Hardware Handbook

First Edition (August 1994)

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Safety information

The construction of the IBM Aptiva* Personal Computer provides extra protection against the risk of electrical shock. The IBM Aptiva PC has a power cord with a three-prong plug that is required to ground metal parts. It is the responsibility of the person installing the computer to connect it to a properly grounded electrical outlet. Seek professional assistance before using an adapter or extension cord; these devices could interrupt the grounding circuit.

If the computer is connected to an electrical outlet that is incorrectly connected to the building wiring, serious electrical shock could result.

For continued protection against the risk of electrical shock:

- Connect your computer only to an electrical outlet of the correct voltage. If you are unsure about the voltage of the electrical outlet you are using, contact your local power company.
- If your computer has cables other than the power cords, you must connect them before plugging the power cords into an electrical outlet. Before removing these cables, you must first unplug the power cords from the outlet.
- If your computer has a telephone connection, do not touch the telephone cords when there is lightning in the area.
- Do not use or store the computer in an area where it can become wet.
- Make sure all replacement parts have characteristics identical or equivalent to the original parts. Other parts may not have the same safety features.
- Personal injury or electrical shock may result if you undertake actions other than those specifically described in this book. This is particularly true if you try to service or repair the power supply, monitor, or built-in modem. Always refer service or repairs to qualified service personnel.

Caution:

Your computer uses lithium batteries. There may be a risk of fire, explosion, or burns if the batteries are handled incorrectly. To ensure safety:

- *Do not recharge, disassemble, heat, or incinerate a lithium battery.*
- *Replace the battery with an identical or equivalent type lithium battery.*
- *Discard used lithium batteries according to local country dispositions.*

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VESA	Video Electronics Standards Association
Windows	Microsoft Corporation
Windows NT	Microsoft Corporation
Works for Windows	Microsoft Corporation

Hardware and software assistance

See your *Services and Support Guide* for information on getting hardware and software assistance.

About this book

The *Hardware Handbook* contains general information about using The IBM Aptiva* Personal Computer. It also provides hardware specifications and installation instructions for most options that you can add to your computer.

For example, this book can help you:

- Select software settings that let you get the best performance from your monitor
- Install a printer driver
- Send commands to your modem
- Determine the cause of many computer problems and fix them yourself
- Install and remove adapter cards
- Install and remove diskette drives, hard disk drives, tape drives, and CD-ROM drives
- Add memory
- Upgrade your processor
- Change your battery

How this book is organized

This book has two parts and an appendix.

"Part 1. Reference information" contains information about using monitors and modems, installing printer drivers, troubleshooting problems, and using the computer's Configuration Utility.

"Part 2. Installing options" contains instructions for installing options in your system unit and on your system board.

"Appendix A. Reference tables" contains technical reference information that you may need when installing options.

Related information

The following publications contain more information about your computer:

Read me first. This booklet contains instructions to help you unpack, setup, and start using your computer.

Services and Support Guide. This folder contains important information about hardware service and software support for your computer. Here you will find information about using the 1-800-number (for hardware assistance) and IBM support services (for answers to questions about your new computer). This folder also contains your warranty and license agreement.

A Guide to All the Extras. This folder contains information about a wide selection of additional software offerings. Be sure to read this information to take full advantage of all The IBM Aptiva Personal Computer offerings.

Online documentation. The software that came preloaded on your computer includes online tutorials and exercises that can help you learn how to use your computer. We suggest you start exploring the online documentation by double-clicking on the Learning Library icon in Program Manager.

Reference information Part 1

In this part, you will find these chapters:

- "Setting up and using a monitor". Describes how the monitor controls work and explains how to set up the software that lets you get the best performance from your monitor.
- "Using a printer". Explains how to install a printer driver.
- "Modem information". Describes the modems that come on some models of The IBM Aptiva Personal Computer, their features, and how they work. This chapter also explains how to send modem commands and includes a table of frequently used commands.
- "Using Rapid Resume Manager". Explains how your computer functions when you have Rapid Resume* Manager features enabled.
- "Troubleshooting". Describes potential computer problems and their solutions.
- "Working with the Configuration Utility". Explains how to use the Utility to change your computer's hardware information.

Setting up and using a monitor 1

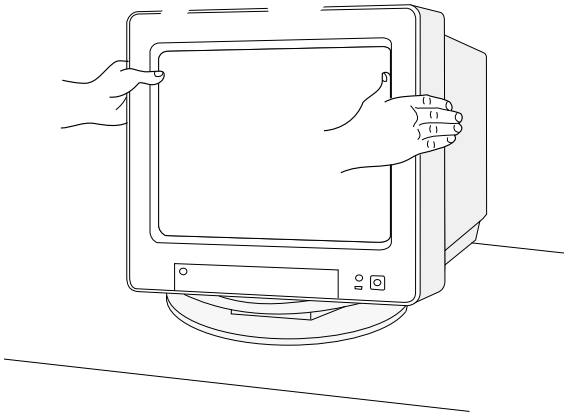
You should have already followed the setup instructions in the *Read Me First* booklet to connect the monitor to the system unit.

Using the tilt/swivel stand

Your monitor may come with a tilt/swivel stand that lets you adjust the screen to a comfortable viewing angle. (Your tilt/swivel stand may come preinstalled. If it is not preinstalled, see the installation instructions that came with your monitor.)

To use the tilt/swivel stand, grasp the monitor with both hands and:

- Pull downward to lower the monitor.
- Push upward to raise the monitor.
- Push side to side to turn the monitor.



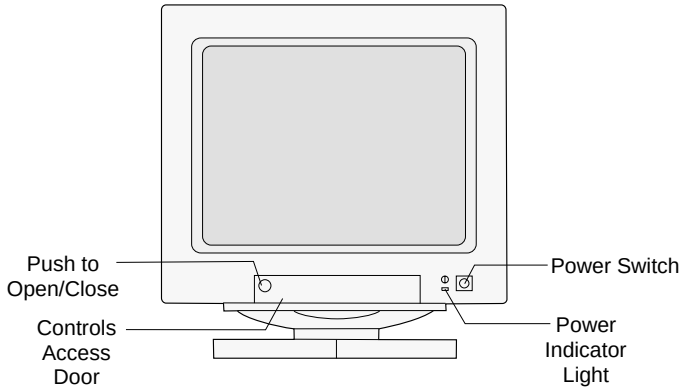
Adjustment tips:

- Tilt the monitor at an angle that gives you the least reflection from lights and windows. This usually means positioning the screen at a right angle to any windows.
- Position the monitor so that the top of the screen is slightly below your eye level.

Adjusting monitor controls

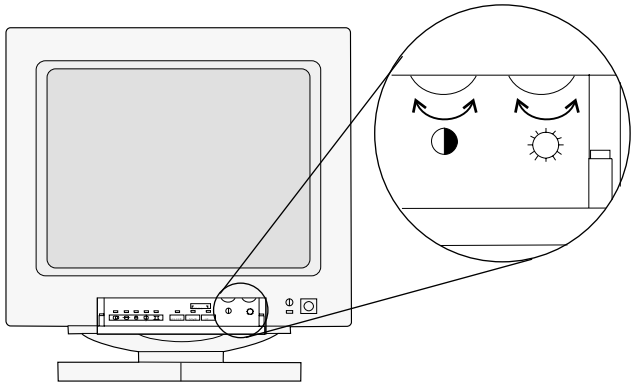
Your monitor has controls for adjusting the image that you see on the screen. The instructions on the next few pages will help you identify and adjust these controls.

The following picture shows a typical monitor. Your monitor may or may not have a controls access door. Push in on the door to open it.



Contrast and brightness controls

Use the contrast and brightness controls to sharpen and change the intensity of the image on your screen. (The controls on your monitor may not be located behind a door as shown in the following picture.)



Most monitors have symbols above the controls that identify the control function.

◑	Contrast	Makes the image sharper.
☼	Brightness	Makes the image lighter or darker.

To adjust the contrast and brightness controls:

1. Be sure the monitor and system unit are turned on. (The power indicator lights on the monitor and system unit are lit when they are on.)
2. Adjust the monitor controls until you get the effect you want.

Adjustment tips:

- Set the brightness level so that the background (the black visible area just outside the data/text area) just disappears.
- Set the contrast level so that text does not appear fuzzy. The edges of the characters should remain sharp.

Image controls

Some monitors have controls that let you adjust the shape and position of the images you see on the screen. These image controls are located on the front of the monitor underneath the screen, typically behind a door.

The following are symbols for common image controls. The symbols are located next to the controls. Your monitor may have some or all of these controls.

Centers the screen image horizontally.

Centers the screen image vertically.

Adjusts the horizontal size of the screen image.

Adjusts the vertical size of the screen image.

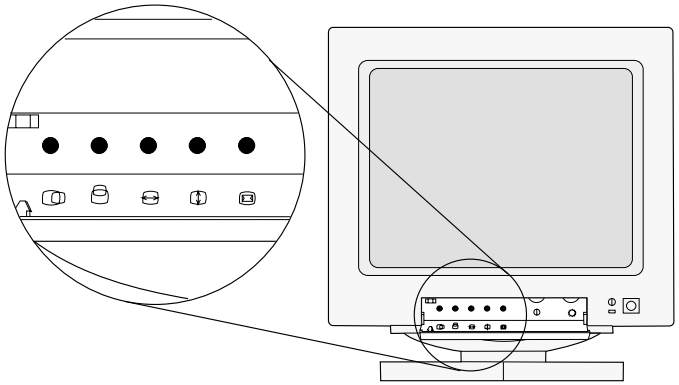
Adjusts the vertical sides of the image from appearing to bow in or out.

Adjusts the angles of the vertical sides of the image.

If your monitor has image controls, they could be either *rotary* or *push button* controls.

Rotary image controls

You turn knobs to adjust rotary image controls. The knob for each control is located next to the symbol.



To adjust a rotary image control, turn the knob to the left or right until you get the effect you want.

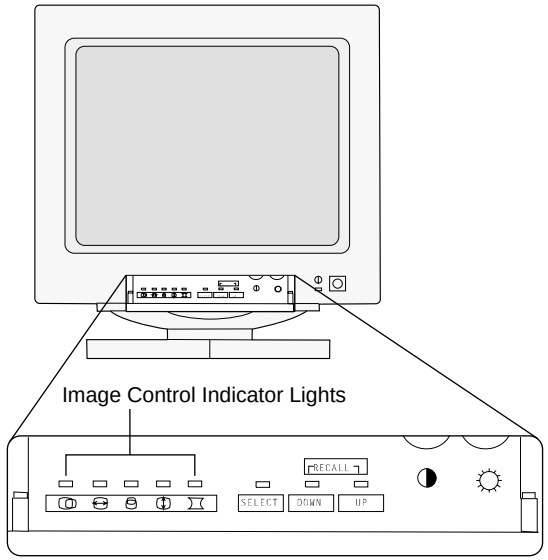
Push button image controls

You adjust some image controls with push buttons. The way that you adjust the push button image controls depends on whether you have a monitor *with* or *without indicator lights.*

Monitors ***with*** image control indicator lights

If your monitor has an indicator light next to each image control symbol, follow these steps to adjust the image controls:

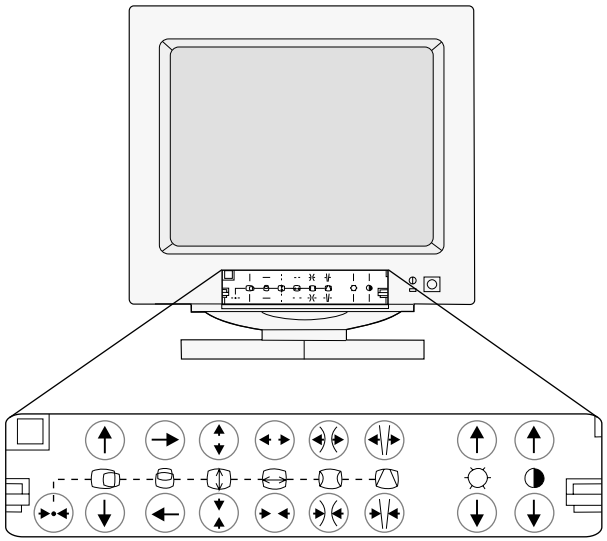
1. Press SELECT until the light next to the symbol for the image control you want to adjust is lit.
2. Press DOWN to decrease the selected effect or press UP to increase the selected effect.



note: *If the monitor cable is disconnected from the system unit, the lights next to the symbols will flash consecutively. This is normal.*

Monitors *without* image control indicator lights

If your monitor has push buttons next to each image control symbol, adjust the image controls by pressing the arrows next to the symbols to increase or decrease the effect. *After you make all of your adjustments, you must wait 5 seconds for the monitor to save the new setting.*



Adjustment tip:

- Use push button image controls to minimize the black border around the data/text area on the screen by adjusting the image size out to the edges of the monitor casing.

Recall function

For monitors with push button image controls, the image control settings for common display modes have been preset at the factory. (A display mode is the combination of the monitor's resolution and horizontal frequency settings. For example, 720x400 at 70Hz.) For some display modes, you can return to (recall) the image control settings set at the factory. For monitors:

- *With* image control indicator lights, you press UP and DOWN together to recall factory settings.
- *Without* image control indicator lights, you press and hold the Reset button, , for about 4 seconds to recall factory settings.

Example:
If you have selected a display mode of 720x400 at 70Hz, common for DOS, and you change the image settings while you are in that mode, you can use the Recall function to return to the factory image control setting.

Power saver feature

Your monitor may have a power saver feature, which allows the monitor to save energy when it has not been used for a specified amount of time. Your IBM Aptiva Personal Computer comes with a special feature called Rapid Resume*, which lets your monitor and computer use this power saver feature. The Aptiva Index describes the Rapid Resume features and gives you step-by-step instructions for setting it up. You can use the Aptiva Index by double-clicking on its icon in Program Manager.

note: *The monitor's power indicator light will begin to flash soon after the system unit turns off when Rapid Resume features are enabled. This is normal.*

Monitor settings

The following definitions will help you understand some of the terms used to describe monitor characteristics.

Table 1: Monitor terms and definitions

Term	Definition
display mode	A resolution setting associated with a vertical frequency setting (and sometimes a color setting). For example, 640x480 at 72 Hz, 256 colors.
horizontal frequency	Rate (in kilohertz [kHz]) at which each line on the screen is drawn.
interlaced	Method of producing an image by drawing only alternating lines until the entire image is completed.
noninterlaced	Method of producing an image by drawing each line, one after the other, until the entire image is completed.
pel (or pixel)	A picture element. A small rectangle or portion of an image that together with other pels make up the entire image.
resolution	The number of pels required to display an image horizontally and vertically. for example, 640x480 means 640 pels horizontally and 480 pels vertically.
SVGA	Super video graphics array. A video standard that provides some of the higher text and graphics resolutions.
vertical frequency	Rate (in hertz [Hz]) at which the entire image is drawn on the screen. Also called “refresh rate”.

Selecting monitor settings

These are the monitor settings that you can select.

- Monitor Frequency. Sets the computer’s video output frequency to match the monitor’s frequency.
- Monitor Resolution. Determines the amount of information that can appear on the screen.
- Number of Colors. Sets the number of colors that can be displayed on the screen.
- Font Size. Sets the size of the characters displayed on the screen.

The values you can choose for Monitor Resolution and Number of Colors depend on the:

- Monitor’s horizontal frequency setting.
- Amount of video memory installed on the computer’s system board. The amount of video memory installed on your system board is listed in the Configuration Utility. For instructions on using the Configuration Utility, see page 59.

Monitor Frequency

If your monitor and system unit came:

- *Packaged together,* your monitor frequency was set correctly at the factory to give you the best performance from your monitor. You do not need to complete the following steps unless you attach a different monitor.
- *Separately*, complete the following steps to get the best performance from your monitor.

You select the Monitor Frequency setting in the Configuration Utility. To select the Monitor Frequency setting:

1. If your monitor and system unit are turned:
   a. *On*, close all of your applications and turn off the system unit. Then turn it on again.
   b. *Off*, turn on your monitor, and then turn on your system unit.
2. Press the F1 key when this symbol appears in the upper right corner of your screen:

   This starts the Configuration Utility.
3. Press the Down Arrow key until the Monitor Frequency setting is highlighted.
4. Look in the documentation that came with your monitor to find the highest *horizontal frequency* that your monitor can support. Horizontal frequency is also called *horizontal scanning frequency.*
5. If the current Monitor Frequency setting is:
   a. Correct for your monitor, press Esc to exit the Configuration Utility.
   b. Not correct for your monitor, press the Left Arrow or Right Arrow key until you see the correct setting. (For additional information about this setting, press F1 while the setting is highlighted.)

Warning!

Do not select a setting that exceeds the capabilities of your monitor. If you do, your monitor will not function properly. If this happens, turn off your system unit and repeat steps 1 through 5.

To save your selection and exit the Configuration Utility, press Esc and then press Enter.

Monitor Resolution, Number of Colors, and Font Size

Once you have selected the correct monitor frequency, the computer knows which resolutions and colors your monitor can support. In Display Select (where you select Monitor Resolution, Number of Colors, and Font Size), you can only select those settings that are supported. Settings that are not supported are gray, and nothing happens when you click on them.

Of the settings that your monitor supports, you should select the ones that are most comfortable for you to work with. You can determine which settings are most comfortable to work with by selecting and trying each one.

To set the Monitor Resolution, Number of Colors, and Font Size settings, follow these steps:

1. Double-click on the *Custom Tools* icon, then click on the *Display Select* button.
2. Click on one of the resolution settings that is not grayed out.
3. Click on one of the color settings that is not grayed out.
4. Click on the font size that you prefer.

note: *For additional information about these settings, see the Help topics in Display Select.*

Tips:

The highest resolution and color settings are not always best. For example:

- Higher resolutions display more pels. While this allows more text and graphics to be displayed, it makes them appear smaller. For most users, 640x480 or 800x600 is a comfortable resolution setting.
- When you select more colors, most software applications will slow down. Only choose as many colors as you need. A color setting of 256 typically provides the fastest performance.

Performance tips

Here are some general guidelines for working with your monitor:

- Place your monitor away from sources of magnetic interference, such as other monitors, unshielded speakers, and electric power lines. (The speakers that come with some models of the computer are shielded.)
- Keep the monitor screen clean by using a nonabrasive screen or glass cleaner. Do not spray the cleaner directly on the screen.
- Under some conditions, interference patterns, such as curved, shadowy lines, can occur. If these patterns appear on your screen, change your software application's background color or design.
- To extend the life of your monitor, turn it off at the end of each day even if it has a power saver feature.
- Check the documentation that came with your software application to see if it will let you select combinations of resolution and color. This could make viewing the screen more comfortable.

Installing a printer driver

After you have attached your printer to your computer as described in the *Read Me First* booklet, you need to install the correct printer driver in Windows.

A printer driver is a file that describes the characteristics of your printer to the software. The software then uses the file to convert your text and graphics into a form that your printer can understand.

To install the correct printer driver:

1. At the Microsoft** Windows** Program Manager screen, double-click on the First Steps icon.
2. Click on Set up your Printer.
3. Click on Start. The "Printers" window appears.
4. Click on Add>>.
5. Click on the name of your printer in the "List of Printers:" box. You may have to scroll through the list until you find the name of your printer.

   If you do not see the name of your printer in the box, your printer may have an emulation mode that allows it to print like one of the printers in the list. Look in the documentation that came with your printer to find information on emulation modes. Then select the name of one of the printers it can emulate in this list.

   If your printer came with a diskette, it may contain the printer driver your printer needs. Follow the instructions in the documentation that came with your printer to install this driver.
6. Click on Install... The name of your printer is now highlighted in the "Installed Printers:" box.
7. While the name of your printer is highlighted in the "Installed Printers" box, click on Set As Default Printer.

note: *Most fax software packages allow you to set the fax modem as the default printer. If your computer came with a fax modem and fax software installed, you must set the fax modem as the default printer while you are sending and receiving faxes. When you are finished using the fax modem, change the default printer back for printing. For more information, see the online Aptiva Index entries pertaining to your fax software.*

8. Make sure the name of your printer appears in the "Default Printer" box. If it doesn't, repeat steps 4 through 7.

9. Click on Setup... to change the default settings for your printer. For example, you can select the paper source, paper size, and page orientation.

10. After you have made your selections, click on OK.

A port is a connection on the back of the system unit in which you plug a device, such as a printer. Most printers are parallel printers, and therefore should be attached to parallel ports.

note: *In the Connect window, you can assign your printer to a port. However, if you have a parallel printer and you attached it to your system unit as described in the Read Me First publication, Windows automatically selects the correct port (LPT1) for you.*

11. Click on Close to save your selections and exit the "Printers" window.

Modem information 3

About built-in modems

Some IBM Aptiva PCs have a built-in modem (modulator-demodulator). Using a telephone network, a modem allows your computer to communicate with other computers or fax machines.

This chapter includes important information about connecting your modem to the telephone network and operating your modem. You'll find useful tips that will help you:

- Use the Auto Answer feature with your modem communications software
- Use the telephone with your modem
- Use the Wake Up on Ring feature if you replace your built-in modem

We've also included a section about how modems work to help you understand the problems you may encounter as you use your modem.

Connecting your modem to the telephone network

Modems are designed to operate over the public switched telephone network (PSTN or PSN). This is an *analog network* commonly used by most households and businesses. Connect the modem to an analog network *only*. If you are not sure about your telephone line, contact your local telephone company.

Warning!

- *Excessive voltages can occur on telephone lines, especially during lightning storms. To avoid any possible damage to sensitive electronic parts, unplug the computer and the telephone cords during such storms.*
- *Some businesses, schools, and buildings have digital telephone systems, known as digital private branch exchange (PBX) systems. These systems do not work with the modem. Connecting your modem to a digital telephone system may damage the modem.*

Types of built-in modems

Most IBM Aptiva PCs purchased in the U.S. and Canada that have built-in modems use one of the modems listed below. The modem you have depends on your computer's model and is shown on the box your computer came in.

2400 bps data modem with 9600 bps send fax and 4800 receive fax capabilities: This modem is GVC F-9424H/R1; it supports Class 1 fax commands.

14,400 bps data modem with 14,400 bps send and receive fax capability: This modem is GVC F-1114HV/R1 or /R6; it supports Class 2 fax commands and V.42bis.

note: *Some IBM Aptiva PCs in the U.S. and Canada, and some models in other countries, may have built-in modems with more features than the modems listed here. If you have one of these models, refer to the modem documentation that came with your computer.*

Operating your modem

You can operate your modem either through a modem communications software package or from your DOS prompt.

Most people use a communications program (software package) to operate their modem. Examples of these programs include Windows Terminal, PFS:WindowWorks**, and Microsoft Works for Windows**. These programs allow you to operate your modem without using the Hayes** AT command set—the commands that modems understand. With these software packages, you operate your modem by choosing menu items from a screen on your computer. If you use a communications program, see the user's guide that came with the software for detailed instructions on operating your modem.

note: *Most modem communication programs also allow you to send specific AT commands to the modem.*

You can also send commands to your modem from the DOS (C:>) prompt. Operating your modem with DOS is difficult and generally for experienced modem users only. With DOS, you must type long AT command strings and you may need to send a variety of commands for each transmission. Also, you are not always sure if your commands have been received and executed by the modem.

To communicate with a modem from DOS, use the ECHO command. Direct these commands to the port your modem is connected to. For example:

C:\ > echo ATS0=0&W0&W1>COM1 and press Enter.

This is an AT command that:

- Stores a 0 into S register 0 to turn Auto Answer off (ATS0=0). S registers are storage areas inside the modem. The S registers hold values that the command set uses to control modem operations. For more information on S registers, see page 28.
- The &W0&W1 portion of the command stores ATS0=0 into memory (NVRAM locations 0 and 1) for future use.
- The command is directed to the modem's port (>COM1).

Whether you use DOS or a modem communications program, you can send a wide variety of commands to your modem. For a detailed listing of modem commands see page 24.

Tips on using your modem

This section provides tips on:

- Using the Auto Answer feature with your modem communications software
- Using the telephone with your modem
- Using your computer's Wake Up on Ring feature if you decide to replace your built-in modem.

Using the Auto Answer feature

If you use a modem communications program, it may require your modem to be set for *Auto Answer*. The Auto Answer feature lets your computer answer calls from another computer automatically.

To start the Auto Answer feature from your communications software, type: ATS0=n. This command tells the modem to answer a call after a certain number of rings. To set the number of rings, replace n with any number from 1 to 255.

Turn AutoAnswer off when you are not using your modem. Otherwise, callers will be greeted with the modem tone. To turn Auto Answer off, you type: ATS0=0.

note: *If you are using AutoAnswer with a fax software application, setting a high number of rings will allow you to answer the telephone before the fax machine does.*

Your modem communications program determines how the modem operates with AutoAnswer. Some fax applications do not require you to type an AT command to turn Auto Answer on or off. For specific instructions, see the user's guide that came with the communications software.

If your computer came with fax software already installed, the fax software documentation was included in the box your computer came in.

Using the telephone with your modem

To avoid interrupting modem communications, follow these telephone operating procedures.

When using the telephone line for communications, do not pick up any telephone receiver on that line. If you do, communications will be interrupted.

Disabling Call Waiting

You may want to disable the Call Waiting feature while using your modem. With Call Waiting, communications can be interrupted when a second call is waiting to be answered.

To disable Call Waiting, contact your telephone company. Different telephone companies have different procedures for disabling this feature. Also, some telephone companies cannot disable Call Waiting. Your telephone company business office should be able to tell you the

procedures and *dialing sequence* required to disable Call Waiting.

A dialing sequence is similar to a command you type on your computer. For example, in some areas the following dialing sequence disables Call Waiting:

(# or *)70,,,(complete telephone number)

The dialing sequence you type on your computer might look like this: *70,,,5554343. The commas (,,,) pause the modem until the command is carried out, then the telephone number is dialed automatically.

Call waiting will be disabled only for the duration of your modem's current call and only from the calling end. For incoming calls, you may find it helpful to change the value of register S10 to a higher number. For more information on S registers, see page 28.

Your modem communications software determines how your modem operates with Call Waiting. For specific instructions, see the user's guide that came with the communications software.

If your computer came with fax software already installed, the fax software documentation was included in the box your computer came in.

How modems work

If you are having problems connecting to other modems, or are interested in learning more about how modems work, the information in this section can help you. This section discusses data modems, connecting to other data modems, fax modems, and choosing fax software applications.

Modem connection process

For two modems to connect, they must be of the *exact same* type and function. A data modem can only connect to a data modem and a fax modem can only connect to a fax modem. Many modern modems are designed with both data and fax capabilities. The data components of these data/fax modems can communicate with data modems, and the fax components can communicate with fax modems.

The connection process is controlled by software built into the modem. This connection process is called a *protocol*. The protocol of one modem communicates with the protocol of another and they "negotiate" to achieve a connection. These protocols must be compatible for the modems to connect.

The result of this negotiation determines the speed at which the two modems connect. Normally a 14,400 bits per second (bps) modem connects with a 9,600 bps modem at the lower speed of 9,600. But, because of phone line noise, they may connect at 2,400 bps. If you use a modem software package (such as Windows Terminal, PFS:WindowWorks, or Microsoft Works for Windows), you should see the final connection speed on the screen. This rate remains constant throughout the session.

Data modems

Data modems send and receive data in the form of codes that represent letters, numbers, and spaces. Each letter of a word is represented by a code. These codes are sent in a series with a different code representing a space between words. Special applications, like word processors, use additional code sequences to indicate font type, bold, italic, and so on.

You use the *Attention* command set (sometimes called the *AT* or *Hayes* command set) to send commands to your data modem. The AT command set has evolved over the years, and some of its "standards" have also changed. Modem default settings and the more sophisticated modem commands, in particular, have changed over time.

Modem protocols govern the way a modem converts digital information from the computer into analog signals that can be transmitted over the telephone lines. Over time, standards have been created for these protocols. These standards are necessary so that modems made by different companies can exchange data.

Primarily, modem standards and recommendations in the United States have been set by two organizations:

- The International Telephone and Telegraph Corporation set the "Bell" standards.
- The International Consultative Committee on Telephony and Telegraphy set the "V." (Vee Dot) recommendations.

Data modems use these standards for speeds up to 14,400 bps:

- Bell 103
- Bell 212A
- CCITT V.21, V.22, V.22bis.,V.23, V.32, and V.32bis

Many modems support all of these standards. Older modems may support some but not all of these standards.

Connecting to other data modems

Phone line noise can cause loss of data and connection when modem speeds rise above 1200 bps. Over time, many different software transmission protocols, such as X-modem, MNP, and V.42bis, have been developed solely to detect and correct the errors caused by phone line noise. Not all of these protocols are compatible. This may be the reason you are unable to connect to another modem.

If your data modem uses any error detection and correction protocol, the modem on the other end must also have the same protocol. For example, if your data modem uses X-modem (one of the early protocols), the modem you're connecting to must also use X-modem. This is why you are asked to choose a transfer type in your software before downloading a file from a bulletin board.

Many different error detection and correction protocols are commonly used today. Examples of the earliest error detection and correction protocols include X-modem, Y-modem, and Kermit. These protocols are performed by software on your computer.

Recently developed protocols include the Microcom Network Protocol (MNP) and V.42bis. These protocols are performed by "firmware." Firmware is software built into the modem. V.42bis is the newer of these two protocols. It has its own methods of error detection and correction, and also incorporates the MNP 4 and 5 protocols. As a result, modems with MNP 4 and 5 and modems with V.42bis can connect with each other.

If you cannot connect to another modem, it may be because the protocol you are using is not compatible with the protocol of the modem on the other end. If you're having trouble connecting to other modems, try following these guidelines.

- If you know what protocols are available on the modem you are connecting to, enable a protocol on your modem that is supported by the other modem. Usually V.42bis works best if both modems support it.
- If you frequently connect to bulletin boards, you should buy a modem software package that includes many different software protocols. Different bulletin boards use different protocols.
- Many network services have their own proprietary protocols. To connect to these services, you often

have to buy the protocol from the service. Other network services rely on CCITT V.42bis or MNP 4 and 5.

Important: *All error detection and correction protocols compress data to avoid slowing the transmission rate. However, combining protocols will not increase your transmission speed or significantly reduce transmission errors.*
For example, running V.42bis and X-modem together will not give you a greater compression rate or transmission speed than running V.42bis alone. Use only one protocol.

Fax modems

Fax modems send and receive facsimiles and generally transmit and receive pictures better than data. In a fax machine, a page is "read" by a scanner and broken into a series of dots representing light and dark portions of the page. These dots compose the pictures, graphics, letters, and numbers printed by the fax machine.

Important: *The scan rate option in your fax software determines the size of a fax and how much time it takes to transmit the file.*

The fax machine scans a page line-by-line and records the number and position of each dot in a scan line. This information is converted into a special code and transmitted to another computer or fax machine. This transmission uses a set of transfer and modulation specifications called protocols.

Fax machines and modems are connected in *Groups*. The modem in your computer works with all Group 3 and most Group 2 fax machines.

Choosing fax software applications

If your computer did not come with preinstalled fax software, you must buy a fax software application to operate your fax modem. Also, if you add a fax modem to your computer, you need to purchase fax software.

You send commands to a fax modem (or the fax portion of a data modem) using a revised version of the AT command set. This revised version includes two different sets of commands: *Class 1* and *Class 2*. Some modems support one class of command while others support both. When buying a fax software application, choose the highest class that your modem supports.

note: *CAS and SENDFAX are two other commonly used command sets. These command sets are not supported by the built-in modems in IBM Aptiva PCs.*

- If your computer has a 2400 bps modem with 9600 bps send fax and 4800 receive fax capabilities, your modem supports Class 1 fax commands.
- If your computer has a 14,400 bps built-in modem with 14,400 send and receive fax capabilities, your modem supports Class 2 fax commands.

Communications settings

The built-in modems in IBM Aptiva PCs are preset to COM1 SERIAL PORT 1. The addresses and interrupts supported by your computer are:

	Address	Interrupt
COM1	03F8	IRQ 4
COM2	02F8	IRQ 3
COM3	03E8	IRQ 4
COM4	02E8	IRQ 3

The built-in external serial ports on the back of your computer support these addresses and interrupts.

Port	Address	Interrupt
Serial A	03F8 03E8	IRQ 4
Serial B	02F8 02E8	IRQ 3

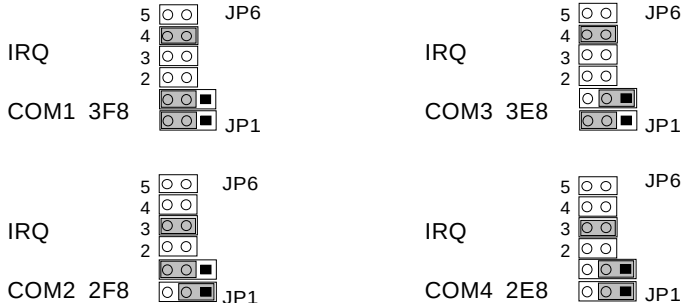
Conflicts may arise if you add adapter cards with serial ports or if you change the address settings on your modem. You can resolve most of these conflicts by using the Configuration Utility to change serial port addresses. See “Working with the Configuration Utility” on page 59 for more information.

Changing modem addresses

The modem address in your communications software must match the address setting on your modem. For example, if the modem address in the software is COM1 3F8, the DIP switches or jumpers on your modem must also be set for COM1 3F8. Help messages in your modem software will help you change your software address. The information below will help you set the DIP switches or jumpers on your modem correctly.

To change the hardware address settings on a built-in 14,400 bps data modem, locate the six DIP switches on the modem bracket on the back of the computer. Use the chart printed on the modem bracket to set the DIP switches for the correct address.

To change hardware address settings on a built-in 2400 bps data modem, you must reset jumpers on the modem. To access the modem jumpers, remove the cover from the computer. To remove the cover, see page 69. The illustration shows how you should set the jumpers for each address.



Modem commands

Table 2 lists the modem commands you are likely to use most often. The built-in modems are compatible with the Hayes AT command set. All commands in this table must be preceded by the letters AT unless otherwise indicated. Not all of the AT commands are listed here.

For example, locate Ds in the Code/Command column of Table 2. To tell your modem to dial a telephone number using touch-tone dialing, type ATDT followed by the telephone number and then press enter. The complete command might look like this: ATDT5554242. To dial the same telephone number using pulse dialing, you would type ATDP5554242. Spaces are not required in the commands unless otherwise indicated.

Table 2: Modem Commands

Code/Command	Function
AT	Begins the command line. The modem is ready to accept a command.
A/	Repeats the last command given, if it is not preceded by AT or followed by a carriage return.
A	Answers the call immediately.
Ds	The modem automatically dials a telephone number "s" where "s" is a complete telephone number. The command may also include the following codes: s=P Pulse dialing s=R Dial an "originate-only" modem s=T Touch-tone dialing s=, Pause while dialing s=@ Wait 30 seconds for a valid ringback followed by 5 seconds silence before next symbol s=; Return to command state after dialing s=! Go off-hook 0.5 seconds s=W Wait for dial tone
Ds=n	Dials one of four stored telephone numbers.
En	Sets Echo on/off n=0 Echo off n=1 Echo on

Table 2: Modem Commands (Continued)

Code/Command	Function
Hn	On/Off Hook n=0 On hook n=1 Off hook
Ln	Sets the volume of the speaker on the modem n=0 Low Volume n=1 Low Volume n=2 Medium volume n=3 High Volume
Mn	Controls when the modem speaker is in use n=0 Speaker Off n=1 Speaker is On except when receiving n=2 Speaker always On n=3 Speaker Off when dialing or receiving
On	Online n=0 Go online n=1 Retrain at 2400 bps
Qn	Sends result codes n=0 Result codes sent n=1 Result codes not sent
Vn	Determines whether the result code is sent in numbers or words. n=0 Result code is sent as numbers n=1 Result code is sent as words
Xn	Sets the type of Result code sent n=0 Basic Result code set (0 to 4) n=1 Extended result code set (0 to 5, and 10) n=2 Extended result code set (0 to 6, and 10) n=3 Extended result code set (0 to 7, and 10) n=4 The whole Result code is sent (0 to 10)

Table 2: Modem Commands (Continued)

Code/Command	Function
Z	Resets the modem to the defaults
Z0	Recalls modem profile 1
Z1	Recalls modem profile 2
&Zn=	Stores up to four telephone numbers in the modem's memory
&V	The modem answers with the active profile and the phone numbers stored in NVRAM
&W0	Saves the current register setting as profile 1
&W1	Saves the current register setting as profile 2
&F&W0&W1	Returns a modem profile to the original factory setting
+++	Escape sequence Return to command state
+FCLASS=?	Shows which class of fax commands the modem supports. If the modem answers: 0,1 it supports Class 1 commands 0,1,2 it supports Class 1 or Class 2 commands 0,2 it supports Class 2 commands

Modem return codes

The following table lists some codes that the modem sends to your computer in response to the commands you type. They are called return codes. Not all of the return codes are listed here.

The codes in this table are sent by the modem to your computer when you enter a modem command.

Table 3: Return Codes

Digit Code	Word Code	Meaning
0	OK	Command was carried out without error
1	Connect	Connected at 300 bits per second (bps)
2	Ring	Ringing signal detected
3	No carrier	Carrier is lost or not heard
4	Error	Error in the command line Invalid command Command line exceeds buffer Invalid character format
5	Connect 1200	Connected at 1200 bps
6	No dial tone	No dial tone during the time-out period
7	Busy	The line being called is busy
8	No answer	The line being called did not answer within the time-out period
10	Connect 2400	Connected at 2400 bps
	WORD FORM	Preceded and terminated by CR LF

S registers

S registers are information storage areas inside the modem. The AT command set uses the S registers to configure modem options. Some S registers have default settings. For normal modem operations, the default settings are usually adequate. However, special circumstances may require you to change some defaults. To change or read the value of an S register, begin the command with the letters AT. Not all of the S registers are listed here.

To read the value of an S register:

- Use the ATS*r*? command (*r*=register number 0-28).

  For example, to read the value of S register 0, type ATS0? and press enter.

To change the value of an S register:

- Use the ATS*r*=*n* command (*r*=register number 0-28, *n*=the new value you want to assign).

  For example, to change the value of S register 0 to 20 rings, type ATS0=20 and press enter.

Table 4: S registers

Register	Function	Range/units	Default
S0	Auto-answer Ring	0-255 /rings	0
S1	Ring counter	0-255 /rings	0
S2	Escape code character	0-127 /ASCII	43
S3	Carriage return character	0-127 /ASCII	13
S4	Line feed character	0-127 /ASCII	10
S5	Backspace character	0-32, 127 /ASCII	8
S6	Dial tone wait time	0-255 /seconds	2
S7	Remote carrier wait time	1-255 /seconds	45
S8	Comma pause time	0-255 /seconds	2

Table 4: S registers (Continued)

Register	Function	Range/units	Default
S9	Carrier detect response time	0-255 /10ths of a second	6
S10	Carrier loss time	0-255 /10ths of a second	14
S11	Touch-tone dialing speed	50-255 /milliseconds	95
S12	Escape character detect time	0-25 /50ths of a second	50
S13	Reserved (Do not use)		None
S14	Echo, response, dialing, originate/answer	Bit-mapped register	None
S15	Reserved (Do not use)		None
S16	RDL, Clear-Down, Retrain Response	Bit-mapped register	None
S17	Reserved (Do not use)		None
S18	Modem test timer	0-255 /seconds	0
S19	Reserved (Do not use)		None
S20	Reserved (Do not use)		None
S21	Originate-only, line, DTR, DCD, DSR, and Long Space Disconnect	Bit-mapped register	None
S22	Speaker, M/B ratio and response	Bit-mapped register	None
S23	DTE data rate, parity, and guard tone	Bit-mapped register	None
S24	Reserved (Do not use)		None
S25	Data Terminal Ready delay	0-100 seconds	5
S26	RTS to CTS delay interval	0-255 /100ths of a second	1
S27	Async/Sync operation, clock source, DCE speed	Bit-mapped register	None
S28	Power-on connect, call-back security, CCITT/Bell mode		None

Modem regulations

FCC and telephone company requirements

If your IBM Aptiva Personal Computer has a built-in modem, the following Federal Communications Commission (FCC) and telephone company requirements apply:

1. The modem adapter card is located in the back of the system unit. It complies with Part 68 of the FCC rules. A label is affixed to the built-in modem that contains, among other things, the FCC registration number, USOC, and Ringer Equivalency Number (REN) for this equipment. If these numbers are requested, slide the top cover forward to see the label, and provide this information to your telephone company.
2. The REN is useful to determine the quantity of devices you may connect to your telephone line and still have those devices ring when your number is called. In most, but not all areas, the sum of the RENs of all devices should not exceed five (5.0). To be certain of the number of devices you may connect to your line, as determined by the REN, you should call your local telephone company to determine the maximum REN for your calling area.
3. If the built-in modem causes harm to the telephone network, the telephone company may discontinue your service temporarily. If possible, they will notify you in advance; if advance notice isn't practical, you will be notified as soon as possible. You will be advised of your right to file a complaint with the FCC.
4. Your telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the proper operation of your equipment. If they do, you will be given advance notice so as to give you an opportunity to maintain uninterrupted service.
5. If you experience trouble with this built-in modem, contact your Authorized Seller, or the Product Support Center – Aptiva PC, IBM Corporation, Dept. BM3/Bldg. 201, Research Triangle Park, NC 27709-2195, 1-800-765-4747, Fax (919) 543-8716 for repair/warranty information. The telephone company may ask you to disconnect this equipment from the network until the problem has been corrected, or until you are sure the equipment is not malfunctioning.
6. No customer repairs are possible to the modem.
7. The modem may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs. Contact your state public utility commission or corporation commission for information.
8. When ordering network interface (NI) service from the Local Exchange Carrier, specify service arrangement USOC RJ11C.

Canadian Department of Communications compliance statement

This equipment does not exceed Class B limits per radio noise emissions for digital apparatus, set out in the Radio Interference Regulation of the Canadian Department of Communications.

Avis de conformitè aux normes du Ministètere des Communications du Canada

Cet équipement ne dépasse pas les limites de Classe B d'émission de bruits radioélectriques pour les appareils numériques, telles que prescrites par le Règlement sur le brouillage radioélectrique établi par le ministère des Communications du Canada.

Canadian Department of Communications certification label

Notice: The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION:
Users should not attempt to make such connections themselves, but should contact the approriate electric inspection authority, or electrician, as appropriate.

Étiqueete d'homologation du Ministère des Communications du Canada

AVIS : L'étiquette du ministère des Communications du Canada identifie le matériel homologué. Cette étiquette certifie que le matériel est conforme à certaines normes de protection, d'exploitation et de sécurité des réseaux de télécommunications. Le ministère n'assure toutefois pas que le matériel fonctionnera à la satisfaction de l'utilisateur.

Avant d'installer ce matériel, l'utilisateur doit s'assurer qu'il est permis de le raccorder aux installations de l'entreprise locale de télécommunications. Le matériel doit également être installé en suivant une méthode acceptée de raccordement. L'abonné ne doit pas oublier qu'il est possible que la conformité aux conditions énoncées ci-dessus n'empêchent pas la dégradation du service dans certaines situations.

Les réparations de matériel homologué doivent être effectuées par un centre d'entretien canadien autorisé désigné par le fournisseur. La compagnie de télécommunications peut demander à l'utilisateur de débrancher un appareil à la suite de réparations ou de modifications effectuées par l'utilisateur ou à cause d'un mauvais fonctionnement.

Pour sa propre protection, l'utilisateur doit s'assurer que tous les fils de mise à la terre de la source d'énergie électrique, des lignes téléphoniques et des canalisations d'eau métalliques, s'il y en a, sont raccordés ensemble. Cette précaution est particulièrement importante dans les régions rurales.

CAUTION:
L'utilisateur ne doit pas tenter de faire ces raccordements lui-même, il doit avoir recours à un service d'inspection des installations électriques ou à un électricien, selon le cas.

LOAD NUMBER (LN)

The load number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the load of all the devices does not exceed 100. The load number of the built-in modem is 10.

INDICE DE CHARGE (IC)

L'INDICE DE CHARGE (IC) assigné à chaque dispositif terminal indique, pour éviter toute surcharge, le pourcentage de la charge totale qui peut être raccordé à un circuit téléphonique bouclé utilisé par ce dispositif. L'extrémité du circuit bouclé peut consister en n'importe quelle combinaison de dispositifs pourvu que la somme des INDICES DE CHARGE de l'ensemble des dispositifs ne dépasse pas 100. L'indice de charge du modem intégré est de 10.

Using Rapid Resume Manager 4

Rapid Resume Manager features

Your IBM Aptiva Personal Computer comes with special software called Rapid Resume Manager that makes using your computer easier and more economical. Rapid Resume Manager has the following features:

- Rapid Resume*. Remembers your Windows desktop when you turn off your computer. The next time you turn on your computer, your Windows programs and files will be open just as you left them. The Automatic Power Off option saves energy by turning your computer off after it has not been used for a period of time that you set.
- Standby. Lets your computer use less energy after it has been inactive for a period of time that you set.
- Scheduler. Turns on the computer for an activity that you specify, such as sending a fax.
- Wake Up on Ring. Turns the computer on when the phone rings to let you receive a fax.

The following table describes the way your computer will normally operate when one of the Rapid Resume Manager features is turned on (enabled). See the Aptiva Index for step-by-step instructions for enabling Rapid Resume Manager features.

Table 5: Rapid Resume Manager normal operation

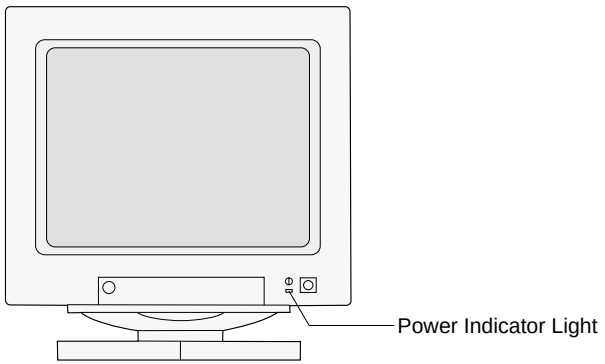
What happens:	Explanation:
Task List appears after turning on the computer.	This is a normal feature of Rapid Resume. Use the Task List to return to an application or disable the Task List in the Rapid Resume options window.
Delay before mouse works.	This is normal for the Standby feature of Rapid Resume. It may take a few seconds.
Computer waits before turning off.	This is normal. In some cases, it can take up to several seconds before Rapid Resume saves the data and turns off the machine.
Can't start the computer from diskette if Rapid Resume is enabled.	After you turn on the computer, press Ctrl + Alt + Delete when you see the Rapid Resume screen. There may be a slight delay before the computer restarts.
Computer comes on when the phone rings.	This is a normal feature of Wake Up on Ring. Disable Wake Up on Ring in Rapid Resume Manager or in the Configuration Utility.
Computer comes on when you haven't pushed the on/off button.	This is a normal feature of Scheduler. If you don't want this to happen, disable Scheduler in Rapid Resume Manager or Wake Up on Alarm in the Configuration Utility.

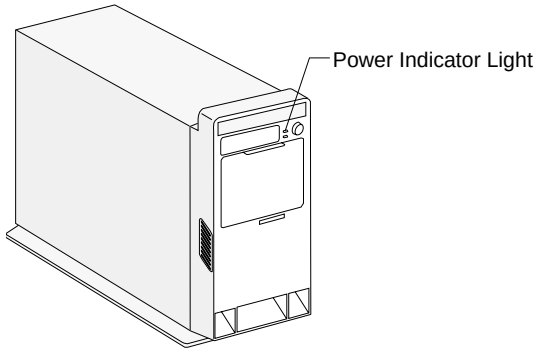
Table 5: Rapid Resume Manager normal operation

What happens:	Explanation:
System unit power indicator light is blinking, but system unit is turned off.	This is a normal feature of Wake Up on Ring. It indicates a fax may be waiting. With Wake Up on Ring enabled, you can select this feature in Rapid Resume Manager or in the Configuration Utility by enabling the Indicator option.

Problem solving steps

Step 1 Are the power indicator lights on the monitor and system unit lit?





Yes Power is reaching the monitor and system unit. Go to Step 2.

No Follow these steps:

a. Press the on/off buttons on the system unit and monitor to make sure they are turned on.

b. Make sure your monitor and system unit cables are connected correctly and securely. Make sure the monitor and system unit power cables are plugged into electrical outlets.Your *Read Me First* booklet shows how the cables should be connected.

c. Make sure the electrical outlets you are using are not controlled by a wall or dimmer switch.

d. If you are using a multiple outlet device (for example, a power surge protector or power strip), make sure it is plugged in and turned on.

If the error continues, check your *Services and Support Guide* for information on obtaining service.

Step 2 Did the system unit beep after it was turned on?

Yes, more than once	There is a problem with the system unit. Follow these steps: a. If an error code is displayed, find the code in "Error codes, descriptions, and corrective actions" on page 50 and take the action listed. b. If an error code is not displayed, check your *Services and Support Guide* for information on obtaining service.
Yes, once	The system unit has passed the power-on self test (POST). Go to Step 3.
No	There is a problem with the system unit. Follow these steps: a. If you added hardware, remove it and restart the computer to see if the problem is corrected. For instructions on installing hardware in your system unit, see "Working with your system unit" on page 69. For instructions on installing options on your system board, see "Working with your system board" on page 87. b. Check that the processor and memory modules are correctly installed. For instructions, see "Working with your system board" on page 87. If the error continues, check your *Services and Support Guide* for information on obtaining service.

Step 3 Is anything displayed on the monitor?

Yes

There is a problem with the system unit if:

- A three or four digit error code appears. Look up the number in the error code table that begins on page 50.
- A blue box containing an error code and message appears. Follow the instructions in the message. For instructions on using the Configuration Utility, see page 59.
- A blinking cursor appears. Check your *Services and Support Guide* for information on obtaining service.
- The image on the screen is unreadable (the image is scrolling, blinking, or flashing). Follow these steps:
  a. You may have selected a Monitor Frequency setting that your monitor does not support. Follow the steps under "Monitor Frequency" on page 10 to select another setting.
  b. Disable the Power-on Password option in the Configuration Utility and record any settings that you have changed (customized) from the default settings (for example, Monitor Frequency). For instructions on using the Configuration Utility, see page 59.
  c. Turn off the system unit. Reset your computer by holding down both mouse buttons while you turn on the system unit. Release the mouse buttons when something appears on your screen.

  Note: Resetting your computer changes all of the settings in the Configuration Utility to the factory defaults. After resetting your computer, re-enter any customized settings in the Configuration Utility.
- The colors displayed are wrong. Check to make sure the monitor cable is connected correctly and securely to the system unit. Your *Read Me First* booklet shows how the cable should be connected.
- Nothing happens when you use the mouse or keyboard. Press the Ctrl + Alt + Delete keys at the same time to restart the computer.

If the problem you are having does not appear in this list, look for a description of the problem in the trouble-shooting tables that begin on page 38.

No

There is a problem with the monitor. Follow these steps:

a. Make sure your monitor cables are connected correctly and securely. Your *Read Me First* booklet shows how the cables should be connected.

b. Adjust the brightness and contrast controls. For instructions, see "Adjusting monitor controls" on page 4.

If the error continues, check your *Services and Support Guide* for information on obtaining service.

Troubleshooting tables

Table 6: Troubleshooting

Hardware problems	
If the problem is:	Here's what to do:
No beep during power-on self test (POST)	1. Make sure that the system unit is turned on. 2. If the error continues, check your *Services and Support Guide* for information on obtaining service.
Error code (and description), more than one beep in self-test, or continuous beep occurs	If an error code: • *Is* displayed, find the code in "Error codes, descriptions, and corrective actions" on page 50 and take the action listed. • *Is not* displayed, check your *Services and Support Guide* for information on obtaining service.
Computer turns off without warning	1. Make sure that the power cords are securely plugged into the electrical outlet. 2. Make sure that the cables are connected correctly and securely to the system unit. 3. If you have enabled the Rapid Resume feature and set up the Automatic Power Off option, or set the Scheduler feature to turn the system unit off, turn the system unit back on. 4. Check for a blown fuse, tripped circuit breaker, or power failure. 5. Unplug the system unit from the electrical outlet, wait 10 seconds, and then plug the system unit back into the electrical outlet. If the computer does not start immediately, push the on/off button on the system unit. 6. If the error continues, check your *Services and Support Guide* for information on obtaining service.
Can't enter password	1. Make sure you are typing the correct password. 2. Make sure the keyboard cable is connected correctly and securely to the keyboard port on the back of the system unit. The keyboard port has this symbol next to it to help you: 3. If you have forgotten your password or if the error continues, check your *Services and Support Guide* for information on obtaining service.

Table 6: Troubleshooting (Continued)

Hardware problems	
If the problem is:	Here's what to do:
Can't read information on diskette or CD	1. Make sure you are using the correct type of diskette; make sure the diskette is formatted correctly. 2. Make sure the diskette or CD is inserted into the drive correctly. 3. Make sure the CD is clean and not scratched. 4. Try to read a diskette or CD that you know is good. If it works, the first diskette or CD is bad. If you can't read the information on the good diskette or CD, there may be a problem with your diskette or CD-ROM drive. Check your *Services and Support Guide* for information on obtaining service.
Can't send information (write) to diskette	1. Make sure the diskette is formatted correctly. 2. Make sure the diskette is not write-protected. 3. Make sure you are sending information to the correct drive. 4. Make sure there is space on the diskette for the information. (Try using a blank, formatted diskette.) 5. If the error continues, check your *Services and Support Guide* for information on obtaining service.
Can't format diskette	1. Make sure the diskette is not write-protected. 2. Make sure you are using the correct type of diskette. 3. If the error continues, check your *Services and Support Guide* for information on obtaining service.
Keyboard doesn't work or only some keys work	1. Make sure the keyboard cable is connected correctly and securely to the keyboard port (not the mouse port) on the back of the system unit. The keyboard port has this symbol next to it to help you: 2. Move your fingers across the keys; make sure no keys are stuck. 3. Make sure you are on a screen that allows typing. Some screens do not. 4. Turn the system unit off; wait 10 seconds; then turn the system unit on. 5. If the error continues, check your *Services and Support Guide* for information on obtaining service.

Table 6: Troubleshooting (Continued)

Hardware problems	
If the problem is:	Here's what to do:
Mouse does not move the cursor	1. Move the mouse onto a mouse pad and try using it. 2. Make sure the current screen allows the use of a mouse. 3. Make sure the mouse cable is connected correctly and securely to the mouse port (not the keyboard port) on the back of the system unit. The mouse port has this symbol next to it to help you: 4. Clean the mouse. For instructions, select the Learning Library icon in Program Manager to see the *Computer Basics* tutorial that came on your system. 5. Turn the system unit off, wait 10 seconds, and then turn the system unit on. 6. If the error continues, check your *Services and Support Guide* for information on obtaining service.
Modem/communications errors	1. Make sure the telephone cord is securely plugged into the telephone outlet in the wall and into the system unit. For instructions, see the *Read Me First* booklet. 2. Make sure the telephone line works by plugging a good telephone into the same telephone outlet that the computer was plugged into. Then make sure you can place a call. 3. Make sure you are calling the correct number, and that you are using the correct communications settings. For additional help, see the user's guide for your communications software. 4. Make sure no one is using the telephone while you are communicating with another computer. 5. If some communications programs work but not others, there may be a configuration problem. For additional help, see the user's guide for your communications software. 6. Make sure your modem cord is connected to an analog telephone line. For additional help, see "Modem information" on page 15. 7. Make sure the modem adapter card is installed correctly. For instructions on installing adapter cards, see "Working with your system unit" on page 69.

Table 6: Troubleshooting (Continued)

Hardware problems	
If the problem is:	Here's what to do:
When the computer is turned on, a picture appears indicating a diskette should be inserted into drive A	1. Insert the Recovery diskette into drive A, and press F1. Follow the instructions on your screen to restore the operating system files to your computer's hard disk. 2. If you are not able to restore the operating system files to your computer's hard disk or if you did not make a Recovery diskette, check your *Services and Support Guide* for information on obtaining service.
Printer error	1. Make sure the printer cable is connected correctly and securely to the printer and to the parallel (printer) port on the back of the system unit. The printer port has this symbol next to it to help you: 2. Make sure the printer power cable is securely connected to an electrical outlet. 3. Make sure the printer is ready for printing. (If the Ready light is flashing, the printer *is not* ready.) 4. Make sure that the correct printer driver is selected in the software, if required. For instructions on selecting a printer driver, see "Using a printer" on page 13. 5. Make sure the paper and the cartridge containing the print material (ink, ribbon, or toner) are loaded correctly. 6. Turn the printer and system unit off and wait 10 seconds. Now turn the printer on *first*, and then the system unit. 7. Make sure the Parallel Port is not set to "Disabled" in the Configuration Utility. 8. Make sure the Parallel Port Mode is set to "Compatible" in the Configuration Utility. 9. For additional help, see the user's guide that came with the printer.

Table 7: Troubleshooting

Software problems	
If the problem is:	Here's what to do:
Computer automatically turns off instead of entering Standby.	Make sure the Standby timer is less than the Automatic Power Off timer.
You hear 3 beeps when you turn the computer off.	Sometimes installing new software changes your AUTOEXEC.BAT file. If you installed new software, make sure the following line is still in the AUTOEXEC.BAT file, and "REM" does not appear at the beginning of the line: C:\PS1TOOLS\PS1PFILE
You turn on the computer to resume where you left off, Windows appears, and then the computer restarts.	1. EMM386 or an upper memory manager program may not be set up properly. Rename the CONFIG.SYS file in the Windows directory (do not delete it), and use the CONFIG.SYS file in the DOS directory by copying it to the Windows directory. 2. If you upgraded your processor, you may need to change the following line in the CONFIG.SYS file to make the values for "I=" and "X=" match these: DEVICE=C:\DOS\EMM386.EXE NOEMS I=E000-EEFF X=EF00-FEFF 3. If the error continues, check your *Services and Support Guide* for information on obtaining service.
Computer doesn't go into Standby or automatically power off when the set time has elapsed.	1. Make sure the Automatic Power Off option is enabled in Rapid Resume. 2. Make sure you don't touch the mouse or keyboard, and don't start an application that involves using the hard disk, such as File Manager or a Windows screen saver. These activities make the timer start over.

Table 7: Troubleshooting (Continued)

Software problems	
If the problem is:	Here's what to do:
POST error occurs when you turn on the computer to resume where you left off.	1. Turn the computer off. Wait 10 seconds. Turn the computer back on. 2. If you have changed your hardware (installed or removed an option), return it to its previous configuration. Try starting the computer again. If the error is corrected, save any work that you want to keep and disable Rapid Resume. Reinstall your hardware. For instructions on installing options in your system unit, see "Working with your system unit" on page 69. For instructions on installing options on your system board, see "Working with your system board" on page 87. 3. If the error continues, check your *Services and Support Guide* for information on obtaining service.
The Rapid Resume Features screen does not appear in the Configuration Utility and the Rapid Resume Manager icon does not appear.	If the error continues, check your *Services and Support Guide* for information on obtaining service.
Computer locks up when you turn it on.	1. If adapter cards are in the computer, make sure the Initialize Adapter Cards option in the Configuration Utility is set to "Reload Device Drivers". 2. If the error continues, check your *Services and Support Guide* for information on obtaining service.
When you turn the computer on, the Windows desktop is not as you left it when you turned the computer off.	1. Make sure another person hasn't used the computer and changed the Windows desktop. 2. Check that Rapid Resume is enabled. 3. If the Initialize Adapter Cards option in the Configuration Utility is set to "Reload Device Drivers", check that "RESUME.EXE" is in the AUTOEXEC.BAT file (make sure "REM" does not appear in front of it). 4. Check that the APM BIOS Mode option in the Configuration Utility is set to "32 Bit Protected". 5. Check that "POWER.EXE" is in the CONFIG.SYS file.

Table 7: Troubleshooting (Continued)

Software problems	
If the problem is:	Here's what to do:
Computer turns off without saving information.	1. Check that Rapid Resume is enabled. 2. Check that the APM BIOS Mode option in the Configuration Utility is set to "32 Bit Protected". 3. Check that "POWER.EXE" is in the CONFIG.SYS file. 4. EMM386 or an upper memory manager program may not be set up properly. Rename the CONFIG.SYS file in the Windows directory (do not delete it), and use the CONFIG.SYS file in the DOS directory by copying it to the Windows directory. 5. If you upgraded your processor, you may need to change the following line in the CONFIG.SYS file to make the values for "I=" and "X=" match these: DEVICE=C:\DOS\EMM386.EXE NOEMS I=E000-EEFF X=EF00-FEFF
Computer does not turn off after 5 minutes.	If the error continues, check your *Services and Support Guide* for information on obtaining service.
Application is not active when you turn the computer on to resume working.	1. Restart the application. Some applications will not operate correctly with Rapid Resume. 2. If adapter cards are in computer, make sure the Initialize Adapter Cards option in the Configuration Utility is set to "Reload Device Drivers".
Adapter cards don't work after you turn the computer on to resume working.	Make sure the Initialize Adapter Cards option in the Configuration Utility is set to "Reload Device Drivers". Some adapter cards do not operate correctly with Rapid Resume.
System unit and monitor are on, but nothing is displayed on the screen.	This is normal. 1. Press a key or move the mouse to exit Standby. 2. Make sure the monitor cables are connected correctly and securely.
Computer turns off or screen is blank during activity (for example, when using a joystick or printing).	1. Press the on/off button. 2. Increase the Automatic Power Off time. 3. Disable Rapid Resume and Standby during long periods of activity such as joystick use or printing.

Table 7: Troubleshooting (Continued)

Software problems	
If the problem is:	Here's what to do:
You added hardware or installed new software and you want to cancel Rapid Resume and restart the computer.	Press Ctrl + Alt + Delete during Rapid Resume. There may be a slight delay before the computer restarts.
Problems using or connecting to networks after turning on the computer to resume working where you left off.	1. Try reconnecting to your network drives. 2. Make sure network drivers, net start commands, and other networking commands come before "RESUME.EXE" in the AUTOEXEC.BAT file. 3. Log off the network before turning off the computer. 4. Use the Standby feature for energy savings instead of Rapid Resume.
Computer shuts off without pressing the on/off button.	Check the Scheduler feature in Rapid Resume Manager to see if you have set the computer to turn off.
You set the computer to start when the phone rings in order to receive a fax, but it received a regular phone call instead.	Either disable Wake Up on Ring or Auto Answer or purchase a hardware telephone line sharing device that will direct calls where you specify (to either an answering machine or a fax modem).
External modem does not turn on the computer when the phone rings.	1. Make sure the modem is turned on. 2. Make sure Wake Up on Ring is enabled. 3. Make sure the modem is connected to serial port A. 4. Make sure the modem supports the ring indicator signal.
The phone rings and the computer turns on, but a fax isn't received.	See the documentation that came with your fax software to make sure it is set up to answer the phone.
A power failure occurred, and the last state of computer was not saved.	Enable the Standby Snapshot option in Rapid Resume Manager or in the Configuration Utility.

Table 7: Troubleshooting (Continued)

Software problems	
If the problem is:	Here's what to do:
An error code appears after you turn your computer on.	If you do not have any work that you want to save, press Enter to continue. If you have work that you want to save: 1. Turn the computer off. 2. If you have: •*Not changed* your hardware, find the error code in "Error codes, descriptions, and corrective actions" on page 50 and follow the suggested actions. •*Changed* your hardware (installed or removed an option), return it to its previous configuration. Then wait 10 seconds and turn the computer on. If the error does not occur again, save any work that you want to keep. If the error occurs again, check your *Services and Support Guide* for information on obtaining service.

Table 8: Troubleshooting

Monitor problems	
If the problem is:	Here's what to do:
Discolored screen	1. Move the monitor away from any equipment that might cause magnetic interference; for example, other monitors, audio speakers, or microphones. (The microphone and speakers that come with some models of the computers are nonmagnetic.) Turn the monitor off, wait 30 minutes, and then turn the monitor on. 2. Select a new video device driver.
Picture shape on monitor screen is poor	Adjust the monitor controls. For instructions, see "Adjusting monitor controls" on page 4 if you are using a monitor that came packaged with your system unit. If you are using a monitor that you purchased separately, see the documentation that came with the monitor.
White screen	1. Make sure that the monitor cable is connected correctly and securely to the system unit. 2. Make sure the system unit and monitor power cables are securely plugged into electrical outlets. 3. Make sure the system unit and monitor are turned on. 4. If available, connect another monitor to your system unit. If the problem is corrected, something may be wrong with your monitor. 5. If the error continues, check your *Services and Support Guide* for information on obtaining service.
Flickering or unsteady picture on monitor screen	1. Select lower resolution and color settings in Display Select. 2. If your monitor is located close to another monitor, move them farther apart. 3. Change the video device driver in your software application.
Screen is an intense yellow, magenta (purple or red-blue), or cyan (blue-green) color	Check your *Services and Support Guide* for information on obtaining service.
Adjustments from earlier use were not saved	1. Use the monitor controls to adjust the image for the display mode you are using. 2. You may have selected more user definable modes than the monitor can save. When this occurs, the newest mode replaces the oldest mode.

Table 8: Troubleshooting (Continued)

Monitor problems	
If the problem is:	Here's what to do:
Image control indicator lights on the monitor flash consecutively	Make sure the monitor cable is securely connected to the system unit.
Any of the following: • Totally blank screen • No cursor displayed • Only the cursor is displayed • Screen is unreadable • Other monitor problems	1. Make sure the monitor cable is correctly and securely connected to the system unit. 2. Make sure the system unit and monitor power cables are securely plugged into electrical outlets. 3. Make sure the system unit and monitor are turned on. (The power indicator lights on the system unit and the monitor are lit when they are on.) 4. Adjust the monitor controls. 5. Change the background colors in your software application or try using a different software application. 6. If you have enabled the Standby feature, press any key or move the mouse to return to a screen image. 7. If you have enabled the Rapid Resume feature and set up the Automatic Power Off option, turn the system unit back on. 8. Unplug the system unit from the electrical outlet, wait 10 seconds, and then plug the system unit back into the electrical outlet. If the computer does not start immediately, push the on/off button on the system unit.

Table 9: Troubleshooting

Multimedia component problems	
If the problem is:	Here's what to do:
Windows "Drive Not Ready" message appears	1. If you are using a CD, make sure the CD is properly inserted into the CD-ROM drive. Wait for the Busy light to go out, and then try again. 2. If you are using a diskette, make sure the diskette is properly inserted into the diskette drive. Wait for the Busy light to go out, and then try again. 3. Click on the Retry button in the Windows box. 4. Remove and inspect the disc. Clean your CD if necessary. 5. If the error continues, check your *Services and Support Guide* for information on obtaining service.
CD-ROM does not play	Check that the side of the CD with the label is facing up in the tray.
No sound comes out of the speakers	1. Check that all speaker connections are correct and secure. For instructions, see the *Read Me First* booklet. 2. Check that the speakers are turned *On.* 3. Check that the speaker volume control is not set at the minimum setting, the AC adapter is connected correctly, and the batteries are good. 4. Check the volume settings in the application you are running (if present). 5. Check the volume settings in the sound card mixer application, if in use. 6. If the error continues, check your *Services and Support Guide* for information on obtaining service.
CD-ROM drive "skips" or plays music erratically	1. Remove and inspect the disc, cleaning if necessary. 2. Check to see if there is something causing the computer to vibrate which may lead to "skipping" of data. 3. If the error continues, check your *Services and Support Guide* for information on obtaining service.
No sound comes out of the headphones	1. Check that the headphone connection is correct. For an audio CD, use the headphone jack on the CD-ROM drive, if provided. For multimedia applications, use the audio output jack on the sound card. 2. If you are using the headphone jack on the front of the CD-ROM drive, adjust the volume control located on the CD-ROM drive. 3. Check the volume settings in the application you are running (if present). 4. Check the volume settings in the sound card mixer application, if in use. 5. If the error continues, check your *Services and Support Guide* for information on obtaining service.

Error codes, descriptions, and corrective actions table

Table 10: Error codes, descriptions, and corrective actions

Error Code	Description	Here's what to do:
101 102 103 104 105 106	System Board Error	1. Turn the system unit off, wait 10 seconds, and then turn the system unit on. 2. If the error continues, check your *Services and Support Guide* for information on obtaining service.
107	System Board Error	1. A memory module (SIMM) has failed. Make sure SIMMs are inserted in the correct sockets and are inserted completely. For instructions on inserting SIMMs, see "Installing and removing memory modules" on page 99. 2. Turn the system unit off, wait 10 seconds, and then turn the system unit on. 3. If the error continues, check your *Services and Support Guide* for information on obtaining service.
108	System Board Error	1. Turn the system unit off, wait 10 seconds, and then turn the system unit on. 2. If the error continues, check your *Services and Support Guide* for information on obtaining service.
110	System Board Parity Error	1. A memory module (SIMM) has failed. Make sure SIMMs are inserted in the correct sockets and are inserted completely. For instructions on inserting SIMMs, see "Installing and removing memory modules" on page 99. 2. Turn the system unit off, wait 10 seconds, and then turn the system unit on. 3. If the error continues, check your *Services and Support Guide* for information on obtaining service.
Note: An X shown as part of the error code in this table represents any number between 0 and 9.		

Table 10: Error codes, descriptions, and corrective actions (Continued)

Error Code	Description	Here's what to do:
111	I/O Channel Parity Error	1. Make sure all adapter cards are installed correctly. For instructions on installing adapter cards, see "Working with your system unit" on page 69. 2. Turn the system unit off, wait 10 seconds, and then turn the system unit on. 3. If the error continues, check your *Services and Support Guide* for information on obtaining service.
114	Adapter ROM Error	1. Make sure all adapter cards are installed correctly. For instructions on installing adapter cards, see "Working with your system unit" on page 69. 2. Turn the system unit off, wait 10 seconds, and then turn the system unit on. 3. If the error continues, check your *Services and Support Guide* for information on obtaining service.
161	Bad CMOS Battery	1. Make sure the battery is installed correctly. If the error continues, install a new battery. For instructions on installing the battery, see "Replacing the battery" on page 102. 2. If the error continues, check your *Services and Support Guide* for information on obtaining service.
Note: An X shown as part of the error code in this table represents any number between 0 and 9.		

Table 10: Error codes, descriptions, and corrective actions (Continued)

Error Code	Description	Here's what to do:
162	Configuration Error	If you are using Rapid Resume, and you do not have any work that you want to save, press Enter to continue. If you have work that you want to save: 1. Turn the system unit off. 2. If you have: • *Not changed* your hardware, there is some other problem. Press Enter to go into Configuration Utility. Press Escape, and then press Enter. The error should not reoccur. • *Changed* your hardware (installed or removed an option), return the computer to its previous configuration. Then wait 10 seconds and turn the system unit on. If the error does not occur again, save any work that you want to keep and reinstall your hardware. If the error occurs again, check your *Services and Support Guide* for information on obtaining service. If you are *not* using Rapid Resume, or you have saved your work: 1. Press Enter while the error message is displayed to start the Configuration Utility. Verify that the options with ▶ next to them were supposed to change. If so, press Esc, then press Enter to save the configuration. If options changed that were not supposed to, check your *Services and Support Guide* for information on obtaining service. 2. Turn the system unit off, wait 10 seconds, and then turn the system unit on. 3. If the error occurs again, check your *Services and Support Guide* for information on obtaining service.
163	Date and Time Incorrect	1. The clock module on the system board may not be set correctly. To set the correct date and time, press Enter while the error message is displayed to use the Configuration Utility. For instructions on using the Configuration Utility, see page 59. 2. If the error continues, check your *Services and Support Guide* for information on obtaining service.
Note: An X shown as part of the error code in this table represents any number between 0 and 9.		

Table 10: Error codes, descriptions, and corrective actions (Continued)

Error Code	Description	Here's what to do:
164	Memory Size Error	1. If you have removed memory from your computer, press Enter while the error message is displayed to make sure the new memory size is correct on the Configuration Utility screen. For instructions on using the Configuration Utility, see page 59. 2. If you have not removed memory from your computer or if the error continues, check your *Services and Support Guide* for information on obtaining service.
20X	Memory Error	1. Make sure memory modules (SIMMs) are inserted in the correct sockets and are inserted completely. For instructions on inserting SIMMs, see "Installing and removing memory modules" on page 99. 2. If the error continues, check your *Services and Support Guide* for information on obtaining service.
225	Unsupported SIMM Error	1. Make sure memory modules (SIMMs) are inserted in the correct sockets. For instructions on correct memory module installation, see "Memory module placement" on page 103. 2. If the error continues, check your *Services and Support Guide* for information on obtaining service.
229	Cache Error	1. Make sure cache memory modules (SRAMs) are inserted in the correct banks and are inserted completely. For instructions on inserting SRAMs, see "Installing cache memory" on page 95. 2. Make sure cache memory jumpers are set correctly. For instructions on setting jumpers, see "Jumper instructions for cache memory upgrades" on page 98. 3. If the error continues, check your *Services and Support Guide* for information on obtaining service.
Note: An X shown as part of the error code in this table represents any number between 0 and 9.		

Table 10: Error codes, descriptions, and corrective actions (Continued)

Error Code	Description	Here's what to do:
262	Memory Parity Configuration Error	1. If you added non-parity memory modules to your computer, press Enter while the error message is displayed to make sure the new memory size is correct in the Configuration Utility. For instructions, see "Working with the Configuration Utility" on page 59. 2. If the error continues, check your *Services and Support Guide* for information on obtaining service.
264	Cache Memory Size Error	1. If you have added cache memory to your computer, make sure all cache memory modules are installed in the correct banks and are inserted completely. 2. Make sure the cache jumpers are set correctly. Turn the system unit off, wait 10 seconds, and then turn the system unit on. For instructions on installing cache memory and setting jumpers, see "Working with your system unit" on page 69. 3. If the error continues, check your *Services and Support Guide* for information on obtaining service.
30X	Keyboard Error	1. Make sure the keyboard and mouse cables are connected correctly and securely to the ports on the back of the system unit. The keyboard port has this symbol next to it to help you: The mouse port has this symbol next to it to help you: 2. Make sure that a key on the keyboard or a mouse button is not being held down. 3. If the error continues, check your *Services and Support Guide* for information on obtaining service.
Note: An X shown as part of the error code in this table represents any number between 0 and 9.		

Table 10: Error codes, descriptions, and corrective actions (Continued)

Error Code	Description	Here's what to do:
662	Diskette Drive Configuration Error	1. If you removed a diskette drive, press Enter while the error message is displayed to make sure the Diskette Drive setting is correct in the Configuration Utility. If the setting is not correct, change the setting. For instructions on changing the configuration, see "Working with the Configuration Utility" on page 59. 2. If the error continues, check your *Services and Support Guide* for information on obtaining service.
762	Math Coprocessor Configuration Error	1. If you changed your processor, press Enter while the error message is displayed to make sure the Math Coprocessor setting is correct in the Configuration Utility. For instructions on changing the configuration, see "Working with the Configuration Utility" on page 59. 2. If the error continues, check your *Services and Support Guide* for information on obtaining service.
962	Parallel Port Configuration Error	1. If you changed a hardware option, press Enter while the error message is displayed to make sure the Parallel Port setting is correct in the Configuration Utility. If the setting is not correct, change the setting. For instructions, see "Working with the Configuration Utility" on page 59. 2. If the error continues, check your *Services and Support Guide* for information on obtaining service.
1101	Serial Port Error	1. Turn the system unit off, wait 10 seconds, and then turn the system unit on. 2. If the error continues, check your *Services and Support Guide* for information on obtaining service.
Note: An X shown as part of the error code in this table represents any number between 0 and 9.		

Table 10: Error codes, descriptions, and corrective actions (Continued)

Error Code	Description	Here's what to do:
1162	Serial Port Configuration Error	1. If you changed a hardware option, press Enter while the error message is displayed to make sure the Serial Port setting is correct in the Configuration Utility. If the setting is not correct, change the setting. For instructions, see "Working with the Configuration Utility" on page 59. 2. If the error continues, check your *Services and Support Guide* for information on obtaining service.
1762	Hard Disk Configuration Error	1. Make sure the cables to all drives are securely attached. 2. Press Enter while the error message is displayed to make sure the drive option settings are correct in the Configuration Utility. For instructions on changing the Configuration Utility, see page 59. 3. If the error continues, check your *Services and Support Guide* for information on obtaining service.
1780/1790 1781/1791	Drive 1 (Hard Disk) Error Drive 2 (Hard Disk) Error	1. Make sure the cables to all drives are securely attached. 2. Press Enter while the error message is displayed to make sure the Processor option's speed setting is correct in the Configuration Utility. (Find the processor speed [in MHz] on the label attached to the front of your system unit.) If the setting is not correct, check your *Services and Support Guide* for information on obtaining service. 3. Make sure the hard disk signal cable is attached to the correct connector on the system board and the jumper settings on the hard disk are correct. For information about drive setup, see "Installing additional drives" on page 79. 4. If the error continues, check your *Services and Support Guide* for information on obtaining service.
Note: An X shown as part of the error code in this table represents any number between 0 and 9.		

Table 10: Error codes, descriptions, and corrective actions (Continued)

Error Code	Description	Here's what to do:
1782/1792 1783/1793	Drive 3 (Hard Disk) Error Drive 4 (Hard Disk) Error	1. Make sure the cables to all hard disk drives are securely attached. 2. Make sure the hard disk signal cable is attached to the correct connector on the system board and the jumper settings on the hard disk are correct. For information about drive setup, see "Installing additional drives" on page 79. 3. If the error continues, check your *Services and Support Guide* for information on obtaining service.
1962	Boot Sequence Error	1. Press Enter while the error message is displayed to make sure the Adapter Card option is set correctly in the Configuration Utility. If the setting is not correct, change the setting. For instructions on changing the Configuration Utility, see page 59. 2. Make sure all adapter cards are installed correctly. For instructions on installing adapter cards, see "Installing adapter cards" on page 74. 3. If the error continues, check your *Services and Support Guide* for information on obtaining service.
2401	Video Error	1. Make sure the monitor cables are correctly and securely connected to the system unit. 2. If a video adapter card is installed, make sure it is inserted correctly. For instructions on installing adapter cards, see "Installing adapter cards" on page 74. 3. If the error continues, remove the video adapter card. If removing the card corrects the error, replace the card with a new one. 4. If the error continues, check your *Services and Support Guide* for information on obtaining service.
Note: An X shown as part of the error code in this table represents any number between 0 and 9.		

Table 10: Error codes, descriptions, and corrective actions (Continued)

Error Code	Description	Here's what to do:
2462	Video Configuration Error	1. Make sure the monitor cables are correctly and securely connected to the system unit. 2. If a video adapter card is installed, press Enter while the error message is displayed to enter the Configuration Utility. Press Esc, then press Enter to exit the Configuration Utility and save the new configuration. 3. Press Enter while the error message is displayed to make sure the settings for the Video Controller, Video Memory, and Monitor Frequency options are correct in the Configuration Utility. For instructions on changing the Configuration Utility, see page 59. 4. If the error continues, check your *Services and Support Guide* for information on obtaining service.
5962	CD-ROM Configuration Error	1. Check that all drive cables are correctly and securely connected. 2. If you added, removed, or moved any drives in your system unit, press Enter while the error message is displayed to enter the Configuration Utility. Verify that only the options for the drives you changed have ▶ next to them. Press Esc, then press Enter to exit the Configuration Utility and save the new configuration. 3. If the error continues, check your *Services and Support Guide* for information on obtaining service.
860X	Pointing Device Error	1. Check that the mouse and keyboard cables are securely connected to the correct ports. 2. Make sure that a key on the keyboard is not being held down. 3. If the error continues, check your *Services and Support Guide* for information on obtaining service.
Note: An X shown as part of the error code in this table represents any number between 0 and 9.		

Working with the Configuration Utility 6

Using the Configuration Utility

The Configuration Utility lets you view and change important information about your computer and its hardware. You may need to use the Configuration Utility in these situations:

- If you add or replace a hardware option (such as a diskette drive, memory module, math coprocessor, or monitor), and you want to verify or make a change.
- To verify a change after removing a hardware option.
- If you get an error code and message.

You can also use the Configuration Utility to:

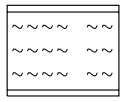
- Check the computer's hardware features. For example, you can use this program to check the amount of memory or the size of the hard disk in your computer.
- Change the computer's serial and parallel port settings, and the parallel port mode.
- Set up or change a password on your computer.
- Change the date and time on your computer
- Reduce the amount of energy your computer uses by setting up the computer's Rapid Resume features.
- Determine which Plug and Play adapter cards you want configured by system BIOS.

Starting the Configuration Utility

The Configuration Utility displays screens that let you *view* information about how your computer is set up (called the *configuration*), or *change* certain information on your computer.

There are two ways to display the Configuration Utility screen:

- If you have an error, your computer shows a *popup window* with an error code and description. Press Enter to get the Configuration Utility screen.
- When you turn your computer on, this symbol appears:



Press F1 while the symbol is displayed to get the Configuration Utility screen.

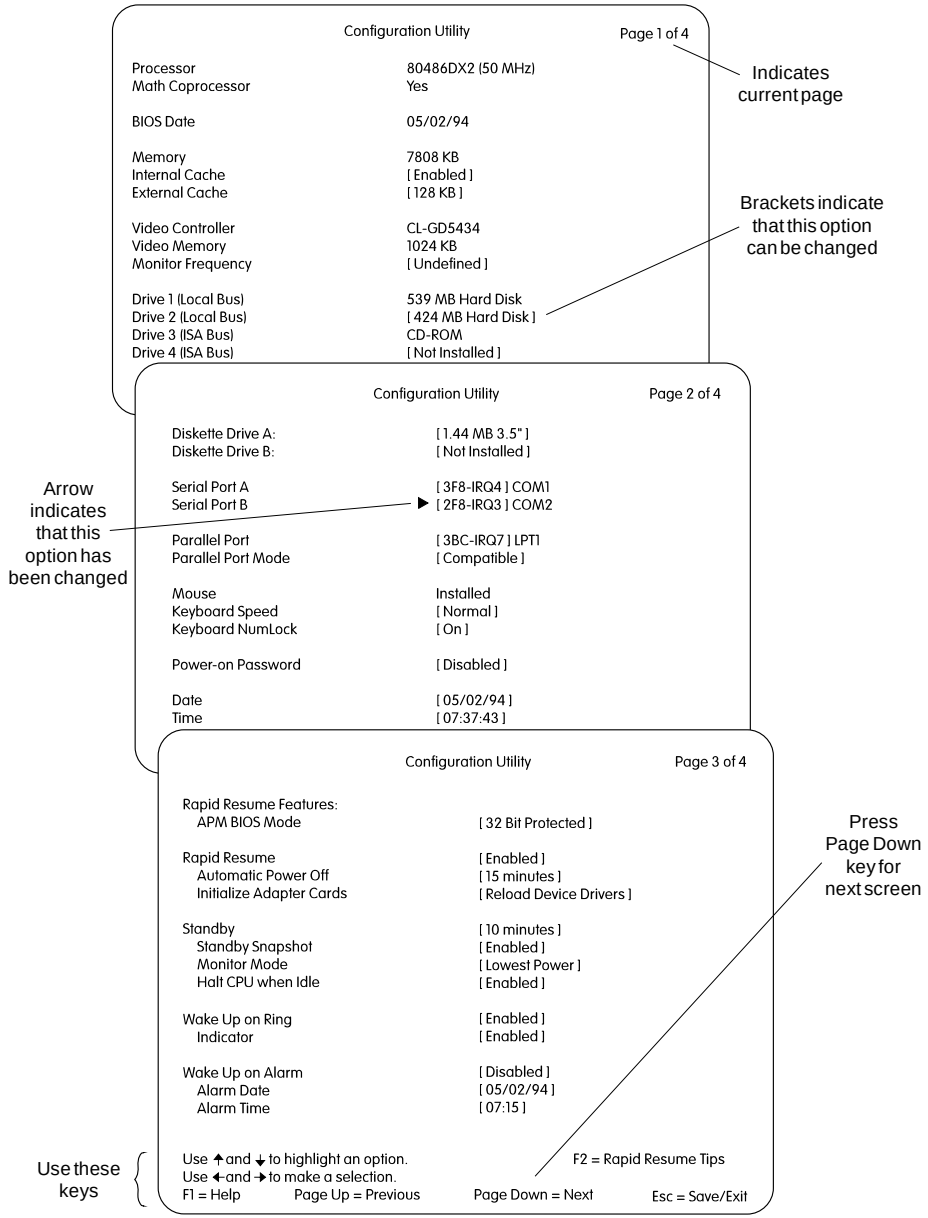
The Configuration Utility screens display the type of information shown here. The actual screens on your computer may look slightly different, but they operate the same way.

Here are the keys you use to move through and make changes to the Configuration Utility screens.

Keys	Function
↑ ↓	Use these arrow keys to highlight an option.
← →	Use these arrow keys to make a selection and change an option.
F1	Press this key if you want more information about an option or general information on using the screen.
F2	Press this key if you want more information about your computer's energy-saving Rapid Resume feature.
Page Down	Press this key to see the next page (screen).
Page Up	Press this key to go to the previous page (screen).

- Brackets [ ] show you which options can be changed on the screen.
- The ▶ symbol on the screen shows you that an option has been changed.

Now that you know how to work with the Configuration Utility screens, read the rest of this chapter to learn about the options you can change on the screen.



Making changes with the Configuration Utility

You can only change some of the information that appears on the Configuration Utility screen. The information you can change is always enclosed in brackets like this: [ ]. The entries on your screen that you can't change provide useful information about your computer and its hardware. For example, if the mouse is not working or installed incorrectly, the entry will show if it is disabled or not installed.

Here are the options you can change on the Configuration Utility screens:

Internal Cache. This option shows the amount of internal cache memory on your computer's system board. You cannot add internal cache memory to your computer.

Cache memory is special buffer storage that holds frequently used instructions and data, and works faster than main storage. With cache memory installed, your applications and programs run faster. You can disable cache memory to slow down your computer.

External Cache. This option shows the amount of external cache memory on your computer's system board. You can add external cache memory to your computer. The maximum amount of cache memory you can install is 256K.

Monitor Frequency. This option lets you change the monitor frequency. If you attach a monitor to your computer that did not come boxed with your system, you must select the correct monitor frequency on the Configuration Utility screen. This monitor frequency setting affects the monitor's *refresh rate*; that is, the rate at which the monitor redraws the image on the screen. Super VGA (SVGA) and multifrequency monitors can refresh text and images faster than other types of monitors. For more information on monitors and setting the monitor frequency, see "Setting up and using a monitor" on page 3.

Drive 2. This option indicates whether a second hard disk has been connected to the Local Bus connector on the system board.

note:

Drive 1 on the Configuration Utility screen is the hard disk that came with your computer. This hard disk is attached to the Local Bus connector on the system board.

If you are adding a second IDE hard disk to your system, it must also be connected to the Local Bus connector. For more information, see page 79.

Drive 4. This option indicates whether a hard disk has been attached to the ISA Bus connector on the system board. If both a CD-ROM and a hard disk are connected to the ISA Bus connector, the jumpers on the hard disk must be set for master mode for it to appear as Drive 3 on the Configuration Utility screen. The CD-ROM must be set as the slave device. It will appear as Drive 4 on the screen.

If a hard disk is the only drive attached to the ISA Bus connector, it appears as Drive 3 on the Configuration

Utility screen. If two hard disks are attached to the this connector, they appear as Drives 3 and 4 on the screen. For more information on adding hard drives to your computer, see page 79.

Diskette Drive (A: or B:). This option shows you an entry for each diskette drive on your computer. If you add or change a diskette drive, you must select the correct diskette drive type on the Configuration Utility screen.

Serial Port. This option lets you change the serial port addresses. Your computer has either one or two serial ports. Each serial port has a special *address* (identifying location) assigned to it. If you add adapter cards to your computer that have additional serial ports, you must make sure that each serial port has a different address.

Serial port A can only be set as address 3F8-IRQ4 or 3E8-IRQ4. Serial port B can only be set as address 2F8-IRQ3 or 2E8-IRQ3. If you change serial port addresses on the Configuration Utility screen, you may also need to make changes to your software. For instructions on changing your software, see the user's guide or online information that came with the software.

Parallel Port. This option lets you change the parallel port address. Your computer has one parallel port with a special address (identifying location) assigned to it. If you add adapter cards to your computer that have additional parallel ports, you must make sure that each parallel port has a different address.

If you change parallel port addresses on the Configuration Utility screen, you may also need to make changes to your software. For instructions on changing your software, see the user's guide or online information that came with your software.

Parallel Port Mode. This option lets you change the mode of the parallel port. The standard mode for the parallel port is the Compatible mode. You can increase the efficiency of your parallel port by using Enhanced modes with supporting hardware.

note: *The Enhanced modes use recent technology and are only supported by newer hardware (such as a printer).*

If you change the mode of your parallel port, you may need to make changes to the supported hardware and its software.

Power-on Password. This option lets you create a *power-on password* to restrict the use of your computer. Each time the computer is turned on, you must enter this password *before* you can use the computer.

A password can be up to seven characters long (letters, numbers, or both). Once you create your password, *be sure to write it down and put it in a secure place.*

Date and Time. These options let you change the date and time on your computer. Your changes take effect immediately.

Type the date in the format shown on the screen. Type the time in 24-hour format. For example:

- 12 midnight is 00:00
- 12 noon is 12:00
- 1 p.m. is 13:00

Rapid Resume options

Page 3 of the Configuration Utility contains the Rapid Resume options. *Rapid Resume* is an exclusive IBM energy-saving feature with many useful options. Rapid Resume can:

- Save the current state of your computer when you turn it off. Any applications or programs open when the computer is turned off will be open when the computer is turned back on.
- Automatically turn off your computer when you have not used the mouse, keyboard, or hard disk for an amount of time you select. If you have an energy-saving monitor, it will also turn off.
- Put your computer in a *Standby* mode to conserve energy when you have not used the mouse, keyboard, or hard disk for an amount of time you select.
- Reduce the time your computer takes to start up.
- Automatically turn on your computer when the phone rings so that your computer can receive a fax.
- Automatically turn on your computer at a date and time you choose.

Here are the Rapid Resume options you can change:

APM BIOS Mode. The Basic Input/Output (*BIOS*) is the machine language that runs your computer. The APM BIOS Mode option shows you the advanced power management (APM) mode that your operating system's APM driver should use when it communicates with BIOS.

note: *If you are using the OS/2* operating system, select 16 Bit Protected for the APM BIOS Mode.*

Rapid Resume. This option lets you turn Rapid Resume on (enabled) or off (disabled).

Automatic Power Off. If you are using the Rapid Resume feature, this option lets you set the amount of time that will pass before your computer turns off automatically. For example: 30 minutes means that if the mouse, keyboard, or hard disk are not used for 30 minutes, the computer turns off automatically.

note: *Only energy-saving monitors will turn off automatically with Rapid Resume.*

The current state of the computer is saved before the computer turns off. Any applications or programs open when the computer powers off will be open when you turn the computer back on.

Initialize Adapter Cards. If you are using the Rapid Resume feature, this option indicates whether your adapter cards will be restarted (initialized) when you turn on your computer.

Standby. This option lets you set the amount of time that will pass before your computer starts conserving energy. For example: 15 minutes means that if the mouse, keyboard, and hard disk are not used for 15 minutes, your display goes blank and the hard disk in your computer starts using less power.

note: *Only energy-saving monitors power down during Standby.*

If you are using the Automatic Power Off feature, the time you set for Standby must be less than the time you set for Automatic Power Off. Otherwise, your computer will turn off before it enters Standby.

Standby Snapshot. This option lets you have the state of your computer saved when it enters Standby. If the electricity goes out or your computer is turned off while in Standby, the computer resumes at the saved state when you turn it back on. Any applications or programs open when the computer shut down will be open when the power returns.

Monitor mode. This option may or may not appear depending on the type of processor installed in your computer. If you see this option, you can change the power mode used to blank the monitor during Standby. If you have an energy-saving monitor, the VESA DPMS setting turns the monitor back on fastest.

note: *Only energy-saving monitors will power down during Standby.*

Slow CPU Clock. This option may or may not appear depending on the type of processor installed in your computer. If you see this option, you can slow the CPU clock during Standby. Slowing the CPU clock conserves power.

Halt CPU when Idle. This option lets you halt the CPU during Standby. This conserves power without affecting the operation of your computer.

Wake Up on Ring. This option lets you have the computer turn on automatically when the phone rings. This is useful if you have a fax modem and use your computer to receive faxes.

note: *With Wake Up on Ring, your computer may turn on automatically when you dial out on a rotary or pulse telephone. If this occurs, disable the Wake Up on Ring feature and use it only when you know you will have incoming fax communications.*

Indicator. If you are using the Wake Up on Ring feature, and you enable the Indicator option, the power light will blink to indicate the computer answered the phone. The Indicator resets when you turn the computer on.

Wake Up on Alarm. This option lets you have the computer turn on automatically at a date and time you specify. Choose the date and time in the Alarm Date and Alarm Time fields. If you select Daily Event, you can set the Alarm Time, but not the Date.

Alarm Date and Time. If you are using the Wake up on Alarm feature, these options let you set the date and time you want the computer to turn on automatically. Enter the date in the format shown on the screen.

Type the time in 24-hour format. For example:

- 12 midnight is 00:00
- 12 noon is 12:00
- 1 p.m. is 13:00

Advanced Configuration Utility options

Page 4 of the Configuration Utility includes Startup Sequence and other advanced options.

Startup Sequence. When you turn your computer on, it looks for the operating system files. Use the Startup Sequence option to tell your computer where to look for these files. The computer can search for these files on a diskette, an adapter card, a network, or a Hard Disk.

Power Switch. If you see this option, and your computer is plugged into a power strip, choose the Power Strip setting to turn your computer on from the switch on the power strip. Choose the On/Off setting to turn the computer on from the on/off button on your computer. If you are using Rapid Resume, you should turn the computer on from the computer's on/off button.

Cache System BIOS. This option may or may not appear depending on the type of processor installed in your computer. The Basic Input/Output System (BIOS) is the machine language that runs your computer. The BIOS in your computer is stored in read-only memory called *ROM*.

The Cache System BIOS option lets you store BIOS in cache memory. Because cache memory works faster than ROM, your programs will usually run faster with this option enabled. This cache memory cannot be write protected. You may need to disable this option when using any application that attempts to write to BIOS, such as a virus checking application.

Disk BIOS Translation. This option lets your computer use IDE hard disks larger than 528 MB with most operating systems.

note: *You may need to disable this option if you are using Novell Netware** with IDE hard disks larger than 528 MB.*

Parameter Table Type. This option tells your computer whether to use Enhanced or Standard Disk Parameter Tables with IDE hard disks larger than 528 MB. Most operating systems use Enhanced tables.

note: *You may need to use Standard tables with the UNIX** operating system.*

Local Bus IDE Mode. This option lets you choose a mode for drives connected to the Local Bus connector (Drive 1 and Drive 2) on your system board. This option is set for High Performance at the factory. To get the best disk performance, it is recommended that you run these drives in High Performance mode.

Read Prefetch. If the Local Bus IDE mode is set for High Performance, you can enable this option for maximum hard disk performance.

note: *A CD-ROM drive connected at the Drive 1 location may require this option to be disabled. Some operating systems, such as Windows NT** and OS/2, may also require this option to be disabled.*

Operate without Keyboard. This option lets you avoid a POST error when the keyboard is disconnected. This option is useful if your computer will be used as a network server.

Plug and Play screen

Page 5 will only appear in the Configuration Utility if you have a Plug and Play adapter card installed. The Plug and Play screen includes the Auto Configure Cards option, and a list of all Plug and Play adapter cards installed in the computer.

Auto Configure Cards. This option lets you choose to have either:

- All Plug and Play adapter cards configured by system BIOS
- Only Plug and Play adapter cards required to boot the system configured by system BIOS

If you have a Plug and Play operating system, your computer may function better if only the Plug and Play adapter cards required to boot the system are configured by system BIOS.

If you choose to have only the adapter cards required to boot the system configured by system BIOS, use your operating system's Plug and Play utilities to configure the other Plug and Play cards.

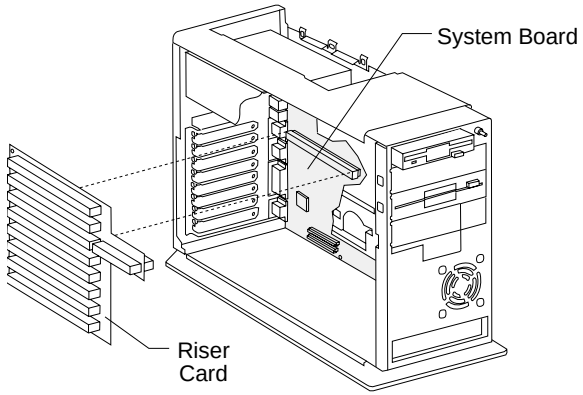
note: *Only the newest operating systems support Plug and Play adapter cards. See the documentation that came with your operating system to determine if it supports Plug and Play adapter cards.*

Installing options Part 2

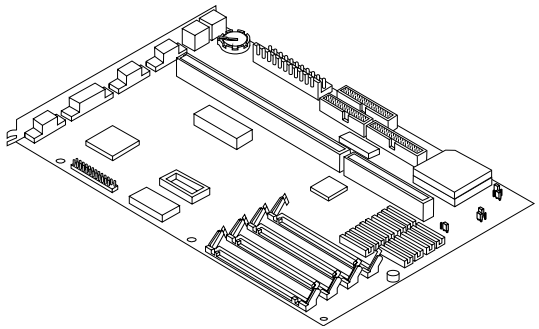
In this part, you will find these chapters:

- "Working with your system unit". Explains how to install adapter cards and drives in your system unit.
- "Working with your system board". Explains how to install the following options on your system board:
  - Single inline memory modules
  - Upgrade processors
  - Cache memory
  - Video memory
  - Replacement batteries

This picture shows how the system board looks when installed in your system unit:



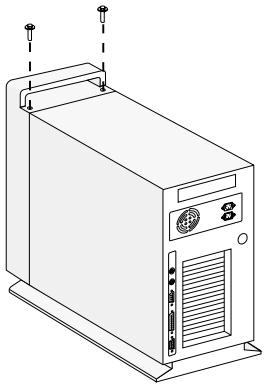
This picture is an example of how the system board is shown in "Chapter 8. Working with your system board" in order to make specific areas easier to see.



How to begin

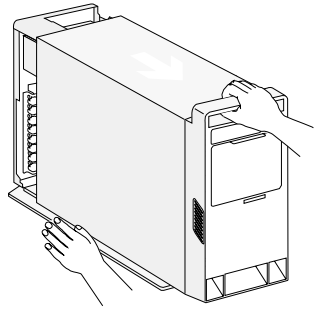
Before you make hardware changes, follow these simple precautions:

1. Turn off the system unit, monitor, and any external options (such as a printer).
2. Disconnect the telephone cord and any external cables.
3. Remove the system unit cover:
   a. Remove the screws.



(Back View)

   b. Slide the cover forward.

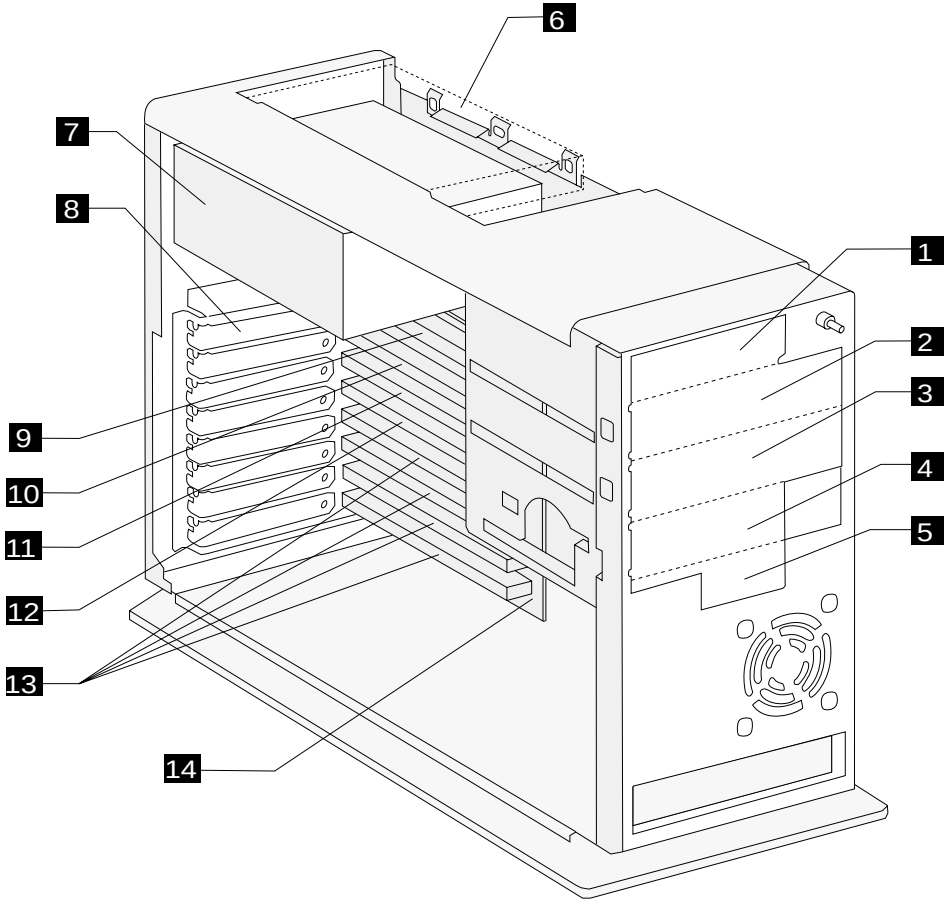


(Front View)

Important: *To prevent electrostatic charge from damaging any part of your computer, touch the computer's bare metal frame before you unplug the system unit, or wear an antistatic wrist strap while making hardware changes.*

4. Unplug the system unit and monitor from the electrical outlets.
5. Unplug the power cords of any external options from the electrical outlets.

Identifying parts of the system unit



Specifications of the system unit

The system unit of your computer has six bays and eight adapter card slot/connectors. (Bays are locations for drives.) On most models, three bays come with drives already installed. Later, you may want to purchase a drive to install in an empty bay.

Diskette drives use the standard diskette advanced technology (AT*) interface. Hard disks use an integrated drive electronics (IDE) AT interface. Your computer supports the American National Standards Institute (ANSI) standard for AT attachment disk drives.

1 Bay 1. This bay can hold a 3.5-inch slim drive, such as a diskette or tape drive.

2 Bay 2. This bay can hold up to a 5.25-inch half high drive, such as a diskette, tape, or CD-ROM drive.

3 Bay 3. This bay can hold up to a 5.25-inch half high drive, such as a diskette, tape, or CD-ROM drive.

4 Bay 4. This bay can hold up to a 3.5-inch half high drive, such as a diskette or tape drive.

5 Bay 5. This bay can hold a 3.5-inch slim hard disk.

6 Bay 6. This bay can hold up to a 3.5-inch slim hard disk.

7 Power supply. Capable of providing 145 watts of power to the system unit.

8 Adapter card slots. Openings for adapter cards.

9 Adapter card connector 1. Holds AT adapter cards.

10 Adapter card connector 2. Holds AT adapter cards.

11 Adapter card connector 3. Holds AT adapter cards. In some system units, there is an extension to this connector that allows you to install a Video Electronics Standards Association (VESA**) local bus adapter card.

12 Adapter card connector 4. Holds AT adapter cards.

13 Adapter cards connector 5 — 8 . Hold AT adapter cards.

14 Riser card. This card holds the adapter card connectors.

Preparing to install adapter cards

The system unit has slots for eight adapter cards. In some system units, there is an extension to one of the adapter card connectors that allows you to install a VESA local bus adapter card.

Adapter card specifications

Use the following table to help you determine what type and size of adapter card to install in each slot/connector. *You can install a card in any empty slot in which the card fits.*

Location	Specifications
Slot/connector 1	Can hold a half-length ISA AT adapter card
Slot/connector 2	Can hold a half-length, three-quarter length, of full-length ISA AT adapter card.
Slot/connector 3	Can hold a half-length, three-quarter length, or full-length adapter card or a VESA local bus adapter card. The riser card must have a VESA extension to install the VESA local bus adapter card.
Slot/connectors 4–8	Each of these slot/connectors can hold a half-length, three-quarter length, or full-length ISA AT adapter card.

Adapter card settings

When you install an adapter card, you may have to set switches or move jumpers to make the cards work together properly. Whether you have to change any settings depends on the types of adapter cards already installed in your computer and the type or types that you are adding.

Some adapter cards are Plug and Play. You don't have to change any settings after installing Plug and Play adapter cards. The computer and the card automatically work together to make sure the settings are correct.

For non-Plug and Play adapter cards, *you* must make sure the settings are correct. If you install a non-Plug and Play adapter card in your computer, look in the documentation that came with the card for instructions on changing system settings. If the documentation refers you to information about your computer's I/O addresses, system board interrupt requests (IRQs), or DMA channel assignments, you can find this information in "Appendix A" beginning on page 103.

The following table can help you when installing adapter cards.

note: *If your computer came with any preinstalled adapter cards, they are non–Plug and Play cards.*

Table 11: Adapter card configurations

Adapter cards currently installed	Adapter card you are installing	Action:
None	Plug and Play	Do not change any settings.
	Non-Plug and Play	Do not change any settings.
Plug and Play	Plug and Play	Do not change any settings.
	Non-Plug and Play	Change the settings in the Plug and Play Setup Utility *before* installing the card. For information on changing the Plug and Play Setup Utility, see the Aptiva Index.
Non-Plug and Play	Plug and Play	Change the settings in the Plug and Play Setup Utility *before* installing the card. For information on changing the Plug and Play Setup Utility, see the Aptiva Index.
	Non-Plug and Play	Do not change any settings.
Both Plug and Play and Non-Plug and Play	Plug and Play	Do not change any settings.
	Non-Plug and Play	Change the settings in the Plug and Play Setup Utility *before* installing the card. For information on changing the Plug and Play Setup Utility, see the Aptiva Index.

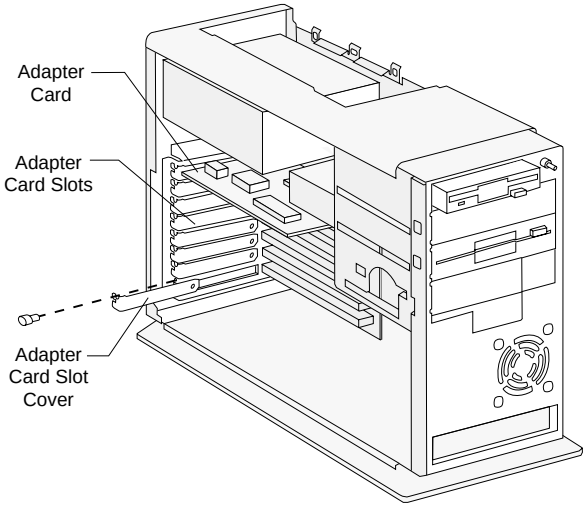
Installing adapter cards

Before you install an adapter card, you must remove the system unit cover. For instructions, see page 69.

For some hardware changes, you may also need to remove preinstalled adapter cards. For instructions on removing adapter cards, see page 88. *(Be sure to notice where the cables connect to the cards. You will need to reattach the cables when you reinstall the adapter cards.)*

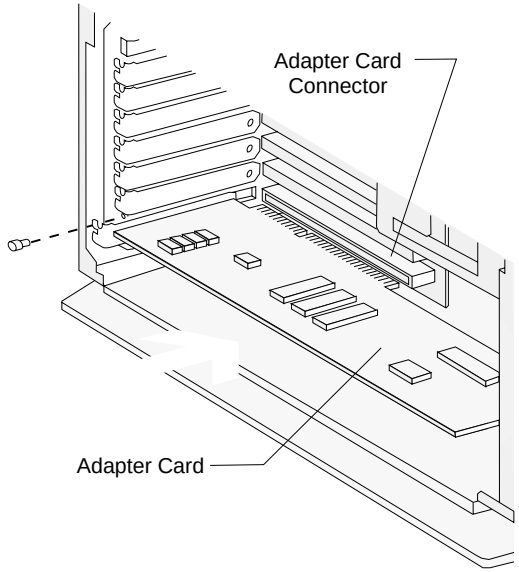
To install an adapter card:

1. Remove the adapter card slot cover screw. Then remove the slot cover.



(Front View)

2. Align and insert the adapter card into the adapter card connector. Insert the screw.



note: *After making hardware changes, reinstall any adapter cards you removed and all necessary screws. Reconnect the cables, if necessary.*

Installing a video adapter card

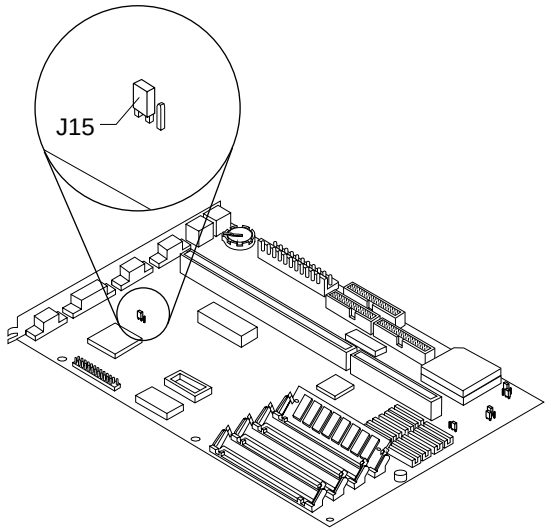
Before you install an adapter card, you must remove the system unit cover. For instructions, see page 69.

For some hardware changes, you may also need to remove preinstalled adapter cards. For instructions on removing adapter cards, see page 88. If these adapter cards have cables attached, disconnect them. *(Be sure to notice where the cables connect to the cards. You will need to reattach the cables when you reinstall the adapter cards.)*

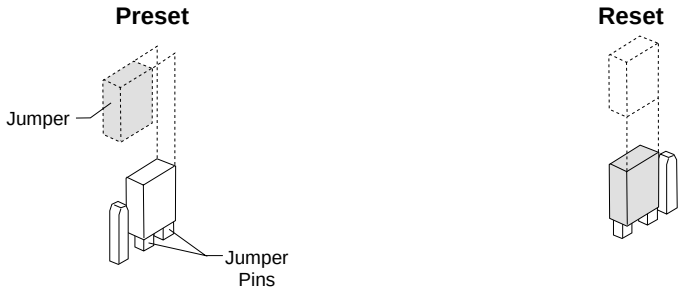
To upgrade your video controller, you must reset (move) the video jumper before installing a video adapter card. This jumper is labeled on your system board as *J15*.

To reset the jumper:

1. Remove all adapter cards and the riser card to access the system board. Follow the instructions on page 88 to remove the adapter cards and the riser card.
2. Locate jumper *J15* on the system board.



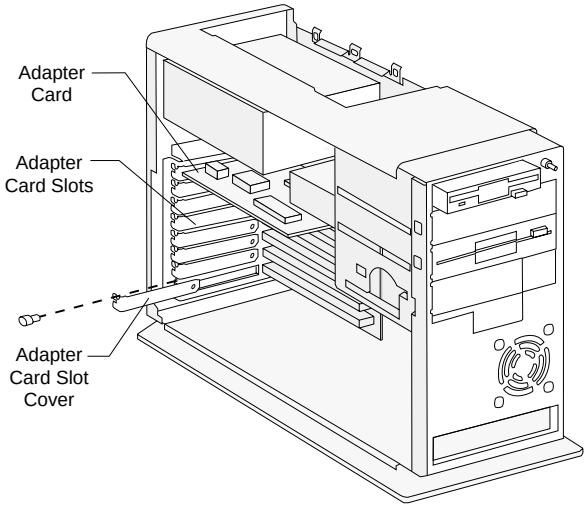
3. Remove the jumper from its preset position, and move it to its reset position. See the *example*.



4. Reinstall the riser card and adapter cards you removed in step 1. (*Steps continued on the next page*.)

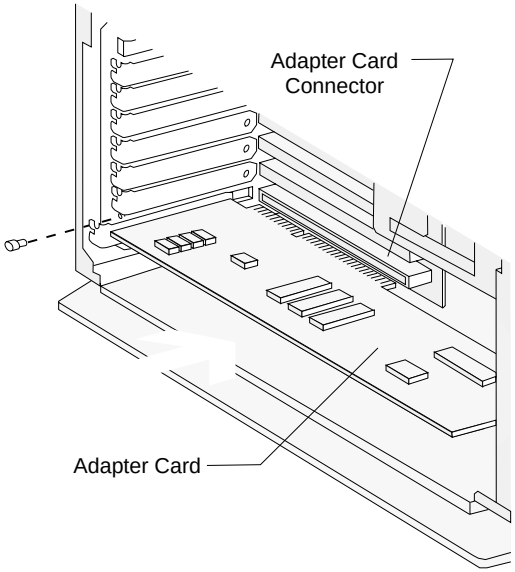
5. Install the video adapter card in any empty slot/ connector in which it fits.

   a. Remove the screw and then the adapter card slot cover.



(Front View)

   b. Align and insert the adapter card into the adapter card connector. Insert the screw.



6. Plug your monitor cable into the video adapter card connector that extends from the adapter card slot to the back of the system unit (instead of the monitor connector on the back of the system unit, which has next to it.)

Preparing to install drives

Before you install an additional:

- Drive (of any type), you may need to purchase power and signal cables.
- Hard disk, see “Installing additional drives” on page 79.
- Diskette, tape, or CD-ROM drive, you may need to remove a bay panel to access the drive after it is installed.

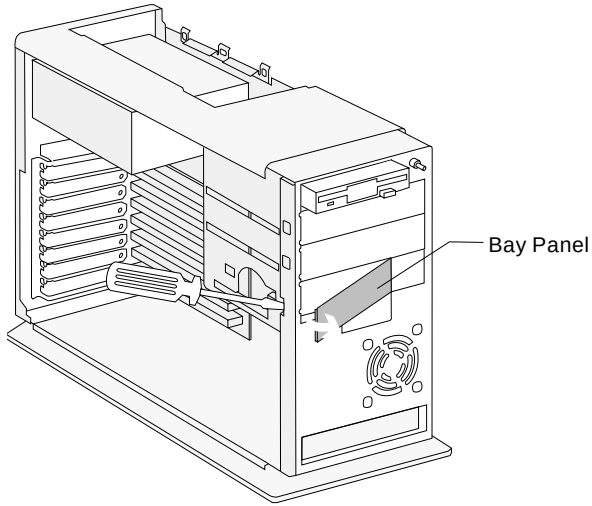
Use the following table to help you determine where to install your drive. *You can install a drive in any empty bay in which the drive fits.*

Bay	Drive Specifications	Bay Capacity
1	Can hold a 3.5-inch slim drive, such as a diskette or tape drive.	101.6 x 25.4 mm (4.0 x 1.0 in.)
2	Can hold up to a 5.25-inch half high drive, such as a diskette, tape, or CD-ROM drive.	149 x 41.3 mm (5.87 x 1.625 in.)
3	Can hold up to a 5.25-inch half high drive, such as a diskette, tape, or CD-ROM drive.	149 x 41.3 mm (5.87 x 1.625 in.)
4	Can hold up to a 3.5-inch half high drive, such as a diskette or tape drive.	101.6 x 41.3 mm (4.0 x 1.625 in.)
5	Can hold a 3.5-inch slim hard disk.	101.6 x 25.4 mm (4.0 x 1.0 in.)
6	Can hold a 3.5-inch slim hard disk	101.6 x 25.4 mm (4.0 x 1.0 in.)

Note: Using the appropriate installation hardware, you can install smaller drives than those listed here.

Before you install a drive, make sure you remove the system unit cover. For cover removal instructions, see page 69.

1. If you are installing a drive in bay 2, 3, or 4, you may need to remove the bay panel first. Use a small, flat-blade screwdriver and refer to the illustration as an example.



(Front View)

2. To ensure that a drive is aligned properly in a bay, do the following:
   a. Insert each screw and tighten loosely.
   b. Then tighten all screws securely.

Installing additional drives

When you install an additional drive, you have to make sure to use signal (also called data) cables that are attached to the correct connector. The system board has two connectors for drive signal cables:

- Local Bus connector (labeled J9 on your system board)
- ISA Bus connector (labeled J10 on your system board)

See pages 90 and 91 to identify the connectors.

note: *To install additional drives, you may have to purchase additional signal and power cables.*

You should attach drives to connectors according to the following table.

Connector	Interface type	Description
Primary drive connector (J9)	IDE/AT Local Bus	Provides the fastest data transfer rate. Preferred location for first and second hard disk drives.
Secondary drive connector (J10)	IDE/AT	Provides normal data transfer rate. Should be used for a third or fourth hard disk or for slower devices, such as CD-ROM drives or tape drives.

Two drives can be attached to each connector with the proper cables. When two drives are attached to one connector, one drive is the Master device, and the other is the Slave device. You specify which drive is the Master and which is the Slave by moving jumpers on the drives.

The hard disk that came preinstalled in your computer is attached to the Local Bus connector and is set as a Master device. If your computer came with a CD-ROM drive, it is attached to the ISA Bus connector and is set as a Master device.

Guidelines for attaching additional drives

- If only one drive is attached to a connector, it must be set as a Master device.
- On each connector, there can be only one drive set as the Master device and one drive set as the Slave device.
- A maximum of four IDE drives can be attached to your computer, two on the Local Bus connector, and two on the ISA Bus connector.
- If a hard disk shares the same connector with a drive that requires a software device driver (such as a CD-ROM drive), the hard disk should be set as the Master device.

To attach an additional drive to the:

- Local Bus connector, you must set the new hard disk as a Slave device. For instructions on setting the new hard disk as a Slave device, see the documentation that came with the drive. You do not need to change any jumpers on the hard disk that came with your computer.

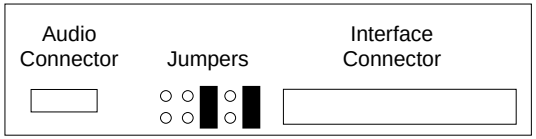
  If you are adding a second IDE hard disk to your system, you must attach it to the Local Bus connector.

- ISA Bus connector, you must set the new hard disk as a Master device if it is the only hard disk attached to this connector. However, if a hard disk is already attached to the ISA Bus connector, you must set the new hard disk as a Slave device. For instructions on setting the new hard disk as a Master or Slave device, see the documentation that came with the drive.

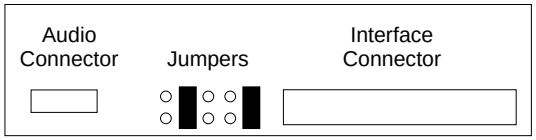
  If a CD-ROM drive is already attached to the ISA Bus connector, you must move the jumper on the CD-ROM drive to set it as a Slave device and set the new hard disk as a Master device.

  If a CD-ROM drive came with your computer, the following pictures show how to set the CD-ROM jumper to make it a Master or Slave device. If you have another type of drive attached to the ISA Bus connector, see the documentation that came with the drive to find the jumper location and instructions for setting it.

Jumper setting for CD-ROM drive as Master device



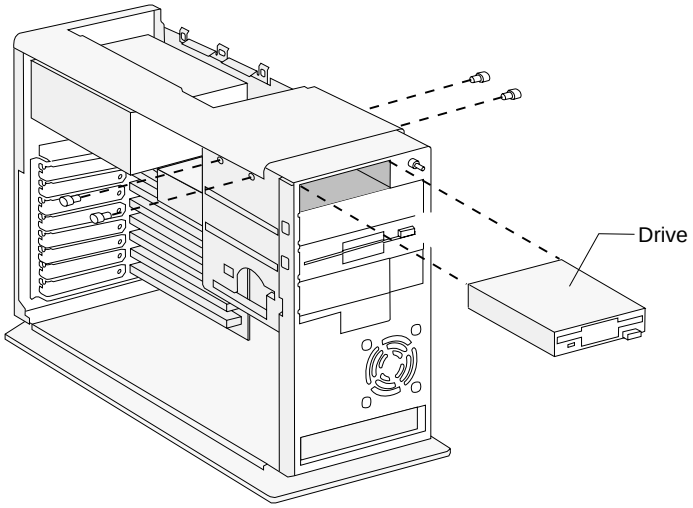
Jumper setting for CD-ROM drive as Slave device



Installing and removing a drive in bay 1

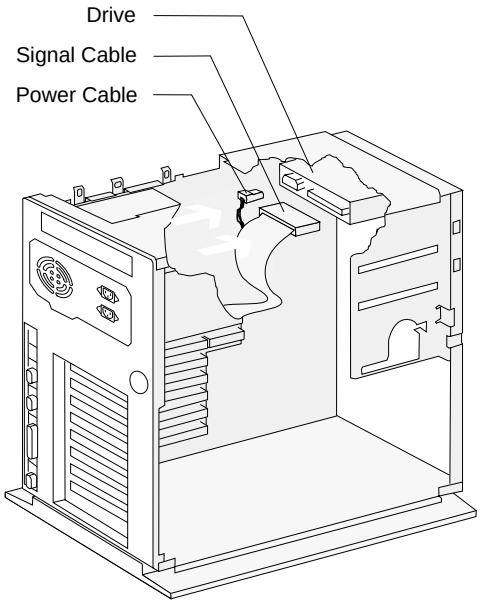
Bay 1 can hold a 3.5-inch slim drive, such as a diskette, or tape drive. For drive removal, reverse the steps shown below.

1. Insert the drive into the bay. Align the screw holes and insert the four screws.



(Front View)

2. Connect the power and signal cables to the drive.



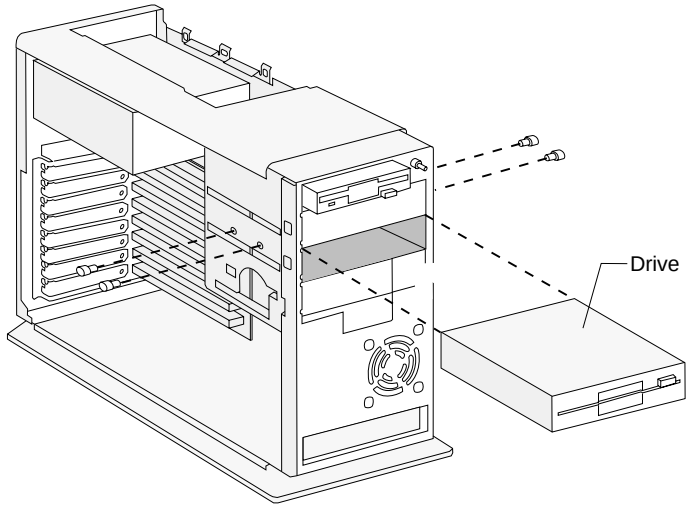
(Back View)

note: *If you are adding a diskette drive or a tape drive that attaches to the Diskette connector, make sure the signal cable you plug into the drive is attached to the Diskette connector on the system board. To identify the Diskette connector on the system board, see "Identifying parts of the system board" on page 90.*

Installing and removing a drive in bay 2 or 3

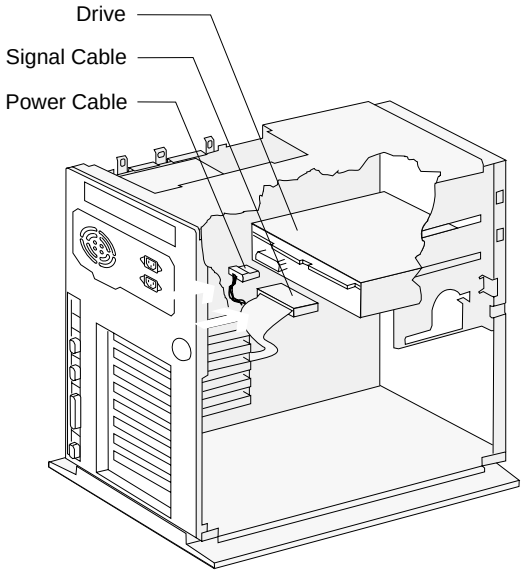
Bay 2 or 3 can hold up to a 5.25-inch half high drive, such as a diskette, tape, or CD-ROM drive. For drive removal, reverse these steps.

1. Insert the drive into the bay. Align the screw holes and insert the four screws.



(Front View)

2. Connect the power and signal cables to the drive.



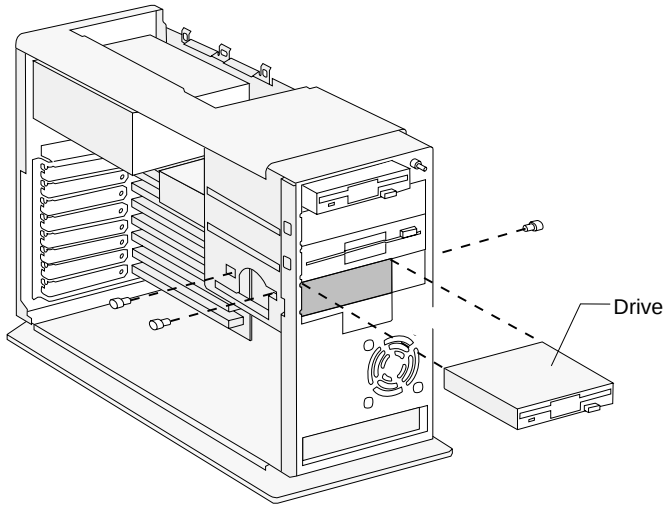
(Back View)

note: *If you are adding a diskette drive or tape drive that attaches to the diskette connector, make sure the signal cable you plug into the drive is attached to the Diskette connector on the system board. If you are adding a CD-ROM, it is recommended that you use the signal cable attached to the ISA Bus connector on the system board. To identify the connectors on the system board, see page 90.*

Installing and removing a drive in bay 4

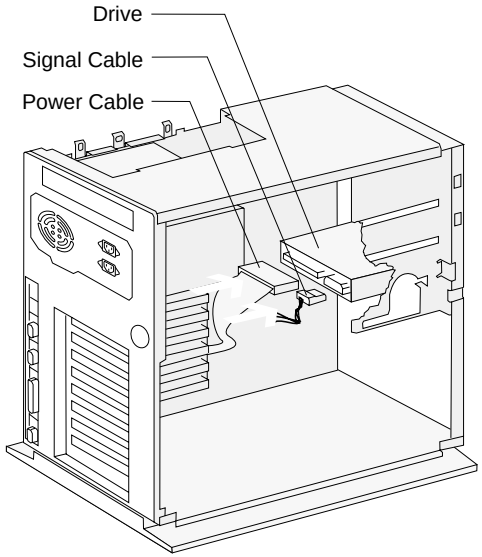
Bay 4 can hold up to a 3.5-inch half high drive, such as a diskette or tape drive. For drive removal reverse these steps.

1. Insert the drive into the bay. Align the screw holes and insert the three screws.



(Front View)

2. Connect the power and signal cables to the drive.



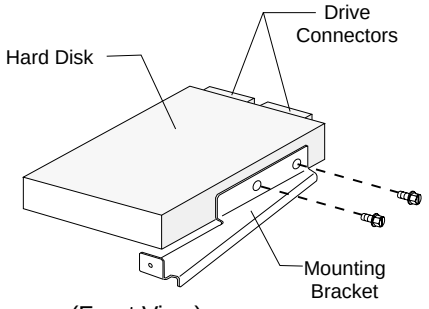
(Back View)

note: *If you are adding a diskette drive or a tape drive that attaches to the Diskette connector, make sure the signal cable you plug into the drive is attached to the Diskette connector on the system board. To identify the Diskette connector on the system board, see "Identifying parts of the system board" on page 90.*

Installing and removing a hard disk in bay 5

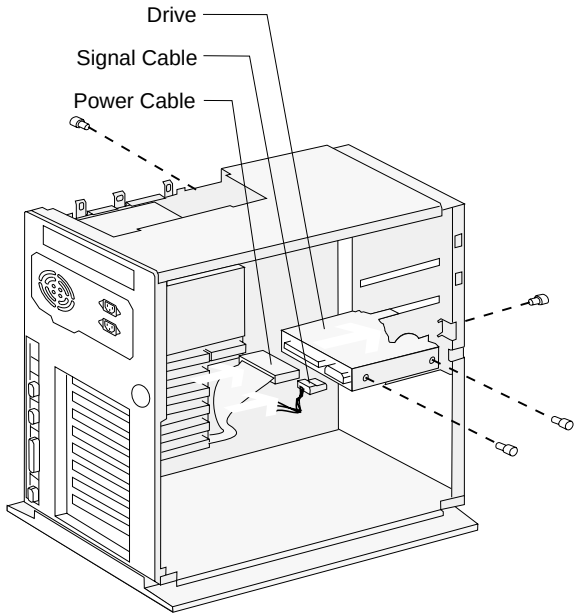
Bay 5 can hold a 3.5-inch slim hard disk. For hard disk removal, reverse these steps.

1. To attach the mounting bracket, align the screw holes and insert the two screws.



(Front View)

2. Insert the hard disk (with the bracket attached) into the bay. Align the screw holes and insert the four screws. Connect the power and signal cables. (To ensure that your hard drive functions properly, read “Installing additional drives” on page 79 before connecting the cables.)

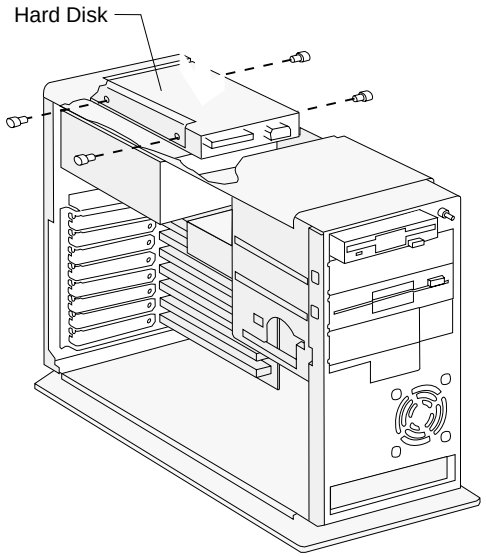


(Back View)

Installing and removing a hard disk in bay 6

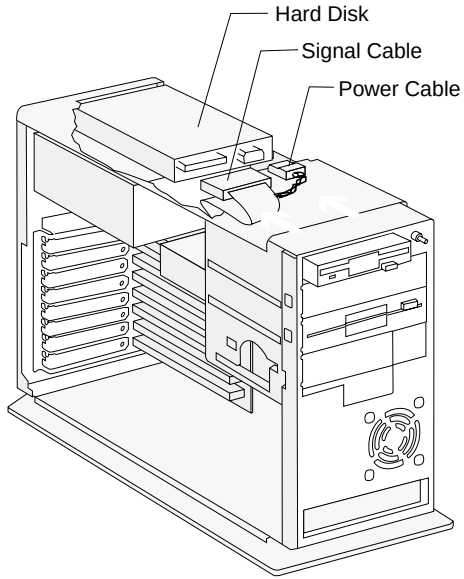
Bay 6 can hold a 3.5-inch slim hard disk. For hard disk removal, reverse these steps.

1. Insert the drive into the bay. Align the screw holes and insert the four screws.



(Front View)

2. Connect the power and signal cables. (To ensure that your hard drive functions properly, read “Installing additional drives” on page 79 before connecting the cables.)

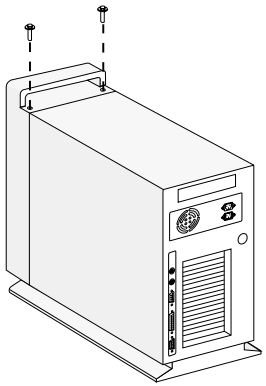


Working with your system board 8

How to begin

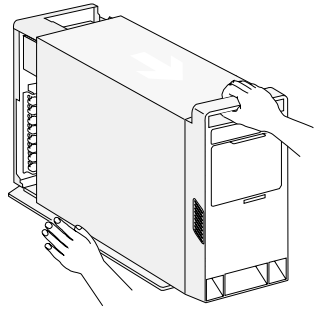
Before you make hardware changes, follow these simple precautions:

1. Turn off the system unit, monitor, and any external options (such as a printer).
2. Disconnect the telephone cord and any external cables.
3. Remove the system unit cover:
   a. Remove the screws.



(Back View)

   b. Slide the cover forward.



(Front View)

Important: *To prevent electrostatic charge from damaging any part of your computer, touch the computer's bare metal frame before you unplug the system unit, or wear an antistatic wrist strap while making hardware changes.*

4. Unplug the system unit and monitor from the electrical outlets.
5. Unplug the power cords of any external options from the electrical outlets.

Removing the adapter cards and the riser card

Before you make changes to the system board, you may need to remove the adapter cards and the riser card.

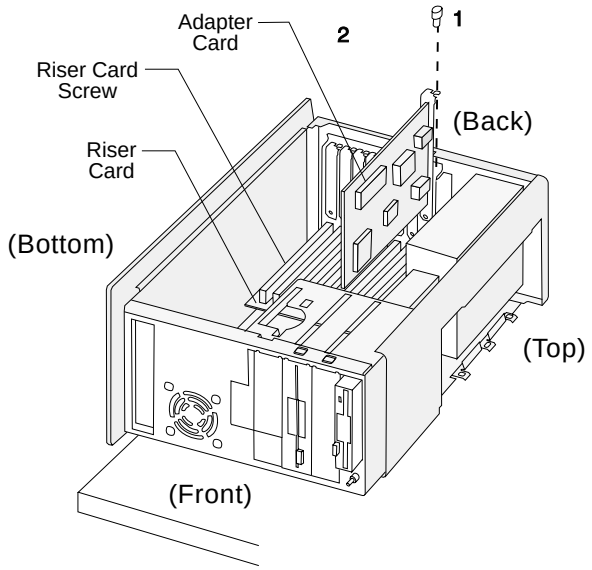
1. Rest your system on a sturdy, flat surface. Turn the system unit so that the system board faces you.

   Lay the system unit on its side. To ensure that the system unit lays flat, make sure the base (bottom) of the system unit hangs over the edge of your work surface as shown in the illustration.

2. Remove all adapter cards from the adapter card slots.

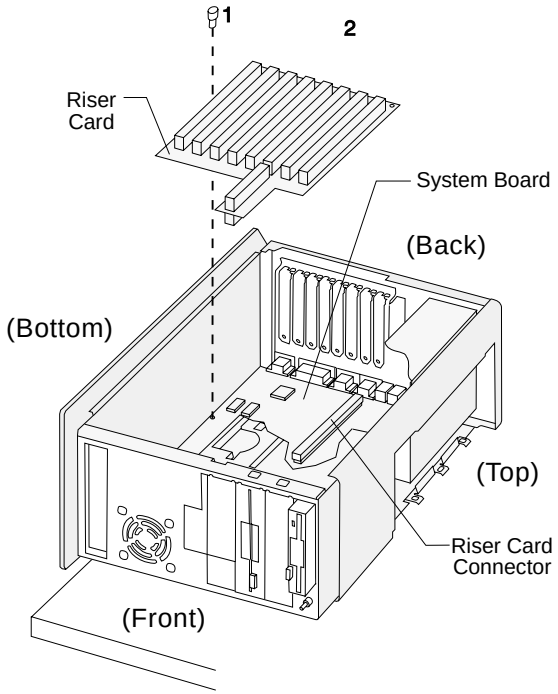
   To remove an adapter card:

   Remove the adapter card screw. Carefully pull the adapter card straight out of the slot so that the card's components do not bend. If an adapter card has cables, disconnect them. Be sure to notice where the cables connect to the cards. You will have to reconnect these cables when you reinstall the card.



Removing the adapter cards and riser card (continued)

3. Remove the riser card screw. Then remove the riser card.

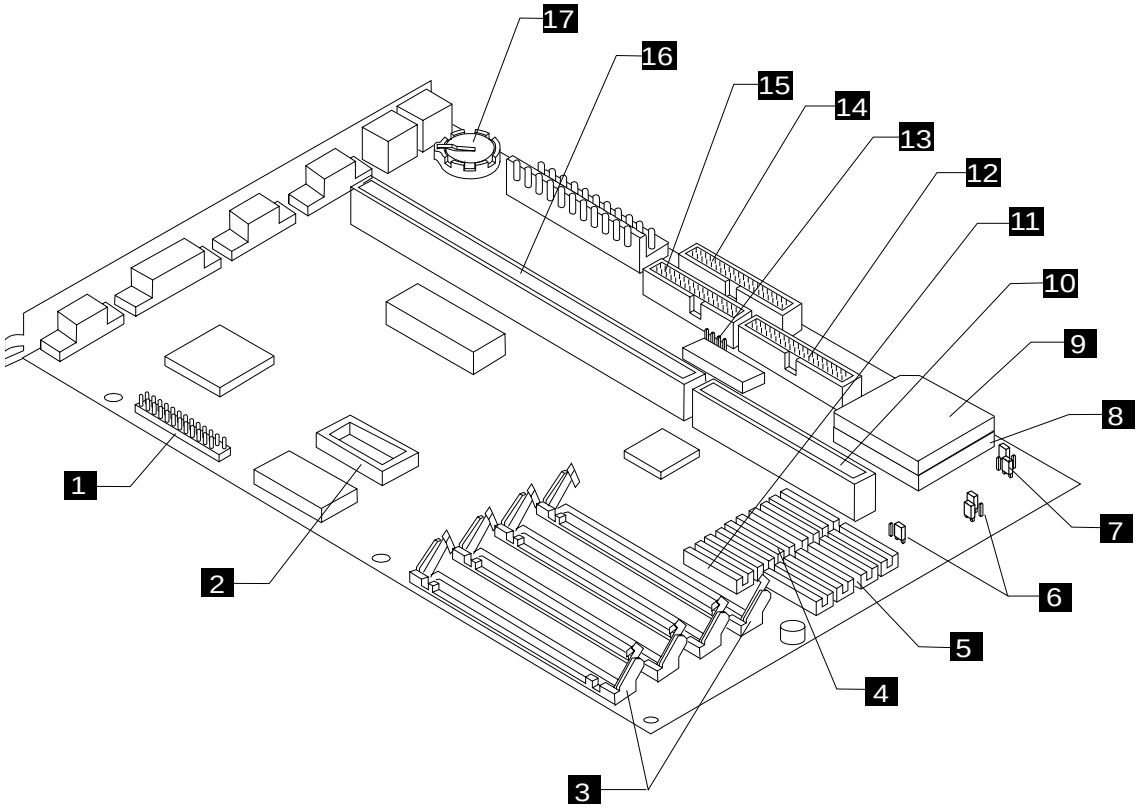


4. After making changes to the system board, remember to:

   a. Reinstall the riser card and all adapter cards.
   b. Insert all screws and tighten them securely.
   c. Reconnect all cables

Identifying parts of the system board

If you plan to add or replace hardware in your computer, you will need to know the layout of the *system board*. This picture shows an example of the system board in your computer. Simply match the system board in your computer to this example to identify the parts of the system board. The items on the next page correspond to the numbered locations on the picture:



Specifications for the system board

The system board is the main circuit board in the system unit. It supports a variety of devices, such as the mouse and keyboard, and provides other basic computer functions. The system board is sometimes called the *planar* or *motherboard*. The system board shown on page 90 has the following parts:

1 VESA feature connector. Used for video and graphics adapter cards.

2 Video memory socket. If your system board has this socket, you can upgrade the video memory on your system board from 512KB to a maximum of 1MB. If your system board does not have this socket, it already has 1MB installed.

Specifications: 40-pin, zigzag inline package (ZIP), 256K x 16, 70 nanosecond (ns), dynamic random access memory (DRAM).

3 Memory module sockets (for SIMMs). Memory modules are also called *single inline memory modules* or *SIMMs*. You can upgrade the memory on your system board to a maximum of 128MB. Some system boards come with 4 or 8MB already installed.

Specifications: 72-pin; 32-bit or 36-bit; 2MB, 4MB, 16MB, or 32MB; 70 or 80 ns for 25 or 50 megahertz (MHz), 70 ns for 33 or 66 MHz; gold contacts; DRAM.

4 Cache memory module sockets (Bank 2). To install a total of 256K of memory use Banks 1 and 2.

5 Cache memory module sockets (Bank 1). To install a total of 128K of memory use Bank 1.

6 Cache memory jumpers. Move these jumpers when you upgrade to 128K or 256K of cache memory.

7 Processor jumper. You may have to reset this jumper if you install an upgrade processor.

8 Processor socket. This is where you install an upgrade processor.

9 Processor. You can upgrade the existing processor.

10 Riser card VESA extension. Some system boards support the Video Electronics Standards Association (VESA) local bus.

11 Cache memory module socket (for Tag address module). If you add cache memory modules, you must add or replace the Tag address module.

Important: *For cache memory specifications, read "Installing cache memory" on page 95.*

12 ISA Bus connector. Holds signal cables that attach to drives.

13 Wake Up on Ring connector. Holds the Wake Up on Ring cable attached to the internal modem.

14 Local Bus connector. Holds signal cables that attach to drives.

15 Diskette connector. Holds signal cables that attach to drives.

16 Riser card connector. The riser card holds the adapter card connectors.

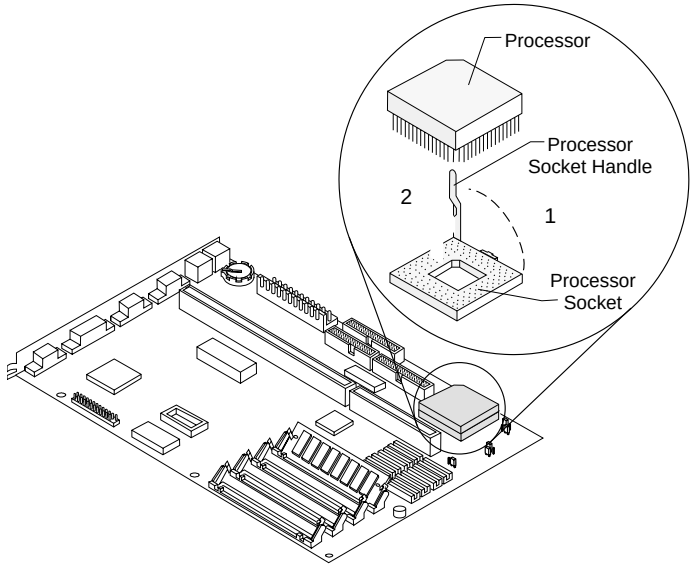
17 Battery. Replace the battery with a 3-volt (CR2032) lithium battery only.

Installing an upgrade processor

Before beginning these steps, you must remove any installed adapter cards and the riser card. Follow the instructions on page 88 to remove the adapter cards and the riser card. You may also need to remove the hard drive and bracket from bay 5. Follow the instructions on page 84 to remove the hard drive and bracket from bay 5. Remember to reinstall any hardware you removed when you are finished.

To remove the old processor:

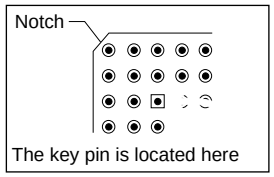
1. Unlatch the processor socket handle and lift it all the way up.
2. Lift the processor out of the processor socket.



To install the upgrade processor:

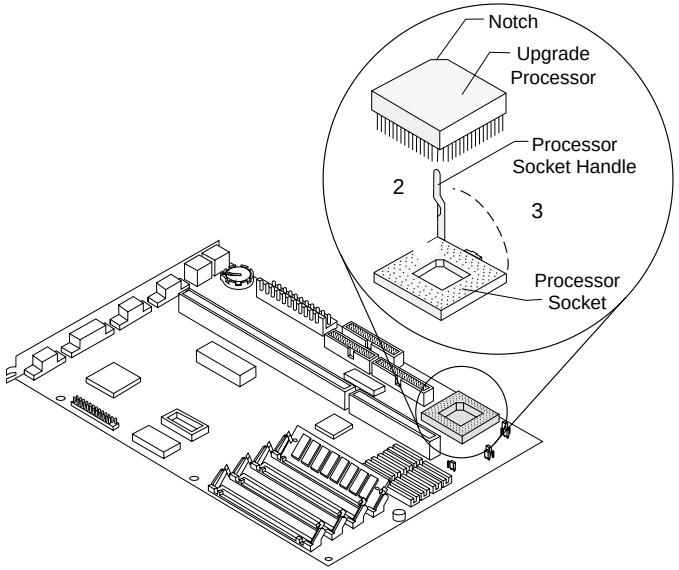
1. Turn the processor so that the pin side (bottom) is facing you. Locate the corner of the processor that has the notch and key pin. The key pin looks like the other pins except that it has a square base.

Bottom View



2. Position the processor notch over the socket as shown. Then place the processor into the socket.

3. Push the processor socket handle down and snap it closed.



4. Follow the instructions on page 94 to reset the jumper.

Jumper instructions for processor upgrades

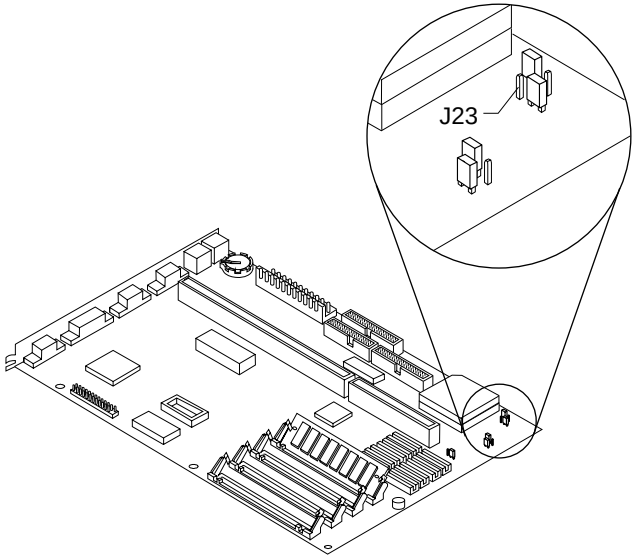
Your computer comes with the jumper *preset* for the old processor. If you upgrade your processor, you may need to *reset* (move) the processor jumper. This jumper is labeled *J23* on your system board.

Use the following table to determine whether you need to reset the jumper.

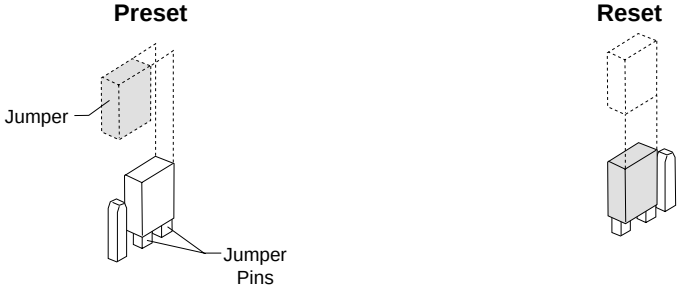
If your processor is a:	And you upgrade to:	Then:
486SX	a 487 math coprocessor or an Intel** OverDrive** processor	Reset J23
486SX2, 486DX, or 486DX2	an Intel OverDrive processor	Do not reset the jumper.

To reset the jumper, do the following:

1. Locate the jumper you need to *reset*.



2. Remove a jumper from its *preset* position, and move it to its *reset* position. See the *example*.



note: *Remember to reinstall all hardware you removed to access the processor.*

Installing cache memory

Before beginning these steps, you must remove any installed adapter cards and the riser card as described on page 88. You may also need to remove drives for easier access.

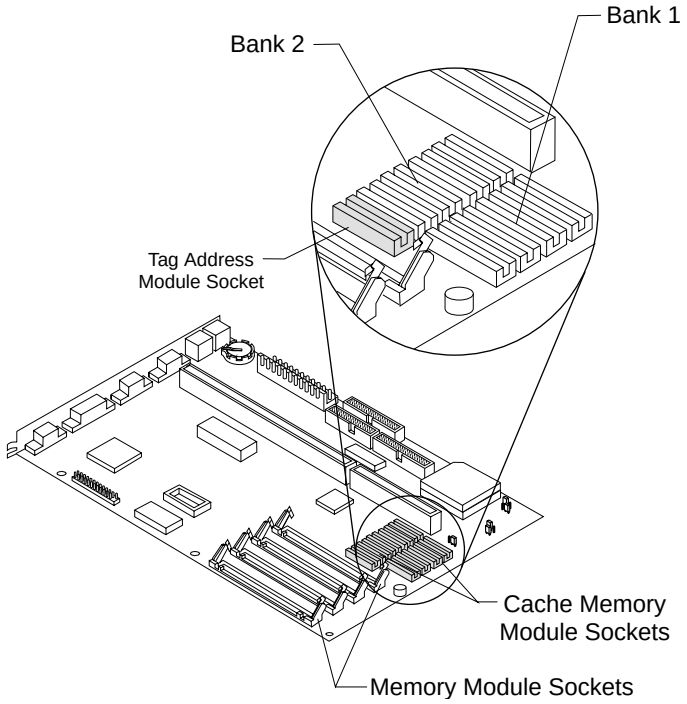
If cache memory modules are not already installed on your system board, you can install either 128K or 256K of cache memory. If cache memory modules are already installed, your computer has 128K of cache memory.

Read the following instructions *before* installing or upgrading cache memory.

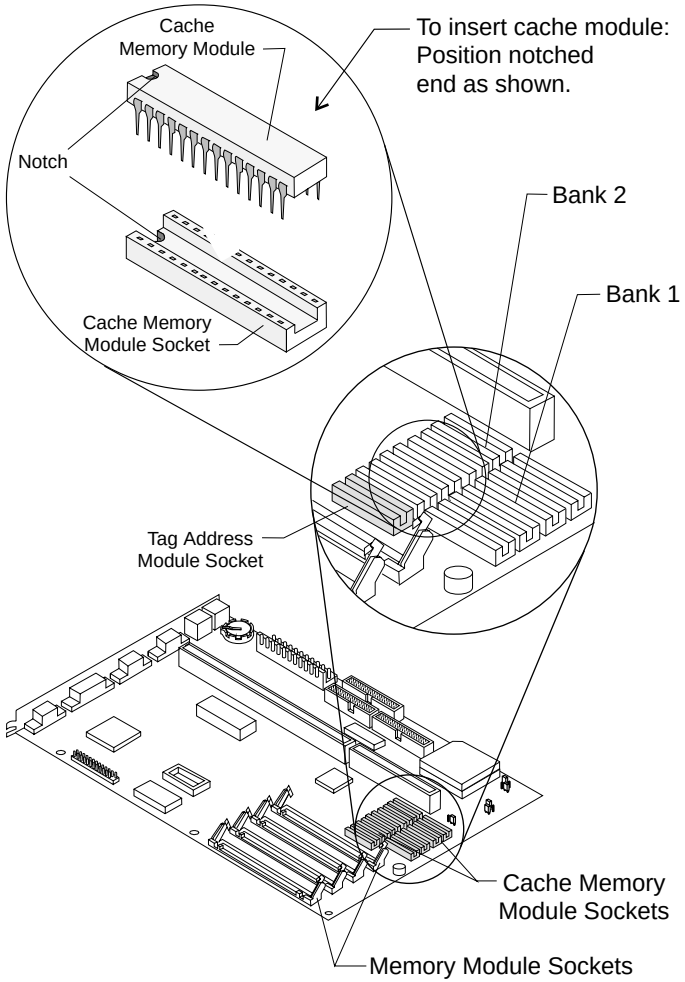
To install a cache memory module:

1. Locate the single inline memory modules (SIMMs) installed in the memory module sockets. Your computer can have from one to four SIMMs installed. Remove all the SIMMs. See “Removing memory modules” on page 100 for instructions.

2. Locate the two banks of cache memory module sockets (Bank 1 and Bank 2). Also locate the Tag Address module socket. This socket is next to Bank 2.



3. To insert a cache memory module, position the notched end of the module as shown. Align the module pins and insert the module into the socket. Use the individual instructions that follow to install 128K or 256K of cache memory, or to upgrade from 128K to 256K.

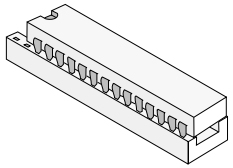


To install 128K:

Caution: *Before inserting a cache memory module into a socket, make sure the notched end of the module is positioned correctly.*
Also make sure the cache memory module pins are aligned with the pin holes in the socket. The module pins bend easily if they are not aligned correctly.

1. *In the Tag Address module socket*, insert the Tag Address module. Use a 28-pin, 8K x 8, 15 nanosecond (ns) Tag Address module.

2. *In Bank 1*, insert four cache memory modules. Use 28-pin, 32K x 8, 20 ns modules. The modules are not as long as the sockets; the sockets have two extra rows of pin holes. Properly inserted modules will look like this:



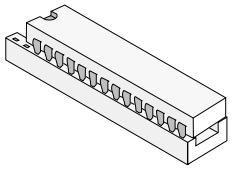
3. *In Bank 2*, do not insert any modules.

4. Reset the jumpers. See the instructions on page 98.

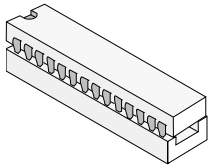
To install 256K:

Caution: *Before inserting a cache memory module into a socket, make sure the notched end of the module is positioned correctly.*
Also make sure the cache memory module pins are aligned with the pin holes in the socket. The module pins bend easily if they are not aligned correctly.

1. *In the Tag Address module socket*, insert the Tag Address module. Use a 28-pin, 32K x 8, 15 nano-second (ns) Tag Address module.
2. *In Bank 1*, insert four cache memory modules. Use 28-pin, 32K x 8, 20 ns modules. The modules are not as long as the sockets; the sockets have two extra rows of pin holes. Properly inserted modules will look like this:



3. *In Bank 2*, insert four cache memory modules. Use 28-pin, 32K x 8, 20 ns modules. Properly inserted modules will look like this:



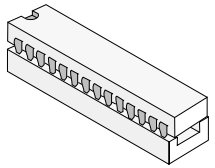
4. Do not reset the jumpers.

note: *Remember to reinstall all hardware you removed from your system to access the cache memory sockets.*

To upgrade from 128K to 256K:

Caution: *Before inserting a cache memory module into a socket, make sure the notched end of the module is positioned correctly.*
Also make sure the cache memory module pins are aligned with the pin holes in the socket. The module pins bend easily if they are not aligned correctly.

1. *In the Tag Address module socket*, remove the existing module and replace it with a 28-pin, 32K x 8, 15 ns Tag Address module.
2. *In Bank 1*, do not remove the four preinstalled modules.
3. *In Bank 2*, insert four cache memory modules. Use 28-pin, 32K x 8, 20 ns modules. Properly inserted modules will look like this.



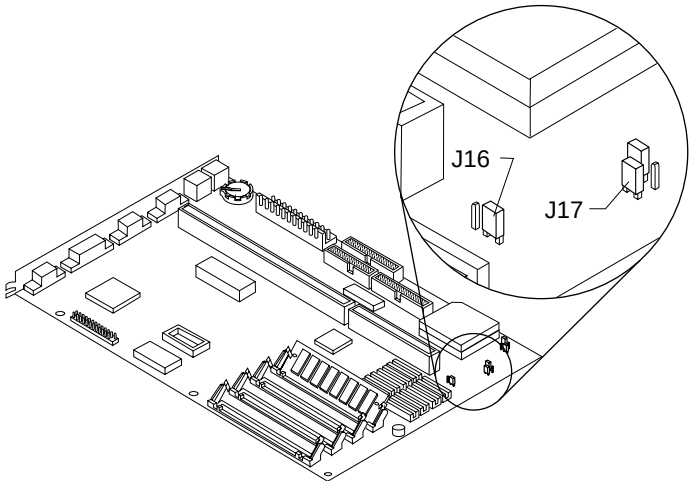
4. Reset the jumpers. See the instructions on page 98.

Jumper instructions for cache memory upgrades

Your computer comes with the jumpers *preset* for 256K of cache memory. If you installed 128K or upgraded from 128K to 256K of cache memory, you must *reset* (move) two cache memory jumpers. The two jumpers you must reset are labeled on your system board as *J16* and *J17*.

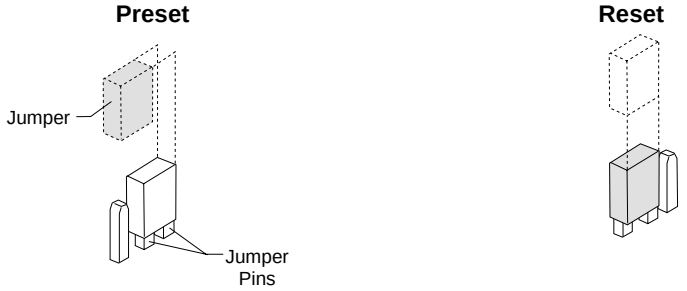
If you need to reset these jumpers, do the following:

1. Locate jumpers J16 and J17.



2. Remove a jumper from its preset position, and move it to its reset position. See the *examples*:

For a 3-pin jumper (J16):



For a 2-pin jumper (J17):

note: *Remember to reinstall all hardware you removed to access the cache memory sockets.*

Installing and removing memory modules

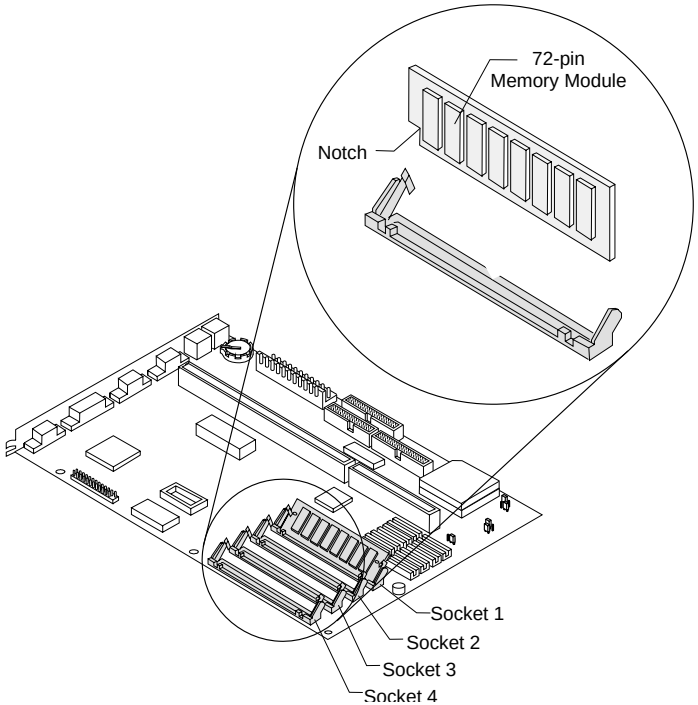
Before beginning these steps, you may need to remove installed adapter cards and the riser card. Follow the instructions on page 88 if you need to remove the adapter cards and the riser card.

Your computer will come with at least one memory module already installed. When you install additional memory, you must fill the sockets in this order: socket 1, socket 2, socket 3, and socket 4. For example, before you install a module in socket 2, a module must be installed in socket 1. For more information, see "Memory module placement" on page 103.

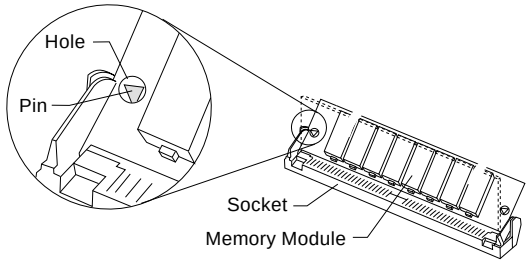
Installing memory modules

To install an additional memory module in an empty socket:

1. Find the notched edge of the module, and position it as shown.
2. Insert the module straight down into the socket until the connectors line up and the module is *firmly* in place. (*Steps continued on next page.*)



3. Press back *firmly* on the memory module until both sides *click*, locking into place. The newly installed memory module will be at an angle with pins showing through the holes on each side.



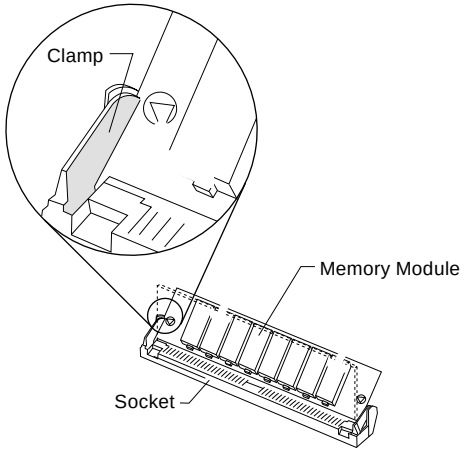
note: *Remember to reinstall all hardware you removed to access the memory module sockets.*

Removing memory modules

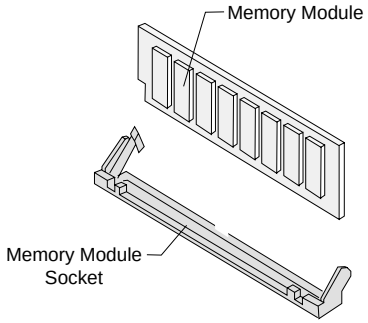
To remove a memory module from its socket:

1. Locate the two clamps that hold the memory module in place (see the following picture). One clamp holds the left edge of the module and the other clamp holds the right.

2. At the same time, push both clamps outward (away from the edges of the module). The module will release and move forward.



3. Lift the module straight out of the socket.



Upgrading video memory

Before beginning these steps, you must remove any installed adapter cards and the riser card. Follow the instructions on page 88 to remove the adapter cards and the riser card.

If your system board has a video memory module socket, you can upgrade the video memory to a maximum of 1MB. If your system board does not have this socket, it already has 1MB installed.

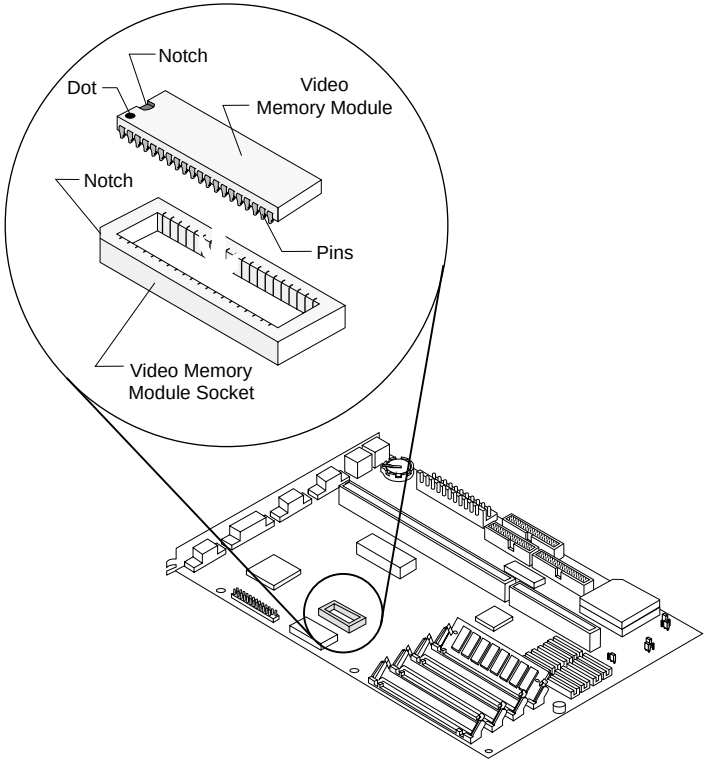
To install a video memory module:

1. One end of the video memory module will have a dot, a notch, or both. Locate the dot or notch on the video memory module.

2. Position the end of the video memory module with the dot or notch as shown.

3. Align the pins on the sides of the memory module with the grooves in the memory module socket.

4. Press straight down *firmly* on the module to insert it into the socket. A properly inserted module will sit completely inside the socket.



note: *Remember to reinstall all hardware you removed to access the video memory socket.*

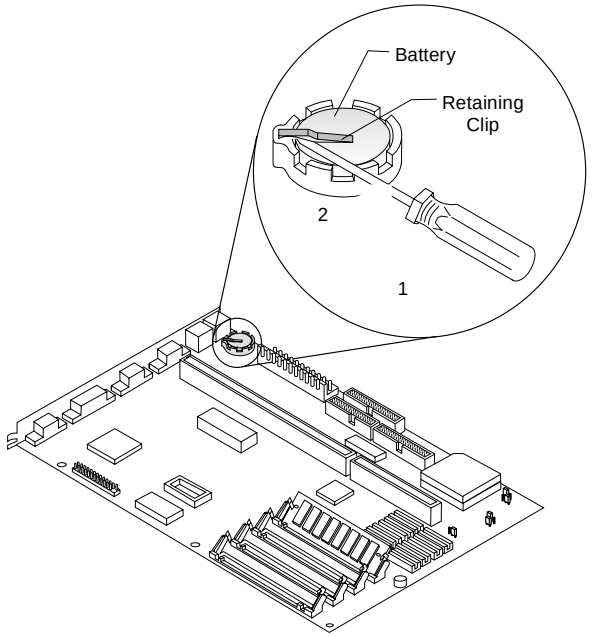
Replacing the battery

Before beginning these steps, you must remove any installed adapter cards and the riser card. Follow the instructions on page 88 to remove the adapter cards and the riser card.

To replace the battery:

1. Place the blade of a small, flat-blade screwdriver under the rear edge of the retaining clip.
2. Turn the screwdriver one quarter turn, raising the clip while pressing down on the old battery to remove it.
3. Raise the retaining clip, and insert a new 3-volt (CR2032) lithium battery in its place.

note: *Remember to reinstall all hardware you removed to access the battery.*



Reference tables Appendix A

Memory module placement

This table shows how to place the single inline memory modules (SIMMs) on your system board. Use this information when adding or removing system memory.

Table 12: Memory module placement

Total memory	Socket 1	Socket 2	Socket 3	Socket 4
2MB	2MB			
4MB	4MB			
4MB	2MB	2MB		
6MB	2MB	4MB		
6MB	2MB	2MB	2MB	
8MB	4MB	4MB		
8MB	8MB			
8MB	2MB	2MB	2MB	2MB
10MB	2MB	8MB		
12MB	4MB	8MB		
12MB	2MB	2MB	8MB	
14MB	2MB	4MB	8MB	
16MB	16MB			
16MB	8MB	8MB		

Table 12: Memory module placement (Continued)

Total memory	Socket 1	Socket 2	Socket 3	Socket 4
16MB	4MB	4MB	8MB	
16MB	4MB	4MB	4MB	4MB
18MB	2MB	8MB	8MB	
20MB	4MB	16MB		
20MB	4MB	8MB	8MB	
20MB	2MB	2MB	8MB	8MB
22MB	2MB	4MB	8MB	8MB
24MB	4MB	4MB	16MB	
24MB	8MB	8MB	8MB	
24MB	4MB	4MB	8MB	8MB
26MB	2MB	8MB	8MB	8MB
28MB	4MB	4MB	16MB	4MB
28MB	4MB	8MB	8MB	8MB
32MB	32MB			
32MB	16MB	16MB		
32MB	8MB	8MB	16MB	
32MB	8MB	8MB	8MB	8MB
36MB	4MB	16MB	16MB	
40MB	4MB	4MB	32MB	
40MB	4MB	4MB	16MB	16MB

Table 12: Memory module placement (Continued)

Total memory	Socket 1	Socket 2	Socket 3	Socket 4
48MB	16MB	16MB	16MB	
48MB	8MB	8MB	32MB	
48MB	8MB	8MB	16MB	16MB
52MB	4MB	16MB	16MB	16MB
64MB	64MB			
64MB	32MB	32MB		
64MB	16MB	16MB	32MB	
64MB	16MB	16MB	16MB	16MB
68MB	4MB	32MB	16MB	16MB
72MB	4MB	4MB	32MB	32MB
80MB	8MB	8MB	32MB	32MB
84MB	4MB	32MB	32MB	16MB
96MB	32MB	32MB	32MB	
96MB	16MB	16MB	32MB	32MB
100MB	4MB	32MB	32MB	32MB
128MB	128MB			
128MB	64MB	64MB		
128MB	32MB	32MB	32MB	32MB

Memory map

This table shows the hexadecimal addresses for the system memory regions. You may use this information for adapter cards that require you to set up memory regions.

Table 13: Memory map

Address range	Description
0-640KB (0-9FFFFH)	Base memory
640-768KB (A0000-BFFFFH)	VGA mode video memory
768-800KB (C0000-C7FFFH)	Video BIOS
800-896KB (C8000-DFFFFH)	Adapter card memory or upper memory
896-959KB (E0000-EFBFFH)	Available for upper memory
959-1024KB (EFC00-FFFFFH)	System BIOS (some may be available for upper memory)
1024KB-128MB (100000-7FFFFFFH)	Extended memory
128-129MB (8000000-80FFFFFH)	Linear mode video memory

System Input/Output (I/O) addresses

This table shows the hexadecimal addresses for each of the system board I/O functions. You may want to use this information if you install an adapter card that requires you to set I/O addresses.

Table 14: System I/O addresses

Address range (hexadecimal)	Function
0000-001F	DMA controller
0020-0021	Interrupt controller 1
0022-0024	Reserved
0040-0043	System timers
0060	Keyboard/mouse controller
0061	System control port B
0064	Keyboard/mouse controller
0070-0071	RTC/CMOS and NMI mask
0080-008F	DMA controller
0092	System control port A
00A0-00A1	Interrupt controller 2
00C0-00DF	DMA controller
00EC-00ED	Reserved
00F0-00FF	Math coprocessor
0102	SVGA controller
0170-0177, 0376	Secondary IDE controller

Table 14: System I/O addresses

Address range (hexadecimal)	Function
01F0-01F7, 03F6	Primary IDE controller
0278-027F, 0678-067A	Parallel port 3
02E80-02EF	Serial port 4
02F8-02FF	Serial port 2
0378-037F, 0728-077A	Parallel port 2
03BC-03BF, 07BC-07BE	Parallel port 1 Note: Parallel port 1 should not be used in EPP mode.
03C0-03CF, 3D4, 3D5, 03DA	Super VGA controller
03E8-03EF	Serial port 3
03F0-03F5, 03F7	Diskette controller
03F8-03FF	Serial port 1
46E8	SVGA controller

System board interrupts

This table shows the system interrupt requests (IRQs) and their functions. You may use this information if you install an adapter card that requires you to set IRQs.

Table 15: System board interrupts

Interrupt request (IRQ)	Function
SMI	Power management
NMI	Parity error or I/O channel check
0	Timer
1	Keyboard
2	Cascade to IRQ8-IRQ15
3	Serial port B
4	Serial port A
5	User available
6	Diskette
7	Parallel port
8	Real-time clock
9	Redirect cascade
10	User available
11	User available
12	Mouse
13	Math coprocessor
14	Primary IDE
15	Secondary IDE

DMA channel assignments

This table shows the channel assignments for direct memory access (DMA). DMA allows I/O devices to transfer data directly to and from memory. You may need to select an open DMA channel if you add an I/O device that uses DMA.

Table 16: DMA channel assignments

DMA channel	Assignment
0	User available
1	ECP parallel port (alternate)
2	Diskette
3	ECP parallel port (default)
4	Cascade
5	User available
6	User available
7	User available
Note: In ECP bi-directional mode, the parallel port may be set to use either DMA channel 3 or DMA channel 1. Jumpers JP8 and JP9 control which DMA channel is used.	

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