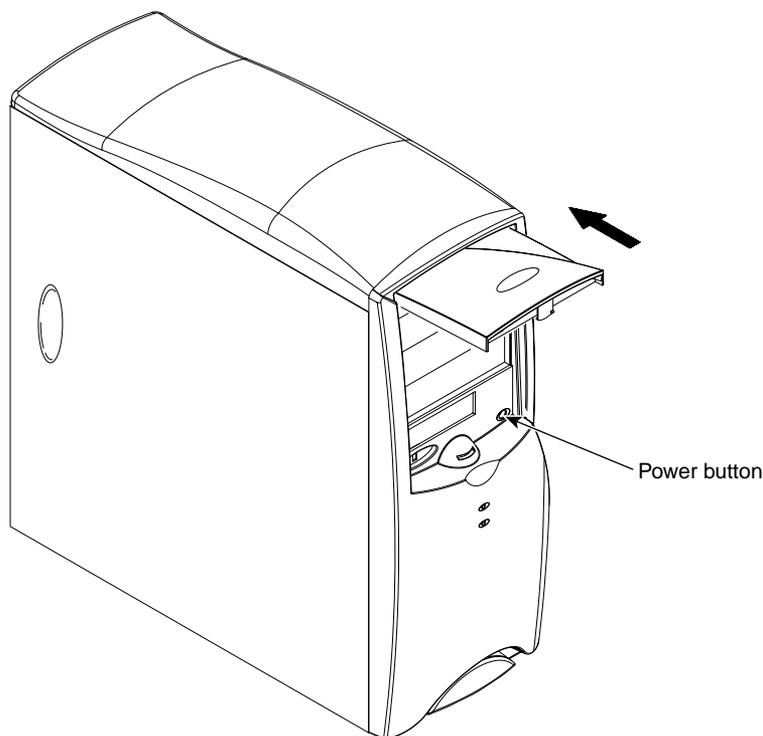


Figure 2-1 Starting the System

To start (apply full power to) the system for the first time, open the door on the front of the base unit and press the Power button.

The first time you start the system, it boots to a Microsoft End User License Agreement (EULA). After reading and accepting the terms of the agreement, follow the instructions to continue operating system Setup. Take the default settings provided by Setup, except as noted in the following text. You can set up a user account and join a workgroup or domain after you configure the system.

To start the computer and go through Setup:

1. Turn on power to the monitor.
2. Turn on power to the base unit. The system starts and the EULA displays.

3. Read the terms of the EULA and then follow the instructions displayed to complete the Setup process. When prompted, enter the Product Identification Number.

Note: You must enter the Product Identification Number before you can continue Setup. You cannot complete Setup if you do not enter this number.

When going through Setup:

- Install the SCSI controller driver software from diskette. You cannot install the SCSI controller driver from the system's driver CD.
- **Do not let Setup auto-detect the system's network controller.** After completing Setup, install the network controller driver software from diskette. See "Finishing Software Setup" on page 35 for instructions.
- If prompted to create an Emergency Repair Disk, do so.
- If prompted to enter a password for the Administrator account, do so.
- If you do not create a user account during Setup, press `enter` or select OK at the logon dialog to log on to the operating system.
- You can use the C:\i386 directory when prompted for the location of the operating system's Setup files. If you delete the i386 directory from the system's hard disk, you must have access to an operating system CD to use the operating system's Setup files.

After you complete Setup and restart the system, you can set up a user account and join a workgroup or domain if needed. See the operating system documentation and operating system Help for more information on Setup, creating a user account, and joining a workgroup or domain.

Finishing Software Setup

After completing operating system Setup, you must take some additional steps to finish setting up the system software.

Installing the Network Controller Driver

Setup completed without auto-detecting the system's network controller. To enable networking, you must manually install the network controller driver software from diskette.

The network controller driver software is in a folder on the system's driver CD. First see the `readme.txt` file for information on creating a driver diskette using the `makems.bat` program. Then see the `ms.txt` file for information on installing the driver software using Network in the operating system Control Panel. Keep the driver diskette for use if you have to reinstall the operating system.

Creating an Emergency Repair Disk

If you did not create an Emergency Repair Disk during Setup, you should do so after completing Setup and configuring the system. See the operating system documentation and Help for information on creating an Emergency Repair Disk.

You can use the files on the Emergency Repair Disk to restore the contents of the operating system registry and the standard operating system driver software. You should update the Emergency Repair Disk frequently, especially after adding or changing system hardware or software.

Installing Driver Software

Driver software (or *drivers*) for most system components and peripheral devices was installed before shipment. You received a CD with your system that contains these drivers. Keep the driver CD in case you have to reinstall the operating system or drivers later.

Because of production timing, drivers for your system may have been revised after your system shipped from the factory. You should check SGI's online services for the latest versions of your system's drivers. If a later version of a driver is available, you can download it and install it on your system; keep it on diskette in case you need to reinstall it later. See the `readme` file delivered with a driver for installation instructions.

Installing QFE Software

Quick-Fix Engineering (QFE) software contains fixes for operating system problems or limitations; these fixes are required for proper operation of your system. QFE software, when required, is delivered on the system's driver CD, and additional QFE software may be delivered on diskette. If you received QFE software with your system, it was installed before shipment. Keep the QFE software in case you have to reinstall it or the operating system later.

Because of production timing, the QFE software for your system may have been revised after your system shipped from the factory. You should check SGI's online services for the latest version of the QFE software for your system. If a later version is available, you can download it and install it on your system; keep it on diskette in case you need to reinstall it later. See the `readme` file delivered with the QFE software for installation instructions.

What's Next?

See Chapter 3, "Configuring the System" to configure the system for use.

See Chapter 4, "Operating the System" for information on operating the system.

See Chapter 6, "Reinstalling the Operating System" if you need to reinstall the operating system and associated system software.

Configuring the System

This chapter describes how to configure basic components of your system for use.

Configuring the Video Display

The first time you start the system, your monitor displays a resolution of 1024 x 768. For the system to use the installed graphics controller at other display resolutions, you must configure the video display driver as described in this section.

Go to Display in the operating system's Control Panel to configure the video display driver, or right-click an open space on the operating system desktop and click Properties in the pop-up menu. You can change the settings for color depth, desktop size, font size, refresh rate, and display type of the system's video display. You can also determine which type of graphics controller is installed on your system.

See the graphics controller documentation delivered with the system, and any README files delivered with the video display driver, for detailed configuration instructions. For more information on configuring the video display, see the operating system documentation and Help.

Resetting the Video Display Resolution

If the monitor connected to your system does not support a resolution of 1024 x 768, you can reset the video display to another resolution.

To reset the video display resolution:

1. Restart the system.
2. At the boot screen, select the VGA mode option, and then log on to the operating system.
3. Go to Display in the operating system's Control Panel.

4. Select a resolution appropriate for your system's monitor.
5. If prompted to restart the system, do so.

Changing the Default Video Display Driver

After configuring the video display and restarting the system, you may need to configure the system to use the installed video display driver by default.

To change the default video display driver:

1. Go to System in the operating system's Control Panel.
2. Under Startup/Shutdown, select the appropriate non-VGA option from the Startup list.

Correcting Initial Video Display Problems

If the system's video display is black, not synchronized, or distorted after you restart the system, you may have a video configuration problem. Do not press `CTRL+ALT+DEL` to log on. Instead, try to correct the problem by using the Last Known Good option to return the system to the last known good configuration recorded by the operating system.

To use the Last Known Good option:

1. Power down and restart the system.
2. Press the space bar when prompted to display the Last Known Good menu.

If using the Last Known Good option fails to correct the video display problems, you can obtain a functional video resolution by restarting the system in VGA mode.

To restart the system in VGA mode:

1. Power down and restart the system.
2. At the boot screen, select the VGA mode option.

After logging on in VGA mode, check for the following common problems and solutions:

- A multi-sync monitor is selected, but a graphics display device with different video timings is connected to the system. Select a different monitor type.

- The monitor selection is incorrect. Select a different monitor type.
- There is not enough video display memory to support the selected resolution and color depth. Install and reconfigure the video display to use a lower resolution and color depth.

Restart the system and, when the boot screen displays, select the appropriate non-VGA version of the operating system to use the reconfigured video display driver. If problems persist, contact the Customer Response Center for help.

Configuring System Audio

The system has a PCI audio controller integrated on the system board. The required driver software was installed before shipment.

If you connect a microphone and speakers to their ports on the I/O panel, you can use the audio mixer software to control the speaker volume, the microphone input level, and other system audio features. The audio mixer is available from the operating system's taskbar tray. You can also configure audio levels by using the operating system's Volume Control and audio control programs. The Volume Control is available from the operating system's taskbar tray.

For more information on using the audio control programs, see the operating system documentation and Help. For more information on the audio controller, see the *System Board Guide*.

Configuring Networking

The system has a 10 Mbit/100 Mbit Ethernet network controller integrated on the system board. The network controller features remote management and Wake-On-LAN capabilities. The required driver software was installed before shipment.

Before you configure networking, ensure that the system is connected to the network. Then go to Network in the operating system's Control Panel to configure networking. Follow the instructions provided to set up the system to connect to and communicate over a network. Be sure to set up the appropriate network protocols, such as TCP/IP, for the network to which you are connecting the system.

After installing network protocols, you may need to reinstall the appropriate operating system Service Pack software as recommended by Microsoft. See the Service Pack documentation delivered with the system for more information.

See the operating system documentation and Help for more information on setting up the operating system to use a network. For more information on the network controller, see the *System Board Guide*.

Configuring Peripheral Devices

If you install additional peripheral devices in the system, you will have to install and configure the associated driver software. You may also have to install or configure any associated application software to use the devices.

You can use the default backup tools provided with the operating system to run a tape drive. Go to Backup on the Administrative Tools program menu. See the operating system documentation and Help for more information.

See the documentation delivered with the peripheral devices for information on installing and configuring driver software and associated application software. See the operating system documentation and Help for information on using peripheral devices with the operating system.

Changing Drive Letters

If you have more than one hard disk drive or CD-ROM drive, you may need to reassign system drive letters. See the operating system Help for more information.

To change drive letters:

1. Exit all applications currently running on your system.
2. Go to Disk Administrator in the Administrative Tools program menu.
3. Select a hard disk drive or the CD-ROM drive.
4. From the Tools menu, click Assign Drive Letter.

Note: If you select the current drive or an otherwise locked drive, you must restart the system to complete the drive letter reassignment.

5. Select a new drive letter to assign to the drive from the list. Click OK, and then click Yes to continue.
6. If necessary, click OK, and then click Yes.
7. Repeat steps 2 through 6 for each drive letter assignment that you want to change.
8. Click Partition, then click Exit. If necessary, restart the system to complete the drive letter reassignments.

Changing Virtual Memory Settings

If you have more than one hard disk drive, you may need to change size and location of your virtual memory page file. See operating system Help for more information.

Consider the following before changing page file settings:

- The size of the page file. If your system is equipped with a large amount of RAM, Setup might create a page file that is unnecessarily large.
- Drive letter reassignments. If you reassigned your drive letters, you may find it necessary to adjust your page file settings.

To change the size and location of the virtual memory page file:

1. Go to System in the operating system's Control Panel.
2. Under Performance, click Change.
3. Click a drive letter in the list, and then type new values in the Initial Size and Maximum Size text boxes.
4. Click Set.
5. Repeat steps 3 and 4 for any additional drives in the list.
6. Click Close, and then click OK.
7. When prompted, click Yes to restart the system with the new settings, or click No to continue with other tasks and use the new settings the next time you restart the system.

Configuring the SCSI Controller

The system has a dual-channel SCSI controller integrated on the system board. Depending on your system's hardware configuration, this low-voltage differential (LVD) controller manages internal and external Ultra, Ultra2, and Ultra3 SCSI peripheral devices. You may need to use the SCSI Configuration Utility to configure the operation of SCSI peripherals connected to the controller.

You may need to change SCSI controller parameters for a single SCSI peripheral device:

- If you are advised to do so by technical support or by the vendor documentation.
- If the SCSI device does not negotiate properly with the controller.
- If you exceed the maximum cable length for connecting SCSI devices to the system. See Chapter 8, "Upgrading the System" for more information.
- If you connect non-Ultra SCSI peripheral devices to the system.

To run the SCSI Configuration Utility:

Press `ctrl+c` when prompted during system boot.

To get online help in the SCSI Configuration Utility:

Press `f1` to see information on the item currently highlighted on screen.

Creating or Updating an Emergency Repair Disk

If you did not create an Emergency Repair Disk during Setup, you should do so after completing Setup and configuring the system. See the operating system documentation and Help for information on creating an Emergency Repair Disk.

You can use the files on the Emergency Repair Disk to restore the contents of the operating system registry and the standard operating system driver software. You should update the Emergency Repair Disk frequently, especially after adding or changing system hardware or software.

Configuring the BIOS

The system's basic input/output system (BIOS) records basic system operating parameters, such as the amount of memory, the boot sequence, and the type of video display. The BIOS is stored in flash-programmable memory, and reads the system parameters in the system's complementary metal-oxide semiconductor (CMOS) memory. When you power off the system, a battery provides power to CMOS memory to retain the system parameters. Each time you power on the system, the BIOS uses these stored parameters to configure the system for operation.

The BIOS Setup program, which is also stored in flash-programmable memory, allows you to manually change the system operating parameters. You can run the BIOS Setup program as the system boots, during the system's power-on self-test (POST). For more information on the BIOS Setup program and how to use it to configure the BIOS, see the *System Board Guide*.

What's Next?

See Chapter 4, "Operating the System" for basic information on operating the system.

See Chapter 8, "Upgrading the System" if you need to reinstall the operating system and associated system software.

Operating the System

This chapter contains important, basic information on operating your system.

Opening and Closing the Door

A door on the front of the system controls access to the Power button, the floppy disk drive, the CD-ROM drive, and other front-access peripheral devices.

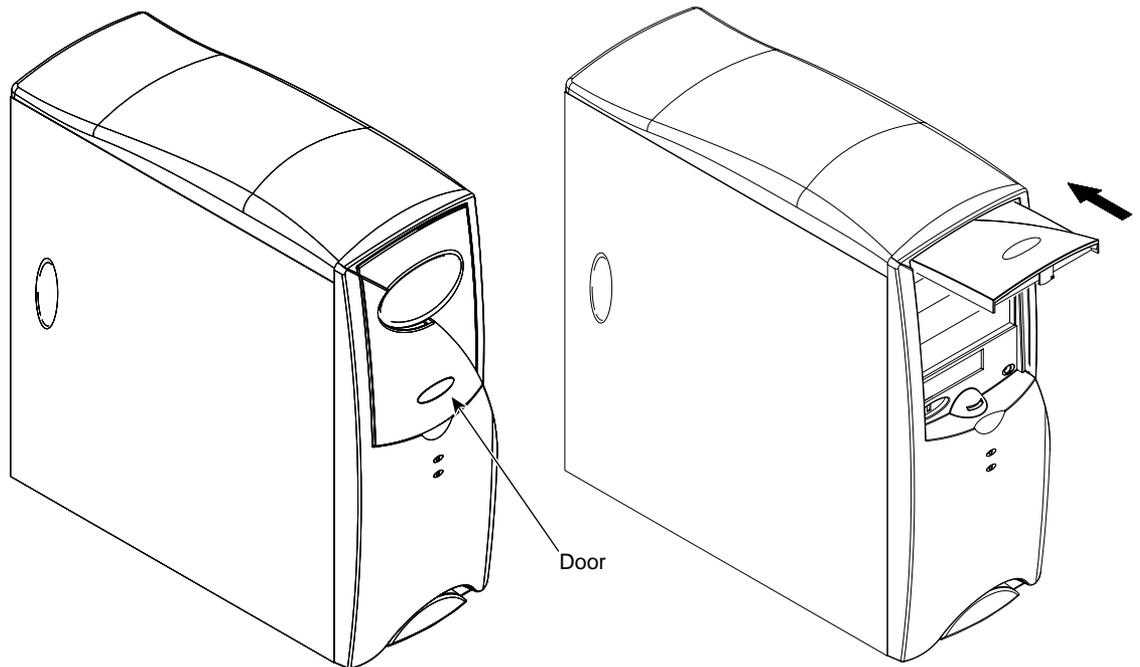


Figure 4-1 Opening and Closing the Door

To open the door:

1. Lift the bottom of the door to swing it up and away from the faceplate.
2. Push the door straight into the base unit.

To close the door:

1. Pull the door straight out of the base unit.
2. Swing the door down until it clicks into place.

Controlling System Power

Caution: The AC power cord for this unit is the service disconnect. To remove AC power from the system, you must unplug the system power cord from its AC power outlet.

When you connect the system's base unit to AC power, auxiliary power is applied to the system. Auxiliary power ensures that system components power up quickly when needed.

The Power button is a momentary contact switch, changing system states when the button is pressed. Depending on the system's current power state, you can use the Power button to start, shut down, and power down the system.

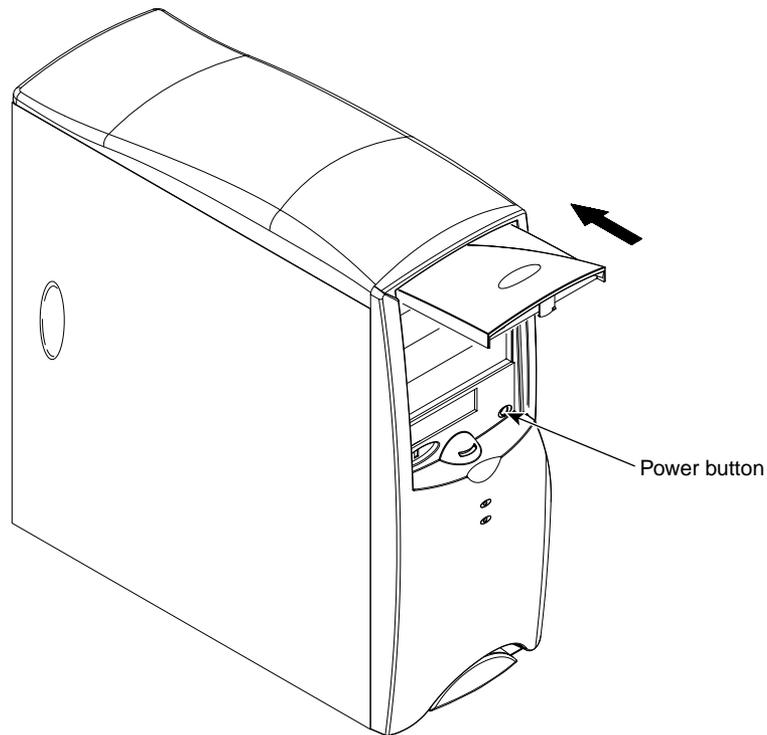


Figure 4-2 System Power Button

Caution: Shut down the operating system before powering down the system. Simply pressing the Power button can cause data corruption or loss. Use Automatic Shutdown or the operating system's shutdown options first. See this and following sections for more information

Table 4-1 The Power Button

Press the Power button...	To...
Momentarily (less than 1 second)	Bring the system to full power from a powered-down state and start the operating system
Momentarily (less than 1 second)	Start the selected automatic shutdown option.
And hold it for at least 4 seconds	Power down the system without using the selected automatic shutdown option or after using the operating system's shutdown function.

See “Using Automatic Shutdown” on page 52 for more information on controlling system power.

Reading System LEDs

The LEDs on the faceplate describe the current operational state of the system.

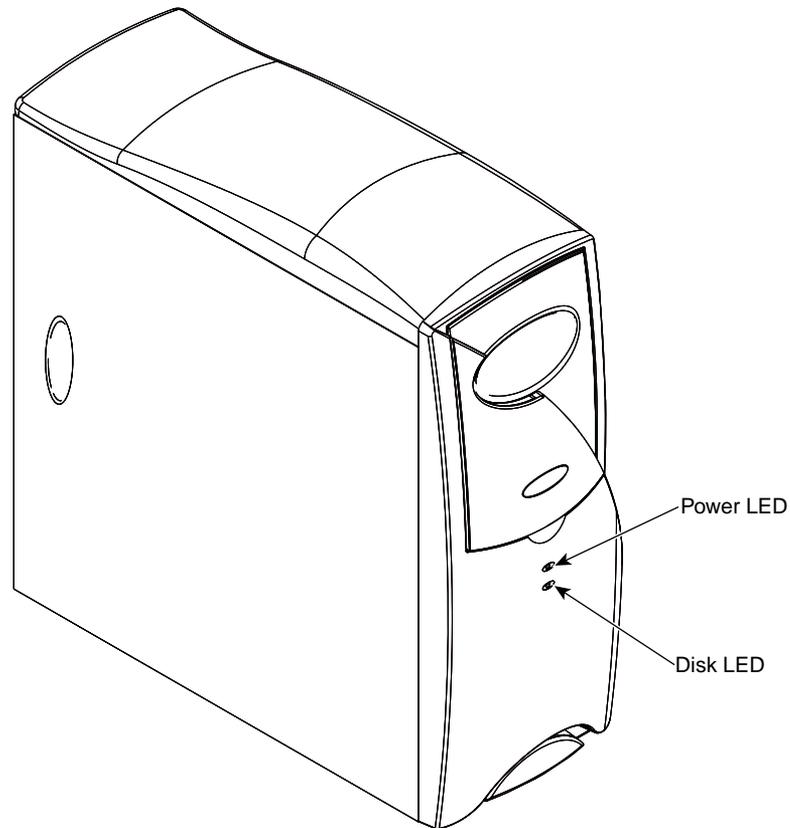


Figure 4-3 Faceplate LEDs

Table 4-2 Reading the Power LED

If the Power LED is...	Then...
Unlit	Auxiliary power is off (fans are not running) or there is a system failure (fans are running)
Amber	Auxiliary power is on; power consumption is reduced

Table 4-2 (continued) Reading the Power LED

If the Power LED is...	Then...
Blinking green	Auxiliary power is on; the system is in an ACPI-compliant power conservation state managed by the operating system; power consumption is reduced
Steady green	Full power is on; power conservation is per device

Table 4-3 Reading the Disk LED

If the Disk LED is...	Then...
Unlit	The system's disk drives are not active
Lit and blinking	The system's disk drives are active
Lit and unblinking	There may be a problem with one or more disk drives

Using Automatic Shutdown

The Shutdown Utility lets you configure various automatic shutdown options for your system. This utility provides shutdown options beyond those available from the operating system Start menu.

The Shutdown Utility displays an Automatic System Shutdown dialog. You can use this dialog to select from several automatic shutdown options. You can also use this dialog to set how long the system waits to execute the selected automatic shutdown option.

To run the Shutdown Utility:

1. From the operating system Start menu, go to Programs » Shutdown » Shutdown Program.
2. Double-click the Shutdown icon in the operating system's taskbar tray, or
3. While the system is running, press the Power button momentarily (less than 1 second).

When you run the Shutdown Utility, the Automatic System Shutdown dialog displays. To configure an automatic shutdown, select an option in the dialog and click Apply. When you have finished configuring the utility, click Start Shutdown to start an

automatic shutdown immediately. After you start the system again, the utility will use the settings you selected.

By default, an automatic shutdown is set for a 10-second delay. You can set a delay of up to 30 seconds. You should set a delay greater than 5 seconds to ensure that you have time to stop an automatic shutdown if needed.

Caution: When configuring an automatic shutdown, use Power Down the Computer to power down the system. If you use Shutdown the Computer, you must press and hold the Power button for 4 seconds to power down the system. You may “suspend” the system if you hold the Power button for less than 4 seconds. If the operating system does not support a Suspend mode, you must then power down the computer before you can restart the system.

See Shutdown Utility Help for more information on this utility.

Starting and Stopping the Operating System

To start the operating system:

1. With the system connected to AC power, press the Power button to bring it to full power.
2. At the boot menu, select the appropriate operating system option, and then press `enter`.

To log on to the operating system:

1. If the logon dialog does not display, press `ctrl+alt+delete` to display it.
2. If user accounts have been set up, type a user name and a password into the appropriate fields.
3. If appropriate, type a domain name into the appropriate field.
4. Select OK or press `enter`.

To log off, restart, shut down, or power down the system:

1. Turn the Power keyswitch right momentarily (less than 1 second). Automatic Shutdown runs and the shutdown timer begins counting down.
2. Select a shutdown option and click Start Shutdown.
3. If you chose an option that requires you to power down the system manually, you can do so when prompted that it is safe to do so.

Caution: The AC power cord for this unit is the service disconnect. To remove AC power from the system, you must unplug the system power cord from its AC power outlet.

For more information on starting and stopping the operating system, see the operating system documentation and Help.

Observing Operating Precautions

Observe the following precautions when operating the system:

- When restarting the system, use the operating system controls instead of turning the power switch off and on. Use the power switch only when instructed, or as the last alternative for restarting the system.
- Never turn off power to the base unit when the disk access LED is lit.
- After turning off power to the base unit, wait at least 30 seconds before turning the power on again. This allows the power supply to stabilize and the disk drives to stop spinning.

Using the Keyboard

The system's PS/2-compatible keyboard includes the following features:

- 104 standard keys, including special application function keys (F1 through F12), arrow keys for moving the cursor, and numeric keys in a keypad.
- Special keys for use with Windows operating systems. Pressing the left or right Windows key (on either side of the space bar) displays the operating system Start menu and Taskbar. Pressing the Application key (to the right of the space bar) displays an application-specific pop-up menu.

Your keyboard may differ from the one shown in the following figure.

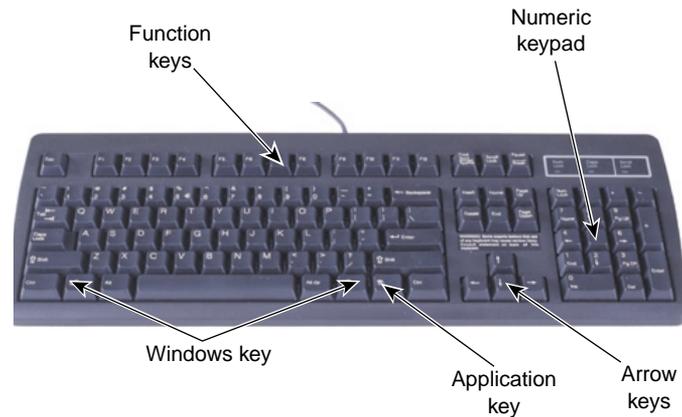


Figure 4-4 Keyboard

Some keyboard keys have special functions:

Table 4-4 Special Keyboard Functions

Key	Function
esc	Usually assigned to an application-specific function; often used to exit.
print scrn	Depending on the application in use, prints the displayed screen to a printer.
scroll lock	Prevents the screen from scrolling.
pause	Temporarily suspends screen scrolling or some operations.
caps lock	Types all letters as capitals.
num lock	Activates the numeric keypad.
ctrl	Used with another key for application-specific functions.
alt	Used with another key for application-specific functions.
delete	Deletes characters.

You can use the Windows keys with other keys to perform certain operating system functions:

Table 4-5 Key Combinations

Key Combination	Action
Windows - f1	Display a pop-up menu for the selected object
Windows - tab	Activate the next button on the taskbar
Windows - e	Run Explorer
Windows - f	Run Find Document
Windows - ctrl -f	Run Find Computer
Windows - m	Minimize all windows
shift - Windows - M	Restore all windows
Windows - r	Display the Run dialog

Using the Mouse

The system's PS/2-compatible mouse is a tracking device that controls the movement and positioning of the pointer (or cursor) displayed on the screen in a graphical display environment.

Your mouse may differ from the one shown in the following figure.

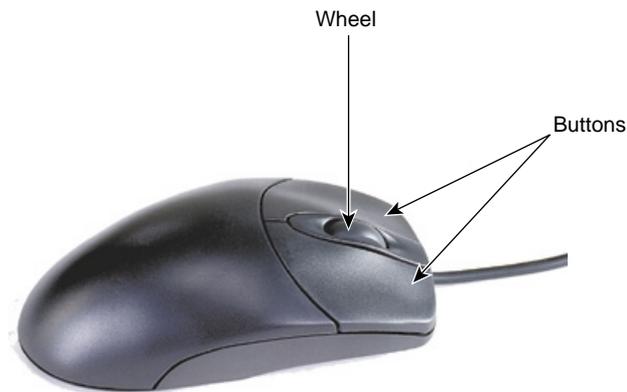


Figure 4-5 Mouse

To use the mouse, ensure it is connected to the system. Place the mouse on a clean, flat surface, such as a desktop or a mouse pad. Rest your hand on the mouse, with a finger on each button and the thumb to the side. Move the mouse across the flat surface to move the pointer on screen.

You can use the mouse to perform several actions:

Table 4-6 Mouse Actions

Action	Description
Point	Move the mouse to point to your selection on the screen.
Click	Press and release the left mouse button once.
Double-click	Press and release the left mouse button twice.
Drag	Press and hold the left mouse button, then move the mouse. Release the button when you finish dragging your selection to a new location.
Right-click	Press and release the right mouse button once.
Scroll	On a wheel mouse, move the wheel back and forth to scroll in an application.

You can find more information on using the wheel mouse by right-clicking the mouse icon in the taskbar tray, or by going to Start/Settings/Control Panel/Mouse and clicking Help in the toolbar.

Using the Floppy Disk Drive

The system's floppy disk drive occupies a 3.5-inch external peripheral device bay, and is accessible through a 3.5-inch slot on the front of the base unit. The drive accepts standard 3.5-inch 720 KB and 1.44 MB diskettes.



Figure 4-6 Floppy Disk Drive

Follow these guidelines to use the floppy disk drive:

- To insert a diskette, slide the diskette with the arrow facing up into the slot. Push the diskette in until it clicks into place and the eject button pops out.
- Before removing a diskette, ensure the drive LED is not lit.
- To remove a diskette, push the eject button and pull the diskette out of the slot.
- To protect the data on a diskette from being overwritten or erased, slide the write-protect tab on the diskette toward the diskette edge until it snaps into place.

Using the CD-ROM Drive

The system's CD-ROM drive occupies a 5.25-inch external peripheral device bay, and is accessible through a tray or a slot at the front of the base unit. The drive supports software ejection of discs and has an external amplified headphone jack.



Figure 4-7 CD-ROM Drive

To use the CD-ROM drive:

- To insert a CD, press the eject button to extend the tray. Place the disc, printed side up, in the tray and press the eject button again to retract the tray.
- To remove a CD, press the eject button, and remove the disc after the tray extends. Then press the eject button again to retract the tray.
- The media player programs included with the operating system allow you to listen to audio compact discs. Insert an audio CD, printed side up, into the drive and start the media player application. Adjust the volume using the operating system's sound control programs.
- Adjust the volume control on the drive for headphones connected to the drive.

Using System Management Software

Your system shipped with the following system management software installed:

- Hardware Monitor is an interface to instrumentation data measured by sensors inside the computer. Event information is reported to the Event Log and displayed graphically.
- DMI Console gives easy access to the system's status and configuration information. DMI Console works with the Desktop Management Interface (DMI), a technology standard that enables the effective management of computers.
- ECC Monitor monitors the system's error correcting code (ECC) memory and reports any problems.
- SMART Disk Driver (SMARTDRV) is a kernel-level driver that supports self-monitoring, analysis, and reporting technology (SMART) for disk drives.

You can find these programs by going to Programs on the operating system's Start menu. See the online Help for each program for more information on how to use it.

Learning About the Operating System

Documentation delivered with your system describes the basic functions of its operating system. Refer to this documentation if you are unfamiliar with the operating system

interface and features. You can also refer to extensive online Help; from the operating system Start menu, go to Help.

Using Hardware Security Features

The system has security features to help prevent unauthorized tampering with internal components.

- An intrusion alert switch notifies Hardware Monitor and the Windows NT Event Log if the left side panel (as viewed from the front of the base unit) is removed.
- A hasp for locking the left side panel (as viewed from the back) is available on the back of the base unit.

Cleaning System Components

Follow these guidelines for cleaning system components:

Table 4-7 Cleaning System Components

Item	How to Clean
Exterior Surfaces	Wipe exterior surfaces of the base unit and the monitor screen with a soft cloth lightly moistened with a mild cleaning agent.
Keyboard	Dust the keys and the keyboard surface with a soft, dry cloth. Use an aerosol cleaner to remove dust and debris from between the keys. Never use liquid to clean the keyboard.
Mouse	Remove the retaining ring and the tracking ball from the bottom of the mouse. Blow gently into the opening. Wipe the tracking ball and the rollers in the opening with a cotton swab moistened with alcohol. Replace the tracking ball and the retaining ring.

Troubleshooting Operational Problems

Use this chapter to identify and resolve some common basic system problems.

Getting Started

If your system is not functioning properly, first do the following:

- Verify the system's power state and ensure the system is properly connected to AC power. See Chapter 1, "Setting Up the Hardware" and Chapter 4, "Operating the System".
- Ensure the data and power cables are properly connected to any external peripheral devices.
- Ensure the data and power cables are properly connected to all internal peripheral devices.

If you cannot resolve the problem or if the instructions in the following sections direct you to do so, contact SGI for further help. Refer to the documentation delivered with various peripheral devices for troubleshooting help if there are problems these devices.

The following chapters in this document contain information and instructions that may be helpful when carrying out troubleshooting procedures and attempting to apply solutions.

System Power

Table 5-1 Fails to power on

Reason	Solution
System is not at full power (Power LED lights amber).	Press the Power button to attempt to apply full power. The Power LED lights green when the system is at full power.
System will not awaken from "suspend" state.	Verify that the Shutdown Utility (SHUTDOWN) is installed. If not, turn system power off and then on again. If so, use the Power Down the Computer option. See Chapter 4 and Chapter 6.
Power cord is not connected.	Verify the power cord is connected to the power receptacle.
Power is not available at the AC power outlet.	Verify power is available at the AC power outlet. Test the outlet with a known working device.
Internal power cables are not connected.	Open the base unit and ensure all power cables are connected.
Power cord is faulty.	Replace power cord.

System Boot

Table 5-2 Does not boot from the expected boot device

Reason	Solution
Boot sequence is not correctly set.	Change the boot sequence. See the <i>System Board Guide</i> for information on running BIOS Setup and changing the boot sequence.
Operating system is not on the system drive.	Reinstall the operating system.

Table 5-3 Series of beeps and error messages display

Message	Explanation and Solution
Refresh Failure	Bad memory refresh circuitry on the system board. Remove and reinstall DIMM(s). If error persists, replace the DIMM(s).
Parity Error	Parity error in the first 64 KB block of memory. Remove and reinstall DIMM(s). If error persists, replace DIMM(s).
Base 64 KB Memory Error	Memory failure in the first 64 KB. Remove and reinstall the DIMM(s). If error persists, replace the DIMM(s).
Timer Not Operational	Memory failure in the first 64 KB, or Timer 1 on the system board is not functioning. Contact SGI for support.
Processor Error	The CPU on the system board generated an error. Contact SGI for support.
8042 - Gate A20 Failure	The BIOS cannot switch to protected mode. Contact SGI for support.
Processor Exception Interrupt	The CPU generated an exception interrupt. Contact SGI for support.
Display Memory Read/Write Error	The sound controller is faulty. Contact SGI for support.
ROM Checksum Error	The ROM checksum value does not match the value encoded in the BIOS. Contact SGI for support.
CMOS Shutdown Register Read/Write Error	The shutdown register for CMOS RAM failed. Contact SGI for support.
Cache Error/External Cache Bad	The external cache is faulty. Contact SGI for support.

Table 5-4 Does not boot from drive A (floppy disk drive) or other expected boot device

Reason	Solution
Boot disk is corrupt or does not have the correct boot utilities.	Replace the bootable diskette with a known working diskette.
Boot sequence may be set to C, A, in which case the machine will not boot from A if there is an operating system on C.	Change the boot sequence. See the <i>System Board Guide</i> for information on running BIOS Setup and changing the boot sequence.
BIOS is corrupted.	Load a new BIOS to the system's flash memory. See the <i>System Board Guide</i> .

Table 5-5 Floppy disk drive is not recognized

Reason	Solution
BIOS is not configured properly.	Reconfigure the floppy disk drive parameters in BIOS Setup. See the <i>System Board Guide</i> for information on running BIOS Setup and changing the boot sequence.
Power cable is not connected.	Open the base unit and ensure the power cable is connected.
Data cable is not connected.	Open the base unit and ensure the data cable is connected.

Table 5-6 System hard disk drive is not recognized

Reason	Solution
Power cable is not connected.	Open the base unit and ensure the power cable is connected.
Data cable is not connected.	Open the base unit and ensure the data cable is connected.

Table 5-6 (continued) System hard disk drive is not recognized

Reason	Solution
SCSI termination is enabled on the hard disk drive you installed.	Disable SCSI termination. See the documentation delivered with the hard disk drive.
Some viruses cause the system to not recognize hard disk drives.	Run a virus scan program that checks the Master Boot Record. Clear any viruses detected by the program.

Table 5-7 CD-ROM drive is not recognized

Reason	Solution
Power cable is not connected.	Open the base unit and ensure the power cable is connected.
Data cable is not connected.	Open the base unit and ensure the data cable is connected.

Table 5-8 Total amount of memory does not display

Reason	Solution
One or more memory modules are faulty.	Identify faulty memory modules by swapping modules until the faulty one is found.
Memory modules are not properly seated in their sockets.	Reseat memory modules in their sockets.

Table 5-9 I/O Card parity error message displays

Reason	Solution
Faulty card is installed in the ISA slot.	Remove the ISA card and then restart the system.

Video

Table 5-10 System is powered on, but screen remains blank

Reason	Solution
Monitor is not powered on.	Turn on power to the monitor.
Power cord is not connected.	Verify the power cord is connected to the power receptacle.
Video cable is not properly connected.	Verify the video cable is connected to the monitor and to the system's video out connector.
Graphics card is not properly seated in its socket.	Open the base unit and reseal the graphics card.
Selected resolution is not supported by the monitor.	Select a supported resolution. See the graphics card documentation for more information.
An improper video display driver is installed.	Install a valid video display driver. See the graphics card documentation for more information.

Audio

Table 5-11 No sound can be heard

Reason	Solution
Speaker volume is low or off.	Adjust speaker volume up.
Speaker cable is not properly connected.	Verify speaker cables are connected to the system's line out port.
Volume is turned off in the software volume control or mixer program.	Open the software volume control or mixer program and turn up the volume.
Headphones are plugged into the system.	Unplug the headphones.

Network

Table 5-12 Cannot connect to other systems on LAN

Reason	Solution
Ethernet cable is disconnected.	Verify the Ethernet cable is connected. If the cable is properly connected, notify your network administrator.
Networking software is configured incorrectly.	Review the network settings in the operating system, and/or notify your network administrator.

Table 5-13 Cannot plot to network printer or plotter on LAN

Reason	Solution
Network cable is disconnected.	Verify the network cable is connected.
Printer or plotter is not added to your system.	Add the printer using the operating system tools, and/or notify your network administrator.
Plot node does not recognize your system.	Notify your network administrator.

Peripheral Drive Errors

Table 5-14 CD-ROM drive LED does not light when system power is on

Reason	Solution
Power cable or data cable is not connected.	Open the base unit and ensure the power cable and data cable are properly connected.

Table 5-15 Floppy disk drive LED does not light when system power is on

Reason	Solution
Power cable or data cable is not connected.	Open the base unit and ensure the power cable and data cable are properly connected.

Miscellaneous Hardware

Table 5-16 "Battery voltage low" message displays

Reason	Solution
Lithium battery voltage on the system board is low.	Replace the lithium battery on the system board.

Table 5-17 System loses BIOS configuration information

Reason	Solution
Lithium battery voltage on the system board is low. The system also displays a "battery voltage low" message during the system boot.	Replace the lithium battery on the system board.

Table 5-18 DMA bus timeout message displays

Reason	Solution
Failure in DMA bus logic has occurred.	Contact SGI for support.

Table 5-19 “Invalid configuration information for SLOT XX” message displays

Reason	Solution
System is not properly configured to recognize the new ISA card.	Use BIOS Setup to reserve system resources for the ISA card. See the <i>System Board Guide</i> .

Reinstalling the Operating System

This chapter provides basic instructions for reinstalling the operating system and associated system software on your system. Before you attempt to reinstall the system software, read and understand the entire chapter.

Before You Begin

Before you attempt to reinstall the operating system, have the following items available:

- Information about your system that you recorded in Chapter 2, “Setting Up the Software”.
- Microsoft’s operating system CD, Setup diskettes, and documentation
- Microsoft’s Service Pack CD (if provided)
- Your system’s driver CD, QFE diskette (if provided), and documentation
- Software diskettes, software CDs, and documentation delivered with any expansion cards or additional peripheral devices

Finding Driver Software

Your system’s driver CD contains driver software (or *drivers*) installed on the system before it shipped from the factory. Use the driver CD as the initial source for most drivers when reinstalling the operating system. (Exceptions include the network controller driver and the SCSI controller driver, which you must install from diskette.)

If updated versions of any drivers have been installed since you received the system, you should first reinstall the operating system using the default drivers from the driver CD. You can then reinstall any updated drivers after ensuring the system is operating correctly.

If a driver you want to install is not available from the driver CD, it may be available from the operating system CD. A driver from your system's driver CD is usually more current than the same driver from the operating system CD.

If expansion cards or peripheral devices have been installed since you received the system, you can get drivers from diskettes or CDs provided with these devices. See the documentation provided with these devices for installation instructions.

You can check SGI's online services for the latest versions of your system's drivers. If a later version of a driver is available, you can download it and install it on your system; keep it on diskette in case you need to reinstall it later. See the `readme` file delivered with a driver for installation instructions.

Installing the Operating System

To install the operating system, follow the instructions in the operating system documentation. See the following text for information you may need to complete operating system Setup.

Do the following **during** installation of the operating system:

- When prompted for the location of the SCSI controller driver and the network controller driver, put their driver diskettes in the system's floppy disk drive, and then direct Setup to find the driver on the diskette. You may have to select the specific folder on the diskette that contains the driver you want to install.
- When prompted for the location of other drivers, put the system's driver CD in the system's CD-ROM drive, and then direct Setup to find the driver on the CD. You may have to select the specific folder on the CD that contains the driver you want to install.
- When prompted, create an Emergency Repair Disk.

Do the following **after** installation of the operating system:

- Install any drivers that were not installed during Setup (from the driver CD, diskettes, or other software CDs). See the `readme` files delivered with these drivers for installation instructions.
- Be sure to reinstall the Shutdown Utility from the driver CD. If you do not, pressing the system's Power button momentarily will put the system in a "suspend" state

from which it may not awaken. You will have to turn system power off and on to return to normal operation.

- Configure the system as described in Chapter 3, “Configuring the System”.
- If your system was running an operating system Service Pack, install this software **after** installing drivers and other system software, and **after** installing application software products.

Do the following **after** you install Service Pack software:

- If you have QFE software for your system, or have downloaded an updated version of the QFE software for your system, install the QFE software. QFE software, when required, is delivered on the system’s driver CD, and additional QFE software may be delivered on diskette. See the `readme` file delivered with the QFE software for installation instructions.
- On a system with Pentium III processors, install Intel’s Streaming SIMD Extension Driver, delivered on your system’s driver CD or as part of the latest Windows NT Service Pack software. This driver increases system performance for drivers and applications designed to take advantage of it. See the `README` file delivered with the driver for more information.

Updating the Operating System

Microsoft Service Packs and Service Releases contain the latest improvements and system fixes for Microsoft operating systems. Service Packs and Releases are created by Microsoft for post-release support. You can obtain them from Microsoft’s online services free of charge.

Caution: If a Service Pack is posted to SGI’s online services, it has been certified for use as described in the announcement of its availability. If you obtain a Service Pack from any other source, be aware that it may not be certified against your hardware.

Gaining Access to System Components

This chapter describes how to gain access to major internal components so you can upgrade and service your system.

Warning: This is a user-serviceable system. Service and upgrade tasks should be performed by users who can follow instructions in a manual to service equipment, and can do so without harm to themselves or damage to the equipment.

Before You Begin

Warning: The system is always on when connected to AC power. Before opening the system, disconnect the system's power cord from its AC power outlet.

Warning: Internal components may be at high temperatures. Allow time for them to cool before handling them.

Warning: Internal components can be damaged by static electricity. Use an antistatic wrist strap connected to the bare metal of the system's chassis to protect against electrostatic discharge.

Note: "Right side" and "left side" are as seen from the **front** of the system.

Avoiding Electrostatic Discharge

Sensitive components inside the base unit can be damaged by static electricity. To protect against electrostatic discharge, take the following precautions:

- Disconnect the base unit from AC power before opening the base unit.
- Touch the bare metal of the base unit chassis before touching any internal components.
- Handle all printed circuit boards as little as possible and only by the edges. Do not touch any gold contacts on a circuit board.
- Leave new parts in their protective packaging until you install them.
- Use a disposable or reusable antistatic wrist strap when servicing or upgrading the system. Once you use a disposable wrist strap, you cannot use it again.
- Attach an antistatic wrist strap to any bare metal part of the base unit chassis. The metal conductor in the elastic sleeve of a reusable antistatic strap must contact bare skin.

Removing and Replacing Side Panels

Warning: The system is always on when connected to AC power. Before opening the system, disconnect the system's power cord from its AC power outlet.

Warning: Replace both side panels before operating the system. This ensures proper airflow for cooling and reduces electromagnetic interference (EMI) emissions.

Note: You can gain access to most internal components by removing the left side panel.

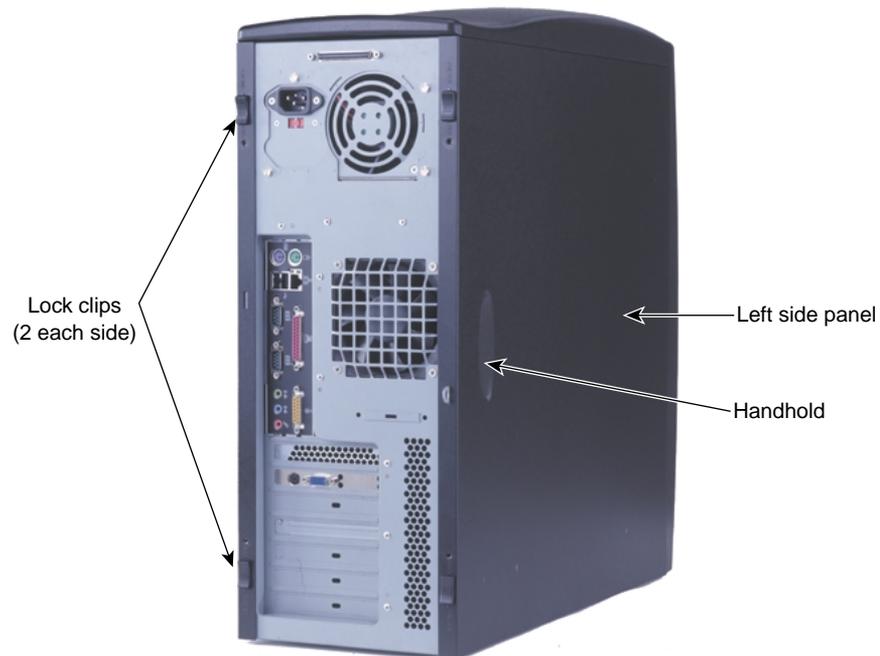


Figure 7-1 Side Panels

To remove a side panel:

1. Remove the two screws (near the lock clips) that secured the panel to the chassis during shipment.
2. Slide both lock clips on the panel away from each other (UNLOCK).
3. Grasp the handhold on the panel, and pull the panel back and away from the chassis.

To replace a side panel:

1. Ensure both lock clips on the panel are in the UNLOCK position.
2. Replace the panel onto the base unit, aligning the tabs on the inside of the panel with the openings at the top and bottom of the chassis, and push the panel forward until it slides into place against the faceplate.
3. Slide both lock clips toward each other (LOCK). You do not need to replace the shipping screws.

Removing and Replacing the Faceplate

Warning: The system is always on when connected to AC power. Before removing the faceplate, disconnect the system's power cord from its AC power outlet.

Warning: Replace the faceplate before operating the system. This ensures proper airflow for cooling.

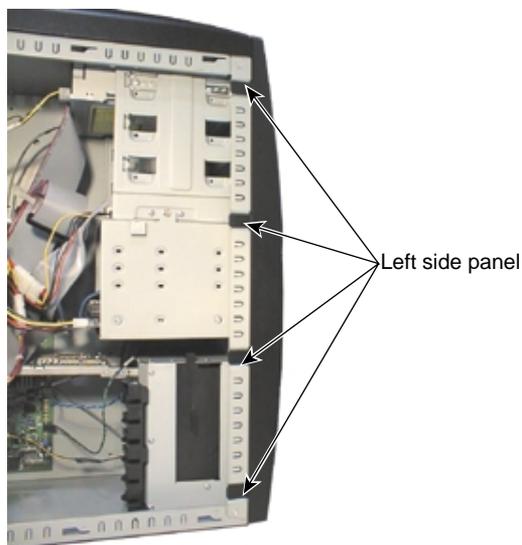


Figure 7-2 Faceplate Tabs

To remove the faceplate:

1. Open the door and stow it in the base unit. You cannot remove the faceplate if the door is closed. See Chapter 4, “Operating the System”.
2. Remove both side panels. See “Opening and Closing the Base Unit” in this chapter.
3. Gently pry and release each of the tabs connecting the faceplate to both sides of the chassis.

Caution: Release the tabs with care. Do not apply more pressure than necessary.

4. Gently pull the faceplate away from the chassis.

To replace the faceplate:

1. Align the tabs on the faceplate with the tab notches and the power switch mounted to the chassis.
2. Gently push the faceplate onto the chassis until all tabs engage.

Caution: Engage the tabs with care. Do not apply more pressure than necessary.

System Components

The following figure shows the system's major components.

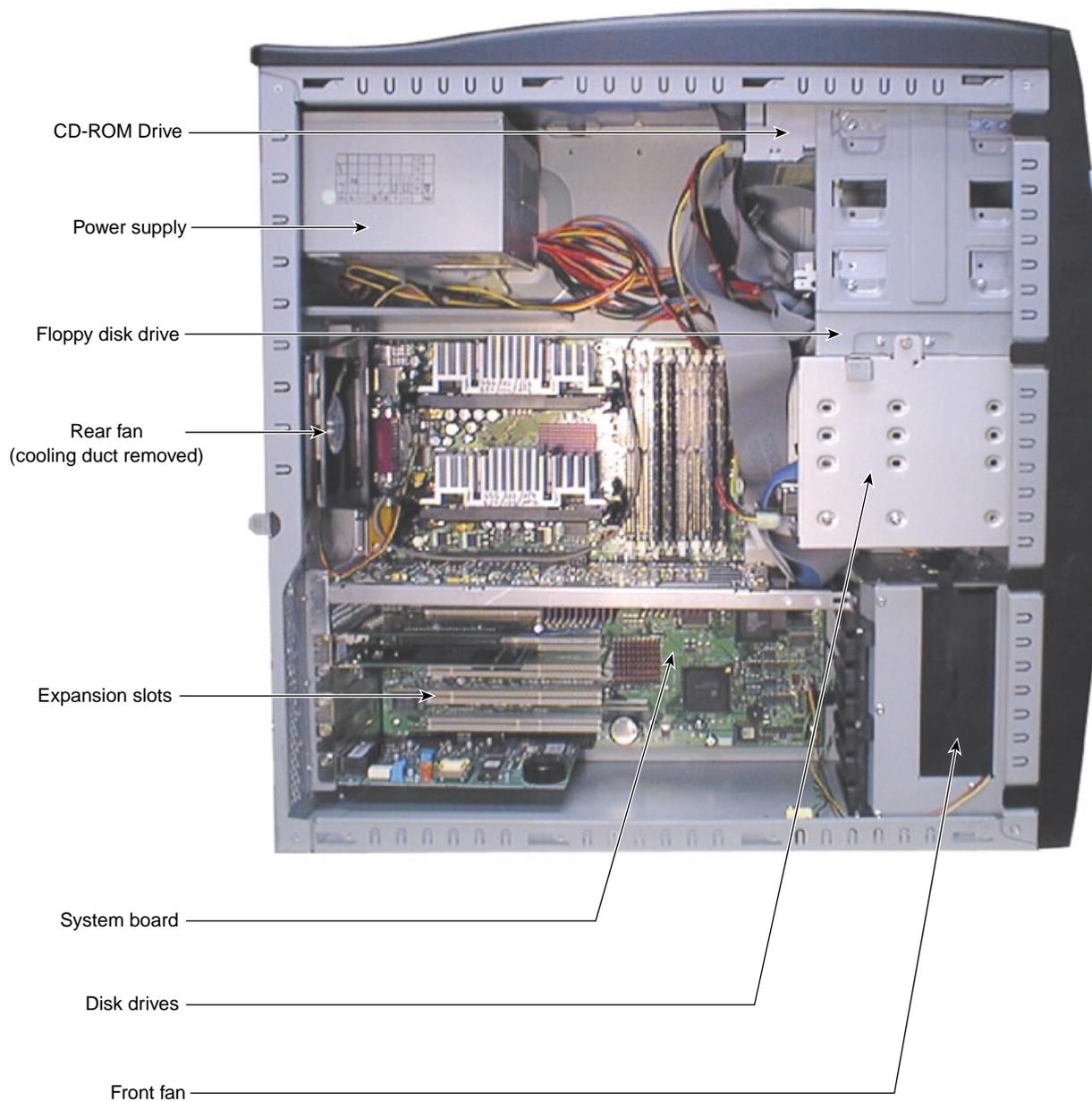


Figure 7-3 System Components

Upgrading the System

This chapter describes how to upgrade your system by adding or replacing system components.

Warning: This is a user-serviceable system. Service and upgrade tasks should be performed by users who can follow instructions in a manual to service equipment, and can do so without harm to themselves or damage to the equipment.

Before You Begin

Warning: The system is always on when connected to AC power. Before opening the system, disconnect the system's power cord from its AC power outlet.

Warning: Internal components may be at high temperatures. Allow time for them to cool before handling them.

Warning: Internal components can be damaged by static electricity. Use an antistatic wrist strap connected to the bare metal of the system's chassis to protect against electrostatic discharge.

Note: "Right side" and "left side" are as seen from the front of the system.

See Chapter 7, "Gaining Access to System Components" for details on opening the system and protecting against electrostatic discharge.

The procedures in this chapter assume you have already removed the left side panel from the system.

Adding Expansion Cards

You can install Accelerated Graphics Port (AGP), Peripheral Component Interconnect (PCI), non-compliant PCI, Industry Standard Architecture (ISA), and Plug-n-Play (PnP) expansion cards in the system. See below for a general description of these types of cards.

- AGP cards are graphics controllers that use the dedicated AGP interface for graphics acceleration. AGP cards contain configuration registers that define resource information to the system during startup. AGP cards do not require manual system configuration when installing the card. The system's BIOS detects the board's presence during startup and reads information from the board's configuration registers to assign the necessary system resources.
- PCI cards contain configuration registers that define resource information to the system during startup. PCI cards do not require manual system configuration when installing the card. The system's BIOS detects the board's presence during startup and reads information from the board's configuration registers to assign the necessary system resources.
- Non-compliant PCI cards do not contain configuration registers that allow the system to automatically assign the necessary resources. These cards install in PCI slots, but you must configure the system's BIOS to assign system resources before installing the card.
- Non-PnP ISA cards do not contain registers that define the resource information to the system during startup. Therefore, you must configure the system's BIOS to define the card to the system before installing the ISA card. This reserves system resources for the card.
- PnP cards are ISA cards that contain configuration registers like PCI cards. During startup, the system's BIOS automatically detects the installed card and assigns the necessary system resources. Since a PnP card is ISA-based, you install it in an ISA slot.

Note: Assign system resources for any non-PnP ISA card and any non-compliant PCI cards before installation. See "Assigning System Resources" on page 85".

Each installed PCI card must draw less than 25 watts of power. The total allowable maximum wattage for PCI cards is 150 watts. The PCI slots are limited to 25 watts power dissipation per the *Peripheral Component Interconnect Specification 2.1*.

Identifying Expansion Card Slots

The system board has seven expansion card slots, located at the lower-left corner of the system board. Slot 7 is a shared slot; you can install a PCI card or an ISA card in this slot, but not both.

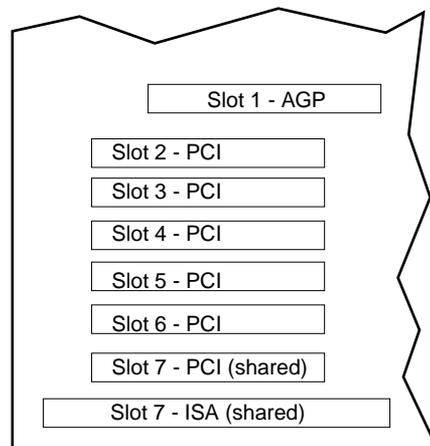


Figure 8-1 Expansion Card Slots

Note the following:

- Slot 1 is for AGP Pro expansion cards.
- Slots 2, 3, 4, and 7 are for 33 MHz (5 V or Universal) PCI expansion cards.
- Slots 5 and 6 are for 66 MHz (3.3 V or Universal) PCI expansion cards. These slots can be used for 33 MHz PCI expansion cards if needed.
- Slot 7 is a shared PCI/ISA slot. This slot can hold either an ISA expansion card or a 33 MHz (5 V or Universal) PCI expansion card.

See the *System Board Guide* for detailed information on the system board's expansion slots.

Installing an Expansion Card

See the documentation that came with the card for details on installation, configuration, cable connections, and operation.

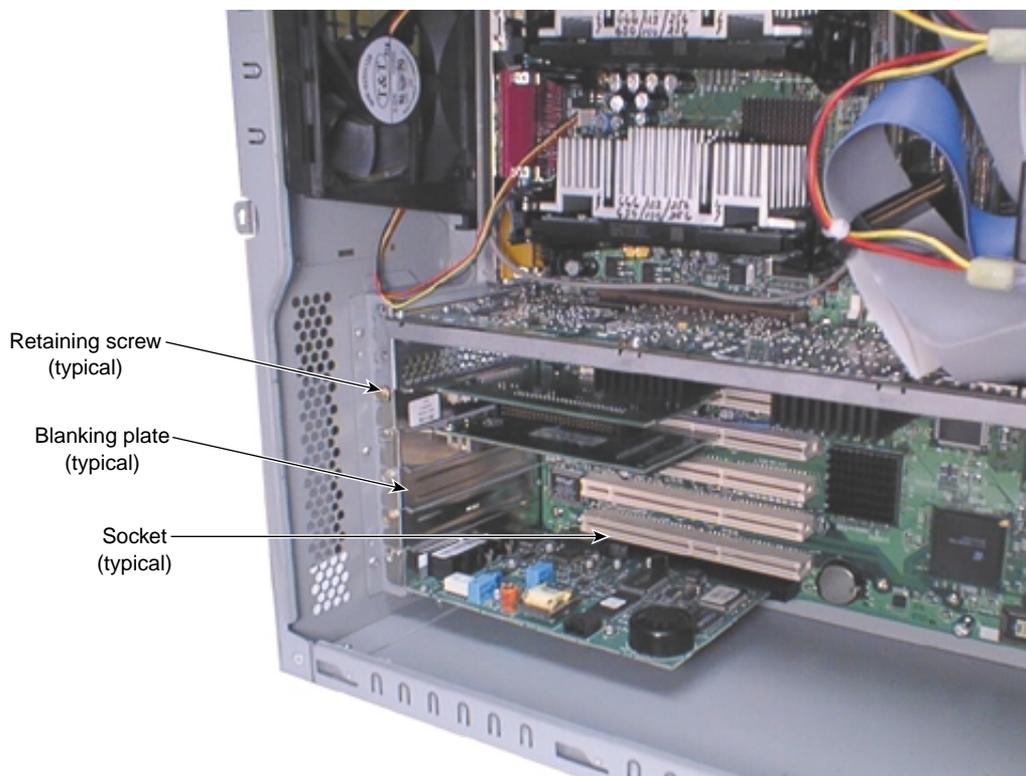


Figure 8-2 Installing an Expansion Card

To install an expansion card:

Warning: The system is always on when connected to AC power. Before performing this task, disconnect the system's power cord from its AC power outlet.

1. Remove the blanking plate from an open slot on the back of the base unit. If there are no open slots and you want to replace an existing expansion card, see Chapter 9, “Servicing the System” for instructions.

Caution: Spare blanking plates are included with the system. Cover an open slot with a blanking plate to ensure proper airflow for cooling and to reduce electromagnetic interference (EMI) emissions.

2. Slide the expansion card carefully into the card guides. Ensure that the connectors on the board’s edge are aligned properly with the socket.
3. Push the card into the socket firmly and evenly until it is fully seated.
4. Secure the card to the card guide with a retaining screw (6-32 x 0.25 hex head).
5. Attach any required cables to internal or external connectors.

Assigning System Resources

Some expansion cards include a configuration diskette that you can use to reserve the system resources required for the card. Other expansion cards do not include a diskette, but require that you manually program the BIOS with the configuration information.

See the *System Board Guide* for details on using BIOS Setup to assign system resources and configure the BIOS for expansion cards.

Disabling On-Board Controllers

You may need to disable the on-board audio, networking, or SCSI controllers to use an expansion card for these functions. You can disable these on-board functions using the BIOS Setup program.

See the *System Board Guide* for details on using BIOS Setup to disable the on-board controllers.

Adding External SCSI Peripheral Devices

The system has a dual-channel low-voltage differential (LVD) SCSI controller integrated on the system board. Depending on your system configuration, you can connect Ultra, Ultra2, or Ultra3 SCSI peripheral devices to the SCSI port on the back of the base unit, and these devices will operate at their respective transfer rates. The SCSI port connects to Channel A of the SCSI controller. See Chapter 1, “Setting Up the Hardware” to locate the SCSI port.

Caution: On a server system, if you do not connect an external SCSI peripheral device to the SCSI port, connect a terminator module to the port.

Choosing SCSI Cables

For each SCSI bus, the type of bus and the data clock speed of the fastest device on that bus determines its maximum length. Knowing this, you can determine the maximum cable length you can use to connect external SCSI devices to the system.

The following table provides a guide to maximum SCSI bus length. Note that bus width (for example, Narrow versus Wide) does not affect the maximum bus length.

Table 8-1 Maximum SCSI bus length

SCSI Bus	Single-Ended Bus	Differential Bus	LVD Bus
Ultra (8 bits, 20 MB/sec)	4.9 ft / 1.5 m	39.4 ft / 12 m	39.4 ft / 12 m
Wide Ultra (16 bits, 40 MB/sec)	Not recommended	Not specified	39.4 ft / 12 m
Ultra2 (16 bits, 80 MB/sec)	Not recommended	Not specified	39.4 ft / 12 m
Ultra3 (16 bits, 160 MB/sec)	Not recommended	Not specified	39.4 ft / 12 m

The total cable length on the system’s SCSI bus is the sum of the following:

- SCSI cable for the internal-access bays – 31 inches (0.7 meters).
- SCSI cable for the external SCSI port – 17 inches (0.4 meters)
- SCSI internal/external cable (replaces the external SCSI port cable) – 34 inches (0.8 meters)

- SCSI cable between the system and the first external device
- SCSI cables between additional external devices
- SCSI cable inside each device connected to the cable – typically 8 inches (0.2 meters) or less

To ensure data integrity and optimum performance, do the following:

- Use the shortest cables possible to connect SCSI devices to the system and to each other.
- Use high-quality SCSI cables to ensure adequate shielding (impedance of 110 to 135 ohms).

Caution: When handling cables, flex them as little as possible. Ensure that cables do not contact sharp metal surfaces or become excessively bent or twisted. In particular, SCSI cables should not have any creased bends.

Choosing SCSI IDs

To determine the ID of each SCSI device on the system, restart the system. When the BIOS screen displays, look for a list of SCSI devices and write down the ID for each device.

By default, some SCSI IDs are already used by system devices:

- The primary system disk drive uses SCSI ID 0
- The SCSI controller uses SCSI ID 7

See the vendor documentation for details on setting a device's SCSI ID.

Terminating SCSI Devices

If the SCSI port is located below the rear fan (standard), the external SCSI bus is not terminated. When you connect SCSI devices to the port, terminate the last device connected to the port.

If the SCSI port is located above the power supply (optional), the system shipped with a terminator module connected to the port. Remove the terminator module to connect SCSI devices to the port.

When connecting devices to the SCSI port:

- **Enable** termination on the last external device on the SCSI cable chain. Use an active terminator.
- **Disable** termination on all other external devices on the SCSI cable chain.

Connecting SCSI Devices

To connect external SCSI devices:

1. If the system is connected to AC power and operating, shut down the system and unplug the system power cord from its AC power outlet.
2. If a terminator module is connected to the SCSI port on the system, remove it.
3. Connect one end of a SCSI cable to the SCSI port on the system.
4. Connect the other end of the SCSI cable to a SCSI peripheral device.
5. Connect a SCSI cable between SCSI ports on any additional SCSI peripheral devices.
6. Set the SCSI ID of **each** peripheral device to a **unique** SCSI ID number. Do not use any SCSI ID numbers already used by the system on that port or channel.
7. For each SCSI peripheral device connected to the port, if the device is:
 - The last or only device on the SCSI chain, **enable** SCSI termination
 - **Not** the last or only device on the SCSI chain, **disable** or **remove** SCSI termination
8. Ensure that the power switch on each peripheral device is in the off position; then connect the power cord from each peripheral device to an AC power outlet.
9. Turn on power to all connected SCSI peripheral devices, and then start the system.
10. If necessary, install software drivers and configure the peripheral devices according to the vendor's instructions.

Changing SCSI Controller or Device Settings

You may need to use the SCSI Configuration Utility to configure the operation of SCSI peripheral devices connected to the integrated SCSI controller. This utility enables you to configure SCSI controller, perform a low-level format on a SCSI hard disk drive, select boot order, and verify media.

You may need to change SCSI controller parameters for a device under the following conditions:

- If you are advised to do so by technical support or instructed to do so by the vendor documentation supplied with the SCSI device.
- If the SCSI device does not negotiate properly with the controller.
- If you exceed the recommended total cable length for connecting SCSI devices to the system.
- If you connect non-Ultra SCSI external devices to the system.

For information on using the SCSI Configuration Utility, see Chapter 3, “Configuring the System”.

Adding Internal Peripheral Devices

A CD-ROM drive, a floppy disk drive, and the primary system disk drive are installed in bays at the front of the base unit chassis. You can add EIDE and SCSI devices to the front-access bays, and SCSI disk drives to the internal-access bays.

A total of four front-access device bays are available in the front-access device cage. The CD-ROM drive and the floppy disk drive occupy two of these bays. A total of three internal-access device bays are available in the internal-access device cage. The primary system disk drive occupies one of these bays.

The following table describes the devices in the peripheral device bays:

Table 8-2 Peripheral Device Bays

Location	Access	Device	Device Size	Bus
Bay 1 (top)	External	CD-ROM drive	5.25 in x 1.6 in	EIDE (Master)
Bay 2	External	EIDE/SCSI device	5.25 in x 1.6 in	EIDE (Either)
Bay 3	External	EIDE/SCSI device	5.25 in x 1.6 in	EIDE (Either)
Bay 4	External	Floppy disk drive	3.5 in x 1.0 in	N/A
Bay 5 *	Internal	Disk drive	3.5 in x 1.0 in *	SCSI
Bay 6 *	Internal	Disk drive	3.5 in x 1.0 in *	SCSI
Bay 7 (bottom) *	Internal	System disk drive	3.5 in x 1.0 in *	SCSI

* Two 3.5-inch x 1.6-inch devices can be installed in bays 5, 6, and 7

The EIDE controller on the system board manages internal EIDE peripheral devices. Two EIDE devices can connect to each of the primary and secondary EIDE channels. The CD-ROM drive connects to the primary EIDE channel as a master device. The cable for the CD-ROM drive can connect to a second (slave) device in one of the front-access device bays. A second cable delivered with the system is available to connect two front-access EIDE devices to the secondary EIDE channel.

A dual-channel low-voltage differential (LVD) SCSI controller on the system board manages internal and external SCSI peripheral devices. SCSI disk drives in the internal-access bays connect to SCSI Channel B. The cable to the SCSI port connects to SCSI Channel A. On some systems, the cable to the SCSI port may also connect to SCSI peripheral devices in the front-access bays (with an optional internal/external cable). Ultra, Ultra2, and Ultra3 SCSI peripheral devices operate at their respective transfer rates.

See the following figure to locate the peripheral device bays.

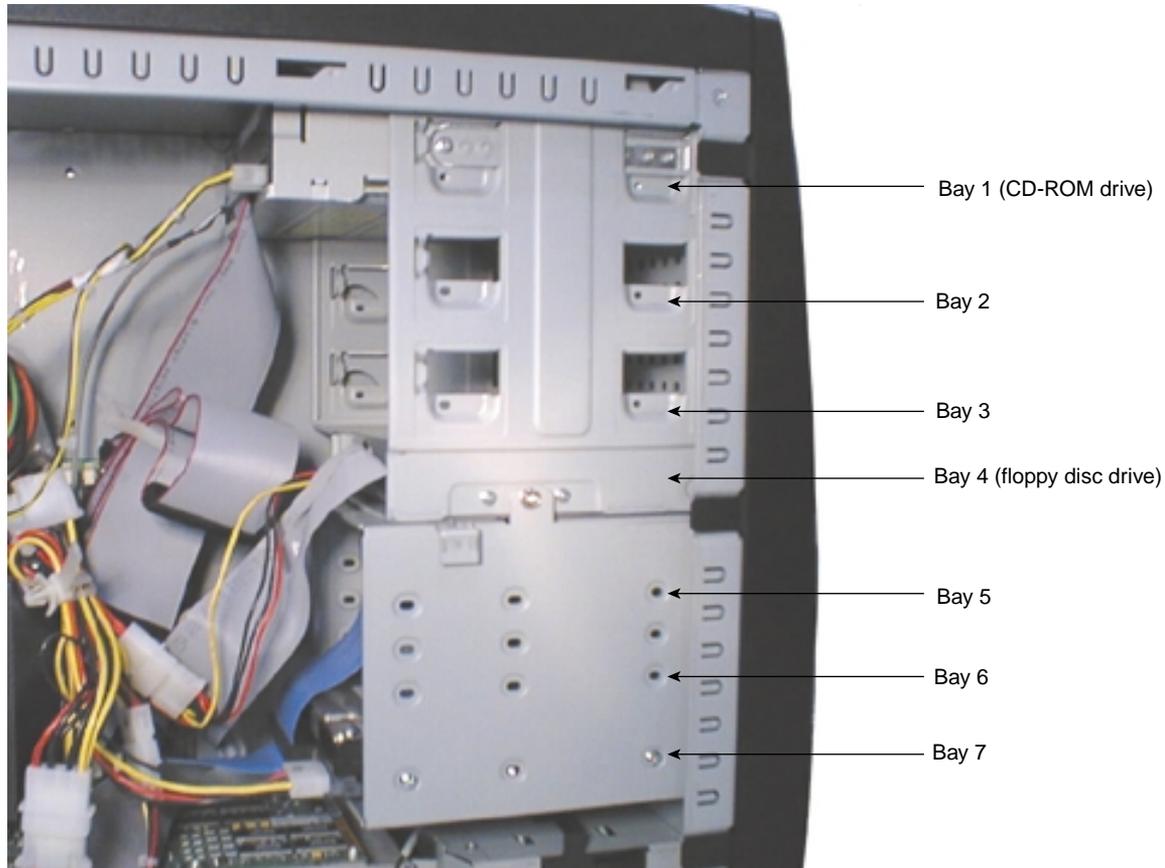


Figure 8-3 Peripheral Device Bays

For more information:

- On how to replace or add an internal peripheral device, see Chapter 9, “Servicing the System”.
- On internal cabling for peripheral devices, see Chapter 10, “System Hardware and Specifications”.
- On SCSI IDs, termination, buses, and the SCSI controller, see “Adding External SCSI Peripheral Devices” on page 86 in this chapter.
- On device power and data connections to the system board, see the *System Board Guide*.

Have the vendor's documentation available to follow instructions for setting the SCSI ID, enabling or disabling termination, installing device drivers when required, and configuring other drive attributes.

If you are installing a internal peripheral device that connects to an expansion card, see the vendor's documentation for installing the expansion card and required cables. See "Adding Expansion Cards" on page 82 for details.

Adding Memory

You can add system memory by installing or replacing dual inline memory modules (DIMMs) in the system board's DIMM sockets. For more information:

- On how to add or replace a DIMM, see Chapter 9, "Servicing the System".
- On DIMMs, DIMM socket locations, and system memory configurations, see the *System Board Guide*.

Upgrading Processors

You can upgrade a single-processor system by installing another processor. As higher-speed processors become available, you can upgrade one- or two-processor systems by replacing the existing processors with faster processors. For more information:

- On how to add or replace a processor, see Chapter 9, "Servicing the System"
- On processors and processor socket locations, see the *System Board Guide*.

Servicing the System

This chapter describes how to replace the major components of your system.

Warning: This is a user-serviceable system. Service and upgrade tasks should be performed by users who can follow instructions in a manual to service equipment, and can do so without harm to themselves or damage to the equipment.

Before You Begin

Warning: The system is always on when connected to AC power. Before opening the system, disconnect the system's power cord from its AC power outlet.

Warning: Internal components may be at high temperatures. Allow time for them to cool before handling them.

Warning: Internal components can be damaged by static electricity. Use an antistatic wrist strap connected to the bare metal of the system's chassis to protect against electrostatic discharge.

Note: "Right side" and "left side" are as seen from the front of the system.

See Chapter 7, "Gaining Access to System Components" for details on opening the system and protecting against electrostatic discharge.

The procedures in this chapter assume you have already removed the left side panel from the system.

Floppy Disk Drive

The floppy disk drive occupies the lowest front-access device bay.

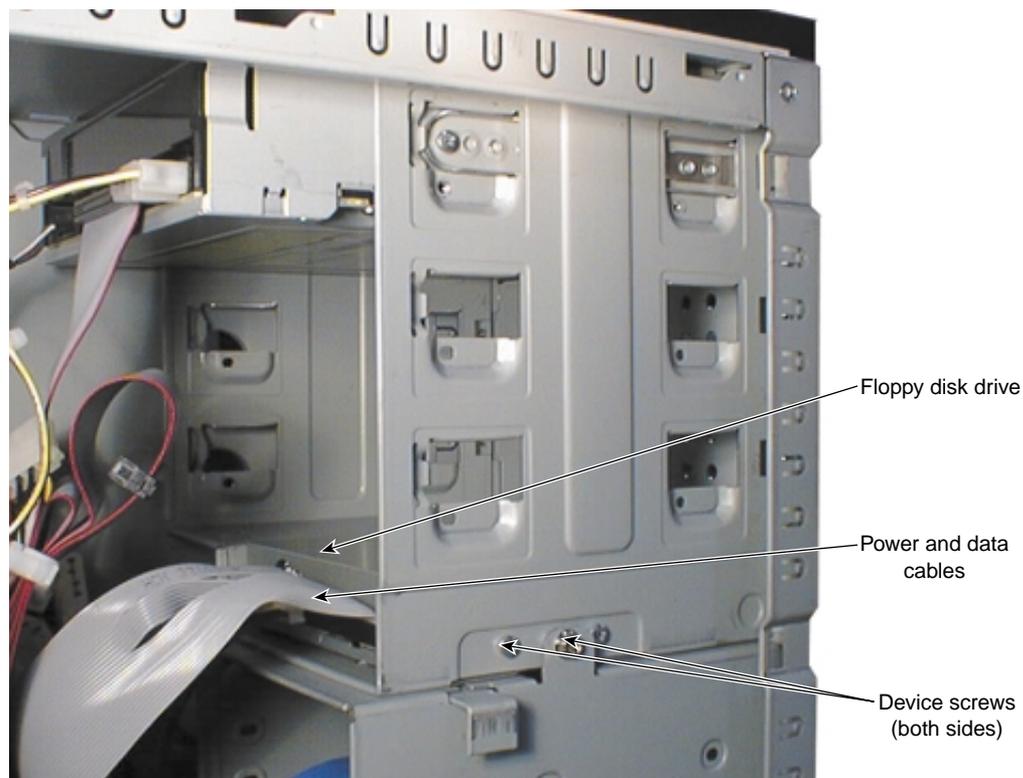


Figure 9-1 Replacing the Floppy Disk Drive

To replace the floppy disk drive:

Warning: The system is always on when connected to AC power. Before performing this task, disconnect the system's power cord from its AC power outlet.

1. Disconnect the power and data cables from the drive.
2. Remove and retain the screws securing the floppy disk drive to its bay (left side only).
3. Slide the drive out the front of the base unit chassis.
4. Slide the new drive into the base unit chassis from the front.
5. Connect the data and power cables to the new drive.
6. Secure the new drive to its bay with the screws removed previously.

Front-Access Peripheral Device

Three 5.25-inch x 1.6-inch peripheral devices may be installed in front-access device bays. Peripheral devices in these bays are accessible from the front of the system. The CD-ROM drive occupies the topmost front-access device bay. Other front-access devices can include Zip or Jaz drives, tape drives, and CD-Recorder (CD-R) drives.

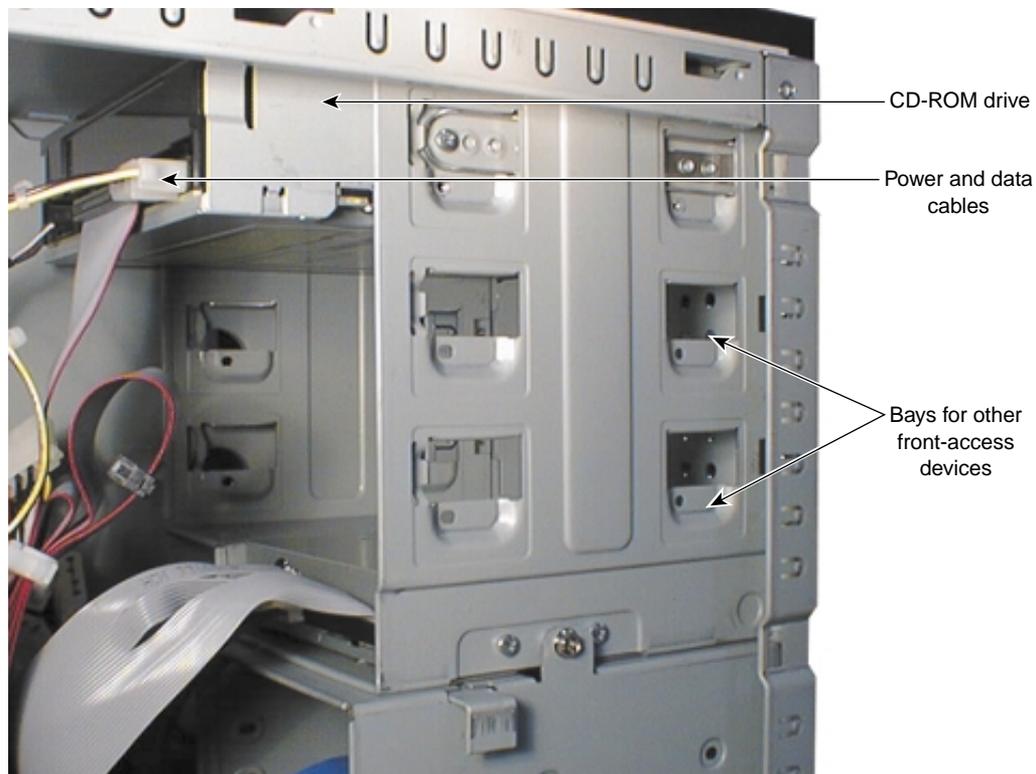


Figure 9-2 Front-Access Peripheral Device Bays

To add or replace a front-access peripheral device:

Warning: The system is always on when connected to AC power. Before performing this task, disconnect the system's power cord from its AC power outlet.

Warning: The CD-ROM drive contains a laser and is classified as a Class 1 Laser Product. To prevent direct exposure to the laser beam and to avoid hazardous radiation exposure, do not try to open the CD-ROM drive enclosure. Return the drive to the manufacturer for repair.

1. Remove the faceplate. See Chapter 7, “Gaining Access to System Components”.
2. If adding a front-access device, remove the plastic blank from the faceplate and the metal blank from the base unit chassis that cover the opening for the device.
3. If replacing a front-access device, disconnect the power and data cables from the device.

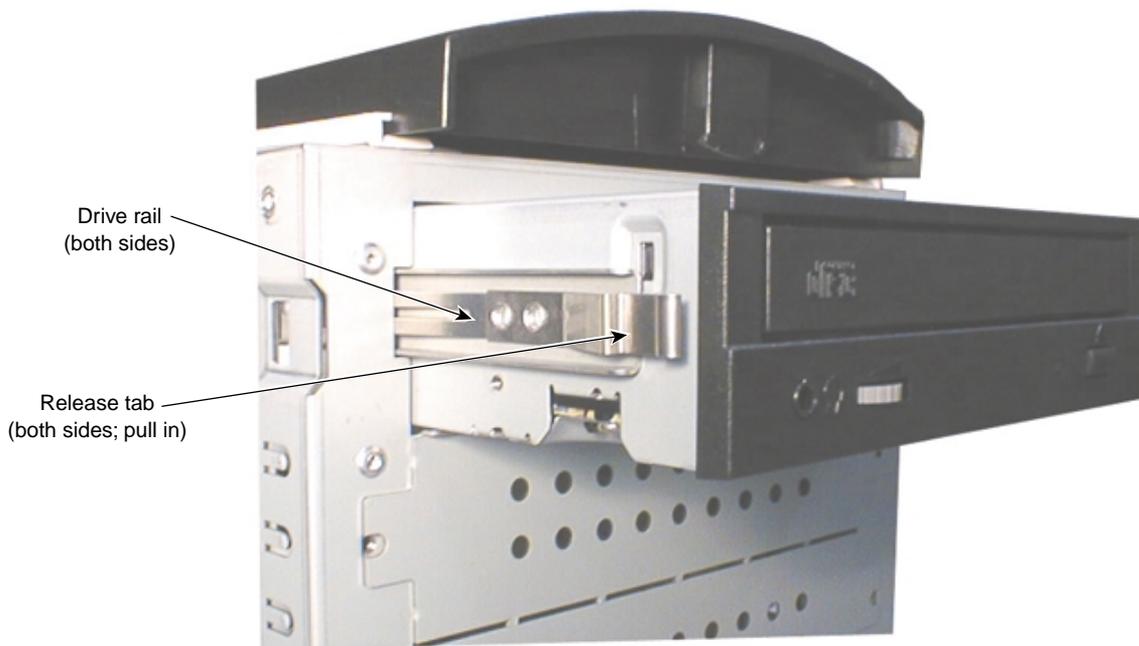


Figure 9-3 Drive Rails and Release Tabs on a Front-Access Device

4. If replacing a front access device, push in the tabs on either side of the device and pull the device out the front of the chassis.
5. Remove the drive rails from the old device and secure them to the new device.
6. Slide the new device into the base unit chassis until the tabs on the drive rails engage.
7. Connect the data and power cables to the new device.

Warning: For continued protection against fire and energy hazards, connect devices in the front-access device bays only to SCSI Channel B.

8. Replace the faceplate.

3.5-inch peripheral devices may also be installed in front-access device bays. Such devices are generally not accessible from the front of the system, and require a device tray (shown in the following figure) for installation in front-access device bays.

To add or replace a 3.5-inch device in a front-access bay:

Warning: The system is always on when connected to AC power. Before performing this task, disconnect the system's power cord from its AC power outlet.

1. Remove the faceplate. See Chapter 7, "Gaining Access to System Components".
2. If adding a device, remove the plastic blank from the faceplate and the metal blank from the base unit chassis that cover the opening for the device.
3. If replacing a device, disconnect the power and data cables from the device.
4. If replacing a device, remove and retain the screws securing the device tray to the front-access bay, and remove the tray from the bay.
5. If replacing a device, separate it from the 3.5-inch mounting bracket in the device tray.
6. Attach the new device to the 3.5-inch mounting bracket in the device tray.
7. Place the device tray in the front-access device bay and secure it to the bay with the screws removed previously.
8. Connect the power and data cables to the device.
9. Replace the faceplate.

A 3.5-inch device tray is shown in the following figure.

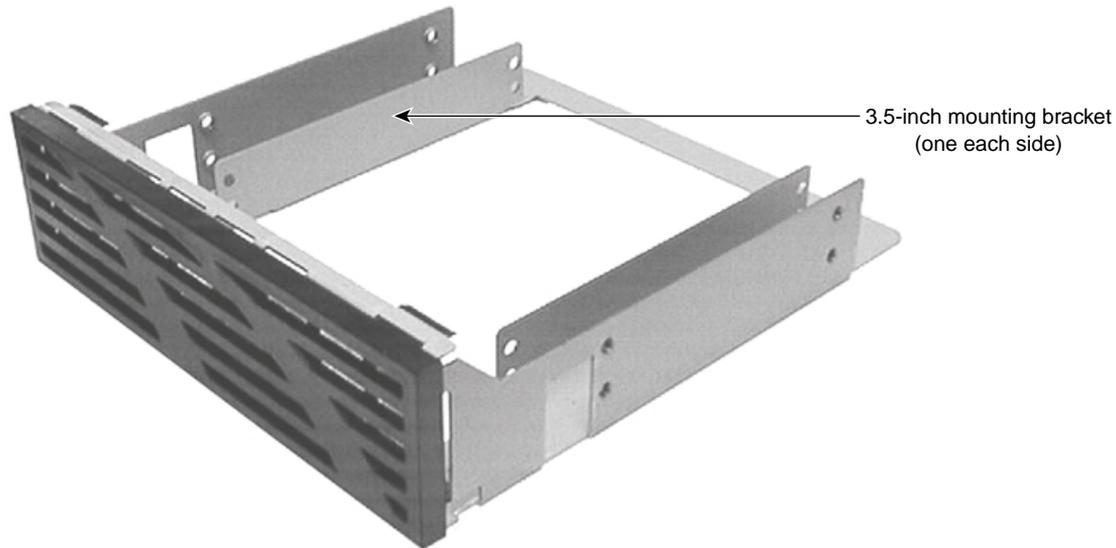


Figure 9-4 3.5-Inch Device Tray

Internal-Access Peripheral Device

Warning: Mishandling a removed disk drive can cause the heads to crash! Subsequent failures may not be noticeable for three to six months. Handle disk drives carefully to avoid damage.

Three 3.5-inch x 1.0-inch peripheral devices, or two 3.5-inch x 1.6-inch peripheral devices, may be installed in the internal-access device bays. These bays are located in a removable cage beneath the front-access device bays, immediately under the floppy disk drive. Peripheral devices in these bays are not accessible from the front of the system. Such devices are usually SCSI disk drives, including the system's primary disk drive.

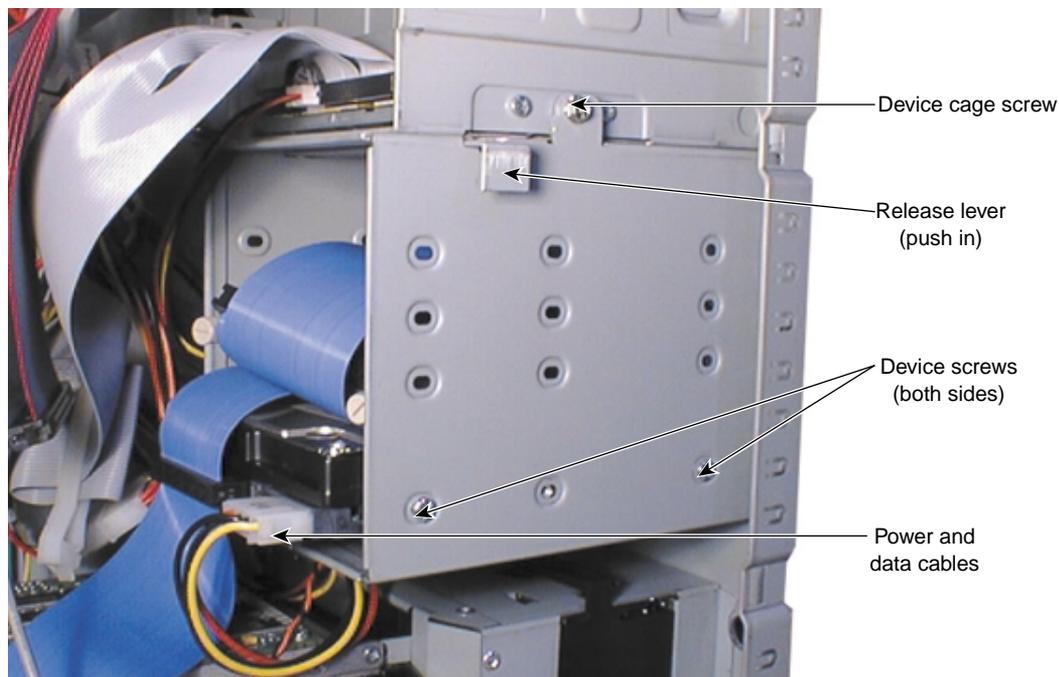


Figure 9-5 Internal-Access Device Bay

To add or replace an internal-access peripheral device:

Warning: The system is always on when connected to AC power. Before performing this task, disconnect the system's power cord from its AC power outlet.

1. Disconnect the power and data cables from all of the devices in the internal-access device cage. Note which cables connect to each device.
2. Remove and retain the screw securing the cage to the base unit chassis.
3. Push the release lever and slide the cage back, down, and out of the base unit chassis.

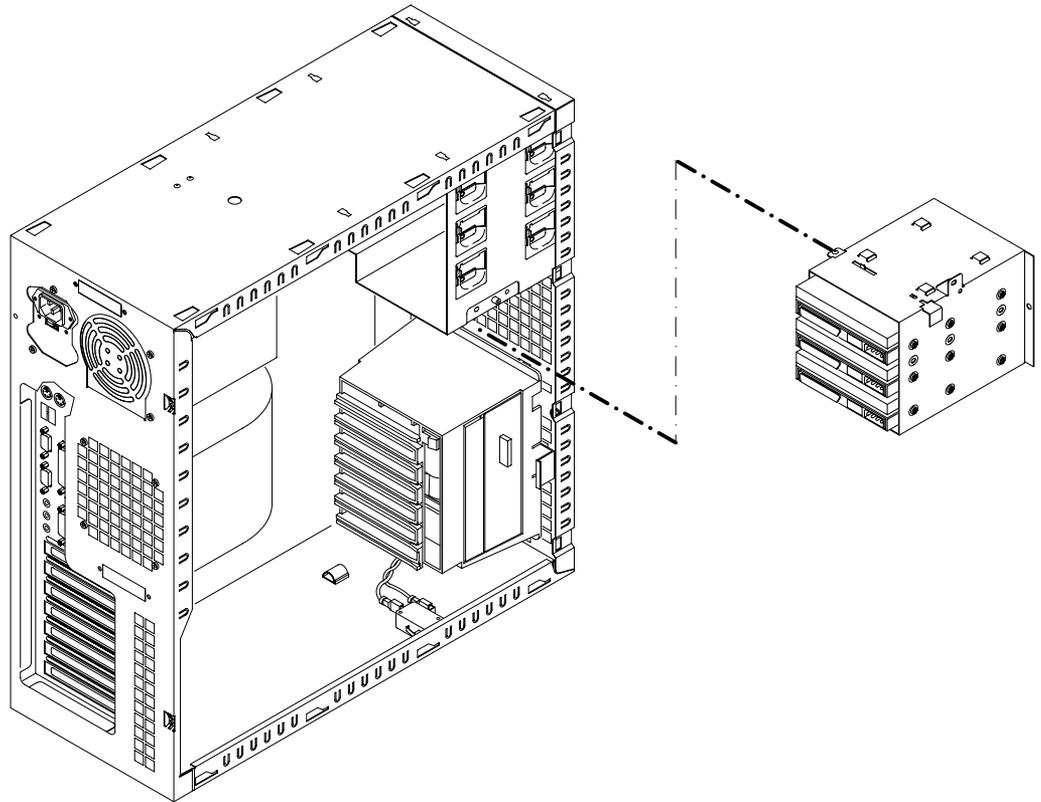


Figure 9-6 Removing the Internal-Access Device Cage

4. If replacing an internal-access device, remove and retain the screws securing the device to the cage, and remove it from the cage.
5. Place the new device in the cage and secure it with the screws removed previously.

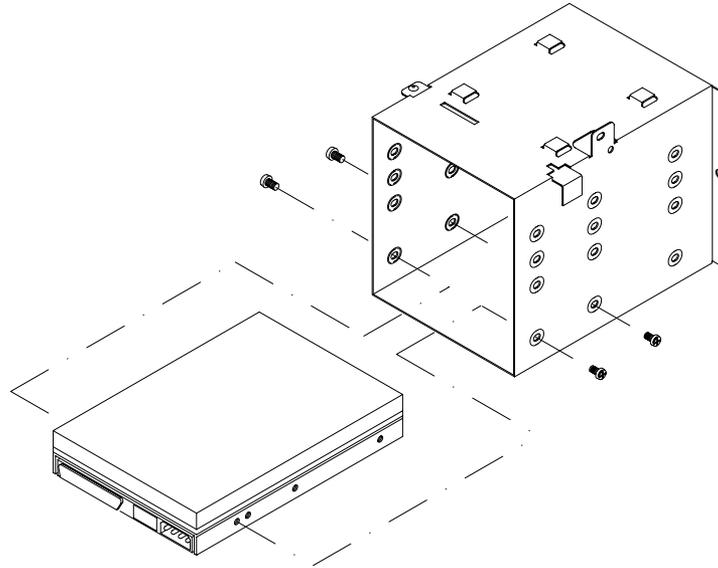


Figure 9-7 Removing or Replacing an Internal-Access Device

6. Align the tabs on the top of the internal-access device cage with the openings in the bottom of the front-access device cage. Then push the release lever, and slide the cage up and forward into the base unit chassis until the release lever engages.
7. Secure the cage to the base unit chassis with the screw removed previously.
8. Connect the power and data cables to all of the devices in the cage.

Warning: For continued protection against fire and energy hazards, connect devices in the internal-access device bays only to SCSI Channel B.

Expansion Card

The system board contains sockets in which expansion cards (such as the graphics controller card) are installed. See Chapter 8, “Upgrading the System” and the *System Board Guide* for more information on expansion cards and their sockets.

To avoid damaging an expansion card and voiding its warranty, take the following precautions:

- Handle the expansion card only by the edges. Do not touch the metallic finger contacts.
- Do not bend, twist, drop, or otherwise handle the expansion card carelessly.
- Do not expose the expansion card to moisture or extreme temperatures.
- Do not remove the expansion card from its antistatic package until you are ready to install it.

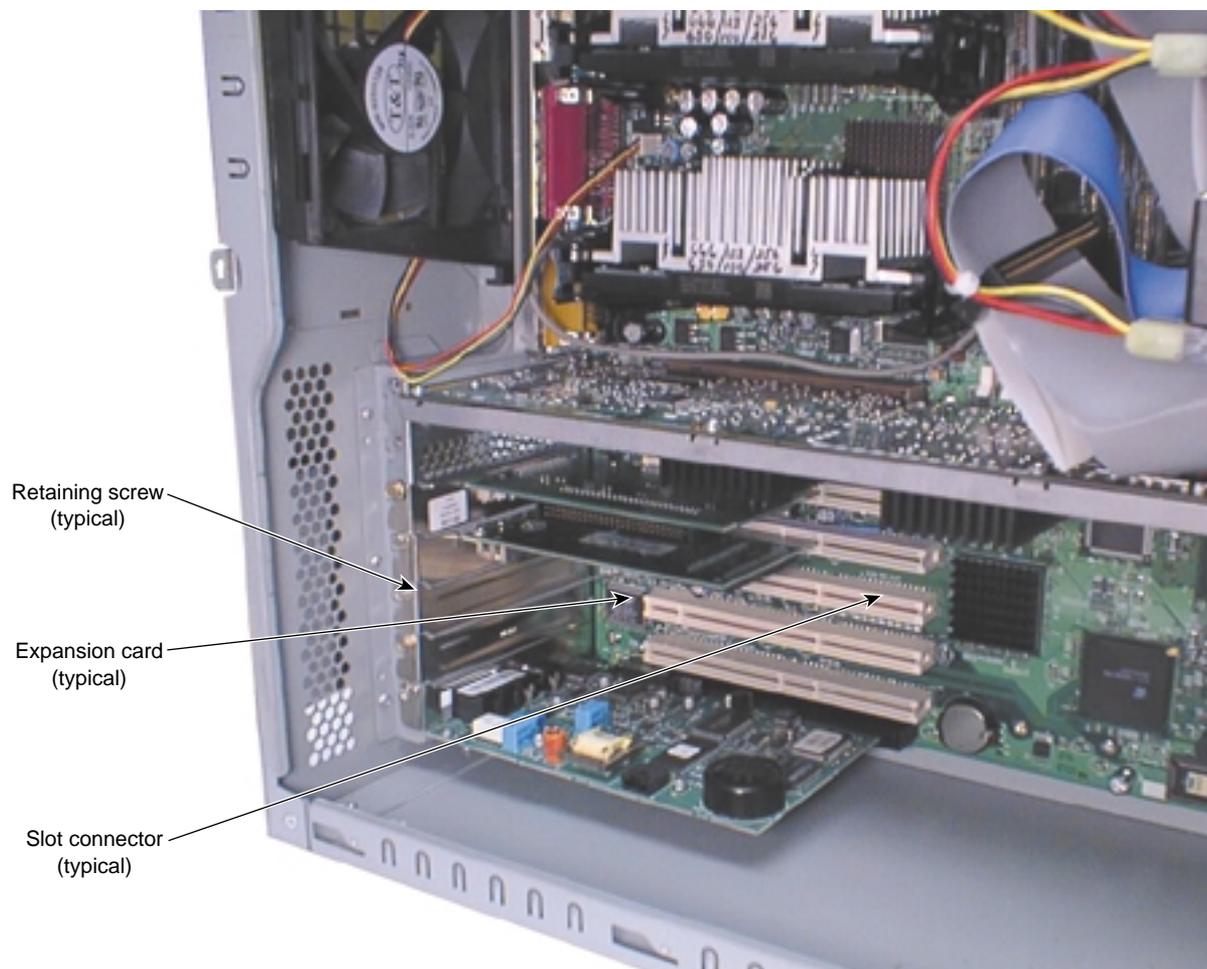


Figure 9-8 Expansion Card

To replace an expansion card:

Warning: The system is always on when connected to AC power. Before performing this task, disconnect the system's power cord from its AC power outlet.

1. Disconnect any external and internal cables from the expansion card.
2. Remove and retain the retaining screw that secures the card to the card guide.
3. Pull the card straight out of its socket, and place the card on an antistatic surface.
4. Remove the new card from its antistatic package and slide it into the socket from which you removed the old card. Push the new card into the socket until it is firmly seated.
5. Secure the new card to the card guide with the retaining screw (6-32 x 0.25 hex head) removed previously.
6. Connect any internal and external cables to the new card.

Memory Module

The system board contains sockets for eight dual inline memory modules (DIMMs).

- Do not touch the metallic finger contacts.
- Do not bend, twist, drop, or otherwise handle the DIMM carelessly.
- Do not expose the DIMM to moisture or extreme temperatures.
- Do not remove the DIMM from its antistatic package until you are ready to install it.

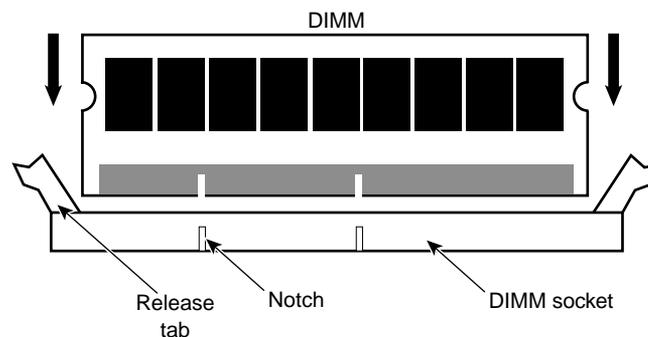


Figure 9-9 Dual Inline Memory Module (DIMM)

To replace a DIMM:

Warning: The system is always on when connected to AC power. Before performing this task, disconnect the system's power cord from its AC power outlet.

1. If replacing a DIMM, press the DIMM socket release tabs outward, away from each other; then grasp the top edge of the DIMM and pull it out of the socket.
2. Remove the new DIMM from its antistatic package. Verify the DIMM has gold-plated fingers that match the gold-plated socket contacts, and the slot keys on the DIMM match the slot keys in the DIMM socket.
3. Orient the DIMM so that the notches match the keys in the socket.
4. Push gently straight down until the release tabs snap into place.
5. Restart the system for the BIOS to detect the new memory.

For more information on DIMMs, DIMM sockets, and system memory configurations, see the *System Board Guide*.

Processor Bus Terminator

On a system with only one processor, a processor bus terminator occupies the other processor slot on the system board. This module ensures proper termination for the processor bus; without it, the system will not function. When you add a second processor, you must remove this module and replace it with the new processor.

Warning: The system is always on when connected to AC power. Before performing this task, disconnect the system's power cord from its AC power outlet.

To remove the processor bus terminator:

Carefully pull the terminator card out of the processor slot.

For more information on the processor bus terminator, see the *System Board Guide*.

Processor Module

The system board contains sockets for two processor modules. Each processor module is secured to the system board with retention clips.

To replace a processor module:

Warning: The system is always on when connected to AC power and the power supplies are switched on. Before opening the system, switch off both power supplies.

1. Pull the locking tabs on the retention clips outward, and slide the processor module out of the retention clips and its slot.
2. Remove the new processor from its antistatic package, and align the processor module over the retention clips and the slot. The processor module is keyed and fits only one way.
3. Press the processor module down until it seats in the slot and the locking tabs on the retention clips click into place.

For more information on processors and processor socket locations, see the *System Board Guide*.

Power Supply

Warning: There are no user-serviceable parts in the power supply. Return the power supply to the manufacturer for repair.

The power supply is located in the upper section of, and is secured to the back of, the base unit chassis. See Chapter 10, “System Hardware and Specifications” for technical information on the power supply.

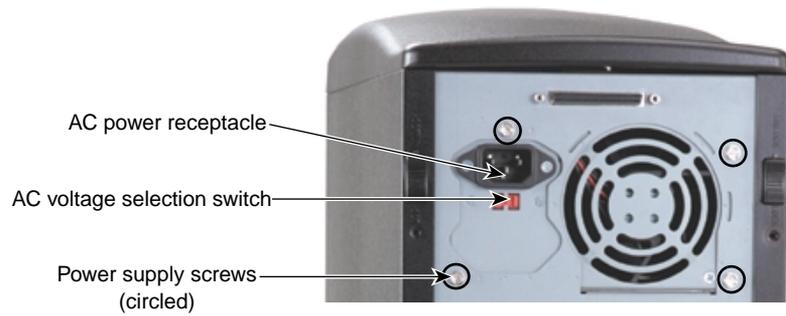


Figure 9-10 Power Supply on Back of Chassis

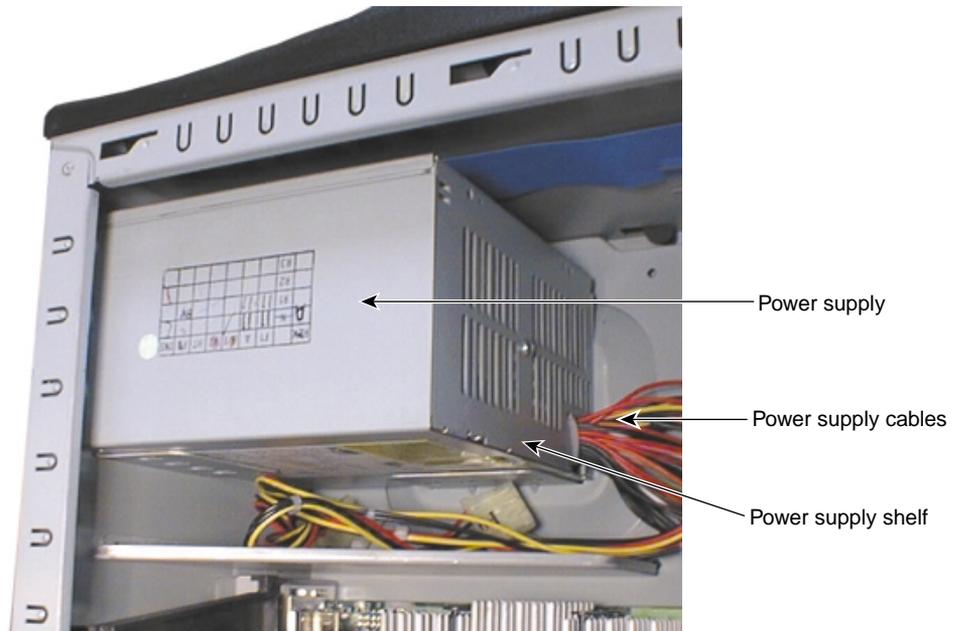


Figure 9-11 Power Supply Unit

To replace the power supply:

Warning: The system is always on when connected to AC power. Before performing this task, disconnect the system's power cord from its AC power outlet.

1. Disconnect the AC power cord from the AC power receptacle at the back of the base unit chassis.
2. Disconnect all power cables from all internal peripheral devices and the system board. Note the locations to which the power cables are connected:

Table 9-1 Power Cable Connections

Cable	Connects to
P1 and P2	ATX power connectors on the system board
P3 through P8	CD-ROM drive, disk drives, and other peripheral devices
P9	Floppy disk drive

3. Remove and retain the screws securing the power supply to the back of the base unit chassis.

Caution: Support the power supply as you remove the screws. Do not let the power supply fall or damage to equipment may result.

4. Remove the power supply from its shelf and the base unit chassis.
5. Place the new power supply on its shelf in the base unit chassis and secure it with the screws removed previously.
6. Make sure the AC voltage selection switch on the power supply (on the back of the base unit) is set to the proper line voltage for your location.
 - If your location uses 90 to 135 volts, the number **115** must be visible.
 - If your location uses 180 to 264 volts, the number **230** must be visible.

Warning: If you do not set the AC voltage selection switch on the power supply correctly, equipment damage may occur when you connect the system to AC power.

7. Reconnect the power cables to the system board and internal devices.
8. Reconnect the AC power cable to the AC power receptacle at the back of the base unit chassis.

Cooling Fans

Two internal fans ensure proper airflow to cool system components in the base unit. One fan is installed in a housing at the front of the base unit chassis. Another fan is secured to the rear of the base unit chassis, and has a cooling duct to direct the airflow over the system's processors.

Caution: Arrows on each fan indicate airflow direction and rotation. Install each fan with the airflow arrow pointing **into** the chassis.

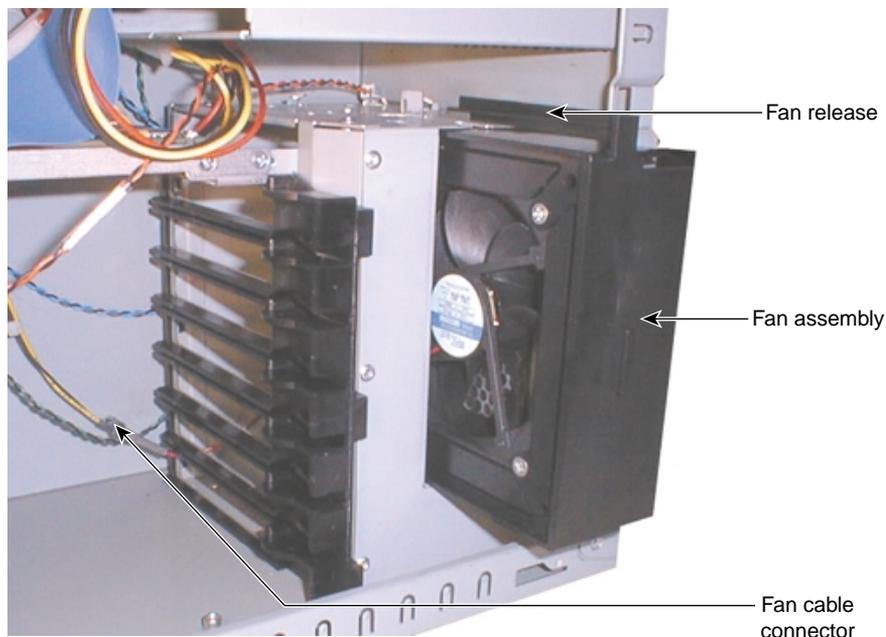


Figure 9-12 Front Fan Assembly

To replace the front fan:

Warning: The system is always on when connected to AC power. Before performing this task, disconnect the system's power cord from its AC power outlet.

1. Disconnect the fan's power cable from its power supply connector.
2. Disengage the release on top of the fan assembly in the expansion card guide, and gently pull the fan assembly out of its housing.
3. Feed the power cable for the new fan into the front fan housing and through the lowest opening in the card guide assembly.
4. Align the new fan assembly with the opening in its housing, and gently push the fan assembly into its housing until the release on top of the fan assembly engages.
5. Connect the new fan's power cable to its power supply connector.

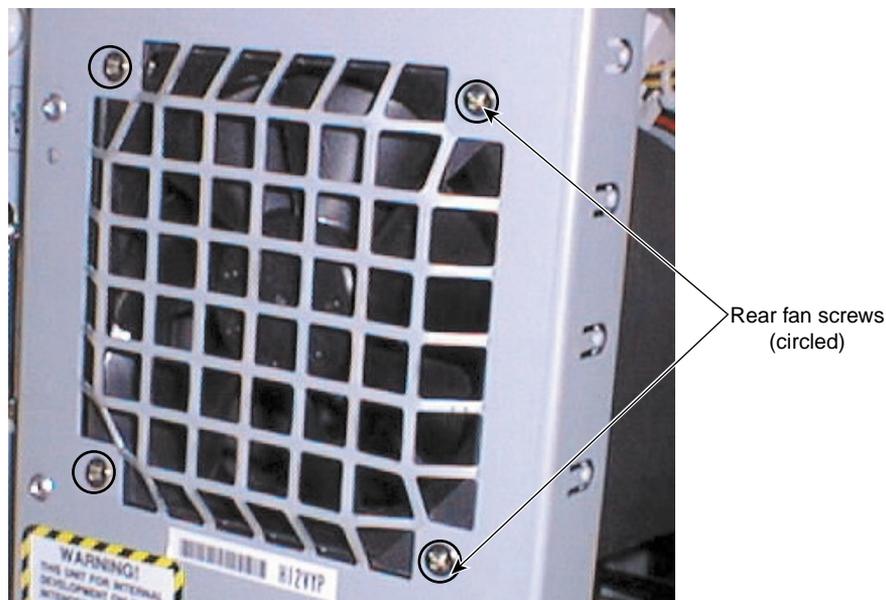


Figure 9-13 Rear Fan Assembly

To replace the rear fan:

Warning: The system is always on when connected to AC power. Before performing this task, disconnect the system's power cord from its AC power outlet.

1. Remove the cooling duct to gain access to the rear fan. Pop the duct out of its catches on the rear fan housing.
2. Disconnect the fan's power cable from its power supply connector.
3. Remove and retain the screws securing the fan to the back of the base unit chassis.

Caution: Support the fan as you remove the screws. Do not let the fan fall onto any installed expansion cards.

4. Note the airflow direction of the new fan (into the chassis) and the position the fan correctly on the chassis.

5. Replace the screws removed previously to secure the fan to the chassis.
6. Connect the fan's power cable to its power supply connector.
7. Replace the cooling duct. Pop the duct into its catches on the rear fan housing.

System Board

See previous procedures in this chapter when necessary. See the *System Board Guide* for connector and socket locations.

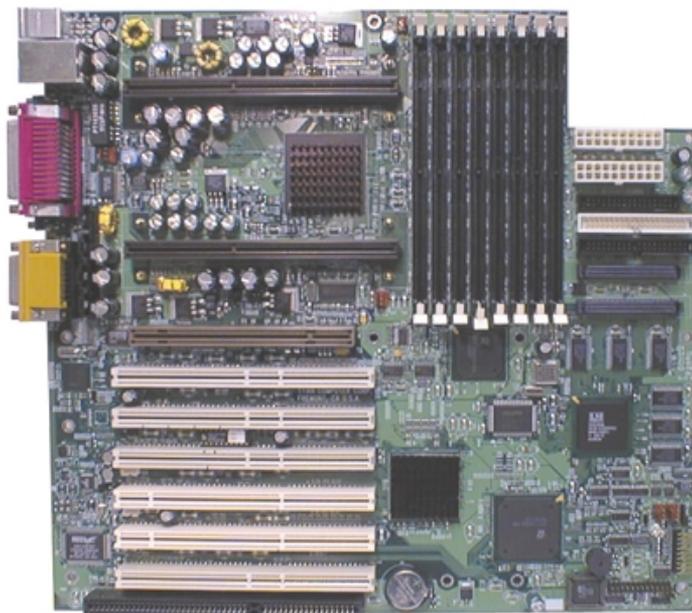


Figure 9-14 System Board

To remove the existing system board:

Warning: The system is always on when connected to AC power. Before performing this task, disconnect the system's power cord from its AC power outlet.

1. Remove the top cover. See Chapter 7, “Gaining Access to System Components”.
2. Note where all cables are connected to the system board, and then disconnect them from the system board.
3. Note where expansion cards are installed, and then remove them, placing them on an antistatic surface.
4. Remove the DIMMs, the processor modules, and the processor bus terminator (if installed), and place them on an antistatic surface.
5. Remove the nuts from the processor retention clips, and then remove the clips from the system board.
6. Remove the 13 screws from the system board.
7. Lift the system board out of the base unit and place it on an antistatic surface.

To install a new system board:

Warning: The system is always on when connected to AC power. Before performing this task, disconnect the system’s power cord from its AC power outlet.

1. Connect the power switch/LED cable to connector J24 **before** installing the new system board.
2. Place the new system board into the base unit front edge first, and then lower the back edge into the base unit. Slide the system board toward the back of the base unit until all mounting holes are aligned with their standoffs.
3. Secure the new system board to the base unit using the 13 screws removed previously.
4. Secure the processor retention clips to the system board with the nuts removed previously.
5. Replace the DIMMs, the processors, and the processor bus terminator (if needed) in the appropriate sockets.
6. Replace the expansion cards in the appropriate expansion card sockets.
7. Reconnect the remaining cables to the system board.
8. Replace the top cover. See Chapter 7, “Gaining Access to System Components”.

CMOS/Clock Lithium Battery

The CMOS/clock lithium battery is located at the bottom of the system board, next to the lowest expansion card slots. The battery may be hidden under installed expansion cards.

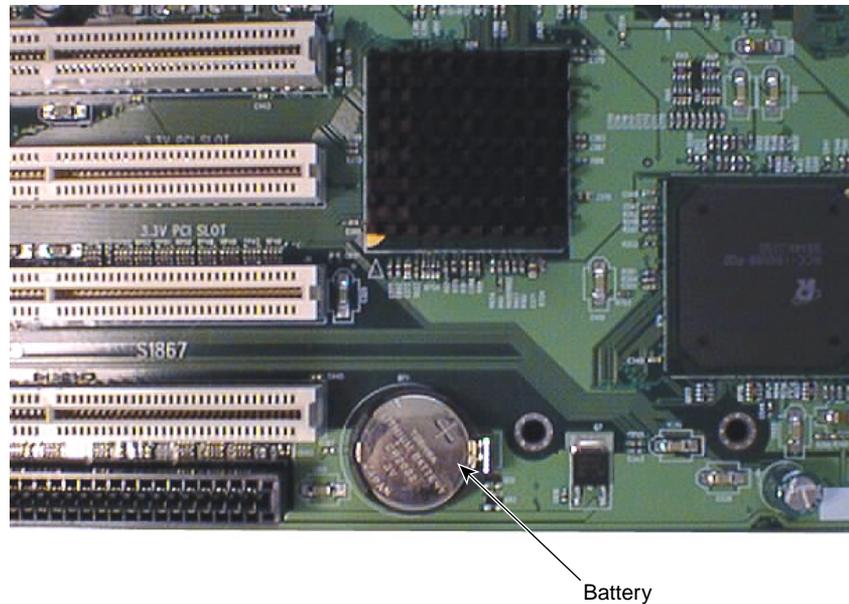


Figure 9-15 CMOS/Clock Lithium Battery

If you must replace the battery, the system will lose its operating parameters stored in CMOS memory. As a result, the system BIOS parameter settings are lost. After you replace the battery, you must reset the date and time and reconfigure the BIOS.

See the *System Board Guide* for detailed information on replacing the battery and on using BIOS Setup to configure the BIOS.

Chassis Intrusion Alarm Switch

The chassis intrusion alarm switch is mounted to the bottom panel of the base unit chassis near the front card guide. See the *System Board Guide* for connector and socket locations.

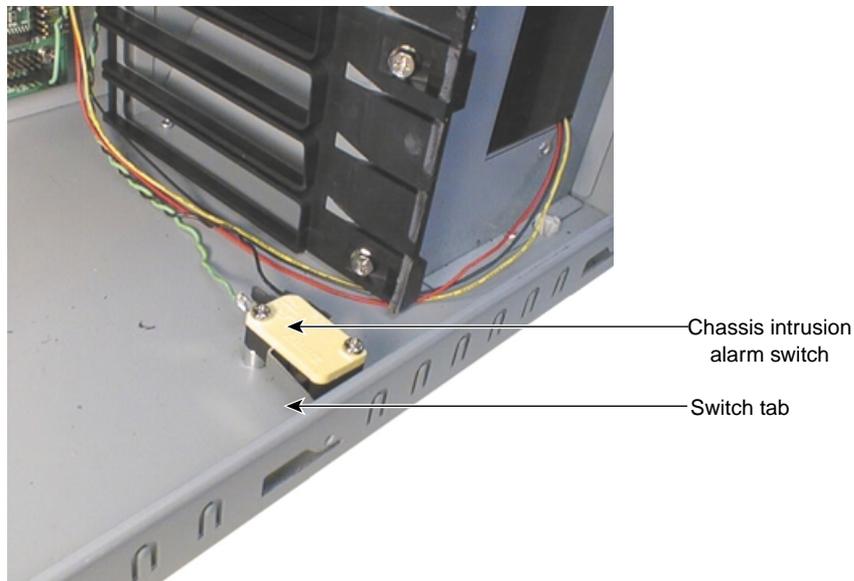


Figure 9-16 Chassis Intrusion Alarm Switch

To replace the chassis intrusion alarm switch:

Warning: The system is always on when connected to AC power. Before performing this task, disconnect the system's power cord from its AC power outlet.

1. Disconnect the alarm switch cable from its connector on the system board.
2. Remove and retain the screws that secure the switch to the base unit chassis, and remove the switch and its cable from the chassis.
3. Align the new switch with the chassis mounting holes and secure it to the chassis with the screws removed previously. Make sure the switch tab faces the back of the base unit.

4. Connect the alarm switch cable to its connector on the system board.

Power Switch, System LEDs, and Light Pipe

The power switch and system LEDs are mounted to the front of the base unit chassis. A light pipe secured to the faceplate guides the light from the LEDs to openings on the faceplate. See the *System Board Guide* for power switch and LED connector locations and details.

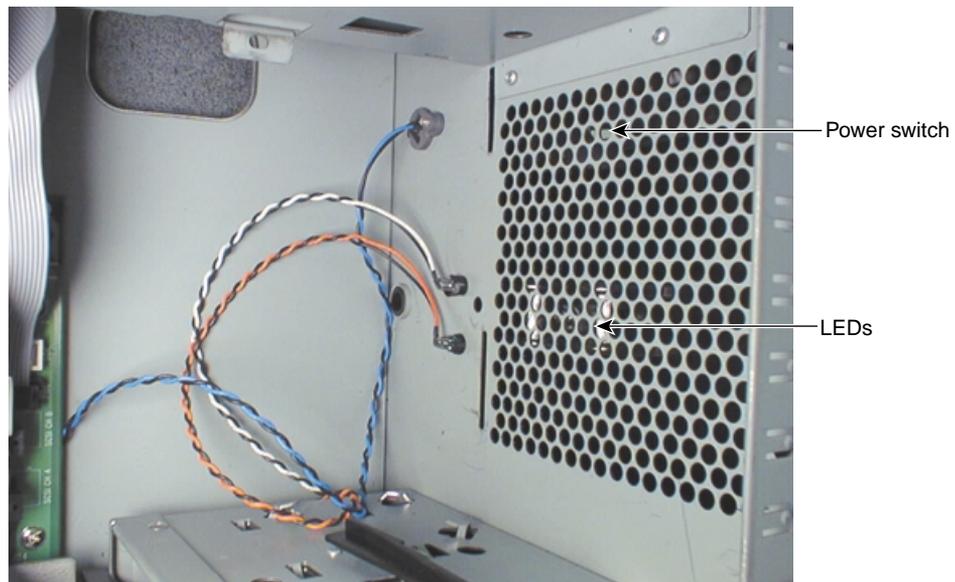


Figure 9-17 Power Switch and System LEDs

Warning: The system is always on when connected to AC power. Before performing this task, disconnect the system's power cord from its AC power outlet.

1. Remove the faceplate. See Chapter 7, "Gaining Access to System Components".
2. Remove the internal-access device cage. See "Internal-Access Peripheral Device" on page 99 in this chapter.

3. Disconnect the power switch/system LED cable from its connector on the system board.
4. Remove and retain the screw that secures the power switch to the base unit chassis.
5. Turn the power switch until its key matches the keyhole in the chassis, and then pull the power switch into the chassis.
6. For each system LED, gently spread the tabs holding it to the chassis, and pull the LED into the chassis.
7. Remove the power switch, system LEDs, and cable from the chassis.

To replace the power switch and system LEDs:

Warning: The system is always on when connected to AC power. Before performing this task, disconnect the system's power cord from its AC power outlet.

1. From inside of the chassis, gently push each LED into the tabs that hold it to the chassis until it clicks into place. Ensure the green LED is on the bottom.
2. From inside the chassis, turn the power switch until its key matches the keyhole in the chassis, and then push the power switch into the hole.
3. Turn the power switch until the screw hole in the switch matches the keyhole in the chassis, and then secure the switch to the chassis with the screw removed previously.
4. Connect the power switch/system LED cable to its connector on the system board.
5. Replace the internal-access device cage.
6. Replace the faceplate.

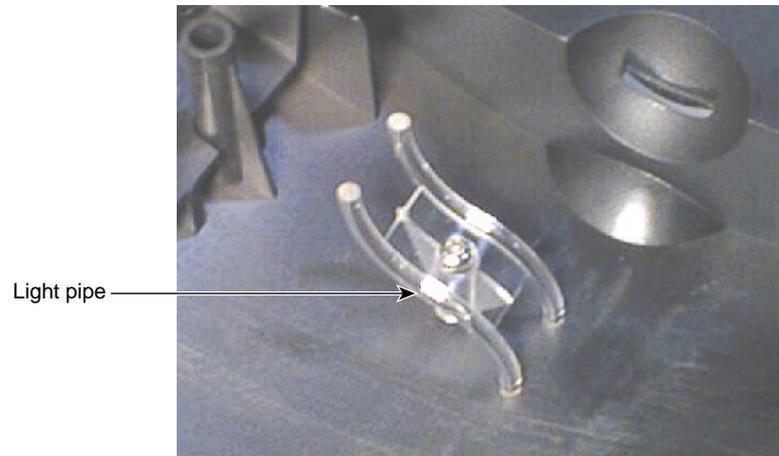


Figure 9-18 Light Pipe

Warning: The system is always on when connected to AC power. Before performing this task, disconnect the system's power cord from its AC power outlet

1. Remove the faceplate. See Chapter 7, "Gaining Access to System Components."
2. Remove and retain the screw securing the light pipe to its mount on the back of the faceplate.
3. Remove the light pipe.
4. Secure the new light pipe to the mount on the back of the faceplate with the screw removed previously.
5. Replace the faceplate.

System Hardware and Specifications

This chapter contains information about hardware and specifications for your system.

This chapter does not contain detailed information on the system board. See the *System Board Guide* delivered with your system for detailed information on the system board and its components, BIOS, memory, slots and sockets, jumpers and connectors, and ports.

Functional Diagram

The following diagram shows the power and data signals of the base unit components.

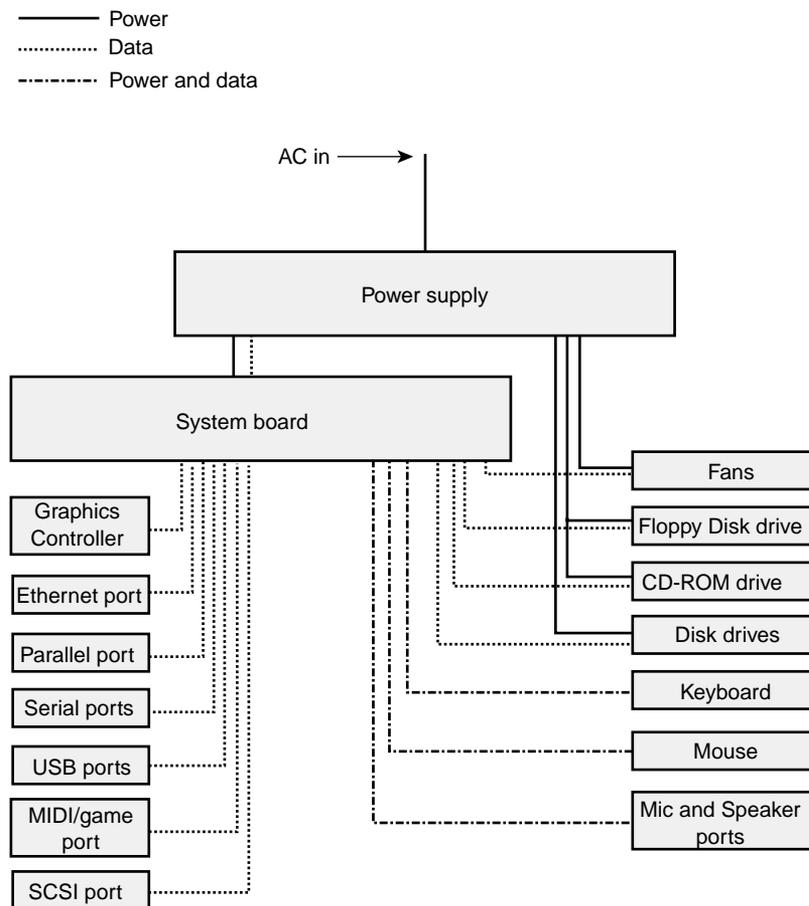


Figure 10-1 Diagram of Power and Data Signals

Internal Peripheral Cabling

The following sections show EIDE and SCSI cable routings and connections to internal peripheral devices, and depicts standard and optional cables used in the system. For detailed information and location of bus connectors on the system board, see the *System Board Guide*.

Caution: When handling cables, flex them as little as possible. Ensure that cables do not contact sharp metal surfaces or become excessively bent or twisted. In particular, SCSI cables should not have any creased bends.

EIDE Cabling

The installed EIDE cable connects the primary EIDE channel to the CD-ROM drive and to another front-access peripheral device. Another EIDE cable, which can connect the secondary EIDE channel to two front-access peripheral devices, is provided with the system but is not installed.

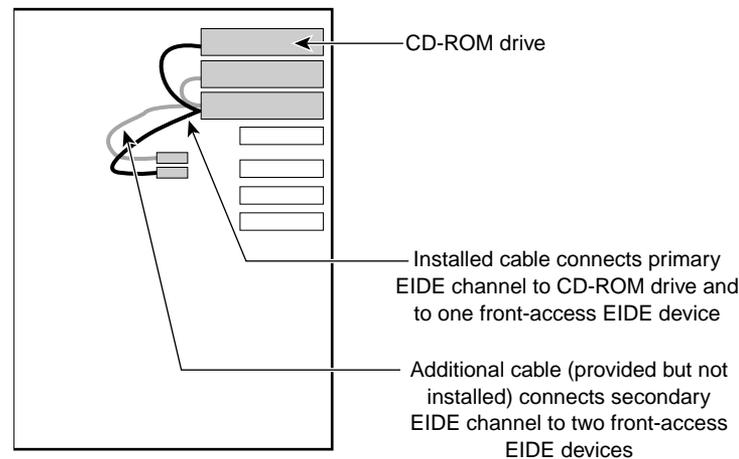


Figure 10-2 EIDE Cable Diagram

SCSI Cabling in a Zx10 System

SCSI cabling in a Zx10 system is as follows:

- A cable connects Channel A of the on-board SCSI controller to the external port on the back of the base unit and, in some systems, to front-access SCSI devices. Either the external-only or the internal/external cable is used, but not both.

Warning: For continued protection against fire and energy hazards, do not connect an external SCSI port to SCSI Channel B. Connect an external SCSI port only to SCSI Channel A.

- A cable connects Channel B of the on-board SCSI controller to up to three SCSI disk drives.

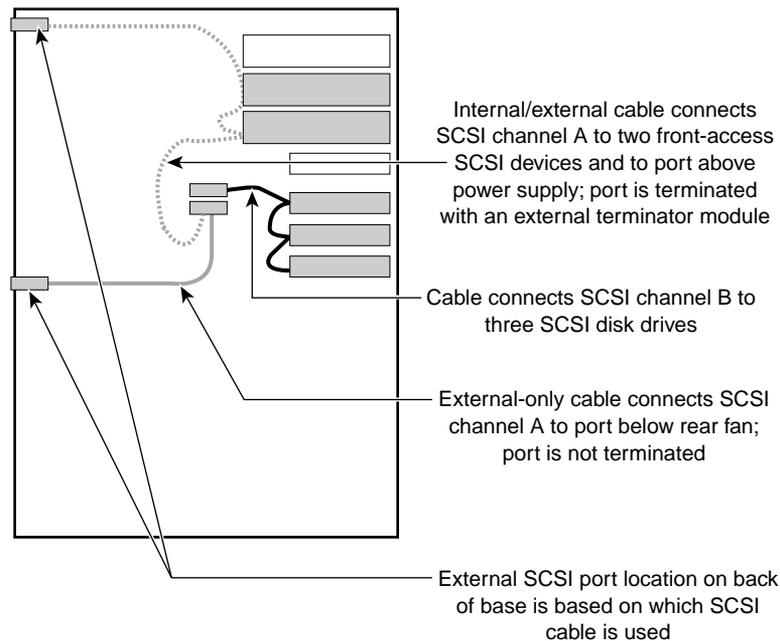


Figure 10-3 SCSI Cable Diagram

SCSI Cabling in a Zx10 VE System

SCSI cabling in a Zx10 VE system is as follows:

- A SCSI cable connects Channel A of the on-board SCSI controller to up to three SCSI devices in internal access bays and to the external port on the back of the base unit (below the rear fan).

Warning: For continued protection against fire and energy hazards, do not connect an external SCSI port to SCSI Channel B. Connect an external SCSI port only to SCSI Channel A.

- A cable connects Channel B of the on-board SCSI controller to up to two SCSI devices in front-access bays and to an internal terminator module.

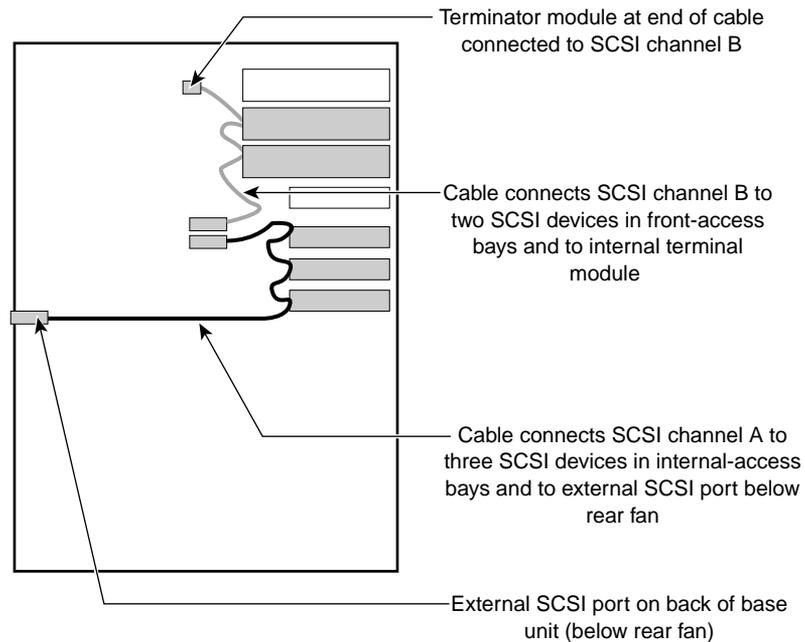


Figure 10-4 SCSI Cable Diagram for a Zx10 VE System

Floppy Disk Drive Cable



Figure 10-5 Floppy Disk Drive Cable

Table 10-1 Floppy Disk Drive Cable

Connector	Connects To
1	Floppy disk drive controller on system board
2	Floppy disk drive

EIDE Device Cables (Installed and Optional)

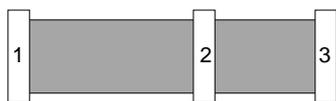


Figure 10-6 EIDE Device Cables

Table 10-2 EIDE Device Cables (Installed and Optional)

Connector	Connects To
1	EIDE connector on system board
2	EIDE device
3	EIDE CD-ROM drive (installed cable) or EIDE device (optional cable)

Internal-Access Device SCSI Cable

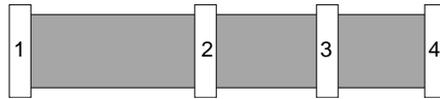


Figure 10-7 Internal-Access Device SCSI Cable

Table 10-3 Internal-Access Device SCSI Cable

Connector	Connects To
1	SCSI Channel B connector on system board
2	SCSI device in internal-access device cage
3	SCSI device in internal-access device cage
4	SCSI device in internal-access device cage

External SCSI Port Cable

This cable is not used on systems that use the internal/external SCSI cable.



Figure 10-8 External SCSI Port Cable

Table 10-4 External SCSI Port Cable

Connector	Connects To
1	SCSI Channel A connector on system board
2	SCSI port on back of base unit

Internal/External SCSI Cable

When used on some systems, this cable replaces the external SCSI port cable.

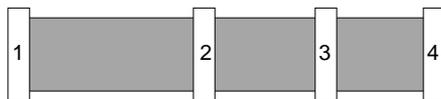


Figure 10-9 Internal/External SCSI Cable

Table 10-5 Internal/External SCSI Cable

Connector	Connects To
1	SCSI Channel A connector on system board
2	SCSI device in front-access device cage
3	SCSI device in front-access device cage
4	SCSI port on back of base unit

Internal/External SCSI Cable (Zx10 VE)



Figure 10-10 Internal/External SCSI Cable (Zx10 VE)

Table 10-6 Internal/External SCSI Cable (Zx10 VE)

Connector	Connects To
1	SCSI Channel A connector on system board
2	SCSI device in internal-access device cage
3	SCSI device in internal-access device cage

Table 10-6 (continued) Internal/External SCSI Cable (Zx10 VE)

Connector	Connects To
4	SCSI device in internal-access device cage
5	SCSI port on back of base unit

Power Supply and Cables

Different power supplies are used in the different system configurations. The power supply in each system is field replaceable. See Chapter 9, “Servicing the System” for details on replacing the power supply.

300 Watt Power Supply

The 300 Watt power supply has a manual switch for selecting either 115 VAC (90-132 VAC) range or 230 VAC (180-264 VAC) range for domestic or international locations. The input frequency is 47-63 Hz, single phase. Input current is 7 amps maximum for the 115 VAC range and 3.5 amps for the 230 VAC range. The power supply has a typical efficiency of 70 percent at maximum output load. The power supply is enclosed in a case that includes a fan for additional airflow.

The 300 Watt power supply has the following DC output specifications.

Table 10-7 300 Watt Power Supply DC Output Specifications

Outputs →	1	2	3	4	5	6 ¹
Nominal Output Voltages (VDC)	+5.0 ²	+3.3 ²	+12.0	-12.0	-5.0	+5.0
Maximum Current Rating (ADC)	30	22	10	0.8	0.5	1

1. Standby +5.0 VDC output voltage is always on.
2. Maximum +5.0 V and +3.3 V combined power is 180W.

The power supply has two power cables, P1 and P2, that connect to ATX power connectors on the system board.

The power supply has six peripheral device power cables (P3 through P8) and one floppy disk drive power cable (P9). These cables connect in daisy-chains to the power supply and to each other as follows:

Power supply → P3 → P4 → P5

Power supply → P6 → P7 → P8 → P9

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Table 10-8 P1 Connector Pinout

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	+3.3V	6	+5.0 V	11	+3.3 V *	16	Ground
2	+3.3V	7	Ground	12	-12.0 V	17	Ground
3	Ground	8	Power Good	13	Ground	18	-5.0 V
4	+5.0V	9	5.0 V Standby	14	Remote On	19	+5.0 V
5	Ground	10	+12.0 V	15	Ground	20	+5.0 V

* + Sense

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Table 10-9 P2 Connector Pinout

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	+3.3V	6	NC	11	+3.3 V	16	NC
2	+3.3 V	7	Ground	12	NC	17	Ground
3	Ground	8	NC	13	NC	18	NC
4	NC	9	NC	14	NC	19	NC
5	NC	10	+12.0 V	15	NC	20	+5.0 V

Table 10-10 P3 through P8 Connector Pinout

Pin	Signal	Pin	Signal
1	+5.0 V	3	Ground
2	Ground	4	+12.0 V

Table 10-11 P9 Connector Pinout

Pin	Signal	Pin	Signal
1	+12.0 V	3	Ground
2	Ground	4	+5.0 V

400 Watt Power Supply

The 400 Watt power supply has a manual switch for selecting either 115 VAC (90-132 VAC) range or 230 VAC (180-264 VAC) range for domestic or international locations. The input frequency is 47-63 Hz, single phase. Input current is 8 amps maximum for the 115 VAC range and 4 amps for the 230 VAC range. The power supply has a minimum efficiency of 70 percent at maximum output load. The power supply is enclosed in a case that includes a fan for additional airflow through the system.

The power supply has the following DC output specifications.

Table 10-12 400 Watt Power Supply DC Output Specifications

Outputs →	1	2	3	4	5	6 ¹
Nominal Output Voltages (VDC)	+5.0 ²	+3.3 ²	+12.0	-12.0	-5.0	+5.0
Maximum Current Rating (ADC)	40	40	15	0.5	0.5	1.5

1. Standby +5.0 VDC output voltage is always on.
2. Maximum +5.0 V and +3.3 V combined power is 300W.

The power supply has two power cables, P1 and P2, that connect to ATX power connectors on the system board.

The power supply has six peripheral device power cables (P3, P4, P5, P6, P7, and P8) and one floppy disk drive power cable (P9). These cables connect in daisy-chains to the power supply and to each other as follows:

Power supply → P3 → P4

Power Supply → P5 → P6

Power supply → P7 → P8 → P9

Table 10-13 P1 Connector Pinout

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	+3.3V	6	+5.0 V	11	+3.3 V *	16	Ground
2	+3.3V	7	Ground	12	-12.0 V	17	Ground
3	Ground	8	Power Good	13	Ground	18	-5.0 V
4	+5.0 V *	9	5.0 V Standby	14	Remote On	19	+5.0 V
5	Ground	10	+12.0 V	15	Ground	20	+5.0 V

* + Sense

Table 10-14 P2 Connector Pinout

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	+3.3V	6	NC	11	+3.3 V	16	NC
2	+3.3 V	7	Ground	12	NC	17	Ground

Table 10-14 (continued) P2 Connector Pinout

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
3	Ground	8	NC	13	NC	18	NC
4	NC	9	NC	14	NC	19	NC
5	NC	10	+12.0 V	15	NC	20	+5.0 V

Table 10-15 P3 through P8 Connector Pinout

Pin	Signal	Pin	Signal
1	+5.0 V	3	Ground
2	Ground	4	+12.0 V

Table 10-16 P9 Connector Pinout

Pin	Signal	Pin	Signal
1	+12.0 V	3	Ground
2	Ground	4	+5.0 V

Cooling Fans

The system has two 92-mm 12 V DC cooling fans that are controlled by circuitry on the system board. The front fan is mounted in a housing at the bottom front of the base unit chassis. The rear fan is mounted to the upper back of the base unit chassis under the system's power supply. Both fans bring cool air into the base unit to force out warm air.

The chassis fans are field replaceable. See Chapter 9, "Servicing the System" for details on replacing the chassis fans.

Caution: To maintain proper airflow to cool system components, make sure you install a new fan with the airflow arrow pointing **into** the chassis.

The power supply contains its own cooling fan. The power supply fan is not field replaceable. If the power supply fan requires replacement, you must replace the power supply. See Chapter 9, “Servicing the System” for details on replacing the power supply.

Hardware Monitoring and Power Management

The system features advanced hardware monitoring and power management capabilities. These features help save energy, prolong system life, and provide for functionality such as remote system wakeup.

When used with Hardware Monitor software, these features enable you to keep track of such things as system voltages, component and chassis temperatures, and fan presence and operation. For more information on the items that can be monitored on your system, see the *System Board Guide* and Hardware Monitor Help.

System Configuration Summary

See the *System Board Guide* for detailed information on the system board and its components.

Table 10-17 System Configuration Summary

Feature	Description
Processors	One or two Intel SC242 (Slot 1)
Processor Bus	133 MHz, 64 bits
Memory Modules	Dual inline memory modules (DIMMs)
Memory Style	168-pin DIMMs, 10 ns, 3.3V, registered/buffered, 72-bit (ECC)
Memory Type	Synchronous Dynamic Random Access Memory (SDRAM)
Memory Bus	133 MHz, 128 bits

Table 10-17 (continued) System Configuration Summary

Feature	Description
Memory Size	256 MB minimum, 6 GB maximum
Memory Expansion	256 MB, 512 MB, or 1,024 MB increments
Graphics	AGP or PCI expansion card
Audio	Creative AudioPCI controller, on system board
SCSI	LSI dual-channel LVD Ultra3 SCSI controller, on system board
Network	Intel 10/100 Mbps Ethernet adapter, on system board
Disk Drives	LVD Ultra3 SCSI
CD-ROM drive	40X or higher EIDE ATAPI-compatible
Keyboard	Windows 95/98 compatible PS/2
Mouse	Two-button wheel mouse
Expansion Slots	One full-length AGP Pro Two fast-and wide PCI (66 MHz, 64 bits, 3.3 V/Universal) Four wide PCI (33 MHz, 64 bits, 5 V/Universal) One full-length ISA (card space shared with one wide PCI slot)
Peripheral Device Bays	One 5.25-inch x 1.6-inch front-access for CD-ROM disk drive One 3.5-inch x 1.6-inch front-access for floppy disk drive Two 5.25-inch x 1.6-inch front-access for EIDE/SCSI non-disk devices Three 3.5-inch x 1.0-inch internal-access bays for SCSI disk drives (can be used as two 3.5-inch x 1.6-inch bays)
I/O Ports	One PS/2 mouse and one PS/2 keyboard – 6-pin mini-DIN One parallel (LPT) – EPP/ECP, 25-pin Centronics-compatible DB25 Two serial (COM) – 9-pin 16550-compatible DB9 Two Universal Serial Bus (USB) – 12 MB/sec One SCSI – Ultra3 Video – SVGA; others vary by controller Audio – Microphone, line in, line out, MIDI/game Network – Ethernet
Power Supply	300 Watts or 400 Watts (varies by system), manual-ranging

System Specifications

Table 10-18 System Specifications

Item	Specifications
Dimensions	21 in high x 8.75 in wide x 20.75 in deep (53.3 cm high x 22.2 cm wide x 52.7 cm deep)
Weight	55 lb (25 kg) fully configured
AC line voltage (US)	90 – 132 VAC, 47 – 63 Hz, 1 phase, 15A/125 V receptacle
AC line voltage (International)	180 – 264 VAC, 47 – 63 Hz, 1 phase, 15A/250 V receptacle
Power consumption	285 W; 3.4 A at 120 VAC maximum configuration
Recommended room temperature	50° to 90° F (10° to 32° C); optimum 70° F (21° C)
Recommended room humidity	20% to 80% (non-condensing); optimum 50%
Heat dissipation	973 BTU/hr

Ergonomics Guide

This appendix gives you information to help you develop proper work habits, establish a proper work environment, and reduce the risk of injury. Review the information in this appendix before using your computer. Follow these guidelines as you use your computer.

Setting Your Work Habits

Take the following steps to evaluate and adjust the way you work at the computer.

Getting Started

1. If you can adjust the work surface or the keyboard support, adjust the chair to rest your feet flat on the floor and to firmly support your thighs with the seat base. Leave the chair at this adjusted position as you go through the following steps.
2. If you cannot adjust the work surface or the keyboard support, adjust your seating position as described in the following steps.

Arms

1. Rest your fingers on the keyboard.
2. Relax your upper arms; they should be nearly vertical at your sides. Your forearms should bend nearly at right angles to your upper arms.
3. If your upper arms are not vertical, adjust the distance between the chair and the keyboard until they are.
4. If your forearms are not at right angles to your upper arm, adjust the height of the keyboard or the chair until they are.
5. If your elbows rest on the chair's armrests, do not let this cause you to raise your shoulders from their relaxed position.

Wrists

1. Rest your fingers on the keyboard. Your wrists should be straight with your forearms.
2. If your wrists bend upward or downward, adjust the height of the keyboard or chair to align your wrists properly with your forearms.
3. If your wrists bend inward or outward, adjust the position of your hands to align your wrists properly with your forearms.

You may find it helpful to use a wrist support for short periods of rest.

Head and Eyes

1. Place the monitor screen between 18 inches (45.1 centimeters) and 31 inches (78.7 centimeters) from your eyes (*Humanscale*, MIT Press).
2. Angle your head downward slightly when you look at the center of the monitor screen.
3. If the monitor is too high or too low, use a suitable support to place it at a comfortable height. Do not assume that using the computer's base unit as a support places the monitor at the correct height.
4. If you continually refer to a document while working at the computer, place the document at the same height and angle as the monitor screen.

Back

The chair you use when working at the computer should firmly support your back when you sit up straight, and your thighs should be at right angles to your torso. The chair should also support the lumbar curve of your back.

1. If you can adjust the chair's backrest angle, make sure your thighs and your torso are nearly at right angles when your feet rest on the floor.
2. If you can adjust the chair's backrest tension, make sure it is firm enough to support your back while working. It should only tilt back under force.
3. If the chair's backrest does not provide lumbar support, use a pad or pillow to provide lumbar support.

Legs

When working at the computer, your lower legs should be at right angles to your thighs. Your upper legs should be positioned so the knees are slightly above the hip joint. Your feet should rest flat on the floor.

1. If your lower legs are not at right angles to your thighs, adjust the chair to be higher.
2. If your feet do not rest flat on the floor, adjust the chair to be higher. You may need to use a footrest to support your feet and maintain the correct position relative to the keyboard.
3. If your thighs are compressed on the seat pan, the chair is too high. Some chairs offer a seat pan tilt adjustment for a greater range of lift.

Setting Your Environment

Adjust the room lighting and the position of the monitor screen to minimize screen glare and reflections:

- Do not work in an over- or under-illuminated room; an average illumination of 50 foot-candles is usually sufficient. Below this level, you should provide task lighting for documents.
- Older individuals may require higher average illumination, up to 100 foot-candles.

Do not work in a cold room. The American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) recommends the following office climate for the average clothed individual:

- Temperature between 73.0 and 79.0 degrees Fahrenheit (22.7 and 26.1 degrees Celsius) during the summer.
- Temperature between 68.0 and 74.5 degrees Fahrenheit (20.0 and 23.6 degrees Celsius) during the winter.
- Relative humidity between 30 and 60 percent all year.

Reducing the Risk of Injury

There are several things you can do to reduce the risk of injury while working with a computer.

Changing Posture

Do not hold any posture for an extended period of time. If possible, change your working posture several times a day. If you can, work part of the day sitting and part of it standing.

Taking Rest Breaks

Take periodic rest breaks during the day. A study sponsored by the National Institute for Occupational Safety and Health (NIOSH; R. Henning, University of Connecticut, 1992) found that adding distributed rest breaks to the traditional work schedule “forestall(ed) the development of discomfort in repetitive VDT work.”

Try using this recommended minimum rest break schedule:

- 30 seconds after each 10 minutes of work.
- 3 minutes after each 50 minutes of work.
- 15 minutes at mid-morning.
- 30 to 45 minutes at lunch.
- 15 minutes at mid-afternoon.

During each rest break, gently and slowly stretch your hands and arms. During longer rest breaks, get up, walk around, and gently stretch as much of your body as you can. Set a schedule of rest breaks and take them. It is easy to focus on your work and forget to take rest breaks; use a timer or a software reminder program to help you remember.

During each rest break, focus on something far away to relax your eye muscles. Avoid close focus activities like reading during a rest break to allow your eyes to rest.

Taking Care of Your Body

Keep your hands and arms warm. Warm up and gently stretch your hands before you start working. You may find it helpful to wear warm, fingerless gloves.

Keep a straight, or “neutral,” wrist position. Use wrist rests and other supports during pauses to help you keep a comfortable wrist position.

Use the minimum force necessary to activate switches (of any type, on any device). Many people use far more force than is required; this is frequently true for point-and-drag operations using a mouse. Excess force puts unnecessary strain on tendons, joints, and soft tissues. You may have to teach yourself to use minimum force.

Be aware that home and hobby activities can contribute to any discomfort or pain you may experience at work.

Maintain good overall muscle tone with a sensible exercise program. See a physician for recommendations, or before starting any exercise program.

Getting Help

If you experience any discomfort or pain, evaluate your work habits, your work environment, and your personal activities. Consult a physician if the discomfort or pain persists.

Seek professional medical attention if you experience a problem. Take an active part in alleviating the problem. Do not rely on self-diagnosis.